STANDARD OPERATING PROCEDURE for TELECOMMUNICATION SERVICES During DISASTERS

Acknowledgement

The Department of Information Technology and Telecom (DITT) would like to take this opportunity to express our appreciation and deep gratitude to Department of Disaster Management (DDM) under Ministry of Home and Cultural Affairs (MOHCA), Bhutan InfoComm & Media Authority (BICMA), Bhutan Power Corporation, and Telcos (Bhutan Telecom Ltd. and Tashi InfoComm Pvt. Ltd.) for their support and providing feedback in finalizing this document.

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STANDARD OPERATING PROCEDURE for TELECOMMUNICATION SERVICES for Responding to DISASTERS

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CHAPTER 1. INTRODUCTION

1.1 Introduction

The Telecommunications sector in Bhutan has experienced rapid growth in the past two decades, fostering economic activity in the form of productivity gains and the generation of significant consumer benefits within the kingdom. With the sector in its developing phase, the Ministry of Information and Communications (MoIC) has felt the need to publish Standard Operating Procedure (SOP) for Telecommunication Services for Responding to Disasters. Telecommunication Services play a critical role during rescue and relief operations.

The Standard Operating Procedure (SOP) is developed through a series of discussions with concerned agencies in order to publish SOP for Telecommunication Services for Responding to Disasters.

The responsibility of Department of Information Technology and Telecom (DITT) under MoIC is to coordinate with BICMA/DDM/TSPs for Emergency Support Function related to provision of telecommunication services by Telecom Service Providers (TSPs) and further coordination with other Government agencies.

1.2 Objective

- To identify Stakeholder Coordination requirements for establishment of emergency telecommunication services in the affected areas
- To identify Stakeholder coordination for restoration of affected telecommunication services

1.3 Scope of SOP

Standard Operating Procedure (SoP) for Telecommunication Services for responding to Disasters shall be followed by all the concerned stakeholders providing and regulating Telecommunication Services in the country during disaster.

This SOP will guide in the restoration of telecommunications services using emergency telecommunication networks in the disaster affected areas.

During disasters, the three fundamental causes for telecommunications infrastructure failure are:

- Physical destruction of Telecommunications Network Components
- Disruption in supporting network infrastructure
- Network Congestion

This SOP will address the aforementioned telecommunications infrastructure failures by putting in place an Emergency Telecommunication Network in the disaster affected areas.

1.4 Bhutan Telecommunications & Broadband Policy 2014

Disaster Communications is one of the key policy elements in the Bhutan Telecommunications & Broadband Policy 2014.

It says "*The Government shall leverage Telecom and ICT infrastructure to prevent, mitigate and manage disasters. It shall work with relevant players to establish a robust communication system for use during disaster. Telecom operators shall be mandated to follow International standards and best practices for contingency planning".*

CHAPTER 2. STANDARD OPERATING PROCEDURE (SOP):

2.1 Four phases of Disaster Management

a. **Mitigation:** Mitigation involves steps to reduce vulnerability to disaster impacts such as injuries and loss of life and property. This might involve changes in local building codes to fortify buildings; revised zoning and land use management; strengthening of public infrastructure; and other efforts to make the community more resilient to a catastrophic event.
b. **Preparedness:** Preparedness focuses on understanding how a disaster might impact the community and how education, outreach and training can build capacity to respond to and recover from a disaster. This may include engaging the business community, pre-disaster strategic planning, and other logistical readiness activities. The disaster preparedness activities guide provides more information on how to better prepare an organization and the business community for a disaster.
c. **Response:** Response addresses immediate threats presented by the disaster, including saving lives, meeting humanitarian needs (food, shelter, clothing, public health and safety), cleanup, damage assessment, and the start of resource distribution. As the response period progresses, focus shifts from dealing with immediate emergency issues to conducting repairs, restoring utilities, establishing operations for public services (including permitting), and finishing the cleanup process.

d. **Recovery:** Recovery is the fourth phase of a disaster and is the restoration of all aspects of the disaster's impact on a community and the return of the local economy to some sense of normalcy. By this time, the impacted region has achieved a degree of physical, environmental, economic and social stability.

2.2 Roles and responsibilities of Agencies during disasters

1. Telecom Service Providers (TSPs) shall adopt appropriate measures to increase the reliability and resiliency of their networks during disasters. BPC shall adopt appropriate measures to increase the reliability and resiliency of OPGW/ADSS Network in Bhutan. BICMA shall ensure adoption of measures by TSPs/ISPs and BPC.
2. TSPs and DITT shall carry out awareness campaigns to use alternate communication mode like SMS rather than using only Voice.
3. TSPs, ISPs and BPC shall have Business Continuity Plans for Disaster in place.
4. TSPs/ISPs shall provide their Disaster Response Task Force with required emergency communication equipment at all Dzongkhags.
5. TSPs shall identify Emergency Communication Facilities to house their emergency communication equipment at National and Dzongkhag Levels. Emergency Communication Equipment shall constitute, including but not limited to, the following equipment:
    a. Satellite Phones
    b. Mobile VANs
    c. Portable BTS
    d. Fiber Optics and accessories
6. ***Telecommunication Coordination Committee Meeting*** shall be convened to discuss and take stock of the telecommunication services situation at National and at the affected Dzongkhag.
7. DDM, MoHCA shall prioritize mobile numbers of concerned officials of RGOB.
8. NEOC under DDM premises shall be identified as a Central Control Room for coordination and management of Disasters.
9. Emergency Operation Center shall be established in the affected Dzongkhag by DDM.
10. Dzongkhag ICTOs/ICTAs shall represent in DCC and report to DCC/NCC.
11. BICMA shall mandate TSPs to regularly carry out emergency disaster drills within their network.
12. BICMA shall mandate TSPs for the establishment of their Disaster Response Task Force at each Dzongkhags. TSP Disaster Response Task Force shall be responsible in immediate provisioning of emergency communication and restoration of communication services in disaster affected areas.

13. BICMA shall mandate infrastructure sharing between TSPs for sharing resources to provide telecommunication services during disaster.
14. BICMA along with members from TSPs and BPC shall have in place a Post Disaster Need Assessment (PDNA) team. The PDNA team shall be responsible to assess the damage and losses of telecommunication services to help restoration work to be carried out efficiently and effectively.
15. BICMA shall mandate TSPs to broadcast important messages, in close consultation with National & Dzongkhag Coordination Committee, to all its subscribers using SMS or other means.
16. BICMA shall mandate TSPs to ensure that its subscribers located in the disaster affected area shall have access to voice/SMS and data services regardless of any reasons including but not limited to non-payment, insufficient balance during disaster.
17. TSPs and BPC shall submit daily reports about their networks to the National Coordination Committee and the affected Dzongkhag Coordination Committee.
18. DITT shall provision the use of South Asia Satellite for emergency communications during disaster if the terrestrial network is damaged.

Specific Roles and Responsibilities of concerned agencies during disaster is given in the following table. There are also few disaster preparedness and responsive actions that must be taken up by some of the agencies which are highlighted in the table below:

S #	Name of Agencies	Roles and Responsibilities during and after Disasters.
1	DITT	1. Represent in NCC. 2. Provision South Asia Satellite to be used for emergency communications during disaster if the terrestrial network is damaged, in consultation with TSPs, BBS, BICMA. 3. Operation and Maintenance of VSAT network 4. Liaise and Follow up with Dzongkhag ICTOs/ICTAs on the health status of VSATs installed across the country
2	BPC	1. Represent in NCC/DCC. 2. Set up equipment charging stations at disaster affected areas for the general public. 3. Adopt appropriate measures to increase the reliability and resiliency of the National Fiber Network. 4. Establish a Business Continuity Plan (BCP) for Disaster.

3	BICMA	1. Represent in NCC 2. Ensure adoption of measures by Telcos/ISPs and BPC. 3. Ensure that Telcos carry out their assigned responsibilities
3	DDM, MoHCA	1. Represent in NCC/DCC 2. Activate NEOC 3. Identify Disaster focal from Dzongkhag/Drungkhag/Gewog 4. Establish an Emergency Operation Center in the disaster affected Dzongkhag. 5. Prioritize mobile numbers of concerned officials of RGOB.
4	TSPs	1. Represent in NCC and DCC. 2. Adopt appropriate measures to increase the reliability and resiliency of the Telecommunication Network. 3. Establish a Business Continuity Plan (BCP) for Disaster. 4. Infrastructure sharing with other TSPs for sharing resources to provide telecommunication services during disaster in the disaster affected areas. 5. Submit daily reports about their networks to the National Coordination Committee and the Dzongkhag Coordination Committee. 6. Provide their Disaster Response Task Force with required emergency communication equipment at all Dzongkhags. 7. Broadcast messages, in close consultation with National & Dzongkhag Coordination Committee, to all its subscribers using SMS or other means. 8. Ensure that its subscribers have access to voice/SMS in disaster affected areas and data services regardless of any reasons including but not limited to non-payment, insufficient balance during disaster. 9. Establish Ground Segments for SAS in 3 regions for Domestic Redundancy (Voice) and 1 Ground Segment in International Internet Gateway for International Redundancy (Voice). 10. Establish Portable VSAT in the disaster affected area if the terrestrial communication network is damaged 11. TSP Disaster Response Task Force shall be responsible in immediate provisioning of emergency communication and restoration of communication services in disaster affected areas.

5	Dzongkhag ICTOs/ICTAs/Gewog focal	1. Represent in DCC 2. Report to DCC/NCC 3. Maintain health, Operation and Maintenance of VSATs installed at Dzongkhags and gewogs
6	National Coordination Committee	1. Activate NCC immediately after disaster 2. Discuss and take stock of the situation at National Level
7	Dzongkhag Coordination Committee	1. Activate DCC in the disaster affected Dzongkhag(s) immediately after disaster 2. Discuss and take stock of the situation at National and at the affected Dzongkhag. 3. Report to NCC/DDMC

Table 1*: Roles and Responsibilities of concerned agencies before/during/after disaster*

CHAPTER 3. INSTITUTIONAL STRUCTURE

Institutional Structure:

1. Disaster Management Act of Bhutan 2013 addresses disaster management by establishment of Disaster Management Committee at National and Dzongkhag Levels - National Disaster Management Authority (NDMA) and Dzongkhag Disaster Management Committee (DDMC) at the National and Dzongkhag Levels respectively to mobilize the requisite assistance to the affected areas and give directions/advisories to the central ministries/agencies as also to the Dzongkhags, Dungkhags, Gewogs and Thromdes to summon their resources and take necessary steps to meet the exigency. Where appropriate the services of the Armed Forces should be called in.

2. Organisational Set Up for **Telecommunication Sector**

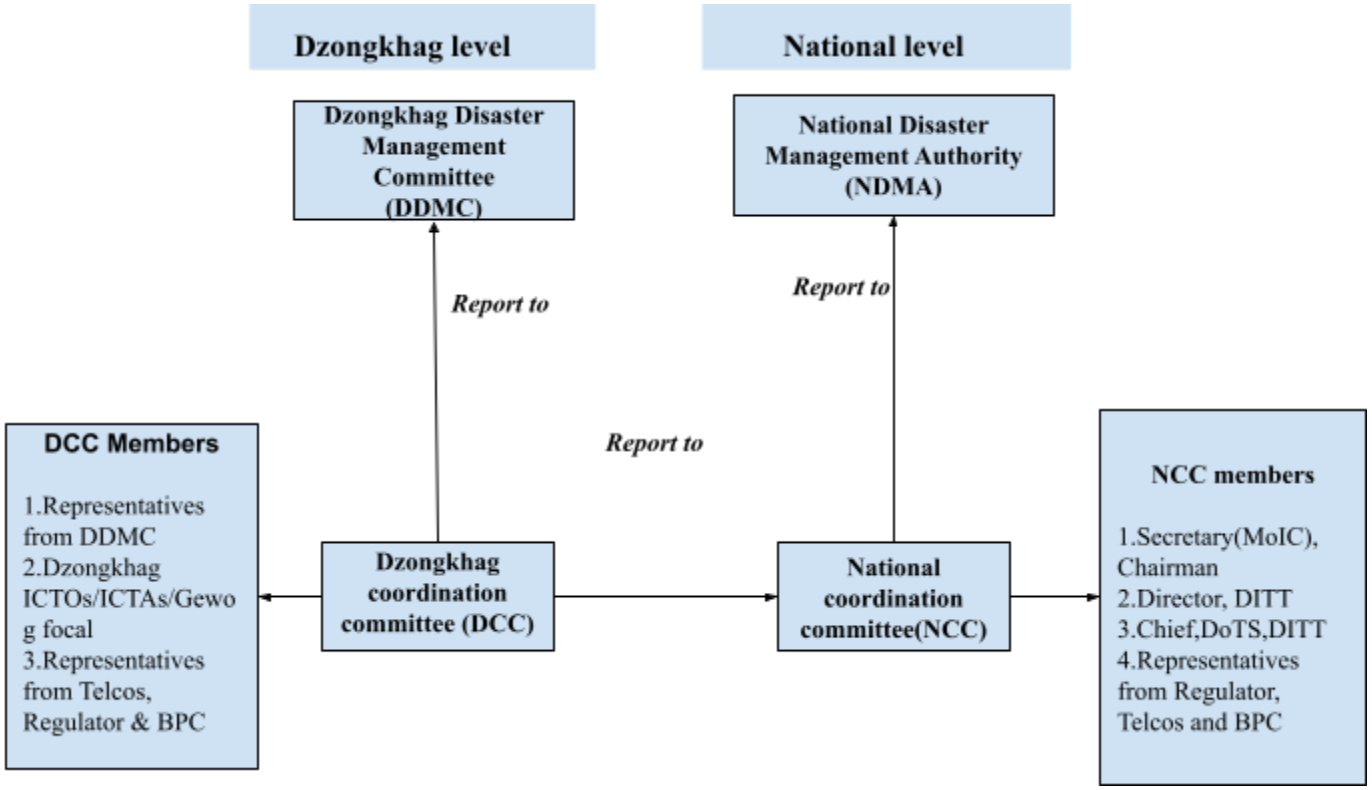
    a. ***National*** Level ***Coordination Committee***: National Coordination Committee will coordinate all disaster related telecommunication activities at National Level. Following members are identified for the committee:
        i. Secretary, MoIC (Chairman)
        ii. Director, DITT, MoIC
        iii. Chief, Division of Telecom and Space (DoTS), DITT, MoIC
        iv. Representatives from Telcos/ISPs, BPC & Regulator (BICMA)

b. ***Dzongkhag*** Level ***Coordination Committee:*** Dzongkhag Coordination Committee will coordinate all disaster related telecommunication activities at Dzongkhag Level:

i. Representative from DDMC
ii. Dzongkhag ICTO/ICTAs/Gewog Focal
iii. Representatives from Telcos & Regulator

Dzongkhag Level Coordination Committee shall also coordinate and monitor all disaster related telecommunication activities at Dungkhag/Gewogs levels.

ORGANISATIONAL STRUCTURE



CHAPTER 4: DISASTER TELECOMMUNICATION EQUIPMENT AS PROPOSED BY TSPs

The description and specification of the proposed Disaster Telecommunication Equipment as proposed by Tashi InfoComm Ltd. is given in *Annexure 1.*

SN	Particulars	Rate in Nu.	Nos.	Total Cost in Nu.
1	*Tecore's multi-technology Network in a Box (Supports GSM, HSPA+ & LTE*	*800,000*	*20*	*16,000,000*

ANNEXURE 1: NETWORK IN A BOX as recommended by TICL

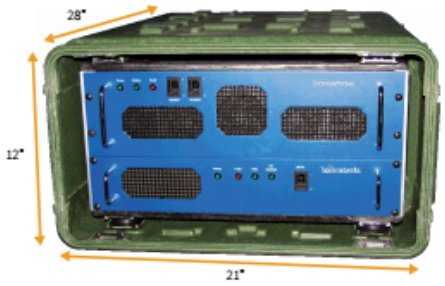
Tecore's multi-technology Network in a Box® (NIB) is the industry's first all-in-one, multi technology, transportable and ready-in minutes network solution capable of supporting LTE and HSPA+ in addition to GSM. By delivering multiple access technologies and streamlining the network through an IP-based architecture, the NIB provides operators with the mostcompact, adaptable, and cost-effective platform for deploying, extending, and evolving their networks.

Tecore has incorporated over 25 years of industry leadership in scalable wireless systems into the design of the NIB architecture. The NIB leverages the patented iCore portfolio of 3GPP-compliant software-defined core network elements, available as a completely integrated core or as individual elements capable of supporting network scalability across multiple locations. The NodeB delivers the 3GPP-compliant access portion of the network. The robust capability set, compact form factor, and cost-effectiveness of the NIB enable a broad range of deployment scenarios for remote and rural operators, larger operators, emergency management, armed forces or peacekeeping missions, and mobile communications networks in transit.

The NIB leverages Tecore's patented multi-technology architecture of the iCore and provides voice, text, and packet data services through standards based network elements developed to relevant 3GPP standards.

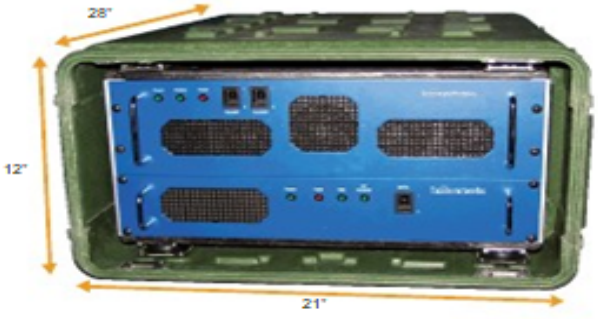
With a flexible architecture supporting network function virtualization and scalability from fewer than 100 to 1,000's of mobile subscribers,the NIB can be deployed cost effectively to meet the customer requirements in multiple deployment scenarios.
The NIB is a robust all-in-one integrated solution (Core Network and RAN) enabling comprehensive management and operations of the network and has been successfully deployed in commercial, government , and private networks on a global basis.

FEATURES AND BENEFITS



- All-in-one network solution, space-optimized as small as 22 cm
- Localized information security including encryption of communications between users and between locations
- Packet data support LTE and HSPA+
- Full suite of voice services, text, and packet data services
- Multiple operation modes including standalone private networks, multi-site, or roaming interconnect with commercial operators networks
- Interworking/connectivity with existing infrastructure such as corporate PBXs and LANs
- Self-Organizing Network (SON) features

7030 Hi Tech Drive Hanover, MD 21076, U.S.A. + 1.410.872.6500 government@Tecore.com www.Tecore.com



Features and benefits

- All-in-one network solution,source-optimized as small as 22cm
- Localized information security including encryption of communications between users and between locations
- Packet data support LTE and HSPA+
- Full suite of voice services,text, and packet data services
- Multiple operation modes including standline private networks, multi-site, or roaming interconnect with commercial operators networks

- interworking/connectivity with existing infrastructure such as corporate PBXs and LANs
- Self-organizing Network(SON) features

Technical Specifications:

Available Technologies	4G LTE, 4G HSPA+ 3G HSPA+ GSM/GPRS/EDGE
Feature Capabilities	Voice(VoLTE),Voice Over IP (VOIP), Messaging, Push- to -Talk(PTT),Internet. IP Data, Self-Organizing Network(SON),Multimedia Broadcast Multi east Service(eMBMS), Commercial Mobile Alert System(CMAS), Earthquake and Tsunami Warning Service(ETWS),View Live Camera Feed, View Real- time Sensor Data,Integrate with C4ISR and Situational, Awareness Platform,GPS Location Capabilities
4G LTE Bands	All 3GPP Bands supported Band 14 for Public Safety
3G/4G Bands	UMTS-1,2,3,4,5,8
2G Bands	GSM-2,3,5,8
Wi Fi	Single (2.4 or 5)
Simultaneous Active Users	Upto 1,000
Provisioned Users	Upto 10,000
Maximum Throughput	
Dimensions	12 x 21 x 28 in
Weight	82 lbs
Power Consumption	400W
Power Input Options	110/240VAC
Transmit Power	Upto 40W per port
Antenna Ports	N-Type;up to 2x2 MIMO

Color Options	Black, Green
Integrated Functional \Capabilities	UMSC/MSC/VLR GGSN/SGSN MME/SAE Gateway HLR/HSS,AuC/AC/AAA SMSC/MMSC RNC, NodeB, eNodeb, BSC, BTS
Interface Capabilities	Standards-based 10/100/1,000 Ethernet Standards-based SIP/VOIP Standards-based T1/E1
RF Capabilities	Omni or multi-sector Pico/Micro/Macro Milli-watts up to 40 watts Output Power

Optional Accessories:

- SIMCards
- Handsets
- Antennas
- Ruggedized Laptop

ANNEXURE 2: RADIO COMMUNICATION NETWORK ARRANGEMENT FOR DISASTER MANAGEMENT as recommended by BTL

General

1. Conventional communication systems of fixed telecommunication and mobile communication networks may be either damaged or the services may be paralyzed due to power outages or congestion during natural disasters like earthquake, flood, windstorm etc. So in this kind of scenario, the alternative communication network that is reliable and resilient, is a must to carry out the disaster rescue and relief operation.
2. Radio communication networks consisting of VHF and HF radio communication systems are found to be a suitable and viable solution. Radio communication networks are independent of terrestrial facilities and infrastructure, hence not vulnerable to any natural disasters. Royal Bhutan Army and Royal Bhutan Police have been using radio

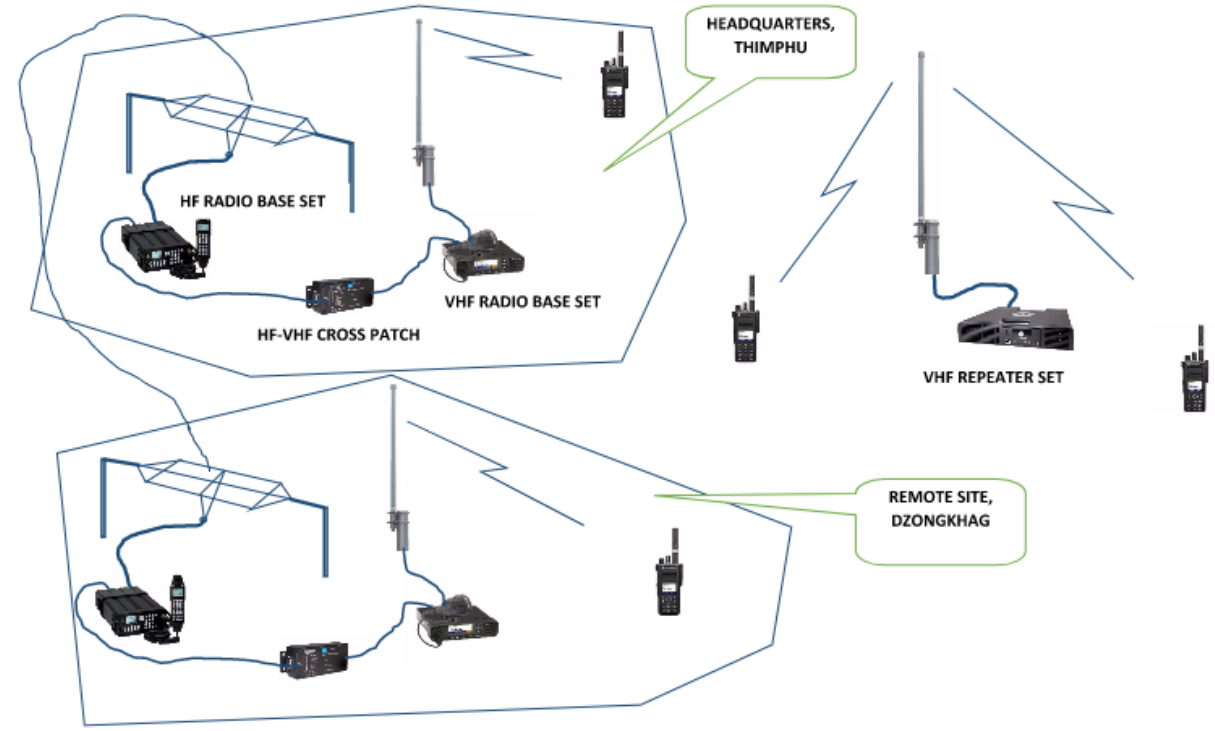
communication systems since their introduction of the services, therefore it is found very suitable and convenient to collaborate with these two organizations in order to set up a nationwide radio communication network on the basis of resources sharing.

3. Presently there are 14 VHF repeater stations (Analog system) in operation for RBA and RBP which are strategically located to provide maximum coverage. These sites are facilitated with a repeater house, solar power system and trained operators manning round the clock.

Proposed Radio Communication Network

4. The proposed radio communication network is a combination of HF radio set for long haul connectivity for remote Dzongkhags to communicate with the Headquarters in Thimphu while VHF radio set is for local communication or regional communication using the repeater stations. However, the VHF radio base set will be integrated with the HF radio base set to provide seamless connectivity for the users with VHF handset to communicate with the Headquarters who will also be in VHF handset without hassle of coming to the radio base station. The pictorial depiction of radio network is as given below:-

DEPICTION OF RADIO COMMUNICATION NETWORK COMPOSED OF INTEGRATED HF-VHF RADIO SETS AND VHF REPEATER SET

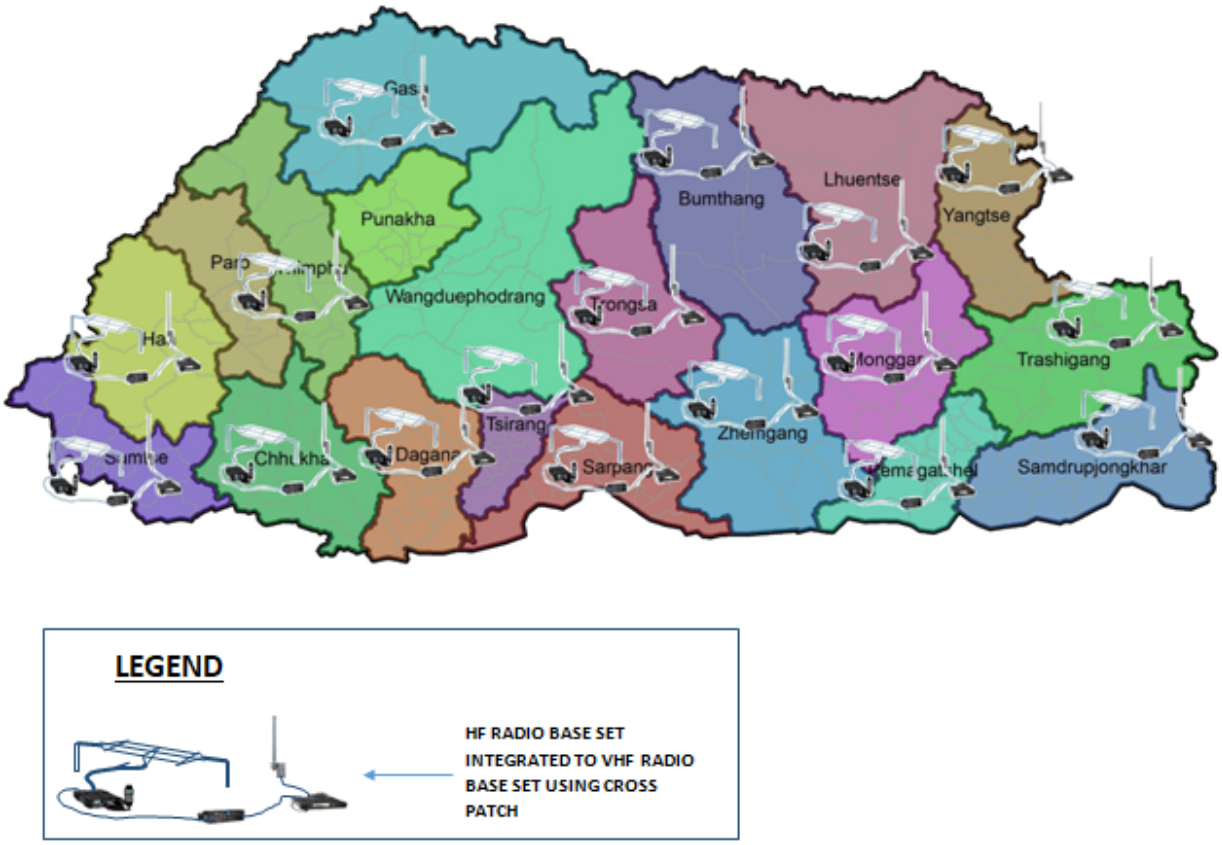


5. Besides the existing 14 VHF repeater stations, five additional new VHF repeater stations have to be installed at the Microwave stations of Bhutan Telecom. Therefore, there are 19 VHF repeater stations in total spread across the country. These repeater stations will be used for local communication, between Gewog to Dzongkhag or Dzongkhag to Headquarters depending on coverage. The detail of location of repeater stations with rough coverage is as tabulated below:-

SN	Repeater Station	Dzongkhag	Coverage	Jurisdiction	Remarks
1	Tharana	Thimphu	Thimphu, Punakha, Part of Gasa and Wangdiphodrang	RBP	
2	JJ Peak	Paro	Paro, Part of Haa and Chhukha	RBP	
3	Chelela	Paro	Haa, Paro	BT	New
4	Takti	Chhukha	Chhukha, and Part of Dagana and Samtse	RBA	
5	Saurani	Samtse	Samtse	RBA	
6	Pelela	Wangdiphodrang	Part of Wangdiphodrang and Trongsa	BT	New
7	Yotongla	Trongsa	Part of Trongsa and Bumthang	BT	New
8	Thrumshingla	Mongar	Part of Bumthang,Zhemgang, Mongar, Lhuentse	BT	New
9	Korila	Mongar	Mongar,part of Yangtse and Tashigang	BT	New
10	Yongla	Pemagatshel	Pemagatshel,part of	RBA	

			Samdrupjongkhar, and Tashigang		
11	Dewathang	Samdrupjongkhar	Part of Samdrupjongkhar and Nganglam	RBA	
12	Samdrupcholing	Samdrupjongkhar	Part of Samdrupjongkhar	RBA	
13	Jomotshangkha	Samdrupjongkhar	Part of samdrupjongkhar	RBA	
14	Nganglam	Pemagatshel	Part of Pemagatshel	RBA	
15	Panbang	Zhemgang	Southern part of Zhemgang	RBP	
16	Tamala	Zhemgang	Northern part of Zhemgang and part of Trongsa	RBA	
17	Darachu	Tsirang	Part of Tsirang and Sarpang	RBA	
18	Setipokhra	Tsirang	Part of Dagana and Tsirang	RBA	
19	Lhamoizingkha	Dagana	Southern part of Dagana	RBA	

6. The illustration of the location of the above mentioned 19 VHF digital repeater stations that are spread across the country is shown in the map below:-



MAP: Location of the VHF Repeater Stations (19 VHF Repeater Stations spread across the country)

In order to connect Dzongkhags to the Headquarters in Thimphu, there are 17 HF (High Frequency) radio stations to be installed. The long haul connectivity of HF radio system will be installed at the Dzongkhag Police stations to be manned by the RBP personnel.The HF radio set will be integrated with VHF radio base station using the HF-VHF cross patch device. However, its use will be purely for disaster management. The local field user will be using a VHF radio handset to connect to the VHF radio base station, and it will transmit the incoming VHF signal to the HF transceiver via cross patch. The HF radio set will further transmit to the Headquarters HF radio station. At the Headquarters, the HF radio set will transmit the incoming HF signal to the VHF base station via cross patch and then to the designated personnel in VHF radio handset. The following table shows the details of the HF radio station and VHF radio base stations to be established at various Dzongkhags.

SN	Dzongkhag	HF Radio Set	VHF Radio Base set	Cross Patch Device
1	Thimphu	1	1	1
2	Gasa	1	1	1
3	Haa	1	1	1
4	Chhukha	1	1	1
5	Samchi	1	1	1
6	Trongsa	1	1	1
7	Bumthang	1	1	1
8	Mongar	1	1	1
9	Lhuntsi	1	1	1
10	Tashiyangtsi	1	1	1
11	Tashigang	1	1	1
12	Pemagatshel	1	1	1
13	Tsirang	1	1	1
14	Dagana	1	1	1
15	Sarpang	1	1	1
16	Zhemgang	1	1	1
17	Samdrupjongkhar	1	1	1

7. Since the analog VHF radio system is in the process of phasing out and shortly its manufacturing may get terminated permanently, therefore the proposed VHF radio system is the digital VHF radio system. The digital VHF repeater set is providing two channels, thus Disaster Management will be available with a dedicated independent channel to be used on a permanent basis.

Cost Estimate:

The prices for the HF and VHF radio equipment are sought from the local vendors (DotCom and Ugen Trading House) for the purpose of cost estimation. The cost estimate only includes the radio equipment required to set up the radio communication network and ***it does not include the user handsets and mobile radio sets.*** The detail cost estimate, **exclusive of taxes,** for the proposal of setting up of integrated HF-VHF base stations in 17 locations, 19 VHF repeaters stations, power supply unit and miscellaneous is as given below:-

SN	Items	Rate(Nu)	Quantity	Amount(Nu)

1	Motorola SLR 8000 , 64 Ch, VHF 136-174 MHz, 100 W Repeater with inbuilt power supply Features Highlight: -64 Channels, 1-100W transmit power(100% continuous cycle), Supports all MOTOTRBO system architectures, Supports 2 simultaneous voice paths in digital TDMA mode, Remote Diagnostics ALarms and Controls(RDAC), Internal Power Supply, Rack Mountable Including: Duplexer with duplexer cable, Pre-selector, Power cable DC GA01567AA,12dbi Omni directional fiberglass antenna, Lightning Arrestor, RG cable 30 meters	11,50,000	24	27,600,000
2	Mobile Radio for Base Station Motorola MotoTrbo XIR M8668i mobile radio(color Display with BT/GPS/WIFI) 45 W,1000 CH, with standard compact microphone, standard bracket, standard power cable and accessory connector kit Including: 9dbi Omni directional fiberglass antenna, Power supply unit, Lightning Arrestor, RG-8 cable 30 Meters, RF connectors	1,60,500	22	3531000
4	Programing cable and software copy for SLR 8000	5500	5	27500
5	Programming cable and software copy for M8600i series	5500	5	27500
6	CODAN HF Base Station with power supply unit, Antenna, Lightning arrestor, microphone, Antenna feeder and connectors.	8,45,000	**22**	**18,590,000**
7	CODAN 3031 CrossParch with connectors	150000	**22**	**3300000**
8	SMF 12 V 200AH Battery	24,000	**50**	**12,00,000**
9	Inverter 2500 KVA	25,000	**7**	**175,000**
10	Copper wire 3/20mm(per roll)	1500	**5**	**7500**
11	Miscellaneous			**10.00000**
12	Total Amount			**54,491,000**

13	Installation cost(2% of the Total cost)			**1109820**
14	GRAND TOTAL AMOUNT(Nu)			**56600820**

The detail breakdown of cost estimate in Dzongkhag wise is as given below:

Dzongkhag	HF radio Set		VHF repeater		VHF radio base set		Crosspatch device		SMF bty 12V200Ah		Inverter 2500watt		Cu wire 3/20	Prgm Cable	Turbo care	Misc	Total	Installation (2%)	Grand total
	Qty	Amt (Nu)	Qty	Amt (Nu)	Qty	Amt (Nu)	Qty	Amt (Nu)	Qty	Amt (Nu)	Qty	Amt (Nu)	Amt	Amt	Amt	Amt	Amt		
Thimphu	1	845000	1	11,50,000	1	160500	1	150000						55000	32500	1000000	3393000		
Haa	1	845000	1	11,50,000	1	160500	1	150000	10	240000	1	25000	1500				2572000		
Gasa	1	845000			1	160500	1	150000									1155500		
Chhukha	1	845000	1	11,50,000	1	160500	1	150000									2305500		
Samchi	1	845000	1	11,50,000	1	160500	1	150000									2305500		
Trongsa	1	845000	1	11,50,000	1	160500	1	150000	10	240000	1	25000	1500				2572000		
Tsirang	1	845000	1	11,50,000	1	160500	1	150000									2305500		
Dagana	1	845000	1	11,50,000	1	160500	1	150000									2305500		
Sarpang	1	845000	1	11,50,000	1	160500	1	150000									2305500		
Bumthang	1	845000	1	11,50,000	1	160500	1	150000	10	240000	1	25000	1500				2572000		
Mongar	1	845000	1	1150000	1	160500	1	150000	10	240000	1	25000	1500				2572000		
Lhuntsi	1	845000			1	160500	1	150000									1155500		
Tashiyangtsi	1	845000			1	160500	1	150000									1155500		
Tashigang	1	845000			1	160500	1	150000									1155500		
Pemagatshel	1	845000	2	2300000	1	160500	1	150000									3455500		
Samdrupjongkhar	1	845000	3	3450000	1	160500	1	150000									4605500		
Zhemgang	1	845000	2	2300000	1	160500	1	150000									3455500		
Wangdiphodrang			1	11,50,000					10	240000	1	25000	1500				1416500		
Paro			1	11,50,000													1150000		
Spares	5	4225000	5	5750000	5	802500	5	750000			2	50000					11577500		
Total	22	18590000	24	27600000	22	3531000	22	3300000	50	1200000	7	175000	7500	55000	32500	1000000	55491000	1109820	**56,600,820**

ANNEXURE 3:SOUTH ASIA SATELLITE (SAS) PROJECT (Operational)

The Indian Space Research Organization (ISRO), Government of India (GoI), launched South Asia Satellite (SAS) on 5th May 2017. The South Asia Satellite (SAS) is a geostationary communication satellite, located at 97.3°E longitude, with coverage over Afghanistan,

Bangladesh, Bhutan, India, Maldives, Nepal and Sri Lanka. The capacity of the satellite is proposed to be utilised for supporting services/applications specific to the individual member countries as well as common to all the countries. The utilisation of the satellite capacity is planned to benefit the people of the country and to strengthen the cooperation among other member countries.

The Department has implemented the following activities/applications using SAS:

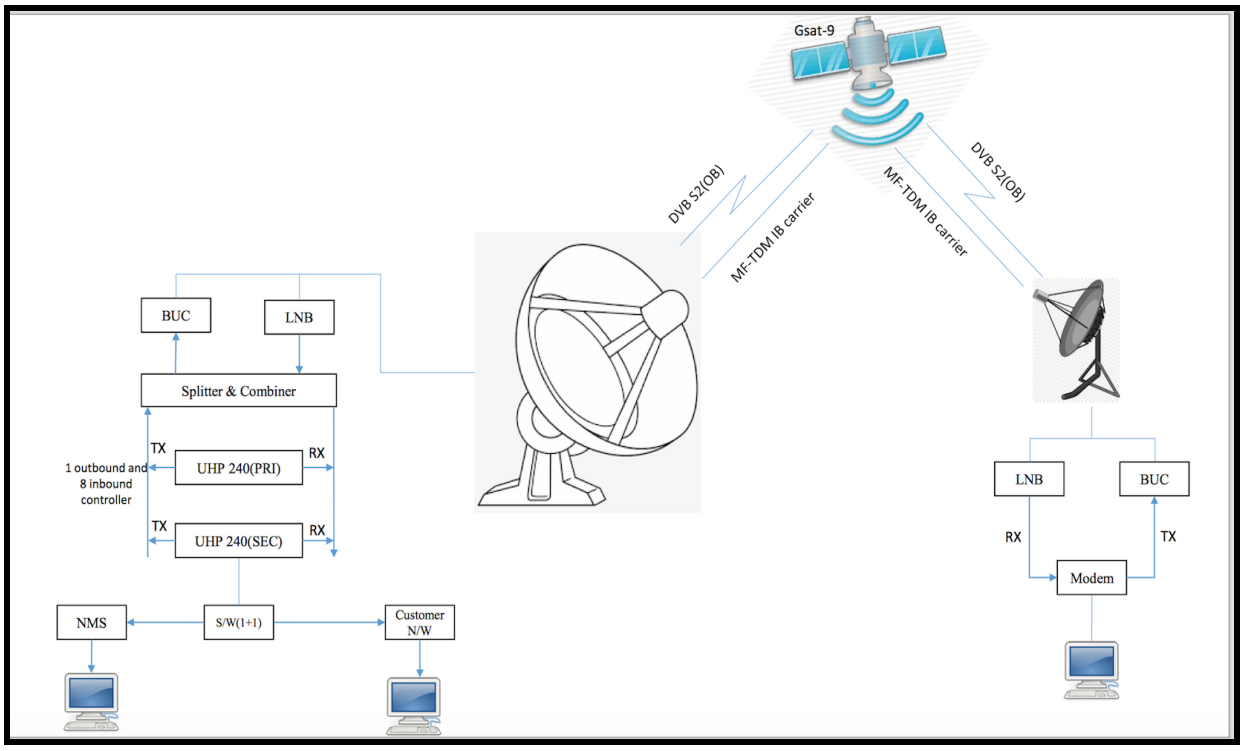
1. Digital Broadcasting: Successfully uplinked 2 BBS TV channels, 2 BBS radio channels and 2 Kuzu FM Radio channels.Consumers will have to purchase a dish and set top box to receive the BBS channels. TV broadcasting, Digital Satellite News Gathering and radio channels provided through SAS will be instrumental during disasters to disseminate information.

2. Disaster Management Support: SAS will be used for emergency communications during times of disaster and emergencies in affected areas to coordinate rescue efforts. The earth station (HUB) at BBSC (HUB) shall provide connectivity to National Emergency Operations Center (NEOC) located at the Department of Disaster Management (DDM) and will be connected to other Dzongkhags/gewogs via VSATs. The department has installed 81 Very Small Aperture Terminal (VSAT) in National Emergency Operation Center (NEOC), 3 regions of Bhutan, 20 district headquarters and 60 gewogs covering the whole nation.The network is capable of Voice Over Internet Protocol (VoIP) and video conferencing services and will also be used for day-to-day communications. This will ensure proper functioning of the network and equipment at any given time.Training and drills will be carried out from time to time to check the health of the equipment and competency of the relevant technical personnel on the ground to manage the onsite equipment.DITT has also provisioned two transportable VSATs that will be used to provide basic services mainly voice at disaster sites.The installation of VSATs were completed and operational from October 22, 2019.

3. Backhaul connectivity:The department along with Telecommunications Service Providers has also installed 6 VSATs in three regions (Western, Central and Eastern regions). Each terminal is capable of receiving and transmitting 2Mbps of voice/data traffic. The VSATs installed shall be utilized to provide emergency voice communications in affected areas and to provide backup connectivity for both domestic and International links for first responders using the Telecommunications networks during disasters.
4. Connecting Offgrid Gewogs: Very Small Aperture Terminals (VSATs) have been installed in the three off-grid gewogs (Soe, Naro and Lingzhi under Thimphu

Dzongkhag) to provide BBS 1 and 2 services and Internet services.

VSAT Network of SAS



ANNEXURE 4: TECHNICAL WORKING GROUP MEMBERS AND DZONGKHAG FOCAL

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