

# Vehicle-mounted Transportable Mobile Base Station and Backhaul Link for Disaster Relief Operation

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## 1. Introduction

Natural disasters like earthquakes and tsunamis have seriously affected people's lives in many parts of the world, and ITU is now involved in many activities and studies relating to disaster mitigation and relief operations, such as the ITU workshop on "Disaster relief systems, network resilience and recovery". In the field of radiocommunication, ITU-R (the ITU Radiocommunication Sector) recently enhanced its relevant Recommendation<sup>1</sup> taking into account the scope of two Resolutions<sup>2,3</sup> so as to include a new application of disaster relief operations, which has been used in NTT DOCOMO's network.

Japan is known to be prone to large earthquakes such as the Great East Japan Earthquake of March 11, 2011, which also caused a huge tsunami. This devastating natural disaster destroyed or damaged much of the telecommunication infrastructure in the affected area, rendering it unusable.

For the quick and efficient recovery of cellular phone services in disaster-hit areas, DOCOMO has developed and introduced a number of vehicle-mounted mobile base stations, which operate in

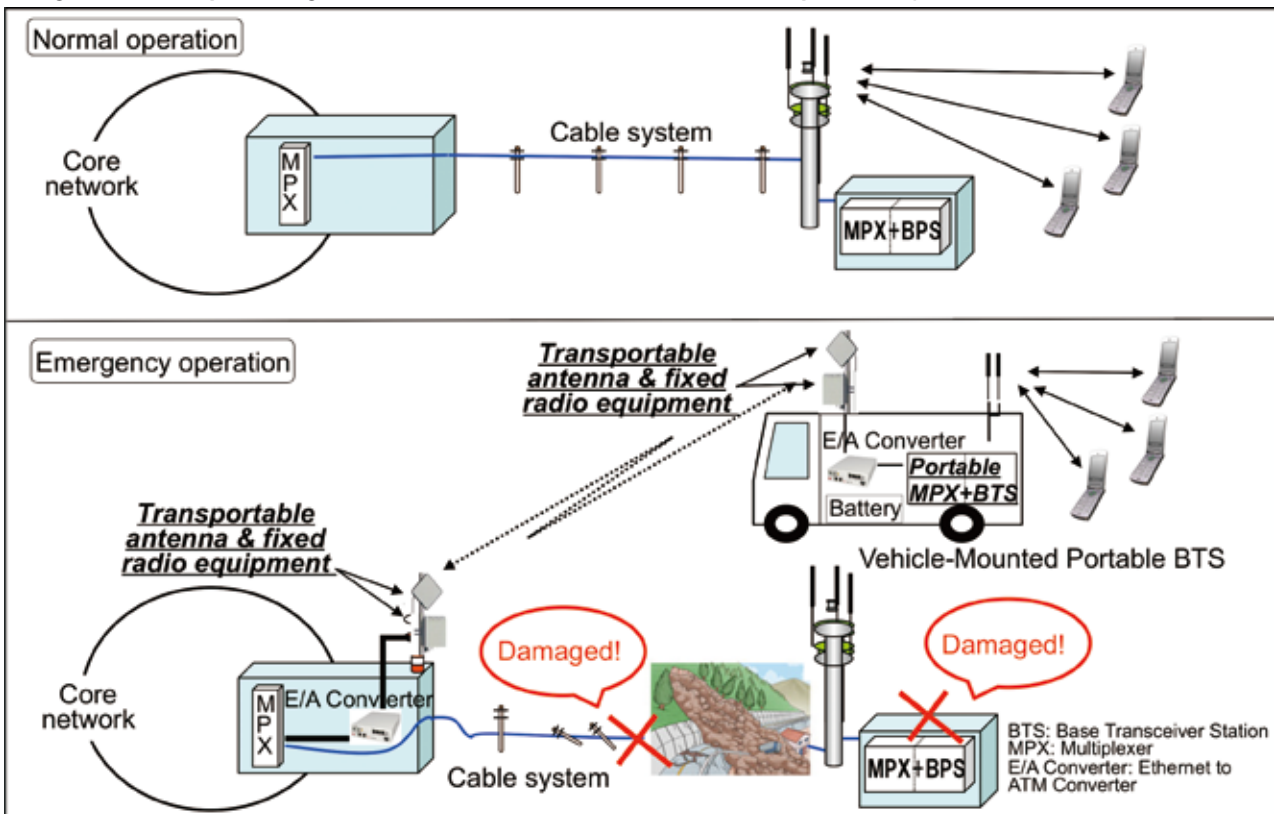
combination with transportable fixed wireless equipment for the backhaul link.

## 2. Disaster countermeasures for NTT DOCOMO's network

To ensure the availability of telecommunication services in the event of a disaster, we aim to build a disaster resilient telecommunication network by improving the reliability of our infrastructure systems (with particular regard to emergency communications) so that our telecommunication services can be recovered quickly.

To achieve better reliability, we have installed backup equipment and links, and we have reinforced our facilities, buildings and towers to make them more earthquake resistant. For emergency communications, we have adopted a call priority service that can be used in disaster situations to safeguard communications to and from regional municipal offices, and network control procedures that enable networks to cope effectively with emergency traffic.

Figure 1: Conceptual diagram of the vehicle-mounted disaster relief operation system



**Photo 1: DOCOMO's vehicle-mounted transportable system**



**Table 1: Main specifications of transportable FWS for disaster relief operation**

Frequency band *	Capacity	Interface	Antenna type	Transmission distance
Upper 4 GHz band (4.92-5.0 GHz)	7-35 Mbit/s	100BASE-TX**	36 cm flat panel	around 10 km
18 GHz band (17.85-17.97 / 18.6 18.72 GHz)	155.52 Mbit/s	STM-1	0.4-1.2 m diameter dish	around 3.5 km

\*: The RF channel is selected within the assigned frequency band.

\*\* : Connected to the MPX (multiplexer) via Ether/ATM converter.

**Table 2: Example parameters of transportable mobile base station**

Frequency band	Bandwidth (Carrier number)	Antenna type
800 MHz (830-845/875-890 MHz)	15 MHz (3 carriers) *	Corner reflector (40 cm x 37 cm)
2 GHz (1 940-1 960/2 130-2 150 MHz)	20 MHz (4 carriers) *	Corner reflector (23 cm x 42 cm)**

\*: 5 MHz bandwidth per carrier.

\*\* : Maximum aperture.

For the quick recovery of telecommunication services, we have prepared both hardware and software measures for disaster recovery. The former consists of vehicle-mounted transportable systems equipped with mobile base station and backhaul links, together with portable generators. For the latter, we have developed procedures for emergency network operations, organized disaster administrative offices, and instigated periodic disaster training.

This article describes our vehicle-mounted transportable systems.

### 3. Vehicle-mounted transportable mobile base station with fixed wireless backhaul links for disaster relief operations

A widespread disaster is liable to disable not only mobile base stations but also the access links to these base stations (using either a fixed wireless system (FWS) or a cable system). Relief vehicles should therefore have both a FWS backhaul link and a mobile base station so that both types of portable equipment can be easily interconnected in the affected area. These operating conditions make it possible to restore the telecommunication infrastructure effectively and to promptly restore services to end-users.

Figure 1 shows a conceptual diagram of the vehicle-mounted disaster relief operation system for this purpose.

As an example, Photo 1 shows such a vehicle-mounted system for DOCOMO's network. This vehicle-mounted system can be easily deployed in the disaster-hit area.

### 4. Technical system description

The transportable backhaul FWS uses different frequency bands depending on the interference conditions and/or the transmission distance required in the disaster-hit area. In particular, the upper 4 GHz and 18 GHz band systems are designed for use by compact lightweight equipment, which is easy

to install on vehicles. The main specifications of these systems are shown in Table 1.

The main specifications of the transportable mobile base station that interconnects with the transportable FWS are shown in Table 2.

#### References

- 1 Recommendation ITU-R F.1105-3: Fixed wireless systems for disaster mitigation and relief operations
- 2 Resolution ITU-R 53-1: The use of radiocommunications in disaster response and relief
- 3 Resolution ITU-R 55-1: ITU studies of disaster prediction, detection, mitigation and relief

### Cover Art



**Fuji sanjurokkei  
Toto Tsukuda oki**  
(The Sea at Tsukuda in Edo,  
from the series 36 Views of  
Mt. Fuji.)

Utagawa Hiroshige (1797-1858)

Woodblock print:  
Courtesy of Sakai Kokodo Gallery