ETSI TS 103 260-1 V1.1.1 (2015-05)

Satellite Earth Stations and Systems (SES);
Reference scenario for the deployment of emergency communications;
Part 1: Earthquake

Reference

DTS/SES-00341-1

Keywords

emergency, satellite

ETSI

650 Route des Lucioles
F-06921 Sophia Antipolis Cedex - FRANCE

Tel.: +33 4 92 94 42 00   Fax: +33 4 93 65 47 16

Siret N° 348 623 562 00017 - NAF 742 C
Association à but non lucratif enregistrée à la
Sous-Préfecture de Grasse (06) N° 7803/88

Important notice

The present document can be downloaded from:
http://www.etsi.org/standards-search

The present document may be made available in electronic versions and/or in print. The content of any electronic and/or print versions of the present document shall not be modified without the prior written authorization of ETSI. In case of any existing or perceived difference in contents between such versions and/or in print, the only prevailing document is the print of the Portable Document Format (PDF) version kept on a specific network drive within ETSI Secretariat.

Users of the present document should be aware that the document may be subject to revision or change of status. Information on the current status of this and other ETSI documents is available at
http://portal.etsi.org/tb/status/status.asp

If you find errors in the present document, please send your comment to one of the following services:
https://portal.etsi.org/People/CommiteeSupportStaff.aspx

Copyright Notification

Contents

Intellectual Property Rights

IPRs essential or potentially essential to the present document may have been declared to ETSI. The information pertaining to these essential IPRs, if any, is publicly available for **ETSI members and non-members**, and can be found in ETSI SR 000 314: *"Intellectual Property Rights (IPRs); Essential, or potentially Essential, IPRs notified to ETSI in respect of ETSI standards"*, which is available from the ETSI Secretariat. Latest updates are available on the ETSI Web server (http://ipr.etsi.org).

Pursuant to the ETSI IPR Policy, no investigation, including IPR searches, has been carried out by ETSI. No guarantee can be given as to the existence of other IPRs not referenced in ETSI SR 000 314 (or the updates on the ETSI Web server) which are, or may be, or may become, essential to the present document.

Foreword

This Technical Specification (TS) has been produced by ETSI Technical Committee Satellite Earth Stations and Systems (SES).

The present document is part 1 of a multi-part deliverable covering the reference scenario for the deployment of emergency communications, as identified below:

Part 1: "Earthquake";

Part 2: "Mass casualty incident in public transportation".

Modal verbs terminology

In the present document "**shall**", "**shall not**", "**should**", "**should not**", "**may**", "**may not**", "**need**", "**need not**", "**will**", "**will not**", "**can**" and "**cannot**" are to be interpreted as described in clause 3.2 of the ETSI Drafting Rules (Verbal forms for the expression of provisions).

"**must**" and "**must not**" are **NOT** allowed in ETSI deliverables except when used in direct citation.

Introduction

Major emergencies or disasters may result in a need for additional resources in local telecommunications networks, especially if they are damaged or overloaded, in order to maintain or enhance the ability of emergency services to respond and coordinate their activities effectively. Satellites can play a role in replacing or supplementing other telecommunications links in these scenarios. For example satellite systems can provide:

- broadband and secure communication facilities anywhere/anytime in locations where no other facilities are available; and
- temporary replacement of broken/saturated infrastructures by means of backhauling;
- fast deployment of temporary communication networks in emergency situations.

Hence a basis for requirements for such links needs to be established, and it is intended that the scenarios defined here may be used for this purpose at a later stage.

The present document is also a response to EC mandate M/496 [i.12], specifically dossier 9 "Disaster Management" part 2: "Emergency Telecommunication Services" which aims to support standardization for the optimal needs of the emergency responders.

The use of satellite communication in disasters is described in ETSI TS 102 181 [i.1].

In the present document clause 4 defines the scenario, in terms of physical effects, what actions need to be taken by which actors (who will have communications needs) and what their tasks are. This definition constitutes a basis for clause 5, which defines the nature of information exchanges needed. Clause 6 defines the detailed parameters relating to positions and movements of scenario actors, which are intended to forma basis for modelling of the scenario response topology. These parameters are generic enough to be applicable or adapted to similar but different scenarios, and may eventually be used to model the requirements for actors' communication exchanges, and associated capacities.

1 Scope

The present document defines an earthquake disaster scenario. The scenario includes definition of the responders involved and their gross communication needs without specifying the network technologies involved. Finally the topology modelling of the responders involved is defined, in terms of their disposition in the Incident Area, their time evolution and their movements (if any).

The scenario is not generic in the sense of representing all emergencies of this type, but is intended to be a "typical" example, and thus a reference in order to allow evaluation and dimensioning of required overall emergency telecommunications.

The regulations and operating procedures for Emergency Responses vary between countries e.g. the organization responsible for the emergency can be the police, the fire and rescue organization, a dedicated organization for this purpose (e.g. civil protection) or others.

The response services defined are limited to safety-related services (i.e. not security such as law enforcement).

Casualties and personnel not active in the rescue operations (e.g. the press) have been excluded, as their communications needs are not covered by the emergency communication systems considered here, but their needs are considered in ETSI TR 102 410 [i.2].

2 References

2.1 Normative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the reference document (including any amendments) applies.

Referenced documents which are not found to be publicly available in the expected location might be found at http://docbox.etsi.org/Reference.

NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long term validity.

The following referenced documents are necessary for the application of the present document.

Not applicable.

2.2 Informative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the reference document (including any amendments) applies.

NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long term validity.

The following referenced documents are not necessary for the application of the present document but they assist the user with regard to a particular subject area.

[i.1] ETSI TS 102 181: "Emergency Communications (EMTEL); Requirements for communication between authorities/organizations during emergencies".

[i.2] ETSI TR 102 410: "Emergency Communications (EMTEL); Basis of requirements for communications between individuals and between individuals and authorities whilst emergencies are in progress".

[i.3] ETSI TR 102 643: "Human Factors (HF); Quality of Experience (QoE) requirements for real-time communication services".

[i.4] Recommendation ITU-T G.114: "Series g: Transmission systems and media, digital systems and networks. One-way transmission time".

[i.5] European Union Handbook on assistance intervention in the Frame of community mechanism for the cooperation of civil protection.

[i.6] United Nations Disaster Assessment and Coordination UNDAC Field Handbook.

[i.7] Hamdi Monia, Franck Laurent and Lagrange Xavier: "Topology modelling and network partitioning: an application to forest firefighting". Radio science bulletin, 2013, pp.8-20.

[i.8] Franck Laurent, Hamdi Monia and Giraldo Rodriguez Carlos: "Topology modelling of emergency communication networks: caveats and pitfalls"; The International Emergency Management Society Workshop 2011, The International Management Society, 22-23 June 2011, Nîmes, France, 2011.

[i.9] Aschenbruck Nils, Gerhards-Padilla Elmar and Martini Peter: "Modelling mobility in disaster area scenarios". Performance Evaluation, 2009, vol. 66, n 12, p. 773-790.

[i.10] Schwamborn Matthias, Aschenbruck Nils and Martini Peter: "A realistic trace-based mobility model for first responder scenarios". Proceedings of the 13th ACM international conference on Modeling, analysis, and simulation of wireless and mobile systems, Bodrum, Turkey, October 17-21, 2010.

[i.11] Huang Ying, He Wenbo, Nahrstedt Klara and Lee Whay C.:"CORPS: Event-driven mobility model for first responders in incident scene". Proceedings of the IEEE Military Communications Conference (MILCOM08), November 2008, pp. 1-7.

[i.12] EC mandate M/496: "M/496 Mandate addressed to CEN, CENELEC and ETSI to develop standardisation regarding spaceindustry (phase 3 of the process)".

3 Definitions and Abbreviations

3.1 Definitions

For the purposes of the present document, the following terms and definitions apply:

casualty: individual in the incident area and requiring evacuation including those who are:

(i) non-injured, but affected,

(ii) injured and treated on site,

(iii) injured and needing treatment off-site (medevac), and

(iv) deceased.

common operating picture (COP): single display of information collected from and shared by more than one agency or organization that contributes to a common understanding of a situation and its associated hazards and risks along with the position of resources and other overlays of information that support individual and collective decision making [i.5]

control centre: operations centre from which the management and co-ordination of the response by each emergency service to an emergency are carried out [i.5]

emergency control centre (ECC): facilities used by emergency organizations to handle rescue actions in response to emergency calls ETSI TS 102 181 [i.1]

emergency service: service, recognized as such by the member state, that provides immediate and rapid assistance in situations where there is a direct risk to life or limb, individual or public health or safety, to private or public property, or the environment but not necessarily limited to these situations [i.1]

field emergency control centre (FECC): facilities used by emergency service organizations to manage, command, coordinate, and control rescue works and logistics in the incident area

hazard area: area with obvious or supposed threats to physical/psychological health, properties, and/or environment

holding area: generic term for an area to which resources and personnel not immediately required at the scene or being held for further use, can be directed to standby [i.5]

incident area: area where the incident occurred, and/or the area which needs communication coverage to manage the response implemented ETSI TS 102 181 [i.1]

incident commander: nominated officer with overall responsibility for management, command, coordination, and control of rescue and relief works in the incident area

local emergency management authority (LEMA): local organization within the public services fully or partly responsible for emergency preparedness and handling of incidents (based on ETSI TS 102 181 [i.1])

mass casualty incident (MCI): incident (or series of incidents) causing casualties on a scale that is beyond the normal resources of the emergency services [i.5]

non-governmental organization (NGO): organization that is neither run or controlled by a government nor a profit-oriented business

personal protective equipment (PPE): protective clothing, helmets, goggles or other garment designed to protect the wearer's body from injury [i.5]

public safety answering point (PSAP): physical location where emergency calls are received under the responsibility of a public authority ETSI TS 102 181 [i.1]

site incident officer: representative from the affected organization, when an incident occurs within the perimeter of an industrial or commercial establishment, public venue, airport or harbour, to liaise with the emergency management structures [i.5]

triage: assessment of casualties and allocation of priorities by the medical or ambulance staff (based on [i.5])

3.2 Abbreviations

For the purposes of the present document, the following abbreviations apply:

CCP	Casualty Collection Point
CFECC	Coordinating Field Emergency Control Centre
CFEEC	Coordinating Field Emergency Control Centre
COP	Common Operating Picture
DCP	Deceased Collection Point
ECC	Emergency Control Centre
EM-DAT	The International Disaster Database
EMTEL	EMergency TELecommunications
EQ	Earthquake
ET	Emergency Team
ETSI	European Telecommunications Standards Institute
FECC	Field Emergency Control Centre
IC	Incident Commander
ICC	Misprint for ECC
ID	IDentification
IPR	Intellectual Property Right
ITU-T	International Telecommunication Union Telecommunications Sector
LEMA	Local Emergency Management Authority
LPG	Liquefied Petroleum Gas
MCI	Mass Casualty Incident
MIC	Medical Incident Commander
MT	Mid-Term Step
NGO	Non Governmental Organization
PMR	Private Mobile Radio
PPE	Personal protective equipment
PSAP	Public Safety Answering Point
QoE	Quality of Experience
QoS	Quality of Service

SAR	Search and rescue
SatEC	Satellite Emergency Communications Working Group
SECC	Sub Service Emergency Control Room
SES	Satellite Earth Station and Systems
SQ	Scenario Quantities
TCC	Temporary Care Centre
TR	Technical Report
TS	Technical Specification
UMTS	Universal Mobile Telecommunications System
USGS	US Geological Survey

4 Disaster scenario

4.1 General

This clause defines an earthquake (EQ) scenario, firstly in terms of its main constituent events and secondly by its physical consequences. Subsequently the response actions by emergency services to this scenario are defined in terms of the casualties involved, the actors and organizations, overall operating modes, duration and dimensioning factors, etc.

The scenario is used as a basis for the topology model, as defined in clause 6.

The earthquake is over in minutes, whereas the responses may continue for days and weeks. Clause 4.4 below and Annex C provide a set of timelines for the various response actions taken.

The main characteristics of an earthquake in an urban area are:

- Many casualties in the incident area.
- The damage may be distributed over a large geographic area.
- Access limitations (damage to infrastructure).
- The need for emergency services exceeds the available resources.
- Limited local hospital treatment capacities and/or treatment specialities.
- Sparse communication network coverage/capacities, both for PMR and commercial wireless services.

A summary of recent earthquakes and their effects is given in annex A as examples of the scale of events being considered.

4.2 Scenario definition

4.2.1 General

A summary of recent EQ s and their effects is given in annex A as examples of the scale of events being considered.

The disaster scenario is an EQ in an urban area. It is of a magnitude sufficient to cause a multitude of physical effects, such as collapsed buildings, disruption of infrastructure, lack of power, lack of telecommunications, fires, risks of chemical accidents, etc. Each of these incidents may not differ much from isolated similar incidents of this nature, but the added challenge is that the incidents happen at the same time, thus reinforcing the effects and strains on available resources.

The EQ hits a city with a total population of 350 000, positioned among mountains in a coastal area. The number of casualties (individuals within the incident area) is 3 000. The EQ happens on a weekday, at mid-day.

The overall physical disposition of effects of the EQ in the incident area is defined in Figure 4.1.

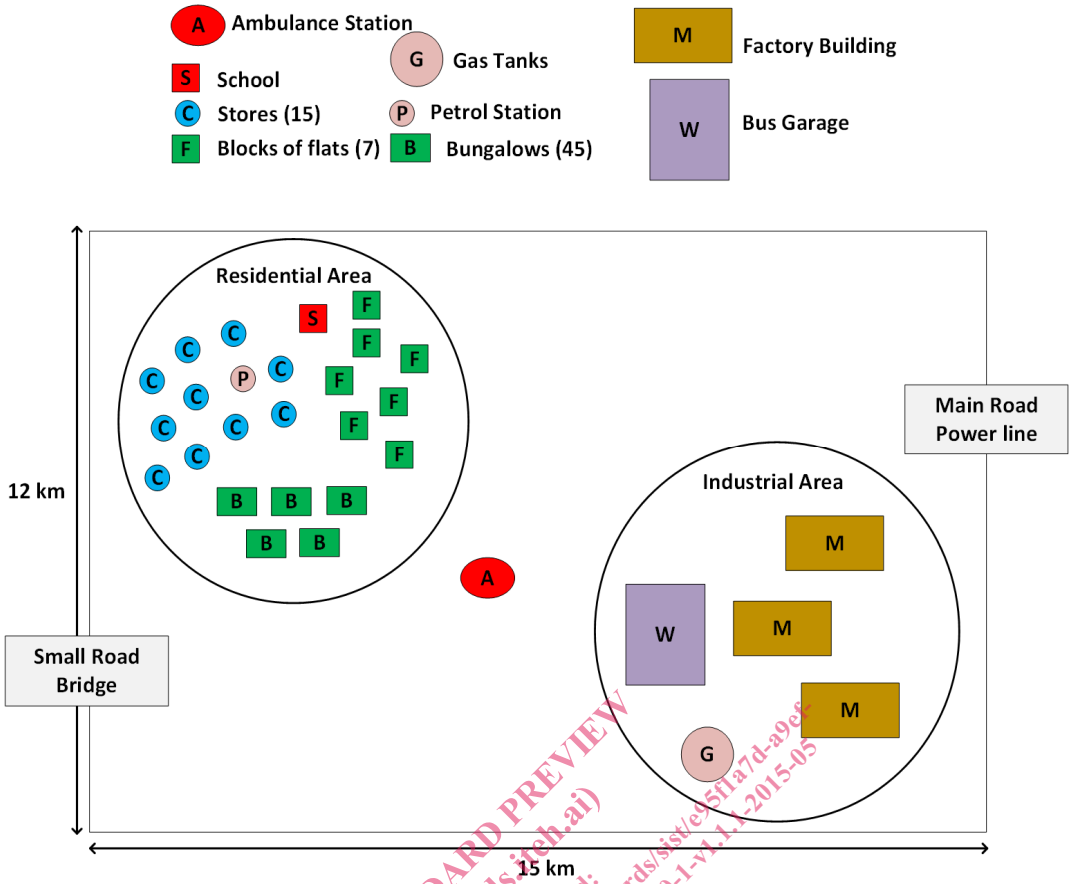

Figure 4.1: Incident area

The distances are:

- Ambulance station to residential area: 3 km
- Ambulance station to industrial area: 2 km
- Ambulance station to entrance small road/ bridge: 6 km

The epicentre of the EQ is at the outskirts of the city. Severe damages, like landslides, collapsed buildings, etc. are limited to an area within a distance of 6 - 8 km from the epicentre.

Outside this area there are limited damages, like broken windows, limited damages to buildings, etc. Hence the incident area is defined as an area 12 x 15 km.

A detailed description of the incident is provided in annex B.

4.2.2 Physical effects

4.2.2.1 Collapse of buildings

There is a large number of buildings in varying state of collapse.

In area A the damages are to domestic structures (blocks of flats) a shopping centre and a school with an enrolment of 350 students and a staff of 100 officers. A total of 1 750 individuals are initially unaccounted for, many of them suspected to be trapped within the buildings, but some may also be out of the area (e.g. at work).

In area B, the damage is primarily to industrial buildings, the total number of individuals in the area at the time of the EQ was 1 500.

4.2.2.2 Fire

There is a fire in a department store in the shopping centre (area A), threatening to spread to other shops as well.

In Area B there is a fire in a bus garage/ workshop.

4.2.3 Disruption of infrastructure

4.2.3.1 Road access

The landslide covers the main road leading into the incident area. Alternative road to the area is via a bridge, which has a weight limit of 3 tons. A result of the limit is that trucks, such as standard fire engines, are unable to enter into the incident area. It is initially unclear whether this bridge has got structural damage.

4.2.3.2 Power

There is a complete loss of power within the incident area. As one of the major power lines pass through the area, there is also a reduced power capacity in the city at large. Some critical facilities, e.g. hospitals, have separate emergency power supply, but others are faced with periodical power cuts.

4.2.3.3 Water supply

Water pipes, both in areas A and B, have been broken, leading to a total loss of water supply.

4.2.3.4 Sanitation

Sewage systems, both in areas A and B, have been broken and are non-functional.

4.2.3.5 Telecommunication

There are widespread damages to telecommunications systems in the incident area. Expert teams are brought in to do repair.

4.3 Tasks and activities

This clause defines the response entities (actors) and their roles within the incident area in handling the disaster. Depending on local/ national organization of services and division of tasks/ responsibilities, the entities involved and their individual areas of work may differ in practice.

In addition to their primary roles, actors may participate in other tasks. The roles will differ between countries, but a typical distribution of roles is given below.

1) Emergency management: setting up of management structures for all involved emergency services, coordination of emergency services, and reporting to the emergency control centre (ECC) and to the local emergency management authority (LEMA) [i.6] and [i.5] leading the coordinating field emergency control centre (CFECC).

2) Fire-fighting: securing the hazard area, fighting fires.

3) Rescue: securing the hazard area, rescuing casualties.

4) Casualty logistics: triage, registration, and treatment of the injured, organizing and conducting medical evacuation out of the incident area, organizing and conducting evacuation of non-injured casualties out of the incident area.

5) Maintenance of public order: documentation.

6) Provisions: providing supplies, shelters and transport.

7) Temporary replacement of destroyed infrastructure/ utilities.

4.4 Disaster response actions

4.4.1 General

The actions of the actors (defined in clause 4.3) in the incident area of this particular scenario are further defined below including overall duration for each action. A more detailed timeline is given in annex C.

Figure 4.2 shows the general organizational hierarchy of the teams of actors (responders) involved.

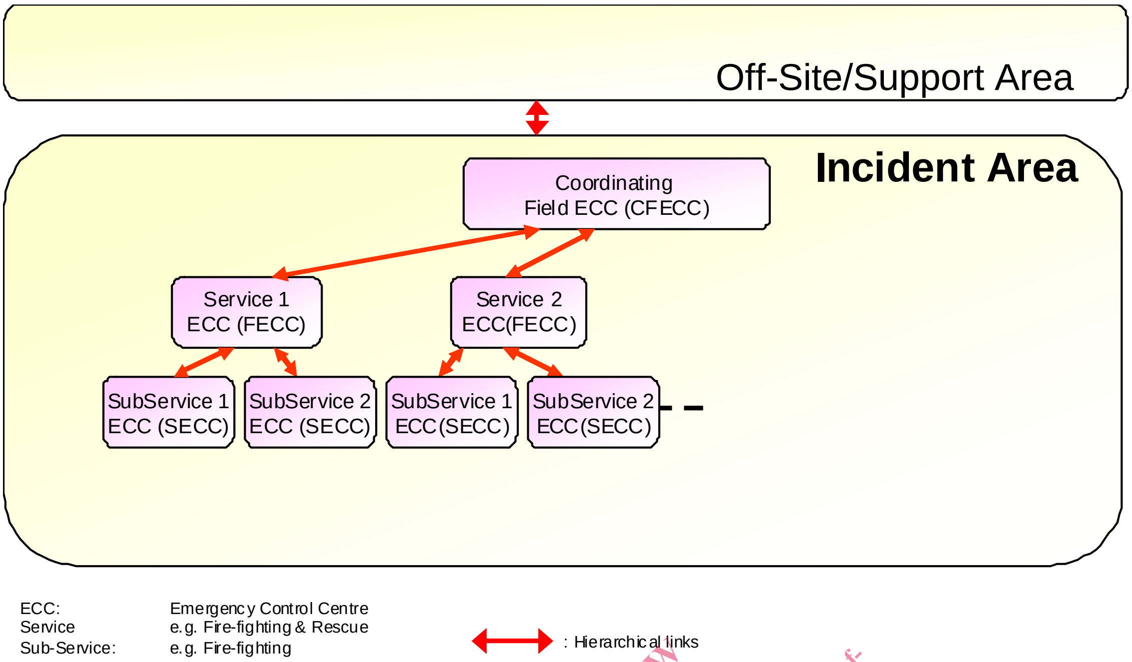

Figure 4.2: Responder Organizational Hierarchy

4.4.2 Emergency management

Deployed emergency services set up their own management structure in terms of service field emergency control centres (FECCs) and SubService emergency control centres (SECCs), as shown in figure 4.2. The actions in table 4.1 are sorted according to their ideal occurrence. In fact, nearly all actions of all involved actors are conducted nearly simultaneously so that there is no distinct order.

Table 4.1: Emergency management

Involved actors	Actions	Start point	Intermediate point	End point	Duration
All involved emergency services	Transport of emergency management personnel and equipment (e.g. command vehicle) to the incident area	First alerting	Arrival	Arrival	Minutes/ hours
Incident commander (IC)	Establishing emergency management structures	Arrival	CFECC in place	End of emergency response works	Days
Fire service	Establishing emergency management structures	Arrival	All FECCs/SECCs in place	End of emergency response works	Days
Rescue service	Establishing emergency management structures	Arrival	All FECCs/SECCs in place	End of emergency response works	Days
Health service	Establishing emergency management structures	Arrival	All FECCs/SECCs in place	End of emergency response works	Days
Relevant authority/non-governmental organization (NGO)	Establishing emergency management structures	Arrival	All FECCs/SECCs in place	End of emergency response works	Days
Site incident officers	E.g. roads department representatives; Consulting to emergency services	Arrival	-	End of emergency response works	Days