



Emergency Communications (EMTEL); Overview of Emergency Communications Network Resilience and Preparedness

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Contents

Intellectual Property Rights	6
Foreword.....	6
Modal verbs terminology.....	6
Introduction	6
1 Scope	8
2 References	8
2.1 Normative references	8
2.2 Informative references.....	8
3 Definition of terms, symbols and abbreviations.....	13
3.1 Terms.....	13
3.2 Symbols	13
3.3 Abbreviations	14
4 Network preparedness and resilience (P&R) concepts.....	17
4.1 Overview	17
4.2 Component level resilience concept.....	19
4.3 Multiple component operation concept	19
4.4 Path/route diversity and separation concepts.....	20
4.5 Void.....	20
4.6 Fault-tolerant concepts	20
4.7 Disaster Recovery (DR) concepts	21
4.8 Service diversity	21
4.9 Network segmentation.....	21
4.10 Isolated operation (network, grid, satellite).....	21
4.11 Planning/enhancing preparedness and resilience.....	21
5 Void.....	22
6 Void.....	22
7 Technologies analysis for Preparedness and Resilience (P&R).....	22
7.1 Introduction	22
7.2 Potential risks and guidelines for preparedness and resilience against these risks	23
7.2.1 Natural events	23
7.2.1.1 Earthquake	23
7.2.1.2 Volcanic eruptions	23
7.2.1.3 Wildfires	24
7.2.1.4 Severe weather conditions.....	25
7.2.1.5 Geomagnetic storms.....	25
7.2.2 Technical triggered events (unintended).....	26
7.2.2.1 Software related risks.....	26
7.2.2.2 Technical Network failure or damage	27
7.2.2.3 Outage of underlying or related infrastructure	28
7.2.3 Human triggered events (intended).....	29
7.2.3.1 Cyber-security attack on critical infrastructure	29
7.2.3.2 Radio jamming.....	30
7.2.3.3 Electromagnetic pulse	30
7.2.3.4 Intentional destruction of terrestrial infrastructure.....	31
7.3 Preparedness and resilience guidelines for physical dependencies	31
7.3.1 Wired Networks	31
7.3.2 Wireless Networks	32
7.3.3 Satellite Services.....	33
7.3.4 Electrical Power.....	35
7.3.5 Buildings.....	35
7.3.6 Equipment.....	35

8	Preparedness and resilience for Enabling Technologies	36
8.1	Overview	36
8.2	Cellular access/WWAN (2G to future 6G), WLAN	36
8.3	Wired connectivity for IMS	37
8.4	Internet of Things (IoT) devices and platforms	38
8.5	Satellite Communication and Navigation Services	38
8.6	Wireless mesh networks	39
8.7	Drones/UAS to support Emergency Communications	39
8.8	Security	40
8.9	Virtualization and Cloud	40
8.10	Public Internet connection	41
8.11	Artificial Intelligence (AI)	42
8.12	Over the top apps for voice and data communication, video distribution, video conferencing	43
8.13	Smart grid, power and utility distribution	43
9	Preparedness and resilience for ECS between individuals/devices and PSAPs	44
9.1	Overview	44
9.2	Core elements of the NG112 architecture	44
9.3	NG112 Emergency Services IP network (ESInet)	45
9.4	IMS Emergency Services	46
9.5	Pan-European Mobile Emergency Application (PEMEA)	47
9.6	Advanced Mobile Location (AML)	47
9.7	eCall	48
9.8	Cospas-Sarsat	49
9.9	Multimedia communication services	49
9.10	Legacy 112 (wireless)	50
9.11	Legacy 112 (landlines)	50
9.12	Legacy 112 (campus & private venues)	51
10	Preparedness and resilience for Public Warning ECS	52
10.1	Overview	52
10.2	Common Alerting Protocol (CAP) and alert message encapsulation	52
10.3	Cellular Public Warning System (PWS)	52
10.4	IoT Public Warning Service	53
10.5	Public Terrestrial Broadcast	54
10.6	Public Satellite Broadcast	54
10.7	Navigation satellite broadcast	55
10.8	Sirens, VMS	55
11	Preparedness and resilience for communications between emergency service teams	56
11.1	Overview	56
11.2	Private Mobile Radio (PMR)	56
11.3	Mission critical communications and services through Public Mobile Networks	57
12	Preparedness and resilience for ECS amongst individuals	58
12.1	Overview	58
12.2	Open data	59
12.3	Social networks	59
Annex A:	Basic architecture	60
A.1	Graphical representation	60
A.2	Local packet exchange/mobile switch to PSAP	61
A.3	PSAP functional components and inter-/intra-PSAP communication	61
A.4	ECC functional components	62
A.5	PSAP/ECC integration/separation	62
Annex B:	Technologies involved in emergency communication services	63
B.0	Introduction	63
B.1	Emergency communications between individuals/devices and PSAPs	63

B.2	Communications from authorities/organizations to individuals, groups, or the general public (public warning)	68
B.3	Communications between emergency services (authorities/organizations)	71
B.4	Communications amongst individuals	73
B.5	Enabling technologies	74
B.6	Related Topics	76
	History	78

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[ETSI TR 102 445 V1.2.1 \(2023-04\)](#)

<https://standards.iteh.ai/catalog/standards/sist/0504be52-be72-43ee-9e56-92073e229af9/etsi-tr-102-445-v1-2-1-2023-04>

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Foreword

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Introduction

The concept of Emergency Telecommunications (EMTEL) addresses a broad spectrum of aspects related to the provisioning of communication services in emergency situations.

In emergency situations, efficient and effective communications are critical. The enabling communication technologies need to perform in a robust and reliable manner, providing the requisite functionality to guaranteed service levels. Network and other emergency communication services resilience and preparedness are important factors in that aim.

The objective of the present document is to provide guidelines and recommendations to maximize the level of preparedness and resilience of emergency communication services based on identified risks for involved technologies.

Clause 4 provides an overview of several key technical concepts that can be employed to enhance the preparedness and resilience of emergency communication networks and services. The four main Emergency Communication Service (ECS) areas considered in the present document include communications from individuals with public authorities/organizations, communications between authorities/organizations (including mission critical communications), communications from authorities/organizations to the individuals (including public warning) and communications amongst individuals.

The analysis in clause 7 starts with a study of the potential threats that may affect these ECS, complemented by general guidelines to address these risks. In a second step, the analysis summarizes common physical dependencies for the technologies enabling ECS and provides generic recommendations to prevent failures and malfunctions.

Clause 8 provides a detailed analysis of the enabling technologies that support the different components involved in ECS. This detailed analysis includes for each enabling technology: the list of risks that may directly affect that technology, specific measures that may be taken for that technology, in addition to those already described in clause 4 and in clause 7, and the list of underlying infrastructures that may have an impact on that technology. This analysis is completed by the identification of the main physical dependencies that may directly affect each technology. For clarity reasons only risks with the potential to directly affect technologies are considered; indirect threats can be traced via the physical dependencies and underlying infrastructure chains.

Clauses 9 to 12 provide similar detailed analysis for the different components of each of the four main ECS areas considered in the present document.

Annex A introduces the main entities/roles and typical communication channels involved for fully deployed management of large-scale incidents.

Annex B includes a short presentation of each of the components contributing to the ECS for the four main ECS areas listed above, a short presentation of the enabling technologies analysed in clause 8, and ends with a summary of several external activities addressing preparedness and resilience.

The concepts and analysis in the present document are expected to be useful to emergency services authorities and decision-makers when setting-up or updating their communication networks and services, as well as to other interested stakeholders. Readers are recommended to start with clauses 4 and 7, as the majority of guidelines is provided in these two clauses. They may then select their topics of interest in clauses 8 to 12, as well as in annexes A and B, for a complete information.

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1 Scope

The present document presents resilience concepts and considers their application within technical systems enabling emergency communications. Furthermore, it considers preparedness of emergency communication services and proposes guidelines for specialized systems and capabilities.

2 References

2.1 Normative references

Normative references are not applicable in the present document.

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 referenced 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 TR 102 180: "Emergency Communications (EMTEL); Basis of requirements for communication of individuals with authorities/organizations in case of distress (Emergency call handling)".
- [i.2] ETSI TS 102 181: "Emergency Communications (EMTEL); Requirements for communication between authorities/organizations during emergencies".
<https://www.etsi.org/standards/standard-preview/etsi-tr-102-445-v1-2-1-2023-04>
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- [i.20] EN 15722:2015: "Intelligent transport systems - Esafety - eCall minimum set of data" (produced by CEN).
- [i.21] IETF RFC 8147: "Next-Generation Pan-European eCall".
- [i.22] ETSI TS 126 267: "Digital cellular telecommunications system (Phase 2+) (GSM); Universal Mobile Telecommunications System (UMTS); eCall data transfer; In-band modem solution; General description (3GPP TS 26.267)".
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- [i.24] ETSI CTI Plugtests Report V0.0.3: "1st NG112 Emergency Services Plugtest".
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[i.81] ETSI TS 133 501: "5G; Security architecture and procedures for 5G System (3GPP TS 33.501)".

[i.82] [Directive \(EU\) 2018/1972](#) of the European Parliament and of the Council of 11 December 2018 establishing the European Electronic Communications Code.

[i.83] [Directive 2009/136/EC](#) of the European Parliament and of the Council of 25 November 2009 amending Directive 2002/22/EC on universal service and users' rights relating to electronic communications networks and services, Directive 2002/58/EC concerning the processing of personal data and the protection of privacy in the electronic communications sector and Regulation (EC) No 2006/2004 on cooperation between national authorities responsible for the enforcement of consumer protection laws.

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[i.98] [Directive \(EU\) 2022/2555](#) of the European Parliament and of the Council of 14 December 2022 on measures for a high common level of cybersecurity across the Union, amending Regulation (EU) No 910/2014 and Directive (EU) 2018/1972, and repealing Directive (EU) 2016/1148.

[i.99] ETSI GS NFV-REL 001: "Network Functions Virtualisation (NFV); Resiliency Requirements".

[i.100] ETSI GS NFV-REL 003: "Network Functions Virtualisation (NFV); Reliability; Report on Models and Features for End-to-End Reliability".

3 Definition of terms, symbols and abbreviations

3.1 Terms

For the purposes of the present document, the terms given in ETSI TR 102 180 [i.1] and the following apply:

app: any communications application, standalone or in a web browser, running on any kind of device, that a person is able to use to initiate an emergency communication to request help

application enabler: communication functionality offered to emergency communication applications to support their execution

call: any type of emergency communication and associated media (analogue or digital) initiated by an individual towards authorities to request help from them

NOTE: This definition applies to the present document.

common operating picture: 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

DCF77: longwave time signal and standard-frequency radio station in Mainflingen, Germany, operated by Physikalisch-Technische Bundesanstalt

NG112: ESInet networking infrastructure and the associated core elements of the NG112 architecture

NOTE: This definition refers to ETSI TS 103 479 [i.10] and is used as a shortened term in the present document.

preparedness: measures to anticipate and prevent failures and outages, i.e. to reduce the risk of a communication service outage

NOTE: Examples are redundant hardware, uninterruptible power supplies, hardening of cables, etc. All these measures increase the availability of a service/system in the context of Emergency Communication Services (ECS). See also: United Nations International Strategy for Disaster Reduction, and more specifically the Sendai framework [i.96].

resilience: measures taken during a system outage alleviating the direct consequences of the outage and allowing the system to return to normal operation

NOTE: Resilience has two aspects:

- i) recovery understood as "getting the affected system back to normal operation as fast as possible" (decreasing the mean time to repair); and
- ii) measures for alternative services to be taken during a system outage alleviating the direct consequences of the outage.

The latter should be described in a contingency plan, and includes for example having at hand portable nomad TV transmitters to deploy after an earthquake destroyed the legacy infrastructure.

WWVB: time signal radio station near Fort Collins, Colorado, U.S.A., operated by the National Institute of Standards and Technology

3.2 Symbols

Void.

3.3 Abbreviations

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

AAIM	Airborne Autonomous Integrity Monitoring
ABAS	Aircraft-Based Augmentation System
ADS-B	Automatic Dependent Surveillance - Broadcast
AI	Artificial Intelligence
AIS	Automatic Identification System
AM	Amplitude Modulation
AML	Advanced Mobile Location
AoA	Angle of Arrival
AoD	Angle of Departure
AP	Application Provider node
APCO	Association of Public safety Communications Officials
ASP	Aggregating Service Provider node
BCF	Border Control Function
BEREC	Body of European Regulators for Electronic Communications
CAP	Common Alerting Protocol
CBS	Cell Broadcast Service
CCS7	Common Channel Signalling system number 7
CER	Critical Entities Resilience
CI/CD	Continuous Integration and Continuous Deployment
CID	Cell ID
CMAS	Commercial Mobile Alert System
COLT	Cell On Light Trucks
COW	Cell On Wheels
CPNI	Centre for the Protection of National Infrastructure
CPE	Customer Premise Equipment
D2D	Device to Device (communication)
DAB	Digital Audio Broadcasting
DMO	Direct Mode Operation
DMR	Digital Mobile Radio
DNS	Domain Name Service
Dos	Denial of Service
dPMR	digital Private Mobile Radio
DR	Disaster Recovery
DRR	Disaster Risk Reduction
DVB	Digital Video Broadcasting
EC	European Commission
ECC	Emergency Control Centre
ECCS	Emergency Communication Cell over Satellite
ECID	Enhanced CID
ECRF	Emergency Call Routing Function
ECS	Emergency Communication Services
EECC	European Electronic Communications Code
E-LORAN	Enhanced Long Range Navigation (also known as eLORAN)
eMBMS	Evolved MBMS
EMP	Electromagnetic pulse
EMTEL	Emergency Communications
ESA	European Space Agency
ESInet	Emergency Services IP network
ESRP	Emergency Services Routing Proxy
ETSI	European Telecommunications Standards Institute
ETWS	Earthquake and Tsunami Warning System
EU	European Union
FCC	Federal Communications Commission
FDMA	Frequency-division Multiple Access
FECC	Field Emergency Control Centres
FM	Frequency Modulation
FTTH	Fibre To The Home

FTTN	Fibre To The Node
FTTP	Fibre To The Premises
GBAS	Ground-Based Augmentation System
GCSE_LTE	Group Communications System Enablers for LTE
GIC	Geomagnetic Induced Current
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
GSM	Global System for Mobile telephony
GSMA	GSM Association
HFC	Hybrid-Fibre Coaxial cable
HLR	Home Location Register
HPUE	High Power UE
HSS	Home Subscriber Server
HTTP	Hypertext Transfer Protocol
HTTPS	Hypertext Transfer Protocol Secure
ICT	Information and Communications Technology
ID	Identity
ID/IP	Intrusion Detection and Intrusion Prevention
IEEE	Institute of Electrical and Electronics Engineers
IETF	Internet Engineering Task Force
IMS	IP Multimedia Subsystem
IMSI	International Mobile Subscriber Identity
IoT	Internet of Things
IOPS	Isolated Operations of Public Safety
IP	Internet Protocol
IPSec	Internet Protocol Security
ISM	Integrity Support Message
ISP	Internet Service Provider
IT	Information Technology
ITU	International Telecommunication Union
ITU-T	International Telecommunication Union Telecommunications standardization sector
LB-SMS	Location Based SMS
LEMA	Local Emergency Management Authority
LIS	Location Information Server
LMPE	Lightweight Messaging Protocol for Emergency service accessibility
LPWAN	Low Power Wide Area Network
LTE	Long-Term Evolution
MAMES	Multiple Alert Message Encapsulation over Satellite
MBMS	Multimedia Broadcast/Multicast Service
MC	Mission Critical
MCData	Mission Critical Data
MCVideo	Mission Critical Video
MCPTT	Mission Critical Push-To-Talk
MEC	Multi-access Edge Computing
MO	Mobile Originated
MS	Mobile Station
MSC	Mobile Switching Centre
MSD	Minimum Set of Data
NAS	Non-Access Stratum
NASA	National Aeronautics and Space Administration
NCC	National Coordinating Center for Communications
NEMA	National Electrical Manufacturers Association
NETP	National Emergency Telecommunication Plan
NFV	Network Function Virtualisation
NGO	Non-Government Organization
NIS	Network and Information Security
NIST	National Institute of Standards and Technology
NOAA	National Oceanic and Atmospheric Administration
NR	New Radio
NRR	Network Resilience and Recovery
NTP	Network Time Protocol
OTDOA	Observed Time Difference Of Arrival