CEPT ECC
Electronic Communications Committee

ECC Recommendation (11)10

Location tracking application for emergency and disaster situations

October 2011

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INTRODUCTION

This ECC Recommendation was developed in response to the demand for “Location Tracking Application for Emergency Services” (LAES) equipment for use in emergency and disaster situations using Ultra-Wideband (UWB) technology. The ECC Recommendation should ensure that frequency bands are available on a harmonised basis to enable the introduction of UWB devices in a timely manner and ensuring economies of scale while ensuring protection of existing applications or services.

It should be noted that this ECC Recommendation is designed to be part of a “regulatory package” on UWB, with various regulatory and legal provisions. The generic regulation for UWB devices in Europe given in Decision ECC/DEC/(06)04 was developed to respond primarily to the core market demand for communication applications and cable replacement. It enables also various types of radiodetermination applications using UWB technology in bands below 10.6 GHz, e.g. location-tracking, sensor technologies.

ECC at its meeting in Cordoba in October 2008 recalled that the industry should be guided that in general the generic UWB regulations should be used primarily, including for planned specific UWB applications, without totally excluding the possibility for specific solutions and only in case of duly justified needs. CEPT overall approach and criteria for handling industry requests for specific UWB regulations is presented in CEPT Report 34.

ETSI submitted to CEPT in 2008 a System Reference Document on spectrum requirements for future Location Tracking Application for Emergency Services (LAES) in disaster situations. These requirements as reviewed and amended following active cooperation between ETSI and CEPT are given in ETSI TR 102 496. The scope of initial compatibility studies to be performed by CEPT is presented in CEPT Report 34.

The intended users of the equipment are well defined in the ETSI Systems Reference Document, where it is stated that the users will be services or agencies, recognised and defined as such by the national administration, responsible for public safety.

A questionnaire was also developed within WG FM so as to better assess and confirm the needs for such application. The questionnaire should also help clarifying the intended market for this equipment. The main conclusion was that there is a clear need for equipment such as LAES for fire and rescue services. Based on the answers provided, 86% of the organisations have a clear need for such system and 72% of the organisations are ready to buy such a system, depending on the cost.

WG FM endorsed the general analysis and conclusions on the replies to the questionnaire on LAES and agreed for the work on LAES to be continued

ECC RECOMMENDATION OF OCTOBER 2011 ON LOCATION TRACKING APPLICATION FOR EMERGENCY AND DISASTER SITUATIONS

"The European Conference of Postal and Telecommunications Administrations,

considering

a) that Ultra-Wideband (UWB) technology shall mean technology for short-range radiocommunication, involving the intentional generation and transmission of radio-frequency energy that spreads over a very large frequency range, which may overlap several frequency bands allocated to radiocommunication services;

b) that the generic UWB regulation presented in Decision ECC/DEC/(06)04 should be used wherever possible for applications using UWB technology in bands below 10.6 GHz;

c) that CEPT overall approach and criteria for handling industry requests for specific UWB regulations is presented in CEPT Report 34;

d) that the ETSI System Reference Document TR 102 496 has provided information on technical characteristics for Location Tracking Application for Emergency Services (LAES) in emergency and disaster situations using UWB technology;

e) that LAES systems are mobile/portable by nature and their use may be restricted to services or agencies, recognised and defined as such by the national administration, responsible for public safety;

f) that LAES systems are intended to be used in emergency and disaster situations for limited time, and also in dedicated training centres;

g) the results of studies on the impact of LAES systems on radio services operating in the band 3.4–4.8 GHz are presented in ECC Report 170;

h) that the compatibility studies provided in ECC Report 170 considered only the case of TDMA LAES systems;

i) that the compatibility studies in ECC Report 170 are based on conservative worst-case assumptions regarding the scenarios of LAES operation, and therefore the regulatory conditions derived from findings of that Report should be more than adequate in the majority of typical LAES usage scenarios, and should not constrain future primary radio services development;

j) that the technical requirements for Detect and Avoid (DAA) mitigation technique to ensure the protection of the radiolocation service in the band 3.1–3.4 GHz are presented in ECC Report 120;

k) that proposed technical and additional requirements for LAES systems provided in Annex 1 of this Recommendation should prevent harmful interference to radiocommunication services when LAES systems are used in emergency situations in the vicinity of sensitive radio stations;

l) that the long term protection objective for radiocommunication services may not be met by LAES systems used in emergency and disaster situations. It could lead to degradation of these radio stations availability for the time of LAES use as shown in ECC Report 170;

m) that specific coordination and authorisation measures provided in Annex 1 of this Recommendation are necessary in order to ensure that the long term protection requirements of radiocommunication services are met in case of LAES operation in dedicated training sites;

n) that, for the protection of radar altimeters in the band 4.2–4.4 GHz, ECC Report 170 recommends to avoid LAES operation in the vicinity of airports runway and also to limit the maximum mean e.i.r.p. spectral density to -47.3 dBm/MHz for outdoor usage;

o) in EU/EFTA countries the radio equipment that is under the scope of this Recommendation may need to comply with the R&TTE Directive. In such cases, conformity with the essential requirements of the R&TTE Directive may be demonstrated by compliance with the applicable harmonised European standard(s) or by using the other conformity assessment procedures set out in the R&TTE Directive;

p) that local frequency coordination may be necessary, especially in a disaster situation, where normally more than one organisation is involved in disaster relief actions (e.g. police, fire and rescue services, military) at the same location and using the same frequencies at the same time;

q) that a description of LAES systems is provided in Annex 2 for informative purposes.

recommends

1. that CEPT administrations should authorise the use of Location Tracking Application for Emergency Services (LAES) in emergency and disaster situations which comply with the technical characteristics and additional requirements for the protection of radio services as shown in Annex 1;

2. that the use of LAES systems should be limited to services or agencies, recognised and defined as such by the national administration, responsible for public safety under appropriate licensing regime;

3. that LAES systems aim to provide accurate indoor location and tracking information of personnel involved in search or rescue operations in buildings and should mainly be used indoor (see intended usage in Annex 2) in order to minimise potential interference on radio services;

4. that LAES systems operate on a non-harmful interference and non-protected basis."

Note:

Please check the Office documentation database http://www.ecodocdb.dk for the up to date position on the implementation of this and other ECC Recommendations.

ANNEX 1: REGULATORY REQUIREMENTS FOR LOCATION TRACKING APPLICATION FOR EMERGENCY SERVICES (LAES) IN DISASTER SITUATIONS

This Annex provides the regulatory requirements for LAES systems operating in the frequency band 3.1 - 4.8 GHz. Section 1 provides the technical requirements and section 2 additional measures required for the protection of radio services.

1. TECHNICAL REQUIREMENTS FOR LAES SYSTEMS

Maximum e.i.r.p. for LAES systems

Table 1: Maximum e.i.r.p. for LAES systems

Frequency range)	Maximum mean e.i.r.p. spectral density	Maximum peak e.i.r.p. (defined in 50 MHz)
Below 1.6 GHz	-90 dBm/MHz	-50 dBm
1.6 GHz to 2.7 GHz	-85 dBm/MHz	-45 dBm
2.7 GHz to 3.1 GHz	-70 dBm/MHz	-36 dBm
3.1 GHz to 3.4 GHz (see note 1)	-70 dBm/MHz	-36 dBm
3.4 GHz to 4.2 GHz (see note 2)	-21.3 dBm/MHz	20 dBm
4.2 GHz to 4.8 GHz (see note 2)	-41.3 dBm/MHz	0 dBm
4.8 GHz to 10.6 GHz	-70 dBm/MHz	-30 dBm
Above 10.6 GHz	-85 dBm/MHz	-45 dBm

Note 1: within the band 3.1 – 3.4 GHz, systems implementing Detect And Avoid (DAA) mitigation technique (see technical parameters for DAA in band 3.1 – 3.4 GHz as defined in ECC/DEC/(06)04) may be permitted to operate with a maximum mean e.i.r.p. spectral density of -41.3 dBm/MHz and a maximum peak e.i.r.p. of 0 dBm defined in 50 MHz. A maximum duty cycle of 5% per transmitter per second also applies.

Note 2: a maximum duty cycle of 5% per transmitter per second applies.

2. ADDITIONAL MEASURES REQUIRED TO ENSURE THE PROTECTION OF RADIOCOMMUNICATION SERVICES

2.1 Registration of LAES users

Users are services or agencies, recognised and defined as such by the national administration, responsible for public safety. Such authorised organisations should be registered in appropriate manner at the national administrations in charge of spectrum management.

2.2 Use in emergency situations

The technical requirements for LAES systems as defined in Table 1 aim to prevent harmful interference on radiocommunication services when LAES networks are used in emergency situations.

National administrations may require authorised user organisations to record their use of LAES systems in emergency situations and to supply these records on request. In the event that interference occurs, the records of the use of LAES systems should facilitate actions under the control of the national administration to identify whether an LAES systems was the source of the interference.

2.3 Training sites

A limited number of permanent sites will be required for training purpose. Specific measures are necessary in order to ensure that the long term protection requirements of radio services are met.

Guidance is given to administration in ECC Report 167 on the practical implementation of a registration/coordination mechanism for UWB LT2 systems. Some of this report may be relevant to the case of LAES training sites.

The following separation distances are recommended in order to ensure the protection of specific radiocommunication services:

- Fixed Service: 3.4-4.2 GHz and 4.4-4.8 GHz;
- Fixed Satellite Service: 3.4-4.2 GHz and 4.5-4.8 GHz;
- Mobile Service: 3.4-4.2 GHz;
- Aeronautical Radio Navigation Service: 4.2-4.4 GHz

2.3.1 Fixed Service: 3.4-4.2 GHz

In order to meet the long term performance objectives of the Fixed Service, separation distances from training sites should be implemented. For example with an angular decoupling of 5° from the FS mainbeam the separation distance can be up to 20 km for LAES used outdoors and up to 5 km for LAES used indoors. Detailed results of compatibility studies are provided in ECC Report 170.

2.3.2 Fixed Satellite Service: 3.4-4.2 GHz

In order to meet the long term performance objectives of the Fixed Satellite Service, separation distances from training sites should be implemented.

For LAES outdoor training sites:

- of up to 19 km from registered/notified FSS earth stations with small diameter antenna (1.2 m and 1.8 m)
- of up to 12.3 km from other registered/notified FSS earth stations and MSS feeder link earth stations.

For LAES indoor training sites:

- of up to 7 km from registered/notified FSS earth stations with small diameter antenna (1.2 m and 1.8 m)
- of up to 3.5 km from other registered/notified FSS earth stations and MSS feeder link earth stations.

2.3.3 Mobile Service (Base stations): 3.4-4.2 GHz

In order to meet the long term objective, separation distances up to 20 km for LAES used outdoor and up to 5 km for LAES used indoor should be implemented (considered similar to FS in 3.4-4.2 GHz).

2.3.4 Aeronautical Radio Navigation Service: 4.2-4.4 GHz

In order to meet objectives of the Aeronautical Radio Navigation Service, it is recommended to avoid LAES training sites in the vicinity of airport runways. Alternatively, a maximum mean e.i.r.p. spectral density of -47.3 dBm/MHz is recommended for outdoor usage in the vicinity of airport runways.

2.3.5 Fixed Service: 4.4-4.8 GHz

In order to meet the long term performance objectives of the Fixed Service, separation distances from training sites of up to 15 km (2 km for an angular decoupling of 5° from the FS mainbeam) from LAES used outdoors and up to 4km (500 m for an angular decoupling of 5° from the FS mainbeam) from LAES used indoors should be implemented where this band is used.

2.3.6 Fixed Satellite Service: 4.5-4.8 GHz

In order to meet objectives of the Fixed Satellite Service, coordination of LAES training sites with FSS may be required on a national basis.

For outdoor LAES training sites:

- 2 km for registered/notified FSS earth stations with small diameter antenna (1.2 m and 1.8 m)
- 1 km for other registered/notified FSS earth stations and MSS feeder link earth stations.

For indoor LAES training sites:

- 500 m for registered/notified FSS earth stations with small diameter antenna (1.2 m and 1.8 m)
- 200 m for other registered/notified FSS earth stations and MSS feeder link earth stations.

2.3.7 Mobile Service: 4.4-4.8 GHz

In order to meet objectives of the Mobile Service, Administrations may provide information about sensitive zones they want to protect (including military trials and training areas). Information on protection distances (including for unmanned aerial vehicle ground station and receiver in the aircraft) is provided in ECC Report 170.

ANNEX 2: (INFORMATIVE)

Description of the Location Tracking Application for Emergency Services (LAES)

About the intended usage

Emergency management or disaster response/recovery agencies may use LAES system to provide accurate indoor location and tracking information of personnel displayed in a central control or for each user.

Since the usage of the system is considered mission critical, locally and temporary, this application would fit in the PP2 and DR categories as defined in Report ITU-R M. 2033 “Radiocommunication objectives and requirements for public protection and disaster relief” These definitions are quoted below.

Public protection (PP) radiocommunication: Radiocommunications used by responsible agencies and organisations dealing with maintenance of law and order, protection of life and property, and emergency situations.

Disaster relief (DR) radiocommunication: Radiocommunications used by agencies and organisations dealing with a serious disruption of the functioning of society, posing a significant, widespread threat to human life, health, property or the environment, whether caused by accident, nature or human activity, and whether developing suddenly or as a result of complex, long-term processes.

Description of the application

In many emergency situations such as fires, the safety and effectiveness of operations are hampered by not knowing where the personnel are. This is particularly true within large buildings, which may be partially or completely collapsed and full of smoke. The purpose of an LAES system is to provide incident commanders at all levels with the precise locations of personnel, displayed in a central control vehicle or anywhere else.

Figure 1 below illustrates a typical scenario, in which a building may be damaged or have collapsed due to fire, terrorist attack or earthquake. It does not attempt to show details of a deployment. A team member is in difficulty, and their position is measured and reported back to allow a rescue to be co-ordinated.

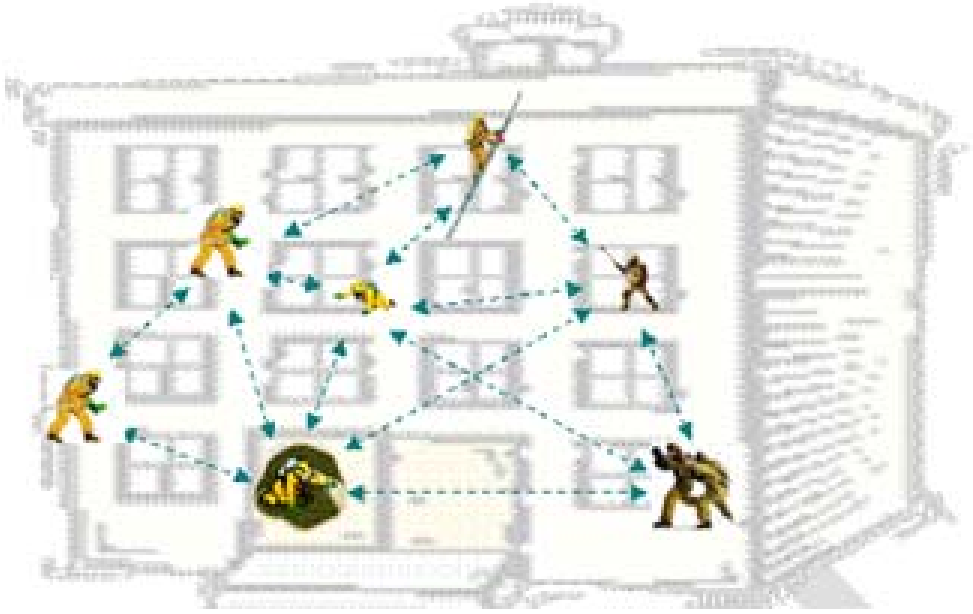

Figure 1: Fire-fighters in a typical scenario

LAES is an Ultra-Wideband (UWB) radio system that is capable of measuring positions accurately within buildings. To be useful in such operations as indoor search or rescue indoors, its accuracy must be about 1 m, which is only possible using UWB. GNSS[1] can be as accurate as this outdoors, but not indoors, while other (non-UWB) radio location technologies which work indoors are less accurate.

The proposed system consists of small UWB (radio) terminals worn or carried by people such as fire-fighters, together with other temporarily static terminals that can be mounted on vehicles or placed within the operational area. Each LAES terminal can work out its position relative to all the other terminals in the system that it can communicate with. A few static terminals (typically 4-6) may be set up outside the building to provide good coverage initially, before anyone enters it, or when there are very few other terminals indoors. Portable units carried into the building can be placed so as to extend or improve the coverage. By using personal terminals as reference points for relative positioning of other personal terminals, LAES provides coverage that extends with the team as they move deep into the building.

Where several terminals are accurately located in absolute (map) co-ordinates, all positions will be measured in map co-ordinates. Terminals can be located automatically by GNSS, when they have good satellite reception, and the positions of static terminals can be recorded against a plan when they are put in place. Absolute positions can be displayed against a digital plan of the building, if one is available. If it is not, but the outline of the building is shown on digital maps, positions are automatically shown against this background. Otherwise an outline can be drawn with simple on-screen graphics tools. Internal details of the building that are needed to control the incident can be added, based on radio reports from the team. The display in a control room or vehicle can be integrated with incident command support systems and software, of the kind now becoming common. Smaller portable displays can also be provided.

The system does not rely on any equipment being installed in the building in advance, as it will be deployed on arrival at the emergency. Personal terminals may be integrated with other equipment, such as communications equipment, which LAES does not necessarily replace. It may provide some independent communications capacity as a back-up, such as an alarm button that leads to an alert on the display screen. A fire-fighter who is waiting for help can be precisely located relative to rescuers, even when there is no detailed floor plan of the building.

The proposed system can be used in situations where lives are at risk, from a small house fire up to major disasters. Most deployments will be for the kind of small-scale emergencies that occur every day, and are dealt with by the emergency services almost as a matter of routine. However, even a small house, filled with smoke, is a very dangerous environment.

The description above is a general description of how an LAES system would operate, but the details will vary, and some systems may not have all the features mentioned. This will depend on choices made by different suppliers, or systems designed for different user groups, or options offered to customers.

[1] Global Navigation Satellite System – a generic term for satellite navigation systems.