ECC Report 189

Future Spectrum Demand for Short Range Devices in the UHF Frequency Bands

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# Executive summary (style: heading 1)

Body text (style: ECC Paragraph)

(advice: the Executive Summary should provide a short and concise explanation on the purpose of the respective ECC Report and should clearly indicate the covered subjects to which it applies. In addition, it should clearly explain the application of the document.)

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**LIST OF ABBREVIATIONS**

|  |  |
| --- | --- |
| **Abbreviation** | **Explanation (style: Arial 10pt bold red (colour values RGB: 210, 35, 42)** |
| **CEPT** | European Conference of Postal and Telecommunications Administrations |
| **ECC** | Electronic Communications Committee |
| **<abbr>** | <explanation – edit the table as necessary> |
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# Introduction

Body text (style: ECC Paragraph)

(advice: this document gives a template for preparing an ECC Report. All existing contents including the annexes are given for information purposes, only, and they shall be replaced by the relevant contents of the new ECC Report.)

# Definitions (optional section)

|  |  |
| --- | --- |
| **Term** | **Definition (style: Arial 10pt bold red (colour values RGB: 210, 35, 42)** |
| **<Term 1>** | <Definition 1> |
| **<Term 2>** | <Definition 2> |
|  |  |
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# Objectives

Four Systems Reference Documents (SRDoc) were developed, each proposing a spectrum allocation for certain SRD and Low Power applications.

These four SRDoc contained seven application proposals;

* TR 102-649-2 Generic SRD, RFID, and Automotive SRD (three applications)
* TR 102 886 Sub-metering / Smart Meters and Smart Grid (two applications)
* TR 103 055 Metropolitan Mesh Machine Networks (M3N) applications. (one application)
* TR 103 056 Alarm and Social Alarm systems (one application)

This chapter takes each of these seven application proposals and discusses the motivation/benefit of each proposal in turn.

## 3.1 Generic SRD

Generic SRD are already installed in large numbers across a wide range of applications within Europe in the 863-870 MHz band (see ECC Report 182 [ref]) and their use is expected to grow rapidly over the next 10-15 years. It is anticipated that the current designations of spectrum for RFID and SRDs will be inadequate to meet their future needs.

The SRD industry has expanded considerably over recent years and has now developed into a number of different industrial sectors. It is anticipated that the present trend in diversification and expansion will continue.

Based on these predictions of market growth, it is very evident that additional spectrum or more efficient use of the existing spectrum will be necessary. This points was already identified in November 2006 in CEPT Report 14 [ref point 1 …] in response to a mandate from the EU Commission to develop a strategy to improve the effectiveness and flexibility of spectrum designation for SRDs. The Report recommended that:

(i) "That CEPT ensures that only the minimum regulations are specified in Recommendation 70-03 and, where appropriate, the application-specific constraints to spectrum use are removed".

(ii) "New bands should preferably be extensions of SRD bands or close to them".

(iii) "Introduction of LBT and/or AFA in existing SRD bands is a first priority. However, any benefit from the introduction of LBT and/or AFA may be short lived if the anticipated growth in SRDs occurs. Therefore the identification of new spectrum for SRDs employing these techniques is a second priority".

Economic value of SRD/RFID/SM incl. their importance for the society has increased. Future proof solutions are needed, also with regard to SRD/RFID/SM as victims and changes in the adjacent spectrum (e.g. LTE). This may also include intra-SRD compatibility considerations.

Existing spectrum in 863-870 MHz is not overcrowded but it is evident that there is a strong device population growth and the <<noise environment>> may change as a result of new services in adjacent spectrum.

## 3.2 RFID

RFID at UHF is currently one of the most promising and discussed automatic identification and data capture (AIDC) technologies. The range of applications is broadening rapidly and includes new applications which incorporate other technologies such as sensors.

Market analysis shows rapidly growing sales for RFID systems.



The blue bars on the chart originated from EPCglobal and were included in CEPT Report 14 of 2006. They show predictions for the annual growth in global tag sales at UHF from 2006 to 2012. Sales in 2006 were predicted at 200k rising to 1.2 billion in 2012, which represents a compound rate of growth of 35%.

The actual sales that were achieved over the same period are shown in red. These figures were provided by IDTechEx, who are an independent and respected source of marketing data. It will be seen that in each year for which they have records, sales have comfortably exceeded predictions.

There is a wide variety of different RFID applications and this number is growing at a rapid pace. This range of applications may be listed under the following broad categories.

* **Logistics and materials handling**: Mobile assets are frequently tagged to track their movement along the supply chain. Typical examples are RFID–tagged cartons, containers and pallets, which are used at different stages during the production process. The objective is to optimize the movement of goods and achieve improved levels of efficiency. Other materials handling applications include libraries, waste management and many other applications in daily life.
* **Asset monitoring and maintenance:** RFID is mostly used to tag fixed and high–value assets. The tags contain a range of data, such as expiry dates and other similar information used for maintenance purposes. Examples include tagged aircraft spares and tagged machines where the maintenance history is stored on the tag. Where data is stored directly on the tag and not on the companies’ network, tags with large memories often are needed.
* **Processes control:** To improve management control RFID tags are attached to items, which move through a manufacturing process. Often information going beyond a simple ID number is stored on the tag to control the production processes. For example this is the case in the automotive industry where tags containing production information are attached to car bodies or smaller parts. The main benefit is the avoidance of costly errors during the production process.
* **Inventory audit:** A prominent application is the use of RFID for inventory audit. Examples include warehouses where pallets and sometimes cases are tagged to improve the speed, accuracy and efficiency of stock control. In most cases, only an ID number and EPC code is stored on the tag, which is used subsequently by the host computer to control or monitor the handling of tagged objects.
* **Anti-theft:** RFID tags are used at item level to prevent theft along the supply chain or at the point of sale. This takes the form of electronic article surveillance devices (EAS), which are installed at the perimeter of a controlled area. Recently the RFID and EAS functions have been combined within a single tag. This informs the shop keeper about which items are being stolen and has a significant impact on the cost/benefit analysis.

Note: some data available about growth of reader sales

It is predicted that the use of RFID in Europe will grow dramatically over the next 15 years. As the commercial benefits of RFID become more widely recognized, the technology will be adopted by many new industries. Some of these applications will require improvements to existing RFID performance. Typical examples include greater reading range, improved reading performance, faster data rates and the use of sensors (e.g. temperature, pressure, etc.) within tags. These requirements can only be met by the provision of additional spectrum.

RFID operating in the 915 to 921 MHz band will benefit twofold over the present 865 to 868 MHz. The benefit of harmonisation with the USA means that tags will be read at the frequency where they are designed to give their maximum response. Tags have a natural Q factor and typical response curve. By operating near the ideal frequency the signal received from the tag should be stronger. The increase in power and bandwidth as compared with 865 to 868 MHz increases the reading performance and potentially permit data rates that are four times faster than those currently possible.

Increased reading performance and potentially permit data rates that are four times faster than those currently possible.

Designation of the band 915 MHz to 921 MHz for use by RFID will satisfy the foreseeable market requirements of the industry for the next 10-15 years.

These needs have been confronted to the recent technical proposals from ETSI (European Telecommunications Standard Institute). The proposal in 102 649 v1.3.1 covers the extension of the current UHF frequency band used in the European Community to another Frequency band from 915 to 921 MHz.:

A studies has been performed by ….based on responses received from 16 French users in 2011 following a quationnaire. One study aspect was to analyses the perception of the users of the utilization of the RFID technology and the expression of their expectations and confront them with the ETSI proposal. The first seven questions of the questionnaire covered the state of the art of the current market and its perspective for the years to come. The two last questions enabled to record the today’s needs on a short term and medium term basis and to confront them to the ETSI proposal.

The responding enterprises represent today around 80% of the French market for the UHF RFID technology and cover the following types of activity:

* Aeronautics (ex : Eurocopter, Airbus/EADS …)
* Automotive (ex: Renault …)
* Retail and distribution
* Others (ex: Systerel, Check Point …)

The following results were recorded:

One of the results was that in consequence of the geographic future development is that a world harmonization would help achieving the market growth. This is exactly what ETSI proposes with the extension to the frequency band range from 915 MHz to 921 MHz; in ad equation with the band used in Northern America (915-921 MHz) and the forthcoming band that will be used in Japan (916 to 922 MHz).

UHF RFID moves more and more towards warehouses applications where all products are tagged with RFID tags. Taking into account the source tagging and the heterogeneity of the products stored in those warehouses, it is probable that the RFID technology will not be capable to detect, for instance, all the 1000 different products put on a pallet instantly or even within an acceptable length of time.

To focus on the results, the increase in the number of applications within two years is substantial. The end users see in the use of the RFID technology a tool that can facilitate logistics and warehouse management applications. Also new applications will be deployed in the sectors of customer services and transport. The responses given by the participants show some examples of current and emerging applications.

|  |  |
| --- | --- |
| **Applications deployed today**  | **New applications**  |
| Anti-theft  | Rail freight  |
| Anti counterfeiting  | Baggage’s management  |
| Access control  | Vehicles fleet management  |
| Airfreight  | Cross-merchandising  |
| Geo-positioning  | Point of sale (Retail and Distribution)  |
| Fleet management  | Vehicles and Aircrafts configuration follow up  |
| Stock management  | Maintenance  |
| Inventories  | Food traceability (“ from the pitchfork to the fork“)  |
| Customer services  |  |
| Containers traceability |  |
| Logistics  |  |
| Production management |  |

Since most of the future applications will concern products directly, and in order to obtain a good reading performance, ETSI proposes to increase the performance of simultaneous readings by enlarging the bandwidth. For logistic applications it is also proposed to increase two fold the maximum emitted power. This will help for the Reading of pallets (« hidden products »)

In a dense RFID devices environment it is often complex to operate several interrogators simultaneously and closed from each other. Even when it works, the reading performances are weakened and the time necessary to do the readings is sometime non compatible with the request of the application.

A substantial increase of RFID devices in a given area and/or volume is foreseen within the next two years. More precisely, the answers received show clearly that within the two year timeframe, the increase in the French market for RFID devices will increase three fold for the tags and two fold for the interrogators.

Other RF devices used in non RFID applications will also increase and as a consequence will interfere with the foreseen RFID applications with a consequential loss of overall performances of the RFID devices. Facing this anticipated situation, the increase of communication channels will help the dense interrogator environment keep its basic performances for RFID applications. At the same time the enlarging of the channel width will help the Reading speed of simultaneous reading of ever increasing number of tags in a given volume.

The analysis of the answers received show clearly that there are six main needs in terms of performances of the RFID systems.



***Repartition of the different needs***

The two main expectations in terms of performance increase are interference resistance and robustness in case of disturbed RF environments. The resistance to RF interference is also mainly due to the existence of a great number of RFID devices in a given environment, with consequential reduction of the performance of the system.

*The proposal of ETSI can surely help solving these anticipated problems.*

|  |  |  |  |
| --- | --- | --- | --- |
| **Needs expressed** | **Does the ETSI proposal cover the issue** | **How?** | **Comments** |
| **Enlarging frequency bands (6 MHz** | **Two fold power increase** | **two fold increase in channel width** |
| **Robustness in a disturbed environment** | ***YES*** | **X** |  | **X** | **In case of a two fold increase of the maximum emitted power, coexistence of many interrogators must be managed by an adequate communication regulation (LBT or AFA or else)** |
| **Interference résistance** | ***YES*** |  | **X** | **X** |  |
| **Simultaneous reading** | ***YES*** | **X** |  | **X** | **If LBT is used the reading speed has a risk to slow down** |
| **Reading distance** | ***YES*** |  | **X** |  |  |
| **Objects moving speed in front of an interrogator** | ***YES*** |  |  | **X** |  |
| **Others (maximum emitted power,/reading efficiency/dense reader mode)** | ***YES*** |  | **X** | **X** |  |

The ETSI proposal answers the various needs identified in the study.

***The main technical advantages are the followings:***

* Increase of the reading distance up to 35%,
* Increase of the reading time in case of simultaneous readings and consequently increase of the moving speed of products,
* Increase of the robustness in disturbed environments,
* Increase of the resistance to RF interferences thanks to more selective and sensitive tags and interrogators,
* Increase of the number of tags read simultaneously ,
* Installation and well-tuning of RFID devices easier.

***The main economic advantages are the followings:***

* Only one type of tag with harmonized frequency (better stock Handling in tag and chip manufacturing, optimized costs, improved deliveries etc.),
* Improved costs for the manufacturing, the installation and the maintenance of interrogators,
* Decrease of running expenses,
* Improvement of the stock management and the logistic flows,
* Better Customer service.

This e study shows a significant increase of the expected growth of the RFID market, in terms of geographic zones, devices deployed, and number of applications focused on the product. The needs expressed are essentially centered on the overall performance of the RFID systems in disturbed environments.

The analysis described in this document clearly shows that the ETSI proposal fits the needs expressed.

The issue concerning the transition period from the existing regulation to the new one proposed remains unresolved at this time but will have to be addressed shortly. At this time, it appears that the use of both frequency range (865-868MHz and 915-921MHz) will be simultaneous, allowing stable performances of RFID devices and permitting the development of new applications.

## 3.3 Sub-Metering, Smart Meter

Smart Meters bi-directional devices are able to communicate both with utility providers and customers. In their simplest form they are able to give consumption and price information in near real time. As smart meter networks become prevalent, they become the enabling technology to provide the incentives to alter consumption and generation of utility resources.

Consumers are increasingly sensitive to resource consumption and in the case of power, their carbon foot print. Smart Metering is the first step in integrating consumers' wishes with the supply of these resources. It enables consumers to use resources more efficiently; this may be based on time variable tariffs or other incentives related to the demand.

Smart Metering primarily targets improvement of energy end-use efficiency as defined by Directive 2006/32/EC, thus contributing to the reduction of primary energy consumption, to the mitigation of CO2 and other greenhouse gas emissions.

According to the European Commission, Standardisation Mandate M/441, to CEN, CENELEC and ETSI, "in the field of measuring instruments for the development of an open architecture for utility meters involving communication protocols enabling interoperability".

 "The general objective of this mandate is to create European standards that will enable interoperability of utility meters (water, gas, electricity, heat), which can then improve the means by which customers' awareness of actual consumption can be raised in order to allow timely adaptation to their demands (commonly referred to as 'Smart Metering')."

Although this strictly defines Smart Metering, it is clear from the first article of the Mandate that its intention far exceeds that of Smart Meters. It particularly requests the development of an "…open architecture for utility meters that supports secure bidirectional communication upstream and downstream … and allows advanced information and management and control systems for consumers and service suppliers."

This intention of the Mandate encapsulates the notion of Smart Grid where computing and communications technologies are integrated with the power-delivery infrastructure.

There are in excess of 300 million gas and electricity meters alone which require replacing to meet the requirements of M441 and a similar number of water and energy meters. There are approximately 157 million water meters installed in Europe and although there is no legislation driving the adoption of Smart Metering for water it is expected that 31 % of all new water meters installed will be Smart or Smart enabled meters by 2016.

Electric vehicles and their Infrastructure:

Many countries are encouraging the sale and promotion of electric vehicles by various means and in a number of European cities there are on-going activities to support their use.

The French government plans to acquire 50,000 electric cars for use by public companies and local authorities. In Germany, the Minister of Transport announced in November 2009 the support of development of electro-mobility by the German government with 1.4 billion Euros over the next few years.

In September 2009, a contract was placed for the delivery of 100,000 cars before 2016, to be sold in Denmark and Israel. A Danish energy supplier will establish the complete charging infrastructure in Denmark and the Danish government announced reduced taxes for electric cars to support this activity. Also in September, the Spanish government provided 10 million Euros for their program "Movelle" to introduce electrical cars in Spain.

Each of these initiatives to promote the manufacture, sale and use of electric vehicles places demands on the charging infrastructure and associated Smart Metering for customer billing. Although the charging infrastructure has not yet been standardised this is being actively pursued.

## 3.4 Smart Grid

technology and see

For the realization of wireless communications for smart smart grids are predominantly frequency bands below 1 GHz best suited.

- 450 MHz (PMR/PAMR)

- Mobile networks (PMR/PAMR elsewhere)

- Public networks (wireless access)

- 870-876 MHz (extension for SRD - applications, ETSI proposal)

Under frequency-regulatory aspects it is also decisive how far realisations are possible within the framework of the existing Regulation (individual allocations, General allocations). Also, some still pending requests outside of radio frequency regulation can affect the future spectrum requirements (security-related requirements, data protection, etc.).

Europe's integrated utility network will be subject to substantial restructuring in the coming years as a direct consequence of the ongoing liberalisation of the energy market. The present electricity supply infrastructure, which is characterised by large, centralised power stations, will evolve into a system comprising both centralised and decentralised electricity supplies including micro generators, electric vehicles as well as small and medium sized renewable sources. This process will place new demands on the engineering of these systems, including equipment specification and control. The anticipated rapid growth in the numbers of decentralised micro generators requires an advanced integration strategy to be developed. Part of this integration will be a supporting communication network to permit the monitoring and control of these generators as they are switched on and off line. This same network can also be used to assist consumers to make informed choices on their consumption.

Hence.a smart grid is made possible by robust, end-to-end communicationstechnologies. These technologies, working alongside the electrical grid, pull indata from all over the grid. Sensing devices are placed throughout the electricalgrid and in consumers’ homes and businesses. Information from the devices aresent to applications that can read and act upon the data.

Important objectives are:

* Improve Power Delivery and Quality:
	+ Automated load balancing in the smart grid;
	+ • Power quality management;
	+ • Automated switching of components of the smart grid and related protection systems
* Increase Operational Efficiency
* Automation of asset monitoring and management
	+ Analytics for decision support;
	+ Connected mobile workforce ;
* Monitor and control renewable energy sources everywhere
	+ Maintain grid stability as renewableenergy sources are added;
	+ Meet environmental targets and regulatory requirements
* Engage Customers in Energy Management
* Information and incentives for reduced or more intelligent energy usage
* Direct load controls
* Improved customer service.

The Smart Grid is the integration of technologies that permit inter alia the:

• coexistence of centralised and decentralised power generation;

• detection and resolution of emerging network issues;

• response to local and system wide inputs;

• rapid communication between peer devices and with centralised and distributed controllers;

• deployment of advanced diagnostics, feedback and control;

• coordination of attached loads and distributed resources.

In all the above cases, messages describing the situation need to be passed from the Smart Meter to the controlled or controlling entity. In circumstances which might compromise the grid reliability a real time response will be required.

Smart energy grids and smart meters are two areas which are very different and should not be treated in the same way.

Smart energy grids are ICT applications which help energy producers to gather information about the behaviour of suppliers and consumers in an automated fashion to improve efficiency, reliability, economics and sustainability and which allow for real-time adjustment of electricity production and distribution. National solutions may be possible and they need not necessarily to be wireless. Even though there are key requirements related to real-time aspects, reliability and robustness, commercial networks should be considered.

According to the responses to this public consultation, in particular from the utilities sector, the security of supply of energy distribution is critical for society, and this is where smart grids and the related ICT infrastructure and service platform will have a key role in the future. It is considered that the load demand on distribution networks will increase as a result of the introduction of electric vehicles, heat pumps and decentralised energy resources, including renewables, and that the challenge to match demand and supply of energy flows within a grid will intensify.

The respondents listed a number of specific security and resilience requirements for ICT infrastructures and services within smart grid systems, in particular resiliency (including power independency) and reliability to achieve high availability, quality of service, real time transfer of information, end-to-end security, protection of confidentiality, authenticity and integrity of data, as well as centralised authentication and remote access control.

Distribution automation, or management and control of the smart grid network, as the most mission-critical area where communication between the primary stations is very important for the stability and operational safety of the networks, and where wired communication solutions, such as fibre optic networks, are currently the preferred solution due to the high level of requirements. However, the general opinion is that wireless solutions will also play an important role in the future smart grid, especially in the lower voltage sections of the distribution grid, where mission-critical communication needs are foreseen to increase.

The existing views on the most suitable ICT infrastructure are diverse. Although some proponents promote their own (cable, radio or satellite based) solutions for part or most of the smart grid data communication purposes, many views were expressed in general in the opinion that the ICT infrastructure used for such purposes will be composed of a mix of different wired and wireless communications, including powerline communication (PLC). This is because each transmission technology has its advantages and disadvantages and subsequently an appropriate combination will enable the market to deploy the services faster and improve the security aspects. However, some argued strongly that PLC is not suitable for any mission-critical kind of telecommunication, as high-frequency transmission on non-shielded lines can pick up external electromagnetic fields and might not work over long periods of time, or because data communication using PLC is not any more possible in case of electricity failure. PLC may also not suitable for gas and water metering purposes.

It is indicated that both wired (mainly fibre) and wireless communications will be very important components of the communications network to support the smart grid of the future. Fibre is appropriate to connect main locations and where high data rates are used (whether aggregated or not), while wireless technologies are needed to provide access to many dispersed end points. The views regarding the portion of communications in smart grids that can be handled via fixed connections are diverse; some say that this portion will be diminishing in the long term, while some others argue that biggest part of mission-critical smart grid communications might be handled by fixed connections in the long term.

From the utilities sector, as well as some equipment manufacturers, estimate that as communication between secondary substations and the associated systems is becoming more important, dedicated or exclusive spectrum for a specific utility application would be the necessity to have optimal control over the wireless solutions, especially as certain non-exclusive spectrum bands may not be appropriate for mission-critical applications. The reasons for the potential inappropriateness listed by some of the utilities include unfavourable licence conditions, inadequate nature or unpredictability of the applicable sharing conditions of available spectrum bands and unsatisfactory protection against (harmful) interference. The smart grid ICT infrastructure could also be in the responsibility of the utility / grid operator, so that it could operate and manage it, whether it was provided by a telecom operator, a competent third party, or the utility itself. The main issue in this respect is that the utility needs to trust the communications since it has to rely on it for all the critical grid management functions.

Most of the national administrations don’t see a justification for dedicated or exclusive spectrum for smart grid services, noting that there are very rare occasions when designating spectrum for a specific service is necessary and stating that any such justifications should be carefully considered, taking into account both technical and economic aspects. Many of them are also in the opinion that existing communication network infrastructures should be sufficient to cover any energy grid specific critical demands. However, a number of them admit that there is no universal answer to the issue of the 'ownership' of the necessary ICT infrastructure/platform; they indicate that this is a matter to be worked out in each market and that the solution may differ from country to country.

In the future, real time monitoring as well as remote measuring and control will increase significantly throughout the grid, partly due to the growing share of renewable energy sources (including private wind and solar plants) and electric vehicles (need for authorisation and billing in charging stations) as well as the increasing use of machine-to-machine (M2M) communications. This will increase the role of ICT/IoT in the process of controlling the network, as well as the need for wireless solutions.

**However, the frequency management will focus on technology and application-neutral solutions to keep flexibility, avoid spectrum fragmentation and foster innovations. At the same time, some applications need very predictable sharing environments. The usage of the terminology M2M or IoTin this respect translates to the non-specific SRD type of use combined with application-neutral medium access conditions. This is in line with the concept stipulated in Draft CEPT Report 44.**

When it comes to the potential problems or risks with the deployment of smart grids, majority of the respondents referred specifically to the issues of security and data privacy, where concerns have been expressed by end customers in several occasions.

The European Commission issued mandate M/490 in March 2011 to the European Standards Organisations with the aim of supporting European Smart Grid deployment.

The objective of this mandate is to develop or update a set of consistent standards within a common European framework that integrating a variety of digital computing and communication technologies and electrical architectures, and associated processes and services, that will achieve interoperability and will enable or facilitate the implementation in Europe of the different high level Smart Grid services and functionalities.

CEN, CENELEC, and ETSI were requested to develop a framework to enable European Standardisation Organisations to perform continuous standard enhancement and development in the field of Smart Grids, while maintaining transverse consistency and promote continuous innovation. The deliverables from this mandate are:

• A technical reference architecture, which will represent the functional information data flows between the main domains and integrate many systems and subsystems architectures.

• A set of consistent standards, which will support the information exchange (communication protocols and data models) and the integration of all users into the electric system operation.

Sustainable standardization processes and collaborative tools to enable stakeholder interactions, to improve the two above and adapt them to new requirements based on gap analysis, while ensuring the fit to high level system constraints such as interoperability, security, and privacy, etc.

## 3.5 Short Range Device, Metropolitan Mesh Machine Networks (M3N) and Smart Metering (SM), (M3N)

M3N combines to some extent the smart metering and smart grids by means of meshed networks. The introduction of meshed networks is intended so that utilities can operate moreefficiently and cost-effectively than ever before.

A M3N is a network composed of the following of elements: Endpoints (Sensors and Actuators), Routers and Gateways.

Sensors and Actuators

Sensing nodes measure a wide range of physical data, including:

• Municipal consumption of gas, water, electricity, etc.

• Municipal generation of waste.

• Meteorological such as temperature, pressure, humidity, UV index, strength and direction of wind, etc.

• Pollution such as gases (sulphur dioxide, nitrogen oxide, carbon monoxide, ozone), heavy metals (e.g. mercury), pH, radioactivity, etc.

• Environment data, such as levels of allergens (pollen, dust), electromagnetic pollution (solar activity), noise, etc.

Sensor nodes run applications that typically gather the measurement data and send it to data collection and processing application(s) on other node(s) (often outside the Network). Sensor nodes are capable of forwarding data.

Actuator nodes are capable of controlling devices such as street or traffic lights. They run applications that receive instructions from control applications on other nodes. There are generally fewer Actuator nodes than Sensor nodes.

Routers and Gateway

Routers form a meshed network over which traffic between endpoints and gateways is dynamically routed. Routers are generally not mobile and need to be small and low cost. They differ from Actuator and Sensor nodes in that they neither control nor sense. However, a Sensor node or Actuator node may also be a router within the M3N.

A Gateway is a Router node which also provides access to a wider infrastructure and may also run applications that communicate with Sensor and Actuator nodes.

Benefits of M3N -

M3N systems are intended to support a large number of applications around a metropolitan area including water meters, waste management, pollution management, parking management, public lighting and self-service bike rental, to name but a few. Wiring the assets of all of these devices would be costly, and so the available of a ubiquitous network, offering low incremental costs of connection to new applications as they come along, with make them commercially viable.

Cellular networks has previously been used to connect remote devices to private control network, and as long as the interconnected devices have a high value such as town information display and parking meters; the cost of embedded modules is a small proportion of the overall cost in these cases.

Many of the new Machine-to-Machine devices, however, are todays more and more often low cost, battery powered and transmits only small amounts of data. Cellular modules are consequently too expensive and consume too much power for such applications especially.

## 3.6 Surveillance Alarms, Fire/Smoke alarms,Intruder alarms, Social Alarms,

Alarm systems are typically telemetry systems that require a very low latency of operation when activated. They also need a very high probability of operational success. They therefore typically prefer to avoid heavily congested channels.

 In most of the cases wireless alarm sensors are battery powered, which leads to a restricted operating time. To cope this restriction manufacturer try to find the optimum balance between transmission power, telegram length and duty cycle. To increase e.g. the transmission reliability by repeating the telegram 2 times will reduce the operating time by 70%..

Alarm systems include

• Social alarms - alerting when a person with reduced capabilities is in distress

• Fire/Smoke alarms – intended to protect life/property by alerting the early signs of fire.

• Intruder alarms – alerting the presence of unauthorised persons

• Surveillance alarms - alerting when remote sensors trigger.

EC Spectrum Priorities

Wireless alarm systems are operated in general under the Short Range Devices (SRD) regulatory framework in SRD-bands (mostly at 868 MHz in Europe) under the following conditions:

1. SRDs in general operate in shared bands and are not permitted to cause harmful interference to radio services;
2. that in general SRDs cannot claim protection from radio services;

There is no dedicated frequency allocation in Europe for alarms other than in the SRD bands.

For social alarms the EC ( 2005/928/EC) and ECC (ECC/DEC/(05)02) recognized the importance of such applications and allocated exclusively two 12,5 kHz channels in the 169 Mhz band for such use. Due to physical reasons (wave length, antenna size, propagation characteristics) most of these social alarms are realized in the 868 MHz band (25 kHz bandwidth, ERC/REC 70-03, Annex 7)

It has to be noted, that the request for “efficient use of spectrum” in the case of alarms/social alarms has to be rated/estimated other than in the case of generic SRD. Before the situation of an emergency alert the dedicated frequency spectrum should be free, or at least occupied only by alive/maintenance messages( e.g.1/day/device). In the case of an emergency situation the alarm system should not compete with other applications in the same band which may decrease the reliability/performance of alarm systems significantly.

In the case of an emergency alert several alarm devices in a certain location may become active depending on the type of alarm. Efficient use of spectrum could be defined of the undisturbed alert transmission during an alert situation and not in between.

There is an increasing demand for wireless alarm systems even due to ongoing establishment of the legislation in the member states for safety reasons in new and existing buildings. Wireless alarms are preferred used in existing buildings (households, public buildings (schools, hospitals ...) historical buildings or environments).

While for new buildings wired solutions can be considered during planning and which offered a higher reliability, the existing buildings may not be equipped with these safety related systems by the owner due to e.g. economic constraints.

Social alarm devices are in general portable (body worn) or at least nomadic (adaptive environmental locations) and therefore have to be wireless.

Social Alarms - In a report issued by Eurostat, the Statistical Office of the European Communities it is projected that the EU27 population to continue to grow older, with the share of the population aged 65 years and over rising from 17.1% in 2008 to 30.0% in 2060, and those aged 80 and over rising from 4.4% to 12.1% over the same period.

By definition Telecare is responsive to incidents and occurrences that may prove dangerous for the client. It has been proved that it can reduce the consequences of falls of the elderly and help prevent adverse events in persons with Dementia. The use of Telecare can help deliver a range of benefits including:

• Reduce the requirement for residential/nursing care

• Reduce the burden placed on carers

• Reduce Intermediate care after hospitalisation

• Reduce acute hospital admissions

• Reduce the consequences of accidents and falls in the home

• Support hospital discharge and intermediate care

The result of using Telecare is substantial cost saving for the care provisioning services both in the socioeconomic community and in the hospital.

Fire/smoke Alarm - The total alarm time and the alarm transmission with a high reliability are very important. The following key points are taken as arguments to install smoke / fire alarm systems.

1. To reduce the amount of loss (material)

2. To reduce the number of people killed by a fire

Most victims in such fires die due to smoke poisoning. It is therefore essential that, in the event of a fire, all people in a building are warned within the first few minutes in order to evacuate the building within the time the fire brigade needs to get to the place of the fire. Smoke alarm devices are the best possible way to warn people in a very early stage of the fire. In countries like USA, UK and Sweden, where these devices have had to be installed by law for many years, the numbers of victims has been reduced by up to 50% since the introduction of these regulations.

Intruder Alarm - In the past years the number of crimes (domestic burglary / dwelling), see Table 5.3 and the damages by building insurance has been going down (source http://epp.eurostat.ec.europa.eu/portal/page/portal/crime/data/database). But the financial cost of this is going up. The main reason therefore is the increase in value in the contents of private households.

Surveillance Alarms - Building surveillance is part of the global management of buildings including access control, temperature regulation, ventilation, electricity generation and consumption and also lifts and automated doors.

Building management is a set of functions like the management of vacancy, alert treatment in case of scenario, fire detection…

Typical building surveillance and technical alarms are comprised of centralized control panels which are connected to monitoring offices via wired IP, or wireless GPRS, GSM, KNX; a variety of sensor devices, and a wireless receiver for interfacing between the control panel and sensor devices. The monitoring office can be in the building or at a remote monitoring centre.

Technical alarms are typically

- flooding or leakage alert

- over temperature detection

- lift failure detection

- automated system failure alert

- abnormal event

- emergency door kept open

- pressure failure detection

Text needed on why radio rather than wired alarms

EC Spectrum Priorities

**Justification**

The Commission Decision for SRDs foresees a regular update of the list of frequencies, as well as their associated conditions of use. This update should be performed on a regular basis in order to take due account of the rapid technological and market developments prevailing in this area. This permanent Mandate to CEPT is to formalise the preparation of the yearly proposal by CEPT for updating the technical annex of Commission Decision on SRDs.

**Objectives**

In addition to the core objectives of the Decision itself, the aim of this permanent mandate is to provide relevant technical information necessary to:

1. Modify, whenever appropriate, the technical conditions of use of the frequency bands included in the technical annex;
2. Identify new frequency bands and/or new applications (types of SRDs) which should be added to the list included in the technical annex of the Decision in order to further the “Class I” equipment category and providing such equipment with legal certainty on EU level, thereby consolidating the Single Market through spectrum harmonisation;
3. Remove frequency bands (and hence types of SRDs) from the list included in the technical annex, when required and duly justified (e.g. in case a particular use has become obsolete);

Continuously improve the presentation of the technical annex to reflect best practices.

The successive updates of the technical annex of the SRD Decision have led to the harmonisation of a number of sharing arrangements that rely on the "type of short-range device" categories in the technical annex to govern the coexistence between SRDs. However, these categories lack legal certainty as their purpose in the technical annex of the SRD Decision is not yet defined. In addition, it is necessary to establish predictable and reliable sharing arrangements in SRD bands while preserving the innovation potential of non-specific SRD designations.

In order to achieve the overall objective to harmonise SRD designations with least constraining usage conditions, an improvement of the regulatory approach for SRDs is warranted to remove application-specific restrictions and to foster beneficial sharing opportunities (BSOs) in harmonised licence-exempt bands based on **non-application specific sharing arrangements that are legally ensured in the internal market**.

Market information

Fire & Smoke

Fire and smoke detectors are mandatory for public buildings. Therefore installations for public buildings represent 93% of the market. The remaining installations are in residential areas. This market is growing 3.3% per year.

The European fire and smoke detectors market represents 1.2 billion € with roughly 9 Million detectors.

As there are approximatly 220 million households in Europe, the listed countries represent already 120 million of them (54.5%). More will follow. Many of these regulations require smoke alarm devices in sleeping and living rooms, which makes approximatley 4 devices resulting in a total of about 468 million devices in these countries only. In other European countries fire brigades advertiseing the benefits of such devices which creats an even higher demand for smoke alarms. Assuming that at least 20% will use wireless networking features, a total of more than 94 million wireless smoke alarm devices will be installed during the next 5 years. A market which will generate more than 5 billion Euros for wireless smoke alarm devices within the next 5 years.

Building Intrusion / Security

Security installations in Europe represent roughly 700000 new installations per year including 8 to 10 devices as an average including as well public and residential installations. That represents an increase of 7 million of devices each year.

There are currently 30 million installations. 25% of these installations are based on wireless devices. Therefore the today installed basis of wireless security devices is 80 to 100 million devices.

The global European market of security represents a total turnover above 2 Billion € with a growth of 3.5% per year (average value over the past ten years). This turnover can be split into 1 Billion € for wireless devices and 1Billion € for related services like remote control centre.

Social Alarm

The total Western European social alarms market in 2005 was estimated to be at$220.3 million. An estimated 734,000 units were sold and the market for social alarm appli-cations is further expected to expand of 6.1 percent over the period of 2005-2012. The penetration level for these applications as part of health and social care services stands at 4.5 percent among people aged 65 and above.

The social alarms market in Europe is influenced by many drivers with the key one being the aging EU population. This is evident from the growth in the elderly segment which is estimated to grow at a CAGR of 1.46 percent from 2003-2006 as opposed to the negative growth of 0.22 percent between people aged 15-64. This demographic trend indicates a rise in the number of dependant people aged above 65, living longer and requiring more demanding health and social care services. Rising health and social care costs to meet the increasing needs of the elderly is a major issue across all EU countries. The population of

informal carers are decreasing due to migration, smaller dispersed families and also due to

the declining practice of caring for the elderly within the family setting.

This trend indicates rising opportunities for Information and Telecommunications infrastructure providers, social alarm equipment suppliers and community service providers in the

future.sss

## 3.7 Automotive Active Safety, Automotive Diagnostic data exchange, Automotive Freight protection, Automotive Environmental & safety systems

The general trend within the automotive industry is that short range communication services are developing rapidly and is expected to be expanded further over the next 10-15 years due to e.g raw material economy, weight, vehicle integration, functionality on safety, security, environment and comfort. This includes new radio communication services and applications to meet the increasing regulatory requirement for improved road safety and sustainable driving but also a technology paradigm shift where wireless communication replaces in car wired systems and where comfort systems and integrated infotainment systems are required by the customers.

The automotive industry is operating with a lead time of 7 years and a 15+ year’s lifetime of vehicles. A long term and sustainable spectrum planning is important.

Automotive SRD applications include:

• Future comfort services in and outside of the vehicle such as activating vehicle facilities and status telemetry information;

• Road-safety/security applications where a predictable sharing environment is justified such as wireless sensors and vehicle alarms, diagnostic data exchange, freight, freight protection.

Short Range Devices currently perform a variety of important functions in modern automobiles including keyless entry/immobilisation. In accordance with information provided by the European Automotive Manufacturers Association (ACEA), the existing passenger car fleet in Europe (ACEA: "Vehicles in use" in 2005) [ref] consists of more than 250 million vehicles. By 2015 the number of vehicles in Europe is expected to increase to 400 million. Currently approximately 60 % of these vehicles are equipped with one or more SRDs. Approximately 6 million new vehicles are sold in Europe every year. 80 % of all new vehicles are currently equipped with SRD devices. Thus in future SRD equipment will be universally used by all vehicles on the roads in Europe.

In addition the variety of different SRDs used in vehicles is also increasing. This includes traditional remote keyless entry systems, which are developed further into passive entry systems and personal car communication systems. Also the adoption of safety related systems such as Tyre Pressure Monitoring Systems (TPMS) and Truck-trailer communication systems is increasing. In addition the deployment of security systems using SRDs is growing including vehicle alarm systems; diagnostic data exchange; freight protection and environmental systems. The adoption of short range communication services within the automotive industry is developing rapidly and is expected to grow further over the next 10-15 years. This is due to such factors as material savings, weight reduction, vehicle integration, safety, security, environment and comfort features. There is a general shift from car wired systems towards wireless communication, which offers improved comfort and convenience. This includes the introduction of integrated infotainment systems that are increasingly requested by customers.

The growing requirement for safety related devices, which are often mandated, increases the need for additional radio spectrum. To provide the increased reliability required for such applications, they should operate in a predictable sharing environment. This could be achieved by designating a sub-band of spectrum to a number of specified SRD services. This is applicable to both automotive and to other safety related services.

New active safety systems are required in vehicles and TPMS will be an integral part of measures required by the European Commission with the objective of achieving the EU policy targets for CO2 emissions. By November 2014 TPMS systems will be mandated in all new vehicles.

A considerable number of malfunctions of the keyless entry systems are reported by customers and this trend will further increase as a consequence of the increase in general SRD applications operating in the existing frequency bands.

# Assessment of the Request (incl. possible mitigation techniques, requirements)

In all cases of all four System Reference Documents, there is the request both for inclusion in the European Recommendation for SRD (ERC Rec 70-03) and for mandatory harmonisation within the EC, by inclusion in the EC Decision harmonising SRD use in the community 2006/771/EC.

Section 7 of this ECC Report indicates that a number of administrations may presently have a particular difficulty in agreeing to the use of SRD in these bands as envisaged by all the SRDoc. Therefore, certain mitigation techniques may be necessary to satisfy the requests. It may be necessary to include mandatory mitigation techniques in regulation, to ensure there is a reasonable opportunity for all the requested technologies to function successfully within the limited spectrum available and to allow sharing with the existing services noted by administrations.

**Overview of the request for spectrum**

The original vision for the frequency bands 870-976/915-921 MHz as defined in TR 102 649-2 is given in Figs. 1 and 2. From the latest SRD/RFID requirements as described above, it is possible to re-draw the proposed bands 870-876 MHz and 915-921 MHz as shown in Figs. X1 and X2 below.

Automotive apps (in specific SRD) need to be shown in overview

All generic appl. (automotive, SM, Alarms, are all in the technology-neutral medium access DC/LDC based on application neutrality but providing predictable sharing environment.

Use only term non-specific

SM/M3N/home automation are specific to the extent that they operate in networks (Erik)

 .

1. **The updated summary of TRs outlining SRD tentative proposal in the band 870-876 MHz**

Within the 870-876 MHz band the exact spectrum allocation and associated technical parameters are not well defined in the TR 102 649-2. There is the expectation that these parameters will become apparent during the WGSE compatibility analysis WI 41. It is also assumed that this work will build upon the WI 23 report that investigated the opportunities to improve spectrum efficiency for SRD allocations.

Within the 915 to 921 MHz band the spectrum allocation is well defined in the TR 102 649.

Intra-SRD interference case studies: in general the prospects of intra-SRD co-existence appear to be moderately reasonably good with interference probabilities between 3-10% at comfortably low levels, even for very dense urban deployment scenarios and **without assuming band segmentation** or any special co-existence requirements except the intrinsic operational DC limits of studied SRD devices.

However, it may be seen that especially the lower powered applications, such as Non-specific SRDs or Home Automation/Sub-Metering devices with transmit powers on the order of 25 mW, might suffer interference from higher power SRD neighbours (typically around 100 mW). **Therefore implementation of additional mitigation mechanisms would be helpful to drive the probability of interference towards zero.**

## 4.1 Generic SRD

As a result of their joint discussions, ETSI\_ERM TG28 and TG34 concluded that it would be desirable to separate the high power transmissions of RFID from the low power levels associated with SRDs. The present document therefore proposes that the band 870 MHz to 876 MHz is designated for use by SRDs at less than 100 mW and the band 915 MHz to 921 MHz is designated for high power devices such as RFID. As important requirement from the industry is that the new SRD bands should be an extension of the present SRD bands or close to them.

Users require improved functionality, features and performance. There is a demand for reliable performance proportionate to the application. Some applications require a very predictable sharing environment, some request even protection, e.g. safe harbour bands, priority applications, or to be treated as applications under the mobile service.

Many indicated that they can share spectrum provided that the exact minimum technical criteria for sharing are identified in spectrum compatibility studies.

Segmentation of the spectrum by defining specific frequency spots for specific applications should be avoided as much as possible, new frequency band segmentation or exclusivity for specific applications cannot be the common target. We need to take into account the lessons learned from 863-870 MHz (see questionnaire) and generate a broad regulation. Application terms are not sharply defined. Application convergence / application innovation is also to some extent blocked by application segmentation.

For technical reasons it is proposed to divide the band into a limited number of sub-bands to cover:

• SRDs using duty cycle up to 1 % or LBT with AFA (or equivalent techniques).

• SRDs that transmit intermittent very short bursts of power and rely on duty cycle for mitigation.

• SRDS covering a number of services and functions with similar behaviour, technical parameters and mitigation techniques that would provide a more predictable sharing environment as requested by the European Commission.

A non-exhaustive list of applications for SRDs using either duty cycle or LBT + AFA (or equivalent techniques) is provided below, based on information in A.2 of the ETSI TR 102 649-2:

Home and Building automation (some examples):

* Lighting control;
* Shutter, awnings and blinds control;
* Windows, doors and gates openers control, garage doors, electrical door lock systems;
* Heating, ventilation regulation and air condition control;
* Swimming pool surveillance and control;
* Combined scenarios;
* Sensors (temperature, wind, light, rain);
* Presence monitoring;

Telemetry and telecommand (some examples):

* Pumping station monitoring;
* Electricity network monitoring;
* Crane and machinery control;

Mixed speech and data (some examples):

* Wireless door entry;
* Alarm ambiance background scanning;
* Baby and elderly monitoring;

Access control (some examples):

* Disabled persons access;
* Security applications;

Machine to Machine (some examples):

* Remote data collection (state of machines);
* Remote control (management);
* Remote payment;
* Remote restaurant/bar customer orders data collection;
* Portable Bar Code Scanner;

Aviation and Maritime applications (some examples):

* Remote data maintenance collection (service information of aircraft downloaded while taxiing).

|  |  |
| --- | --- |
|  | **Type of Predictable Sharing Environment** |
| **Technology proposal** | **Low Cost** | **High Reliability / Low latency** | **High Speed Data** | **Higher Power Set Bandwidth** |
| Generic SRD | Yes | Partly, for some applications | Not defined | 870-876 MHz: 25 mWDC up to 1%, DAAAPCMaximum occupied bandwidth: 600 kHz |

* The vast majority of these applications are either fixed installed applications, nomadic use applications or used at very specific locations (e.g. aircraft taxiing). There are practically no fully mobile non-specific SRD applications provided in ETSI TR 102 649-2 under the generic SRD proposal. Only some (not all) automotive applications indicate fully mobile use.
* The ETSI proposal in TR 102 649-2 is focussing on the frequency range 870-873 MHs for generic SRD but leaves the upper limit subject to change depending on the outcome of the spectrum engineering studies
* Higher emission limits than 25 mW may be combined with lower emissions over time / duty cycle. The following combinations are under study:

|  |  |
| --- | --- |
| 1 mW | 5% |
| 25 mW | 1% |
| 100 mW | 0.1% |

* The use of APC and DAA may improve the coexistence situation.
* Spectrum fragmentation should be avoided and much as possible.
* Cost considerations may lead for generic SRD to limited receiver performance capabilities which are interlinked with a limited range of power capabilities. A minimum receiver performance may be needed to be standardised.
* The proposal for specific SRDs with the same power level of 25 mW is using the same duty cycle limit of 1% and may only differ in terms of deployment numbers and the assumed usage densities.
* Many specific SRD applications for which the ETSI TR 102 649-2 is focussing on the frequency range 873-876 MHz are encompassed in the envelope parameters as indicated above:
* Metering: 25 mW, channel BW of 200 kHz, DC up to 1%;
* Alarms: 25 mW, channel BW of 200 kHz, DC up to 1%;
* Portable Alarms (for personal security): 100 mW, channel BW of 25 kHz, DC up to 0.1%;
* Automotive Devices[[1]](#footnote-1): 100 mW and more, channel BW up to 500 kHz, DC up to 0.1% (transmit power and DC are inter-linked as shown in Table 2).
* The minimum requirement indicated for the main specific SRD sectors above is to have a minimum for 2 MHz of usable spectrum;
* Some automotive, smart metering and M3N applications indicate the need for higher emissions than 100 mW with up to 500 mW.
* There is also demand for an FHSS usage case option.

## 4.2 RFID

As a result of their joint discussions, ETSI\_ERM TG28 and TG34 concluded that it would be desirable to separate the high power transmissions of RFID from the low power levels associated with SRDs. The present document therefore proposes that the band 870 MHz to 876 MHz is designated for use by SRDs at less than 100 mW and the band 915 MHz to 921 MHz is designated for high power devices such as RFID.

To satisfy the perceived future market requirements for RFID, it is proposed that interrogators will operate in the band 915 MHz to 921 MHz at power levels of up to 4 W e.r.p. in four channels of 400 kHz each. The remainder of the band will be used for the low level response from the tags. This will increase reading performance and potentially permit data rates that are four times faster than those currently possible.

RFID with detect-and-avoid for protection of ER-GSM (and perhaps also other services) are under study.

Figure should be w/o ALD

Only generic SRD with medium access rules (application neutral)

Why 200 kHz spacing (upper part GSM-R ??)

Adaptations needed in SRD vs RFIS situation compared with 865-868 MHz situation?

****

1. **The updated summary of TRs outlining SRD/RFID requirements in the band 915-921 MHz**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Frequency bands** | **Power** | **Duty cycle** | **Channel bandwidth** | **Notes** |
| **Interrogators:**915 MHz to 921 MHzInterrogator centre frequencies916,5 MHz917,7 MHz918,9 MHz920,1 MHz |  4 W e.r.p. on a single interrogator channel for each individual interrogator | No mandatory limit for transmitter on-time. However interrogators will not be allowed to transmit longer than it is necessary to perform the intended operation | fc ± 200 kHz | Interrogators may operate in any of the four high power channels |
| **Tags:**Between 915 MHzto 921 MHz | < -10 dBme.r.p. per tag |  | fc ± 1 000 kHz for tag response |  |
| **SRDs:**915 MHz to 921 MHzCenter frequencies for high power SRD channels916,5 MHz917,7 MHz918,9 MHz920.1 MHz |  0,1 W e.r.p. in RFID high power channels | 0,1 % duty cycle or LBT + AFA | fc ± 200 kHz | Transmit levels outside of high power channels will not be allowed to exceed 25 mWe.r.p. |
| NOTE: fc are the carrier frequencies of the interrogators. SRD receivers should be category 2(valid for LBT equip.?) or better as specified in EN 300 220 [**Error! Reference source not found.**]. To minimize the risk of interference from RFID, SRDs may use LBT with AFA or equivalent techniques in the high power channels. Suitable separation distances should be studied. To minimize the risk of interference from SRDs to RFID tag responses, SRDs should use LBT with AFA or equivalent techniques in the remaining 2,2MHz. Suitable separation distances should be studied. |

RFID summary table to be filled in

|  |  |
| --- | --- |
|  | **Type of Predictable Sharing Environment** |
| **Technology proposal** | **Low Cost** | **High Reliability / Low latency** | **High Speed Data** | **Higher Power Set Bandwidth** |
| RFID |  |  |  | Yes |

## 4.3 Sub-Metering, Smart Meter

For smart metering / smart grid there is a proposal by ETSI, to use approximately 1 MHz in the frequency range of 870-876 MHz with up to 25 mW output power. The focus of the use should be to see this in the in-house domain. An exclusive use of the frequency range by smart metering / smart grid is not foreseen. Furthermore, it is planned to govern also this use in the future in the context of a general allocation.

It must be distinguished:

a. the wireless consumption reading

b. b. automatic adjustment of consumption

(In particular, a) and (b)) seem to be, since it's a few bytes/h, hardly critical applications, for the most part of indoor, 10-20 meters to be an SRD theme.

Dedicated terms of use appear useful, to this SRD to decouple from other SRD applications (e.g. to avoid co-frequent use with continuous transmissions).(if any LDC regime or a certain medium access regulation, which excludes for example continuous or transmissions with high activity).

Scenarios: one can distinguish between:

(a) meter - home gateway

(b) meter - neigbour gateway

(c) meter - network gateway

(SRD theme is actually more a) and b)

 Need to know what is standardized under standardisation mandate, M/441

 extension area for wireless M-bus EN 13757-4 may support a dedicated range, for example above of 870 MHz? (LS to standardization)

The present document investigates the use of the frequency allocation 873 MHz to 876 MHz for Smart Metering SRDs.

• The distance between meters in some deployments may be greater than the radio range achievable with 25 mWe.r.p.

• A 1 % duty cycle limit may not be appropriate under all circumstances for Smart Metering applications.

• Smart Metering applications may require data rates in excess of 100 kbps.

• A channelisation scheme consistent with E-GSM-R is required for spectrum efficiency.

Therefore;

The proposed allocation for Smart Meters is;

Table 1: Proposed Operating Parameters

Parameter Value

Power 100 mWe.r.p.

Channelisation 200 kHz

Duty Cycle Overall 2,5 % measured over a specified interval without peak limit in any sub-interval (see note)

Access Mechanism Aloha or CSMA/CA

NOTE: Subject to the outcome of compatibility studies

The TR 102 886 makes precise request for a spectrum allocation for Smart Meters in the band 873 MHz to 876 MHz:

• a duty cycle of 2,5 % with no limit applied in any period;

• a power limit of not less than 100 mWe.r.p. (500 mWe.r.p. assumed);

• the channelization scheme proposed for SRD devices to correspond to the E-GSM-R scheme.

Smart metering:

 Bandwidth: Low, from 10 to 30 kbps;

 Latency: very diverse ranges cited, depending on technology, from >1 second for distribution automation operations up to 24 hours;

 Availability: Range from 95% to 99.999%;

 Security: overwhelmingly high support;

 Coverage: Range from <95% of nationwide population to 99% of territory covering suburban and urban areas or100% population.

|  |  |
| --- | --- |
|  | **Type of Predictable Sharing Environment** |
| **Technology proposal** | **Low Cost** | **High Reliability / Low latency** | **High Speed Data** | **Higher Power Set Bandwidth****Usage density** |
| Sub-Metering, Smart Meter | YES | No15 min transmission update | NoUp to 100 kbps (instantaneous BW) | 873-876 MHz25 mW, 0.1% DC100-500mW, up to 2.5% (specific DC)% for some applications and using max Tx on restrictions4x200-250 kHzUp to 25,000 / km2 in urban centres |

## 4.4 Smart Grid

Communications / data transfer

The respondents to a questionnaire from the EC [ref] had a variety of views concerning the specific communications / data transfer related requirements for the "mission-critical" applications; some examples are shown below:

a. The suggested minimum time for resiliency, or power supply independency, ranged from 8-12 hours (depending on services) up to 72 hours (for the most critical services and sites);

b. The maximum allowed delay, or latency, suggested for the most critical (high voltage teleprotection) services varied from 3 ms to 10 ms, or to 'low-double-digit' milliseconds, and for other high priority services the variation was in general between 50 ms and 100 ms, some indicating the maximum delay for certain mission-critical applications to be even up to 1 second;

c. The availability of the services should be better than 99.9% for any mission-critical service according to some of the respondents, while some indicated 99% availability to be sufficient. For the most critical services, the required level of availability was seen to be between 99.5% (some indicated only one value for all mission-critical services) and 99.999%;

d. The bandwidth / data rate requirements for mission-critical applications were in general seen to be up to around few Mbps (megabits per second), ranging from some hundreds of kbps (kilobits/s) to 100 Mbps; however in the latter value the possible future needs for data concentration / aggregation points had already been considered.

Utilities indicate that they should be able to operate their own infrastructure for mission critical services, or at least request dedicated networks for part or overall smart grid systems, as resilient uniform nationwide coverage with a guaranteed quality of service (QoS) cannot be provided by commercial telecommunication networks, which are also not regarded as able to handle safely the mission-critical data. Even though certain commercial solutions are technically compliant, some utility companies do not want to rely on commercial operators due to the lack of level of control; these utilities are of the opinion that such solutions do not offer a complete end-to-end control or guaranteed QoS, and that the promised power autonomy, redundancy and availability can be insufficient.

Telecom operators and some equipment manufacturers state that existing commercial telecommunication networks can deliver discrete or end-to-end solutions over shared or dedicated infrastructure meeting the negotiated Service Level Agreements (SLAs) on the required performances for the smart grid communication needs.

Regarding the question on the ownership and control of the communication networks, the respondents in general either indicated that there is no definitive answer applicable to all situations and that the answer depends on a number of factors. A number of respondents were in the opinion that the ownership of communication infrastructure is not necessary and that shared infrastructure will typically be the most cost-optimised solution, while some stated that infrastructure fully owned and controlled by utilities would be required to handle mission critical services.

On the synergies between utilities companies and telecom operators, in general infrastructure (e.g. radio sites and masts, backhaul capacity, dark fibre, cable ducts and tunnels, utility poles) sharing is seen to improve cost-effectiveness and the use of existing resources as well as to extend geographical coverage. However, some respondents note that infrastructure sharing is also an issue subject to national regulations and circumstances, and the question remains how to deal with the limits of responsibility, commercial issues and competition. Some utilities indicate that shared infrastructure can be an option when the utility has a sufficient level of control over the solution.

 Reliability: Range between 10 and 72 hours.

|  |  |
| --- | --- |
|  | **Type of Predictable Sharing Environment** |
| **Technology proposal** | **Low Cost** | **High Reliability / Low latency** | **High Speed Data** | **Higher Power Set Bandwidth** |
| Smart Grid | Yes | YES99 % to 99.995%100% coverage6-1000 ms latencyHigh security needed | kbps to few Mbps | Depending on technical solution |

Utilities, municipalities, and large industrial concerns provide critical infrastructure. Supported applications must be reliable, secure, and robust in the presence of security threats and operational stress.

Latency, reliability and availability requirements for these applications vary: some, such as tele-protection for high-voltage sub-stations are safety-critical with stringent ‘sub-cycle’ latency requirements of less than 10ms; no form of radio (except perhaps microwave) is suitable for this type of application.

At the other extreme, process-control type applications – because they are deployed in millions of end points - will become increasingly important. For example, applications to better manage the ‘fine tuning’ of the power network, such as local power generation integration or electric power conservation via voltage reduction are becoming necessary for today’s power grids.

The availability of licensed spectrum is not in-of-itself a guarantee of end-to-end reliable service, especially when such networks are shared by many users. The only solution that will guarantee such quality requirements is massive overprovisioning of network infrastructure and/or dedicating large spectrum bands or pre-emption mechanisms. For some applications, such as tele-protection, this use of dedicated spectrum bands might be sensible. For almost all other applications, however, this would break the business case and be fiscally unacceptable to utilities.

Low bit rate, relatively low latency (near real-time) Smart Grid applications currently exist across the globe using sub-GHz shared spectrum. These include micro-inverters (converting solar panels’ power to mains voltage) talking to meters, electric vehicle charging stations coordinating with transformer monitors, and even teamed switch re-closers. Further, more and more smart grid standards are being developed atop shared or lightly licensed spectrum. These include TVWS standards:

in the IEEE 802.22 (a 802.16 derivative), a standard for Wireless Regional Area Network (WRAN) using white spaces in the TV frequency spectrum;

 802.11ah, a standard for sub-1GHz sensor network, smart metering due to be released in May 2015;

802.15.4m, a standard for telecommunications and information exchange between systems operating on local and metropolitan networks;

whilst in Europe, the ‘weightless’ specification should be complete in Feb/March 2013, and is expected by ETSI to be submitted by the Weightless SIG.

Two standards being considered by the weightless SIG:

The first is the white space standard, which, in the UK, Ofcom is pushing ahead with a Voluntary National Standard (VNS). This will define the rules to WS access and will be technology neutral. This has been designed to interoperate with an EU standard and may well also change as EU rules are introduced. CEPT SE43 has been very active in this area, publishing three reports (ECC Reports 159, 185, 186) looking at the technical and operational requirements for operation in TV White Spaces..

The second is, application protocol work that is also under development within the ‘weightless’ SIG, and is monitoring the IEEE work but not active in any of the working groups such as 802.11af.

In the last two years, regulators in Japan and China have freed up shared spectrum for these types of applications, and other countries outside of Europe are likely to do likewise.

China has explicitly allocated 470 - 510 MHz to M2M/SM/SG applications coincident with the development of the global Smart Utility Networks standard, IEEE 802.15.4g. China has also acknowledged the need for communications networks with these sorts of application characteristics (i.e., relatively low duty cycles and bit rates; the capability to mesh for reliability) by ensuring that 779 - 787 MHz is allocated for these purposes.

Japan has realized that the rules governing the 950 - 958 MHz band were too constrained (i.e., onerous transmit powers and duty cycles) made the band unsuitable for M2M/SM/SG. While ostensibly earmarked for RFID applications, Japan has allocated 916 - 923 MHz in anticipation of near-global harmonization for this band. Importantly, though, Japan has recognized that application characteristics for M2M/SM/SG are similar to those of RFID and are explicitly mandating Japan's national Smart Meter rollout uses 916 - 923 MHz in line with the principles underlying IEEE 802.15.4g. Similar schemes are being adopted in Hong Kong and many countries in Southeast Asia.

Australia has a similar ISM band to Region 2 countries, whilst Korea allows Ubiquitous Sensor Networks (USNs) to share with RFID devices in the band 920.6-923.6MHz. Other countries in Asia and South America are actively considering similar allocations.

Utilities operate critical infrastructure, collect sensitive consumer data, and deploy substations scattered throughout the service region, often where physical security is a challenge. Industry is agreed that the most appropriate networking protocol is IP (v6), but this very standardisation makes it more attractive to potential cyberattacks. The importance of cyber-security cannot be overstated. The inherent openness of the network with its many remote physical ports and air interfaces means that it is incumbent on the industry to ensure that appropriate encryption and defensive designs are employed.

In conclusion, latency, reliability, security and availability requirements are demanding for smart grid applications. At first glance this might be seen as incompatible with the licence-exempt/SRD concepts of no harmful interference to others and no protection from others. However, extremely reliable systems have been deployed in shared spectrum for modern Smart Grid applications around the world. Further, the Smart Grid includes a set of applications linking millions of latency-tolerant end points having less stringent requirements, and for which license-exempt solutions would be ideal. Clearly from the evaluation of this perspective, however, it is not possible to justify a dedicated SRD allocation.

## 4.5 M3N

(check parameters again)

The proposal investigates the use of M3N in the UHF Band.

• 0,1 % duty cycle is very low for M3N operation.

• Co-existence with permanently transmitting high powered RFID equipment will harm M3N reliability and battery lifetime.

• The distance between M3N devices in some deployments may be greater than the radio range achievable with 25 mW EIRP.

• M3N application may require data rates up to 100 kbps.

• Human acceptable / IP acceptable latency.

• A 25 ms transmit time limitation (Ton) is too short to comply with MAC mechanism needed by battery powered devices to prevent idle listening.

• A 200 kHz channelization scheme (sub-divisible into 100 kHz or 50 kHz) consistent with E-GSM-R (between 873 MHz and 876 MHz), is required for spectrum efficiency and coexistence with Smart Metering.

Therefore, the M3N requirements in the band 870 to 876 MHz are;

Parameter Value

Power 100 mW EIRP

Channelization 200 kHz (with 50 kHz and 100 kHz sub channel)

Duty Cycle Overall 1,25 % measured over a specified interval without peak limit in any sub interval,†, when required for coexistence with existing services

Overall 1 % measured over a specified interval without peak limit in any sub-interval and without transmit time limitation† (outside 873 MHz to 876 MHz band to avoid coexistence issue with E-GSM-R)

Bandwidth As Smart Metering is a part of M3N, requirement identified in 102 MHz to 886 MHz between 873 MHz to 876 MHz band, in co-existence with E-GSM-R

800 kHz outside E-GSM-R band for M3N devices requiring transmit time longer than 25 ms, situated as close as possible of the 873 MHz to 876 MHz Band (Subject to the outcome of compatibility studies.)

The TR 103 055 makes precise request for a spectrum allocation for Smart Metering and Mesh Metropolitan Machine Network in the band 873 MHz to 876 MHz:

• a duty cycle of 1,25 %;

• a power limit of not less than 100 mW EIRP (500 mWe.r.p. assumed);

• the 200 kHz channelization scheme proposed for SRD devices to correspond to the E-GSM-R scheme.

In addition there is a further request for a frequency band of 800 kHz immediately below 873 MHz for high performance UHF SRD systems for Smart Metering and Mesh Metropolitan Machine Network.

• a duty cycle of 1 % without transmit time limitation;

• a power limit of not less than 100 mW EIRP (to be compatible with other co-channel SRD);

200 kHz channelization, sub-divisible in 100 kHz or 50 kHz channel.sss

|  |  |
| --- | --- |
|  | **Type of Predictable Sharing Environment** |
| **Technology proposal** | **Low Cost** | **High Reliability / Low latency** | **High Speed Data** | **Higher Power Set Bandwidth** |
| M3N | Yes | No | Up to 100 kbps | 100-500 mW range1.25 % DC (25 ms max single TX on)200 kHz channelization, sub-divisible in 100 kHz or 50 kHz channel |

## 4.6 Surveillance Alarms, Fire/Smoke alarms,Intruder alarms, Social Alarms,

The TR 103 056 makes request for a dedicated spectrum allocation for Alarms in the band 875.6 – 876MHz. The technical parameters are:

25 mWe.r.p.

Band edges in compliant to GSM-R channel plan.

 Indicative DC:

* Max Transmitter On Time / per single transmission: [700ms]
* Min Transmitter Off Time between two transmissions: [400ms]
* Sum of Ton times / minute = DC/min [2.5]%/min
* Sum of Ton times / hour = DC/hr: [0,1]%/hr

The DC / LDC requirement to be defined during compatibility analysis

The TR103 056 also requests shared spectrum in the bands 915 – 915.2MHz and 920.8 – 921.0MHz. The technical parameters are;

25 mWe.r.p.

The DC / LDC requirement to be defined during compatibility analysis

Band edges in compliant to GSM-R channel plan.

|  |  |
| --- | --- |
|  | **Type of Predictable Sharing Environment** |
| **Technology proposal** | **Low Cost** | **High Reliability / Low latency** | **High Speed Data** | **Higher Power Set Bandwidth** |
| Alarms | Yes | Yes | ? | 25 mWDC, LDC |

## 4.7 Automotive Active Safety, Automotive Diagnostic data exchange, Automotive Freight protection, Automotive Environmental & safety systems

Automotive applications could be included in the specific SRD approach.

|  |  |
| --- | --- |
|  | **Type of Predictable Sharing Environment** |
| **Technology proposal** | **Low Cost** | **High Reliability / Low latency** | **High Speed Data** | **Higher Power Set Bandwidth** |
| Automotive | Yes | Yes | 1 to 100 kbpsOr 600kchips/s (DSSS) | 25 kHz up to 1.2 MHzDC .1% to 1%25 mW to to 500 mW873-876 MHz |

Dedicated Alarm band: it should rather be a band for specific SRD with DC/LDC and needing a predictable sharing environment

# Specific Benefits of harmonization

Make category specific benefits clear Sections 5.1, 5.2, 5.3, 5.5 and 5.6 all need expanding to state the actual benefits of harmonisation

## 5.1 Generic SRD

For generic SRD the benefits of further European harmonisation are discussed in paragraph 0.6.2 of the Report into the “Study on the Legal, Economic & Technical Aspects of Collective Use of Spectrum (CUS) in the European Community ”. This report concludes that the benefits of harmonisation are “substantial”.

## 5.2 RFID

For 900 MHz RFID the benefits of harmonisation with the USA allow for greater probability of successfully reading a tag. Tags have a natural resonance (Q-factor) which is determined in manufacture. By sharing a common frequency with the USA, tags can be read nearer their point of maximum response amplitude. Harmonisation within Europe of RFID tags is essential to allow for the benefits in cross border trade in RFID tagged products. Harmonisation both throughout Europe and the USA will increase these benefits further.

## 5.3 Sub-Metering, Smart Meter

Smart Meterinstallations tend to be fixed. Therefore the technical reasons for harmonisation are less clear than for mobile SRD. However the economic benefits of scale detailed in the CUS Report are once again substantial.

## 5.4 Smart Grid

Smart Meters installation tend to be fixed. Therefore the technical reasons for harmonisation are less clear than for mobile SRD. However the economic benefits of scale detailed in the CUS Report are once again substantial.

The views on the existence of barriers that would impede co-investment are mixed. National administrations and telecom operators do not see any barriers that would hinder co-investment between utilities and telecom sectors. Utilities noted that the telecommunication legislation was fragmented in several Member States, causing restrictions, legal barriers or different approaches to cooperation between utilities and telecoms. Infrastructure companies' responses were more diverse; some indicate that national regulations could hinder co-investment, while others note that the lack of a dedicated spectrum for smart grid purposes could be inhibiting co-investment.

The vast majority of respondents to the EC call [ref] supported the need for interoperability of various smart energy grid related areas or services. Responses cite Various reasons for supporting the need for interoperability were given, including the creation of economies of scale and cost reduction, reduction in the risk of cross-border interference, and greater flexibility.

Several infrastructure providers cite smart grid applications as being an area that could benefit from harmonisation of shared spectrum at EU level. Examples of spectrum uses that could be a good partner for sharing include smart connections, smart grid equipment, electric vehicles, public safety users, commercial networks, PPDR (public safety and disaster relief), railway networks, M2M style applications that share common application characteristics, spectrum used for IP-based communication, and short-range communication. Reasons for the sharing of spectrum include to ensure economies-of-scale of smart grid equipment due to manufacturers and developers having access to the entire EU market, the encouragement of competition, development of products for the whole EU market resulting in lower prices paid by utilities, and potentially lower spectrum acquisition costs. Other respondents are of the view that spectrum should not be shared and do not provide any services that they feel could be shared.

A majority of respondents provide examples of economic, social and environmental impacts resulting from the shared use of spectrum for smart grid and smart meter applications, most of which are positive to varying degrees.

Utilities cite faster implementation of technologies as an environmental benefit, a reduction of costs in smart meters due to the amortisation of development costs in the long-term, a reduction in cost due to increased competition for the utility sector, and better economic and environmental impacts due to reduced deployment and operating costs.

Infrastructure providers referencing smart grid applications cite a larger harmonised market for vendors, leading to lower costs to utilities and thus to consumers. Radio pollution or radio smog could be reduced, thus reducing environmental impacts. Regarding smart meters, infrastructure providers note potential enlargement of the European market for smart and green appliances, and impacts due to an increase in consumer awareness of consumption and energy efficiency.

## 5.5 M3N

M3N installations tend to be fixed. Therefore the technical reasons for harmonisation are less clear than for mobile SRD. Is it just the economy of scale?

## 5.6 Surveillance Alarms, Fire/Smoke alarms,Intruder alarms, Social Alarms,

Alarm installations tend to be fixed. Therefore the technical reasons for harmonisation are less clear than for mobile SRD. Is it just the economy of scale?

## 5.7 Automotive Active Safety, Automotive Diagnostic data exchange, Automotive Freight protection, Automotive Environmental & safety systems

For Automotive applications of, Freight protection, Environmental & safety systems, Remote key entry / keyless entry, In-car remote operation, Comfort systems outside the vehicle and Infotainment fitted to vehicles, there is a clear need for harmonisation, given the mobility of vehicles.

The increasing requirements for road-safety services which are often politically mandated increases the general spectrum requirement and in particular frequency bands with a more predictable sharing environment.

For road-safety related SRD applications here is also a need to consider a new approach for some applications requiring a higher level of protection with a more predictable sharing environment as outlined in CEPT Report 44.

Unlike home automation, smart grids and smart metering applications, automotive SRD applications are not fixedly installed. Vehicles can go across boarders and this has to be taken into account, should the spectrum in 870-876 MHz / 915 -921 MHz is not available for SRD applications on a fully harmonised European basis.

# Most suitable frequency option

## 6.1 Generic SRD

The frequency band 870 MHz to 876 MHz and its duplex pairing 915 MHz to 921 MHz was the subject of a CEPT review in September 2008. A summary of the re-assignment plans for these frequency bands in the major markets identified in annex F is shown in annex A. The output of this review revealed that this duplex pairing was allocated for digital land mobile applications in accordance with ERC/Dec(96)04 [i.6] and ECC/Dec(04)06 [i.7] and for military use. The common use of this duplex pair within Europe is for tactical military relays.

In the lower and upper band most administrations were of the view that some sharing of part of the band would be possible following co-existence analysis and only if existing services could be protected.

In advance of any harmonised approach to the use of this band the German regulator has to issue a licence to the Deutsche Bahn to operate GSM-R in the band 873 MHz to 876 MHz. OFCOM in the UK recently completed a consultation where it invited interested parties to comment on potential uses and licensing schemes for the frequency band 872 MHz to 876 MHz and the complementary duplex frequencies. At the time of writing this document the final results of this consultation were not expected.

Spectrum options should be considered in this most precious part of the UHF band. There is a clear need to evaluate the options with regard to the impact, since a final decision for new spectrum is likely to be irreversible. Improvements to achieve more efficient use in 863-870 MHz have also to be considered. 870-876/915-921 MHz proposed by ETSI.

## 6.2 RFID

Other proposals noted: whitespace/geolocation in 470-790 MHz for apps such as RFID and other high-end SRD, 821-832 MHz duplex gap. Higher frequencies may also need to be discussed.

Operation by RFID in the proposed band 915 – 921 MHz will provide the following important benefits:

* **Harmonised frequency band.** RFID is a global business with more and more tagged items increasingly moving between the three ITU Regions. Outside Europe, the majority of the world’s trading nations operate RFID at UHF within the frequency range 902 – 928 MHz. This ensures that the performance of RFID is consistent across these countries, which is of big benefit for users. Already tags have been optimized for operation in the band 902 - 928 MHz. This development has simplified the international movement of goods – particularly for those items that are tagged at source. However it has left Europe in a position where the performance of RFID is inferior to what is being achieved in the rest of the world. Also the need to manufacture non-standard equipment for use in Europe is likely to lead to higher equipment costs. To ensure that RFID in Europe can compete on an equal basis, it will be important to designate global parameters for operating frequencies, power levels and spectrum masks.
* **Higher data rates.** Increased bandwidth will permit RFID in Europe to operate at the maximum data rate specified in the ISO standard 18000-6. This will have two important benefits. Firstly it will enable RFID interrogators to read faster moving tagged items as they pass monitoring points, which will allow the use of RFID on processes that have a requirement to track fast moving items. Secondly there is often a need to increase the number of tagged items on pallets while maintaining existing handling times. Higher data rates will make this possible.
* **Higher transmitted power.** Increased power levels will give the obvious advantage that some applications will be capable of operating at greater ranges. This is particular beneficial in certain logistics applications. However there is another less obvious benefit. Typically the reading performance for tagged cases on pallets is of the order of 98 – 99%. The reason for the missing 1 or 2 % of tags is due to them being positioned in the centre of the pallet where signal levels are much reduced. Higher power levels will permit these tags to be read. The consequent reduction in effort in handling such discrepancies will represent a substantial saving.
* **Simplified installation.** With the continued growth of RFID, it is inevitable that some users will wish to operate interrogators that are physically close together. This is particularly likely to apply to certain industrial and materials handling applications. However due to inter-modulation products, a minimum separation is required between interrogators operating on the same or adjacent channels. This can prevent interrogators from being positioned in optimum locations. The availability of additional channels with increased channel spacing will largely overcome this limitation.
* **Frequency diversity**. In applications where it is necessary to read stationary tagged items, this can lead to problems due to standing wave nulls. Such situations can arise in certain production and inventory applications. The use of frequency diversity can substantially eliminates such problems. Interrogators would be designed to switch their frequency of operation between the bands 865 – 868 MHz and 915 – 921 MHz.
* **Ranging** The ability to change the frequency of transmission of interrogators between the two RFID bands will make it possible to perform ranging. This will allow the position of tags to be determined. An example of where ranging can be of particular benefit is at the exit of a shop, which is fitted with a combined RFID/EAS system. The system would detect the position of suspect tags that are within the zone of the shop exit. A further important benefit of ranging is that it reduces the problems associated with unwanted reflections.

## 6.3 Sub-Metering, Smart Meter

The use of the frequency range 169,4-169,8125 MHz is in the process of being revised and will be available for smart metering / smart grids. The possible use of the about 400 kHz for smart metering / smart grid in this frequency range can be considered only as a supplement, but is well suited because of the ideal propagation conditions to read meters in cellars.

The topic of smart metering / smart grid is very complex and must be divided into different areas. It is in principle to distinguish between reading meters for electricity, but also gas, heat and water (metering), control of energy networks and the integration of intelligent electric appliances. This caused various interfaces and several ways of data transmission. Trunked radio and mobile networks to wireless, nationwide read meters suitable within the existing terms and conditions and individual allocations. The integration of renewable power generators and also intelligent electricity into the power grid could be realized with radio equipment of short range on the basis of a general allocation. For purely in-house applications (smart home) already existing radio applications (WLAN, ZigBee) are generally available.

Sub-GHz bands between 400-500 MHz or 800-1000 MHz are the most cited in the discussions for wireless metering technologies, offering a combination of large coverage area and low bit rates with smaller coverage distance and higher bit rates.

The results of detailed investigations performed [ref Uni Dortmund as was commissioned by the German Ministry of Economics] also confirm this view due to the propagation characteristics above 1 GHz limit drastically the possibility to reach all the endpoint / metering sensors in a network (often inside, or even in basements).

## 6.4 Smart Grid

Electricity generation from renewable and conventional energy, the efficient and reliable distribution of electrical energy are requiring solutions for decentralised small producers of electricity and operators of the electricity transport networks. Communication channels are required, which can be realised also wirelessly to some extent.

For this purpose, in particular to smart grids, there are already a number of frequency options available or under discussion to meet the requirements of intelligent electricity networks.

Frequency options:

For the realization of wireless communications for smart smart grids are predominantly frequency bands below 1 GHz best suited.

- 450 MHz (PMR/PAMR)

- Mobile networks (PMR/PAMR elsewhere)

- Public networks (wireless access)

- 870-876 MHz (extension for SRD - applications, ETSI proposal)

Under frequency-regulatory aspects it is also decisive how far realisations are possible within the framework of the existing Regulation (individual allocations, General allocations). Also, some still pending requests outside of radio frequency regulation can affect the future spectrum requirements (security-related requirements, data protection, etc.).

Utilities generally favour using different technologies depending on technical and operational capabilities as well as strategy. Currently, only GSM/GPRS (at 900 MHz) and CDMA (at 450 MHz) can be considered. In the long term, other technologies such as UMTS, HSPA, LTE or RF meshed network solutions may also be considered. Other stakeholders generally supported the use of GSM and 4G/LTE technology in the short/long term respectively, but also included other technologies including EVDO, PMR(TETRA), WAN or Smart Utility Network (IEEE 802.15.4g) and future WiFi (IEEE 802.11ah) associated to mesh routing protocol for shorter ranges.

National administrations and utilities overwhelmingly believe PMR networks could be implemented on a shared basis, but caution different requirements by public users and situations when utilities and 'blue light' services would want priority network access at the same time. Infrastructure providers' and telecom operators' responses were more varied. Some believe that current telecommunications networks are suitable and sufficient; others agree with PMR sharing but caution the challenges it would require, and some feel it must be a dedicated spectrum and should not be shared.

Utilities responses to the use of mission-critical services on a shared PMR network vary. Some are of the opinion that not all 'mission-critical' communications can be met by wireless technologies, while others feel that a shared network could work if Service Level Agreements are such that using a shared network is transparent for the utility. A couple of responses also favour the use of shared PMR as a back-up system during emergency situations. Responses from infrastructure manufacturers do not eliminate the possibility of using 'mission-critical' services on a shared PMR network, but cite various challenges (e.g. high costs, equipment compatibility, resilience, End Point Design complexity, built-in network management) as reasons for choosing other possibilities.

Sub-GHz bands between 400-500 MHz or 800-1000MHz are also the most cited in the EC call [ref] for long and short range wireless technologies, offering a combination of large coverage area and low bit rates with smaller coverage distance and higher bit rates.

The results of detailed investigations performed by the university of Dortmund [ref] also confirm this view due to the propagation characteristics above 1 GHz limit drastically the possibility to reach all the endpoint / sensors in a network.

## 6.5 M3N

Given the close similarity between Smart metering, remote meter reading, smart grid network, and all the M3N applications, it is recommended to designate the 873 MHz to 876 MHz band not only to smart metering devices but also to the more generic M3N devices and sensor (who include some meters).

## 6.6 Surveillance Alarms, Fire/Smoke alarms,Intruder alarms, Social Alarms,

*Michael to contact euroalarm. Nick to contact UK alarms associations*

The preferred future frequency allocation is in the upper part of the 870 to 876 MHz (see figure 1) because these applications may very likely coexist with GSM-R due to

low activity factor and

low duty cycle and with

c. short telegram bursts only in the case of an alert

A second allocation may be in the band 918 – 921 MHz (Michael, what’s your opinion about this?) 🡪this was in the proposal of the alarm SRDoc 🡪 see picute in chapter 4.2 / Figure 2

The existing frequency allocation in the 868 MHz band (ERC Rec 70-03, Annex 7) should be kept due to an installed basis of billions of devices and systems in CEPT countries. Otherwise the performance, reliability and functionality may decrease significantly due to competition with other applications in the same band which generates a non predicting base load.

## 6.7 Automotive Active Safety, Automotive Diagnostic data exchange, Automotive Freight protection, Automotive Environmental & safety systems

Thomas to get text from Soren Hess Text needs to state why the Spectrum allocated to ITS is not already sufficient?

# Existing Nationalspectrum use in the 870-876 MHz and 915-921 MHz bands

Replies were received from 43 administrations by 1 August 2012 (countries in bold).

|  |  |
| --- | --- |
| **Albania****Andorra****Austria**Azerbaijan**Belarus****Belgium****Bosnia Herzegovina****Bulgaria****Croatia****Cyprus****Czech Republic****Denmark****Estonia****Finland****France****Georgia****Germany****Greece****Hungary****Iceland****Ireland****Italy****Latvia****Liechtenstein** | **Lithuania****Luxembourg****Former Yugoslavian Republic of of Macedonia****Malta**Monaco**Montenegro****Moldova****Norway****Polen****Portugal**Romania**Russian Federation**San Marino**Serbia****Slovak Republic****Slovenia****Spain****Sweden****Switzerland****The Netherlands****The United Kingdom****Turkey****Ukraine**Vatican City |

Two questions were included in the questionnaire and all administrations which answered have provided responses to both questions.

**1 Existing Usage in 870-876/915-921 MHz**

This overview shows that the real implementation of PMR/PAMR is not high in Europe, despite of having ECC/DEC/(04)06 and reflection in the ECA table. PMR/PAMR systems are currently used in only six countries in this frequency band and several countries reported that PMR/PAMR has been allocation in their country but that network operation either has been terminated, or the network rollout being very limited, or network not fully put into operation, or either be simply unused (no licences awarded). One country plans to move from defense system usage towards PMR/PAMR usage. The PMR/PAMR usage is in some cases only in parts of the band (Georgia only 870-876 MHz, Poland 870-874.44 MHz, Spain: 4 local licenses. Ukraine reported to terminate usage by 1 January 2016.

There is considerable military usage in the band. A nearly equal number of countries are now also planning with E-GSM-R, although this needs still to materialize in the market.

The ARNS situation (time limited according to RR 5.323) may apply also to Azerbaijan who did not answer the questionnaire (this is not esplicitly recorded since ARNS is being phased out).

**Responses received by 1 August 2012**

|  |  |  |
| --- | --- | --- |
| **Country** | **What is the current use of the bands 870-876 MHz and 915-921 MHz in your country?** | **What are your short, medium and long term plans with regard to the future use?** |
| Albania | 870-876 and 915-921 MHz bands are identified as the favorite for Tactical Radio Relay, especially for cross-border cooperation | No change plans. |
| Andorra | Usage PMR/PAMR designated but not implemented | No change planned |
| Austria | Currently, the sub band 873 – 876 / 918 – 921 MHz is used according to the amended ECC/DEC/(02)05 for the extension of the GSM-R band.The sub band 870 – 873 / 915 – 918 MHz is currently not used (foreseen for PMR systems). Any European harmonisation measures are welcomed. | No changes are foreseen with respect to the extension band for GSM-R.Concerning the other part of this band the Austrian Administration can follow any additional harmonisation measures in principal. |
| Belarus | ARNS (time limited), PMR/PAMR allocated but not used | No further plans |
| Belgium | Governmental use (e.g. Unmanned Aeronautical Vehicle, Unmanned Ground Vehicle or Tactical Radio Relay); | E-GSM-R (also reflected in ECC Decision (04)06 and ECC Decision (02)05) |
| Bosnia Herzegovina | PMR/PAMR as per Rule 50/2010 which transponded stipulations of T/R 25-05. However, No licensed issued nor planned. | No plans for change at the moment |
| Bulgaria | The whole band 870-876/915-921 MHz (2x6 MHz) is used by governmental applications (defense usage). Governmental usage will stay in the future and will not change. | No change |
| Croatia | Military services, PMR/PAMR/ E-GSM-R. No PMR/PAMR networks are implemented/in operation in the market and intention to close the governmental use in this band. | Only E-GSM-R planned yet |
| Cyprus | The frequency bands are currently being used according to the frequency plan by the government (TRR, lower half of duplex band) and by digital land mobile PMR/PAMR (no licenses awarded) | No future use planned yet. |
| Czech Republic | The guard bands 870-872/915-917 MHz are not used and are not designated for any application. The bands 872-875.8/917-920.8 MHz are designated for applications in accordance with ECC Decision (04)06 (i.e. category 2). Current holder of block assignment has terminated operation of CDMA network, however licence is valid until 2015.The bands 875.8-876/920.8-921 MHz are guard bands (no utilisation). | Short plans: There is no short plan until we will get information about future plan from the licence holder.Medium plans and long term plans: The CTO has no specific plans; however, future utilisation will reflect European harmonisation, if required. |
| Denmark | No use | SRD and RFID |
| Estonia | No use. Reserved until public competition. | Waiting for results of international working groups. Will not decide plans with regard to the future use before decisions are made in international level. |
| Finland | Governmental use until the end of 2013 Designated for PMR/PAMR according to ECC/DEC/(04)06 but no actual PMR/PAMR users on these bands Other usage: test networks | Ficora supports CEPT studies on additional UHF spectrum for SRD, RFID and smart metering applications. Based on these studies these frequency bands may be considered for the above mentioned applications. |
| France | Governmental use for several kind of applications such as unmanned systems (air, sea and ground), remote control and telemetry, data links, etc. | A governmental usage of those bands for the applications mentioned above will be maintained in the future. Sharing of the 870-873 MHz band with secondary SRD applications is not considered.  |
| Georgia | 870-876 MHz band is used by CDMA-850 systems and radio-microphone devices. 915-921 MHz is currently used by SRD applications and radio-modems. | No change planned |
| Germany | 870-873 MHz/ 915-918 MHzGovernmental use(implemented, exclusive usage)873-876 MHz / 918-921 MHz E-GSM-R (license awarded), PMR/PAMR licenses possible but not awarded. | No change planned  |
| Greece | Exclusively Governmental Use (Tactical Communication System, Radio Relay) | No change planned |
| Hungary | Not used at present | 2. 870–873/915–918 MHz planned for wide band PMR/PAMR land mobile radiotelephone systems.2. & 3. 873–876/918–921 MHz planned for wide band PMR/PAMR land mobile radiotelephone systems, including E-GSM-R systems. |
| Iceland | Fixed (point to point links) | Short term plan: Fixed (point to point links)No medium or long term plans |
| Ireland | The bands 872 – 876 MHz and 917 – 921 MHz, are licensed within Ireland until December 2015 for Wideband Digital Mobile Data Services.The network has not yet been built up, and has minimal operation within Ireland (limited only to north county Dublin). The technology used is flash ofdm.870 – 872MHz and 915 – 917 MHz are currently unused in Ireland.  | ComReg has not yet determined its plans with regard to future use within these bands; however, a review of future use of the bands has been included in ComReg’s work programme for the period 2011 – 2013, for attention towards the end of this period. |
| Italy | MOBILE NETWORK by DEFENCE and SECURITY BODIES AND C2 UAV (whole 2 x 6 MHz) | No changes planned |
| Latvia | Identified for Wide Band Digital Land Mobile PMR/PAMR systems (according to ECC/DEC/(04)06)At this moment the band is not used. | Short term (3-5 years):Wide Band Digital Land Mobile PMR/PAMR systems (according to ECC/DEC/(04)06)Long term (5-10 years): no changes or adjustment to harmonised use of the band in Europe |
| Liechtenstein | 870 – 873 MHz: Until today no RIS and no use.873 – 876 MHz: RIS RIR0501-01 and RIR0501-05. Land mobile/GSM; individual assignment due shortly915 – 918 MHz: Until today no RIS and no use.918 – 921 MHz: RIS RIR0501-03 and RIR0501-05. Land mobile/GSM; Individual assignment due shortly  | Short and Medium term plans:870 – 873 MHz: reserved for future use by SRDs. 873 – 876 MHz: Primary allocation to GSM-R and use by GSM-R.915 – 918 MHz: reserved for future use by SRDs.918 – 921 MHz: Primary allocation to GSM-R and use by GSM-R.Long term plans:870 – 873 MHz: reserved for future use by SRDs. 873 – 876 MHz: Primary allocation to Railway mobile communication systems.915 – 918 MHz: reserved for future use by SRDs.918 – 921 MHz: Primary allocation to Railway mobile communication systems. |
| Lithuania | No use | PMR/PAMR according to ECC/DEC/(04)06 |
| Luxembourg | 1. Although the frequency band is a shared civil/military band, no military application (such as tactical radio relay) is currently in use.2. The frequency band has been allocated to PMR/PAMR applications (in accordance with ECC DEC (04)06) for some years, but no licences have yet been granted.3. Currently there is no intention to extend the GSM-R frequency range to include as well the band 873-876MHz/918-921MHz.4. Luxembourg recently granted a temporary licence for the band 870-876MHz to an energy utility company for utilisation of smart grid applications. | In Luxembourg, there is a request for this band for smart metering applications, which is mainly intended for carrying out tests of the relevant radio equipment. |
| Former Yugoslavian Republic of Macedonia | The bands 870-876 MHz and 915-921 MHz are allocated for Fixed and Land Mobile Service (no licenses awarded) | Plans for GSM-R / PMR/PAMR  |
| Malta | Not used | No plans |
| Moldava | 870-876 MHz – SRD possible;915-921 MHz in pair with 870-876 MHz for PMR/PAMR is provided by National Radiofrequency Table, but there are no registered or operating PMR/PAMR networks; | No plans |
| Montenegro | Digital PMR/PAMR (no license awarded) and TRR (Tactical radio relay) in lower half of the band | In further planning of this band, the most recent technological trends shall be taken into consideration, as well as the experience of the CEPT member countries and realistic needs of Montenegrin users |
| Norway | 870,5-876 & 915,5-1921 designated for individual service neutral licenseNo current use | Awaiting international harmonisation |
| Poland | 870 – 874.44 MHz: individual licensed PMR/PAMR applications, 869.4-874.44 MHz (downlink) paired with 824.4-829.44 MHz (uplink), CDMA, CDMA 2000 1xEV-DO)874.44 – 876 MHz not used915 – 921 MHz not used | medium or long term plans: a) re-farming (release) of the frequency range 870 – 874.44 MHz - moving CDMA and CDMA 2000 1xEV-DO applications into another frequency bandb) introduction of harmonized frequency usage in the bands 870-876/915-921 MHz in accordance with CEPT (and/or EU) regulations, e.g. extension of GSM-R band (E-GSM-R i.e. 873-876/918-921 MHz) |
| Portugal | - 870-873 MHz is being tested for a smart metering system, by the energy distribution operator;- 873-876 MHz paired with 918-921 MHz is being used by military; | Some adjustments might occur on the quantity of spectrum in use in the 870-876/915-921 MHz band in the short/medium term. GSM-R extension would be possible inside core GSM-R band since only 2x2 MHz being used currently. |
| Russian Federation | Band 870-876 MHzARNS on primary basisBand 915-921 MHzARNS on primary basisSpace operation service for telemetry, tracking, and control purposesMobile, except aeronautical mobile on secondary basisBand 916-921 MHzRFID  | Decommissioning of ARNS after the end of depreciation period and deployment same service in other bands |
| Serbia | Defense Systems | Medium term plan is to use the band for PMR/PAMR |
| Slovak Republic | 872 - 876 MHz digital wideband cellular network - CDMA; (duplex +45 MHz)917 - 921 MHz digital wideband cellular network - CDMA, duplex -45 MHz; (General license for terminals) | Yes, but only for frequency sectors 870 - 872/915 - 917 MHz and it also depends on results of study of compatibility. |
| Slovenia | Land military systems in 870 – 873 MHz (MS) / 915 – 918 MHz (BS). PMR/PAMR possible in upper half of the band but no licenses awarded. | Extension of land military systems or PMR/PAMR for the upper half of the band |
| Spain | There are 4 local licences in Spain, broadband digital technology for applications as M2M, meter reading and data. Technologies could be LTE or WiMax. | No change planned.  |
| Sweden | No use  | No short term plans for this band. Awaiting the results of the EC Spectrum Inventory.  |
| Switzerland | 870 – 873 MHz: Until today no RIS and no use.873 – 876 MHz: RIS RIR0501-01 and RIR0501-05. Licences will be assigned shortly915 – 918 MHz: Until today no RIS and no use.918 – 921 MHz: RIS RIR0501-03 and RIR0501-05. Licences will be assigned shortly | Short and Medium term plans:870 – 873 MHz: reserved for future use by SRDs. 873 – 876 MHz: Primary allocation to GSM-R and use by GSM-R.915 – 918 MHz: reserved for future use by SRDs.918 – 921 MHz: Primary allocation to GSM-R and use by GSM-R.Long term plans:870 – 873 MHz: reserved for future use by SRDs. 873 – 876 MHz: Primary allocation to Railway mobile communication systems.915 – 918 MHz: reserved for future use by SRDs.918 – 921 MHz: Primary allocation to Railway mobile communication systems. |
| The Netherlands | Military | Military use for the foreseeable future, new equipment has recently been purchased. |
| Turkey | 870-876 MHz: Designated to PMR/PAMR and Fixed Links. No implementation yet.915-921MHz: Designated for PMR/PAMR. No implementation yet. | No plans yet. |
| Ukraine | In accordance with the Plan of radio frequency resource usage in Ukraine the band of 870-876 MHz is actually used by REFs of CDMA-800 cellular communication systems, to organize of BS->AS communication links (deadline of technology usage – 1st January, 2016).Besides, both specified bands are used by special users REFs, relating to radio navigation and radiolocation service (for example, RSBN/PRMG), and will be used till the end of its operation term. | For a present day, there are no plans concerning conversion of the bands 870-876 MHz and 915-921 MHz in future, after the termination of their use by above-mentioned REFs. |
| United Kingdom | In the UK the bands 870-872 MHz and 915-917 MHz are allocated to the Military.The 872-876 MHz and 917-921 MHz bands are allocated for civil use (but not used for some time now).The Met Service operates Wind Profiler Radar (1 site) in the 915 MHz band. The use of this technology will continue and further sites may be added in future. | The UK military have identified their bands for commercial sharing opportunities under its Defence Spectrum Reform work. Should the use of these bands be changed to SRD, MOD will review any contract it has agreed and consider its position.The 2011 UK Government initiative, “Enabling UK growth – Releasing public spectrum, Making 500 MHz of spectrum available by 2020” (page 35) identified that there may be the opportunity to release the military bands 870-872 MHz and 915-917 MHz.<http://www.culture.gov.uk/images/publications/Spectrum_Release.pdf>In 2009 Ofcom consulted on the release of the civil bands <http://stakeholders.ofcom.org.uk/consultations/872_876_mhz/>Ofcom published an update on this spectrum in February 2010. In light of the progress of CEPT work on the use of this band subsequent to our 2010 update, Ofcom is planning to publish a further document in Q1 2013 which will consider if the UK should seek to release this band in line with the CEPT, for example to enable use of low power, licence exempt, short range devices. It will also consider the potential release of the 870-872 / 915-917 MHz alongside 872-876 MHz / 917-921 MHz if and when management of this is transferred to Ofcom from government.http://stakeholders.ofcom.org.uk/spectrum/spectrum-awards/prospective-awards/ |

**Information received from the UIC WGFM Group:**

This information shows that the planned E-GSM-R is likely to be used at local hotspots such as some metropolitan stations or big shunting sites only in the vast majority of cases. At the present time, it should also be noted that 3GPP has not assigned the Mobile Class Mark (identity for E-GSM-R capability in the GSM protocol for GSM equipment having implemented the E-GSM-R frequencies), i.e. E-GSM-R is in planning stage with first tests to be expected in 2013.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Land** | **Use Case** | **assigned** | **usage planed** | **not planed** |
| DB (DE) | shunting, Train Radio | x |   |   |
| Network Rail (UK) | shunting, GPRS Monitoring |   | x |   |
| Adif (Spain) | shunting, hot spot coverage etc. |   | x |   |
|  SBB (SUI) | Hot spot coverage |   | x |   |
| ProRail(NL) | shunting, PMR/short range radio, local capacity enhancements for telemetry applications, migration to next generation radio services |   | x |   |
| ÖBB (A) | shunting (yards), coverage of hot spots or disposed application areas |   | x |   |
| Trafikverket(SE) | Possibly to use during and after migration to other technology for the railway |   | x |   |
| FTA(FIN) | shunting, switch-man and train brake testing communications and during the migration period from GSM technology to the next generation radio technology |   |   | x |
| RFF (FR) | plans to use the ER-band in congested or subject to congestion areas, like Paris large railway stations or shunting areas, some important railway nodes etc.  |  | X |  |

Military usage: The NATO JOINT CIVIL AND MILITARY FREQUENCY AGREEMENT (NJFA), defines in the frequency range 790-960 MHz essential military requirements from 10 to 60 MHz for tactical radio relay of which 10 MHz should be harmonised spectrum for training in border areas, subject to bilateral/ multilateral agreements. Furthermore, based on present equipment, the deployment of a Corps-size Reaction Force requires 50 MHz of spectrum, although it is recognised that some countries will have problems fulfilling such a requirement.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | **870/915** | **871/916** | **872/917** | **873/918** | **874/919** | **875/920** | **876/921** |
| **Andorra** |  |
| **Albania** |  |
| **Austria** |  | E-GSM-R

|  |  |
| --- | --- |
|  | Not used or going to be unused |
|  | Planned E-GSM-R |
|  | Usage based on PMR/PAMR licences |
|  | Governmental/military usage |

 |
| **Belarus** | ARNS (phased out) |  |
| **Belgium** |  | E-GSM-R |
| **Bosnia Herzegov.** |  |
| **Bulgaria** |  |
| **Croatia** |  | E-GSM-R |
| **Cyprus** |  |  |
| **Czech Republic** |  | Usage terminated |
| **Denmark** |  |
| **Estonia** |  |
| **Finland** | Governmental use terminates |
| **France** |  |
| **Georgia** | 870-876: CDMA-850 Network, 915-921 possible for SRD/RFID |
| **Germany** |  | E-GSM-R |
| **Greece** |  |
| **Hungary** |  | E-GSM-R |
| **Iceland** | Limited p-t-p links, time-limited |
| **Ireland** |  |
| **Italy** |  |
| **Latvia** |  |
| **Liechtenstein** |  | E-GSM-R |
| **Lithuania** |  |
| **Luxemburg** | Request for Smart Metering |
| **FYROM** |  | E-GSM-R |
| **Malta** |  |
| **Moldava** |  |
| **Montenegro** |  |  |
| **Norway** |  |
| **Poland** | 870-874.44 MHz CDMA 2000 EV-DO, rest unused |  |
| **Portugal** | Request for Smart Metering |  |
| **Russian Federation** | RFID 916-921 MHz, (ARNS phased out), satellite TTC |
| **Serbia** | Medium term plan to move from defense systems to PMR/PAMR |
| **Slovak Republic** |  | CDMA Network |
| **Slovenia** |  |  |
| **Spain** | 4 **local** licenses for M2M, Metering based  |
| **Sweden** |  |
| **Switzerland** |  | E-GSM-R |
| **The Netherlands** |  |
| **Turkey** |  |
| **Ukraine** | CDMA-800 systems, (deadline of technology usage – 1st January, 2016) |
| **UK** | Plus Wind Profiler (a site) and unused military allocation  |

**The result may lead to a situation where many administration may have a spectrum usage opportunity for secondary applications in the band, however, some may not have in all or parts of the bands, mainly due to the unlimited in time military/governmental usage. A possible outcome after finalisation of the compatibility studies could therefore be to have entries in ERC REC 70-03 which could be implemented by administrations for those frequency opportunities where no military/governmental usage occurs.**

**Based on the preliminary indications from PT SE24 as well as the spectrum inventory information collected by means of the questionnaire for the bands 870-876/915-921 MHz, SRD/MG works on the basis of facing three different situations in the CEPT:**

**1. Some countries where all or parts of the bands could be used by SRD with rather simple spectrum access due to the underused or unused band situation,**

**2. In some countries, more sophisticated spectrum access is needed (e.g. E-GSM-R protection),**

**3. In some countries all or parts of the bands are used by governmental, mostly military usage. In some of these countries, this might be seen even as use on exclusive basis.**

**It is therefore necessary to keep the flexibility in the approach at the moment, and to avoid spectrum fragmentation by dividing spectrum over different applications. On the other side, some split may be unavoidable, also because there are applications needing a more predictable sharing environment than others. This will be considered when the results from SE24 are fully available in early 2013.**

# Technology Standards

8.1Text from TG17, TG28 and TG34 – standards for 870-876 MHz and 915-921 MHz.

Awaiting the development of standards in ERM.

8.2 SRD Rx performance chapter

**Receiver specifications**

**Introduction**

Receiver specifications have been and are still subject of a long debate in both ETSI and CEPT. Opinions of regulators and industry vary although the need for better receiver specifications is acknowledged by all. The source for discussion is partly the fact that receiver specifications may be defined for a number of technical and other reasons. The technical reasons are:

*Defining EMC:* Functioning of the receiver is influenced trough EM radiation leaking trough the cabinet or entering the cabinet trough cabling. EM energy does not necessarily enter the receiver trough the antenna port or the integral antenna. Examples are Low Frequency Detection in the AF stages of the receiver or variations in the power Supply voltage as the result of an EM field but also the spurious radiation of the receiver itself.

*Frequency management and planning:* For the functional description of a radio system usually a link budget is defined consisting of a transmitting power and modulation type, a propagation path and the minimum sensitivity of the receiver. The receiver parameters are in this case related to sensitivity and selectivity such as blocking, LO phase noise, adjacent channel selectivity etc.

*Improving spectrum efficiency:* A receiver uses the spectrum just like a transmitter. If for example the IF filter is too wide (wider than necessary for the reception of the transmitted signal), spectrum is wasted since it could be used by another receiver transmitter combination . The parameters are the same as for Frequency management and planning but the values may differ. A radio system may function without problems but could still waste spectrum resources because its receiving bandwidth is relaxed.

**Receiver classes**

In the 20-1000 MHz SRD standard EN 300 220 receivers are classified in class 1, 2 and 3. Class 3 of the lowest and class 1 as the highest class. Each class contains one or more receiver parameters and its associated value. The values of the parameters are set by a mix of EMC, frequency management and spectrum efficiency reasons. In the SRD world restrictions are usually based on cost versus compatibility and these parameters are no difference.

For the customer/end user and industry the classes are more useful than the actual parameters because they can be easily used to show the quality or suitability of the product. It is also easy for a regulator other than the spectrumregulator to make a receiver class mandatory for a particular application. Examples are safety and alarm applications.

The concept of using classes is ok but there is a risk. A class may be modified easily in the harmonised standard without giving the non technical user or regulator info about such a change in a direct way. The manufacturer may be tempted to strive for a more relaxed set of parameters within the receiver class used to reduce cost and still give the assumption of the same quality. To avoid obscurity it might be better to introduce more subclasses within the existing classes and do not change them anymore. For example a Class 1a, 1b and 1c, were 1b is the baseline in the form of the existing class 1 and 1a a more strict and 1c a relaxed subset of class 1. This way industry has more choice and the user has the assumption of a stable receiver class.

**Receiver classes vs Receiver parameters**

Receiver parameters have an impact on intra SRD sharing, specially were high and low power and narrow and wide bandwidth systems need to work together in the same environment.

The existing classes contain parameters for blocking an adjacent channel selectivity. A balance of power in a sharing environment is supported by defining certain values for blocking, all classes contain this value for blocking so a quality assessment in the environment based on power levels can be made. For selectivity however there is no value for the classes 2 and 3 which are the most used classes for equipment on the market. An assessment on spectrum efficiency and even establishing a predictable sharing environment cannot be made from a regulatory point of view. Existing industry seems to be happy with this situation but a newcomer may have problems with hidden receiver parameters limiting their access because the sharing environment is not that predictable. For the new frequencybands 915-921 MHz and 870-876 MHz clear bandwidth parameters should be established for all equipment that wishes to use it. It is not necessary for these parameters to be very tight in all cases since we have 3, or in the future maybe more, receiver classes.

# Outcome of Compatibility studies [ECC REPORT WI-41 FROM SE PT 24]

## 10.1 OverView

Main results of SE24 study

Based on current progress the following *very tentative (August 2012)* conclusions may be drawn:

* SRD deployment in the sub-band 873-876 MHz needs to address the problem of protecting ER-GSM uplinks. It is clear that this is not possible unless some forms of mitigation are imposed on SRDs. The precise nature and conditions of co-existence are still subject to further investigation, although some positive ideas are underway;
* RFID/SRD deployment in the band 918-921 MHz may require some form of Cognitive Radio in order to achieve co-existence with the ER-GSM downlink. This might include the ability to decode the BCCH signal from GSM-R BTS and thus avoid those channels in use in an area served by GSM-R BTS or interaction with a data base;
* SRD deployment in sub-bands for countries where no radio services are in place should pose less of a challenge. However some forms of mitigation mechanisms may be still required in order to ensure sharing of the sub-band between different families of SRDs ;
* It will not be possible for SRDs to share the same frequencies with governmental services, such as Tactical RRL and UAVs, unless some kinds of mitigation techniques are implemented. This might take the form of Cognitive Radio, DAA, etc.

## 10.2 Protection of other services and applications: GSM-R

The 873-876/918-921 is earmarked for railway E- GSM-R services, and so would be the primary service in eight CEPT countries as was indicated in the WGFM questionnaire responses. [Comment on when and how the sub-bands will be given over to E-GSM-R]. SRD operation in this band, therefore, would be as a secondary use and would be required not to cause harmful interference to E-GSM-R.

Interference avoidance can, traditionally, be achieved by maintaining geographical separation (although this would be difficult without introducing at least a light licensing regime) or restricting transmit powers to ultra-low levels.

Alternatively, built-in recovery mechanisms within the GSM standard (forward error correction, data interleaving and voice codec interpolation) can be relied upon to provide some level of interference robustness, and when combined with SRD duty cycle pattern restrictions might reduce interference to an acceptable level.

Finally, intelligent SRD radios may be able to detect and avoid (DAA) railway operations in specific 200 kHz channels, either by gleaning information over the air (e.g. using BCCH information) or other means. The power levels employed by GSM-R systems would be much higher than those used by SRDs, resulting in an unbalanced situation, thereby minimising the effect of ‘hidden nodes’ because the SRDs would be easily able to detect the primary services.

Therefore the DAA mechanism with its regular scanning of the operational frequency bands and ‘blacklisting’ of identified occupied channels is likely to be much more effective than, for example, LBT which requires listen periods between each transmission and would, therefore, be more cumbersome (and less efficient) to implement.

The GSM-R core band (at 876-880/921-925MHz) has specifications agreed to support full interoperability within the European Rail Traffic Management System (ERTMS): GSM-R voice and data; and European Train Control System (ETCS), and these are embodied in various specification from ETSI, the ERA and the UIC’s EIRENE project. The detailed requirements relevant to compatibility with SRDs are set out in the subset93 requirements, which include provisions for transparent and protected data bearers, voice bearers and, as a non-mandatory requirement, GPRS bearers.

The potential GSM-R extension band has no formal agreement or specifications on ECTS/ERTMS requirements, In addition, due to interoperability reasons, it is highly unlikely to have such requirements in the future in the E-GSM-R band, but for the purpose of this study, coexistence testing in the 873-876 MHz band has assumed that transparent data bearers to support ETCS/Subset93 requirements will be required. Testing of the compatibility of protected data and voice bearers have also been carried out. The tests included interference to both established bearers and radios attempting to set up calls.

[Summary of both compatibility testing investigations in the 873-876MHz band]

[Situation in the 918-921 MHz band?]

[DAA using BCCH]

[Results of STF397 avoidance tests]

# Conclusions

## 11.1 Proposed regulatory regime

Preliminary information from the spectrum engineering studies suggests that SRD deployment in the sub-band 873-876 MHz needs to address the problem of protecting E-GSM-R uplinks. It is clear that this is not possible unless some forms of mitigation are imposed on SRDs. The precise nature and conditions of co-existence are still subject to further investigation, although some positive ideas are underway.

RFID/SRD deployment in the band 918-921 MHz may require some form of Cognitive Radio in order to achieve co-existence with the E-GSM-R downlink. This might include the ability to decode the BCCH signal from GSM-R BTS and thus avoid those channels in use in an area served by GSM-R BTS or interaction with a data base. Mr Weber however also stressed that the E-GSM-R is still in the planning stage without having the E-GSM-R service identifier specified in the 3GPP. In addition, information collected regarding E-GSM-R plans suggests that deployment will be restricted to some geographical areas and the usage of a limited number of GSM-R channels in the 3 MHz upper duplex band.

SRD deployment in sub-bands for countries where no radio services are in place should pose less of a challenge. However some forms of mitigation mechanisms may be still required in order to ensure sharing of the sub-band between different families of SRDs.

It will not be possible for SRDs to share the same frequencies with governmental services, such as TRR and UAVs, unless some kinds of mitigation techniques are implemented. In addition, some administrations have clearly indicated to use all or parts of the band for governmental services on an exclusive basis. Belgium, Germany and Austria confirmed this position in the WGFM meeting. Germany provided the information about the German situation with regard to this subject. Germany emphasised that the bands 870-873 MHz and 915-918 MHz are designated exclusively for military radio applications and that it cannot be expected that they can be made available e.g. for short range device applications in the foreseeable future. France has the similar situation in the band 870-873 MHz.

Designation of the band 870 MHz to 876 MHz for use by SRDs will satisfy the foreseeable market requirements of the industry for the next 10-15 years.

## 11.2 Technical and operational conditions which may be attached Text

Text

## 11.3 Protection of Other Serivces and Applications

How to protect governmental usage from SRD applications which are not fixed installed applications – Government sevices less polite? SRD have LBT? Grey listing channels in FHSS? WI-41 specified mitigation techniques should take the government services into account in the study!

Automotive applications: how can one protect governmental applications?? See above.

Tactical military applications (Olivier, Erik -> some text) Maybe part of Erik’s “tactical” paper in this section?

For the foreseeable time in the future, (no full harmonisation?)

Everybody to make a proposal..this is crucial

## 11.4 Development of A Harmonised European Standard

Text waiting developments in ERM – based on outcome of WI-41

## 11.5 Improvements in 863-870 MHz

Awaiting outcome of WI-42

## 11.7 conclusions and recommendations

Text proposed 70-03 Annex table.

List of reference

1. ETSI TR 102 649-2….
2. ECC ..
3. etc
4. heading (style: ECC annex - heading1)

Body text (style: ECC Paragraph)

* 1. heading 2 (style: ECC annex heading2)
1. Heading (style: ECC Annex heading1)
	* + 1. Heading 4 (style: ECC Annex heading4)
2. List of reference
3. Reference one (style: reference)
4. Reference two
5. Etc.
1. The requirements for Automotive family of SRDs may need revision, noting the currently discussed draft revision of TR 102 649, where Automotive applications, such as Vehicle-to-Vehicle communications may require up to 500 mW transmit power and up to 1 MHz channel bandwidth, with TPC mitigation technique [↑](#footnote-ref-1)