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Electromagnetic compatibility and Radio spectrum Matters (ERM); System Reference document (SRdoc); Spectrum Requirements for Narrow band Point-to-Multipoint (nP2M) system operating in the 430 MHz - 470 MHz frequency range

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Contents

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Foreword

This Technical Report (TR) has been produced by ETSI Technical Committee Electromagnetic compatibility and Radio spectrum Matters (ERM).

Executive Summary

Narrow-band point-to-multipoint systems (nP2M) provide a solution for the delivery of short messages to large receiver populations. They are optimized to guarantee very high levels of reliability as required by safety services, to be cost-efficient and to support energy-efficient operation of low-cost receivers. A typical application of nP2M systems is cost-efficient alerting services for European citizens.

With the Europe-wide provision of a spectrum of 150 kHz in the 430 MHz to 470 MHz range for an appropriate nP2M technology, the requirements of transporting urgent information to very large groups of European citizens can be easily realized and the required applications implemented. The designation of the spectrum can vary from country to country and can be divided into two blocks (bundles) with 3 adjacent 25 kHz channels each. It is beneficial but not required when neighbouring countries use the same frequencies for at least one of the blocks. In accordance with the European spectrum allocation table, a number of technologies with which nP2M can and must coexist beneficially are situated in and around the 430 MHz to 470 MHz band. Mutual benefits are possible in the area of two-way communication in security applications (380 MHz - 400 MHz), professional PMR applications (410 MHz - 430 MHz) and short-range applications in the 433 MHz band, to name just a few examples. The economical and affordable development of mass applications that use multiple technologies simultaneously requires that nP2M be located very close to these bands.

nP2M systems are designed to utilize spectrum resources efficiently by reusing spectrum in different, non-neighboured geographical regions. The geographical granularity to be supported is determined by the receiver populations, that need to be addressed (e.g. a city). In order to allow this reuse of spectrum in different regions efficiently and to support the required overall system capacity, the frequency band 430 MHz to 470 MHz is well suited. Lower spectrum bands would result in coverage areas larger than the required geographical granularity.

Providing spectrum for nP2M operations would serve the public interest in the light of these emergency notification services offered by nP2M systems. The present document provides an overview of typical nP2M technologies that could address this opportunity. Higher frequencies would not allow achieving the required coverage quality.

The SRdoc also describes and discusses the required technical specifications, possible implementation scenarios including co-existence scenarios with the incumbent services, market data and spectrum regulation (including a substantiated radio spectrum request). The document is also a basis for the further development of a standard for nP2M services.

The proponents have an interest in addressing a growing market for nP2M services in the 430 MHz to 470 MHz frequency range but are concerned that no specific regulatory guidance from CEPT/ECC exists for administrations wishing to implement nP2M systems.

Currently nP2M systems are operating on 20 kHz or 25 kHz carriers. It is advantageous to designate three neighboured carriers each of 25 kHz, since this carrier aggregation (bundling) allows to use the centred carrier for serving very simple low cost receivers (with low interference rejection capabilities) or, vice versa, allows to support applications with very high requirements on reliability and coverage on the centred carrier. The receiver capabilities specified for the simple receiver class specified below takes this deployment strategy into account and, thus, focuses on the receiver capabilities for the centred 25 kHz band.

Bundling also reduces the number of potentially effected other systems. Three isolated nP2M carriers have six neighbouring carriers where deployed other systems might be affected by adjacent channel interference. Bundling of three nP2M carriers will reduce this to only two neighboured carriers where other systems might be affected by adjacent channel interference.

Introduction

The present document has been developed to support the co-operation between ETSI and the Electronic Communications Committee (ECC) of the European Conference of Postal and Telecommunications Administrations (CEPT).

The present document is intended to help to find an appropriate frequency range by describing the system and providing an estimation of the radio spectrum demand for Narrow band Point-to-Multipoint (nP2M) system. It thus intends to lay the foundation for industry to quickly implement an innovative and useful system within Europe while avoiding harmful interference with other services and systems.

Status of the pre-approval draft system reference document

The present document has been developed and agreed by TC ERM TG DMR. The information in it has not yet undergone coordination by ERM. It contains final information.

Table 1: Document status

Target version	**Pre-approval date version (see note)**				
V1.1.1	**a**	**s**	**m**	**Date**	**Description**
V1.1.1	0.0.1			11 May 2011	Submitted to TG DMR for first review
V.1.1.1	0.0.2			05 October 2011	Submitted to TG DMR for second review
V.1.1.1	0.0.3			23 April 2012	Submitted to TG DMR for approval
V.1.1.1	0.0.4			25 September 2012	Submitted to TG DMR for approval
V.1.1.1	0.0.5			19 October 2012	Submitted to TGDMR for AbC. To be submitted to TC ERM for consideration and approval.
V1.1.1	0.0.6			23 November 2012	Approved by ERM and sent to internal enquiry by 30 November
V.1.1.1	0.0.7			07 February 2013	Sent to second round of internal enquiry after comment resolution
NOTE: See EG 201 788 [i.49] (V2.1.1), clause A.2.					

1 Scope

The present document describes Narrow band Point-to-Multipoint (nP2M) system.

It includes in particular:

- Market information.
- Technical information including expected sharing and compatibility issues.
- Regulatory issues.

2 References

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

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

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

2.1 Normative references

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

Not applicable.

2.2 Informative references

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

[i.1] ITU-R Radio Regulations, Edition 2012; Article 5.

[i.2] ERC Report 25: "The European table of frequency allocations and utilisations in the frequency range 9 kHz to 3000 GHz".

[i.3] APWPT Press Release of 08 June 2011.

NOTE: Available at http://www.apwpt.org/downloads/pm-07062011-e-petition-zum-schutz-der-drahtlos.pdf.

[i.4] ECC/DEC/(08)05: "Harmonisation of frequency bands for the implementation of digital Public Protection and Disaster Relief (PPDR) radio applications in bands within the 380-470 MHz range".

[i.5] ECC/DEC/(04)02: "Harmonised frequencies, technical characteristics and exemption from individual licensing of Non-specific Short Range Devices operating in the frequency band 433.050-434.790 MHz excluding audio and voice applications".

[i.6] ERC/REC 70-03: "Relating to the use of short range devices (SRD)".

[i.7] ETSI EN 301 783 (all parts): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Land Mobile Service; Commercially available amateur radio equipment".

[i.8] European Commission's press release IP/09/1595.

[i.9] ETSI EN 300 220 (all parts): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Short Range Devices (SRD); Radio equipment to be used in the 25 MHz to 1 000 MHz frequency range with power levels ranging up to 500 mW".

[i.10] ETSI EN 300 224 (all parts): "ElectroMagnetic Compatibility and Radio Spectrum Matters (ERM); On-site paging service".

[i.11] ECC/DEC/(05)12: "Harmonised frequencies, technical characteristics, exemption from individual licensing and free carriage and use of digital PMR 446 applications operating in the frequency band 446.1- 446.2 MHz".

[i.12] ERC/DEC(98)25: "Harmonised frequency band to be designated for PMR 446".

[i.13] ETSI EN 300 296 (all parts): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Land Mobile Service; Radio equipment using integral antennas intended primarily for analogue speech".

[i.14] ETSI EN 300 113 (all parts): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Land mobile service; Radio equipment intended for the transmission of data (and/or speech) using constant or non-constant envelope modulation and having an antenna connector".

[i.15] ETSI EN 301 166 (all parts): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Land Mobile Service; Radio equipment for analogue and/or digital communication (speech and/or data) and operating on narrow band channels and having an antenna connector".

[i.16] ECC/DEC/(06)06: "Availability of frequency bands for the introduction of Narrow Band Digital Land Mobile PMR/PAMR in the 80 MHz, 160 MHz and 400 MHz bands".

[i.17] T/R 25-08: "Planning criteria and coordination of frequencies in the land mobile service in the range 29.7 921 MHz".

[i.18] ETSI EN 300 086 (all parts): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Land Mobile Service; Radio equipment with an internal or external RF connector intended primarily for analogue speech".

[i.19] ETSI EN 300 219 (all parts): "ElectroMagnetic Compatibility and Radio Spectrum Matters (ERM); Land Mobile Service; Radio equipment transmitting signals to initiate a specific response in the receiver".

[i.20] ETSI EN 300 341 (all parts): "ElectroMagnetic Compatibility and Radio Spectrum Matters (ERM); Land Mobile Service (RP 02); Radio equipment using an integral antenna transmitting signals to initiate a specific response in the receiver".

[i.21] ETSI EN 300 390 (all parts): "ElectroMagnetic Compatibility and Radio Spectrum Matters (ERM); Land Mobile Service; Radio equipment intended for the transmission of data (and speech) and using an integral antenna".

[i.22] ETSI EN 300 471 (all parts): "ElectroMagnetic Compatibility and Radio Spectrum Matters (ERM); Land Mobile Service; Rules for Access and the Sharing of common used channels by equipment complying with EN 300 113".

[i.23] ETSI EN 302 561: "Electromagnetic compatibility and Radio spectrum Matters (ERM); Land Mobile Service; Radio equipment using constant or non-constant envelope modulation operating in a channel bandwidth of 25 kHz, 50 kHz, 100 kHz or 150 kHz; Harmonized EN covering essential requirements of article 3.2 of the R&TTE Directive".

[i.24] Summary report of the EU Workshop on "A Long Term Approach to Radio Spectrum for PMSE in Europe", Brussels, 26 October 2010.

NOTE: Available at https://ec.europa.eu/digital-agenda/sites/digital-agenda/files/pmse_present_0.pdf.

[i.25] ECC/DEC/(04)06: "Availability of frequency bands for the introduction of Wide Band Digital Land Mobile PMR/PAMR in the 400 MHz and 800/900 MHz bands".

[i.26] ERC/DEC/(96)04: "Frequency bands for the introduction of the Trans European Trunked Radio System (TETRA)".

[i.27] ETSI EN 300 392 (all parts): "Terrestrial Trunked Radio (TETRA); Voice plus Data (V+D)".

[i.28] ETSI EN 301 449: "Electromagnetic compatibility and Radio spectrum Matters (ERM); Harmonized EN for CDMA spread spectrum base stations operating in the 450 MHz cellular band (CDMA 450) and 410, 450 and 870 MHz PAMR bands (CDMA-PAMR) covering essential requirements of article 3.2 of the R&TTE Directive".

[i.29] ETSI EN 301 526: "Electromagnetic compatibility and Radio spectrum Matters (ERM); Harmonized EN for CDMA spread spectrum mobile stations operating in the 450 MHz cellular band (CDMA 450) and 410, 450 and 870 MHz PAMR bands (CDMA-PAMR) covering essential requirements of article 3.2 of the R&TTE Directive".

[i.30] ETSI EN 302 426: "Electromagnetic compatibility and Radio spectrum Matters (ERM); Harmonized EN for CDMA spread spectrum Repeaters operating in the 450 MHz cellular band (CDMA450) and the 410 MHz, 450 MHz and 870 MHz PAMR bands (CDMA-PAMR) covering essential requirements of article 3.2 of the R&TTE Directive".

[i.31] ETSI EN 303 035 (all parts): "Terrestrial Trunked Radio (TETRA); Harmonized EN for TETRA equipment covering essential requirements under article 3.2 of the R&TTE Directive".

[i.32] Call for Experts for Specialist Task Force UB (ETSI/ERM-TG17) on methods, parameters and test procedures for cognitive interference mitigation techniques for use by PMSE devices (Program-Making and Special Events)", ETSI, 17 June 2009.

[i.33] Recommendation T/R 32-02: "Frequencies to be used by on-board communication stations".

[i.34] "ETSI Special Task Force STF386 (PMSE): Cognitive Radio ERM-TG17 WP3", R. Weigel/G. Fischer, Brussels, 26 January 2010.

NOTE: Available at http://cordis.europa.eu/fp7/ict/future-networks/crw/13fischer.pdf.

[i.35] Frequenzen für drahtlose Mikrofone: So geht es in Deutschland, den Niederlanden, Österreich und der Schweiz weiter", APWT, Baiersdorf, Germany, 8 April 2011.

[i.36] Renewable Energies Act (EEG) of Germany (Erneuerbare-Energien-Gesetz).

[i.37] Eurostat for 2010.

NOTE: Available at http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=educ_ilev&lang=en.

[i.38] ETSI TR 102 683 (V1.1.1) (2009-09): "Reconfigurable Radio Systems (RRS); Cognitive Pilot Channel (CPC)".

[i.39] Recommendation. Recommendation ITU-R M.539-3: "Technical and operational characteristics of international radio-paging systems".

NOTE: Suppressed on 19/10/07 (RA-07).

[i.40] Recommendation ITU-R M.584-2: "Codes and formats for radio paging".

[i.41] ERC Report 075: "Narrowband return path two way paging compatibility studies in the 406.1 - 410 MHz, 440 - 470 MHz and 862 - 871 MHz bands".

[i.42] ECC Report 022: "The technical impact of introducing TAPS on 12.5 / 25 kHz PMR/PAMR technologies in the 380-400, 410-430 and 450-470 MHz bands".

[i.43] ECC Report 039: "The technical impact of introducing CDMA-PAMR on 12.5 / 25 kHz PMR/PAMR technologies in the 410-430 and 450-470 MHz bands".

[i.44] Directive of the European Parliament and of the Council of December 21, 2010, COM (2010) 781.

[i.45] ETSI TS 102 182: "Emergency Communications (EMTEL); Requirements for communications from authorities/organizations to individuals, groups or the general public during emergencies".

[i.46] Energy Map.

NOTE: Available at http://www.energymap.info/download.html.

[i.47] The federal government.

NOTE: Available at http://www.bundesregierung.de/Content/EN/Artikel/2010/05/2010-05-03-elektromobilitaetsgipfel_en.html?nn=447030.

[i.48] Council Directive 96/82/EC of 9 December 1996 on the control of major-accident hazards involving dangerous substances.

[i.49] ETSI EG 201 788: "Electromagnetic compatibility and Radio spectrum Matters (ERM); Guidance for drafting an ETSI System Reference document (SRdoc)".

[i.50] Recommendation ITU-R M.1174-2: "Technical characteristics of equipment used for on-board vessel communications in the bands between 450 and 470 MHz".

[i.51] ETSI EN 300 720 (all parts): "Electromagnetic compatibility and Radio Spectrum Matters (ERM); Ultra-High Frequency (UHF) on-board communications systems and equipment".

[i.52] World Radiocommunication Conference 2007 (WRC-07): "Bringing all radio services together".

[i.53] World Radiocommunication Conference 1997 (WRC-97).

[i.54] World Radiocommunication Conference 2003 (WRC-03).

[i.55] Eurostat 12/2005.

3 Definitions, symbols and abbreviations

3.1 Definitions

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

Narrow band Point-to-Multipoint (nP2M) system: unidirectional radio system for digital data that pages all or groups of appropriately equipped receivers in a predefined area and delivers short messages

3.2 Symbols

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

dB	deciBel
dBi	deciBel relative to an isotropic radiator
dBm	deciBel relative to 1 mW
ppm	parts per million

3.3 Abbreviations

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

ACPR	Adjacent Channel Power Ratio
APWPT	Association of Professional Wireless Production Technologies
CEPT	Conference of European Postal and Telecommunications Administration
CPC	Cognitive Pilot Channel
DFV	German Fire Service Association
DIY	Do-it-yourself
DMR	Digital Mobile Radio
EC	European Commission
ECA	European Common Allocation
ECC	Electronics Communications Committee
EEG	Renewable Energies Act (EEG) of Germany (Erneuerbare-Energien-Gesetz)
EESS	Earth Exploration Satellite Service

ERC	European Radiocommunications Committee
ERP	Effective Radiated Power
ETSI	European Telecommunications Standards Institute
EU	European Union
FSK	Frequency Shift Keying
GSM	Global Service for Mobile communication
IMT	International Mobile Telecommunications
IP	Internet Protocol
ISM	Industrial, Scientific and Medical
ITU	International Telecommunication Union
ITU-R	International Telecommunication Union – Radiocommunication Sector
MAC	Media Access Control
NOC	National Operating Centre
nP2M	Narrow band Point-to-Multipoint
PA	Public Access
PMR	Private Mobile Radio
PMSE	Program-Making and Special Events
POCSAG	Post Office Code Standardisation Advisory Group
PPDR	Public Protection and Disaster Relief
PWMS	Professional Wireless Microphone System
RF	Radio Frequency
SFN	Single Frequency Network
SMS	Short Messaging Service
TDM	Time Division Multiplexing
TG	Task Group
TGDMR	Task Group DMR
US	United States

4 Comments on the System Reference Document

No ETSI members raised any comments.

5 Presentation of the system or technology

5.1 Definitions and applications

A Narrow band Point-to-Multipoint (nP2M) system is a unidirectional radio system for digital data that pages all or groups of appropriately equipped receivers in a predefined area and delivers short messages.

Receivers can be addressed individually, as group or as the whole nP2M receiver population in a predefined area. nP2M receivers are radio equipment able to be paged by nP2M systems and able to demodulate respective delivered short messages.

Applications based on nP2M radio systems comprise but are not limited to:

- alerting services for disasters or any other kind of events of broad relevance;
- unidirectional information services supporting applications in the area of smart energy management (information broadcast on current energy rate to households and, in particular, white good products); or
- update or maintenance of information provided to industry and consumer products (weather stations, cognitive pilot channel for radio equipment without bidirectional connectivity (e.g. PMSE equipment)).

nP2M can provide better coverage and higher availability than competing alerting systems (e.g. sirens, send eMails or SMS, TETRA with call out service), and the limited complexity of the receivers allows an economically reasonable application of nP2M in applications than other systems.

5.2 Societal benefits

At present, there is no Europe-wide standard organized way of alerting and informing the public in times of emergency even though we have suffered many such disasters in the past decade and before. The benefits of nP2M technology to society are immense in that a service warning the public of danger (down to household level) and informing them of actions to take can be immediately implemented in much of Europe and is easily and economically implemented in areas that do not currently benefit from nP2M services. In addition, the cost of developing and administering the warning services can be offset by the deployment of commercial services like those listed in clause 5.1. Furthermore, nP2M services can significantly ease the implementation of many crucial new applications and services as smart energy management, intelligent traffic guidance, and environment monitoring. In many European countries, for ecological reasons, it has been decided to have variable spot energy prices with information given to citizens in advance. NP2M will help European countries to realize ecological targets given by e.g. European Commission without discriminating any groups of citizens.

Disaster Warning

As more and more risks are found in many occurrences that were considered very safe and predictable, our society needs flexible and above all affordable means of warning inhabitants in the very improbable case of emergencies and disasters. A suitable platform for such warning media is nP2M.

Citizens want to be reliably informed about any facts relevant for their region resulting from any kind of critical situations, and in particular in cases where power outage or communication breakdowns aggravate the scenario.

In such cases, European citizens should be able to receive appropriate warnings and all-clear messages.

The technology is implemented independently from other terrestrial and mobile wireless communication networks, and is thus an important safety back-up for day-to-day communication systems, in particular those based on the public internet or public mobile communications networks that - in cases of disasters - are often overloaded or that can easily be attacked or be harmed unintentionally.

Fair Public Access to Significant Information

Every citizen wants to and should be informed in problem situations, and should be alerted and warned in emergencies. In case of an alarm, volunteer first aid agencies, including those far from the emergency scene, should also be summoned and informed. Information that is relevant day in and day out, such as information on weather and all other significant conditions, should also be provided as widely as possible, and in any case affordably, to the population of Europe. nP2M permits the production of ready-to-use modules for integration into many different home appliances at costs far below any competing technology, and with extremely low power consumption that makes them independent of power grid outages (infrastructure and receivers).

nP2M is thus an affordable and fair communication medium for everyone meeting the requirements of many critical services.

Ecology and Investment Security

The technology requires less energy per square kilometre of wireless coverage than any other current mobile technology. 2-way systems have much smaller cell size and much more sites for that reason. Because of the complexity, such base stations have at least the same power consumption as nP2M stations. The only technology, which has a similar but not equal or better efficiency, is paging system, which is the predecessor of nP2m System. nP2M permits the production of modules that can be powered for years, in some cases for up to a decade, by small lithium batteries without depending on any external power supply.

At the same time, switching and status control by nP2M can help in utilizing electric power economically, by activating power loads at particular times of day when alternative energy supplies are highest. The inhabitants of Europe can benefit from information provided affordably to all households about the rate charged for electrical power, which can vary in the future every quarter of an hour. This is a significant stimulus for economical use.

With its robust design and resource-saving implementation, nP2M technology is a candidate technology and enabler for many other applications requiring extremely energy efficient and reliable signalling and alerting.

The Autonomous Character of nP2M-based Solutions

In an increasingly convenient, but also increasingly vulnerable world in which people are more intensively connected by different kinds of network infrastructures, nP2M is a redundant and in certain cases a vital medium: A solution that can be essential for survival in the worst case. The broadcast character of nP2M is different from all packet-oriented and connection-oriented media. nP2M can be used as a back-up medium for a number of critical and near-critical situations.

The technology is downwardly compatible with a communication medium that has been proven millions of times over: mobile paging. nP2M is a disruptive technology in the best sense of the term: it builds on the advantages of existing technology, including proven reliable availability and maximum ease of use, and adds new components to develop completely novel applications.

Internationally Connective, Flexible and Adaptive

nP2M base stations have a large coverage range, many times that of typical cellular transmitters. The technology is especially suitable for international use in European border areas with special risks, such as the flood area between Germany and Poland, the Benelux countries, nuclear power stations near national borders, etc. Language barriers can be accommodated very economically, or overcome by means of appropriate visual media (e.g. messages are displayed in the language of the user of the receiver).

nP2M is thus ideally suited, even in unpredictable situations, for a diverse, converging European society.

Because of its very low cost, power consumption and other requirements, nP2M is ideally flexible and adaptive for integration in other systems yet to be invented.

Distinction for European Industry

nP2M helps European manufacturers by providing a distinguishing added benefit for their products, giving them a competitive advantage over non-European products, or in some cases making them competitive to begin with.

Where EU manufacturers currently hold less than a 5 % share of the smoke alarm market, for example, their market share can grow to many times that size with integration of nP2M-based services, which are a feature that is not easily imitated. Other products too can draw a competitive advantage from dynamic features implemented by means of nP2M. At affordable cost, such features can target the mass market, not just technophile early users.

Price as a Barrier to Commercialization

Many of the applications implemented using nP2M can also be realized using other, more expensive technologies. But to achieve mass-marketable solutions, to attain the level of utilization associated with "plug and play" and "anyone can use it", receiving and displaying information has to be more than just technically possible. The success or failure of applications such as comprehensive population warning or the transmission of weather and storm information is generally determined, in part or entirely, by the price charged to the end user. That price should also include the enormous margin of distribution and sales costs: for mass-market products, retail chains alone have a mark-up of at least 50 %.

nP2M is simple and robust, and developed with minimal costs both for network operations and for end user devices. Due to the comparatively low operating costs for services, the service fees can be paid once for all with the initial purchase. In marketing nP2M-based weather stations, the manufacturers even added the benefit of the nP2M application without raising prices: instead, they were paid in increased market share.

nP2M is thus a technology that is affordable for all citizens and can truly provide added benefits for all citizens.

Information Across Borders

As the member states of Europe, with their very different territorial sizes, grow together, it is especially advantageous to provide services internationally. The harmonization of the frequency band for nP2M across the borders of the individual member states will permit international roaming as well as the transmission and reception of identical information in the EU's internal border areas. The application logic in the user devices then provides the required localized information display, which is tailored to the end user (e.g. his preferred language) and independent of the abstract, universal form of the information in transmission.

The Right to Access to Information

Regardless of their nationality and social situation, inhabitants want non-discriminatory access to information - and in the case of social alerting, they need it. nP2M is an important building block to fulfil this need. The provision of regionally specific high-quality weather information, for display or for the control of energy-consuming user devices, is already a persuasive contribution. Naturally such information includes warnings when appropriate.

Because the population is in need and will supply themselves; the sales figures for personal weather stations show rapid penetration in Germany and France. The application has spread with a speed that is comparable in some cases with the rapid market conquest of GSM and cellular wireless services in general.

Spectrum Re-farming with Clear Benefits to Citizens

The new apportionment of the frequency bands called "digital dividend" to cellular telephony operators was coupled with substantial obligations to improve rural bandwidth coverage. Although this strategy has often shown positive consequences, its success has sometimes fallen short of individual expectations. In such cases, the discussions that have arisen, partly in connection with the distribution of significant spectrum resources to large telecom players, are exacerbated by the fact that the redistribution of frequency bands has brought with it a substantial if not critical impairment of event-driven wireless applications such as Programme Making and Special Events (PMSE). Such impairments especially affect municipalities and small businesses in the entertainment and educational sectors. After the re-farming of the digital dividend, nP2M can help to address the demand for an affordable control of the bands assigned to PMSE by means of cognitive procedures, which will finally make them usable on a broad scale. The problem is a substantial one. The German association of professional wireless production technologies (APWPT) alone has valued the cost of conversion at up to 700 million Euro and demands compensation [i.3].

With regard to economy, European integration, and progress, nP2M can thus contribute significantly to the utility and the feasibility of PMSE, including professional wireless microphone systems (PWMS) in particular.

6 Market information

6.1 Selected Market Segments

nP2M faces a number of opportunities in the market. A few of these are described systematically in the following sections. The market segments can be grouped as follows:

1) General citizen information.
2) Helping to control and reduce energy consumption.
3) Social alarm.
4) First-responder alerting.
5) Cognitive pilot channel for radio applications.

More detailed market information can be found in annex A.

6.1.1 General Citizen Information

nP2M permits simultaneous, prompt delivery of information, simply, redundantly to other media, and in combination with warning information. nP2M information is easy to receive independently of mains power, and thus both affordable and usable to a large segment of the population.

In all, general citizen information over nP2M can be addressed to Europe's 195 000 000 households.

6.1.2 Helping to Control and Reduce Energy Consumption, Primarily in Households

Economical use of energy requires knowledge of the momentary conditions, including the rates charged by energy suppliers in Europe, which need to be set dynamically. Saving energy is the most important contribution to securing Europe's energy supply in the long term. Especially after the recent events in the Pacific region, public willingness to contribute in this way has increased significantly. The national governments force energy suppliers to motivate consumers to use energy ecologically through rates that are dynamically adapted to production, and in particular to the rapidly changing energy production from renewable wind and solar energy sources [i.36].

nP2M based user devices are a means to these ends: Where automatic processes support inhabitants, the use of nP2M-based embedded systems is planned. An example module which can be embedded into other devices can be found in clause 7.1.2.2.

The potential market for these applications is Europe's 197 000 000 households.

6.1.3 Social Alarm

Recent emergencies have shown that improbable and unpredictable events especially harm those who, considering themselves invulnerable, are unprepared and inflexible in their ability to react. Wherever dependency on the invulnerable availability of electrical power, IP network services, or mobile telephony is the rule, there is a market for nP2M. Reaching people in Europe in near-crisis situations when mains power, the internet, and mobile phone networks, or even two of the three break down, is what nP2M can do.

6.1.3.1 Warning System with Widespread Availability

With 197 million households in the 27 member countries of the EU, there is plenty of work for emergency communication systems. The special flexibility, uniform basis, simplicity and mass affordability of warning instruments are necessitated by transport accidents with critical consequences. Thus the theoretical total market volume for smoke alarms with a second function (independent from detecting smoke) that will receive and present warning information by means of nP2M is about 394 000 000 units.

Education

The effects and frequency of emergencies in educational institutions are increasing. Among the regrettable examples are the massacres in Finland, the school shootings in Germany, the similar events in the US that grow more frequent due to imitation with each passing year, as young people in particular become more closely networked.

In Europe, 19 % of the population, or about 93 000 000 persons, are students [i.37]. Not every student group in the same manner will be part of emergency preventing and fighting communication systems. Nevertheless a fast growing number of educational institutes have the requirement for such kind of systems in an economical manner. nP2M is an important contribution to solve these kinds of problems.

Industry

Extrapolating an estimate of 1 000 recipients per industrial plant covered by EU Directive 96/82/EC [i.48] (knows as Seveso Directive) throughout Europe yields about 10 million recipients in Europe.

6.1.4 First-Responder Alerting

In Europe we have a great number of first responders in emergencies, with various forms and organizations in the 27 individual countries. These agencies need to be ready to respond rapidly at unpredictable emergency scenes at all times. The alerting instruments necessary to summon these agencies should be affordable, discreet, meaningful, with universal coverage and maximum quality, and most of all, should be as independent as possible from all other communication media, such as cellular phones and even TETRA/public safety radio, particularly during emergencies, so that they have the high functional redundancy and autonomy in the situations in which they are needed.

Well over 90 % of fire-fighters in Europe are volunteers, and thus need to be reachable economically and practically anywhere. The number of these groups of European citizens being part of first responder forces easily is higher than 5 million people.

6.1.5 Cognitive Pilot Channel for Radio Equipment

Program-Making and Special Events (PMSE) equipment includes numerous short-range wireless devices such as microphones and monitors, wireless intercoms, cameras, special effect and remote control equipment, Public Access (PA) systems for conferences, headphones for simultaneous translation, and audio systems for tour guides.

The frequency band used for a PMSE application should be free of interference for the duration of the given production.

PMSE currently uses "digital dividend" frequency bands that have been allocated to or set aside for paging by pertinent European initiatives [i.8]. Alternative bands proposed for PMSE are often situated in higher frequency ranges with poorer signal propagation characteristics.

Many professional, regional and even municipal applications are threatened.

The EU is making efforts to solve this problem [i.24].

ETSI has supported these efforts by founding a "specialist task force" [i.32]. One of the task force's objectives is to specify cognitive features for PMSE, such as responsiveness to changes in the available or contested frequencies. Other tasks include proposing PMSE protocols that use such features, and proposing methodological approaches to quality measurement. TR 102 683 [i.38] describes the advantages of having a Cognitive Pilot Channel (CPC) for efficient spectrum usage. The use of one-directional (downlink-only) CPCs operating in separate frequency bands is explicitly listed as option. The concept foresees that the CPC provides information about the availability of spectrum resources or the rules for spectrum usage in predefined geographical areas.

nP2M can make a significant contribution enabling advanced spectrum management systems, in particular geo-database systems, as they are currently discussed for example for PMSE devices.

A number of stakeholders are discussing this topic intensely (Notably the Association of Professional Wireless Production Technologies (APWPT), a colloquium of 24 associations and 20 other organizations from seven countries). An important goal is to prevent the pioneering "digital dividend" initiative from causing collateral damage in hundreds of PMSE applications, some of which were not originally considered. The German project CoMoRa (http://www.comora.de) is currently developing advanced spectrum management systems exploiting potential CPC capabilities of nP2M.

Market Volume

Current sales of PMSE devices in Europe are 700 000 units annually [i.34]. It is estimated that about 8 million user devices, mostly wireless microphones, will be sold in Europe in the next ten years. Ten years is an appropriate horizon, since that is the term of frequency allocations in Austria for example [i.35]. A large part of these sales will occur in the near future, since replacements will be necessary (and heavily subsidized in some countries) due to frequency changes in connection with the digital dividend. Up to 50 % of such devices could benefit from new cognitive channel allocation features using nP2M. The total market volume would be about 5 million units.

6.2 Overall Market Size for nP2M

For estimating realistic market volume for nP2M, only applications of nearer future and/or existing applications, have been taken into consideration. Market share assumptions have been made on case by case basis (see annex A). More than 110 million places of nP2M application could be counted, largest number of them applications of "social alarm" followed by information applications and green applications.

7 Technical information

The nP2M applications are services based on wide-area data broadcast systems (nP2M transmitter networks). The system comprises a National Operating Centre (NOC) where the messages to be delivered are collected. The NOC delivers the messages via satellite or any other network to the network of transmitting base stations. The base stations transmit the messages using dedicated carriers. Depending on the mode of operation, individual receivers, groups of receivers, or all receivers can be addressed. In general, nP2M systems are compatible with Recommendation ITU-R M.539-3 [i.39] and Recommendation ITU-R M.584-2 [i.40].

The nP2M system uses dedicated carrier frequencies that the receivers are listening to. Currently the carrier bandwidth is 20 kHz or 25 kHz. The transmitters (base stations) will support several or all assigned carriers whereas receivers typically demodulate only one receiver-specific carrier. Receivers, demodulating more than one carrier frequency, will have higher energy consumption but might be required by specific future applications.

Depending on the application and the respective receiver population to be covered, different coverage options will be supported. A network of Europe-wide, nation-wide or regional SFNs uses a small number of narrowband frequency bands applying frequency reuse and time multiplexing techniques to meet the coverage requirements of the nP2M applications.

In order to reflect the technical and economic needs of the broad range of applications, nP2M systems support two classes of receivers. One class is optimized for low cost (hereafter called as "simple receiver"), the other class is optimized for high reliability (hereafter called as "standard receiver").

Specific carrier allocation scheme with, for example, at least three neighbouring carriers results in significant additional advantages with respect to network planning and system capacity. By allocating bundles of three neighboured carriers to an nP2M system, adjacent channel interference problems of the low cost receivers can easily be taken into account and, with this, the system capacity and the service coverage and call success rate can be significantly improved. This option is typically required for high priority alerting applications.

7.1 Detailed technical description

7.1.1 High level requirements

The above described applications supported by nP2M systems result in a set of technical requirements that are not yet met by any single existing system. The nP2M system specification and the spectrum demand are derived from these requirements.

nP2M system simultaneously supports applications with different technical requirements on coverage. Availability Mechanisms, that allow adapting the coverage levels and receiver addressing, should be specified.

7.1.2 High level Receiver Requirements

The specification of two different classes of receivers reflects the different needs of applications.

Many of the services and applications to be supported are cost-sensitive. In particular alerting services are usually exposed to cost pressure by the funding public authorities and social insurance programs. In order to get these services in particular social alerting services supported, cost-efficient solutions are required. Means to guarantee this cost-efficiency are a reuse of the existing infrastructure and other existing investments and a simultaneous use of the infrastructure by commercially attractive services that can co-fund the infrastructure costs. In addition, receivers need to be cost efficient from a manufacturing as well as maintenance point of view.

In order to provide cost-efficiency, to protect existing investments and to provide a future-proof system evolution required by applications with long life-cycles, backwards compatibility with existing paging services and applications should be supported to the extent possible. The current spectrum designation for legacy paging services is still required and the additional spectrum should be designated neighboured or close to the current spectrum.

Some services will be used by citizens travelling throughout Europe. Therefore, solutions should be provided to support roaming and mobility in Europe (or beyond) for the radio as well as the signalling. Spectrum harmonized throughout Europe will be required.

In order to support receiver roaming in areas with different carrier allocations and/or to support multi-purpose receivers that provide energy-efficient and simultaneous support of different applications, multi-carrier receivers are supported.

In order to guarantee a reliable operation, the receivers have a sufficient battery stand-by time and allow easy battery exchange or recharging. The details are application-specific. The protocols in nP2M covers signalling modes optimized with respect to the receiver power consumption.

Receivers should be protected against manipulation and wrong handling by users.

nP2M system and receivers provide means to test the regular operation of the receivers as well as an out-of-coverage indication.

Depending on the application, different means to inform the user on incoming messages are provided by the receivers.

Depending on the application, the nP2M system supports different alerting times. The nP2M system offers the option to repeat messages.

7.1.2.1 Examples of standard receiver

Standard receivers will be used mainly for professional applications. Most of the devices, using a standard receiver, will support only one functionality, as the main purpose of the device.

The maintenance and the (basic) configuration (e.g. frequency, radio codes, etc.) will be performed by the operator or a professional Radio-Workshop. Such devices are typically sold via PMR-dealers, nP2M network operators or system integrators. The configuration and the allowance to use the nP2M-network are typically agreed between the nP2M-network operator and the manufacturer.

One typical type of a standard receiver is a Pager e.g. for alerting the volunteer fireman. Such devices are designed for the mobile use and will be carried at the belt.

Figure 1: Typical nP2M pagers

Another type of device is designed for the stationary use. For example a professional wall mounted alerting device or a larger LED-display showing the text of an alert.

Figure 2: Wall mounted warn device

Figure 3: Large wall mounted LED-display

7.1.2.2 Examples of simple receiver

Simple receiver will be used for mass market applications. Most of the devices using a simple receiver use the nP2M receiver for a second functionality besides the main purpose of the device. This can be done by integrating a nP2M-module as a slave-module into a host-device.

The maintenance and (basic) configuration (e.g. frequency, radio codes) of the device will be performed by the manufacturer and is not subject to change after production. Such devices are typically sold via consumer electronics shops, DIY or supermarkets. The configuration and the allowance to use the nP2M-network are typically agreed between the nP2M-network operator and the manufacturer.

Thus nP2M-module will operate with extremely low power consumption. It is possible to operate such devices for a decade with a standard lithium cell used today for devices like household smoke alarms with a battery life of 10 years.

A picture of a module for a simple receiver is given below, which is under development.

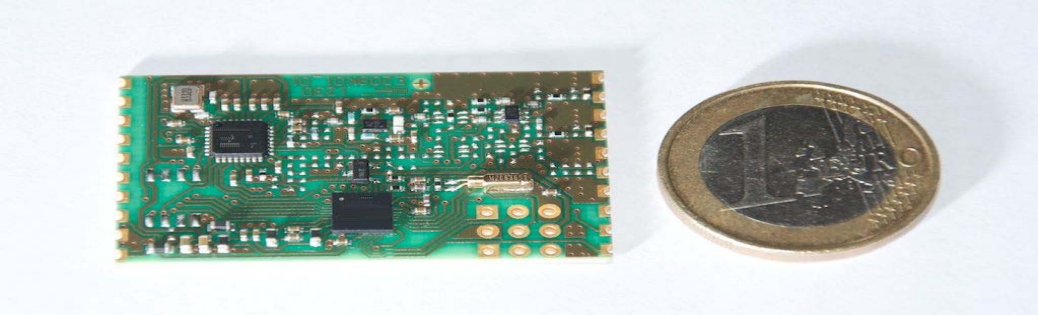

Figure 4: nP2M module for simple receiver

One main application of simple receiver will be the reception of public-alerts sent out by the authorities in the case of a disaster and/or thread within a specific area. The nP2M-module will receive such alerts and will inform the host that a warning for the installation area is active. To get such functionality it is necessary to personalize the device once at the time of installation, this can be done also via the nP2M network by transmitting a personalized setup message to the device e.g. after the owner typed in the installation-address at a website. For data privacy reasons this data is only stored within the nP2M module, the "web-application" will not store this data.

Some examples are:

A typical household smoke detector will alert people with the inbuilt beeper when detecting smoke and has integrated a nP2M-module which will trigger the same inbuilt beeper when detecting (receiving) a population alert for the place where the device is installed.

Figure 5: Typical household smoke detectors with integrated nP2M-module

A typical household weather station will show not only the local temperature and humidity acquired by local sensors, a weather station with an inbuilt nP2M Module will receive the weather forecast for the area from time to time and will show this information together with the local sensor data. Severe weather warnings can also be received and displayed.

Figure 6: A typical household weather station with an inbuilt nP2M Module

A device to support the economical use of energy can be the energy traffic light. A device showing the actual (colour) and future (graph) energy price, which are based on the actual amount of energy available in the "energy-grid". Such device will integrate the "normal citizen" into the process and help to control the use of energy by showing the benefit (price). An evolution can be reached when integrating a nP2M-module into white goods as a host which can use the same information to control the energy consumption. A main advantage, compared to other technologies using home networks (e.g. WiFi, Zigbee®), is, besides the price, that there is no need to connect the device to a personal network, it is just plug and play.

Figure 7: Energy traffic light device showing the existing and future energy prices

7.1.3 System topology and frequency re-use

A typical nP2M system deployment is based on:

- a National Operating Centre (NOC) where the requests for messages to be delivered and their respective content are collected; and
- a network of base stations transmitting the messages on dedicated radio carriers to the receivers in their coverage area.

Any receiver has one or several pre-assigned carrier frequencies in a limited tuning range on which it intends to receive messages.

The NOC performs the coding and scheduling of the messages. The messages are then forwarded to the respective base stations using transmission techniques fulfilling the highest requested reliability requirements. The base stations do not perform any additional coding of the messages, but only the signal processing steps related to the physical layer and MAC layer radio transmission (parity check coding, forward error correction coding, multiplexing, modulation, etc.). The coding of the messages and the framing of the transmitted signal is POCSAG compatible. POCSAG is specified in Recommendation ITU-R M.584-2 [i.40].

The overall coverage area, served by a NOC, is divided in transmission zones that are served by one or several (using SFN operation) base stations. Neighboured transmission zones use different carrier frequencies. Alternatively, certain zones might just not transmit any signal allowing to the use of less carriers. Today, three different carrier frequencies are used. The carrier frequencies are changed cyclically so that any carrier frequency is used in any zone and the respective receivers can be served independent of their location. The transmission period per frequency should be flexible and can be adapted to the requirement of the applications.

Receivers close to the border of transmission zones should be allowed to demodulate the signals from two or more zones so that the notification delay can be reduced. Receivers should not be required to support this operation.

7.1.4 Receiver call options

Receivers can be called by their individual identifiers, as a member of a group (group call), and using their location (coverage area of transmitter groups). Details of the addressing and message coding scheme are backwards compatible with legacy systems to the extent required.

7.1.5 Bandwidth, Modulation and Data Rate

Currently nP2M uses 20 kHz or 25 kHz carriers. Each receiver demodulates only one carrier. A 2-FSK modulation (non-return-to-zero) with 512 Baud or 1 200 Baud is used where a positive frequency shift represents a binary "0" and a negative frequency shift represents a binary "1".

7.1.6 Codes and formats

The data codes and formats used by nP2M are compatible with the specification given in Recommendation ITU-R M.584-2 [i.40] . A transmission consists of a preamble followed by batches of complete code-words, each batch commencing with a synchronization codeword.

7.2 Technical parameters and implications on spectrum

i. Bandwidth and spectrum designation

Currently, the carrier bandwidth is set to 20 kHz or 25 kHz in order to ease backwards compatibility and to allow cheap and energy-efficient receiver implementation. Current radio modems supporting lower bandwidth are not available or do not fulfil the requirements of nP2M systems. In long term, the expected additional nP2M capacity demand not covered by the requested 150 kHz (2 times 3 x 25 kHz) might be covered by introducing 12,5 kHz bandwidth options. This option will depend on the availability of corresponding radio modems which do not exist today or in the foreseeable future.

nP2M system supports applications with only local relevance (e.g. a city). In order to optimize the spectrum utilization efficiency and to maximize the overall system capacity, nP2M system reuses spectrum in non-neighboured regions. In order to allow this reuse of spectrum in different regions efficiently, to support the required overall system capacity, and to avoid adjacent channel interference causing losses in call success rate, the frequency band 430 to 470 MHz is well suited, which can be used as a tuning range for better implementation of nP2M system. Lower spectrum bands would result in coverage areas larger than the required geographical granularity and this will cause spectrum efficiency losses due to inter-region interference (information would be transmitted to areas larger than the areas of interest and, with this, spectrum would be wasted).

In order to guarantee a cost-efficient network structure (base station density) and in order to meet indoor coverage requirements, the carrier frequency should be as low as possible under to above described side-conditions.

A good compromise between these two requirements is the 430 MHz - 470 MHz band where both conditions can be met and where the legacy paging systems are already operating.

Given the existing usage of nP2M receivers by many - in particular budget-sensitive governmental organizations - reuse and extension of today's spectrum usage in the 430 MHz - 470 MHz band will allow a cost-efficient network support.

For nP2M system, the designation of neighboured frequency bands is beneficial. This neighboured designation will minimize the potential interference to other systems and, at the same time, increase the coverage probability for nP2M services.

"Neighboured frequency band" designation is shown below. Figure 8 shows three nP2M systems (nP2M sys 1 ... 3) in green and two neighboured other systems in red. It is beneficial that the center nP2M system is designed to support the more critical and sensitive services requiring higher transmit power (higher transmit (Tx) power of center nP2M system (sys 2) is shown below).

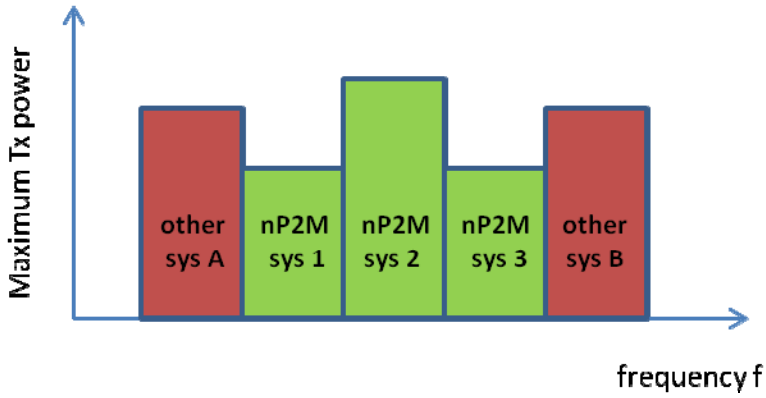

Figure 8: Illustration of "neighboured frequency band designation concept"

ii. Advantages of designating neighboured frequency bands to nP2M

Main advantage of designating neighboured carrier frequencies for nP2M is a reduced and easier to handle adjacent channel interference. Any carrier is causing interference to neighbouring carriers that can potentially cause receiver blocking or intermodulation problems. This interference is affected by two measures: the higher the serving desired signal at the victim receiver is, and, the larger the distance between interferer carrier and the victim carrier is, the lower is the sensitivity towards adjacent channel interference.

Given that nP2M carriers use the same transmission tower infrastructure (co-sited transmission), the system performance degradations caused by mutual adjacent channel interference is minimized if the nP2M carriers are directly neighboured. In particular the center nP2M carrier is "protected" by having two neighboured carriers that are both transmitted co-sited. Thus, this carrier is used to support highly sensitive services requesting a higher coverage level or a lower out-of-coverage probability.

The adjacent channel interference to non nP2M systems is also reduced by the proposed approach since the two outer nP2M carriers (nP2M sys 1 and sys 3 figure 8) can be transmitted with a reduced power level (since only supporting less sensitive services).

Taking the current spectrum designations for paging systems and the expected coverage requirements as well as above arguments into account, a spectrum of at least two times three neighboured carriers, each of 25 kHz, in the 430 MHz - 470 MHz tuning range, and harmonized across Europe, needs to be designated and supported by the transmitter networks. Preferably the current nP2M spectrum designations in the 448 MHz and 466 MHz need to be complemented by the neighbouring carriers. As pointed out in the spectrum demand analysis designation of two blocks of 3 x 25 kHz (two blocks of three neighboured 25 kHz carriers) allows initiating the migration of the system. Thus, the basic requirement sums up to 150 kHz in total.

7.2.1 Status of technical parameters

7.2.1.1 Sharing and compatibility studies already available

Following compatibility studies have already been conducted that could be used for further studies in the band:

- ERC Report 075 [i.41];
- ECC Report 022 [i.42]; and
- ECC Report 039 [i.43].

7.2.1.2 Sharing and compatibility issues still to be considered

According to the ECA Table, following systems should be considered in any possible in-band compatibility scenario for the whole 430 MHz- 470 MHz as tuning range:

i. Public protection and disaster relief (PPDR) systems.

ii. Active sensors operating within EESS.

iii. Non-specific SRDs.

iv. Paging systems.

v. PMR/PAMR.

vi. Amateur radio.

vii. Amateur satellite.

viii. Wind profiler radars (geographical sharing).

ix. Public cellular networks.

x. Maritime on-board communications.

xi. Meteorological aids.

7.2.2 Transmitter parameters

7.2.2.1 Transmitter Output Power/Radiated Power

i. Transmitter RF performance

- The maximum transmitter power is 100 W ERP (50 dBm).
- The adjacent channel power ratio (ACPR) is smaller or equal to 70 dBc.
- The intermodulation suppression (IM3) is larger than 70 dB.
- Spurious emissions are smaller or equal to -36 dBm/25 kHz:

The duty cycle is up to 100 %.

A typical distance between base stations is 15 km.

ii. Transmitter mask

Two spectrum masks are given below representing 25 kHz single channel case and three neighboured 25 kHz channel case.

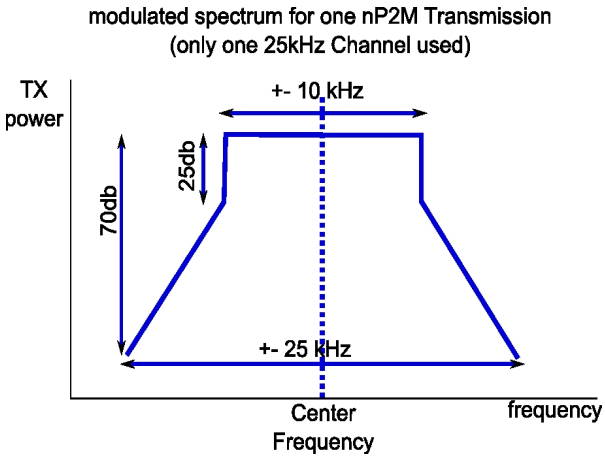

Figure 9: Spectrum mask for 25 kHz single channel case

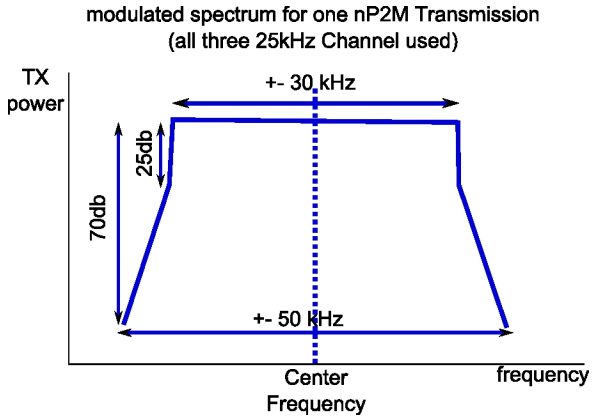

Figure 10: Spectrum mask for three neighboured 25 kHz channel case

7.2.2.2 Antenna Characteristics

nP2M transmitters typically use omnidirectional antennas with 0 dBi maximum gain.

7.2.2.3 Operating Frequency and Bandwidth

nP2M system will use the 430 MHz - 470 MHz band as tuning range.

An overall spectrum designation of 150 kHz (2 times 3 x 25 kHz) across Europe is required where always three 25 kHz carriers are bundled (carrier aggregation).

It is preferred to complement the existing spectrum designations.

7.2.2.4 Unwanted emissions

Spurious emissions are smaller or equal -36 dBm/25 kHz.

Intermodulation suppression should be larger than 70 dB at operating transmit power.

7.2.2.5 Modulation

2FSK modulation is supported.

7.2.3 Receiver parameters

i. Receiver RF performance for "Standard Receiver" class

- The receiver sensitivity in the 430 MHz - 470 MHz band should be below 15 µV/m for 1 200 Baud. When carried close to the body, the respective sensitivity is 10 µV/m.
- The minimum required signal-to-noise ratio in the demodulated carrier band should be -6 dB.
- The adjacent channel protection should be ≥ 50 dB.
- The minimum interference protection for other bands should be ≥ 65 dB.
- The minimum intermodulation protection should be ≥ 45 dB.

ii. Receiver RF performance for "Simple receiver" class

- The receiver sensitivity in the 430 - 470 MHz band should be below 15 µV/m for 1 200 Baud.

Receivers of the "Simple Receiver" class are assumed to be used only when three carriers are aggregated. They will only be served by the centre carrier so that receiver interference protection falls within the responsibility of the operator of the nP2M system. The receivers can also be used when the outer carriers are not in use at all (also not by other users). The needed protection for the simple receiver against transmissions on other frequencies should not include transmissions on the direct adjacent 25 kHz channel, because the nP2M system takes care that there are no transmission on that band during transmissions directed to "simple receivers".

- The minimum required signal-to-noise ratio in the demodulated carrier band should be -6 dB.
- The adjacent channel protection for the second next adjacent band (25 kHz bandwidth) should be ≥ 45 dB.
- The minimum interference protection for other bands should be ≥ 65 dB.
- The minimum intermodulation protection should be ≥ 45 dB.

Additional receiver requirements are application dependent. They comprise minimum performance parameters for the stand-by period, the operating temperature range, user notification options, out-of-coverage notification, self-testing options, and others.

7.2.4 Channel access parameters

nP2M receivers typically demodulate only one carrier in order to keep the complexity and power consumption low.

nP2M receivers can be addressed by a receiver-specific identifier and/or a group identifier.

The addressing scheme will be backwards compatible with existing paging services and allows an efficient demodulation of the received signal and identification of the target receiver or receiver group.

In order to address receivers in a certain target region, only the transmitter stations covering this region will transmit the paging and information signal using SFN operation.

Frequency/carrier reuse is supported by either not using a certain carrier in guard areas or by using TDM operation where the call target group is switched from time interval to time interval.

The transmit power allocated to the carriers can be different and will be selected depending on the target receiver group or the priority of the service supported. In case of bundles of three carriers, the center carrier will usually be assigned the highest transmit power and will be used for high priority calls. In this case, the two outer carriers might even be switched off in order to reduce the co-channel interference. In typical deployments the distance between transmitters not in SFN operation is between 30 km and 150 km.

7.3 Information on relevant standard(s)

The used data formats should be backwards compatible with Recommendation ITU-R M.584-2 [i.40].

Expected ETSI actions:

- Development of European Harmonized Standard after the approval of SRdoc by ETSI, and designation of the requested frequency band for nP2M by CEPT/ECC.

8 Radio spectrum request and justification

Current paging networks operate in the 400 MHz band where the propagation properties allow supporting the high requirements on coverage probability with a base station network density for appropriate infrastructure costs. The 400 MHz band also allows a level of carrier reuse and geographical selectivity of the nP2M services that reflects the requirements of the services and application supported.

In order to provide backwards compatibility, to maintain the support of existing services for already deployed receivers, and to save investments in infrastructure in particular the base station network, nP2M should be deployed in the 430 MHz - 470 MHz band. This entire range could be considered as a tuning range for nP2M deployment provided that two bundles of three 25 kHz channels could be used by nP2M system.

Several nP2M receivers are deployed in the devices or are supporting applications using the 430 MHz - 470 MHz band. There are also nP2M receivers integrated in devices using the ISM 433 MHz band for short range communication. Implementation issues on the device side as well as coverage planning is simplified when nP2M use the 430 MHz - 470 MHz band as a tuning range throughout Europe.

In order to allow a Europe-wide deployment of nP2M services, a harmonized spectrum designation for nP2M is beneficial. Since many applications are cost-critical (because they are funded by tax-payers or social insurance services), the use of low cost receivers is required. "Scale of economic benefits" and "one carrier only demodulation" are key aspects for providing these low cost receivers.

Since the number of applications requiring nP2M services will grow significantly in the coming years, and since the availability of sufficient transport capacity will provide cross-funding opportunities for service of high value for the European society by commercially attractive services, and since the costs per service will be reduced by a broader use of the infrastructure, a minimum of 150 kHz spectrum harmonized across Europe and bundled in clusters of 3 x 25 kHz each is required.

9 Regulations

9.1 Current regulations

Current nP2M systems using frequencies in the 448 MHz and 466 MHz ranges with a maximum transmit power of 100 W ERP are already in operation (e.g. in Germany and France). Interference problems caused by these paging systems affecting other systems were not reported.

Significant interference problems are therefore not expected, however, detailed studies on this topic should be considered.

9.2 Proposed regulation and justification

ECC is requested to designate 150 kHz frequency band for nP2M operations within the 430 MHz - 470 MHz range. The proposed specifications of nP2M operations within the 430 MHz - 470 MHz range are as follows:

- Licensing of operation of nP2M devices:
  - The operation and frequency designation to operator should be licensed to guarantee a useful grade of service and reliable network operations.

- The mobile devices (receiver) should not be licensed. The mobile devices are controlled by the network (operator), but there is no need to licence single devices. Due to the fact that the mobile devices are only receivers there is no negative impact from any mobile np2M device to services in the used frequency band.

- Frequencies:
  - The regulation has to take into account the fact that the networks will grow and the network planning has to be performed at the deployment phase. Therefore, the network operator should not only know the dedicated frequencies for the first demand, it is also necessary that the two adjacent channels are also designated to this network for further usage.
  - The spectrum to be designated for the nP2M service should not be licensed in the start phase. The basic requirement for a national network rollout consists of three to six channels of 25 kHz each resulting in an overall basic demand of 75 kHz to 150 kHz. Therefore, two times 3 x 25 kHz, in total 150 kHz seems a realistic approach for the basic Europe-wide implementation of nP2M system. Here, the nP2M system will operate on the centre 25 kHz channel of the 3 x 25 kHz channel aggregations.

- Harmonized standard:
  - Development of a European Harmonized Standard will be considered after the approval of SRdoc by ETSI, and after the designation of the requested spectrum for nP2M by CEPT/ECC.

Annex A:
Detailed market information

A.1 General Citizens Information

EXAMPLE: Personal Weather Station.

One example is the personal weather stations based on nP2M technology that have been widely sold in France and Germany since 2008. The technology is spreading information at a rate comparable to and in some cases faster than the recruitment of new cellular telephony subscribers. Within just 18 months, more than two million households (out of a total of some 65 million in the two countries) have been outfitted with this technology, for the application of "weather information" alone.

A.2 Green Applications

In keeping with national and international resolutions, one goal of business and government in the current decade will be to replace a large part of the conventional energy consumed with renewable energy, and to further reduce conventional energy production by conservation measures.

The economical use of energy requires knowledge of the momentary conditions, including the rates charged by energy suppliers in Europe, which need to be set dynamically. Conserving energy is the most important contribution to securing Europe's energy supply in the long term. Especially after the recent events in the Pacific region, public willingness to contribute in this way has increased significantly. The national governments are forcing energy suppliers to motivate consumers to use energy ecologically through rates that are dynamically adapted to production, and in particular to the rapidly changing energy production from renewable wind and solar energy sources: witness for example the Renewable Energies Act (EEG) in Germany [i.36].

nP2M-based user devices are a means to these ends: Where automatic processes support consumers, the use of nP2M-based embedded systems is planned. An example module which can be embedded into other devices can be found in clause 7.1.2.2.

The potential market for these applications is Europe's 197 000 000 households.

Energy production as a whole is becoming more varied, with many new and innovative energy producers and power being fed into the grid at many points. In 2009 there were more than 500 000 energy producers feeding in seven to 100 kW in Germany alone [i.46]. Such small-scale, decentralized power producers include roofs covered with photovoltaic panels, heat pumps, and other technologies. Techniques for controlling and addressing such small producers should be kept very economical in order not to exceed their benefits. Three million such producers in Germany would extrapolate to 20 million in Europe.

The German government has set an intermediate goal of more than a million electric-powered passenger cars by 2020. [i.47]. Charging such cars takes much longer than filling a tank with a fossil fuel. That makes it all the more important to coordinate this form of energy consumption with energy production and distribution. Affordable on-demand control is called for to turn the electric "fuel pumps" on and off as supply and demand vary. nP2M can do this. The potential market in Europe by 2020 is expected to be up to six or possibly eight million units.

It is also estimated that storage heaters, once considered "power hogs", will become appealing again as a way to use the surplus of decentralized power production at certain times of day. Extrapolating from the 15 000 units existing in Berlin today, there are about 2 million targets for nP2M applications in Europe.

In addition, more than 28 million application points need to be equipped with control functions for new energy integration projects, such as virtual power stations.

Because nP2M is a very efficient way to achieve this, we estimate the possible market penetration at 25 %, or seven million units.

A.3 Social Alarm

A.3.1 European Households

With 196 593 000 households in the 27 member countries of the EU, there is plenty of work for emergency communication systems. The special flexibility, uniform basis, simplicity and mass affordability of warning instruments are necessitated by transport accidents with critical consequences such as the aircraft crashes at Amsterdam-Schiphol and at Ueberlingen in southern Germany; by flood hazards of unpredictable dimensions, exacerbated by the heavy urbanization of fluvial landscapes; and by natural disasters such as the forest fires in southern France. One of these instruments has been demanded by the world's largest association of first responders, the German Fire Service Association (DFV) at least since August 2008: the implementation of additional function within household smoke alarms for population alerting, for every European household, if possible. In households that have smoke alarms today (as required already in Great Britain and in 10 of the 16 German states), an average of two such devices are installed in each household. Thus the theoretical total market volume for smoke alarms that can also receive and present warning information by means of nP2M is about 394 000 000 units, two devices per each European household.

A.3.2 Education

The effects and frequency of emergencies in educational institutions are increasing. Among the regrettable examples are:

- the massacre in Finland (note 1);
- the school shootings in Germany (note 2);
- the similar events in the US (note 3);

that grow more frequent due to imitation with each passing year, as young people in particular become more closely networked. In such emergency situations it is especially important to have a dedicated, unified, flexible and affordable information channel - one that is not influenced by other applications - to two target groups, the educators and administrators in the facilities and the students themselves. The connection and the prompt communication of information authorized by the competent government agencies to the responsible administrators in the facilities is an important element of the Amok Prevention programme in the German state of Baden-Württemberg.

NOTE 1: Jokela School Massacre, 7th November 2007.

NOTE 2: Erfurt, 26nd April 2002; Winnenden, 11th March 2009.

NOTE 3: Virginia Tech Massacre, 16th April 2007.

4 300 schools have been outfitted with two nP2M-based user devices. The population of Baden-Württemberg is about ten million, so the programme currently uses about 9 receivers per 10 000 inhabitants. In the US, an application in place at Providence College is an example of preventive information for all (or most) students based on the services that in Europe would be covered by the nP2M field. In Europe, 19 % of the population, or about 94 000 000 persons, are students (source: Eurostat 12/2005).

A.3.3 Industry

There are 9 850 to 10 100 sites designated as major accident hazards involving dangerous substances, or "Seveso Sites", in the directives of the European Commission and the current documents of the European Parliament and the European Commission [i.44]. Experience shows that there are several thousand public or quasi-public facilities in the vicinity of a typical site in this classification that would require special early warning in case of an emergency.

EXAMPLE: Near the Hoechst industrial park in Frankfurt am Main, Germany, there are 2 000 schools, child care facilities, and health care institutions. Extrapolating an estimate of 1 000 recipients per Seveso site throughout Europe yields about 10 million recipients in Europe.

A.4 First Responders

In Europe we have a great number of first responders in emergencies, with various forms and organizations in the 27 individual countries. These agencies need to be ready to respond rapidly at unpredictable emergency scenes at all times. The alerting instruments necessary to summon these agencies should be affordable, discreet, meaningful, with universal coverage and maximum quality, and most of all, should be as independent as possible from all other communication media, such as cellular phones and even TETRA/public safety radio, particularly during emergencies, so that they have the high functional redundancy and autonomy in the situations in which they are needed.

Well over 90 % of fire-fighters in Europe are volunteers, and thus need to be reachable economically and practically anywhere.

The German Fire-fighters' Association, which alone unites around 42 % of European fire-fighters, demands reliable and affordable alerting. In Germany and elsewhere, about half of fire fighters are already reachable today by means of technologies that can be subsumed (with downward compatibility) under nP2M. It is important in this context that nP2M is allocated the frequency bands near those used by TETRA/ public safety radio in many member countries, which affords the opportunity of manufacturing dual-capability user devices as recommended by TS 102 182 [i.45].

In Germany, more than 3 000 areas have been identified as particularly hazardous; France has some 3 500 "Seveso sites", or areas that require special readiness for emergencies. Extrapolating this density by population to the 27 EU member countries, there are about 23 000 areas in Europe in which special attention should be given to prompt population alerting.

The responsible regional government agencies and companies that handle hazardous substances are the first channels of information and distribution for nP2M-based population warning solutions.

A.5 Summary of Market Estimation Figures

Table A.1: Part of potential Market for nP2M

	Market size	Penetration Target	Volume
Information	197 000	10 %	19 700
Green Applications	197 000	5 %	9 850
Social Alarm	502 500	16 %	80 400
First Responders	2 600	50 %	1 300
Cognitive Radio	2 100	25 %	525
NOTE: Volume is given in thousands.			

The estimates for social alarm applications are derived from the estimates for the three major target groups mentioned in clauses A.3.1 to A.3.3. The estimate is based on the following figures.

Table A.2: Potential nP2M Market: "Social Alarm"

	Market size in T.	Penetration Target	Volume in thousands
Households	394 000	20 %	78 800
Education	4 500	20 %	900
	94 000	2 %	1 880
Industry	10 000	5 %	500
Weighted Sum	502 500	16 %	80 400

A.6 Distribution channels

Specific distribution channels, some tested and some yet to be developed, are possible for the individual application groups.

User devices for "general information propagation" (such as weather stations) are already sold today through the major retail chains, online and in DIY stores. This requires partnerships with specialized distributors, like those already in place with the three large distributors in Germany and France. Some of these contacts can be expanded. The sales partners can enjoy very high margins, up to 50 % of the retail price, so that their sales motivation is very high.

"Green applications" are marketed in cooperation with large and small energy suppliers in Europe. An appropriate marketing partnership already exists today with a subsidiary of the world's largest power utility, Electricité de France, and with another European market leader.

The nP2M-based social alarm applications are marketed through the interest groups concerned. Important allies here are the first-responders, the responsible industries, and municipalities with a pronounced or high hazard level.

Alerting of first-responders is implemented by the operating agencies, usually municipal governments. Experience with such agencies has been gathered in all the large European countries, combining direct sales with individualized marketing activities.

Annex B:
Current regulations

B.1 Current allocation of the 430 MHz - 470 MHz band

Current allocation of the band 430 MHz - 470 MHz is as follows as given in Article 5 of the ITU Radio Regulations [i.1].

Table B.1: 430 MHz - 470 MHz allocation

Allocation to services		
Region 1	**Region 2**	**Region 3**
430-432 AMATEUR RADIOLOCATION 5.271 5.272 5.273 5.274 5.275 5.276 5.277	**430-432** RADIOLOCATION Amateur 5.271 5.276 5.277 5.278 5.279	
432-438 AMATEUR RADIOLOCATION Earth exploration-satellite (active) 5.279A 5.138 5.271 5.272 5.276 5.277 5.280 5.281 5.282	**432-438** RADIOLOCATION Amateur Earth exploration-satellite (active) 5.279A 5.271 5.276 5.277 5.278 5.279 5.281 5.282	
438-440 AMATEUR RADIOLOCATION 5.271 5.273 5.274 5.275 5.276 5.277 5.283	**438-440** RADIOLOCATION Amateur 5.271 5.276 5.277 5.278 5.279	
440-450 FIXED MOBILE except aeronautical mobile Radiolocation 5.269 5.270 5.271 5.284 5.285 5.286		
450-455 FIXED MOBILE 5.286AA 5.209 5.271 5.286 5.286A 5.286B 5.286C 5.286D 5.286E		
455-456 FIXED MOBILE 5.286AA 5.209 5.271 5.286A 5.286B 5.286C 5.286E	455-456 FIXED MOBILE 5.286AA MOBILE-SATELLITE (Earth-to-space) 5.286A 5.286B 5.286C 5.209	**455-456** FIXED MOBILE 5.286AA 5.209 5.271 5.286A 5.286B 5.286C 5.286E
456-459 FIXED MOBILE 5.286AA 5.271 5.287 5.288		
459-460 FIXED MOBILE 5.286AA 5.209 5.271 5.286A 5.286B 5.286C 5.286E	**459-460** FIXED MOBILE 5.286AA MOBILE-SATELLITE (Earth-to-space) 5.286A 5.286B 5.286C 5.209	**459-460** FIXED MOBILE 5.286AA 5.209 5.271 5.286A 5.286B 5.286C 5.286E
460-470 FIXED MOBILE 5.286AA Meteorological-satellite (space-to-Earth) 5.287 5.288 5.289 5.290		

Footnotes:

5.138 The following bands:

6 765 kHz - 6 795 kHz	(centre frequency 6 780 kHz),
433,05 MHz - 434,79 MHz	(centre frequency 433,92 MHz) in Region 1 except in the countries mentioned in No. **5.280**,
61 GHz - 61,5 GHz	(centre frequency 61,25 GHz),
122 GHz - 123 GHz	(centre frequency 122,5 GHz), and
244 GHz - 246 GHz	(centre frequency 245 GHz)

are designated for industrial, scientific and medical (ISM) applications. The use of these frequency bands for ISM applications shall be subject to special authorization by the administration concerned, in agreement with other administrations whose radiocommunication services might be affected. In applying this provision, administrations shall have due regard to the latest relevant Recommendation ITU-Rs.

5.209 The use of the bands 137 MHz - 138 MHz, 148 MHz - 150,05 MHz, 399,9 MHz - 400,05 MHz, 400,15 MHz - 401 MHz, 454 MHz - 456 MHz and 459 MHz - 460 MHz by the mobile-satellite service is limited to non-geostationary-satellite systems (WRC-97).

5.269 *Different category of service:* in Australia, the United States, India, Japan and the United Kingdom, the allocation of the bands 420 MHz - 430 MHz and 440 MHz - 450 MHz to the radiolocation service is on a primary basis (see No. **5.33**).

5.270 *Additional allocation:* in Australia, the United States, Jamaica and the Philippines, the bands 420 MHz - 430 MHz and 440 MHz - 450 MHz are also allocated to the amateur service on a secondary basis.

5.271 *Additional allocation:* in Belarus, China, India, Kyrgyzstan and Turkmenistan, the band 420 MHz - 460 MHz is also allocated to the aeronautical radionavigation service (radio altimeters) on a secondary basis (WRC-07).

5.272 *Different category of service:* in France, the allocation of the band 430 MHz - 434 MHz to the amateur service is on a secondary basis (see No. **5.32**).

5.273 *Different category of service:* in the Libyan Arab Jamahiriya, the allocation of the bands 430 MHz - 432 MHz and 438 MHz - 440 MHz to the radiolocation service is on a secondary basis (see No. **5.32**) (WRC-03).

5.274 *Alternative allocation:* in Denmark, Norway and Sweden, the bands 430 MHz - 432 MHz and 438 MHz - 440 MHz are allocated to the fixed and mobile, except aeronautical mobile, services on a primary basis.

5.275 *Additional allocation:* in Croatia, Estonia, Finland, Libyan Arab Jamahiriya, The Former Yugoslav Republic of Macedonia, Montenegro, Serbia and Slovenia, the bands 430 MHz - 432 MHz and 438 MHz - 440 MHz are also allocated to the fixed and mobile, except aeronautical mobile, services on a primary basis (WRC-07).

5.276 *Additional allocation:* in Afghanistan, Algeria, Saudi Arabia, Bahrain, Bangladesh, Brunei Darussalam, Burkina Faso, Burundi, Egypt, the United Arab Emirates, Ecuador, Eritrea, Ethiopia, Greece, Guinea, India, Indonesia, Iran (Islamic Republic of), Iraq, Israel, Italy, Libyan Arab Jamahiriya, Jordan, Kenya, Kuwait, Lebanon, Malaysia, Malta, Nigeria, Oman, Pakistan, the Philippines, Qatar, the Syrian Arab Republic, the Dem. People's Rep. of Korea, Singapore, Somalia, Switzerland, Tanzania, Thailand, Togo, Turkey and Yemen, the band 430-440 MHz is also allocated to the fixed service on a primary basis and the bands 430 MHz - 435 MHz and 438 MHz - 440 MHz are also allocated to the mobile, except aeronautical mobile, service on a primary basis (WRC-07).

5.277 *Additional allocation:* in Angola, Armenia, Azerbaijan, Belarus, Cameroon, Congo (Rep. of the), Djibouti, the Russian Federation, Georgia, Hungary, Israel, Kazakhstan, Mali, Moldova, Mongolia, Uzbekistan, Poland, Kyrgyzstan, Slovakia, Romania, Rwanda, Tajikistan, Chad, Turkmenistan and Ukraine, the band 430 MHz - 440 MHz is also allocated to the fixed service on a primary basis (WRC-07).

5.280 In Germany, Austria, Bosnia and Herzegovina, Croatia, The Former Yugoslav Republic of Macedonia, Liechtenstein, Montenegro, Portugal, Serbia, Slovenia and Switzerland, the band 433,05 MHz - 434,79 MHz (centre frequency 433,92 MHz) is designated for industrial, scientific and medical (ISM) applications. Radiocommunication services of these countries operating within this band must accept harmful interference which may be caused by these applications. ISM equipment operating in this band is subject to the provisions of No. **15.13** (WRC-07).

5.281 *Additional allocation:* in the French overseas departments and communities in Region 2 and India, the band 433,75 MHz - 434,25 MHz is also allocated to the space operation service (Earth-to-space) on a primary basis. In France and in Brazil, the band is allocated to the same service on a secondary basis.

5.282 In the bands 435 MHz - 438 MHz, 1 260 MHz - 1 270 MHz, 2 400 MHz - 2 450 MHz, 3 400 MHz - 3 410 MHz (in Regions 2 and 3 only) and 5 650 MHz - 5 670 MHz, the amateur-satellite service may operate subject to not causing harmful interference to other services operating in accordance with the Table (see No. **5.43**). Administrations authorizing such use shall ensure that any harmful interference caused by emissions from a station in the amateur-satellite service is immediately eliminated in accordance with the provisions of No. **25.11**. The use of the bands 1 260 MHz - 1 270 MHz and 5 650 MHz - 5 670 MHz by the amateur-satellite service is limited to the Earth-to-space direction.

5.283 *Additional allocation:* in Austria, the band 438 MHz - 440 MHz is also allocated to the fixed and mobile, except aeronautical mobile, services on a primary basis.

5.284 *Additional allocation:* in Canada, the band 440 MHz - 450 MHz is also allocated to the amateur service on a secondary basis.

5.285 *Different category of service:* in Canada, the allocation of the band 440 MHz - 450 MHz to the radiolocation service is on a primary basis (see No. **5.33**).

5.286 The band 449,75 MHz - 450,25 MHz may be used for the space operation service (Earth-to-space) and the space research service (Earth-to-space), subject to agreement obtained under No. **9.21**.

5.286A The use of the bands 454 MHz - 456 MHz and 459 MHz - 460 MHz by the mobile-satellite service is subject to coordination under No. **9.11A** (WRC-97).

5.286AA The band 450 MHz - 470 MHz is identified for use by administrations wishing to implement International Mobile Telecommunications (IMT). See Resolution **224 (Rev.WRC-07)**. This identification does not preclude the use of this band by any application of the services to which it is allocated and does not establish priority in the Radio Regulations (WRC-07).

5.286B The use of the band 454 MHz - 455 MHz in the countries listed in No. **5.286D**, 455 MHz - 456 MHz and 459 MHz - 460 MHz in Region 2, and 454 MHz - 456 MHz and 459 MHz - 460 MHz in the countries listed in No. **5.286E**, by stations in the mobile-satellite service, shall not cause harmful interference to, or claim protection from, stations of the fixed or mobile services operating in accordance with the Table of Frequency Allocations (WRC-97).

5.286C The use of the band 454 MHz - 455 MHz in the countries listed in No. **5.286D**, 455 MHz - 456 MHz and 459 MHz - 460 MHz in Region 2, and 454 MHz - 456 MHz and 459 MHz - 460 MHz in the countries listed in No. **5.286E**, by stations in the mobile-satellite service, shall not constrain the development and use of the fixed and mobile services operating in accordance with the Table of Frequency Allocations (WRC-97).

5.286D *Additional allocation:* in Canada, the United States and Panama, the band 454 MHz - 455 MHz is also allocated to the mobile-satellite service (Earth-to-space) on a primary basis (WRC-07).

5.286E *Additional allocation:* in Cape Verde, Nepal and Nigeria, the bands 454 MHz - 456 MHz and 459 MHz - 460 MHz are also allocated to the mobile-satellite (Earth-to-space) service on a primary basis (WRC-07).

5.287 In the maritime mobile service, the frequencies 457.525 MHz, 457.550 MHz, 457.575 MHz, 467.525 MHz, 467.550 MHz and 467.575 MHz may be used by on-board communication stations. Where needed, equipment designed for 12.5 kHz channel spacing using also the additional frequencies 457.5375 MHz, 457.5625 MHz, 467.5375 MHz and 467.5625 MHz may be introduced for on-board communications. The use of these frequencies in territorial waters may be subject to the national regulations of the administration concerned. The characteristics of the equipment used shall conform to those specified in Recommendation ITU-R M.1174-2 [i.50] (WRC-07).

5.288 In the territorial waters of the United States and the Philippines, the preferred frequencies for use by on-board communication stations shall be 457.525 MHz, 457.550 MHz, 457.575 MHz and 457.600 MHz paired, respectively, with 467.750 MHz, 467.775 MHz, 467.800 MHz and 467.825 MHz. The characteristics of the equipment used shall conform to those specified in Recommendation ITU-R M.1174-2 [i.50] (WRC-03).

5.289 Earth exploration-satellite service applications, other than the meteorological-satellite service, may also be used in the bands 460 MHz - 470 MHz and 1 690 MHz - 1 710 MHz for space-to-Earth transmissions subject to not causing harmful interference to stations operating in accordance with the Table.

5.290 Different category of service: In Afghanistan, Azerbaijan, Belarus, China, the Russian Federation, Japan, Mongolia, Kyrgyzstan, Slovakia, Tajikistan, Turkmenistan and Ukraine, the allocation of the band 460 MHz - 470 MHz to the meteorological-satellite service (space-to-Earth) is on a primary basis (see No. **5.33**), subject to agreement obtained under No. **9.21** (WRC-07).

B.2 Utilization of the 430 MHz - 470 MHz band in Europe

Current utilization of the band (430 MHz - 470 MHz) in Europe is given in ERC Report 25 [i.2]:

Table B.2: Utilization of the 430-470 MHz band in Europe

430 MHz - 432 MHz band

Utilization	ERC/ECC Documentation	European Standard
Amateur	-	EN 301 783 [i.7]
PPDR	ECC/DEC/(08)05 [i.4]	-

432 MHz - 433.05 MHz band

Utilization	ERC/ECC Documentation	European Standard
Active sensors (satellite)		-
Amateur	-	EN 301 783 [i.7]
PPDR	ECC/DEC/(08)05 [i.4]	-

433,05 MHz - 434,79 MHz band

Utilization	ERC/ECC Documentation	European Standard
Active sensors (satellite)		-
Amateur	-	EN 301 783 [i.7]
ISM	-	-
Non-specific SRDs	ECC/DEC/(04)02 [i.5] ERC/REC 70-03 [i.6]	EN 300 220 [i.9]
PPDR	ECC/DEC/(08)05 [i.4]	-

434,79 MHz - 438 MHz band

Utilization	ERC/ECC Documentation	European Standard
Active sensors (satellite)		-
Amateur	-	EN 301 783 [i.7]
Amateur satellite	- (Restricted to 435 MHz - 438 MHz)	EN 301 783 [i.7]
PPDR	ECC/DEC/(08)05 [i.4]	-

438 MHz - 440 MHz band

Utilization	ERC/ECC Documentation	European Standard
Amateur	-	EN 301 783 [i.7]
PPDR	ECC/DEC/(08)05 [i.4]	-

440 MHz - 450 MHz band

Utilization	ERC/ECC Documentation	European Standard
On-site paging	-	EN 300 224 [i.10]
PMR 446 and Digital PMR 446	ECC/DEC/(05)12 [i.11] ERC/DEC/(98)25 [i.12] (Analogue PMR in 446 MHz - 446,1 MHz) (Digital PMR in 446,1 MHz - 446,2 MHz)	EN 300 296 [i.13] EN 300 113 [i.14] EN 301 166 [i.15]
PMR/PAMR	ECC/DEC/(06)06 [i.16] T/R 25-08 [i.17]	EN 300 296 [i.13] EN 300 113 [i.14] EN 301 166 [i.15] EN 300 086 [i.18] EN 300 219 [i.19] EN 300 341 [i.20] EN 300 390 [i.21] EN 300 471 [i.22] EN 302 561 [i.23]
Wind profiler radars	-	-
PPDR (tuning range basis)	ECC/DEC/(08)05 [i.4]	-

450 MHz - 455 MHz band

Utilization	ERC/ECC Documentation	European Standard
On-site paging	-	EN 300 224 [i.10]
PMR/PAMR	ECC/DEC/(06)06 [i.16] ECC/DEC/(04)06 [i.25] ERC/DEC/(96)04 [i.26] T/R 25-08 [i.17]	EN 300 296 [i.13] EN 300 113 [i.14] EN 301 166 [i.15] EN 300 086 [i.18] EN 300 219 [i.19] EN 300 341 [i.20] EN 300 390 [i.21] EN 302 561 [i.23] EN 300 392 [i.27] EN 301 449 [i.28] EN 301 526 [i.29] EN 302 426 [i.30] EN 303 035 [i.31]
PPDR (tuning range basis)	ECC/DEC/(08)05 [i.4]	-

455 MHz - 456 MHz band

Utilization	ERC/ECC Documentation	European Standard
Existing public mobile cellular networks	-	-
On-site paging	-	EN 300 224 [i.10]
PMR/PAMR	ECC/DEC/(06)06 [i.16] ECC/DEC/(04)06 [i.25] ERC/DEC/(96)04 [i.26] T/R 25-08 [i.17]	EN 300 296 [i.13] EN 300 113 [i.14] EN 301 166 [i.15] EN 300 086 [i.18] EN 300 219 [i.19] EN 300 341 [i.20] EN 300 390 [i.21] EN 300 471 [i.22] EN 302 561 [i.23] EN 300 392 [i.27] EN 301 449 [i.28] EN 301 526 [i.29] EN 302 426 [i.30] EN 303 035 [i.31]
PPDR (tuning range basis)	ECC/DEC/(08)05 [i.4]	-

456 MHz - 459 MHz band

Utilization	ERC/ECC Documentation	European Standard
Existing public mobile cellular networks	-	-
Maritime on board communications	T/R 32-02 [i.33] (Within the band 457.525 MHz - 457.575 MHz)	EN 300 720 [i.51]
On-site paging	-	EN 300 224 [i.10]
PMR/PAMR	ECC/DEC/(06)06 [i.16] ECC/DEC/(04)06 [i.25] ERC/DEC/(96)04 [i.26] T/R 25-08 [i.17]	EN 300 296 [i.13] EN 300 113 [i.14] EN 301 166 [i.15] EN 300 086 [i.18] EN 300 219 [i.19] EN 300 341 [i.20] EN 300 390 [i.21] EN 300 471 [i.22] EN 302 561 [i.23] EN 300 392 [i.27] EN 301 449 [i.28] EN 301 526 [i.29] EN 302 426 [i.30] EN 303 035 [i.31]
PPDR (tuning range basis)	ECC/DEC/(08)05 [i.4]	-

459 - 460 MHz band

Utilization	ERC/ECC Documentation	European Standard
Existing public mobile cellular networks	-	-
Maritime on board communications	T/R 32-02 [i.33]	EN 300 720 [i.51]
On-site paging	-	EN 300 224 [i.10]
PMR/PAMR	ECC/DEC/(06)06 [i.16] ECC/DEC/(04)06 [i.25] ERC/DEC/(96)04 [i.26] T/R 25-08 [i.17]	EN 300 296 [i.13] EN 300 113 [i.14] EN 301 166 [i.15] EN 300 086 [i.18] EN 300 219 [i.19] EN 300 341 [i.20] EN 300 390 [i.21] EN 300 471 [i.22] EN 302 561 [i.23] EN 300 392 [i.27] EN 301 449 [i.28] EN 301 526 [i.29] EN 302 426 [i.30] EN 303 035 [i.31]
PPDR (tuning range basis)	ECC/DEC/(08)05 [i.4]	-

460 MHz - 470 MHz band

Utilization	ERC/ECC Documentation	European Standard
Existing public mobile cellular networks	-	-
Maritime on board communications	T/R 32-02 [i.33] (Within the band 467.525 MHz - 467.575 MHz)	EN 300 720 [i.51]
Meteorological aids	-	-
On-site paging	-	EN 300 224 [i.10]
PMR/PAMR	ECC/DEC/(06)06 [i.16] ECC/DEC/(04)06 [i.25] ERC/DEC/(96)04 [i.26] T/R 25-08 [i.17]	EN 300 296 [i.13] EN 300 113 [i.14] EN 301 166 [i.15] EN 300 086 [i.18] EN 300 219 [i.19] EN 300 341 [i.20] EN 300 390 [i.21] EN 300 471 [i.22] EN 302 561 [i.23] EN 300 392 [i.27] EN 301 449 [i.28] EN 301 526 [i.29] EN 302 426 [i.30] EN 303 035 [i.31]
Space Research/EESS	-	-
PPDR (tuning range basis)	ECC/DEC/(08)05 [i.4]	-

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