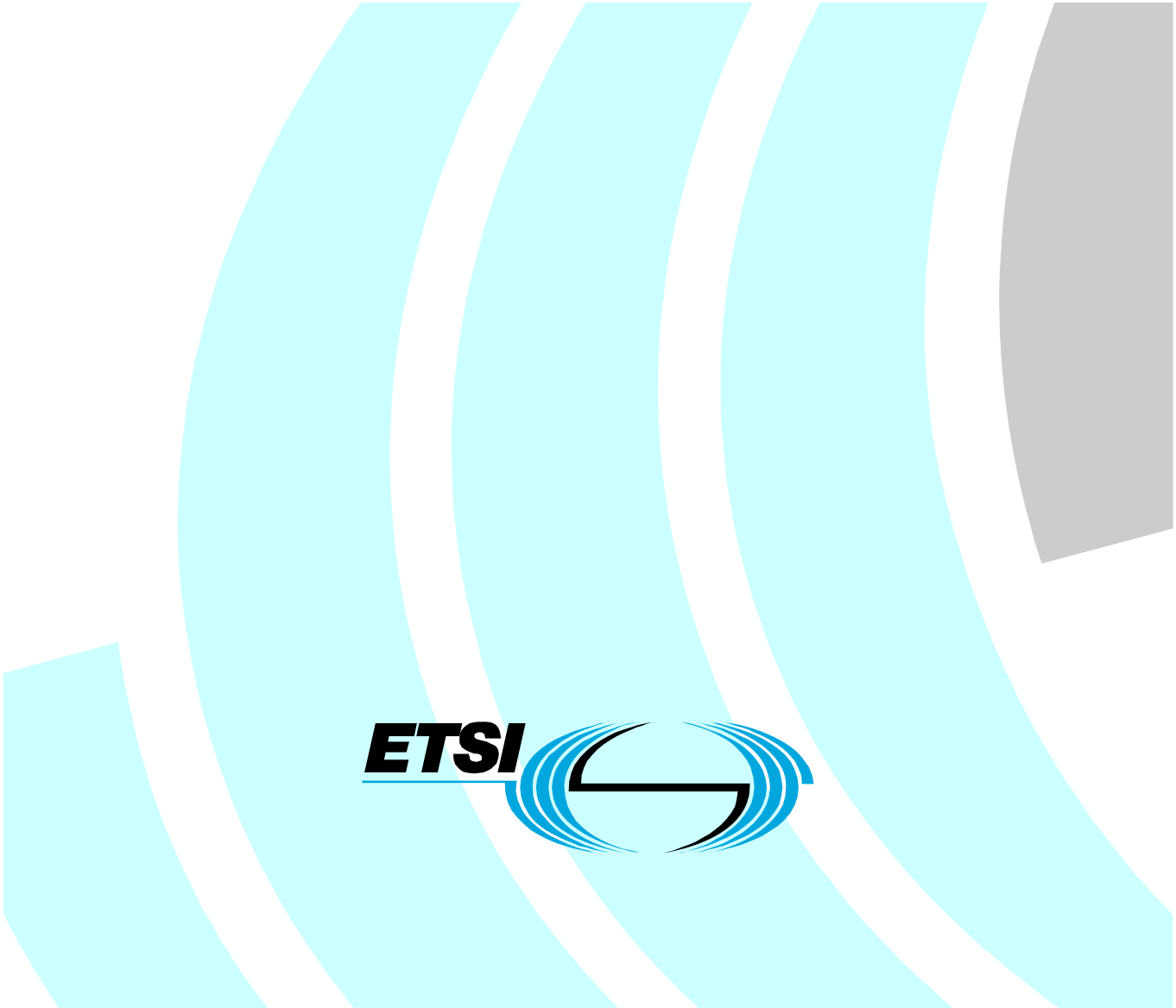
ETSI TR 102 433 V1.2.1 (2007-09)

Technical Report

Electromagnetic compatibility and Radio spectrum Matters (ERM); Digital Private Mobile Radio (DPMR) using a channel spacing of 6,25 kHz and operating in specified VHF and UHF bands under general authorization without individual rights; System reference document



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ETSI

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

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

Siret N° 348 623 562 00017 - NAF 742 C
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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).

The present document covers the Electromagnetic compatibility and Radio spectrum Matters (ERM); System reference document for Digital Private Mobile Radio (DPMR) using a channel spacing of 6,25 kHz and operating in the following frequency ranges:

- 446,1 MHz to 446,2 MHz; and/or
- 149,01875 MHz to 149,11875 MHz

under general authorization without individual rights.

Introduction

TR 102 433 V1.1.1 [1] was produced to request from ECC a spectrum identification for Digital PMR 446 in the UHF frequency range. As a result from the work in ECC, CEPT/ECC/DEC(05)12 [11] was approved.

The present document is a revision of V1.1.1 of TR 102 433 [1] and contains a proposal for ECC to consider the possibility to prepare a new ECC Decision for additional frequencies for digital licence- exempt PMR in the VHF frequency range (see also clause 4.1).

1 Scope

The present document has been developed in order to provide information on the usage of radio frequencies for digital land mobile radio equipment offering peer-to-peer functionality complying with DPMR specifications (referenced later in the present document as "DPMR") using a channel spacing of 6,25 kHz and operating in the 446,1 MHz to 446,2 MHz and/or 149,01875 MHz to 149,11875 MHz frequency bands, both under general-authorization-with-no-individual-rights operation.

It includes necessary information to support the co-operation between ETSI and the Electronic Communications Committee (ECC) of the European Conference of Post and Telecommunications administrations (CEPT), including:

- Detailed market information (annex A).
- Technical information (annex B).
- Expected compatibility issues (annex C).

2 References

For the purposes of this Technical Report (TR) the following references apply:

References are either specific (identified by date of publication and/or edition or version number) or non specific.

- For a specific reference, subsequent revisions do not apply.
- For a non specific reference, the latest version 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.

[1] ETSI TR 102 433 (V1.1.1): "Electromagnetic compatibility and Radio spectrum Matters (ERM);Digital Private Mobile Radio (DPMR) using a channel spacing of 6,25 kHz and operating in the frequency range from 446,1 MHz to 446,2 MHz under general authorization without individual rights; System reference document".

[2] ETSI EN 301 166-1: "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; Part 1: Technical characteristics and methods of measurement".

[3] ETSI EN 301 166-2: "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; Part 2: Harmonized EN covering essential requirements of article 3.2 of the R&TTE Directive".

[4] ERC/DEC(98)25: "ERC Decision of 23 November 1998 on the harmonized frequency band to be designated for PMR 446".

[5] ERC/DEC(98)26: "ERC Decision of 23 November 1998 on Exemption from Individual Licensing of PMR 446 equipment".

[6] ERC/DEC(98)27: "ERC Decision of 23 November 1998 on free circulation and use of PMR 446 equipment in CEPT member countries enlarging the field of application of ERC/DEC/(95)01".

[7] ERC Report 25: "The European table of frequency allocations and utilizations covering the frequency range 9 kHz to 275 GHz".

[8] Directive 1999/5/EC of the European Parliament and of the Council of 9 March 1999 on radio equipment and telecommunications terminal equipment and the mutual recognition of their conformity (R&TTE Directive).

[9] ETSI TR 102 335-1: "Electromagnetic compatibility and Radio spectrum Matters (ERM); System reference document for harmonized use of Digital Mobile Radio (DMR); Part 1: Tier 1 DMR#, expected to be for general authorization with no individual rights operation".

[10] ETSI EN 300 296-1: "Electromagnetic compatibility and Radio spectrum Matters (ERM); Land mobile service; Radio equipment using integral antennas intended primarily for analogue speech; Part 1: Technical characteristics and methods of measurement".

[11] CEPT/ECC/DEC(05)12 :"ECC Decision of 28 October 2005 on harmonized 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".

[12] CEPT/ECC/DEC(06)06 :"ECC Decision of 7 July 2006 on the 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".

[13] Report on "Economic impact of the use of radio spectrum in the UK" by Europe Economics.

[14] ETSI TS 102 490 V1.3.1: "Electromagnetic compatibility and Radio spectrum Matters (ERM);Peer-to-Peer Digital Private Mobile Radio using FDMA with a channel spacing of 6,25 kHz with e.r.p. of up to 500 mW".

3 Definitions and abbreviations

3.1 Definitions

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

Digital Private Mobile Radio (DPMR): peer-to-peer narrow band (6,25 kHz) digital PMR application standardized within ETSI (TS 102 490 [14])

dedicated antenna: permanently attached or removable antenna supplied and tested with the radio equipment, designed as an indispensable part of the equipment

NOTE: Dual frequency band (VHF and UHF) devices may have different antennae for each band.

Digital PMR 446: license-exempt digital PMR equipment operating under ECC/DEC(05)12 [11]

peer-to-peer: communication technique where any radio unit may communicate with one or more other radio units without the need for any additional equipment (e.g. repeater)

plug and play: of or pertaining to the ability of certain operating systems to automatically:

a) detect a new device that has been added to the system;

b) uniquely identify that device; and

c) install the appropriate drivers and system files for that device

PMR 446: license-exempt analogue PMR equipment operating under ERC/DEC(98)25 [4], ERC/DEC(98)26 [5] and ERC/DEC(98)27 [6], and complying with EN 300 296-1 [10]

3.2 Abbreviations

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

BIIS1200	Binary Interchange of Information and Signalling at 1 200 bit/s
CEPT	European Conference of Post and Telecommunications administrations
DMR	Digital Mobile Radio
DPMR	Digital Private Mobile Radio
ECA	European Common Allocations table
ECC	Electronic Communications Committee
EMF	ElectroMotive Force
ERC	European Radiocommunications Committee
ERP	Effective Radiated Power
GSM	Global System for Mobile communication
ITU	International Telecommunication Union
PAMR	Public Access Mobile Radio
PMR	Private Mobile Radio
RF	Radio Frequency
RSSI	Received Signal Strength Indication
SRDoc	System Reference Document
TETRA	TErrestrial Trunked RAdio
VHF	Very High Frequency
UHF	Ultra High Frequency

4 Executive summary

4.1 Status of the System Reference Document

Version 1.2.1 of the present document was developed by ERM TG DMR to include the use of VHF frequencies in addition to the UHF frequencies already identified in ECC/DEC(05)12 [11] (Digital PMR 446).

Its version 1.2.1_2.0.4 was approved by ERM RM#36, in May 2007. It has been forwarded to ECC WGFM for consideration.

It was subsequently offered to TC-ERM#32 where it was approved for publication.

4.2 Technical issues

DPMR is a new generation of digital PMR radio that is designed to operate within 6,25 kHz channels (compliant with EN 301 166-1 [2] and EN 301 166-2 [3]). The equipment will use a dedicated antenna. In case of non-removable integral antenna equipment, the device will either have a permanent internal or a temporary internal 50 Ω RF connector (necessary to ensure compliance with EN 301 166-1 [2] and EN 301 166-2 [3]).

It will operate with a limited functionality that offers only simplex, peer-to-peer voice and data communications and is proposed as suitable for low cost and for general-authorization-with-no-individual-rights operation in the frequency bands from 446,1 MHz to 446,2 MHz and/or 149,01875 MHz to 149,11875 MHz .

4.2.1 Applications

DPMR is specifically targeted at small PMR systems in all areas where analogue PMR or PMR 446 is currently applied today. It will provide voice and data services (typically such as short messages data services).

4.2.1.1 Spectrum requirement and justifications

There is a demand for a suitable frequency designation offering a service similar to PMR 446 but using digital technology that also provides users with simple data transmission.

The frequency band 446,1 MHz to 446,2 MHz has already been identified by ECC/DEC/(05)12 [11]. In addition to this UHF band, an additional candidate VHF band from 149,01875 MHz to 149,11875 MHz is proposed. This additional frequency band is already covered by the recently developed ECC/DEC(06)06 for narrowband digital PMR/PAMR [12]. ECC/DEC(06)06 [12] identifies inter alia the frequency range from 146 MHz to 174 MHz for narrow band Digital Land Mobile PMR/PAMR using channel spacings up to 25 kHz under individual licensing.

It is desirable that the frequencies are made available all over Europe, so that the corresponding equipment could be classified as Class 1 under the R&TTE Directive (1999/5/EC [8]).

License-exempt Digital PMR is envisaged as complementing the current analogue PMR 446 by providing other additional features that are currently being developed in the air-interface standards for DMR and DPMR.

The addition of VHF frequencies for use by DPMR is considered to be complementary to the UHF use of DPMR (see clause B.2.2).

4.2.2 Spectrum parameters

4.2.2.1 Radiated power

VHF DPMR radios for this application will be operating with the same RF power as DPMR 446 radios, i.e. 500 mW ERP. The equipment will be a handheld terminal with dedicated antennae only.

DPMR handheld terminals may also offer dynamic RF power control. This will have the effect of increasing the frequency re-use and thus improving spectrum efficiency (capacity) over that of analogue PMR/PMR 446.

DPMR handheld terminals will operate in half the channel bandwidth of current analogue PMR 446 radios and improve spectrum efficiency even further.

4.2.2.2 Transmitted bandwidth

The transmitted bandwidth will comply with the spectrum mask required for 6,25 kHz channels as defined in EN 301 166-1 [2] and EN 301 166-2 [3].

4.2.2.3 Frequency considerations

A requirement has been identified for an additional sixteen 6,25 kHz wide harmonized channels (or 100 kHz frequency band) for DPMR within the 2 meter VHF band. These frequencies are proposed to be made available under general-authorization-with-no-individual-rights operation, in addition to the existing DPMR 446 frequencies.

Within the frequency range of 149,01875 MHz to 149,11875 MHz, the following centre frequencies (nominal channel centre frequencies) are intended:

149,021875 MHz; 149,028125 MHz; 149,034375 MHz; 149,040625 MHz; 149,046875 MHz; 149,053125 MHz; 149,059375 MHz; 149,065625 MHz; 149,071875 MHz; 149,078125 MHz; 149,084375 MHz; 149,090625 MHz; 149,096875 MHz; 149,103125 MHz; 149,109375 MHz; 149,115625 MHz.

In addition to the existing:

446,103125 MHz; 446,109375 MHz; 446,115625 MHz; 446,121875 MHz; 446,128125 MHz; 446,134375 MHz; 446,140625 MHz; 446,146875 MHz; 446,153125 MHz; 446,159375 MHz; 446,165625 MHz; 446,171875 MHz; 446,178125 MHz; 446,184375 MHz; 446,190625 MHz; 446,196875 MHz.

The maximum frequency error of the DPMR equipment does not exceed 1/10 of the channel spacing, i.e. 0,625 kHz, which is mandatory in order to comply with EN 301 166-1 [2] and EN 301 166-2 [3].

4.2.3 Current regulations

For radio spectrum coexistence the radio equipment will comply with the current harmonized standard EN 301 166-2 [3]. The frequency band 446,1 MHz to 446,2 MHz has already been identified by ECC/DEC/(05)12 [11].

4.2.4 Compatibility issues

It is also intended that DPMR will co-exist in the same UHF spectrum with DMR tier 1 peer-to-peer digital PMR application which is based on 12,5 kHz channel spacing (TR 102 335-1 [9]). In order to optimize the sharing, centre frequencies of both types of peer-to-peer DMR applications are offset.

The proposed equipment for DPMR will also have transmitter time-out functionality for both voice and data applications. Unmodulated, unused carriers will not be transmitted. This is also specified in TS 102 490 [14].

When accessing a channel to transmit, the equipment may take into account activity present on the channel. This could include other DPMR, digital or analogue activity. This listen-before-talk functionality is included in the product standard TS 102 490 [14]. The listen-before-talk function may differentiate between various parameters such as RSSI, channel synchronization as well as group or colour code.

5 Main conclusions

5.1 Business importance

The transition to digital technology in all sectors of radio communications is vital in order to meet the user expectations whilst improving spectrum efficiency.

The success of DPMR is crucial to the future of the low-end mobile radio market.

DPMR has a very simple level of functionality in a similar manner to analogue PMR 446.

ECC has reacted to this demand and already identified the frequency band 446,1 MHz to 446,2 MHz for Digital PMR 446. However, several countries have not yet been able to free the spectrum detailed in ECC/DEC/(05)12 [11] from existing usage. It is felt that the new proposed VHF allocation would also create marketing possibilities for those countries where this is still the case. Alternatively, at least one country (Germany) has already implemented the proposed VHF designation in addition to the spectrum detailed in ECC/DEC/(05)12 [11]. It is important that the corresponding frequencies are harmonized throughout the European Community. A pan-European harmonized frequency designation would give the economy of scale required to produce terminals at a price that can compete with analogue technology. The proposal contained in the present document is expected to accelerate the transition of analogue to more spectrum efficient digital technology.

5.2 Expected timing for products to market

Commercial DPMR products for the 446 MHz band have been available since early 2006. Development of a VHF derivative version should be achievable within a reasonably short time frame and early 2008 would be possible.

The revised DPMR standard relevant to these products for both the VHF and UHF bands (TS 102 490 [14]) has been published in April 2007. Therefore, a decision for the harmonized spectrum is required to be available for general-authorization-with-no-individual-rights by mid 2008. However, it is again expected that some countries may need a longer transition time to free the spectrum from existing usage until it will become available.

5.3 Requested ECC actions

ETSI requests that the ECC considers the proposal contained in the present document when preparing a new ECC Decision for the VHF frequencies.

These frequencies are requested, on a harmonized European wide basis for a simplex, peer-to-peer digital speech and data service for general-authorization-with-no-individual-rights operation.

The VHF frequencies proposed in the present document are preferred. However, if alternative VHF frequencies are deemed more suitable for harmonization in Europe, then this is acceptable. A survey of administrations could be undertaken by ECC to establish suitable frequency availability.

A new separate ECC Decision has been considered a preferred solution by ETSI since ECC/DEC/(05)12 [11] is still in process of being implemented by some administrations.

NOTE 1: ECC/DEC(06)06 [12] identifies inter alia the frequency range from 146 MHz to 174 MHz

NOTE 2: The frequency band 446,1 MHz to 446,2 MHz has already been identified by ECC/DEC/(05)12 [11].

Annex A:
Detailed market information

A.1 Range of applications

DPMR is especially effective in those applications currently served by PMR 446 analogue voice where the new technology will offer data communications as well as digital speech.

Given the increase in voice plus signalling applications in analogue PMR today, DPMR is most effective in increasing spectrum efficiency by means of doubling usable RF channels compared to current 12,5 kHz technology.

The VHF communications proposed by the present document is preferable for outdoor use including outdoor sports activities, outdoor production areas, construction sites, water sport, team events, hunting and forest activities and security applications.

A.2 Market size and value

The current European PMR market is estimated at more than 1,5 million terminals (see note) per year throughout the member states, with a total value likely to exceed 500 million Euros in 2005.

NOTE: IMS Research June 2001.

If we disregard the "high-end" digital market that is represented for example by TETRA and other similar technologies, we still have just less than 1,5 million analogue terminals entering the market each year.

The overall economic impact in the UK alone, as an example, provided by PMR in 2006 has been identified to be in the order of 2 billion Euros [13].

There is little growth in traditional licensed services, but there is an explosive growth in license exempt services such as DPMR/PMR 446. It may also be said that licence exempt services have been "a victim of their own success" in that the existing frequency designation has become saturated and new users have difficulty in finding a usable radio channel in metropolitan areas. The expansion of the existing frequency designation for DPMR would help to alleviate this problem.

In the short time since the original ECC/DEC/(05)12 [11] decision, large quantities of DPMR radios have been placed on the market despite that band not yet being available in all member countries.

It is expected that additional VHF frequencies would increase the total addressable market for such products significantly. This is also supported by an increase in operating range of about 30 % to 50 % compared with DPMR at 446 MHz. Therefore, DPMR at VHF will complement the DPMR 446 market size and value.

The introduction of products for license- exempt usage in VHF will help to decrease product costs, further enabling the transition to digital PMR in the VHF band.

The introduction of additional spectrum for DPMR for general-authorization-with-no-individual-rights operation, coupled with its additional unique features is expected to accelerate this growth provided that any transition periods proposed by CEPT administrations are kept to a minimum.

The functionality and features of such a low cost digital technology attracts new users into this market, as well as providing overwhelming reasons to upgrade for existing users.

A.3 Traffic evaluation

Voice traffic evaluation is similar to current analogue PMR deployment. However, DPMR offers considerable improvement in voice and data applications, where the channel data throughput is enhanced by an order of at least double compared to current PMR technology such as BIIS1200, combined with a spectrum efficiency of almost double that offered by BIIS1200.

DPMR may also offer dynamic RF power control by the terminals. This has the effect of increasing the frequency re-use by radio users thus improving spectrum efficiency even further.

Annex B:
Technical information

B.1 Detailed technical description

B.1.1 Overview

DPMR is based on the technical and signalling characteristics of low cost, low complexity terminals based on a fully digital implementation and FDMA.

DPMR is two or more radios in peer-to-peer mode and in spectrum identified for general-authorization-with-no-individual-rights usage. This may be likened to a digital version of PMR 446 but with the added virtues of data, privacy and additional unique features.

The VHF band also offers a larger operating range compared with UHF of about 30 % to 50 % (as an overall result of less attenuation versus less antenna gain based on 7 cm to 10 cm long antennas).

149 MHz is about 1/3 of 446 MHz. Under assumption of the same field strength levels, the antenna input EMF voltages in the 2 m Band are expected to be 3 times higher (~ 10 dB) compared to the 446 MHz Band as a result of differing antenna factors. The ideal quarterwave antenna whip length for 0 dBd is around 50 cm in the 2 m band. State-of-the-art shortened plug-in antennae (e.g. shortened normal mode helix-type antennae) can be assumed to have around -3dBd to -6 dBd gain. There will be around 6 dB more input voltage under the same field strength than on 446 MHz (ERP limit values are 500 mW on both frequencies) and generally a better reception quality on 2 m under similar test conditions.

B.1.2 Key user features

Clauses B.1.2.1 through B.1.2.5 list of DPMR technical features visible to the user that offer advancement over existing license-exempt analogue PMR.

B.1.2.1 Battery life

A criticism of PMR, particularly the digital formats, is the short operational period before batteries need to be recharged. GSM handsets have set user's expectations for battery life. Attention to the protocol complexity and built in "power save" are characteristics of the DPMR signalling standard TS 102 490 [14]. The result is that DPMR handsets have a considerably better battery life than current analogue PMR handsets.

B.1.2.2 Speech quality

Digital radio systems require a vocoder to compress and digitize the speech. There is continuous research into vocoder design. Early low bit rate vocoders, which although intelligible, were far from natural sounding. With the advances in both vocoder algorithms and digital hardware, speech quality is at least as good as GSM.

B.1.2.3 Security

DPMR, in common with other digital formats, offers protection from the casual eavesdropper armed with a simple scanner.

B.1.2.4 Data

DPMR radios offer the functionality of connected and/or packet data modes. These data transport mechanisms can be integrated into the radio equipment and suitable drivers to offer a plug and play interface to personal computers will be developed.

B.1.2.5 Channels

DPMR offers users double the number of channels available compared to existing 12,5 kHz technology in the UHF band. Dual band DPMR could even offer quadruple the number of channels.

Channels are selected manually by the user as usual with PMR 446 and Digital PMR 446 equipment.

B.2 Technical justification for spectrum

B.2.1 Power

B.2.1.1 License-exempt operation

DPMR terminals for operation under a general-authorization-with-no-individual-rights regime are designed to comply with the same characteristics as those applied to equivalent analogue technology (PMR 446). In this respect, the same power limit of 500 mW ERP applies, accompanied by the mandatory requirement for equipment to have a dedicated antenna.

B.2.2 Frequency

The frequency band referred to in the present document is from 149,01875 MHz to 149,11875 MHz. This is in addition to Digital PMR 446 as identified by ECC/DEC/(05)12 [11]. No guard band will be required to Land Mobile services operating in adjacent channels because of compliance with EN 301 166-1 [2] and EN 301 166-2 [3].

16 × 6,25 kHz contiguous simplex channels are proposed to be accommodated within the VHF frequency range.

There are typical wave propagation differences between VHF and UHF and as a consequence, VHF has a considerably larger communication range under nearly all outdoor situations:

- Reflexions and standing waves:
  - VHF band radiations are affected by reflexions on metallic and other conductive surfaces (e.g. water), more than reflexions on non metallic surfaces. On UHF however, even non metallic surfaces like rocks, concrete etc are able to deliver strong reflexion effects, which can even enable reception in tunnels and inside buildings. This is due to multi-path reflexions.
- Mobile reception under movement (e.g. from vehicles):
  - Reception is affected by flutter fading and standing wave field conditions in reflexion areas. On UHF, the speed under which the flutter fading appears is about 3 times the value of VHF, an effect which disappears above a certain driving speed. VHF radiation has a more smooth behaviour, the maxima and minima are less (i.e. less reflexions) and fading effects in standing wave areas occur with about 1/3 of the speed compared to UHF. Consequently, VHF is better for equipment under the scope of the product standard TS 102 490 [14].
- Wave propagation through or around obstacles:
  - Obstacles like houses, hills, etc can be better penetrated when using VHF frequencies. In addition, under reflexion- free conditions, the VHF band is always the better choice.
- Absorption effects:
  - The stronger thermal absorption of UHF radiated energy by water molecules cannot be neglected. During spring and summer, forests absorb UHF radiation extensively and a communication link in such environments is often totally interrupted at these times, while working well in winter time. VHF is hardly affected by such absorption.

Based on the above, VHF communications is preferable for outdoor use including outdoor sports activities, outdoor production areas, construction sites, water sport, team events, hunting and forest activities and security applications.

B.2.2.1 License-exempt operation

DPMR terminals will only be capable of operation on the frequencies identified for general-authorization-with-no-individual-rights operation.

B.2.3 Bandwidth and other radio parameters

The specifications and operating parameters of DPMR in VHF and UHF are defined in TS 102 490 [14] and EN 301 166-1 [2] and EN 301 166-2 [3].

Annex C:
Expected compatibility issues

C.1 Coexistence studies (if any)

Coexistence studies are not envisaged to be necessary.

NOTE: this question was addressed when ECC discussed Digital PMR 446 and it was concluded that no studies were necessary.

Furthermore, it should also be noted that the initial usage density of DPMR in the VHF band would be low in the first years after market placement. This could potentially be used by administrations for the provision of a transition period in which the proposed frequency band would be opened to coexistence with the existing individual licensed usage. In addition, no new individual usage should be licensed within this transition period.

ECC is requested to study the utilization level within Europe in the 149 MHz frequency range (e.g. by a survey to administrations). In the past, the proposed frequencies were used by several countries for analogue mobile networks which are not in operation anymore. There is little information about widespread new usage in this band.

C.2 Current ITU allocations

The VHF frequency band proposed is allocated to the Mobile Service in Region 1 and in the ECA [7].

Table C.2.1: Excerpt from the European Common Allocations Table

Frequency band	Allocations	Applications
148,4 MHz to 149,9 MHz	Mobile Mobile-Satellite (earth-to-space)	PMR/PAMR MSS Earth stations

Currently, ECC/DEC(06)06 [12] already covers the 149 MHz frequency range proposal for narrowband digital PMR/PAMR, however on the basis of individual licenses.

Germany has already issued a license exempt ruling for license- exempt PMR in the VHF frequency range.

C.3 Sharing issues

DPMR co-exists in the same spectrum with the DMR tier 1 peer-to-peer digital PMR application which is based on 12,5 kHz channel spacing as described in TR 102 335-1 [9] in the 446 MHz UHF frequency range.

Sharing issues in the VHF band during the transition period are referred to in clause C.1.

History

Document history		
V1.1.1	June 2005	Publication
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