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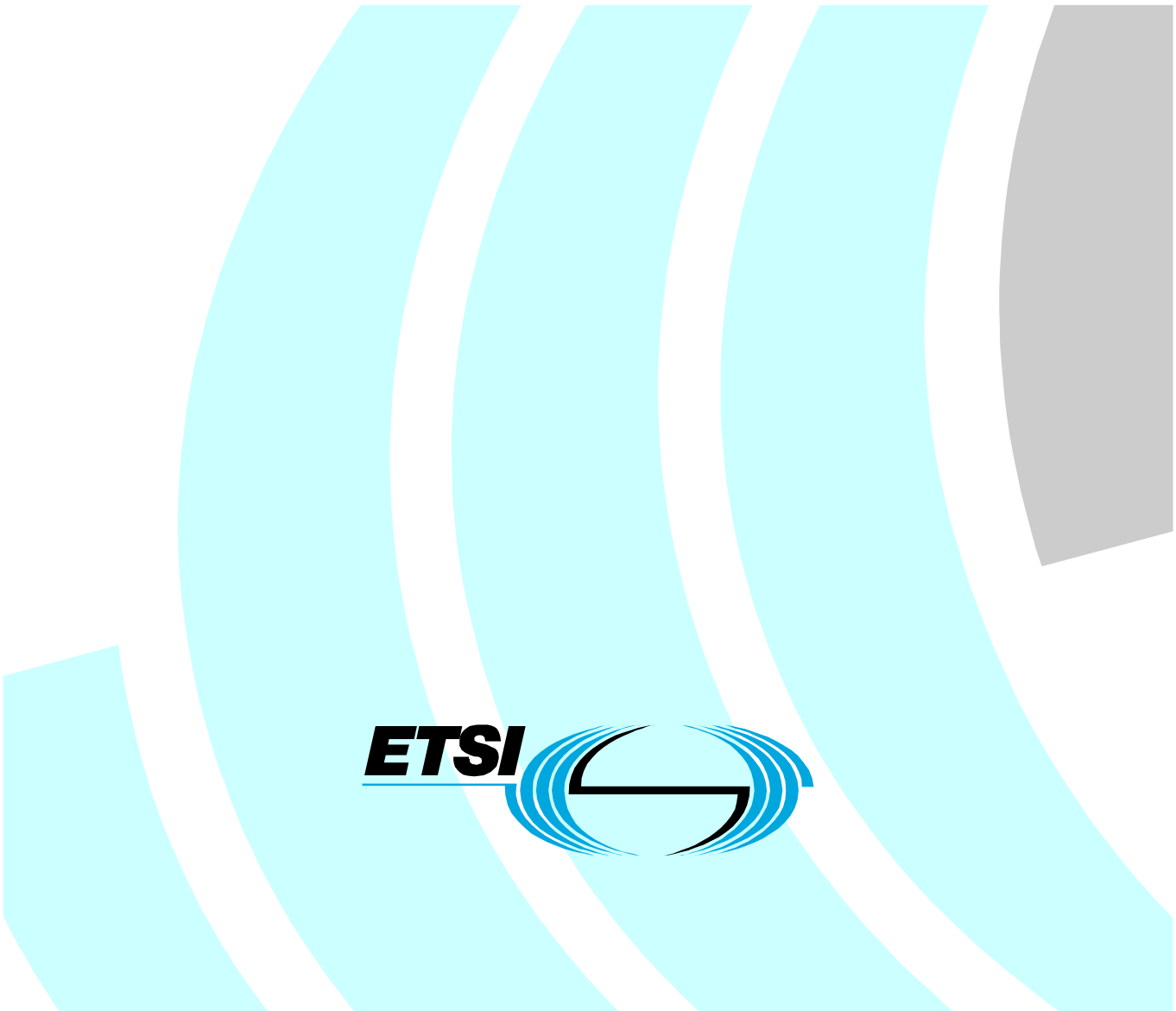
Technical Report

Electromagnetic compatibility and Radio spectrum Matters (ERM); System Reference Document for use of the band 169,4 MHz to 169,8 MHz for Digital Interchange of Information and Signalling (DIIS)



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Foreword

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

1 Scope

The present document defines the requirements for radio frequency usage for radios operating under the DIIS protocol operating in the ERMES band.

It includes necessary information to support the co-operation between ETSI and the European Radiocommunications Committee (ERC) 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:

[1] ETSI ETS 300 230: "Radio Equipment and Systems (RES); Land mobile service; Binary Interchange of Information and Signalling (BIIS) at 1 200 bit/s (BIIS 1 200)".

[2] ETSI EN 300 113-1: "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; Part 1: Technical characteristics and methods of measurement".

[3] ETSI EN 300 113-2: "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; Part 2: Harmonized EN covering essential requirements under article 3.2 of the R&TTE Directive".

[4] ETSI EN 300 390-1: "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; Part 1: Technical characteristics and test conditions".

[5] ETSI EN 300 390-2: "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; Part 2: Harmonized EN covering essential requirements under article 3.2 of the R&TTE Directive".

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

[7] 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".

3 Definition and abbreviations

3.1 Definition

For the purposes of the present document, the following term and definition applies:

peer-to-peer: single radio unit which may communicate with one or more other radio units without the need for additional equipment

3.2 Abbreviations

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

BIIS1200	Binary Interchange of Information and Signalling
DIIS	Digital Interchange of Information and Signalling
PAMR	Public Access Mobile Radio
PMR	Private Mobile Radio
PMR446	Licence-exempt ETSI PMR standard operating under ERC/DEC(98)26 and ERC/DEC(98)27
TETRA	TErrestrial Trunked RAdio

4 Executive summary

4.1 Status of the System Reference Document

The ERM TG32 DIIS working group has approved the present document.

4.2 Technical issues

DIIS is a new generation of digital PMR radio that is designed to operate within the existing channel rasters or spacing used in land mobile frequency bands in Europe.

4.2.1 Applications

DIIS is specifically targeted at small to medium sized PMR systems in all areas where analogue PMR is currently applied today. It will provide voice and data services.

4.2.1.1 Spectrum requirement and justifications

It is expected that DIIS will be implemented within the classic land mobile allocations by a natural re-farming process of old analogue PMR systems. However, the concerns about co-existence means that some defined parts of the PMR frequency bands need to be marked as preferential for DIIS protocol.

A separate System Reference Document will be published to cover the general deployment of DIIS technology in licensed land mobile frequency bands other than those covered by the present document.

There is a requirement for a suitable allocation and specification offering the same or similar status as PMR446. For reasons given below, it is preferable that this is a unique allocation not shared with PMR446. The ERMES band of 169,4 MHz to 169,8 MHz would be an ideal candidate.

4.2.2 Spectrum parameters

4.2.2.1 Radiated power

DIIS radios will be operating with RF specifications broadly similar to those of current analogue PMR radios, i.e. 1 W to 5 W for handheld equipment and 5 W to 25 W for mobile and base station equipment.

DIIS will also offer dynamic RF power control by the terminals. This will have the effect of increasing the frequency re-use by radio users thus improving spectrum efficiency.

4.2.2.2 Transmitted bandwidth

The transmitted bandwidth will comply with EN 300 113-1 [2] or EN 300 390-1 [4] as appropriate.

4.2.2.3 Frequency considerations

Applicable frequencies will be the same as those currently used by analogue PMR radio systems and the 169,4 MHz to 169,8 MHz (ERMES) band would be an ideal candidate.

The present document specifically applies to the ERMES band above and a separate document will cover DIIS deployment outside of the ERMES band.

4.2.3 Current regulations

For spectrum conformity testing the radio will comply with the current harmonized standard EN 300 113-2 [3] or EN 300 390-2 [5] as appropriate.

4.2.4 Compatibility issues

The primary co-existence issue to consider is that of allocation of shared frequencies between DIIS and analogue PMR users.

Whilst DIIS radios will be able to co-exist within the framework of a defined "polite" channel access protocol, it is doubtful that all analogue radios will be able to distinguish between noise and DIIS modulated signals. It is unlikely that all types of current analogue PMR will be able to obey such a polite channel access protocol.

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 requirements whilst improving spectrum efficiency. To date the lower market sectors of PMR have not been addressed in ETSI standardization. The success of the DIIS protocol will be crucial to the future of the low-end market.

As the DIIS protocol can be implemented at a very simple level of functionality, it is only logical that such use should be treated in a similar manner as the analogue PMR equivalent. The entry-level of the analogue equivalent is the PMR446 specification and an entry-level of DIIS should be available under similar terms with a defined set of frequencies and a specification that allows a licence-exempt status. Of course it will be important that such a frequency allocation is harmonized throughout the European Community. A pan-European harmonized allocation will give the economy of scale required to produce terminals at price to compete with analogue technology. This will remove the need for the warning symbol (class 2) and the 4-week notification period resulting in faster rollout times.

Outside of this entry-level licence-exempt grade of product, DIIS would be administered in an equivalent manner to analogue PMR.

5.2 Expected timing for products to market

It is expected that the draft EN for the DIIS protocol will be completed by the end of 2002. It is estimated that commercial DIIS products would be available for first customer shipments within 24 months of the standard being published.

5.3 Requested ERC actions

This TG requests that ERC allocate this frequency band on a harmonized European wide basis to a digital speech and data service using a polite protocol. DIIS is an example of a suitable protocol.

The frequency band covered by the present document covers the frequency range from 169,4 MHz to 169,8 MHz. This permits a total of 32 channels in 12,5 KHz spacing provided no guard bands are required.

The TG further requests that this spectrum be divided equally between low power peer-to-peer licence-exempt and higher powered licensed spectrum.

Annex A:
Detailed market information

A.1 Range of applications

DIIS technology is particularly aimed at providing significantly advanced features compared to that available with analogue PMR and PAMR today.

DIIS will be especially effective in those applications currently served by mixed analogue voice and digital signalling where the new technology will offer enhanced data rates and digital speech.

Given the increase in voice + signalling applications in analogue PMR today, DIIS will be most effective in increasing spectrum efficiency by means of offering greater throughput for the same channel spectrum mask.

A.2 Market size and value

The current European PMR market is estimated at more than 1,5 million terminals per year throughout the member states with a total value likely to exceed 450 million Euros in 2002.

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

There is no growth in the traditional licensed services, but there is an explosive growth in the licence exempt services such as PMR446.

The existing licence exempt service offers an easy access to PMR technology and the benefits that this brings. It is seen as a crucial reason for this growth. The introduction of licence exempt spectrum for DIIS, coupled with its additional unique features is expected to accelerate this growth.

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

A.3 Traffic evaluation

Voice traffic evaluation will be similar to current analogue PMR deployment. However, DIIS will offer considerable improvement in voice and data applications where the channel data throughput will be enhanced by an order of at least a ten times magnitude compared to current PMR technology such as BIIS1200, see ETS 300 230 [1].

DIIS will also offer dynamic RF power control by the terminals. This will have the effect of increasing the frequency re-use by radio users thus improving spectrum efficiency.

Annex B:
Technical information

B.1 Detailed technical description

B.1.1 Overview

DIIS will define the technical and signalling characteristics of low complexity mobile or hand portable terminals based on a fully digital implementation. The term low complexity encompasses everything from two terminals operating in peer-to-peer mode, scaleable right up to licensed multi-site PMR radio systems using trunked repeaters and simulcast systems.

DIIS stands for Digital Interchange of Information and Signalling. It will be an EN standard for the transmission of digital speech, short messages and data under the rules of a defined co-existence protocol. It applies to equipment designed to operate within the professional mobile radio service and to the associated frequency planning.

The DIIS entry level is two or more radios in peer-to-peer mode and in licence exempt spectrum. This may be likened to a digital version of PMR446 but with the added virtues of scalability, privacy and additional unique features that DIIS offers.

B.1.2 Key user features

This is a list of DIIS technical features visible to the user that offer advancement over existing analogue PMR.

B.1.2.1 Battery life

A criticism of PMR, particularly the digital formats, is the endurance of the handsets. GSM handsets have set user's expectations for battery life. Attention to the protocol complexity and built in "power save" is a characteristic of the DIIS signalling standard. The result is that DIIS handsets will potentially have a considerably better battery life than today's 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 will be at least as good as today's 12,5 kHz analogue FM.

B.1.2.3 Security

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

B.1.2.4 Data

DIIS provides an integral and flexible data transport mechanism with a "plug and play" interface.

B.1.2.5 Duplex

Duplex operation is a considerable problem for the analogue PMR equipment. There is no low cost solution for portable analogue PMR, but DIIS for example can use time division multiplex techniques to solve this problem.

DIIS supports simplex, duplex, semi-duplex, and "smart" semi-duplex, which is a variable time division duplex that provides improved voice quality by varying the time-slices according to the speech energy required in a particular direction.

B.2 Technical justification for spectrum

B.2.1 Power

B.2.1.1 Licensed operation

DIIS terminals will be capable of operation at similar RF powers as those employed by current analogue PMR. Terminals will be adjustable or programmable within the range of powers typically licensed within member states.

B.2.1.2 Licence-exempt operation

DIIS terminals can be designed to comply with the same characteristics as those applied to equivalent analogue technology (PMR446). In this respect, it would be possible to apply the same value of not exceeding 500 mW ERP.

B.2.2 Frequency

The frequency band referred to in the present document covers the frequency range from 169,4 MHz to 169,8 MHz. This permits a total of 32 channels in 12,5 KHz spacing provided no guard bands are required.

This TG requests that this spectrum be divided equally between licence-exempt and licensed spectrum.

B.2.2.1 Licensed operation

DIIS terminals will be capable of operation in all of the current VHF and UHF land mobile allocations.

DIIS terminals will also be capable of complying with a polite channel access protocol where sharing of analogue channels is envisaged, however it is probable that not all analogue PMR terminals will be able to distinguish DIIS modulation from noise, and thereby cause interference to DIIS systems on the same channel.

B.2.2.2 Licence-exempt operation

DIIS terminals will be capable of operation in all of the current VHF and UHF land mobile allocations.

DIIS terminals can be designed to comply with similar requirements as are applicable to current licence-exempt analogue technology.

PMR446 is a non-polite protocol and will not interoperate easily with DIIS, and sharing of channels would at best reduce the performance and at worst make the system unusable resulting in great customer dissatisfaction.

B.2.3 Bandwidth and other radio parameters

DIIS radio equipment will comply with the current harmonized standard EN 300 113-2 [3] or EN 300 390 [4] as appropriate.

The specifications and operating parameters of DIIS will be no different from current analogue PMR in terms of those parameters relevant to spectrum planning and administration.

B.3 Information on current version of relevant ETSI standard

The ETSI standards relevant to DIIS are:

- EN 300 113-2 [3] for spectrum planning parameters.
- EN 300 390 [4] for spectrum planning parameters.
- ETSI work item DEN/ERM-TG32DIIS032 (see bibliography) for the operational protocol.

Annex C:
Expected compatibility issues

C.1 Coexistence studies (if any)

None.

C.2 Current ITU allocations

None.

C.3 Sharing issues

As noted in the present document, sharing with analogue radios is possible but may result in compromises to the efficient operation of the DIIS protocol. Sharing with other digital technologies that can offer similarly polite co-existence protocols should be possible.

Annex D: Bibliography

- 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".
- DEN/ERM-TG32DIIS032: "Electromagnetic compatibility and Radio spectrum Matters (ERM); Land mobile service; Digital Interchange of Information and Signalling (DIIS) at higher bit rates (9 600 bit/s or higher)".

History

Document history		
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