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**Electromagnetic compatibility and
Radio spectrum Matters (ERM);
System Reference document (SRdoc);
Technical characteristics of Radio equipment
to be used in the 76 GHz to 77 GHz band;
Short-Range Radar to be fitted
on fixed transport infrastructure**

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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
Association à but non lucratif enregistrée à la
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Foreword

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

EC Decision 2011-829-EU [i.9] obliges EU Member States to allow the use of the 76 GHz to 77 GHz band for Road Transport an Telematics for *terrestrial vehicles and infrastructure systems*.

This EC Decision is subject to an update process. CEPT Report 44 [i.10] is the recommendation from CEPT for the 5th update cycle. In this it is recommended to broaden the category of Road Transport and Traffic Telematics (RTTT) to Transport and Traffic Telematics (TTT), and to change the usage restriction on 76 GHz to 77 GHz band to *ground based vehicle and infrastructure systems only*.

The draft revised Decision [i.11] indicates that these recommendations are being adopted.

Accordingly, the present document describes fixed infrastructure radar systems in a range of transport applications.

A previously published ETSI System Reference Document, TR 102 704 [i.7], discusses the use of 76 GHz to 77 GHz band by radars mounted on ground based vehicles other than automobiles.

The purpose of the present document is to provide details of how fixed infrastructure radar are used within the transportation sector, and to indicate the parameters under which these systems operate.

Modal verbs terminology

In the present document "**shall**", "**shall not**", "**should**", "**should not**", "**may**", "**may not**", "**need**", "**need not**", "**will**", "**will not**", "**can**" and "**cannot**" are to be interpreted as described in clause 3.2 of the ETSI Drafting Rules (Verbal forms for the expression of provisions).

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Executive summary

The present document provides information about fixed surveillance radar installations in the 76 GHz to 77 GHz band.

The majority of the systems described here are high value infrastructure systems serving functions of safety and efficiency in the transport field. Typical uses are for surveillance of critical highway situations such as tunnels and large road intersections. There is a requirement in the EU for Automatic Incident Detection in road tunnels which have a control room and are 500 m or longer [i.1].

Other users of the 76 GHz to 77 GHz band include vehicle radars and the Radio Astronomy Service. The important sharing scenarios are therefore a large number of vehicle radars with a small number of fixed radars and with the RAS conducting measurements from 8 sites in Europe.

The 76 GHz to 77 GHz band is designated for both fixed and vehicle radars by 2011-829-EU (the EC Decision on Short Range Devices) [i.9]. Currently there is a harmonised standard for vehicle radars, EN 301 091-1 [i.8], but fixed radars are outside its scope. The fixed radars described here operate with the same signal parameters as vehicle radars - they are in fact compliant with the technical requirements of EN 301 091-1 [i.8].

It should be noted that the fixed radars described do not constitute a new proposal. They represent an established application with a significant installed base. Systems are currently being installed in many European countries (Annex B), but by their nature as high capital cost infrastructure systems they cannot be expected to become massively deployed items.

The present document also examines the sharing scenarios. An acceptable arrangement with the RAS is a small exclusion zone around each millimetre wave observatory site (Annex E). An initial study shows that probability of a scanning infrastructure radar interfering with a vehicular radar is even less than that of a vehicular radar interfering with another vehicular radar (Annex D).The purposes of the present document include:

1) To provide information to CEPT, EC and other bodies to assist studies and regulatory decisions.

2) To pave the way for ETSI to develop a harmonised standard for fixed surveillance radars.

The present document concentrates on applications for surveillance radars in the transport field. The proponents of the SRdoc also note that there are applications in other fields and these are described in clause B.3.

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 Post and Telecommunications Administrations (CEPT).

The European Commission Decision on harmonisation of the radio spectrum for use by short-range devices 2006/771/EC sets out the harmonised frequency bands as well as the technical usage conditions under which SRDs can be used across Europe. Last updated in December 2011 under EC Decision 2011/829/EU [i.9], the decision sets the usage scope for this band as "terrestrial vehicle and infrastructure systems".

The 76 GHz RTTT Standard EN 301 091-1 [i.8] defines the technical characteristics and test methods for radar equipment operating in the 76 GHz to 77 GHz band. Early versions of EN 301 091-1 [i.8] define the scope as covering both fixed radar installations, and mobile. Subsequent versions of EN 301 091-1 [i.8] have limited the scope to road vehicles only. Other than the definition of the scope, the fixed radar systems presented are fully compliant with the latest versions of EN 301 091-1 [i.8].

The 76 GHz to 77 GHz band is highly versatile and can be used also for safety relevant radar applications which operate either as part of a fixed transport installation, or on a mobile vehicle. These safety related fixed transport installations are the subject of the present document.

The main benefits of using the 76 GHz to 77 GHz frequency band for these applications are that overall radar sensor package sizes can be made of a reasonable size without overly large or cumbersome antenna. These are suitable for roadside installation. With high operating frequency, high resolution range measurements are possible. In addition componentry is readily available in this band. These advantages are further discussed within.

1 Scope

The present document describes the application of fixed transport surveillance radar systems in the 76 GHz to 77 GHz band. Short Range Radars operating in this band are used in a variety of applications, the majority of which are safety related.

The present document includes in particular:

- market information for applications apart from road vehicles;
- technical information regarding the typical radar installations;
- regulatory issues and interference studies whilst considering other band users.

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 referenced 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. For non-specific references, the latest version of the referenced document (including any amendments) applies.

[i.1] L167/39: "Directive 2004/54/EC of the European Parliament and of the Council of 29 April 2004 on minimum safety requirements for tunnels in the Trans-European Road Network".

[i.2] WN 96W0000071: "The Impact of Rapid Incident Detection on Freeway Accident Fatalities".

[i.3] Rail Safety and Standards Board: "Half-year safety performance report 2012/13".

[i.4] Network Rail: "Strategic Business Plan for England & Wales January 2013".

[i.5] European Railway Agency: "Railway safety performance in the European Union 2012".

[i.6] European Commission: "Mobility and Transport, Road Safety, Level Crossings".

NOTE: Available at: http://ec.europa.eu/transport/road_safety/topics/infrastructure/level_crossing/index_en.htm.

[i.7] ETSI TR 102 704 (V1.2.1) (2010-12): "Electromagnetic compatibility and Radio spectrum Matters (ERM); System Reference Document; Short Range Devices (SRD); Radar sensors for non-automotive; ground based vehicular applications in the 76 GHz to 77 GHz frequency range".