



**Electromagnetic compatibility
and Radio spectrum Matters (ERM);
Test Specification for the RFID Interoperability Test Event
in Brazil May 2013**

iTeh STANDARDS PREVIEW
https://standards.iteh.ai/standards/etn/etn-103302-v1.1.1-6115-4555-99d6-8255ae44d2-2015-04-12/

Reference

DTS/ERM-TG34-263

Keywords

ID, radio, RFID

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
Sous-Préfecture de Grasse (06) N° 7803/88

Important notice

The present document can be downloaded from:

<http://www.etsi.org/standards-search>

The present document may be made available in electronic versions and/or in print. The content of any electronic and/or print versions of the present document shall not be modified without the prior written authorization of ETSI. In case of any existing or perceived difference in contents between such versions and/or in print, the only prevailing document is the print of the Portable Document Format (PDF) version kept on a specific network drive within ETSI Secretariat.

Users of the present document should be aware that the document may be subject to revision or change of status. Information on the current status of this and other ETSI documents is available at

<http://portal.etsi.org/tb/status/status.asp>

If you find errors in the present document, please send your comment to one of the following services:

<https://portal.etsi.org/People/CommitteeSupportStaff.aspx>

Copyright Notification

No part may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm except as authorized by written permission of ETSI.

The content of the PDF version shall not be modified without the written authorization of ETSI.

The copyright and the foregoing restriction extend to reproduction in all media.

© European Telecommunications Standards Institute 2015.

All rights reserved.

DECT™, **PLUGTESTS™**, **UMTS™** and the ETSI logo are Trade Marks of ETSI registered for the benefit of its Members. **3GPP™** and **LTE™** are Trade Marks of ETSI registered for the benefit of its Members and of the 3GPP Organizational Partners.

GSM® and the GSM logo are Trade Marks registered and owned by the GSM Association.

Contents

| | |
|---|-----------|
| Intellectual Property Rights | 4 |
| Foreword..... | 4 |
| Modal verbs terminology..... | 4 |
| Introduction | 4 |
| 1 Scope | 5 |
| 2 References | 5 |
| 2.1 Normative references | 5 |
| 2.2 Informative references..... | 5 |
| 3 Definitions, symbols and abbreviations | 5 |
| 3.1 Definitions | 5 |
| 3.2 Symbols..... | 6 |
| 3.3 Abbreviations | 6 |
| 4 Test preparation..... | 6 |
| 4.1 Arrangements | 6 |
| 4.2 Equipment | 7 |
| 4.3 Application Scenarios..... | 7 |
| 4.4 Test arrangements..... | 8 |
| 4.5 Selection of Tags..... | 9 |
| 4.6 Noise Level Measurement..... | 10 |
| 5 Test Procedure..... | 11 |
| 5.1 Scenario 1 - Comparative Performance of FHSS and 4 Channel Plan | 11 |
| 5.2 Scenario 2 - Comparison of Mitigation Techniques | 12 |
| 5.3 Scenario 3: Analysis of Interference between RFID and GSM..... | 13 |
| 5.4 Scenario 4: Door Portal Application | 14 |
| 5.5 Measurement Uncertainties | 15 |
| Annex A (informative): Bibliography..... | 16 |
| History | 17 |

Intellectual Property Rights

IPRs essential or potentially essential to the present document may have been declared to ETSI. The information pertaining to these essential IPRs, if any, is publicly available for **ETSI members and non-members**, and can be found in ETSI SR 000 314: *"Intellectual Property Rights (IPRs); Essential, or potentially Essential, IPRs notified to ETSI in respect of ETSI standards"*, which is available from the ETSI Secretariat. Latest updates are available on the ETSI Web server (<http://ipr.etsi.org>).

Pursuant to the ETSI IPR Policy, no investigation, including IPR searches, has been carried out by ETSI. No guarantee can be given as to the existence of other IPRs not referenced in ETSI SR 000 314 (or the updates on the ETSI Web server) which are, or may be, or may become, essential to the present document.

Foreword

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

Modal verbs terminology

In the present document "**shall**", "**shall not**", "**should**", "**should not**", "**may**", "**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).

"**must**" and "**must not**" are **NOT** allowed in ETSI deliverables except when used in direct citation.

Introduction

Currently the Brazilian regulations concerning RFID are based on the FHSS mode of operation, as commonly used in the Americas, rather than the four channel plan that has been adopted in Europe. However with the increasing number of RFID technologies and applications available at UHF, the Brazilian RFID community has recently expressed a strong interest in participating in an ETSI Plugtests event. They believed that this would provide them with a better understanding of the role of ETSI within Europe and of the standardization activities that had taken place on RFID at UHF within the ETSI Technical Body TC ERM TG34.

CPqD is aware of the increasing number of RFID technologies and applications presently available at UHF. Furthermore in Brazil GSM operates in the frequency bands 907,5 - 915 MHz, which is adjacent to the band occupied by RFID. These factors have led CPqD to identify the need to perform an interoperability test in co-operation with an independent international standardization body. Subsequently arrangements were made to perform Plugtests with the European Telecommunications Standards Institute (ETSI).

The present document describes a test plan to evaluate the comparative performance of the FHSS mode of operation as commonly used in the Americas and the four channel plan that has been adopted in Europe.

1 Scope

The present document describes the test scenarios performed at the RFID Interoperability event in Brazil. The interoperability event, also called Plugtests event is being organized by ETSI, CPqD and FP7 Probe-IT Project. The event took place from 20 - 24 May 2013 at the CPqD Head Quarters, in Campinas, Brazil.

The primary purpose of the tests was to compare the performance between interrogators when configured in the FHSS mode and interrogators configured to operate in accordance with the 4 channel plan, defined by ETSI and adopted in Europe. In addition further tests were carried out to assess the reading performance of tags when attached to "unfriendly" items and the effect of tag orientation.

2 References

2.1 Normative 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.

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

Not applicable.

2.2 Informative 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.

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

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] ETSI TR 103 271: "Electromagnetic compatibility and Radio spectrum Matters (ERM); Report on RFID Brazil Plugtests 20th - 24th May 2013".

3 Definitions, symbols and abbreviations

3.1 Definitions

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

interrogator: device that can read and write to RFID tags

tag: transponder that holds data and responds to an interrogation signal

Tari: reference time interval for a data-0 in interrogator-to-tag signalling

3.2 Symbols

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

| | |
|-----|------------------------------|
| dB | decibel |
| dBm | power level relative to 1 mW |
| kHz | kilo Hertz |
| m | metres |
| MHz | Mega Hertz |
| us | micro second |

3.3 Abbreviations

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

| | |
|------|---|
| BER | Bit Error Rate |
| DAA | Detect And Avoid |
| EIRP | Effective Isotropic Radiated Power |
| EPC | Electronic Product Code |
| FDM | Frequency-Division Multiplexing |
| FHSS | Frequency Hopping Spread Spectrum |
| FM | Frequency Modulation |
| GSM | Global System for Mobile communications |
| RBW | Resolution BandWidth |
| RF | Radio Frequency |
| RFID | Radio Frequency IDentification |
| SMA | SubMiniature version A (connector) |
| TDM | Time-Division Multiplexing |
| UHF | Ultra High Frequency |
| VBW | Video BandWidth |

4 Test preparation

4.1 Arrangements

The test schedule for the Plugtests, has been split as follows:

- 1st Day Check and prepare equipment for the tests;
- 2nd Day Comparison between FHSS and 4-channel plan;
- 3rd Day a.m. Complete comparison of mitigation techniques;
p.m. GSM interference tests;
preparation for tag performance tests;
- 4th Day Perform tag performance tests;
- 5th Day Assess results and tear down;

Sufficient mains power points were provided. The mains supplies are both 110 V and 220 V at 60 Hz using the types of plugs illustrated in Figure 1.

110 ~ 127V/ 60 Hz - Phase/Neutral and 220V / 60 Hz - Phase / Phase

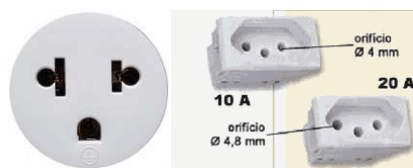


Figure 1: Picture of mains plugs

The Parts 1 and 2 of the Plugtest were supervised by Representatives from ETSI. They were assisted by representatives of CPqD. Following completion of Parts 1 and 2 representatives from CPqD shall supervise Part 3 and Part 4 assisted by the representatives from ETSI. On completion of the Plugtest CPqD and ETSI jointly prepare a Technical Report (ETSI TR 103 271 [i.1]), which includes an analysis of the test results.

4.2 Equipment

ETSI provided the following equipment for the Plugtests:

- 1) 3 x demonstrators capable of operating in the band 915 - 921 MHz and incorporating DAA. Additionally they had the ability to operate under the four channel plan. Each interrogator was capable of driving at least two antennas with an output of 4 W eirp.
- 2) All interrogators were fitted with SMA female connectors.
- 3) The software application for operating the demonstrators and controlling operation of the DAA. This software included the ability to log the successful reading of tags together with recording the total time taken to complete the operation.

CPqD provided:

- 1) 3 x interrogators using FHSS mode and modified for operation at Brazilian frequencies.
- 2) 4 x circularly polarized antennas for operation in the band 902 - 928 MHz for use in scenarios 1, 2 and 3.
- 3) An additional four antennas for scenario 4.
- 4) 3 x laptops for interfacing with the interrogators under test.
- 5) 3 x cardboard sheets each with 50 tags mounted on one side as shown in Figure 4.
- 6) An additional 120 tags applied as described in clause 5.4.
- 7) Three simulated portals as illustrated in Figure 3.
- 8) One GSM emulator.
- 9) One portal for use in scenario 4.
- 10) One optical light beam for use in scenario 4.

4.3 Application Scenarios

The test plan defines four different application scenarios. Each scenario describes the set-up in which RFID interrogators and tags are used. The four test scenarios are:

- Scenario 1: Comparative performance of FHSS and 4 channel Plan.
- Scenario 2: Comparison of mitigation techniques.
- Scenario 3: Analysis of interference between RFID and GSM.
- Scenario 4: Analysis of tag performance.

The detailed specifications for these scenarios are described in clause 5.

4.4 Test arrangements

Scenarios 1, 2 and 3 shall be performed in a semi-anechoic chamber. A picture of the chamber, which is at least 19 m in length, is shown in Figure 2. The environmental conditions inside the chamber are:

- Ambient temperature: 20 to 26 °C;
- Relative Humidity: 40 to 60 %.

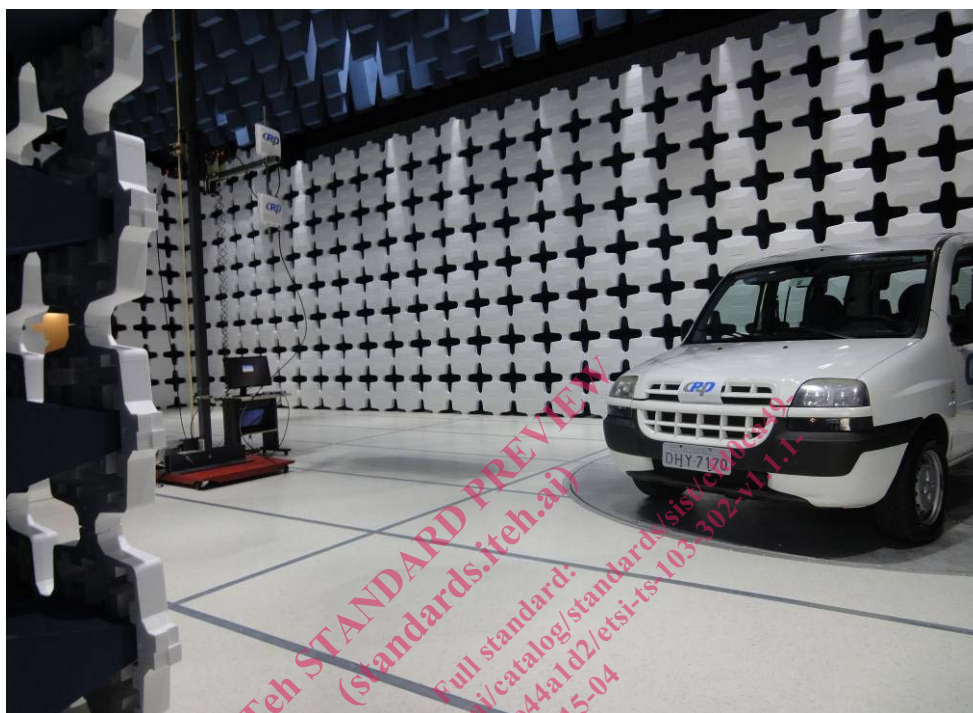
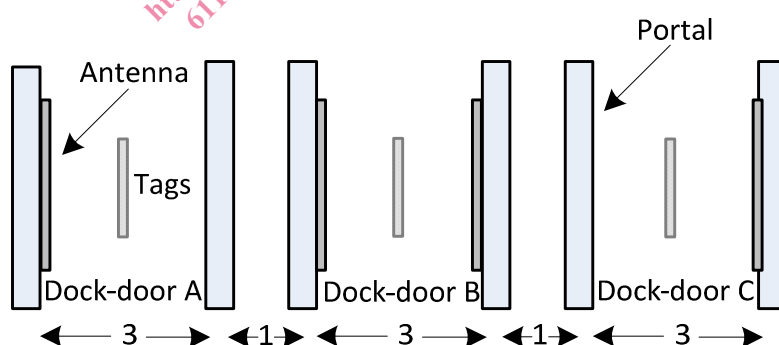


Figure 2: Semi-Anechoic Chamber

Three adjacent portals shall be installed inside the chamber in accordance with the dimensions in Figure 3. In order to minimize interference, shielding (at least 1 m wide by 1,5 m high) shall be placed between the portals.



Note: All dimensions in metres

Figure 3: Layout of dock-doors

The tags, which shall be mounted on cardboard sheets, shall be placed midway between the dock-doors.

CPqD shall make an additional portal available in order to evaluate the performance of different tags as specified in scenario 4.

4.5 Selection of Tags

For scenarios 1, 2 and 3, 150 tags shall be fixed in equal numbers to three cardboard sheets. For scenario 4, tags shall be attached to cartons as specified in clause 5.4.

The tags shall be selected from 500 samples using the selection and verification method described below.

This process seeks to select the tags with the most consistent performance.

In order to perform the selection, the following equipment is required:

- RFID interrogator with control software;
- RFID antenna with circular polarization;
- Measurement antenna;
- Spectrum analyser.

Using the above equipment, the following steps shall be performed in order to select the tags:

- 1) Connect the RFID interrogator to a computer which has the RFID application installed;
- 2) Connect the RFID antenna (with circular polarization) to the RFID interrogator using a cable with a known cable loss;
- 3) Install the RFID antenna on a non-metallic support (recommended wood or plastic);
- 4) Adjust the RFID antenna to a height of 1,15 m above the ground;
- 5) Mount the measurement antenna on a non-metallic support (recommended wood or plastic)
- 6) Adjust the measurement antenna to a height of 1,2 m above the ground;
- 7) Align the measurement antenna parallel to the face of the RFID antenna;
- 8) Position the measurement antenna at a distance of 1 m from the RFID antenna;
- 9) Using an RF cable (with known cable loss), connect the measurement antenna to the spectrum analyzer;
- 10) Disable the frequency hop mode in the interrogator;
- 11) Configure the interrogator to operate at 915 MHz;
- 12) Adjust the output power of the interrogator to +30 dBm;
- 13) Configure the spectrum analyser to the following parameters:
 - Central Frequency: 915 MHz;
 - Span: 100 MHz;
 - RBW and VBW: automatic;
 - Max Hold;
- 14) Verify that the measured maximum peak power is in the range +10 and +20 dBm;
- 15) Record the measured value;
- 16) Record the EPC number of the tag under test
- 17) Mount the tag on a non-metallic support (recommended wood or plastic);
- 18) Adjust the tags to an average height of to 1,2 m above the ground;
- 19) Position the tag at a distance of 10 m from the circular polarized antenna;