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RAIN RFID Suitable for animal identification in the UHF (860-930 MHz) band?

Josef Preishuber-Pflügl June 2022

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We have a **PASSION** for providing trusted hardware and software communication solutions to empower our customers to develop excellent products for seamless connectivity.



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OUR SOLUTIONS



WIRELESS TESTING

Covering concept, design, implementation, configuration, verification and testing

COMMUNICATION MODULES

Solutions for identification, authentication, and authorization of secure end-to-end communication.

TRUSTED CONNECTIVITY

Software cores for integrated hardware modules to improve product development.



20+ years in RFID standardization



Convener ISO/IEC JTC1 SC31 **WG4** – Radio communications (RFID, RTLS, Security) prior Project Editor **ISO/IEC 18000-63** - UHF RFID Vice-Chairman **ETSI** ERM **TG34** RFID Rapporteur ETSI **FN 302 208** UHF RFID Chairman RAIN RFID **TWG** (Technical Work Group)

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Difference LF and UHF RFID



LF (Low Frequency)

- •<135kHz
- Inductive coupling
- Range < 10 cm (70 cm gates)
- Coil tag antennas
- •ISO 11784/5
- •ISO 14223
- Insensitive to liquids / bodies
- No detuning by bodies
- Frequency globally available
- European regulations
 - ♦ CEPT 70-03
 - ✤ ETSI EN300 330

UHF (Ultra High Frequency)

- •860-930 (960) MHz
- Wave propagation (+inductive coupling)
- Range < 20 m (inductive << 10 cm)</p>
- Dipole tag antennas
- •ISO/IEC 18000-63
- GS1 EPC UHF Gen2
- Strong attenuations through liqquids / bodies
- Detuning and counter measures for bodies
- Frequency globally available
- European regulations
 - ♦ CEPT 70-03
 - ETSI EN302 208

RAIN RFID Air Interface



ISO/IEC 18000-63 GS1 EPC UHF

- ISO/IEC 18000-63:2021, Information technology — Radio frequency identification for item management — Part 63: Parameters for air interface communications at 860 MHz to 960 MHz Type C
- GS1 EPC[™] Radio-Frequency Identity Protocols Generation-2 UHF RFID Standard, Specification for RFID Air Interface Protocol for Communications at 860 MHz – 960 MHz, *Release 2.1, Ratified, Jul 2018*





One Air Interface – Two data sets

- . ISO
 - * UII: T-Bit (=1), AFI, identifer
 - TID: E0, ICM, Serial number
- . GS1
 - * EPC: T-Bit (=0), identifier
 - * TID: E2, MDID, optional Serial number, ...



EUROPEAN RADIO REGULATIONS









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Sources: etsi.org, wikipedia.org, europe.eu



The documents

E ECC Extension during the second		ETSI EN 302 208 v3.3.1 (2020-08)
ERC Recommendation		HARMONISED EUROPEAN STANDARD
Relating to the use of Short Range Devices (SRD) Troase 1997 Eutocoguant concondructis 23 Outdate 2020 Pieses Note Implementation Status page 44		Radio Frequency Identification Equipment operating in ti band 865 MHz to 868 MHz with power levels up to 2 W ar in the band 915 MHz to 921 MHz with power levels up to 4 Harmonised Standard for access to radio spectrum

	English edition	Legislation	Volume 64 20 July 2021
	Contents		
_		1 Legislative acts	
		DIRECTIVES	
the		 Directive (EU) 2021/1187 of the European Parliament streamlining measures for advancing the realisation of (TEN-T) 	and of the Council of 7 July 2021 on the trans-European transport network
na kW;		II Non-legislative acts	
		REGULATIONS	
		Council Implementing Regulation (EU) 2021/1188 of 19 Regulation (EC) No 2580/2001 on specific restrictive mm and entities with a view to combating terrorism, and r 2021/138	July 2021 implementing Article 2(3) of easures directed against certain persons epcaling Implementing Regulation (EU)
		 Commission Delegated Regulation (EU) 2021/1189 of 7 M 2018/848 of the European Parliament and of the Council of plant reproductive material of organic heterogene species () 	ay 2021 supplementing Regular of (A as regards the production at the stink rous material of pagicular or
		 Commission Implementing Regulation (EU) 2021/1190 of specifications of data requirements for the topic 'ICT up year 2022, pursuant to Regulation (EU) 2019/2152 of Council () 	15 July 2 vin see and ext proc 20 mod Europe visa
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		No 540/2011 ()	ampresenting Regulation (CO) 37
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Source: cept.org, etsi.org, europa.eu

CEPT REC 70-03

- · UHF RFID 865-868 MHz band
 - Available for >15 years
 - & 4 Channels
 - * 2 Werp transmit power
 - * 200 kHz transmit channels
- · UHF RFID 915-921 MHz band
 - Available for a few years
 - & 4 Channels
 - * 4 Werp transmit power
 - * 400 kHz transmit channels

 - * Some countries do not provide any channel
 - \circ Germany $\Box \Box$
 - The Netherlands □□





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Reader receiver sensitivity

Limits receiver sensitivity

Setup

Table 2a: Receiver sensitivity limits

Category	Limit
Category I (> 30 dBm e.r.p.)	-60 dBm
Category II (> 13 to 30 dBm e.r.p.)	-55 dBm
Category III (≤ 13 dBm e.r.p.)	-45 dBm



Figure 15b: Conducted test set up for receiver sensitivity with (emulated) tag with variable backscatter

NOTE: For testing of ISO/IEC 18000-63 [i.20] compliant products it is recommended to use the protocol settings details as described for the ISO/IEC 18046-2 [i.17] reader sensitivity test. Values like Tari, RTcal, TRcal, BLF, DR and M should be recorded.

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Source: www.etsi.org/deliver/etsi_en/302200_302299/302208/03.03.01_60/en_302208v030301p.pdf



ISO – ETSI aligned

ISO/IEC 18046-2:2020

Information technology — Radio frequency identification device performance test methods — Part 2: Test methods for interrogator performance

ISO/IEC 18046-3:2020

ABSTRACT Information technology — Radio frequency identification device performance test This document define requirements and tagentification. The su

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Status: @ Publishe ABSTRACT

Edition: 2

This document defines test methods for performance characteristics of RFID tags for item management and specifies the general requirements and test requirements for tags which are applicable to the selection of devices for an application. The summary of the test reports forms a unified tag datasheet.

GENERAL INFORMATION [©]

Status : ⊘ Published

Publication date: 2020-10

Edition: 3

Number of pages : 51

Source: iso.org



The Value

- Standards define the globally reproducible test methods
- Traceable
- Globally reproducible
- Test equipment independent
- Meaningful in terms of physics
- Relevant to correlate test result with application performance



One method for each topic

- Aligned across global recognized standards from standards organizations
- International test standards for RAIN air interface (ISO/IEC 18000-63, GS1 EPC Gen2)
 - * ISO/IEC 18046-2
 - * ISO/IEC 18046-3
- Utilization for European standards
 - * EN 302 208

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RAIN RFID in tyres – Use CISC

Cases An example with similar requirements as Animal ID?

Most interesting uses cases

- Assembled tire portal
- On-vehicle tire inspection
- Tire manufacturing portal

Additional uses cases

- Manufacturer shipment
- Dealer
- Doublewheels
- Moving car on-vehicle inspection





REQUIREMENTS

Short distance (Near-Field) Long distance (Far-Field)

Global use

- Suitable for all countries globally
- Fit for as many applications as possible

Requirements

- Minimum of 10 cm read range
- Preferable more than 50 cm read range
- Longer read range may make it easier or not



ISO Application Standards

ISO/TC 31	Tyres, rims and valves
ISO/TC 31/WG 10	RFID tyre tags

Dedicated standards for RFID tyre tags

- ISO 20909:2019
 Radio frequency identification (RFID) tyre tags
- ISO 20910:2019
 Coding for radio frequency identification (RFID) tyre tags
- ISO 20911:2020
 Radio frequency identification (RFID) tyre tags Tyre attachment classification
- ISO 20912:2020
 Conformance test methods for RFID enabled tyres





ISO 20909:2019

Radio frequency identification (RFID) tyre tags

Elements

- Reference to ISO/IEC 18000-63 / GS1 EPC Gen 2 (= RAIN RFID Air interface)
- 860 930 MHz band
- 3 techologies of RFID enabled tyre
 - Embedded (-25 °C to 80 °C, 5 MPa/200 °C, lifetime)
 - Patch (as embedded, may be removed)
 - Sticker (-25 °C to 60 °C)
- SGTIN-96 encoding / permalocked
- 15 cm reading distance
- Kill must be disabled



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ISO 20910:2019

Coding for radio frequency identification (RFID) tyre tags

Elements

- Memory bank use
- Command support
- SGTIN-96 encoding / permalocked
- GS1 coding (T=0)
- Kill must be disabled

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ISO 20911:2020

Radio frequency identification (RFID) tyre tags — Tyre attachment classification

Technolofy and requirements

- Embedded
- Patch
- Sticker







ISO 7000-3010 Registed ISO Symbol Registration date: 2010-03-12





ISO 20912:2020

Conformance test methods for RFID enabled tyres

Elements

- Measurement methods
 - Open space
 - Semi-anechoic chamber
- Measurement equipment
 - ✤ Handheld reader
 - REVISION Dedicated high-end RFID test equipment



Relevant standards

- RAIN RFID Air interface
 - ISO/IEC 18000-63 / GS1 EPC[™] Gen2 UHF RFID
- Conformance standards
 - ISO/IEC 18047-63 / GS1 EPC Gen2 UHF RFID Devices Conformance Requirements

Performance standards

- ✤ ISO/IEC 18046-2, Interrogator tests
- ✤ ISO/IEC 18046-3, Tag tests
- Radio regulations
 - ♦ CEPT REC 70-03 / ETSI EN 302 208 ABSTRACT IT
 - o Reader requirements
 - o Tag requirements
 - * FCC part 15 / part 90
 - o Reader requirements

ISO/IEC 18046-2:2020

Information technology — Radio frequency identification device performance test methods — Part 2: Test methods for interrogator performance

ISO/IEC 18046-3:2020

Ø	ABSTRACT This document defi requirements and t	ACT Information technology — Radio frequency identification device performance t ent defimethods — Part 3: Test methods for tag performance			
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	Edition : 2	ADDITACT PREVIEW This document defines test methods for performance chan specifies the general requirements and test requirements for an application. The summary of the test reports forms.	actenistics of RFID tags for item management and for tags which are applicable to the selection of devices unified tag datasheet.		
		GENERAL INFORMATION [©]			
		Status : @ Published	Publication date: 2020-10		
		Edition : 3	Number of pages : 51	-	





Conclusions

ISO does great work on RFID standards

ISO/IEC JTC1 SC 31 AIDC

- Well developed and mature technology standards
- Fitting set of test standards
- Data standards

Commitees refering to technology standards

- ISO application standards referring to
 SC31 technology standards
 SC31 test standards
- RAIN RFID standards are using SC31 standards as basis
- GS1 standards refer or align with SC31 standards



QUESTIONS?

.... ask me at j.preishuber-pfluegl@cisc.at

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ABSTRACT

- Abstract:
- The session will cover an introduction into UHF RFID and the differences to LF and HF RFID. It will show how UHF RFID developed in the last 20 years. What standards and documents are available and how this can be used for Animal ID.
- Furthermore, it will cover an introduction into the most important standards from ISO/IEC, GS1 and RAIN Alliance, as well as applications that can be utilised for animal ID.

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What is Conformance about?

Motivation

Ensure that products from multiple sources work with each other

Content

- Verification of minimum requirements
- Verification of a minimum performance

Scope

- Test methods for conformance
- Excludes regulatory requirements

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What is Performance about?

- Motivation
 - Find the test suitable product for an application

Content

- * Comparison of products
- Comparison of solutions

Scope

- Test methods for performance characteristics
- General requirements
- Test requirements
- Tag and interrogator performance