
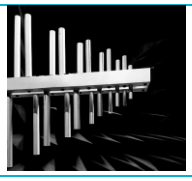
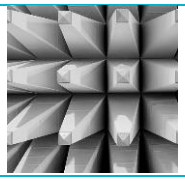

TEST REPORT

Test Report No.: 1-8244-24-01-05_TR1-R01

DAkkS Deutsche Akkreditierungsstelle D-PL-12047-01-00

Testing Laboratory

cetecom advanced GmbH
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66117 Saarbruecken/Germany
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Accredited Test Laboratory:
The testing laboratory (area of testing) is accredited according to DIN EN ISO/IEC 17025 (2018-03) by the Deutsche Akkreditierungsstelle GmbH (DAkkS)
The accreditation is valid for the scope of testing procedures as stated in the accreditation certificate with the registration number: D-PL-12047-01-00.

Applicant

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Phone: +33 2 30 05 54 03
Contact: CORLIN Rémi
e-mail: remi.corlin@biolog-id.com

Manufacturer

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Contact: CORLIN Rémi
e-mail: remi.corlin@biolog-id.com

Test Standard/s

CFR 47 – Part 1, §1.1310 RF exposure limits (100 kHz to 6 GHz) for SAR (BR)

For further applied test standards please refer to section 3 of this test report.

Test Item

Kind of test item:	Industrial RFID Reader
Device type:	Fixed device
Model name:	**PRD_6640005B**
S/N serial number:	prototype
FCC ID:	2AKUFPRD66405B
Hardware status:	02
Software status:	N.A.
Firmware status:	V1.24
Frequency:	134.2 kHz
Antenna:	10 integrated antennas / coil antenna
Power supply:	120 V AC by AC mains
Accessories:	--
Test sample status:	identical prototype
Exposure category:	general population / uncontrolled environment

This test report is electronically signed and valid without handwritten signature. For verification of the electronic signatures, the public keys can be requested at the testing laboratory.

Test Report authorised:

cn=Alexander Hnatovskiy, o=cetecom advanced GmbH, ou=HNA-230601, email=alexander.hnatovskiy@cetecomadvanced.com, c=DE
2024.09.26 10:57:15 +02'00'

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cn=Marco Scigliano, o=cetecom advanced GmbH, ou=SCI-230601, email=Marco.Scigliano@cetecomadvanced.com, c=DE
2024.09.26 10:18:45 +02'00'

Marco Scigliano
Testing Manager
Radio Labs

1 Table of contents

2 General information

2.1 Notes and disclaimer

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2.2 Application details

Date of receipt of order:	2024-06-27
Date of receipt of test item:	2024-09-12
Start of test:	2024-09-12
End of test:	2024-09-12

2.3 Statement of compliance

The EMF values found for the PRD_6640005B Industrial RFID Reader are below the maximum allowed levels according to the standards listed in section 3.

3 Test standard/s:

Test Standard	Version	Test Standard Description
IEEE Std. C95-3	2021	IEEE Recommended Practice for the Measurement of Potentially Hazardous Electromagnetic Fields – RF and Microwave

FCC KDBs:

KDB 865664D01v01	August 7, 2015	FCC OET SAR measurement requirements 100 MHz to 6 GHz
KDB 865664D02v01	October 23, 2015	RF Exposure Compliance Reporting and Documentation Considerations
KDB 447498D01v06	October 23, 2015	Mobile and Portable Devices RF Exposure Procedures and Equipment Authorization Policies
KDB 680106 D01v04	October 24, 2023	Equipment Authorization of Wireless Power Transfer devices

3.1 RF exposure limits

Reference levels for general public (uncontrolled environment) exposure to time-varying electric and magnetic fields

According to: CFR47, Subpart I - §1.1310 Radiofrequency radiation exposure limits				
Frequency Range (MHz)	**Electric Field** (V/m)	**Magnetic Field** (A/m)	**Power density** (mW/cm^2)	**Averaging time** (minutes)
Occupational / Controlled Exposure				
0.3-3.0	614	1.63	*100	6
3.0-30	1842/f	4.89/ f	*900/f^2	6
30-300	61.4	0.163	1.0	6
300-1500	--	--	f/300	6
1500-100000	--	--	5	6
General Population / Uncontrolled Exposure				
0.3-1.34	**614**	**1.63**	***100**	**30**
1.34-30	824/f	2.19/f	*180/f^2	30
30-300	27.5	0.073	0.2	30
300-1500	--	--	f/1500	30
1500-100000	--	--	1.0	30

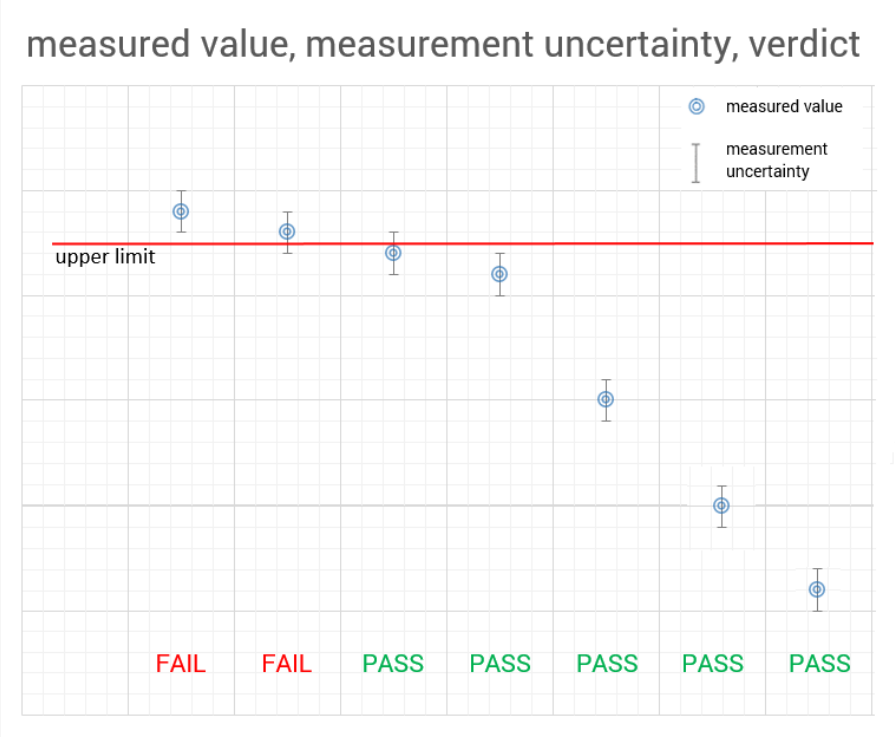
Extention of measurement range of the table to 134.2 kHz:

According to FCC KDB 680106 D01 Paragraph 3, RF Exposure requirements clause 3, the emission limits in the frequency range from 100 to 300 kHz should be assessed versus the limits at 300 kHz in Table 1 of CFR 47 – Section 1.310. This guidance is also followed for this RFID application, although it is not a WPT device.

	E-field	H-field	B-field
Frequency	V / m	A/m	µT
0.3 – 3.0 MHz	**614**	**1.63**	2.0

4 Reporting statements of conformity – decision rule

Only the measured values related to their corresponding limits will be used to decide whether the equipment under test meets the requirements of the test standards listed in chapter 3.
The measurement uncertainty is mentioned in this test report, see chapter 9, but is not taken into account - neither to the limits nor to the measurement results. Measurement results with a smaller margin to the corresponding limits than the measurement uncertainty have a potential risk of more than 5% that the decision might be wrong."



5 Summary of Measurement Results

☒	**No deviations from the technical specifications ascertained**
☐	Deviations from the technical specifications ascertained

A minimum safety distance of **20 cm** from the human body to the antenna is required for bystanders when the device is used for RFID scanning.

6 Test Environment

Ambient temperature:	20 – 24 °C
Relative humidity content:	40 – 50 %
Air pressure:	not relevant for this kind of testing
Power supply:	230 V / 50 Hz

7 Test Set-up

7.1 Measurement system

7.1.1 Broadband Electromagnetic Field Test system

A state of the art Broadband Electromagnetic Field Test system was used. The probes of the system are fitted with three sensors which measure the field strength of the X, Y and Z plane directions separately. The field strength is calculated by the instrument's processor by summing the squares of the three measured values.

The frequency range 5 Hz to 60 GHz is covered.
Depending on the used probe type Electric and Magnetic Field or Electric Field only is detectable.

• EHP-50D	5 Hz to 100 kHz	Electric and Magnetic Field
• EHP-50F	5 Hz to 400 kHz	Electric and Magnetic Field
• HF 3061	300 kHz to 30 MHz	Magnetic Field
• EF 0691	100 kHz to 6 GHz	Electric Field
• EF 6092	100 MHz to 60 GHz	Electric Field
• ELT 400 3cm²	1 Hz to 400 kHz	Magnetic Field

7.1.2 Test equipment list

	Manufacturer	Device	Type	Serial number	Last Calibration	Calibration cycle (months)
☒	Narda	Electric and Magnetic Field Meter	NBM-550	F-0319	2023-04-12	24
☐	Narda	Electric and Magnetic Field Meter	NBM-520	D-1234	2021-05-10	24
☒	Narda	Electric and Magnetic Field Meter	ELT 400	N-0915	2023-04-20	24
☒	Narda	Electric Field Probe (100 kHz - 6 GHz)	EF 0691	G-0027	2023-04-12	24
☐	Narda	Electric Field Probe (100 MHz - 60 GHz)	EF 6092	A-0071	2021-05-10	24
☐	Narda	Magnetic Field Probe (300 kHz to 30 MHz)	HF 3061	D-0404	2023-04-12	24
☐	Narda	Electric and Magnetic Field Analyser (5 Hz – 100 kHz)	EHP-50D	230WX50108	2023-04-13	24
☐	Narda	Electric and Magnetic Field Analyser (5 Hz – 400 kHz)	EHP-50F	000WX60907	2023-01-18	24
☒	Narda	Magnetic Field Probe (1 Hz – 400 kHz)	B-Field 3cm²	C-0393	2023-04-20	24

☒ Devices used during the test ☐ Devices not used during the test

7.1.3 Averaging

For time efficient testing an average of 8 seconds was used. With some spot checks was verified, that caused by the time structure of the measured responses, the results did not change with a 6-minute-averaging.

7.1.4 Uncertainties

The probe uncertainties stated by the manufacturer are considered to be the main relevant and dominant issues.

7.1.4.1 Typical uncertainty of EF0691

Flatness of frequency response[a] Calibration uncertainty not included	±1.0 dB (1 MHz to 4 GHz) ±1.5 dB (0.3 MHz to 5 GHz) -2.5 dB typ. @ 0.15 MHz	
Calibration uncertainty[b] @ 0.2 mW/cm² (27.5 V/m)	0.8 dB (≤ 300 MHz) 1.5 dB (300 MHz to 1.2 GHz) 1.3 dB (≥ 1.2 GHz)	
Linearity Referred to 0.2 mW/cm² (27.5 V/m)	±0.5 dB (2.2 to 316 V/m)	±0.5 dB (0.0013 to 26.5 mW/cm²)
Isotropic response[C]	±1 dB	
Temperature response	+0.2/ -1 dB (0 °C to 50 °C, related to 23 °C)	

(a) Frequency response can be compensated for by the use of correction factors stored in the probe memory
(b) Accuracy of the fields generated to calibrate the probes
(c) Uncertainty due to varying polarization (verified by type approval test for meter with probe). Ellipse ratio included and calibrated for each probe

7.1.4.2 Typical uncertainty of ELT 400 with B-Field 3cm² probe

Measurement uncertainty [1)]	±6% (50 Hz to 120 kHz)

[1)] The measurement uncertainty includes flatness, isotropy, absolute and linearity variations (frequency range: 1 Hz to 400 kHz or 10 Hz to 400 kHz).

The uncertainty increases at the frequency band limits (10 Hz, 30 Hz, 400 kHz) to –1 dB based on the nominal frequency response.

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narda Safety Test Solutions
an L3 Technologies Company

UNCERTAINTY

The reported expanded uncertainty *U* is based on a standard uncertainty multiplied by a coverage factor *k* = 1.96, providing a level of confidence of approximately 95 %. The uncertainty evaluation has been carried out in accordance with the "Guide to the Expression of Uncertainty in Measurement" (GUM). The reported measurement uncertainty is derived from the uncertainty of the calibration procedure and the object during calibration, and makes no allowance for drift or operation under other environmental conditions.

MEASURING CONDITIONS

The calibration was performed using a continuous wave signal (CW). The magnetic flux density was set to nominal 2.5 µT.

RESULTS

Frequency Response

f	X_{nom}	RS						U
kHz	V/T	Pos. Y	Pos. YZ	Pos. Z	Pos. ZX	Pos. X	Pos. XY	%
0,052	13.72	0.9949	0.9966	1.0156	1.0149	1.0012	0.9805	0.92
0,4	105.57	0.9993	0.9992	1.0191	1.0168	1.0044	0.9835	0.57
30	7.90k	1.0030	1.0098	1.0192	1.0155	1.0059	0.9984	0.75
120	30.71k	1.0045	1.0130	1.0248	1.0247	1.0129	1.0029	0.81
400	65.24k	0.9872	0.9989	1.0169	1.0100	0.9936	0.9878	2.17

INTERPRETATION

The worst-case uncertainty of the object was calculated from the calibration results reported in the "Frequency Response" section using commonly accepted statistical rules.

Frequency Range	worst-case uncertainty U_{probe}
1 Hz to 120 kHz	2.96 %
120 kHz to 400 kHz	3.13 %

Note: As the object is purely a coil the function is not restricted at low frequencies.

The total uncertainty of the system shall be calculated using $U_{system} = \sqrt{U_{meter}^2 + U_{probe}^2}$

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7.1.5 Validation procedure

Before performing the tests the empty test chamber was checked for system immanent frequency responses. The following background signal level was detected. All levels are small enough to allow accurate proof of the limits to be considered.

Probe	Frequency Range	Magnetic Flux Density (B) in µT	Magnetical Field Strength in A/m	Electrical Field Strength in V/m	Remark
EF 0691	100 kHz – 6 GHz	--	--	0.15	
ELT 400 + 3cm²	1 – 400 kHz	2.129	1.694	--	

7.1.6 Definition of test position and distances

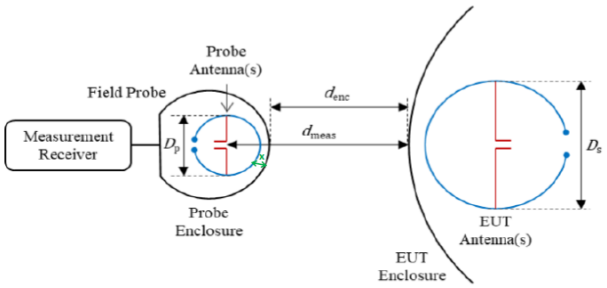
In absence of an equipment specific regulation with given test distances, all not further noted test positions were measured in “touched” mode, the probe radome touching the DUT at the defined test position.

Due to the mechanical concept of the used probe a distance between DUT surface and electrical centre of the probe antennas remains.

Probe type	Maximum distance (cm)	
	Magnetic Field	Electrical Field
EF 0691	--	3.5
ELT 400 + 3cm²	1.5	--

7.1.7 Applicable minimum distances for measurements

Based on Chapter 7.1 of RSS 102 SPR 002 for each measurement probe the applicable minimum testing distance needs to be considered as measurements with a smaller distance will not provide reliable results.



The shortest distance separating the probe and EUT antennas, denoted by d_{meas} above, is proportional to the probe antenna size requirements outlined in section 7.1.7 of RSS 102 SPR 002. x was defined as the distance between internal coil (D_p) and enclosure of probe antenna.

The following lists gives the applicable minimum distances for RSS 102 SPR 002 measurements:

Probe	Range	D_p	$d_{meas} \geq 1.7 x D_p$	x distance, coil to outer enclosure	$D_{enc}@d_{meas}$	Dimension of probe (H x B x T) as specified
	kHz	[cm]	[cm]	[cm]	[cm]	[mm]
EF 0691	100 – 6 x 10^6	6.3	10.7	0.15	7.4	318 x 66 Ø
ELT 400 + 3 cm²	0.001 - 400	2.9	4.9	0.15	3.3	250 x 32 Ø

7.1.8 Anisotrophical probe behaviour management

As EMF measurements for safety and health aspects are often performed in the nearfield of a radiation source it is important to be aware of the not ideal isotropic performance of a typical probe and how to reproduce reliable results.

During measurements the following steps are performed to get always the highest possible field strength result and validate that the measured results are always the worst case scenario with the highest energy emitted by the source.

Step 1: Finding the position of the highest radiated field source with a basic probe orientation.
Step 2: Turning the probe to all possible orientations to find the orientation that delivers the maximum field strength.

7.2 Test Setup and Probe information

For considering worst-case conditions all measurements were performed at smallest possible distance from the device under test. Limits shown in the tables below are the lowest ones within the wideband frequency ranges of the field probes applied.

Test positions see photo documentation (Annex A).

During the measurements the DUT was switched on in normal operating mode.

Internal Probe	ELT 400 3cm² 1.5 cm
Distances:	EF 0691 / 0692 3.5 cm

7.3 Test results RF Exposure

frequency 134.2 kHz							
test position	distance (cm)	H (A/m)	Limit (A/m)	Probe	E (V/m)	Limit (V/m)	Probe
front	0*	11.0	**1.63**	ELT 400 3cm²	17.6	**614**	EF0691
front	20	0.9	**1.63**		7.1	**614**	

Table 1: Test results E-/ H-f@134.2kHz, RMS values (6 Minutes interval)

7.4 Final verdict

A minimum safety distance of **20 cm** from the human body to the antenna is required for bystanders when the device is used for RFID scanning.

Annex A: Photo documentation

Photo 1: EUT

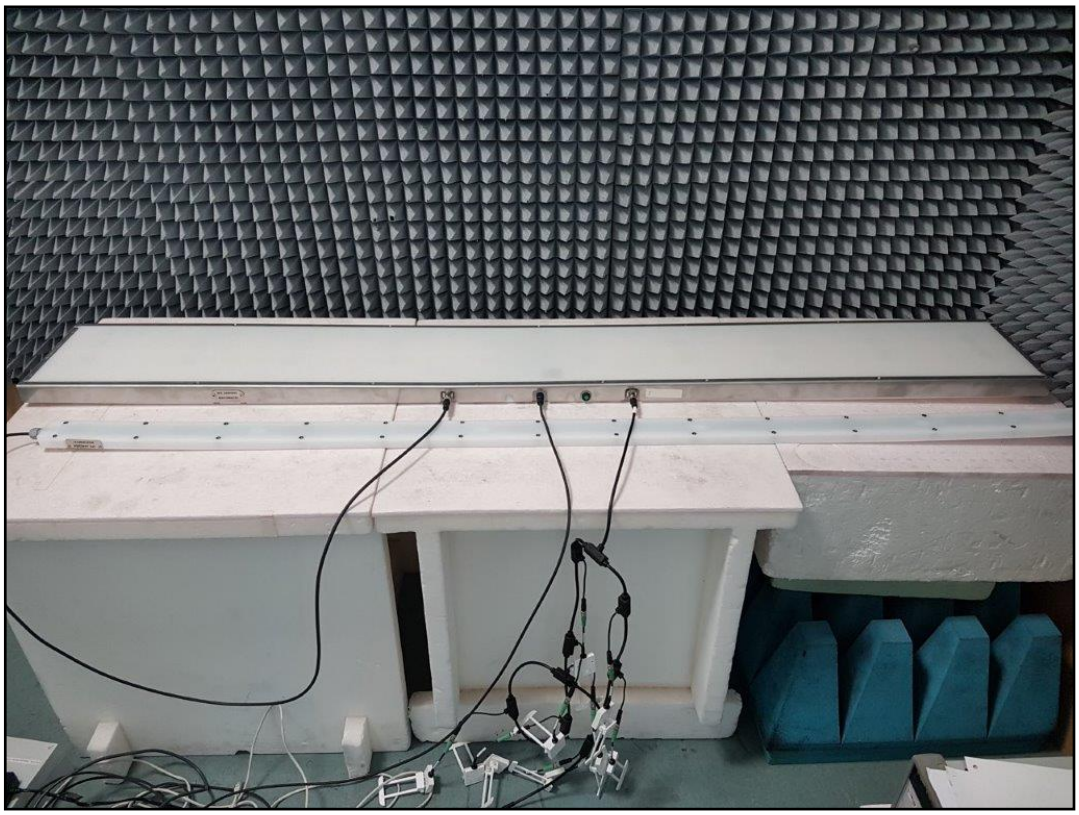


Photo 2: Test position – Front with ELT 400 3cm² probe (0mm distance)

Photo 3: Test position – Front with EF0691 probe (0mm distance)

Annex B: Document History

Version	Applied Changes	Date of Release
	Initial Release	2024-09-23

Annex C: Further Information

Glossary

BW	-	Bandwidth
DTS	-	Distributed Transmission System
DUT	-	Device under Test
EUT	-	Equipment under Test
FCC	-	Federal Communication Commission
FCC ID	-	Company Identifier at FCC
HW	-	Hardware
Inv. No.	-	Inventory number
N/A	-	not applicable
PCB	-	PCS Licensed Transmitter
PCE	-	Personal Consumption Expenditure (PCS Licensed Transmitter held to ear)
PCS	-	Personal Consumption Services
OET	-	Office of Engineering and Technology
S/N	-	Serial Number
SW	-	Software