

Prüfbericht-Nr.: <i>Test report no.:</i>	DE25XCPF 001	Auftrags-Nr.: <i>Order no.:</i>	1173499 70	Seite 1 von 11 Page 1 of 11
Kunden-Referenz-Nr.: <i>Client reference no.:</i>	-	Auftragsdatum: <i>Order date:</i>	2024-08-30	
Auftraggeber: <i>Client:</i>	Gutermann Technology GmbH, Gottlieb-Daimler-Str. 10, 88214 Ravensburg, Deutschland			
Prüfgegenstand: <i>Test item:</i>	Radio Logger			
Bezeichnung / Typ-Nr.: <i>Identification / Type no.:</i>	ZS850-L22			
Auftrags-Inhalt: <i>Order content:</i>	Prüfung der Funkparameter nach FCC & ISED <i>Test of radio parameters acc. to FCC & ISED</i>			
Prüfgrundlage: <i>Test specification:</i>	Vollprüfung / Complete test RF exposure evaluation acc. to FCC CFR 47 Part 15 Subpart C §15.247 (i) acc. to RSS-102 issue 6			
Wareneingangsdatum: <i>Date of sample receipt:</i>	2024-10-28	For reasons of confidentiality, no photos of the EUT are included in this report. For EUT and test setup photos please see the Photo Documentation to this report Number.		
Prüfmuster-Nr.: <i>Test sample no.:</i>	A003850445-001 to 033			
Prüfzeitraum: <i>Testing period:</i>	2025-02-04 - 2025-02-04			
Ort der Prüfung: <i>Place of testing:</i>	Nürnberg Nuremberg			
Prüflaboratorium: <i>Testing laboratory:</i>	Wireless Labor Wireless Test Lab			
Prüfergebnis*: <i>Test result*:</i>	Pass			
erstellt von: <i>created by:</i>		genehmigt von: <i>authorized by:</i>		
Datum: <i>Date:</i>	2025-02-25 Signed by: Shrivas Naikar	Ausstellungsdatum: <i>Issue date:</i>	2025-02-25 Signiert von: Matthias Kraeutlein	
Stellung / Position:	Sachverständige(r)/Expert	Stellung / Position:	Sachverständige(r)/Expert	
Sonstiges / <i>Other:</i>				
Zustand des Prüfgegenstandes bei Anlieferung: <i>Condition of the test item at delivery:</i>	Prüfmuster vollständig und unbeschädigt <i>Test item complete and undamaged</i>			
* Legende:	P(ass) = entspricht o.g. Prüfgrundlage(n) F(ail) = entspricht nicht o.g. Prüfgrundlage(n) N/A = nicht anwendbar N/T = nicht getestet			
* Legend:	P(ass) = passed a.m. test specification(s) F(ail) = failed a.m. test specification(s) N/A = not applicable N/T = not tested			
Dieser Prüfbericht bezieht sich nur auf das o.g. Prüfmuster und darf ohne Genehmigung der Prüfstelle nicht auszugsweise vervielfältigt werden. Dieser Bericht berechtigt nicht zur Verwendung eines Prüfzeichens. <i>This test report only relates to the above mentioned test sample. Without permission of the test center this test report is not permitted to be duplicated in extracts. This test report does not entitle to carry any test mark.</i>				

Prüfbericht-Nr.: DE25XCPF 001
Test report no.:

Seite 2 von 11
Page 2 of 11

Produktbeschreibung
Product description

1	Alle eingesetzten Prüfmittel waren zum angegebenen Prüfzeitraum gemäß eines festgelegten Kalibrierungsprogramms unseres Prüfhauses kalibriert. Sie entsprechen den in den Prüfprogrammen hinterlegten Anforderungen. Die Rückverfolgbarkeit der eingesetzten Prüfmittel ist durch die Einhaltung der Regelungen unseres Managementsystems gegeben. Detaillierte Informationen bezüglich Prüfkonditionen, Prüfequipment und Messunsicherheiten sind im Prüflabor vorhanden und können auf Wunsch bereitgestellt werden. <i>The equipment used during the specified testing period was calibrated according to our test laboratory calibration program. The equipment fulfils the requirements included in the relevant standards. The traceability of the test equipment used is ensured by compliance with the regulations of our management system.</i> <i>Detailed information regarding test conditions, equipment and measurement uncertainty is available in the test laboratory and could be provided on request.</i>
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3	Prüfklausel mit der Note * wurden an qualifizierte Unterauftragnehmer vergeben und sind unter der jeweiligen Prüfklausel des Berichts beschrieben. Abweichungen von Prüfspezifikation(en) oder Kundenanforderungen sind in der jeweiligen Prüfklausel im Bericht aufgeführt. <i>Test clauses with remark of * are subcontracted to qualified subcontractors and described under the respective test clause in the report.</i> <i>Deviations of testing specification(s) or customer requirements are listed in specific test clause in the report.</i>
4	Die Entscheidungsregel für Konformitätserklärungen basierend auf numerischen Messergebnissen in diesem Prüfbericht basiert auf der "Null-Grenzwert-Regel" und der "Einfachen Akzeptanz" gemäß ILAC G8:2019 und IEC Guide 115:2021, es sei denn, in der auf Seite 1 dieses Berichts genannten angewandten Norm ist etwas anderes festgelegt oder vom Kunden gewünscht. Dies bedeutet, dass die Messunsicherheit nicht berücksichtigt wird und daher auch nicht im Prüfbericht angegeben wird. Zu weiteren Informationen bezüglich des Risikos durch diese Entscheidungsregel siehe ILAC G8:2019. <i>The decision rule for statements of conformity, based on numerical measurement results, in this test report is based on the "Zero Guard Band Rule" and "Simple Acceptance" in accordance with ILAC G8:2019 and IEC Guide 115:2021, unless otherwise specified in the applied standard mentioned on Page 1 of this report or requested by the customer. This means that measurement uncertainty is not taken in account and hence also not declared in the test report. For additional information to the resulting risk based of this decision rule please refer to ILAC G8:2019.</i>
5	Wenn auf dem Bericht kein Akkreditierungshinweis aufgebracht ist, wurde der Bericht nicht im akkreditierten Bereich erstellt und ist folglich auch nicht vom EA MLA abgedeckt. Unabhängig davon wurde der Bericht auf Basis der allgemeinen Regeln der ISO/IEC 17000er Reihe erstellt. Mit "#" gekennzeichnete Prüfungen sind nicht Bestandteil der Akkreditierung D-PL-14169-03-00. <i>If there is no accreditation notice on the report, the report has not been produced in the accredited area and is consequently not covered by the EA MLA. Regardless of this, the report has been prepared based on the general rules of the ISO/IEC 17000 series. Tests marked with "#" are not covered by the accreditation D-PL-14169-03-00.</i>

Prüfbericht-Nr.: DE25XCPF 001
Test report no.:

Seite 3 von 11
Page 3 of 11

Produktbeschreibung
Product description

1	Test item	Radio Logger
2	Typ-No.	ZS850-L22
3	Test sample obtaining	☒ Sampling by customer ☐ Sampling by TÜV Rheinland Group ☐ others:
4	Identical Type	MLS-L22
5	Supported radio technologies evaluated in this report	Proprietary Radio
6	Serial-No.	-
7	Description of EUT	ZONESCAN 850 Logger allows to find leaks in water pipes underground. It measures the acoustic signal on the pipe and sends the data, through radio, to the cloud or specific device to be analysed. The server on the cloud, or an Android device on the field, collects the acoustic data and calculates the existence of the leak and its position.
8	Max RF output power (measured)	17.76 dBm (conducted)
9	Operating Frequency (declared)	902-928 MHz
10	Channel Bandwidth (declared)	250KHz
11	Number of Channels	50
12	Modulation	FSK
13	Rated Voltage / Frequency	3,67V DC Battery Powered
14	FCC-ID of the product	FCC ID: ZSS-ZS850915L
15	IC of the product	IC: 9789A-ZS850915L
16	Radio Chip / Antenna Type	☐ Radio module with an antenna on module PCB ☐ Radio module with dedicated antenna ☒ Radio chip with user-accessible antenna connector
17	Radio Module Certification	Report Nr.: NA ☐ Certified radio module ☐ Certified radio module with given antenna
18	Antenna Name	ANT-ROD-65+ANT-BASE-06, ANT-ZS-FLEX-65, ANT-ZS-STUB
19	Antenna Type	☐ Integral antenna (designed as a fixed part of the EUT) ☐ Dedicated antenna (removable, obligation to be used) ☒ Permanent antenna connector
20	Antenna number of chains	1
21	Antenna Gain (measured)	ANT-ROD-65 0.94 dBi ANT-ZS-FLEX-65 0.34 dBi ANT-ZS-STUB -0.31 dBi
22	Software / Firmware Version	GDR0185001
23	Hardwareversion	ZS850-L22 & MLS-L22 (Unique model type considered as Hardware version)
24	Provided Samples	A003850445-001 to 033
25	Conducted measurements sample	A003850445-030
26	Radiated measurements sample	A003850445-022
27	Companion Device used for radio connection with the EUT	EUT in Test Mode. Therefore, no Companion Device was used.
28	Auxiliary equipment used to set up the EUT	Test Jig with Customer Laptop
29	Data Cable	USB
30	Temperature Range	-30°C – 70°C
31	Environment	Indoor and Outdoor

Prüfbericht-Nr.: DE25XCPF 001
Test report no.:

Seite 4 von 11
Page 4 of 11

Prüfdokumentation
Test documentation

Contents

1	Registration	5
2	EUT Classification	5
2.1	Wireless technologies and frequencies supported by the EUT	5
2.2	Technical data summary taken from Test reports in 2.1	5
2.3	Standard specific classification of the EUT	5
3	Test results in detail FCC RF exposure evaluation	7
3.1	Maximum Permissible Exposure Evaluation (MPE) Mobile device or fixed RF source	7
4	Test results in detail ISED RF exposure Compliance	9
4.1	ISED Maximum Exposure Requirements	9
5	Change history	11

Prüfbericht-Nr.: DE25XCPF 001
Test report no.:

Seite 5 von 11
Page 5 of 11

Prüfdokumentation
Test documentation

1 Registration

The measurement facilities for conducted and radiated disturbance measurements of the TÜV Rheinland LGA Products have been found to be in compliance with the requirements of Section 2.948 of the FCC Rules. Measurement data will be accepted in conjunction with applications for Certification under Parts 15 and 18 of the Commission's Rules.

FCC Registration Number: 939976

Bundesnetzagentur Registration Number: BNetzA-CAB-17/21-16

The measurement facilities are also recognized by Innovation, Science and Economic Development (ISED) Canada to test to Canadian radio equipment requirements.

Company Number: 11235A

CAB Identifier: DE0018

2 EUT Classification

2.1 Wireless technologies and frequencies supported by the EUT.

Technology	Used Test report for evaluation	Frequency Range Op.Band [MHz]		Used Center Frequency Range [MHz]		Evaluated in this report
		F _{Low}	F _{High}	F _{Low}	F _{High}	
Proprietary Radio	DE24L3OV 001	902	928	904	918.7	☒

2.2 Technical data summary taken from Test reports in 2.1

2.2.1 Maximum conducted power used in Test report

Technology	Antenna	Band (TX)	TX Frequency [MHz]	P _{max} conducted [dBm]	Ant. Gain [dBi]	P _{max} EIRP [dBm]
Proprietary Radio	ANT-ROD-65	902-928 MHz	911.17	17.76	0.94	18.70
Proprietary Radio	ANT-ZS-FLEX-65	902-928 MHz	911.17	17.76	0.34	18.10
Proprietary Radio	ANT-ZS-STUB	902-928 MHz	911.17	17.76	-0.31	17.45

Measurement values from the test reports are measured conducted as dBm values

2.3 Standard specific classification of the EUT

2.3.1 Applied FCC standards

FCC CFR 47 Part 15 Subpart C §15.247 (i)

FCC CFR 47 Part 1 Subpart I §1.1310(e)(1) (limits)

FCC CFR 47 Part 2 Subpart J §2.1091 (mobile)

FCC KDB 447498 D04 v01 – Interim General RF Exposure procedures Guidance (Procedures and Equipment Authorization Policies for Mobile and Portable Devices)

2.3.2 Applied ISED standards

RSS-GEN (General Requirements for Compliance of Radio Apparatus)

RSS-102 issue 6 (Radio Frequency (RF) Exposure Compliance of Radiocommunication Apparatus)

Health Canada's Safety Code 6 (2015)

Prüfbericht-Nr.: DE25XCPF 001
Test report no.:

Seite 6 von 11
Page 6 of 11

Prüfdokumentation
Test documentation

2.3.3 Exposure conditions

	Type of exposure
☒	General public exposure/Uncontrolled exposure
☐	Occupational exposure/Controlled exposure

	Separation distance – Intended usage location
☐	< 20 cm – portable
☐	Body-worn device -
☐	Limb-worn device -
☐	Head exposure device -
☐	Implanted device
☒	≥ 20 cm
☒	Fixed device (physically secured at one location, even temporarily) specific mitigation actions are required
☐	Mobile device

Prüfbericht-Nr.: DE25XCPF 001
Test report no.:

Seite 7 von 11
Page 7 of 11

Prüfdokumentation
Test documentation

3 Test results in detail FCC RF exposure evaluation

Radio frequency devices operating under the provisions of FCC CFR 47 Part 15 Subpart C - §15.247 (i) or are subject to the radio frequency radiation exposure requirements specified in §§ 1.1307(b), 1.1310, 2.1091, and 2.1093, as appropriate.

3.1 Maximum Permissible Exposure Evaluation (MPE) Mobile device or fixed RF source

3.1.1 Description

For operations within the frequency range of 300 kHz and 6 GHz (inclusive), the limits for maximum permissible exposure (MPE), derived from whole-body SAR limits and listed in Table 1 to § 1.1310(e)(1), may be used instead of whole-body SAR limits to evaluate the environmental impact of human exposure to RF radiation as specified in § 1.1307(b) of this part, except for portable devices as defined in § 2.1093 of this chapter as these evaluations shall be performed according to the SAR provisions in § 2.1093.

3.1.2 Limits

Limits for Maximum Permissible Exposure (MPE) to radiofrequency electromagnetic fields from §1.1310(e)(1) are shown in the table below.

Table 1 to § 1.1310(e)(1) - Limits for Maximum Permissible Exposure (MPE)				
Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm ²)	Averaging time (minutes)
(i) Limits for 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
300-1,500			f/300	<6
1,500-100,000			5	<6
(ii) Limits for 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
300-1,500			f/1500	<30
1,500-100,000			1.0	<30

f = frequency in MHz. * = Plane-wave equivalent power density.

Prüfbericht-Nr.: DE25XCPF 001
Test report no.:

Seite 8 von 11
Page 8 of 11

Prüfdokumentation
Test documentation

3.1.3 Evaluation for Technologies assumed to be in far field at the distance d

In the far-field zone of an electromagnetic source, electric field strength, magnetic field strength and power density are interrelated by simple mathematical expressions, where any one of these parameters defines the remaining two.

For the MPE evaluation the maximum measured output powers $P_{\max}$ for each Band from the above-mentioned test reports are considered.

With these, the respective power densities S in a distance of d can be calculated with $S = \frac{P_{\max}}{4\pi d^2}$. For this calculation $P_{\max}$ has to be specified as or transferred to an EIRP/ERP Value.

Technology	Band [MHz]	Antenna	Antenna Gain [dBi]	Frequency [MHz]	$P_{\max}$ conducted [dBm]	$P_{\max}$ conducted Including tune up tolerance [mW]	S [mW/cm ²]	S_L [mW/cm ²]
Proprietary Radio	902-928	ANT-ROD-65	0.94	918.67	17.76	94.623	0.02337	0.6074
	902-928	ANT-ZS-FLEX-65	0.34	918.67	17.76	94.623	0.02035	0.6074
	902-928	ANT-ZS-STUB	-0.31	918.67	17.76	94.623	0.01752	0.6074

Note:

- d is distance: 20cm
- Tune- Up Tolerance is ± 2 as declared by the customer

3.1.4 Final test result

3.1.4.1 Single RF source

The equipment meets the requirements according to §15.247 (i) since the calculated result for the power density is below the applicable limit from §1.1310(e)(1)

Final test result	Pass
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Prüfdokumentation
Test documentation

4 Test results in detail ISED RF exposure Compliance

Radio frequency devices operating under the provisions of RSS-Gen are subject to the radio frequency radiation exposure requirements specified in RSS-102.

Test reduction methods employed to reduce the testing burden and ensure timely access to the Canadian market are accepted. However, the allowance to apply test reduction methods does not constitute an exemption from compliance with the applicable exposure limit(s) and the other relevant requirements. The use of any test reduction methods for certification purposes does not prevent ISED from employing enforcement measures regarding non-compliances with Health Canada's Safety Code 6 limits specified in this document; including those that are outside of the scope of test reduction methods.

The specific test reduction methods for NS, SAR, APD, IPD and FRL are outlined in each specific standard.

4.1 ISED Maximum Exposure Requirements

According to RSS-102 issue 6, Industry Canada has adopted the SAR and RF field strength limits established in Health Canada's RF exposure guideline, Safety Code 6 (2015) and its Notice. Any updates to Safety Code 6 and/or its Notice will supersede the values outlined in RSS-102 issue 6

4.1.1 Electric Field Strength, Magnetic Field Strength and Power Density (10 MHz - 300 GHz)

According to the limits of human exposure in Safety Code 6 clause 2.2.2:

To ensure compliance with the basic restrictions at frequencies between 10 MHz and 300 GHz, the reference levels for electric- and magnetic-field strength and power density must be complied with.

Table 5. Reference Levels for Electric Field Strength, Magnetic Field Strength and Power Density in Uncontrolled Environments

Frequency (MHz)	Electric Field Strength (E_{RL}), (V/m, RMS)	Magnetic Field Strength (H_{RL}), (A/m, RMS)	Power Density (S_{RL}), (W/m ²)	Reference Period (minutes)
10 - 20	27.46	0.0728	2	6
20 - 48	$58.07 / f^{0.25}$	$0.1540 / f^{0.25}$	$8.944 / f^{0.5}$	6
48 - 300	22.06	0.05852	1.291	6
300 - 6000	$3.142 f^{0.3417}$	$0.008335 f^{0.3417}$	$0.02619 f^{0.6834}$	6
6000 - 15000	61.4	0.163	10	6
15000 - 150000	61.4	0.163	10	$616000 / f^{1.2}$
150000 - 300000	$0.158 f^{0.5}$	$4.21 \times 10^{-4} f^{0.5}$	$6.67 \times 10^{-5} f$	$616000 / f^{1.2}$

Frequency, f , is in MHz.

Prüfbericht-Nr.: DE25XCPF 001
Test report no.:

Seite 10 von 11
Page 10 of 11

Prüfdokumentation
Test documentation

Table 6. Reference Levels for Electric Field Strength, Magnetic Field Strength and Power Density in Controlled Environments

Frequency (MHz)	Electric Field Strength (E_{RL}), (V/m, RMS)	Magnetic Field Strength (H_{RL}), (A/m, RMS)	Power Density (S_{RL}), (W/m ²)	Reference Period (minutes)
10 - 20	61.4	0.163	10	6
20 - 48	$129.8 / f^{0.25}$	$0.3444 / f^{0.25}$	$44.72 / f^{0.5}$	6
48 - 100	49.33	0.1309	6.455	6
100 - 6000	$15.60 f^{0.25}$	$0.04138 f^{0.25}$	$0.6455 f^{0.5}$	6
6000 - 15000	137	0.364	50	6
15000 - 150000	137	0.364	50	$616000 / f^{1.2}$
150000 - 300000	$0.354 f^{0.5}$	$9.40 \times 10^{-4} f^{0.5}$	$3.33 \times 10^{-4} f$	$616000 / f^{1.2}$

Frequency, f , is in MHz.

4.1.1.1 Evaluation for Technologies assumed to be in far field at the distance d

In the far-field zone of an electromagnetic source, electric field strength, magnetic field strength and power density are interrelated by simple mathematical expressions, where any one of these parameters defines the remaining two.

For the Maximum Exposure evaluation, the maximum measured output powers P_{max} for each Band from the above-mentioned test reports are considered.

With these, the respective power densities S in a distance of d can be calculated with $S = \frac{P_{max}}{4\pi d^2}$. For this calculation P_{max} has to be specified as or transferred to an EIRP/ERP Value.

Technology	Band [MHz]	Antenna	Antenna Gain [dBi]	Frequency [MHz]	P_{max} conducted [dBm]	P_{max} conducted including tune up tolerance [mW]	S [W/m ²]	S_L [W/m ²]
Proprietary Radio	902-928	ANT-ROD-65	0.94	911.17	17.76	94.623	0.2337	2.7588
	902-928	ANT-ZS-FLEX-65	0.34	911.17	17.76	94.623	0.2035	2.7588
	902-928	ANT-ZS-STUB	-0.31	911.17	17.76	94.623	0.1752	2.7588

Note:

- d is distance: 20cm
- Tune- Up Tolerance is ± 2 as declared by the customer

4.1.2 Final test result

The equipment is compliant according to Health Canada Safety Code 6 (2015).

Final test result	Pass
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Prüfbericht-Nr.: DE25XCPF 001
Test report no.:

Seite 11 von 11
Page 11 of 11

Änderungsverzeichnis
Change history

5 Change history

Revision Number	List of revisions	Date of issue
001	Initial Release	2025-02-25

Note: Latest revision report will replace all previous reports.

Ende des Prüfberichts
End of Test Report