Prüfbericht-Nr.: *Test report no.:*	**DE25XCPF 001**	**Auftrags-Nr.:** *Order no.*:	1173499 70	Seite 1 von 11 *Page 1 of 11*
Kunden-Referenz-Nr.: *Client reference no.*:	-	**Auftragsdatum:** *Order date:*	2024-08-30	
Auftraggeber: *Client*:	Gutermann Technology GmbH, Gottlieb-Daimler-Str. 10, 88214 Ravensburg, Deutschland			
Prüfgegenstand: *Test item*:	Radio Logger			
Bezeichnung / Typ-Nr.: *Identification / Type no.*:	ZS850-L22			
Auftrags-Inhalt: *Order content*:	Prüfung der Funkparameter nach FCC & ISED *Test of radio parameters acc. to FCC & ISED*			
Prüfgrundlage: *Test specification*:	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: *Date of sample receipt*:	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.: *Test sample no:*	A003850445-001 to 033	
Prüfzeitraum: *Testing period*:	2025-02-04 - 2025-02-04	
Ort der Prüfung: *Place of testing*:	Nürnberg *Nuremberg*	
Prüflaboratorium: *Testing laboratory:*	Wireless Labor *Wireless Test Lab*	
Prüfergebnis*: *Test result**:	Pass	

erstellt von: *created by:*	X Signed by: Shrinivas Naikar	**genehmigt von:** *authorized by*:	X Signiert von: Matthias Kraeutlein
Datum: *Date:* 2025-02-25		**Ausstellungsdatum:** *Issue date:* 2025-02-25	
Stellung / Position:	Sachverständige(r)/Expert	**Stellung** / Position:	Sachverständige(r)/Expert

Sonstiges / -
Other:

Zustand des Prüfgegenstandes bei Anlieferung: *Condition of the test item at delivery*:	Prüfmuster vollständig und unbeschädigt *Test item complete and undamaged*

* 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*

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. *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.* *Detailed information regarding test conditions, equipment and measurement uncertainty is available in the test laboratory and could be provided on request.*
2	Wie vertraglich vereinbart, wurde dieses Dokument nur digital unterzeichnet. Der TÜV Rheinland hat nicht überprüft, welche rechtlichen oder sonstigen diesbezüglichen Anforderungen für dieses Dokument gelten. Diese Überprüfung liegt in der Verantwortung des Benutzers dieses Dokuments. Auf Verlangen des Kunden kann der TÜV Rheinland die Gültigkeit der digitalen Signatur durch ein gesondertes Dokument bestätigen. Diese Anfrage ist an unseren Vertrieb zu richten. Eine Umweltgebühr für einen solchen zusätzlichen Service wird erhoben. Informationen zur Verifizierung der Authentizität unserer Dokumente erhalten Sie auf folgender Webseite: go.tuv.com/digital-signature *As contractually agreed, this document has been signed digitally only. TUV Rheinland has not verified and unable to verify which legal or other pertaining requirements are applicable for this document. Such verification is within the responsibility of the user of this document. Upon request by its client, TUV Rheinland can confirm the validity of the digital signature by a separate document. Such request shall be addressed to our Sales department. An environmental fee for such additional service will be charged. For information on verifying the authenticity of our documents, please visit the following website: go.tuv.com/digital-signature*
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. *Test clauses with remark of * are subcontracted to qualified subcontractors and descripted under the respective test clause in the report.* *Deviations of testing specification(s) or customer requirements are listed in specific test clause in the report.*
4	Die Entscheidungsregel für Konformitätserklärungen basierend auf numerischen Messergebnisen 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. *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.*
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. *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.*

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

Prüfdokumentation
Test documentation

Contents

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)

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

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 §1.310(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.

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 Pmax 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/cm²]	S_L [mW/cm²]
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

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	$0.158 f^{0.5}$	$4.21\times10^{-4} f^{0.5}$	$6.67\times10^{-5} f$	$616000 / f^{1.2}$

Frequency, f, is in MHz.

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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	$0.354 f^{0.5}$	$9.40\times10^{-4} f^{0.5}$	$3.33\times10^{-4} f$	$616000 / f^{1.2}$

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 Pmax 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/m²]	S_L [W/m²]
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

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