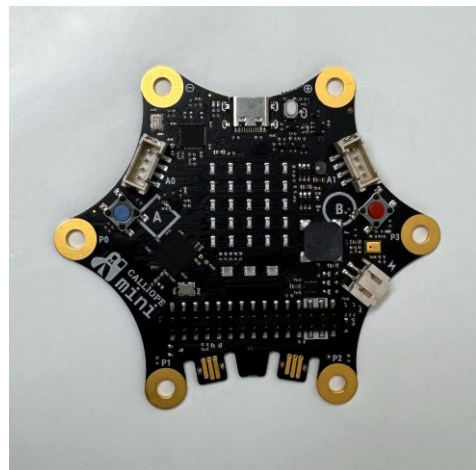


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Kunden-Referenz-Nr.: <i>Client reference No.:</i>		Auftragsdatum: <i>Order date:</i>	2023-07-24	
Auftraggeber: <i>Client:</i>	Calliope gGmbH, Raumerstr. 11, 10437 Berlin, +49 (0)30 4849 2030			
Prüfgegenstand: <i>Test item:</i>	Calliope mini			
Bezeichnung / Typ-Nr.: <i>Identification / Type no.:</i>	Calliope mini V3			
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) RF exposure evaluation acc. to RSS-102 issue 5			
Wareneingangsdatum: <i>Date of sample receipt:</i>	2023-09-11			
Prüfmuster-Nr.: <i>Test sample no.:</i>	A003559646-002 to 003			
Prüfzeitraum: <i>Testing period:</i>	2023-10-04 - 2023-10-23			
Ort der Prüfung: <i>Place of testing:</i>	Nürnberg <i>Nuremberg</i>			
Prüflaboratorium: <i>Testing laboratory:</i>	Wireless Labor <i>Wireless Test Lab</i>			
Prüfergebnis*: <i>Test result*:</i>	Pass			
geprüft von: <i>tested by:</i> X		genehmigt von: <i>authorized by:</i> X		
Datum: <i>Date:</i> 16.01.2024 Signed by: Shriniwas Naikar		Datum: <i>Issue date:</i> 17.01.2024 Signiert von: Matthias Kraeutlein		
Stellung / Position		Stellung / Position		
Sachverständige(r)/Expert		Sachverständige(r)/Expert		
Sonstiges / Other:	FCC ID: 2AQMD-CALLIOPE-V30 IC ID: 24686-CALLIOPEV30 Dieser Prüfbericht DE23P51J 002 ersetzt den Prüfbericht DE23P51J 001 (siehe Änderungsverzeichnis) / The test report DE23P51J 002 replaces the test report DE23P51J 001 (see change history)			
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:	1 = sehr gut P(ass) = entspricht o.g. Prüfgrundlage(n)	2 = gut F(ail) = entspricht nicht o.g. Prüfgrundlage(n)	3 = befriedigend F(ail) = entspricht nicht o.g. Prüfgrundlage(n)	4 = ausreichend N/A = nicht anwendbar
* Legende:	1 = very good P(ass) = passed a.m. test specification(s)	2 = good F(ail) = failed a.m. test specification(s)	3 = satisfactory F(ail) = failed a.m. test specification(s)	4 = sufficient N/A = not applicable
5 = mangelhaft N/T = nicht getestet 5 = poor 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 a. m. 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>				



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Anmerkungen
Remarks

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. Detailed information regarding test conditions, equipment and measurement uncertainty is available in the test laboratory and could be provided on request.</i>
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. <i>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.</i>
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 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. <i>The decision rule for statements of conformity 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.</i>

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Produktbeschreibung
Product description

1	Test item	Calliope mini
2	Typ-No.	Calliope mini V3
3	Test sample obtaining	☒ Sending by customer ☐ Sampling by TÜV Rheinland Group ☐ others:
4	Supported radio technologies	BLE 5.1
5	Description of EUT	The Calliope mini has been designed to be a micro controller board for the use by children aged 8-16 in schools. It is an open development system.
6	Max RF output power (declared)	0 dBm
7	Operating Frequency (declared)	2402MHz – 2480MHz
8	Channel Bandwidth (declared)	1MHz
9	Number of Channels	40
10	Modulation	GFSK
11	Rated Voltage / Frequency	2-5V DC (Battery Operated)
12	Radio Module / Antenna Type	☒ Radio module with antenna on module PCB ☐ Radio module with dedicated antenna ☐ Radio module with user accessible antenna connector
13	Antenna Name	PCB Antenna
14	Antenna Type	☒ Integral antenna ☐ Dedicated antenna ☐ Permanent antenna connector
15	Antenna number of chains	1
16	Antenna Gain (declared)	3.14 dBi
17	Software	6.0.27
18	Hardware	REV14
19	Used Samples	A003559646-002 to 003
20	Accessory Devices	A003562613-001 (Battery holder)
21	I/O Ports	Refer to the product specification (Section 6, 7 and 8)
22	Temperature Range	-10° to 50°C
23	Environment	Indoor and Outdoor

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Absatz <i>Clause</i>	Anforderungen – Prüfungen / <i>Requirements - Tests</i>	Bemerkungen / <i>Remarks</i>	Ergebnis <i>Result</i>
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FCC 15.247 (i)	RF exposure evaluation	-	P ☒ F ☐ N/A ☐ N/T ☐
RSS-102 Issue 5	RF exposure compliance of radiocommunication apparatus	-	P ☒ F ☐ N/A ☐ N/T ☐

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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

The named technologies are only those falling in the specification of the applied standard.

Technology	Frequency Range (TX)	TX Function	Test report
GNSS	1559 - 1610 MHz	None (only Receiver)	
BLE 5.1	2402 - 2480 MHz	SISO	DE23OWMA 001
GSM 900 (GPRS)	880 – 915 MHz	SISO	

2.2 Standard specific classification of the EUT

2.2.1 Applied standards.

- FCC CFR 47 Part 15 Subpart C §15.247 (i)
- FCC CFR 47 Part 1 Subpart I §1.1307 (b)
- FCC CFR 47 Part 1 Subpart I §1.1310 (limits)
- FCC CFR 47 Part 2 Subpart J §2.1091 (mobile)
- FCC CFR 47 Part 2 Subpart J §2.1093 (portable)
- FCC KDB 447498 D01 v06 – RF Exposure procedures and equipment authorization policies for mobile and portable devices
- 447498 D04 Interim General RF Exposure Guidance v01
- RSS-102 issue 5

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2.2.2 Exposure conditions

	Type of exposure
☒	General public exposure
☐	Occupational exposure

	Separation distance – Intended usage location
☒	≤ 20 cm – portable Declared minimum test separation, ensured by enclosure: 5 mm
☐	Body-worn device
☐	Limb-worn device
☐	Head exposure device
☐	Implanted device
☐	> 20 cm
☐	Fixed device
☐	Mobile device

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Test documentation

3 Test results in detail

3.1 FCC SAR test exclusion requirements

Limit:

FCC KDB 447498 D01 v06, chapter 4.3.1:

For 100 MHz to 6 GHz and test separation distances ≤ 50 mm, the 1-g and 10-g SAR test exclusion thresholds are determined by the following:

$[(\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm})] \cdot [\sqrt{f(\text{GHz})}]$
 ≤ 3.0 for 1-g SAR, and ≤ 7.5 for 10-g extremity SAR

FCC KDB 447498 D01 v06, Appendix A:

Appendix A gives example values for the converted formula of chapter 4.3.1 towards the max. power of channel, including tune-up tolerance for 1-g SAR test exclusion and varying frequencies and min. test separation distances.

For the frequency 2450MHz and a test separation distance of 5 mm the 1-g SAR test exclusion threshold of channel is $10 \text{ mW} \triangleq 10 \text{ dBm}$.

For 10-g extremity SAR test exclusion the power thresholds are 2.5 times higher than the 1-g SAR test exclusion threshold. Leading to a SAR test exclusion of $2.5 \cdot 10 \text{ mW} = 25 \text{ mW} \triangleq 13.9 \text{ dBm}$.

Evaluation of Compliance:

As it can be seen in test report DE23OWMA 001 the Declared maximum conducted output power is worst power than the measured power. Therefore, declared maximum conducted power is considered for the evaluation.

Considering the separation distance of 5 mm and 1dB tune up tolerance as declared by the customer.

Signal	Frequency [MHz]	ERP [dBm]	Antenna Gain [dBi]	EIRP (Including Tune-up tolerance) [dBm]	EIRP (Including Tune-up tolerance) [mW]	Limit (1-g SAR) [mW]	Limit (10-g SAR) [mW]	Result
Declared	2402-2480	0	3.14	4.14	2.5941	10	25	Pass

Result:

The equipment is compliant according to FCC KDB 447498 D01 v06 because the constraint for the output power level at the test separation distance for standalone SAR test exclusion is met.

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3.2 ISED SAR evaluation exemption requirements

Limit:

RSS 102 issue 5, chapter 2.5.1:

SAR evaluation is required if the separation distance between the user and/or bystander and the antenna and/or radiating element of the device is less than or equal to 20 cm, except when the device operates at or below the applicable output power level (adjusted for tune-up tolerance) for the specified separation distance defined in Table 1.

Output power level shall be the higher of the maximum conducted or equivalent isotropically radiated power (e.i.r.p.) source-based, time-averaged output power.

☐	For controlled use devices where the 8 W/kg for 1 gram of tissue applies, the exemption limits for routine evaluation in Table 1 are multiplied by a factor of 5.
☐	For limb-worn devices where the 10 gram value applies, the exemption limits for routine evaluation in Table 1 are multiplied by a factor of 2.5.
☒	If the operating frequency of the device is between two frequencies located in Table 1, linear interpolation shall be applied for the applicable separation distance.
☒	For test separation distance less than 5 mm, the exemption limits for a separation distance of 5 mm can be applied to determine if a routine evaluation is required.
☐	For medical implants devices, the exemption limit for routine evaluation is set at 1 mW. The output power of a medical implants device is defined as the higher of the conducted or e.i.r.p to determine whether the device is exempt from the SAR evaluation
☐	Transmitters operating between 0.003-10 MHz, meeting the exemption from routine SAR evaluation, shall demonstrate compliance to the instantaneous limits in Section 4.

Table 1: SAR evaluation — Exemption limits for routine evaluation based on frequency and separation distance^{4.5}

Frequency (MHz)	Exemption Limits (mW)				
	At separation distance of ≤5 mm	At separation distance of 10 mm	At separation distance of 15 mm	At separation distance of 20 mm	At separation distance of 25 mm
≤300	71 mW	101 mW	132 mW	162 mW	193 mW
450	52 mW	70 mW	88 mW	106 mW	123 mW
835	17 mW	30 mW	42 mW	55 mW	67 mW
1900	7 mW	10 mW	18 mW	34 mW	60 mW
2450	4 mW	7 mW	15 mW	30 mW	52 mW
3500	2 mW	6 mW	16 mW	32 mW	55 mW
5800	1 mW	6 mW	15 mW	27 mW	41 mW

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Frequency (MHz)	Exemption Limits (mW)				
	At separation distance of 30 mm	At separation distance of 35 mm	At separation distance of 40 mm	At separation distance of 45 mm	At separation distance of ≥50 mm
≤300	223 mW	254 mW	284 mW	315 mW	345 mW
450	141 mW	159 mW	177 mW	195 mW	213 mW
835	80 mW	92 mW	105 mW	117 mW	130 mW
1900	99 mW	153 mW	225 mW	316 mW	431 mW
2450	83 mW	123 mW	173 mW	235 mW	309 mW
3500	86 mW	124 mW	170 mW	225 mW	290 mW
5800	56 mW	71 mW	85 mW	97 mW	106 mW

Considering the separation distance of 5 mm as declared by the customer and a frequency of 2450 MHz the maximum output power at 5 mm distance is 4 mW= 6.02 dBm.

Over linear interpolation the limit for 2402 MHz is given with 4.26 mW $\pm$ 6.294 dBm and for 2480 MHz with 3.94 mW $\pm$ 5.954 dBm.

Considering 1dB tune up tolerance as declared by the customer.

Evaluation of Compliance:

As it can be seen in test report DE23OWMA 001 the Declared maximum conducted output power is worst power than the measured power. Therefore, declared maximum conducted power is considered for the evaluation.

Signal	Frequency [MHz]	ERP [dBm]	Antenna Gain [dBi]	EIRP (Including Tune-up tolerance) [dBm]	EIRP (Including Tune-up tolerance) [mW]	Limit at 2402 MHz [mW]	Limit at 2480 MHz [mW]	Result
Declared	2402-2480	0	3.14	4.14	2.5941	4.26	3.94	Pass

Result:

The equipment is compliant according to RSS 102 issue 5 because the constraint for the output power level at the separation distance for SAR evaluation exemption is met.

Final test result

Pass

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Zusatzdokumentation
Additional documentation

4 Details provided by the customer.

- minimum test separation, ensured by enclosure: 5 mm
- Tune-up tolerance 1dB

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Änderungsverzeichnis
Change history

5 Change history.

Revision Number	List of revisions	Date of issue
DE23P51J 001	Initial Release	09.11.2023
DE23P51J 002	Antenna Gain and Software version updated as per reviewer comment	17.01.2024
Note: Latest revision report will replace all previous reports.		

Ende des Prüfberichts
End of Test Report