Test Report 20-1-0017101T02a-C1

Number of pages:	16	**Date of Report:**	2021-Mar-16
Testing company:	CETECOM GmbH Im Teelbruch 116 45219 Essen Germany Tel. + 49 (0) 20 54 / 95 19-0 Fax: + 49 (0) 20 54 / 95 19-150	**Applicant:**	SICK AG
Test Object / Tested Device(s):	**UWB Tag** **LOCU101-0110**		
FCC ID:	WRMLOCU1	**IC:**	10066A-LOCU1

Testing has been carried out in accordance with:

FCC Regulations:
Title 47 CFR, Chapter I
FCC Regulations, Subchapter A
Subpart B: §15.107, §15.109 (Class B limits)

ISED Regulations:
ICES-003, Issue 6 (2016+Update 2019)

Deviations, modifications or clarifications (if any) to above mentioned documents are written in each section under "Test method and limit".

Test Results:

☒ **The EUT complies with the requirements in respect of all parameters subject to the test.**
The test results relate only to devices specified in this document

The current version of the Test Report CETECOM_TR20_1_0017101T02a_C1 replaces the Test Report CETECOM_TR20_1_0017101T02a dated 2020-Nov-25. The replaced test report is herewith invalid.

Signatures:

Ninovic Perez
2021.03.17
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01'00'

Dipl.-Ing. Ninovic Perez	B. Sc. Hicham Laayouni
Test Lab Manager	Test Manager
Authorization of test report	Responsible of test report

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1 General information

1.1 Disclaimer and Notes

The test results of this test report relate exclusively to the test item specified in this test report as specified in chapter 2.7. CETECOM does not assume responsibility for any conclusions and generalizations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by the test item.
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Also we refer on special conditions which the applicant should fulfill according §2.927 to §2.948, special focus regarding modification of the equipment and availability of sample equipment for market surveillance tests.

1.1. Summary of Test Results

Test case	Reference in FCC ☒	Reference in ISED ☒	Reference in RSS-GEN ☒	Remark	Result
Radiated field strength emissions 30 MHz – 1 GHz	§15.109 §15.33 §15.35	ICES-003, Issue 6	RSS-Gen., Issue 5 Chapter 8.9, Chapter 7.3	--	PASSED
Radiated field strength emissions above 1 GHz	§15.109 §15.33 §15.35	ICES-003, Issue 6	RSS-Gen., Issue 5 Chapter 8.9, Chapter 7.3	--	PASSED

PASSED	The EUT complies with the essential requirements in the standard.
FAILED	The EUT does not comply with the essential requirements in the standard.
NP	The test was not performed by the CETECOM Laboratory.

1.2. Summary of Test Methods

Test case	Test method
Radiated field strength emissions 30 MHz – 1 GHz	ANSI C63.4-2014 chapter 8.2.3
Radiated field strength emissions above 1 GHz	ANSI C63.4-2014 chapter 8.3

2 Administrative Data

2.1 Identification of the Testing Laboratory

Company name:	CETECOM GmbH
Address:	Im Teelbruch 116 45219 Essen - Kettwig Germany
Responsible for testing laboratory:	Dipl.-Ing. Ninovic Perez
Accreditation scope:	DAkkS Webpage
Test location:	CETECOM GmbH; Im Teelbruch 116; 45219 Essen - Kettwig

2.2 General limits for environmental conditions

Temperature:	22±2° C
Relative. humidity:	25±15% rH
Barometric Pressure:	1019 hPa

2.3 Test Laboratories sub-contracted

Company name:

2.4 Organizational Items

Order No.:	1
Responsible test manager:	B. Sc. Hicham Laayouni
Receipt of EUT:	2020-Jul-20
Date(s) of test:	2020-Aug-12
Version of template:	13.02

2.5 Applicant's details

Applicant's name:	SICK AG
Address:	Erwin-Sick-Str. 1 79183 Waldkirch Germany
Contact Person:	Tobias Hofmann
Contact Person's Email:	tobias.hofmann@sick.de

2.6 Customer's details

Applicant's name:	Mobilisis d.o.o.
Address:	Varaždinska ulica - Odvojak II 7 42000 Varaždin – Jalkovec Croatia
Contact Person:	Branimir Paic
Contact Person's Email:	bpaic@mobilisis.hr

2.7 Manufacturer's details

Applicant's name:	Please see applicant´s details
Address:	Please see applicant´s details

2.8 EUT: Type, S/N etc. and short descriptions used in this test report

Short description*)	PMT Sample No.	EUT	Type	S/N	HW status	FW status
EUT 1	20-1-00171S04	UWB Tag	LOCU101-0110	19500112	v1r3	3.125.7
EUT 2**)	20-1-00171S04	UWB Tag	LOCU101-0110	19500112	v1r3.1	3.125.7

*) EUT short description is used to simplify the identification of the EUT in this test report.

) The listed additional **untested variant (EUT 2) is not object of evaluated of compliance. For further information please see annex 5: Customer declaration

2.9 Auxiliary Equipment (AE): Type, S/N etc. and short descriptions

Short description*)	PMT Sample No.	Auxiliary Equipment	Type	S/N	HW status	SW status
AE 1	--	--	--	--	--	--

*) AE short description is used to simplify the identification of the auxiliary equipment in this test report.

2.10 Connected cables

Cable short description *)	Cable type	Connectors	Length
CAB 1	--	--	--

*) AE short description is used to simplify the identification of the auxiliary equipment in this test report.

2.11 EUT set-ups

set-up no.*)	Combination of EUT and AE	Description
1	EUT 1	--

*) EUT set-up no. is used to simplify the identification of the EUT set-up in this test report.

2.12 EUT operation modes

EUT operating mode no.*)	Operating modes	Additional information
Operating mode 1	Test mode	Accelerometer UWB TX disabled

*) EUT operating mode no. is used to simplify the test report.

3 Equipment under test (EUT)

3.1 General Data of Main EUT as Declared by Applicant

Product name	UWB Tag	
Kind of product	LOCU101-0110 (LOCU Rechargeable Advanced)	
Firmware	☐ for normal use	☒ Special version for test execution
	☐ AC Mains	-
	☐ DC Mains	-
	☒ Battery	Li-Pol 300 mAh, 3.7 V DC
EUT sample type	**Production**	
Weight	45 g	
Size	90.2 x 42.9 x 15.5 [mm]	
Interfaces/Ports	--	
For further details refer Applicants Declaration & following technical documents: --		

3.2 Modifications on Test sample

Additions/deviations or exclusions	--

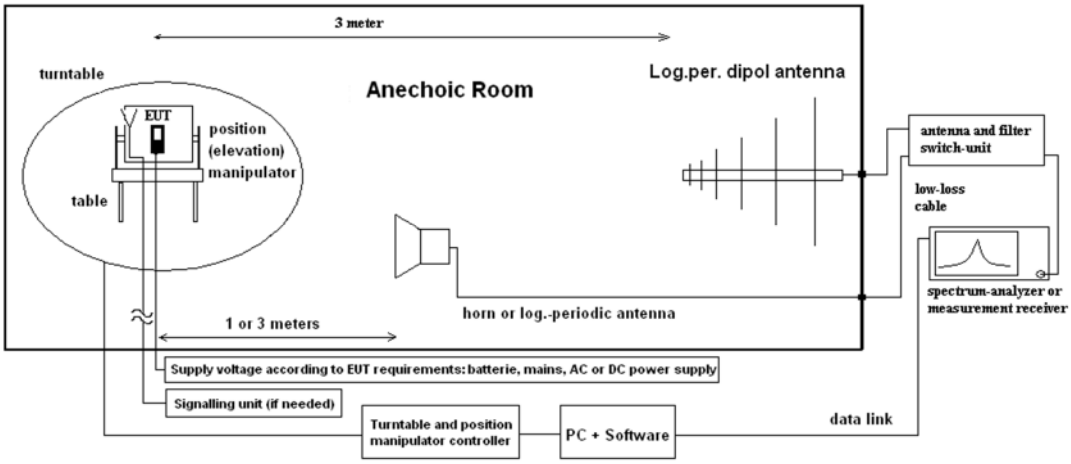
4 Measurements

4.1 Radiated field strength emissions 30 MHz – 1 GHz

4.1.1 Description of the general test setup and methodology, see below example:

Evaluating the field emissions have to be done first by an exploratory emissions measurement and a final measurement for most critical frequencies. The tests are performed in a NSA-compliant semi anechoic room (SAR) recognized by the regulatory commissions.

Schematic:



Testing method:

The measurement is made according to relevant reference clauses:
(See Tables *Summary of Test Results* and *Summary of Test Methods* on page 5)

Exploratory, preliminary measurements
The EUT and its associated accessories are placed on a non-conductive table of 0.8 m height which is placed on the turntable. By rotating the turntable (range 0° to 360°, step 20°), the emission spectrum and its characteristics was recorded with an EMI-receiver, broadband antenna and software.

Measurement antenna: horizontal and vertical, heights: 1.0 m and 1.82 m as worst-case determined by an exploratory emission measurements. A logarithmic periodic antenna is used for the frequency range 30 MHz to 1 GHz. The results are documented in a diagram. Critical frequencies (low margin to limit) are saved within a table for further investigations. If various operating modes are supported, further investigations are made to find the worst-case of them. Also the interconnection cables and equipment position were varied in order to maximize the emissions.

Final measurement on critical frequencies
Based on the exploratory measurements, the most critical frequencies are re-measured by maintaining the EUT's worst-case operation mode, cable position, etc. either on 10 m OATS or 3 m semi-anechoic room.
First a frequency zoom around the critical frequency is done to locate the frequency more precisely. After this step, for all identified critical frequencies, the maximum peak was determined.

Following parameters were varied: the turntable angle continuously in the range 0 to 360 degree, the EUT itself either over 3-orthogonal axis (not defined usage position) or 2-orthogonal axis (defined usage position). The measurement antenna height between 1 m and 4 m.
On the determined worst-case position, a final measurement with necessary bandwidth and detector according standard has been carried out

Formula:

$E_C = E_R + AF + C_L + D_F - G_A$ (1)

$M = L_T - E_C$ (2)

AF = Antenna factor
C_L = Cable loss
D_F = Distance correction factor (if used)
E_C = Electrical field – corrected value
E_R = Receiver reading
G_A = Gain of pre-amplifier (if used)
L_T = Limit
M = Margin

All units are dB-units, positive margin means value is below limit.

4.1.2 Measurement Location

Test site	120901 - SAC - Radiated Emission <1GHz

4.1.3 Limit

Frequency Range [MHz]	Class B ☒ (3 meters)		Class A ☐ (10 meters)			
	Limit [µV/m]	Limit [dBµV/m]	Limit [µV/m]	Limit [dBµV/m]	Detector	RBW / VBW [kHz]
30 - 88	100	40.0	90	39.0	Quasi peak	100 / 300
88 - 216	150	43.5	150	43.5	Quasi peak	100 / 300
216 - 960	200	46.0	210	46.4	Quasi peak	100 / 300
960 - 1000	500	54.0	300	49.5	Quasi peak	100 / 300

4.1.4 Result

Diagram	Channel	Op. Mode	Maximum Level [dBµV/m] Frequency Range 30 – 1000MHz	Margin to Limit [dB]	Result
3.01	--	1	37.67 dBµV/m @ 928.35 MHz	8.33 dB	PASSED
3.02	--	1	34.88 dBµV/m @ 927.21 MHz	11.12 dB	PASSED

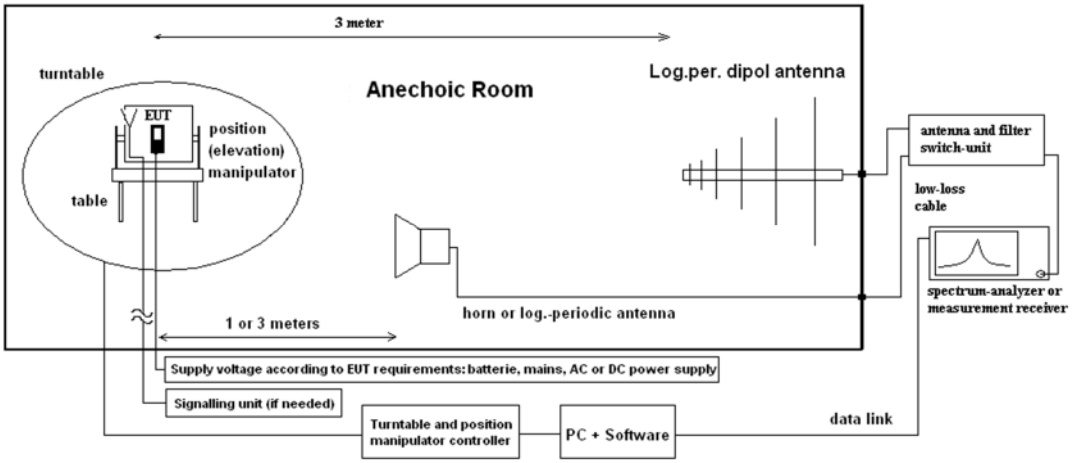
Remark: for more information and graphical plot see annex A1 **CETECOM_TR20_1_0017101T02a_C1_A1**

4.2 Radiated field strength emissions above 1 GHz

4.2.1 Description of the general test setup and methodology, see below example:

Evaluating the emissions have to be done first by an exploratory emissions measurement and a final measurement for most critical frequencies. The tests are performed in a CISPR 18-1-4:2010 compliant fully anechoic room (FAR) recognized by the regulatory commission. The measurement distance was set to 3 meter for frequencies up to 18 GHz and 2 meter above 18 GHz. Horn antennas are used for frequency range 1 GHz to 40 GHz. The EUT is aligned within 3 dB beam width of the measurement antenna with three orthogonal axis measurements on the EUT.

Schematic:



Testing method:

The measurement is made according to relevant reference clauses:
(See Tables *Summary of Test Results* and *Summary of Test Methods* on page 5)

Exploratory, preliminary measurements

The EUT and its associated accessories are placed on a non-conductive table of 0.8 m height which is placed on the turntable. By rotating the turntable (range 0° to 360°, step 15°). The emission spectrum and its characteristics was recorded with an EMI-receiver, broadband antenna and software.
The measurements are performed in horizontal and vertical polarization of the measurement antennas. The results are documented in a diagram. Critical frequencies (low margin to limit) are saved within a table for further investigations. If various operating modes are supported, further investigations are made to find the worst-case of them. Also the interconnection cables and equipment position were varied in order to maximize the emissions.

Final measurement on critical frequencies

Based on the exploratory measurements, the most critical frequencies are re-measured by maintaining the EUT's worst-case operation mode, cable position, etc.

First a frequency zoom around the critical frequency is done to locate the frequency more precisely. After this step, for all identified critical frequencies, the maximum peak was determined.
Following parameters were varied: the turntable angle continuously in the range 0 to 360 degree, the EUT itself over 3-orthogonal axis and the height for EUT with large dimensions or three axis scan for portable/small equipment.

On the determined worst-case position, a final measurement with necessary bandwidth and detector according standard has been carried out.

Formula:

$E_C = E_R + A_F + C_L + D_F - G_A$ (1)

$M = L_T - E_C$ (2)

E_C = Electrical field – corrected value
E_R = Receiver reading
M = Margin
L_T = Limit
A_F = Antenna factor
C_L = Cable loss
D_F = Distance correction factor (if used)
G_A = Gain of pre-amplifier (if used)

All units are dB-units, positive margin means value is below limit.

4.2.2 Measurement Location

Test site	120904 - FAC1 - Radiated Emissions

4.2.3 Limit

Radiated emissions limits (3 meters)				
Frequency Range [MHz]	Limit [µV/m]	Limit [dBµV/m]	Detector	RBW / VBW [kHz]
Above 1000	500	54	Average	1000 / 3000
Above 1000	5000	74	Peak	1000 / 3000

4.2.4 Result

Diagram	Channel	Op. Mode	Maximum Level [dBµV/m] Frequency Range 1 – 40 GHz	Margin to Limit [dB]	Result
4.01	--	1	46.836 dBµV/m @ 14.17 GHz	7.164 dB (Average)	PASSED
4.02	--	1	51.03 dBµV/m @ 39.98 GHz	2.97 dB (Average)	PASSED

Remark: for more information and graphical plot see annex A1 **CETECOM_TR20_1_0017101T02a_C1_A1**

4.3 Results from external laboratory

None	--

4.4 Opinions and interpretations

None	--

5 Equipment lists

ID	Description	Manufacturer	SerNo	Cal due date
120901 - SAC - Radiated Emission < 1GHz, 21.07.2025				
20574	Biconilog Hybrid Antenna BTA-L	Frankonia GmbH	980026L	03.05.2022
20487	CETECOM Semi Anechoic Chamber < 1 GHz	ETS-Lindgren Gmbh	-	15.07.2025
20341	Digital Multimeter Fluke 112	Fluke Deutschland GmbH	81650455	25.05.2022
20620	EMI Test Receiver ESU26	Rohde & Schwarz Messgerätebau GmbH	100362	13.05.2021
20482	filter matrix Filter matrix SAR 1	CETECOM GmbH	-	
20885	Power Supply EA3632A	Agilent Technologies Deutschland GmbH	75305850	
120904 - FAC1 - Radiated Emissions				
20720	EMC32 [FAC]	Rohde & Schwarz Messgerätebau GmbH	V10.52	
20489	EMI Test Receiver ESU40	Rohde & Schwarz Messgerätebau GmbH	1000-30	13.05.2021
20254	High Pass Filter 5HC 2600/12750-1.5KK (GSM1800/1900/DECT)	Trilithic	23042	
20549	Log.Per-Antenna HL025	Rohde & Schwarz Messgerätebau GmbH	1000060	31.07.2021
20611	Power Supply E3632A	Agilent Technologies Deutschland GmbH	KR 75305854	
20338	Pre-Amplifier 100MHz - 26GHz JS4-00102600-38-5P	Miteq Inc.	838697	
20484	Pre-Amplifier 2,5GHz - 18GHz AMF-5D-02501800-25-10P	Miteq Inc.	1244554	
20287	Pre-Amplifier 25MHz - 4GHz AMF-2D-100M4G-35-10P	Miteq Inc.	379418	
20690	Spectrum Analyzer FSU	Rohde & Schwarz Messgerätebau GmbH	100302/026	23.05.2021

Tools used in 'P1M1'

6 Measurement Uncertainty valid for conducted/radiated measurements

The reported uncertainties are calculated based on the standard uncertainty multiplied with the appropriate coverage factor **k**, such that a confidence level of approximately 95% is achieved. For uncertainty determination, each component used in the concrete measurement set-up was taken in account and it contribution to the overall uncertainty according its statistical distribution calculated.

RF-Measurement	Reference	Frequency range	Calculated uncertainty based on a confidence level of 95%						Remarks
Conducted emissions (U_{CISPR})	-	9 kHz - 150 kHz 150 kHz - 30 MHz	4.0 dB 3.6 dB						-
Power Output radiated	-	30 MHz - 4 GHz	3.17 dB						Substitution method
Power Output conducted	-	Set-up No.	Cel-C1	Cel-C2	BT1	W1	W2	--	
		9 kHz - 12.75 GHz	N/A	0.60	0.7	0.25	N/A	--	-
		12.75 GHz - 26.5 GHz	N/A	0.82	--	N/A	N/A	--	
Conducted emissions on RF-port	-	9 kHz - 2.8 GHz	0.70	N/A	0.70	N/A	0.69	--	N/A - not applicable
		2.8 GHz - 12.75 GHz	1.48	N/A	1.51	N/A	1.43	--	
		12.75 GHz – 18 GHz	1.81	N/A	1.83	N/A	1.77	--	
		18 GHz - 26.5 GHz	1.83	N/A	1.85	N/A	1.79	--	
Occupied bandwidth	-	9 kHz - 4 GHz	0.1272 ppm (Delta Marker)						Frequency error
			1.0 dB						Power
Emission bandwidth	- -	9 kHz - 4 GHz	0.1272 ppm (Delta Marker)						Frequency error
			See above: 0.70 dB						Power
Frequency stability	-	9 kHz - 20 GHz	0.0636 ppm						-
Radiated emissions Enclosure	-	150 kHz - 30 MHz	5.01dB						Magnetic field strength
		30 MHz - 1 GHz 1 GHz - 18 GHz 18 GHz - 26.5 GHz	5.83 dB 4.91 dB 5.06 dB						Electrical Field strength

7 Versions of test reports (change history)

Version	Applied changes	Date of release
--	Initial release	2020-Nov-25
C1	Updated test results according to annex 1.	2021-Mar-16
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End Of Test Report