RF Exposure Assessment

On

H.4904 Wireless Sensor Network MoComp® Bogie Diagnostic Solution – Wireless Sensor Node (WSN)

FCC ID: 2BED5-0002
IC: 32092-0002

Assessment Reference: MDE_SIEM_2311_MPE_01

Date: 2024-03-19

Test Laboratory:
7layers GmbH
Borsigstraße 11
40880 Ratingen
Germany

Contents

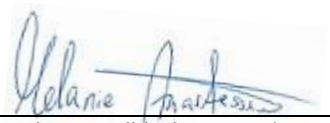
1 Summary

The RF-exposure assessment according to KDB 447498 D01 General RF Exposure Guidance v06 shows, that the worst-case RF exposure values of the assessed radio technologies and bands are below the Limits for General Population/Uncontrolled Exposure:

- Table 1 (II) to § 1.1310(E)(1) of 47 CFR Ch. I (10–1–21 Edition).

COMMENTS:

- Assessment limited to supported North American and Canadian frequency bands.
- Prediction Distance R = 20 cm.



(responsible for report)
Melanie Anastassiou

2 Revision History

Report version control			
Version	Release date	Change Description	Version validity
initial	2024-03-19	--	valid
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3 Administrative Data

3.1 Testing Laboratory

Company Name:	7layers GmbH
Address:	Borsigstr. 11 40880 Ratingen Germany
Report Template Version:	2022-10-21

3.2 Project Data

Responsible for report:	Melanie Anastassiou
Date of Report:	2024-03-19

3.3 Applicant Data

Company Name:	Siemens Mobility Austria GmbH
Address:	Eggenberger Str. 31 8020 Graz Austria
Contact Person:	Jürgen Derler

3.4 Manufacturer Data

Company Name:	please see Applicant Data
Address:	
Contact Person:	

4 Test object Data

Declared EUT data by the supplier	
Kind of Device product description	H.4904 Wireless Sensor Network
Product name(s)	MoComp® Bogie Diagnostic Solution
Type(s)	Wireless Sensor Node (WSN)
Integrated transmitter	The EUT uses GFSK modulation on 40 channels in the 2.4GHz band. The first channel is transmitting on 2402 MHz and the channel spacing is 2 MHz.
Antenna / Gain	Integral / 3 dBi
Supplied document(s)	Test Report: MDE_SIEM_2311_FCC_03

5 Assessment

5.1 Assessment method and subject of assessment

Calculation of power density and comparison with reference levels for general public exposure.
Applicability area and limitations: Power density can be calculated in far field region.

Applied Standards:

- IEEE Std C95.3-2021, D.4.2 Antennas – Main beam on-axis, general method for determining the power density at points in the radiating near-field and far-field antenna regions.

Specific information:

- Values used for calculation are based on 7layers Test Report and customers information.
- Output power values are based on 7layers Test Report.

Worst case considerations:

- Main beams of the antennas are directed to the same point in the prediction distance.
- Output power values are based on the 7layers Test Report.
- Antenna gain values are based on values declared by the manufacturer.
- Cable loss of internal antenna cables set to 0.
- Duty cycle factor = 1.

5.2 Exposure limits

Extract of

- Table 1 (II) to § 1.1310(E)(1) of 47 CFR Ch. I (10–1–21 Edition).

Frequency range	*Power density*	*Power density*
MHz	*W/m²*	*mW/cm²*
300 – 1500	f/150	f/1500
1500 - 100000	10	1

Note:
f in MHz

5.3 Formulas used for calculation

5.3.1 Single-frequency exposures (exposures to one source)

Table D.2—Determining power density on antenna main beam axis

$$S_{FF} = \frac{G_i P_{in}}{4\pi d^2}$$

In this report is the power density S_i at frequency i calculated in mW/cm^2.
G_i is the (isotropic) far-field antenna gain (power ratio) at frequency i.
P_{in} is the power into the antenna in mW => P_{mW}.
d is the distance to the antenna in cm.

5.3.2 Multi-frequency exposures (exposures to multiple sources)

Summation based on IEEE Std C95.1-2019, D.2

$$\sum_{i=1}^{n} \frac{exposure_i}{ERL_i} < 1$$

In this report is the power density calculated. In the tables below is "*exposure*" = S_i = power density at frequency i.
ERL_i is the corresponding exposure reference level at frequency i.

IEEE Std C95.1-2019:
exposure reference level (ERL): The maximum exposure level relative to ambient electric and/or magnetic field strength or power density, induced and/or contact current, or contact voltage.
NOTE 1— ERLs provide an adequate margin of safety against established adverse health effects.
NOTE 6— In some documents, ERLs are called reference levels, derived limits, permissible exposure limits, maximum permissible exposure values, action levels, or investigation levels.

5.4 Calculation

5.4.1 Single-frequency exposure(s)

Prediction Distance d in cm =>	20	TX freq. band	Prediction freq.	Avarage (temporal) power (log.)	Avarage (temporal) power (lin)	Max. Gain (log.)	Gain (lin.)	Power density at distance d	FCC Power density limit at frequency f_i	FCC Ratio to exposure reference level	IC Power density limit at frequency f_i	IC Ratio to exposure reference level	Cpmpliance Conclusion
		f_{Band}	f_i	P_{dBm}	P_{mW}	g_{dBi}	G_i	S_i	ERL_i	S_i / ERL_i	ERL_i	S_i / ERL_i	-
Radio technology	Band	MHz	MHz	dBm	mW	dBi	-	mW/cm²	mW/cm²	-	mW/cm²	-	-
Bluetooth LE prop.	2.4 GHz ISM	2402 - 2480	2402	-4,2	0,38	3	2,00	0,000	1,000	0,000	0,535	0,000	Pass

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