

# RF Exposure Assessment

On  
C400 ECU MID NA 4.5G

Type 1589.1

FCC ID: 2AJW515891

**Assessment Reference:** MDE\_CONTI\_2134\_MPE\_04

**Date:** 2024-10-18

**Test Laboratory:**

7layers GmbH  
Borsigstraße 11  
40880 Ratingen  
Germany

**Note:**

The following test results relate only to the devices specified in this document. This report shall not be reproduced in parts without the written approval of the test laboratory.

**7layers GmbH**  
Borsigstraße 11  
40880 Ratingen, Germany  
T +49 (0) 2102 749 0  
F +49 (0) 2102 749 350  
[www.7layers.com](http://www.7layers.com)

Geschäftsführer /  
Managing Directors:  
Sebastian Doose  
Stefan Kischka  
Bernhard Retka

Registergericht registered in:  
Düsseldorf, HRB 75554  
USt-IdNr VAT No.:  
DE203159652  
TAX No. 147/5869/0385  
A Bureau Veritas Group Company

## Contents

|     |                                                   |   |
|-----|---------------------------------------------------|---|
| 1   | Summary.....                                      | 3 |
| 2   | Revision History.....                             | 3 |
| 3   | Administrative Data.....                          | 4 |
| 3.1 | Testing Laboratory .....                          | 4 |
| 3.2 | Project Data .....                                | 4 |
| 3.3 | Applicant Data .....                              | 4 |
| 3.4 | Manufacturer Data.....                            | 4 |
| 4   | Test object Data .....                            | 5 |
| 5   | Assessment.....                                   | 6 |
| 5.1 | Assessment method and subject of assessment ..... | 6 |
| 5.2 | Exposure limits .....                             | 7 |
| 5.3 | Formulas used for calculation.....                | 7 |
| 5.4 | Calculation .....                                 | 8 |

## 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 frequency bands
- Prediction Distance R = 20 cm

---

(approved by)  
Imad Hjiye

---

(responsible for report)  
Melanie Anastassiou

## 2 Revision History

| Report version control |              |                    |                  |
|------------------------|--------------|--------------------|------------------|
| Version                | Release date | Change Description | Version validity |
| initial                | 2024-10-18   | --                 | valid            |
| --                     | --           | --                 | --               |

### **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: 2024-10-18

#### **3.3 Applicant Data**

Company Name: Continental Automotive Technologies GmbH  
Address: Heinrich-Hertz-Straße 45  
78052 Villingen-Schwenningen  
Germany  
Contact Person: Patrick Seng

#### **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<br>product description | The CM4 is a communication module with several wired interfaces to the vehicle. Additional functions as GNSS, mobile communication, WiFi and Bluetooth are provided. |
| Product name(s)                       | C400 ECU MID NA 4.5G                                                                                                                                                 |
| Type(s)                               | Type 1589.1                                                                                                                                                          |
| Integrated transmitter                | Cellular, WiFi, Bluetooth, GNSS.                                                                                                                                     |

## **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.
- IEEE Std C95.1-2019, D.2 Multifrequency exposures (exposures to multiple sources)

Specific information:

- Values used for calculation are based on supplied documents and supplied RF exposure reports.
- Output power values are based on the supplied RF exposure reports.

## 5.2 Exposure limits

Extract of

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

| <i>Frequency range</i> | <i>Power density</i>   | <i>Power density</i>     |
|------------------------|------------------------|--------------------------|
| <i>MHz</i>             | <i>W/m<sup>2</sup></i> | <i>mW/cm<sup>2</sup></i> |
| 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  $\text{mW/cm}^2$ .

$G_i$  is the (isotropic) far-field antenna gain (power ratio) at frequency  $i$ .

$P_{in}$  is the power into the antenna in  $\text{mW} \Rightarrow P_{\text{mW}}$ .

$d$  is the distance to the antenna in  $\text{cm}$ .

### 5.3.2 Multi-frequency exposures (exposures to multiple sources)

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

$$\sum_{i=1}^n \frac{\text{exposure}_i}{\text{ERL}_i} < 1$$

In this report is the power density calculated. In the tables below is “*exposure*” =  $S_i$  = power density at frequency  $i$ .

$\text{ERL}_i$  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 Cellular Single-frequency exposures

| Prediction Distance d in cm => | 20              | Prediction freq. | Avarage (temporal) power (log.) | Avarage (temporal) power (lin) | Max. Gain (log.) | Gain (lin.)    | Power density at distance d | Power density limit at frequency f <sub>i</sub> | Ratio to exposure reference level | Sum of S <sub>i</sub> / ERL <sub>i</sub> | Compliance, if Sum of S <sub>i</sub> / ERL <sub>i</sub> < 1 |
|--------------------------------|-----------------|------------------|---------------------------------|--------------------------------|------------------|----------------|-----------------------------|-------------------------------------------------|-----------------------------------|------------------------------------------|-------------------------------------------------------------|
|                                |                 | f <sub>i</sub>   | P <sub>dBm</sub>                | P <sub>mW</sub>                | g <sub>dB</sub>  | G <sub>i</sub> | S <sub>i</sub>              | ERL <sub>i</sub>                                | S <sub>i</sub> / ERL <sub>i</sub> | -                                        | -                                                           |
| Radio technology               | Band            | MHz              | dBm                             | mW                             | dB               | -              | mW/cm <sup>2</sup>          | mW/cm <sup>2</sup>                              | -                                 | -                                        | -                                                           |
| UMTS                           | FDDI            | 1850,0           | 23,5                            | 223,87                         | 6                | 3,98           | 0,177                       | 1,000                                           | 0,177                             | 0,177                                    | Pass                                                        |
| UMTS                           | FDDV            | 824,0            | 23,5                            | 223,87                         | 6                | 3,98           | 0,177                       | 0,549                                           | 0,323                             | 0,323                                    | Pass                                                        |
| LTE                            | eFDD2           | 1850,0           | 23,0                            | 199,53                         | 7                | 5,01           | 0,199                       | 1,000                                           | 0,199                             | 0,199                                    | Pass                                                        |
| LTE                            | eFDD4           | 17010,0          | 23,0                            | 199,53                         | 7                | 5,01           | 0,199                       | 1,000                                           | 0,199                             | 0,199                                    | Pass                                                        |
| LTE                            | eFDD5           | 824,0            | 23,0                            | 199,53                         | 7                | 5,01           | 0,199                       | 0,549                                           | 0,362                             | 0,362                                    | Pass                                                        |
| LTE                            | eFDD7           | 2500,0           | 23,0                            | 199,53                         | 7                | 5,01           | 0,199                       | 1,000                                           | 0,199                             | 0,199                                    | Pass                                                        |
| LTE                            | eFDD12          | 699,0            | 23,0                            | 199,53                         | 7                | 5,01           | 0,199                       | 0,466                                           | 0,427                             | 0,427                                    | Pass                                                        |
| LTE                            | eFDD13          | 777,0            | 23,0                            | 199,53                         | 7                | 5,01           | 0,199                       | 0,518                                           | 0,384                             | 0,384                                    | Pass                                                        |
| LTE                            | eFDD14          | 788,0            | 23,0                            | 199,53                         | 7                | 5,01           | 0,199                       | 0,525                                           | 0,379                             | 0,379                                    | Pass                                                        |
| LTE                            | eTDD41          | 2496,0           | 23,0                            | 199,53                         | 7                | 5,01           | 0,199                       | 1,000                                           | 0,199                             | 0,199                                    | Pass                                                        |
| Blueboth LE                    | 2.4 GHz ISM     | 2402,0           | -2,0                            | 0,63                           | 4,4              | 2,75           | 0,000                       | 1,000                                           | 0,000                             | 0,000                                    | Pass                                                        |
| Blueboth Classic               | 2.4 GHz ISM     | 2402,0           | 3,5                             | 2,24                           | 4,4              | 2,75           | 0,001                       | 1,000                                           | 0,001                             | 0,001                                    | Pass                                                        |
| WLAN 2.4 GHz                   | 2.4 GHz ISM     | 2412,0           | 11,5                            | 14,13                          | 4,4              | 2,75           | 0,008                       | 1,000                                           | 0,008                             | 0,008                                    | Pass                                                        |
| WLAN 5 GHz                     | U-NII Subband 1 | 5180,0           | 7,0                             | 5,01                           | 5                | 3,16           | 0,003                       | 1,000                                           | 0,003                             | 0,003                                    | Pass                                                        |

Bold marked = worst case band of the radio technology

Information: 10 W m-2 = 1 mW cm-2

### 5.4.2 Calculation of multi-frequency exposures

| Prediction Distance d in cm => | 20              | Prediction freq. | Avarage (temporal) power (log.) | Avarage (temporal) power (lin) | Max. Gain (log.) | Gain (lin.)    | Power density at distance d | Power density limit at frequency f <sub>i</sub> | Ratio to exposure reference level | Sum of S <sub>i</sub> / ERL <sub>i</sub> | Compliance, if Sum of S <sub>i</sub> / ERL <sub>i</sub> < 1 |
|--------------------------------|-----------------|------------------|---------------------------------|--------------------------------|------------------|----------------|-----------------------------|-------------------------------------------------|-----------------------------------|------------------------------------------|-------------------------------------------------------------|
|                                |                 | f <sub>i</sub>   | P <sub>dBm</sub>                | P <sub>mW</sub>                | g <sub>dB</sub>  | G <sub>i</sub> | S <sub>i</sub>              | ERL <sub>i</sub>                                | S <sub>i</sub> / ERL <sub>i</sub> | -                                        | -                                                           |
| Radio technology               | Band            | MHz              | dBm                             | mW                             | dB               | -              | mW/cm <sup>2</sup>          | mW/cm <sup>2</sup>                              | -                                 | -                                        | -                                                           |
| LTE                            | eFDD12          | 699              | 23                              | 199,53                         | 7                | 5,01           | 0,199                       | 0,466                                           | 0,427                             | 0,438                                    | Pass                                                        |
| WLAN 2.4 GHz                   | 2.4 GHz ISM     | 2412             | 11,5                            | 14,13                          | 4,4              | 2,75           | 0,008                       | 1,000                                           | 0,008                             |                                          |                                                             |
| WLAN 5 GHz                     | U-NII Subband 1 | 5180             | 7                               | 5,01                           | 5                | 3,16           | 0,003                       | 1,000                                           | 0,003                             |                                          |                                                             |

Information: 10 W m-2 = 1 mW cm-2

END OF REPORT