

FCC RF Exposure Assessment

on

CMBTRX1

FCC ID: KR5CMBTRX1

Report Reference: MDE_CONTI_2514_MPE_01

Test Laboratory:

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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.

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1 Applied Standards

Type of Authorization

Certification for an Intentional Radiator

Applicable FCC Rules

Prepared in accordance with the requirements of FCC Rules and Regulations as listed in 47 CFR Ch.1 Parts 1 and 2 (10-1-24 Edition). The following subparts are applicable to the results in this test report.

Part 1, Subpart I

Practice and Procedure, Procedures Implementing the National Environmental Policy Act of 1969

§ 1.1307:

Actions that may have a significant environmental effect, for which Environmental Assessments (EAs) must be prepared.

Part 2, Subpart J

Equipment Authorization Procedures, Certification

§ 2.1091:

Radiofrequency radiation exposure evaluation: mobile devices.

§ 2.1093:

Radiofrequency radiation exposure evaluation: portable devices.

The following KDB is applied:

KDB 447498 D04, v01:

Interim General RF Exposure Guidance
RF Exposure Procedures and Equipment Authorization Policies for
Mobile and Portable Devices

2 Summary

This RF-exposure evaluation according to the – in chapter 1 - mentioned rule parts and KDB shows, that the worst-case RF exposure values of the assessed radio technologies and bands are below the exemption limits of the mentioned rule parts. The following exemption rule part(s) were selected:

☐	1-mW Test Exemption, § 1.1307(b)(3)(i)(A) 447498 D04 Interim General RF Exposure Guidance v01, 2.1.2 Per § 1.1307(b)(3)(i)(A), a single RF source is <i>exempt RF device</i> (from the requirement to show data demonstrating compliance to RF exposure limits, as previously mentioned) if the available maximum time-averaged power is no more than 1 mW, regardless of separation distance. This exemption applies to all operating configurations and exposure conditions, for the frequency range 100 kHz to 100 GHz, regardless of fixed, mobile, or portable device exposure conditions. This is a standalone exemption, and it cannot be applied in conjunction with any other test exemption.
☒	MPE based test exemption, § 1.1307(b)(3)(i)(C) 447498 D04 Interim General RF Exposure Guidance v01, 2.1.4 An alternative to the SAR-based exemption is provided in § 1.1307(b)(3)(i)(C), for a much wider frequency range, from 300 kHz to 100 GHz, applicable for separation distances greater or equal to $\lambda/2\pi$, where λ is the free-space operating wavelength in meters. The MPE-based test exemption condition is in terms of ERP, defined as the product of the maximum antenna gain and the delivered maximum time-averaged power. For this case, a RF source is an <i>RF exempt device</i> if its ERP (watts) is no more than a frequency-dependent value, as detailed tabular form in Appendix B. These limits have been derived based on the basic specifications on Maximum Permissible Exposure (MPE) considered for the FCC rules in § 1.1310(e)(1).
☐	SAR based test exemption, § 1.1307(b)(3)(i)(B) 447498 D04 Interim General RF Exposure Guidance v01, 2.1.3 A more comprehensive exemption, considering a variable power threshold that depends on both the <i>separation distance</i> and power, is provided in § 1.1307(b)(3)(i)(B). This exemption is applicable to the frequency range between 300 MHz and 6 GHz, with <i>test separation distances</i> between 0.5 cm and 40 cm, and for all RF sources in fixed, mobile, and portable device exposure conditions. Accordingly, a RF source is considered an <i>RF exempt device</i> if its available maximum time-averaged (matched conducted) power or its effective radiated power (ERP), whichever is greater, are below a specified threshold. This exemption threshold was derived based on general population 1-g SAR requirements.
☐	1-mW Test Exemption for Multiple Sources, § 1.1307(b)(3)(ii)(A) 447498 D04 Interim General RF Exposure Guidance v01, 2.2.1
☐	Simultaneous Transmission with both SAR-based and MPE-Based Test Exemptions, § 1.1307(b)(3)(ii)(B) 447498 D04 Interim General RF Exposure Guidance v01, 2.2.2

Declared separation distance by the applicant: 20 cm

Final Result:

According to the checked 47 CFR rule parts and KDB 447498 D04 v01 subchapters, the RF Exposure Test Exemptions apply.

All ratios – for the declared separation distances(s) - are below 1 ($\leq 100\%$).

Certification can be obtained without the need of showing data (measurements, or analytical/numerical modelling) to demonstrate RF Exposure compliance.

COMMENTS:

- The assessment is limited to supported North American frequency bands.



(responsible for accreditation scope)
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(responsible for report)
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3 Revision History

Report version control			
Version	Release date	Change Description	Version validity
initial	2026-08-25	--	valid
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4 Administrative Data

4.1 Testing Laboratory

Company Name: 7layers GmbH

Address: Borsigstr. 11
40880 Ratingen
Germany

Laboratory accreditation no: DAKkS D-PL-12140-01-00

ISED CAB Identifier DE0007; ISED#: 3699A

FCC Designation Number: DE0015

FCC Test Firm Registration: 929146

Responsible for accreditation scope: Dipl.-Ing. Marco Kullik

Report Template Version: 2026-02-04

4.2 Project Data

Responsible for report: Dipl.-Ing. Michael Albert

Date of Report: 2026-08-25

4.3 Applicant Data

Company Name: AUMOVIO Germany GmbH

Address: Siemensstraße 12
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Contact Person: Mr. Lothar Weigert

4.4 Manufacturer Data

Company Name: see Applicant Data

Address:

Contact Person:

5 Test object Data

Declared EUT data by the supplier	
Kind of Device product description	UWB (Ultra Wide Band) and BLE (Bluetooth Low Energy) transceiver module.
Product name	CMBTRX1
Type	-
HW	22/08.03
SW	06FF
Integrated transmitter	yes
supported Radio technologies	- BLE (Bluetooth Low Energy) transceiver - UWB (Ultra Wide Band)
Supplied document(s)	7layers test reports: - MDE_CONTI_2135_FCC_01 - MDE_CONTI_2519_FCC_02
Antennas	BLE: Integrated IFA (inverted-F antenna) with antenna gain: CH37 / CH38 / CH39 at 2402.0 MHz / 2426.0 MHz / 2480.0 MHz 5.8 dBi / 5.0 dBi / 5.0 dBi UWB: Integrated monopole antenna with antenna gains CH5 / CH6 / CH8 / CH9 at 6489.6 MHz / 6988.8 MHz / 7488.0 MHz / 7987.2 MHz Ant1: 6.8 dBi / 7.0 dBi / 6.5 dBi / 5.4 dBi Ant2: 3.9 dBi / 3.4 dBi / 5.0 dBi / 4.8 dBi
Supplied document(s)	Antenna data sheet: AUMOVIO: CMBTRX1_Antenna_information.pdf

6 Assessment

6.1 Assessment method and technologies of assessment

Specific information:

- Values used for calculation are based on supplied documents.
- Output power values are based on the supplied test reports and technical data sheet + tolerances.
- Antenna gain values are taken from the supplied data sheet.

Worst case considerations:

- Main beams of the antennas are directed to the same point in the prediction distance.
- Cable loss of internal antenna cables set to 0
- Duty factor Bluetooth low energy = 1
- UWB channel power calculation:

Peak Value (50 MHz RBW) [dBm EIRP]	Peak Value (50 MHz RBW) [mW EIRP]	Max. OBW [MHz]	Peak Channel Power @600 MHz [mW EIRP]	Peak Channel Power @600 MHz [dBm EIRP]	Peak Channel Power @600 MHz [dBm conducted]
-6.0	0.251	600	3.0	4.8	-2.0

- Duty factor UWB = 0.14
- The following radio technologies can transmit independently from each other:
 - o BLE +UWB

Selected bands for multi frequency exposure calculations:
worst case of each technology.

6.2 Single RF Source exemption limits

6.2.1 1 mW Blanket Exemption

The 1 mW Blanket Exemption of § 1.1307(b)(3)(i)(A) applies for single fixed, mobile, and portable RF sources with available maximum time-averaged power of no more than 1 mW, regardless of separation distance.

The 1 mW blanket exemption applies at separation distances less than 0.5 cm, including where there is no separation. This exemption shall not be used in conjunction with other exemption criteria other than those for multiple RF sources in paragraph § 1.1307(b)(3)(ii)(A).

The 1 mW exemption is independent of service type and covers the full range of 100 kHz to 100 GHz, but it shall not be used in conjunction with other exemption criteria or in devices with higher-power transmitters operating in the same time-averaging period. Exposure from such higher-power transmitters would invalidate the underlying assumption that exposure from the lower-power transmitter is the only contributor to SAR in the relevant volume of tissue.

6.2.2 MPE-based Exemption

General frequency and separation-distance dependent MPE-based effective radiated power (ERP) thresholds are in Table B.1 [Table 1 of § 1.1307(b)(1)(i)(C)] to support an exemption from further evaluation from 300 kHz through 100 GHz.

RF Source Frequency			Minimum Distance			Threshold ERP
f_L MHz		f_H MHz	$\lambda_L/2\pi$		$\lambda_H/2\pi$	W
0.3	-	1.34	159 m	-	35.6 m	$1920 R^2$
1.34	-	30	35.6 m	-	1.6 m	$3450 R^2/f^2$
30	-	300	1.6 m	-	159 mm	$3.83 R^2$
300	-	1500	159 mm	-	31.8 mm	$0.0128 R^2 f$
1500	-	100000	31.8 mm	-	0.5 mm	$19.2 R^2$

Subscripts L and H are low and high; λ is wavelength.
From § 1.1307(b)(3)(i)(C), modified by adding Minimum Distance columns

The table applies to any RF source (i.e., single fixed, mobile, and portable transmitters) and specifies power and distance criteria for each of the five frequency ranges used for the MPE limits. These criteria apply at separation distances from any part of the radiating structure of at least $\lambda/2\pi$. The thresholds are based on the general population MPE limits with a single perfect reflection, outside of the reactive near-field, and in the main beam of the radiator. For mobile devices that are not exempt per Table B.1 [Table 1 of § 1.1307(b)(1)(i)(C)] at distances from 20 cm to 40 cm and in 0.3 GHz to 6 GHz, evaluation of compliance with the exposure limits in § 1.1310 is necessary if the ERP of the device is greater than ERP_{20cm} in Formula (B.1) [repeated from § 2.1091(c)(1) and § 1.1307(b)(1)(i)(B)].

$$P_{th} (mW) = ERP_{20cm} (mW) = \begin{cases} 2040f & 0.3 \text{ GHz} \leq f < 1.5 \text{ GHz} \\ 3060 & 1.5 \text{ GHz} \leq f \leq 6 \text{ GHz} \end{cases} \quad (\text{B.1})$$

If the ERP is not easily obtained, then the available maximum time-averaged power may be used (i.e., without consideration of ERP only if the physical dimensions of the radiating structure(s) do not exceed the electrical length of $\lambda/4$ or if the antenna gain is less than that of a half-wave dipole.

SAR-based exemptions are constant at separation distances between 20 cm and 40 cm to avoid discontinuities in the threshold when transitioning between SAR-based and MPE-based exemption criteria at 40 cm, considering the importance of reflections.

6.2.3 SAR-based Exemption

SAR-based thresholds are derived based on frequency, power, and separation distance of the RF source. The formula defines the thresholds in general for either available maximum time-averaged power or maximum time-averaged ERP, whichever is greater.

If the ERP of a device is not easily determined, such as for a portable device with a small form factor, the applicant may use the available maximum time-averaged power exclusively if the device antenna or radiating structure does not exceed an electrical length of $\lambda/4$.

As for devices with antennas of length greater than $\lambda/4$ where the gain is not well defined, but always less than that of a half-wave dipole (length $\lambda/2$), the available maximum time-averaged power generated by the device may be used in place of the maximum time-averaged ERP, where that value is not known.

The separation distance is the smallest distance from any part of the antenna or radiating structure for all persons, during operation at the applicable ERP. In the case of mobile or portable devices, the separation distance is from the outer housing of the device where it is closest to the antenna.

The SAR-based exemption formula of § 1.1307(b)(3)(i)(B), repeated here as Formula (B.2), applies for single fixed, mobile, and portable RF sources with available maximum time-averaged power or effective radiated power (ERP), whichever is greater, of less than or equal to the threshold P_{th} (mW).

This method shall only be used at separation distances from 0.5 cm to 40 cm and at frequencies from 0.3 GHz to 6 GHz (inclusive). P_{th} is given by Formula (B.2).

$$P_{th} \text{ (mW)} = \begin{cases} ERP_{20cm} \left(\frac{d}{20cm}\right)^x & d \leq 20 \text{ cm} \\ ERP_{20cm} & 20 \text{ cm} < d < 40 \text{ cm} \end{cases} \quad (\text{B.2})$$

where

$$x = -\log_{10} \left(\frac{60}{ERP_{20cm} \sqrt{f}} \right)$$

and f is in GHz, d is the separation distance (cm), and ERP_{20cm} is per Formula (B.1).

6.3 Multiple RF Source exemption limits

6.3.1 1-mW Test Exemption for Multiple Sources

The available maximum time-averaged power of each source is no more than 1 mW and there is a separation distance of two centimeters between any portion of a radiating structure operating and the nearest portion of any other radiating structure in the same device, except if the sum of multiple sources is less than 1 mW during the time-averaging period, in which case they may be treated as a single source (separation is not required). This exemption may not be used in conjunction with other exemption criteria other than those in paragraph (b)(3)(i)(A) of this section. Medical implant devices may only use this exemption and that in paragraph (b)(3)(i)(A).

6.3.2 Simultaneous Transmission with both SAR-Based and MPE-Based exemption limits

Either SAR-based or MPE-based exemption may be considered for test exemption for fixed, mobile, or portable device exposure conditions; therefore, the contributions from each exemption in conjunction with the measured SAR (*Evaluated_k* term) shall be used to determine exemption for simultaneous transmission according to Formula (C.1) [repeated from § 1.1307(b)(3)(ii)(B)].

$$\sum_{i=1}^a \frac{P_i}{P_{th,i}} + \sum_{j=1}^b \frac{ERP_j}{ERP_{th,i}} + \sum_{k=1}^c \frac{Evaluated_k}{Exposure Limit_k} \leq 1 \quad (C.1)$$

- a number of fixed, mobile, or portable RF sources claiming exemption using the § 1.1307(b)(3)(i)(B) formula for P_{th} , including existing exempt transmitters and those being added.
- b number of fixed, mobile, or portable RF sources claiming exemption using the applicable § 1.1307(b)(3)(i)(C) Table 1 formula for Threshold ERP, including existing exempt transmitters and those being added.
- c number of existing fixed, mobile, or portable RF sources with known evaluation for the specified minimum distance
- P_i the available maximum time-averaged power or the ERP, whichever is greater, for fixed, mobile, or portable RF source i at a distance between 0.5 cm and 40 cm (inclusive).
- $P_{th,i}$ the exemption threshold power (P_{th}) according to the § 1.1307(b)(3)(i)(B) formula for fixed, mobile, or portable RF source i .
- ERP_j the available maximum time-averaged power or the ERP, whichever is greater, of fixed, mobile, or portable RF source j .
- $ERP_{th,i}$ exemption threshold ERP for fixed, mobile, or portable RF source j , at a distance of at least $\lambda/2n$, according to the applicable § 1.1307(b)(3)(i)(C) Table 1 formula at the location in question.
- $Evaluated_k$ the maximum reported SAR or MPE of fixed, mobile, or portable RF source k either in the device or at the transmitter site from an existing evaluation.
- $Exposure Limit_k$ either the general population/uncontrolled maximum permissible exposure (MPE) or specific absorption rate (SAR) limit for each fixed, mobile, or portable sources, as applicable

The sum of the ratios of the applicable terms for SAR-based, MPE-based and measured SAR or MPE shall be less than 1, to determine simultaneous transmission exposure compliance.

6.4 Calculation

6.4.1 Calculation of single-frequency exposures

Table 1: Single RF Sources Subject to Routine Environmental Evaluation
Limit: FCC §1.1307(b)(3)(i)(C), Table 1

Prediction Distance d in cm =>	20															
		TX frequ. band	Prediction frequ.	Maximum Conducted Power during Transmission	Duty factor (lin.)	Duty factor (log.)	Average (temporal) power (log.)	Average (temporal) power (lin.)	Gain (log.)	Gain (log.)	Gain (lin.)	Minimum Distance	ERP Power	ERP Power limit at distance d & frequency f _i	Ratio to exposure reference level	Compliance, if ERP _i /ERP _{Thi} < 1
		f _{Band}	f _i	P _{dBm}	-	-	P _{dBm}	P _{mW}	g _{dBi}	g _{dBd}	G _d	R	ERP _i	ERP _{Thi}	ERP _i /ERP _{Thi}	-
Radio technology	Band	MHz	MHz		-	dB	dBm	mW	dB _i	dB _d	-	m	mW	mW	-	-
Bluetooth LE	2.4 GHz ISM	2402 - 2480	2402.0	3.3	1.000	0.0	3.3	2.14	5.8	3.66	2.32	0.02	4.966	768.000	0.006466	Pass
UWB	3.1 GHz – 10.6 GHz	6489.6 - 7987.2	6489.6	-2.0	0.140	-8.5	-10.569	0.09	6.8	4.66	2.92	0.01	0.25652	768.000	0.000334	Pass

Bold marked = worst case band of the radio technology

6.4.2 Calculation of multi-frequency exposures

Table 1: Multi RF Sources Subject to Routine Environmental Evaluation (all MPE exempted)
Limit: FCC §1.1307(b)(3)(ii)(B)

Prediction Distance d in cm =>	20	TX frequ. band	Prediction frequ.	Maximum Conducted Power during Transmission	Duty factor (lin.)	Duty factor (log.)	Average (temporal) power (log.)	Average (temporal) power (lin.)	Gain (log.)	Gain (log.)	Gain (lin.)	Minimum Distance	ERP Power	ERP Power limit at distance d & frequency f _i	Ratio to exposure reference level	Sum of ERP _i / ERP _{Thi}	Compliance, if Sum of ERP _i / ERP _{Thi} < 1
		f _{Band}	f _i	P _{dBm}	-	-	P _{dBm}	P _{mW}	g _{dBi}	g _{dBd}	G _d	R	ERP _i	ERP _{Thi}	ERP _i / ERP _{Thi}	-	-
Radio technology	Band	MHz	MHz		-	dB	dBm	mW	dBi	dBd	-	m	mW	mW	-	-	-
Bluetooth LE	2.4 GHz ISM	2402 - 2480	2402.0	3.3	1.000	0.0	3.3	2.14	5.8	3.66	2.32	0.02	4.966	768.000	0.006466	0.0068000	Pass
UWB	3.1 GHz – 10.6 GHz	6489.6 - 7987.2	6489.6	-2.0	0.140	-8.5	-10.569	0.09	6.8	4.66	2.92	0.01	0.25652	768.000	0.000334		

*****END OF REPORT*****