



BNetzA-CAB-02/21-102



RF Exposure Evaluation according to KDB 447498 D04 v01

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Certification numbers and labeling requirements	
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Document authorised:



Alexander Hnatovskiy
Lab Manager
Radio Labs



Marco Scigliano
Testing Manager
Radio Labs

1. SAR-Based Exemption (KDB 447498 D04 Interim General RF Exposure Guidance v01)

..2.1.3 SAR-Based Exemption

A more comprehensive exemption, considering a variable power threshold that depends on both the separation distance 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 test separation distances 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 RF exempt device 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 and is detailed in Appendix C.

..B.4 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).

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

where

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

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

The example values shown in Table B.2 are for illustration only.

Table B.2—Example Power Thresholds (mW)

Frequency (MHz)	Distance (mm)									
	5	10	15	20	25	30	35	40	45	50
300	39	65	88	110	129	148	166	184	201	217
450	22	44	67	89	112	135	158	180	203	226
835	9	25	44	66	90	116	145	175	207	240
1900	3	12	26	44	66	92	122	157	195	236
2450	3	10	22	38	59	83	111	143	179	219
3600	2	8	18	32	49	71	96	125	158	195
5800	1	6	14	25	40	58	80	106	136	169

2. EUT technologies

Declared minimum safety distance: 20 cm

MPE based exempted technologies:

Technologies:	Max. power		Antenna gain max.: [dBi] *	Max EIRP for RF Exposure	#
	conducted	EIRP			
BT LE 2450 MHz	-/-	5.7 dBm	< 0 dB	5.7 dBm	A
Proprietary 941-959.7 MHz	-/-	11.94 dBm	< 0 dB	11.94 dBm	B

*) worst case of all antenna types, channels and modulations (overrated)

SRD Technology	Frequency [MHz]		Reference #	Output Power [dBm]			Power [mW]		Share of Limit %
	f _{Min}	f _{Max}		P _{cond}	P _{EIRP}	P _{RF Exp}	P _{Result}	P _{Limit}	
Bluetooth LE	2402	2480	A	N/A	5.70	5.7	3.72	768.00	0.48%
Proprietary	941	960	B	N/A	11.9	11.9	15.63	240.60	6.50%

Details and origins of the measurements shown in the table above:

#	Results from:	Additional information
A	1-6002_23-01-11-DRAFT	cetecom advanced GmbH
B	1-6002_23-01-19-DRAFT	cetecom advanced GmbH

3. Collocation

Technology	Share of Limit
Proprietary	6.50%
Bluetooth Classic/LE	0.48%
Sum	6.98%

4. Conclusion

This prediction demonstrates the following:

The power density levels for FCC at a distance of 20 cm are below the maximum levels allowed by regulations.

Conclusion: RF exposure evaluation is not required.