



RF Exposure Evaluation according to KDB 447498 D01 v06 & FCC Rule 47 CFR 2.1093

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Certification numbers and labeling requirements	
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1. SAR test exclusion (KDB 447498 D01 General RF Exposure Guidance v06)

4.3.1. Standalone SAR test exclusion considerations

Unless specifically required by the *published RF exposure KDB procedures*, standalone 1-g head or body and 10-g extremity SAR evaluation for general population exposure conditions, by measurement or numerical simulation, is not required when the corresponding *SAR Test Exclusion Threshold* condition(s), listed below, is (are) satisfied. These test exclusion conditions are based on source-based time-averaged maximum conducted output power of the RF channel requiring evaluation, adjusted for tune-up tolerance, and the minimum *test separation distance* required for the exposure conditions. The minimum *test separation distance* defined in 4.1 f) is determined by the smallest distance from the antenna and radiating structures or outer surface of the device, according to the host form factor, exposure conditions and platform requirements, to any part of the body or extremity of a user or bystander. To qualify for SAR test exclusion, the *test separation distances* applied must be fully explained and justified, typically in the SAR measurement or SAR analysis report, by the operating configurations and exposure conditions of the transmitter and applicable host platform requirements, according to the required *published RF exposure KDB procedures*. When no other RF exposure testing or reporting are required, a statement of justification and compliance must be included in the equipment approval, in lieu of the SAR report, to qualify for SAR test exclusion. When required, the device specific conditions described in the other *published RF exposure KDB procedures* must be satisfied before applying these SAR test exclusion provisions; for example, handheld PTT two-way radios, handsets, laptops and tablets, etc.

- a) For 100 MHz to 6 GHz and *test separation distances* ≤ 50 mm, the 1-g and 10-g SAR test exclusion thresholds are determined by the following:

$[(\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm})] \cdot [\sqrt{f_{\text{(GHz)}}}] \leq 3.0$ for 1-g SAR, and ≤ 7.5 for 10-g extremity SAR, where

- $f_{\text{(GHz)}}$ is the RF channel transmit frequency in GHz
- Power and distance are rounded to the nearest mW and mm before calculation
- The result is rounded to one decimal place for comparison
- The values 3.0 and 7.5 are referred to as *numeric thresholds* in step b) below

The test exclusions are applicable only when the minimum *test separation distance* is ≤ 50 mm, and for transmission frequencies between 100 MHz and 6 GHz. When the minimum *test separation distance* is < 5 mm, a distance of 5 mm according to 4.1 f) is applied to determine SAR test exclusion.

- b) For 100 MHz to 6 GHz and *test separation distances* > 50 mm, the 1-g and 10-g SAR test exclusion thresholds are determined by the following (also illustrated in Appendix B):

- 1) $\{[\text{Power allowed at numeric threshold for 50 mm in step a)}] + [(\text{test separation distance} - 50 \text{ mm}) \cdot (f_{\text{(MHz)}}/150)]\}$ mW, for 100 MHz to 1500 MHz
- 2) $\{[\text{Power allowed at numeric threshold for 50 mm in step a)}] + [(\text{test separation distance} - 50 \text{ mm}) \cdot 10]\}$ mW, for > 1500 MHz and ≤ 6 GHz

- c) For frequencies below 100 MHz, the following may be considered for SAR test exclusion (also illustrated in Appendix C):

- 1) For *test separation distances* > 50 mm and < 200 mm, the power threshold at the corresponding test separation distance at 100 MHz in step b) is multiplied by $[1 + \log(100/f_{\text{(MHz)}})]$
- 2) For *test separation distances* ≤ 50 mm, the power threshold determined by the equation in c) 1) for 50 mm and 100 MHz is multiplied by $\frac{1}{2}$
- 3) SAR measurement procedures are not established below 100 MHz.

2. EUT technologies

Declared minimum safety distance: **<5 mm**

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}	
NFMI	3.84	3.84	B	1.36	1.36	1.3	1.36	572.93	0.24%
Bluetooth LE	2402	2480	A,B	-2.6	-7.0	-2.6	0.55	9.53	5.77%

Notes:

- Max rated conducted output power taken from customer's tune up info

Referenced Documents:

#	Results from:
A	1-9868-25-01-07_TR1-R01
B	DOC-10005468_3 - Operational Description

Collocation

Technology	Share of Limit
NFMI	0.23%
Bluetooth LE	5.77%
Sum	6.00%

Power Density evaluation(FCC Rule 47 CFR 2.1093)

$$S = PG / 4 \pi R^2$$

where: S = Power density
P = Power input to the antenna
G = Antenna gain
R = Distance to the center of radiation of the antenna
PG = Output power including antenna gain (EIRP)

The table below is excerpted from Table 1 - Limits for Maximum Permissible Exposure (MPE) - "General Population/Uncontrolled Exposure" according to § 1.1310(e)(1)

Frequency Range (MHz)	Power Density (mW/cm ²)	Averaging Time (minutes)
3.0-30	180/f ²	30
1500 – 3 000 000	1	30

where f = Frequency (MHz)

Prediction: worst case

	Technology	NFMI	Bluetooth LE	
	Frequency	3.84	2450	MHz
P·G	Meas. EIRP	1.36	-2.6	dBm
R	Distance	0.5	0.5	cm
S	MPE limit for uncontrolled exposure	12.2	1.0	mW/cm ²
	Calculated Power density:	0.4356	0.1750	mW/cm ²
	Calculated percentage of limit:	3.57%	17.50%	
	Sum Calculated percentage of limit:	21.07%		

This prediction demonstrates the following:

The power density levels for FCC at a distance of 3 cm are below the maximum levels allowed by regulations.

3. Conclusion

This prediction demonstrates the following:

The power & power density levels for FCC at a distance of <5 mm are below the maximum levels allowed by regulations.

Conclusion: RF exposure tests are not required.