

## SAR test exclusion considerations

Guidance Applied: KDB 447498 D01v06

### KDB 447498 D01 Section 4.3.1 Standalone SAR test exclusion considerations

a) For 100 MHz to 6 GHz and test separation distances  $\leq 50$  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  $\leq 7.5$  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  $\leq 50$  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  $\leq 6$  GHz

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

- 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  $\leq 50$  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.

### Determination of exemption according to KDB 447498 D01 Section 4.3.1 a)

Bluetooth, Bluetooth LE and WLAN

Mode	Transmitting Frequency (MHz)	Separation distance (mm)	ANT Gain (dBi)	Max. power with tune-up tolerance (dBm) <sup>Note1</sup>	Max. power with tune-up tolerance (mW)	Power thresholds	SAR test exclusion thresholds
Bluetooth(1Mbps)	2 480.00	5.0	1.38	9.75	9.440 6	2.97	3.00
Bluetooth LE(1Mbps)	2 480.00	5.0	1.38	4.50	2.818 4	0.89	3.00
WLAN(802.11g)	2 462.00	5.0	1.38	9.75	9.440 6	2.96	3.00
WLAN(802.11a)	5 240.00	5.0	2.80	7.90	6.166 0	2.82	3.00
WLAN(802.11a)	5 320.00	5.0	2.69	7.90	6.166 0	2.84	3.00
WLAN(802.11a)	5 720.00	5.0	2.29	7.90	6.166 0	2.95	3.00
WLAN(802.11a)	5 825.00	5.0	0.94	7.90	6.166 0	2.98	3.00

Note1: Please refer to the operation description for Max tune-up power.

### Determination of exemption according to KDB 447498 D01 Section 4.3.1 c)2)

13.56 MHz NFC

Transmitting Frequency (MHz)	Field strength (dBuV/m @3m)	Max Power[EIRP] (dBm)	Max power[EIRP] (mW)	Separation distance (mm)	Threshold at 50mm 4.3.1 a) In mW	Threshold per 4.3.1 b)1) in mW	Threshold per 4.3.1 c)2) in mW
13.56	66.3	-28.9	0.001 3	5.0	47.4	17.4	16.3

Note: EIRP was calculated using the following.

$$\text{EIRP} = E_{\text{Meas}} + 20\log(d_{\text{Meas}}) - 104.7$$

EIRP: equivalent isotropically radiated power, in dBm

$E_{\text{Meas}}$ : field strength of the emission at the measurement distance, in dBuV/m

$d_{\text{Meas}}$ : measurement distance, in m

**KDB 447498 D01 Section 4.3.2 Simultaneous transmission SAR test exclusion considerations**

b) When an antenna qualifies for the standalone SAR test exclusion of 4.3.1 and also transmits simultaneously with other antennas, the standalone SAR value must be estimated according to the following to determine the simultaneous transmission SAR test exclusion criteria:

- 1)  $[(\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm})] \cdot [\sqrt{f_{\text{(GHz)}}/x}] \text{ W/kg}$ , for test separation distances  $\leq 50 \text{ mm}$ ;  
 where  $x = 7.5$  for 1-g SAR and  $x = 18.75$  for 10-g SAR.
- 2)  $0.4 \text{ W/kg}$  for 1-g SAR and  $1.0 \text{ W/kg}$  for 10-g SAR, when the test separation distance is  $> 50 \text{ mm}$ .

**Calculations for Simultaneous Transmission (Worst case)**

Mode	Transmitting Frequency (MHz)	Separation distance (mm)	Max. power (mW)	Estimated SAR value(W/kg)	Sum of SAR value(W/kg)	Requirement (W/kg)	Note
WLAN(802.11a)	5 825.00	5.0	9.440 6	0.396 8	0.396 9	1.6	-
NFC	13.56	5.0	0.001 3	0.000 1			-

Sample Calculation

$$\text{Estimated SAR value(W/kg)} = [(9.440 6 \text{ mW}) / (5 \text{ mm})] \cdot [\sqrt{5.825 \text{ (GHz)} / 7.5}] \text{ W/kg} = 0.396 8 \text{ W/kg}$$

**Conclusion:** SAR evaluation for general population exposure conditions by measurement or numerical simulation is not required