
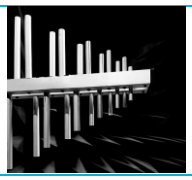
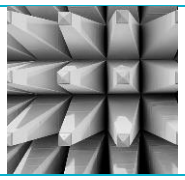

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BNetzA-CAB-02/21-102

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SAR Test exclusion documentation according to FCC KDB 447498

Report identification number: 1-5216/22-01-05 Exclusion (FCC)

contains the module with the following certification numbers	
FCC ID	OKY12117810A01A

This test report is electronically signed and valid without handwritten signature. For verification of the electronic signatures, the public keys can be requested at the testing laboratory.

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EUT technologies:

Technologies:	Max. declared cond. AVG Power	Max. measured EIRP	Antenna gain
NFC 125 kHz	22.08 dBm (=161.4mW)	-12.0 dBµV (Peak)@300m = - 67.30 dBm [1)]	< 0 dBi
NFC 13.56 MHz	18.88 dBm (=77.2mW)	44.18 dBµV (Peak)@30m = -31.0 dBm [2)]	< 0 dBi
BT LE 2450	2.62 dBm (=1.83mW)	- 3.85 dBm [3)]	< 0 dBi

NOTE:
The measured PEAK EIRP according [1)] , [2)] , [3)] proofs that the EUT antenna gain is far below 0dBi and that considering the max. declared output power is by far larger than the EIRP. Conducted values will be used for the RF exposure calculation. EIRP values are for information only.

The following table shows the max. declared Peak values and duty corrections for NFC 125 kHz / 13.56 MHz and BT LE:

Technology	Max. decl. cond. Peak power: [dBm] [5)]	Duty cycle [4)] [%]	Max. declared cond. AVG Power [dBm]
NFC 125 kHz	200 mW	80.7	161.4 mW
NFC 13.56 MHz	400 mW	19.3	77.2 mW
BT LE [3)]	3.98 mW	46.0	1.83 mW

[1)] Test results for EIRP taken from CTC advanced GmbH report 1-5216/22-01-03. (page 19)

[2)] Test results for EIRP taken from CTC advanced GmbH report 1-5216/22-01-03. (page 20)

[3)] BT LE result provided by manufacturer (Datasheet for Silicon Labs BGM220S)
Duty Cycle is the typical BT LE peak to average ratio of 46%.

[4)] The duty cycles can be found in Annex A of this document.

[5)] Max. output power for the125 kHz circle is 200 mW according customer declaration.

Collocation:

Note: NFC 125 kHz and 13.56 MHz can be active at the same time, but only with interleaving of packages switched on board level. That means that they don't transmit at the same time.

Active scenario: / **Technology**	**1**	**2**	**3**	**4**
NFC 125 kHz / 13.56 MHz	x		x	
BT LE	x	x		

SAR test exclusion according to KDB447498 (General RF Exposure Guidance v06)

Equation from Chapter 4.3.1: Standalone SAR test exclusion considerations page 11 and ff.

BT LE:

(1) Standalone SAR test exclusion for 100 MHz to 6 GHz at test separation distances ≤ 50mm

$$(Threshold_{1\text{-}g;10\text{-}g}) \times d_{seperation} / f^{0.5}$$

where

$Threshold_{1\text{-}g;10\text{-}g}$ is 3 for 1-g; 7.5 for 10-g
$d_{seperation}$ is the min. test separation distance; 5mm is used if the distance is less
f is the RF channel transmit frequency

The table below gives the calculated maximal power that could be used for source based time averaged conducted or radiated power, adjusted for tune up tolerance. If this is at or below the calculated value the DUT is exempted from SAR evaluation.

frequency [MHz]	$d_{separation}$ [mm]	$Threshold_{1\text{-}g}$	Powerlimit [mW]	$P_{max\text{-}declared}$		Exclusion
				[dBm]	[mW]	
2450.00	**5**	3	9.58	2.62	1.83	yes

NFC:

(c) (2) Standalone SAR test exclusion below 100 MHz < 50mm

$$0.5 \times (Threshold_{100MHz}) \times (1+\log(100/f))$$

where

$Threshold_{1\text{-}g;10\text{-}g}$ is 3 for 1-g; 7.5 for 10-g
f is the RF channel transmit frequency
$Threshold_{100MHz,50mm}$ is $Threshold_{1\text{-}g;10\text{-}g} \times d / f^{0.5}$; with f = 100MHz and d=50mm

The table below gives the calculated maximal power that could be used for source based time averaged conducted power, adjusted for tune up tolerance. If this is below the calculated value
SAR testing is excluded.

frequency [MHz]	Threshold1-g;10-g	$Threshold_{100MHz,50mm}$	Powerlimit [mW]	$P_{max\text{-}declared}$		Exclusion
				[dBm]	[mW]	
0.13	3	474.34	925.70	22.08	161.4	yes
13.56	3	474.34	442.97	18.88	77.3	yes

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Collocation:

Overview:

Technology , [MHz]	NFC, 125 kHz	NFC, 13.56 MHz	BT LE
Exemption based on	SAR exclusion		
Limit EIRP [mW]:	925.7	442.97	9.58
Result EIRP [mW]:	161.4	77.2	1.83
Limit-Exhaustion [%]	17.4	17.4	19.1
Collocated percentage [%] [NFC 13.56 MHz + BT LE]	36.5		
Verdict:	Pass		

NOTE:
NFC 125 kHz and 13.56 MHz do not transmit the same time.

This prediction demonstrates the following:

The power density levels for FCC that are larger than the minimum safety-distances stated above, are below the maximum levels allowed by regulations.

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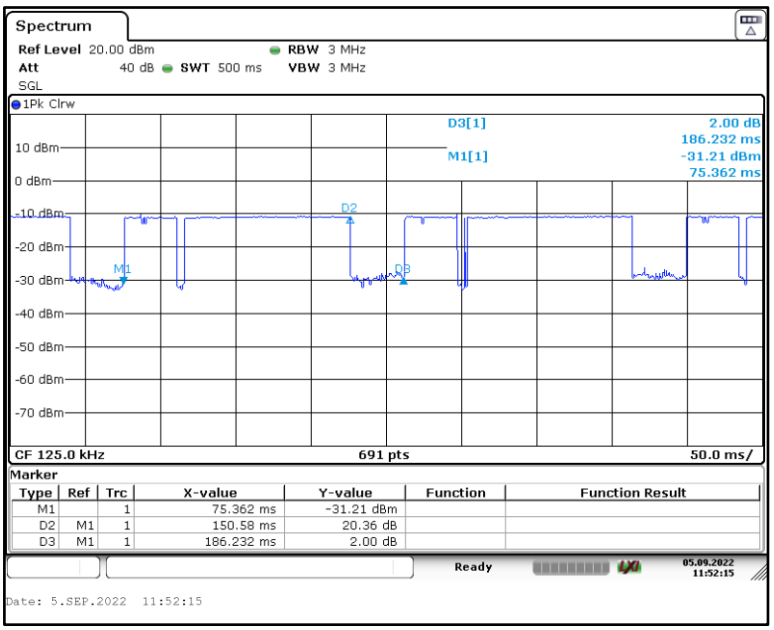
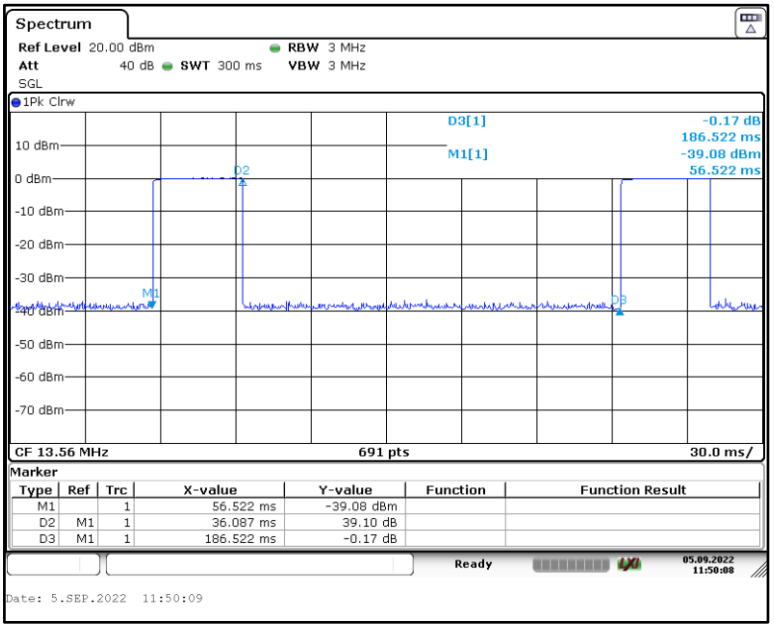
Annex A: Duty cycles

Duty cycle 125 kHz of the EUT:



Duty Cycle 80.7%

Duty cycle 13.56 MHz of the EUT:



Duty Cycle 19.3%

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