

Product Name : U-Prox access control system
FCC ID : 2BLQF-482026137ECX

BLE:

RF Exposure evaluation

According to 447498 D04 Interim General RF Exposure Guidance v01

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

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

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

BLE:

Ant gain = 4 dBi

MAX output power : -1.076dBm@2480MHz

ERP=-1.076+4-2.15=0.774dBm

WORSE CASE:

$10^{0.0774} = 1.195 \text{ mW} < 2.79 \text{ mW}$

Then SAR evaluation is not required

NFC&RF ID:

The device as documented in the exhibits for FCC ID: 2BLQF-482026137ECX contains a NFC transmitter operating at 13.56 MHz and a RF ID operating at 125 kHz. The following RF exposure evaluation is in accordance with the guidance as provided in KDB Publication 447498 D01 General RF Exposure Guidance v06. The NFC transmitter can not simultaneously transmit with the WPT transmitter.

Determination of the SAR test exclusion power thresholds:

KDB Publication 447498 D01 General RF Exposure Guidance v06 Clause 4.3.1 - Standalone SAR test exclusion considerations

Clause 4.3.1 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:

$$\left(\frac{\text{max. power of channel, including tune-up tolerance, mW}}{\text{min. test separation distance, mm}} \right) \times \sqrt{f_{(\text{GHz})}} \leq 3.0 \text{ for 1-g SAR or } \leq 7.5 \text{ for 10-g extremity SAR}$$

$$\text{max. power of channel, including tune-up tolerance, mW} \leq \left(\frac{3.0}{\sqrt{f_{(\text{GHz})}}} \right) \times (\text{min. test separation distance, mm})$$

$$f_{(\text{GHz})} = 0.1 ; \text{ Minimum test separation distance} = 50 \text{ mm}$$

$$1\text{-g SAR test exclusion power threshold: max. power of channel, including tune-up tolerance, mW} \leq \left(\frac{3.0}{\sqrt{0.1}} \right) \times 50$$

$$1\text{-g SAR test exclusion power threshold: max. power of channel, including tune-up tolerance, mW} \leq 475 \text{ mW}$$

Clause 4.3.1 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:

Clause 4.3.1 b) 1):

$$\text{Power allowed at numeric threshold for 50 mm in step 4.3.1 a)} + \left((\text{test separation distance} - 50 \text{ mm}) \times \left(\frac{f_{(\text{MHz})}}{150} \right) \right) \text{ mW for 100 MHz to 1500 MHz}$$

$$f_{(\text{MHz})} = 100$$

$$\text{Minimum test separation distance} = 50 \text{ mm}$$

$$1\text{-g SAR test exclusion power threshold: } 475 \text{ mW} + \left((50 - 50) \times \left(\frac{100}{150} \right) \right) \text{ mW for 100 MHz to 1500 MHz}$$

$$1\text{-g SAR test exclusion power threshold: } 475 \text{ mW for 100 MHz to 1500 MHz}$$

Clause 4.3.1 c):

For frequencies below 100 MHz, the following may be considered for SAR test exclusion:

Clause 4.3.1 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 4.3.1 b) is multiplied by:

NFC:

$$\left(1 + \log\left(\frac{100}{f_{\text{MHz}}}\right)\right)$$

f (MHz) = 13.56 ; 1-g SAR test exclusion threshold obtained in step 4.3.1 b) 1): 475 mW

1-g SAR test exclusion power threshold for step 4.3.1 c) 1) is:

$$475 \text{ mW} \times \left(1 + \log\left(\frac{100}{f_{\text{MHz}}}\right)\right) = 475 \text{ mW} \times \left(1 + \log\left(\frac{100}{13.56}\right)\right) = 475 \text{ mW} \times (1 + \log(7.375)) = 475 \text{ mW} \times 1.868 = 888 \text{ mW}$$

RF ID:

$$\left(1 + \log\left(\frac{100}{f_{\text{MHz}}}\right)\right)$$

f (MHz)=0.125; 1-g SAR test exclusion threshold obtained in step 4.3.1 b) 1): 475 mW

1-g SAR test exclusion power threshold for step 4.3.1 c) 1) is:

$$475 \text{ mW} \times (1 + \log(100/f(\text{MHz}))) = 475 \text{ mW} \times 3.90309 = 1854 \text{ mW}$$

Clause 4.3.1 c) 2):

For test separation distances ≤ 50 mm, the power threshold determined by the equation in 4.3.1 c) 1) for 50 mm and 100 MHz is multiplied by $\frac{1}{2}$:

NFC:

1-g SAR test exclusion power threshold for step 4.3.1 c) 2) is: $888 \text{ mW} \times \frac{1}{2} = 443 \text{ mW}$ (for operation on 13.56 MHz and where the minimum separation distance between the user and the transmitter is $\leq 50 \text{ mm}$).

Conversion of measured field strength on 13.56 MHz (NFC) from dBuV/m to mW:

If D is 3 mm as in Equation (39):

$EIRP [\text{dBm}] = E [\text{dBuV/m}] - 95.2$, $E = 62.70 \text{ dBuV/m} @ 3 \text{ m}$

$EIRP = 62.70 \text{ dBuV/m} @ 3 \text{ m} - 95.2 = -32.5 \text{ dBm} = 0.000562 \text{ mW}$

Conclusion:

The 1-g SAR test exclusion power threshold for operation on 13.56 MHz, and where the minimum separation distance between the user and the transmitter is $\leq 50 \text{ mm}$, is: 443 mW

The radiated RF output power of the NFC transmitter as contained in FCC ID:

2BLQF-482026137ECX is determined as being:

0.000562 mW.

The NFC transmitter as contained in FCC ID: 2BLQF-482026137EOG is deemed to comply with CFR 47, Part 1.1310 (Radiofrequency radiation exposure limits) and therefore meets the requirement for portable devices as stipulated by CFR 47, Part 2.1093.

RF ID:

1-g SAR test exclusion power threshold for step 4.3.1 c) 2) is: $1854 \text{ mW} \times \frac{1}{2} = 926 \text{ mW}$ (for operation on 0.125 MHz and where the minimum separation distance between the user and the transmitter is $\leq 50 \text{ mm}$).

Conversion of measured field strength on 0.125 MHz (RF ID) from dBuV/m to mW:

If D is 3 mm as in Equation (39):

$EIRP [\text{dBm}] = E [\text{dBuV/m}] - 95.2$, $E = 72.50 \text{ dBuV/m} @ 3 \text{ m}$

$EIRP = 72.50 \text{ dBuV/m} @ 3 \text{ m} - 95.2 = -22.7 \text{ dBm} = 0.005370 \text{ mW}$

Conclusion:

The 1-g SAR test exclusion power threshold for operation on 0.125 MHz, and where the minimum separation distance between the user and the transmitter is $\leq 50 \text{ mm}$, is: 926 mW

The radiated RF output power of the NFC transmitter as contained in FCC ID:

2BLQF-482026137ECX is determined as being:

0.005370 mW.

The NFC transmitter as contained in FCC ID: 2BLQF-482026137ECX is deemed to comply with CFR 47, Part 1.1310 (Radiofrequency radiation exposure limits) and therefore meets the requirement for portable devices as stipulated by CFR 47, Part 2.1093.

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	KDB Publication	MAX output power	Ant Gain	WORSE CASE	Distance	Limit	Result
BLE	447498 D04 Interim General RF Exposure Guidance v01	-1.076dBm @2402MHz	4 dBi	1.195mW	5 mm	2.79mW	Pass
NFC	447498 D01 General RF Exposure Guidance v06	62.70 dBuV/m @3m, 13.56MHz	4 dBi	0.000562 mW	5 mm	443 mW	Pass
RF ID	447498 D01 General RF Exposure Guidance v06	72.50 dBuV/m @3m, 0.125MHz	4 dBi	0.005370 mW	5 mm	926 mW	Pass