

Maximum Permissible Exposure (MPE) & Exposure evaluation

Report identification number: 1-1467/20-04-09 Exemption / MPE (FCC)

Certification numbers and labeling requirements	
FCC ID	2AHPPAPX01

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1. EUT technologies

Cellular Technology	Frequency Band [MHz]		Output Power [dBm]		Corrected EIRP for RF Exposure [dBm]	Referenced Document
	Min.	Max.	Max Rated	EIRP		
LTE Band 2	1850	1910	24.0	30.0	30.0	A, B
LTE Band 4	1710	1755	24.0	30.0	30.0	A, B
LTE Band 5	824	849	24.0	30.0	30.0	A, B
LTE Band 7	2500	2570	24.0	30.0	30.0	A, B
LTE Band 12	699	716	24.0	30.0	30.0	A, B
LTE Band 13	777	787	24.0	30.0	30.0	A, B
LTE Band 14	788	798	24.0	30.0	30.0	A, B
LTE Band 25	1850	1915	24.0	30.0	30.0	A, B
LTE Band 26	814	849	24.0	30.0	30.0	A, B
LTE Band 66	1710	1780	24.0	30.0	30.0	A, B
LTE Band 71	663	698	24.0	30.0	30.0	A, B

Referenced Documents:

#	Results from:
A	RC7611 Module MPE Evaluation (Module's MPE, FCC ID: N7NRC76B)
B	airprime_wp76xx_product_technical_specification_rev11_0.pdf provided by customer

SRD Technology	Frequency Band [MHz]		Output Power Radiated (Average)		EIRP for RF Exposure [dBm]	Referenced Document
	Min.	Max.	ERP	EIRP		
Bluetooth Classic	2402	2480	N/A	8.2	8.2	C
Bluetooth LE	2402	2480	N/A	6.6	6.6	D
WLAN 2.4 GHz	2412	2462	N/A	23.8	23.8	E

Referenced Documents:

#	Results from:
C	Test Report 1-1467_20-04-05 (CTC)
D	Test Report 1-1467_20-04-06 (CTC)
E	MPE SA151228C18B (taken from original module with FCC ID: VPYLB1DX)

SRD Technology	Frequency Band [MHz]		Output Power [dBm]		Power for RF Exposure [dBm]	Referenced Document
	Min.	Max.	Cond.	EIRP		
RFID 13.56 MHz	13.56	13.56	19.7	-29.6	19.7	F

Note:

- According to section 4.3 of 447498 D01 v06 SAR test exclusion conditions are based on source-based time-averaged maximum conducted output power of the RF channel.
- Conducted output power provided by customer (see Annex A): $P = U I = 3.1 \text{ V} \times 30 \text{ mA} = 19.7 \text{ dBm}$
- Radiated output power measured in lab (see Annex B, C): 55.22 dBμV @ 10 m

Referenced Documents:

#	Results from:
F	Test Report 1-1467_20-04-02

2. MPE at given distance (KDB 447498 D01 General RF Exposure Guidance v06)

Equation from page 18 of OET Bulletin 65, Edition 97-01

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

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

The table below is excerpted from Table 1B of 47 CFR 1.1310 titled "Limits for Maximum Permissible Exposure (MPE), Limits for General Population/Uncontrolled Exposure"

Frequency Range (MHz)	Power Density (mW/cm ²)	Averaging Time (minutes)
300 -1500	f/1500	30
1500 - 100000	1.0	30

where f = Frequency (MHz)

Declared minimum safety distance: **20 cm**

Cellular Technology	Frequency Band [MHz]		Distance [cm]	EIRP for RF Exposure [dBm]	Power Density [mW/cm ²]		Share of Limit [%]
	Min.	Max.			Caculated	Limit	
LTE Band 2	1850	1910	20	30.0	0.20	1.00	19.90%
LTE Band 4	1710	1755	20	30.0	0.20	1.00	19.90%
LTE Band 5	824	849	20	30.0	0.20	0.55	36.23%
LTE Band 7	2500	2570	20	30.0	0.20	1.00	19.90%
LTE Band 12	699	716	20	30.0	0.20	0.47	42.71%
LTE Band 13	777	787	20	30.0	0.20	0.52	38.43%
LTE Band 14	788	798	20	30.0	0.20	0.53	37.89%
LTE Band 25	1850	1915	20	30.0	0.20	1.00	19.90%
LTE Band 26	814	849	20	30.0	0.20	0.54	36.68%
LTE Band 66	1710	1780	20	30.0	0.20	1.00	19.90%
LTE Band 71	663	698	20	30.0	0.20	0.44	45.03%

SRD Technology	Frequency Band [MHz]		Distance [cm]	EIRP for RF Exposure [dBm]	Power Density [mW/cm ²]		Share of Limit [%]
	Min.	Max.			Caculated	Limit	
Bluetooth Classic	2402	2480	20	8.2	0.00	1.00	0.13%
Bluetooth LE	2402	2480	20	6.6	0.00	1.00	0.09%
WLAN 2.4 GHz	2412	2462	20	23.8	0.05	1.00	4.77%

3. 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 and tables in Annex C.

(c) (1) Standalone SAR test exclusion below 100 MHz at test separation distances > 50mm and < 200mm

$$(\text{Threshold}_{100\text{MHz} > 50\text{mm}}) \times (1 + \log(100/f))$$

where

$\text{Threshold}_{1\text{-g}; 10\text{-g}}$ is 3 for 1-g; 7.5 for 10-g
 $d_{\text{separation}}$ is the min. test separation distance (>50mm and <200mm)
 f is the RF channel transmit frequency
 $\text{Threshold}_{50\text{mm}; 100\text{MHz} < 50\text{mm}}$ is $\text{Threshold}_{1\text{-g}; 10\text{-g}} \times d / f^{0.5}$
 with $f = 100\text{MHz}$ and $d=50\text{mm}$
 $\text{Threshold}_{100\text{MHz} > 50\text{mm}}$ is $(\text{Threshold}_{50\text{mm}; 100\text{MHz} < 50\text{mm}}) + (d_{\text{separation}} - 50\text{mm}) \times f / 150$
 with $f = 100\text{MHz}$

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.

SRD Technology	Frequency Band [MHz]		Distance [mm]	EIRP for RF Exposure [dBm]	Power [mW]		Share of Limit [%]
	Min.	Max.			Calculated	Limit	
RFID 13.56 MHz	13.56	13.56	199	19.7	93.33	1071.48	8.71%

4. Collocation overview:

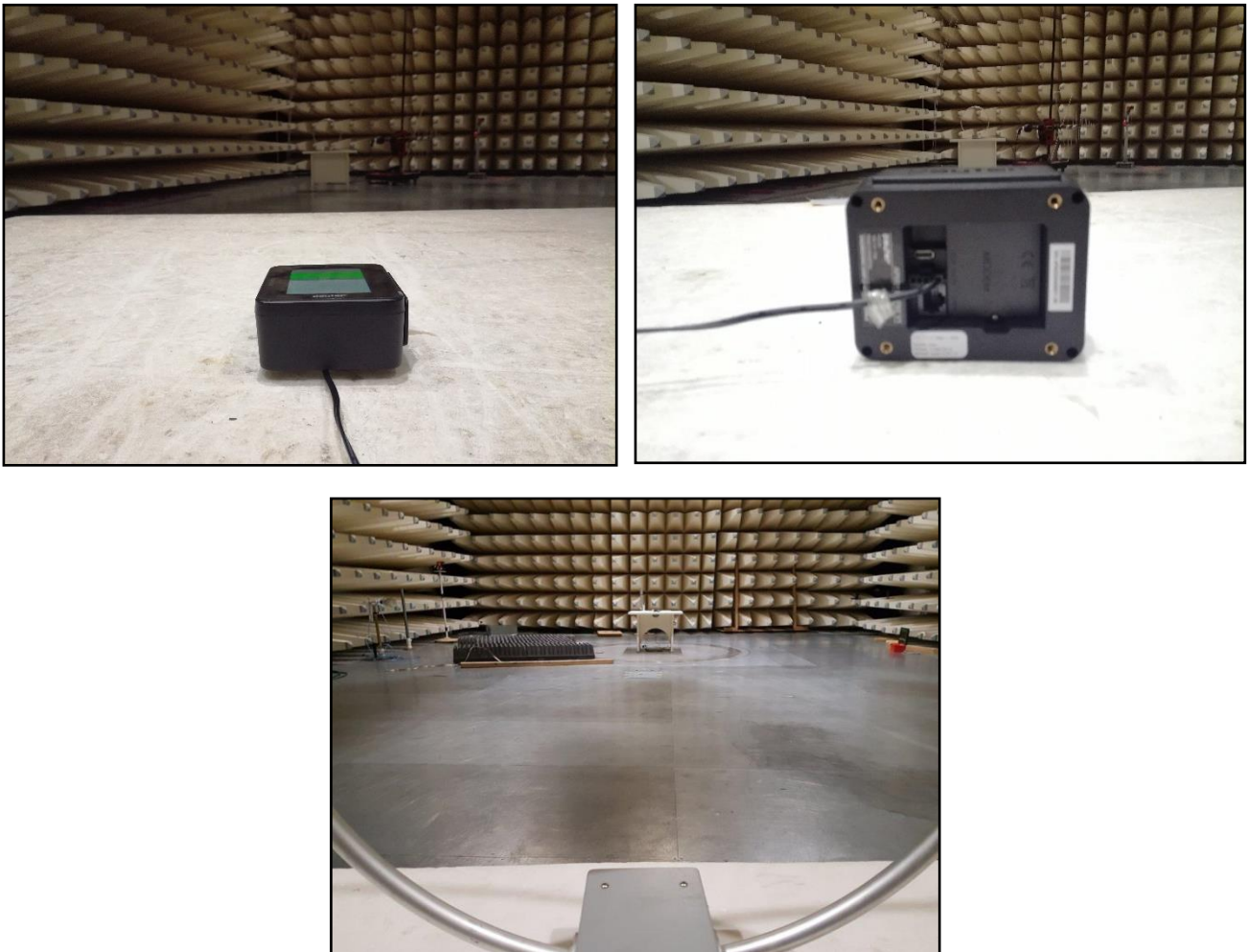
Technology	Share of Limit [%]
LTE Band 71	45.03%
Bluetooth/ WLAN 2.4 GHz	4.77%
RFID 13.56 MHz	8.71%
Sum	58.52%

This prediction demonstrates the following:

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

Annex A: Conducted output power RFID 13.56 MHz

pins TX1 and TX2						
V _{OH}	high-level output voltage	pins TX1 and TX2; T _{VDD_IN} = 3.1 V and I _{OH} = 30 mA	V _{TVDD_IN} – 150	-	-	mV
V _{OL}	low-level output voltage	pins TX1 and TX2; T _{VDD_IN} = 3.1; I _{TX} = 30 mA	-	-	200	mV
R _{OL}	low-level output resistance	V _{TX} = V _{TVDD} – 100 mV; CWGsN = 01h	-	-	80	Ω
		V _{TX} = V _{TVDD} – 100 mV; CWGsN = 0Fh	-	-	10	Ω
R _{OH}	high-level output resistance	V _{TX} = V _{TVDD} – 100 mV	-	-	10	Ω

Annex B: Pictures of the EIRP measurement for 13.56MHz with 10m distance

LoopAntenna: EMCO 6502A (Correction factor @ 13.56MHz +9.5 dB)

