



Maximum Permissible Exposure (MPE) & Exposure evaluation

Report identification number: 1-1328/20-01-06-A

Certification numbers and labeling requirements	
FCC ID	2AYEK-GWX
ISED number	26767-GWX
HVIN (Hardware Version Identification Number)	GWX
PMN (Product Marketing Name)	GWX
FVIN (Firmware Version Identification Number)	-/-
HMN (Host Marketing Name)	-/-

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EUT technologies:

Technologies:	Power Average Conducted [dBm]	Radiated average output power [dBm]	Max. Power for RF Exposure [dBm] ISED EIRP	Max. Power for RF Exposure [dBm] FCC ERP
	Measured Value	Measured Value		
GSM 850 MHz	32.2	31.0 (ERP) 33.15 (EIRP)	30.15*	28.0*
GSM 1900	29.7	30.8 (ERP) 32.95 (EIRP)	29.95*	27.8*
UMTS 1880 MHz	22.8	25.45 (ERP) 27.6 (EIRP)	27.6	25.45
UMTS 1700 MHz	23.1	25.75 (ERP) 27.9 (EIRP)	27.9	25.75
UMTS 850 MHz	23.0	25.3 (ERP) 27.45 (EIRP)	27.45	25.3
LTE FDD 2 1900 MHz	22.6	24.05 (ERP) 26.2 (EIRP)	26.2	24.05
LTE FDD 4 1750 MHz	23.10	21.85 (ERP) 24.0 (EIRP)	24.0	21.85
LTE FDD 5 850 MHz	23.30	22.5 (ERP) 24.65 (EIRP)	24.65	22.5
LTE FDD 12 700 MHz	23.20	21.1 (ERP) 23.25 (EIRP)	23.25	21.1
LTE FDD 13 700 MHz	22.90	21.5 (ERP) 23.65 (EIRP)	23.65	21.5
LTE FDD 25 1900 MHz	23.40	23.05 (ERP) 25.2 (EIRP)	25.2	23.05
LTE FDD 26 850 MHz	23.10	21.8 (ERP) 23.95 (EIRP)	23.95	21.8
LTE FDD 41 2600 MHz	23.20	21.45 (ERP) 23.7 (EIRP)	23.7	21.45
SRD proprietary 2450 MHz	3.2	5.85 (ERP) 8.0 (EIRP)	8.0	5.85
RFID 13.56 MHz	22.65 (calculated value)	-58.67	22.65	22.65

*The values are corrected by 3 dB as the worst case is when 4 from 8 time slots are active at the same time which leads to a duty cycle of 50%.

RFID:

Technologies:	Max. declared cond. AVG Power	Max. measured EIRP @ 10m ¹⁾	Antenna gain
NFC 13.56 MHz	22.65 dBm	22.5 dBµV (Peak, w/o TAG) = -62.27 dBm 26.1 dBµV (Peak, w/ TAG) = -58.67 dBm	< 0 dBi

NOTE:

The measured PEAK EIRP @10m proves that the EUT antenna gain is far below 0dBi and that considering the max. declared output power of 22.65dBm (=184mW) is by far larger than the EIRP. Thus for it is correct to use the conducted value as the worst case base for the RF exposure calculation.

Declared output power is taken from the max data according NFC Datasheet NT3H2111_2211 (NXP Semiconductors):

I_{max} = 40 mA

V_{max} = 4.6 V

P_{max} = 184 mW

Declared minimum safety distances: 20 cm**Collocation overview:**

Technology \ Active scenario:	1
Cellular	x
SRD 2.4 GHz	x
RFID 13.56	x

Prediction of MPE limit 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)

Prediction: worst case

Technologies:	GSM	SRD	
Frequency (MHz)	850	2450	
Declared max power	28.0	5.9	dBm
Distance	20.0	20.0	cm
Power limit uncontrolled exposure	N/A	N/A	mW
Power Density limit uncontrolled exposure	0.5670	1.0000	mW/cm ²
Calculated Power:	N/A	N/A	mW
Calculated Power density:	0.1256	0.0008	mW/cm ²
Calculated percentage of Limit:	22.15%	0.08%	
Collocation:			
Sum:	22.23%		

The calculated power density limit for uncontrolled exposure for GSM850 is 0.567 mW/cm².

As per 447498 D01 General RF Exposure Guidance v06 Page 31, Appendix C the SAR test exclusion threshold for 13.56 MHz at 5 cm is 443 mW. The value is extrapolated from 474 mW for 10 MHz and 308 mW for 50 MHz.

The 22.7 dBm (184 mW) RFID output power value is 41.55% of 443 mW, which is the SAR test exclusion limit.

The sum of exclusion limits is 22.23% + 41.55% = 63.78%

This prediction demonstrates the following:

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

Conclusion: RF exposure evaluation is not required.

Prediction of MPE limit at given distance - ISED

RSS-102, general limitations for E- and H- Field

Reference levels for general public (uncontrolled environment) exposure to time-varying electric and magnetic fields

According to: RSS 102-ISSUE 05		
Frequency Range (MHz)	Power density (W/m ²)	Reference Period (minutes)
0.003-10	--	Instantaneous*
0.1-10	--	6**
1.1-10	--	6**
10-20	2	6
20-48	$8.944 / f^{0.5}$	6
48-300	1.291	6
300-6000	$0.02619 \times f^{0.6834}$	6
6000-15000	10	6
15000-150000	10	$616000 / f^{1.2}$
150000-300000	$6.67 \times 10^{-5} \times f$	$616000 / f^{1.2}$
Note: f is frequency in MHz. * Based on nerve stimulation (NS). ** Based on specific absorption rate (SAR).		

NOTE:

The calculated limit for 850MHz is 2.63W/m²

The calculated limit for 2450MHz is 5.42W/m²

The calculated limit for RFID 13.56 MHz is 2W/m².

Prediction: worst case

		GSM / UMTS / LTE	SRD proprietary	RFID	
	Frequency	850	2450	13.56	MHz
R	Distance	20	20	20	cm
PG	Maximum EIRP	30.15	8	22.65	dBm
PG	Maximum EIRP	1035.1	6.3	184.1	mW
S	Power density	2.1	0.01255	0.36621	W/m ²
	Exclusion Limit from above:	2.63	5.42	2.00	W/m ²
	Calculated percentage of Limit:	78.30%	0.23%	18.31%	
	Scenario 1: GSM / UMTS / LTE + SRD + RFID Calculated percentage of Limit:	96.84%			

Conclusion: RF exposure evaluation is not required.