

Maximum Permissible Exposure (MPE) & Exposure evaluation

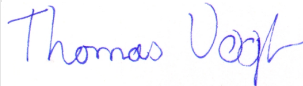
Report identification number: 1-1110/16-21-04-A

Certification numbers and labeling requirements	
FCC ID	2AKG8KMTC QIPAH3-W (GSM/UMTS module)
IC number	22187-KMTC 7830A-AH3W (GSM/UMTS module)
HVIN (Hardware Version Identification Number)	KMT-C
PMN (Product Marketing Name)	KMT-C
FVIN (Firmware Version Identification Number)	-/-
HMN (Host Marketing Name)	-/-

Version –A: Calculation for maximum allowed antenna gain.

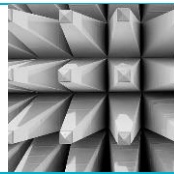
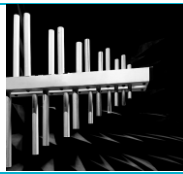
This test report is electronically signed and valid without handwriting signature. For verification of the electronic signatures, the public keys can be requested at the testing laboratory.

Document authorized:



DN: cn=Thomas Vogler, o=CTC advanced
GmbH, ou=VOG-161125,
email=thomas.vogler@ctcadvanced.com,
c=DE
Datum: 2017.03.17 11:05:36 +01'00'

Thomas Vogler
Testing Manager
Radio Communications & EMC



Prediction of MPE limit at given distance - FCC

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 (declared by provider)
 R = Distance to the center of radiation of the antenna

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)

Case 1 GSM850

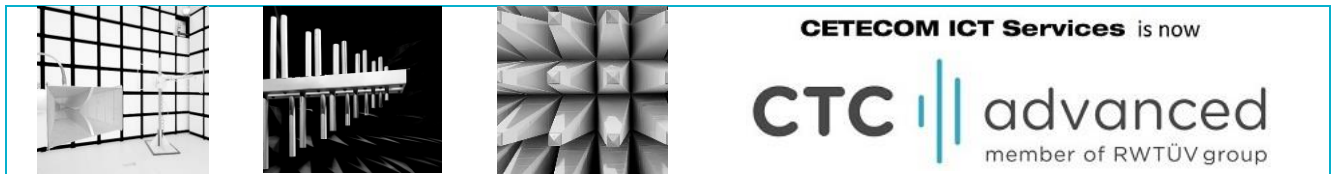
		< 1500 MHz
	Technology	GSM 850
P	Maximum power (slotted)	33.5 dBm
P	Maximum power (GPRS averaged with 4 time slots)	30.5 dBm
R	Distance	20 cm
G	Antenna gain	0 dBi
S	MPE limit for uncontrolled exposure	0.56 mW/cm ²
	Calculated Power density:	0.223 mW/cm ²
		39.8 %
	Max antenna gain for 100% limit	0.64 dBi

Case 2 WCDMA 850

		< 1500 MHz
	Technology	WCDMA 850
P	Maximum power	24.5 dBm
R	Distance	20 cm
G	Antenna gain	0 dBi
S	MPE limit for uncontrolled exposure	0.56 mW/cm ²
	Calculated Power density:	0.056 mW/cm ²
		10.0 %
	Max antenna gain for 100% limit	0.64 dBi

Case 3 PCS 1900

		> 1500 MHz
	Technology	PCS 1900
P	Maximum power (slotted)	30.5 dBm
P	Maximum power (GPRS averaged with 4 time slots)	27.5 dBm
R	Distance	20 cm
G	Antenna gain	0 dBi
S	MPE limit for uncontrolled exposure	1.0 mW/cm ²
	Calculated Power density:	0.16 mW/cm ²
		11.2 %
	Max antenna gain	2.5 dBi



Note : Max. antenna gain limitation in the 850 MHz band has been derived from RSS-102 limit
Max. antenna gain limitation in the 1900 MHz band is caused by FCC part 24 E EIRP limit : max. 2 W
(33.0 dBm) burst power

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 when used with an antenna with **maximum gain 0.64 dBi in the 850 MHz band and 2.5 dBi in the 1900 MHz band.**

Prediction of MPE limit at given distance - IC

RSS-102, Issue 5, 2.5.2

RF exposure evaluation is required if the separation distance between the user and/or bystander and the device's radiating element is greater than 20 cm, except when the device operates as follows:

- below 20 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 1 W (adjusted for tune-up tolerance);
- at or above 20 MHz and below 48 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than $4.49/f^{0.5} \text{ W}$ (adjusted for tune-up tolerance), where f is in MHz;
- at or above 48 MHz and below 300 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 0.6 W (adjusted for tune-up tolerance);
- at or above 300 MHz and below 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than $1.31 \times 10^{-2} f^{0.6834} \text{ W}$ (adjusted for tune-up tolerance), where f is in MHz;
- at or above 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 5 W (adjusted for tune-up tolerance).

Case 1 GSM850

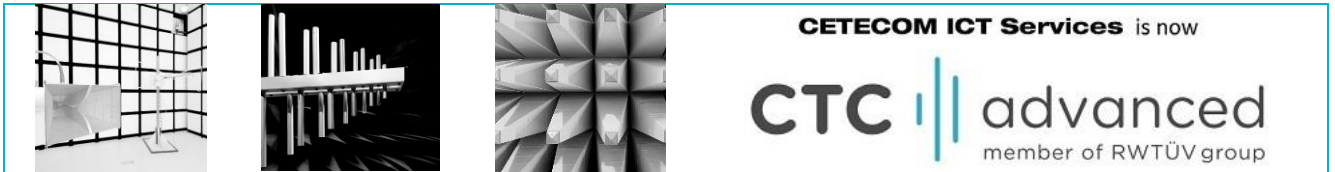
	Technology	GSM 850
P	Maximum power (slotted)	33.5 dBm
P	Maximum power (GPRS averaged with 4 time slots)	30.5 dBm
G	Antenna gain	0 dBi
S	MPE limit for uncontrolled exposure	1300 mW
	Calculated output power:	1122 mW
		86.3 %
	Max antenna gain for 100% limit	0.64 dBi

Case 2 WCDMA 850

	Technology	WCDMA 850
P	Max power	24.5 dBm
G	Antenna gain	0 dBi
S	MPE limit for uncontrolled exposure	1300 mW
	Calculated output power:	281 mW
		21.7 %
	Max antenna gain for 100% limit	0.64 dBi

Case 3 PCS 1900

	Technology	PCS 1900
P	Maximum power (slotted)	30.5 dBm
P	Maximum power (GPRS averaged with 4 time slots)	27.5 dBm
G	Antenna gain	0 dBi
S	MPE limit for uncontrolled exposure	2280 mW
	Calculated output power:	562 mW
		24.7 %
	Max antenna gain	2.5 dBi



Note : max. antenna gain limitation in the 850 MHz band has been derived from RSS-102 limit
Max antenna gain limitation in the 1900 MHz band is caused by FCC part 24 E EIRP limit : max. 2 W
(33.0 dBm) burst power

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 when used with an antenna with **maximum gain 0.64 dBi in the 850 MHz band and 2.5 dBi in the 1900 MHz band.**

Conclusion: for applications where minimum distance to radiating element is 20cm Annex C of RSS-102 should be filled out.