



MDE_UBLOX_0902

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Maximum Permissible Exposure for product: Lucy-H200

Dear Mr. Comar,

please find enclosed your Maximum Permissible Exposure calculations
for the Lucy-H200.

Best Regards


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Maximum Permissible Exposure

(as specified in Table 1B of 47 CFR 1.1310 – Limits for Maximum Permissible Exposure (MPE), Limits for General Population/Uncontrolled Exposure)

Frequency range (MHz)	Power density (mW/cm ²)
300 – 1500	f/1500
1,500 – 100000	1.0

(as specified in Table 2 in EN 1999/519-EC)

Frequency range (MHz)	Power density (mW/cm ²)
400 – 2000	f/2000
2000 - 300000	1 mW/cm ²

General Comment

The Lucy-H200 operates with power reduction as described in 3 GPP TS 51.010-1 v9.01. For reference see table 2. For determination of the maximum antenna gain in this calculation the power reduction and the duty cycle effect are considered. Table 1 shows measured power values in different uplink slot operation modes and the calculated RMS power under consideration of the duty cycle effect.

Typical max output power (calibration target, calibration tolerances not considered)

Operative Mode		GSM850/GSM900		GSM1800/GSM1900	
		Power/slot [dBm]	Nof TX slots	Power/slot [dBm]	Nof TX slots
GSM	Normal TCH	32.2	1	29.2	1
GPRS	1-TX-GMSK	32.2	1	29.2	1
GPRS	2-TX-GMSK	30.5	2	27.5	2
GPRS	3-TX-GMSK	29.0	3	27.5	3
GPRS	4-TX-GMSK	27.0	4	26.0	4
EDGE	1-TX-8PSK	26.0	1	25.0	1
EDGE	2-TX-8PSK	24.2	2	23.5	2
EDGE	3-TX-8PSK	22.4	3	21.8	3
EDGE	4-TX-8PSK	20.6	4	21.8	4

UMTS Operative Mode	Band I	Band II	Band V
	Average Power [dBm]	Average Power [dBm]	Average Power [dBm]
Max Power setting	23.0	23.0	23.0

Table 1: Power values of Lucy-H200

Number of timeslots in uplink assignment	Permissible nominal reduction of maximum output power, (dB)
1	0
2	3,0
3	4,8
4	6,0
5	7,0
6	7,8
7	8,5
8	9,0

Table 2: Allowed power reduction in multi slot class operation modes for Rel5 and onwards devices, ref: 3GPP TS 51.010-1 v9.01



Calculations 850/900 MHz band

Maximum RMS output power at Antenna terminal according to table 1
30.5 dBm – 6.02 dBm (2TX) = 24.48 dBm

Maximum output power at Antenna terminal according Test report
MDE_UBLOX_0902_FCCb: 33.29 dBm

Prediction distance R: 20 cm
Prediction frequency: 824.20 MHz

MPE limit **S**: 0.5494 mW/cm²

Equation OET bulletin 65, page 18, edition 97-01: $S = P \cdot G / (4\pi R^2)$

S = power density

P = power input to the antenna

G = power gain of the antenna in the direction of interest relative to an isotropic radiator

R = distance to the centre of radiation of the antenna

Maximum permissible antenna gain considering S limit **5.85 dBi**

Maximal permissible antenna gain considering output power limitation of 7 Watts ERP (FCC §22.931).

$G = 10 \cdot \log(7000) - 33.29 + 2.15$ **7.30 dBi**

Prediction

The maximum allowed MPE value of 0.5494 mW/cm² will be reached in a distance of 20 cm in case that an antenna with an antenna gain of 5.85 dBi is used. Considering the max output power of 7 Watts ERP (FCC §22.931) for mobile stations the maximum antenna gain is 7.30 dBi, which is higher than 5.85 dBi. For mobile stations the antenna gain is limited to 5.85 dBi in accordance to the FCC regulations.

Calculations 1800 MHz band

Maximum RMS output power at Antenna terminal according to table 1
27.5 dBm – 4.26 dBm (3TX) = 23.24 dBm

Prediction distance R: 20 cm
Prediction frequency: 1710.2 MHz

MPE limit **S**: 1 mW/cm² (according to FCC Bulletin 65)

Equation OET bulletin 65, page 18, edition 97-01: $S = P \cdot G / (4\pi R^2)$

S = power density

P = power input to the antenna

G = power gain of the antenna in the direction of interest relative to an isotropic radiator

R = distance to the centre of radiation of the antenna

Maximum permissible antenna gain considering S limit **15.03 dBi**

Prediction

The maximum allowed MPE value of 0.8551 mW/cm² will be reached in a distance of 20 cm in case that an antenna with an antenna gain of 15.03 dBi is used. This means that the power density levels in a distance of 20 cm are in accordance with the EN regulations as long as the used antenna has a gain below 15.03 dBi.



Calculations 1900 MHz band

Maximum RMS output power at Antenna terminal according to table 1
27.5 dBm – 4.26 dBm (3TX) = 23.24 dBm

Maximum output power at Antenna terminal according Test report
MDE_UBLOX_0902_FCCc: 30.72 dBm

Enhancement factor EF 2.56 (see FCC Bulletin OET 65)
Prediction distance **R**: 20 cm
Prediction frequency: 1850.2 MHz

MPE limit **S**: 1 mW/cm²

Equation OET bulletin 65, page 18, edition 97-01: $S = EF * P * G / (4\pi R^2)$

S = power density

P = power input to the antenna

G = power gain of the antenna in the direction of interest relative to an isotropic radiator

R = distance to the centre of radiation of the antenna

Maximum permissible antenna gain (Table 1B of 47 CFR 1.1310): **9.69 dBi**
Maximum permissible antenna gain for mobile / portable stations: **2.29 dBi**
(Considering 2 Watts EIRP FCC §24.235: $G = 10 * \log(2000) - 30.72$)

Prediction

The maximum allowed MPE value of 1 mW/cm² will be reached in a distance of 20 cm in case that an antenna with an antenna gain of 9.69 dBi is used. This means that the power density levels in a distance of 20 cm are in accordance with the FCC regulations as long as the used antenna has a gain below 9.69 dBi. Considering the max output power of 2 Watts EIRP (FCC §24.235) for mobile / portable stations the maximum antenna gain is 2.29 dBi, which is lower than 9.69 dBi. For mobile and portable stations the antenna gain is limited to 2.29 dBi in accordance with the FCC regulations.

Calculations 2100 MHz band

Maximum RMS output power at Antenna terminal according to table 1 23.00 dBm

Enhancement factor EF 2.56 (see FCC Bulletin OET 65)

Prediction distance **R**: 20 cm

Prediction frequency: 1922.40 MHz

MPE limit **S**: 0.9612 mW/cm²

Equation OET bulletin 65, page 18, edition 97-01: $S = EF \cdot P \cdot G / (4\pi R^2)$

S = power density

P = power input to the antenna

G = power gain of the antenna in the direction of interest relative to an isotropic radiator

R = distance to the centre of radiation of the antenna

Maximum permissible antenna gain: **9.76 dBi**

Prediction

The maximum allowed MPE value of 0.9612 mW/cm² will be reached in a distance of 20 cm in case that an antenna with an antenna gain of 9.76 dBi is used. This means that the power density levels in a distance of 20 cm are in accordance with the EN regulations as long as the used antenna has a gain below 9.76 dBi.