

4 FCC §2.1091 & ISED RSS-102 - RF Exposure

4.1 Applicable Standards

According to FCC §2.1091 (Mobile Devices) RF exposure is calculated.

Limits for General Population/Uncontrolled Exposure

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm ²)	Averaging Time (minute)
Limits for General Population/Uncontrolled Exposure				
0.3-1.34	614	1.63	*(100)	30
1.34-30	824/f	2.19/f	*(180/f ²)	30
30-300	27.5	0.073	0.2	30
300-1500	/	/	f/1500	30
1500-100,000	/	/	1.0	30

Note: f = frequency in MHz

* = Plane-wave equivalent power density

According to ISED RSS-102 Issue 5:

2.5.2 Exemption Limits for Routine Evaluation – RF Exposure Evaluation

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 MHz⁶ 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 $4.49/f^{0.5}$ 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 $1.31 \times 10^{-2} f^{0.6834}$ 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).

In these cases, the information contained in the RF exposure technical brief may be limited to information that demonstrates how the e.i.r.p. was derived.

4.2 MPE Prediction

Predication of MPE limit at a given distance, Equation from OET Bulletin 65, Edition 97-01

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

Where: S = power density

P = power input to antenna

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

R = distance to the center of radiation of the antenna

The MPE calculation was based on the power of cellular networks since the cellular networks has higher power.

4.3 Test Results for FCC

Model: OKO 5MS5 with Module FCC ID: RI7ME910G1WW

Frequency Band	Max Conducted Power (dBm)	Tune-up Power (dBm)	Evaluated Distance (cm)	Antenna Gain (dBi)	Power Density (mW/cm ²)	Limit (mW/cm ²)	Result
NB-IoT							
2	23.86	25	20	0	0.063	1.0	Pass
4	23.62	25	20	0	0.063	1.0	Pass
5	23.24	25	20	0	0.063	0.549	Pass
12	23.56	25	20	0	0.063	0.466	Pass
13	23.68	25	20	0	0.063	0.518	Pass
25	23.7	25	20	0	0.063	1.0	Pass
26	23.86	25	20	0	0.063	0.543	Pass
66	23.81	25	20	0	0.063	1.0	Pass
71	21.89	22	20	0	0.032	0.442	Pass
85	23.63	25	20	0	0.063	0.465	Pass

Frequency Band	Max Conducted Power (dBm)	Tune-up Power (dBm)	Evaluated Distance (cm)	Antenna Gain (dBi)	Power Density (mW/cm ²)	Limit (mW/cm ²)	Result
eMTC							
2	23.86	25	20	0	0.063	1.0	Pass
4	23.62	25	20	0	0.063	1.0	Pass
5	23.24	25	20	0	0.063	0.549	Pass
12	23.56	25	20	0	0.063	0.466	Pass
13	23.68	25	20	0	0.063	0.518	Pass
25	23.7	25	20	0	0.063	1.0	Pass
26	23.86	25	20	0	0.063	0.543	Pass
66	23.81	25	20	0	0.063	1.0	Pass
85	23.63	25	20	0	0.063	0.465	Pass

Frequency Band	Max Conducted Power (dBm)	Tune-up Power (dBm)	Division Factors (dB)	Antenna Gain (dBi)	Max E.R.P./E.I.R.P (dBm)	Evaluated Distance (cm)	Power Density (mW/cm ²)	Limit (mW/cm ²)	Result
GPRS									
850(1slot)	33.23	33.5	-9.03	0	24.47	20	0.056	0.549	Pass
850(2slots)	31.87	33.5	-6.02	0	27.48	20	0.111	0.549	Pass
850(3slots)	29.91	30	-4.26	0	25.74	20	0.075	0.549	Pass
850(4slots)	27.67	28	-3.01	0	24.99	20	0.063	0.549	Pass
1900(1slot)	30.26	30.5	-9.03	0	21.47	20	0.028	1.0	Pass
1900(2slots)	30.41	30.5	-6.02	0	24.48	20	0.056	1.0	Pass
1900(3slots)	29.56	30	-4.26	0	25.74	20	0.075	1.0	Pass
1900(4slots)	28.98	29	-3.01	0	25.99	20	0.079	1.0	Pass
EDGE									
850(1slot)	27.31	28	-9.03	0	18.97	20	0.016	0.549	Pass
850(2slots)	27.52	28	-6.02	0	21.98	20	0.031	0.549	Pass
850(3slots)	27.84	28	-4.26	0	23.74	20	0.047	0.549	Pass
850(4slots)	26.84	27	-3.01	0	23.99	20	0.050	0.549	Pass
1900(1slot)	26.72	27	-9.03	0	17.97	20	0.012	1.0	Pass
1900(2slots)	26.53	27	-6.02	0	20.98	20	0.025	1.0	Pass
1900(3slots)	26.44	27	-4.26	0	22.74	20	0.037	1.0	Pass
1900(4slots)	26.30	27	-3.01	0	23.99	20	0.050	1.0	Pass

Model: OKO 58S5 with Module FCC ID: RI7LE910NAV2

Frequency Band	Reference Frequency (MHz)	Tune-up Power (dBm)	Evaluated Distance (cm)	Antenna Gain (dBi)	Power Density (mW/cm ²)	Limit (mW/cm ²)	Result
LTE FDD							
FDD 12	699.0	24.00	20	0	0.050	0.466	Pass
FDD 17	704.0	24.00	20	0	0.050	0.469	Pass
FDD 13	777.0	24.00	20	0	0.050	0.518	Pass
FDD 5	824.7	24.00	20	0	0.050	0.55	Pass
FDD 4	1710.7	24.00	20	0	0.050	1.000	Pass
FDD 2	1850.7	24.00	20	0	0.050	1.000	Pass
WCDMA/HSPA							
FDD V	826.4	24.50	20	0	0.056	0.551	Pass
FDD II	1852.4	24.50	20	0	0.056	1.000	Pass

4.4 RF Exposure Exemption Evaluation for ISED

Model: OKO 5MS5 with Module IC: 5131A-ME910G1WW

Frequency Band	Max Conducted Power (dBm)	Tune-up Power (dBm)	Antenna Gain (dBi)	Tune-up EIRP (W)	Limit (W)	Result
NB-IoT						
2	23.86	25	0	0.316	2.239	Exempt
4	23.62	25	0	0.316	2.122	Exempt
5	23.24	25	0	0.316	1.288	Exempt
12	23.56	25	0	0.316	1.151	Exempt
13	23.68	25	0	0.316	1.238	Exempt
25	23.7	25	0	0.316	2.239	Exempt
26	23.86	25	0	0.316	1.278	Exempt
66	23.81	25	0	0.316	2.122	Exempt
71	21.89	22	0	0.158	1.110	Exempt
85	23.63	25	0	0.316	1.150	Exempt

Frequency Band	Max Conducted Power (dBm)	Tune-up Power (dBm)	Antenna Gain (dBi)	Tune-up EIRP (W)	Limit (W)	Result
eMTC						
2	23.86	25	0	0.316	2.239	Exempt
4	23.62	25	0	0.316	2.122	Exempt
5	23.24	25	0	0.316	1.288	Exempt
12	23.56	25	0	0.316	1.151	Exempt
13	23.68	25	0	0.316	1.238	Exempt
25	23.7	25	0	0.316	2.239	Exempt
26	23.86	25	0	0.316	1.278	Exempt
66	23.81	25	0	0.316	2.122	Exempt
85	23.63	25	0	0.316	1.150	Exempt

Frequency Band	Max Conducted Power (dBm)	Tune-up Power (dBm)	Division Factors (dB)	Antenna Gain (dBi)	Max E.R.P/E.I.R.P (dBm)	Max E.R.P/E.I.R.P (W)	Limit (W)	Result
GPRS								
850(1slot)	33.23	33.5	-9.03	0	24.47	0.280	1.288	Exempt
850(2slots)	31.87	33.5	-6.02	0	27.48	0.560	1.288	Exempt
850(3slots)	29.91	30	-4.26	0	25.74	0.375	1.288	Exempt
850(4slots)	27.67	28	-3.01	0	24.99	0.316	1.288	Exempt
1900(1slot)	30.26	30.5	-9.03	0	21.47	0.140	2.239	Exempt
1900(2slots)	30.41	30.5	-6.02	0	24.48	0.281	2.239	Exempt
1900(3slots)	29.56	30	-4.26	0	25.74	0.375	2.239	Exempt
1900(4slots)	28.98	29	-3.01	0	25.99	0.397	2.239	Exempt
EDGE								
850(1slot)	27.31	28	-9.03	0	18.97	0.079	1.288	Exempt
850(2slots)	27.52	28	-6.02	0	21.98	0.158	1.288	Exempt
850(3slots)	27.84	28	-4.26	0	23.74	0.237	1.288	Exempt
850(4slots)	26.84	27	-3.01	0	23.99	0.251	1.288	Exempt
1900(1slot)	26.72	27	-9.03	0	17.97	0.063	2.239	Exempt
1900(2slots)	26.53	27	-6.02	0	20.98	0.125	2.239	Exempt
1900(3slots)	26.44	27	-4.26	0	22.74	0.188	2.239	Exempt
1900(4slots)	26.30	27	-3.01	0	23.99	0.251	2.239	Exempt

Model: OKO 58S5 with Module IC: 5131A-LE910NAV2

Frequency Band	Reference Frequency (MHz)	Tune-up Power (dBm)	Antenna Gain (dBi)	Tune-up EIRP (W)	Limit (W)	Result
LTE FDD						
FDD 12	699.0	24.00	0	0.251	1.151	Pass
FDD 17	704.0	24.00	0	0.251	1.157	Pass
FDD 13	777.0	24.00	0	0.251	1.238	Pass
FDD 5	824.7	24.00	0	0.251	1.289	Pass
FDD 4	1710.7	24.00	0	0.251	2.122	Pass
FDD 2	1850.7	24.00	0	0.251	2.240	Pass
WCDMA/HSPA						
FDD V	826.4	24.50	0	0.282	1.291	Pass
FDD II	1852.4	24.50	0	0.282	2.241	Pass