

RF Exposure evaluation

FCC ID: 2AL7V-REOLINKGO

1. Applicable Standard

According to §1.1307(b)(1), systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess of the Commission's guidelines.

According to §1.1310 and §2.1091 RF exposure is calculated.

KDB447498 v06: Mobile and Portable Devices RF Exposure Procedures and Equipment Authorization Policies.

2. Limit

FCC:

Systems operating under the provisions of FCC 47 CFR section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess of the Commission's guidelines.

In accordance with 47 CFR FCC Part 2 Subpart J, section 2.1091 this device has been defined as mobile device whereby a distance of 0.2m normally can be maintained between the user and the device, and below RF Permissible Exposure limit shall comply with.

In accordance with KDB447498D01 for Simultaneous transmission MPE test exclusion applies when the sum of the MPE ratios for all simultaneous transmitting antennas incorporated in a host device, based on the calculated/estimated, numerically modeled or measured field strengths or power density, is ≤ 1.0 . The MPE ratio of each antenna is determined at the minimum test separation distance required by the operating configurations and exposure conditions of the host device, according to the ratio of field strengths or power density to MPE limit, at the test frequency.

Either the maximum peak or spatially averaged results from measurements or numerical simulations may be used to determine the MPE ratios. Spatial averaging does not apply when MPE is estimated using simple calculations based on far-field plane-wave equivalent conditions. The antenna installation and operating requirements for the host device must meet the minimum test separation distances required by all antennas, in both standalone and simultaneous transmission operations, to satisfy compliance.

Limits for Maximum Permissible Exposure (MPE)/Controlled Exposure

Frequency Range(MHz)	Electric Field Strength(V/m)	Magnetic Field Strength(A/m)	Power Density (mW/cm ²)	Averaging Time (minute)
Limits for Occupational/Controlled Exposure				
0.3 – 3.0	614	1.63	(100) *	6
3.0 – 30	1842/f	4.89/f	(900/f ²)*	6
30 – 300	61.4	0.163	1.0	6
300 – 1500	/	/	f/300	6
1500 – 100,000	/	/	5	6

Limits for Maximum Permissible Exposure (MPE)/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 Occupational/Controlled Exposure				
0.3 – 3.0	614	1.63	(100) *	30
3.0 – 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

F=frequency in MHz

*=Plane-wave equivalent power density

3. Conducted Power Results

Manufacturing tolerance

UMTS

UMTS Band 2			
Channel	Channel 9262	Channel 9400	Channel 9538
Target (dBm)	22.0	22.0	22.0
Tolerance ±(dB)	1.0	1.0	1.0
UMTS Band 2 HSDPA(sub-test 1)			
Channel	Channel 9262	Channel 9400	Channel 9538
Target (dBm)	21.5	21.5	21.5
Tolerance ±(dB)	1.0	1.0	1.0
UMTS Band 2 HSDPA(sub-test 2)			
Channel	Channel 9262	Channel 9400	Channel 9538
Target (dBm)	21.5	21.5	21.5
Tolerance ±(dB)	1.0	1.0	1.0
UMTS Band 2 HSDPA(sub-test 3)			

Channel	Channel 9262	Channel 9400	Channel 9538
Target (dBm)	21.5	21.5	21.5
Tolerance $\pm$ (dB)	1.0	1.0	1.0
UMTS Band 2 HSDPA(sub-test 4)			
Channel	Channel 9262	Channel 9400	Channel 9538
Target (dBm)	21.0	21.0	21.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
UMTS Band 2 HSUPA(sub-test 1)			
Channel	Channel 9262	Channel 9400	Channel 9538
Target (dBm)	21.0	21.0	21.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
UMTS Band 2 HSUPA(sub-test 2)			
Channel	Channel 9262	Channel 9400	Channel 9538
Target (dBm)	20.0	20.0	20.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
UMTS Band 2 HSUPA(sub-test 3)			
Channel	Channel 9262	Channel 9400	Channel 9538
Target (dBm)	21.0	21.0	221.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
UMTS Band 2 HSUPA(sub-test 4)			
Channel	Channel 9262	Channel 9400	Channel 9538
Target (dBm)	20.0	20.0	20.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
UMTS Band 2 HSUPA(sub-test 5)			
Channel	Channel 9262	Channel 9400	Channel 9538
Target (dBm)	21.0	21.0	21.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0

UMTS Band 4			
Channel	Channel 1312	Channel 1413	Channel 1513
Target (dBm)	22.5	22.5	22.5
Tolerance $\pm$ (dB)	1.0	1.0	1.0
UMTS Band 4 HSDPA(sub-test 1)			
Channel	Channel 1312	Channel 1413	Channel 1513
Target (dBm)	22.0	22.0	22.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
UMTS Band 4 HSDPA(sub-test 2)			
Channel	Channel 1312	Channel 1413	Channel 1513
Target (dBm)	22.0	22.0	22.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
UMTS Band 4 HSDPA(sub-test 3)			
Channel	Channel 1312	Channel 1413	Channel 1513
Target (dBm)	22.0	22.0	22.0

Tolerance $\pm$ (dB)	1.0	1.0	1.0
UMTS Band 4 HSDPA(sub-test 4)			
Channel	Channel 1312	Channel 1413	Channel 1513
Target (dBm)	21.5	21.5	21.5
Tolerance $\pm$ (dB)	1.0	1.0	1.0
UMTS Band 4 HSUPA(sub-test 1)			
Channel	Channel 1312	Channel 1413	Channel 1513
Target (dBm)	21.0	21.0	21.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
UMTS Band 4 HSUPA(sub-test 2)			
Channel	Channel 1312	Channel 1413	Channel 1513
Target (dBm)	20.0	20.0	20.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
UMTS Band 4 HSUPA(sub-test 3)			
Channel	Channel 1312	Channel 1413	Channel 1513
Target (dBm)	21.0	21.0	221.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
UMTS Band 4 HSUPA(sub-test 4)			
Channel	Channel 1312	Channel 1413	Channel 1513
Target (dBm)	20.0	20.0	20.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
UMTS Band 4 HSUPA(sub-test 5)			
Channel	Channel 1312	Channel 1413	Channel 1513
Target (dBm)	21.0	21.0	21.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0

UMTS Band 5			
Channel	Channel 4132	Channel 4182	Channel 4233
Target (dBm)	22.0	22.0	22.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
UMTS Band V HSDPA(sub-test 1)			
Channel	Channel 4132	Channel 4182	Channel 4233
Target (dBm)	22.0	22.0	22.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
UMTS Band V HSDPA(sub-test 2)			
Channel	Channel 4132	Channel 4182	Channel 4233
Target (dBm)	22.0	22.0	22.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
UMTS Band V HSDPA(sub-test 3)			
Channel	Channel 4132	Channel 4182	Channel 4233
Target (dBm)	22.0	22.0	22.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0

UMTS Band V HSDPA(sub-test 4)			
Channel	Channel 4132	Channel 4182	Channel 4233
Target (dBm)	21.0	21.0	21.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
UMTS Band V HSUPA(sub-test 1)			
Channel	Channel 4132	Channel 4182	Channel 4233
Target (dBm)	20.50	20.50	20.50
Tolerance $\pm$ (dB)	1.0	1.0	1.0
UMTS Band V HSUPA(sub-test 2)			
Channel	Channel 4132	Channel 4182	Channel 4233
Target (dBm)	20.0	20.2	20.2
Tolerance $\pm$ (dB)	1.0	1.0	1.0
UMTS Band V HSUPA(sub-test 3)			
Channel	Channel 4132	Channel 4182	Channel 4233
Target (dBm)	20.5	20.5	20.5
Tolerance $\pm$ (dB)	1.0	1.0	1.0
UMTS Band V HSUPA(sub-test 4)			
Channel	Channel 4132	Channel 4182	Channel 4233
Target (dBm)	20.0	20.0	20.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
UMTS Band V HSUPA(sub-test 5)			
Channel	Channel 4132	Channel 4182	Channel 4233
Target (dBm)	20.50	20.50	20.50
Tolerance $\pm$ (dB)	1.0	1.0	1.0

LTE

LTE Band 2			
Channel	Channel 19100	Channel 18900	Channel 18700
Target (dBm)	22.5	22.5	22.5
Tolerance $\pm$ (dB)	1.0	1.0	1.0
LTE Band 4			
Channel	Channel 19957	Channel 20175	Channel 20393
Tune-up(dB)	22	22	22
Tolerance $\pm$ (dB)	1.0	1.0	1.0
LTE Band 12			
Channel	Channel 20017	Channel 23095	Channel 23173
Tune-up(dB)	23	23	23
Tolerance $\pm$ (dB)	1.0	1.0	1.0

LTE MPR will follow up 3GPP setting as below:

Modulation	Channel bandwidth / Transmission bandwidth (NRB)						MPR (dB)
	1.4MHz	3.0MHz	5MHz	10MHz	15MHz	20MHz	
QPSK	≤ 5	≤ 4	≤ 8	≤ 12	≤ 16	≤ 18	0
QPSK	> 5	> 4	> 8	> 12	> 16	> 18	1
16 QAM	≤ 5	≤ 4	≤ 8	≤ 12	≤ 16	≤ 18	1
16 QAM	> 5	> 4	> 8	> 12	> 16	> 18	2

4. MPE Calculation Method

FCC:

Predication of MPE limit at a given distance

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 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

5. Result

Mode	Minimum Separation Distance (cm)	Output Power (Turn-up Procedure)		Antenna Gain (Numeric)	Power Density At 20 cm (mW/cm ²)	Power Density Limit (mW/cm ²)	Test Results
		dBm	mW				
WCDMA Band 2	20.00	23.0	199.526	0.738	0.029309	1.0000	PASS
WCDMA Band 4	20.00	23.5	223.872	0.746	0.033242	1.0000	PASS
WCDMA Band 5	20.00	23.0	199.526	0.815	0.032367	0.55	PASS
LTE Band 2	20.00	23.5	223.872	0.738	0.032886	1.0000	PASS
LTE Band 4	20.00	23.0	199.526	0.746	0.029627	1.0000	PASS
LTE Band 12	20.00	24.0	251.189	0.830	0.041498	0.47	PASS

6. Simultaneous transmission MPE Considerations

According to KDB447498 :For mobile exposure host platform to qualify for simultaneous transmission MPE test exclusion, all transmitters and antennas in the host must be either evaluated for MPE compliance, by measurement or computational modeling, or qualify for the standalone MPE test exclusion in section 7.1.

Simultaneous transmission MPE test exclusion applies when the sum of the MPE ratios for all simultaneous transmitting antennas incorporated in a host device, based on the calculated/estimated, numerically modeled or measured field strengths or power density, is ≤ 1.0 .

This means that:

Σ of MPE ratios ≤ 1.0

The EUT is Not Applicable.

7. Conclusion

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment.