

DEKRA Testing and Certification S.A.U.TCB

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Report: 58363_WP7610

RF exposure analysis for the equipment – Maximum Antenna Gain

Model: WP7610

FCC ID: N7NWP7610

IC: 2417C-WP7610

The device Sierra wireless WP7610 is a module designed to be installed in other devices. This device is to be used only for fixed and mobile applications. If the final product after integration is intended for portable use, new applications and FCC and IC are required.

The antenna(s) used for this transmitter must be installed to provide a separation distance of at least 20 cm from all the persons and must not be co-located or operating in conjunction with any other antenna or transmitter except as under the conditions described KDB 447498 D01 General RF Exposure Guidance.

MPE exposure limits

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 (MHz) /1500	30
1500 – 100.000	1,0	30

The table below is excerpted from RSS-102, Issue 5, 4, titled “Table 4: RF Field Strength Limits for Devices Used by the General Public”:

Frequency Range (MHz)	Power density (W/m ²)	Averaging time (minutes)
300 – 6000	$0.02619 \cdot f^{0.6834}$	6

EIRP limits

Band	Frequency (MHz) (Lowest Frequency)	Maximum conducted output power (per tune-up) (dBm)	Duty cycle (%)	FCC MPE limit (mW/cm ²)	IC MPE limit (mW/cm ²)	FCC/IC MPE limit (mW/cm ²)	FCC EIRP limit (W)	IC EIRP limit (W)
FDD 12	699,0	24,00	100,0%	0,466	0,230	0,23017	4,92	5,00
FDD 13	777,0	24,00	100,0%	0,518	0,247	0,24743	4,92	5,00
FDD 14	788,0	24,50	100,0%	0,525	0,250	0,24982	4,92	5,00
FDD 17	704	24,00	100,0%	0,469	0,231	0,23130	4,92	5,00
WCDMA Band V	826,4	24,50	100,0%	0,551	0,258	0,25807	11,48	11,50
FDD 5	824,0	24,00	100,0%	0,549	0,258	0,25756	11,48	11,50
FDD 4	1710,0	24,00	100,0%	1,000	0,424	0,42419	1,00	1,00
FDD 66	1710,0	24,00	100,0%	1,000	0,424	0,42419	1,00	1,00
WCDMA Band IV	1710,0	24,00	100,0%	1,000	0,424	0,42419	1,00	1,00

WCDMA Band II	1850,0	24,00	100,0%	1,000	0,448	0,44763	2,00	2,00
FDD 2	1850,0	24,00	100,0%	1,000	0,448	0,44763	2,00	2,00

Using the equation $S = \frac{PG}{4\pi R^2}$ to calculate the exposure to electromagnetic fields

where: S = power density (in appropriate units, e.g. mW/cm²)
P = power input to the antenna (in appropriate units, e.g., mW)
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 (appropriate units, e.g., cm)

The maximum antenna gain that can be used in the WP7610 is shown in the following table:

Band	Frequency (MHz) (Lowest Frequency)	Maximum conducted output power (per tune-up) (dBm)	Duty cycle (%)	FCC MPE limit (mW/cm ²)	IC MPE limit (mW/cm ²)	FCC/IC MPE limit (mW/cm ²)	FCC EIRP limit (W)	IC EIRP limit (W)	Evaluation distance for compliance with MPE limits (cm)	Antenna gain to meet FCC/IC MPE limit (dBi)	Antenna gain to meet FCC EIRP limit (dBi)	Antenna gain to meet IC EIRP limit (dBi)	Maximun antenna gain to meet all the limits (dBi)	Maximun antenna gain to meet all the limits per frequency band (dBi)
FDD 12	699,0	24,00	100,0%	0,466	0,230	0,23017	4,92	5,00	20	6,63	12,91	12,98	6,63	6,63
FDD 13	777,0	24,00	100,0%	0,518	0,247	0,24743	4,92	5,00	20	6,94	12,91	12,98	6,94	6,48
FDD 14	788,0	24,50	100,0%	0,525	0,250	0,24982	4,92	5,00	20	6,48	12,41	12,48	6,48	
FDD 17	704	24,00	100,0%	0,469	0,231	0,23130	4,92	5,00	20	6,65	12,91	12,98	6,65	
WCDMA Band V	826,4	24,50	100,0%	0,551	0,258	0,25807	11,48	11,50	20	6,63	16,09	16,10	6,63	6,63
FDD 5	824,0	24,00	100,0%	0,549	0,258	0,25756	11,48	11,50	20	7,12	16,59	16,60	7,12	
FDD 4	1710,0	24,00	100,0%	1,000	0,424	0,42419	1,00	1,00	20	9,28	6,00	6,00	6,00	
FDD 66	1710,0	24,00	100,0%	1,000	0,424	0,42419	1,00	1,00	20	9,28	6,00	6,00	6,00	6,00
WCDMA Band IV	1710,0	24,00	100,0%	1,000	0,424	0,42419	1,00	1,00	20	9,28	6,00	6,00	6,00	
WCDMA Band II	1850,0	24,00	100,0%	1,000	0,448	0,44763	2,00	2,00	20	9,52	9,01	9,01	9,01	
FDD 2	1850,0	24,00	100,0%	1,000	0,448	0,44763	2,00	2,00	20	9,52	9,01	9,01	9,01	9,01

And according to these maximum antenna gains calculated, the spectral power density for each band is shown in the table below:

Band	Frequency (MHz) (Lowest Frequency)	Maximum conducted output power (per tune-up) (dBm)	Duty cycle (%)	Antenna gain (dBi)	FCC/IC MPE limit (mW/cm ²)	FCC EIRP limit (W)	IC EIRP limit (W)	FCC/IC EIRP limit (W)	Evaluation distance for compliance with MPE limits (cm)	$S = \frac{PG}{4\pi R^2}$	MPE Ratio (S/MPE limit)
FDD 12	699,0	24,00	100,0%	6,63	0,23017	4,92	5,00	4,92	20	0,23000	0,99926
FDD 13	777,0	24,00	100,0%	6,48	0,24743	4,92	5,00	4,92	20	0,22219	0,89801
FDD 14	788,0	24,50	100,0%	6,48	0,24982	4,92	5,00	4,92	20	0,24930	0,99795
FDD 17	704,0	24,00	100,0%	6,48	0,23130	4,92	5,00	4,92	21	0,20154	0,87133
WCDMA Band V	826,4	24,50	100,0%	6,63	0,25807	11,48	11,50	11,48	20	0,25807	0,99997
FDD 5	824,0	24,00	100,0%	6,63	0,25756	11,48	11,50	11,48	20	0,23000	0,89300
FDD 4	1710,0	24,00	100,0%	6,00	0,42419	1,00	1,00	1,00	20	0,19894	0,46899
FDD 66	1710,0	24,00	100,0%	6,00	0,42419	1,00	1,00	1,00	20	0,19894	0,46899
WCDMA Band IV	1710,0	24,00	100,0%	6,00	0,42419	1,00	1,00	1,00	20	0,19894	0,46899
WCDMA Band II	1850,0	24,00	100,0%	9,01	0,44763	2,00	2,00	2,00	20	0,39786	0,88881
FDD 2	1850,0	24,00	100,0%	9,01	0,44763	2,00	2,00	2,00	20	0,39786	0,88881

The declared antenna gain of 6 dBi in all these bands compliant to the Normative Document, based on a 20 cm distance between antenna and human body.