

RF Exposure

FCC ID: 2AC6AURA4

Applicant: Shenzhen Chainway Information Technology Co., Ltd.

Exposure category: General population/uncontrolled environment

EUT Type: Production Unit

Device Type: Fixed Android UHF Reader

Refer Standard: FCC Part 2.1091: Radio Frequency (RF) Exposure Compliance of Radio communication Apparatus (All Frequency Bands)

FCC MPE Limited:

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 (minutes)
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

Test Data

Predication of MPE limit at a given distance

$$S = \frac{PG}{4\pi R^2}$$

Where: 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, the power gain factor, is normally numeric gain.

R = distance to the center of radiation of the antenna (appropriate units, e.g., cm)

SRD Antenna Gain information

2.4G WLAN: 1.52dBi

5G WLAN: 1.01dBi

BT: 1.52 dBi

RFID: 9.0dBi

WWAN Antenna Gain information:

Max gain: 1.25dBi

Worst-Case mode Conducted Output Power Results for 2.4G WIFI

802.11b mode

Channel	Frequency (MHz)	Output Power(dBm)	Tune Up tolerance(dBm)
1	2412	13.07	13±1
6	2437	12.62	13±1
11	2462	13.26	13±1

Worst-Case mode Conducted Output Power Results for BT /BLE

Bluetooth				
Band	Mode	Test Frequency	Power(dBm)	Tune-up tolerance(dBm)
BT EDR	GFSK	2402	0.70	0±1
	GFSK	2441	0.78	0±1
	GFSK	2480	-0.29	0±1
	pi/4DQPSK	2402	0.87	0±1
	pi/4DQPSK	2441	0.63	0±1
	pi/4DQPSK	2480	-0.21	0±1
	8DPSK	2402	1.14	1±1
	8DPSK	2441	0.93	1±1
	8DPSK	2480	0.09	1±1
BLE	GFSK	2402	-8.15	-8±1
	GFSK	2440	-8.29	-8±1
	GFSK	2480	-8.73	-8±1

Worst-Case mode Conducted Power Test results of band U-NII-1/U-NII-3

802.11a mode		
Frequency (MHz)	Conducted Output Power (dBm)	Tune Up tolerance(dBm)
5180	13.09	13±1
5220	13.42	13±1
5240	12.76	13±1
5745	9.27	9±1
5785	9.13	9±1
5825	8.07	9±1

Worst-Case mode Conducted Output Power Results for RFID

Channel	Frequency (MHz)	Measured Output Power (dBm)	Tune Up tolerance(dBm)
1	902.75	22.919	23 ±1
26	915.25	24.095	25 ±1
50	927.25	24.863	25 ±1

Worst-Case mode Conducted Output Power Results for WWAN

Band	Channel	Frequency (MHz)	Max Tune up power(dBm)	Max Tune up power(W)	Duty cycle(%)	Average power(W)
WCDMA850	Low	826.4	23.00	0.200	100	0.200
	Mid	836.6	23.00	0.200	100	0.200
	High	846.4	23.00	0.200	100	0.200
WCDMA1900	Low	1852.4	23.00	0.200	100	0.200
	Mid	1880.0	23.00	0.200	100	0.200
	High	1907.6	23.00	0.200	100	0.200
LTE Band 2	Low	1860.0	23.00	0.200	100	0.200
	Mid	1880.0	23.00	0.200	100	0.200
	High	1900.0	23.00	0.200	100	0.200
LTE Band 4	Low	1720.0	24.00	0.251	100	0.200
	Mid	1732.5	24.00	0.251	100	0.200
	High	1745.0	24.00	0.251	100	0.200
LTE Band 5	Low	829.0	23.00	0.200	100	0.200
	Mid	836.5	23.00	0.200	100	0.200
	High	844.0	23.00	0.200	100	0.200
LTE Band 7	Low	2510.0	22.00	0.158	100	0.158
	Mid	2535.0	22.00	0.158	100	0.158
	High	2560.0	22.00	0.158	100	0.158
LTE Band 12	Low	704.0	23.00	0.200	100	0.200
	Mid	707.5	23.00	0.200	100	0.200
	High	711.0	23.00	0.200	100	0.200
LTE Band 17	Low	709.0	23.00	0.200	100	0.200
	Mid	710.0	23.00	0.200	100	0.200
	High	711.0	23.00	0.200	100	0.200

Note: for power tolerance please refer to tune up for detail.

Calculation results (for 2.4G WIFI): Worst-case mode

Frequency (MHz)	Maximum tune up power(dBm)	RF distance(cm)	Result (mW/cm ²)	Limit (mW/cm ²)	Ratio
2412	14	20	0.0067	1.0	0.0067
2437	14	20	0.0067		0.0067
2462	14	20	0.0067		0.0067

Calculation results (for BT/BLE)

Bluetooth						
Band	Mode	Test Frequency	Maximum tune up power(dBm)	Result (mW/cm ²)	Limit (mW/cm ²)	Ratio
BT EDR	GFSK	2402	1	0.0003	1.0	0.0003
	GFSK	2441	1	0.0003		0.0003
	GFSK	2480	1	0.0003		0.0003
	pi/4DQPSK	2402	1	0.0003		0.0003
	pi/4DQPSK	2441	1	0.0003		0.0003
	pi/4DQPSK	2480	1	0.0003		0.0003
	8DPSK	2402	2	0.0004		0.0004
	8DPSK	2441	2	0.0004		0.0004
	8DPSK	2480	2	0.0004		0.0004
BLE	GFSK	2402	-7	0.0001	1.0	0.0001
	GFSK	2440	-7	0.0001		0.0001
	GFSK	2480	-7	0.0001		0.0001

Calculation results (for 5G WIFI): Worst-Case mode

Frequency (MHz)	Maximum tune up power(dBm)	RF distance(cm)	Result (mW/cm ²)	Limit (mW/cm ²)	Ratio
5180	14	20	0.0067	1.0	0.0067
5220	14	20	0.0067		0.0067
5240	14	20	0.0067		0.0067
5745	10	20	0.0027		0.0027
5785	10	20	0.0027		0.0027
5825	10	20	0.0027		0.0027

Calculation results (for RFID)

Channel	Frequency (MHz)	Max. ERP (Include tune up power)(dBm)	Result(mW/cm ²)	Limit(mW/cm ²)	Ratio
Low	902.75	33.0	0.0667	0.602	0.1108
Mid	915.25	35.0	0.1056	0.610	0.1731
High	927.25	35.0	0.1056	0.618	0.1709

Calculation results (for WWAN): Worst-Case mode

Band	Channel	Frequency (MHz)	Result(mW/cm ²)	Limit(mW/cm ²)	Ratio
WCDMA850	Low	826.4	0.0529	0.55	0.0962
	Mid	836.6	0.0529	0.56	0.0945
	High	846.4	0.0529	0.56	0.0945
WCDMA1900	Low	1852.4	0.0529	1.00	0.0529
	Mid	1880.0	0.0529	1.00	0.0529
	High	1907.6	0.0529	1.00	0.0529
LTE Band 2	Low	1860.0	0.0529	1.00	0.0529
	Mid	1880.0	0.0529	1.00	0.0529
	High	1900.0	0.0529	1.00	0.0529
LTE Band 4	Low	1720.0	0.0667	1.00	0.0667
	Mid	1732.5	0.0667	1.00	0.0667
	High	1745.0	0.0667	1.00	0.0667
LTE Band 5	Low	829.0	0.0529	0.55	0.0962
	Mid	836.5	0.0529	0.56	0.0945
	High	844.0	0.0529	0.56	0.0945
LTE Band 7	Low	2510.0	0.0421	1.00	0.0421
	Mid	2535.0	0.0421	1.00	0.0421
	High	2560.0	0.0421	1.00	0.0421
LTE Band 12	Low	704.0	0.0529	0.47	0.1126
	Mid	707.5	0.0529	0.47	0.1126
	High	711.0	0.0529	0.47	0.1126
LTE Band 17	Low	709.0	0.0529	0.47	0.1126
	Mid	710.0	0.0529	0.47	0.1126
	High	711.0	0.0529	0.47	0.1126

Simultaneous Transmission Calculation (Worst-case mode)

No.	Transmitter Combinations	Scenario Supported or not
1	WWAN+2.4G WLAN+BT+RFID	Yes
2	WWAN +5G WLAN+BT+RFID	Yes

Max Simultaneous Transmission Calculation (Worst-case mode)

No.	Worst Mode	MPE Ratio	Results
1	LTE Band 17 +2.4G WIFI+BT+RFID	$0.1126+0.0067+0.0004+0.1731=$	$0.2928 < 1.0(\text{pass})$