

FCC RF Exposure Evaluation

1. Product Information

FCC ID	2A3RD-IRT5300AW5T2D
Product Name	Industrial 4G wireless router
Test Model	IRT5300-AW-5T2D, IRT5300, IRT5300L, IRT1000, IRT2000, IRT3000, IRT4000, IRT5000, IRT6000, IRT7000
Power Supply	For AC Adapter Input: AC100-240V~50/60Hz 0.3A Output: 12.0V/1A
Hardware version	IRT5300-AW-5T2D V1.0.0
Software version	IRT5300-V2.1100.2B2020110304R1373H00000
Modulation Type	802.11b: DSSS 802.11g/802.11n(H20)/802.11n(H40): OFDM (WCDMA)QPSK; (LTE)QPSK 16QAM
Antenna Type	External Antenna
Antenna Gain	2.4G WIFI: ANT1: 0dBi ANT2: 0dBi WCDMA: 0dBi for WCDMA Band II; 0dBi for WCDMA Band IV; 0dBi for WCDMA Band V; LTE: 0dBi for LTE Band 2; 0dBi for LTE Band 4; 0dBi for LTE Band 12;
Frequency Range	2412 – 2462 MHz / 824– 849MHz / 1850– 1910 MHz / 1710– 1755 MHz/ 699– 716 MHz
Exposure Category	General population/uncontrolled environment
EUT Type	Production Unit
Device Type	Mobile Device

Note: This product 2.4G WIFI does not support MIMO.

2. Evaluation Method and Limit

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 modelled 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.

3. Refer Evaluation Method

[ANSI C95.1-1999](#): IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz.

[FCC KDB publication 447498 D01 General RF Exposure Guidance v06](#): Mobile and Portable Devices RF Exposure Procedures and Equipment Authorization Policies.

[FCC CFR 47 part1 1.1310](#): Radiofrequency radiation exposure limits.

[FCC CFR 47 part2 2.1091](#): Radiofrequency radiation exposure evaluation: Mobile Device

3. 2 Limit

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

4. MPE Calculation Method

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. Antenna Information

IRT5300-AW-5T2D can only use antennas certificated as follows provided by manufacturer;

Internal Identification	Antenna type and antenna number	Operate frequency band	Maximum antenna gain	Note
Antenna 1 Antenna 2	External Antenna	2412MHz – 2462 MHz	0dBi	WLAN Antenna
Antenna	External Antenna	600 MHz – 3000 MHz	0dBi	WCDMA/LTE Antenna

Note: This product 2.4G WIFI does not support MIMO.

6. Conducted Power Results

[2.4GWIFI Max Conducted Power]

Mode	Channel	Frequency(MHz)	Max Conducted Power(dBm) Antenna 1	Max Conducted Power(dBm) Antenna 2
IEEE 802.11b	1	2412	16.22	15.47
	6	2437	16.51	14.83
	11	2462	16.05	14.50
IEEE 802.11g	1	2412	18.64	17.90
	6	2437	18.30	16.67
	11	2462	17.78	16.39
IEEE 802.11n HT20	1	2412	18.27	17.51
	6	2437	17.93	16.62
	11	2462	17.24	15.83
IEEE 802.11n HT40	3	2422	18.95	17.79
	6	2437	18.59	17.23
	9	2452	18.12	17.00

[WCDMA Max Average Power]

Test Mode	Channel	Frequency (MHz)	Max Average Power (dBm)
WCDMA Band II	Low	1852.4	22.69
	Middle	1880	23.34
	High	1907.6	23.20
WCDMA Band IV	Low	1712.4	23.15
	Middle	1732.6	23.47
	High	1752.6	23.91
WCDMA Band V	Low	826.4	23.73
	Middle	836.4	23.81
	High	846.6	23.20

[LTE Max Average Power]

Test Mode	Channel	Frequency (MHz)	Max Average Power (dBm)
LTE- Band 2	Low	1850.7	24.02
	Middle	1880.0	24.12
	High	1909.3	24.23
LTE -Band 4	Low	1710.7	24.06
	Middle	1732.5	24.09
	High	1754.3	23.96
LTE- Band 12	Low	699.7	23.42
	Middle	707.5	23.51
	High	715.3	23.66

7. Manufacturing Tolerance

[2.4GWIFI Max Conducted Power]

Mode	Channel	Frequency(MHz)	Max Conducted Power(dBm) Antenna 1	Max Conducted Power(dBm) Antenna 2	ANT Max. Tune Up Power (dBm)
IEEE 802.11b	1	2412	16.22	15.47	16.0±1.0
	6	2437	16.51	14.83	16.0±1.0
	11	2462	16.05	14.50	16.0±1.0
IEEE 802.11g	1	2412	18.64	17.90	18.0±1.0
	6	2437	18.30	16.67	18.0±1.0
	11	2462	17.78	16.39	18.0±1.0
IEEE 802.11n HT20	1	2412	18.27	17.51	18.0±1.0
	6	2437	17.93	16.62	17.0±1.0
	11	2462	17.24	15.83	17.0±1.0
IEEE 802.11n HT40	3	2422	18.95	17.79	18.0±1.0
	6	2437	18.59	17.23	18.0±1.0
	9	2452	18.12	17.00	18.0±1.0

[WCDMA Max Average Power]

Test Mode	Channel	Max Average Power (dBm)	ANT Max. Tune Up Power (dBm)
WCDMA Band II	Low	22.69	23.0±1.0
	Middle	23.34	23.0±1.0
	High	23.20	23.0±1.0
WCDMA Band IV	Low	23.15	23.0±1.0
	Middle	23.47	23.0±1.0
	High	23.91	23.0±1.0
WCDMA Band V	Low	23.73	23.0±1.0
	Middle	23.81	23.0±1.0
	High	23.20	23.0±1.0

[LTE Max Average Power]

Test Mode	Channel	Max Average Power (dBm)	ANT Max. Tune Up Power (dBm)
LTE- Band 2	Low	24.02	24.0±1.0
	Middle	24.12	24.0±1.0
	High	24.23	24.0±1.0
LTE -Band 4	Low	24.06	24.0±1.0
	Middle	24.09	24.0±1.0
	High	23.96	24.0±1.0
LTE- Band 12	Low	23.42	23.0±1.0
	Middle	23.51	23.0±1.0
	High	23.66	23.0±1.0

8. Evaluation Results

8.1 Standalone MPE

As declared by the Applicant, the EUT is a wireless device used in a fix application, at least 20 cm from any body part of the user or nearby persons; from the maximum EUT RF output power, the minimum separation distance, $r = 20\text{cm}$, as well as the gain of the used antenna refer to antenna information, the RF power density can be obtained.

2.4GWIFI

Modulation Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	Duty Cycle	MPE (mW/cm ²)	MPE Limits (mW/cm ²)
	dBm	mW					
IEEE 802.11b	17.0	50.1187	0.0	1.0000	100%	0.0100	1.0000
IEEE 802.11g	19.0	79.4328	0.0	1.0000	100%	0.0158	1.0000
IEEE 802.11n HT20	19.0	79.4328	0.0	1.0000	100%	0.0158	1.0000
IEEE 802.11n HT40	19.0	79.4328	0.0	1.0000	100%	0.0158	1.0000

WCDMA

Modulation Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm ²)	MPE Limits (mW/cm ²)
	dBm	mW				
WCDMA Band II	24.0	251.1886	0.0	1.0000	0.0500	1.0000
WCDMA Band IV	24.0	251.1886	0.0	1.0000	0.0500	1.0000
WCDMA Band V	24.0	251.1886	0.0	1.0000	0.0500	0.5493

LTE

Modulation Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm ²)	MPE Limits (mW/cm ²)
	dBm	mW				
LTE Band 2	25.0	316.2278	0.0	1.0000	0.0629	1.0000
LTE Band 4	25.0	316.2278	0.0	1.0000	0.0629	1.0000
LTE Band 12	24.0	251.1886	0.0	1.0000	0.0500	0.4660

Remark:

1. Output power including tune-up tolerance;
2. MPE evaluate distance is 20cm from user manual provide by manufacturer;

8.2 Simultaneous Transmission MPE

The sample support two 2.4GWLAN and another one LTE&WCDMA transmit antenna, but only with interleaving of packages switched on board level, This product 2.4G WIFI does not support MIMO. That means that they don't transmit at the same time. No need consider simultaneous transmission;

9. Conclusion

The measurement results comply with the FCC Limit per 47 CFR 2.1091 for the uncontrolled RF Exposure of mobile device.

.....THE END OF REPORT.....