

FCC RF Exposure Evaluation

1. Product Information

FCC ID:	2AANYIR611S	
Product name	Industrial cellular router	
Model number	IR611-S	
Power supply	12 Vdc From Adapter Input AC120V/60Hz	
Modulation Type	WIFI	802.11b : DSSS 802.11g/n : OFDM
	WCDMA	BPSK
	LTE	QPSK, 16QAM
Antenna Type	Sucker Antenna	
Antenna Gain	For WIFI: Chain 0 Sucker antenna with 3dBi gain Chain 1 Sucker antenna with 3dBi gain For WCDMA/LTE: Main antenna: 2.5dBi AUX-Only RX: 2.5dBi	
Hardware version	V3.4	
Software version	V2.3.0	
FCC Operation frequency	WIFI	2412MHz~2462MHz
	WCDMA	826.4 MHz ~ 846.6 MHz (FOR WCDMA 850) 1852.4 MHz ~ 1907.6 MHz (FOR WCDMA 1900)
	LTE	LTE Band 2: 1805.7 MHz ~ 1909.3MHz LTE Band 4: 1710.7 MHz ~ 1754.3 MHz LTE Band 5: 824.7 MHz ~ 848.3 MHz LTE Band 12: 699.7 MHz ~ 715.3 MHz
Exposure category	General population/uncontrolled environment	
EUT Type	Production Unit	

2. Evaluation method and Limit

According to ANSI/IEEE C95.1-1992, the Criteria Listed in Table 1 shall be used to evaluate the environmental impact of human exposure to radio frequency (RF) radiation as specified in §1.1310.

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm ²)	Averaging time (minutes)
(A) 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
300-1,500			f/300	6
1,500-100,000			5	6
(B) 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
300-1,500			f/1500	30
1,500-100,000			1.0	30

f = frequency in MHz * = Plane-wave equivalent power density

The MPE was calculated at **20 cm** to show compliance with the power density limit.

The following formula was used to calculate the Power Density:

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

Where:

S = Power Density

P = Output Power at Antenna Terminals

G = Gain of Transmit Antenna (linear gain)

R = Distance from Transmitting Antenna

According to KDB Publication 447498 D01, Section 7.2

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

3. Conducted Power

3.1 Test Setup Block Diagram for WWAN



3.2 Test Setup Block Diagram for WLAN



3.3 Test Procedure

WWAN:

- 1) The EUT was directly connected to the Base Station and antenna output port as show in the Block diagram;
- 2) Reading average power in RMS detector.

WLAN

- 1) The EUT was directly connected to the spectrum analyser and antenna output port as show in the Block diagram;
- 2) Reading average power in RMS detector.

3.3 Measurement Equipment

Item	Equipment	Manufacturer	Model No.	Inventory No.	Last Cal.	Next Cal.
1	Base Station	R&S	CMW500	164998	2019-01-23	2020-01-22
2	Spectrum Analyzer	Keysight	N9010A	MY56070788	2019-01-23	2020-01-22

For WLAN

Frequency Range(MHz)	Mode	Rate	Declared maximum conducted average Output Power(dBm)	Max. positive tolerance according to manufacturer
2412~2462	802.11b	1 Mbps	Chain 0: 13 Chain 1: 14	2
2412~2462	802.11g	6 Mbps	Chain 0: 14	2

			Chain 1: 14	
2412~2462	802.11n HT20	MCS8	18	2
2422~2452	802.11n HT40	MCS8	18	2

For WWAN

Band	Channel	Power(dBm)	EIRP/ERP(dBm)	Tolerance According to manufacturer
Band II	9262	22.12	24.62	1.5
Band II	9400	21.79	24.29	1.5
Band II	9538	21.55	24.05	1.5
Band V	4132	22.70	23.06	1.5
Band V	4182	22.53	22.89	1.5
Band V	4233	22.87	23.23	1.5

Band	Channel	SubTest	Power(dBm)	EIRP/ ERP(dBm)	Tolerance According to manufacturer
Band II	9262	HSDPA_Sub1	21.93	24.43	1.5
Band II	9262	HSDPA_Sub2	21.91	24.41	1.5
Band II	9262	HSDPA_Sub3	21.33	23.83	1.5
Band II	9262	HSDPA_Sub4	21.10	23.6	1.5
Band II	9400	HSDPA_Sub1	21.56	24.06	1.5
Band II	9400	HSDPA_Sub2	21.53	24.03	1.5
Band II	9400	HSDPA_Sub3	21.48	23.98	1.5
Band II	9400	HSDPA_Sub4	21.34	23.84	1.5
Band II	9538	HSDPA_Sub1	21.25	23.75	1.5
Band II	9538	HSDPA_Sub2	21.25	23.75	1.5
Band II	9538	HSDPA_Sub3	21.21	23.71	1.5
Band II	9538	HSDPA_Sub4	21.18	23.68	1.5
Band V	4132	HSDPA_Sub1	22.76	23.12	1.5
Band V	4132	HSDPA_Sub2	22.74	23.1	1.5
Band V	4132	HSDPA_Sub3	22.21	22.57	1.5
Band V	4132	HSDPA_Sub4	21.94	22.3	1.5
Band V	4182	HSDPA_Sub1	22.50	22.86	1.5
Band V	4182	HSDPA_Sub2	22.52	22.88	1.5
Band V	4182	HSDPA_Sub3	22.48	22.84	1.5
Band V	4182	HSDPA_Sub4	22.43	22.79	1.5
Band V	4233	HSDPA_Sub1	22.61	22.97	1.5
Band V	4233	HSDPA_Sub2	22.61	22.97	1.5
Band V	4233	HSDPA_Sub3	22.62	22.98	1.5
Band V	4233	HSDPA_Sub4	22.56	22.92	1.5

Band	Channel	SubTest	Power(dBm)	EIRP/ ERP(dBm)	Tolerance According to manufacturer
Band II	9262	HSUPA_Sub1	21.48	23.98	1.5
Band II	9262	HSUPA_Sub2	20.24	22.74	1.5
Band II	9262	HSUPA_Sub3	21.05	23.55	1.5
Band II	9262	HSUPA_Sub4	21.15	23.65	1.5
Band II	9262	HSUPA_Sub5	20.89	23.39	1.5
Band II	9400	HSUPA_Sub1	21.75	24.25	1.5
Band II	9400	HSUPA_Sub2	21.19	23.69	1.5
Band II	9400	HSUPA_Sub3	21.31	23.81	1.5
Band II	9400	HSUPA_Sub4	21.06	23.56	1.5
Band II	9400	HSUPA_Sub5	21.94	24.44	1.5
Band II	9538	HSUPA_Sub1	20.75	23.25	1.5
Band II	9538	HSUPA_Sub2	21.34	23.84	1.5
Band II	9538	HSUPA_Sub3	21.66	24.16	1.5
Band II	9538	HSUPA_Sub4	21.17	23.67	1.5
Band II	9538	HSUPA_Sub5	20.69	23.19	1.5
Band V	4132	HSUPA_Sub1	22.19	22.55	1.5
Band V	4132	HSUPA_Sub2	21.11	21.47	1.5
Band V	4132	HSUPA_Sub3	21.82	22.18	1.5
Band V	4132	HSUPA_Sub4	21.74	22.1	1.5
Band V	4132	HSUPA_Sub5	22.06	22.42	1.5
Band V	4182	HSUPA_Sub1	22.31	22.67	1.5
Band V	4182	HSUPA_Sub2	21.27	21.63	1.5
Band V	4182	HSUPA_Sub3	21.82	22.18	1.5
Band V	4182	HSUPA_Sub4	21.39	21.75	1.5
Band V	4182	HSUPA_Sub5	22.15	22.51	1.5
Band V	4233	HSUPA_Sub1	22.67	23.03	1.5
Band V	4233	HSUPA_Sub2	21.85	22.21	1.5
Band V	4233	HSUPA_Sub3	21.75	22.11	1.5
Band V	4233	HSUPA_Sub4	21.39	21.75	1.5
Band V	4233	HSUPA_Sub5	22.08	22.44	1.5

Band	Bandwidth	Modulation	Channel	RB Configuration	Result(dBm)	EIRP/ ERP(dBm)	Tolerance According to manufacturer
Band2	1.4MHz	QPSK	18607	1RB#0	21.53	24.03	1.5
Band2	3MHz	QPSK	18615	1RB#0	21.46	23.96	1.5
Band2	5MHz	QPSK	18900	1RB#0	21.54	24.04	1.5
Band2	10MHz	QPSK	19150	1RB#0	21.48	23.98	1.5
Band2	15MHz	QPSK	18900	1RB#0	22.00	24.5	1.5

Band2	20MHz	QPSK	18700	1RB#0	21.79	24.29	1.5
Band4	1.4MHz	QPSK	20175	1RB#5	21.86	24.36	1.5
Band4	3MHz	QPSK	19965	1RB#0	21.96	24.46	1.5
Band4	5MHz	QPSK	20175	1RB#0	21.98	24.48	1.5
Band4	10MHz	QPSK	20350	1RB#0	22.07	24.57	1.5
Band4	15MHz	QPSK	20025	1RB#0	22.21	24.71	1.5
Band4	20MHz	QPSK	20050	1RB#0	22.13	24.63	1.5
Band5	1.4MHz	QPSK	20525	1RB#5	22.45	22.81	1.5
Band5	3MHz	QPSK	20415	1RB#0	22.49	22.85	1.5
Band5	5MHz	QPSK	20525	1RB#0	22.46	22.82	1.5
Band5	10MHz	QPSK	20525	1RB#0	22.39	22.75	1.5
Band12	1.4MHz	QPSK	23095	1RB#5	24.49	24.85	2
Band12	3MHz	QPSK	23095	1RB#8	24.47	24.83	2
Band12	5MHz	QPSK	23095	1RB#12	24.60	24.96	2
Band12	10MHz	QPSK	23095	1RB#24	24.52	24.88	2

4. Evaluation Results

Collocated WWAN and other Wireless							For FCC	
Band	Frequency (MHz)	Antenna Gain (dBi)	Maximum Power (dBm)	Maximum EIRP (dBm)	Maximum EIRP (W)	Average EIRP (mW)	Power Density at 20cm (mW/cm ²)	Limit (mW/cm ²)
WCDMA Band 5	804	2.5	23.5	26.000	0.398	398.107	0.079	0.536
WCDMA Band 2	1850	2.5	22.5	25.000	0.316	316.228	0.063	1.000
LTE Band 12	700	2.5	25	27.500	0.562	562.341	0.112	0.466
LTE Band 5	824	2.5	23.5	26.000	0.398	398.107	0.079	0.549
LTE Band 4	1710	2.5	22.5	25.000	0.316	316.228	0.063	1.000
LTE Band 2	1850	2.5	22.5	25.000	0.316	316.228	0.063	1.000
2.4GHz WLAN	2412	2.5	20	22.500	0.178	177.828	0.035	1.000

For WIFI and LTE can transmit simultaneously, the total evaluation result as below:

Collocated WWAN and other Wireless					For FCC		
No.	Configurations	Maximum MPE Value (mw/cm ²)			Limits(mw/cm ²)	Margin(mw/cm ²)	PASS/Fail
		WWAN	WLAN	Transmit simultaneously			
1	WCDMA Band 5	0.079	0.035	0.182	1	0.818	PASS
2	WCDMA Band 2	0.063	0.035	0.098	1	0.902	PASS
3	LTE Band 12	0.112	0.035	0.275	1	0.725	PASS
4	LTE Band 5	0.079	0.035	0.179	1	0.821	PASS

5	LTE Band 4	0.063	0.035	0.098	1	0.902	PASS
6	LTE Band 2	0.063	0.035	0.098	1	0.902	PASS

Remark:

1. *Output power including tune up tolerance;*

5. Conclusion

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

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