

FCC RF EXPOSURE EVALUATION REPORT

Product Name: Industrial Cellular Router
Trade Mark: N/A
Model No.: IR611-S
Report Number: 180119001RFC-2
Test Standards: FCC 47 CFR Part 1 Subpart I
FCC ID: 2AANYIR611S
Test Result: PASS
Date of Issue: March 21, 2018

Prepared for:

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CONTENTS

1. GENERAL INFORMATION	4
1.1 CLIENT INFORMATION	4
1.2 EUT INFORMATION	4
1.3 PRODUCT SPECIFICATION SUBJECTIVE TO THIS STANDARD	4
1.4 OTHER INFORMATION	5
1.5 GENERAL DESCRIPTION OF APPLIED STANDARDS	5
1.6 TEST LOCATION	5
1.7 TEST FACILITY	5
1.8 DEVIATION FROM STANDARDS	6
1.9 ABNORMALITIES FROM STANDARD CONDITIONS	6
1.10 OTHER INFORMATION REQUESTED BY THE CUSTOMER	6
2. EQUIPMENT LIST	6
3. MPE EVALUATION	7
3.1 REFERENCE DOCUMENTS FOR EVALUATION	7
3.2 MPE COMPLIANCE REQUIREMENT	7
3.2.1 LIMITS	7
3.2.2 TEST PROCEDURE	7
3.3 MPE CALCULATION METHOD	7
3.4 MPE CALCULATION RESULTS	7
3.4.1 FOR WLAN	8
3.4.2 FOR WWAN	9
3.4.3 SIMULTANEOUS MULTI-BAND TRANSMISSION MPE ANALYSIS	9
APPENDIX 1 PHOTOS OF TEST SETUP	10
APPENDIX 2 PHOTOS OF EUT CONSTRUCTIONAL DETAILS	10

1. GENERAL INFORMATION

1.1 CLIENT INFORMATION

Applicant:	Beijing Inhand Networks Technology Co., Ltd.
Address of Applicant:	101, West Wing, 11th Floor, No.101 Lize central Park, Wangjing Chaoyang District, Beijing 100102 China
Manufacturer:	Beijing Inhand Networks Technology Co., Ltd.
Address of Manufacturer:	101, West Wing, 11th Floor, No.101 Lize central Park, Wangjing Chaoyang District, Beijing 100102 China

1.2 EUT INFORMATION

Product Name:	Industrial Cellular Router	
Model No.:	IR611-S	
Add. Model No.:	IR601-S, IR621-S, IR631-S, IR641-S, IR651-S, IR661-S, IR671-S, IR681-S, IR691-S	
Trade Mark:	N/A	
DUT Stage:	Identical Prototype	
EUT Supports Function:	E-UTRA Bands:	FDD Band 2/ Band 4/ Band 12
	2.4 GHz ISM Band:	IEEE 802.11b/g/n
Software Version:	V2.3.0.r4537	
Hardware Version:	V3.4	
Sample Received Date:	January 20, 2018	
Sample Tested Date:	January 20, 2018 to March 12, 2018	
Note: These models are identical in interior structure, electrical circuits and components, and the differences as follows: software, the number of network ports and model name, declared by the manufacturer.		

1.3 PRODUCT SPECIFICATION SUBJECTIVE TO THIS STANDARD

For 2.4 GHz ISM Band of Wi-Fi		
Frequency Range:	2400 MHz to 2483.5 MHz	
Support Standards:	IEEE 802.11b, IEEE 802.11g, IEEE 802.11n-HT20, IEEE 802.11n-HT40	
Type of Modulation:	IEEE 802.11b: DSSS(CCK, DQPSK, DBPSK) IEEE 802.11g: OFDM(64-QAM, 16-QAM, QPSK, BPSK) IEEE 802.11n-HT20: OFDM(64-QAM, 16-QAM, QPSK, BPSK) IEEE 802.11n-HT40: OFDM(64-QAM, 16-QAM, QPSK, BPSK)	
Data Rate:	IEEE 802.11b: Up to 11 Mbps IEEE 802.11g: Up to 54 Mbps IEEE 802.11n-HT20: Up to MCS15 IEEE 802.11n-HT40: Up to MCS15	
Number of Channels:	IEEE 802.11b: 11 IEEE 802.11g: 11 IEEE 802.11n-HT20: 11 IEEE 802.11n-HT40: 7	
Channel Separation:	5 MHz	
Antenna Type:	Chain 0	Sucker antenna
	Chain 1	Sucker antenna
Antenna Gain:	Chain 0	2 dBi
	Chain 1	2 dBi
Directional gain:	2 dBi	
Maximum Peak Power:	SISO_ Chain 0	IEEE 802.11b: 20.24 dBm IEEE 802.11g: 24.08 dBm IEEE 802.11n-HT20: 23.88 dBm IEEE 802.11n-HT40: 23.18 dBm

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	SISO_ Chain 1	IEEE 802.11b: 19.83 dBm IEEE 802.11g: 23.69 dBm IEEE 802.11n-HT20: 23.39 dBm IEEE 802.11n-HT40: 22.33 dBm
	MIMO_ Chain 0+1	IEEE 802.11n-HT20: 26.65 dBm IEEE 802.11n-HT40: 25.79 dBm

1.4 OTHER INFORMATION

Test channels for 2.4 GHz ISM Band of Wi-Fi				
Mode	Tx/Rx Frequency	Test RF Channel Lists		
		Lowest(L)	Middle(M)	Highest(H)
IEEE 802.11b	2412 MHz to 2462 MHz	Channel 1	Channel 6	Channel 11
		2412 MHz	2437 MHz	2462 MHz
IEEE 802.11g	2412 MHz to 2462 MHz	Channel 1	Channel 6	Channel 11
		2412 MHz	2437 MHz	2462 MHz
IEEE 802.11n-HT20	2412 MHz to 2462 MHz	Channel 1	Channel 6	Channel 11
		2412 MHz	2437 MHz	2462 MHz
IEEE 802.11n-HT40	2422 MHz to 2452 MHz	Channel 3	Channel 6	Channel 9
		2422 MHz	2437 MHz	2452 MHz

1.5 GENERAL DESCRIPTION OF APPLIED STANDARDS

The EUT is a RF product, according to the specifications of the manufacturers. It must comply with the requirements of the following standards:

FCC 47 CFR Part 1 Subpart I

All test items have been performed and recorded as per the above standards

1.6 TEST LOCATION

All tests were performed at:

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1.7 TEST FACILITY

The test facility is recognized, certified, or accredited by the following organizations:

CNAS-Lab Code: L9069

The measuring equipment utilized to perform the tests documented in this report has been calibrated once a year or in accordance with the manufacturer's recommendations, and is traceable under the ISO/IEC/EN 17025 to international or national standards. Equipment has been calibrated by accredited calibration laboratories.

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IC-Registration No.: 21600-1

The 3m Semi-anechoic chamber of Shenzhen UnionTrust Quality and Technology Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 21600-1.

A2LA-Lab Certificate No.: 4312.01

Shenzhen UnionTrust Quality and Technology Co., Ltd. has been accredited by A2LA for technical competence in the field of electrical testing, and proved to be in compliance with ISO/IEC 17025: 2005 General Requirements for the Competence of Testing and Calibration Laboratories and any additional program requirements in the identified field of testing.

FCC Accredited Lab.

Designation Number: CN1194

Test Firm Registration Number: 259480

1.8 DEVIATION FROM STANDARDS

None.

1.9 ABNORMALITIES FROM STANDARD CONDITIONS

None.

1.10 OTHER INFORMATION REQUESTED BY THE CUSTOMER

None.

2. EQUIPMENT LIST

Please refer to the RF test report.

3. MPE EVALUATION

3.1 REFERENCE DOCUMENTS FOR EVALUATION

No.	Identity	Document Title
1	FCC 47 CFR Part 1 Subpart I	PROCEDURES IMPLEMENTING THE NATIONAL ENVIRONMENTAL POLICY ACT OF 1969
2	KDB 447498 D01 General RF Exposure Guidance v06	RF EXPOSURE PROCEDURES AND EQUIPMENT AUTHORIZATION POLICIES FOR MOBILE AND PORTABLE DEVICES

3.2 MPE COMPLIANCE REQUIREMENT

3.2.1 Limits

According to §1.1307(b)(1), system operating under the provisions of this section shall be operating in a manner that the public is not exposed to radio frequency energy level in excess limit for maximum permissible exposure.

Limits for Occupational / Controlled Exposure

Frequency range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/cm ²)	Averaging Times E ² , H ² or S (minutes)
0.3-3.0	614	1.63	(100)*	6
3.0-30	1842/f	4.89/f	(900/f)*	6
30-300	61.4	0.163	1.0	6
300-1500	/	/	F/300	6
1500-100000	/	/	5	6

Limits for General Population / Uncontrolled Exposure

Frequency range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/cm ²)	Averaging Times E ² , H ² or S (minutes)
0.3-1.34	614	1.63	(100)*	30
1.34-30	824/f	2.19/f	(180/f)*	30
30-300	27.5	0.073	0.2	30
300-1500	/	/	F/1500	30
1500-100000	/	/	1	30

Note: f = frequency in MHz: * = Plane-wave equivalents power density.

3.2.2 Test Procedure

Software provided by client enabled the EUT to transmit and receive data at lowest, middle and highest channel individually.

3.3 MPE CALCULATION METHOD

$$S = PG/4\pi R^2 = EIRP/4\pi R^2$$

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, the power gain factor is normally numeric gain.

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

3.4 MPE CALCULATION RESULTS

Note: For the test results, the EUT had been tested with all conditions. But only the worst case was shown in

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test report.

3.4.1 For WLAN

For Wi-Fi function, operating at 2412MHz to 2462 MHz for IEEE802.11b/g/n and

3.4.1.1 Antenna Type:

Chain 0: Integral Antenna

Chain 1: Integral Antenna

3.4.1.2 Antenna Gain:

Chain 0: 2412MHz to 2462 MHz: 2 dBi

Chain 1: Same as chain 0

For MIMO mode (2Tx/2Rx), there are two transmission antennas. Both Chain 0 and Chain 1 used at the same time and antenna ports have uniform output powers. The Chain 0 and Chain 1 antenna ports can be used alone. The transmit signals are uncorrelated with each other.

The directional gain = $G_{ANT} = 2 \text{ dBi}$

For SISO mode (1Tx/1Rx), there are two transmission antennas. Both Chain 0 and Chain 1 used at the same time and antenna ports have uniform output powers. The Chain 0 and Chain 1 antenna ports cannot be used alone

The antenna gain = Chain 0 or Chain 1 = 2 dBi

3.4.1.3 Results for WLAN

Operating Mode		Freq.	Declared maximum conducted average output power	Max. positive tolerance according manufacturer	Antenna Gain	Calculated maximum EIRP	Declared maximum EIRP	MPE Limit	MPE Value
		(MHz)	(dBm)		(dBi)	(dBm)	(mW)	(mw/cm ²)	
SISO	IEEE 802.11b IEEE 802.11g	2412	18	2	2	20	100.00	1	0.0199
		2437	18	2	2	20	100.00	1	0.0199
		2462	18	2	2	20	100.00	1	0.0199

Operating Mode		Freq.	Declared maximum conducted average output power	Max. positive tolerance according manufacturer	Antenna Gain	Calculated maximum EIRP	Declared maximum EIRP	MPE Limit	MPE Value
		(MHz)	(dBm)		(dBi)	(dBm)	(mW)	(mw/cm ²)	
MIMO	IEEE 802.11n-HT20	2412	18	2	2	20	100.00	1	0.0199
		2437	18	2	2	20	100.00	1	0.0199
		2462	18	2	2	20	100.00	1	0.0199
	IEEE 802.11n-HT40	2422	18	2	2	20	100.00	1	0.0199
		2437	18	2	2	20	100.00	1	0.0199
		2452	18	2	2	20	100.00	1	0.0199

3.4.2 For WWAN

Operating Mode	Freq.	Declared maximum conducted output power	Max. positive tolerance according manufacturer	Antenna Gain	Calculated maximum EIRP	Duty cycle	Equivalent EIRP	MPE Limit	MPE Value
	(MHz)	(dBm)	(dBm)	(dBi)	(dBm)	(%)	(mW)	(mw/cm ²)	
LTE Band 2	1850.0	23.5	0.5	2.0	26.0	100	398.11	1.0	0.0792
LTE Band 4	1710.0	23.5	0.5	2.0	26.0	100	398.11	1.0	0.0792
LTE Band 12	699.0	23.5	0.5	2.0	26.0	100	398.11	0.466	0.0792

Note 1: Calculated maximum EIRP = Declared maximum conducted output power + Max. positive tolerance according manufacturer + Antenna Gain.

Note 2: Declared maximum EIRP = $10^{\left(\frac{\text{Calculated maximum EIRP}}{10}\right)}$.

Note 3: Equivalent EIRP = Declared maximum EIRP * Duty cycle.

Note 4: Margin = MPE Limit - MPE Value.

3.4.3 Simultaneous Multi-band Transmission MPE Analysis

3.4.4.1 List of Mode for Simultaneous Multi-band Transmission

No.	Configurations	Hotspot SAR
1	LTE + WLAN	Yes

3.4.4.2 Results for transmit simultaneously

No.	Configurations	Maximum MPE Value (mw/cm ²)			WWAN Limits (mw/cm ²)	Margin (mw/cm ²)	Pass/Fail
		WWAN	WLAN	Transmit simultaneously			
1	LTE Band 2	0.0792	0.0199	0.1019	1.0	0.9009	Pass
2	LTE Band 4	0.0792	0.0199	0.1019	1.0	0.9009	Pass
3	LTE Band 12	0.0792	0.0199	0.1019	0.466	0.3669	Pass

APPENDIX 1 PHOTOS OF TEST SETUP

N/A

APPENDIX 2 PHOTOS OF EUT CONSTRUCTIONAL DETAILS

Refer to Appendix 2 for EUT external and internal photos.

*** End of Report ***

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