RF Exposure Evaluation Declaration

Product Name	:	Advanced Industrial 4G/LTE Router, WWAN Failover Manager
Trade Name	:	BEC, Billion
Model No.	:	MX-200, MX-200e, M100
FCC ID.	:	QI3BIL-MX200-R

Applicant	:	Billion Electric Co., Ltd.
Address	:	8F., No.192, Sec. 2, Zhongxing Rd., Xindian Dist., New Taipei City 231, Taiwan (R.O.C.)

Date of Receipt	:	Jan. 05, 2016
Date of Declaration	:	Feb. 21, 2017
Report No.	:	1710161R-RFUSP02V00
Report Version	:	V1.0

Testing Laboratory
3024

1. RF Exposure Evaluation

1.1. Limits

According to FCC 1.1310: The criteria listed in the following table shall be used to evaluate the environment impact of human exposure to radio frequency (RF) radiation as specified in 1.1307(b)

LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm^2)	Average Time (Minutes)
(A) Limits for Occupational/ Control Exposures				
300-1500	--	--	F/300	6
1500-100,000	--	--	5	6
(B) Limits for General Population/ Uncontrolled Exposures				
300-1500	--	--	F/1500	6
1500-100,000	--	--	1	30

F= Frequency in MHz

Friis Formula

Friis transmission formula: $Pd = (Pout*G)/(4*pi*r^2)$

Where

Pd = power density in mW/cm^2

Pout = output power to antenna in mW

G = gain of antenna in linear scale

Pi = 3.1416

R = distance between observation point and center of the radiator in cm

Pd id the limit of MPE, 1 mW/cm^2 . If we know the maximum gain of the antenna and the total power input to the antenna, through the calculation, we will know the distance r where the MPE limit is reached.

1.2. Test Procedure

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

The temperature and related humidity: 18℃ and 78％ RH.

1.3. Test Result of RF Exposure Evaluation

Product	Advanced Industrial 4G/LTE Router, WWAN Failover Manager
Test Mode	Transmit
Test Condition	RF Exposure Evaluation

Antenna Gain

698-960 MHz : Antenna Gain: The maximum Gain measured in fully anechoic chamber is0.71dBi or 1.18dBi in linear scale.

1710-2700 MHz : Antenna Gain: The maximum Gain measured in fully anechoic chamber is 3.7dBi or 2.34dBi in linear scale.

Output Power into Antenna & RF Exposure Evaluation Distance:

WCDMA Band 5

Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density at R = 20 cm (mW/cm^2)	Limit (mW/cm^2.)
826.4	331.1311	0.07773	1.00
836.6	347.5362	0.08159	1.00
846.6	332.6596	0.07809	1.00

WCDMA Band 2

Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density at R = 20 cm (mW/cm^2)	Limit (mW/cm^2.)
1852.4	864.9679	0.40267	1.00
1880.0	853.1001	0.39714	1.00
1907.6	770.9035	0.35888	1.00

WCDMA Band 5_HSUPA

Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density at R = 20 cm (mW/cm^2)	Limit (mW/cm^2.)
826.4	872.9714	0.20493	1.00
836.6	901.5711	0.21165	1.00
846.6	879.0225	0.20635	1.00

WCDMA Band 5_HSDPA

Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density at R = 20 cm (mW/cm^2)	Limit (mW/cm^2.)
826.4	726.1060	0.17046	1.00
836.6	687.0684	0.16129	1.00
846.6	778.0366	0.18265	1.00

WCDMA Band 2_HSUPA

Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density at R = 20 cm (mW/cm^2)	Limit (mW/cm^2.)
1852.4	744.7320	0.34669	1.00
1880.0	749.8942	0.34910	1.00
1907.6	711.2135	0.33109	1.00

WCDMA Band 2_HSDPA

Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density at R = 20 cm (mW/cm^2)	Limit (mW/cm^2.)
1852.4	591.5616	0.27539	1.00
1880.0	615.1769	0.28638	1.00
1907.6	558.4702	0.25998	1.00

Product	Advanced Industrial 4G/LTE Router, WWAN Failover Manager
Test Mode	Transmit
Test Condition	RF Exposure Evaluation

Antenna Gain

1710-2700 MHz : Antenna Gain: The maximum Gain measured in fully anechoic chamber is 3.7dBi or 1.91dBi in linear scale.

Output Power into Antenna & RF Exposure Evaluation Distance:

WCDMA Band 4

Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density at R = 20 cm (mW/cm^2)	Limit (mW/cm^2.)
1712.4	833.6812	0.38810	1.00
1732.6	772.6806	0.35970	1.00
1752.6	847.2274	0.39441	1.00

WCDMA Band 4_HSUPA

Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density at R = 20 cm (mW/cm^2)	Limit (mW/cm^2.)
1712.4	575.4399	0.26788	1.00
1732.6	500.0345	0.23278	1.00
1752.6	530.8844	0.24714	1.00

WCDMA Band 4_HSDPA

Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density at R = 20 cm (mW/cm^2)	Limit (mW/cm^2.)
1712.4	537.0318	0.25000	1.00
1732.6	509.3309	0.23711	1.00
1752.6	538.2698	0.25058	1.00