

## RF Exposure Evaluation declaration

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

Applicant : Billion Electric Co., Ltd.

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Report No. : 1710161R-SAUSP01V00

Report Version : V1.0



The test results relate only to the samples tested.

The test results shown in the test report are traceable to the national/international standard through the calibration of the equipment and evaluated measurement uncertainty herein.

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## 1. GENERAL INFORMATION

### 1.1. EUT Description

Product Name	Advanced Industrial 4G/LTE Router, WWAN Failover Manager
Model No.	MX-200, MX-200e, M100
Trade Name	BEC, Billion
IMEI No.	35907206
FCC ID	QI3BIL-MX200-R
Modulation	LTE Band 25 : QPSK/16-QAM LTE Band 26 : QPSK/16-QAM LTE Band 41 : QPSK/16-QAM
TX Frequency	LTE Band 25: 1850~1915MHz LTE Band 26 : 814MHz~849MHz LTE Band 41: 2496~2690MHz
Rx Frequency	LTE Band 25: 1930~1995MHz LTE Band 26: 859~894MHz LTE Band 41: 2496~2690MHz
Bandwidth	LTE Band 25: 1.4MHz/3MHz/5MHz/10MHz/15MHz/20MHz LTE Band 26: 1.4MHz/3MHz/5MHz/10MHz/15MHz LTE Band 41: 5MHz/10MHz/15MHz/20MHz
HW Version	1.011
SW Version	1.04.1.103p
Antenna Type	Dipole

Note: 1.The EUT is including three models.

2.The difference of each model is shown as below:

#### Hardware & Software comparison table:

	MX-200	M100	MX-200e
Trade Name	BEC	Billion	BEC
Hardware design	PCBA/Layout/Scheme/ Key component/housing / interface ...100% same		
LTE antennas (SMA)	Detachable LTE Antenna *2pcs	Detachable LTE Antenna *2pcs	Detachable LTE Antenna *2pcs
GPS antenna (SMA)	1	1	1
SIM slot (2FF)	1	1	1
RS-232 (DB-9)	1	1	1
Ethernet Giga port	2	2	2
Power input	9-56VDC	9-56VDC	9-56VDC
External color	Casing: Metal/Black	Casing: Metal/Black	Casing: Metal/Black
Software function	with VPN	with VPN	without VPN

### 1.2. Antenna List :

No.	Manufacturer	Part No.	Peak Gain
1	Cortec Technolgy Inc.	AN0727-64DP5BSM	0.71 dBi for 700-960MHz 3.7 dBi for 1710-2700MHz

## 2. RF Exposure Evaluation

### 2.1. 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 <sup>2</sup> )	Average Time (Minutes)
<b>(A) Limits for Occupational/ Control Exposures</b>				
300-1500	--	--	F/300	6
1500-100,000	--	--	5	6
<b>(B) Limits for General Population/ Uncontrolled Exposures</b>				
300-1500	--	--	F/1500	30
1500-100,000	--	--	1	30

F= Frequency in MHz

Friis Formula

Friis transmission formula:  $P_d = (P_{out} * G) / (4 * \pi * R^2)$

Where

$P_d$  = power density in mW/cm<sup>2</sup>

$P_{out}$  = 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

$P_d$  is the limit of MPE, 1 mW/cm<sup>2</sup>. 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.

### 2.2. 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: 21°C and 60% RH.

### 2.3. Test Result of RF Exposure Evaluation

Product : MX-200, MX-200e, M100  
 Test Item : RF Exposure Evaluation  
 Test Site : N/A

#### LTE Band 25 (For Part 24) -Peak Gain: 3.7dBi

Frequency	Conducted Peak Power (dBm)	Maximum ERP/EIRP (W)	Maximum ERP/EIRP Limit (W)	Duty Cycle (%)	Conducted Average Power (dBm)	Output Power to Antenna (mW)	Power Density at R = 20 cm (mW/cm <sup>2</sup> )	Limit (mW/cm <sup>2</sup> )	Pass/Fail
1855	23.32	0.504	2	100	23.32	214.8	0.1002	1	Pass
1882.5	23.31	0.502	2	100	23.31	214.3	0.0999	1	Pass
1910	23.41	0.514	2	100	23.41	219.3	0.1023	1	Pass

#### LTE Band 26 (For Part 22) -Peak Gain: 0.71dBi

Frequency	Conducted Peak Power (dBm)	Maximum ERP/EIRP (W)	Maximum ERP/EIRP Limit (W)	Duty Cycle (%)	Conducted Average Power (dBm)	Output Power to Antenna (mW)	Power Density at R = 20 cm (mW/cm <sup>2</sup> )	Limit (mW/cm <sup>2</sup> )	Pass/Fail
825.5	22.97	0.142	7	100	22.97	198.2	0.0464	0.55	Pass
836.5	22.78	0.136	7	100	22.78	189.7	0.0444	0.56	Pass
846.5	22.85	0.138	7	100	22.85	192.8	0.0452	0.56	Pass

#### LTE Band 41 -Peak (For Part 27) Gain:3.7dBi

Frequency	Conducted Peak Power (dBm)	Maximum ERP/EIRP (W)	Maximum ERP/EIRP Limit (W)	Duty Cycle (%)	Conducted Average Power (dBm)	Output Power to Antenna (mW)	Power Density at R = 20 cm (mW/cm <sup>2</sup> )	Limit (mW/cm <sup>2</sup> )	Pass/Fail
2501	22.11	0.381	2	100	22.11	162.6	0.0758	1	Pass
2593	21.77	0.352	2	100	21.77	150.3	0.0701	1	Pass
2685	21.85	0.359	2	100	21.85	153.1	0.0714	1	Pass

Note: The conducted output power is refer to report No.: 1710161R-HPUSP43V00 from the DEKRA

#### LTE Band 26 (For Part 90) -Peak Gain: 0.71dBi

Frequency	Conducted Peak Power (dBm)	Maximum ERP/EIRP (W)	Maximum ERP/EIRP Limit (W)	Duty Cycle (%)	Conducted Average Power (dBm)	Output Power to Antenna (mW)	Power Density at R = 20 cm (mW/cm <sup>2</sup> )	Limit (mW/cm <sup>2</sup> )	Pass/Fail
815.5	22.95	0.142	7	100	22.95	197.2	0.0462	0.54	Pass
819	23.32	0.154	7	100	23.32	214.8	0.0503	0.55	Pass
822.5	23.04	0.145	7	100	23.04	201.4	0.0472	0.55	Pass

Note: The conducted output power is refer to report No.: 1710161R-HPUSP02V00 from the DEKRA.