RF Exposure Evaluation declaration

Product Name : Triple-SIM 4G/LTE Router with WWAN Failover

Model No. : MX-221P, MX-221

FCC ID : QI3BIL-MX221P

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 :	Mar. 22, 2019
Date of Declaration :	Apr. 26, 2019
Report No. :	1930373R-SAUSP03V00
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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Issued Date : Apr. 26, 2019 Report No.: 1930373R-HPUSP03V0 DECKRA Product Name : Triple-SIM 4G/LTE Router with WWAN Failover Applicant : Billion Electric Co., Ltd. Address : 8F., No.192, Sec. 2, Zhongxing Rd., Xindian Dist., New Taipe City 231, Taiwan (R.O.C.) Manufacturer : Billion Electric Co., Ltd. Trade Name : BEC, Billion Model No. : MX-221P, MX-221 Measurement Standard : FCC 47 CFR 1.1310 Test Result : Complied Documented By : <u>Amny Choce</u> (Senior Adm. Specialist / Anny Chou) Tested By : <u>Vorean Cheen</u> (Senior Engineer / Vorana Chen) Approved By : <u>Mamma</u>		Test Report
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Model No. : MX-221P, MX-221 Measurement Standard : FCC 47 CFR 1.1310 Test Result : Complied Documented By : <u>Anny Choa</u> (Senior Adm. Specialist / Anny Chou) Tested By : <u>Vorana Chen</u> (Senior Engineer / Vorana Chen) Approved By : <u>Mambuan</u>	Trade Name	: BEC, Billion
Measurement Standard : FCC 47 CFR 1.1310 Test Result : Complied Documented By : <u>Ammy Choa</u> (Senior Adm. Specialist / Anny Chou) Tested By : <u>Vorana Chen</u> (Senior Engineer / Vorana Chen) Approved By : <u>Mamma</u>	Model No.	: MX-221P , MX-221
Test Result : Complied Documented By : <u>Amny Choa</u> (Senior Adm. Specialist / Anny Chou) Tested By : <u>Vorana Chen</u> (Senior Engineer / Vorana Chen) Approved By : <u>Mandada</u>	Measurement Standard	: FCC 47 CFR 1.1310
Documented By : Amny Choa (senior Adm. Specialist / Anny Chou) Tested By : Vorame Chen (senior Engineer / Vorana Chen) Approved By : Mathematical Chen (Director (Wincont Lin))	Test Result	: Complied
Approved By : Vorana Chen (Senior Engineer / Vorana Chen)	Documented By	(Senior Adm. Specialist / Anny Chou)
(Senior Engineer / Vorana Chen) Approved By : Manda	Tested By	Vorana Chen
Approved By :		(Senior Engineer / Vorana Chen)
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(Director / vincent Lin)		(Director /Vincent Lin)



1. GENERAL INFORMATION

1.1. EUT Description

Product Name	Triple-SIM 4G/LTE Router with WWAN Failover
Model No.	MX-221P , MX-221
Trade Name	BEC, Billion
IMEI No.	86683404
FCC ID	QI3BIL-MX221P
TX Frequency	LTE Band 2: 1850 MHz ~1910 MHz
	LTE Band 4: 1710 MHz~1755 MHz
Rx Frequency	LTE Band 2: 1930 MHz ~1990 MHz
	LTE Band 4: 2110 MHz ~2155 MHz
HW Version	V1.010
SW Version	V1.04.1.303

1.2. Antenna List :

No	Manufacturer	Part No	Antenna Type	Peak Gain
1	Grand-Tek	OA-L71-12-05-C5-BL	Dipolo Antonno	
	Technology	TX Mode	Dipole Antenna	
2	Grand-Tek	OA-L71-12-05-C5-BL	Dinala Antonna	2 EdBi for 1 71 CHz 2 17 CHz
	Technology	(Only RX Mode)		3.50B110F1.71 GH2 ~2.17 GH2

1.3. The different description of Model

The different description of Model							
Model	MX-221P MX-221						
Product Name	Triple-SIM 4G/LTE Router	with WWAN Failover					
Trade Name	BEC, Billion						
LTE antennas(SMA)	Detachable LTE Antenna *2pcs						
SIM slot (2FF)	3						
Gigabit Ethernet port	2						
Power input from PoE PoE injector	PoE-PD (802.3at PD complaint (25.5W) No						
Power Input: Power adapter	12VDC 1.2A						
External color	Casing: ABS /	Dark blue					
Software	without V	/PN					

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).

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

LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

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

 \mathbf{R} = distance between observation point and center of the radiator in cm

Pd is 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.

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 .

2.2. Test Result of RF Exposure Evaluation

Product	:	Triple-SIM 4G/LTE Router with WWAN Failover
Test Item	:	RF Exposure Evaluation
Test Site	:	N/A

LTE Band 2 -Peak Gain: 3.5dBi

Frequency	Conducted Peak Power (dBm)	Maximum EIRP (W)	Maximum EIRP Limit (W)	Duty Cycle (%)	Conducted Average Power (dBm)	Output Power to Antenna (mW)	Power Density at R = 20 cm (mW/cm^2)	Limit (mW/cm ²)	Pass/Fail
1850.7	22.60	0.407	2	100	22.60	181.97	0.0810	1	Pass
1880	22.66	0.413	2	100	22.66	184.50	0.0822	1	Pass
1908.5	22.90	0.437	2	100	22.90	194.98	0.0868	1	Pass

Note: The conducted output power is refer to report No.: 1930373R-HPUSP37V00 from the DEKRA.

LTE Band 4-Peak Gain: 3.5dBi

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 ²)	Limit (mW/cm ²)	Pass/Fail
1720	21.93	0.349	1	100	21.93	155.96	0.0695	1	Pass
1732.5	22.13	0.366	1	100	22.13	163.31	0.0727	1	Pass
1750	22.05	0.359	1	100	22.05	160.32	0.0714	1	Pass

Note: The conducted output power is refer to report No.: 1930373R-HPUSP37V00 from the DEKRA.