

Test Report No:
2430013R-RFUSV26S-A

TEST REPORT

FCC Rules & Regulations

Product Name	5G NR Module
Brand Name	BEC by BILLION
Model No.	MX-220-UT-5G
FCC ID	QI3BEC-MX220UT5G
Applicant's Name / Address	Billion Electric Co., Ltd. 8F., No. 192, Sec. 2, Zhongxing Rd., Xindian Dist., New Taipei City 231 Taiwan
Manufacturer's Name	Billion Electric Co., Ltd.
Test Method Requested, Standard	FCC CFR Title 47 Part 96 ANSI/TIA-603-E-2016 ANSI C63.26-2015
Verdict Summary	IN COMPLIANCE
Documented By Ida Tung	Ida Tung
Tested by Joe Wang	Joe Wang
Approved By Will Chen	Will Chen
Date of Receipt	2024/03/01
Date of Issue	2024/06/14
Report Version	V1.0

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Competences and Guarantees

DEKRA is a testing laboratory competent to carry out the tests described in this report.

In order to assure the traceability to other national and international laboratories, DEKRA has a calibration and maintenance program for its measurement equipment.

DEKRA guarantees the reliability of the data presented in this report, which is the result of the measurements and the tests performed to the item under test on the date and under the conditions stated in the report and it is based on the knowledge and technical facilities available at DEKRA at the time of performance of the test.

DEKRA is liable to the client for the maintenance of the confidentiality of all information related to the item under test and the results of the test.

The results presented in this Test Report apply only to the particular item under test established in this document.

IMPORTANT: No parts of this report may be reproduced or quoted out of context, in any form or by any means, except in full, without the previous written permission of DEKRA.

General Conditions

1. The test results relate only to the samples tested.
2. The test results shown in the test report are traceable to the national/international standard through the calibration report of the equipment and evaluated measurement uncertainty herein.
3. This report must not be used to claim product endorsement by TAF or any agency of the government.
4. The test report shall not be reproduced without the written approval of DEKRA Testing and Certification Co., Ltd.
5. Measurement uncertainties evaluated for each testing system and associated connections are given here to provide the system information for reference. Compliance determinations do not take into account measurement uncertainties for each testing system, but are based on the results of the compliance measurement.

Revision History

Version	Description	Issued Date
V1.0	Initial issue of report	2024/06/14

Summary of Test Result

Report Clause	Ref Std. Clause	Test Items	Result (PASS/FAIL)	Remark
3	Part 2.1046, 96.41(b)	RF Output Power	PASS	-
-	Part 2.1046, 96.41(b)	Maximum Power Spectral Density	PASS	Note
-	Part 2.1049, 96.41	Occupied Bandwidth	PASS	Note
-	Part 2.1051, 96.41	Spurious Emission at Antenna Terminals	PASS	Note
4	Part 2.1051, 96.41	Spurious Emission	PASS	-
-	Part 2.1055	Frequency Stability	PASS	Note
-	Part 96.41	Peak to Average Ratio	PASS	Note

Note:

This report is to request the Class II Permissive Change for FCC ID: QI3BEC-MX220UT5G. The major change filed under this application is to:

Change #1: Only 5G NR n48 band is enabled, other WCDMA, LTE and 5G NR bands are disabled by SW.

Change #2: Add 1 antenna and this antenna is used for the platform: Advanced Industrial 5G Router, model: MX-220-UT-5G.

Change #3: Reduce the Output Power through firmware

Except for the above differences, the hardware design is identical with the original grant.

According to the major change, DEKRA tests RF Output Power and Radiated Spurious Emission, and other testing data refer to original module reports.

Comments and Explanations

The declared of product specification for EUT presented in the report are provided by the manufacturer, and the manufacturer takes all the responsibilities for the accuracy of product specification.

1. General Information

1.1. EUT Description

Frequency Range	3550 ~ 3700 MHz (Uplink) 3550 ~ 3700 MHz (Downlink)	
Bandwidth	SCS: 30 kHz	10 / 20 / 40 MHz
Type of Modulation	DFT-s-OFDM (pi/2 BPSK / QPSK / 16QAM / 64QAM / 256QAM) CP-OFDM (QPSK / 16QAM / 64QAM / 256QAM)	
Maximum Output Power	13.53 dBm	
Maximum E.I.R.P	22.43 dBm	

Accessories Information					
No.	Equipment Name	Brand Name	Model No.	Rating	Remark
1	AC to DC Power adapter	BILLION	BA024-15016AXU	Input: AC 100-240V~0.7A 50/60Hz Output: 15V  1.6A	With power cable: Non-Shielded, 1.6m
No.	Equipment Name	Description			
2	Terminal Block 3P to DC Jack cable	Brand Name: E-CALL, Model No.: 0116-368-J, Non-Shielded, 0.08m			
3	DB9 Female to Male Cable	Brand Name: Pan-International, Model No.: P96301A-23, Non-Shielded, 1m			

Host Information		
Brand Name	Product Name	Model No.
	Advanced Industrial 5G Router	MX-220-UT-5G

Antenna Information						
Item.	Ant.	Brand Name	Model No.	Type	Gain (dBi)	Remark
1	0	BECbyBILLION	ANT-SX-5048	Directional	8.8	RX
	1				8.9	TX/RX
	2				8.8	RX
	3				8.9	TX/RX

1.2. Testing Location Information

Site Description	Accredited by TAF
	Accredited Number: 3023

Test Laboratory	DEKRA Testing and Certification Co., Ltd.
	Linkou Laboratory
Address	No.5-22, Ruishukeng Linkou District, New Taipei City, 24451, Taiwan, R.O.C.
Performed Location	No. 26, Huaya 1st Rd., Guishan Dist., Taoyuan City 333411, Taiwan, R.O.C.
Phone Number	+886-3-275-7255
Fax Number	+886-3-327-8031

Ambient conditions in the laboratory:

Performed Item	Items	Required	Actual	Test Date
RF Output Power	Temperature (°C)	15~35 °C	23.1 °C	2024/05/02 ~ 2024/05/03
	Humidity (%RH)	20~75 %	58.9 %	
Radiated Emission	Temperature (°C)	15~35 °C	24.8 °C	2024/05/10
	Humidity (%RH)	20~75 %	62.4 %	

1.3. Measurement Uncertainty

Uncertainties have been calculated according to the DEKRA internal document with the emissions test results be included in the report. The measurement uncertainties given below are based on a 95% confidence level (based on a coverage factor (k=2)).

Test Item	Uncertainty
RF Output Power	± 1.58 dB
Radiated Spurious Emissions	± 5.88dB for 30MHz~1GHz
	± 3.11dB for 1GHz~18GHz
	± 3.09dB for 18GHz~40GHz

1.4. List of Test Equipment

Instrument	Manufacturer	Model No.	Serial No.	Cal. Date	Next Cal. Date
Universal Radio Communication Tester	Anritsu	MT8000A	6262134961	2023.05.30	2024.05.29
DC Power Supply	Keysight	E36234A	MY59001234	2023.11.09	2024.11.08
Bi-Log Antenna	SCHWARZBECK	VULB9168	9168-0675	2023.08.09	2025.08.08
Horn Antenna	Com-Power	AH-840	101101	2023.12.04	2025.12.03
Horn Antenna	RF SPIN	DRH18-E	210802A18ES	2024.03.28	2025.03.27
Pre-Amplifier	SGH	0301	20211007-7	2024.01.10	2025.01.09
Pre-Amplifier	EMCI	EMC051845SE	980632	2024.01.10	2025.01.09
Pre-Amplifier	EMCI	EMC05820SE	980362	2024.01.10	2025.01.09
Pre-Amplifier	EMCI	EMC184045SE	980369	2024.01.10	2025.01.09
Coaxial Cable	EMCI	EMC102-KM-KM-600	1160314	2024.01.10	2025.01.09
Coaxial Cable	EMCI	EMC102-KM-KM-7000	170242	2024.01.10	2025.01.09
Spectrum Analyzer	R&S	FSV3044	101115	2024.01.11	2025.01.10
Coaxial Cable	SUHNER	SUCOFLEX 106	25450/6	2024.01.10	2025.01.09
Coaxial Cable	SGH	SGH18	2021003-8	2024.01.10	2025.01.09
Coaxial Cable	SGH	HA800	GD20110222-8	2024.01.10	2025.01.09
Coaxial Cable	EMCI	EMC106	151113	2024.01.10	2025.01.09

Note: Test Software Version: e3 230303 dekra V9.

2. Test Configuration of EUT

2.1. Test Condition

EUT Operational Condition	
Testing Voltage	AC 120V/60Hz for host and DC 3.3V for module

2.2. The Measurement Configuration

Test Mode	Mode 1: 5G NR n48
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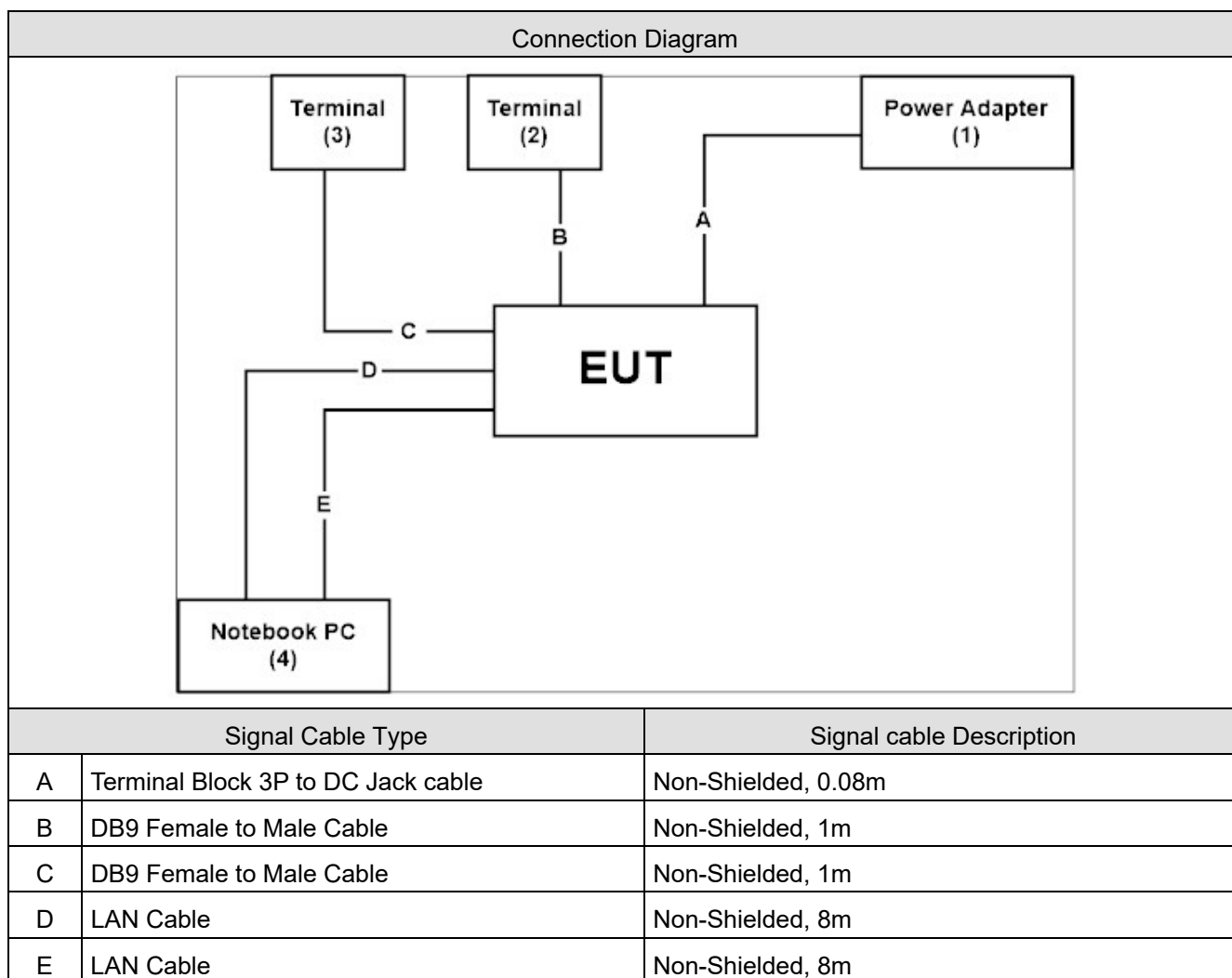
Note:

1. Determining compliance shall be based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.
2. Regarding frequency band operation, the lowest, middle and highest frequency of channel were selected to perform the test, and the details were shown on this report.
3. The device was tested under all configurations, combinations, bandwidths, RB configurations and modulations, and the worst case was found in PI/2 BPSK modulation, therefore the “Radiated Spurious Emission” test items perform PI/2 BPSK modulation in this report.
4. The EUT was performed at X axis, Y axis and Z axis positions for radiated spurious emission test. The worst case was found and the measurement will follow this same test configuration.

2.3. Tested System Details

	Product	Manufacturer	Model No.	Description
1	AC to DC Power adapter	BILLION	BA024-15016AXU	N/A
2	Terminal	N/A	N/A	N/A
3	Terminal	N/A	N/A	N/A
4	Notebook PC	DELL	Latitude 5580	2HRD7H2

2.4. Configuration of Tested System

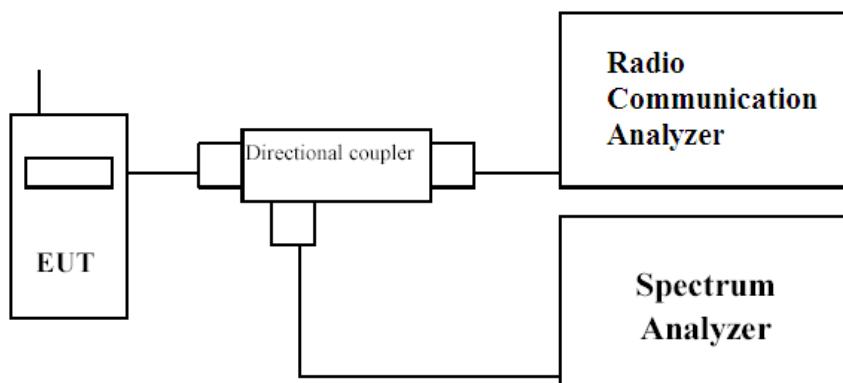


2.5. EUT Operating Procedures

1.	Setup the EUT connect to the base station.
2.	Setup the parameter (Band, Channel, Frequency).
3.	The EUT will continue receive the signal from LTE and 5GNR function.
4.	Repeat the above procedure (2) and (3).

3. RF Output Power

3.1. Test Setup



3.2. Test Limit

Type	Device	Maximum EIRP (dBm/10 MHz)	Maximum PSD (dBm/MHz)
X	End User Device	23	N/A
	Category A CBSD	30	20
	Category B CBSD	47	37

3.3. Test Procedure

1. Channel power measurements are performed using the signal analyzer's "channel power" measurement capability for signals with continuous operation.
2. RBW = 1 – 5% of the expected OBW, not to exceed 1MHz.
3. VBW ≥ 3 x RBW.
4. Span = 1.5 times the OBW.
5. No. of sweep points > 2 x span / RBW.
6. Detector = RMS.
7. Trigger is set to "free run" for signals with continuous operation with the sweep times set to "auto".
8. The integration bandwidth was set to 10MHz.
9. Trace mode = trace averaging (RMS) over 100 sweeps.
10. The trace was allowed to stabilize.

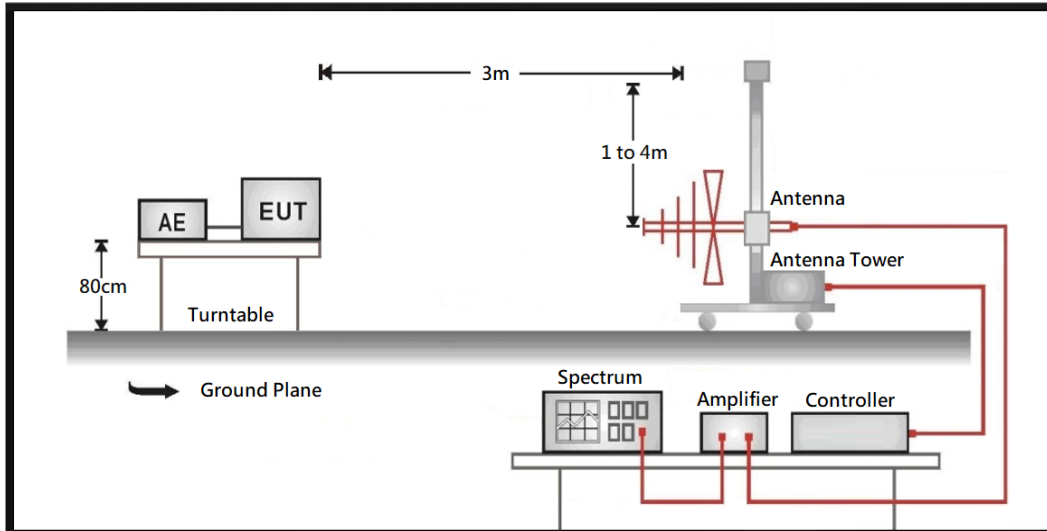
3.4. Test Result of RF Output Power

Refer as Appendix A

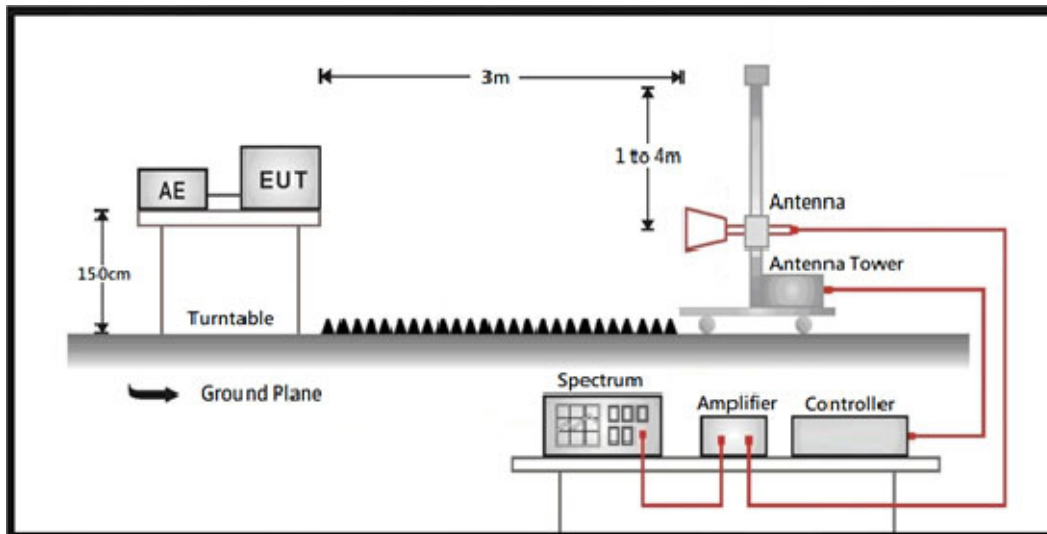
4. Spurious Emissions

4.1. Test Setup

Radiated Spurious Measurement: below 1GHz



Radiated Spurious Measurement: above 1GHz



4.2. Test Procedure

Radiated Spurious Measurement:

The EUT and its simulators are placed on a turn table which is 0.8 or 1.5 meter above ground. The turn table can rotate 360 degrees to determine the position of the maximum emission level. The height of the receiving antenna is varied between one meter and four meters to search the maximum spurious emission for both horizontal and vertical polarizations. The resolution bandwidth of the spectrum analyzer was set at 1 MHz, sufficient scans were taken to show the out of band Emission if any up to 10th harmonic. Taking the record of maximum spurious emission.

4.3. Test Result of Spurious Emission

Refer as Appendix B