

RF Exposure Report

Report No.: MFBCMA-WTW-P23030799

FCC ID: RAXTMOG4AR

Test Model: TMO-G4AR

Received Date: 2023/3/15

Test Date: 2023/5/11

Issued Date: 2023/5/23

Applicant: Arcadyan Technology Corporation

Address: No.8, Sec.2, Guangfu Rd., Hsinchu City 30071, Taiwan, R.O.C.

Issued By: Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch
Hsin Chu Laboratory

Lab Address: E-2, No.1, Li Hsin 1st Road, Hsinchu Science Park, Hsinchu City 300,
Taiwan

Test Location: E-2, No.1, Li Hsin 1st Road, Hsinchu Science Park, Hsinchu City 300,
Taiwan

**FCC Registration /
Designation Number:** 723255 / TW2022



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Release Control Record

Issue No.	Description	Date Issued
MFBCMA-WTW-P23030799	Original release.	2023/5/23

1 Certificate of Conformity

Product: 5G Gateway

Brand: T-Mobile

Test Model: TMO-G4AR

Sample Status: Engineering sample

Applicant: Arcadyan Technology Corporation

Test Date: 2023/5/11

FCC Rule Part: FCC Part 2 (Section 2.1091)

Standard: KDB 447498 D01 General RF Exposure Guidance v06

The above equipment has been tested by **Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's EMC characteristics under the conditions specified in this report.

Prepared by : Luna Yu , **Date:** 2023/5/23
Luna Yu / Specialist

Approved by : May Chen , **Date:** 2023/5/23
May Chen / Manager

2 RF Exposure

2.1 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)
Limits For General Population / Uncontrolled Exposure				
0.3-1.34	614	1.63	(100)*	30
1.34-30	824/f	2.19/f	(180/f ²)*	30
30-300	27.5	0.073	0.2	30
300-1500	...	...	f/1500	30
1500-100,000	...	...	1.0	30

f = Frequency in MHz ; *Plane-wave equivalent power density

2.2 MPE Calculation Formula

$$P_d = (P_{out} \cdot G) / (4 \cdot \pi \cdot r^2)$$

where

P_d = power density in mW/cm²

P_{out} = output power to antenna in mW

G = gain of antenna in linear scale

π = 3.1416

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

2.3 Classification

The antenna of this product, under normal use condition, is at least 21 cm away from the body of the user.
So, this device is classified as **Mobile Device**.

2.4 Antenna Gain

Antenna NO.	RF Chain NO.	Brand	Model	Antenna Net Gain (dBi)	Frequency range	Antenna Type	Connector Type	Cable Length (mm)
Wi-Fi + BT	Ant. 0	PSA	RFPCA261017IMLB403_A	1.77	2.4~2.4835 GHz	Dipole	ipex(MHF1)	171
				0.68	5.15~5.25 GHz			
				0.81	5.25~5.35 GHz			
				1.25	5.47~5.725 GHz			
				2.35	5.725~5.85 GHz			
	Ant. 1	PSA	RFPCA261013IMLB402_A	1.49	2.4~2.4835 GHz	Dipole	ipex(MHF1)	130
				0.42	5.15~5.25 GHz			
				1.01	5.25~5.35 GHz			
				1.68	5.47~5.725 GHz			
				2.14	5.725~5.85 GHz			
	Ant. 2	PSA	RFPCA261007IMLB402_A	1.33	2.4~2.4835 GHz	Dipole	ipex(MHF1)	75
				0.71	5.15~5.25 GHz			
				1.12	5.25~5.35 GHz			
				1.54	5.47~5.725 GHz			
				2.13	5.725~5.85 GHz			
	Ant. 3	PSA	RFPCA261008IMLB401_A	1.25	2.4~2.4835 GHz	Dipole	ipex(MHF1)	80
				0.58	5.15~5.25 GHz			
				1.23	5.25~5.35 GHz			
				1.49	5.47~5.725 GHz			
				2.32	5.725~5.85 GHz			
	BT+DFS(RX)	PSA	RFPCA261024IMLB401_A	4.72	2.4~2.4835 GHz	Dipole	ipex(MHF1)	245
				3.90	5.15~5.25 GHz			
				4.23	5.25~5.35 GHz			
				4.43	5.47~5.725 GHz			
				4.43	5.725~5.85 GHz			

Antenna NO.	RF Chain NO.	Brand	Model	Antenna Net Gain (dBi)	Frequency range	Antenna Type	Connector Type	Cable Length (mm)
WWAN Antenna (Internal)	B71 (TRx) (M2)	PSA	RFPCA811609IMMB403_B	3.17	663-698 MHz	Monopole	ipex(MHF1)	94
	B71 (Rx)(M1)		RFPCA811609IMMB402_A	3.10	663-698 MHz	Monopole	ipex(MHF1)	93
	B71 (Rx) (D1)		RFPCA652018IMMB401_A	2.09	663-698 MHz	Monopole	ipex(MHF1)	205
	B71 (Rx)(D2)		RFFPA656320IMMB401_B	2.01	663-698 MHz	Monopole	ipex(MHF1)	189
	B12 (TRx)(M2)	PSA	RFPCA811609IMMB403_B	3.34	698-716 MHz	Monopole	ipex(MHF1)	94
	B12 (Rx)(D2)		RFFPA656320IMMB401_B	2.05	698-716 MHz	Monopole	ipex(MHF1)	189
	B5 (TRx)(M2)	PSA	RFPCA811609IMMB403_B	1.68	824-849 MHz	Monopole	ipex(MHF1)	94
	B5 (Rx) (D2)		RFFPA656320IMMB401_B	0.63	824-849 MHz	Monopole	ipex(MHF1)	189
	B4/B66 (TRx) (M2)	PSA	RFPCA811609IMMB403_B	3.69	1710-1780 MHz	Monopole	ipex(MHF1)	94
	B4/B66 (TRx) (M1)		RFPCA811609IMMB402_A	5.13	1710-1780 MHz	Monopole	ipex(MHF1)	93
	B4/B66 (Rx) (D1)		RFPCA652018IMMB401_A	4.26	1710-1780 MHz	Monopole	ipex(MHF1)	205
	B4/B66 (Rx) (D2)		RFFPA656320IMMB401_B	4.10	1710-1780 MHz	Monopole	ipex(MHF1)	189
	B2/B25 (TRx) (M2)	PSA	RFPCA811609IMMB403_B	3.33	1850-1915 MHz	Monopole	ipex(MHF1)	94
	B2/B25 (TRx) (M1)		RFPCA811609IMMB402_A	4.78	1850-1915 MHz	Monopole	ipex(MHF1)	93
	B2/B25 (Rx) (D1)		RFPCA652018IMMB401_A	3.79	1850-1915 MHz	Monopole	ipex(MHF1)	205
	B2/B25 (Rx) (D2)		RFFPA656320IMMB401_B	4.11	1850-1915 MHz	Monopole	ipex(MHF1)	189
	B41 (TRx) (M2)	PSA	RFPCA811609IMMB403_B	2.78	2496-2690 MHz	Monopole	ipex(MHF1)	94
	B41 (TRx) (M1)		RFPCA811609IMMB402_A	3.02	2496-2690 MHz	Monopole	ipex(MHF1)	93
	B41 (Rx) (Omni-Antenna HC1O)		RFPCA380906IMMB401_A	4.45	2496-2690 MHz	Dipole	ipex(MHF1)	60
	B41 (Rx) (Omni-Antenna HC2O)		RFPCA380912IMMB401_A	3.67	2496-2690 MHz	Dipole	ipex(MHF1)	125
	B41 (Rx) (Semi-Antenna HC1S)		RFPCA474709IMMB401_A	7.59	2496-2690 MHz	Dipole	ipex(MHF1)	96
	B41 (Rx) (Semi-Antenna HC2S)		RFPCA474709IMMB401_A	7.76	2496-2690 MHz	Dipole	ipex(MHF1)	82
	B48 (TRx) (M2)		RFPCA811609IMMB403_B	0.94	3550-3700 MHz	Monopole	ipex(MHF1)	94
	B48 (TRx) (M1)		RFPCA811609IMMB402_A	1.02	3550-3700 MHz	Monopole	ipex(MHF1)	93
	B48 (Rx) (Omni-Antenna HC1O)	PSA	RFPCA380906IMMB401_A	4.64	3550-3700 MHz	Dipole	ipex(MHF1)	60
	B48 (Rx) (Omni-Antenna HC2O)		RFPCA380912IMMB401_A	4.03	3550-3700 MHz	Dipole	ipex(MHF1)	125
	B48 (Rx) (Semi-Antenna HC1S)		RFPCA474709IMMB401_A	7.67	3550-3700 MHz	Dipole	ipex(MHF1)	96
	B48 (Rx) (Semi-Antenna HC2S)		RFPCA474709IMMB401_A	8.01	3550-3700 MHz	Dipole	ipex(MHF1)	82

Antenna NO.	RF Chain NO.	Brand	Model	Antenna Net Gain (dBi)	Frequency range	Antenna Type	Connector Type	Cable Length (mm)
WWAN Antenna (Internal)	B77 (TRx) (M2)	PSA	RFPCA811609IMMB403_B	0.84	3300-4200 MHz	Monopole	ipex(MHF1)	94
	B77(TRx) (M1)		RFPCA811609IMMB402_A	0.91	3300-4200 MHz	Monopole	ipex(MHF1)	93
	B77 (Rx) (Omni-Antenna HC1O)		RFPCA380906IMMB401_A	4.73	3300-4200 MHz	Dipole	ipex(MHF1)	60
	B77 (Rx) (Omni-Antenna HC2O)		RFPCA380912IMMB401_A	4.14	3300-4200 MHz	Dipole	ipex(MHF1)	125
	B77 (Rx) (Semi-Antenna HC1S)		RFPCA474709IMMB401_A	7.98	3300-4200 MHz	Dipole	ipex(MHF1)	96
	B77 (Rx) (Semi-Antenna HC2S)		RFPCA474709IMMB401_A	8.13	3300-4200 MHz	Dipole	ipex(MHF1)	82

* Detail antenna specification please refer to antenna datasheet and/or antenna measurement report.

2.5 Calculation Result of Maximum Conducted Power

For Bluetooth

Operation Mode	Evaluation Frequency (MHz)	Max Avg. Power (mW)	Antenna Gain (dBi)	Distance (cm)	Power Density (mW/cm ²)	Limit (mW/cm ²)	Result
Bluetooth	2402-2480	11.83	4.72	21	0.00633	1	Pass

For WLAN - CDD Mode

Operation Mode	Evaluation Frequency (MHz)	Max Avg. Power (mW)	Antenna Gain (dBi)	Distance (cm)	Power Density (mW/cm ²)	Limit (mW/cm ²)	Result
WLAN 2.4 GHz	2412-2462	988.614	1.77	21	0.26815	1	Pass
WLAN 5 GHz	5180-5825	997.474	2.35	21	0.30921	1	Pass

For WLAN - Beamforming Mode

Operation Mode	Evaluation Frequency (MHz)	Max Avg. Power (mW)	Antenna Gain (dBi)	Distance (cm)	Power Density (mW/cm ²)	Limit (mW/cm ²)	Result
WLAN 2.4 GHz	2412-2462	641.372	7.48	21	0.64783	1	Pass
WLAN 5 GHz	5180-5825	863.913	6.62	21	0.71585	1	Pass

For WWAN

Operation Mode	Evaluation Frequency (MHz)	Max Avg. Power (mW)	Antenna Gain (dBi)	Distance (cm)	Power Density (mW/cm ²)	Limit (mW/cm ²)	Result
LTE Band 2	1850-1910	243.22	4.78	21	0.13193	1	Pass
LTE Band 4	1710-1755	242.661	5.13	21	0.14268	1	Pass
LTE Band 5	824-849	251.767	1.68	21	0.06689	0.54933	Pass
LTE Band 12	698-716	249.459	3.34	21	0.09713	0.46533	Pass
LTE Band 25	1850-1915	248.885	4.78	21	0.13501	1	Pass
LTE Band 48	3550-3700	124.165	1.02	21	0.02834	1	Pass
LTE Band 66	1710-1780	231.739	5.13	21	0.13625	1	Pass
LTE Band 71	663-698	259.417	3.17	21	0.09713	0.442	Pass
LTE Band 2 CA	1850-1910	199.986	4.78	21	0.10848	1	Pass
LTE Band 48	3652.5-3690	116.949	1.02	21	0.02669	1	Pass
LTE Band 48 CA	3550-3700	116.949	1.02	21	0.02669	1	Pass
NR 25	1850-1915	290.402	4.78	21	0.15753	1	Pass
NR 41	2496-2690	414.954	3.02	21	0.15009	1	Pass
NR 48	3550-3700	120.126	1.02	21	0.02742	1	Pass
NR 66	1710-1780	273.526	5.13	21	0.16082	1	Pass
NR 71	663-698	295.801	3.17	21	0.11075	0.442	Pass
NR 77	3700-3980	651.682	0.91	21	0.14501	1	Pass
NR 77	3450-3650	647.142	0.91	21	0.14400	1	Pass

NOTE:

- Determining compliance based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.

Conclusion:

The formula of calculated the MPE is:

$CPD1 / LPD1 + CPD2 / LPD2 + \dots \text{etc.} < 1$

CPD = Calculation power density

LPD = Limit of power density

WLAN - CDD Mode

WLAN 2.4 GHz + LTE Band 71 = $0.26815 / 1 + 0.09713 / 0.442 = 0.48790$

WLAN 2.4 GHz + NR 71 = $0.26815 / 1 + 0.11075 / 0.442 = 0.51872$

WLAN 5 GHz + Bluetooth + LTE Band 71 = $0.30921 / 1 + 0.00633 / 1 + 0.09713 / 0.442 = 0.53529$

WLAN 5 GHz + Bluetooth + NR 71 = $0.30921 / 1 + 0.00633 / 1 + 0.11075 / 0.442 = 0.56611$

WLAN - Beamforming Mode

WLAN 2.4 GHz + LTE Band 71 = $0.64783 / 1 + 0.09713 / 0.442 = 0.86758$

WLAN 2.4 GHz + NR 71 = $0.64783 / 1 + 0.11075 / 0.442 = 0.89840$

WLAN 5 GHz + Bluetooth + LTE Band 71 = $0.71585 / 1 + 0.00633 / 1 + 0.09713 / 0.442 = 0.94193$

WLAN 5 GHz + Bluetooth + NR 71 = $0.71585 / 1 + 0.00633 / 1 + 0.11075 / 0.442 = 0.97275$

Therefore the maximum calculations of above situations are less than the “1” limit.

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