RF EXPOSURE REPORT

CERTIFICATE OF CONFORMITY

FCC Rule Part:	**FCC Part 2 (Section 2.1091)**
Report No.:	MFBEIH-WTW-P22120620 R1
FCC ID:	P27-TMOG4SE
Product:	T-Mobile 5G Gateway
Brand:	T-Mobile
Model No.:	TMO-G4SE
Received Date:	2022/12/19
Test Date:	2023/2/15
Issued Date:	2023/5/5
Applicant:	Sercomm Corp.
Address:	8F, No. 3-1, YuanQu St., NanKang, Taipei 115, Taiwan, R.O.C.
Issued By:	Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch Lin Kou Laboratories
Lab Address:	No. 47-2, 14th Ling, Chia Pau Vil., Lin Kou Dist., New Taipei City, Taiwan
Test Location:	No. 19, Hwa Ya 2nd Rd., Wen Hwa Vil., Kewi Shan Dist., Taoyuan City 33383, Taiwan
FCC Registration / Designation Number:	788550 / TW0003

Approved by: Jeremy Lin , **Date:** 2023/5/5

Jeremy Lin / Project Engineer

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Prepared by : Lena Wang / Specialist

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Release Control Record

Issue No.	Description	Date Issued
MFBEIH-WTW-P22120620	Original Release	2023/3/31
MFBEIH-WTW-P22120620 R1	Revise P10~11 External Antenna gain and data	2023/5/5

1 Certificate

Product:	T-Mobile 5G Gateway
Brand:	T-Mobile
Test Model:	TMO-G4SE
Sample Status:	Engineering Sample
Applicant:	Sercomm Corp.
Test Date:	2023/2/15
FCC Rule Part:	FCC Part 2 (Section 2.1091)
Standard:	KDB 447498 D04 Interim General RF Exposure Guidance v01

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 RF characteristics under the conditions specified in this report.

2 Applicable RF Exposure Limit

§ 1.1310 Radiofrequency radiation exposure limits.

(a) Specific absorption rate (SAR) shall be used to evaluate the environmental impact of human exposure to radiofrequency (RF) radiation as specified in § 1.1307(b) of this part within the frequency range of 100 kHz to 6 GHz (inclusive).
(b) The SAR limits for occupational/controlled exposure are 0.4 W/kg, as averaged over the whole body, and a peak spatialaverage SAR of 8 W/kg, averaged over any 1 gram of tissue (defined as a tissue volume in the shape of a cube). Exceptions are the parts of the human body treated as extremities, such as hands, wrists, feet, ankles, and pinnae, where the peak spatial-average SAR limit for occupational/controlled exposure is 20 W/kg, averaged over any 10 grams of tissue (defined as a tissue volume in the shape of a cube). Exposure may be averaged over a time period not to exceed 6 minutes to determine compliance with occupational/controlled SAR limits.
(c) The SAR limits for general population/uncontrolled exposure are 0.08 W/kg, as averaged over the whole body, and a peak spatial-average SAR of 1.6 W/kg, averaged over any 1 gram of tissue (defined as a tissue volume in the shape of a cube). Exceptions are the parts of the human body treated as extremities, such as hands, wrists, feet, ankles, and pinnae, where the peak spatial-average SAR limit is 4 W/kg, averaged over any 10 grams of tissue (defined as a tissue volume in the shape of a cube). Exposure may be averaged over a time period not to exceed 30 minutes to determine compliance with general population/uncontrolled SAR limits.

(e) Maximum Permissible Exposure (MPE) to radiofrequency electromagnetic fields

- Limits for General Population/Uncontrolled Exposure

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.

- Limits for Occupational/Controlled Exposure

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				
0.3-3.0	614	1.63	*(100)	≤6
3.0-30	1842/f	4.89/f	*($900/f^2$)	<6
30-300	61.4	0.163	1.0	<6
300-1,500			f/300	<6
1,500-100,000			5	<6

f = frequency in MHz. * = Plane-wave equivalent power density.

MPE-based Exemption – §1.1307(b)(3)(i)(C)

- The minimum separation distance (R in meters) from the body of a nearby person for the frequency (f in MHz) at which the source operates, the ERP (watts) is no more than the calculated value prescribed for that frequency. The MPE-based test exemption condition is in terms of ERP, defined as the product of the maximum antenna gain and the delivered maximum time-averaged power.
- Table applies to any RF source (i.e. single fixed, mobile, and portable transmitters) and specifies power and distance criteria for each of the five frequency ranges used for the MPE limits.

RF Source frequency (MHz)	Minimum Distance		Threshold ERP (watts)
	$\lambda_L/2\pi$	$\lambda_H/2\pi$	
0.3-1.34	159 m–35.6 m		1,920 R^2.
1.34-30	35.6 m–1.6 m		3,450 R^2/f^2.
30-300	1.6 m–159 mm		3.83 R^2.
300-1,500	159 mm–31.8 mm		0.0128 R^2f.
1,500-100,000	31.8 mm–0.5 mm		19.2 R^2.
R must be at least λ/2π, where λ is the free-space operating wavelength in meters.			

MPE-based Exemption – §1.1307(b)(3)(i)(B)

- For mobile devices that are not exempt per Table 1 of §1.1307(b)(1)(i)(C) and device at distances from 20 cm to 40 cm and in 0.3 GHz to 6 GHz. The MPE-based test exemption condition is in terms of ERP, defined as the product of the maximum antenna gain and the delivered maximum time-averaged power.

$$P_{\text{th}}\,(\text{mW}) = ERP_{20\,\text{cm}}\,(\text{mW}) = \begin{cases} 2040f & 0.3\ \text{GHz} \le f < 1.5\ \text{GHz} \\ 3060 & 1.5\ \text{GHz} \le f \le 6\ \text{GHz} \end{cases}$$

Routine Evaluation

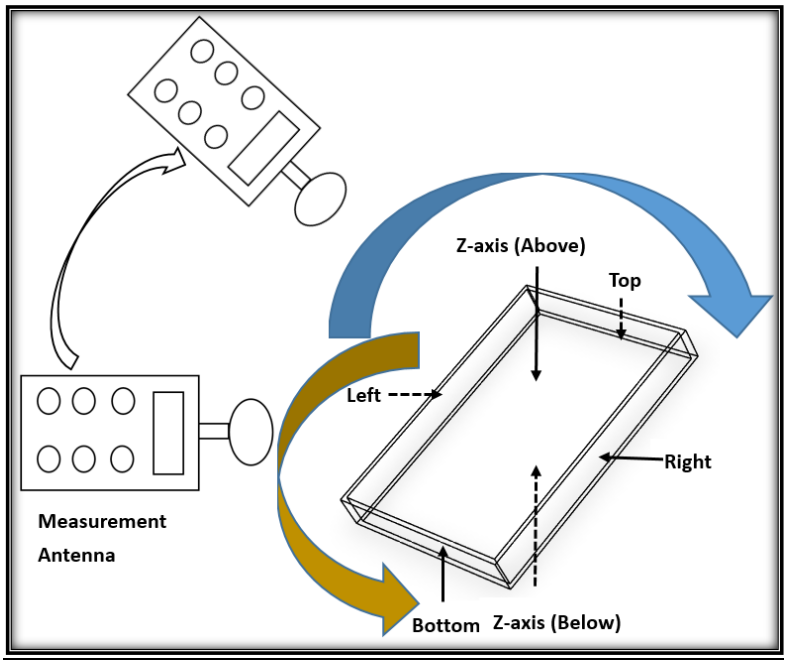
Routine Evaluation Procedure - Single and/or Multiple RF Sources

- MPE compliance are measurement in all directions surrounding the antenna and radiating structures of the device.

  For non-directional antennas, MPE evaluation points shall be along radials extending from the antenna (axis) that are no more than 30° apart. The direction of maximum exposure shall be aligned with one of the radials.

  For each specific exposure condition, the evaluation points along the longest dimension (e.g., vertical) shall use a spatial resolution of 10 cm or less, and shall extend at least 10 cm beyond the exposed portions of a person's body or until the evaluated results are less than 10% of the MPE limit. For exposures occurring next to the ground or next to a ground plane, the evaluation points shall be no closer than 10 cm from the ground.

Test Setup



Note: The measurement antenna are moving and surrounding the EUT when performed the test, the test results recorded the highest values for each sides of the EUT (left/right/top/bottom/z-axis)

Test Instruments

The calibration interval of the all test instruments are 12 months and the calibrations are traceable to NML/ROC and NIST/USA.

2.1 RF Exposure

Description Manufacturer	Model No.	Serial No.	Calibrated Date	Calibrated Until
EM Field Meter SGH	SMP2 Dual	22SN1913	2022/4/21	2023/4/20

Notes:

1. The test was performed in Oven room.
2. Tested Date: 2023/3/14

Fixed RF sources operating in the same time-averaging period – §1.1307(b)(3)(ii)(B)

- Either SAR-based or MPE-based exemption may be considered for test exemption for fixed, mobile, or portable device exposure conditions; therefore, the contributions from each exemption in conjunction with the measured SAR (Evaluatedk term) should be used to determine exemption for simultaneous transmission according to Formula below,

$$\sum_{i=1}^{a} \frac{P_i}{P_{th,i}} + \sum_{j=1}^{b} \frac{ERP_j}{ERP_{th,j}} + \sum_{k=1}^{c} \frac{Evaluated_k}{Exposure\ Limit_k} \leq 1$$

The sum of the ratios of the applicable terms for SAR-based, MPE-based and measured SAR or MPE should be less than 1, to determine simultaneous transmission exposure compliance.

Where:

a = number of fixed, mobile, or portable RF sources claiming exemption using paragraph (b)(3)(i)(B) of this section for P_{th}, including existing exempt transmitters and those being added.

c = number of existing fixed, mobile, or portable RF sources with known evaluation for the specified minimum distance including existing evaluated transmitters.

$P_{th,i}$ = the exemption threshold power (P_{th}) according to paragraph (b)(3)(i)(B) of this section for fixed, mobile, or portable RF source *i.*

$ERP_{th,j}$ = exemption threshold ERP for fixed, mobile, or portable RF source *j,* at a distance of at least λ/2π according to the applicable formula of paragraph (b)(3)(i)(C) of this section.

Exposure Limit$_k$ = either the general population/uncontrolled maximum permissible exposure (MPE) or specific absorption rate (SAR) limit for each fixed, mobile, or portable RF source *k,* as applicable from § 1.1310 of this chapter.

b = number of fixed, mobile, or portable RF sources claiming exemption using paragraph (b)(3)(i)(C) of this section for Threshold ERP, including existing exempt transmitters and those being added.

P_i = the available maximum time-averaged power or the ERP, whichever is greater, for fixed, mobile, or portable RF source *i* at a distance between 0.5 cm and 40 cm (inclusive).

ERP_j = the ERP of fixed, mobile, or portable RF source *j.*

Evaluated$_k$ = the maximum reported SAR or MPE of fixed, mobile, or portable RF source *k* either in the device or at the transmitter site from an existing evaluation at the location of exposure.

3 Test Results

3.1 RF Exposure

Environmental Conditions:	25°C, 60% RH	Tested By:	Wayne Lin

For Single RF Source

WLAN

MPE-based Exemption §1.1307(b)(3)(i)(B)							
Operation Mode	Frequency Band (MHz)	Average Power (mW)	Antenna Gain (dBi)	Maximum ERP (mW)	Distance (cm)	Limit Threshold (mW)	Test Result
Bluetooth	2402-2480	6.486	1.7	5.848	20	3060	Pass
CDD WLAN 2.4 GHz	2412-2462	992.48	3.8	1451.182	20	3060	Pass
WLAN 5 GHz_CDD	5180-5240	879.653	3.4	1173.036	20	3060	Pass
WLAN 5 GHz_BF	5180-5240	491.993	8.84	2295.931	20	3060	Pass
WLAN 5 GHz_CDD	5260-5320	227.584	3.4	303.488	20	3060	Pass
WLAN 5 GHz_BF	5260-5320	128.863	8.84	601.351	20	3060	Pass
WLAN 5 GHz_CDD	5500-5720	239.377	3.9	358.164	20	3060	Pass
WLAN 5 GHz_BF	5500-5720	126.72	8.94	605.125	20	3060	Pass
WLAN 5 GHz_CDD	5745-5825	985.663	3.8	1441.214	20	3060	Pass

Routine Evaluation (General Population)					
Operation Mode	Frequency Band (MHz)	Power Density (mW/cm^2)	Test Distance (cm)	Limit (mW/cm^2)	Test Result
BF WLAN 2.4 GHz	2412-2462	0.028	20	1	Pass
BF WLAN 5 GHz	5180-5825	0.034	20	1	Pass

WWAN

For Internal Antenna

LTE

MPE-based Exemption §1.1307(b)(3)(i)(C)							
Operation Mode	Frequency Band (MHz)	Average Power (mW)	Antenna Gain (dBi)	Maximum ERP (mW)	Distance (cm)	Limit Threshold (mW)	Test Result
LTE Band 2	1850.7-1909.3	316.228	3	384.592	20	768	Pass
LTE Band 4(OAI/DA)	1710.7-1754.3	316.228	2.7	358.922	20	768	Pass
LTE Band 5	824.7-848.3	316.228	2.2	319.89	20	422.246	Pass
LTE Band 12	699.7-715.3	316.228	1.4	266.073	20	358.246	Pass
LTE Band 25	1850.7-1914.3	316.228	3	384.592	20	768	Pass
LTE Band 48(OA)	3552.5-3697.5	112.202	4.7	201.837	20	768	Pass
LTE Band 66(OAIDA)	1710.7-1779.3	316.228	2.7	358.922	20	768	Pass

Routine Evaluation (General Population)					
Operation Mode	Frequency Band (MHz)	Power Density (mW/cm^2)	Test Distance (cm)	Limit (mW/cm^2)	Test Result
LTE Band 41	2498.5-2687.5	0.052	20	1	Pass
LTE Band 71	665.5-695.5	0.056	20	0.443	Pass

5GNR

MPE-based Exemption §1.1307(b)(3)(i)(C)							
Operation Mode	Frequency Band (MHz)	Average Power (mW)	Antenna Gain (dBi)	Maximum ERP (mW)	Distance (cm)	Limit Threshold (mW)	Test Result
5G NR n25	1852.5-1912.5	316.228	3	384.592	20	768	Pass
5G NR n48	3555-3694.98	79.433	2	76.736	20	768	Pass
5G NR n66(OAI/DA)	1712.5-1777.5	316.228	2.7	358.922	20	768	Pass

MPE-based Exemption §1.1307(b)(3)(i)(B)							
Operation Mode	Frequency Band (MHz)	Average Power (mW)	Antenna Gain (dBi)	Maximum ERP (mW)	Distance (cm)	Limit Threshold (mW)	Test Result
5G NR n77(OA)	3705-3975	602.56	4.7	1083.928	20	3060	Pass

Routine Evaluation (General Population)					
Operation Mode	Frequency Band (MHz)	Power Density (mW/cm^2)	Test Distance (cm)	Limit (mW/cm^2)	Test Result
5G NR n41	2501.01-2685	0.066	20	1	Pass
5G NR n71	665.5-695.5	0.061	20	0.443	Pass

For External Antenna

LTE

MPE-based Exemption §1.1307(b)(3)(i)(C)							
Operation Mode	Frequency Band (MHz)	Average Power (mW)	Antenna Gain (dBi)	Maximum ERP (mW)	Distance (cm)	Limit Threshold (mW)	Test Result
LTE Band 4(EA)	1710.7-1754.3	281.838	4.59	494.31	20	768	Pass
LTE Band 48(EA)	3552.5-3697.5	79.433	2.64	88.92	20	768	Pass
LTE Band 66(EA)	1710.7-1779.3	281.838	4.59	494.31	20	768	Pass
LTE Band 2	1850.7-1909.3	316.228	4.59	554.626	20	768	Pass
LTE Band 25	1850.7-1914.3	316.228	4.59	554.626	20	768	Pass

MPE-based Exemption §1.1307(b)(3)(i)(B)							
Operation Mode	Frequency Band (MHz)	Average Power (mW)	Antenna Gain (dBi)	Maximum ERP (mW)	Distance (cm)	Limit Threshold (mW)	Test Result
LTE Band 12	699.7-715.3	316.228	1.35	263.027	20	1427.388	Pass
LTE Band 41	2498.5-2687.5	316.228	3.99	483.059	20	3060	Pass
LTE Band 71	665.5-695.5	316.228	1.9	298.538	20	1357.62	Pass

Routine Evaluation (General Population)					
Operation Mode	Frequency Band (MHz)	Power Density (mW/cm^2)	Test Distance (cm)	Limit (mW/cm^2)	Test Result
LTE Band 5	824.7-848.3	0.061	20	0.549	Pass

5GNR

MPE-based Exemption §1.1307(b)(3)(i)(C)							
Operation Mode	Frequency Band (MHz)	Average Power (mW)	Antenna Gain (dBi)	Maximum ERP (mW)	Distance (cm)	Limit Threshold (mW)	Test Result
5G NR n41	2501.01-2685	416.869	3.99	636.795	20	768	Pass
5G NR n48	3555-3694.98	79.433	2.64	88.92	20	768	Pass
5G NR n71	665.5-695.5	316.228	1.9	298.538	20	340.736	Pass

Routine Evaluation (General Population)					
Operation Mode	Frequency Band (MHz)	Power Density (mW/cm^2)	Test Distance (cm)	Limit (mW/cm^2)	Test Result
5G NR n25	1852.5-1912.5	0.06	20	1	Pass
5G NR n66(EA)	1712.5-1777.5	0.059	20	1	Pass
5G NR n77(EA)	3705-3975	0.058	20	1	Pass

Note:

1. Determining compliance based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.
2. The above Max Power for WWAN is Tune-up Power which client declared.
3. Detail antenna specification please refer to antenna datasheet and/or antenna measurement report.
4. The EUT contains certified WWAN module with FCC ID: GKRRMLN1T.

For Multiple RF Sources (Simultaneous Operations)

Multiple RF Sources (Simultaneous Operations)							
Exemption Evaluation					Sum of Ratios	Limit of Ratios	Test Result
Operation Mode	Frequency Band (MHz)	Maximum ERP (mW)	Limit Threshold (mW)	Ratio			
Bluetooth	2402-2480	5.848	3060	0.002	0.94	1	Pass
5G NR n71	665.5-695.5	298.538	340.736	0.876			
Routine Evaluation (General Population)							
Operation Mode	Operation Mode	Power Density (mW/cm^2)	Limit (mW/cm^2)	Ratio			
BF WLAN 2.4 GHz	2412-2462	0.028	1	0.028			
BF WLAN 5 GHz	5180-5825	0.034	1	0.034			

4 Conclusion

Source-base time average power is below Exemption Criteria and/or Routine Evaluation MPE thresholds, therefore the device is compliant FCC RF exposure requirement.

5 Information of the Testing Laboratories

We, Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch, were founded in 1988 to provide our best service in EMC, Radio, Telecom and Safety consultation. Our laboratories are FCC recognized accredited test firms and accredited according to ISO/IEC 17025.

If you have any comments, please feel free to contact us at the following:

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