


FCC SAR TEST REPORT

FCC ID : E2KFM101GL
Equipment : LTE Module
Brand Name : Fibocom
Model Name : FM101-GL
Applicant : Dell Inc.
One Dell Way Round Rock, Texas 78682 United States
Manufacturer : Dell Inc.
One Dell Way Round Rock, Texas 78682 United States
Standard : FCC 47 CFR Part 2 (2.1093)

We, SPORTON INTERNATIONAL INC., would like to declare that the tested sample provide by manufacturer and the test data has been evaluated in accordance with the test procedures given in 47 CFR Part 2.1093 and FCC KDB and has been pass the FCC requirement.

The test results in this report apply exclusively to the tested model / sample. Without written approval of SPORTON INTERNATIONAL INC. Laboratory, the test report shall not be reproduced except in full.



Approved by: Cona Huang / Deputy Manager



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1. Equipment Under Test (EUT) Information

1.1 General Information

Product Feature & Specification	
Equipment Name	LTE Module
Brand Name	Fibocom
Model Name	FM101-GL
FCC ID	E2KFM101GL
Wireless Technology and Frequency Range	WCDMA Band II: 1850 MHz ~ 1910 MHz WCDMA Band IV: 1710 MHz ~ 1755 MHz WCDMA Band V: 824 MHz ~ 849 MHz LTE Band 2: 1850 MHz ~ 1910 MHz LTE Band 4: 1710 MHz ~ 1755 MHz LTE Band 5: 824 MHz ~ 849 MHz LTE Band 7: 2500 MHz ~ 2570 MHz LTE Band 12: 699 MHz ~ 716 MHz LTE Band 13: 777 MHz ~ 787 MHz LTE Band 14: 788 MHz ~ 798 MHz LTE Band 17: 704 MHz ~ 716 MHz LTE Band 25: 1850 MHz ~ 1915 MHz LTE Band 26: 814 MHz ~ 849 MHz LTE Band 30: 2305 MHz ~ 2315 MHz LTE Band 38: 2570 MHz ~ 2620 MHz LTE Band 41: 2496 MHz ~ 2690 MHz LTE Band 48: 3550 MHz ~ 3700 MHz LTE Band 66: 1710 MHz ~ 1780 MHz LTE Band 71: 663 MHz ~ 698 MHz
Mode	RMC 12.2Kbps HSDPA HSUPA DC-HSDPA LTE: QPSK, 16QAM
EUT Stage	Identical Prototype
Remark: 1. This device has two antenna vendors; RF exposure evaluation selects Hong-Bo as the main test, Speed will spot check worst case found in Hong-Bo.	

Host Information	
Equipment Name	Portable Computer
Brand Name	DELL
Marketing Name	P29T
Integrated WLAN Module	Brand Name: Intel® Wi-Fi 6E AX203 Model Name: AX203D2W
Wireless Technology and Frequency Range	WLAN 2.4GHz Band: 2400 MHz ~ 2483.5 MHz WLAN 5.2GHz Band: 5150 MHz ~ 5250 MHz WLAN 5.3GHz Band: 5250 MHz ~ 5350 MHz WLAN 5.6GHz Band: 5470 MHz ~ 5725 MHz WLAN 5.8GHz Band: 5725 MHz ~ 5895 MHz Bluetooth: 2400 MHz ~ 2483.5 MHz
Mode	WLAN: 802.11a/b/g/n/ac/ax HT20/HT40/VHT80/HE20/HE40/HE80 Bluetooth BR/EDR/LE
Remark: 1. The Intel AX203D2W WLAN/BT module is also integrated into this host. The WLAN and Bluetooth SAR results are referenced from Intel SAR report, report number: 200928-02.TR07 (FCC ID: PD9AX203D2) and 210209-01.TR53 (FCC ID: PD9AX203D2) and these SAR results are also used to perform simultaneous transmission analysis.	

Reviewed by: Jason Wang
 Report Producer: Carlie Tsai



WWAN Antenna Information				
Hong Bo 260-2443 COMPAL P/N: DC33002U50L	Ant. Type	MONOPOLE	Peak Gain	WCDMA Band II: 3.80 WCDMA Band IV: 1.71 WCDMA Band V: -0.86 LTE Band 2: 3.80 LTE Band 4: 1.71 LTE Band 5: -0.86 LTE Band 7: 2.28 LTE Band 12: -0.76 LTE Band 13: 0.13 LTE Band 14: -0.50 LTE Band 17: -0.76 LTE Band 25: 3.80 LTE Band 26: -0.86 LTE Band 30: 0.88 LTE Band 38: 0.46 LTE Band 41: 2.28 LTE Band 48: 0.16 LTE Band 66: 2.73 LTE Band 71: -0.97
Speed F-0G-FH-6171-001-00 COMPAL P/N: DC33002UF0L	Ant. Type	MONOPOLE	Peak Gain	WCDMA Band II: 3.61 WCDMA Band IV: 1.73 WCDMA Band V: -0.96 LTE Band 2: 3.61 LTE Band 4: 1.73 LTE Band 5: -0.96 LTE Band 7: 1.51 LTE Band 12: -1.40 LTE Band 13: -0.82 LTE Band 14: -0.61 LTE Band 17: -1.40 LTE Band 25: 3.61 LTE Band 26: -0.96 LTE Band 30: 0.99 LTE Band 38: 0.59 LTE Band 41: 1.51 LTE Band 48: 0.75 LTE Band 66: 2.56 LTE Band 71: -1.81

Antenna Information										
Hong-Bo	Ant. Type	PIFA	connector	I-Pex(NGFF)	Speed	Ant. Type	PIFA	connector	I-Pex(NGFF)	
	Model No.	260-24443 (Compal P/N:DC33002U50L)				Model No.	F-0G-FH-6171-001-00 (Compal P/N:DC33002UF0L)			
	Peak Gain (dBi)					Peak Gain (dBi)				
	2400~2483.5MHz	2.58	5850~5925MHz	2.72		2400~2483.5MHz	2.77	5850~5925MHz	2.85	
	5150~5250MHz	1.45	5925~6425MHz	NA		5150~5250MHz	1.75	5925~6425MHz	NA	
	5250~5350MHz	1.55	6425~6525MHz	NA		5250~5350MHz	1.75	6425~6525MHz	NA	
	5470~5725MHz	2.48	6525~6875MHz	NA		5470~5725MHz	2.5	6525~6875MHz	NA	
5725~5850MHz	2.64	6875~7125MHz	NA	5725~5850MHz	2.85	6875~7125MHz	NA			



2. Guidance Applied

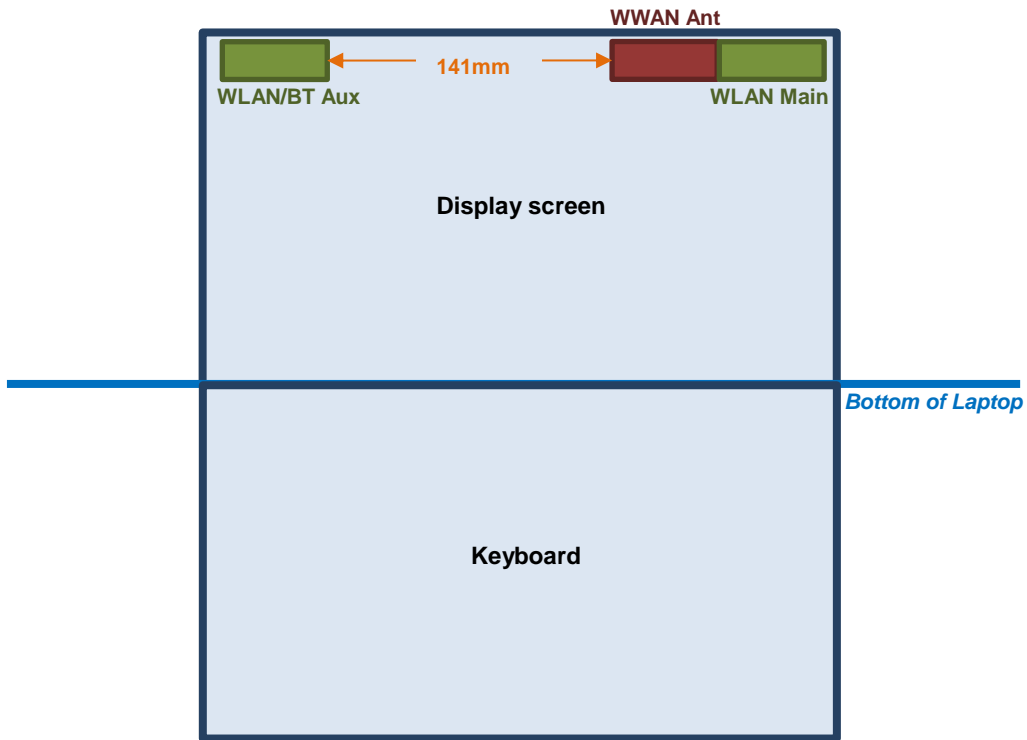
The Specific Absorption Rate (SAR) testing specification, method, and procedure for this device is in accordance with the following standards, the below KDB standard may not including in the TAF code without accreditation.

- FCC 47 CFR Part 2 (2.1093)
- ANSI/IEEE C95.1-1992
- IEEE 1528-2013
- FCC KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz v01r04
- FCC KDB 865664 D02 SAR Reporting v01r02
- FCC KDB 447498 D01 General RF Exposure Guidance v06
- FCC KDB 616217 D04 SAR for laptop and tablets v01r02

3. Maximum Tune-up limit (Unit: dBm)

Frequency Band		Tune-up Limit
WCDMA	WCDMA Band II	24.5
	WCDMA Band IV	24.5
	WCDMA Band V	24.5
LTE	Band 2	24
	Band 4	24
	Band 5	25
	Band 7	24
	Band 12	25
	Band 13	25
	Band 14	25
	Band 17	25
	Band 25	24
	Band 26	25
	Band 30	23
	Band 38	24
	Band 41	24
	Band 41_HPUE	27
	Band 48	22
Band 66	24	
Band 71	25	

4. Antenna Location



The separation distance for antenna to edge :

Antenna	To Bottom of Laptop (mm)
WWAN Antenna	198
WLAN Main Antenna	198
WLAN/BT Aux Antenna	198



<SAR test exclusion table>

General Note:

1. The below table, when the distance is < 50 mm exclusion threshold is "Ratio", when the distance is > 50 mm exclusion threshold is "mW"
2. Maximum power is the source-based time-average power and represents the maximum RF output power among production units
3. Per KDB 447498 D01v06, for larger devices, the test separation distance of adjacent edge configuration is determined by the closest separation between the antenna and the user.
4. Per KDB 447498 D01v06, standalone SAR test exclusion threshold is applied; If the test separation distance is < 5mm, 5mm is used to determine SAR exclusion threshold.
5. Per KDB 447498 D01v06, the 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at *test separation distances* ≤ 50 mm are determined by:
 - $[(\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm})] \cdot \sqrt{f(\text{GHz})} \leq 3.0$ for 1-g SAR and ≤ 7.5 for 10-g extremity SAR
 - f(GHz) is the RF channel transmit frequency in GHz
 - Power and distance are rounded to the nearest mW and mm before calculation
 - The result is rounded to one decimal place for comparison
6. Per KDB 447498 D01v06, at 100 MHz to 6 GHz and for *test separation distances* > 50 mm, the SAR test exclusion threshold is determined according to the following
 - a) [Threshold at 50 mm in step 1) + (test separation distance - 50 mm) · (f(MHz)/150)] mW, at 100 MHz to 1500 MHz
 - b) [Threshold at 50 mm in step 1) + (test separation distance - 50 mm) · 10] mW at > 1500 MHz and ≤ 6 GHz

Exposure Position	Wireless Interface	WCDMA Band V	WCDMA Band IV	WCDMA Band II	LTE Band 71	LTE Band 12	LTE Band 13	LTE Band 14	LTE Band 17	LTE Band 5	LTE Band 26	LTE Band 4	LTE Band 66	LTE Band 2	LTE Band 25	LTE Band 30	LTE Band 7	LTE Band 38	LTE Band 41	LTE Band 48
	Calculated Frequency (MHz)	846	1750	1907	695	715	784	795	713	848	848	1754	1779	1909	1914	2312	2567	2617	2680	3690
	Maximum power (dBm)	24.5	24.5	24.5	25.0	25.0	25.0	25.0	25.0	25.0	25.0	24.0	24.0	24.0	24.0	23.0	24.0	24.0	24.0	22.0
	Maximum rated power(mW)	281.84	281.84	281.84	316.23	316.23	316.23	316.23	316.23	316.23	316.23	251.19	251.19	251.19	251.19	199.53	251.19	251.19	251.19	158.49
Bottom of Laptop	Separation distance(mm)	198.0																		
	exclusion threshold	998.0	1593.0	1589.0	866.0	883.0	943.0	953.0	881.0	1000.0	1000.0	1593.0	1592.0	1589.0	1588.0	1579.0	1574.0	1573.0	1572.0	1558.0
	Testing required?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

5. Simultaneous Transmission Analysis

NO.	Simultaneous Transmission Configurations	Body
1.	WWAN + WLAN2.4GHz Main Ant + WLAN2.4GHz Aux Ant	Yes
2.	WWAN + WLAN2.4GHz Main Ant + Bluetooth Aux Ant	Yes
3.	WWAN + WLAN5GHz Main Ant + WLAN5GHz Aux Ant + Bluetooth Aux Ant	Yes

General Note:

- The Intel AX203D2W WLAN/BT module is also integrated into this host. The WLAN and Bluetooth SAR results are referenced from Intel SAR report, report number: 200928-02.TR07 (FCC ID: PD9AX203D2) and these SAR results are also used to perform simultaneous transmission analysis.
- According to KDB 447498 D01v06, an estimated 0.4 W/kg for 1-g SAR and 1.0 W/kg for 10-g SAR, when the test separation distances is > 50 mm is used for Sim-Tx analysis.
- The Scaled SAR summation is calculated based on the same configuration and test position.
- Per KDB 447498 D01v06, simultaneous transmission SAR is compliant if,
 - Scalar SAR summation < 1.6W/kg.
 - $SPLSR = (SAR_1 + SAR_2)^{1.5} / (\min. \text{ separation distance, mm})$, and the peak separation distance is determined from the square root of $[(x_1-x_2)^2 + (y_1-y_2)^2 + (z_1-z_2)^2]$, where (x1, y1, z1) and (x2, y2, z2) are the coordinates of the extrapolated peak SAR locations in the zoom scan.
 - If $SPLSR \leq 0.04$, simultaneously transmission SAR measurement is not necessary.
 - Simultaneously transmission SAR measurement, and the reported multi-band SAR < 1.6W/kg.
 - The SPLSR calculated results please refer to section 5.2.

5.1 Body Exposure Conditions

Exposure Position	1	2	3	4	5	6	1+2+3 Summed 1g SAR (W/kg)	1+2+6 Summed 1g SAR (W/kg)	1+4+5+6 Summed 1g SAR (W/kg)	SPLSR	Case No
	Maximum WWAN	WLAN2.4GHz Main Ant	WLAN2.4GHz Aux Ant	WLAN5GHz Main Ant	WLAN5GHz Aux Ant	Bluetooth Aux Ant					
Bottom of Laptop at 0mm	0.400	0.360	0.340	0.800	0.760	0.030	1.100	0.790	1.990	0.02	Case 1

5.2 SPLSR Evaluation and Analysis

General Note:

- According to antenna location the minimum distance between each transmit antenna is using for SPLSR analysis
- Simultaneous transmission SAR test exclusion is determined for each operating configuration and exposure condition according to the reported standalone SAR of each applicable simultaneously transmitting antenna. When the sum of 1-g or 10-g SAR of all simultaneously transmitting antennas in an operating mode and exposure condition combination is within the SAR limit, SAR test exclusion applies to that simultaneous transmission configuration. Therefore, the adjacent transmit antennas will be summed first, and then the SPLSR calculation will be evaluated with the farther transmitted antennas.
- $SPLSR = (SAR_1 + SAR_2)^{1.5} / (\min. \text{ separation distance, mm})$. If $SPLSR \leq 0.04$, simultaneously transmission SAR measurement is not necessary

Case 1	Band	Position	SAR (W/kg)	Minimum distance (mm)	Summed SAR (W/kg)	SPLSR Results	Simultaneous SAR
	Maximum WWAN + WLAN5GHz Main Ant	Bottom of Laptop	1.2	141.0	1.99	0.02	Not required
	WLAN5GHz + BT Aux Ant		0.79				

Test Engineer : Kevin Guo



6. References

- [1] FCC 47 CFR Part 2 “Frequency Allocations and Radio Treaty Matters; General Rules and Regulations”
- [2] ANSI/IEEE Std. C95.1-1992, “IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz”, September 1992
- [3] IEEE Std. 1528-2013, “IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques”, Sep 2013
- [4] SPEAG DASY System Handbook
- [5] FCC KDB 447498 D01 v06, “Mobile and Portable Device RF Exposure Procedures and Equipment Authorization Policies”, Oct 2015
- [6] FCC KDB 616217 D04 v01r02, “SAR Evaluation Considerations for Laptop, Notebook, Netbook and Tablet Computers”, Oct 2015
- [7] FCC KDB 865664 D01 v01r04, "SAR Measurement Requirements for 100 MHz to 6 GHz", Aug 2015.
- [8] FCC KDB 865664 D02 v01r02, “RF Exposure Compliance Reporting and Documentation Considerations” Oct 2015.