

FCC SAR Test Report

APPLICANT : Motorola Mobility, LLC
EQUIPMENT : Mobile Cellular Phone
BRAND NAME : Motorola
MODEL NAME : 4594
FCC ID : IHDT56QG3
STANDARD : FCC 47 CFR Part 2 (2.1093)
ANSI/IEEE C95.1-1992
IEEE 1528-2003

We, SPORTON INTERNATIONAL INC., would like to declare that the tested sample has been evaluated in accordance with the procedures and had been in compliance with the applicable technical standards.

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



Reviewed by: Eric Huang / Deputy Manager



Approved by: Jones Tsai / Manager



SPORTON INTERNATIONAL INC.

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Table of Contents

1. Statement of Compliance	3
2. Administration Data	3
3. Guidance Standard	4
4. Equipment Under Test (EUT)	4
4.1 General Information	4
4.2 Maximum Tune-up Limit.....	5
4.3 General LTE SAR Test and Reporting Considerations.....	6
5. RF Exposure Limits.....	7
5.1 Uncontrolled Environment.....	7
5.2 Controlled Environment.....	7
6. Simultaneous Transmission Analysis	8
6.1 Head Exposure Conditions	8
6.2 Hotspot Exposure Conditions.....	9
6.3 Body-Worn Accessory Exposure Conditions.....	9
7. References.....	10
Appendix A. WWAN Reference Report	
Appendix B. BT/WiFi Reference Report	
Appendix C. Supplemental SAR Reference Report	

Revision History

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FA542019-03	Rev. 01	Initial issue of report	May. 20, 2015

1. Statement of Compliance

The maximum results of Specific Absorption Rate (SAR) found during testing for **Motorola Mobility, LLC, Mobile Cellular Phone, 4594**, are as follows.

Equipment Class	Frequency Band	Highest SAR Summary			
		Head (Separation 0mm)	Body-worn (Separation 15mm)	Wireless Router (Separation 10mm)	Highest Simultaneous Transmission SAR (W/kg)
		1g SAR (W/kg)			
PCE	GSM850	0.41	0.49	0.62	1.18
	GSM1900	0.31	0.46	0.97	
	LTE Band 7	0.20	1.13	0.75	
DTS	2.4GHz WLAN	0.49	0.05	0.09	1.18
DSS	Bluetooth	0.09	0.01	0.02	1.13

This device is in compliance with Specific Absorption Rate (SAR) for general population/uncontrolled exposure limits (1.6 W/kg) specified in FCC 47 CFR part 2 (2.1093) and ANSI/IEEE C95.1-1992, and had been tested in accordance with the measurement methods and procedures specified in IEEE 1528-2003.

2. Administration Data

Testing Laboratory	
Test Site	SPORTON INTERNATIONAL INC.
Test Site Location	No.52, Hwa Ya 1st Rd., Hwa Ya Technology Park, Kwei-Shan District, Taoyuan City, Taiwan (R.O.C.) TEL: +886-3-327-3456 FAX: +886-3-328-4978

Applicant	
Company Name	Motorola Mobility, LLC
Address	222 W Merchandise Mart Plaza, Suite 1800, Chicago, IL 60654, United States

Manufacturer	
Company Name	Motorola Mobility, LLC
Address	222 W Merchandise Mart Plaza, Suite 1800, Chicago, IL 60654, United States

3. Guidance Standard

The Specific Absorption Rate (SAR) testing specification, method, and procedure for this device is in accordance with the following standards:

- FCC 47 CFR Part 2 (2.1093)
- ANSI/IEEE C95.1-1992
- IEEE 1528-2003
- FCC KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz v01r03
- FCC KDB 865664 D02 SAR Reporting v01r01
- FCC KDB 447498 D01 General RF Exposure Guidance v05r02
- FCC KDB 648474 D04 SAR Evaluation Considerations for Wireless Handsets v01r02
- FCC KDB 248227 D01 802.11 Wi-Fi SAR v02
- FCC KDB 941225 D01 3G SAR Procedures v03
- FCC KDB 941225 D05 SAR for LTE Devices v02r03
- FCC KDB 941225 D06 Hotspot Mode SAR v02

4. Equipment Under Test (EUT)

4.1 General Information

Product Feature & Specification	
Equipment Name	Mobile Cellular Phone
Brand Name	Motorola
Model Name	4594
FCC ID	IHDT56QG3
IMEI Code	355491060004373
Wireless Technology and Frequency Range	GSM850: 824.2 MHz ~ 848.8 MHz GSM1900: 1850.2 MHz ~ 1909.8 MHz LTE Band 7: 2502.5 MHz ~ 2567.5 MHz WLAN 2.4GHz Band: 2412 MHz ~ 2462 MHz Bluetooth: 2402 MHz ~ 2480 MHz
Mode	• GSM/GPRS/EGPRS • RMC/AMR 12.2Kbps • HSDPA • HSUPA • DC-HSDPA • LTE: QPSK, 16QAM • 802.11b/g/n HT20/ • Bluetooth v3.0 with EDR , Bluetooth v4.0 with LE
GSM / (E)GPRS Transfer mode	Class B – EUT cannot support Packet Switched and Circuit Switched Network simultaneously but can automatically switch between Packet and Circuit Switched Network.
EUT Stage	Identical Prototype
Remark:	
1. This report does not test any RF exposure result, all the cellular frequency band evaluation which refer to the Sporton FCC SAR Report, FCC ID: IHDT56QG2, Report No: FA542019-01A or Appendix A, and the BT/WLAN evaluation which refer to the Sporton FCC SAR Report, FCC ID: IHDT56QG1, Report No: FA542019A or Appendix B and these SAR results also used perform simultaneous transmission analysis. 2. While operating in body-adjacent exposure configurations during a mobile hotspot session, reduced power limits are enforced on the LTE B7 transmitter. More detailed information which can be referred to “operational description”.	

4.2 Maximum Tune-up Limit

Mode	Burst average power(dBm)	
	GSM 850	GSM 1900
GSM (GMSK, 1 Tx slot)	33.50	30.50
GPRS (GMSK, 1 Tx slot)	33.50	30.50
GPRS (GMSK, 2 Tx slots)	32.00	29.00
GPRS (GMSK, 3 Tx slots)	30.00	27.00
GPRS (GMSK, 4 Tx slots)	28.00	25.00
EDGE (8PSK, 1 Tx slot)	28.00	27.00
EDGE (8PSK, 2 Tx slots)	26.00	25.00
EDGE (8PSK, 3 Tx slots)	24.00	23.00
EDGE (8PSK, 4 Tx slots)	22.00	21.00

Band / Mode		Average power(dBm)
LTE	Band 7	24.00

Mode			Average Power (dBm)
2.4GHz WLAN	802.11b		16.00
	802.11g	CH 1	14.00
		CH 6	15.50
		CH 11	12.00
	802.11n-HT20	CH 1	13.00
		CH 6	14.50
		CH 11	9.50
Bluetooth	v3.0 with EDR		10.00
	v4.0 with LE		1.00

4.3 General LTE SAR Test and Reporting Considerations

Summarized necessary items addressed in KDB 941225 D05 v02r03										
FCC ID	IHDT56QG3									
Equipment Name	Mobile Cellular Phone									
Operating Frequency Range of each LTE transmission band	LTE Band 7: 2502.5 MHz ~ 2567.5 MHz									
Channel Bandwidth	LTE Band 07: 5MHz, 10MHz, 15MHz, 20MHz									
Release and Category	Rel10, Cat4									
uplink modulations used	QPSK, and 16QAM									
LTE Voice / Data requirements	Voice and Data									
LTE MPR permanently built-in by design	Table 6.2.3-1: Maximum Power Reduction (MPR) for Power Class 3									
	Modulation	Channel bandwidth / Transmission bandwidth (RB)						MPR (dB)		
		1.4 MHz	3.0 MHz	5 MHz	10 MHz	15 MHz	20 MHz			
		QPSK	> 5	> 4	> 8	> 12	> 16		> 18	≤ 1
		16 QAM	≤ 5	≤ 4	≤ 8	≤ 12	≤ 16		≤ 18	≤ 1
	16 QAM	> 5	> 4	> 8	> 12	> 16	> 18	≤ 2		
LTE A-MPR	In the base station simulator configuration, Network Setting value is set to NS_01 to disable A-MPR during SAR testing and the LTE SAR tests was transmitting on all TTI frames (Maximum TTI)									
Spectrum plots for RB configuration	A properly configured base station simulator was used for the SAR and power measurement; therefore, spectrum plots for each RB allocation and offset configuration are not included in the SAR report.									
Power reduction applied to satisfy SAR compliance	Yes, When operating in hotspot mode that LTE B7 power reduction applied to satisfy SAR compliance, the detail information please refer to Appendix C and “operational description”.									
Transmission (H, M, L) channel numbers and frequencies in each LTE band										
LTE Band 7										
	Bandwidth 5 MHz		Bandwidth 10 MHz		Bandwidth 15 MHz		Bandwidth 20 MHz			
	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)		
L	20775	2502.5	20800	2505	20825	2507.5	20850	2510		
M	21100	2535	21100	2535	21100	2535	21100	2535		
H	21425	2567.5	21400	2565	21375	2562.5	21350	2560		

5. RF Exposure Limits

5.1 Uncontrolled Environment

Uncontrolled Environments are defined as locations where there is the exposure of individuals who have no knowledge or control of their exposure. The general population/uncontrolled exposure limits are applicable to situations in which the general public may be exposed or in which persons who are exposed as a consequence of their employment may not be made fully aware of the potential for exposure or cannot exercise control over their exposure. Members of the general public would come under this category when exposure is not employment-related; for example, in the case of a wireless transmitter that exposes persons in its vicinity.

5.2 Controlled Environment

Controlled Environments are defined as locations where there is exposure that may be incurred by persons who are aware of the potential for exposure, (i.e. as a result of employment or occupation). In general, occupational/controlled exposure limits are applicable to situations in which persons are exposed as a consequence of their employment, who have been made fully aware of the potential for exposure and can exercise control over their exposure. The exposure category is also applicable when the exposure is of a transient nature due to incidental passage through a location where the exposure levels may be higher than the general population/uncontrolled limits, but the exposed person is fully aware of the potential for exposure and can exercise control over his or her exposure by leaving the area or by some other appropriate means.

Limits for Occupational/Controlled Exposure (W/kg)

Whole-Body	Partial-Body	Hands, Wrists, Feet and Ankles
0.4	8.0	20.0

Limits for General Population/Uncontrolled Exposure (W/kg)

Whole-Body	Partial-Body	Hands, Wrists, Feet and Ankles
0.08	1.6	4.0

1. Whole-Body SAR is averaged over the entire body, partial-body SAR is averaged over any 1gram of tissue defined as a tissue volume in the shape of a cube. SAR for hands, wrists, feet and ankles is averaged over any 10 grams of tissue defined as a tissue volume in the shape of a cube.

6. Simultaneous Transmission Analysis

NO.	Simultaneous Transmission Configurations	Portable Handset			Note
		Head	Body-worn	Hotspot	
1.	GSM(Voice) + WLAN2.4GHz(data)	Yes	Yes		
2.	LTE(Voice) + WLAN2.4GHz(data)	Yes	Yes		
3.	GSM(Voice) + Bluetooth(data)	Yes	Yes		
4.	LTE(Voice) + Bluetooth(data)	Yes	Yes		
5.	GPRS/EDGE(Data) + WLAN2.4GHz(data)	Yes	Yes	Yes	2.4GHz Hotspot
6.	LTE(Data) + WLAN2.4GHz(data)	Yes	Yes	Yes	2.4GHz Hotspot
7.	GPRS/EDGE(Data) + Bluetooth(data)	Yes	Yes	Yes	Bluetooth Tethering
8.	LTE(Data) + Bluetooth(data)	Yes	Yes	Yes	Bluetooth Tethering

General Note:

- This report does not test any RF exposure result, all the cellular frequency band evaluation which refer to the Sporton FCC SAR Report, FCC ID: IHDT56QG2, Report No: FA542019-01A or Appendix D, and the BT/WLAN evaluation which refer to the Sporton FCC SAR Report, FCC ID: IHDT56QG1, Report No: FA542019A or Appendix E and these SAR results also used perform simultaneous transmission analysis.
- This device supported VoIP in EGPRS, LTE (e.g. 3rd party VoIP).
- The Scaled SAR summation is calculated based on the same configuration and test position.
- WLAN and Bluetooth share the same antenna, and cannot transmit simultaneously.
- Per KDB 447498 D01v05r02, simultaneous transmission SAR is compliant if,
 - Scalar SAR summation < 1.6W/kg.
 - $SPLSR = (SAR1 + SAR2)^{1.5} / (\min. \text{ separation distance, mm})$, and the peak separation distance is determined from the square root of $[(x1-x2)^2 + (y1-y2)^2 + (z1-z2)^2]$, 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.

6.1 Head Exposure Conditions

WWAN Band		Exposure Position	1	2	3	1+2 Summed 1g SAR (W/kg)	1+3 Summed 1g SAR (W/kg)
			WWAN	2.4GHz WLAN	2.4GHz Bluetooth		
			1g SAR (W/kg)	1g SAR (W/kg)	1g SAR (W/kg)		
GSM	GSM850	Right Cheek	0.412	0.146	0.027	0.56	0.44
		Right Tilted	0.192	0.108	0.020	0.30	0.21
		Left Cheek	0.289	0.494	0.087	0.78	0.38
		Left Tilted	0.179	0.208	0.035	0.39	0.21
	GSM1900	Right Cheek	0.289	0.146	0.027	0.44	0.32
		Right Tilted	0.067	0.108	0.020	0.18	0.09
		Left Cheek	0.314	0.494	0.087	0.81	0.40
		Left Tilted	0.076	0.208	0.035	0.28	0.11
LTE	LTE Band 7	Right Cheek	0.161	0.146	0.027	0.31	0.19
		Right Tilted	0.107	0.108	0.020	0.22	0.13
		Left Cheek	0.202	0.494	0.087	0.70	0.29
		Left Tilted	0.044	0.208	0.035	0.25	0.08

6.2 Hotspot Exposure Conditions

WWAN Band		Exposure Position	1	2	3	1+2 Summed 1g SAR (W/kg)	1+3 Summed 1g SAR (W/kg)
			WWAN	2.4GHz WLAN	2.4GHz Bluetooth		
			1g SAR (W/kg)	1g SAR (W/kg)	1g SAR (W/kg)		
GSM	GSM850	Front	0.619	0.048	0.001	0.67	0.62
		Back	0.577	0.085	0.001	0.66	0.58
		Left side	0.121			0.12	0.12
		Right side	0.397	0.089	0.020	0.49	0.42
		Top side		0.056	0.005	0.06	0.01
		Bottom side	0.142			0.14	0.14
	GSM1900	Front	0.970	0.048	0.001	1.02	0.97
		Back	0.631	0.085	0.001	0.72	0.63
		Left side	0.140			0.14	0.14
		Right side	0.572	0.089	0.020	0.66	0.59
		Top side		0.056	0.005	0.06	0.01
		Bottom side	0.624			0.62	0.62
LTE	LTE Band 7	Front	0.518	0.048	0.001	0.57	0.52
		Back	0.621	0.085	0.001	0.71	0.62
		Left side	0.247			0.25	0.25
		Right side	0.029	0.089	0.020	0.12	0.05
		Top side		0.056	0.005	0.06	0.01
		Bottom side	0.748			0.75	0.75

6.3 Body-Worn Accessory Exposure Conditions

WWAN Band		Exposure Position	1	2	3	1+2 Summed 1g SAR (W/kg)	1+3 Summed 1g SAR (W/kg)
			WWAN	2.4GHz WLAN	2.4GHz Bluetooth		
			1g SAR (W/kg)	1g SAR (W/kg)	1g SAR (W/kg)		
GSM	GSM850	Front	0.487	0.023	0.001	0.51	0.49
		Back	0.420	0.053	0.001	0.47	0.42
	GSM1900	Front	0.464	0.023	0.001	0.49	0.47
		Back	0.359	0.053	0.001	0.41	0.36
LTE	LTE Band 7	Front	0.671	0.023	0.001	0.69	0.67
		Back	1.127	0.053	0.001	1.18	1.13

7. 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. 1528-2003, “Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques”, December 2003
- [4] SPEAG DASY System Handbook
- [5] FCC KDB 248227 D01 v2, “SAR Guidance for IEEE 802.11 (WiFi) Transmitters”, Mar 2015.
- [6] FCC KDB 447498 D01 v05r02, “Mobile and Portable Device RF Exposure Procedures and Equipment Authorization Policies”, Feb 2014
- [7] FCC KDB 648474 D04 v01r02, “SAR Evaluation Considerations for Wireless Handsets”, Dec 2013.
- [8] FCC KDB 941225 D01 v03, “3G SAR MEAUREMENT PROCEDURES”, Oct 2014
- [9] FCC KDB 941225 D05 v02r03, “SAR Evaluation Considerations for LTE Devices”, Dec 2013
- [10] FCC KDB 941225 D06 v02, “SAR Evaluation Procedures for Portable Devices with Wireless Router Capabilities”, Oct 2014.
- [11] FCC KDB 865664 D01 v01r03, “SAR Measurement Requirements for 100 MHz to 6 GHz”, Feb 2014.
- [12] FCC KDB 865664 D02 v01r01, “RF Exposure Compliance Reporting and Documentation Considerations” May 2013.