RF Exposure Evaluation Report

APPLICANT	:	Motorola Solutions Inc.
EQUIPMENT	:	WAVE Two-Way Mobile Radio
BRAND NAME	:	Motorola Solutions
MODEL NAME	:	TLK 150
MODEL NUMBER	:	HK2131A
FCC ID	:	AZ492FT7127
STANDARD	:	47 CFR Part 2.1091

The product evaluation date was started from Oct. 18, 2022 and completed on Oct. 18, 2022. We, Sporton International Inc. (Kunshan), would like to declare that the device has been evaluated in accordance with 47 CFR Part2.1091, and pass the limit. Without written approval of Sporton International Inc. (Kunshan), the test report shall not be reproduced except in full.

Si Zhang

Approved by: Si Zhang

ACCREDITED Cert #5145.02

Sporton International Inc. (Kunshan)
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People's Republic of China

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Revision History

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FA9N0421-08	Rev. 01	Initial issue of report.	Jan. 06, 2023

1. Administration Data

1.1. Testing Laboratory

Sporton International Inc. (Kunshan) is accredited to ISO/IEC 17025:2017 by American Association for Laboratory Accreditation with Certificate Number 5145.02.

Testing Laboratory			
Test Firm	Sporton International Inc. (Kunshan)		
Test Site Location	No. 1098, Pengxi North Road, Kunshan Economic Development Zone Jiangsu Province 215300 People's Republic of China TEL : +86-512-57900158 FAX : +86-512-57900958		
Test Site No.	Sporton Site No.	FCC Designation No.	FCC Test Firm Registration No.
	SAR01-KS	CN1257	314309

Applicant	
Company Name	Motorola Solutions Inc.
Address	8000 West Sunrise Boulevard, Fort Lauderdale, Florida

Manufacturer	
Company Name	Motorola Solutions Malaysia Sdn. Bhd.
Address	Plot 2A, Medan Bayan Lepas, Mukim 12, S.W.D. 11900 Bayan Lepas, Penang, Malaysia.

2. Guidance Applied

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- FCC 47 CFR Part 2.1091
- KDB 447498 D04 Interim General RF Exposure Guidance v01
- FCC 47 CFR Part 1.1307

3. Description of Equipment Under Test (EUT)

Product Feature & Specification	
EUT Type	WAVE Two-Way Mobile Radio
Brand Name	Motorola Solutions
Model Name	TLK 150
Model Number	HK2131A
FCC ID	AZ492FT7127
Wireless Technology and Frequency Range	WCDMA Band II: 1850 MHz ~ 1910 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 13 : 777 MHz ~ 787 MHz LTE Band 17: 704 MHz ~ 716 MHz WLAN 2.4GHz Band: 2412 MHz ~ 2462 MHz WLAN 5.2GHz Band: 5180 MHz ~ 5240 MHz WLAN 5.3GHz Band: 5260 MHz ~ 5320 MHz WLAN 5.5GHz Band: 5500 MHz ~ 5720 MHz WLAN 5.8GHz Band: 5745 MHz ~ 5825 MHz Bluetooth: 2402 MHz ~ 2480 MHz
Mode	RMC/AMR 12.2Kbps HSDPA HSUPA LTE: QPSK, 16QAM WLAN 2.4GHz 802.11b/g/n HT20/HT40 WLAN 5GHz 802.11a/n HT20/HT40 WLAN 5GHz 802.11ac VHT20/VHT40/VHT80 Bluetooth BR/EDR/LE
Antenna Type/ Gain	For WWAN antenna: External Antenna WCDMA Band V: 1.70 dBi WCDMA Band II: 2.80 dBi LTE Band 2 : 2.80 dBi LTE Band 4 : 2.50 dBi LTE Band 5 : 1.70 dBi LTE Band 7 : 1.10 dBi LTE Band 13 : 0.30 dBi LTE Band 17 : 0.90 dBi WLAN2.4GHz antenna: <2412 MHz ~ 2462 MHz > Chip Antenna with gain -0.1 dBi Bluetooth antenna: <2402 MHz ~ 2480 MHz > Chip Antenna with gain -0.1 dBi WLAN5GHz antenna: <5180 MHz ~ 5240 MHz > Chip Antenna with gain 1.9 dBi <5260 MHz ~ 5320 MHz > Chip Antenna with gain 1.8 dBi <5500 MHz ~ 5720 MHz > Chip Antenna with gain 0.9 dBi <5745 MHz ~ 5825 MHz> Chip Antenna with gain 0.1 dBi
HW Version	P3
SW Version	TLK150_BASE_ENG_R03.05.01
EUT Stage	Identical Prototype

Remark: The above EUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.

Comments and Explanations:
1. 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.
2. The maximum RF output tune up power, antenna gain also the safe distance used for evaluate RF exposure were declared by manufacturer.

4. Maximum RF average output tune up power among production units

<WCDMA/LTE >

Mode		Maximum Average power(dBm)
WCDMA	Band II	25.00
	Band V	25.00
LTE	Band 2	25.00
	Band 4	25.00
	Band 5	25.00
	Band 7	25.00
	Band 13	25.00
	Band 17	25.00

<WLAN 2.4GHz>

Mode		Maximum Average Power (dBm)
2.4GHz	802.11b	19.00
	802.11g	15.50
	802.11n-HT20	14.00
	802.11n-HT40	12.00

<Bluetooth > For Bluetooth Module

Band / Mode	Average Power (dBm)			
	BR / EDR			LE
	1M	2M	3M	GFSK
Bluetooth	9.50	6.50	6.50	0.00

<WLAN 5GHz>

Mode		Maximum Average Power (dBm)
5.2GHz	802.11a	15.00
	802.11n-HT20	13.00
	802.11n-HT40	12.00
	802.11ac-VHT20	13.00
	802.11ac-VHT40	12.00
	802.11ac-VHT80	11.00
5.3GHz	802.11a	15.00
	802.11n-HT20	13.00
	802.11n-HT40	12.00
	802.11ac-VHT20	13.00
	802.11ac-VHT40	12.00
	802.11ac-VHT80	11.00
5.5GHz	802.11a	15.00
	802.11n-HT20	13.00
	802.11n-HT40	12.00
	802.11ac-VHT20	13.00
	802.11ac-VHT40	12.00
	802.11ac-VHT80	11.00
5.8GHz	802.11a	15.00
	802.11n-HT20	13.00
	802.11n-HT40	12.00
	802.11ac-VHT20	13.00
	802.11ac-VHT40	12.00
	802.11ac-VHT80	11.00

5. RF Exposure Limit Introduction

1. Per 1.1307(b)(3), (i) For single RF sources (i.e., any single fixed RF source, mobile device, or portable device, as defined in paragraph (b)(2) of this section): A single RF source is exempt if:

(A) The available maximum time-averaged power is no more than 1 mW, regardless of separation distance. This exemption may not be used in conjunction with other exemption criteria other than those in paragraph (b)(3)(ii)(A) of this section. Medical implant devices may only use this exemption and that in paragraph (b)(3)(ii)(A);

(B) Or the available maximum time-averaged power or effective radiated power (ERP), whichever is greater, is less than or equal to the threshold Pth (mW) described in the following formula. This method shall only be used at separation distances (cm) from 0.5 centimeters to 40 centimeters and at frequencies from 0.3 GHz to 6 GHz (inclusive). Pth is given by:

$$\mathrm{P}_{th}\ (\mathrm{mW}) = \begin{cases} \mathrm{ERP}_{20\ cm}\ (\mathrm{d}/20\ \mathrm{cm})^{x} & d \le 20\ cm \\ \mathrm{ERP}_{20\ cm} & 20\ cm < d \le 40\ cm \end{cases} \quad [1]$$

Where $x = -\log_{10}(\frac{60}{ERP_{20\ cm}\sqrt{f}})$ and f is in GHz [2]

and $\mathrm{ERP}_{20\ cm}\ (\mathrm{mW}) = \begin{cases} 2040\mathrm{f} & 0.3\ GHz < f \le 1.5\ GHz \\ 3060 & 1.5\ GHz < f \le 6\ GHz \end{cases}$ [3]

(C) Or using Table 1 and 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. For the exemption in Table 1 to apply, R must be at least λ/2π, where λ is the free-space operating wavelength in meters. If the ERP of a single RF source is not easily obtained, then the available maximum time-averaged power may be used in lieu of ERP if the physical dimensions of the radiating structure(s) do not exceed the electrical length of λ/4 or if the antenna gain is less than that of a half-wave dipole (1.64 linear value)

Table 1 to § 1.1307(b)(3)(i)(C) - Single RF Sources Subject to Routine Environmental Evaluation

RF Source frequency (MHz)	Threshold ERP (watts)
0.3-1.34	1,920 R^2
1.34-30	3,450 R^2 /f^2
30-300	3.83 R^2
300-1,500	0.0128 R^2 f
1,500-100,000	19.2 R^2

2. For multiple RF sources: Multiple RF sources are exempt if:

(A) The available maximum time-averaged power of each source is no more than 1 mW and there is a separation distance of two centimeters between any portion of a radiating structure operating and the nearest portion of any other radiating structure in the same device, except if the sum of multiple sources is less than 1 mW during the time-averaging period, in which case they may be treated as a single source (separation is not required). This exemption may not be used in conjunction with other exemption criteria other than those is paragraph (b)(3)(i)(A) of this section. Medical implant devices may only use this exemption and that in paragraph (b)(3)(i)(A).

(B) In the case of ¦xed RF sources operating in the same time-averaging period, or of multiple mobile or portable RF sources within a device operating in the same time averaging period, if the sum of the fractional contributions to the applicable thresholds is less than or equal to 1 as indicated in the following equation.

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

a. a = number of fixed, mobile, or portable RF sources claiming exemption using the § 1.1307(b)(3)(i)(B) formula for *P*th, including existing exempt transmitters and those being added.

b. b = number of fixed, mobile, or portable RF sources claiming exemption using the applicable § 1.1307(b)(3)(i)(C) Table 1 formula for Threshold ERP, including existing exempt transmitters and those being added.

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

d. *Pi,* 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)

e. *P*th,*i* the exemption threshold power (*P*th) according to the § 1.1307(b)(3)(i)(B) formula for fixed, mobile, or portable RF source *i*.

f. *ERPj* the available maximum time-averaged power or the ERP, whichever is greater, of fixed, mobile, or portable RF source *j*.

g. *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 § 1.1307(b)(3)(i)(C) Table 1 formula at the location in question.

h. *Evaluatedk* 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.

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

j. The relationship between EIRP and ERP is: ERP (dBm) = EIRP - 2.15, Where EIRP is the sum of the conducted power (dBm) and the antenna gain (dBi)

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

6. Radio Frequency Radiation Exposure Evaluation

6.1. Standalone assessment

Band	Antenna Gain (dBi)	Maximum Conducted Power (dBm)	Maximum EIRP (dBm)	Maximum ERP (dBm)	Maximum ERP (mW)	Separation Distance (cm)	Part1.1307 option(b) Threshold (mW)	Part1.1307 option(b) P/Pth
WCDMA Band 2	2.80	25.00	27.80	25.65	367.28	20	3060.000	0.120
WCDMA Band 5	1.70	25.00	26.70	24.55	285.10	20	1680.960	0.188
LTE Band 2	2.80	25.00	27.80	25.65	367.28	20	3060.000	0.120
LTE Band 4	2.50	25.00	27.50	25.35	342.77	20	3060.000	0.112
LTE Band 5	1.70	25.00	26.70	24.55	285.10	20	1680.960	0.188
LTE Band 7	1.10	25.00	26.10	23.95	248.31	20	3060.000	0.103
LTE Band 13	0.30	25.00	25.30	23.15	206.54	20	1585.080	0.200
LTE Band 17	0.90	25.00	25.90	23.75	237.14	20	1436.160	**0.220**
WLAN2.4GHz Band	-0.10	19.00	18.90	16.75	47.32	20	3060.000	**0.026**
WLAN5.2GHz Band	1.90	15.00	16.90	14.75	29.85	20	3060.000	**0.010**
WLAN5.3GHz Band	1.80	15.00	16.80	14.65	29.17	20	3060.000	0.010
WLAN5.5GHz Band	0.90	15.00	15.90	13.75	23.71	20	3060.000	0.010
WLAN5.8GHz Band	0.10	15.00	15.10	12.95	19.72	20	3060.000	0.010
Bluetooth	-0.10	9.50	9.40	7.25	5.31	20	3060.000	**0.03**

Note:
1. Chose the maximum power density to do MPE analysis.

6.2. Simultaneous Transmission MPE Test Exemption

WWAN P/Pth Ratio	WLAN 2.4GHz P/Pth Ratio	Sum of the Ratio WWAN + WLAN 2.4GHz
0.220	0.026	0.246

WWAN P/Pth Ratio	WLAN 5GHz P/Pth Ratio	Bluetooth P/Pth Ratio	Sum of the Ratio WWAN + WLAN 5GHz + Bluetooth
0.220	0.010	0.003	0.233

Note:
1. According to the EUT characteristic, WLAN 5GHz and Bluetooth can transmit simultaneously.
2. WLAN2.4GHz and Bluetooth share the same antenna, and they cannot transmit simultaneously each other.
3. EUT will choose either WLAN 2.4GHz or WLAN 5GHz according to the network signal condition; therefore, 2.4GHz WLAN and 5GHz WLAN will not operate simultaneously at any moment.
4. According to Part1.1307 (b)(3)(i)(B), the P/Pth Ratio is using for Sim-Tx analysis, above table was showing summation ratio is smaller than 1.

Conclusion:

According to 47 CFR §1.1307 (b)(3)(i)(B), the RF exposure analysis concludes that the RF Exposure is FCC compliant.

------THE END------