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RF EXPOSURE EVALUATION Maximum Permissible Exposure (MPE)

Applicant Name:
Microsoft Corporation
One Microsoft Way
Redmond, WA 98052
United States

Date of Testing:
3/14/2022-7/1/2022
Test Report Issue Date:
7/22/2022
Test Site/Location:
Element Lab. Columbia, MD, USA
Test Report Serial No.:
1M2204040049-20-R1.C3K

FCC ID:	C3K1997
APPLICANT:	Microsoft Corporation

EUT Type: Portable Computing Device
FCC Classification: PCS Licensed Transmitter (PCB)
Citizens Band End User Devices (CBE)
Digital Transmission System (DTS)
Part 15 Spread Spectrum Transmitter (DSS)
Unlicensed National Information Infrastructure TX (NII)
15E 6 GHz Low Power Indoor Client (6XD)
FCC Rule Part: FCC Part 1 (§1.1310) and Part 2 (§2.1091)
Test Procedure(s): KDB 447498 D01 v06

This equipment has been shown to be capable of compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in FCC KDB 447498 D01. Test results reported herein relate only to the item(s) tested.

Note: This revised Test Report (S/N: 1M2204040049-20-R1.C3K) supersedes and replaces the previously issued test report on the same subject device for the same type of testing as indicated. Please discard or destroy the previously issued test report(s) and dispose of it accordingly.

I attest to the accuracy of data. All measurements reported herein were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

RJ Ortanez
Executive Vice President




FCC ID: C3K1997	MAXIMUM PERMISSIBLE EXPOSURE REPORT	Approved by: Technical Manager
Test Report S/N: 1M2204040049-20-R1.C3K	Test Dates: 3/14/2022-7/1/2022	EUT Type: Portable Computing Device
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1.0 RF EXPOSURE EVALUATION – MAXIMUM PERMISSIBLE EXPOSURE (MPE)

1.1 Introduction

This document is prepared to show compliance with the RF Exposure requirements as required in §1.1310 of the FCC Rules and Regulations.

The limit for Maximum Permissible Exposure (MPE), specified in FCC §1.1310, is listed in Table 1-1. According to FCC §1.1310: the criteria listed in the following table shall be used to evaluate the environmental impact of human exposure to radio-frequency (RF) radiation as specified in §1.1307(b).

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm ²)	Average Time (Minutes)
(A) Limits For Occupational / Control Exposures (f = frequency)				
30-300	61.4	0.163	1.0	6
300-1500	...	...	f/300	6
1500-100,000	...	...	5.0	6
(B) Limits For General Population / Uncontrolled Exposure (f = frequency)				
30-300	27.5	0.073	0.2	30
300-1500	...	...	f/1500	30
1500-100,000	...	...	1.0	30

Table 1-1. Limits for Maximum Permissible Exposure (MPE)

1.2 EUT Description

The **Microsoft Corporation FCC ID: C3K1997** is a Portable Computing Device containing 2.4GHz transmit output ports, 5GHz, and 6GHz transmit output ports capable for transmitting 802.11a/b/g/n/ac/ax modes and WCDMA/HSPA, and Multi-band LTE, Multi-band 5G NR operation. This MPE evaluation will cover RF Exposure for simultaneous transmission modes of transmitters operating at maximum power.

EUT:

Company Name: Microsoft Corporation

FCC ID: C3K1997

Antenna(s): Please see technical description for list of available antenna options

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1.3 Procedure

The procedure used to determine the RF power density was based upon a calculation for determining compliance with the MPE requirements.

The power generated by each transmitter used in this product was initially measured by a power meter or spectrum analyzer and the powers were recorded. Through use of the Friis transmission formula and knowledge of the maximum antenna gain to be used, the power density level is calculated at a distance of 20cm.

Friis Transmission Formula

Friis transmission formula: $P_d = (P_{out} * G) / (4\pi r^2)$

Where,

P_d = Power Density (mW/cm²)

π = 3.1416

P_{out} = output power to antenna (mW)

r = distance between observation point and center of the radiator (cm)

G = gain of antenna in linear scale

Calculated MPE

The power density limit for General Population/Uncontrolled Exposure at each frequency is determined based on the information in Table 1-1.

There is no co-location between the electric fields of any two transmitters therefore following power densities are calculated for each individual transmitter by frequency at 20cm spacing:

Tech	Max Power (dBm)	Max Power (mW)	Ant Gain (dBi)	Ant Gain (linear)	MPE (mW/cm ²)	MPE Limit (mW/cm ²)	% MPE
LTE Band 66	25.7	371.535	2.20	1.66	0.123	1.000	0.123


Table 1-2. Calculated MPE Data for Cellular Band

Tech	Max Power (dBm)	Max Power (mW)	Dir. Ant Gain (dBi)	MPE (mW/cm ²)	MPE Limit (mW/cm ²)	% MPE
2.4GHz WiFi (Ant6+7)	24	251.189	4.51	0.141	1.000	0.141

Table 1-3. Calculated MPE Data for 2.4GHz (MIMO) Band

Tech	Max Power (dBm)	Max Power (mW)	Dir. Ant Gain (dBi)	MPE (mW/cm ²)	MPE Limit (mW/cm ²)	% MPE
5GHz WiFi (Ant6+7)	21	125.893	6.11	0.102	1.000	0.102

Table 1-4. Calculated MPE Data for 5GHz (MIMO) Band


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Tech	EIRP (dBm)	EIRP (mW)	MPE (mW/cm ²)	MPE Limit (mW/cm ²)	% MPE
FR2 n260	32.5	1778.279	0.354	1.000	0.354

Table 1-5. Calculated MPE Data for NR n260 Band


Simultaneous Scenarios	% MPE
2.4GHz + 5/6GHz + FR2 EN-DC	71.99%

Table 1-6. Co-location MPE Data for Simultaneous Transmission

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2.0 CONCLUSION

The device meets the mobile RF exposure limit at a 20cm separation distance as specified in §2.1091 of the FCC Rules and Regulations. An appropriate RF exposure compliance statement will be placed in the user's manual.

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