



**FCC Part 1 Subpart I
FCC Part 2 Subpart J
RSS 102 ISSUE 5**

RF EXPOSURE REPORT

FOR

PORTABLE COMPUTING DEVICE

MODEL NUMBER: 1964

FCC ID: C3K1964

REPORT NUMBER: R13541206-E11

ISSUE DATE: 2021-08-28

**Prepared for
MICROSOFT CORPORATION
ONE MICROSOFT WAY
REDMOND, WA 98052-6399, USA**

**Prepared by
UL LLC
12 LABORATORY DR.
RESEARCH TRIANGLE PARK, NC 27709 USA
TEL: (919) 549-1400**



REVISION HISTORY

Rev.	Issue Date	Revisions	Revised By
V1	2021-08-24	Initial Issue	Brian T. Kiewra
V2	2021-08-28	Revised notes in Section 7.	Brian T. Kiewra

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: Microsoft Corporation
One Microsoft Way
Redmond, WA 98052-6399
USA

EUT DESCRIPTION: Portable Computing Device

MODEL: 1964

SERIAL NUMBER: 0F0003K211200C
0F0003W211200C
0F0003V211200C

SAMPLE RECEIPT DATE: 2021-04-12

DATE TESTED: 2021-08-24

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
FCC PART 1 SUBPART I & PART 2 SUBPART J	Complies
RSS 102 ISSUE 5	Complies

UL LLC. tested the above equipment in accordance with the requirements set forth in the above standards. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical components. All samples tested were in good operating condition throughout the entire test program. Measurement Uncertainties are published for informational purposes only and were not taken into account unless noted otherwise.

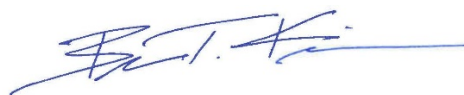
This document may not be altered or revised in any way unless done so by UL LLC. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL LLC. will constitute fraud and shall nullify the document.

Approved & Released
For UL LLC By:



Michael Antola
Staff Engineer
Consumer Technology Division
UL LLC

Prepared By:



Brian T. Kiewra
Project Engineer
Consumer Technology Division
UL LLC

2. TEST METHODOLOGY

All calculations were made in accordance with FCC Parts 1.1310, 2.1091, 2.1093, KDB 447498 D01 v06, KDB 447498 D03 V01, IEEE Std C95.1-2005, IEEE Std C95.3-2002, IC Safety Code 6 and RSS 102 Issue 5.

3. REFERENCES

All measurements were made as documented in UL LLC Test Report R13541206-E1, -E2, -E3, -E4 for operation in the 2.4 GHz band and R13541206-E5, -E6, -E7, -E8, -E9, -E10 for operation in the 5 GHz band.

Output power is excerpted from the applicable test reports and Antenna gain data is excerpted from product documentation provided by the applicant.

4. FACILITIES AND ACCREDITATION

UL LLC is accredited by A2LA, certification # 0751.06, for all testing performed within the scope of this report. Testing was performed at the locations noted below.

	Address	ISED CABID	ISED Company Number	FCC Registration
<input type="checkbox"/>	Building: 12 Laboratory Dr RTP, NC 27709, U.S.A	US0067	2180C	703469
<input checked="" type="checkbox"/>	Building: 2800 Perimeter Park Dr. Suite B Morrisville, NC 27560, U.S.A		27265	

5. DECISION RULES AND MEASUREMENT UNCERTAINTY

5.1. METROLOGICAL TRACEABILITY

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

5.2. DECISION RULES

For all tests where the applicable $U_{LAB} \leq U_{MAX}$ the Decision Rule is based on Simple Acceptance in accordance with ISO Guide 98-4: 2012 Clause 8.2, where $U_{MAX} = 30\%$ (0.3) for RF Exposure evaluations. (Measurement uncertainty is not taken into account when stating conformity with a specified requirement.)

For all tests where the applicable $U_{LAB} > U_{MAX}$ the Decision Rule is based on Guarded Acceptance in accordance with ISO Guide 98-4: 2012 Clause 8.3.2, with a guard band equal to $(U_{LAB} - U_{MAX})$, where $U_{MAX} = 30\%$ (0.3) for RF Exposure evaluations. (Test results are adjusted by the value of the guard band to determine conformity with a specified requirement.)

5.3. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

PARAMETER	U_{Lab}
RF output power, conducted	0.45dB (AV)

Uncertainty figures are valid to a confidence level of 95%.

6. MAXIMUM PERMISSIBLE EXPOSURE (LIMITS AND EQUATIONS)

6.1. FCC RULES

§1.1310 The criteria listed in Table 1 shall be used to evaluate the environmental impact of human exposure to radio-frequency (RF) radiation as specified in §1.1307(b), except in the case of portable devices which shall be evaluated according to the provisions of §2.1093 of this chapter.

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm ²)	Averaging time (minutes)
(A) Limits for Occupational/Controlled 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
(B) 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
300-1,500			f/1500	30
1,500-100,000			1.0	30

f = frequency in MHz

* = Plane-wave equivalent power density

Notes:

- (1) Occupational/controlled exposure limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when a person is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure.
- (2) General population/uncontrolled exposure limits apply in 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 fully aware of the potential for exposure or cannot exercise control over their exposure

6.2. ISED RULES

For the purpose of this standard, Innovation, Science and Economic Development (ISED) has adopted the SAR and RF field strength limits established in Health Canada’s RF exposure guideline, Safety Code 6.

Table 4: RF Field Strength Limits for Devices Used by the General Public (Uncontrolled Environment)

Frequency Range (MHz)	Electric Field (V/m rms)	Magnetic Field (A/m rms)	Power Density (W/m ²)	Reference Period (minutes)
0.003-10 ²¹	83	90	-	Instantaneous*
0.1-10	-	0.73/ <i>f</i>	-	6**
1.1-10	87/ <i>f</i> ^{0.5}	-	-	6**
10-20	27.46	0.0728	-2	6
20-48	58.07/ <i>f</i> ^{0.25}	0.1540/ <i>f</i> ^{0.25}	8.944/ <i>f</i> ^{0.5}	6
48-300	22.06	0.05852	1.291	6
300-6000	3.142 <i>f</i> ^{0.3417}	0.008335 <i>f</i> ^{0.3417}	0.02619 <i>f</i> ^{0.6834}	6
6000-15000	61.4	0.163	10	6
15000-150000	61.4	0.163	10	616000/ <i>f</i> ^{1.2}
150000-300000	0.158 <i>f</i> ^{0.5}	4.21 x 10 ⁻⁴ <i>f</i> ^{0.5}	6.67 x 10 ⁻⁵ <i>f</i>	616000/ <i>f</i> ^{1.2}

Note: *f* is frequency in MHz.

* Based on nerve stimulation (NS).

** Based on specific absorption rate (SAR).

6.3. EQUATIONS

POWER DENSITY

Power density is given by:

$$S = \text{EIRP} / (4 * \text{Pi} * \text{D}^2)$$

Where

S = Power density in mW/cm²
EIRP = Equivalent Isotropic Radiated Power in mW
D = Separation distance in cm

Power density in units of mW/cm² is converted to units of W/m² by multiplying by 10.

DISTANCE

Distance is given by:

$$D = \text{SQRT} (\text{EIRP} / (4 * \text{Pi} * S))$$

Where

D = Separation distance in cm
EIRP = Equivalent Isotropic Radiated Power in mW
S = Power density in mW/cm²

SOURCE-BASED DUTY CYCLE

Where applicable (for example, multi-slot cell phone applications) a duty cycle factor may be applied.

$$\text{Source-based time-averaged EIRP} = (\text{DC} / 100) * \text{EIRP}$$

Where

DC = Duty Cycle in %, as applicable
EIRP = Equivalent Isotropic Radiated Power in mW

MIMO AND COLOCATED TRANSMITTERS (IDENTICAL LIMIT FOR ALL TRANSMITTERS)

For multiple chain devices, and colocated transmitters operating simultaneously in frequency bands where the limit is identical, the total power density is calculated using the total EIRP obtained by summing the EIRP (in linear units) of each transmitter.

$$\text{Total EIRP} = (\text{EIRP1}) + (\text{EIRP2}) + \dots + (\text{EIRPn})$$

where

EIRPx = Source-based time-averaged EIRP of chain x or transmitter x

The total EIRP is then used to calculate the Power Density or the Distance as applicable.

MIMO AND COLOCATED TRANSMITTERS (NON-IDENTICAL LIMIT FOR ALL TRANSMITTERS)

For multiple colocated transmitters operating simultaneously in frequency bands where different limits apply:

The Power Density at the specified separation distance is calculated for each transmitter chain or transmitter.

The fraction of the exposure limit is calculated for each chain or transmitter as (Power Density of chain or transmitter) / (Limit applicable to that chain or transmitter).

The fractions are summed.

Compliance is established if the sum of the fractions is less than or equal to one.

7. RF EXPOSURE RESULTS

This report contains data provided by the customer which can impact the validity of results. UL LLC is only responsible for the validity of results after the integration of the data provided by the customer.

In the table(s) below, Power and Gain are entered in units of dBm and dBi respectively and conversions to linear forms are used for the calculations.

Band	Mode	Antenna	Separation Distance (cm)	AVG Output Power (dBm)	Ant. Gain (dBi)	EIRP (dBm)	Duty Cycle (%)	EIRP (mW)	FCC PD (mW/cm ²)	FCC PD Limit (mW/cm ²)
BLE	GFSK - 2Mbps	Ant A		4.34	3.90	8.24	100.0	6.67		
BT	GFSK	Ant A		10.18	3.90	14.08	100.0	25.59		
2.4GHz WLAN	802.11b	Ant A		19.11	3.90	23.01	100.0	199.99		
2.4GHz WLAN	802.11b	Ant B		19.26	5.50	24.76	100.0	299.23		
5GHz WLAN	802.11ax HE80	Ant A		19.96	7.80	27.76	100.0	597.04		
5GHz WLAN	802.11ax HE80	Ant B		19.49	7.70	27.19	100.0	523.60		
Total			20					1652.10	0.32884	1.00

Notes:

- 1) The manufacturer configures output power so that the maximum power, after accounting for manufacturing tolerances, will never exceed the maximum power level measured.
- 2) The measured power in the tables above is the maximum power amongst various data rates, modes, and modulations.
- 3) AVG output power chosen that results in worst-case EIRP.
- 4) 100% duty cycle used as worst-case.
- 5) Possible simultaneous transmissions:

Tx Mode	Antenna A (BT/BLE)	Antenna A (WLAN)	Antenna B (WLAN)
1	X (BT)	X (5GHz)	X (5GHz)
2	X (BT)	-	X (2.4GHz)
3	-	X (5GHz)	X (5GHz)
4	-	X (2.4GHz)	X (2.4GHz)

- 6) The results table above is a worst-case scenario as power from all bands, antennas, and worst-case modes are summed to cover all simultaneous transmission possibilities.

END OF TEST REPORT