TEST REPORT

Report Number. : 12802195-E9V2

Applicant	:	Microsoft Corp. One Microsoft Way Redmond, WA 98052
Model	:	1876
FCC ID	:	C3K1876
EUT Description	:	Portable Computing Device
Test Standard(s)	:	FCC 47 CFR PART 1 SUBPART I FCC 47 CFR PART 2 SUBPART J

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NVLAP LAB CODE 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
V1	9/17/2019	Initial Issue	--
V2	9/17/2019	Section 6: DC Update & Antenna term update	Henry Lau

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: Microsoft Corp.
One Microsoft Way
Redmond, WA 98052

EUT DESCRIPTION: Portable Computing Device

MODEL: 1876

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
FCC PART 1 SUBPART I & PART 2 SUBPART J	Complies

UL Verification Services Inc. 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 Verification Services Inc. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL Verification Services Inc. will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of the U.S. government.

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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.

3. REFERENCES

All measurements were made as documented in test report UL Verification Services Inc. Document 12802195-E6, E7 for operation for licensed bands, UL Verification Services Inc. Document 12802195-E1, E2, E3 for operation in the 2.4 GHz band and UL Verification Services Inc. Document 12802195-E4 for operation in the 5 GHz bands.

Output power, Duty cycle and Antenna gain data is excerpted from the applicable test reports.

4. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 47173 and 47266 Benicia Street, and 47658 Kato Road, Fremont, California, USA. Line conducted emissions are measured only at the 47173 address. The following table identifies which facilities were utilized for radiated emission measurements documented in this report. Specific facilities are also identified in the test results sections.

The above test sites and facilities are covered under FCC Test Firm Registration # 208313. Chambers above are covered under Industry Canada company address and respective code 2324A.

UL Verification Services Inc. is accredited by NVLAP, Laboratory Code 200065-0.

5. MAXIMUM PERMISSIBLE EXPOSURE (LIMITS AND EQUATIONS)

5.1. 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

5.2. EQUATIONS

POWER DENSITY

Power density is given by:

S = EIRP / (4 * Pi * D^2)

Where

S = Power density in mW/cm^2
EIRP = Equivalent Isotropic Radiated Power in mW
D = Separation distance in cm

Power density in units of mW/cm^2 is converted to units of W/m^2 by multiplying by 10.

DISTANCE

Distance is given by:

D = SQRT (EIRP / (4 * Pi * S))

Where

D = Separation distance in cm
EIRP = Equivalent Isotropic Radiated Power in mW
S = Power density in mW/cm^2

SOURCE-BASED DUTY CYCLE

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

Source-based time-averaged EIRP = (DC / 100) * 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.

Total EIRP = (EIRP1) + (EIRP2) + ... + (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.

6. RF EXPOSURE RESULTS

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.

Single Chain and non-colocated transmitters

Band	Mode	Separ. Distance (cm)	Output AVG Power (dBm)	Ant. Gain (dBi)	Duty Cycle (%)	EIRP (mW)	FCC PD (mW/cm^2)	FCC PD Limit (mW/cm^2)
1900.0	LTE 2	20	24.00	1.60	100.0	363.08	0.07	1.00
1700.0	LTE 4	20	25.00	1.60	100.0	457.09	0.09	1.00
850.0	LTE 5	20	25.00	-0.80	100.0	263.03	0.05	0.55
2500.0	LTE 7	20	25.00	0.10	100.0	323.59	0.06	1.00
600.0	LTE 12	20	25.00	-1.10	100.0	245.47	0.05	0.47
700.0	LTE 13	20	25.00	-1.00	100.0	251.19	0.05	0.52
700.0	LTE 14	20	25.00	-0.90	100.0	257.04	0.05	0.53
1900.0	LTE 25	20	24.00	1.60	100.0	363.08	0.07	1.00
850.0	LTE 26	20	25.00	-0.60	100.0	275.42	0.05	0.54
2300.0	LTE 30	20	23.70	0.20	100.0	245.47	0.05	1.00
2600.0	LTE 41	20	25.00	0.10	63.3	204.83	0.04	1.00
1700.0	LTE 66	20	25.00	1.60	100.0	457.09	0.09	1.00
1900.0	WCDMA 2	20	24.00	1.60	100.0	363.08	0.07	1.00
850.0	WCDMA 5	20	25.00	-0.80	100.0	263.03	0.05	0.55
2.4 GHz	BLE	20	6.00	0.60	82.4	3.77	0.00	1.00
2.4 GHz	Bluetooth	20	6.00	0.60	77.1	3.52	0.00	1.00
2.4 GHz	WLAN	20	19.50	1.20	99.1	116.43	0.02	1.00
5 GHz	WLAN	20	19.50	2.40	98.0	151.78	0.03	1.00

Single Chain and non-colocated transmitters

Band	Mode	FCC Limit (mW/cm^2)	Output AVG Power (dBm)	Antenna Gain (dBi)	EIRP (dBm)	Duty Cycle (%)	EIRP (mW)	Separ. Distance FCC (cm)
1900.0	LTE 2	1.00	24.00	1.60	25.60	100.0	363.08	5.38
1700.0	LTE 4	1.00	25.00	1.60	26.60	100.0	457.09	6.03
850.0	LTE 5	0.55	25.00	-0.80	24.20	100.0	263.03	6.17
2500.0	LTE 7	1.00	25.00	0.10	25.10	100.0	323.59	5.08
600.0	LTE 12	0.47	25.00	-1.10	23.90	100.0	245.47	6.47
700.0	LTE 13	0.52	25.00	-1.00	24.00	100.0	251.19	6.20
700.0	LTE 14	0.53	25.00	-0.90	24.10	100.0	257.04	6.23
1900.0	LTE 25	1.00	24.00	1.60	25.60	100.0	363.08	5.38
850.0	LTE 26	0.54	25.00	-0.60	24.40	100.0	275.42	6.35
2300.0	LTE 30	1.00	23.70	0.20	23.90	100.0	245.47	4.42
2600.0	LTE 41	1.00	25.00	0.10	25.10	63.3	204.83	4.04
1700.0	LTE 66	1.00	25.00	1.60	26.60	100.0	457.09	6.03
1900.0	WCDMA 2	1.00	24.00	1.60	25.60	100.0	363.08	5.38
850.0	WCDMA 5	0.55	25.00	-0.80	24.20	100.0	263.03	6.17
2.4 GHz	BLE	1.00	6.00	0.60	6.60	82.4	3.77	0.55
2.4 GHz	Bluetooth	1.00	6.00	0.60	6.60	77.1	3.52	0.53
2.4 GHz	WLAN	1.00	19.50	1.20	20.70	99.1	116.43	3.04
5 GHz	WLAN	1.00	19.50	2.40	21.90	98.0	151.78	3.48

Multiple chain or colocated transmitters									
Band	**Mode**	**Chain for MIMO**	**Separ. Dist. (cm)**	**Output AVG Power (dBm)**	**Ant. Gain (dBi)**	**Duty Cycle (%)**	**EIRP (mW)**	**FCC PD (mW/cm^2)**	**FCC PD Limit (mW/cm^2)**
2.4 GHz	BLE	N/A		6.00	0.60	82.4	3.77		
2.4 GHz	BT	N/A		6.00	0.60	77.1	3.52		
2.4 GHz	WLAN	1		19.50	0.60	99.1	101.42		
2.4 GHz	WLAN	2		19.50	1.20	99.1	116.44		
Combined			20				225.15	0.04	1.00

Multiple chain or colocated transmitters								
Band	**Mode**	**Chain for MIMO**	**FCC Limit (mW/cm^2)**	**Output AVG Power (dBm)**	**Ant. Gain (dBi)**	**Duty Cycle (%)**	**EIRP (mW)**	**Separ. Distance FCC (cm)**
2.4 GHz	BLE	N/A		6.00	0.60	82.4	3.8	
2.4 GHz	BT	N/A		6.00	0.60	77.1	3.5	
2.4 GHz	WLAN	1		19.50	0.60	99.1	101.4	
2.4 GHz	WLAN	2		19.50	1.20	99.1	116.4	
Combined			1.00				225.2	4.23

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Multiple chain or colocated transmitters									
Band	**Mode**	**Chain for MIMO**	**Separ. Dist. (cm)**	**Output AVG Power (dBm)**	**Ant. Gain (dBi)**	**Duty Cycle (%)**	**EIRP (mW)**	**FCC PD (mW/cm^2)**	**FCC PD Limit (mW/cm^2)**
2.4 GHz	BLE	N/A		6.00	0.60	82.4	3.77		
2.4 GHz	BT	N/A		6.00	0.60	77.1	3.52		
5 GHz	WLAN	1		19.50	2.40	98.0	151.78		
5 GHz	WLAN	2		19.50	2.00	98.0	138.38		
Combined			20				297.45	0.06	1.00

Multiple chain or colocated transmitters								
Band	**Mode**	**Chain for MIMO**	**FCC Limit (mW/cm^2)**	**Output AVG Power (dBm)**	**Ant. Gain (dBi)**	**Duty Cycle (%)**	**EIRP (mW)**	**Separ. Distance FCC (cm)**
2.4 GHz	BLE	N/A		6.00	0.60	82.4	3.8	
2.4 GHz	BT	N/A		6.00	0.60	77.1	3.5	
5 GHz	WLAN	1		19.50	2.40	98.0	151.8	
5 GHz	WLAN	2		19.50	2.00	98.0	138.4	
Combined			1.00				297.5	4.87

Multiple chain or colocated transmitters

Band	(GHz)	0.7	2.4	2.4
Mode		LTE	WLAN	WLAN
Transmitter		Cell	Chain 1	Chain 2
Separation Distance	(cm)	20	20	20
Output Power	(dBm)	25.0	19.5	19.5
Antenna Gain	(dBi)	1.6	0.6	1.2
Duty Cycle	(%)	100	99.1	99.1
Source Based EIRP	(mW)	457.1	101.4	116.4
FCC Power Density	(mW/cm^2)	0.09	0.02	0.02
FCC Power Density Limit	(mW/cm^2)	0.52	1	1
Fraction of Limit	(%)	17.5	2.0	2.3
Sum of Fractions (%)	21.8			

Multiple chain or colocated transmitters

Band	(GHz)	0.7	5	5
Mode		LTE	WLAN	WLAN
Transmitter		Cell	Chain 1	Chain 2
Separation Distance	(cm)	20	20	20
Output Power	(dBm)	25.0	19.5	19.5
Antenna Gain	(dBi)	1.6	2.4	2.0
Duty Cycle	(%)	100	100	100
Source Based EIRP	(mW)	457.1	154.9	141.3
FCC Power Density	(mW/cm^2)	0.09	0.03	0.03
FCC Power Density Limit	(mW/cm^2)	0.52	1	1
Fraction of Limit	(%)	17.5	3.1	2.8
Sum of Fractions (%)	23.4			

Notes:

1) The output power listed above is the maximum power including tolerance.

2) The antenna gain in the tables above is the maximum antenna gain among various channels within the specified band.

3) Colocated calculation use the worst case LTE(band

END OF TEST REPORT