RF EXPOSURE REPORT

REPORT NO.:	SA140430E05B
MODEL NO.:	1653
FCC ID:	C3K1653
RECEIVED:	Apr. 30, 2014
TESTED:	July 31, 2014
ISSUED:	Sep. 02, 2014
APPLICANT:	Microsoft Corporation
ADDRESS:	One Microsoft Way Redmond WA 98052
ISSUED BY:	Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch Hsin Chu Laboratory
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RELEASE CONTROL RECORD

ISSUE NO.	REASON FOR CHANGE	DATE ISSUED
SA140430E05B	Original release	Sep. 02, 2014

1. CERTIFICATION

PRODUCT:	802.11a/b/g/n 2T2R dual-band wireless LAN radio
BRAND NAME:	Microsoft
MODEL NO.:	1653
TEST SAMPLE:	ENGINEERING SAMPLE
APPLICANT:	Microsoft Corporation
TESTED DATE:	July 31, 2014
STANDARDS:	FCC Part 2 (Section 2.1091)
	KDB 447498 D03
	IEEE C95.1

The above equipment (Model: 1653) has been tested by **Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's EMC characteristics under the conditions specified in this report.

PREPARED BY : _____ , **DATE:** *Sep. 02, 2014*
(Lori Chung, Specialist)

APPROVED BY : _____ , **DATE:** *Sep. 02, 2014*
(May Chen, Manager)

2. RF EXPOSURE LIMIT

LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

FREQUENCY RANGE (MHz)	ELECTRIC FIELD STRENGTH (V/m)	MAGNETIC FIELD STRENGTH (A/m)	POWER DENSITY (mW/cm^2)	AVERAGE TIME (minutes)
LIMITS FOR GENERAL POPULATION / UNCONTROLLED EXPOSURE				
300-1500	…	…	F/1500	30
1500-100,000	…	…	1.0	30

F = Frequency in MHz

3. MPE CALCULATION FORMULA

$Pd = (Pout*G) / (4*pi*r^2)$

where

Pd = power density in mW/cm^2

Pout = output power to antenna in mW

G = gain of antenna in linear scale

pi = 3.1416

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

4. CLASSIFICATION

The antenna of this product, under normal use condition, is at least 20cm away from the body of the user. So, this device is classified as **Mobile Device**.

5. ANTENNA GAIN

The antennas provided to the EUT, please refer to the following table:

Accessory Radio							
Ant. No.	Brand	Model	Ant. Gain(dBi) <including cable loss>	Frequency range (GHz ~ GHz)	Ant. Type	Connecter Type	Cable Length (mm)
1	Microsoft	NA	2.2	2.4~2.5	PCB	i-PEX	295
	Microsoft	NA	3.14	5.15~5.85	PCB	i-PEX	295

Network Radio							
Ant. No.	Transmitter Circuit	Brand	Model	Ant. Gain(dBi) <including cable loss>	Frequency range (GHz ~ GHz)	Ant. Type	Connecter Type
1	Chain (0)	Microsoft	NA	4.79	2.4~2.5	PCB	NA
				3.49	5.15~5.85		
2	Chain (1)	Microsoft	NA	1.87	2.4~2.5	PCB	NA
				2.63	5.15~5.85		

6. CALCULATION RESULT OF MAXIMUM CONDUCTED POWER

For 15.247 and 15.407(U-NII-1 & U-NII-3) data was copied from the original test report (Report No.: SA140430E05).

For Accessory Radio:

15.247(2.4GHz):

FREQUENCY–(MHz)	MAX POWER (mW)	ANTENNA GAIN (dBi)	DISTANCE (cm)	POWER DENSITY (mW/ cm^2)	LIMIT (mW/cm^2)
2412 ~ 2462	588.844	2.2	20	0.19441	1

15.407(5GHz_ U-NII-1):

FREQUENCY (MHz)	MAX POWER (mW)	ANTENNA GAIN (dBi)	DISTANCE (cm)	POWER DENSITY (mW/ cm^2)	LIMIT (mW/cm^2)
5180 ~ 5240	34.041	3.14	20	0.01396	1

15.407(U-NII-2A):

FREQUENCY (MHz)	MAX POWER (mW)	ANTENNA GAIN (dBi)	DISTANCE (cm)	POWER DENSITY (mW/ cm^2)	LIMIT (mW/cm^2)
5260 - 5320	34.119	3.14	20	0.01399	1

15.407(U-NII-2C):

FREQUENCY (MHz)	MAX POWER (mW)	ANTENNA GAIN (dBi)	DISTANCE (cm)	POWER DENSITY (mW/ cm^2)	LIMIT (mW/cm^2)
5500 - 5580 & 5660 - 5700	36.644	3.14	20	0.01502	1

15.407(5GHz_ U-NII-3):

FREQUENCY (MHz)	MAX POWER (mW)	ANTENNA GAIN (dBi)	DISTANCE (cm)	POWER DENSITY (mW/ cm^2)	LIMIT (mW/cm^2)
5745 ~ 5825	36.898	3.14	20	0.01513	1

For Network Radio:

15.247(2.4GHz):

FREQUENCY–(MHz)	MAX POWER (mW)	ANTENNA GAIN (dBi)	DISTANCE (cm)	POWER DENSITY (mW/ cm^2)	LIMIT (mW/cm^2)
2412 ~ 2462	629.359	6.46	20	0.55415	1

Note: Directional gain = 10 log[($10^{G1/20}$ + $10^{G2/20}$)^2 / 2] = 6.46dBi

15.407(5GHz_ U-NII-1):

FREQUENCY (MHz)	MAX POWER (mW)	ANTENNA GAIN (dBi)	DISTANCE (cm)	POWER DENSITY (mW/ cm^2)	LIMIT (mW/cm^2)
5180 ~ 5240	168.582	6.08	20	0.13600	1

Note: Directional gain = 10 log[($10_{G1/20}$ + $10^{G2/20}$)^2 / 2] = 6.08dBi

15.407(U-NII-2A):

FREQUENCY (MHz)	MAX POWER (mW)	ANTENNA GAIN (dBi)	DISTANCE (cm)	POWER DENSITY (mW/ cm^2)	LIMIT (mW/cm^2)
5260 - 5320	240.484	6.08	20	0.19401	1

Note: Directional gain = 10 log[($10_{G1/20}$ + $10^{G2/20}$)^2 / 2] = 6.08dBi

15.407(U-NII-2C):

FREQUENCY (MHz)	MAX POWER (mW)	ANTENNA GAIN (dBi)	DISTANCE (cm)	POWER DENSITY (mW/ cm^2)	LIMIT (mW/cm^2)
5500 - 5580 & 5660 - 5700	240.731	6.08	20	0.19421	1

Note: Directional gain = 10 log[($10^{G1/20}$ + $10^{G2/20}$)^2 / 2] = 6.08dBi

15.407(5GHz_ U-NII-3):

FREQUENCY (MHz)	MAX POWER (mW)	ANTENNA GAIN (dBi)	DISTANCE (cm)	POWER DENSITY (mW/ cm^2)	LIMIT (mW/cm^2)
5745 ~ 5825	119.519	6.08	20	0.09642	1

Note: Directional gain = 10 log[($10^{G1/20}$ + $10^{G2/20}$)^2 / 2] = 6.08dBi

CONCLUSION:

The (WiFi) Accessory Radio (1x1) and Features (WiFi) Network Radio (2x2) can transmit simultaneously as below table, the formula of calculated the MPE is:

Condition	Technology	
	Networking Radio(2x2)	Accessory radio(1x1)
1	2.4GHz Band	5GHz U-NII-1 or 2A Band
2	2.4GHz Band	5GHz U-NII-3 or 2C Band
3	5GHz U-NII-1 or 2A Band	2.4GHz Band
4	5GHz U-NII-1 or 2A Band	5GHz U-NII-3 or 2C Band
5	5GHz U-NII-3 or 2C Band	2.4GHz Band
6	5GHz U-NII-3 or 2C Band	5GHz U-NII-1 or 2A Band
The emission of the simultaneous operation has been evaluated and no non-compliance was found.		

$CPD_1 / LPD_1 + CPD_2 / LPD_2$ + ……etc. < 1

CPD = Calculation power density

LPD = Limit of power density

For Network Radio (2.4G) + Accessory Radio (5G_ U-NII-1 or 2A):

Therefore, the worst-case situation is 0.19441 / 1 + 0.19401 / 1= 0.388, which is less than “1”. This confirmed that the device comply with FCC 1.1310 MPE limit.

For Network Radio (2.4G) + Accessory Radio (5G_ U-NII-3 or 2C):

Therefore, the worst-case situation is 0.19441 / 1 + 0.19421 / 1= 0.389, which is less than “1”. This confirmed that the device comply with FCC 1.1310 MPE limit.

For Network Radio (5G_ U-NII-1 or 2A) + Accessory Radio (2.4G):

Therefore, the worst-case situation is 0.01399 / 1 + 0.55415 / 1= 0.568, which is less than “1”. This confirmed that the device comply with FCC 1.1310 MPE limit.

For Network Radio (5G_ U-NII-1 or 2A) + Accessory Radio (5G_ U-NII-3 or 2C):

Therefore, the worst-case situation is 0.01399 / 1 + 0.19421 / 1= 0.208, which is less than “1”. This confirmed that the device comply with FCC 1.1310 MPE limit.

For Network Radio (5G_ U-NII-3 or 2C) + Accessory Radio (2.4G):

Therefore, the worst-case situation is 0.01513 / 1 + 0.55415 / 1= 0.569, which is less than “1”. This confirmed that the device comply with FCC 1.1310 MPE limit.

For Network Radio (5G_ U-NII-3 or 2C) + Accessory Radio (5G_ U-NII-1 or 2A):

Therefore, the worst-case situation is 0.01513 / 1 + 0.19401 / 1= 0.209, which is less than “1”. This confirmed that the device comply with FCC 1.1310 MPE limit.

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