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47 C.F.R. Part 1, Subpart I, Section 1.1310
47 C.F.R. Part 2, Subpart J, Section 2.1091

RF EXPOSURE REPORT

For

Computer

Model:
TREK-688, TREK-688XXXXXXXXXXXXXXX (where "X" may be any alphanumeric character , “-” or blank)

Trade Name: ADVANTECH

Issued to

Advantech Co. Ltd.
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Issued by

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Testing Laboratory
1309

Revision History

Rev.	Issue Date	Revisions	Effect Page	Revised By
00	February 15, 2016	Initial Issue	ALL	Doris Chu
01	June 6, 2016	1. Added simultaneous transmission sar analysis	P. 8	Doris Chu

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1. LIMIT

According to §15.247(i), systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy levels in excess of the Commission's guidelines. See § 1.1307(b)(1) of this chapter.

2. EUT SPECIFICATION

EUT	Computer
Model	TREK-688, TREK-688XXXXXXXXXXXXXXX (where "X" may be any alphanumeric character , "-" or blank)
Trade Name	ADVANTECH
Model Discrepancy	All the above models are identical except for the designation of model numbers. The suffix of (where "X" may be any alphanumeric character , "-" or blank) on model number is just for marketing purpose only.
Frequency band (Operating)	☒ Bluetooth 2.1 + EDR / 4.0: 2402 ~ 2480 MHz 802.11b/g/n HT20: 2412MHz ~ 2462MHz 802.11n HT40: 2422MHz ~ 2452MHz 802.11a/n HT20: 5180MHz ~ 5700MHz / 5745MHz ~ 5825MHz 802.11n HT40: 5190MHz ~ 5670MHz / 5755MHz ~ 5795MHz ☐ Others
Device category	☐ Portable (<20cm separation) ☒ Mobile (>20cm separation) ☐ Others
Exposure classification	☐ Occupational/Controlled exposure (S = 5mW/cm^2) ☒ General Population/Uncontrolled exposure (S=1mW/cm^2)
Antenna Specification	BT -0.79 dBi (Numeric gain: 0.83) 2.4GHz -0.79 dBi (Numeric gain: 0.83) 5GHz -5.96 dBi (Numeric gain: 0.25) Type: Dipole Antenna
Measurement Average output power	See table below

System	Power	
Bluetooth 2.1 + EDR:	1.14 dBm	(1.300 mW)
Bluetooth 4.0:	0.87 dBm	(1.222 mW)
IEEE 802.11b Mode:	20.10 dBm	(102.329 mW)
IEEE 802.11g Mode:	19.46 dBm	(88.308 mW)
IEEE 802.11n HT 20 Mode:	16.31 dBm	(42.756 mW)
IEEE 802.11n HT 40 Mode:	12.85 dBm	(19.275 mW)
IEEE 802.11a Mode:	17.34 dBm	(54.200 mW)
IEEE 802.11n HT 20 Mode:	17.54 dBm	(56.754 mW)
IEEE 802.11n HT 40 Mode:	17.52 dBm	(56.494 mW)

Power Target / Tolerance

System	Target Power	Tolerance
Bluetooth 2.1 + EDR:	0.0 dBm	± 1.5 dB
Bluetooth 4.0:	0.0 dBm	± 1.5 dB
IEEE 802.11b Mode:	19.5 dBm	± 1.5 dB
IEEE 802.11g Mode:	19.5 dBm	± 1.5 dB
IEEE 802.11n HT 20 Mode:	16.0 dBm	± 1.5 dB
IEEE 802.11n HT 40 Mode:	12.0 dBm	± 1.5 dB
IEEE 802.11a Mode:	16.0 dBm	± 1.5 dB
IEEE 802.11n HT 20 Mode:	16.0 dBm	± 1.5 dB
IEEE 802.11n HT 40 Mode:	16.5 dBm	± 1.5 dB

Max tune up Power / Max time Average Power

Bluetooth 2.1 + EDR:	1.50 dBm	(1.413 mW)
Bluetooth 4.0:	1.50 dBm	(1.413 mW)
IEEE 802.11b Mode:	21.00 dBm	(125.893 mW)
IEEE 802.11g Mode:	21.00 dBm	(125.893 mW)
IEEE 802.11n HT 20 Mode:	17.50 dBm	(56.234 mW)
IEEE 802.11n HT 40 Mode:	13.50 dBm	(22.387 mW)
IEEE 802.11a Mode:	17.50 dBm	(56.234 mW)
IEEE 802.11n HT 20 Mode:	17.50 dBm	(56.234 mW)
IEEE 802.11n HT 40 Mode:	18.00 dBm	(63.096 mW)

Evaluation applied

☒ MPE Evaluation*
☐ SAR Evaluation
☐ N/A

3. TEST RESULTS

No non-compliance noted.

Calculation

Given $E = \frac{\sqrt{30 \times P \times G}}{d}$ & $S = \frac{E^2}{377}$

Where E = Field strength in Volts / meter
P = Power in Watts
G = Numeric antenna gain
d = Distance in meters
S = Power density in milliwatts / square centimeter

Combining equations and re-arranging the terms to express the distance as a function of the remaining variables yields:

$$S = \frac{30 \times P \times G}{377 d^2}$$

Changing to units of mW and cm, using:

P (mW) = P (W) / 1000 and

d (cm) = d(m) / 100

Yields

$$S = \frac{30 \times (P/1000) \times G}{377 \times (d/100)^2} = 0.0796 \times \frac{P \times G}{d^2}$$ ***Equation 1***

Where d = Distance in cm
P = Power in mW
G = Numeric antenna gain
S = Power density in mW / cm^2

4. MAXIMUM PERMISSIBLE EXPOSURE

Substituting the MPE safe distance using d = 20 cm into Equation 1:

$$S = 0.000199 \times P \times G$$

Where P = Power in mW

G = Numeric antenna gain

S = Power density in mW / cm²

Bluetooth 2.1 + EDR:

Ch.	Frq.(MHz)	P (mW)	Gain (num.)	D (cm)	Power density in mW / cm²	Limit (mW/cm2)
79	2480	1.413	0.83	20	0.0002	1

Bluetooth 4.0:

Ch.	Frq.(MHz)	P (mW)	Gain (num.)	D (cm)	Power density in mW / cm²	Limit (mW/cm2)
40	2480	1.413	0.83	20	0.0002	1

IEEE 802.11b mode:

Ch.	Frq.(MHz)	P (mW)	Gain (num.)	D (cm)	Power density in mW / cm²	Limit (mW/cm2)
6	2437	125.893	0.83	20	0.0208	1

IEEE 802.11g mode:

Ch.	Frq.(MHz)	P (mW)	Gain (num.)	D (cm)	Power density in mW / cm²	Limit (mW/cm2)
6	2437	125.893	0.83	20	0.0208	1

IEEE 802.11n HT20 mode:

Ch.	Frq.(MHz)	P (mW)	Gain (num.)	D (cm)	Power density in mW / cm²	Limit (mW/cm2)
6	2437	56.234	0.83	20	0.0093	1

IEEE 802.11n HT40 mode:

Ch.	Frq.(MHz)	P (mW)	Gain (num.)	D (cm)	Power density in mW / cm²	Limit (mW/cm2)
6	2437	22.387	0.83	20	0.0037	1

IEEE 802.11a mode:

Ch.	Frq.(MHz)	P (mW)	Gain (num.)	D (cm)	Power density in mW / cm²	Limit (mW/cm2)
140	5700	56.234	0.25	20	0.0028	1

IEEE 802.11a HT20 mode:

Ch.	Frq.(MHz)	P (mW)	Gain (num.)	D (cm)	Power density in mW / cm²	Limit (mW/cm2)
140	5700	56.234	0.25	20	0.0028	1

IEEE 802.11a HT40 mode:

Ch.	Frq.(MHz)	P (mW)	Gain (num.)	D (cm)	Power density in mW / cm²	Limit (mW/cm2)
134	5670	63.096	0.25	20	0.0031	1

5. SIMULTANEOUS TRANSMISSION SAR ANALYSIS

Both of the WLAN and BT can transmit simultaneously, the formula of calculated the MPE is:

CPD1 / LPD1 + CPD2 / LPD2 + ……etc. < 1

CPD = Calculation power density

LPD = Limit of power density

WIFI+BT

Therefore, the worst-case situation is 0.0002 / 1 + 0.0208 / 1 = 0.021, which is less than “1”.