

RF Exposure Evaluation Report

FCC 47 CFR § 2.1091

for

WiFi+Bluetooth 5.2 System on Module

Model Name.: PIXI-IW416

Prepared for:

TechNexion Ltd.

**16F-5, No. 736, Zhongzheng Road, ZhongHe District, 23511,
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Prepared by

Compliance Certification Services Inc.

Wugu Laboratory

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New Taipei City, Taiwan.**

Issue Date: August 7, 2023

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Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 90 days only.

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Revision History

Rev.	Issue Date	Revisions	Effect Page	Revised By
00	August 7, 2023	Initial Issue	ALL	Allison Chen

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1 Attestation of Test Results

Applicant Name	TechNexion Ltd.
Model Name	PIXI-IW416
Applicable Standards	FCC 47 CFR § 2.1091 FCC 47 CFR § 1.1307 FCC 47 CFR § 1.1310 Published RF exposure KDB procedures
Receive EUT Date:	May 16, 2023
<p>Compliance Certification Services Inc. , tested the above equipment in accordance with the requirements set forth in the above standards. Determination of compliance is based on the results of the compliance measurement,not taking into account measurement instrumentation uncertainty.All indications of Pass/Fail in this report are opinions expressed by Compliance Certification Services Inc, based on interpretations and/or observations of test results. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.</p>	
<p>Approved & Released By:</p> 	
<p>Sky Zhou Asst. Section Manager Compliance Certification Services Inc.</p>	

2 Test Specification, Methods and Procedures

The tests documented in this report were performed in accordance with FCC 47 CFR § 2.1091, the following FCC Published RF exposure [KDB](#) procedures:

- 447498 D04 Interim General RF Exposure Guidance v01
- 865664 D02 RF Exposure Reporting v01r02

3 Device Under Test (DUT) Information

3.1 DUT Description

Product	WiFi+Bluetooth 5.2 System on Module
Trade Name	TechNexion
Model No.	PIXI-IW416
Model Discrepancy	N/A
Hardware Version	A1
Software Version	1.0
Sample Stage	Identical prototype

3.2 Wireless Technologies

Frequency bands	<input checked="" type="checkbox"/> Bluetooth: 2402 MHz~2480 MHz <input checked="" type="checkbox"/> 802.11b/g/n HT20: 2412 MHz~2462 MHz <input checked="" type="checkbox"/> 802.11n HT40: 2422 MHz~2452 MHz <input checked="" type="checkbox"/> 802.11a/n HT20: 5180MHz ~ 5240MHz / 5745MHz ~ 5825MHz <input checked="" type="checkbox"/> 802.11n HT40: 5190MHz ~ 5230MHz / 5755MHz ~ 5795MHz <input type="checkbox"/> 802.11ac VHT20/ax HE20: 5180MHz ~ 5240MHz / 5260MHz ~ 5320MHz / 5500MHz ~ 5700MHz / 5745MHz ~ 5825MHz <input type="checkbox"/> 802.11ac VHT40/ax HE40: 5190MHz ~ 5230MHz / 5270MHz ~ 5310MHz / 5510MHz ~ 5690MHz / 5755MHz ~ 5795MHz <input type="checkbox"/> 802.11ac VHT80/ax HE80: 5210MHz / 5290MHz / 5530MHz ~ 5610MHz / 5775MHz <input type="checkbox"/> 802.11ac VHT160/ax HE160: 5250 MHz / 5570 MHz <input type="checkbox"/> Others
Exposure classification	<input type="checkbox"/> Occupational/Controlled exposure (S = 5mW/cm ²) <input checked="" type="checkbox"/> General Population/Uncontrolled exposure

Report No.: TMWK2305001497KS

Antenna Specification	<p>Type / Brand / Model: 1. PIFA Antenna / TechNexion / VM2450-25523-OOX-180 2. Dipole Antenna / TechNexion / VM2450-ASSY1005</p> <p>(1) Bluetooth & WIFI 2.4GHz: 1. PIFA Antenna Gain: 2.5 dBi 2. Dipole Antenna Gain: 4 dBi</p> <p>(2) WIFI 5GHz: 1. PIFA Antenna Gain: 3 dBi 2. Dipole Antenna Gain: 6 dBi</p> <p style="text-align: center;">Antenna Gain:</p> <table border="0"> <tr> <td>Bluetooth</td> <td>4.00 dBi</td> <td>(Numeric gain: 2.51)</td> <td>Worst</td> </tr> <tr> <td>WIFI 2.4GHz</td> <td>4.00 dBi</td> <td>(Numeric gain: 2.51)</td> <td>Worst</td> </tr> <tr> <td>WIFI 5.2GHz (U-NII 1)</td> <td>6.00 dBi</td> <td>(Numeric gain: 3.98)</td> <td>Worst</td> </tr> <tr> <td>WIFI 5.8GHz (U-NII 3)</td> <td>6.00 dBi</td> <td>(Numeric gain: 3.98)</td> <td>Worst</td> </tr> </table>	Bluetooth	4.00 dBi	(Numeric gain: 2.51)	Worst	WIFI 2.4GHz	4.00 dBi	(Numeric gain: 2.51)	Worst	WIFI 5.2GHz (U-NII 1)	6.00 dBi	(Numeric gain: 3.98)	Worst	WIFI 5.8GHz (U-NII 3)	6.00 dBi	(Numeric gain: 3.98)	Worst																				
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Notes:

- For more details, please refer to the User's manual of the EUT.
- Disclaimer: Antenna information is provided by the applicant, test results of this report are applicable to the sample EUT received.
- The tune up power referred the AVG power of the test report TMWK2305001496KR, TMWK2305001499KR, TMWK2307002174KR and TMWK2307002175KR for RF Exposure assessment purpose.

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4 Maximum Permissible Exposure

4.1 Limits for Maximum Permissible Exposure (MPE)

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
<u>1,500-100,000</u>			1.0	30

4.2 MPE Calculation Method

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:

$$P \text{ (mW)} = P \text{ (W)} / 1000 \text{ and}$$

$$d \text{ (cm)} = d \text{ (m)} / 100$$

Yields

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

Where d = Distance in cm

P = Power in mW

G = Numeric antenna gain

S = Power density in mW / cm²

If, Substituting the MPE safe distance using d = 30 cm into Equation 1:

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

4.3 MPE EXEMPTION

- (A) The available maximum time-averaged power is no more than 1 mW
- (B) The available maximum time-averaged power or effective radiated power (ERP), whichever is greater, is less than or equal to the threshold P_{th} (mW) described in the following formula. This method shall only be used at separation distances (cm) from 0.5 centimeters to 40 centimeters and at frequencies from 0.3 GHz to 6 GHz (inclusive). P_{th} is given by:

$$P_{th} \text{ (mW)} = \begin{cases} ERP_{20 \text{ cm}} (d/20 \text{ cm})^x & d \leq 20 \text{ cm} \\ ERP_{20 \text{ cm}} & 20 \text{ cm} < d \leq 40 \text{ cm} \end{cases}$$

Where

$$x = -\log_{10} \left(\frac{60}{ERP_{20 \text{ cm}} \sqrt{f}} \right) \text{ and } f \text{ is in GHz;}$$

and

$$ERP_{20 \text{ cm}} \text{ (mW)} = \begin{cases} 2040f & 0.3 \text{ GHz} \leq f < 1.5 \text{ GHz} \\ 3060 & 1.5 \text{ GHz} \leq f \leq 6 \text{ GHz} \end{cases}$$

d = the separation distance (cm);

- (C) Using Table 1 and the minimum separation distance (R in meters) from the body of a nearby person for the frequency (f in MHz) at which the source operates, the ERP (watts) is no more than the calculated value prescribed for that frequency. For the exemption in Table 1 to apply, R must be at least $\lambda/2\pi$, where λ is the free-space operating wavelength in meters. If the ERP of a single RF source is not easily obtained, then the available maximum time-averaged power may be used in lieu of ERP if the physical dimensions of the radiating structure(s) do not exceed the electrical length of $\lambda/4$ or if the antenna gain is less than that of a half-wave dipole (1.64 linear value).

Single RF Sources Subject to Routine Environmental Evaluation	
RF Source frequency (MHz)	Threshold ERP (watts)
0.3-1.34	1,920 R^2 .
1.34-30	3,450 R^2/f^2 .
30-300	3.83 R^2 .
300-1,500	0.0128 R^2f .
1,500-100,000	19.2 R^2 .

Note: R is in meters, f is in MHz.

4.4 Multiple RF sources

In the case of fixed RF sources operating in the same time-averaging period, or of multiple mobile or portable RF sources within a device operating in the same time averaging period, if the sum of the fractional contributions to the applicable thresholds is less than or equal to 1 as indicated in the following equation),

$$\sum_{i=1}^a \frac{P_i}{P_{th,i}} + \sum_{j=1}^b \frac{ERP_j}{ERP_{th,j}} + \sum_{k=1}^c \frac{Evaluated_k}{Exposure Limit_k} \leq 1$$

5 MPE Exemption Option B

Bluetooth

Mode	Frequency (MHz)	R(m)	Max Tune-up power (dBm)	G(dBi)	Max Tune-up EIRP (dBm)	Max Tune-up ERP (dBm)	Max Tune-up ERP (mW)	ERP Threshold (mW)	MPE Exemption
BT	2480.00	0.2	10.0	4.0	14.00	11.85	15.311	3060	Complies
BLE_2 Mbps	2440.00	0.2	10.0	4.0	14.00	11.85	15.311	3060	Complies

WIFI 2.4GHz (DTS)

Mode	Frequency (MHz)	R(m)	Max Tune-up power (dBm)	G(dBi)	Max Tune-up EIRP (dBm)	Max Tune-up ERP (dBm)	Max Tune-up ERP (mW)	ERP Threshold (mW)	MPE Exemption
IEEE 802.11b	2462.00	0.2	17.0	4.0	21.00	18.85	76.736	3060	Complies
IEEE 802.11g	2462.00	0.2	16.0	4.0	20.00	17.85	60.954	3060	Complies
IEEE 802.11n HT 20	2462.00	0.2	14.0	4.0	18.00	15.85	38.459	3060	Complies
IEEE 802.11n HT 40	2437.00	0.2	15.0	4.0	19.00	16.85	48.417	3060	Complies

WIFI 5.2GHz (U-NII 1)

Mode	Frequency (MHz)	R(m)	Max Tune-up power (dBm)	G(dBi)	Max Tune-up EIRP (dBm)	Max Tune-up ERP (dBm)	Max Tune-up ERP (mW)	ERP Threshold (mW)	MPE Exemption
IEEE 802.11a	5240.00	0.2	15.0	6.0	21.00	18.85	76.736	3060	Complies
IEEE 802.11n HT 20	5240.00	0.2	15.0	6.0	21.00	18.85	76.736	3060	Complies
IEEE 802.11n HT 40	5230.00	0.2	15.0	6.0	21.00	18.85	76.736	3060	Complies

WIFI 5.8GHz (U-NII 3)

Mode	Frequency (MHz)	R(m)	Max Tune-up power (dBm)	G(dBi)	Max Tune-up EIRP (dBm)	Max Tune-up ERP (dBm)	Max Tune-up ERP (mW)	ERP Threshold (mW)	MPE Exemption
IEEE 802.11a	5825.00	0.2	15.0	6.0	21.00	18.85	76.736	3060	Complies
IEEE 802.11n HT20	5825.00	0.2	15.0	6.0	21.00	18.85	76.736	3060	Complies
IEEE 802.11n HT40	5795.00	0.2	15.0	6.0	21.00	18.85	76.736	3060	Complies

6 Simultaneous Transmission Exempt

In the case of fixed RF sources operating in the same time-averaging period, or of multiple mobile or portable RF sources within a device operating in the same time averaging period, if the sum of the fractional contributions to the applicable thresholds is less than or equal to 1 as indicated in the following equation),

$$\sum_{i=1}^a \frac{P_i}{P_{th,i}} + \sum_{j=1}^b \frac{ERP_j}{ERP_{th,j}} + \sum_{k=1}^c \frac{Evaluated_k}{Exposure Limit_k} \leq 1$$

Simultaneous Transmission Condition

RF Exposure Condition	Item	Capable Transmit Configurations		
	1	WiFi 2.4GHz	+	Bluetooth
1	WiFi 5GHz	+	Bluetooth	

6.1 Sum of the WIFI 2.4GHz & Bluetooth

Mode	Frequency (MHz)	Max Tune-up ERP(mW)	ERP Threshold(mW)	simultaneous Transmission	simultaneous Transmission Limit
WiFi 2.4GHz	2462.00	76.736	3060	0.030	≤1
Bluetooth	2480.00	15.311	3060		

6.2 Sum of the WIFI 5GHz & Bluetooth

Mode	Frequency (MHz)	Max Tune-up ERP(mW)	ERP Threshold(mW)	simultaneous Transmission	simultaneous Transmission Limit
WiFi 5GHz	5825.00	76.736	3060	0.030	≤1
Bluetooth	2480.00	15.311	3060		



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7 Facilities

All measurement facilities used to collect the measurement data are located at

No.11, Wugong 6th Rd., Wugu Dist., New Taipei City, Taiwan.

No. 12, Ln. 116, Wugong 3rd Rd., Wugu Dist., New Taipei City, Taiwan.

END OF REPORT