Radio Exposure Evaluation Report

FCC ID	:	**UIDX6**
Equipment	:	**11ax Tri-band Extender**
Brand Name	:	**ARRIS**
Model Name	:	**X6**
Applicant	:	**ARRIS** **3871 Lakefield Drive Suite 300 SUWANEE Georgia United States 30024**
Manufacturer	:	**Gemtek Technology** **No.15-1 Zhonghua Road, Hsinchu Industrial Park, Hukou, Hsinchu, Taiwan, R.O.C**
Standard	:	**47 CFR FCC Part 2 Subpart J, section 2.1091**

The product was received on Aug. 29, 2022, and testing was started from Sep. 27, 2022 and completed on Oct. 28, 2022. We, SPORTON INTERNATIONAL INC. Hsinhua Laboratory, would like to declare that the tested sample has been evaluated in accordance with the procedures given in 47 CFR FCC Part 2 Subpart J, section 2.1091 and shown compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval of SPORTON INTERNATIONAL INC. Hsinhua Laboratory, the test report shall not be reproduced except in full.

Approved by: Jackson Tsai

SPORTON INTERNATIONAL INC. Hsinhua Laboratory
No.52, Huaya 1st Rd., Guishan Dist., Taoyuan City 333411, Taiwan (R.O.C.)

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History of this test report

Report No.	Version	Description	Issued Date
FA282903	01	Initial issue of report	Apr. 11, 2023

Summary of Test Result

Report Clause	Ref Std. Clause	Test Items	Result (PASS/FAIL)	Remark
2	-	Exposure evaluation	PASS	-

Declaration of Conformity:
The test results with all measurement uncertainty excluded are presented in accordance with the regulation limits or requirements declared by manufacturers.
Comments and Explanations:
None

Reviewed by: Barry Hsiao

Report Producer: Michelle Tsai

1 General Description

1.1 Information

1.1.1 EUT General Information

RF General Information			
Evaluation Mode	**Frequency Range (MHz)**	**Operating Frequency (MHz)**	**Modulation Type**
2.4GHz WLAN	2400-2483.5	2412-2462	802.11b: DSSS (DBPSK, DQPSK, CCK) 802.11g/n: OFDM (BPSK, QPSK, 16QAM, 64QAM) VHT: OFDM (BPSK, QPSK, 16QAM, 64QAM, 256QAM) 802.11ax: OFDMA (BPSK, QPSK, 16QAM, 64QAM, 256QAM, 1024QAM)
5GHz WLAN	5150-5250 5250-5350 5470-5725 5725-5850	5180-5240 5260-5320 5500-5700 5745-5825	802.11a/n: OFDM (BPSK, QPSK, 16QAM, 64QAM) 802.11ac: OFDM (BPSK, QPSK, 16QAM, 64QAM, 256QAM) 802.11ax: OFDMA (BPSK, QPSK, 16QAM, 64QAM, 256QAM, 1024QAM)
6GHz WLAN	5925-7125	5955-7095	802.11ax: OFDMA (BPSK, QPSK, 16QAM, 64QAM, 256QAM, 1024QAM)

1.1.2 Antenna Information

Ant.	Brand	Model Name	Antenna Type	Connector	Support
1	Gemtek	LPVN-GM-TX-P-005	PCB	I-Pex	2.4GHz+5GHz
2	Gemtek	LPVN-GM-TX-P-006	PCB	I-Pex	2.4GHz+5GHz
3	Gemtek	LPVN-GM-TX-P-001	PCB	I-Pex	6GHz
4	Gemtek	LPVN-GM-TX-P-002	PCB	I-Pex	6GHz
5	Gemtek	LPVN-GM-TX-P-003	PCB	I-Pex	6GHz
6	Gemtek	LPVN-GM-TX-P-004	PCB	I-Pex	6GHz

Ant.	Port	Gain (dBi)								
		2.4GHz	5GHz				6GHz			
			U-NII-1	U-NII-2A	U-NII-2C	U-NII-3	U-NII-5	U-NII-6	U-NII-7	U-NII-8
1	1	3.78	2.01	1.76	2.74	2.04	-	-	-	-
2	2	4.11	2.22	2.21	2.44	3.62	-	-	-	-
3	1	-	-	-	-	-	2.62	2.46	2.28	3.06
4	2	-	-	-	-	-	2.13	2.19	3.40	2.53
5	3	-	-	-	-	-	2.96	2.22	2.03	3.37
6	4	-	-	-	-	-	3.02	2.13	2.41	2.78

Composite Gain (dBi)									
2.4GHz		5GHz							
		U-NII-1		U-NII-2A		U-NII-2C		U-NII-3	
2T1S	2T2S	2T1S	2T2S	2T1S	2T2S	2T1S	2T2S	2T1S	2T2S
4.46	4.11	2.65	2.22	2.78	2.21	3.08	2.74	4.24	3.62

Note 1: The EUT has six antennas.

For 2.4GHz function:

For IEEE 802.11 b/g/n/VHT/ax mode (2TX/2RX)

Ant. 1 (port 1) ~ Ant. 2 (port 2) could transmit/receive simultaneously.

For 5GHz function:

For IEEE 802.11 a/n/ac/ax mode (2TX/2RX)

Ant. 1 (port 1) ~ Ant. 2 (port 2) could transmit/receive simultaneously.

For 6GHz function:

For IEEE 802.11 a/ax mode (4TX/4RX)

Ant. 3 (port 1) ~ Ant. 6 (port 4) could transmit/receive simultaneously.

1.1.3 Accessories

AC Adapter 1 (US Plug)	Brand Name	ASIAN POWER	Model Name	WB-24M12FU
	Power Rating	I/P:100-120Vac, 0.7A, O/P: 12Vdc, 2A		
	DC Power Cable	1.8 meter, non-shielded cable, w/o ferrite core		
AC Adapter 2 (US Plug)	Brand Name	NetBit	Model Name	NBS24M120200VU
	Power Rating	I/P:100-120Vac, 0.6A, O/P: 12Vdc, 2A		
	DC Power Cable	1.8 meter, non-shielded cable, w/o ferrite core		
AC Adapter 3 (US Plug)	Brand Name	NetBit	Model Name	NBS24N120200VU
	Power Rating	I/P:100-120Vac, 0.6A, O/P: 12Vdc, 2A		
	DC Power Cable	1.8 meter, non-shielded cable, w/o ferrite core		
RJ45 Cable	Category	CAT 5e	In/Out door	indoor
	Signal Line	1.5 meter, non-shielded cable		

Reminder: Regarding to more detail and other information, please refer to user manual.

1.2 Applicable Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- 47 CFR FCC Part 2 Subpart J, section 2.1091
- KDB 447498 D04 Interim General RF Exposure Guidance v01

The following reference test guidance is not within the scope of accreditation of TAF.

- 47 CFR Part 1.1307
- 47 CFR Part 1.1310

1.3 Testing Location

Test Lab.：Sporton International Inc. Hsinhua Laboratory			
☒	Hsinhua **(TAF:** 3785**)**	**ADD:** No.52, Huaya 1st Rd., Guishan Dist., Taoyuan City 333411, Taiwan (R.O.C.)	
		TEL: 886-3-327-3456	**FAX:** 886-3-327-0973
	Test site Designation No. TW3785 with FCC.		
☐	Wen 33rd.St. **(TAF:** 3785**)**	**ADD:** No.14-1, Ln. 19, Wen 33rd St., Guishan Dist., Taoyuan City 333010, Taiwan (R.O.C.)	
		TEL: 886-3-318-0787	**FAX:** 886-3-318-0287
	Test site Designation No. TW0008 with FCC.		

2 Maximum Permissible Exposure

2.1 Limit of Maximum Permissible Exposure

(A) Limits for Occupational / Controlled Exposure

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/ cm²)	Averaging Time |E|²,|H|² or S (minutes)
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
300-1500	-	-	F/300	6
1500-100,000	-	-	5	6

(B) Limits for General Population / Uncontrolled Exposure

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/ cm²)	Averaging Time |E|²,|H|² or S (minutes)
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
300-1500	-	-	F/1500	30
1500-100,000	-	-	1.0	30

Note: f = frequency in MHz ; *Plane-wave equivalent power density

Multiple Transmitters Condition
Co-location as simultaneously transmitting (co-transmitting) and the evaluation shall be consider that simultaneous transmissions from co-located devices the individual transmitters are evaluated separately. After sum of the individual value (basic restriction / reference level) are measured/calculated also have to under basic restriction / reference level.
Co-transmitting mode: WLAN 2.4GHz+WLAN 5GHz+WLAN 6GHz

2.2 RF Exposure Exempt Measurement

Option	Refer Std.	Exemption Exposure Thresholds (TL)
A	§1.1307(b)(3)(i)(A)	Available maximum time-averaged power is no more than 1 mW
B	§1.1307(b)(3)(i)(B)	$\mathrm{P}th(mW) = \begin{cases} ERP_{20cm}(d/20cm)^x \rightarrow d \le 20cm \\ ERP_{20cm} \rightarrow 20cm < d \le 40cm \end{cases}$ $x = -\log_{10}\left(\frac{60}{ERP_{20cm}\sqrt{f}}\right)$ and f is in GHz $\begin{cases} ERP_{20cm} : 0.3GHz \le f < 1.5GHz \rightarrow 2040f(mW) \\ ERP_{20cm} : 1.5GHz \le f \le 6GHz \rightarrow 3060(mW) \end{cases}$
C	§1.1307(b)(3)(i)(C)	$\begin{cases} 0.3 \sim 1.34MHz \rightarrow ERP(\mathrm{W}) = 1920R^2 \\ 1.34 \sim 30MHz \rightarrow ERP(\mathrm{W}) = 3450R^2/f^2 \\ 30 \sim 300MHz \rightarrow ERP(\mathrm{W}) = 3.83R^2 \\ 300 \sim 1500MHz \rightarrow ERP(\mathrm{W}) = 0.0128R^2 f \\ 1500 \sim 100000MHz \rightarrow ERP(\mathrm{W}) = 19.2R^2 \end{cases}$ f is in MHz; R is in m; $\mathrm{R} > \lambda/2\pi$

2.3 Multiple RF Sources Exposure

Refer Std.	Exemption Exposure Thresholds (TL)
§1.1307(b)(3)(ii)(A)	The available maximum time-averaged power of each source is no more than 1 mW and there is a separation distance of two centimeters between any portion of a radiating structure operating and the nearest portion of any other radiating structure in the same device, except if the sum of multiple sources is less than 1 mW during the time-averaging period, in which case they may be treated as a single source (separation is not required)
§1.1307(b)(3)(ii)(B)	$\sum_{i=1}^{a}\frac{P_i}{P_{th,i}}+\sum_{j=1}^{b}\frac{ERP_j}{ERP_{th,j}}+\sum_{k=1}^{c}\frac{Evaluated_k}{ExposureLimit_k}\le 1$ a = number of fixed, mobile, or portable RF sources claiming exemption using paragraph §1.1307(b)(3)(i)(B) of this section for P , including existing exempt transmitters and those being added. b = number of fixed, mobile, or portable RF sources claiming exemption using paragraph §1.1307(b)(3)(i)(C) of this section for Threshold ERP, including existing exempt transmitters and those being added. c = number of existing fixed, mobile, or portable RF sources with known evaluation for the specified minimum distance including existing evaluated transmitters. P_i = the available maximum time-averaged power or the ERP, whichever is greater, for fixed, mobile, or portable RF source i at a distance between 0.5 cm and 40 cm (inclusive). $P_{th,i}$ = the exemption threshold power (P_{th}) according to paragraph §1.1307(b)(3)(i)(B) of this section for fixed, mobile, or portable RF source i. ERP_j = the ERP of fixed, mobile, or portable RF source j. $ERP_{th,j}$ = exemption threshold ERP for fixed, mobile, or portable RF source j, at a distance of at least λ/2π according to the applicable formula of paragraph §1.1307 (b)(3)(i)(C) of this section. $Evaluated_k$ = the maximum reported SAR or MPE of fixed, mobile, or portable RF source k either in the device or at the transmitter site from an existing evaluation at the location of exposure. $Evaluated\ Limit_k$ = either the general population/uncontrolled maximum permissible exposure (MPE) or specific absorption rate (SAR) limit for each fixed, mobile, or portable RF source k, as applicable from § 1.1310 of this chapter.

2.4 MPE Calculation Method

The MPE was calculated at 20 cm to show compliance with the power density limit.
The following formula was used to calculate the Power Density:

E (V/m) = $\frac{\sqrt{30 \times P \times G}}{d}$ Power Density: *Pd* (W/m²) = $\frac{E^2}{377}$

E = Electric field (V/m)

P = RF output power (W)

G = EUT Antenna numeric gain (numeric)

d = Separation distance between radiator and human body (m)

The formula can be changed to

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

2.5 Calculated Result and Limit

Exposure Environment: General Population / Uncontrolled Exposure

<Non-Beamforming>

WLAN 2.4GHz

Mode	DG (dBi)	Power (dBm)	EIRP (dBm)	Tolerance (dB)	Tune-up ERP (mW)	Distance (cm)	S (mW/cm^2)	S Limit (mW/cm^2)	Option	TL ERP (mW)	TL Ratio
2.4G;G1D	4.11	27.03	31.14	0.50	889.4264	20.00	0.29022	1.000	B	3060	0.2907
2.4G;D1D	4.11	25.07	29.18	0.50	566.3827	20.00	0.18481	1.000	B	3060	0.1851

WLAN 5GHz

Mode	DG (dBi)	Power (dBm)	EIRP (dBm)	Tolerance (dB)	Tune-up ERP (mW)	Distance (cm)	S (mW/cm^2)	S Limit (mW/cm^2)	Option	TL ERP (mW)	TL Ratio
5.2G;D1D	2.22	26.96	29.18	0.50	566.3827	20.00	0.18481	1.000	B	3060	0.1851
5.3G;D1D	2.21	23.94	26.15	0.50	281.9097	20.00	0.09199	1.000	B	3060	0.0921
5.6G;D1D	2.74	23.97	26.71	0.50	320.7082	20.00	0.10465	1.000	B	3060	0.1048
5.8G;D1D	3.62	26.71	30.33	0.50	738.0912	20.00	0.24084	1.000	B	3060	0.2412

WLAN 6GHz

Mode	DG (dBi)	Power (dBm)	EIRP (dBm)	Tolerance (dB)	Tune-up ERP (mW)	Distance (cm)	S (mW/cm^2)	S Limit (mW/cm^2)	Option	TL ERP (mW)	TL Ratio
6.2G;D1D	-	-	25.72	0.50	255.3348	20.00	0.08332	1.000	C	768	0.3325
6.4G;D1D	-	-	24.73	0.50	203.2872	20.00	0.06633	1.000	C	768	0.2647
6.7G;D1D	-	-	26.47	0.50	303.4660	20.00	0.09902	1.000	C	768	0.3951
7.0G;D1D	-	-	25.00	0.50	216.3266	20.00	0.07059	1.000	C	768	0.2817

<Beamforming>

WLAN 2.4GHz

Mode	DG (dBi)	Power (dBm)	EIRP (dBm)	Tolerance (dB)	Tune-up ERP (mW)	Distance (cm)	S (mW/cm^2)	S Limit (mW/cm^2)	Option	TL ERP (mW)	TL Ratio
2.4G;D1D	4.46	24.75	29.21	0.50	570.3087	20.00	0.18609	1.000	B	3060	0.1864

WLAN 5GHz

Mode	DG (dBi)	Power (dBm)	EIRP (dBm)	Tolerance (dB)	Tune-up ERP (mW)	Distance (cm)	S (mW/cm^2)	S Limit (mW/cm^2)	Option	TL ERP (mW)	TL Ratio
5.2G;D1D	2.65	26.40	29.05	0.50	549.6801	20.00	0.17936	1.000	B	3060	0.1796
5.3G;D1D	2.78	23.81	26.59	0.50	311.9680	20.00	0.10180	1.000	B	3060	0.1020
5.6G;D1D	3.08	23.83	26.91	0.50	335.8227	20.00	0.10958	1.000	B	3060	0.1097
5.8G;D1D	4.24	26.32	30.56	0.50	778.2336	20.00	0.25394	1.000	B	3060	0.2543

WLAN 6GHz

Mode	DG (dBi)	Power (dBm)	EIRP (dBm)	Tolerance (dB)	Tune-up ERP (mW)	Distance (cm)	S (mW/cm^2)	S Limit (mW/cm^2)	Option	TL ERP (mW)	TL Ratio
6.2G;D1D	-	-	24.67	0.50	200.4980	20.00	0.06542	1.000	C	768	0.2611
6.4G;D1D	-	-	25.95	0.50	269.2217	20.00	0.08785	1.000	C	768	0.3505
6.7G;D1D	-	-	25.85	0.50	263.0934	20.00	0.08585	1.000	C	768	0.3426
7.0G;D1D	-	-	25.43	0.50	238.8416	20.00	0.07793	1.000	C	768	0.3110

Note 1: Option A, B and C refer as clause 2.2
Note 2: For option B, Pth(mW) convert to TL ERP(mW); For option C, ERP(W) convert to TL ERP(mW)
Note 3: TL Ratio=Tune-up ERP(mW)/TL ERP(mW)

Simultaneous Transmission Analysis Mode: WLAN 2.4GHz+WLAN 5GHz+WLAN 6GHz

Mode	DG (dBi)	Power (dBm)	EIRP (dBm)	Tolerance (dB)	Tune-up ERP (mW)	Distance (cm)	S (mW/cm^2)	S Limit (mW/cm^2)	Option	TL ERP (mW)	TL Ratio
2.4G;G1D	4.11	27.03	31.14	0.50	889.4264	20.00	0.29022	1.000	B	3060	0.2907
5.8G;D1D	4.24	26.32	30.56	0.50	778.2336	20.00	0.25394	1.000	B	3060	0.2543
6.7G;D1D	-	-	26.47	0.50	303.4660	20.00	0.09902	1.000	C	768	0.3951
										Sum Ratio	0.9401
										Ratio Limit	1

Note 1: Option A, B and C refer as clause 2.2
Note 2: For option B, Pth(mW) convert to TL ERP(mW); For option C, ERP(W) convert to TL ERP(mW)
Note 3: TL Ratio=Tune-up ERP(mW)/TL ERP(mW)
Note 4: Refer as clause 2.3 Multiple RF Sources Exposure. Please follow below option and sum TL ration table.

Option	Sum TL Ratio_B	Option	Sum TL Ratio_C	Option	Sum TL Ratio_E
B	$\sum_{i=1}^{a} \frac{P_i}{P_{th,i}}$	C	$\sum_{j=1}^{b} \frac{ERP_j}{ERP_{th,j}}$	E	$\sum_{k=1}^{c} \frac{Evaluated_k}{ExposureLimit_k}$

Note: The above antenna gain was declared by manufacturer.

———THE END———