

FCC Maximum Permissible RF Exposure (MPE) Estimation Report

**In accordance with the requirements of
FCC 47 CFR Part 2(2.1091), ANSI/IEEE C95.1-1992 and
KDB 447498 D01**

Product Name: ScreenBeam 960

Trademark: Actiontec

Model Name: SBWD960B

Family Model: N/A

Report No.: S19082001504004

FCC ID: LNQSBWD960B

Prepared for

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TEST RESULT CERTIFICATION

Applicant's name : Actiontec Electronics Inc

Address : 3301 Olcott St Santa Clara, CA 95054 United States

Manufacturer's Name : Actiontec Electronics Inc

Address : 3301 Olcott St Santa Clara, CA 95054 United States

Product description

Product name : ScreenBeam 960

Trademark : Actiontec

Model and/or type reference : SBWD960B

Family Model : N/A

Standards : FCC 47 CFR Part 1(1.1310)
FCC 47 CFR Part 2(2.1091)
ANSI/IEEE C95.1-1992
KDB 447498 D01

This device described above has been tested by Shenzhen NTEK. Testing has shown that this device is capable of compliance with MPE specified in FCC 47 CFR Part 2(2.1091) and ANSI/IEEE C95.1-1992. The test results in this report apply only to the tested sample of the stated device/equipment. Other similar device/equipment will not necessarily produce the same results due to production tolerance and measurement uncertainties.

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Date of Test

Date (s) of performance of tests : 23 Aug. 2019 ~ 16 Sep. 2019

Date of Issue : 18 Sep. 2019

Test Result : **Pass**

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(Test Engineer) (Eileen Liu)

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※ ※ Revision History ※ ※

REV.	DESCRIPTION	ISSUED DATE	REMARK
Rev.1.0	Initial Test Report Release	18 Sep. 2019	Eileen Liu

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1 General Information

1.1 RF Exposure Requirements

1.1.1 RF Exposure Limits

Table - 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				

A rough estimation of the expected exposure in power flux density on a given point can be made with the following equation:

$$S = \frac{P_t * G_t}{4 * \pi * R^2}$$

Where:

S = Power density (mW/cm²)

P_t = Conducted output power (dBm)

G_t = numeric gain of the antenna in the direction of interest relative to an isotropic radiator (dBi)

R = distance to the centre of radiation of the antenna (cm)

EIRP = P_t * G_t

The antenna of the product, under normal use condition is at least 20 cm away from the body of the user. Warning statement to the user for keeping at least 20cm separation distance and the prohibition of operating to a person has been printed on the user's manual. Therefore, the S of the device is calculated with R=20cm, and if it is below the limit S, then we can conclude the device complies with the rules.

1.1.2 Additional Description

An estimation of MPE in this application for product is used to ensure if it complies to the rules of the standard in the regulation list above.

Maximum permissible exposure (MPE) refers to the RF energy that is acceptable for human exposure. It is broken down into two categories, Occupational/controlled and General population/uncontrolled.

Occupational/controlled 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 an individual is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure.

General population/uncontrolled exposures apply in situations in which the general public may be exposed, or in which persons that 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.

We analysis if it comply with the limits for General population/uncontrolled exposure. The FCC's MPE limits for field strength and power density are given in 47CFR 1.1310(Table below).These limits are generally based on recommended exposure guidelines published by the National Council on Radiation Protection and Measurements (NCRP), and also partly based on guidelines recommended by the American National Standards Institute (ANSI) in Section 4.1 of ANSI/IEEE C95.1.

1.2 EUT Description

Device Information			
Product Name	ScreenBeam 960		
Trade Name	Actiontec		
Model Name	SBWD960B		
Family Model	N/A		
FCC ID	LNQSBWD960B		
Device Phase	Identical Prototype		
Exposure Category	General population / Uncontrolled environment		
Antenna Type	PCB Antenna		
Antenna Gain	Refer to next table Note1		
Device Operating Configurations			
Supporting Mode(s)	BT LE& WLAN 2.4G/5.2G/5.8G		
Test Modulation	WLAN(DSSS/OFDM), BT(GFSK)		
Operating Frequency Range(s)	Band	Tx (MHz)	Rx (MHz)
	BT LE	2402-2480	
	WLAN 2.4G	2412-2462	
	WLAN 5.2G	5180-5240	
	WLAN 5.8G	5745-5825	

Note1:

BT Antenna	Antenna Type	Antenna Gain
		(dBi)
ANT1	PCB	-0.64

WLAN Antenna	Antenna Type	Antenna Gain(dBi)		
		2.4G	5.2G	5.8G
ANT1	PCB	2.80	4.86	3.36
ANT2	PCB	2.91	4.40	4.30
ANT3	PCB	3.47	5.22	5.11
ANT4	PCB	2.52	4.83	4.93

1.3 Test specification(s)

FCC 47 CFR Part 1(1.1310)
FCC 47 CFR Part 2(2.1091)
ANSI/IEEE C95.1-1992
KDB 447498 D01 General RF Exposure Guidance

1.4 Ambient Condition

Ambient temperature	20°C – 24°C
Relative Humidity	30% – 70%

2 RF Output Power

BT LE:

Mode	Frequency (MHz)	Antenna	Conducted Power (dBm)	Limit (dBm)	Verdict
BLE	2402	Ant 1	2.313	30	Pass
BLE	2440	Ant 1	2.42	30	Pass
BLE	2480	Ant 1	2.049	30	Pass

WLAN-2.4G:

8812 Module:

Test Channel	Frequency (MHz)	Power Setting	Duty Cycle Factor (dB)	Peak Output Power(dBm)		Total	LIMIT (dBm)	Verdict
				ANT 1	ANT 2	(dBm)		
TX 802.11b Mode								
1	2412	Default	0	23.52	22.65	-	30	PASS
6	2437	Default	0	24.39	24.20	-	30	PASS
11	2462	Default	0	22.07	22.11	-	30	PASS
TX 802.11 g Mode								
1	2412	Default	0	18.48	18.16	-	30	PASS
6	2437	Default	0	20.88	20.65	-	30	PASS
11	2462	Default	0	17.79	16.56	-	30	PASS
TX 802.11 n20M Mode(Single TX)								
1	2412	Default	0	18.42	18.10	-	30	PASS
6	2437	Default	0	20.93	20.61	-	30	PASS
11	2462	Default	0	17.76	16.50	-	30	PASS
TX 802.11 n20M Mode(MIMO TX)								
1	2412	Default	0	15.47	15.16	18.33	30	PASS
6	2437	Default	0	19.65	19.68	22.68	30	PASS
11	2462	Default	0	15.24	15.10	18.18	30	PASS
TX 802.11 n40M Mode(Single TX)								
3	2422	Default	0	14.55	14.29	-	30	PASS
6	2437	Default	0	20.40	20.16	-	30	PASS
9	2452	Default	0	15.68	15.43	-	30	PASS
TX 802.11 n40M Mode(MIMO TX)								
3	2422	Default	0	14.23	14.08	17.17	30	PASS
6	2437	Default	0	19.20	19.16	22.19	30	PASS
9	2452	Default	0	13.26	13.15	16.22	30	PASS

8192 Module:

Test Channel	Frequency (MHz)	Power Setting	Duty Cycle Factor (dB)	Peak Output Power(dBm)		Total	LIMIT (dBm)	Verdict
				ANT 3	ANT 4	(dBm)		
TX 802.11b Mode								
1	2412	Default	0	22.40	22.20	-	30	PASS
6	2437	Default	0	22.67	22.86	-	30	PASS
11	2462	Default	0	23.17	23.40	-	30	PASS
TX 802.11 g Mode								
1	2412	Default	0	16.24	17.78	-	30	PASS
6	2437	Default	0	18.80	18.97	-	30	PASS
11	2462	Default	0	18.75	19.57	-	30	PASS
TX 802.11 n20M Mode(Single TX)								
1	2412	Default	0	15.19	17.26	-	30	PASS
6	2437	Default	0	18.67	18.97	-	30	PASS
11	2462	Default	0	18.18	19.12	-	30	PASS
TX 802.11 n20M Mode(MIMO TX)								
1	2412	Default	0	15.12	15.66	18.41	29.98	PASS
6	2437	Default	0	17.60	18.29	20.97	29.98	PASS
11	2462	Default	0	16.07	17.04	19.59	29.98	PASS
TX 802.11 n40M Mode(Single TX)								
3	2422	Default	0	14.87	16.66	-	30	PASS
6	2437	Default	0	18.20	18.60	-	30	PASS
9	2452	Default	0	16.99	18.01	-	30	PASS
TX 802.11 n40M Mode(MIMO TX)								
3	2422	Default	0	14.13	14.64	17.40	29.98	PASS
6	2437	Default	0	17.06	17.75	20.43	29.98	PASS
9	2452	Default	0	15.33	16.18	18.79	29.98	PASS

WLAN-5.2G:
8812 Module-SISO:

Mode	Frequency (MHz)	Conducted Power (dBm)		Duty Factor (dB)	Total Power (dBm)	Limit (dBm)	Verdict
		Ant 1	Ant 2				
802.11a	5180	17.61	17.27	0	17.61	30	Pass
802.11a	5200	19.35	18.82	0	19.35	30	Pass
802.11a	5240	20.02	19.5	0	20.02	30	Pass
802.11ac20	5180	16.47	16.8	0	16.47	30	Pass
802.11ac20	5200	18.56	18.6	0	18.56	30	Pass
802.11ac20	5240	19.21	19.33	0	19.21	30	Pass
802.11ac40	5190	14.49	14.84	0	14.49	30	Pass
802.11ac40	5230	19.39	18.77	0	19.39	30	Pass
802.11ac80	5210	14.64	14.35	0	14.64	30	Pass
802.11n(HT20)	5180	16.98	17.25	0	16.98	30	Pass
802.11n(HT20)	5200	19.29	18.8	0	19.29	30	Pass
802.11n(HT20)	5240	19.94	19.35	0	19.94	30	Pass
802.11n(HT40)	5190	14.5	14.8	0	14.5	30	Pass

802.11n(HT40)	5230	19.46	18.77	0	19.46	30	Pass
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8812 Module-MIMO:

Test Channel	Frequency	Maximum output power. Antenna port		Total Power	LIMIT	Result
		(AV) (dBm)		(AV)		
	(MHz)	ANT 1	ANT 2	dBm	dBm	
TX 802.11 n20M Mode						
CH36	5180	16.31	16.00	19.17	28.36	Pass
CH40	5200	18.68	17.84	21.29	28.36	Pass
CH48	5240	19.43	18.67	22.08	28.36	Pass
TX 802.11 n40M Mode						
CH38	5190	14.57	14.63	17.61	28.36	Pass
CH46	5230	18.07	17.19	20.66	28.36	Pass
TX 802.11 AC20M Mode						
CH36	5180	16.83	16.64	19.75	28.36	Pass
CH40	5200	18.46	17.62	21.07	28.36	Pass
CH48	5240	18.97	18.15	21.59	28.36	Pass
TX 802.11 AC40M Mode						
CH38	5190	14.60	14.72	17.67	28.36	Pass
CH46	5230	18.00	17.26	20.66	28.36	Pass
TX 802.11 AC80M Mode						
CH42	5210	14.34	14.16	17.26	22.34	Pass

8192 Module-SISO:

Mode	Frequency (MHz)	Conducted Power (dBm)		Duty Factor (dB)	Total Power (dBm)	Limit (dBm)	Verdict
		Ant 3	Ant 4				
802.11a	5180	15.34	16.17	0	15.34	23.98	Pass
802.11a	5200	17.67	16.97	0	17.67	23.98	Pass
802.11a	5240	17.55	17.05	0	17.55	23.98	Pass
802.11n(HT20)	5180	14.63	15.5	0	14.63	23.98	Pass
802.11n(HT20)	5200	17.53	16.81	0	17.53	23.98	Pass
802.11n(HT20)	5240	17.22	16.64	0	17.22	23.98	Pass
802.11n(HT40)	5190	13.83	13.59	0	13.83	23.98	Pass
802.11n(HT40)	5230	19.15	19.28	0	19.15	23.98	Pass

8192 Module-MIMO:

Test Channel	Frequency	Maximum output power. Antenna port		Total Power	LIMIT	Result
		(AV) (dBm)		(AV)		
	(MHz)	ANT 3	ANT 4	dBm	dBm	
TX 802.11 n20M Mode						
CH36	5180	12.38	12.67	15.54	21.94	Pass
CH40	5200	12.16	12.30	15.24	21.94	Pass

CH48	5240	12.03	12.24	15.15	21.94	Pass
TX 802.11 n40M Mode						
CH38	5190	14.04	14.11	17.09	21.94	Pass
CH46	5230	15.65	15.86	18.77	21.94	Pass

WLAN-5.8G:

8812 Module-SISO:

Mode	Frequency (MHz)	Conducted Power (dBm)		Duty Factor (dB)	Total Power (dBm)	Limit (dBm)	Verdict
		Ant 1	Ant 2				
802.11a	5745	19.93	19.7	0	17.61	30	Pass
802.11a	5785	19.79	19.69	0	19.35	30	Pass
802.11a	5825	20	20	0	20.02	30	Pass
802.11ac20	5745	19.04	18.97	0	16.47	30	Pass
802.11ac20	5785	18.69	18.79	0	18.56	30	Pass
802.11ac20	5825	18.47	18.86	0	19.21	30	Pass
802.11ac40	5755	18.56	18.48	0	14.49	30	Pass
802.11ac40	5795	18.27	18.31	0	19.39	30	Pass
802.11ac80	5775	17.29	17.88	0	14.64	30	Pass
802.11n(HT20)	5745	19.42	19.19	0	16.98	30	Pass
802.11n(HT20)	5785	19.12	19.04	0	19.29	30	Pass
802.11n(HT20)	5825	19.09	19.16	0	19.94	30	Pass
802.11n(HT40)	5755	18.52	18.39	0	14.5	30	Pass
802.11n(HT40)	5795	18.17	18.21	0	19.46	30	Pass

8812 Module-MIMO:

Test Channel	Frequency	Maximum output power. Antenna port		Total Power	LIMIT	Result
		(AV) (dBm)		(AV)		
	(MHz)	ANT 1	ANT 2	dBm	dBm	
TX 802.11 n20M Mode						
CH149	5745	18.94	18.90	21.93	29.15	Pass
CH157	5785	18.73	18.95	21.85	29.15	Pass
CH165	5825	19.47	19.50	22.50	29.15	Pass
TX 802.11 n40M Mode						
CH151	5755	16.90	17.47	20.20	29.15	Pass
CH159	5795	16.90	17.36	20.15	29.15	Pass
TX 802.11 AC20M Mode						
CH149	5745	17.65	18.30	21.00	29.15	Pass
CH157	5785	17.63	18.13	20.90	29.15	Pass
CH165	5825	18.04	18.26	21.16	29.15	Pass
TX 802.11 AC40M Mode						
CH151	5755	16.97	17.70	20.36	29.15	Pass
CH159	5795	17.01	17.50	20.27	29.15	Pass
TX 802.11 AC80M Mode						

CH155	5775	16.33	16.79	19.58	29.15	Pass
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8192 Module-SISO:

Mode	Frequency (MHz)	Conducted Power (dBm)		Duty Factor (dB)	Total Power (dBm)	Limit (dBm)	Verdict
		Ant 3	Ant 4				
802.11a	5745	19.38	19	0	15.34	30	Pass
802.11a	5785	18.77	18.78	0	17.67	30	Pass
802.11a	5825	18.39	18.25	0	17.55	30	Pass
802.11n(HT20)	5745	18.83	18.71	0	14.63	30	Pass
802.11n(HT20)	5785	18.59	18.37	0	17.53	30	Pass
802.11n(HT20)	5825	17.9	17.99	0	17.22	30	Pass
802.11n(HT40)	5755	16.4	17.32	0	13.83	30	Pass
802.11n(HT40)	5795	16.78	16.8	0	19.15	30	Pass

8192 Module-MIMO:

Test Channel	Frequency	Maximum output power. Antenna port		Total Power	LIMIT	Result
		(AV) (dBm)		(AV)		
	(MHz)	ANT 3	ANT 4	dBm	dBm	
TX 802.11 n20M Mode						
CH149	5745	17.34	17.40	20.38	27.97	Pass
CH157	5785	17.21	17.17	20.20	27.97	Pass
CH165	5825	16.77	16.79	19.79	27.97	Pass
TX 802.11 n40M Mode						
CH151	5755	16.65	16.71	19.69	27.97	Pass
CH159	5795	16.17	16.26	19.23	27.97	Pass

3 RF Exposure Evaluation

3.1 Operation in BT LE

Channel Freq. (MHz)	modulation	conducted power	Tune-up power	Max		Antenna	Evaluation result at 20cm	Power density Limits
		(dBm)	(dBm)	tune-up power		Gain	Power density(mW/cm ²)	(mW/cm ²)
				(dBm)	(mW)	Numeric		
2402	GFSK	2.313	2±1	3	1.995262	0.86	0.00034	1
2440		2.42	2±1	3	1.995262	0.86	0.00034	1
2480		2.049	2±1	3	1.995262	0.86	0.00034	1

3.2 Operation in WLAN 2.4G

SISO

Module	Antenna	Tune-up limit (dBm)	Gain (dBi)	EIRP (dBm)	EIRP (mW)	R(cm)	S (mW/cm ²)	MPE Limit (mW/cm ²)	Conclusion
8812	ANT 1	24.5	2.80	27.3	537.03	20	0.1068	1	Pass
	ANT 2	24.5	2.91	27.41	550.81	20	0.1096	1	Pass
8192	ANT 3	24	3.47	27.47	558.47	20	0.1111	1	Pass
	ANT 4	24	2.52	26.52	448.75	20	0.0893	1	Pass

3.3 Operation in WLAN 5G

SISO-5.2G

Module	Antenna	Tune-up limit (dBm)	Gain (dBi)	EIRP (dBm)	EIRP (mW)	R(cm)	S (mW/cm ²)	MPE Limit (mW/cm ²)	Conclusion
8812	ANT 1	20.5	4.86	25.36	343.56	20	0.0683	1	Pass
	ANT 2	20	4.40	24.4	275.42	20	0.0548	1	Pass
8192	ANT 3	20	5.22	25.22	332.66	20	0.0662	1	Pass
	ANT 4	20	4.83	24.83	304.09	20	0.0605	1	Pass

SISO-5.8G

Module	Antenna	Tune-up limit (dBm)	Gain (dBi)	EIRP (dBm)	EIRP (mW)	R(cm)	S (mW/cm ²)	MPE Limit (mW/cm ²)	Conclusion
8812	ANT 1	20	3.36	23.36	216.77	20	0.0431	1	Pass
	ANT 2	20	4.30	24.3	269.15	20	0.0535	1	Pass
8192	ANT 3	19.5	5.11	24.61	289.07	20	0.0575	1	Pass
	ANT 4	19	4.93	23.93	247.17	20	0.0492	1	Pass

4 Exposure calculations for multiple sources

When a number of sources at different frequencies, and/or broadband sources, contribute to the total exposure, it becomes necessary to weigh each contribution relative to the MPE in accordance with the provisions of Table (A) and Table (B). To comply with the MPE, the fraction of the MPE in terms of E^2 , H^2 (or power density) incurred within each frequency interval should be determined and the sum of all such fractions should not exceed unity.

In order to ensure compliance with the MPE for a controlled environment, the sum of the ratios of the power density to the corresponding MPE should not exceed unity. That is

$$\sum_{i=1}^n \frac{S_i}{MPE_i}$$

The product also has multiple transmitters The Simultaneous Transmission Possibilities are as below:

Simultaneous Tx Combination	Configuration
1	WLAN 2.4G MIMO
2	WLAN 5.2G MIMO
3	WLAN 5.8G MIMO
4	BT LE& WLAN

4.1 Estimation for WLAN2.4G MIMO

Module	Antenna	Tune-up limit (dBm)	Gain (dBi)	EIRP (dBm)	EIRP (mW)	R (cm)	S (mW/cm ²)	MPE Limit (mW/cm ²)	Calculation result	Conclusion
8812	ANT 1	20	2.80	22.8	190.55	20	0.0379	1	0.0768	Pass
	ANT 2	20	2.91	22.91	195.43	20	0.0389	1		
8192	ANT 3	18	3.47	21.47	140.28	20	0.0279	1	0.0531	Pass
	ANT 4	18.5	2.52	21.02	126.47	20	0.0252	1		

4.2 Estimation for WLAN5G MIMO

5.2G MIMO:

Module	Antenna	Tune-up limit (dBm)	Gain (dBi)	EIRP (dBm)	EIRP (mW)	R (cm)	S (mW/cm ²)	MPE Limit (mW/cm ²)	Calculation result	Conclusion
8812	ANT 1	19.5	4.86	24.36	272.90	20	0.0543	1	0.0978	Pass
	ANT 2	19	4.40	23.4	218.78	20	0.0435	1		
8192	ANT 3	16	5.22	21.22	132.43	20	0.0263	1	0.0504	Pass
	ANT 4	16	4.83	20.83	121.06	20	0.0241	1		

5.8G MIMO:

Module	Antenna	Tune-up limit (dBm)	Gain (dBi)	EIRP (dBm)	EIRP (mW)	R (cm)	S (mW/cm ²)	MPE Limit (mW/cm ²)	Calculation result	Conclusion
8812	ANT 1	19.5	3.36	22.86	193.20	20	0.0384	1	0.0861	Pass
	ANT 2	19.5	4.30	23.8	239.88	20	0.0477	1		
8192	ANT 3	17.5	5.11	22.61	182.39	20	0.0363	1	0.0711	Pass
	ANT 4	17.5	4.93	22.43	174.98	20	0.0348	1		

4.3 Estimation for WLAN& BT LE

Transmitting Mode	R(cm)	S (mW/cm ²)	Total S (mW/cm ²)	MPE Limit (mW/cm ²)	Conclusion
BT LE	20	0.00034	0.22104	1.000	Pass
8812 Module WLAN2.4G SISO Mode-ANT 2		0.1096			
8192 Module		0.1111			

WLAN2.4G SISO Mode-ANT 3					
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According to the Table above, we can conclude that the calculation results of all simultaneous transmission possibilities are less than 1, so it is into compliance.
Therefore the product also meets the requirements under multiple sources condition.

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