RF Exposure Evaluation Declaration

FCC ID: 2ABLK-GS4227E

APPLICANT: Calix Inc.

Application Type: Certification

Product: GigaSpire, GigaSpire BLAST$^{u6.1}$

Model No.: GS4227E, GS4220E

Brand Name: Calix

FCC Classification: Digital Transmission System (DTS)
Unlicensed National Information Infrastructure (NII)

Test Procedure(s): KDB 447498 D01v06

Test Date: January 07, 2020

Reviewed By: (Kevin Guo)

Approved By: (Robin Wu)

ACCREDITED
TESTING LABORATORY
CERTIFICATE #3628.01

Revision History

Report No.	Version	Description	Issue Date	Note
1911RSU033-U3	Rev. 01	Initial report	02-02-2020	Valid

1. PRODUCT INFORMATION

1.1. Equipment Description

Product Name:	GigaSpire, GigaSpire BLAST$^{u6.1}$
Model No.:	GS4227E, GS4220E
Brand Name:	Calix
Wi-Fi Specification:	802.11a/b/g/n/ac/ax

Note 1: There are the same hardware design, PCB layout between product names and models, except the data rate of the white RJ45 port. For this port, GS4227E supports 2.5Gbps, but GS4220E supports 1Gbps only.

Note 2: The difference addressed as above doesn't affect the RF test result, so we selected GS4227E (product name: GigaSpire) for all RF testing.

1.2. Description of Available Antennas

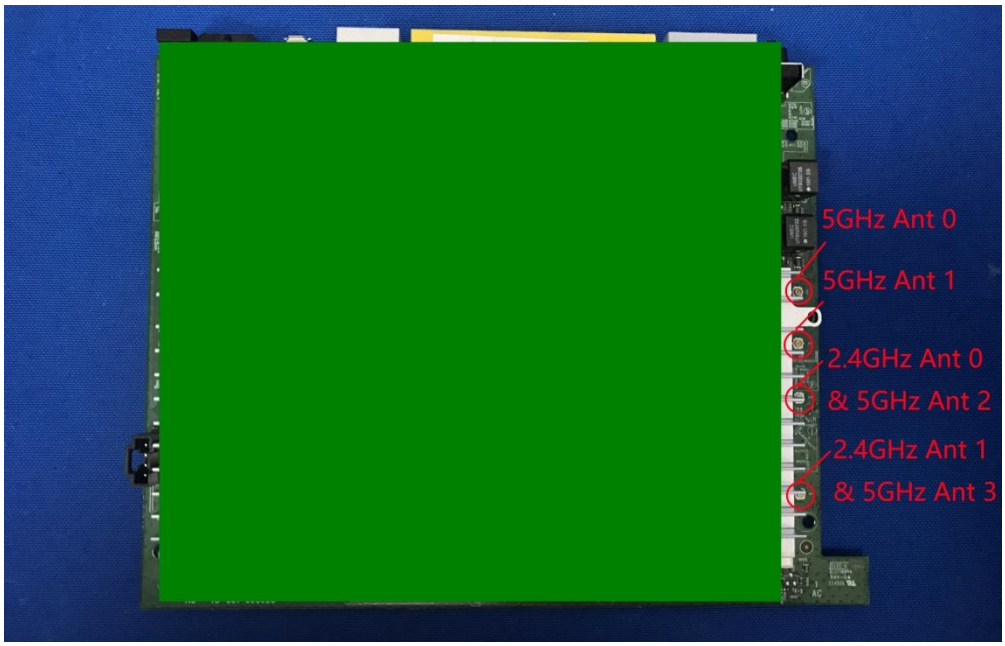
Antenna Type	Frequency Band (MHz)	T_X Paths	Directional Gain (dBi)	
			Non Beam-Forming Mode	Beam-Forming Mode
PCB Antenna	2412 ~ 2462	2	2.62	5.52
	5150 ~ 5250	4	1.89	6.90
	5250 ~ 5350	4	1.89	6.90
	5470 ~ 5725	4	2.03	7.44
	5725 ~ 5850	4	1.20	6.34

Note:

1. The EUT supports Beam Forming technology, and the Beam Forming mode support 802.11ac/ax, not include 802.11a/b/g. Its transmit signals are correlated, then Directional gain = 10 log $[(10^{G1/20} + 10^{G2/20} + \ldots + 10^{GN/20})^2/N_{ANT}]$ dBi [Note the "20"s in the denominator of each exponent and the square of the sum of terms; the object is to combine the signal levels coherently.
2. The EUT also support Non Beam-Forming technology, and Non Beam-Forming mode support 802.11a/b/g/n/ac/ax, its transmit signals are uncorrelated, then Directional gain = 10 log$[(10^{G1/10} + 10^{G2/10} + \ldots + 10^{GN/10})/N_{ANT}]$ dBi

1.3. Description of Antenna RF Port

Antenna RF Port						
--	2.4GHz RF Port		5GHz RF Port			
Software Control Port	Ant 0	Ant 1	Ant 0	Ant 1	Ant 2	Ant 3



2. RF Exposure Evaluation

2.1. Limits

According to FCC 1.1310: The criteria listed in the following table shall be used to evaluate the environment impact of human exposure to radio frequency (RF) radiation as specified in 1.1307(b)

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)
(A) Limits for Occupational/ Control Exposures				
300-1500	--	--	f/300	6
1500-100,000	--	--	5	6
(B) Limits for General Population/ Uncontrolled Exposures				
300-1500	--	--	f/1500	6
1500-100,000	--	--	1	30

f= Frequency in MHz

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

Pd is the limit of MPE, $1mW/cm^2$. If we know the maximum gain of the antenna and the total power input to the antenna, through the calculation, we will know the distance r where the MPE limit is reached.

2.2. Test Result of RF Exposure Evaluation

Product	GigaSpire
Test Item	RF Exposure Evaluation

Antenna Gain: Refer to clause 1.2.

Test Mode	Frequency Band (MHz)	Maximum EIRP (dBm)	Safety Distance (cm)	Power Density (mW/cm^2)	Limit of Power Density (mW/cm^2)
802.11b/g/n/ax	2412 ~ 2462	34.14	27	0.2832	1
802.11 a/n/ac/ax	5180 ~ 5240 5745 ~ 5825	35.81	27	0.4160	1

CONCLUSION:

Both of the WLAN 2.4GHz Band and WLAN 5GHz Band can transmit simultaneously.

The max Power Density at R (27 cm) = $0.2832mW/cm^2 + 0.4160mW/cm^2 = 0.6992mW/cm^2 < 1mW/cm^2$.

So the safety distance is 27cm for device installed without any other radio equipment.

The End

Appendix A - EUT Photograph

Refer to “191RSU033-UE” file.