RF Exposure Report

Report No.:	SA191209E01-1
FCC ID:	RSE-FGA5330
Equipment Name:	Gateway
Trade Name:	Technicolor
Model Number:	FGA5330
Product Code:	FGA5330TCH2
Received Date:	Dec. 09, 2019
Test Date:	Feb. 21 to 22, 2020
Issued Date:	June 17, 2020
Applicant:	Technicolor Delivery Technologies Belgium
Address:	Prins Boudewinnlaan 47 Edegem B-2650 Belgium
Issued By:	Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch Hsin Chu Laboratory
Lab Address:	E-2, No.1, Li Hsin 1st Road, Hsinchu Science Park, Hsinchu City 300, Taiwan
FCC Registration / Designation Number:	723255 / TW2022

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Release Control Record

Issue No.	Description	Date Issued
SA191209E01-1	Original release.	June 17, 2020

1 Certificate of Conformity

Product:	Gateway
Brand:	Technicolor
Test Model:	FGA5330
Product Code:	FGA5330TCH2
Sample Status:	LAB2A
Applicant:	Technicolor Delivery Technologies Belgium
Test Date:	Feb. 21 to 22, 2020
Standards:	FCC Part 2 (Section 2.1091) IEEE C95.3-2002
References Test Guidance:	KDB 447498 D01 General RF Exposure Guidance v06

The above equipment has been tested by **Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's EMC characteristics under the conditions specified in this report.

Prepared by : _____ , **Date:** June 17, 2020

Claire Kuan / Specialist

Approved by : _____ , **Date:** June 17, 2020

Clark Lin / Technical Manager

2 RF Exposure

2.1 Limits for Maximum Permissible Exposure (MPE)

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm^2)	Average Time (minutes)
Limits For General Population / Uncontrolled Exposure				
300-1500	…	…	F/1500	30
1500-100,000	…	…	1.0	30

F = Frequency in MHz

2.2 MPE 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

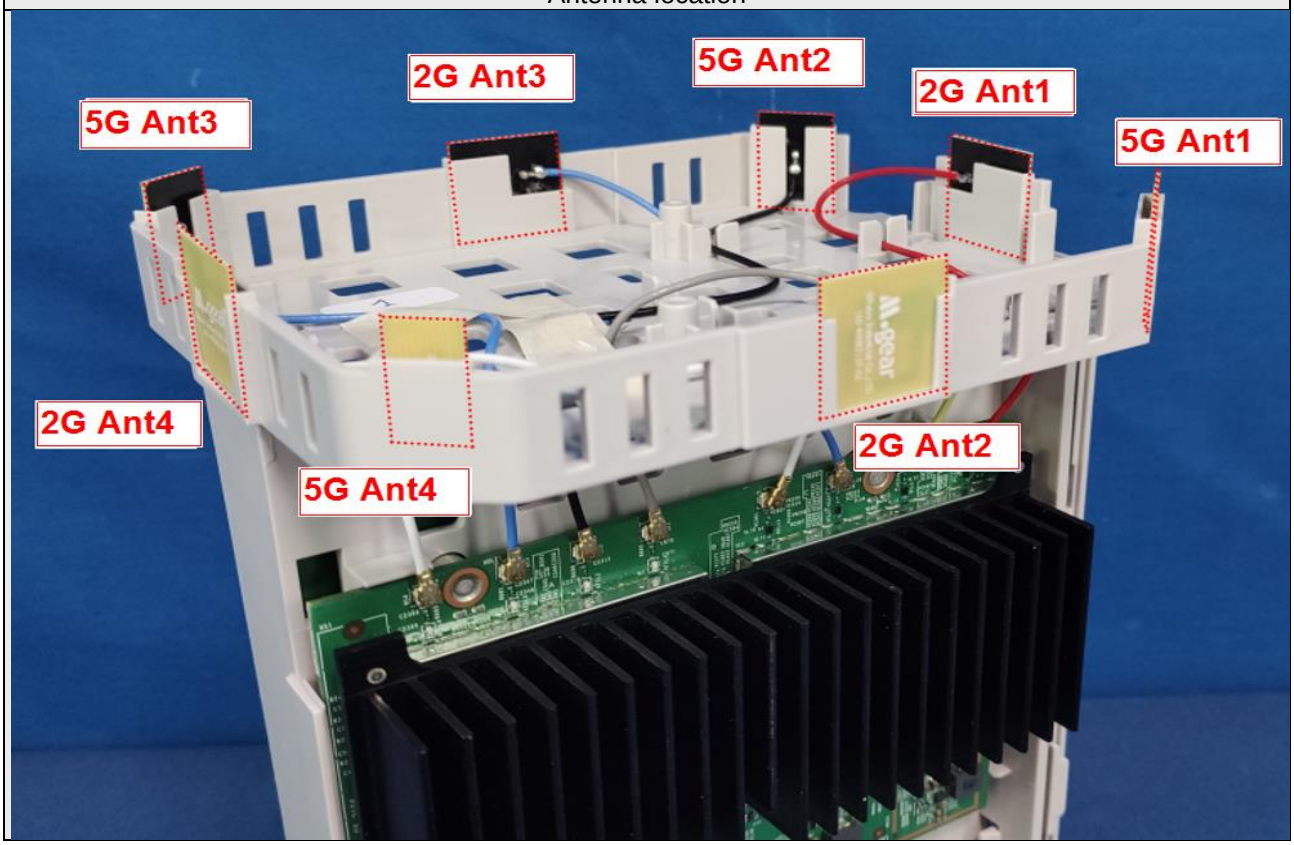
R = distance between observation point and center of the radiator in cm

2.3 Classification

The antenna of this product, under normal use condition, is at least 20cm away from the body of the user. So, this device is classified as **Mobile Device**.

2.4 Antenna Gain

Antenna location



Ant.	Brand	Model Name	Antenna Type	Connector
2G-1	WHA YU	C107-511586-A	PCB PIFA	I-pex
2G-2	WHA YU	C107-511589-A	PCB PIFA	I-pex
2G-3	WHA YU	C107-511587-A	PCB PIFA	I-pex
2G-4	WHA YU	C107-511588-A	PCB PIFA	I-pex

Antenna & Bandwidth for 2400~2483.5MHz

Number of Transmit Antennas	1TX		2TX		3TX		4TX	
Bandwidth Mode	20 MHz	40 MHz	20 MHz	40 MHz	20 MHz	40 MHz	20 MHz	40 MHz
802.11b	V	X	X	X	X	X	X	X
802.11g	V	X	V	X	V	X	V	X
802.11n	V	V	V	V	V	V	V	V
802.11ac	V	V	V	V	V	V	V	V
802.11ax	V	V	V	V	V	V	V	V

For 2400~2483.5MHz

Frequency	Max Gain (dBi) For SISO mode							
	Ant. 1		Ant. 2		Ant. 3		Ant. 4	
	20 MHz	40 MHz	20 MHz	40 MHz	20 MHz	40 MHz	20 MHz	40 MHz
2412MHz	1.83	-	1.89	-	1.36	-	1.42	-
2422MHz	-	1.30	-	1.92	-	1.89	-	1.49
2437MHz	1.02	1.02	2.02	2.02	1.65	1.65	1.22	1.22
2452MHz	-	0.89	-	1.92	-	1.23	-	0.87
2462MHz	0.66	-	1.76	-	0.86	-	0.91	-

Frequency	Maximum Gain (dBi) for CDD mode			
	CDD mode (1 Stream 4 TX) for Power Gain (KDB 662911 Option 2)		CDD mode (1 Stream 4 TX) for PSD Gain (KDB 662911 Option 2)	
	20 MHz	40 MHz	20 MHz	40 MHz
2412MHz	1.89	-	5.68	-
2422MHz	-	1.92	-	5.74
2437MHz	2.02	2.02	5.83	5.83
2452MHz	-	1.92	-	5.53
2462MHz	1.76	-	5.64	-

Frequency	Maximum Gain (dBi) for TxBF mode	
	TxBF mode (1 Stream 4 TX) for Power & PSD Gain (KDB 662911 Option 2)	
	20 MHz	40 MHz
2412MHz	5.68	-
2422MHz	-	5.74
2437MHz	5.83	5.83
2452MHz	-	5.53
2462MHz	5.64	-

Frequency	Maximum Gain (dBi) for TxBF mode	
	TxBF mode (2 Stream 4 TX) for Power & PSD Gain (KDB 662911 Option 2)	
	20 MHz	40 MHz
2412MHz	3.95	-
2422MHz	-	4.02
2437MHz	4.12	4.12
2452MHz	-	3.83
2462MHz	3.83	-

Frequency	Maximum Gain (dBi) for TxBF mode	
	TxBF mode (3 Stream 4 TX) for Power & PSD Gain (KDB 662911 Option 2)	
	20 MHz	40 MHz
2412MHz	1.87	-
2422MHz	-	1.93
2437MHz	1.83	1.83
2452MHz	-	1.67
2462MHz	1.62	-

Note:

1. Antenna Gain refer to “FGA5330_Antenna Test Report V1.18.pdf” files
2. Maximum Correlated Directional Gain = $10 \log[(10^{G1/20} + 10^{G2/20} + \ldots + 10^{GN/20})^2 / N_{ANT}]$ dBi
3. Maximum Uncorrelated Directional Gain = $10 \log[(10^{G1/10} + 10^{G2/10} + \ldots + 10^{GN/10}) / N_{ANT}]$ dBi

Antenna & Bandwidth for 5150~5850MHz

Ant.	Brand	Model Name	Antenna Type	Connector
5G-1	WHA YU	C107-511590-A	PCB Loop	I-pex
5G-2	WHA YU	C107-511591-A	PCB Dipole	I-pex
5G-3	WHA YU	C107-511592-A	PCB Dipole	I-pex
5G-4	WHA YU	C107-511593-A	PCB Dipole	I-pex

Antenna & Bandwidth

Antenna	1st (TX)				2nd (TX)			
Bandwidth Mode	20 MHz	40 MHz	80 MHz	160 MHz	20 MHz	40 MHz	80 MHz	160 MHz
802.11a	V	X	X	X	V	X	X	X
802.11n	V	V	X	X	V	V	X	X
802.11ac	V	V	V	V	V	V	V	V
802.11ax	V	V	V	V	V	V	V	V

Antenna	3rd (TX)				4th (TX)			
Bandwidth Mode	20 MHz	40 MHz	80 MHz	160 MHz	20 MHz	40 MHz	80 MHz	160 MHz
802.11a	V	X	X	X	V	X	X	X
802.11n	V	V	X	X	V	V	X	X
802.11ac	V	V	V	V	V	V	V	V
802.11ax	V	V	V	V	V	V	V	V

Frequency	Maximum Gain (dBi) for CDD mode							
	CDD mode (1 Stream 4 TX) for Power Gain				CDD mode (1 Stream 4 TX) for PSD Gain			
	20 MHz	40 MHz	80MHz	160MHz	20 MHz	40 MHz	80MHz	160MHz
5180MHz	2.85	-	-	-	6.07	-	-	-
5190MHz	-	2.83	-	-	-	6.03	-	-
5200MHz	2.53	-	-	-	6.12	-	-	-
5210MHz	-	-	2.64	-	-	-	5.83	-
5230MHz	-	2.5	-	-	-	6.08	-	-
5240MHz	2.64	-	-	-	5.83	-	-	-
5250MHz	-	-	-	3.04	-	-	-	6.16
5260MHz	3.04	-	-	-	5.87	-	-	-
5270MHz	-	2.60	-	-	-	6.33	-	-
5290MHz	-	-	2.81	-	-	-	5.98	-
5300MHz	2.69	-	-	-	6.18	-	-	-
5310MHz	-	2.30	-	-	-	6.01	-	-
5320MHz	2.56	-	-	-	5.75	-	-	-
5500MHz	2.38	-	-	-	6.08	-	-	-
5510MHz	-	2.78	-	-	-	6.32	-	-
5530MHz	-	-	2.97	-	-	-	6.59	-
5550MHz	-	2.75	-	-	-	6.00	-	-
5570MHz	-	-	-	3.45	-	-	-	5.70
5580MHz	3.13	-	-	-	6.58	-	-	-
5610MHz	-	-	2.92	-	-	-	5.47	-
5670MHz	-	3.09	-	-	-	5.67	-	-
5690MHz	-	-	3.72	-	-	-	6.63	-
5700MHz	3.17	-	-	-	5.86	-	-	-
5710MHz	-	3.23	-	-	-	5.96	-	-
5720MHz	3.18	-	-	-	5.85	-	-	-
5745MHz	3.20	-	-	-	5.91	-	-	-
5755MHz	-	4.18	-	-	-	7.26	-	-
5775MHz	-	-	3.62	-	-	-	6.39	-
5785MHz	4.05	-	-	-	5.96	-	-	-
5795MHz	-	2.94	-	-	-	6.00	-	-
5825MHz	3.78	-	-	-	5.83	-	-	-

Note:

1. Antenna Gain refer to “FGA5330_Antenna Test Report V1.18.pdf” files
2. Maximum Correlated Directional Gain = $10 \log[(10^{G1/20} + 10^{G2/20} + \ldots + 10^{GN/20})^2 / N_{ANT}]$ dBi
3. Maximum Uncorrelated Directional Gain = $10 \log[(10^{G1/10} + 10^{G2/10} + \ldots + 10^{GN/10}) / N_{ANT}]$ dBi
4. The Max. Power = Max. tune up power including tolerance.

Frequency	Maximum Gain (dBi) for TxBF mode			
	TxBF mode (1 Stream 4 TX) for Power Gain & PSD Gain			
	20 MHz	40 MHz	80MHz	160MHz
5180MHz	6.07	-	-	-
5190MHz	-	6.03	-	-
5200MHz	6.12	-	-	-
5210MHz	-	-	5.83	-
5230MHz	-	6.08	-	-
5240MHz	5.83	-	-	-
5250MHz	-	-	-	6.16
5260MHz	5.87	-	-	-
5270MHz	-	6.33	-	-
5290MHz	-	-	5.98	-
5300MHz	6.18	-	-	-
5310MHz	-	6.01	-	-
5320MHz	5.75	-	-	-
5500MHz	6.08	-	-	-
5510MHz	-	6.32	-	-
5530MHz	-	-	6.59	-
5550MHz	-	6.00	-	-
5570MHz	-	-	-	5.70
5580MHz	6.58	-	-	-
5610MHz	-	-	5.47	-
5670MHz	-	5.67	-	-
5690MHz	-	-	6.63	-
5700MHz	5.86	-	-	-
5710MHz	-	5.96	-	-
5720MHz	5.85	-	-	-
5745MHz	5.91	-	-	-
5755MHz	-	7.26	-	-
5775MHz	-	-	6.39	-
5785MHz	5.96	-	-	-
5795MHz	-	6.00	-	-
5825MHz	5.83	-	-	-

Note:

1. Antenna Gain refer to “FGA5330_Antenna Test Report V1.18.pdf” files
2. Maximum Correlated Directional Gain = $10 \log[(10^{G1/20} + 10^{G2/20} + \ldots + 10^{GN/20})^2 / N_{ANT}]$ dBi
3. Maximum Uncorrelated Directional Gain = $10 \log[(10^{G1/10} + 10^{G2/10} + \ldots + 10^{GN/10}) / N_{ANT}]$ dBi
4. The Max. Power = Max. tune up power including tolerance.

Frequency	Maximum Gain (dBi) for TXBF mode			
	TXBF mode (2 Stream 4 TX) for Power Gain & PSD Gain			
	20 MHz	40 MHz	80MHz	160MHz
5180MHz	4.44	-	-	-
5190MHz	-	4.60	-	-
5200MHz	4.66	-	-	-
5210MHz	-	-	4.36	-
5230MHz	-	4.63	-	-
5240MHz	4.36	-	-	-
5250MHz	-	-	-	4.64
5260MHz	4.47	-	-	-
5270MHz	-	4.86	-	-
5290MHz	-	-	4.55	-
5300MHz	4.61	-	-	-
5310MHz	-	4.48	-	-
5320MHz	4.25	-	-	-
5500MHz	4.28	-	-	-
5510MHz	-	4.56	-	-
5530MHz	-	-	4.87	-
5550MHz	-	4.58	-	-
5570MHz	-	-	-	4.27
5580MHz	4.66	-	-	-
5610MHz	-	-	3.87	-
5670MHz	-	4.16	-	-
5690MHz	-	-	5.02	-
5700MHz	4.43	-	-	-
5710MHz	-	4.20	-	-
5720MHz	4.32	-	-	-
5745MHz	4.27	-	-	-
5755MHz	-	5.7	-	-
5775MHz	-	-	4.87	-
5785MHz	4.40	-	-	-
5795MHz	-	4.11	-	-
5825MHz	4.58	-	-	-

Note:

1. Antenna Gain refer to “FGA5330_Antenna Test Report V1.18.pdf” files
2. Maximum Correlated Directional Gain = $10 \log[(10^{G1/20} + 10^{G2/20} + \ldots + 10^{GN/20})^2 / N_{ANT}]$ dBi
3. Maximum Uncorrelated Directional Gain = $10 \log[(10^{G1/10} + 10^{G2/10} + \ldots + 10^{GN/10}) / N_{ANT}]$ dBi
4. The Max. Power = Max. tune up power including tolerance.

Frequency	Maximum Gain (dBi) for TXBF mode			
	TXBF mode (3 Stream 4 TX) for Power Gain & PSD Gain			
	20 MHz	40 MHz	80MHz	160MHz
5180MHz	2.51	-	-	-
5190MHz	-	2.33	-	-
5200MHz	2.39	-	-	-
5210MHz	-	-	2.25	-
5230MHz	-	2.51	-	-
5240MHz	2.25	-	-	-
5250MHz	-	-	-	2.40
5260MHz	2.25	-	-	-
5270MHz	-	2.66	-	-
5290MHz	-	-	2.32	-
5300MHz	2.31	-	-	-
5310MHz	-	2.17	-	-
5320MHz	1.94	-	-	-
5500MHz	2.19	-	-	-
5510MHz	-	2.58	-	-
5530MHz	-	-	2.88	-
5550MHz	-	2.56	-	-
5570MHz	-	-	-	2.25
5580MHz	2.46	-	-	-
5610MHz	-	-	1.99	-
5670MHz	-	2.26	-	-
5690MHz	-	-	3.05	-
5700MHz	2.57	-	-	-
5710MHz	-	2.31	-	-
5720MHz	2.48	-	-	-
5745MHz	2.51	-	-	-
5755MHz	-	3.42	-	-
5775MHz	-	-	2.65	-
5785MHz	2.50	-	-	-
5795MHz	-	1.92	-	-
5825MHz	2.38	-	-	-

Note:

1. Antenna Gain refer to “FGA5330_Antenna Test Report V1.18.pdf” files
2. Maximum Correlated Directional Gain = $10 \log[(10^{G1/20} + 10^{G2/20} + \ldots + 10^{GN/20})^2 / N_{ANT}]$ dBi
3. Maximum Uncorrelated Directional Gain = $10 \log[(10^{G1/10} + 10^{G2/10} + \ldots + 10^{GN/10}) / N_{ANT}]$ dBi
4. The Max. Power = Max. tune up power including tolerance.

2.5 Calculation Result of Maximum Conducted Power

For WLAN – 2.4GHz Worst Condition: 11ax (20MHz) 1S4T TxBF

Frequency (MHz)	Conducted Power		Directional Gain (dBi)	Distance (cm)	Power Density (mW/cm^2)	Limit (mW/cm^2)
	(dBm)	(mW)				
2437	27.62	578.096	5.83	30	0.19567	1

Note:

1. Pout*G = EIRP Power = Conducted Power(mW) * Gain(numeric)
2. Gain(dBi) to Gain(numeric) = $10^{(5.83/10)} = 3.828$
3. Distance (cm) = r = declare by manufacture = 30 cm
4. Pd = (Pout*G) / (4*pi*r2) = (578.096 * 3.828) / (4 * 3.1416 * 30^2) = 0.19568 (mW/cm^2)

For WLAN – 5GHz_U_NII_1 Worst Condition: 11ax (20MHz) 1S4T TxBF

Frequency (MHz)	Conducted Power		Directional Gain (dBi)	Distance (cm)	Power Density (mW/cm^2)	Limit (mW/cm^2)
	(dBm)	(mW)				
5200	29.65	922.571	6.12	30	0.33388	1

Note:

1. Pout*G = EIRP Power = Conducted Power(mW) * Gain(numeric)
2. Gain(dBi) to Gain(numeric) = $10^{(6.12/10)} = 4.093$
3. Distance (cm) = r = declare by manufacture = 30 cm
4. Pd = (Pout*G) / (4*pi*r^2) = (922.571 * 4.093) / (4 * 3.1416 * 30^2) = 0.33388 (mW/cm^2)

For WLAN – 5GHz_U_NII_2A Worst Condition: 11ax (20MHz) 1S4T TxBF

Frequency (MHz)	Conducted Power		Directional Gain (dBi)	Distance (cm)	Power Density (mW/cm^2)	Limit (mW/cm^2)
	(dBm)	(mW)				
5300	23.73	236.048	6.18	30	0.08662	1

Note:

1. Pout*G = EIRP Power = Conducted Power(mW) * Gain(numeric)
2. Gain(dBi) to Gain(numeric) = $10^{(6.33/10)} = 4.150$
3. Distance (cm) = r = declare by manufacture = 30 cm
4. Pd = (Pout*G) / (4*pi*r^2) = (236.048 * 4.150) / (4 * 3.1416 * 30^2) = 0.08662 (mW/cm^2)

For WLAN – 5GHz_U_NII_2C Worst Condition: 11ax (20MHz) 1S4T TxBF

Frequency (MHz)	Conducted Power		Directional Gain (dBi)	Distance (cm)	Power Density (mW/cm^2)	Limit (mW/cm^2)
	(dBm)	(mW)				
5580	23.33	215.278	6.58	30	0.08861	1

Note:

1. Pout*G = EIRP Power = Conducted Power(mW) * Gain(numeric)
2. Gain(dBi) to Gain(numeric) = $10^{(6.08/10)} = 4.550$
3. Distance (cm) = r = declare by manufacture = 30 cm
4. Pd = (Pout*G) / (4*pi*r^2) = (215.278 * 4.550) / (4 * 3.1416 * 30^2) = 0.08861 (mW/cm^2)

For WLAN – 5GHz_U_NII_3 Worst Condition: 11ax (40MHz) 1S4T TxBF

Frequency (MHz)	Conducted Power		Directional Gain (dBi)	Distance (cm)	Power Density (mW/cm^2)	Limit (mW/cm^2)
	(dBm)	(mW)				
5755	28.65	732.825	7.26	30	0.34478	1

Note:

1. Pout*G = EIRP Power = Conducted Power(mW) * Gain(numeric)
2. Gain(dBi) to Gain(numeric) = $10^{(2.50/10)}$ = 5.321
3. Distance (cm) = r = declare by manufacture = 30 cm
4. Pd = (Pout*G) / (4*pi*r2) = (732.825 *5.321) / (4 * 3.1416 * 30^2) = 0.34478 (mW/cm^2)

Conclusion:

The formula of calculated the MPE is:

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

CPD = Calculation power density

LPD = Limit of power density

WLAN 2.4GHz + WLAN 5GHz = (0.19567 / 1) + (0.34478 / 1) = 0.54045

Therefore the maximum calculations of above situations are less than the “1” limit.

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