RF Exposure Report

Report No.:	SA170724C44A
FCC ID:	RSE-589VACV2HP
Equipment Name:	Technicolor xDSL Gateway
Trade Name:	technicolor
Model Number:	TG589vac v2 HP
Gateway code:	DSLWBA589HP
Received Date:	Jul. 26, 2017
Test Date:	Aug. 21 ~ Sep. 14, 2017
Issued Date:	Nov. 03, 2017
Applicant:	Technicolor Delivery Technologies Belgium
Address:	Prins Boudewijnlaan 47 Edegem B-2650 Belgium
Issued By:	Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch
Lab Address:	No. 47-2, 14th Ling, Chia Pau Vil., Lin Kou Dist., New Taipei City, Taiwan (R.O.C.)
Test Location:	No. 19, Hwa Ya 2nd Rd., Wen Hwa Vil., Kwei Shan Dist., Taoyuan City 33383, TAIWAN (R.O.C.)

Testing Laboratory
2021

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Release Control Record

Issue No.	Description	Date Issued
SA170724C44A	Original release.	Nov. 03, 2017

1 Certificate of Conformity

Equipment Name:	Technicolor xDSL Gateway
Trade Name:	technicolor
Test Model:	TG589vac v2 HP
Gateway code:	DSLWBA589HP
Sample Status:	Product Unit
Applicant:	Technicolor Delivery Technologies Belgium
Test Date:	Aug. 21 ~ Sep. 14, 2017
Standards:	FCC Part 2 (Section 2.1091) KDB 447498 D01 General RF Exposure Guidance v06 IEEE C95.1

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:** Nov. 03, 2017

Polly Chien / Specialist

Approved by : _____ , **Date:** Nov. 03, 2017

Ken Liu / Senior 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

For WLAN – 2.4GHz:

Ant.	Brand	Model Name	Antenna Type	Connector
1	-	-	Printed Antenna	Murata
2	-	-	Printed Antenna	Murata

Antenna & Bandwidth for 2400~2483.5MHz

Antenna	1st (TX)		2nd (TX)	
Bandwidth Mode	20 MHz	40 MHz	20 MHz	40 MHz
802.11b	V	X	X	X
802.11g	V	X	X	X
802.11n	V	V	V	V

For 2400~2483.5MHz

Frequency	Antenna Gain (dBi)			
	Ant. 1 (W2)		Ant. 2 (W1)	
	20 MHz	40 MHz	20 MHz	40 MHz
2412MHz	3.37	-	2.08	-
2422MHz	-	3.16	-	2.01
2437MHz	3.58	3.58	1.69	1.69
2452MHz	-	3.54	-	1.73
2462MHz	3.33	-	1.62	-

Frequency	Maximum Gain (dBi) for SDM mode SDM mode (2 Stream 2 TX) for Power & PSD Gain (KDB 662911 Option 2)	
	20 MHz	40 MHz
2412MHz	0.93	-
2422MHz	-	0.75
2437MHz	1.18	1.18
2452MHz	-	1.04
2462MHz	0.82	-

Note:

1. "TG589vac v2 HP_FCC General antenna table_20160112.xls" 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

For WLAN – 5GHz:

Ant.	Brand	Model Name	Antenna Type	Connector
1	WHA YU	C107-511288-A	PCB Antenna	I-Pex
2	WHA YU	C107-511323-A	PCB Antenna	I-Pex
3	WHA YU	C107-511324-A	PCB Antenna	I-Pex

Antenna & Bandwidth

Antenna	1st (TX)			2nd (TX)			3rd (TX)		
Bandwidth Mode	20 MHz	40 MHz	80 MHz	20 MHz	40 MHz	80 MHz	20 MHz	40 MHz	80 MHz
802.11a	V	X	X	V	X	X	V	X	X
802.11n	V	V	X	V	V	X	V	V	X
802.11ac	V	V	V	V	V	V	V	V	V

Frequency	Maximum Gain (dBi) for CDD mode					
	CDD mode (1 Stream 3 TX) for Power Gain			CDD mode (1 Stream 3 TX) for PSD Gain		
	20 MHz	40 MHz	80MHz	20 MHz	40 MHz	80MHz
5180MHz	4.15	-	-	6.51	-	-
5190MHz	-	4.08	-	-	6.13	-
5200MHz	4.31	-	-	6.33	-	-
5210MHz	-	-	4.28	-	-	7.02
5230MHz	-	4.35	-	-	7.13	-
5240MHz	4.06	-	-	6.28	-	-
5260MHz	4.15	-	-	6.54	-	-
5270MHz	-	4.26	-	-	6.38	-
5290MHz	-	-	4.22	-	-	6.92
5300MHz	4.40	-	-	6.64	-	-
5310MHz	-	4.22	-	-	6.57	-
5320MHz	4.30	-	-	6.45	-	-
5500MHz	4.23	-	-	6.73	-	-
5510MHz	-	4.28	-	-	6.97	-
5530MHz	-	-	3.95	-	-	7.07
5550MHz	-	4.06	-	-	7.25	-
5580MHz	3.96	-	-	6.87	-	-
5670MHz	-	4.38	-	-	6.50	-
5700MHz	4.20	-	-	7.30	-	-
5745MHz	4.19	-	-	7.03	-	-
5755MHz	-	3.78	-	-	7.17	-
5775MHz	-	-	4.16	-	-	7.26
5785MHz	4.39	-	-	7.53	-	-
5795MHz	-	4.25	-	-	7.64	-
5825MHz	4.12	-	-	7.07	-	-

Note:

1. "TG589vac v2 HP_FCC General antenna table_20160112.xls" 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

Frequency	Maximum Gain (dBi) for SDM mode					
	SDM mode (3 Stream 3 TX) for Power Gain			SDM mode (3 Stream 3 TX) for PSD Gain		
	20 MHz	40 MHz	80MHz	20 MHz	40 MHz	80MHz
5180MHz	1.77	-	-	1.77	-	-
5190MHz	-	1.75	-	-	1.75	-
5200MHz	1.94	-	-	1.94	-	-
5210MHz	-	-	2.36	-	-	2.36
5230MHz	-	2.48	-	-	2.48	-
5240MHz	1.56	-	-	1.56	-	-
5260MHz	1.95	-	-	1.95	-	-
5270MHz	-	1.64	-	-	1.64	-
5290MHz	-	-	2.34	-	-	2.34
5300MHz	2.10	-	-	2.10	-	-
5310MHz	-	1.92	-	-	1.92	-
5320MHz	1.91	-	-	1.91	-	-
5500MHz	2.00	-	-	2.00	-	-
5510MHz	-	2.28	-	-	2.28	-
5530MHz	-	-	2.33	-	-	2.33
5550MHz	-	2.49	-	-	2.49	-
5580MHz	2.14	-	-	2.14	-	-
5670MHz	-	1.74	-	-	1.74	-
5700MHz	2.57	-	-	2.57	-	-
5745MHz	2.40	-	-	2.40	-	-
5755MHz	-	2.43	-	-	2.43	-
5775MHz	-	-	2.53	-	-	2.53
5785MHz	2.80	-	-	2.80	-	-
5795MHz	-	2.94	-	-	2.94	-
5825MHz	2.31	-	-	2.31	-	-

Note:

1. “TG589vac v2 HP_FCC General antenna table_20160112.xls” 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

Frequency	Maximum Gain (dBi) for TXBF mode					
	TXBF mode (1 Stream 3 TX) for Power Gain			TXBF mode (1 Stream 3 TX) for PSD Gain		
	20 MHz	40 MHz	80MHz	20 MHz	40 MHz	80MHz
5180MHz	6.51	-	-	6.51	-	-
5190MHz	-	6.13	-	-	6.13	-
5200MHz	6.33	-	-	6.33	-	-
5210MHz	-	-	7.02	-	-	7.02
5230MHz	-	7.13	-	-	7.13	-
5240MHz	6.28	-	-	6.28	-	-
5260MHz	6.54	-	-	6.54	-	-
5270MHz	-	6.38	-	-	6.38	-
5290MHz	-	-	6.92	-	-	6.92
5300MHz	6.64	-	-	6.64	-	-
5310MHz	-	6.57	-	-	6.57	-
5320MHz	6.45	-	-	6.45	-	-
5500MHz	6.73	-	-	6.73	-	-
5510MHz	-	6.97	-	-	6.97	-
5530MHz	-	-	7.07	-	-	7.07
5550MHz	-	7.25	-	-	7.25	-
5580MHz	6.87	-	-	6.87	-	-
5670MHz	-	6.50	-	-	6.50	-
5700MHz	7.30	-	-	7.30	-	-
5745MHz	7.03	-	-	7.03	-	-
5755MHz	-	7.17	-	-	7.17	-
5775MHz	-	-	7.26	-	-	7.26
5785MHz	7.53	-	-	7.53	-	-
5795MHz	-	7.64	-	-	7.64	-
5825MHz	7.07	-	-	7.07	-	-

Note:

1. “TG589vac v2 HP_FCC General antenna table_20160112.xls” 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

Frequency	Maximum Gain (dBi) for TXBF mode					
	TXBF mode (2 Stream 3 TX) for Power Gain			TXBF mode (2 Stream 3 TX) for PSD Gain		
	20 MHz	40 MHz	80MHz	20 MHz	40 MHz	80MHz
5180MHz	4.62	-	-	4.62	-	-
5190MHz	-	4.58	-	-	4.58	-
5200MHz	4.80	-	-	4.80	-	-
5210MHz	-	-	4.92	-	-	4.92
5230MHz	-	5.07	-	-	5.07	-
5240MHz	4.34	-	-	4.34	-	-
5260MHz	4.59	-	-	4.59	-	-
5270MHz	-	4.50	-	-	4.50	-
5290MHz	-	-	5.00	-	-	5.00
5300MHz	5.01	-	-	5.01	-	-
5310MHz	-	4.84	-	-	4.84	-
5320MHz	4.60	-	-	4.60	-	-
5500MHz	4.38	-	-	4.38	-	-
5510MHz	-	4.95	-	-	4.95	-
5530MHz	-	-	4.69	-	-	4.69
5550MHz	-	4.77	-	-	4.77	-
5580MHz	4.52	-	-	4.52	-	-
5670MHz	-	4.38	-	-	4.38	-
5700MHz	5.01	-	-	5.01	-	-
5745MHz	4.98	-	-	4.98	-	-
5755MHz	-	4.88	-	-	4.88	-
5775MHz	-	-	5.02	-	-	5.02
5785MHz	5.24	-	-	5.24	-	-
5795MHz	-	5.42	-	-	5.42	-
5825MHz	4.75	-	-	4.75	-	-

Note:

1. “TG589vac v2 HP_FCC General antenna table_20160112.xls” 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

3 Calculation Result of Maximum Conducted Power

*Power density is performed using the maximum tuned RF output power including tolerances.

For WLAN – 2.4GHz: 11n 20 MHz MCS8, 2Tx SDM, Ant. 1+2

Frequency (MHz)	Max Conducted Power (mW)	Directional Gain (dBi)	Distance (cm)	Power Density (mW/cm^2)	Limit (mW/cm^2)
2437	189.234	1.18	20	0.04940	1

Note:

1. Pout*G = EIRP Power = Max Conducted Power(mW) * Gain(numeric)
2. Gain(dBi) to Gain(numeric) = $10^{(1.18/10)}$ = 1.3122
3. Distance (cm) = r = declare by manufacture = 20 cm
4. Pd = (Pout*G) / ($4*pi*r^2$) = (189.234 * 1.3122) / ($4 * 3.1416 * 20^2$) = 0.04940 (mW/cm^2)

For WLAN – 5GHz_U_NII 1: 11ac (40MHz) MCS0, 1S3T TxBF Ant. 1+2+3

Frequency (MHz)	Max Conducted Power (mW)	Directional Gain (dBi)	Distance (cm)	Power Density (mW/cm^2)	Limit (mW/cm^2)
5230	263.027	7.13	20	0.27023	1

Note:

1. Pout*G = EIRP Power = Max Conducted Power(mW) * Gain(numeric)
2. Gain(dBi) to Gain(numeric) = $10^{(7.13/10)}$ = 5.1642
3. Distance (cm) = r = declare by manufacture = 20 cm
4. Pd = (Pout*G) / ($4*pi*r^2$) = (263.027 * 5.1642) / ($4 * 3.1416 * 20^2$) = 0.27023 (mW/cm^2)

For WLAN – 5GHz_U_NII 2a Worst Condition: 11ac (20MHz) 1S3T TxBF Ant. 1+2+3

Frequency (MHz)	Max Conducted Power (mW)	Directional Gain (dBi)	Distance (cm)	Power Density (mW/cm^2)	Limit (mW/cm^2)
5300	119.674	6.64	20	0.10983	1

Note:

1. Pout*G = EIRP Power = Max Conducted Power(mW) * Gain(numeric)
2. Gain(dBi) to Gain(numeric) = $10^{(6.64/10)}$ = 4.6132
3. Distance (cm) = r = declare by manufacture = 20 cm
4. Pd = (Pout*G) / ($4*pi*r^2$) = (119.674 * 4.6132) / ($4 * 3.1416 * 20^2$) = 0.10983 (mW/cm^2)

For WLAN – 5GHz_U_NII 2c Worst Condition: 11ac (20MHz) 1S3T TxBF Ant. 1+2+3

Frequency (MHz)	Max Conducted Power (mW)	Directional Gain (dBi)	Distance (cm)	Power Density (mW/cm^2)	Limit (mW/cm^2)
5700	104.713	7.30	20	0.11187	1

Note:

1. Pout*G = EIRP Power = Max Conducted Power(mW) * Gain(numeric)
2. Gain(dBi) to Gain(numeric) = $10^{(7.30/10)}$ = 5.3703
3. Distance (cm) = r = declare by manufacture = 20 cm
4. Pd = (Pout*G) / ($4*pi*r^2$) = (104.713 * 5.3703) / ($4 * 3.1416 * 20^2$) = 0.11187 (mW/cm^2)

For WLAN – 5GHz_U_NII 3: 11ac 20MHz MCS0, 1S3T TxBF, Ant. 1+2+3

Frequency (MHz)	Max Conducted Power (mW)	Directional Gain (dBi)	Distance (cm)	Power Density (mW/cm^2)	Limit (mW/cm^2)
5785	232.809	7.53	20	0.26226	1

Note:

1. Pout*G = EIRP Power = Max Conducted Power(mW) * Gain(numeric)
2. Gain(dBi) to Gain(numeric) = $10^{(7.53/10)}$ = 5.6624
3. Distance (cm) = r = declare by manufacture = 20 cm
4. Pd = (Pout*G) / (4*pi*r2) = (232.809 * 5.6624) / (4 * 3.1416 * 20^2) = 0.26226 (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 = 0.04940 / 1 + 0.27023 / 1 = 0.31963

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

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