Testing Laboratory 3787

RADIO EXPOSURE TEST REPORT

FCC ID	:	TV7CB5A60Y
Equipment	:	CubeG-5ac60ay
Brand Name	:	MikroTik
Model Name	:	CubeG-5ac60ay-US, CubeG-5ac60ay-SA-US
Applicant	:	Mikrotikls SIA Brivibas gatve 214i, Riga, LV-1039 Latvia
Manufacturer	:	MIKROTIKLS SIA Brivibas gatve 214i, Riga, LV-1039 Latvia
Standard	:	47 CFR Part 2.1091

The product was received on Mar. 03, 2021, and testing was started from Oct. 02, 2021 and completed on Nov. 25, 2021. We, Sporton International Inc. Hsinchu Laboratory, would like to declare that the tested sample has been evaluated in accordance with the procedures given in 47 CFR Part 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. Hsinchu Laboratory, the test report shall not be reproduced except in full.

Approved by: Sam Chen

Sporton International Inc. Hsinchu Laboratory
No.8, Ln. 724, Bo'ai St., Zhubei City, Hsinchu County 302010, Taiwan (R.O.C.)

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History of this test report

Report No.	Version	Description	Issued Date
FA130319	01	Initial issue of report	Feb. 18, 2022

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:
The declared of product specification for EUT presented in the report are provided by the manufacturer, and the manufacturer takes all the responsibilities for the accuracy of product specification.

Reviewed by: Sam Chen

Report Producer: Viola Huang

1 General Description

1.1 EUT General Information

RF General Information			
Evaluation Mode	**Frequency Range (MHz)**	**Operating Frequency (MHz)**	**Modulation Type**
5GHz WLAN	5150-5250 5725-5850	5180-5240 5745-5825	802.11a/n: OFDM (BPSK, QPSK, 16QAM, 64QAM) 802.11ac: OFDM (BPSK, QPSK, 16QAM, 64QAM, 256QAM)
60GHz	57-71 GHz	58.32 GHz 60.48 GHz 62.64 GHz	π/2-BPSK, π/2-QPSK, π/2-16QAM

1.2 Antenna Information

For EUT 1

For WLAN 5GHz

Ant.	Port	Brand	Model Name	Antenna Type	Connector	Gain (dBi)
1	1	MikroTik	CubeG-5ac60ay	Onboard Patch Antenna	I-PEX	11.5

Note1: For WLAN function (1TX, 1RX):

Only port 1 can be used as transmitting/receiving functions.

For WiGig 60GHz

Ant.	Brand	Model Name	Antenna Type	Connector	Gain (dBi)
1	MikroTik	60G-phased-array	60G-patch antenna array	N/A	30

Note2: The above information was declared by manufacturer.

For GPS

Ant.	Brand	Model Name	Antenna Type	Connector	Gain (dBi)
1	MikroTik	LHG GPS	inverted F antenna	N/A	2.2

Note3: The above information was declared by manufacturer.

For EUT 2

For WLAN 5GHz

Ant.	Port	Brand	Model Name	Antenna Type	Connector	Gain (dBi)
1	1	MikroTik	CubeG-5ac60ay-SA	Onboard Patch Antenna	N/A	11.5

Note1: For WLAN function (1TX, 1RX):

Only port 1 can be used as transmitting/receiving functions.

For WiGig 60GHz

Ant.	Brand	Model Name	Antenna Type	Connector	Gain (dBi)
1	MikroTik	60G-phased-array	60G-patch antenna array	N/A	15

Note2: The above information was declared by manufacturer.

For GPS

Ant.	Brand	Model Name	Antenna Type	Connector	Gain (dBi)
1	MikroTik	LHG GPS	inverted F antenna	N/A	2.2

Note3: The above information was declared by manufacturer.

1.3 Table for Multiple Listing

The model names in the following table are all refer to the identical product.

EUT No.	Model Name	Antenna Gain (dBi)	Description
		WiGig 60GHz	
1	CubeG-5ac60ay-US	30	The different model names equip with different 60GHz antennas.
2	CubeG-5ac60ay-SA-US	15	

Note: The above information was declared by manufacturer.

1.4 Accessories

Accessories				
Equipment Name	Brand Name	Model Name	Rating	Remark
Adapter	CULLPOWER	SAW30-240-0 800U A	INPUT: 100-240V ~ 50/60Hz, 0.8A OUTPUT: 24V, 800mA	Non-shielded, 1.5m
PoE	MikroTik	RBGPOE	-	Power cable: Non-shielded, 0.2m RJ-45 cable: Shielded, 0.1m

1.5 Testing Location

Testing Location Information	
Test Lab.：Sporton International Inc. Hsinchu Laboratory	
Hsinchu	ADD: No.8, Ln. 724, Bo'ai St., Zhubei City, Hsinchu County 302010, Taiwan (R.O.C.)
(TAF: 3787)	TEL: 886-3-656-9065 FAX: 886-3-656-9085
	Test site Designation No. TW3787 with FCC.
	Conformity Assessment Body Identifier (CABID) TW3787 with ISED.

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

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

2.3 Calculated Result and Limit

Exposure Environment: General Population / Uncontrolled Exposure

For WLAN 5GHz

Mode	DG (dBi)	Power (dBm)	EIRP (dBm)	Tolerance (dB)	Tune-up EIRP (dBm)	Tune-up EIRP (W)	Distance (cm)	S (mW/cm^2)	S Limit (mW/cm^2)
5.2G;D1D	11.50	17.64	29.14	0.50	29.64	0.92045	20	0.18312	1.00000
5.8G;D1D	11.50	18.41	29.91	0.50	30.41	1.09901	20	0.21864	1.00000

For 60GHz

Mode 1 : EUT 1

Worst-case Integrated Band Power of Unwanted Emission (30MHz ~ 40GHz)						
Start (MHz)	Stop (MHz)	Limit (dBuV/m at 3m)	Limit (mW EIRP)	RBW (MHz)	Num Intervals	Integrated Band Power (mW)
30	88	40	3.01995E-06	0.1	580	0.002
88	216	43.5	6.76083E-06	0.1	1280	0.009
216	960	46	1.20226E-05	0.1	7440	0.089
960	1000	54	7.58578E-05	0.1	400	0.030
1000	40000	54	7.58578E-05	1	39000	2.958
Total						3.089

Total Integrated Band Power of All Emission (30MHz ~ 200GHz)				
Test Frequency (GHz)	30MHz ~ 40GHz Integrated Band Power (mW)	40 ~ 200GHz EIRP (dBm)	40 ~ 200GHz EIRP (mW)	30MHz ~200GHz Total Integrated Band Power (mW)
58.32	3.089	28.87	771.49	774.583
60.48		30.72	1180.11	1183.195
62.64		29.71	936.27	939.358

Maximum Permissible Exposure of Fundamental Emissions							
Separation Distance (cm)	20						
Maximum EIPR Power of Test Frequency (GHz)	Ant. Gain (dBi)	Average EIRP Power (dBm)	Tolerance (dB)	Tune-up Average EIRP Power (dBm)	Tune-up Average EIRP Power (mW)	Power Density (S) (mW/cm^2)	Limit of Power Density (S) (mW/cm^2)
60.48	30	30.72	0.50	31.22	1324.10	0.264	1.00

Mode 2 : EUT 2

Worst-case Integrated Band Power of Unwanted Emission (30MHz ~ 40GHz)						
Start (MHz)	Stop (MHz)	Limit (dBuV/m at 3m)	Limit (mW EIRP)	RBW (MHz)	Num Intervals	Integrated Band Power (mW)
30	88	40	3.01995E-06	0.1	580	0.002
88	216	43.5	6.76083E-06	0.1	1280	0.009
216	960	46	1.20226E-05	0.1	7440	0.089
960	1000	54	7.58578E-05	0.1	400	0.030
1000	40000	54	7.58578E-05	1	39000	2.958
Total						3.089

Total Integrated Band Power of All Emission (30MHz ~ 200GHz)				
Test Frequency (GHz)	30MHz ~ 40GHz Integrated Band Power (mW)	40 ~ 200GHz EIRP (dBm)	40 ~ 200GHz EIRP (mW)	30MHz ~200GHz Total Integrated Band Power (mW)
58.32	3.089	29.77	949.14	952.234
60.48		32.70	1861.75	1864.837
62.64		33.00	1997.11	2000.194

Maximum Permissible Exposure of Fundamental Emissions							
Separation Distance (cm)	20						
Maximum EIPR Power of Test Frequency (GHz)	Ant. Gain (dBi)	Average EIRP Power (dBm)	Tolerance (dB)	Tune-up Average EIRP Power (dBm)	Tune-up Average EIRP Power (mW)	Power Density (S) (mW/cm²)	Limit of Power Density (S) (mW/cm²)
62.64	15	33.00	0.50	33.50	2240.79	0.446	1.00

Simultaneous Transmission Analysis:

Mode 1: EUT 1 + WLAN 5GHz + 60GHz

Mode	DG (dBi)	Power (dBm)	EIRP (dBm)	Tolerance (dB)	Tune-up EIRP (dBm)	Tune-up EIRP (W)	Distance (cm)	S (mW/cm^2)	S Limit (mW/cm^2)	Ratio (S/Limit)
5G	11.50	18.41	29.91	0.50	30.41	1.09901	20	0.21864	1.00000	0.21864
60G	30.00	0.73	30.73	0.50	31.23	1.32739	20	0.2636	1.00000	0.26356
									Sum Ratio	0.48220
									Ratio Limit	1

Mode 2: EUT 2 + WLAN 5GHz + 60GHz

Mode	DG (dBi)	Power (dBm)	EIRP (dBm)	Tolerance (dB)	Tune-up EIRP (dBm)	Tune-up EIRP (W)	Distance (cm)	S (mW/cm^2)	S Limit (mW/cm^2)	Ratio (S/Limit)
5G	11.50	18.41	29.91	0.50	30.41	1.09901	20	0.21864	1.00000	0.21864
60G	15.00	18.01	33.01	0.50	33.51	2.24425	20	0.4467	1.00000	0.44671
									Sum Ratio	0.66535
									Ratio Limit	1

Note: The above antenna gain was declared by manufacturer.

———THE END———