



TEST REPORT

KCTL KCTL Inc. 65, Sinwon-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Korea TEL: 82-31-285-0894 FAX: 82-505-299-8311 www.kctl.co.kr	Report No.: KR20-SRF0226 Page (1) of (10)	
1. Client ◦ Name : Kaonbroadband CO., Ltd ◦ Address : 884-3, Seongnam-daero, Bundang-gu, Seongnam-si, Gyeonggi-do, Republic of Korea ◦ Date of Receipt : 2020-03-18 2. Use of Report : Certification 3. Name of Product / Model : GPON Gateway / PG2141 4. Manufacturer / Country of Origin : Kaonbroadband CO., Ltd / Korea 5. FCC ID : 2AXCW-PG2141 6. Date of Test : 2020-04-17 to 2020-07-03 7. Location of Test : ☒ Permanent Testing Lab ☐ On Site Testing (Address: Address of testing location) 8. Test method used : 47 CFR Part 1.1310 9. Test Results : Refer to the test result in the test report		
Affirmation	Tested by Name : Euijung Kim (Signature)	Technical Manager Name : Heesu Ahn (Signature)
2020-08-27 KCTL Inc. As a test result of the sample which was submitted from the client, this report does not guarantee the whole product quality. This test report should not be used and copied without a written agreement by KCTL Inc.		

REPORT REVISION HISTORY

Date	Revision	Page No
2020-08-27	Originally issued	-

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General remarks for test reports

Nothing significant to report.

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1. General information

Client : Kaonbroadband CO., Ltd
 Address : 884-3, Seongnam-daero, Bundang-gu, Seongnam-si, Gyeonggi-do, Republic of Korea
 Manufacturer : Kaonbroadband CO., Ltd
 Address : 884-3, Seongnam-daero, Bundang-gu, Seongnam-si, Gyeonggi-do, Republic of Korea
 Laboratory : KCTL Inc.
 Address : 65, Sinwon-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Korea
 Accreditations : FCC Site Designation No: KR0040, FCC Site Registration No: 687132
 VCCI Registration No. : R-20080, G-20078, C-20059, T-20056
 Industry Canada Registration No. : 8035A
 KOLAS No.: KT231

2. Device information

Equipment under test : GPON Gateway
 Model : PG2141
 Frequency range : 2 412 MHz ~ 2 462 MHz (802.11b/g/n_HT20)
 2 422 MHz ~ 2 452 MHz (802.11n_HT40)
 UNII-1: 5 180 MHz ~ 5 240 MHz (11a/n_HT20/ac_VHT20)
 UNII-1: 5 190 MHz ~ 5 230 MHz (11n_HT40/ac_VHT40)
 UNII-1: 5 210 MHz (11ac_VHT80)
 UNII-2A: 5 260 MHz ~ 5 320 MHz (11a/n_HT20/ac_VHT20)
 UNII-2A: 5 270 MHz ~ 5 310 MHz (11n_HT40/ac_VHT40)
 UNII-2A: 5 290 MHz (11ac_VHT80)
 UNII-2C: 5 500 MHz ~ 5 720 MHz (11a/n_HT20/ac_VHT20)
 UNII-2C: 5 510 MHz ~ 5 710 MHz (11n_HT40/ac_VHT40)
 UNII-2C: 5 530 MHz ~ 5 690 MHz (11ac_VHT80)
 UNII-3: 5 745 MHz ~ 5 825 MHz (11a/n_HT20/ac_VHT20)
 UNII-3: 5 755 MHz ~ 5 795 MHz (11n_HT40/ac_VHT40)
 UNII-3: 5 775 MHz (11ac_VHT80)
 Modulation technique : DSSS (802.11b)
 OFDM (802.11a/g/n_HT20/ HT40/ac_VHT20/ VHT40/ VHT80)
 Number of channels : 11 ch (802.11b/g/n_HT20)_2.4 GHz Band
 9 ch (802.11n_HT40)_2.4 GHz Band
 UNII-1: 4 ch (20 MHz), 2 ch (40 MHz), 1 ch (80 MHz)
 UNII-2A: 4 ch (20 MHz), 2 ch (40 MHz), 1 ch (80 MHz)
 UNII-2C: 12 ch (20 MHz), 6 ch (40 MHz), 3 ch (80 MHz)
 UNII-3: 5 ch (20 MHz), 2 ch (40 MHz), 1 ch (80 MHz)
 Power source : DC 12 V
 Antenna specification : PCB Antenna
 2.4G ANT 0: 1.90 dBi, ANT 1: 1.90 dBi, ANT 2: 1.90 dBi
 UNII-1 ANT 0: 1.50 dBi, ANT 1: 1.60 dBi, ANT 2: 1.60 dBi, ANT 3: 1.70 dBi
 UNII-2A ANT 0: 1.60 dBi, ANT 1: 1.50 dBi, ANT 2: 1.50 dBi, ANT 3: 1.60 dBi
 UNII-2C ANT 0: 1.80 dBi, ANT 1: 2.00 dBi, ANT 2: 2.00 dBi, ANT 3: 1.70 dBi

UNII-3 ANT 0: 2.00 dBi, ANT 1: 1.70 dBi, ANT 2: 1.70 dBi, ANT 3: 1.60 dBi

Software version : PG2141_OrigSDK.FCC_v1.0.15.w

Hardware version : REV1.0

Operation temperature : 22 °C

2.1. Accessory information

Equipment	Manufacturer	Model	Serial No.	Power source
AC Adapter	MOSO Technology Co., Ltd.	MSA-C2000IS 12.0-24Y-DE	N/A	Input: 100-240V~, 50/60 Hz, 0.7A max Output: DC 12V, 2A

2.2. Frequency/channel operations

This device contains the following capabilities:

2.4 GHz WIFI: WLAN 802.11b/g/n(HT20,HT40)

5 GHz WIFI: WLAN 802.11a/g/n(HT20,HT40)/ac(VHT20,VHT40,VHT80)

Ch.	Frequency (MHz)
01	2 412
.	.
06	2 437
.	.
11	2 462

Table 2.2.1. 802.11b/g/n(HT20) mode

Ch.	Frequency (MHz)
03	2 422
.	.
06	2 437
.	.
09	2 452

Table 2.2.2. 802.11n(HT40) mode

UNII-1

Ch.	Frequency (MHz)
36	5 180
44	5 220
48	5 240

UNII-2A

Ch.	Frequency (MHz)
52	5 260
60	5 300
64	5 320

UNII-2C

Ch.	Frequency (MHz)
100	5 500
120	5 600
140	5 700
144	5 720

UNII-3

Ch.	Frequency (MHz)
149	5 745
157	5 785
165	5 825

Table 2.2.3. 802.11a/n/ac_HT20/VHT20 mode

UNII-1

Ch.	Frequency (MHz)
38	5 190
46	5 230

UNII-2A

Ch.	Frequency (MHz)
54	5 270
62	5 310

UNII-2C

Ch.	Frequency (MHz)
102	5 510
118	5 590
134	5 670
142	5 710

UNII-3

Ch.	Frequency (MHz)
151	5 755
159	5 795

Table 2.2.4. 802.11n/ac_HT40/VHT40 mode

UNII-1

Ch.	Frequency (MHz)
42	5 210

UNII-2A

Ch.	Frequency (MHz)
58	5 290

UNII-2C

Ch.	Frequency (MHz)
106	5 530
122	5 610
138	5 690

UNII-3

Ch.	Frequency (MHz)
155	5 775

Table 2.2.5. 802.11ac_VHT80 mode

3. Measurement uncertainty

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI C63.10-2013.

All measurement uncertainty values are shown with a coverage factor of $k=2$ to indicate a 95 % level of confidence. The measurement data shown herein meets or exceeds the U_{CISPR} measurement uncertainty values specified in CISPR 16-4-2 and thus, can be compared directly to specified limits to determine compliance.

Parameter	Expanded uncertainty ($\pm$)
Conducted RF power	1.76 dB

4. RF Exposure

Regulation

This document is prepared to show compliance with the RF Exposure requirements as required in §1.1310 of the FCC rules and Regulations.

The limit for Maximum Permissible Exposure (MPE), specified in FCC §1.1310, is listed in Table 1-1. According to FCC §1.1310: the criteria listed in the following table shall be used to evaluate the environmental impact of human exposure to radio-frequency (RF) radiation as specified in §1.1307(b).

Table 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]	Averaging Time [minute]
(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 ~ 15 000	/	/	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/1 500	30
1 500 ~ 15 000	/	/	1.0	30

f =frequency in MHz, $*$ = plane-wave equivalent power density

Per the guidance of KDB 680106, the E-field and H-field limits shown in the table above are extended down to 100 kHz

4.1. Test results

MPE (Maximum Permissible Exposure) Prediction

Predication of MPE limit at a given distance: Equation from page 18 of OET Bulletin 65, Edition 97-01

$$S = PG / 4\pi R^2 \quad (\Rightarrow R = \sqrt{PG / 4\pi S})$$

S = power density [mW / cm^2]

P = Power input to antenna [mW]

G = Power gain of the antenna in the direction of interest relative to an isotropic radiator

R = distance to the center of radiation of the antenna [cm]

RF Exposure Compliance Issue

The information should be included in the user's manual:

This appliance and its antenna must not be co-located or operation is conjunction with any other antenna or transmitter. A minimum separation distance of 20 cm must be maintained between the antenna and the person for this appliance to satisfy the RF exposure requirements.

Note.

1. The power density P_d (5th column) at a distance of 20 cm calculated from the friis transmission

Formula is far below the limit of 1 mW / cm^2 .

2. Unequal antenna gains, with equal transmit powers. For antenna gains given by $G_1, G_2, \dots, G_N$ dBi (i) If transmit signals are correlated, then

Directional gain = $10 \log[(10G_1/20 + 10G_2/20 + \dots + 10G_N/20)^2 / N \sum G_i^2]$ dB i [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.]

Antenna gain

Antenna \ Band	2.4 GHz	5 GHz U-NII-1	5 GHz U-NII-2A	5 GHz U-NII-2C	5 GHz U-NII-3
ANT 0	1.90	1.50	1.60	1.80	2.00
ANT 1	1.90	1.60	1.50	2.00	1.70
ANT 2	1.90	1.60	1.50	2.00	1.70
ANT 3	-	1.70	1.60	1.70	1.60
MIMO	1.90	1.70	1.60	2.00	2.00

Calculation Result of RF exposure

Maximum tune-up tolerance

-WLAN (2.4 GHz)

Mode	Frequency [MHz]	Max Tune-up Power [dBm]	Max Tune-up Power [mW]	Ant Gain [dBi]	Ant Gain [mW]	Power density at 20 cm [mW/cm ²]	Limit [mW/cm ²]
802.11b_ ANT 0	2 437	22.00	158.49	1.90	1.55	0.048 83	1.000 00
802.11b_ ANT 1	2 437	22.00	158.49	1.90	1.55	0.048 83	1.000 00
802.11b_ ANT 2	2 412	22.00	158.49	1.90	1.55	0.048 83	1.000 00
802.11b_ 3TX MIMO	2 437	25.00	316.23	1.90	1.55	0.097 44	1.000 00

-WLAN (5 GHz)

UNII-1

Mode	Frequency [MHz]	Max Tune-up Power [dBm]	Max Tune-up Power [mW]	Ant Gain [dBi]	Ant Gain [mW]	Power density at 20 cm [mW/cm ²]	Limit [mW/cm ²]
802.11a_ Ant 0	5 240	23.00	199.53	1.60	1.45	0.056 07	1.000 00
802.11a_ Ant 1	5 240	23.00	199.53	1.60	1.45	0.057 38	1.000 00
802.11a_ Ant 2	5 240	23.00	199.53	1.60	1.45	0.057 38	1.000 00
802.11a_ Ant 3	5 240	23.00	199.53	1.70	1.48	0.058 71	1.000 00
802.11a_ 4TX MIMO	5 240	25.50	354.81	1.70	1.48	0.104 41	1.000 00

UNII-2A

Mode	Frequency [MHz]	Max Tune-up Power [dBm]	Max Tune-up Power [mW]	Ant Gain [dBi]	Ant Gain [mW]	Power density at 20 cm [mW/cm ²]	Limit [mW/cm ²]
802.11n HT20_ Ant 0	5 260	21.00	125.89	1.60	1.45	0.036 20	1.000 00
802.11n HT20_ Ant 1	5 260	21.00	125.89	1.50	1.41	0.035 38	1.000 00
802.11n HT20_ Ant 2	5 260	21.00	125.89	1.50	1.41	0.035 38	1.000 00
802.11n HT20_ Ant 3	5 260	21.00	125.89	1.60	1.45	0.036 20	1.000 00
802.11ac VHT40_ 4TX MIMO	5 270	23.50	223.87	1.60	1.45	0.064 38	1.000 00

UNII-2C

Mode	Frequency [MHz]	Max Tune-up Power [dBm]	Max Tune-up Power [mW]	Ant Gain [dBi]	Ant Gain [mW]	Power density at 20 cm [mW/cm ²]	Limit [mW/cm ²]
802.11n HT20_ Ant 0	5 700	20.00	100.00	1.80	1.51	0.030 11	1.000 00
802.11a_ Ant 1	5 700	20.00	100.00	2.00	1.58	0.031 53	1.000 00
802.11a_ Ant 2	5 600	20.00	100.00	2.00	1.58	0.031 53	1.000 00
802.11a_ Ant 3	5 600	20.00	100.00	1.70	1.48	0.029 43	1.000 00
802.11ac VHT40_ 4TX MIMO	5 710	23.00	199.53	2.00	1.58	0.062 91	1.000 00

UNII-3

Mode	Frequency [MHz]	Max Tune-up Power [dBm]	Max Tune-up Power [mW]	Ant Gain [dBi]	Ant Gain [mW]	Power density at 20 cm [mW/cm ²]	Limit [mW/cm ²]
802.11n HT20_ Ant 0	5 825	22.50	177.83	2.00	1.58	0.056 07	1.000 00
802.11a_ Ant 1	5 825	22.50	177.83	1.70	1.48	0.052 33	1.000 00
802.11a_ Ant 2	5 825	22.50	177.83	1.70	1.48	0.052 33	1.000 00
802.11n HT20_ Ant 3	5 825	22.50	177.83	1.60	1.45	0.051 14	1.000 00
802.11a_ 4TX MIMO	5 825	28.00	630.96	2.00	1.58	0.198 94	1.000 00

End of test report