



# TEST REPORT

## KCTL Inc.

28 Mosan-gil, Jeongnam-myeon, Hwaseong-si,  
Gyeonggi-do, Republic of Korea(18516)  
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[www.kctl.co.kr](http://www.kctl.co.kr)

Report No.:  
KR19-HEF0012-C

Page (1) of (29)

# KCTL

### 1. Client

- Name : KAON Media Co.,Ltd.
- Address : Kaonmedia Building, 884-3, Seongnam-daero, Bundang-gu,  
Seongnam-si, Gyeonggi-do, Korea
- Date of Receipt : 2019-02-21

### 2. Use of Report : -



### 3. Name of Product and Model : Docsis Wifi Gateway / CG2200

### 4. Manufacturer and Country of Origin : KAON Media Co.,Ltd. / Indonesia

### 5. Date of Test : 2019-03-06 - 2019-04-29

### 6. Test method used : FCC Part 15 Subpart B


### 7. Test Results : Complied

Affirmation	Tested by	Technical Manager
	Name : Jayang Cho  (Signature)	Name : Jaehyun Park  (Signature)

2019-04-29

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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.

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## REPORT REVISION HISTORY


Date	Revision	Page No
2019-03-13	Originally issued	-
2019-04-17	Basic model and variant model changed	1, 9
2019-04-23	Basic model changed, variant model delete, added USB port comment, frequency range and data change	1, 9, 13, 24, 26
2019-04-29	Insert uncertainty, change frequency range and test set up photos	1, 6, 7, 9, 20, 22, 24, 26

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## Contents

<b>1. Applicant information .....</b>	<b>4</b>
<b>2. Laboratory information.....</b>	<b>5</b>
<b>3. Test system configuration.....</b>	<b>6</b>
3.1 Operation environment.....	6
3.2 Measurement Uncertainty .....	7
3.3 Measurement Program.....	7
<b>4. Description of EUT .....</b>	<b>8</b>
4.1 General information.....	8
4.2 Product description.....	9
4.3 Auxiliary equipments .....	10
4.4 Test configuration .....	11
4.5 Operating conditions .....	13
<b>5. Summary of test results .....</b>	<b>14</b>
5.1 Summary of EMI emission test results .....	14
<b>6. Test results .....</b>	<b>15</b>
6.1 Conducted Emissions.....	15
6.2 Radiated Emission .....	20
<b>7. EUT photographs .....</b>	<b>27</b>

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## 1. Applicant information

**Applicant:** KAON Media Co.,Ltd.

**Address:** Kaonmedia Building, 884-3, Seongnam-daero, Bundang-gu,  
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**E-mail:** gj.kim@kaonmedia.com

**Contact name:** Gyeongjin Kim

**Manufacturer:** KAON Media Co.,Ltd.

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**Contact name:** Gyeongjin Kim

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Report No.:  
KR19-HEF0012-C

Page (5) of (29)

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## 2. Laboratory information

### Address

#### **KCTL Inc. (Hwaseong Lab.)**

28, Mosan-gil, Jeongnam-myeon, Hwaseong-si, Gyeonggi-do, 18516, Korea

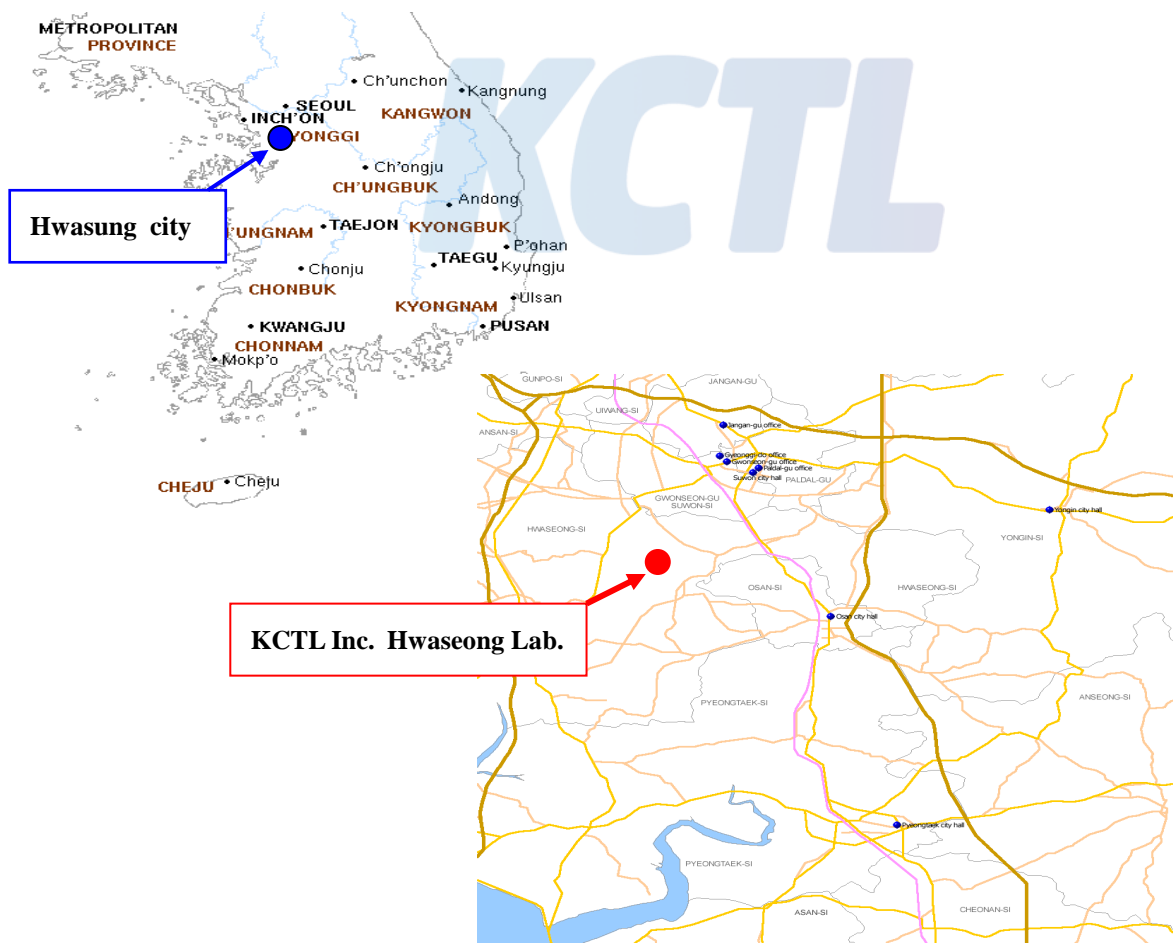
Telephone Number: 82 31 286 5881

Facsimile Number: 82 31 8059 1154

FCC Site Designation No: KR0040

KOLAS NO.: KT231

### **SITE MAP**



### 3. Test system configuration

#### 3.1 Operation environment

	Temperature	Humidity	Pressure
Shielded Room (CE)	22.3 °C	38.6 % R.H.	-
Chamber 10 m (RE)	22.3 °C	34.7 % R.H.	-
Chamber 3 m (RE)	22.1 °C	32.7 % R.H.	-

#### Test site

These testing items were performed following locations;

Test item	Test site
Conducted Emission	Shielded Room
Radiated Emission (Below 1 GHz)	10 m Chamber
Radiated Emission (Above 1 GHz)	10 m Chamber (Suwon Lab. 4F)

### 3.2 Measurement Uncertainty

All measurements involve certain levels of uncertainties, especially in field of EMC.

The factors contributing to uncertainties are test receiver, cable loss, antenna factor calibration, Antenna directivity, antenna factor variation with height, antenna phase center variation, antenna frequency interpolation, measurement distance variation, site imperfection, mismatch, and system repeatability. Based on CISPR 16-4-2, the measurement uncertainty level with a 95 % confidence level was applied.

Conducted Emission measurement_AMN (Confidence level about 95 %, $k = 2$ )		
Shielded Room	9 kHz ~ 150 kHz : 1.94 dB	
	150 kHz ~ 30 MHz : 2.42 dB	
Radiated Emission measurement (Confidence level about 95 %, $k = 2$ )		
10 m Chamber	30 MHz ~ 1 GHz	3 m: 4.92 dB
		10 m: 4.92 dB
10 m Chamber (Suwon Lab. 4F)	1 GHz ~ 6 GHz	3 m : 6.32 dB
	6 GHz ~ 18 GHz	3 m : 6.66 dB
	18 GHz ~ 40 GHz	3 m : 6.74 dB

### 3.3 Measurement Program

These test items were performed by software programs;

Test item	Measurement Program	Used
Conducted Emission	TEPTO-DV/AM V 4.1.0083 ( tsj corporation )	☑
Radiated Emission(Below 1 GHz)	EMI_V 2.01.0060 (tsj corporation)	☑
Radiated Emission(Above 1 GHz)	EP5RE_V 5.11.10 (TOYO)	☑

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Report No.:  
KR19-HEF0012-C

Page (8) of (29)



## 4. Description of EUT

### 4.1 General information

#### Specification

Main Chipset	(DOCSIS 3.0 24x8) BCM3384ZU - 2300 DMIPS Zephyr Process, 1GHz dual-issue - 1600 DMIPS VIPER Process, 600MHz dual WLAN BCM4360 (3x3 802.11n) WLAN BCM4360 (3x3 802.11ac)
Memory	Flash: NOR 32MB RAM : 256MB DDR3
Wi-Fi	802.11 a/b/g/n/ac MU-MIMO 2.4GHz 3x3 + 5GHz 3x3 Dual Band Concurrent Internal Antennas
Mesh	KAON Smart Mesh
Front	12xLED (PWR, DS, US, Online, 2.4G, 5G, ETH1~4, TEL 1~2) WPS Button
Rear	1xReset pin-hole 4xGbE LAN Ports 1xCableIn 2xTEL Ports 1xPower In
Power	DC 12V(2.5A)
Package	CG2200 User Guide Ethernet Cable Power Supply Serial Label, Giftbox Label



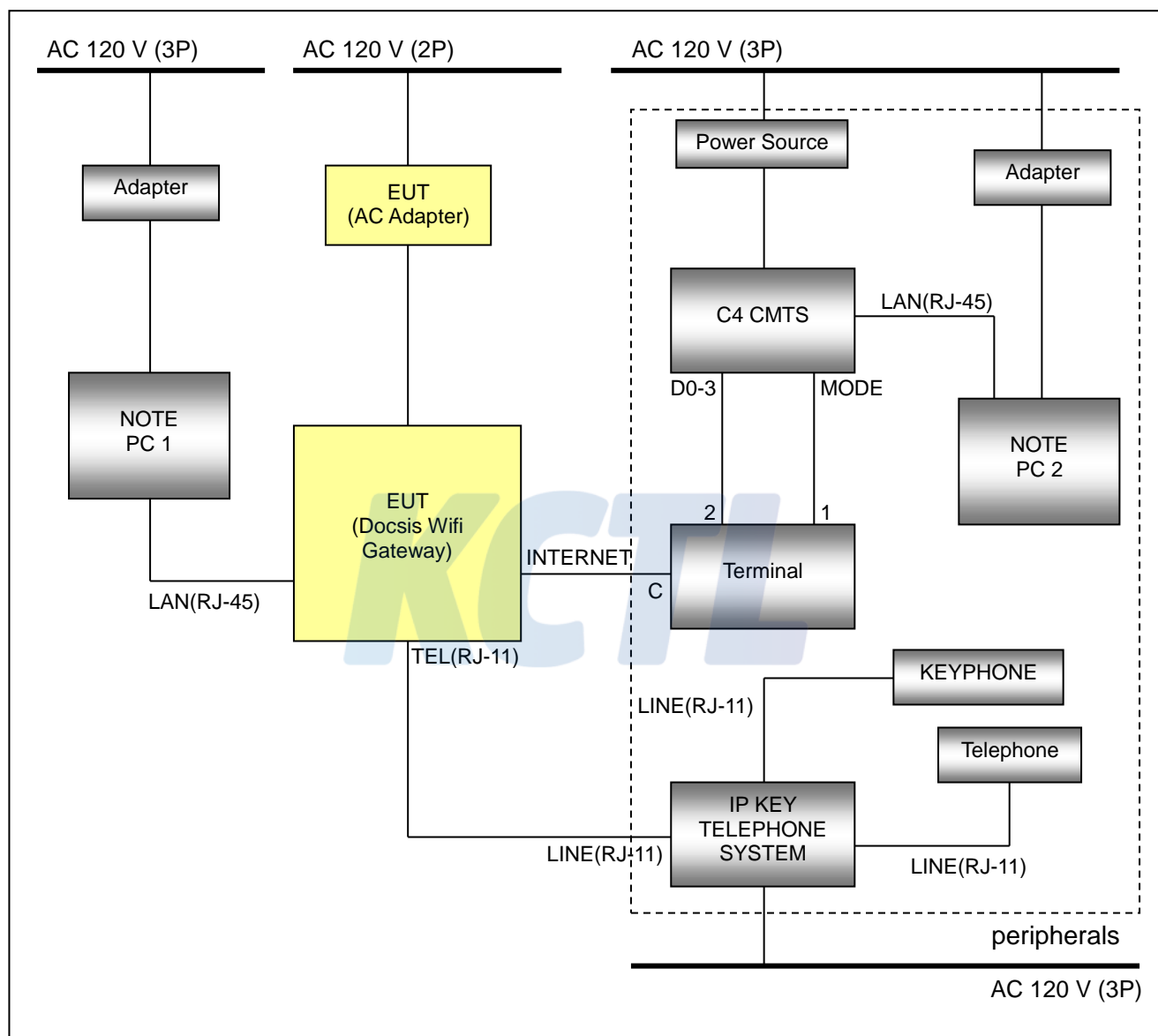
## 4.2 Product description

Type of product	Docsis Wifi Gateway
Model name (Basic)	CG2200
Model name (Variant)	
Difference	
Trade name	
Serial no	-
Testing voltage	AC 120 V, 60 Hz
Input range	AC (100-240) V, 50/60 Hz
Internal clock frequency	5825 MHz

### 4.3 Auxiliary equipments

Type	Model / Part #	S/N	Manufacturer
NOTE PC 1	Probook 6570b	-	HP
Adapter	PPP009H	-	Chincony Power Technology (Suzhou)Co., Ltd.
NOTE PC 2	V360	-	Lenovo
Adapter	CPA-A065	-	Chincony Power Technology (Suzhou)Co., Ltd.
C4 CMTS	CADANT C4 CMTS	-	ARRIS
Power Source	-	-	tyco
Terminal	H1012060714ST	-	NetWave
IP KEY TELEPHONE SYSTEM	LDK-828	-	LG-NORTEL
KEYPHONE	LKD-30D	-	LG Information & Communications Co., Ltd.
Telephone	GS-460	-	VKX,Ltd.

#### 4.4 Test configuration



	Start		End		Cable	
	Name	I/O port	Name	I/O port	Length (m)	Spec.
1	<b>EUT (Docsis Wifi Gateway)</b>	Power	AC Adapter (EUT)	-	1.5	Unshield
2		LAN(RJ-45)	NOTE PC 1	LAN(RJ-45)	3.0	Unshield
3		INTERNET	Terminal	C	20.0	Shield
4		TEL(RJ-11)	IP KEY TELEPHONE SYSTEM	LINE(RJ-11)	3.0	Unshield
5	NOTE PC 1	Power	Adapter	-	1.5	Shield
6	NOTE PC 2	Power	Adapter	-	1.5	Shield
7	C4 CMTS	Power	Power Source	-	2.0	Unshield
8		D0-3	Terminal	2	2.0	Shield
9		MODE	Terminal	1	2.0	Shield
10		LAN(RJ-45)	NOTE PC 2	LAN(RJ-45)	3.0	Unshield
11	IP KEY TELEPHONE SYSTEM	LINE(RJ-11)	Telephone	LINE(RJ-11)	3.0	Unshield
12		LINE(RJ-11)	KEYPHONE	LINE(RJ-11)	3.0	Unshield

## 4.5 Operating conditions

The EUT was configured as normal intended use.

Test mode	Normal operating
1	After connecting the EUT with the peripherals, it was tested while monitoring the TEL function using IP KEY TELEPHONE SYSTEM and calling the IP address on the NOTE PC. And it was tested while monitoring the the normal operation status of the EUT on the NOTE PC.

- Note : USB port is a debug port that is not used by ordinary users

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## 5. Summary of test results

In the above configuration tested, The EUT complied with the requirement of the specification

### 5.1 Summary of EMI emission test results

FCC Part 15 Subpart B (Class B)

ANSI C63.4 – 2014

Applied	Test items	Test method	Result
<input checked="" type="checkbox"/>	Conducted Emission	ANSI C63.4 – 2014	Pass
<input checked="" type="checkbox"/>	Radiated Emission	ANSI C63.4 – 2014	Pass

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## 6. Test results

### 6.1 Conducted Emissions

Test specification	FCC Part 15, Section 15.107, Class B		
Testing voltage	AC 120 V, 60 Hz		
Test facility	Shielded Room		
Date	2019-03-08		
Temperature (°C)	22.3 °C	Humidity (% R.H.)	38.6 % R.H.
Remarks	Pass		

#### 6.1.1 Limits of conducted emissions measurement

☒ AC main

Frequency [MHz]	Class A (dB( $\mu$ V))		Class B (dB( $\mu$ V))	
	Quasi-peak	Average	Quasi-peak	Average
0.15 ~ 0.5	79	66	66 ~ 56	56 ~ 46
0.5 ~ 5	73	60	56	46
5 ~ 30	73	60	60	50

The limit decreases linearly with the logarithm of frequency

### 6.1.2 Measurement procedure

The measurements were performed in a shielded room. EUT was setup as shown in photograph and placed on a non-metallic table height of 0.8 m above the reference ground plane. The rear of table was located 0.4 m to the vertical conducted plane. EUT was power through the LISN, which was bonded to the ground plane. The LISN power was filtered. Each EUT power lead, except ground (safety) lead was individually connected through a LISN to input power source. EUT signal cables that hung closer than 0.4 m to the Horizontal metal ground 0.3 m ~ 0.4 m long. The power cord was bundles in the center. All peripheral equipment was powered from a sub LISN. The LISN and ISN were positioned 0.8 m from the EUT. Peak and Average detection were used in preliminary testing and Quasi-peak and Average detections were used at final measurement. Both lines of power cord, hot and neutral, were measured.

### 6.1.3 Used equipments

Equipment	Model	Serial No.	Makers	Next Cal. Date	Used
Two Line V-Network	ENV216	100258	Rohde & Schwarz	2020-01-03	<input checked="" type="checkbox"/>
Two Line V-Network	ENV216	101371	Rohde & Schwarz	2019-09-20	<input checked="" type="checkbox"/>
EMI TEST RECEIVER	9010F	020WW40403	NARDA	2019-06-18	<input checked="" type="checkbox"/>



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KR19-HEF0012-C  
Page (17) of (29)

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### 6.1.4 Photographs of test setup

#### AC Main



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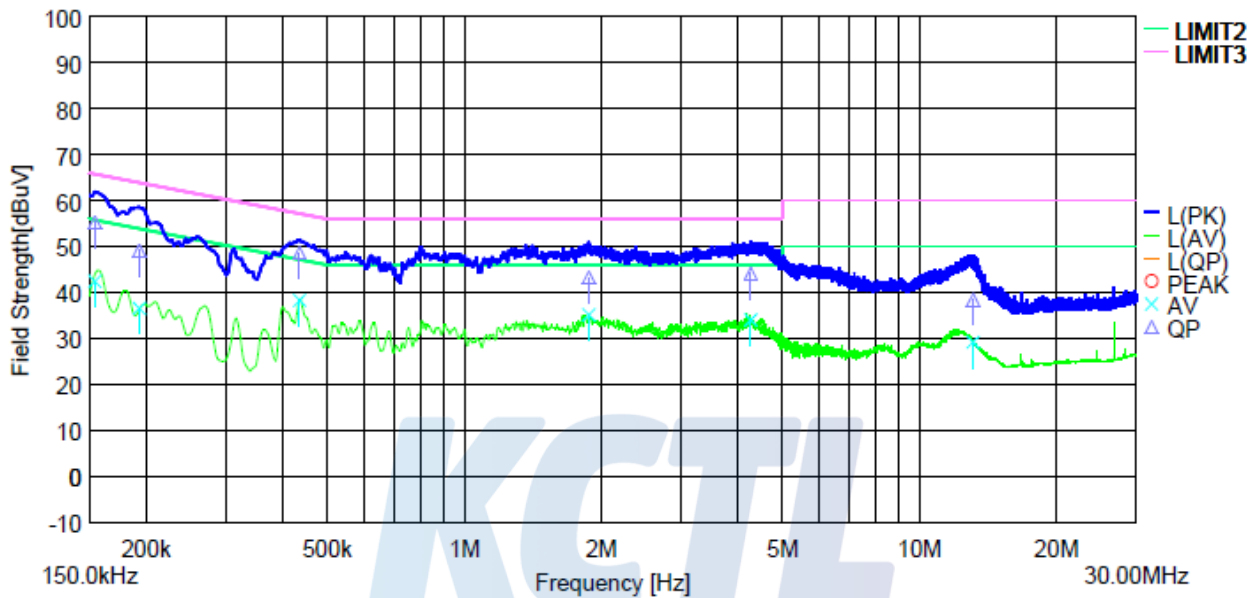
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Page (18) of (29)

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### 6.1.5 Conducted emissions measurement result

#### AC Main



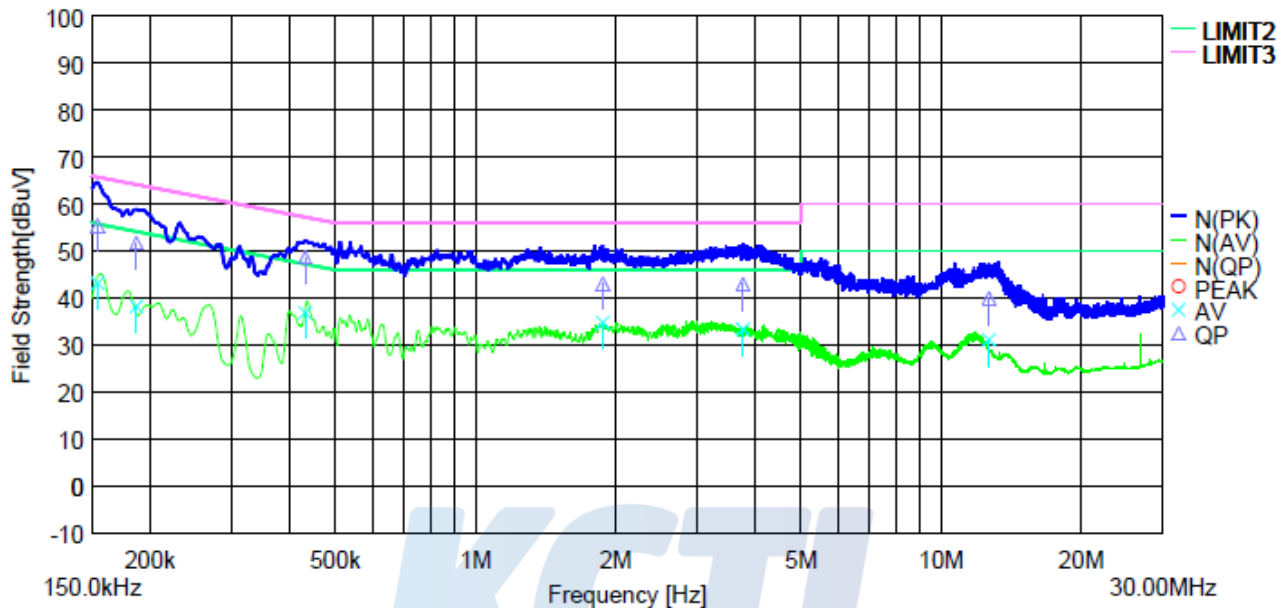
Freq.	Mode	Level			Factor			PEAK	CAV	QP	Limit			Margin		
		PEAK	CAV	QP	LISN	Loss	Gain				PEAK	CAV	QP	PEAK	CAV	QP
[MHz]		[dBuV]			[dB]			[dBuV]			[dBuV]			[dB]		
0.15409	L	---	32.56	45.40	9.85	0.03	0.00	---	42.44	55.28	---	55.78	65.78	---	13.34	10.50
0.19295	L	---	26.51	39.09	9.99	0.06	0.00	---	36.56	49.14	---	53.91	63.91	---	17.35	14.77
0.43426	L	---	28.32	38.62	9.91	0.04	0.00	---	38.27	48.57	---	47.17	57.17	---	8.90	8.60
1.87598	L	---	25.30	33.42	9.77	0.09	0.00	---	35.16	43.28	---	46.00	56.00	---	10.84	12.72
4.26045	L	---	24.04	34.12	9.87	0.13	0.00	---	34.04	44.12	---	46.00	56.00	---	11.96	11.88
13.13371	L	---	18.61	27.85	10.39	0.20	0.00	---	29.20	38.44	---	50.00	60.00	---	20.80	21.56

[L]

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Report No.:  
KR19-HEF0012-C  
Page (19) of (29)

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Freq.	Mode	Level			Factor			PEAK	CAV	QP	Limit			Margin		
		PEAK	CAV	QP	LISN	Loss	Gain				PEAK	CAV	QP	PEAK	CAV	QP
[MHz]		[dBuV]			[dB]			[dBuV]			[dBuV]			[dB]		
0.15409	N	---	33.21	45.56	9.89	0.03	0.00	---	43.13	55.48	---	55.78	65.78	---	12.65	10.30
0.18681	N	---	28.12	41.61	10.06	0.04	0.00	---	38.22	51.71	---	54.18	64.18	---	15.96	12.47
0.43017	N	---	26.92	38.67	9.93	0.05	0.00	---	36.90	48.65	---	47.25	57.25	---	10.35	8.60
1.87598	N	---	24.89	33.20	9.80	0.09	0.00	---	34.78	43.09	---	46.00	56.00	---	11.22	12.91
3.75329	N	---	23.36	32.95	9.88	0.14	0.00	---	33.38	42.97	---	46.00	56.00	---	12.62	13.03
12.67767	N	---	20.49	29.32	10.48	0.16	0.00	---	31.12	39.95	---	50.00	60.00	---	18.88	20.05

[N]

## 6.2 Radiated Emission

Test specification	FCC Part 15, Section 15.109, Class B		
Testing voltage	AC 120 V, 60 Hz		
Test facility	10 m Chamber / 10 m Chamber (Suwon Lab. 4F)		
Test distance	10 m / 3 m		
Date	2019-03-06 / 2019-04-29		
Temperature (°C)	22.3 °C / 22.1 °C	Humidity (% R.H.)	34.7 % R.H. / 32.7 % R.H.
Remarks	Pass		

### 6.2.1 Limits of radiated emission measurement

☒ Limits below 1 GHz

Frequency [MHz]	Class A (dB(μV/m)) @ 10 m	Class B (dB(μV/m)) @ 3 m
30-88	39	40
88-216	43.5	43.5
216-960	46.4	46
Above 960	49.5	54

☒ Limits above 1 GHz

Frequency [GHz]	Class A @ 3 m		Class B @ 3 m	
	Average limit (dB(μV/m))	Peak limit (dB(μV/m))	Average limit (dB(μV/m))	Peak limit (dB(μV/m))
1 ~	60	80	54	74

Note - The lower limit applies at the transition frequency.

## 6.2.2 Measurement procedure

The test was done at a 10 m Chamber with a quasi-peak detector.

EUT was placed on a non-metallic table height of 0.8 m above the reference ground plane.

Cables were folded back and forth forming a bundle 0.3 m to 0.4 m long and were hanged at a 0.4 m height to the ground plane. Cables connected to EUT were fixed to cause maximum emission.

Test was made with the antenna positioned in both the horizontal and vertical planes of polarization. The measurement antenna was varied in height above the conducting ground plane to obtain the maximum signal strength.

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### 6.2.3 Used equipments

Equipment	Model no.	Serial no.	Makers	Next Cal. Date	Used
Test Receiver	ESCI	100561	Rohde & Schwarz	2019-09-20	<input checked="" type="checkbox"/>
BI-LOG Ant.	VULB9160	3049	Schwarzbeck	2019-08-31	<input checked="" type="checkbox"/>
Amplifier	310N	185938	SONOMA	2020-01-03	<input checked="" type="checkbox"/>
Double Ridge Horn Antenna	3117-PA	00161083	ETS-LINDGREN	2019-09-14	<input checked="" type="checkbox"/>
Spectrum Analyzwer	N9040B	US56050101	AGILENT	2019-10-31	<input checked="" type="checkbox"/>
Horn Antenna	3116	00086635	ETS-LINDGREN	2019-05-10	<input checked="" type="checkbox"/>
AMPLIFIER	JS44-1800400 0-33-8P	2000996	AGILENT	2019-10-30	<input checked="" type="checkbox"/>

### 6.2.4 Sample calculation

The field strength is calculated adding the antenna Factor, cable loss and, Antenna pad adding, subtracting the amplifier gain from the measured reading.

The sample calculation is as follow:

$$\text{Result QP}[\text{dB}(\mu\text{V}/\text{m})] = \text{Reading QP}[\text{dB}(\mu\text{V})] + \text{ANT FACTOR} [\text{dB}/\text{m}] + \text{LOSS} [\text{dB}] - \text{GAIN} [\text{dB}]$$

Result QP : The final measure

Reading QP : Instrument readings

ANT FACTOR: Antenna Factor

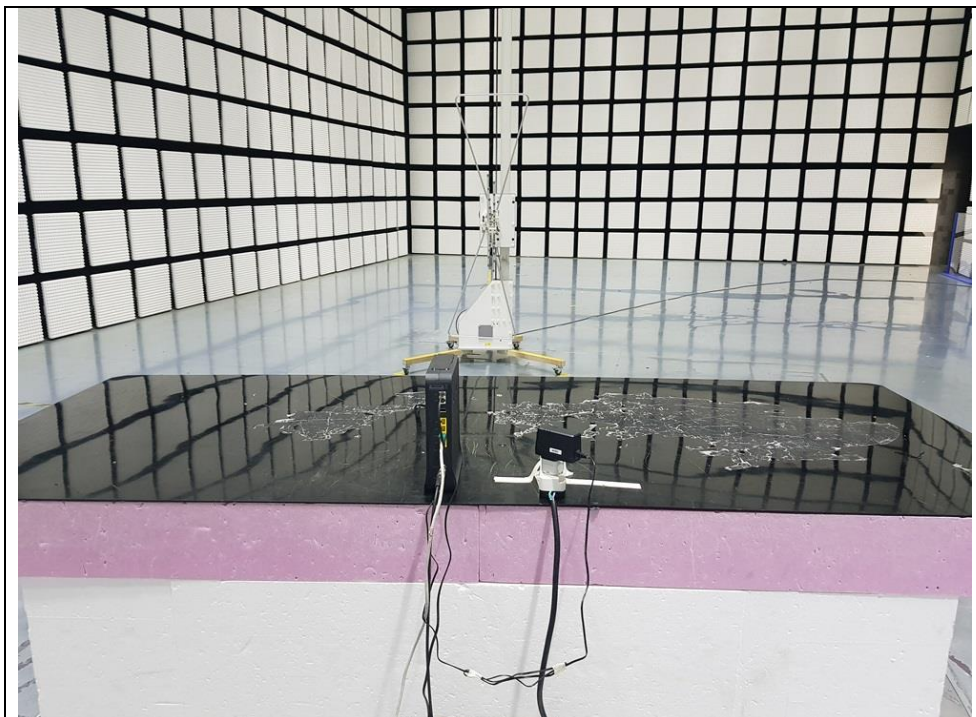
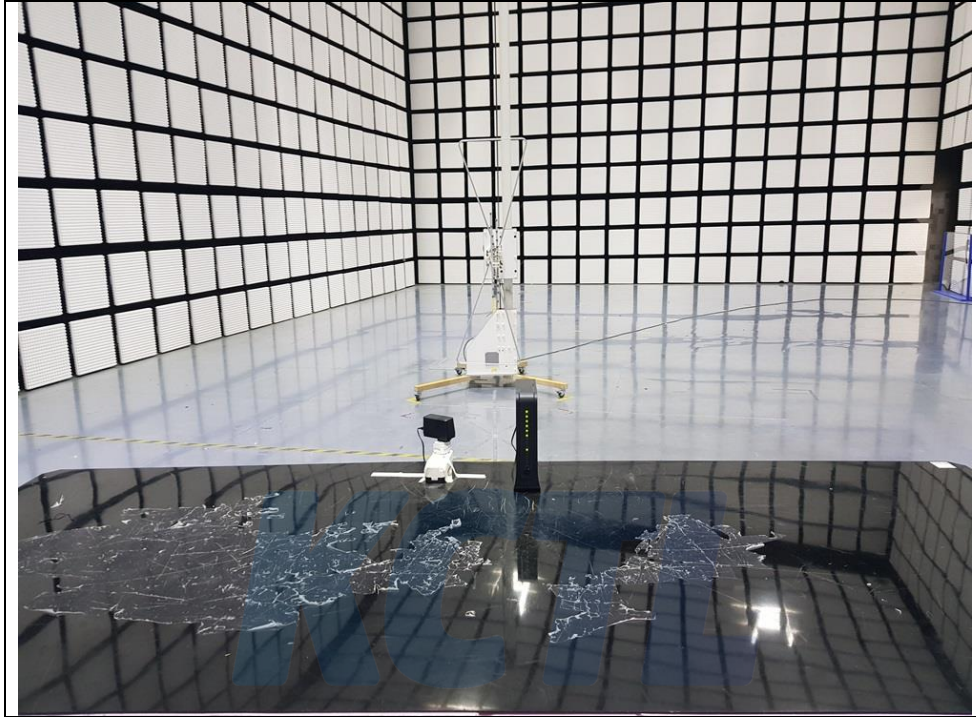
LOSS: Cable Loss

GAIN: Amplifier Gain



## 6.2.5 Photographs of test setup

30 MHz ~ 1 GHz



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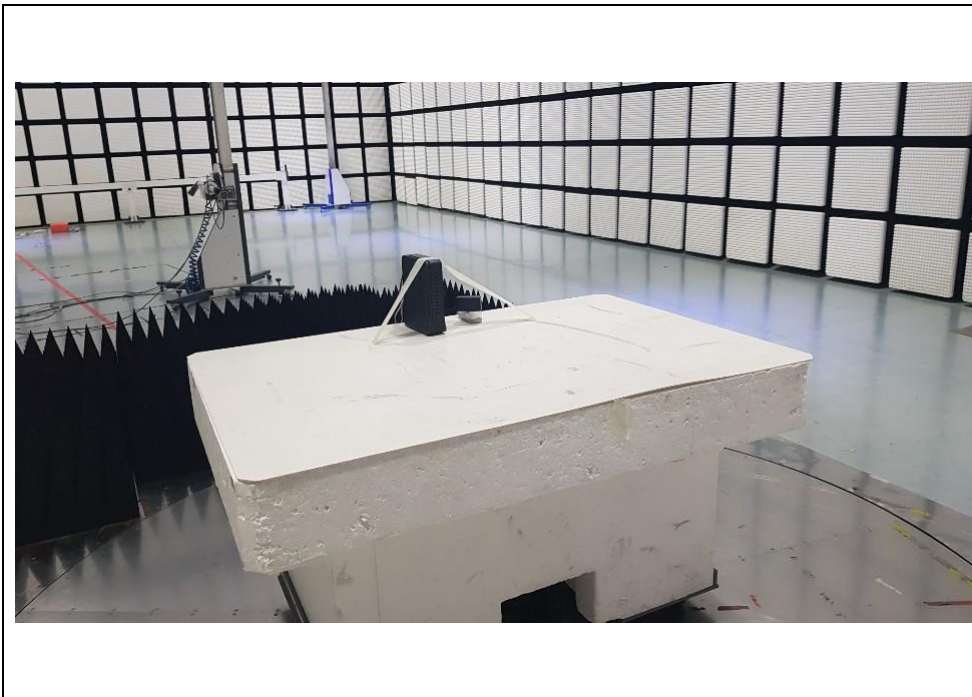
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Page (24) of (29)

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1 GHz - 18 GHz



18 GHz - 30 GHz





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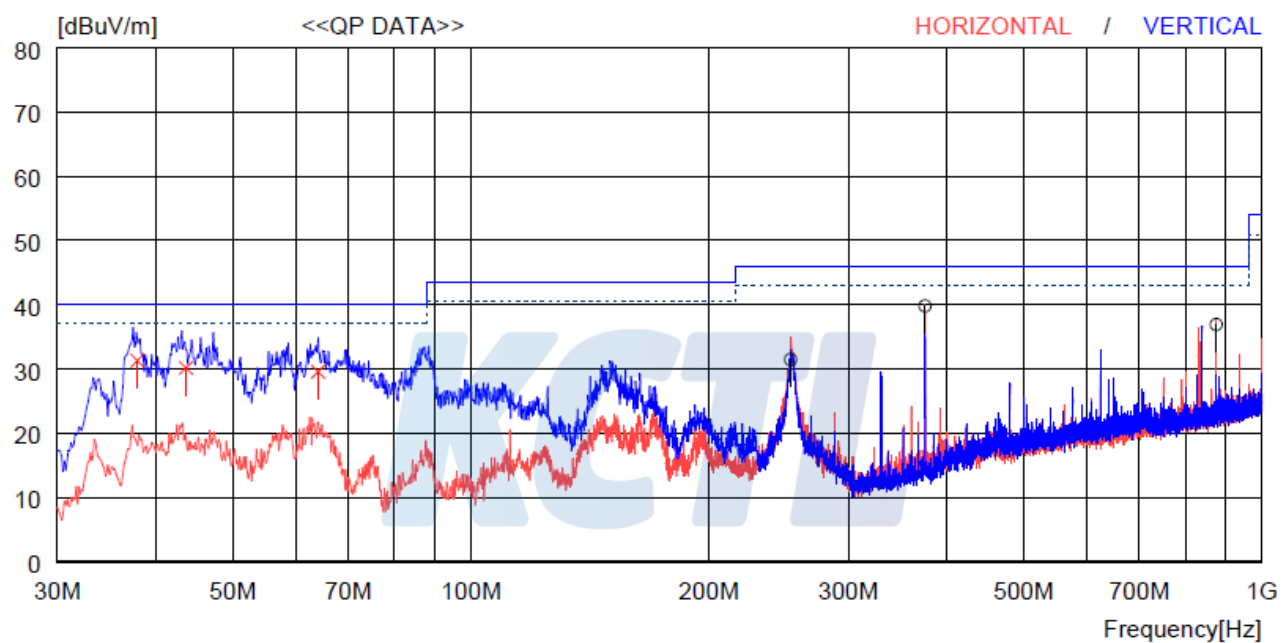
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Page (25) of (29)

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## 6.2.6 Radiated emission measurement result

### Graph and Data

30 MHz ~ 1 GHz



No.	FREQ [MHz]	READING QP [dBuV]	ANT FACTOR [dB]	LOSS [dB]	GAIN [dB]	RESULT QP [dBuV/m]	LIMIT [dBuV/m]	MARGIN [dB]	ANTENNA [cm]	TABLE [deg]
----- Horizontal -----										
1	253.671	42.8	17.3	2.8	31.4	31.5	46.0	14.5	110	270
2	374.994	46.8	20.5	3.9	31.4	39.8	46.0	6.2	100	238
3	874.994	34.2	28.3	5.9	31.5	36.9	46.0	9.1	108	311
----- Vertical -----										
4	37.839	44.0	17.9	1.0	31.6	31.3	40.0	8.7	106	36
5	43.611	42.5	18.2	1.1	31.6	30.2	40.0	9.8	115	22
6	64.071	43.1	16.8	1.3	31.6	29.6	40.0	10.4	101	125

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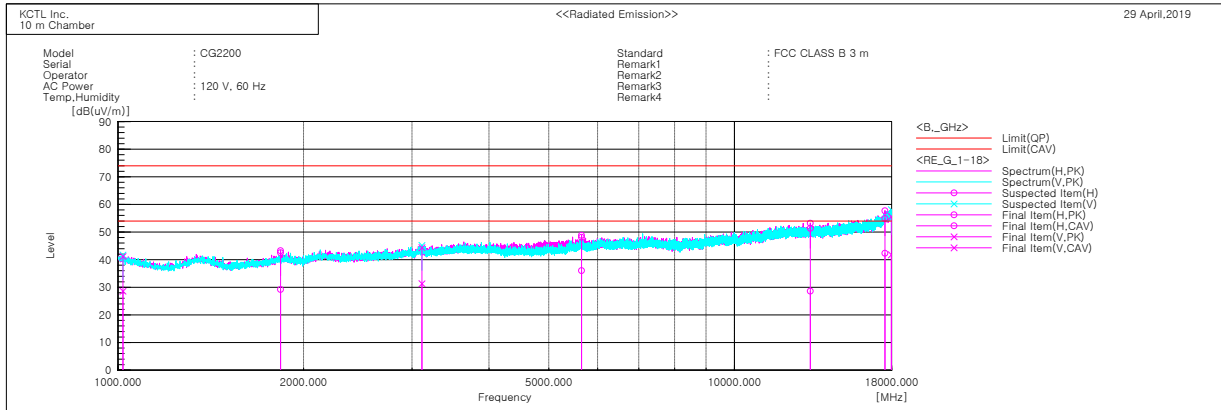
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Report No.:  
KR19-HEF0012-C  
Page (26) of (29)



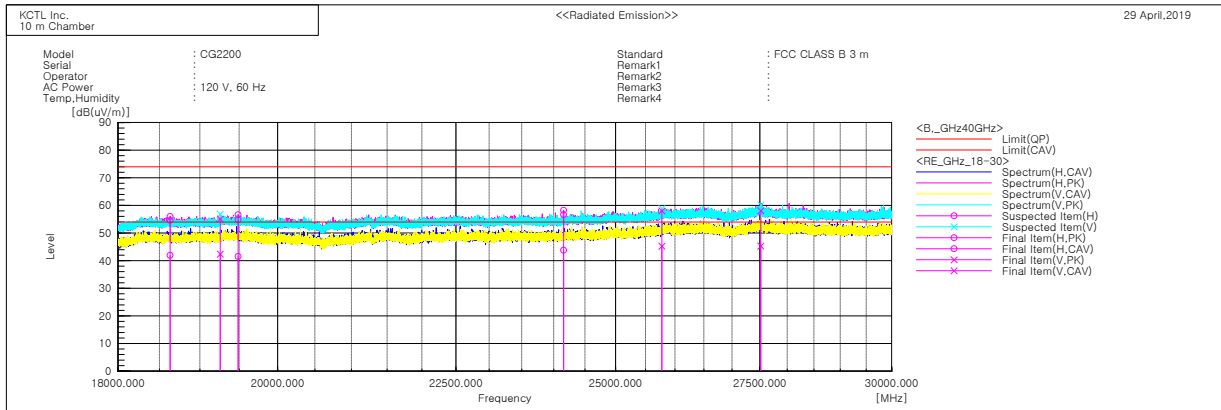
## 1 GHz - 18 GHz



### Final Result

No.	Frequency [MHz]	(P)	Reading PK [dB(uV)]	Reading CAV [dB(uV)]	c.f [dB(1/m)]	Result PK [dB(uV/m)]	Result CAV [dB(uV/m)]	Limit PK [dB(uV/m)]	Limit AV [dB(uV/m)]	Margin PK [dB]	Margin CAV [dB]	Height [cm]	Angle [deg]
1	1018.765	V	56.9	44.3	-15.7	41.2	28.6	74.0	54.0	32.8	25.4	118.0	244.0
2	1835.552	H	57.1	43.8	-14.6	42.5	29.2	74.0	54.0	31.5	24.8	217.0	304.0
3	3111.512	V	53.7	40.6	-9.3	44.4	31.3	74.0	54.0	29.6	22.7	400.0	45.0
4	5652.274	H	53.2	41.1	-5.1	48.1	36.0	74.0	54.0	25.9	18.0	293.0	22.0
5	13283.110	H	49.7	27.0	1.6	51.3	28.6	74.0	54.0	22.7	25.4	195.0	312.0
6	17554.580	H	46.3	33.7	8.6	54.9	42.3	74.0	54.0	19.1	11.7	99.8	278.4
7	17976.200	V	45.6	31.8	10.0	55.6	41.8	74.0	54.0	18.4	12.2	118.0	148.0

## 18 GHz - 30 GHz



### Final Result

No.	Frequency [MHz]	(P)	Reading PK [dB(uV)]	Reading CAV [dB(uV)]	c.f [dB(1/m)]	Result PK [dB(uV/m)]	Result CAV [dB(uV/m)]	Limit PK [dB(uV/m)]	Limit AV [dB(uV/m)]	Margin PK [dB]	Margin CAV [dB]	Height [cm]	Angle [deg]
1	18629.430	H	48.6	35.9	6.0	54.6	41.9	74.0	54.0	19.4	12.1	189.0	15.0
2	19257.660	V	48.8	36.1	6.3	55.1	42.4	74.0	54.0	18.9	11.6	400.0	224.0
3	19486.870	H	48.2	34.9	6.6	54.8	41.5	74.0	54.0	19.2	12.5	291.0	35.0
4	24158.110	H	48.1	35.3	8.5	56.6	43.8	74.0	54.0	17.4	10.2	196.0	222.0
5	25775.190	V	45.8	33.0	12.2	58.0	45.2	74.0	54.0	16.0	8.8	107.0	31.0
6	27517.080	V	44.3	31.5	13.8	58.1	45.3	74.0	54.0	15.9	8.7	218.0	314.0

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Report No.:  
KR19-HEF0012-C  
Page (27) of (29)

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## 7. EUT photographs

Front View



Rear View



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Report No.:  
KR19-HEF0012-C  
Page (28) of (29)

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Left View



Right View



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Report No.:  
KR19-HEF0012-C  
Page (29) of (29)

**KCTL**Inside