

TEST REPORT



DT&C Co., Ltd.

42, Yurim-ro, 154Beon-gil, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea, 17042
Tel : 031-321-2664, Fax : 031-321-1664

1. Report No : DRTFCC2001-0009(2)

2. Customer

• Name : LG Electronics USA, Inc.

• Address : 1000 Sylvan Ave. Englewood Cliffs, New Jersey, United States 07632

3. Use of Report : FCC Original Grant

4. Product Name / Model Name : Mobile Phone / OA2001

FCC ID : ZNFOA2001


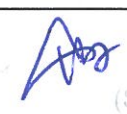
5. Test Method Used : ANSI C63.10-2013

Test Specification : FCC Part 15.225

6. Date of Test : 2019.11.28 ~ 2020.01.17, 2020.01.29

7. Testing Environment : Refer to appended test report.

8. Test Result : Refer to the attached test result.

Affirmation	Tested by	Reviewed by
	Name: JungWoo Kim  (Signature)	Name: Guenki Son  (Signature)

The test results presented in this test report are limited only to the sample supplied by applicant and the use of this test report is inhibited other than its purpose. This test report shall not be reproduced except in full, without the written approval of DT&C Co., Ltd.

2020 . 01 . 29 .

DT&C Co., Ltd.

If this report is required to confirmation of authenticity, please contact to report@dtnc.net

Test Report Version

Test Report No.	Date	Description	Tested by	Reviewed by
DRTFCC2001-0009	Jan. 17, 2020	Initial issue	JungWoo Kim	Guenki Son
DRTFCC2001-0009(1)	Jan. 28, 2020	Revised the section 4.2.1 & 4.2.3	JaeJin Lee	Guenki Son
DRTFCC2001-0009(2)	Jan. 29, 2020	Revised the section 4.2.2 & 4.2.3	JungWoo Kim	Guenki Son

CONTENTS

1. General Information.....	4
1.1. Testing Laboratory	4
1.2. Testing Environment.....	4
1.3. Measurement Uncertainty	4
1.4. Details of Applicant.....	5
1.5. Description of EUT	5
1.6. EUT CAPABILITIES	5
2. Information about test items.....	6
2.1 Test mode	6
2.2 Tested frequency	6
2.3 EMI Suppression Device(s)/Modifications	6
3. Antenna requirements.....	6
4. Test report	7
4.1 Summary of tests	7
4.2 Transmitter requirements	8
4.2.1 20dB bandwidth	8
4.2.2 In-band emissions	9
4.2.3 Out-of-band emissions	11
4.2.4 Frequency Stability	13
4.2.5 AC Line Conducted Emissions.....	14
APPENDIX.....	17

1. General Information

1.1. Testing Laboratory

DT&C Co., Ltd.		
The 3 m test site and conducted measurement facility used to collect the radiated data are located at the 42, Yurim-ro, 154beon-gil, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea 17042. The test site complies with the requirements of § 2.948 according to ANSI C63.4-2014.		
- FCC MRA Accredited Test Firm No. : KR0034		
www.dtnet.net		
Telephone	:	+ 82-31-321-2664
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1.2. Testing Environment

Ambient Condition	
▪ Temperature	+22 °C ~ +23 °C
▪ Relative Humidity	35 % ~ 41 %

1.3. Measurement Uncertainty

The measurement uncertainties shown below were calculated in accordance with requirements of ANSI C 63.4-2014. All measurement uncertainty values are shown with a coverage factor of $k = 2$ to indicate a 95 % level of confidence.

Parameter	Measurement uncertainty
AC conducted emission	2.4 dB (The confidence level is about 95 %, $k = 2$)
Radiated Disturbance (Below 1 GHz)	5.1 dB (The confidence level is about 95 %, $k = 2$)

1.4. Details of Applicant

Applicant : LG Electronics USA, Inc.
Address : 1000 Sylvan Ave. Englewood Cliffs, New Jersey, United States 07632
Contact person : Kyung-Su Han

1.5. Description of EUT

FCC Equipment Class	Low Power Communications Device Transmitter(DXX)
EUT	Mobile Phone
Model Name	OA2001
Add Model Name	KA2004
Serial Number	Identical prototype
Power Supply	DC 3.87 V
Frequency Band	13.56 MHz
Modulation Type	ASK
Channel(s)	1
Antenna type	Loop Antenna

1.6. EUT CAPABILITIES

This EUT contains the following capabilities:

850/1900 GSM, 850/1700/1900 WCDMA/HSUPA, Multi-band LTE, 802.11b/g/n/ac/ax WLAN(2.4GHz)
802.11a/n/ac/ax WLAN(5GHz), Bluetooth(BDR, EDR, LE), NFC, WPC, Dual Display.

2. Information about test items

2.1 Test mode

Test mode1	Continuous transmitting mode
Test mode2	Continuous transmitting mode(With Dual Display ^{Note1})

Note 1: The dual display cover is provided to the users as an accessory.

So, the radiated test items were performed at standalone configuration and condition of equipped with dual display.
(The dual screen communicates with the main unit via USB connection.)

Note 2: The worst case data rate was determined according to the fundamental emission level.

And data rate was tested at the worst case(106 kbps).

2.2 Tested frequency

Channel	TX Frequency(MHz)
Lowest	13.56
Middle	-
Highest	-

2.3 EMI Suppression Device(s)/Modifications

EMI suppression device(s) added and/or modifications made during testing

→ None

3. Antenna requirements

“An intentional radiator antenna shall be designed to ensure that no antenna other than that furnished by the responsible party can be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section.”

The antenna is attached on the device by means of unique coupling method (Spring Tension).

Therefore this E.U.T Complies with the requirement of §15.203

4. Test report

4.1 Summary of tests

FCC part section(s)	RSS section(s)	Parameter	Limit	Test condition	Status Note 1
2.1049	-	20 dB Bandwidth	-	Radiated	C
-	RSS-Gen [6.7]	Occupied Bandwidth	-		NA
15.225 (a)	RSS-210 [B6(a)]	In-Band Emissions	15,848 $\mu\text{V/m}$ @ 30 m 13.553 – 13.567 MHz		C Note 3
15.225 (b)	RSS-210 [B6(b)]	In-Band Emissions	334 $\mu\text{V/m}$ @ 30 m 13.410 – 13.553 MHz 13.567 – 13.710 MHz		C Note 3
15.225 (c)	RSS-210 [B6(c)]	In-Band Emissions	106 $\mu\text{V/m}$ @ 30 m 13.110 – 13.410 MHz 13.710 – 14.010 MHz		C Note 3
15.225 (d) 15.209	RSS-210 [B6(d)] RSS-GEN [8.9]	Out-of Band Emissions	Emissions outside of the specified band (13.110-14.010 MHz) must meet the radiated limits detailed in 15.209		C Note 3
15.225 (e)	RSS-210 [B6]	Frequency Stability	± 0.01 % of operating frequency	Temp & Humid Test Chamber	C
15.207	RSS-Gen [8.8]	AC Conducted Emissions	FCC Part 15.207	AC Line Conducted	C
15.203	-	Antenna Requirements	FCC Part 15.203	-	C

Note 1: C=Comply NC=Not Comply NT=Not Tested NA=Not Applicable

Note 2: For radiated emission tests below 30 MHz were performed on semi-anechoic chamber which is correlated with OATS.

Note 3: This test items were performed both normal and Dual Screen capability conditions.

4.2 Transmitter requirements

4.2.1 20dB bandwidth

- Procedure:

The 20 dB Bandwidth is measured with a spectrum analyzer connected via a receive antenna placed near the EUT while the EUT is operating in transmission mode.

And spectrum analyzer setting use following test procedure of **ANCSI C63.10-2013 – Section 6.9.2.**

1. Center frequency = EUT channel center frequency
2. Span = 2 ~ 5 times the OBW
3. RBW = 1 % ~ 5 % OBW
4. VBW $\geq 3 \times$ RBW
5. Detector = Peak
6. Trace = Max hold
7. The trace was allowed to stabilize
8. Determine the reference value = Set the spectrum analyzer marker to the highest level of the displayed trace
9. Using the marker-delta function of the instrument, determine the “-xx dB down amplitude” using [(reference value) - xx].
10. Reset the marker-delta function and move the marker to the other side of the emission until the delta marker amplitude is at the same level as the reference marker amplitude. The marker-delta frequency reading at this point is the specified emission bandwidth.

- Measurement Data: **Comply**

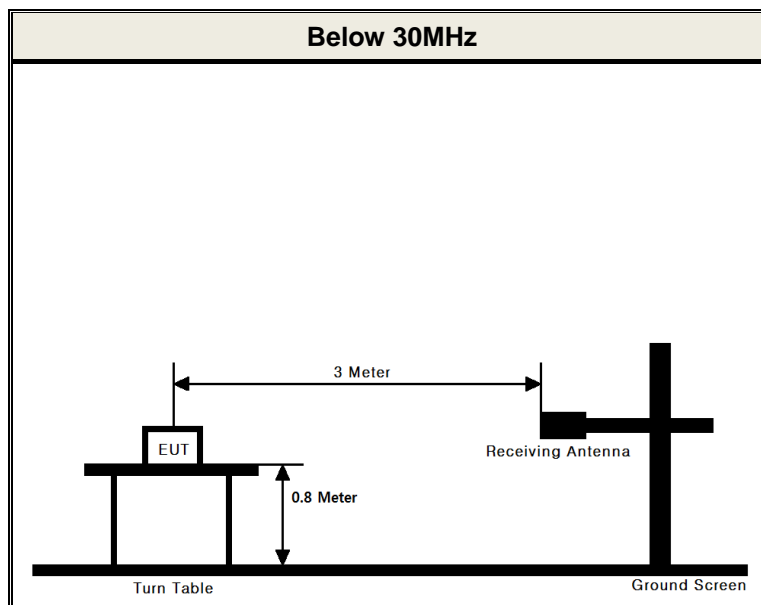


Note: The 20dB bandwidth was measured at all data rate and the worst case data was reported (This test item was tested at 424 kbps.)

- Minimum Standard: NA

4.2.2 In-band emissions

- Test Configuration



- Procedure: The radiated emission was tested according to the **section 6.4 of the ANSI C63.10-2013**.

The EUT was placed on a 0.8 m high non-conductive table and it was placed at 3m distance from the antenna. Measurements were performed for each of the three antenna orientations. (ie. parallel, perpendicular, and ground-parallel)

Also, measurements were performed with the EUT oriented in 3 orthogonal axis and rotated 360 degrees to determine worst-case orientation for maximum emissions.

RBW = As specified in below table, VBW $\geq 3 \times$ RBW, Sweep = Auto, Detector = Peak
Trace mode = Max Hold until the trace stabilizes.

Frequency	RBW
9-150 kHz	200-300 Hz
0.15-30 MHz	9-10 kHz
30-1000 MHz	100-120 kHz
> 1000 MHz	1 MHz

- Minimum Standard: Part 15.225(a), (b), (c) & RSS-210 [B6(a), (b), (c)]

Frequency Band [MHz]	Limit at 30 m measurement distance	
	[uV/m]	[dBuV/m]
13.553-13.567	15,848	84.00
13.410-13.553 13.567-13.710	334	50.47
13.110-13.410 13.710-14.010	106	40.51

- Measurement Data: Test mode 1

Tested Frequency : 13.56 MHz
Measurement Distance : 3 Meters

Test Frequency Band [MHz]	Freq. [MHz]	EUT Axis.	ANT (Note 1)	Reading Level [dBuV]	T.F [dB/m]	Field Strength @3 m [dBuV/m]	Field Strength @30 m [dBuV/m]	Limit [dBuV/m]	Margin [dB]
13.110 ~ 13.410	13.351	Y	P	15.20	19.10	34.30	-5.70	40.51	46.21
13.410 ~ 13.553	13.553	Y	P	21.80	19.10	40.90	0.90	50.47	49.57
13.553 ~ 13.567	13.561	Y	P	29.30	19.10	48.40	8.40	84.00	75.60
13.567 ~ 13.710	13.567	Y	P	25.90	19.10	45.00	5.00	50.47	45.47
13.710 ~ 14.010	13.774	Y	P	15.80	19.10	34.90	-5.10	40.51	45.61

- Measurement Data: Test mode 2

Tested Frequency : 13.56 MHz
Measurement Distance : 3 Meters

Test Frequency Band [MHz]	Freq. [MHz]	EUT Axis.	ANT (Note 1)	Reading Level [dBuV]	T.F [dB/m]	Field Strength @3 m [dBuV/m]	Field Strength @30 m [dBuV/m]	Limit [dBuV/m]	Margin [dB]
13.110 ~ 13.410	13.348	Y	P	15.80	19.10	34.90	-5.10	40.51	45.61
13.410 ~ 13.553	13.553	Y	P	22.90	19.10	42.00	2.00	50.47	48.47
13.553 ~ 13.567	13.561	Y	P	30.40	19.10	49.50	9.50	84.00	74.50
13.567 ~ 13.710	13.567	Y	P	26.80	19.10	45.90	5.90	50.47	44.57
13.710 ~ 14.010	13.774	Y	P	16.60	19.10	35.70	-4.30	40.51	44.81

Note 1. Loop antenna orientation

“P”: Parallel, “V”: perpendicular, “G”: ground-parallel

Note 2. This test item was performed at 3 m and the data were extrapolated to the specified measurement distance of 30 m using the square of an inverse linear distance extrapolation factor (40 dB/decade) as specified in §15.31(f)2.

▪ Extrapolation Factor = $20 \log_{10}(30/3)^2 = 40 \text{ dB}$

Note 3. All data were recorded using a spectrum analyzer employing a peak detector.

If PK results were meet Quasi-peak limit, Quasi-peak measurements were omitted.

Note 4. Sample Calculation.

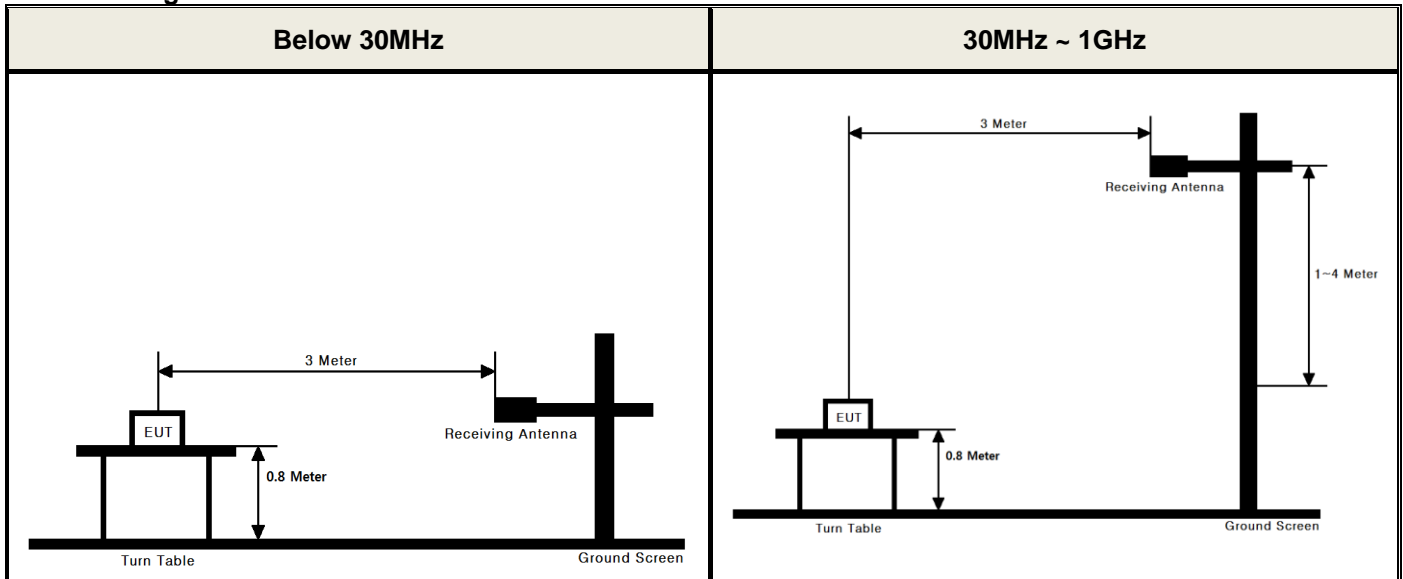
Margin = Limit – Field Strength @ 30 m / Field Strength @ 30 m = Field Strength @ 3 m – 40 dB

Field Strength @ 3 m = Reading + T.F / T.F = AF + CL

Where, T.F = Total Factor, AF = Antenna Factor, CL = Cable Loss

4.2.3 Out-of-band emissions

- Test configuration



- **Procedure:** The radiated emission was tested according to the **section 6.4, 6.5 of the ANSI C63.10-2013.**

The EUT was tested from 9 kHz up to the 1 GHz excluding the band 13.110-14.010 MHz.

The EUT was placed on a 0.8 m high non-conductive table and it was placed at 3m distance from the antenna. For measurements below 30MHz were performed for each of the three antenna orientations.

(ie. parallel, perpendicular, and ground-parallel) For measurements above 30MHz were performed for each of the both horizontal and vertical polarizations.

Also, measurements were performed with the EUT oriented in 3 orthogonal axis and rotated 360 degrees to determine worst-case orientation for maximum emissions.

RBW = As specified in below table, VBW $\geq 3 \times$ RBW, Sweep = Auto, Detector = Peak
Trace mode = Max Hold until the trace stabilizes.

Frequency	RBW
9-150 kHz	200-300 Hz
0.15-30 MHz	9-10 kHz
30-1000 MHz	100-120 kHz
> 1000 MHz	1 MHz

- **Minimum Standard: Part 15.209, 225(d) & RSS-210[B6(d)], RSS-GEN[8.9]**

• **FCC Part 15.209(a):**

Frequency [MHz]	Field Strength [$\mu\text{V/m}$]	Measurement Distance [Meters]
0.009 ~ 0.490	2400/F(kHz)	300
0.490 ~ 1.705	24000/F(kHz)	30
1.705 ~ 30	30	30
30 ~ 88	100 **	3
88 ~ 216	150 **	3
216 ~ 960	200 **	3
Above 960	200	3

** Except as provided in 15.209(g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g. 15.231 and 15.241.

• **FCC Part 15.209(b):**

In the emission table above, the tighter limit applies at the band edges.

- Measurement Data: Test mode 1

Tested Frequency : 13.56 MHz
Measurement Distance : 3 Meters

Frequency [MHz]	EUT Axis.	ANT (Note 1)	Reading [dBuV]	T.F [dB/m]	Distance factor [dB]	Field Strength [dBuV/m]	Limit [dBuV/m]	Margin [dB]
0.498	Y	P	21.8	18.7	80	-39.5	23.0	62.5
0.557	Y	P	19.7	18.7	40	-1.6	32.4	34
0.764	Y	P	20.4	18.7	40	-0.9	26.0	26.9
12.564	Y	P	13.9	19.1	40	-7.0	29.5	36.5
16.755	Y	P	15.3	19.6	40	-5.1	29.5	34.6
27.270	Y	P	12.9	20.2	40	-6.9	29.5	36.4
38.730	Y	V	39.7	-9.5	0	30.2	40.0	9.8
57.160	Y	V	36.1	-9.1	0	27.0	40.0	13.0
741.974	Y	H	31.4	3.8	0	35.2	46.0	10.8
873.890	Y	H	30.8	5.6	0	36.4	46.0	9.6
893.289	Y	H	31.5	5.8	0	37.3	46.0	8.7

- Measurement Data: Test mode 2

Tested Frequency : 13.56 MHz
Measurement Distance : 3 Meters

Frequency [MHz]	EUT Axis.	ANT (Note 1)	Reading [dBuV]	T.F [dB/m]	Distance factor [dB]	Field Strength [dBuV/m]	Limit [dBuV/m]	Margin [dB]
0.492	Y	P	23.3	18.7	80	-38	34.7	72.7
0.692	Y	P	20.6	18.7	40	-0.7	30	30.7
12.879	Y	P	14.1	19.1	40	-6.8	28.5	35.3
22.755	Y	P	16.2	19.5	40	-4.3	29.5	33.8
27.120	Y	P	12.3	20.2	40	-7.5	29.5	37
30.970	Y	H	39.3	-10.2	0	29.1	40	10.9
31.940	Y	V	46.6	-10.1	0	36.5	40	3.5
44.550	Y	V	40.1	-8.3	0	31.8	40	8.2
84.320	Y	V	38.3	-13	0	25.3	40	14.7
191.990	Y	H	42.6	-9.6	0	33	43.5	10.5
627.517	Y	V	37.7	1.3	0	39	46	7.0
904.929	Y	H	32.8	6	0	38.8	46	7.2
917.538	Y	H	32.7	6.4	0	39.1	46	6.9
937.908	Y	H	33.1	6.8	0	39.9	46	6.1
942.758	Y	V	33	6.8	0	39.8	46	6.2

Note 1. Loop antenna orientation (30 MHz Below)

“P”= Parallel, “V”= perpendicular, “G”= ground-parallel

Bilog antenna polarization (30 MHz above)

“H”= Horizontal, “V”= Vertical

Note 2. All data were recorded using a spectrum analyzer employing a peak detector.

If PK results were meet Quasi-peak limit, Quasi-peak measurements were omitted.

Note 3. No other spurious and harmonic emissions were reported greater than listed emissions above table.

Note 4. Sample calculation

Margin = Limit – Field Strength

Field Strength = Reading + T.F – Distance factor

T.F = AF + CL – AG

Distance factor = $20\log(\text{Measurement distance} / \text{The measured distance})^2$

Where, T.F = Total Factor, AF = Antenna Factor, CL = Cable Loss, AG = Amplifier Gain

4.2.4 Frequency Stability

- Procedure:

Part 15.225 requires that devices operating in the 13.553 – 13.567 MHz shall maintain the carrier frequency within 0.01 % of the operating frequency over the temperature variation of -20 degrees to + 50 degrees C at normal supply voltage.

- Measurement Data: Comply

Operating Frequency : 13,560,000 Hz

VOLTAGE (%)	POWER (V _{DC})	TEMP (°C)	Frequency (Hz)	Freq. Dev. (Hz)	Deviation (%)
100%	3.870	+20(ref)	13,560,473	473	0.003490
100%		-20	13,560,214	214	0.001579
100%		-10	13,560,103	103	0.000761
100%		0	13,560,063	63	0.000467
100%		+10	13,560,321	321	0.002369
100%		+20	13,560,473	473	0.003490
100%		+30	13,560,245	245	0.001808
100%		+40	13,560,615	615	0.004537
100%		+50	13,560,184	184	0.001358
115%	4.451	+20	13,560,310	310	0.002282
BATT.ENDPOINT	2.300	+20	13,560,021	21	0.000157

- Minimum Standard: Part 15. 225(e) & RSS-210 [B6]

The frequency tolerance of the carrier signal shall be maintained within ± 0.01 % of the operating frequency.

4.2.5 AC Line Conducted Emissions

- Test Requirements and limit

For an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 μ H/50 ohms line impedance stabilization network (LISN).

Frequency Range (MHz)	Conducted Limit (dBuV)	
	Quasi-Peak	Average
0.15 ~ 0.5	66 to 56 *	56 to 46 *
0.5 ~ 5	56	46
5 ~ 30	60	50

* Decreases with the logarithm of the frequency

Compliance with this provision shall be based on the measurement of the radio frequency voltage between each power line (LINE and NEUTRAL) and ground at the power terminals.

- Test Configuration

See test photographs for the actual connections between EUT and support equipment.

- Test Procedure

1. The EUT is placed on a wooden table 80 cm above the reference ground plane.
2. The EUT is connected via LISN to a test power supply.
3. The measurement results are obtained as described below:
4. Detectors – Quasi Peak and Average Detector.

- **Measurement Data:** **Comply** (refer to the next page)

Test mode 1

Measurement Data

Results of Conducted Emission

DTNC

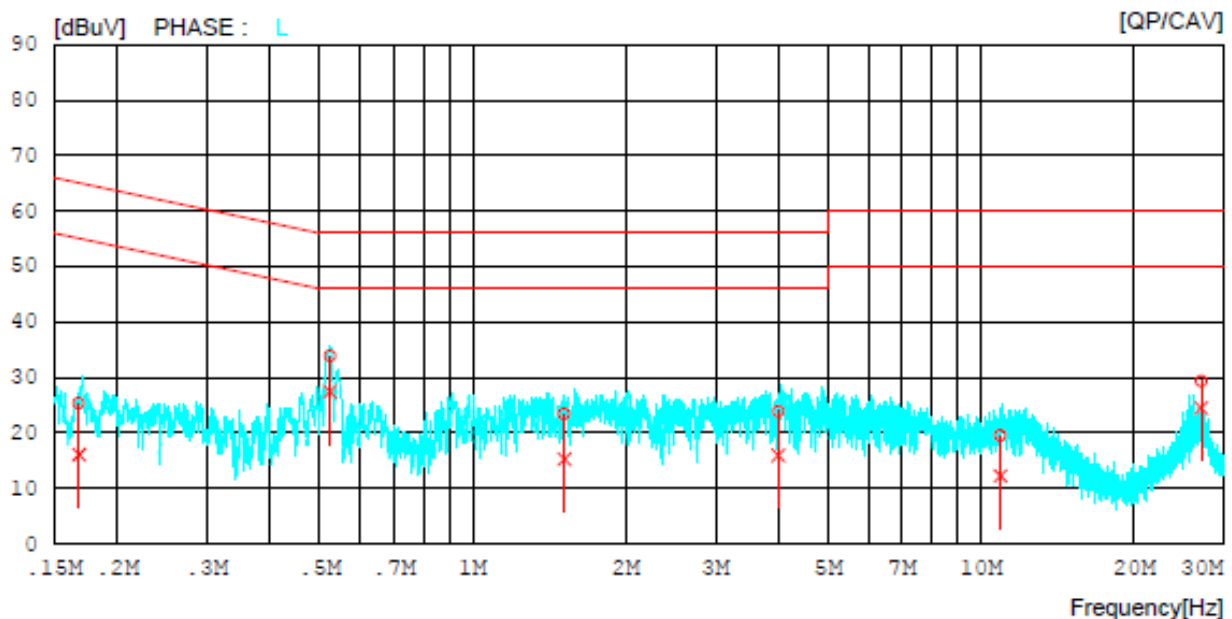
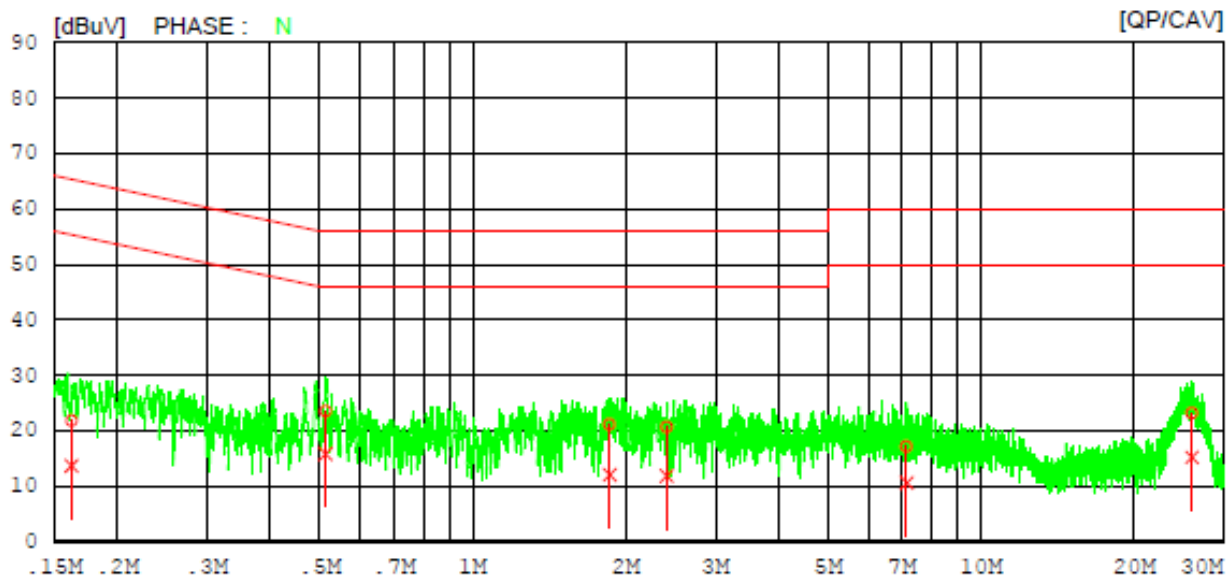
Date 2019-12-27

Order No.
Model No. OA2001
Serial No.
Test Condition NFC

Reference No.
Power Supply 120 V, 60 Hz
Temp/Humi. 23 °C / 35 %
Operator Kim Jung woo

Memo

LIMIT : FCC P15.207 QP
FCC P15.207 AV



Measurement Data

Results of Conducted Emission

DTNC

Date 2019-12-27

Order No.		Reference No.	
Model No.	OA2001	Power Supply	120 V, 60 Hz
Serial No.		Temp/Humi.	23 °C / 35 %
Test Condition	NFC	Operator	Kim Jung woo

Memo

LIMIT : FCC P15.207 QP
FCC P15.207 AV

NO	FREQ [MHz]	READING		C.FACTOR [dB]	RESULT		LIMIT		MARGIN		PHASE
		QP [dBuV]	CAV [dBuV]		QP [dBuV]	CAV [dBuV]	QP [dBuV]	CAV [dBuV]	QP [dBuV]	CAV [dBuV]	
1	0.16222	11.92	3.74	9.94	21.86	13.68	65.35	55.35	43.49	41.67	N
2	0.51328	13.52	5.94	9.95	23.47	15.89	56.00	46.00	32.53	30.11	N
3	1.85900	11.13	2.03	10.03	21.16	12.06	56.00	46.00	34.84	33.94	N
4	2.40667	10.61	1.78	10.05	20.66	11.83	56.00	46.00	35.34	34.17	N
5	7.13247	6.96	0.43	10.22	17.18	10.65	60.00	50.00	42.82	39.35	N
6	26.00747	12.54	4.55	10.68	23.22	15.23	60.00	50.00	36.78	34.77	N
7	0.16778	15.30	6.06	9.94	25.24	16.00	65.07	55.07	39.83	39.07	L
8	0.52350	23.86	17.44	9.95	33.81	27.39	56.00	46.00	22.19	18.61	L
9	1.51413	13.37	5.26	10.01	23.38	15.27	56.00	46.00	32.62	30.73	L
10	3.98773	13.74	5.80	10.11	23.85	15.91	56.00	46.00	32.15	30.09	L
11	10.91342	9.19	1.87	10.36	19.55	12.23	60.00	50.00	40.45	37.77	L
12	27.12044	18.63	13.76	10.67	29.30	24.43	60.00	50.00	30.70	25.57	L

APPENDIX

TEST EQUIPMENT FOR TESTS

Type	Manufacturer	Model	Cal.Date (yy/mm/dd)	Next.Cal.Date (yy/mm/dd)	S/N
Spectrum Analyzer	Agilent Technologies	N9020A	18/12/19	19/12/19	MY49060056
			19/12/16	20/12/16	
Spectrum Analyzer	Agilent Technologies	N9020A	18/12/16	19/12/16	MY46471251
			19/12/19	20/12/19	
DC Power Supply	Agilent Technologies	66332A	18/12/18	19/12/18	US37476998
			19/12/16	20/12/16	
Multimeter	FLUKE	17B	18/12/16	19/12/16	26030065WS
			19/12/19	20/12/19	
Signal Generator	Rohde Schwarz	SMBV100A	18/12/19	19/12/19	255571
			19/12/16	20/12/16	
Thermohygrometer	BODYCOM	BJ5478	18/12/27	19/12/27	120612-1
			19/12/18	20/12/18	
Thermohygrometer	BODYCOM	BJ5478	18/12/27	19/12/27	120612-2
			19/12/18	20/12/18	
Loop Antenna	ETS-Lindgren	6502	19/09/18	20/09/18	00226186
Loop Antenna	Schwarzbeck	FMZB1513	18/01/30	20/01/30	1513-128
BILOG ANTENNA	Schwarzbeck	VULB 9160	19/04/23	21/04/23	9160-3362
PreAmplifier	H.P	8447D	18/12/18	19/12/18	2944A07774
			19/12/16	20/12/16	
Temp & Humi Test Chamber	SJ Science	SJ-TH-S50	19/06/25	20/06/25	SJ-TH-S50-130930
EMI Receiver	ROHDE&SCHWARZ	ESW44	19/07/30	20/07/30	101645
Cable	Radiall	TESTPRO3	19/01/16	20/01/16	M-01
			20/01/16	21/01/16	
Cable	Junkosha	MWX315	19/01/16	20/01/16	M-05
			20/01/16	21/01/16	
Cable	Junkosha	MWX221	19/01/16	20/01/16	M-06
			20/01/16	21/01/16	
Thermohygrometer	TESTO	608-H1	19/01/31	20/01/31	34862883
EMI Test Receiver	Rohde Schwarz	ESC17	19/01/30	20/01/30	100910
PULSE LIMITER	Rohde Schwarz	ESH3-Z2	19/09/17	20/09/17	101333
LISN	SCHWARZBECK	NNLK 8121	19/05/23	20/05/23	6183
Cable	DT&C	Cable	19/01/16	20/01/16	RF-82
			20/01/16	21/01/16	

Note1: The measurement antennas were calibrated in accordance to the requirements of ANSI C63.5-2017

Note2: The cable is not a regular calibration item, so it has been calibrated by DT & C itself.