



TEST REPORT

EMI Test for FCC Certification of PWFMDDB200 Model

APPLICANT
LG Electronics Inc.

REPORT NO.
HCT-EM-2104-FC001

DATE OF ISSUE
May 12, 2021

Tested by
Hyun-Jin Lim

Technical Manager
Jeong-Hyun Choi

HCT CO., LTD.
Bongjai Huh
BongJai Huh / CEO

Accredited by KOLAS, Republic of KOREA



HCT Co., Ltd.

74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, 17383 KOREA
Tel. +82 31 645 6300 Fax. +82 31 645 6401



<h1 style="margin: 0;">TEST REPORT</h1> <p style="margin: 0;">EMI Test for FCC Certification</p>	<p>REPORT NO. HCT-EM-2104-FC001</p> <p>DATE OF ISSUE May 12, 2021</p> <p>FCC ID. BEJPWFMDB200</p>
--	---

Applicant	LG Electronics Inc. 84, Wanam-ro, Seongsan-gu, Changwon-si, Gyeongsangnam-do, 51554, Korea
Product Name	Cloud Gateway
Model Name	PWFMDB200
Date of Test	April 01, 2021
Test Standard Used	FCC CFR 47 PART 15 Subpart B Class B ANSI C63.4-2014
Test Results	Refer to the present document
Manufacturer	LG Electronics Inc.

The result shown in this test report refer only to the sample(s) tested unless otherwise stated.

This test results were applied only to the test methods required by the standard.



REVISION HISTORY

The revision history for this test report is shown in table.

Revision No.	Date of Issue	Description
0	May 12, 2021	Initial Release

This laboratory is not accredited for the test results marked *.

The above Test Report is the accredited test result by (KS Q) ISO/IEC 17025 and KOLAS (Korea Laboratory Accreditation Scheme), which signed the ILAC-MRA.

* The report shall not be reproduced except in full (only partly) without approval of the laboratory.

CONTENTS

1. GENERAL INFORMATION	5
1.1 Description of EUT	5
1.2 Tested System Details	5
1.3 Cable Description	5
1.4 Noise Suppression Parts on Cable. (I/O Cable)	6
1.5 Test Facility	7
1.6 Calibration of Measuring Instrument	7
1.7 Measurement Uncertainty	7
2. DESCRIPTION OF TEST	8
2.1 Measurement of Conducted Emission	8
2.2 Measurement of Radiated Emission	9
2.3 Configuration of Tested System	10
3. PRELIMINARY TEST	11
3.1 Conducted Emission	11
3.2 Radiated Emission	11
4. EMISSION TEST SUMMARY	12
4.1 Conducted Emission	12
4.2 Radiated Emission Below 1 GHz	13
4.3 Radiated Emission Above 1 GHz	15
5. CONCLUSION	16
6. APPENDIX A. TEST SETUP PHOTOGRAPHS	19



1. GENERAL INFORMATION

1.1 Description of EUT

The EUT is Cloud Gateway.

FCC ID	BEJPWFMDB200
Model Name	PWFMDB200
Product Name	Cloud Gateway
Frequency Range	2 412 MHz to 2 462 MHz
Power Supply Voltage	DC 12 V
Manufacturer	LG Electronics Inc.

1.2 Tested System Details

All equipment descriptions used in the tested system (including inserted cards) are:

Device Type	Model Name	Serial Number	Manufacturer
EUT	PWFMDB200	-	LG Electronics
DC Power Supply	PWS-3003D	04050810	Protek
Outdoor Simulator	-	-	LG Electronics
Outdoor Simulator Adaptor	PA-1041-0	L21542003642	LITE-ON Power Technology (DONGGUAN)
RJ45 Cable	-	-	-
Notebook PC	HP ProBook 650 G1	5CG5520P9J	HP
Notebook PC Adaptor	Series PPP014H-S	F1-09040230370D	Hipro Electronics (Suzhou)
Serial Mouse	Serial 2 Button mouse	02031069	Radio Shack

NOTE.

1. This product is used by receiving 12 VDC power supply.
2. WiFi 2.4 GHz mode and Ethernet communication mode are not used simultaneously in the environment in which they are used.

1.3 Cable Description

Product Name	Port	Power Cord Shielded (Y/N)	I/O Cable Shielded (Y/N)	Length (m)
EUT	DC IN	Y	Y	(P) 3.0
	RS485	Y	Y	(D) 3.0
	LAN	N	N	(D) 3.0
Outdoor Simulator	DC IN	N	N/A	(P) 1.8
	RS485	Y	Y	(D) 3.0
Outdoor Simulator Adaptor	AC IN	N	N/A	(P) 1.8
Notebook PC	LAN	N	N	(D) 3.0
	DC IN	N	N/A	(P) 1.8
	Serial	N	N/A	(D) 3.0
Notebook PC Adaptor	AC IN	N	N/A	(P) 1.8
DC Power Supply	AC IN	N	N/A	(P) 1.8

NOTE. The marked "(D)" means the data cable and "(P)" means the power cable.

1.4 Noise Suppression Parts on Cable (I/O Cable)

Product Name	Port	Ferrite Bead (Y/N)	Location	Metal Hood (Y/N)	Location
EUT	DC IN	N	N/A	N	N/A
	RS485	N	N/A	N	N/A
	LAN	N	N/A	N	N/A
Outdoor Simulator	DC IN	N	N/A	N	N/A
	RS485	N	N/A	N	N/A
Outdoor Simulator Adaptor	AC IN	N	N/A	N	N/A
Notebook PC	LAN	N	N/A	Y	Both End
	DC IN	Y	Notebook PC End	Y	Notebook PC End
	Serial	N	N/A	Y	Both End
Notebook PC Adaptor	AC IN	N	N/A	N	N/A
DC Power Supply	AC IN	N	N/A	N	N/A

1.5 Test Facility

Test site is located at 74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, Rep. of Korea. Those measurement facilities are constructed in conformance with the requirements of ANSI C63.4-2014. The Normalized site attenuations (30 MHz to 1 GHz) and Site validation (1 GHz to 18 GHz) were performed in accordance with the standard in ANSI C63.4-2014. This testing laboratories are accredited and accordance with the recognized international Standard ISO/IEC 17025:2017. (KOLAS, Accreditation No. KT197)

1.6 Calibration of Measuring Instrument

The measuring equipment, which was utilized in performing the tests documented herein, has been calibrated in accordance with the manufacturers recommendations for utilizing calibration equipment, which is traceable to recognized national standards. Especially, all antenna for measurement is calibrated in accordance with the requirements of C63.5:2017

1.7 Measurement Uncertainty

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI C63.4-2014. 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.

Test Item	Test Site (Chamber)	Expanded Uncertainty
Radiated Emissions (30 MHz to 1 GHz)	3 m Semi Anechoic Chamber #1	4.9 dB
Radiated Emissions (1 GHz to 18 GHz)	3 m Semi Anechoic Chamber #1	4.6 dB



2. DESCRIPTION OF TEST

2.1 Measurement of Conducted Emission

The test procedure was in accordance with ANSI C63.4-2014, Clause 7.3

- a. The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN).
 If the EUT is connected to the PC through USB, the AC power-line adapter of the PC is directly connected to a line impedance stabilization network (LISN).
 Other support units were connected to the power mains through another LISN.
 The two LISNs provide $50 \Omega / 50 \mu\text{H}$ of coupling impedance for the measuring instrument.
- b. Both conducted lines are measured in Quasi-Peak and Average mode, including the worst-case data points for each tested configuration.
- c. The frequency range from 150 kHz to 30 MHz was searched.

[Conducted Emission Limits]

FCC Part15 Subpart B

Frequency (MHz)	Class A		Class B	
	Quasi-Peak (dB μ V)	Average (dB μ V)	Quasi-Peak (dB μ V)	Average (dB μ V)
0.15 to 0.5	79	66	66 to 56*	56 to 46*
0.5 to 5	73	60	56	46
5 to 30	73	60	60	50

[*] Decreases with the logarithm of the frequency.



2.2 Measurement of Radiated Emission

The test procedure was in accordance with ANSI C63.4-2014, Clause 8.3

- a. The EUT was placed on the top of a turn table 0.8 meters above the ground at a semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 m away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. The antenna height is varied from 1 m to 4 m above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 m to 4 m and the turn table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to Quasi-Peak detect function and specified bandwidth with maximum hold mode when the test frequency is below 1 GHz.
- f. The test-receiver system was set to Peak and Average detect function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz.
- g. Place the measurement antenna away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response. (1 GHz to 40 GHz)

[Radiated Emission Limits]

FCC Part15 Subpart B

Frequency (MHz)	Class A			Class B		
	Antenna Distance (m)	Field Strength (μV/m)	Quasi-Peak (dBμV/m)	Antenna Distance (m)	Field Strength (μV/m)	Quasi-Peak (dBμV/m)
30 to 88	10	90	39.0	3	100	40.0
88 to 216	10	150	43.5	3	150	43.5
216 to 960	10	210	46.4	3	200	46.0
Above 960	10	300	49.5	3	500	54.0
Frequency (MHz)	Antenna Distance (m)	Class A		Class B		
		Peak (dBμV/m)	Average (dBμV/m)	Peak (dBμV/m)	Average (dBμV/m)	
Above 1 000	3	80	60	74	54	

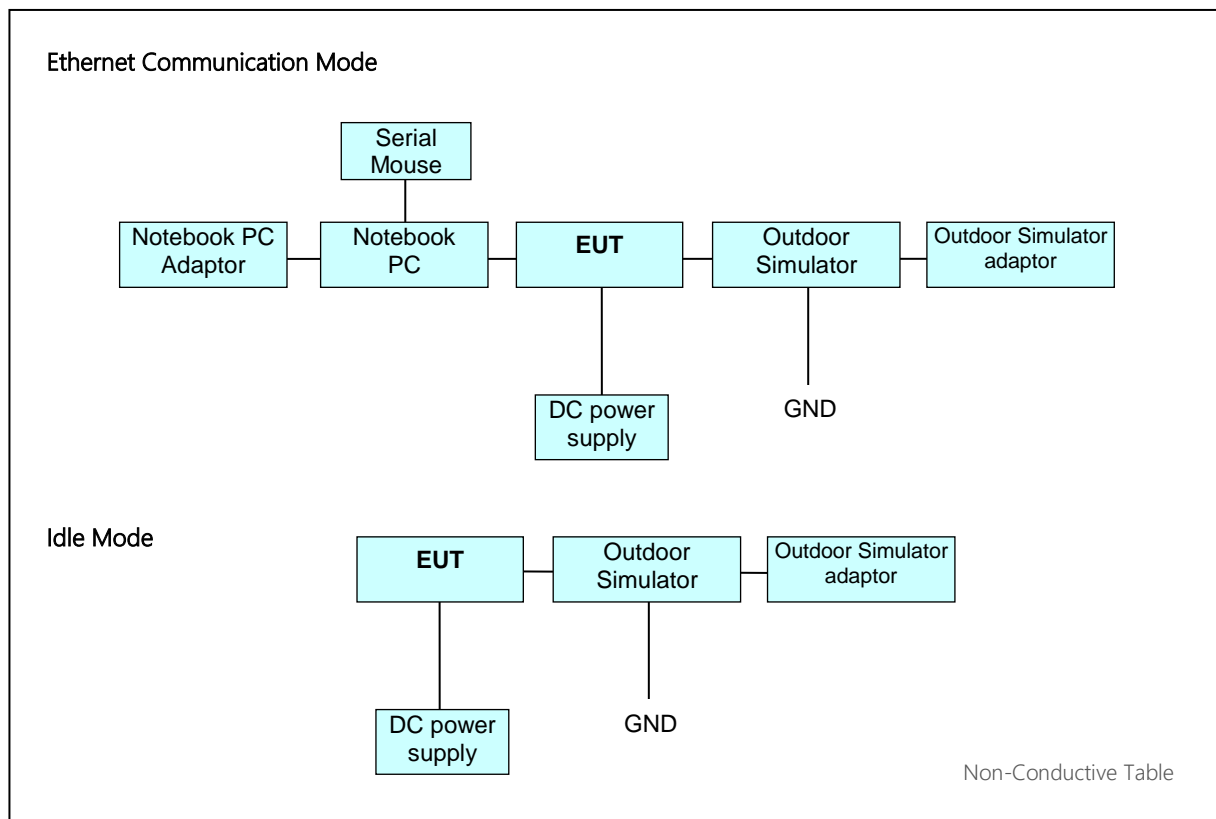
2.2.1 Frequency Range of Radiated Measurements

An unintentional radiator, including a digital device, the spectrum shall be investigated from the lowest radio frequency signal generated or used in the device, without going below the lowest frequency for which a Radiated Emission limit is specified, up to the frequency shown in the following table

FCC Part15 Subpart B

Highest frequency generated or used in the device or on which the device operates or tunes (MHz)	Upper frequency of measurement range (MHz)
Below 1.705	30
1.705 to 108	1 000
108 to 500	2 000
500 to 1 000	5 000
Above 1 000	5th harmonic of the highest frequency or 40 GHz, whichever is lower

2.3 Configuration of Tested System



3. PRELIMINARY TEST

3.1 Conducted Emission (Not Applicable)

It was tested the following operating mode, after connecting all peripheral devices.

Operating Modes: Not applicable

3.2 Radiated Emission

It was tested the following operating mode, after connecting all peripheral devices.

Operating Modes: Ethernet Communication mode
IDLE mode



4. CONDUCTED EMISSION AND RADIATED EMISSION TEST SUMMARY

4.1 Conducted Emission (Not Applicable)

4.1.1 Measuring instruments

Type	Model Name	Manufacturer	Serial Number	Calibration Cycle	Calibration Date
<input type="checkbox"/> EMI test receiver	ESR7	Rohde & Schwarz	101910	1 year	09.16.2020
<input type="checkbox"/> LISN	ENV216	Rohde & Schwarz	102245	1 year	09.04.2020
<input type="checkbox"/> LISN	ENV216	Rohde & Schwarz	100073	1 year	04.07.2021
<input type="checkbox"/> Software	EMC32	Rohde & Schwarz	-	-	-

4.1.2 Operating Condition

The test results of conducted emission at mains ports provide the following information:

Test Standard Used	FCC CFR 47 PART 15 Subpart B Class B ANSI C63.4-2014
Detector	Quasi-Peak, CISPR-Average
Bandwidth	9 kHz (6 dB)
Test Site	EMI Shield Room
Temperature	- °C
Relative Humidity	- %
Test Date	-

- Calculation Formula:**
1. Conductor L1 = Hot, Conductor N = Neutral
 2. Corr. = LISN Factor + Cable Loss
 3. QuasiPeak or CAverage= Receiver Reading + Corr.
 4. Margin = Limit – QuasiPeak or CAverage

4.2 Radiated Emission Below 1 GHz

4.2.1 Measuring instruments

Type	Model Name	Manufacturer	Serial Number	Calibration Cycle	Calibration Date
<input checked="" type="checkbox"/> EMI test receiver	ESU40	Rohde & Schwarz	100524	1 year	05.12.2020
<input checked="" type="checkbox"/> Bilog antenna	VULB9168	Schwarzbeck	255	2 year	03.15.2021
<input checked="" type="checkbox"/> Antenna master	MA4640-XP-ET	INNCO SYSTEM	-	-	-
<input checked="" type="checkbox"/> Antenna master controller	CO3000	INNCO SYSTEM	CO3000/870 /35990515/L	-	-
<input checked="" type="checkbox"/> Turn Table	1060	INNCO SYSTEM	-	-	-
<input checked="" type="checkbox"/> Turn Table controller	CO2000	INNCO SYSTEM	CO2000/095 /7590304/L	-	-
<input checked="" type="checkbox"/> Software	EMC32	Rohde & Schwarz	-	-	-

4.2.2 Operating Condition

The test results of radiated emission provide the following information:

Used Test Standard	FCC CFR 47 PART 15 Subpart B Class B ANSI C63.4-2014
Detector	Quasi-Peak
Bandwidth	120 kHz (6 dB)
Test Site	3 m Semi Anechoic Chamber #1
Temperature	23.0 °C
Relative Humidity	45.6 %
Test Date	April 01, 2021

- Calculation Formula:**
1. POL. H = Horizontal, POL. V = Vertical
 2. QuasiPeak = Reading (Receiver Reading) + Corr.
 3. Corr. (Correction Factor) = Antenna Factor + Cable Loss
 4. Margin = Limit - QuasiPeak

4.2.3 Measuring Data

Ethernet Communication mode

Frequency (MHz)	Quasi Peak (dB μ V/m)	Antenna Height (cm)	POL. (H/V)	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dB μ V/m)
35.918440	29.6	117.7	V	134.0	18.9	10.4	40.0
47.755360	29.9	100.0	V	145.0	19.9	10.1	40.0
50.409960	32.1	100.0	V	135.0	20.0	7.9	40.0
68.664320	25.2	100.0	V	128.0	18.4	14.8	40.0
181.783840	33.2	100.0	V	1.0	18.2	10.3	43.5
256.625640	39.4	117.9	H	127.0	18.9	6.6	46.0

IDLE mode

Frequency (MHz)	Quasi Peak (dB μ V/m)	Antenna Height (cm)	POL. (H/V)	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dB μ V/m)
35.476800	29.8	100.0	V	50.0	18.9	10.2	40.0
68.740360	33.6	100.0	V	277.0	18.4	6.4	40.0
181.852960	31.0	225.1	H	57.0	18.2	12.5	43.5
296.938800	38.6	116.7	V	343.0	20.4	7.4	46.0
500.001040	37.9	100.0	V	233.0	25.4	8.1	46.0
519.740000	35.8	100.0	V	360.0	25.8	10.2	46.0
544.517680	40.2	174.9	V	102.0	26.3	5.8	46.0

4.3 Radiated Emission Above 1 GHz

4.3.1 Measuring instruments

Type	Model Name	Manufacturer	Serial Number	Calibration Cycle	Calibration Date
<input checked="" type="checkbox"/>	EMI test receiver	ESU40	Rohde & Schwarz	100524	1 year 05.12.2020
<input checked="" type="checkbox"/>	Antenna master	MA4640-XP-ET	INNCO SYSTEM	-	-
<input checked="" type="checkbox"/>	Antenna master controller	CO3000	INNCO SYSTEM	CO3000/870/ 35990515/L	-
<input checked="" type="checkbox"/>	Turn table	1060	INNCO SYSTEM	-	-
<input checked="" type="checkbox"/>	Turn table controller	CO2000	INNCO SYSTEM	CO2000/095/ 7590304/L	-
<input checked="" type="checkbox"/>	Low noise amplifier	TK-PA18H	TESTEK	170034-L	1 year 03.02.2021
<input checked="" type="checkbox"/>	Horn antenna	BBHA 9120D	Schwarzbeck	01836	1 year 07.23.2020
<input checked="" type="checkbox"/>	Software	EMC32	Rohde & Schwarz	-	-

4.3.2 Operating Condition

The test results of radiated emission provide the following information:

Used Test Standard	FCC CFR 47 PART 15 Subpart B Class B ANSI C63.4-2014
Detector	Peak mode: Peak (RBW: 1 MHz, VBW: 3 MHz) CISPR-Average mode: Peak (RBW: 1 MHz, VBW: 10 Hz)
Highest Frequency	2 462 MHz
Tested Frequency Range	1 GHz to 18 GHz
Test Site	3 m Semi Anechoic Chamber #1
Temperature	23.0 °C
Relative Humidity	45.6 %
Test Date	April 01, 2021

- Calculation Formula:**
1. POL. H = Horizontal, POL. V = Vertical
 2. Peak or CAverage = Reading (Receiver Reading) + Corr.
 3. Corr. (Correction Factor) = Antenna Factor+ Cable Loss –Amplifier Gain
 4. Margin = Limit - Peak or CAverage

4.3.3 Measuring Data

Ethernet Communication mode

Frequency (MHz)	Peak (dB μ V/m)	Antenna Height (cm)	POL. (H/V)	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dB μ V/m)
1328.715000	42.9	202.4	V	0.0	-27.1	31.1	74.0
1999.320000	46.2	100.0	V	51.0	-25.4	27.8	74.0
2592.405000	48.6	299.5	V	59.0	-22.7	25.4	74.0
2663.695000	48.0	110.4	V	68.0	-22.5	26.0	74.0
5974.610000	46.7	100.0	V	114.0	-15.1	27.3	74.0
9891.915000	45.0	249.4	V	112.0	-7.6	29.0	74.0

Frequency (MHz)	CAverage (dB μ V/m)	Antenna Height (cm)	POL. (H/V)	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dB μ V/m)
1328.715000	29.4	202.4	V	0.0	-27.1	24.6	54.0
1999.320000	40.9	100.0	V	51.0	-25.4	13.1	54.0
2592.405000	32.4	299.5	V	59.0	-22.7	21.6	54.0
2663.695000	28.4	110.4	V	68.0	-22.5	25.6	54.0
5974.610000	30.3	100.0	V	114.0	-15.1	23.7	54.0
9891.915000	32.1	249.4	V	112.0	-7.6	21.9	54.0

WiFi 2.4 GHz Carrier Freq: 2 421.2 MHz

WiFi 2.4 GHz Harmonic Freq: 4 923.6 MHz, 7 354.6 MHz, 12.18 GHz, 17.19 GHz



IDLE mode

Frequency (MHz)	Peak (dB μ V/m)	Antenna Height (cm)	POL. (H/V)	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dB μ V/m)
1191.145000	43.1	248.9	H	213.0	-27.5	30.9	74.0
1980.135000	36.2	100.0	H	197.0	-25.4	37.8	74.0
2771.985000	42.7	189.4	H	252.0	-22.2	31.3	74.0
3565.385000	35.9	190.5	H	12.0	-20.5	38.1	74.0
7864.560000	42.7	242.5	H	200.0	-10.2	31.3	74.0
10923.695000	45.8	149.5	V	267.0	-4.5	28.2	74.0

Frequency (MHz)	CAverage (dB μ V/m)	Antenna Height (cm)	POL. (H/V)	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dB μ V/m)
1191.145000	26.8	248.9	H	213.0	-27.5	27.2	54.0
1980.135000	26.8	100.0	H	197.0	-25.4	27.2	54.0
2771.985000	25.7	189.4	H	252.0	-22.2	28.3	54.0
3565.385000	22.2	190.5	H	12.0	-20.5	31.8	54.0
7864.560000	29.7	242.5	H	200.0	-10.2	24.3	54.0
10923.695000	33.2	149.5	V	267.0	-4.5	20.8	54.0

WiFi 2.4 GHz Carrier Freq: 2 411 MHz

WiFi 2.4 GHz Harmonic Freq: 4 823.3 MHz, 7 235.6 MHz, 9 647.9 MHz, 12.061 GHz, 14.47 GHz, 16.88 GHz



5. CONCLUSION

The data collected shows that the **Product Name: Cloud Gateway, Model Name: PWFMDB200** complies with §15.107 and §15.109 of the FCC rules



6. APPENDIX A. TEST SETUP PHOTO

Please refer to Appendix. A and test setup photo file no. as follows;

File No.	Date of Issue	Description
HCT-EM-2104-FC001-P	May 12, 2021	Initial Release

End of report