



TEST REPORT

EMI Test for FCC SDoC of MR23GA Model

APPLICANT

LG Electronics Inc.

REPORT NO.

HCT-EM-2207-FC003

DATE OF ISSUE

July 08, 2022

Tested by
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Accredited by KOLAS, Republic of KOREA

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TEST REPORT

EMI Test for
FCC SDoC

REPORT NO.

HCT-EM-2207-FC003

DATE OF ISSUE

July 08, 2022

FCC ID.

BEJMR23GA

Applicant

LG Electronics Inc.

222, LG-ro, Jinwi-myeon, Pyeongtaek-si, Gyeonggi-do,
451-713 Republic of Korea

Product Name

Magic Remote

Model Name

MR23GA

Date of Test

June 04, 2022 to June 09, 2022

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.

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

REVISION HISTORY

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

Revision No.	Date of Issue	Description
0	July 08, 2022	Initial Release

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. (KOLAS Accreditation No. KT197)

If this report is required to confirmation of authenticity, please contact to www.hct.co.kr



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1. GENERAL INFORMATION

1.1 Description of EUT

The EUT is Magic Remote.

FCC ID	BEJMR23GA
Model Name	MR23GA
Product Name	Magic Remote
Frequency Range	2 402 MHz to 2 480 MHz (Bluetooth)
Operating Voltage	DC 3 V (Rated)
Manufacturer	LG Electronics Inc.

NOTE.

This product is a wireless remote controller, it does not have a port to connect peripherals and has a built-in battery (DC 3 V).

1.2 Tested System Details

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

Device Type	Model Name	Serial Number	Manufacturer
Magic Remote	MR23GA	-	LG Electronics Inc.

1.3 Cable Description

Product Name	Port	Power Cord Shielded (Y/N)	I/O Cable Shielded (Y/N)	Length (m)
EUT	-	N/A	N/A	N/A

"(D)" Data cable, "(P)" 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	-	N/A	N/A	N/A	-



1.5 Test Facility

Test site is located at 74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, South 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 and ANSI C63.4a-2017. Our laboratories are accredited and designated in accordance with the provisions of Radio Waves ACT and International Standard ISO/IEC 17025:2017. (National Radio Research Agency, CABID No. KR0032)

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 Emission (30 MHz to 1 GHz)	3 m Semi Anechoic Chamber #1	5.8 dB
Radiated Emission (1 GHz to 18 GHz)	3 m Semi Anechoic Chamber #1	4.8 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

Frequency (MHz)	Resolution Bandwidth (kHz)	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	9	79	66	66 to 56*	56 to 46*
0.5 to 5	9	73	60	56	46
5 to 30	9	73	60	60	50

NOTE. 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

- 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.
- The EUT was set 3 m away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- 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.
- 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.
- 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.
- 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.
- 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

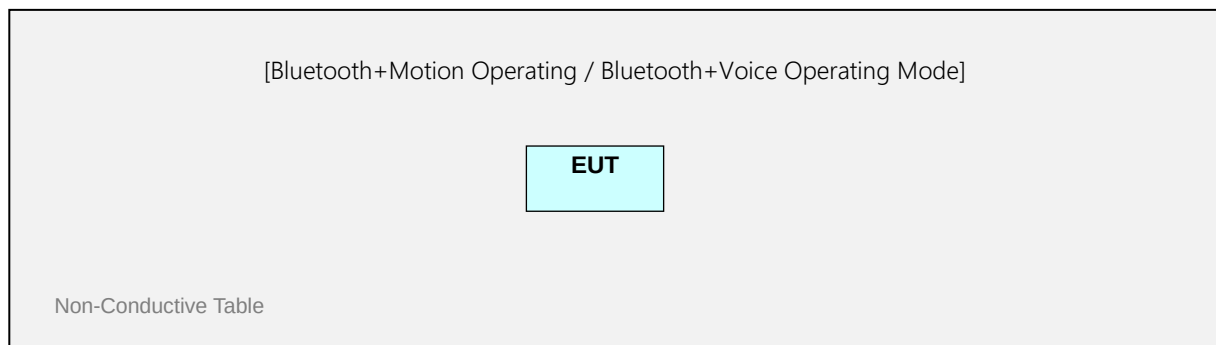
Frequency (MHz)	Class A			Class B		
	Antenna Distance (m)	Field Strength (μ V/m)	Quasi-Peak (dB μ V/m)	Antenna Distance (m)	Field Strength (μ V/m)	Quasi-Peak (dB μ V/m)
30 to 88	10	90	39.0	3	100	40.0
88 to 216	10	150	43.5	3	150	43.5
216 to 960	10	210	46.4	3	200	46.0
Above 960	10	300	49.5	3	500	54.0
Frequency (MHz)	Antenna Distance (m)	Class A		Class B		
		Peak (dB μ V/m)	Average (dB μ V/m)	Peak (dB μ V/m)	Average (dB μ V/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

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. OPERATION OF THE EUT

During preliminary test and final tests, the following operating mode was investigated.

3.1 Conducted Emission (Not applicable)

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

Operating Mode: Not applicable

3.2 Radiated Emission

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

Operating Mode: Bluetooth+Motion Operating mode
Bluetooth+Voice Operating 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
☐ EMI Test Receiver	ESR7	Rohde & Schwarz	101910	1 year	06.07.2022
☐ LISN	ENV216	Rohde & Schwarz	102245	1 year	08.23.2021
☐ LISN	ESH3-Z5	Rohde & Schwarz	100282	1 year	05.16.2022
☐ 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
Frequency Range	0.15 MHz to 30 MHz
Detector	Quasi-Peak, CISPR-Average
Bandwidth	9 kHz (6 dB)
Test Site	EMI Shield Room
Temperature	max. - °C, min. - °C
Relative Humidity	max. - %, min. - %
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

4.1.3 Measuring Data

Not applicable

4.2 Radiated Emission Below 1 GHz

4.2.1 Measuring instruments

Type	Manufacturer	Model Name	Serial Number	Calibration Cycle	Calibration Date
10 m Semi Anechoic Chamber #1					
☐ EMI test receiver	ESU26	Rohde & Schwarz	100241	1 year	06.14.2022
☐ Bilog Antenna	VULB 9168	SCHWARZBECK	847	2 year	05.27.2022
☐ Antenna master	MA4000-EP	INNCO systems	MA4000/283	N/A	-
☐ Turn Table	DT3000-3t	INNCO systems	DT3000/69	N/A	-
☐ Low Noise Amplifier	TK-PA01S	TESTEK	200112-L	1 year	06.14.2022
10 m Semi Anechoic Chamber #2					
☐ EMI Test Receiver	ESW44	Rohde & Schwarz	101946	1 year	07.07.2021
☐ Bilog Antenna	VULB9168	Schwarzbeck	760	2 year	02.22.2021
☐ Ant MAST	MA4000-EP	INNCO systems	-	N/A	-
☐ Ant MAST Controller	CO3000	INNCO systems	CO3000/999/ 40240317/G	N/A	-
☐ Turn Table	DDT6000/3000-5T	INNCO systems	-	N/A	-
☐ Low Noise Amplifier	TK-PA1S	TESTEK	190005-L	1 year	04.11.2022
3 m Semi Anechoic Chamber #1					
☒ EMI Test Receiver	ESU40	Rohde & Schwarz	100524	1 year	05.10.2022
☒ Bilog Antenna	VULB9168	Schwarzbeck	255	2 year	03.15.2021
☒ Antenna master	MA4640-XP-ET	INNCO SYSTEM	-	N/A	-
☒ Antenna master controller	CO3000	INNCO SYSTEM	CO3000/870 /35990515/L	N/A	-
☒ Turn Table	1060	INNCO SYSTEM	-	N/A	-
☒ Turn Table controller	CO2000	INNCO SYSTEM	CO2000/095 /7590304/L	N/A	-
☒ Software	EMC32	Rohde & Schwarz	-	-	-
3 m Semi Anechoic Chamber #2					
☐ EMI Test Receiver	ESU40	Rohde&Schwartz	100361	1 year	09.17.2021
☐ Bilog Antenna	VULB 9168	SCHWARZBECK	01156	2 year	05.27.2022
☐ Antenna Master	MA4640-XP-ET	INNCO SYSTEM	-	N/A	-
☐ Antenna Master Controller	CO3000	INNCO SYSTEM	CO3000/1250 /4892320/P	N/A	-
☐ Turn Table	DS2000-S	INNCO SYSTEM	-	N/A	-
☐ Turn Table Controller	CO2000	INNCO SYSTEM	CO3000/1250 /4892320/P	N/A	-

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
Frequency Range	30 MHz to 1 000 MHz
Detector	Quasi-Peak
Bandwidth	120 kHz (6 dB)
Measurement Distance	3 m
Antenna height	1 m to 4 m
Test Site	3 m Semi Anechoic Chamber #1
Temperature	max. 24.5 / min. 22.9 °C
Relative Humidity	max. 44.3 / min. 39.3 %
Test Date	June 04 / June 07, 2022

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

Radiated Emission (30 to 1 000) MHz, Bluetooth+Motion Operating Mode

Frequency (MHz)	Quasi Peak (dBμV/m)	Antenna Height (cm)	POL. (H/V)	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)
59.3189	17.7	125.0	V	324.0	19.7	22.3	40.0
166.5380	26.4	117.8	V	192.0	19.3	17.1	43.5
199.7044	25.0	125.2	V	331.0	16.9	18.5	43.5
270.6566	24.8	116.7	V	30.0	19.5	21.2	46.0
684.5809	28.5	174.7	V	233.0	28.6	17.5	46.0
926.2084	31.9	274.8	H	30.0	31.9	14.1	46.0

Radiated Emission (30 to 1 000) MHz, Bluetooth+Voice Operating Mode

Frequency (MHz)	Quasi Peak (dBμV/m)	Antenna Height (cm)	POL. (H/V)	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)
53.7736	17.4	116.9	V	312.0	19.9	22.6	40.0
166.2134	24.8	125.2	V	216.0	19.3	18.7	43.5
199.9572	24.3	100.0	V	214.0	16.8	19.2	43.5
300.8275	27.7	125.3	V	177.0	20.6	18.3	46.0
792.6660	30.7	119.0	H	94.0	30.5	15.3	46.0
951.6324	32.2	325.1	V	230.0	32.1	13.8	46.0

4.3 Radiated Emission Above 1 GHz

4.3.1 Measuring instruments

Type	Manufacturer	Model Name	Serial Number	Calibration Cycle	Calibration Date
3 m Semi Anechoic Chamber #1					
☒ EMI test receiver	Rohde & Schwarz	ESU40	100524	1 year	05.10.2022
☒ Low Noise amplifier	TESTEK	TK-PA18H	170034-L	1 year	02.24.2022
☒ Horn antenna	Schwarzbeck	BBHA 9120D	01836	1 year	07.20.2021
☒ Antenna master	INNCO Systems	MA4640-XP-ET	-	N/A	-
☒ Antenna master controller	INNCO Systems	CO3000	CO3000/870/ 35990515/L	N/A	-
☒ Turn table	INNCO Systems	1060	-	N/A	-
☒ Turn table controller	INNCO Systems	CO2000	CO2000/095/ 7590304/L	N/A	-
☐ Power Amplifier	TESTEK	TK-PA1840H	170030-L	1 year	02.24.2022
☐ Horn Antenna	Schwarzbeck	BBHA9170	BBHA 9170 #786	1 year	11.18.2021
☒ Band Reject Filter	Wainwright Instruments	WRCJ2400/2483.5 -2370/2520-60/14SS	1	1 year	02.07.2022
☒ Software	Rohde & Schwarz	EMC32	-	-	-
3 m Semi Anechoic Chamber #2					
☐ EMI test receiver	ESU40	Rohde&Schwarz	100361	1 year	09.17.2021
☐ Horn Antenna	BBHA 9170	SCHWARZBECK	810	1 year	04.25.2022
☐ Power Amplifier	TK-PA1804H	TESTEK	170033-L	1 year	04.15.2022
☐ Horn Antenna	BBHA 9120D	Schwarzbeck	1641	1 year	06.29.2021
☐ Horn Antenna	BBHA 9120D	SCHWARZBECK	296	-	-
☐ Horn Antenna	BBHA 9120D	SCHWARZBECK	1518	1 year	09.15.2021
☐ Amplifier	CBLU5183530	CERNEX	24348	1 year	06.02.2022
☐ Antenna Master	MA4640-XP-ET	INNCO SYSTEM	-	N/A	-
☐ Antenna Master Controller	CO3000	INNCO SYSTEM	CO3000/1250 /4892320/P	N/A	-
☐ Turn Table	DS2000-S	INNCO SYSTEM	-	N/A	-
☐ Turn Table Controller	CO2000	INNCO SYSTEM	CO3000/1250 /4892320/P	N/A	-
10 m Semi Anechoic Chamber #1					
☐ EMI test receiver	ESU26	ROHDE&SCHWARZ	100241	1 year	06.14.2022
☐ Horn Antenna	BBHA 9120 D	SCHWARZBECK	1639	1 year	09.06.2021
☐ Antenna master	AS2000-PP	INNCO systems	AS2000/135/ 34270914/L	N/A	-
☐ Turn table	DT3000-3t	INNCO systems	DT3000/69	N/A	-
☐ Amplifier	CBLU1183540	CERNEX	21691	1 year	06.14.2022
10 m Semi Anechoic Chamber #2					
☐ EMI Test Receiver	ESW44	Rohde & Schwarz	101946	1 year	07.07.2021
☐ Amplifier	TK-PA6S	TESTEK	130012	1 year	01.18.2022
☐ Horn Antenna	BBHA 9120D	SCHWARZBECK	1641	1 year	06.29.2021
☐ Horn Antenna	BBHA 9120D	Schwarzbeck	1152	1 year	02.23.2022
☐ Ant MAST	MA4000-EP	INNCO systems	-	N/A	-
☐ Ant MAST Controller	CO3000	INNCO systems	CO3000/999 /40240317/G	N/A	-
☐ Ant MAST	MA4640/800 XP-ET	INNCO systems	-	N/A	-
☐ Ant MAST Controller	CO3000	INNCO systems	CO3000/951 /38590616/G	N/A	-
☐ Turn Table	DDT6000/3000-5T	INNCO systems	-	N/A	-

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, CISPR-Average
Bandwidth	1 MHz
Highest Frequency	2 480 MHz
Tested Frequency Range	1 GHz to 18 GHz
Measurement Distance	3 m
Antenna height	1 m to 4 m
Test Site	3 m Semi Anechoic Chamber #1
Temperature	max. 24.7 / min. 23.1 °C
Relative Humidity	max. 44.1 / min. 39.7 %
Test Date	June 08 / June 09, 2022

- 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

Radiated Emission (1 to 18) GHz, Bluetooth+Motion Operating Mode

Frequency (MHz)	Peak (dBμV/m)	Antenna Height (cm)	POL. (H/V)	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)
2343.7200	43.3	160.6	H	231.0	-23.2	30.7	74.0
7642.6300	43.3	135.5	V	343.0	-9.3	30.7	74.0
9429.0700	45.3	100.0	H	128.0	-7.1	28.7	74.0
13216.4200	46.5	100.0	H	105.0	-1.8	27.5	74.0
14228.2850	48.2	149.7	H	172.0	0.2	25.8	74.0
17998.5021	55.2	149.9	V	226.0	10.4	18.8	74.0

Frequency (MHz)	CAverage (dBμV/m)	Antenna Height (cm)	POL. (H/V)	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)
2343.7200	21.0	160.6	H	231.0	-23.2	33.0	54.0
7642.6300	30.9	135.5	V	343.0	-9.3	23.1	54.0
9429.0700	32.3	100.0	H	128.0	-7.1	21.7	54.0
13216.4200	33.6	100.0	H	105.0	-1.8	20.4	54.0
14228.2850	35.4	149.7	H	172.0	0.2	18.6	54.0
17998.5021	43.1	149.9	V	226.0	10.4	10.9	54.0

BLUETOOTH Fundamental Frequency : 2.4756 GHz

BLUETOOTH Harmonic Frequency : 4.8080 GHz



Radiated Emission (1 to 18) GHz, Bluetooth+Voice Operating Mode

Frequency (MHz)	Peak (dBμV/m)	Antenna Height (cm)	POL. (H/V)	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)
2367.1450	33.9	149.9	H	59.0	-23.1	40.1	74.0
2571.5750	32.8	197.4	V	147.0	-22.3	41.2	74.0
8028.3550	43.7	238.6	V	157.0	-8.9	30.3	74.0
10739.1050	46.0	100.0	V	108.0	-3.9	28.0	74.0
14596.8250	48.3	249.9	V	18.0	0.7	25.7	74.0
17990.6931	56.0	109.6	V	19.0	10.3	18.0	74.0

Frequency (MHz)	CAverage (dBμV/m)	Antenna Height (cm)	POL. (H/V)	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)
2367.1450	21.2	149.9	H	59.0	-23.1	32.8	54.0
2571.5750	29.0	197.4	V	147.0	-22.3	25.0	54.0
8028.3550	31.2	238.6	V	157.0	-8.9	22.8	54.0
10739.1050	33.5	100.0	V	108.0	-3.9	20.5	54.0
14596.8250	36.1	249.9	V	18.0	0.7	17.9	54.0
17990.6931	43.1	109.6	V	19.0	10.3	10.9	54.0

BLUETOOTH Fundamental Frequency : 2.4654 GHz

BLUETOOTH Harmonic Frequency : 4.8267 GHz



5. 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-2207-FC003-P	July 08, 2022	Initial Release

End of report