

ELECTROMAGNETIC EMISSION COMPLIANCE REPORT

Test Report No. : OT-222-RED-062
Reception No. : 2202000517
Applicant : LG Electronics USA, Inc.
Address : 111 Sylvan Ave, North Building, Englewood Cliffs, New Jersey, 07632, United States
Manufacturer : LG Electronics Inc.
Address : 222 LG-ro Jinwi-myeon, Pyeongtaek-si, Gyeonggi-do, Korea
Type of Equipment : Bluetooth Earbud (Cradle)
Model Names : TONE-FP7P
Multiple Model Name : TONE-TFP7P, TONE-TFP7WP, TONE-FP7PWP, TONE-FP7CP, TONE-FP7WCP
Serial number : N/A
Total page of Report : 27 pages (including this page)
Date of Incoming : February 14, 2022
Test Period : February 15, 2022 ~ February 16, 2022
Date of Issuing : February 21, 2022

SUMMARY

The equipment complies with the requirement of

FCC CFR 47 PART 15 SUBPART B, Section 15.101 and IC ICES-003 Issue 7

This test report contains only the results of a single test of the sample supplied for the examination.

Reviewed by:



Seung-Hyun, Park / Senior Manager
EMC Testing Div.
ONETECH Corp.

Approved by:



Gea-Won, Lee / Exe. Managing Director
EMC Testing Div.
ONETECH Corp.

CONTENTS

Page

1. VERIFICATION OF COMPLIANCE	4
2. TEST FACILITY	5
3. PRODUCT INFORMATION.....	6
3.1 DESCRIPTION OF EUT.....	6
3.2 MODEL DIFFERENCES.....	6
3.3 SUPPORT EQUIPMENT	7
3.4 SYSTEM CONFIGURATION.....	7
3.5 CABLE DESCRIPTION FOR THE EUT	7
3.6 EQUIPMENT MODIFICATIONS	7
3.7 INFORMATION OF MEASUREMENT SOFTWARE.....	7
4. DESCRIPTION OF TESTS	8
4.1 TEST METHODOLOGY.....	8
4.2 TEST CONDITION.....	8
4.3 CONDUCTED EMISSION	9
4.4 RADIATED EMISSION.....	9
5. FINAL RESULT OF MEASUREMENT	10
5.1 CONDUCTED EMISSION TEST.....	10
5.1.1 Operating Environment.....	10
5.1.2 Test Setup	10
5.1.3 Measurement uncertainty.....	10
5.1.4 Limit	10
5.1.5 Test Equipment used.....	10
5.1.6 Test Data	11
5.2 RADIATED EMISSION TEST	13
5.2.1 Operating Environment.....	13
5.2.2 Test Setup	13
5.2.3 Measurement uncertainty.....	13
5.2.4 Limit	13
5.2.5 Test Equipment used.....	14
5.2.6 Test Data	15
6. SAMPLE CALCULATIONS	27

Revision History

Rev. No.	Issued Report No.	Issued Date	Revisions	Section Affected
0	OT-222-RED-062	February 21, 2022	Initial Issue	All

1. VERIFICATION OF COMPLIANCE

-. Applicant : LG Electronics USA, Inc.
 -. Address : 111 Sylvan Ave, North Building, Englewood Cliffs, New Jersey, 07632, United States
 -. Manufacturer : LG Electronics Inc.
 -. Address : 222 LG-ro Jinwi-myeon, Pyeongtaek-si, Gyeonggi-do, Korea
 -. Factory : BLUECOM
 -. Address : C5-4, Area CN1, Trang Due Industrial Park, An Duong District, Haiphong City, Vietnam
 -. MODEL NAME : TONE-FP7P
 -. SERIAL NUMBER : N/A
 -. BRAND/TRADE NAME : LG
 -. DATE : February 21, 2022

EQUIPMENT CLASS	Other Class B digital devices & peripherals
E.U.T. DESCRIPTION	Bluetooth Earbud (Cradle)
MEASUREMENT PROCEDURES	Original Grant
TYPE OF EQUIPMENT TESTED	ANSI C63.4a: 2017 and ICES-003 ISSUE 7
KIND OF EQUIPMENT AUTHORIZATION REQUESTED	Supplier's Declaration of Conformity (SDoC)
STANDARDS	FCC PART 15 (Class B) ICES-003 ISSUE 7 Class B Apparatus
MODIFICATIONS ON THE EQUIPMENT TO ACHIEVE COMPLIANCE	None
FINAL TEST WAS CONDUCTED ON	10 m Semi anechoic chamber

ONETECH Corp. tested the above equipment in accordance with the requirements set forth in the above standard. The test results show that equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

2. TEST FACILITY

The Onetech Corp. has been designated to perform equipment testing in compliance with ISO/IEC 17025 by Radio Research Agency as accreditation body. The Onetech Corp. is accredited for measuring devices subject to Declaration of Conformity (DOC) under Parts 15 & 18 as a Conformity Assessment Body (CAB) with designation number KR0013.

These measurement tests were conducted at Onetech Corp.

The 10 m semi anechoic chamber and conducted measurement facilities are located at

- 1) 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea.
- 2) 12-5, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea.



3. PRODUCT INFORMATION

3.1 Description of EUT

The LG Electronics USA, Inc., Model TONE-FP7P (referred to as the EUT in this report) is a Bluetooth Earbud (Cradle).

Product specification described herein was obtained from product data sheet or user's manual.

CHASSIS TYPE	Plastic
LIST OF EACH OSC. or CRY. FREQ. (FREQ. \geq 1 MHz)	40 MHz
RF FREQ.	2 402 MHz ~ 2 480 MHz
ELECTRICAL RATING	Charging case: DC 5 V, 500 mA Lithium ion battery of cradle: 3.7 Vdc, 390 mAh
NUMBER OF PCB LAYERS	-
EXTERNAL CONNECTOR	Charging case : Charging terminals, Charge port(USB Type C)
Temperature Range	0 °C ~ 40 °C

3.2 Model Differences

-. The following lists consist of the added model and their differences.

Model Name	Differences	Tested
TONE-FP7P	Basic Model	<input checked="" type="checkbox"/>
TONE-TFP7P	This model is identical to the basic model except for the Marketing area (Korea) and model name.	<input type="checkbox"/>
TONE-TFP7WP	This model is identical to the basic model except for the Color(White), Marketing area (KOREA) and model name.	<input type="checkbox"/>
TONE-FP7PWP	This model is identical to the basic model except for the Color (White) and model name.	<input type="checkbox"/>
TONE-FP7CP	This model is identical to the basic model except for the model name.	<input type="checkbox"/>
TONE-FP7WCP	This model is identical to the basic model except for the Color (White) and model name.	<input type="checkbox"/>

Note: 1. Applicant consigns only basic model to test. Therefore, this test report just guarantees the units, which have been tested.

2. The Applicant/manufacture is responsible for the compliance of all variants.

3.3 Support Equipment

The model numbers for all the equipments that were used in the tested system is:

Description	Model	Manufacturer	Connected to
Bluetooth Earbud (Cradle) (EUT)	TONE-FP7P	LG Electronics Inc.	Adapter
Adapter	ADS-12BA-06Y 05010EPK	Shenzhen Honor Electronic Co.,Ltd	EUT
Bluetooth Earbud	TONE-TFP7	LG Electronics Inc.	-
Smartphone	LGM-G600K	LG Electronics Inc.	EUT

3.4 System Configuration

DEVICE TYPE	MANUFACTURER	MODEL/PART NUMBER	FCC ID
Bluetooth Earbud (Cradle)	LG Electronics Inc.	TONE-FP7P	ZNFTONEFP9C

3.5 Cable Description for the EUT

Cable	Shielded	Ferrite Bead	Metal Shell	Length (m)	Connected to
Bluetooth Earbud (Cradle)	Charging terminals	-	-	-	Earbud
	Charge port (USB Type C)	Y	N	0.5	Adapter
	* Charge port (USB Type C)	N	N	0.7	Smartphone
Bluetooth Earbud	Charging terminals	-	-	-	EUT (Cradle)

* AUX+BT Mode

3.6 Equipment Modifications

-. None

3.7 Information of Measurement Software

	Chamber name	Software name	Software version
<input type="checkbox"/> -	Conducted Emission #1	Noise Terminal Voltage Measurement	2.00.0180
<input type="checkbox"/> -	Conducted Emission #2	EMC32	10.60.10
<input checked="" type="checkbox"/> -	Conducted Emission #3	Noise Terminal Voltage Measurement	2.00.0178
<input type="checkbox"/> -	Radiated Emission 10 m SAC 1	Radiated Emission Measurement	2.00.0201
<input checked="" type="checkbox"/> -	Radiated Emission 10 m SAC 2	Radiated Emission Measurement	2.00.0202
<input type="checkbox"/> -	Radiated Emission 3 m SAC	Radiated Emission Measurement	2.00.0202

4. DESCRIPTION OF TESTS

4.1 Test Methodology

Both conducted and radiated testing was performed according to the procedures in ANSI C63.4a: 2017.

Radiated testing was performed at a distance of 3 m from EUT to the antenna.

4.2 Test Condition

The test conditions of the noted test mode(s) in this test report are;

1) Test Voltage / Frequency

- AC 120 V / 60 Hz

2) Test Mode(s)

Test Mode		Operating States
1	Charging	a) The USB Type C port on the EUT was connected to the adapter and then the Earbud was charging operate.
2	AUX + BT	a) The USB Type C port on the EUT was connected to the Smartphone and then the EUT was pairing the Earbud operate.

4.3 Conducted Emission

The EUT was placed on a non-conductive 1.0 m × 1.5 m table, which is 0.8 m in height above the reference ground plane and 0.4 m away from the vertical conducting plane (over 2 m × 2 m) that is bonded to the reference ground plane. The power of EUT is fed through a 50 Ω/ 50 μH + 5 Ω LISN and all support equipment is powered from another LISN. Powers to the LISN are filtered by high-current high insertion loss power line filter.

Sufficient time for EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition.

The RF output of the LISN was connected to the EMI test receiver.

Exploratory measurements were conducted to identify the highest emission by operating the EUT in a range of typical modes of operation, cable positions, system configuration and arrangement.

Based on exploratory measurements, the final measurements were conducted at the worst test conditions.

Exploratory measurements were scanned using Peak mode of EMI Test receiver from 150 kHz to 30 MHz with 20 ms sweep time. The final measurements were measured with Quasi-Peak and CISPR Average mode.

The bandwidth of EMI Test Receiver was set to 9 kHz. Interface cables were connected to the available interface ports of the test unit. Excess cable lengths were bundled at center with 30 cm ~ 40 cm.

4.4 Radiated Emission

Exploratory Radiated measurements were conducted at the 3 m semi anechoic chamber in order to identify the highest emission by operating the EUT in a range of typical modes of operation, cable positions, system configuration and arrangement.

Based on exploratory measurements, the final measurements were conducted at the worst test conditions.

Final measurements were made at 10 m semi anechoic chamber that complies with CISPR 16/ ANSI C63.4a:2017/ ICES-003.

Exploratory measurements were scanned using Peak mode of EMI Test receiver and final measurements were measured with Quasi-Peak mode (Below 1 GHz) and Peak & CISPR Average mode (Above 1 GHz).

The system was rotated 360°, and the antenna was varied in height between 1.0 m and 4.0 m in order to determine the maximum emission levels. This procedure was performed for both horizontal and vertical polarization of the receiving antenna.

5. FINAL RESULT OF MEASUREMENT

Exploratory measurement was done in normal operation mode. And the final measurement was selected for the maximized emission level.

5.1 Conducted Emission Test

5.1.1 Operating Environment

Ambient temperature : 18.4 °C
Relative humidity : 42.7 % R.H.

5.1.2 Test Setup

The EUT and other support equipment were placed on a non-conductive table, 0.8 m height above the reference ground plane. The power of EUT was fed through a 50 Ω / 50 μ H + 5 Ω LISN. The ground plane was electrically bonded to the reference ground system and all power lines were filtered from ambient.

5.1.3 Measurement uncertainty

Conducted emission, quasi-peak detection : ± 3.9 dB
Conducted emission, CISPR-average detection : ± 3.9 dB

Measurement uncertainty is calculated in accordance with CISPR 16-4-2. The measurement uncertainty is given with a confidence of 95 % with the coverage factor, $k = 2$.

5.1.4 Limit

Frequency of Emission (MHz)	Conducted Limit (dB μ V)	
	Quasi-peak	CISPR 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

5.1.5 Test Equipment used

Model Number	Manufacturer	Description	Serial Number	Last Cal. (Interval)
■ ESCI	Rohde & Schwarz	Test Receiver	101420	Mar. 23, 2021 (1Y)
■ NSLK8126	SCHWARZ BECK	LISN	8126480	Oct. 13, 2021 (1Y)
□ 3825/2	EMCO	AMN	9109-1867	Mar. 22, 2021 (1Y)
■ 11947A	Hewlett Packard	Transient Limiter	3107A02762	Mar. 22, 2021(1Y)

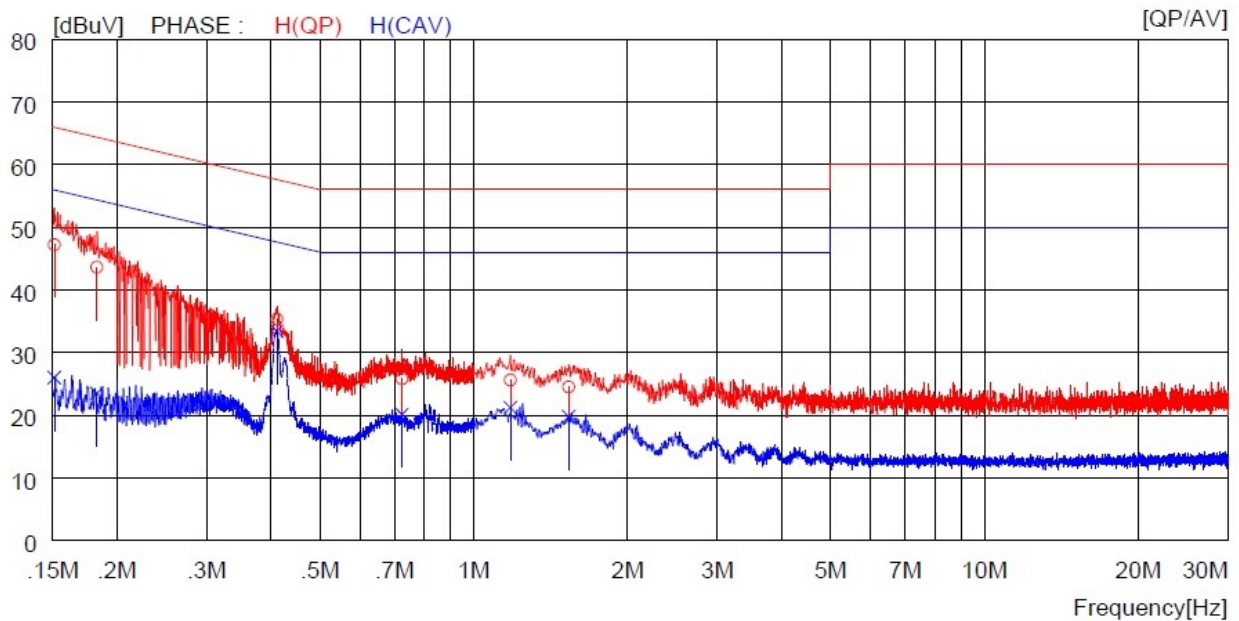
All test equipment used is calibrated on a regular basis.

5.1.6 Test Data

-. Test Result : Pass

Tested by: Ji-Hwan, Jang / Manager

Test Mode 1 (Charging)			
Frequency range	: 0.15 MHz ~ 30 MHz	Test Date	: February 15, 2022
Resolution bandwidth	: 9 kHz	Tested Line	: HOT LINE

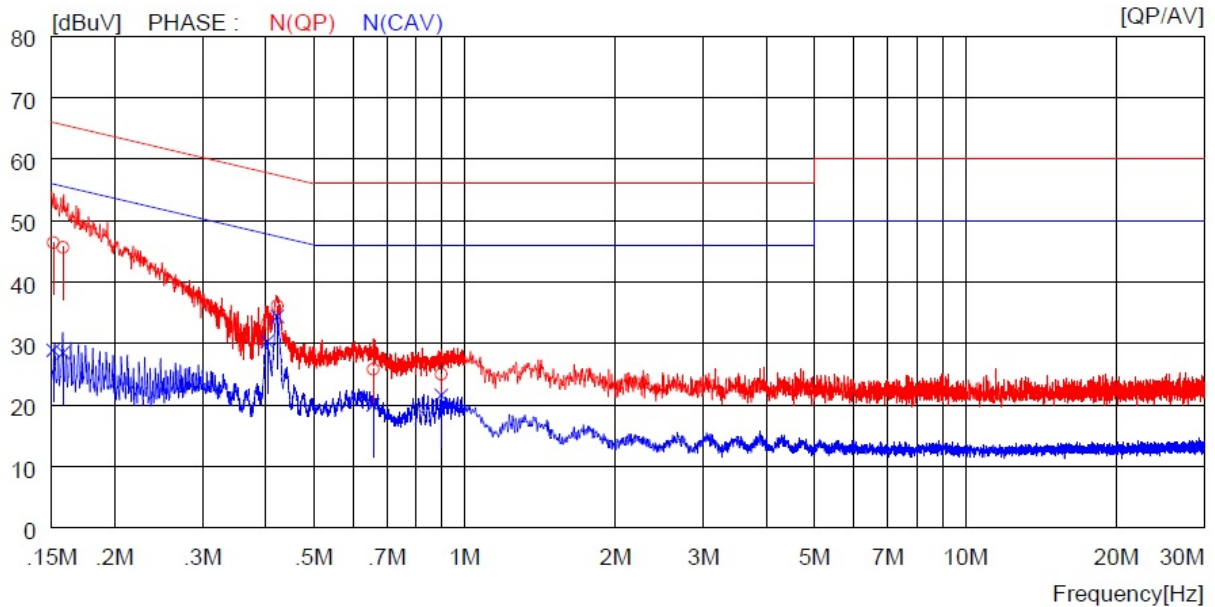


NO	FREQ [MHz]	READING		C.FACTOR [dB]	RESULT		LIMIT		MARGIN		PHASE
		QP [dBuV]	AV [dBuV]		QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	
1	0.15100	37.1	----	10.1	47.2	----	65.9	----	18.7	----	H (QP)
2	0.18300	33.5	----	10.1	43.6	----	64.3	----	20.7	----	H (QP)
3	0.41200	25.2	----	10.1	35.3	----	57.6	----	22.3	----	H (QP)
4	0.72400	15.7	----	10.1	25.8	----	56.0	----	30.2	----	H (QP)
5	1.18000	15.5	----	10.1	25.6	----	56.0	----	30.4	----	H (QP)
6	1.53600	14.4	----	10.1	24.5	----	56.0	----	31.5	----	H (QP)
7	0.15100	----	15.9	10.1	----	26.0	----	55.9	----	29.9	H (CAV)
8	0.18300	----	13.4	10.1	----	23.5	----	54.3	----	30.8	H (CAV)
9	0.41200	----	23.3	10.1	----	33.4	----	47.6	----	14.2	H (CAV)
10	0.72400	----	10.0	10.1	----	20.1	----	46.0	----	25.9	H (CAV)
11	1.18000	----	11.1	10.1	----	21.2	----	46.0	----	24.8	H (CAV)
12	1.53600	----	9.7	10.1	----	19.8	----	46.0	----	26.2	H (CAV)

Remark: Margin (dB) = Limit – Level (Result)

The result level in above table is included the transducer factor that means insertion loss (LISN), cable loss and attenuator.

Test Mode 1 (Charging)			
Frequency range	: 0.15 MHz ~ 30 MHz	Test Date	: February 15, 2022
Resolution bandwidth	: 9 kHz	Tested Line	: NEUTRAL LINE



NO	FREQ [MHz]	READING		C. FACTOR [dB]	RESULT		LIMIT		MARGIN		PHASE
		QP [dBuV]	AV [dBuV]		QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	
1	0.15100	36.3	----	10.1	46.4	----	65.9	----	19.5	----	N (QP)
2	0.15800	35.5	----	10.1	45.6	----	65.6	----	20.0	----	N (QP)
3	0.40400	23.2	----	10.1	33.3	----	57.8	----	24.5	----	N (QP)
4	0.42300	26.0	----	10.1	36.1	----	57.4	----	21.3	----	N (QP)
5	0.65700	15.7	----	10.1	25.8	----	56.0	----	30.2	----	N (QP)
6	0.89900	14.9	----	10.1	25.0	----	56.0	----	31.0	----	N (QP)
7	0.15100	----	18.8	10.1	----	28.9	----	55.9	----	27.0	N (CAV)
8	0.15800	----	18.4	10.1	----	28.5	----	55.6	----	27.1	N (CAV)
9	0.40400	----	20.2	10.1	----	30.3	----	47.8	----	17.5	N (CAV)
10	0.42300	----	24.3	10.1	----	34.4	----	47.4	----	13.0	N (CAV)
11	0.65700	----	9.9	10.1	----	20.0	----	46.0	----	26.0	N (CAV)
12	0.89900	----	11.5	10.1	----	21.6	----	46.0	----	24.4	N (CAV)

Remark: Margin (dB) = Limit – Level (Result)

The result level in above table is included the transducer factor that means insertion loss (LISN), cable loss and attenuator.

5.2 Radiated Emission Test

5.2.1 Operating Environment

Ambient temperature : 24.9 °C
Relative humidity : 42.3 % R.H.

5.2.2 Test Setup

The radiated emissions measurements were on the in 10 m semi anechoic chamber. The EUT and all local support equipments were placed on a non-conductive turntable approximately 0.8 m above the ground plane.

The frequency spectrum from 30 MHz to 25 000 MHz was scanned and emission levels maximized at each frequency recorded. The system was rotated 360°, and the antenna was varied in height between 1.0 m and 4.0 m in order to determine the maximum emission levels. This procedure was performed for both horizontal and vertical polarization of the receiving antenna.

5.2.3 Measurement uncertainty

Radiated emission electric field intensity, 30 MHz ~ 1 000 MHz : ± 4.6 dB
Radiated emission electric field intensity, 1 GHz ~ 25 GHz : ± 6.0 dB

Measurement uncertainty is calculated in accordance with CISPR 16-4-2. The measurement uncertainty is given with a confidence of 95 % with the coverage factor, $k = 2$.

5.2.4 Limit

-. FCC Part 15 Subpart B

Frequency of Emission (MHz)	Resolution bandwidth	Field strength @ 3 m (dBμV/m)	
30 ~ 88 88 ~ 216 216 ~ 230 230 ~ 960 960 ~ 1 000	120 kHz	Quasi-peak	
		40.0	
		43.5	
		46.0	
		46.0	
		54.0	
> 1 000	1 MHz	Peak Limit	CISPR Average Limit
		74.0	54.0

-. ICES-003

Frequency of Emission (MHz)	Resolution bandwidth	Field strength @ 3 m (dB μ V/m)	Field strength @ 10 m (dB μ V/m)
30 ~ 88 88 ~ 216 216 ~ 230 230 ~ 960 960 ~ 1 000	120 kHz	Quasi-peak	Quasi-peak
		40.0	30.0
		43.5	33.1
		46.0	35.6
		47.0	37.0
		54.0	43.5
Frequency of Emission (MHz)	Resolution bandwidth	Field strength @ 3 m (dB μ V/m)	
> 1 000	1 MHz	Peak Limit	CISPR Average Limit
		74.0	54.0

5.2.5 Test Equipment used

	Model Number	Manufacturer	Description	Serial Number	Last Cal. (Interval)
■ -	ESW	Rohde & Schwarz	Test Receiver	101851	Mar. 23, 2021 (1Y)
■ -	VULB9163	Schwarzbeck	Trilog Broadband Antenna	9163-225	Sep. 14, 2020 (2Y)
■ -	3115	ETS-LINDGREN	Horn Antenna	34823	Aug. 18, 2021 (1Y)
■ -	SAS-574	A.H. System	Horn Antenna	676	Oct. 21, 2021 (1Y)
■ -	8447D	Hewlett Packard	Amplifier	2944A07777	Mar. 15, 2021 (1Y)
■ -	PAM-118A	Com-Power	Amplifier	18040081	Oct. 12, 2021 (1Y)
■ -	PAM-840A	Com-Power	Amplifier	461339	Oct. 18, 2021 (1Y)
■ -	CO3000	Innco Systems GmbH	Controller	N/A	N/A
■ -	DT5000	Innco Systems GmbH	Turn Table	N/A	N/A
■ -	MA4000-EP	Innco Systems GmbH	Antenna Master	N/A	N/A
■ -	MA4640-XPET	Innco Systems GmbH	Antenna Master	N/A	N/A

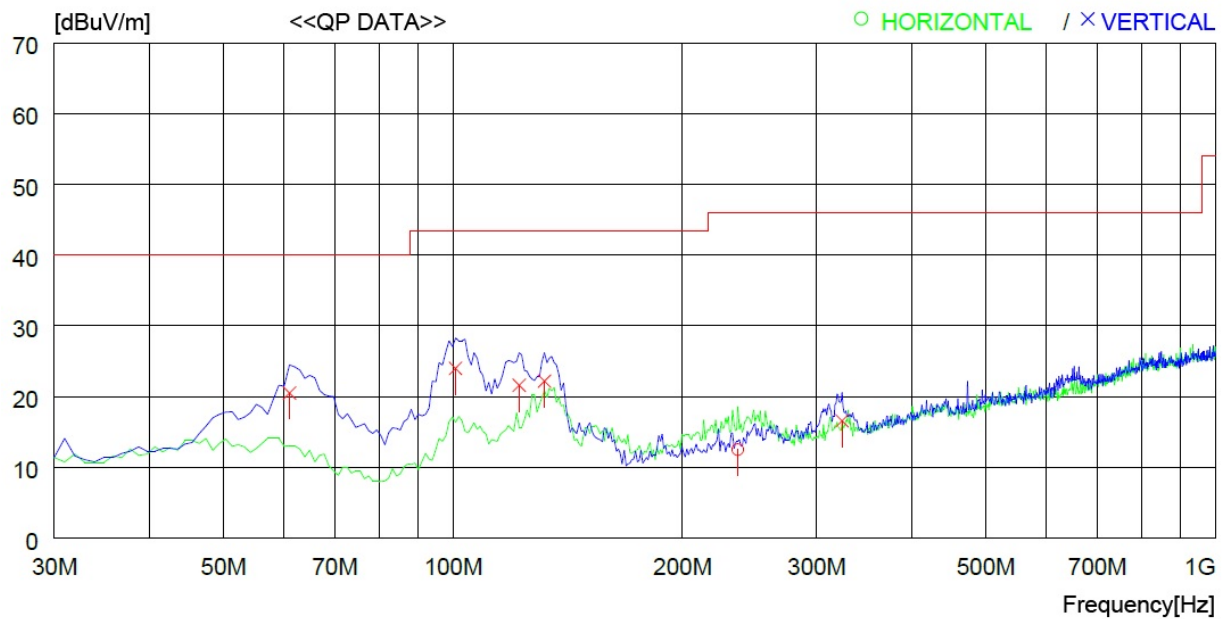
All test equipment used is calibrated on a regular basis.

5.2.6 Test Data

-. Test Result : Pass

Tested by: Ji-Hwan, Jang / Manager

Test Mode 1 (Charging)			
Frequency range	: 30 MHz ~ 1 000 MHz	Applied Standards	: FCC Part 15 Subpart B
Resolution bandwidth	: 120 kHz	Test Date	: February 16, 2022
Detector Mode	: Quasi-Peak	Measurement distance	: 3 m



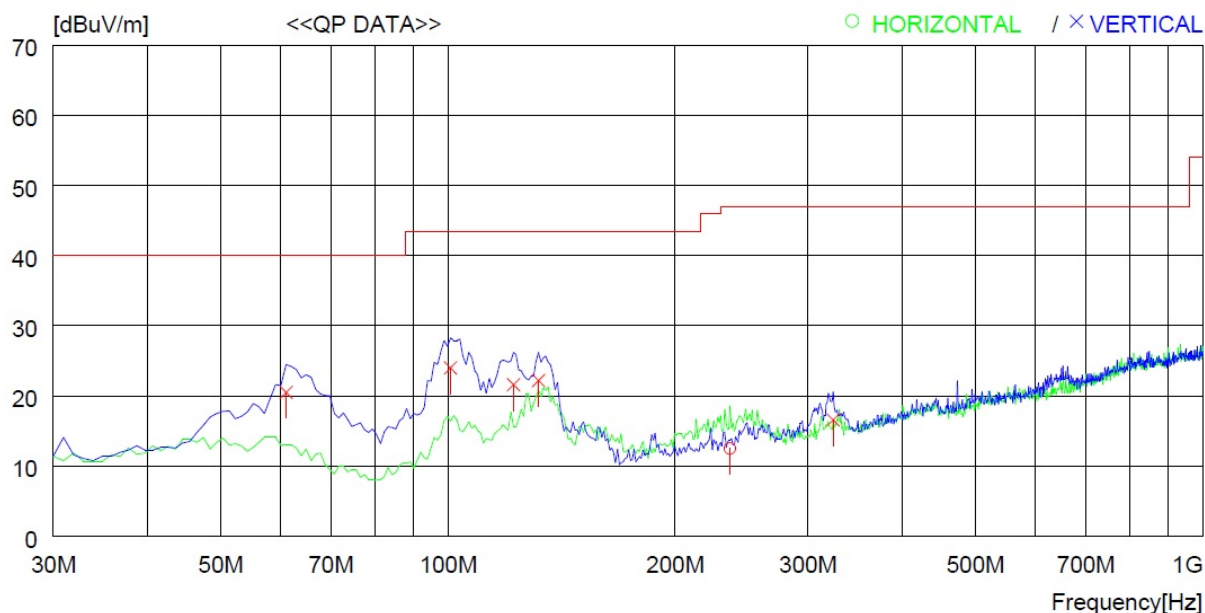
No.	FREQ [MHz]	READING QP [dBuV]	ANT FACTOR [dB]	LOSS [dB]	GAIN [dB]	RESULT [dBuV/m]	LIMIT [dBuV/m]	MARGIN [dB]	ANTENNA [cm]	TABLE [DEG]
----- Horizontal -----										
1	236.610	23.0	12.1	5.0	27.6	12.5	46.0	33.5	200	43
----- Vertical -----										
2	61.040	33.2	13.0	2.6	28.3	20.5	40.0	19.5	100	359
3	100.810	36.6	11.9	3.7	28.2	24.0	43.5	19.5	100	359
4	122.150	36.5	9.3	3.9	28.1	21.6	43.5	21.9	100	145
5	131.850	37.4	8.7	4.1	28.0	22.2	43.5	21.3	100	176
6	323.910	24.9	13.9	5.5	27.7	16.6	46.0	29.4	100	359

Remark: Margin (dB) = Limit – Result

Result = Reading Quasi-Peak + Antenna Factor + Loss – Gain

Loss and Gain in above table means Cable Loss and Pre-amplifier gain.

Test Mode 1 (Charging)			
Frequency range	: 30 MHz ~ 1 000 MHz	Applied Standards	: ICES-003 Issue 7
Resolution bandwidth	: 120 kHz	Test Date	: February 16, 2022
Detector Mode	: Quasi-Peak	Measurement distance	: 3 m



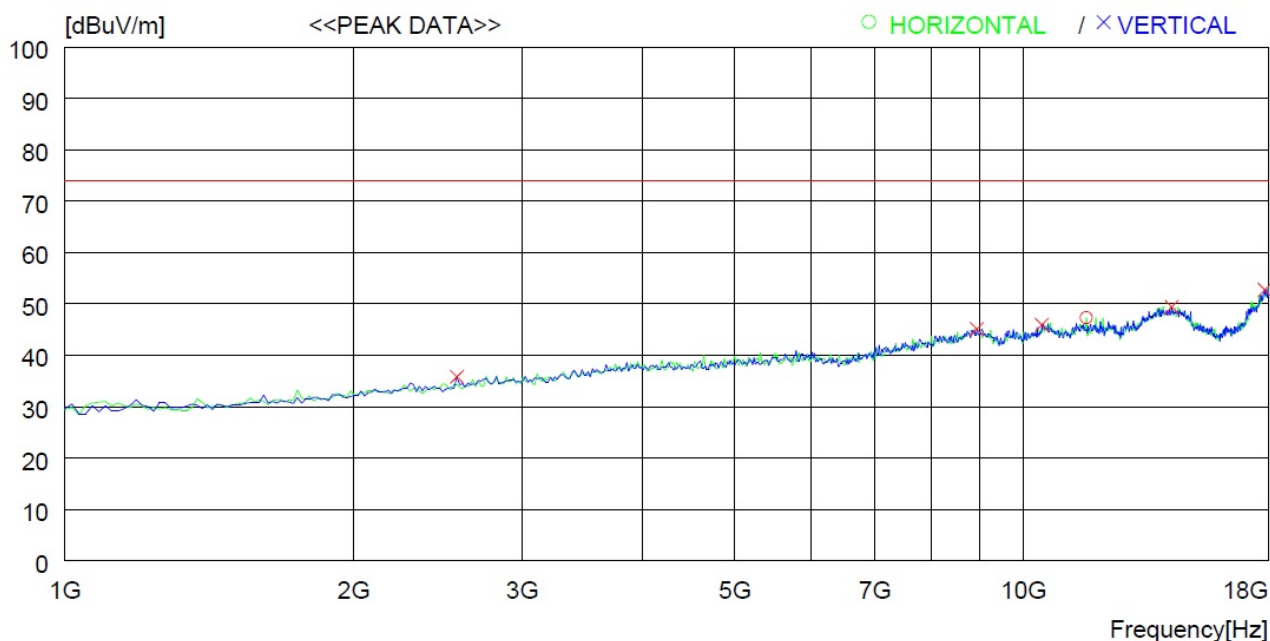
No.	FREQ	READING	ANT	LOSS	GAIN	RESULT	LIMIT	MARGIN	ANTENNA	TABLE
	[MHz]	QP	FACTOR	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dB]	[cm]	[DEG]
----- Horizontal -----										
1	236.610	23.0	12.1	5.0	27.6	12.5	47.0	34.5	200	43
----- Vertical -----										
2	61.040	33.2	13.0	2.6	28.3	20.5	40.0	19.5	100	359
3	100.810	36.6	11.9	3.7	28.2	24.0	43.5	19.5	100	359
4	122.150	36.5	9.3	3.9	28.1	21.6	43.5	21.9	100	145
5	131.850	37.4	8.7	4.1	28.0	22.2	43.5	21.3	100	176
6	323.910	24.9	13.9	5.5	27.7	16.6	47.0	30.4	100	359

Remark: Margin (dB) = Limit – Result

Result = Reading Quasi-Peak + Antenna Factor + Loss – Gain

Loss and Gain in above table means Cable Loss and Pre-amplifier gain.

Test Mode 1 (Charging)			
Frequency range	: 1 GHz ~ 18 GHz	Test Date	: February 16, 2022
Resolution bandwidth	: 1 MHz	Measurement distance	: 3 m
Detector Mode	: Peak		



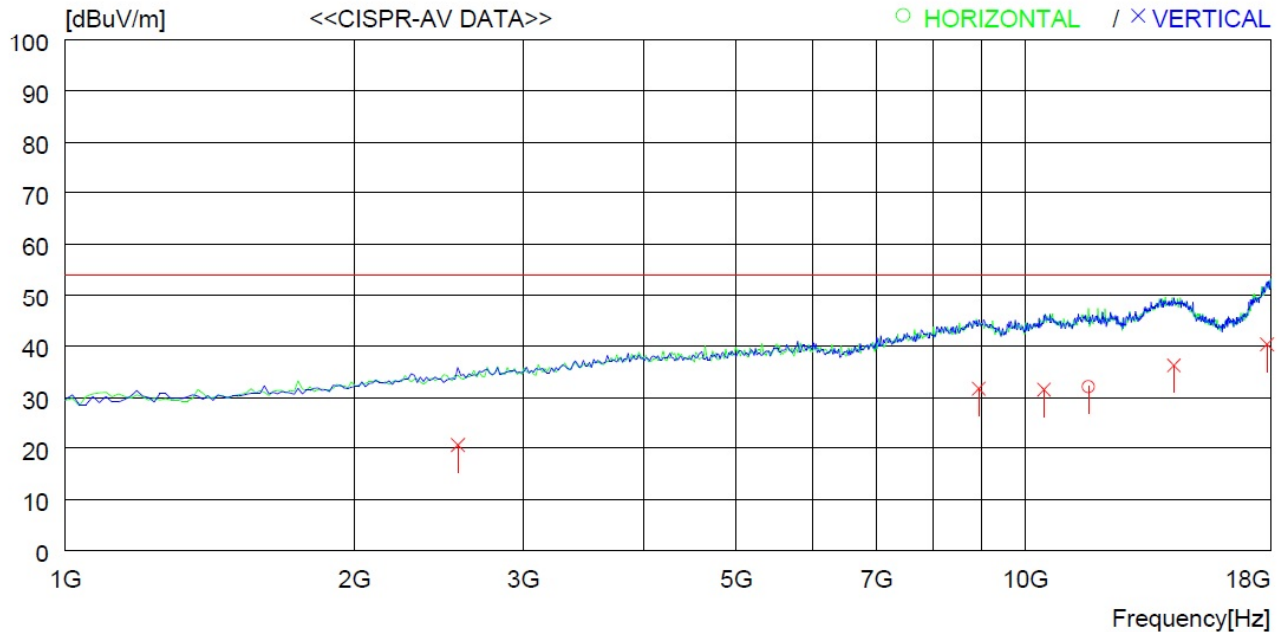
No.	FREQ [MHz]	READING [dBuV]	ANT PEAK FACTOR [dB]	LOSS [dB]	GAIN [dB]	RESULT [dBuV/m]	LIMIT [dBuV/m]	MARGIN [dB]	ANTENNA [cm]	TABLE [DEG]
----- Horizontal -----										
1	11625.000	43.8	38.7	7.5	42.7	47.3	74.0	26.7	100	353
----- Vertical -----										
2	2564.000	46.8	28.3	3.5	42.8	35.8	74.0	38.2	100	286
3	8939.000	42.0	38.4	6.8	42.1	45.1	74.0	28.9	200	0
4	10452.000	43.5	37.8	7.3	42.7	45.9	74.0	28.1	100	0
5	14277.000	41.2	41.7	8.7	42.2	49.4	74.0	24.6	100	204
6	17847.000	39.8	46.4	9.8	43.3	52.7	74.0	21.3	100	319

Remark: Margin (dB) = Limit – Result

Result = Reading Peak + Antenna Factor + Loss – Gain

Loss and Gain in above table means Cable Loss and Pre-amplifier gain.

Test Mode 1 (Charging)			
Frequency range	: 1 GHz ~ 18 GHz	Test Date	: February 16, 2022
Resolution bandwidth	: 1 MHz	Measurement distance	: 3 m
Detector Mode	: CISPR-Average		



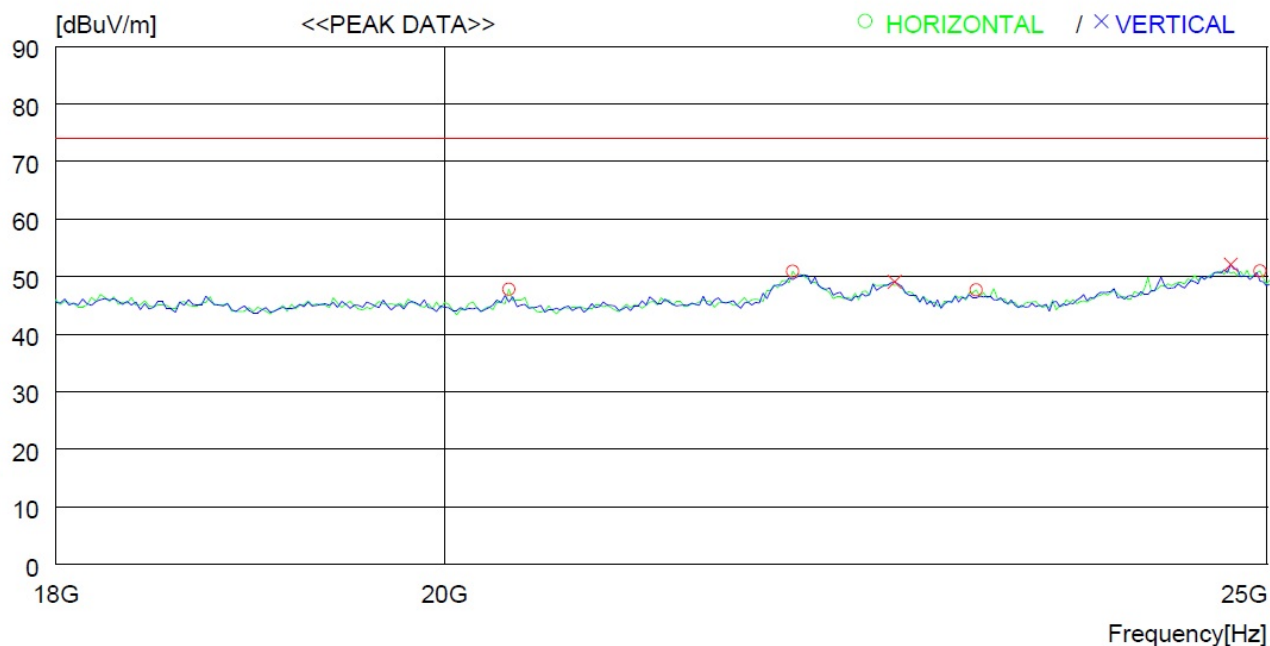
No.	FREQ [MHz]	READING CAV [dBuV]	ANT FACTOR [dB]	LOSS [dB]	GAIN [dB]	RESULT [dBuV/m]	LIMIT [dBuV/m]	MARGIN [dB]	ANTENNA [cm]	TABLE [DEG]
----- Horizontal -----										
1	11625.970	28.6	38.7	7.5	42.7	32.1	54.0	21.9	100	353
----- Vertical -----										
2	2564.842	31.5	28.3	3.5	42.8	20.5	54.0	33.5	100	286
3	8939.714	28.6	38.4	6.8	42.1	31.7	54.0	22.3	200	0
4	10452.360	29.1	37.8	7.3	42.7	31.5	54.0	22.5	100	0
5	14277.290	28.0	41.7	8.7	42.2	36.2	54.0	17.8	100	204
6	17847.850	27.4	46.4	9.8	43.3	40.3	54.0	13.7	100	319

Remark: Margin (dB) = Limit – Result

Result = Reading CISPR-Average + Antenna Factor + Loss – Gain

Loss and Gain in above table means Cable Loss and Pre-amplifier gain.

Test Mode 1 (Charging)			
Frequency range	: 18 GHz ~ 25 GHz	Test Date	: February 16, 2022
Resolution bandwidth	: 1 MHz	Measurement distance	: 3 m
Detector Mode	: Peak		



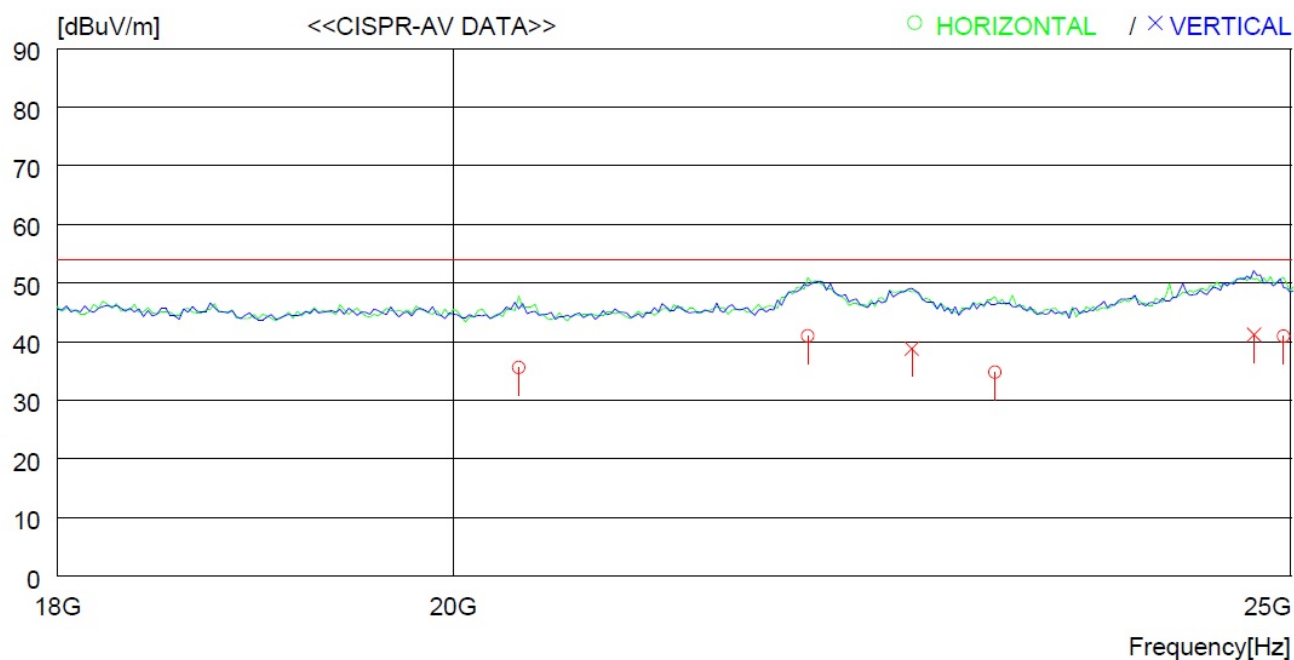
No.	FREQ [MHz]	READING [dBuV]	ANT PEAK FACTOR [dB]	LOSS [dB]	GAIN [dB]	RESULT [dBuV/m]	LIMIT [dBuV/m]	MARGIN [dB]	ANTENNA [cm]	TABLE [DEG]
----- Horizontal -----										
1	20354.000	39.4	40.1	10.5	42.2	47.8	74.0	26.2	100	0
2	21982.000	42.5	40.1	11.0	42.7	50.9	74.0	23.1	100	0
3	23104.000	39.4	40.0	11.3	43.0	47.7	74.0	26.3	200	0
4	24952.000	41.8	40.2	11.5	42.5	51.0	74.0	23	100	161
----- Vertical -----										
5	22598.000	40.7	40.1	11.2	42.9	49.1	74.0	24.9	200	236
6	24754.000	43.0	40.2	11.5	42.6	52.1	74.0	21.9	100	354

Remark: Margin (dB) = Limit – Result

Result = Reading Peak + Antenna Factor + Loss – Gain

Loss and Gain in above table means Cable Loss and Pre-amplifier gain.

Test Mode 1 (Charging)			
Frequency range	: 18 GHz ~ 25 GHz	Test Date	: February 16, 2022
Resolution bandwidth	: 1 MHz	Measurement distance	: 3 m
Detector Mode	: CISPR-Average		



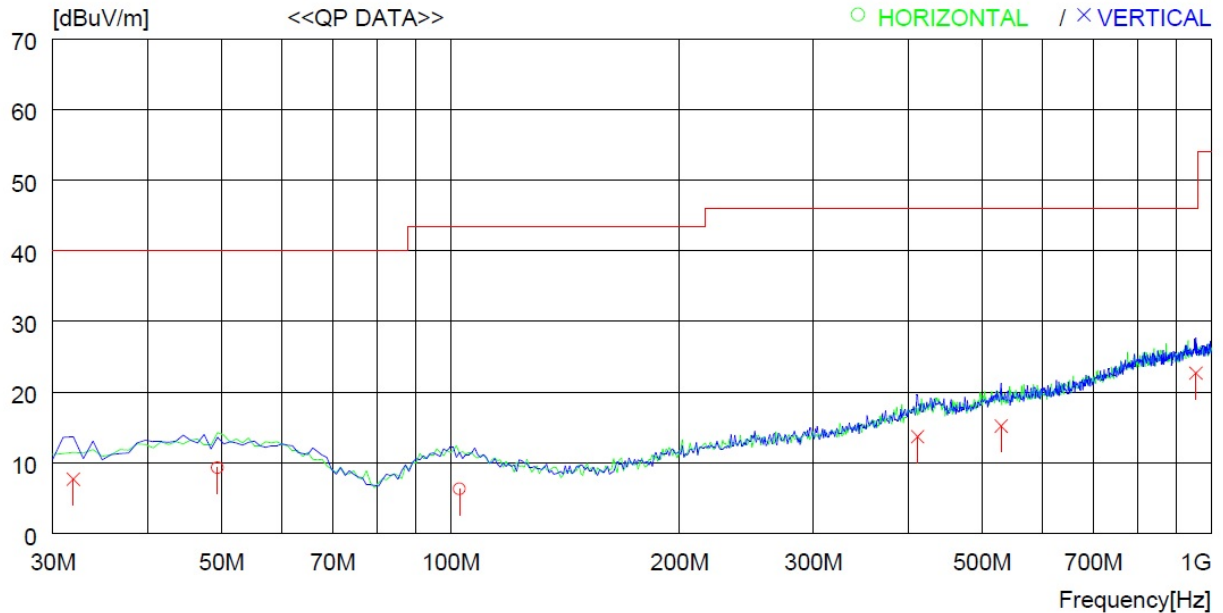
No.	FREQ	READING	ANT	LOSS	GAIN	RESULT	LIMIT	MARGIN	ANTENNA	TABLE
	[MHz]	CAV	FACTOR	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dB]	[cm]	[DEG]
----- Horizontal -----										
1	20354.450	27.2	40.1	10.5	42.2	35.6	54.0	18.4	100	0
2	21982.140	32.6	40.1	11.0	42.7	41.0	54.0	13.0	100	0
3	23104.590	26.5	40.0	11.3	43.0	34.8	54.0	19.2	200	0
4	24952.500	31.7	40.2	11.5	42.5	40.9	54.0	13.1	100	161
----- Vertical -----										
5	22598.430	30.4	40.1	11.2	42.9	38.8	54.0	15.2	200	236
6	24754.750	32.1	40.2	11.5	42.6	41.2	54.0	12.8	100	354

Remark: Margin (dB) = Limit – Result

Result = Reading CISPR-Average + Antenna Factor + Loss – Gain

Loss and Gain in above table means Cable Loss and Pre-amplifier gain.

Test Mode 2 (AUX + BT)			
Frequency range	: 30 MHz ~ 1 000 MHz	Applied Standards	: FCC Part 15 Subpart B
Resolution bandwidth	: 120 kHz	Test Date	: February 16, 2022
Detector Mode	: Quasi-Peak	Measurement distance	: 3 m



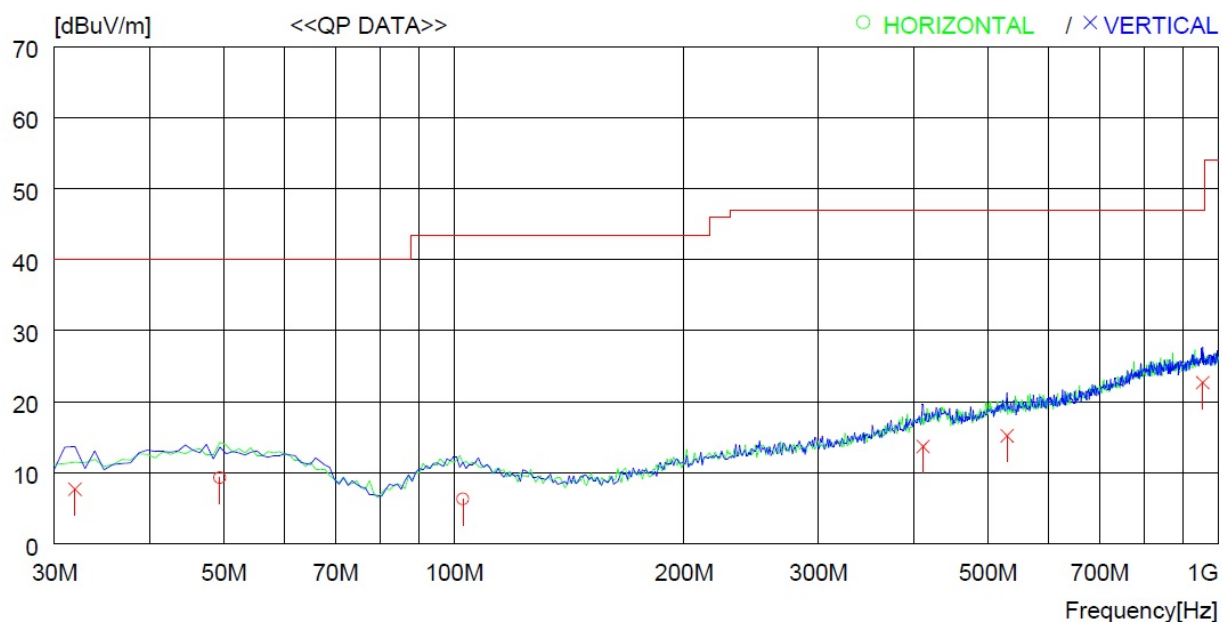
No.	FREQ	READING	ANT	LOSS	GAIN	RESULT	LIMIT	MARGIN	ANTENNA	TABLE
	[MHz]	[dBuV]	FACTOR	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dB]	[cm]	[DEG]
----- Horizontal -----										
1	49.400	21.3	14.0	2.3	28.3	9.3	40.0	30.7	200	359
2	102.750	18.9	11.7	3.8	28.1	6.3	43.5	37.2	200	359
----- Vertical -----										
3	31.940	22.5	11.8	1.7	28.3	7.7	40.0	32.3	100	325
4	411.210	19.1	15.9	7.0	28.3	13.7	46.0	32.3	100	0
5	529.550	18.0	17.8	8.1	28.7	15.2	46.0	30.8	100	0
6	954.397	17.7	22.4	10.2	27.6	22.7	46.0	23.3	300	359

Remark: Margin (dB) = Limit – Result

Result = Reading Quasi-Peak + Antenna Factor + Loss – Gain

Loss and Gain in above table means Cable Loss and Pre-amplifier gain.

Test Mode 2 (AUX + BT)			
Frequency range	: 30 MHz ~ 1 000 MHz	Applied Standards	: ICES-003 Issue 7
Resolution bandwidth	: 120 kHz	Test Date	: February 16, 2022
Detector Mode	: Quasi-Peak	Measurement distance	: 3 m



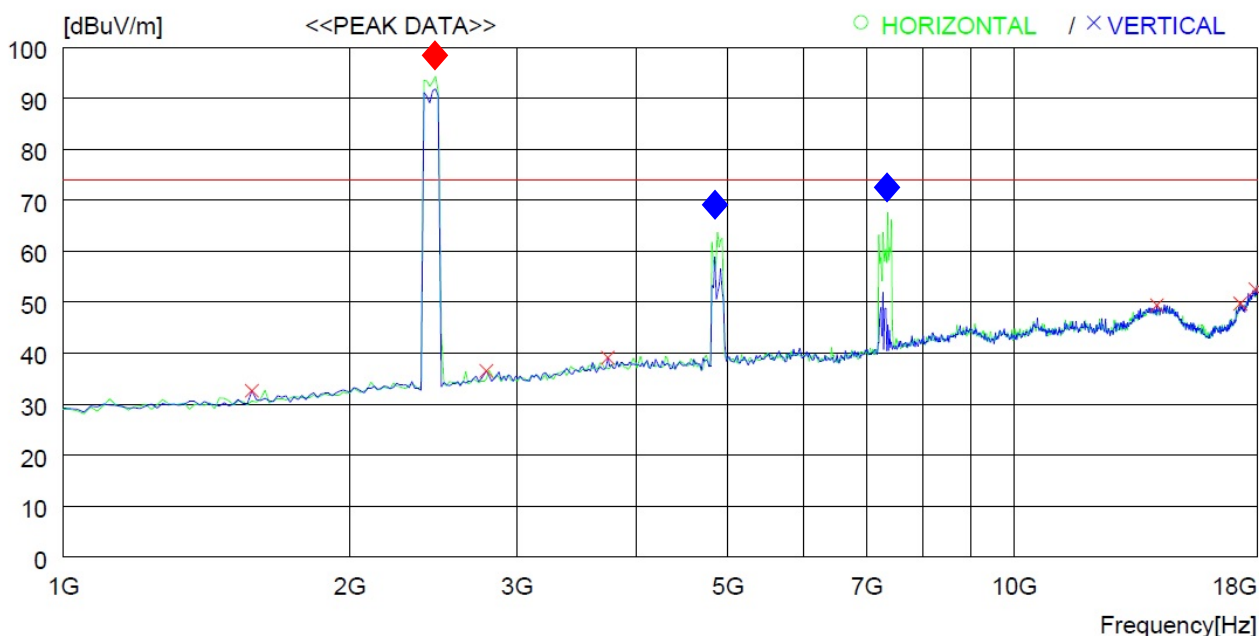
No.	FREQ	READING	ANT	LOSS	GAIN	RESULT	LIMIT	MARGIN	ANTENNA	TABLE
	[MHz]	QP	FACTOR	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dB]	[cm]	[DEG]
----- Horizontal -----										
1	49.400	21.3	14.0	2.3	28.3	9.3	40.0	30.7	200	359
2	102.750	18.9	11.7	3.8	28.1	6.3	43.5	37.2	200	359
----- Vertical -----										
3	31.940	22.5	11.8	1.7	28.3	7.7	40.0	32.3	100	325
4	411.210	19.1	15.9	7.0	28.3	13.7	47.0	33.3	100	0
5	529.550	18.0	17.8	8.1	28.7	15.2	47.0	31.8	100	0
6	954.397	17.7	22.4	10.2	27.6	22.7	47.0	24.3	300	359

Remark: Margin (dB) = Limit – Result

Result = Reading Quasi-Peak + Antenna Factor + Loss – Gain

Loss and Gain in above table means Cable Loss and Pre-amplifier gain.

Test Mode 2 (AUX + BT)			
Frequency range	: 1 GHz ~ 18 GHz	Test Date	: February 16, 2022
Resolution bandwidth	: 1 MHz	Measurement distance	: 3 m
Detector Mode	: Peak		



No.	FREQ [MHz]	READING [dBuV]	ANT PEAK FACTOR [dB]	LOSS [dB]	GAIN [dB]	RESULT [dBuV/m]	LIMIT [dBuV/m]	MARGIN [dB]	ANTENNA [cm]	TABLE [DEG]
----- Vertical -----										
1	1578.000	46.5	25.3	2.8	42.0	32.6	74.0	41.4	100	12
2	2785.000	46.7	29.0	3.8	43.0	36.5	74.0	37.5	100	153
3	3737.000	46.7	31.6	4.3	43.5	39.1	74.0	34.9	100	145
4	14124.000	41.3	41.6	8.7	42.2	49.4	74.0	24.6	100	359
5	17286.000	41.0	42.7	9.5	43.5	49.7	74.0	24.3	100	340
6	17932.000	38.9	47.0	9.9	43.3	52.5	74.0	21.5	100	359

Remark: Margin (dB) = Limit – Result

Result = Reading Peak + Antenna Factor + Loss – Gain

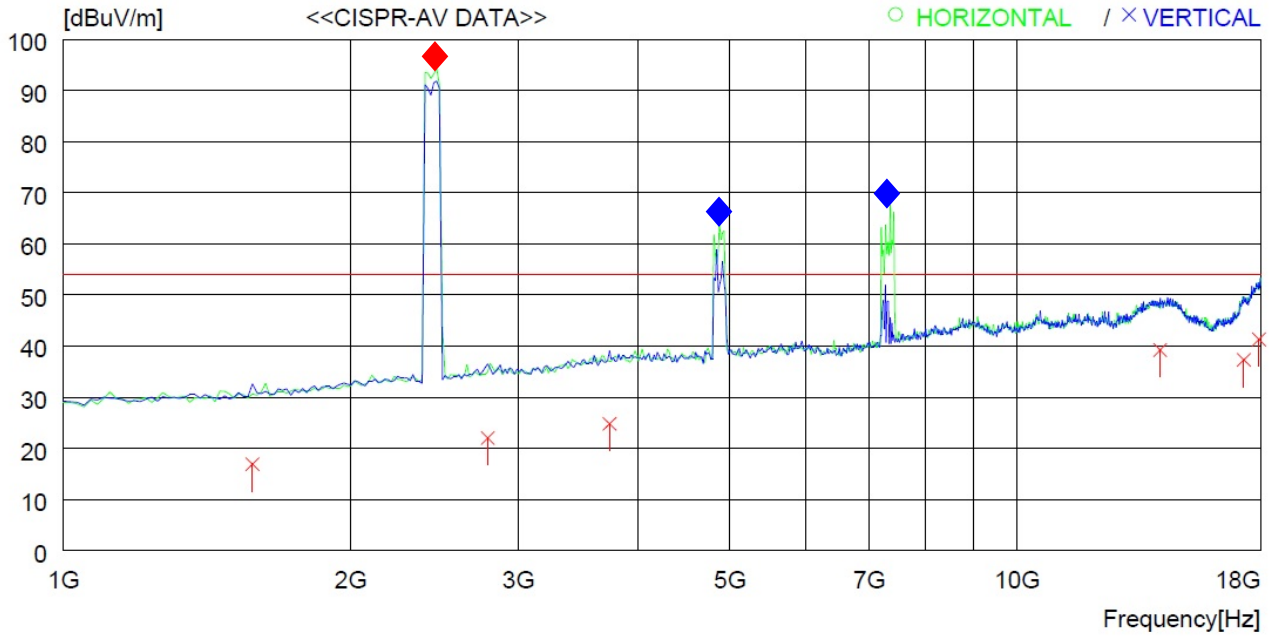
Loss and Gain in above table means Cable Loss and Pre-amplifier gain.

* Radiated emissions (Tx/Rx frequencies) from the transceiver shall be ignored.

Bluetooth: 2 402 ~ 2 480 MHz

* ◆ - Exclusion band Carrier Frequency, ◆ - Exclusion band Harmonic Frequency

Test Mode 2 (AUX + BT)			
Frequency range	: 1 GHz ~ 18 GHz	Test Date	: February 16, 2022
Resolution bandwidth	: 1 MHz	Measurement distance	: 3 m
Detector Mode	: CISPR-Average		



No.	FREQ	READING	ANT	LOSS	GAIN	RESULT	LIMIT	MARGIN	ANTENNA	TABLE
	[MHz]	CAV	FACTOR	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dB]	[cm]	[DEG]
----- Vertical -----										
1	1578.109	30.8	25.3	2.8	42.0	16.9	54.0	37.1	100	12
2	2785.514	32.2	29.0	3.8	43.0	22.0	54.0	32.0	100	153
3	3737.725	32.4	31.6	4.3	43.5	24.8	54.0	29.2	100	145
4	14124.880	31.1	41.6	8.7	42.2	39.2	54.0	14.8	100	359
5	17286.500	28.6	42.7	9.5	43.5	37.3	54.0	16.7	100	340
6	17932.060	27.7	47.0	9.9	43.3	41.3	54.0	12.7	100	359

Remark: Margin (dB) = Limit – Result

Result = Reading CISPR-Average + Antenna Factor + Loss – Gain

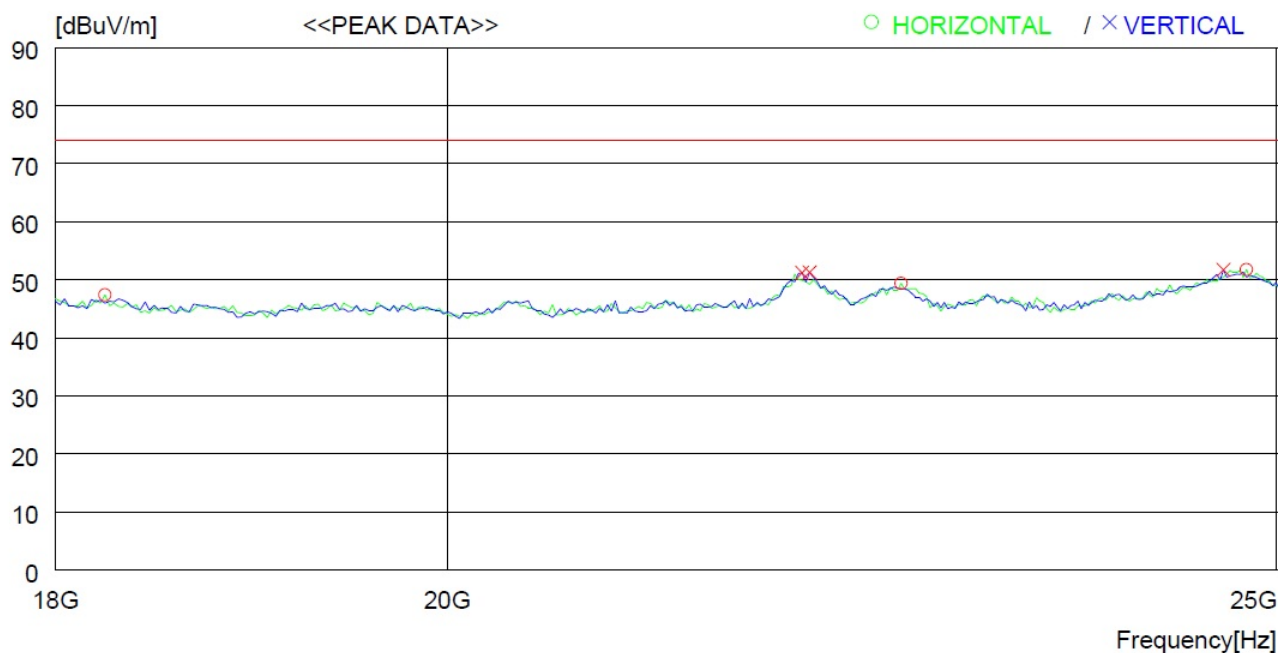
Loss and Gain in above table means Cable Loss and Pre-amplifier gain.

* Radiated emissions (Tx/Rx frequencies) from the transceiver shall be ignored.

Bluetooth: 2 402 ~ 2 480 MHz

* ◆ - Exclusion band Carrier Frequency, ◆ - Exclusion band Harmonic Frequency

Test Mode 2 (AUX + BT)			
Frequency range	: 18 GHz ~ 25 GHz	Test Date	: February 16, 2022
Resolution bandwidth	: 1 MHz	Measurement distance	: 3 m
Detector Mode	: CISPR-Average		



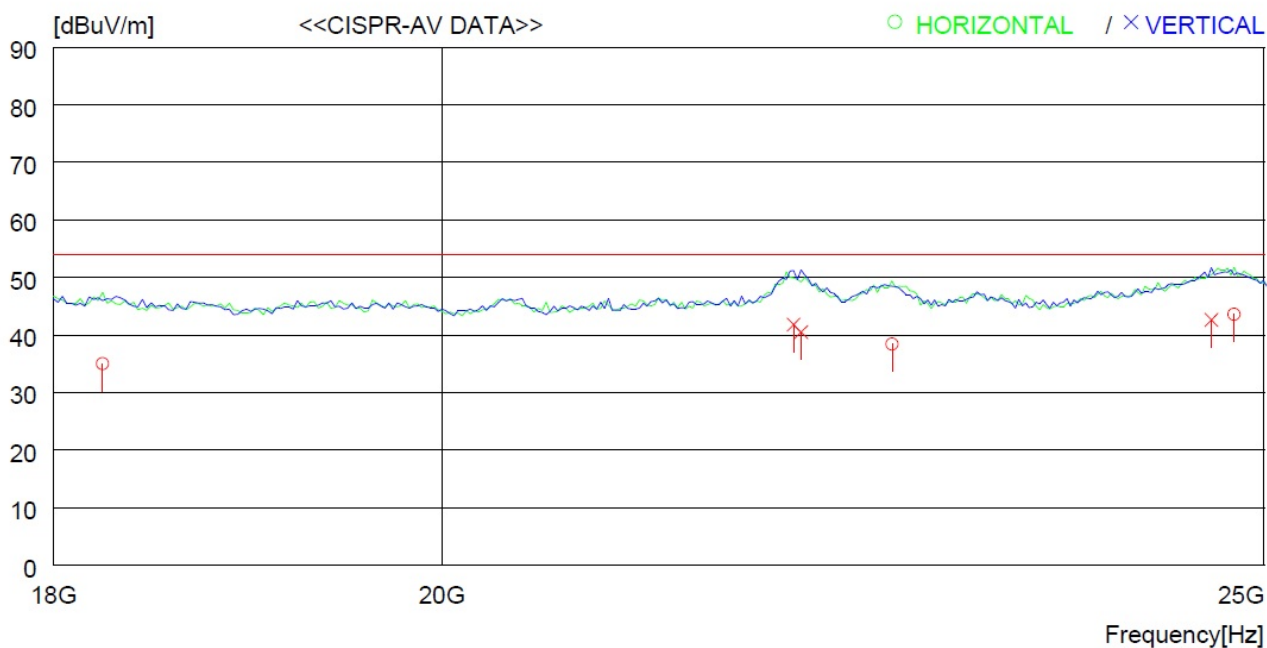
No.	FREQ [MHz]	READING [dBuV]	ANT PEAK FACTOR [dB]	LOSS [dB]	GAIN [dB]	RESULT [dBuV/m]	LIMIT [dBuV/m]	MARGIN [dB]	ANTENNA [cm]	TABLE [DEG]
----- Horizontal -----										
1	18242.000	37.7	40.1	9.7	40.1	47.4	74.0	26.6	100	284
2	22598.000	41.0	40.1	11.2	42.9	49.4	74.0	24.6	100	238
3	24798.000	42.7	40.2	11.5	42.6	51.8	74.0	22.2	100	0
----- Vertical -----										
4	22004.000	42.8	40.1	11.0	42.7	51.2	74.0	22.8	100	41
5	22048.000	43.0	40.1	11.0	42.8	51.3	74.0	22.7	100	167
6	24644.000	42.8	40.1	11.5	42.7	51.7	74.0	22.3	100	359

Remark: Margin (dB) = Limit – Result

Result = Reading Peak + Antenna Factor + Loss – Gain

Loss and Gain in above table means Cable Loss and Pre-amplifier gain.

Test Mode 2 (AUX + BT)			
Frequency range	: 18 GHz ~ 25 GHz	Test Date	: February 16, 2022
Resolution bandwidth	: 1 MHz	Measurement distance	: 3 m
Detector Mode	: CISPR-Average		



No.	FREQ	READING	ANT	LOSS	GAIN	RESULT	LIMIT	MARGIN	ANTENNA	TABLE
	[MHz]	CAV	FACTOR	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dB]	[cm]	[DEG]
----- Horizontal -----										
1	18242.740	25.3	40.1	9.7	40.1	35.0	54.0	19.0	100	284
2	22598.450	30.0	40.1	11.2	42.9	38.4	54.0	15.6	100	238
3	24798.070	34.5	40.2	11.5	42.6	43.6	54.0	10.4	100	0
----- Vertical -----										
4	22004.220	33.4	40.1	11.0	42.7	41.8	54.0	12.2	100	41
5	22048.640	32.2	40.1	11.0	42.8	40.5	54.0	13.5	100	167
6	24644.230	33.7	40.1	11.5	42.7	42.6	54.0	11.4	100	359

Remark: Margin (dB) = Limit – Result

Result = Reading CISPR-Average + Antenna Factor + Loss – Gain

Loss and Gain in above table means Cable Loss and Pre-amplifier gain.

6. SAMPLE CALCULATIONS

$$\text{dB}\mu\text{V} = 20 \text{ Log}_{10}(\mu\text{V})$$

$$\text{Margin} = \text{Limit} - \text{Result}$$

-. Example 1: 0.41200 MHz

Class B Limit	= 47.6 dB μ V (CISPR-Average)
Reading	= 23.3 dB μ
Correction Factor	= Cable Loss + Pulse Limiter
	= 10.1 dB
Total	= 33.4 dB μ V
Margin	= 47.6 dB μ V – 33.4 dB μ V
	= 14.2 dB

-. Example 2: 24798.070 MHz

Class B Limit	= 54.0 dB μ V/m (CISPR-Average)
Reading	= 34.5 dB μ V
Correction Factor	= Antenna Factor (40.2 dB/m) + Cable Loss (11.5 dB) - Amp. Gain (42.6 dB)
	= 9.1 dB
Total	= 43.6 dB μ V/m
Margin	= 54.0 dB μ V/m – 43.6 dB μ V/m
	= 10.4 dB

APPENDIX A

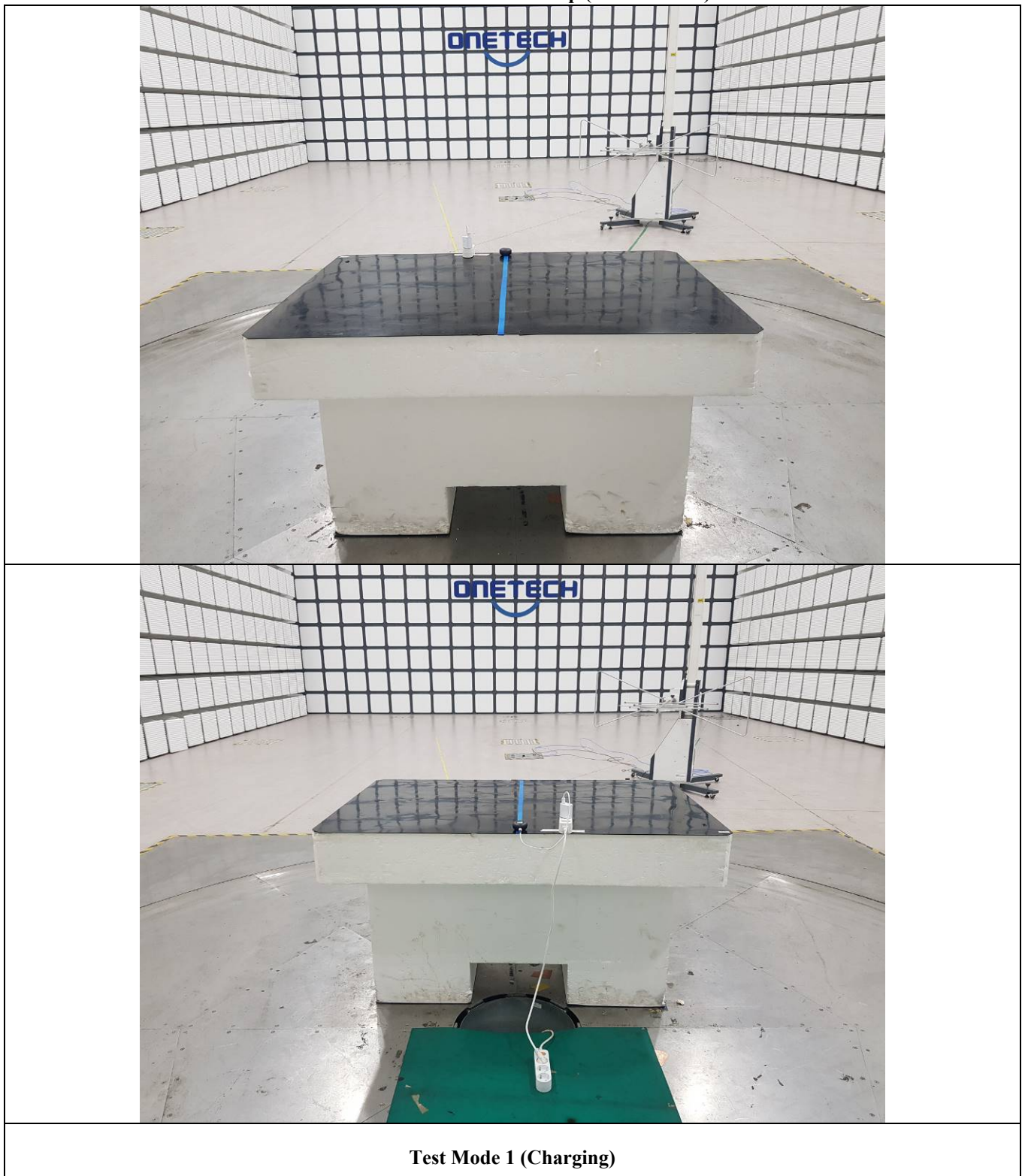
[TEST SET UP PHOTOGRAPHS]

Conducted Emission Test Set Up



Test Mode 1 (Charging)

Radiated Emission Test Set Up (Below 1 GHz)



Test Mode 1 (Charging)



Test Mode 2 (AUX + BT)

Radiated Emission Test Set Up (Above 1 GHz)

