



# CERTIFICATION TEST REPORT

**Report Number. :** 4790375043-FR1V2

**Applicant :** SEGI LIMITED  
Unit J2, 4/F, Block 1, Kinho Industrial Building,  
14-24 Au Pui Wan Street, Shatin, New Territories  
HONGKONG, China

**Model :** ANT-1WAF

**FCC ID :** VA5ANH500-1WLF  
**IC :** 7087A-1WANH500LF

**EUT Description :** Keyless Entry System

**Test Standard(s) :** FCC 47 CFR PART 15 SUBPART C  
INDUSTRY CANADA RSS-Gen Issue 5  
INDUSTRY CANADA RSS-210 Issue 10

**Date Of Issue:**

July 25, 2022

**Prepared by:**

UL Korea, Ltd.

26th floor, 152, Teheran-ro, Gangnam-gu Seoul, 06236, Korea

Suwon Test Site: UL Korea, LTD. Suwon Laboratory

218 Maeyeong-ro, Yeongtong-gu

Suwon-si, Gyeonggi-do, 16675, Korea

TEL: (031) 337-9902

FAX: (031) 213-5433



**Testing Laboratory**

**TL-637**

Revision History

<u>Rev.</u>	<u>Issue Date</u>	<u>Revisions</u>	<u>Revised By</u>
V1	07/15/22	Initial issue	Jaehyong Lee
V2	07/25/22	Updated to address about the TCB's question	Jaehyong Lee

## TABLE OF CONTENTS

<b>1. ATTESTATION OF TEST RESULTS .....</b>	<b>4</b>
<b>2. TEST METHODOLOGY .....</b>	<b>5</b>
<b>3. FACILITIES AND ACCREDITATION .....</b>	<b>5</b>
<b>4. CALIBRATION AND UNCERTAINTY .....</b>	<b>6</b>
4.1. <i>MEASURING INSTRUMENT CALIBRATION.....</i>	6
4.2. <i>SAMPLE CALCULATION.....</i>	6
4.3. <i>DECISION RULES.....</i>	6
4.4. <i>MEASUREMENT UNCERTAINTY .....</i>	6
<b>5. EQUIPMENT UNDER TEST .....</b>	<b>7</b>
5.1. <i>DESCRIPTION OF EUT.....</i>	7
5.2. <i>MAXIMUM OUTPUT POWER.....</i>	7
5.3. <i>WORST-CASE CONFIGURATION .....</i>	7
5.4. <i>DESCRIPTION OF TEST SETUP.....</i>	7
<b>6. TEST AND MEASUREMENT EQUIPMENT .....</b>	<b>9</b>
<b>7. APPLICABLE LIMITS AND TEST RESULTS .....</b>	<b>10</b>
7.1. <i>99% BANDWIDTH .....</i>	10
7.2. <i>RADIATED EMISSIONS .....</i>	11
7.3. <i>AC MAINS LINE CONDUCTED EMISSIONS.....</i>	16

# 1. ATTESTATION OF TEST RESULTS

**COMPANY NAME:** SEGI LIMITED  
**EUT DESCRIPTION:** Keyless Entry System  
**MODEL NUMBER:** ANT-1WAF  
**SERIAL NUMBER:** Identical prototype  
**DATE TESTED:** 2022-05-12 ~ 2022-05-13;

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
CFR 47 Part 15 Subpart C	Complies
INDUSTRY CANADA RSS-210 Issue 10	Complies
INDUSTRY CANADA RSS-GEN Issue 5	Complies

UL Korea, Ltd. tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by UL Korea, Ltd. based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

**Note:** The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL Korea, Ltd. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL Korea, Ltd. will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by IAS, any agency of the Federal Government, or any agency of any government.

Approved & Released For  
UL Korea, Ltd. By:



Anthony Kim  
Senior Laboratory Engineer  
UL Korea, Ltd.

Tested By:



Jaehyong Lee  
Laboratory Engineer Associate  
UL Korea, Ltd.

## 2. TEST METHODOLOGY

1. FCC CFR 47 Part 2.
2. FCC CFR 47 Part 15.
3. ANSI C63.10-2013.
4. IC RSS-GEN Issue 5.
5. IC RSS-210 Issue 10.

## 3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea. Line conducted emissions are measured only at the 218 address. The following table identifies which facilities were utilized for radiated emission measurements documented in this report. Specific facilities are also identified in the test results sections.

218 Maeyeong-ro	
<input type="checkbox"/>	Chamber 1
<input type="checkbox"/>	Chamber 2
<input type="checkbox"/>	Chamber 3
<input checked="" type="checkbox"/>	10m Chamber

Used ISED Test Site Reg.(company number): 2324L  
CAB Identifier: KR0161

UL Korea, Ltd. is accredited by IAS, Laboratory Code TL-637. The full scope of accreditation can be viewed at <https://www.iasonline.org/wp-content/uploads/2017/05/TL-637-cert-New.pdf>.

## 4. CALIBRATION AND UNCERTAINTY

### 4.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

### 4.2. SAMPLE CALCULATION

Where relevant, the following sample calculation is provided:

$$\begin{aligned} \text{Field Strength (dBuV/m)} &= \text{Measured Voltage (dBuV)} + \text{Antenna Factor (dB/m)} + \\ &\text{Cable Loss (dB)} - \text{Preamp Gain (dB)} \\ 28.9 \text{ dBuV/m} &= 36.5 \text{ dBuV} + 18.7 \text{ dB/m} + 0.6 \text{ dB} - 26.9 \text{ dB} \end{aligned}$$

### 4.3. DECISION RULES

Decision rule for statement(s) of conformity is based on Procedure 2, Clause 4.4.3 in IEC Guide 115:2007.

### 4.4. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

PARAMETER	UNCERTAINTY
Conducted Disturbance, 0.15 to 30 MHz	3.02 dB
Radiated Disturbance, 9 kHz to 30 MHz	1.72 dB

Uncertainty figures are valid to a confidence level of 95%.

## 5. EQUIPMENT UNDER TEST

### 5.1. DESCRIPTION OF EUT

The EUT is a Keyless Entry System with 125 kHz.

### 5.2. MAXIMUM OUTPUT POWER

Fundamental Frequency [kHz]	Mode	E Field FCC(300m distance) [dB $\mu$ V/m]	H Field IC(300m distance) [dB $\mu$ A/m]
125	Tx	15.49	-36.01

### 5.3. WORST-CASE CONFIGURATION

The spurious emissions was investigated in three orthogonal orientations X, Y and Z it was determined that Y orientation was worst-case orientation.

### 5.4. DESCRIPTION OF TEST SETUP

#### SUPPORT EQUIPMENT & PERIPHERALS

Support Equipment List				
Description	Manufacturer	Model	Serial Number	FCC ID
Test Jig	SEGI	N/A	N/A	N/A

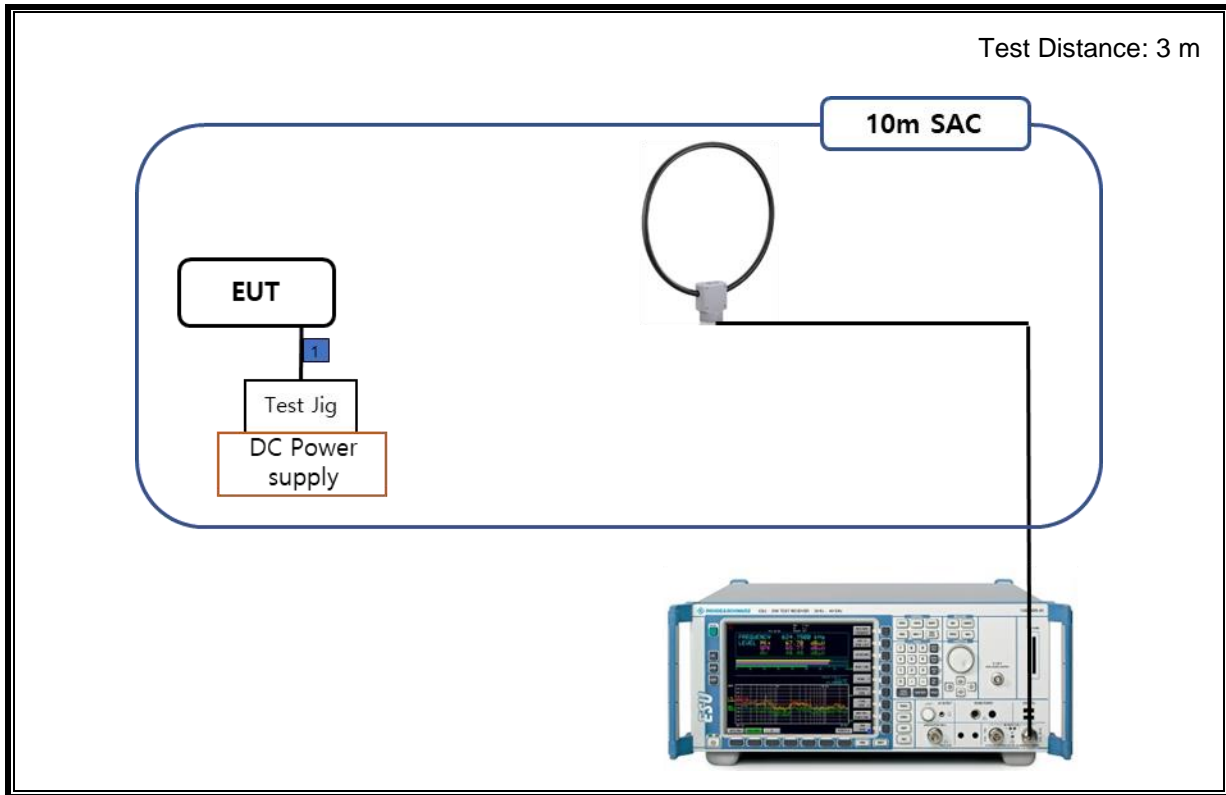
#### I/O CABLES

I/O Cable List						
Cable No.	Port	# of identical ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	DC & Data	1	Pin	Unshielded	2.5	From EUT to Jig

#### TEST SETUP

The EUT was tested in forced transmit mode using test jig.

**SETUP DIAGRAM FOR TESTS**





## 6. TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment was utilized for the tests documented in this report:

Test Equipment List				
Description	Manufacturer	Model	S/N	Cal Due
Spectrum Analyzer, 44 GHz	KEYSIGHT	N9030B	MY57143717	2023-01-11
EMI Test Receive, 44 GHz	R&S	ESW44	101848	2022-08-02
Antenna, Loop, 9kHz-30MHz	R&S	HFH2-Z2E	100900	2023-08-06
BIAS UNIT	R&S	IN600	100974	N/A
Open Switch and Control Platform	R&S	OSP220	101456	N/A
Filter Bank	R&S	Filter Bank	N/A	N/A
DC Power Supply	Smtechno	SDP 30-5D	305DSE076	2022-08-02
UL Software				
Description	Manufacturer	Model	Version	
Radiated software	R&S	EMC32	Ver 10.60.10	

## 7. APPLICABLE LIMITS AND TEST RESULTS

### 7.1. 99% BANDWIDTH

#### LIMITS

None; for reporting purposes only.

#### TEST PROCEDURE

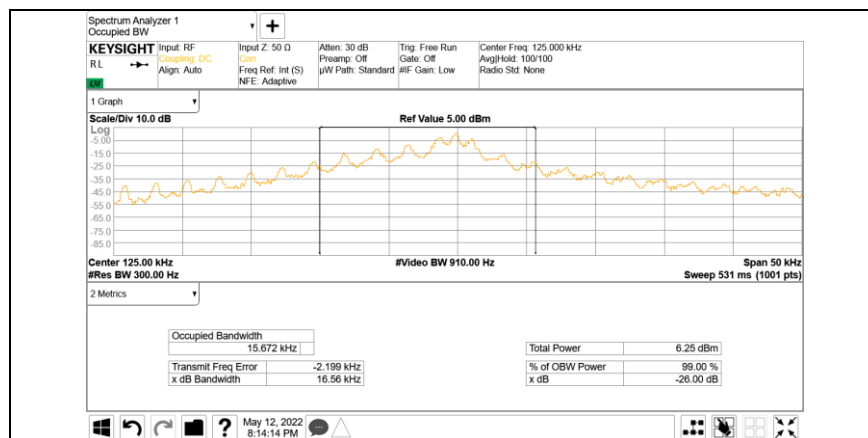
The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the 99 % bandwidth and to 1% of the span. The VBW is set to  $\geq 3$  times the RBW. The spectrum analyzer internal 99% bandwidth function is utilized.

Note: The RBW setting is lowest set(1Hz) of SA, due to the too low of OBW.

#### RESULTS

Frequency [kHz]	99% Bandwidth [kHz]
125	15.672

#### 99% BANDWIDTH PLOTS



## 7.2. RADIATED EMISSIONS

### LIMIT

FCC §15.209 (a)

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (m)
0.009–0.490	2400/F(kHz)	300
0.490–1.705	24000/F(kHz)	30
1.705–30.0	30	30
30–88	100	3
88 to 216	150	3
216 to 960	200	3
Above 960 MHz	500	3
Note: The lower limit shall apply at the transition frequency.		

\*\* Except as provided in paragraph (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.

§15.209 (b) In the emission table above, the tighter limit applies at the band edges.

Formula for converting the filed strength from uV/m to dBuV/m is:  
 Limit (dBuV/m) = 20 log limit (uV/m)

IC RSS-GEN Sections 8.9 and 8.10.

Frequency (MHz)	Field strength ( $\mu\text{V}/\text{m}$ at 3 m)
30 – 88	100
88 – 216	150
216 – 960	200
Above 960	500

Frequency (MHz)	Magnetic field strength (H-Field) ( $\mu\text{A}/\text{m}$ )	Measurement Distance (m)
0.009–0.490 <sup>Note 1</sup>	6.37/F (F in kHz)	300
0.490–1.705	63.7/F (F in kHz)	30
1.705–30.0	0.08	30
Note 1: The emission limits for the ranges 9-90 kHz and 110-490 kHz are based on measurements employing a linear average detector.		

Note: The limits for spurious emissions below 30 MHz in RSS GEN Section 8.9 Table 6 are given in dBuA/m while the FCC Part 15.209(a) limits are expressed in dBuV/m. Using the free space impedance of  $377\Omega$  to convert between electric and magnetic field strength (a factor of 51.5dB in logarithmic units) the two sets of limits are equivalent and therefore a measured value of X dBuV/m shown in the plots and tables is equal to a magnetic field strength of (X - 51.5) dBuA/m and the margin of that emission relative to the RSS GEN limit (FCC 15.209 limit – 51.5) dBuA/m would be the same as the margin to the FCC limit detailed in those plots/tables.

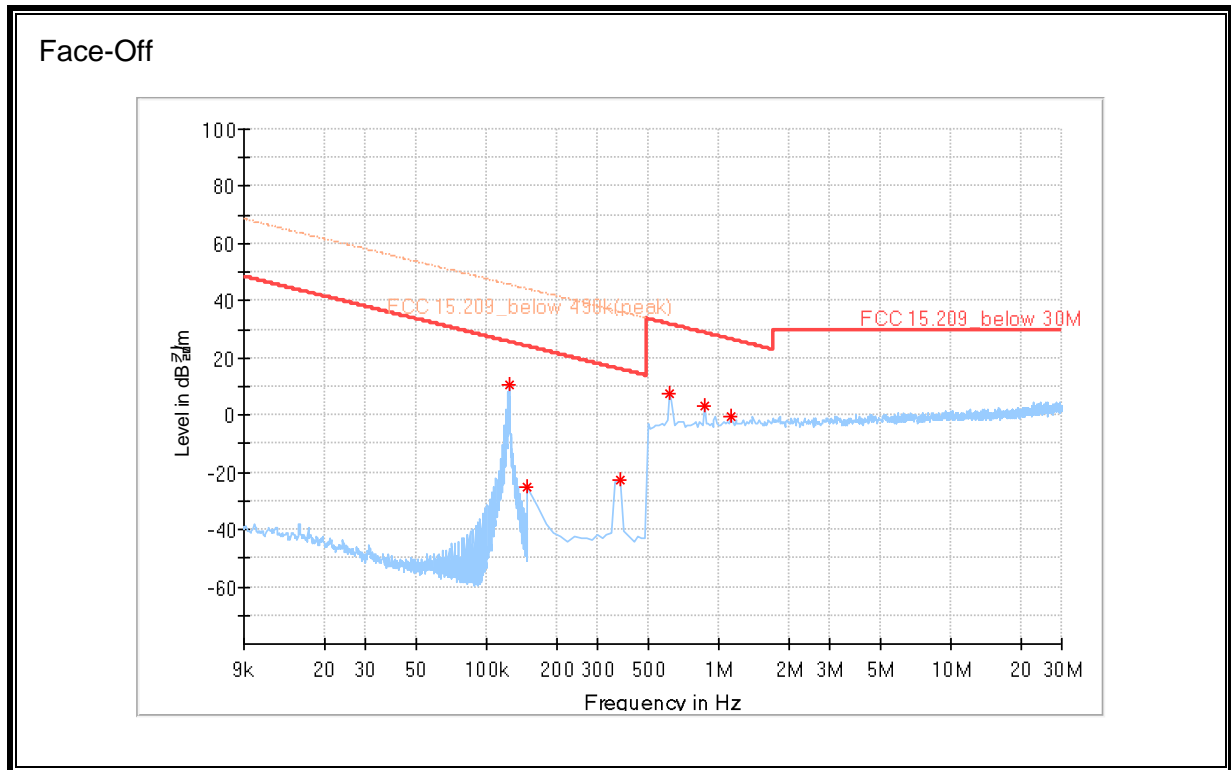
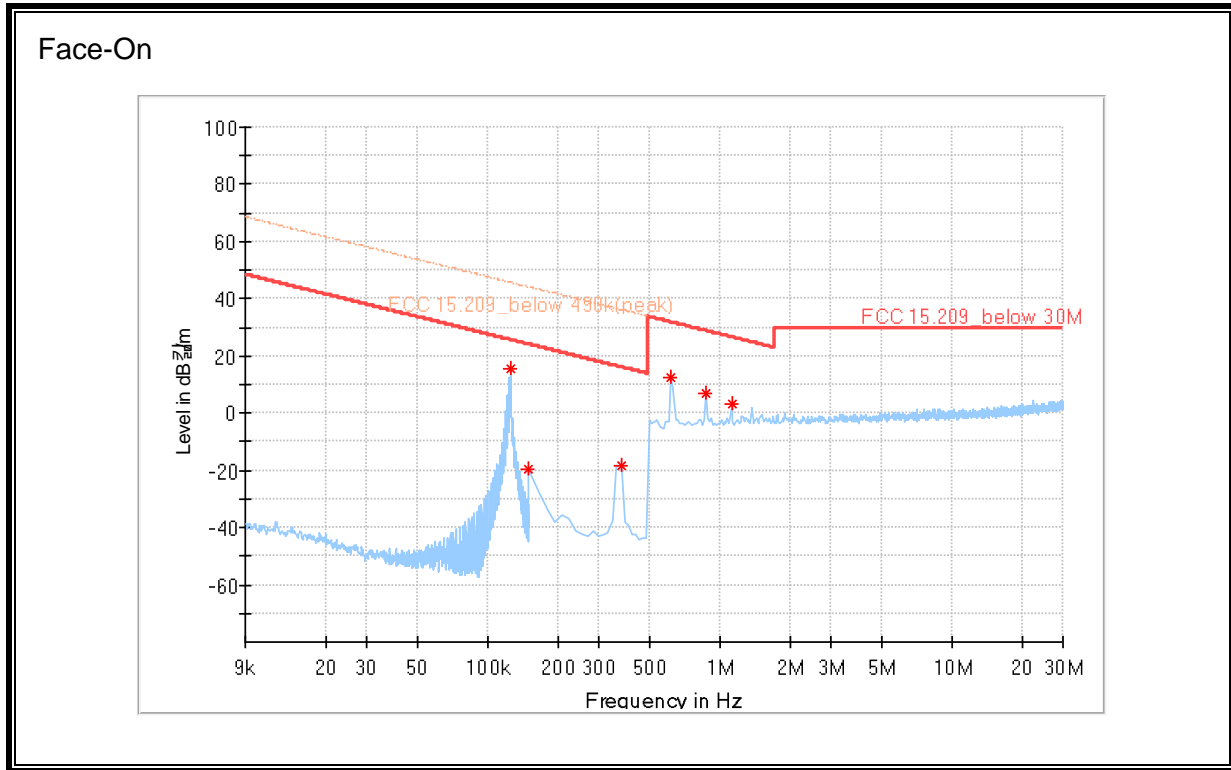
**TEST PROCEDURE**

ANSI C63.10: 2013

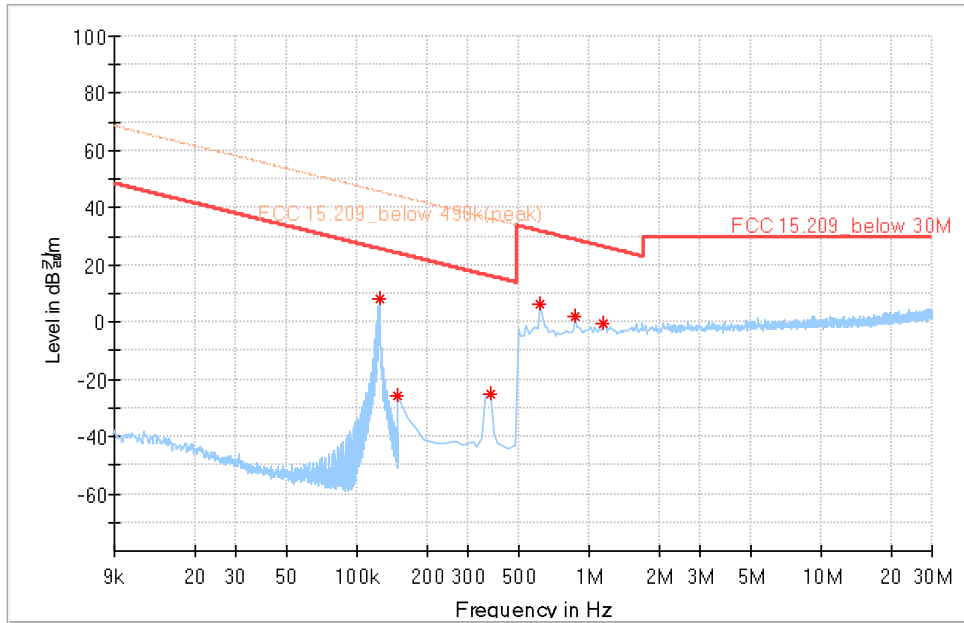
**RESULTS**

See the following pages.

**RADIATED EMISSIONS FUNDAMENTAL & 9 KHz to 30 MHz**



parallel to the ground plane



**TEST DATA**

[Face-On]

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Pol	Azimuth (deg)	Corr. (dB/m)
** 0.124933	15.49	25.66	10.18	0.200	H	0.0	-58.9
0.150000	-19.40	24.08	43.48	9.000	H	350.0	-58.9
0.373875	-18.18	16.15	34.33	9.000	H	358.0	-58.7
0.612675	12.44	31.87	19.43	9.000	H	357.0	-18.7
0.866400	6.81	28.86	22.06	9.000	H	344.0	-18.6
1.120125	3.01	26.64	23.63	9.000	H	0.0	-18.4

\*\* Fundamental

Result = Reading + Corr. Factor(Ant. Factor + Cable + Distance Factor)

[Face-Off]

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Pol	Azimuth (deg)	Corr. (dB/m)
** 0.124933	10.82	25.66	14.84	0.200	H	264.0	-58.9
0.150000	-25.21	24.08	49.28	9.000	H	293.0	-58.9
0.373875	-22.70	16.15	38.85	9.000	H	87.0	-58.7
0.612675	7.59	31.87	24.27	9.000	H	276.0	-18.7
0.866400	2.96	28.86	25.90	9.000	H	276.0	-18.6
1.120125	-0.22	26.64	26.86	9.000	H	260.0	-18.4

\*\* Fundamental

Result = Reading + Corr. Factor(Ant. Factor + Cable + Distance Factor)

[Parallel to the ground plane]

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Pol	Azimuth (deg)	Corr. (dB/m)
** 0.124933	8.42	25.66	17.24	0.200	H	0.0	-58.9
0.150000	-26.01	24.08	50.09	9.000	H	186.0	-58.9
0.373875	-25.05	16.15	41.20	9.000	H	10.0	-58.7
0.612675	6.10	31.87	25.77	9.000	H	169.0	-18.7
0.866400	2.23	28.86	26.64	9.000	H	176.0	-18.6
1.149975	-0.50	26.41	26.91	9.000	H	349.0	-18.4

\*\* Fundamental

Result = Reading + Corr. Factor(Ant. Factor + Cable + Distance Factor)

Note 1: Radiated test were investigated with three receiving antenna axes: Face-on, Face-off and horizontal (parallel to the ground plane) were set for final test.

Note 2: Although these tests were performed other than open field test site, adequate comparison measurements were confirmed against 10m open field test site. Therefore, sufficient tests were made to demonstrate that the alternative site produces results that correlated with the one of tests made in an open field site based on KDB 414788.

### 7.3. AC MAINS LINE CONDUCTED EMISSIONS

#### TEST PROCEDURE

ANSI C63.10: 2013

The EUT is placed on a non-conducting table 40 cm from the vertical ground plane and 80 cm above the horizontal ground plane. The EUT is configured in accordance with ANSI C63.10.

The receiver is set to a resolution bandwidth of 9 kHz. Peak detection is used unless otherwise noted as quasi-peak or average.

Line conducted data is recorded for both NEUTRAL and HOT lines.

#### LIMIT

FCC §15.207 (a)

IC RSS-GEN Sections 8.8

Frequency range (MHz)	Limits (dB $\mu$ V)	
	Quasi-peak	Average
0.15 to 0.50	66 to 56*	56 to 46*
0.50 to 5	56	46
5 to 30	60	50

\*Decreases with the logarithm of the frequency.

#### RESULTS (N/A)

This EUT is only supplied by vehicular battery.

## END OF REPORT