EVALUATION REPORT

for Certification

Manufacturer: Seronics Co.,Ltd

#181 Gongdan-dong, Gumi-Si,

Gyeoungsangbuk-Do, South Korea

Attn: Mr. Hak-Ki Kim / General Manager

Date of Issue: Dec. 24, 2020

Order Number: GETEC-C1-20-651

Test Report Number: GETEC-E3-20-083

Test Site: GUMI UNIVERSITY EMC CENTER

CAB Designation Number: KR0033

RESPONSIBLE PARTY	**: Seronics Co.,Ltd**
ADDRESS	**: #36, Suchul-Daero, 9(gu)-gil, Gumi-Si, Gyeoungsangbuk-Do, South Korea**
CONTACT PERSON	**: Young Su Park / Principal Research Engineer**

Rule Part(s)	**: FCC Part 15 Subpart C-Intentional Radiator § 15.247**
	FCC Part 15 Subpart E-UNII Devices § 15.407
Test Method	**: ANSI C63.10 (2013)**
Equipment Class	**: Digital Transmission System(DTS)**
	Unlicensed National Information Infrastructure(NII)
EUT Type	**: Screen Mirroring Device**
Type of Authority	**: Certification**
Model Name	**: SC-00DA**

This equipment has been shown to be in compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in ANSI C63.10 (2013)

I attest to the accuracy of data. All measurements reported herein were performed by me or were made under my supervision and are correct to the vest of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

Tested by,

Sung-Joo Park / Associate Engineer
GUMI UNIVERSITY EMC CENTER

Reviewed by,

Hyun Kim / Technical Manager
GUMI UNIVERSITY EMC CENTER

Version

Test Report No.	Date	Description
GETEC-E3-20-083	Dec. 24, 2020	- First Approval Report

CONTENTS

Scope: *Measurement and determination of electromagnetic emissions (EME) of radio frequency devices including intentional and / or unintentional radiators for compliance with technical rules and regulations of the Federal Communications Commission.*

1. General Information

Applicant: Seronics Co.,Ltd

Applicant Address: #36, Suchul-Daero, 9(gu)-gil, Gumi-Si, Gyeoungsangbuk-Do, South Korea

Manufacturer: Seronics Co.,Ltd

Manufacturer Address: #36, Suchul-Daero, 9(gu)-gil, Gumi-Si, Gyeoungsangbuk-Do, South Korea

Contact Person: Young Su Park/ Principal Research Engineer

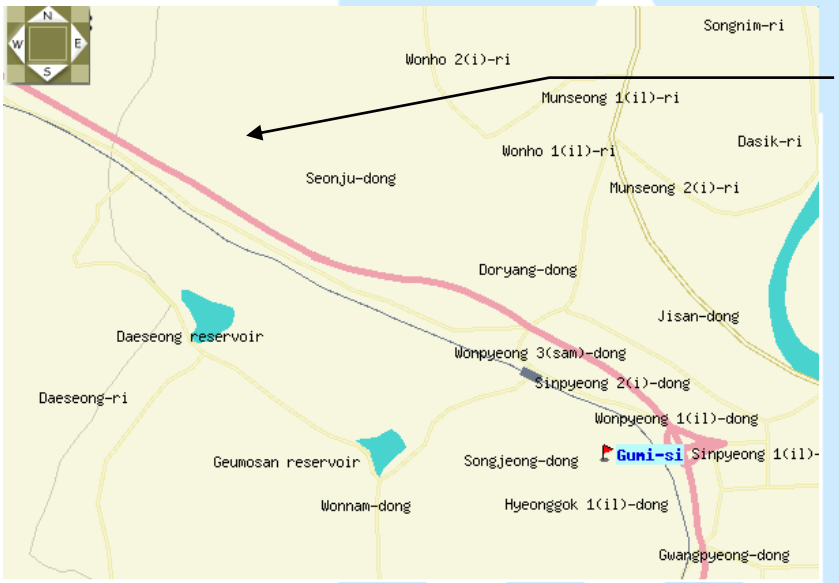
Telephone Number: +82-54-468-6140

- **FCC ID.** 2AX4BSC00DA
- **Equipment Class** Digital Transmission System (DTS)
  Unlicensed National Information Infrastructure(NII)
- **EUT Type** Screen Mirroring Device
- **Model Name** SC-00DA
- **Rule Part(s)** FCC Part 15 Subpart C-Intentional Radiator § 15.247
  FCC Part 15 Subpart E-UNII Devices § 15.407
- **Test Method** ANSI C63.10 (2013)
- **Type of Authority** Certification
- **Test Procedure(s)** ANSI C63.10 (2013)
- **Dates of Test** Nov. 12, 2020 ~ Dec. 04, 2020
- **Place of Test** **GUMI UNIVERSITY EMC CENTER** (FCC Test firm Registration No.: 269701)
  37 Yaeun-ro, Gumi-si, Gyeongsangbuk-do, 730-711, Republic of Korea
- **Test Report Number** GETEC-E3-20-083
- **Dates of Issue** Dec. 24, 2020

2. Introduction

The measurement procedure described in American National Standard for Methods of Measurement of Radio-Nose Emissions From Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz (ANSI C63.4-2009) was used in determining radiated and conducted emissions emanating from **Seronics Co.,Ltd Screen Mirroring Device(Model name: SC-00DA).**

These measurement tests were conducted at **GUMI UNIVERSITY EMC CENTER**.
The site address is 37 Yaeun-ro, Gumi-si, Gyeongsangbuk-do, 730-711, Republic of Korea
This test site is one of the highest point of GUMI UNIVERSITY at about 200 kilometers away from Seoul city and 40 kilometers away from Daege city. It is located in the valley surrounded by mountains in all directions where ambient radio signal conditions are quiet and a favorable area to measure the radio frequency interference on open field test site for the computing and ISM devices manufactures. The detailed description of the measurement facility was found to be in compliance with the requirements of §2.948 according to ANSI C63.10 (2013)



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Republic of Korea
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Fig 1. The map above shows the Gumi University in vicinity area.

3. Product Information

3.1 Description of EUT

The Equipment under Test (EUT) is the **Seronics Co.,Ltd Screen Mirroring Device (Model Name: SC-00DA) FCC ID.: 2AX4BSC00DA**

Equipment

-. Equipment	: Screen Mirroring Device
-. Model name	: SC-00DA
-. Serial number	: Proto type
-. Electrical Rating	: DC 5 V
-. Power Consumption	: Maximum 2.5 W / Standard 1.5 W
-. Manufacturer	: Seronics Co.,Ltd
-. Dimensions	: 63.8 mm * 638. Mm * 13.5 mm (USB cable 85.5 mm)
-. Weight	: 46 g
-. Interface	: USB 2.0

Internal RF module

-. Frequency Range	: 2412 to 2462 MHz 5180 to 5320 MHz 5500 to 5700 MHz 5745 to 5825 MHz
-. Modulation	: DSSS, OFDM, 256QAM, 64QAM, 16QAM, QPSK, BPSK
-. Antenna Specification	: Antenna type : Monopole antenna Gain : 2.1 dBi(2412 to 2462 MHz) / 2.4 dBi(5180 to 5825 MHz)

3.2 Definition of models

-None.

3.3 Support Equipment / Cables used

3.3.1 Used Support Equipment

Description	Manufacturer	Model Name	S/N & FCC ID.
Notebook Computer	SAMSUNG Electronics	NT500R3W	S/N: 0Q2V91JJ100096T FCC ID.: N/A
SIGNAGE	LG Electronics Inc.	55 inch	-

3.3.2 System configuration

Description	Manufacturer	Model Name	S/N & FCC ID.
Wireless LAN & Bluetooth Combo Module	TAIYO YUDEN CO., LTD.	WYSAGVDXG	S/N: N/A FCC ID: RYYWYSAGVDXG

3.3.3 Used Cable(s)

Cable Name	Condition	Description
-	-	-

3.4 Modification Item(s)

-. None

4. Antenna Requirement - §15.203

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

4.1 Description of Antenna

The **Seronics Co.,Ltd Screen Mirroring Device.** comply with the requirement of §15.203 with a Monopole antenna permanently attached to the transmitter.

5. Description of tests

5.1 Test Condition

The EUT was installed, arranged and operated in a manner that is most representative of equipment as typically used.

The measurements were carried out while varying operating modes and cable positions within typically arrangement to determine maximum emission level.

The representative and worst test mode(s) were noted in the test report.

- Test Voltage / Frequency: 5 V / DC
- Operating condition during the test(s) :
  -. Continuous mirroring mode, the laptop screen is mirrored to the SIGNAGE screen via Wi-Fi.

6. References Standards

- FCC Part 15 (2009) Subpart C-Intentional Radiator §15.247
- FCC Part 15 (2009) Subpart E-UNII Devices §15.407
- ANSI C 63.10 (2013): American National Standard for Testing Unlicensed Wireless Devices

7. SUMMARY OF TEST RESULTS

FCC Part Section(s)	Test Description	Test Result
§15.407 (for Power Measurement)	26 dB Bandwidth	N/A[1)]
§15.247(a)(2) §15.407(e)	6 dB Bandwidth	N/A[1)]
§15.247(b)(3) §15.407(a)	Conducted Maximum Output Power	N/A[1)]
§15.407(h)1	Transmit Power Control (TPC)	N/A[1)]
§15.247(e) §15.407(a)	Power Spectral Density	N/A[1)]
§15.407(g)	Frequency Stability	N/A[1)]
§15.247(d)	Conducted Out of Band Emission Emissions	N/A[1)]
§15.407(b)	Undesirable Emissions	N/A[1)]
§15.207(a)	AC Power line Conducted Emissions	Pass
§15.205, §15.209	Radiated Spurious Emissions	Pass
§15.247(d), §15.205, §15.209, § 15.407(b)(5)	Radiated Restricted Band Edge	N/A[1)]

1) The device used the approved module without modification. Therefore, it is not applied because it is a test item verified in the module.

8. AC Power line Conducted emission

-Test Description

The Line conducted emission test facility is inside a 4 m × 8 m × 2.5 m shielded enclosure. (Test firm Registration Number: 269701)

The EUT was placed on a non-conducting 1.0 m by 1.5 m table, which is 0.8 m in height and 0.4 m away from the vertical wall of the shielded enclosure.

The EUT is powered from the Rohde & Schwarz LISN (ENV216) and the support equipment is powered from the Rohde & Schwarz LISN (ENV216). 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 (Rohde & Schwarz, ESCI).

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 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.

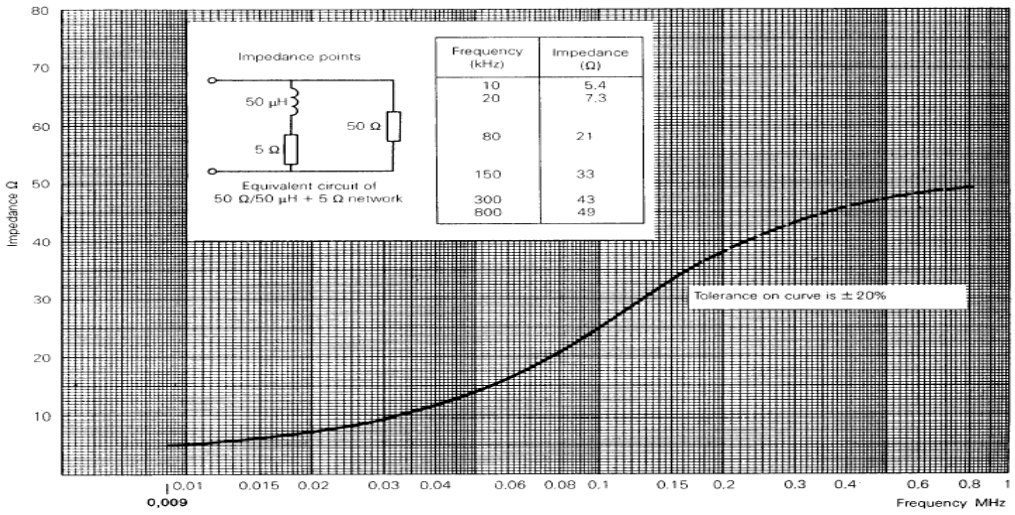


Fig 2. Impedance of LISN

8.1 Operating Environment

Temperature : °C
Relative Humidity : % R.H.

8.2 Test Set-up

The conducted emission measurements were performed in the shielded room.
The EUT was placed on wooden table, 0.8 m heights above the floor, 0.4 m from the reference ground plane (GRP) wall and 0.8 m from AMN & ISN.
AMN is bonded on horizontal reference ground plane.
The ground plane, which was electrically bonded to the shield room, ground system and all power lines entering the shield room, were filtered.

8.3 Measurement Uncertainty

The measurement uncertainty was calculated in accordance with ISO “Guide to the expression of uncertainty in measurement.”
The measurement uncertainty was given with a confidence of 95 %.

Test Items	Uncertainty	Remark
Conducted emission (9 kHz ~ 150 kHz)	3.78 dB	Confidence level of approximately 95 % (k = 2)
Conducted emission (150 kHz ~ 30 MHz)	3.31 dB	Confidence level of approximately 95 % (k = 2)

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2.
The listed uncertainties are the worst case uncertainty for the entire range of measurement. please note that the uncertainty values are provided for informational purposes only are not used in determining the PASS/FAIL results

8.4 Limit

RFI Conducted	FCC Limit(dBμV/m) Class B	
Freq. Range	Quasi-Peak	Average
150 kHz ~ 0.5 MHz	66 ~ 56*	56 ~ 46*
0.5 MHz ~ 5 MHz	56	46
5 MHz ~ 30 MHz	60	50
*Limits decreases linearly with the logarithm of frequency.		

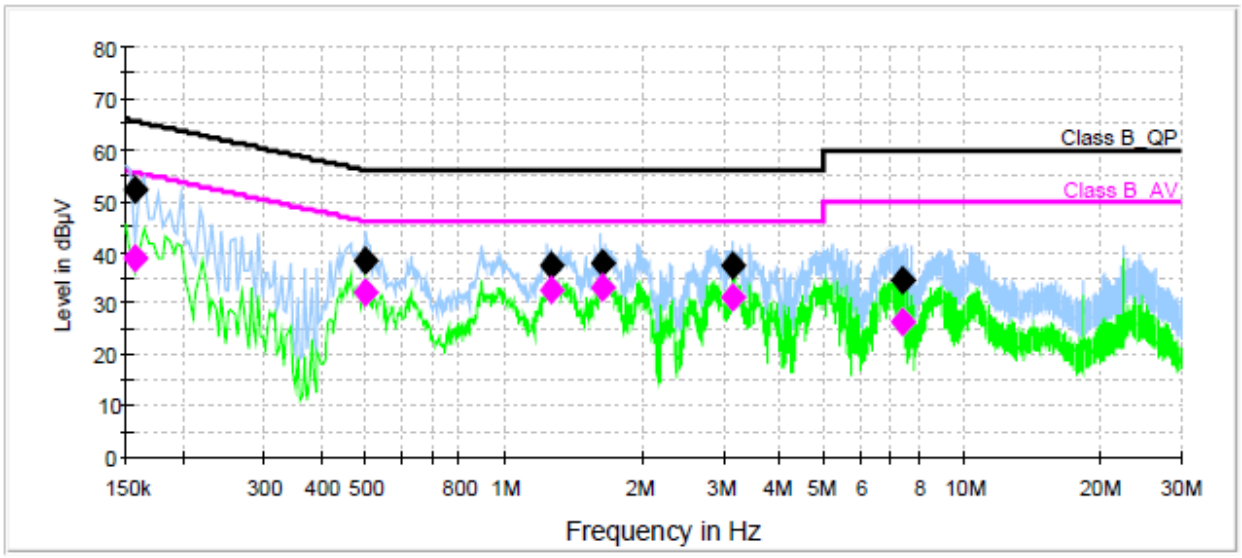
8.5 Test Equipment used

	Model Name	Manufacturer	Description	Serial Number	Due to Calibration
■-	ESCI	Rohde & Schwarz	EMI test receiver	100237	Apr. 08, 2021
□-	ENV216	Rohde & Schwarz	LISN	100172	Apr. 07, 2021
■-	ENV216	Rohde & Schwarz	LISN	100173	Apr. 07, 2021
■-	EMC 32	Rohde & Schwarz	Testing Software	VER8.53	N/A

8.6 Test data for Conducted Emission

-. Test Date : Nov. 13, 2020
-. Reference Standard : FCC Part 15.207(a)
-. Test Procedure(s) : ANSI C63.10 (2019)
-. Operating Condition : Continuous Mirroring mode
-. Power Source : DC 5 V
-. Frequency rage : 0.15 MHz to 30 Mhz
-. Line : AC power line (Live and Neutral)
-. Comment : -

AC Power Line Conducted emission



Class B_QP
Class B_AV
Preview Result 1-PK+
Preview Result 2-AVG
Final Result 1-QPK
Final Result 2-CAV

Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.158000	52.4	1000.0	9.000	Off	L1	9.7	13.1	65.6	
0.501238	38.5	1000.0	9.000	Off	L1	9.7	17.5	56.0	
1.271025	37.3	1000.0	9.000	Off	N	9.6	18.7	56.0	
1.640075	37.9	1000.0	9.000	Off	N	9.7	18.1	56.0	
3.162962	37.5	1000.0	9.000	Off	N	9.8	18.5	56.0	
7.431750	34.6	1000.0	9.000	Off	L1	9.9	25.4	60.0	

Frequency (MHz)	CAverage (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.158000	38.8	1000.0	9.000	Off	L1	9.7	16.8	55.6	
0.501238	32.0	1000.0	9.000	Off	L1	9.7	14.0	46.0	
1.271025	32.3	1000.0	9.000	Off	N	9.6	13.7	46.0	
1.640075	32.9	1000.0	9.000	Off	N	9.7	13.1	46.0	
3.162962	31.2	1000.0	9.000	Off	N	9.8	14.8	46.0	
7.431750	26.1	1000.0	9.000	Off	L1	9.9	23.9	50.0	

9. Radiated Spurious

Exploratory Radiated measurements were conducted at the 3m 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 of below 1GHz were made at 3m or 10 m Chamber that complies with CISPR 16/ANSI C63.10.
Above 1GHz final measurements were conducted at the 3m Chamber only.

For measurements above 1GHz, the bottom side of 3m chamber was installed with absorbers in order to meet SVSWR Limit.
Exploratory measurements were scanned using Peak mode of EMI Test receiver and final measurements were measured with Quasi-Peak mode (Below 1GHz) and Peak & Average mode (Above 1GHz).

The measurements were performed by rotating the EUT 360° and adjusting the receive antenna height from 1.0 m to 4.0 m. All frequencies were investigated in both horizontal and vertical antenna polarity.

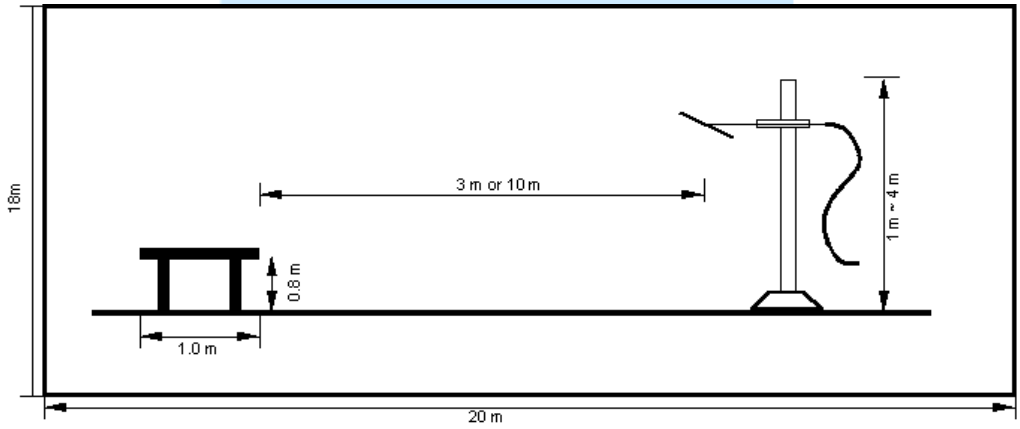


Fig 3. Dimensions of test site (Below 1GHz)

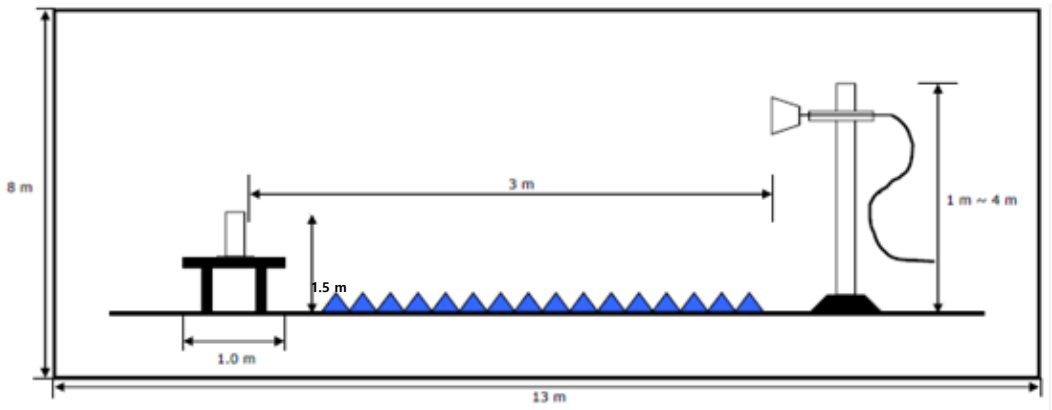


Fig 4. Dimensions of test site (Above 1GHz)

9.1 Operating environment

Temperature : 21.9 ℃
Relative humidity : 66.4 % R.H.

9.2 Test set-up

A preliminary and final measurement was at 3 m anechoic chamber.
The EUT was placed on a non-conducting table.
For emissions testing at or below 1 GHz, the table height is 80 cm above the reference ground plane.
For emission measurements above 1 GHz, the table height is 1.5 m above the reference ground plane.

The turntable with EUT 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.

9.3 Measurement uncertainty

The measurement uncertainty was calculated in accordance with ISO “Guide to the expression of uncertainty in measurement”.
The measurement uncertainty was given with a confidence of 95 %.

Test items(Anechoic Chamber)	Uncertainty	Remark
Radiated emission (30 MHz ~ 300 MHz, 3 m, Vertical)	5.14 dB	Confidence level of approximately 95 % (k = 2)
Radiated emission (30 MHz ~ 300 MHz, 3 m, Horizontal)	5.10 dB	Confidence level of approximately 95 % (k = 2)
Radiated emission (300 MHz ~ 1 000 MHz, 3 m, Vertical)	6.05 dB	Confidence level of approximately 95 % (k = 2)
Radiated emission (300 MHz ~ 1 000 MHz, 3 m, Horizontal)	5.19 dB	Confidence level of approximately 95 % (k = 2)
Radiated emission (1 000 MHz ~ 6 000 MHz, 3 m, V/H)	5.20 dB	Confidence level of approximately 95 % (k = 2)
Radiated emission (6 000 MHz ~ 18 000 MHz, 3 m, V/H)	5.20 dB	Confidence level of approximately 95 % (k = 2)
Radiated emission (18 000 MHz ~ 26 000 MHz, 3 m, V/H)	5.53 dB	Confidence level of approximately 95 % (k = 2)

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2.
The listed uncertainties are the worst case uncertainty for the entire range of measurement. please note that the uncertainty values are provided for informational purposes only are not used in determining the PASS/FAIL results

9.4 Limit

20 dB in any 100 kHz bandwidth outside the operating frequency band. In case the emission fall within the restricted band specified on 15.205(a) limit in the table below has to be followed.

Frequencies (MHz)	Field Strength (microvolt/meter)	Measurement Distance (meters)
0.009 ~ 0.490	2 400/F (kHz)	300
0.490 ~ 1.705	2 400/F (kHz)	30
1.705 ~ 30.0	30	30
30 ~ 88	100	3
88 ~ 216	150	3
216 ~ 960	200	3
Above 960	500	3

9.5 Test Equipment used

Model Name	Manufacturer	Description	Serial Number	Due to Calibration
■ - ESU40	Rohde & Schwarz	EMI Test Receiver	100266	Apr. 10, 2021
■ - HFH2-Z2	Rohde & Schwarz	Loop Antenna	100041	Dec. 19, 2021
■ - VULB9160	Schwarzbeck	Broadband Test Antenna	3313	Sep. 16, 2021
■ - BBHA9120D	Schwarzbeck	Horn Antenna	207	Sep. 15, 2021
■ - BBHA9170	Schwarzbeck	Horn Antenna	766	Nov. 18, 2021
■ - MCU066	maturo GmbH	Position Controller	1390306	N/A
■ - TT2.5SI	maturo GmbH	Turntable	1390307	N/A
■ - CO3000	Innco system GmbH	Position Controller	CO3000/1804/4 2760218/P	N/A
■ - MA4640-XP-ET	Innco system GmbH	Antenna Mast	5580916	N/A
■ - TK-PA18H	TESTEK	Low Noise Amplifier	180001-L	Apr. 08, 2021
■ - TK-PA1840H	TESTEK	Amplifier	170007-L	Apr. 10, 2021
■ - WHKX3.0/18G-10SS	WAINWRIGHT INSTRUMENTS	High pass filter	SN31	Apr. 08, 2021
■ - WHKX7.0/18G-10SS	WAINWRIGHT INSTRUMENTS	High pass filter	SN33	Apr. 08, 2021
■- EMC 32	Rohde & Schwarz	Testing Software	VER10.50.10	N/A

9.6 Test data for Radiated Spurious Emission

-. Test Date : Nov. 12 ~ Dec. 04, 2020
-. Reference Standard : FCC Part 15.247(d), FCC Part 15.407(b)
-. Measuring Distance : 10 m(9 kHz to 1 GHz) / 3 m (1 GHz to 40 GHz)
-. Resolution Bandwidth : 200 Hz, 9 kHz(Below 30 MHz) / 120 kHz(30 MHz ~ 1GHz) / 1 MHz(Above 1GHz)
-. Detector mode : Quasi Peak detector mode / Peak detector mode / Average detector mode
-. Power Source : DC 5 V
-. Note : Through three orthogonal axes were investigated and the worst case is report

Radiated Spurious Emission (9 kHz to 1 000 MHz)

Frequency [MHz]	Pol.	Reading [dBuV]	Transducer Factor [dB]	Test Result [dBuV/m]	Limits [dBuV/m]	Margin [dB]	Detector Type
38.24	V	54.37	-29.00	25.37	30.00	4.63	QPK
42.63	V	55.76	-29.00	26.76	30.00	3.24	QPK
47.03	V	53.39	-28.00	25.39	30.00	4.61	QPK
59.03	V	53.81	-29.00	24.81	30.00	5.19	QPK
126.38	V	53.11	-29.00	24.11	30.00	5.89	QPK
150.00	H	52.82	-26.00	26.82	30.00	3.18	QPK
350.00	H	54.05	-22.00	32.05	37.00	4.95	QPK

Radiated Spurious Emission (1 GHz to 40 GHz)

Frequency [MHz]	Pol.	Frequency Component	Reading [dBuV]	Transducer Factor [dB]	Test Result [dBuV/m]	Limits [dBuV/m]	Margin [dB]	Detector Type
2516.16	H	Other	80.58	-17.80	62.78	74.00	11.22	PK
2516.16	H	Other	46.44	-17.80	28.64	54.00	25.36	CAV
4923.93	H	2nd Harmonics	67.64	-7.70	59.94	74.00	16.06	PK
4923.93	H	2nd Harmonics	41.17	-7.70	33.47	54.00	20.53	CAV
7386.43	H	3rd Harmonics	55.74	-0.50	55.24	74.00	18.76	PK
7386.43	H	3rd Harmonics	34.12	-0.50	33.62	54.00	20.38	CAV

Note 1)
If the maximized peak measured value complies with the average limit, then it is unnecessary to perform an average measurement.

Note 2)
Test Result = Reading + Transducer Factor
Where, Transducer Factor = ACF + CL
ACF = Antenna Collection Factor
CL = Cable loss + Preamplifier gain + High Pass Filter
Pol.: H(Horizontal), V(Vertical)

10. Sample Calculations

$$dB\mu V = 20 \text{ Log } {}_{10}(\mu V/m)$$
$$dB\mu V = dBm + 107$$
$$\mu V = 10^{(dB\mu V/20)}$$

10.1 Example 1 :

■ **20.3 MHz**

Class B Limit = 250 µV = 48 dBµV

Reading = 39.2 dBµV

$10^{(39.2dB\mu V/20)}$ = 91.2 µV

Margin = 48 dBµV - 39.2 dBµV

= 8.8 dB

10.2 Example 2 :

■ **66.7 MHz**

Class B Limit = 100 µV/m = 40.0 dBµV/m

Reading = 31.0 dBµV

Antenna Factor + Cable Loss = 5.8 dB

Total = 36.8 dBµV/m

Margin = 40.0 dBµV/m – 36.8 dBµV/m

= 3.2 dB

11. Recommendation & Conclusion

The data collected shows that the **Seronics Co.,Ltd Screen Mirroring Device (Model Name: SC-00DA)** was complies with §15.247 and §15.407 of the FCC Rules.

- The end -