EMC TEST REPORT

KOSTEC CO., Ltd. 28(175-20, Annyeong-dong) 406-gil sejaro, Hwaseong-si, Gyeonggi-do, Korea Tel:031-222-4251, Fax:031-222-4252	Report No. : KST-FCC-210031(1)	KOSTEC Co., Ltd. http://www.kostec.org

1. Applicant

- Name : TOKYO ELECTRON KOREA LIMITED
- Address : 51, Jangangongdan 6-gil, Jangan-myeon, Hwaseong-si,Gyeonggi-do, 18579 Korea

2. Test Item

- Product Name : SES-EN (Sensor Extend Solution For Extend Node)
- Model Name : DS0-SEEN
- FCC ID : 2A2YU-DS0-SEEN

3. Manufacturer

- Name : TOKYO ELECTRON KOREA LIMITED
- Address : 51, Jangangongdan 6-gil, Jangan-myeon, Hwaseong-si,Gyeonggi-do, 18579 Korea

4. Date of Test : Jul. 23, 2021 to Jul. 24, 2021 and Sep. 11, 2021

5. Test Method Used :

ANSI C63.4:2014
47 CFR Part 15 Subpart B Class A
Industry Canada ICES-003 Issue 7
CAN/CSA-CISPR 32:17

6. Test Result : Pass

7. Note: -

The results shown in this test report refer only to the sample(s) tested unless otherwise stated.
This test report is not related to KOLAS accreditation.

Affirmation	Tested by Name : Sang-Woo, Jeong (Signature)	Technical Manager Name : Chang-Ho, Lee (Signature)

2021 . 09 . 17 .

KOSTEC Co., Ltd.

Revision History of Test Report

Rev.	Revisions	Effect page	Reviewed	Date
-	Initial issue	All	Chang-Ho, Lee	Jul. 29, 2021
1	Add AC power test	All	Chang-Ho, Lee	Sep. 17, 2021

Contents

1. General Information

1.1 Information of EUT

Product Name	SES-EN (Sensor Extend Solution For Extend Node)
Model Name	DS0-SEEN
Serial No.	None
Type of Sample Tested	Pre-production
Supplied Power for Test	AC 120 V, 60 ㎐
Port	6 Pin Connector x 2, 8 Pin Connector
Whether or not ground	Ground

This information was provided by the customer

Clock used	280 ㎒	
High Frequency Used	280 ㎒	
Model differences		
Model name	Difference	Tested (checked)
DS0-SEEN	Basic Model (the basic model that was fully tested)	☒
DS0-SEENI100	Variant Models Same as the basic model	-

1.2 Applicants Information

Applicant	TOKYO ELECTRON KOREA LIMITED
Address	51, Jangangongdan 6-gil, Jangan-myeon, Hwaseong-si, Gyeonggi-do, 18579 Korea
Telephone No.	+82-31-831-6189
Facsimile No.	+82-31-260-5290
Contact person	Jeong Woon Lee (Ju.lee@tel.com)

2. Information of Testing Laboratory

Test laboratory and address

KOSTEC Co., Ltd.

28(175-20,Annyeong-dong)406-gil sejaro, Hwaseong-si Gyeonggi-do, Korea

Telephone Number: 82-31-222-4251

Facsimile Number: 82-31-222-4252

Registration information

KOLAS No.: KT232

RRA(National Radio Research Agency): KR0041

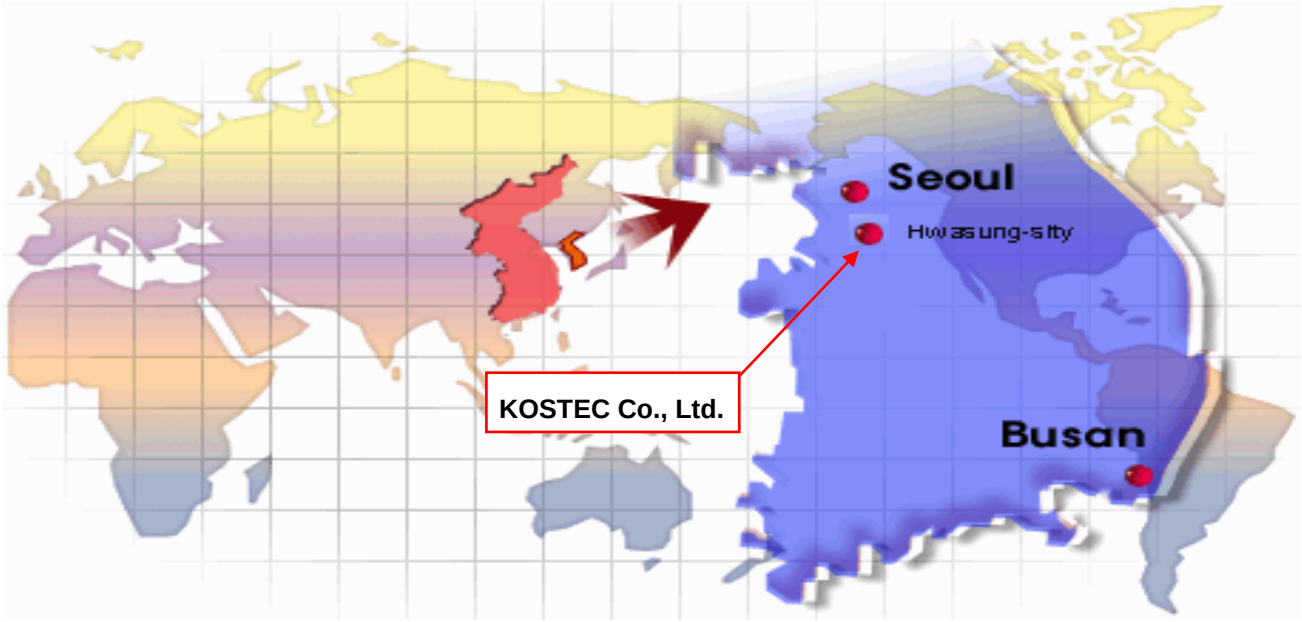
FCC Designation No.: KR0041

IC Designation No.: KR0041

VCCI Membership No. : 2005

VCCI Registration No. of EMI site: R-14202 / C-14685 / G-10834 / T-12225

Route Map of Measurement Facility



3. Test System Configuration

3.1 Operation Environment

Test Items	Test date	Temp (℃)	Humidity (%R.H.)
Conducted Emissions	Sep. 11	23	51
Radiated Emission (Below 1 ㎓)	Jul. 23	23	53
Radiated Emission (Above 1 ㎓)	Jul. 24	20	48

3.2 Measurement Uncertainty

Test Items	k_p	Expanded Uncertainty	Note
Conducted Emissions	2	±3.62 ㏈	-
Radiated Emission (Below 1 ㎓)	2	±3.62 ㏈	-
Radiated Emission (Above 1 ㎓)	2	±3.58 ㏈	-

3.3 Sample calculation

Conducted Emission

The field strength is calculated by adding the LISN factor, cable loss from the measured reading. The sample calculation is as follows:

FS = MR + Factor
MR = Meter Reading
Factor = Ant. Factor, Cable Loss, etc

If MR is 30 ㏈, LISN Factor 1 ㏈, CL 1 ㏈
The result (MR) is 30 + 1 + 1 = 32 ㏈㎶

4. Condition and Procedure for Test activities

4.1 Configuration of EUT

Description	Model or Part No.	Serial No.	Manufacturer
SES-EN (Sensor Extend Solution For Extend Node)	**DS0-SEEN**	**None**	**TOKYO ELECTRON KOREA LIMITED**

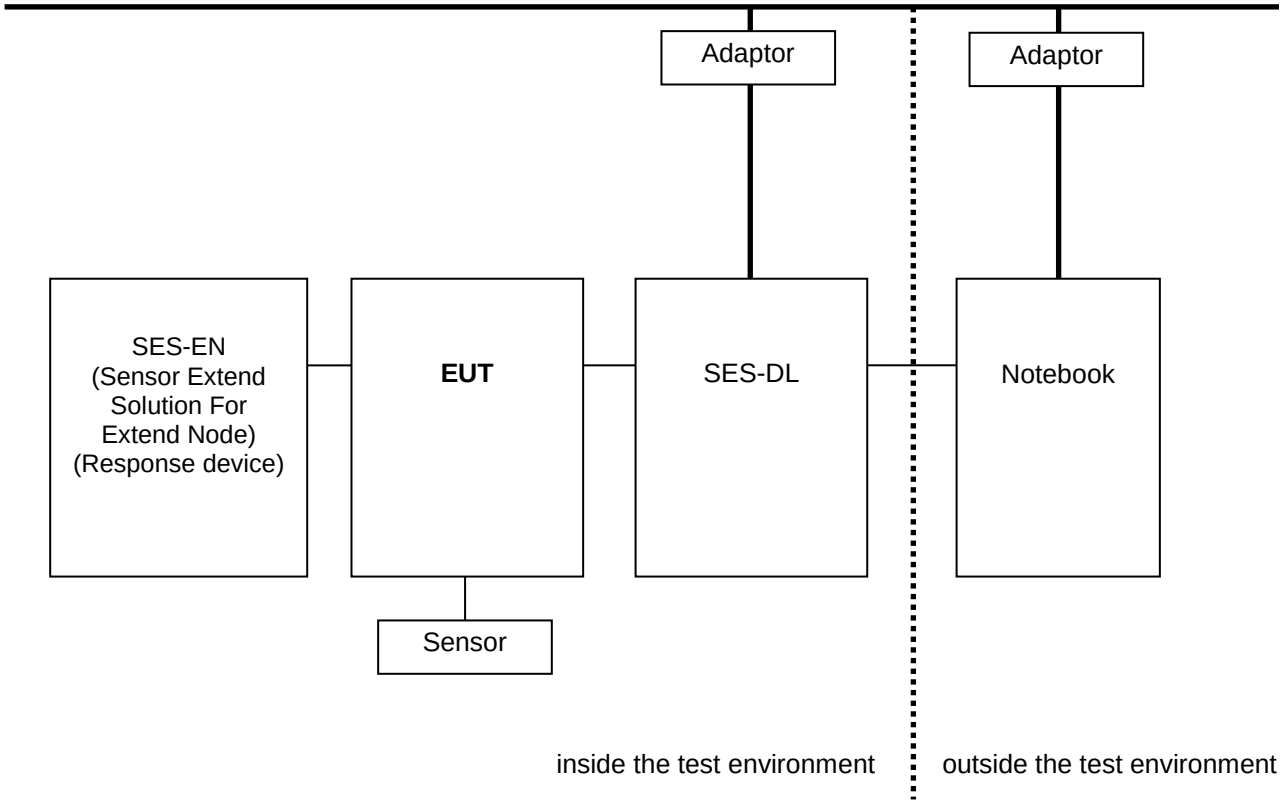
4.2 Used Peripherals

Description	Model or Part No.	Serial No.	Manufacturer
SES-DL	DS0-SEDLBS00	DL201911270005	TOKYO ELECTRON KOREA LIMITED
Adaptor (for SES-DL)	ATS065T-P240	None	Adapter technology Co., Ltd.
Sensor	2471025LD2DG2HD	9057358	Setra
SES-EN (Sensor Extend Solution For Extend Node) (Response device)	DS0-SEEN	None	TOKYO ELECTRON KOREA LIMITED

4.3 Used cables

Cable Type	Shield	Length (m)	Ferrite	Connector	Connection Point 1	Connection Point 2
6 Pin Connector	Yes	5.0	No	6 Pin Connector	EUT	SES-DL
6 Pin Connector	Yes	5.0	No	6 Pin Connector	EUT	SES-EN (Sensor Extend Solution For Extend Node) (Response device)
8 Pin Connector	No	1.0	No	8 Pin Connector	EUT	Sensor
DC In	No	1.0	Yes	3 Pin Connector	SES-DL	Adaptor
RJ-45	No	10.0	No	RJ-45	SES-DL	Notebook

4.4 EUT Test Configuration



4.5 Operating conditions

After setting, each I/O Ports of EUT was connected to peripherals.
After that, the EUT were observed on continuously operating conditions.

* Notebook Program : Data logger setting tool

5. Summary of Test Results

5.1 Modification to the EUT

-

5.2 Summary of Test Results

The following tests were performed on a sample submitted for evaluation of compliance with FCC Part 15 Subpart B		
Clause	Test Requirement	Result
15.107	Conducted Emissions	Pass
15.109	Radiated Emission (Below 1 ㎓)	Pass
15.109	Radiated Emission (Above 1 ㎓)	Pass

Note 1) N/A mean is Not Applicable.
Note 2) Decision rule: The statement of conformity in this report was judged according to the specification limits of the standard without considering uncertainty.
Note 3) 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 C63.4-2014

6. Test Results

6.1 Conducted Emission

6.1.1 Measurement procedure

In the range of 0.15 ㎒ to 30 ㎒, the conducted disturbance was measured and set-up was made accordance with ANSI C63.4.
If the EUT is table top equipment, it was placed on a wooden table with a height of 0.8 m above the reference ground plane and 0.4 m from the conducting wall of the shielded room.
Also if the EUT is floor-standing equipment, it was placed on a non-conducted support with a height up to 0.15 m above the reference ground plane.
Connect the EUT's power source lines to the appropriate power mains / peripherals through the LISN. All the other peripherals are connected to the 2nd LISN, if any.
Unused measuring port of the LISN was resistively terminated by 50 ohm terminator.
The measuring port of the LISN for EUT was connected to spectrum analyzer.
Using conducted emission test software, the emissions were scanned with peak detector mode.
After scanning over the frequency range, suspected emissions were selected to perform final measurement. When performing final measurement, the receiver was used which has Quasi-Peak detector and Average detector.
By varying the configuration of the test sample and the cable routing it was attempted to maximize the emission.
For further description of the configuration refer to the picture of the test set-up.

6.1.2 Limit for conducted emission

(1) Conducted emission at mains ports.

Frequency range [㎒]	Limits [dB(μV)]			
	Quasi-peak		Average	
	Class A	Class B	Class A	Class B
0.15 to 0.50	79	66 to 56	66	56 to 46
0.50 to 5	73	56	60	46
5 to 30		60		50
Note 1 The lower limit shall apply at the transition frequencies. Note 2 The limit decreases linearly with the logarithm of the frequency in the range 0.15 ㎒ to 0.5 ㎒.				

Note) 1. Emission level = Reading value + Correction factor.
2. Correction factor = Cable loss + Insertion loss of LISN
3. Margin = Limit - Emission level

6.1.3 Used equipment

Equipment	Model No.	Serial No.	Manufacturer	Next cal date	Used
Test Receiver	ESCS30	100111	Rohde & Schwarz	2022. 01. 20	●
EMI RECEIVER	ER-30	L0910A010	LIG	2022. 08. 30	-
Pulse Limiter	ESH3-Z2	100097	Rohde & Schwarz	2022. 01. 20	●
Pulse Limiter	ESH3-Z2	100022	Rohde & Schwarz	2022. 01. 20	-
LISN	ESH3-Z5	100147	Rohde & Schwarz	2022. 01. 20	●
LISN	ESH2-Z5	100044	Rohde & Schwarz	2022. 01. 20	-
LISN	ESH2-Z5	100060	Rohde & Schwarz	2022. 01. 20	-
LISN	3825/2	9402-2163	ETS-Lindgren	2022. 01. 20	-
Test Program	ESxS-K1 Ver2.2	None	Rohde & Schwarz	-	●
Test Program	ETS2008 Ver2.40	None	LIG	-	-

6.1.4 Test data

< Class A >

Freq. [㎒]	Factor [dB]		POL	QP				CISPR-AV			
	LISN	CABLE +P/L		Limit [dB(㎶)]	Reading [dB(㎶)]	Result [dB(㎶)]	Margin [dB]	Limit [dB(㎶)]	Reading [dB(㎶)]	Result [dB(㎶)]	Margin [dB]
0.154	0.11	10.04	N	79.00	48.77	48.88	30.12	66.00	39.30	39.41	26.59
0.158	0.13	10.02	L	79.00	48.61	48.74	30.26	66.00	39.70	39.83	26.17
0.326	0.11	9.86	N	79.00	47.34	47.45	31.55	66.00	38.80	38.91	27.09
0.369	0.12	9.86	L	79.00	53.20	53.32	25.68	66.00	42.20	42.32	23.68
0.380	0.11	9.86	N	79.00	52.32	52.43	26.57	66.00	43.20	43.31	22.69
0.408	0.12	9.86	L	79.00	50.75	50.87	28.13	66.00	42.40	42.52	23.48
0.443	0.11	9.86	N	79.00	47.10	47.21	31.79	66.00	39.20	39.31	26.69
0.470	0.12	9.86	L	79.00	45.80	45.92	33.08	66.00	37.50	37.62	28.38
0.830	0.13	10.06	L	73.00	36.89	37.02	35.98	60.00	27.90	28.03	31.97
0.838	0.12	10.06	N	73.00	38.06	38.18	34.82	60.00	27.50	27.62	32.38
3.349	0.20	10.03	L	73.00	38.92	39.12	33.88	60.00	29.60	29.80	30.20
3.384	0.19	10.03	N	73.00	41.09	41.28	31.72	60.00	30.50	30.69	29.31

* LISN: LISN insertion Loss, Cable: Cable Loss, P/L: pulse limiter factor
* L: Line. Live, N: Line. Neutral
* Reading: test receiver reading value (with cable loss & pulse limiter factor)
* Result = LISN + Reading

6.1.5 Conducted emission test graph

Line. Live

Kostec Co.,Ltd 11 Sep 2021 09:57

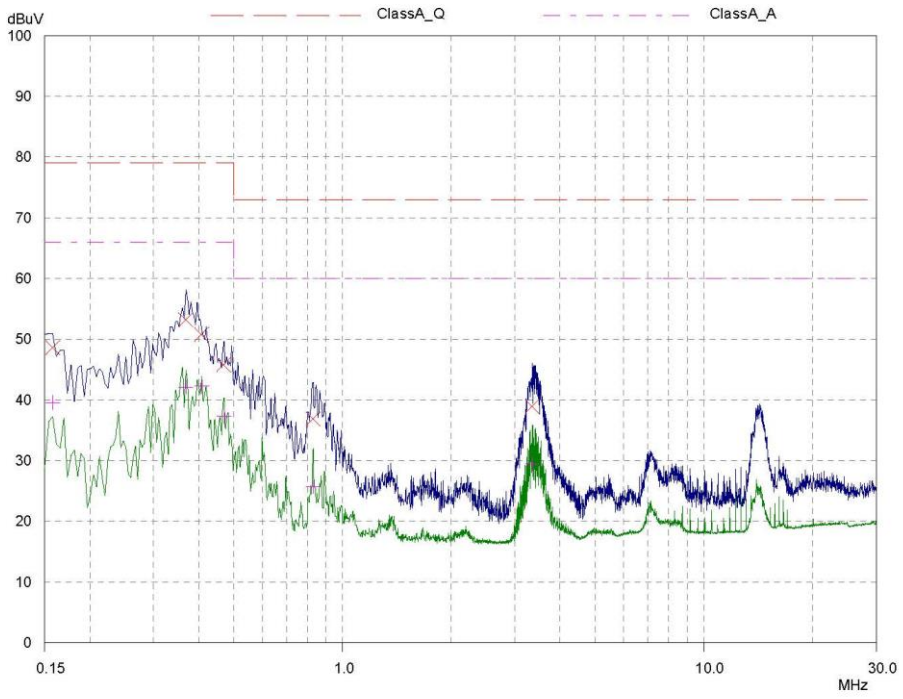
Conducted Emission

EUT:	KST-PO-21-0095
Manuf:	
Op Cond:	AC 120 V, 60 Hz
Operator:	S.W.JEONG
Test Spec:	FCC
Comment:	LIVE
Result File:	95_l.dat : New Measurement
Scan Settings	(1 Range)

Frequencies			Receiver Settings					
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge
150kHz	30MHz	3.9063kHz	9kHz	PK+AV	10msec	15 dB	OFF	60dB

Transducer	No.	Start	Stop	Name
	11	9kHz	30MHz	MAIN

Final Measurement:		
	Detectors:	X QP / + AV
	Meas Time:	1sec
	Peaks:	25
	Acc Margin:	50 dB



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Line. Neutral

Kostec Co.,Ltd

11 Sep 2021 09:49

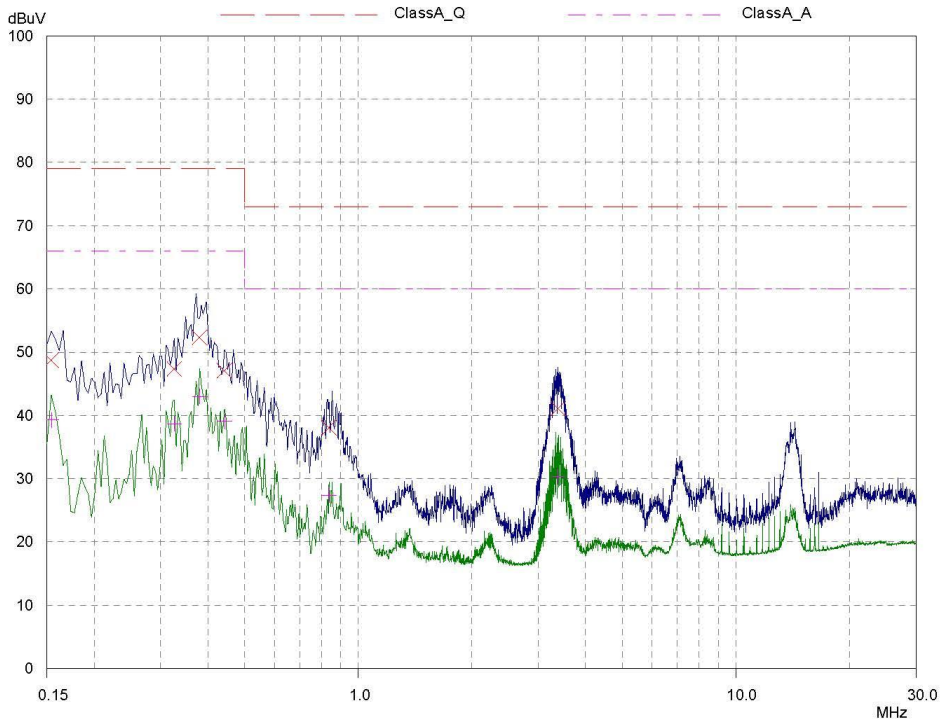
Conducted Emission

EUT:	KST-PO-21-0095
Manuf:	
Op Cond:	AC 120 V, 60 Hz
Operator:	S.W.JEONG
Test Spec:	FCC
Comment:	NEUTRAL
Result File:	95_n.dat : New Measurement
Scan Settings	(1 Range)

Frequencies			Receiver Settings					
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge
150kHz	30MHz	3.9063kHz	9kHz	PK+AV	10msec	15 dB	OFF	60dB

Transducer	No.	Start	Stop	Name
	11	9kHz	30MHz	MAIN

Final Measurement:		
	Detectors:	X QP / + AV
	Meas Time:	1sec
	Peaks:	25
	Acc Margin:	50 dB



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6.2 Radiated Emission

6.2.1 Measurement procedure

The radiated disturbance was measured and set-up was made accordance with ANSI C63.4.
If the EUT is tabletop equipment, it was placed on a wooden table with a height of 0.8 m above the reference ground plane and 3 m or 10 m away from the interference receiving antenna in the 10 m semi-anechoic chamber.
Also if the EUT is floor-standing equipment, it was placed on a non-conducted support with a height up to 0.15 m above the reference ground plane.
Rotate the EUT from (0 - 360)° and position the receiving antenna at heights from (1 - 4) m above the reference ground plane continuously to determine associated with higher emission levels and record them.
The measurement was made in both the vertical and horizontal polarization, and the maximum value is presented in the report.
For below 1 ㎓ frequency range, Quasi-Peak detector with 120 ㎑ RBW was used.
Also Peak and Average detector with 1 ㎒ RBW were used for above 1 ㎓ frequency range.
For further description of the configuration refer to the picture of the test set-up.

6.2.2 Limit for Radiated emission

- The test frequency range of Radiated disturbance measurements are listed below.

Highest frequency generated or used in the device or on which the device operates or tunes [㎒]	**Upper frequency of measurement range [㎒]**
Below 108	1 000
108 – 500	2 000
500 – 1 000	5 000
Above 1 000	5th harmonic of the highest frequency or 40 ㎓, whichever is lower

(1) Limit for Radiated emission below 1 000 ㎒

Frequency range [㎒]	**Class A Equipment (10 m distance)**	**Class B Equipment (3 m distance)**
	Quasi-peak [dB(μV/m)]	**Quasi-peak [dB(μV/m)]**
30 to 88	39.1	40
88 to 216	43.5	43.5
216 to 960	46.4	46
960 to 1 000	49.5	54
Note 1 The lower limit shall apply at the transition frequency. Note 2 Additional provisions may be required for cases where interference occurs. Note 3 According to 15.109(g), as an alternative to the radiated emission limit shown above, digital devices may be shown to comply with the standards(CISPR), Pub. 22 shown as below.		
Frequency range [㎒]	**Class A Equipment (10 m distance)**	**Class B Equipment (10 m distance)**
	Quasi-peak [dB(μV/m)]	**Quasi-peak [dB(μV/m)]**
30 to 230	40	30
230 to 1 000	47	37

(2) Limits for Radiated emission above 1 000 ㎒ at a measuring distance of 3 m

Frequency [㎓]	Class A Equipment		Class B Equipment	
	Peak [dB(μV/m)]	Average [dB(μV/m)]	Peak [dB(μV/m)]	Average [dB(μV/m)]
1 to 40	80	60	74	54

Note) 1. Emission level = Reading value + Correction factor.
2. Correction factor = Cable loss - Amp gain + Antenna factor + Distance compensation value
3. Margin = Limit - Emission level

Fig.1 Dimensions of test site (Below 1 ㎓) : Class A (10 m), Class B (3 m)

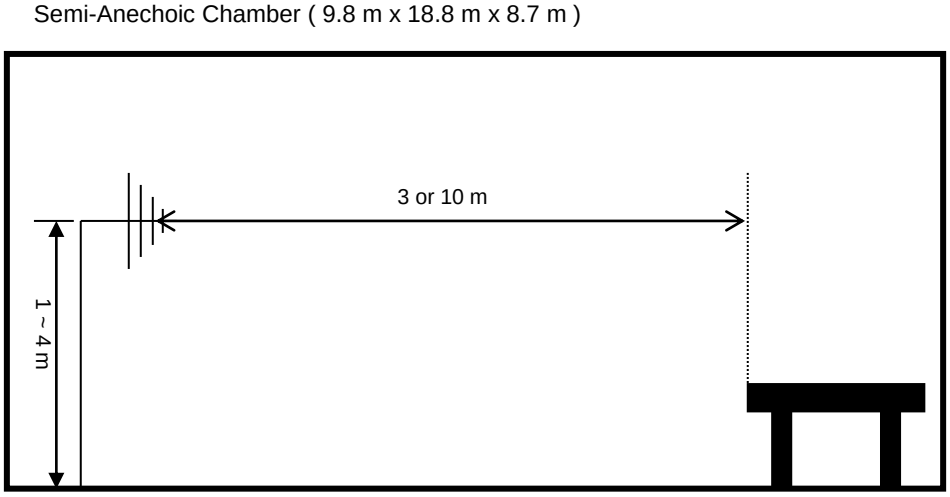
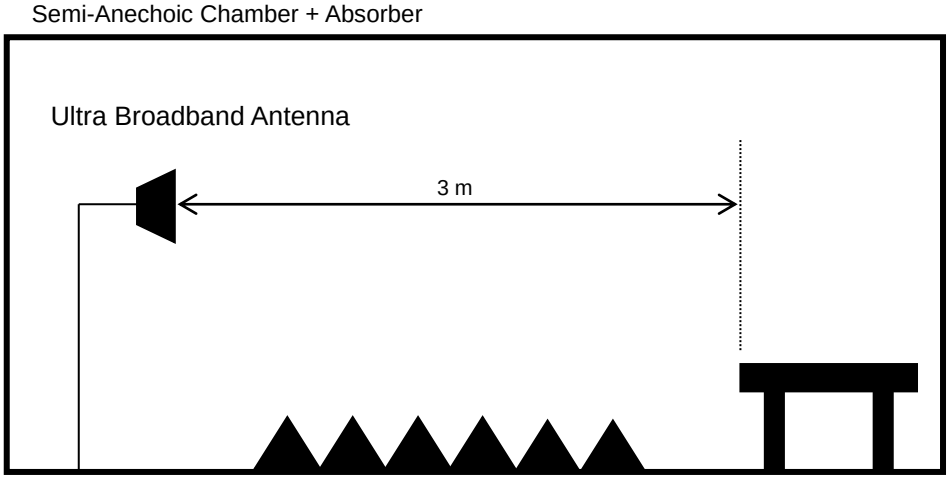


Fig.2 Dimensions of test site (Above 1 ㎓)



6.2.3 Used equipment

1) Below 1 ㎓

3 m Semi-Anechoic chamber

Equipment	Model No.	Serial No.	Manufacturer	Next cal date	Used
Test Receiver	ESI	837514/004	Rohde & Schwarz	2021. 08. 31	-
Hybrid Antenna	VULB9168	606	Schwarzbeck	2022. 09. 21	-
LOW NOISE AMPLIFIER	TK-PA01S	200141-L	TESTEK	2021. 09. 23	-
Antenna Mast	MA4640	None	innco systems GmbH	-	-
Turn Table	DS2000-S-1t	None	innco systems GmbH	-	-

10 m Semi-Anechoic chamber

Equipment	Model No.	Serial No.	Manufacturer	Next cal date	Used
Test Receiver	ESCI7	100823	Rohde & Schwarz	2022. 01. 20	●
Test Receiver	ESPI	100488	Rohde & Schwarz	2022. 01. 20	-
Biconilog Antenna	3142B	1745	ETS-Lindgren	2022. 04. 24	●
Biconilog Antenna	3142B	9910-1432	ETS-Lindgren	2022. 04. 07	-
AMPLIFIER	TK-PA6S	120009	TESTEK	2022. 01. 19	●
Antenna Master	MA4000-EP	None	innco systems GmbH	-	●
Turn Table	None	None	innco systems GmbH	-	●

2) Above 1 ㎓

3 m Semi-Anechoic chamber

Equipment	Model No.	Serial No.	Manufacturer	Next cal date	Used
Test Receiver	ESI	837514/004	Rohde & Schwarz	2021. 08. 31	●
Horn Antenna	3115	2996	ETS-Lindgren	2022. 02. 14	●
Broadband Horn Antenna	BBHA 9170	743	SCHWARZBECK MESS-ELEKTRONIK	2023. 01. 21	-
Antenna Mast	MA4640	None	innco systems GmbH	-	●
Turn Table	DS2000-S-1t	None	innco systems GmbH	-	●
AMPLIFIER	8449B	3008A02577	Agilent	2022. 01. 19	●
Low Noise Amplifier	TK-PA1840H	160010-L	TESTEK	2022. 01. 21	-

10 m Semi-Anechoic chamber

Equipment	Model No.	Serial No.	Manufacturer	Next cal date	Used
Test Receiver	ESI	837514/004	Rohde & Schwarz	2021. 08. 31	-
Test Receiver	ESCI7	100823	Rohde & Schwarz	2022. 01. 20	-
Test Receiver	ESCI7	100969	Rohde & Schwarz	2022. 01. 20	-
Horn Antenna	3115	2996	ETS-Lindgren	2022. 02. 14	-
Antenna Master	MA4000-EP	None	innco systems GmbH	-	-
Turn Table	None	None	innco systems GmbH	-	-
AMPLIFIER	TK-PA6S	120009	TESTEK	2022. 01. 19	-
AMPLIFIER	8449B	3008A02577	Agilent	2022. 01. 19	-
AMPLIFIER	8449B	3008A00149	H.P	2021. 09. 01	-
Low Noise Amplifier	TK-PA1840H	160010-L	TESTEK	2022. 01. 21	-

6.2.4 Test data

a) Below 1 ㎓

< Class A >

Freq. [㎒]	Reading [dB(㎶)]	POL	H [m]	Factor			Limit [dB(㎶/m)]	Result [dB(㎶/m)]	Margin [dB]
				ANT. [dB/m]	CABLE [dB]	AMP. [dB]			
32.47	38.28	V	1.0	22.15	1.21	40.37	39.10	21.28	17.82
45.53	45.21	V	1.0	15.44	1.43	41.23	39.10	20.85	18.25
94.76	48.70	V	1.0	13.94	2.09	41.44	43.50	23.29	20.21
192.41	50.95	V	1.0	16.09	3.04	41.34	43.50	28.74	14.76
242.63	48.90	V	1.0	18.25	3.46	41.56	46.40	29.05	17.35
281.50	49.35	H	4.0	18.67	3.75	41.73	46.40	30.04	16.36

*Result = Reading + Antenna factor + Cable loss - AMP. *Reading : Test receiver reading value
*POL = Antenna polarization / H = Antenna Height *Receiving antenna mode : Horizontal, Vertical
*ANT. = Antenna factor / CABLE = Cable loss / AMP. : Gain of the amplifier

b) Above 1 ㎓

< Class A >

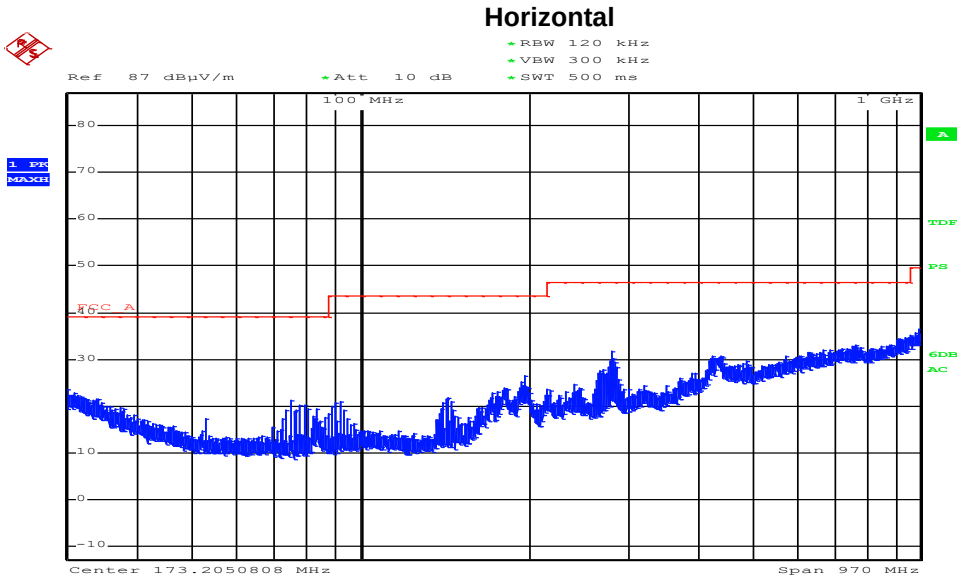
Freq. [㎓]	Reading		POL	H [m]	Factor				Peak			CISPR Average		
	Peak [dB(㎶)]	Average [dB(㎶)]			ANT. [dB/m]	CABLE [dB]	AMP. [dB]	Distance [dB]	Limit [dB(㎶/m)]	Result [dB(㎶/m)]	Margin [dB]	Limit [dB(㎶/m)]	Result [dB(㎶/m)]	Margin [dB]
1.874	44.76	33.24	V	1.0	27.17	5.07	31.53	0.00	80.00	45.48	34.52	60.00	33.96	26.04

*Result = Reading + Antenna factor + Cable loss - AMP. + Distance compensation value
*Reading : test receiver reading value *POL = Antenna Polarization / H = Antenna Height
*ANT. = Antenna factor / CABLE = used Cable loss / AMP. : Gain of the Amplifier /
Distance : Distance compensation value
* Receiving Antenna Mode : Horizontal, Vertical

※ Except for the above data, the emission levels were very low, so that the other data are not reported. (See Radiated Emission Graph)

6.2.5 Radiated Emission test graph

a) Below 1 ㎓



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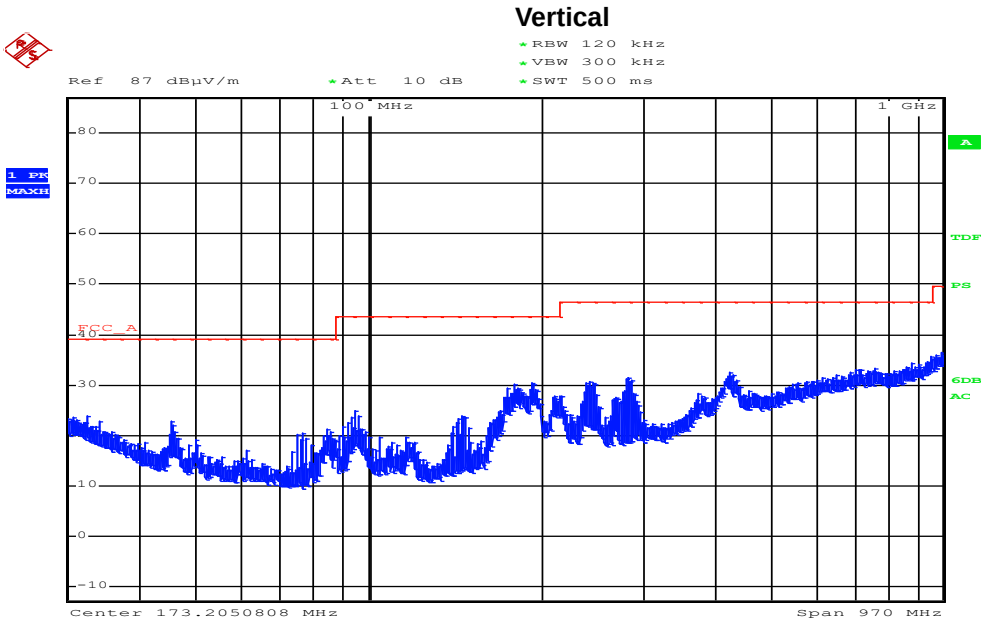

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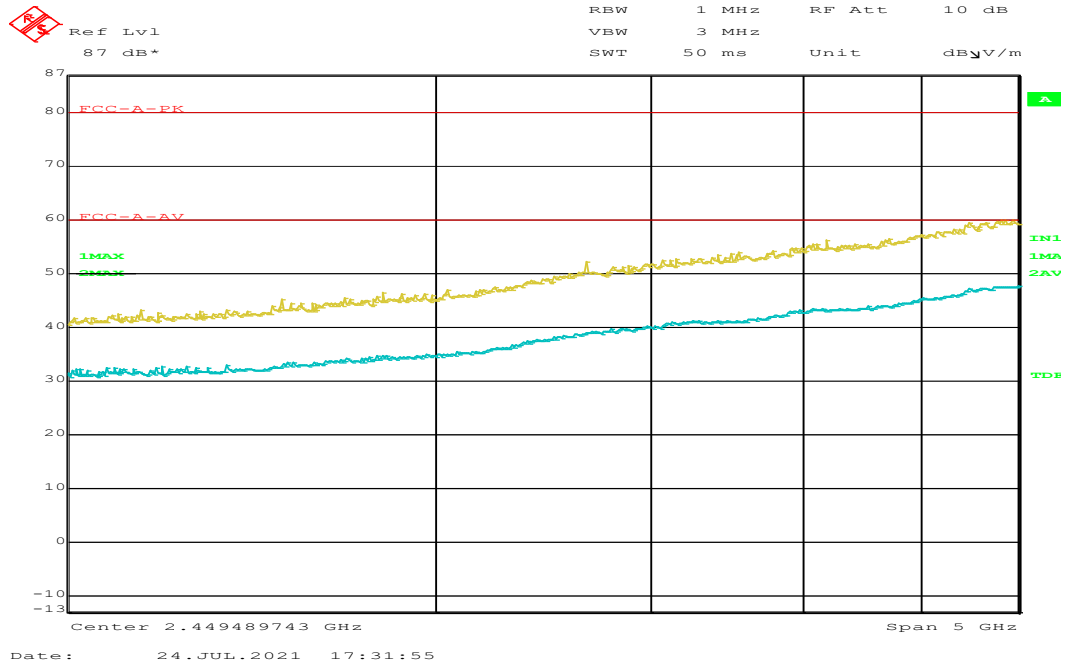
b) Above 1 ㎓

Horizontal



Vertical