RF TEST REPORT

Test Equipment	:	Hamster Pro Trio
Model Name	:	XU20ASCL
FCC ID	:	2ADE9XU20ASCL
Date of Receipt	:	2022.06.15
Test Duration	:	2022.06.24 ~ 2022.07.07
Date of Issue	:	2022.07.18

Applicant : Secugen Corporation
2065 Martin Avenue Suite 102, Santa Clara, California, 95050, United States.

Test Laboratory : Lab-T, Inc.
2182-42 Baegok-daero, Mohyeon-eup, Cheoin-gu, Yongin-si Gyeonggi-do 17036, Republic of Korea

Test Specification	:	FCC Part 15 Subpart C 15.225
Test Result	:	Pass

The above equipment was tested by Lab-T Testing Laboratory for compliance with the requirements of FCC Rules and Regulations.
The test results presented in this test report are limited only to the sample supplied by applicant and the use of this test report is inhibited other than its purpose.
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Tested By:
Engineer
Namhyoung Kwon

Reviewed By:
Technical Manager
SangHoon Yu

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1. Revision History

Test Report #	Date	Description
TRRFCC22-0013	22.07.18	Initial issue

2. Information

2.1 Applicant Information

Applicant Name	Secugen Corporation
Address	2065 Martin Avenue Suite 102, Santa Clara, California, 95050, United States.
Telephone No.	+82-70-7762-5309
Person in Charge	JongSung Kim / Senior Engineer of R&D
1. Manufacturer	Woo Kyung optics co.,ltd.
Address	(Sin-gil-dong), 301, 8, Haebong-ro 330beon-gil, Danwon-gu Ansan-si, Gyeonggi-do, Korea
2. Manufacturer	SecuGen Korea Co.,LTD.
Address	506, 8, Haebong-ro 330beon-gil, Danwon-gu Ansan-si, Gyeonggi-do, Repudlic of Korea

2.2 Test Laboratory Information

Corporate Name	Lab-T, Inc.
Representative	Duke(Jongyoung) Kim
Address	2182-42 Baegok-daero, Mohyeon-eup, Cheoin-gu, Yongin-si, Gyeonggi-do 17036, Korea(Republic of)
Telephone	+82-31-322-6767
Fax	+82-31-322-6768
E-mail	info@lab-t.net
FCC Designation No.	KR0159
FCC Registration No.	133186
IC Registration No.	22000

2.3 Test Site

Test Site	used	Address
Building L	☒	2182-40 Baegok-daero, Mohyeon-eup, Cheoin-gu, Yongin-si, Gyeonggi-do 17036, Korea(Republic of)
Building T	☒	2182-42 Baegok-daero, Mohyeon-eup, Cheoin-gu, Yongin-si, Gyeonggi-do 17036, Korea(Republic of)
Building A	☐	2182-44 Baegok-daero, Mohyeon-eup, Cheoin-gu, Yongin-si, Gyeonggi-do 17036, Korea(Republic of)

3. Information About Test Equipment

3.1 Equipment Information

Equipment Type	Hamster Pro Trio
Model Name	XU20ASCL
Frequency Range	13.56 MHz
Modulation Type	ASK
Power Supply	DC 5 V
S/W Version	-
H/W Version	V102

Note 1 : The above EUT information was declared by the manufacturer.

3.2 Antenna Information

Type	Model No.	Gain	Note.
Loop Antenna	-	-	-

3.3 Test Frequency

Test Mode	Test Frequency (MHz)
ASK	13.56

3.4 Tested Companion Device Information

Type	Manufacturer	Model	Note
Laptop	Lenovo	80K6	Used Conducted Emission
Laptop Adaptor	Lenovo	ADLX65NCC3A	Used Conducted Emission

4. Test Report

4.1 Summary

FCC Part 15C 225			
Reference	Parameter	Clause	Status
Transmitter Requirements			
15.215(c)	20 dB Bandwidth	4.3.1	C
15.225(e)	Frequency Tolerance of Carrier Signal	4.3.2	C
15.225(a) 15.225(b) 15.225(c) 15.225(d) 15.205(a) 15.209(a)	In-band Fundamental Emission, In-band and Out-band Spurious Emission	4.3.3	C
15.207(a)	Conducted Emissions	4.3.4	C
Note 1 : C = Comply N/C = Not Comply N/T = Not Tested N/A = Not Applicable			

* The general test methods used to test this device is ANSI C63.10:2020

4.2 Measurement Uncertainty

Mesurement Items	Expanded Uncertainty
Radiated Spurious Emissions (30 MHz under)	3.96 dB (The confidence level is about 95 %, *k*=2)
Radiated Spurious Emissions (30 MHz ~ 1 GHz)	4.78 dB (The confidence level is about 95 %, *k*=2)
Conducted emission	2.36 dB (The confidence level is about 95 %, *k*=2)

4.3 Transmitter Requirements

4.3.1 20 dB Bandwidth

4.3.1.1 Regulation

Accoding to §15.215(c) Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§15.217 through 15.257 and in subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated. In the case of intentional radiators operating under the provisions of subpart E, the emission bandwidth may span across multiple contiguous frequency bands identified in that subpart. The requirement to contain the designated bandwidth of the emission within the specified frequency band includes the effects from frequency sweeping, frequency hopping and other modulation techniques that may be employed as well as the frequency stability of the transmitter over expected variations in temperature and supply voltage. If a frequency stability is not specified in the regulations, it is recommended that the fundamental emission be kept within at least the central 80% of the permitted band in order to minimize the possibility of out-of-band operation.

4.3.1.2 Measurement Procedure

These test measurement settings are specified in section 6.9.2 of ANSI C63.10-2020

4.3.1.3 Result

Comply (measurement data : refer to the next page)

4.3.1.4 Measurement data

Test mode : ASK

Frequency (MHz)	Results (kHz)	Lowest Frequency (MHz)	Highest Frequency (MHz)
13.560 0	1.529 0	13.559 7	13.561 2

4.3.2 Frequency Tolerance of Carrier Signal

4.3.2.1 Regulation

According to §15.225(e) The frequency tolerance of the carrier signal shall be maintained within ±0.01% of the operating frequency over a temperature variation of −20 degrees to + 50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

4.3.2.2 Measurement Procedure

These test measurement settings are specified in section 6.8.1 and 6.8.2 of ANSI C63.10-2020

4.3.2.3 Result

Comply (measurement data : refer to the next page)

4.3.2.4 Measurement data

Test mode : 0 min

Frequency (MHz)	Temp (℃)	Lowest Frequency (MHz)	Highest Frequency (MHz)	Center Frequency (Hz)	Tolerance (%)
13.560 0	-20	13.559 960	13.561 199	13 560 580	0.004 274
	-10	13.559 840	13.561 289	13 560 565	0.004 163
	0	13.559 810	13.561 339	13 560 575	0.004 237
	10	13.559 840	13.561 309	13 560 575	0.004 237
	20	13.559 870	13.561 249	13 560 560	0.004 126
	30	13.559 860	13.561 159	13 560 510	0.003 757
	40	13.559 760	13.561 259	13 560 510	0.003 757
	50	13.559 720	13.561 249	13 560 485	0.003 573
	Voltage(%)[Note 1]				
	85	13.559 710	13.561 229	13 560 470	0.003 462
	115	13.559 710	13.561 239	13 560 475	0.003 499

Note 1: This test was measured at room temperature

Test mode : 2 min

Frequency (MHz)	Temp (℃)	Lowest Frequency (MHz)	Highest Frequency (MHz)	Center Frequency (Hz)	Tolerance (%)
13.560 0	-20	13.559 830	13.561 319	13 560 575	0.004 237
	-10	13.559 860	13.561 299	13 560 580	0.004 274
	0	13.559 850	13.561 289	13 560 570	0.004 200
	10	13.559 790	13.561 319	13 560 555	0.004 089
	20	13.559 770	13.561 289	13 560 530	0.003 905
	30	13.559 720	13.561 259	13 560 490	0.003 610
	40	13.559 720	13.561 249	13 560 485	0.003 573
	50	13.559 720	13.561 209	13 560 465	0.003 426

Test mode : 5 min

Frequency (MHz)	Temp (℃)	Lowest Frequency (MHz)	Highest Frequency (MHz)	Center Frequency (Hz)	Tolerance (%)
13.560 0	-20	13.559 830	13.561 319	13 560 575	0.004 237
	-10	13.559 820	13.561 329	13 560 575	0.004 237
	0	13.559 830	13.561 299	13 560 565	0.004 163
	10	13.559 780	13.561 299	13 560 540	0.003 979
	20	13.559 760	13.561 269	13 560 515	0.003 794
	30	13.559 730	13.561 239	13 560 485	0.003 573
	40	13.559 710	13.561 239	13 560 475	0.003 499
	50	13.559 700	13.561 219	13 560 460	0.003 389

Test mode : 10 min

Frequency (MHz)	Temp (℃)	Lowest Frequency (MHz)	Highest Frequency (MHz)	Center Frequency (Hz)	Tolerance (%)
13.560 0	-20	13.559 840	13.561 309	13 560 575	0.004 237
	-10	13.559 870	13.561 279	13 560 575	0.004 237
	0	13.559 810	13.561 309	13 560 560	0.004 126
	10	13.559 770	13.561 289	13 560 530	0.003 905
	20	13.559 760	13.561 249	13 560 505	0.003 721
	30	13.559 760	13.561 199	13 560 480	0.003 536
	40	13.559 760	13.561 179	13 560 470	0.003 462
	50	13.559 700	13.561 219	13 560 460	0.003 389

4.3.3 In-band Fundamental Emission, In-band and Out-band Spurious Emission

4.3.3.1 Regulation

According to §15.225(a),(b),(c),(d) (a) The field strength of any emissions within the band 13.553-13.567 MHz shall not exceed 15,848 microvolts/meter at 30 meters.
(b) Within the bands 13.410-13.553 MHz and 13.567-13.710 MHz, the field strength of any emissions shall not exceed 334 microvolts/meter at 30 meters.
(c) Within the bands 13.110-13.410 MHz and 13.710-14.010 MHz the field strength of any emissions shall not exceed 106 microvolts/meter at 30 meters.
(d) The field strength of any emissions appearing outside of the 13.110-14.010 MHz band shall not exceed the general radiated emission limits in §15.209.

According to §15.209(a) Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency(MHz)	Field strength(microvolts/meter)	Measurement distance(meters)
0.009 - 0.490	2 400/F(kHz)	300
0.490 - 1.705	24 000/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

** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this section shallnot 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.

4.3.3.2 Measurement Procedure

1) The preliminary and final rdiated measurements were performed to determine the frequency producing the maximum emissions in at a 10m anechoic chamber. The EUT was tested at a distance 3 meters.
2) The EUT was placed on the top of the 0.8-meter height, 1 × 1.5 meter non-metallic table. To find the maximum emission levels, the height of a measuring antenna was changed and the turntable was rotated 360°.
3) The antenna polarization was also changed from vertical to horizontal. The spectrum was scanned from 9 kHz to 30 MHz using the loop antenna, and from 30 to 1 000 MHz using the TRILOG broadband antenna.
4) Each frequency found during preliminary measurements was re-examined and investigated. The test-receiver system was set up to average, peak, and quasi-peak detector function with specified bandwidth.

Note1 : The resolution bandwidth of test receiver/spectrum analyzer is 200 Hz for Quasi-peak detection (QP) at frequency below 150 kHz.
Note2 : The resolution bandwidth of test receiver/spectrum analyzer is 9 kHz for Quasi-peak detection (QP) at frequency 150 kHz to 30 MHz
Note3 : The resolution bandwidth of test receiver/spectrum analyzer is 120 kHz for Quasi-peak detection (QP) at frequency below 1 GHz.
Note4 : The video bandwidth of test receiver/spectrum analyzer is three times as much as resolution bandwidth

4.3.3.3 Result

Comply (measurement data : refer to the next page)

4.3.3.4 Measurement data

Test mode : 9 kHz ~ 30 MHz

Frequency (MHz)	Detector	Note 1	Pol. (V/H)	Reading (dBµV)	Ant Factor (dB)	Cable Loss (dB)	Result at 3m (dBµV/m)	Result at 30m (dBµV/m)	Limit at 30m (dBµV/m)	Margin (dB)
13.560 5	QP	F	H	42.40	10.90	0.60	53.90	13.90	84.00	70.10
13.560 5	QP	F	V	46.40	10.90	0.60	57.90	17.90	84.00	66.10

Frequency (MHz)	Detector	Note 1	Pol. (V/H)	Reading (dBµV)	Ant Factor (dB)	Cable Loss (dB)	Result at 3m (dBµV/m)	Result at 300m (dBµV/m)	Limit at 300m (dBµV/m)	Margin (dB)
Spurious	Not Detected	S	-	-	-	-	-	-	-	-

Note 1 : "F" : Fundamental, "S" : Spurious
Note 2 : Result : Reading + Ant Factor + Cable Loss
Note 3 : According to §15.31 (f)(2);
Result at 30m (dBµV/m) = Result at 3m(dBµV/m)-40log(30/3) (dBµV/m)
Result at 300m (dBµV/m) = Result at 3m(dBµV/m)-40log(300/3) (dBµV/m)
Note 4 : Not Detected means peak measurement did not take place because it is more than 20dB difference in the limit

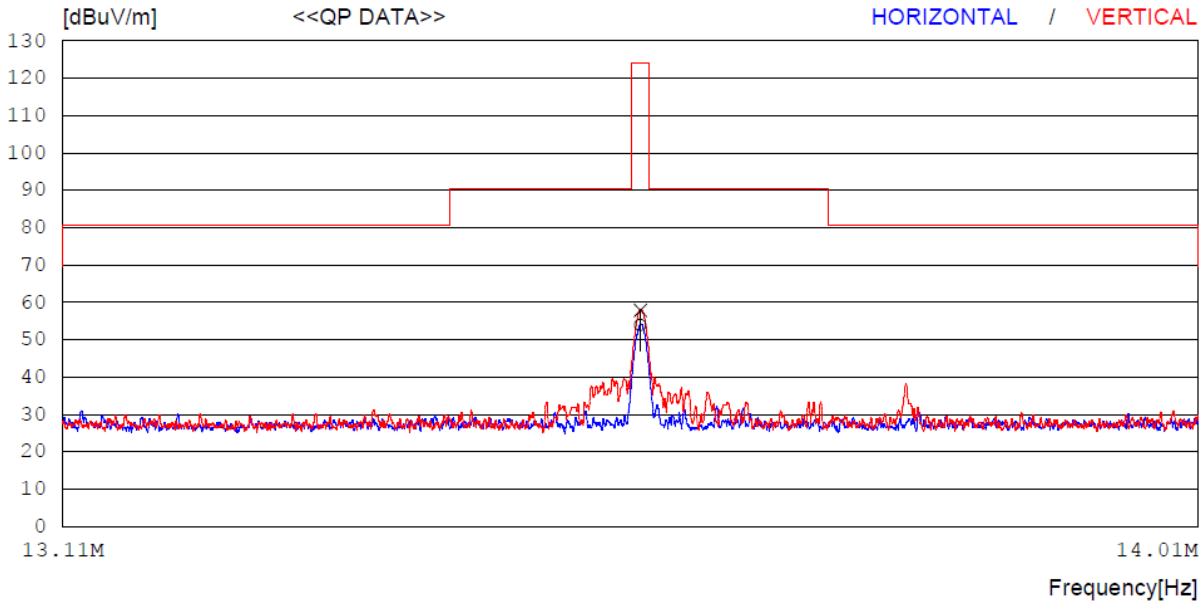
Test mode : 30 MHz ~ 1 GHz

Frequency (MHz)	Detector	Note 1	Pol. (V/H)	Reading (dBµV)	Ant Factor (dB)	Loss (dB)	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
40.670	QP	S	H	34.80	19.40	-29.50	24.70	40.00	15.30
40.680	QP	S	V	46.20	19.40	-29.50	36.10	40.00	3.90
135.607	QP	S	H	45.60	18.70	-28.00	36.30	43.50	7.20
135.601	QP	S	V	40.00	18.70	-28.00	30.70	43.50	12.80
479.946	QP	S	H	41.50	23.70	-26.40	38.80	46.00	7.20
479.946	QP	S	V	42.80	23.70	-26.40	40.10	46.00	5.90
797.684	QP	S	V	38.70	28.60	-25.80	41.50	46.00	4.50
960.195	QP	S	H	30.00	30.10	-24.10	36.00	54.00	18.00

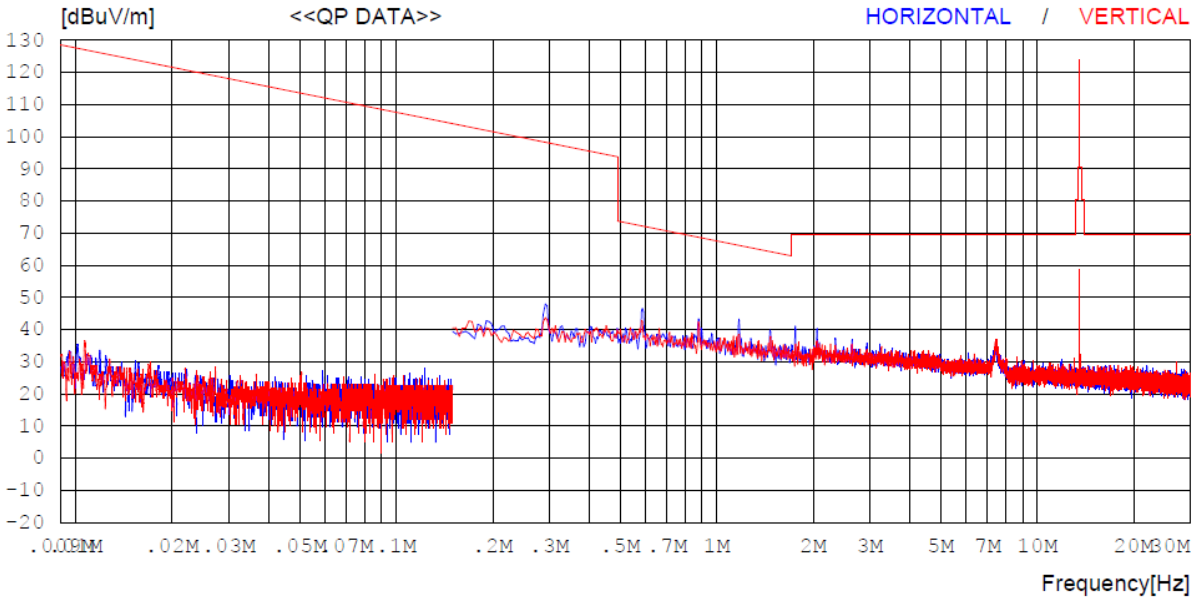
Note 1 : "F" : Fundamental, "S" : Spurious
Note 2 : Loss : Cable loss - Amp gain
Note 3 : Result : Reading + Ant Factor + Loss

4.3.3.5 Measurement Plot

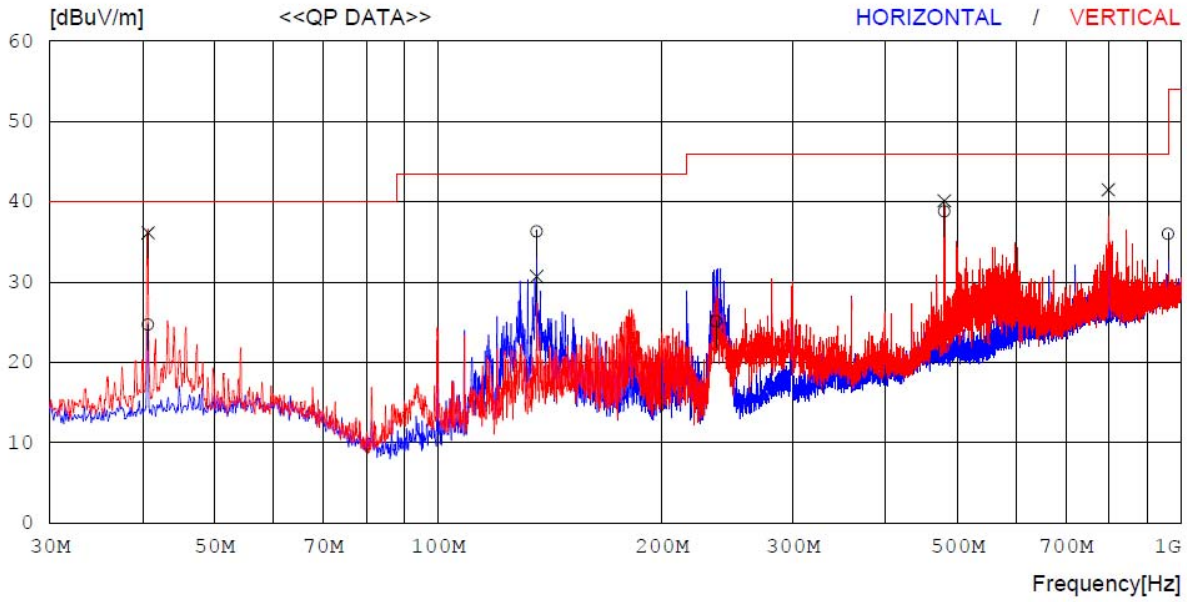
Test mode : 9 kHz ~ 30 MHz_In-band Fundamental, Spurious Emission



Test mode : 9 kHz ~ 30 MHz_Out-band Spurious Emission



Test mode : 30 MHz ~ 1 GHz



4.3.4 Conducted Emission

4.3.4.1 Regulation

According to §15.207(a), for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 μH/50 Ω line impedance stabilization network (LISN).
Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

Frequency of emission (MHz)	Conducted limit (dBμV)	
	Qausi-peak	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.

According to §15.107(a), for unintentional device, except for Class A digital devices, line conducted emission limits are the same as the above table.

4.3.4.2 Measurement Procedure

1) The EUT was placed on a wooden table of size, 1 m by 1.5 m, raised 80 cm in which is located 40 cm away from the vertical wall and 1.5 m away from the side wall of the shielded room.

2) Each current-carrying conductor of the EUT power cord was individually connected through a 50 Ω/50 μH LISN, which is an input transducer to a Spectrum Analyzer or an EMI/Field Intensity Meter, to the input power source.

3) Exploratory measurements were made to identify the frequency of the emission that had the highest amplitude relative to the limit by operating the EUT in a range of typical modes of operation, cable position, and with a typical system equipment configuration and arrangement. Based on the exploratory tests of the EUT, the one EUT cable configuration and arrangement and mode of operation that had produced the emission with the highest amplitude relative to the limit was selected for the final measurement.

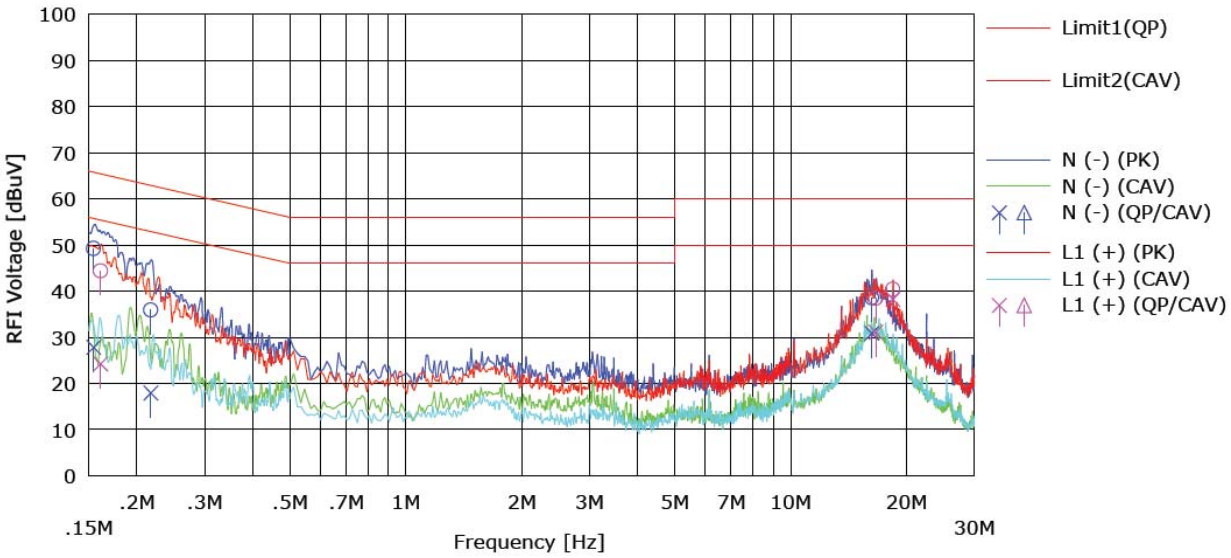
4) The final test on all current-carrying conductors of all of the power cords to the equipment that comprises the EUT (but not the cords associated with other non-EUT equipment is the system) was then performed over the frequency range of 0.15 MHz to 30 MHz.

5) The measurements were made with the detector set to PEAK amplitude within a bandwidth of 10 kHz or to QUASIPEAK and AVERAGE within a bandwidth of 9 kHz. The EUT was in transmitting mode during the measurements.

4.3.4.3 Result

Comply (measurement data : refer to the next page)

4.3.4.4 Measurement data



NO	FREQ	READING QP	READING CAV	C.FACTOR	RESULT QP	RESULT CAV	LIMIT QP	LIMIT CAV	MARGIN QP	MARGIN CAV	PHASE
	[MHz]	[dBuV]	[dBuV]	[dB]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	
1	0.15443	29.4	8.0	19.9	49.2	27.8	65.8	55.8	16.6	28.0	N (-)
2	0.21754	16.0	-1.9	19.8	35.9	17.9	62.9	52.9	27.0	35.0	N (-)
3	16.25848	18.4	10.7	20.1	38.5	30.9	60.0	50.0	21.5	19.1	N (-)
4	0.16108	24.4	4.3	20.0	44.3	24.2	65.4	55.4	21.1	31.2	L1 (+)
5	16.63803	18.3	10.9	20.1	38.4	31.1	60.0	50.0	21.6	18.9	L1 (+)
6	18.43204	20.2	18.0	20.2	40.4	38.2	60.0	50.0	19.6	11.8	L1 (+)

APPENDIX I

TEST EQUIPMENT USED FOR TESTS

To facilitate inclusion on each page of the test equipment used for related tests, each item of test equipment.

Equipment	Manufacturer	Model	Serial No.	Cal. Date (yy.mm.dd)	Next Cal.Date (yy.mm.dd)
FSV Signal Analyzer	ROHDE&SCHWARZ	FSV40	101010	2022-04-18	2023-04-18
Dynamic Measurement DC Source	HP	66332A	US37471465	2022-01-12	2023-01-12
ATTENUATOR	INMET	26A-20	TR011	2021-10-12	2022-10-12
HUMIDITY/TEMP DATA RECORDER	LUTRON	MHB-382SD	79735	2022-04-16	2023-04-16
Digital MultiMeter	HP	34401A	US36025428	2022-01-10	2023-01-10
Signal Generator	ROHDE&SCHWARZ	SMB100A	178384	2021-10-13	2022-10-13
Temp & Humi Test Chamber	ESPEC	SH-241	92004150	2022-04-13	2023-04-13
EMI Test Receiver	ROHDE&SCHWARZ	ESU40	100445	2021-09-10	2022-09-10
BiLog Antenna	Schwarzbeck	VULB9168	00821	2021-03-31	2023-03-31
Attenuator	JFW	50F-006	6 dB-3	2022-04-14	2023-04-14
Antenna Mast	TOKIN	5977	-	-	-
Controller	TOKIN	5909L	141909L-1	-	-
Turn Table	TOKIN	5983-1.5	-	-	-
Semi-Anechoic Chamber	SY-CORPORATION	-	-	-	-
PREAMPLIFIER	TSJ	MLA-10k01-b01-27	1870367	2022-04-13	2023-04-13
Active Loop H-Field	ETS	6502	00150598	2022-06-02	2024-06-02