RF TEST REPORT

Test item	:	Hamster Pro Duo CL
Model No.	:	XU20CL
Order No.	:	DTNC1409-04158
Date of receipt	:	2014-09-24
Test duration	:	2014-10-03 ~ 2014-10-13
Date of issue	:	2014-10-21
Use of report	:	FCC Original Grant

Applicant : Secugen Corporation
2065 Martin Ave Suite 108, Santa Clara California 95050 United States

Test laboratory : DT&C Co., Ltd.
683-3, Yubang-Dong, Cheoin-Gu, Yongin-Si, Gyeonggi-Do, 449-080, Korea

Test specification	:	FCC Part 15.225
Test environment	:	See appended test report
Test result	:	☒ Pass ☐ Fail

Tested by:

Engineer
HyunSu Son

Reviewed by:

Technical Manager
HongHee Lee

Test Report Version

Test Report No.	Date	Description
DRTFCC1410-1321	Oct. 21. 2014	Initial issue

CONTENTS

1. Equipment information

1.1 Equipment description

FCC Equipment Class	Low Power Communications Device Transmitter(DXX)
Equipment type	Hamster Pro Duo CL
Equipment model name	XU20CL
Equipment add model name	NA
Equipment serial no.	Identical prototype
Frequency band	13.56MHz
Modulation type	ASK
Channel	1
Power	DC 5V(USB)
Antenna type	Loop Antenna

1.2 Ancillary equipment

Equipment	Model No.	Serial No.	Manufacturer	Note
-	-	-	-	-
-	-	-	-	-

2. Information about test items

2.1 Test mode

Test mode1	Continuous transmitting mode
Test mode2	-

Note: For this test mode, a test program was supported by manufacturer.

2.2 Auxiliary equipment

Equipment	Model No.	Serial No.	Manufacturer	Note
Notebook Computer	CQ62-207AU	CNF0327B7P	HP	DoC
AC Adapter	PPP009D	608425-003	HP	DoC

2.3 Tested frequency

	TX Frequency(MHz)	RX Frequency(MHz)
Lowest Channel	13.56	13.56
Middle Channel	-	-
Highest Channel	-	-

2.4 Tested environment

Temperature	:	24~ 25 °C
Relative humidity content	:	47 ~ 48 % R.H.
Details of power supply	:	DC 5V

2.5 EMI Suppression Device(s)/Modifications

EMI suppression device(s) added and/or modifications made during testing
→ None

3. ANTENNA REQUIREMENTS

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

The antenna is attached to the internal PCB.
Therefore this E.U.T Complies with the requirement of §15.203

3. Test report

3.1 Summary of tests

FCC part section(s)	RSS section(s)	Parameter	Limit	Test condition	Status Note 1
2.1049	RSS-Gen [4.6.1]	Occupied bandwidth	NA	Radiated	C
15.225 (a)	RSS-210 [A2.6 (a)]	In-band emissions	15,848μN/m @ 30m 15.553 – 13.567 MHz		C
15.225 (b)	RSS-210 [A2.6 (b)]	In-band emissions	334μN/m @ 30m 13.410 – 13.553 MHz 13.567 – 13.710 MHz		C
15.225 (c)	RSS-210 [A2.6 (c)]	In-band emissions	106μN/m @ 30m 13.110 – 13.410 MHz 13.710 – 14.010 MHz		C
15.225 (d) 15.205 15.209	RSS-210 [A2.6 (d)] RSS-Gen [7.2.2 & 5]	Out-of band emissions	Emissions outside of the specified band (13.110-14.010 MHz) must meet the radiated limits detailed in 15.209		C
15.225 (e)	RSS-210 [A2.6]	Frequency stability	±0.01% of operating frequency	Conducted	C
15.207	RSS-Gen [7.2.4]	AC conducted emissions	FCC Part 15.207	AC Line Conducted	C
15.203	-	Antenna requirements	FCC Part 15.203	-	C

Note 1: **C**=Comply **NC**=Not Comply **NT**=Not Tested **NA**=Not Applicable

The sample was tested according to the following specification:
ANSI C-63.10-2009

3.2 Transmitter requirements

3.2.1 Occupied bandwidth

- Procedure:

The 20dB Bandwidth is measured with a spectrum analyzer connected via a receive antenna placed near the EUT while the EUT is operating in transmission mode.

- Measurement Data: Comply

- Minimum Standard: NA

3.2.2 In-band emissions

- Procedure:

The EUT was placed on a 0.8m high wooden table inside a 10m semi anechoic chamber. An antenna was placed at 3 m distance from the EUT Measurements were performed with the EUT oriented in 3 orthogonal axis and rotated 360 degrees to determine worst-case orientation for maximum emissions. A loop antenna was used for this test item. And this test item was performed for both vertical and horizontal polarization.

- **Measurement Data: Comply**

Test Frequency Band [MHz]	Freq. [MHz]	EUT Posi.	Reading Level [dBuV]	T.F	Field Strength @3m [dBuV/m]	Field Strength @30m [dBuV/m]	Limit [dBuV/m]	Margin [dB]
13.110 ~ 13.410	13.348	Y	29.70	18.80	48.50	8.50	40.51	32.01
13.410 ~ 13.553	13.552	Y	41.30	18.80	60.10	20.10	50.47	30.37
13.553 ~ 13.567	13.560	Y	48.00	18.80	66.80	26.80	84.00	57.20
13.567 ~ 13.710	13.568	Y	40.30	18.80	59.10	19.10	50.47	31.37
13.710 ~ 14.010	13.772	Y	30.10	18.80	48.90	8.90	40.51	31.61

Note 1. This test item was performed using a loop antenna.

Note 2. This test item was performed at 3m and the data were extrapolated to the specified measurement distance of 30m using the square of an inverse linear distance extrapolation factor (40 dB/decade) as specified in §15.31(f)2.

▪ Extrapolation Factor = 20 $\log_{10}(30/3)^2$ = 40dB

Note 3. All data were recorded using a spectrum analyzer employing a peak detector.
If PK results were meet Quasi-peak limit, Quasi-peak measurements were omitted.

Note 4. Sample Calculation.

Margin = Limit – Field Strength @ 30m **/** Field Strength @ 30m = Field Strength @ 3m – 40dB
Field Strength @ 3m = Reading + T.F **/** T.F = AF + CL – AG
Where, T.F = Total Factor, AF = Antenna Factor, CL = Cable Loss, AG = Amplifier Gain

- Minimum Standard: Part 15.225(a), (b), (c)& RSS-210 A2.6(a), (b), (c)

Frequency Band [MHz]	Limit	
	[uV/m]	[dBuV/m]
13.553-13.567	15,848	84.00
13.410-13.553 13.567-13.710	334	50.47
13.110-13.410 13.710-14.010	106	40.51

3.2.3 Out-of-band emissions

- Procedure:

The EUT was tested from 9kHz up to the 1GHz excluding the band 13.110-14.010MHz. All measurements were recorded with spectrum analyzer employing a peak detector for emissions below 30MHz. Above 30MHz a Quasi-peak detector was used. All out-of-band emissions must not exceed the limits §15.209. A loop antenna was used for searching for emissions below 30MHz.

- Measurement Data: Comply (refer to the next page)

- Minimum Standard: Part 15. 205, 209, 225(d) & RSS-210 A2.6 (d), RSS-Gen 7.2.2, RSS-Gen 7.2.5

▪ **FCC Part 15.205 (a):** Only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	MHz	GHz	GHz
0.009 ~ 0.110	8.41425 ~ 8.41475	108 ~ 121.94	1300 ~ 1427	3.6 ~ 4.4	14.47 ~ 14.5
0.495 ~ 0.505	12.29 ~ 12.293	123 ~ 138	1435 ~ 1626.5	4.5 ~ 5.15	15.35 ~ 16.2
2.1735 ~ 2.1905	12.51975 ~ 12.52025	149.9 ~ 150.05	1645.5 ~ 1646.5	5.35 ~ 5.46	17.7 ~ 21.4
4.125 ~ 4.128	12.57675 ~ 12.57725	156.52475 ~ 156.52525	1660 ~ 1710	7.25 ~ 7.75	22.01 ~ 23.12
4.17725 ~ 4.17775	13.36 ~ 13.41	156.7 ~ 156.9	1718.8 ~ 1722.2	8.025 ~ 8.5	23.6 ~ 24.0
4.20725 ~ 4.20775	16.42 ~ 16.423	162.0125 ~ 167.17	2200 ~ 2300	9.0 ~ 9.2	31.2 ~ 31.8
6.215 ~ 6.218	16.69475 ~ 16.69525	167.72 ~ 173.2	2310 ~ 2390	9.3 ~ 9.5	36.43 ~ 36.5
6.26775 ~ 6.26825	16.80425 ~ 16.80475	240 ~ 285	2483.5 ~ 2500	10.6 ~ 12.7	Above 38.6
6.31175 ~ 6.31225	25.5 ~ 25.67	322 ~ 335.4	2655 ~ 2900	13.25 ~ 13.4	
8.291 ~ 8.294	37.5 ~ 38.25	399.90 ~ 410	3260 ~ 3267		
8.362 ~ 8.366	73 ~ 74.6	608 ~ 614	3332 ~ 3339		
8.37625 ~ 8.38675	74.8 ~ 75.2	960 ~ 1240	3345.8 ~ 3358		

▪ **FCC Part 15.205(b):**

The field strength of emissions appearing within these frequency bands shall not exceed the limits shown in §15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in §15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in §15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in §15.35 apply to these measurements.

▪ **FCC Part 15.209(a):**

Frequency [MHz]	Field Strength [uV/m]	Measurement Distance [Meters]
0.009 ~ 0.490	2400/F(kHz)	300
0.490 ~ 1.705	24000/F(kHz)	30
1.705 ~ 30	30	30
30 ~ 88	100 **	3
88 ~ 216	150 **	3
216 ~ 960	200 **	3
Above 960	200	3

** Except as provided in 15.209(g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88MHz, 174-216MHz or 470-806MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g. 15.231 and 15.241.

▪ **FCC Part 15.209(b):**

In the emission table above, the tighter limit applies at the band edges.

- Measurement Data:

Tested Frequency : **13.56MHz**

Measurement Distance : **3 Meters**

Frequency [MHz]	EUT Posi.	ANT Pol	Reading [dBuV]	T.F [dB/m]	Distance factor	Field Strength [dBuV/m]	Limit [dBuV/m]	Margin [dB]
0.373	Y	N/A	34.6	19.1	80	-26.3	16.2	42.5
0.485	Y	N/A	21.3	19.0	80	-39.7	13.9	53.6
0.688	Y	N/A	35.3	19.0	40	14.3	30.9	16.6
1.377	Y	N/A	25.8	19.1	40	4.9	24.8	19.9
40.684	Y	V	46.9	-16.7	0	30.2	40.0	9.8
210.052	Y	H	50.4	-17.4	0	33.0	43.5	10.5
935.619	Y	V	44.6	-0.5	0	44.1	46.0	1.9
962.742	Y	V	42.8	-0.2	0	42.6	54.0	11.4

Note 1. All measurements were recorded using a spectrum analyzer employing a peak detector for blew 30MHz and a Quasi-peak detector for above 30MHz.

Note 2. Both Vertical and Horizontal polarities of the receiver antenna were evaluated with the worst case emissions being reported. The worst-case emissions are reported.

Note 3. No other spurious and harmonic emissions were reported greater than listed emissions above table.

Note 4. Sample calculation

Margin = Limit – Field Strength

Field Strength = Reading + T.F – Distance factor

T.F = AF + CL – AG

Distance factor = 20log(Measurement distance / The measured distance)^2

Where, T.F = Total Factor, AF = Antenna Factor, CL = Cable Loss, AG = Amplifier Gain

3.2.4 Frequency Stability

- Procedure:

Part 15.225 requires that devices operating in the 13.553 – 13.567 MHz shall maintain the carrier frequency within 0.01% of the operating frequency over the temperature variation of -20 degrees to + 50 degrees C at normal supply voltage.

- Measurement Data: Comply

Operating Frequency : **13,560,000Hz**

VOLTAGE (%)	POWER (V_{DC})	TEMP (℃)	Frequency (Hz)	Freq. Dev. (Hz)	Deviation (%)
100%	5.000	+20(ref)	13,559,787	-213	0.001573
100%		-20	13,559,795	-205	0.001510
100%		-10	13,559,793	-207	0.001527
100%		0	13,559,784	-216	0.001590
100%		+10	13,559,789	-211	0.001559
100%		+20	13,559,787	-213	0.001573
100%		+30	13,559,791	-209	0.001539
100%		+40	13,559,789	-211	0.001553
100%		+50	13,559,795	-205	0.001509
85%	4.250	+20	13,559,770	-230	0.001693
115%	5.750	+20	13,559,793	-207	0.001527

- Minimum Standard: Part 15. 225(e) & RSS-210 A2.6

The frequency tolerance of the carrier signal shall be maintained within ±0.01% of the operating frequency.

3.2.5 AC Line Conducted Emissions

- Procedure:

The conducted emissions are measured in the shielded room with a spectrum analyzer in peak hold. While the measurement, EUT had its hopping function disabled at the middle channels in line with Section 15.21(m). Emissions closest to the limit are measured in the quasi-peak and average detector mode with the tuned receiver using a bandwidth of 9 kHz. The emissions are maximized further by cable manipulation and Exerciser operation. The highest emissions relative to the limit are listed.

- Measurement Data: Comply (refer to the next page)

- Minimum Standard: FCC Part 15.207(a) & RSS-Gen 7.2.4

Frequency Range (MHz)	Conducted Limit (dBuV)	
	Quasi-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

Measurement Data

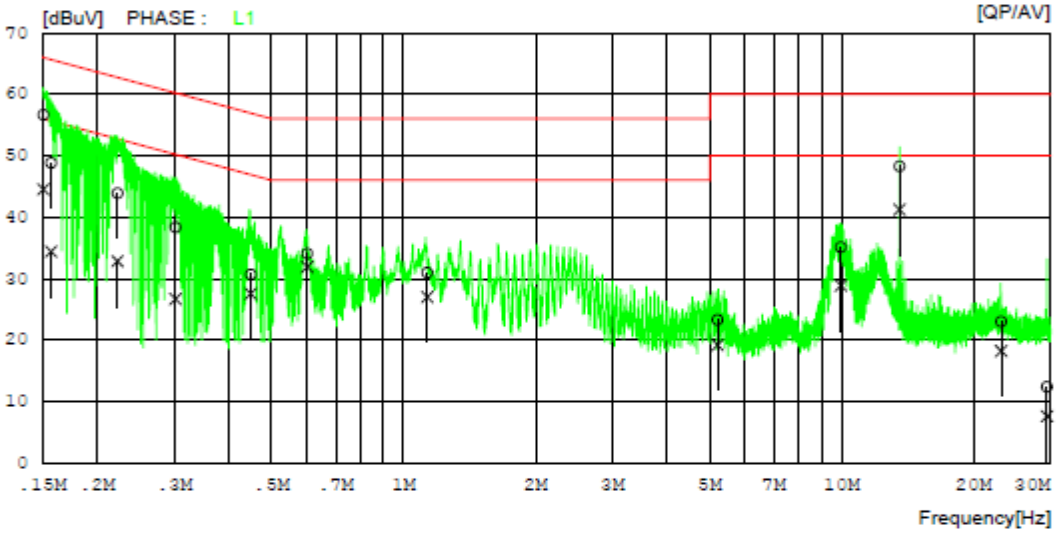
Results of Conducted Emission

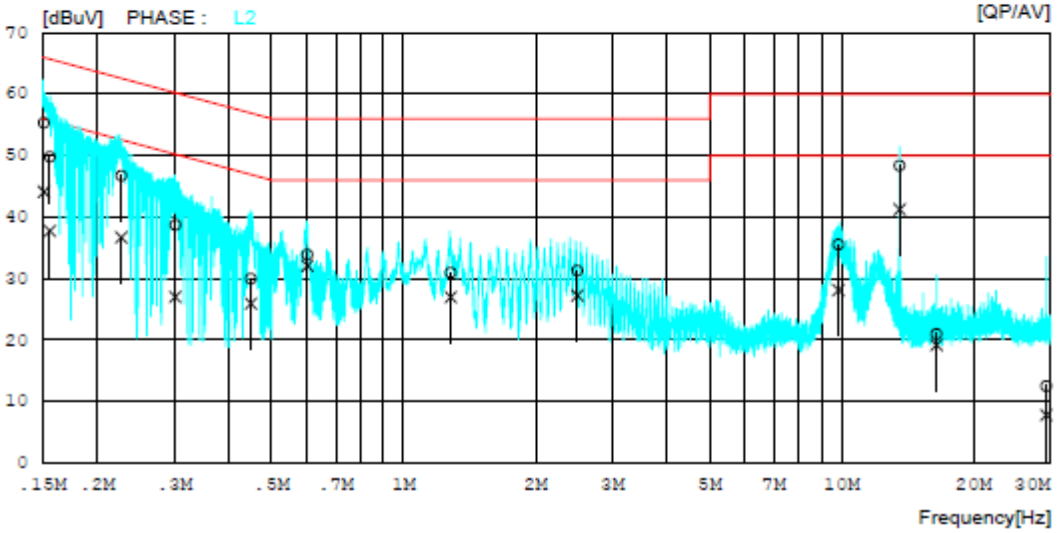
Date : 2014-10-13

Model No.	:	XU20CL	Referrence No.	:	
Type	:		Power Supply	:	120 V 60 Hz
Serial No.	:	Identical prototype	Temp/Humi.	:	22 ' C 49 % R.H.
Test Condition	:	NFC 13.56MHz	Operator	:	H.S.SON

Memo :

LIMIT : FCC P15.207 QP
FCC P15.207 AV





Measurement Data

Results of Conducted Emission

Date : 2014-10-13

Model No.	:	XU20CL	Referrence No.	:	
Type	:		Power Supply	:	120 V 60 Hz
Serial No.	:	Identical prototype	Temp/Humi.	:	22 ' C 49 % R.H.
Test Condition	:	NFC 13.56MHz	Operator	:	H.S.SON

Memo :

LIMIT : FCC P15.207 QP
FCC P15.207 AV

NO	FREQ	READING QP	READING AV	C.FACTOR	RESULT QP	RESULT AV	LIMIT QP	LIMIT AV	MARGIN QP	MARGIN AV	PHASE
	[MHz]	[dBuV]	[dBuV]	[dB]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	
1	0.15061	46.3	34.2	10.3	56.6	44.5	66.0	56.0	9.4	11.5	L1
2	0.15680	38.5	24.1	10.3	48.8	34.4	65.6	55.6	16.8	21.2	L1
3	0.22244	33.6	22.5	10.3	43.9	32.8	62.7	52.7	18.8	19.9	L1
4	0.30144	28.1	16.4	10.3	38.4	26.7	60.2	50.2	21.8	23.5	L1
5	0.44815	20.5	17.3	10.2	30.7	27.5	56.9	46.9	26.2	19.4	L1
6	0.60250	23.9	21.7	10.2	34.1	31.9	56.0	46.0	21.9	14.1	L1
7	1.13320	20.8	16.8	10.2	31.0	27.0	56.0	46.0	25.0	19.0	L1
8	5.20740	13.0	8.9	10.3	23.3	19.2	60.0	50.0	36.7	30.8	L1
9	9.95940	24.5	18.3	10.6	35.1	28.9	60.0	50.0	24.9	21.1	L1
10	13.55920	37.5	30.4	10.8	48.3	41.2	60.0	50.0	11.7	8.8	L1
11	23.12940	11.9	7.1	11.1	23.0	18.2	60.0	50.0	37.0	31.8	L1
12	29.43520	1.2	-3.6	11.2	12.4	7.6	60.0	50.0	47.6	42.4	L1
13	0.15103	45.0	33.8	10.3	55.3	44.1	65.9	55.9	10.6	11.8	L2
14	0.15585	39.5	27.4	10.3	49.8	37.7	65.7	55.7	15.9	18.0	L2
15	0.22703	36.4	26.4	10.3	46.7	36.7	62.6	52.6	15.9	15.9	L2
16	0.30142	28.4	16.7	10.3	38.7	27.0	60.2	50.2	21.5	23.2	L2
17	0.44832	19.7	15.7	10.2	29.9	25.9	56.9	46.9	27.0	21.0	L2
18	0.60350	23.7	21.9	10.2	33.9	32.1	56.0	46.0	22.1	13.9	L2
19	1.28180	20.8	16.7	10.2	31.0	26.9	56.0	46.0	25.0	19.1	L2
20	2.49320	21.1	17.0	10.2	31.3	27.2	56.0	46.0	24.7	18.8	L2
21	9.83080	24.9	17.5	10.6	35.5	28.1	60.0	50.0	24.5	21.9	L2
22	13.56000	37.6	30.5	10.7	48.3	41.2	60.0	50.0	11.7	8.8	L2
23	16.47060	10.2	8.4	10.8	21.0	19.2	60.0	50.0	39.0	30.8	L2
24	29.33780	1.3	-3.4	11.2	12.5	7.8	60.0	50.0	47.5	42.2	L2

APPENDIX

TEST EQUIPMENT FOR TESTS

Type	Manufacturer	Model	Cal.Date (yy/mm/dd)	Next.Cal.Date (yy/mm/dd)	S/N
MXA Signal Analyzer	Agilent	N9020A	14/09/15	15/09/15	MY50200834
DC Power Supply	SM techno	SDP30-5D	14/02/10	15/02/10	305DLJ204
Vector Signal Generator	Rohde Schwarz	SMBV100A	14/01/07	15/01/07	255571
Multimeter	HP	34401A	14/02/27	15/02/27	3146A13475
Loop Antenna	Schwarzbeck	FMZB1513	14/04/29	16/04/29	1513-128
EMI TEST RECEIVER	R&S	ESCI7	14/02/27	15/02/27	100910
CVCF	EM TEST	ENTWAVE 60-400	14/05/26	15/05/26	P1311115470
LISN	SCHWARZBECK	NNLK8121	14/08/18	15/08/18	NNLK8121-580
PULSE LIMITER	R&S	ESH3-Z2	14/01/08	15/01/08	101334
Temp &Humi Test Chamber	SJ Science	SJ-TH-S50	14/03/10	15/03/10	SJ-TH-S50-140205
Thermohygrometer	BODYCOM	BJ5478	14/05/13	15/05/13	120612-2
Low Noise Pre Amplifier	TSJ	MLA-010K01-B01-27	14/04/09	15/04/09	1844539
EMI TEST RECEVER	ROHDE&SCHWARZ	ESR	14/02/27	15/02/27	101061
TRILOG Broadband Test-Antenna	SCHWARZBECK	VULB 9160	13/12/16	15/12/16	3358