

TEST REPORT

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Revision History

Issued Report No.	Issued Date	Revisions	Effect Section
ICRT-TR-E232414-0A	2023. 09. 26	Initial Issue	All



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1. Applicant & Manufacturer & Test Laboratory Information

1.1 Applicant information

Applicant	HANMI MICRONICS INC.
Address	72, Samdo-ro 48beon-gil, Yangchon-eup, Gimpo-si, Gyeonggi-do, Korea.

1.2 Manufacturer Information

Applicant	HANMI MICRONICS INC.
Address	72, Samdo-ro 48beon-gil, Yangchon-eup, Gimpo-si, Gyeonggi-do, Korea.

1.3 Test Laboratory Information

Laboratory	ICR Co., Ltd.
Address	112, Hwanggeum 3-ro 7beon-gil, Hagun-ri, Yangchon-eup, Gimpo-si, Gyeonggi-do, Korea
Telephone No.	+82-2-6351-9002
Fax No.	+82-2-6351-9007
KOLAS No.	KT652
KC & FCC	KR0165

1.4 Measurement Uncertainty

Parameter	Uncertainty	Limit
Occupied Channel Bandwidth	2.75%	±5 %
RF output power, conducted	1.39 dB	±1.5 dB
Power Spectral Density, conducted	1.65 dB	±3 dB
Unwanted Emissions, conducted	1.82 dB	±3 dB
Supply voltages	0.06%	±3 %
Time	1.17%	±5 %
All emissions, radiated (Under the 1 GHz)	3.22 dB	±6 dB
All emissions, radiated (Above the 1 GHz)	3.67 dB	±6 dB



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2. Equipment under Test(EUT) Information

2.1 General Information

Product Name	Wireless Keyboard
Model Name	CaluX
Additional Model Name	-
FCC ID	2A3QW-CALUX
Power Supply	DC 3.7 V

2.2 Additional Information

Equipment Class	DSS - Direct Sequence Spread	
Device Type	Stand-alone	
Operating Frequency	Bluetooth BDR	2 402 MHz ~ 2 480 MHz
	FHSS	2 402 MHz ~ 2 479 MHz
RF Output Power	Bluetooth BDR	-5.08 dBm
	FHSS	1.28 dBm
Number of Channel	Bluetooth BDR	79
	FHSS	78
Modulation Type	GFSK	
Antenna Type	PCB Antenna	
Antenna Gain	1.58 dBi	
Hopping Mode	pseudorandom	



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3. Test Summary

3.1 Test standards and results

FCC Part 15 Subpart C			
Clause	Test items	Applied	Results
§15.247 (a)(1)	20 dB Bandwidth	■	N/A (See note 1)
§15.247 (a)(1)	Carrier Frequency Separation	■	N/A (See note 1)
§15.247 (a)(1) (iii)	Number of Hopping Frequencies	■	N/A (See note 1)
§15.247 (a)(1) (iii)	Time of Occupancy (dwell Time)	■	N/A (See note 1)
§15.247 (b)(1)	Maximum Conducted Output Power	■	N/A (See note 1)
§15.247 (d)	Conducted Spurious Emission & Band edge	■	N/A (See note 1)
§15.247 (d) & §15.209 & §15.205	Radiated Spurious Emission & Band edge	■	PASS
§15.207	Power Line Conducted Emission	■	N/A (See note 1)
Note 1 : Refer to original report (ICRT-TR-E231134-0A)			

3.2 Purpose of the test

- To determine whether the equipment under test fulfills the requirements of the standards stated in section 3.1 and the provision of Article 3.2 of Directive 2014/53/EU

3.3 Test Methodology

- Both conducted and radiated testing was performed according to the procedures in ANSI C63.10: 2013. Radiated testing was performed at a distance of 3 m from EUT to the antenna.

3.4 Configuration of Test System

- Both conducted and radiated testing was performed according to the procedures in ANSI C63.10: 2013. Radiated testing was performed at a distance of 3 m from EUT to the antenna.

3.4.1 Radiated emission test

- Preliminary radiated emissions test were conducted using the procedure in ANSI C63.10: 2013 to determine the worse operating conditions. Final radiated emission tests were conducted at 3 m Semi Anechoic Chamber.

The turntable was rotated through 360 degrees and the EUT was tested by positioned three orthogonal planes to obtain the highest reading on the field strength meter. Once maximum reading was determined, the search antenna was raised and lowered in both vertical and horizontal polarization.



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3.5 Antenna requirement

- According to §15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall 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 manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

And according to §15.247(b)(4), the conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi

Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Result: Pass

The transmitter has a **PCB Antenna**. The directional gain of the antenna is **1.58 dBi**.



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4. Test Result

4.1 Radiated Spurious Emission

4.1.1 Test procedure

ANSI C63.10-2013 Clause 6.4, 6.5, 6.6

4.1.2 Limit

§15.247 (d)

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in § 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in § 15.205(a), must also comply with the radiated emission limits specified in § 15.209(a) (see § 15.205(c)).

§15.209 Radiated emission limits; general requirements.(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	2400/F(kHz)	300
0.490–1.705	24000/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 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.



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§15.205 Restricted bands of operation.(a),(b)

MHz	MHz	MHz	GHz
0.090–0.110	16.42–16.423	399.9–410	4.5–5.15
¹ 0.495–0.505	16.69475–16.69525	608–614	5.35–5.46
2.1735–2.1905	16.80425–16.80475	960–1240	7.25–7.75
4.125–4.128	25.5–25.67	1300–1427	8.025–8.5
4.17725–4.17775	37.5–38.25	1435–1626.5	9.0–9.2
4.20725–4.20775	73–74.6	1645.5–1646.5	9.3–9.5
6.215–6.218	74.8–75.2	1660–1710	10.6–12.7
6.26775–6.26825	108–121.94	1718.8–1722.2	13.25–13.4
6.31175–6.31225	123–138	2200–2300	14.47–14.5
8.291–8.294	149.9–150.05	2310–2390	15.35–16.2
8.362–8.366	156.52475–156.52525	2483.5–2500	17.7–21.4
8.37625–8.38675	156.7–156.9	2690–2900	22.01–23.12
8.41425–8.41475	162.0125–167.17	3260–3267	23.6–24.0
12.29–12.293	167.72–173.2	3332–3339	31.2–31.8
12.51975–12.52025	240–285	3345.8–3358	36.43–36.5
12.57675–12.57725	322–335.4	3600–4400	(²)
13.36–13.41			

¹ Until February 1, 1999, this restricted band shall be 0.490–0.510 MHz.

² Above 38.6

Except as provided in paragraphs (d) and (e) of this section, 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.



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4.1.3 Test data

Result : Pass

- Below 30 MHz_Low ch_BDR

Frequency (MHz)	Reading (dBuV/m)	Detector	Pol.	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dBuV/m)	Note
It was not found any emissions peaks found from the EUT.								

- Below 30 MHz_Mid ch_BDR

Frequency (MHz)	Reading (dBuV/m)	Detector	Pol.	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dBuV/m)	Note
It was not found any emissions peaks found from the EUT.								

- Below 30 MHz_High ch_BDR

Frequency (MHz)	Reading (dBuV/m)	Detector	Pol.	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dBuV/m)	Note
It was not found any emissions peaks found from the EUT.								



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- Below 30 MHz_Low ch_FHSS

Frequency (MHz)	Reading (dBuV/m)	Detector	Pol.	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dBuV/m)	Note
It was not found any emissions peaks found from the EUT.								

- Below 30 MHz_Mid ch_FHSS

Frequency (MHz)	Reading (dBuV/m)	Detector	Pol.	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dBuV/m)	Note
It was not found any emissions peaks found from the EUT.								

- Below 30 MHz_High ch_FHSS

Frequency (MHz)	Reading (dBuV/m)	Detector	Pol.	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dBuV/m)	Note
It was not found any emissions peaks found from the EUT.								



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- 30 MHz ~ 1 GHz_Low ch_BDR

Frequency (MHz)	Reading (dBuV/m)	Detector	Pol.	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dBuV/m)	Note
72.00	57.09	QP	H	-28.1	28.99	40.00	11.01	
143.98	54.19	QP	H	-28.4	25.79	43.50	17.71	
288.02	45.94	QP	H	-22.0	23.94	46.00	22.06	
311.98	45.79	QP	H	-21.4	24.39	46.00	21.61	

- 30 MHz ~ 1 GHz_Mid ch_BDR

Frequency (MHz)	Reading (dBuV/m)	Detector	Pol.	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dBuV/m)	Note
72.00	57.72	QP	H	-28.1	29.62	40.00	10.38	
95.96	48.41	QP	H	-25.3	23.11	43.50	20.39	
133.31	52.80	QP	V	-28	24.80	43.50	18.70	
143.98	54.88	QP	H	-28.4	26.48	43.50	17.02	

- 30 MHz ~ 1 GHz_High ch_BDR

Frequency (MHz)	Reading (dBuV/m)	Detector	Pol.	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dBuV/m)	Note
72.00	56.92	QP	H	-28.1	28.82	40.00	11.18	
131.17	52.89	QP	V	-27.9	24.99	43.50	18.51	
143.98	55.13	QP	H	-28.4	26.73	43.50	16.77	
182.58	50.26	QP	H	-26.5	23.76	43.50	19.74	



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- 30 MHz ~ 1 GHz_Low ch_FHSS

Frequency (MHz)	Reading (dBuV/m)	Detector	Pol.	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dBuV/m)	Note
52.31	58.07	QP	V	-23.1	34.97	40.00	5.03	
53.67	60.28	QP	V	-23.2	37.08	40.00	2.92	
302.76	63.43	QP	H	-21.6	41.83	46.00	4.17	
421.59	59.26	QP	H	-18.0	41.26	46.00	4.74	

- 30 MHz ~ 1 GHz_Mid ch_FHSS

Frequency (MHz)	Reading (dBuV/m)	Detector	Pol.	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dBuV/m)	Note
31.07	62.60	QP	V	-26.9	35.70	40.00	4.30	
53.67	60.23	QP	V	-23.2	37.03	40.00	2.97	
302.67	64.82	QP	H	-21.6	43.22	46.00	2.78	
415.77	60.55	QP	H	-18.2	42.35	46.00	3.65	

- 30 MHz ~ 1 GHz_High ch_FHSS

Frequency (MHz)	Reading (dBuV/m)	Detector	Pol.	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dBuV/m)	Note
47.95	57.51	QP	V	-22.9	34.61	40.00	5.39	
53.67	59.25	QP	V	-23.2	36.05	43.50	7.45	
302.76	64.79	QP	H	-21.6	43.19	43.50	0.31	
421.40	60.51	QP	H	-18.0	42.51	43.50	0.99	



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- 1 GHz Above_Low ch_BDR

Frequency (MHz)	Reading (dBuV/m)	Detector	Pol.	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dBuV/m)	Note
2 359.50	46.52	PK	V	-10.8	35.72	74	38.28	Restricted band
	32.86	AVG	V		22.06	54	31.94	
4 803.50	42.23	PK	V	-1.7	40.53	74	33.47	2nd Harmonic
	28.77	AVG	V		27.07	54	26.93	
7 206.00	40.23	PK	V	3.0	43.23	74	30.77	3rd Harmonic
	27.03	AVG	V		30.03	54	23.97	
9 607.20	40.00	PK	V	5.4	45.40	74	28.60	4nd Harmonic
	26.48	AVG	V		31.88	54	22.12	

- 1 GHz Above_Mid ch_BDR

Frequency (MHz)	Reading (dBuV/m)	Detector	Pol.	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dBuV/m)	Note
4 882.00	43.33	PK	V	-1.6	41.73	74	32.27	2nd Harmonic
	31.15	AVG	V		29.55	54	24.45	
7 323.60	40.24	PK	H	2.7	42.94	74	31.06	3rd Harmonic
	26.76	AVG	H		29.46	54	24.54	
9 764.40	38.67	PK	H	6.4	45.07	74	28.93	4nd Harmonic
	25.45	AVG	H		31.85	54	22.15	

- 1 GHz Above_High ch_BDR

Frequency (MHz)	Reading (dBuV/m)	Detector	Pol.	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dBuV/m)	Note
2 490.50	46.24	PK	H	-10.2	36.04	74	37.96	Restricted band
	32.88	AVG	H		22.68	54	31.32	
4 959.50	44.25	PK	V	-1.5	42.75	74	31.25	2nd Harmonic
	31.53	AVG	V		30.03	54	23.97	
7 440.00	40.52	PK	H	2.5	43.02	74	30.98	3rd Harmonic
	26.82	AVG	H		29.32	54	24.68	
9 920.40	38.55	PK	H	5.8	44.35	74	29.65	4nd Harmonic
	24.92	AVG	H		30.72	54	23.28	



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- 1 GHz Above_Low ch_FHSS

Frequency (MHz)	Reading (dBuV/m)	Detector	Pol.	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dBuV/m)	Note
2 384.50	46.05	PK	H	-10.7	35.35	74	38.65	Restricted band
	32.80	AVG	H		22.10	54	31.90	
4 804.50	47.76	PK	V	-1.7	46.06	74	27.94	2nd Harmonic
	33.13	AVG	V		31.43	54	22.57	
7 206.00	41.36	PK	H	3.0	44.36	74	29.64	3rd Harmonic
	27.38	AVG	H		30.38	54	23.62	
9 608.40	39.55	PK	H	5.5	45.05	74	28.95	4nd Harmonic
	26.30	AVG	H		31.80	54	22.20	

- 1 GHz Above_Mid ch_FHSS

Frequency (MHz)	Reading (dBuV/m)	Detector	Pol.	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dBuV/m)	Note
4 893.00	46.1	PK	V	-1.6	44.50	74	29.50	2nd Harmonic
	31.47	AVG	V		29.87	54	24.13	
7 339.20	42.18	PK	V	2.7	44.88	74	29.12	3rd Harmonic
	27.75	AVG	V		30.45	54	23.55	
9 783.60	38.81	PK	V	6.3	45.11	74	28.89	4nd Harmonic
	25.37	AVG	V		31.67	54	22.33	

- 1 GHz Above_High ch_FHSS

Frequency (MHz)	Reading (dBuV/m)	Detector	Pol.	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dBuV/m)	Note
2 485.00	48.30	PK	H	-10.2	38.10	74	35.90	Restricted band
	33.39	AVG	H		23.19	54	30.81	
4 958.50	47.50	PK	V	-1.5	46.00	74	28.00	2nd Harmonic
	32.74	AVG	V		31.24	54	22.76	
7 437.60	41.78	PK	V	2.5	44.28	74	29.72	3rd Harmonic
	27.49	AVG	V		29.99	54	24.01	
9 915.60	39.28	PK	H	5.8	45.08	74	28.92	4nd Harmonic
	25.36	AVG	H		31.16	54	22.84	



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5. Used equipment

	Description	Model Name	Manufacturer	Serial Number	Next Cal
■	DC POWER SUPPLY	E3632A	AGILANT	MY51300069	2024-03-03
■	LOOP ANTENNA	HFH2-Z2	R&S	100271	2025-03-08
■	BI-Log ANTENNA	VULB 9162	SCHWARZBECK	120	2024-12-26
■	SIGNAL CONDITIONING UNIT	SCU 08	R&S	100746	2024-04-03
■	EMI TEST RECEIVER	ESR26	R&S	101462	2024-04-04
■	DOUBLE RIDGED HORN ANTENNA	HF907	R&S	102556	2024-08-04
■	SIGNAL CONDITIONING UNIT	SCU18	R&S	102342	2024-04-03
■	EMI TEST RECEIVER	ESR26	R&S	101461	2024-04-04
■	HORN ANTENNA	LB-42-10-C-KF	A-INFOMW	J202024625	2024-03-07
■	PREAMPLIFIER	AMF-4F-18265- 35-8P-1	MITEQ	-	2024-03-07

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