



TEST REPORT

KCTL Inc. 65, Sinwon-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Korea TEL: 82-31-285-0894 FAX: 82-505-299-8311 www.kctl.co.kr	Report No.: KR17-SRF0047 Page (1) of (18)				
1. Client ◦ Name : SELVAS Healthcare, Inc. ◦ Address : 174 Gajung-ro, Yuseong-gu Daejeon South Korea ◦ Date of Receipt : 2017-04-11 2. Use of Report : - 3. Name of Product and Model : BrailleSense Polaris / H532B 4. Manufacturer and Country of Origin : SELVAS Healthcare, Inc. / Korea 5. FCC ID : 2AL4DH532B 6. Date of Test : 2017-05-12 to 2017-05-22 7. Test Standards : FCC Part 15 Subpart C 15.225 8. Test Results : Refer to the test result in the test report					
<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 15%; text-align: center; vertical-align: middle;">Affirmation</td> <td style="width: 45%; padding: 5px;"> Tested by Name : Euijung Kim (Signature) </td> <td style="width: 40%; padding: 5px;"> Technical Manager Name : Changmin Kim (Signature) </td> </tr> </table>			Affirmation	Tested by Name : Euijung Kim (Signature)	Technical Manager Name : Changmin Kim (Signature)
Affirmation	Tested by Name : Euijung Kim (Signature)	Technical Manager Name : Changmin Kim (Signature)			
2017-05-26					
KCTL Inc.					
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REPORT REVISION HISTORY

Date	Revision	Page No
2017-05-26	Originally issued	-

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1. Client information

Applicant: SELVAS Healthcare, Inc.
Address: 174 Gajung-ro, Yuseong-gu Daejeon South Korea
Telephone number: 82-42-864-4460
Facsimile number: 82-42-864-4462
Contact person: Yunsae Lee / aiden.y.lee@selvas.com

Manufacturer: SELVAS Healthcare, Inc.
Address: 174 Gajung-ro, Yuseong-gu Daejeon South Korea

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2. Laboratory information

Address

KCTL Inc.

65, Sinwon-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Korea

Telephone Number: 82 31 285 0894

Facsimile Number: 82 505 299 8311

FCC Site Designation No: KR0040, FCC Site Registration No: 687132

VCCI Registration No. : R-3327, G-198, C-3706, T-1849

Industry Canada Registration No. : 8035A

KOLAS NO.: KT231

SITE MAP



3. Description of E.U.T.

3.1 Basic description

Applicant	SELVAS Healthcare, Inc.
Address of Applicant	174 Gajung-ro, Yuseong-gu Daejeon South Korea
Manufacturer	SELVAS Healthcare, Inc.
Address of Manufacturer	174 Gajung-ro, Yuseong-gu Daejeon South Korea
Type of equipment	BrailleSense Polaris
Basic Model	H532B
Serial number	N/A

3.2 General description

Frequency Range	2 412 MHz ~ 2 462 MHz (802.11b/g/n HT20) 2 422 MHz ~ 2 452 MHz (802.11n HT40) 5 180 MHz ~ 5 240 MHz (802.11ac VHT20) 5 745 MHz ~ 5 825 MHz (802.11ac VHT20) 2 402 MHz ~ 2 480 MHz (Bluetooth, Bluetooth Low Energy) 13.56 MHz (NFC)
Type of Modulation	802.11b : DSSS, 802.11g/n/ac : OFDM, Bluetooth, Bluetooth Low Energy : GFSK, $\pi/4$ DQPSK, 8DPSK NFC : ASK
The number of channels	2.4 GHz: 11 ch (802.11b/g/n HT20), 7 ch (802.11n HT40), 79 ch (Bluetooth), 40 ch (Bluetooth Low Energy) 5 GHz: 5 150 MHz Band: 4 (802.11ac VHT20) 5 725 MHz Band: 4 (802.11ac VHT20) 13.56 MHz: 1 ch
Type of Antenna	Loop Antenna
Power supply	DC 3.80 V
Product SW/HW version	V5.32.01 / V6.1
Radio SW/HW version	V5.32.01 / V6.1
Test SW Version	Dut labtool 2.0.0.89
RF power setting in TEST SW	15

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

3.3 Test frequency

Frequency	13.560 MHz
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4. Summary of test results

4.1 Standards & results

Rule Reference	Parameter	Status
15.203	Antenna Requirement	C
15.225 (a)	In-band Fundamental Emission	C
15.225 (b)	In-band Spurious Emission	C
15.225 (c)	In-band Spurious Emission	C
15.225 (d) 15.209	Out-of-band Spurious Emission	C
15.225 (e)	Frequency Stability Tolerance	C
15.207	Conducted Emissions	C
Note ₁): C = complies, NC = Not complies, NT = Not tested, NA = Not Applicable Note ₂): The worst case is Y scheme(Please refer to the "Test setup photos" to check X, Y, Z configuration).		

4.2 Uncertainty

Measurement Item	Expanded Uncertainty $U = kU_c (k = 2)$	
Radiated Spurious Emissions	30 MHz ~ 300 MHz:	+4.94 dB, -5.06 dB
		+4.93 dB, -5.05 dB
	300 MHz ~ 1 000 MHz:	+4.97 dB, -5.08 dB
		+4.84 dB, -4.96 dB
Conducted Emissions	1 GHz ~ 25 GHz:	+6.03 dB, -6.05 dB
	9 kHz ~ 150 kHz:	3.75 dB
	150 kHz ~ 30 MHz:	3.36 dB

5. Test results

5.1 Antenna Requirement

5.1.1 Regulation

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.

5.1.2 Result

-Complied

The Loop antenna is permanently attached on PCB board.

5.2 In-band Fundamental Emission

5.2.1 Minimum Standard

15.225 (a) The field strength of any emission within the band 13.553-13.567 MHz shall not exceed 15,848 microvolts/meter at 30 meters.

5.2.2 Measurement Procedure

Test Procedure The Radiated Electric Field Strength intensity has been measured on semi anechoic chamber with a ground plane and at a distance of 3m.

Frequency : From 9 kHz to 30 MHz at distance 3m The EUT was rotated a full revolution in order to obtain the maximum value of the electric field intensity.

Frequency : From 30 MHz to 1 GHz at distance 3m The measuring antenna height varied between 1 and 4m and EUT was rotated a full revolution in order to obtain the maximum value of the electric field intensity.

The measurements were performed for both vertical and horizontal antenna polarization.

Measurements were performed with a QP, PK, and AV detector. The radiated emission measurements were made with the following detector function of the test receiver (below 1 GHz).

Frequency	9 - 90 kHz	90 - 110 kHz	150 - 490 kHz	490 kHz - 30 MHz	30 MHz -1 GHz
Detector type	PK/AV	QP	PK/AV	QP	QP
IF bandwidth	200 Hz	200 Hz	9 kHz	9 kHz	120 kHz

- Part 15 Section 15.31 (f)(2) (9 kHz - 30 MHz)

[Limit at 3m]=[Limit at 300m]-40 x log(3[m]/300[m])

[Limit at 3m]=[Limit at 30m]-40 x log (3[m]/30[m])

5.2.3 Test Result

- Complied

Voltage [V]	Frequency [MHz]	Reading [dB μ V]	Cable Loss [dB]	Amp Gain [dB]	Antenna Factor [dB]	Correction Factor [dB]	field strength dBuV/m at 3 m	Limit dBuV/m at 3 m	Margin [dB]
QP DATA.									
3.80	13.56	48.10	0.91	-32.67	19.56	-12.20	35.90	124.00	88.10

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5.3 In-band Spurious Emission

5.3.1 Regulation

15.225 (b) With in 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.

15.225 (c) With in 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.

5.3.2 Test Result

- Complied

Measurement Distance: 3 m

Frequency [MHz]	Receiver Bandwidth [kHz]	Reading [dB(μV)]	Pol. [V/H]	Cable Loss [dB]	Amp Gain [dB]	Antenna Factor [dB]	Factor [dB]	Limit [dB(μV/m)]	Result [dB(μV/m)]	Margin [dB]
QP DATA.										
13.19	9	35.10	V	1.00	-32.67	19.57	-12.10	80.50	23.00	57.50
13.45	9	34.90	H	0.91	-32.67	19.56	-12.20	90.50	22.70	67.80
13.67	9	36.80	H	0.91	-32.67	19.56	-12.20	90.50	24.60	65.90
13.87	9	35.10	V	0.92	-32.67	19.55	-12.20	80.50	22.90	57.60

Margin (dB) = Limit – Actual

[Result] = Reading – Amp Gain + AF + CL

1. H = Horizontal, V = Vertical Polarization

2. AF/CL = Antenna Factor and Cable Loss

Note: This test was performed by using peak detector mode If peak result meets the limit, QP measurement is skipped.

5.4 Out-of-band Spurious Emission

5.4.1 Regulation

15.225 (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

Frequency (MHz)	Field Strength ($\mu V/m$)	Measurement distance (meters)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30(29.54 dB $\mu V/m$)	30
30.0-88.0	100(40 dB $\mu V/m$)	3
88-216	150(43.5 dB $\mu V/m$)	3
216-960	200 (46 dB $\mu V/m$)	3
Above 960	500 (53.98 dB $\mu V/m$)	3

5.4.2 Measurement Procedure

The spurious emissions from the EUT will be measured on an 10 m Anechoic chamber in the frequency range of 9 kHz to 30 MHz using a tuned receiver and a shielded loop antenna.

The antenna was positioned 3, 10 or 30 meters horizontally from the EUT.

Measurements have been made in all three orthogonal axes and the shielded loop antenna was rotated to locate the maximum of the emissions.

In the case where larger measuring distances are required the results will be extrapolated based on the values measured on the closer distances according to Section 15.31 (f) (2) [2].

The final measurement will be performed with an EMI Receiver set to Quasi Peak detector except for the frequency bands 9 kHz to 90 kHz and 110 to 490 kHz where an average detector will be used according to Section 15.209 (d) [2].

The final level, expressed in dB $\mu V/m$, is arrived at by taking the reading from the EMI receiver (Level dB μV) and adding the antenna correction factor and cable loss factor (Factor dB) to it. This result then has to be compared with the relevant FCC limit. The resolution bandwidth during the measurement is as follows:

9 kHz – 150 kHz: ResBW: 200 Hz

150 kHz – 30 MHz: ResBW: 9 kHz

The preliminary radiated measurements were performed to determine the frequency producing the maximum emissions in an anechoic chamber at a distance of 3 meters.

The EUT was placed on the top of the 0.8 meter height, 1 x 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°.

The antenna polarization was also changed from vertical to horizontal. The spectrum was scanned from 30 to 1 000 MHz using the BILOG antenna. To obtain the final measurement data, the EUT was arranged on a turntable situated on a 10 m chamber. The EUT was tested at a distance 3 meters.

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.

5.4.3 Test Result

- Complied

Measurement Distance: 3 m

-Below 30 MHz

Frequency [MHz]	Receiver Bandwidth [kHz]	Reading [dB(μV)]	Pol. [V/H]	Cable Loss [dB]	Amp Gain [dB]	Antenna Factor [dB]	Factor [dB]	Limit [dB(μV/m)]	Result [dB(μV/m)]	Margin [dB]
QP DATA.										
6.17	9	36.90	V	0.59	-32.69	19.70	-12.40	69.50	24.50	45.00
27.13	9	39.20	V	1.51	-32.68	19.07	-12.10	69.50	27.10	42.40

-Above 30 MHz

Frequency [MHz]	Receiver Bandwidth [kHz]	Reading [dB(μV)]	Pol. [V/H]	Cable Loss [dB]	Amp Gain [dB]	Antenna Factor [dB]	Factor [dB]	Limit [dB(μV/m)]	Result [dB(μV/m)]	Margin [dB]
QP DATA.										
35.58	120	25.40	V	1.87	-32.53	21.86	-8.80	46.00	16.60	29.40
201.57	120	27.30	V	4.00	-32.49	15.39	-13.10	46.00	14.20	31.80
299.90	120	28.50	H	5.23	-32.53	19.20	-8.10	46.00	20.40	25.60
832.07	120	20.20	H	8.89	-32.45	25.96	2.40	46.00	22.60	23.40
975.14	120	19.80	H	9.50	-31.38	27.18	5.30	54.00	25.10	28.90

Margin (dB) = Limit – Actual

[Result] = Reading – Amp Gain + AF + CL

1. H = Horizontal, V = Vertical Polarization

2. AF/CL = Antenna Factor and Cable Loss

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5.5 Frequency tolerance

5.5.1 Regulation

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.

5.5.2 Test Result

- Complied

VOLTAGE [%]	POWER [V]	TEMP [°C]	FREQ [Hz]	FREQ.DEV [Hz]	Deviation [%]
100	3.80	20	13 559 885	-115	-0.000 85
		-20	13 559 867	-133	-0.000 98
		-10	13 559 883	-117	-0.000 86
		0	13 559 912	-88	-0.000 65
		10	13 559 920	-80	-0.000 59
		20	13 559 916	-84	-0.000 62
		25	13 559 920	-80	-0.000 59
		30	13 559 899	-101	-0.000 74
		40	13 559 876	-124	-0.000 91
		50	13 559 861	-139	-0.001 03
85	3.23	20	13 559 885	-115	-0.000 85
115	4.37	20	13 559 885	-115	-0.000 85

5.6 Conducted Emission

5.6.1 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)	
	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.

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.

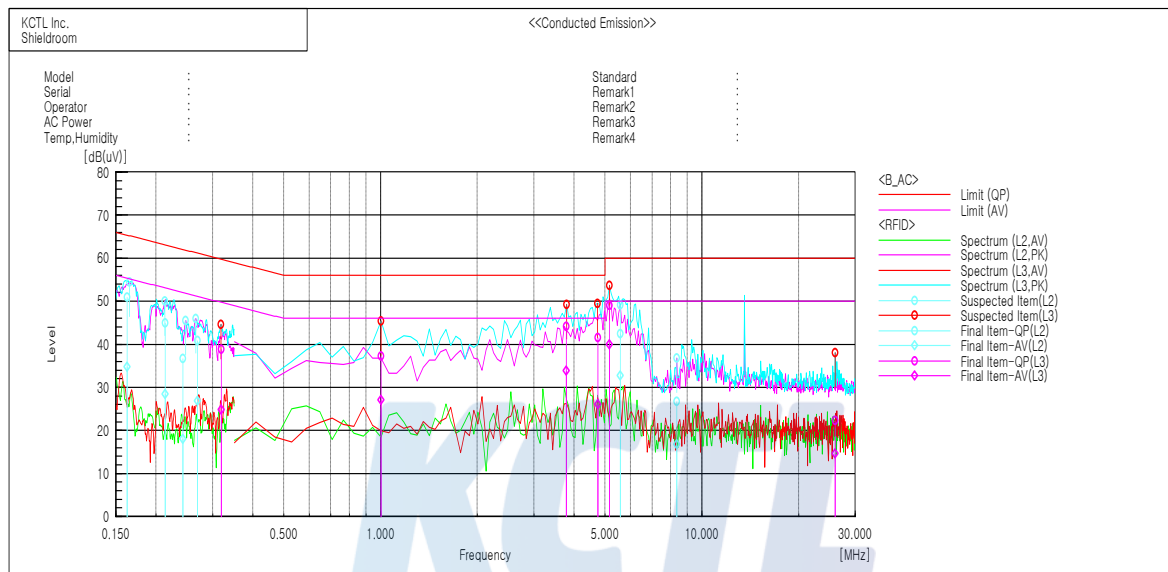
5.6.2 Measurement Procedure

- 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 1.5m away from the side wall of the shielded room.
- 2) Each current-carrying conductor of the EUT power cord was individually connected through a 50Ω/50µH 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 QUASI-PEAK and AVERAGE within a bandwidth of 9 kHz. The EUT was in transmitting mode during the measurements.

5.6.3 Test Result

- Complied

Figure4. The plot of Conducted Emission



Final Result

--- L2 Phase ---

No.	Frequency [MHz]	Reading QP [dB(μV)]	Reading CAV [dB(μV)]	c.f [dB]	Result QP [dB(μV)]	Result CAV [dB(μV)]	Limit QP [dB(μV)]	Limit AV [dB(μV)]	Margin QP [dB]	Margin CAV [dB]
1	0.16252	40.8	24.7	10.1	50.9	34.8	65.3	55.3	14.4	20.5
2	0.21338	35.1	18.6	9.9	45.0	28.5	63.1	53.1	18.1	24.6
3	0.2422	26.9	8.2	9.7	36.6	17.9	62.0	52.0	25.4	34.1
4	0.26932	31.2	17.1	9.7	40.9	26.8	61.1	51.1	20.2	24.3
5	5.56822	32.4	22.7	10.0	42.4	32.7	60.0	50.0	17.6	17.3
6	8.35164	16.5	6.5	10.2	26.7	16.7	60.0	50.0	33.3	33.3

--- L3 Phase ---

No.	Frequency [MHz]	Reading QP [dB(μV)]	Reading CAV [dB(μV)]	c.f [dB]	Result QP [dB(μV)]	Result CAV [dB(μV)]	Limit QP [dB(μV)]	Limit AV [dB(μV)]	Margin QP [dB]	Margin CAV [dB]
1	0.31944	28.9	14.9	9.9	38.8	24.8	59.7	49.7	20.9	24.9
2	1.00294	27.4	17.1	9.9	37.3	27.0	56.0	46.0	18.7	19.0
3	3.78658	34.2	23.8	10.0	44.2	33.8	56.0	46.0	11.8	12.2
4	4.7405	31.5	16.0	10.0	41.5	26.0	56.0	46.0	14.5	20.0
5	5.1549	39.0	29.9	10.0	49.0	39.9	60.0	50.0	11.0	10.1
6	25.96812	11.2	3.5	11.1	22.3	14.6	60.0	50.0	37.7	35.4

6. Test equipment used for test

	Equipment Name	Manufacturer	Model No.	Serial No.	Next Cal. Date
■	Spectrum Analyzer	R & S	FSV30	100807	17.08.30
■	DC Power Supply	Agilent	E3632A	MY40027567	18.05.15
■	Temp & Humid Chamber	ESPEC CORP.	SH-661	92004048	18.01.06
■	Bilog Antenna	TESEQ	CBL 6112D	37876	18.08.05
■	ATTENUATOR	Agilent	8491B	MY39270292	18.08.05
■	Loop Antenna	R & S	HFH2-Z2	100355	18.03.03
■	EMI TEST RECEIVER	R & S	ESCI7	100732	17.08.25
■	AMPLIFIER	SONOMA	310N	344922	17.08.26
■	Antenna Mast	Innco Systems	MA4000-EP	303	-
■	Turn Table	Innco Systems	DT2000	79	-
■	TWO-LINE V - NETWORK	R & S	ENV216	101352	17.08.26
■	Signal Generator	R & S	SMR40	100007	18.05.15
■	Vector Signal Generator	R & S	SMBV100A	257566	18.01.06
■	Cable Assembly	HUER+SUHNER	SUCOFLEX 102	MY3570/2	-