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TEST REPORT

KCTL Inc.
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Suwon-si, Gyeonggi-do, 16677, Korea
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1. Client

- Name : Savi Technology, Inc.
- Address : 3601 Eisenhower Avenue, STE 280, Alexandria VA 22304
- Date of Receipt : 2018-02-20

2. Use of Report : -

3. Name of Product and Model : Locate / ST-920-CL

4. Manufacturer and Country of Origin : Dae Kyung Philippines., Inc. / Philippines

5. FCC ID : KL7ST-920-CL

6. Date of Test : 2018-02-22 to 2018-03-02

7. Test Standards : FCC Part 2, Part 22(H), Part 24(E)

8. Test Results : Refer to the test result in the test report

Affirmation	Tested by Name : Heesu Ahn (Signature)	Technical Manager Name : Jongha Choi (Signature)

2018-03-09

KCTL Inc.

As a test result of the sample which was submitted from the client, this report does not guarantee the whole product quality. This test report should not be used and copied without a written agreement by KCTL Inc.

REPORT REVISION HISTORY

Date	Revision	Page No
2018-03-05	Originally issued	-
2018-03-08	Revised FCC ID and added test equipment	1, 15
2018-03-09	Revised antenna gain and added procedure remark	6, 9, 11

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1. Client information

Applicant:	Savi Technology, Inc.
Address:	3601 Eisenhower Avenue, STE 280, Alexandria VA 22304
Telephone number:	+1 571 227 7928
Facsimile number:	+1 571 227 7960
Contact person:	Matt Beyea / mbeyea@savi.com

Manufacturer:	Dae Kyung Philippines., Inc.
Address:	Lot No. 1-6, Block 20, Phase IV , Main Avenue, PEZA , Rosario, Cavite 4106, Philippines

KCTL

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

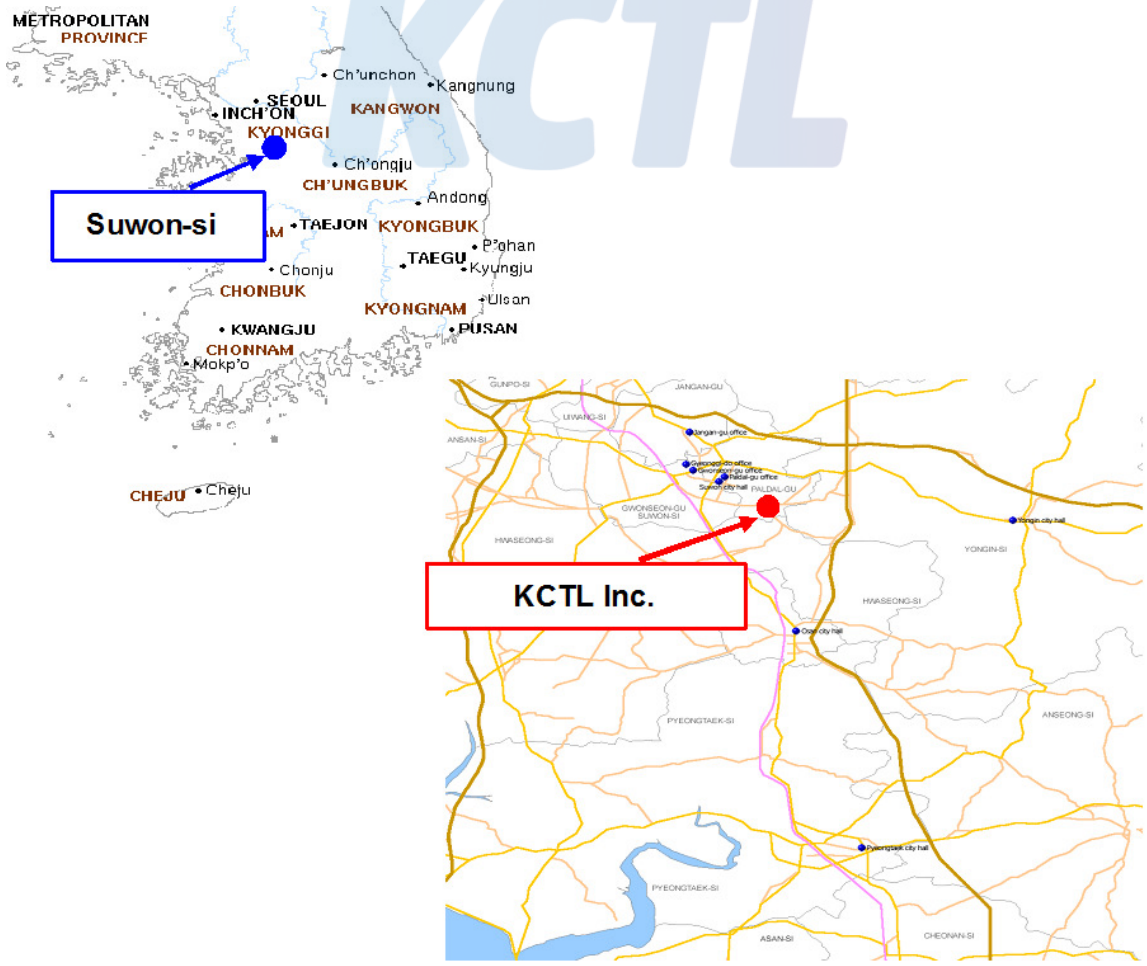
FCC Site Designation No: KR0040, FCC Site Registration No: 687132

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	Savi Technology, Inc.
Address of Applicant	3601 Eisenhower Avenue, STE 280, Alexandria VA 22304
Manufacturer	Dae Kyung Philippines., Inc.
Address of Manufacturer	Lot No. 1-6, Block 20, Phase IV , Main Avenue, PEZA , Rosario, Cavite 4106, Philippines
Type of equipment	Locate
Basic Model	ST-920-CL
Serial number	N/A

3.2 General description

Frequency Range	GSM 850 : 824.2 ㎒ ~ 848.8 ㎒ GSM 1900 : 1 850.2 ㎒ ~ 1 909.8 ㎒
Type of Modulation	GMSK
The number of channels	GSM 850 : 125 Channel GSM 1900 : 300 Channel
Antenna Gain	GSM 850 : -0.3 dBi GSM 1900 : -1.7 dBi
Rated Power	GSM 850 : 33.0 dBm GSM 1900 : 30.0 dBm
Power supply	DC 3.7 V

Note : The above EUT information was declared by the manufacturer.
Note : Approved Module name : SIM868 (FCC ID: UDV-201607)

3.3 Test frequency

The transmitter has a maximum average output power as follows:

- GSM

Frequency (㎒)	Band (Mode)	Channel
824.2	GSM 850 (GPRS)	128
836.4		190
848.8		251
1 850.2	GSM 1900 (GPRS)	512
1 880.0		661
1 909.8		810

Note : We found out the test mode with the highest power level after we analyze all the test mode and slots. So we chose 1 TX Slot of GPRS (worst case) as a representative.

3.4 Test Voltage

Mode	Voltage
Nominal Voltage	DC 3.7 V

3.5 Sample Calculation

Where relevant, the following sample calculation is provided:
- E.R.P or E.I.R.P = Substitute Level (dBm) + Ant. Gain (dBi) - Cable Loss (dB)

1) The EUT mounted on a non-conductive turntable is 1.5 meter above test site ground level.
2) During the test, the turn table is rotated until the maximum signal is found.
3) Record the field strength meter's level.
4) Replace the EUT woth dipole/Horn antenna that is connected to a calibration signal generator.
5) Increase the signal generator output till the field strength meter's level is equal to the item 3).
6) The signal generator output level with Ant. Gain and cable loss are the rating of effective radiated power(E.R.P or E.I.R.P).

4. Summary of test results

4.1 Standards & results

FCC Rule Reference	Parameter	Report Section	Test Result
22.913(a)(2) 24.232(c)	Effective Radiated Power Equivalent Isotropic Radiated Power	5.1	C
2.1053 22.917(a) 24.238(a)	Radiated Spurious Emission	5.2	C
Note : C = Complies, NC = Not Complies, NT = Not Tested, NA = Not Applicable			

- The general test methods used to test on this device are ANSI/TIA-603-E-2016, ANSI C63.26(2015) and KDB 971168 D01 v03

4.2 Uncertainty

Measurement Item	Expanded Uncertainty U = *k*Uc (*k* = 2)	
Voltage	0.24 %	
Temperature	2 ℃	
Radiated Spurious emissions	30 ㎒ ~ 180 ㎒	3.16 ㏈
	180 ㎒ ~ 4 ㎓	3.05 ㏈
	4 ㎓ ~ 26 ㎓	3.12 ㏈

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5. Test results

5.1 Radiated Power(ERP/EIRP)

5.1.1 Regulation

FCC §22.913(a)(2), §24.232(c)

5.1.2 Measurement Procedure

The method of measurement used to test this device are ANSI/TIA-603-E-2016 and KDB 971168 D01 v03 Section 5.1.2.

This procedure can be used to measure the peak power in either a CW-like or noise-like narrowband RF signal.
The measurement instrument must have a RBW that is greater than or equal to the OBW of the signal to be measured and a VBW ≥ 3 x RBW

a) Set the RBW ≥ OBW.
b) Set VBW ≥ 3 x RBW.
c) Set span ≥ 2 x OBW.
d) Sweep time ≥ 10 x (number of point in sweep) x (transmission symbol perdiod).
e) Detector = peak.
f) Trace mode = max hold.
g) Allow trace to fully stabilize.
h) Use the peak marker dunction to determine the peak amplitude level.

Remark:
- Actual setting: RBW = 1 MHz, VBW = 3 MHz

5.1.3 Test Result

- Complied

GSM 850

Frequency (㎒)	Ant. Pol. (H/V)	E.R.P.		Substitute Level	ANT Gain	Cable Loss	Limit (W)
		(dB m)	(W)	(dB m)	(dB d)	(dB)	
824.2	V	17.32	0.054 0	21.84	-0.72	3.80	7.00
836.4	V	17.15	0.051 9	21.83	-0.84	3.84	7.00
848.8	V	17.13	0.051 6	21.96	-0.96	3.87	7.00

GSM 1900

Frequency (㎒)	Ant. Pol. (H/V)	E.I.R.P.		Substitute Level	ANT Gain	Cable Loss	Limit (W)
		(dB m)	(W)	(dB m)	(dB i)	(dB)	
1 850.20	H	12.78	0.019 0	13.41	5.09	5.72	2.00
1 880.00	H	12.68	0.018 5	13.88	4.60	5.80	2.00
1 909.80	H	11.97	0.015 7	13.74	4.11	5.88	2.00

Note : The E.R.P or E.I.R.P = Substitute Level (dBm) + Ant. Gain (dBd or dBi) – Cable Loss (dB)
The E.R.P or E.I.R.P was measured in three orthogonal EUT position (x-axis, y-axis, z-axis)
Worst cases are y-axis.

5.2 Radiated Spurious emission

5.2.1 Regulation

FCC §2.1053, §22.917(a), §24.238(a)

5.2.2 Measurement Procedure

The method of measurement used to test this device are ANSI/TIA-603-E-2016 and KDB 971168 D01 v03 Section 5.8. and 6.1.

a) Set the RBW
   - 100 kHz below 1 GHz
   - 1 MHz above 1GHz
b) Set VBW
   - 300 kHz below 1 GHz
   - 3 MHz above 1GHz
c) Detector = peak.
d) Trace mode = max hold.
e) Allow trace to fully stabilize.
f) Use the peak marker dunction to determine the peak amplitude level.

Remark:
- Actual setting: RBW = 100 kHz below 1 GHz, 1 MHz above 1 GHz
  VBW = 300 kHz below 1 GHz, 3 MHz above 1 GHz

5.2.3 Test Result

- Complied

GSM 850

Operating Frequency : 824.20 ㎒
Channel : 128
Measured Output Power : 17.32 dBm = 0.054 0 W
Limit = 43+10log(P) dB = 30.32 dBc

Frequency (㎒)	Ant. Pol. (H/V)	E.R.P. (dB m)	Substitute Level (dB m)	ANT Gain (dB d)	Cable Loss (dB)	dB c	Margin (dB)
1 648.08	H	-24.00	-24.78	6.23	5.45	41.32	11.00
2 472.18	H	-28.60	-27.96	6.04	6.68	45.92	15.60
3 296.29	V	-35.40	-35.62	8.00	7.78	52.72	22.40
4 121.39	V	-27.50	-28.18	10.03	9.35	44.82	14.50
5 769.60	V	-37.30	-36.82	10.92	11.40	54.62	24.30

Note : The E.R.P = Substitute Level (dBm) + Ant. Gain (dBd) - Cable Loss (dB)

Operating Frequency : 836.40 ㎒
Channel : 190
Measured Output Power : 17.15 dBm = 0.051 9 W
Limit = 43+10log(P) dB = 30.15 dBc

Frequency (㎒)	Ant. Pol. (H/V)	E.R.P. (dB m)	Substitute Level (dB m)	ANT Gain (dB d)	Cable Loss (dB)	dB c	Margin (dB)
1 673.08	H	-20.90	-21.61	6.19	5.48	38.05	7.90
2 509.19	H	-31.30	-30.66	6.10	6.74	48.45	18.30
3 345.29	H	-33.80	-34.05	8.11	7.86	50.95	20.80
4 182.40	V	-24.80	-25.15	9.96	9.61	41.95	11.80
5 855.61	V	-38.70	-38.09	10.85	11.46	55.85	25.70

Note : The E.R.P = Substitute Level (dBm) + Ant. Gain (dBd) - Cable Loss (dB)

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Operating Frequency : 848.80 ㎒
Channel : 251
Measured Output Power : 17.13 dBm = 0.051 6 W
Limit = 43+10log(P) dB = 30.13 dBc

Frequency (㎒)	Ant. Pol. (H/V)	E.R.P. (dB m)	Substitute Level (dB m)	ANT Gain (dB d)	Cable Loss (dB)	dB c	Margin (dB)
1 698.09	H	-22.40	-22.93	6.04	5.51	39.53	9.40
2 546.19	H	-38.90	-38.21	6.12	6.81	56.03	25.90
3 395.30	V	-39.80	-40.08	8.21	7.93	56.93	26.80
4 243.41	V	-23.10	-23.21	9.77	9.66	40.23	10.10
5 941.62	V	-38.00	-37.13	10.72	11.59	55.13	25.00

Note : The E.R.P = Substitute Level (dBm) + Ant. Gain (dBd) - Cable Loss (dB)

GSM 1900

Operating Frequency : 1 850.20 ㎒
Channel : 512
Measured Output Power : 12.78 dBm =0.019 0 W
Limit = 43+10log(P) dB = 25.79 dBc

Frequency (㎒)	Ant. Pol. (H/V)	E.I.R.P. (dB m)	Substitute Level (dB m)	ANT Gain (dB i)	Cable Loss (dB)	dB c	Margin (dB)
3 699.82	H	-39.15	-38.66	8.43	8.92	51.93	26.14
5 549.79	V	-44.85	-44.11	10.50	11.24	57.63	31.84
9 249.72	H	-39.75	-38.65	13.31	14.41	52.53	26.74
12 027.89	H	-34.85	-31.59	13.08	16.34	47.63	21.84

Note : The E.I.R.P = Substitute Level (dBm) + Ant. Gain (dBi) - Cable Loss (dB)

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Operating Frequency : 1 880.00 ㎒
Channel : 661
Measured Output Power : 12.68 dBm =0.018 5 W
Limit = 43+10log(P) dB = 25.67 dBc

Frequency (㎒)	Ant. Pol. (H/V)	E.I.R.P. (dB m)	Substitute Level (dB m)	ANT Gain (dB i)	Cable Loss (dB)	dB c	Margin (dB)
3 761.06	H	-35.85	-35.35	8.48	8.98	48.53	22.86
5 640.03	V	-40.45	-40.01	10.78	11.22	53.13	27.46
9 401.20	H	-39.45	-38.17	13.22	14.50	52.13	26.46

Note : The E.I.R.P = Substitute Level (dBm) + Ant. Gain (dBi) - Cable Loss (dB)

Operating Frequency : 1 909.80 ㎒
Channel : 810
Measured Output Power : 11.97 dBm =0.015 7 W
Limit = 43+10log(P) dB = 24.96 dBc

Frequency (㎒)	Ant. Pol. (H/V)	E.I.R.P. (dB m)	Substitute Level (dB m)	ANT Gain (dB i)	Cable Loss (dB)	dB c	Margin (dB)
1 947.69	V	-25.95	-24.16	4.19	5.98	37.92	12.96
1 989.70	V	-29.75	-27.94	4.27	6.08	41.72	16.76
3 819.80	H	-38.05	-37.53	8.52	9.04	50.02	25.06
5 729.20	H	-38.55	-38.30	10.91	11.16	50.52	25.56
9 548.79	H	-37.85	-36.35	13.18	14.68	49.82	24.86

Note : The E.I.R.P = Substitute Level (dBm) + Ant. Gain (dBi) - Cable Loss (dB)

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6. Test equipment used for test

	Equipment Name	Manufacturer	Model No.	Serial No.	Next Cal. Date
■	Spectrum Analyzer	AGILENT	N9040B	MY57010132	18.11.23
■	Spectrum Analyzer	R&S	FSV30	101437	18.08.01
■	Radio Communication Tester	R&S	CMU200	106191	18.05.15
■	Attenuator	Weinschel ENGINEERING	10	AJ1239	18.05.16
■	Amplifier	SONOMA INSTRUMENT	317	321041	19.01.05
■	Amplifier	L-3 Narda-MITEQ	AFS5-00101800-25-S-5	2054570	18.11.20
■	Amplifier	L-3 Narda-MITEQ	JS44-18004000-33-8P	2000996	18.08.02
■	Dipole Antenna	SCHWARZBECK	VHA9103	3093	19.05.19
■	Dipole Antenna	SCHWARZBECK	UHA9105	2703	19.05.19
■	Bilog Antenna	Teseq GmbH	CBL 6143A	35039	18.05.19
■	Bilog Antenna	SCHWARZBECK	VULB9163	552	18.05.10
■	Horn Antenna	ETS.lindgren	3117	161225	18.05.19
■	Horn Antenna	ETS.lindgren	3117	155787	18.10.20
■	Horn Antenna	ETS.lindgren	3116	00086635	18.04.25
■	Horn Antenna	Steatite Antennas	QMS-00225	17790	18.08.01
■	Highpass Filter	Wainwright Instruments GmbH	WHKX3.0/18G-12SS	44	19.01.31
■	Highpass Filter	Wainwright Instruments GmbH	WHKX1.0/1.5S-10SS	14	19.01.31
■	Signal Generator	R&S	SMR40	100007	18.05.15
■	RF Selector	TOYO Corporation	NS5800	1003-010	N/A
■	Band Selector	TOYO Corporation	NS5800	1003-135	N/A
■	Band Selector	TOYO Corporation	NS5800	1003-320	N/A
■	Antenna Mast	MATURO	EAS 1.5	042/8941211	N/A
■	Antenna Mast	MATURO	EAS 1.5	043/8941211	N/A
■	Turn Table	MATURO	TT 0.8 PF	041/8941211	N/A

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