



# TEST REPORT

<p><b>KCTL Inc.</b>                  65, Sinwon-ro, Yeongtong-gu,                  Suwon-si, Gyeonggi-do, 16677, Korea                  TEL: 82-31-285-0894 FAX: 82-505-299-8311  <a href="http://www.kctl.co.kr">www.kctl.co.kr</a></p>	<p>Report No.:  <b>KR18-SRF0017-B</b>                  Page (1) of (15)</p>	
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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 	Technical Manager 
	Name : Heesu Ahn (Signature)	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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**KCTL****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**

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# KCTL

## 2. Laboratory information

### Address

#### **KCTL Inc.**

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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**



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### 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 MHz ~ 848.8 MHz GSM 1900 : 1 850.2 MHz ~ 1 909.8 MHz
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)

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### 3.3 Test frequency

The transmitter has a maximum average output power as follows:

- GSM

Frequency (MHz)	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 with 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).

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## 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 $U = kUc (k = 2)$	
Voltage	0.24 %	
Temperature	2 °C	
Radiated Spurious emissions	30 MHz ~ 180 MHz	3.16 dB
	180 MHz ~ 4 GHz	3.05 dB
	4 GHz ~ 26 GHz	3.12 dB



## 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  $\geq 3 \times$  RBW

- a) Set the RBW  $\geq$  OBW.
- b) Set VBW  $\geq 3 \times$  RBW.
- c) Set span  $\geq 2 \times$  OBW.
- d) Sweep time  $\geq 10 \times$  (number of point in sweep)  $\times$  (transmission symbol period).
- 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

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### 5.1.3 Test Result

- Complied

#### GSM 850

Frequency (MHz)	Ant. Pol. (H/V)	E.R.P.		Substitute Level (dB m)	ANT Gain (dB d)	Cable Loss (dB)	Limit (W)
		(dB m)	(W)				
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 (MHz)	Ant. Pol. (H/V)	E.I.R.P.		Substitute Level (dB m)	ANT Gain (dB i)	Cable Loss (dB)	Limit (W)
		(dB m)	(W)				
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.

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## 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

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## 5.2.3 Test Result

- Complied

### GSM 850

Operating Frequency : 824.20 MHz

Channel : 128

Measured Output Power : 17.32 dBm = 0.054 0 W

Limit = 43+10log(P) dB = 30.32 dBc

Frequency (MHz)	Ant. Pol. (H/V)	E.R.P.	Substitute Level	ANT Gain	Cable Loss	dB c	Margin (dB)
		(dB m)	(dB m)	(dB d)	(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 MHz

Channel : 190

Measured Output Power : 17.15 dBm = 0.051 9 W

Limit = 43+10log(P) dB = 30.15 dBc

Frequency (MHz)	Ant. Pol. (H/V)	E.R.P.	Substitute Level	ANT Gain	Cable Loss	dB c	Margin (dB)
		(dB m)	(dB m)	(dB d)	(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 MHz

Channel : 251

Measured Output Power : 17.13 dBm = 0.051 6 W

Limit = 43+10log(P) dB = 30.13 dBc

Frequency (MHz)	Ant. Pol. (H/V)	E.R.P.	Substitute Level	ANT Gain	Cable Loss	dB c	Margin (dB)
		(dB m)	(dB m)	(dB d)	(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)

**KCTL****GSM 1900**

Operating Frequency : 1 850.20 MHz

Channel : 512

Measured Output Power : 12.78 dBm = 0.019 0 W

Limit = 43+10log(P) dB = 25.79 dBc

Frequency (MHz)	Ant. Pol. (H/V)	E.I.R.P.	Substitute Level	ANT Gain	Cable Loss	dB c	Margin (dB)
		(dB m)	(dB m)	(dB i)	(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 MHz  
Channel : 661  
Measured Output Power : 12.68 dBm = 0.018 5 W  
Limit = 43+10log(P) dB = 25.67 dBc

Frequency (MHz)	Ant. Pol. (H/V)	E.I.R.P.	Substitute Level	ANT Gain	Cable Loss	dB c	Margin (dB)
		(dB m)	(dB m)	(dB i)	(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 MHz  
Channel : 810  
Measured Output Power : 11.97 dBm = 0.015 7 W  
Limit = 43+10log(P) dB = 24.96 dBc

Frequency (MHz)	Ant. Pol. (H/V)	E.I.R.P.	Substitute Level	ANT Gain	Cable Loss	dB c	Margin (dB)
		(dB m)	(dB m)	(dB i)	(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)

## 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