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TEST REPORT

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

1. Client

- Name : Namsung Corporation
- Address : ACE Techno Tower 13th Fl, 197-22, Guro-dong, Guro-gu, Seoul South Korea
- Date of Receipt : 2017-09-14

2. Use of Report : -

3. Name of Product and Model : KESM system / PTS-1

4. Manufacturer and Country of Origin : SEMYEONG / Korea

5. FCC ID : GJW- PTS-1

7. Date of Test : 2017-11-15 to 2017-11-16

8. Test Standards : FCC Part 15 Subpart C
Section 15.209, Section 15.231

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

Affirmation	Tested by Name : Euijung Kim (Signature)	Technical Manager Name : Seungyong Kim (Signature)

2018-01-04

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
2017-11-16	Originally Issued	-
2017-12-28	Changed Applicant name, address and contact person by the Request of client	Several page
2018-01-03	Added note for calibration date	19
2018-01-04	Added Next cal date	19

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1. Client information

Applicant:	Namsung Corporation
Address:	ACE Techno Tower 13th Fl, 197-22, Guro-dong, Guro-gu, Seoul South Korea
Telephone number:	82-2-2026-1122
Contact person:	Byungjae Ahn / bejayahn@namsung.com

Manufacturer:	SEMYEONG
Address:	260, Seonggeo-gil, Seonggeo-eup, Seobuk-gu, Cheonan-si, Chungcheongnam-do, Republic of Korea

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

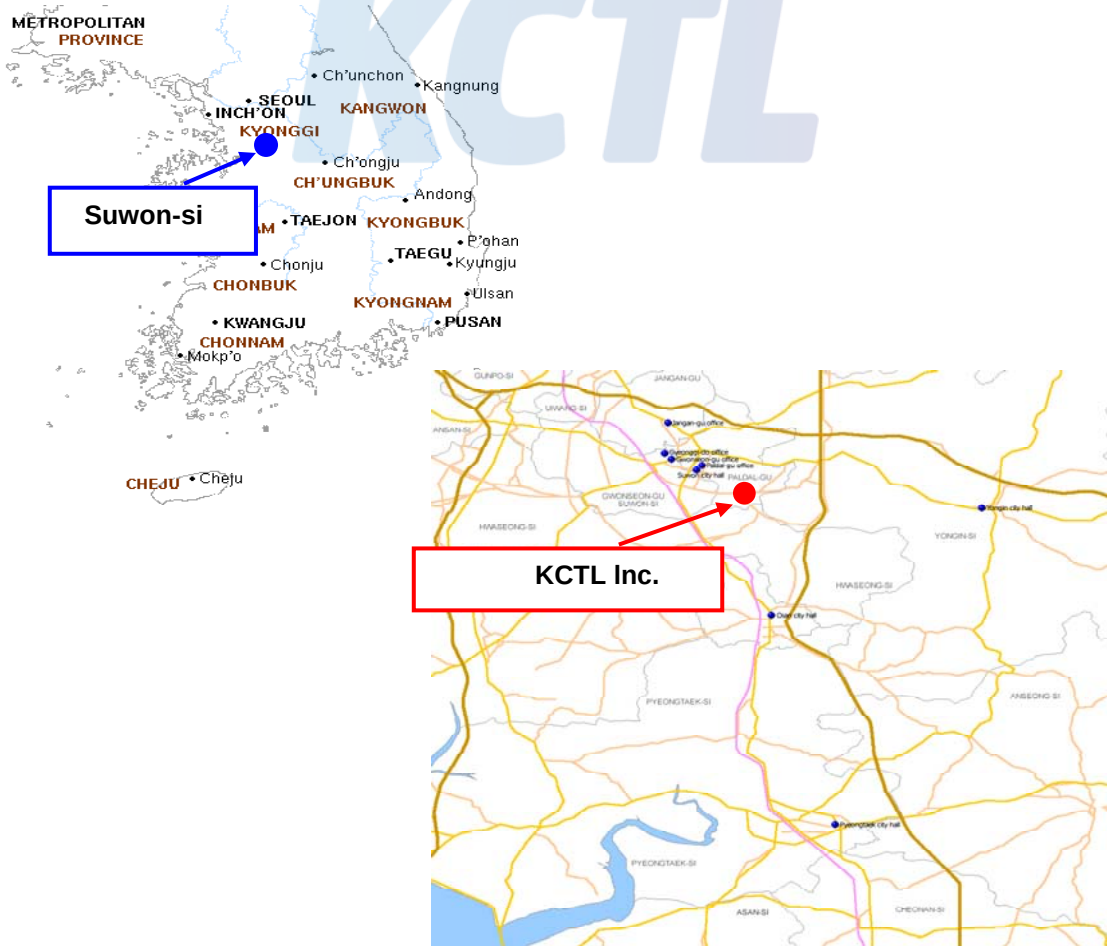
FCC Site Designation No: KR0040, FCC Site Registration No: 687132

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:	Namsung Corporation
Address of Applicant	ACE Techno Tower 13th Fl, 197-22, Guro-dong, Guro-gu, Seoul South Korea
Manufacturer	SEMYEONG
Address of Applicant	260, Seonggeo-gil, Seonggeo-eup, Seobuk-gu, Cheonan-si, Chungcheongnam-do, Republic of Korea
Type of equipment	KESM system
Basic Model	PTS-1
Serial number	N/A

3.2 General description

Frequency Range	433.92 ㎒ (Tx)
Type of Modulation	FSK
The number of channels	1 Channel
Type of Antenna	PCB Antenna
Power supply	DC 3 V
Test SW Version	N/A$_{1)}$
RF power setting in TEST SW	N/A$_{2)}$

Note$_{1)}$: The above EUT information was declared by the manufacturer.
Note$_{2)}$: N/A$_{1)}$ No test SW was used during testing.
N/A$_{2)}$ RF power setting was not able to alter during testing.

3.3 Test frequency

Test Frequency [㎒]
433.92 ㎒

3.4 Normal and extreme test conditions

Test condition	Temperature [℃]	Voltage [V]
NTNV	21	DC 3 V

Note 1 : N:Normal T:Temperature V:Voltage H:Highest L:Lowest

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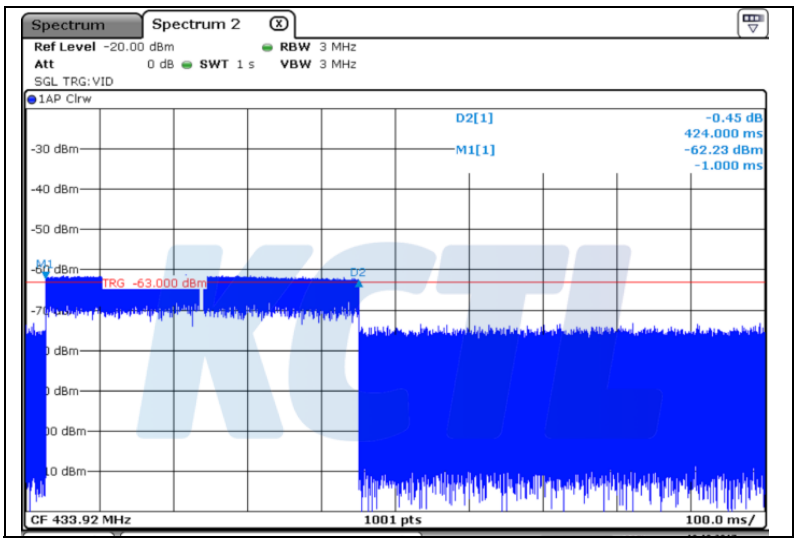
- Duty Cycle

EUT transmits only one transmission.

Tx on time : 424 ms

Remark
- Duty Cycle Correction Factor is not allowed because Tx on time exceeds 100 ms.
- Average measurement was performed during radiated spuruious emission.

- **Tx On time:**



4. Summary of test results

4.1 Standards & results

FCC Rule	Parameter	Test Result
15.203	Antenna Requirement	C
15.209(a) 15.231(b)	Radiated emission, Spurious Emission and Field Strength of Fundamental	C
15.231(c)	Bandwidth Measurement	N/T (Note$_2$)
15.231(a)	Transmission Time	N/T (Note$_2$)
15.207(a)	Conducted Emissions	N/A (Note$_3$)

Note$_{1)}$: C = complies, NC = Not complies, NT = Not tested, NA = Not Applicable
Note$_{2)}$: By the request of client, only radiated spurious emission test was carried out.
Note$_{3)}$: This test is not applicable because the EUT uses battery and it's not to be connected to the public utility(AC) power line.

4.2 Uncertainty

Measurement Item	Expanded Uncertainty U = *k*Uc (*k* = 2)	
Conducted RF power	1.44 dB	
Conducted Spurious Emissions	1.52 dB	
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
	1 GHz ~ 25 GHz:	+6.03 dB, -6.05 dB
Conducted Emissions	9 kHz ~ 150 kHz:	3.75 dB
	150 kHz ~ 30 MHz:	3.36 dB

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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 pcb antenna is an integral antenna, and no antenna other than that furnished by the responsible party shall be used with the device.

5.2 Field strength of Fundamental

5.2.1 Regulation

According to §15.209(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: 83

Frequency (㎒)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009 - 0.490	2 400/F(㎑)	300
0.490 - 1.705	24 000/F(㎑)	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 ㎒, 76-88 ㎒, 174-216 ㎒ or 470-806 ㎒. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241.

According to §15.231(b)
In addition to the provisions of Section 15.205, the field strength of emissions from intentional radiators operated under this Section shall not exceed the following:

Fundamental Frequency (㎒)	Field Strength of Fundamental (microvolts/meter)	Field Strength of Spurious Emissions (microvolts/meter)
40.66 - 40.70	2,250	225
70 - 130	1,250	125
130 - 174	1,250 to 3,750 **	125 to 375 **
174 - 260	3,750	375
260 - 470	3,750 to 12,500 **	375 to 1,250 **
Above 470	12,500	1,250

** linear interpolations

Where F is the frequency in ㎒, the formulas for calculating the maximum permitted fundamental field strengths are as follows: for the band 130-174 ㎒, ㎶ /m at 3 meters = 56.81818(F) - 6136.3636; for the band 260-470 ㎒, ㎶ /m at 3 meters = 41.6667(F) - 7083.3333. The maximum permitted unwanted emission level is 20 ㏈ below the maximum permitted fundamental level.

5.2.2 Test procedure

The method of measurement used to test this Unlicensed Wireless device is ANSI C63.10-2013.

a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter anechoic chamber test site. The table was rotated 360 degrees to determine the position of the highest radiation.

b. During performing radiated emission below 1 ㎓, the EUT was set 3 meters away from the interference receiving antenna, which was mounted on the top of a variable-height antenna tower. During performing radiated emission above 1 ㎓, the EUT was set 3 meter away from the interference-receiving antenna.

c. The antenna is a broadband antenna, and its height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.

d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the table was turned from 0 degrees to 360 degrees to find the maximum reading.

e. The test-receiver system was set to peak detect function and specified bandwidth with Maximum Hold Mode.

f. If the emission level of the EUT in peak mode was 10 ㏈ lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10 ㏈ margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

g. It tested x,y and z – 3 axis each, mentioned only worst case data at this report.

h. In this case, both of average and peak output of fundamental are measured then reported.

5.2.3 Test Result

- Complied

Peak DATA.

Frequency [MHz]	Receiver Bandwidth [kHz]	Pol. [V/H]	Reading [dB(μV)]	Cable Loss [dB]	Amp Gain [dB]	Antenna Factor [dB]	Factor [dB]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]
433.92	120	H	65.49	4.76	-35.73	22.24	-8.90	56.59	100.83	44.24

NOTE:
1. PK Limit = 80.83 + 20 = 100.83 dB
2. Factor(dB) = ANT Factor - Amp Gain + Cable Loss

Average DATA.

Frequency [MHz]	Receiver Bandwidth [kHz]	Pol. [V/H]	Reading [dB(μV)]	Cable Loss [dB]	Amp Gain [dB]	Antenna Factor [dB]	Factor [dB]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]
433.92	120	H	63.86	4.76	-35.73	22.24	-8.90	54.96	80.83	25.87

NOTE:
1. AV Limit = 80.83 dB
2. Factor(dB) = ANT Factor - Amp Gain + Cable Loss

5.3 Spurious Emission

5.3.1 Regulation

According to §15.209(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: 83

Frequency (㎒)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009 - 0.490	2 400/F(㎑)	300
0.490 - 1.705	24 000/F(㎑)	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 ㎒, 76-88 ㎒, 174-216 ㎒ or 470-806 ㎒. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241..

According to §15.231(b)
In addition to the provisions of Section 15.205, the field strength of emissions from intentional radiators operated under this Section shall not exceed the following:

Fundamental Frequency (㎒)	Field Strength of Fundamental (microvolts/meter)	Field Strength of Spurious Emissions (microvolts/meter)
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70 - 130	1,250	125
130 - 174	1,250 to 3,750 **	125 to 375 **
174 - 260	3,750	375
260 - 470	3,750 to 12,500 **	375 to 1,250 **
Above 470	12,500	1,250

** linear interpolations

5.3.2 Measurement Procedure

The method of measurement used to test this Unlicensed Wireless device is ANSI C63.10-2013.

a. The EUT was placed on the top of a rotating table 0.8 meters, 1.5 meter above the ground at a 3 meter anechoic chamber test site. The table was rotated 360 degrees to determine the position of the highest radiation.

b. During performing radiated emission below 1 ㎓, the EUT was set 3 meters away from the interference receiving antenna, which was mounted on the top of a variable-height antenna tower. During performing radiated emission above 1 ㎓, the EUT was set 3 meter away from the interference-receiving antenna.

c. The antenna is a broadband antenna, and its height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.

d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the table was turned from 0 degrees to 360 degrees to find the maximum reading.

e. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

f. If the emission level of the EUT in peak mode was 10 ㏈ lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10 ㏈ margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

g. It tested x,y and z – 3 axis each, mentioned only worst case data at this report.

Note

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 ㎑ for Peak detection (PK) and Quasi-peak detection (QP) at frequency below 1 ㎓.
2. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 1 ㎒ for Peak detection and frequency above 1 ㎓.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1 ㎒ and the video bandwidth is 1/T for Average detection (AV) at frequency above 1 ㎓. (where T = pulse width)

5.3.3 Test Result

- Complied

- Below 1 ㎓ data

Frequency [㎒]	Receiver Bandwidth [㎑]	Pol. [V/H]	Reading [dB(㎶)]	Cable Loss [dB]	Amp Gain [dB]	Antenna Factor [dB]	Factor [dB]	Result [dB(㎶/m)]	Limit [dB(㎶/m)]	Margin [dB]
Quasi-Peak DATA. Emissions below 30 ㎒										
-	Not Detected	-	-	-	-	-	-	-	-	-
Quasi-Peak DATA. Emissions below 1 ㎓										
59.83	120	H	40.00	1.60	-28.82	12.33	-14.89	25.11	60.83	35.72
87.11	120	H	44.11	1.97	-34.72	14.31	-18.44	25.67	60.83	35.16
613.82	120	H	27.39	5.79	-35.29	24.66	-4.84	22.55	60.83	38.28
867.84	120	H	44.49	6.88	-34.02	26.24	-0.90	43.59	60.83	17.24
994.54	120	V	25.70	7.48	-33.37	27.35	1.46	27.16	54.00	26.84

- Above 1 ㎓ data

Frequency [㎒]	Receiver Bandwidth [㎑]	Pol. [V/H]	Reading [dB(㎶)]	Cable Loss [dB]	Amp Gain [dB]	Antenna Factor [dB]	Factor [dB]	Result [dB(㎶/m)]	Limit [dB(㎶/m)]	Margin [dB]
Peak DATA. Emissions above 1 ㎓										
1 301.22	1 000	H	80.60	2.76	-61.07	25.00	-33.31	47.29	74.00	26.71
2 169.28	1 000	H	81.86	3.55	-59.17	28.12	-27.50	54.35	80.83	26.48
2 603.31	1 000	H	74.20	3.86	-59.18	28.95	-26.37	47.83	80.83	33.00
Average DATA. Emissions above 1 ㎓										
1 301.22	1 000	H	77.21	2.76	-61.07	25.00	-33.31	43.90	54.00	10.10
2 169.28	1 000	H	77.64	3.55	-59.17	28.12	-27.50	50.14	60.83	10.69
2 603.31	1 000	H	71.68	3.86	-59.18	28.95	-26.37	45.31	60.83	15.52

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5.4 Bandwidth Measurement

5.4.1 Regulation

The bandwidth of the emission shall be no wider than 0.25 % of the center frequency for devices operating above 70 ㎒ and below 900 ㎒. Bandwidth is determined at the point 20 ㏈ down from the modulated carrier.

5.4.2 Measurement Procedure

The method of measurement used to test this Unlicensed Wireless device is ANSI C63.10-2013.

1. The transmitter output is connected to the spectrum analyzer.
2. The bandwidth of the fundamental frequency was measured with the spectrum analyzer using RBW=10 ㎑,VBW=30 ㎑ and Span= 300 ㎑.
3. The bandwidth of fundamental frequency was measured and recorded.

5.4.3 Test Result

Result: NT : By the request of client, only radiated spurious emission test was carried out.

5.5 Transmission Time

5.5.1 Regulation

A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.

5.5.2 Measurement Procedure

The method of measurement used to test this Unlicensed Wireless device is ANSI C63.10-2013.

1. The transmitter output is connected to the spectrum analyzer.
2. The bandwidth of the fundamental frequency was measured with the spectrum analyzer using RBW=100 ㎑,VBW=300 ㎑, Span=0 ㎐.
3. The bandwidth of fundamental frequency was measured and recorded.

5.5.3 Test Result

Result: NT : By the request of client, only radiated spurious emission test was carried out.

6. Test equipment used for test

	Equipment Name	Manufacturer	Model No.	Serial No.	Cal. Date	Next Cal. Date
■	EMI Test Receive	R & S	ESCI	100732	17.08.24	18.08.24
■	Signal Generator	R & S	SMR40	100007	17.05.15	18.05.15
■	Spectrum Analyzer	R & S	FSV30	100810	17.08.01	18.08.01
■	Bi-Log Antenna	SCHWARZBECK	VULB 9163	552	17.05.10	18.05.10
■	Amplifier	SONOMA INSTRUMENT	310N	186280	17.04.06	18.04.06
■	Amplifier	SONOMA INSTRUMENT	310N	344922	17.08.25	18.08.25
■	COAXIAL FIXED ATTENUATOR	HP	8491A	16861	17.04.06	18.04.06
■	Horn antenna	ETS.lindgren	3117	155787	17.10.20	18.10.20
■	AMPLIFIER	L-3 Narda-MITEQ	AMF-7D-01001800-22-10P	2003683	17.06.12	18.06.12
■	LOOP Antenna	R & S	HFH2-Z2	100355	17.03.03	18.03.03
■	Antenna Mast	MATURO	AM4.0	079/3440509	- 1)	- 1)
■	Antenna Mast	Innco Systems	MA4000-EP	303	- 1)	- 1)
■	Turn Table	MATURO	CO2000-SOFT	-	- 1)	- 1)
■	Turn Table	Innco Systems	DT2000S-1t	79	- 1)	- 1)
■	Highpass Filter	Wainwright InstrumentsGmbH	WHK0.5/ 13G-10SS	4	17.01.31	18.01.31
■	Vector Signal Generator	R & S	SMBV100A	257566	17.01.06	18.01.06

1) : Not Calibration Requirement