

Certification of Compliance

CFR 47 Part 15 Subpart C

Test Report File No. : 10-IST-0230 Date of Issue : April 24, 2010

Model(s) : SPS-700A
Kind of Product : Electric Payment System
FCC ID : P4YSPS-700A
Applicant : Samsung SDS Co.,Ltd.
Address : 707-19, Touksam2-Dong, Kangnam-Gu, Seoul, Korea
Manufacturer : Samsung SDS Co.,Ltd.
Address : 707-19, Touksam2-Dong, Kangnam-Gu, Seoul, Korea

Test Result

Positive

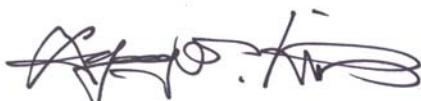
Negative

Reviewed By



S.J.CHO / EMC Group Manager

Approved By



B.S.KIM / Chief

Comment(s)

- Investigations requested : Measurement to the relevant clauses of FCC rules and regulations Part 15 Subpart C.
- The test report is consists of 28 pages.
- The test result only responds to the tested sample.
- It is not allowed to copy this report even partly without the allowance of IST EMC Laboratory.
- This equipment as for has been shown to be capable of continued compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in ANSI C63.4

I assume full responsibility for accuracy and completeness of these data.



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Note:

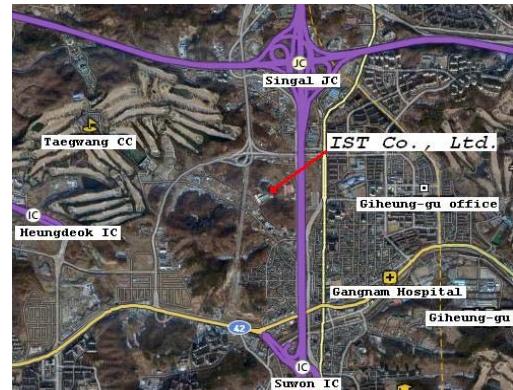
INFORMATIONS OF TEST LABORATORY

EMC LABORATORY of IST Co., Ltd.

400-19, Singal-dong, Giheung-gu, Yongin-si, Kyonggi-Do, 449-860, Korea

TEL : +82 31 326 6700

FAX : +82 31 326 6797



- VCCI Registration No. : 1739
- FCC Registration No. : 400603
- KCC Registration No. : KR0018
- FCC MRA Registration No. : 801060
- KOLAS Registration No. : KT118

ENVIRONMENTAL CONDITIONS

Temperature 19.5 °C Humidity 45 %

Atmospheric pressure 1018 mbar

POWER SUPPLY SYSTEM USED

Power supply system DC 12V(Refer to the product information)

PRODUCT INFORMATION

Item		Specification
Bluetooth	Frequency Range	2402 ~ 2480 MHz
	Modulation Technique	FHSS
	Number of Channel	79
	Antenna/Gain	Dipole Antenna / 2dBi
	Operating Voltage	DC 12V / 800mA

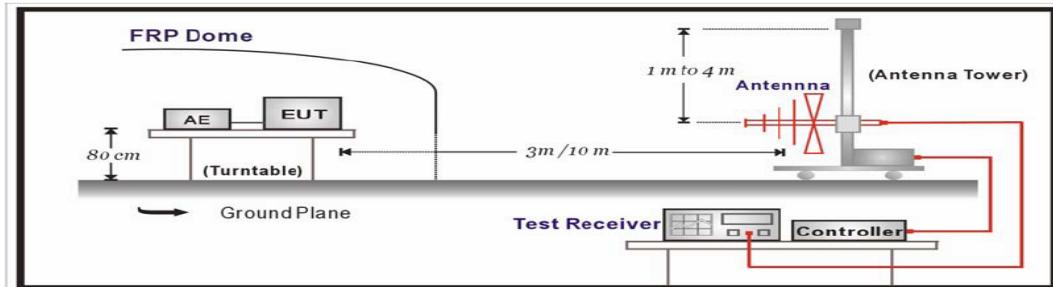
- Regards to the frequency band operation; the highest that was included the lowest, middle and highest frequency of channel were selected to perform the test, and then shown on this report.
- Please refer to user's manual.

Radiated Emissions:

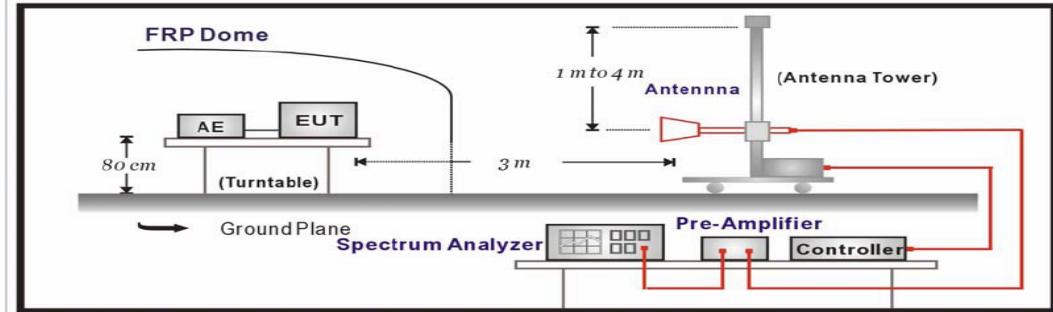
The measurement was performed over the frequency range of 30MHz to 1GHz using antenna as the input transducer to a Spectrum analyzer or a Field Intensity Meter. The measurement was made with the detector set for "quasi-peak" within a bandwidth of 120kHz. Procedure of Test

Preliminary measurements were made at 3 meter using bi-log antennas, and spectrum analyzer to determine the frequency producing the max. emission in anechoic chamber. Appropriate precaution was taken to ensure that all emission from the EUT were maximized and investigated. The system configuration, mode of operation, turn-table azimuth and height with respect to the antenna were noted for each frequency found. The spectrum was scanned from 30MHz to 1000MHz using bi-log antenna. Above 1GHz, linearly polarized double ridge horn antennas were used. Final measurements were made at open site with 3-meters test distance using bi-log antenna or horn antenna. The OATS have been verified in regular for its normalized site attenuation. The test equipment was placed on a wooden table. Sufficient time for the EUT, peripheral equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. Each frequency found during pre-scan measurements was re-examined by manual. The detector function was set to CISPR quasi-peak mode and the bandwidth of the receiver was set to 120kHz or 1MHz depending on the frequency of type of signal. The EUT, peripheral equipment and interconnecting cables were re-configured to the set-up producing the max. emission for the frequency and were placed on top of a 0.8-meter high nonmetallic 1 x 1.5 meter table. The EUT, peripheral equipment, and interconnecting cables were re-arranged and manipulated to maximize each emission. The turntable containing the system was rotated; the antenna height was varied 1 to 4 meters and stopped at the azimuth or height producing the maximum emission. Each emission was maximized by: varying the mode of operation to the EUT and/or peripheral equipment and changing the polarity of the antenna, whichever determined the worst-case emission. (The bandwidth below 1GHz setting on the field strength meter is 120KHz and above 1GHz is 1MHz.)

Under 1GHz Test Setup:



Above 1GHz Test Setup:



Radiated Emissions Test, 9 kHz to 30 MHz (Magnetic Field Test)

1. The preliminary radiated measurements were performed to determine the frequency producing the maximum emissions at a distance of 3 meters according to Section 15.31(f)(2).
2. The EUT was placed on the top of the 0.8-meter height, 1 x 1.5 meter non-metallic table.
3. Emissions from the EUT are maximized by adjusting the orientation of the Loop antenna and rotating the EUT on the turntable. Manipulating the system cables also maximizes EUT emissions if applicable.
4. To obtain the final measurement data, 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 with specified bandwidth.

Measurement Uncertainty Calculations

The measurement uncertainties stated were calculated in accordance with the requirements of NIST Technical Note 1297 and NIS 81 (1994).

TYPE	Contribution	Probability Distribution	Uncertainty	Remark
B	AMN Impedance Voltage Division Factor Attenuation : AMN to Receiver	Triangular normal(k=2) normal(k=2)	+2.6/-2.7 dB ±0.2 ±0.1	CISPR
	Receiver(ESCI(S/N:100374)) Sine-Wave Voltage Accuracy Pulse Amplitude Response Pulse Repetition Rate Response	normal(k=2) Rectangular Rectangular	±1.0 dB ±1.5 dB ±1.5 dB	CISPR
	Mismatch AMN to Receiver	U-Shaped	+0.7/-0.8 dB	CISPR
	Reading	normal(k=1)	±0.1	
	Combined Standard Uncertainty	normal	± 1.8 dB	
	Expanded Uncertainty U	normal(k=2)	± 3.6 dB	95 %

$$U = -3.70 / +3.42 \text{ (k=2, 95.45% confidence level)}$$

TYPE	Contribution	Probability Distribution	Uncertainty	Remark
B	Antenna AF factor AF frequency interpolation AF height deviations directivity difference phase center location(3 m) phase center location(10 m)	Normal(k=2) Rectangular Rectangular Rectangular Rectangular	±0.56 ±0.30 dB ±0.50 dB ±0.30 dB +1.0/-0.0 dB ±1.0 dB ±0.30 dB	CAL. CISPR CISPR CISPR CISPR
	Receiver Sine Wave Voltage Accuracy Pulse Amplitude Sensibility Pulse Frequency Response Random Noise	Normal(k=2) Normal(k=2) Normal(k=2) Normal(k=2)	±0.20 dB ±0.40 dB ±0.57 dB ±0.35 dB	CAL. CAL. CAL. CAL.
	Mismatch : Antenna - receiver	U-Shaped	+0.9/-1.0 dB	CISPR
	Table height	Normal(k=2)	±0.01 dB	CISPR
	Separation distance(3 m) Separation distance(10 m)	Rectangular	±0.30 dB ±0.10 dB	CISPR
	Combined standard Uncertainty	Normal	± 1.13	
	Expanded Uncertainty U	Normal(k=2)	± 2.26 dB	95 %

$$U = ±2.26 \text{ (k=2, 95% confidence level)}$$

Equipment Under Test

EUT Type :

- Table-Top.
- Floor-Standing.
- Table-Top and Floor-Standing(Combination).
- Built-in

Operation – mode of the E.U.T. :

The equipment under test was operated during the measurement under following conditions :

- Standby Mode
- Operational Condition : Continue Transmitting

SUMMARY

Test Descriptions

<input type="checkbox"/> Conducted Emission	N/A
- The EUT uses the DC Power.	
<input checked="" type="checkbox"/> Radiated Emission	PASS
- Radiated Emission Result	
<input checked="" type="checkbox"/> Peak power output	PASS
- Test result	
<input checked="" type="checkbox"/> Band edge	PASS
- Test result	
<input checked="" type="checkbox"/> Frequency Separation/Occupied Bandwidth	PASS
- Test Result	
<input checked="" type="checkbox"/> Number of hopping frequency	PASS
- Test Result	
<input checked="" type="checkbox"/> Time of occupancy(Dwell time)	PASS
- Test result	

Note :

- means that the test is applicable,
- means that the test is not applicable.

Test Date

Begin of Testing : March 15, 2010 - End of Testing : April 23, 2010

Prepared By

U.H. Ryu

U.H. Ryu / Senior Engineer

Radiated Spurious Emission

[Applicable]

◆ Test Equipment Used

Name	Type	Manufacturer	Calibration. Date	Serial Number
ESCS30	EMI Receiver	Rohde & Schwarz	Sep. 17, 2009	100171
SPECTRUM ANALYZER	R3273	ADVANTEST	Aug. 28, 2009	110600587
Loop Antenna	HFH2-Z2	Rohde & Schwarz	Oct. 23, 2008	8620771017
Log-bicon Antenna	VULB9161SE	Schwarz beck	Jul. 21, 2009	4089
HORN-Antenna	3115	EMCO	Dec. 22, 2009	9012-3602
HORN-Antenna	SAS-571	A.H. SYSTEMS	Dec. 22, 2009	500
PRE AMPLIFIER	8449B OPT H02	Rohde & Schwarz	Oct. 11, 2009	3008A0530

Note : 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to RRL, KRISS, KTL and HCT.

2. The calibration interval of horn ant. and loop ant. is 24 months

Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. For the limit is employed average value, therefore the peak value can be transferred to average value by subtracting the duty factor. The basic equation with a sample calculation is as follows:

$$\text{Peak} = \text{Reading} + \text{Corrected Factor}$$

Where

Corr. Factor = Antenna Factor + Cable Factor - Amplifier Gain (if any)

Limit

Emissions radiated outside of the specified bands, shall be according to the general radiated limits in 15.209 as following:

Frequencies(MHz)	Field Strength(microvolt/meter)	Measurement Distance(meter)
0.009 ~ 0.490	2400/F(kHz)	300
0.490 ~ 1.750	24000/F(kHz)	30
1.750 ~ 30.0	30	30
30 ~ 88	100	3
88 ~ 216	150	3
216 ~960	200	3
Above 960	500	3

Radiated Emission Result

[Applicable]

EUT	SPS-700A	PROBE	Below 1 GHz
POWER	DC 12 V	NOTE	Normal link

Frequency MHz	Reading dBuV	P (H, V)	Ant. Factor dB	Cable Loss dB	AMP GAIN dB	Limit dBuV	Total dBuV	Margin dB
*62.01	18.8	H	11.6	1.7	0.0	40.0	32.1	7.9
65.89	19.7	V	10.1	1.7	0.0	40.0	31.5	8.5
88.20	16.3	H	9.4	1.9	0.0	43.5	27.6	15.9
105.66	15.6	H	10.8	2.0	0.0	43.5	28.4	15.1
119.24	17.1	H	10.8	2.0	0.0	43.5	29.9	13.6
186.17	15.1	H	13.5	2.5	0.0	43.5	31.1	12.4
195.87	16.0	V	11.7	2.6	0.0	43.5	30.0	13.5
212.36	19.8	H	11.0	2.7	0.0	43.5	33.5	10.0
239.52	20.1	V	11.1	2.8	0.0	46.0	34.0	12.0
265.71	17.1	H	11.6	3.0	0.0	46.0	31.7	14.3

Note :

1. Remark "*" means that the data is the worst emission level.
2. All reading levels are Quasi-peak value.
3. Measurement level = reading level + correct factor

EUT	SPS-700A	PROBE	Above 1 GHz
POWER	DC 12 V	NOTE	Low Ch

Test Data

Frequency MHz	Reading dBuV		P	Ant. Factor dB	Cable Loss dB	AMP GAIN dB	Limit dBuV		Total dBuV		Margin dB	
	Peak	AV					Peak	AV	Peak	AV	Peak	AV
	4804.25	51.4	39.6	V	10.80	11.2	36.17	74.0	54.0	37.23	25.43	36.77
7206.21	52.8	40.1	V	11.94	14.9	35.78	74.0	54.0	43.86	31.16	30.14	22.84
4804.25	52.7	39.9	H	10.80	11.2	36.17	74.0	54.0	38.53	25.73	35.47	28.27
7206.21	51.9	41.7	H	11.94	14.9	35.78	74.0	54.0	42.96	32.76	31.04	21.24

Restricted Band Edge Test Data

Frequency MHz	Reading dBuV		P	Ant. Factor dB	Cable Loss dB	AMP GAIN dB	Limit dBuV		Total dBuV		Margin dB	
	Peak	AV					Peak	AV	Peak	AV	Peak	AV
	2364.15	48.4	36.8	H	9.25	7.8	36.18	74.0	54.0	29.27	17.67	44.73
2390.87	49.9	39.8	V	9.25	7.8	36.18	74.0	54.0	30.77	20.67	43.23	33.33

EUT	SPS-700A	PROBE	Above 1 GHz
POWER	DC 12 V	NOTE	Middle Ch

Test Data

Frequency MHz	Reading dBuV		P	Ant. Factor dB	Cable Loss dB	AMP GAIN dB	Limit dBuV		Total dBuV		Margin dB	
	Peak	AV					Peak	AV	Peak	AV	Peak	AV
	4882.35	52.3	39.9	V	10.80	11.2	36.17	74.0	54.0	38.13	25.73	35.87
7323.59	52.1	40.8	V	11.94	14.9	35.78	74.0	54.0	43.16	31.86	30.84	22.14
4882.35	52.5	40.0	H	10.80	11.2	36.17	74.0	54.0	38.33	25.83	35.67	28.17
7323.59	52.6	40.9	H	11.94	14.9	35.78	74.0	54.0	43.66	31.96	30.34	22.04

EUT	SPS-700A	PROBE	Above 1 GHz
POWER	DC 12 V	NOTE	High Ch

Test Data

Frequency MHz	Reading dBuV		P	Ant. Factor dB	Cable Loss dB	AMP GAIN dB	Limit dBuV		Total dBuV		Margin dB	
	Peak	AV					Peak	AV	Peak	AV	Peak	AV
	4960.82	51.6	39.2	V	10.80	11.2	36.17	74.0	54.0	37.43	25.03	36.57
7440.10	52.4	41.1	V	11.94	14.9	35.78	74.0	54.0	43.46	32.16	30.54	21.84
4960.82	51.6	39.2	H	10.80	11.2	36.17	74.0	54.0	37.43	25.03	36.57	28.97
7440.10	52.8	41.7	H	11.94	14.9	35.78	74.0	54.0	43.86	32.76	30.14	21.24

Restricted Band Edge Test Data

Frequency MHz	Reading dBuV		P	Ant. Factor dB	Cable Loss dB	AMP GAIN dB	Limit dBuV		Total dBuV		Margin dB	
	Peak	AV					Peak	AV	Peak	AV	Peak	AV
	2496.25	49.5	37.6	H	9.25	7.8	36.18	74.0	54.0	30.37	18.47	43.63
2494.75	48.5	37.7	V	9.25	7.8	36.18	74.0	54.0	29.37	18.57	44.63	35.43

Peak Power Output

◆Test Equipment

The following test equipment are used during the test:

Item	Equipment	Manufacturer	Model no/Serial No.	Last Cal.
1	Spectrum Analyzer	ADVANTEST	R3273 / 95090431	Oct. 11, 2009
2	RF ROOM			

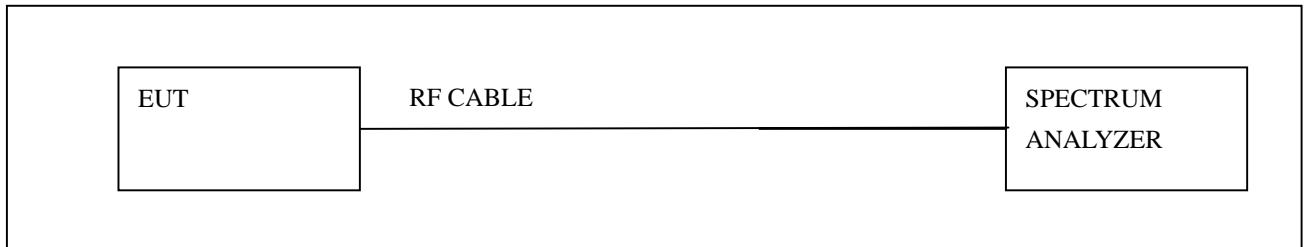
Note : All equipment upon which need to calibrated are with calibration period of 1 year.

◆Limits

The maximum peak output power of the intentional radiator shall not exceed the following :

1. According to § 15.247(b)(3), for systems using digital modulation in the bands of 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz : 1Watt.
2. 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

◆Test Setup



◆Test Procedure

The transmitter output is connected to the Spectrum analyzer. The Spectrum analyzer is set to the peak power detection.

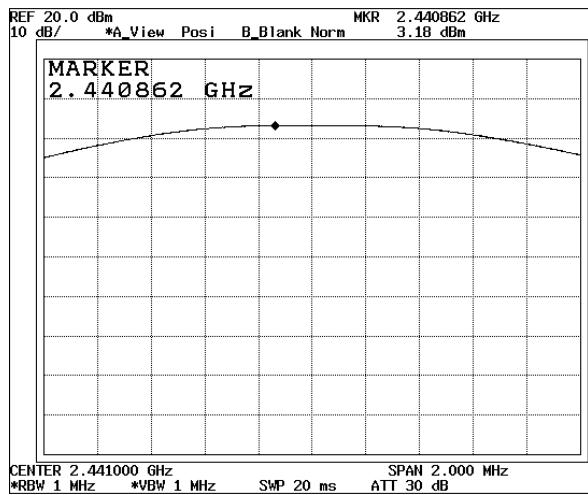
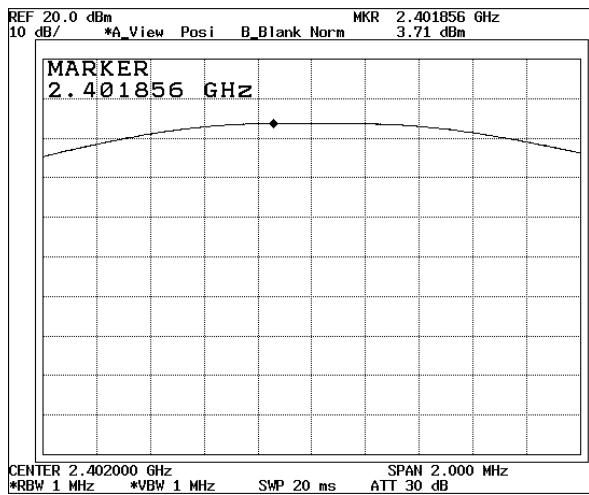
Peak Power Test result

Product	SPS-700A
Test Item	Peak Power Output
Test Mode	Tx / Channel 0, 39, 78
Test Site	RF Room
Measurement Method	Conducted

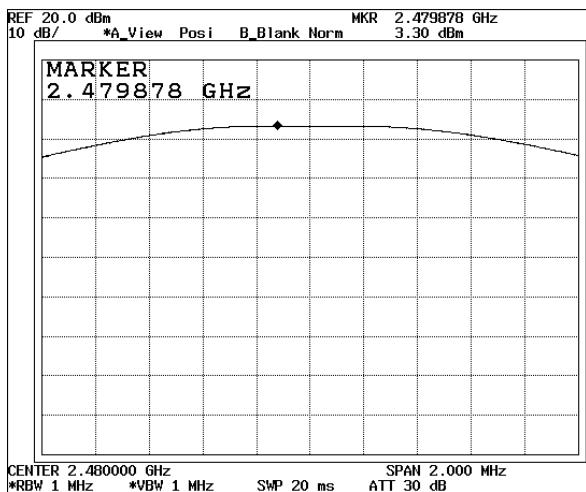
Channel No.	Frequency (MHz)	Measure Level (dBm)	Limit (dBm)	Result
0	2402	3.71	1Watt=30dBm	Pass
39	2441	3.18	1Watt=30dBm	Pass
78	2480	3.30	1Watt=30dBm	Pass

Channel 0

Channel 39



Channel 78



Note : Measurement level = reading level + correct factor

Band Edge

◆ TEST Equipment

The following test equipment are used during the test:

Name	Type	Manufacturer	Calibration. Date	Serial Number
ESCS30	EMI Receiver	Rohde & Schwarz	Sep. 17, 2009	100171
SPECTRUM ANALYZER	R3273	ADVANTEST	Oct. 11, 2009	95095431
HORN-Antenna	3115	EMCO	Dec. 12, 2009	9012-3602
HORN-Antenna	HF906	Rohde & Schwarz	Dec. 12, 2009	100530
PRE AMPLIFIER	8449B OPT H02	Rohde & Schwarz	Oct. 11, 2009	3008A0530

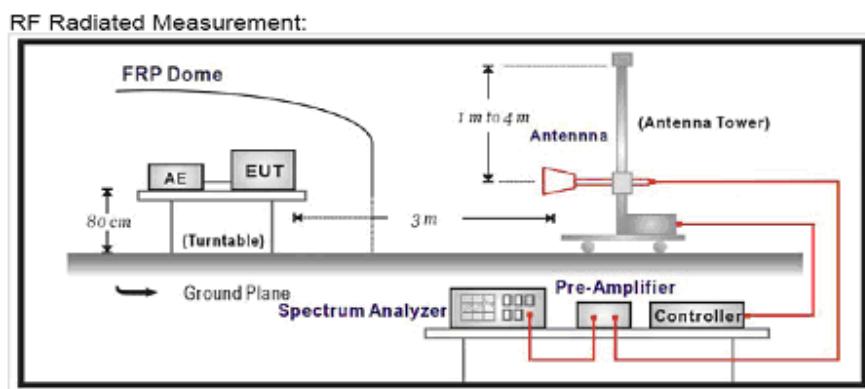
*Note : 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to RRL, KRISS, KTL and HCT.
 2. The calibration interval of horn ant. and loop ant. is 24 months*

◆ Limits

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum 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.

Attenuation below the general limits specified in section 15.209(a) is not required. In addition, radiated emission which fall in the restricted bands, as defined in section 15.205(a), must also comply with the radiated emission limits specified in section 15.209(a)(see Section 15.205(c)).

◆ Test setup



◆ Test procedure

The EUT and its simulators are placed on a turn table which is 0.8 meter above ground. The turn table can rotate 360 degrees to determine the position of the maximum emission level. The EUT was positioned such that the distance from antenna to the EUT was 3 meters. The antenna can move up and down between 1 meter and 4 meters to fine out the maximum emission level.

Both horizontal and vertical polarization of the antenna are set on measurement. In order to find the maximum emission, all of the interface cables must be manipulated according to ANSI C63.4:2003 on radiated measurement.

The bandwidth below 1 GHz setting on the field strength meter is 120 kHz, above 1GHz are 1MHz.

Test specification

According to FCC Part 15 Subpart C paragraph 15.247

Band Edge Test result

Product	SPS-700A
Test Item	Band Edge
Test Mode	Tx / Channel 0, 78
Test Site	Test chamber
Measurement Method	Radiated

Channel : 0 CH(2402 MHz)



Channel : 78 CH(2480 MHz)



Frequency Separation/ Occupied Bandwidth

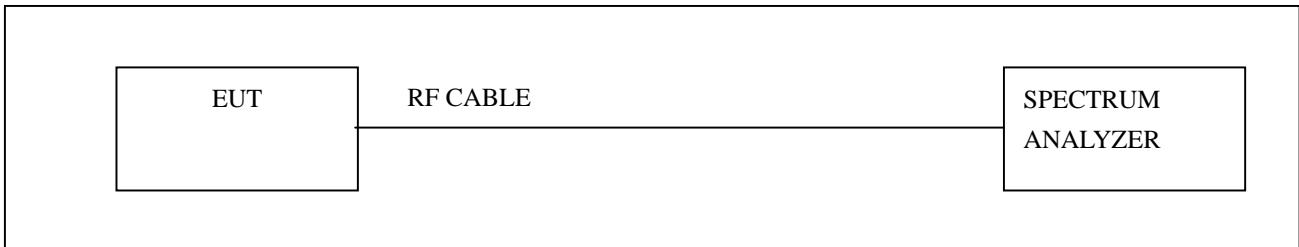
◆Test Equipment

The following test equipment are used during the test:

Item	Equipment	Manufacturer	Model no/Serial No.	Last Cal.
1	Spectrum Analyzer	ADVANTEST	R3273 / 95090431	Oct.11, 2009
2	RF ROOM			

Note : All equipment upon which need to calibrated are with calibration period of 1 year.

◆Test Setup



◆Limits

According to 15.247(a)(1), Frequency hopping systems operation in the 2400-2483.5 MHz band may have hopping carrier frequencies that are separated by 25 KHz or two-third of 20 dB band width of hopping channel, is greater.

◆Test Procedure

The transmitter output is connected to the Spectrum analyzer.

According to FCC CFR Title 47 Part 15 Subpart C Section 15.247

Test result

Product	SPS-700A
Test Item	Frequency Separation / Occupied Bandwidth
Test Mode	Transmit
Test Site	RF Room
Measurement Method	Conducted

Channel Separation(KHz)	20dB bandwidth (KHz)		Limit (KHz)	Result
1005	channel	-	>25 or >2/3 of the 20dB BW	Pass
	Low CH	924		
	Middle CH	930		
	High CH	906		

Occupied Bandwidth(99% BW)

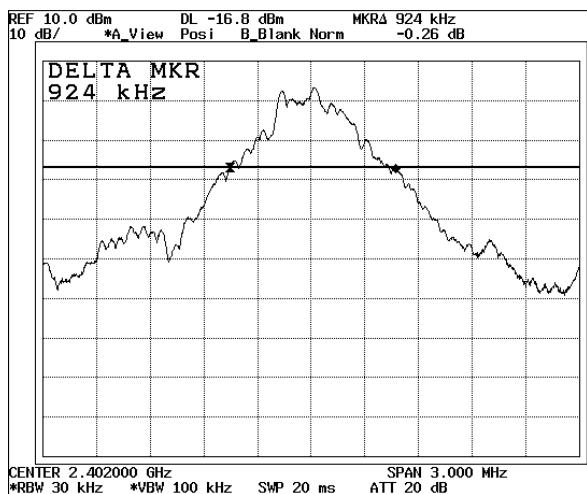
Channel	99% BW(KHz)	Result
Low CH	858	Pass
Middle CH	852	
High CH	855	

Channel Separation

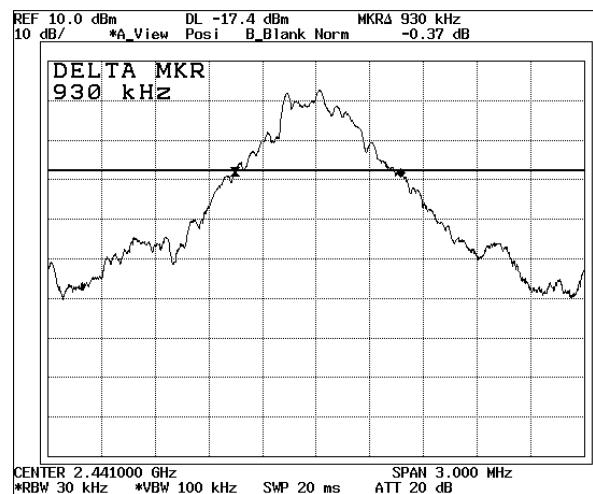


20dB bandwidth

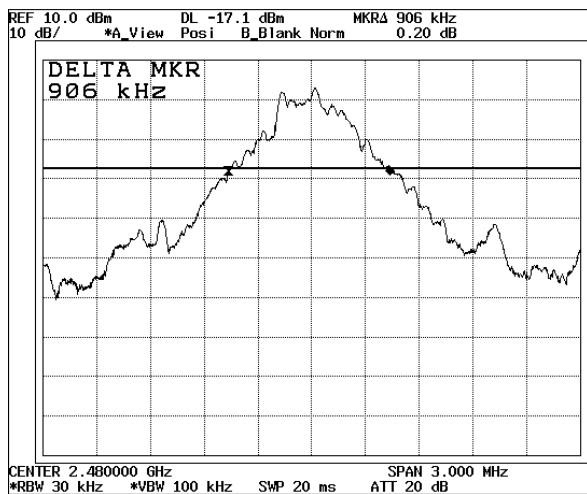
Channel 0



Channel 39

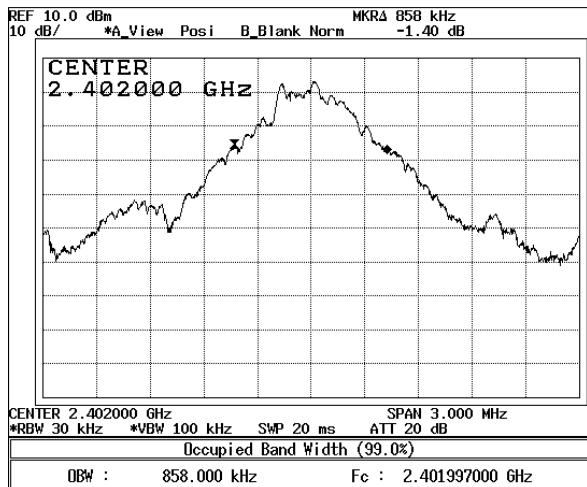


Channel 78

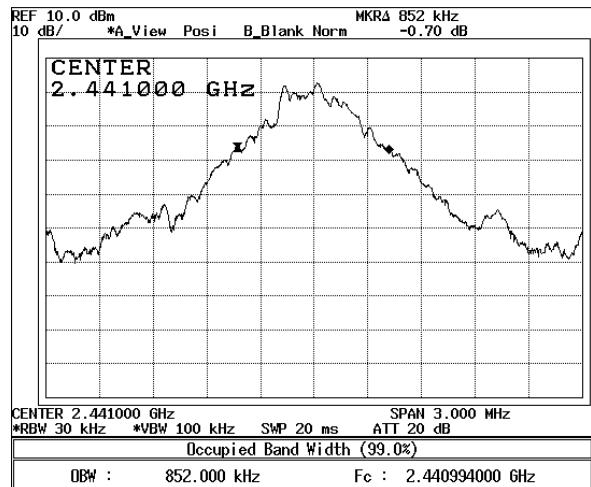


Occupied bandwidth(99 %)

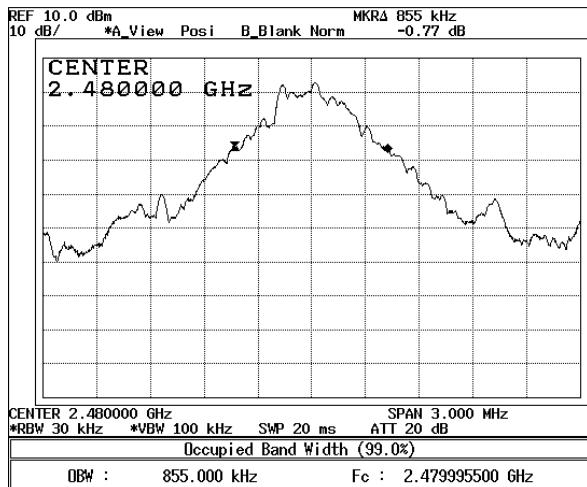
Channel 0



Channel 39



Channel 78



Number of Hopping Frequency

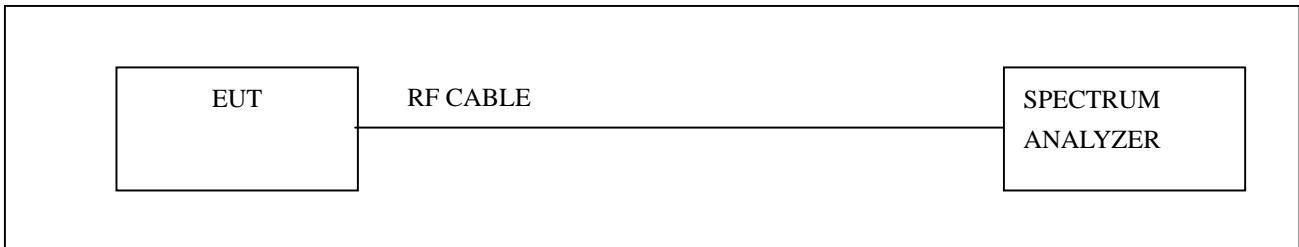
◆Test Equipment

The following test equipment are used during the test:

Item	Equipment	Manufacturer	Model no/Serial No.	Last Cal.
1	Spectrum Analyzer	ADVANTEST	R3273 / 95090431	Oct.11, 2009
2	RF ROOM			

Note : All equipment upon which need to calibrated are with calibration period of 1 year.

◆Test Setup



◆Limits

According to 15.247(a)(1)(ii), Frequency hopping systems operation in the 2400-2483.5 MHz bands shall use at least 15 hopping frequencies.

◆Test Procedure

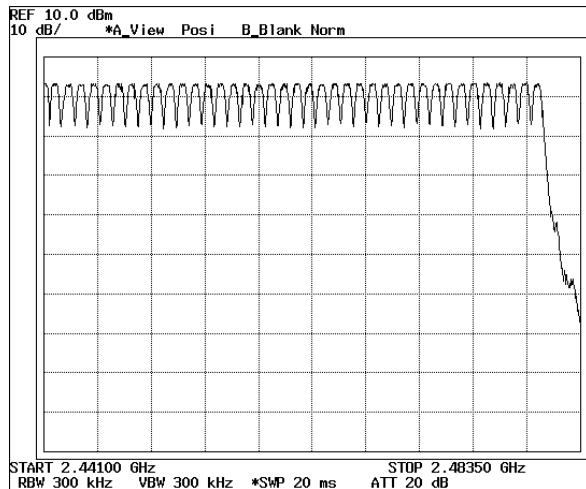
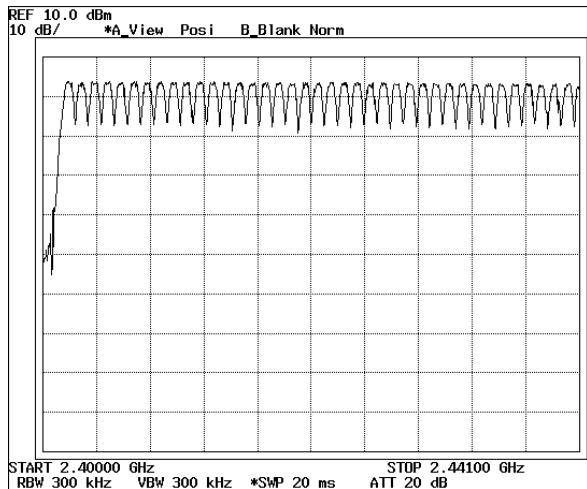
The transmitter output is connected to the Spectrum analyzer.

According to FCC CFR Title 47 Part 15 Subpart C Section 15.247

Test result

Product	SPS-700A
Test Item	Number of hopping frequency
Test Mode	Transmit
Test Site	RF Room
Measurement Method	Conducted

Channel (No. of channel)	Limit (No. of channel)	Result
79	>15	Pass



Time of Occupancy(Dwell Time)

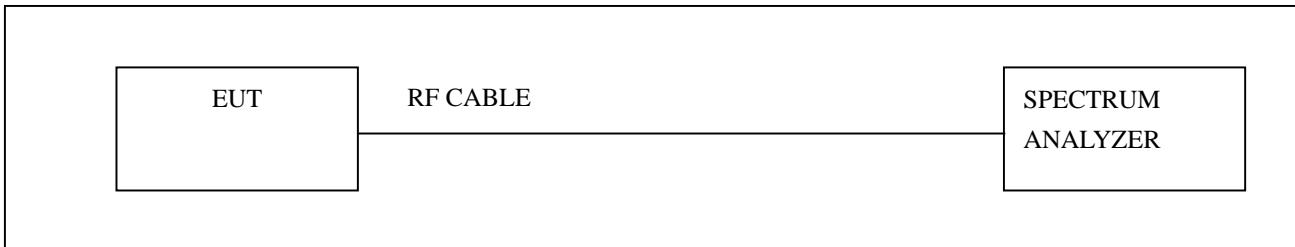
◆Test Equipment

The following test equipment are used during the test:

Item	Equipment	Manufacturer	Model no/Serial No.	Last Cal.
1	Spectrum Analyzer	ADVANTEST	R3273 / 95090431	Oct. 11, 2009
2	RF ROOM			

Note : All equipment upon which need to calibrated are with calibration period of 1 year.

◆Test Setup



◆Limits

According to 15.247(a)(1)(iii), Frequency hopping systems operating in the 2400-2483.5 MHz bands. The average time of occupancy on any channels shall not greater than 0.4s within a period 0.4s multiplied by the number of hopping channels employed.

◆Test Procedure

The transmitter output is connected to the Spectrum analyzer.

According to FCC CFR Title 47 Part 15 Subpart C Section 15.247

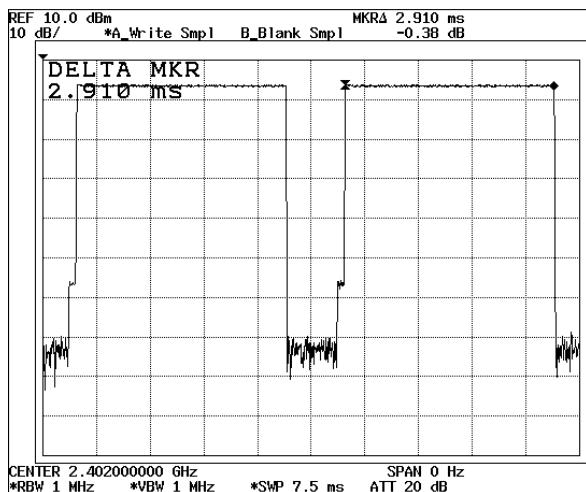
Test result

Test Item	Dwell Time
Test Mode	Transmit (DH5 : the longest packet type)
Test Site	RF Room
Measurement Method	Conducted

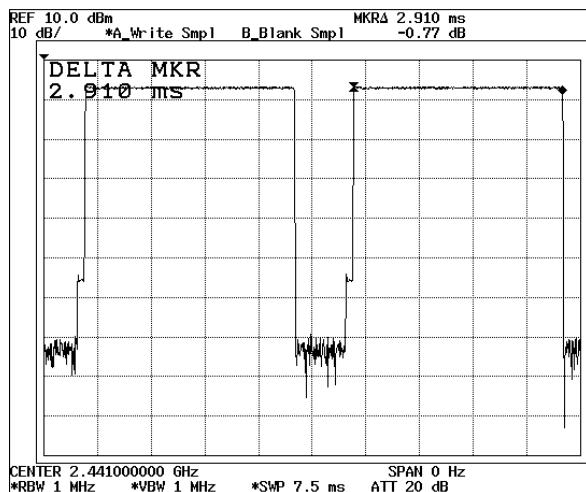
Channel No.	Pulse Time (ms)	Total of Dwell (ms)	Period Time (s)	Limit (ms)	Result
Low CH	2.910	310.40	31.6	400	Pass
Middle CH	2.910	310.40	31.6		Pass
High CH	2.902	309.55	31.6		Pass

$$\begin{aligned}
 \text{Dwell Time} &= \text{time slot length} * \text{hop rate}/\text{Number of hopping channels} * 31.6s \\
 &= 2.910 * (1600/6) / 79 * 31.6 = 310.40(\text{ms})
 \end{aligned}$$

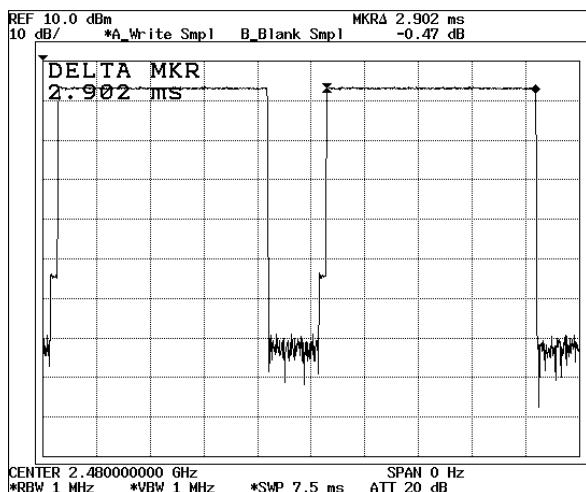
Channel 0



Channel 39



Channel 78



Note : Measurement level = reading level + correct factor

Antenna requirements

According to FCC 47 CFR 15.203

“an intentional radiator antenna shall be designed to ensure that no antenna other than that furnished by the responsible party can be used with the device. The use of a permanently attached or an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section”

* the antenna of this EUT are permanently attached.

* the EUT complies with the requirement of 15.203

The Photos of Equipment Under Test



Front view



rear view