

RF TEST REPORT

Test report No.: EMC- FCC- R0022
FCC ID: A3LSSAR2001
Type of equipment: RFID Reader
Basic Model: SSA-R2001
Applicant: SAMSUNG ELECTRONICS CO., LTD.
FCC Rule Part(s): FCC Part 15 Subpart C 2008
Frequency Range: 13.56 MHz
Test result: Complied

The above equipment was tested by EMC compliance Testing Laboratory for compliance with the requirements of FCC Rules and Regulations.
The results of testing in this report apply to the product/system which was tested only. Other similar equipment will not necessarily produce the same results due to production tolerance and measurement uncertainties.

Date of test: September 14, 2009 ~ September 21, 2009

Issued date: September 24 , 2009


Tested by: _____
KIM, CHANG MIN


Approved by: _____
YOO, SUNG YOUNG

[Contents]

1. Client information	3
2. Laboratory information	4
3. Description of E.U.T.....	5
3.1 Basic description	5
3.2 General description	5
3.3 Test frequency	6
4. Summary of test results	7
4.1 Standards & results	7
4.2 Uncertainty	7
5. Test results	8
5.1 In-band Emission (15.225 (a)).....	8
5.2 In-band Emission (15.225 (b)(c)).....	10
5.3 Out-of-band Emission (15.225 (d),15.209)	11
5.4 Frequency tolerance (15.225 (e))	13
5.5 Conducted Emission- N/A	14
6. Test equipment used for test	15

Appendix 1 Test setup photos

Appendix 2 External photos of EUT

Appendix 3 Internal photos of EUT

Appendix 4 Block diagram

Appendix 5 Schematics

Appendix 6 User manual

Appendix 7 Part list

Appendix 8 Layout diagram

1. Client information

Applicant : SAMSUNG ELECTRONICS CO., LTD.
Address : 416 Maetan3-Dong, YeongTong-Gu, Suwon-Si,
Gyeonggi-Do, Korea, 443-742
Telephone number : +82-31-277-3695
Facsimile number : +82-31-277-2784
Contact person : Kang Je Soon / js2002.kang@samsung.com

Manufacturer: GM SMD Co., Ltd.
Address : 416 2F 89-4 Dodang-dong ,Wonmi-gu ,Bucheon-si,
Gyeonggi-do, Korea

2. Laboratory information

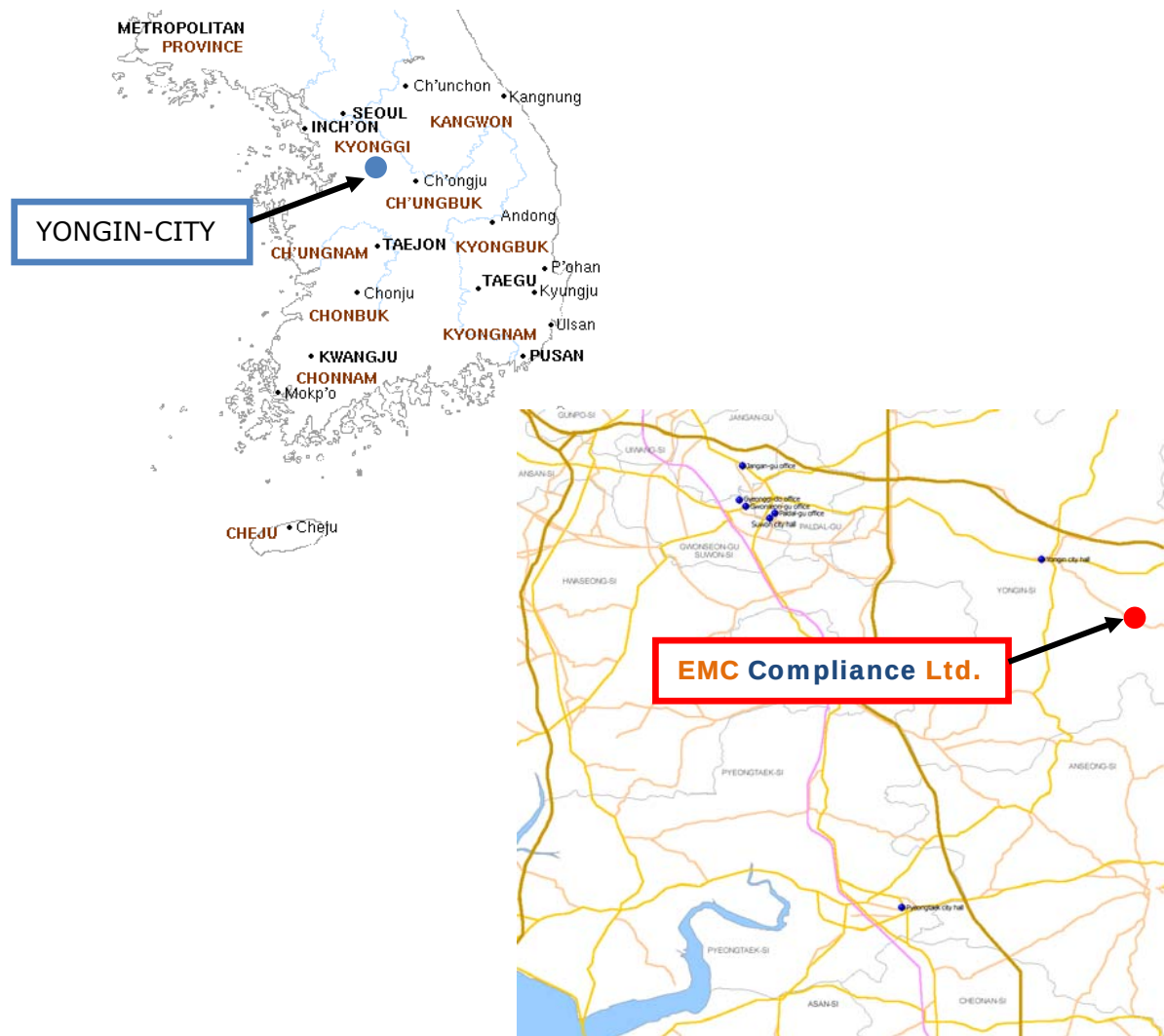
Address

EMC Compliance Ltd.
82-1, JEIL-RI, YANGJI-MYUN, CHURINGU, YONGIN-CITY, KYUNGKI-DO,
KOREA 449-825
Telephone Number: 82 31 336 9919 Facsimile Number: 82 31 336 4767

Certificate

CBTL Testing Laboratory, KOLAS NO.: 231
FCC Filing No.: 793334
VCCI Registration No.: C-1713, R-1606, T-258

SITE MAP



3. Description of E.U.T.

3.1 Basic description

Applicant :	SAMSUNG ELECTRONICS CO., LTD.
Address of Applicant:	416 Maetan3-Dong, YeongTong-Gu, Suwon-Si, Gyeonggi-Do, Korea, 443-742
Manufacturer:	GM SMD Co., Ltd
Address of Manufacturer:	2F 89-4 Dodang-dong, Wonmi-gu, Bucheon-si, Gyeonggi-do, Korea
Type of equipment:	Stand-alone radio equipment
Basic Model:	SSA-R2001
Varient model:	-
Serial number:	Engineering Sample

3.2 General description

Frequency	13.56 MHz
Type of Modulation	ASK
Number of Channels	1 channel
Type of Antenna	Integral (PCB Loop antenna)
Power supply	DC 12 V / Max.75mA
Extreme Power supply	Lower voltage: DC 10.2 V, Upper voltage: DC 13.8V
Operating temperature	-25°C to +50°C
Operating Humidity	10% to 90% Relative Humidity Non-Condensing
Dimension (W x H x D(mm))	87.0 x 109.0 x 31.0
Weight	160g
Reading Time(card)	30ms
Input port	2 ea : External LED Control, External Buzzer Control)
Output port	34bit Wiegand, 4/8bit Burst for PIN (Selectable)
LED indicator	3 LED Indicators (Red, Green and Orange)
Beeper	Piezo buzzer
Keypad	12 Key Numeric Keypad with Back Lighting

3.3 Test frequency

	Frequency
Low frequency	-
Middle frequency	13.56 MHz
High frequency	-

4. Summary of test results

4.1 Standards & results

Rule Reference	Parameter	Status
15.225 (a)	In-band Emission	C
15.225 (b)	In-band Emission	C
15.225 (c)	In-band Emission	C
15.225 (d) 15.209	Out-of -band Emission	C
15.225 (e)	Frequency Stability Tolerance	C
15.207	Conducted Emissions	NA *
Note: C=complies NC= Not complies NT=Not tested NA=Not Applicable *The test is not applicable since the EUT is not the device that is designed to be connected to the public utility(AC) power line.		

4.2 Uncertainty

Measurement Item	Combined Standard Uncertainty U _c	Expanded Uncertainty U = KU _c (K = 2)
Conducted RF power	± 0.272 dB	± 0.544 dB
Radiated disturbance	± 1.943 dB	± 3.886 dB
Conducted disturbance	± 1.265 dB	± 2.53 dB

5. Test results

5.1 In-band Emission (15.225 (a))

5.1.1 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.

5.1.2 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 9kHz to 30MHz at distance 3m The EUT was rotated a full revolution in order to obtain the maximum value of the electric field intensity.

Frequency : From 30MHz to 1GHz 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 1GHz).

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

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

[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])

5.1.3 Test Result

- Complies

EUT	RFID Reader		
Operating Frequency	13.56MHz	Model Name	SSA-R2001
Operating Mode	Transmitter Mode	Modulation Technology	ASK
Environmental Condition	23℃/45%	Test Channel	1ch
Tested By	Changmin kim	Power Rate	12V DC

Frequency	POL	Reading (dBuV)	Correction Factor		field strength dBuV/m at 3 m
			Ant(dB)	Cable(dB)	
13.56MHz	H	56.8	9.61	0.91	67.32
13.56MHz	V	51.8	9.61	0.91	62.32
Maximum Level(dBμA / m)					67.32
Limit(dBuV / m) at 3m					124 dBuV/m
margin					56.68
Uncertainty					±3.8dB

Note: Field strength limit was calculated with 40dB/dec

5.2 In-band Emission (15.225 (b)(c))

5.2.1 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.

5.2.2 Test Result

- Complied

Measurement Distance: 3m

Frequency [MHz]	Receiver Bandwidth [kHz]	Reading [dB(μV)]	Pol. [V/H]	ATT [dB]	Amp Gain [dB]	AF [dB(1/m)]	CL [dB]	Limit [dB(μV/m)]	Result [dB(μV/m)]	Margin [dB]
QP DATA										
13.350	9	35.36	H	-	-	9.64	0.280	80.51	45.28	35.23
13.772	9	38.58	H	-	-	9.61	0.280	80.51	48.47	32.04

Margin (dB) = Limit – Actual

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

1. H = Horizontal, V = Vertical Polarization

2. ATT = Attenuation (10dB pad and/or Insertion Loss of HPF), AF/CL = Antenna Factor and Cable Loss

* The spurious emission at the frequency does not fall in the restricted bands.

** The measured result is within the test standard limit by a margin less than the measurement uncertainty; it is therefore not possible to state compliance based on the 95 % level of confidence. However, the result indicates that compliance is more probable than non-compliance.

NOTE: All emissions not reported were more than 20 dB below the specified limit or in the noise floor.

5.3 Out-of-band Emission (15.225 (d),15.209)

5.3.1 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 (uV / 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(29.54dBuV/m)	30
30.0-88.0	100(40 dBuV/m)	3
88-216	150(43.5 dBuV/m)	3
216-960	200 (46 dBuV/m)	3
Above 960	500 (53.98 dBuV/m)	

5.3.2 Measurement Procedure

The spurious emissions from the EuT will be measured on an open area test site 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 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 dBμV/m, is arrived at by taking the reading from the EMI receiver (Level dBμV) 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

5.3.3 Test Result

-Complied

Measurement Distance: 3m

-Above 30MHz

Frequency [MHz]	Receiver Bandwidth [kHz]	Reading [dB(μV)]	Pol. [V/H]	ATT [dB]	Amp Gain [dB]	AF [dB(1/m)]	CL [dB]	Limit [dB(μV/m)]	Result [dB(μV/m)]	Margin [dB]
QP DATA.										
203.01	120	15.0	V	-	-	11.17	2.74	43.5	28.91	14.59
216.97	120	15.5	V	-	-	11.53	2.84	46.0	29.87	16.13
230.53	120	10.5	V	-	-	11.91	2.95	46.0	25.36	20.64
244.09	120	15.0	H	-	-	12.30	3.03	46.0	30.33	15.67
257.65	120	13.9	V	-	-	12.69	3.10	46.0	29.69	16.31
257.66	120	15.2	H	-	-	12.69	3.10	46.0	30.99	15.01
244.09	120	14.6	V	-	-	12.30	3.03	46.0	29.93	16.07

Margin (dB) = Limit – Actual

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

1. H = Horizontal, V = Vertical Polarization

2. ATT = Attenuation (10dB pad and/or Insertion Loss of HPF), AF/CL = Antenna Factor and Cable Loss

* The spurious emission at the frequency does not fall in the restricted bands.

** The measured result is within the test standard limit by a margin less than the measurement uncertainty; it is therefore not possible to state compliance based on the 95 % level of confidence. However, the result indicates that compliance is more probable than non-compliance.

NOTE: All emissions not reported were more than 20 dB below the specified limit or in the noise floor.

5.4 Frequency tolerance (15.225 (e))

5.4.1 Regulation

15.225 (e) The frequency tolerance of the carrier signal shall be maintained within $\pm 0.01\%$ 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.

5.4.2 Test Result

- Complied

VOLTAGE (%)	POWER (V)	TEMP (°C)	FREQ (Hz)	FREQ.DEV (Hz)	Deviation (%)
100	12	20	13560608	-8	-0.000059%
		-20	13560544	56	0.000413%
		-10	13560574	26	0.000192%
		0	13560609	-9	-0.000066%
		10	13560646	-46	-0.000339%
		20	13560698	-98	-0.000723%
		25	13560628	-28	-0.000206%
		30	13560621	-21	-0.000155%
		40	13560588	12	0.000088%
		50	13560566	34	0.000251%
85	10.2	20	13560609	-9	-0.000066%
115	13.8	20	13560608	-8	-0.000059%

5.5 Conducted Emission- N/A

5.4.1 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 50μH/50Ω 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.

5.4.2 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.

6. Test equipment used for test

	Description	Manufacture	Model No.	Serial No.	Next Cal Date.
■	Temp & humidity chamber	taekwang	TK-500	TK002	10.09.07
□	Power Meter	Agilent	E4416A	GB41292365	09.10.30
□	Frequency Counter	HP	5351B	3049A01295	09.10.30
■	Spectrum Analyzer	Agilent	E4407B	US39010142	09.10.30
■	Signal Generator	HP	E4432B	GB39340611	09.10.30
□	Modulation Analyzer	HP	8901B	3538A05527	09.11.07
□	Function Generator	Agilent	33250A	MY4006432	10.01.29
□	Audio Analyzer	HP	8903B	3011A10372	09.10.30
□	AC Power Supply	KIKUSUI	PCR2000W	GB001619	09.10.30
□	DC Power Supply	Tektronix	PS2521G	TW53135	09.10.30
■	DC Power Supply	Tektronix	PS2520G	TW50517	10.02.17
□	Dummy Load	BIRD	8141	7560	10.08.17
□	Dummy Load	BIRD	8401-025	799	10.08.18
□	EMI Test Receiver	R&S	ESHS10	1004.0401.10	10.06.08
□	EMI Test Receiver	R&S	ESVD	841729/010	10.08.17
■	EMI Test Receiver	R&S	ESCI	100001	10.08.18
□	Attenuator	HP	8494A	2631A09825	09.11.03
□	Attenuator	HP	8496A	3308A16640	09.11.03
□	Attenuator	R&S	RBS1000	D67079	09.11.04
□	Attenuator	HP	11581A	29738	10.01.09
□	Power sensor	Agilent	E9321A	US40390422	09.11.03
□	Power sensor	Agilent	E9325A	US40420186	09.11.03
■	LOOP Antenna	EMCO	6502	9205-2745	10.05.22
■	BILOG Antenna	Schwarzbeck	VULB 9160	3228	10.02.21
□	HORN Antenna	ETS	3115	00062589	09.12.26
□	Power Divider	HP	11636A	05441	10.08.21
□	Two Line V-network	R & S	ESH3-Z5	-	-
■	Biconical Antenna	A.H.Systems	SAS-540	2560	09.11.16
■	L/P Antenna	A.H.Systems	SAS-5100-2	1035	09.11.16