

Nemko Korea CO., Ltd.

300-2, Osan-Ri, Mohyun-Myun, Yongin-City, Kyungki-Do, KOREA

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FCC EVALUATION REPORT FOR CERTIFICATION

Applicant :

Samsung Electronics Co., Ltd.

416, Maetan3-Dong, Youngtong-Gu,

Suwon-Si, Kyungki-Do, Korea

Attn : Mr. Jong-Uk, Kim

Dates of Issue : March 05, 2004

Test Report No. : NK2EE011

Test Site : Nemko Korea Co., Ltd.

EMC site, Korea

FCC ID

A3LSRCS401RF

CONTACT PERSON

Samsung Electronics Co.,Ltd
416, Maetan3-Dong, Youngtong-Gu, Suwon-Si,
Kyungki-Do, Korea
Mr. Jong-Uk, Kim
Telephone No. : +82 31 200 5754

FCC Rule Part(s):

Part 15 & 2

Classification :

Part 15 Subpart C –Intentional Radiators

EUT Type:

RF Remote Controller

Out Frequency:

418 MHz

The device bearing the FCC ID specified above has been shown to comply with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in ANSI C63.4-1992.

I attest to the accuracy of data and all measurements reported herein were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.



Tested By : S. H. Baek
Engineer



Reviewed By : H.H. Kim
Manager & Chief Engineer

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SCOPE

Measurement and determination of electromagnetic emissions (EME) of radio frequency devices including intentional and/or unintentional radiators for compliance with the technical rules and regulations of the Federal Communications Commission under FCC part 15.

Responsible Party : Samsung Electronics Co., Ltd.

Contact Person : Mr. Jong-Uk, Kim

Tel : +82 31 200 5754

Manufacturer : Remote Solution Co., Ltd.

92, Chogok-Ri, Nam-Myun, Kimchon-City, Kyungbuk,
Korea

- FCC ID: A3LSRCS401RF
- Model: SRC-S401RF/A
- EUT Type: RF Remote Controller

- Classification: Part 15 Subpart C – Intentional Radiators
- Rule Part(s): FCC Part 15 & Part 2
- Test Procedure(s): ANSI C63.4 (1992)
- Dates of Test: January 12, 2004 to March 05, 2004
- Place of Tests: Nemko Korea Co., Ltd. EMC Site
- Test Report No.: NK2EE011

INTRODUCTION

The measurement procedure described in American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9kHz to 40GHz (ANSI C63.4-1992) was used in determining radiated and conducted emissions emanating from **Samsung Electronics Co., Ltd.**

FCC ID : **A3LSRCS401RF**, RF Remote Controller.

These measurement tests were conducted at **Nemko Korea Co., Ltd. EMC Laboratory**.

The site address is 300-2, Osan-Ri, Mohyun-Myun, Yongin-City, Kyungki-Do, KOREA

The area of Nemko Korea Corporation Ltd. EMC Test Site is located in a mountain area at 80 kilometers (48 miles) southeast and Seoul International Airport (Incheon Airport), 30 kilometers (18miles) south-southeast from central Seoul.

It is located in the valley surrounded by mountains in all directions where ambient radio signal conditions are quiet and a favorable area to measure the radio frequency interference on open field test site for the computing and ISM devices manufactures.

The detailed description of the measurement facility was found to be in compliance with the requirements of § 2.948 according to ANSI C63.4 on October 19, 1992.



Nemko Korea Co., Ltd.
OPEN AREA TEST SITE
300-2, Osan-Ri, Mohyun-Myun, Yongin-
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Fax)+82-31-322-2332

Fig. 1. The map above shows the Seoul in Korea vicinity area.

The map also shows Nemko Korea Corporation Ltd. EMC Lab and Incheon Airport.

TEST CONDITIONS & EUT INFORMATION

Operating During Test

The EUT was continuously operated at switch on mode.

Operational Description

When the button is pressed, the battery applies 3V DC. And the Micom is wake up, The LED (under marking 'DIREC TV') action will be shown.

At the same time RF source signal from Micom pin #20 is oscillated to Q1(RF module's Q1) By 418MHz saw resonator. ASK Modulation.

And finally modulated signal is amplified through Q2 (power amplifier) then radiated to Antenna at air.

EUT Information

Chipset(s) :	IC3 (3P80C5XZZSMB5)
Clock(s) :	X1 (4.0MHz)
RF Frequency :	417.99MHz
Method :	ASK Format

- Modifications during the test.

R(6) on the schematic diagram was changed from 2.4 $k\Omega$ to 2.0 $k\Omega$.

RECOMMENDATION/CONCLUSION

The data collected shows that the **Samsung Electronics Co., Ltd.**
FCC ID : **A3LSRCS401RF**, **RF Remote Controller**. complies with § 15.209,
15.231 of the FCC Rules.

SAMPLE CALCULATION

$$\text{dB } \mu\text{V} = 20 \log_{10} (\mu\text{V}/\text{m})$$

$$\mu\text{V} = 10^{(\text{dB } \mu\text{V}/20)}$$

EX. 1.

@600 MHz

§ 15.231 limit = 1250 $\mu\text{V}/\text{m}$ = 61.9 dB $\mu\text{V}/\text{m}$

Reading = 39.9 dB μV (calibrated level)

Antenna factor + (Cable Loss + Amplifier) = 18.7 – 22.3 = -3.6dB

Total = 39.9 – 3.6 = 36.3 dB $\mu\text{V}/\text{m}$

Margin = 61.9 – 36.3 = 25.6dB

25.6 dB below the limit

DESCRIPTION OF TESTS

Radiated Emissions

Preliminary measurement were made indoors at 3 meter using broad band antennas, broadband amplifier, and spectrum analyzer to determine the frequency producing the maximum EME. Appropriate precaution was taken to ensure that all EME from the EUT were maximized and investigated. The Technology configuration, clock speed, mode of operation or video resolution, turntable azimuth with respect to the antenna was note for each frequency found.

The spectrum was scanned from 30 to 1000MHz using Biconical log Antenna(ARA, LPB-2520/A). Above 1GHz, Doppels Teg Horn antenna (EMCO, DAA-37121:upto 1~18GHz) was used.

Final Measurements were made outdoors at 3 or 10m test range using Logbicon Super Antenna(Schwarzbeck, VULB9166) or Doppels Teg Horn antenna.(EMCO, DAA-37121)

The test equipment was placed on a wooden table.

Sufficient time for the EUT, support 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 reexamined and investigated using EMI test receiver.(ESCS30)

The detector function was set to CISPR quasi-peak mode or Average mode or Peak mode and the bandwidth of the receiver was set to 120KHz or 1MHz depending on the frequency or type of signal.

The half wave dipole antenna was tuned to the frequency found during preliminary radiated measurements.

The EUT support equipment and interconnecting cables were re configured to the setup producing the maximum emission for the frequency and were placed on top of a 0.8m high non- metallic 1.0X 1.5 meter table.

The EUT, support equipment and interconnecting cables were re-arranged and manipulated to maximize each EME emission.

The turn table containing the Technology was rotated; the antenna height was varied 1 to 4meter and stopped at the azimuth or height producing the maximum emission.

Each EME reported was calibrated using the R/S signal generator.

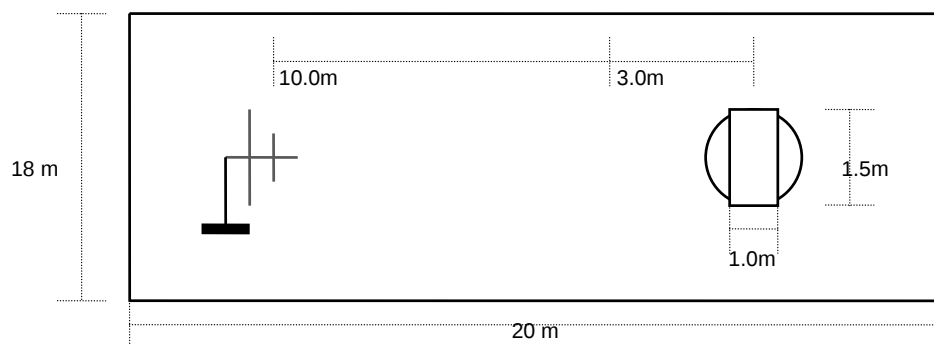


Fig. 2. Dimensions of Outdoor Test Site

§ 15.203 Antenna Requirement

An intentional radiator antenna shall be designed to ensure that no antenna other than that furnished by the applicant can be used with the device. The use of permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with this requirement.

§ 15.231(a) (1) Provisions for periodic operation

The EUT employs a switch that will automatically deactivate the transmitter within no more than 5 seconds of being released.

Applied Modulation

The modulation used was the test procedure specified in ANSI C63.4-1992. For modulation, various keys were used to determine the worst-case modulation. The worst-case modulation that produces the widest bandwidth was used during final testing.

TEST DATA

Radiated Emissions; general requirements(Section 15.209)

FCC ID : A3LSRCS401RF

Frequency (MHz)	Reading (dB μ V)	Pol* (H/V)	AF+CL+Amp (dB)**	Result (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
-	-	-	-	-	-	-

*) Any emission appearing on frequencies wasn't detected during radiated disturbance measurements.

**) Please see the page 10.

Table 1. Radiated Measurements at 3meters

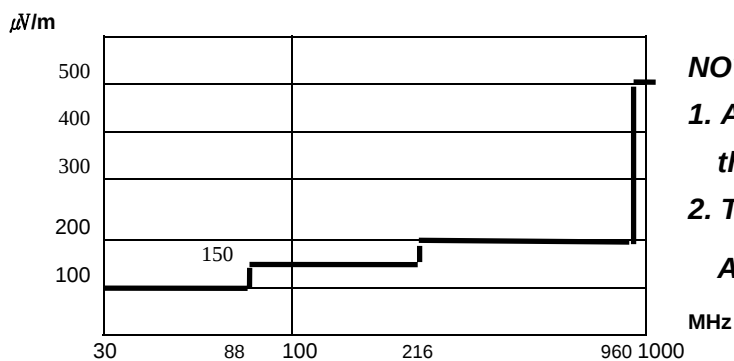


Fig. 3. Limits at 3 meters

NOTES:

1. All modes of operation were investigated the worst-case emission are reported.
2. The radiated limits are shown on Figure 3.

Above 1GHz the limit is 500 μ V/m.

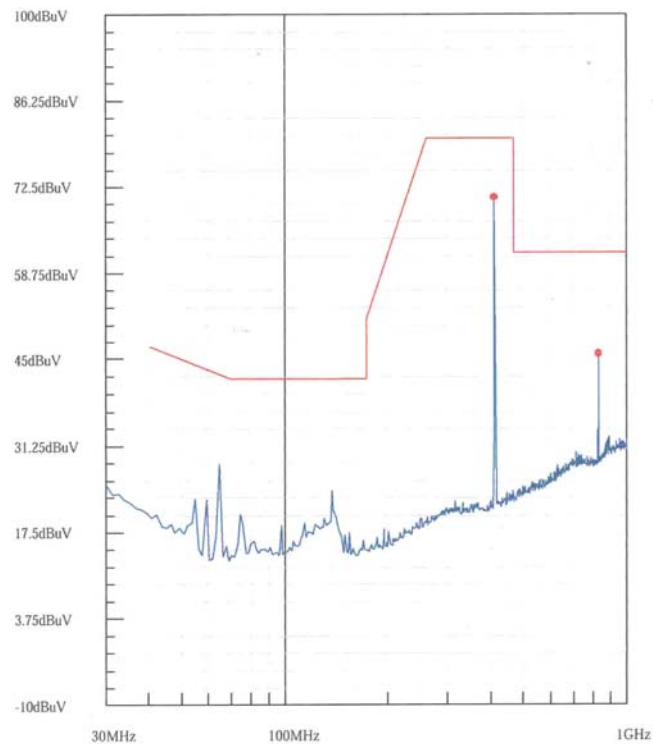
NOTES:

1. *Pol. H =Horizontal V=Vertical
2. **AF+CL+Amp. = Antenna Factor + Cable Loss + Amplifier.

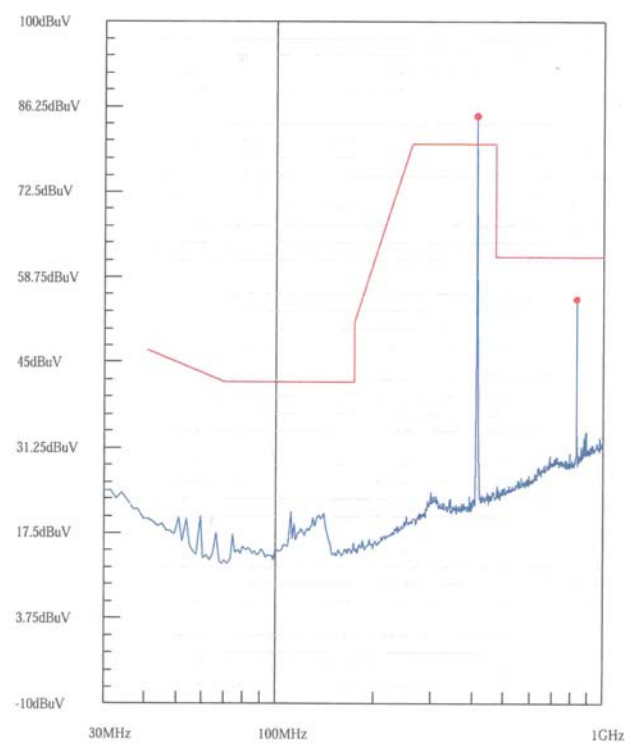
Baek Sung-hyun

Tested by **S. H. Baek**

TEST DATA



Vertical (30~1000MHz)



Horizontal (30~1000MHz)

TEST DATA

Radiated Emissions; Section 15.231

FCC ID : A3LSRCS401RF

Frequency range :30MHz to 1GHz

Detector: Peak

Frequency (MHz)	Reading (dB μ V)	D.C.F (dB)	Pol* (H/V)	AF+CL+Amp (dB)**	Result (dB μ V/m)	Limit (dB μ V/m)
835.98	57.30	-8.85	H	-2.10	46.35	60.30
835.98	47.80	-8.85	V	-2.10	36.85	60.30

Table 2. Radiated Measurements at 3meters

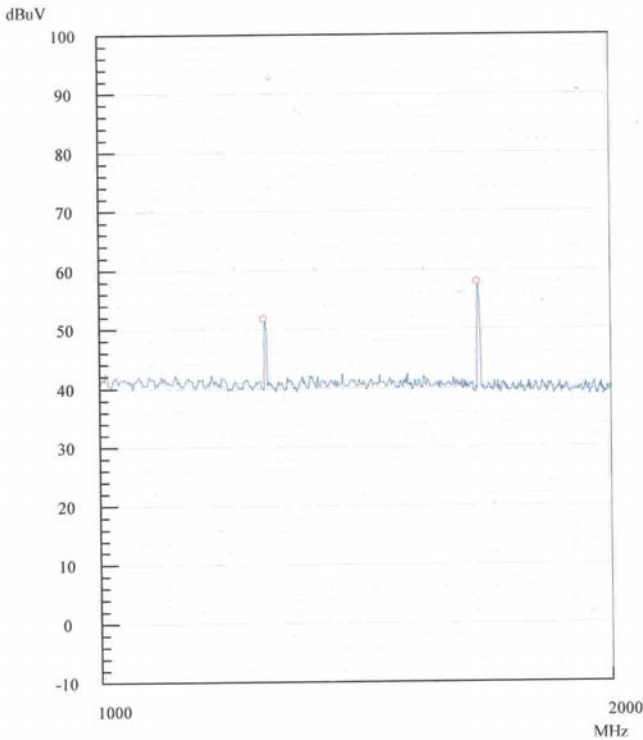
NOTES:

1. *Pol. H =Horizontal V=Vertical
2. **AF+CL+Amp. = Antenna Factor + Cable Loss + Amplifier.
3. "Duty Cycle Factor (D.C.F) = $20\log(9.75\text{msec} + 0.537\text{msec} \times 49) / 100\text{msec}$
= -8.85dB (Please see the page 14)"
4. Please see the test graph at page 12~13.

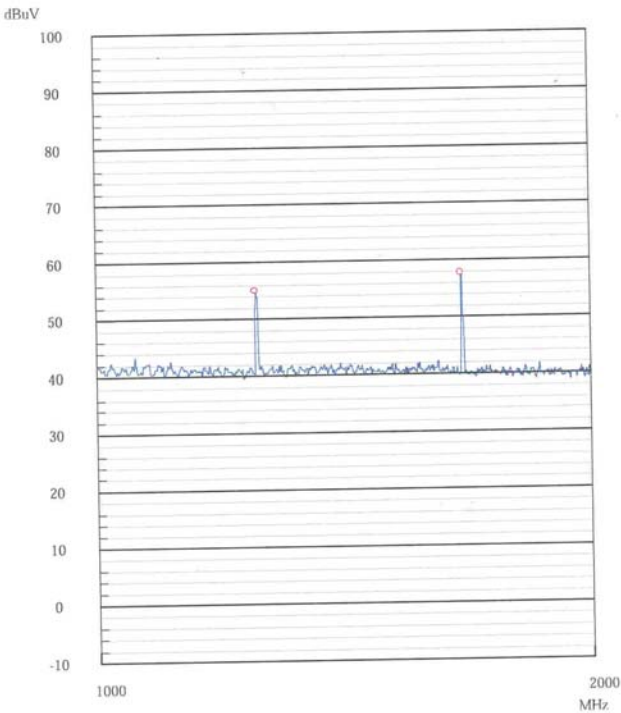


Tested by **S. H. Baek**

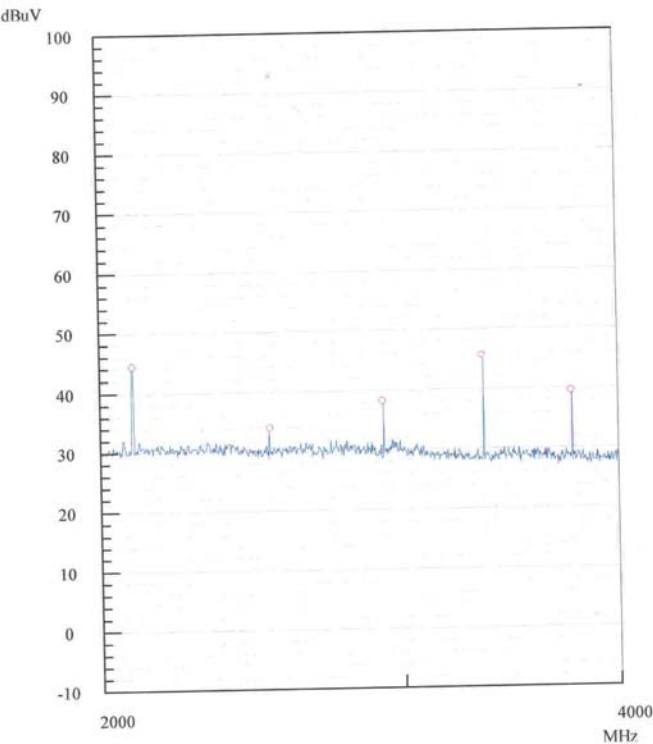
TEST DATA



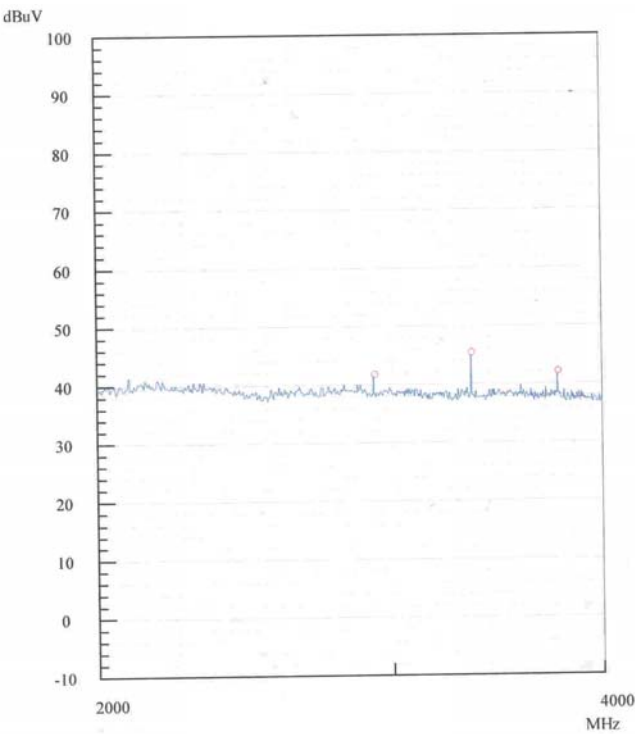
Vertical (1000~2000MHz)



Horizontal (1000~2000MHz)

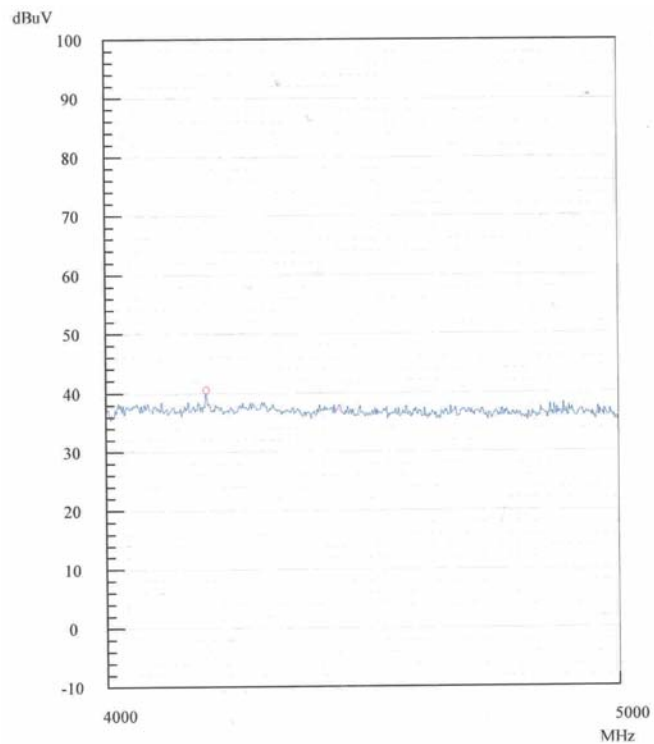


Vertical (2000~4000MHz)

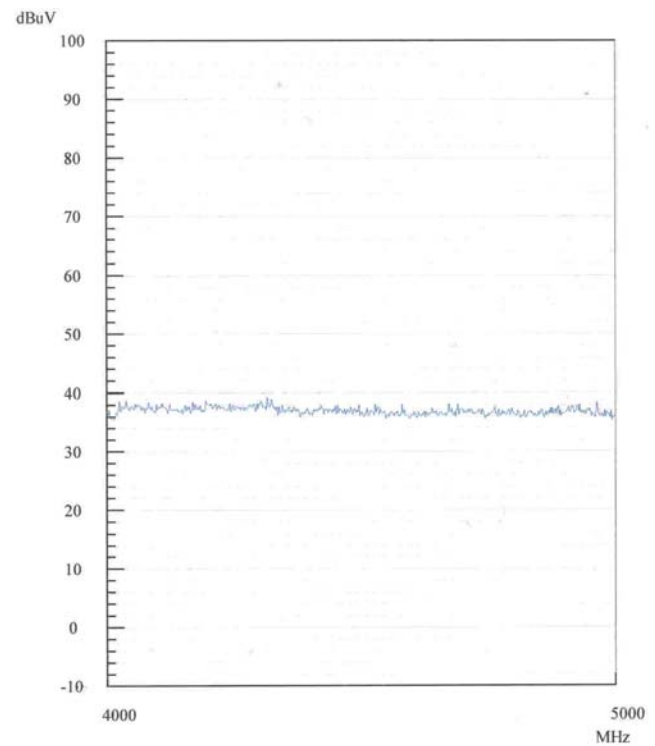


Horizontal (2000~4000MHz)

TEST DATA



Vertical (4000~5000MHz)



Horizontal (4000~5000MHz)

TEST DATA

Radiated Emissions ; Above 70MHz(Section 15.231)

FCC ID : A3LSRCS401RF

Frequency range :Above 1GHz

Detector: Peak

Radiated Spurious Emission Limits

Frequency	Limit (dBuV/m)
Fundamental (417.99MHz)	80.30
Harmonics	60.30
Restricted Band Emission	54.00

Radiated Emission Test Data

Field	Frequency	*)Pol.	Reading (dB μ V)	D.C.F	**)C.L+Amp+A.F	Result (dB μ V/m)	Limit (dB μ V/m)
Strength	(MHz)	(H/V)	PK	(dB)	(dB)	AV	AV
Fundamental	417.99	H	91.90	-8.85	-8.00	75.05	80.30
Fundamental	417.99	V	77.10	-8.85	-8.00	60.25	80.30
Harmonics	835.98	H	57.30	-8.85	-2.10	46.35	60.30
Harmonics	835.98	V	47.80	-8.85	-2.10	36.85	60.30
Harmonics	1253.97	H	55.10	-8.85	-7.88	38.37	60.30
Harmonics	1253.97	V	51.80	-8.85	-7.88	35.07	60.30
Harmonics	1671.96	H	57.80	-8.85	-5.68	43.27	60.30
***) Harmonics	1671.96	V	57.90	-8.85	-5.68	43.37	54.00
Harmonics	2089.95	V	44.40	-8.85	-3.90	31.65	60.30
Harmonics	2507.94	V	34.00	-8.85	-2.33	22.82	60.30
Harmonics	2925.93	V	38.30	-8.85	0.19	29.64	60.30
Harmonics	2925.93	H	41.70	-8.85	0.20	33.05	60.30
Harmonics	3343.92	V	45.50	-8.85	1.43	38.08	60.30
***) Harmonics	3343.92	H	45.30	-8.85	1.50	37.95	54.00
***) Harmonics	3761.91	V	51.80	-8.85	4.00	46.95	54.00
***) Harmonics	3761.91	H	42.00	-8.85	4.10	37.25	54.00

Table 4. Radiated Measurements at 3meters

NOTES:

1. *Pol. H =Horizontal V=Vertical
2. **CL+Amp+AF = Cable Loss + Amplifier + Antenna Factor
3. *** The limit at § 15.205 restricted bands of operation is the table shown in § 15.209.
4. The Antenna is manipulated through typical positions and length during the tests.
5. The emissions are maximized by changing polarity of the antenna.
6. The preliminary radiated emissions testing was made by rotating through three orthogonal axes.
The emissions through orthogonal axes "X" is worst case data. The position shows in photograph page 21.
7. The bandwidth of the emission at 20dB point shall be no wider than 0.25% of the center frequency.
8. Up to the 10th harmonics were investigated according to § 15.33 and the worst –case is reported.
9. "Duty Cycle Factor (D.C.F) = $20\log (36.06 / 100) = -8.85\text{dB}$ (Please see the page 14)

A handwritten signature in blue ink, appearing to read 'Baek Sung-hun'.

Tested by **S. H. Baek**

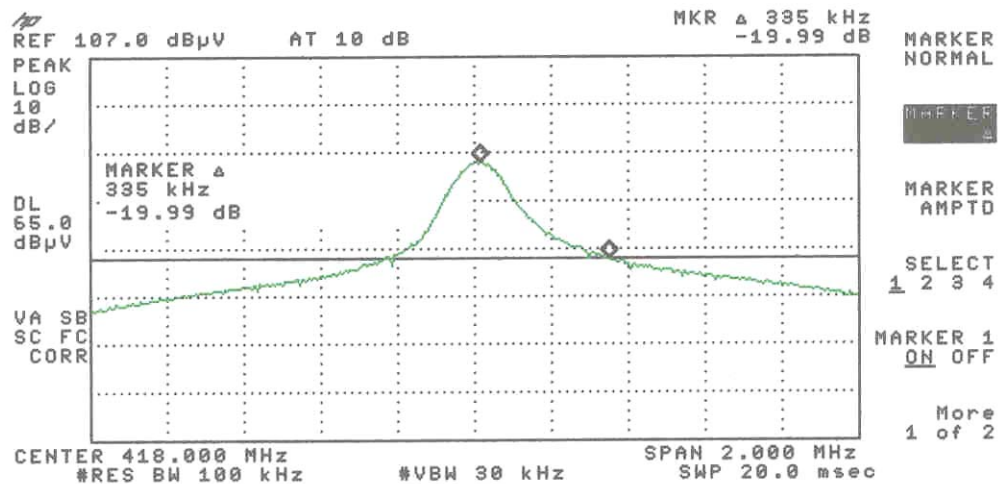
PLOTS OF EMISSIONS(Section 15.231(c))

Occupied bandwidth was performed by coupling the output of the EUT to the input of a spectrum analyzer.

FCC Part 15.231 states that the 20dB bandwidth of the modulated carrier shall be no greater than the limits shown in the following Table.

Frequency Range (MHz)	Occupied Bandwidth Limit
70-900MHz	0.25%

Occupied bandwidth Test Data



Occupied bandwidth Test Results

Frequency (MHz)	Bandwidth	Limit	Pass/Fail
417.99MHz	670.0KHz	1.044MHz	Pass

Figure of Duty Cycle(Section 15.35(c))

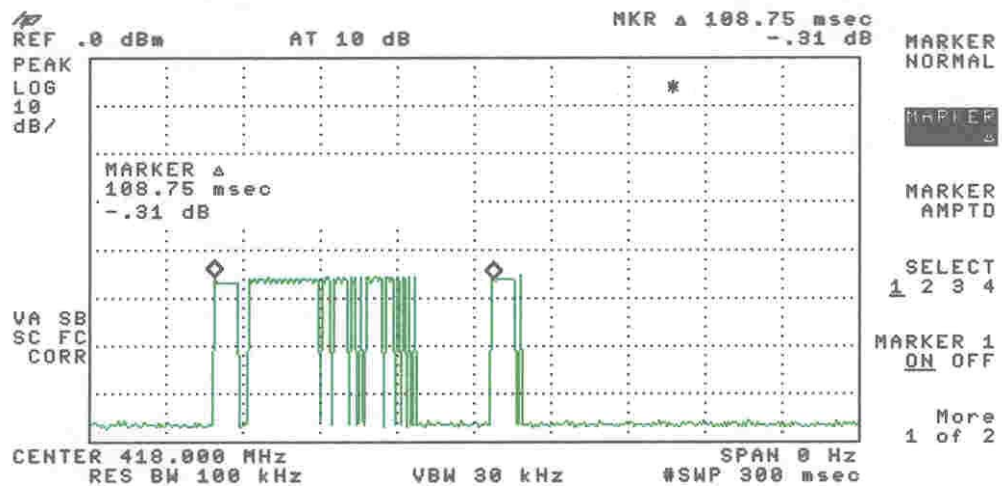
Duty Cycle Correction

Measurements may be adjusted where pulsed RF is utilized to find the average level associated with a quantity.

This calculation is applied to limits for pulsed licensed and unlicensed devices

The following show the plots of the modulated carrier. The spectrum analyzer was set to Zero Span. Calculations of the duty cycle correction factor were obtained from time provided by the plots.

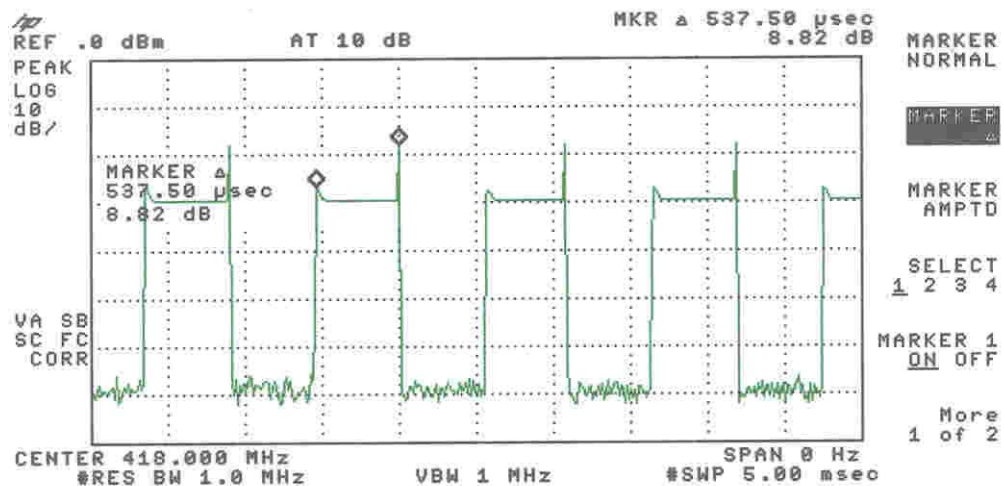
1. Total Time Per Code Group Test Data



Total Time = 108.75 msec (Period)

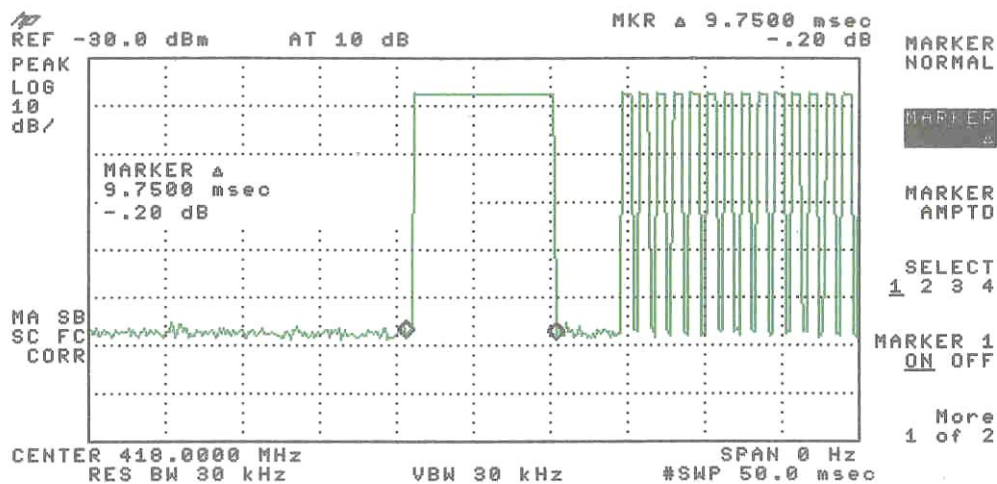
Figure of Duty Cycle(Section 15.35(c))

2.1 On Time Group Test Data



On Time Group = 0.537 msec * 49EA = 26.313 msec

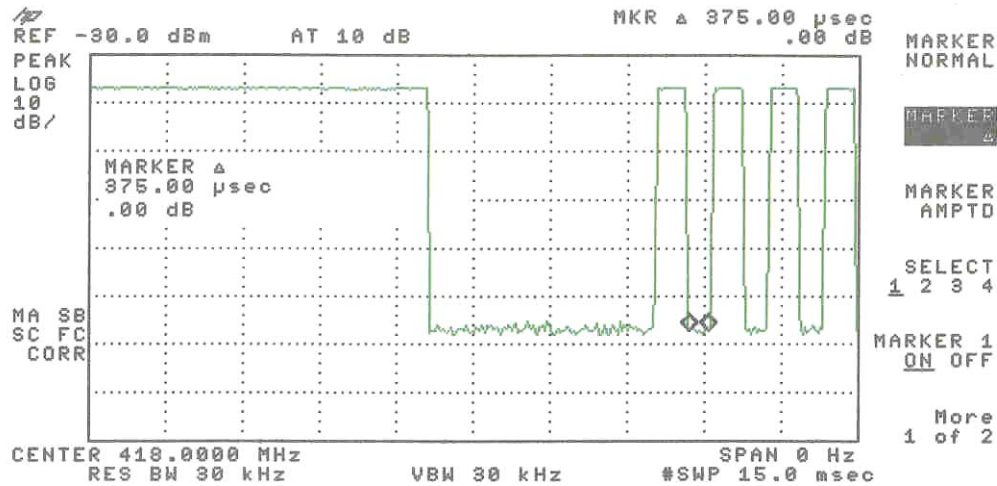
2.2 On Time Group Test Data



On Time Group = 9.75 msec

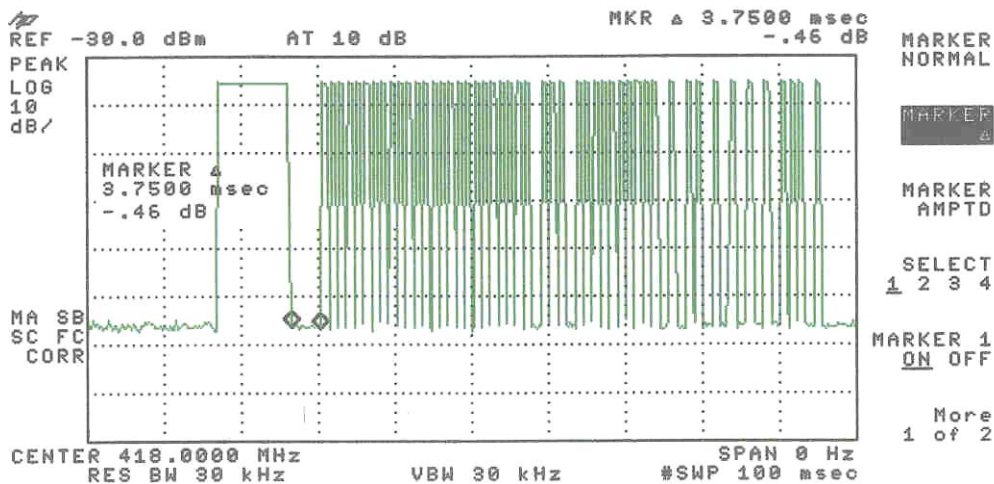
Figure of Duty Cycle(Section 15.35(c))

3.1 OFF Time Group Test Data



OFF Time Group = 0.375 msec

3.2 OFF Time Group Test Data



OFF Time Group = 3.75 msec

Figure of Duty Cycle(Section 15.35(c))

From the data in Figure the following calculations are made.

On Time Group : $9.75\text{msec} + 0.537\text{msec} * 49\text{EA} = 36.063\text{msec}$

Total Time = $108.75\text{ msec} > 100\text{msec}$

Duty Cycle Factor (D.C.F) = $20\log (36.06 / 100) = -8.85\text{dB}$

** The measured field strength shall be determined from the average absolute voltage during a 0.1 second*

ACCURACY OF MEASUREMENT

The Measurement Uncertainties stated were calculated in accordance with the requirements of NIST Technical Note 1297 with the confidence level of 95%

1. Radiation Uncertainty Calculation

Contribution	Probability Distribution	Uncertainty(+/-dB)
Antenna Factor	Normal (k=2)	± 0.5
Cable Loss	Normal (k=2)	± 0.04
Receiver Specification	Rectangular	± 2.0
Antenna directivity	Rectangular	± 1.0
Antenna Factor variation with Height		
Antenna Phase Center Variation		
Antenna Factor Frequency Interpolation		
Measurement Distance Variation		
Site Imperfections	Rectangular	± 2.0
Mismatch:Receiver VRC $r_i=0.3$ Antenna VRC $r_R=0.1(B_i)0.4(L_p)$ Uncertainty Limits $20\text{Log}(1\pm r_i r_R)$	U-Shaped	$+ 0.25 / - 0.26$
System Repeatibility	Std.deviation	± 0.05
Repeatability of EUT	-	-
Combined Standard Uncertainty	Normal	± 1.77
Expended Uncertainty U	Normal (k=2)	± 3.5

2. Conducted Uncertainty Calculation

Contribution	Probability Distribution	Uncertainty(+/-dB)
Receiver Specification	Normal (k=2)	± 2.0
LISN coupling spec.	Normal (k=2)	± 0.4
Cable and input attenuator cal.	Rectangular	± 0.4
Mismatch:Receiver VRC $r_i=0.3$ LISN vrc $r_g=0.1$ Uncertainty Limits $20\text{Log}(1\pm r_i r_R)$	U-Shaped	± 0.26
System Repeatibility	Std.deviation	± 0.68
Repeatability of EUT	-	-
Combined Standard Uncertainty	Normal	± 1.18
Expended Uncertainty U	Normal (k=2)	± 2.4

TEST EQUIPMENT

No.	Instrument	Manufacturer	Model	Calibration Date
1	*Test Receiver	R & S	ESCS 30	2003.09
2	*Amplifier	HP	8447F	2004.01
3	*Amplifier	HP	8449B	2003.07
4	Spectrum Analyzer	Advantest	R3265A	2003.12
5	*Spectrum Analyzer	HP	8566B	2003.03
6	*Logbicon Super Antenna	Schwarzbeck	VULB9166	2003.05
7	*Doppels Teg Horn	EMCO	DAA-37121	2003.10
8	Dipole Antenna	R & S	VHA9103	2003.05
9	Dipole Antenna	R & S	UHA9105	2003.05
10	Biconical Log Antenna	ARA	LPB-2520/A	2003.05
11	Absorbing Clamp	R & S	MDS21	2003.06
12	High Voltage Probe	R & S	ESH2-Z3	2003.10
13	Signal Generator	R & S	SMP02	2003.03
14	Matching Pad	R & S	RAM358.5414.02	2003.05
15	LISN	R & S	ESH3-Z5	2003.11
16	LISN	Kyoritsu	KNW-407	2003.04
17	LISN	Kyoritsu	KNW-408	2003.12
18	*Position Controller	EM Eng.	N/A	N/A
19	*Turn Table	EM Eng.	N/A	N/A
20	*Antenna Mast	EM Eng.	N/A	N/A
21	*Anechoic Chamber	EM Eng.	N/A	N/A

*) Test equipment used during the test