





## Nemko Korea CO., Ltd.

300-2, Osan-Ri, Mohyun-Myun, Yongin-City, Kyungki-Do, KOREA TEL:+82 31 322 2333 FAX:+82 31 322 2332

#### FCC EVALUATION REPORT FOR CERTIFICATION

#### **Applicant:**

Samsung Electro-Mechanics Co., Ltd. Dates of Issue: September 20, 2004

416, Maetan3-Dong, Paldal-Gu, Test Report No.: NK2ER176

Suwon-Shi, Kyunggi-Do, Rep.of Korea Test Site: Nemko Korea Co., Ltd.

Attn: Mr. JunHwan, Lim EMC site, Korea

FCC ID

E2XSPP1000T

**CONTACT PERSON** 

Samsung Electro-Mechanics Co.,Ltd 416, Maetan3-Dong, Paldal-Gu, Suwon-Shi, Kyunggi-Do, Rep.of Korea Mr. JunHwan, Lim Telephone No.: +82 31 210 6497

FCC Rule Part(s): Part 15 & 2

Classification: Part 15 Subpart C –Intentional Radiators

EUT Type: Presenter

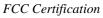
Out Frequency: 2404.5~2480.5 MHz

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 C63.4-2001.

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 : Seob Lee** 

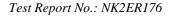
Reviewed By : H.H. Kim





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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 Electro-Mechanics Co., Ltd.

**Contact Person :** Mr. JunHwan, Lim

Tel: +82 31 210 6497

Manufacturer: 1.Samsung Electro-Mechanics Co., Ltd.

314, Maetan3-Dong, Paldal-Gu, Suwon-Shi, Kyunggi-Do,

Korea, 442-743.

2.Dongguan Samsung Electro-Mechanics Co.,Ltd

Quan-Tang Village,Liao-Bu Town,Dong-Quan City,

Quang-Dong Province P.R China, 523425

FCC ID: E2XSPP1000TModel: SPP1000TEUT Type: Presenter

• Classification: Part 15 Subpart C – Intentional Radiators

Rule Part(s): FCC Part 15 & Part 2Test Procedure(s): ANSI C63.4 (2001)

Dates of Test: September 06, 2004 to September 20, 2004

Place of Tests: Nemko Korea Co., Ltd. EMC Site

Test Report No.: NK2ER176



#### 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 Electro-Mechanics Co., Ltd.

FCC ID: E2XSPP1000T, Presenter.

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 June 06, 1992.

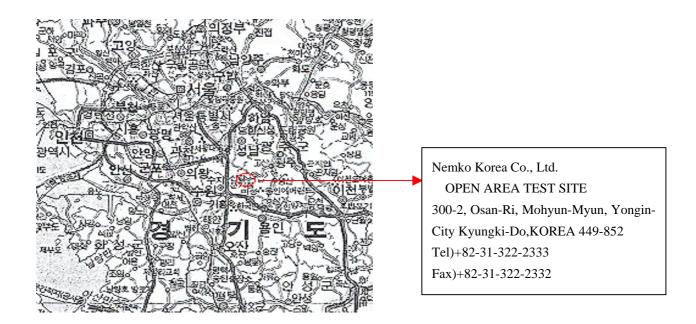


Fig. 1. The map above shows the Seoul in Korea vicinity area.

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



### TEST CONDITIONS & EUT INFORMATION

### **Operating During Test**

The EUT was operated at the test mode continuously.

### **Operational Description**

When the button is pressed, the battery applies 3V DC. And the data to be saving is input at EEPROM to PIN 4,5 of the RF chip(nRF24E2). The LED action will be shown.

And finally the modulated signal is amplified through U1 (RF Chip) then radiated to the Antenna at air.

### **EUT Information**

Chipset(s):	U1 (nRF24F2)
Clock(s):	X1 (16MHz)
RF Frequency:	2404.5~2480.5MHz
Method :	GFSK Format
Power Supply	3.0V,AAA size Battery 2 pcs



### **SUMMARY OF TEST RESULTS**

The EUT has been tested according to the following specification:

Name of Test	Paragraph No.	Result	Remark
Power line Conducted Emission	15.207	N/A	EUT is operated by 3V batteries
Radiated Emission( Spurious )	15.209	Complies	
Radiated Emission( Fundamental )	15.249	Complies	

### RECOMMENDATION/CONCLUSION

The data collected shows that the **Samsung Electro-Mechanics Co., Ltd.** FCC ID: **E2XSPP1000T, Presenter.** complies with \$ 15.209,15.249 of the FCC Rules.

#### SAMPLE CALCULATION

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

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

#### EX. 1.

@2404 MHz

§ 15.249 limit = 50 mV/m = 94 dB  $\mu$ V/m

Reading = 43.60 dB  $\mu V$  (calibrated level)

Antenna factor + (Cable Loss + Amplifier) = 28.53 + (4.65 - 33.1) = 0.08dB

Total =  $43.60 + 0.08 = 43.68 \text{ dB } \mu\text{V/m}$ 

Margin = 94.0 - 43.68 = 50.32dB

50.32 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, Above 1GHz, Horn antenna (Scwarzbeck BBHA 9120D: upto 18GHz) was used.

Final Measurements were made outdoors at 3 or 10m test range using Logbicon Super Antenna(Schwarzbeck, VULB9166) or Horn antenna. (Schwarzbeck BBHA9120D:upto18GHz, BBHA9170:Upto40GHz) 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.

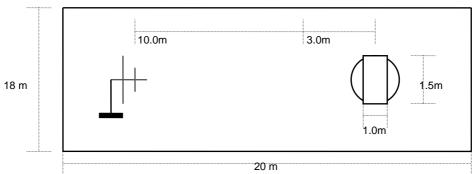
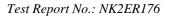


Fig. 2. Dimensions of Outdoor Test Site







## § 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 s unique coupling to the intentional radiator shall be considered sufficient to comply with this requirement.



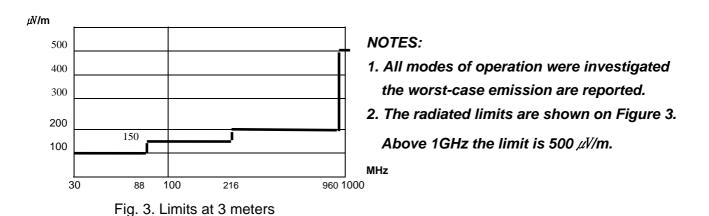
### Radiated Emissions; general requirements(Section 15.209)

FCC ID: E2XSPP1000T

Frequency	Reading	Pol*	AF+CL+Amp	Result	Limit	Margin
(MHz)	$(dB\mu V)$	(H/V)	(dB) **	$(dB\mu V/m)$	$(dB\mu V/m)$	(dB)
-	-	-	-	-	-	1

<sup>\*)</sup> Any emission appearing on frequencies wasn't detected during radiated disturbance measurements.

**Table 1. Radiated Measurements at 3meters** 



#### **NOTES:**

1. \*Pol. H =Horizontal V=Vertical

2. \*\*AF+CL+Amp. = Antenna Factor + Cable Loss + Amplifier.

Tested by Seob. Lee

<sup>\*\*)</sup> All modes of operation were investigated and the worst -case emission are reported.



Radiated Emissions; Above 1000MHz(Section 15.249)

FCC ID: E2XSPP1000T

Fundamental Frequency : CH1(2404.5MHz)

**Operating Mode: Transmitting** 

**Radiated Spurious Emission Limits** 

Frequency	Limit (dBuV/m)
Fundamental (2404.5~2480.5MHz)	94.00
Harmonics	54.00

#### **Radiated Emission Test Data**

Field	Frequency	*)Pol.	Reading (dBµV)	D.C.F	**) C.L+Amp+A.F	Result (dBµV/m)	Limit (dBµV/m)	Margin
Strength	(MHz)	(H/V)	PK	(dB)	(dB)	AV	AV	(dB)
Spurious	2311.60	Н	61.00	-46.9	-0.07	14.13	54.00	39.87
Spurious	2311.60	V	55.80	-46.9	-0.07	8.93	54.00	45.07
Spurious	2363.90	Н	59.70	-46.9	0.00	12.81	54.00	41.19
Spurious	2363.90	V	56.40	-46.9	0.00	9.51	54.00	44.49
Fundamental	2404.50	Н	90.50	-46.9	0.08	43.60	94.00	50.40
Fundamental	2404.50	V	87.30	-46.9	0.08	40.40	94.00	53.60
Harmonics	4809.00	Н	60.20	-46.9	8.37	13.29	54.00	40.71
Harmonics	4809.00	V	59.80	-46.9	8.37	12.89	54.00	41.11
Harmonics	7213.80	Н	48.20	-46.9	12.75	1.26	54.00	52.74
Harmonics	7213.80	V		-46.9	12.75		54.00	
Harmonics	9618.60	Н	47.00	-46.9	18.40	0.11	54.00	53.89
Harmonics	9618.60	V		-46.9	18.40		54.00	

**Table 4. Radiated Measurements at 3meters** 



FCC ID: E2XSPP1000T

Fundamental Frequency : CH37(2440.5MHz)

**Operating Mode: Transmitting** 

#### **Radiated Spurious Emission Limits**

Frequency	Limit (dBuV/m)
Fundamental (2404.5~2480.5MHz)	94.00
Harmonics	54.00

#### **Radiated Emission Test Data**

Field	Frequency	*)Pol.	Reading (dBµV)	D.C.F	**) C.L+Amp+A.F	Result (dBµV/m)	Limit (dBµV/m)	Margin
Strength	(MHz)	(H/V)	PK	(dB)	(dB)	AV	AV	(dB)
Spurious	2420.00	Н	55.80	-46.9	0.20	8.92	54.00	45.08
Spurious	2420.00	V	52.50	-46.9	0.20	5.62	54.00	48.38
Fundamental	2440.50	Н	89.00	-46.9	0.36	42.14	94.00	51.86
Fundamental	2440.50	V	84.70	-46.9	0.36	37.84	94.00	56.16
Spurious	2477.00	Н	53.90	-46.9	0.64	6.98	54.00	47.02
Spurious	2477.00	V	49.30	-46.9	0.64	2.38	54.00	51.62
Spurious	2541.20	Н	49.90	-46.9	1.09	3.02	54.00	50.98
Spurious	2541.20	V	50.50	-46.9	1.09	3.62	54.00	50.38
Harmonics	4881.40	Н	55.00	-46.9	8.49	8.08	54.00	45.92
Harmonics	4881.40	V	53.00	-46.9	8.49	6.08	54.00	47.92
Harmonics	7322.00	Н	48.20	-46.9	13.04	1.31	54.00	52.69
Harmonics	7322.00	V		-46.9	13.04		54.00	
Harmonics	9762.80	Н	48.20	-46.9	18.23	1.26	54.00	52.74
Harmonics	9762.80	V		-46.9	18.23		54.00	

**Table 4. Radiated Measurements at 3meters** 



FCC ID: E2XSPP1000T

Fundamental Frequency : CH77(2480.5MHz)

**Operating Mode: Transmitting** 

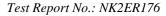
#### **Radiated Spurious Emission Limits**

Frequency	Limit (dBuV/m)
Fundamental (2404.5~2480.5MHz)	94.00
Harmonics	54.00

#### **Radiated Emission Test Data**

Field	Frequency	*)Pol.	Reading (dBµV)	D.C.F	**) C.L+Amp+A.F	Result (dB\(\mu\)V/m)	Limit (dBµV/m)	Margin
Strength	(MHz)	(H/V)	PK	(dB)	(dB)	AV	AV	(dB)
Spurious	2420.00	Н	56.20	-46.9	0.20	9.32	54.00	44.68
Spurious	2420.00	V	55.60	-46.9	0.20	8.72	54.00	45.28
Spurious	2446.60	Н	57.20	-46.9	0.40	10.25	54.00	43.75
Spurious	2446.60	V	48.90	-46.9	0.40	1.95	54.00	52.05
Fundamental	2480.50	Н	86.60	-46.9	0.66	39.68	94.00	54.32
Fundamental	2480.50	V	80.10	-46.9	0.66	33.18	94.00	60.82
Spurious	2508.40	Н	54.60	-46.9	0.87	7.70	54.00	46.30
Spurious	2508.40	V	51.60	-46.9	0.87	4.70	54.00	49.30
Spurious	2541.20	Н	54.20	-46.9	1.09	7.32	54.00	46.68
Spurious	2541.20	V	8.20	-46.9	1.09	1.32	54.00	
Harmonics	4961.40	Н	53.60	-46.9	8.63	6.66	54.00	47.34
Harmonics	4961.40	V	53.60	-46.9	8.63	6.66	54.00	
Harmonics	7442.10	Н	48.50	-46.9	13.44	1.59	54.00	52.41
Harmonics	7442.10	V		-46.9	13.44		54.00	
Harmonics	9922.70	Н	48.10	-46.9	17.87	1.15	54.00	52.85
Harmonics	9922.70	V		-46.9	17.87		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 Antenna is manipulated through typical positions and length during the tests.
- 4.Remark "---" means that the emissions level is too low to be measured
- 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.

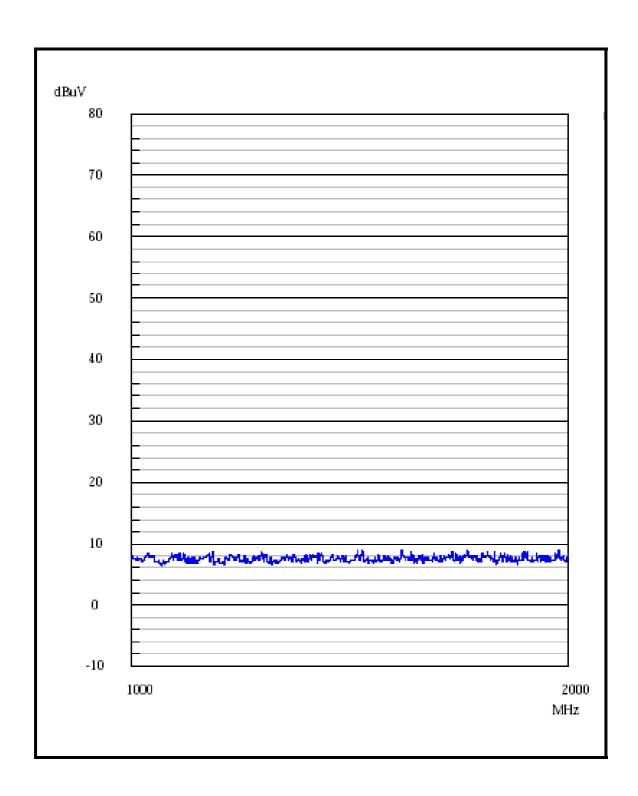
The emissions through orthogonal axis "Y" is worst case data. The position shows in photograph page 21.

- 7. Up to the 10<sup>th</sup> harmonics were investigated according to § 15.33 and the worst –case is reported.
- 8. "Duty Cycle Factor (D.C.F) =  $20\log(0.45 / 100) = -46.9dB$  (Please see the page 28)

Tested by Seob.Lee



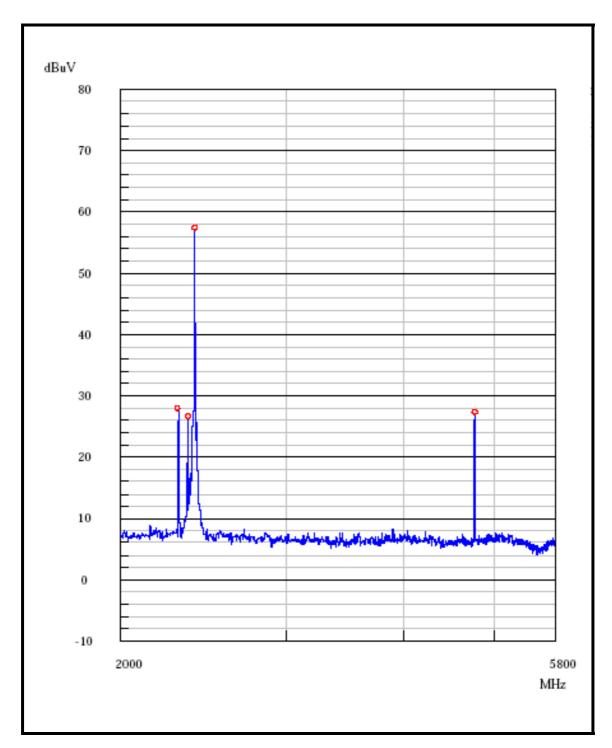
Frequency: CH1(2404.5MHz)
Horizontal Y-axis (1GHz~2GHz)





Frequency: CH1(2404.5MHz)

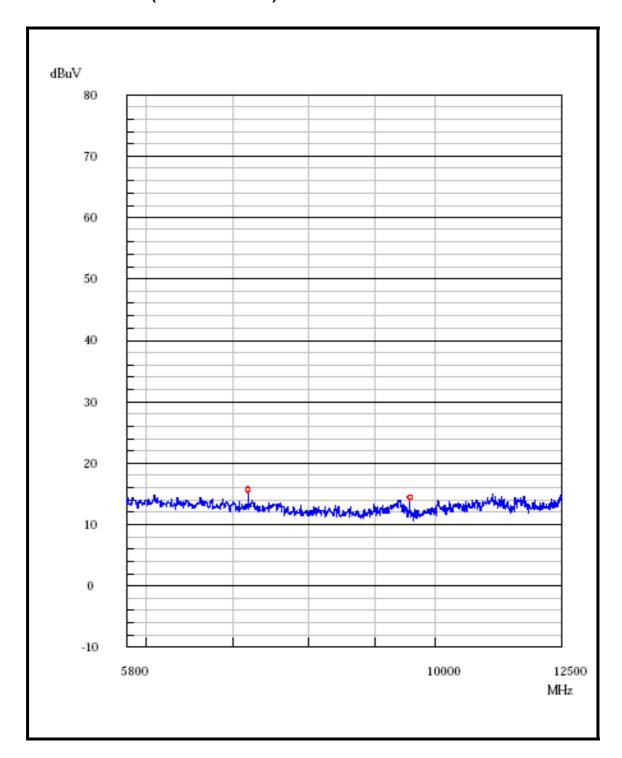
Horizontal Y-axis (2GHz~5.8GHz)





Frequency: CH1(2404.5MHz)

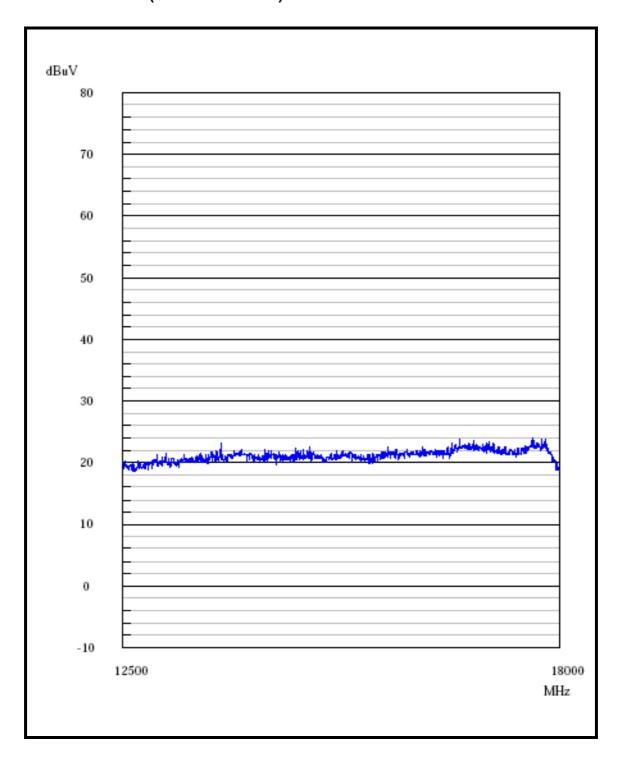
Horizontal X-axis (5.8GHz~12.5GHz)





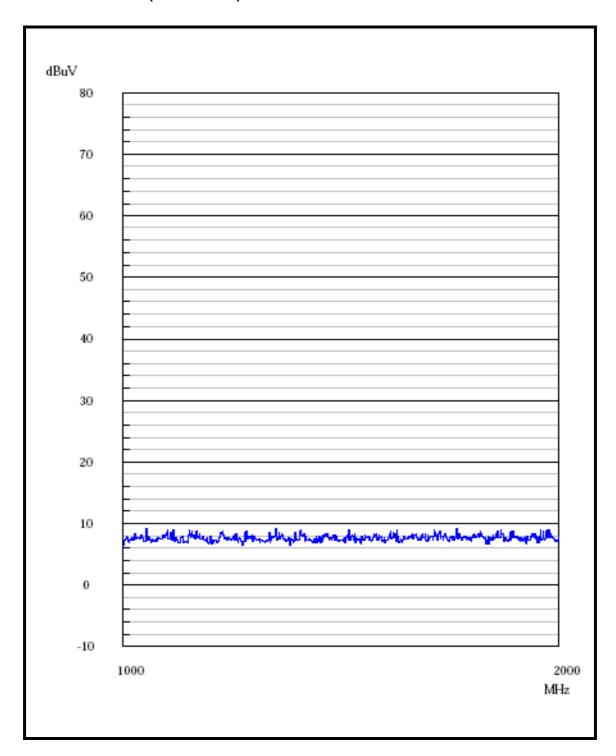
Frequency: CH1(2404.5MHz)

Horizontal X-axis (12.5GHz~18.0GHz)



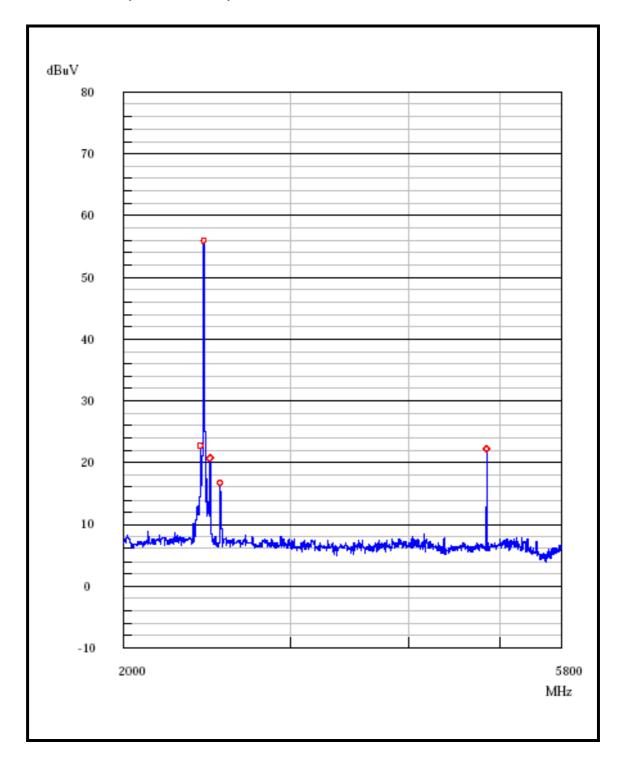


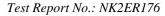
Frequency: CH37(2440.5MHz)
Horizontal Y-axis (1GHz~2GHz)

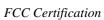




Frequency: CH37(2440.5MHz)
Horizontal Y-axis (2GHz~5.8GHz)



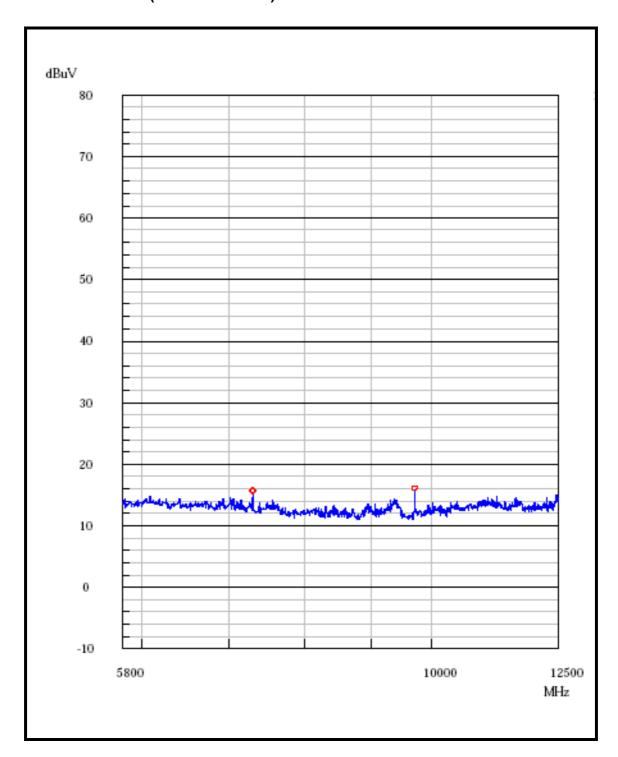






Frequency: CH37(2440.5MHz)

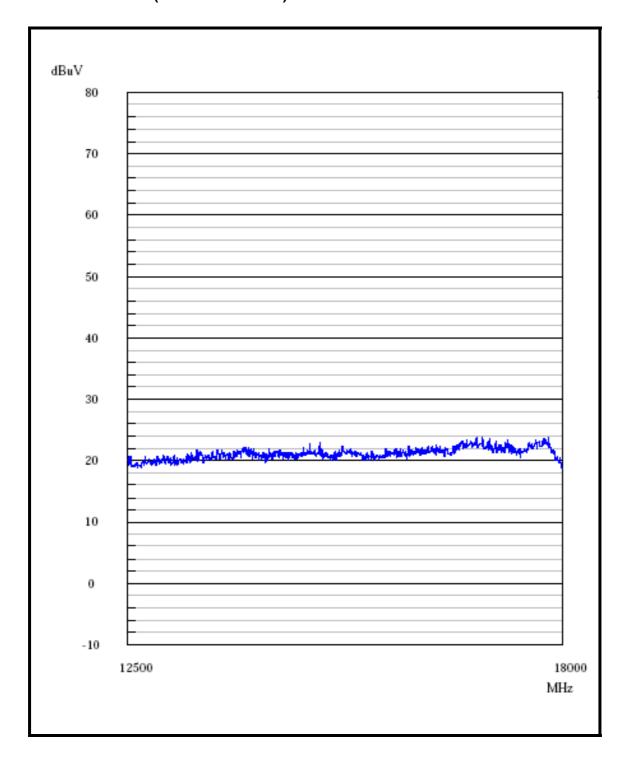
Horizontal X-axis (5.8GHz~12.5GHz)





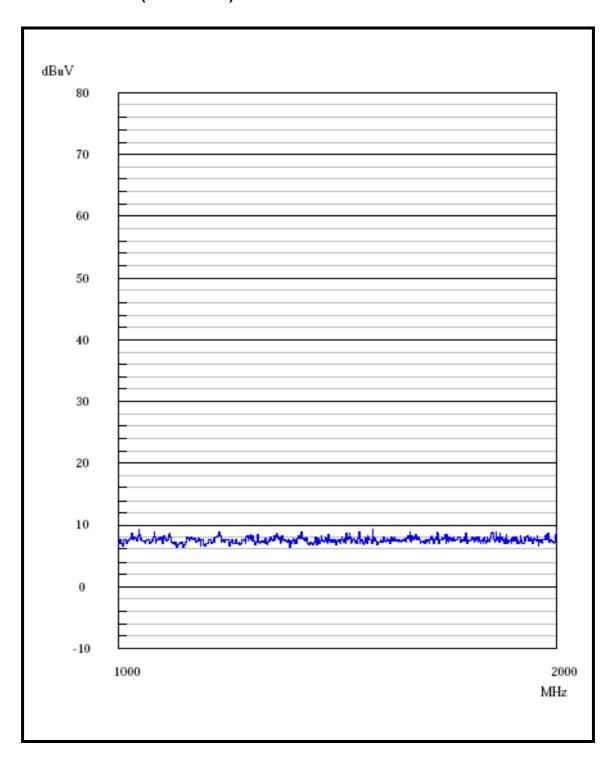
Frequency: CH37(2440.5MHz)

Horizontal X-axis (12.5GHz~18.0GHz)



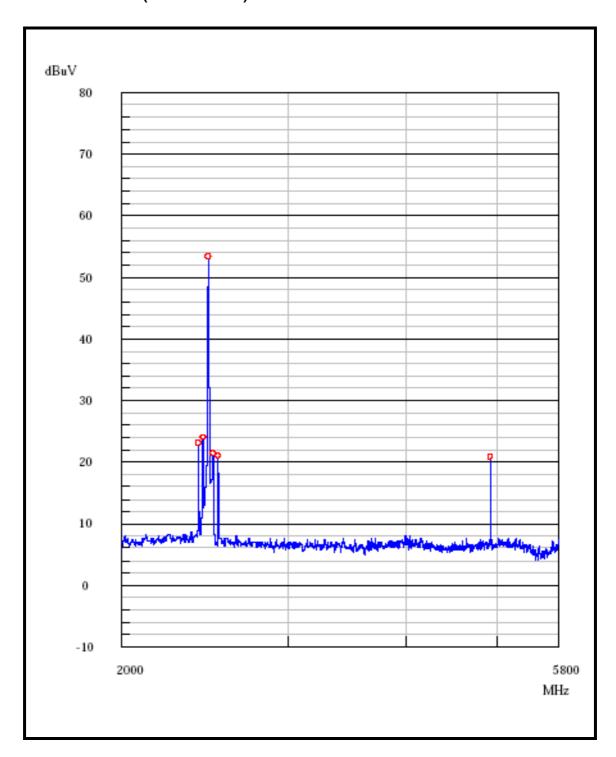


Frequency: CH77(2480.5MHz)
Horizontal Y-axis (1GHz~2GHz)





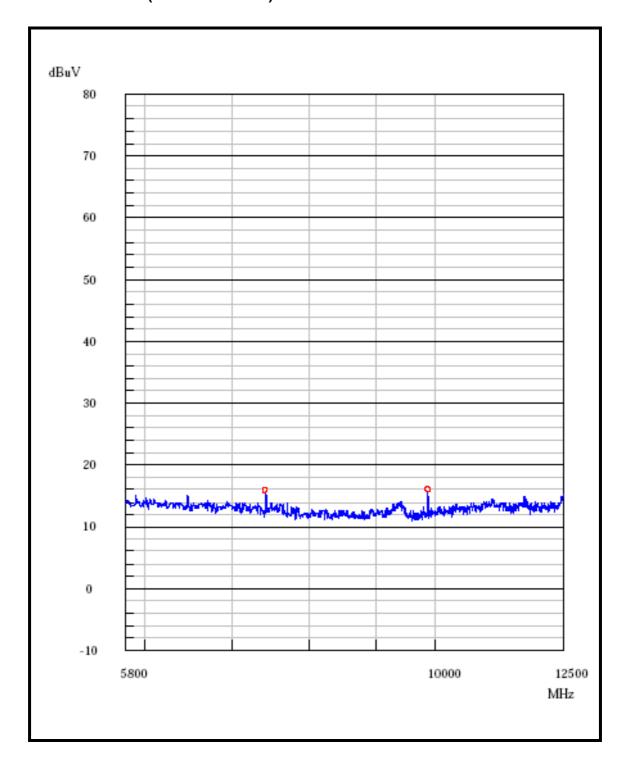
Frequency: CH77(2480.5MHz)
Horizontal Y-axis (2GHz~5.8GHz)





Frequency: CH77(2480.5MHz)

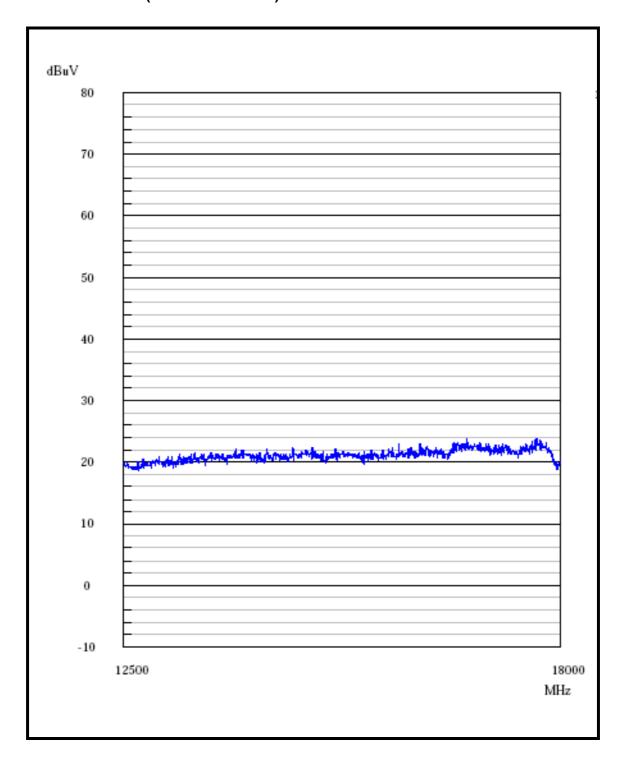
Horizontal X-axis (5.8GHz~12.5GHz)





Frequency: CH77(2480.5MHz)

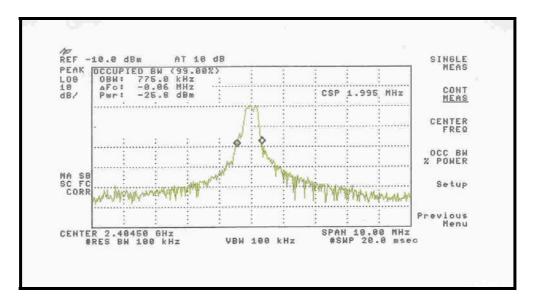
Horizontal X-axis (12.5GHz~18.0GHz)



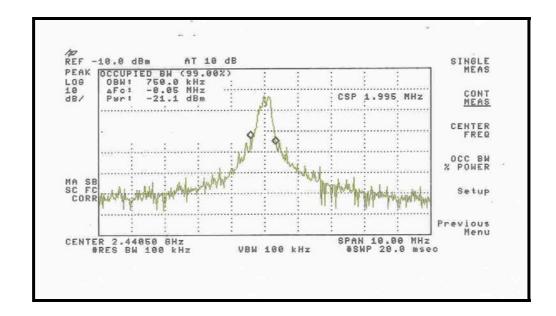


Occupied bandwidth was performed by coupling the output of the EUT to the input of a spectrum analyzer.

Fundamental Frequency: CH1(2404.5MHz)

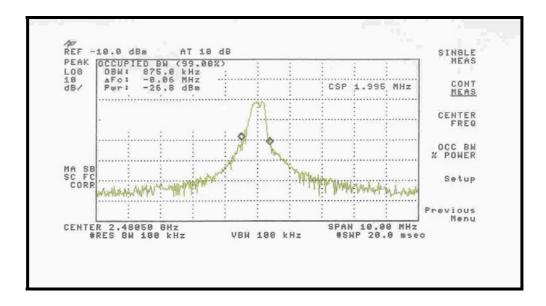


#### Fundamental Frequency: CH37(2440.5MHz)





### Fundamental Frequency : CH37(2440.5MHz)



#### Occupied bandwidth Test Results

Frequency (MHz)	Bandwidth
2404.5MHz	775.0KHz
2440.5MHz	750.0KHz
2480.5MHz	875.0KHz



### Figure of Duty Cycle(Section 15.35(c))

### **Duty Cycle Correction**

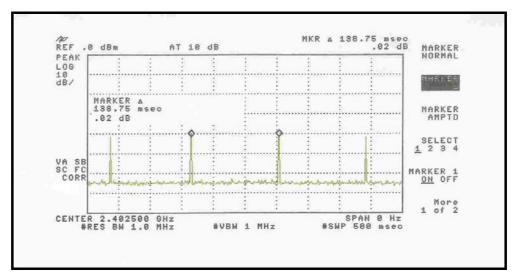
Measurements may be adjusted where pulsed RF is utilized to find the average level associated with a quantity.

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

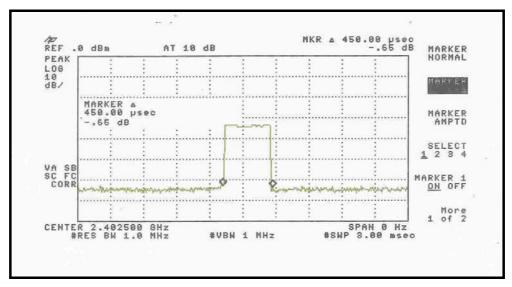


Total Time = 138.75 msec (Period)



## Figure of Duty Cycle(Section 15.35(c))

#### 2.On Time Test Data



On Time = 450usec

# Figure of Duty Cycle(Section 15.35(c))

From the data in Figure the following calculations are made.

On Time : 450usec

**Total Time = 138.75 msec > 100msec** 

Duty Cycle Factor (D.C.F) =  $20\log(0.45/100) = -46.9dB$ 

<sup>\*</sup> 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		
Antenna Factor variation with Height		
Antenna Phase Center Variation	Rectangular	± 1.0
Antenna Factor Frequency Interpolation		
Measurement Distance Variation		
Site Inperfections	Rectangular	± 2.0
Mismatch:Receiver VRC ri=0.3		
Antenna VRC rR=0.1(Bi)0.4(Lp)	U-Shaped	+ 0.25 / - 0.26
Uncertainty Limits 20Log(1+/-ri rR)		
System Repeatibilty	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 ri=0.3		
LISN vrc rg=0.1	U-Shaped	± 0.26
Uncertainty Limits 20Log(1+/-ri rR)		
System Repeatibilty	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	<b>Calibration Date</b>
1	*Test Receiver	R & S	ESCS 30	2004.08
2	Test Receiver	R & S	ESCS 30	2003.12
3	*Amplifier	HP	8447F	2004.01
4	Amplifier	НР	8447D	2004.07
5	*Spectrum Analyzer	Advantest	R3265A	2004.12
6	*Spectrum Analyzer	НР	8566B	2004.03
7	*Logbicon Super Antenna	Schwarzbeck	VULB9166	2004.05
8	* Horn Antenna	<b>Electro-Metrics</b>	RGA-60	2003.10
9	* Horn Antenna	<b>Electro-Metrics</b>	RGA-60	2003.12
10	Dipole Antenna	R & S	VHA9103	2004.05
11	Dipole Antenna	R & S	UHA9105	2004.05
12	*Biconical Log Antenna	ARA	LPB-2520/A	2004.05
13	High Voltage Probe	R & S	ESH2-Z3	2003.10
14	Signal Generater	R & S	SMP02	2004.03
15	LISN	R & S	ESH3-Z5	2003.11
16	LISN	Kyoritsu	KNW-407	2004.03
17	LISN	Kyoritsu	KNW-408	2003.12
18	CDN	FCC	NCD-T4	2004.05
19	CDN	FCC	NCD-T2	2004.05
20	*Position Controller	Seoyoung EMC	N/A	N/A
21	*Turn Table	Seoyoung EMC	N/A	N/A
22	*Antenna Mast	Seoyoung EMC	N/A	N/A
23	*Anechoic Chamber	Seoyoung EMC	N/A	N/A
24	Shielded Room	EM Eng.	N/A	N/A

<sup>\*)</sup> Test equipment used during the test



### APPENDIX A - SAMPLE LABEL

### **Labelling Requirements**

The sample label shown shall be *permanently affixed* at a conspicuous location on the device and be readily visible to the user at the time of purchase.

\*\*\* The following paragraph specified in the user manual.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

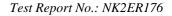


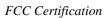


## APPENDIX D- BLOCK DIAGRAM



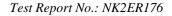
## APPENDIX E - USER'S MANUAL

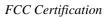






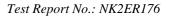
# APPENDIX F – Schematic Diagrams

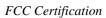






# APPENDIX G – Pattern Diagrams







## APPENDIX H - Part List