Nemko Korea CO., Ltd.

300-2, Osan-Ri, Mohyun-Myun, Yongin-City, Kyungki-Do, KOREA
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FCC EVALUATION REPORT FOR CERTIFICATION

Manufacturer:
Young Electronics Corporation.
609-2,Hyosung-dong, Kaeyang-ku, Incheon
Korea
Attn : Mr. Jae-Beom, Joo

Dates of Issue : February 13, 2003
Test Report No. : NK2DE027
Test Site : Nemko Korea Co., Ltd.
EMC site, Korea

FCC ID

QT2EMS2YOUNG

CONTACT PERSON

Young Electronics Corporation.
609-2, Hyosung-dong, Kaeyang-ku, Incheon
Korea
Mr. Jae-Beom, Joo
Telephone No. : +82 32 554 5347

FCC Rule Part(s):	Part 15 & 2
Classification :	Part 15 Subpart C – Intentional Radiators
EUT Type:	RF Remote Controller
Output Frequency:	310MHz

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 : C. S. Choi
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* :	Young Electronics Corporation.
Contact Person :	Mr. Jae-Beom, Joo
Manufacturer :	Young Electronics Corporation. 609-2, Hyosung-dong, Kaeyang-ku, Incheon, Korea Tel : +82 32 554 5347/Fax : +82 32 554 5349

- FCC ID: QT2EMS2YOUNG
- Model: EMS2YOUNG
- EUT Type: RF Remote Controller

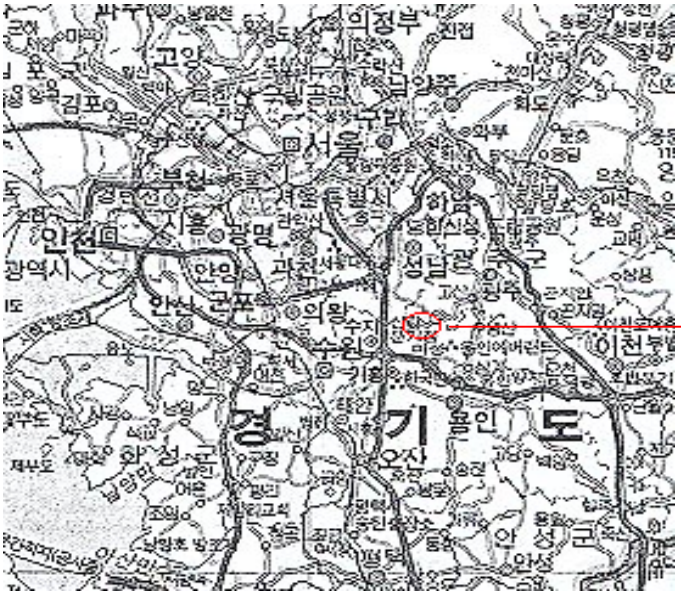
- Classification: Part 15 Subpart C –Intentional Radiators
- Rule Part(s): FCC Part 15 & Part 2
- Test Procedure(s): ANSI C63.4 (1992)
- Dates of Test: January 20, 2003 to February 05, 2003
- Place of Tests: Nemko Korea Co., Ltd. EMC Site
- Test Report No.: NK2DE027

** NOTE: Please refer to the duties and responsibilities of the Responsible Party attached.*

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 **Young Electronics Corporation.**
FCC ID : **QT2EMS2YOUNG, 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 50 kilometers (30 miles) southeast and Seoul International Airport (Kimpo 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-City Kyungki-Do,KOREA 449-852
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Fig. 1. The map above shows the Seoul in Korea vicinity area.
The map also shows Nemko Korea Corporation Ltd. EMC Lab and Kimpo Airport.

TEST CONDITIONS & EUT INFORMATION

Operating During Test

The EUT was operated continuously at switched on mode.

EUT Information

Chipset(s)	CF-745(IC1)
Output Power	-37dBm
Output frequency	310MHz
Power supply	12V DC (5V DC Regulation)

DESCRIPTION OF TESTS

Radiated Emissions

Preliminary measurement were made indoors at 1 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, log periodic antenna (Rohde Schwarz HL025:upto 18GHz) was used.
Final Measurements were made outdoors at 3 or 10m test range using Logbicon Super Antenna(Schwarzbeck, VULB9166) or log periodic antenna.(Rohde Schwarz HL025)
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.

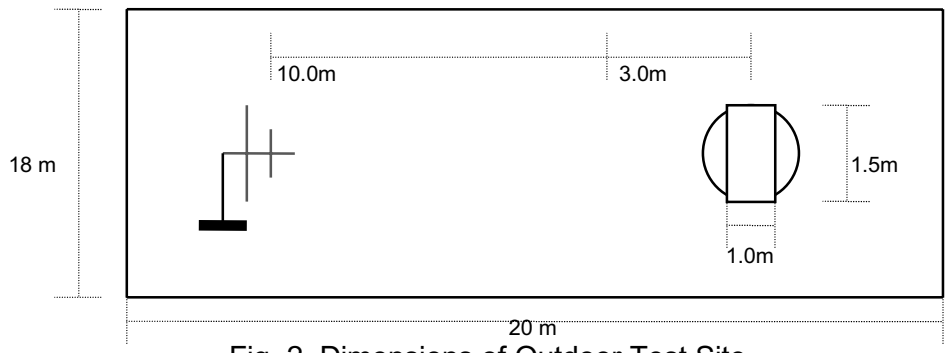


Fig. 2. Dimensions of Outdoor Test Site

§ 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.

Conclusion
The EMS2YOUNG, RF remote controller complies with the requirement of § 15.203 with an omni-directional antenna uniquely coupled to the transmitter.

§ 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

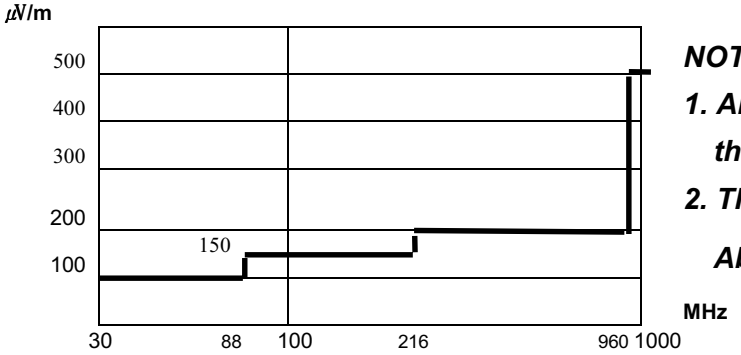
Radiated Emissions; general requirements(Section 15.209)

FCC ID : QT2EMS2YOUNG

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

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

Table 1. Radiated Measurements at 3meters



NOTES:

1. All modes of operation were investigated the worst-case emission are reported.

2. The radiated limits are shown on Figure 4. Above 1GHz the limit is 500 μV/m.

Fig. 3. Limits at 3 meters

NOTES:

1. *Pol. H =Horizontal V=Vertical

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

3. Measurements using CISPR quasi-peak mode. Above 1GHz, peak detector function mode is used using a resolution bandwidth of 1MHz and a video bandwidth of 1MHz. The peak level complies with the average limit. Peak mode is used with linearly polarized horn antenna and low-loss microwave cable.

*Tested by **C. S. Choi***

TEST DATA

Radiated Emissions ; Above 70MHz(Section 15.231)

FCC ID : QT2EMS2YOUNG

Field Strength	Frequency (MHz)	*)Pol. (H/V)	Reading(dBμV) AV	Reading(dBμV) PK	**)A.F (dB)	**)C.L+Amp (dB)	Result(dBμV/m) AV	Result(dBμV/m) PK	Limit(dBμV/m) AV	Limit(dBμV/m) PK
Fundamental	310.00	H	56.4	71.3	12.8	-23.8	45.4	60.3	75.3	95.3
Spurious	620.00	H	33.0	46.7	18.7	-21.8	29.9	43.6	55.3	75.3
Emissions	930.00	H	16.0	29.8	23.3	-18.9	20.4	34.2	55.3	75.3
***	1240.00	H	50.3	63.5	24.1	-32.3	42.0	55.3	54.0	74.0
***	1550.00	H	47.3	59.3	26.1	-32.3	41.1	53.1	54.0	74.0
	1860.00	H	44.3	54.8	27.3	-31.4	40.1	50.6	55.3	75.3
	2170.00	H	40.0	53.5	28.3	-31.8	36.5	50.0	55.3	75.3
	2480.00	H	38.3	45.5	29.7	-31.0	36.9	44.2	55.3	75.3
***	2790.00	H	32.5	41.8	31.2	-31.8	31.9	41.2	54.0	74.0
	3100.00	H	35.3	42.0	32.3	-31.8	35.8	42.5	55.3	75.3

Table 2. Radiated Measurements at 3meters

NOTES:

1. *Pol. H =Horizontal V=Vertical
2. **CL+Amp. = Cable Loss + Amplifier. A.F= Antenna Factor
3. The limit at fundamental frequency is uV/m =41.6667(Frequency)-7083.3333 at 3m, using Average detector. The maximum permitted unwanted emission level is 20 below the maximum permitted fundamental level. This limit is shown at §15.231 table.
4. *** The limit at §15.205 restricted bands of operation is the table shown in §15.209.
5. The Antenna is manipulated through typical positions and length during the tests.
6. The emissions are maximized by changing polarity of the antenna.
7. 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 17.
8. The bandwidth of the emission at 20dB point shall be no wider than 0.25% of the center frequency.
9. Up to the 10th harmonics were investigated according to §15.33 and the worst –case is reported.

Tested by **C. S. Choi**

PLOTS OF EMISSIONS(Section 15.231(c))

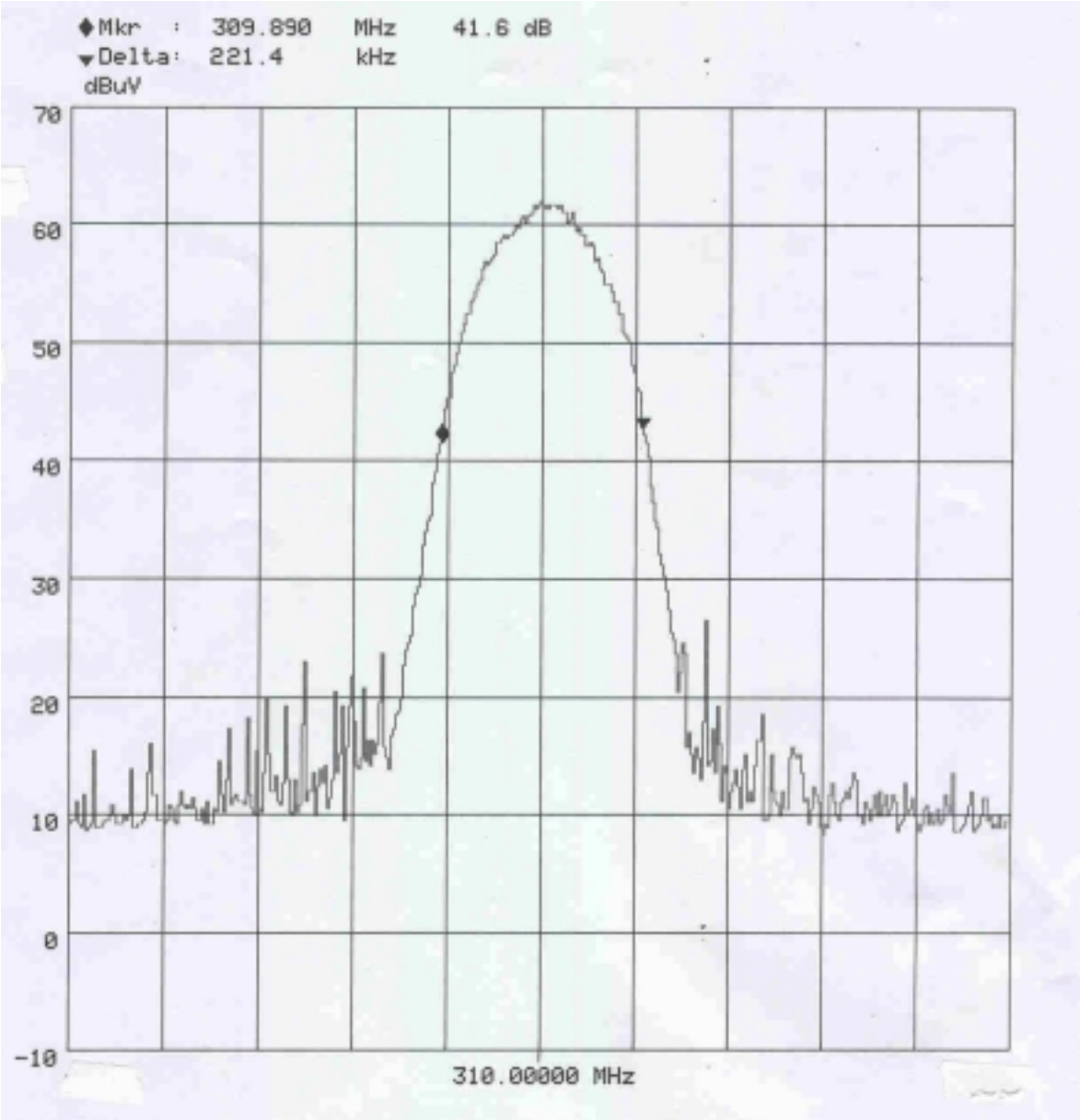
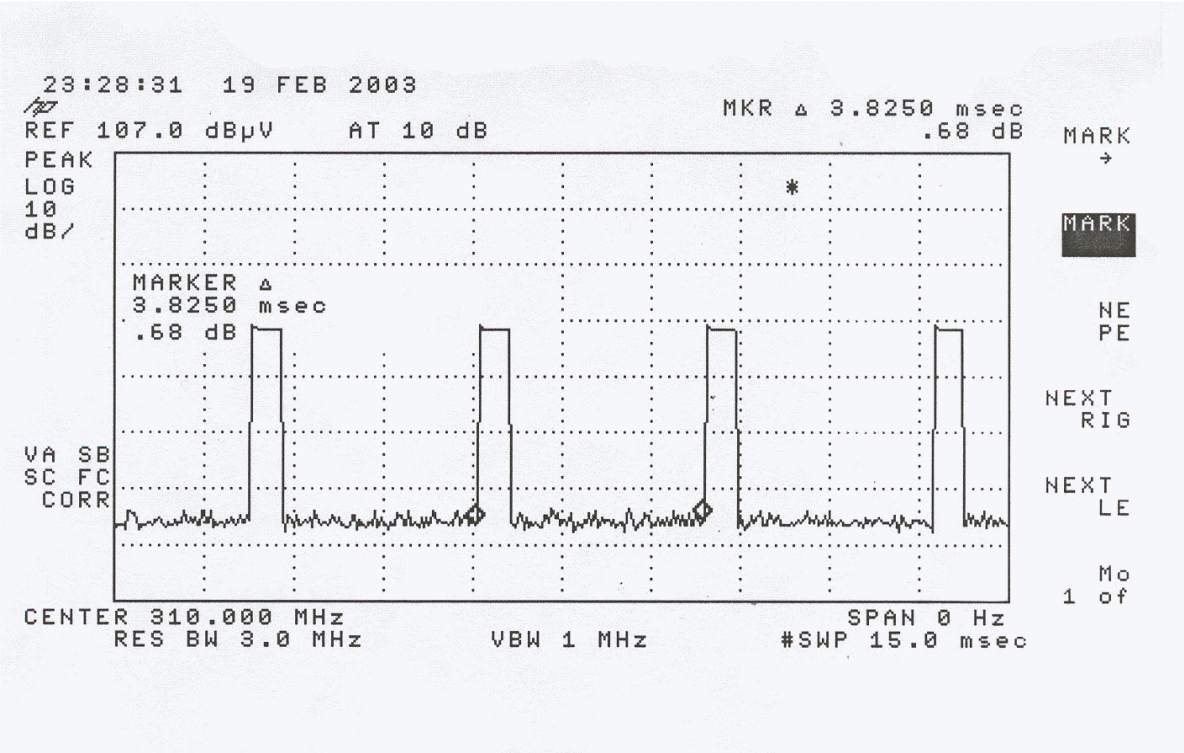
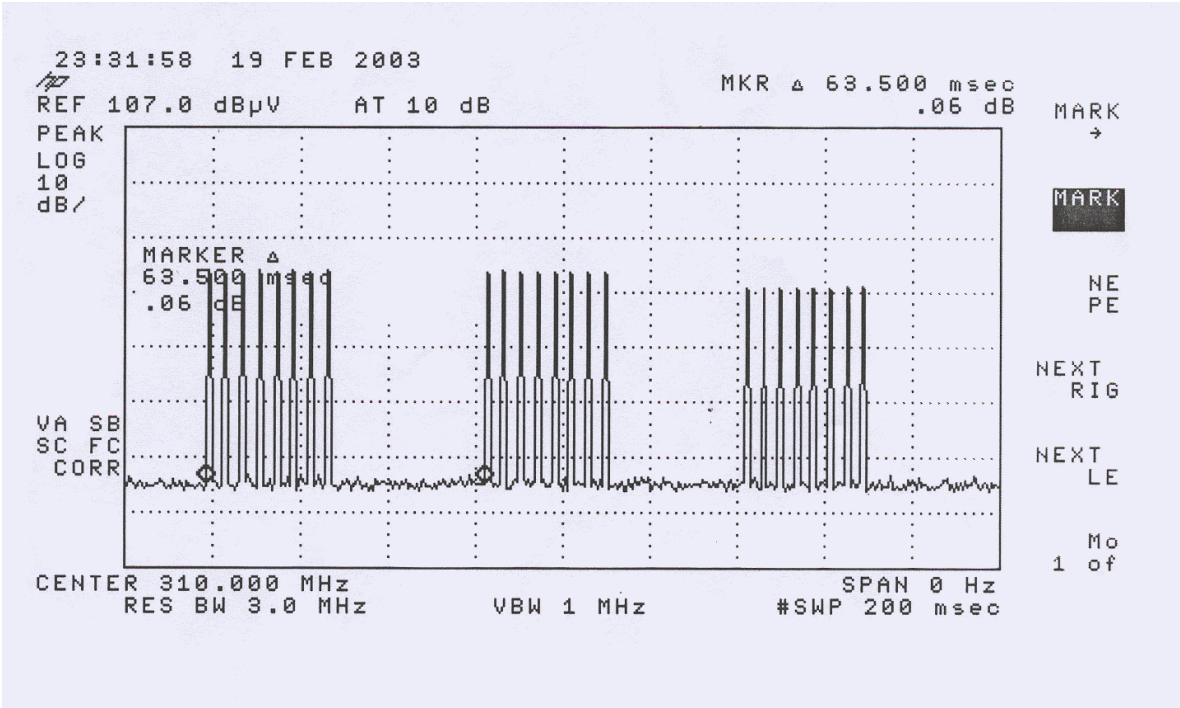


Figure of Duty Cycle(Section 15.35(c))



Duty cycle = 0.6 / 3.825 X 100 =15.68 %



Duty cycle = 29.25 / 63.5 X 100 =46.06 %

SAMPLE CALCULATIONS

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

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

EX. 1.

@620 MHz *§15.231* limit = 1250 μV/m = 61.9 dB μV/m

Reading = 33.0 dB μV(calibrated level)
Antenna factor +(Cable Loss+ Amplifier) = 18.7 – 21.8 = -3.1dB
Total = 33.0-3.1=29.9 dB μV/m
Margin = 61.9 –29.9 = 32.0 dB
32.0 dB below the limit

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 Inperfections	Rectangular	± 2.0
Mismatch:Receiver VRC ri=0.3 Antenna VRC rR=0.1(Bi)0.4(Lp) Uncertainty Limits 20Log(1+/-ri rR)	U-Shaped	+ 0.25 / - 0.26
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 Uncertainty Limits 20Log(1+/-ri rR)	U-Shaped	± 0.26
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	Calibration Date
1	*Test Receiver	R & S	ESCS 30	2002.09
2	Test Receiver	PMM	PMM9000	2002.06
3	*Amplifier	HP	8447F	2002.09
4	*Amplifier	HP	8449B	2002.04
5	*Spectrum Analyzer	Advantest	R3265A	2002.03
6	*Logbicon Super Antenna	Schwarzbeck	VULB9166	2002.05
7	*Log-Periodic Antenna	R & S	HL025	2003.01
8	Dipole Antenna	R & S	VHA9103	2002.05
9	Dipole Antenna	R & S	UHA9105	2002.05
11	Biconical Log Antenna	ARA	LPB-2520/A	2003.01
12	Asorbing Clamp	R & S	MDS21	2002.03
13	High Voltage Probe	R & S	ESH2-Z3	2002.09
14	Signal Generater	R & S	SMP02	2002.12
15	Matching Pad	R & S	RAM358.5414.02	2002.05
16	LISN	R & S	ESH3-Z5	2002.10
17	LISN	Kyoritsu	KNW-407	2002.04
18	LISN	Kyoritsu	KNW-408	2002.04
19	*Position Controller	EM Eng.	N/A	N/A
20	*Turn Table	EM Eng.	N/A	N/A
21	*Antenna Mast	EM Eng.	N/A	N/A
22	*Anechoic Chamber	EM Eng.	N/A	N/A
23	*Shielded Room	EM Eng.	N/A	N/A

***) Test equipment used during the test**

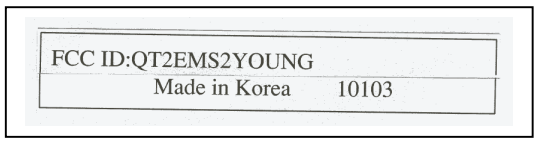
RECOMMENDATION/CONCLUSION

The data collected shows that the **Young Electronics Corporation.**
FCC ID : **QT2EMS2YOUNG, RF Remote controller.** complies with § 15.209, 15.231 of the FCC Rules.
The highest emission observed was at **1240 MHz** for radiated emissions with a margin of **12.0 dB.**

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.



- **FCC ID Location of EUT**

APPENDIX B – CIRCUIT DIAGRAM

APPENDIX E – USER'S MANUAL

APPENDIX F – Schematic Diagrams

APPENDIX G – Pattern Diagrams

APPENDIX H – Part List