



Ecom Sertech Corp.

Rm. 258, Bldg. 17, NO.195, Sec.4 Chung Hsing Rd., ChuTugn Chen, Hsinchu, Taiwan 310, R.O.C
TEL: 886-3-5918012 FAX: 886-3-5825720

FCC ID : LWN9312F24
Report No. : ER04-12-049FRF
Page 1 of 32



TEST REPORT

Product Name : Industrial Radio Remote Controller
Model Number : F24
Data Applies to : F24-10D ; F24-10S ; F24-8D ; F24-8S ; F24-6D ;
F24-6S
Brand Name : TELECRANE
FCC ID : LWN9312F24

Applicant : LEE'S HI-TECH ENTERPRISE CO., LTD
Address : 8F-1, NO.288-2, Hsin-Ya Rd, Chien-Chen
Zone(806), Kaohsiung, Taiwan, R.O.C.

Received Date : December 20, 2004
Tested Date : December 20 ~ 27, 2004

Notes :

1. This report will be invalid if duplicated or photocopied in part.
2. This report refers only to the specimen(s) submitted to testing, and be invalid as separately used.
3. This report is invalid without examination stamp and signature of this institute.
4. The tested specimen(s) will be preserved for thirty days from the date issued.
5. The report must not be used to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the federal government.



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Page 2 of 32

Test Report Certification

Product Name : Industrial Radio Remote Controller
Model Number : F24
Data Applies to : F24-10D ; F24-10S ; F24-8D ; F24-8S ; F24-6D ;
F24-6S
Brand Name : TELECRANE
FCC ID : LWN9312F24
Applicant : LEE'S HI-TECH ENTERPRISE CO., LTD

Measurement Standard :

47 CFR Part 15 Subpart B and C(Section 15.231)
ANSI C63.4-2003

Tested By : Ken Tu, Date : December 30, 2004
(Ken Tu)

Approved By : C.F. Wu, Date : Decmeber 30, 2004
(C.F. Wu, Manager)



WE HEREBY CERTIFY THAT: The measurements shown in the attachment were made in accordance with the procedures indicated, and the energy emitted by the equipment was found to be within the limits applicable. We assume full responsibility for the accuracy and completeness of these measurements and vouch for the qualifications of all persons taking them.



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Report No. : ER04-12-049FRF
Page 3 of 32

TABLE OF CONTENTS

TITLE	PAGE NO.
1. GENERAL INFORMATION	4
1.1 General Statement	4
1.2 General Description of EUT & Power	4
1.3 EUT & Peripherals Setup Diagram	5
1.4 EUT Operating Condition	5
1.5 Description of Test Site	5
1.6 Summary of Test Results	6
2. TRANSMITTER AUTO-OFF AND DUTY CYCLE	7
2.1 Test Equipments	7
2.2 Test Setup	7
2.3 Test Procedures	7
2.4 Uncertainty of Radiated Emission	7
2.5 Test Result	8-13
3. RADIATED EMISSION TEST	14
3.1 Test Equipments	14
3.2 Test Setup	14
3.3 Radiation Limit	15
3.4 Test Procedures	16
3.5 Uncertainty of Radiated Emission	16
3.6 Radiated RF Noise Measurement Results	17-21
3.7 Photos of Radiated Test	23-28
4. BANDWIDTH MEASUREMENT	29
4.1 Test Equipments	29
4.2 Test Setup	29
4.3 Limits of Bandwidth Measurement	29
4.4 Test Procedure	29
4.5 Uncertainty of Conducted Emission	29
4.6 Test Results	30
4.7 Photo of Bandwidth Measurement	31
5. ANTENNA REQUIREMENT	32
5.1 Standard Applicable	32
5.2 Antenna Connected Construction	32



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Report No. : ER04-12-049FRF
Page 4 of 32

1. GENERAL INFORMATION

1.1 General Statement

MEASUREMENT DEVIATION : Comply with standard in full

TRACEABILITY : This test result is traceable to national or international std.

1.2 General Description of EUT & Power

Product Name	Industrial Radio Remote Controller
Model Number	F24
Data Applies To	F24-10D ; F24-10S ; F24-8D ; F24-8S ; F24-6D ; F24-6S
Frequency Range	428.5MHz ~ 438.5MHz
Operated Selection	manual
Type of Modulation	FSK
EUT Description	The EUT was the transmitter of a industrial remote control system. The EUT is for transmission of a control signal used with remote switch. It does not activate automatically and transmit periodically at a regular predetermined interval.
Antenna Type	Helix Antenna, Antenna Gain : 1.5dBi, Connector : PITCH 2.0
Power Source	3VDC (For Transmitter device) from two AA battery

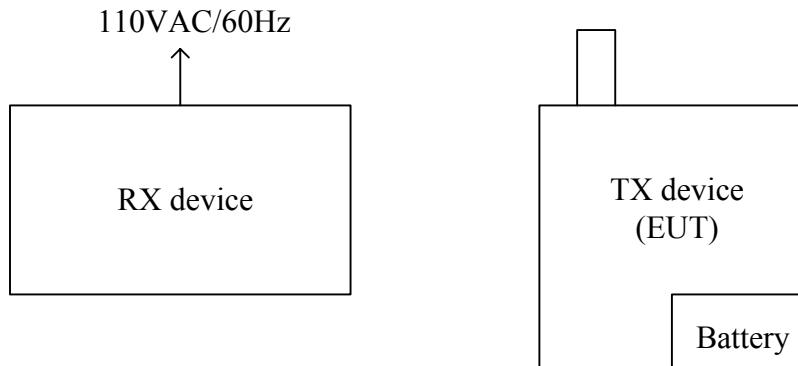
Note :

The difference of the series model

Brand Model Different Item	TELECRANE		TELECRANE				
	F24	F24-10D	F24-10S	F24-8D	F24-8S	F24-6D	F24-6S
Transmitter PCB	same	same	same	same	same	same	same
Transmitter Power Supply	same	same	same	same	same	same	same
Transmitter RF Circuits Design	same	same	same	same	same	same	same
Transmitter Key Numbers & Spec.	Ten units of double-speed push-button+ One unit of Start key.	same	Ten units of single-speed push-button+ One unit of Start key.	Eight units of double-speed push-button+ One unit of Start key.	Eight units of single-speed push-button+ One unit of Start key.	Six units of double-speed push-button+ One unit of Start key.	Six units of single-speed push-button+ One unit of Start key.

To add a series model for business necessary. (Double-Speed push-button : 3003.0451 ; Single-Speed push-button : B3w-4050)
The products between these for models are all the same except for Transmitter Key Numbers & Spec. After a preliminary test, double-speed push-button mode has highest emission. The double-speed push-button mode was recorded in final test report as representative.

1.3 EUT & Peripherals Setup Diagram



1.4 EUT Operating Condition

- (1) Set up the EUT as described in set up diagram.
- (2) Switch on the operation button.
- (3) Start test.

1.5 Description of Test Site

SITE DESCRIPTION

FCC Certificate NO. : 90585
BSMI Certificate NO. : SL2-IN-E-0002
NVLAP Lab Code : 200118-0
CNLA Certificate NO. : CNLA-ZL97018E
VCCI Certificate NO. : R-1189, C-1250
TÜV Rheinland Certificate NO. : 10008375

NAME OF SITE : Ecom Sertech Corp. Hsin-Chu Lab.
(Spin-off from ITRI / ERSO on Apr. 01, 2003)
SITE LOCATION : Rm.258, Bldg.17, NO.195 , Sec. 4, Chung Hsing Rd.,
Chu-Tung Chen. Hsin-Chu, Taiwan 310 R.O.C.



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FCC ID : LWN9312F24
Report No. : ER04-12-049FRF
Page 6 of 32

1.6 Summary of Test Results

The EUT has been tested according to the following specifications :

APPLIED STANDARD : 47 CFR Part 15, Subpart B and Subpart C			
Standard Section	Test Type and Limit	Result	REMARK
15.231(b)	Field strength of Fundamental	PASS	Meet the requirement of limit
15.231(b)	Field strength of Harmonics	PASS	Meet the requirement of limit
15.231(b)(3)	Transmitter Radiated Emissions Limit : 15.231(b)	PASS	Meet the requirement of limit
15.231(a)(1)	Deactivate transmission within 5 seconds of being released	PASS	Manually operated only
15.231(a)(2)	Cease transmission within 5 seconds after activation	N/A	Manually operated only
15.231(a)(3)	Transmit periodically at a regular predetermined interval.	N/A	Manually operated only
15.231(c)	Bandwidth Limit: Center frequency×0.25%	PASS	Meet the requirement of limit



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FCC ID : LWN9312F24
Report No. : ER04-12-049FRF
Page 7 of 32

2. TRANSMITTER AUTO-OFF AND DUTY CYCLE

2.1 Test Equipments

The following test equipments are utilized in making the measurements contained in this report.

Description & Manufacturer	Model No.	Serial No.	Date Of Calibration
R/S SPECTRUM ANALYZER	FSEK30	835253/002	September 06, 2004

2.2 Test Setup

The diagram below shows the test setup that is utilized to perform the measurements for duty cycle and power off duration.



2.3 Test Procedures

1. The tests were performed with the equipment under test (EUT) connected to the spectrum directly.
2. The spectrum was turned to the center frequency of the emission and set to the zero span with proper sweep time.
3. The duration of transmission of ON/OFF was determined by the spectrum with the function of marker and cursor line.
4. The spectrum was used to check whether the EUT stop transmission or not within 5 seconds after the EUT was powered off.

2.4 Uncertainty of Radiated Emission

The uncertainty of time domain measurement is $\pm 1\mu\text{s}$.

2.5 Test Result

1. For the fundamental frequency (428.56MHz)

The EUT in manual mode complies with the requirement of FCC 15.231(a). After exploratory tests, the duty factor is calculated with following formula:

$$20 \log \frac{\text{Total Duty}}{\text{Period of Pulse Train}}$$

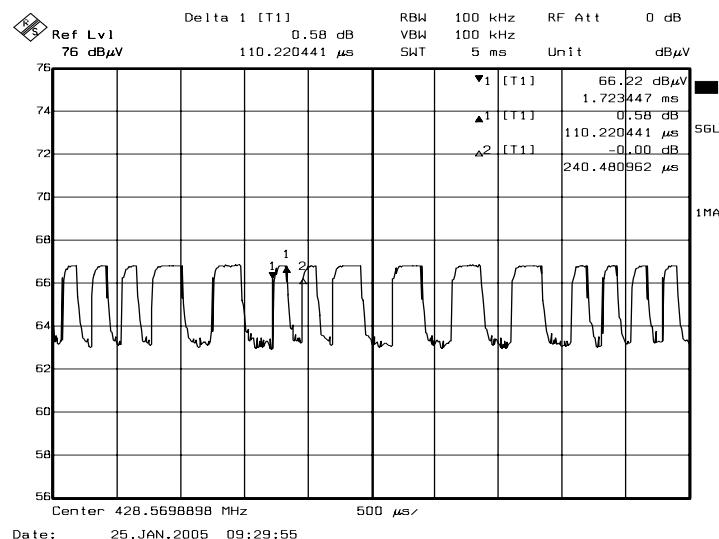
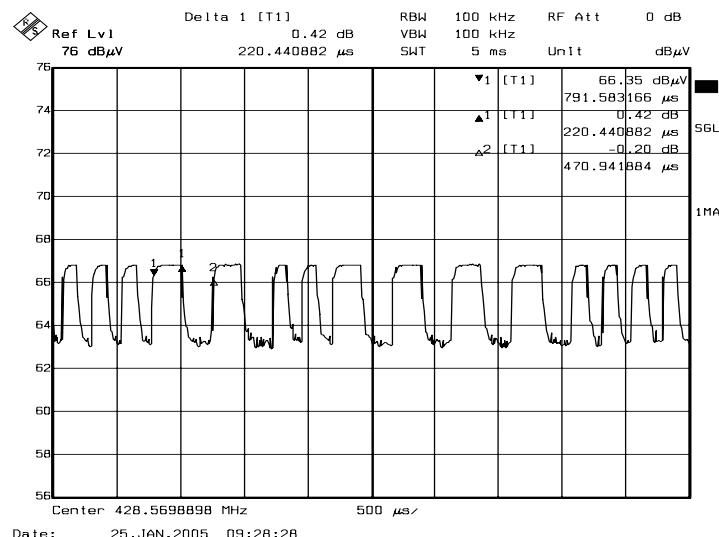
Total Duty = $N_1 L_1 + N_2 L_2 + \dots + N_{n-1} L_n$ (Where N_1 is number of type 1 pulse, L_1 is length of type 1 pulse...)

We have found (Please check the duty-cycle plots below.)

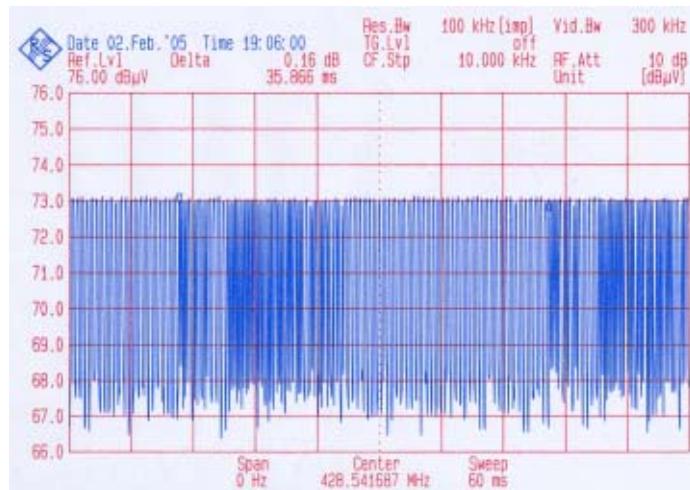
$N_1 = 55$, $N_2 = 42$, $L_1 = 220.44\mu\text{s}$, $L_2 = 110.22\mu\text{s}$

$$\text{Duty Factor} = 20 \log \frac{16753.44 \mu\text{s}(\text{Ton})}{35866 \mu\text{s}(\text{Tp})} = -6.61\text{dB}$$

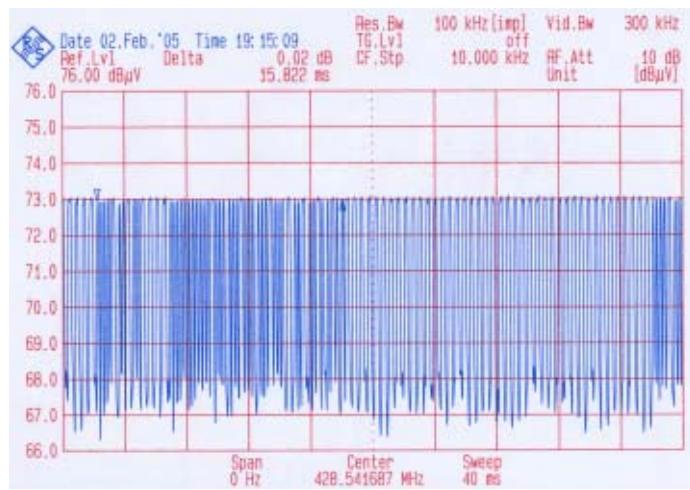
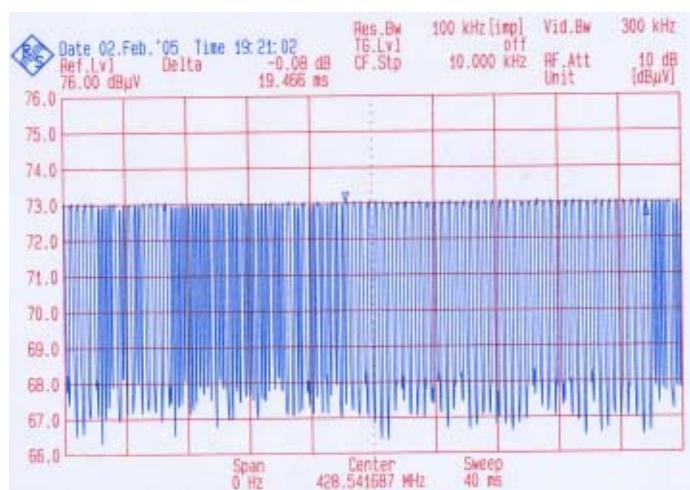
Ton



Tp



Channel Number



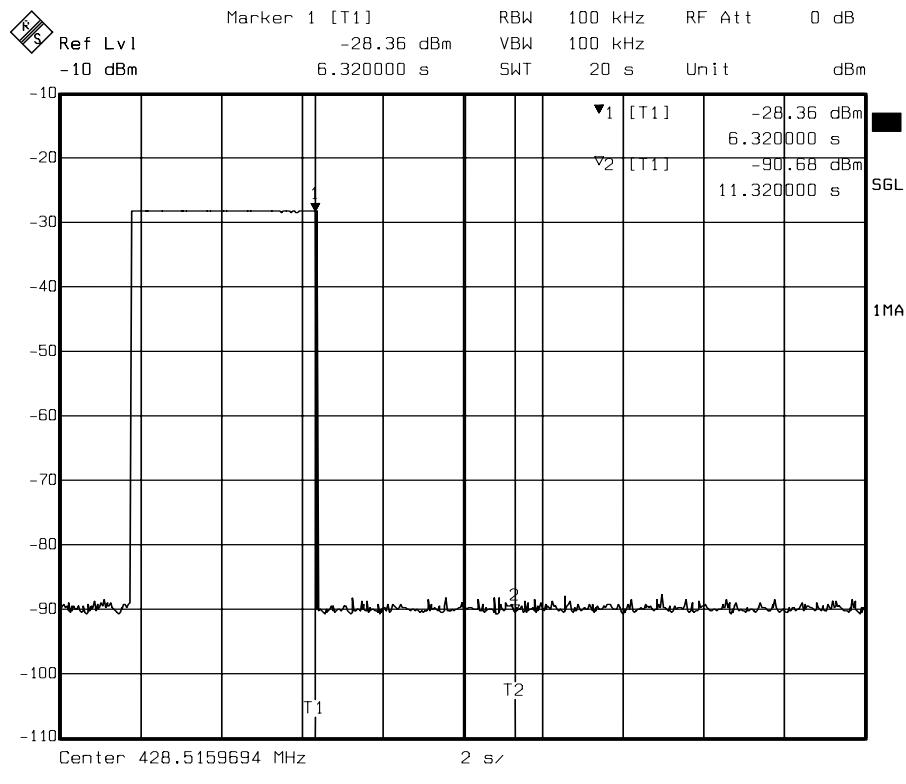


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FCC ID : LWN9312F24
Report No. : ER04-12-049FRF
Page 10 of 32

The transmitter ceases transmission immediately after being released and complied with the requirement in section 15.231(a)(1).



2. For the fundamental frequency (438.44MHz)

The EUT in manual mode complies with the requirement of FCC 15.231(a). After exploratory tests, the duty factor is calculated with following formula:

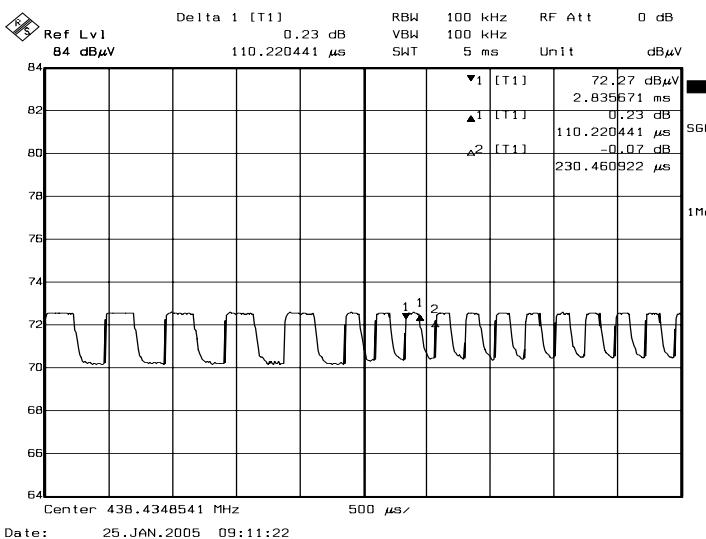
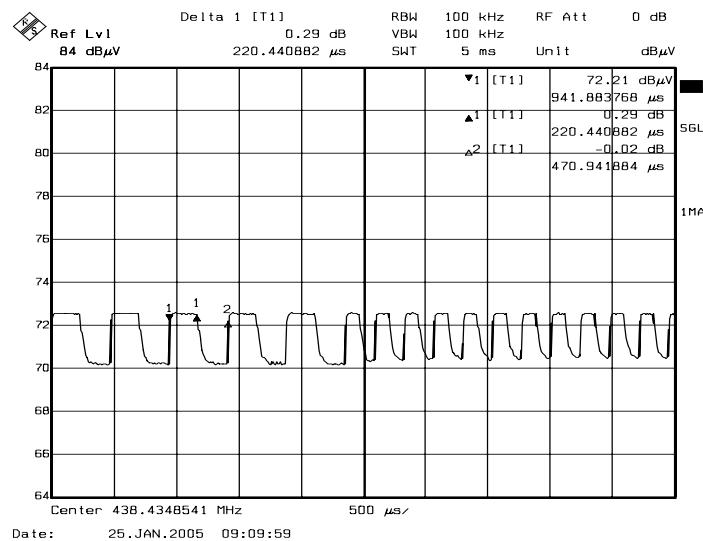
$$20 \log \frac{\text{Total Duty}}{\text{Period of Pulse Train}}$$

Total Duty = $N_1 L_1 + N_2 L_2 + \dots + N_{n-1} L_n$ (Where N_1 is number of type 1 pulse, L_1 is length of type 1 pulse...)

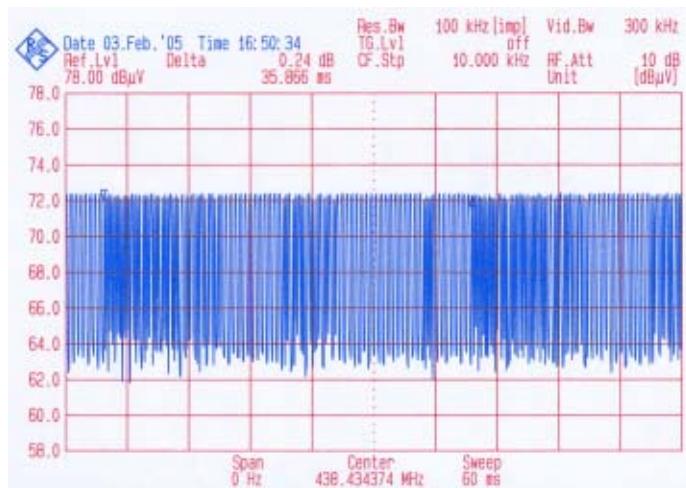
We have found (Please check the duty-cycle plots below.)

$N_1 = 51$, $N_2 = 50$, $L_1 = 220.44\mu\text{s}$, $L_2 = 110.22\mu\text{s}$

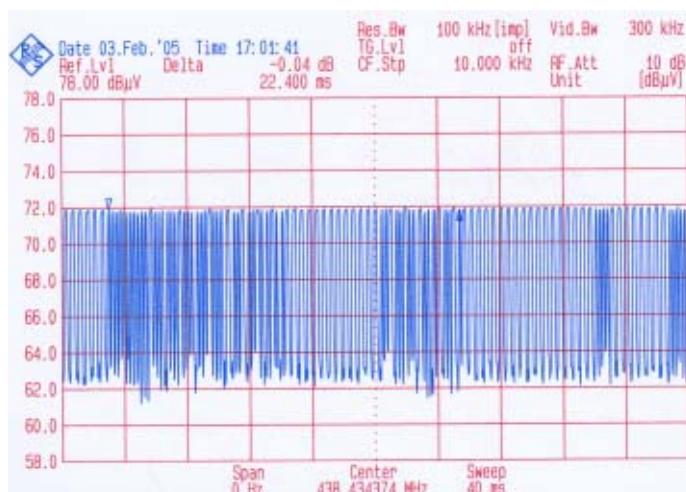
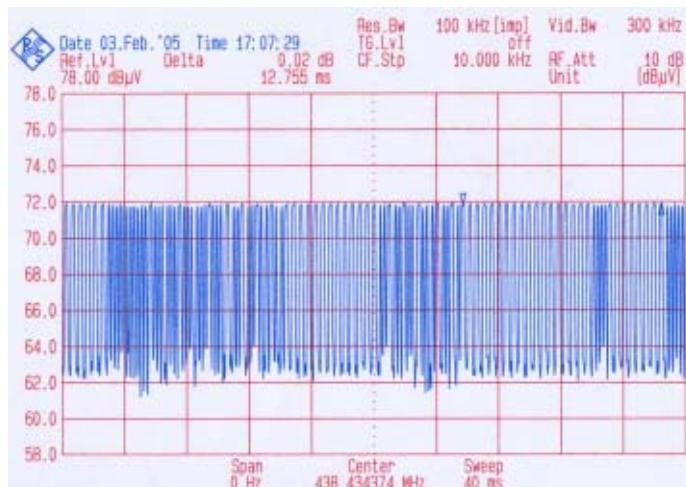
$$\text{Duty Factor} = 20 \log \frac{16753.44 \mu\text{s}(\text{Ton})}{35866 \mu\text{s}(\text{Tp})} = -6.61\text{dB}$$

Ton


Tp



Channel Number



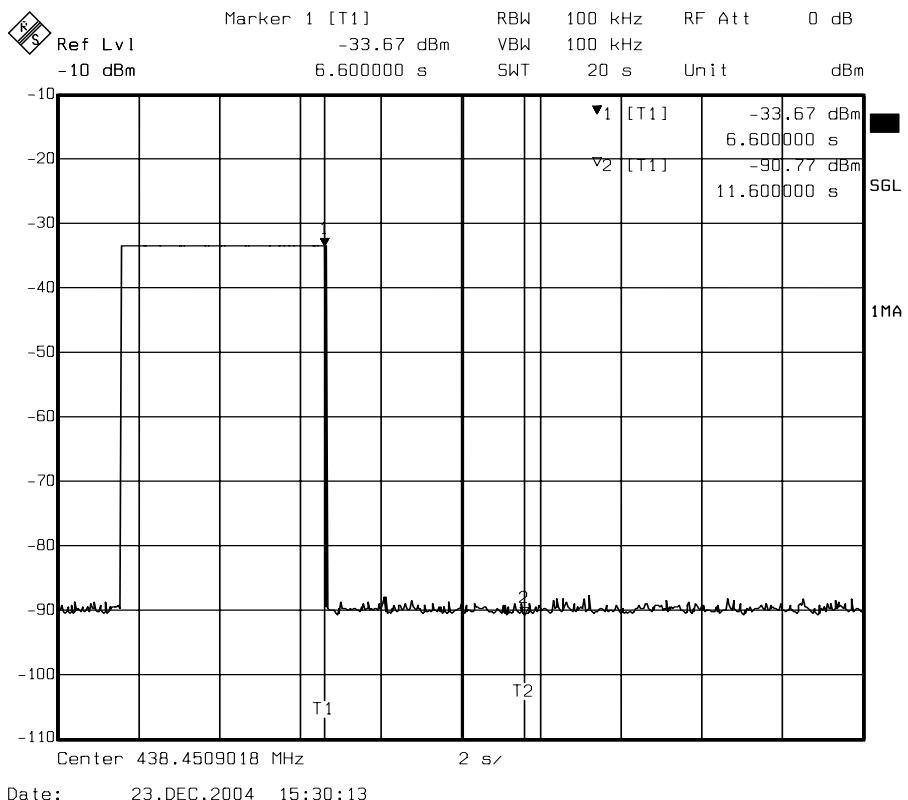


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FCC ID : LWN9312F24
Report No. : ER04-12-049FRF
Page 13 of 32

The transmitter ceases transmission immediately after being released and complied with the requirement in section 15.231(a)(1).



3. RADIATED EMISSION TEST

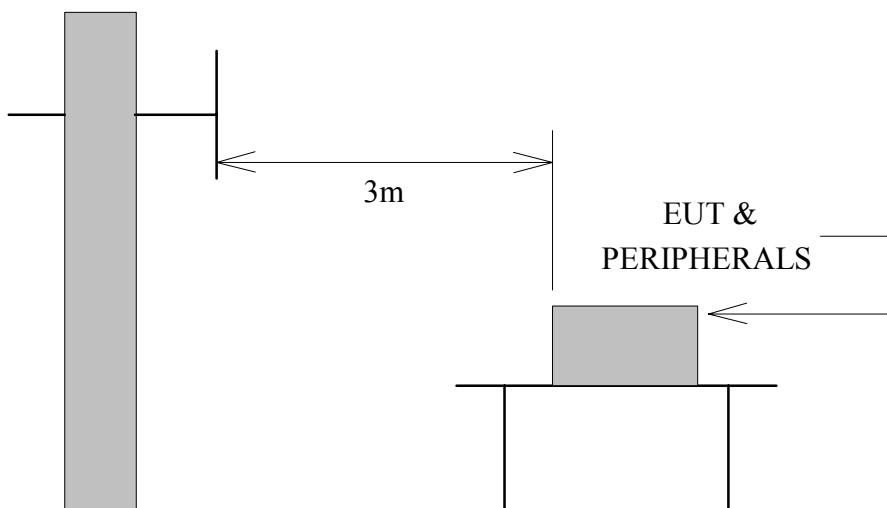
3.1 Test Equipments

The following test equipments are utilized in making the measurements contained in this report.

Manufacturer or Type	Model No	Serial No	Date of Calibration	Calibration Period	Remark
CHASE BI-LOG ANTENNA	CBL6112B	2421	June 15, 2004	1 Year	FINAL
R/S SPECTRUM ANALYZER	FSEK30	835253/002	September 06, 2004	1 Year	FINAL
OPEN SITE	-----	No.2	May 07, 2004	1 Year	FINAL
N TYPE COAXIAL CABLE	CHA9525	4	June 03, 2004	1 Year	FINAL
Horn Antenna	AH-118	10089	April 09, 2004	1 Year	FINAL
HP Pre-amplifier	8449B	3008A01471	November 24, 2004	1 Year	FINAL
HP High pass filter	84300/80038	002	CAL. ON USE	1 Year	FINAL
Horn Antenna	AH-840	3077	February 25, 2004	1 Year	FINAL

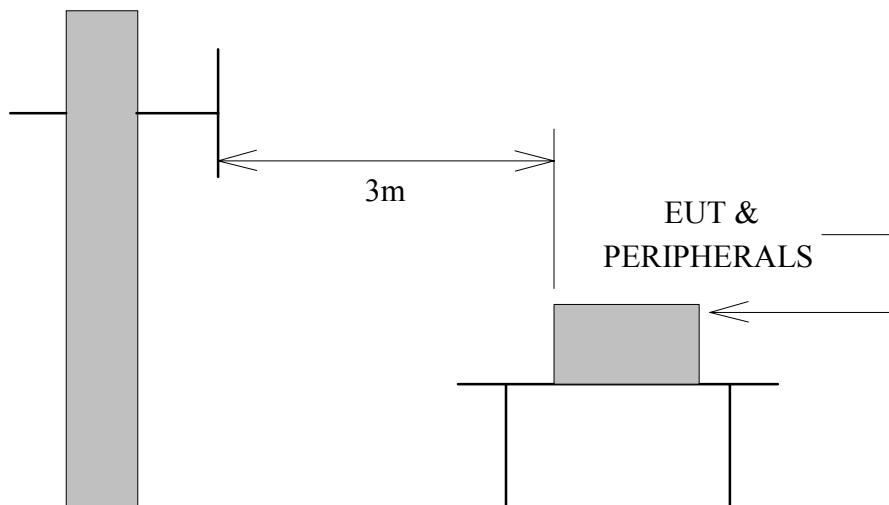
3.2 Test Setup

1. The diagram below shows the test setup that is utilized to make the measurements for emission below 1GHz.(For Transmitter device)



Antenna Elevation Variable

2. The diagram below shows the test setup that is utilized to make the measurements for emission above 1GHz.(For Transmitter device)



Antenna Elevation Variable

3.3 Radiation Limit

For intentional device, according to § 15.231(b), the general requirement of field strength of radiated emissions from intentional radiators at a distance of 3 meters shall not exceed the following table.

Fundamental Frequency (MHz)	Distance (Meters)	Field Strength of Fundamental (μ V/M)	Field Strength of Spurious Emission (μ V/M)
40.66-40.70	3	2250	225
70-130	3	1250	125
130-174	3	1250 to 3750	125 to 375
174-260	3	3750	375
260-470	3	3750 to 12500	375 to 1250
Above 470	3	12500	1250



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FCC ID : LWN9312F24
Report No. : ER04-12-049FRF
Page 16 of 32

3.4 Test Procedures

- a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 10 meter open area test site. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. During performing radiated emission below 1GHz, the EUT (Transmitter device) was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower. During performing radiated emission above 1GHz, the EUT (Transmitter device) was set 3 meters away from the interference-receiving antenna.
- c. The antenna is a broadband antenna, and its height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarization of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- f. If the emission level of the EUT in peak mode was 10 dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10 dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

3.5 Uncertainty of Radiated Emission

The uncertainty of radiated emission is $\pm 2.72\text{dB}$.



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FCC ID : LWN9312F24
Report No. : ER04-12-049FRF
Page 17 of 32

3.6 Radiated RF Noise Measurement Results

The frequency spectrum from 30 MHz to 4000 MHz for Transmitter was investigated. All emissions not reported are much lower than the prescribed limits.

Company	LEE' S HI-TECH ENTERPRISE CO., LTD	Test Date	2004/12/21
Product Name	Industrial Radio Remote Controller	Test By	Ken Tu
Model Name	F24	TEMP & Humidity	20.9°C, 72%

Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading at 3m(dB μ V)		Limits (dB μ V/m)	Emission Level at 3m(dB μ V/m)		Detector Mode
			Horizontal	Vertical		Horizontal	Vertical	
30.00	17.01	0.97	*	*	40.00	*	*	QP
▲428.56	18.24	4.95	44.30	48.10	80.65	67.49	71.29	QP
857.12	21.12	7.05	14.00	21.20	60.65	42.17	49.37	QP
1285.68	23.60	8.99	15.00	16.00	80.65	47.59	48.59	PK
1285.68	—	—	—	—	60.65	40.98	41.98	AVG
1714.26	25.97	10.74	14.80	15.20	80.65	51.51	51.91	PK
1714.26	—	—	—	—	60.65	44.90	45.30	AVG
4285.60	---	---	---	---	74.00	---	---	PK
4285.60	---	---	---	---	54.00	---	---	AVG

REMARKS :

1. * Undetectable
2. Emission level (dB μ V/m) = Antenna Factor (dB/m) + Cable loss (dB) + Meter Reading (dB μ V).
3. Remark “▲” means fundamental frequency for Transmitter device.
4. The emission value below 1GHz is quasi-peak value and the emission value above 1GHz is both peak and average value.
PK : Peak value; AVG : Average value; QP : Quasi-peak value.
5. The measurement was searched to 10th harmonic, Remark “---” means that the emissions level is too low to be measured.
6. Remark “※”means the Restricted band.
7. For the fundamental frequency (428.56MHz), X-axis direction, detailed in setup photo.
8. Average = Peak Value + Duty Factor (Duty Factor = -6.61dB)



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Page 18 of 32

The frequency spectrum from 30 MHz to 4000 MHz for Transmitter was investigated. All emissions not reported are much lower than the prescribed limits.

Company	LEE' S HI-TECH ENTERPRISE CO., LTD		Test Date		2004/12/21	
Product Name	Industrial Radio Remote Controller		Test By		Ken Tu	
Model Name	F24		TEMP & Humidity		20.9°C, 72%	

Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading at 3m(dB μ V)		Limits (dB μ V/m)	Emission Level at 3m(dB μ V/m)		Detector Mode
			Horizontal	Vertical		Horizontal	Vertical	
30.00	17.01	0.97	*	*	40.00	*	*	QP
▲428.56	18.24	4.95	45.20	41.40	80.65	68.39	64.59	QP
857.12	21.12	7.05	20.80	15.70	60.65	48.97	43.87	QP
1285.68	23.60	8.99	16.70	15.00	80.65	49.29	47.59	PK
1285.68	—	—	—	—	60.65	42.68	40.98	AVG
1714.26	25.97	10.74	13.90	14.50	80.65	50.61	51.21	PK
1714.26	—	—	—	—	60.65	44.00	44.60	AVG
4285.60	---	---	---	---	74.00	---	---	PK
4285.60	---	---	---	---	54.00	---	---	AVG

REMARKS :

1. * Undetectable
2. Emission level (dB μ V/m) = Antenna Factor (dB/m) + Cable loss (dB) + Meter Reading (dB μ V).
3. Remark “▲” means fundamental frequency for Transmitter device.
4. The emission value below 1GHz is quasi-peak value and the emission value above 1GHz is both peak and average value.
PK : Peak value; AVG : Average value; QP : Quasi-peak value.
5. The measurement was searched to 10th harmonic, Remark “---” means that the emissions level is too low to be measured.
6. Remark “※”means the Restricted band.
7. For the fundamental frequency (428.56MHz), Y-axis direction, detailed in setup photo.
8. Average = Peak Value + Duty Factor (Duty Factor = -6.61dB)



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Page 19 of 32

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Company	LEE' S HI-TECH ENTERPRISE CO., LTD			Test Date	2004/12/21		
Product Name	Industrial Radio Remote Controller			Test By	Ken Tu		
Model Name	F24			TEMP & Humidity	20.9°C, 72%		

Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading at 3m(dB μ V)		Limits (dB μ V/m)	Emission Level at 3m(dB μ V/m)		Detector Mode
			Horizontal	Vertical		Horizontal	Vertical	
30.00	17.01	0.97	*	*	40.00	*	*	QP
▲428.56	18.24	4.95	48.20	44.50	80.65	71.39	67.69	QP
857.12	21.12	7.05	16.30	16.90	60.65	44.47	45.07	QP
1285.68	23.60	8.99	14.30	15.00	80.65	46.89	47.59	PK
1285.68	—	—	—	—	60.65	40.28	40.98	AVG
1714.26	25.97	10.74	13.80	14.00	80.65	50.51	50.71	PK
1714.26	—	—	—	—	60.65	43.90	44.10	AVG
4285.60	---	---	---	---	74.00	---	---	PK
4285.60	---	---	---	---	54.00	---	---	AVG

REMARKS :

1. * Undetectable
2. Emission level (dB μ V/m) = Antenna Factor (dB/m) + Cable loss (dB) + Meter Reading (dB μ V).
3. Remark “▲” means fundamental frequency for Transmitter Device.
4. The emission value below 1GHz is quasi-peak value and the emission value above 1GHz is both peak and average value.
PK : Peak value; AVG : Average value; QP : Quasi-peak value.
5. The measurement was searched to 10th harmonic, Remark “---” means that the emissions level is too low to be measured.
6. Remark “※”means the Restricted band.
7. For the fundamental frequency (428.56MHz), Z-axis direction, detailed in setup photo.
8. Average = Peak Value + Duty Factor (Duty Factor = -6.61dB)



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FCC ID : LWN9312F24
Report No. : ER04-12-049FRF
Page 20 of 32

The frequency spectrum from 30 MHz to 4000 MHz for Transmitter was investigated. All emissions not reported are much lower than the prescribed limits.

Company	LEE' S HI-TECH ENTERPRISE CO., LTD	Test Date	2004/12/21
Product Name	Industrial Radio Remote Controller	Test By	Ken Tu
Model Name	F24	TEMP & Humidity	20.9°C, 72%

Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading at 3m(dB μ V)		Limits (dB μ V/m)	Emission Level at 3m(dB μ V/m)		Detector Mode
			Horizontal	Vertical		Horizontal	Vertical	
30.00	17.01	0.97	*	*	40.00	*	*	QP
▲438.44	18.19	4.98	45.20	47.60	80.97	68.37	70.77	QP
876.88	21.24	7.14	11.30	18.90	60.97	39.68	47.28	QP
1315.35	23.78	9.11	13.60	13.70	74.00	46.48	46.58	PK
1315.35	—	—	—	—	54.00	39.87	39.97	AVG
1753.76	26.31	10.96	12.60	13.30	80.97	49.87	50.57	PK
1753.76	—	—	—	—	60.97	43.26	43.96	AVG
4384.40	---	---	---	---	74.00	---	---	PK
4384.40	---	---	---	---	54.00	---	---	AVG

REMARKS :

1. * Undetectable
2. Emission level (dB μ V/m) = Antenna Factor (dB/m) + Cable loss (dB) + Meter Reading (dB μ V).
3. Remark “▲” means fundamental frequency for Transmitter device.
4. The emission value below 1GHz is quasi-peak value and the emission value above 1GHz is both peak and average value.
PK : Peak value; AVG : Average value; QP : Quasi-peak value.
5. The measurement was searched to 10th harmonic, Remark “---” means that the emissions level is too low to be measured.
6. Remark “※”means the Restricted band.
7. For the fundamental frequency (438.44MHz), X-axis direction, detailed in setup photo.
8. Average = Peak Value + Duty Factor (Duty Factor = -6.61dB)



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FCC ID : LWN9312F24
Report No. : ER04-12-049FRF
Page 21 of 32

The frequency spectrum from 30 MHz to 4000 MHz for Transmitter was investigated. All emissions not reported are much lower than the prescribed limits.

Company	LEE' S HI-TECH ENTERPRISE CO., LTD		Test Date		2004/12/21	
Product Name	Industrial Radio Remote Controller		Test By		Ken Tu	
Model Name	F24		TEMP & Humidity		20.9°C, 72%	

Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading at 3m(dB μ V)		Limits (dB μ V/m)	Emission Level at 3m(dB μ V/m)		Detector Mode
			Horizontal	Vertical		Horizontal	Vertical	
30.00	17.01	0.97	*	*	40.00	*	*	QP
▲438.44	18.19	4.98	48.20	45.70	80.97	71.37	68.87	QP
876.88	21.24	7.14	17.10	13.50	60.97	45.48	41.88	QP
1315.35	23.78	9.11	16.60	15.20	74.00	49.48	48.08	PK
1315.35	—	—	—	—	54.00	42.87	41.47	AVG
1753.76	26.31	10.96	12.20	14.50	80.97	49.47	51.77	PK
1753.76	—	—	—	—	60.97	42.86	45.16	AVG
4384.40	---	---	---	---	74.00	---	---	PK
4384.40	---	---	---	---	54.00	---	---	AVG

REMARKS :

1. * Undetectable
2. Emission level (dB μ V/m) = Antenna Factor (dB/m) + Cable loss (dB) + Meter Reading (dB μ V).
3. Remark “▲” means fundamental frequency for Transmitter device.
4. The emission value below 1GHz is quasi-peak value and the emission value above 1GHz is both peak and average value.
PK : Peak value; AVG : Average value; QP : Quasi-peak value.
5. The measurement was searched to 10th harmonic, Remark “---” means that the emissions level is too low to be measured.
6. Remark “※”means the Restricted band.
7. For the fundamental frequency (438.44MHz), Y-axis direction, detailed in setup photo.
8. Average = Peak Value + Duty Factor (Duty Factor = -6.61dB)



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FCC ID : LWN9312F24
Report No. : ER04-12-049FRF
Page 22 of 32

The frequency spectrum from 30 MHz to 4000 MHz for Transmitter was investigated. All emissions not reported are much lower than the prescribed limits.

Company	LEE' S HI-TECH ENTERPRISE CO., LTD			Test Date	2004/12/21		
Product Name	Industrial Radio Remote Controller			Test By	Ken Tu		
Model Name	F24			TEMP & Humidity	20.9°C, 72%		

Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading at 3m(dB μ V)		Limits (dB μ V/m)	Emission Level at 3m(dB μ V/m)		Detector Mode
			Horizontal	Vertical		Horizontal	Vertical	
30.00	17.01	0.97	*	*	40.00	*	*	QP
▲438.44	18.19	4.98	46.30	39.20	80.97	69.47	62.37	QP
876.88	21.24	7.14	13.50	14.30	60.97	41.88	42.68	QP
1315.35	23.78	9.11	15.00	16.20	74.00	47.88	49.08	PK
1315.35	—	—	—	—	54.00	41.27	42.77	AVG
1753.76	26.31	10.96	12.20	14.50	80.97	49.27	49.77	PK
1753.76	—	—	—	—	60.97	42.66	43.16	AVG
4384.40	---	---	---	---	74.00	---	---	PK
4384.40	---	---	---	---	54.00	---	---	AVG

REMARKS :

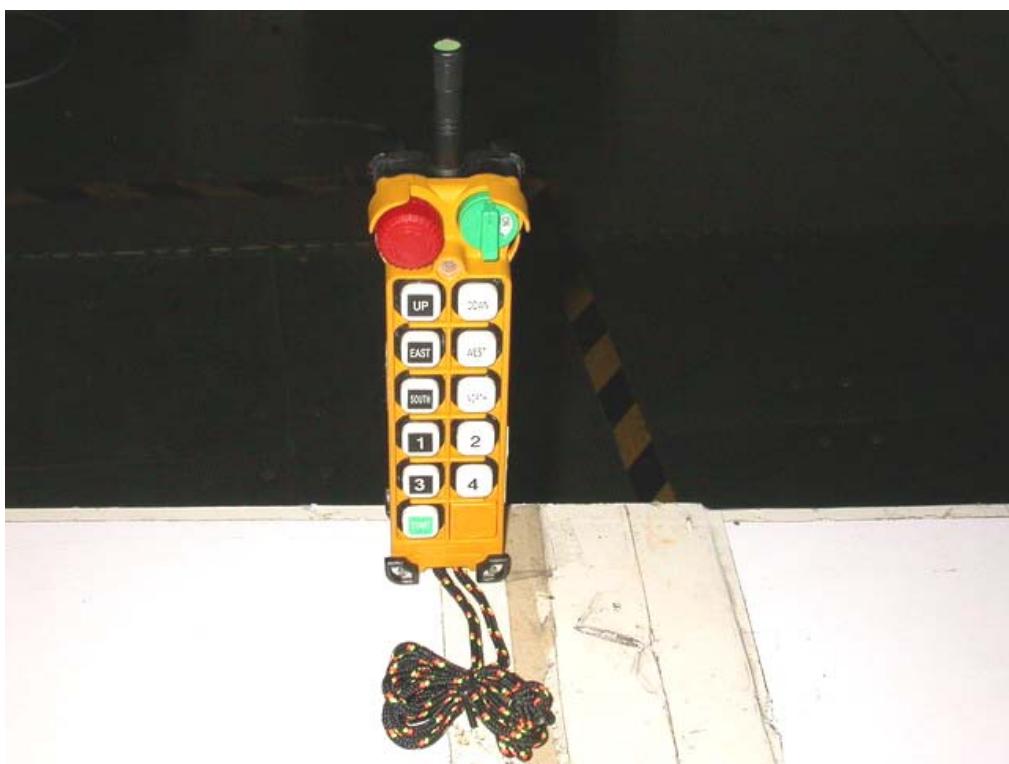
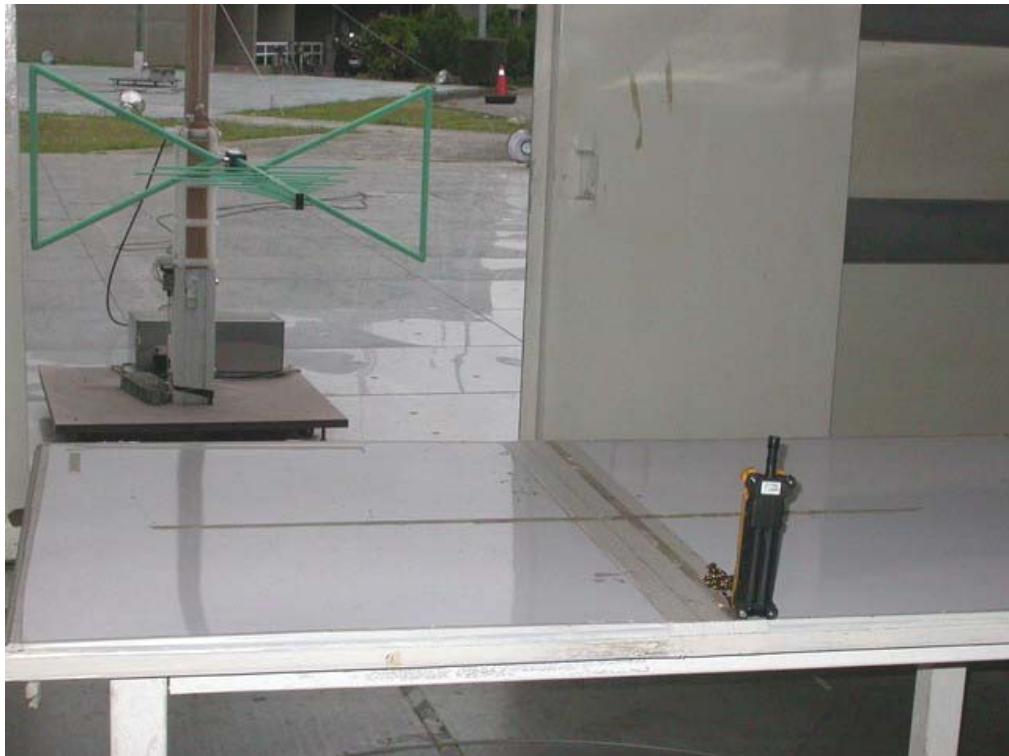
1. * Undetectable
2. Emission level (dB μ V/m) = Antenna Factor (dB/m) + Cable loss (dB) + Meter Reading (dB μ V).
3. Remark “▲” means fundamental frequency for Transmitter Device.
4. The emission value below 1GHz is quasi-peak value and the emission value above 1GHz is both peak and average value.
PK : Peak value; AVG : Average value; QP : Quasi-peak value.
5. The measurement was searched to 10th harmonic, Remark “---” means that the emissions level is too low to be measured.
6. Remark “※”means the Restricted band.
7. For the fundamental frequency (438.44MHz), Z-axis direction, detailed in setup photo.
8. Average = Peak Value + Duty Factor (Duty Factor = -6.61dB)

3.7 Photos of Radiated Test

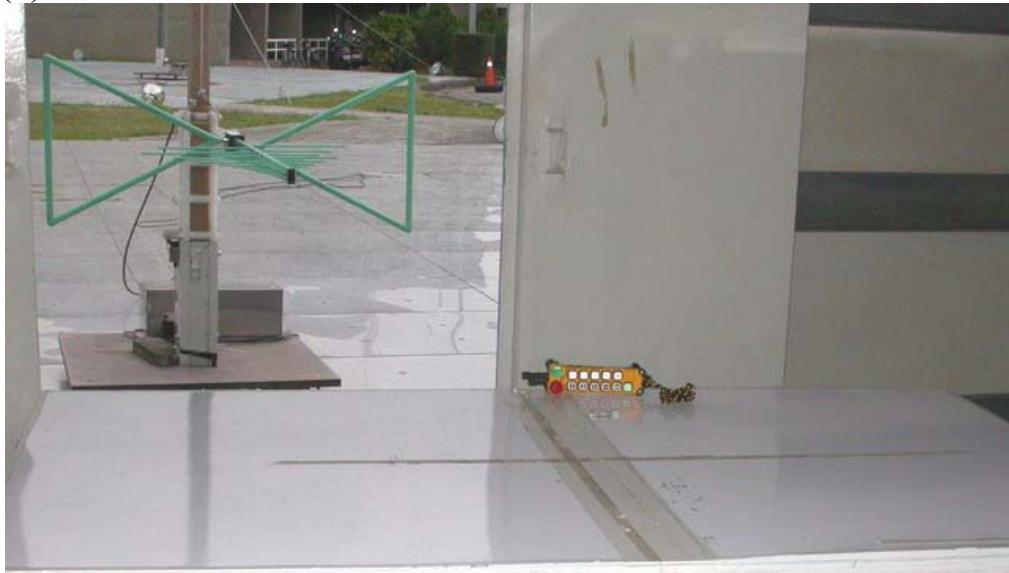
TX mode :

(1) X-axis





(2) Y-axis

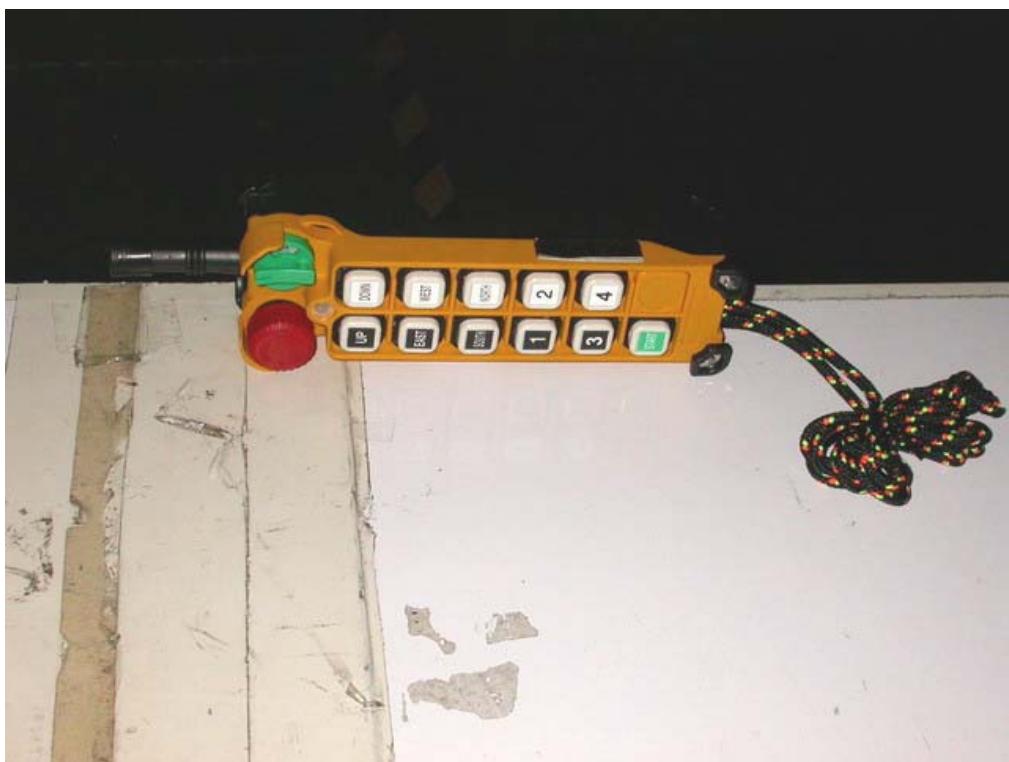




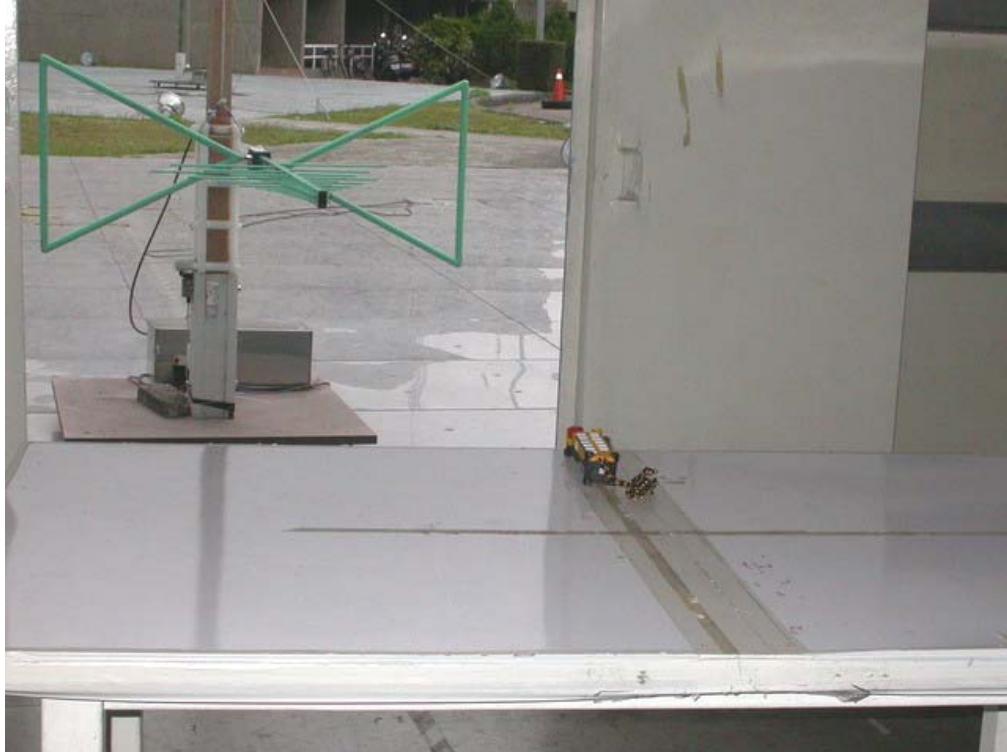
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FCC ID : LWN9312F24
Report No. : ER04-12-049FRF
Page 26 of 32



(3) Z-axis





4. BANDWIDTH MEASUREMENT

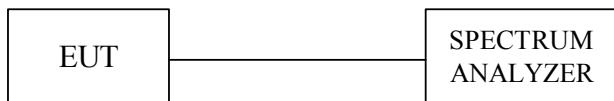
4.1 Test Equipments

Description & Manufacturer	Model No.	Serial No.	Date Of Calibration
ROHDE & SCHWARZ SPECTRUM ANALYZER	FSEK30	835253/002	September 06, 2004

Note :

1. The measurement uncertainty is less than +/- 2.6dB, which is calculated as per the NAMAS document NIS81.
2. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.

4.2 Test Setup



4.3 Limits of Bandwidth Measurement

The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz. For devices operating above 900 MHz, the emission shall be no wider than 0.5% of the center frequency. Bandwidth is determined at the points 20dB down from the modulated carrier.

4.4 Test Procedure

The transmitter output was connected to the spectrum analyzer through an attenuator. The bandwidth of the fundamental frequency was measured by spectrum analyzer with 100 KHz RBW and 100MHz VBW. The 20dB bandwidth is defined as the total spectrum the power of which is higher than peak power minus 20dB.

4.5 Uncertainty of Conducted Emission

The uncertainty of conducted emission is $\pm 200\text{KHz}$.



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FCC ID : LWN9312F24
Report No. : ER04-12-049FRF
Page 30 of 32

4.6 Test Results

Input Power (System)	3VDC (For TX device) from two AA battery	Environmental Conditions	20.9°C, 72%RH
Tested By	Ken Tu		

1. For the fundamental frequency (428.56MHz)

Center Frequency (MHz)	Bandwidth (kHz)	Minimum Limit (kHz)	Pass / Fail
428.56	517.03	1071.40	PASS

Note : The fundamental frequency of EUT is 428.56MHz. The minimum bandwidth limit will be the 0.25% of the center frequency that is $428.56\text{MHz} \times 0.25\% = 1071.40\text{ kHz}$.

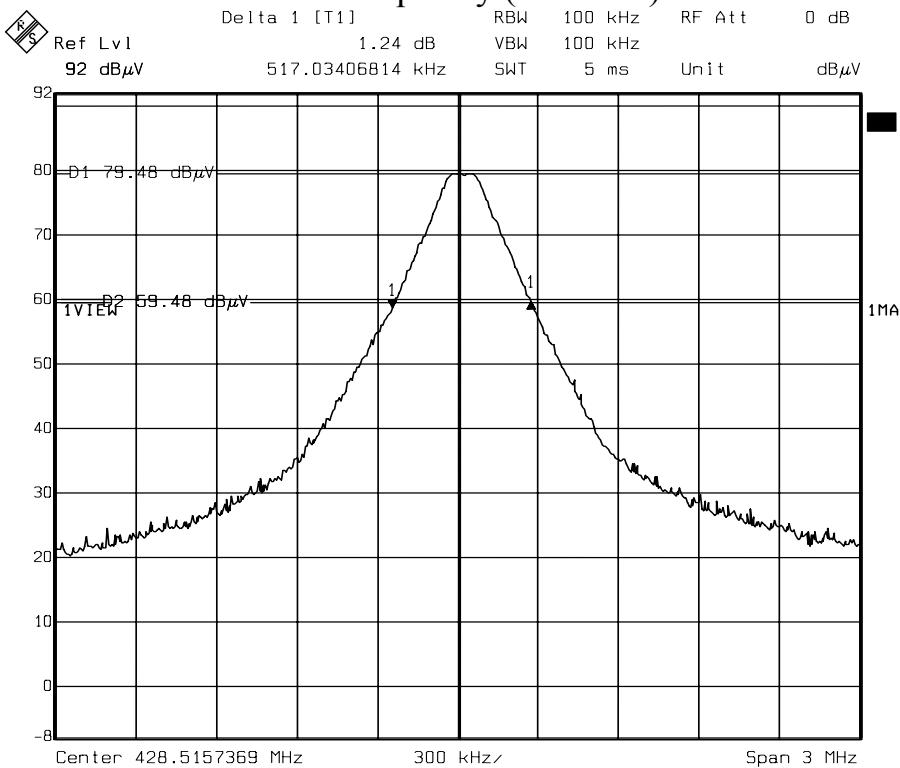
2. For the fundamental frequency (438.44MHz)

Center Frequency (MHz)	Bandwidth (kHz)	Minimum Limit (kHz)	Pass / Fail
438.44	489.25	1096.10	PASS

Note : The fundamental frequency of EUT is 438.44MHz. The minimum bandwidth limit will be the 0.25% of the center frequency that is $438.44\text{MHz} \times 0.25\% = 1096.1\text{ kHz}$.

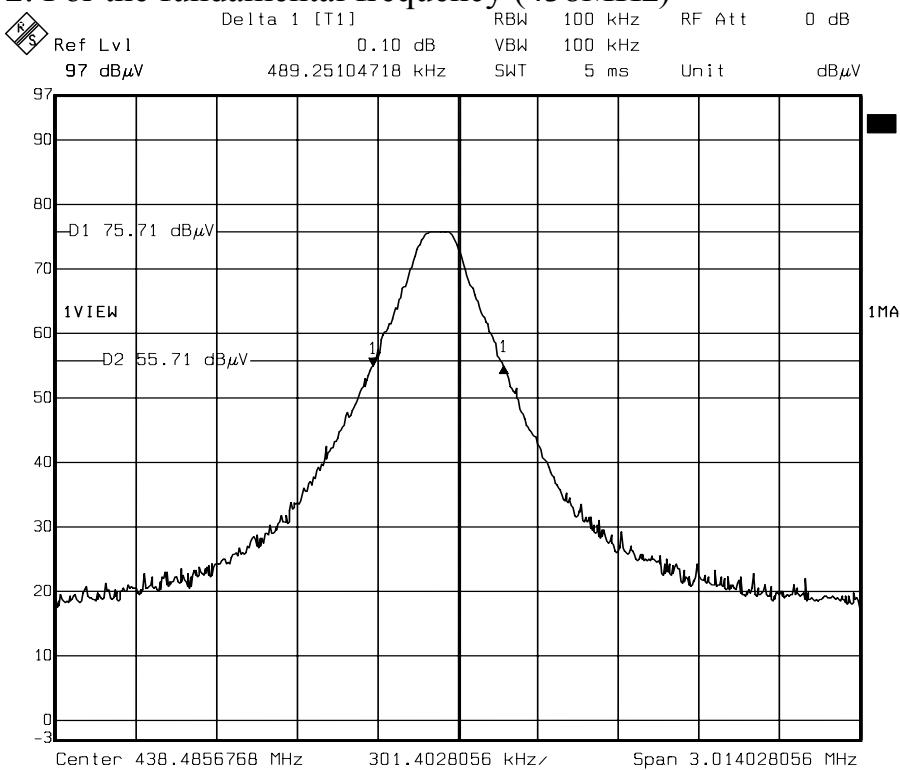
4.7 Photo of Bandwidth Measurement

1. For the fundamental frequency (428MHz)



Date: 22.DEC.2004 17:16:04

2. For the fundamental frequency (438MHz)



Date: 22.DEC.2004 16:03:43



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FCC ID : LWN9312F24
Report No. : ER04-12-049FRF
Page 32 of 32

5. ANTENNA REQUIREMENT

5.1 Standard Applicable

For intentional device, according to FCC 47 CFR Section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

5.2 Antenna Connected Construction

The antenna used in this product is Helix antenna. And the maximum Gain of the antenna is only 1.5dBi.