

FCC TEST REPORT

Test report No: EMC- FCC- R0056

FCC ID: AZIRF2400REV0

Type of equipment: TRANSMITTER REMOCON

Model Name: RF2400 REMOCON REV0

Brand Name: -

Applicant: Celtech World Co.,Ltd

FCC Rule Part(s): FCC Part 15 Subpart C
Section 15.203, Section 15.209
Section 15.207, Section 15.249

Frequency Range: 2433 MHz


Test result: Complied


The above equipment was tested by EMC compliance Testing Laboratory for compliance with the requirements of FCC Rules and Regulations.

The results of testing in this report apply to the product/system which was tested only. Other similar equipment will not necessarily produce the same results due to production tolerance and measurement uncertainties.

Date of test: December 13, 2011 ~ December 15 , 2011

Issued date: December 20, 2011


Tested by: _____
SON, MIN GI


Approved by: _____
KIM, CHANG MIN

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1. Client information

Applicant:	Celtech World Co.,Ltd
Address:	Rm.506,B-dong, Woolimlions Valley, #425, Cheongcheon-dong, Bupyeong-gu, In-cheon, Korea
Telephone number:	+82-32-552-1045
Facsimile number :	+82-32-552-1046
Contact person:	Shin Dong Wook/Technical Manager
Manufacturer:	Celtech World Co.,Ltd
Address :	Rm.506,B-dong, Woolimlions Valley, #425, Cheongcheon-dong, Bupyeong-gu, In-cheon, Korea

2. Laboratory information

Address

EMC Compliance Ltd.

480-5 Shin-dong, Yeongtong-gu, Suwon-city, Gyeonggi-do, 443-390, Korea,

Telephone Number: 82 31 336 9919 Facsimile Number: 82 31 336 4767

Certificate

CBTL Testing Laboratory, KOLAS NO.: 231

FCC Filing No.: KR0040

VCCI Registration No.: C-1713, R-1606, T-258

SITE MAP



3. Description of E.U.T.

3.1 Basic description

Applicant :	Celtech World Co.,Ltd
Address of Applicant:	Rm.506,B-dong, Woolimlions Valley, #425, Cheongcheon-dong, Bupyeong-gu, In-cheon, Korea
Manufacturer:	Celtech World Co.,Ltd
Address of Manufacturer:	Rm.506,B-dong, Woolimlions Valley, #425, Cheongcheon-dong, Bupyeong-gu, In-cheon, Korea
Type of equipment:	TRANSMITTER REMOCON
Basic Model:	RF2400 REMOCON REV0
Brand name:	-
Serial number:	Proto Type

3.2 General description

Frequency Range	2433 MHz
Type of Modulation	2-FSK
Number of Channels	1 channel
Type of Antenna	CHIP Antenna
Antenna Gain	0 dBi
Transmit Power	Under -20 dBm (declared by the applicant)
Baudrate	10 kbps
Data Format	NRZ
Power supply	DC 3 V (AAA size battery)
Working Current	30 mA
Dimension	152.7 x 41.0 x 21.0 (mm)

3.3 Test frequency

	Frequency
Low frequency	-
Middle frequency	2433 MHz
High frequency	-

3.4 Test Voltage

mode	Voltage
Normal voltage	DC 3 V

4. Summary of test results

4.1 Standards & results

Rule Reference	Parameter	Report Section	Test Result
15.203, 15.247(b)(4)	Antenna Requirement	5.1	C
15.249(a), (c), (d) 15.209(a)	Spurious Emission, Band Edge, and Restricted bands	5.7	C
15.207(a)	Conducted Emissions	5.9	NA*

Note: C=complies
NC= Not complies
NT=Not tested
NA=Not Applicable

*The test is not applicable since the EUT is not the device that is designed to be connected to the public utility(AC) power line.

4.2 Uncertainty

Measurement Item	Combined Standard Uncertainty U _c	Expanded Uncertainty U = KU _c (K = 2)
Conducted RF power	± 1.106 dB	± 3.120 dB
Radiated disturbance	+2.280dB / - 2.278 dB	+4.560dB / - 4.556 dB
Conducted disturbance	+1.883 dB / - 1.676 dB	+3.766dB / - 3.352 dB

5. Test results

5.1 Antenna Requirement

5.1.1 Regulation

According to §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. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

5.1.2 Result

-Complied

The transmitter has an chip antenna. The directional gain of the antenna is 0 dBi.

5.2 SPURIOUS EMISSION, BAND EDGE, AND RESTRICTED BANDS

5.2.1 Regulation

According to §15.249(a), Except as provided in paragraph (b) of this section, the field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

Fundamental Frequency	Field strength of Fundamental (millivolt/meter)	Field strength of Harmonics (microvolts/meter)
902-928 MHz	50	500
2400-2483.5MHz	50	500
5725-5875 MHz	50	500
24.0-24.25 GHz	250	2500

According to §15.249(c), Field strength limits are specified at a distance of 3 meters.

According to §15.249(d), Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in Section 15.209, whichever is the lesser attenuation.

According to §15.209(a), Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

** The emission limits shown in the above table are based on measurement instrumentation employing a CISPR quasi-peak detector and above 1000 MHz are based on the average value of measured emissions.

According to §15.209(a), Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field strength of Fundamental (millivolt/meter)	Field strength of Harmonics (microvolts/meter)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	30
30-88	100**	3
88-216	150**	3
216-960	200**	3
Above 960	500	3

** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g., sections 15.231 and 15.241.

5.2.2 Measurement Procedure

1) Spurious Radiated Emissions:

1. The preliminary radiated measurements were performed to determine the frequency producing the maximum emissions in an anechoic chamber at a distance of 3 meters.
2. The EUT was placed on the top of the 0.8-meter height, 1×1.5 meter non-metallic table. To find the maximum emission levels, the height of a measuring antenna was changed and the turntable was rotated 360° .
3. The antenna polarization was also changed from vertical to horizontal. The spectrum was scanned from 9kHz to 30 MHz using the loop antenna, and from 30 to 1000 MHz using the TRILOG broadband antenna, and from 1000 MHz to 26500 MHz using the horn antenna.
4. To obtain the final measurement data, the EUT was arranged on a turntable situated on a 4×4 meter at the Open Area Test Site. The EUT was tested at a distance 3 meters.
5. Each frequency found during preliminary measurements was re-examined and investigated. The test-receiver system was set up to average, peak, and quasi-peak detector function with specified bandwidth.

5.2.3 Test Result

-complied

1. Band edge compliance of RF Radiated Emissions was shown in figure 1.
2. Measured value of the Field strength of spurious Emissions (Radiated)

Frequency [MHz]	Receiver Bandwidth [kHz]	Reading [dB(μV)]	Pol. [V/H]	Factor (Amp Gain + Attenuator + AF + CL)	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]
Quasi-Peak DATA. Emissions below 30MHz							
		Not detected (In the noise floor)					
Quasi-Peak DATA. Emissions below 1GHz							
33.170	120	H	31.3	-15.7	15.6	40.0	24.4
44.256	120	H	24.4	-14.4	10.0	40.0	30.0
58.184	120	V	23.9	-14.4	9.5	40.0	30.5
108.085	120	V	35.6	-17.6	18.0	43.5	25.5
172.996	120	H	33.1	-14.4	18.7	43.5	24.8
Peak DATA. Emissions above 1GHz							
2432.25	1000	H	72.3	-1.9	70.4	114.0	43.6
2432.25	1000	V	69.2	-1.9	67.3	114.0	46.4
4865.38	1000	H	48.5	5.5	54.0	74.0	20.0
Above 4900.00	Not Detected	-	-	-	-	-	-
Average DATA. Emissions above 1GHz							
2432.25	1000	H	71.8	-1.9	69.9	94.0	25.9
2432.25	1000	V	68.5	-1.9	66.6	94.0	27.0
4865.38	1000	H	41.1	5.5	46.6	54.0	7.4
Above 4900.00	Not Detected	-	-	-	-	-	-

5.2.3.1 Test Result

Factor(dB) = ANT Factor+ Amp Gain + Cable Loss

Margin (dB) = Limit - Result

[Result = Reading – Factor]

1. H = Horizontal, V = Vertical Polarization

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

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

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

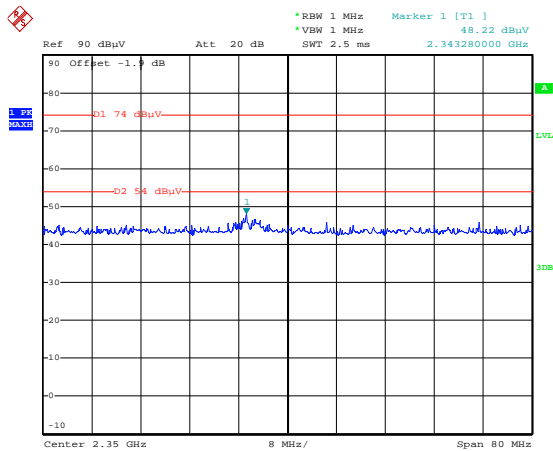
NOTE: All emissions not reported were more than 20 dB below the specified limit or in the noise floor.

5.2.4 Test Plot

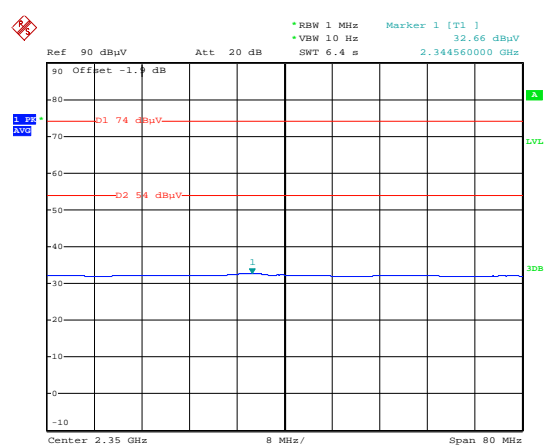
Figure 1. Plot of the Band Edge (Radiated)

- Measured offset's value compensate to Factor's value on Spectrum
(-offset (-1.9dB) : cable loss+amp gain+ant factor)
- Worst case pol: Horizontal

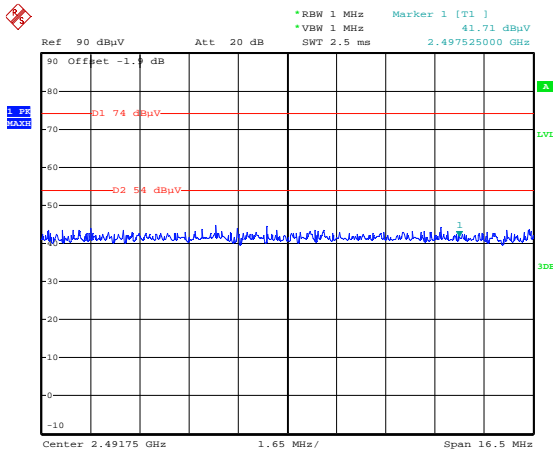
Lowest frequency : PEAK



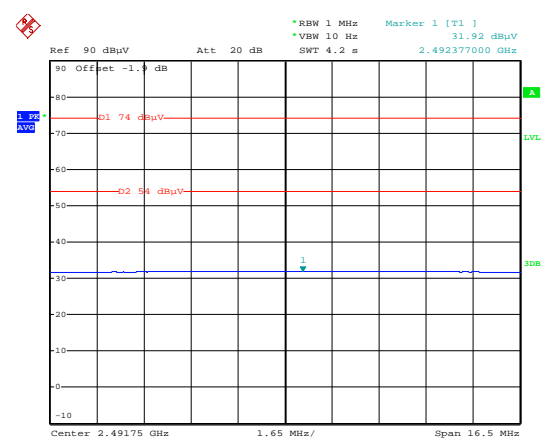
Lowest frequency : AVERAGE



Highest frequency : PEAK



Highest frequency : AVERAGE



5.3 Conducted Emission (N/A)

5.3.1 Regulation

According to §15.207(a), for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 μ H/50 Ω line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

Frequency of emission (MHz)	Conducted limit (dB μ V)	
	Qausi-peak	Average
0.15 – 0.5	66 to 56 *	56 to 46 *
0.5 – 5	56	46
5 – 30	60	50

* Decreases with the logarithm of the frequency.

According to §15.107(a), for unintentional device, except for Class A digital devices, line conducted emission limits are the same as the above table.

5.9.2 Measurement Procedure

1. The EUT was placed on a wooden table of size, 1 m by 1.5 m, raised 80 cm in which is located 40 cm away from the vertical wall and 1.5m away from the side wall of the shielded room.
2. Each current-carrying conductor of the EUT power cord was individually connected through a 50 Ω /50 μ H LISN, which is an input transducer to a Spectrum Analyzer or an EMI/Field Intensity Meter, to the input power source.
3. Exploratory measurements were made to identify the frequency of the emission that had the highest amplitude relative to the limit by operating the EUT in a range of typical modes of operation, cable position, and with a typical system equipment configuration and arrangement. Based on the exploratory tests of the EUT, the one EUT cable configuration and arrangement and mode of operation that had produced the emission with the highest amplitude relative to the limit was selected for the final measurement.
4. The final test on all current-carrying conductors of all of the power cords to the equipment that comprises the EUT (but not the cords associated with other non-EUT equipment is the system) was then performed over the frequency range of 0.15 MHz to 30 MHz.
5. The measurements were made with the detector set to PEAK amplitude within a bandwidth of 10 kHz or to QUASI-PEAK and AVERAGE within a bandwidth of 9 kHz. The EUT was in transmitting mode during the measurements.

6. Test equipment used for test

	Description	Manufacture	Model No.	Serial No.	Next Cal Date.
<input type="checkbox"/>	Temp & humidity chamber	taekwang	TK-04	TK001	12.12.10
<input type="checkbox"/>	Temp & humidity chamber	taekwang	TK-500	TK002	12.09.05
<input type="checkbox"/>	Power Meter	Agilent	E4416A	GB41292365	12.10.26
<input type="checkbox"/>	Frequency Counter	HP	5351B	3049A01295	12.09.07
<input type="checkbox"/>	Spectrum Analyzer	Agilent	E4407B	US39010142	12.10.26
<input checked="" type="checkbox"/>	Spectrum Analyzer	R & S	FSP40	100209	12.10.26
<input checked="" type="checkbox"/>	Signal Generator	HP	E4432B	GB39340611	12.10.26
<input type="checkbox"/>	Modulation Analyzer	HP	8901B	3538A05527	12.10.26
<input type="checkbox"/>	Audio Analyzer	HP	8903B	3729A19213	13.01.11
<input type="checkbox"/>	AC Power Supply	KIKUSUI	PCR2000W	GB001619	12.10.25
<input type="checkbox"/>	DC Power Supply	Tektronix	PS2520G	TW50517	13.02.06
<input checked="" type="checkbox"/>	DC Power Supply	Tektronix	PS2521G	TW53135	12.10.25
<input type="checkbox"/>	Dummy Load	BIRD	8141	7560	12.09.16
<input type="checkbox"/>	Dummy Load	BIRD	8401-025	799	12.09.16
<input checked="" type="checkbox"/>	EMI Test Receiver	R&S	ESCI	100001	12.07.11
<input type="checkbox"/>	Attenuator	HP	8494A	2631A09825	12.10.26
<input type="checkbox"/>	Attenuator	HP	8496A	3308A16640	12.10.26
<input type="checkbox"/>	Attenuator	R&S	RBS1000	D67079	12.10.26
<input type="checkbox"/>	Power sensor	Agilent	E9325A	US40420186	12.10.26
<input checked="" type="checkbox"/>	LOOP Antenna	EMCO	EMCO6502	9205-2745	13.05.23
<input checked="" type="checkbox"/>	BILOG Antenna	Schwarzbeck	VULB 9168	375	13.09.21
<input checked="" type="checkbox"/>	HORN Antenna	ETS	3115	00086706	13.11.21
<input checked="" type="checkbox"/>	HORN Antenna	ETS	3116	00086632	13.11.15
<input checked="" type="checkbox"/>	Signal Generator	HP	E4432B	GB39340611	12.10.26
<input type="checkbox"/>	Power Divider	Weinschel	1580-1	NX375	12.10.26
<input type="checkbox"/>	Power Divider	Weinschel	1580-1	NX380	12.09.14
<input type="checkbox"/>	Power Divider	Weinschel	1594	671	12.09.14
<input type="checkbox"/>	Test Receiver	R&S	ESHS30	844827/011	12.08.16
<input type="checkbox"/>	LISN	R&S	ESH3-Z5	846125/024	12.08.04
<input type="checkbox"/>	LISN	PMM	L3-32	0120J20305	-