SKT

SK TECH CO., LTD.

Certificate of Compliance

Test Report No.:	**SKTTRT-031014-005**		
NVLAP CODE:	**200220-0**		
Applicant:	**A-Tech Co., Ltd.**		
Applicant Address:	**5-3 Gomak-ri, Wolgot-Myeon, Gimpo, Kyunggi-Do, Korea**		
Device Under Test:	**Radio Control System – RAPIER**		
FCC ID:	**RJ4**	**Model No.:**	**AP-T2PA**
Receipt No.:	SKTEU03-0570(-2)	**Date of receipt:**	October 8, 2003
Date of Issue:	October 14, 2003		
Location of Testing:	**SK TECH CO., LTD.** 820-2, Wolmoon-Ri, Wabu-Up, Namyangju-Si, Kyunggi-Do, Korea		
Test Procedure:	**ANSI C63.4 / 2001**		
Test Specification:	**FCC Title 47, Part 15 Subpart C**		
Equipment Class:	**Part 15 Low Power Communication Device Transmitter**		
Test Result:	The above-mentioned device has been tested and passed.		

Tested & Reported by: *Jong-Soo, Yoon*

10/14/2003

Signature *Date*

Approved by: *Jae-Kyung, Bae*

10/14/2003

Signature *Date*

Other Aspects:	
Abbreviations:	**· OK, Pass = passed · Fail = failed · N/A = not applicable**

☞
- **This test report is not permitted to copy partly without our permission.**
- **This test result is dependent on only equipment to be used.**
- **This test result is based on a single evaluation of one sample of the above mentioned.**
- **This test report must not be used to claim product endorsement by NVLAP or any agency of the U.S Government.**
- **We certify that this test report has been based on the measurement standards that is traceable to the national or International standards.**

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NVLAP Lab. Code: 200220-0

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1. GENERAL

These tests were performed using the test procedure outlined in ANSI C63.4, 2001 for intentional radiators, and in accordance with the limits set forth in FCC Part 15.227 for Low Power Communication Device Transmitter. The EUT (Equipment Under Test) has been shown to be capable of compliance with the applicable technical standards.

We attest to the accuracy of data. All measurements reported herein were performed by SK Tech Co., Ltd. and were made under Chief Engineer's supervision.
We assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

2. TEST SITE

SK TECH Co., Ltd.

2.1 Location

820-2, Wolmoon Ri, Wabu-Up, Namyangju-Si, Kyunggi-Do, Korea

This test site is in compliance with ISO/IEC 17025 for general requirements for the competence of testing and calibration laboratories.
This laboratory is accredited by NVLAP for NVLAP Lab. Code: 200220-0 and DATech for DAR-Registration No.: TTI-P-G155/97-10

2.2 List of Test and Measurement Instruments

Equipment Type	Manufacturer	Model No.	Serial No.	Cal. Due Date
EMI Test Receiver	Rohde&Schwarz	ESVS 10	825120/013	10, 2003
EMI Test Receiver	Rohde&Schwarz	ESVS 10	834468/008	10, 2003
EMC Spectrum Analyzer	Agilent	E7405A	US40240203	12, 2003
Amplifier	H.P	8447F	3113A05153	10, 2003
TRILOG broadband antenna	Schwarzbeck	VULB9160	3141	05, 2004
Antenna Mast	TOKIN	5907	N/A	N/A
Antenna & Turntable controller	TOKIN	5906	N/A	N/A
50Ω Switcher	Anritsu	MP59B	6100214538	N/A

2.3 Test Date

Date of Application : October 8, 2003
Date of Test : October 11, 2003 ~ October 13, 2003

2.4 Test Environment

See each test item's description.

3. DESCRIPTION OF THE EQUIPMENT UNDER TEST

The product specification described herein was obtained from the product data sheet or user's manual.

3.1 Rating and Physical Characteristics

Type (Model No.)	Transmitter	Receiver*
	AP-T2PA	AP-R2AN, AP-RE1AN
Power source	DC 12V (AA battery x 8)	-
Local Oscillator or X-Tal	X-Tal: 27.045 MHz	-
Transmit Frequency	27.045 MHz (fixed)	-
Antenna Type	Integral	-
Type of Modulation	ASK	-
RF Output power	10mW under	-
Interface Ports	Charging Jack **	-

* The verification report for the receivers, AP-R2AN & AP-RE1AN including Speed Controller (AP-EN1) and Servo (AP-S301), should be issued with other test report number.

** The EUT only employs battery power for operation and does not operate from the AC power lines. Although the EUT makes provision for the use of battery chargers via the Charging Jack, the Power Switch on it does not permit operating while charging.

3.2 Equipment Modifications

None.

3.3 Submitted Documents

Block diagram

Schematic diagram

Part List

User manual

4. MEASUREMENT CONDITIONS

4.1 Description of test configuration

The EUT was configured for testing in a typical fashion (as a user would normally use it). The EUT has 6-transmitter codes (throttle trigger – Neutral, Forward, and Backward & steering wheel – Neutral, Left, and Right). Once the Power Switch turned ON, the EUT transmitted the activation code (throttle trigger – Neutral & steering wheel – Neutral).

During the exploratory tests, all 6-transmitter codes were investigated to find the worst-case emission mode. The final radiated data were taken in the worst operating condition as below.

Operating Mode
Throttle trigger – Forward / Steering wheel - Neutral

4.2 List of Peripherals

Equipment Type	FCC ID	Manufacture	Model	Serial Number

The EUT was tested as a stand-alone device.

4.3 Type of Used Cables

Description	Length	Type of shield	Manufacturer	Remark

None

4.4 Uncertainty

Radiated disturbance

Uc (Combined standard Uncertainty) = ± 2.37 dB

Expanded uncertainty U = KUc = ±4.74dB (K = 2)

5. TEST AND MEASUREMENTS

Summary of Test Results

Requirement	CFR Section	Report Section	Test Result
Antenna Requirement	15.203	5.1	PASS
Conducted Emissions	15.207	*	*
Field Strength (Fundamental)	15.227(a)	5.2	PASS
Radiated Spurious Emissions	15.227(b)	5.2	PASS
Occupied bandwidth	15.227(b)	5.3	PASS

**** Not required, the EUT only employs battery power for operation. The Power Switch on it does not permit operating while charging.***

5.1 ANTENNA REQUIREMENT

5.1.1 Regulation

FCC 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. 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 Part 15C. The manufacturer may design the unit so that the user can replace a broken antenna, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of Sections 15.211, 15.213, 15.217, 15.219, or 15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with Section 15.31 (d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this Part are not exceeded.

5.1.2 Result: PASS

The transmitter has an integral antenna and does meet the requirements of this section.

5.2 RADIATED EMISSIONS

5.2.1 Regulation

According to §15.227(a), the field strength of any emission within the band 26.96 – 27.28 MHz shall not exceed 10,000 microvolts/meter at 3 meters. The emission limit is based on measurement instrumentation employing an average detector. The provisions in Section 15.35 for limiting peak emissions apply.

Fundamental frequency (MHz)	Field strength of fundamental (uV/m @ 3m)	Field strength of fundamental (dBuV/m @ 3m)
26.96 – 27.28	10,000	80.0

According to §15.227(b), the field strength of any emissions which appear outside of this band shall not exceed the general radiated emission limits in §15.209.

Frequency (MHz)	Field strength (uV/m @ 3m)	Field strength (dBuV/m @ 3m)
30–88	100	40.0
88–216	150	43.5
216–960	200	46.0
Above 960	500	54.0

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.

5.2.2 Test Procedure

Preliminary radiated measurements were performed to determine the frequency producing the maximum emissions in an anechoic chamber at a distance of 3 meters. The EUT was placed on the top of the 0.8 meter high, 1 x 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°. The antenna polarization was also changed from vertical to horizontal. The spectrum was scanned from 30 to 1000 MHz using the TRILOG broadband antenna.

To obtain the final test data, the EUT was arranged on a turntable situated on a 4x4 meter at the Open Area Test Site. The EUT was tested at a 3-meter test distance. 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. The

presence of ambient signals was verified by turning the EUT off. In case an ambient signal was detected, the measurement bandwidth was reduced temporarily and verification was made that an additional adjacent peak did not exist. This ensures that the ambient signal does not hide any emissions from the EUT.

The EUT was operated in transmitting mode and tested in three orthogonal planes. The measurements were performed at the operating frequency: 27.045 MHz.

5.2.3 Test Results: PASS

Table 1: Measured values of the Field strength

Frequency [MHz]	Receiver Bandwidth [kHz]	Pol. (V/H)	Antenna Height [m]	Table Angle [°]	Reading [dB(μV)]	Amp Gain [dB]	AF / CL [dB(1/m)]	Actual [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]
AVERAGE data, emissions in 15.227(a) bands										
27.05	120	V	1	0	93.02	28.4	12.43/0.4	77.45	80.0	2.55
PEAK data, emissions in 15.227(a) bands										
27.05	120	V	1	0	95.17	28.4	12.43/0.4	79.60	100.0	20.40
Quasi-peak data, emissions in 15.227(b) / 15.209 bands										
54.09	120	V	1	0	52.75	28.2	12.40/0.7	37.65	40.0	2.35
110.31	120	V	1	0	40.40	27.8	11.07/1.5	25.17	43.5	18.33

1. H = Horizontal, V = Vertical Polarization
2. AF/CL = Antenna Factor and Cable Loss
3. The spectrum was scanned from 30 MHz to 1 GHz. All emissions not reported were more than 20 dB below the specified limit or in the noise floor.

Margin (dB) = Limit – Actual

[Actual = Reading – Amp Gain + AF + CL]

5.3 OCCUPIED BANDWIDTH

5.3.1 Regulation

According to §15.227(b), the field strength of any emissions which appear outside of this band shall not exceed the general radiated emission limits in §15.209.

5.3.2 Test Procedure

ANSI C63.4-2001 Section 13.1.7, Occupied Bandwidth Measurements. The bandwidth is measured at an amplitude level reduced from the reference level by a specified ratio. The reference level is the level of the highest amplitude signal observed from the transmitter at either the fundamental frequency or first-order modulation products in all typical modes of operation, including the unmodulated carrier, even if atypical. Once the reference level is established, the equipment is conditioned with typical modulating signals to produce worst-case (widest) bandwidth.
The measurements were performed at the operating frequency 27.045 MHz. The spectrum trace data around fundamental frequency of the EUT was obtained with the spectrum analyzer in "Max Hold" mode. The bandwidth value was determined between the two points of 26dB down from the reference level.

5.3.3 Test Results: PASS

Table 2: Measured values of the Occupied bandwidth

Operating frequency (MHz)	26 dB Bandwidth (kHz)	Limit (MHz)
27.045	8.778	*within* 26.96 – 27.28

Figure 1: Plot of the Occupied bandwidth

Operating at 27.045 MHz