Guangdong Shiji Technology Co.,Ltd

Application
For
Certification

FCC ID: 2ALUJS70W720PB

Controller

Model: P70-GPS, S70W720P-D(GPS)

Brand Name: Promark, SJ R/C

2.4GHz Transmitter

Report No.: 170710037GZU-001

We hereby certify that the sample of the above item is considered to comply with the requirements of FCC Part 15, Subpart C for Intentional Radiator, mention 47 CFR [10-1-15]

Prepared and Checked by:	Approved by:
Sign on file	Digitally signed by Kidd Yang Location: Intertek Testing Services
Surel Guo Engineer	Kidd Yang Senior Project Engineer Date: July 7, 2017

TRF No.: FCC 15C_TX_c

LIST OF EXHIBITS

MEASUREMENT/TECHNICAL REPORT

Guangdong Shiji Technology Co.,Ltd

Model: P70-GPS

FCC ID: 2ALUJS70W720PB

This report concerns (check one:) Original Grant X Class II Change _____

Equipment Type: DXX - Part 15 Low Power Communication Device Transmitter

Deferred grant requested per 47 CFR 0.457(d)(1)(ii)? Yes _____ No X

If yes, defer until: _____
date

Company Name agrees to notify the Commission by: _____
date
of the intended date of announcement of the product so that the grant can be issued on that date.

Transition Rules Request per 15.37? Yes _____ No X

If no, assumed Part 15, Subpart C for intentional radiator – the new 47 CFR [10-1-15 Edition] provision.

Report prepared by:

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Exhibit type	File Description	Filename
Test Report	Test Report	report.pdf
Test Setup Photo	Radiated Emission	radiated photos.pdf
Test Report	Bandedge Plot	bandedge.pdf
Test Report	20dB BW Plot	bw.pdf
External Photo	External Photo	external photos.pdf
Internal Photo	Internal Photo	internal photos.pdf
Block Diagram	Block Diagram	block.pdf
Schematics	Circuit Diagram	circuit.pdf
Operation Description	Technical Description	descri.pdf
ID Label/Location	Label Artwork and Location	label.pdf
User Manual	User Manual	manual.pdf
Cover Letter	Confidentiality Letter	request.pdf
Cover Letter	Letter of Agency	agency.pdf

EXHIBIT 1

GENERAL DESCRIPTION

1.0 General Description

1.1 Product Description

The equipment under test (EUT) is a Controller with 2.4GHz wireless control function operating in 2402-2478MHz. The EUT is powered by rechargeable battery (DC 3.7V, 300mAh) which can be charged by USB port (DC 5V).For more detail information pls. refer to the user manual.

The Model: S70W720P-D(GPS) is the same as the Model: P70-GPS in hardware and electrical aspect. The difference in model number and brand name as marketing strategy. Details as below:

Model No.	Brand name
P70-GPS	Promark
S70W720P-D(GPS)	SJ R/C

Antenna type: Integral antenna

Modulation Type: GFSK

Antenna gain: 0dBi Max

For electronic filing, the brief circuit description is saved with filename: descri.pdf.

1.2 Related Submittal(s) Grants

This is an application for certification of a controller which has 2.4GHz wireless control function, other digital functions were reported in the verification report: 170710031GZU-002. And there has Drone Quadcopter (FCC ID: 2ALUJS70W720PA) which associated with this EUT, is filed at the same time, and is subjected to report: 170710031GZU-001.

1.3 Test Methodology

Radiated emission measurement was performed according to the procedures in ANSI C63.10 (2013). Radiated emission measurement was performed in Semi-anechoic chamber. For radiated emission measurement, preliminary scans were performed in the semi-anechoic chamber only to determine the worst case modes. All radiated tests were performed at an antenna to EUT distance of 3 meters, unless stated otherwise in the "**Justification Section**" of this Application. All other measurements were made in accordance with the procedures in part 2 of CFR 47.

1.4 Test Facility

The Semi-Anechoic chamber and shield room used to collect the radiated data and conducted data are **EMTEK (Shenzhen) Co., Ltd.** and located at Bldg. 69, Majialong Industry Zone, Nanshan District, Shenzhen, Guangdong, 518052, China. This test facility and site measurement data have been fully placed on file with File Number: 4480A.

EXHIBIT 2

SYSTEM TEST CONFIGURATION

2.0 System Test Configuration

2.1 Justification

The system was configured for testing in a typical fashion (as a customer would normally use it), and in the confines as outlined in ANSI C63.10 (2013).

The EUT was powered by fully charged DC 3.7 V rechargeable battery during the test.

For maximizing emissions, the EUT was rotated through 360°, the antenna height was varied from 1 meter to 4 meters above the ground plane, and the antenna polarization was changed. This step by step procedure for maximizing emissions led to the data reported in Exhibit 3.

The EUT was operated standalone and placed in the central of the styrene turntable.

The equipment under test (EUT) was configured for testing in a typical fashion (as a customer would normally use it). The EUT was placed on the styrene turntable, which enabled the engineer to maximize emissions through its placement in the three orthogonal axes.

2.2 EUT Exercising Software

The EUT exercise program (provided by client) used during testing was designed to exercise the various system components in a manner similar to a typical use.

2.3 Special Accessories

No special accessory attached.

2.4 Equipment Modification

Any modifications installed previous to testing by Guangdong Shiji Technology Co.,Ltd will be incorporated in each production model sold / leased in the United States.

No modifications were installed by Intertek Testing Services Shenzhen Ltd Guangzhou Branch.

2.5 Measurement Uncertainty

When determining the test conclusion, the Measurement Uncertainty of test has been considered.

2.6 Support Equipment List and Description

N/A

EXHIBIT 3

EMISSION RESULTS

3.0 Emission Results

Data is included worst-case configuration (the configuration which resulted in the highest emission levels).

3.1 Radiated Test Results

A sample calculation, configuration photographs and data tables of the emissions are included.

3.1.1 Field Strength Calculation

The field strength is calculated by adding the reading on the Spectrum Analyzer to the factors associated with preamplifiers (if any), antennas, cables, pulse desensitization and average factors (when specified limit is in average and measurements are made with peak detectors). A sample calculation is included below.

FS = RA + AF + CF - AG + PD + AV

Where FS = Field Strength in dBµV/m
RA = Receiver Amplitude (including preamplifier) in dBµV
CF = Cable Attenuation Factor in dB
AF = Antenna Factor in dB
AG = Amplifier Gain in dB
PD = Pulse Desensitization in dB
AV = Average Factor in -dB

In the radiated emission table which follows, the reading shown on the data table may reflect the preamplifier gain. An example of the calculations, where the reading does not reflect the preamplifier gain, follows:

FS = RA + AF + CF - AG + PD + AV

Assume a receiver reading of 62.0 dBµV is obtained. The antenna factor of 7.4 dB and cable factor of 1.6 dB is added. The amplifier gain of 29 dB is subtracted. The pulse desensitization factor of the spectrum analyzer was 0 dB, and the resultant average factor was -10 dB. The net field strength for comparison to the appropriate emission limit is 32 dBµV/m. This value in dBµV/m was converted to its corresponding level in µV/m.

RA = 62.0 dBµV
AF = 7.4 dB
CF = 1.6 dB
AG = 29.0 dB
PD = 0 dB
AV = -10 dB
FS = 62 + 7.4 + 1.6 - 29 + 0 + (-10) = 32 dBµV/m

Level in µV/m = Common Antilogarithm [(32 dBµV/m)/20] = 39.8 µV/m

3.1.2 Radiated Emission Configuration Photograph

For electronic filing, the worst case radiated emission configuration photograph is saved with filename: radiated photos. pdf.

3.1.3 Radiated Emissions

The data on the following page lists the significant emission frequencies, the limit and the margin of compliance. Numbers with a minus sign are below the limit.

Worst Case Radiated Emission
at
54.720 MHz

Judgement: Passed by 18.0 dB

TEST PERSONNEL:

Sign on file

Surel Guo, Engineer
Typed/Printed Name

June 5, 2017
Date

Applicant: Guangdong Shiji Technology Co.,Ltd
Model: P70-GPS
Sample: 1/1
Worst Case Operating Mode: Transmitting (2402MHz)
Modulation type: GFSK

Date of Test: June 5, 2017

Table 1

Radiated Emissions

Polarization	Frequency (MHz)	Reading (dBµV)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m (dBµV/m)	Limit at 3m (dBµV/m)	Margin (dB)
Horizontal	32.940	24.0	20.0	16.3	20.3	40.0	-19.7
Horizontal	93.060	30.9	20.0	9.3	20.2	43.5	-23.3
Horizontal	304.980	25.7	20.0	15.5	21.2	46.0	-24.8
Vertical	54.720	33.6	20.0	8.4	22.0	40.0	-18.0
Vertical	82.380	31.3	20.0	8.8	20.1	40.0	-19.9
Vertical	92.565	34.1	20.0	9.3	23.4	43.5	-20.1

NOTES:
1. Quasi-Peak detector is used except for others stated.
2. All measurements were made at 3 meters. Harmonic emissions not detected at the 3-meter distances were measured at 0.3-meter and an inverse proportional extrapolation was performed to compare the signal level to the 3-meter limit. No other harmonic emissions than those reported were detected at a test distance of 0.3-meter.
3. Negative value in the margin column shows emission below limit.
4. All emissions are below the QP limit.

3.1.4 Transmitter Spurious Emissions (Radiated)

Worst Case Radiated Emission
at
7434.000 MHz

For electronic filing, the worst case radiated emission configuration photograph is saved with filename: radiated photos. pdf.

The data on the following page lists the significant emission frequencies, the limit and the margin of compliance. Numbers with a minus sign are below the limit.

Judgement: Passed by 6.1 dB

TEST PERSONNEL:

Sign on file

Surel Guo, Engineer
Typed/Printed Name

June 5, 2017
Date

Applicant: Guangdong Shiji Technology Co.,Ltd
Model: P70-GPS
Sample: 1/1
Worst Case Operating Mode: Transmitting

Date of Test: June 5, 2017

Table 2

Radiated Emissions

(2402MHz)

Polarization	Frequency (MHz)	Reading (dBµV)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m (dBµV/m)	Peak Limit at 3m (dBµV/m)	Margin (dB)
Horizontal	2402.000	106.5	36.7	28.5	98.3	114.0	-15.7
Horizontal	4804.000	68.1	36.7	28.5	59.9	74.0	-14.1
Horizontal	7206.000	60.3	36.1	33.1	57.3	74.0	-16.7

Polarization	Frequency (MHz)	Reading (dBµV)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Average Factor (-dB)	Net at 3m (dBµV/m)	Average Limit at 3m (dBµV/m)	Margin (dB)
Horizontal	2402.000	106.5	36.7	28.5	17.7	80.6	94.0	-13.4
Horizontal	4804.000	68.1	36.7	28.5	17.7	42.2	54.0	-11.8
Horizontal	7206.000	60.3	36.1	33.1	17.7	39.6	54.0	-14.4

Notes: 1. Peak Detector Data unless otherwise stated.

2. All measurements were made at 3 meter. Harmonic emissions not detected at the 3-meter distance were measured at 0.3-meter and an inverse proportional extrapolation was performed to compare the signal level to the 3-meter limit. No other harmonic emissions than those reported were detected at a test distance of 0.3-meter.

3. Negative value in the margin column shows emission below limit.

4. Horn antenna is used for the emission over 1000MHz.

Applicant: Guangdong Shiji Technology Co.,Ltd
Model: P70-GPS
Sample: 1/1
Worst Case Operating Mode: Transmitting

Date of Test: June 5, 2017

Table 3

Radiated Emissions

(2440MHz)

Polarization	Frequency (MHz)	Reading (dBµV)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m (dBµV/m)	Peak Limit at 3m (dBµV/m)	Margin (dB)
Horizontal	2440.000	111.5	36.7	28.5	103.3	114.0	-10.7
Horizontal	4880.000	71.3	36.7	28.5	63.1	74.0	-10.9
Horizontal	7320.000	66.5	36.1	33.1	63.5	74.0	-10.5

Polarization	Frequency (MHz)	Reading (dBµV)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Average Factor (-dB)	Net at 3m (dBµV/m)	Average Limit at 3m (dBµV/m)	Margin (dB)
Horizontal	2440.000	111.5	36.7	28.5	17.7	85.6	94.0	-8.4
Horizontal	4880.000	71.3	36.7	28.5	17.7	45.4	54.0	-8.6
Horizontal	7320.000	66.5	36.1	33.1	17.7	45.8	54.0	-8.2

Notes: 1. Peak Detector Data unless otherwise stated.

2. All measurements were made at 3 meter. Harmonic emissions not detected at the 3-meter distance were measured at 0.3-meter and an inverse proportional extrapolation was performed to compare the signal level to the 3-meter limit. No other harmonic emissions than those reported were detected at a test distance of 0.3-meter.

3. Negative value in the margin column shows emission below limit.

4. Horn antenna is used for the emission over 1000MHz.

Applicant: Guangdong Shiji Technology Co.,Ltd
Model: P70-GPS
Sample: 1/1
Worst Case Operating Mode: Transmitting

Date of Test: June 5, 2017

Table 4

Radiated Emissions

(2478MHz)

Polarization	Frequency (MHz)	Reading (dBµV)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m (dBµV/m)	Limit at 3m (dBµV/m)	Margin (dB)
Horizontal	2478.000	108.8	36.7	28.6	100.7	114.0	-13.3
Horizontal	4956.000	68.6	36.7	28.6	60.5	74.0	-13.5
Horizontal	7434.000	68.3	36.1	33.4	65.6	74.0	-8.4

Polarization	Frequency (MHz)	Reading (dBµV)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Average Factor (-dB)	Net at 3m (dBµV/m)	Average Limit at 3m (dBµV/m)	Margin (dB)
Horizontal	2478.000	108.8	36.7	28.6	17.7	83.0	94.0	-11.0
Horizontal	4956.000	68.6	36.7	28.6	17.7	42.8	54.0	-11.2
Horizontal	7434.000	68.3	36.1	33.4	17.7	47.9	54.0	-6.1

Notes: 1. Peak Detector Data unless otherwise stated.

2. All measurements were made at 3 meter. Harmonic emissions not detected at the 3-meter distance were measured at 0.3-meter and an inverse proportional extrapolation was performed to compare the signal level to the 3-meter limit. No other harmonic emissions than those reported were detected at a test distance of 0.3-meter.

3. Negative value in the margin column shows emission below limit.

4. Horn antenna is used for the emission over 1000MHz.

EXHIBIT 4

EQUIPMENT PHOTOGRAPHS

4.0 Equipment Photographs

For electronic filing, the photographs of the tested EUT are saved with filename: external photos.pdf & internal photos.pdf.

EXHIBIT 5

PRODUCT LABELLING

5.0 Product Labelling

For electronic filing, the FCC ID label artwork and the label location are saved with filename: label.pdf.

EXHIBIT 6

TECHNICAL SPECIFICATIONS

6.0 Technical Specifications

For electronic filing, the block diagram and schematics of the tested EUT are saved with filename: block.pdf and circuit.pdf respectively.

EXHIBIT 7

INSTRUCTION MANUAL

7.0 Instruction Manual

For electronic filing, a preliminary copy of the Instruction Manual is saved with filename: manual.pdf.

This manual will be provided to the end-user with each unit sold/leased in the United States.

EXHIBIT 8

MISCELLANEOUS INFORMATION

8.0 Miscellaneous Information

This miscellaneous information includes details of the measured bandedge, the test procedure and calculation of factor such as pulse desensitization.

8.1 Bandedge Plot

For electronic filing, the plot shows the fundamental emission when modulated is saved with filename: bandedge.pdf. From the plot, the field strength of any emissions outside of the specified frequency band are attenuated to the general radiated emission limits in section 15.209. It fulfils the requirement of 15.249(d).

Peak Measurement

Bandedge compliance is determined by applying marker-delta method, i.e (Bandedge Plot).

(i) Lower channel 2402MHz:

Peak Resultant field strength = Fundamental emissions (peak value) – delta from the bandedge plot

= 98.3 dBµv/m-30.5dB
= 67.8 dBµv/m

Average Resultant field strength = Fundamental emissions (Average value) – delta from the bandedge plot

= 80.6 dBµV/m–30.5 dB
= 50.1 dBµV/m

(ii) Upper channel 2478MHz:

Peak Resultant field strength = Fundamental emissions (peak value) – delta from the bandedge plot

= 100.7 dBµv/m-34.0dB
= 66.7 dBµv/m

Average Resultant field strength = Fundamental emissions (Average value) – delta from the bandedge plot

= 83.0 dBµV/m–34.0 dB
= 49.0 dBµV/m

The resultant field strength meets the general radiated emission limit in section 15.209, which does not exceed 74dBµv/m (Peak Limit) and 54dBµv/m (Average Limit).

8.1 Bandedge Plot (cont'd)

Pursuant to FCC part 15 Section 15.215(c), the 20dB bandwidth of the emission was contained within the frequency band designated (mentioned as above) which the EUT operated. The effects, if any, from frequency sweeping, frequency hopping, other modulation techniques and frequency stability over excepted variations in temperature and supply voltage were considered.

Figure 8.1 Bandwidth

8.2 Discussion of Pulse Desensitization

Pulse desensitivity is not applicable for this device. The effective period (T_{eff}) is approximately 1.1594 ms for a digital "1" bit, as shown in the plots of Exhibit 8.3. With a resolution bandwidth (3dB) of 1MHz, so the pulse desensitivity factor is 0dB.

8.3 Transmitter Duty Cycle Calculation, FCC Rule 15.35(b, c)

Averaging factor in dB = 20 log (duty cycle)

The specification for output field strengths in accordance with the FCC rules specify measurements with an average detector. During testing, a spectrum analyzer incorporating a peak detector was used. Therefore, a reduction factor can be applied to the resultant peak signal level and compared to the limit for measurement instrumentation incorporating an average detector.

The time period over which the duty cycle is measured is 100 milliseconds, or the repetition cycle, whichever is a shorter time frame. The worst case (highest percentage on) duty cycle is used for the calculation. The duty cycle is measured by placing the spectrum analyzer in zero scan (receiver mode) and linear mode at maximum bandwidth (3 MHz at 3dB down) and viewing the resulting time domain signal output from the analyzer on a Tektronix oscilloscope. The oscilloscope is used because of its superior time base and triggering facilities.

A plot of the worst-case duty cycle as detected in this manner are saved with filename: af.pdf

The duty cycle is simply the on-time divided by the period:

The duration of one cycle = 17.8261 ms
Effective period of the cycle = 1.1594*2 ms=2.3188 ms

DC = 2.3188 ms / 17.8261 ms = 0.1301 or 13.01%

Therefore, the averaging factor is found by $20\log_{10}0.1301$ = -17.7 dB

8.4 Emissions Test Procedures

The following is a description of the test procedure used by Intertek Testing Services in the measurements of transmitters operating under Part 15, Subpart C rules.

The test set-up and procedures described below are designed to meet the requirements of ANSI C63.10 - 2013.

The transmitting equipment under test (EUT) is placed on a styrene turntable which is four feet in diameter, up to 1GHz 0.8m and above 1GHz 1.5m in height above the ground plane. During the radiated emissions test, the turntable is rotated and any cables leaving the EUT are manipulated to find the configuration resulting in maximum emissions. The EUT is adjusting through all three orthogonal axes to obtain maximum emission levels. The antenna height and polarization are varied during the testing to search for maximum signal levels.

Detector function for radiated emissions is in peak mode. Average readings, when required, are taken by measuring the duty cycle of the equipment under test and subtracting the corresponding amount in dB from the measured peak readings.

The frequency range scanned is from the lowest radio frequency signal generated in the device which is greater than 9 kHz to the tenth harmonic of the highest fundamental frequency or 40 GHz, whichever is lower.

Detector function for conducted emissions is in QP & AV mode and IFBW setting is 9 kHz from the frequency band 150 kHz to 30MHz.

8.4 Emissions Test Procedures (cont'd)

The EUT is warmed up for 15 minutes prior to the test.

AC power to the unit is varied from 85% to 115% nominal and variation in the fundamental emission field strength is recorded. If battery powered, a new, fully charged battery is used.

Conducted measurements are made as described in ANSI C63.10 - 2013.

The IF bandwidth used for measurement of radiated signal strength was 10 kHz for emission below 30 MHz and 120 kHz for emission from 30 MHz to 1000 MHz. Where pulsed transmissions of short enough pulse duration warrant, a greater bandwidth is selected according to the recommendations of Hewlett Packard Application Note 150-2. Above 1000 MHz, a resolution bandwidth of 1 MHz is used (RBW 3MHz used for fundamental emission).

Transmitter measurements are normally conducted at a measurement distance of three meters. However, to assure low enough noise floor in the restricted bands and above 1 GHz, signals are acquired at a distance of one meter or less. All measurements are extrapolated to three meters using inverse scaling, but those measurements taken at a closer distance are so marked.

EXHIBIT9

TEST EQUIPMENT LIST

9.0 Test Equipment List

Equipment No.	Equipment	Manufacturer	Model No.	Serial No.	Cal. Date	Due Date
EE089	EMI Test Receiver	Rohde & Schwarz	ESU	1302.6005 .26	17-May-2017	17-May-2018
EE040	Pre-Amplifier	HP	8447F	2944A079 99	17-May-2017	17-May-2018
EE043	Bilog Antenna	Schwarzbeck	VULB9163	142	17-May-2017	17-May-2018
EE049	Power meter	Anritsu	ML2487A	6K000036 13	28-May-2017	28-May-2018
EE050	Power sensor	Anritsu	MA2491A	32263	28-May-2017	28-May-2018
EE147	Cable	Schwarzbeck	AK9513	ACRX1	17-May-2017	17-May-2018
EE169	Cable	Rosenberger	N/A	FP2RX2	17-May-2017	17-May-2018
EE168	Cable	Schwarzbeck	AK9513	CRPX1	29-May-2017	29-May-2018
EE170	Cable	Schwarzbeck	AK9513	CRRX2	29-May-2017	29-May-2018
EE096	Pre-Amplifier	A.H.	PAM-0126	1415261	17-May-2017	17-May-2018
EE094	Horn Antenna	Schwarzbeck	BBHA 9120	707	29-May-2017	29-May-2018
EE097	Cable	H+B	0.5M SF104-26.5	289147/4	29-May-2017	29-May-2018
EE100	Cable	H+B	3M SF104-26.5	295838/4	29-May-2017	29-May-2018
EE101	Cable	H+B	6M SF104-26.5	295840/4	29-May-2017	29-May-2018
EE095	Horn Antenna	Schwarzbeck	BBHA 9170	BBHA9170 399	17-May-2017	17-May-2018
EE343	EMI Test Receiver	Rohde & Schwarz	FSV40	132.1-3008K39-100967-AP	29-May-2017	29-May-2018
EE240	Pre-Amplifier	Lunar EM	LNA26G40 -40	J10131310 28001	17-May-2017	17-May-2018
EE234	Horn Antenna	AHS/USA	SAS-573	184	17-May-2017	17-May-2018
EE312	Cable	A.H	SAC-40G-1	414	17-May-2017	17-May-2018
EE313	Cable	A.H	SAC-40G-1	413	17-May-2017	17-May-2018