

Import Marketing Solutions Inc.

Application For Certification

FCC ID: 2AI4WP70VRC

VR Drone

Model: P70-VR

2.4GHz Transmitter

Report No.: 160712025SZN-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

Hardy Suo Project Engineer Kidd Yang

Senior Project Engineer Date: July 25, 2016

- The test results reported in this test report shall refer only to the sample actually tested and shall not refer or be deemed to refer to bulk from which such a sample
 may be said to have been obtained.
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TRF No.: FCC 15C_TX_c

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MEASUREMENT/TECHNICAL REPORT

Import Marketing Solutions Inc.

Model: P70-VR

FCC ID: 2AI4WP70VRC

This report concerns (check one)	Original Grant Y	Class II Change
This report concerns (check one:)	Oligiliai Grafit <u> X</u>	Class II Change
Equipment Type: DXX - Part 15 Low Pow	er Communication Devi	ce Transmitter
Deferred grant requested per 47 CFR 0.4	57(d)(1)(ii)? Yes	No <u>X</u>
	If yes, defer until	:
		date
Company Name agrees to notify the Com	mission by:	
of the intended data of appearancement of	the product so that the	date
of the intended date of announcement of date.	the product so that the	grant can be issued on that
		_
Transition Rules Request per 15.37?	Yes	8 No <u>X</u>
If no, assumed Part 15, Subpart C for Edition] provision.	intentional radiator -	the new 47 CFR [10-1-15
Report prepared by:		_
	Hardy Suo Intertek Testing Servic Kejiyuan Branch 6F, Block D, Huahan I Nanshan District, She Phone: (86 755) 861 Fax: (86 755) 860	Building, Langshan Road, nzhen, P. R. China 4 0743

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List of attached file

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 VR Drone with 2.4GHz wireless control function operating in 2404-2480MHz. The EUT is powered by DC 6V (*AA* batteries x 4). For more detail information pls. refer to the user manual.

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 transmitter for the VR Drone which has 2.4GHz wireless control function, and there has VR Drone Quadcopter (FCC ID: 2AI4WP70VRD) which associated with this EUT, is filed at the same time, and is subjected to report: 160712024SZN-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.

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1.4 Test Facility

The Semi-anechoic chamber used to collect the radiated data is **Intertek Testing Services Shenzhen Ltd. Kejiyuan Branch** and located at 6F, D Block, Huahan Building, Langshan Road, Nanshan District, Shenzhen, P. R. China. This test facility and site measurement data have been fully placed on file with the FCC (Registration Number: 242492).

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 4 new *AA* batteries 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 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 Import Marketing Solutions Inc. will be incorporated in each production model sold / leased in the United States.

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

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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.

 $RA = 62.0 dB\mu V$

AF = 7.4 dB

CF = 1.6 dB

 $AG = 29.0 \, dB$

PD = 0 dB

AV = -10 dB

 $FS = 62 + 7.4 + 1.6 - 29 + 0 + (-10) = 32 dB\mu V/m$

Level in μ V/m = Common Antilogarithm [(32 dB μ V/m)/20] = 39.8 μ V/m

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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 710.620 MHz

Judgement: Passed by 12.5 dB

TEST PERSONNEL:

Sign on file

<u>Hardy Suo, Project Engineer</u> Typed/Printed Name

July 20, 2016 Date

Applicant: Import Marketing Solutions Inc. Date of Test: July 20, 2016

Model: P70-VR Sample: 1/1

Worst Case Operating Mode: Transmitting (2402MHz)

Modulation type: GFSK

Table 1

Radiated Emissions

Polarization	Frequency	Reading	Pre-	Antenna	Net	Limit	Margin
	(MHz)	(dBµV)	Amp	Factor	at 3m	at 3m	(dB)
			Gain	(dB)	(dBµV/m)	(dBµV/m)	
			(dB)				
Horizontal	61.579	27.1	20.0	7.4	14.5	40.0	-25.5
Horizontal	264.895	27.4	20.0	14.2	21.6	46.0	-24.4
Horizontal	710.620	29.6	20.0	23.9	33.5	46.0	-12.5
Vertical	84.962	30.3	20.0	8.6	18.9	40.0	-21.1
Vertical	135.248	27.4	20.0	9.3	16.7	43.5	-26.8
Vertical	145.690	28.1	20.0	9.7	17.8	43.5	-25.7

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.

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3.1.4 Transmitter Spurious Emissions (Radiated)

Worst Case Radiated Emission at 7212.000 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 5.0 dB

TEST PERSONNEL:

Sign on file

Hardy Suo, Project Engineer
Typed/Printed Name

July 20, 2016 Date

Date of Test: July 20, 2016

Applicant: Import Marketing Solutions Inc.

Model: P70-VR Sample: 1/1

Worst Case Operating Mode: Transmitting

Table 2

Radiated Emissions

(2404MHz)

Polarization	Frequency	Reading	Pre-	Antenna	Net	Peak Limit	Margin
	(MHz)	(dBµV)	Amp	Factor	at 3m	at 3m	(dB)
	, , ,	, , ,	Gain	(dB)	(dBµV/m)	(dBµV/m)	, ,
			(dB)				
Vertical	2404.000	107.2	36.7	28.5	99.0	114.0	-15.0
Vertical	4808.000	65.4	36.7	28.5	57.2	74.0	-16.8
Vertical	7212.000	64.8	36.1	33.1	61.8	74.0	-12.2

Polarization	Frequency	Reading	Pre-	Antenna	Average	Net	Average Limit	Margin
	(MHz)	(dBµV)	Amp	Factor	Factor	at 3m	at 3m	(dB)
			Gain	(dB)	(-dB)	(dBµV/m)	(dBµV/m)	
			(dB)		, ,			
Vertical	2404.000	107.2	36.7	28.5	12.8	86.2	94.0	-7.8
Vertical	4808.000	65.4	36.7	28.5	12.8	44.4	54.0	-9.6
Vertical	7212.000	64.8	36.1	33.1	12.8	49.0	54.0	-5.0

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.

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Applicant: Import Marketing Solutions Inc.

Date of Test: July 20, 2016

Model: P70-VR Sample: 1/1

Worst Case Operating Mode: Transmitting

Table 3

Radiated Emissions

(2442MHz)

Polariza	tion	Frequency	Reading	Pre-	Antenna	Net	Peak Limit	Margin
		(MHz)	(dBµV)	Amp	Factor	at 3m	at 3m	(dB)
			, , ,	Gain	(dB)	(dBµV/m)	(dBµV/m)	, ,
				(dB)	, ,		, , ,	
Vertic	al	2442.000	107.7	36.7	28.5	99.5	114.0	-14.5
Vertic	al	4884.000	65.3	36.7	28.5	57.1	74.0	-16.9
Vertic	al	7326.000	64.6	36.1	33.1	61.6	74.0	-12.4

Polarization	Frequency	Reading	Pre-	Antenna	Average	Net	Average Limit	Margin
	(MHz)	(dBµV)	Amp	Factor	Factor	at 3m	at 3m	(dB)
			Gain	(dB)	(-dB)	(dBµV/m)	(dBµV/m)	
			(dB)		` ,			
Vertical	2442.000	107.7	36.7	28.5	12.8	86.7	94.0	-7.3
Vertical	4884.000	65.3	36.7	28.5	12.8	44.3	54.0	-9.7
Vertical	7326.000	64.6	36.1	33.1	12.8	48.8	54.0	-5.2

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.

TRF No.: FCC 15C_TX_c FCC ID: 2AI4WP70VRC

Date of Test: July 20, 2016

Applicant: Import Marketing Solutions Inc.

Model: P70-VR Sample: 1/1

Worst Case Operating Mode: Transmitting

Table 4

Radiated Emissions

(2480MHz)

Polarization	Frequency	Reading	Pre-	Antenna	Net	Limit	Margin
	(MHz)	(dBµV)	Amp	Factor	at 3m	at 3m	(dB)
			Gain	(dB)	(dBµV/m)	(dBµV/m)	
			(dB)				
Vertical	2480.000	107.5	36.7	28.6	99.4	114.0	-14.6
Vertical	4960.000	65.5	36.7	28.6	57.4	74.0	-16.6
Vertical	7440.000	64.4	36.1	33.4	61.7	74.0	-12.3

Polarization	Frequency	Reading	Pre-	Antenna	Average	Net	Average Limit	Margin
	(MHz)	(dBµV)	Amp	Factor	Factor	at 3m	at 3m	(dB)
			Gain	(dB)	(-dB)	(dBµV/m)	(dBµV/m)	
			(dB)		` ,			
Vertical	2480.000	107.5	36.7	28.6	12.8	86.6	94.0	-7.4
Vertical	4960.000	65.5	36.7	28.6	12.8	44.6	54.0	-9.4
Vertical	7440.000	64.4	36.1	33.4	12.8	48.9	54.0	-5.1

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.

TRF No.: FCC 15C_TX_c FCC ID: 2AI4WP70VRC

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 <u>Technical Specifications</u>

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 <u>Instruction Manual</u>

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 <u>Miscellaneous Information</u>

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 2404MHz:

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

= $99.0 \text{ dB}\mu\text{v/m}$ -59.9dB= $39.1 \text{ dB}\mu\text{v/m}$

(ii) Upper channel 2480MHz:

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

= 99.4 dB μ v/m-57.3 dB = 42.1 dB μ v/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).

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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 2.304 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 $dB = 20 \log (duty \text{ cycle})$

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 = 10.000 msEffective period of the cycle = 2.304 ms

DC = 2.304 ms / 10.000 ms = 0.2304 or 23.04%

Therefore, the averaging factor is found by $20\log_{10}0.2304 = -12.8$ 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 <u>Test Equipment List</u>

Equipment No.	Equipment	Manufacturer	Model No.	Serial No.	Cal. Date	Due Date
SZ061-12	BiConiLog Antenna	ETS	3142E	00166158	15-Sep-2015	15-Sep-2016
SZ185-01	EMI Receiver	R&S	ESCI	100547	23-Jan-2016	23-Jan-2017
SZ061-09	Horn Antenna	ETS	3115	00092346	31-Oct-2015	31-Oct-2016
SZ061-07	Pyramidal Horn Antenna	ETS	3160-09	00083067	01-Sep-2015	01-Sep-2016
SZ061-06	Active Loop Antenna	Electro-Metrics	EM-6876	217	11-May-2016	11-May-2017
SZ056-03	Spectrum Analyzer	R&S	FSP 30	101148	14-Jun-2016	14-Jun-2017
SZ056-06	Spectrum Analyzer	R&S	FSV40	101101	02-Jul-2016	02-Jul-2017
SZ181-04	Preamplifier	Agilent	8449B	3008A02474	23-Jan-2016	23-Jan-2017
SZ188-01	Anechoic Chamber	ETS	RFD-F/A- 100	4102	16-Apr-2016	16-Apr-2018
SZ062-02	RF Cable	RADIALL	RG 213U		30-Jun-2016	30-Dec-2016
SZ062-05	RF Cable	RADIALL	0.04- 26.5GHz		06-Apr-2016	06-Oct-2016
SZ062-12	RF Cable	RADIALL	0.04- 26.5GHz		06-Apr-2016	06-Oct-2016
SZ067-04	Notch Filter	Micro-Tronics	BRM5070 2-02		23-May-2016	23-May-2017