Test Report No. 7191168302-EECY17/06 dated 26 Oct 2017



Note: This report is issued subject to the Testing and Certification Regulations of the TÜV SÜD Group and the General Terms and Conditions of Business of TÜV SÜD PSB Pte Ltd. In addition, this report is governed by the terms set out within this report.

4	RT ON TESTING IN ACCORDANCE V 7 CFR FCC Parts 15B & C OF A SmartTag [Model : STG-873W] [FCC ID : YOPGS2200M]	VITH	Choose certainty. Add value.
TEST FACILITY	TÜV SÜD PSB Pte Ltd Electrical & Electronics Centre (EE No. 1 Science Park Drive, Singapor		
FCC REG. NO.	994109 (Test Firm Registration Nur SG0002 (Designation Number)	mber)	
IND. CANADA REG. NO.	2932I-1 (3m and 10m Semi-Anechoi 2932N-1 (10m Semi-Anechoic Chan		
PREPARED FOR	Cadi Scientific Pte Ltd 31 Ubi Road 1 #07-01A Aztech Building Singapore 408694 Tel : (65) 6276 2676	Fax : (65) 6276 6210	6
QUOTATION NUMBER	2191067989		
JOB NUMBER	7191168302 UU		
TEST PERIOD	14 Sep 2017 – 25 Oct 2017		
PREPAR WWW Quek Ker Higher Associa	g Huat	APPROVED BY	

LA-2007-0380-A LA-2007-0381-F LA-2007-0382-B

LA-2007-0383-G



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SAC-SINGLAS

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LA-2007-0384-G

LA-2007-0385-E LA-2007-0386-C LA-2010-0464-D

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The results reported herein have been performed in accordance with the terms of accreditation under the Singapore Accreditation Council. Inspections/Calibrations/Tests marked "Not SAC-SINGLAS Accredited" in this Report are not included in the SAC-SINGLAS Accreditation Schedule for our inspection body/laboratory.



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TEST SUMMARY

The product was tested in accordance with the customer's specifications.

Test Results Summary

Test Standard	Description	Pass / Fail		
47 CFR FCC Part 15				
15.107(a), 15.207	Conducted Emissions	Not Applicable *See Note 6		
15.109(a), 15.205, 15.209	Radiated Emissions (Spurious Emissions inclusive Restricted Bands Requirement)	Pass		
15.247(a)(2)	Spectrum Bandwidth (6dB Bandwidth Measurement)	Not Tested *See Note 8		
15.247(b)(3)	Maximum Peak Power	Not Tested *See Note 8		
15.247(d)	RF Conducted Spurious Emissions (Non- Restricted Bands)	Not Tested *See Note 8		
15.247(d)	RF Conducted Spurious Emissions (Restricted Bands)	Not Tested *See Note 8		
15.247(d)	Band Edge Compliance (Conducted)	Not Tested *See Note 8		
15.247(d)	Band Edge Compliance (Radiated)	Not Tested *See Note 8		
15.247(e)	Peak Power Spectral Density	Not Tested *See Note 8		



TEST SUMMARY

Notes

1. The channels as listed below, under the different configurations were tested for 802.11b WLAN.

Transmit Channel	Frequency (GHz)	Modulation	Data Rate
Channel 1 (Lower Channel)	2.412	DBPSK	1Mbps
Channel 6 (Middle Channel)	2.437	DBPSK	1Mbps
Channel 11 (Upper Channel)	2.462	DBPSK	1Mbps
Channel 1 (Lower Channel)	2.412	DQPSK	2Mbps
Channel 6 (Middle Channel)	2.437	DQPSK	2Mbps
Channel 11 (Upper Channel)	2.462	DQPSK	2Mbps
Channel 1 (Lower Channel)	2.412	CCK	11Mbps
Channel 6 (Middle Channel)	2.437	CCK	11Mbps
Channel 11 (Upper Channel)	2.462	CCK	11Mbps

2. The channels as listed below, under the different configurations were tested for 802.11g WLAN.

Transmit Channel	Frequency (GHz)	Modulation	Data Rate
Channel 1 (Lower Channel)	2.412	BPSK	9Mbps
Channel 6 (Middle Channel)	2.437	BPSK	9Mbps
Channel 11 (Upper Channel)	2.462	BPSK	9Mbps
Channel 1 (Lower Channel)	2.412	QPSK	18Mbps
Channel 6 (Middle Channel)	2.437	QPSK	18Mbps
Channel 11 (Upper Channel)	2.462	QPSK	18Mbps
Channel 1 (Lower Channel)	2.412	16QAM	36Mbps
Channel 6 (Middle Channel)	2.437	16QAM	36Mbps
Channel 11 (Upper Channel)	2.462	16QAM	36Mbps
			-
Channel 1 (Lower Channel)	2.412	64QAM	54Mbps
Channel 6 (Middle Channel)	2.437	64QAM	54Mbps
Channel 11 (Upper Channel)	2.462	64QAM	54Mbps

3. The channels as listed below, under the different configurations were tested for 802.11n WLAN.

Transmit Channel	Frequency (GHz)	Modulation	Data Rate
Channel 1 (Lower Channel)	2.412	BPSK	6.5Mbps
Channel 6 (Middle Channel)	2.437	BPSK	6.5Mbps
Channel 11 (Upper Channel)	2.462	BPSK	6.5Mbps
Channel 1 (Lower Channel)	2.412	QPSK	19.5Mbps
Channel 6 (Middle Channel)	2.437	QPSK	19.5Mbps
Channel 11 (Upper Channel)	2.462	QPSK	19.5Mbps
Channel 1 (Lower Channel)	2.412	16QAM	39Mbps
Channel 6 (Middle Channel)	2.437	16QAM	39Mbps
Channel 11 (Upper Channel)	2.462	16QAM	39Mbps
Channel 1 (Lower Channel)	2.412	64QAM	65Mbps
Channel 6 (Middle Channel)	2.437	64QAM	65Mbps
Channel 11 (Upper Channel)	2.462	64QAM	65Mbps



TEST SUMMARY

Notes (continued)

- 4. The EUT is a Class B device when in non-transmitting state and meets the 47 CFR FCC Part15B Class B requirements.
- 5. All test measurement procedures are according to ANSI C63.4: 2014, ANSI C63.10: 2013 and KDB 558074 D01 DTS Measurement Guidance V04.
- 6. The Equipment Under Test (EUT) is a battery operated device / DC operated device and contains no provision for public utility connections.
- 7. The EUT was tested using fully charged batteries with DC voltage of 3.6Vdc.
- 8. Refer to Bay Area Compliance Labs Corp, issued test report, R1606202-247 dated 17 Aug 2016.

Modifications

No modifications were made.



PRODUCT DESCRIPTION

Description	:	The Equipment Under Test(s) (EUT(s)) is a SmartTag . It is a location tracking tag.
Applicant	:	Cadi Scientific Pte Ltd 31 Ubi Road 1 #07-01A Aztech Building Singapore 408694
Manufacturer	:	Cadi Scientific Pte Ltd 31 Ubi Road 1 #07-01A Aztech Building Singapore 408694
Factory		Cadi Scientific Pte Ltd 31 Ubi Road 1 #07-01A Aztech Building Singapore 408694
Model Number(s)		STG-873W
FCC ID	į	YOPGS2200M
Serial Number(s)	:	1. 94F551000006 2. 94F551000008
Microprocessor(s)	:	PIC18LF46K22
Operating Frequency		125kHz (LF Receiver) 38kHz (IR Receiver) 2.4GHz (Wi-Fi)
Clock / Oscillator Frequency	:	32.768kHz external crystal oscillator 16MHz internal RC oscillator
Modulation	:	DSSS, OFDM (Wi-Fi 802.11b/g/n)
Antenna Gain	:	3.35dBi
Port / Connectors	:	Nil
Rated Input Power	:	3.6Vdc battery operated
Accessories	:	Nil



SUPPORTING EQUIPMENT DESCRIPTION

The EUT was tested as a stand-alone unit without any supporting equipment.





EUT OPERATING CONDITIONS

47 CFR FCC Part 15

1. Radiated Emissions (Spurious Emissions inclusive Restricted Bands Requirement)

The EUT was exercised by operating in maximum continuous transmission in test mode, i.e transmitting at lower, middle and upper channels respectively at one time.





47 CFR FCC Part 15.205 Restricted Bands

N	ЛНz			MHz			MHz			GHz	
0.090	-	0.110	16.42	-	16.423	399.9	-	410	4.5	-	5.15
0.495	-	0.505	16.69475	-	16.69525	608	-	614	5.35	-	5.46
2.1735	-	2.1905	16.80425	-	16.80475	960	-	1240	7.25	-	7.75
4.125	-	4.128	25.5	-	25.67	1300	-	1427	8.025	-	8.5
4.17725	-	4.17775	37.5	-	38.25	1435	-	1626.5	9.0	-	9.2
4.20725	-	4.20775	73	-	74.6	1645.5	-	1646.5	9.3	-	9.5
6.215	-	6.218	74.8	-	75.2	1660	-	1710	10.6	-	12.7
6.26775	-	6.26825	108	-	121.94	1718.8	-	1722.2	13.25	-	13.4
6.31175	-	6.31225	123		138	2200	-	2300	14.47	-	14.5
8.291	-	8.294	149.9	33	150.05	2310	N	2390	15.35	-	16.2
8.362	-	8.366	156.52475	- 1	156.52525	2483.5	-	2500	17.7	-	21.4
8.37625	-	8.38675	156.7	- 1	156.9	2690		2900	22.01	-	23.12
8.41425	-	8.41475	162.0125	14	167.17	3260	-	3267	23.6	-	24.0
12.29	-	12.293	167.72	9-	173.2	3332	-	3339	31.2	-	31.8
12.51975	-	12.52025	240	-	285	3345.8	-	3358	36.43	-	36.5
12.57675	-	12.57725	322	-	335.4	3600		4400	Ab	ove 3	8.6
13.36	-	13.41									

47 CFR FCC Parts 15.109(a) and 15.209 Radiated Emission Limits

Frequency Range (MHz)	Quasi-Peak Limit Values (dBµV/m)			
0.009 - 0.490	20 log [2400 / F (kHz)] @ 300m			
0.490 - 1.705	20 log [24000 / F (kHz)] @ 30m			
1.705 - 30.0	30.0 @ 30m			
30 - 88	40.0 @ 3m			
88 - 216	43.5 @ 3m			
216 - 960	46.0 @ 3m			
Above 960	54.0* @ 3m			
* For frequency bands 9kHz – 90kHz, 110kHz – 490kHz and above 1GHz, average detector was used. A peak limit of 20dB above the average limit does apply.				

47 CFR FCC Parts 15.109(a) and 15.209 Radiated Emission Test Instrumentation

Instrument	Model	S/No	Cal Due Date
R&S EMI Test Receiver	ESU40	100355	14 Sep 2018
Schaffner Bilog Antenna – (30MHz-2GHz) BL4	CBL6112B	2593	18 Jan 2018
Com-Power Preamplifier (1MHz-1GHz)	PAM-103	441158	12 Sep 2018
TDK-RF Horn Antenna	HRN-0118	130256	18 Oct 2018
R&S Preamplifier (1GHz -18GHz)	SCU18	102191	10 Mar 2018
ETS Horn Antenna(18GHz-40GHz)(Ref)	3116	0004-2474	18 Oct 2018
Agilent Preamplifier(1GHz-26.5GHz) (PA18)	8449D	3008A02305	02 Oct 2018
EMCO Loop Ant (ext)	6502	9108-2673	16 Feb 2018
Micro-tronics Bandstop Filter (2.4GHz)	BRM50701-02	007	13 Aug 2019



47 CFR FCC Parts 15.109(a) and 15.209 Radiated Emission Test Setup

- 1. The EUT and supporting equipment were set up in accordance with the requirements of the standard on top of a 1.5m X 1.0m X 0.8m high, non-metallic table for measurement up to 1GHz. For measurement above 1GHz, 1.5m height table was used.
- 2. The filtered power supply for the EUT and supporting equipment were tapped from the appropriate power sockets located on the turntable.
- 3. The relevant broadband antenna was set at the required test distance away from the EUT and supporting equipment boundary.

47 CFR FCC Parts 15.109(a) and 15.209 Radiated Emission Test Method

- 1. The EUT was switched on and allowed to warm up to its normal operating condition.
- 2. A prescan was carried out to pick the worst emission frequencies from the EUT. For EUT which is a portable device, the prescan was carried out by rotating the EUT through three orthogonal axes to determine which altitude and equipment arrangement produces such emissions.
- 3. The test was carried out at the selected frequency points obtained from the prescan in step 2. Maximization of the emissions, was carried out by rotating the EUT, changing the antenna polarization, and adjusting the antenna height in the following manner:
 - a. Vertical or horizontal polarisation (whichever gave the higher emission level over a full rotation of the EUT) was chosen.
 - b. The EUT was then rotated to the direction that gave the maximum emission.
 - c. Finally, the antenna height was adjusted to the height that gave the maximum emission.
- 4. A Quasi-peak measurement was made for that frequency point if it was less than or equal to 1GHz. For frequency point in the range of 9kHz 90kHz, 110kHz 490kHz and above 1GHz, both Peak and Average measurements were carried out.
- 5. Steps 3 and 4 were repeated for the next frequency point, until all selected frequency points were measured.
- 6. The frequency range covered was from the lowest radio frequency signal generated from the EUT, without going below 9kHz to 10th harmonics of the EUT fundamental frequency, using the loop antenna for frequency below 30MHz, Bi-log antenna for frequencies from 30MHz up to 1GHz, and the Horn antenna above 1GHz.

Sample Calculation Example

At 300 MHz	Q-P limit (Class B) = 46.0 dB μ V/m
Log-periodic antenna factor & cable loss at 300 MHz	= 18.5 dB
Q-P reading obtained directly from EMI Receiver = 4 (Calibrated level inc	0.0 dΒμV/m luding antenna factors & cable losses)
Therefore, Q-P margin = 46.0 - 40.0 = 6.0	i.e. 6.0 dB below Q-P limit



47 CFR FCC Parts 15.109(a), 15.205 and 15.209 Radiated Emission Results

Test Input Power	3.6Vdc	Temperature	24°C
Test Distance	10m (<30MHz)	Relative Humidity	60%
	3m (≥30MHz –		
	25GHz)		
Data Speed	802.11g @ 6Mbps (Worst)	Atmospheric Pressure	1030mbar
		Tested By	Chang Wai Kit

Spurious Emissions ranging from 9kHz – 30MHz (for 9kHz – 90kHz, 110kHz – 490kHz) *See Note 5

Freq (GHz)	Peak Value (dBμV/m)	Peak Limit (dBμV/m)	Peak Margin (dB)	AV Value (dBμV/m)	AV Limit (dBµV/m)	AV Margin (dB)	Height (cm)	Azimuth (Degrees)	Pol (H/V)	Ch
		- /	Sill			-				
		-	-		-	\				-
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				2000 - 1 8 8	10000,	7 -1				

Spurious Emissions ranging from 9kHz – 30MHz *See Note 5

Frequency (MHz)	Q-P Value (dBµV/m)	Q-P Limit (dBµV/m)	Q-P Margin (dB)	Height (cm)	Azimuth (Degrees)	Pol (H/V)	Channel
		-					
		- 6	LI'III				
	1		UU)		
	-	-	- 4	é 177	/		
				-			
				- 0			

Spurious Emissions ranging from 30MHz - 1GHz

Frequency (MHz)	Q-P Value (dBµV/m)	Q-P Limit (dBµV/m)	Q-P Margin (dB)	Height (cm)	Azimuth (Degrees)	Pol (H/V)	Channel (Worst)
43.7630	2.0	40.0	38.0	183	194	V	6
48.1700	1.5	40.0	38.5	252	187	V	6
51.4490	2.1	40.0	37.9	100	201	V	6
60.9410	0.1	40.0	39.9	100	285	V	6
87.9200	1.0	40.0	39.0	171	133	Н	6
97.1930	7.9	43.5	35.6	203	239	V	6



47 CFR FCC Parts 15.109(a), 15.205 and 15.209 Radiated Emission Results

Spurious Emissions above 1GHz – 25GHz

Freq (GHz)	Peak Value (dBµV/m)	Peak Limit (dBµV/m)	Peak Margin (dB)	AV Value (dBμV/m)	AV Limit (dBµV/m)	AV Margin (dB)	Height (cm)	Azimuth (Degrees)	Pol (H/V)	Ch
2.2499	40.2	74.0	33.8		54.0	13.8 *See Note 3	100	55	Н	1
4.8254	39.8	74.0	34.2		54.0	14.2 *See Note 3	300	123	V	1
5.4819	39.7	74.0	34.3		54.0	14.3 *See Note 3	200	4	Н	1
13.2120	50.7	74.0	23.3		54.0	3.3 *See Note 3	200	351	V	1
13.8332	52.2	74.0	21.8	43.9	54.0	10.1	300	97	V	1
14.1816	51.8	74.0	22.2	43.0	54.0	11.0	400	320	V	1

Spurious Emissions above 1GHz – 25GHz

Freq (GHz)	Peak Value (dBµV/m)	Peak Limit (dBµV/m)	Peak Margin (dB)	AV Value (dBµV/m) ∗See Note 2	AV Limit (dBµV/m)	AV Margin (dB) *See Note 3	Height (cm)	Azimuth (Degrees)	Pol (H/V)	Ch
2.1994	37.1	74.0	36.9	241	54.0	16.9	100	55	V	6
2.2751	37.9	74.0	36.1		54.0	16.1	200	70	Н	6
4.8759	39.5	74.0	34.5		54.0	14.5	400	270	V	6
5.1536	39.6	74.0	34.4		54.0	14.4	200	236	Н	6
6.5606	42.2	74.0	31.8		54.0	11.8	400	124	Н	6
7.5908	44.4	74.0	29.6		54.0	9.6	300	177	Н	6

Spurious Emissions above 1GHz – 25GHz

Freq (GHz)	Peak Value (dBµV/m)	Peak Limit (dBµV/m)	Peak Margin (dB)	AV Value (dBμV/m) *See Note 2	AV Limit (dBµV/m)	AV Margin (dB) *See Note 3	Height (cm)	Azimuth (Degrees)	Pol (H/V)	Ch
2.0479	33.9	74.0	40.1		54.0	20.1	200	253	V	11
2.2246	36.1	74.0	37.9		54.0	17.9	100	43	Н	11
2.9821	36.0	74.0	38.0		54.0	18.0	399	122	V	11
4.9264	40.9	74.0	33.1		54.0	13.1	300	162	V	11
7.6665	45.0	74.0	29.0		54.0	9.0	300	124	V	11
12.9848	48.4	74.0	25.6		54.0	5.6	100	257	V	11



<u>Notes</u>

- 1. All possible modes of operation were investigated. Only the worst case emissions measured, using the correct CISPR detectors, are reported. All other emissions were relatively insignificant.
- 2. As the measured peak shows compliance to the average limit, as such no average measurement was required.
- 3. The average margin indicates the margin of the measured peak value below the average limit.
- 4. "--" indicates no emissions were found and shows compliance to the limits.
- 5. The measurement was done at 10m. The measured results were extrapolated to the specified test limits as specified in § 15.209 (a) based on 40dB/decade.
- 6. Quasi-peak measurement was used for frequency measurement up to 1GHz. Average and peak measurements were used for emissions above 1GHz. The average measurement was done by averaging over a complete cycle of the pulse train, including the blanking interval as the pulse train duration does not exceed 0.1 second.
- 7. A "positive" margin indicates a PASS as it refers to the margin present below the limit line at the particular frequency. Conversely, a "negative" margin indicates a FAIL.
- EMI receiver Resolution Bandwidth (RBW) and Video Bandwidth (VBW) settings: <u>30MHz - 1GHz</u> RBW: 120kHz VBW: 1MHz <u>>10Hz</u> <u>>10Hz</u>

RBW: 1MHz VBW: 3MHz

- 9. The upper frequency of radiated emission investigations was according to requirements stated in Section 15.33(a) for intentional radiators & Section 15.33(b) for unintentional radiators.
- 10. The channel in the table refers to the transmit channel of the EUT.
- 11. <u>Radiated Emissions Measurement Uncertainty</u> All test measurements carried out are traceable to national standards. The uncertainty of the measurement at a confidence level of approximately 95%, with a coverage factor of 2, in the range 30MHz – 25GHz is ±4.0dB.



Please note that this Report is issued under the following terms :

- 1. This report applies to the sample of the specific product/equipment given at the time of its testing/calibration. The results are not used to indicate or imply that they are applicable to other similar items. In addition, such results must not be used to indicate or imply that TÜV SÜD PSB approves, recommends or endorses the manufacturer, supplier or user of such product/equipment, or that TÜV SÜD PSB in any way "guarantees" the later performance of the product/equipment. Unless otherwise stated in this report, no tests were conducted to determine long term effects of using the specific product/equipment.
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- 5. Unless otherwise stated, the tests were carried out in TÜV SÜD PSB Pte Ltd, No.1 Science Park Drive Singapore 118221.



July 2011

TCB

GRANT OF EQUIPMENT AUTHORIZATION



Certification Issued Under the Authority of the Federal Communications Commission By:

> Bay Area Compliance Laboratory Corp. 1274 Anvilwood Avenue Sunnyvale, CA 94089 A

Date of Grant: 09/26/2016

Application Dated: 09/26/2016

Gainspan Corporation 3590 N. First Street Suite 300 San Jose, CA 95134

Attention: Adrian Gradinaru , Engineering Manager

NOT TRANSFERABLE

EQUIPMENT AUTHORIZATION is hereby issued to the named GRANTEE, and is VALID ONLY for the equipment identified hereon for use under the Commission's Rules and Regulations listed below.

	FCC IDENTIFIER:	YOPGS2200M			
	Name of Grantee:	Gainspan Corporation			
	Equipment Class:	Digital Transmission Sys	tem		
	Notes:	Low Power 802.11 b/g/n2	0 Wi-Fi Ma	dule	
	Modular Type:	Single Modular	mille		
Grant Notes	FCC Rule Parts	Frequency <u>Range (MHZ)</u>	Output <u>Watts</u>	Frequency <u>Tolerance</u>	Emission <u>Designator</u>
	15C	2412.0 - 2462.0	0.088	a Mr. O	
		881		TAVA	
only in the mobile co when the module is OEM integrators. Or with equal or lesser	onfigurations associated with sold to OEM integrators and nly those antenna(s) tested v gain may be used with this to	ted. This module is approved this filing. This grant is valid of must be installed by the OEM with the device or similar anten ransmitter. The antenna(s) use paration distance of at least 2000	nly l or na(s) ed for	IONS +	

this transmitter must be installed to provide a separation distance of at least 20 cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter. End-users may not be provided with the module installation instructions. Installation of this device into portable RF Exposure category host devices requires the submission of a Class II permissive change or new application. Compliance of this device in all final host configurations is the responsibility of the Grantee.