

Skytech II, Inc.

TEST REPORT

SCOPE OF WORK:

47 CFR FCC Part 15.231 – Radio Spectrum report

Model:

VCS-ECOTSS01-B, VCS-ECOTSS02-B, VCS-ECOTSS04-B,
AF-4000TSS01-B, AF-4000TSS02-B, SPTS-H-L-TH-B,
RCAF-1031TS-4B

REPORT NUMBER

220400269THC-001

ISSUE DATE

Jul. 05, 2022

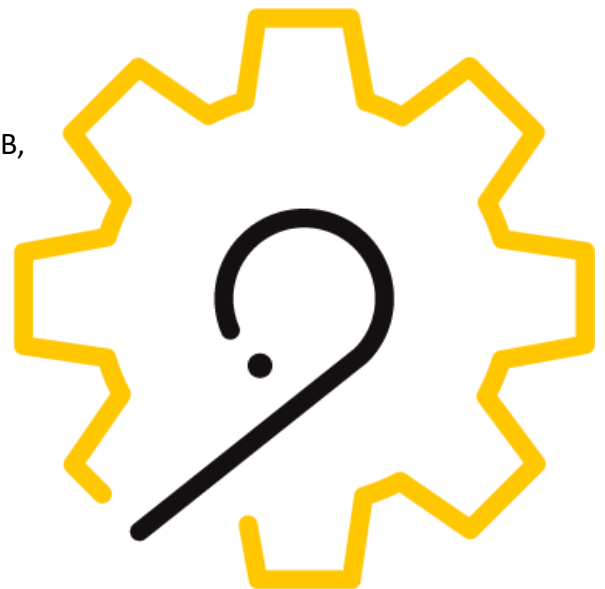
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Radio Spectrum TEST REPORT

Applicant:	Skytech II, Inc. 9230 Conservation Way, Ft. Wayne, IN 46809, USA
Product:	Remote control transmitter
Model No.:	VCS-ECOTSS01-B, VCS-ECOTSS02-B, VCS-ECOTSS04-B, AF-4000TSS01-B, AF-4000TSS02-B, SPTS-H-L-TH-B, RCAF-1031TS-4B
FCC ID:	K9LAFTS3TX
Test Method/ Standard:	47 CFR FCC Part 15.231
Test By:	Intertek Testing Services Taiwan Ltd., Hsinchu Laboratory No. 11, Lane 275, Ko-Nan 1 Street, Chia-Tung Li, Shiang-Shan District, Hsinchu City, Taiwan



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Revision History

Report No.	Issue Date	Revision Summary
220400269THC-001	Jul. 05, 2022	Original report

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Summary of Test Data

Test Requirement	Applicable Rule	Result
Radiated Emission test	15.231(b), 15.209	Pass
Measured bandwidth	15.231(c)	Pass
Timing requirement of operated transmitter	15.231(b)	Pass
Conducted Emission test	15.207	N/A
Antenna Requirement	15.203	Pass

Note: Please note that the test results with statement of conformity, the decision rules which are based on: Safety Testing: the specification, standard or IEC Guide 115.

Other Testing: the specification, standard and not taking into account the measurement uncertainty.

1. General Information

1.1 Identification of the EUT

Product:	Remote control transmitter
Model No.:	VCS-ECOTSS01-B
Operating Frequency:	303.8 MHz
Rated Power:	DC 6V
Power Cord:	N/A
Sample receiving date:	2022/4/19
Sample condition:	Workable
Test Date(s):	2022/6/21 ~ 2022/6/22

1.2 Additional information about the EUT

The customer confirmed the models listed as below were series model to model VCS-ECOTSS01-B (EUT), the difference between main model and series model are listed as below.

Model Number	Different
VCS-ECOTSS01-B	Full Function for VS series receivers
VCS-ECOTSS02-B	Flame-B, Fan, Lights, Aux disabled by default
VCS-ECOTSS04-B	Full variable Flame Modulation for VCS series receivers
AF-4000TSS01-B	Thermostat disabled by default
AF-4000TSS02-B	Full Function for AF series receivers
SPTS-H-L-TH-B	Full Variable Flame Modulation for AF series receivers
RCAF-1031TS-4B	For RCAF-1031-4 series receivers

1.3 Antenna description

Antenna Type : Coil Antenna
Connector Type : Fixed

2. Test specifications

2.1 Test standard

The EUT was performed according to the procedures in FCC Part 2.1053 and the requirement in FCC Part 15 Subpart C Section 15.231.

2.2 Operation mode

The EUT was supplied with DC 6V from battery.

The EUT powered on will transmit signal continued.

The signal is maximized through rotation and placement in the three orthogonal axes.



X axis



Y axis



Z axis

After verifying three axes, we found the maximum electromagnetic field was occurred at X axis. The final test data was executed under this configuration.

Frequency (MHz)	Signal on time(ms)	Signal on & off time(ms)	Duty Cycle	Duty Cycle factor
303.8	0.50	1.51	0.333	9.560

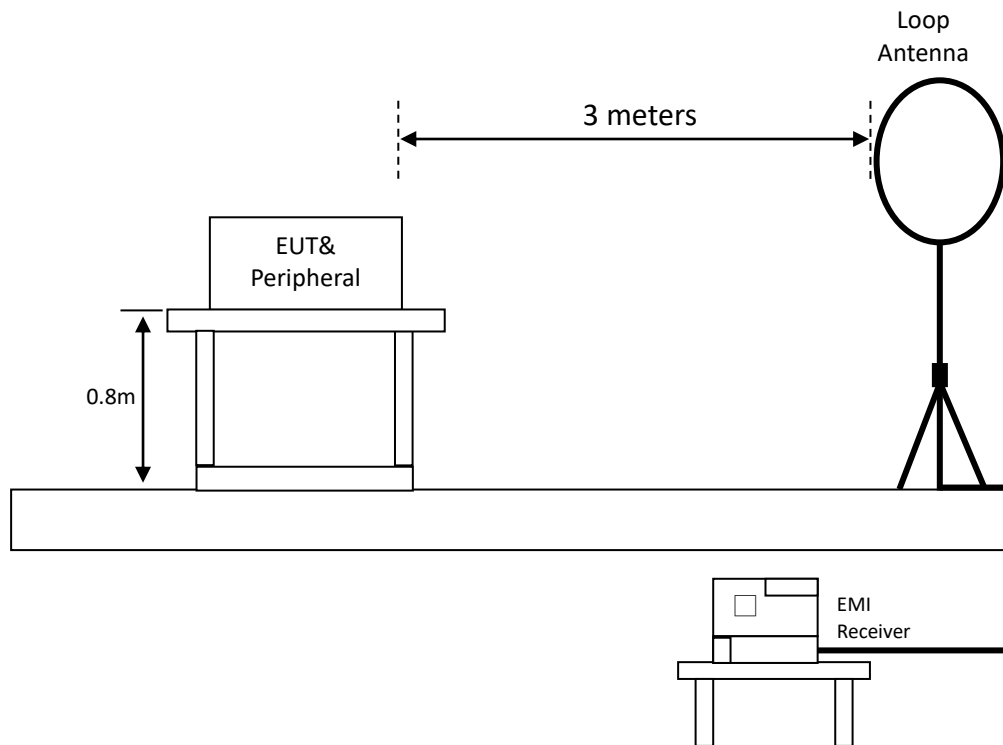
2.3 Peripherals equipment

Peripherals	Brand	Model No.	Serial No.	Data cable
AAA Battery*4	GP	GP24G	N/A	N/A

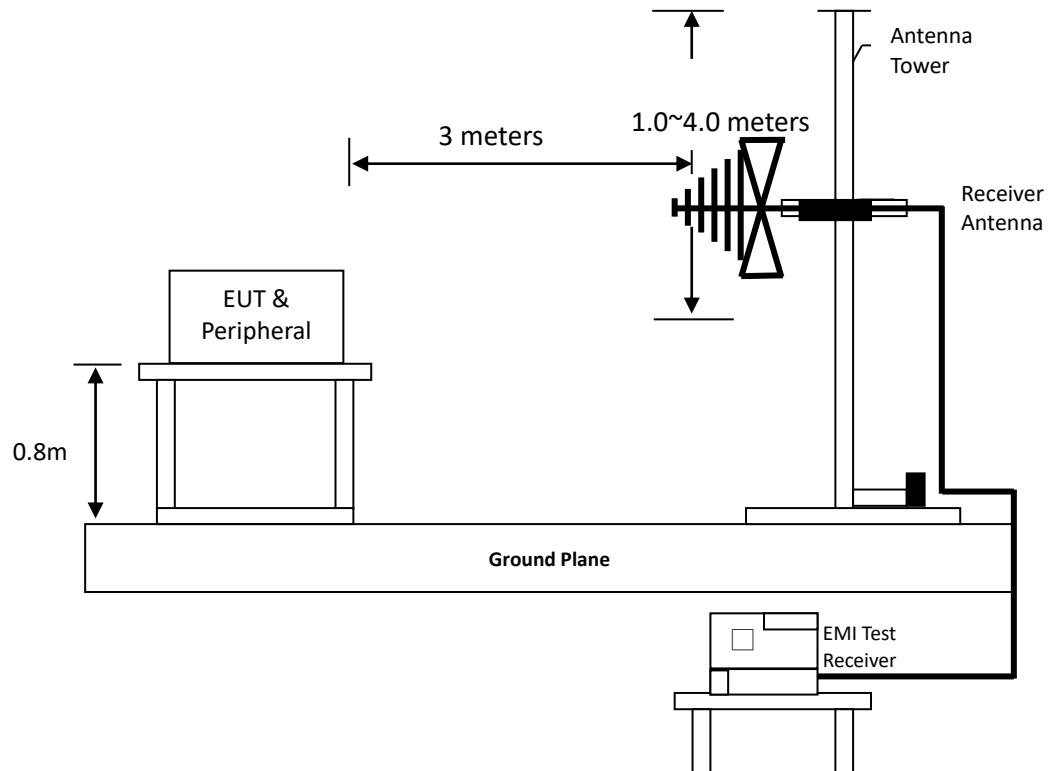
3. Radiated emission test FCC 15.231 (b)

3.1 Test setup & procedure

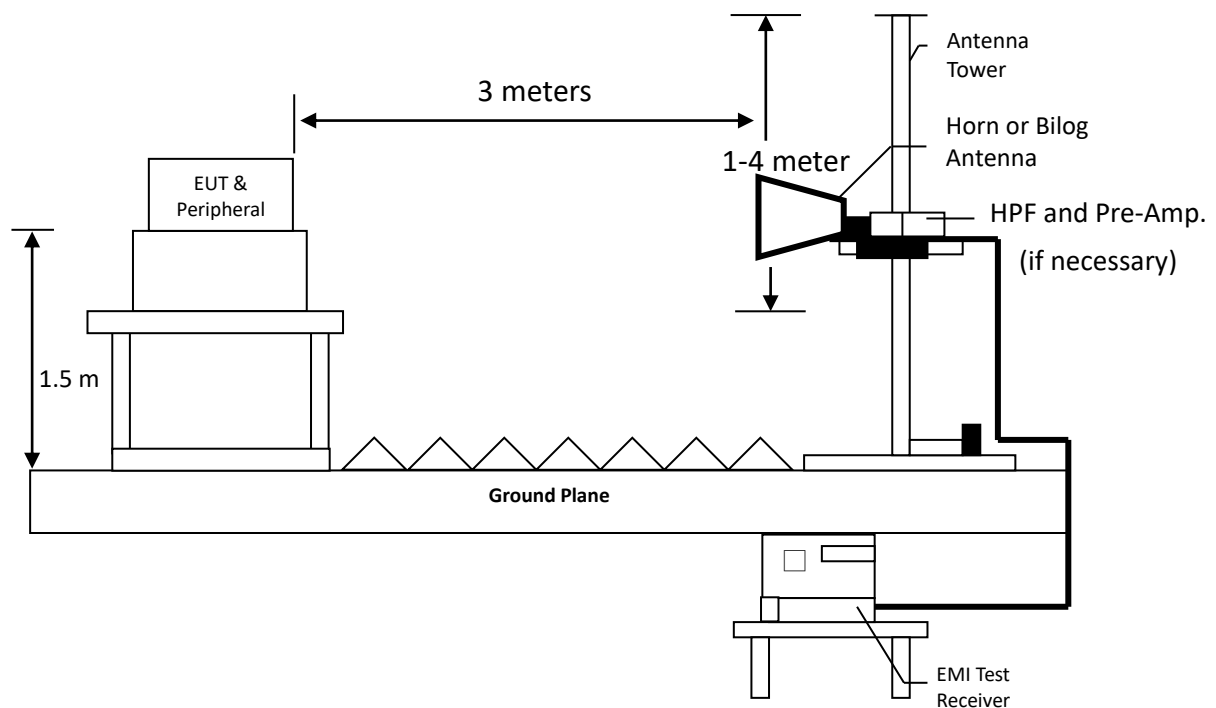
3.1.1 Radiated emission from 9kHz to 30MHz uses Loop Antenna:



3.1.2 Radiated emission below 1GHz using Bilog Antenna



3.1.3 Radiated emission above 1GHz using Horn Antenna



3.2 Radiated emission limit

3.2.1 Fundamental and harmonics emission limits

Frequency (MHz)	Field Strength of Fundamental		Field Strength of Harmonics	
	(uV/m@3 m)	(dBuV/m@3 m)	(uV/m@3 m)	(dBuV/m@3 m)
303.8	5575	74.92	557.5	54.92

3.2.2 General radiated emission limit

The spurious Emission shall test through the 10th harmonic. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a).

Frequency MHz	15.209 Limits (dBµV/m@3m)
30-88	40
88-216	43.5
216-960	46
Above 960	54

Remark:

1. In the above table, the tighter limit applies at the band edges.
2. Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system

3.3 Radiated emission test data FCC 15.231

3.3.1 Measurement results: Fundamental emission

Temperature: 29 °C

Relative Humidity: 56 %

Test date: 2022/6/21

Frequency (MHz)	Spectrum Analyzer Detector	Antenna Polarization	Correction Factor (dB/m)	Reading (dBμV)	Corrected Reading (dBμV/m)	Limit @ 3 m (dBμV/m)	Margin (dB)
303.80	PK	V	21.69	42.60	64.29	94.92	-30.63
303.80	AV	V	-	-	54.73	74.92	-20.19
303.80	PK	H	21.69	54.22	75.91	94.92	-19.01
303.80	AV	H	-	-	66.35	74.92	-8.57

Remark: Correction Factor = Antenna Factor + Cable Loss

Note: AV Corrected Reading = PK Corrected Reading +Duty cycle correction factor (-9.56)

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3.3.2 Measurement results: frequencies equal to or less than 1 GHz

Temperature: 29 °C
Relative Humidity: 56 %
Test date: 2022/6/21

9kHz – 30MHz

Antenna Polarization	Frequency (MHz)	Detector	Correction Factor (dB/m)	Reading (dBμV)	Corrected Reading (dBμV/m)	Limit @ 3 m (dBμV/m)	Margin (dB)
Perpendicular	0.009	AV	18.11	55.56	73.67	128.52	-54.85
Perpendicular	0.129	AV	18.04	50.91	68.95	105.56	-36.61
Perpendicular	0.159	AV	18.14	46.62	64.76	103.63	-38.87
Perpendicular	0.369	AV	18.68	43.41	62.09	96.28	-34.19
Perpendicular	0.519	QP	18.81	35.79	54.60	73.34	-18.74
Perpendicular	0.789	QP	18.98	29.36	48.34	69.68	-21.34

Remark: Corr. Factor = Antenna Factor + Cable Loss

Antenna Polarization	Frequency (MHz)	Detector	Correction Factor (dB/m)	Reading (dBμV)	Corrected Reading (dBμV/m)	Limit @ 3 m (dBμV/m)	Margin (dB)
Parallel	0.009	AV	18.11	54.85	72.96	128.52	-55.56
Parallel	0.099	QP	17.97	50.08	68.05	107.84	-39.79
Parallel	0.249	AV	18.45	43.65	62.10	99.69	-37.59
Parallel	0.369	AV	18.68	40.32	59.00	96.28	-37.28
Parallel	0.519	QP	18.81	35.08	53.89	73.34	-19.45
Parallel	0.759	QP	18.95	29.24	48.19	70.06	-21.87

Remark: Corr. Factor = Antenna Factor + Cable Loss

Antenna Polarization	Frequency (MHz)	Detector	Correction Factor (dB/m)	Reading (dBμV)	Corrected Reading (dBμV/m)	Limit @ 3 m (dBμV/m)	Margin (dB)
Ground-parallel	0.009	AV	18.11	54.39	72.50	128.52	-56.02
Ground-parallel	0.159	AV	18.14	47.17	65.31	103.63	-38.32
Ground-parallel	0.219	AV	18.35	44.85	63.20	100.85	-37.65
Ground-parallel	0.399	AV	18.71	40.80	59.51	95.59	-36.08
Ground-parallel	0.519	QP	18.81	33.45	52.26	73.34	-21.08
Ground-parallel	0.819	QP	18.99	29.65	48.64	69.36	-20.72

Remark: Corr. Factor = Antenna Factor + Cable Loss

30MHz – 1GHz

Antenna Polarization	Frequency (MHz)	Spectrum Analyzer Detector	Correction Factor (dB/m)	Reading (dBμV)	Corrected Reading (dBμV/m)	Limit @ 3 m (dBμV/m)	Margin (dB)
Horizontal	456.80	QP	25.81	1.14	26.95	54.92	-27.97
Horizontal	684.75	QP	30.09	1.13	31.22	54.92	-23.70
Horizontal	730.34	QP	31.10	1.28	32.38	54.92	-22.54
Horizontal	811.82	QP	32.27	0.49	32.76	54.92	-22.16
Horizontal	865.17	QP	32.79	0.59	33.38	54.92	-21.54
Horizontal	911.73	QP	33.64	4.61	38.25	54.92	-16.67

Remark: Corr. Factor = Antenna Factor + Cable Loss

Antenna Polarization	Frequency (MHz)	Spectrum Analyzer Detector	Correction Factor (dB/m)	Reading (dBμV)	Corrected Reading (dBμV/m)	Limit @ 3 m (dBμV/m)	Margin (dB)
Vertical	496.57	QP	26.57	6.77	33.34	54.92	-21.58
Vertical	602.30	QP	28.96	1.70	30.66	54.92	-24.26
Vertical	644.01	QP	29.68	2.19	31.87	54.92	-23.05
Vertical	798.24	QP	32.04	1.91	33.95	54.92	-20.97
Vertical	831.22	QP	32.53	1.71	34.24	54.92	-20.68
Vertical	911.73	QP	33.64	2.86	36.50	54.92	-18.42

Remark: Corr. Factor = Antenna Factor + Cable Loss

3.3.3 Measurement results: frequency above 1GHz

Temperature: 29 °C
 Relative Humidity: 56 %
 Test date: 2022/6/21

Frequency (MHz)	Spectrum Analyzer Detector	Ant. Pol. (H/V)	Correction Factor (dB/m)	Reading (dBμV)	Corrected Reading (dBμV/m)	Limit @ 3 m (dBμV/m)	Margin (dB)
1215.2	PK	H	-21.24	58.82	37.58	74.00	-36.42
1519	PK	H	-20.21	65.26	45.05	74.00	-28.95
1822.8	PK	H	-20.36	62.15	41.79	74.92	-33.13
2126.6	PK	H	-17.72	66.06	48.34	74.92	-26.58
2430.4	PK	H	-16.75	65.09	48.34	74.92	-26.58
2734.2	PK	H	-15.37	68.53	53.16	74.00	-20.84
3038	PK	H	-14.62	58.77	44.15	74.92	-30.77
1215.2	PK	V	-21.24	57.85	36.61	74.00	-37.39
1519	PK	V	-20.21	61.10	40.89	74.00	-33.11
1822.8	PK	V	-20.36	62.36	42.00	74.92	-32.92
2126.6	PK	V	-17.72	64.60	46.88	74.92	-28.04
2430.4	PK	V	-16.75	57.63	40.88	74.92	-34.04
2734.2	PK	V	-15.37	64.38	49.01	74.00	-24.99
3038	PK	V	-14.62	58.03	43.41	74.92	-31.51

Remark: Correction Factor = Antenna Factor + Cable Loss + High Pass Filter Loss - Pre_Amplifier Gain

Note: AV Corrected Reading = PK Corrected Reading +Duty cycle correction factor (-9.56)

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4. Measured bandwidth FCC 15.231(C)

Temperature: 29 °C
Relative Humidity: 57 %
Test date: 2022/6/22

The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70MHz and below 900MHz. Bandwidth is determined at the points 20dB down from the modulated carrier.

Frequency (MHz)	20dB Occupied Bandwidth (MHz)	Limit (MHz)	Result
303.80	0.102	0.760	Pass

20dB Occupied Bandwidth



5. Timing requirement of operated transmitter

Temperature: 29 °C
Relative Humidity: 57 %
Test date: 2022/6/22

A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.

Frequency (MHz)	Transmission Time (s)	Limit (s)	Result
303.80	0.5255	< 5	Pass

Transmitter Pulse Duration



6. Conducted emission FCC 15.207

Since the EUT is not connected to AC source, therefore, the test can be waived.

Appendix A: Test equipment list

Test Equipment/ Test site	Brand	Model No.	Serial No.	Calibration Date	Next Calibration Date
EMI Test Receiver	Rohde & Schwarz	ESR7	101822	2021/08/16	2022/08/15
Signal Analyzer	Agilent	N9030A	MY51380492	2021/08/17	2022/08/16
Active Loop Antenna	SCHWARZBECK MESS-ELEKTRONIC	FMZB1519	1519-067	2022/04/13	2023/04/12
Broadband Antenna	SHWARZBECK	VULB 9168	9168-172	2022/01/20	2023/01/19
Horn Antenna	EMCO	BBHA 9120 D	9120D-456	2022/01/21	2023/01/20
Broadband Amplifier	SGH	SGH118(45dB)	20220105-1	2022/01/07	2023/01/06
966-2(A) Cable	SUHNER	SMA / EX 100	N/A	2022/03/04	2023/03/03
966-2(B) Cable	SUHNER	SUCOFLEX 104P	CB0005	2022/03/04	2023/03/03
966-2 Cable	SUHNER	SUCOFLEX 104P	9403/4P	2021/11/30	2022/11/29
966-2_3m Semi-Anechoic Chamber	966_2	CEM-966_2	N/A	2022/01/14	2023/01/13
20dB Attenuator	Mini-Circuits	BW-S20W5+	N/A	2022/05/25	2023/05/24
Test software	Audix	e3	V9	NCR	NCR

Note: No Calibration Required (NCR).

Appendix B: Measurement Uncertainty

This uncertainty represents an expanded uncertainty expressed at approximately the 95 % confidence level using a coverage factor of $k=2$.

Item	Uncertainty
Timing requirement of operated transmitter	1.27 dB
Occupied Bandwidth	7.78 %
Radiated disturbances from 9kHz~30MHz in a semi-anechoic chamber at a distance of 3m	3.70 dB
Vertically polarized radiated disturbances from 30MHz~1GHz in a semi-anechoic chamber at a distance of 3m	5.16 dB
Horizontally polarized radiated disturbances from 30MHz~1GHz in a semi-anechoic chamber at a distance of 3m	5.02 dB
Radiated disturbances from 1GHz~18GHz in a semi-anechoic chamber at a distance of 3m	5.17 dB
AC Power Line Conducted Emission	3.08 dB