

Certification Test Report

FCC ID: YKD-25TWD3000-029

FCC Rule Part: 15.247

ACS Report Number: 12-2102.W04.1B

Manufacturer: L-3 Communications CyTerra Corporation
Model: Range-R Link

Test Begin Date: **August 13, 2012**
Test End Date: **October 4, 2012**

Report Issue Date: October 17, 2012



FOR THE SCOPE OF ACCREDITATION UNDER CERTIFICATE NUMBER AT-1533

This report must not be used by the client to claim product certification, approval, or endorsement by ACCLASS, ANSI, or any agency of the Federal Government.

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This report contains 14 pages

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1 GENERAL

1.1 Purpose

The purpose of this report is to demonstrate compliance with Part 15 Subpart C of the FCC's Code of Federal Regulations for a class II permissive change for the specific test requirements described in this document.

The purpose of the class II permissive change is to add a new antenna and co-location when integrated within host device Range-R, FCC ID: YKD-25TWD3000.

1.2 Product description

The L3-Cyterra Range-R link is an IEEE 802.11 b/g/n wireless module. The module is incorporated inside of host device Range-R which is comprised of a stepped-frequency continuous wave (SFCW) radar transceiver, digital signal processor (DSP), display and power supply electronics enclosed in a rugged, water resistant, light-weight plastic housing. The Range-R cycles through a sequence of 120 frequencies in 2 MHz increments from 3.18 GHz to 3.42 GHz. At each of the frequencies, it transmits a maximum 26 mW power level with no modulation.

Technical Details

Mode of Operation: WLAN 802.11b/g/n
 Frequency Range: 802.11b/g: 2142 MHz – 2462 MHz
 802.11n HT20: 2142 MHz – 2462 MHz
 Number of Channels: 802.11b/g: 11
 802.11n HT20: 11
 Channel Separation: 5 MHz
 Transmit Data Rates: 802.11b: 11, 5.5, 2, 1 Mbps
 802.11g: 54, 48, 36, 24, 18, 12, 9, 6 Mbps
 802.11n HT20: 65, 58.5, 52, 39, 26, 19.5, 13, 6.5 Mbps
 Modulations: 802.11b: DSSS (CCK)
 802.11g: OFDM (64QAM, 16QAM, QPSK, BPSK)
 802.11n HT20/40: OFDM (64QAM, 16QAM, QPSK, BPSK)

Table 1.2- 1: Collocated Radios

Radio	Company	Model Number	FCC ID
Radar	L-3 Cyterra	Range-R	YKD-25TWD3000

Manufacturer Information:
 L-3 Communications CyTerra Corporation
 7558 Southland Blvd, Suite 130
 Orlando, FL 32809

Test Sample Serial Number(s): DSP-3212-0002

Test Sample Condition: The unit was in good physical condition with no visible damages.

1.3 Test Methodology and Considerations

The Range-R Link was evaluated for radiated emissions when configured with a 2dBi chip antenna and integrated within the Range-R host device up to the 10th harmonic of the fundamental frequencies. Preliminary measurements were performed for the host device set in three orthogonal orientations. The final measurements were performed using the EUT orientation and data rates considered as the worst case. The unit was also evaluated for inter-modulations with both the 2.4 GHz WLAN and 3 GHz Radar radios transmitting at the same time. The inter-modulation products of the co-configured radios were found to be compliant.

The maximum power settings of the module were adjusted from nominal for compliance purposes per the customer recommendation. The table below describes the Range-R Link test configurations during the radiated emissions evaluation.

Table 1.3-1: Configurations evaluated

Mode of Operation	Frequency (MHz)	Channel	Output Power	Data Rate
802.11b	2412	1	Full	1 Mbps
	2437	6	Full	1 Mbps
	2462	11	Full	1 Mbps
802.11g	2412	1	Low	6 Mbps
	2437	6	Low	6 Mbps
	2462	11	Low	6 Mbps
802.11n HT20	2412	1	Medium	6.5 Mbps
	2437	6	Medium	6.5 Mbps
	2462	11	Medium	6.5 Mbps

In order for the Range-R Link to meet the unintentional radiated emissions requirements in the host configuration, the Range-R host device was modified as described below.

- 1) Mechanical post connecting the Digital board to chassis ground.
- 2) Copper tape connecting the RF board to chassis ground.

Preliminary evaluations were performed on the radar transceiver for degradation of the radiated spurious emissions following the modifications. No degradation could be observed.

The unintentional emissions test results are reported separately in a verification report.

2 TEST FACILITIES

2.1 Location

The radiated and conducted emissions test sites are located at the following address:

Advanced Compliance Solutions, Inc.
3998 FAU Blvd, Suite 310
Boca Raton, Florida 33431
Phone: (561) 961-5585
Fax: (561) 961-5587
www.acstestlab.com

FCC Test Firm Registration #: 587595
Industry Canada Lab Code: 4175C

2.2 Laboratory Accreditations/Recognitions/Certifications

ACS is accredited to ISO/IEC 17025 by ANSI-ASQ National Accreditation Board under their ACLASS program and has been issued certificate number AT-1533 in recognition of this accreditation. Unless otherwise specified, all test methods described within this report are covered under the ISO/IEC 17025 scope of accreditation.

2.3 Radiated & Conducted Emissions Test Site Description

2.3.1 Semi-Anechoic Chamber Test Site

The EMC radiated test facility consists of an RF-shielded enclosure. The interior dimensions of the indoor semi-anechoic chamber are approximately 48 feet (14.6 m) long by 36 feet (10.8 m) wide by 24 feet (7.3 m) high and consist of rigid, 1/8 inch (0.32 cm) steel-clad, wood core modular panels with steel framing. In the shielded enclosure, the faces of the panels are galvanized and the chamber is self-supporting. 8-foot RF absorbing cones are installed on 4 walls and the ceiling. The steel-clad ground plane is covered with vinyl floor.

The turntable is driven by pneumatic motor, which is capable of supporting a 2000 lb. load. The turntable is flushed with the chamber floor which it is connected to, around its circumference, with a continuous metallic loaded spring. An EMCO Model 1050 Multi-device Controller controls the turntable position.

A pneumatic motor is used to control antenna polarizations and height relative to the ground. The height information is displayed on the control unit EMCO Model 1050.

The control room is an RF shielded enclosure attached to the semi-anechoic chamber with two bulkhead panels for connecting RF, and control cables. The dimension of the room is 7.3 m x 4.9 m x 3 m high and the entrance doors of both control and conducted rooms are 3 feet (0.91 m) by 7 feet (2.13 m).

A diagram of the Semi-Anechoic Chamber Test Site is shown in Figure 2.3.1-1 below:

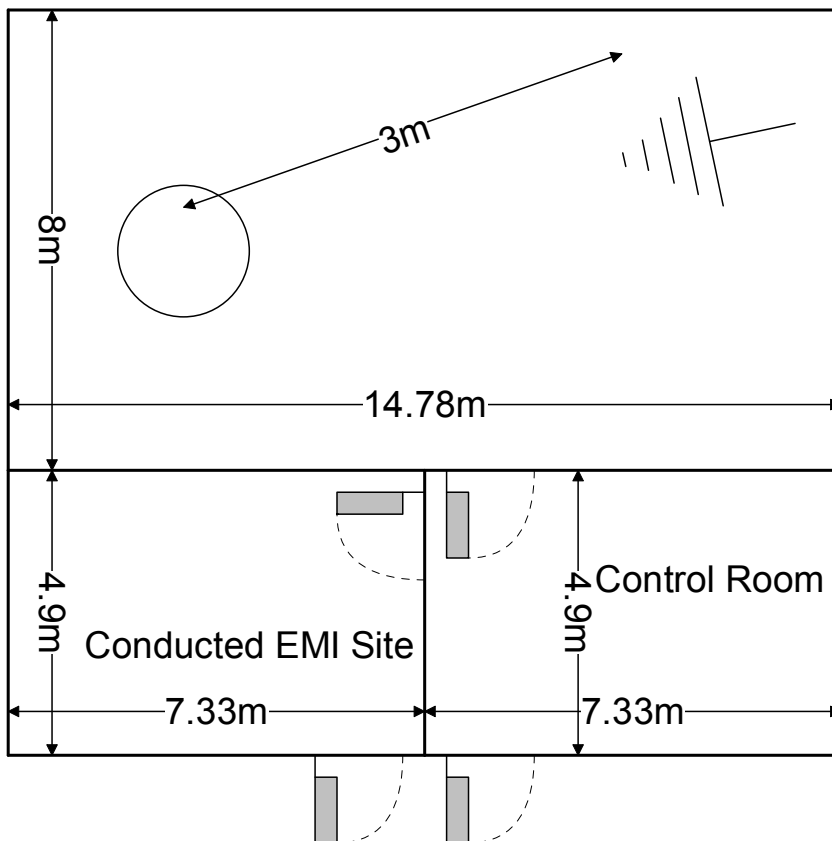


Figure 2.3.1-1: Semi-Anechoic Chamber Test Site

2.3.2 Conducted Emissions Test Site Description

The dimensions of the shielded conducted room are 7.3 x 4.9 x 3 m³. As per ANSI C63.4 2003 requirements, the data were taken using two LISNs; a Solar Model 8028-50 50 Ω/50 μH and an EMCO Model 3825, which are installed as shown in Photograph 3. For 220 V, 50 Hz, a Polarad LISN (S/N 879341/048) is used in conjunction with a 1 kVA, 50 Hz/220 V EDGAR variable frequency generator, Model 1001B, to filter conducted noise from the generator.

A diagram of the room is shown below in figure 2.3.2-1:

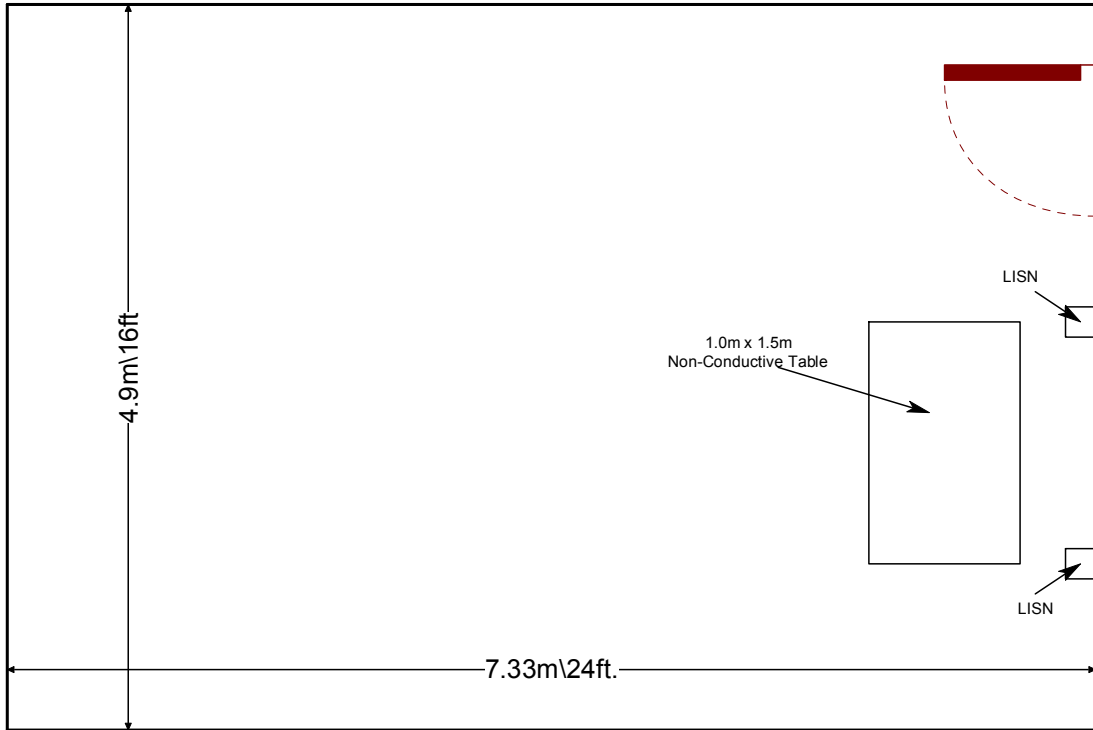


Figure 2.3.2-1: AC Mains Conducted EMI Site

3 APPLICABLE STANDARD REFERENCES

The following standards were used:

- ❖ ANSI C63.4-2003: Method of Measurements of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the 9KHz to 40GHz
- ❖ US Code of Federal Regulations (CFR): Title 47, Part 2, Subpart J: Equipment Authorization Procedures, 2012
- ❖ US Code of Federal Regulations (CFR): Title 47, Part 15, Subpart C: Radio Frequency Devices, Intentional Radiators, 2012
- ❖ KDB Publication No. 558074 – Guidance for Performing Measurements on Digital Transmission Systems (DTS) Operating under Section 15.247, January 18, 2012

4 LIST OF TEST EQUIPMENT

The calibration interval of test equipment is annually or the manufacturer's recommendations. Where the calibration interval deviates from the annual cycle based on the instrument manufacturer's recommendations, it shall be stated below.

Table 4-1: Test Equipment

AssetID	Manufacturer	Model #	Equipment Type	Serial #	Last Calibration Date	Calibration Due Date
523	Agilent	E7405	Spectrum Analyzers	MY45103293	1/5/2011	1/5/2013
524	Chase	CBL6111	Antennas	1138	1/7/2011	1/7/2013
2006	EMCO	3115	Antennas	2573	3/2/2011	3/2/2013
2008	COM-Power	AH-826	Antennas	81009	NCR	NCR
2011	Hewlett-Packard	HP 8447D	Amplifiers	2443A03952	1/2/2012	1/2/2013
2037	ACS Boca	Chamber EMI Cable Set	Cable Set	2037	1/2/2012	1/2/2013
2044	QMI	N/A	Cables	2044	1/2/2012	1/2/2013
2070	Mini Circuits	VHF-8400+	Filter	2070	1/19/2012	1/19/2013
2072	Mini Circuits	VHF-3100+	Filter	30737	1/19/2012	1/19/2013
2076	Hewlett Packard	HP5061-5458	Cables	2076	1/2/2012	1/2/2013
2086	Merrimac	FAN-6-10K	Attenuators	23148-83-1	12/30/2011	12/30/2012
2089	Agilent Technologies, Inc.	83017A	Amplifiers	3123A00214	12/22/2011	12/22/2012
2091	Agilent Technologies, Inc.	8573A	Spectrum Analyzers	2407A03233	12/12/2011	12/12/2013
2095	ETS Lindgren	TILE4! - Version 4.2.A	Software	85242	NCR	NCR

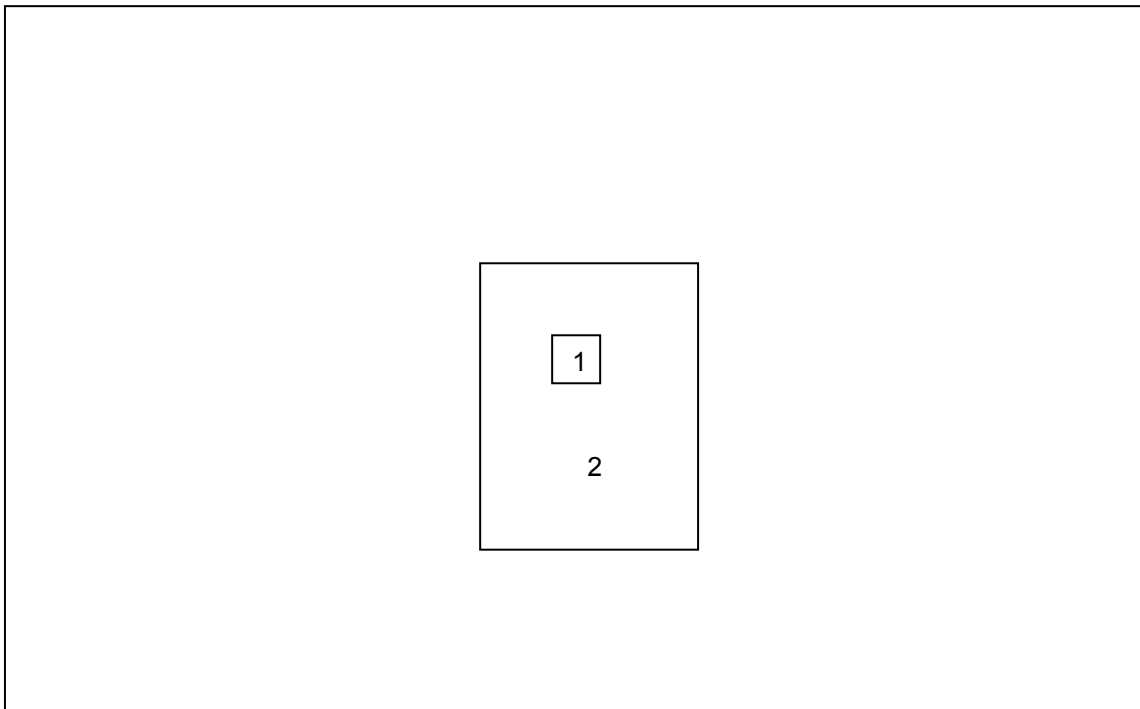
NCR=No Calibration Required

5 EUT AND SUPPORT EQUIPMENT

Table 5-1: EUT and Support Equipment

Item #	Type Device	Manufacturer	Model/Part #	Serial #
1	EUT	L-3 CyTerra	Range-R Link	DSP-3212-0002
2	Host Device	L-3 CyTerra	Range-R	N/A

6 EQUIPMENT UNDER TEST SETUP BLOCK DIAGRAM



7 SUMMARY OF TESTS

Along with the tabular data shown below, plots were taken of all signals deemed important enough to document.

7.1 Antenna Requirement – FCC: Section 15.203

The Range-R link uses a 2 dBi chip antenna which is implanted on the PCB.

7.2 Radiated Spurious Emissions - FCC Section 15.205

7.2.1 Measurement Procedure

Radiated emissions tests were made over the frequency range of 30MHz to 26GHz, 10 times the highest fundamental frequency.

The EUT was rotated through 360° and the receive antenna height was varied from 1m to 4m so that the maximum radiated emissions level would be detected. For frequencies below 1000MHz, quasi-peak measurements were made using a resolution bandwidth RBW of 120 kHz and a video bandwidth VBW of 300 kHz. For frequencies above 1000MHz, peak measurements were made with RBW and VBW of 1 MHz and 3MHz respectively. The average measurements were performed in the linear scale with a VBW of 10 Hz.

For frequencies below 10 GHz, the measurements were performed at 3m. For frequencies above 10 GHz, the emissions were measured at 1m and the limits were corrected using a distance correction factor of $20 \cdot \log(3/1)$ dB ≈ 9.54 dB.

The emissions at the band edges were also measured and are reported in Section 7.2.2.

7.2.2 Measurement Results

Radiated spurious emissions found in the band of 30MHz to 26GHz are reported below.

Table 7.2.2-1: Radiated Spurious Emissions Tabulated Data – WLAN 802.11b (1 Mbps)

Frequency (MHz)	Level (dBuV)		Antenna Polarity (H/V)	Correction Factors (dB)	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg			pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
Low Channel (2412 MHz)										
2389.05	62.84	56.13	H	-8.43	54.41	47.70	74.0	54.0	19.60	6.30
2389.05	58.45	49.82	V	-8.43	50.02	41.39	74.0	54.0	24.00	12.60
2390	67.78	54.19	H	-8.42	59.36	45.77	74.0	54.0	14.60	8.20
2390	61.74	48.58	V	-8.42	53.32	40.16	74.0	54.0	20.70	13.80
4824	52.58	48.58	H	-1.25	51.33	47.33	74.0	54.0	22.70	6.70
4824	51.86	47.08	V	-1.25	50.61	45.83	74.0	54.0	23.40	8.20
12060	44.59	31.33	H	11.60	56.19	42.93	83.5	63.5	27.30	20.60
12060	46.12	34.90	V	11.60	57.72	46.50	83.5	63.5	25.80	17.00
Middle Channel (2437 MHz)										
4874	52.30	47.29	H	-1.12	51.18	46.17	74.0	54.0	22.80	7.80
4874	50.37	44.77	V	-1.12	49.25	43.65	74.0	54.0	24.80	10.40
12185	45.51	33.62	V	11.68	57.19	45.30	83.5	63.5	26.30	18.20
High Channel (2462 MHz)										
2483.5	61.84	48.15	H	-8.03	53.81	40.12	74.0	54.0	20.2	13.9
2483.5	60.30	46.69	V	-8.03	52.27	38.66	74.0	54.0	21.7	15.3
2498.76	58.03	45.54	H	-7.97	50.06	37.57	74.0	54.0	23.9	16.4
2498.23	57.23	43.16	V	-7.97	49.26	35.19	74.0	54.0	24.7	18.8
4924	51.51	47.48	H	-0.99	50.52	46.49	74.0	54.0	23.5	7.5
4924	49.82	44.63	V	-0.99	48.83	43.64	74.0	54.0	25.2	10.4
12310	45.12	33.39	V	11.77	56.89	45.16	83.5	63.5	26.6	18.3

*Note:

All emissions falling in the restricted bands above 12310 MHz were attenuated below the noise floor of the measurement equipment.

Table 7.2.2-2: Radiated Spurious Emissions Tabulated Data – WLAN 802.11g (6.0 Mbps)

Frequency (MHz)	Level (dBuV)		Antenna Polarity (H/V)	Correction Factors (dB)	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg			pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
Low Channel (2412 MHz)										
2364.35	58.80	47.61	H	-8.53	50.27	39.08	74.0	54.0	23.7	14.9
2364.82	57.34	45.98	V	-8.53	48.81	37.45	74.0	54.0	25.2	16.5
2390	61.99	46.14	H	-8.42	53.57	37.72	74.0	54.0	20.4	16.3
2390	60.05	43.42	V	-8.42	51.63	35.00	74.0	54.0	22.4	19.0
4824	52.69	45.27	H	-1.25	51.44	44.02	74.0	54.0	22.6	10.0
4824	51.27	37.86	V	-1.25	50.02	36.61	74.0	54.0	24.0	17.4
12060	52.79	34.13	H	11.60	64.39	45.73	83.5	63.5	19.1	17.8
12060	53.17	34.06	V	11.60	64.77	45.66	83.5	63.5	18.7	17.8
Middle Channel (2437 MHz)										
4874	52.05	44.24	H	-1.12	50.93	43.12	74.0	54.0	23.1	10.9
4874	50.53	37.60	V	-1.12	49.41	36.48	74.0	54.0	24.6	17.5
12185	52.13	34.64	H	11.68	63.81	46.32	83.5	63.5	19.7	17.2
12185	53.74	34.67	V	11.68	65.42	46.35	83.5	63.5	18.1	17.1
High Channel (2462 MHz)										
2483.5	56.46	44.50	H	-8.03	48.43	36.47	74.0	54.0	25.6	17.5
2483.5	56.72	44.27	V	-8.03	48.69	36.24	74.0	54.0	25.3	17.8
2496.58	57.58	44.51	H	-7.98	49.60	36.53	74.0	54.0	24.4	17.5
2486.51	58.33	42.94	V	-8.02	50.31	34.92	74.0	54.0	23.7	19.1
4924	52.92	45.77	H	-0.99	51.93	44.78	74.0	54.0	22.1	9.2
4924	50.33	36.36	V	-0.99	49.34	35.37	74.0	54.0	24.7	18.6
12310	54.82	35.75	H	11.77	66.59	47.52	83.5	63.5	16.9	16.0
12310	55.43	35.41	V	11.77	67.20	47.18	83.5	63.5	16.3	16.3

*Note:

All emissions falling in the restricted bands above 12310 MHz were attenuated below the noise floor of the measurement equipment.

Table 7.2.2-3: Radiated Spurious Emissions Tabulated Data – WLAN 802.11n HT20 (6.5 Mbps)

Frequency (MHz)	Level (dBuV)		Antenna Polarity (H/V)	Correction Factors (dB)	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg			pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
Low Channel (2412 MHz)										
2363.87	59.24	46.07	V	-8.53	50.71	37.54	74.0	54.0	23.3	16.5
2380.57	64.76	46.94	H	-8.46	56.30	38.48	74.0	54.0	17.7	15.5
2390	69.24	51.28	H	-8.42	60.82	42.86	74.0	54.0	13.2	11.1
2390	64.23	47.65	V	-8.42	55.81	39.23	74.0	54.0	18.2	14.8
4824	50.61	45.26	H	-1.25	49.36	44.01	74.0	54.0	24.6	10.0
4824	48.77	39.86	V	-1.25	47.52	38.61	74.0	54.0	26.5	15.4
Middle Channel (2437 MHz)										
4874	50.49	45.26	H	-1.12	49.37	44.14	74.0	54.0	24.6	9.9
4874	48.89	40.85	V	-1.12	47.77	39.73	74.0	54.0	26.2	14.3
High Channel (2462 MHz)										
2483.5	66.84	46.52	H	-8.03	58.81	38.49	74.0	54.0	15.2	15.5
2483.5	59.96	44.95	V	-8.03	51.93	36.92	74.0	54.0	22.1	17.1
2493.67	58.53	44.99	H	-7.99	50.54	37.00	74.0	54.0	23.5	17.0
4924	51.00	46.25	H	-0.99	50.01	45.26	74.0	54.0	24.0	8.7
4924	49.81	41.15	V	-0.99	48.82	40.16	74.0	54.0	25.2	13.8

*Note:

All emissions falling in the restricted bands above 4924 MHz were attenuated below the noise floor of the measurement equipment.

7.2.3 Sample Calculation:

$$R_C = R_U + CF_T$$

Where:

 CF_T = Total Correction Factor (AF+CA+AG)-DC (Average Measurements Only) R_U = Uncorrected Reading R_C = Corrected Level

AF = Antenna Factor

CA = Cable Attenuation

AG = Amplifier Gain

DC = Duty Cycle Correction Factor

Example Calculation: PeakCorrected Level: $58.8 + (-8.53) = 50.27\text{dBuV/m}$ Margin: $74\text{dBuV/m} - 50.27\text{dBuV/m} = 23.7\text{dB}$ **Example Calculation: Average**Corrected Level: $47.61 + (-8.53) - 0 = 39.08\text{dBuV}$ Margin: $54\text{dBuV} - 39.08\text{dBuV} = 14.9\text{dB}$ **8 CONCLUSION**

In the opinion of ACS, Inc. the Range-R Link, manufactured by L-3 Communications CyTerra Corporation meets the requirements of FCC Part 15 subpart C based on the test results documented in this test report.

END REPORT