Lab Code: 200167-0

FCC PART 90

TEST AND MEASUREMENT REPORT

For

Pacific Crest Corporation

510 DeGuigne Drive, Sunnyvale, CA 94085, USA

FCC ID: KEAADLV
Model: ADLV-1, ADLV-2

Report Type: Original Report	**Product type:** UHF Transceiver Module

Test Engineer: Dennis Huang

Report Number: R0907271-90

Report Date: 2009-08-18

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DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	R0907271-90	Original Report	2009-08-18

1 General Information

1.1 Product Description for Equipment Under Test (EUT)

This test and measurement report has been prepared on behalf of *Pacific Crest Corporation* and their product, *FCC ID: KEAADLV models: ADLV-1, ADLV-2, ADLS-1, ADLS-2, TDL 450L-1, TDL-450L-2* or the EUT as referred to in the rest of this report. The EUT is a transceiver designed to provide data communication using UHF radio frequencies. *FCC ID: KEAADLV models: ADLV-1 and ADLV-2* were tested as the worst case configuration in this report. Refer to the Declaration of Similarity Letter

Specifications	
Frequency Band	390~430 MHz 430~470 MHz
Tx RF Output Power	4 Watts (Maximum)
Channel Spacing	25 kHz; 12.5 kHz
Modulation	GMSK, 4LFSK

1.2 Mechanical Description

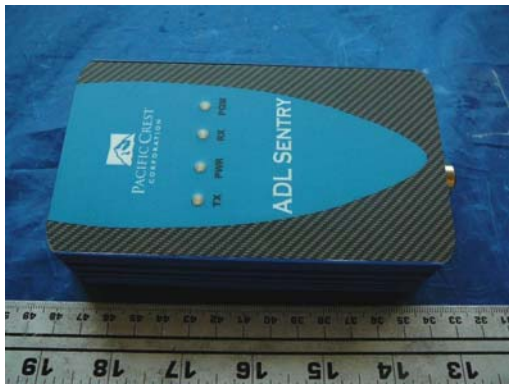
The EUT measures approximately 140.0 mm (L) x 84 mm (W) x 35.0 mm (H) and weighs 621 g.

** The test data gathered are from production sample, serial number: 0926003, 0926001 provided by the manufacturer.*

1.3 EUT Photo

ADLV-1/-2

TDL 450L-1/-2



ADLS-1/-2

Additional photos in Exhibit C

1.4 Objective

This type approval report is prepared on behalf of *Pacific Crest Corporation* in accordance with Part 2 and Part 90 of the Federal Communication Commissions rules.

The objective of the manufacturer is to determine compliance with FCC rules, spurious radiated emissions.

1.5 Related Submittal(s)/Grant(s)

FCC Part 90 conducted test report provided by Pacific Crest, Report number: ADLVFCC063009

1.6 Test Methodology

All tests and measurements indicated in this document were performed in accordance with the Code of Federal Regulations Title 47 Part 2, Sub-part J as well as the following individual parts:

Part 90 – Private Land Mobile Radio Service

Applicable Standards: TIA/EIA-603-C, ANSI 63.4-2003, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 kHz to 40 GHz.

All radiated and conducted emissions measurement was performed at Bay Area Compliance Laboratory, Corp. The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

1.7 Measurement Uncertainty

All measurements involve certain levels of uncertainties, especially in the field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, antenna factor calibration, antenna directivity, antenna factor variation with height, antenna phase center variation, antenna factor frequency interpolation, measurement distance variation, site imperfections, mismatch (average), and system repeatability.

Based on NIS 81, The Treatment of Uncertainty in EMC Measurements, the values ranging from $\pm$2.0 dB for Conducted Emissions tests and $\pm$4.0 dB for Radiated Emissions tests are the most accurate estimates pertaining to uncertainty of EMC measurements at BACL Corp.

Detailed instrumentation measurement uncertainties can be found in BACL Corp. report QAP-018.

1.8 Test Facility

The Test site used by BACL Corp. to collect radiated and conducted emissions measurement data is located at it's facility in Sunnyvale, California, USA.

Test site at BACL has been fully described in reports submitted to the Federal Communication Commission (FCC) and Voluntary Control Council for Interference (VCCI). The details of these reports has been found to be in compliance with the requirements of Section 2.948 of the FCC Rules on February 11 and December 10, 1997 and Article 8 of the VCCI regulations on December 25, 1997. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-2003.

The Federal Communications Commission, Industry Canada, and Voluntary Control Council for Interference have the reports on file and are listed under FCC file 31040/SIT 1300F2, IC registration number: 3062A, and VCCI Registration No.: C-1298 and R-1234. The test site has been approved by the FCC, IC, and VCCI for public use and is listed in the FCC Public Access Link (PAL) database.

Additionally, BACL is a National Institute of Standards and Technology (NIST) accredited laboratory, under the National Voluntary Laboratory Accredited Program (Lab Code 200167-0). The current scope of accreditations can be found at http://ts.nist.gov/ts/htdocs/210/214/scopes/2001670.htm

2 System Test Configuration

2.1 Justification

The EUT was configured for testing according to TIA/EIA 603-C

The EUT was tested in the normal (native) operating mode to represent *worst*-case results during the final qualification test, the test software was provided by the client.

2.2 EUT Exercise Software

Software provided by the customer was used to exercise the system in a mode simulating normal operating conditions.

2.3 Equipment Modifications

No modifications were made to the EUT.

2.4 EUT Internal Configuration Details

Manufacturers	Descriptions	Models	Serial Numbers
Pacific Crest Corporation	390~430 MHz PCB Board	ADLV-1	0926003
Pacific Crest Corporation	430~470 MHz PCB Board	ADLV-2	09260031
Pacific Crest Corporation	Display Board Assembly	MDLS.16263-C-EHT-HV-G-LED1G	-

2.5 Interface Ports and Cabling

Cable Description	Length (m)	From	To
RS232	2	EUT	Laptop*

**Note: Laptop was used only to program the EUT.*

2.6 Power Supply Information

Manufacturer	Description	Model	Serial Number
XP Power	AC/DC Adapter	AEL40US12	-

3 Summary of Test Results

FCC Rule	Description of Tests	Results
§ 2.1046 § 90.205	RF Output Power	Compliant *
§ 2.1047	Modulation Characteristics	N/A
§ 2.1049 § 90.209	Emission mask, Occupied Bandwidth	Compliant *
§ 2.1051 § 90.210	Spurious emissions at antenna terminals	Compliant *
§ 2.1053 § 90.210	Field strength of spurious radiation	Compliant
§ 2.1055 § 90.213	Frequency stability vs. temperature Frequency stability vs. voltage	Compliant *
§ 90.214	Transient Frequency Behavior	Compliant *
§ 2.1091	RF Exposure	Compliant

Note: N/A; There is no specific requirement for digital modulation; therefore modulation characteristic is not presented.

* Please refer to the conducted test report (Report number: ADLVFCC063009)

4 FCC §2.1091 – RF Exposure

4.1 Applicable Standards

According to §2.1091 and §1.1307(b)(1), systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess of the Commission's guidelines.

According to §1.1310 and §2.1091 RF exposure is calculated.

Limits for General Population/Uncontrolled Exposure

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm^2)	Averaging Time (minutes)
Limits for General Population/Uncontrolled Exposure				
0.3-1.34	614	1.63	*(100)	30
1.34-30	824/f	2.19/f	$*(180/f^2)$	30
30-300	27.5	0.073	0.2	30
300-1500	/	/	f/1500	30
1500-100,000	/	/	1.0	30

f = frequency in MHz
* = Plane-wave equivalent power density

4.2 MPE Prediction

Predication of MPE limit at a given distance

$S = PG/4\pi R^2$

Where: S = power density
P = power input to antenna
G = power gain of the antenna in the direction of interest relative to an isotropic radiator
R = distance to the center of radiation of the antenna

390 ~ 430 MHz Band

Maximum peak output power at antenna input terminal (dBm):	36.02
Maximum peak output power at antenna input terminal (mW):	4000
Prediction distance (cm):	120
Prediction frequency (MHz):	390.15
Antenna Gain, typical (dBi):	5.0
Maximum Antenna Gain (numeric):	3.16
Power density at predication frequency and distance (mW/cm^2):	0.07
MPE limit for uncontrolled exposure at predication frequency (mW/cm^2):	0.2601

430 ~ 470 MHz Band

Maximum peak output power at antenna input terminal (dBm):	36.1
Maximum peak output power at antenna input terminal (mW):	4073.80
Prediction distance (cm):	120
Prediction frequency (MHz):	469.85
Antenna Gain, typical (dBi):	5.0
Maximum Antenna Gain (numeric):	3.16
Power density at predication frequency and distance (mW/cm^2):	0.071
MPE limit for uncontrolled exposure at predication frequency (mW/cm^2):	0.3132

Result

The device is compliant with the requirement MPE limit for uncontrolled exposure. The maximum power density at the distance of 120 cm is 0.0711mW/cm^2 (Limit 0.3132 mW/cm^2)

5 FCC §2.1046 – Conducted Output Power

5.1 Applicable Standards

Per FCC §2.1046 and §90.205: maximum ERP is dependent upon the station's antenna HAAT and required service area.

5.2 Test Procedure

TIA-603-C §2.2.1

5.3 Test Results

Please refer to Part 90 conducted test report provided by Pacific Crest (Report Number: ADLVFCC063009).

6 FCC §2.1047 & §90.207 - Modulation Characteristic

6.1 Applicable Standard

§2.1047 & §90.207:

(a) Equipment which utilizes voice modulated communication shall show the frequency response of the audio modulating circuit over a range of 100 to 5000 Hz. for equipment which is required to have a low pass filter, the frequency response of the filter, or all of the circuitry installed between the modulation limited and the modulated stage shall be supplied.
(b) Equipment which employs modulation limiting, a curve showing the percentage of modulation versus the modulation input voltage shall be supplied.

6.2 Test Procedure

TIA-603-C §2.2.3

6.3 Test Results

N/A; There is no specific requirement for digital modulation; therefore modulation characteristic is not presented.

7 FCC §2.1049 & § 90.209 – Occupied Bandwidth and Emission Mask

7.1 Applicable Standard

§2.1049, §90.210

12.5 kHz bandwidth:

For any frequency removed from the center of the authorized bandwidth f_0 to 5.625 kHz removed from f_0, 0dB.

On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 5.626kHz but no more than 12.5kHz, at least 7.27 (f_d –2.88kHz) dB.

On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 12.5kHz at least:

50+10logP or 70 dB

25 kHz bandwidth:

On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 5kHz but not more than 10kHz, at least 83 Log (f_d /5) dB.

On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 10kHz but not more than 250% of the authorized bandwidth, at least 29 Log (f_d^2 /11) dB or 50 dB.

On any frequency removed from the center of the authorized bandwidth by more than 250% of the authorized bandwidth: least 43+ 10 Log (P).

7.2 Test Procedure

The RF output of the transmitter was connected to the input of the spectrum analyzer through sufficient attenuation.

The resolution bandwidth of the spectrum analyzer was set at 100 Hz and the spectrum was recorded in the frequency band ±50 KHz or $\pm$ 25 kHz from the carrier frequency.

7.3 Test Results

Please refer to Part 90 conducted test report provided by Pacific Crest (Report Number: ADLVFCC063009).

8 FCC §2.1051 & §90.210 – Spurious Emissions at Antenna Terminals

8.1 Applicable Standard

§2.1051 and §90.210.

On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 12.5kHz at least:

50+10logP or 70 dB

On any frequency removed from the center of the assigned channel by more than 250 percent at least:

43+10log (P)

8.2 Test Procedure

TIA-603-C §2.2.13

8.3 Test Results

Please refer to Part 90 conducted test report provided by Pacific Crest (Report Number: ADLVFCC063009).

9 FCC §2.1053 & §90.210 - Radiated Spurious Emissions

9.1 Applicable Standard

§2.1053 and §90.210

9.2 Test Procedure

TIA-603-C §2.2.12

The transmitter was placed on a wooden turntable, and it was transmitting into a non-radiating load which was also placed on the turntable.

The measurement antenna was placed at a distance of 3 meters from the EUT. During the tests, the antenna height and polarization as well as EUT azimuth were varied in order to identify the maximum level of emissions from the EUT. The test was performed by placing the EUT on 3-orthogonal axis.

The frequency range up to tenth harmonic of the fundamental frequency was investigated.

Remove the EUT and replace it with substitution antenna. A signal generator was connected to the substitution antenna by a non-radiating cable. The absolute levels of the spurious emissions were measured by the substitution.

Spurious emissions in dB = 10 log (TX power in Watts/0.001) – the absolute level

Spurious attenuation limit in dB = 43 + 10 Log_{10} (power out in Watts) for EUT with a 25 KHz channel bandwidth.

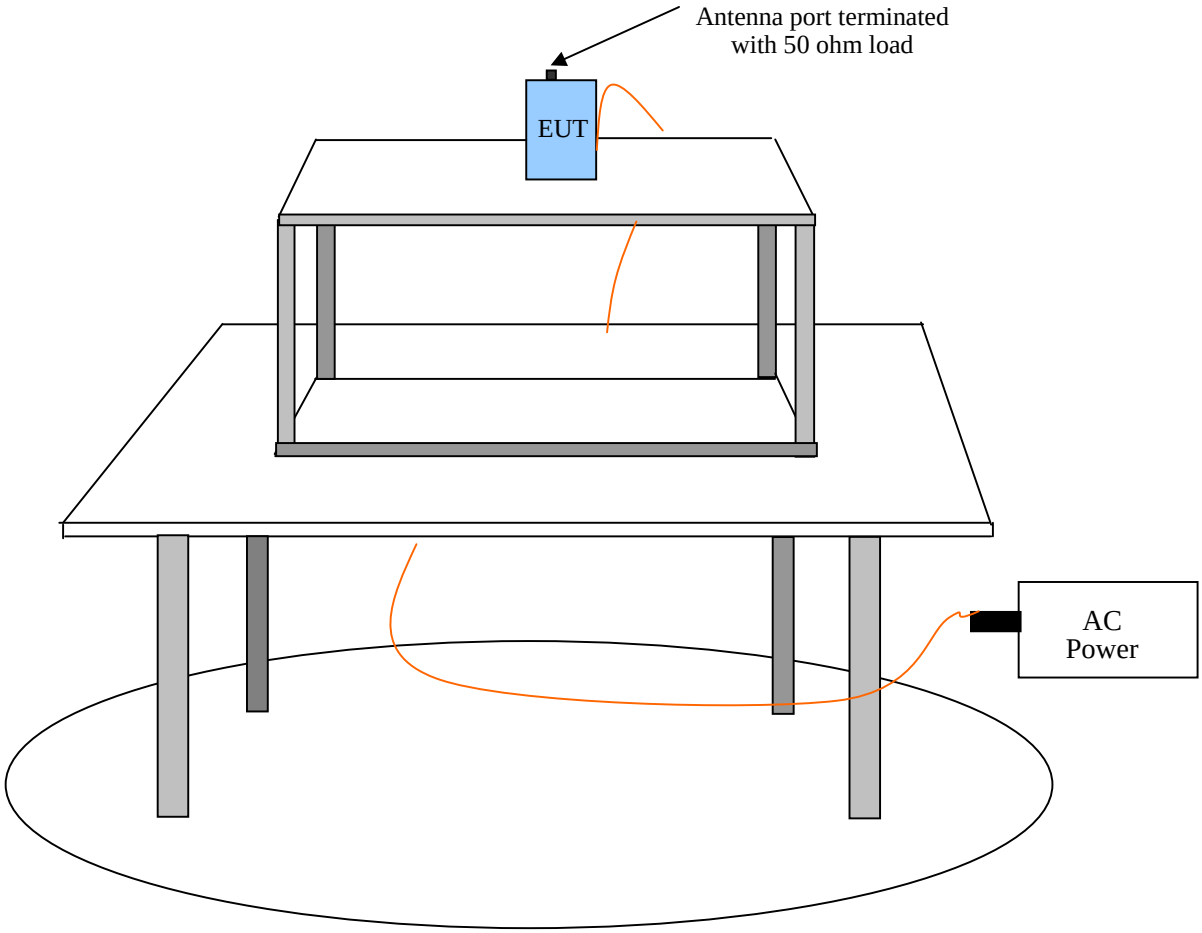
Spurious attenuation limit in dB = 50 + 10 Log_{10} (power out in Watts) for EUT with a 12.5 KHz channel bandwidth.

9.3 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date
Agilent	Spectrum Analyzer	E4440A	US44303352	2009-05-31
Sunol Sciences	Antenna	JB1	A103105-3	2009-03-25
A.R.A	Horn Antenna	DRG-118/A	1132	2009-07-28
A. H. Systems	Antenna, Horn, DRG	SAS-200/571	261	2009-07-01
Ducommun	Pre-Amplifier	ALN-09173030-01	988251-03R	2009-03-04
Daniels Electronic	50ohm Terminator	50-T-MN	1681	-
HP	Pre-Amplifier	8447D	2944A06639	2009-03-06

* **Statement of Traceability:** BACL attests that all calibrations have been performed per the NVLAP requirements, traceable to NIST.

9.4 Test Setup



9.5 Test Environmental Conditions

Temperature:	15~25 °C
Relative Humidity:	20~32 %
ATM Pressure:	100.9~101.1kPa

** The testing was performed by Dennis Huang on 2009-7-31 to 2009-8-5.*

9.6 Summary of Test Results

390~ 430 MHz Band

-27.27 dB at **819.7 MHz** in the **Vertical** polarization

430~ 470 MHz Band

-20.66 dB at **1349.55 MHz** in the **Horizontal** polarization

Please refer to the following tables for detailed results.

9.7 Test Result

Test Mode: Transmitting mode

Note: Transmitter standby mode is not applicable to this device

390~ 430 MHz Band

Middle Channel (Channel spacing 12.5 kHz)

Indicated		Azimuth (degrees)	Test Antenna		Substituted					Limit (dBm)	Margin (dB)
Frequency (MHz)	S.A. Amp. (dBuV)		Height (m)	Polar (H/V)	Frequency (MHz)	Level (dBm)	Ant. Cord. (dBi)	Cable Loss (dB)	Absolute Level (dBm)		
819.7	48.86	137	1.00	H	819.7	-47.27	0	0.67	-47.94	-20	-27.94
819.7	42.41	335	1.14	V	819.7	-47.60	0	0.67	-48.27	-20	-27.27

Middle Channel (Channel spacing 25 kHz)

Indicated		Azimuth (degrees)	Test Antenna		Substituted					Limit (dBm)	Margin (dB)
Frequency (MHz)	S.A. Amp. (dBuV)		Height (m)	Polar (H/V)	Frequency (MHz)	Level (dBm)	Ant. Cord. (dBi)	Cable Loss (dB)	Absolute Level (dBm)		
-	-	-	-	-	-	-	-	-	-	-13	-
-	-	-	-	-	-	-	-	-	-	-13	-

Note: All emission levels are very low and more than 20 dB margin, thus data are not recorded.

430~ 470 MHz Band

Middle Channel (Channel spacing 12.5 kHz)

Indicated		Azimuth (degrees)	Test Antenna		Substituted					Limit (dBm)	Margin (dB)
Frequency (MHz)	S.A. Amp. (dBuV)		Height (m)	Polar (H/V)	Frequency (MHz)	Level (dBm)	Ant. Cord. (dBi)	Cable Loss (dB)	Absolute Level (dBm)		
1349.55	66.10	21	1.37	H	1349.55	-47.10	7.4	0.96	-40.66	-20	-20.66
2249.25	63.52	168	1.30	V	2249.25	-44.49	8.9	6.21	-41.80	-20	-21.80
2249.25	62.69	298	1.00	H	2249.25	-46.86	8.9	6.21	-44.17	-20	-24.17
3148.95	57.97	289	1.00	H	3148.95	-46.27	9.5	7.59	-44.36	-20	-24.36

Middle Channel (Channel spacing 25 kHz)

Indicated		Azimuth (degrees)	Test Antenna		Substituted					Limit (dBm)	Margin (dB)
Frequency (MHz)	S.A. Amp. (dBuV)		Height (m)	Polar (H/V)	Frequency (MHz)	Level (dBm)	Ant. Cord. (dBi)	Cable Loss (dB)	Absolute Level (dBm)		
-	-	-	-	-	-	-	-	-	-	-13	-
-	-	-	-	-	-	-	-	-	-	-13	-

10 FCC §2.1055 & §90.213- Frequency Stability

10.1 Applicable Standard

§2.1055 and §90.213.

10.2 Test Procedure

Frequency Stability vs. Temperature: The equipment under test was connected to an external DC power supply and the RF output was connected to a frequency counter via feed-through attenuators. The EUT was placed inside the temperature chamber. The DC leads and RF output cable exited the chamber through an opening made for the purpose.

After the temperature stabilized for approximately 20 minutes, the frequency output was recorded from the counter.

Frequency Stability vs. Voltage: An external variable DC power supply was connected to the equipment under test. The voltage was set to 110% of the nominal value and was then decreased until the transmitter light no longer illuminated; i.e., the end point. The output frequency was recorded for each voltage.

10.3 Test Results

Please refer to Part 90 conducted test report provided by Pacific Crest (Report Number: ADLVFCC063009).

11 FCC §90.214 – Transient Frequency Behavior

11.1 Standard Applicable

§90.214, Transmitters designed to operate in the 150–174 MHz and 421–512 MHz frequency bands must maintain transient frequencies within the maximum frequency difference limits.

11.2 Test Method

TIA/EIA-603-C §2.2.19

11.3 Test Result

Please refer to Part 90 conducted test report provided by Pacific Crest (Report Number: ADLVFCC063009).