

# USER'S MANUAL

## MODEL PT-90 TELEMETRY TRANSMITTER



### INTRODUCTION

The Communications Specialists Model PT-90 is to be used as a telemetry transmitter to locate livestock and other animals by doppler positioning or triangulation. It also transmits back data relative to activity, mortality, etc. by changing pulse rate. It is FCC Certified and must be used with a valid FCC license, issued for telemetry uses, under Part 90.259 of the Rules. It is preprogrammed at the factory to operate in the 217-220Mhz band. Power output is 95mW. The PT-90 is waterproof and includes a changeable, screw-on, antenna. It uses a widely available CR123A Lithium battery or a LIR 17335 rechargeable Lithium battery. The transmitter can be disabled to preserve battery life by sliding the supplied magnet into the slot between top of the transmitter and the collar.

### BATTERY INSTALLATION

First remove the magnet, if installed. Then slide the supplied CR123A Lithium battery into the collar battery compartment + (positive) end in first. Screw on the battery compartment cap with a screwdriver or coin. A small amount of Vaseline on the battery compartment cap "O" ring will allow easy cap removal and keep the battery compartment watertight. Dispose of any used batteries properly. If the battery is inserted backwards, the transmitter will not function but it will not be damaged. Simply reverse it to start the transmitter working. If you are using the LIR17335 rechargeable Lithium Ion battery and quick charger, please note that if a discharged battery is being charged, the LED indicator light on the charger will be orange. When the battery is charged, it will change to green. A battery can be left in the charger indefinitely without being damaged. The rechargeable battery can be recharged over 500 times before needing replacement. Charge time is less than 3 hours.

## FCC COMPLIANCE NOTICE

In order to legally operate this transmitter, you must be first meet the eligibility requirements of FCC Part 90.35. This means you must be engaged in a commercial or educational activity. Then you must have a valid FCC License yourself or be part of a for-profit or non-profit sharing agreement as detailed in 90.179 held by your equipment provider or someone else. If you choose to obtain your own FCC License, we will help you with the following required steps. We will recommend a License Administrator who will prepare your license application and submit it to a Frequency Coordinator. A few questions will need to be answered such as your company name, address, area of planned operation, etc. We will provide the technical information required such as frequencies requested, output power, emission type, etc. A separate fee will be required for the Administrator, Frequency Coordinator, and FCC. After your license is issued and equipment installed, the Administrator will notify the FCC that buildout is complete. Your license will normally be issued for a 10 year term. All operation is secondary to the fixed and mobile services. The FCC ID for this transmitter is CFXPT-90.

**CAUTION:** Any changes or modifications to this device could void the user's authority to operate the equipment.

**CAUTION:** This device is restricted to mobile operations only and may not be person- worn, co-located or operated in conjunction with any other antenna or transmitter.

## WARRANTY

The PT-90 is warranted to be free of defects in materials and workmanship for a period of one (1) year from the date of purchase. Just return the unit to the factory and we will repair or replace it at no charge.



**COMMUNICATIONS SPECIALISTS, INC.**  
426 WEST TAFT AVENUE • ORANGE, CA 92865-4296  
714.998.3021 • FAX 714.974.3420  
US & CANADA **800.854.0547** • FAX 800.850.0547  
[www.com-spec.com](http://www.com-spec.com)



**Flom Test Labs**  
EMI, EMC, RF Testing Experts Since 1963

toll-free: (866) 311-3268  
fax: (480) 926-3598  
<http://www.flomlabs.com>  
[info@flomlabs.com](mailto:info@flomlabs.com)

**Date:** May 29, 2007

Federal Communications Commission  
Via: Electronic Filing

**Attention:** Authorization & Evaluation Division

**Applicant:** Communications Specialists, Inc.  
**Equipment:** PT-90  
**FCC ID:** CFXPT-90  
**FCC Rules:** 90.259, 90.217(c)

Gentlemen:

On behalf of the Applicant, enclosed please find Application Form 731, Engineering Test Report and all pertinent documentation, the whole for approval of the referenced equipment as shown.

Filing fees are attached.

We trust the same is in order. Should you need any further information, kindly contact the writer who is authorized to act as agent.

Sincerely yours,

Hoosamuddin S. Bandukwala, Lab Director

enclosure(s)  
cc: Applicant  
HSB/je

Flom Test Labs  
3356 North San Marcos Place, Suite 107  
Chandler, Arizona 85225-7176  
(866) 311-3268 phone, (480) 926-3598 fax

FCC ID: CFXPT-90  
MFA p0750013, d0750081



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Gentlemen:

On behalf of the Applicant, enclosed please find Application Form 731, Engineering Test Report and all pertinent documentation, the whole for approval of the referenced equipment as shown i.e.:

- a) Application Form
- b) Test Report (if applicable)
- c) Filing Fees
- d) Copy of Original Grant
- e) Expository Statement and/or letter by Applicant
- f) Photos (if applicable)
- g) Label Drawing (if changes have been made)

We trust the same is in order. Should you need any further information, kindly contact the writer who is authorized to act as agent.

Sincerely yours,

Hoosamuddin S. Bandukwala, Lab Director

enclosure(s)  
cc: Applicant  
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## **Transmitter Certification**

of

FCC ID: CFXPT-90  
Model: PT-90

to

### **Federal Communications Commission**

Rule Part(s) 90.259, 90.217(c)

Date of report: May 29, 2007

**On the Behalf of the  
Applicant:**

Communications Specialists, Inc.

**At the Request of:**

Communications Specialists, Inc.  
426 W. Taft Ave  
Orange, CA 92665

**Attention of:**

Spence Porter, President  
(800) 854-0547; (714) 998-3021  
FAX: (800) 850-0547; (714) 974-3420

Supervised by:

Hoosamuddin S. Bandukwala, Lab Director

Flom Test Labs  
3356 North San Marcos Place, Suite 107  
Chandler, Arizona 85225-7176  
(866) 311-3268 phone, (480) 926-3598 fax

FCC ID: CFXPT-90  
MFA p0750013, d0750081

## List of Exhibits

(FCC **Certification** (Transmitters) - Revised 9/28/98)

Applicant: Communications Specialists, Inc.

FCC ID: CFXPT-90

### By Applicant:

1. Letter of Authorization
2. Confidentiality Request: 0.457 And 0.459
3. Part 90.203(e) & (g) Attestation
4. Identification Drawings, 2.1033(c)(11)
  - Label
  - Location of Label
  - Compliance Statement
  - Location of Compliance Statement
5. Photographs, 2.1033(c)(12)
6. Documentation: 2.1033(c)
  - (3) User Manual
  - (9) Tune Up Info
  - (10) Schematic Diagram
  - (10) Circuit Description
  - Block Diagram
  - Parts List
  - Active Devices
7. MPE/SAR Report

### By M.F.A. Inc.:

- A. Testimonial & Statement of Certification

## **The Applicant has been cautioned as to the following:**

### **15.21 Information to the User.**

The users manual or instruction manual for an intentional radiator shall caution the user that changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

### **15.27(a) Special Accessories**

Equipment marketed to a consumer must be capable of complying with the necessary regulations in the configuration in which the equipment is marketed. Where special accessories, such as shielded cables and/or special connectors are required to enable an unintentional or intentional radiator to comply with the emission limits in this part, the equipment must be marketed with, i.e. shipped and sold with, those special accessories. However, in lieu of shipping or packaging the special accessories with the unintentional or intentional radiator, the responsible party may employ other methods of ensuring that the special accessories are provided to the consumer, without additional charge.

Information detailing any alternative method used to supply the special accessories for a grant of equipment authorization or retained in the verification records, as appropriate. The party responsible for the equipment, as detailed in § 2.909 of this chapter, shall ensure that these special accessories are provided with the equipment. The instruction manual for such devices shall include appropriate instructions on the first page of text concerned with the installation of the device that these special accessories must be used with the device. It is the responsibility of the user to use the needed special accessories supplied with the equipment.

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90.217(c), 2.1051	Unwanted Emissions (Transmitter Conducted)	8
90.217(c), 2.1053(a)	Field Strength of Spurious Radiation	10
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Required information per ISO 17025-2005, paragraph 5.0:

a) **Test Report**

b) Laboratory: Flom Test Lab  
(FCC: 31040/SIT) 3356 N. San Marcos Place, Suite 107  
(Canada: IC 2044) Chandler, AZ 85225

c) Report Number: d0750081

d) Client: Communications Specialists, Inc.  
426 W. Taft Ave  
Orange, CA 92665

e) Identification: PT-90  
FCC ID: CFXPT-90

EUT Description:

f) EUT Condition: Not required unless specified in individual tests.

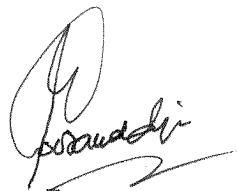
g) Report Date: May 29, 2007  
EUT Received:

h, j, k): As indicated in individual tests.

i) Sampling method: No sampling procedure used.

l) Uncertainty: In accordance with MFA internal quality manual.

m) Supervised by:



Hoosamuddin S. Bandukwala, Lab Director

n) Results: The results presented in this report relate only to the item tested.

o) Reproduction: This report must not be reproduced, except in full, without written permission from this laboratory.

Accessories used during testing:

Type	Quantity	Manufacturer	Model	Serial No.	FCC ID
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Sub-part

2.1033(c)(14):

## Test and Measurement Data

All tests and measurement data shown were performed in accordance with FCC Rules and Regulations, Volume II; Part 2, Sub-part J, Sections 2.947, 2.1033(c), 2.1041, 2.1046, 2.1047, 2.1079, 2.1051, 2.1053, 2.1055, 2.1057 and the following individual Parts:

- ☐ 15 – Radio Frequency Devices (unlicensed)
- ☐ 21 – Domestic Public Fixed Radio Services
- ☐ 22 – Public Mobile Services
- ☐ 22 Subpart H - Cellular Radiotelephone Service
- ☐ 22.901(d) - Alternative technologies and auxiliary services
- ☐ 23 – International Fixed Public Radiocommunication services
- ☐ 24 – Personal Communications Services
- ☐ 74 Subpart H - Low Power Auxiliary Stations
- ☐ 80 – Stations in the Maritime Services
- ☐ 80 Subpart E - General Technical Standards
- ☐ 80 Subpart F - Equipment Authorization for Compulsory Ships
- ☐ 80 Subpart K - Private Coast Stations and Marine Utility Stations
- ☐ 80 Subpart S - Compulsory Radiotelephone Installations for Small Passenger Boats
- ☐ 80 Subpart T - Radiotelephone Installation Required for Vessels on the Great Lakes
- ☐ 80 Subpart U - Radiotelephone Installations Required by the Bridge-to-Bridge Act
- ☐ 80 Subpart V - Emergency Position Indicating Radio Beacons (EPIRB'S)
- ☐ 80 Subpart W - Global Maritime Distress and Safety System (GMDSS)
- ☐ 80 Subpart X - Voluntary Radio Installations
- ☐ 87 – Aviation Services
- ☒ 90 – Private Land Mobile Radio Services
- ☐ 94 – Private Operational-Fixed Microwave Service
- ☐ 95 Subpart A - General Mobile Radio Service (GMRS)
- ☐ 95 Subpart C - Radio Control (R/C) Radio Service
- ☐ 95 Subpart D - Citizens Band (CB) Radio Service
- ☐ 95 Subpart E - Family Radio Service
- ☐ 95 Subpart F - Interactive Video and Data Service (IVDS)
- ☐ 97 - Amateur Radio Service
- ☐ 101 – Fixed Microwave Services

## Standard Test Conditions and Engineering Practices

Except as noted herein, the following conditions and procedures were observed during the testing:

In accordance with ANSI C63.4-2003 Draft, section 6.1.9, and unless otherwise indicated in the specific measurement results, the ambient temperature of the actual EUT was maintained within the range of 10° to 40°C (50° to 104 °F) unless the particular equipment requirements specify testing over a different temperature range. Also, unless otherwise indicated, the humidity levels were in the range of 10% to 90% relative humidity.

Prior to testing, the EUT was tuned up in accordance with the manufacturer's alignment procedures. All external gain controls were maintained at the position of maximum and/or optimum gain throughout the testing.

Measurement results, unless otherwise noted, are worst-case measurements.

## A2LA

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"A2LA has accredited Flom Test Labs, Inc. Chandler, AZ for technical competence in the field of Electrical Testing. The accreditation covers the specific tests and types of tests listed on the agreed scope of accreditation. This laboratory meets the requirements of ISO 17025:2005 'General Requirements for the Competence of Testing and Calibration Laboratories' and any additional program requirements in the identified field of testing."

Please refer to [www.a2la.org](http://www.a2la.org) for current scope of accreditation.

Certificate Number: **2152.01**

## List of General Information Required for Certification

In Accordance with FCC Rules and Regulations,  
Volume II, Part 2 and to

90.259, 90.217(c) Sub-part 2.1033

(c)(1):

**Name and Address of Applicant:** Communications Specialists, Inc.  
426 W. Taft Ave  
Orange, CA 92665

**Manufacturer:** Communications Specialists, Inc.  
426 W. Taft Ave  
Orange, CA 92665

(c)(2): **FCC ID:** CFXPT-90

**Model Number:** PT-90

(c)(3): **Instruction Manual(s):**

Please see attached exhibits

(c)(4): **Type of Emission:** N0N6K50

(c)(5): **Frequency Range, MHz:** 217.00625 to 219.99375

(c)(6): **Power Rating, Watts:** 5.5 mW  
       \_\_\_\_\_ Switchable                      \_\_\_\_\_ Variable                      \_\_\_\_\_ N/A

**FCC Grant Note:**

(c)(7): **Maximum Power Rating, Watts:** 120 mW

**DUT Results:** Passes \_\_\_\_\_ x \_\_\_\_\_ Fails \_\_\_\_\_

The unit was tested with a monopole cable antenna with a gain of -3dBi.

Subpart 2.1033 (continued)

(c)(8): Voltages & currents in all elements in final RF stage, including final transistor or solid-state device:

Collector Current, A	=	.05A
Collector Voltage, Vdc	=	4.1 VDC
Supply Voltage, Vdc	=	3.2 - 4.1 VDC

(c)(9): **Tune-Up Procedure :**

Please see attached exhibits

(c)(10): **Circuit Diagram/Circuit Description:**

Including description of circuitry & devices provided for determining and stabilizing frequency, for suppression of spurious radiation, for limiting modulation and limiting power.

Please see attached exhibits

(c)(11): **Label Information:**

Please see attached exhibits

(c)(12): **Photographs:**

Please see attached exhibits

(c)(13): **Digital Modulation Description:**

☐ Attached Exhibits  
☒ N/A

(c)(14): **Test and Measurement Data :**

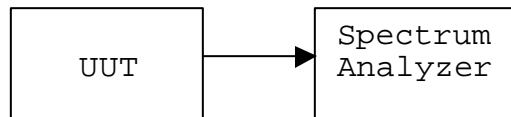
Follows

**Name of Test:** Carrier Output Power (Conducted)  
**Specification:** 90.217, 2.1046(a)  
**Test Equipment:** i00329, i00330

### Test Procedure

The UUT was connected to a spectrum analyzer with the resolution and video bandwidths set to 1MHz. The MAX hold function was used to capture the trace and the peak value was measured. The cable and connector loss was input as an offset to ensure that the recorded values were correct.

### Test Set-Up



### Test Results

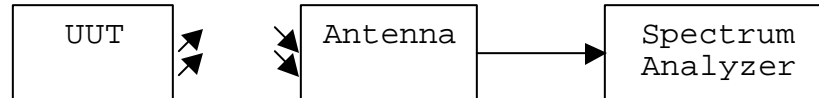
Frequency MHz	Recorded Level dBμV	Limit dBμV	Result
217.00625	112.1	128	Pass
219.99375	112.2	128	Pass

**Name of Test:** RF Power Output (Radiated)  
**Specification:** 90.217, 2.1046(a)  
**Test Equipment:** i00048, i00049, i00050, i00051, i00088

### Test Procedure

The UUT was tested in an Open Area Test Site (OATS) set 3m from the receiving transducer. A spectrum analyzer was used to verify that the UUT met the requirements for Radiated Spurious Emissions. The peak fundamental reading was taken.

### Test Setup



### Test Results

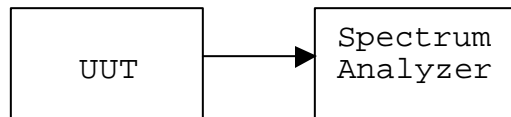
Frequency MHz	Recorded Level dBμV/m	Correction Factor dB	Corrected Level dBμV/m	Limit dBμV/m	Result
217.00625	98.0	18.9	116.9	128	Pass
219.99375	98.4	18.9	117.3	128	Pass

**Name of Test:** Unwanted Emissions (Transmitter Conducted)  
**Specification:** 90.217(c), 2.1051  
**Test Equipment:** i00329, i00330

### Test Procedure

The UUT was connected to a spectrum analyzer and the reference level was offset for the maximum signal level. A display line was placed –30 dBc and the conducted emissions were plotted to a frequency greater than the 10<sup>th</sup> harmonic. The highest emission for the high and low frequencies was recorded.

### Test Set-Up

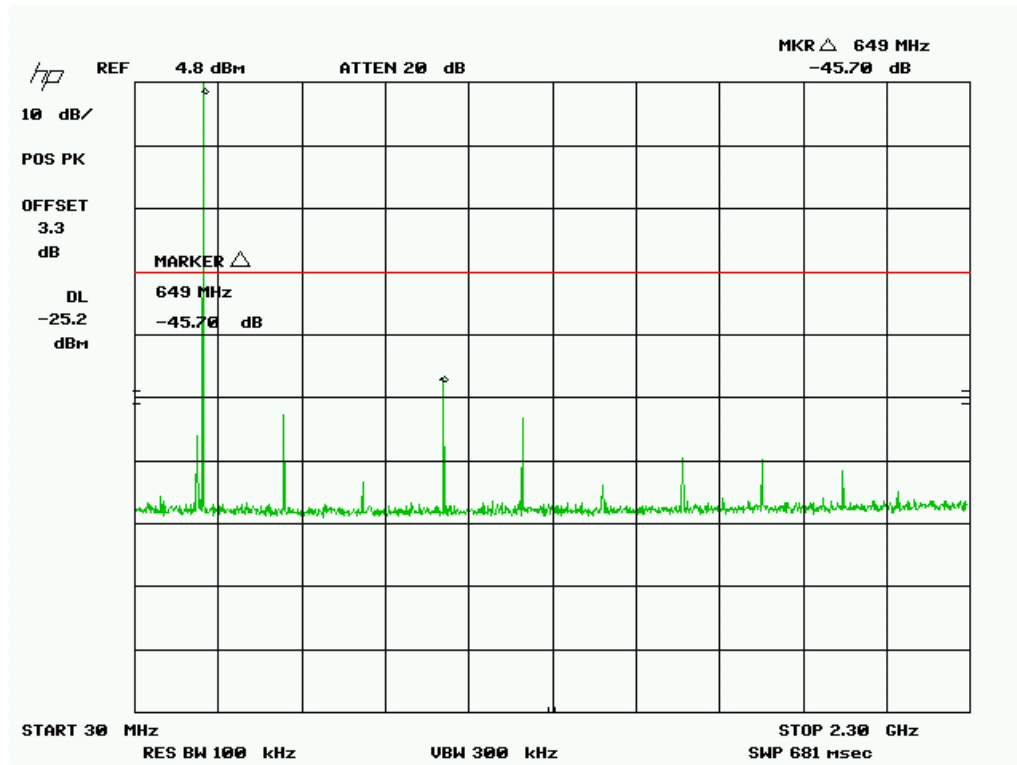


### Test Results

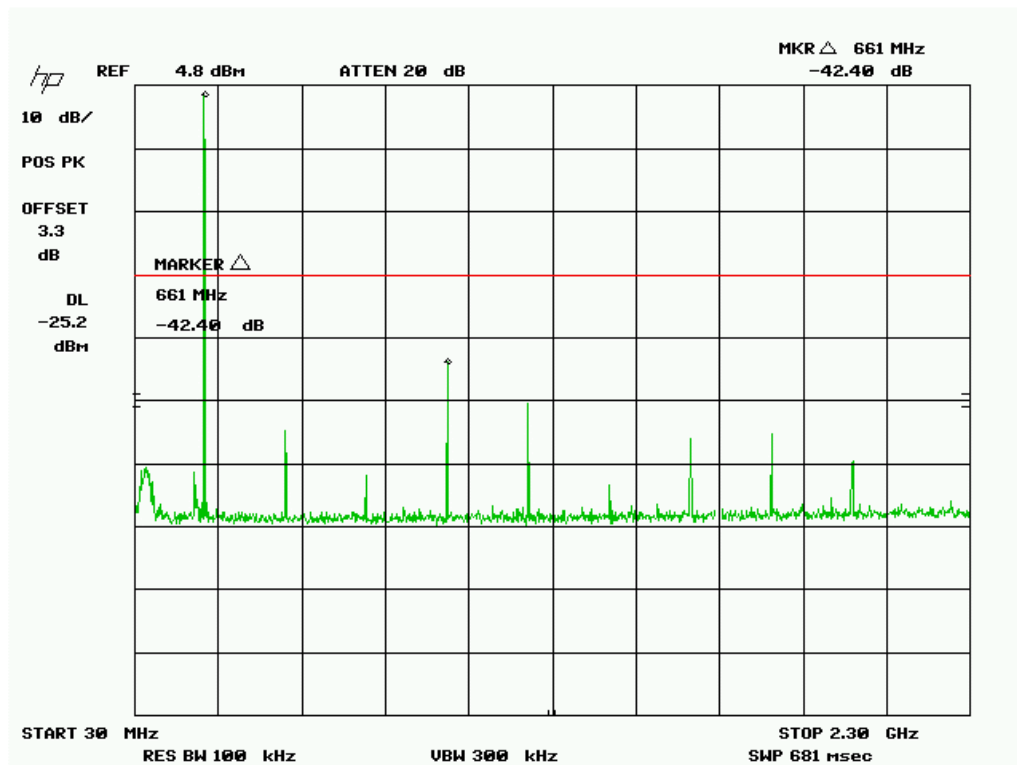
Tuned Frequency MHz	Recorded Level dBc	Limit dBc	Result
217.00625	-45.7	-30	Pass
219.99375	-42.4	-30	Pass



## 217.00625 MHz Plot



## 219.99375 MHz Plot

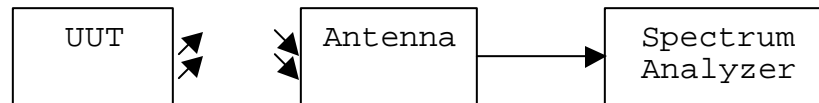


**Name of Test:** Field Strength of Spurious Radiation  
**Specification:** 90.217(c), 2.1053(a)  
**Test Equipment:** i00048, i00049, i00050, i00051, i00089, i00103

### Test Procedure

The UUT was tested in an Open Area Test Site (OATS) set 3m from the receiving transducer. A spectrum analyzer was used to verify that the UUT met the requirements for Radiated Spurious Emissions. The spectrum to the 10<sup>th</sup> harmonic was investigated to ensure all emissions were greater than -30 dBc.

### Test Setup



### 217.00625 Results

Frequency MHz	Recorded Level dBμV/m	Correction Factor dB	Corrected Level dBμV/m	Limit dBμV/m	Result
434.025	44.7	21.6	66.3	86.9	Pass
651.075	40.8	25.9	66.7	86.9	Pass
868.049	38.38	28.36	67.4	86.9	Pass
1085.122	37.6	30.0	67.6	86.9	Pass
1302.139	38.0	31.2	69.2	86.9	Pass
1519.164	37.5	32.3	69.8	86.9	Pass
1736.197	38.1	33.7	71.8	86.9	Pass
1953.222	40.4	35.0	75.4	86.9	Pass
2170.247	38.5	36.1	74.6	86.9	Pass

### 219.99375 Results

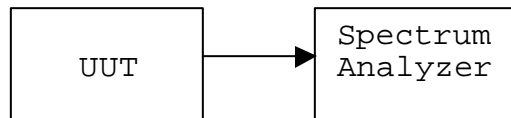
Frequency MHz	Recorded Level dBμV/m	Correction Factor dB	Corrected Level dBμV/m	Limit dBμV/m	Result
439.975	35.1	21.7	56.8	87.3	Pass
659.962	28.3	26.0	54.3	87.3	Pass
879.883	34.6	28.5	63.1	87.3	Pass
1099.937	38.9	30.1	69.0	87.3	Pass
1316.925	38.1	31.3	69.4	87.3	Pass
1539.912	37.9	32.4	70.3	87.3	Pass
1759.900	38.3	33.9	72.2	87.3	Pass
1979.997	38.5	35.2	73.7	87.3	Pass
2199.937	38.8	36.1	74.9	87.3	Pass

**Name of Test:** Emission Masks (Occupied Bandwidth)  
**Specification:** 90.217(c), 90.259, 2.1049(c)(1)  
**Test Equipment:** i00029

### Test Procedure

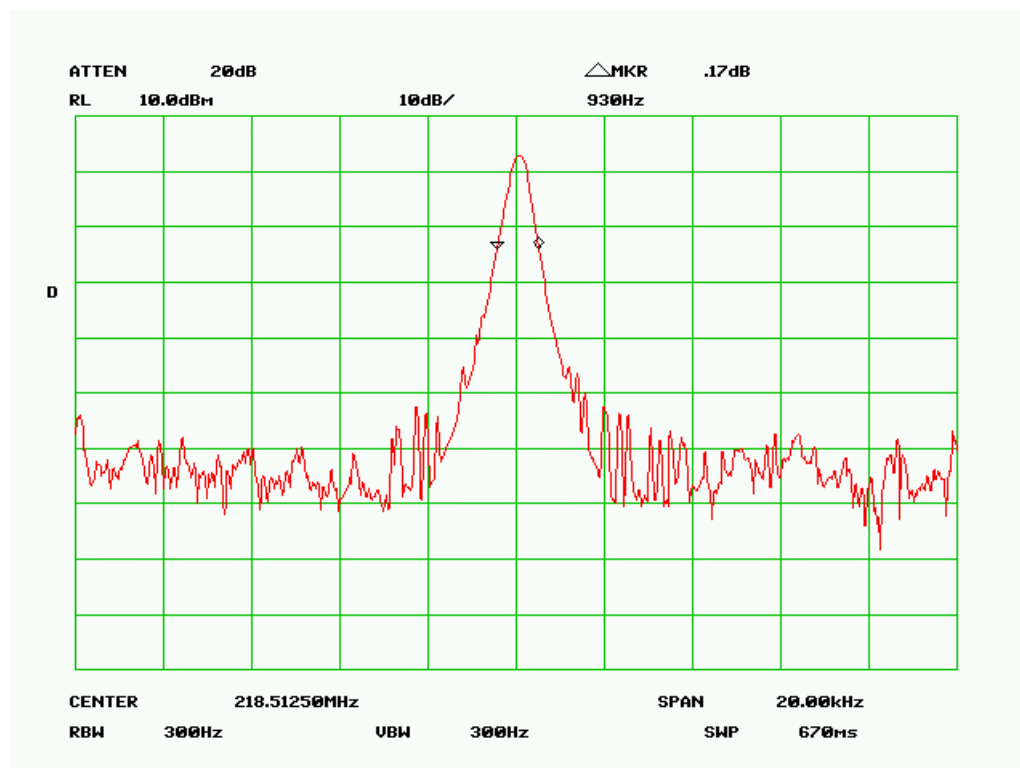
The UUT was connected to a spectrum analyzer. The occupied bandwidth and transmission masks were both examined and plotted to verify they meet the specifications.

### Test Setup

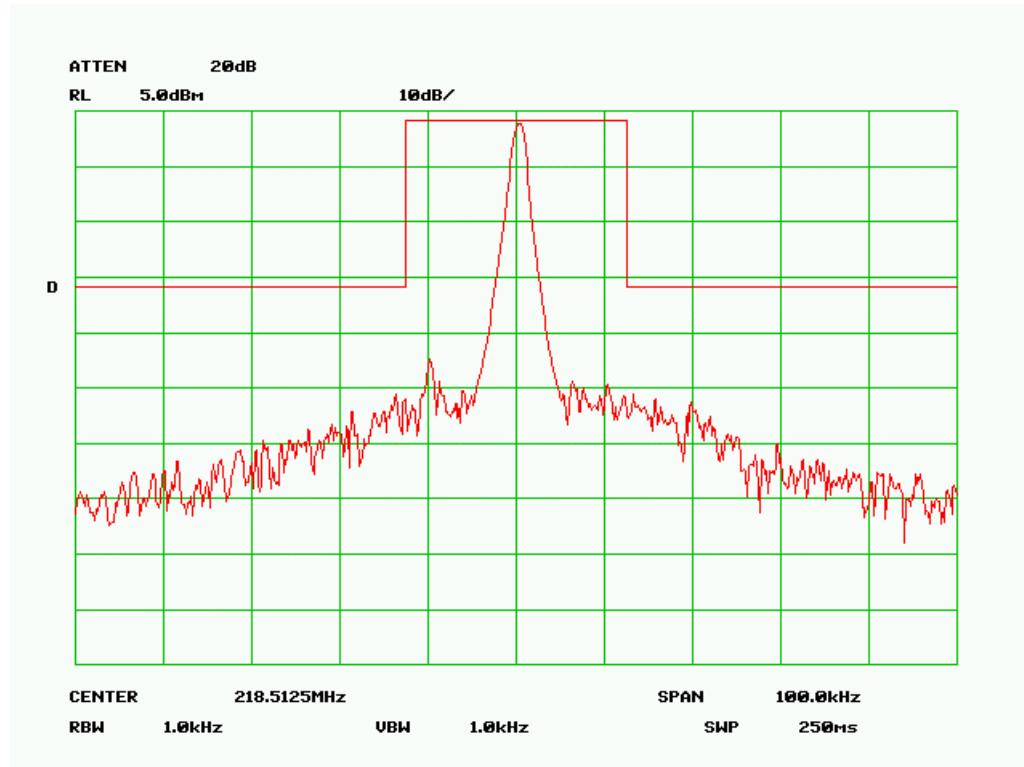


### Test Results (occupied bandwidth)

Measured Bandwidth	Bandwidth Limit	Result
930 Hz	6.5 kHz	Pass



# Test Plot (transmission mask)



**Name of Test:** Frequency Stability (Temperature Variation)  
**Specification:** 47 CFR 2.1055(a)(1)  
**Test Equipment:** i00027, i00029

### Test Procedure

The UUT was placed inside of a thermal test chamber and the RF output was connected to a spectrum analyzer. The temperature was set to 25°C and the spectrum analyzer was set so the TX was on the center frequency. The temperature was varied from -30°C to +50°C in 10°C increments with a 30-minute soak time at each level. The MAX hold function of the analyzer was used to capture the transmission and the ? marker function was utilized to measure the frequency stability.

### Test Set-Up



### Test Results

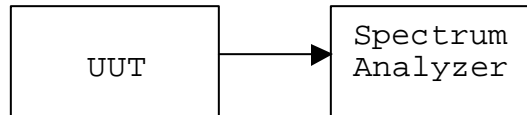
Measured Low Frequency MHz	Measured High Frequency MHz	Frequency Variation Hz	Frequency Variation PPM	Limit Hz	Limit PPM	Result
218.512490	218.512599	109	0.5	110	0.5	Pass

**Name of Test:** Frequency Stability (Voltage Variation)  
**Specification:** 47 CFR 2.1055(d)(1)  
**Test Equipment:** i00008, i00029

### Test Procedure

The UUT was connected to a variable DC power supply and the input voltage was varied from 85% to 115% while the RF output was monitored with a spectrum analyzer. The MAX hold function of the analyzer was used to capture the transmission and the ? marker function was utilized to measure the frequency stability.

### Test Set-Up



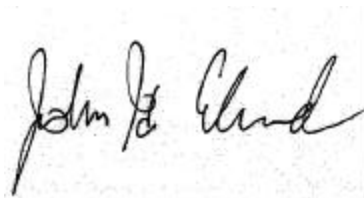
### Test Results

Measured Low Frequency MHz	Measured High Frequency MHz	Frequency Variation Hz	Frequency Variation PPM	Limit Hz	Limit PPM	Result
218.512545	218.512545	0	0	110	0.5	Pass

### Test Equipment Utilized

Asset#	Manufacturer	Model	Serial Number	Calibration Cycle	Calibration Due
i00008	Kenwood	PR19-3A	5080154	N/A	N/A
i00027	Tenney	Tenney Jr	9083-76J-234	12 mo.	9/12/2007
i00029	HP	8563E	3213A00104	12 mo.	3/9/2008
i00048	HP	85662A	2511AD1467	12 mo.	8/30/2007
i00049	HP	8566B	2511AD1467	12 mo.	8/30/2007
i00050	HP	85685A	2510A00185	12 mo.	7/25/2007
i00051	HP	85650A	2521A00647	12 mo.	7/25/2007
i00088	EMCO Biconical	3109B	2336	12 mo.	10/14/2007
i00089	Apriel Log Periodic	2001	001500	12 mo.	10/25/2007
i00103	EMCO Horn	3115	9028-3925	36 mo.	10/4/2009
i00329	HP	85662A	3144A20376	12 mo.	4/16/2008
i00330	HP	8566b	3138A07426	12 mo.	4/16/2008

In addition to the above listed equipment standard RF connectors and cables were utilized in testing. Their proper operation was verified prior to testing.

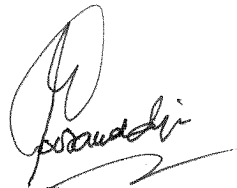


### END OF TEST REPORT

**Testimonial  
and  
Statement of Certification**

**This is to Certify:**

1. **That** the application was prepared either by, or under the direct supervision of, the undersigned.
2. **That** the technical data supplied with the application was taken under my direction and supervision.
3. **That** the data was obtained on representative units, randomly selected.
4. **That**, to the best of my knowledge and belief, the facts set forth in the application and accompanying technical data are true and correct.



Certifying Engineer:

Hoosamuddin S. Bandukwala, Lab Director



## CFXPT-90 DESCRIPTION OF CIRCUITRY

The CFXPT-90 transmitter is a PLL synthesized design using a 0.5ppm TCXO as the reference oscillator.

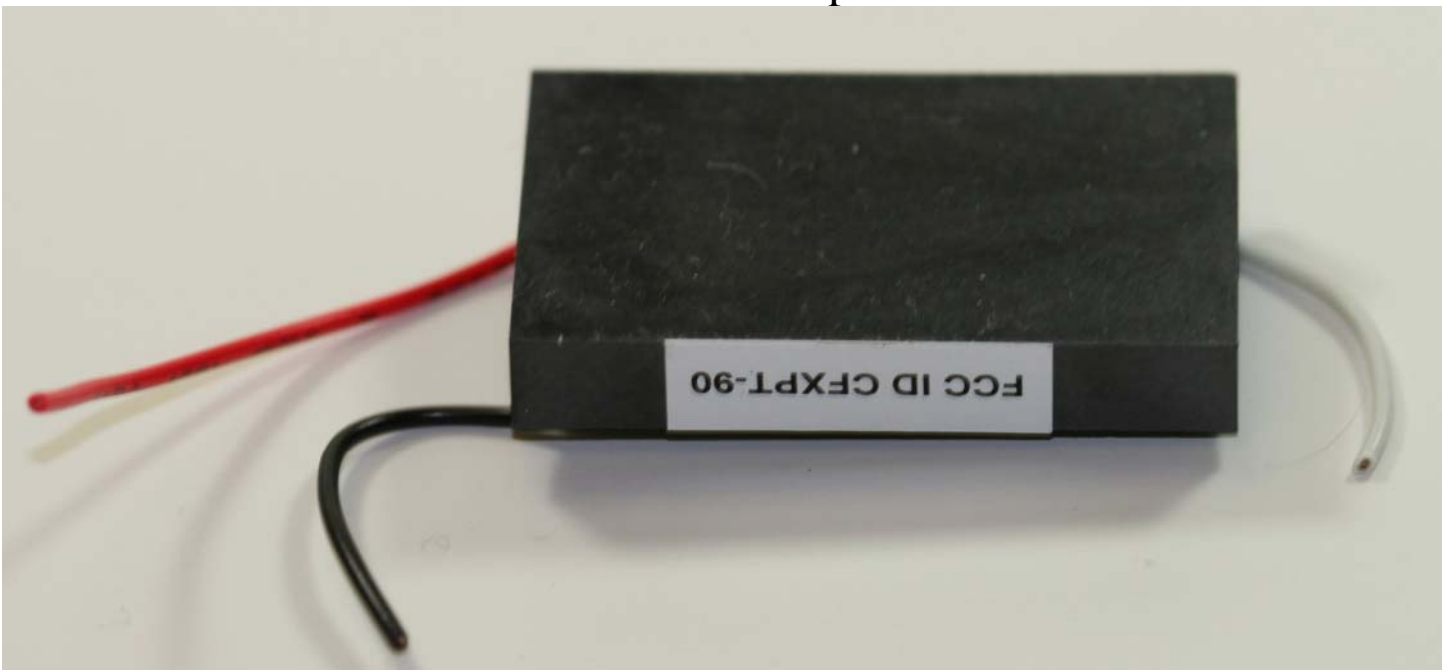
A microprocessor controls all of the functions of the PLL, oscillator, and amplifier stages.

The circuit has a 1 stage VCO oscillator locked to the PLL, followed by 4 stages of amplification. Any harmonic or spurious signals are filtered out by a 5th order 230Mhz low pass filter before reaching the antenna.

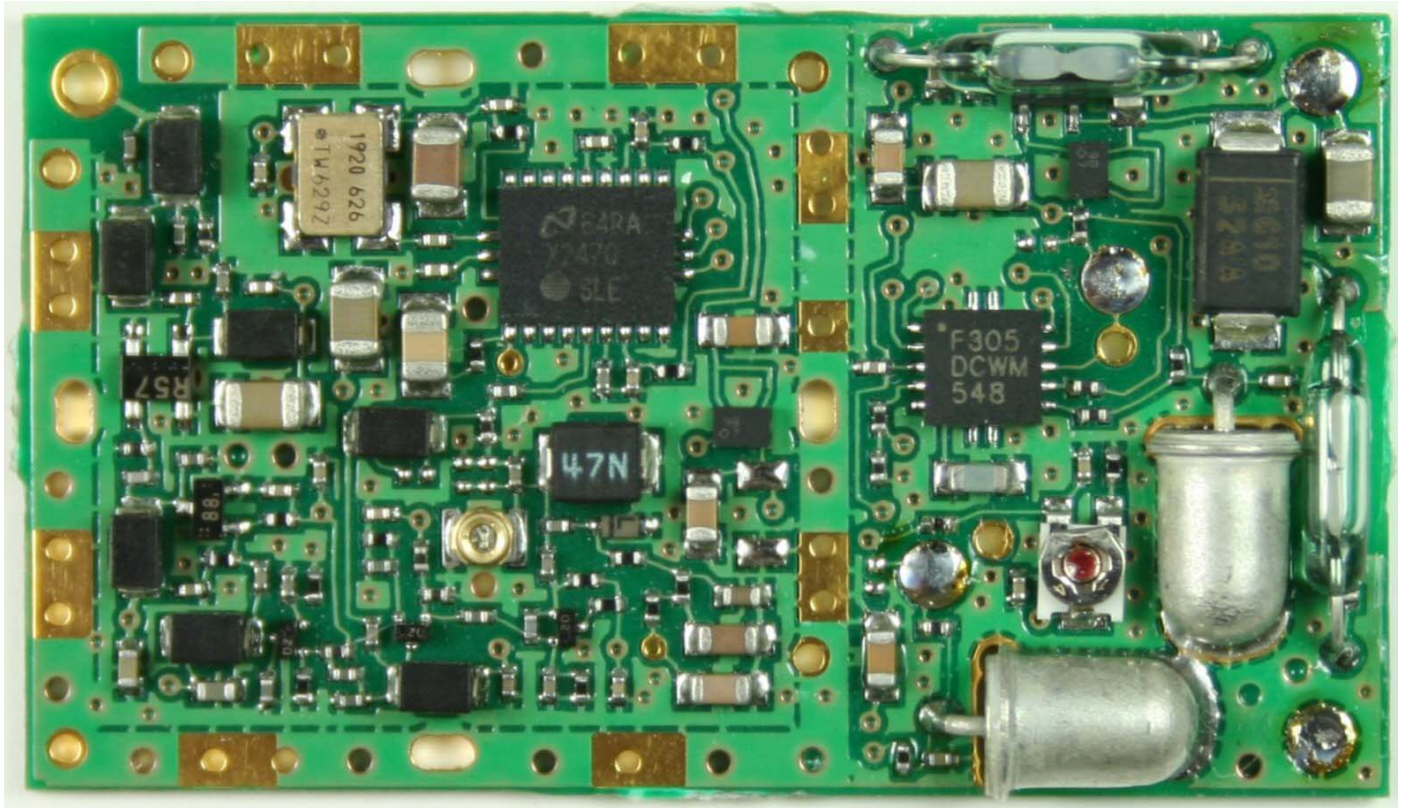
External topside photo



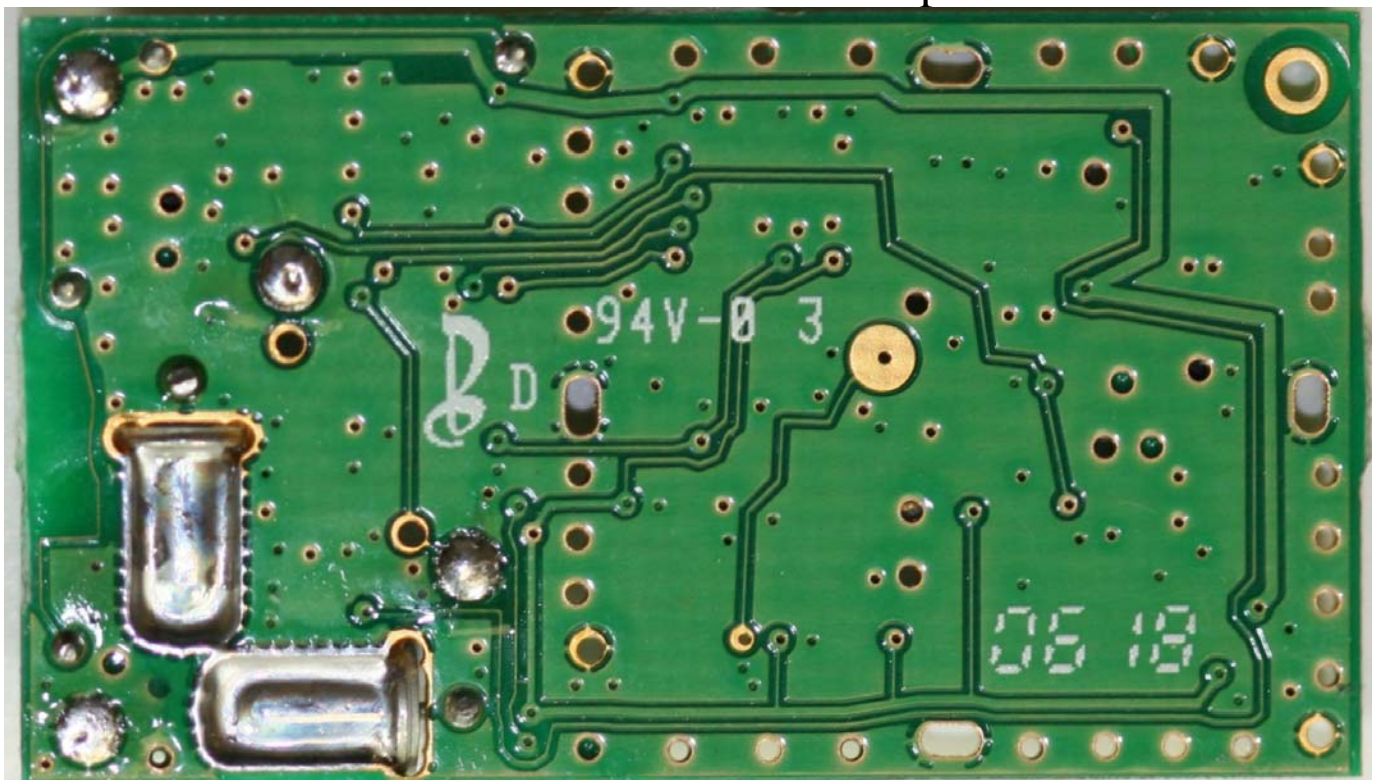
External bottom photo



Printed Circuit Board Front photo without shield

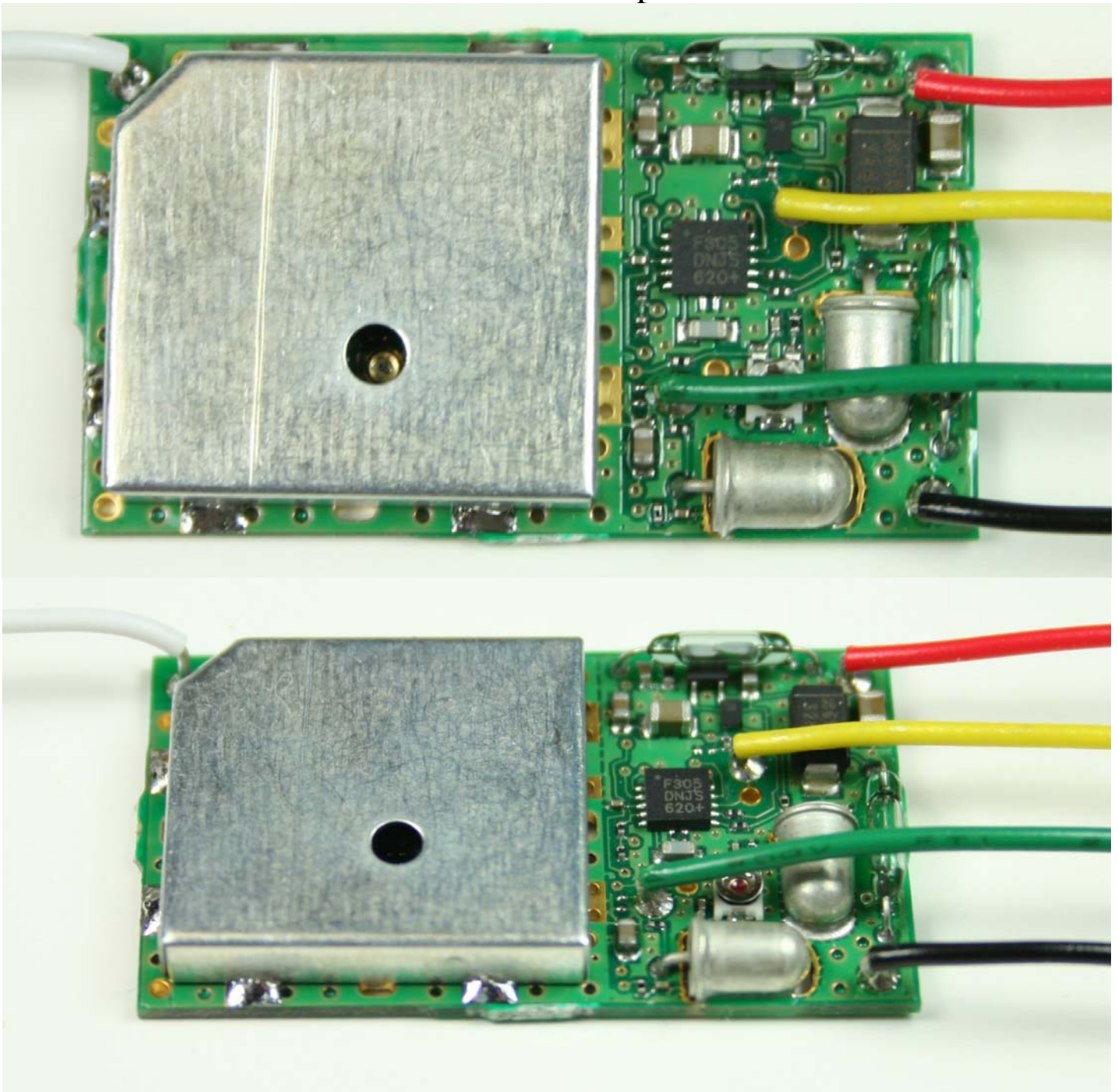


Printed Circuit Board bottom photo





Printed Circuit Board Front photo with shield



# CFXPT-90 Parts Lists

value	Designator	Footprint
0.01u F	C-01	0402
0.1u F	C-02	0603
100p F	C-03	0402
0.1u F	C-04	0603
1000p F	C-05	0201
0.01u F	C-06	0402
1000p F	C-07	0201
10u F, 6.3V	C-08	0805
1000p F	C-09	0201
1000p F	C-10	0201
0.1u F	C-11	0603
1000p F	C-12	0201
330p F, NPO, 880Hz	C-13	0603
0.1u F	C-14	0603
1000p F	C-15	0201
none	C-16	0201
1000p F	C-17	0201
1p F	C-18	0201
7p F	C-19	0201
5p F	C-20	0201
5p F	C-21	0201
220p F	C-22	0603
3900p F	C-23	0603
1u F	C-24	0805
1000p F	C-25	0201
1000p F	C-26	0201
100p F	C-27	0201
1000pF	C-28	0201
47p F	C-29	0201
1000p F	C-30	0201
56p F	C-31	0201
1000p F	C-32	0201
6p F	C-33	0201
5p F	C-34	0201
1000p F	C-35	0201
1000p F	C-36	0201
6p F	C-37	0201
33p F	C-38	0201
0.01u F	C-39	0402
1000p F	C-40	0201
82p F	C-41	0402
22p F	C-42	0201
5p F	C-43	0201
5p F	C-44	0201
100 pF	C-45	0201
1000p F	C-46	0201
1000p F	C-47	0201
0p F	C-48	0201
10u F, 6.3V	C-49	0805
1000p F	C-50	0201
1p F	C-51	0201
10uF, 10V	C-52	0805
100p F	C-53	0201
0.01u F	C-54	0402
10u F, 6.3V	C-55	0805
10u F	C-56	0805
0.1u F	C-57	0603
0.056u F	C-58	0805
6p F	C-59	0201
100p F	C-60	0201
0p F	C-61	0201
4p F	C-62	0201
1000p F	C-63	0201
1000p F	C-64	0201

value	Designator	Footprint
MA27V0700	D-01	SSS-mini
S2AADICT	D-02	Diode-SMA
47n H	L-03	1008
56n H	L-04	0805
56n H	L-05	0805
56n H	L-06	0805
33n H	L-07	0805
12n H	L-08	0805
12n H	L-09	0805
100n H	L-10	0805
NE681M13	Q-01	CEL-M13
NE681M13	Q-02	CEL-M13
NE681M13	Q-03	CEL-M13
NE68819	Q-04	CEL-19
NE664M04	Q-05	CEL-M04
18K OH	R-01	0201
10K OH	R-02	0201
1M OH	R-03	0201
1M OH	R-04	0201
10M OH	R-05	0402
10K OH	R-06	0201
1K OH	R-07	0201
10 OH	R-08	0201
150 OH	R-09	0201
1.5K OH	R-10	0201
330 OH	R-11	0201
10 OH	R-12	0201
33K OH	R-13	0201
1.0K OH	R-14	0201
100K OH	R-15	0201
6.8K OH	R-16	0201
680 OH	R-17	0201
10K OH	R-18	0201
10K OH	R-19	0201
27K OH	R-20	0201
10 OH	R-21	0201
1K OH	R-22	0201
1M OH	R-23	0201
10K OH	R-24	0201
1K OH	R-25	0201
22K OH	R-26	0201
56K OH	R-27	0201
150 OH	R-28	0201
10K OH	R-29	0201
56K OH	R-32	0201
10K OH	R-33	0201
10K OH	R-34	0201
CM-1600	SW-01	COMUS-1600
CM1600	SW-02	COMUS-1600
ORD-213	SW-03	magnetic-sw
ORD-213	SW-04	magnetic-sw
LP3987-2.5V	U-01	NS-TLA05-LP3987
8051F305	U-02	MLP-11-B-8051F30X-1
TC7SL04FU	U-03	SSOP-5-P-0.65-TC7SC04FU
LMX2470	U-04	NS-LMX2470
LP3987-2.5V	U-05	NS-TLA05-LP3987
JN015	VC-01	VOLTRONICS-JN
10K OH	VR-01	POT-P2W
TTS-18-19.2Mhz	XTAL-01	TEW-TTS18

## CFXPT-90

### List of Active devices and functions.

Designator	Parts #		Function
Q-01	Q-NE681M13		Oscillator
Q-02	Q-NE681M13		buffer amplifier
Q-03	Q-NE681M13		pre-amplifier
Q-04	Q-NE68819		driver amplifier
Q-05	Q-NE664M04		final amplifier
U-01	U-LP3987ITLX-2.5V		voltage regulator
U-02	U-C8051F305		CPU
U-03	U-TC7SL04FU		inverter
U-04	U-LMX2470		PLL synthesizer
U-05	U-LP3987ITLX-2.5V		voltage regulator
XTAL-01	X-TTS18-19.2MHz		crystal oscillator TCXO 0.5 ppm

## CFXPT-90 FACTORY TUNE UP PROCEDURE PRIOR TO POTTING

1. Download test firmware. This changes the CFXPT-90 frequency to 216.000MHz.
2. Adjust trimmer pot VR-01 to set the VCO frequency to 216.000MHz (+ or - 10Hz).
3. With the frequency at 216.000MHz, align VC-1 so the VCO test voltage is 0.3v (+ or - 0.1V).
4. Check power output to make sure it is 17.0dBm to 19.5dBm.
5. Check that all harmonics or spurious signals are at least 50dB down from main carrier.
6. Download test firmware to change the transmitting frequency to 222.000MHz
7. Check that the VCO frequency is 222.000MHz (+ or - 10Hz).
8. Check that the VCO test point is less than 1.7v.
9. Check that the power output is 17.0dBm to 19.5dBm.
10. Check that all harmonics or spurious signals are at least 50dB down from main carrier.