FCC FORM 731

FEDERAL COMMUNICATIONS COMMISSION
Washington, DC 20554

APPLICATION FOR EQUIPMENT AUTHORIZATION

Approved by OMB 3060-0057
Expires 3/31/88

1.(a) Grantee Code assigned by FCC: B 2 N

(b) Manufacturer Code assigned by FCC: 9 C L

FOR FCC STAFF USE

2.(a) Applicant's FULL business name: RACON INCORPORATED

(b) Applicant's COMPLETE address (Number, street, city, state, ZIP code): 12628 Interurban Avenue South
Seattle, Washington 98168

(c) Name and title of person at above address to receive grant (SEE INSTRUCTIONS): Daniel A. Blattman, President (C.E.O.)

3.(a) Instead of applicant, FCC is authorized to mail original grant to (Firm name, number, street, city, state, ZIP code): N/A

(b) Name and title of person at above address to receive grant: N/A

File No.: EQU

Application dated

Data entered _____ by

Examiner _____

4.(a) FULL name of equipment manufacturer, if different from item 2(a) above: N/A

(b) Address of equipment manufacturer, if different from item 2(b) above (Number, street, city, state, ZIP code): N/A

Reviewer(s)

Equipment Code:

Print _____ authorization(s)

Microfiched _____ date by _____

5. Has a request for confidentiality been filed for any portion(s) of the data contained in this application pursuant to Section 0.459 of the Commission's rules, or has a waiver of any sections of the Commission's rules been filed?	YES	NO
		X

6. Kind of equipment authorization requested (Check ONE box only): [X] Certification [ ] Type Acceptance [ ] Type Approval [ ] Notification (See Instructions)

7.(a) Kind of equipment: Microwave Field Disturbance Sensor

(b) Equipment will be operated under FCC Rules Part(s): 15

8. Application is for (Check ONE box only)

[X] 1 Original Equipment — List FCC ID in Item 9(a) and trade name, if any in Item 9(b).

[ ] 2 Change in identification of presently authorized equipment — List FCC ID in Item 9(a) and trade name, if any in Item 9(b). Complete Items 10(a), (c), (d), and (e).

[ ] 3 Change in manufacturer of presently authorized equipment — List FCC ID in Item 9(a) and trade name, if any in Item 9(b). Complete Items 10(b), (c), (d), and (e).

[ ] 4 Modification of presently authorized equipment — List FCC ID in Item 9(a) and trade name, if any in Item 9(b). Give date of original grant _____ If no FCC ID assigned, complete Items 11(a)-11(d).

9.(a) FCC ID (grantee and manufacturer codes listed in Item 1(a) and 1(b), plus number assigned by applicant. SEE INSTRUCTIONS: B 2 N 9 C L 1 4 1 0 0

(b) Trade Name(s), if any (maximum of 30 characters each - see Instructions): Racon 14100

10.(a) Name of present grantee, if different from Item 2(a) above: N/A

(b) Name of present manufacturer, if different from Item 4(a) above: N/A

(c) FCC ID, if assigned/ Model or Type No., and Trade name, if any: B2N9CL14100 Racon 14100

(d) FCC Type Approval No., if assigned: N/A

(e) Date of original grant: N/A

11.(a) Complete ONLY if no FCC ID assigned to equipment to be modified (Model or type No.): N/A

(b) Trade Name, if any: N/A

(c) FCC Type Approval No., if assigned: N/A

(d) Date of original grant: N/A

12.(a) Is the equipment, or section(s) thereof, subject to more than one equipment authorization? [ ] Yes [X] No If yes, complete Item 12(b), and 12(c), 12(d), or 12(e), as appropriate.

(b) Additional equipment authorization(s) required for equipment [ ] Certification [ ] Type Acceptance [ ] Type Approval

(c) FCC ID listed on simultaneously filed RCVR or RCVR section application

(d) FCC ID listed on simultaneously filed XMTR or XMTR section application

(e) FCC ID listed on other simultaneously filed application

FOR FCC STAFF USE ONLY	FOR FCC STAFF USE ONLY

All previous editions of this form are obsolete.

13. EQUIPMENT SPECIFICATIONS	
(a) Frequency range (list all frequency bands covered in equipment) 10.525 GHz ± .025 GHz	(b) Rated RF Power output (if variable, give range) 1.7mW
(c) Power output to final RF amplifier (if applicable) N/A	(d) Rated frequency tolerance ±25 MHz
(e) Emission designator(s) A2	(f) Power supply (Check appropriate box(es)) ☐ AC ☒ Battery ☐ Other (specify) External 12VDC supply with 12V battery backup

14. Total number of exhibits submitted with application _____ Attach list of exhibits

15.(a) Technical information contact (Firm name, number, street, city, state, ZIP code)	(b) Nontechnical information contact, if different from Item 15(a) (Firm name, number, street, city, state, ZIP code)
Racon Inc. 12628 Interurban Ave. S. Seattle, WA 98168	
(c) Name and title of person at above address Robert J. Hume, Engineering Tech	(d) Name and title of person at above address

(e) Telephone information (USA ONLY)	Area code	Number	Extension	(f) Telephone information (USA ONLY)	Area code	Number	Extension
	206	241-1110	32				

16. APPLICANT CERTIFICATION

I certify that I am authorized to sign for the applicant and that all the statements in this application and in the exhibits attached hereto are true and correct to the best of my knowledge and belief. If I am an agent authorized to complete, and sign this application on behalf of the applicant, a copy of such authorization, signed by the applicant, is attached hereto.

I further certify that, if the applicant is not the actual manufacturer of the equipment listed herein, appropriate arrangements have been made with the manufacturer to assure that production units of this equipment bearing the name and FCC IDENTIFIER listed in this application will continue to comply with the Commission's requirements.

Applicant's full business name ► Racon Incorporated
(Must agree with name in item 2(a))

▲ Written signature of authorized signer	▲ Typed/printed name of authorized signer
	Daniel A. Blattman
▲ Title of authorized signer	▲ Date (Month, Day, Year)
President (C.E.O.)	May 27, 1987

WILLFUL FALSE STATEMENTS MADE ON THIS APPLICATION ARE PUNISHABLE BY FINE AND IMPRISONMENT, U.S. CODE, TITLE 18, SECTION 1001.

NOTICE TO INDIVIDUALS REQUIRED BY THE PRIVACY ACT OF 1974 AND THE PAPERWORK REDUCTION ACT OF 1980

The solicitation of the personal information requested in this form is to determine if your equipment is suitable for an equipment authorization pursuant to the Commission's Rules. The information will be used by the FCC staff to evaluate the equipment and to maintain a computer data base of authorized equipment. No authorization can be granted unless all information requested is provided. Your response is required to obtain this equipment authorization.

DISCLOSURE OF INFORMATION

Unless otherwise determined, all data submitted will be made available for public inspection. Sec. 47 C.F.R. Sec. 0.457(d)(2); 5 U.S.C. Sec. 552.

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   That private companies reproducing the form refrain from including therein or attaching thereto any advertising matter or deleting any material from the form;

3. That private companies reproducing the form exercise care to assure that the form being reproduced or distributed is the current edition presently used by the Commission for the type of application involved; such private company to be advised that, though the Commission will endeavor to keep the public advised of revisions in the form, it cannot assume responsibility to the extent of eliminating any element of risk against overstocking, etc.

RACON INC. ENGINEERING REPORT			NO. 0023	REV 0
COMPILED R.J.HUME	APPROVED	DATE 5/27/87	SHEET 1 OF 23	

TITLE
14100 FCC CERTIFICATION REPORT

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TITLE

14100 FCC CERTIFICATION

List_of_Exhibits

Exhibit A ----- Draft of User Instruction Manual
Exhibit B ----- Transmitter Block Diagram
Exhibit C ----- Receiver Block Diagram
Exhibit D ----- Transmitter Schematic Diagram
Exhibit E ----- Receiver Schematic Diagram
Exhibit F ----- Circuit Description

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TITLE

14100 FCC CERTIFICATION

I. Technical Report Pursuant to 15.44

A. Name and Address of Manufacturer

Racon, Inc.
12628 Interurban Avenue South
Seattle, WA 98168

B Trade Name and Marketing Company

Trade Name: Racon 14100
Company: Racon, Inc.
12628 Interurban Avenue South
Seattle, WA 98168

C. Model Number

Model No. 14100

D. List of Additional Model Numbers and/or Trade Names:

None

E. Draft of User Instruction Manual

See Exhibit A.

II. Expository Statement Pursuant to 15.45

A. Block Diagram of Model 14100

See Exhibit B and C.

B. Statement of System Operation and Specifications

The Model No. 14100 Field Disturbance Sensor Transmitter is designed to provide a pattern of microwave energy. The receiver monitors the microwave energy level and provides intrusion protection by alarming when a field

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disturbance is detected. Typical system application would provide a perimeter protection zone around high risk areas. The principle of detection depends on observing the received changes in subcarrier amplitude caused by slight changes in signal strength (a dynamic multipath environment caused by a moving target), a momentary or fixed blockage, attempted signal jamming by a foreign transmitter, or by tampering with the system.

The Model 14100 is housed in a metal enclosure designed to provide RFI and weather protection. The design incorporates a dielectric resonator oscillator coupled through the Racon Waveguide bandpass filter to provide the microwave energy. No user adjustments are provided for critical parameters of radiation such as power out, frequency, or antenna configuration.

SPECIFICATIONS

MICROWAVE FREQUENCY: 10.525 GHz ± 0.025 GHz

MICROWAVE OUTPUT: Less than 0.25 volt/meter @ 30 meters

ANTENNA PATTERN: Approximately 3.5 degrees horizontal and vertical beam width at -3dB points.

ANTENNA POLARIZATION: E-Plane Vertical

MODULATION: Class A2

MODULATION FREQUENCIES: 6 crystal controlled
A 9520 Hz
B 10913 Hz
C 12093 Hz
D 13160 Hz
E 14436 Hz
F 15980 Hz

OPERATING TEMPERATURES: -40 degrees C to +60 degrees C

POWER ON INDICATOR: LED

POWER INPUT: 12 VDC (less than 360 M.W. continuous power dissipation per half system)

TAMPER CIRCUIT: Normally closed and open. (Contact ratings: 28 VDC @ 1 amp, 110 VAC @ 3 amps).

SIZE: 31"W x 24"H x 12"Deep

WEIGHT: 18 pounds

MOUNTING: Designed for attaching to 3 1/2" O.D. pipe.

RACON P/N: 10070-001-01

C. Circuit Diagram

See Exhibit D and E

D. Description of Circuit Operation

See Exhibit F

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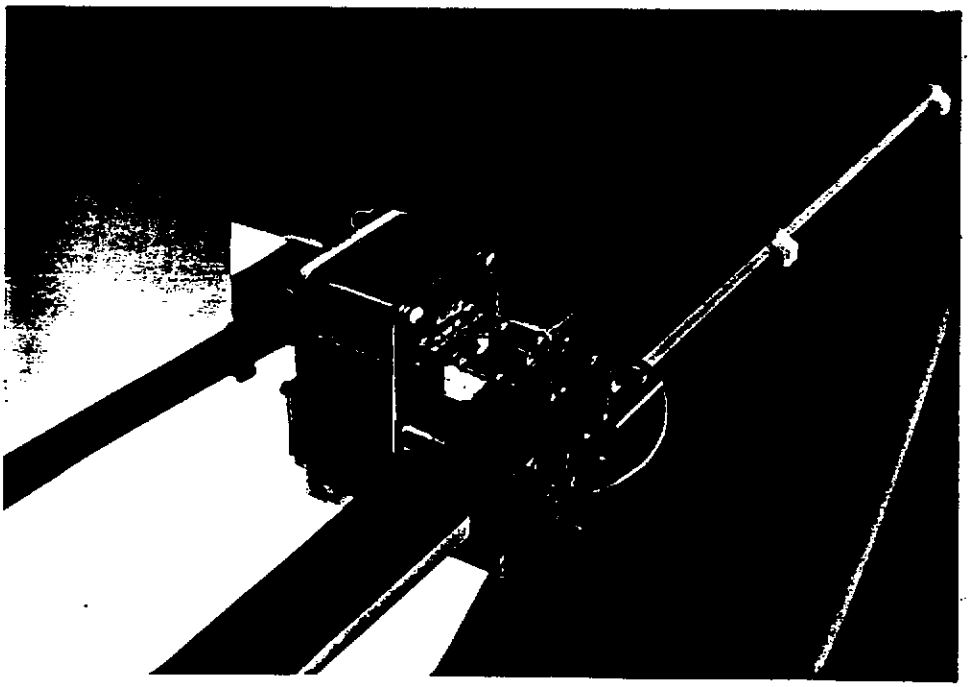
E. Description of R.F. Source, Filter and Antenna

The Dielectric Resonator Oscillator is a Gaas FET device with a ceramic disc used as a tuned feedback structure. The Model 14100 employs a waveguide launched DRO with a standard X-Band flange for mounting. The DRO is coupled through the Racon waveguide filter to the feed horn.

The Racon P/N10002-001-02 waveguide filter has been used in several FCC certified systems. The filter was tested by the Hewlett-Packard Company with the following results: "At 15GHz the isolation reached 85dB. At 21GHz the signal through the filter was below the noise. Isolation exceeds 85dB."

The antenna system uses the Racon P/N10006-302-01 tapered feed horn as the feed for a shrouded 23" diameter parabolic reflector. 3dB beamwidth for this vertically polarized system is less than 3.5 degrees in both the E and H planes. The RF source, waveguide filter and tapered feed horn are mounted on a crossbar within the parabolic shroud.



FEED, FILTER, AND OSCILLATOR MOUNTED IN UNIT

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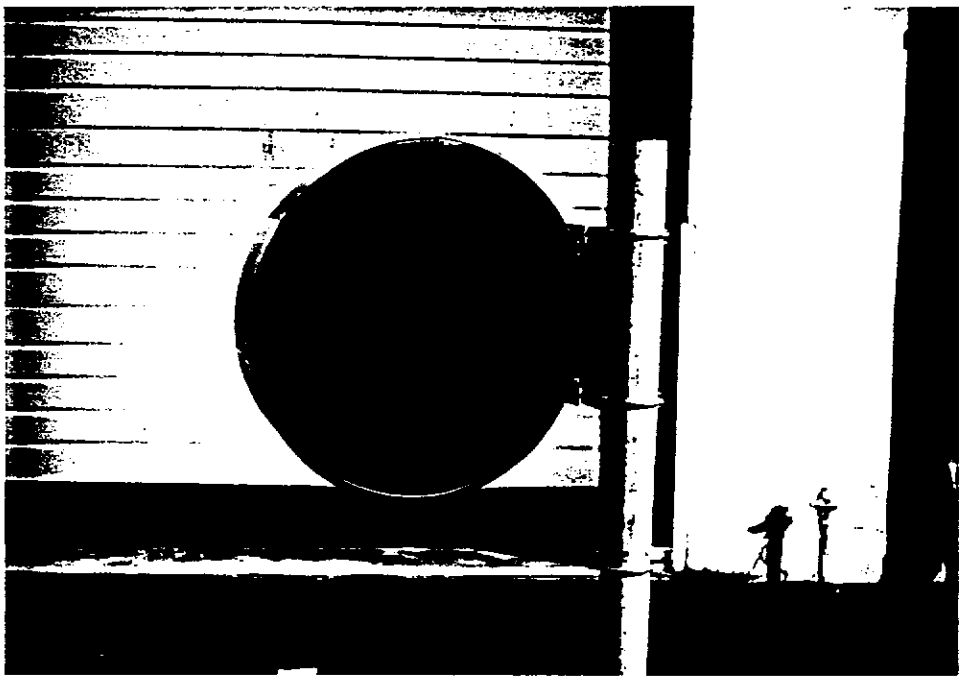
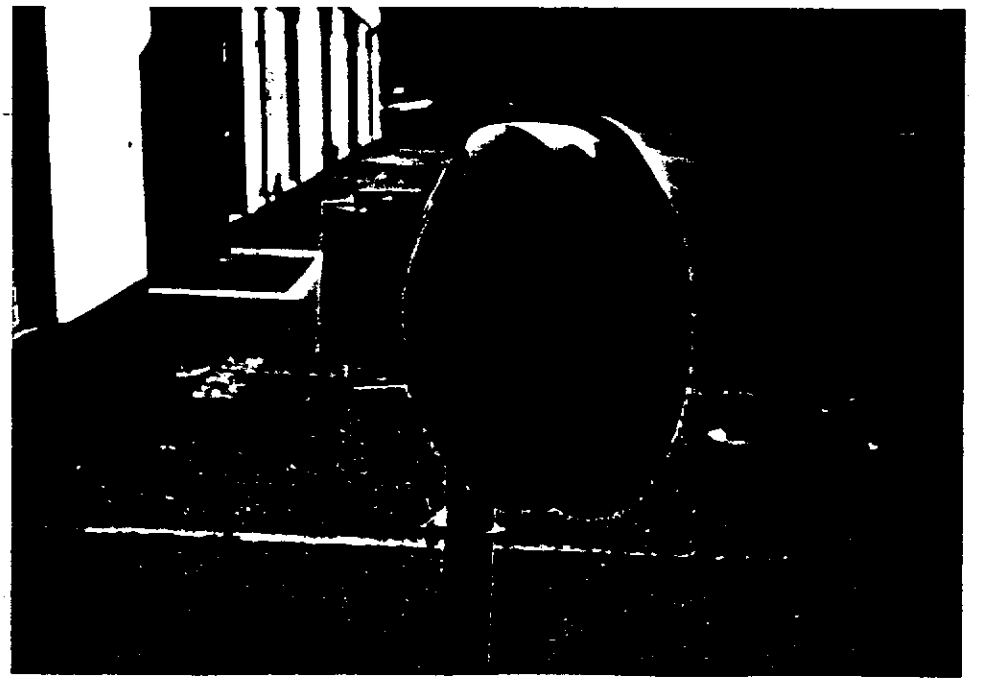
III. Photographs Pursuant to F.C.C. 15.46

A. Exterior Appearance



Model 14100 mounted on 3 1/2" O.D. Pipe



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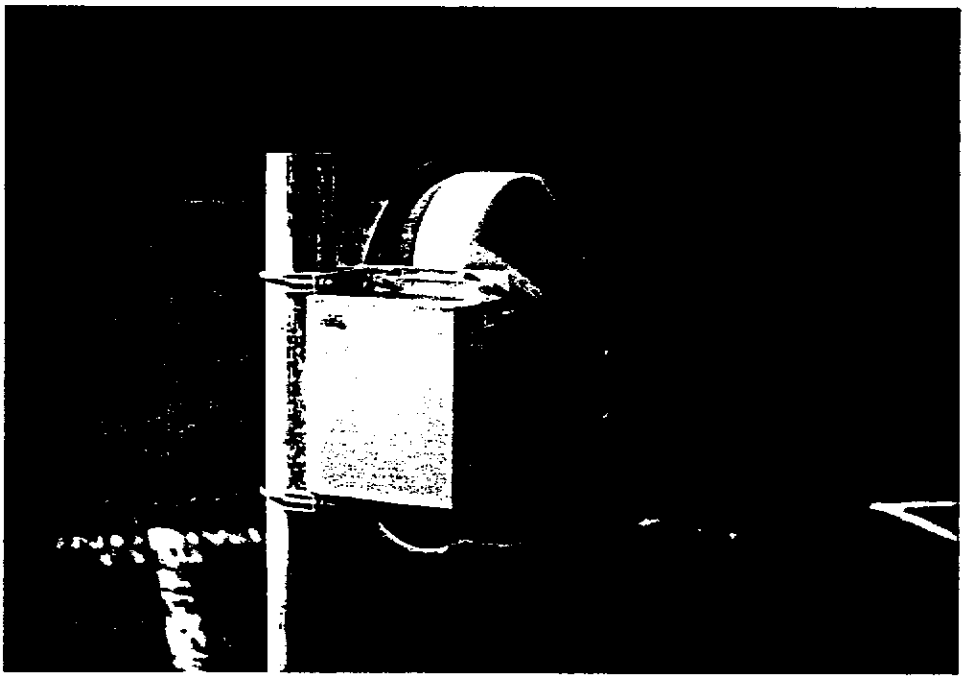
B. Construction



Model 14100 showing two major mechanical components. (Parabolic Reflector and Electronics Enclosure.)

The Racon 14100 parabolic and enclosure are constructed from .090 aluminum. All external fasteners are of stainless steel including two 3 1/2" pipe clamps used to attach each unit to a fixed position mounting pole. The feed for the antenna is brass, the waveguide filter zinc, and the faceplate is plexiglas.

C. Component Placement and Controls

The user has access to the printed circuit board through a hinged door in the electronics enclosure. The user has the ability to select any one of six modulation frequencies by setting dip switch S3 on the transmitter while insuring that switch S3 on the receiver is set to the same position. Other transmitter controls include pot R10 test signal modulation depth and two external inputs to enable the self test mode.

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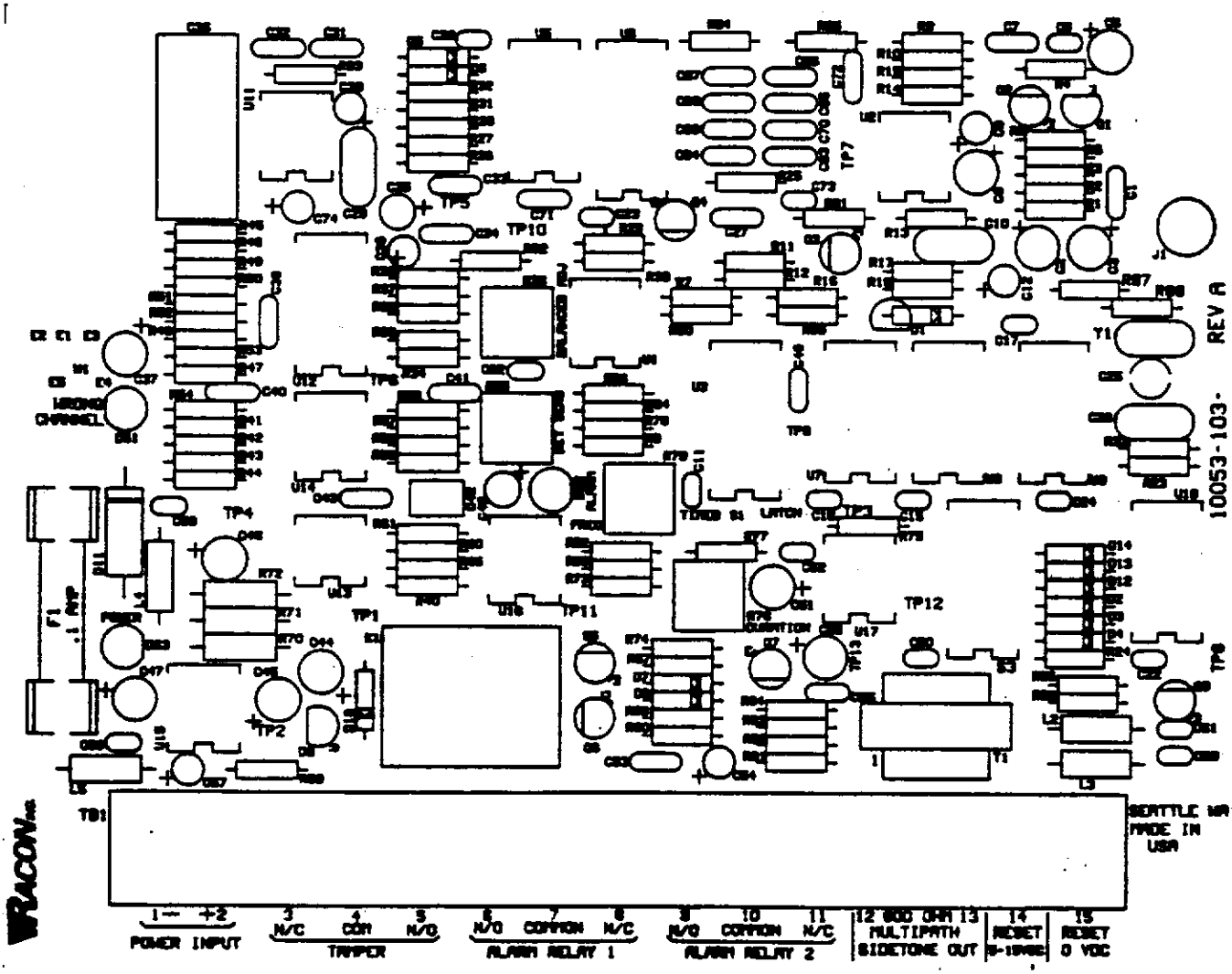
14100 FCC CERTIFICATION



PRINTED CIRCUIT BOARD SILKSCREEN SHOWING COMPONENT PLACEMENT (RX BOARD)

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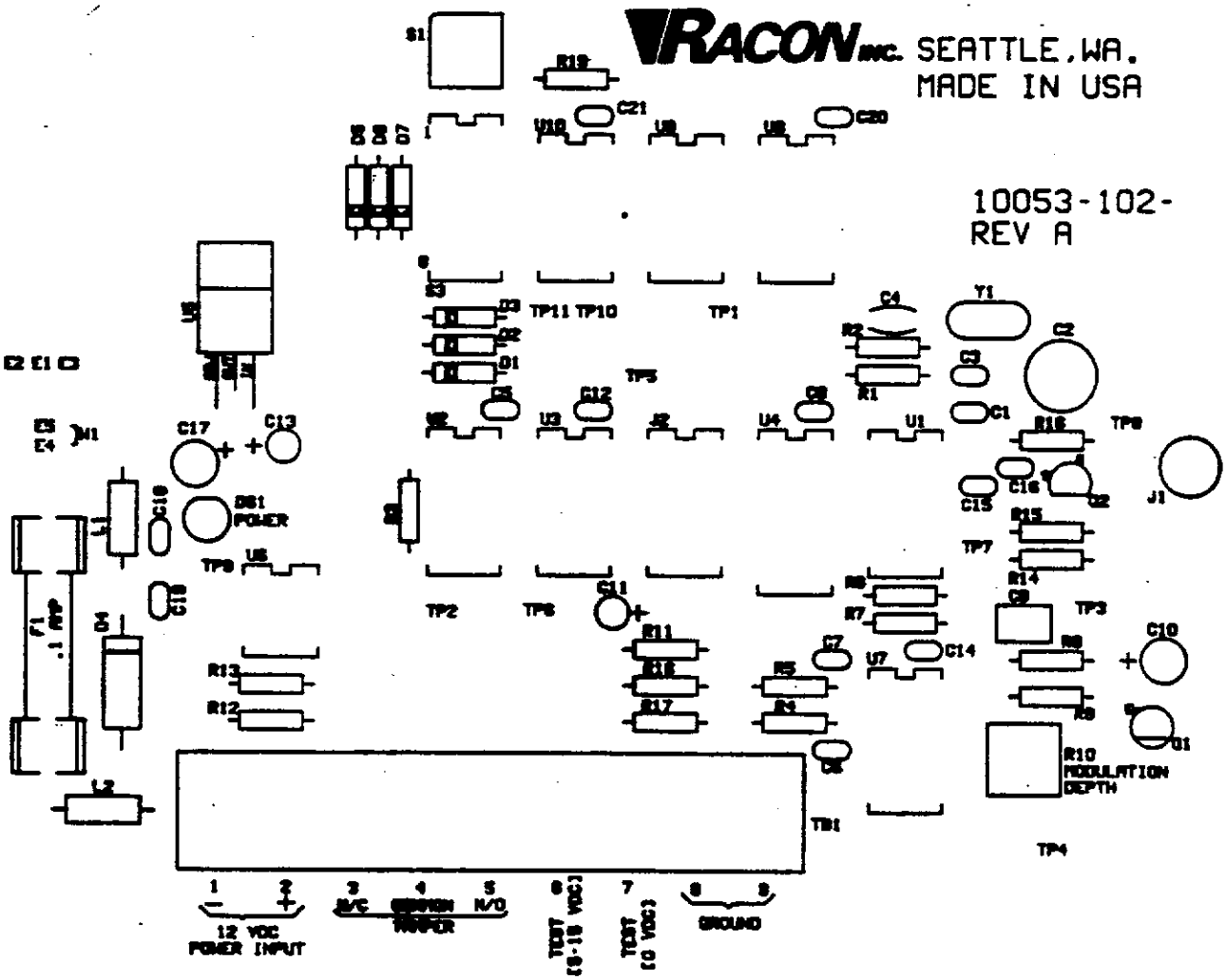

PRINTED CIRCUIT BOARD SILKSCREEN SHOWING COMPONENT PLACEMENT (TX BOARD)

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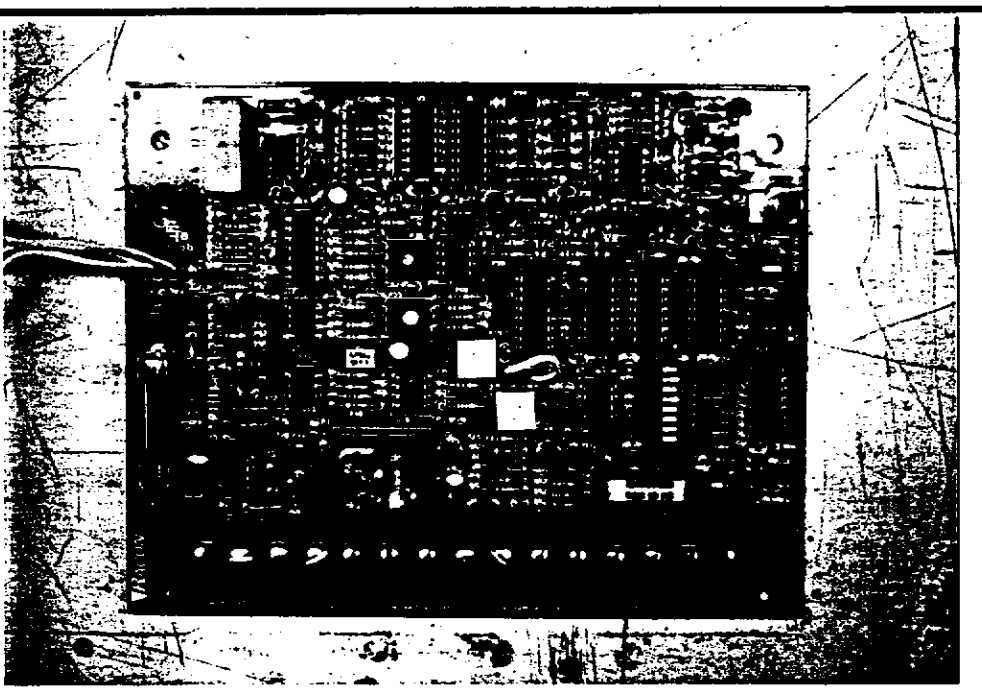

PHOTO SHOWING RX BOARD

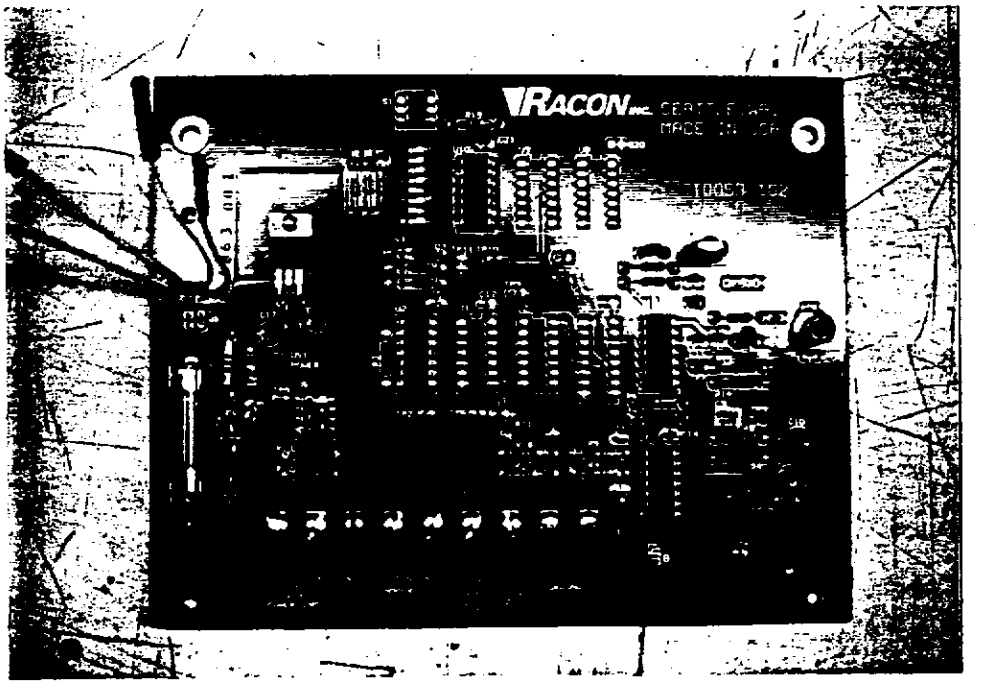

PHOTO SHOWING TX BOARD

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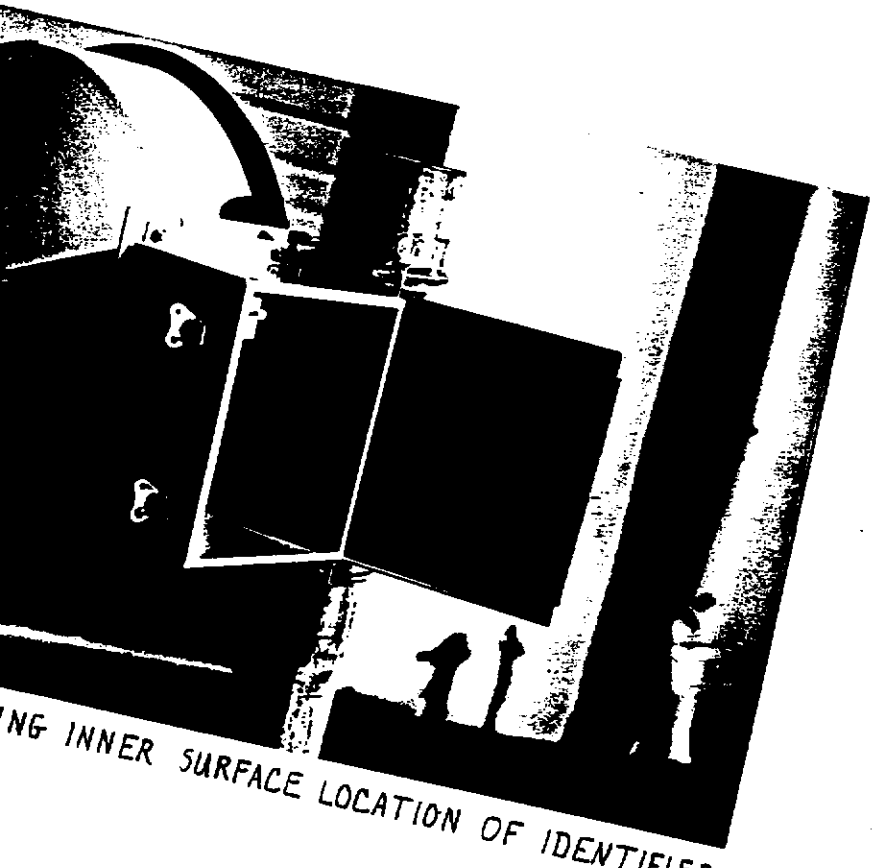
The receiver allows the user the ability to adjust multipath sensitivity R55, alarm time R76, alarm mode S1 (latch or time), and receiver channel S3.

Label Context and Location Information

The identifier label for both the transmit and receive half are located on the inside surface of the electronic enclosure access door of each associated unit. In addition, a silkscreen is applied to the bottom right corner of the outside of the access door.

Racon, Inc.
Seattle, Washington
98168
Model 14100



NG INNER SURFACE LOCATION OF IDENTIFIER

TITLE

14100 FCC CERTIFICATION

RACON 14100 TRANSMITTER
Microwave Security System

GENERAL INFORMATION

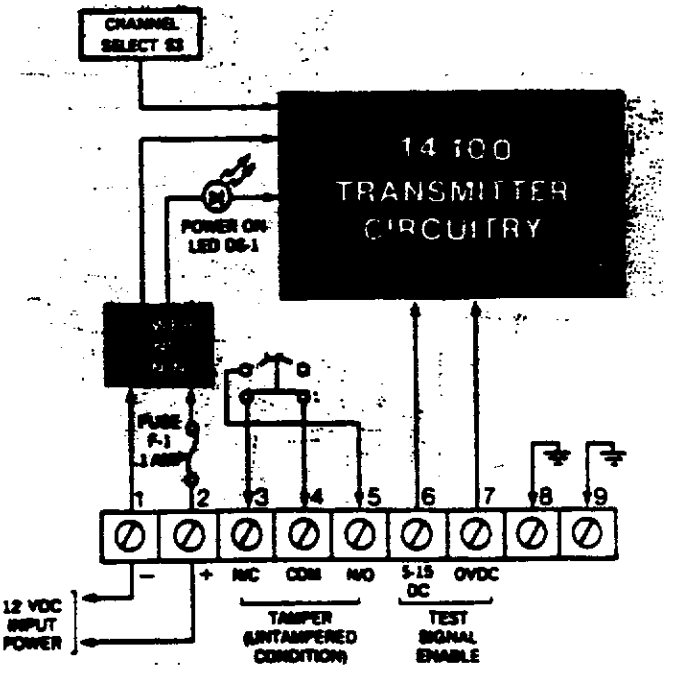
1. DO NOT VOID YOUR WARRANTY—READ "INSTALLATION & OPERATION MANUAL" before attempting installation.
2. To PREVENT ELECTRICAL SHOCK disconnect DC power prior to servicing. REFER SERVICING TO QUALIFIED SERVICE PERSONNEL.
3. FOR WARRANTY SERVICE –First contact factory stating the transmitter and receiver serial numbers. The factory will recommend the necessary action to be taken.
4. Insure both the transmitter and receiver are set to the same channel (A, B,..., F).
5. THIS DEVICE COMPLIES WITH FCC RULES PART 15. Operation of this device is subject to the following two conditions:
   A. This device may not cause harmful interference.
   B. This device must accept any interference that may be received, including interference that may cause undesired operation.

SPECIFICATIONS

FREQUENCY: 10.525 GHz
FCC CERTIFIED: Part 15. FCC license not required
MICROWAVE OUTPUT: Less than .25 volt meter at 100 feet
ANTENNA PATTERN: Single lobe. approximately 3.5° horizontal and vertical
ANTENNA POLARIZATION: E plane vertical
MODULATION: Class A2

POWER ON INDICATOR: LED
POWER INPUT: 12 VDC
TAMPER SWITCH: SPDT 28 VDC at 1 AMP

FCC ID:BZNSCL'14100



TX IDENTIFIER LABEL

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TITLE
14100 FCC CERTIFICATION

14100 RECEIVER
Microwave Security System

RACON

GENERAL INFORMATION

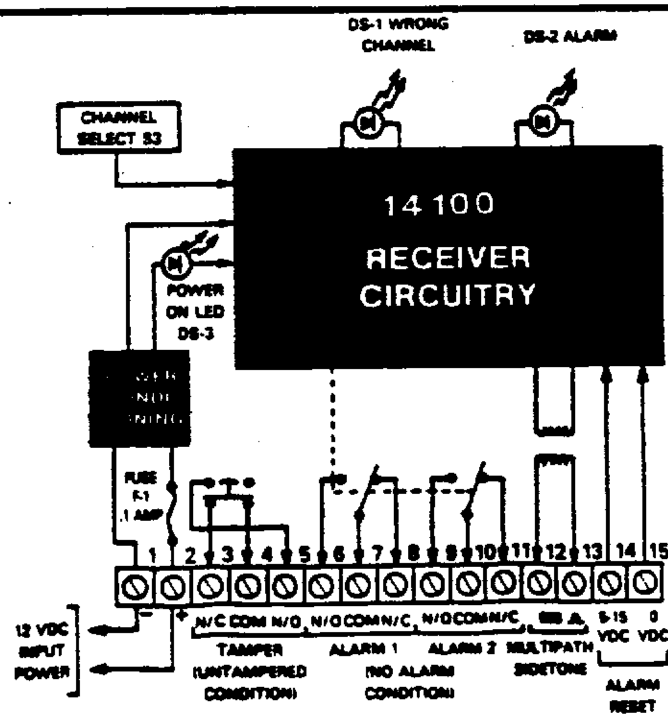
1. DO NOT VOID YOUR WARRANTY—Read "INSTALLATION & OPERATION MANUAL" before attempting installation.
2. To PREVENT ELECTRICAL SHOCK disconnect DC power prior to servicing. REFER SERVICING TO QUALIFIED SERVICE PERSONNEL.
3. FOR WARRANTY SERVICE—First contact factory stating the transmitter and receiver serial numbers. The factory will recommend the necessary action to be taken.
4. Insure the receiver and transmitter are set to the same operating channel (A, B,.... F). The "ALARM" and "WRONG CHANNEL" LEDS are not illuminated during normal operation.
5. Detection zone alignment is accomplished by first physically aligning transmitter and receiver by sight. Final alignment is achieved by monitoring (using a high impedance voltmeter) the AGC voltage at test point 10 to ground. Maximize the voltage reading by slowly aligning the transmitter and receiver assemblies. Repeat as necessary.
6. Operational walk tests are made by monitoring the n/c alarm circuit output, terminals 7 and 8 with an ohm meter.

SPECIFICATIONS

FREQUENCY: 10.525GHz
ANTENNA PATTERN: Single lobe, approximately 3.5° horizontal and vertical
DEMODULATION: Class A2

ALARM RELAY: DPDT 28 VDC at 2 AMP MAX
TAMPER SWITCH: SPDT 28 VDC at 1 AMP
POWER INPUT: 12 VDC

FCC ID:B2N9CL14100



RACON
Seattle, Washington

3/87

RX IDENTIFIER LABEL

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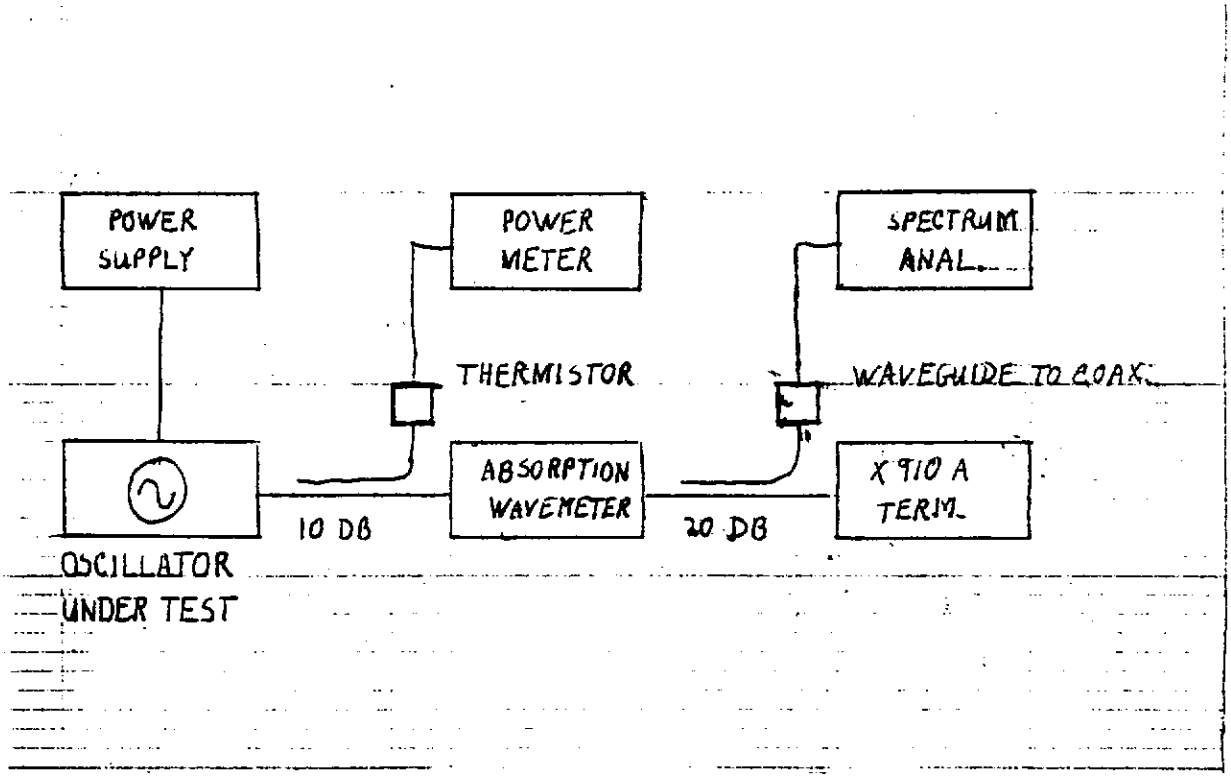
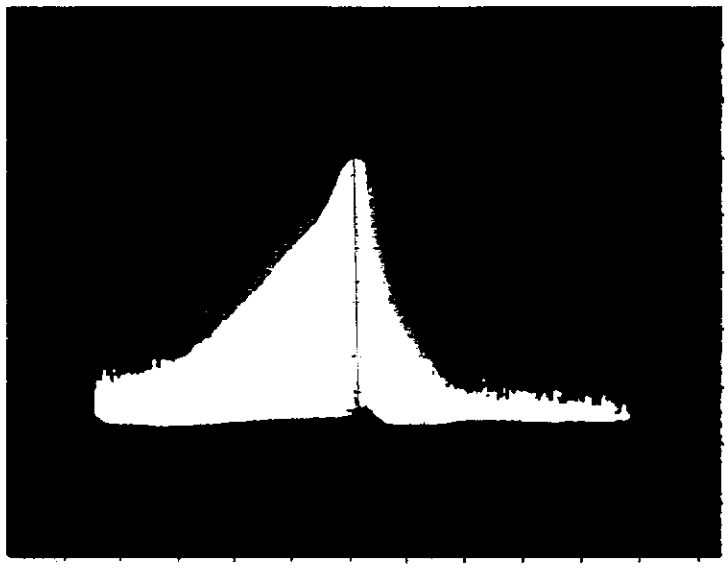
IV Report of Measurement Pursuant to Sub-part F

A. Operating Frequency. All Model 14100 RF sources are adjusted for fundamental frequency compliance. Each unit is set to 10.525 GHz using the test set-up as in diagram below.



PRODUCTION TEST RANGE FOR DRO ADJUSTMENT

Spectral analyzes of the 14100 transmitter are shown below.



Model No. 14100 Frequency Spectrum from HP 141T
Scanwidth: 2 Mhz/Div.
Center Frequency: 10.525
Display: 10 dB Log

Test Method

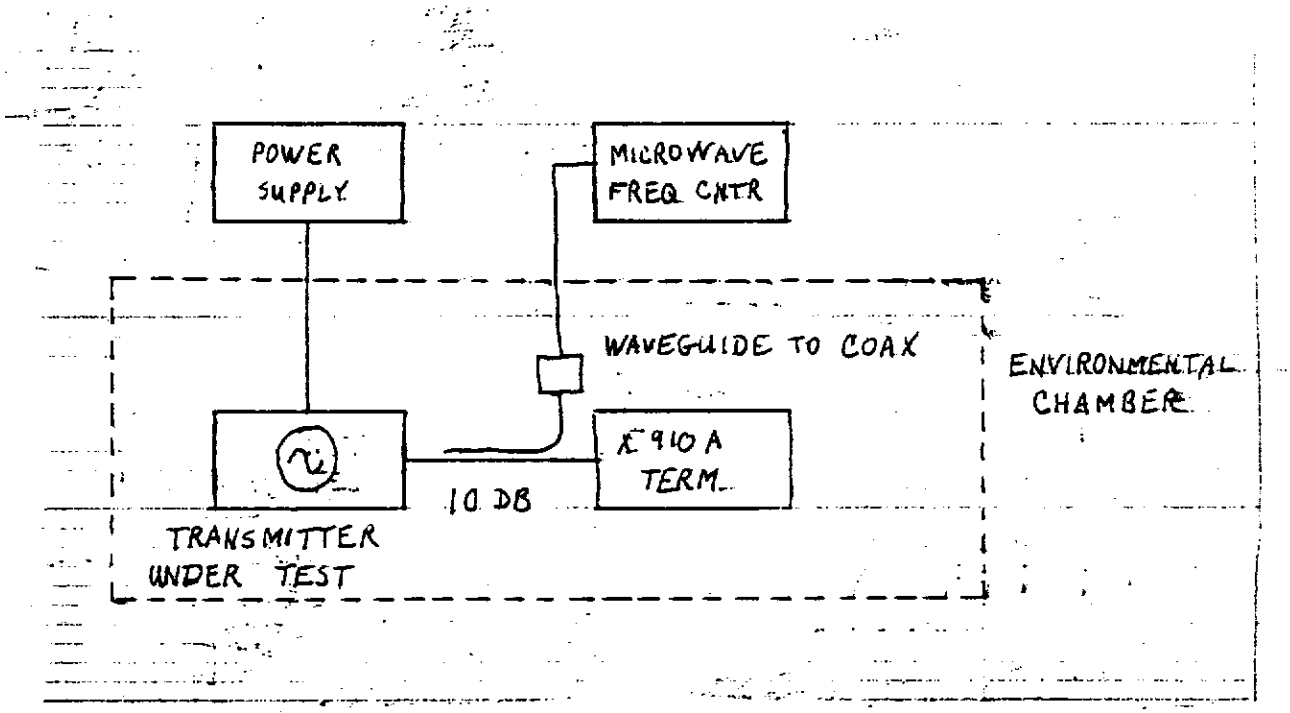
1. Allow unit under test to reach normal operating temperature.

2. Adjust R.F. source to 10.525 GHz as read from HP 5343A Microwave Frequency Counter.

3. Apply pulse modulation with proposed transmitter board and photograph.

B. Permitted Band of Operation
(Frequency Stability vs. Temperature)

Instrumentation



Test Method

1. Instrumented as diagrammed unit was allowed to soak at -40 degrees C for two hours after which time frequency was recorded.

2. Thereafter the chamber was allowed to stabilize at each desired temperature and soak one hour minimum before frequencies were recorded.

3. D.C. voltage input was varied ± 15% at each temperature and recorded.

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?

Results:

Using the relationships

$P = P_r / A = E^2 / Z_o$

$A = \lambda^2 g / 4\pi$

Where P = power density in watts/meter
P = received power in watts
A = effective area of receive antenna in meters
E = electric field strength in volts/meter
Z = free space intrinsic impedance = 377 ohms
= wavelength of transmitter frequency in meters = .0285
g = power ratio gain of receive antenna = $10^{1.8}$

The electric field strength can be calculated from -38 dBm received average power then converting to watts 1.6×10^{-7} watts. Giving 1.6×10^{-7} watts times 377 ohms/.0041 effective area of 18 dBi horn = E^2. Or $\sqrt{1.6 \times 10^{-7}}$ times 377/.0041 = E = 121,000 microvolts/meter this falls into compliance of not exceeding 250,000 microvolts per meter.

2. Second Harmonic Measurement.

These measurements were done in essentially the same manner as fundamental field strength except a 15 dBi (Waveline type 899) K Band horn coupled to an HP Spectrum Analyzer was used. Due to extremely low signal level of the second harmonic this measurement was beyond the capabilities of these instruments insuring a minimum of 25 dB suppression of second harmonic.

3. Third Harmonic.

This measurement was made like second harmonic except waveline type 1099 15 dBi. A band horn was substituted. Third harmonic was below the capabilities of measurement at any range. Thus third harmonic is of very inconsequential level.

4. Spurious Emissions.

The frequency spectrum was swept from 10.0 KHz to 18 GHz and no spurious responses were found. This was accomplished by setting the spectrum analyzer noise floor at -60 dBm and noting any images found and comparing to any frequencies developed in the Model 14100.

5. Total RF Output Power.

Total RF power was measured by mounting a Hewlett Packard waveguide thermistor on the output side of the Bandpass Filter. Total power was set at +2 dBm average at this point.

6. Power Input - D.C. to Source.

The D.R.O. is being driven by switched 5 volts D.C. drawing nominally 30 mA while in the ON state.

V. A. Location of Test Site

The range for all measurements was an open outside area adjacent to the Racon Engineering Facility.

B. Physical Description and Characteristics of the Test Site

The test site was a level asphalt surface. There were no structures within five times the source to receiver distance on the beam centerline at the time of measurement. See diagram and photos of test site.

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C. Description of Supports.

The unit under test was mounted on a 3 1/2" diameter steel post 54" above ground level. The receive horns were held in place with a panavise mounted on a tripod. This arrangement gave maximum portability with minimal field disturbance and good control of alignment.

REFERENCE HORN SUPPORT

D. List of Equipment Used and Calibration Dates.

Device	Serial Number	Last Calibrated
HP Spec. An. RF 8555A	2209A12781	9-29-86
HP Spec. An. IF 8552B	1841A15965	9-29-86
HP Thermistor X 486 A	11752	11-13-86
HP Power Meter 432 A	618-00294	3-27-87
HP Microwave Frequency Counter 5343 A	2428A01847	11-13-86
HP Waveguide Termination X910 B	-----	------
HP Mixer 11517 A	-----	5-4-87
HP Waveguide Adaptor 11519 A	-----	------
HP Waveguide Adaptor 11520 A	-----	------
HP Thermistor K 486 A	04084	-----
Associated Environmental Systems Environmental Chamber BK-1108	5913	------
Racon 18 dBi Horn 10.5 GHz 10000-224-01	-----	------
Waveline K Band Horn 15 dBi 21 GHz 899	-----	------
Waveline A Band Horn 15 dBi 31.5 GHz 1099	-----	------

E. Statement of Facilities Availability

The Racon, Inc. test facility is normally available for other persons or companies at prevailing costs and terms. Racon, Inc. reserves the right to approve or disapprove such usage at any time.