ANNEX XIII. STABILITY AND BUOYANCY

Manual Data Collection / Observation Record

Date: 11 Sept 00 Time: _____

Tested by: Pat Dugie Approved by: Rosa Barrineau

Test Description: Stability & Buoyancy test

Specification Reference: RTCM 32-2000/SC110-CD2

pcRc A15.0

Test Results:

HORIZ TO UPRIGHT 1.5 sec

BUOYANCY: UNIT weight = 2.2 lb

force under water = 0.6 lb

$\frac{2.2+0.6}{2.2} = 1.27$ RESERVE BUOYANCY = 27%

ANTENNA BASE ABOVE WATER: 411 mm

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ANNEX XIV. INADVERTENT ACTIVATION TEST

Manual Data Collection / Observation Record

Date: 4 Oct 00 Time: _____

Tested by: Pat Dugie Approved by: Rosa Barrineau

Test Description: Inadvertent activation test

Specification Reference: RTCM 32-2000/SC110-C02
ECRA A16.0

Test Results: During force of 2300 liters/min
unit did not release from
holding mechanism. Unit did not
activate

Intentionally Blank

ANNEX XV.

121.5 MHZ AUXILIARY RADIO-LOCATING DEVICE TRANSMITTER

AMBIENT TEMPERA:

Manual Data Collection / Observation Record

Date: 10/16/00 Time: 1415

Tested by: [signature] Approved by: Rosa Barrineau

Test Description: 121.5 modulation char - ambient

Specification Reference: RTCM 32-2000 /SC 110-C02

para A.17.2

Test Results: XMTR DUTY CYCLE: 100%

carrier freq: 121.49875 MHz

PWR OUT: 14.6 dBm

mod. min freq: 354

mod. max freq: 1136

OFF = 782

mod duty cycle = 48%

mod. factor = 100%

Sweep rep rate: 2.25sec

MINIMUM TEMPERATURE

Manual Data Collection / Observation Record

Date: 10/16/00 Time: 1715

Tested by: _____ Approved by: Rosa Barrineau

Test Description: Low temp - 121.5 modulation check

Specification Reference: RTCM 32-2000/SC110-CD2
Para A.17.2.

Test Results: XMTR Duty Cycle: 100%
Carrier freq 121.49540 MHz
Power Output 14.7 dbm.
mod. Min freq 370 Hz
Mod Max freq 1111 Hz
Diff 741
~~Sweep~~ Rate 2.14 ~~Hz~~
Mod ~~duty~~ cycle ~~49%~~ 47%
Mod ~~duty~~ factor 100%

Manual Data Collection / Observation Record

Date: 10/16/00 Time: _____

Tested by: C Bak Approved by: Rosa Baranceau

Test Description: Hi Temp 121.5 Modulation Check.

Specification Reference: RTCM 32/2000 /SC 110-CD2
Para 2.1.7.2

Test Results: xmtr Duty Cycle 100%
Carrier Freq 121.498
Power Output. 17 dbm.
MOD Min Freq 357 Hz.
MOD MAX FREQ. 1204
Dif. 847
Sweep Rate. 2.13 Hz.
Mod duty Cycle 46%
Mod factor. ~~%~~ 99.8%

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ANNEX XVI. Peak Effective Radiated Power

(121.5 MHz Auxiliary Radio-Locating Device) Measurement

This document was provided by the manufacturer.

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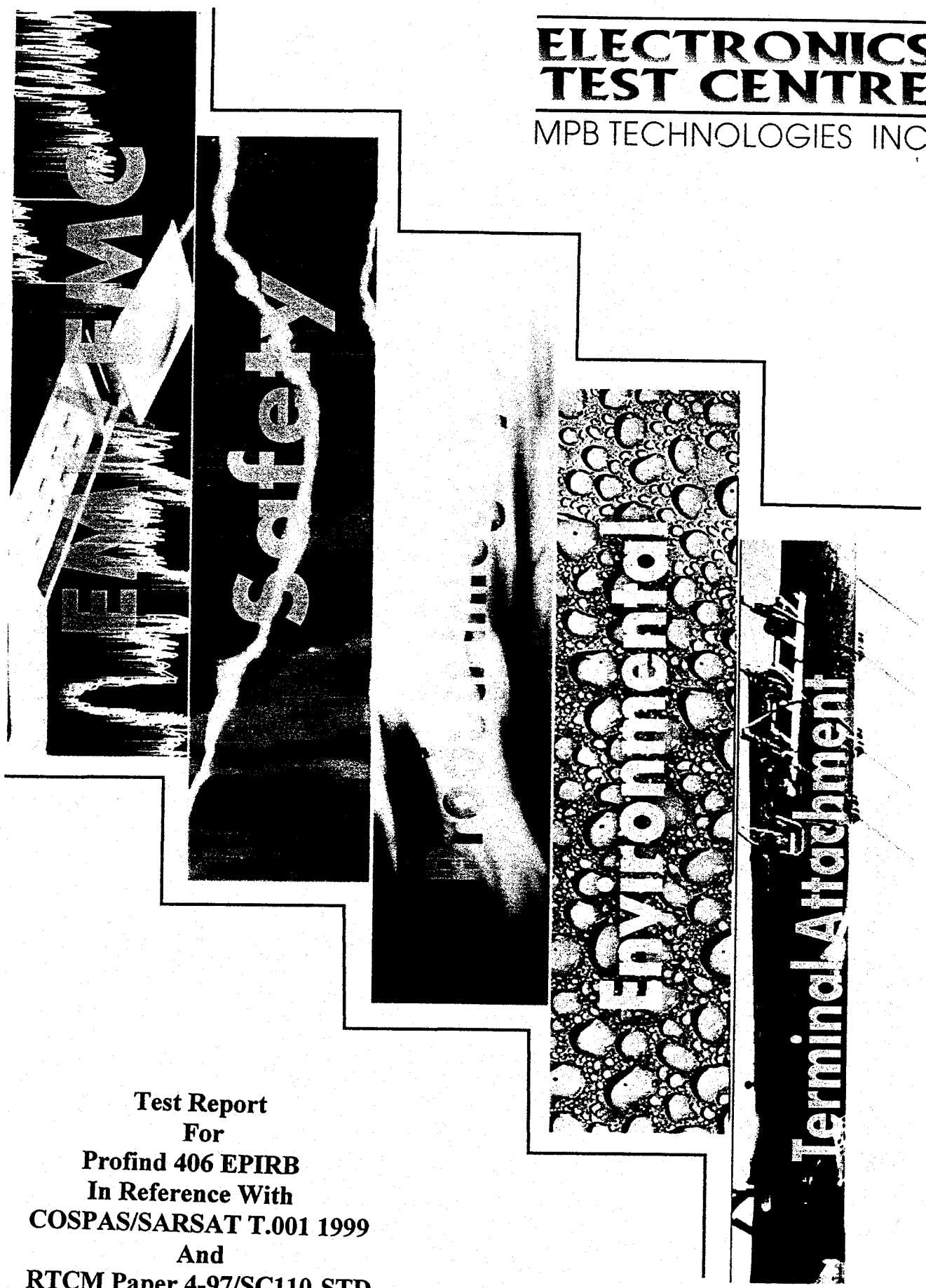
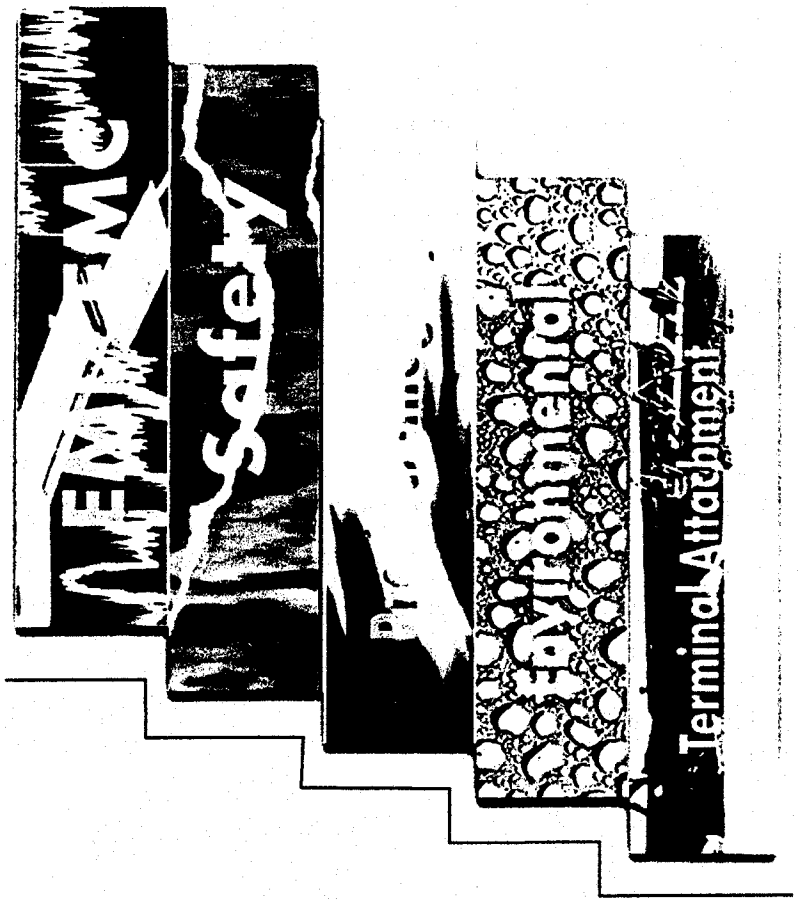


ELECTRONICS TEST CENTRE

MPB TECHNOLOGIES INC.

Test Report
For
Profind 406 EPIRB
In Reference With
COSPAS/SARSAT T.001 1999
And
RTCM Paper 4-97/SC110-STD
WO# S4FL2329



ELECTRONICS TEST CENTRE

SCC #319

AUSTEL

NVLAP

TEST CENTRE
MPB TECHNOLOGIES INC.

Test Report Prepared By:

Electronics Test Centre
MPB Technologies Inc.
Unit 100
302 Legget Drive
Kanata Ontario K2K 1Y5

FINDINGS LETTER
ON THE

ProFind 406 EPIRB

IN REFERENCE WITH
COSPAS/SARSAT T.001 1999
and RTCM Paper 4-97/SC110-STD

MPBT Findings Letter No.: S42FL2329 **Customer No.: 002046**

Test Personnel: D. Zanette

Prepared for:

SEIMAC Limited
271 Brownlow Avenue
Dartmouth, Nova Scotia
Canada B3B 1W6

Dan Zanette
Lab Supervisor
Electromagnetic Services
Electromagnetics Division
Authorized Signatory

Sept-9-2000

AUSTEL Industry Canada Industrie Canada FC 319 CE NVLAP ISO/IECGuide25: 1990

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1.1 SCOPE
1.2 APPLICANT
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1.5 GENERAL TEST CONDITIONS AND ASSUMPTIONS

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3.0 TEST FACILITY

4.0 TEST EQUIPMENT

APPENDIX A EUT CLIENT DESCRIPTION
APPENDIX B Calibration Data

1.0 INTRODUCTION

1.1 SCOPE

The purpose of this findings letter is to present the findings and results of antenna testing performed with reference to the COSPAS/SARSAT 1999 specification and RTCM 1997 specification.

1.2 APPLICANT

This findings letter has been prepared for SEIMAC Limited.

1.3 APPLICABILITY

All test procedures, limits, and results defined in this document apply to the SEIMAC Limited ProFind 406 unit, which shall be referred to herein as the Equipment Under Test (**EUT**).

The results contained in this report relate only to the item(s) tested.

This report does not imply product endorsement by NVLAP or the Canadian or US governments.

1.4 TEST SAMPLE DESCRIPTION

The test sample, provided for testing was the ProFind 406 EPIRB.

Product Type: Distress Beacons

Serial Number: 26

Model Number: ProFind 406

Frequency of operation: 126.6MHz and 406.028MHz

Cables: NA

Power Requirements: Internal battery pack

Peripheral Equipment: NA

1.5 GENERAL TEST CONDITIONS AND ASSUMPTIONS

The EUT was set up and exercised using the configurations, modes of operation and arrangements defined in this report only. All inputs and outputs to and from other equipment associated with the EUT were adequately simulated.

Where relevant, the EUT was only tested using the monitoring methods and test criteria defined in this report.

All testing, unless otherwise noted, was performed under the following environmental conditions:

Temperature: 17 to 23 °C

Humidity: 45 to 75 %

Barometric Pressure: 68 to 106 kPa

MEASUREMENT UNCERTAINTY

The following measurement uncertainty with 95% confidence level was calculated using the methods defined in NAMAS document NIS81: May 1994.

For Radiated E-Field Emissions

Frequency $= \pm 1 \times 10^{-3}$ MHz

Amplitude $= \pm 2.5$ dB

MEASUREMENT DATA

Accuracy ± 2dB

G= 20 x log (f)-AF-29.79

AF at 406MHz= 16.5= gain 5.8 AFc + $\frac{AF}{P}$ P = $\frac{Cos\ (90 \times sine)}{Cos\ (0)}$

Raw Data

Raw Data Vertical Polarization of ProFind 406

Elevation/ Azimuth	10°	20°	30°	40°	50°(45°)
0°	5.6	6	5.6	-0.4	-2.6
30°	5.6	6.2	5.8	0	-3.2
60°	4.8	6	5.8	0	-3
90°	5.2	6	5.4	-0.2	-2.8
120°	5.4	6	5.2	0	-2.4
150°	5.4	6	5	-0.2	-2.2
180°	5.2	5.6	5	0	-2.2
210°	4.2	5.6	5.2	0.4	-2
240°	4.6	5.8	5.2	0.2	-2.4
270°	4.6	5.6	5.4	0.2	-2.2
300°	4.6	5.4	5.6	0.4	-2.4
330°	5.6	5.8	5.4	0.2	-2.4

Path Loss	-34.3	-34.7	-35.4	-36.5	-38
Antenna Gain	5.88	4.88	3.78	1.38	-0.42

Cable loss –1.5 Raw Data

Horizontal Polarization

Elevation/ Azimuth	10°	20°	30°	40°	50°(45°)
0°	-13.6	-17.2	-11.2	-20.8	-25.2
30°	-11	-28.2	-11.6	-18	-41.4
60°	-11.6	-17.2	-14.8	-20.4	-27.8
90°	-12.2	-20.6	-16	-20.6	-22.8
120°	-11.6	-15.4	-19.6	-23.2	-21
150°	-15	-17	-18	-21.4	-27.6
180°	-16	-18.8	-18	-26	-23.8
210°	-17	-30	-15	-21	-24.6
240°	-13.4	-18.6	-17.4	-25.2	-29.2
270°	-18.6	-23	-12.8	-24.6	-28.2
300°	-21.6	-14	-13.6	-23.8	-21.2
330°	-13.4	-14.6	-13	-27.6	-23.8

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Azimuth Angle Degrees	406.028 MHz Corrected Data for the Profind 406				
	Elevation Angle (Degrees)				
	10	20	30	40	45
0	35.57	37.34	38.81	36.26	37.34
30	35.62	37.52	39.00	36.69	36.72
60	34.82	37.34	38.96	36.66	36.93
90	35.20	37.33	38.55	36.46	37.16
120	35.41	37.35	38.33	36.64	37.58
150	35.36	37.34	38.14	36.45	37.73
180	35.15	36.94	38.14	36.63	37.75
210	34.15	36.92	38.36	37.05	37.94
240	34.59	37.14	38.34	36.83	37.53
270	34.54	36.93	38.59	36.83	37.73
300	34.53	36.77	38.77	37.04	37.58
330	35.58	37.16	38.58	36.83	37.55

121.6 MHz
Beacon (RAW DATA)

	Elevation Vertical	Elevation Horizontal
Azimuth Angle	9 deg 78 cm	9 deg 78 cm
0^0	-12.0	-39.8
30^0	-12.0	-40.8
60^0	-12.0	-41.2
90^0	-12.2	-41.8
120^0	-12.0	-42.0
150^0	-12.2	-43.0
180^0	-12.4	-43.0
210^0	-12.2	-43.4
240^0	-12.4	-41.8
270^0	-12.2	-41.2
300^0	-12.0	-40.4
330^0	-12.0	-40.4

Path Loss	-28.2	-28.2
Cable Loss	-0.75	-0.75
Antennae Gain	-0.82	-0.82

A-XVI-10

121.6 MHz Radiated Power Out
(Corrected Data)

Azimuth Angle (Degrees)	Radiated Power	
	Vertical 9 deg	Horizontal 9 deg
0	17.77	-10.03
30	17.77	-11.03
60	17.77	-11.43
90	17.57	-12.03
120	17.77	-12.23
150	17.57	-13.23
180	17.37	-13.23
210	17.57	-13.63
240	17.37	-12.03
270	17.57	-11.43
300	17.77	-10.63
330	17.77	-10.63

ADDITIONAL ANTENNA DATA IN APPENDIX B

3.0 TEST FACILITY

LOCATION

The EUT was tested at the Electronics Test Centre, located in Kanata, Ontario, Canada.

GROUNDING PLAN

406 MHz Test

The EUT was located on a 2.5 meter circular ground plane 75 cm above the open field test sight ground plane according to the client's specifications.

121.6 MHz Test

The EUT was located in a 2 meter metallic turntable, which is flush mounted on a 12 meter by 20 meter rectangular ground plane according to the client's specifications.

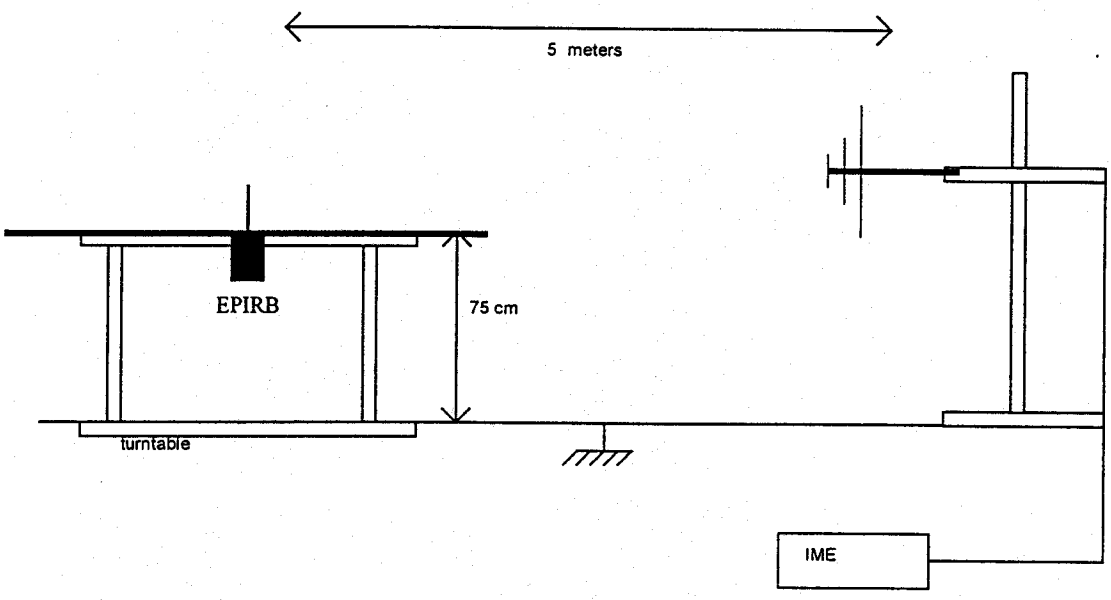
POWER

The EUT was powered via an on board battery pack.

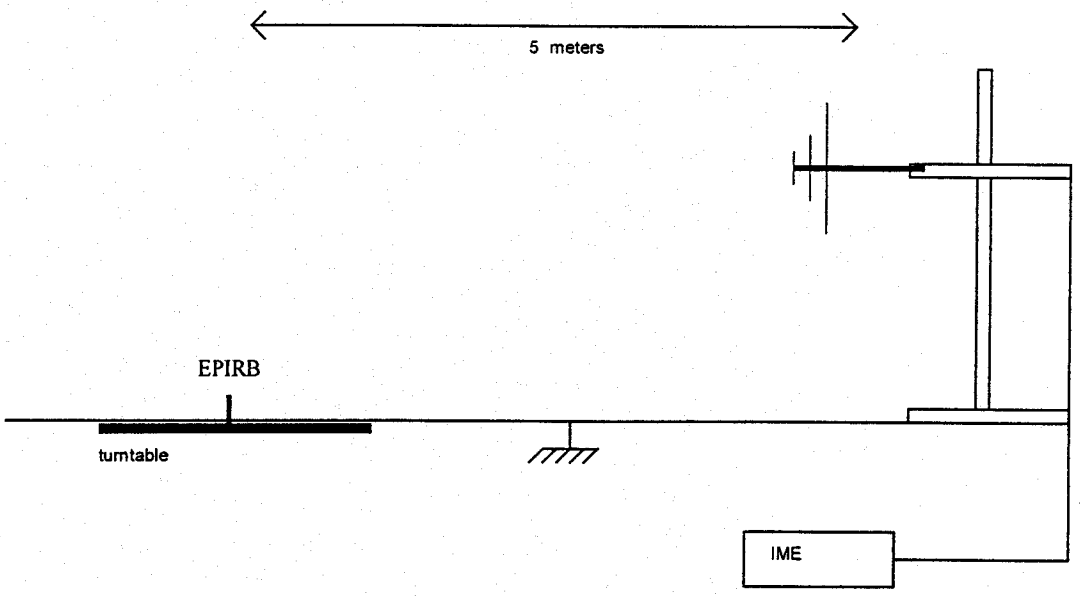
A-XVI-11

EPIRB Antenna Measurement Setup

406 MHz EPIRB Setup



121.6 MHz EPIRB Setup



4.0 TEST EQUIPMENT

The following equipment was utilized for this procedure. All measurement devices are calibrated annually, traceable to NIST. Please refer to Appendix A for calibration data.

a) Spectrum Analyzer
c) Power Isolation Transformers
d) Biconilog antenna (25 MHz to 2 GHz)
e) Antenna mast positioner, and controller
f) Flush-mounted turntable, and controller

APPENDIX A

EPIRB

Information Supplied by Client

A-XVI-14

APPENDIX B

TEST EQUIPMENT and CALIBRATION REPORT

ELECTRONICS TEST CENTRE
MPB TECHNOLOGIES INC.

Equipment used in test EPIRB - EPIRB (DAN2329)

Asset	Device	Characteristics	Manufacturer	Model #	Serial #	Cal Date	Cal Due Date
2831	analyzer	Spectrum Analyzer	Advantest	R4136	71220067	Dec 31, 1999	Dec 31, 2000
4281	antenna	Biconilog Antenna	Antenna Research	LPB-2520/A	1048	Dec 28, 1999	Dec 28, 2000
4527	Site 9	Display	PC /Monitor	hrv-1024	209k100479	Monitored	Monitored
4828	OATS	Open Area Test Site	MPBT			Oct 07, 2000	Oct 07, 2001

C:\Equipment Lists\DAN2329\EPIRB\EPIRB - EPIRB (Sep 22, 2000 - 09-24-26 AM).doc

ANTENNA RESEARCH INFORMATION

FOLLOWING PAGES

A.R.A.

EMC Innovative Solutions and Products
Antenna Research Associates, Inc
48 Wexford Drive
Oakdale, NY 11769
Phone: (631) 563-3616 • Fax: (631) 218-8895
E-mail tdarc5@cs.com
http://www.ara-inc.com

Antenna Research Associates, Inc.

DATE: 31 August 31, 2000

TO: Dan Zanette, Electronics Test Ctr. Tel#: (613) 599-6800
cc.
FROM: Tim D'Arcangelis, ARA FAX#: (613) 599-7614
SUBJECT: Beam width of LPB-2520 and LPB-2513 BiCog antennas.

FAX TRANSMISSION COVER SHEET

I'm sorry that we could not provide you with the measured beam width of the subject antenna at the requested frequencies. However, since talking to you I put together a spreadsheet for estimating the beamwidth vs "look-down" angle. To do this I made some reasonable assumptions.

1) The beamwidth of the log periodic antenna is virtually constant for a given gain. About 105 degrees in E-Field plane (vertical up-down angle) and 75 degrees in the H-Field plane (horizontal polarization up-down angle).

2) Since the LPB-2520 is a combination of two antennas (a broadband dipole and log periodic antenna) the assumption for beam width is not as clear, however, because the beamwidth is rather broad, the error due to an erroneous guess will be relatively small. A reasonable pattern assumption for this antenna is a dipole pattern with developing forward directivity (decreasing energy out the back). For this I assume180 degrees in the H-plane and 120 degrees in the E-plane.

With these assumptions we arrive at the following 3dB beamwidths and coverage on a half angle of 53 degrees (the results of a 4 meter height and a 3 meter transmit distance.

[illegible] total pages including this cover sheet. If all pages are not received, please call (631) 567-3594.
Please feel free to contact me if you require any additional information.

Engineering Services • Integration • Manufacturing

1) For 400 MHz (a pure log periodic pattern)

Up-down E-Field plane (vert. polarization) – Half angle radiation pattern = 37.5
The coverage at half angle 53° is –6dB.

Up-down H-Field plane (hor. polarization) – Half angle radiation pattern 53°
The coverage at half angle 53° is –3dB.

2) For 121 MHz (a hybrid pattern of dipole and log periodic antenna in the transition frequency area).

Up-down E-plane (vertical polarization) – Half angle radiation pattern = 60°
The coverage at half angle 53° is –2.3dB.

Up-down H-plane (horizontal polarization) – Half angle radiation pattern 90°
The coverage at half angle 53° is –1dB.

NOTE: I tried beamwidths above and below the estimated beam widths and found differences in the order of 1dB from the "reasonable estimate".

I believe these results are well within the expectations of the "formula" used in the standard that you mentioned.

Please call if you have any questions.

Sincerely,

Tom Steingel

ANNEX XVII. HUMIDITY

WSMR ELECTRONIC PROVING GROUND, US ARMY, FORT HUACHUCA, ARIZONA
MANU: SEIMAC MODEL NO: PROFIND 406 SERIAL NO: ~~029~~ 23 SCH
BEACON CERTIFICATION TEST RESULTS - Post Humidity Aliveness check
MEASUREMENT DATE: 12 Sep 2000 TIME: 14:54:28

TESTED BY: _____ APPROVED BY: Rosa Barrineau

SPECIFICATIONS TESTED	LIMITS	RESULTS	UNITS	COMMENTS
Nominal transmitted frequency	406.028 ±.001	406.027738	MHz	passed
Short term frequency stability	< 2.0E-9	5.82E-10		passed
Medium term: mean slope	< 1.0E-9	+1.36E-10	/min	passed
residual deviation	< 3.0E-9	2.65E-10		passed

WSMR ELECTRONIC PROVING GROUND, US ARMY, FORT HUACHUCA, ARIZONA
MANU: SEIMAC MODEL NO: PROFIND 406 SERIAL NO: 0~~29~~23 SCH
BEACON CERTIFICATION TEST RESULTS - Post HUMIDITY ALIVENESS CHECK
MEASUREMENT DATE: 12 Sep 2000 TIME: 14:35:10

TESTED BY: _____ APPROVED BY: Rosa Barrineau

SPECIFICATIONS TESTED	LIMITS	RESULTS	UNITS	COMMENTS
Tx ouput power level	3.15 TO 7.93	4.53	W	passed
Tx ouput power level	3.15 TO 7.93	4.53	W	passed
Tx ouput power level	3.15 TO 7.93	4.52	W	passed

WSMR ELECTRONIC PROVING GROUND, US ARMY, FORT HUACHUCA, ARIZONA
MANU: SEIMAC MODEL NO: PROFIND 406 SERIAL NO: 029~~23~~ 5CH
BEACON CERTIFICATION TEST RESULTS - Post Humidity Aliveness check
MEASUREMENT DATE: 12 Sep 2000 TIME: 14:55:35

TESTED BY: _____ **APPROVED BY:** Rosa Parrineau

BEACON DIGITAL MESSAGE VERIFICATION

SYNCHRONIZATION BIT #:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Should be:	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Decoded:	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

*** BIT SYNCHRONIZATION OK ***

FRAME SYNCHRONIZATION BIT #:	16	17	18	19	20	21	22	23	24
Should be:	0	0	0	1	0	1	1	1	1
Decoded:	0	0	0	1	0	1	1	1	1

*** FRAME SYNCHONIZATION OK ***

MESSAGE TYPE: SHORT MESSAGE (bit 25 = 0)

DIGITAL MESSAGE IN HEXADECIMAL: A D C D 0 0 0 0 0 C 4 0 4 0 1 2 5 4 1 8 2

BEACON BCH CODE VERIFICATION

BCH CODE BIT #:	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05	06
Should be:	0	0	1	0	0	1	0	1	0	1	0	0	0	0	0	1	1	0	0	0	0
Decoded:	0	0	1	0	0	1	0	1	0	1	0	0	0	0	0	1	1	0	0	0	0

*** BCH CODE OK ***

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ANNEX XVIII. ORIENTATION TEST

VERTICAL

WSMR ELECTRONIC PROVING GROUND, US ARMY, FORT HUACHUCA, ARIZONA
MANU: SEIMAC MODEL NO: PROFIND 406 SERIAL NO:029
BEACON CERTIFICATION TEST RESULTS - ORIENTATION TEST - VERT
MEASUREMENT DATE: 20 Jul 2000 TIME: 06:20:30

TESTED BY: _____ **APPROVED BY:** Rosa Barrineau

BEACON DIGITAL MESSAGE VERIFICATION

SYNCHRONIZATION BIT #:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Should be:	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Decoded:	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

*** BIT SYNCHRONIZATION OK ***

FRAME SYNCHRONIZATION BIT #:	16	17	18	19	20	21	22	23	24
Should be:	0	0	0	1	0	1	1	1	1
Decoded:	0	0	0	1	0	1	1	1	1

*** FRAME SYNCHONIZATION OK ***

MESSAGE TYPE: SHORT MESSAGE (bit 25 = 0)

DIGITAL MESSAGE IN HEXADECIMAL: A D C D 0 0 0 0 0 C 4 0 4 0 1 2 5 4 1 8 2

BEACON BCH CODE VERIFICATION

BCH CODE BIT #:	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05	06
Should be:	0	0	1	0	0	1	0	1	0	1	0	0	0	0	0	1	1	0	0	0	0
Decoded:	0	0	1	0	0	1	0	1	0	1	0	0	0	0	0	1	1	0	0	0	0

*** BCH CODE OK ***

WSMR ELECTRONIC PROVING GROUND, US ARMY, FORT HUACHUCA, ARIZONA
MANU: SEIMAC MODEL NO: PROFIND 406 SERIAL NO: 029
BEACON CERTIFICATION TEST RESULTS - ORIENTATION TEST - VERT
MEASUREMENT DATE: 20 Jul 2000 TIME: 06:28:20

TESTED BY: _____ APPROVED BY: Rosa Barrineau

SPECIFICATIONS TESTED	LIMITS	RESULTS	UNITS	COMMENTS
Nominal transmitted frequency	406.028 ±.001	406.028104	MHz	passed
Short term frequency stability	< 2.0E-9	4.06E-10		passed
Medium term: mean slope	< 1.0E-9	-1.02E-10	/min	passed
residual deviation	< 3.0E-9	7.37E-10		passed

WSMR ELECTRONIC PROVING GROUND, US ARMY, FORT HUACHUCA, ARIZONA
MANU: SEIMAC MODEL NO: PROFIND 406 SERIAL NO: 029
BEACON CERTIFICATION TEST RESULTS - ORIENTATION - VERT
MEASUREMENT DATE: 20 Jul 2000 TIME: 06:29:55
TESTED BY: APPROVED BY: Rosa Barrineau

SPECIFICATIONS TESTED	LIMITS	RESULTS	UNITS	COMMENTS
Tx ouput power level	3.15 TO 7.93	4.54	W	passed

HORIZONTAL

WSMR ELECTRONIC PROVING GROUND, US ARMY, FORT HUACHUCA, ARIZONA
MANU: SEIMAC MODEL NO: PROFIND 406 SERIAL NO: 029
BEACON CERTIFICATION TEST RESULTS - ORIENTATION TEST - HORIZ
MEASUREMENT DATE: 14 SEP 2000 TIME: 06:02:31

TESTED BY: _____ **APPROVED BY:** Rosa Barrineau

BEACON DIGITAL MESSAGE VERIFICATION

SYNCHRONIZATION BIT #:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Should be:	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Decoded:	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

*** BIT SYNCHRONIZATION OK ***

FRAME SYNCHRONIZATION BIT #:	16	17	18	19	20	21	22	23	24
Should be:	0	0	0	1	0	1	1	1	1
Decoded:	0	0	0	1	0	1	1	1	1

*** FRAME SYNCHONIZATION OK ***

MESSAGE TYPE: SHORT MESSAGE (bit 25 = 0)

DIGITAL MESSAGE IN HEXADECIMAL: A D C D 0 0 0 0 0 C 4 0 4 0 1 2 5 4 1 8 2

BEACON BCH CODE VERIFICATION

BCH CODE BIT #:	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05	06
Should be:	0	0	1	0	0	1	0	1	0	1	0	0	0	0	0	1	1	0	0	0	0
Decoded:	0	0	1	0	0	1	0	1	0	1	0	0	0	0	0	1	1	0	0	0	0

*** BCH CODE OK ***

WSMR ELECTRONIC PROVING GROUND, US ARMY, FORT HUACHUCA, ARIZONA
MANU: SEIMAC MODEL NO: PROFIND 406 SERIAL NO: 029
BEACON CERTIFICATION TEST RESULTS - ORIENTATION - HORIZ
MEASUREMENT DATE: 14 SEP 2000 TIME: 06:06:31

TESTED BY: _____ **APPROVED BY:** Rosa Barrineau

SPECIFICATIONS TESTED	LIMITS	RESULTS	UNITS	COMM
Tx ouput power level	3.15 TO 7.93	4.31	W	pas
Tx ouput power level	3.15 TO 7.93	4.30	W	pas
Tx ouput power level	3.15 TO 7.93	4.30	W	pas

WSMR ELECTRONIC PROVING GROUND, US ARMY, FORT HUACHUCA, ARIZONA
MANU: SEIMAC MODEL NO: PROFIND 406 SERIAL NO: 029
BEACON CERTIFICATION TEST RESULTS - ORIENTATED - HOME
MEASUREMENT DATE: 20 Jul 2000 TIME: 06:08:56

TESTED BY: C Baker APPROVED BY: Rosa Barrineau

SPECIFICATIONS TESTED	LIMITS	RESULTS	UNITS	COMMENTS
Nominal transmitted frequency	406.028 ±.001	406.028102	MHz	passed
Short term frequency stability	< 2.0E-9	4.37E-10		passed
Medium term: mean slope	< 1.0E-9	-1.58E-09	/min	failed
residual deviation	< 3.0E-9	7.79E-10		passed

UPSIDE DOWN

WSMR ELECTRONIC PROVING GROUND, US ARMY, FORT HUACHUCA, ARIZONA
MANU: SEIMAC MODEL NO: PROFIND 406 SERIAL NO:029
BEACON CERTIFICATION TEST RESULTS - ORIENTATION UPSIDE DOWN
MEASUREMENT DATE: 20 Jul 2000 TIME: 07:02:31
TESTED BY: _____ **APPROVED BY:** Rosa Barrineau

BEACON DIGITAL MESSAGE VERIFICATION

SYNCHRONIZATION BIT #:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Should be:	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Decoded:	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

*** BIT SYNCHRONIZATION OK ***

FRAME SYNCHRONIZATION BIT #:	16	17	18	19	20	21	22	23	24
Should be:	0	0	0	1	0	1	1	1	1
Decoded:	0	0	0	1	0	1	1	1	1

*** FRAME SYNCHONIZATION OK ***

MESSAGE TYPE: SHORT MESSAGE (bit 25 = 0)

DIGITAL MESSAGE IN HEXADECIMAL: A D C D 0 0 0 0 0 C 4 0 4 0 1 2 5 4 1 8 2

BEACON BCH CODE VERIFICATION

BCH CODE BIT #:	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05	06
Should be:	0	0	1	0	0	1	0	1	0	1	0	0	0	0	0	1	1	0	0	0	0
Decoded:	0	0	1	0	0	1	0	1	0	1	0	0	0	0	0	1	1	0	0	0	0

*** BCH CODE OK ***

WSMR ELECTRONIC PROVING GROUND, US ARMY, FORT HUACHUCA, ARIZONA
MANU: SEIMAC MODEL NO: PROFIND 406 SERIAL NO: 029
BEACON CERTIFICATION TEST RESULTS - ORIENTATION TEST - UPSIDE DOWN
MEASUREMENT DATE: 14 SEP 2000 TIME: 06:56:03

TESTED BY: _____ **APPROVED BY:** Rosa Barrineau

SPECIFICATIONS TESTED	LIMITS	RESULTS	UNITS	COMMENTS
Nominal transmitted frequency	406.028 ±.001	406.027738	MHz	passed
Short term frequency stability	< 2.0E-9	5.32E-10		passed
Medium term: mean slope	< 1.0E-9	+8.28E-11	/min	passed
residual deviation	< 3.0E-9	2.25E-10		passed

WSMR ELECTRONIC PROVING GROUND, US ARMY, FORT HUACHUCA, ARIZONA
MANU: SEIMAC MODEL NO: PROFIND 406 SERIAL NO: ~~029~~ 027 ~~028~~
BEACON CERTIFICATION TEST RESULTS - ORIENTATION UPSIDE DOWN
MEASUREMENT DATE: 20 Jul 2000 TIME: 07:00:55
TESTED BY: APPROVED BY: Rosa Barrineau

SPECIFICATIONS TESTED	LIMITS	RESULTS	UNITS	COMMENTS
Tx ouput power level	3.15 TO 7.93	4.53	W	passed
Tx ouput power level	3.15 TO 7.93	4.51	W	passed
Tx ouput power level	3.15 TO 7.93	4.50	W	passed

RETURN TO VERTICAL

WSMR ELECTRONIC PROVING GROUND, US ARMY, FORT HUACHUCA, ARIZONA
MANU: SEIMAC MODEL NO: PROFIND 406 SERIAL NO: 029
BEACON CERTIFICATION TEST RESULTS - ORIENTATION TEST RETURN TO VERT
MEASUREMENT DATE: 20 Jul 2000 TIME: 07:20:35

TESTED BY: _____ **APPROVED BY:** Rosa Barrineau

BEACON DIGITAL MESSAGE VERIFICATION

SYNCHRONIZATION BIT #:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Should be:	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Decoded:	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

*** BIT SYNCHRONIZATION OK ***

FRAME SYNCHRONIZATION BIT #:	16	17	18	19	20	21	22	23	24
Should be:	0	0	0	1	0	1	1	1	1
Decoded:	0	0	0	1	0	1	1	1	1

*** FRAME SYNCHONIZATION OK ***

MESSAGE TYPE: SHORT MESSAGE (bit 25 = 0)

DIGITAL MESSAGE IN HEXADECIMAL: A D C D 0 0 0 0 0 4 4 0 4 0 1 0 0 A A 9 A

BEACON BCH CODE VERIFICATION

BCH CODE BIT #:	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05	06
Should be:	0	0	0	0	0	0	0	0	1	0	1	0	1	0	1	0	1	0	0	1	1
Decoded:	0	0	0	0	0	0	0	0	1	0	1	0	1	0	1	0	1	0	0	1	1

*** BCH CODE OK ***

WSMR ELECTRONIC PROVING GROUND, US ARMY, FORT HUACHUCA, ARIZONA
MANU: SEIMAC MODEL NO: PROFIND 406 SERIAL NO: 029
BEACON CERTIFICATION TEST RESULTS - ORIENTATION TEST - RETURN TO VERT
MEASUREMENT DATE: 20 Jul 2000 TIME: 07:08:37

TESTED BY: JC VH **APPROVED BY:** Rosa Barrineau

SPECIFICATIONS TESTED	LIMITS	RESULTS	UNITS	COMMENTS
Nominal transmitted frequency	406.028 ±.001	406.028109	MHz	passed
Short term frequency stability	< 2.0E-9	4.58E-10		passed
Medium term: mean slope	< 1.0E-9	-1.37E-10	/min	passed
residual deviation	< 3.0E-9	7.02E-10		passed

WSMR ELECTRONIC PROVING GROUND, US ARMY, FORT HUACHUCA, ARIZONA
MANU: SEIMAC MODEL NO: PROFIND 406... SERIAL NO: 029
BEACON CERTIFICATION TEST RESULTS - ORIENTATION TEST RETURN TO VERT
MEASUREMENT DATE: 20 Jul 2000 TIME: 07:15:53

TESTED BY: [signature] **APPROVED BY:** Rosa Barrineau

SPECIFICATIONS TESTED	LIMITS	RESULTS	UNITS	COMMENTS
Tx ouput power level	3.15 TO 7.93	4.51	W	passed
Tx ouput power level	3.15 TO 7.93	4.53	W	passed

APPENDIX B. SUMMARY TEST RESULTS

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Table C2. SUMMARY OF TEST RESULTS

PARAMETERS TO BE MEASURED DURING TESTS	RANGE OF SPECIFICATION	UNITS	TEST RESULTS			COMMENTS
			T_{min} (-40° C)	T_{amb} (+20° C)	T_{max} (+55° C)	
1. INITIAL ALIVENESS TEST (A1.0)						
• Carrier Frequency	406.028 ±0.001	MHz		406.0281		
• Power Output	35 – 39	dBm		36.5		
2. DRY HEAT CYCLE (A3.0)						
• Aliveness Test (during 2-hour period)						
- Carrier Frequency	406.028 ±0.001	MHz			406.0279	
- Power Output	35 – 39	dBm			36.4	
• Aliveness Test (at end of 2-hour period)						
- Carrier Frequency	406.028 ±0.001	MHz			406.0279	
- Power Output	35 – 39	dBm			36.4	
3. DAMP HEAT CYCLE (A4.0)						
• Aliveness Test (during 2-hour period)						
- Carrier Frequency	406.028 ±0.001	MHz			406.0281	
- Power Output	35 – 39	dBm			36.5	
• Aliveness Test (at end of 2-hour period)						
- Carrier Frequency	406.028 ±0.001	MHz			406.0281	
- Power Output	35 – 39	dBm			36.5	

PARAMETERS TO BE MEASURED DURING TESTS	RANGE OF SPECIFICATION	UNITS	TEST RESULTS			COMMENTS
			T_{min} (-40° C)	T_{amb} (+20° C)	T_{max} (55° C)	
4. VIBRATION TEST (A5.0)						
• Exterior Mechanical Inspection	No damage	✓		✓		
Aliveness Test:						
- Carrier Frequency	406.028 ±0.001	MHz		406.0277		
- Power Output	35 – 39	dBm		36.3		
• Activation	No activation during test	✓		✓		
5. BUMP TEST (A6.0)						
• Exterior Mechanical Inspection	No damage	✓		✓		
• Aliveness Test:						
- Carrier Frequency	406.028 ±0.001	MHz		406.0281		
- Power Output	35 – 39	dBm		36.5		
• Activation	No activation during test	✓		✓		
6. SALT FOG TEST (A7.0)						
• Exterior Mechanical Inspection	No damage	✓		✓		
• Aliveness Test:						
- Carrier Frequency	406.028 ±0.001	MHz		406.0281		
- Power Output	35 – 39	dBm		36.5		

PARAMETERS TO BE MEASURED DURING TESTS	RANGE OF SPECIFICATION	UNITS	TEST RESULTS			COMMENTS
			T_{min} (-40° C)	T_{amb} (+20° C)	T_{max} (+55° C)	
7-A. DROP TEST (A8.1)						
On Hard Surface						
• Exterior Mechanical Inspection	No damage	✓	✓			
• Aliveness Test:						
- Carrier Frequency	406.028 ±0.001	MHz	406.0281			
- Power Output	35 – 39	dBm	36.8			
• Activation	No activation during test	✓	✓			
7-B. DROP TEST (A8.2)						
In Water						
• Exterior Mechanical Inspection	No damage	✓		✓		
• Aliveness Test:						
- Carrier Frequency	406.028 ±0.001	MHz		406.0281		
- Power Output	35 – 39	dBm		36.6		

PARAMETERS TO BE MEASURED DURING TESTS	RANGE OF SPECIFICATION	UNITS	TEST RESULTS			COMMENTS
			T_{min} (-40° C)	T_{amb} (+20° C)	T_{max} (+55° C)	
8. LEAKAGE AND IMMERSION TEST (A9.0)						
• Aliveness Test:						
- Carrier Frequency	406.028 ±0.001	MHz		406.028		
- Power Output	35 – 39	dBm		36.6		
• Interior Inspection	No water	✓		✓		
9. SPURIOUS EMISSIONS TEST (A10.0)						
• 406 MHz	Figure 2-1	✓ (attach graphs)		✓	✓	Part of C-S
• 121.5 MHz	Figure 2-6	✓ (attach graphs)		✓	✓	

PARAMETERS TO BE MEASURED DURING TESTS	RANGE OF SPECIFICATION	UNITS	TEST RESULTS			COMMENTS
			T_{min} (-40° C) Min Stowage to 0° C water*	T_{amb} (+20° C)	T_{max} (+55° C) Max Stowage to 25° C water*	
10. THERMAL SHOCK TEST (A11.0)			*		*	
• Self-Activation in Water	≤5	minutes	5 sec.		5 sec.	Fresh Water
• Aliveness Test:						*Stress cracks in dome felt and observed during low temp shock. No water penetration evident.
- Carrier Frequency	406.028 ±0.001	MHz	406.0279		406.0279	
- Power Output	35 – 39	dBm	36.9		36.8	
• Frequency Stability						
- Short-term Stability	≤0.002	parts/million in 100 ms	$7.09E^{-10}$		$3.59E^{-10}$	
- Medium-term Stability:						
Mean Slope	≤0.001	parts/million /minute	$5.45E^{-10}$		$3.44E^{-10}$	
Residual Frequency Variation	≤0.003	parts/million	$6.34E^{-10}$		$2.28E^{-10}$	

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PARAMETERS TO BE MEASURED DURING TESTS	RANGE OF SPECIFICATION	UNITS	TEST RESULTS			COMMENTS
			T_{min} (-40° C) Min Stowage to 0° C water*	T_{amb} (+20° C)	T_{max} (+55° C) Max Stowage to 25° C water*	
10A. THERMAL SHOCK TEST (A11.0)			*		*	
• Self-Activation in Water	≤5	minutes	1		4 sec.	Salt Water
• Aliveness Test:						
- Carrier Frequency	406.028 ±0.001	MHz	406.0279		406.0279	
- Power Output	35 – 39	dBm	36.9		35.9	
• Frequency Stability						
- Short-term Stability	≤0.002	parts/million in 100 ms	$6.90E^{-10}$		$3.76E^{-10}$	
- Medium-term Stability:						
Mean Slope	≤0.001	parts/million /minute	$5.26E^{-10}$		$3.17E^{-10}$	
Residual Frequency Variation	≤0.003	parts/million	$3.84E^{-10}$		$1.93E^{-10}$	
11. COSPAS-SARSAT TYPE APPROVAL TESTS (A12.0)	C-S Certificate (attach test report)	✓	✓	✓	✓	

PARAMETERS TO BE MEASURED DURING TESTS	RANGE OF SPECIFICATION	UNITS	TEST RESULTS			COMMENTS
			T_{min} (-40° C)	T_{amb} (+20° C)	T_{max} (+55° C)	
12. OPERATIONAL LIFE, STROBE LIGHT, AND SELF-TESTS (A13.0)						
Operational Life						ETERN Battery
• Frequency						
• Nominal Carrier	406.028 ±0.001	MHz	406.0278			
• Short-term Stability	≤0.002	parts/million in 100 ms	$7.0E^{-10}$			
• Medium-term Stability						
- Mean Slope	≤0.001	parts/ million/ minute	$1.0E^{-10}$			
- Residual Variation	≤0.003	parts/million	$2.5E^{-10}$			
• RF Power Output	35 – 39	dBm	36.8			
• Strobe Flash Rate	20 – 30	/min	21			
• Auxiliary Radio-Locating Peak Envelope Output Power	14 – 20	dBm	14.7			

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PARAMETERS TO BE MEASURED DURING TESTS	RANGE OF SPECIFICATION	UNITS	TEST RESULTS			COMMENTS
			T_{min} (-40° C)	T_{amb} (+20° C)	T_{max} (+55° C)	
12A. OPERATIONAL LIFE, STROBE LIGHT, AND SELF-TESTS (A13.0)						
Operational Life						SAFT Battery
• Frequency						
• Nominal Carrier	406.028 ±0.001	MHz	406.0278			
• Short-term Stability	≤0.002	parts/million in 100 ms	$6.5E^{-10}$			
• Medium-term Stability						
- Mean Slope	≤0.001	parts/ million/ minute	0			
- Residual Variation	≤0.003	parts/million	$3.0E^{-10}$			
• RF Power Output	35 – 39	dBm	36.9			
• Strobe Flash Rate	20 – 30	/min	20			
• Auxiliary Radio-Locating Peak Envelope Output Power	14 – 20	dBm	14.4			

PARAMETERS TO BE MEASURED DURING TESTS	RANGE OF SPECIFICATION	UNITS	TEST RESULTS			COMMENTS
			T_{min} (-40° C)	T_{amb} (+20° C)	T_{max} (+55° C)	
12.1 STROBE LIGHT TEST (A13.2)						
• Flash Rate	20 - 30	/min	20	21	20	
• Effective Intensity	≥0.75	Cd	0.85	0.84	0.89	
• Pulse Duration	10^{-6} to 10^{-2}	s	$1.1E^{-4}$	$8.5E^{-5}$	$1.5E^{-4}$	
12.2 SELF-TEST (A13.2)						
• RF Pulse Duration	≤0.444 sec	✓	✓	✓	✓	Part of C-S
• Frame Synchronization Pattern	0 1101 0000	✓	✓	✓	✓	
• Number of RF Bursts	1 Burst	✓	✓	✓	✓	

PARAMETERS TO BE MEASURED DURING TESTS	RANGE OF SPECIFICATION	UNITS	TEST RESULTS			COMMENTS
			T_{min} Stowage (-50° C)	T_{amb} (+20° C)	T_{max} Stowage (+70° C)	
13. AUTOMATIC RELEASE MECHANISM TEST (A14.0)						
• Normal Mounted Orientation	Release and float free before 4 meters; automatic activation	✓	✓	✓	✓	Part No. 57500
• Rolling 90° Starboard		✓		✓		
• Rolling 90° Port		✓		✓		
• Rolling 90° Bow Down		✓		✓		
• Rolling 90° Stern Down		✓		✓		
• Upside Down		✓		✓		
13A. AUTOMATIC RELEASE MECHANISM TEST (A14.0)						
• Normal Mounted Orientation	Release and float free before 4 meters; automatic activation	✓	✓	✓	✓	HAMMAR H 20
• Rolling 90° Starboard		✓		✓		
• Rolling 90° Port		✓		✓		
• Rolling 90° Bow Down		✓		✓		
• Rolling 90° Stern Down		✓		✓		
• Upside Down		✓		✓		

PARAMETERS TO BE MEASURED DURING TESTS	RANGE OF SPECIFICATION	UNITS	TEST RESULTS			COMMENTS
			T_{min} Stowage (-50° C)	T_{amb} (+20° C)	T_{max} Stowage (+70° C)	
14. STABILTY AND BUOYANCY TEST (A16.0)						
• Time to Upright	≤2	s		1.5		
• Reserve Buoyancy	≥5	%		27		
• Float Upright; Antenna Base	>4	cm		4.1		
15. INADVERTENT ACTIVATION TEST (A16.0)						
• Activation/Release	UUT should not release from bracket or automatically activate	✓		✓		

PARAMETERS TO BE MEASURED DURING TESTS	RANGE OF SPECIFICATION	UNITS	TEST RESULTS			COMMENTS
			T_{min} (-40° C)	T_{amb} (+20° C)	T_{max} (+55° C)	
16. AUXILIARY RADIO-LOCATING DEVICE TRANSMITTER TEST (A17.0)						
• Carrier Frequency	121.5 ±0.006	MHz	121.499	121.498	121.498	
• PERP	14 - 20	dBm	14.7	14.6	17	
• Duty Cycle	100	%	100	100	100	
• Modulation						
- Frequency	≥700 Hz within range of 300 – 1600 Hz	Hz	370-1111 741	354-1136 782	357-1204 847	
- Direction	Upward	✓	✓	✓	✓	
- Duty Cycle	33 – 55	%	47	48	46	
- Factor	0.85 – 1.0	#	1.0	1.0	0.99	
- Sweep Repetition Rate	2 – 4	Hz	2.1	2.2	2.1	
• Antenna						
- Pattern	Omni-directional	✓		✓		
- Polarization	Vertical	✓		✓		
- VSWR	≤1.5:1	✓		N/A not removable		

PARAMETERS TO BE MEASURED DURING TESTS	RANGE OF SPECIFICATION	UNITS	TEST RESULTS			COMMENTS
			T_{min} (-40° C)	T_{amb} (+20° C)	T_{max} (+55° C)	
17. HUMIDITY TEST (A18.0)						
• Aliveness Test:						
- Carrier Frequency	406.028 ±0.001	MHz			406.0277	
- Power Output	35 – 39	dBm			36.6	
18. ORIENTATION TEST (A19.0)						
VERTICAL						
• Aliveness Test:						
- Carrier Frequency	406.028 ±0.001	MHz		406.028		
- Power Output	35 – 39	dBm		36.6		
UPSIDE DOWN						
• Aliveness Test:						
- Carrier Frequency	406.028 ±0.001	MHz		406.028		
- Power Output	35 – 39	dBm		36.5		
HORIZONTAL						
• Aliveness Test:						
- Carrier Frequency	406.028 ±0.001	MHz		406.028		
- Power Output	35 – 39	dBm		36.6		

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APPENDIX C. PHASE MODULATION FAILURE

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Technical Report – TR-419-99-013 V1.1
Oct 30, 2000
Phase Modulation Failure

Revision History	Date	Change
Initial Release V1.0	Sept 22, 2000	
Release V1.1	Oct 30, 2000	Added Addendum section

During certification testing the ProFind 406 EPIRB failed the phase modulation test at low temperatures. An investigation was carried out to determine the cause of this failure.

1. Phase Modulation Circuit

Phase modulation in the ProFind 406 is achieved by injecting an offset current into the feedback loop of the phase-lock-loop (PLL) circuit. A simplified schematic diagram for the circuit is shown in Figure 1.

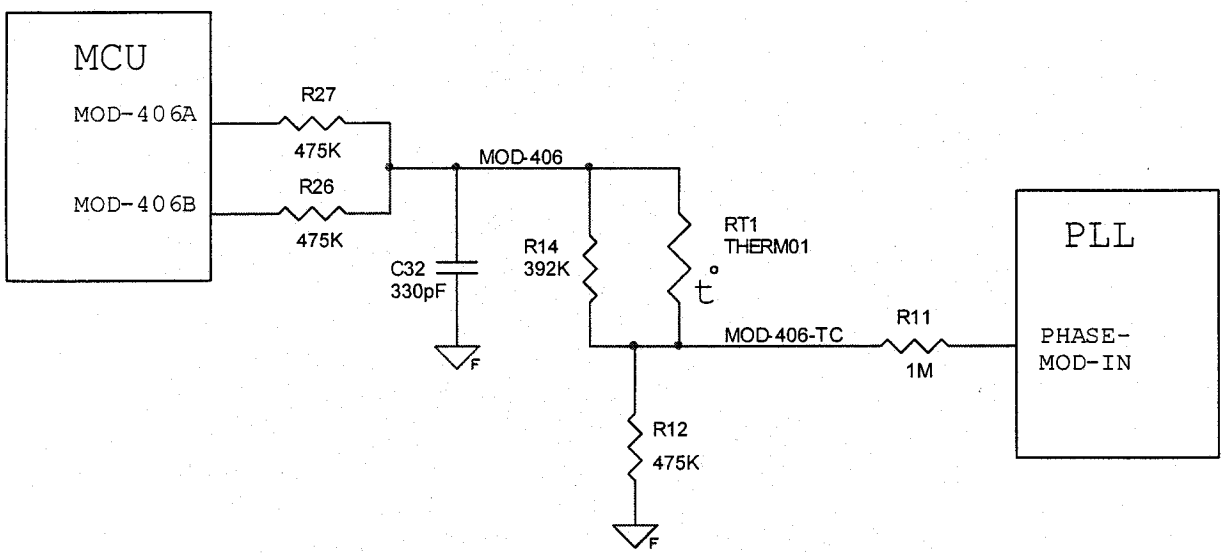

Figure 1. Phase Modulation Circuit

2. Theory of Operation

Digital signals *MOD-406A* and *MOD-406B* from the micro-controller (MCU) are set to one of three different state to achieve the different levels of modulation:

a) During un-modulated carrier (zero phase modulation), *MOD-406A* is set high and *MOD-406B* is set low.
b) For +1.1 radian phase modulation both *MOD-406A* and *MOD-406A* are set high.
c) For -1.1 radian phase modulation both *MOD-406A* and *MOD-406A* are set low.

Signal *MOD-406* is a summing point whose nominal voltage will be one of three levels depending on the modulation state (+1.1, 0, or –1.1 radians). Capacitor C32 controls the rise and fall time of the modulation signal.

Resistor R14 in parallel with thermistor RT1 and series resistor R12 provide a voltage divider network whose output signal *MOD-406-TC*. The current through resistor R11 is proportional to the voltage at *MOD-406-TC* and is used to phase modulate the PLL. The sensitivity of the modulation input signal *PHASE-MOD-IN* is temperature dependent. It is less sensitive at high temperatures. To compensate for this effect, thermistor RT1 is used to increase the modulation current signal into the PLL. The overall effect is to have a relatively constant phase modulation of the PLL over the operating temperature range.

3. Cause of Failure

The circuit described above has been used in several ARGOS transmitter circuits which have a similar phase modulation specifications. Some minor changes were required to adapt the design for the ProFind 406 because of different operating voltages.

During the development and in-house testing, the test engineer found that the phase modulation level measurements were too low (by about 0.1 radians). To increase the modulation he increased the value of R12 from 375K to 475k. This increased the modulation level but he also inadvertently changed the temperature characteristic of the compensating circuit.

The circuit was tested after the resistor value was changed but due to a malfunctioning test chamber, the circuit was only tested over a temperature range of -20°C to +55°C. If the circuit had been tested over the complete temperature range it would have shown that the modulation levels were too high at low temperatures.

As a result of this investigation we found that the in-house test measurements were performed with an uncalibrated instrument which gave readings which were low by about 0.1 radians. The assumption that the modulation level needed to be increased was false. Changing the resistor value increased the modulation level unnecessarily and caused the circuit to exceed the modulation specifications at low temperature. Unfortunately this was not tested sufficiently prior to certification testing.

4. Modulation Symmetry

More detailed in-house testing on separate test units has confirmed the findings at Fort Huachuca. The test results not only indicate that the average modulation levels are too high, but that there is a small offset between the positive modulation level and the negative modulation level. This is caused by the fact that the phase detector response is not quite symmetrical about its operating point. It is slightly more sensitive in the positive direction than the negative direction.

This asymmetry can be corrected by changing the relative values of R26 and R27. The optimum values for R26 and R27 are being evaluated presently.

5. Recommendations

Changing the resistor value R12 should bring the phase modulation with the specified limits. Further testing is recommended to determine the optimum value to minimize the variation with temperature.

It is also recommended that the values of R26 and R27 be changed slightly to make the positive and negative levels more symmetrical which would provide more head room for unit to unit variation.

Addendum

Further investigation found that the following component values should be changed:

Component	Changed from	Changed to
R26	475K	No change
R27	475K	500K
R12	402K	475K

APPENDIX D. DISTRIBUTION

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