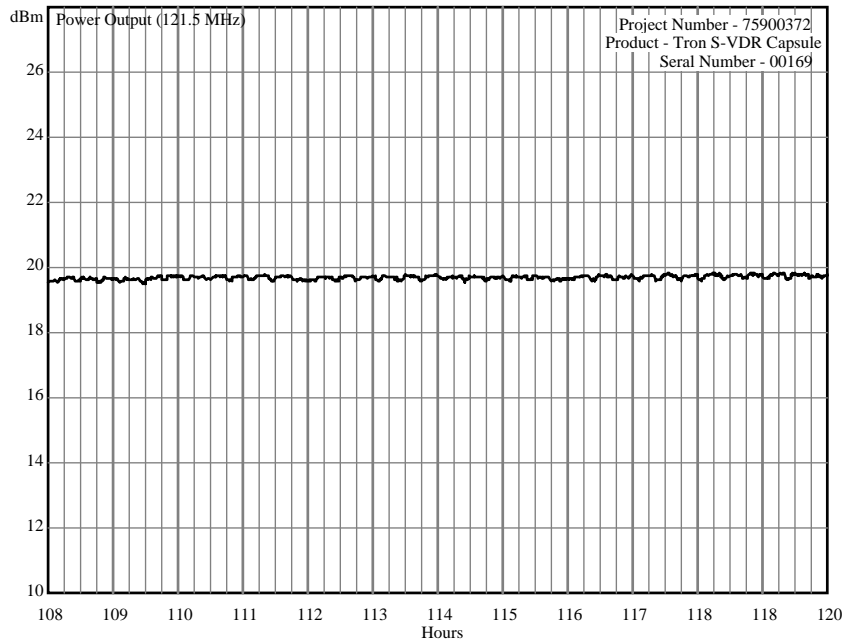
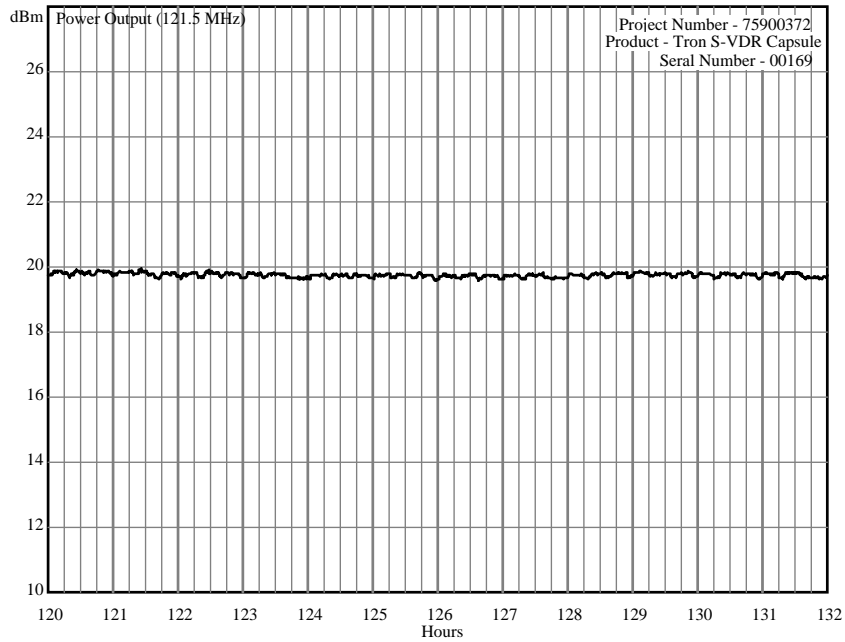


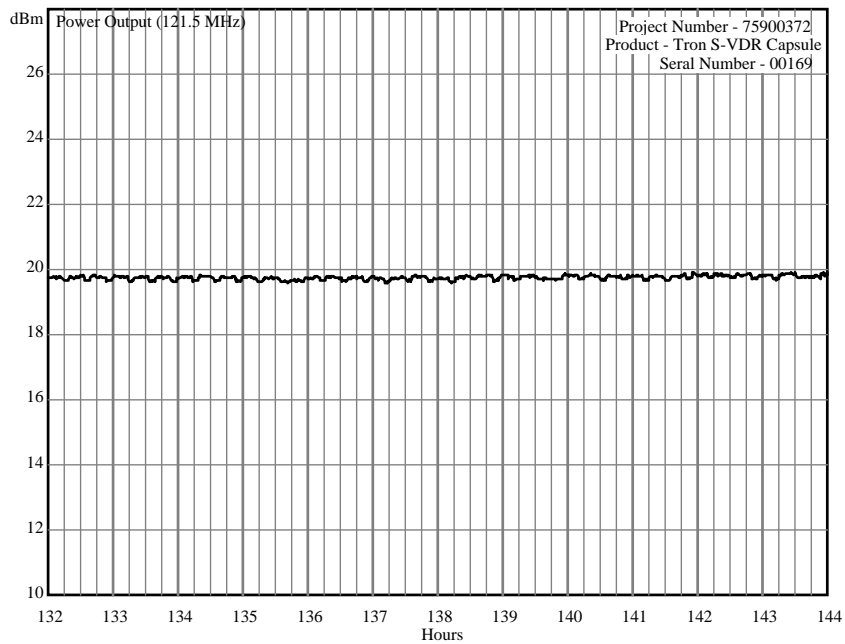
Power Graph 11



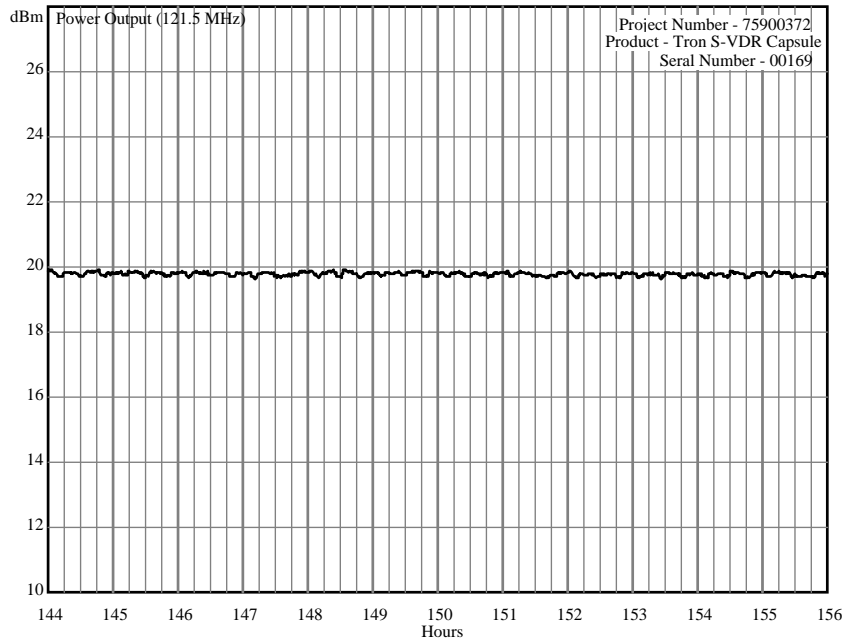
Power Graph 12



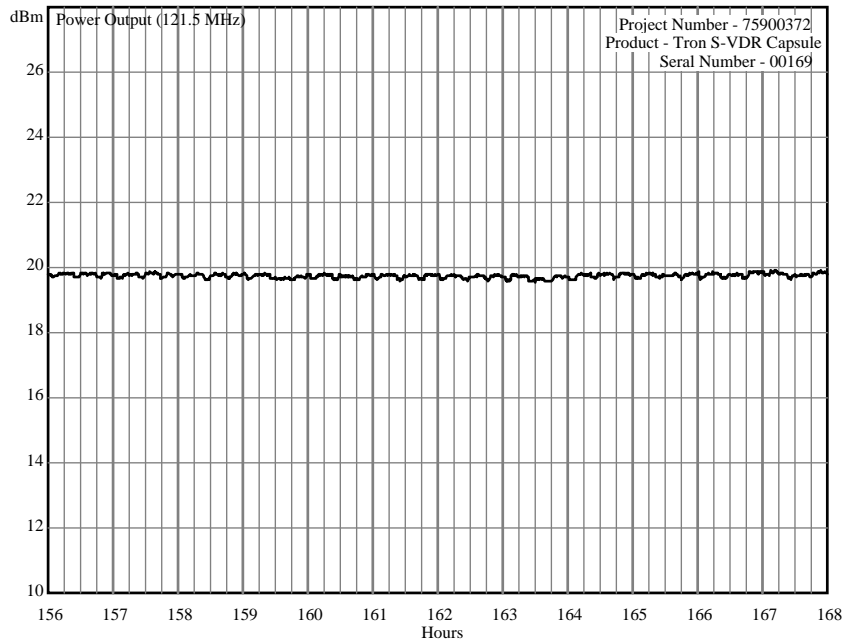
Power Graph 13



Power Graph 14



Power Graph 15



Power Graph 16



Product Service

## 2.14 STROBE LIGHT TEST

### 2.14.1 Specification Reference

RTCM Paper 77-2002/SC110-STD, Clause A13.2

### 2.14.2 Equipment Under Test

TÜV testing only: Tron S-VDR Capsule, Serial Number 00169; and Tron S-VDR Capsule with bracket, Serial Number: 100AA102. Note: this sample not TÜV controlled, see Test Results, below.

### 2.14.3 Date of Test and Modification State

TÜV testing only: 4<sup>th</sup> October 2007 - Modification State 1

### 2.14.4 Test Equipment Used

TÜV testing only: The major items of test equipment used for the above tests are identified in Section 3.1.

### 2.14.5 Test Set-up and Operating Modes

TÜV testing only: The test was performed with the EUT in the following mode(s): Operating

### 2.14.6 Environmental Conditions

Ambient Temperature 21.6°C  
Relative Humidity 55%  
Atmospheric Pressure 1018mbar

### 2.14.7 Test Results

Tests (see note, below) completed as per customer supplied information, see Annex A.

Note: All tests completed as per customer supplied information under Clause A13.2 except strobe light duration; this was not completed at extreme operating temperatures. Test was conducted under the scope of this report at all three temperatures – extreme operating high, low and ambient for comparison (customer supplied information indicated a pulse duration of approximately 40us).

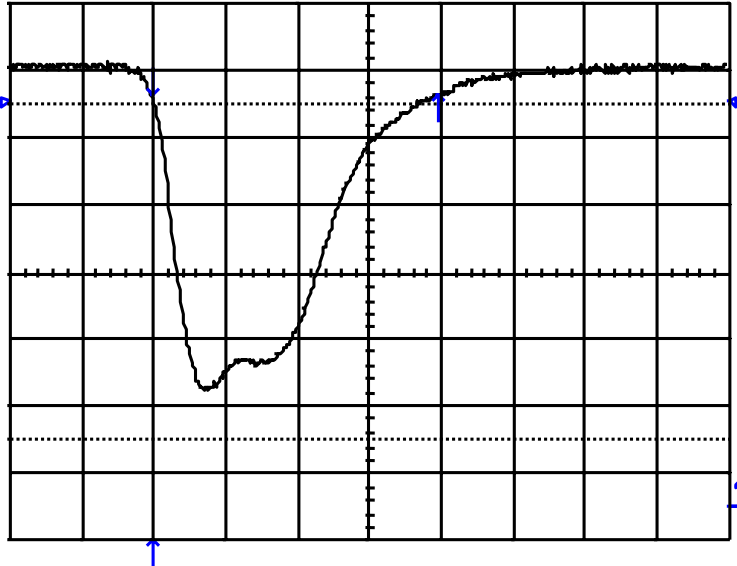
#### Strobe Light Duration Summary

Parameter	Units	Test Results		
		T <sub>min</sub> (-20°C)	T <sub>amb</sub> (21.6°C)	T <sub>max</sub> (+55°C)
Pulse duration, 10% Points	Us	39.4	39.9	38.9



4-Oct-07  
11:14:37

1  
10  $\mu$ s  
2.00 V  
-0.06 V



10  $\mu$ s  
1 2 V DC  
2 1 V +

$\Delta t$  39.90  $\mu$ s  $\frac{1}{\Delta t}$  25.062 kHz

10 MS/s

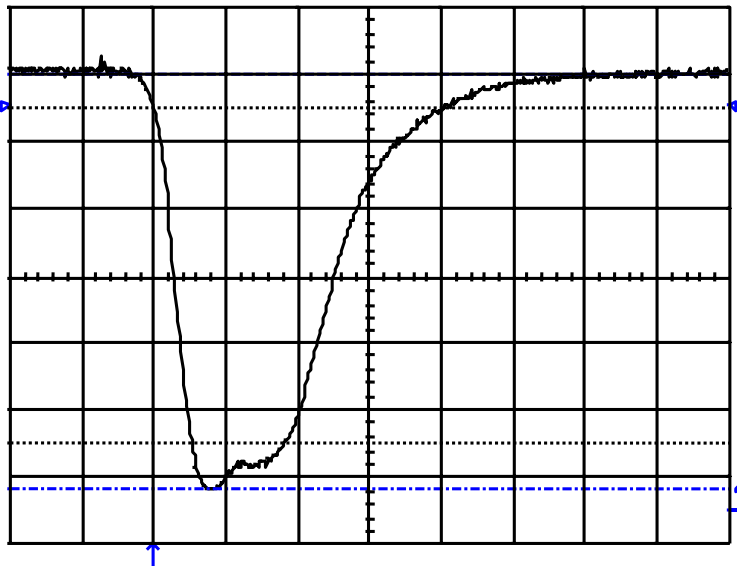
1 DC 12.04 V

STOPPED

Pulse Duration – Ambient

4-Oct-07  
13:39:08

1  
10  $\mu$ s  
2.00 V  
12.38 V



10  $\mu$ s  
1 2 V DC  
2 1 V +

1 DC 12.04 V

10 MS/s

STOPPED

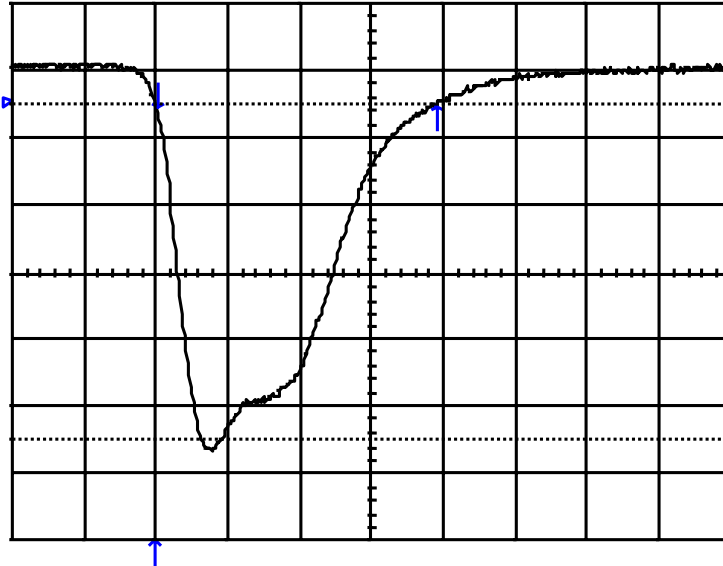
Pulse Duration – High Temperature (+55°C)



Product Service

4-Oct-07  
18:21:33

1  
10  $\mu$ s  
2.00 V  
0.01 V



10  $\mu$ s  
1 2 V DC  
2 1 V +

$\Delta t$  38.90  $\mu$ s  $\frac{1}{A}$  25.706 kHz

1 DC 12.04 V

MEASURE

Off Cursors  
Parameters

mode  
Time  
Amplitude

type  
Relative  
Absolute

show  
Diff - Ref  
Diff & Ref

Reference  
cursor  
Track Off On

Di fference  
cursor

10 MS/s

STOPPED

Pulse Duration – Low Temperature (-20°C)



Product Service

## 2.15 SELF-TEST

### 2.15.1 Specification Reference

RTCM Paper 77-2002/SC110-STD, Clause A13.2

### 2.15.2 Equipment Under Test

Tron S-VDR Capsule, Serial Number 00169

### 2.15.3 Date of Test and Modification State

Test at Ambient: 30<sup>th</sup> August 2007 - Modification State 1  
 Test at +55°C: 22<sup>nd</sup> June 2007 - Modification State 0  
 Test at -20°C: 11<sup>th</sup> July 2007 - Modification State 0

### 2.15.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

### 2.15.5 Test Set-up and Operating Modes

The test was performed with the EUT in the following mode(s): Operating and Self-test

### 2.15.6 Environmental Conditions

	20 <sup>th</sup> June 2007	11 <sup>th</sup> July 2007	30 <sup>th</sup> August 2007
Ambient Temperature	23.5°C	24.2°C	22.0°C
Atmospheric Pressure	1004mbar	1008mbar	1017mbar

### 2.15.7 Test Results

#### Summary of Aliveness test results

Stage	Pass / Fail
Ambient Aliveness Test	Pass
Ambient Self-test	Pass
High Temperature (+55°C) Aliveness Test	Pass
High Temperature (+55°C) Self-test	Pass
Low Temperature (-20°C) Aliveness Test	Pass
Low Temperature (-20°C) Self-test	Pass



Product Service

Beacon Test Report (Aliveness Test, Ambient Temperature)

**Beacon Test Report**  
203C4D8152FFBFF

**Organization:**  
**Tested By:**  
**Date:** 30-Aug-07 11:23:26 AM  
**Tester Model/Serial No./File Name:** BT100S/1025/00372-ST-3  
**Tester Cal Due Date:** Nov 10, 2006  
**Tester Temperature:** 23°C

**PASS**       **FAIL**      **INITIALS:** \_\_\_\_\_

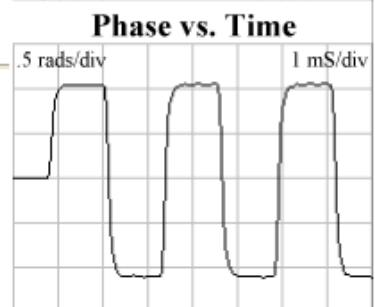
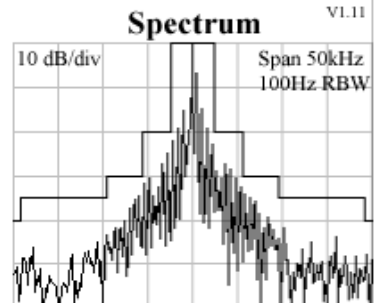
**Notes:** Add text comments here.

**15 Hex ID:** 203C4D8152FFBFF  
**Full Hex:** FFFE2F901E26C0A97FDFFE74CF3783E0F66C  
**Burst Mode:** Normal Mode (Long)  
**Protocol:** Standard Test Protocol  
**Country 257:** Norway  
**Bits 41 - 64:** 2539689

**Position Source:** Internal GPS  
**Auxiliary Radio:** 121.5 MHz  
**Bits 107-110:** Default  
**Latitude:** \* \* \* \* \*  
**Longitude:** \* \* \* \* \*

**406 MHz Measurements**  
**406 Frequency (INT REF):** 406.0279 MHz  
**406 Power (5 Watt):** 36.8 dBm  
**Power Rise Time:** < 5 ms  
**Phase Deviation:** -1.1 +1.04 radians  
**Modulation Rise Time:** 198 uS  
**Modulation Fall Time:** 198 uS  
**Modulation Symmetry:** 0.3%  
**Modulation Bit Rate:** 398.5 bps  
**CW Preamble:** 160 ms

**DISCLAIMER:** IN NO EVENT SHALL WS TECHNOLOGIES INC. OR ITS DISTRIBUTORS OR AGENTS BE LIABLE FOR ANY DAMAGES OR LOSSES INCURRED AS A RESULT OF THE USE OR FAILURE OF THIS MEASUREMENT EQUIPMENT.







Product Service

Beacon Test Report (Self-test, Ambient Temperature)

**Beacon Test Report**  
203C4D8152FFBFF

**Organization:**  
**Tested By:**  
**Date:** 30-Aug-07 12:09:13 PM  
**Tester Model/Serial No./File Name:** BT100S/1025/00372-ST-6  
**Tester Cal Due Date:** Nov 10, 2006  
**Tester Temperature:** 20°C

**PASS**       **FAIL**      **INITIALS:** \_\_\_\_\_

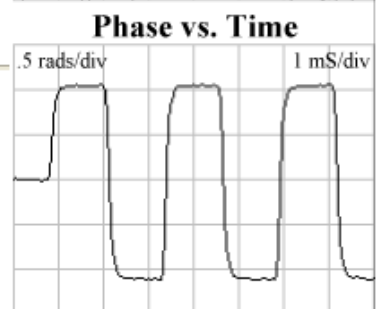
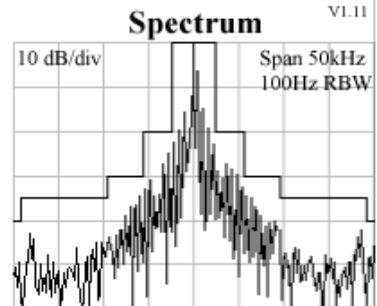
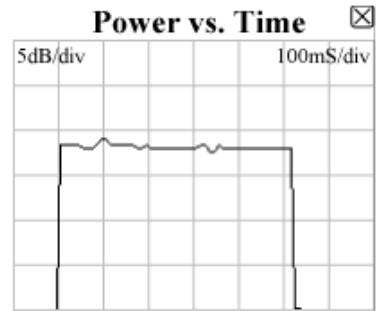
Notes: Add text comments here.

**15 Hex ID:** 203C4D8152FFBFF  
**Full Hex:** FFFED0901E26C0A97FDFFE74CF3783E0F66C  
**Burst Mode:** Self Test Mode (Long)  
**Protocol:** Standard Test Protocol  
**Country 257:** Norway  
**Bits 41 - 64:** 2539689

**Position Source:** Internal GPS  
**Auxiliary Radio:** 121.5 MHz  
**Bits 107-110:** Default  
**Latitude:** \* \* \* \* \*  
**Longitude:** \* \* \* \* \*

**406 MHz Measurements**  
**406 Frequency (INT REF):** 406.0279 MHz  
**406 Power (5 Watt):** 37.8 dBm  
**Power Rise Time:** < 5 ms  
**Phase Deviation:** -1.1 +1.04 radians  
**Modulation Rise Time:** 209 uS  
**Modulation Fall Time:** 198 uS  
**Modulation Symmetry:** 0%  
**Modulation Bit Rate:** 398.5 bps  
**CW Preamble:** 159.9 ms

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Product Service

Beacon Test Report (Aliveness Test, High Temperature, +55°C)

## Beacon Test Report

203C4D8152FFBFF

**Organization:** TUV Product Service Ltd  
**Tested By:** Emergency Beacons Dept.  
**Date:** 22-Jun-07 9:31:36 AM  
**Tester Model/Serial No./File Name:** BT100S/1025/75900372\_ST+55-1  
**Tester Cal Due Date:** Nov 10, 2006  
**Tester Temperature:** 31°C

**PASS**     
  **FAIL**     
 **INITIALS:** \_\_\_\_\_

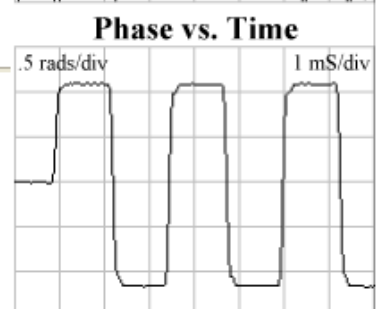
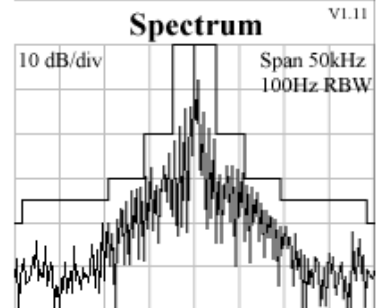
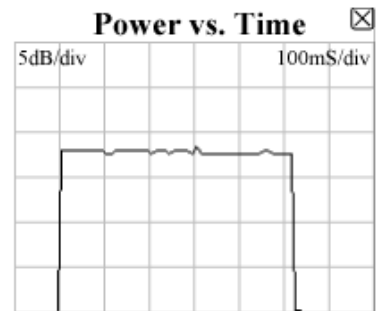
Notes: Add text comments here.

**15 Hex ID:** 203C4D8152FFBFF  
**Full Hex:** FFFE2F901E26C0A97FDFFE74CF3783E0F66C  
**Burst Mode:** Normal Mode (Long)  
**Protocol:** Standard Test Protocol  
**Country 257:** Norway  
**Bits 41 - 64:** 2539689

**Position Source:** Internal GPS  
**Auxiliary Radio:** 121.5 MHz  
**Bits 107-110:** Default  
**Latitude:** \* \* \* \* \*  
**Longitude:** \* \* \* \* \*

**406 MHz Measurements**  
**406 Frequency (INT REF):** 406.0279 MHz  
**406 Power (5 Watt):** 36.5 dBm  
**Power Rise Time:** : < 5 ms  
**Phase Deviation:** -1.16 +1.08 radians  
**Modulation Rise Time:** 177 uS  
**Modulation Fall Time:** 165 uS  
**Modulation Symmetry:** 0.3%  
**Modulation Bit Rate:** 397.9 bps  
**CW Preamble:** 159.2 ms

**DISCLAIMER:** IN NO EVENT SHALL WS TECHNOLOGIES INC. OR ITS DISTRIBUTORS OR AGENTS BE LIABLE FOR ANY DAMAGES OR LOSSES INCURRED AS A RESULT OF THE USE OR FAILURE OF THIS MEASUREMENT EQUIPMENT.





Product Service

Beacon Test Report (Self-test, High Temperature, +55°C)

## Beacon Test Report

203C4D8152FFBFF

**Organization:** TUV Product Service Ltd  
**Tested By:** Emergency Beacons Dept.  
**Date:** 22-Jun-07 9:38:06 AM  
**Tester Model/Serial No./File Name:** BT100S/1025/75900372\_ST+55-2  
**Tester Cal Due Date:** Nov 10, 2006  
**Tester Temperature:** 28°C

**PASS**     
  **FAIL**     
 **INITIALS:** \_\_\_\_\_

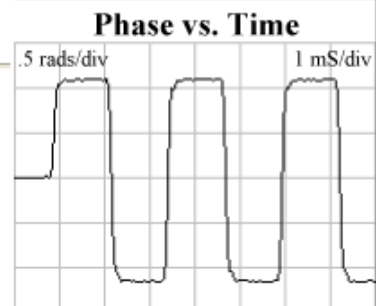
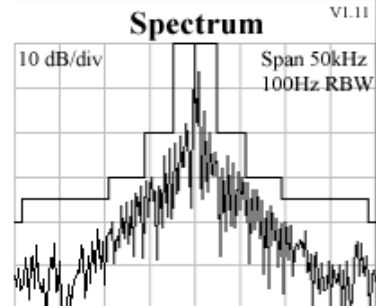
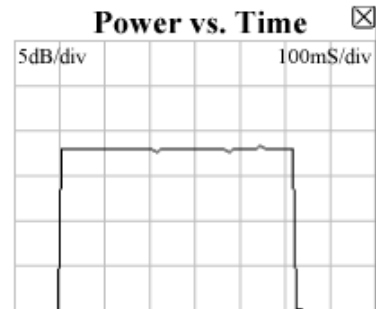
Notes: Add text comments here.

**15 Hex ID:** 203C4D8152FFBFF  
**Full Hex:** FFFED0901E26C0A97FDFFE74CF3783E0F66C  
**Burst Mode:** Self Test Mode (Long)  
**Protocol:** Standard Test Protocol  
**Country 257:** Norway  
**Bits 41 - 64:** 2539689

**Position Source:** Internal GPS  
**Auxiliary Radio:** 121.5 MHz  
**Bits 107-110:** Default  
**Latitude:** \* \* \* \* \*  
**Longitude:** \* \* \* \* \*

**406 MHz Measurements**  
**406 Frequency (INT REF):** 406.0279 MHz  
**406 Power (5 Watt):** 37 dBm  
**Power Rise Time:** : < 5 ms  
**Phase Deviation:** -1.15 +1.09 radians  
**Modulation Rise Time:** 92 uS  
**Modulation Fall Time:** 117 uS  
**Modulation Symmetry:** 0.3%  
**Modulation Bit Rate:** 397.9 bps  
**CW Preamble:** 160 ms

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 DISTRIBUTORS OR AGENTS BE LIABLE FOR ANY DAMAGES OR  
 LOSSES INCURRED AS A RESULT OF THE USE OR FAILURE OF THIS  
 MEASUREMENT EQUIPMENT.





Product Service

Beacon Test Report (Aliveness Test, Low Temperature, -20°C)

## Beacon Test Report

203C4D8152FFBFF

**Organization:** TUV Product Service Ltd  
**Tested By:** Emergency Beacons Dept.  
**Date:** 22-Jun-07 2:57:01 PM  
**Tester Model/Serial No./File Name:** BT100S/1025/75900372\_ST-20-1  
**Tester Cal Due Date:** Nov 10, 2006  
**Tester Temperature:** 26°C

**PASS**       **FAIL**      **INITIALS:** \_\_\_\_\_

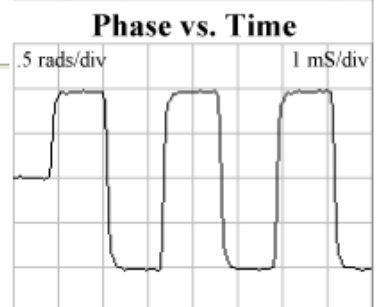
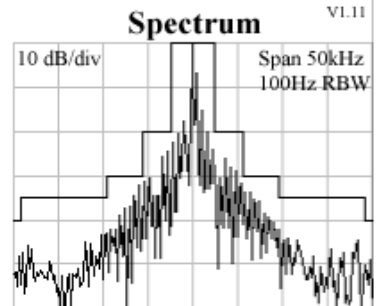
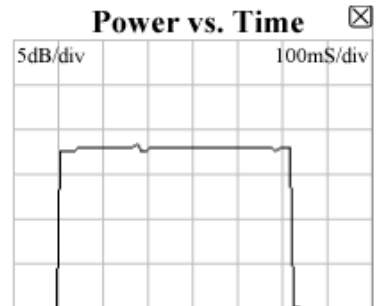
Notes: Add text comments here.

**15 Hex ID:** 203C4D8152FFBFF  
**Full Hex:** FFFE2F901E26C0A97FDFFE74CF3783E0F66C  
**Burst Mode:** Normal Mode (Long)  
**Protocol:** Standard Test Protocol  
**Country 257:** Norway  
**Bits 41 - 64:** 2539689

**Position Source:** Internal GPS  
**Auxiliary Radio:** 121.5 MHz  
**Bits 107-110:** Default  
**Latitude:** \* \* \* \* \*  
**Longitude:** \* \* \* \* \*

**406 MHz Measurements**  
**406 Frequency (INT REF):** 406.028 MHz  
**406 Power (5 Watt):** 36.9 dBm  
**Power Rise Time:** : < 5 ms  
**Phase Deviation:** -1.01 +0.96 radians  
**Modulation Rise Time:** 177 uS  
**Modulation Fall Time:** 177 uS  
**Modulation Symmetry:** 0.7%  
**Modulation Bit Rate:** 398.3 bps  
**CW Preamble:** 159.3 ms

DISCLAIMER: IN NO EVENT SHALL WS TECHNOLOGIES INC. OR ITS DISTRIBUTORS OR AGENTS BE LIABLE FOR ANY DAMAGES OR LOSSES INCURRED AS A RESULT OF THE USE OR FAILURE OF THIS MEASUREMENT EQUIPMENT.





Product Service

Beacon Test Report (Self-test, Low Temperature, -20°C)

## Beacon Test Report

203C4D8152FFBFF

**Organization:** TUV Product Service Ltd  
**Tested By:** Emergency Beacons Dept.  
**Date:** 22-Jun-07 3:25:02 PM  
**Tester Model/Serial No./File Name:** BT100S/1025/75900372\_ST-20-3  
**Tester Cal Due Date:** Nov 10, 2006  
**Tester Temperature:** 32°C

**PASS**     
  **FAIL**     
 **INITIALS:** \_\_\_\_\_

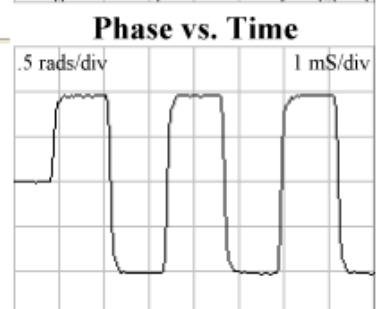
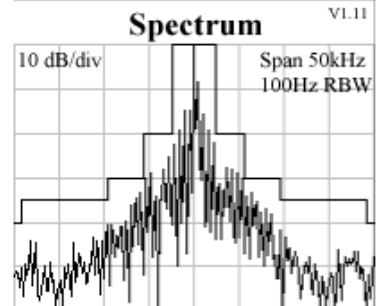
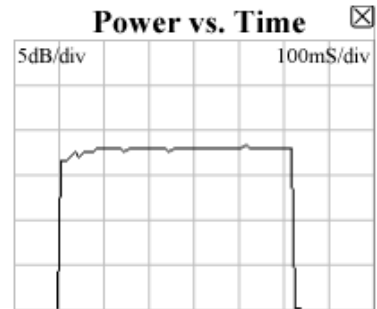
Notes: Add text comments here.

**15 Hex ID:** 203C4D8152FFBFF  
**Full Hex:** FFFED0901E26C0A97FDFFE74CF3783E0F66C  
**Burst Mode:** Self Test Mode (Long)  
**Protocol:** Standard Test Protocol  
**Country 257:** Norway  
**Bits 41 - 64:** 2539689

**Position Source:** Internal GPS  
**Auxiliary Radio:** 121.5 MHz  
**Bits 107-110:** Default  
**Latitude:** \* \* \* \* \*  
**Longitude:** \* \* \* \* \*

**406 MHz Measurements**  
**406 Frequency (INT REF):** 406.0281 MHz  
**406 Power (5 Watt):** 37 dBm  
**Power Rise Time:** : > 5 ms  
**Phase Deviation:** -1.01 +0.95 radians  
**Modulation Rise Time:** 177 uS  
**Modulation Fall Time:** 177 uS  
**Modulation Symmetry:** 0.3%  
**Modulation Bit Rate:** 398.5 bps

DISCLAIMER: IN NO EVENT SHALL WS TECHNOLOGIES INC. OR ITS DISTRIBUTORS OR AGENTS BE LIABLE FOR ANY DAMAGES OR LOSSES INCURRED AS A RESULT OF THE USE OR FAILURE OF THIS MEASUREMENT EQUIPMENT.





Product Service

Self-test Results

Parameter	Units	Test Results		
		T <sub>min</sub> (-20°C)	T <sub>amb</sub>	T <sub>max</sub> (+55°C)
Pulse duration	ms	520.4906	521.5855	520.4217
Frame sync pattern	9 binary bits	0 1101 0000	0 1101 0000	0 1101 0000
Number of bursts	number	1	1	1
15 Hex ID	15 hexadecimal bits	203C4 D8152 FFBFF	203C4 D8152 FFBFF	203C4 D8152 FFBFF



Product Service

## **2.16 AUTOMATIC RELEASE MECHANISM AND AUTOMATIC ACTIVATION TESTS**

### **2.16.1 Specification Reference**

RTCM Paper 77-2002/SC110-STD, Clause A14.0

### **2.16.2 Test Results**

Test completed as per customer supplied information, see Annex A for information.  
Note: Extreme Stowage Temperatures utilised were not in accordance with the specification, RTCM Paper 77-2002/SC110-STD, Table 2-1.



Product Service

## **2.17 STABILITY AND BUOYANCY TEST**

### **2.17.1 Specification Reference**

RTCM Paper 77-2002/SC110-STD, Clause A15.0

### **2.17.2 Equipment Under Test**

TÜV testing only: Tron S-VDR Capsule, Serial Number 00519; and Tron S-VDR Capsule with bracket, Ser. Nr: 100AA102. Note: this sample not TÜV controlled, see Test Results, below.

### **2.17.3 Date of Test and Modification State**

TÜV testing only: 15<sup>th</sup> February 2007 - Modification State 0

### **2.17.4 Test Equipment Used**

TÜV testing only: The major items of test equipment used for the above tests are identified in Section 3.1.

### **2.17.5 Test Set-up and Operating Modes**

TÜV testing only: The test was performed with the EUT in the following mode(s): Idle\*

\*Note: EUT activated (entered Operating mode automatically) on contact with water.

### **2.17.6 Environmental Conditions**

Ambient Temperature	25.2°C
Relative Humidity	27%
Atmospheric Pressure	1009mbar

### **2.17.7 Test Results**

#### Stability

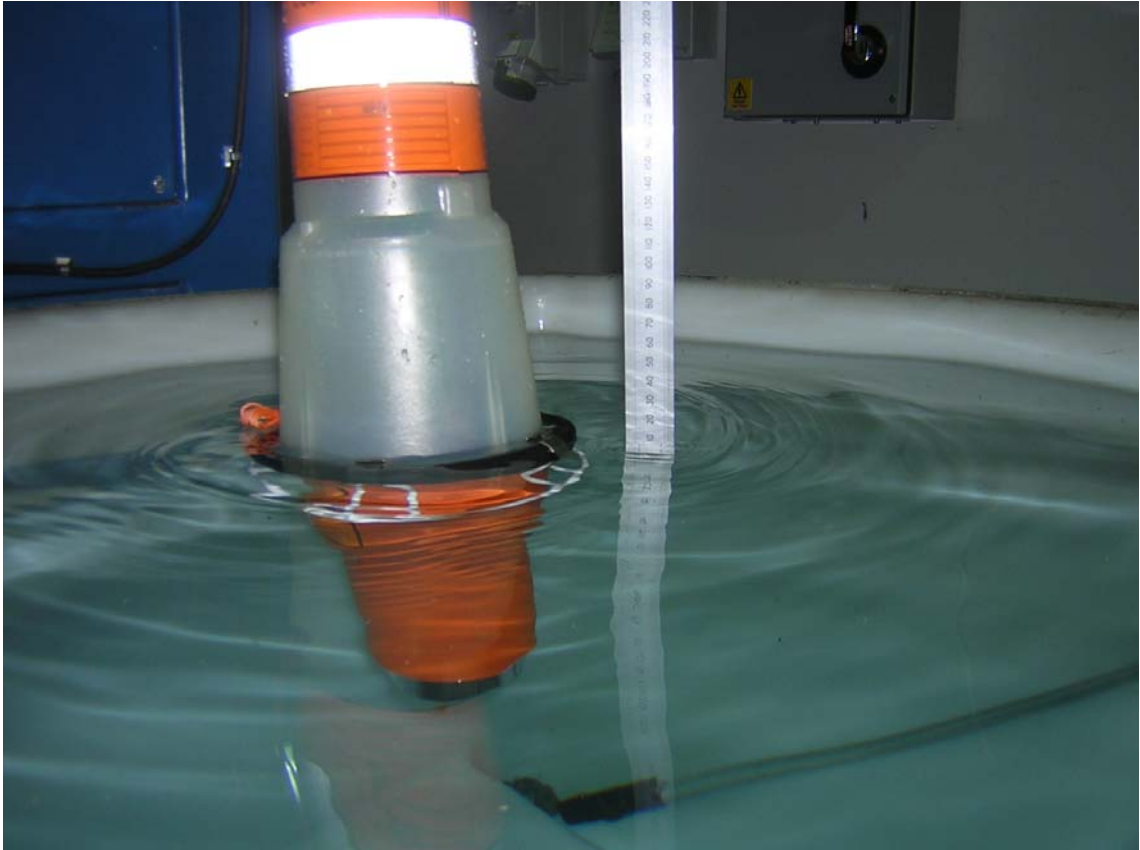
Test passed as per customer supplied information, see Annex A for information.





Uprightness

The EUT was immersed in calm fresh water as shown in the following photograph and floated upright.



EUT Immersed In Fresh Water

Antenna Height

Test passed as per customer supplied information, see Annex A for information.



Product Service

### Reserve Buoyancy

A large tank was filled with domestic tap water. A 20Kg mass with a pulley attachment was submerged into the tank. The pulley converted an upwards vertical force into a downwards force, completely submerging the EUT into the tank. The upwards vertical force supplied by the engineer was measured with a force gauge. This was the buoyant force. The EUT was strapped with cable ties to create a central fixing point for the pulley at the base of the EUT.

EUT mass = 3.532 Kg  
 EUT weight = 34.69 N

Buoyant forces measured were 30.6, 29.9, 30.2, 28.7 and 30.3 N  
 Mean = 29.90N

Reserve buoyancy =  $\frac{\text{Buoyant Force}}{\text{Weight}}$  =  $\frac{29.90}{34.69}$

Reserve buoyancy = 0.8619



Product Service

**2.18 INADVERTENT ACTIVATION TEST**

**2.18.1 Specification Reference**

RTCM Paper 77-2002/SC110-STD, Clause A16.0

**2.18.2 Test Results**

Test passed as per customer supplied information, see Annex A for information.



Product Service

## 2.19 CARRIER FREQUENCY TEST

### 2.19.1 Specification Reference

RTCM Paper 77-2002/SC110-STD, Clause A17.1

### 2.19.2 Equipment Under Test

Tron S-VDR Capsule, Serial Number 00169

### 2.19.3 Date of Test and Modification State

Test at Ambient: 6<sup>th</sup> August 2007 - Modification State 1  
 Test at +55°C: 21<sup>st</sup> June 2007 - Modification State 0  
 Test at -20°C: 11<sup>th</sup> July 2007 - Modification State 0

### 2.19.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

### 2.19.5 Test Set-up and Operating Modes

The test was performed with the EUT in the following mode(s): Operating

### 2.19.6 Environmental Conditions

	21 <sup>st</sup> June 2007	11 <sup>th</sup> July 2007	6 <sup>th</sup> August 2007
Ambient Temperature	23.8°C	24.2°C	24.6°C
Atmospheric Pressure	1004mbar	1008mbar	1005mbar

### 2.19.7 Test Results

Parameter	Units	Test Results		
		T <sub>min</sub> (-20°C)	T <sub>amb</sub>	T <sub>max</sub> (+55°C)
Carrier Frequency	MHz	121.5010939	121.5003269	121.4991623



Product Service

## 2.20 MODULATION CHARACTERISTICS (TRANSMITTER DUTY CYCLE)

### 2.20.1 Specification Reference

RTCM Paper 77-2002/SC110-STD, Clause A17.2

### 2.20.2 Equipment Under Test

Tron S-VDR Capsule, Serial Number 00169

### 2.20.3 Date of Test and Modification State

Test at Ambient: 7<sup>th</sup> August 2007 - Modification State 1  
 Test at +55°C: 21<sup>st</sup> June 2007 - Modification State 0  
 Test at -20°C: 11<sup>th</sup> July 2007 - Modification State 0

### 2.20.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

### 2.20.5 Test Set-up and Operating Modes

The test was performed with the EUT in the following mode(s): Operating

### 2.20.6 Environmental Conditions

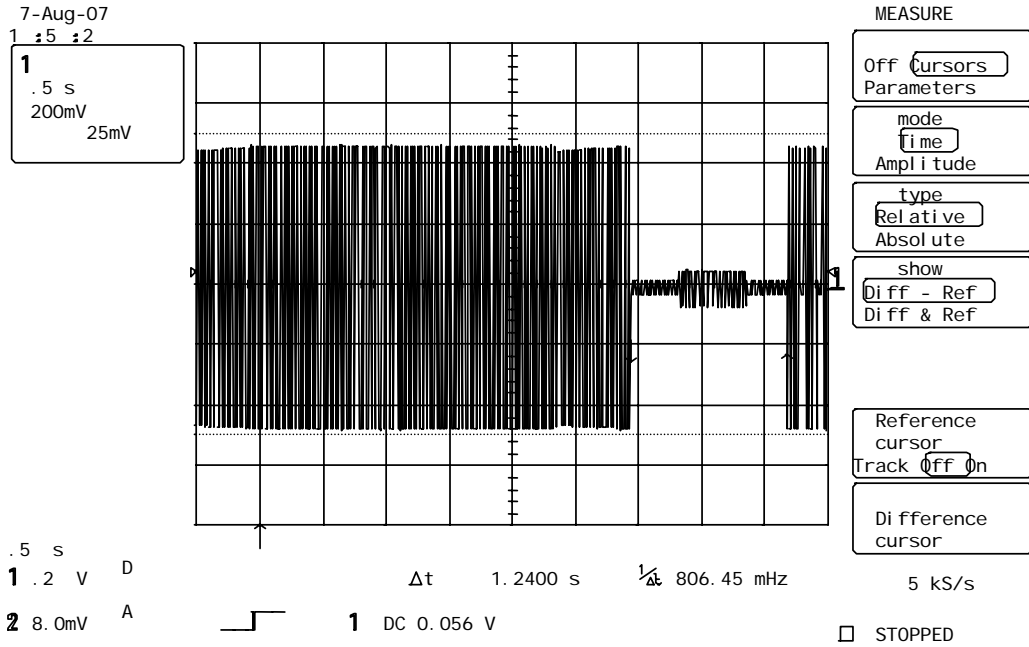
	21 <sup>st</sup> June 2007	11 <sup>th</sup> July 2007	7 <sup>th</sup> August 2007
Ambient Temperature	24.1°C	25.6°C	24.2°C
Atmospheric Pressure	1007mbar	1005mbar	1010mbar

### 2.20.7 Test Results

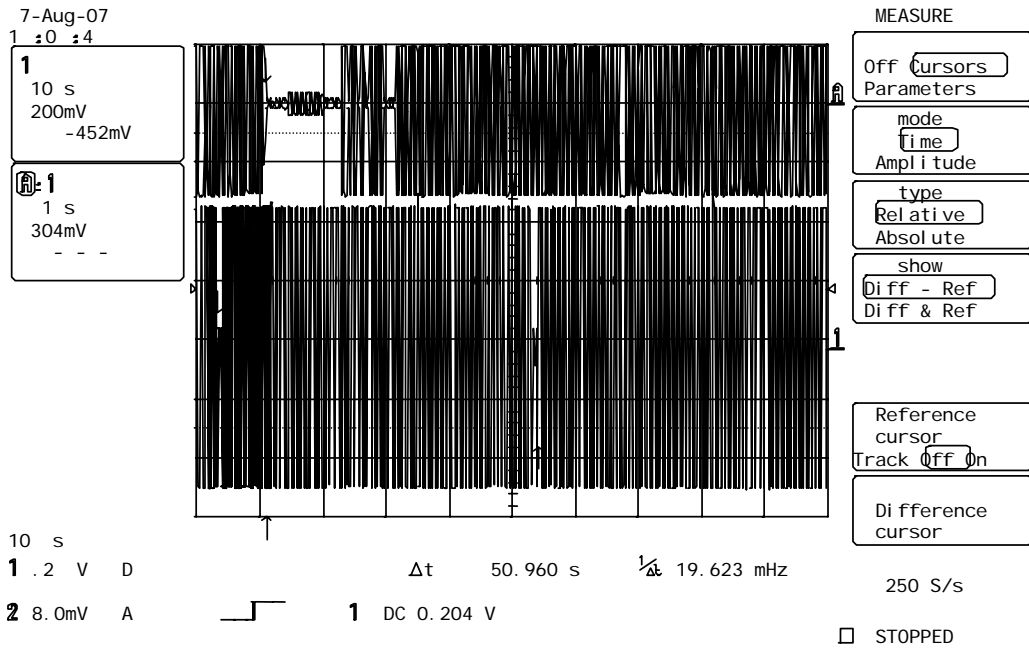
Parameter	Units	Test Results		
		T <sub>min</sub> (-20°C)	T <sub>amb</sub>	T <sub>max</sub> (+55°C)
121.5 MHz transmission interruption duration	seconds	1.2500	1.2400	1.2500
121.5 MHz transmission interruption interval	seconds	47.800	50.960	48.700
Transmitter Duty Cycle	%	97.4	97.6	97.4



Product Service



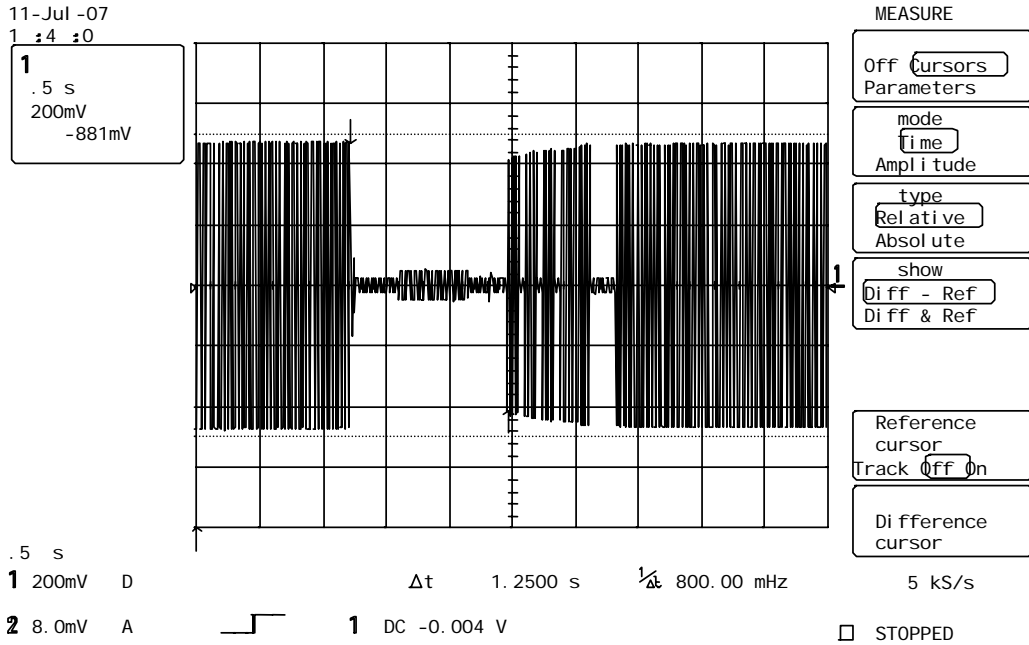
Plot showing 121.5MHz interruption duration (Ambient Temperature)



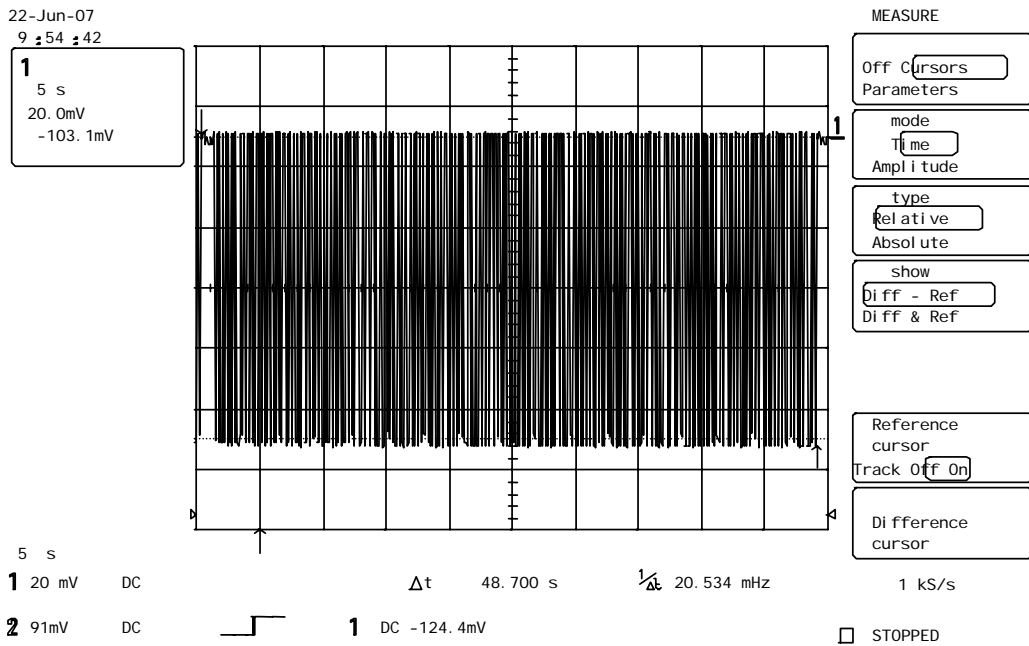
Plot showing 121.5MHz interruption interval (Ambient Temperature)



Product Service



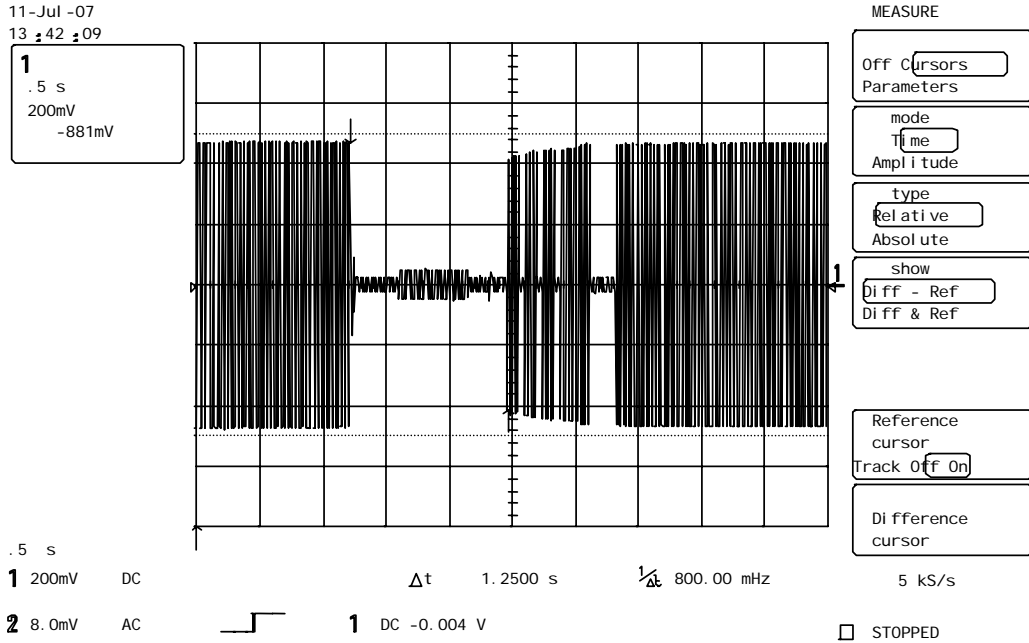
Plot showing 121.5MHz interruption duration (High Temperature, +55°C)



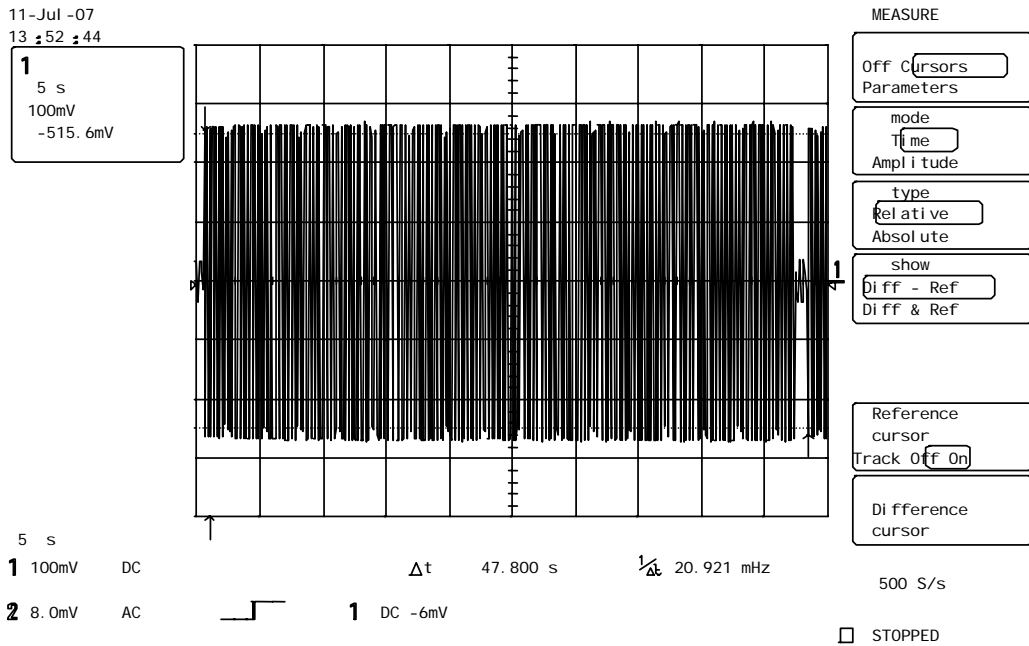
Plot showing 121.5MHz interruption interval (High Temperature, +55°C)



Product Service



Plot showing 121.5MHz interruption duration (Low Temperature, -20°C)



Plot showing 121.5MHz interruption interval (Low Temperature, -20°C)





Product Service

## 2.21 MODULATION CHARACTERISTICS (MODULATION FREQUENCY AND SWEEP REPETITION RATE, MODULATION DUTY CYCLE)

### 2.21.1 Specification Reference

RTCM Paper 77-2002/SC110-STD, Clause A17.2

### 2.21.2 Equipment Under Test

Tron S-VDR Capsule, Serial Number 00169

### 2.21.3 Date of Test and Modification State

Test at Ambient:	6 <sup>th</sup> August 2007	- Modification State 1
Test at +55°C:	21 <sup>st</sup> June 2007	- Modification State 0
Test at -20°C:	11 <sup>th</sup> July 2007	- Modification State 0
Sweep Direction Retest:	24 <sup>th</sup> to 25 <sup>th</sup> October 2007	- Modification State 1

### 2.21.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

### 2.21.5 Test Set-up and Operating Modes

The test was performed with the EUT in the following mode(s): Operating

### 2.21.6 Environmental Conditions

	21 <sup>st</sup> June 2007	11 <sup>th</sup> July 2007	6 <sup>th</sup> August 2007
Ambient Temperature	23.8°C	24.2°C	24.6°C
Atmospheric Pressure	1004mbar	1008mbar	1005mbar
	24 <sup>th</sup> August 2007	25 <sup>th</sup> August 2007	
Ambient Temperature	23.7°C		
Atmospheric Pressure	1019mbar		



Product Service

**2.21.7 Test Results**

The EUT was connected to the automated test rack, the following results were obtained.

Parameter	Units	Test Results		
		T <sub>min</sub> (-20°C)	T <sub>amb</sub>	T <sub>max</sub> (+55°C)
Frequency Range	Hz	1139.63	1089.6	1148.65
Minimum Frequency	Hz	325.93	366.42	326.1
Maximum Frequency	Hz	1465.56	1456.02	1474.74
Sweep Direction	Upward / Downward	Downward*	Downward*	Downward*
Modulation Duty Cycle	%	47.44	45.54	46.55
Sweep repetition rate	sweeps per second	2.50	2.94	2.47

\* See Sweep Direction Retest, below.

Sweep Direction Retest

EUT was reprogrammed in “US Mode” and the sweep direction was retested, the following results were obtained.

Parameter	Units	Test Results		
		T <sub>min</sub> (-20°C)	T <sub>amb</sub>	T <sub>max</sub> (+55°C)
Sweep Direction	Upward / Downward	Upward	Upward	Upward



Product Service

## 2.22 MODULATION CHARACTERISTICS (MODULATION FACTOR)

### 2.22.1 Specification Reference

RTCM Paper 77-2002/SC110-STD, Clause A17.2

### 2.22.2 Equipment Under Test

Tron S-VDR Capsule, Serial Number 00169

### 2.22.3 Date of Test and Modification State

Test at Ambient: 6<sup>th</sup> August 2007 - Modification State 1  
 Test at +55°C: 22<sup>nd</sup> June 2007 - Modification State 0  
 Test at -20°C: 11<sup>th</sup> July 2007 - Modification State 0

### 2.22.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

### 2.22.5 Test Set-up and Operating Modes

The test was performed with the EUT in the following mode(s): Operating

### 2.22.6 Environmental Conditions

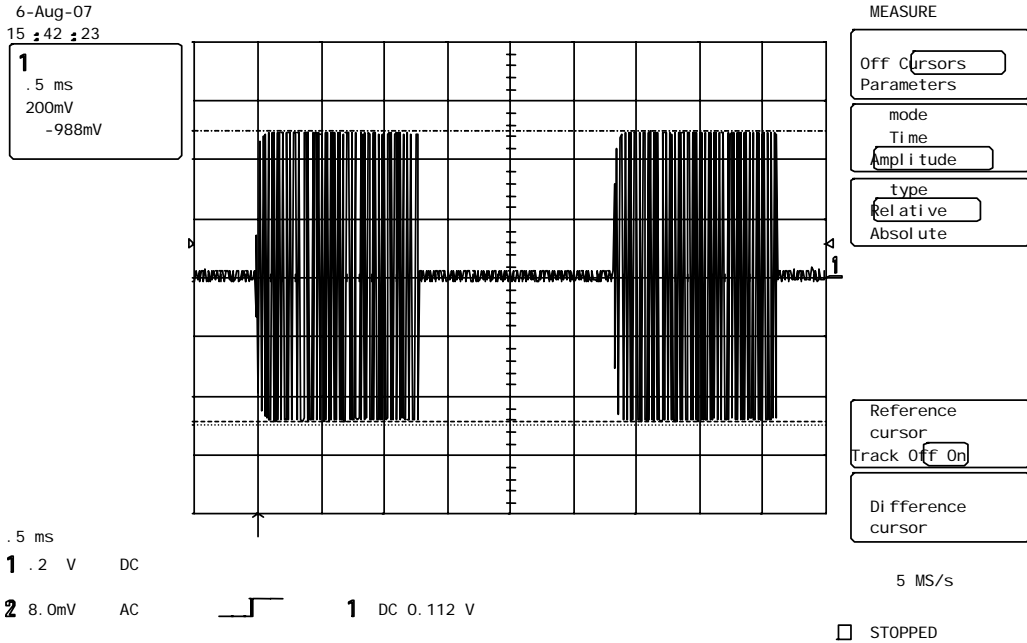
	22 <sup>nd</sup> June 2007	11 <sup>th</sup> July 2007	6 <sup>th</sup> August 2007
Ambient Temperature	23.4°C	24.2°C	24.6°C
Atmospheric Pressure	999mbar	1008mbar	1005mbar

### 2.22.7 Test Results

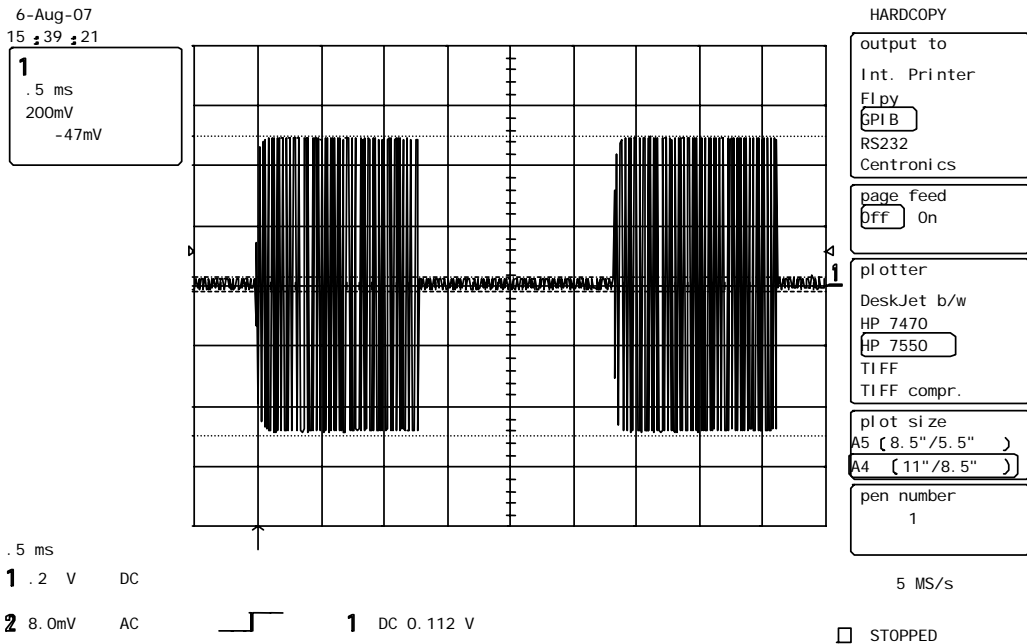
Parameter	Units	Test Results		
		T <sub>min</sub> (-20°C)	T <sub>amb</sub>	T <sub>max</sub> (+55°C)
A	mv	537	-988	409
B	mv	22	-47	25
Modulation Duty Cycle	%	92.1	90.9	88.5



Product Service



Plot showing "A" (Ambient Temperature)



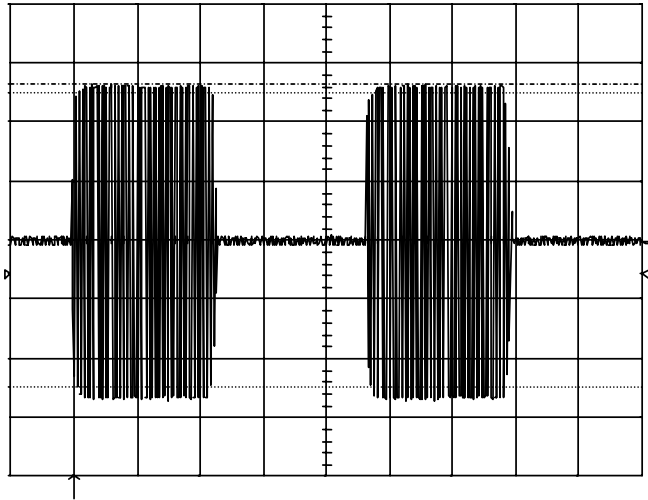
Plot Showing "B" (Ambient Temperature)



Product Service

22-Jun-07  
9 : 34 : 57

**1**  
.5 ms  
200mV  
537mV



.5 ms  
**1** .2 V DC  
**2** 91mV DC



**1** DC -0.108 V

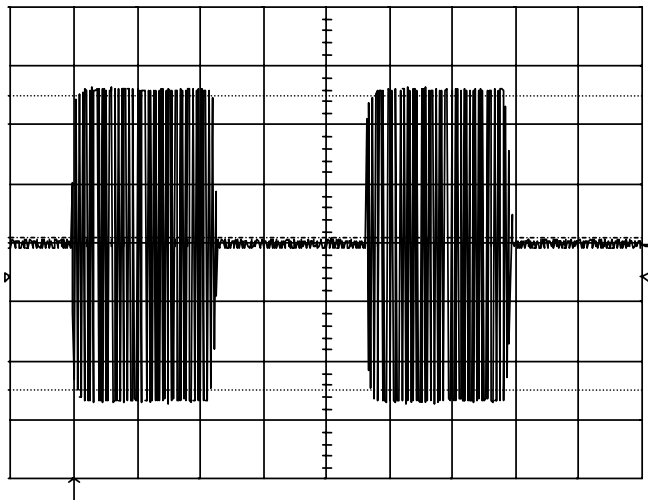
10 MS/s

STOPPED

Plot showing "A" (Low Temperature, +55°C)

22-Jun-07  
9 : 37 : 29

**1**  
.5 ms  
200mV  
22mV



.5 ms  
**1** .2 V DC  
**2** 91mV DC



**1** DC -0.108 V

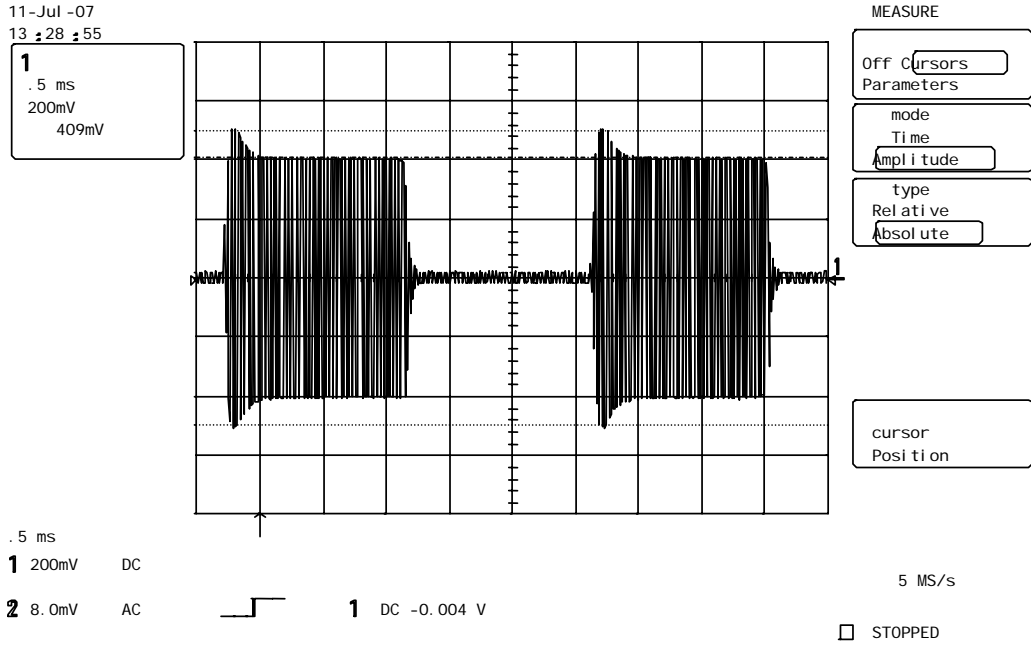
10 MS/s

STOPPED

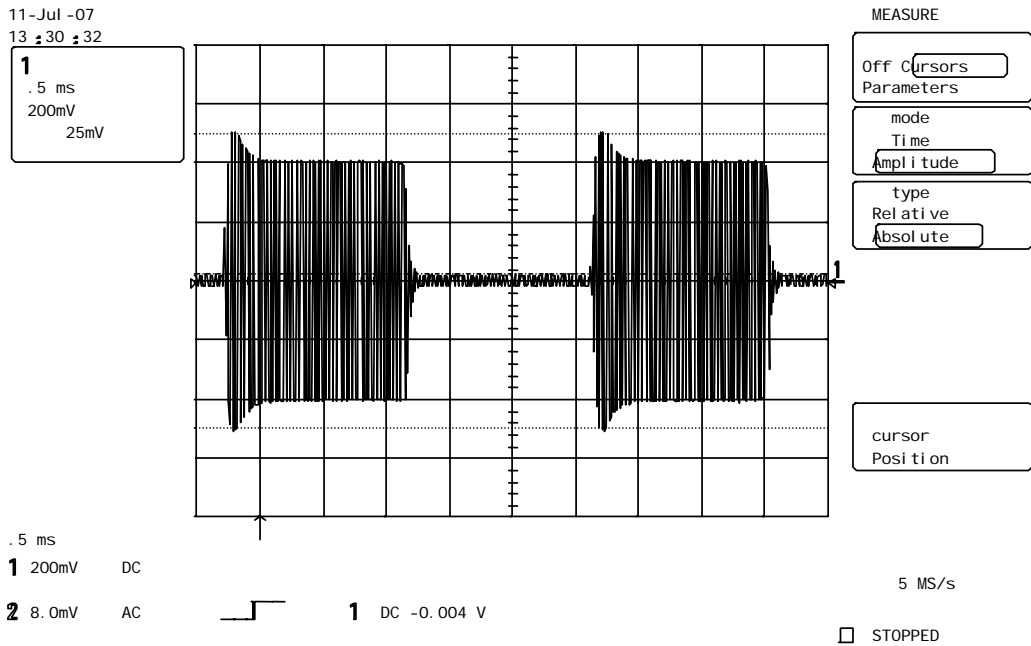
Plot Showing "B" (Low Temperature, +55°C)



Product Service



Plot showing "A" (Low Temperature, -20°C)



Plot Showing "B" (Low Temperature, -20°C)



Product Service

## 2.23 MODULATION CHARACTERISTICS (FREQUENCY COHERENCE)

### 2.23.1 Specification Reference

RTCM Paper 77-2002/SC110-STD, Clause A17.2

### 2.23.2 Equipment Under Test

Tron S-VDR Capsule, Serial Number 00169

### 2.23.3 Date of Test and Modification State

Test at Ambient:	6 <sup>th</sup> August 2007	- Modification State 1
Test at +55°C:	7 <sup>th</sup> September 2007	- Modification State 1
Test at -20°C:	10 <sup>th</sup> August 2007	- Modification State 1

### 2.23.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

### 2.23.5 Test Set-up and Operating Modes

The test was performed with the EUT in the following mode(s): Operating

### 2.23.6 Environmental Conditions

	6 <sup>th</sup> August 2007	7 <sup>th</sup> September 2007	10 <sup>th</sup> August 2007
Ambient Temperature	24.6°C	24.6°C	24.3°C
Atmospheric Pressure	1005mbar	1025mbar	1013mbar

### 2.23.7 Test Results

The following plots show that 30% of the output power of the EUT does lie within  $\pm 30$ Hz of the carrier. The modulation was disabled by means of a dip switch on the EUT main PCB for the purposes of this test.

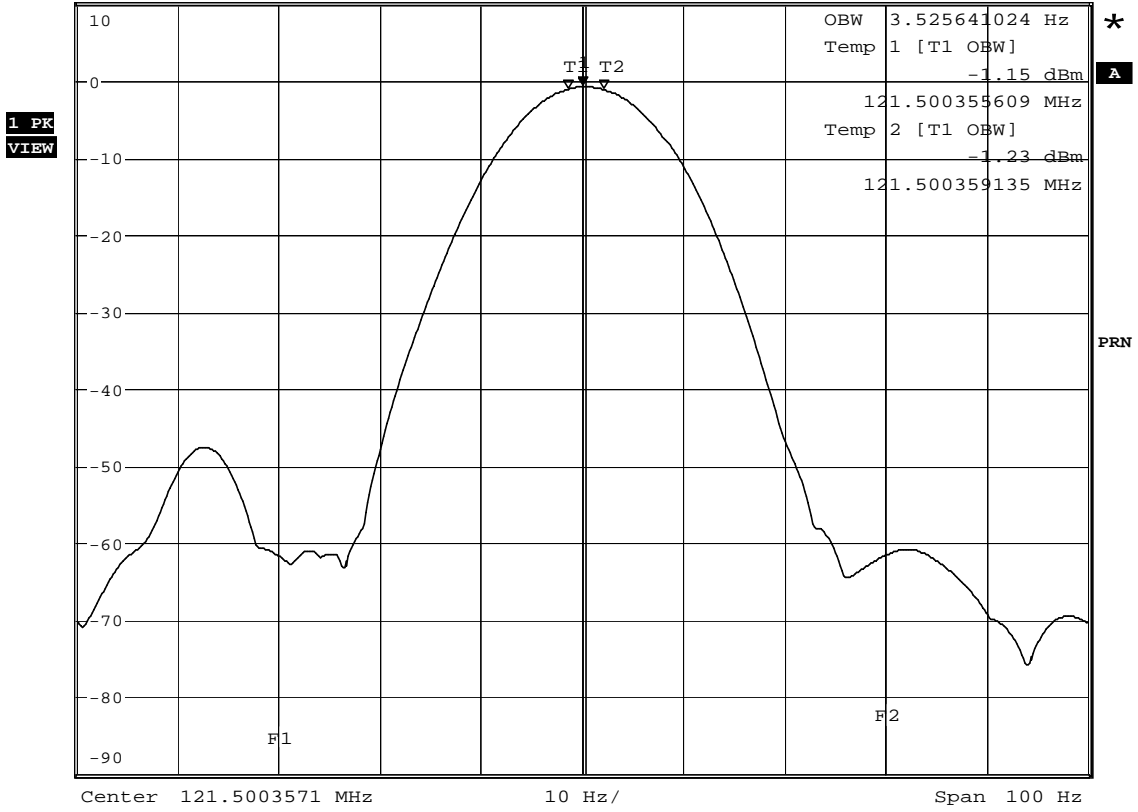
The frequency drift plots (with two traces) show the outline of the transmitted RF (121.5 MHz) before and after the interruption for the 406 MHz RF burst. It can be seen that the peaks are less than  $\pm 30$ Hz from one another. I.e. carrier did not shift by more than  $\pm 30$ Hz.



Product Service



\*RBW 10 Hz      Marker 1 [T1 ]  
 \*VBW 30 Hz      -0.84 dBm  
 Ref 10 dBm      \*Att 10 dB      SWT 1 s      121.500357051 MHz



Date: 6.AUG.2007 14:08:48

Frequency Coherence – Ambient





Product Service

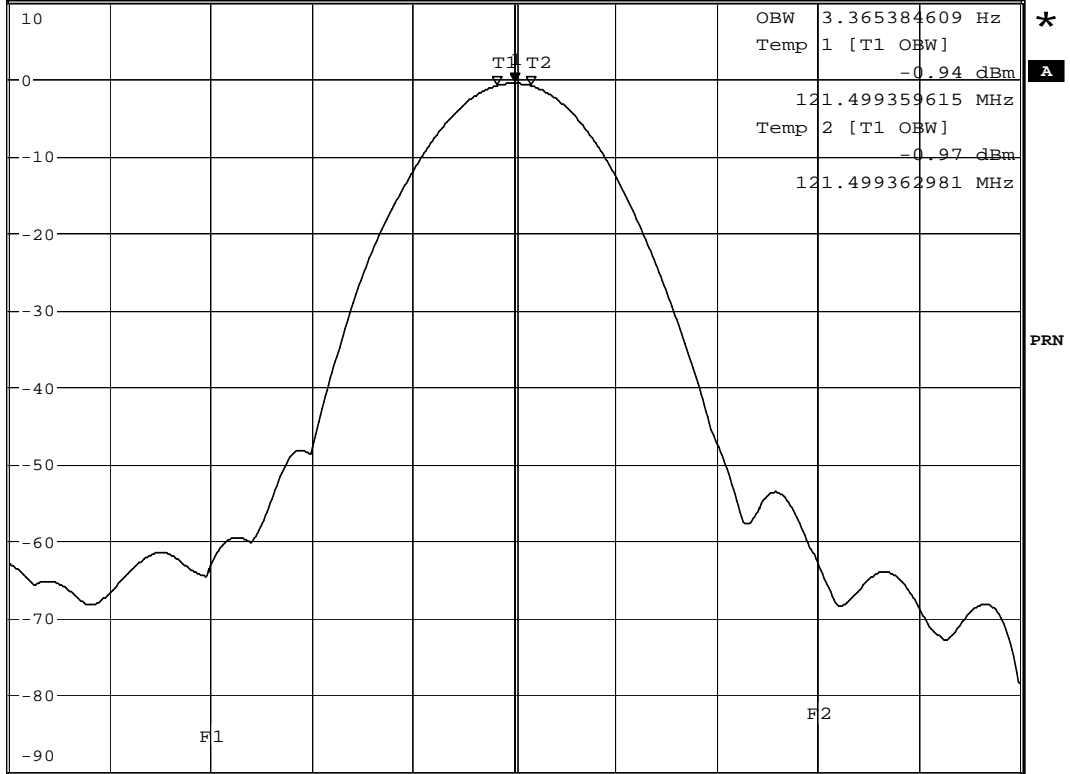


\*RBW 10 Hz      Marker 1 [T1 ]  
\*VBW 30 Hz      -0.68 dBm  
SWT 1 s          121.499361378 MHz

Ref 10 dBm

Att 15 dB

1 PK  
VIEW



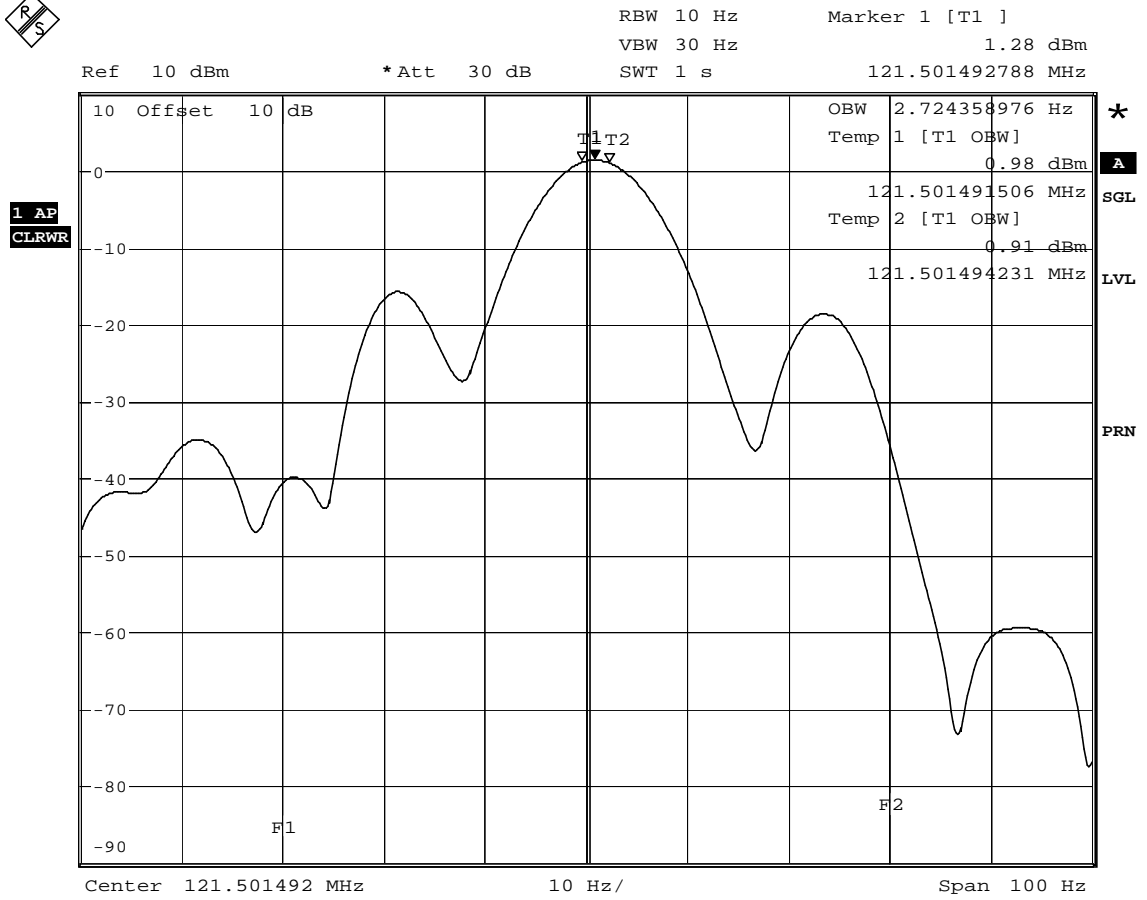
Center 121.4993614 MHz      10 Hz/      Span 100 Hz

Date: 7.SEP.2007 16:55:12

Frequency Coherence – High (+55°C)



Product Service



Date: 10.AUG.2007 16:46:50

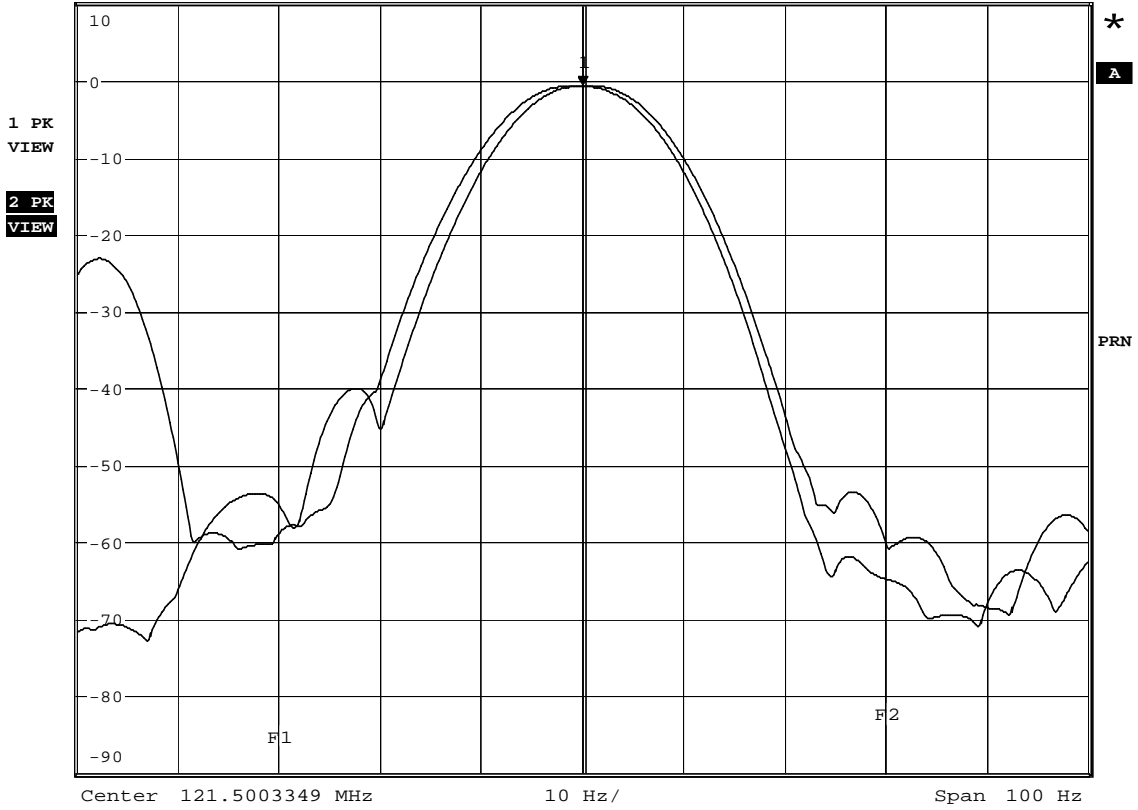
Frequency Coherence – Low (-20°C)



Product Service



Ref 10 dBm      \*Att 10 dB      \*RBW 10 Hz      Marker 1 [T1 ]  
 \*VBW 30 Hz      -0.80 dBm  
 SWT 1 s      121.500334891 MHz



Date: 6.AUG.2007 14:53:03

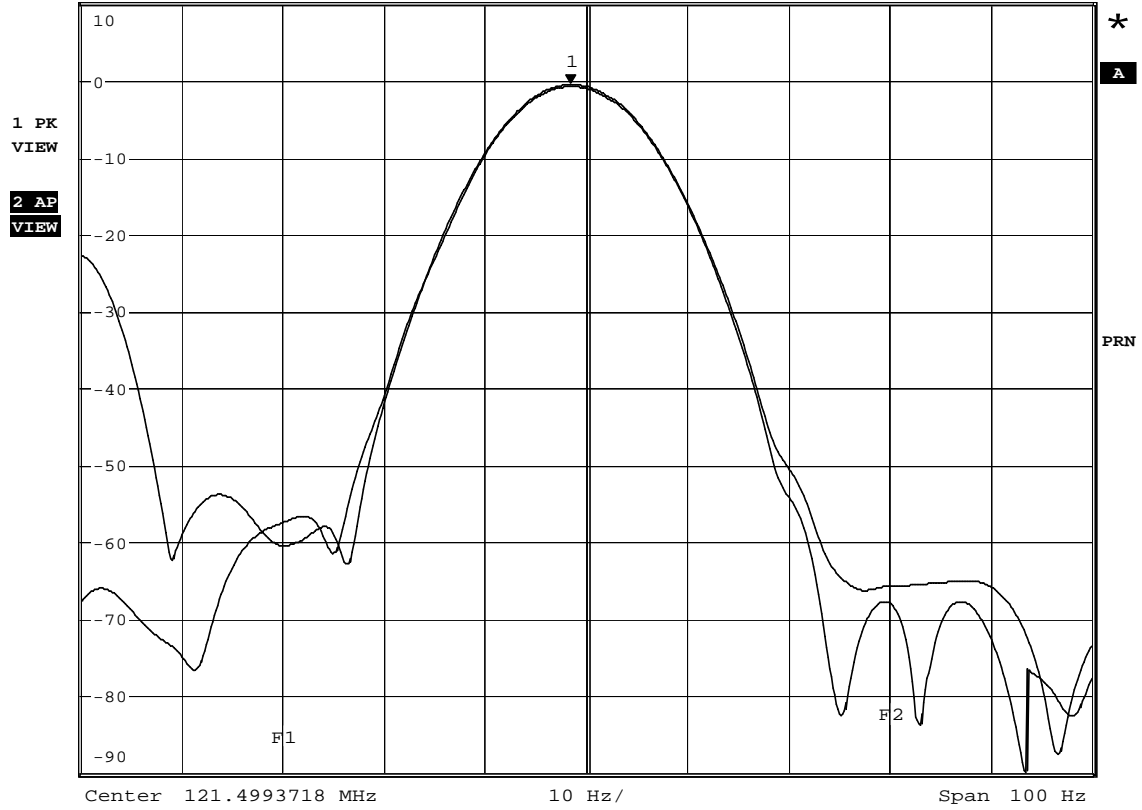
Frequency Drift – Ambient



Product Service



Ref 10 dBm Att 35 dB \*RBW 10 Hz Marker 1 [T1 ]  
\*VBW 30 Hz -0.60 dBm  
SWT 1 s 121.499370192 MHz



Date: 7.SEP.2007 16:48:39

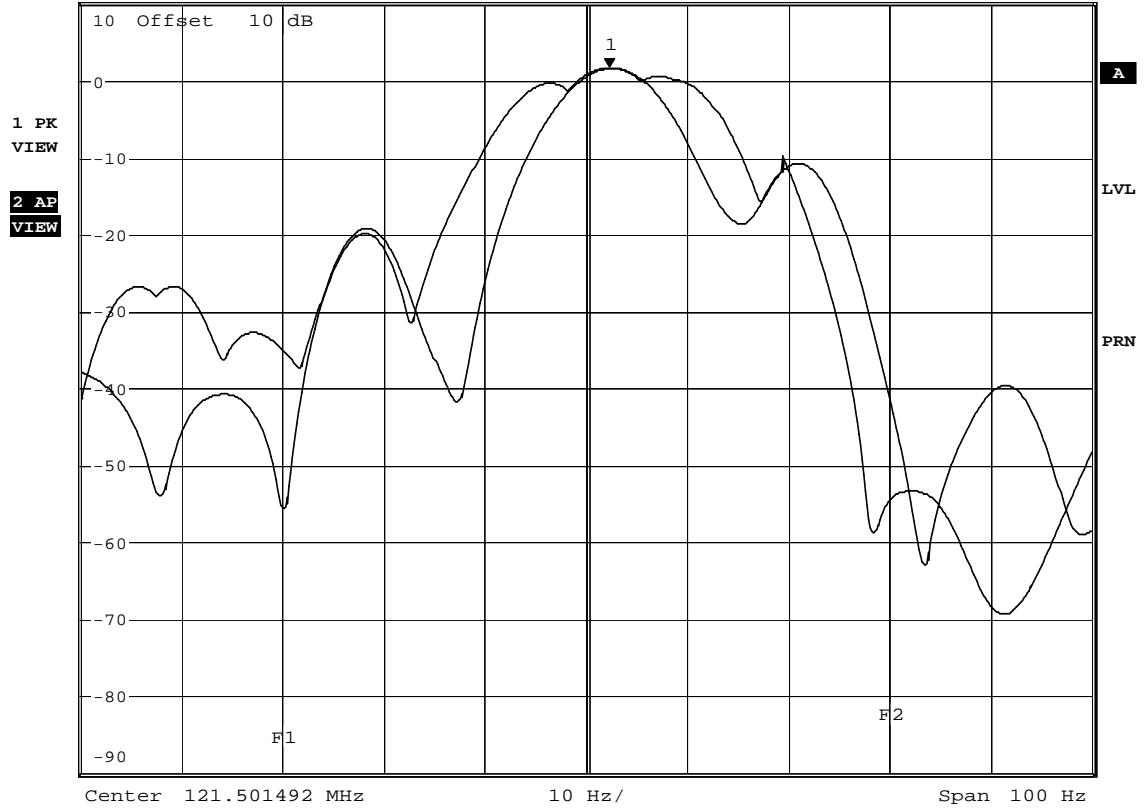
Frequency Drift – High (+55°C)



Product Service



Ref 10 dBm      \*Att 30 dB      RBW 10 Hz      Marker 1 [T1 ]  
VBW 30 Hz      1.57 dBm  
SWT 1 s      121.501494231 MHz



Date: 10.AUG.2007 16:54:39

Frequency Drift – Low (-20°C)



Product Service

**2.24 PEAK EFFECTIVE RADIATED POWER**

**2.24.1 Specification Reference**

RTCM Paper 77-2002/SC110-STD, Clause A17.3

**2.24.2 Equipment Under Test**

Tron S-VDR Capsule, Serial Number 00516

**2.24.3 Date of Test and Modification State**

22<sup>nd</sup> October 2007 - Modification State 0

**2.24.4 Test Equipment Used**

The major items of test equipment used for the above tests are identified in Section 3.1.

**2.24.5 Test Set-up and Operating Modes**

The test was performed with the EUT in the following mode(s): Operating

**2.24.6 Test Results**

Note: EUT battery used for test had been operational in the same beacon for a duration of »44hours.

Measurements were made (in dBm) at an arbitrarily chosen azimuth angle across a range of elevation angles. Upon finding the maximum, the elevation was fixed and 12 measurements made at 30° azimuth increments.

These results (from the vertically polarised dipole) were converted to PERP in mW. See the following table.

Elevation (°)	Azimuth (°)											
	0	30	60	90	120	150	180	210	240	270	300	330
5	79.2											
10	90.9											
15	103.6	112.0	99.8	93.2	95.3	95.3	99.8	99.8	95.3	95.3	102.1	112.0
20	74.0											

The median result was calculated to be 99.8mW, or 19.99dBm.

The ratio between the maximum and minimum values was calculated to be 1.2 (showing the antenna to be Omnidirectional)



Product Service

**2.25 VSWR MEASUREMENT**

**2.25.1 Specification Reference**

RTCM Paper 77-2002/SC110-STD, Clause A17.1

**2.25.2 Test Results**

Antenna is not removable, hence test is not applicable.



Product Service

**2.26 HUMIDITY TEST**

**2.26.1 Specification Reference**

RTCM Paper 77-2002/SC110-STD, Clause A18

**2.26.2 Equipment Under Test**

Tron S-VDR Capsule, Serial Number 00519

**2.26.3 Date of Test and Modification State**

18<sup>th</sup> to 19<sup>th</sup> October 2007 - Modification State 0

**2.26.4 Test Equipment Used**

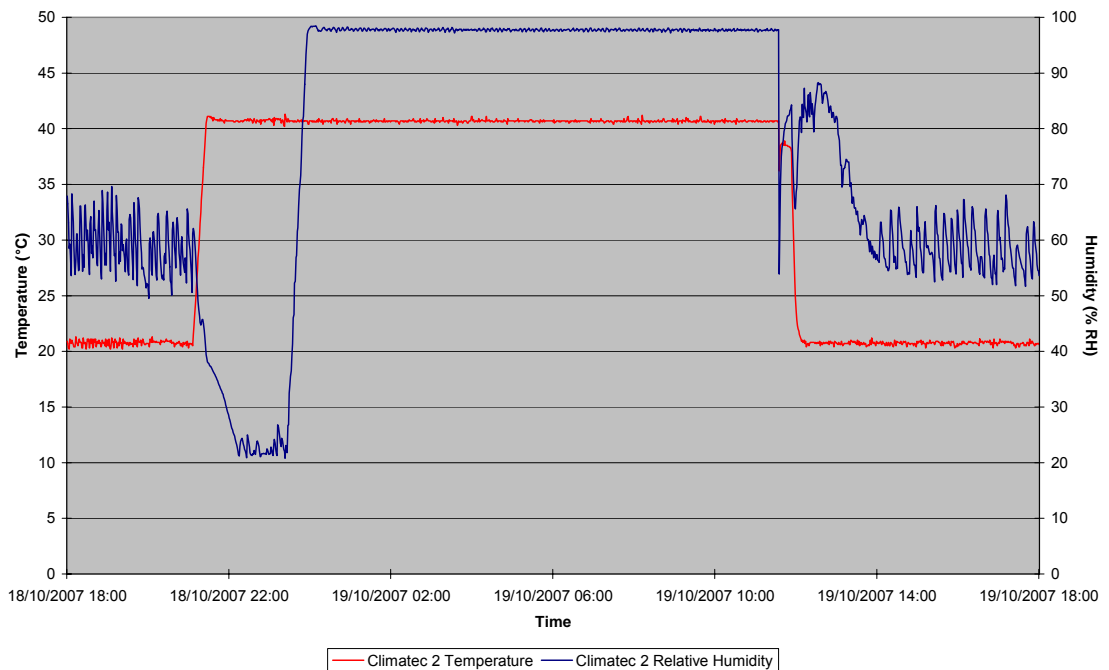
The major items of test equipment used for the above tests are identified in Section 3.1.

**2.26.5 Test Set-up and Operating Modes**

The test was performed with the EUT in the following mode(s): Idle

**2.26.6 Environmental Conditions**

Humidity Test Conditions Plot







Product Service

### 2.26.7 Test Results

The EUT was subjected to an Aliveness Test before the commencement of testing, see Beacon Test Report below.

18<sup>th</sup> October 2007

The EUT was dismantled, exposing the internal electrical components to the humid test environment.

The EUT was positioned in the climatic chamber. The chamber conditions were adjusted to +40°C, 97% RH. The chamber conditions were maintained for a period of 11 hours 30 minutes.

19<sup>th</sup> October 2007

The EUT was removed from the chamber into laboratory ambient conditions. The EUT was powered on immediately after being removed from the chamber. An Aliveness Test was performed 15 minutes after the EUT was removed from the chamber, see Beacon Test Report below.



Product Service

Beacon Test Report (Pre-test)

## Beacon Test Report

203C4D840EFFBFF

**Organization:**  
**Tested By:**  
**Date:** 16-Oct-07 5:46:25 PM  
**Tester Model/Serial No./File Name:** BT100S/1025/jo-1  
**Tester Cal Due Date:** Nov 10, 2006  
**Tester Temperature:** 22°C

**PASS**       **FAIL**      **INITIALS:** \_\_\_\_\_

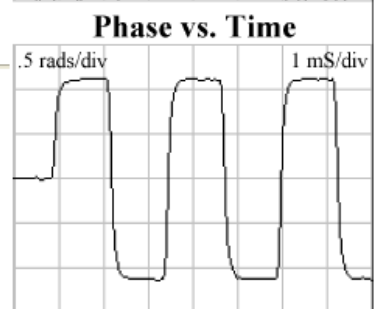
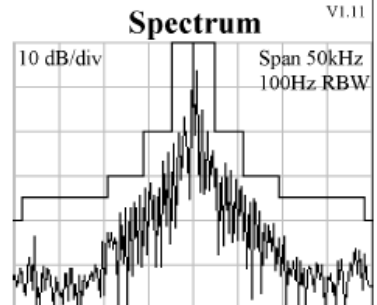
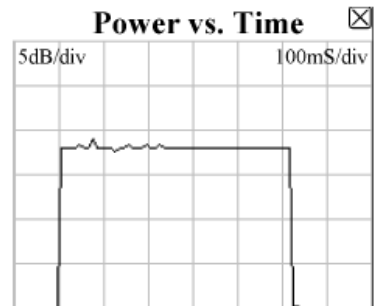
**Notes:** Add text comments here.

**15 Hex ID:** 203C4D840EFFBFF  
**Full Hex:** FFFED0901E26C2077FDFFFCA677783E0F66C  
**Burst Mode:** Self Test Mode (Long)  
**Protocol:** Standard Test Protocol  
**Country 257:** Norway  
**Bits 41 - 64:** 2540039

**Position Source:** Internal GPS  
**Auxiliary Radio:** 121.5 MHz  
**Bits 107-110:** Default  
**Latitude:** \* \* \* \* \*  
**Longitude:** \* \* \* \* \*

**406 MHz Measurements**  
**406 Frequency (INT REF):** 406.0281 MHz  
**406 Power (INT ANT):** 56%  
**Power Rise Time:** < 5 ms  
**Phase Deviation:** -1.11 +1.1 radians  
**Modulation Rise Time:** 198 uS  
**Modulation Fall Time:** 209 uS  
**Modulation Symmetry:** 0%  
**Modulation Bit Rate:** 398.3 bps  
**CW Preamble:** 160.1 ms

**DISCLAIMER:** IN NO EVENT SHALL WS TECHNOLOGIES INC. OR ITS DISTRIBUTORS OR AGENTS BE LIABLE FOR ANY DAMAGES OR LOSSES INCURRED AS A RESULT OF THE USE OR FAILURE OF THIS MEASUREMENT EQUIPMENT.





Product Service

Beacon Test Report (Post-Test)

## Beacon Test Report

203C4D840EFFBFF

**Organization:**  
**Tested By:**  
**Date:** 19-Oct-07 11:59:05 AM  
**Tester Model/Serial No./File Name:** BT100S/1025/jtrn-svdr-psthum-1  
**Tester Cal Due Date:** Nov 10, 2006  
**Tester Temperature:** 25°C

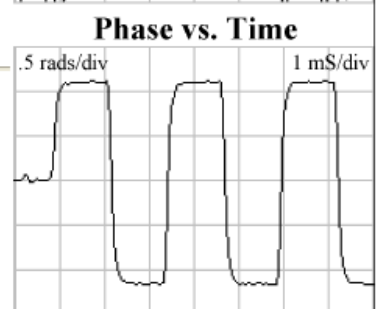
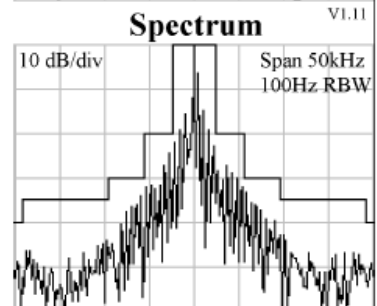
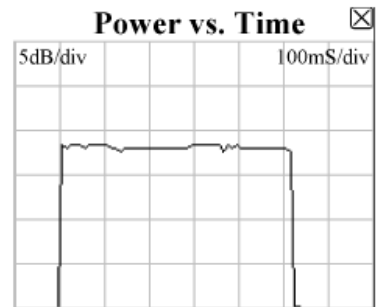
**PASS**       **FAIL**      **INITIALS:** \_\_\_\_\_

**Notes:** Add text comments here.

**15 Hex ID:** 203C4D840EFFBFF  
**Full Hex:** FFFE2F901E26C2077FDFFCA677783E0F66C  
**Burst Mode:** Normal Mode (Long)  
**Protocol:** Standard Test Protocol  
**Country 257:** Norway  
**Bits 41 - 64:** 2540039

**Position Source:** Internal GPS  
**Auxiliary Radio:** 121.5 MHz  
**Bits 107-110:** Default  
**Latitude:** \* \* \* \* \*  
**Longitude:** \* \* \* \* \*

**406 MHz Measurements**  
**406 Frequency (INT REF):** 406.0281 MHz  
**406 Power (INT ANT):** 51%  
**Power Rise Time:** < 5 ms  
**Phase Deviation:** -1.14 +1.1 radians  
**Modulation Rise Time:** 188 uS  
**Modulation Fall Time:** 198 uS  
**Modulation Symmetry:** 0.8%  
**Modulation Bit Rate:** 398.1 bps  
**CW Preamble:** 159.6 ms



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Product Service

**2.27 ORIENTATION TEST****2.27.1 Specification Reference**

RTCM Paper 77-2002/SC110-STD, Clause A17.1

**2.27.2 Equipment Under Test**

Tron S-VDR Capsule, Serial Number 00519

**2.27.3 Date of Test and Modification State**

3<sup>rd</sup> October 2007 - Modification State 0

**2.27.4 Test Equipment Used**

The major items of test equipment used for the above tests are identified in Section 3.1.

**2.27.5 Test Set-up and Operating Modes**

The test was performed with the EUT in the following mode(s): Operating

**2.27.6 Environmental Conditions**

Ambient Temperature	23.1°C
Relative Humidity	58.5%
Atmospheric Pressure	1013mbar



Product Service

2.27.7 Test Results

Beacon Orientation – Vertical (Initial)

### Beacon Test Report

203C4D840EFFBFF

**Organization:**  
**Tested By:**  
**Date:** 03-Oct-07 3:59:07 PM  
**Tester Model/Serial No./File Name:** BT100S/1025/00372-HexChk-vertical-1  
**Tester Cal Due Date:** Nov 10, 2006  
**Tester Temperature:** 23°C

**PASS**       **FAIL**      **INITIALS:** \_\_\_\_\_

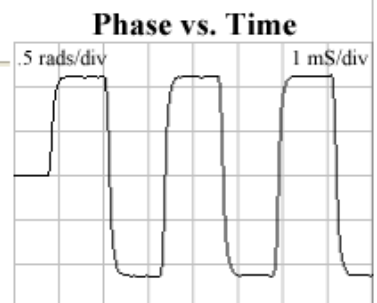
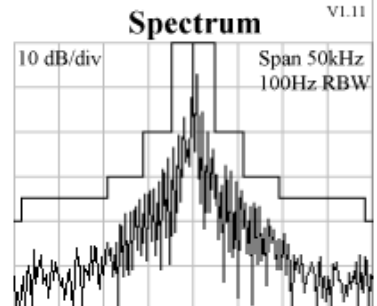
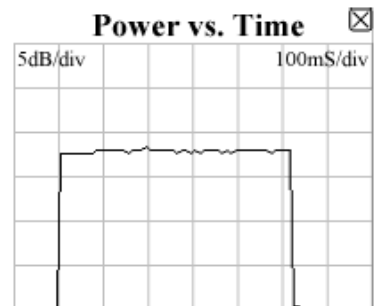
Notes: Add text comments here.

**15 Hex ID:** 203C4D840EFFBFF  
**Full Hex:** FFFE2F901E26C2077FDFFFC677783E0F66C  
**Burst Mode:** Normal Mode (Long)  
**Protocol:** Standard Test Protocol  
**Country 257:** Norway  
**Bits 41 - 64:** 2540039

**Position Source:** Internal GPS  
**Auxiliary Radio:** 121.5 MHz  
**Bits 107-110:** Default  
**Latitude:** \* \* \* \* \*  
**Longitude:** \* \* \* \* \*

**406 MHz Measurements**  
**406 Frequency (INT REF):** 406.0281 MHz  
**406 Power (INT ANT):** 78%  
**Power Rise Time:** < 5 ms  
**Phase Deviation:** -1.13 +1.11 radians  
**Modulation Rise Time:** 188 uS  
**Modulation Fall Time:** 198 uS  
**Modulation Symmetry:** 1.9%  
**Modulation Bit Rate:** 398.3 bps  
**CW Preamble:** 159.3 ms

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Product Service

Beacon Orientation – Horizontal

## Beacon Test Report

203C4D840EFFBFF

**Organization:**

**Tested By:**

**Date:** 03-Oct-07 4:03:15 PM

**Tester Model/Serial No./File Name:** BT100S/1025/00372-HexChk-horizontal-1

**Tester Cal Due Date:** Nov 10, 2006

**Tester Temperature:** 25°C



**PASS**



**FAIL**

**INITIALS:** \_\_\_\_\_

**Notes:** Add text comments here.

**15 Hex ID:** 203C4D840EFFBFF

**Full Hex:** FFFE2F901E26C2077FDFFFC677783E0F66C

**Burst Mode:** Normal Mode (Long)

**Protocol:** Standard Test Protocol

**Country 257:** Norway

**Bits 41 - 64:** 2540039

**Position Source:** Internal GPS

**Auxiliary Radio:** 121.5 MHz

**Bits 107-110:** Default

**Latitude:** \* \* \* \* \*

**Longitude:** \* \* \* \* \*

**406 MHz Measurements**

**406 Frequency (INT REF):** 406.0281 MHz

**406 Power (INT ANT):** 65%

**Power Rise Time:** < 5 ms

**Phase Deviation:** -1.12 +1.12 radians

**Modulation Rise Time:** 188 uS

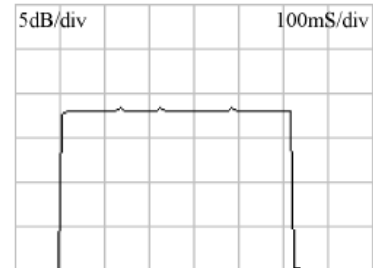
**Modulation Fall Time:** 188 uS

**Modulation Symmetry:** 0.7%

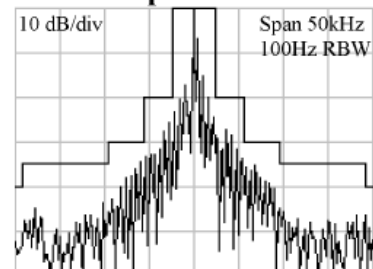
**Modulation Bit Rate:** 398.1 bps

**CW Preamble:** 159.6 ms

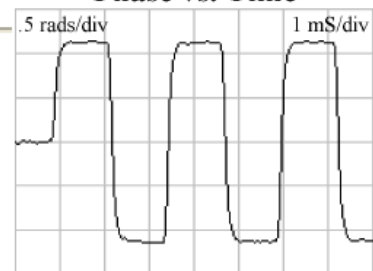
**Power vs. Time**



**Spectrum** V1.11



**Phase vs. Time**



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Product Service

Beacon Orientation – Inverted

## Beacon Test Report

203C4D840EFFBFF

**Organization:**

**Tested By:**

**Date:** 03-Oct-07 4:06:34 PM

**Tester Model/Serial No./File Name:** BT100S/1025/00372-HexChk-upside-down-1

**Tester Cal Due Date:** Nov 10, 2006

**Tester Temperature:** 25°C



**PASS**



**FAIL**

**INITIALS:** \_\_\_\_\_

**Notes:** Add text comments here.

**15 Hex ID:** 203C4D840EFFBFF

**Full Hex:** FFFE2F901E26C2077FDFFFC677783E0F66C

**Burst Mode:** Normal Mode (Long)

**Protocol:** Standard Test Protocol

**Country 257:** Norway

**Bits 41 - 64:** 2540039

**Position Source:** Internal GPS

**Auxiliary Radio:** 121.5 MHz

**Bits 107-110:** Default

**Latitude:** \* \* \* \* \*

**Longitude:** \* \* \* \* \*

**406 MHz Measurements**

**406 Frequency (INT REF):** 406.0281 MHz

**406 Power (INT ANT):** 71%

**Power Rise Time:** < 5 ms

**Phase Deviation:** -1.13 +1.11 radians

**Modulation Rise Time:** 188 uS

**Modulation Fall Time:** 198 uS

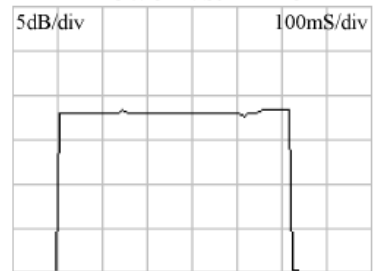
**Modulation Symmetry:** 0.8%

**Modulation Bit Rate:** 398.1 bps

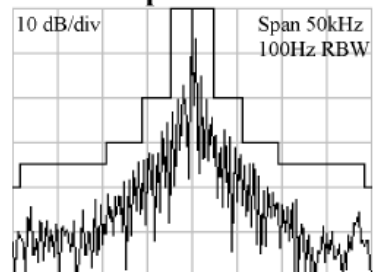
**CW Preamble:** 160 ms

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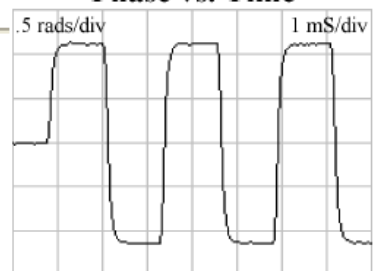
**Power vs. Time**



**Spectrum** V1.11



**Phase vs. Time**





Product Service

Beacon Orientation – Vertical

## Beacon Test Report

203C4D840EFFBFF

**Organization:**

**Tested By:**

**Date:** 03-Oct-07 4:09:55 PM

**Tester Model/Serial No./File Name:** BT100S/1025/00372-HexChk-vertical2-1

**Tester Cal Due Date:** Nov 10, 2006

**Tester Temperature:** 25°C



**PASS**



**FAIL**

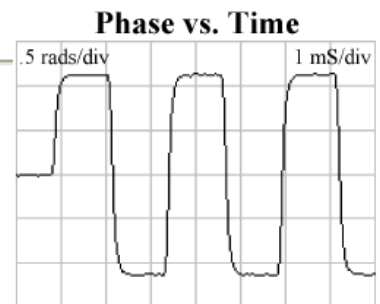
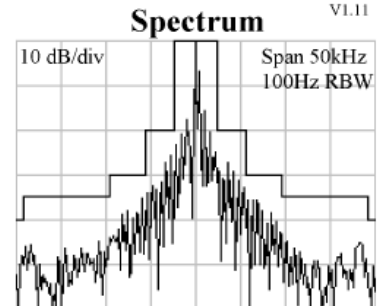
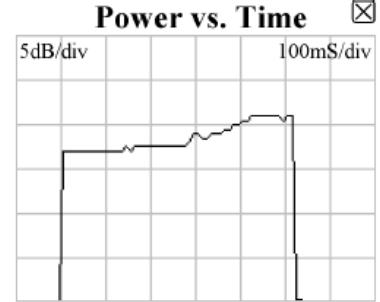
**INITIALS:** \_\_\_\_\_

**Notes:** Add text comments here.

**15 Hex ID:** 203C4D840EFFBFF  
**Full Hex:** FFFE2F901E26C2077FDFFFC6A677783E0F66C  
**Burst Mode:** Normal Mode (Long)  
**Protocol:** Standard Test Protocol  
**Country 257:** Norway  
**Bits 41 - 64:** 2540039

**Position Source:** Internal GPS  
**Auxiliary Radio:** 121.5 MHz  
**Bits 107-110:** Default  
**Latitude:** \* \* \* \* \*  
**Longitude:** \* \* \* \* \*

**406 MHz Measurements**  
**406 Frequency (INT REF):** 406.0281 MHz  
**406 Power (INT ANT):** 60%  
**Power Rise Time:** < 5 ms  
**Phase Deviation:** -1.12 +1.12 radians  
**Modulation Rise Time:** 177 uS  
**Modulation Fall Time:** 188 uS  
**Modulation Symmetry:** 0.3%  
**Modulation Bit Rate:** 398.1 bps  
**CW Preamble:** 159.3 ms



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Product Service

### **SECTION 3**

#### **TEST EQUIPMENT USED**



### 3.1 TEST EQUIPMENT USED

List of absolute measuring and other principal items of test equipment.

Instrument	Manufacturer	Type No	TE Number	Calibration Due
<b>Section 2.23 Beacons - 121 Frequency Coherence</b>				
Temperature Chamber	Montford	2F3	467	O/P Mon
Spectrum Analyser	Rohde & Schwarz	FSU26	2747	24-Jul-2008
Attenuator (20dB, 20W)	Weinschel	1	3032	4-Jul-2008
Hygrometer	Rotronic	I-1000	3068	25-Apr-2008
Attenuator (20dB, 10W)	Aeroflex / Weinschel	23-20-34	3160	30-May-2008
<b>Section 2.15 Beacons – Self-test</b>				
Climatic Chamber	Heraeus Votsch	VM 04/100	85	O/P Mon
Rubidium Frequency Standard	Quartzlock	A10-B	92	22-Dec-2007
Signal Generator	Agilent	8665B	170	24-Sep-2007
High Resolution Oscilloscope	Gould	840	182	31-Jan-2008
Beacon RF Unit	TUV	N/A	3066	TU
Termination (50ohm, 6W)	Micronde	R404613	3074	24-Feb-2008
Termination (50ohm, 15W)	Diamond Antenna	DL-30N	3098	16-Mar-2008
Attenuator (20dB, 10W)	Aeroflex / Weinschel	23-20-34	3158	30-May-2008
Attenuator (20dB, 10W)	Aeroflex / Weinschel	23-20-34	3160	30-May-2008
Attenuator (3dB, 20W)	Aeroflex / Weinschel	23-3-34	3162	19-Jun-2008
Thermocouple Thermometer	Fluke	51	3172	18-Jun-2008
Bandpass filter	Trilithic	5BE406/35-1-AA	3206	TU
Time Interval Analyser	Yokogawa	TA720 704510	3253	4-Oct-2007
Cable (1m, N Type)	Rhophase	NPS-1601-1000-NPS	3351	18-Apr-2008
Cable (1m, N Type)	Rhophase	NPS-1601-1000-NPS	3352	18-Apr-2008
Cable (2m, N Type)	Rhophase	NPS-1601-2000-NPS	3357	18-Apr-2008



Instrument	Manufacturer	Type No	TE Number	Calibration Due
<b>Section 2.22 Beacons - 121 Modulation Factor</b>				
Oscilloscope	LeCroy	9370	2832	21-Sep-2007
Hygrometer	Rotronic	I-1000	3068	25-Apr-2008
Attenuator (20dB, 10W)	Aeroflex / Weinschel	23-20-34	3160	30-May-2008
<b>Section 2.13 Beacons - Operational Life</b>				
Climatic Chamber	Heraeus Votsch	VM 04/100	85	O/P Mon
Rubidium Frequency Standard	Quartzlock	A10-B	92	22-Dec-2007
Frequency -Time Analyser	Hewlett Packard	5372A	93	27-Aug-2007
Beacon RF Unit	TUV	N/A	97	TU
Logic Analyser	Hewlett Packard	1631D	155	6-Sep-2007
Signal Generator	Hewlett Packard	8663A	765	24-Oct-2007
Stop Clock	R.S Components	RS328 061	2674	TU
Attenuator (20dB, 75W)	Bird	8308-200	3076	26-Feb-2008
Termination (50ohm, 15W)	Diamond Antenna	DL-30N	3097	16-Mar-2008
Attenuator (20dB, 10W)	Aeroflex / Weinschel	23-20-34	3159	30-May-2008
Attenuator (3dB, 20W)	Aeroflex / Weinschel	23-3-34	3163	30-May-2008
Thermocouple Thermometer	Fluke	51	3172	18-Jun-2008
Bandpass filter	Trilithic	5BE406/35-1-AA	3206	28-Jul-2008
ESA-E Series Spectrum Analyser	Agilent	E4402B	3348	16-Apr-2008
Cable (1m, N Type)	Rhophase	NPS-1601-1000-NPS	3350	18-Apr-2008
Cable (2m, N Type)	Rhophase	NPS-1601-2000-NPS	3355	18-Apr-2008
Cable (2m, N Type)	Rhophase	NPS-1601-2000-NPS	3357	18-Apr-2008
Cable (3m, N-type)	Rhophase	NPS-1601-3000-NPS	3360	18-Apr-2008



Instrument	Manufacturer	Type No	TE Number	Calibration Due
<b>Section 2.27 Beacons - Orientation Test</b>				
Beacon Tester	WS Technologies	BT 100S	87	TU
Stop Clock	R.S Components	RS328 061	2674	TU
Hygrometer	Rotronic	I-1000	3068	25-Apr-2008
ESA-E Series Spectrum Analyser	Agilent	E4402B	3348	16-Apr-2008
<b>Section 2.10 Beacons - Spurious Emissions</b>				
Climatic Chamber	Heraeus Votsch	VM 04/100	85	O/P Mon
Spectrum Analyser	Hewlett Packard	E4407B	1154	31-May-2007
Montford F43	Montford	4FT CUBED	2126	2-Nov-2007
Hygrometer	Rotronic	I-1000	3068	25-Apr-2008
Attenuator (20dB, 75W)	Bird	8308-200	3076	26-Feb-2008
Attenuator (20dB, 10W)	Aeroflex / Weinschel	23-20-34	3158	30-May-2008
Attenuator (20dB, 10W)	Aeroflex / Weinschel	23-20-34	3159	30-May-2008
Attenuator (20dB, 10W)	Aeroflex / Weinschel	23-20-34	3160	1-Jun-2007
Thermocouple Thermometer	Fluke	51	3172	18-Jun-2008
ESA-E Series Spectrum Analyser	Agilent	E4402B	3348	16-Apr-2008
Climatic Chamber	Heraeus Votsch	VM 04/100	85	O/P Mon
Beacon Tester	WS Technologies	BT 100S	87	TU
Rubidium Frequency Standard	Quartzlock	A10-B	92	22-Dec-2007
Signal Generator	Agilent	8665B	170	24-Sep-2007
High Resolution Oscilloscope	Gould	840	182	31-Jan-2008
Power Splitter	Weinschel	1506A	606	7-Sep-2007
Power Meter	Hewlett Packard	436A	751	12-Sep-2007
Termination (50ohm, 15W)	Radio Spares	612-192	2416	2-Aug-2007
Stop Clock	R.S Components	RS328 061	2674	TU



Instrument	Manufacturer	Type No	TE Number	Calibration Due
<b>Section 2.10 Beacons - Spurious Emissions</b>				
Beacon RF Unit	TUV	N/A	3066	TU
Hygrometer	Rotronic	I-1000	3068	25-Apr-2008
Termination (50ohm, 6W)	Micronde	R404613	3074	24-Feb-2008
Termination (50ohm, 15W)	Diamond Antenna	DL-30N	3098	16-Mar-2008
Attenuator (20dB, 10W)	Aeroflex / Weinschel	23-20-34	3159	30-May-2008
Attenuator (20dB, 10W)	Aeroflex / Weinschel	23-20-34	3160	30-May-2008
Attenuator (3dB, 20W)	Aeroflex / Weinschel	23-3-34	3163	30-May-2008
Bandpass filter	Trilithic	5BE406/35-1-AA	3206	TU
Time Interval Analyser	Yokogawa	TA720 704510	3253	4-Oct-2007
Timer	Radio Spares	427-590	3281	TU
Power Sensor	Agilent	8482A	3290	14-Nov-2007
ESA-E Series Spectrum Analyser	Agilent	E4402B	3348	16-Apr-2008
Cable (1m, N Type)	Rhophase	NPS-1601-1000-NPS	3350	18-Apr-2008
Cable (1m, N Type)	Rhophase	NPS-1601-1000-NPS	3354	18-Apr-2008
Cable (2m, N Type)	Rhophase	NPS-1601-2000-NPS	3355	18-Apr-2008
Cable (3m, N-type)	Rhophase	NPS-1601-3000-NPS	3360	18-Apr-2008
<b>Section 2.14 Beacons - Strobe Light Test</b>				
Dual Power Supply Unit	Hewlett Packard	6253A	271	O/P Mon
Temperature Chamber	Montford	2F3	467	O/P Mon
Multimeter	Fluke	79-3	611	31-May-2008
1GHz Digital Oscilloscope	Lecroy	9370M	612	24-Sep-2008
Weiss Technik (T)	Weiss Technik	WEISS ALT	2133	24-Nov-2007
Hygrometer	Rotronic	I-1000	2891	6-Jan-2008
Thermocouple Thermometer	Fluke	51	3174	18-Jun-2008
Strobe Light Transducer	TUV	5 to 20 volts	3459	TU



Instrument	Manufacturer	Type No	TE Number	Calibration Due
<b>Section 2.9 Climatic – Leakage and Immersion</b>				
Digital Pressure Indicator	Druck	DPI 700	2351	18-Jun-2008
Stopwatch	Farnell	SUPER LAB/SPLIT	2465	15-Jun-2008
Regulator	Unknown		2517	TU
<b>Section 2.7 Climatic – Drop Test (On Hard Surface)</b>				
Climatic Chamber	Climatec	Climatec 1	2124	9-Nov-2007
Tape Measure	Stanley		2276	TU
Hardwood Block	Unknown	ELM	2650	TU
<b>Sections 2.11 and 2.12 Climatic – Thermal Shock Tests</b>				
Beacon Tester	WS Technologies	BT 100S	87	TU
ESA-E Series Spectrum Analyser	Agilent	E4402B	3348	16-Apr-2008
<b>Section 2.21 Radio (Tx) – Modulation Frequency</b>				
Spectrum Analyser	Rohde & Schwarz	FSEM	37	17-Mar-2008
Climatic Chamber	Heraeus Votsch	VM 04/100	85	O/P Mon
Signal Generator	Agilent	8665B	170	24-Sep-2007
Attenuator 10dB 25W	Weinschel	46-10-43	400	13-Apr-2008
Oscilloscope	Lecroy	9370	2832	21-Sep-2007
Beacon RF Unit	TUV	N/A	3066	TU
Hygrometer	Rotronic	I-1000	3068	25-Apr-2008
Termination (50ohm, 6W)	Micronde	R404613	3074	24-Feb-2008
Attenuator (20dB, 10W)	Aeroflex / Weinschel	23-20-34	3158	30-May-2008
Attenuator (20dB, 10W)	Aeroflex / Weinschel	23-20-34	3160	30-May-2008
Thermocouple Thermometer	Fluke	51	3172	18-Jun-2008
Time Interval Analyser	Yokogawa	TA720 704510	3253	4-Oct-2007
Cable (1m, N Type)	Rhophase	NPS-1601-1000-NPS	3351	18-Apr-2008
Cable (2m, N Type)	Rhophase	NPS-1601-2000-NPS	3357	18-Apr-2008



Product Service

Instrument	Manufacturer	Type No	TE Number	Calibration Due
<b>Sections 2.20, 2.21 and 2.22 Radio (Tx) - Modulation Characteristics</b>				
Climatic Chamber	Heraeus Votsch	VM 04/100	85	O/P Mon
Beacon RF Unit	TUV	N/A	97	TU
Signal Generator	Agilent	8665B	170	24-Sep-2007
High Resolution Oscilloscope	Gould	840	182	31-Jan-2008
Termination (50ohm, 15W)	Radio Spares	612-192	2425	2-Aug-2007
Oscilloscope	Lecroy	9370	2832	21-Sep-2007
Beacon RF Unit	TUV	N/A	3066	TU
Termination (50ohm, 6W)	Micronde	R404613	3074	24-Feb-2008
Attenuator (20dB, 10W)	Aeroflex / Weinschel	23-20-34	3158	30-May-2008
Attenuator (20dB, 10W)	Aeroflex / Weinschel	23-20-34	3160	30-May-2008
Thermocouple Thermometer	Fluke	51	3172	18-Jun-2008
Time Interval Analyser	Yokogawa	TA720 704510	3253	4-Oct-2007
Cable (1m, N Type)	Rhophase	NPS-1601-1000-NPS	3351	18-Apr-2008
Cable (2m, N Type)	Rhophase	NPS-1601-2000-NPS	3357	18-Apr-2008

TU – Traceability Unscheduled

OP MON – Output Monitored with Calibrated Equipment



Product Service

## **SECTION 4**

### **PHOTOGRAPHS**





4.1 PHOTOGRAPHS OF EQUIPMENT UNDER TEST (EUT)



Front View of EUT



View of EUT in release mechanism



Product Service

## **SECTION 5**

### **DISCLAIMERS AND COPYRIGHT**



Product Service

**5.1 DISCLAIMERS AND COPYRIGHT**

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Product Service

**ANNEX A**

**CUSTOMER SUPPLIED INFORMATION**



Modification Information

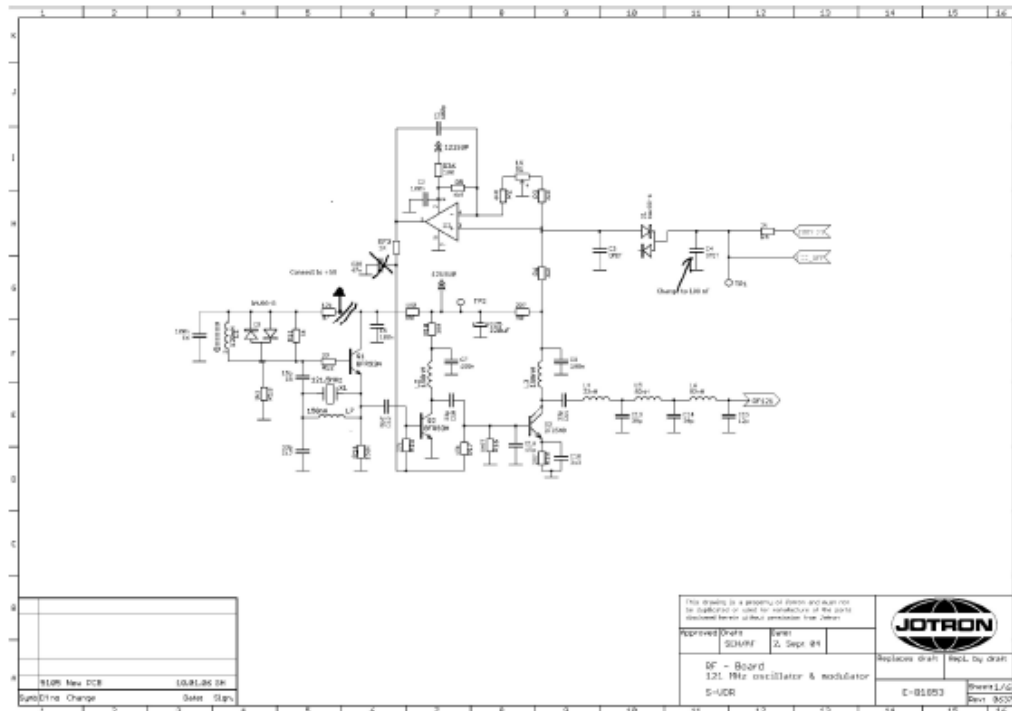
	Modifications VHF	Number
	SVDR	Page 1(1)

The 121.5MHz VHF transmitter failed at frequency coherency in -20 °C.

We changed the X-tal because the main problem to the VHF transmitter was a bad X-tal. We also connected the crystal oscillator bias to a stabilized voltage, so any drop in battery voltage not will affect the crystal oscillator.

The overshoot was caused by a too fast modulation loop. The capacitor C28 was removed and a capacitor C4 was changed from "not mounted" to 100 nF.

Picture 1:

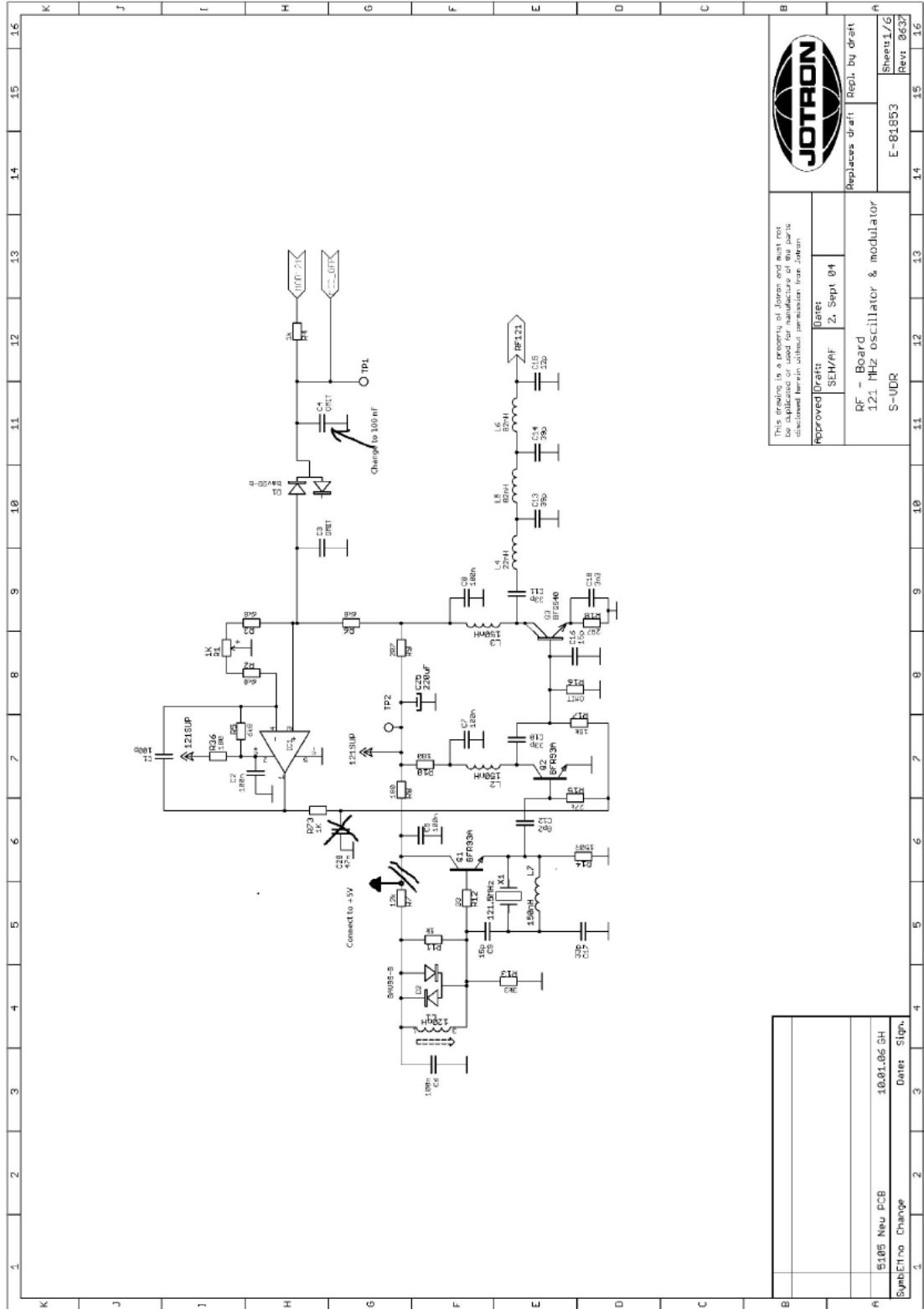


Author: Arne Fredriksen

15. Aug-2007



Modification Information (Detail of Schematic, Above)



		Replaces draft		Repl. by draft	
		E-81853		Sheet 1/6	
This drawing is a property of Jotron and must not be duplicated or used for manufacture of the parts discussed herein without permission from Jotron.		Approved	Draft		
		SEH/AF	2. Sept 04		
RF - Board		121 MHz oscillator & modulator			
S-UDR					

5105 New PCB	10.01.06 SH
Symbol no Change	Date: Sign.



Information On Previous Testing (Inadvertent Activation Test)

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### 3.5 Hose Stream tests

#### 3.5.1 Test specifications and sequence

IEC 61097-2 ed.2 Section A2.1 (5.5.1.1)

#### 3.5.2 Test program

Install the satellite EPIRB in its release mechanism in a fixed bracket.

Direct a stream from a hose at the EUT for a period of five minutes:

- Diameter of the nozzle is 63.5 mm.
- Water delivery rate is approx. 2300 liters per minute.
- The end of the nozzle is 3.5 meters away from the EUT and 1.5 meter above the base of the antenna.

During the test rotate the EPIRB unit so that the water strikes the EUT from all directions over an arc of at least 180 deg.

Verify that the EUT do not release from its bracket, nor activated automatically as a result of the water from the hose stream.

Visual inspection and aliveness test.

#### 3.5.3 Equipment under test

Name : Tron S-VDR Capsule with bracket.

Ser. Nr: 100AA102

#### 3.5.4 Test site

Sandefjord fire station.

#### 3.5.5 Test Equipment

Fire hydrant.

Fire truck with debit meter


Mechanical support

#### 3.5.6 Test result

Passed





	<p>Test Report</p>	<p>Version A</p>
<p>15.11.05</p>	<p>Tron S-VDR CAPSULE</p>	<p>Page 17 of 39</p>

**3.5.7 Description of the hose stream test**

A tube with 63,5mm diameter was connected to the fire tube. To access the correct amount of water we calibrated the water pressure against a 200-liter barrel to be filled within 5 seconds. This corresponds to 2300 liters of water per minute.

We made a stable rig that was movable in relation to the hose stream. The rig was placed so that the water tube was 3.5 meters away from the EUT and 1.5 meter above the base of the antenna.

The EUT was then fastened to the rig and tested in different positions related to the hose stream. The test lasted 5 minutes in each position, and it was tested that the EPIRB part of the EUT did not activate during the tests.

Between each test, the function of the EPIRB part of the EUT was tested.





Product Service

Information On Previous Testing (Strobe Light Test)



	Test Report	Version A
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### 3.4 Strobe Light tests

#### 3.4.1 Test specifications and sequence

IEC 61097-2ed.2 Section A1.12 (5.3.3.3)

#### 3.4.2 Test program

The effective luminous intensity and flash rate shall be checked at the normal temperature and at the extreme temperatures. The effective luminous intensity shall be defined by the following formula as indicated in IMO Resolution A.689(17) - Testing of life-saving appliances, 10.2.2:

$$\frac{\int_{t_1}^{t_2} i \cdot dt}{0.2 + (t_2 - t_1)}$$

where:

$i$  is the instantaneous intensity;

0,2 is the Blondel-Rey constant;

$t_2 - t_1$  are the time limits of integration in seconds.

The effective luminous intensity shall be at least 0,75 cd. The flash rate shall be 20 to 30 times per minute.

NOTE - Where the tests required at extreme temperature cannot be carried out within the environmental chamber, other methods may be used which approximate the required conditions.

#### 3.4.3 Equipment under test

Name : Tron S-VDR CAPSULE

Ser. Nr: 100AA104

#### 3.4.4 Test site

Jotron Electronics AS, 1<sup>st</sup> floor lab. closet.

#### 3.4.5 Test Equipment

IL 1700 Light measuring equipment with calibration certificates.

SED033 sensor with type Y filter and type L30 lens.

#### 3.4.6 Test result

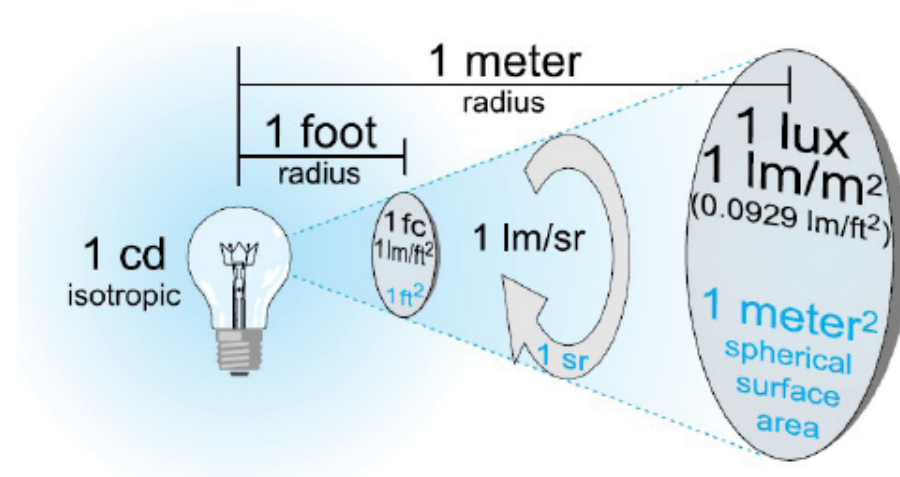
Passed



	<p>Test Report</p>	<p>Version A</p>
<p>15.11.05</p>	<p>Tron S-VDR CAPSULE</p>	<p>Page 13 of 39</p>

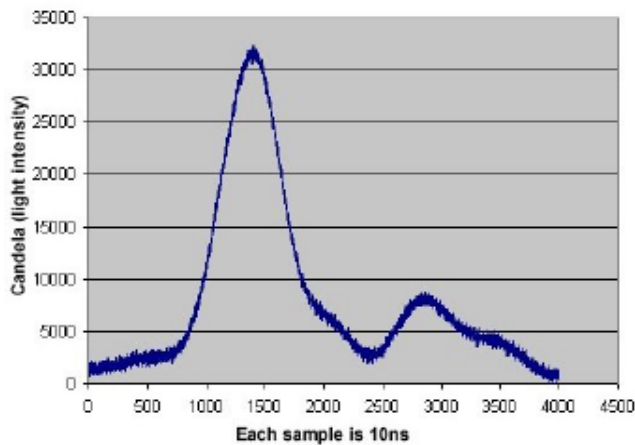
**3.4.7 Description of light test**

The closet was covered inside with black textiles and the light measure equipment was mounted. The calibration factor for lux measurement was installed in the IL 1700.




**Figure 3.3.7a The relation between the units**

From this relation we can conclude that if we use a distance of 1 meter between the sensor and the light source, 1 lux is equivalent to 1 candela.



**Figure 3.3.7.b Pulse duration of the EUT light source**



	<p>Test Report</p>	<p>Version A</p>
<p>15.11.05</p>	<p>Tron S-VDR CAPSULE</p>	<p>Page 14 of 39</p>

The pulse width is less than 40µs. When this is inserted into the formula for calculation of effective intensity, the pulse width is very small related to the Blondel-Rey constant of 200ms.

Removing the pulse width from the formula gives an error rate of just 0,2%.

The formula can therefore be simplified like this:

$$\frac{\int_{t_1}^{t_2} i \cdot dt}{t_1} = 5 \cdot \int_{t_1}^{t_2} i \cdot dt$$

(0.2)

**3.4.8 Conclusion**

The light source of the EUT is to be placed 1 meter from the sensor. The IL 1700 is set to zero point the background lightning and to measure integrated light. The integrated light can then be measured during 5 pulses, and the final value will be directly in candela.



**Figure 3.3.8a Showing light sensor with lens and a measure stick**



**Figure 3.3.8b Front of IL 1700**



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#### 3.4.9 Description of light test

We decided to do four tests at each temperature.

The EUT was placed into a freezer the previous day to reach - 20°C for the first test.

The EUT was then heated up to room temperature and tested again.

The EUT was finally heated up to + 50°C and tested again.

The flash rate of the light was controlled.

EUT at - 20°C	EUT at room temperature	EUT at + 50°C
1,00	1,89	2,00
1,09	1,89	1,98
1,03	1,90	1,98
1,03	1,87	1,94

All values is in Candela

#### 3.4.10 Flash rate

The flash rate was 21 at all temperatures.



Information On Previous Testing (Automatic Release Mechanism And Automatic Activation Tests)

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### 3.2 Automatic Release Mechanism & Automatic Activation tests.

#### 3.2.1 Test specifications and sequence

IEC 61097-2 ed.2 Section A2.2 (5.2.1)

#### 3.2.2 Test program

The satellite EPIRB installed in the automatic release mechanism shall be submerged in water, at normal temperature for all tests. The water temperature shall be noted. The following tests may be performed in any sequence.

The test at normal temperature shall be performed six times with the equipment rotated each time as follows:

- normal mounting position (as defined in the equipment manual, see 3.11);
- rolling 90° to starboard;
- rolling 90° to port;
- pitching 90° bow down;
- pitching 90° stern down;
- upside-down position.

The satellite EPIRB shall be automatically released and float free of the mounting before reaching, at any orientation, a depth of 4 m or, at a water pressure equivalent to that depth, namely 40 kPa.

The test at the extreme temperatures shall be performed in the normal mounting position(s) only, as defined in the equipment manuals. (Section 5.2.1 of IEC 61097-2-2ed.)

#### 3.2.3 Equipment under test

Name : Tron S-VDR CAPSULE with bracket.

Ser. Nr: 100AA102

#### 3.2.4 Test site

Sandefjord public pool.

#### 3.2.5 Test Equipment

Mechanical support

Tron Dec, Cospas Sarsat tester

#### 3.2.6 Test result

Passed



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### 3.2.7 Description of test

The EUT was placed into a moveable freezer the previous day, and the freezer with the EUT inside was brought to Sandefjord public pool in the morning of the test day. The temperature of the EUT was then -20°C.

With the use of the mechanical support, the EUT was lowered into the water in normal mounting position where it automatically released at a depth of 3 meters.

The EUT was then warmed to room temperature and the other automatic release test was performed successfully according to the different mounting positions defined in the standard:

- normal mounting position
- rolling 90° to starboard;
- rolling 90° to port;
- pitching 90° bow down;
- pitching 90° stern down;
- upside-down position.

Finally the EUT was heated up to +50°C and in normal mounting position the EUT was lowered into the water where it automatically released at a depth of 3 meters.

The EPIRB of the EUT was automatically activated as soon as it was released from the bracket.



Picture 3.1.7. Close up showing the EUT being lowered into the pool in upside-down position.





Information On Previous Testing (Stability And Buoyancy Test)

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### 3.3 Buoyancy, Stability And Activation tests

#### 3.3.1 Test specifications and sequence

IEC 61097-2-ed.2 Section A2.3 (5.3.2.2)

#### 3.3.2 Stability test program

With the antenna deployed in its normal operating position, the EUT shall, when rotated to a horizontal position about any axis, be submerged in fresh water just below the surface, and when released pass through an upright position within 2 s.

NOTE - Fresh water is defined as normal domestic tap water.

#### 3.3.3 Buoyancy test program

In calm fresh water, the EUT shall float upright with the base of the antenna a minimum of 40 mm above the water line.

The reserve buoyancy of the EUT shall be at least 5 % when determined by one of the following methods:

- a) The complete unit shall be submerged and the buoyant force shall be measured with a scale. The buoyant force shall be divided by the weight of the unit. The result shall be at least 1,05.
- b) The location of the water line shall be determined on the floating EUT. The calculated or measured volume of the unit above the water-level shall be divided by the calculated or measured volume below the water level. The result shall be at least 1,05.

#### 3.3.4 Activation test

The EPIRB part of the EUT shall be activated when the EUT is submerged into water.

#### 3.3.5 Equipment under test

Name : Tron S-VDR CAPSULE

Ser. Nr: 100AA102

#### 3.3.6 Test site

Jotron Electronics AS environmental lab.

#### 3.3.7 Test Equipment

Fresh water container with water overflow pipe.

Container and weight

#### 3.3.8 Test result

Passed



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15.11.05	Tron S-VDR CAPSULE	Page 10 of 39

### 3.3.9 Description of buoyancy test

Archimedes Principle – displaced water weight

The test tank was filled with water until water flows from the overflow pipe into the container. The tank is then left to enable the water level to normalise so that no further drips emerge from the overflow pipe.

The container was then emptied for water and dried off.



The EUT was then gently introduced into the tank and allowed to float naturally on the water. The overflowing water from the overflow pipe goes into the container. The water level was given sufficient time to allow it to normalise so that no further drips emerge from the overflow pipe.

The weight of the water collected was recorded as “EUT naturally floating displacement”.

According to Archimedes’ principle this weight of displaced water is equal to the mass (weight) of the body (SVDR) displacing the water.





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The EUT was then gently lowered into the tank such that it was just submerged, using controlled finger pressure.

The overflowing water from the overflow pipe goes into the container. The water level was given sufficient time to allow it to normalize so that no further drips emerge from the overflow pipe.

The weight of all the water collected was recorded as "weight of totally displaced water".

The excess buoyancy factor is a ratio of the weight of totally displaced water divided by the EUT naturally floating displacement.

**Weight of totally displaced water = 6304,5 grams**

**EUT naturally floating displacement = 3554,5 grams**

**Excess buoyancy factor =  $(6304,5/3554,5) = 1,77$**

### 3.3.10 Description of stability test

The EUT was rotated to a horizontal position about any axis, and when released passed through an upright position within 1 s.

### 3.3.11 Description of activation test

The EPIRB part of the EUT was activated when the EUT was submerged into water.



Product Service

Information On Previous Testing (Stability And Buoyancy Test)

**Jotron AS**  
Jotron Phontech AS  
Jotron UK Ltd.  
Jotron Asia Pte. Ltd.  
Jotron USA, Inc.  
UAB Jotron



To whom it may concern.

Tjodalyng: 29.10.2007

**STATEMENT OF ANTENNA HEIGHT OVER THE FLOAT LINE**

for

**Tron S-VDR CAPSULE and L-3 FFSVR**

We declare that the 406MHz antenna start height is 40mm above the float line.

Eirik Storjordet  
Certification Manager

DNB Nor Bank ASA | 0021 Oslo | Norway | Bank account: 24400508514 | IBAN: NO6624400508514 | BIC: DNBNOR33 | Reg.no.: NO917713324 MVA  
QA Certificate: NS-EN ISO 9001:2000

[www.jotron.com](http://www.jotron.com)

**Jotron AS**  
P.O. Box 54 | NO-3280 Tjodalyng | Norway

Tel: +47 33 13 97 00  
Fax: +47 33 12 67 80



Product Service

Waiver Request (High Temperature Thermal Shock Test)

**Jotron AS**  
Jotron Phontech AS  
Jotron UK Ltd.  
Jotron Asia Pte. Ltd.  
Jotron USA, Inc.  
UAB Jotron



**TUV Product Service Ltd**  
**Octagon House, Concorde Way,**  
**Segensworth North, Fareham,**  
**Hampshire**  
**PO15 5RL, United Kingdom**

Tjodalyng: 01.11.2007

**STATEMENT**

Measuring result of Thermal Shock (A.11.0)  
- mean slope measurement

The Tron S-VDR CAPSULE was constructed to meet the Cospas Sarsat T.007 standard saying  $0,002 \pm 10^{-9}$ . The measurements is within these limits.

The RTCM demands is not updated to reflex the CS T.007 at this point.

We therefore ask to have this measurement approved.

Eirik Storjordet  
Certification Manager

DNB Nor Bank ASA | 0021 Oslo | Norway | Bank account: 24400508514 | IBAN: NO6624400508514 | BIC: DNBAN0KK | Reg.no.: NO917713324 MVA  
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Product Service

**ANNEX B**

**COSPAS-SARSAT TYPE APPROVAL CERTIFICATE(S)**



Cospas-Sarsat Type Approval Certificate (Tron S-VDR Capsule)

Database ID: 155-1

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TAC Number:  TAC Date:  TAC Rev Date:

Beacon Model Name:

Additional Names:

Manufacturer:

Tx Frequencies:  In Production:  Class

Type:  Tested Life:   
 FF=Float Free (24 / 48 hrs)

Battery:   
 Manufacturer (Model, No of Cells):

Protocols Tested:  *Protocol Notes: U=User; UL=User Location; SL=Standard Location; NL=National Location*

Self Test:

Self Test RF:  Self Test RF (Short/Long):

Self Test Format Flag:  Self Test Consistent with 15 Hex ID:

Homer Freq:  Homer Duty Cycle:

Homer Power:

Strobe Light:  Strobe Brightness:

Strobe Duty Cycle:

Nav Device:

Nav Device Model:

Separable Antenna:

Antenna Model:

Additional Functions:

Comments General:

TAC Rev History:

Database ID: 155-1



Cospas-Sarsat Type Approval Certificate (L-3 FFSVR)

Database ID: 155-2

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TAC Number:  TAC Date:  TAC Rev Date:

Beacon Model Name:

Additional Names:

Manufacturer:

Tx Frequencies:  In Production:  Class

Type:  Tested Life:   
 FF=Float Free (24 / 48 hrs)

Battery:   
 Manufacturer (Model, No of Cells):

Protocols Tested:  *Protocol Notes: U=User; UL=User Location; SL=Standard Location; NL=National Location*

Self Test:

Self Test RF:  Self Test RF (Short/Long):

Self Test Format Flag:  Self Test Consistent with 15 Hex ID:

Homer Freq:  Homer Duty Cycle:

Homer Power:

Strobe Light:  Strobe Brightness:

Strobe Duty Cycle:

Nav Device:

Nav Device Model:

Separable Antenna:

Antenna Model:

Additional Functions:

Comments General:

TAC Rev History:

Database ID: 155-2