MT400 406MHz EPIRB

PROTECTION AGAINST CONTINUOUS TRANSMISSION

1. INTRODUCTION

The MT400 architecture and circuitry contains integral security features designed to eliminate the occurrence of an extended on channel emission.

2. PROTECTION FEATURES

The following features all act to ensure than an extended transmission event will not occur:

2.1 Microcontroller Watchdog Timer

This feature protects against a software execution failure which may have been either hardware or software induced.

A hardware based counter is provided which is clocked off the microcontroller's oscillator. The counters value must be reset by software intervention every 3 seconds; else associated circuitry will force a hard reset. The reset of the controller's circuitry and software is designed to clear the fault condition by resetting all registers and variables to their initial start-up values.

2.2 Low Voltage Detect and Reset

This feature protects against an execution failure which by induced by a failing battery supply.

Operating currents widely fluctuate during the normal EPIRB operating cycle as some functions, such as 406MHz transmission and strobe operation, are energy intensive. A reduced operating voltage or 'glitch' can affect proper software operation. For this reason the supply voltage is monitored. If it crosses an alarm threshold high current functions are immediately aborted so that the operating voltage is restored. A lower second alarm threshold is provided which signals that a critically low supply condition is being approached. Note, the alarm thresholds are monitored to avoid the occurrence of attempted, then aborted, 406MHz transmissions at end of battery life.

2.3 Circuit Enable Functions

This feature protects against the failure of the 406MHz circuitry to turn off when instructed to do so by the executable software.

Each major functional element, namely the reference oscillator, 406MHz generator and RF power amplifier, are enabled and disabled by their own independent control signal. All three functions must be simultaneously active for a 406MHz emission to occur. Normally between transmissions these functions are disabled.

2.4 System Lock-up

This feature protects against a stalled microprocessor clock during a 406MHz transmission.

If the microprocessor clock fails then no software will execute and the watchdog timer will be ineffective. All microprocessor outputs would remain static.

The 406 Mhz generator enable input is edge triggered. That is, a level transition will enable that circuit for approximately 1.5s duration, after which that function will automatically de-activate.

3. CONCLUSION

Current COSPAS-SARSAT specifications require that (C/S T.001, para 2.3.8):

> *'The distress beacon shall be designed to limit any inadvertent continuous transmission to a maximum of 45 seconds.'*

The MT400 design provides robust protection against the occurrence of an extended transmission ever exceeding 1.5 seconds.

Fault Mode Analysis (FMA) has identified that 2 or more independent failures within a single EPIRB unit would be required for these features to be overcome.

MT400 406MHz EPIRB

LONG TERM FREQUENCY STABILITY

1. INTRODUCTION

Quartz crystals display a gradual shift in nominal frequency over time. This phenomenon is generally referred to as 'crystal aging'.

C/S T.001 (para 2.3.1) requires that newer beacons maintain their frequency within +2kHz /-5kHz of 406.028MHz over a 5 year period.

The effect of crystal aging must be considered to determine that the requirement of C/S T.001 is met.

2. ACCELERATED AGING

An accelerated aging technique may be applied to a crystal to determine its expected long term aging characteristics.

To gain a statistically significant sample it was decided that data from 40 units would be analysed. Further to address production consistency crystals were randomly selected from 4 separate production batches (10 from each).

The crystals were placed into a chamber and the temperature elevated to a constant 85°C for the test duration. It is accepted within the industry that each 7 days exposure to 85°C is equivalent to 1 year of aging at 25°C.

Each crystal's frequency was recorded within the chamber over the test duration (refer Figure 1).

Note that the frequency was not recorded between days 50 to 66 however the crystals remained within the chamber under accelerated aging conditions for that period.

Five years of aging corresponds to 35 days of accelerated aging at 85°C (ie 5 x 7days). The specifications and results are summarised within Table 1.

Limit Type	C/S T.001 Absolute shift at 5yrs	C/S T.001 Relative to operating freq (5yrs)	Worst Case Measurement within 5yr period	Specification MARGIN
Low	-5kHz	-12.31ppm	-0.78ppm	1,578 %
High	+2kHz	+4.93ppm	+0.1	4,930 %

Table 1 - Specifications & Results within 5yrs window

Furthermore, a fifteen year of aging corresponds to 105 days of accelerated aging at 85°C (ie 15 x 7days). The results for this comparison are summarised within Table 2.

Limit Type	C/S T.001 Absolute shift at 5yrs	Relative to operating freq	Worst Case Measurement within 15yr period	MARGIN 15yr performance wrt to 5yr Spec
Low	-5kHz	-12.31ppm	-1.3	947 %
High	+2kHz	+4.93ppm	+0.1	4,930 %

Table 2 - Fifteen Year Aging Results (not C/S requirement)

3. CONCLUSION

The expected long term performance of crystals used within the MT400 easily meet COSPAS-SARSAT specified requirements.

It is worth noting that the MT400's output frequency is fully programmable. Therefore the crystal's initial frequency is irrelevant. The ambient operating frequency of 406.028MHz is set during factory calibration where accuracy superior to the specified ± 1kHz is easily achievable.

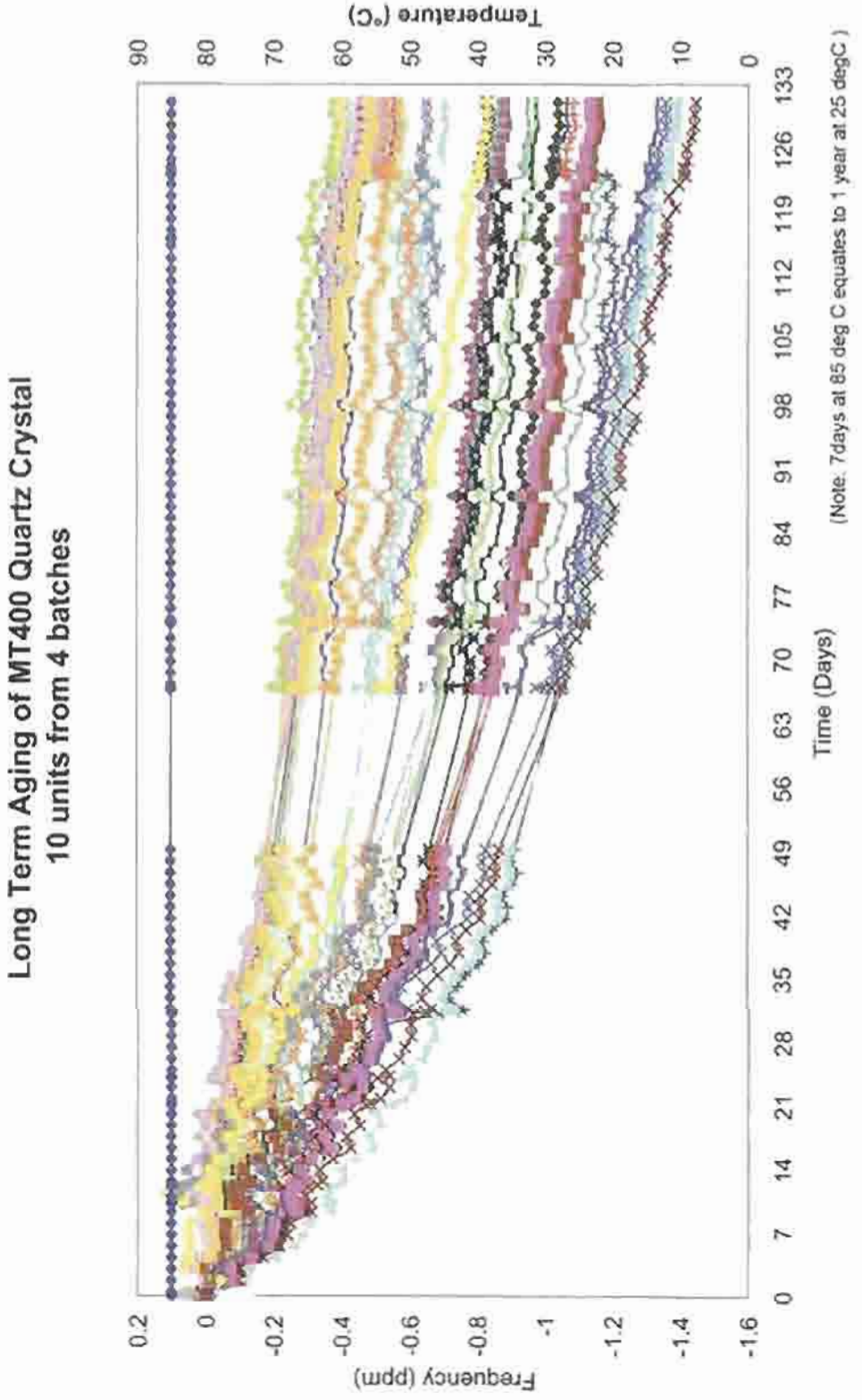


Figure 1 - Measurement Results

MT400 406MHz EPIRB

PRODUCTION RUN, REPETITION RATE RANDOMISATION

1. INTRODUCTION

The MT400 design uses a pseudo-random number generator to apply a variance of up to ±2.5s to the base 50s repetition rate. This calculation is performed between each and every transmission burst.

The product serial number is used as an initialisation seed at power up to ensure a unique starting seed for the sequence, and therefore further enhance the randomisation performance.

2. CONCLUSION

Each MT400 displays a unique random repetition period to ensure that the transmission bursts of two or more active units will not become synchronised.

MT400 406MHz EPIRB

50 OHM INTERFACE ADAPTOR

1. INTRODUCTION

The MT400 is equipped with a permanently attached (integral) antenna. To obtain optimum power efficiency the 121.5MHz and 406MHz amplifier circuits are directly matched to the respective antenna impedance at those frequencies.

In order to support laboratory measurements it is convenient to have an adaptor which simulates the antenna and provides a 50 ohm interface port to which test equipment may be directly connected.

2. TECHNICAL DESCRIPTION

2.1 Antenna Measurements

With the MT400 in a standard deployment, the antenna has been measured as presenting the following impedances at the interface with the internal circuitry:

$Z_{121} = 2.0 - j193$ (6.8pF)

$Z_{406} = 72 - j8.5$ (47pF)

2.2 Circuit Configuration

The Circuit of Figure 1 was designed and optimised so as to present the above impedances when it is used to replace the MT400 antenna.

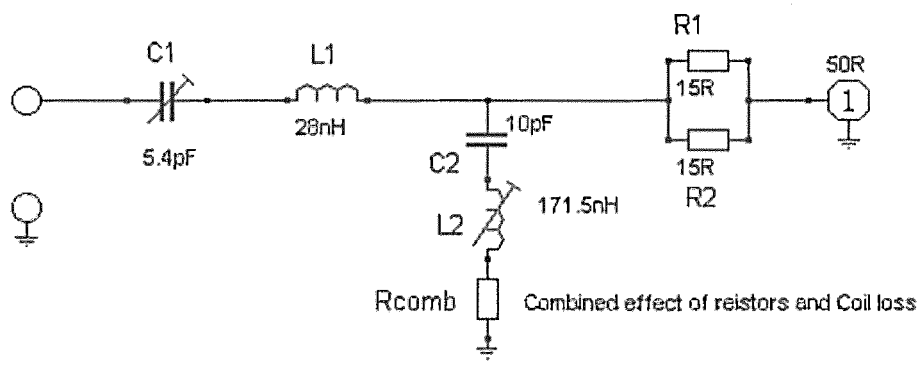


Figure 1 – 50 ohm Interface Adaptor

2.3 Circuit Description

C2 and L2 are series resonant at 121.5MHz providing a pure resistance consisting of Coil losses and Rcomb. This Resistance is in shunt with R1, R2 and the 50 Ohm load.

C1 is then adjusted such that C1 and L1 provide a net reactance of –j193 at 121MHz.

C2, L2 and Rcomb provide a large inductive reactance at 406 MHz (+j400) which is considerably larger than the combined resistance R1, R2 and the load.

The value of L1 was calculated such that when C1 is adjusted for correct impedance at 121.5 MHz, the combined reactance of C1 and L1 is appropriate at 406MHz.

A theoretical design was used as a starting point. Component values were adjusted on the physical unit, based on impedance measurements made using a Vector Network Analyser (this is why the nominal circuit values may not appear to be optimal in a theoretical analysis).

2.4 Loss Calibration

The unit was calibrated to determine circuit, cable and connector loss:

Loss @ 121Mhz = 14.38 dB

Loss @ 406MHz = 1.32 dB

2.5 Loss Correction (on Test Unit)

On return from testing at Intespace (Toulouse) it was found that the calibration correction for unit #204 at 121.5 MHz was incorrect. Investigation of the transfer characteristics showed that the coil L2 had been slightly detuned during installation at Intespace, resulting in a lesser attenuation at 121.5MHz.

When measured with a calibrated MT400 the attenuation was found to be 5.2dB less than indicated in the initial calibration data:

Loss @ 121Mhz = 9.18 dB (test unit)

The loss calibration at 121.5MHz is extremely sensitive to the tuning of the notch due to the low impedances present. This appears to be the only effect though, as measurements confirmed that DC power consumption during 121.5MHz operation remained unchanged.

Both 406MHz calibration and operation are completely unaffected.

406 MHz BEACON SELF-TEST CHARACTERISTICS

406 MHz Beacon Model(s): ___ MT400 _____

	Answer (√) Yes	No
1. Does beacon have a self-test mode ?	...✓...	.....
if yes :		
• does self-test have a separate switch position ?	...✓...	.....
• does self-test switch automatically return to normal position when released ? if not, how long until the first "distress" message is emitted:_____	...✓...	.....
• does self-test transmit a 406 MHz signal ?	...✓...	.....
if yes:		
- unmodulated signal only	.....	...✓...
- normal data, but with inverted frame synchronization pattern	...✓...	.....
- 1 burst only	...✓...	.....
• does self-test transmit a 121.5 MHz signal ?	...✓...	.....
if yes:		
- for less than 1 second	...✓...	.....
- continually while self-test switch is activated	.....	...✓...
- other (please specify) : __Unmodulated at peak RF power__	...✓...	
• does self-test transmit any other frequency (e.g. 243 MHz) ?	.....	...✓...
2. Result of self-test is indicated by:		
• pass/fail display indicator light	...✓...	.....
• strobe light flash	...✓...	.....
• other (please specify) : __ Audible annunciator _____	...✓...	
3. Can the self-test be performed without removing the beacon from its mounting bracket ?	...✓...	.....
4. What parameters are internally tested by the self-test ?		
• battery voltage	...✓...	.....
• RF power	...✓...	.....
• approximate RF frequency	.....	...✓...
• phase locked loop	...✓...	.....
• other (please specify) : _System User data (eg UIN) memory parity check_	...✓...	
5. Do the above characteristics apply to this beacon model:		
• **for all countries where beacon is sold ?**	...✓...	.....
if no, please specify : _____		
• **for all production serial numbers?**	...✓...	.....
if no, please specify : _____		

6. Comments: _____

MT400 406MHz EPIRB

POWER SOURCE

1. INTRODUCTION

The MT400 contains an integral battery consisting of 2 series wired high energy long life cells. This battery is replaced approximately every five years to ensure that sufficient capacity exists to support the specified beacon performance and operational duration.

The battery is non-user replaceable, requiring that the MT400 be returned to an authorised service centre.

The battery contains protective features, as does the MT400 beacon circuitry

2. IMPLEMENTATION DETAILS

The cells used within the MT400 are the Saft Lo 26 SX type.

They are 3.0V Primary lithium-sulfur-dioxide (LiSO2) high drain capability spiral D-size cells. Please refer to the manufacturer's data sheet, provided, for further details.

It is worth noting that these cells are hermetically sealed; but include a vent to improve cell safety should it be exposed to an abnormal operating condition.

The battery circuit diagram is shown in Figure 1. A fusible link is provided at the cell series connection. A short circuit or abnormally high current condition at the battery pack output causes the link to fuse.

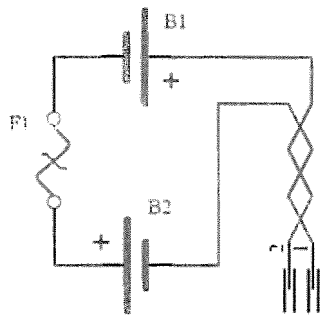


Figure 1- Battery Pack Circuit Diagram

The potential of cell reversal is not a problem with this 2 battery design. Should a cell reverse, the resultant battery output will be too low to drive the MT400 circuitry. This will cause the MT400 to shut down, as for a pack that has reached its end-of-life.

The cells are protected at each end; a plastic moulding over one end, a silicon insulator at the other (Figure 2). The implementation does not compromise each cell's integral safety vents (verified through destructive tests, and advice from Saft).

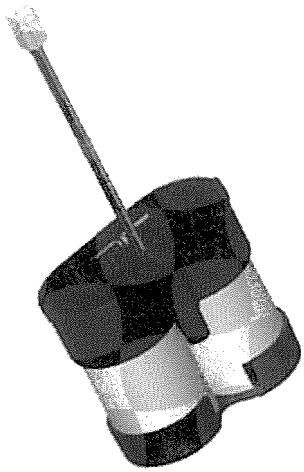


Figure 2 - Battery Pack Assembly

Additionally, a board mounted fuse has been provided in the negative lead at the power pack connector on the MT400 PCB. Choosing to fuse the negative lead offers improved protection as the electrically floating battery pack is surrounded by a conductive chassis at ground potential.

LO 26 SX

3.0 V Primary lithium - sulfur dioxide ($Li-SO_2$) High Drain capability Spiral D-size cell

For high drain applications up to 3 A continuous, 10 A pulse currents, possibly combined with exposure to extreme temperatures.

Key features

- High and stable discharge voltage
- Performance not affected by cell orientation
- Low self discharge rate *(less than 3% after 1 year of storage at +21°C/+70°F)*
- Hermetic glass-to-metal sealing
- Built-in safety vent (at the negative end of the cell)
- 1 A-fused version not restricted for transport
- UL Component Recognition (File Number MH 15076)
- Meets shock, vibration and other environmental requirements of military specifications
- Made in the USA

Main applications

- Radiocommunications and other military applications
- Beacons and Emergency Location Transmitters
- Sonobuoys

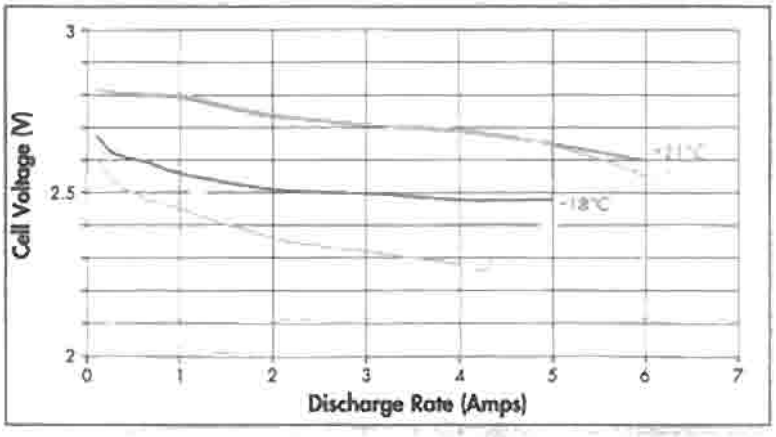
... etc.

Cell size reference	**R20 - D**
Electrical characteristics *(typical values for cells stored for one year or less)*	
Nominal capacity	7.5 Ah
(at 240 mA +21°C/+70°F 2.0 V cut off. The capacity restored by the cell varies according to current drain, temperature and cut off).	
Open circuit voltage *(at +21°C)*	3.0 V
Nominal voltage *(at 240 mA +21°C/+70°F)*	2.8 V
Maximum recommended continuous current *(to avoid over-heating. Higher currents possible, consult Saft).*	3 A
Pulse capability : *varies according to pulse characteristics (frequency, duration), temperature, cell history (storage conditions prior to usage) and the application's acceptable minimum voltage. Consult Saft.*	
Storage *(recommended)*	+30°C/+86°F
max *(possible without leakage)*	-60°C (-76°F) / +85°C (+185°F)
Operating temperature range	-60°C (-76°F) / +71°C (+160°F)
(Short excursions up to 85°C possible at currents below 1 A).	
Physical characteristics	
Diameter *(max)*	33.8 mm (1.33")
Height *(max. finish with radial tabs)*	59.3 mm (2.33")
Typical weight	85 g (2.98 oz)
Weight of Li metal	2.4g
Standard cell comes with two radial 0.15 mm thick nickel tabs	
Finish with positive button on request	
Finish with 1 A fuse on request	

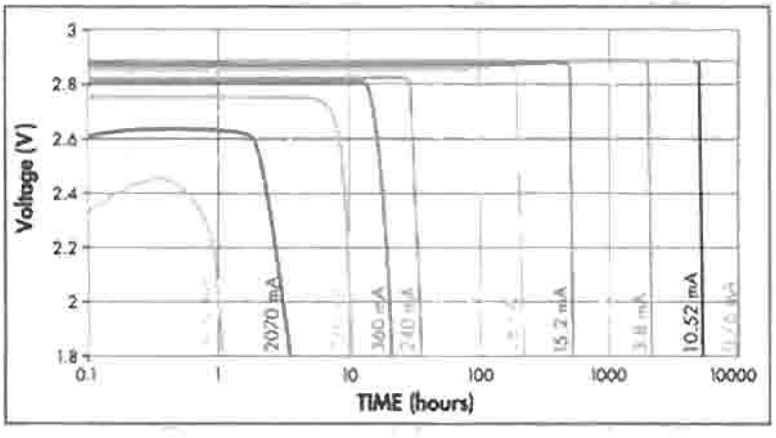
SAFT

LO 26 SX

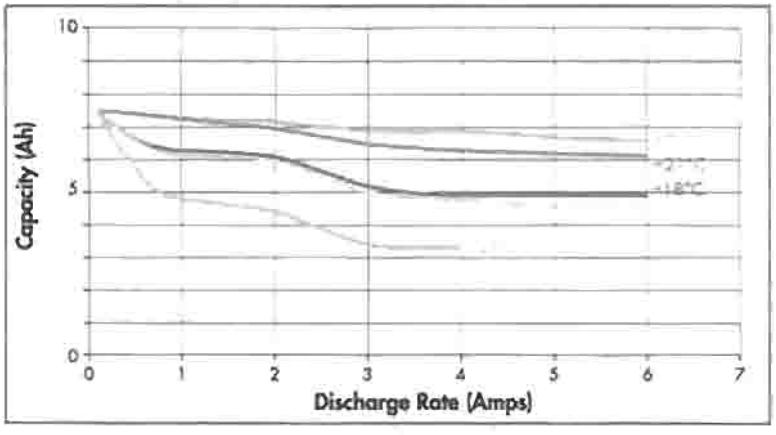
Voltage at mid-discharge versus Current and Temperature (2.0 V cut off)

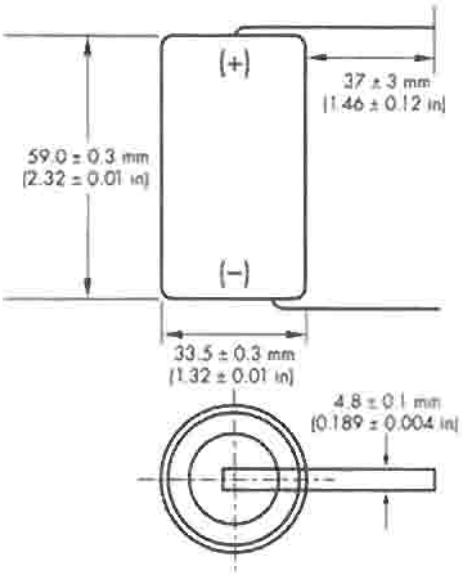


Typical discharge profiles at +21°C/+70°F



Capacity versus Current and Temperature (2.0 V cut off)





overall dimensions

Handling precautions

- Do not puncture, open or mutilate. Cell is pressurised.
- Do not obstruct the safety vent mechanism.
- Do not short circuit or charge
- Do not expose to fire or temperatures above 70°C (160°F).

SAFT

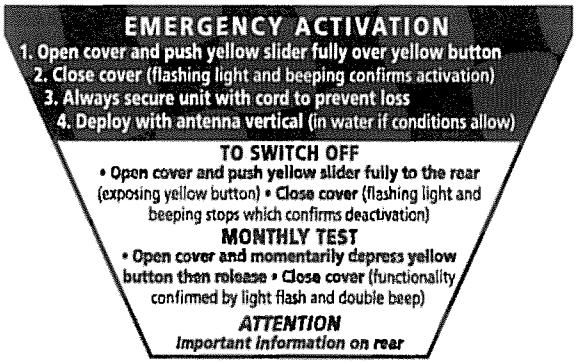
12, rue Sadi Carnot
93170 Bagnolet - France
Tel +33 (0)1 49 93 17 70
Fax +33 (0)1 49 93 19 69

313, Crescent Street
Valdese NC 28690 USA
Tel +1 (828) 874 41 11
Fax +1 (828) 879 39 81

Internet: http://www.saftbatteries.com

Doc. N°: 12.00 - 31030.2
Published by the Communications Department

INFORMATION ONLY



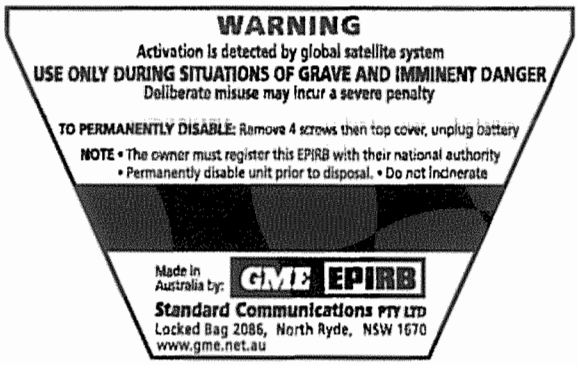
MT400 Sample label- FRONT□

□

NOTE: Content may change depending on target market □ requirements.

STANDARD COMMUNICATIONS PTY LTD 6 frank Street. Gladesville NSW Australia 2111			
DRAWN MS	DESCRIPTION ARTWORK MT400 CHASSIS (FACE B)		
DATE 19/05/03	DO NOT SCALE PRINT		
	PART NO.	UNITS	SHEET OF 1:1
APP CD	SUPP DRG. NO.	SIZE A4	SCALE 1:1
	DEVELOPMENT NO.	DRAWING NO. 41576 - ISS. 1	
DISK FILE: Marian's HD		FILE NAME: 41576-1 MT400 Face B	

INFORMATION ONLY



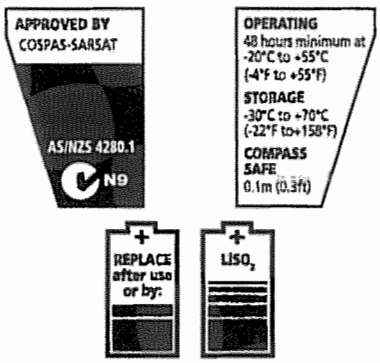
MT400 Sample label- REAR□

□

NOTE: Content may change depending on target market □ requirements.

STANDARD COMMUNICATIONS PTY LTD 6 frank Street. Gladesville NSW Australia 2111			
DRAWN MS	DESCRIPTION ARTWORK MT400 CHASSIS (FACE D)		
DATE 19/05/03	DO NOT SCALE PRINT		
	PART NO.	UNITS	SHEET OF 1:1
APP CD	SUPP DRG. NO.	SIZE A4	SCALE 1:1
	DEVELOPMENT NO.	DRAWING NO. 41739 - ISS. 1	
	DISK FILE: Marian's HD	FILE NAME:41739-1 MT400 Face D	

INFORMATION ONLY



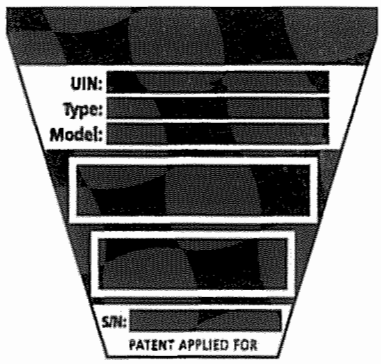
MT400 Sample label- SIDE□

□

NOTE: Content may change depending on target market □ requirements.

STANDARD COMMUNICATIONS PTY LTD 6 frank Street. Gladesville NSW Australia 2111			
DRAWN MS	DESCRIPTION ARTWORK MT400 CHASSIS (FACE E)		
DATE 23/05/03	DO NOT SCALE PRINT		
	PART NO.	UNITS	SHEET OF 1:1
APP CD	SUPP DRG. NO.	SIZE A4	SCALE 1:1
	DEVELOPMENT NO.	DRAWING NO. 41785 - ISS. 1	
	DISK FILE: Marian's HD	FILE NAME: 41785-1 MT400 Face E	

INFORMATION ONLY



MT400 Sample label- SIDE□

□

NOTE: Content may change depending on target market □ requirements.

STANDARD COMMUNICATIONS PTY LTD 6 frank Street. Gladesville NSW Australia 2111			
DRAWN MS	DESCRIPTION ARTWORK MT400 CHASSIS (FACE C)		
DATE 23/05/03	DO NOT SCALE PRINT		
	PART NO.	UNITS	SHEET OF 1:3
APP CD	SUPP DRG. NO.	SIZE A4	SCALE 1:1
	DEVELOPMENT NO.	DRAWING NO. 41738 - 1	ISS.
	DISK FILE: Marian's HD	FILE NAME: 41738-1 MT400 Face C	

MT400 Qualification Testing

Low Temperature Operating Life – Battery Preconditioning

Table of Contents

Tables

1. INTRODUCTION

Cospas-Sarsat C/S T.007, IEC61097-2 and ETSI EN 300 066 all specify a level of battery pre-conditioning prior to conducting an operational life test at the minimum operating temperature condition.
The pre-conditioning requirements of both IEC and ETSI are identical and will therefore be covered by a single analysis within this document. A separate analysis is provided per Cospas-Sarsat C/S T.007.
The more demanding of the two pre-conditioning periods will be adopted for the certification of the MT400, there-by demonstrating compliance to all three specifications.

2. ASSOCIATED DOCUMENTS

Information within the documents identified at Table 1 has been used as the basis for some of the calculations presented here-in. They are provided as attachments for reference purposes.

Description	Designation
Battery Manufacturer's Datasheet	Attachment 1
Battery Self Discharge, Manufacturer's correspondence.	Attachment 2
Interpretation of date code, Manufacturer's correspondence.	Attachment 3

Table 1 - Supporting Documentation

3. DEFINITIONS AND ABBREVIATIONS

Term		Definition/Description
Rated Life	≡	Extends from the date of battery cell manufacture to that date declared on the beacon as the latest date of replacement. The beacon is designed to operate fully within specifications when powered by batteries, which have not reached their replacement date.
Useful Life	≡	The useful life of the battery is defined as the period of time after the date of battery cell manufacture that the beacon will continue to meet the power input requirements f that unto
hrs	≡	Hours. Unless otherwise state are in decimal (i.e. 6.5 hrs is 6 & ½ hrs)
Ah	≡	Ampere-hour
s	≡	second
mA	≡	milli-ampere
ms	≡	milli-second
ETSI	≡	European Telecommunications Standards Institute
IEC	≡	International Electrotechnical Commission
wrt	≡	with respect to

Table 2 - Definitions and Abbreviations

4. CALCULATION

4.1 Determination of Equivalent Activation Period

4.1.1 Energy Consumption per 50s Activation Cycle

The current and duration requirements seen by the battery for each separate MT400 function are provided at Table 3.

This demand is then equated to an energy requirement, expressed in Ampere-hours, per unit of operational time. For the MT400, and the purposes of this analysis, a convenient unit of time is a single complete 'activation cycle' of nominally 50s duration.

Note: Knowledge of the rate of energy consumption is applied to determine the period of time that an MT400 needs to be activated so as to discharge the battery by a known amount, prior to conducting operational life testing.

Description	Duration (ms)	Current (mA)	Quantity	Energy (Ah)
406MHz, short message	440	2496	1	0.000305
121.5MHz carrier, modulated	48100	67	1	0.000895
Audible alert	100	61	17.5	0.000030
LED strobe	260	341	17.5	0.000431
Energy per 50s activation cycle				0.001661

Table 3 - Energy per 50s activation cycle

4.1.2 Self Discharge "(a1, a2, E)"

The battery rate of self-discharge (Table 4) has been obtained from the cell datasheet and for direct correspondence with the cell manufacturer. Each figure given is the total loss from date of manufacture (ie non-cumulative).

The 15 year figure is given for information purposes only and does not feature within the analysis of this document.

Elapsed Duration		Capacity Loss (at 21°C)	
(yrs wrt new)	Comment on capacity loss	(% wrt new)	Source
0	New cell	0	---
1	Estimated typ as ≈80% of rated maximum	2.5	Cell Datasheet
5	Typical value	5	Attachment 2
10	Typical value	8	Attachment 2
15	Typical value	10	Attachment 2

Table 4 - Cell capacity loss over time

Description	Operation		units
Cell capacity at new		7.00	Ah
Capacity loss at 1 year	x (Table 4)	2.5	%
Self-discharge energy loss at 1 year		0.18	Ah
Energy per 50s activation cycle	/	0.001661	Ah
No. 50s act cyc consuming equiv. energy to 1yr s'dist		105.36	
Hours per 50s activation cycle	x	(50/60)/60	
"(E)" Equivalent (1yr loss) activation time		**1.46**	**hrs**
Cell capacity at new		7.00	Ah
Capacity loss at 5 years	x (Table 4)	5	%
Self-discharge energy loss at 5 years		*0.35*	Ah
Energy per 50s activation cycle	/	0.001661	Ah
No. 50s act cyc consuming equiv. energy to 5yr s'dist		*210.73*	
Hours per 50s activation cycle	x	(50/60)/60	
"(a2)" Equivalent (5yr loss) activation time		***2.93***	**hrs**
Cell capacity at new		7.00	Ah
Capacity loss at 10 years	x (Table 4)	8	%
Self-discharge energy loss at 10 years		0.56	Ah
Energy per 50s activation cycle	/	0.001661	Ah
No. 50s act cyc consuming equiv energy to 10yr s'dist		337.17	
Hours per 50s activation cycle	x	(50/60)/60	
"(a1)" Equivalent (10yr loss) activation time		**4.68**	**hrs**

Table 5 - Calculation of "(a1)" ,"(a2)" and "(E)"

4.1.3 Self Test "(b)"

The current and duration requirements seen by the battery for each separate MT400 function during a routine 'Self-Test' operation are provided at Table 6.

This demand is then equated to an energy requirement, expressed in Ampere-hours for completion of a single self-test.

It is worthy to note that the 121.5MHz homer is un-modulated during self-test, which accounts for the current draw being significantly higher than in normal swept tone operation.

Description	Duration (ms)	Current (mA)	Quantity	Energy (Ah)
406MHz, short message	440	2496	1	0.000305
121.5MHz carrier, unmodulated	300	161	1	0.000013
Audible alert	100	61	2	0.000003
LED strobe	260	341	1	0.000025
				0.000347

Table 6 - Energy per self-test

The MT400 is specified for a routine monthly self-test over its 5 year rated battery life.

Description	Operation		units
Number of Years		5	
Months per year	x	12	
Number of self-test over battery life		60	
Energy consumed per self-test cycle	x (Table 6)	0.000347	Ah
Total self-test energy consumed over battery life		0.020790	Ah
Energy per 50s activation cycle	/	0.001661	Ah
No. 50s act cyc consuming equiv. energy to tot s'test		12.52	
Hours per 50s activation cycle	x	(50/60)/60	
"(b)" Equivalent (Self-test) activation time		**0.17**	**hrs**

Table 7 - Calculation of "(b)"

4.1.4 Stand-by "(c)"

The MT400 does not draw current in the OFF state.

Description	Operation		units
"(c)" Equivalent (Stand-by) activation time		**0.00**	**hrs**

Table 8 - Calculation of "(c)"

4.2 Battery Pre-Conditioning Prior to Low Temp Life Test

4.2.1 IEC/ETSI Specification Method "(a1, b, c, E)"

Calculations according to the IEC/ETSI method are shown in Table 9.

Description	Formula		Equivalent Activation Period (hrs)
Self Discharge, Useful life (10yrs)	(a1)	4.68	
Self Test (monthly over 5yrs)	(b)	0.17	
Standby Load (5yrs)	(c)	0.00	
Total pre-conditioning activation period for new cells	(p)=(a1+b+c)		4.86
Discharge due to existing test cell age	(E)	1.46	
		-	1.46
Pre-conditioning activation period for actual test cells	(p)-(E)		**3.40**

Table 9 - IEC/ETSI Pre-conditioning Calculations

4.2.2 C/S T.007 Test Specification Method "(a2, b, c, E)"

Calculations according to the COSPAS SARSAT method are shown in Table 10.
Note, it is believed that the intention is that energy loss due to self-discharge should be included (although this is not explicitly stated in C/S T.007). For the purpose of this analysis self-discharge has been included as represents a more stringent requirement.

Description	Formula		Equivalent Activation Period (hrs)
Self Discharge, Rated life (5yrs)	(a2)	2.93	
Self Test (monthly over 5yrs)	(b)	0.17	
Standby Load (5yrs)	(c)	0.00	
Total pre-conditioning activation period for new cells	(p)=(a2+b+c)	3.10	
Correction Co-efficient	(f)	1.65	
Corrected pre-conditioning activation period for new cells	(p)x(f)		5.12
Discharge due to existing test cell age	(E)	1.46	
		-	1.46
Required pre-conditioning activation period (actual cells)	(p x f)-(E)		**3.66**

Table 10 - COSPAS-SARSAT Pre-conditioning Calculations

4.2.3 Selected Method and Pre-Test Discharge Duration

After accounting for the current age of the test cells (1year as of April 2003) the IEC/ETSI methods require a minimum 3.40 hrs of pre-test activation, whereas the COSPAS/SARSAT method requires a minimum of 3.66 hrs.

For the purpose of the low temperature life test the later is the more demanding of the two pre-conditioning periods, and will therefore be adopted for the certification of the MT400 there-by demonstrating compliance to all three specifications.

PRE-TEST DISCHARGE DURATION > 3.66 hrs

ATTACHMENT 1

LO 26 SX

3.0 V Primary lithium - sulfur dioxide ($Li-SO_2$) High Drain capability Spiral D-size cell

For high drain applications up to 3 A continuous, 10 A pulse currents, possibly combined with exposure to extreme temperatures.

Key features

- High and stable discharge voltage
- Performance not affected by cell orientation
- Low self discharge rate *(less than 3% after 1 year of storage at +21°C/+70°F)*
- Hermetic glass-to-metal sealing
- Built-in safety vent (at the negative end of the cell)
- 1 A-fused version not restricted for transport
- UL Component Recognition (File Number MH 15076)
- Meets shock, vibration and other environmental requirements of military specifications
- Made in the USA

Main applications

- Radiocommunications and other military applications
- Beacons and Emergency Location Transmitters
- Sonobuoys

... etc.

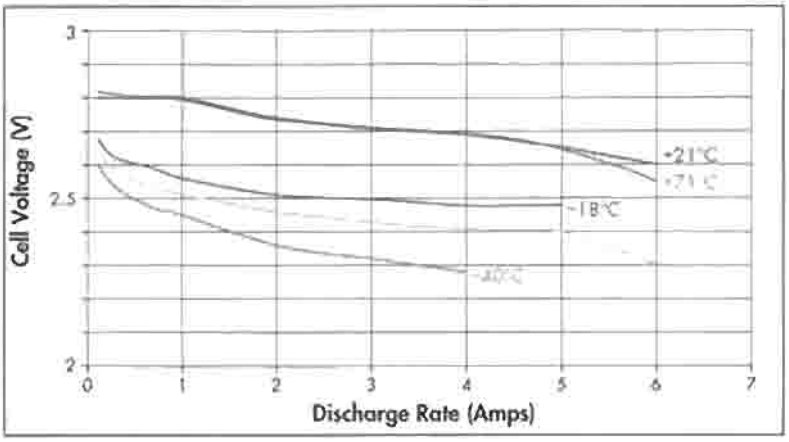
Cell size reference	**R20 - D**
Electrical characteristics *(typical values for cells stored for one year or less)*	
Nominal capacity	7.5 Ah
(at 240 mA +21°C/+70°F 2.0 V cut off. The capacity restored by the cell varies according to current drain, temperature and cut off).	
Open circuit voltage *(at +21°C)*	3.0 V
Nominal voltage *(at 240 mA +21°C/+70°F)*	2.8 V
Maximum recommended continuous current *(to avoid over-heating. Higher currents possible, consult Saft).*	3 A
Pulse capability : *varies according to pulse characteristics (frequency, duration), temperature, cell history (storage conditions prior to usage) and the application's acceptable minimum voltage. Consult Saft.*	
Storage *(recommended)*	+30°C/+86°F
max *(possible without leakage)*	-60°C (-76°F) / +85°C (+185°F)
Operating temperature range	-60°C (-76°F) / +71°C (+160°F)
(Short excursions up to 85°C possible at currents below1 A).	
Physical characteristics	
Diameter *(max)*	33.8 mm (1.33")
Height *(max; finish with radial tabs)*	59.3 mm (2.33")
Typical weight	85 g (2.98 oz)
Weight of Li metal	2.4g
Standard cell comes with two radial 0.15 mm thick nickel tabs	
Finish with positive button on request	
Finish with 1 A fuse on request	

SAFT

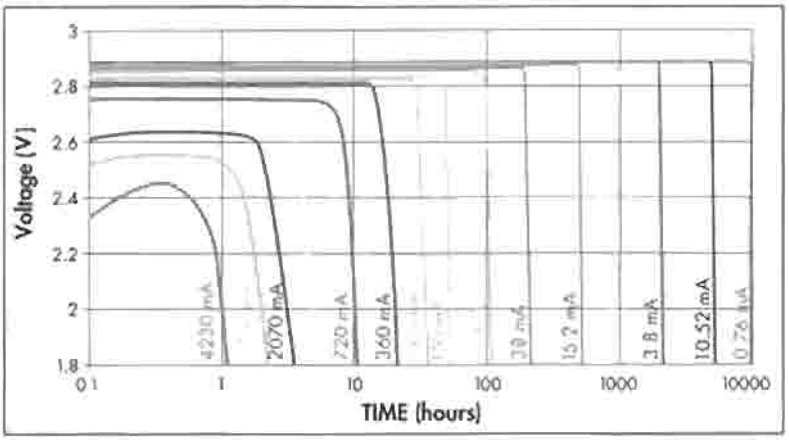
ATTACHMENT 1

LO 26 SX

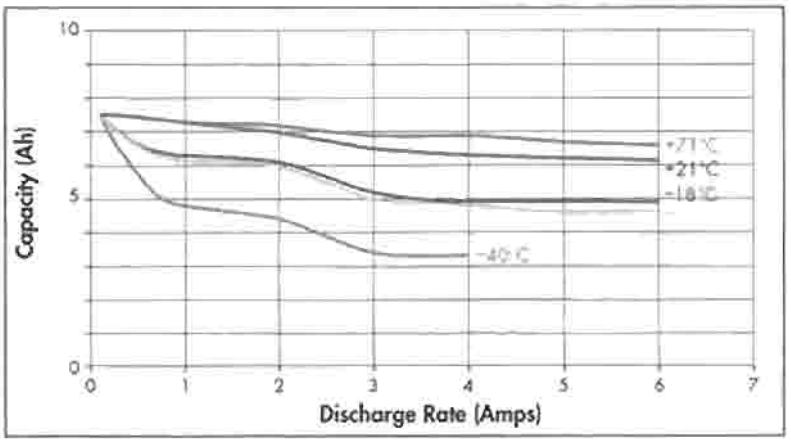
Voltage at mid-discharge versus Current and Temperature (2.0 V cut off)

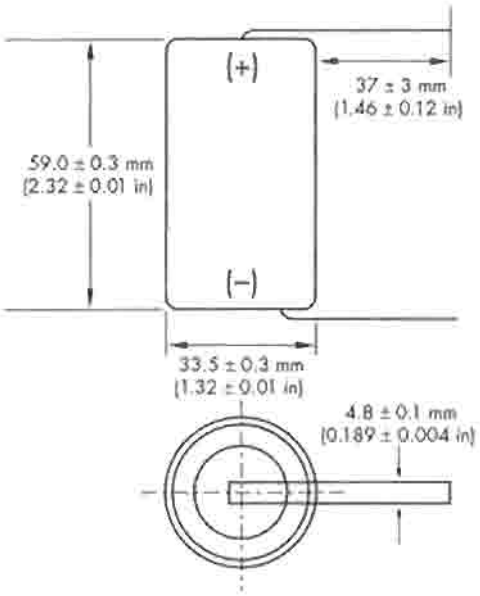


Typical discharge profiles at +21°C/+70°F



Capacity versus Current and Temperature (2.0 V cut off)





overall dimensions

Handling precautions

- Do not puncture, open or mutilate. Cell is pressurised.
- Do not obstruct the safety vent mechanism.
- Do not short circuit or charge
- Do not expose to fire or temperatures above 70°C (160°F).

SAFT

12, rue Sadi Carnot
93170 Bagnolet - France
Tel +33 (0)1 49 93 17 70
Fax +33 (0)1 49 93 19 69

313, Crescent Street
Valdese NC 28690 USA
Tel +1 (828) 874 41 11
Fax +1 (828) 879 39 81

Internet: http://www.saftbatteries.com

Doc. Nº. 12.00 - 31030.2
Published by the Communications Department

ATTACHMENT 2.

SAFT

To: Craig Duncan June 26, 2003

Subject: Capacity Retention of LO26SX(D size $LiSO_2$ primary lithium cell)

Saft has performed a number of tests on capacity retention of our $LiSO_2$ cells and batteries. $LiSO_2$ is the most prevalently used chemistry for military portable batteries, and the LO26SX cell is the most used cell type in military batteries. The excellent capacity retention after long periods of storage is one of the major strengths of $LiSO_2$ that has resulted in its popularity for use in military applications.

Saft LiSO2 cells and batteries stored in warehouse conditions have been tested after up to 15 years storage. The average temperature during the storage period is in the range of 20 to 25°C with a maximum temperature of 40°C. Military batteries up to 5 years storage in military use(including deployment in the Middle East during Dessert Storm) have been capacity tested as well. From the results of testing of aged batteries Saft has developed typical capacity retention rates. The capacity loss is greatest in the first 1 to 2 years and gradually reduces to almost negligible loss with time after that. After 5 years aging typical $LiSO_2$ battery capacity is 95% of its initial capacity; after 10 years approximately 92%; and after 15 years the typical capacity is still greater than 90%.

Respectfully,

Michael S. Sink
Mgr. New Business Development
Direct Voice: 828-879-5031 Fax: 828-879-3981
email: mike.sink@saftamerica.com

ATTACHMENT 2

SAFT

To: Craig Duncan June 26, 2003

Subject: Capacity Retention and Pulse Effects: LO26SX(D size $LiSO_2$ primary lithium cell)

Saft has performed a number of tests on capacity retention of our $LiSO_2$ cells and batteries. $LiSO_2$ is the most prevalently used chemistry for military portable batteries, and the LO26SX cell is the most used cell type in military batteries. The excellent capacity retention after long periods of storage is one of the major strengths of $LiSO_2$ that has resulted in its popularity for use in military applications.

Saft LiSO2 cells and batteries stored in warehouse conditions have been tested after up to 15 years storage. The average temperature during the storage period is in the range of 20 to 25°C with a maximum temperature of 40°C. Military batteries up to 5 years storage in military use(including deployment in the Middle East during Dessert Storm) have been capacity tested as well. From the results of testing of aged batteries Saft has developed typical capacity retention rates. The capacity loss is greatest in the first 1 to 2 years and gradually reduces to almost negligible loss with time after that. After 5 years aging typical $LiSO_2$ battery capacity is 95% of its initial capacity; after 10 years approximately 92%; and after 15 years the typical capacity is still greater than 90%.

In an operational environment where the LO26SX cell is subjected to short pulses periodically the amount of capacity loss due to the pulsing has been found to be essentially the amount of capacity loss due to the pulse current and time. There is a negligible effect on the self-discharge rate as listed above due to infrequent and short pulses. In the case of a 2 amp by 0.5 second pulse applied on a once per month basis the added discharge due to the pulsing over a 5 year period would represent less than 0.25% of the LO26SX capacity. This is not sufficient to significantly disturb the normal self-discharge rate of the cells. To be on the conservative side the estimated self-discharge rate could be increased by 0.5% per year over the results of non-pulsed storage conditions. At this rate the capacity after five years would be typically 92%; after 10 years 87%.

Respectfully,

Michael S. Sink
Mgr. New Business Development
Direct Voice: 828-879-5031 Fax: 828-879-3981
email: mike.sink@saftamerica.com

ATTACHMENT 3.

From: Wayne.Pitt@saft.alcatel.com.au
To: 'Kevan Wilson-Elswood'
Sent: Friday, April 04, 2003 4:53 PM
Subject: RE: Lithium battery application information

Hi Kevan,

The cells will be market with a code, similar to the following; 991127Y. This is year month day, with the letter being a production identifier. If you do not find the identification code on the outside of the white sleeve, you may have to peel off the outside white heat shrink sleeve, and check the cell can underneath. If you have any problems at all, please do not hesitate in contacting me.

Regards
Wayne

-----Original Message-----
From: Kevan Wilson-Elswood [mailto:kelswood@gme.net.au]
Sent: Friday, 4 April 2003 15:14
To: Wayne.Pitt@saft.alcatel.com.au
Subject: Re: Lithium battery application information
Importance: High

Hello Wayne,
Sorry to bother you again but this is fairly important. To get an accurate idea of how to simulate self dicharse on the LO26SX cells we need to know when they were manufactured. I note that the cell bodies are stamped with a code. Can we deduce the date of Manufacture from that code.
Thanks for any help you can provide

Kevan Wilson-Elswood
Senior Design Engineer
Standard Communications Pty Ltd
Gladesville, Australia

intespace
L'Intelligence de l'Environnement

STANDARD COMMUNICATIONS PTY.LTD.
6, Frank Street
GLADESVILLE NSW 2111
(Australia)

Attention : Mr. Craig DUNCAN

Toulouse, October 23rd, 2003

DELIVERY NOTE N° BE03.219 AP-ET/GP/gg

Number	DESIGNATION	COMMENTS
1	COMPLEMENTARY C/S TEST REPORT OF 406 MHz DISTRESS BEACON	Reference : M4586 Rev. 2
7	Updated (rev. 1) pages : N° 4, 6, 7, 8, 9, appendix A (2) of Test Report ref. M4586 Std Com.	Other addressees : - 1 copy to Mr. S. MIKAILOV, COSPAS/SARSAT Sec - 1 copy to Mr. Sarthou, CNES – DSO/RC/AS

Best Regards,

p.o. G. Peyrou

Gérard PEYROU
TECHNOLOGIC TESTS DEPARTMENT

2, rond-point Pierre Guillaumat - BP 4356 - 31029 Toulouse cedex 4 - FRANCE
Tél. +33 (0) 5 61 28 11 11 - Fax +33 (0) 5 61 28 11 12
www.intespace.fr - marketing@intespace.fr

intespace
L'Intelligence de l'Environnement

Toulouse, 17 October 2003

INTESPACE reference : M4586-Rev2

COMPLEMENTARY C/S TEST REPORT OF 406 MHz DISTRESS BEACON

MANUFACTURER :	STANDARD COMMUNICATIONS PTY. LTD.
BEACON MODEL :	MT400 Rev 2

Written : 17/10/2003
By : Gerard PEYROU
Visa :

Approved : 20/10/2003
By : Didier NAWS
Visa : D. N

Quality Control : 22-10-03
By : André LOUIT
Visa : P. A. HOFFMANN

Distribution :

- Mr	Craig DUNCAN	STANDARD COMMUNICA	(1 copy)
- Mr	S. MIKAILOV	COSPAS/SARSAT Sec	(1 copy)
- Mr	M. SARTHOU	CNES - DSO/RC/AS	(1 copy)
- INTESPACE		ITS/AP/ET	(1 copy)

2, rond-point Pierre Guillaumat - BP 4356 - 31029 Toulouse cedex 4 - FRANCE
Tél. +33 (0) 5 61 28 11 11 - Fax +33 (0) 5 61 28 11 12
www.intespace.fr - marketing@intespace.fr
S.A. au capital de 3 904 560 Euros - RCS : TOULOUSE B 326 100 971 - SIRET : 326 100 971 00018 - APE : 743 B - TVA : FR16326100971

1 - ADMINISRATION

1.1. WORK ORDER

Manufacturer : STANDARD COMMUNICATIONS PTY. LTD.
Address : 6, Frank street - GLADESVILLE NSW 2111 - AUSTRALIA

Represented by : Mr Craig DUNCAN

1.2. INTESPACE TEST CENTER

The test operations have been conducted by : Mr G. PEYROU

1.3. SCHEDULE

Start of test:	14 October 2003
End of test :	17 October 2003

1.4. WORK REFERENCE : **M4586-Rev2**

1.5. EQUIPMENT UNDER TEST

The results from this test report concern only the equipment here after referenced :

- Commercial designation :
- Model : MT400 Rev 2
- Sérial number: MT0

2 - TEST FACILITIES

- ARGOS - COSPAS/SARSAT Certification Test Bench.
- Anechoic chamber for antenna test .
- Toulouse CNES MCC .

3 - OBJECTIVE OF TESTS

To check modulation signal at 3 beacon operating temperatures in normal configuration and with VSWR 3:1

4 - STANDARS AND TEST PROCEDURES APPLICABLE

COSPAS-SARSAT standards :

- "C/S T. 001- Issue 3 - Revision 4 - October 2002 "
- "C/S T. 007- Issue 3 - Revision 9 - October 2002"

INTESPACE Radio Beacon Test Procédures :

- " COSPAS-SARSAT Certification Test"	Réf. ITS : 572 AP/QA
- " 406 MHz Caracteristic Antenna Test "	Réf. ITS : 566 AP/QA
- " Radio Beacon Test Report "	Réf. ITS : 579 AP/QA-f

5 - RESULTS

See following pages :

- application form for a COSPAS-SARSAT 406 MHz beacon Type Approval Certificate,
- summary of 406 MHz beacon test results
- test results : data and graphs

APPLICATION FOR A COSPAS - SARSAT 406 MHz BEACON TYPE APPROVAL CERTIFICATE

Beacon Manufacturer : STANDARD COMMUNICATIONS PTY. LTD.

Beacon model : MT400 Rev 2

Beacon Number : MT0

Name and Location of Beacon Test Facility : INTESPACE / CNES Toulouse

Beacon Type : Aviation : ☐ Land : ☐ Maritime : ☑

Antenna Model :

Specified Operating Temperature Range -20 °C to 55 °C

Specified Operating Lifetime : 24 hr ☐ 48 hr ☑ Other ☐ Specify :

Beacon Battery Type(s)

Chemistry : LiSO2
Manufacturer & model n° : SAFT / LO 26SX
Size & number of cells : D Size / 2 Cells

Extra Features in Beacon	**No**	**Yes**	**Details**	
a) Auxiliary Radio-Locating Device :	☐	☑	Frequency Power Tx. Duty Cycle	: 121.5 MHz : 17 dBm (50 Ω) : Continious (> 96 %)
b) Transmits Encoded Position Data	☑	☐	Nav. Device Type Manufacturer Model	: : : :
c) Transmits Long Message (144 bits)	☑	☐		
c) Automatic Activation :	☑	☐		
d) Built-in Strobe light :	☐	☑	Intensity Flash rate	> 0,75 Cd : 20/21 per mn
e) Selft-test mode	☐	☑		
f) Other	☐	☑	Specify	: Audible Annunciator

I hereby confirm that the 406 MHz beacon described above has been successfully tested in accordance with the COSPAS-SARSAT Type Approval Standard (C/S T.007) and complies with the COSPAS-SARSAT Specification (C/ST T.001) as demonstrated in the attached report.

Dated : 17 October 2003 Signed :

(for test facility)

TableC2 : SUMMARY OF 406 MHz BEACON TEST RESULTS

PARAMÈTRES TO BE MEASURED DURING TESTS		RANGE OF SPECIFICATION	UNITS	TEST RESULTS			COMMENTS
				$T_{min.}$ -20°C (±3)	$T_{amb.}$ 22°C (±3)	$T_{max.}$ 55°C (±3)	
1 - POWER OUTPUT							
o transmitter power output		35 - 39	dBm	36,6	35,7	35,4	
o Power output rise time		< 5	ms	1,06	1,34	1,53	
o power output 1 ms before burst		must be < -10 dBm	√ *				Not checked
2 - DIGITAL MESSAGE							Data and graphs pages 9 to 18
	Bits number						
o bit sync	1-15	15 bits "1"	√	√	√	√	
o frame sync	16-24	9 bits (000101111)	√	√	√	√	
o format flag	25	1 bit	√	0	0	0	
o protocol flag	26	1 bit	√	1	1	1	
o identification/position code	27-85	59 bits	√	√	√	√	
o BCH code	86-106	21 bits	√	√	√	√	
o emerg. code/nat. use/supplem. data	107-112	6 bits	data bits	000000	000000	000000	
o additional data/BCH (if applicable)	113-144	32 bits	√	N/A	N/A	N/A	Not applicable
o position error (if applicable)		< 5	km	N/A	N/A	N/A	

PARAMÈTRES TO BE MEASURED DURING TESTS	RANGE OF SPECIFICATION	UNITS	TEST RESULTS			COMMENTS
			$T_{min.}$ -20°C (±3)	$T_{amb.}$ 22°C (±3)	$T_{max.}$ 55°C (±3)	
3 - DIGITAL MESSAGE GENERATOR						Data and graphs pages 9 to 18
o repetition rate :						
minimum T_R =	47,5	seconds	48,0	48,0	48,0	
maximum T_R =	52,5	seconds	52,0	52,0	52,0	
o bit rate						
minimum f_b =	396	bits/sec.	399,67	399,68	399,67	
maximum f_b =	404	bits/sec.	399,75	399,75	399,76	
o total transmission time :						
short message =	435.6 - 444.4	ms	440,88	440,70	440,57	
long message (optional) =	514.8 - 525.2	ms				
o CW preamble						
minimum T_1 =	158,4	ms	160,63	160,45	160,39	
maximum T_1 =	161,6	ms	160,70	160,53	160,45	
o first burst delay	> 47,5	seconds	> 47,5	> 47,5	> 47,5	

PARAMÈTRES TO BE MEASURED DURING TESTS	RANGE OF SPECIFICATION	UNITS	TEST RESULTS			COMMENTS
			$T_{min.}$ -20°C (±3)	$T_{amb.}$ 22°C (±3)	$T_{max.}$ 55°C (±3)	
4 - MODULATION						Data and graphs
o biphase-L		√	√	√	√	pages 9 to 18
o rise time	50 - 250	microsec.	150	140	150	
o fall time	50 - 250	microsec.	140	140	130	
o phase deviation : positive	+ (1.0 to 1.2)	radians	+ 1,07	+ 1,06	+ 1,08	
o phase deviation : negative	- (1.0 to 1.2)	radians	- 1,11	- 1,11	- 1,07	
o symmetry measurement	≤ 0.05		4,01E-06	+ 0,0160	+ 0,0160	
5 - 406 MHz TRANSMITTED FREQUENCY						Data pages 10, 13 and 16
o nominal value	as specified in C/S T.001 and C/S T.012	MHz	406,0279406	406,0279152	406,0279386	
o short term stability	≤ 2×10^{-9}	/100 ms	4,46E-10	2,18E-10	3,30E-10	
o medium term stability						
. slope	(-1 to +1) x 10^{-9}	/minute	-1,18E-10	-1,03E-11	2,18E-10	
. residual frequency variation	≤ 3×10^{-9}		7,57E-10	1,25E-09	5,56E-10	
6 - SPURIOUS EMISSION ** (into 50 ohms)						See graphs pages 19 to 22
o in-band (406.0 - 406.1 MHz)	see spurious emission mask in C/S T.001	√	√	√	√	

PARAMÈTRES TO BE MEASURED DURING TESTS	RANGE OF SPECIFICATION	UNITS	TEST RESULTS			COMMENTS
			$T_{min.}$ -20°C (±3)	$T_{amb.}$ 22°C (±3)	$T_{max.}$ 55°C (±3)	
7 - 406 MHz VSWR CHECK after open circuit, short cicuit, then while VSWR is 3:1, measure :						See data and graphs pages 23 to 29
o nominal transmitted frequency	as specified in C/S T.001 and C/S T.012	MHz	406,0279424	406,0279383	406,0279409	
Modulation :						
o rise time	50 - 250	microsec.	149,7	149,7	149,7	
o fall time	50 - 250	microsec.	149,7	139,7	159,7	
o phase deviation : positive	+ (1.0 to 1.2)	radians	1,05	1,07	1,07	
o phase deviation : negative	- (1.0 to 1.2)	radians	-1,12	-1,07	-1,10	
o symmetry measurement	≤ 0.05	√	+ 0,0080	+ 0,0121	+ 0,0079	
o digital message	must be correct	√	√	√	√	
8 - SELF-TEST MODE (if applicable)						Not checked
o frame sync	9 bits (011010000)	√				
o format flag	1/0	bit				
o single radiated burst	≤ 440 /520 (+1%)	ms				
o default position data (if applicable)	must be correct	√				
o description provided		√				
o design data provided on protection against repetitive self-test mode transmissions	protection provided	√				
o single burst verification	one burst	√				
o provides for beacon 15 Hex ID	must be correct	√				

CERTIFICATION TEST RESULTS ON
MT400 Rev 2 STANDARD COMMUNICATIONS PTY. LTD. EPIRB
N° MT0

at -20° C, 22° C and 55° C

Certification Test at -20°C Date of test : 15-oct-03

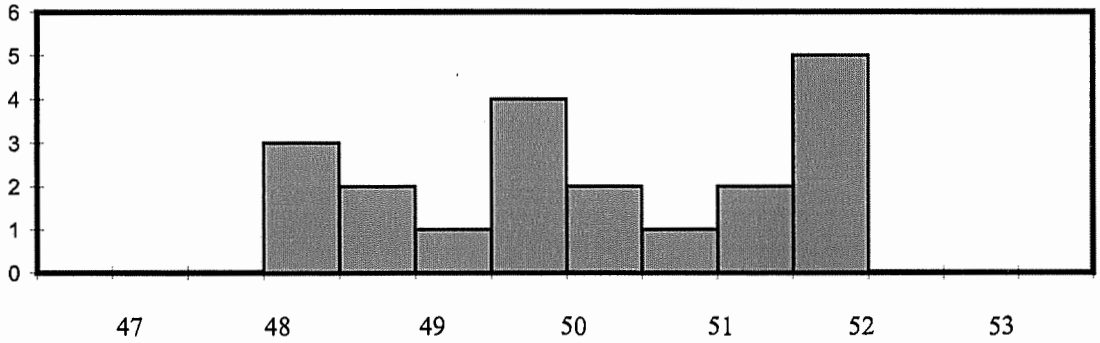
Manufacturer : Standard Communications
Beacon Type : MT400 Rev2
Number : MT0

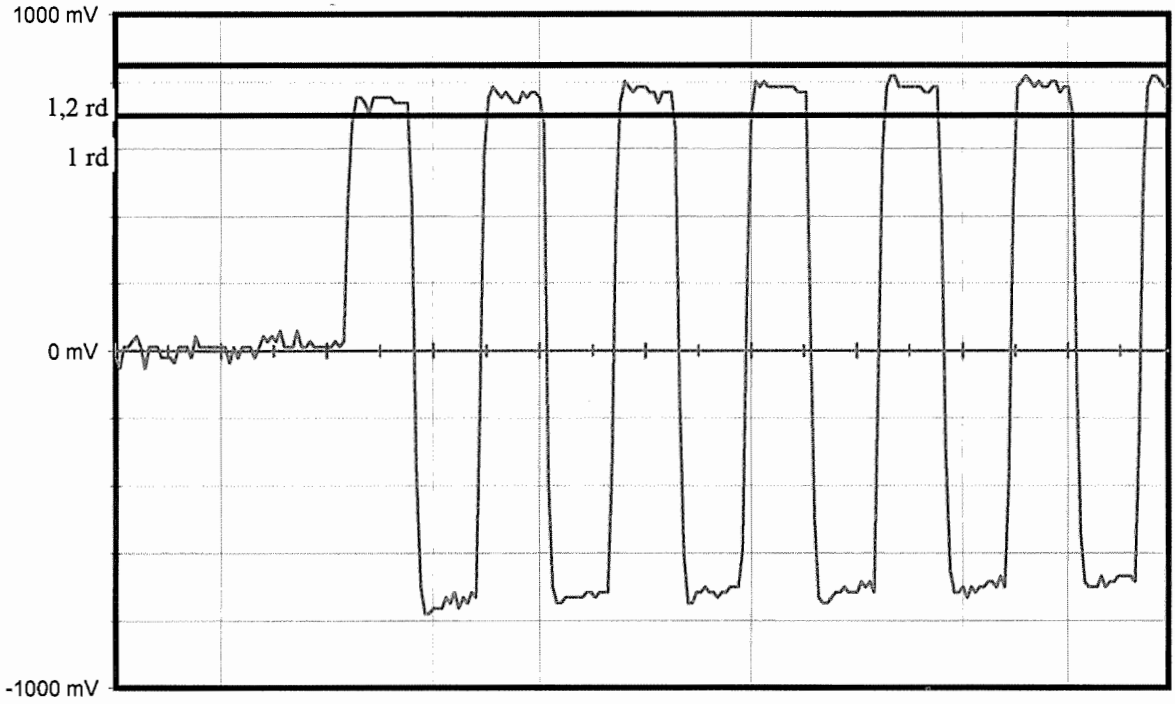
Message

Message received		FFFE2F5F7703C4800000086FFE80
Format Flag	25	0
Protocol flag	26	1
Ident./Position code	27-85	BEEE07890000001
Country Code/Country	27-36	503 / AUSTRALIA
Protocol Code : U/Std-Nat	37-39/37-40	11
Protocol Code Used	37-39/37-40	
Identification Data	40-85/41-64/41-58	1E
Identification Used		:::::::
Calculated BCH1	25-85	01BFFA
Readed BCH1	86-106	01BFFA
Homing	84-85	01
Em.cod/nat.use/supp.data	107-112	000000
Emer cod / Encod pos data	107	0
Activation type	108	0 Manual
Calculated BCH2	107-132	
Readed BCH2	133-144	
Latitude position		
Longitude position		
Delta position		

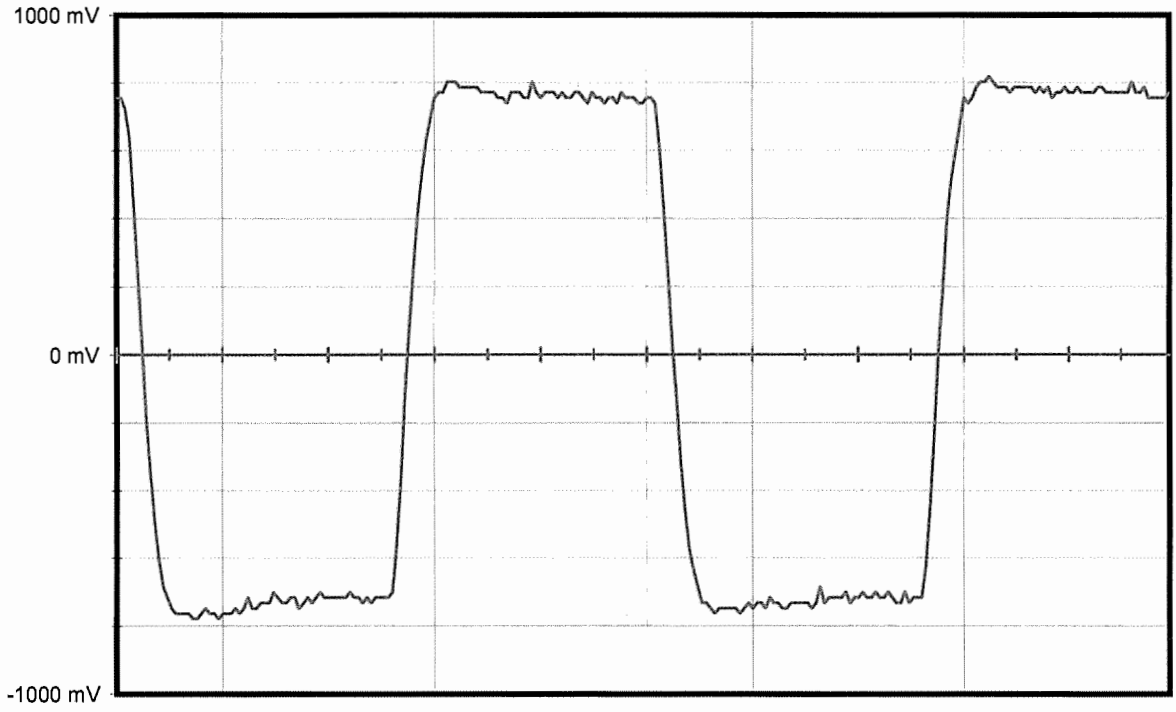
Electrical and other parameters

CW preamble	ms	158,4 <	< 162,6	160,66
Total transmission time	ms	434,6 <	<445,4	440,88
Modulation frequency	Hz	395,4<	< 404,6	399,70
Phase deviation : total	rd		<=2,40	2,17
Phase deviation : positive	rd	1,00 <	< 1,20	1,07
Phase deviation : negative	rd	-1,20 <	< -1,00	-1,11
Symmetry measurement	%		<=5 %	4,01E-04
Nominal frequency : F2	Hz			406027940,61
Short term2				2,82E-10
Short term3				4,46E-10
Slope				-1,18E-10
Residual				7,57E-10
406 MHz power output	dBm			36,6
Homing frequency	MHz			Not checked
121,5 MHz power output	dBm			Not checked
Soak temperature	°C			-19,6
Extra feature				No

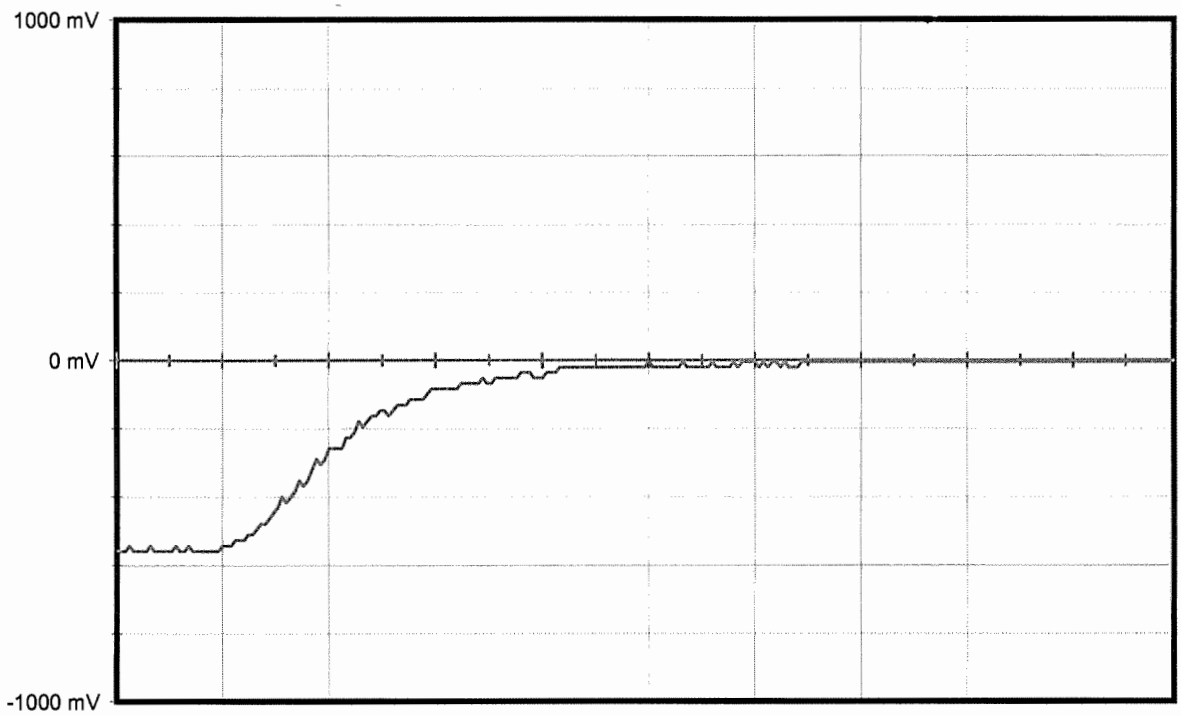




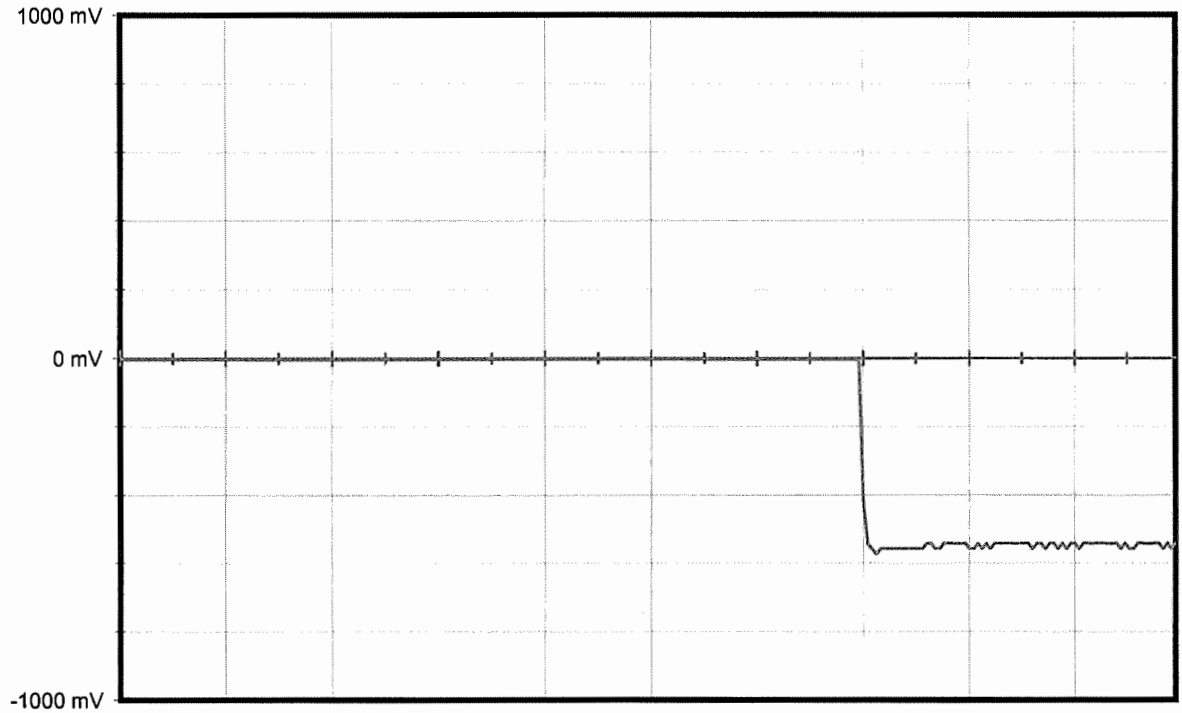
0 ms 10 ms 20 ms
Vmarker1 850 mv ==> 1,2 rd 2 ms/div.
Vmarker2 700 mv ==> 1 rd



8 ms 10,5 ms 13 ms
Duty Cycle : 4,008E-06 0,5 ms/div.
falltime(1)<= 139,721 us risetime(1)<= 149,701 us
+width(1) 1,24751 ms -widht(1) 1,2475 ms



-1 ms 1,5 ms 4 ms
risetime(1)<= 1057,88 us 0,5 ms/div.



-3,5 ms -1 ms 1,5 ms
falltime(1)<= 29,9399 us 0,5 ms/div.

Certification Test at 22°C Date of test : 14-oct-2003

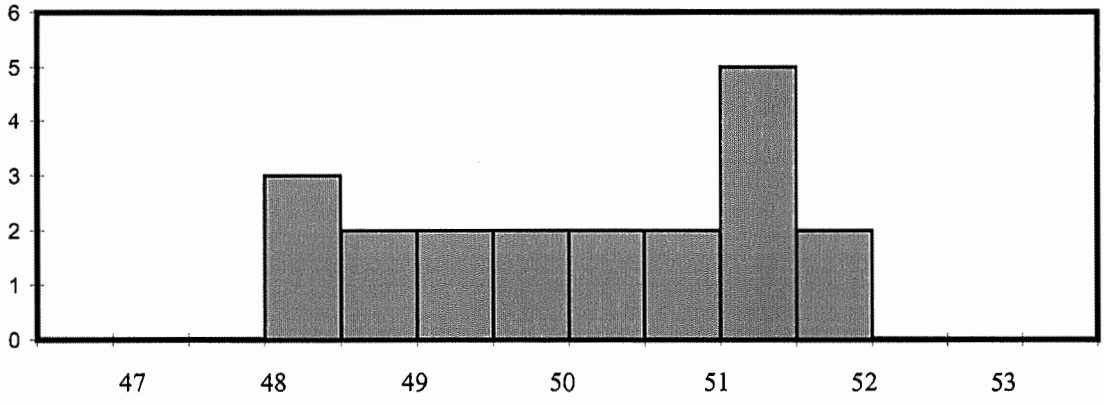
Manufacturer : Standard Communications
Beacon Type : MT400 Rev2
Number : MT0

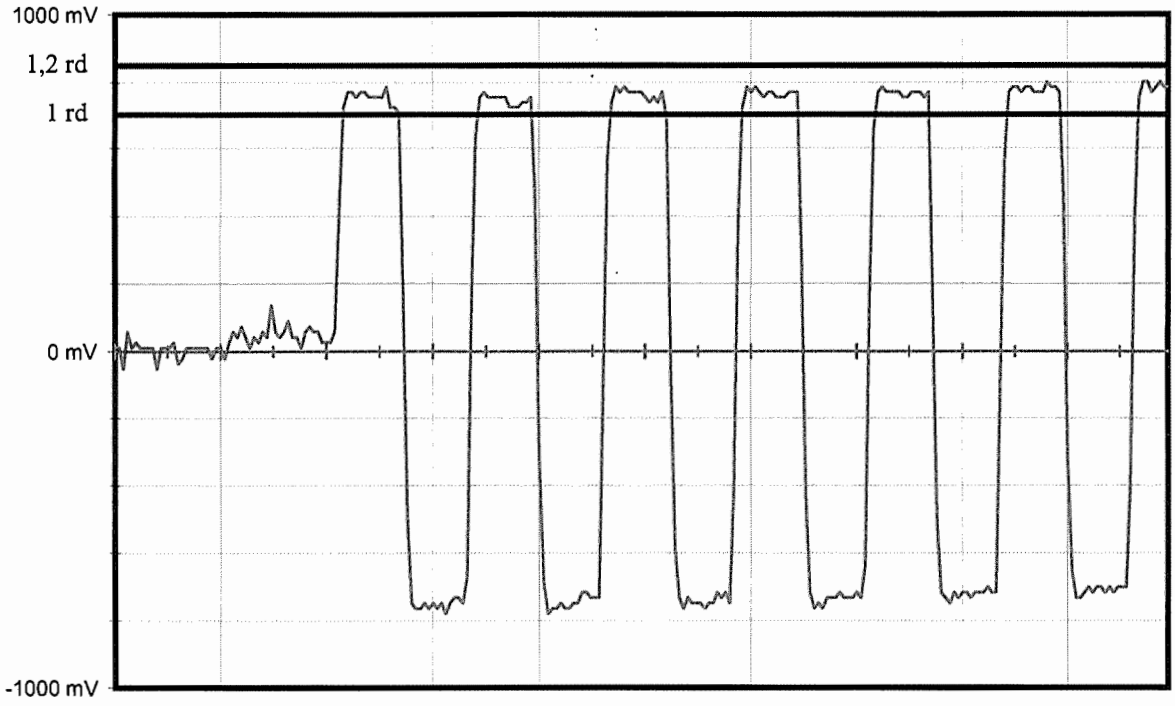
Message

Message received		FFFE2F5F7703C4800000086FFE80
Format Flag	25	0
Protocol flag	26	1
Ident./Position code	27-85	BEEE07890000001
Country Code/Country	27-36	503 / AUSTRALIA
Protocol Code : U/Std-Nat	37-39/37-40	11
Protocol Code Used	37-39/37-40	
Identification Data	40-85/41-64/41-58	1E
Identification Used		:::::::
Calculated BCH1	25-85	01BFFA
Readed BCH1	86-106	01BFFA
Homing	84-85	01
Em.cod/nat.use/supp.data	107-112	000000
Emer cod / Encod pos data	107	0
Activation type	108	0
Calculated BCH2	107-132	
Readed BCH2	133-144	
Latitude position		
Longitude position		
Delta position		

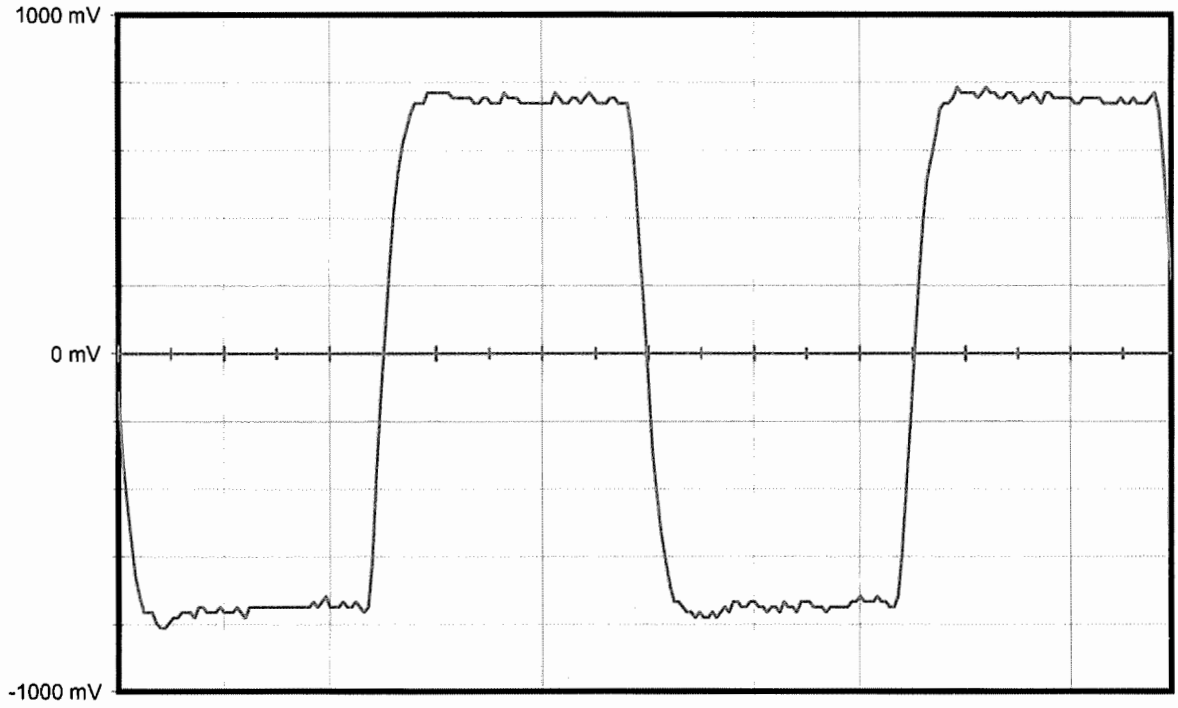
Electrical and other parameters

CW preamble	ms	158,4 <	< 162,6	160,48
Total transmission time	ms	434,6 <	<445,4	440,70
Modulation frequency	Hz	395,4<	< 404,6	399,71
Phase deviation : total	rd		<=2,40	2,17
Phase deviation : positive	rd	1,00 <	< 1,20	1,06
Phase deviation : negative	rd	-1,20 <	< -1,00	-1,11
Symmetry measurement	%		<=5 %	1,60
Nominal frequency : F2	Hz			406027915,22
Short term2				1,96E-10
Short term3				2,18E-10
Slope				-1,03E-11
Residual				1,25E-09
406 MHz power output	dBm			35,7
Homing frequency	MHz			Not checked
121,5 MHz power output	dBm			Not checked
Soak temperature	°C			19,6
Extra feature				No

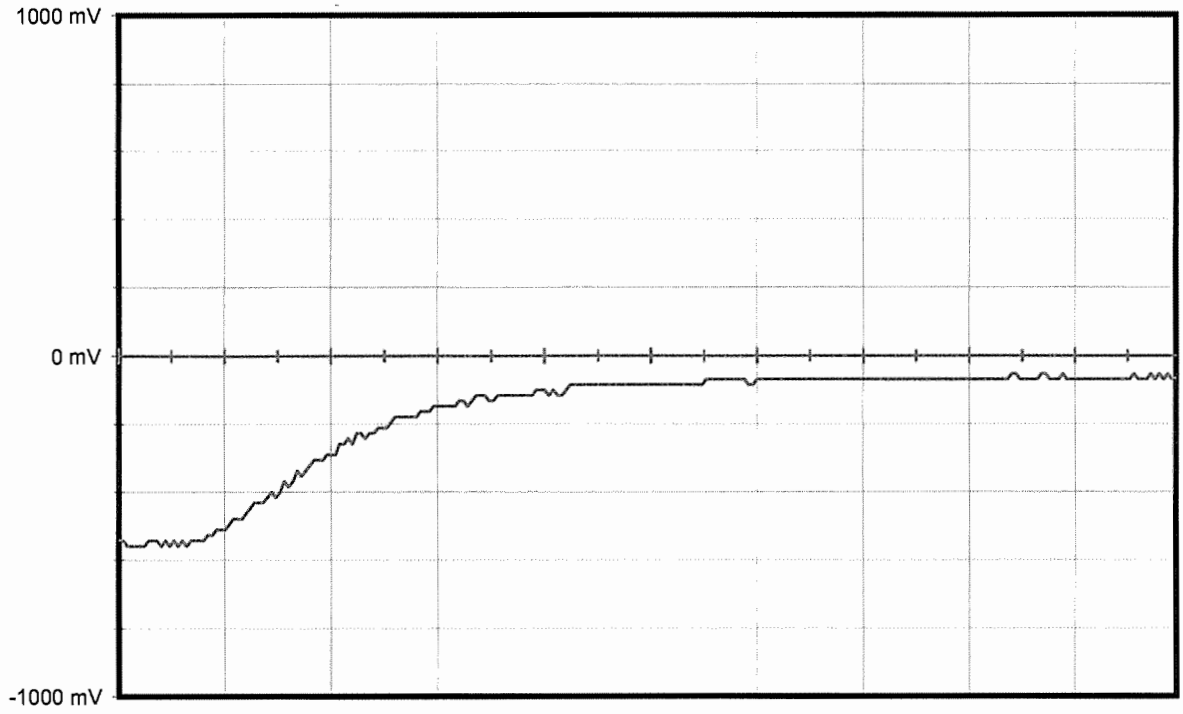




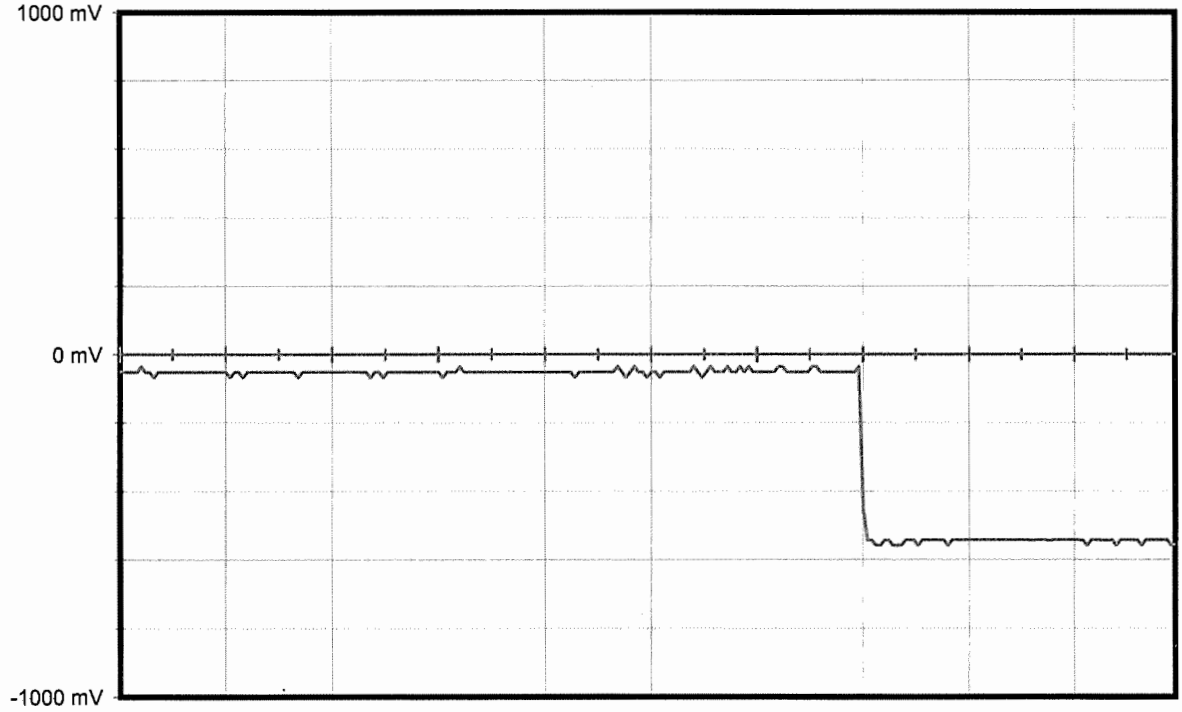
0 ms 10 ms 20 ms
Vmarker1 850 mv ==> 1,2 rd 2 ms/div.
Vmarker2 700 mv ==> 1 rd



8 ms 10,5 ms 13 ms
Duty Cycle : 0,015995928 0,5 ms/div.
falltime(1)<= 139,721 us risetime(1)<= 139,721 us
+width(1) 1,22755 ms -widht(1) 1,26746 ms



-1 ms 1,5 ms 4 ms
risetime(1)<= 1337,33 us 0,5 ms/div.



-3,5 ms -1 ms 1,5 ms
falltime(1)<= 29,9399 us 0,5 ms/div.

Certification Test at 55°C Date of test : 16-oct-2003

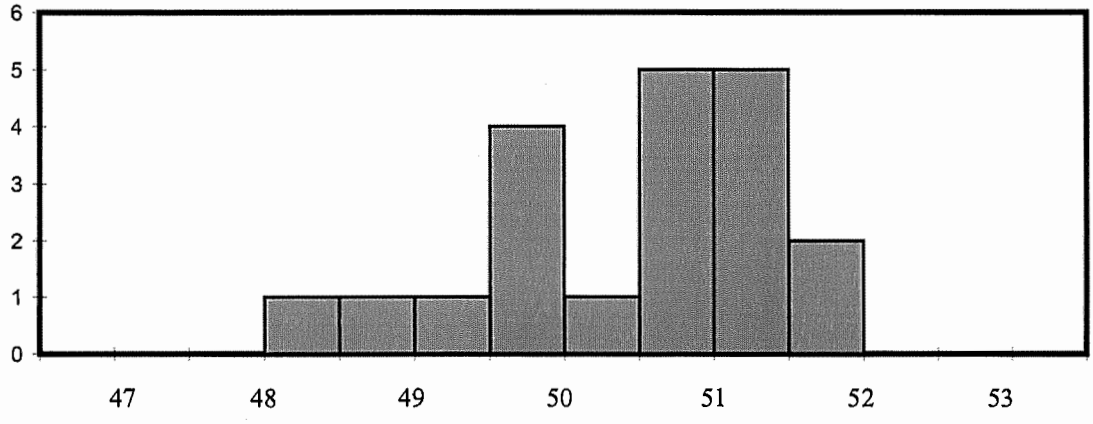
Manufacturer : Standard Communications
Beacon Type : MT400 Rev2
Number : MT0

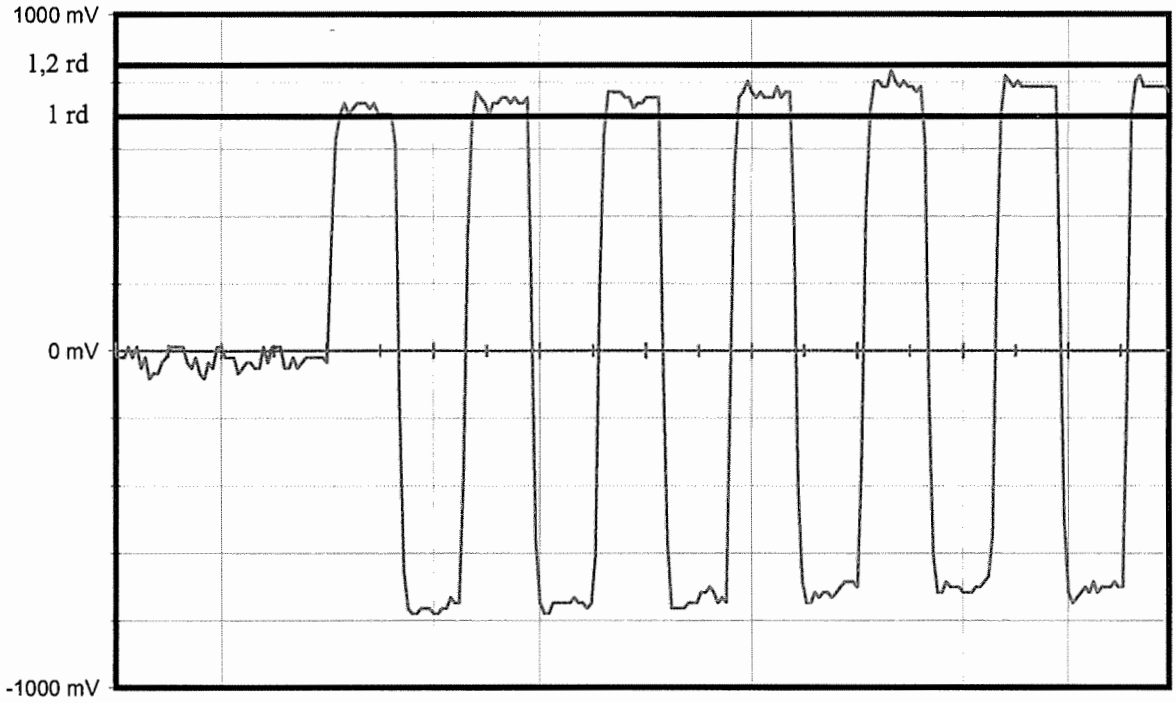
Message

Message received		FFFE2F5F7703C4800000086FFE80
Format Flag	25	0
Protocol flag	26	1
Ident./Position code	27-85	BEEE07890000001
Country Code/Country	27-36	503 / AUSTRALIA
Protocol Code : U/Std-Nat	37-39/37-40	11
Protocol Code Used	37-39/37-40	
Identification Data	40-85/41-64/41-58	1E
Identification Used		:::::::
Calculated BCH1	25-85	01BFFA
Readed BCH1	86-106	01BFFA
Homing	84-85	01
Em.cod/nat.use/supp.data	107-112	000000
Emer cod / Encod pos data	107	0
Activation type	108	0
Calculated BCH2	107-132	
Readed BCH2	133-144	
Latitude position		
Longitude position		
Delta position		

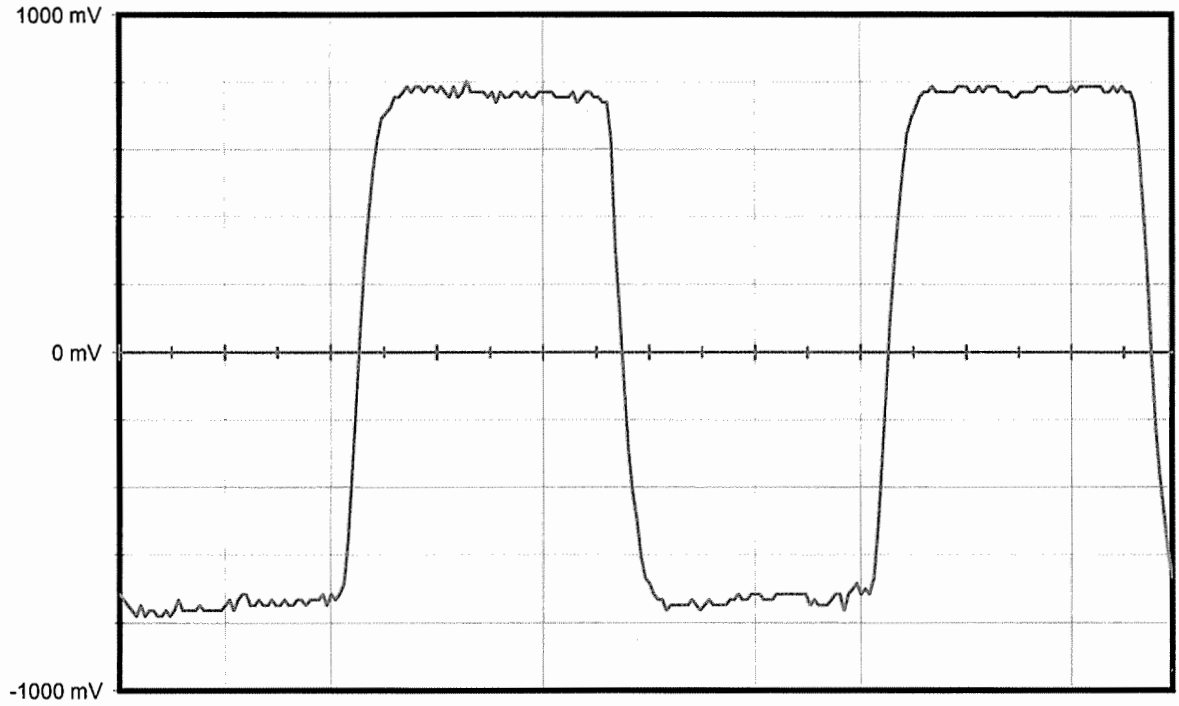
Electrical and other parameters

CW preamble	ms	158,4 <	< 162,6	160,41
Total transmission time	ms	434,6 <	<445,4	440,57
Modulation frequency	Hz	395,4<	< 404,6	399,70
Phase deviation : total	rd		<=2,40	2,15
Phase deviation : positive	rd	1,00 <	< 1,20	1,08
Phase deviation : negative	rd	-1,20 <	< -1,00	-1,07
Symmetry measurement	%		<=5 %	1,60
Nominal frequency : F2	Hz			406027938,65
Short term2				2,42E-10
Short term3				3,30E-10
Slope				2,18E-10
Residual				5,56E-10
406 MHz power output	dBm			35,4
Homing frequency	MHz			Not checked
121,5 MHz power output	dBm			Not checked
Soak temperature	°C			54,4
Extra feature				No

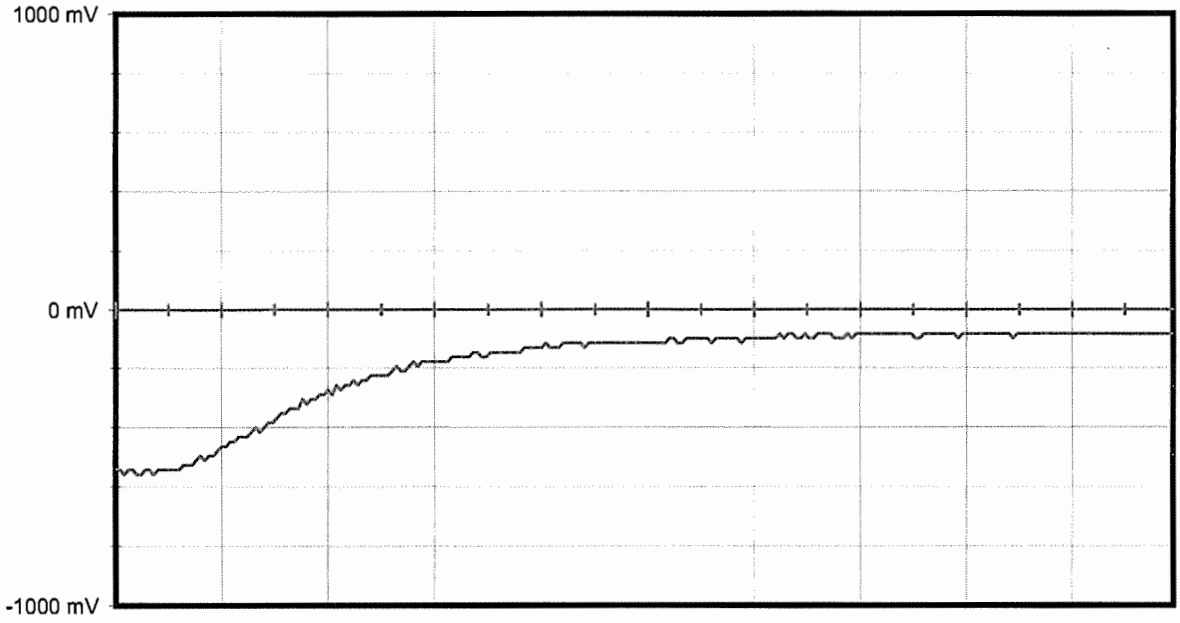




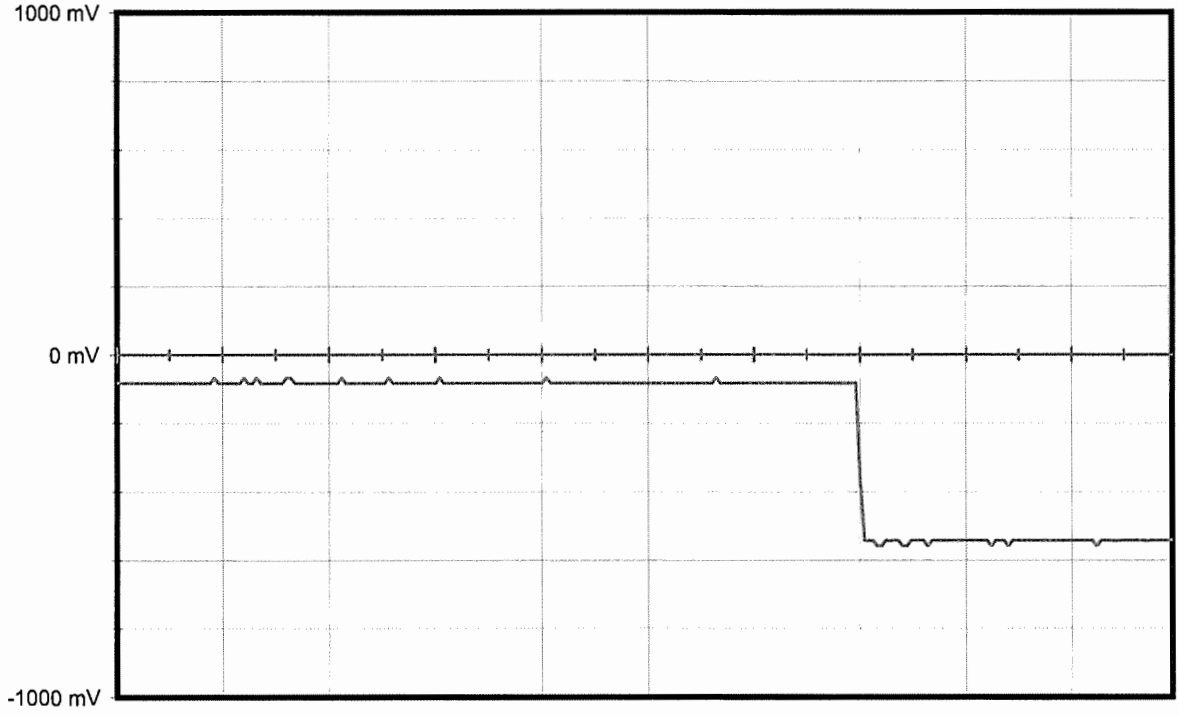
0 ms 10 ms 20 ms
Vmarker1 850 mv ==> 1,2 rd 2 ms/div.
Vmarker2 700 mv ==> 1 rd



8 ms 10,5 ms 13 ms
Duty Cycle : 0,016 0,5 ms/div.
falltime(1)<= 129,741 us risetime(1)<= 149,7 us
+width(1) 1,22754 ms -widht(1) 1,26746 ms



-1 ms 1,5 ms 4 ms
risetime(1)<= 1526,95 us 0,5 ms/div.

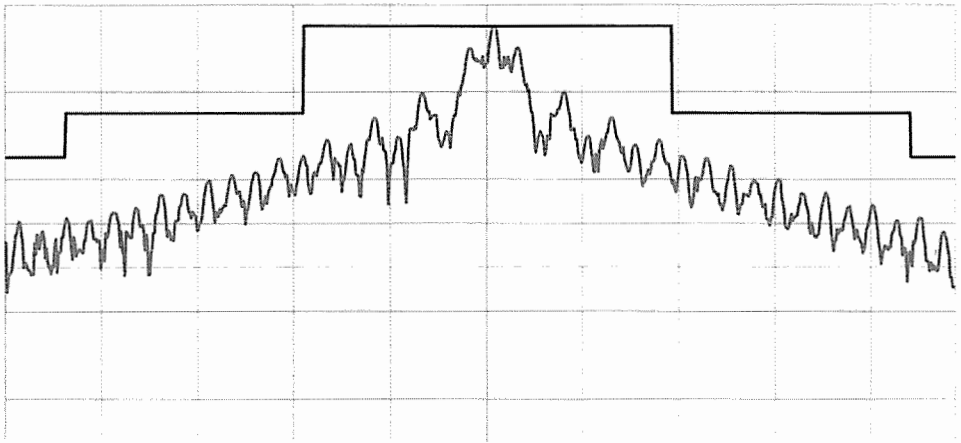


-3,5 ms -1 ms 1,5 ms
falltime(1)<= 29,9399 us 0,5 ms/div.

SPURIOUS EMISSIONS RESULTS
MT400 Rev 2 STANDARD COMMUNICATIONS PTY. LTD. EPIRB
N° MT0
at -20° C, 22° C and 55° C

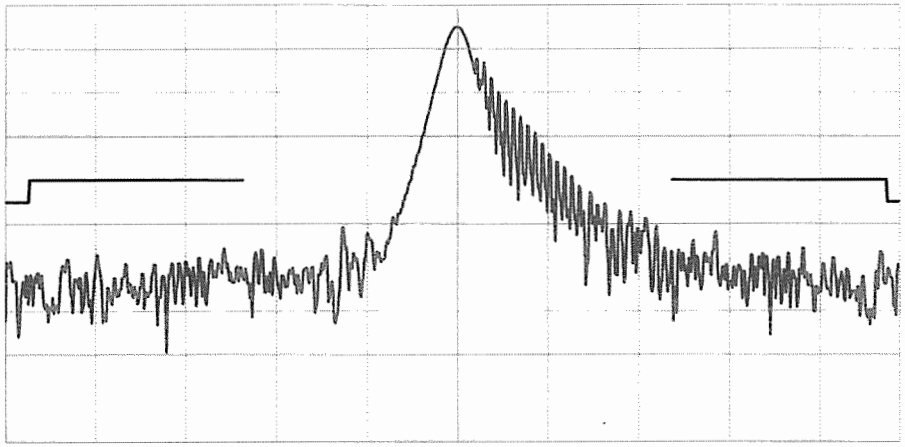
Standard Communications
MT400
C204 Rev2
Certification nominale
406 MHz
-20 °C

CF : 406,028 MHz SP : 16 KHz



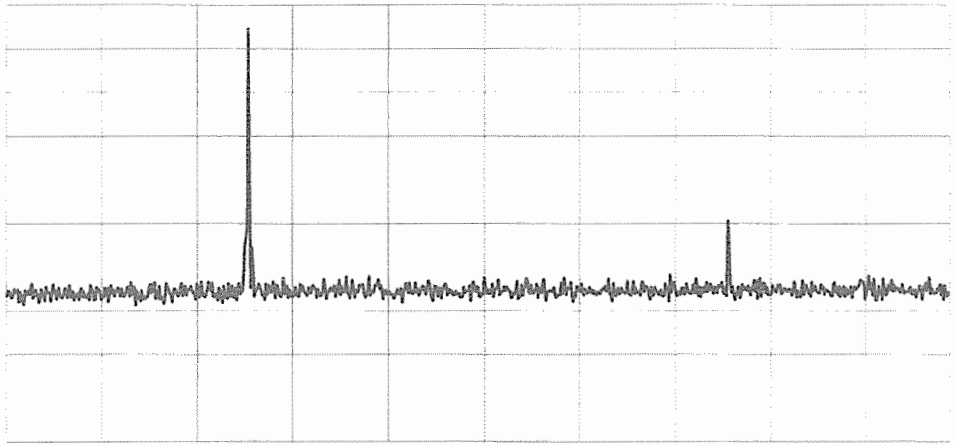
Rb : 0,1 KHz 10 dB/div. St : 4,8 S

CF : 406,028 MHz SP : 50 KHz



Rb : 1 KHz 10 dB/div. St : 0,305 S

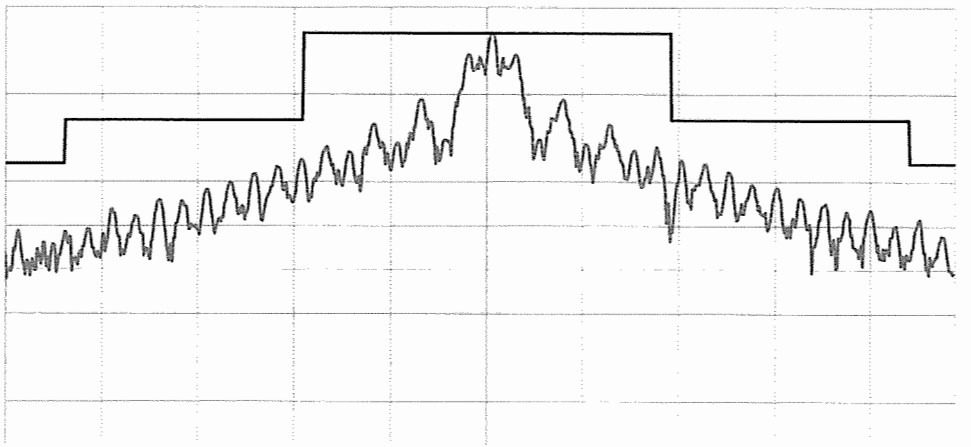
CF : 600 MHz Delta : -43,85 dB SP : 800000 KHz



Rb : 100 KHz 10 dB/div. St : 0,24 S

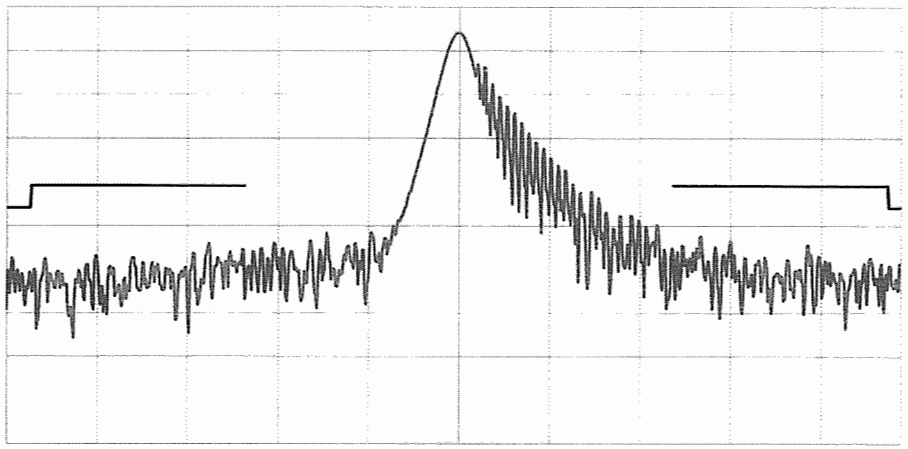
Standard Communications
MT400
C204 Rev2
Certification nominale
406 MHz
22 °C

CF : 406,028 MHz SP : 16 KHz



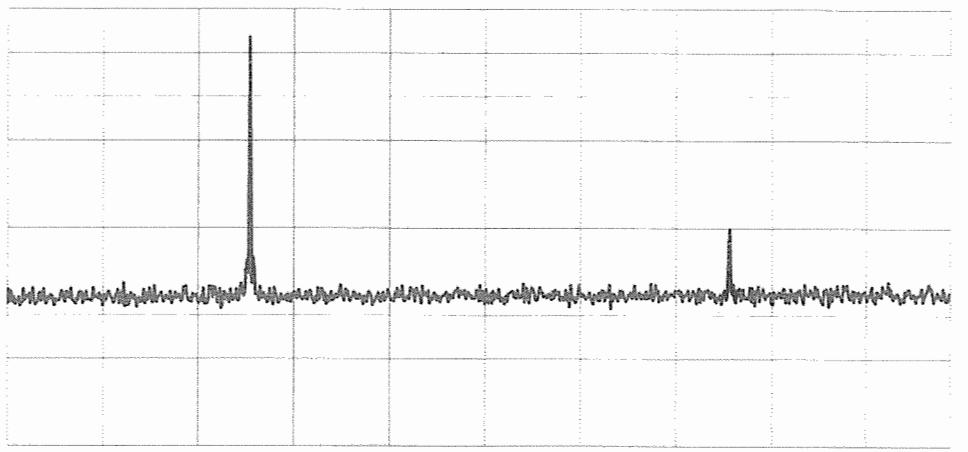
Rb : 0,1 KHz 10 dB/div. St : 4,8 S

CF : 406,028 MHz SP : 50 KHz



Rb : 1 KHz 10 dB/div. St : 0,305 S

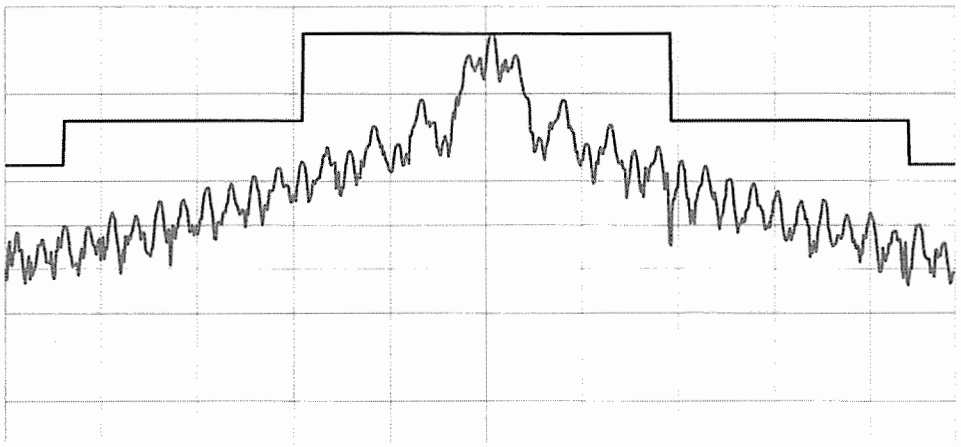
CF : 600 MHz Delta : -43,82 dB SP : 800000 KHz



Rb : 100 KHz 10 dB/div. St : 0,24 S

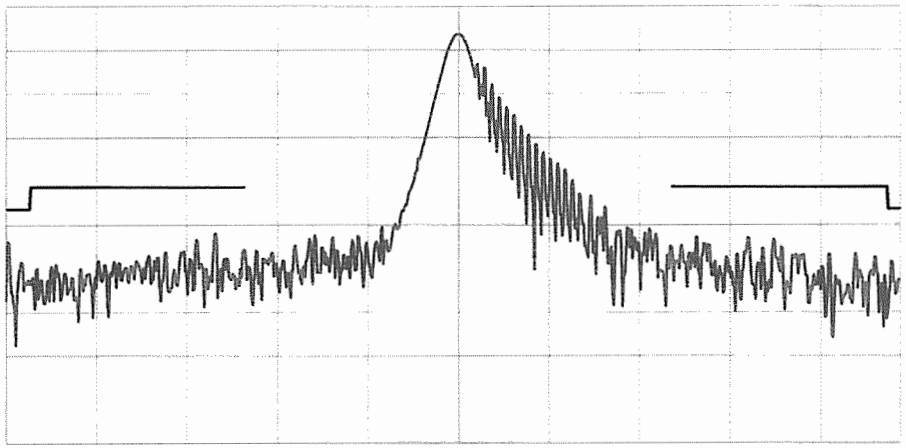
Standard Communications
MT400
C204 Rev2
Certification nominale
406 MHz
55 °C

CF : 406,028 MHz SP : 16 KHz



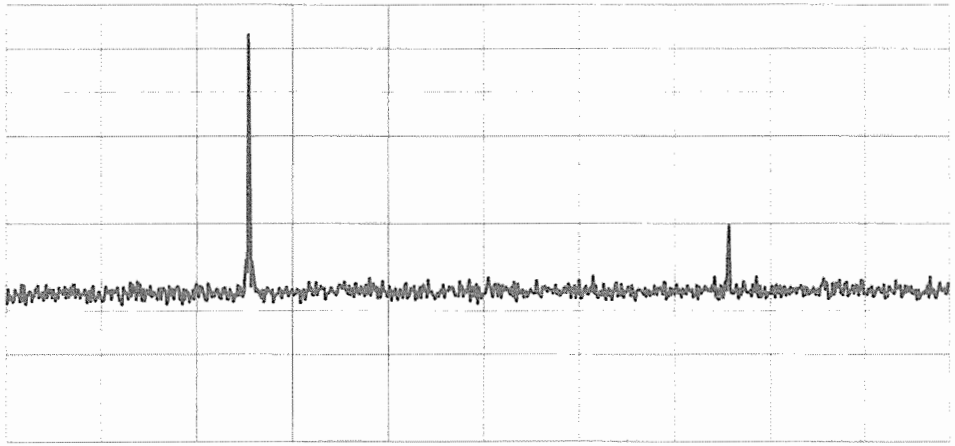
Rb : 0,1 KHz 10 dB/div. St : 4,8 S

CF : 406,028 MHz SP : 50 KHz



Rb : 1 KHz 10 dB/div. St : 0,305 S

CF : 600 MHz Delta : -43,7 dB SP : 800000 KHz



Rb : 100 KHz 10 dB/div. St : 0,24 S

406 MHz VSWR 3:1 TEST RESULTS ON
MT400 Rev 2 STANDARD COMMUNICATIONS PTY. LTD. EPIRB
N° MT0

at -20° C, 22° C and 55° C

Certification Test VSWR at -20°C Date of test : 16-oct-03

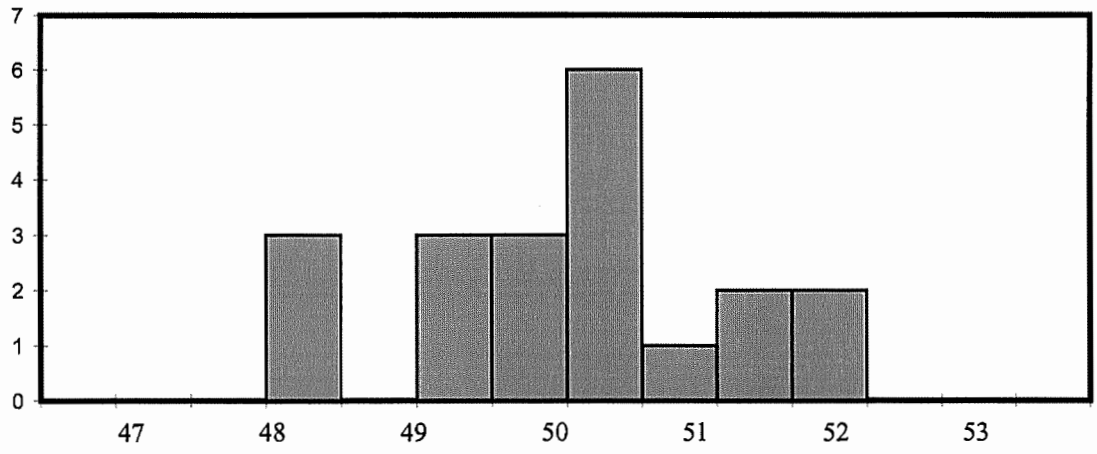
Manufacturer : Standard Communications
Beacon Type : MT400 Rev2
Number : MT0

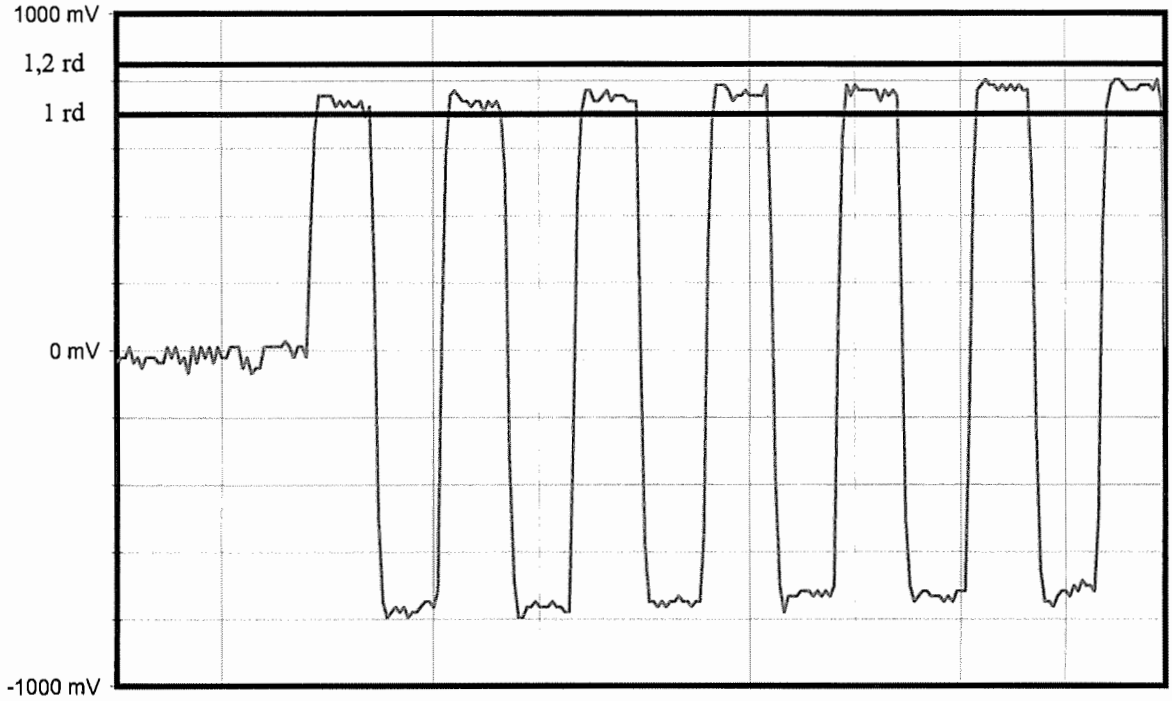
Message

Message received		FFFE2F5F7703C4800000086FFE81
Format Flag	25	0
Protocol flag	26	1
Ident./Position code	27-85	BEEE07890000001
Country Code/Country	27-36	503 / AUSTRALIA
Protocol Code : U/Std-Nat	37-39/37-40	12
Protocol Code Used	37-39/37-40	
Identification Data	40-85/41-64/41-58	1E
Identification Used		:::::::
Calculated BCH1	25-85	01BFFA
Readed BCH1	86-106	01BFFA
Homing	84-85	01
Em.cod/nat.use/supp.data	107-112	000000
Emer cod / Encod pos data	107	0
Activation type	108	0 Manual
Calculated BCH2	107-132	
Readed BCH2	147-144	
Latitude position		
Longitude position		
Delta position		

Electrical and other parameters

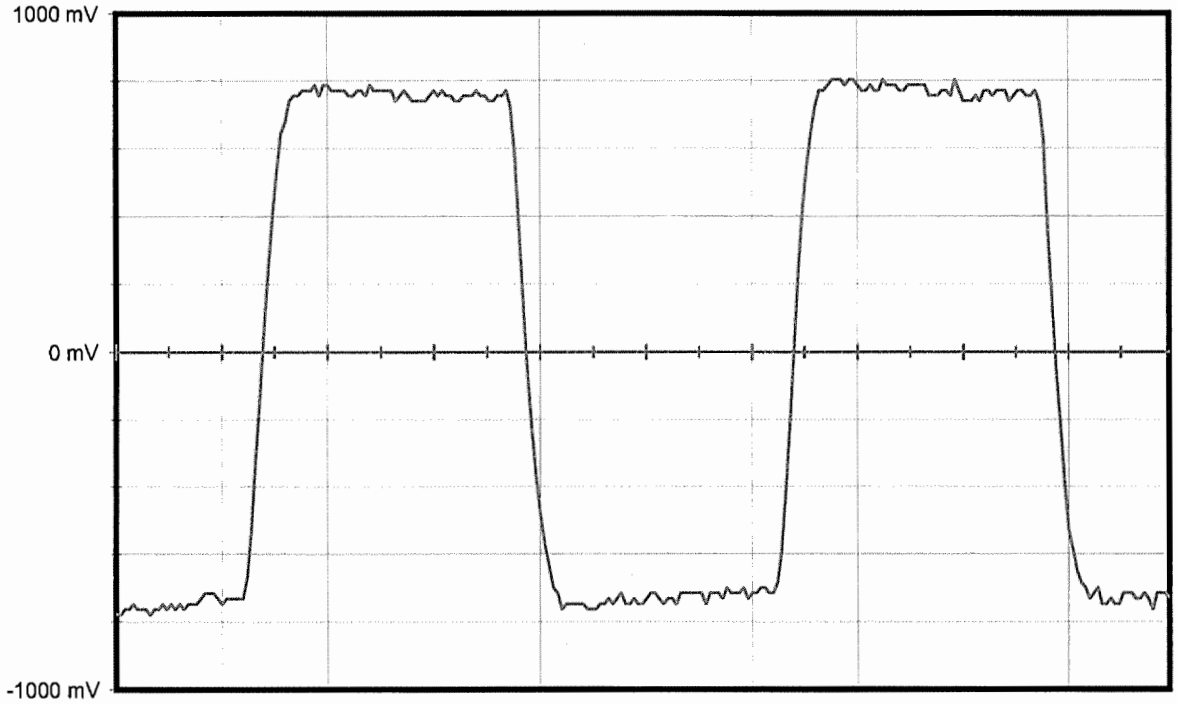
Rise time Modulation	ms			0,1497
Fall time Modulation	ms			0,1497
Phase deviation :positive	rd	1,00 <	< 1,20	1,05
Phase deviation : negative	rd	-1,20 <	< -1,00	-1,12
Symmetry measurement	%		<=5 %	0,80
Nominal frequency : F2	Hz			406027942,43





Vmarker1 850 mv ==> 1,2 rd
Vmarker2 700 mv ==> 1 rd

2 ms/div.



Duty Cycle : 0,008003976
falltime(1)<= 149,7 us
+width(1) 1,23752 ms

0,5 ms/div.
risetime(1)<= 149,701 us
-widht(1) 1,25749 ms

Certification Test VSWR at 22°C Date of test : 16 oct 2003

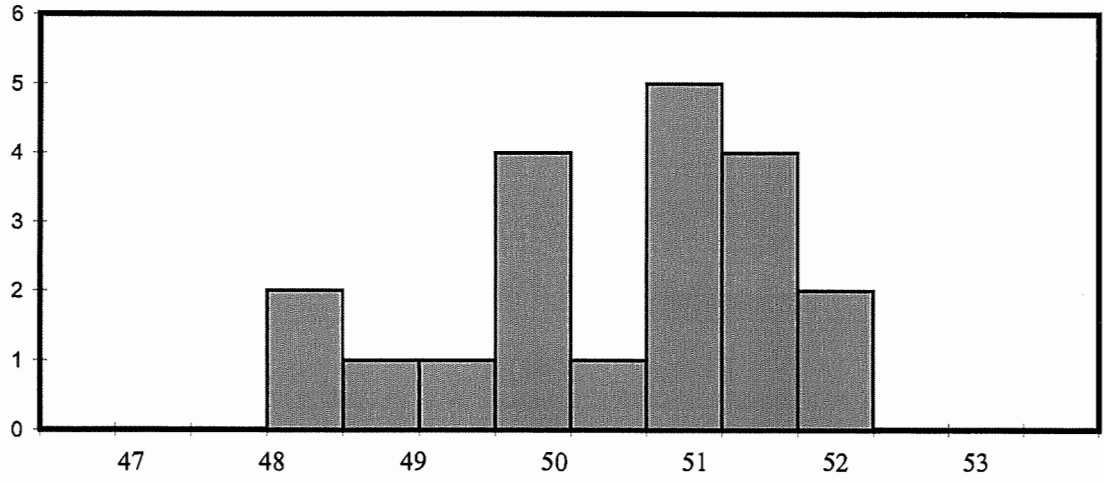
Manufacturer : Standard Communications
Beacon Type : MT400 Rev2
Number : MT0

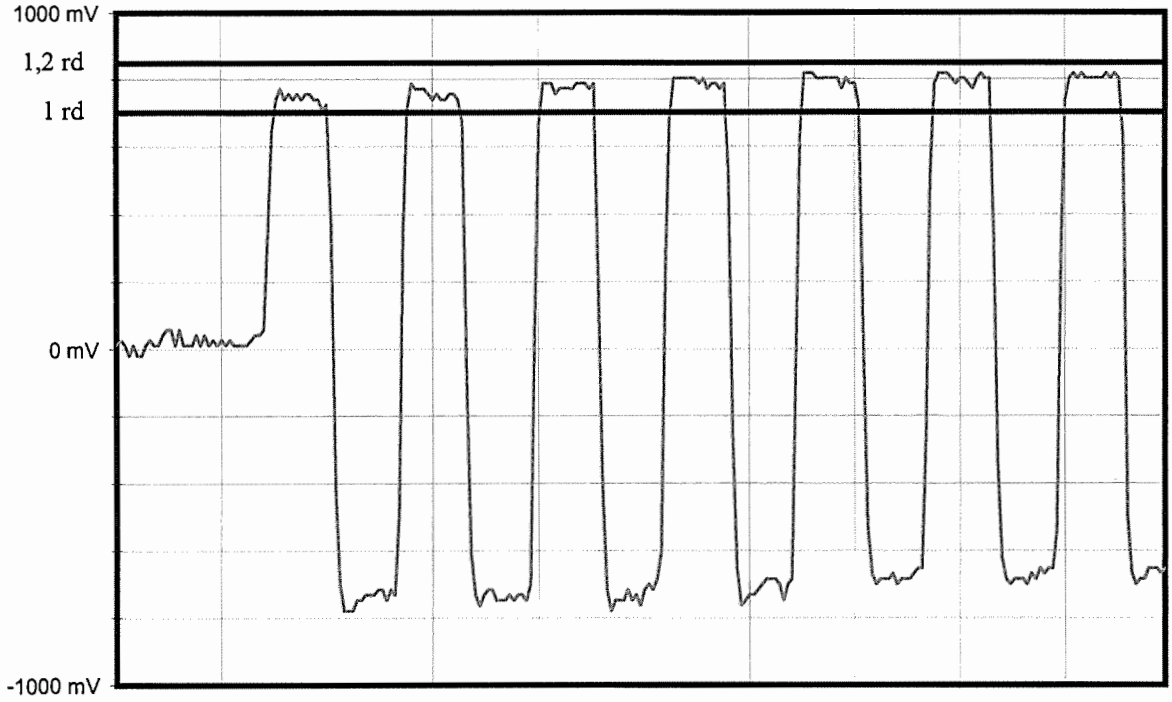
Message

Message received		FFFE2F5F7703C4800000086FFE82
Format Flag	25	0
Protocol flag	26	1
Ident./Position code	27-85	BEEE07890000001
Country Code/Country	27-36	503 / AUSTRALIA
Protocol Code : U/Std-Nat	37-39/37-40	13
Protocol Code Used	37-39/37-40	
Identification Data	40-85/41-64/41-5	1E
Identification Used		:::::::
Calculated BCH1	25-85	01BFFA
Readed BCH1	86-106	01BFFA
Homing	84-85	01
Em.cod/nat.use/supp.data	107-112	000000
Emer cod / Encod pos data	107	0
Activation type	108	0 Manual
Calculated BCH2	107-132	
Readed BCH2	147-144	
Latitude position		
Longitude position		
Delta position		

Electrical and other parameters

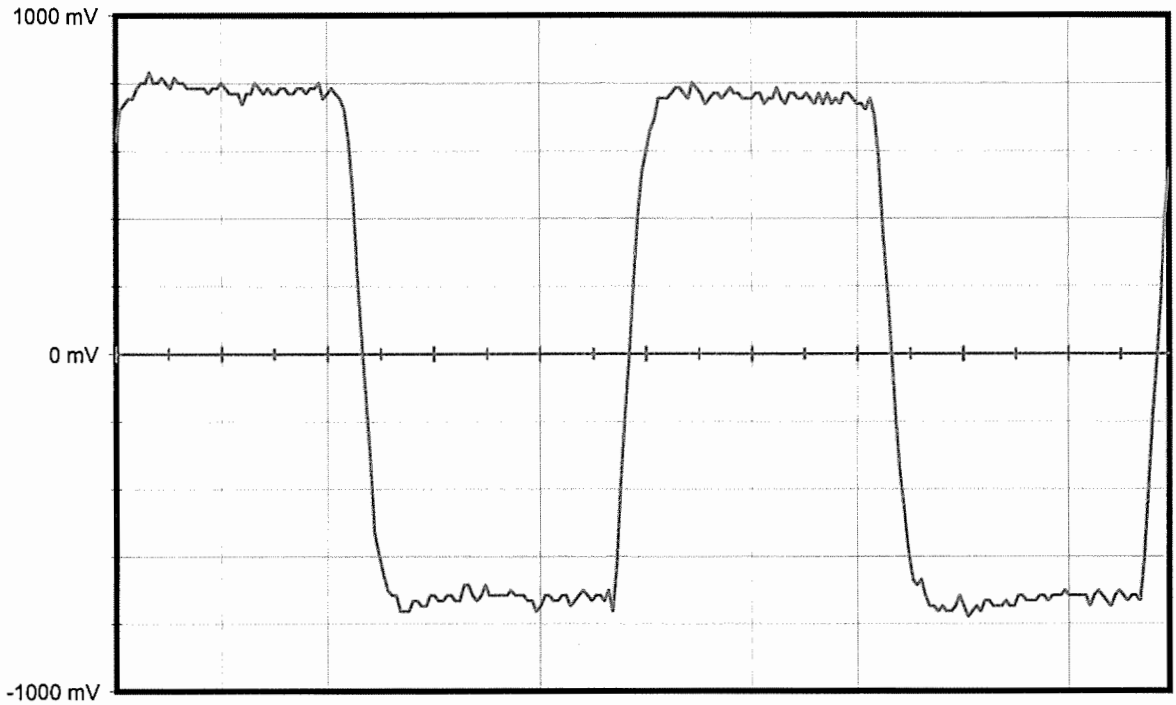
Rise time Modulation	ms			0,1497
Fall time Modulation	ms			0,1397
Phase deviation :positive	rd	1,00 <	< 1,20	1,07
Phase deviation : negative	rd	-1,20 <	< -1,00	-1,07
Symmetry measurement	%		<=5 %	1,21
Nominal frequency : F2	Hz			406027938,33





Vmarker1 850 mv ==> 1,2 rd
Vmarker2 700 mv ==> 1 rd

2 ms/div.



Duty Cycle : 0,012052168
falltime(1)<= 139,72 us
+width(1) 1,22754 ms

0,5 ms/div.
risetime(1)<= 149,701 us
-widht(1) 1,25749 ms

Certification Test VSWR at 55°C Date of test : 16 oct 2003

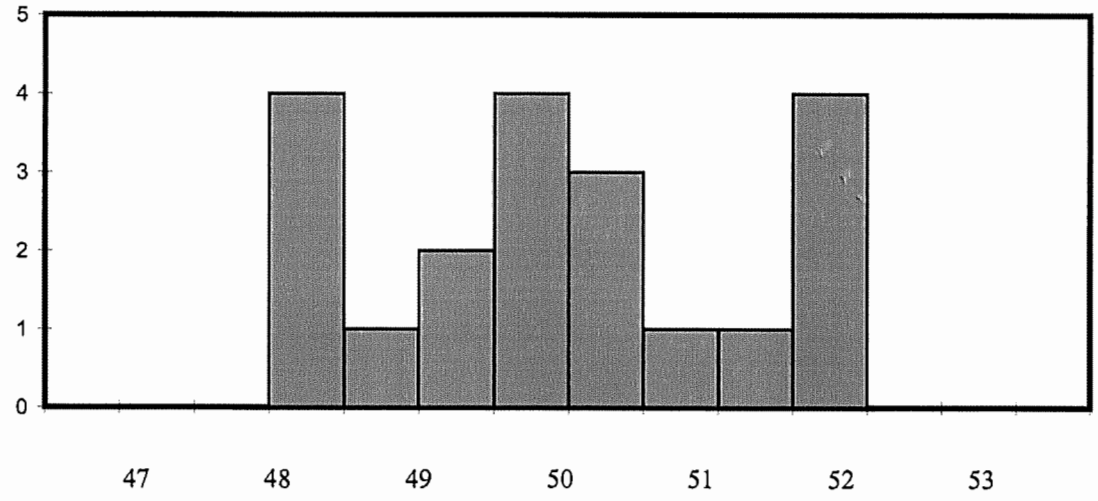
Manufacturer : Standard Communications
Beacon Type : MT400 Rev2
Number : MT0

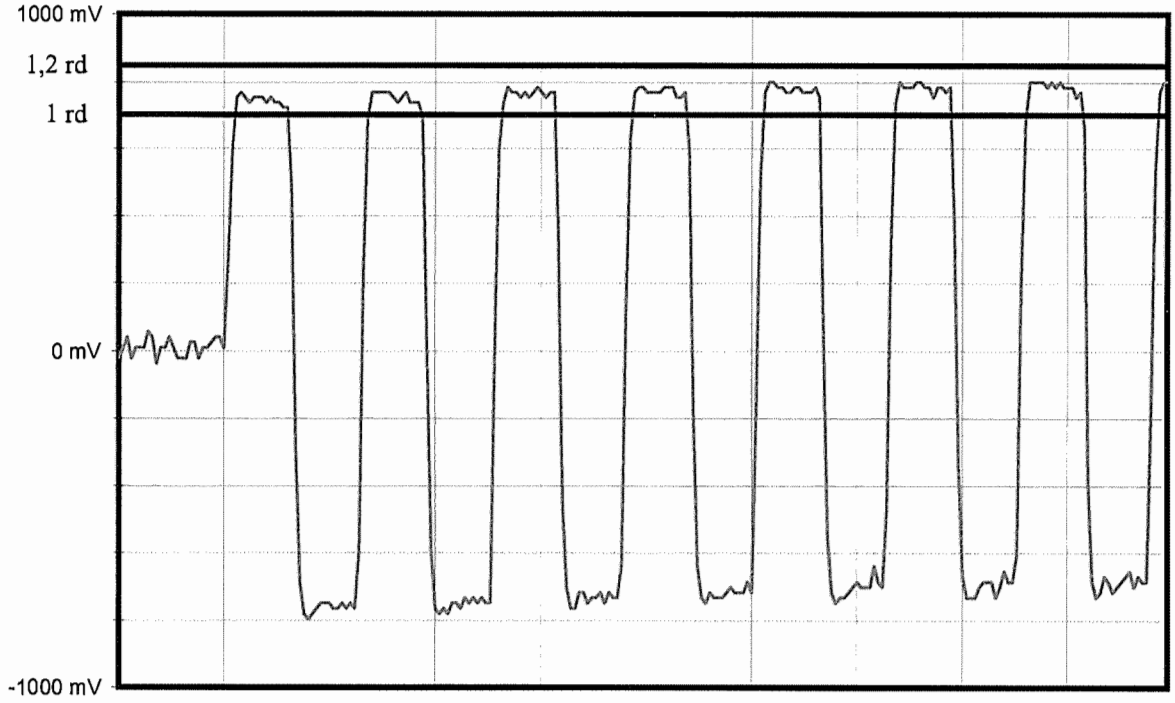
Message

Message received		FFFE2F5F7703C4800000086FFE83
Format Flag	25	0
Protocol flag	26	1
Ident./Position code	27-85	BEEE07890000001
Country Code/Country	27-36	503 / AUSTRALIA
Protocol Code : U/Std-Nat	37-39/37-40	14
Protocol Code Used	37-39/37-40	
Identification Data	40-85/41-64/41-58	1E
Identification Used		:::::::
Calculated BCH1	25-85	01BFFA
Readed BCH1	86-106	01BFFA
Homing	84-85	01
Em.cod/nat.use/supp.data	107-112	000000
Emer cod / Encod pos data	107	0
Activation type	108	0 Manual
Calculated BCH2	107-132	
Readed BCH2	147-144	
Latitude position		
Longitude position		
Delta position		

Electrical and other parameters

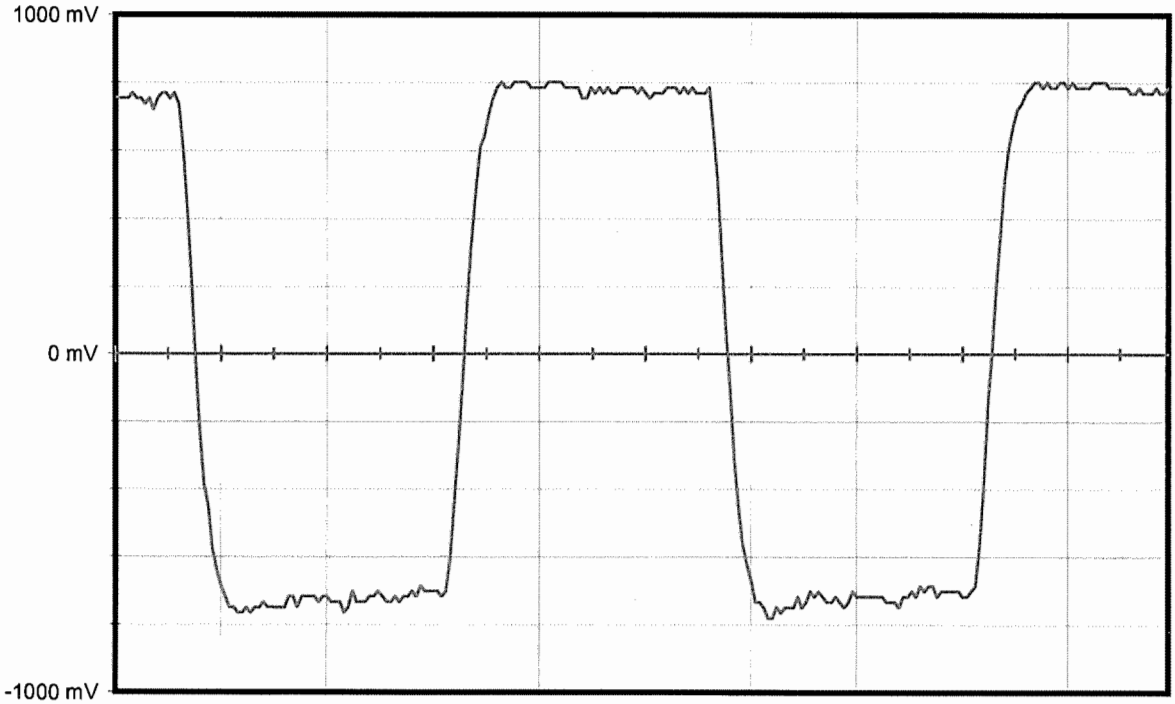
Rise time Modulation	ms			0,1597
Fall time Modulation	ms			0,1497
Phase deviation :positive	rd	1,00 <	< 1,20	1,07
Phase deviation : negative	rd	-1,20 <	< -1,00	-1,10
Symmetry measurement	%		<=5 %	0,79
Nominal frequency : F2	Hz			406027940,88





Vmarker1 850 mv ==> 1,2 rd
Vmarker2 700 mv ==> 1 rd

2 ms/div.



Duty Cycle : 0,007936508
falltime(1)<= 159,68 us
+width(1) 1,2475 ms

0,5 ms/div.
risetime(1)<= 149,701 us
-widht(1) 1,26746 ms