Product Service

SECTION 3

TEST EQUIPMENT USED

3.1 TEST EQUIPMENT

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

Instrument	Manufacturer	Type No.	TE No.	Calibration Period (months)	Calibration Due
Section 2.1, 2.2, 2.4, 2.5 Constant Temperature Tests					
Power Meter	Hewlett Packard	436A	83	12	7-Sep-2016
Climatic Chamber	Heraeus Votsch	VM 04/100	85	-	O/P Mon
Rubidium Frequency Standard	Quartzlock	A10-B	92	12	11-Feb-2016
Time Interval Analyser	Yokogawa	TA720	181	12	24-Apr-2016
Termination (50ohm)	Diamond Antenna	DL-30N	219	12	3-Nov-2015
Termination (50ohm)	Diamond Antenna	DL-30N	226	12	6-Feb-2016
Attenuator (10dB, 10W)	Weinschel	23-10-34	470	12	18-Nov-2015
Signal Generator (100kHz to 2.6GHz)	Hewlett Packard	8663A	1063	12	9-Apr-2016
Hygromer	Rotronic	I-1000	2829	12	27-Oct-2015
Beacon RF Unit	TUV SUD Product Service	N/A	3066	-	TU
Attenuator (20dB, 10W)	Aeroflex / Weinschel	23-20-34	3159	12	3-Jun-2016
Attenuator (3dB, 20W)	Aeroflex / Weinschel	23-03-34	3162	12	18-Nov-2015
Bandpass filter	Trilithic	5BE406/35-1-AA	3206	12	14-Sep-2016
Short Circuit	TUV SUD Product Service	Short Cicuit	3272	-	TU
Power Sensor	Agilent Technologies	8482A	3289	12	16-Jan-2016
ESA-E Series Spectrum Analyser	Agilent Technologies	E4402B	3348	12	7-Sep-2016
Cable (1m, N Type)	Rhophase	NPS-1601-1000-NPS	3354	12	30-Apr-2016
ScopeCorder	Yokogawa	DL750	4175	12	28-Jan-2016
1 metre N-Type Cable	Florida Labs	NMS-235SP-39.4-NMS	4509	12	20-May-2016
Bandpass Filter (1MHz)	KR Electronics	3219-SMA	4600	12	10-Jul-2016
Section 2.11 Navigation System					
Beacon Tester	WS Technologies	BT 100S	87	-	TU
Antenna (Double Ridge Guide, 1GHz-18GHz)	EMCO	3115	235	22	28-Nov-2015
Attenuator (10dB, 10W)	Weinschel	23-10-34	470	12	18-Nov-2015
Spectrum Analyser	Agilent Technologies	E4407B	1154	12	14-Aug-2016
Attenuator (10dB, 10W)	Trilithic	HFP-50N	1377	12	22-Oct-2015
Programmable Power Supply	Iso-tech	IPS 2010	2436	-	O/P Mon
GPS/SBAS Simulator	Spirent	STR4500	3056	-	TU
Copper GRP	TUV SUD Product Service	27cm Diameter	3538	-	TU
Humidity & Temperature Meter	Radio Spares	1361C	4420	12	20-May-2016
0.92 to 2.2 GHz Coupler	Narda	3042B	4472	12	5-Dec-2015

Instrument	Manufacturer	Type No.	TE No.	Calibration Period (months)	Calibration Due
Section 2.7 Operating Lifetime					
Power Meter	Hewlett Packard	436A	47	12	14-Jul-2016
Climatic Chamber	Heraeus Votsch	VM 04/100	85	-	O/P Mon
Rubidium Frequency Standard	Quartzlock	A10-B	92	12	11-Feb-2016
Time Interval Analyser	Yokogawa	TA720	181	12	24-Apr-2016
Digital Temperature Indicator + T/C	Fluke	51	412	12	19-Feb-2016
Signal Generator (100kHz to 2.6GHz)	Hewlett Packard	8663A	1063	12	9-Apr-2016
Spectrum Analyser	Agilent Technologies	E4407B	1154	12	14-Aug-2016
Hygromer	Rotronic	A1	2677	12	11-Jun-2016
Beacon RF Unit	TUV SUD Product Service	N/A	3066	-	TU
Attenuator (20dB, 10W)	Aeroflex / Weinschel	23-20-34	3159	12	3-Jun-2016
Attenuator (20dB, 10W)	Aeroflex / Weinschel	23-20-34	3160	12	9-Jun-2016
Attenuator (3dB, 20W)	Aeroflex / Weinschel	23-03-34	3162	12	18-Nov-2015
Bandpass filter	Trilithic	5BE406/35-1-AA	3206	12	14-Sep-2016
Beacon Tester	WS Technologies	BT100S	3263	-	TU
Power Sensor	Agilent Technologies	8482A	3290	12	16-Jan-2016
Bandpass Filter	Trilithic	5BE121.55/35-3-BA	3410	12	14-Sep-2016
ScopeCorder	Yokogawa	DL750	4175	12	28-Jan-2016
1 metre N-Type Cable	Florida Labs	NMS-235SP-39.4-NMS	4510	12	21-May-2016
1 metre SMA Cable	Florida Labs	SMS-235SP-39.4-SMS	4512	12	29-Jan-2016
1 metre K-Type Cable	Florida Labs	KMS-180SP-39.4-KMS	4519	12	29-Jan-2016
Section 2.9 Satellite Qualitative Test					
Beacon Tester	WS Technologies	BT 100S	87	-	TU
Copper GRP	TUV SUD Product Service	27cm Diameter	3538	-	TU
Humidity & Temperature Meter	Radio Spares	1361C	4420	12	20-May-2016
Section 2.3 Spurious Emissions					
Climatic Chamber	Heraeus Votsch	VM 04/100	85	-	O/P Mon
Rubidium Frequency Standard	Quartzlock	A10-B	92	12	11-Feb-2016
Hygromer	Rotronic	I-1000	2829	12	27-Oct-2015
Attenuator (20dB, 10W)	Aeroflex / Weinschel	23-20-34	3159	12	3-Jun-2016
Attenuator (3dB, 20W)	Aeroflex / Weinschel	23-03-34	3162	12	18-Nov-2015
Bandpass filter	Trilithic	5BE406/35-1-AA	3206	12	14-Sep-2016
ESA-E Series Spectrum Analyser	Agilent Technologies	E4402B	3348	12	7-Sep-2016
1 metre N-Type Cable	Florida Labs	NMS-235SP-39.4-NMS	4509	12	20-May-2016

Instrument	Manufacturer	Type No.	TE No.	Calibration Period (months)	Calibration Due
Section 2.8 Temperature Gradient					
Power Meter	Hewlett Packard	436A	47	12	14-Jul-2016
Climatic Chamber	Heraeus Votsch	VM 04/100	85	-	O/P Mon
Rubidium Frequency Standard	Quartzlock	A10-B	92	12	11-Feb-2016
Time Interval Analyser	Yokogawa	TA720	181	12	24-Apr-2016
Digital Temperature Indicator + T/C	Fluke	51	412	12	19-Feb-2016
Signal Generator (100kHz to 2.6GHz)	Hewlett Packard	8663A	1063	12	9-Apr-2016
Beacon RF Unit	TUV SUD Product Service	N/A	3066	-	TU
Attenuator (20dB, 10W)	Aeroflex / Weinschel	23-20-34	3159	12	3-Jun-2016
Attenuator (3dB, 20W)	Aeroflex / Weinschel	23-03-34	3162	12	18-Nov-2015
Bandpass filter	Trilithic	5BE406/35-1-AA	3206	12	14-Sep-2016
Power Sensor	Agilent Technologies	8482A	3290	12	16-Jan-2016
ScopeCorder	Yokogawa	DL750	4175	12	28-Jan-2016
1 metre N-Type Cable	Florida Labs	NMS-235SP-39.4-NMS	4510	12	21-May-2016
1 metre SMA Cable	Florida Labs	SMS-235SP-39.4-SMS	4512	12	29-Jan-2016
Section 2.6 Thermal Shock					
Power Meter	Hewlett Packard	436A	83	12	7-Sep-2016
Climatic Chamber	Heraeus Votsch	VM 04/100	85	-	O/P Mon
Rubidium Frequency Standard	Quartzlock	A10-B	92	12	11-Feb-2016
Time Interval Analyser	Yokogawa	TA720	181	12	24-Apr-2016
Digital Temperature Indicator + T/C	Fluke	51	412	12	19-Feb-2016
Signal Generator (100kHz to 2.6GHz)	Hewlett Packard	8663A	1063	12	9-Apr-2016
Hygromer	Rotronic	I-1000	2829	12	27-Oct-2015
Beacon RF Unit	TUV SUD Product Service	N/A	3066	-	TU
Attenuator (20dB, 10W)	Aeroflex / Weinschel	23-20-34	3159	12	3-Jun-2016
Attenuator (3dB, 20W)	Aeroflex / Weinschel	23-03-34	3162	12	18-Nov-2015
Bandpass filter	Trilithic	5BE406/35-1-AA	3206	12	14-Sep-2016
Power Sensor	Agilent Technologies	8482A	3289	12	16-Jan-2016
Cable (1m, N Type)	Rhophase	NPS-1601-1000-NPS	3354	12	30-Apr-2016
ScopeCorder	Yokogawa	DL750	4175	12	28-Jan-2016
1 metre N-Type Cable	Florida Labs	NMS-235SP-39.4-NMS	4509	12	20-May-2016
Section 2.10 Antenna Characteristics					
Roberts Antenna 406MHz	Compliance Design		1860	24	27-Feb-2016
Test Receiver	Rohde & Schwarz	ESIB40	2941	12	23-Dec-2015

TU – Traceability Unscheduled: OP MON – Output Monitored with Calibrated Equipment

Product Service

SECTION 4

PHOTOGRAPHS

4.1 PHOTOGRAPHS OF EQUIPMENT UNDER TEST (EUT)

Conducted Sample - Front View

Radiated Sample - Front View

Radiated Sample - Rear View

Radiated Sample - Side View

<u>Float Free Case</u>

Float Free Case - Internal View

Test Setup - Conducted measurements

Satellite Qualitative - Configuration 5

Satellite Qualitative - Configuration 7

Satellite Qualitative - Configuration 8

Antenna Characteristics - Configuration 1

Antenna Characteristics - Configuration 4

SECTION 5

ACCREDITATION, DISCLAIMERS AND COPYRIGHT

5.1 ACCREDITATION, DISCLAIMERS AND COPYRIGHT

UKAS
TESTING
0141

This report relates only to the actual item/items tested.

Our UKAS Accreditation does not cover opinions and interpretations and any expressed are outside the scope of our UKAS Accreditation.

Results of tests not covered by our UKAS Accreditation Schedule are marked NUA (Not UKAS Accredited).

ANNEX A

CUSTOMER SUPPLIED INFORMATION

Product Service

Document Type		
	Issue	01.01
Approved:	Date Last Amended	19/11/2014
	Last Amended by	S Nolan
Document Title	E101V Navigation System, Beacon and Message Coding Test Results	

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Message Coding Protocols
Navigation System Test Results
Beacon Coding Software Results

Product SafeSea E101V EPIRB

Software Issue 01:00

Date 17 November 2015

Characteristic	Specification	
Message Coding Protocols:	(x) Tick the boxes below against the intended protocol options	
User Protocol (tick where appropriate)	☐	Maritime with MMSI
	☐	Maritime with Radio Call Sign
	☐	EPIRB Float Free with Serial Number
	☐	EPIRB Non Float Free with Serial Number
	☐	Radio Call Sign
	☐	Aviation
	☐	ELT with Serial Number
	☐	ELT with Aircraft Operator and Serial Number
	☐	ELT with Aircraft 24-bit Address
	☐	PLB with Serial Number
	☐	National (Short Message Format)
	☐	National (Long Message Format)
Standard Location Protocol (tick where appropriate)	☒	EPIRB with MMSI
	☒	EPIRB with Serial Number
	☐	ELT with 24-bit Address
	☐	ELT with Aircraft Operator Designator
	☐	ELT with Serial Number
	☐	PLB with Serial Number

Document Type		
	Issue	01.01
	Date Last Amended	19/11/2014
	Last Amended by	S Nolan
Document Title	E101V Navigation System, Beacon and Message Coding Test Results	

National Location Protocol (tick where appropriate)	☒	National Location: EPIRB
	☐	National Location: ELT
	☐	National Location: PLB
User Location Protocol (tick where appropriate)	☒	Maritime with MMSI
	☒	Maritime with Radio Call Sign
	☒	EPIRB Float Free with Serial Number
	☒	EPIRB Non Float Free with Serial Number
	☒	Radio Call Sign
	☐	Aviation
	☐	ELT with Serial Number
	☐	ELT with Aircraft Operator and Serial Number
	☐	ELT with Aircraft 24-bit Address
	☐	PLB with Serial Number

Document Type		
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	Date Last Amended	19/11/2014
	Last Amended by	S Nolan
Document Title	E101V Navigation System, Beacon and Message Coding Test Results	

ocean SIGNAL

BEACON CODING SOFTWARE RESULTS

Table F-D.1 of C/S T.007 (Issue 4 – Rev. 9 October 2014)

Examples of User Protocol Beacon Messages

Protocol	Operational Message (in hexadecimal including bit	Self-Test Message (in hexadecimal including bit
Maritime User Protocol with MMSI	N/A	N/A
Maritime User Protocol with Radio Call Sign	N/A	N/A
Radio Call Sign User Protocol	N/A	N/A
Serial User: Float-Free EPIRB with Serial Number	N/A	N/A
Serial User: Non Float-Free EPIRB with Serial Number	N/A	N/A
Aviation User Protocol	N/A	N/A
Serial User: ELT with Serial Number	N/A	N/A
Serial User: ELT with Aircraft Operator Designator & Serial Number	N/A	N/A
Serial User: ELT with Aircraft 24-bit Address	N/A	N/A
Serial User: PLB with Serial Number	N/A	N/A
National User (Short)	N/A	N/A
National User (Long)	N/A	N/A
User Test	N/A	N/A

Table F-D.2 of C/S T.007 (Issue 4 – Rev. 9 October 2014)

Examples of Standard, National Location and RLS Location Protocol Beacon Messages

Protocol	Operational Message (in hexadecimal including bit and frame synchronisation bits)		Self-Test Message (in hexadecimal including bit and frame synchronisation bits)	GNSS Self Test Message (if applicable, in hexadecimal including bit and frame synchronisation bits)
	Location 'A'	Location 'B'		Location 'A'
Standard Location: EPIRB with MMSI	FFFE2F8C92F42 3F0334032603 9779B469B07	FFFE2F8C92F42 3F03340210CC 8F786A4D7C0	FFFED08C92F423 F07FDFFB2BF037 83E0F66C	N/A
Standard Location: EPIRB with Serial Number	FFFE2F8C96F9C 063334030D92 6779B469B07	FFFE2F8C96F9C 063334023B5D 7F786A4D7C0	FFFED08C96F9 C0637FDFF992 EF3783E0F66C	N/A
Standard Location: ELT with 24-bit Address	N/A	N/A	N/A	N/A
Standard Location: ELT with Aircraft Operator Designator	N/A	N/A	N/A	N/A
Standard Location: PLB with Serial Number	N/A	N/A	N/A	N/A
Standard Location: Test	FFFE2F8C9EF9C 06333403176D CF79B469B07	FFFE2F8C9EF9C 0633340221A2 D7786A4D7C0	FFFED08C9EF9C 0637FDFF83D15 B783E0F66C	N/A
National Location: EPIRB	FFFE2F8C9A001 8CCD601675A6 FF704240E3D	FFFE2F8C9A001 8CCD001148B8 83795340DF8	FFFED08C9A001 8DFC0FF02AD44 779F3C0010	N/A
National Location: ELT	N/A	N/A	N/A	N/A
National Location: PLB	N/A	N/A	N/A	N/A
National Location: Test	FFFE2F8C9F00C 04CD6016385A 07704240E3D	8C9F00C04CD0 01105447B795 340DF8	FFFED08C9F00C 05FC0FF06728BF 79F3C0010	N/A
RLS Location: (ELT, EPIRB or PLB)	N/A	N/A	N/A	N/A

Table F-D.3 of C/S T.007 (Issue 4 – Rev. 9 October 2014)
Examples of User-Location Protocol Beacon Messages

Protocol	Operational Message (in hexadecimal including bit and frame synchronisation bits)		Self-Test Message (in hexadecimal including bit and frame synchronisation bits)	GNSS Self Test Message (if applicable, in hexadecimal including bit and frame synchronisation bits)
	Location 'A'	Location 'B'		Location 'A'
Maritime Protocol with MMSI	FFFE2FCC9418 6186186689DE 52A66A01650C	FFFE2FCC94186 186186689DE5 2A668011965	FFFED0CC94186 186186689DE52 AFE0FF0146	N/A
Maritime Protocol with Radio Call Sign	FFFE2FCC9526F 6F06B268F9F3 2266A01650C	FFFE2FCC9526F 6F06B268F9F32 2668011965	FFFED0CC9526 F6F06B268F9F 322FE0FF0146	N/A
Radio Call Sign	FFFE2FCC9DBD BC1A55468ED9 F6266A01650C	FFFE2FCC9DBD BC1A55468ED9 F62668011965	FFFED0CC9DBD BC1A55468ED9 F62FE0FF0146	N/A
Serial User-Location: Float-Free EPIRB	FFFE2FCC96A0 00C6007CEEBD 42E66A01650C	FFFE2FCC96A00 0C6007CEEBD4 2E668011965	FFFED0CC96A00 0C6007CEEBD4 2EFE0FF0146	N/A
Serial User-Location: Non Float-Free EPIRB	FFFE2FCC9720 00C6007CEB7F B1666A01650C	FFFE2FCC97200 0C6007CEB7FB 16668011965	FFFED0CC97200 0C6007CEB7FB1 6FE0FF0146	N/A
Aviation	N/A	N/A	N/A	N/A
Serial User-Location: ELT	N/A	N/A	N/A	N/A
Serial User-Location: ELT with Aircraft Operator Designator & Serial Number	N/A	N/A	N/A	N/A
Serial User-Location: ELT with Aircraft 24-bit address	N/A	N/A	N/A	N/A
Serial User-Location: PLB	N/A	N/A	N/A	N/A
User- Location: Test	FFFE2FCC9E00 C05FC0FF010D 87666A01650C	FFFE2FCC9E00C 05FC0FF010D8 76668011965	FFFED0CC9E00C 05FC0FF010D87 7783E0F66C	N/A

Document Type		
	Issue	01.01
	Date Last Amended	19/11/2014
	Last Amended by	S Nolan
Document Title	E101V Navigation System, Beacon and Message Coding Test Results	

Analysis of Beacon Messages

In all the tests involving a location protocol the following positions where used:

- Location 'A' = **51°21' 51" N, 1° 23' 25" E**
- Location 'B' = **51°16' 38" N, 1° 4' 50" E**
- Distance between locations = **23.6 Km**

The 'Bit Analysis' tables are taken from the '406 MHz Decode Program Version 3.2' available on the Cospas-Sarsat website, and using the '30 Hexadecimal ID' input format for Location.

Results Burst Files

Protocol	Location 'A'	Location 'B'	Self Test
Standard Location: EPIRB with MMSI	Burst-17149.htm	Burst-17150.htm	Burst-17151.htm
Standard Location: EPIRB with Serial Number	Burst-17152.htm	Burst-17153.htm	Burst-17154.htm
National Location: EPIRB	Burst-17155.htm	Burst-17156.htm	Burst-17157.htm
Maritime Protocol with MMSI	Burst-17158.htm	Burst-17159.htm	Burst-17160.htm
Maritime Protocol with Radio Call Sign	Burst-17161.htm	Burst-17162.htm	Burst-17163.htm
Radio Call Sign	Burst-17179.htm	Burst-17180.htm	Burst-17181.htm
Serial User-Location: Float-Free EPIRB	Burst-17164.htm	Burst-17165.htm	Burst-17166.htm
Serial User-Location: Non Float-Free EPIRB	Burst-17167.htm	Burst-17168.htm	Burst-17169.htm
User- Location: Test	Burst-17170.htm	Burst-17171.htm	Burst-17172.htm
Standard Location: Test	Burst-17173.htm	Burst-17174.htm	Burst-17175.htm
National Location: Test	Burst-17176.htm	Burst-17177.htm	Burst-17178.htm

Example decode Standard Location EPIRB with MMSI Location A

Burst-17149.htm

Full Hex FFFE2F8C92F423F03340326039779B469B07

ITEM	BITS	VALUE
Message format: long format	25	1
Protocol: Location Protocol	26	0
Country code: 201 - Albania	27-36	0011001001
Type of location protocol: Standard Location - EPIRB (MMSI)	37-40	0010
MID: 999999	41-60	11110100001000111111
Specific Beacon: 0	61-64	0000
Latitude Sign: North	65	0
Latitude Degrees: 51	66-72	0110011
Latitude Minutes: 15	73-74	01
Longitude Sign: East	75	0
Longitude Degrees: 1	76-83	00000001
Longitude Minutes: 30	84-85	10
BCH 1 Encoded:	86-106	010011000000011100101
BCH 1 Calculated:	N/A	010011000000011100101
Fixed bits (1101): Pass	107-110	1101
Position Data: Encoded Position Data Source From Internal Navigation Device	111	1
Aux Device: 121.5 MHz homer	112	1
Latitude Offset Sign: +	113	1
Latitude Offset Minutes: 6	114-118	00110
Latitude Offset Seconds: 52	119-122	1101
Longitude Offset Sign: -	123	0
Longitude Offset Minutes: 6	124-128	00110
Longitude Offset Seconds: 36	129-132	1001
BCH 2 Encoded:	133-144	101100000111
BCH 2 Calculated:	N/A	101100000111
Composite Latitude: 51.36444444444445 Degrees North	N/A	Composite Longitude: 1.39 Degrees East
15 Hex ID:	N/A	1925E847E0FFBFF

Lat: 51°21’52” N

Long: 1°23’24” E

Example decode Standard Location EPIRB with MMSI Location B

Burst-17150.htm

Full Hex FFFE2F8C92F423F03340210CC8F786A4D7C0

ITEM	BITS	VALUE
Message format: long format	25	1
Protocol: Location Protocol	26	0
Country code: 201 - Albania	27-36	0011001001
Type of location protocol: Standard Location - EPIRB (MMSI)	37-40	0010
MID: 999999	41-60	11110100001000111111
Specific Beacon: 0	61-64	0000
Latitude Sign: North	65	0
Latitude Degrees: 51	66-72	0110011
Latitude Minutes: 15	73-74	01
Longitude Sign: East	75	0
Longitude Degrees: 1	76-83	00000001
Longitude Minutes: 0	84-85	00
BCH 1 Encoded:	86-106	001000011001100100011
BCH 1 Calculated:	N/A	001000011001100100011
Fixed bits (1101): Pass	107-110	1101
Position Data: Encoded Position Data Source From Internal Navigation Device	111	1
Aux Device: 121.5 MHz homer	112	1
Latitude Offset Sign: +	113	1
Latitude Offset Minutes: 1	114-118	00001
Latitude Offset Seconds: 40	119-122	1010
Longitude Offset Sign: +	123	1
Longitude Offset Minutes: 4	124-128	00100
Longitude Offset Seconds: 52	129-132	1101
BCH 2 Encoded:	133-144	011111000000
BCH 2 Calculated:	N/A	011111000000
Composite Latitude: 51.2777777777778 Degrees North	N/A	Composite Longitude: 1.08111111111111 Degrees East
15 Hex ID:	N/A	1925E847E0FFBFF

Lat: 51°16′40″ N

Long: 1°4′52″ E

NAVIGATION SYSTEM TEST RESULTS

Table F-C.1 of C/S T.007 (Issue 4 Rev. 9 October 2014)

Position Data encoding Results User Location Protocol

Script Reference (See Table D.1)	Value of Encoded Location Bits Transmitted by Beacon (Hexadecimal)	Confirmation that BCH Correct (✓)
1	Bits 108 – 132 = **0FE0FF0**	✓
2	Bits 108 – 132 = **1001000** Number of seconds after providing navigation data that beacon transmitted the above encoded location information: **18.4**	✓
3	Bits 108 – 132 = **0000000**	✓
4	Bits 108 – 132 = **0006B3C**	✓
5	Bits 108 – 132 = **1007B3C**	✓
6	Bits 108 – 132 = **1B28590**	✓
7	Bits 108 – 132 = **1B29590**	✓
8	Bits 108 – 132 = **0B41B40**	✓
9	Bits 108 – 132 = **0B3CB40**	✓
10	Bits 108 – 132 = **14918A7**	✓
Self-Test Navigation Test Scripts (C/S T.007 Issue 4 Rev. 9 October 2014)		
11	Bits 108 – 132 = **0FE0FF0**	✓
12	Bits 108 – 132 = **0FE0FF0**	✓

Table F-C.2 of C/S T.007 (Issue 4 Rev. 9 October 2014)

Position Data encoding Results Standard Location Protocol

Script Reference (See Table D.2)	Value of Encoded Location Bits Transmitted by Beacon (Hexadecimal)	Confirmation that BCH Correct (✓)
1	Bits 65 – 85 = 0FFBFF Bits 113 – 132 = 83E0F	✓
2	Bits 65 – 85 = 100400 Bits 113 – 132 = 8420E Number of seconds after providing navigation data that beacon transmitted the above encoded location information: 23.1	✓
3	Bits 65 – 85 = 000000 Bits 113 – 132 = 8360D	✓
4	Bits 65 – 85 = 000ACF Bits 113 – 132 = 0F222	✓
5	Bits 65 – 85 = 0012CE Bits 113 – 132 = 93A60	✓
6	Bits 65 – 85 = 100ECF Bits 113 – 132 = 0FA10	✓
7	Bits 65 – 85 = 1B2964 Bits 113 – 132 = 80A00	✓
8	Bits 65 – 85 = 1B2D64 Bits 113 – 132 = 84E00	✓
9	Bits 65 – 85 = 0B46D0 Bits 113 – 132 = 03801	✓
10	Bits 65 – 85 = 0B42D0 Bits 113 – 132 = 08009	✓
11	Bits 65 – 85 = 14962A Bits 113 – 132 = 80200	✓
Self-Test Navigation Test Scripts (C/S T.007 Issue 4 Rev. 9 October 2014)		
12	Bits 65 – 85 = 0FFBFF Bits 113 – 132 = 83E0F	✓
13	Bits 65 – 85 = 0FFBFF Bits 113 – 132 = 83E0F	✓

Table F-C.3 of C/S T.007 (Issue 4 Rev. 9 October 2014)

Position Data encoding Results National Location Protocol and RLS Location Protocol

Script Reference (See Table D.3)	Value of Encoded Location Bits Transmitted by Beacon (Hexadecimal)	Confirmation that BCH Correct (✓)
1	Bits 59 – 85 = 3F81FE0 Bits 113 – 126 = 27CF	✓
2	Bits 59 – 85 = 4002000 Bits 113 – 126 = 284E Number of seconds after providing navigation data that beacon transmitted the above encoded location information: 31.8	✓
3	Bits 59 – 85 = 0000000 Bits 113 – 126 = 26CD	✓
4	Bits 59 – 85 = 0019678 Bits 113 – 126 = 060D	✓
5	Bits 59 – 85 = 001567A Bits 113 – 126 = 2710	✓
6	Bits 59 – 85 = 401B677 Bits 113 – 126 = 0740	✓
7	Bits 59 – 85 = 6CA0B20 Bits 113 – 126 = 06C0	✓
8	Bits 59 – 85 = 6CA2B20 Bits 113 – 126 = 21C0	✓
9	Bits 59 – 85 = 2D03680 Bits 113 – 126 = 0701	✓
10	Bits 59 – 85 = 2CF5680 Bits 113 – 126 = 2009	✓
11	Bits 59 – 85 = 523F14F Bits 113 – 126 = 2040	✓
Self-Test Navigation Test Scripts (C/S T.007 Issue 4 Rev. 9 October 2014)		
12	Bits 59 – 85 = 3F81FE0 Bits 113 – 126 = 27CF	✓
13	Bits 59 – 85 = 3F81FE0 Bits 113 – 126 = 27CF	✓

ANNEX A

Navigation System Test Script Reference

User Location Protocol Test results

Script	Tester File Name	Hex Code
1	Burst-17124.htm	FFFE2F8C9A0018C00CB3C75F91F618340D4A
2 (18.4s)	Burst-17125.htm	FFFE2F8C9A0018C00AB3D6522BF69C400105
3	Burst-17126.htm	FFFE2F8C9A0018E00DB3B817B0B61D0004FD
4	Burst-17127.htm	FFFE2F8C9A0018F65059066854F61B0003FC
5	Burst-17128.htm	FFFE2F8C9A0018F6515901EA1FF687000C0E
6	Burst-17129.htm	FFFE2F8C9A0018D681B400BA34F61C0407F7
7	Burst-17130.htm	FFFE2F8C9A0018D67AB40067B8F680240E90
8	Burst-17131.htm	FFFE2F8C9A0018E91F8A7F0960B681000B0F
9	Burst-17132.htm	FFFED08C9A0018DFC0FF02AD44769F3C0672
10	Burst-17133.htm	FFFED08C9A0018DFC0FF02AD44769F3C0672
11	Burst-17134.htm	FFFED0CC94186186186689DE52AFE0FF0146
12	Burst-17135.htm	FFFED0CC94186186186689DE52AFE0FF0146

Document Type		
	Issue	01.01
	Date Last Amended	19/11/2014
	Last Amended by	S Nolan
Document Title	E101V Navigation System, Beacon and Message Coding Test Results	

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Standard Location Protocol Test results

Script	Tester File Name	Hex Code
1	Burst-17111.htm	FFFE2F8C96F9C0637FDFF992EF3783E0F66C
2 (23.1s)	Burst-17112.htm	FFFE2F8C96F9C063802000E2FF778420EDF0
3	Burst-17113.htm	FFFE2F8C96F9C063000005DAAE778360D373
4	Burst-17114.htm	FFFE2F8C96F9C06300567C8315770F2220AE
5	Burst-17115.htm	FFFE2F8C96F9C06300967714DAF793A602AA
6	Burst-17116.htm	FFFE2F8C96F9C063807679BB44770FA10C2D
7	Burst-17117.htm	FFFE2F8C96F9C063D94B204CB6B780A00F76
8	Burst-17118.htm	FFFE2F8C96F9C063D96B2467C3B784E007A2
9	Burst-17119.htm	FFFE2F8C96F9C0635A3686FB0977038016F7
10	Burst-17120.htm	FFFE2F8C96F9C0635A1682D07C77080098C0
11	Burst-17121.htm	FFFE2F8C96F9C063A4B151B249F78020001B
12	Burst-17122.htm	FFFED08C96F9C0637FDFF992EF3783E0F66C
13	Burst-17123.htm	FFFED08C96F9C0637FDFF992EF3783E0F66C

National Location Protocol Test results

Script	Tester File Name	Hex Code
1	Burst-17136.htm	FFFE2F8C9A0018DFC0FF02AD44779F3C0010
2 (31.8s)	Burst-17137.htm	FFFE2F8C9A0018E00100011ABD37A1380347
3	Burst-17138.htm	FFFE2F8C9A0018C00000065448F79B340105
4	Burst-17139.htm	FFFE2F8C9A0018C00CB3C75F91F718340B28
5	Burst-17140.htm	FFFE2F8C9A0018C00AB3D6522BF79C400767
6	Burst-17141.htm	FFFE2F8C9A0018E00DB3B817B0B71D00029F
7	Burst-17142.htm	FFFE2F8C9A0018F65059066854F71B00059E
8	Burst-17143.htm	FFFE2F8C9A0018F6515901EA1FF787000A6C
9	Burst-17144.htm	FFFE2F8C9A0018D681B400BA34F71C040195
10	Burst-17145.htm	FFFE2F8C9A0018D67AB40067B8F7802408F2
11	Burst-17146.htm	FFFE2F8C9A0018E91F8A7F0960B781000D6D
12	Burst-17147.htm	FFFED08C9A0018DFC0FF02AD44779F3C0010
13	Burst-17148.htm	FFFED08C9A0018DFC0FF02AD44779F3C0010

T.007; 5.j Compliance statements

The following statements justify that the design of the rescueME EPIRB1 meets the following criteria.

i. provides protection against continuous transmission (see section A.3.4),

406MHz Transmit Time Out

The precise timing control of a 406MHz transmission is performed by the micro controller, IC4, which controls the application of PA supply voltage. To ensure that a transmission can last no longer than 45 seconds, due to a fault; when the PA supply voltage is switched on, C42 is charged through R25. The time constant of this network is much shorter that the 45seconds limit. This charging voltage is compared to the input threshold of TR3A. When the threshold has been exceeded TR3A switches on, turning TR3B off, this in turn switches TR4 off thus removing the supply voltage from the PA and ending any further transmission.

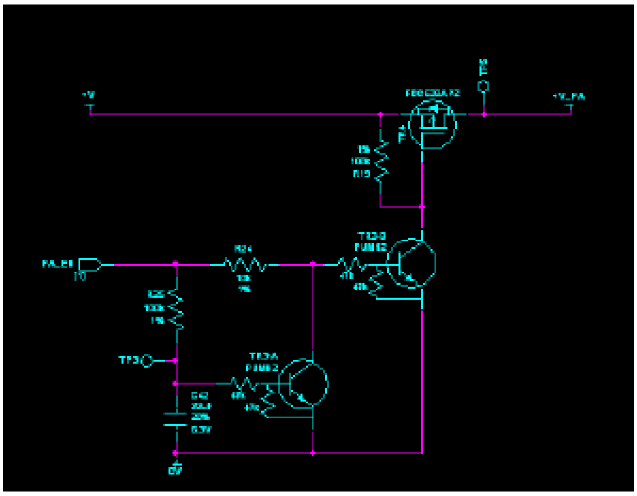

Figure 1: TX Timeout circuitry

ii. meets the frequency stability requirements over 5 years (see section A.3.5),

Statements from Rakon Limited providing evidence of five year stability for the TCXO can be found in Annex 1 of this section.

iii. provides protection from repetitive self-test mode transmissions

a. Beacon Self Test

The self-test function of the EPIRB is implemented in the following sequence of in-line steps; there is no looping or repetition of any step:

- The 121.5MHz homing beacon is started, the modulation is monitored and after three sweeps of the modulation frequency the beacon is turned off.
- The 406MHz message transmitter is activated and monitored; after one test message has been transmitted the transmitter is turned off.
- The strobe LED light is activated and after one flash it is turned off.
- The indicator LEDs are flashed to indicate pass / fail status.
- The EPIRB then enters a shutdown mode in which it switches off power from the battery to all parts of the circuit except the micro. It is not possible to start another self-test if the test switch is held down.

To prevent inadvertent lockup of the test mode, during the self-test procedure the switch is continuously monitored by sampling its condition every 10 milliseconds by interrupt under the control of a hardware timer. The operation of the hardware timer and the operational software are continually monitored for integrity by the use of a hardware watchdog timer.

In summary, it is not possible to perform repeated self-tests unless by deliberate action on the part of the user to re-initiate the test.

b. GNSS Receiver Self Test

The GNSS self-test is limited to checking operation of the internal GPS receiver only; there are no test transmissions of either 121.5MHz or 406MHz systems.

The test involves turning on the internal GPS receiver and waiting for a position fix to be obtained, once this condition is met then the EPIRB will report the status by use of the LEDs and then switch off. At the time that the GPS receiver is turned on a timer is also started, this timer is implemented by counting interrupts generated from a hardware timer which in turn is monitored by the system watchdog. This timer will run for 5 minutes or be stopped by a position fix being obtained, whichever occurs first. If the timer completes its run then the EPIRB will report a failure by the use of the LEDs. It is not possible to repeat the test or perform any other function if the switch is held down.

Product Service

In summary the GNSS self-test mode is limited to a maximum duration of 5 minutes and cannot be repeated unless a deliberate action is taken to reinitiate the test.

iv. Self test contains only default position

During the self test, the transmission is coded with the default position data listed in T.007 Annex D. The GPS receiver is not activated during a self test.

No test transmission is transmitted during a GPS receiver test.

v. Protection against transmitting erroneous position data

The navigation information provided by the GPS receiver is checked to ensure a 2D position is available and that the HDOP value is less than 50, before the position is added to the transmitted message. Otherwise the default values are inserted. (With the quoted accuracy of the Quectel L70 GPS receiver and an HDOP of 50 this equates to a position error of approximately 125m)

Annex 1: Rakon statement on MTS of five year period

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TEST REPORT

Report number	2010-029
Date of issue	6th July 2010
Product description	Temperature Compensated Crystal Oscillator (TCXO)
Product type	CFPT-9000
Rakon Part number	E5344LFT
Construction	Surface mount; 7.0x5.0mm, 10-pad
Output Frequency	12.688750 MHz
Class	II
Number tested	20

TESTS PERFORMED

Mid Term Frequency stability (MTS) over a 6-month period. Data is used to predict the performance of the device over a 5-year period.

Test sequence

1) Measure MTS over the temperature range -20°C to +55°C to -20°C
2) Store for 1-month at room temperature (+20°C ± 5°C)
3) Measure MTS over the temperature range -20°C to +55°C to -20°C
4) Store for 1-month at room temperature (+20°C ± 5°C)
5) Repeat testing & storage sequence for a further 4 months

Applicable standard: Cospas-Sarsat T.007, issue 4, revision 3

SUMMARY OF TEST RESULTS

TEST	PASS	FAIL	REMARKS
Residual (5-year prediction)	20	0	Minimum Cpk = 1.488
Minimum Static Slope (5-year prediction)	20	0	Minimum Cpk = 5.794
Maximum Static Slope (5-year prediction	20	0	Minimum Cpk = 12.391
Minimum Gradient Slope (5-year prediction)	20	0	Minimum Cpk = 1.431
Maximum Gradient Slope (5-year prediction	20	0	Minimum Cpk = 1.428
Aging Mid Frequency (5-year prediction)	20	0	Minimum Cpk = 28.250

CONCLUSIONS

The conclusion reached following the analysis of the data contained within this report indicates that the failure rate for this product after 5-years operation will be less than 3000 ppm.

Testing conducted by	Ian Payne
Report prepared by	David Lowrie
Report approved by	David R Woodall

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TÜV SÜD Product Service

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MEDIUM TERM FREQUENCY STABILITY (MTS) - 5-YEAR PREDICTION				
Device: E5344LFT	Frequency: 12.688750 MHz	Class: II	Package: SM (7x5.0mm),10-pad	Date: 06-July-2010

RESIDUAL (ppb)

Serial Number / Time (Days)	1	30	60	90	150	180	Slope	Intercept	Predicted Residual after 5 years	
1	1.07	1.04	0.61	0.45	0.53	0.55	-0.268	1.138	0.267	
3	1.06	1.53	1.07	1.00	1.01	1.10	-0.024	1.166	1.069	
7	0.64	0.64	0.63	0.62	0.65	0.62	-0.005	0.641	0.626	
9	0.38	0.41	0.21	0.31	0.54	0.67	0.063	0.318	0.525	
11	0.43	0.43	0.21	0.39	0.56	0.60	0.038	0.376	0.499	
13	0.59	0.70	0.61	0.80	0.82	0.77	0.089	0.573	0.861	
17	1.34	1.36	1.38	0.56	0.89	1.39	-0.140	1.379	0.922	
19	0.59	0.53	0.48	0.53	0.52	0.54	-0.030	0.580	0.483	
21	1.62	1.36	0.73	1.13	0.89	0.99	-0.319	1.632	0.596	
27	1.27	1.21	0.80	0.98	1.24	1.66	0.018	1.165	1.223	
29	0.72	0.80	0.62	0.86	0.83	0.74	0.028	0.717	0.807	
31	0.73	0.91	0.64	0.62	0.74	0.93	0.017	0.735	0.789	
33	0.89	0.95	0.82	0.96	1.00	1.45	0.123	0.814	1.215	
37	0.67	0.59	0.29	1.09	0.82	0.76	0.113	0.505	0.873	
44	0.63	0.60	0.55	0.68	0.74	0.74	0.041	0.592	0.723	
46	0.90	0.95	0.89	0.85	0.82	0.87	-0.026	0.922	0.837	
52	0.43	0.39	0.47	0.38	0.48	0.67	0.051	0.388	0.554	
54	0.77	0.76	0.68	0.78	0.82	0.73	-0.002	0.760	0.753	
56	0.53	0.53	0.35	0.49	0.63	0.56	0.009	0.500	0.530	
60	0.92	0.77	0.65	0.65	0.63	0.97	-0.073	0.882	0.645	
							Maximum		**1.223**	
							Minimum		**0.267**	
							Mean		**0.741**	
							Standard Deviation		**0.249**	
							Upper Spec. Limit		**3.000**	
									2 Sigma (95% Conf.)	3 Sigma (99% Conf.)
							Calc. Max. value		1.239	1.488
							Cpk (Upper)		n/a	3.023

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MEDIUM TERM FREQUENCY STABILITY (MTS) - 5-YEAR PREDICTION

Device:	Frequency:	Class:	Package:	Date:
E5344LFT	12.688750 MHz	II	SM (7x5.0mm),10-pad	06-July-2010

MINIMUM STATIC SLOPE (ppb/min)

Serial Number / Time (Days)	1	30	60	90	150	180	Slope	Intercept	Predicted Minimum Static Slope after 5 years	
1	-0.03	-0.01	-0.01	-0.01	-0.03	-0.03	0.002	-0.024	-0.016	
3	-0.11	-0.10	-0.13	-0.12	-0.14	-0.13	-0.011	-0.104	-0.140	
7	-0.17	-0.15	-0.25	-0.17	-0.15	-0.16	0.000	-0.176	-0.174	
9	-0.08	-0.08	-0.09	-0.07	-0.08	-0.08	0.001	-0.081	-0.079	
11	-0.15	-0.14	-0.14	-0.14	-0.13	-0.14	0.006	-0.150	-0.130	
13	-0.08	-0.08	-0.08	-0.07	-0.08	-0.07	0.003	-0.081	-0.072	
17	-0.19	-0.13	-0.01	-0.01	-0.02	-0.03	0.082	-0.197	0.070	
19	-0.08	-0.11	-0.14	-0.10	-0.09	-0.09	-0.007	-0.090	-0.114	
21	-0.11	-0.12	-0.08	-0.08	-0.09	-0.08	0.014	-0.115	-0.071	
27	-0.08	-0.08	-0.03	-0.05	-0.04	-0.07	0.014	-0.081	-0.036	
29	-0.05	-0.05	-0.11	-0.06	-0.07	-0.08	-0.013	-0.049	-0.091	
31	-0.08	-0.09	-0.08	-0.08	-0.07	-0.09	0.000	-0.082	-0.081	
33	-0.02	-0.06	-0.09	-0.02	-0.05	-0.08	-0.018	-0.024	-0.083	
37	-0.10	-0.09	-0.13	-0.10	-0.10	-0.11	-0.004	-0.099	-0.111	
44	-0.05	-0.06	-0.06	-0.05	-0.06	-0.06	-0.003	-0.060	-0.060	
46	-0.08	-0.09	-0.07	-0.07	-0.07	-0.07	0.005	-0.084	-0.066	
52	-0.06	-0.10	-0.12	-0.11	-0.12	-0.11	-0.025	-0.062	-0.145	
54	-0.06	-0.08	-0.11	-0.07	-0.08	-0.10	-0.013	-0.062	-0.105	
56	-0.08	-0.11	-0.09	-0.11	-0.11	-0.11	-0.013	-0.081	-0.123	
60	-0.04	-0.06	-0.07	-0.08	-0.06	-0.07	-0.014	-0.042	-0.086	
							Maximum		0.070	
							Minimum		-0.174	
							Mean		-0.086	
							Standard Deviation		0.053	
							Upper Spec. Limit		1.000	
							Lower Spec. Limit		-1.000	
									2 Sigma (95% Conf.)	ligma (99% Conf.)
							Calc. Max. value		0.020	0.072
							Calc. Min. value		-0.191	-0.243
							Cpk (Upper)		n/a	6.880
							Cpk (Lower)		n/a	5.794

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MEDIUM TERM FREQUENCY STABILITY (MTS) - 5-YEAR PREDICTION				
Device: E5344LFT	Frequency: 12.688750 MHz	Class : II	Package: SM (7x5.0mm),10-pad	Date: 06-July-2010
MAXIMUM STATIC SLOPE (ppb/min)				

Serial Number / Time (Days)	1	30	60	90	150	180	Slope	Intercept	Predicted Maximum Static Slope after 5 years	
1	0.10	0.08	0.19	0.08	0.12	0.09	0.005	0.103	0.118	
3	0.12	0.06	0.11	0.07	0.08	0.10	-0.017	0.114	0.059	
7	0.05	0.06	0.05	0.06	0.05	0.07	0.004	0.050	0.064	
9	0.04	0.05	0.02	0.02	0.05	0.07	0.004	0.035	0.048	
11	0.08	0.08	0.05	0.07	0.07	0.11	0.001	0.074	0.079	
13	0.06	0.04	0.05	0.08	0.05	0.08	0.004	0.053	0.067	
17	0.23	0.21	0.14	0.13	0.11	0.10	-0.057	0.245	0.059	
19	0.06	0.09	0.03	0.17	0.05	0.08	0.007	0.066	0.088	
21	0.08	0.10	0.06	0.09	0.07	0.08	-0.002	0.084	0.076	
27	0.12	0.07	0.07	0.10	0.16	0.12	0.004	0.100	0.113	
29	0.09	0.07	0.05	0.08	0.09	0.08	-0.004	0.083	0.070	
31	0.06	0.06	0.05	0.05	0.08	0.11	0.008	0.052	0.078	
33	0.11	0.07	0.12	0.12	0.13	0.12	0.008	0.099	0.125	
37	0.07	0.07	0.04	0.11	0.10	0.08	0.009	0.063	0.094	
44	0.01	0.04	0.02	0.03	0.02	0.05	0.010	0.012	0.046	
46	0.06	0.05	0.05	0.08	0.05	0.06	0.000	0.058	0.059	
52	0.05	0.05	0.08	0.07	0.05	0.08	0.009	0.049	0.078	
54	0.05	0.07	0.03	0.06	0.05	0.09	0.007	0.048	0.069	
56	0.04	0.05	0.03	0.04	0.06	0.04	0.002	0.039	0.047	
60	0.17	0.14	0.19	0.13	0.15	0.11	-0.016	0.174	0.121	
							Maximum		0.125	
							Minimum		0.046	
							Mean		0.078	
							Standard Deviation		0.025	
							Upper Spec. Limit		1.000	
							Lower Spec. Limit		-1.000	
									2 Sigma (95% Conf.)	3 Sigma (99% Conf.)
							Calc. Max. value		0.127	0.152
							Calc. Min. value		0.028	0.003
							Cpk (Upper)		n/a	12.391
							Cpk (Lower)		n/a	14.484

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MEDIUM TERM FREQUENCY STABILITY (MTS) - 5-YEAR PREDICTION

Device:	Frequency:	Class:	Package:	Date:
E5344LFT	12.688750 MHz	II	SM (7x5.0mm),10-pad	06-July-2010

MINIMUM GRADIENT SLOPE (ppb/min)

Serial Number / Time (Days)	1	30	60	90	150	180	Slope	Intercept	Predicted Minimum Gradient Slope after 5 years
1	-1.01	-0.91	-0.90	-0.92	-0.93	-0.95	0.035	-0.993	-0.879
3	-1.01	-1.00	-1.07	-1.00	-0.99	-1.04	-0.005	-1.011	-1.026
7	-0.73	-0.72	-0.78	-0.72	-0.72	-0.74	-0.002	-0.732	-0.738
9	-0.52	-0.50	-0.49	-0.50	-0.50	-0.49	0.012	-0.519	-0.481
11	-0.20	-0.17	-0.22	-0.18	-0.20	-0.22	-0.004	-0.192	-0.205
13	-0.33	-0.28	-0.25	-0.25	-0.24	-0.23	0.043	-0.333	-0.192
17	-0.49	-0.45	-0.60	-0.45	-0.52	-0.55	-0.019	-0.480	-0.541
19	-0.69	-0.66	-0.64	-0.65	-0.66	-0.65	0.018	-0.687	-0.629
21	-1.18	-1.16	-1.16	-1.15	-1.17	-1.19	0.003	-1.173	-1.163
27	-0.97	-0.94	-0.83	-0.90	-1.05	-1.09	-0.023	-0.927	-1.001
29	-0.99	-0.95	-0.94	-0.96	-0.95	-0.94	0.020	-0.987	-0.922
31	-0.83	-0.83	-0.83	-0.84	-0.75	-0.79	0.019	-0.843	-0.780
33	-1.01	-1.03	-0.98	-1.00	-1.03	-1.05	-0.007	-1.005	-1.029
37	-0.26	-0.26	-0.25	-0.28	-0.27	-0.34	-0.016	-0.248	-0.300
44	-0.47	-0.49	-0.54	-0.58	-0.53	-0.55	-0.038	-0.465	-0.590
46	-0.84	-0.83	-0.79	-0.76	-0.71	-0.75	0.048	-0.857	-0.701
52	-0.42	-0.42	-0.44	-0.46	-0.49	-0.48	-0.028	-0.407	-0.497
54	-0.97	-1.00	-1.01	-1.01	-1.03	-1.04	-0.028	-0.966	-1.055
56	-0.35	-0.33	-0.35	-0.37	-0.35	-0.39	-0.010	-0.340	-0.373
60	-0.35	-0.27	-0.29	-0.27	-0.25	-0.30	0.034	-0.342	-0.233

Maximum	-0.192	
Minimum	-1.163	
Mean	-0.667	
Standard Deviation	0.311	
Upper Spec. Limit	2.000	
Lower Spec. Limit	-2.000	
	2 Sigma (95% Conf.)	3 Sigma (99% Conf.)
Calc. Max. value	-0.046	0.285
Calc. Min. value	-1.288	-1.599
Cpk (Upper)	n/a	2.862
Cpk (Lower)	n/a	1.431

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MEDIUM TERM FREQUENCY STABILITY (MTS) - 5-YEAR PREDICTION				
Device: E5344LFT	Frequency: 12.688750 MHz	Class: II	Package: SM (7x5.0mm),10-pad	Date: 06-July-2010

MAXIMUM GRADIENT SLOPE (ppb/min)

Serial Number / Time (Days)	1	30	60	90	150	180	Slope	Intercept	Predicted Maximum Gradient Slope after 5 years	
1	1.26	0.92	0.97	1.00	1.02	1.02	-0.111	1.210	0.848	
3	1.06	1.04	1.01	1.04	1.06	1.05	-0.006	1.052	1.034	
7	0.55	0.57	0.60	0.63	0.66	0.68	0.052	0.532	0.700	
9	0.45	0.44	0.45	0.44	0.43	0.43	-0.008	0.452	0.427	
11	0.19	0.19	0.18	0.19	0.20	0.20	0.003	0.187	0.197	
13	0.19	0.19	0.17	0.17	0.17	0.18	-0.008	0.191	0.165	
17	1.05	1.06	0.39	0.48	0.52	0.54	-0.270	1.108	0.227	
19	0.69	0.68	0.69	0.74	0.69	0.70	0.007	0.687	0.710	
21	1.14	1.17	1.16	1.15	1.16	1.18	0.012	1.141	1.179	
27	0.69	0.67	0.49	0.45	0.45	0.49	-0.109	0.715	0.360	
29	0.99	0.95	0.92	0.92	0.93	0.93	-0.030	0.988	0.891	
31	0.86	0.85	0.86	0.91	0.78	0.77	-0.024	0.878	0.798	
33	1.08	1.05	1.06	1.06	1.07	1.09	-0.002	1.071	1.066	
37	0.28	0.26	0.23	0.24	0.24	0.24	-0.020	0.280	0.216	
44	0.44	0.46	0.49	0.51	0.52	0.55	0.042	0.427	0.564	
46	0.97	0.67	0.60	0.62	0.62	0.65	-0.166	0.988	0.449	
52	0.38	0.39	0.38	0.40	0.41	0.42	0.014	0.374	0.420	
54	0.95	0.95	0.95	0.95	0.96	0.97	0.005	0.946	0.964	
56	0.33	0.33	0.37	0.37	0.39	0.40	0.029	0.319	0.412	
60	0.25	0.26	0.23	0.22	0.22	0.21	-0.017	0.258	0.204	
							Maximum		1.179	
							Minimum		0.165	
							Mean		0.592	
							Standard Deviation		0.329	
							Upper Spec. Limit		2.000	
							Lower Spec. Limit		-2.000	
									2 Sigma (95% Conf.)	3 Sigma (99% Conf.)
							Calc. Max. value		1.249	1.578
							Calc. Min. value		-0.066	-0.395
							Cpk (Upper)		n/a	1.428
							Cpk (Lower)		n/a	2.628

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MEDIUM TERM FREQUENCY STABILITY (MTS) - 5-YEAR PREDICTION				
Device: E5344LFT	Frequency: 12.688750 MHz	Class: II	Package: SM (7x5.0mm),10-pad	Date: 06-July-2010

AGING - MID FREQUENCY (ppm)

Serial Number / Time (Days)	1	30	60	90	150	180	Slope	Intercept	Predicted Aging-Mid Frequency after 5 years	
1	-0.19	-0.20	-0.18	-0.19	-0.20	-0.20	-0.003	-0.189	-0.198	
3	-0.09	-0.09	-0.12	-0.14	-0.15	-0.16	-0.029	-0.078	-0.173	
7	0.07	0.06	0.01	0.00	-0.01	-0.01	-0.037	0.080	-0.042	
9	-0.03	-0.03	-0.12	-0.14	-0.15	-0.15	-0.057	-0.011	-0.198	
11	0.00	-0.04	-0.07	-0.08	-0.09	-0.09	-0.041	0.006	-0.130	
13	0.00	0.01	-0.06	-0.07	-0.08	-0.08	-0.038	0.015	-0.110	
17	-0.06	0.06	-0.12	-0.15	-0.15	-0.15	-0.048	-0.018	-0.174	
19	0.02	0.00	-0.05	-0.06	-0.07	-0.07	-0.042	0.029	-0.108	
21	0.03	0.03	-0.03	-0.04	-0.05	-0.05	-0.038	0.042	-0.081	
27	-0.03	-0.03	-0.09	-0.10	-0.12	-0.12	-0.041	-0.015	-0.150	
29	0.03	-0.03	-0.03	-0.04	-0.04	-0.04	-0.032	0.027	-0.078	
31	-0.04	-0.05	-0.11	-0.12	-0.05	-0.05	-0.015	-0.047	-0.094	
33	-0.06	-0.05	-0.17	-0.18	-0.19	-0.20	-0.069	-0.028	-0.255	
37	0.08	0.06	0.01	0.00	-0.01	-0.01	-0.042	0.089	-0.048	
44	-0.03	-0.04	-0.10	-0.11	-0.12	-0.13	-0.044	-0.017	-0.161	
46	0.07	0.07	0.01	0.00	-0.02	-0.02	-0.041	0.085	-0.050	
52	0.00	-0.01	-0.07	-0.09	-0.09	-0.10	-0.045	0.013	-0.135	
54	0.03	0.03	-0.02	-0.03	-0.03	-0.03	-0.029	0.039	-0.057	
56	0.00	-0.01	-0.05	-0.06	-0.06	-0.06	-0.029	0.007	-0.088	
60	0.03	0.03	-0.02	-0.03	-0.04	-0.04	-0.033	0.041	-0.066	
							Maximum		-0.042	
							Minimum		-0.255	
							Mean		-0.120	
							Standard Deviation		0.060	
							Upper Spec. Limit		4.925	
							Lower Spec. Limit		-12.315	
									2 Sigma (95% Conf.)	3 Sigma (99% Conf.)
							Calc. Max. value		0.000	0.059
							Calc. Min. value		-0.239	-0.298
							Cpk (Upper)		n/a	28.250
							Cpk (Lower)		n/a	68.296

T.007: 5.i TCXO Data Sheets

The reference oscillator crystal for the 406MHz transmitter in the E101V EPIRB is made by RAKON Ltd. The following data sheets and sample data are attached.

TÜV SÜD Product Service

ocean SIGNAL

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Oscillator Specification: E5344LF(T)
Issue 1, 24th February 2010

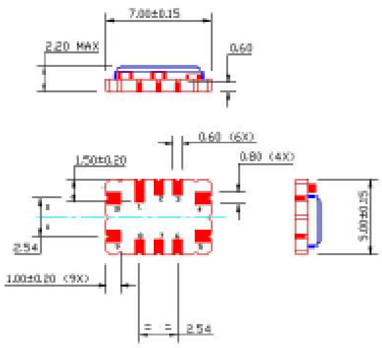
Designed for use in "Cospas-Sarsat" Emergency Beacon Applications

Outline in mm

Pad Connections
1. Do not connect
2. NC
3. Do not connect
4. GND
5. RF Output
6. NC
7. NC
8. Tri-State Control (Enable)*
9. Supply, +Vs
10. Do not connect

* leave unconnected if not required

Weight 170mg (typical)



Marking includes
- Manufacturers ID (R)
- Manufacturing identifier (X XX)
- Pad 1 / Static sensitivity identifier (Δ)
- Abbreviated P/N (5344)
- Device date code (YW)
- Serial number (nnnn)

R X XX
Δ 5344YWnnnn

Electrical

Nominal Frequency, Fo	12.688750 MHz
Supply Voltage, Vs	3.3 V ± 10%
Input Current	≤ 4.0 mA
Output:	
Type	HCMOS
Load	15 pF
Vol	≤ 0.1 * Vs
Voh	≥ 0.9 * Vs
Duty cycle @ 50%	45% to 55%
Rise time, 10% to 90%	≤ 8 ns
Fall time, 90% to 10%	≤ 8 ns
Frequency Stability	
Calibration Tolerance at 25°C	≤ ± 0.5 ppm
Temperature, -20°C to 55°C	≤ ± 0.2 ppm reference to $(F_{MAX}+F_{MIN})/2$
Supply Voltage, ± 10%	≤ ± 0.1 ppm reference to frequency at 3.3V
Load, ± 5pF	≤ ± 0.1 ppm reference to frequency at 15 pF
Allan Variance (tau=100ms)	≤ 1.0 ppb

Page 1 of 2

Figure 1: Reference Crystal Data Sheet - Sheet 1 of 2

Product Service

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Oscillator Specification: E5344LF(T)
Issue 1, 24th February 2010

Designed for use in "Cospas-Sarsat" Emergency Beacon Applications

Medium Term Stability specified and measured according to C/S T.001 & T.007* (averaged over 18 measurements in 15 minute period, and following 15 minute power up period)

Mean Slope dF/dt	
Steady state conditions	≤ ± 0.7 ppb/min
During and 15 minutes after variable temperature conditions	≤ ± 1.7 ppb/min (dT/dt ≤ ± 5ºC / hour)
Residual dF from slope	≤ ± 2.0 ppb (dT/dt ≤ ± 5ºC / hour)

Test results shipped with each device, identified by date and serial number, retained for 10 years.

Reflow soldering	≤ ± 1.0 ppm
Ageing, first year	≤ ± 1.0 ppm
Ageing, 10 years	≤ ± 3.0 ppm
Tri-State	
Pad 8 open circuit or ≥ 0.6Vs	Output Enabled
Pad 8 ≤ 0.2Vs	Output High impedance

In Tri-state mode, the output stage is disabled but the oscillator and compensation circuit are still active (current consumption 1mA typ.).

Phase Noise (typical values)	-90 dBc/Hz at 10 Hz -115 dBc/Hz at 100 Hz -127 dBc/Hz at 1 kHz -137 dBc/Hz at 10 kHz -143 dBc/Hz at 100 kHz

Environmental

Operating Temperature Range	-20 to +55°C
Storage Temperature Range	-55 to +125°C
Vibration	IEC 60068-2-6 Test Fc, 10-60Hz 1.5mm displacement, at 98.1 ms^{-2}, 30 minutes in each of three mutually perpendicular axes at 1 octave per minute
Shock	IEC 60068-2-27 Test Ea, 980ms^{-2} acceleration for 6ms duration, 3 shocks in each direction along three mutually perpendicular axes
Soldering	SMD product suitable for Convection Reflow soldering. Peak temperature 260°C. Maximum time above 220°C, 60 secs.
Solderability	MIL-STD-202, Method 208, Category 3
RoHS	Parts are fully compliant with the European Union directive 2002/95/EC on the restriction of the use of certain hazardous substances in electrical and electronic equipment. Note these RoHS compliant parts are suitable for assembly using both Lead-free solders and Tin/Lead solders.
Marking	Laser Marked
Packaging	Parts ordered with suffix 'T' are supplied on Tape-and-Reel.

* COSPAS SARSAT 406MHz distress beacons specification C/S T.001 (Issue 3, Revision 9, OCT 2008) and C/S T.007 (Issue 4, Revision 3, OCT 2008)

Page 2 of 2

Figure 2: Reference Crystal Data Sheet - Sheet 2 of 2

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TEST REPORT

Report number	2010-029
Date of issue	6th July 2010
Product description	Temperature Compensated Crystal Oscillator (TCXO)
Product type	CFPT-9000
Rakon Part number	E5344LFT
Construction	Surface mount; 7.0x5.0mm, 10-pad
Output Frequency	12.688750 MHz
Class	II
Number tested	20

TESTS PERFORMED

Mid Term Frequency stability (MTS) over a 6-month period. Data is used to predict the performance of the device over a 5-year period.

Test sequence

1) Measure MTS over the temperature range -20°C to +55°C to -20°C
2) Store for 1-month at room temperature (+20°C ± 5°C)
3) Measure MTS over the temperature range -20°C to +55°C to -20°C
4) Store for 1-month at room temperature (+20°C ± 5°C)
5) Repeat testing & storage sequence for a further 4 months

Applicable standard — Cospas-Sarsat T.007, issue 4, revision 3

SUMMARY OF TEST RESULTS

TEST	PASS	FAIL	REMARKS
Residual (5-year prediction)	20	0	Minimum Cpk = 1.488
Minimum Static Slope (5-year prediction)	20	0	Minimum Cpk = 5.794
Maximum Static Slope (5-year prediction	20	0	Minimum Cpk = 12.391
Minimum Gradient Slope (5-year prediction)	20	0	Minimum Cpk = 1.431
Maximum Gradient Slope (5-year prediction	20	0	Minimum Cpk = 1.428
Aging Mid Frequency (5-year prediction)	20	0	Minimum Cpk = 28.250

CONCLUSIONS

The conclusion reached following the analysis of the data contained within this report indicates that the failure rate for this product after 5-years operation will be less than 3000 ppm.

Testing conducted by	Ian Payne
Report prepared by	David Lowrie
Report approved by	David R Woodall

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Figure 3: Rakon Long term Stability declaration

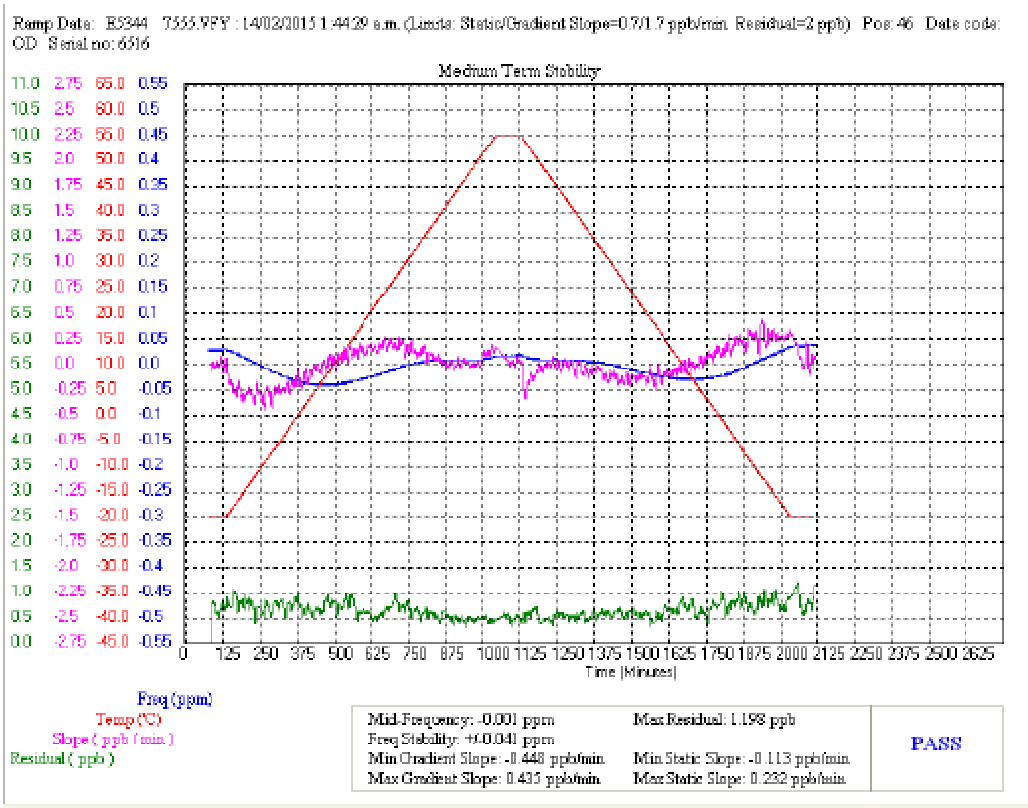


Figure 4: Frequency stability plot for crystal used in SafeSea E101V – Unit SNo 0800003P Rakon Serial №OD6516

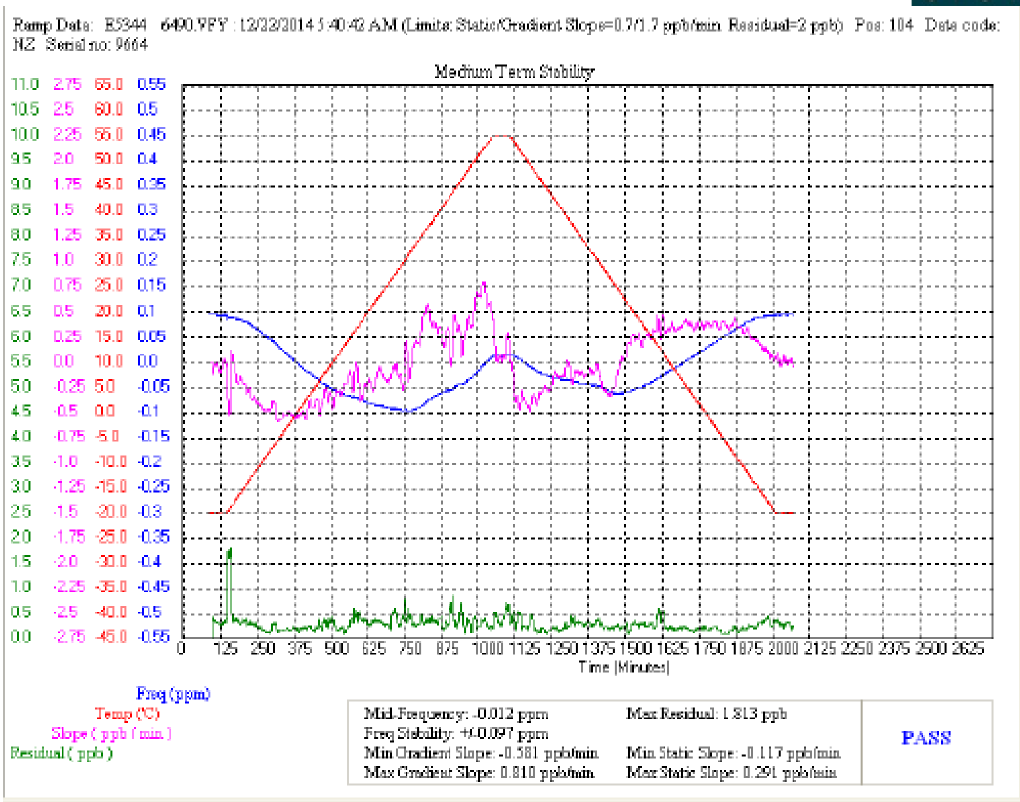


Figure 5: **Frequency stability plot for crystal used in SafeSea E101V – Unit SNo 0800004P Rakon Serial №NZ9664**

Product Service

T.007: 5.n GNSS Operation

The E101V EPIRB uses a Quectel L70 GPS module to determine its latitude and longitude position.

Every time the EPIRB is switched from off to on the GPS is powered up in a cold start mode to acquire the position.

Once a position has been acquired by the receiver then the position is stored for transmission and the GPS module is turned off to conserve battery capacity. The GPS receiver is powered for a maximum period of five minutes if no position has been received.

The GPS position is considered valid if it was obtained less than four hours from the current time. After the position is four hours old a new GPS position must be obtained or the EPIRB will revert to the default position data message until a new valid GPS position is received.

The GPS is cycled on and off as follows if no GPS fix is obtained.

Elapsed Time	ON (maximum)	Cycle Period
0 hour up to 1st hour	5mins	10mins
2nd hour	5mins	15mins
3rd hour up to 7th hour	5mins	30mins
8th hour onwards	5mins	1hr

Once the GPS has a fix and has encoded the location into the beacon message. The following applies.

The GPS is cycled on and off as follows after a GPS fix is obtained.

Elapsed Time	ON (maximum)	Cycle Period
0 up to 6th hour	5mins	30mins
7th hour onwards	5mins	1hr

Without a GPS Signal present the GPS module operates in Acquisition mode which draws the maximum current. With a GPS signal received the unit will move from Acquisition to Tracking mode, once a valid position is achieved (when the GPS HDOP value is less than 50) the GPS module is switched into Standby mode (off). In addition to checking the HDOP value the EPIRB microprocessor also parses the format of the received messages from the GNSS receiver and verifies that the checksum sent from the GNSS receiver is correct before using the data. So the accuracy and format of the data is checked. The content is verified by validating the checksum preventing corrupted data from being encoded into the burst data.

To determine "worst case conditions" for the beacon operating life testing we must consider both operating the GPS with and without a GPS signal present in the first 6 hours as after this time the timings are identical for with and without a GPS signal present. (When a signal is present we must assume that the fix is obtained in the last instant before the GPS ON {acquisition time is terminated by the beacon processor})*.

Without a GPS signal present the GPS will be ON (Acquisition) for 90 minutes and in OFF (standby) for 270 minutes.

With a GPS signal present the GPS will be ON* (Acquisition) for 60 minutes and in OFF (standby) for 300minutes.

For current consumption figures see sections c. and d.

Product Service

Quectel L70

Compact GPS Module Ultra Low Consumption Fast Positioning

EASY™ Technology

Ultra Low Power Consumption

Tiny Size

Super Tracking Sensitivity –163dBm

Extended Temperature Range -40°C to +85°C

Anti-Jamming

RoHS Compliant

GPS+QZSS

GPS

L70, a SMD type module, brings the high performance of MTK positioning engine to the industrial applications with compact profile, ultra low power consumption and fast positioning capability.

Combining advanced AGPS called EASY™ (Embedded Assist System) and proven AlwaysLocate™ technology, L70 achieves the highest performance and fully meets the industrial standard. EASY™ technology ensures L70 can calculate and predict orbits automatically using the ephemeris data (up to 3 days) stored in internal flash memory, so L70 can fix position quickly even at indoor signal levels with low power consumption. With AlwaysLocate™ technology, L70 can adaptively adjust the on/off time to achieve balance between positioning accuracy and power consumption according to the environmental and motion conditions.

Additional feature of embedded logger function called LOCUS allows L70 to log position information to internal flash memory at default intervals of 15 seconds and provide typically more than 16 hours log capacity without adding cost.

With its tiny design, high precision and sensitivity, L70 is perfectly suitable for a broad range of M2M applications such as portable device, automotive, personal tracking, security and industrial PDA.

Key benefits

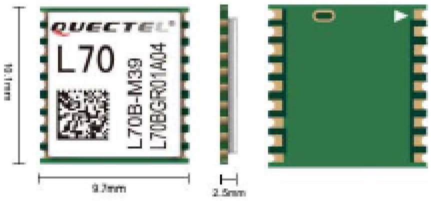
- Extremely compact size: 10.1 x 9.7 x 2.5mm
- EASY™, advanced AGPS technology without external memory
- Ultra low power consumption in tracking mode, 12mA
- AlwaysLocate™, an intelligent controller of periodic mode
- LOCUS, innate logger solution with no need of host and external flash
- High sensitivity -163dBm@Tracking, -148dBm@Acquisition
- 66 acquisition channels, 22 tracking channels
- Support QZSS
- Support DGPS, SBAS(WAAS/EGNOS/MSAS/GAGAN)
- Anti-Jamming, Multi-tone Active Interference Canceller

Wireless Module Expert

Product Service

Quectel L70

Compact GPS Module
Ultra Low Consumption
Fast Positioning



General Specifications

L1 Band Receiver (1575.42MHz)	Channel	22 (Tracking) / 66 (Acquisition)
	C/A code	
	SBAS	WAAS, EGNOS MSAS,GAGAN
Horizontal Position Accuracy	Autonomous	<2.5 m CEP
Velocity Accuracy	Without aid	<0.1m/s
Acceleration Accuracy	Without aid	0.1 m/s²
Timing Accuracy	1PPS out	10ns
Reacquisition Time		<1s
TTFF@-130dBm with EASY™	Cold Start	<15s
	Warm Start	<5s
	Hot start	<1s
TTFF@-130dBm without EASY™	Cold Start	<35s
	Warm Start	<30s
	Hot Start	<1s
Sensitivity	Acquisition	-148dBm
	Tracking	-163dBm
	Reacquisition	-160dBm
Environmental	Operating Temperature	-40℃ to 85℃
	Storage Temperature	-45℃ to 125℃
Dynamic Performance	Maximum Altitude	Max.18000m
	Maximum Velocity	Max.515m/s
	Maximum Acceleration	4G
Dimensions	10.1 x 9.7 x 2.5mm	
Weight	Approx. 0.6g	

Power Management

Power supply	2.8V ~ 4.3V
Power Acquisition	18mA
Power Tracking	12mA
Power Saving	Typ.1.4mA @AlwaysLocate™(Note1)
	7uA @Backup Mode
	200uA@Standby Mode
	Periodic Mode
Antenna Type	Active or Passive
Antenna Power	External or Internal VCC_RF

Note1: Measured in GPS system under outdoor static mode.

Serial Interfaces

Serial Interfaces	UART: Adjustable 4800~115200 bps Default: 9600bps
Update rate	1Hz (Default), up to10Hz
I/O Voltage	2.7V ~ 2.9V
Protocols	NMEA 0183 PMTK

Wireless Module Expert

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Tel: +86 21 51086236
Fax: +86 21 54453668
Email: info@quectel.com

Product Service

Components for GPS Receivers

Dielectric Microwave Antenna Elements

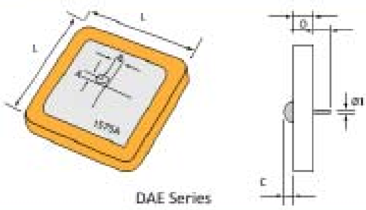
RoHS compliant 2002/95/EC

Standard Specifications

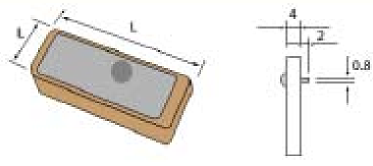
Part Number	Dimensions (mm)							Nominal Centre Frequency (MHz)	-10dB Bandwidth (MHz)	VSWR at CF (Max) (RL at CF dB)	Polarization Model	Impedence (Ω)
	L	H	A	B	C	D	Φ1					
DAE1575R3530A	35x35	3.0	4.5	0	0.6	3.2	0.8	1575.42 ±1.023	15	1.5 (-14.0)	RHCP	50
DAE1575R2540A	25x25	4.0	2.5	0	0.6	3.3	0.8	1575.42 ±1.023	15	1.5 (-14.0)	RHCP	50
DAE1575R2540B	25x25	4.0	1.7	1.9	0.6	3.3	0.8	1575.42 ±1.023	15	1.5 (-14.0)	RHCP	50
DAE1575R2520A	25x25	2.0	2.5	0	0.6	3.0	0.8	1575.42 ±1.023	8.0	1.5 (-14.0)	RHCP	50
DAE1575R2520B	25x25	2.0	1.7	1.9	0.6	3.0	0.8	1575.42 ±1.023	8.0	1.5 (-14.0)	RHCP	50
DAE1575R2040A	20x20	4.0	1.6	0	0.6	3.2	0.8	1575.42 ±1.023	6.0	1.5 (-14.0)	RHCP	50
DAE1575R2020A	20x20	2.0	1.6	0	0.6	3.2	0.8	1575.42 ±1.023	5.0	1.5 (-14.0)	RHCP	50
DAE1575R1840A	18x18	4.0	1.1	0	0.6	1.9	0.8	1575.42 ±1.023	5.0	1.5 (-14.0)	RHCP	50
DAE1575R1840B	18x18	4.0	1.4	0	0.6	3.3	0.8	1575.42 ±1.023	5.0	1.5 (-14.0)	RHCP	50
DAE1575R1820A	18x18	2.0	1.1	0	0.6	1.9	0.8	1575.42 ±1.023	5.0	1.5 (-14.0)	RHCP	50
DAE1575R1820B	18x18	2.0	1.4	0	0.6	3.3	0.8	1575.42 ±1.023	5.0	1.5 (-14.0)	RHCP	50
DAE1575R1540A	15x15	4.0	1.1	0	0.6	1.9	0.8	1575.42 ±1.023	5.0	1.5 (-14.0)	RHCP	50
DAE1575R1520A	15x15	2.0	1.1	0	0.6	1.9	0.8	1575.42 ±1.023	4.0	1.5 (-14.0)	RHCP	50
DAE1575R1340A	13x13	4.0	0.9	0	0.6	1.9	0.8	1575.42 ±1.023	4.0	1.5 (-14.0)	RHCP	50
DAE1575R1340B	13x13	4.0	0.5	0.5	0.6	1.9	0.8	1575.42 ±1.023	4.0	1.5 (-14.0)	RHCP	50
DAE1375R1240A	12x12	4.0	0.7	0	0.6	1.7	0.8	1575.42 ±1.023	4.0	1.5 (-14.0)	RHCP	50
DAE868R2540F	25x25	4.0	1.9	0	0.6	3.3	0.8	868	2.0	1.5 (-14.0)	RHCP	50
DAE925R6150A	61.5x61.5	5.0	7.6	0	0.6	3.2	0.8	925	8.0	1.5 (-14.0)	RHCP	50
DAE925R6170A	61.5x61.5	7.0	7.6	0	0.6	3.2	0.8	925	8.0	1.5 (-14.0)	RHCP	50
DAE953R2540G	25x25	4.0	1.9	0	0.6	3.3	0.8	953	3.0	1.5 (-14.0)	RHCP	50
DAE1176Z540H	25x25	4.0	2.5	0	0.6	1.9	0.8	1175	10.0	1.5 (-14.0)	RHCP	50
DAE2338L2040C	20x20	4.0	1.6	0	0.6	3.2	0.8	2338	56.0	1.5 (-14.0)	RHCP	50
DAE2338L2540B	25x25	4.0	1.7	1.9	0.6	3.3	0.8	2338	48.0	1.5 (-14.0)	RHCP	50
DAE2338L2540D	25x25	4.0	1.9	0	0.6	3.3	0.8	2338	56.0	1.5 (-14.0)	RHCP	50
DAE2338L2550B	25x25	5.0	1.7	1.9	0.6	3.3	0.8	2338	46.0	1.5 (-14.0)	RHCP	50
DAE2338L2860B	28x28	6.0	3.0	3.0	0.6	3.2	0.8	2338	120.0	1.5 (-14.0)	RHCP	50
DAE2338L2860C	28x28	6.0	5.5	0	0.6	3.3	0.8	2338	220.0	1.5 (-14.0)	RHCP	50
DAE5810R1330C	13x13	3.0	0.9	1.2	0.6	3.3	0.8	5810	400.0	1.5 (-14.0)	RHCP	50

Part Number	Dimensions							Nominal Freq (MHz)	Real Part at CF Ω	Imaginary Part at CF (Ω)	Polarization Model	Impedence (Ω)
	L	H	A	B	C	D	Φ1					
DAL1574X2006A	20x6	4.0				2.0	0.8	1575.42	80 ±10	-45 ±10	Linear	50
DAL1575X1606A	16x6	4.0				2.0	0.8	1575.42	70 ±10	-85 ±10	Linear	50

Dimensions (mm)



DAE Series



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