Report On

Radio Testing of the
Linwave Technology Ltd
LW26 RACON
In accordance with LW26-70118904 Transponder Qualification and Compliance Test Plan

COMMERCIAL-IN-CONFIDENCE

Document 75931125 Report 01 Issue 2 April 2016

Product Service

TÜV SÜD Product Service, Octagon House, Concorde Way, Segensworth North,
Fareham, Hampshire, United Kingdom, PO15 5RL
Tel: +44 (0) 1489 558100. Website: www.tuv-sud.co.uk

REPORT ON

Radio Testing of the
Linwave Technology Ltd
LW26 RACON
In accordance with LW26-70118904 Transponder Qualification and Compliance Test Plan

Document 75931125 Report 01 Issue 2

April 2016

PREPARED FOR

Linwave Technology Ltd
Marlin Building
Sadler Road
Lincoln
LN6 3RS

PREPARED BY

Simon Bennett
Senior Engineer

APPROVED BY

Nic Forsyth
Authorised Signatory

DATED 22 April 2016

This report has been revised to reference a revised Manufacturer test plan

Product Service

CONTENTS

Product Service

SECTION 1

REPORT SUMMARY

Radio Testing of the
Linwave Technology Ltd
LW26 RACON
In accordance with LW26-70118904
Transponder Qualification and Compliance Test Plan

Product Service

1.1 INTRODUCTION

The information contained in this report is intended to show the verification of Radio Testing of the Linwave Technology Ltd LW26 RACON to the requirements of LW26-70118904 Transponder Qualification and Compliance Test Plan.

Objective	To perform Radio Testing to determine the Equipment Under Test's (EUT's) compliance with the Test Specification, for the series of tests carried out.
Manufacturer	Linwave Technology Ltd
Model Number(s)	LW26
Serial Number(s)	1
Hardware Version	02
Software Version	Modification State 0 0.3 FPGA Revision: 1.001 RTOS: V8.2.0 Modification State 1 0.3 FPGA Revision: 1.257 RTOS: V8.2.0
Number of Samples Tested	1
Test Specification/Issue/Date	ITU-R M.824-2, Edition 2 December 2004
Test Plan/Issue/Date	LW26-70118904 Transponder Qualification and Compliance Test Plan Issue 3, 07 April 2016
Disposal Reference Number Date	Held Pending Disposal Not Applicable Not Applicable
Order Number Date	102973 30 June 2015
Start of Test	13 July 2015
Finish of Test	5 August 2015
Name of Engineer(s)	S Bennett N Rousell G Lawler
Related Document(s)	IALA Recommendation R-101 Ed.2 (Dec.2004)

Product Service

1.2 BRIEF SUMMARY OF RESULTS

A brief summary of the tests carried out in accordance with LW26-70118904 Transponder Qualification and Compliance Test Plan is shown below.

Section	Test Plan Clause	Test Description	Result	Comments/Base Standard
Transmit				
2.1	10.4.5	Dry Heat (Storage)	-	Refer to TUV SUD document 75931125 Report 04.
2.2	10.4.5	Dry Heat (Functional)	-	Refer to TUV SUD document 75931125 Report 04.
2.3	10.4.6	Damp Heat	-	Refer to TUV SUD document 75931125 Report 04.
2.4	10.4.7	Low Temperature	-	Refer to TUV SUD document 75931125 Report 04.
2.5	10.4.8	Vibration	-	Refer to TUV SUD document 75931125 Report 04.
2.6	13.1.1	Antenna Aperture	N/A	Manufacturer declaration
2.7	13.1.2	Antenna Gain	Pass	
2.8	13.1.3	Receiver Sensitivity	Pass	
2.9	13.1.4	Carrier Power	Pass	~~Output Power does not meet 1W requirements as defined in test plan LW26-70118904 Draft 1~~
2.10	13.1.5	Blocking Period	Pass	

Product Service

Section	Test Plan Clause	Test Description	Result	Comments/Base Standard
Transmit				
2.11	13.1.5	Receiver – Primary Radar Pulse Length	Pass	
2.12	-	Transmitter – Frequency Error	Pass	
2.13	13.1.6	Delay After Receipt of Interrogation	Pass	
2.14	-	Morse Characteristics	Pass	
2.15	13.1.5	Response Duration	Pass	

Product Service

1.3 PRODUCT INFORMATION

1.3.1 Technical Description

The Equipment Under Test (EUT) was a Linwave Technology Ltd LW26 as shown in the photograph below. A full technical description can be found in the manufacturer's documentation.

Equipment Under Test

Product Service

1.4 DEVIATIONS FROM THE STANDARD

No deviations from the applicable test standard were made during testing.

1.5 MODIFICATION RECORD

The table below details modifications made to the EUT during the test programme. The modifications incorporated during each test are recorded on the appropriate test pages.

Modification State	Description of Modification still fitted to EUT	Modification Fitted By	Date Modification Fitted
0	As supplied by the customer	Not Applicable	Not Applicable
1	FPGA Revised from 1.001 to 1.257	Customer	4 August 2015
2	Coms cable electrically bonded to electronics case inside the unit reducing emissions at 156-165MHz	Customer	7 August 2015

Product Service

SECTION 2

TEST DETAILS

Radio Testing of the
Linwave Technology Ltd LW26
In accordance with LW26-70118904
Transponder Qualification and Compliance Test Plan

2.1 DRY HEAT (STORAGE)

2.1.1 Specification Reference

LW26-70118904 Transponder Qualification and Compliance Test Plan, Clause 10.4.5

Refer to TUV SUD document 75931125 Report 04.

2.2 DRY HEAT (FUNCTIONAL)

2.2.1 Specification Reference

LW26-70118904 Transponder Qualification and Compliance Test Plan, Clause 10.4.5

Refer to TUV SUD document 75931125 Report 04.

2.3 DAMP HEAT

2.3.1 Specification Reference

LW26-70118904 Transponder Qualification and Compliance Test Plan, Clause 10.4.6

Refer to TUV SUD document 75931125 Report 04.

2.4 LOW TEMPERATURE

2.4.1 Specification Reference

LW26-70118904 Transponder Qualification and Compliance Test Plan, Clause 10.4.7

Refer to TUV SUD document 75931125 Report 04.

2.5 VIBRATION

2.5.1 Specification Reference

LW26-70118904 Transponder Qualification and Compliance Test Plan, Clause 10.4.8

Refer to TUV SUD document 75931125 Report 04.

2.6 ANTENNA APERTURE

2.6.1 Specification Reference

LW26-70118904 Transponder Qualification and Compliance Test Plan, Clause 13.1.1

2.6.2 Equipment Under Test

LW26

2.6.3 Test Results

Manufacturer Information – see Annex A.

2.7 ANTENNA GAIN

2.7.1 Specification Reference

LW26-70118904 Transponder Qualification and Compliance Test Plan, Clause 13.1.2

2.7.2 Equipment Under Test and Modification State

LW26 S/N: Prototype 2 - Modification State 0

2.7.3 Date of Test

13th July 2015 to 10th August 2015

2.7.4 Test Equipment Used

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

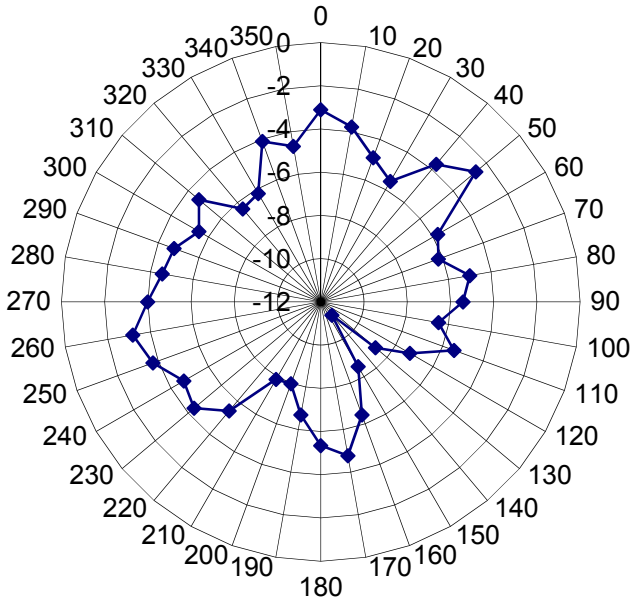
2.7.5 Environmental Conditions

Ambient Temperature	19.1 - 20.7 °C
Relative Humidity	52.0 - 67.0 %

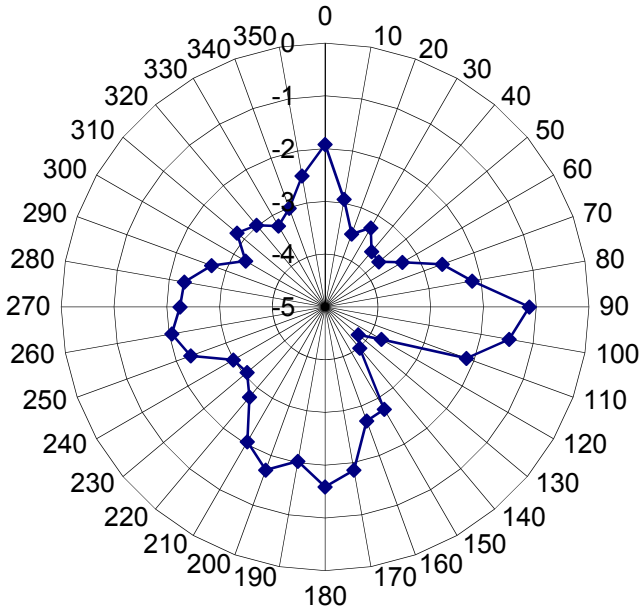
2.7.6 Test Results

Antenna Gain (dBi)			
3000 MHz		9350 MHz	
Horizontal	Vertical	Horizontal	Vertical
-2.64	-1.13	+6.33	-14.83

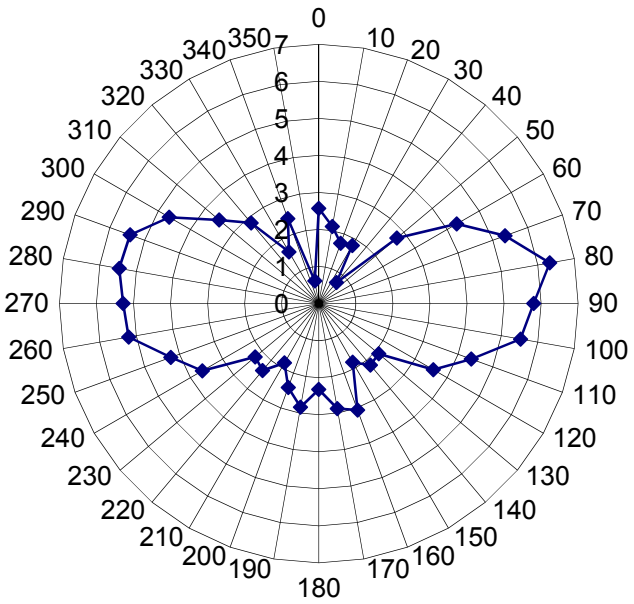
3000 MHz – Horizontal – Gain (dBi)



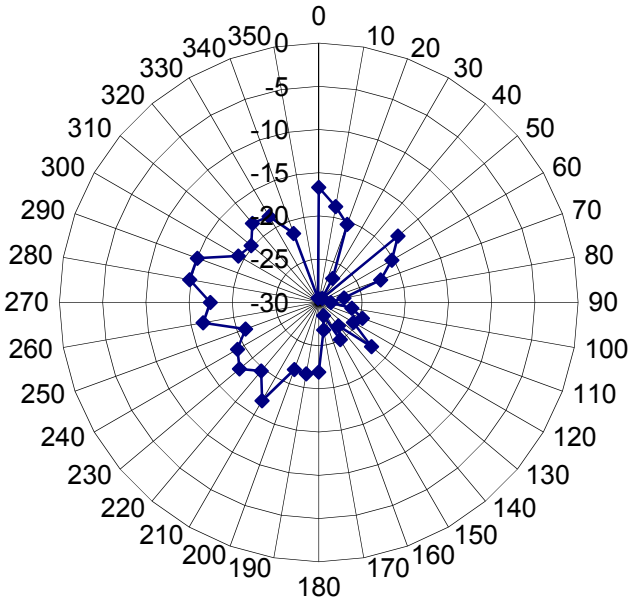
3000 MHz – Vertical– Gain (dBi)



9350 MHz – Horizontal– Gain (dBi)



9350 MHz - Vertical– Gain (dBi)



Product Service

2.8 RECEIVER SENSITIVITY

2.8.1 Specification Reference

LW26-70118904 Transponder Qualification and Compliance Test Plan, Clause 13.1.3

2.8.2 Equipment Under Test and Modification State

LW26 S/N: Prototype 2 - Modification State 0

2.8.3 Date of Test

13 July 2015

2.8.4 Test Equipment Used

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

2.8.5 Environmental Conditions

Ambient Temperature	22.7 °C
Relative Humidity	64.0 %

2.8.6 Test Results

Conducted

Receiver Sensitivity (dBm)	
3000 MHz	9350 MHz
-52.32	-49.04

Radiated

Receiver Sensitivity (dBm)	
3000 MHz	9350 MHz
-51.19	-55.37

The test result was measured at the input to the antenna connector. The Radiated result is the Conducted result including the maximum measured Antenna Gain.

LW26-70118904 Limit Clause 10.4.1 (a)

Receiver Sensitivity	≤ - 50 dBm

Product Service

2.9 CARRIER POWER

2.9.1 Specification Reference

LW26-70118904 Transponder Qualification and Compliance Test Plan, Clause 13.1.4

2.9.2 Equipment Under Test and Modification State

LW26 S/N: Prototype 2 - Modification State 0

2.9.3 Date of Test

13 July 2015

2.9.4 Test Equipment Used

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

2.9.5 Environmental Conditions

Ambient Temperature	22.7 °C
Relative Humidity	64.0 %

2.9.6 Test Results

Conducted Carrier Power			
3000 MHz		9350 MHz	
dBm	W	dBm	W
29.19	0.830	27.83	0.607

3000 MHz Antenna Gain: -1.13 dBi
9350 MHz Antenna Gain: +6.33 dBi

EIRP			
3000 MHz		9350 MHz	
dBm	W	dBm	W
28.06	0.640	34.16	2.606

The EUT was set to transmit an unmodulated carrier at the frequencies defined in the tables above. The path loss between the EUT and the measuring instrumentation was measured and subsequently entered as an offset into the Power Meter which was used for all conducted measurements. The Antenna Gain was then added to the test results to give the EIRP.

LW26-70118904 Limit Clause 10.4.1 (a) & (b)

Carrier Power	Nominally 1 W EIRP (3 GHz) Nominally 4W EIRP (9 GHz) +/-2dB

Product Service

2.10 BLOCKING PERIOD

2.10.1 Specification Reference

LW26-70118904 Transponder Qualification and Compliance Test Plan, Clause 13.1.6
ITU-R M824-2 – Annex 1 Item 2 - 2

2.10.2 Equipment Under Test and Modification State

LW26 S/N: Prototype 2 - Modification State 0
LW26 S/N: Prototype 2 - Modification State 1

2.10.3 Date of Test

28 July 2015 & 5 August 2015

2.10.4 Test Equipment Used

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

2.10.5 Environmental Conditions

Ambient Temperature	21.8 - 23.0 °C
Relative Humidity	47.9 - 51.7 %

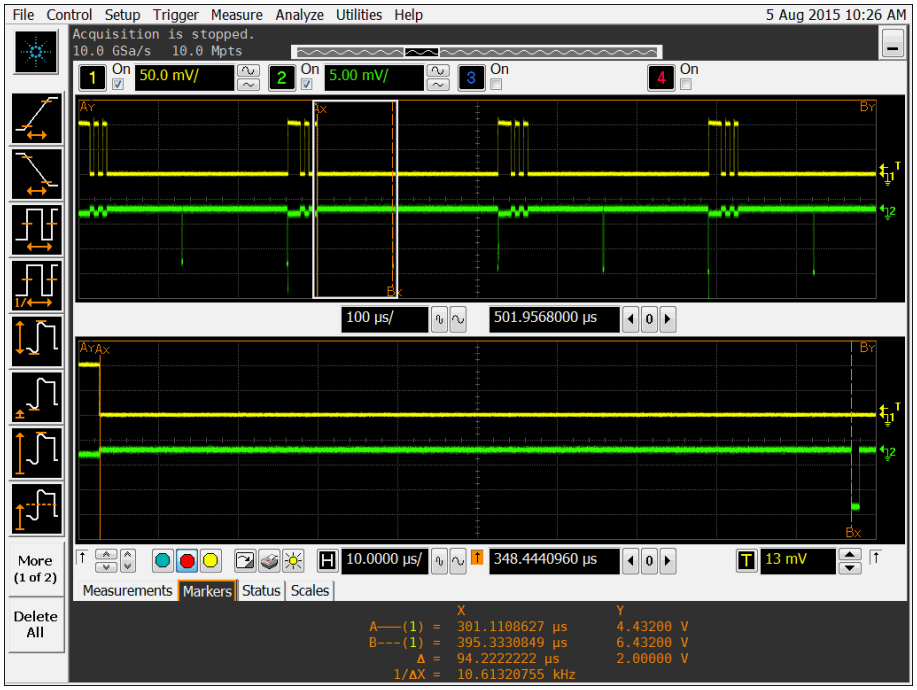
2.10.6 Test Results

Blocking Period (µs)			
3000 MHz		9350 MHz	
PRI	Result	PRI	Result
132	94.22	133	94.72

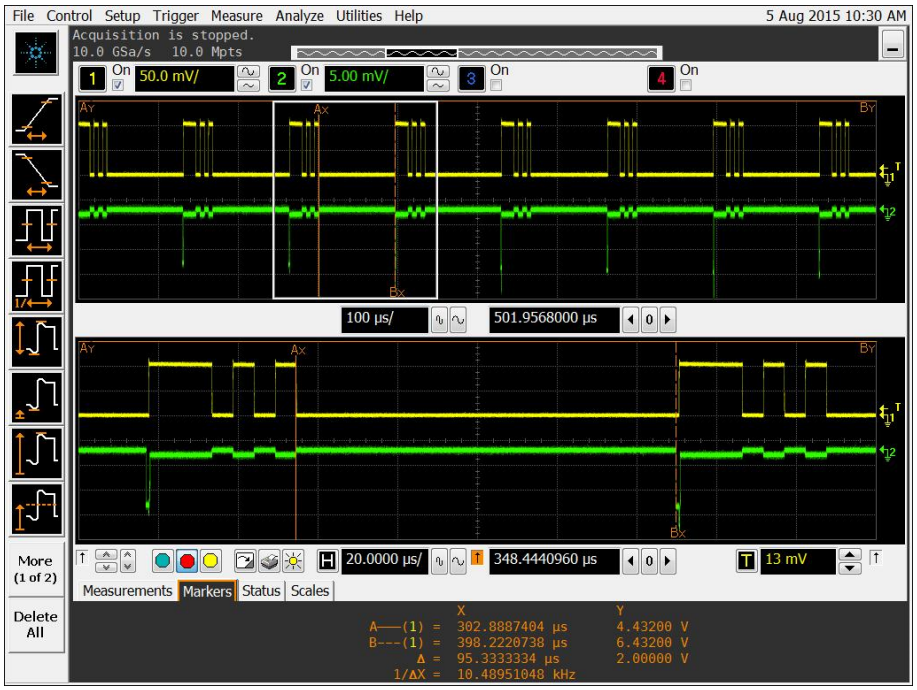
A test signal with a varying PRI and fixed pulse width of 1 µs was used. The PRI was increased from 130 µs until a response was detected for all interrogations. This point was 133 µs for 3000 MHz and 135 µs for 9350 MHz. The time between the end of the EUT response to the next trigger point was measured and found to be < 100 µs. The EUT was therefore deemed to pass the requirements of the recommendation as the limit is ≤ 100 µs.

Product Service

3000 MHz - PRI – 132 µs – Responses Not Detected To Each Interrogation



3000 MHz - PRI – 133 µs – Responses Detected To Each Interrogation



Product Service

9350 MHz - PRI – 133 µs – Responses Not Detected To Each Interrogation

9350 MHz - PRI – 135 µs – Responses Detected To Each Interrogation

Remarks

3000 MHz – Modification State 1
9350 MHz – Modificaition State 0

Limit Clause ITU-R 824-2 Annex 1 Item 2 - 2

≤ 100 µs

2.11 RECEIVER – PRIMARY RADAR PULSE LENGTH

2.11.1 Specification Reference

LW26-70118904 Transponder Qualification and Compliance Test Plan
ITU-R M824-2 – Annex 1 Item 2 - 3

2.11.2 Equipment Under Test and Modification State

LW26 S/N: Prototype 2 - Modification State 1

2.11.3 Date of Test

5t August 2015

2.11.4 Test Equipment Used

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

2.11.5 Environmental Conditions

Ambient Temperature	23.1 °C
Relative Humidity	50.8 %

2.11.6 Test Results

Receiver – Primary Radar Pulse Length		
3000 MHz – 50 ns Pulse Width		
Trial No	Signal Received	Response Generated
1	Yes	Yes
2	Yes	Yes
3	Yes	Yes
4	Yes	Yes
5	Yes	Yes

Receiver – Primary Radar Pulse Length		
9350 MHz – 50 ns Pulse Width		
Trial No	Signal Received	Response Generated
1	Yes	Yes
2	Yes	Yes
3	Yes	Yes
4	Yes	Yes
5	Yes	Yes

A pulse length of 50 ns was generated using a Pulse Generator connected to the Pulse Input of the Signal Generator. The Pulse Length at the output of the Signal Generator/Diode Detector was calibrated using an oscilloscope. The simulated Radar signal was sent to the EUT and it was confirmed that the transmission was received and subsequently a response transmitted. The transmitted response was confirmed to consist of a dash and two dots and was < 0.7 µs after the signal generator simulated Radar transmission burst. 5 trials were conducted at each test frequency and on each occasion it was confirmed that a response was received and a response transmitted.

Limit Clause ITU-R 824-2 Annex 1 Item 2 - 3

A minimum pulse width of 50 ns shall be detected and a response provided

2.12 TRANSMITTER – FREQUENCY ERROR

2.12.1 Specification Reference

LW26-70118904 Transponder Qualification and Compliance Test Plan
ITU-R M824-2 – Annex 1 Item 3

2.12.2 Equipment Under Test and Modification State

LW26 S/N: Prototype 2 - Modification State 0

2.12.3 Date of Test

28 July 2015

2.12.4 Test Equipment Used

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

2.12.5 Environmental Conditions

Ambient Temperature	22.6 °C
Relative Humidity	43.3 %

2.12.6 Test Results

Receiver – Primary Radar Pulse Length		
3000 MHz – 50 ns Pulse Width		
Trial No	Signal Received	Response Generated
1	Yes	Yes
2	Yes	Yes
3	Yes	Yes
4	Yes	Yes
5	Yes	Yes

Receiver – Primary Radar Pulse Length		
9350 MHz – 50 ns Pulse Width		
Trial No	Signal Received	Response Generated
1	Yes	Yes
2	Yes	Yes
3	Yes	Yes
4	Yes	Yes
5	Yes	Yes

Product Service

Frequency error was measured as a 2 stage approach:

Step 1: The EUT was sent a simulated Radar pulse and it was checked that the EUT received the response.

Step 2: Based on the measured and recorded frequency by the EUT, this was then entered into the test software to transmit an unmodulated carrier which was measured using a Spectrum Analyser.

Both the Signal Generator and Spectrum Analyser were connected to an external 10 MHz Rubidium Standard.

5 trials were completed to ascertain the maximum frequency error of the EUT.

Measured Received Radar Pulses				
3000 MHz				
Trial No	Start Frequency (MHz)		End Frequency (MHz)	
	50 ns Pulse	200 ns Pulse	50 ns Pulse	200 ns Pulse
1	3000	3000	3000	3000
2	3000	3000	3000	3000
3	3000	3000	3000	3000
4	3000	3001	3000	3000
5	3000	3000	3000	3000

Measured Received Radar Pulses				
9350 MHz				
Trial No	Start Frequency (MHz)		End Frequency (MHz)	
	50 ns Pulse	200 ns Pulse	50 ns Pulse	200 ns Pulse
1	9351	9350	9350	9350
2	9350	9350	9350	9350
3	9350	9350	9350	9350
4	9350	9350	9350	9350
5	9350	9350	9350	9349

3000 MHz		9350 MHz	
Measured Frequency Error (MHz)	Corrected Frequency Error (MHz) (see note 1)	Measured Frequency Error (MHz)	Corrected Frequency Error (MHz) (see note 1)
0.03205	0.53205	0.91987	1.41987

The EUT measures the frequency in a series of 1 MHz bins. Hence, it is possible to have a received frequency which is reported as being 9350 MHz but could actually be between 9349.5 MHz and 9350.5 MHz. This could result in a frequency being transmitted which is actually 0.5 MHz in error. Therefore, the result above has been corrected from the measured result including the potential error of 0.5 MHz.

Limit Clause ITU-R 824-2 Annex 1 Item 3

< 0.2 µs Pulse Width	> 0.2 µs Pulse Width
± 1.5 MHz	± 3.5 MHz

2.13 DELAY AFTER RECEIPT OF INTERROGATION

2.13.1 Specification Reference

LW26-70118904 Transponder Qualification and Compliance Test Plan, Clause 13.1.5
ITU-R M824-2 – Annex 1 Item 4 - 1

2.13.2 Equipment Under Test and Modification State

LW26 S/N: Prototype 2 - Modification State 0
LW26 S/N: Prototype 2 - Modification State 1

2.13.3 Date of Test

28 July 2015

2.13.4 Test Equipment Used

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

2.13.5 Environmental Conditions

Ambient Temperature	21.5 – 21.2 °C
Relative Humidity	49.2 % - 53.6 %

2.13.6 Test Results

Mod State 1

3000 MHz	
Trial Number	Delay (µs)
1	0.693
2	0.691
3	0.687
4	0.687
5	0.681

Mod State 0

9350 MHz	
Trial Number	Delay (µs)
1	0.680
2	0.676
3	0.684
4	0.682
5	0.684

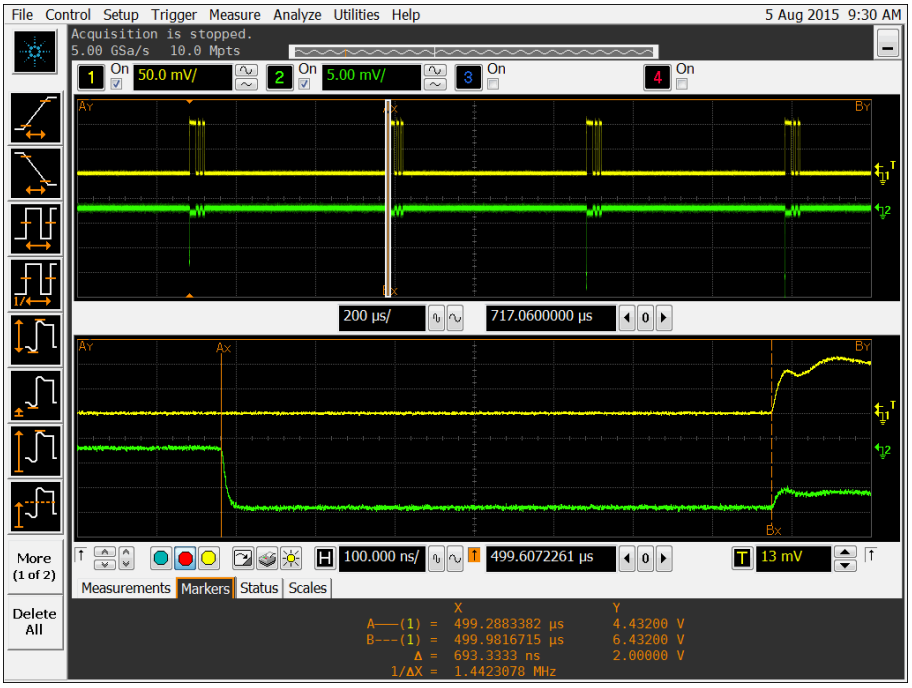
Two crystal detectors were used to monitor the transmissions from the EUT. The outputs were independently fed into channel inputs on a Digital Storage Oscilloscope. The channels were

Product Service

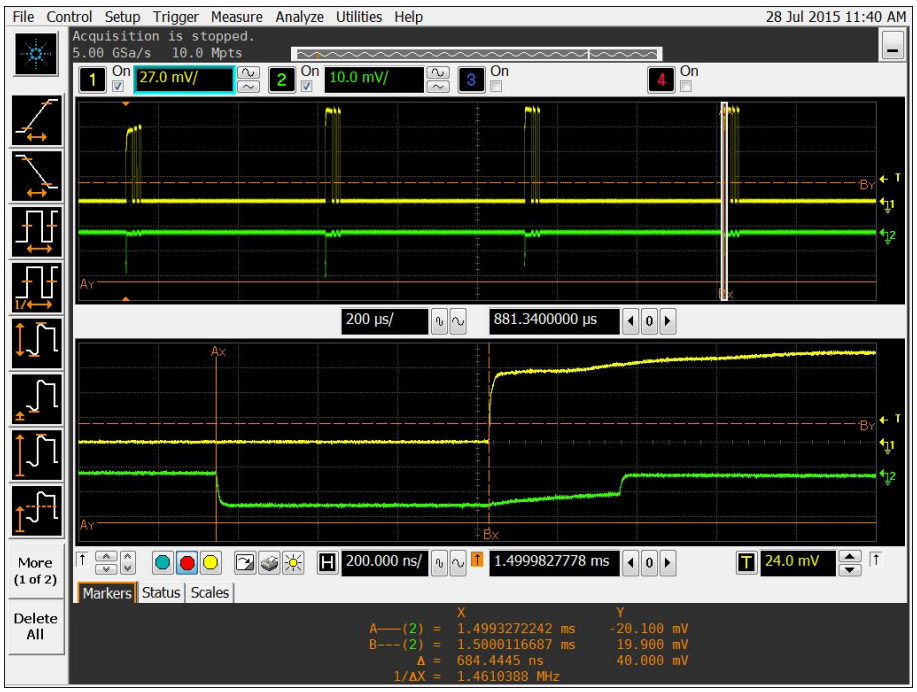
monitored and the time between associated Radar Pulses and Return Response transmissions was measured. Five measurements were recorded and compared with the test limit.

The worst case delay time plot is shown for information on both test frequencies.
Note: Channel 2 trace is inverted due to use of a negative biased Crystal Detector.

3000 MHz – 0.691 µs – Delay After Receipt Of Interrogation



9350 MHz – 0.684 µs – Delay After Receipt Of Interrogation



Product Service

Remarks

3000 MHz – Modification State 1
9350 MHz – Modificaition State 0

Limit Clause ITU-R 824-2 Annex 1 Item 4 - 1

0.7 µs

Product Service

2.14 MORSE CHARACTERISTICS

2.14.1 Specification Reference

LW26-70118904 Transponder Qualification and Compliance Test Plan
ITU-R M824-2 – Annex 1 Item 4 - 2

2.14.2 Equipment Under Test and Modification State

LW26 S/N: Prototype 2 - Modification State 0

2.14.3 Date of Test

28 July 2015

2.14.4 Test Equipment Used

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

2.14.5 Environmental Conditions

Ambient Temperature	22.1 °C (Mod State 0)	23.2 °C (Mod State 1)
Relative Humidity	45.9 % (Mod State 0)	50.9 % (Mod State 1)

2.14.6 Test Results

3000 MHz				
DASH (µs)	GAP (µs)	DOT (µs)	GAP (µs)	DOT (µs)
15.84	5.28	5.28	5.28	5.28

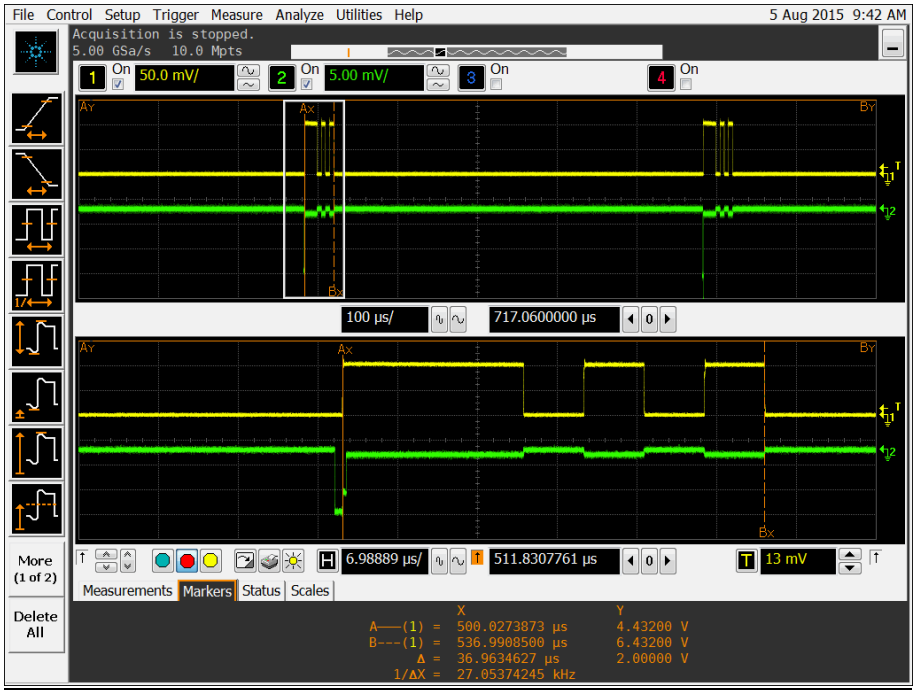
Total Transmission Time (Morse D) : 37.79 µs

9350 MHz – Morse Measurements				
DASH (µs)	GAP (µs)	DOT (µs)	GAP (µs)	DOT (µs)
16.26	5.38	5.39	5.38	5.38

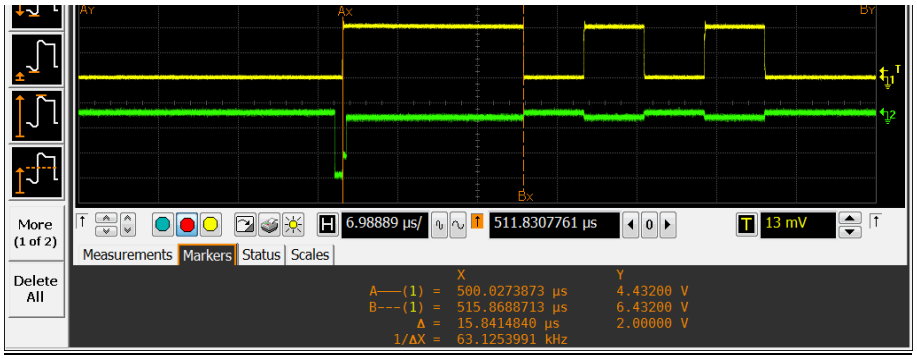
Total Transmission Time (Morse D) : 37.79 µs

Product Service

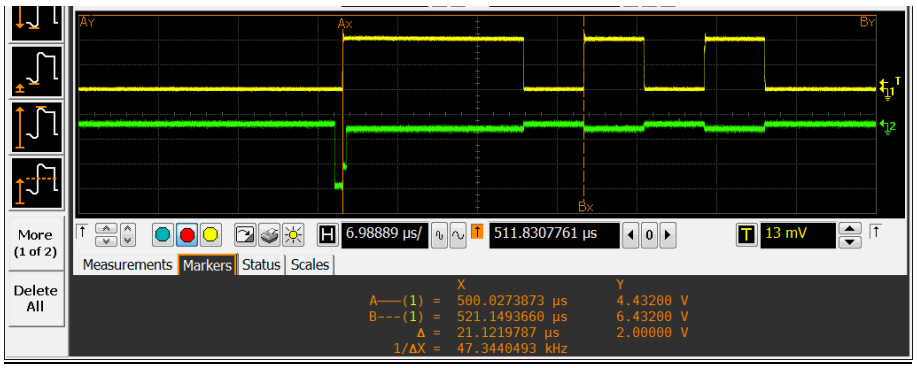
3000 MHz - Morse – Overall Length



3000 MHz - Morse – Dash Length

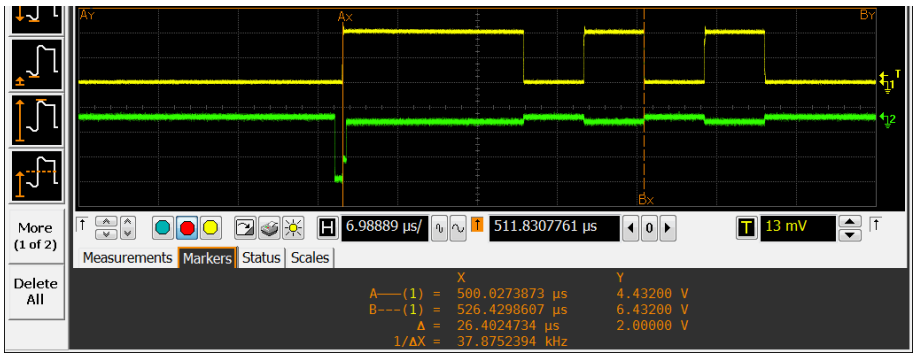


3000 MHz - Morse – Dash Length + Gap Length

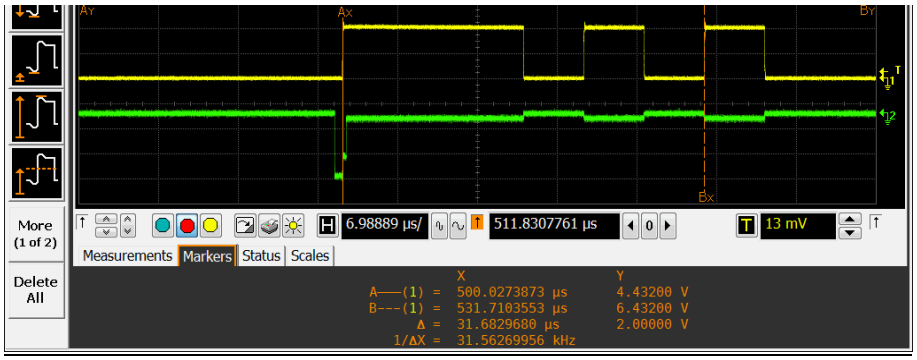


Product Service

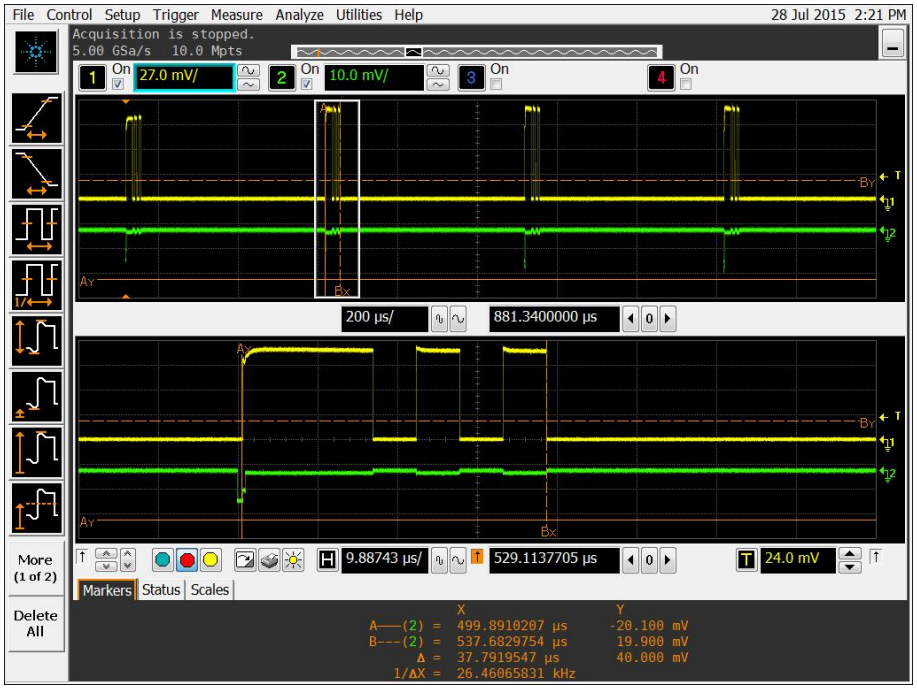
3000 MHz - Morse – Dash Length + Gap Length + Dot Length



3000 MHz - Morse – Dash Length + Gap Length + Dot Length + Gap

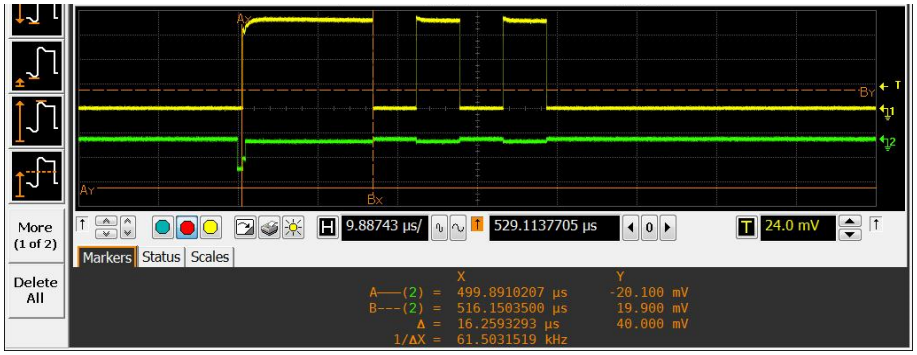


9350 MHz - Morse – Overall Length

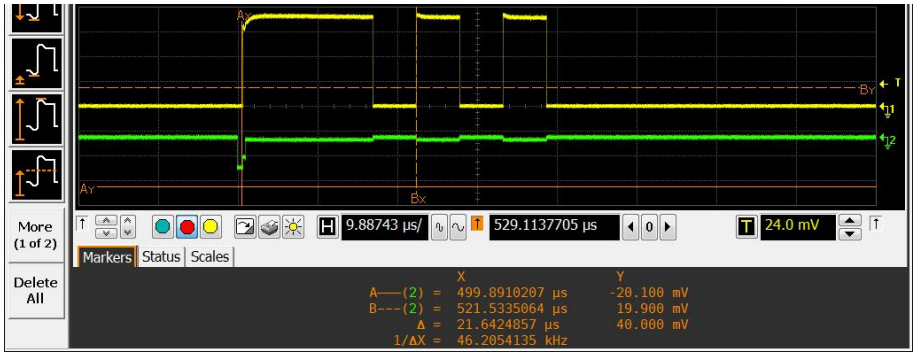


Product Service

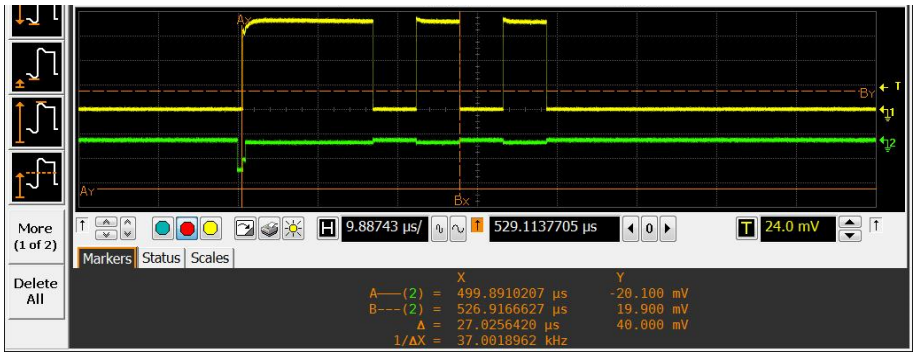
9350 MHz - Morse – Dash Length



9350 MHz - Morse – Dash Length + Gap Length

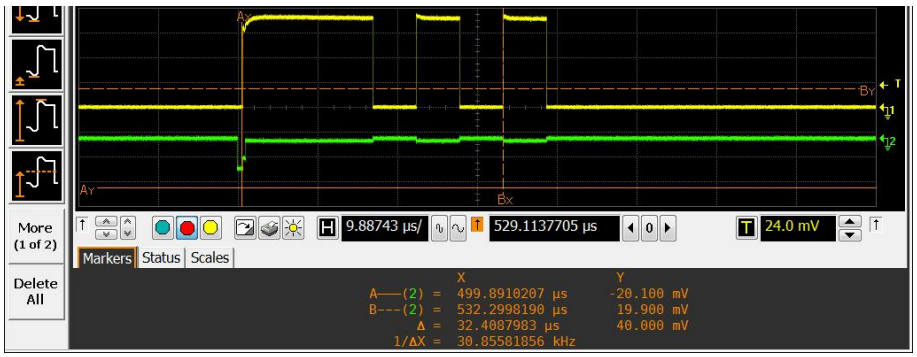


9350 MHz - Morse – Dash Length + Gap + Dot Length



Product Service

9350 MHz - Morse – Dash Length + Gap + Dot +Gap Length



The manufacturer declared the Morse character to be 'D' – DASH, DOT, DOT.
The EUT was interrogated using a simulated Radar signal and a response captured. Measurements were made of the Morse signal. By observation, it was confirmed that the message was made up of one dash and two dots. All dots and gaps were equal length in time. It was confirmed that one dash was equal to three dot lengths.

Remarks

3000 MHz – Modification State 1
9350 MHz – Modificaition State 0

Limit Clause ITU-R 824-2 Annex 4 Item 2

The identification coding should comprise the full length of the radar beacon response and, where a Morse letter is used, the response should be divided with a ratio of one dash equal to three dots and one dot equal to one space. The coding should normally commence with a dash.

2.15 RESPONSE DURATION

2.15.1 Specification Reference

LW26-70118904 Transponder Qualification and Compliance Test Plan, Clause 13.1.5
ITU-R M824-2 – Annex 1 Item 4 - 3

2.15.2 Equipment Under Test and Modification State

LW26 S/N: - Modification State

2.15.3 Date of Test

29 July 2015 & 5 August 2015

2.15.4 Test Equipment Used

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

2.15.5 Environmental Conditions

Ambient Temperature	22.8 - 22.9 °C
Relative Humidity	44.3 - 51.4 %

2.15.6 Test Results

Using the test software provided by the manufacturer, the response duration was varied between the minimum and maximum values. The maximum and minimum values demonstrate that the EUT is capable of adjusting its response length as displayed on the Radar screen. Depending on the Morse character, it is possible for the EUT response to exceed 5 miles. As the manufacturer cannot foresee all scenarios in which the EUT will be deployed, ensuring that compliance is achieved will be determined by the installer at time of installation. The manufacturer has implemented measures to ensure compliance with the recommendation can be achieved when installation instructions are adhered to.

Declared Minimum Morse Message Length: 6 µs
Declared Maximum Morse Message Length: 60 µs

Worst case message length = 13 characters, (13 dot lengths)

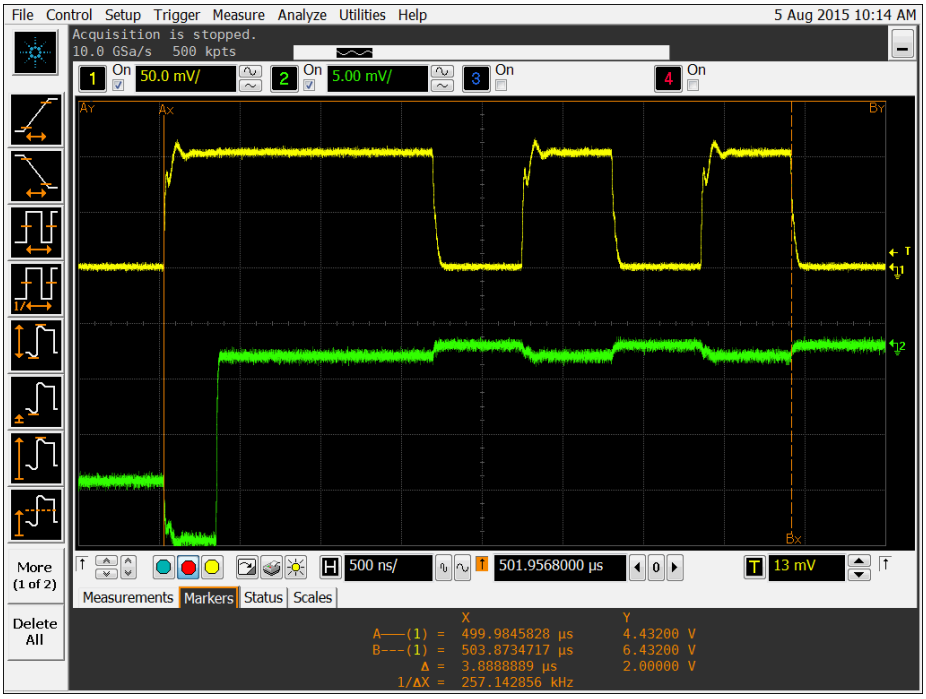
Morse D = 7 character lengths

Therefore:

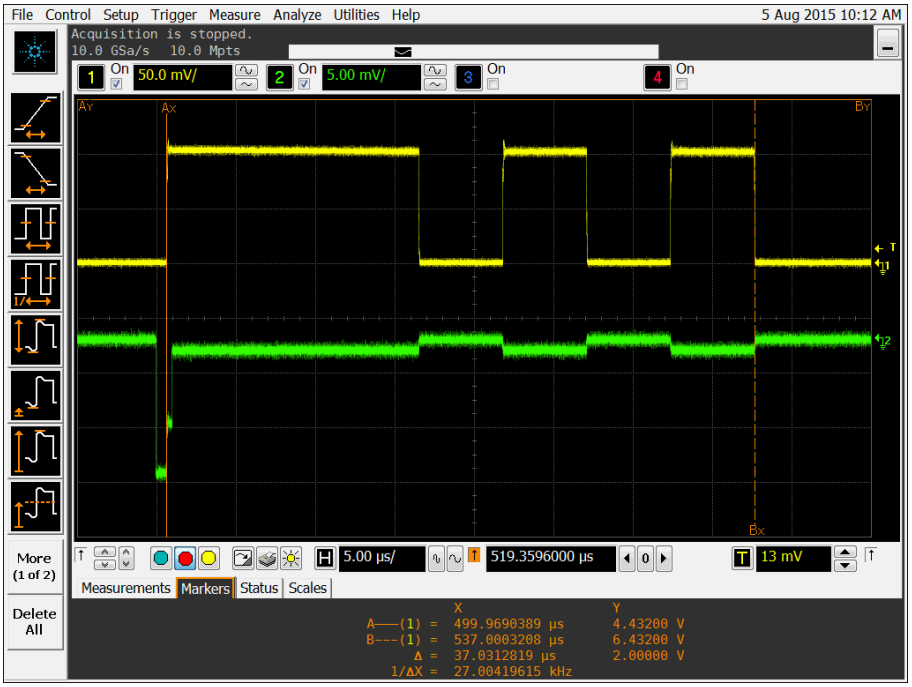
Theoretical Minimum Morse Message Length = 7 / 13 x 6 = 3.23 µs
Theoretical Maximum Morse Message Length = 7 / 13 x 60 = 32.3 µs

Product Service

3000 MHz – Measured Minimum Morse Message Length – 3.89 µs

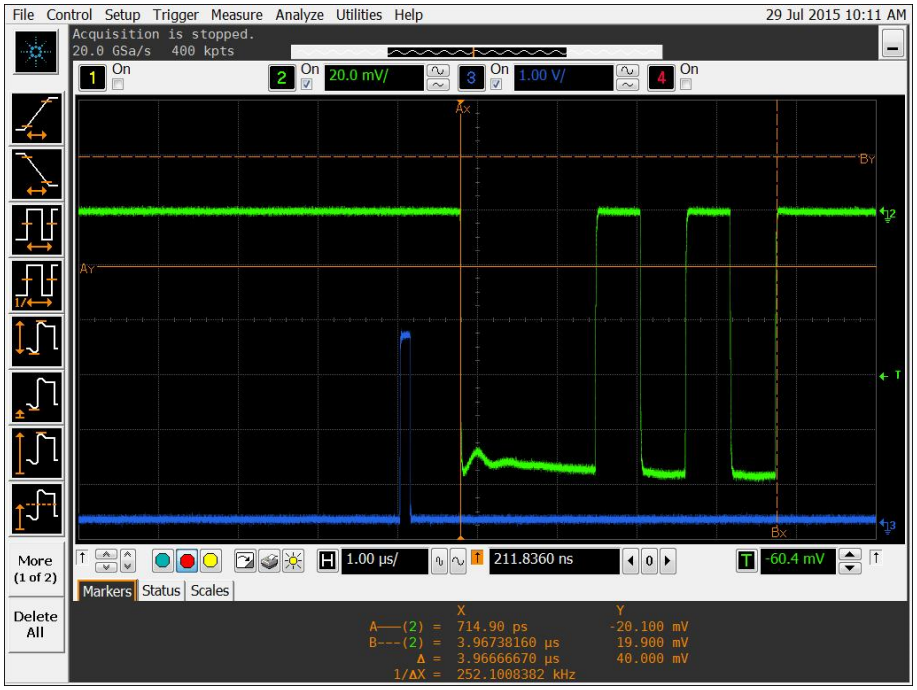


3000 MHz – Measured Maximum Morse Message Length – 37.03 µs

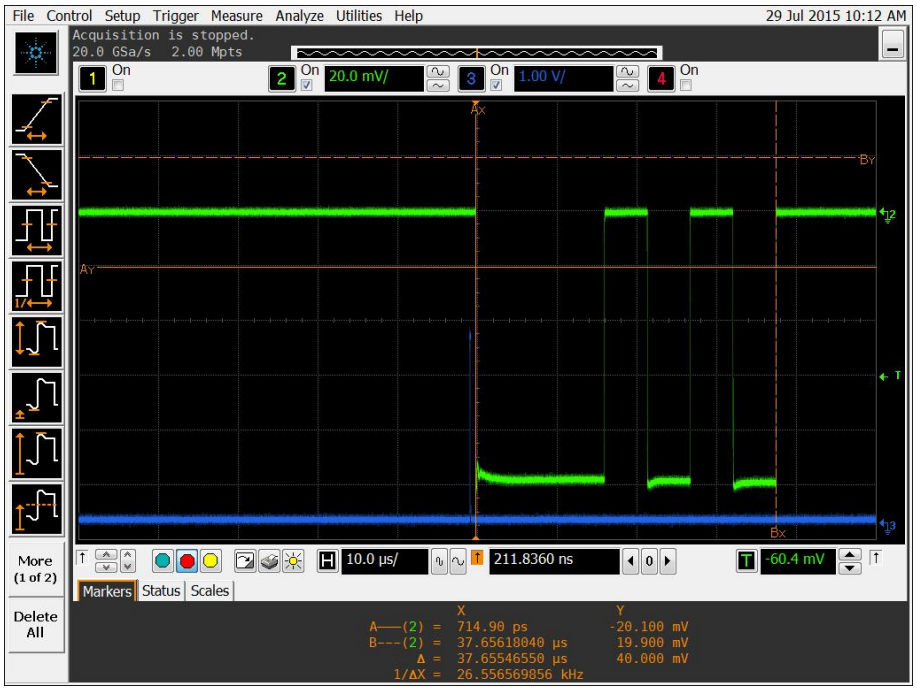


Product Service

9350 MHz – Measured Minimum Morse Message Length – 3.97 µs



9350 MHz – Measured Maximum Morse Message Length – 37.66 µs



Remarks

3000 MHz – Modification State 1
9350 MHz – Modificaition State 0

Limit Clause ITU-R 824-2 Annex 4 Item 3

The duration of the response should be approximately 20 % of the maximum range requirement of the particular radar beacon, or should not exceed five miles, whichever is the lower value. In certain cases, the duration of the response may be adjusted to suit the operational requirements for the particular radar beacon, (see Note 1).

Note 1: Characteristics for antenna aperature and gain, receiver sensitivity, transmitter power, racon response dutration, racon ON/OFF period and side-lobe suppression should be determined by Authorities.

Product Service

SECTION 3

TEST EQUIPMENT USED

Product Service

3.1 TEST EQUIPMENT USED

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

Instrument	Manufacturer	Type No.	TE No.	Calibration Period (months)	Calibration Due
Section 2.7 – Antenna Gain					
Screened Room	Rainford	Rainford	1545	24	20-Dec-2017
Control Equipment	Inn-Co GmbH	CO 1000	1606	-	TU
Antenna Mast	Maturo Gmbh	TAM 4.0-P	3916	-	TU
Antenna Mast Controller	Maturo Gmbh	NCD	3917	-	TU
Cable	Rhophase	NPS-2303-9000-MPS	3791	-	TU
EMI Test Receiver	Rohde & Schwarz	ESU40	3506	12	27-Oct-2015
Antenna	Schaffner	CBL6143	234	12	29-Apr-2016
Cable	Scott Cables	KPS-1501-2000-KPS	4527	6	29 July 2015
Cable	SSI Cable Corp.	1501-13-13-7m WA(-)	3600	-	TU
Antenna	EMCO	3115	235	12	28-Nov-2015
Signal Generator	Rohde & Schwarz	SMR40	1002	12	25-Sept-2015
Multimeter	Iso-tech	IDM101	2417	12	26-Sep-2015
Power Supply	Farnell	H60-25	1092	-	TU
Section 2.8 - Receiver Sensitivity					
Multimeter	Fluke	75 Mk3	455	12	23-Jul-2015
Attenuator (10dB)	Weinschel	47-10-34	481	12	1-Apr-2016
Hygrometer	Rotronic	I-1000	3220	12	24-Jul-2015
Network Analyser	Rohde & Schwarz	ZVA 40	3548	12	3-Sep-2015
1 Metre SMA Cable	Rhophase	3PS-1801A-1000-3PS	4099	12	7-Nov-2015
Calibration Unit	Rohde & Schwarz	ZV-Z54	4368	12	24-Sep-2015
Power Supply	Rohde & Schwarz	HMP4040	020138313	-	TU
Section 2.9 - Carrier Power					
Multimeter	Fluke	75 Mk3	455	12	23-Jul-2015
Attenuator (30dB/50W)	Aeroflex / Weinschel	47-30-34	3164	12	12-Dec-2015
Hygrometer	Rotronic	I-1000	3220	12	24-Jul-2015
Network Analyser	Rohde & Schwarz	ZVA 40	3548	12	3-Sep-2015
P-Series Power Meter	Agilent Technologies	N1911A	3980	12	22-Sep-2015
50 MHz-18 GHz Wideband Power Sensor	Agilent Technologies	N1921A	3982	12	22-Sep-2015
1 Metre SMA Cable	Rhophase	3PS-1801A-1000-3PS	4099	12	7-Nov-2015
1501A 4.0M Km Km Cable	Rhophase	KPS-1501A-4000-KPS	4301	12	7-Nov-2015
Calibration Unit	Rohde & Schwarz	ZV-Z54	4368	12	24-Sep-2015
Power Supply	Rohde & Schwarz	HMP4040	020138313	-	TU
Section 2.10 - Blocking Period					
20dB Attenuator	Narda	4772-20	456	-	TU
Attenuator (10dB)	Weinschel	47-10-34	481	12	1-Apr-2016
Crystal Detector	Hewlett Packard	8470B	484	-	O/P Mon
Broadband Resistive Power Divider	Weinschel	1506A	601	12	24-Mar-2016
Power Divider	Weinschel	1506A	603	12	2-Jun-2016
Crystal Detector	Hewlett Packard	8470B	1320	12	5-Jun-2016
Hygromer	Rotronic	A1	2677	12	11-Jun-2016
Multimeter	Fluke	79 Series II	3057	12	6-Oct-2015
Oscilloscope	Agilent Technologies	DSO9104A	4142	12	28-Aug-2015
Signal Generator	Agilent	83650B	3844A00866	-	O/P Mon
Function Generator	Agilent	33250A	US0000226	-	O/P Mon
Power Supply	Rohde & Schwarz	HMP4040	020138313	-	TU
Section 2.11 - Receiver – Primary Radar Pulse Length					
Pulse Generator	Hewlett Packard	8013B	180	-	O/P Mon
20dB Attenuator	Narda	4772-20	456	-	TU

Product Service

Attenuator (10dB)	Weinschel	47-10-34	481	12	1-Apr-2016
Crystal Detector	Hewlett Packard	8470B	484	-	O/P Mon
Broadband Resistive Power Divider	Weinschel	1506A	601	12	24-Mar-2016
Power Divider	Weinschel	1506A	603	12	2-Jun-2016
Crystal Detector	Hewlett Packard	8470B	1320	12	5-Jun-2016
Hygromer	Rotronic	A1	2677	12	11-Jun-2016
Multimeter	Fluke	79 Series II	3057	12	6-Oct-2015
Oscilloscope	Agilent Technologies	DSO9104A	4142	12	28-Aug-2015
Signal Generator	Agilent	83650B	3844A00866	-	O/P Mon
Function Generator	Agilent	33250A	US0000226	-	O/P Mon
Power Supply	Rohde & Schwarz	HMP4040	020138313	-	TU
Pulse Generator	Hewlett Packard	8013B	180	-	O/P Mon
Section 2.12 - Frequency Error					
Pulse Generator	Hewlett Packard	8013B	180	-	O/P Mon
20dB Attenuator	Narda	4772-20	456	-	TU
Attenuator (10dB)	Weinschel	47-10-34	481	12	1-Apr-2016
Crystal Detector	Hewlett Packard	8470B	484	-	O/P Mon
Broadband Resistive Power Divider	Weinschel	1506A	601	12	24-Mar-2016
Power Divider	Weinschel	1506A	603	12	2-Jun-2016
Crystal Detector	Hewlett Packard	8470B	1320	12	5-Jun-2016
Hygromer	Rotronic	A1	2677	12	11-Jun-2016
Multimeter	Fluke	79 Series II	3057	12	6-Oct-2015
Rubidium Frequency Standard	Symmetricom	8040C	3490	12	8-Apr-2016
Signal Generator	Agilent	83650B	3844A00866	-	O/P Mon
Function Generator	Agilent	33250A	US0000226	-	O/P Mon
Power Supply	Rohde & Schwarz	HMP4040	020138313	-	TU
Oscilloscope	Agilent Technologies	DSO9104A	4142	12	28-Aug-2015
Pulse Generator	Hewlett Packard	8013B	180	-	O/P Mon
Section 2.13 - Delay After Receipt Of Interrogation					
20dB Attenuator	Narda	4772-20	456	-	TU
Attenuator (10dB)	Weinschel	47-10-34	481	12	1-Apr-2016
Crystal Detector	Hewlett Packard	8470B	484	-	O/P Mon
Broadband Resistive Power Divider	Weinschel	1506A	601	12	24-Mar-2016
Power Divider	Weinschel	1506A	603	12	2-Jun-2016
Crystal Detector	Hewlett Packard	8470B	1320	12	5-Jun-2016
Hygromer	Rotronic	A1	2677	12	11-Jun-2016
Multimeter	Fluke	79 Series II	3057	12	6-Oct-2015
Oscilloscope	Agilent Technologies	DSO9104A	4142	12	28-Aug-2015
Signal Generator	Agilent	83650B	3844A00866	-	O/P Mon
Function Generator	Agilent	33250A	US0000226	-	O/P Mon
Power Supply	Rohde & Schwarz	HMP4040	020138313	-	TU
Section 2.14 - Morse Characteristics					
20dB Attenuator	Narda	4772-20	456	-	TU
Attenuator (10dB)	Weinschel	47-10-34	481	12	1-Apr-2016
Crystal Detector	Hewlett Packard	8470B	484	-	O/P Mon
Broadband Resistive Power Divider	Weinschel	1506A	601	12	24-Mar-2016
Power Divider	Weinschel	1506A	603	12	2-Jun-2016
Crystal Detector	Hewlett Packard	8470B	1320	12	5-Jun-2016
Hygromer	Rotronic	A1	2677	12	11-Jun-2016
Multimeter	Fluke	79 Series II	3057	12	6-Oct-2015
Oscilloscope	Agilent Technologies	DSO9104A	4142	12	28-Aug-2015
Signal Generator	Agilent	83650B	3844A00866	-	O/P Mon
Function Generator	Agilent	33250A	US0000226	-	O/P Mon
Power Supply	Rohde & Schwarz	HMP4040	020138313	-	TU
Section 2.15 - Response Duration					
20dB Attenuator	Narda	4772-20	456	-	TU
Attenuator (10dB)	Weinschel	47-10-34	481	12	1-Apr-2016
Crystal Detector	Hewlett Packard	8470B	484	-	O/P Mon
Broadband Resistive Power Divider	Weinschel	1506A	601	12	24-Mar-2016
Power Divider	Weinschel	1506A	603	12	2-Jun-2016
Crystal Detector	Hewlett Packard	8470B	1320	12	5-Jun-2016

Hygromer	Rotronic	A1	2677	12	11-Jun-2016
Multimeter	Fluke	79 Series II	3057	12	6-Oct-2015
Oscilloscope	Agilent Technologies	DSO9104A	4142	12	28-Aug-2015
Signal Generator	Agilent	83650B	3844A00866	-	O/P Mon
Function Generator	Agilent	33250A	US0000226	-	O/P Mon
Power Supply	Rohde & Schwarz	HMP4040	020138313	-	TU

TU – Traceability Unscheduled
O/P MON – Output Monitored with Calibrated Equipment

Product Service

SECTION 4

PHOTOGRAPHS

Product Service

4.1 PHOTOGRAPHS OF EQUIPMENT UNDER TEST (EUT)

Connector View

Product Service

SECTION 5

DISCLAIMERS AND COPYRIGHT

Product Service

5.1 DISCLAIMERS AND COPYRIGHT

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

Product Service

ANNEX A

CUSTOMER SUPPLIED INFORMATION

Product Service

Transponder Antenna/Radome Specification

Mechanical

Height of Radome	530mm (TBC)
Diameter of Radome	280mm (TBC)
Weight of Radome and Antennas	6.8kg
Submersion Capability	10m min.

Electrical

Frequency of Operation	
S band	2.9 to 3.1GHz
X band	9.2 to 9.5GHz
Output power to antenna	30dBm
Lightning protection – Surge protection (1ms)	3000V

X band	
Gain	6dBi
Polarisation	Horizontal
Vertical divergence	22 degrees
Effective Isotropic Radiated Power (EIRP)	36dBm

S band – Dual Polarisation	
Gain	1dBi horizontal, 0dBi vertical
Polarisation	Horizontal and vertical
Vertical divergence	22 degrees
Effective Isotropic Radiated Power (EIRP)	30 to 31dBm

Environmental

Operating Temperature range	
GMU and ATEX Category 3	-40°C to +70°C
ATEX Category 2	-20°C to +40°C

Product Service

Interface

Internal Antenna interface	
S band	SMA Female (TBC)
X band	SMA Female (TBC)

Outline (TBC)