



Test Report




Test of: BT900

To: Radio Frequency, Test Suite Structure (TSS) and Test Purpose (TP),
System Specification (RF.TS/4.1.0) 03 December 2013

Low Energy RF PHY Test Specification (TS): Test Suite Structure (TSS)
and Test Purposes (TP) RF-PHY.TS.4.1.0, 03 December 2013

Test Report Serial No: UL-BQT-RP10325637JD01A V2.0

Version 2.0 Supersedes All Previous Versions

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<u>Signature:</u>	
<u>Date of Issue:</u>	22 May 2014
<u>Test Dates</u>	09 May 2014 to 14 May 2014

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1. Customer Details

Company Name:	Laird
Customer Contact:	Raj Khatri
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Telephone N^o:	01628858994
Email:	raj.khatri@lairdtech.com

2. Manufacturer Details




Company Name:	Laird
Customer Contact:	Raj Khatri
Address:	Saturn House, Mercury Park Wycombe Lane Wooburn Green Bucks HP10 0HH United Kingdom
Telephone No:	01628858994
Email:	raj.khatri@lairdtech.com





3. Summary of Testing

3.1. Test Specification

Reference:	Radio Frequency, Test Suite Structure (TSS) and Test Purpose (TP), System Specification (RF.TS/4.1.0) 03 December 2013 Low Energy RF PHY Test Specification (TS): Test Suite Structure (TSS) and Test Purposes (TP) RF-PHY.TS.4.1.0, 03 December 2013
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3.2. Summary of Test Results

Measurement Type	Applicability	Result
Basic Rate	Y	
EDR	Y	
LE	Y	

KEY:  = Complied  = Complied, within uncertainty  = Did not comply, within uncertainty  = Did not comply

3.3. Extreme Test Conditions

Temperature:	-40 to 85 °C
Voltage:	1.8 to 3.6 V

3.4. Reference Test System Software

Description::	Version
BITE RF Test System	1.0.0.20
Bluetooth LE TestManager2	1.0.0.3

3.5. Location of Testing

All the measurements described in this report were performed at the premises of UL VS Ltd, Unit 3 Horizon, Wade Road, Kingsland Business Park, Basingstoke, Hampshire RG24 8AH.

3.6. Deviations from the Test Specification

For the measurements contained within this test report, there were no deviations from, additions to, or exclusions from the test specification identified above, nor from the requirements defined in the basic standards called up within it.

4. Equipment under Test (EUT)

4.1. Description of EUT

Intelligent BTv4.0 Dual Mode Module featuring smartBASIC

4.2. Identification of Equipment under Test (EUT)

Product Name	BT900 series
Test Number	10325637JD01
Trademark:	Laird
Type Identification	End product
Bluetooth Address:	00025B00A5A5
Serial N^o:	Board #6
Date of Receipt:	09 May 2014
Software Version:	9.x.y.z
Hardware Version:	-B0

4.3.Integrated Pre-tested and Qualified Components/Sub-Systems

Supplier	Bluetooth ID	Product ID	Version	Covered Functionality
Cambridge Silicon Radio	B017701	CSR8811	CSR8811, A08	BB , Radio , LM , HCI , RF PHY , Link Layer

5. Test Results Basic and Enhanced Data Rate:

5.1. Test Result Summary

The following table summarises the test results obtained. A definition of the result categories can be found at the end of the result tables.

Passed:	52
Failed:	0
Total:	52

5.2. Test Campaign Report

The header definitions used in the test result table are as follows:

Test Case:	Test Case identity as specified in the test specification
Description:	Test Case name as specified in the test specification
Test Condition:	<p>Environmental and voltage conditions under which the specified test case was performed.</p> <p>Vmin = Minimum Voltage conditions Vmax = Maximum Voltage conditions Tmin = Minimum temperature conditions Tmax = Maximum temperature conditions Nominal = Nominal voltage and temperature conditions N/A = Indicates that the test is not applicable under the specified test conditions.</p>
Result:	<p>Records the verdict assigned to each test case run to completion. Following verdicts are possible:</p> <p>Pass: If the test case passed Fail: If the test case failed</p>
Applicable:	<p>The result of test case mapping in accordance with the test specification, Yes = performed and No = not performed</p>

5.3.Limits and Reservations

The test results presented in this test report apply only to the particular implementation under test (IUT) declared in section 4 of this report, for the functionality described in the relevant Implementation Conformance Statement (ICS), as presented for test on the date(s) declared on page 1 and configured as declared in the relevant Implementation Extra Information for Testing (IXIT).

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5.4.Special Notes

This document has been written in the format of a status report. Full test results are available on request

5.5. Test Result Summary – Basic Rate and Enhanced Data Rate:

Test Case	Description	Test Condition (Pass/Fail)			
		Nominal	Tmin/Vnom	Tmax/Vnom	Applicable
TRM/CA/01/C	Output Power	PASS	PASS	PASS	Yes
TRM/CA/02/C	Power Density	PASS	PASS	PASS	Yes
TRM/CA/03/C	Power Control	PASS	N/A	N/A	Yes
TRM/CA/04/C	TX Output Spectrum – Frequency Range	PASS	PASS	PASS	Yes
TRM/CA/05/C	TX Output Spectrum – 20dB Bandwidth	PASS	PASS	PASS	Yes
TRM/CA/06/C	TX Output Spectrum – ACP	PASS	PASS	PASS	Yes
TRM/CA/07/C	Modulation Characteristics	PASS	PASS	PASS	Yes
TRM/CA/08/C	Initial Carrier Frequency Tolerance	PASS	PASS	PASS	Yes
TRM/CA/09/C	Carrier Frequency Drift	PASS	PASS	PASS	Yes
RCV/CA/01/C	Sensitivity – Single Slot	PASS	PASS	PASS	Yes
RCV/CA/02/C	Sensitivity – Multi Slot	PASS	PASS	PASS	Yes
RCV/CA/03/C	C/I Performance	PASS	N/A	N/A	Yes
RCV/CA/04/C	Blocking	PASS	N/A	N/A	Yes
RCV/CA/05/C	Intermodulation Characteristics	PASS	N/A	N/A	Yes
RCV/CA/06/C	Maximum Input Level	PASS	N/A	N/A	Yes
TRM/CA/10/C	EDR Relative Transmit Power	PASS	PASS	PASS	Yes
TRM/CA/11/C	EDR Carrier Frequency Stability and Modulation Accuracy	PASS	PASS	PASS	Yes
TRM/CA/12/C	EDR Differential Phase Encoding	PASS	N/A	N/A	Yes
TRM/CA/13/C	EDR In-band Spurious Emissions	PASS	PASS	PASS	Yes
TRM/CA/14/C	Enhanced power control	PASS	N/A	N/A	
RCV/CA/07/C	EDR Sensitivity	PASS	PASS	PASS	Yes
RCV/CA/08/C	EDR BER Floor Performance	PASS	N/A	N/A	Yes
RCV/CA/09/C	EDR C/I Performance	PASS	N/A	N/A	Yes
RCV/CA/10/C	EDR Maximum Input Level	PASS	N/A	N/A	Yes

6. Test Results Low Energy:

6.1. Test Result Summary

The following table summarises the test results obtained. A definition of the result categories can be found at the end of the result tables.

Passed:	18
Failed:	0
Total:	18

6.2. Test Campaign Report

The header definitions used in the test result table are as follows:

Test Case:	Test Case identity as specified in the test specification
Description:	Test Case name as specified in the test specification
Test Condition:	<p>Environmental and voltage conditions under which the specified test case was performed.</p> <p>Vmin = Minimum Voltage conditions Vmax = Maximum Voltage conditions Tmin = Minimum temperature conditions Tmax = Maximum temperature conditions Nominal = Nominal voltage and temperature conditions N/A = Indicates that the test is not applicable under the specified test conditions.</p>
Result:	<p>Records the verdict assigned to each test case run to completion. Following verdicts are possible:</p> <p>Pass: If the test case passed Fail: If the test case failed</p>
Applicable:	<p>The result of test case mapping in accordance with the test specification, Yes = performed and No = not performed</p>

6.3.Limits and Reservations

The test results presented in this test report apply only to the particular implementation under test (IUT) declared in section 4 of this report, for the functionality described in the relevant Implementation Conformance Statement (ICS), as presented for test on the date(s) declared on page 1 and configured as declared in the relevant Implementation Extra Information for Testing (IXIT).

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6.4.Special Notes

This document has been written in the format of a status report. Full test results are available on request

6.5. Test Result Summary – Low Energy:

Test Case	Description	Test Condition (Pass/Fail)			
		Nominal	Tmin/Vnom	Tmax/Vnom	Applicable
TRM-LE/CA/01/C	Output Power at NOC	PASS	N/A	N/A	Yes
TRM-LE/CA/02/C	Output Power at EOC	N/A	PASS	PASS	Yes
TRM-LE/CA/03/C	In-band Emissions at NOC	PASS	N/A	N/A	Yes
TRM-LE/CA/04/C	In-band Emissions at EOC	N/A	PASS	PASS	Yes
TRM-LE/CA/05/C	Modulation Characteristics	PASS	N/A	N/A	Yes
TRM-LE/CA/06/C	Carrier Frequency Offset and Drift at NOC	PASS	N/A	N/A	Yes
TRM-LE/CA/07/C	Carrier Frequency Offset and Drift at EOC	N/A	PASS	PASS	Yes
RCV-LE/CA/01/C	Receiver Sensitivity at NOC	PASS	N/A	N/A	Yes
RCV-LE/CA/02/C	Receiver Sensitivity at EOC	N/A	PASS	PASS	Yes
RCV-LE/CA/03/C	C/I and Receiver Selectivity Performance	PASS	N/A	N/A	Yes
RCV-LE/CA/04/C	Blocking Performance	PASS	N/A	N/A	Yes
RCV-LE/CA/05/C	Intermodulation Performance	PASS	N/A	N/A	Yes
RCV-LE/CA/06/C	Maximum Input Signal Level	PASS	N/A	N/A	Yes
RCV-LE/CA/07/C	PER Report Integrity	PASS	N/A	N/A	Yes

7. Test Equipment

7.1. BITE RF Test System

RFI No.	Instrument	Manufacturer	Type No.	Serial No.
A1239	Attenuator	Agilent	11708A	30031
C1354	Cable	Teledyne Reynolds Limited	269-0200-1500 0910	001
E0511	Temperature Chamber	Vötsch	VTM7004	585660877000 10
M1068	Thermometer	RS	206-3750	93102884
M1072	BITE Bluetooth Qualification Tester	CETECOM	BITE	E1111000014
M1073	Power Sensor	Agilent Technologies	8485D	MY41090235
M1074	Power Sensor	Agilent Technologies	8482A	MY41090498
M1075	Power Meter	Agilent Technologies	E4416A	GB41290711
M1076	Synthesised Sweeper	Agilent Technologies	83752A	3610A02604
M1077	Signal Generator	Agilent Technologies	E4433B	US41312579
M1078	Test Set	Anritsu Limited	MT8850A	6k00000244
M1079	Spectrum Analyser	Agilent Technologies	E7405A	US41160317
M1082	Frequency Distribution Amplifier	Timetech GmbH	1 HE	107
M1460	EDR BITE Protocol Tester for V2.0+EDR & LE	AT4 Wireless	T1212	E1111000014

8. Measurement Uncertainty: BITE RF Test System

According to Bluetooth Radio Frequency, Test Suite Structure (TSS) and Test Purpose (TP), System Specification (RF.TS/4.1.0) 03 December 2013, the following uncertainty values^{1,2} have been calculated and compared to the specified limits as in the table below.

8.1. RF Conducted Measurements

Measurement Uncertainty	RF Tester Uncertainty	Specification limit	Test Case
Absolute RF power (wanted channel) (6.10.1)	± 1.08 dB	± 1.2 dB	TRM01, 03
Absolute RF power (unwanted in BT band) (6.10.1)	± 1.62 dB	± 3.0 dB	TRM02, 04, 06
Relative RF power (6.10.2.)	± 0.87 dB	± 1 dB	TRM01, 03, 05
Absolute radio frequency (6.10.4.)	± 3.7 kHz	± 5 kHz	TRM/CA/08/C
Relative drift radio frequency (6.10.5.)	± 0.6 kHz	± 1 kHz	TRM/CA/09/C
Peak frequency deviation (6.10.6.)	± 1.4 kHz	± 4 kHz	TRM/CA/07/C

Note(s):

1: All values reflect a 95% confidence level.

2: All values are valid for temperatures between 20°C and 30°C.

9.Measurement Uncertainty: BITE RF Test System

According to Bluetooth Low Energy RF PHY Test Specification (TS): Test Suite Structure (TSS) and Test Purposes (TP) RF-PHY.TS.4.1.0, 03 December 2013, the following uncertainty values^{1,2} have been calculated and compared to the specified limits as in the table below.

9.1. RF Conducted Measurements LE

Measurement Uncertainty	RF Tester Uncertainty	Specification limit	Test Case
Absolute RF power (wanted channel)	$\pm 1.19\text{dB}$	± 1.2	TRM-LE/CA-01 (02)-C (Output power)
Absolute RF power (emissions in and outside of 2.4000 - 2.4835)	$\pm 1.19\text{dB}$	$\pm 3.0\text{ dB}$	TRM-LE/CA-03 (04)-C (In-band emissions)
Absolute Frequency (RF frequencies)	$\pm 0.3212\text{ kHz}$	$\pm 5.0\text{ kHz}$	TRM-LE/CA-05-C (Modulation Characteristics)
Absolute Frequency (Frequency deviation of modulated signal)	$\pm 1.2298\text{ kHz}$	$\pm 4.0\text{ kHz}$	TRM-LE/CA-05-C (Modulation Characteristics)
Absolute Frequency (Frequency deviation of modulated signal)	$\pm 1.2298\text{ kHz}$	$\pm 4.0\text{ kHz}$	TRM-LE/CA-05-C (Modulation Characteristics)
Absolute Frequency (RF frequencies)	$\pm 0.3212\text{ kHz}$	$\pm 5.0\text{ kHz}$	TRM-LE/CA-06 (7)-C (Carrier frequency offset and drift)
Relative frequency (frequency drift of carrier during modulation)	$\pm 0.4310\text{ kHz}$	$\pm 1.0\text{ kHz}$	TRM-LE/CA-06 (7)-C (Carrier frequency offset and drift)
Relative frequency (Drift rate)	$\pm 0.6095\text{ kHz}$	N/A	TRM-LE/CA-06 (7)-C (Carrier frequency offset and drift)

Note(s):

1: All values reflect a 95% confidence level.

2: All values are valid for temperatures between 20°C and 30°C.

10.Revision history

Version Number	Revision Details		
	Page No(s)	Clause	Details
1.0	-	-	<ul style="list-style-type: none">Initial Version
2.0	5	3.3	<ul style="list-style-type: none">Error: Voltage range corrected to 1.8 to 3.3 V
	6	4.2	<ul style="list-style-type: none">Trademark corrected to Laird

Annex A - RF Implementation Conformance Statement (ICS)

Item	Capability	Reference	Status	Support: Yes or No	Values Allowed	Values Supported
1,2,3	Power Class (1, 2 or 3)	RF, 3	M	Yes	1, 2 or 3	1
4	Power Control	RF, 3	C.1	Yes	-	-
5	1-slot packets supported	BB, 6.5	M	Yes	-	-
6	3-slot packets supported	BB, 6.5	O	Yes	-	-
7	5-slot packets supported	BB, 6.5	O	Yes	-	-
8	79 Channels	RF, 2	M	Yes	-	-
9	Support for GFSK modulation	RF, 3.1	M	Yes	-	-
10	Support for $\pi/4$ - DQPSK modulation	RF, 3.2	C.2	Yes	-	-
11	Support for 8DPSK modulation	RF, 3.2	C.3	Yes	-	-
12	Enhanced Power Control	RF, 3	C.4	Yes	-	-

- C.1** Mandatory to support if Power Class 1 is supported, optional to support if Power Class 2 or 3 is supported.
- C.2** Mandatory if SUMM-ICS, 2-1/4 OR 2-1/6 is claimed;
Optional if SUMM-ICS, 2-1/3 OR 2-1/5 is claimed;
Excluded otherwise.
- C.3** Mandatory if SUMM-ICS, 2-1/4 OR 2-1/6 is claimed;
Else Optional if (RF PICS, 1/8 AND SUMM-ICS, 2-1/3 OR 2-1/5) is claimed;
Excluded otherwise.
- C.4** Optional if SUM_ICCS, 21/8 AND 1/4 supported, ELSE Excluded.

Annex B - RF Implementation Extra Information For Testing (IXIT)

Item	Parameter Name	Type	Test Case Reference	Value
1	Time for TX power control	ms	TRM/CA/03/ (E/C) Power Control	1000
2	In-band Image frequency	MHz	RCV/CA/03/ (E/C) C/I Performance	3
3	Value n for intermodulation test	Integer	RCV/CA/05/ (E/C) Intermodulation Performance	5
4	Type of power source	-	Chapter 6.3, RF Test specification	DC
5	Nominal power source voltage	V	Chapter 6.3, RF Test specification	3.3V or 1.8V
6	Operating temperature range	°C	Chapter 6.4, RF Test specification	-40 to 85
7	Extreme power source voltage	V	Chapter 6.4, RF Test specification	1.8V to 3.6V
8	Antenna gain	dB	Chapter 6.4, RF Test specification	2

Annex C - RF LE Implementation Conformance Statement (ICS)

Bluetooth LE RF Capabilities

Item	Capability	Reference	Status	Support: Yes or No
1	LE Transmitter (Non-connectable, Broadcaster)	[2], 3	C.1	No
2	LE Receiver (Non-connectable, Observer)	[2]. 4	C.1	No
3	LE Transceiver (Connectable, Peripheral/Central)	[2], 3 & 4	C.1	Yes

C.1 At least one of the capabilities shall be supported

Bluetooth LE Test Interface Capabilities

Item	Capability	Reference	Status	Support: Yes or No
1	HCI Test Interface	[3], 2	C.1	Yes
2	UART Test Interface	[3], 3	C.1	No

C.1 At least one of the capabilities shall be supported

Annex D – RF LE Implementation Extra Information For Testing (IXIT)

Item	Parameter Name	Type	Test Case Reference	Value
1	Inband Image frequency	MHz	RF-PHY:P1:1	3
2		MHz	RF-PHY:P1:2	3
3		MHz	RF-PHY:P1:3	3
4	Value n for Intermodulation test	Integer	RF-PHY:P2:1	5
5		Integer	RF-PHY:P2:2	5
6		Integer	RF-PHY:P2:3	5
7	Type of power source		RF-PHY:P3	DC
8	Power source voltage	V	RF-PHY:P4:1	3.3 or 1.8
9		V	RF-PHY:P4:2	3.6
10		V	RF-PHY:P4:3	1.8
11	Operating temperature	°C	RF-PHY:P5:1	20
12		°C	RF-PHY:P5:2	85
13		°C	RF-PHY:P5:3	-40
14	Air humidity range (relative)	%	RF-PHY:P6:1	95
15		%	RF-PHY:P6:2	45
16		%	RF-PHY:P6:3	40 to 95
17	Test interface implementation		RF-PHY:P7:1	HCI
18		bps	RF-PHY:P7:2	115200
19	Antenna gain	dBi	RF-PHY-PHY:P8	2