



TEST REPORT

Test Report No. : UL-RPT-RP14250574-116A

Manufacturer : Chiaro Technology Ltd
Model No. : EB01
Technology : *Bluetooth* – Low Energy
Test Standard(s) : Partial Test of ETSI EN 300 328 V2.2.2 (2019-07)

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3. The sample tested is in compliance with the above standard(s).
4. The test results in this report are traceable to the national or international standards.
5. Version 1.0.

Date of Issue: 24 May 2022

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1 Customer Information

Company Name:	Chiaro Technology Ltd
Address:	63-66 Hatton Garden, London, EC1N 8LE United Kingdom

2 Summary of Testing

2.1 General Information

Specification Reference:	EN 300 328 V2.2.2 (2019-07)
Specification Title:	Wideband transmission systems; Data transmission equipment operating in the 2,4 GHz band; Harmonised Standard for access to radio spectrum
Location of Testing:	Unit 3 Horizon, Wade Road, Kingsland Business Park, Basingstoke, Hampshire, RG24 8AH, United Kingdom
Test Dates:	22 April 2022 to 28 April 2022

2.2 Summary of Test Results

Clause	Measurement	Result
5.4.9	Transmitter Unwanted Emissions in the Spurious Domain	
5.4.10	Receiver Spurious Emissions	
Key to Results  = Complied  = Complied, within uncertainty  = Did not comply, within uncertainty  = Did not comply		

2.3 Deviations from the Test Specification

Only radiated spurious emissions testing requested.

For the measurements contained within this test report, there were no deviations from, additions to, or exclusions from the test specification identified above.

3 Equipment Under Test (EUT)

3.1 Identification of Equipment Under Test (EUT)

Brand Name:	Chiaro Technology Limited
Model Name or Number:	EB01
Test Sample Serial Number:	0740002033621
Hardware Version:	BOM-000836 Rev J
Firmware Version:	SFW-000820 Rev C

3.2 Description of EUT

The equipment under test was a breast pump to be used by lactating women to express and collect milk from their breast. The EUT is intended for a single user.

3.3 Modifications Incorporated in the EUT

No modifications were applied to the EUT during testing.

3.4 Additional Information Related to Testing

Category of Equipment:	Bluetooth Low Energy (Digital Transmission System)		
Power Supply Requirement(s):	Nominal	5.0 VDC	
Channel Spacing:	2 MHz		
Modulation:	GFSK		
Data Rate: LE	1 Mbit/s		
Data Rate: LE2M	2 Mbit/s		
Transmit/Receive Frequency Range:	2400 MHz to 2483.5 MHz		
Transmit/Receive Channels Tested:	Channel ID	Channel Number	Channel Frequency (MHz)
	Bottom	37	2402
	Top	39	2480

3.5 Support Equipment

The following support equipment was used to exercise the EUT during testing:

Description:	Support Laptop
Brand Name:	Lenovo
Model Name or Number:	ThinkPad
Serial Number:	PF1EJ3BY

Description:	USB Repeater 2.0 Extension
Brand Name:	Manhattan
Model Name or Number:	None Stated
Serial Number:	None Stated

4 Operation and Monitoring of the EUT during Testing

4.1 Operating Modes

The EUT was tested in the following operating mode(s):

- Transmitting in *Bluetooth* LE test mode at maximum power on bottom or top channel as required.
- Receive Mode on bottom or top channel as required.

4.2 Configuration and Peripherals

The EUT was tested in the following configuration(s):

- Transmit tests: A test laptop was used to place the EUT into *Bluetooth LE* test mode using CoolTerm software. The application was used to enable continuous transmission in different modes, set transmit power setting and change channels as required.
- Receive/Idle tests: The test laptop supplied with the customer's test application was used to place the EUT into *Bluetooth* LE test mode. The *Bluetooth* LE mode was active but not transmitting.
- The EUT was powered via a USB diagnostic cable during testing.
- Radiated spurious emissions were performed with the EUT in the position that produced worst case with respect to emission and data rate. A pair of breast shields were connected to the EUT. There were no other ports left on the EUT to populate.

5 Measurements, Examinations and Derived Results

5.1 General Comments

Measurement uncertainties are evaluated in accordance with current best practice. Our reported expanded uncertainties are based on standard uncertainties, which are multiplied by an appropriate coverage factor to provide a statistical confidence level of approximately 95%. Please refer to Section 6 *Measurement Uncertainty* for details.

In accordance with UKAS requirements all the measurement equipment is on a calibration schedule. All equipment was within the calibration period on the date of testing.

5.2 Test Results

5.2.1 Transmitter Unwanted Emissions in the Spurious Domain

Test Summary:

Test Engineer:	Nick Raptopoulos	Test Date:	28 April 2022
Test Sample Serial Number:	0740002033621		

Clause:	5.4.9
Test Method:	5.4.9.2.2

Environmental Conditions:

Temperature (°C):	21
Relative Humidity (%):	45 to 46

Note(s):

1. The emission was independent of EUT frequency.
2. All other emissions were at least 6 dB below the applicable limit or below the level of the measurement system noise floor.

Results: LE / Bottom Channel

Frequency (MHz)	Level (dBm)	Limit (dBm)	Margin (dB)	Result
48.005	-61.6	-54.0	7.6	Complied

Results: LE / Top Channel

Frequency (MHz)	Level (dBm)	Limit (dBm)	Margin (dB)	Result
48.005	-61.6	-54.0	7.6	Complied

Limits: Clause 4.3.2.9.3, Table 12: Transmitter limits for spurious emissions

Frequency Range	Maximum Power	Bandwidth
30 to 47 MHz	-36 dBm	100 kHz
47 to 74 MHz	-54 dBm	100 kHz
74 to 87.5 MHz	-36 dBm	100 kHz
87.5 to 118 MHz	-54 dBm	100 kHz
118 to 174 MHz	-36 dBm	100 kHz
174 to 230 MHz	-54 dBm	100 kHz
230 to 470 MHz	-36 dBm	100 kHz
470 to 694 MHz	-54 dBm	100 kHz
694 to 1000 MHz	-36 dBm	100 kHz
1 to 12.75 GHz	-30 dBm	1 MHz

Transmitter Unwanted Emissions in the Spurious Domain (continued)**Test Equipment Used:**

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
K0002	3m RSE Chamber	Rainford EMC	N/A	N/A	23 Mar 2023	12
M1995	Test Receiver	Rohde & Schwarz	ESU40	100428	12 Oct 2022	12
M2016	Thermohygrometer	Testo	608-H1	45046428	09 Dec 2022	12
A288	Antenna	Chase	CBL6111A	1589	24 Jan 2023	12
A211112	Pre-Amplifier	Atlantic Microwave	A-LNAKX-380116-S5S5	210837002	18 Mar 2023	12
A2131	Low Pass Filter	AtlanTecRF	AFL-02000	JFB1004-002	10 Nov 2022	12
A2973	High Pass Filter	AtlanTecRF	AFH-03000	16080900032	10 Nov 2022	12
A3137	Antenna	Schwarzbeck	BBHA 9120 B	00703	25 Mar 2023	12
A3140	Antenna	Schwarzbeck	HWRD750	00028	25 Mar 2023	12
A3152	Antenna	Schwarzbeck	UBAA 9114	9114-422	19 Oct 2024	36
A3009	Attenuator	AtlanTecRF	AN18-06	208801#4	10 Nov 2022	12
G0615	Signal Generator	Rohde & Schwarz	SMBV100A	260473	19 Mar 2023	36
M1011	Power Sensor	Hewlett Packard	8485D	2847A00141	22 Jul 2022	12
M1435	Power Meter	Hewlett Packard	437B	3125U14631	21 Jul 2022	12

5.2.2 Receiver Spurious Emissions**Test Summary:**

Test Engineer:	Vi Van	Test Date:	22 April 2022
Test Sample Serial Number:	0740002033621		

Clause:	5.4.10
Test Method:	5.4.10.2.2

Environmental Conditions:

Temperature (°C):	19
Relative Humidity (%):	46

Note(s):

- During radiated tests between 1 GHz to 4 GHz, it was not possible to achieve the pre-scan noise floor to limit clearance of >12 dB required by EN 300 328 Section 5.4.10.2.1.2. 1 GHz to 4 GHz pre-scans were repeated in a reduced measurement bandwidth in order to obtain the required noise floor to limit margin. No additional spurious emissions were observed.
- All emissions were at least 6 dB below the applicable limit or below the level of the measurement system noise floor.

Results: Bottom Channel

Frequency (MHz)	Level (dBm)	Limit (dBm)	Margin (dB)	Result
See Note 2				

Results: Top Channel

Frequency (MHz)	Level (dBm)	Limit (dBm)	Margin (dB)	Result
See Note 2				

Limits: Clause 4.3.2.10.3, Table 13: Spurious emission limits for receivers

Frequency Range	Maximum Power	Measurement Bandwidth
30 MHz to 1 GHz	-57 dBm	100 kHz
1 GHz to 12.75 GHz	-47 dBm	1 MHz

Receiver Spurious Emissions (continued)**Test Equipment Used:**

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
K0010	3m RSE Chamber	Rainford EMC	N/A	N/A	16 Nov 2022	12
M2041	Thermohygrometer	Testo	608-H1	45119912	09 Dec 2022	12
M1886	Test Receiver	Rohde & Schwarz	ESU26	100554	22 Jun 2022	12
A3025	Pre Amplifier	Com Power Corp.	PAM-118A	551126	18 Nov 2022	12
A259	Antenna	Chase	CBL6111	1513	26 Oct 2022	12
A1071	Antenna	EMCO	EMCO 3115	9811-5625	02 Jul 2023	36
A428	Antenna	Flann Microwave	12240-20	134	18 Sep 2022	36
A427	Antenna	Flann Microwave	14240-20	150	18 Sep 2022	36
A429	Antenna	Flann Microwave	16240-20	561	18 Sep 2022	36

6 Measurement Uncertainty & Decision Rule

Overview

No measurement or test can ever be perfect and the imperfections give rise to error of measurement in the results. Consequently the result of a measurement is only an approximation to the value of the measurand (the specific quantity subject to measurement) and is only complete when accompanied by a statement of the uncertainty of the approximation.

The expression of uncertainty of a measurement result allows realistic comparison of results with reference values and limits given in specifications and standards.

Decision Rule

The decision rule applied is based upon the accuracy method criteria. The measurement uncertainty is met and the result is considered in conformance with the requirement criteria if the observed value is within the prescribed limit.

Measurement Uncertainty

The reported expanded uncertainties below are based on a standard uncertainty multiplied by an appropriate coverage factor such that a confidence level of approximately 95% is maintained. For the purposes of this document “approximately” is interpreted as meaning “effectively” or “for most practical purposes”.

Measurement Type	Confidence Level (%)	Calculated Uncertainty
Radiated Spurious Emissions (30 MHz to 1000 MHz)	95%	±3.30 dB
Radiated Spurious Emissions (>1000 MHz)	95%	±3.16 dB

The methods used to calculate the above uncertainties are in line with those recommended within the various measurement specifications. Where measurement specifications do not include guidelines for the evaluation of measurement uncertainty the published guidance of the appropriate accreditation body is followed.

7 Report Revision History

Version Number	Revision Details		
	Page No(s)	Clause	Details
1.0	-	-	Initial Version

--- END OF REPORT ---