

Produkte
Products

Prüfbericht - Nr.: 14047048 001

Test Report No.:

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Auftraggeber: Able Trend Technology Limited
Client: Unit 217, 2/F, Building 12W, Phase 3
 Hong Kong Science Park
 Shatin, Hong Kong

Gegenstand der Prüfung: Bluetooth Low Energy Module
Test Item:

Bezeichnung: LE1204 **Serien-Nr.:** **Engineering sample**
Identification: **Serial No.:**

Wareneingangs-Nr.: A000462828-001 **Eingangsdatum:** 24.11.2016
Receipt No.: A000469790-001 **Date of Receipt:** 06.12.2016

Prüfort: TÜV Rheinland Hong Kong Ltd.
Testing Location: 3/F., Fou Wah Industrial Building, 10-16 Pun Shan Street, Tsuen Wan, Hong Kong
 Hong Kong Productivity Council
 HKPC Building, 78 Tat Chee Avenue, Kowloon, Hong Kong

Zustand des Prüfgegenstandes bei Anlieferung: Test samples are not damaged and suitable
Condition of test item at delivery: for testing.

Prüfgrundlage: FCC Part 15 Subpart C
Test Specification: ANSI C63.10-2013

Prüfergebnis: Das vorstehend beschriebene Gerät wurde geprüft und entspricht oben
Test Results: genannter Prüfgrundlage.
 The above mentioned product was tested and **passed**.

Prüflaboratorium: TÜV Rheinland Hong Kong Ltd.
Testing Laboratory: 3-4, 11/F., Fou Wah Industrial Building, 10-16 Pun Shan Street, Tsuen Wan,
 Hong Kong

geprüft/ tested by:

kontrolliert/ reviewed by:

15.12.2016 Mika Chan
 Project Manager 

15.12.2016 Sharon Li
 Department Manager 

Datum Name/Stellung
 Date Name/Position
 Unterschrift
 Signature

Datum Name/Stellung
 Date Name/Position
 Unterschrift
 Signature

Sonstiges: FCC ID: 2AATFML041E2
 Other Aspects

Abkürzungen: P(pass) = entspricht Prüfgrundlage
 F(fail) = entspricht nicht Prüfgrundlage
 N/A = nicht anwendbar
 N/T = nicht getestet

Abbreviations: P(pass) = passed
 F(fail) = failed
 N/A = not applicable
 N/T = not tested

Dieser Prüfbericht bezieht sich nur auf das o.g. Prüfmuster und darf ohne Genehmigung der Prüfstelle nicht
 auszugsweise vervielfältigt werden. Dieser Bericht berechtigt nicht zur Verwendung eines Prüfzeichens.
 This test report relates to the a. m. test sample. Without permission of the test center this test report is not permitted to be
 duplicated in extracts. This test report does not entitle to carry any safety mark on this or similar products.

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Product information

Manufacturers declarations

Transceiver	
Operating frequency range	2402 - 2480 MHz
Type of modulation	GFSK
Number of channels	40
Channel separation	2 MHz
Type of antenna	Chip Antenna
Antenna gain (dBi)	1.6
Power level	fix
Type of equipment	stand alone radio device
Connection to public utility power line	No
Nominal voltage	V _{nor} : 3.3 VDC
Independent Operation Modes	Transmit and receive

Product function and intended use

The equipment under test (EUT) is a ultralow power Bluetooth Low Energy (BLE) compliant wireless module LE1204 that is a high performance and cost effective compact solution. The Bluetooth Smart module provides a complete 2.4GHz Bluetooth system based on TI CC2640 chipset, which is a single chip radio and baseband IC for Bluetooth 2.4GHz systems. This module is fully compliant to Bluetooth v4.0 Single-Mode BLE for data communications.

FCC ID: 2AATFML041E2

Models	Product description
LE1204	Bluetooth Low Energy Module

Submitted documents

Circuit Diagram
 Block Diagram
 Technical Description
 Bill of material
 User manual
 Label

Independent Operation Modes

The basic operation modes are:

- Transmitting mode.

For further information refer to User Manual

Related Submittal(s) Grants

This is a single application for certification of the Bluetooth Low Energy transmitter.

Remark

The test results in this test report are only relevant to the tested sample and does not involve any assessment in the production.

Test Set-up and Operation Mode

Principle of Configuration Selection

Emission: The equipment under test (EUT) was configured to measure its highest possible radiation level. The test modes were adapted accordingly in reference to the instructions for use.

Test Operation and Test Software

Test operation should refer to test methodology.

- 1) Special software is provided by the applicant to set the device to operate in a fixed frequency channel and maximum RF output power level. The setting of the maximum RF output power shall be fixed on the final product.
- 2) Pre-scan has been conducted to determine the worst-case mode from all possible combinations between available modulations and data rate.

Special Accessories and Auxiliary Equipment

AC/DC power adapter
Brand: Apple
Model: A1399
Input rating: 100-240VAC, 50-60Hz, 0.15A
Output rating: 5VDC, 1.0A

Countermeasures to achieve EMC Compliance

- none

Test Methodology

Radiated Emission

The radiated emission measurements of the transmitter part were performed according to the procedures in ANSI C63.10-2013. The radiated emission measurements of the battery pack charging part were performed according to the procedures in ANSI C63.4-2014.

For measurement below 1GHz - the equipment under test (EUT) was placed at the middle of the 80 cm height turntable. For measurement above 1GHz - the EUT was placed at the middle of the 1.5 m height turntable and RF absorbing material was placed on ground plane between turntable and measuring antenna. During the testing, the EUT was operated standalone and arranged for maximum emissions. The EUT was tested in three orthogonal planes.

The investigation is performed with the EUT rotated 360 °, the antenna height scanned between 1m and 4m, and the antenna rotated to repeat the measurements for both the horizontal and vertical antenna polarizations. Repeat the measurement steps until the maximum emissions were obtained.

All radiated tests were performed at an antenna to EUT with 3 meters distance, unless stated otherwise in particular parts of this test report.

Field Strength Calculation

The field strength at 3 m was established by adding the meter reading of the spectrum analyzer to the factors associated with antenna correction factor, cable loss, preamplifiers and filter attenuation.

The equation is expressed as follow:

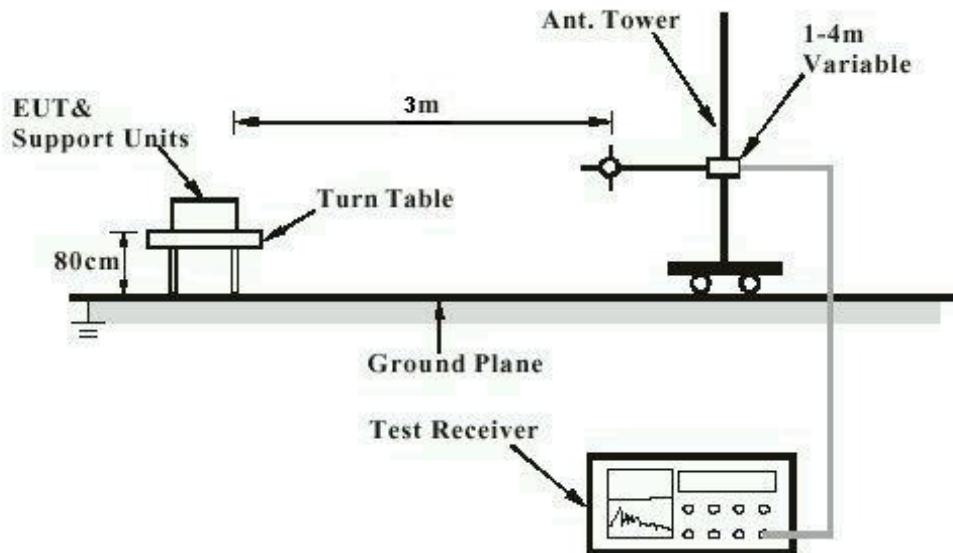
$$FS = R + AF + CF + FA - PA$$

Where FS = Field Strength in dBuV/m at 3 meters.
R = Reading of Spectrum Analyzer in dBuV.
AF = Antenna Factor in dB.
CF = Cable Attenuation Factor in dB.
FA = Filter Attenuation Factor in dB.
PA = Preamplifier Factor in dB.

FA and PA are only be used for the measuring frequency above 1 GHz.

Test Setup Diagram

Diagram of Measurement Configuration for Radiation Test



Note: Measurements above 1 GHz are done with a table height of 1.5m. In addition, there is RF absorbing material on the floor of the test site for above 1GHz measurement.

Diagram of Measurement Equipment Configuration for Mains Conduction Measurement (if applicable)

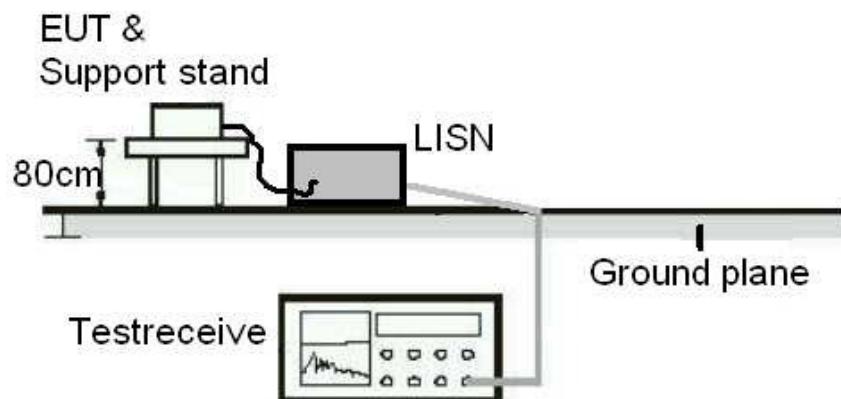
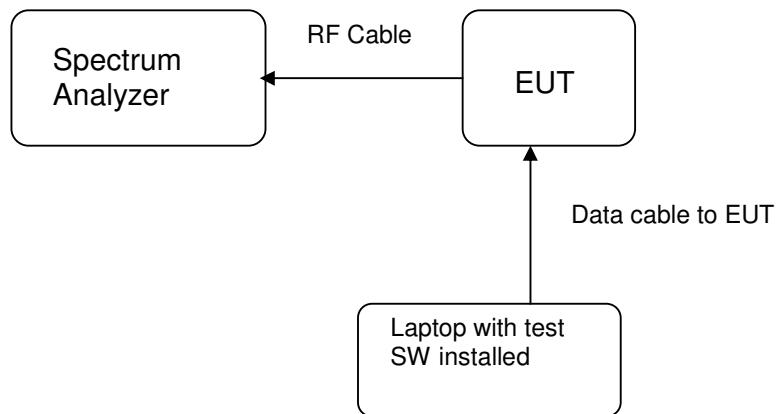


Diagram of Equipment Configuration for Antenna-port Conducted Measurement (if applicable)



List of Test and Measurement Instruments

Hong Kong Productivity Council (Registration number: 90656)

Radiated Emission

Equipment	Manufacturer	Type	Cal. Date	Due Date
Semi-anechoic Chamber	Frankonia	Nil	25-Apr-16	25-Apr-17
New Fully Anechoic Chamber	TDK	N/A	19-Apr-16	19-Apr-17
Cable	Hubersuhner	SUCOFLEX 104	31-Mar-16	31-Mar-18
Test Receiver	R & S	ESU40	26-Jul-16	26-Jul-17
Bi-conical Antenna	R & S	HK116	1-Sep-15	01-Sep-17
Log Periodic Antenna	R & S	HL223	1-Sep-15	01-Sep-17
Coaxial cable	Harbour	LL335	10-Jun-16	10-Jun-18
Microwave amplifier 0.5-26.5GHz, 25dB gain	HP	83017A	18-Jul-16	18-Jul-18
High Pass Filter (cutoff freq. =1000MHz)	Trilithic	23042	28-Oct-15	28-Oct-17
Horn Antenna	EMCO	3115	26-Aug-15	26-Aug-17
Active Loop Antenna	EMCO	6502	27-Oct-16	27-Oct-17

AC Mains Conducted Emission

Equipment	Manufacturer	Type	Cal. Date	Due Date
Test Receiver	R & S	ESU40	26-Jul-16	26-Jul-17
RF Voltage Probe	Schwarzbeck	TK9416	11-Feb-16	11-Feb-17
LISN	R&S	ESH3-Z5	15-Jun-16	15-Jun-17
Double Shield Cable	Radiall	RG142	14-Sep-15	14-Sep-17
Pulse Limiter	R&S	ESH3-Z2	03-Jun-16	03-Jun-18

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Radio Test

Equipment	Manufacturer	Type	Cal. Date	Due Date
Signal Analyzer	R & S	FSV40	28-Dec-15	28-Dec-2017

Measurement Uncertainty

The estimated combined standard uncertainty for power-line conducted emissions measurements is $\pm 3.43\text{dB}$.

The estimated combined standard uncertainty for radiated emissions measurements is $\pm 5.10\text{dB}$ (30MHz to 200MHz) and $\pm 5.08\text{dB}$ (200MHz to 1000MHz) and is $\pm 5.10\text{dB}$ (30MHz to 200MHz) and $\pm 5.08\text{dB}$ (above 1GHz).

The estimated combined standard uncertainty for antenna conducted emission is $\pm 1.56\text{dB}$

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor of $k=2$, which for the level of confidence is approximately 95%.

Results FCC Part 15 – Subpart C

FCC 15.203 – Antenna Requirement 1		Pass
FCC Requirement: No antenna other than that furnished by the responsible party shall be used with the device		
Results:	a) Antenna type: b) Manufacturer and model no: c) Peak Gain:	SMT Chip Antenna Mitsubishi AM03DP-ST01 1.6 dBi
Verdict:	Pass	

FCC 15.204 – Antenna Requirement 2		N/A
FCC Requirement: An intentional radiator may be operated only with the antenna with which it is authorized. If an antenna is marketed with the intentional radiator, it shall be of a type which is authorized with the intentional radiator.		
Results:	Only one integral antenna can be used.	
Verdict:	N/A	

FCC 15.207 – Conducted Emission on AC Mains		Pass				
Test Specification : ANSI C63.10 – 2013						
Mode of operation : TX mode						
Port of testing : AC Mains input port of power supply						
Detector : Quasi-peak and Average						
RBW : 9 kHz						
Supply voltage : 120Vac 60Hz						
Temperature : 23°C						
Humidity : 50%						
Requirement: 15.207(a)						
Results:	Pass					
Live measurement						
Frequency range (MHz)	Frequency (MHz)	Quasi-peak dB μ V	Average dB μ V	Limit QP (dB μ V)	Limit AV (dB μ V)	Verdict
0,15 – 0,5	0.706	39.4	32.9	66 - 56	56 - 46	Pass
> 0,5 - 5	no peak found	---	---	56	46	Pass
> 5 - 30	no peak found	---	---	60	50	Pass
Neutral measurement						
Frequency range (MHz)	Frequency (MHz)	Quasi-peak dB μ V	Average dB μ V	Limit QP (dB μ V)	Limit AV (dB μ V)	Verdict
0,15 – 0,5	0.694	35.7	26.9	66 - 56	56 - 46	Pass
> 0,5 - 5	no peak found	---	---	56	46	Pass
> 5 - 30	no peak found	---	---	60	50	Pass

Results: Pre-scan has been conducted to determine the worst-case mode from all possible combinations between available modulations and data rate.

The radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150kHz to 30MHz does not exceed the limits. For test Results plots refer to Appendix 1, page 2.

FCC 15.247 (a)(2) – 6dB Bandwidth Measurement		Pass	
FCC Requirement: Systems using digital modulation techniques may operate in the 902 – 928 MHz, 2400 – 2483.5 MHz, and 5725 – 5850 MHz bands. The minimum 6dB bandwidth shall be at least 500kHz.			
Test Specification : ANSI C63.10 – 2013 Mode of operation : TX mode Port of testing : Temporary antenna port Detector : Peak RBW/VBW : 100KHz/ 300KHz Supply voltage : 3.7 Vdc Temperature : 23°C Humidity : 50%			
Results: For test protocols please refer to Appendix 1			
Channel frequency (MHz)	6 dB left (MHz)	6 dB right (MHz)	6dB bandwidth (kHz)
2402	2401.640	2402.371	730.6
2440	2439.640	2440.371	730.6
2480	2479.604	2480.346	742.5

FCC 15.247(b)(3) – Maximum Peak Conducted Output Power		Pass	
FCC Requirement: For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850MHz bands: 1 Watt (30dBm)			
Test Specification : ANSI C63.10 – 2013 Mode of operation : TX mode Port of testing : Temporary antenna port Detector : Peak Supply voltage : 3.7 Vdc Temperature : 23°C Humidity : 50%			
Results: For test protocols please refer to Appendix 1			
Frequency (MHz)	Measured Output Power (dBm)	Limit (W/dBm)	Verdict
2402	-1.07	1 / 30.0	Pass
2440	-1.21	1 / 30.0	Pass
2480	-1.60	1 / 30.0	Pass

FCC 15.247(e) – Power Spectral Density		Pass	
FCC Requirement: For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.			
Test Specification : ANSI C63.10 – 2013 Mode of operation : TX mode Port of testing : Temporary antenna port Detector : Peak RBW/VBW span : ≥ 100 KHz / $\geq 3 \times$ RBW Supply voltage : 3.7 Vdc Temperature : 23°C Humidity : 50%			
Results: For test protocols please refer to Appendix 1			
Operating frequency (MHz)	Power density (dBm)	Limit (dBm)	Verdict
2402	-1.08	8.0	Pass
2440	-1.27	8.0	Pass
2480	-1.65	8.0	Pass

FCC 15.247(d) – Spurious Conducted Emissions		Pass			
Test Specification : ANSI C63.10 – 2013 Mode of operation : TX mode Port of testing : Temporary antenna port Detector : Peak RBW/VBW : 100 kHz / 300 kHz Supply voltage : 3.7 Vdc Temperature : 23 °C Humidity : 50 %					
FCC Requirement: In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.					
Results: Pre-scan has been conducted to determine the worst-case mode from all possible combinations between available modulations and data rate.					
Only the worst cases is shown below. For test protocols refer to Appendix 1					
Operating frequency (MHz)	Spurious frequency (MHz)	Spurious Level (dBm)	Reference value (dBm)	Delta (dB)	Verdict
2402	2400.00	-46.39	-1.08	-45.31	Pass
2440	No peak found	---	-1.27	---	Pass
2480	2484.638	-57.60	-1.65	-55.95	Pass

FCC 15.205 – Radiated Emissions in Restricted Frequency Bands		Pass
Test Specification	: ANSI C63.10 – 2013	
Mode of operation	: TX mode	
Port of testing	: Enclosure	
Detector	: Peak	
RBW/VBW	: 100 kHz / 300 kHz for f < 1 GHz 1 MHz / 3 MHz for f > 1 GHz	
Supply voltage	: 3.7 Vdc	
Temperature	: 23°C	
Humidity	: 50%	
FCC Requirement:	In any 100kHz bandwidth outside the frequency band at least 20dB below the highest level of the desired power. In addition, radiated emissions which fall in the restricted bands, as defined in section 15.205(a), must also comply with the radiated emission limits specified in section 15.205(c).	
Results:	<p>Pre-scan has been conducted to determine the worst-case mode from all possible combinations between available modulations and data rate.</p> <p>All three transmit frequency modes comply with the field strength within the restricted bands. There is no spurious found below 30MHz.</p>	
Mode: 2402MHz TX	Vertical Polarization	
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
47.998	35.4	40.0 / QP
95.996	35.1	43.0 / QP
383.980	28.5	46.0 / QP
479.983	29.6	46.0 / QP
4804.037	55.84	74.0 / PK
4804.037	44.82	54.0 / AV
Mode: 2402 MHz TX	Horizontal Polarization	
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
95.996	33.1	43.0 / QP
191.993	37.7	43.0 / QP
311.990	40.3	46.0 / QP
383.986	37.4	46.0 / QP
4803.650	54.18	74.0 / PK
4804.000	41.46	54.0 / AV
Mode: 2440 MHz TX	Vertical Polarization	
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
47.998	35.9	40.0 / QP
95.996	34.6	43.0 / QP
383.986	27.5	46.0 / QP
4880.575	53.84	74.0 / PK
4879.787	40.34	54.0 / AV
Mode: 2440 MHz TX	Horizontal Polarization	

Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
95.996	31.7	43.0 / QP
191.993	31.8	43.0 / QP
311.990	40.1	46.0 / QP
383.986	36.9	46.0 / QP
4874.050	54.31	74.0 / PK
4879.875	41.31	54.0 / AV
Mode: 2480MHz TX		Vertical Polarization
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
47.998	31.1	40.0 / QP
143.995	33.0	43.0 / QP
239.990	28.0	46.0 / QP
311.990	28.5	46.0 / QP
383.986	27.6	46.0 / QP
4959.875	54.91	74.0 / PK
4959.862	41.11	54.0 / AV
Mode: 2480 MHz TX		Horizontal Polarization
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
119.995	30.4	43.0 / QP
196.993	36.2	43.0 / QP
383.986	36.2	46.0 / QP
479.983	34.9	46.0 / QP
4960.362	55.07	74.0 / PK
4959.925	42.47	54.0 / AV