

Produkte Products

> Seite 1 von 16 Prüfbericht - Nr.: 14025254 001 Page 1 of 16 Test Report No.:

Armour Automotive Limited

Auftraggeber: Woolmer Way, Bordon Client: Hampshire GU35 9QE

United Kingdom

Gegenstand der Prüfung: Bluetooth Car Kit

Test Item:

Bezeichnung: iO PLAY2 Serien-Nr.: Engineering sample

Identification: Serial No.:

Wareneingangs-Nr.: 00101116216-004 Eingangsdatum: 16.11.2010

Receipt No .: Date of Receipt:

TÜV Rheinland Hong Kong Ltd. Prüfort:

8/F., Niche Centre, 14 Wang Tai Road, Kowloon Bay, Kowloon, Hong Kong Testing Location:

Hong Kong Productivity Council

HKPC Building, 78 Tat Chee Avenue, Kowloon, Hong Kong

FCC Part 15 Subpart C Prüfgrundlage:

ANSI C63.4-2003 Test Specification: CISPR 22:1997

Das vorstehend beschriebene Gerät wurde geprüft und entspricht oben Prüfergebnis:

genannter Prüfgrundlage. Test Results:

The above mentioned product was tested and passed.

TUV Rheinland Hong Kong Ltd. Prüflaboratorium:

9-10/F., Emperor International Square, 7 Wang Tai Road, Kowloon Bay, Kowloon, Hong Kong Testing Laboratory:

geprüft/ tested by: kontrolliert/ reviewed by:

01.02.2011 Project Engineer 01.02.2011 Assistant Manager Datum Name/Stellung Unterschrift Datum Name/Stellung Unterschrift

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Rev.: 1.2 2009-12-29 / approved: M. Jungnitsch

Date Name/Position Signature Name/Position Date Signature

Sonstiges: FCCID: VUHIOPLY2 Other Aspects

Mika Chan

Abkürzungen: P(ass) entspricht Prüfgrundlage Abbreviations: P(ass) passed entspricht nicht Prüfgrundlage F(ail) failed F(ail) N/A nicht anwendbar not applicable N/T

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.

nicht getestet



Table of Content

	Page
Cover Page	1
Table of Content	2
Product information	4
Manufacturers declarations	4
Product function and intended use	5
Submitted documents	5
Remark	
Special accessories and auxiliary equipment	
List of Test and Measurement Instruments	
Results FCC Part 15 – Subpart C	
Subclause 15.203 – Antenna Information	7
Subclause 15.204 – Antenna Information	7
Subclause 15.207 – Disturbance Voltage on AC Mains	7
Subclause 15.247 (a)(1) – Carrier Frequency Separation	7
Subclause 15.247 (a)(1)(iii) – Number of hopping channels	8
Subclause 15.247 (a)(1)(iii) – Time of Occupancy (Dwell Time)	Pass8
Subclause 15.247 (a) – 20 dB Bandwidth	9
Subclause 15.247 (a) – Hopping Sequence	Pass 10
Subclause 15.247 (a) – Equal Hopping Frequency Use	Pass11
Subclause 15.247 (a) – Receiver Input Bandwidth	Pass 12
Subclause 15.247 (a) – Receiver Hopping Capability	Pass 12
Subclause 15.247 (b)(1) – Peak Output Power	Pass 12
Subclause 15.247 (d) – Band edge compliance of conducted emissions	Pass 13
Subclause 15.205 – Band edge compliance of radiated emissions	Pass 13
Subclause 15.247 (d) – Spurious Conducted Emissions	Pass 14
Subclause 15.247 (c) – Spurious Radiated Emissions	Pass15
Appendix 1 – Test protocols	25pages
Appendix 2 – Test setup	2pages

Date: 01.02.2011





Appendix 3 – Photo documentation	9 pages
Appendix 4 – Product documentation	33 pages

Test Report No.: 14025254 001 Date: 01.02.2011 page 3 of 16



Product information

Manufacturers declarations

	Transceiver
Operating frequency range	2402 - 2480 MHz
Type of modulation	GFSK; Pi/4 DQPSK; 8 DPSK
Number of channels	79
Channel separation	1 MHz
Type of antenna	Integral
Antenna gain (dBi)	0
Power level	fix
Type of equipment	stand alone, plug-in radio device
Connection to public utility power line	No
Nominal voltage	V _{nor} : 12.0 V
Independent Operation Modes	Page scan
	Inquiry scan
	Connection state - ACL Link
	Connection state - SCO Link

Test Report No.: 14025254 001 Date: 01.02.2011 page 4 of 16



Product function and intended use

The test item is a Bluetooth carkit based on the Bluetooth technology.

Bluetooth is a short-range radio link intended to be a cable replacement between portable and/or fixed electronic devices.

Bluetooth operates in the unlicensed ISM Band at 2.4GHz. With the introduction of the enhanced data rate (EDR) feature, the data rates can be up to 3 Mb/s.

An increase in the peak data rate beyond the basic rate of 1 Mb/s is achieved by modulating the RF carrier using phase shift keying (PSK) techniques, resulting in an increase of two to three times the number of bits per symbol. The 2 Mb/s EDR packets use a Pi/4-DQPSK modulation and the 3 Mb/s EDR packets use 8DPSK modulation.

Submitted documents

Circuit Diagram Block Diagram Bill of material User manual

Remark

Preliminary tests were performed in different data rate to find the worst radiated emission. The data rate shown in the table below is the worst-case rate with respect to the specific test item. Investigation has been done on all the possible configurations for searching the worst cases.

Special accessories and auxiliary equipment

The product has been tested together with the following additional accessory:

- ISO Harness
- 8 ohm speaker X 4
- AUX connection cable
- OLED Display
- Control console
- Microphone
- iPod connection cable

Test Report No.: 14025254 001 Date: 01.02.2011 page 5 of 16



List of Test and Measurement Instruments

	Equipment used	Manufacturer	Model	S/N	Due Date
			No.		
\boxtimes	Semi-anechoic Chamber	Frankonia	Nil	Nil	27-Apr-11
\boxtimes	Test Receiver	R&S	ESU26	100050	25-May-11
\boxtimes	Bi-conical Antenna	R&S	HK116	100242	13-Apr-12
\boxtimes	Log Periodic Antenna	R&S	HL223	841516/020	13-Apr-12
	Coaxial cable 50ohm	Rosenberger	RTK081- 05S-05S-	LA2-001-10M /	08 Dec 11
			10m	001	
\boxtimes	Microwave amplifer 0.5-				
	26.5GHz, 25dB gain	HP	83017A	3950M00241	03-Oct-11
\boxtimes	High Pass Filter (cutoff				
	freq. =1000MHz)	Trilithic	23042	9829213	30-Oct-11
\boxtimes	Horn Antenna	EMCO	3115	9002-3351	16-Apr-12
\boxtimes	Spectrum Analyser	R&S	FSP 30	100416	17-Sep-12
\boxtimes	Active Loop Antenna	EMCO	6502	9107-2651	06-Feb-11
\boxtimes	Test Receiver	R&S	ESCS 30	100201	11 Jan 12
\boxtimes	Artificial Mains Network	R&S	ESH3-Z5	100230	11 Jan 11

Test Report No.: 14025254 001 Date: 01.02.2011 page 6 of 16



Results FCC Part 15 - Subpart C

Subclause 15.203 - Antenna Information

Pass

Requirement: No antenna other than that furnished by the responsible party shall be used with the

device

Results: Permanent attached antenna

Verdict: Pass

Subclause 15.204 - Antenna Information

Pass

Requirement: Provide information for every antenna proposed for the use with the EUT

Results: a) Antenna type: Integral b) Manufacturer and model no: N.A.

b) Manufacturer and model no: N.A. c) Gain with reference to an isotropic radiator: 0 dBi

Verdict: Pass

Subclause 15.207 - Disturbance Voltage on AC Mains

N/A

Subclause 15.247 (a)(1) – Carrier Frequency Separation

Pass

Requirement: Frequency hopping systems shall have hopping channel carrier frequencies separated

by a minimum of 25kHz or the 2/3*20dB bandwidth of the hopping channel, whichever is

greater.

Test Specification: FCC Part 15 Subpart A – Subclause 15.31

Mode of operation: Tx mode (hopping on), GFSK Port of testing: Temporary antenna port

Detector : Peak

RBW/VBW : 100 kHz / 300 kHz

Supply voltage : 12.0VDC from DC power supply

Temperature : 23°C Humidity : 50%

Results: Pre-scan has been conduced to determine the worst-case mode from all possible

combinations between available modulations and packet types.

The centre frequencies of the hopping channels are separated by more than the

2/3*20dB bandwidth. For test Results plots refer to Appendix 1, page 2.

Verdict: Pass

Test Report No.: 14025254 001 Date: 01.02.2011 page 7 of 16



Subclause 15.247 (a)(1)(iii) – Number of hopping channels

Pass

Requirement: Frequency hopping systems operating in the 2400MHz-2483.5MHz bands shall use at

least 15 hopping frequencies.

Test Specification: FCC Part 15 Subpart A - Subclause 15.31

Mode of operation: Tx mode (hopping on), GFSK Port of testing: Temporary antenna port

Detector : Peak

RBW/VBW : 1 MHz / 3 MHz

Supply voltage : 12.0VDC from DC power supply

Temperature : 23°C Humidity : 50%

Results: The total number of hopping frequencies is more than 15. For test Results plots refer to

Appendix 1, page 3.

Verdict: Pass

Subclause 15.247 (a)(1)(iii) – Time of Occupancy (Dwell Time)

Pass

Requirement: Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15

channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels

employed.

Test Specification: FCC Part 15 Subpart A – Subclause 15.31

Mode of operation: Tx mode (hopping on), DH5 packet

Port of testing : Temporary antenna port

Detector : Peak

RBW/VBW : 1 MHz / 3 MHz

Supply voltage : 12.0VDC from DC power supply

Temperature : 23°C Humidity : 50%

Results: Time period calculation = $0.4 \times 79 = 31.6 \text{s}$

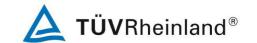
Dwell time = $64 \times 2.912 \cdot 10^{-3} = 186.37 \times 10^{-3}$

 $<= 400 \times 10^{-3} \text{ s}$

For test protocols please refer to Appendix 1, page 4-5.

Verdict: Pass

Test Report No.: 14025254 001 Date: 01.02.2011 page 8 of 16



Subclause 15.247 (a) - 20 dB Bandwidth

Pass

Requirement: Frequency hopping systems shall have hopping channel carrier frequencies separated

by a minimum of 25kHz or the 2/3*20dB bandwidth of the hopping channel, whichever is

greater.

Test Specification: FCC Part 15 Subpart A – Subclause 15.31 Mode of operation: Tx mode (2402MHz, 2441MHz, 2480MHz),

Port of testing : Temporary antenna port

Detector : Peak

RBW/VBW : 30 kHz / 100 kHz

Supply voltage : 12.0VDC from DC power supply

Temperature : 23°C Humidity : 50%

Results: Pre-scan has been conduced to determine the worst-case mode from all possible

combinations between available modulations and packet types.

For test protocols refer to Appendix 1, page 6-8.

8 DPSK Modulation

Frequency (MHz)	20 dB left (MHz)	20 dB right (MHz)	20dB bandwidth (MHz)
2402	0.648	0.618	1.266
2441	0.648	0.618	1.266
2480	0.642	0.624	1.266

GFSK Modulation

Frequency (MHz)	20 dB left (MHz)	20 dB right (MHz)	20dB bandwidth (MHz)
2402	0.444	0.420	0.864
2441	0.438	0.396	0.834
2480	0.444	0.402	0.846

Test Report No.: 14025254 001 Date: 01.02.2011 page 9 of 16



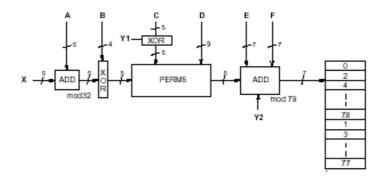
Subclause 15.247 (a) - Hopping Sequence

Pass

Requirement: The hopping sequence is generated and provided with an example.

Hopping sequence

The channel is represented by a pseudo-random hopping sequence hopping through the 79 RF channels. The hopping sequence is unique for the piconet and is determined by the Bluetooth device address of the master. The X input determines the phase in the 32-hop segment, whereas Y1 and Y2 selects between master-to-slave and slave-to-master transmission. The inputs A to D determine the ordering within the segment, the inputs E and F determine the mapping onto the hop frequencies.



Test Report No.: 14025254 001 Date: 01.02.2011 page 10 of 16



Example data:								
Hop sequen	. ,		NECTIO	ON STA	TE:			
CLK start: 0 ULAP: 0x00								
#ticks:			08 0a	0c 0e	10 12	14 16	l 18 1a	1c 1e
0x0000010:	08 66	10 70	12 19	14 23	16 01	18 05	20 33	22 37
0x0000030:	24 03	26 07	28 35	30 39	32 72	34 76	36 25	38 29
0x0000050:	40 74	42 78	44 27	46 31	48 09	50 13	52 41	54 45
0x0000070:	56 11	58 15	60 43	62 47	32 17	36 19	34 49	38 51
0x0000090:								
0x00000b0:	56 37	60 39	58 69	62 71	64 25	68 27	66 57	70 59
0x0000d0:								
0x00000f0:								
0x0000110:								
0x0000130:								
0x0000150:								
0x0000170:								
0x0000190:								
0x00001b0:				•	•			
0x00001d0:								
0x00001f0:								
0x0000210:								
0x0000230:								
0x0000250:								
0x0000270:								
0x0000290:								
0x00002b0: 0x00002d0:								
0x00002d0.								
0x0000210.								
0x0000310.								
0x0000350:								
0x0000330:								
0x0000370:								
0x0000350:								
0x00003d0:								
0x00003f0:								

Subclause 15.247 (a) – Equal Hopping Frequency Use

Pass

Requirement: Each of the transmitter's hopping channels is used equally on average.

Equal hopping frequency use

The EUT complies with the Bluetooth RF specifications. For details refer to the Bluetooth standard.

Test Report No.: 14025254 001 Date: 01.02.2011 page 11 of 16



Subclause 15.247 (a) - Receiver Input Bandwidth

Pass

Requirement:

The associated receiver(s) complies with the requirement that its input bandwidth matches the bandwidth of the transmitted signal.

Receiver input bandwidth

The receiver bandwidth is equal to the receiver bandwidth in the 79 hopping channel mode, which is 1 MHz. The receiver bandwidth was verified during Bluetooth RF conformance testing.

Subclause 15.247 (a) - Receiver Hopping Capability

Pass

Requirement:

The associated receiver has the ability to shift frequencies in synchronisation with the

transmitted signals.

Receiver hopping Capability

The EUT complies with the Bluetooth RF specifications. For details refer to the Bluetooth standard.

Subclause 15.247 (b)(1) - Peak Output Power

Pass

Test Specification: FCC Part 15 Subpart A – Subclause 15.31 Mode of operation: Tx mode (2402MHz, 2441MHz, 2480MHz)

Port of testing : Temporary antenna port

Detector : Peak

RBW/VBW : 3 MHz / 10 MHz

Supply voltage : 12.0VDC from DC power supply

Temperature : 23°C Humidity : 50%

Requirement: For frequency hopping systems operating in the 2400-2483.5 MHz band employing at

least 75 hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 Watt. For all other frequency hopping systems in the 2400 – 2483.5 MHz band:

0.125 Watts.

Results: For test protocols please refer to Appendix 1, page 9-13.

GFSK Modulation

Frequency (MHz)	Maximum peak output power (dBm)	Cable attenuation (dB)	Output power (dBm)	Limit (W/dBm)	Verdict
2402	1.11	3.52	4.630	1 / 30.0	Pass
2441	1.44	3.65	5.090	1 / 30.0	Pass
2480	1.57	3.60	5.170	1 / 30.0	Pass

Pi/4 DQPSK Modulation

Frequency (MHz)	Maximum peak output power (dBm)	Cable attenuation (dB)	Output power (dBm)	Limit (W/dBm)	Verdict
2402	0.59	3.52	4.110	1 / 30.0	Pass
2441	0.83	3.65	4.480	1 / 30.0	Pass
2480	0.59	3.60	4.190	1 / 30.0	Pass

Test Report No.: 14025254 001 Date: 01.02.2011 page 12 of 16



8 DPSK Modulation							
Frequency (MHz)	Maximum peak output power (dBm)	Cable attenuation (dB)	Output power (dBm)	Limit (W/dBm)	Verdict		
2402	0.71	3.52	4.230	1 / 30.0	Pass		
2441	0.99	3.65	4.640	1 / 30.0	Pass		
2480	0.86	3.60	4.460	1 / 30.0	Pass		

Subclause 15.247	7 (d) – Band edge compliance of conducted emissions Pass	
Mode of operation Port of testing Detector RBW/VBW	: FCC Part 15 Subpart A – Subclause 15.31 : Tx mode (2402MHz, 2480MHz), 8DPSK : Temporary antenna port : Peak : 100 kHz / 300 kHz : 12.0VDC from DC power supply : 23°C : 50%	
Requirement:	In any 100 kHz bandwidth outside the frequency band in which the spread spectrum 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 either an RF conducted or a radiated measurement.	
Results:	Pre-scan has been conduced to determine the worst-case mode from all possible combinations between available modulations and packet types. There is no peak found outside any 100 kHz bandwidth of the operating frequency be For test protocols refer to Appendix 1, page 14-15.	and.

Subclause 15.205	5 – Band edge compliance of radiated emissions	Pass
Mode of operation Port of testing Detector	: FCC Part 15 Subpart A – Subclause 15.31 : Tx mode (2402MHz, 2480MHz), 8DPSK : Temporary antenna port : Peak : 1 MHz / 3 MHz : 12.0VDC from DC power supply : 23°C : 50%	
Requirement:	Radiated emissions which fall in the restricted bans, as defined in 15 comply with the radiated emission limits specified in 15.209(a).	.205 (a), must also
Results:	There is no peak found in the restricted bands. For test protocols refe page 16-23.	er to Appendix 1,

Test Report No.: 14025254 001 Date: 01.02.2011 page 13 of 16



Subclause 15.247 (d) - Spurious Conducted Emissions

Pass

Test Specification: FCC Part 15 Subpart A - Subclause 15.31

Mode of operation: Tx mode (2402MHz, 2441MHz, 2480MHz), 8DPSK

Port of testing : Temporary antenna port

Detector : Peak

RBW/VBW : 100 kHz / 300 kHz

Supply voltage : 12.0VDC from DC power supply

Temperature : 23 °C Humidity : 50 %

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 conduced to determine the worst-case mode from all possible

combinations between available modulations and packet types.

There is no peak found outside any 100kHz bandwidth of the operating frequency band in the three transmit frequency. All three transmit frequency modes comply with the limit stated in subclause 15.247(d). For test protocols refer to Appendix 1, page 24-25.

Operating frequency (MHz)	Spurious frequency (MHz)	Spurious Level (dBm)	Reference value (dBm)	Delta (dB)	Verdict
2402	4800.000	-43.52	5.67	-49.19	Pass
2441	4850.000	-40.42	5.49	-45.91	Pass
2480	4950.000	-41.66	5.03	-46.69	Pass

Test Report No.: 14025254 001 Date: 01.02.2011 page 14 of 16



Subclause 15.247	Pass					
	: ANSI C63.4 – 2003 : Tx mode (2402MHz, 2441MHz, 2480MHz), 8DPSK : Enclosure : Peak : 100 kHz / 300 kHz for f < 1 GHz 1 MHz / 3 MHz for f > 1 GHz : internal batteries has been activated : 23°C : 50%					
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 section15.205(a), must also comply with the radiated emission limits specified in section 15.205(c).					
Results:	Pre-scan has been conduced to determine the worst-case mode from all possible combinations between available modulations and packet types. All three transmit frequency modes comply with the field strength within the restricted bands. There is no spurious found below 30MHz.					
Tx frequency 2402MHz Vertical Polarization						
Freq MHz		Level dBuV/m	Limit/ Detector dBuV/m			
191.999		26.00	43.5 / QP			
223.948		20.30	46 / QP			
4804.279		59.66	74.0 / P			
4803.990		39.76	54.0 / A			
Tx frequency 2402	2MHz	Horizontal Polarization				
Freq		Level	Limit/ Detector			
MHz		dBuV/m	dBuV/m			
192.000		36.30	43.5 / QP			
198.334		23.70	43.5 / QP			
212.853		22.20	43.5 / QP			
4804.247		52.20	74.0 / P			
4804. Tx frequency 2441		35.83 Vertical Polarization	54.0 / A			
			Limit/Datasta			
Freq MHz		Level dBuV/m	Limit/ Detector dBuV/m			
192.000		25.80	43.5 / QP			
287.960		17.30	45.37 QF 46 / QP			
4882.340		55.73	74.0 / P			
4881.987		38.29	54.0 / A			
Tx frequency 2441		Horizontal Polarization				
Freq MHz		Level dBuV/m	Limit/ Detector dBuV/m			
192.000		36.60	43.5 / QP			
192.000		23.40	43.5 / QP			
137.020		ZJ.40	40.0 / QF			

Test Report No.: 14025254 001 Date: 01.02.2011 page 15 of 16



223.934	27.40	46/ QP
4881.907	51.88	74.0 / P
4881.955	36.70	54.0 / A
Tx frequency 2480MHz	Vertical Polarization	
Freq	Level	Limit/ Detector
MHz	dBuV/m	dBuV/m
191.999	26.90	43.5QP
282.650	13.00	46 / QP
4960.288	58.51	74.0 / P
4959.936	39.61	54.0 / A
Tx frequency 2480MHz	Horizontal Polarization	
Freq	Level	Limit/ Detector
MHz	dBuV/m	dBuV/m
181.350	31.90	43.5 / QP
191.998	37.00	43.5 / QP
208.010	25.80	43.5 / QP
4960.304	53.95	74.0 / P
4959.952	37.76	54.0 / A

Test Report No.: 14025254 001 Date: 01.02.2011 page 16 of 16