

Prüfbericht - Nr.: 14016991 001

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Test Report No.:

Auftraggeber: ModeLabs Technologies Limited
Client:
 31/F., China Online Centre
 333 Lockhart Road
 Wanchai
 Hong Kong

Gegenstand der Prüfung: Wideband Transmission System - Bluetooth Handsfree Carkit
Test Item:

Bezeichnung: BLUETREK SURFACE
Identification: SOUND COMPACT (nxt) **Serien-Nr.:** **Engineering sample**
Serial No.:

Wareneingangs-Nr.: 070913005-3 **Eingangsdatum:** 13.09.2007
Receipt No.: **Date of Receipt:**

Prüfort: TÜV Rheinland Hong Kong Ltd.
Testing Location:
 9th Floor, Oriental News Building, 7 Wang Tai Road, Kowloon Bay, Kowloon, Hong Kong
Hong Kong Productivity Council
 HKPC Building, 78 Tat Chee Avenue, Kowloon, Hong Kong

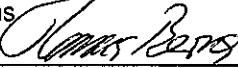
Prüfgrundlage: FCC Part 15 Subpart C
Test Specification:
 ANSI C63.4-2003
 CISPR 22:1997

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

Prüflaboratorium: TÜV Rheinland Hong Kong Ltd.
Testing Laboratory:
 9th Floor, Oriental News Building, 7 Wang Tai Road, Kowloon Bay, Kowloon, Hong Kong

geprüft/ tested by:

kontrolliert/ checked by:

30.01.2008	Sharon Li Project Engineer		30.01.2008	Thomas Berns Manager	
Datum Date	Name/Stellung Name/Position	Unterschrift Signature	Datum Date	Name/Stellung Name/Position	Unterschrift Signature

 Sonstiges:
 Other Aspects

FCCID: QITBT3C

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	FHSS modulation
Number of channels	79
Channel separation	1 MHz
Type of antenna	Integral Antenna
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} : 3.7 V
Independent Operation Modes	Page scan Inquiry scan Connection state - ACL Link Connection state - SCO Link

Product function and intended use

The test item is a Handsfree Car Kit 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 2.4 GHz. In the US a band of 83.5 MHz width is available. In this band, 79 RF channels spaced 1 MHz apart are defined.

The channel is represented by a pseudo-random hopping sequence through the 79 channels. The channel is divided into time slots, with a nominal slot length of 625 µs, where each slot corresponds to different RF hop frequencies. The nominal hop rate is 1600 hops/s. The symbol rate on the channel is 1 Ms/s.

Submitted documents

Circuit Diagram

Block Diagram

Bill of material

User manual

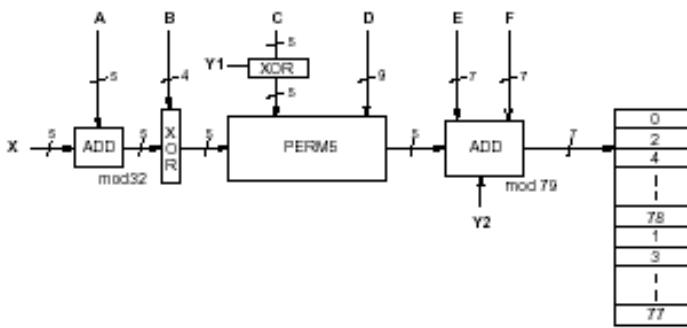
List of Test and Measurement Instruments

	Equipment used	Manufacturer	Model No.	S/N	Cal. Date	Due Date
<input checked="" type="checkbox"/>	Semi-anechoic Chamber	Frankonia	Nil	Nil	28-Mar-07	28-Mar-08
<input checked="" type="checkbox"/>	Test Receiver	R & S	ESVS30	842807/009	06-Aug-07	06-Aug-08
<input checked="" type="checkbox"/>	Bi-conical Antenna	R & S	HK116	841489/016	08-Feb-06	08-Feb-08
<input checked="" type="checkbox"/>	Log Periodic Antenna	R & S	HL223	841516/020	03-Feb-06	03-Feb-08
<input checked="" type="checkbox"/>	Coaxial cable 50ohm	Rosenberger	RTK081-05S-05S-10m	LA2-001-10M / 002	15-May-07	15-May-08
<input checked="" type="checkbox"/>	Microwave amplifier 0.5-26.5GHz, 25dB gain	HP	83017A	3950M00241	Nil	Nil
<input checked="" type="checkbox"/>	High Pass Filter (cutoff freq. =1000MHz)	Trilithic	23042	9829213	Nil	Nil
<input checked="" type="checkbox"/>	Horn Antenna	EMCO	3115	9002-3347	02-Feb-06	02-Feb-08
<input checked="" type="checkbox"/>	Spectrum Analyser	R & S	FSP 30	100416	08-Jun-07	08-Jun-08
<input checked="" type="checkbox"/>	Loop Antenna	EMCO	6502	9107-2651	20-Dec-07	20-Dec-09
<input checked="" type="checkbox"/>	EMI Test receiver	R & S	ESCS 30	100201	14-Dec-07	14-Dec-08
<input type="checkbox"/>	Artificial Mains Network	R & S	ESH3-Z5	100230	05-Dec-06	05-Dec-07
<input type="checkbox"/>	Pulse Limiter	R & S	ESH3-Z2	100161	06-Dec-06	06-Dec-07
<input type="checkbox"/>	Spectrum Analyzer	R & S	FSP 30	100007	13-Feb-06	12-Feb-08

Result 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	
Result:	Permanent attached antenna	
Verdict:	Pass	
Subclause 15.204 – Antenna Information		Pass
Requirement:	Provide information for every antenna proposed for the use with the EUT	
Result:	a) Antenna type:	Permanent attached antenna
	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.
The device is not functioning (no RF radiations) during charging		
Subclause 15.247 (a) – Carrier Frequency Separation		Pass
Requirement:	Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25kHz or the 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), DH1 packet	
Port of testing	: Temporary antenna port	
Detector	: Peak	
RBW/VBW	: 100 kHz / 300 kHz	
Supply voltage	: 3.7VDC from DC power supply	
Temperature	: 23°C	
Humidity	: 50%	
Result:	The centre frequencies of the hopping channels are separated by more than the 20dB bandwidth. For test results plots refer to Appendix 1, page 2.	
Verdict:	Pass	

Subclause 15.247 (a) – Time of Occupancy (Dwell Time)		Pass		
Requirement:	Frequency hopping systems in the 2400 – 2483.5 MHz band shall use at least 15 non-overlapping 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	: 3.7VDC from DC power supply			
Temperature	: 23°C			
Humidity	: 50%			
Result:	The screenshot in Appendix 1 page 4 shows the occurrence of a channel in a 31.6 s time period. In normal hopping mode Bluetooth is using 79 hopping channels only. The frequency was used 64 times. The dwell time for the longest supported packet type is about 3 ms. As a result the average time of occupancy will not be greater than 400 ms.			
i.e.	Time period calculation: $0.4 \times 79 = 31.6\text{s}$			
	Limit calculation: $64 \times 2.920 \times 10^{-3} = 186.88 \times 10^{-3}$ $\leq 400 \times 10^{-3} \text{ s}$			
For test protocols please refer to Appendix 1, page 3.				
Verdict: Pass				

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 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), DH5 packet			
Port of testing : Temporary antenna port			
Detector : Peak			
RBW/VBW : 30 kHz / 100 kHz			
Supply voltage : 3.7VDC from DC power supply			
Temperature : 23°C			
Humidity : 50%			
Results			
For test protocols refer to Appendix 1, page 4-5.			
Frequency (MHz)	20 dB left (MHz)	20 dB right (MHz)	20dB bandwidth (MHz)
2402	0.448	0.468	0.916
2441	0.444	0.468	0.912
2480	0.448	0.464	0.912
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.			
			

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Example data:

Hop sequence {k} for CONNECTION STATE:

CLK start: 0x00000010

ULAP: 0x00000000

#ticks: 00 02 | 04 06 | 08 0a | 0c 0e | 10 12 | 14 16 | 18 1a | 1c 1e |

0x00000010: 08 66 | 10 70 | 12 19 | 14 23 | 16 01 | 18 05 | 20 33 | 22 37 |
 0x00000030: 24 03 | 26 07 | 28 35 | 30 39 | 32 72 | 34 76 | 36 25 | 38 29 |
 0x00000050: 40 74 | 42 78 | 44 27 | 46 31 | 48 09 | 50 13 | 52 41 | 54 45 |
 0x00000070: 56 11 | 58 15 | 60 43 | 62 47 | 32 17 | 36 19 | 34 49 | 38 51 |
 0x00000090: 40 21 | 44 23 | 42 53 | 46 55 | 48 33 | 52 35 | 50 65 | 54 67 |
 0x000000b0: 56 37 | 60 39 | 58 69 | 62 71 | 64 25 | 68 27 | 66 57 | 70 59 |
 0x000000d0: 72 29 | 76 31 | 74 61 | 78 63 | 01 41 | 05 43 | 03 73 | 07 75 |
 0x000000f0: 09 45 | 13 47 | 11 77 | 15 00 | 64 49 | 66 53 | 68 02 | 70 06 |
 0x00000110: 01 51 | 03 55 | 05 04 | 07 08 | 72 57 | 74 61 | 76 10 | 78 14 |
 0x00000130: 09 59 | 11 63 | 13 12 | 15 16 | 17 65 | 19 69 | 21 18 | 23 22 |
 0x00000150: 33 67 | 35 71 | 37 20 | 39 24 | 25 73 | 27 77 | 29 26 | 31 30 |
 0x00000170: 41 75 | 43 00 | 45 28 | 47 32 | 17 02 | 21 04 | 19 34 | 23 36 |
 0x00000190: 33 06 | 37 08 | 35 38 | 39 40 | 25 10 | 29 12 | 27 42 | 31 44 |
 0x000001b0: 41 14 | 45 16 | 43 46 | 47 48 | 49 18 | 53 20 | 51 50 | 55 52 |
 0x000001d0: 65 22 | 69 24 | 67 54 | 71 56 | 57 26 | 61 28 | 59 58 | 63 60 |
 0x000001f0: 73 30 | 77 32 | 75 62 | 00 64 | 49 34 | 51 42 | 57 66 | 59 74 |
 0x00000210: 53 36 | 55 44 | 61 68 | 63 76 | 65 50 | 67 58 | 73 03 | 75 11 |
 0x00000230: 69 52 | 71 60 | 77 05 | 00 13 | 02 38 | 04 46 | 10 70 | 12 78 |
 0x00000250: 06 40 | 08 48 | 14 72 | 16 01 | 18 54 | 20 62 | 26 07 | 28 15 |
 0x00000270: 22 56 | 24 64 | 30 09 | 32 17 | 02 66 | 06 74 | 10 19 | 14 27 |
 0x00000290: 04 70 | 08 78 | 12 23 | 16 31 | 18 03 | 22 11 | 26 35 | 30 43 |
 0x000002b0: 20 07 | 24 15 | 28 39 | 32 47 | 34 68 | 38 76 | 42 21 | 46 29 |
 0x000002d0: 36 72 | 40 01 | 44 25 | 48 33 | 50 05 | 54 13 | 58 37 | 62 45 |
 0x000002f0: 52 09 | 56 17 | 60 41 | 64 49 | 34 19 | 36 35 | 50 51 | 52 67 |
 0x00000310: 38 21 | 40 37 | 54 53 | 56 69 | 42 27 | 44 43 | 58 59 | 60 75 |
 0x00000330: 46 29 | 48 45 | 62 61 | 64 77 | 66 23 | 68 39 | 03 55 | 05 71 |
 0x00000350: 70 25 | 72 41 | 07 57 | 09 73 | 74 31 | 76 47 | 11 63 | 13 00 |
 0x00000370: 78 33 | 01 49 | 15 65 | 17 02 | 66 51 | 70 67 | 03 04 | 07 20 |
 0x00000390: 68 55 | 72 71 | 05 08 | 09 24 | 74 59 | 78 75 | 11 12 | 15 28 |
 0x000003b0: 76 63 | 01 00 | 13 16 | 17 32 | 19 53 | 23 69 | 35 06 | 39 22 |
 0x000003d0: 21 57 | 25 73 | 37 10 | 41 26 | 27 61 | 31 77 | 43 14 | 47 30 |
 0x000003f0: 29 65 | 33 02 | 45 18 | 49 34 | 19 04 | 21 08 | 23 20 | 25 24 |

Subclause 15.247 (a) – Equal Hopping Frequency Use	Pass
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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.

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) – Peak Output Power		Pass
Test Specification	: FCC Part 15 Subpart A – Subclause 15.31	
Mode of operation	: Tx mode (2402MHz, 2441MHz, 2480MHz), DH1 packet	
Port of testing	: Temporary antenna port	
Detector	: Peak	
RBW/VBW	: 1 MHz / 3 MHz	
Supply voltage	: 3.7VDC 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.	

Result

All three transmit frequency modes comply with the maximum peak output power limit.

For test protocols please refer to Appendix 1, page 6-7.

Frequency (MHz)	Maximum peak output power (dBm)	Cable attenuation (dB)	Output power (dBm)	Limit (W/dBm)	Verdict
2402	-0.29	3.52	3.23	1 / 30.0	Pass
2441	-0.12	3.65	3.53	1 / 30.0	Pass
2480	-0.48	3.60	3.12	1 / 30.0	Pass

Subclause 15.247 (b) – Band edge compliance		Pass		
Test Specification	: FCC Part 15 Subpart A – Subclause 15.31			
Mode of operation	: Tx mode (2402MHz, 2441MHz, 2480MHz), DH1 packet			
Port of testing	: Temporary antenna port			
Detector	: Peak			
RBW/VBW	: 300 kHz / 1 MHz			
Supply voltage	: 3.7VDC 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.			
Result				
There is no peak found outside any 100 kHz 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(c).				
For test protocols refer to Appendix 1, page 8-12.				

Subclause 15.247 (c) – Spurious Conducted Emissions		Pass		
Test Specification	: FCC Part 15 Subpart A – Subclause 15.31			
Mode of operation	: Tx mode (2402MHz, 2441MHz, 2480MHz), DH1 packet			
Port of testing	: Temporary antenna port			
Detector	: Peak			
RBW/VBW	: 100 kHz / 300 kHz			
Supply voltage	: 3.7VDC 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.			
Result				
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(c).				
For test protocols refer to Appendix 1, page 13-17.				

Operating frequency (MHz)	Spurious frequency (MHz)	Spurious Level (dBm)	Reference value (dBm)	Delta (dB)	Verdict
2402	No peak found	-	-	-	Pass
2441	No peak found	-	-	-	Pass
2480	No peak found	-	-	-	Pass

Subclause 15.247 (c) – Spurious Radiated Emissions		Pass		
Test Specification	: ANSI C63.4 - 2003			
Mode of operation	: Tx mode (2402MHz, 2441MHz, 2480MHz), DH1 packet			
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	: internal batteries has been activated			
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.			
Result				
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		
549.62	31.30	43.5 / QP		
1600.70	49.80	74.0 / P		
1600.57	48.98	54.0 / A		
4803.89	49.71	74.0 / P		
4803.91	39.96	54.0 / A		
Tx frequency 2402MHz	Horizontal Polarization			
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m		
No peak found	-	43.5 / QP		
1600.63	47.17	74.0 / P		
1600.67	46.30	54.0 / A		
4804.18	48.29	74.0 / P		
4803.97	36.68	54.0 / A		

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Tx frequency 2441MHz		
Vertical Polarization		
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
No peak found	-	43.5 / QP
1626.63	50.93	74.0 / P
1626.67	50.21	54.0 / A
4882.04	53.86	74.0 / P
4882.10	49.44	54.0 / A

Tx frequency 2441MHz		
Horizontal Polarization		
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
No peak found	-	43.5 / QP
1626.69	48.67	74.0 / P
1626.66	47.77	54.0 / A
4881.88	49.63	74.0 / P
4882.10	46.14	54.0 / A

Tx frequency 2480MHz		
Vertical Polarization		
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
550.46	31.30	43.5 / QP
1652.66	44.01	74.0 / P
1652.66	42.46	54.0 / A
4959.90	53.94	74.0 / P
4960.00	50.94	54.0 / A

Tx frequency 2480MHz		
Horizontal Polarization		
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
No peak found	-	43.5 / QP
1652.63	47.58	74.0 / P
1652.68	46.74	54.0 / A
4959.92	50.96	74.0 / P
4960.03	47.03	54.0 / A