

Produkte
 Products


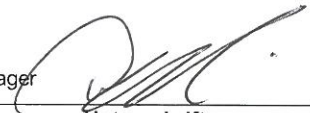
Prüfbericht - Nr.: 14025909 001		Seite 1 von 15	
<i>Test Report No.:</i>		<i>Page 1 of 15</i>	
Auftraggeber: <i>Client:</i>	Sennheiser Communications A/S Langager 6 DK-2680 Solrød Strand Denmark		
Gegenstand der Prüfung: <i>Test Item:</i>	Bluetooth Mono Headset		
Bezeichnung: <i>Identification:</i>	VMX 200	Serien-Nr.: <i>Serial No.:</i>	Engineering sample
Wareneingangs-Nr.: <i>Receipt No.:</i>	00110121104-003	Eingangsdatum: <i>Date of Receipt:</i>	21.01.2011
Prüfört: <i>Testing Location:</i>	TÜV Rheinland Hong Kong Ltd. 8/F., Niche Centre, 14 Wang Tai Road, Kowloon Bay, Kowloon, Hong Kong Hong Kong Productivity Council HKPC Building, 78 Tat Chee Avenue, Kowloon, Hong Kong		
Prüfgrundlage: <i>Test Specification:</i>	FCC Part 15 Subpart C ANSI C63.4-2003 CISPR 22:1997		
Prüfergebnis: <i>Test Results:</i>	Das vorstehend beschriebene Gerät wurde geprüft und entspricht oben genannter Prüfgrundlage. The above mentioned product was tested and passed .		
Prüflaboratorium: <i>Testing Laboratory:</i>	TÜV Rheinland Hong Kong Ltd. 9-10/F., Emperor International Square , 7 Wang Tai Road, Kowloon Bay, Kowloon, Hong Kong		
geprüft/ tested by:		kontrolliert/ reviewed by:	
29.04.2011	Mika Chan Project Engineer	29.04.2011	Sharon Li Assistant Manager
Datum <i>Date</i>	Name/Stellung <i>Name/Position</i>	Unterschrift <i>Signature</i>	Datum <i>Date</i>
			
		Unterschrift <i>Signature</i>	
Sonstiges: Other Aspects		FCCID: DMOCBMSAD	
Abkürzungen:	P(ass) = entspricht Prüfgrundlage F(ail) = entspricht nicht Prüfgrundlage N/A = nicht anwendbar N/T = nicht getestet	Abbreviations:	P(ass) = passed F(ail) = 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. <i>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.</i>			

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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 gain (dBi)	0.6
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
Software version	0010
Hardware version	04
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 Bluetooth Headset 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.

The Bluetooth uses GFSK (Gaussian Frequency Shift Keying) modulation where a binary one is represented by a positive frequency deviation and a binary zero by a negative frequency deviation. 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 μ s, 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

Remark

-

Special accessories and auxiliary equipment

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

AC/DC Power adaptor
Model number: SSA-3P 050015EU
Input: 100-240VAC, 50/60Hz, 0.2A
Output: 5.0VDC 150mA

List of Test and Measurement Instruments

	Equipment used	Manufacturer	Model No.	S/N	Due Date
<input checked="" type="checkbox"/>	Semi-anechoic Chamber	Frankonia	Nil	Nil	27-Apr-11
<input checked="" type="checkbox"/>	Test Receiver	R & S	ESU8	100141	25-May-11
<input checked="" type="checkbox"/>	Bi-conical Antenna	R & S	HK116	100242	13-Apr-12
<input checked="" type="checkbox"/>	Log Periodic Antenna	R & S	HL223	841516/020	13-Apr-12
<input checked="" type="checkbox"/>	Coaxial cable 50ohm	Rosenberger	RTK081-05S-05S-10m	LA2-001-10M / 002	08-Dec-11
<input checked="" type="checkbox"/>	Microwave amplifier 0.5-26.5GHz, 25dB gain	HP	83017A	3950M00241	03-Oct-11
<input checked="" type="checkbox"/>	High Pass Filter (cutoff freq. =1000MHz)	Trilithic	23042	9829213	30-Oct-11
<input checked="" type="checkbox"/>	Horn Antenna	EMCO	3115	9002-3351	16-Apr-12
<input checked="" type="checkbox"/>	FSP 30 Spectrum Analyser	R & S	FSP 30	100286	17-Sep-12
<input checked="" type="checkbox"/>	Active Loop Antenna	EMCO	6502	9107-2651	19-Apr-12
<input checked="" type="checkbox"/>	Semi-anechoic Chamber	Frankonia	Nil	Nil	27-Apr-11
<input checked="" type="checkbox"/>	Test Receiver	R & S	ESU8	100141	25-May-11
<input checked="" type="checkbox"/>	Bi-conical Antenna	R & S	HK116	100242	13-Apr-12

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.
	c) Gain with reference to an isotropic radiator:	0.6 dBi
Verdict:	Pass	

Subclause 15.207 – Disturbance Voltage on AC Mains		Pass				
Test Port: AC mains input port of the charger Applied voltage: 100VAC Applicable only to equipment designed to be connected to the public utility power line. Adaptor Model: SSA-3P 050015EU 1) Mode of operation: Charging mode						
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	0.156	37.6	20.2	66 - 56	56 - 46	Pass
	0.234	33.2	17.8	66 - 56	56 - 46	Pass
	0.362	33.0	22.5	66 - 56	56 - 46	Pass
> 0,5 - 5	4.330	24.4	15.0	56	46	Pass
> 5 - 30	-	-	-	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	0.150	36.4	18.4	66 - 56	56 - 46	Pass
	0.186	33.4	15.0	66 - 56	56 - 46	Pass
	0.356	33.9	20.9	66 - 56	56 - 46	Pass
> 0,5 - 5	4.642	28.1	15.4	56	46	Pass
> 5 - 30	-	-	-	60	50	Pass

Results: 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 2-3.

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 $2/3 \cdot 20\text{dB}$ 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 : 3.7VDC from DC power supply
 Temperature : 23°C
 Humidity : 50%

Results: The centre frequencies of the hopping channels are separated by more than the $2/3 \cdot 20\text{dB}$ bandwidth. For test Results plots refer to Appendix 1, page 4.

Verdict: Pass

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 : 3.7VDC 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 5.

Verdict: Pass

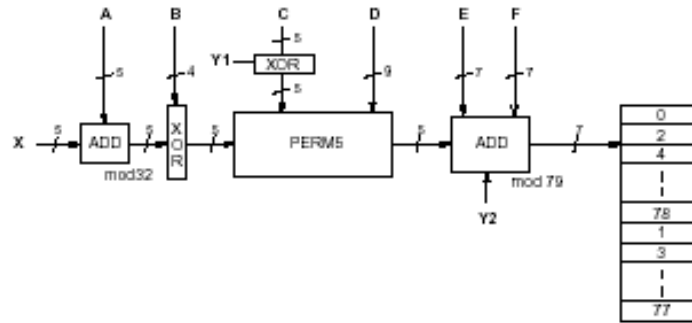
Subclause 15.247 (a)(1)(iii) – Time of Occupancy (Dwell Time)		Pass
Requirement:	Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number 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	: 3.7VDC from DC power supply	
Temperature	: 23°C	
Humidity	: 50%	
Results:	Time period calculation = $0.4 \times 79 = 31.6\text{s}$ Dwell time = $64 \times 2.872 \times 10^{-3} = 183.80 \times 10^{-3}$ $\leq 400 \times 10^{-3} \text{ s}$	
	For test protocols please refer to Appendix 1, page 6.	
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 $\frac{2}{3} \times 20\text{dB}$ 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), (GFSK)		
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 7-8.		
Frequency (MHz)	20 dB left (MHz)	20 dB right (MHz)	20dB bandwidth (MHz)
2402	0.444	0.402	0.846
2441	0.432	0.438	0.870
2480	0.450	0.480	0.930

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.



Example data:

Hop sequence {k} for CONNECTION STATE:

CLK start: 0x0000010

ULAP: 0x00000000

#ticks: 00 02 | 04 06 | 08 0a | 0c 0e | 10 12 | 14 16 | 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:	40 21	44 23	42 53	46 55	48 33	52 35	50 65	54 67
0x00000b0:	56 37	60 39	58 69	62 71	64 25	68 27	66 57	70 59
0x00000d0:	72 29	76 31	74 61	78 63	01 41	05 43	03 73	07 75
0x00000f0:	09 45	13 47	11 77	15 00	64 49	66 53	68 02	70 06
0x0000110:	01 51	03 55	05 04	07 08	72 57	74 61	76 10	78 14
0x0000130:	09 59	11 63	13 12	15 16	17 65	19 69	21 18	23 22
0x0000150:	33 67	35 71	37 20	39 24	25 73	27 77	29 26	31 30
0x0000170:	41 75	43 00	45 28	47 32	17 02	21 04	19 34	23 36
0x0000190:	33 06	37 08	35 38	39 40	25 10	29 12	27 42	31 44
0x00001b0:	41 14	45 16	43 46	47 48	49 18	53 20	51 50	55 52
0x00001d0:	65 22	69 24	67 54	71 56	57 26	61 28	59 58	63 60
0x00001f0:	73 30	77 32	75 62	00 64	49 34	51 42	57 66	59 74
0x0000210:	53 36	55 44	61 68	63 76	65 50	67 58	73 03	75 11
0x0000230:	69 52	71 60	77 05	00 13	02 38	04 46	10 70	12 78
0x0000250:	06 40	08 48	14 72	16 01	18 54	20 62	26 07	28 15
0x0000270:	22 56	24 64	30 09	32 17	02 66	06 74	10 19	14 27
0x0000290:	04 70	08 78	12 23	16 31	18 03	22 11	26 35	30 43
0x00002b0:	20 07	24 15	28 39	32 47	34 68	38 76	42 21	46 29
0x00002d0:	36 72	40 01	44 25	48 33	50 05	54 13	58 37	62 45
0x00002f0:	52 09	56 17	60 41	64 49	34 19	36 35	50 51	52 67
0x0000310:	38 21	40 37	54 53	56 69	42 27	44 43	58 59	60 75
0x0000330:	46 29	48 45	62 61	64 77	66 23	68 39	03 55	05 71
0x0000350:	70 25	72 41	07 57	09 73	74 31	76 47	11 63	13 00
0x0000370:	78 33	01 49	15 65	17 02	66 51	70 67	03 04	07 20
0x0000390:	68 55	72 71	05 08	09 24	74 59	78 75	11 12	15 28
0x00003b0:	76 63	01 00	13 16	17 32	19 53	23 69	35 06	39 22
0x00003d0:	21 57	25 73	37 10	41 26	27 61	31 77	43 14	47 30
0x00003f0:	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
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)(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 : 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.					
Results: For test protocols please refer to Appendix 1, page 9-10.					
GFSK Modulation					
Frequency (MHz)	Maximum peak output power (dBm)	Cable attenuation (dB)	Output power (dBm)	Limit (W/dBm)	Verdict
2402	3.79	3.52	7.310	1 / 30.0	Pass
2441	3.55	3.65	7.200	1 / 30.0	Pass
2480	2.91	3.60	6.510	1 / 30.0	Pass

Subclause 15.247 (d) – Band edge compliance of conducted emissions					Pass
Test Specification : FCC Part 15 Subpart A – Subclause 15.31 Mode of operation : Tx mode (2402MHz, 2480MHz), GFSK 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.					
Results: Pre-scan has been conducted 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 band. For test protocols refer to Appendix 1, page 11-12.					

Subclause 15.205 – Band edge compliance of radiated emissions		Pass
Test Specification : FCC Part 15 Subpart A – Subclause 15.31 Mode of operation : Tx mode (2402MHz, 2480MHz), GFSK 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:	Radiated emissions which fall in the restricted bans, as defined in 15.205 (a), must also comply with the radiated emission limits specified in 15.209(a).	
Results:	There is no peak found in the restricted bands. For test protocols refer to Appendix 1, page 13-20.	

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), GFSK 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.				
Results:	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 21-22.				
Operating frequency (MHz)	Spurious frequency (MHz)	Spurious Level (dBm)	Reference value (dBm)	Delta (dB)	Verdict
2402	6400.000	-48.52	1.22	-49.74	Pass
2441	6500.000	-47.40	-1.01	-46.39	Pass
2480	6600.000	-45.59	2.51	-48.10	Pass

Subclause 15.247 (c) – Spurious Radiated Emissions		Pass
Test Specification : ANSI C63.4 – 2003 Mode of operation : Tx mode (2402MHz, 2441MHz, 2480MHz), GFSK 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 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: 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
1601.987	44.00	74.0 / P
1601.971	40.11	54.0 / A
4803.958	64.78	74.0 / P
4803.942	41.45	54.0 / A
Tx frequency 2402MHz		Horizontal Polarization
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
1602.083	44.26	74.0 / P
1601.971	40.36	54.0 / A
4804.439	61.09	74.0 / P
4803.990	40.19	54.0 / A
Tx frequency 2441MHz		Vertical Polarization
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
1628.029	43.95	74.0 / P
1627.981	40.15	54.0 / A
4882.067	66.96	74.0 / P
4881.971	42.45	54.0 / A
Tx frequency 2441MHz		Horizontal Polarization
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
1628.231	45.53	74.0 / P
1627.990	42.51	54.0 / A
4881.971	62.24	74.0 / P
4882.003	40.81	54.0 / A
Tx frequency 2480MHz		Vertical Polarization
Freq	Level	Limit/ Detector

MHz	dBuV/m	dBuV/m
1652.692	46.37	74.0 / P
1652.660	43.38	54.0 / A
4960.016	68.29	74.0 / P
4959.952	43.53	54.0 / A
Tx frequency 2480MHz Horizontal Polarization		
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
1653.926	46.58	74.0 / P
1653.974	43.32	54.0 / A
4960.298	61.53	74.0 / P
4959.945	40.71	54.0 / A