Produkte
Products

Prüfbericht - Nr.: *Test Report No.:*	**14026448 001**		**Seite 1 von 16** *Page 1 of 16*
Auftraggeber: *Client:*	**GN Netcom A/S** **Lautrupbjerg 7** **DK-2750 Ballerup** **Denmark**		
Gegenstand der Prüfung: *Test Item:*	**Bluetooth Headset**		
Bezeichnung: *Identification:*	**OTE7**	**Serien-Nr.:** *Serial No.:*	**Engineering sample**
Wareneingangs-Nr.: *Receipt No.:*	**00110421007-003**	**Eingangsdatum:** *Date of Receipt:*	**21.04.2011**
Prüfort: *Testing Location:*	**TÜV Rheinland (Guangdong) Ltd. EMC Laboratory** Guangzhou Auto Market, Yuan Gang Section of Guangshan Road, Guangzhou, 510650, P.R. China		
Prüfgrundlage: *Test Specification:*	**FCC Part 15 Subpart C** **ANSI C63.4-2003** **CISPR 22:1997**		
Prüfergebnis: *Test Results:*	**Das vorstehend beschriebene Gerät wurde geprüft und entspricht oben genannter Prüfgrundlage.** The above mentioned product was tested and **passed**.		
Prüflaboratorium: *Testing Laboratory:*	**TÜV Rheinland (Guangdong) Ltd.** No. 199 Kezhu Road, Guangzhou Science City, Guangzhou, Guangdong, 510663, P.R.China		

geprüft/ *tested by:*			**kontrolliert/** *reviewed by:*		
18.05.2011	Mr. Ken Kuang Project Engineer		18.05.2010	Mr. Liangdong Xie Project Manager	
Datum *Date*	**Name/Stellung** *Name/Position*	**Unterschrift** *Signature*	**Datum** *Date*	**Name/Stellung** *Name/Position*	**Unterschrift** *Signature*

Sonstiges/ *Other Aspects:* **: FCCID: BCE-OTE7**

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

Table of Content

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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	PIFA
Antenna gain (dBi)	1
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 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.
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. The USB connector is for charging only, no data exchange supported.

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 case.

Special accessories and auxiliary equipment

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

N/A

List of Test and Measurement Instruments

Kind of Equipment	Manufacturer	Type	S/N	Due Date
FSP30 Spectrum Analyzer	Rohde & Schwarz	FSP30	100286	16-Mar-12
EMI Test Receiver	Rohde &Schwarz	ESCI	100216	16-Mar-12
Trilog-Broadband Antenna	Schwarzbeck	VULB9168	209	21-Aug-12
Double-Ridged Waveguide Horn Antenna	Rohde &Schwarz	HF 906	100385	24-Aug-11
Band Reject Filter	Micro-Tronics	BRM50702	023	16-Mar-12
Pre-Amplifier	MITEQ	AFS42-00101800-25-S-42	1101599	11-Aug-13
Horn Antenna	EMCO	3160-09	21642	26-Jun-14
Pre-Amplifier	MITEQ	AFS33-18002650-30-8P-44	1108282	16-Mar-13
Loop Antenna	Rohde &Schwarz	HFH2-Z2	100111	16-Mar-13
SAC	Albatross Projects GmbH	N/A	9460000.9	17-Jul-13
EMI Test Receiver	Rohde &Schwarz	ESCS 30	100316	16-Mar-12
Artificial Mains Network	Rohde &Schwarz	ESH3-Z5	100114	16-Mar-12
Pulse Limiter	Rohde &Schwarz	ESH3-Z2	100701	16-Mar-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:	PIFA
	b) Manufacturer and model no:	N.A.
	c) Gain with reference to an isotropic radiator:	1 dBi
Verdict:	Pass	

Subclause 15.207 – Disturbance Voltage on AC Mains	**N/A**
EUT could not be operated during battery charging.	

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 Mode of operation Port of testing Detector RBW/VBW Supply voltage Temperature Humidity	: FCC Part 15 Subpart A – Subclause 15.31 : Tx mode (hopping on), GFSK : Temporary antenna port : Peak : 100 kHz / 300 kHz : 3.7VDC from DC power supply : 23ºC : 50%
Results: **Verdict:**	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. 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 Mode of operation Port of testing Detector RBW/VBW Supply voltage Temperature Humidity	: FCC Part 15 Subpart A – Subclause 15.31 : Tx mode (hopping on), GFSK : Temporary antenna port : Peak : 1 MHz / 3 MHz : 3.7VDC from DC power supply : 23ºC : 50%
Results: **Verdict:**	The total number of hopping frequencies is more than 15. For test Results plots refer to Appendix 1, page 3. 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 : 23ºC
Humidity : 50%

Results: Time period calculation = 0.4 x 79 = 31.6s
Dwell time = 64 x 2.896 x 10^{-3} = 185.3 x 10^{-3}
<= 400 x 10^{-3} s

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

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 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 : 3.7VDC from DC power supply
Temperature : 23ºC
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 5-7.

8 DPSK Modulation

Frequency (MHz)	20 dB left (MHz)	20 dB right (MHz)	20dB bandwidth (MHz)
2402	0.654	0.624	1.278
2441	0.648	0.624	1.272
2480	0.654	0.618	1.272

GFSK Modulation

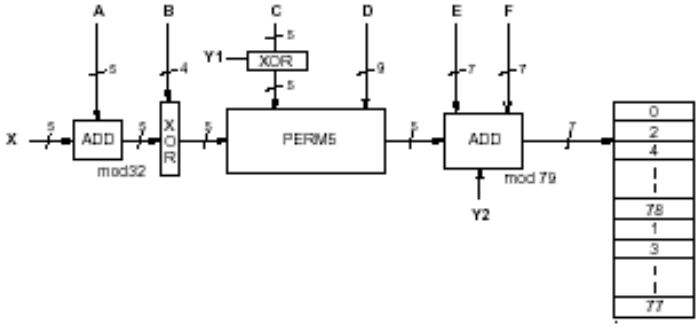
Frequency (MHz)	20 dB left (MHz)	20 dB right (MHz)	20dB bandwidth (MHz)
2402	0.456	0.480	0.936
2441	0.456	0.486	0.942
2480	0.456	0.474	0.930

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 : 23ºC
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 8-12.

GFSK Modulation

Frequency (MHz)	Maximum peak output power (dBm)	Cable attenuation (dB)	Output power (dBm)	Limit (W/dBm)	Verdict
2402	-0.69	3.52	2.830	1 / 30.0	Pass
2441	-1.79	3.65	1.860	1 / 30.0	Pass
2480	-2.58	3.60	1.020	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	-0.85	3.52	2.670	1 / 30.0	Pass
2441	-1.79	3.65	1.860	1 / 30.0	Pass

2480	-3.65	3.60	-0.050	1 / 30.0	Pass

8 DPSK Modulation

Frequency (MHz)	Maximum peak output power (dBm)	Cable attenuation (dB)	Output power (dBm)	Limit (W/dBm)	Verdict
2402	-0.63	3.52	2.890	1 / 30.0	Pass
2441	-2.65	3.65	1.000	1 / 30.0	Pass
2480	-3.38	3.60	0.220	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), 8DPSK
Port of testing : Temporary antenna port
Detector : Peak
RBW/VBW : 100 kHz / 300 kHz
Supply voltage : 3.7VDC from DC power supply
Temperature : 23ºC
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 100 kHz bandwidth of the operating frequency band. For test protocols refer to Appendix 1, page 13-14.

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), 8DPSK
Port of testing : Temporary antenna port
Detector : Peak
RBW/VBW : 1 MHz / 3 MHz
Supply voltage : 3.7VDC from DC power supply
Temperature : 23ºC
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 15-18.

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 : 3.7VDC from DC power supply
Temperature : 23 ºC
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 19-20.

Operating frequency (MHz)	Spurious frequency (MHz)	Spurious Level (dBm)	Reference value (dBm)	Delta (dB)	Verdict
2402	4804.000	-38.76	-1.74	-37.02	Pass
2441	4850.000	-37.86	-2.73	-35.13	Pass
2480	4950.000	-35.65	-3.85	-31.80	Pass

Subclause 15.247 (c) – Spurious Radiated Emissions	**Pass**

Test Specification : ANSI C63.4 – 2003
Mode of operation : Tx mode (2402MHz, 2441MHz, 2480MHz), 8DPSK
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 : 23ºC
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 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**
38.000	10.0	40 / QP
53.150	9.8	40 / QP
119.000	9.4	43.5 / QP
150.300	12.0	43.5 / QP
385.400	12.9	46 / QP
533.900	16.2	46 / QP
1602.000	37.3	74.0 / P
1602.000	30.7	54.0 / A
4804.000	42.2	74.0 / P
4804.000	31.0	54.0 / A

Tx frequency 2402MHz Horizontal Polarization

Freq MHz	**Level dBuV/m**	**Limit/ Detector dBuV/m**
43.350	10.6	40 / QP
56.900	9.7	40 / QP
148.350	11.6	43.5 / QP
330.350	11.8	46 / QP
437.750	14.5	46 / QP
571.400	17.1	46 / QP
1602.000	36.5	74.0 / P
1602.000	29.2	54.0 / A
4804.000	41.9	74.0 / P
4804.000	30.6	54.0 / A

Tx frequency 2441MHz Vertical Polarization

Freq	**Level**	**Limit/ Detector**

MHz	dBuV/m	dBuV/m
34.750	9.9	40 / QP
52.650	9.6	40 / QP
144.350	11.2	43.5 / QP
339.900	12.0	46 / QP
540.850	16.6	46 / QP
656.250	19.7	46 / QP
1627.000	36.0	74.0 / P
1627.000	27.0	54.0 / A
4882.000	44.0	74.0 / P
4882.000	33.9	54.0 / A
Tx frequency 2441MHz	Horizontal Polarization	
Freq MHz	**Level dBuV/m**	**Limit/ Detector dBuV/m**
39.450	11.0	40 / QP
54.150	10.0	40 / QP
145.300	11.6	43.5 / QP
173.900	9.9	43.5 / QP
371.450	12.7	46 / QP
529.800	16.1	46 / QP
1627.000	35.2	74.0 / P
1627.000	28.0	54.0 / A
4882.000	41.9	74.0 / P
4882.000	29.6	54.0 / A
Tx frequency 2480MHz	Vertical Polarization	
Freq MHz	**Level dBuV/m**	**Limit/ Detector dBuV/m**
37.300	9.5	40 / QP
47.100	10.2	40 / QP
93.300	6.4	43.5 / QP
146.050	11.4	43.5 / QP
325.850	11.7	46 / QP
524.100	17.1	46 / QP
1652.000	38.1	74.0 / P
1652.000	31.4	54.0 / A
4960.000	43.4	74.0 / P
4960.000	31.8	54.0 / A
Tx frequency 2480MHz	Horizontal Polarization	
Freq MHz	**Level dBuV/m**	**Limit/ Detector dBuV/m**
40.650	10.1	40 / QP
57.650	9.9	40 / QP
126.900	10.0	43.5 / QP
149.200	11.9	43.5 / QP
291.900	10.5	46 / QP
473.900	15.2	46 / QP
1652.000	34.6	74.0 / P
1652.000	25.9	54.0 / A
4960.000	42.9	74.0 / P
4960.000	30.8	54.0 / A