Prüfbericht - Nr.: Test Report No.	**14014146 001**		**Seite 1 von 13** Page 1 of 13
Auftraggeber: Applicant	**BenQ Mobile GmbH & Co. OHG** **Haidenauplatz 1** **81667 Munich**		
Gegenstand der Prüfung: Test item	**Mobile Sound Set BT**		
Bezeichnung: Identification	**IMS-100**	**Serien-Nr.:** Serial No.	**Engineering sample**
Wareneingangs-Nr.: Receipt No.	**06082201, 060821035-039**	**Eingangsdatum:** Date of receipt	**22.08.2006**
Prüfort: Testing location	**TÜV Rheinland Hong Kong Ltd.** Room 8, 25th Floor, Skyline Tower, 39 Wang Kwong Road, Kowloon Bay Kowloon, Hong Kong **Hong Kong Productivity Council** HKPC Building, 78 Tat Chee Avenue, Kowloon, Hong Kong		
Prüfgrundlage: Test specification	**FCC Part 15 Subpart C** **ANSI C63.4-2003** **CISPR 22:1997**		
Prüfergebnis: Test Result	**Das vorstehend beschriebene Gerät wurde geprüft und entspricht oben genannter Prüfgrundlage.** The above mentioned product was tested and **passed**.		

geprüft / tested by:			**kontrolliert** / reviewed by:		
12.09.2006	Sharon Li		12.09.2006	Thomas Berns	
Datum Date	**Name** Name	**Unterschrift** Signature	**Datum** Date	**Name** Name	**Unterschrift** Signature

Sonstiges: **FCCID: PWX-IMS100**
Other Aspects

Abkürzungen:			Abbreviations:		
	OK, Pass, P	= entspricht Prüfgrundlage		OK, Pass, P	= passed
	Fail, F	= entspricht nicht Prüfgrundlage		Fail, F	= failed
	N/A	= nicht anwendbar		N/A	= not applicable
	NT	= nicht getestet		NT	= not tested

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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}: 6 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 Stereo Speaker 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

Special accessories and auxiliary equipment

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

Ktec AC Adaptor
Model: KSAFC0600120W1EU
Input: 100-240V, 50/60Hz, 0.3A
Output: 6V, 1.2A

List of Test and Measurement Instruments

Hong Kong Productivity Council (Registration number: 90656)

Kind of Equipment	Manufacturer	Type	S/N
Double Ridge Horn Antenna	EMCO	3115	9002-3347
Spectrum Analyzer	Rohde & Schwarz	FSP30	1093.4495K30
Active Loop Antenna	EMCO	6502	9107-2651

TÜV Rheinland Hong Kong Ltd.

Kind of Equipment	Manufacturer	Type	S/N
Spectrum Analyser	R&S	FSP 30	100007

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: Inverted F type antenna soldered to the circuit board
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	Pass

Test Port: AC mains input port of the charger
Applied voltage: 110VAC
Applicable only to equipment designed to be connected to the public utiliy power line.

1) Mode of operation: Operating

Live measurement

Frequency range (MHz)	Frequency (MHz)	Quasi-peak dBµV	Average dBµV	Limit QP (dBµV)	Limit AV (dBµV)	Verdict
0,15 – 0,5	0.168000	34.1	20.6	66 - 56	56 - 46	Pass
> 0,5 - 5	-	-	-	56	46	Pass
> 5 - 30	28.758000	39.0	34.8	60	50	Pass

Neutral measurement

Frequency range (MHz)	Frequency (MHz)	Quasi-peak dBµV	Average dBµV	Limit QP (dBµV)	Limit AV (dBµV)	Verdict
0,15 – 0,5	0.174000	44.1	36.4	66 - 56	56 - 46	Pass
> 0,5 - 5	2.136000	32.1	27.3	56	46	Pass
> 5 - 30	28.854000	38.9	34.5	60	50	Pass

Result: 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.

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 : 6VDC from DC power supply
Temperature : 23ºC
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 : 6VDC from DC power supply
Temperature : 23ºC
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 x 79 = 31.6s

Limit calculation:
$64 \times 2.928 \times 10^{-3} = 187.4 \times 10^{-3}$
$<= 400 \times 10^{-3}$ 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 : 6VDC from DC power supply
Temperature : 23ºC
Humidity : 50%

Results

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

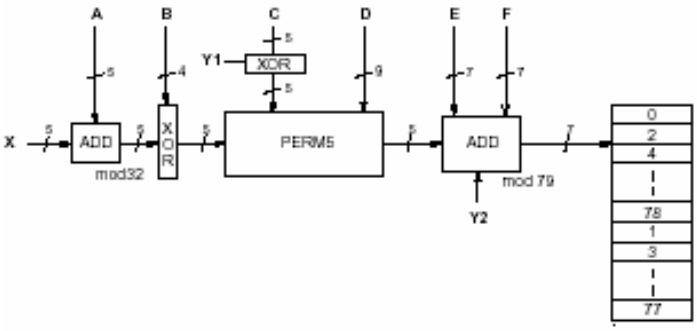
Frequency (MHz)	20 dB left (MHz)	20 dB right (MHz)	20dB bandwidth (MHz)
2402	0.456	0.464	0.920
2441	0.460	0.468	0.928
2480	0.460	0.468	0.928

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) – 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 : 6VDC 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.
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	-2.63	3.52	0.89	1 / 30.0	Pass
2441	-2.83	3.65	0.82	1 / 30.0	Pass
2480	-2.75	3.60	0.85	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 : 100 kHz / 1 MHz
Supply voltage : 6VDC 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.

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 8-9.

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 : 6VDC 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.

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 10-.

Operating frequency (MHz)	Spurious frequency (MHz)	Spurious Level (dBm)	Reference value (dBm)	Delta (dB)	Verdict
2402	-	-	-	-	Pass
2441	-	-	-	-	Pass
2480	-	-	-	-	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 : 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.

Result

All three transmit frequency modes comply with the field strength within the restricted bands.

Tx frequency 2402MHz Vertical Polarization

Freq MHz	**Level dBuV/m**	**Limit/ Detector dBuV/m**
43.4472	37.70	40.0 / QP
1601.9664	45.02	74.0 / P
1602.0064	43.89	54.0 / A

Tx frequency 2402MHz Horizontal Polarization

Freq MHz	**Level dBuV/m**	**Limit/ Detector dBuV/m**
76.4800	37.20	40.0 / QP
277.5800	36.40	46.0 / QP
1602.0464	51.43	74.0 / P
1602.0264	50.95	54.0 / A

Tx frequency 2441MHz	Vertical Polarization	
Freq MHz	**Level dBuV/m**	**Limit/ Detector dBuV/m**
43.4516	37.50	40.0 / QP
1627.9800	45.39	74.0 / P
1627.9800	42.73	54.0 / A
Tx frequency 2441MHz	Horizontal Polarization	
Freq MHz	**Level dBuV/m**	**Limit/ Detector dBuV/m**
76.4760	35.70	40.0 / QP
277.5200	34.60	46.0 / QP
1627.9800	50.44	74.0 / P
1628.0200	49.88	54.0 / A
Tx frequency 2480MHz	Vertical Polarization	
Freq MHz	**Level dBuV/m**	**Limit/ Detector dBuV/m**
43.4744	37.30	40.05 / QP
264.0200	32.10	46.0 / QP
1654.0200	47.83	74.0 / P
1653.9200	41.82	54.0 / A
Tx frequency 2480MHz	Horizontal Polarization	
Freq MHz	**Level dBuV/m**	**Limit/ Detector dBuV/m**
76.5172	32.90	40.0 / QP
1654.0200	47.00	74.0 / P
1654.0600	45.54	54.0 / A