

Produkte
Products

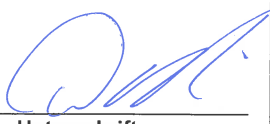
Prüfbericht - Nr.: 14045642 001			Seite 1 von 20				
Test Report No.:			Page 1 of 20				
Auftraggeber: Client:		Megabyte Limited Unit 507, Building 12W No. 12 Science Park West Avenue Hong Kong Science Park, Shatin, N.T. Hong Kong					
Gegenstand der Prüfung: UHF Portable RFID Reader							
Test Item:							
Bezeichnung: Identification:		H3B-01-MB, H3B-01-39, H3B-01-PH		Serien-Nr.: Engineering sample Serial No.:			
Wareneingangs-Nr.: Receipt No.:		A000386196-003		Eingangsdatum: 30.06.2016 Date of Receipt:			
Prüfört: Testing Location:		TÜV Rheinland Hong Kong Ltd. 3/F., Fou Wah Industrial Building, 10-16 Pun Shan Street, Tsuen Wan, Hong Kong Hong Kong Productivity Council HKPC Building, 78 Tat Chee Avenue, Kowloon, Hong Kong					
Zustand des Prüfgegenstandes bei Anlieferung: Condition of test item at delivery:			Test sample(s) is/are not damaged and suitable for testing.				
Prüfgrundlage: Test Specification:		FCC Part 15 Subpart C ANSI C63.10-2013					
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 Hong Kong Ltd. 3-4, 11/F., Fou Wah Industrial Building, 10-16 Pun Shan Street, Tsuen Wan, Hong Kong					
geprüft/ tested by:			kontrolliert/ reviewed by:				
12.12.2016 Datum Date			12.12.2016 Datum Date				
Mika Chan Name/Stellung Name/Position			Sharon Li Name/Stellung Name/Position				
 Unterschrift Signature			 Unterschrift Signature				
Sonstiges: FCC ID: XEK-MHANDH3							
Other Aspects							
<table style="width: 100%; border: none;"> <tr> <td style="width: 50%; vertical-align: top;"> Abkürzungen: P(ass) = entspricht Prüfgrundlage F(ail) = entspricht nicht Prüfgrundlage N/A = nicht anwendbar N/T = nicht getestet </td> <td style="width: 50%; vertical-align: top;"> Abbreviations: P(ass) = passed F(ail) = failed N/A = not applicable N/T = not tested </td> </tr> </table>						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
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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	GFSK; Pi/4 DQPSK; 8 DPSK
Number of channels	79
Channel separation	1 MHz
Type of antenna	Chip Antenna
Antenna gain (dBi)	0.5
Power level	fix
Type of equipment	stand alone radio device
Connection to public utility power line	No
Nominal voltage	V _{nom} : 100-240VAC and 3.7 VDC
Independent Operation Modes	Transmit and receive

Product function and intended use

The equipment under test (EUT) is a UHF Portable RFID Reader with Bluetooth (dual mode) and NFC function.

The manufacturer declared that the model: H3B-01-39 and H3B-01-PH are identical to the model H3B-01-MB except the logo plate.

FCC ID: XEK-MHANDH3

Models	Product description
H3B-01-MB, H3B-01-39, H3B-01-PH	UHF Portable RFID Reader

Submitted documents

Circuit Diagram
 Block Diagram
 Technical Description
 Bill of materials
 User manual
 Rating label

Independent Operation Modes

The basic operation modes are:

- Transmitting mode.

For further information refer to User Manual

Related Submittal(s) Grants

This is a composite device, for NFC (13.56 MHz) portion please refer to test report No. 14045643 001.
For RFID (902 MHz – 928 MHz) portion please refer to test report No. 14045640 001.
For Bluetooth low energy portion please refer to test report No. 14045641 001.
For receiver portion of the RFID transceiver please refer to test report No. 14045640 001.

This is a single application for certification of the Classic Bluetooth transmitter.

Remark

The test results in this test report are only relevant to the tested sample and does not involve any assessment in the production.

Test Set-up and Operation Mode

Principle of Configuration Selection

Emission: The EUT was configured to measure its highest possible radiation level. The test modes were adapted accordingly in reference to the instructions for use.

Test Operation and Test Software

Test operation should refer to test methodology.

- 1) Special software is provided by the applicant to set the device to operate in a fixed frequency channel and maximum RF output power level. The setting of the maximum RF output power shall be fixed on the final product.
- 2) Pre-scan has been conducted to determine the worst-case mode from all possible combinations between available modulations and data rate.

Special Accessories and Auxiliary Equipment

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

- AC-DC adaptor model: EA1024AR-050 (Provided by Appliant)

Countermeasures to achieve EMC Compliance

- none

Test Methodology

Radiated Emission

The radiated emission measurements of the transmitter part were performed according to the procedures in ANSI C63.10-2013. The radiated emission measurements of the battery pack charging part were performed according to the procedures in ANSI C63.4-2014.

For measurement below 1GHz - the equipment under test (EUT) was placed at the middle of the 80 cm height turntable. For measurement above 1GHz - the EUT was placed at the middle of the 1.5 m height turntable and RF absorbing material was placed on ground plane between turntable and measuring antenna. During the testing, the EUT was operated standalone and arranged for maximum emissions. The EUT was tested in three orthogonal planes.

The investigation is performed with the EUT rotated 360°, the antenna height scanned between 1m and 4m, and the antenna rotated to repeat the measurements for both the horizontal and vertical antenna polarizations. Repeat the measurement steps until the maximum emissions were obtained.

All radiated tests were performed at an antenna to EUT with 3 meters distance, unless stated otherwise in particular parts of this test report.

Field Strength Calculation

The field strength at 3 m was established by adding the meter reading of the spectrum analyzer to the factors associated with antenna correction factor, cable loss, preamplifiers and filter attenuation.

The equation is expressed as follow:

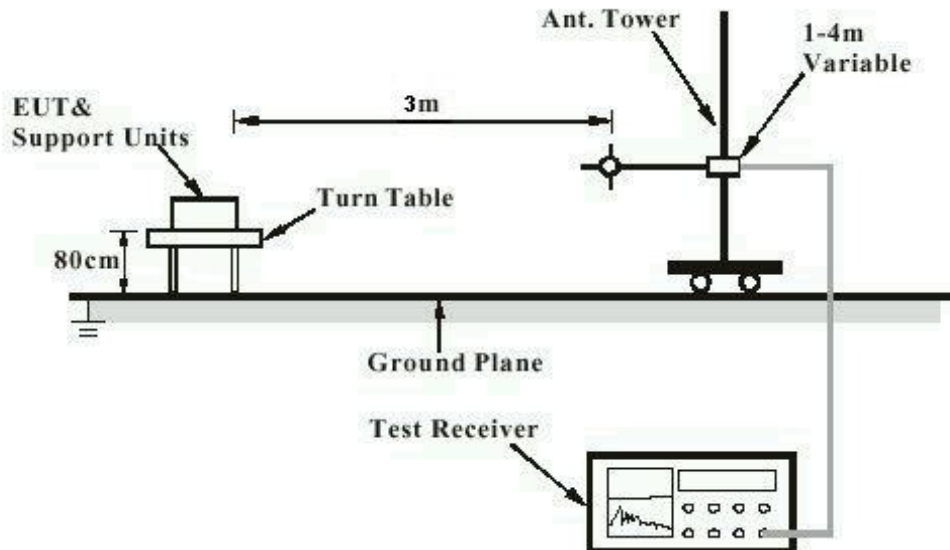
$$FS = R + AF + CF + FA - PA$$

Where FS = Field Strength in dBuV/m at 3 meters.
R = Reading of Spectrum Analyzer in dBuV.
AF = Antenna Factor in dB.
CF = Cable Attenuation Factor in dB.
FA = Filter Attenuation Factor in dB.
PA = Preamplifier Factor in dB.

FA and PA are only be used for the measuring frequency above 1 GHz.

Test Setup Diagram

Diagram of Measurement Configuration for Radiated Emission Test



Note: Measurements above 1 GHz are done with a table height of 1.5m. In addition, there is RF absorbing material on the floor of the test site for above 1GHz measurement.

Diagram of Measurement Equipment Configuration for Mains Conduction Measurement (if applicable)

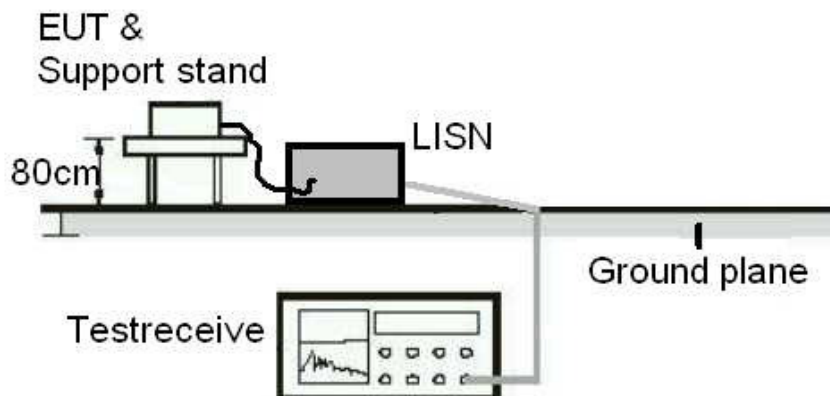
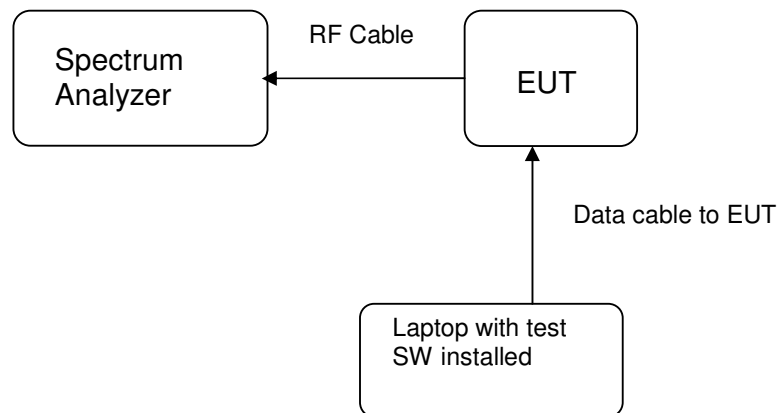


Diagram of Equipment Configuration for Antenna-port Conducted Measurement (if applicable)



List of Test and Measurement Instruments

Hong Kong Productivity Council (FCC Registration number: 90656)**Radiated Emission**

Equipment	Manufacturer	Type	Cal. Date	Due Date
Semi-anechoic Chamber	Frankonia	Nil	25-Apr-16	25-Apr-17
New Fully Anchoic Chamber	TDK	N/A	19-Apr-16	19-Apr-17
Cable	Hubersuhner	SUCOFLEX 104	31-Mar-16	31-Mar-18
Test Receiver	R & S	ESU40	26-Jul-16	26-Jul-17
Bi-conical Antenna	R & S	HK116	1-Sep-15	01-Sep-17
Log Periodic Antenna	R & S	HL223	1-Sep-15	01-Sep-17
Coaxial cable	Harbour	LL335	10-Jun-16	10-Jun-18
Microwave amplifier 0.5-26.5GHz, 25dB gain	HP	83017A	18-Jul-16	18-Jul-18
High Pass Filter (cutoff freq. =1000MHz)	Trilithic	23042	28-Oct-15	28-Oct-17
Horn Antenna	EMCO	3115	26-Aug-15	26-Aug-17
Active Loop Antenna	EMCO	6502	27-Oct-16	27-Oct-17

AC Mains Conducted Emission

Equipment	Manufacturer	Type	Cal. Date	Due Date
Test Receiver	R & S	ESU40	26-Jul-16	26-Jul-17
RF Voltage Probe	Schwarzbeck	TK9416	11-Feb-16	11-Feb-17
LISN	R&S	ESH3-Z5	15-Jun-16	15-Jun-17
Double Shield Cable	Radiall	RG142	14-Sep-15	14-Sep-17
Pulse Limiter	R&S	ESH3-Z2	03-Jun-16	03-Jun-18

TÜV Rheinland Hong Kong Ltd**Radio Test**

Equipment	Manufacturer	Type	Cal. Date	Due Date
Spectrum Analyzer	R & S	FSP30	12-Jan-15	12-Jan-2017

Measurement Uncertainty

The estimated combined standard uncertainty for power-line conducted emissions measurements is $\pm 3.43\text{dB}$.

The estimated combined standard uncertainty for radiated emissions measurements is $\pm 5.10\text{dB}$ (30MHz to 200MHz) and $\pm 5.08\text{dB}$ (200MHz to 1000MHz) and is $\pm 5.10\text{dB}$ (30MHz to 200MHz) and $\pm 5.08\text{dB}$ (above 1GHz).

The estimated combined standard uncertainty for antenna conducted emission is $\pm 1.56\text{dB}$

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor of $k=2$, which for the level of confidence is approximately 95%.

Results FCC Part 15 – Subpart C

FCC 15.203 – Antenna Requirement 1		Pass
FCC Requirement: No antenna other than that furnished by the responsible party shall be used with the device		
Results:	a) Antenna type: Integral Chip antenna b) Manufacturer and model no: ACX AT3216-B2R7HAA_3216 c) Peak Gain: 0.5 dBi	
Verdict:	Pass	

FCC 15.204 – Antenna Requirement 2		N/A
FCC Requirement: An intentional radiator may be operated only with the antenna with which it is authorized. If an antenna is marketed with the intentional radiator, it shall be of a type which is authorized with the intentional radiator.		
Results:	Only one integral antenna can be used.	
Verdict:	N/A	

FCC 15.207 – Conducted Emission on AC Mains						Pass
Test Specification : ANSI C63.10 – 2013 Mode of operation : TX mode Port of testing : AC Mains input port of power supply Detector : Quasi-peak and Average RBW : 9 kHz Supply voltage : 120Vac 60Hz Temperature : 23°C Humidity : 50%						
Requirement: 15.207(a)						
Results: Pass						
Live measurement						
Frequency range (MHz)	Frequency (MHz)	Quasi-peak dBµV	Average dBµV	Limit QP (dBµV)	Limit AV (dBµV)	Verdict
0,15 – 0,5	0.170	49.2	31.2	66 - 56	56 - 46	Pass
	0.182	50.1	33.0	66 - 56	56 - 46	Pass
> 0,5 - 5	no peak found	---	---	56	46	Pass
> 5 - 30	16.286	35.8	28.1	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	0.164	50.7	29.8	66 - 56	56 - 46	Pass

	0.174	49.9	30.7	66 - 56	56 - 46	Pass
	0.198	52.1	34.8	66 - 56	56 - 46	Pass
> 0,5 - 5	no peak found	---	---	56	46	Pass
> 5 - 30	23.914	38.8	28.3	60	50	Pass

Results: Pre-scan has been conducted to determine the worst-case mode from all possible combinations between available modulations and data rate.

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.

FCC 15.247 (a)(1) – 20 dB Bandwidth

Test Specification : FCC KDB DA 00-705
 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
 Temperature : 23°C
 Humidity : 50%

Results: Pre-scan has been conducted to determine the worst-case mode from all possible combinations between available modulations and packet types.

For test protocols refer to Appendix 1.

GFSK Modulation

Frequency (MHz)	20 dB left (MHz)	20 dB right (MHz)	20dB bandwidth (MHz)
2402	2401.530	2402.500	0.970
2441	2440.528	2441.492	0.964
2480	2479.528	2480.496	0.968

8DPSK Modulation

Frequency (MHz)	20 dB left (MHz)	20 dB right (MHz)	20dB bandwidth (MHz)
2402	2401.350	2402.660	1.310
2441	2440.340	2441.660	1.320
2480	2479.340	2480.660	1.320

FCC 15.247 (a)(1) – Carrier Frequency Separation		Pass
FCC 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 KDB DA 00-705 Mode of operation : Tx mode (hopping on), GFSK and 8DPSK Port of testing : Temporary antenna port Detector : Peak RBW/VBW : 100 kHz / 300 kHz Supply voltage : 3.7VDC Temperature : 23°C Humidity : 50%		
Results: Pre-scan has been conducted 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.		
Verdict: Pass		
GFSK Modulation		
Test Frequency (MHz)	Channel separation (MHz)	Two-third of 20dB bandwidth (MHz)
2441	1.002	0.647
8DPSK Modulation		
Test Frequency (MHz)	channel separation (MHz)	Two-third of 20dB bandwidth (MHz)
2441	0.996	0.880

FCC 15.247 (a)(1)(iii) – Number of hopping channels		Pass
FCC Requirement: Frequency hopping systems operating in the 2400MHz-2483.5MHz bands shall use at least 15 hopping frequencies.		
Test Specification : FCC KDB DA 00-705 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 Temperature : 23°C Humidity : 50%		
Results: The total number of hopping frequencies is more than 15. For test Results plots refer to Appendix 1.		
Verdict: Pass		

FCC 15.247 (a)(1)(iii) – Time of Occupancy (Dwell Time)**Pass**

FCC 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 KDB DA 00-705
 Mode of operation : Tx mode (hopping on), DH5 packet
 Port of testing : Temporary antenna port
 Detector : Peak
 RBW/VBW : 100 KHz / 300 KHz
 Supply voltage : 3.7VDC
 Temperature : 23°C
 Humidity : 50%

Results: Time period calculation = $0.4 \times 79 = 31.6\text{s}$
 Dwell time = $108 \times 2.890 \times 10^{-3} = 312.12 \times 10^{-3}\text{s}$
 $\leq 400 \times 10^{-3}\text{s}$

For test protocols please refer to Appendix 1.

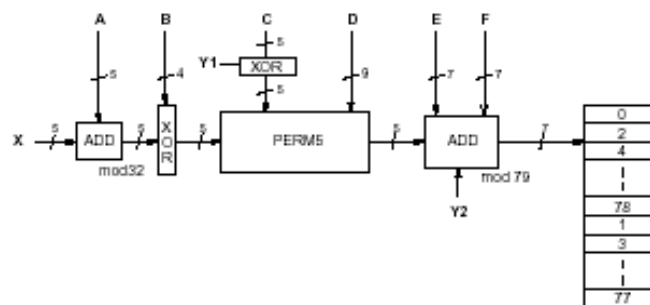
Verdict: Pass

FCC 15.247 (a) – Hopping Sequence**Pass**

FCC 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 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 |

```

FCC 15.247 (a) – Equal Hopping Frequency Use**Pass****FCC 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.

FCC 15.247 (a) – Receiver Input Bandwidth**Pass****FCC 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.

FCC 15.247 (a) – Receiver Hopping Capability	Pass
FCC 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.	

FCC 15.247 (b)(1) – Peak Output Power					Pass
Test Specification : FCC KDB DA 00-705 Mode of operation : Tx mode (2402MHz, 2441MHz, 2480MHz), GFSK and 8DPSK Port of testing : Temporary antenna port Detector : Peak RBW/VBW : 3 MHz / 10 MHz Supply voltage : 3.7VDC Temperature : 23°C Humidity : 50%					
FCC Requirement: For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping 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.					
GFSK Modulation					
Frequency (MHz)	Maximum peak output power (dBm)	Cable (dB)	Output power (dBm)	Limit (W/dBm)	Verdict
2402	5.58	0	5.58	1 / 30.0	Pass
2441	6.72	0	6.72	1 / 30.0	Pass
2480	7.43	0	7.43	1 / 30.0	Pass
8DPSK Modulation					
Frequency (MHz)	Maximum peak output power (dBm)	Cable attenuation (dB)	Output power (dBm)	Limit (W/dBm)	Verdict
2402	4.34	0	4.34	0.125 / 21.0	Pass
2441	5.77	0	5.77	0.125 / 21.0	Pass
2480	6.66	0	6.66	0.125 / 21.0	Pass

FCC 15.247 (d) – Spurious Conducted Emissions					Pass
Test Specification : FCC KDB DA 00-705 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 Temperature : 23 °C Humidity : 50 %					
FCC 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. All three transmit frequency modes comply with the limit stated in subclause 15.247(d). For test protocols refer to Appendix 1.					
GFSK					
Operating frequency (MHz)	Spurious frequency (MHz)	Spurious Level (dBm)	Reference value (dBm)	Delta (dB)	Verdict
2402	No peak found	---	5.42	---	Pass
2441	No peak found	---	6.52	---	Pass
2480	No peak found	---	7.21	---	Pass

FCC 15.247 (d) – Spurious Radiated Emissions		Pass
Test Specification : ANSI C63.10 – 2013 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 : 100-240VAC and 3.7 VDC Temperature : 23°C Humidity : 50%		
FCC 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 conducted 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
4804.288	54.14	74.0 / PK
4803.967	44.04	54.0 / AV
Tx frequency 2402MHz Horizontal Polarization		
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
383.920	36.0	46.0 / QP
4804.160	53.11	74.0 / PK
4803.967	40.88	54.0 / AV
Tx frequency 2441MHz Vertical Polarization		
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
383.060	30.5	46.0 / QP
4881.951	53.29	74.0 / PK
4881.951	42.70	54.0 / AV
Tx frequency 2441MHz Horizontal Polarization		
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
383.090	37.5	46.0 / QP
4881.487	53.55	74.0 / PK
4881.967	42.75	54.0 / AV
Tx frequency 2480MHz Vertical Polarization		
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m

4959.647	56.53	74.0 / PK
4959.983	47.33	54.0 / AV
Tx frequency 2480MHz Horizontal Polarization		
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
383.950	36.3	46.0 / QP
4959.551	55.37	74.0 / PK
4959.967	44.42	54.0 / AV

FCC 15.247 (d) – Band edge compliance of conducted emissions**Pass**

Test Specification : FCC KDB DA 00-705
Mode of operation : Tx mode (2402MHz, 2480MHz, hopping on), GFSK
Port of testing : Temporary antenna port
Detector : Peak
RBW/VBW : 100 kHz / 300 kHz
Supply voltage : 3.7VDC
Temperature : 23°C
Humidity : 50%

FCC 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.

GFSK

Frequency	Emission frequency (MHz)	Spurious Level (dBm)	Reference value (dBm)	Delta (dB)	Verdict
Lower band, hopping on	2399.200	-36.92	7.21	-44.13	Pass
Upper band, hopping on	2483.820	-39.14	7.21	-46.35	Pass
Lower band, hopping off	2400.000	-33.19	7.21	-40.40	Pass
Upper band, hopping off	2488.120	-39.42	7.21	-46.63	Pass