

**Table 8: Hopping Channel Carrier Frequency Separation**

Channel	Adjacent Hopping channel separation (kHz)	Limit
Low	1012	At least 25kHz or two-thirds of the 20dB bandwidth of the hopping channel, whichever is greater.
Mid	1008	
High	996	Note: refer to table 6 for the value of 20dB bandwidth

Please refer to Appendix 1 for measurement data.

## 5.7 Number of Hopping Frequency Used

**RESULT:**
**Pass**

Date of testing	:	Sep. 25, 2009
Test specification	:	FCC Part 15 Per Section 15.247(a)(1)(iii)
Limits	:	FCC Part 15 Per Section 15.247(a)(1)(iii) Frequency hopping system in the 2400-2483.5 MHz band shall use at least 15 non-overlapping channels
Deviations from Standard Test procedures	:	None
Test procedure	:	Procedure specified in ANSI C63.4
Kind of test site	:	Shielded room
Operation mode	:	Bluetooth transmitting with hopping at the full channel set
Power supply	:	DC 3.7V
Temperature	:	22°C
Humidity	:	55%

**Test procedure:**

1. Connect the antenna port of the EUT to the spectrum analyzer by a low loss cable.
2. Set the EUT to proper test mode with relative test software and hardware.
3. Spectrum analyzer setting: RBW = 100 kHz,  $VBW \geq RBW$ , Frequency Span = wide enough to cover the channels to be plotted.
4. Set the spectrum analyzer to Max-hold mode and plot the result(s) with record of all hopping channel.

**Table 9: Number of hopping frequency**

Number of hopping frequency:	79
Limit:	At least 15 non-overlapping channels

Please refer to Appendix 1 for measurement data.

## 5.8 Time of Occupancy (Dwell Time)

**RESULT:****Pass**

Date of testing	:	Sep. 24, 2009
Test specification	:	FCC Part 15 Per Section 15.247(a)(1)(iii)
Limits	:	FCC Part 15 Per Section 15.247(a)(1)(iii)
For frequency hopping system operating in the 2400-2483.5MHz band, 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.		
Deviations from Standard Test procedures	:	None
Test Procedure	:	Procedure specified in ANSI C63.4
Kind of test site	:	Shielded room
Operation mode	:	Bluetooth transmitting with hopping at the full channel set (DH5 mode)
Power supply	:	DC 3.7V
Temperature	:	22°C
Humidity	:	55%

**Test procedure:**

1. Connect the antenna port of the EUT to the spectrum analyzer by a low loss cable.
2. Set the EUT to proper test mode with relative test software and hardware.
3. Spectrum analyzer setting: Centered Frequency = measured channel, RBW = 1MHz,  $VBW \geq RBW$ , Frequency Span = 0 Hz.
4. Set sweep time properly to capture the entire dwell time per hopping channel.
5. Set detector type to Peak and trace mode to Max Hold and make the measurement.
6. Repeat step 3-5 until all channels measured were complete.

**Table 10: Dwell Time (DH5 mode)**

channel	Frequency (GHz)	Dwell time of one signal Burst (ms)	Total Dwell Time (ms)	Limit (ms)
Low	2.402	2.960	(2.960 x <b>106.81</b> ) = 316.16	400
Mid	2.441	2.960	(2.960 x <b>106.81</b> ) = 316.16	400
High	2.480	2.960	(2.960 x <b>106.81</b> ) = 316.16	400

**Note :**

Period = 0.4 (seconds) x 79 (channels) = 31.6 seconds

For Bluetooth system, there are 1600 timeslots in one second. The DH5 mode operates on a 5-slot transmission and 1-slot receiving basis. Thus there are  $1600 / (5+1) = 266.7$  transmission per second. In one period for each particular channel there are  $(266.7/79) \times 31.6 = 106.81$  times of transmission.

Dwell Time in one period(ms) = Dwell time of one-slot transmission(ms) multiplexes **106.81**

Please refer to Appendix 1 for measurement data.

## 5.9 Out-of-Band Emission

**RESULT:****Pass**

Date of testing	:	Sep. 25, 2009
Test specification	:	FCC Part 15 Per Section 15.247(d)
Limits	:	FCC Part 15 Per Section 15.247(d)
<p>In any 100kHz 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 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.</p>		
<p>In addition: FCC Part 15 - radiated emission which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in section 15.209(a).</p>		
Deviations from Standard Test procedures	:	None
Test Procedure	:	Procedure specified in ANSI C63.4
Kind of test site	:	Shielded room
Operation mode	:	Bluetooth transmitting at the highest and lowest channel (band edge)
Power supply	:	DC 3.7V
Temperature	:	22°C
Humidity	:	55%

**Test procedure:**

1. Connect the antenna port of the EUT to the spectrum analyzer by a low loss cable.
2. Set the EUT to proper test mode with relative test software and hardware.
3. Spectrum analyzer setting: RBW = 100 kHz, VBW $\geq$ RBW.
4. Set proper frequency span respectively for out-of-band emission measurement of the band edge and the whole range (up to 10 times of the carrier frequency.)
5. Set the trace mode to Max Hold and mark the peak reading of any spurious emission recorded.

**Table 11: Out-Of-Band Emission measurement (conducted)**

<b>Emission (Carrier operating at Channel low, mid and high)</b>	<b>Attenuation</b>	<b>Limit (dB)</b>
30MHz to 25GHz	All emission in this 100kHz bandwidth are attenuated more than 20dB from the carrier	$\Delta \geq 20$

Note: Refer to Appendix 1 for measurement data.

**Table 12: Band Edges Emission in the Restricted Bands by Marker Delta Method**

<b>Frequency [MHz]</b>	<b>dBc [dB]</b>	<b>PK [dB<math>\mu</math>V/m]</b>	<b>AV [dB<math>\mu</math>V/m]</b>	<b>Polarity (H/V)</b>	<b>PK limit [dB<math>\mu</math>V/m]</b>	<b>AV limit [dB<math>\mu</math>V/m]</b>
2484.0	46.40	46.06	---	H	74	54
2376.0	58.25	35.68	---	H	74	54

**NOTE:**

1. The Peak carrier field strength of the highest/lowest channel is 92.46dB $\mu$ V/m, 93.93dB $\mu$ V/m. The above field strength levels were measured in horizontal polarity which is the worst case.
2. The dBc value between the carrier maximum power and band edge emission power of the frequency listed in the table is calculated from the test record showed in Appendix 1.
3. Peak value of the high/low band edge emission listed in the table is calculated by the below formula: PK value of band edge emission = Peak carrier field strength – dBc value in item2

\*Note: Please refer to Appendix 1 for measurement data. Disturbances other than those mentioned above are small or not detectable. Please refer to the Appendix 1 for the noise floor of the band edge emission.

## 6 Photographs of the Test Set-Up

Photograph 1: Set-up for Conducted Emission



Set up for 15.209(a)

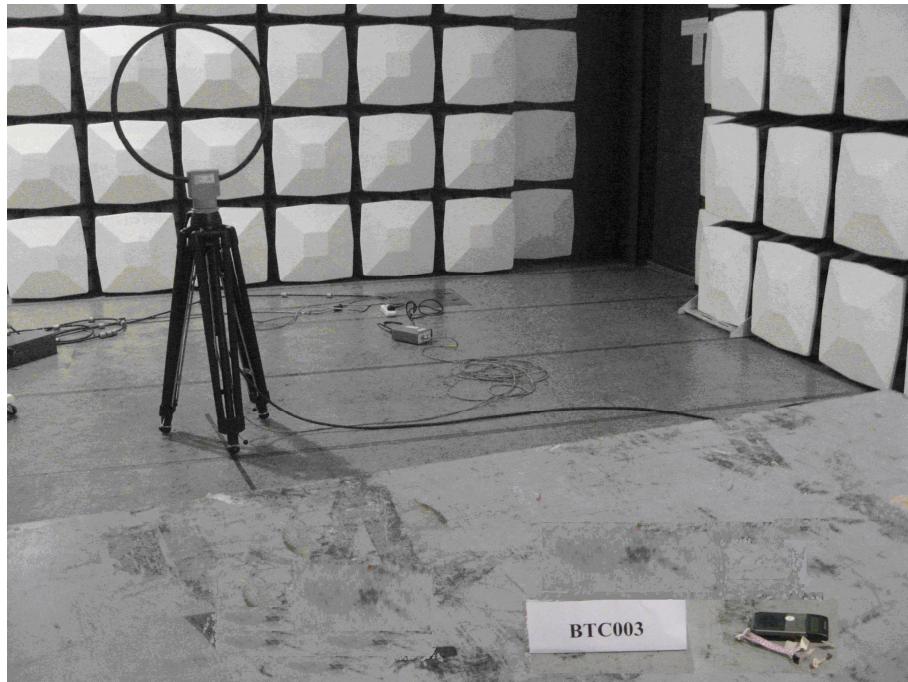


Set up for 15.109(a)

**Prüfbericht - Nr.:** **16019616 001**  
*Test Report No.:*

**Seite 30 von 33**  
*Page 30 of 33*

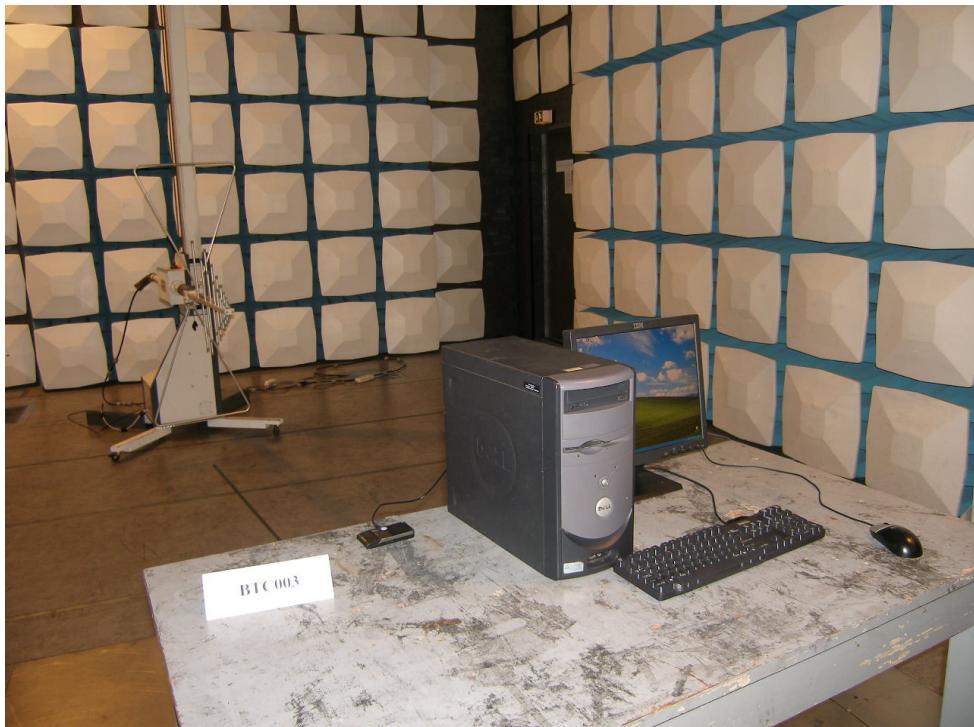
**Photograph 2: Set-up for Radiation Measurement below 1GHz**



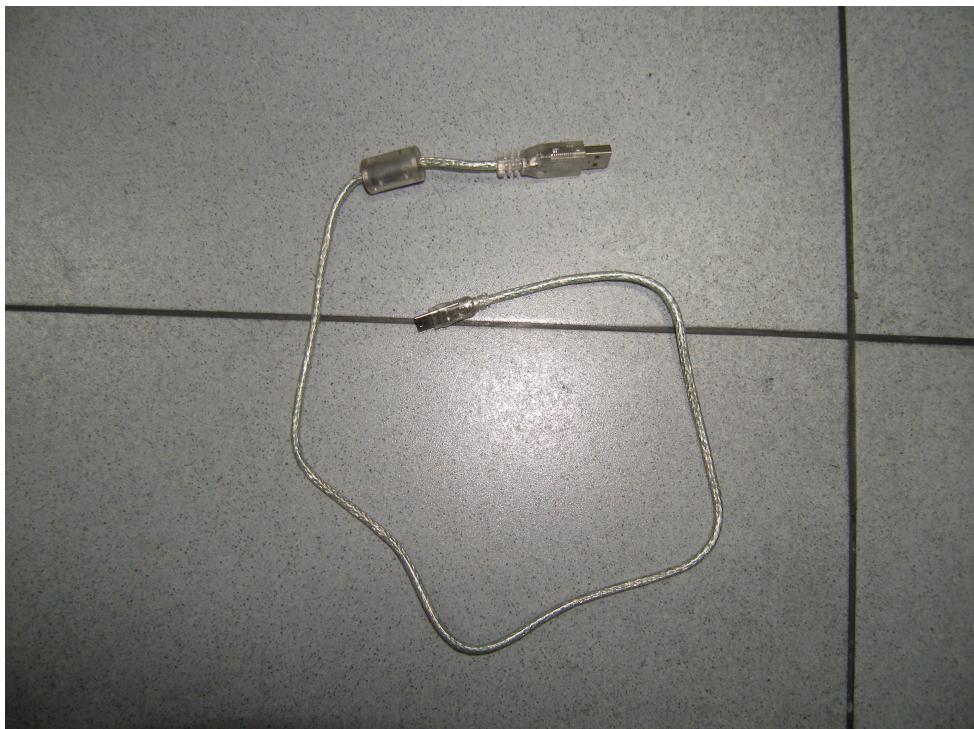
**Set up for 15.209(a)**

Prüfbericht - Nr.: **16019616 001**  
Test Report No.:

Seite 31 von 33  
Page 31 of 33



**Set up for 15.109(a)**

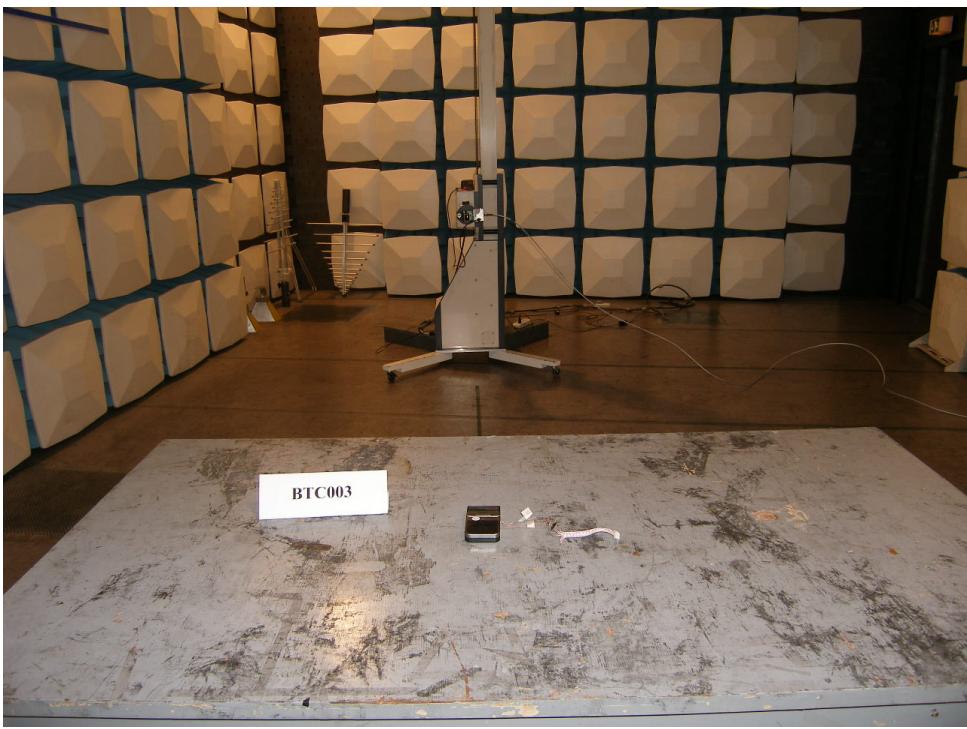


**USB cable**

Prüfbericht - Nr.: **16019616 001**  
Test Report No.:

Seite 32 von 33  
Page 32 of 33

**Photograph 3: Set-up for Radiation Measurement above 1GHz**



## 7 List of Tables

Table 1: List of Test and Measurement Equipment.....	6
Table 2: Disturbance Voltage on AC Mains (test result for 15.207(a)).....	15
Table 3: Radiated Emission (Bluetooth: Transmitting at channel low, test result for 15.209(a)).....	17
Table 4: Radiated Emission (Bluetooth: Transmitting at channel mid, test result for 15.209(a)).....	17
Table 5: Radiated Emission (Bluetooth: Transmitting at channel high, test result for 15.209(a)).....	18
Table 6: Peak Conducted Power .....	20
Table 7: 20dB Bandwidth .....	21
Table 8: Hopping Channel Carrier Frequency Separation.....	23
Table 9: Number of hopping frequency .....	24
Table 10: Dwell Time (DH5 mode) .....	26
Table 11: Out-Of-Band Emission measurement (conducted).....	28
Table 12: Band Edges Emission in the Restricted Bands by Marker Delta Method.....	28

## 8 List of Photographs

Photograph 1: Set-up for Conducted Emission.....	29
Photograph 2: Set-up for Radiation Measurement below 1GHz .....	30
Photograph 3: Set-up for Radiation Measurement above 1GHz.....	31