Table 3: Radiated Emission (Bluetooth: Transmitting at channel low, test result for 15.209(a))

Frequency	QP	AV	PK	Polarity	Limit		
					QP	AV	PK
[MHz]	[dBµV/m]			(H/V)	[dBµV/m]		
320.0	38.5	N/A	N/A	H	46.0	N/A	N/A
480.1	41.1	N/A	N/A	H	46.0	N/A	N/A
3204.0	N/A	31.2	42.5	H	N/A	54.0	74.0
4804.0	N/A	39.7	50.4	H	N/A	54.0	74.0
8463.0	N/A	33.0	46.2	H	N/A	54.0	74.0
22708.0	N/A	44.2	57.5	H	N/A	54.0	74.0
24195.0	N/A	42.6	55.0	H	N/A	54.0	74.0
241.2	20.6	N/A	N/A	V	46.0	N/A	N/A
288.0	22.5	N/A	N/A	V	46.0	N/A	N/A
1602.0	N/A	34.6	45.6	V	N/A	54.0	74.0
3204.0	N/A	33.1	42.6	V	N/A	54.0	74.0
4804.0	N/A	42.2	52.6	V	N/A	54.0	74.0
22754.0	N/A	44.3	56.8	V	N/A	54.0	74.0
24182.0	N/A	42.5	55.1	V	N/A	54.0	74.0
*)---							

Table 4: Radiated Emission (Bluetooth: Transmitting at channel mid, test result for 15.209(a))

Frequency	QP	AV	PK	Polarity	Limit		
					QP	AV	PK
[MHz]	[dBµV/m]			(H/V)	[dBµV/m]		
480.0	36.5	N/A	N/A	H	46.0	N/A	N/A
512.0	36.1	N/A	N/A	H	46.0	N/A	N/A
3253.0	N/A	32.1	42.5	H	N/A	54.0	74.0
4882.0	N/A	35.1	47.8	H	N/A	54.0	74.0
6034.0	N/A	30.8	44.3	H	N/A	54.0	74.0
22824.0	N/A	44.2	57.2	H	N/A	54.0	74.0
24167.0	N/A	42.4	54.6	H	N/A	54.0	74.0
192.0	21.1	N/A	N/A	V	43.5	N/A	N/A
512.0	26.5	N/A	N/A	V	46.0	N/A	N/A
1627.0	N/A	33.3	45.8	V	N/A	54.0	74.0
3252.5	N/A	26.2	39.4	V	N/A	54.0	74.0
4882.0	N/A	44.3	56.9	V	N/A	54.0	74.0
22743.0	N/A	44.2	57.0	V	N/A	54.0	74.0
24224.0	N/A	42.6	55.5	V	N/A	54.0	74.0
*)---							

Table 5: Radiated Emission (Bluetooth: Transmitting at channel high, test result for 15.209(a))

Frequency	QP	AV	PK	Polarity	Limit		
					QP	AV	PK
[MHz]	[dBµV/m]			(H/V)	[dBµV/m]		
480.0	35.2	N/A	N/A	H	46.0	N/A	N/A
640.0	35.7	N/A	N/A	H	46.0	N/A	N/A
3305.5	N/A	29.1	41.6	H	N/A	54.0	74.0
4960.0	N/A	34.0	49.0	H	N/A	54.0	74.0
7311.0	N/A	32.4	45.6	H	N/A	54.0	74.0
22666.0	N/A	43.9	56.3	H	N/A	54.0	74.0
25485.0	N/A	43.0	56.0	H	N/A	54.0	74.0
160.0	23.1	N/A	N/A	V	43.5	N/A	N/A
511.5	25.8	N/A	N/A	V	46.0	N/A	N/A
1653.0	N/A	39.9	47.2	V	N/A	54.0	74.0
4960.0	N/A	35.2	51.1	V	N/A	54.0	74.0
22847.0	N/A	44.1	56.7	V	N/A	54.0	74.0
25449.0	N/A	43.0	55.1	V	N/A	54.0	74.0
*)---							

*) Note:
The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz at frequency below 1GHz.

The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz at frequency above 1GHz.

Measurement is made from 9kHz to 25 GHz. Disturbances other than those mentioned above are small or not detectable.

Refer to Appendix 1 for the test result for 15.109(a)

5.3 Antenna requirement

RESULT: **Pass**

Date of testing	:	---
Test specification	:	FCC Part 15 Per Section 15.203 FCC Part 15 Per Section 15.247(b)

For intentional device, according to 15.203, and intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

And according to 15.247(b), if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by amount in dB than the directional gain of the antenna exceeds of 6dBi.

As the BT antenna is permanently printed on RF Board, there is no consideration of replacement.

And the max gain of the antenna is 0dBi.

5.4 Maximum Peak Output Power

RESULT: **Pass**

Date of testing	:	Sep. 25, 2009
Test specification	:	FCC Part 15 Per Section 15.247(b)(1)
Limits	:	FCC Part 15 Per Section 15.247(b)(1) For frequency hopping systems operating in the band 2400-2483.5 MHz employing at least 75 hopping channels, the maximum peak conducted output power shall not exceed 1 W; for all other frequency hopping systems in the band, the maximum peak conducted output power shall not exceed 0.125 W.
Deviations from Standard Test procedures	:	None
Test procedure	:	Procedure specified in ANSI C63.4
Kind of test site	:	Shielded room
Operation mode	:	Bluetooth continuously transmitting on the measured channel.
Power supply	:	DC 3.7V
Temperature	:	22°C
Humidity	:	52%

Table 6: Peak Conducted Power

Channel	Frequency (MHz)	Power Reading(dBm)	Cable Loss (dB)	Output Power		Limit (mW) *
				(dBm)	(mW)	
Low	2402.2	5.57	0.40	5.97	3.95	1000
Mid	2440.8	5.22	0.40	5.62	3.64	1000
High	2479.8	4.87	0.40	5.27	3.37	1000
*Note: Refer to the test result of "Number of Hopping Channel Used" for the non-overlap channel number.						

5.5 20dB Bandwidth

RESULT: **Pass**

Date of testing	:	Sep. 25, 2009
Test specification	:	FCC Part 15 Per Section 15.247(a)(1)
Limits	:	FCC Part 15 Per Section 15.247(b)(1) Frequency hopping systems operating in the band 2400-2483.5 MHz may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 0.125W.
Deviations from Standard Test procedures	:	None
Test procedure	:	Procedure specified in ANSI C63.4
Operation mode	:	Bluetooth continuously transmitting on the measured channel.
Kind of test site	:	Shielded room
Power supply	:	DC 3.7V
Temperature	:	22°C
Humidity	:	52%

Test procedure:

1. Connect the antenna port of the EUT to the spectrum analyzer by a low lost cable.
2. Set the EUT to proper test mode with relative test software and hardware.
3. Spectrum analyzer setting: Centered Frequency= measured channel, RBW=10kHz, VBW=30kHz.
4. Mark the peak power frequency point and the -20dB upper and lower frequency points.
5. Read the frequency delta value between the -20dB upper and lower frequency points.
6. Repeat step 2 to 5 until all the channels required are finished.

Table 7: 20dB Bandwidth

Channel	Frequency (GHz)	Test Result (kHz)
Low	2402.0	920
Mid	2441.0	920
High	2480.0	916

Please refer to Appendix 1 for measurement data.

5.6 Hopping Channel Carrier Frequency Separation

RESULT: **Pass**

Date of testing	:	Sep. 25, 2009
Test specification	:	FCC Part 15 Per Section 15.247(a)(1)
Limits	:	FCC Part 15 Per Section 15.247(a)(1) Frequency hopping systems operating in the band 2400-2483.5 MHz may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 0.125W.
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 lost cable.
2. Set the EUT to proper test mode with relative test software and hardware.
3. Spectrum analyzer setting: Centered Frequency = measured channel, RBW = 30 kHz, VBW = 100 kHz, Frequency Span = wide enough to cover the adjacent channel.
4. Mark the peak power frequency point of the measured channel and its adjacent channel(s)
5. Read the frequency delta value between the measured channel and its adjacent channel(s)
6. Repeat step 3 to 5 until all the channels measured are finished.

Table 8: Hopping Channel Carrier Frequency Separation

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

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 lost cable.
2. Set the EUT to proper test mode with relative test software and hardware.
3. Spectrum analyzer setting: RBW = 100 kHz, VBW≥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℃
Humidity	:	55%

Test procedure:

1. Connect the antenna port of the EUT to the spectrum analyzer by a low lost 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≥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 **106.81**) = 316.16	400
Mid	2.441	2.960	(2.960 x **106.81**) = 316.16	400
High	2.480	2.960	(2.960 x **106.81**) = 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) x 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)
		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.
		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).
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 lost cable.
2. Set the EUT to proper test mode with relative test software and hardware.
3. Spectrum analyzer setting: RBW = 100 kHz, VBW≥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)

Emission (Carrier operating at Channel low, mid and high)	**Attenuation**	**Limit (dB)**
30MHz to 25GHz	All emission in this 100kHz bandwidth are attenuated more than 20dB from the carrier	△≥20

Note: Refer to Appendix 1 for measurement data.

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

Frequency [MHz]	**dBc** [dB]	**PK** [dBμV/m]	**AV** [dBμV/m]	**Polarity** (H/V)	**PK limit** [dBμV/m]	**AV limit** [dBμV/m]
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 92.46dBuV/m, 93.93dBuV/m. The above field strength levels were measured in horizontal polarity which is the worst case.

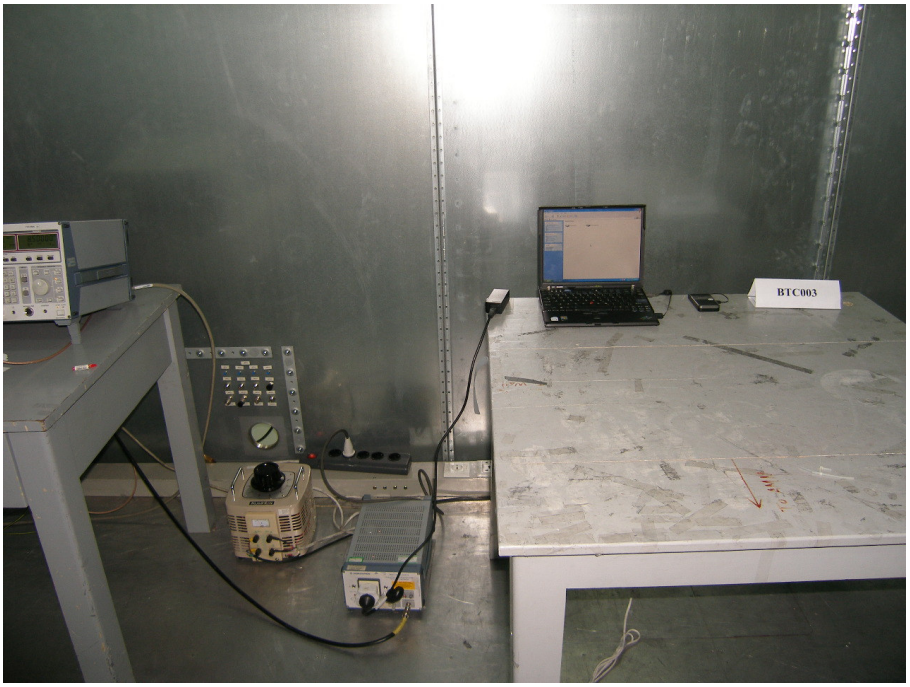
2. The dBc value between the carrier maximum power and band edge emission power of the frequency listed in the table is calculated from the test record showed in Appendix 1.

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

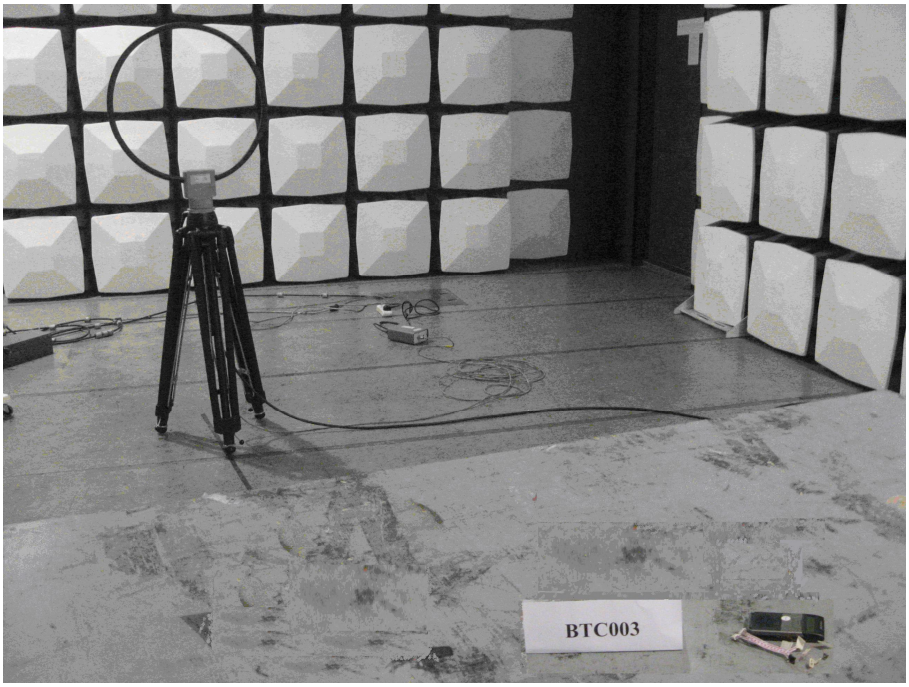
Photograph 1: Set-up for Conducted Emission

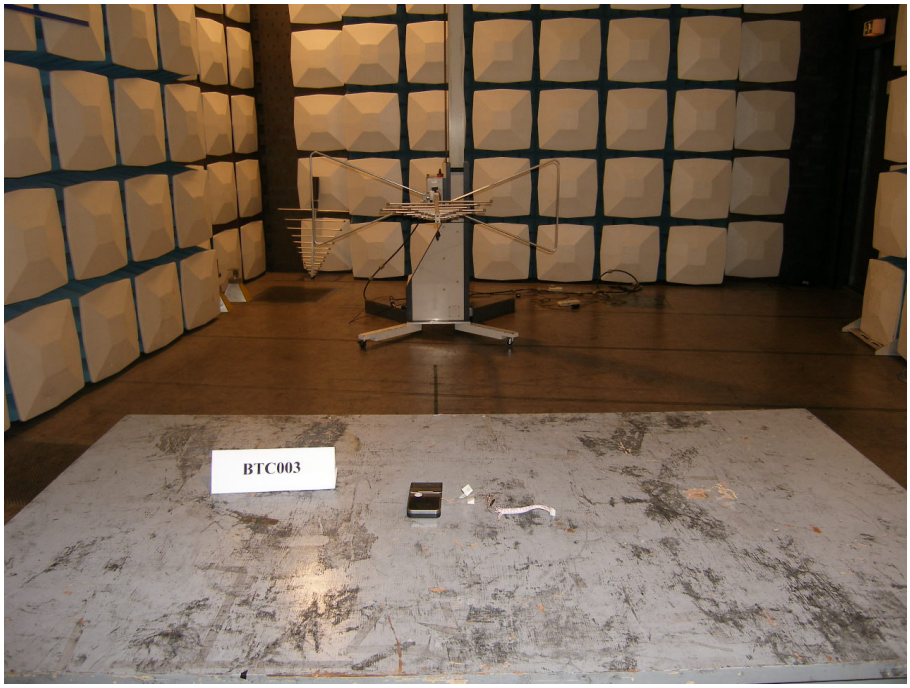


Set up for 15.209(a)

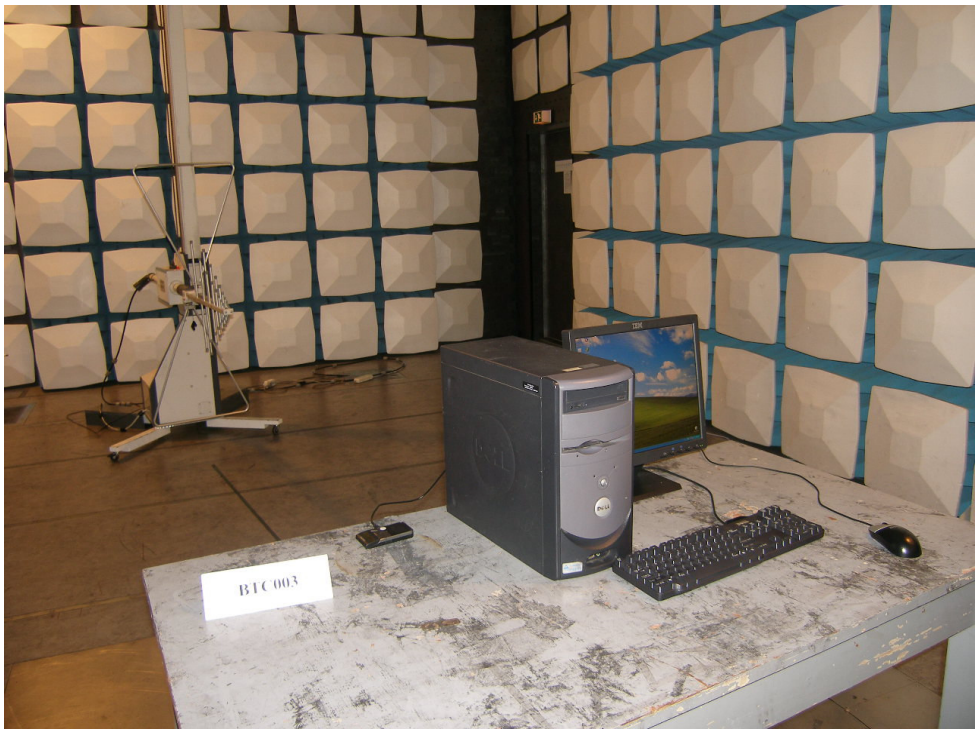
Set up for 15.109(a)

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

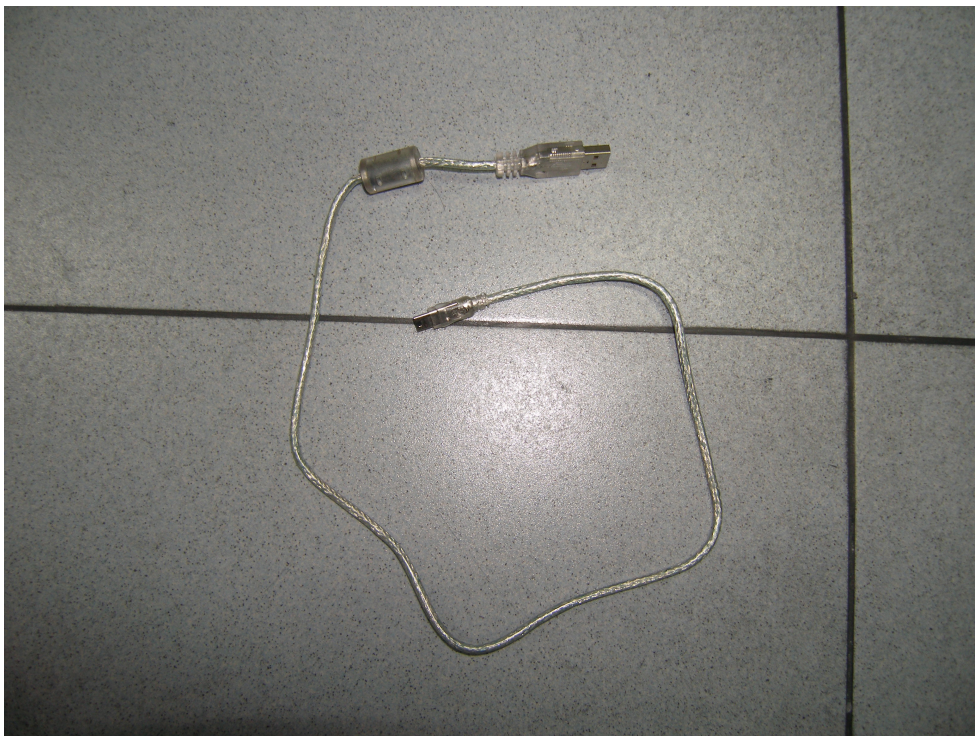




Set up for 15.209(a)

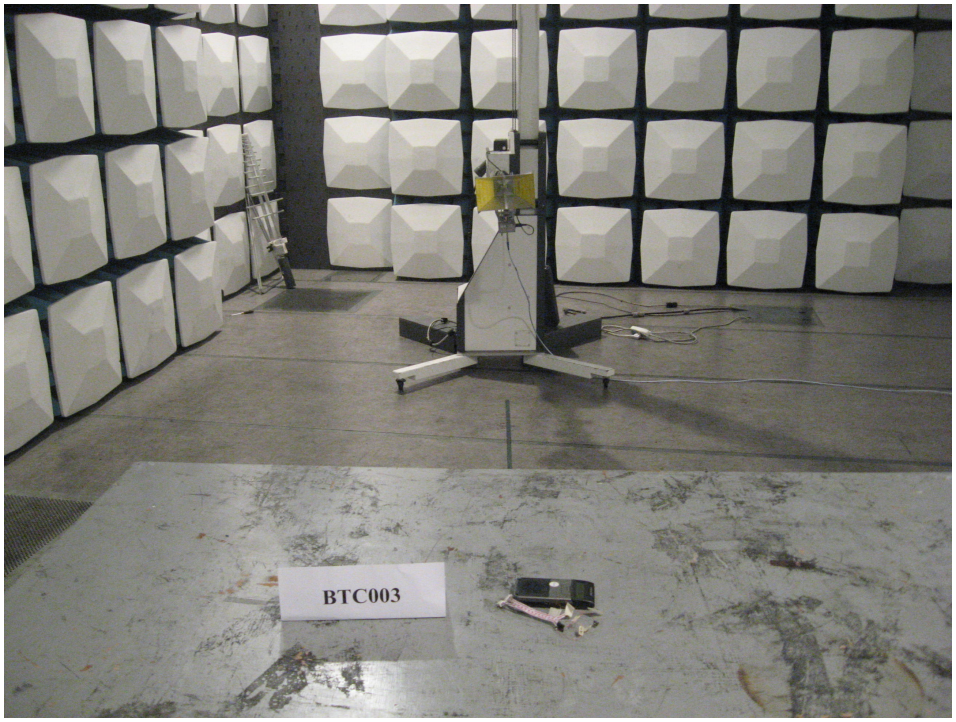


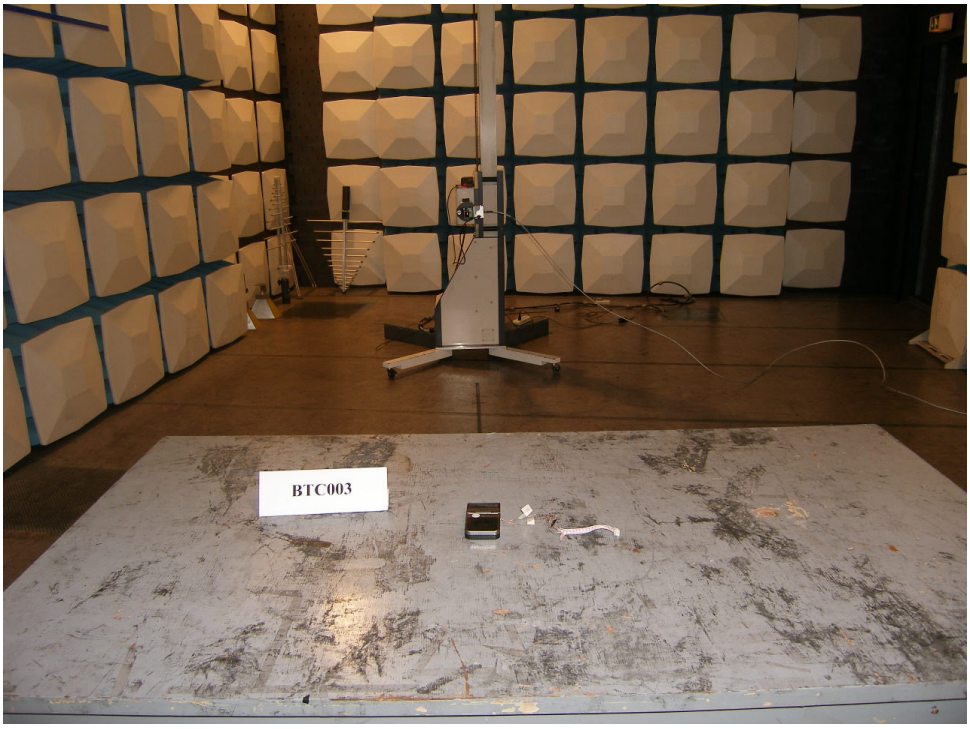
Set up for 15.109(a)



USB cable

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





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