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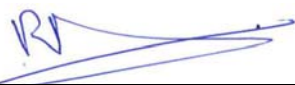
Report Reference ID:	160138-1TRFWL
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Test specification:	<p>Title 47 - Telecommunication          Chapter I - Federal Communications Commission          Subchapter A - General          Part 15 - Radio Frequency Devices          Subpart C - Intentional Radiators</p> <p><b>§15.247</b> - Operation within the bands 902–928 MHz, 2400–2483.5 MHz and 5725–5850 MHz</p>
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Applicant:	<p>Mitel Networks Corporation          350 Legget Drive          Kanata, ON, Canada          K2K 2W7</p>
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Apparatus:	Bluetooth Module
Model:	Bluetooth Module
FCC ID:	EHTBT1

Testing laboratory:	<p>Nemko Canada Inc.          303 River Road          Ottawa, ON, Canada          K1V 1H2</p> <p>Telephone: (613) 737-9680          Facsimile: (613) 737-9691</p>
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	Name and title	Date
Tested by:	David Duchesne, Wireless/EMC Specialist	November 25, 2010
Reviewed by:	 Richard Brazeau, Laboratory Manager	November 25, 2010



Nemko Canada Inc., a testing laboratory, is accredited by the Standards Council of Canada.  
 The tests included in this report are within the scope of this accreditation.

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## Section 1: Report summary

### 1.1 Test specification

FCC Part 15 Subpart C, 15.247

Operation within the bands 902–928 MHz, 2400–2483.5 MHz and 5725–5850 MHz.

### 1.2 Statement of compliance

In the configuration tested the EUT was found compliant

This report contains an assessment of apparatus against specifications based upon tests carried out on samples submitted at Nemko Canada Inc. These tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with Part 15; Subpart C. Radiated tests were conducted in accordance with ANSI C63.4-2003.

### 1.3 Exclusions

None

### 1.4 Registration number

Test site FCC ID number: 176392 (3 m Semi anechoic chamber)

### 1.5 Test report revision history

Revision #	Details of changes made to test report
TRF	Original report issued

### 1.6 Limits of responsibility

Note that the results contained in this report relate only to the items tested and were obtained in the period between the date of initial receipt of samples and the date of issue of the report.

This test report has been completed in accordance with the requirements of ISO/IEC 17025. All results contain in this report are within Nemko Canada's ISO/IEC 17025 accreditation.

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## Section 2: Summary of test results

### 2.1 FCC Part 15 Subpart C – Intentional Radiators, test results

#### General requirements for FCC Part 15

Part	Test description	Verdict
§15.31(e)	Variation of power source	See Notes 1
§15.31(m)	Number of operating frequencies	See Notes 2
§15.203	Antenna requirement	See Notes 2
§15.207(a)	Conducted limits	Pass

#### Specific requirements for FCC Part 15 Subpart C, 15.247

Part	Test description	Verdict
§15.247(a)(1)(i)	Frequency hopping systems operating in the 902–928 MHz band	N/A
§15.247(a)(1)(ii)	Frequency hopping systems operating in the 5725–5850 MHz band	N/A
§15.247(a)(1)(iii)	Frequency hopping systems operating in the 2400–2483.5 MHz band	Pass
§15.247(a)(2)	Minimum 6 dB bandwidth for systems using digital modulation techniques	N/A
§15.247(b)(1)	Maximum peak output power of frequency hopping systems operating in the 2400–2483.5 MHz band and 5725–5850 MHz band	Pass
§15.247(b)(2)	Maximum peak output power of Frequency hopping systems operating in the 902–928 MHz band	N/A
§15.247(b)(3)	Maximum peak output power of systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands	N/A
§15.247(b)(4)	Maximum peak output power	N/A
§15.247(c)(1)	Fixed point-to-point operation with directional antenna gains greater than 6 dBi	N/A
§15.247(c)(2)	Transmitters operating in the 2400–2483.5 MHz band that emit multiple directional beams	N/A
§15.247(d)	Spurious emissions	Pass
§15.247(e)	Power spectral density for digitally modulated devices	N/A
§15.247(f)	Time of occupancy for hybrid systems	N/A

Notes:

1. Transmit output power was measured while supply voltage was varied from 102 to 138 VAC (85 to 115 % of the nominal rated supply voltage). No change in transmit output power was observed.
2. The frequency band is 83.5 MHz (2400 to 2483.5 MHz) therefore number of operating frequencies is test was 3 (low, mid, high).
3. The antenna used for this product is Internal Patch antenna that no antenna other than that furnished by the responsible party shall be used with the device, The maximum peak gain of this antenna is 0 dBi.

## Section 3: Equipment under test (EUT) and application details

### 3.1 Product details

Product name:	Bluetooth module
Model name/number:	Bluetooth module
Serial number:	1007000143

### 3.2 Sample information

Receipt date:	November 10, 2010
Nemko sample ID number:	Item # 4

### 3.3 EUT technical specifications

Operating band:	2400 – 2483.5 MHz
Operating frequency:	2402 – 2480 MHz
Modulation type:	Bluetooth (GFSK, PI/4 DQPSK, and 8DPSK)
Number of channels:	79
Channel spacing:	1 MHz
Antenna type:	Integral (0 dBi)
Power source:	120/60Hz VAC (Powered via host unit that connects to AC Mains)

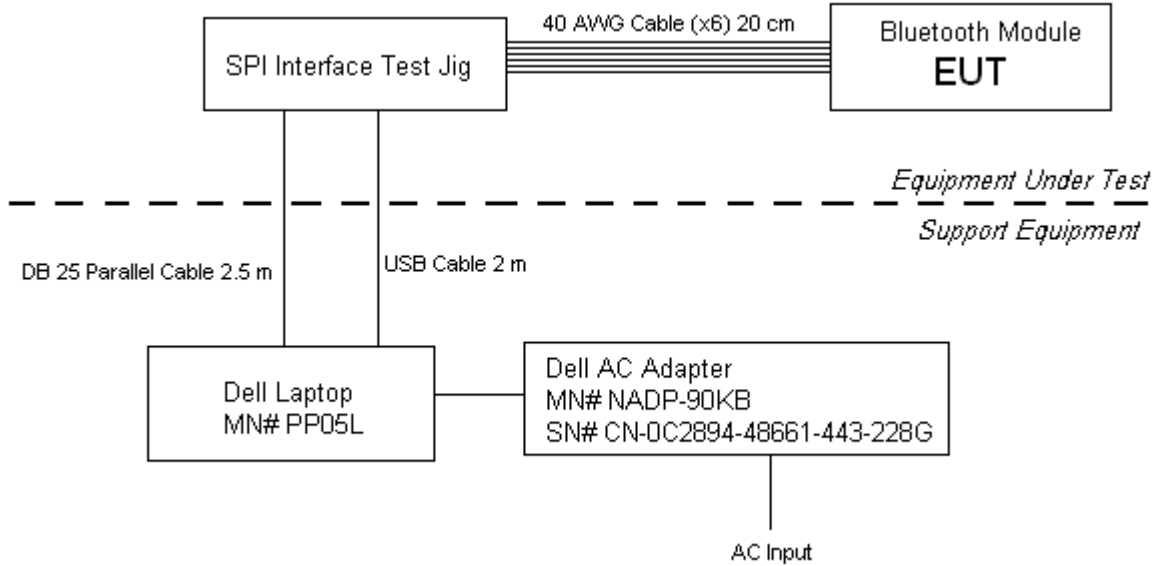
### 3.4 EUT description

The Bluetooth Module connects to a 5330/5340/5360 IP Phone to enable adding a Bluetooth Cordless Handset and Charging Plate or • A 3rd-party Bluetooth headset.

### 3.5 Operation of the EUT during testing

The EUT was controlled to transmit or receive at desired frequency from remote PC

3.6 EUT setup diagram



## Section 4: Engineering considerations

### 4.1 Modifications incorporated in the EUT

There were no modifications performed to the EUT during this assessment.

### 4.2 Technical judgment

None

### 4.3 Deviations from laboratory tests procedures

No deviations were made from laboratory test procedures.

## Section 5: Test conditions

### 5.1 Power source and ambient temperatures

#### Normal temperature, humidity and air pressure test conditions

Temperature: 15–30 °C  
Relative humidity: 20–75 %  
Air pressure: 86–106 kPa

When it is impracticable to carry out tests under these conditions, a note to this effect stating the ambient temperature and relative humidity during the tests shall be recorded and stated.

#### Power supply range

The normal test voltage for equipment to be connected to the mains shall be the nominal mains voltage. For the purpose of the present document, the nominal voltage shall be the declared voltage, or any of the declared voltages  $\pm 5\%$ , for which the equipment was designed.



## Section 6: Measurement uncertainty

Nemko Canada measurement uncertainty has been calculated using guidance of UKAS LAB 34:2003 and TIA-603-B Nov 7, 2002. All calculations have been performed to provide a confidence level of 95 % and can be found in Nemko Canada document MU-003.



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## Section 7: Test equipment

### 7.1 Test equipment list

Equipment	Manufacturer	Model no.	Asset no.	Cal cycle	Next cal.
3 m EMI test chamber	TDK	SAC-3	FA002047	1 year	Mar. 09/11
Receiver/spectrum analyzer	Rohde & Schwarz	ESU 26	FA002043	1 year	Jan. 14/11
Receiver/spectrum analyzer	Rohde & Schwarz	ESU 40	FA002071	1 year	Nov. 30/10
Bilog antenna	Sunol	JB3	FA002108	1 year	Jan. 18/11
Horn antenna #2	Emco	3115	FA000825	1 year	Jan. 18/11
Horn antenna #1	Emco	3115	FA000649	1 year	Feb 09/11
Horn 18–26.5 GHz	Electro-metrics	SH-50/60-1	FA000479	—	COU
1–18 GHz amplifier	JCA	JCA118-503	FA002091	1 year	Sept. 23/11
18–26 GHz amplifier	Narda	BBS-1826N612	FA001550	—	COU
50 coax cable	Huber + Suhner	NONE	FA002013	1 year	Sept. 01/11
50 coax cable	Huber + Suhner	NONE	FA002074	1 year	July 13/11
LISN	Tegam	95300-50	FA000986	1 year	Jan. 22/11
LISN	Tegam	95300-50	FA000987	1 year	Jan. 22/11
Temperature chamber	Thermotron	SM-16C	FA001030	1 year	NCR
Multimeter	Fluke	16	FA001831	1 year	Jan. 12/11
Air probe	Fluke	NONE	FA001561	—	NCR

Note: N/A = not applicable, NCR = no cal required, COU = cal on use, OUT = out for cal/repair



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<b>Section 8: Testing data</b>		<b>Product: Bluetooth Module</b>	
<b>Test name: Clause 15.207(a) Conducted limits</b>			
<b>Test date: November 04, 2010</b>		<b>Test engineer: David Duchesne</b>	<b>Verdict: Pass</b>
<b>Specification: FCC Part 15 Subpart C</b>			

## Section 8: Testing data

### 8.1 Clause 15.207(a) Conducted limits

#### § 15.207 Conducted limits.

(a) Except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50  $\mu$ H/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

Frequency of emission (MHz)	Conducted limit (dB $\mu$ V)	
	Quasi-peak	Average
0.15–0.5	66 to 56*	56 to 46*
0.5–5	56	46
5–30	60	50

\*-Decreases with the logarithm of the frequency.

#### Special notes

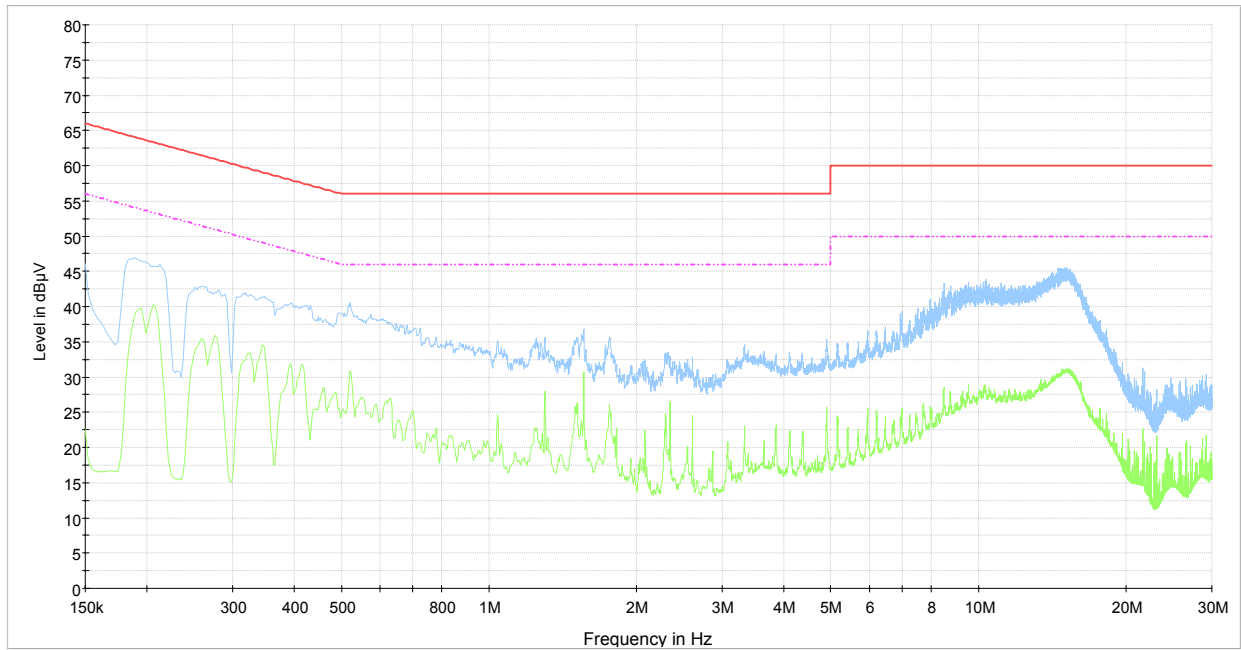
None



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<b>Section 8: Testing data</b>		<b>Product: Bluetooth Module</b>	
<b>Test name: Clause 15.207(a) Conducted limits</b>			
<b>Test date: November 04, 2010</b>		<b>Test engineer: David Duchesne</b>	<b>Verdict: Pass</b>
<b>Specification: FCC Part 15 Subpart C</b>			

**Test data**



120VAC 60Hz Phase Line  
 — CISPR 22 Mains QP Class B Limit  
 - - - CISPR 22 Mains AV Class B Limit  
 Preview Peak Detector  
 Preview Average Detector

The spectral scan has been corrected with transducer factors (i.e. cable loss, LISN factors, and attenuators) for determination of compliance.

A preview measurement was generated with the receiver in continuous scan mode Emissions detected within 6 dB or above limit were re-measured with the appropriate detector against the correlating limit and recorded as the final measurement.

**Receiver/Spectrum analyzer settings:**

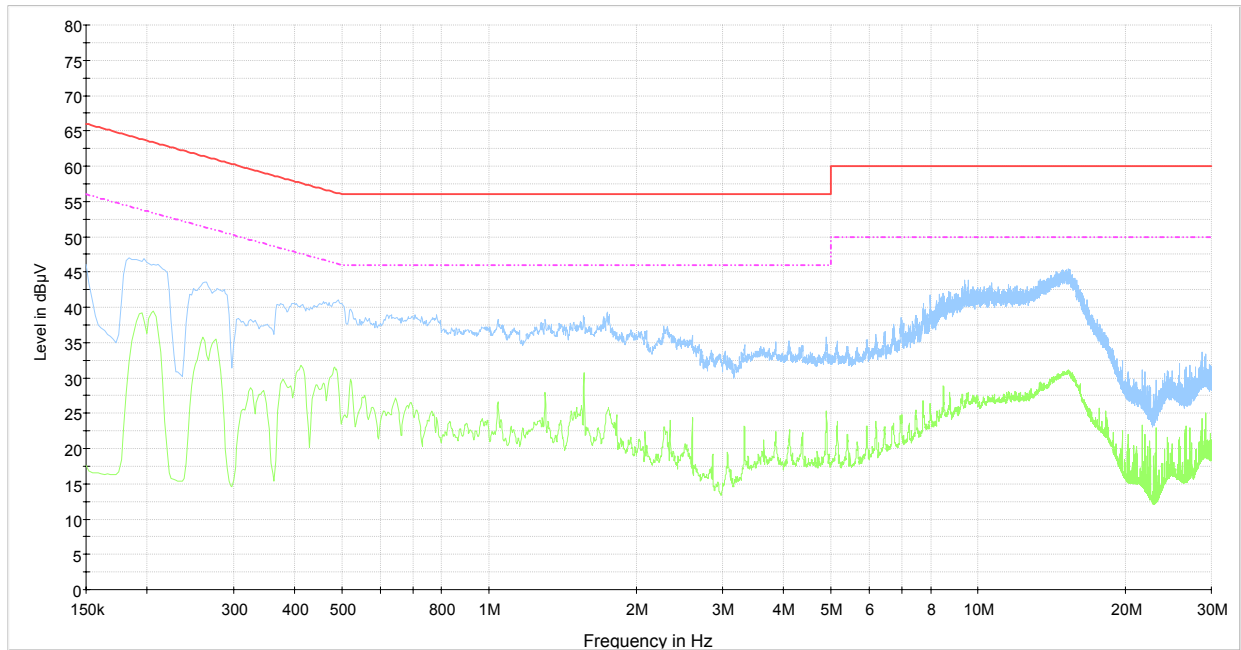
<b>Preview measurements</b>	<b>Final measurement</b>
Receiver: 9 kHz RBW, Peak and Average detector, max hold	Receiver: 9 kHz RBW, Quasi-peak and Average detector
Measurement time 100 ms	



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<b>Section 8: Testing data</b>		<b>Product: Bluetooth Module</b>	
<b>Test name: Clause 15.207(a) Conducted limits</b>			
<b>Test date: November 04, 2010</b>		<b>Test engineer: David Duchesne</b>	<b>Verdict: Pass</b>
<b>Specification: FCC Part 15 Subpart C</b>			

Test data, continued



- 120VAC 60Hz Neutral Line
- CISPR 22 Mains QP Class B Limit
- - - CISPR 22 Mains AV Class B Limit
- Preview Peak Detector
- Preview Average Detector

The spectral scan has been corrected with transducer factors (i.e. cable loss, LISN factors, and attenuators) for determination of compliance.

A preview measurement was generated with the receiver in continuous scan mode. Emissions detected within 6 dB or above limit were re-measured with the appropriate detector against the correlating limit and recorded as the final measurement.

Receiver/Spectrum analyzer settings:

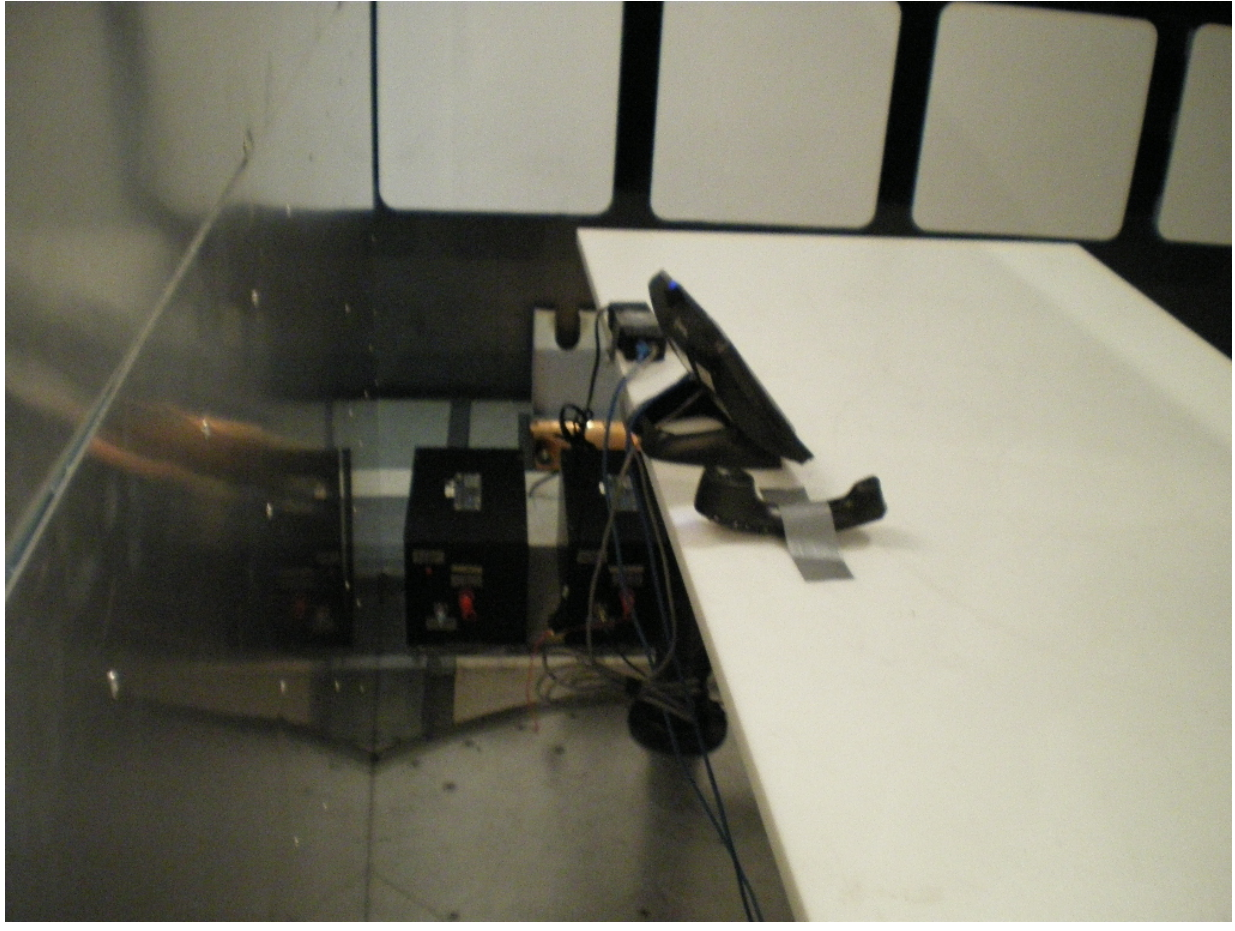
Preview measurements	Final measurement
Receiver: 9 kHz RBW, Peak and Average detector, max hold	Receiver: 9 kHz RBW, Quasi-peak and Average detector
Measurement time 100 ms	



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<b>Section 8: Testing data</b>		<b>Product: Bluetooth Module</b>	
<b>Test name: Clause 15.207(a) Conducted limits</b>			
<b>Test date: November 04, 2010</b>		<b>Test engineer: David Duchesne</b>	<b>Verdict: Pass</b>
<b>Specification: FCC Part 15 Subpart C</b>			

Setup photo





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<b>Section 8: Testing data</b>		<b>Product: Bluetooth Module</b>	
<b>Test name: Clause 15.247(a)(1) (iii) Frequency hopping requirements</b>			
<b>Test date: November 18, 2010</b>		<b>Test engineer: David Duchesne</b>	<b>Verdict: Pass</b>
<b>Specification: FCC Part 15 Subpart C</b>			

## 8.2 Clause 15.247(a)(1) (iii) Frequency hopping requirements

### § 15.247 Operation within the bands 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz.

- (a) Operation under the provisions of this Section is limited to frequency hopping and digitally modulated intentional radiators that comply with the following provisions:
- (1) Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400–2483.5 MHz band 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 125 mW. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.
    - (iii) 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. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

### Special notes

- Tests performed with modulation enabled.
- RF power level is not user adjustable, all measurements were made with the highest power level available to the user for that combination.
- Client provided a temporary antenna connector.



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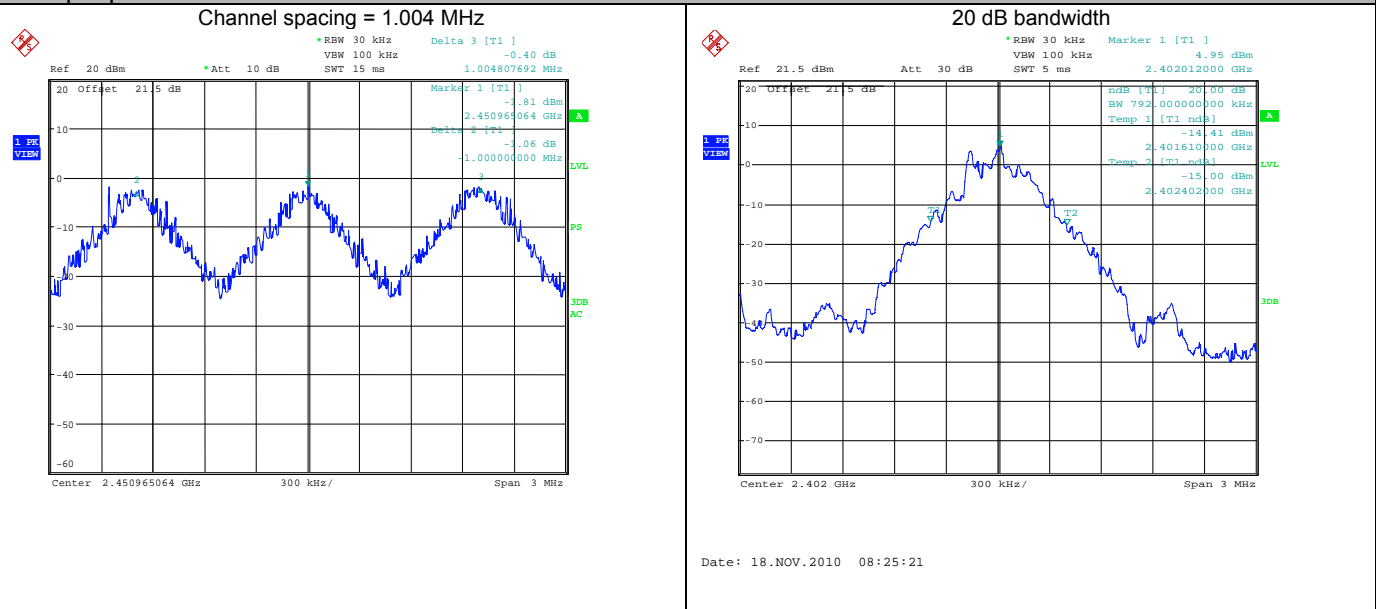
<b>Section 8: Testing data</b>		<b>Product: Bluetooth Module</b>	
<b>Test name: Clause 15.247(a)(1) (iii) Frequency hopping requirements</b>			
<b>Test date: November 18, 2010</b>	<b>Test engineer: David Duchesne</b>		<b>Verdict: Pass</b>
<b>Specification: FCC Part 15 Subpart C</b>			

## Test data

### Carrier frequency separation

### Measured result

#### Sample plots



#### Channel spacing = 1.004 MHz

- Low Channel:** 20 dB Bandwidth = 0.792 MHz
- Mid Channel:** 20 dB Bandwidth = 0.762 MHz
- High Channel:** 20 dB Bandwidth = 0.762 MHz

#### Measurement details

##### Carrier Frequency Separation

- The EUT's hopping function was enabled.
- Spectrum analyzer settings:
  - Span = wide enough to capture the peaks of two adjacent channels
  - Resolution Bandwidth (RBW)  $\geq$  1% of the span
  - Video (or Average) Bandwidth (VBW)  $\geq$  RBW
  - Sweep = auto
  - Detector function = peak
  - Trace = max hold

##### 20 dB Bandwidth

###### Spectrum analyzer settings:

- Span = approximately 2 to 3 times the 20 dB bandwidth, centered on a hopping channel
- RBW  $\geq$  1% of the 20 dB bandwidth
- VBW  $\geq$  RBW
- Sweep = auto
- Detector function = peak
- Trace = max hold





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**Section 8: Testing data**

**Product: Bluetooth Module**

**Test name: Clause 15.247(a)(1) (iii) Frequency hopping requirements**

**Test date: November 18, 2010**

**Test engineer: David Duchesne**

**Verdict: Pass**

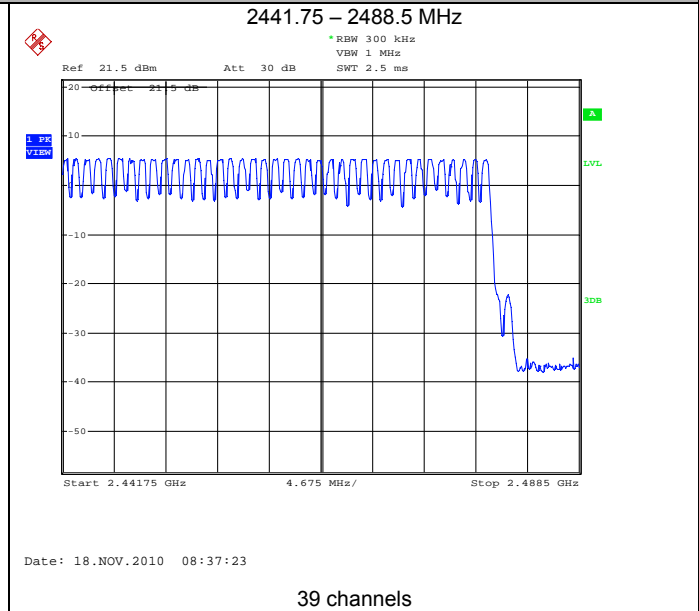
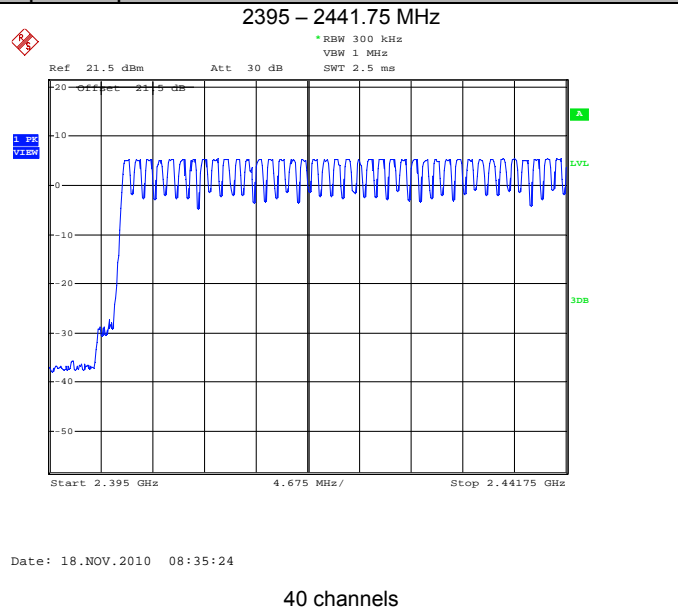
**Specification: FCC Part 15 Subpart C**

**Test data**

Number of hopping frequencies

Measured result

**Spectral plots**



EUT utilizes 79 (40 +39) hopping channels (limit is 15)

**Measurement details**

- The EUT's hopping function enabled.
- Spectrum analyzer settings:
  - Span = the frequency band of operation
  - RBW = 300 kHz
  - VBW ≥ RBW
  - Sweep = auto
  - Detector function = peak
  - Trace = max hold



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Section 8: Testing data

Product: Bluetooth Module

Test name: Clause 15.247(a)(1) (iii) Frequency hopping requirements

Test date: November 18, 2010

Test engineer: David Duchesne

Verdict: Pass

Specification: FCC Part 15 Subpart C

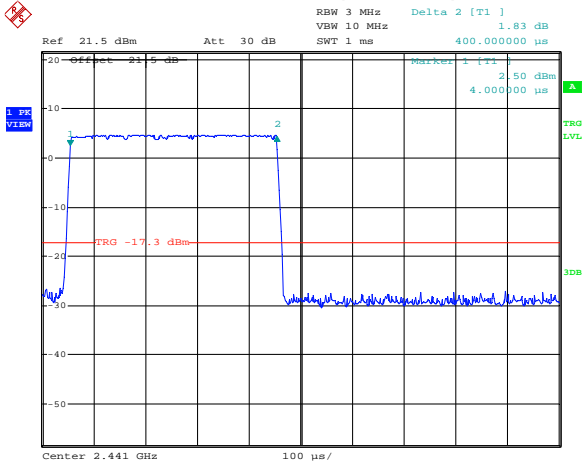
Test data, continued

Average time of occupancy

Measured result

Spectral plots

GSFK 1-slot (Dwell time)



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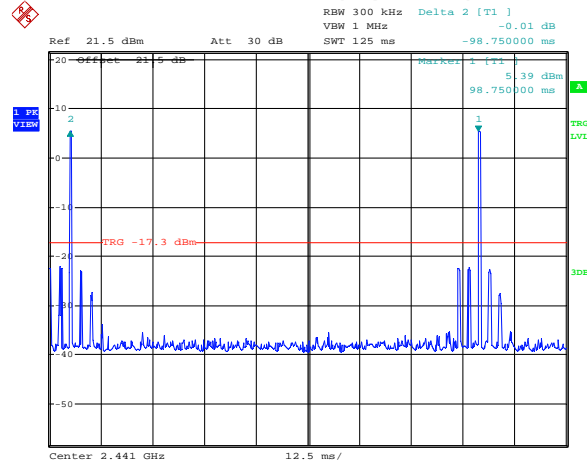
- Dwell time = 0.4 ms
- Hop interval = 98.75 ms
- Period = 0.4 (seconds/channel) x 79 (channel) = 31.6 s

Average time of occupancy = (Period / hop interval) \* Dwell time

Average time of occupancy = (31.6 s / 0.09875 s) \* 0.0004 s

Average time of occupancy = 128 ms

GSFK 1-slot (Hop interval)



Date: 18.NOV.2010 08:52:17



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Section 8: Testing data

Product: Bluetooth Module

Test name: Clause 15.247(a)(1) (iii) Frequency hopping requirements

Test date: November 18, 2010

Test engineer: David Duchesne

Verdict: Pass

Specification: FCC Part 15 Subpart C

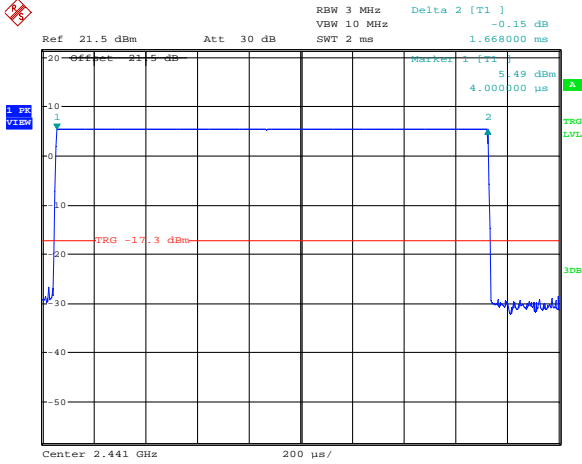
Test data, continued

Average time of occupancy, continued

Measured result, continued

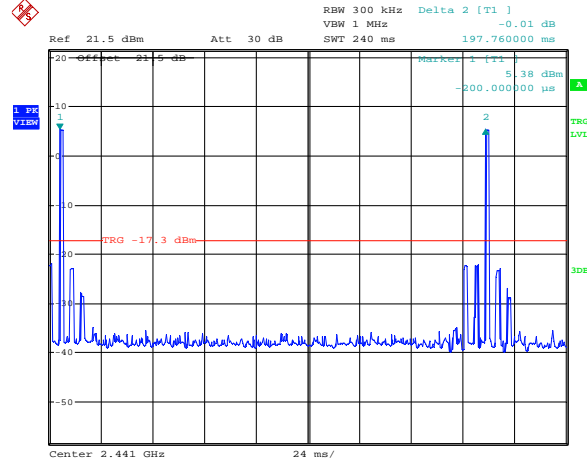
Spectral plots

GSFK 3-slot (Dwell time)



Date: 18.NOV.2010 08:46:51

GSFK 3-slot (Hop interval)



Date: 18.NOV.2010 08:53:32

- Dwell time = 1.67 ms
- Hop interval = 197.76 ms
- Period = 0.4 (seconds/channel) x 79 (channel) = 31.6 s

Average time of occupancy = (Period / hop interval) \* Dwell time

Average time of occupancy = (31.6 s / 0.19776 s) \* 0.00167 s

Average time of occupancy = 267 ms



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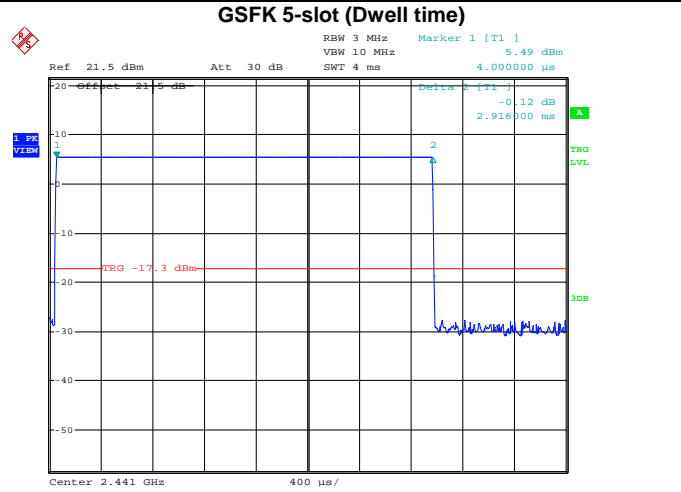
<b>Section 8: Testing data</b>		<b>Product: Bluetooth Module</b>	
<b>Test name: Clause 15.247(a)(1) (iii) Frequency hopping requirements</b>			
<b>Test date: November 18, 2010</b>		<b>Test engineer: David Duchesne</b>	<b>Verdict: Pass</b>
<b>Specification: FCC Part 15 Subpart C</b>			

**Test data, continued**

**Average time of occupancy, continued**

**Measured result, continued**

**Spectral plots**



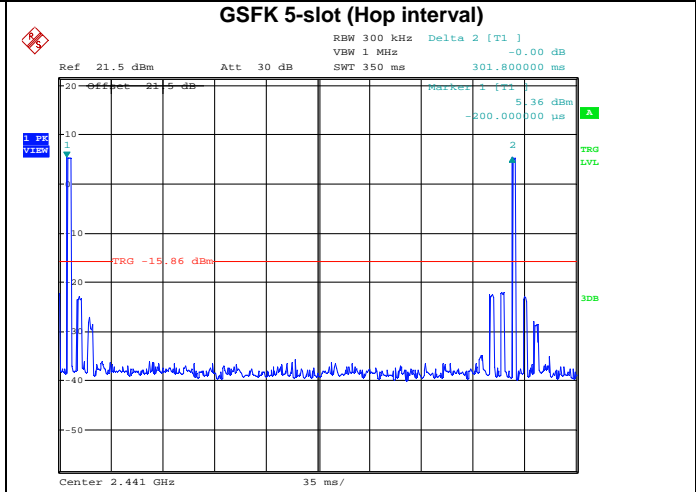
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- Dwell time = 2.916 ms
- Hop interval = 301.8 ms
- Period = 0.4 (seconds/channel) x 79 (channel) = 31.6 s

Average time of occupancy = (Period / hop interval) \* Dwell time  
 Average time of occupancy = (31.6 s / 0.3018 s) \* 0.002916 s  
 Average time of occupancy = 305.3 ms

**Measurement details**

- The EUT's hopping function enabled.
- Spectrum analyzer settings:
  - Span = zero span, centered on a hopping channel
  - RBW = 1 MHz, VBW ≥ RBW
  - Sweep = as necessary to capture the entire dwell time per hopping channel
  - Detector function = peak
  - Trace = max hold



Date: 18.NOV.2010 08:57:04



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<b>Section 8: Testing data</b>		<b>Product: Bluetooth Module</b>	
<b>Test name: Clause 15.247(b)(1) Maximum peak conducted output power</b>			
<b>Test date: November 18, 2010</b>		<b>Test engineer: David Duchesne</b>	<b>Verdict: Pass</b>
<b>Specification: FCC Part 15 Subpart C</b>			

### 8.3 Clause 15.247(b) (1) Maximum peak conducted output power

#### § 15.247 Operation within the bands 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz.

(b) The maximum peak conducted output power of the intentional radiator shall not exceed the following:

- (1) 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.

#### Special notes

- Tests performed with modulation enabled.
- RF power level is not user adjustable, all measurements were made with the highest power level available to the user for that combination.
- Client provided a temporary antenna connector.

#### Test data

##### Measured results

Conducted output power				
Frequency (MHz)	Modulation	Conducted output power (dBm)	Limit (dBm)	Margin (dB)
2402	GFSK (1-slot)	5.46	30	24.54
2441	GFSK (1-slot)	5.56	30	24.44
2480	GFSK (1-slot)	5.46	30	24.54

EIRP calculation						
Frequency (MHz)	Modulation	Conducted output power (dBm)	Antenna Factor (dBi)	EIRP (dBm)	EIRP Limit (dBm)	Margin (dB)
2402	GFSK (1-slot)	5.46	0	5.46	36	30.54
2441	GFSK (1-slot)	5.56	0	5.56	36	30.44
2480	GFSK (1-slot)	5.46	0	5.46	36	30.54

EIRP = Conducted output power [dBm] + antenna gain [dBi]  
Antenna gain = 0 dBi

Maximum output power = 5.56 dBm                      Limit = 30 dBm  
Maximum EIRP = 5.56 dBm                                Limit = 36 dBm

All test modulation and data rates were verified. Only the worst-case results have been recorded.

##### Measurement details

Spectrum analyzer setting:

- Span = approximately 5 times the 20 dB bandwidth, centered on a hopping channel
- RBW > the 20 dB bandwidth of the emission being measured (Measured 20 dB bandwidth was 0.792 MHz)
- VBW ≥ RBW
- Sweep = auto
- Detector function = peak
- Trace = max hold

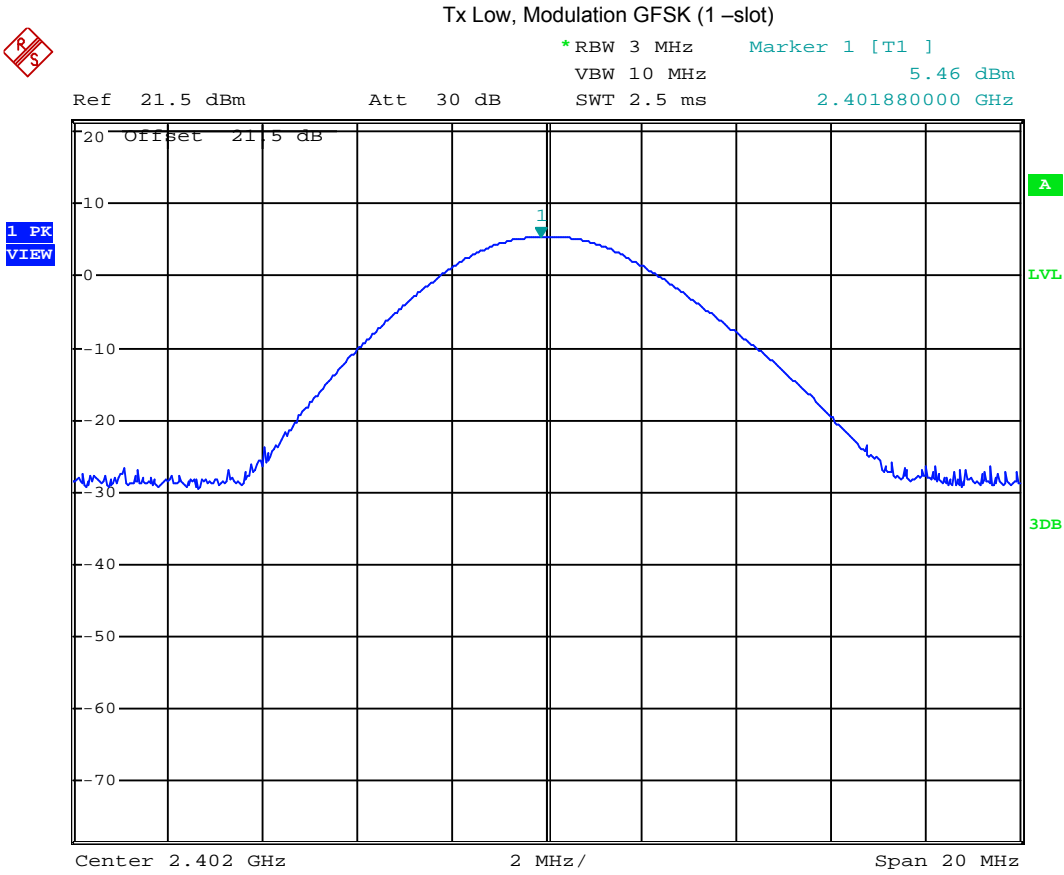


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<b>Section 8: Testing data</b>		<b>Product: Bluetooth Module</b>	
<b>Test name: Clause 15.247(b)(1) Maximum peak conducted output power</b>			
<b>Test date: November 18, 2010</b>		<b>Test engineer: David Duchesne</b>	<b>Verdict: Pass</b>
<b>Specification: FCC Part 15 Subpart C</b>			

### Test data

Sample plot



Date: 18.NOV.2010 08:17:22

 <small>Nemko Canada Inc., 303 River Rd, Ottawa, ON, Canada, K1V 1H2</small>	<b>Section 8:</b> Testing data	<b>Product:</b> Bluetooth Module	
	<b>Test name:</b> Clause 15.247(d) Spurious emissions		
	<b>Test date:</b> November 18, 2010	<b>Test engineer:</b> David Duchesne	<b>Verdict:</b> Pass
	<b>Specification:</b> FCC Part 15 Subpart C		

## 8.4 Clause 15.247(d) Spurious emissions

### § 15.247 Operation within the bands 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz.

- (d) 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, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

### Special notes

- RF power level is not user adjustable, all measurements were made with the highest power level available to the user for that combination.
- Tests performed with modulation enabled.

#### RF conducted measurements

- The spectrum was searched from 30 MHz to 10<sup>th</sup> harmonic for low, mid and high carrier frequencies.
- Client provided a temporary antenna connector.

#### RF Radiated measurements

- The spectrum was searched from 30 MHz to 10<sup>th</sup> harmonic for low, mid and high carrier frequencies.
- EUT was verified as a modular and then installed inside a representative Mitel base and handset IP phone. Only the worst case results have been included.



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<b>Section 8: Testing data</b>		<b>Product: Bluetooth Module</b>	
<b>Test name: Clause 15.247(d) Spurious emissions</b>			
<b>Test date: November 18, 2010</b>		<b>Test engineer: David Duchesne</b>	<b>Verdict: Pass</b>
<b>Specification: FCC Part 15 Subpart C</b>			

Special notes, continued

§15.209 – Radiated emission limits

Frequency (MHz)	Field strength		Measurement distance (m)
	( $\mu$ V/m)	(dB $\mu$ V/m)	
0.009–0.490	2400/F	67.6–20log(F)	300
0.490–1.705	24000/F	87.6–20log(F)	30
1.705–30.0	30	29.5	30
30–88	100	40.0	3
88–216	150	43.5	3
216–960	200	46.0	3
above 960	500	54.0	3

Notes:

- F = fundamental frequency in kHz
- In the emission table above, the tighter limit applies at the band edges.
- For frequencies above 1 GHz the limit on peak RF emissions is 20 dB above the maximum permitted average emission limit applicable to the equipment under test.

§15.205 – Restricted bands of operation.

MHz	MHz	MHz	GHz
0.090–0.110	16.42–16.423	399.9–410	4.5–5.15
0.495–0.505	16.69475–16.69525	608–614	5.35–5.46
2.1735–2.1905	16.80425–16.80475	960–1240	7.25–7.75
4.125–4.128	25.5–25.67	1300–1427	8.025–8.5
4.17725–4.17775	37.5–38.25	1435–1626.5	9.0–9.2
4.20725–4.20775	73–74.6	1645.5–1646.5	9.3–9.5
6.215–6.218	74.8–75.2	1660–1710	10.6–12.7
6.26775–6.26825	108–121.94	1718.8–1722.2	13.25–13.4
6.31175–6.31225	123–138	2200–2300	14.47–14.5
8.291–8.294	149.9–150.05	2310–2390	15.35–16.2
8.362–8.366	156.52475–156.52525	2483.5–2500	17.7–21.4
8.37625–8.38675	156.7–156.9	2690–2900	22.01–23.12
8.41425–8.41475	162.0125–167.17	3260–3267	23.6–24.0
12.29–12.293	167.72–173.2	3332–3339	31.2–31.8
12.51975–12.52025	240–285	3345.8–3358	36.43–36.5
12.57675–12.57725	322–335.4	3600–4400	Above 38.6
13.36–13.41			





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<b>Section 8: Testing data</b>		<b>Product: Bluetooth Module</b>	
<b>Test name: Clause 15.247(d) Spurious emissions</b>			
<b>Test date: November 18, 2010</b>		<b>Test engineer: David Duchesne</b>	<b>Verdict: Pass</b>
<b>Specification: FCC Part 15 Subpart C</b>			

**Test data**

**Spurious RF conducted emissions**

**Measured results**

Sweep 30 MHz to 25 GHz					
Frequency (MHz)	Frequency Hopping	Modulation	Below Tx Fundamental (dB)	Limit (dB)	Margin (dB)
-	On	GFSK (1-slot)	38.76	20	18.76
2402	Off		38.82	20	18.82
2441	Off		38.52	20	18.52
2480	Off		38.26	20	18.26
Band edge – low side					
Frequency (MHz)	Frequency Hopping	Modulation	Below Tx Fundamental (dB)	Limit (dB)	Margin (dB)
-	On	GFSK (1- slot)	37.99	20	17.99
2402	Off		33.69	20	13.69
Band edge – high side					
Frequency (MHz)	Frequency Hopping	Modulation	Below Tx Fundamental (dB)	Limit (dB)	Margin (dB)
-	On	GFSK (1- slot)	44.95	20	24.95
2480	Off		45.8	20	25.8

All test modulation and data rates were verified. Only the worst-case results have been recorded.

**Measurement details**

Spectrum analyzer setting:

- RBW = 100 kHz
- VBW ≥ RBW
- Sweep = auto
- Detector function = peak
- Trace = max hold



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Section 8: Testing data

Product: Bluetooth Module

Test name: Clause 15.247(d) Spurious emissions

Test date: November 18, 2010

Test engineer: David Duchesne

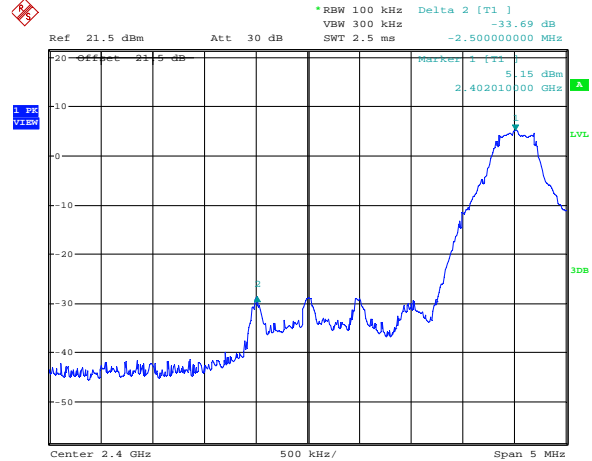
Verdict: Pass

Specification: FCC Part 15 Subpart C

Test data, continued

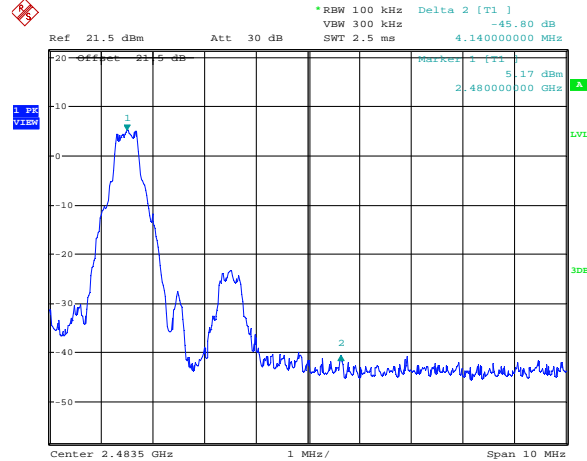
Spurious RF conducted emissions – sample plots

Band edge – low side Non hopping



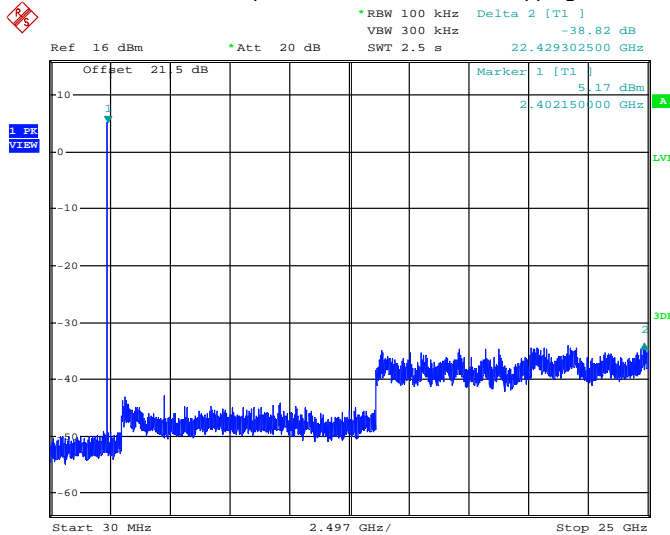
Date: 18.NOV.2010 09:03:35

Band edge – high side Non Hopping



Date: 18.NOV.2010 09:08:38

Sweep 30 MHz to 25 GHz Non Hopping



Date: 18.NOV.2010 10:00:58



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Section 8: Testing data

Product: Bluetooth Module

Test name: Clause 15.247(d) Spurious emissions

Test date: November 18, 2010

Test engineer: David Duchesne

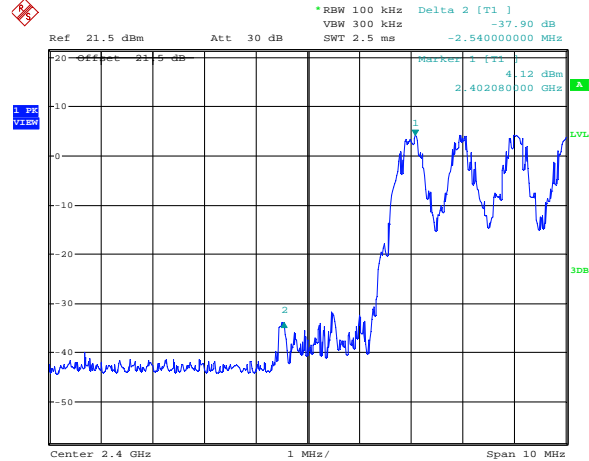
Verdict: Pass

Specification: FCC Part 15 Subpart C

Test data, continued

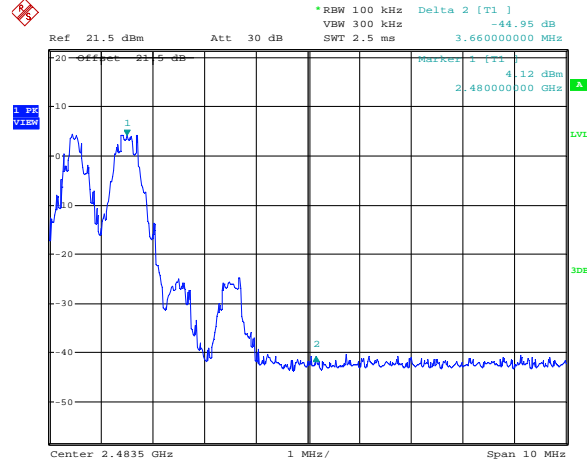
Spurious RF conducted emissions – Sample plots

Band edge – low side Hopping



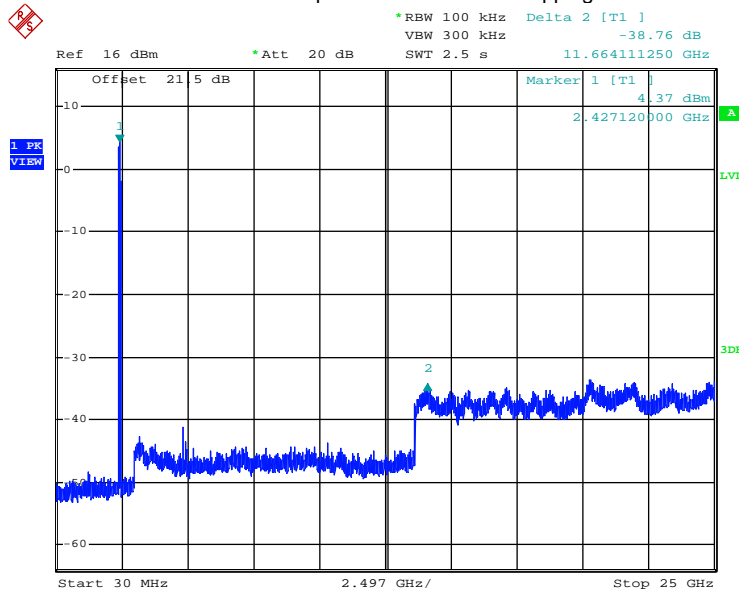
Date: 18.NOV.2010 09:01:46

Band edge – high side Hopping



Date: 18.NOV.2010 09:10:10

Sweep 30 MHz to 25 GHz Hopping



Date: 18.NOV.2010 09:19:07



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<b>Section 8: Testing data</b>		<b>Product: Bluetooth Module</b>	
<b>Test name: Clause 15.247(d) Spurious emissions</b>			
<b>Test date: November 18, 2010</b>		<b>Test engineer: David Duchesne</b>	<b>Verdict: Pass</b>
<b>Specification: FCC Part 15 Subpart C</b>			

### Test data, continued

#### Radiated spurious emissions found in the Restricted bands defined in FCC Part 15 Subpart C, 15.205

#### Measured results

Fundamental Freq. (MHz)	Frequency (MHz)	Antenna Polarization	Peak field strength (dBmV/m)	Peak limit (dBµV/m)	Peak margin (dB)	Duty cycle corr. (dB)	Avg field strength (dBµV/m)	Avg limit (dBµV/m)	Avg margin (dB)
2402	2389	V	58.58	74	15.42	30.7	27.88	54	26.12
2402	4804	V	62.86	74	11.14	30.7	32.16	54	21.84
2441	4882	V	66.20	74	7.8	30.7	35.5	54	18.5
2480	2483.58	V	71.69	74	2.31	30.7	40.99	54	13.01
2480	4960	V	61.58	74	12.42	30.7	30.88	54	23.12

All test modulation and data rates were verified. Only the worst-case results have been recorded.

#### Measurement details

- The EUT was placed at 80 cm height on a non-conducting support above ground plane inside a semi-anechoic chamber.
- Measurement antenna was located 3m from EUT.
- The EUT were rotated 0 to 360 degree and the antenna height was varied between 1m and 4m in order to maximize the emission. Measurements in both horizontal and vertical polarities were made and the data was recorded.
- All measurements performed:
  - within 30–1000 MHz range: using a peak detector with 100 kHz/300 kHz RBW/VBW
  - above 1 GHz: using peak detector with 1 MHz/3 MHz RBW/VBW for peak results
  - and using average detector with 1 MHz/3 MHz RBW/VBW for average results

#### Duty cycle/average factor calculations

§15.35(c) When the radiated emission limits are expressed in terms of the average value of the emission, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds.

$$Duty\ cycle / average\ factor = 20 \times \log_{10} \left( \frac{T_{x100ms}}{100ms} \right)$$

GFSK (1-slot)

Dwell time = 0.4 ms

Two pulses per 100 ms

Duty Cycle correction Factor = 20 log (0.8/100)

Duty Cycle correction Factor = -41.93 dB

GFSK (3-slot)

Dwell time = 1.67 ms

One pulse per 100 ms

Duty Cycle correction Factor = 20 log (1.67/100)

Duty Cycle correction Factor = -35.55 dB

GFSK (5-slot)

Dwell time = 2.916 ms

One pulse per 100 ms

Duty Cycle correction Factor = 20 log (2.916/100)

Duty Cycle correction Factor = -30.7 dB

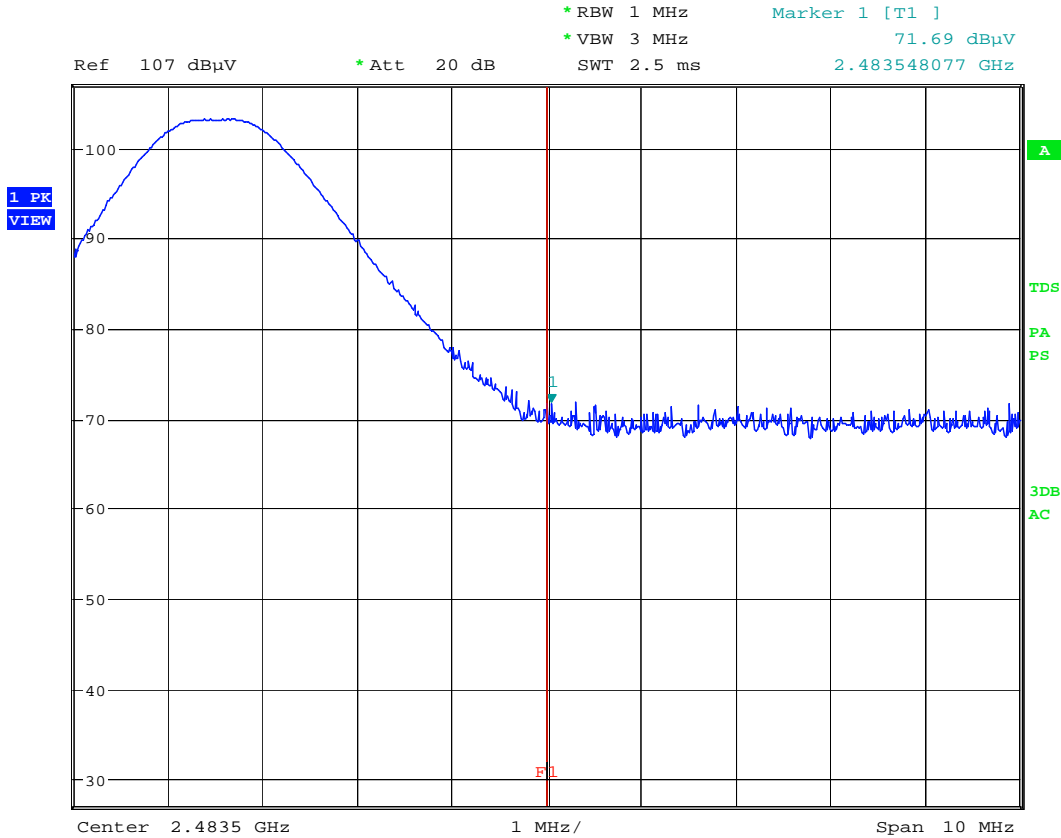


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<b>Section 8: Testing data</b>		<b>Product: Bluetooth Module</b>	
<b>Test name: Clause 15.247(d) Spurious emissions</b>			
<b>Test date: November 18, 2010</b>		<b>Test engineer: David Duchesne</b>	<b>Verdict: Pass</b>
<b>Specification: FCC Part 15 Subpart C</b>			

Test data, continued

Radiated spurious emissions sample plot



Date: 18.NOV.2010 14:59:57

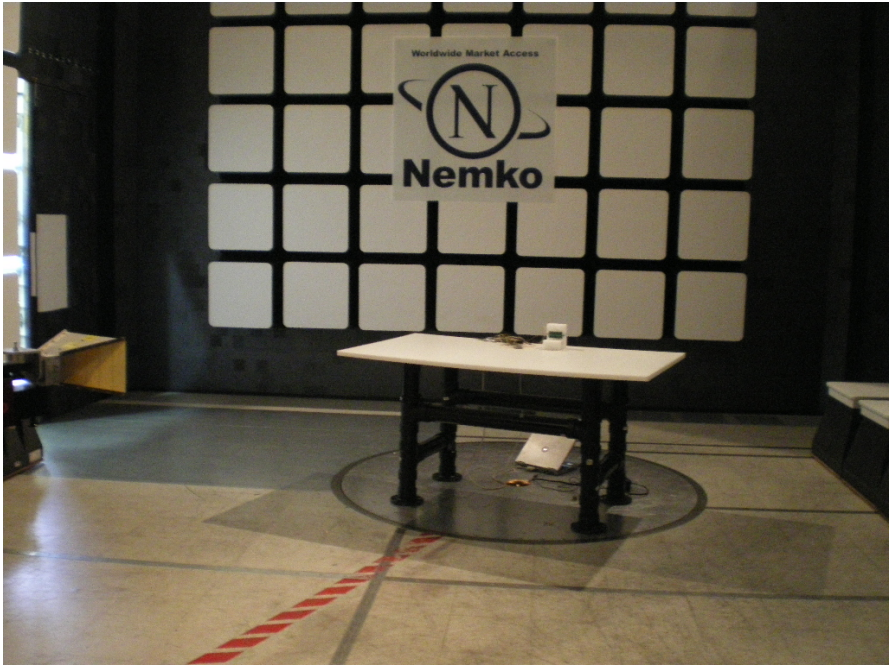
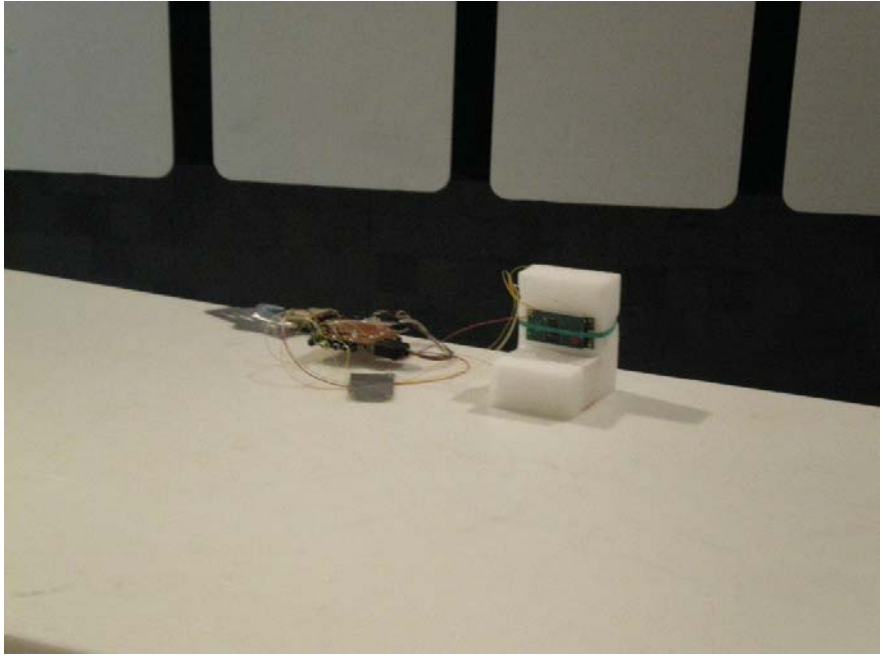
Spectral plot has been corrected with transducer factors (i.e. antenna factors, cable loss, amplifier gains, and attenuators)



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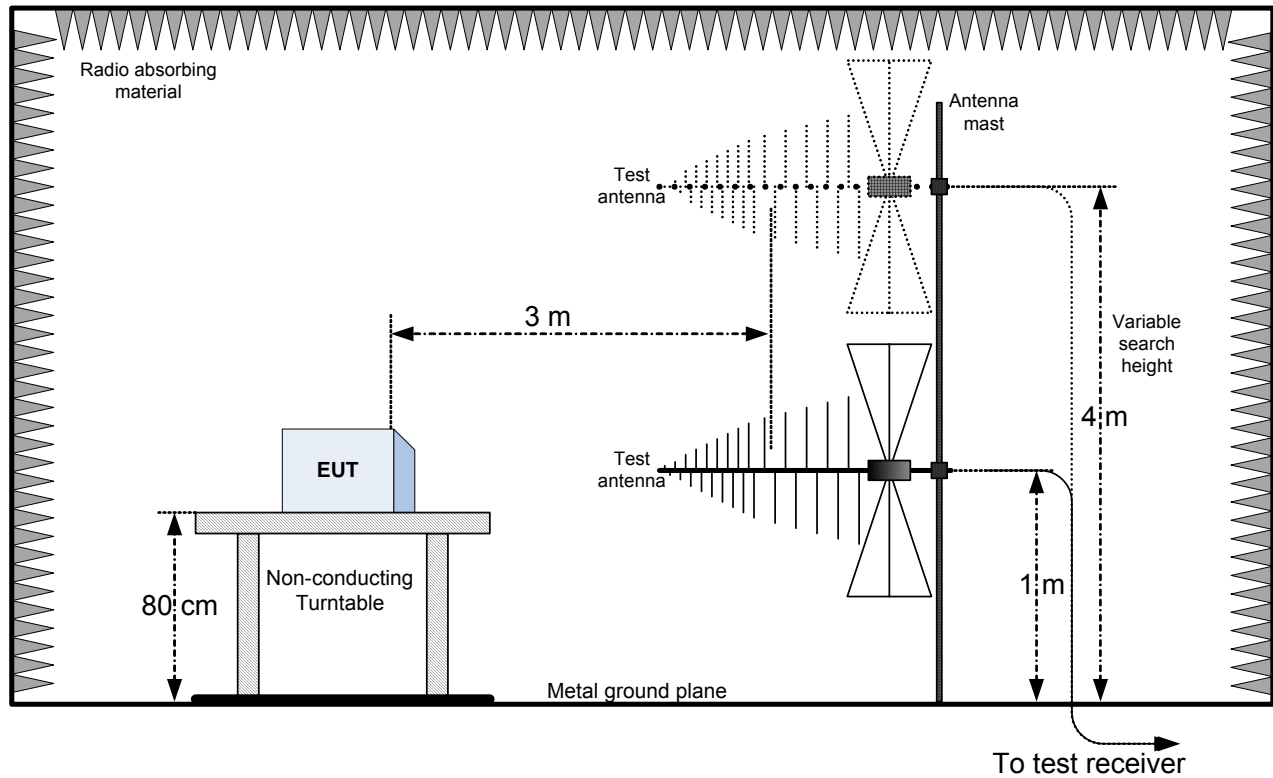
<b>Section 8: Testing data</b>	<b>Product: Bluetooth Module</b>	
<b>Test name: Clause 15.247(d) Spurious emissions</b>		
<b>Test date: November 18, 2010</b>	<b>Test engineer: David Duchesne</b>	<b>Verdict: Pass</b>
<b>Specification: FCC Part 15 Subpart C</b>		

Setup photos



## Section 8: Block diagrams of test set-ups

### Radiated emissions set-up



### Conducted emissions set-up

