

# EMC & RF Test Report

As per

## RSS-247 Issue 2 & FCC Part 15 Subpart 15.247

Unlicensed Intentional Radiators

on the

### BrailleNote Touch (WiFi)



Issued by:

**TÜV SÜD Canada Inc.**  
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Abderrahmane  
Ferhat, Eng.  
Project Engineer

A handwritten signature in black ink, appearing to read "Ferhat".

Testing produced for

The Humanware logo, featuring the word "Humanware" in a stylized font where the "H" and "w" are connected, with a small orange sun-like icon above the "i".

See Appendix A for full client &  
EUT details.

Industry  
Canada  
Registration #  
6844B-1

The CE mark, consisting of the letters "CE" in a bold, rounded font.

A logo for "AL Accredited" featuring a globe and the letters "AL".

AL  
ACCREDITED

Testing Laboratory  
Certificate #2955.02

The FCC logo, which includes the letters "FCC" in a bold font, "FEDERAL COMMUNICATIONS COMMISSION", and "USA".

FCC  
FEDERAL COMMUNICATIONS  
COMMISSION  
USA

Registration #  
382292

Client	<b>Technologies HumanWare inc.</b>	 Canada
Product	<b>BrailleNote Touch</b>	
Standard(s)	RSS-247 Issue 2 FCC Part 15 Subpart 15.247	

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Client	<b>Technologies HumanWare inc.</b>	 Canada
Product	<b>BrailleNote Touch</b>	
Standard(s)	RSS-247 Issue 2 FCC Part 15 Subpart 15.247	

## Report Scope

This report addresses the EMC verification testing and test results of the **BrailleNote Touch**, and is herein referred to as EUT (Equipment Under Test). The EUT was tested for compliance against the following standards:

RSS-247 Issue 2:2017

FCC Part 15 Subpart C 15.247:2016

Test procedures, results, justifications, and engineering considerations, if any, follow later in this report.

This report does not imply product endorsement by any government, accreditation agency, or TÜV SÜD Canada Inc.

Opinions or interpretations expressed in this report, if any, are outside the scope of TÜV SÜD Canada Inc accreditations. Any opinions expressed do not necessarily reflect the opinions of TÜV SÜD Canada Inc, unless otherwise stated.

Client	<b>Technologies HumanWare inc.</b>	 Canada
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Standard(s)	RSS-247 Issue 2 FCC Part 15 Subpart 15.247	

## Summary

The results contained in this report relate only to the item(s) tested.

EUT:	<b>BrailleNote Touch</b>
FCC Certification #, FCC ID:	XT5BNT432
Industry Canada Certification #, IC:	8670A-BNT432
EUT passed all tests performed	Yes
Tests conducted by	Abderrahmane Ferhat

For testing dates, see "Testing Environmental Conditions and Dates".

Client	Technologies HumanWare inc.	 Canada
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## Test Results Summary

Standard/Method	Description	Class/Limit	Result
FCC 15.203	Antenna Requirement	Unique	Pass See Justification
FCC 15.205 RSS-GEN (Table 6)	Restricted Bands for Intentional Operation	QuasiPeak Average	Pass See Justification
FCC 15.207 RSS-GEN (Table 3)	Power Line Conducted Emissions	QuasiPeak Average	Pass
FCC 15.209 RSS-GEN (Table 4)	Spurious Radiated Emissions	QuasiPeak Average	Pass
FCC 15.247(a)2 RSS-247 5.2(1)	6 dB Bandwidth	> 500 kHz	Pass
FCC 15.247(b)2 RSS-247 5.4(4)	Max Output Power	< 1 Watt	Pass
FCC 15.247(b)4 RSS-247 5.4(4)	Antenna Gain	< 6 dBi	Pass See Justifications
FCC 15.247(d) RSS-247 5.5	Antenna Conducted Spurious	< 20 dBc	Pass
FCC 15.247(e) RSS-247 5.2(2)	Spectral Density	< 8 dBm (3 kHz BW)	Pass
FCC 15.247(i) RSS-102	RF Exposure	—	Pass See justification and SAR report
<b>Overall Result</b>			<b>Pass</b>

If the product as tested or otherwise complies with the specification, the EUT is deemed to comply with the requirement and is deemed a 'PASS' grade. If not 'FAIL' grade will be issued. Note that 'PASS' / 'FAIL' grade is independent of any measurement uncertainties. A 'PASS' / 'FAIL' grade within measurement uncertainty is marked with a '\*'.

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## **Notes, Justifications, or Deviations**

The following notes, justifications for tests not performed or deviations from the above listed specifications apply:

For the Antenna requirement specified in FCC 15.203 (RSS-247 section 5.5), the unit uses a chip antenna, model FR05-S1-N-0-102 from FRACTUS ANTENNAS (1.7dBi gain ) with less than 6 dBi gain.

For the Restricted Bands of operation, the EUT is designed to only operate between 2400 – 2483.5 MHz.

The EUT is not a hybrid system and FCC 15.247 (f) does not apply to it. However the 15.247 (d) requirement of power density were met and are detailed later in this test report.

For the scope of this test report, the EUT was mounted in three orthogonal axis to maximize emissions. Worst case results are presented.

SAR assessment is applicable to the EUT. The separation distance between radiating structure of the EUT and human body is < 5 mm. According to FCC KDB 447498 Section 4.3.1 5), an assessment distance of 5 mm is applied. See SAR report.

## **Sample Calculation(s)**

### **Radiated Emission Test**

Margin = Limit – (Received Signal + Antenna Factor + Cable Loss – Pre-Amp Gain)

Margin = 50.5dB $\mu$ V/m – (50dB $\mu$ V + 10dB + 2.5dB – 20dB)

Margin = 8.0 dB (pass)

### **Power Line Conducted Emission Test**

Margin = Limit – (Received Signal + Attenuation Factor + Cable Loss + LISN Factor)

Margin = 73.0dB $\mu$ V – (50dB $\mu$ V + 10dB + 2.5dB + 0.5dB)

Margin = 10.0 dB (pass)

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## Applicable Standards, Specifications and Methods

- ANSI C63.4:2014    Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
- ANSI C63.10:2013    American National Standard For Testing Unlicensed Wireless Devices
- CFR 47 FCC 15    Code of Federal Regulations – Radio Frequency Devices, Subpart C:2016    Intentional Radiators
- CISPR 22:2008    Information Technology Equipment - Radio Disturbance Characteristics - Limits and Methods of Measurement
- FCC KDB 558074:    FCC KDB 558074 Digital Transmission Systems, measurements 2016    and procedures
- ICES-003 Issue 6    Digital Apparatus - Spectrum Management and 2016    Telecommunications Policy Interference-Causing Equipment Standard
- RSS-GEN Issue 4    General Requirements and Information for the Certification of 2014    Radio Apparatus
- RSS-247 Issue 2:2017    Issue 1: Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices
- ISO 17025:2005    General Requirements for the Competence of Testing and Calibration Laboratories

Client	<b>Technologies HumanWare inc.</b>	 Canada
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Standard(s)	RSS-247 Issue 2 FCC Part 15 Subpart 15.247	

## Document Revision Status

Revision 0 - June 4, 2017. Initial Release

Revision 1 - July 31, 2017. RSS-247 Issue 1 revised to RSS-247 Issue 2

Client	<b>Technologies HumanWare inc.</b>	 Canada
Product	<b>BrailleNote Touch</b>	
Standard(s)	RSS-247 Issue 2 FCC Part 15 Subpart 15.247	

## Definitions and Acronyms

The following definitions and acronyms are applicable in this report.  
See also ANSI C63.14.

**AE** – Auxiliary Equipment. A digital accessory that feeds data into or receives data from another device (host) that in turn, controls its operation.

**BW** – Bandwidth. Unless otherwise stated, this refers to the 6 dB bandwidth.

**EMC** – Electro-Magnetic Compatibility. The ability of an equipment or system to function satisfactorily in its electromagnetic environment without introducing intolerable electromagnetic disturbances to anything in that environment.

**EMI** – Electro-Magnetic Immunity. The ability to maintain a specified performance when the equipment is subjected to disturbance (unwanted) signals of specified levels.

**EUT** – Equipment Under Test. A device or system being evaluated for compliance that is representative of a product to be marketed.

**ITE** – Information Technology Equipment with a primary function(s) of entry, storage, display, retrieval, transmission, processing, switching, or control, of data.

**LISN** – Line Impedance Stabilization Network

**NCR** – No Calibration Required

**RF** – Radio Frequency

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## Testing Facility

Testing for EMC on the EUT was carried out at TÜV SÜD Canada testing lab in Laval, near Montréal, Québec, Canada. The testing lab has a calibrated 3m semi-anechoic chamber which allows measurements on an EUT that has a maximum width or length of up to 2m and a height of up to 3m. The chamber is equipped with a turntable that is capable of testing devices up to 3300lb in weight. This facility is capable of testing products that are rated for 120Vac and 240Vac single phase, or devices that are rated for a 208Vac 3 phase input. DC capability is also available for testing. The chamber is equipped with a mast that controls the polarization and height of the antenna. Control of the mast occurs in the control room adjoining the shielded chamber. Radiated emission measurements are performed using a BiLog antenna and a Horn antenna where applicable. Conducted emissions, unless otherwise stated, are performed using a LISN and using the Vertical Ground plane if applicable. For ESD testing, the HCP is 1.6m x 0.8m and the VCP is 0.5m x 0.5m. The reference ground plane, when applicable, is 1.6m x 1.6m.

### ***Calibrations and Accreditations***

The 3m semi-anechoic chamber is registered with Federal Communications Commission (FCC, 382292) and Industry Canada (IC, 6844B-1). This chamber was calibrated for Normalized Site Attenuation (NSA) using test procedures outlined in ANSI C63.4 "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz". The chamber is lined with ferrite tiles and absorption cones to minimize any undesired reflections. The NSA data is kept on file at TÜV SÜD Canada. For radiated susceptibility testing, a 16 point field calibration has been performed on the chamber. The field uniformity data is kept on file at TÜV SÜD Canada. TÜV SÜD Canada Inc is accredited to ISO 17025 by A2LA with Testing Certificate #2955.02. The laboratory's current scope of accreditation listing can be found as listed on the A2LA website. All measuring equipment is calibrated on an annual or bi-annual basis as listed for each respective test.

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## ***Testing Environmental Conditions and Dates***

Following environmental conditions were recorded in the facility during time of testing

Date	Test	Initials	Temperature (°C)	Humidity (%)	Pressure (kPa)
01-Sep-2016 to 07-Sep-2016	Radiated Emissions	AF	20 – 24	40 – 51	98.0 – 102.0
21-Sep-2016 to 22-Sep-2016	Antenna Conducted Emissions	AF	20 – 24	40 – 51	98.0 – 102.0
19-Apr-2016	Power Line Conducted Emissions	AF	20 – 24	40 – 51	98.0 – 102.0

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## **Detailed Test Results Section**

Client	<b>Technologies HumanWare inc.</b>	 Canada
Product	<b>BrailleNote Touch</b>	
Standard(s)	RSS-247 Issue 2 FCC Part 15 Subpart 15.247	

## ***6dB Bandwidth of Digitally Modulated Systems***

### **Purpose**

The purpose of this test is to ensure that the bandwidth occupied exceeds a stated minimum. This helps ensure the utilization of the frequency allocation is sufficiently wide. This also helps prevent corruption of data by ensuring adequate data separation to distinguish the reception of the intended information.

### **Limits and Method**

The limit is as specified in FCC Part 15.247(a)2 and RSS-247.

Systems using digital modulation techniques may operate in the 902 - 928 MHz, 2400 - 2483.5 MHz, and 5725 - 5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz. This should be measured with a 100 kHz RBW and a 300 kHz VBW.

The method is given in Section 8.1 of FCC KDB 558074 and ANSI C63.10.

### **Results**

The EUT passed.

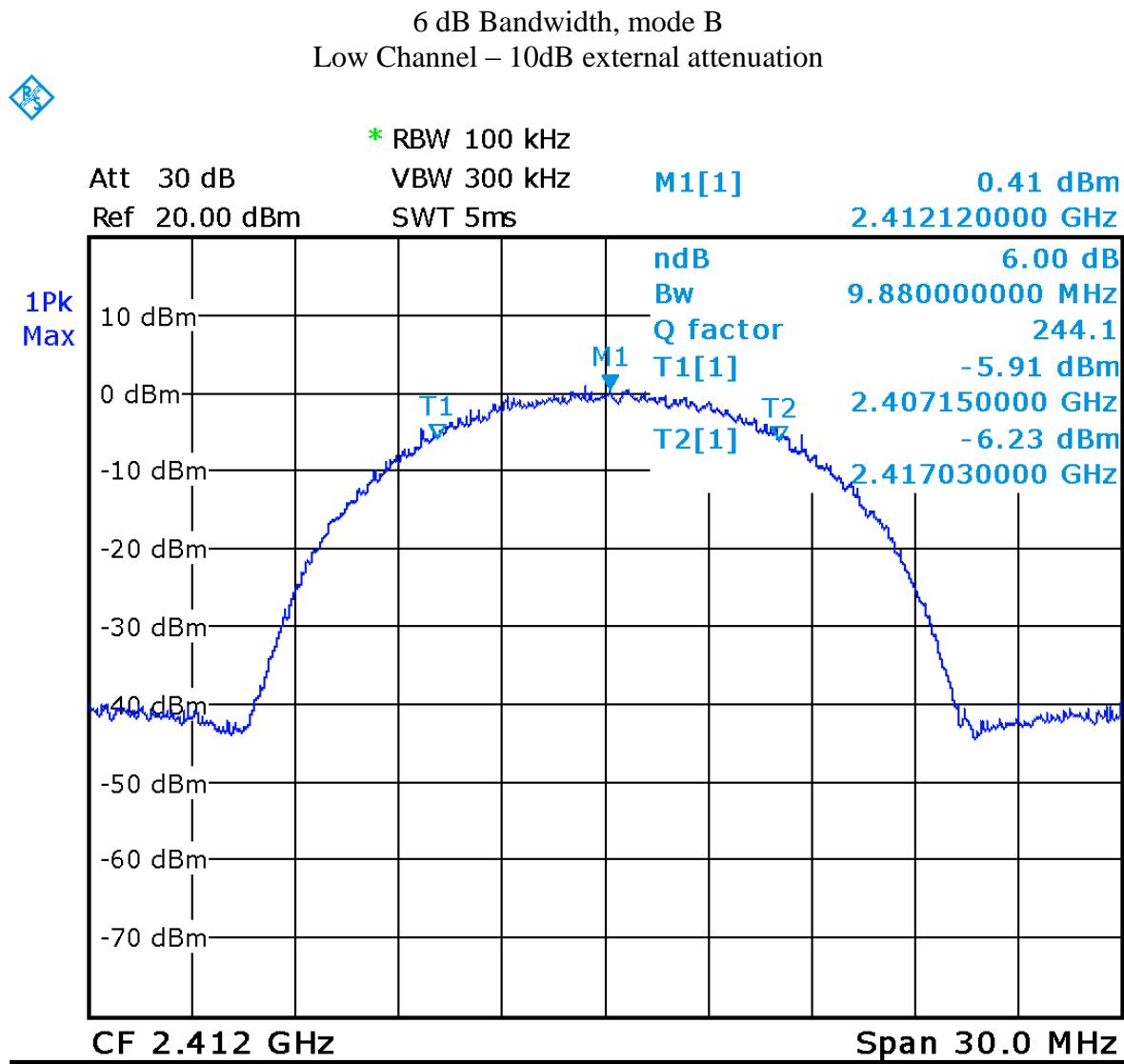
The minimum 6 dB BW measured was 9.401 MHz for mode B (16.407 MHz for mode G), and the maximum 99% BW at full power setting was 14.431 MHz for mode B (16.707MHz for mode G).

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	99% Bandwidth (MHz)
Lo Channel (B)	2412	9.880	14.431
Mid Channel (B)	2437	10.719	14.371
Hi Channel (B)	2462	9.401	14.371
Lo Channel (G)	2412	16.407	16.707
Mid Channel (G)	2437	16.467	16.647
Hi Channel (G)	2462	16.407	16.647

Client	<b>Technologies HumanWare inc.</b>	 Canada
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Standard(s)	RSS-247 Issue 2 FCC Part 15 Subpart 15.247	

## Graphs

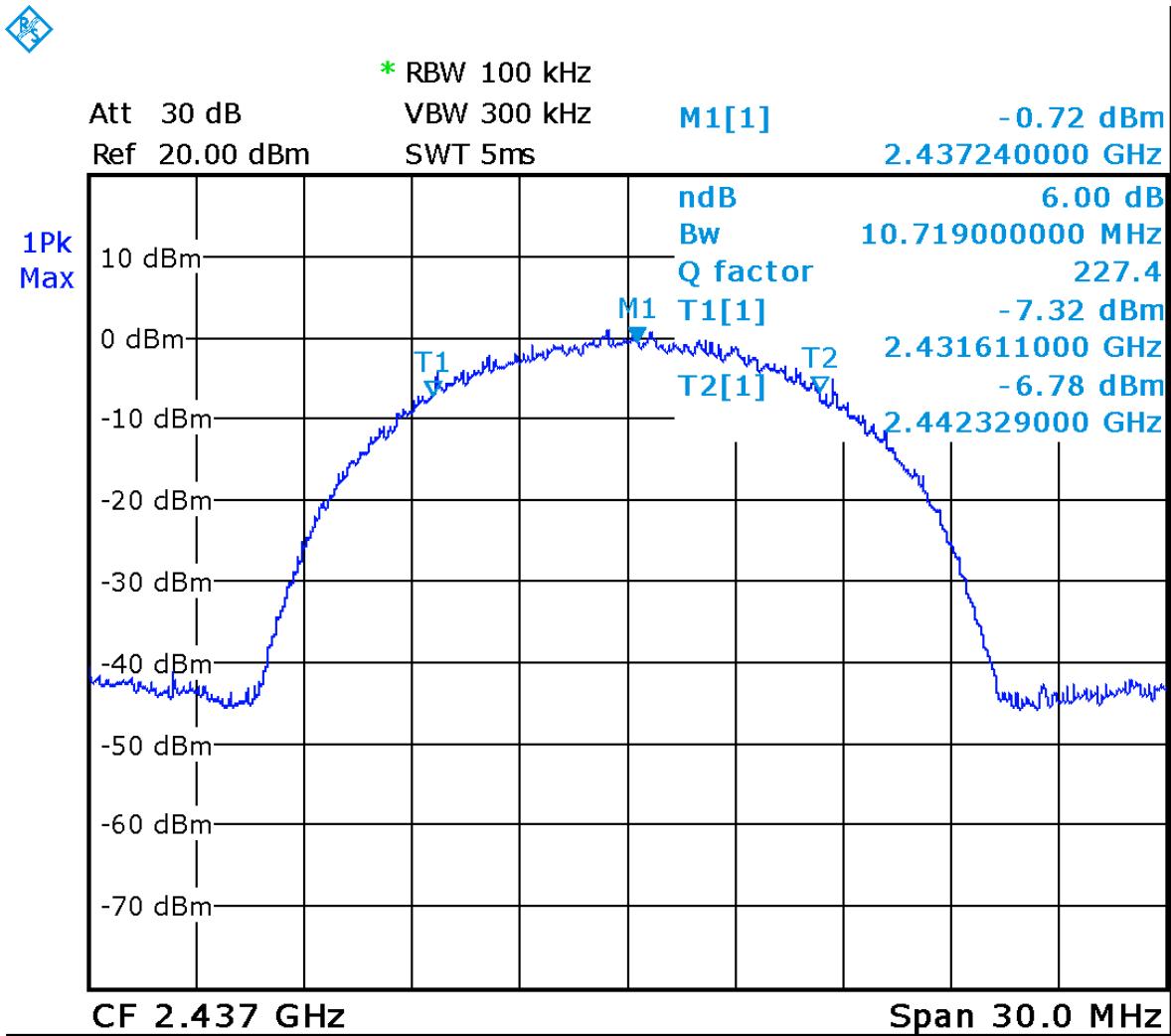
The graphs showed below show the OBW during the operation of the device. This is measured by a max hold on the spectrum analyzer and the highest resolution bandwidth that is sufficiently low to exhibit the 6 dB bandwidth of a channel during operation of the EUT. Max hold is performed for a duration of not less than 1 minute.



Date: 21.SEP.2016 13:23:35

Client	<b>Technologies HumanWare inc.</b>	 Canada
Product	<b>BrailleNote Touch</b>	
Standard(s)	RSS-247 Issue 2 FCC Part 15 Subpart 15.247	

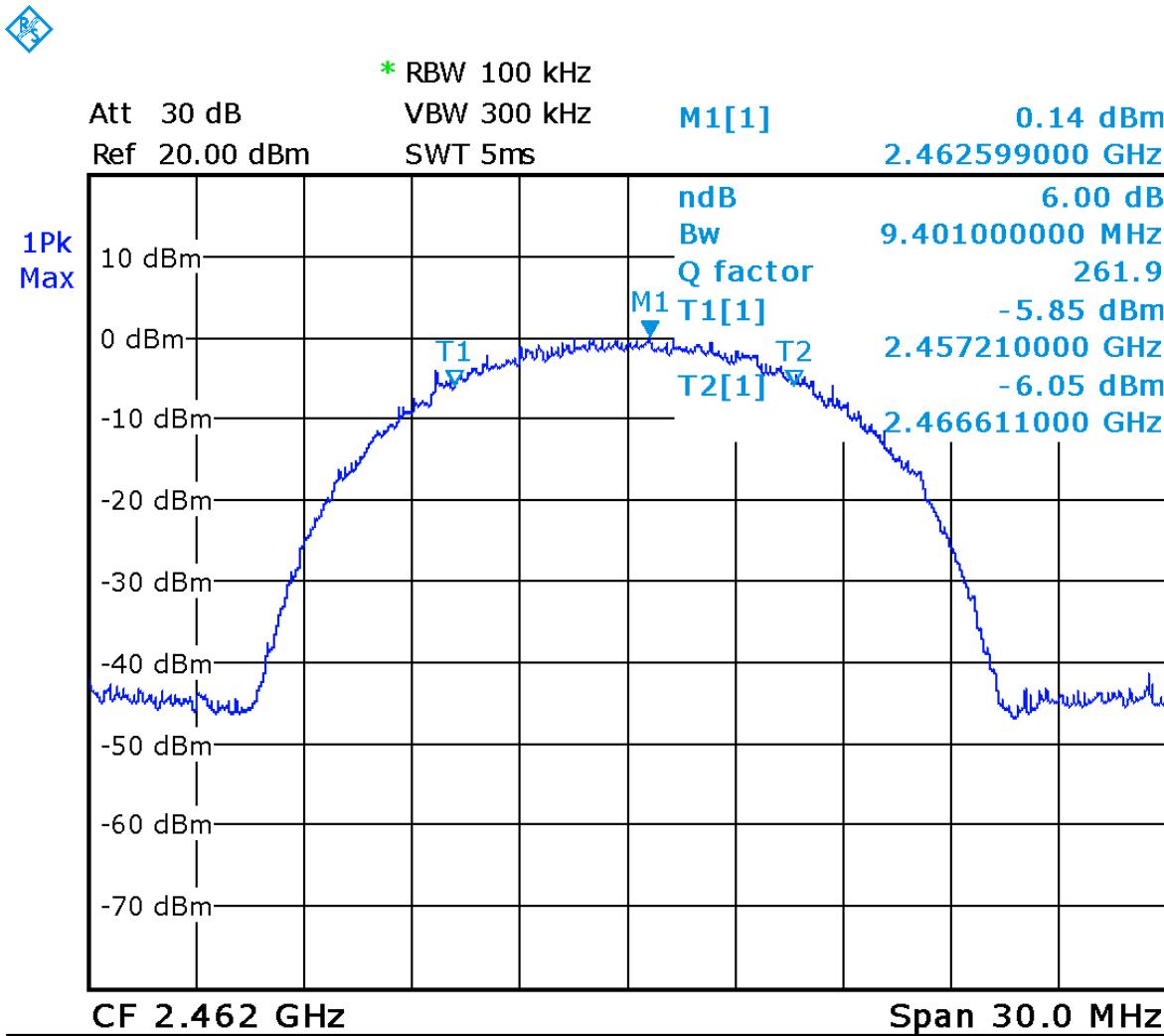
6 dB Bandwidth, mode B  
Mid Channel – 10dB external attenuation



Date: 21.SEP.2016 13:26:16

Client	Technologies HumanWare inc.	 Canada
Product	BrailleNote Touch	
Standard(s)	RSS-247 Issue 2 FCC Part 15 Subpart 15.247	

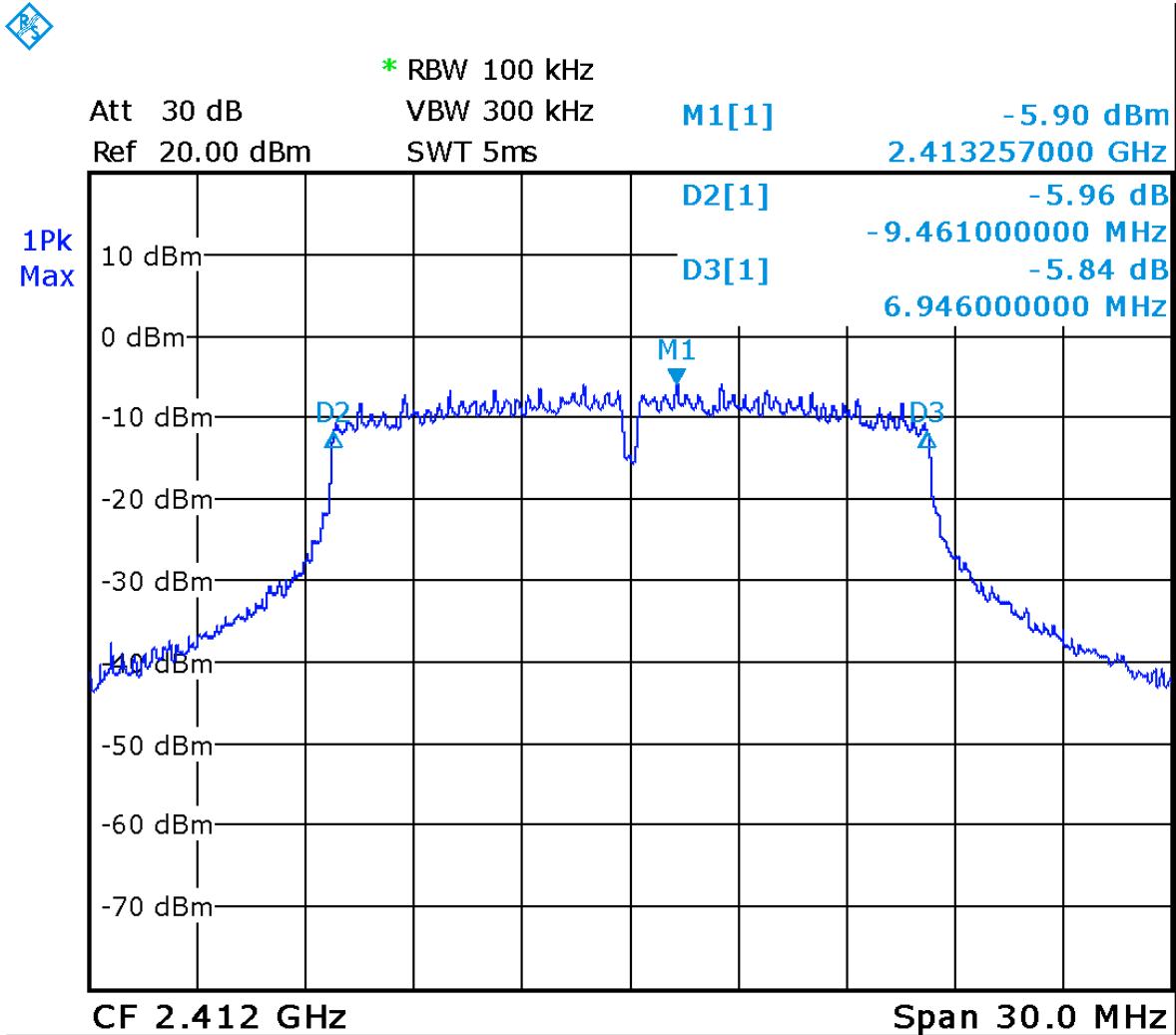
6 dB Bandwidth, mode B  
Hi Channel – 10dB external attenuation



Date: 21.SEP.2016 13:28:08

Client	Technologies HumanWare inc.	 Canada
Product	BrailleNote Touch	
Standard(s)	RSS-247 Issue 2 FCC Part 15 Subpart 15.247	

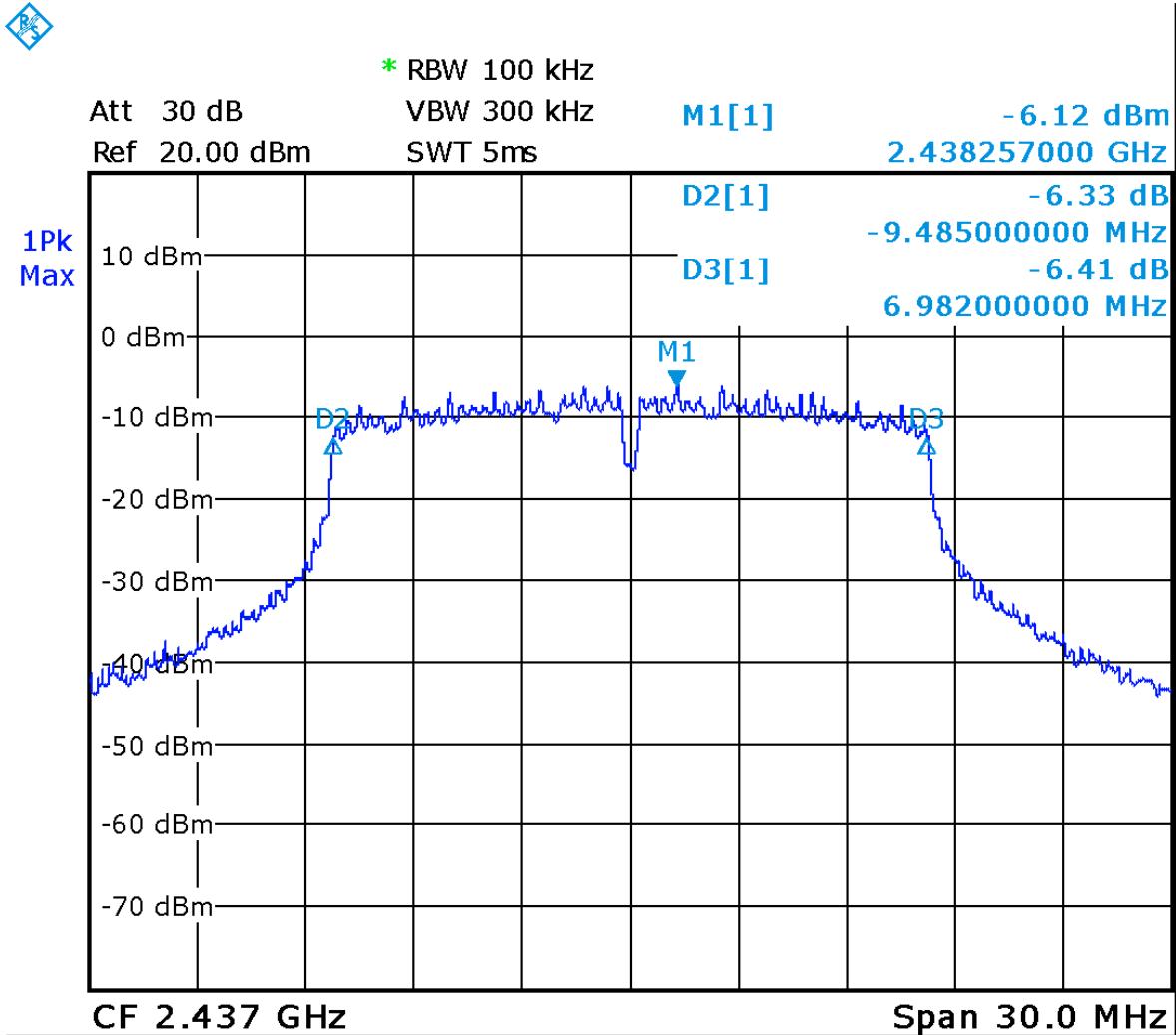
6 dB Bandwidth, mode G  
Low Channel – 10dB external attenuation



Date: 21.SEP.2016 12:59:35

Client	<b>Technologies HumanWare inc.</b>	 Canada
Product	<b>BrailleNote Touch</b>	
Standard(s)	RSS-247 Issue 2 FCC Part 15 Subpart 15.247	

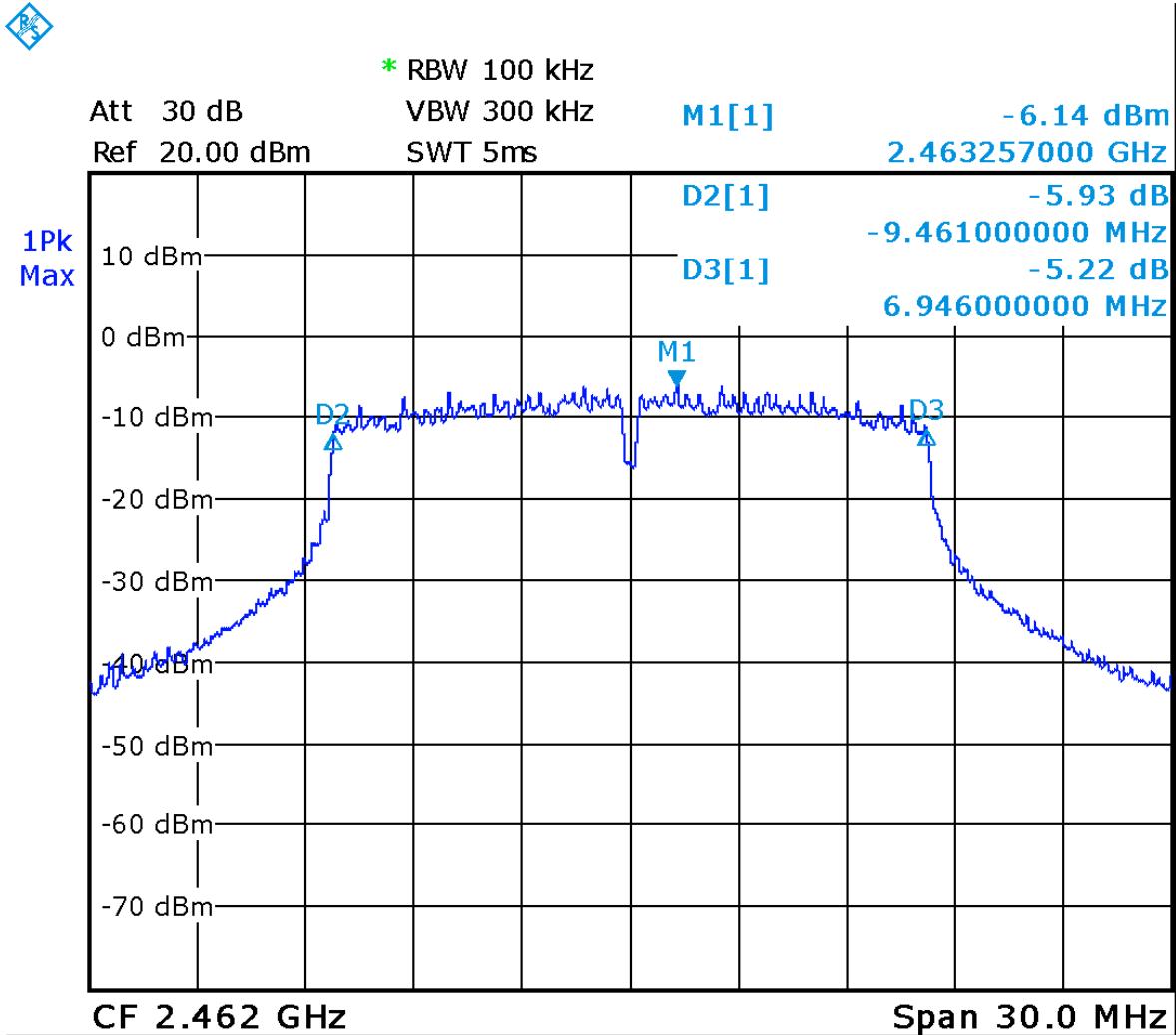
6 dB Bandwidth, mode G  
Mid Channel – 10dB external attenuation



Date: 21.SEP.2016 13:03:44

Client	Technologies HumanWare inc.	 Canada
Product	BrailleNote Touch	
Standard(s)	RSS-247 Issue 2 FCC Part 15 Subpart 15.247	

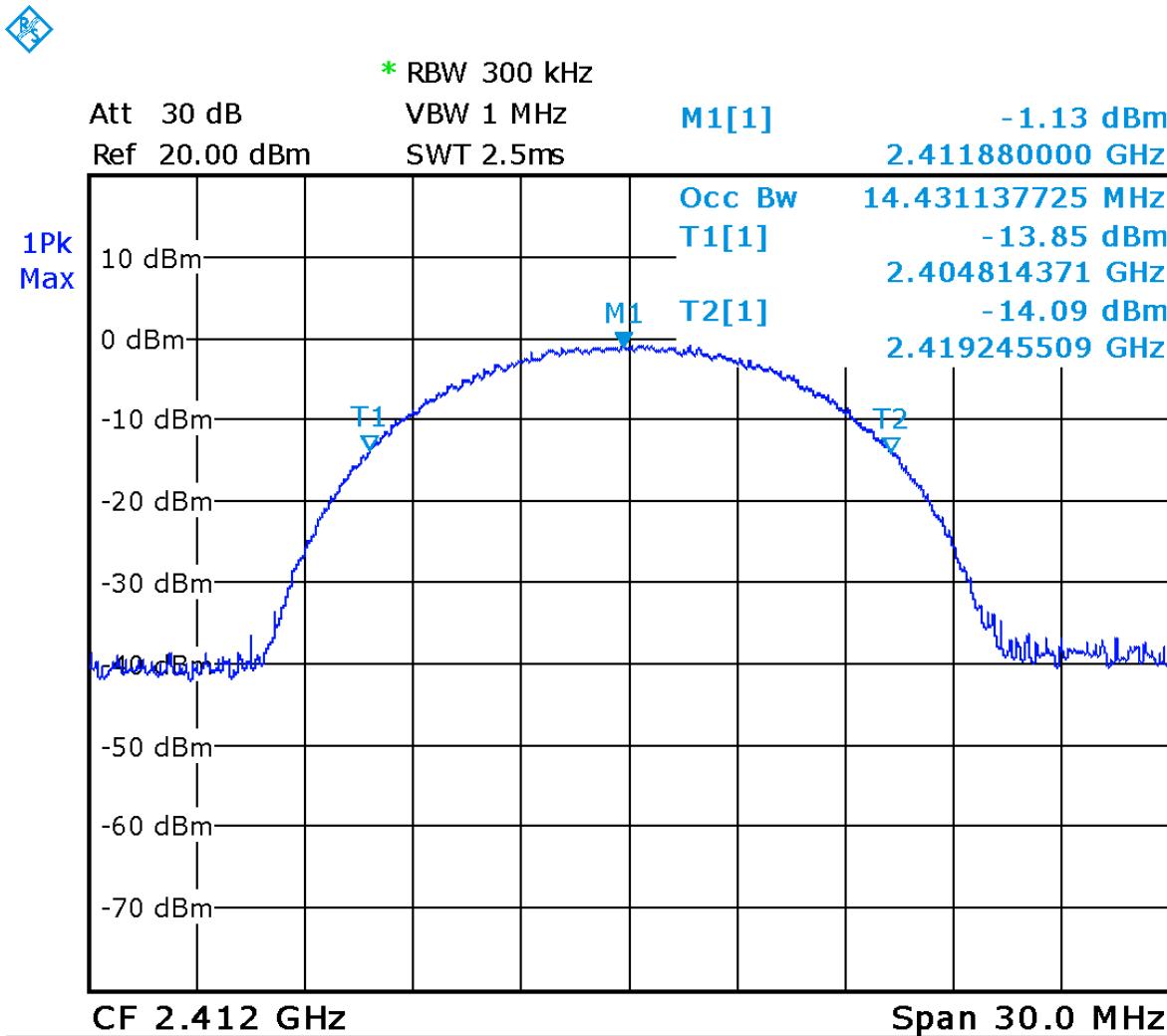
6 dB Bandwidth, mode G  
Hi Channel – 10dB external attenuation



Date: 21.SEP.2016 13:08:50

Client	<b>Technologies HumanWare inc.</b>	 Canada
Product	<b>BrailleNote Touch</b>	
Standard(s)	RSS-247 Issue 2 FCC Part 15 Subpart 15.247	

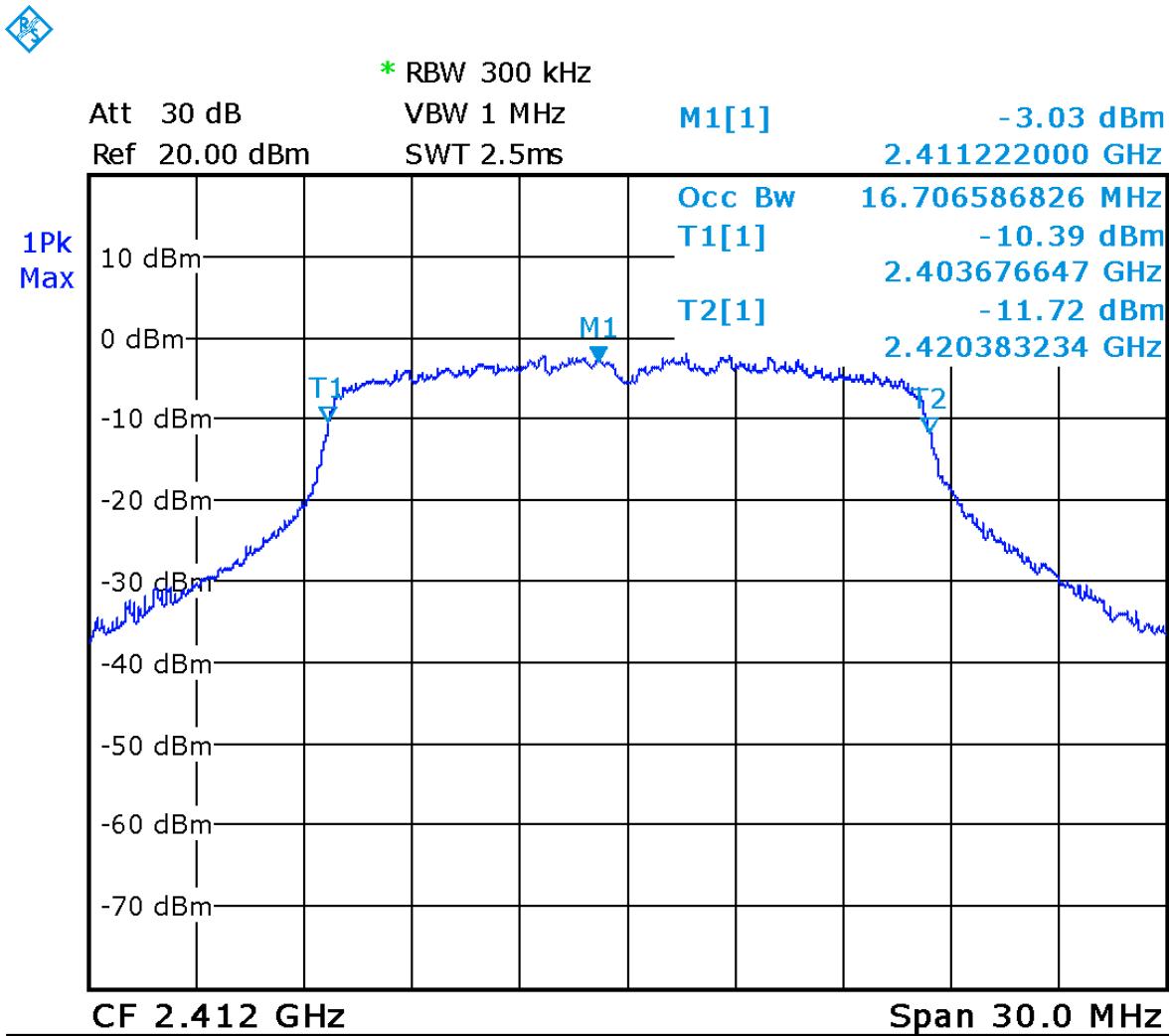
99% Bandwidth, mode B  
Low Channel – 10dB external attenuation



Date: 21.SEP.2016 14:02:49

Client	<b>Technologies HumanWare inc.</b>	 Canada
Product	<b>BrailleNote Touch</b>	
Standard(s)	RSS-247 Issue 2 FCC Part 15 Subpart 15.247	

99% Bandwidth, mode G  
Low Channel – 10dB external attenuation



Date: 21.SEP.2016 14:23:30

Note: See 'Appendix B – EUT & Test Setup Photos' for photos showing the test set-up.

Client	<b>Technologies HumanWare inc.</b>	 Canada
Product	<b>BrailleNote Touch</b>	
Standard(s)	RSS-247 Issue 2 FCC Part 15 Subpart 15.247	

## Test Equipment List

Equipment	Model No.	Manufacturer	Last Calibration Date	Next Calibration Date	Asset #
Spectrum Analyzer	FSL6	Rohde & Schwarz	Jan 28, 2016	Jan 28, 2018	4095
Attenuator 10 dB	4779-10	narda	NCR	NCR	4096

Client	Technologies HumanWare inc.	 Canada
Product	BrailleNote Touch	
Standard(s)	RSS-247 Issue 2 FCC Part 15 Subpart 15.247	

## Maximum Peak Envelope Conducted Power - DM

### Purpose

The purpose of this test is to ensure that the maximum power conducted to the radiating element does not exceed the limits specified. This ensures that if the end-user replaces the antenna, the maximum power does not exceed an amount which may create an excessive power level.

### Limits and Method

The limits are defined in FCC Part 15.247(b) and RSS-247.

For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands, the peak limit is 1 watt (30 dBm).

The method is given in Section 9.1.2 of FCC KDB 558074 and ANSI C63.10.

### Results

The EUT passed. The EUT was set to transmit at maximum power (PWR = 80.7 mW in mode B, and PWR = 25.1mW in mode G). Three channels were measured. The following table shows the peak power:

Channel	Frequency (MHz)	Measured Peak Power dBm	External & Cable Attenuation dB	Corrected Peak Power dBm	Peak Power (mW)
Low Channel (B)	2412	8.79	10	18.79	75.7
Mid Channel (B)	2437	8.94	10	18.94	78.3
Hi Channel (B)	2462	9.07	10	19.07	80.7
Low Channel (G)	2412	3.88	10	13.88	24.4
Mid Channel (G)	2437	3.95	10	13.95	24.8
Hi Channel (G)	2462	4.00	10	14.00	25.1

### Graphs

The plots shown below show the peak power output of the device during the antenna conducted measurements during transmit operation of the EUT.

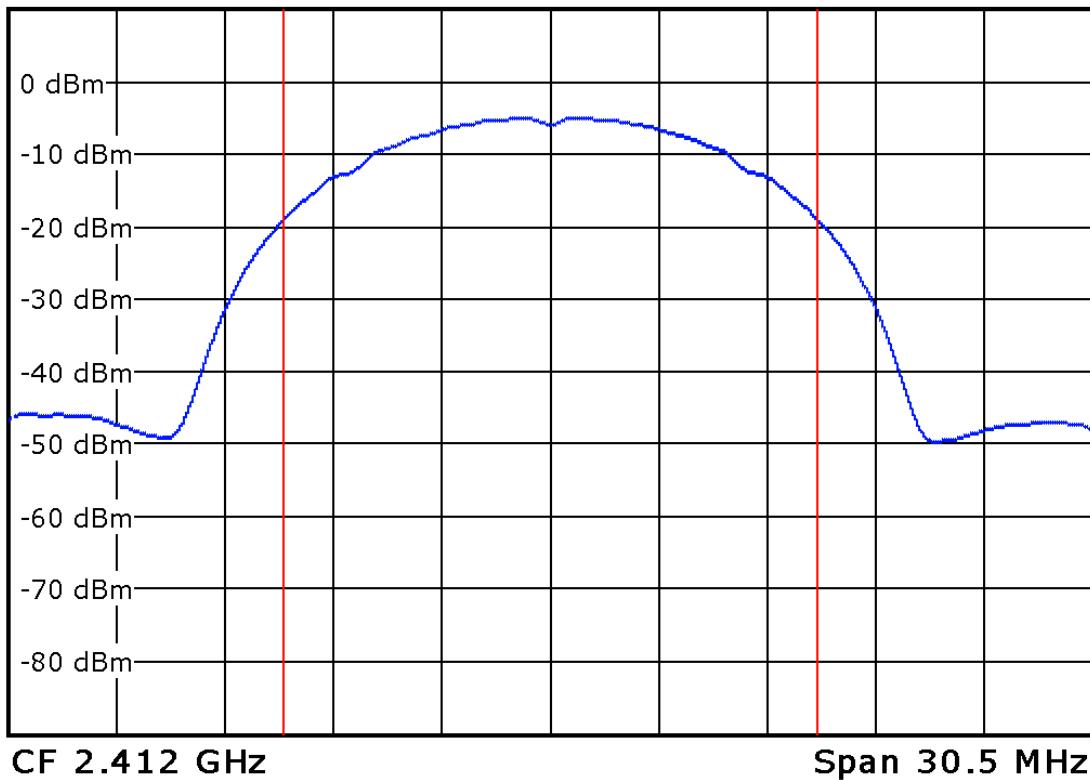
Client	<b>Technologies HumanWare inc.</b>	 Canada
Product	<b>BrailleNote Touch</b>	
Standard(s)	RSS-247 Issue 2 FCC Part 15 Subpart 15.247	

Peak Power, mode B  
Low Channel – 10dB external attenuation



Att 30 dB                    \* RBW 300 kHz  
Ref 10.00 dBm              \* VBW 3 MHz  
                                \* SWT 180s

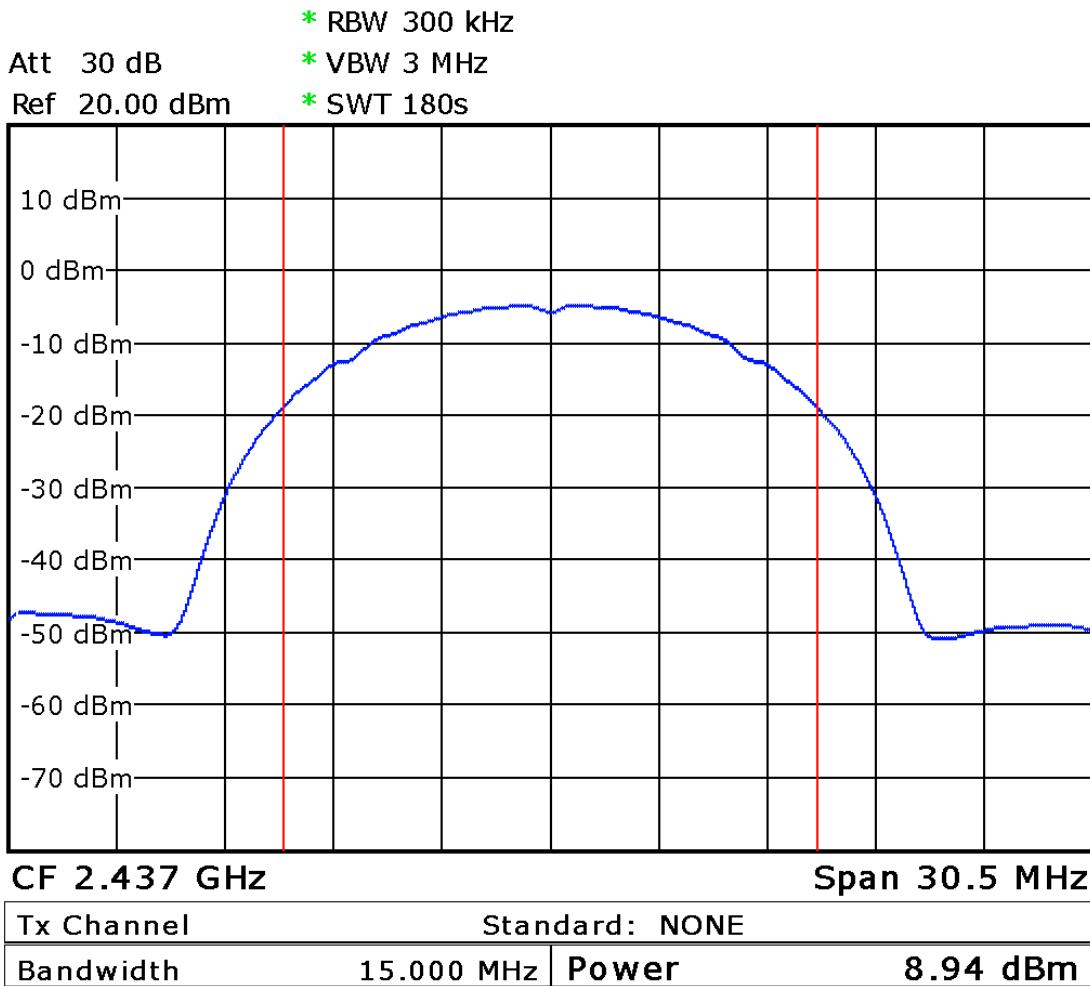
1Rm  
View



Date: 21.SEP.2016 17:41:53

Client	<b>Technologies HumanWare inc.</b>	 Canada
Product	<b>BrailleNote Touch</b>	
Standard(s)	RSS-247 Issue 2 FCC Part 15 Subpart 15.247	

Peak Power, mode B  
Mid Channel – 10dB External attenuation



Date: 21.SEP.2016 18:10:26

Client	<b>Technologies HumanWare inc.</b>	 Canada
Product	<b>BrailleNote Touch</b>	
Standard(s)	RSS-247 Issue 2 FCC Part 15 Subpart 15.247	

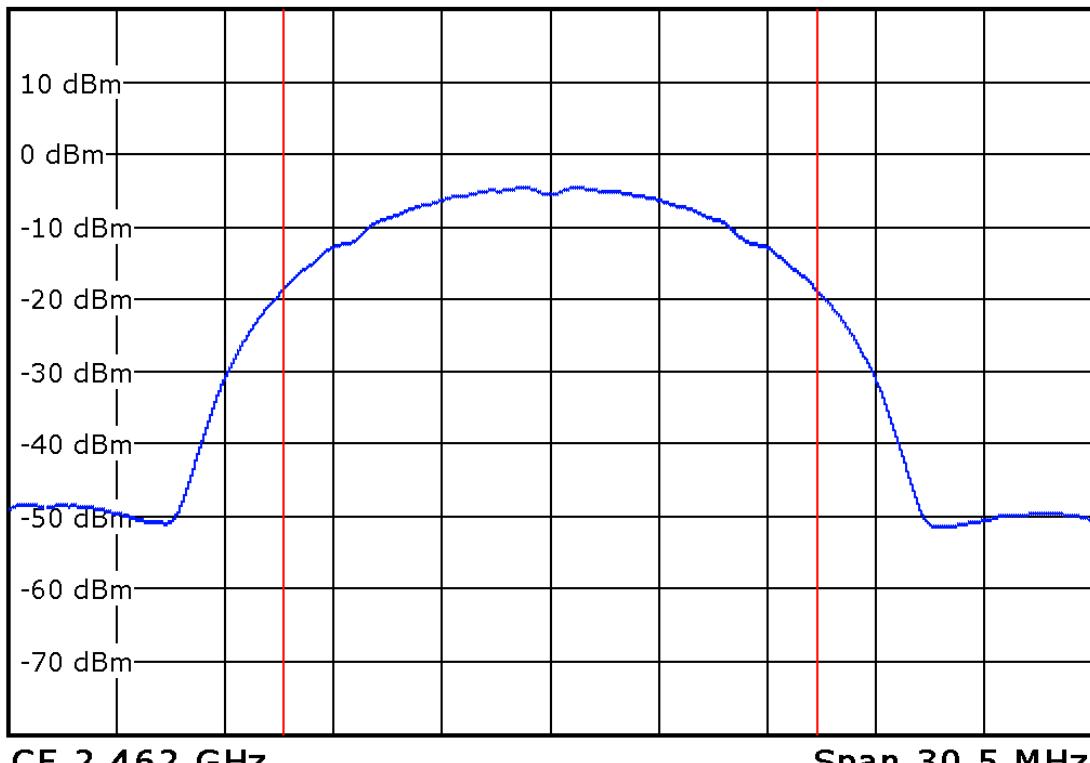
Peak Power, mode B  
Hi Channel – 10dB External Attenuation



Att 30 dB  
Ref 20.00 dBm

\* RBW 300 kHz  
\* VBW 3 MHz  
\* SWT 180s

1Rm  
View



Tx Channel	Standard: NONE		
Bandwidth	15.000 MHz	Power	9.07 dBm

Date: 21.SEP.2016 18:17:03

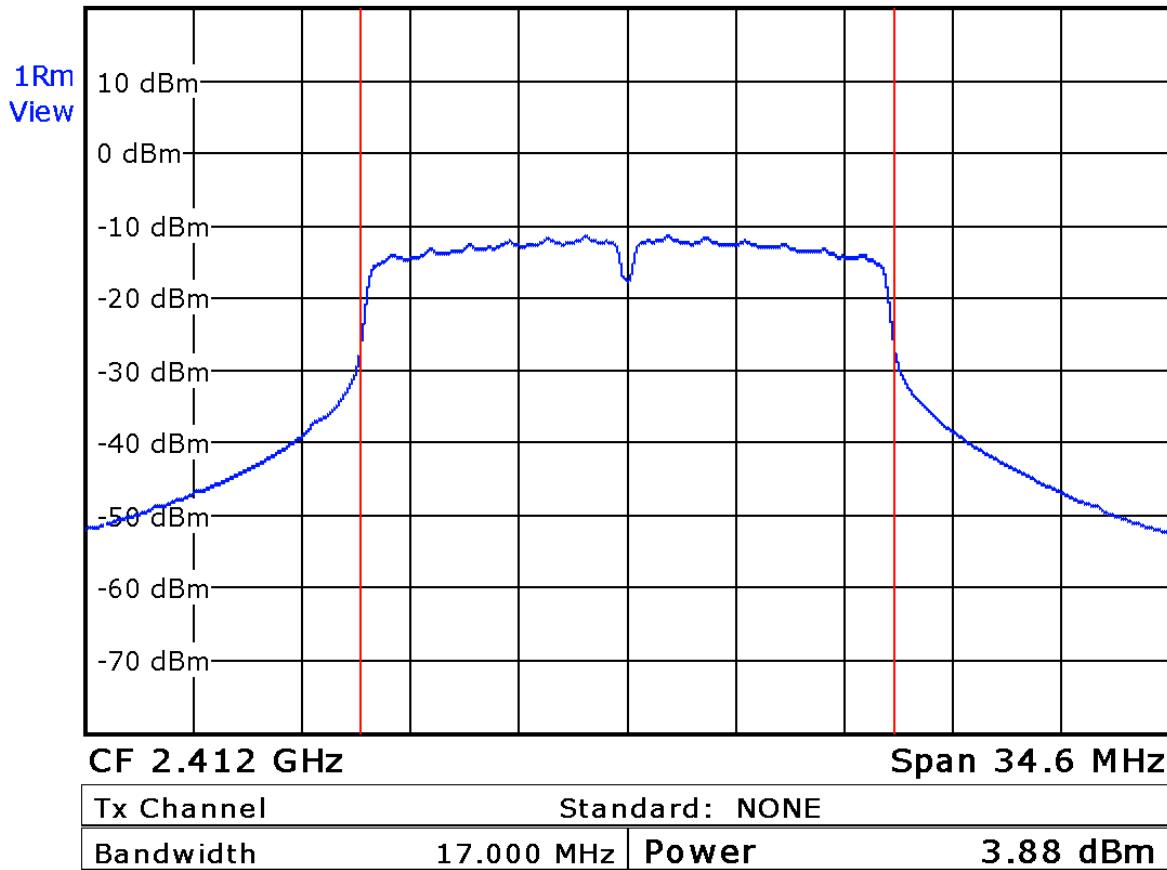
Client	<b>Technologies HumanWare inc.</b>	 Canada
Product	<b>BrailleNote Touch</b>	
Standard(s)	RSS-247 Issue 2 FCC Part 15 Subpart 15.247	

## Peak Power, mode G

## Low Channel – 10dB external attenuation



Att 30 dB \* VBW 3 MHz  
Ref 20.00 dBm \* SWT 180s



Date: 21.SEP.2016 18:39:51

Client	<b>Technologies HumanWare inc.</b>	 Canada
Product	<b>BrailleNote Touch</b>	
Standard(s)	RSS-247 Issue 2 FCC Part 15 Subpart 15.247	

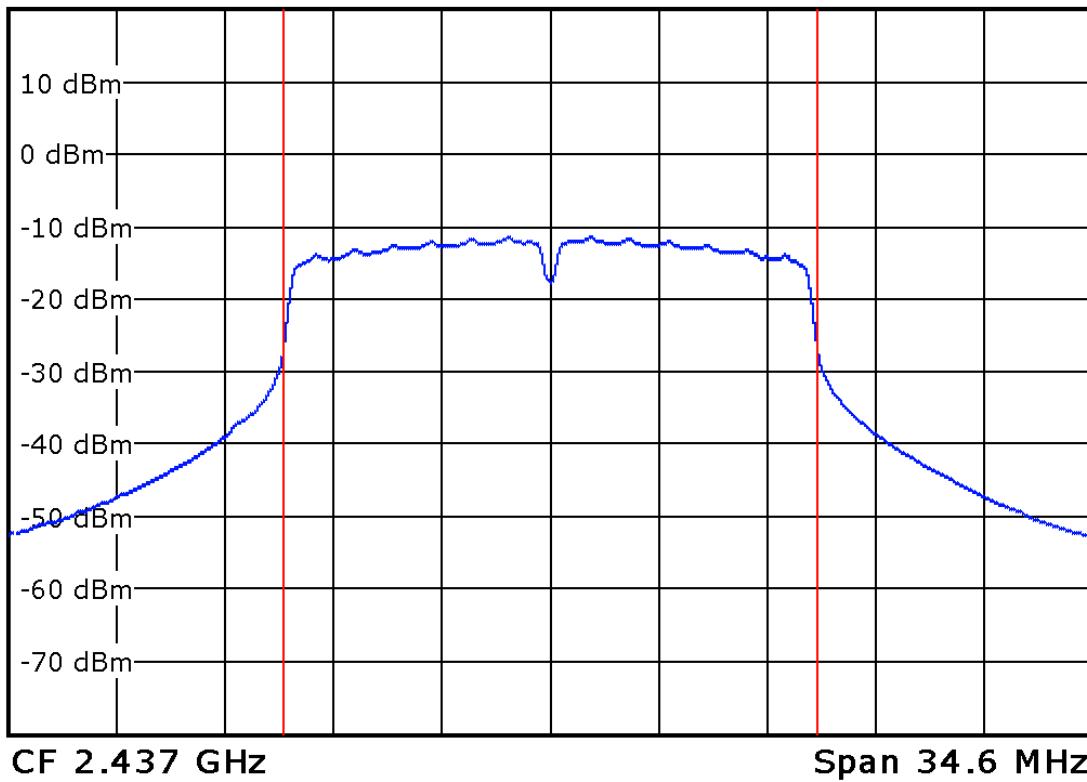
Peak Power, mode G  
Mid Channel – 10dB External attenuation



Att 30 dB  
Ref 20.00 dBm

\* RBW 300 kHz  
\* VBW 3 MHz  
\* SWT 180s

1Rm  
View



Date: 21.SEP.2016 18:29:47

Client	<b>Technologies HumanWare inc.</b>	 Canada
Product	<b>BrailleNote Touch</b>	
Standard(s)	RSS-247 Issue 2 FCC Part 15 Subpart 15.247	

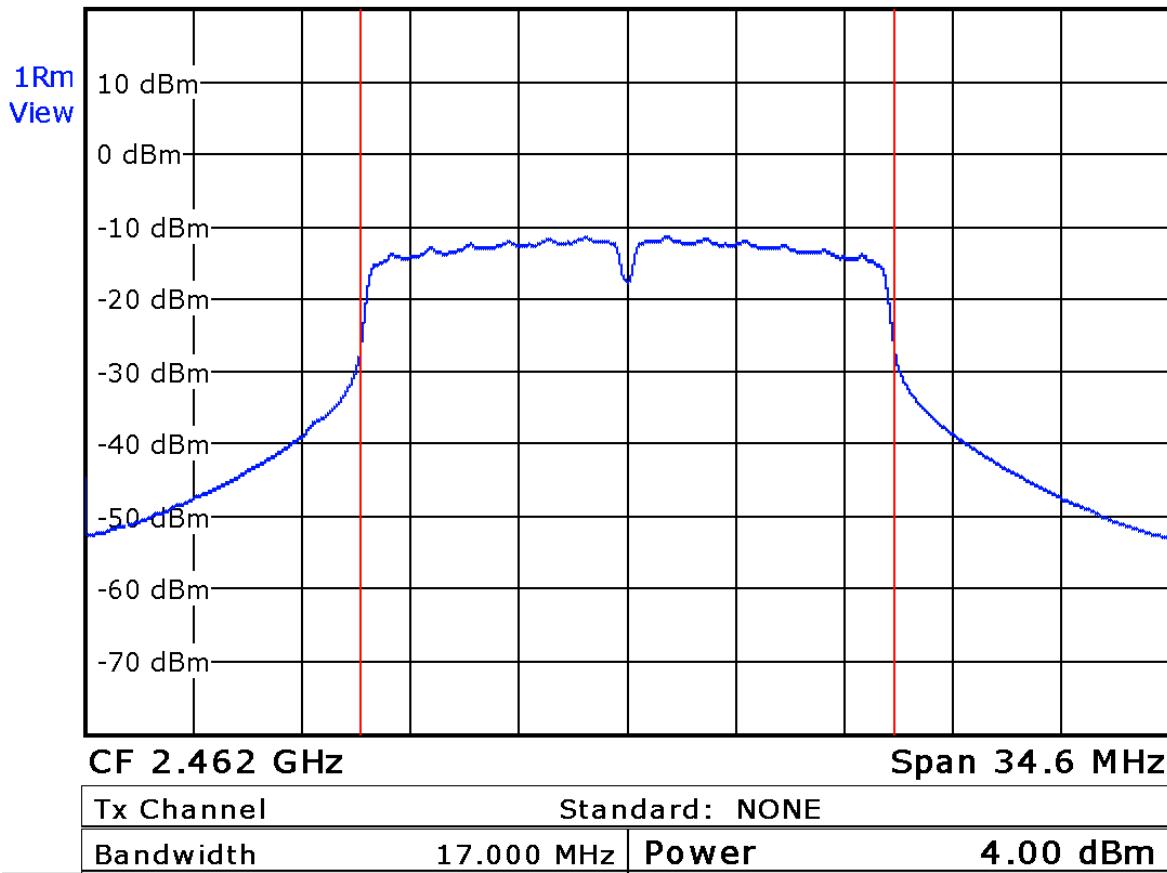
## Peak Power, mode G

## Hi Channel – 10dB External Attenuation



Att 30 dB  
Ref 20.00 dBm

- \* RBW 300 kHz
- \* VBW 3 MHz
- \* SWT 180s



Date: 21.SEP.2016 18:23:48

See 'Appendix B – EUT and Test Setup Photos' for photos showing the test set-up.

Client	<b>Technologies HumanWare inc.</b>	 Canada
Product	<b>BrailleNote Touch</b>	
Standard(s)	RSS-247 Issue 2 FCC Part 15 Subpart 15.247	

## Test Equipment List

Equipment	Model No.	Manufacturer	Last Calibration Date	Next Calibration Date	Asset #
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Client	<b>Technologies HumanWare inc.</b>	 Canada
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Standard(s)	RSS-247 Issue 2 FCC Part 15 Subpart 15.247	

## ***Antenna Spurious Conducted Emissions (-20 dBc Requirement)***

### **Purpose**

The purpose of this test is to ensure that the maximum power conducted to the radiating element at frequencies outside of the authorized spectrum does not exceed the limits specified. This ensures that the only the intended signal is delivered to the radiating element.

### **Limits and Method**

The limits are defined in 15.247(d). In any 100 kHz band, the peak spurious harmonics emissions must be at least 20 dB below the fundamental. Spurious Conducted emissions are to be evaluated up to the 10<sup>th</sup> harmonic. This -20 dBc requirement also applies at the 'band edge' or 2.4 GHz and 2.4835 GHz.

The method is given in Section 11 of FCC KDB 558074 and ANSI C63.10

### **Results**

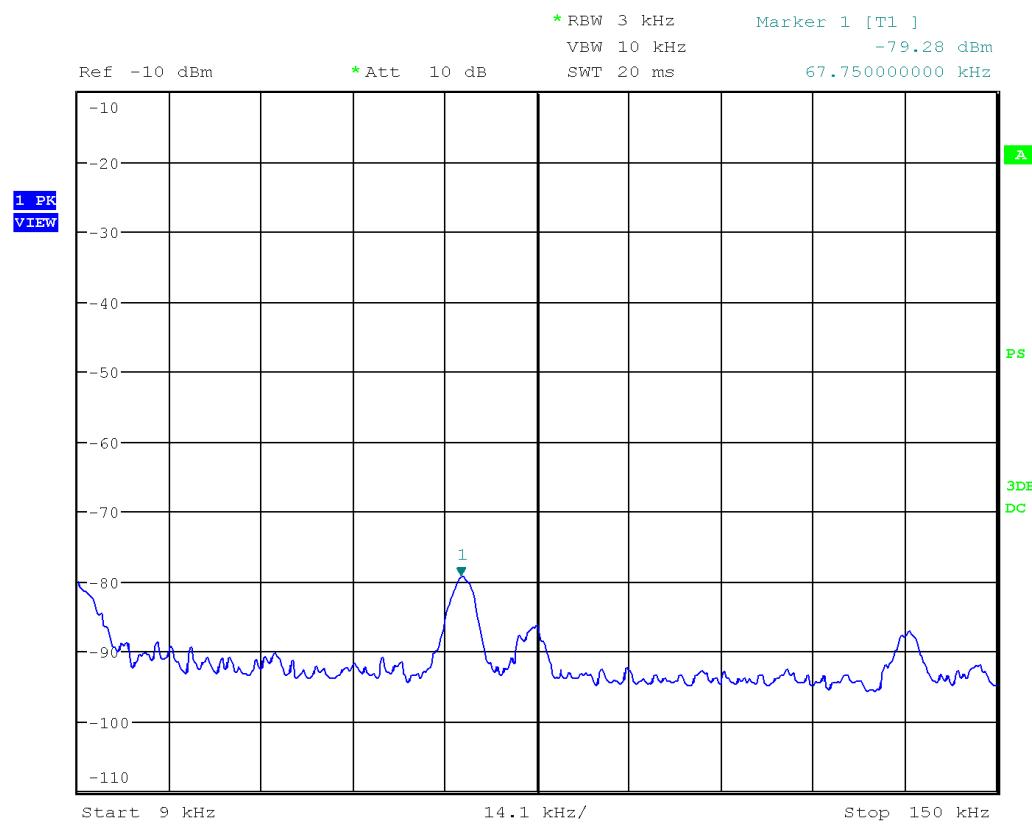
The EUT passed. Low, middle and high bands were measured. The worst case is presented as a graph for the spectrum. The -20 dBc requirement is shown for the lower band edge at 2.4 GHz in the low band and also for the higher band edge at 2.4835 GHz in the high band.

Client	<b>Technologies HumanWare inc.</b>	 Canada
Product	<b>BrailleNote Touch</b>	
Standard(s)	RSS-247 Issue 2 FCC Part 15 Subpart 15.247	

## Graphs

The graphs shown below show the worst case peak power output of the device during the antenna conducted measurement during transmit operation of the EUT. Note there was 10 dB of external attenuation during this measurement.

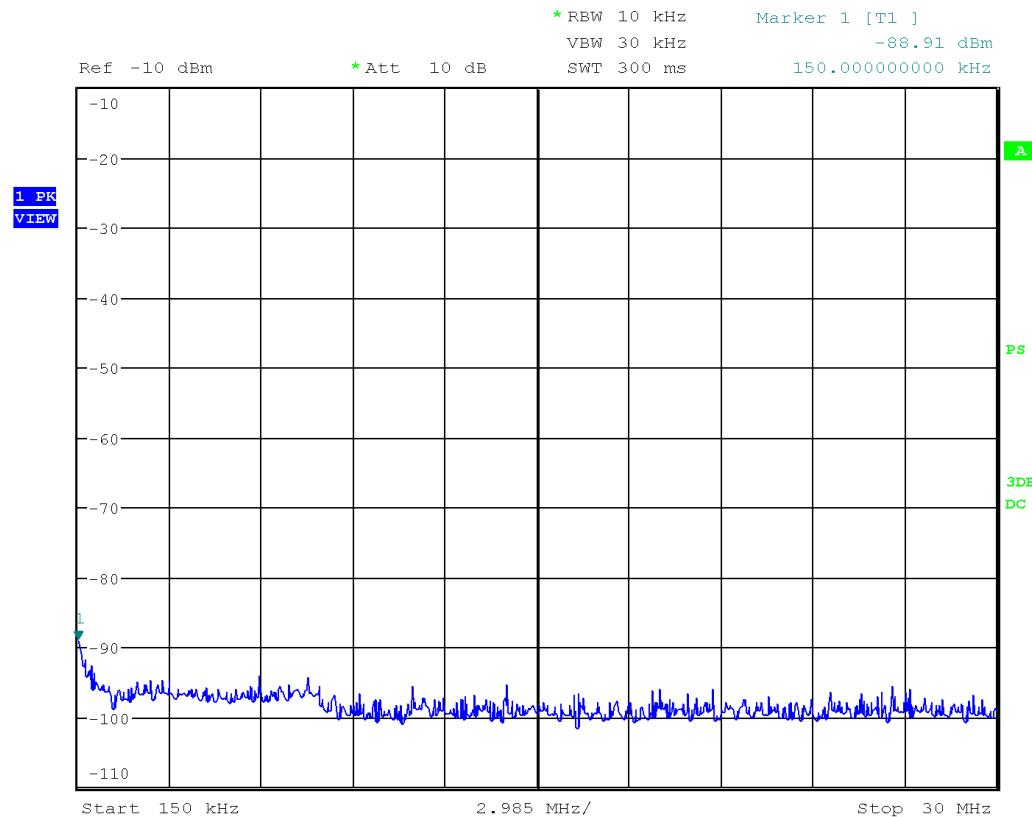
### 9 kHz to 150 kHz (Low channel, mode B)



Date: 22.SEP.2016 14:22:57

Client	<b>Technologies HumanWare inc.</b>	 Canada
Product	<b>BrailleNote Touch</b>	
Standard(s)	RSS-247 Issue 2 FCC Part 15 Subpart 15.247	

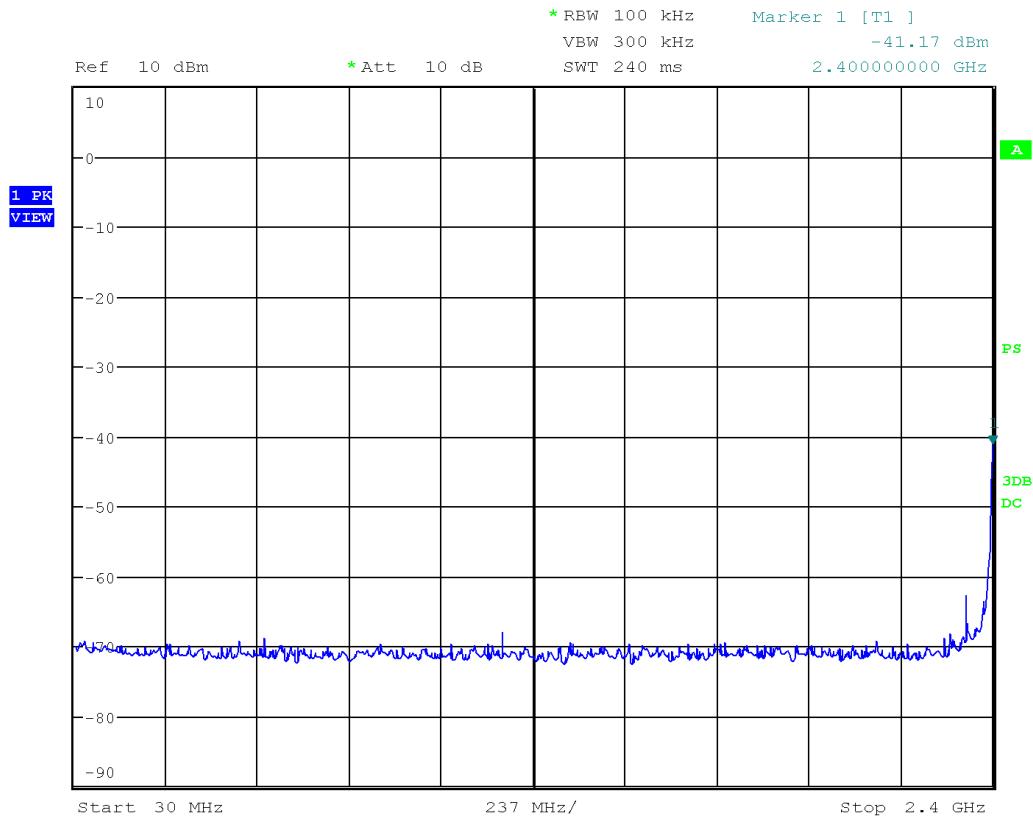
### 150 kHz to 30 MHz (Low channel, mode B)



Date: 22.SEP.2016 14:24:43

Client	<b>Technologies HumanWare inc.</b>	 Canada
Product	<b>BrailleNote Touch</b>	
Standard(s)	RSS-247 Issue 2 FCC Part 15 Subpart 15.247	

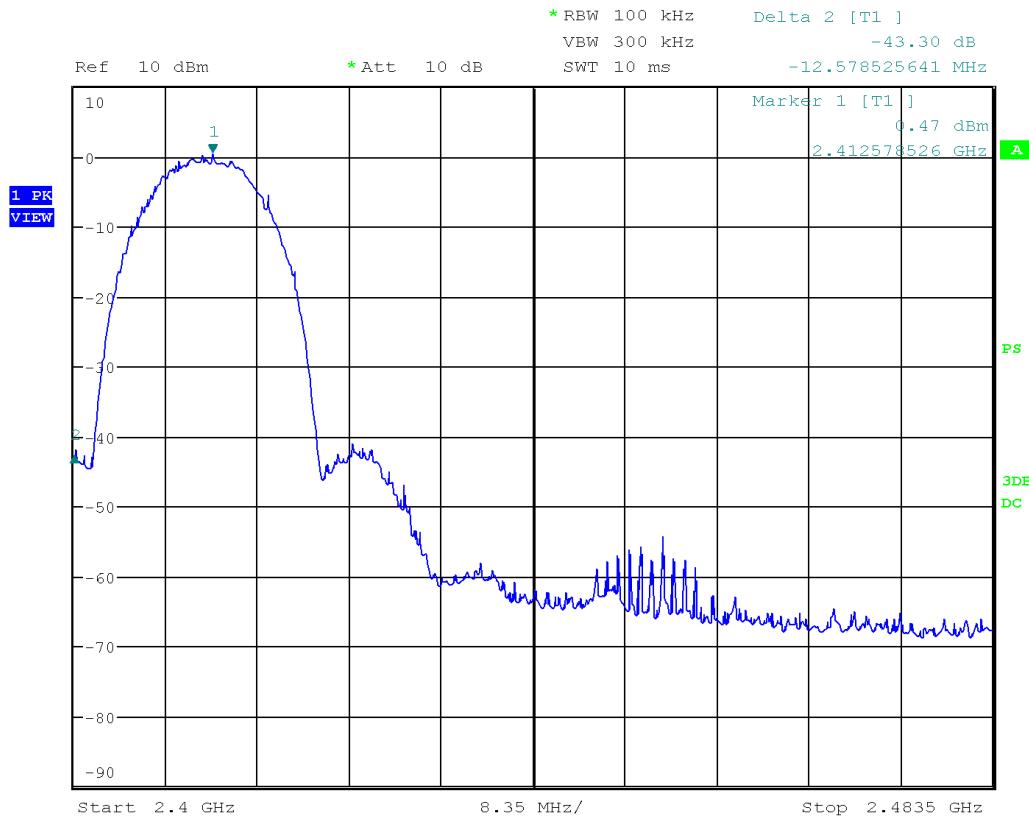
30 MHz to 2.4 GHz (Low channel, mode B)



Date: 22.SEP.2016 14:20:23

Client	<b>Technologies HumanWare inc.</b>	 Canada
Product	<b>BrailleNote Touch</b>	
Standard(s)	RSS-247 Issue 2 FCC Part 15 Subpart 15.247	

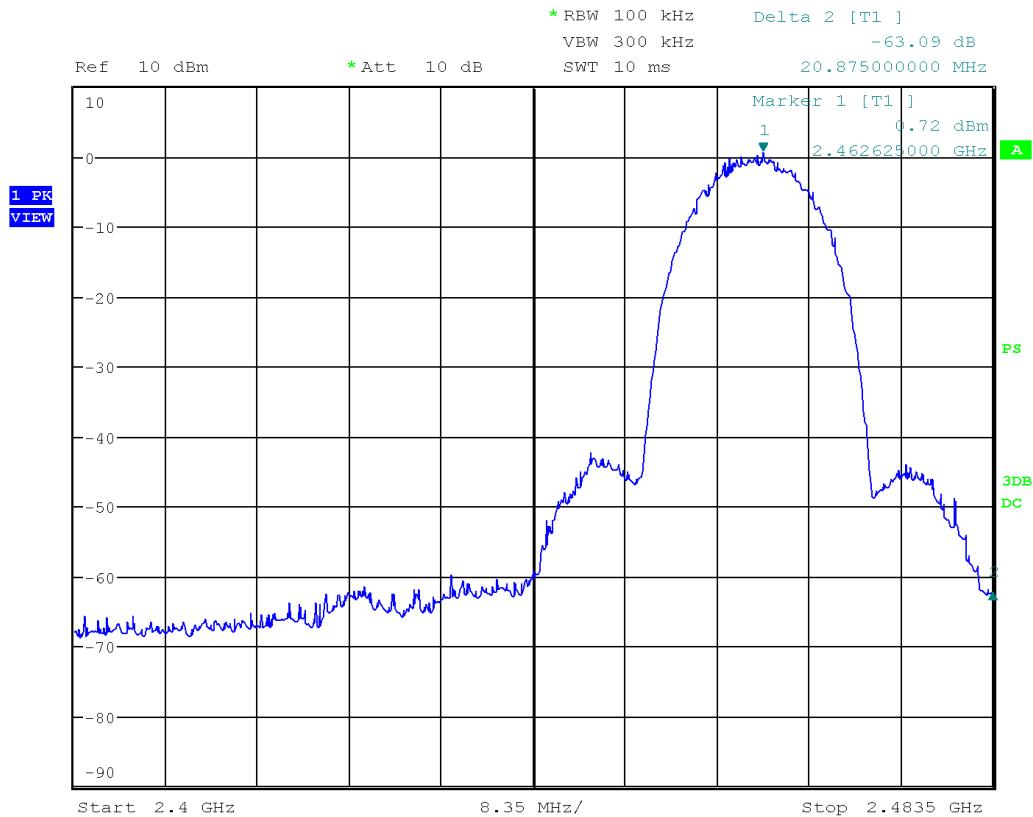
## 2.4 GHz to 2.4835 GHz (Low channel band edge, mode B)



Date: 22.SEP.2016 14:18:59

Client	<b>Technologies HumanWare inc.</b>	 Canada
Product	<b>BrailleNote Touch</b>	
Standard(s)	RSS-247 Issue 2 FCC Part 15 Subpart 15.247	

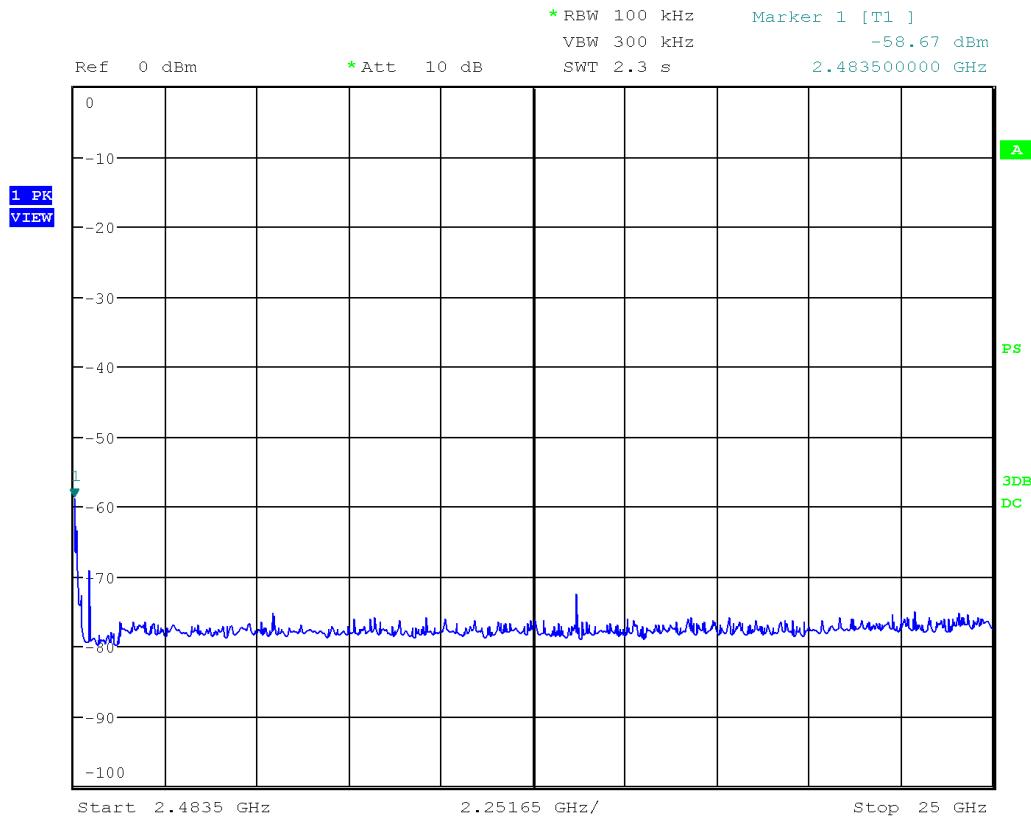
## 2.4 GHz to 2.4835 GHz (high channel band edge, mode B)



Date: 22.SEP.2016 14:17:06

Client	<b>Technologies HumanWare inc.</b>	 Canada
Product	<b>BrailleNote Touch</b>	
Standard(s)	RSS-247 Issue 2 FCC Part 15 Subpart 15.247	

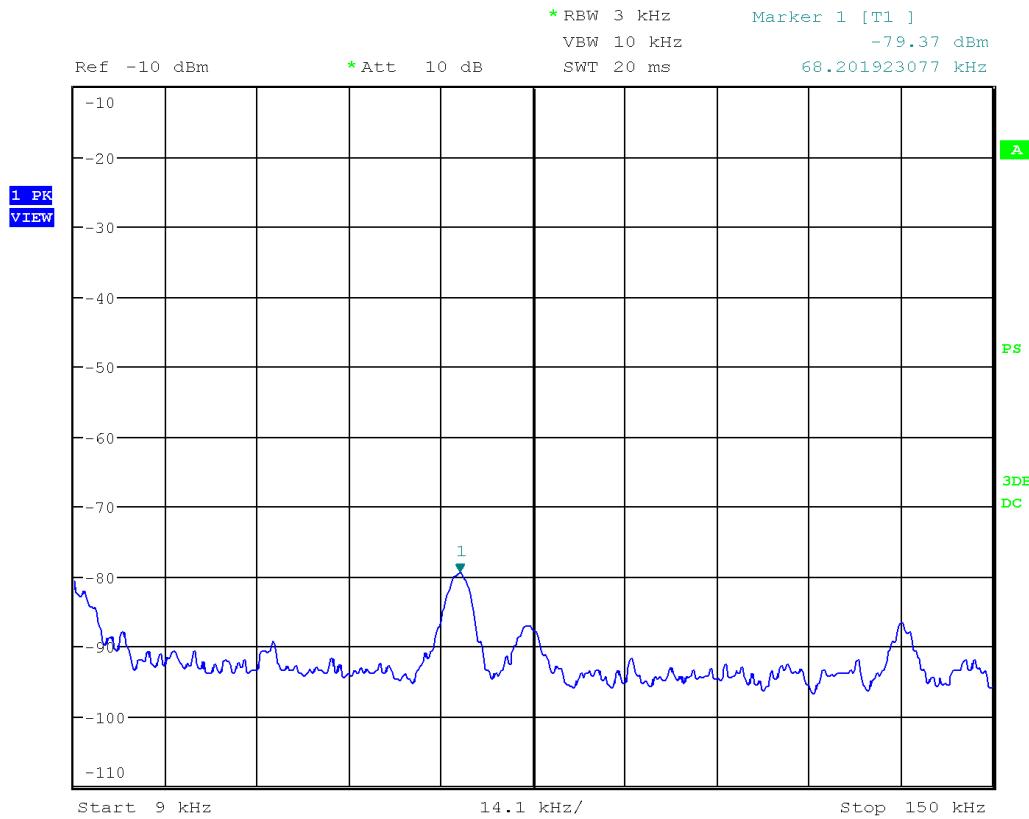
2.4835 GHz to 25 GHz (High channel, mode B)



Date: 22.SEP.2016 14:12:27

Client	<b>Technologies HumanWare inc.</b>	 Canada
Product	<b>BrailleNote Touch</b>	
Standard(s)	RSS-247 Issue 2 FCC Part 15 Subpart 15.247	

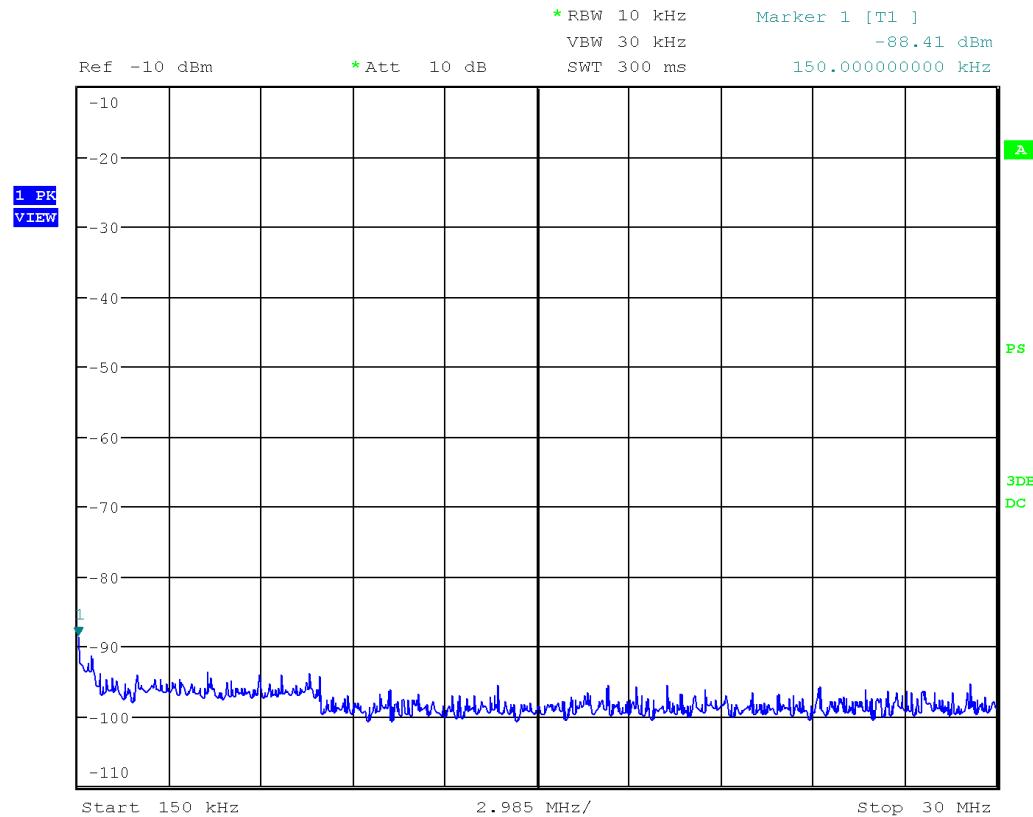
### 9 kHz to 150 kHz (Low channel, mode G)



Date: 22.SEP.2016 13:55:30

Client	<b>Technologies HumanWare inc.</b>	 Canada
Product	<b>BrailleNote Touch</b>	
Standard(s)	RSS-247 Issue 2 FCC Part 15 Subpart 15.247	

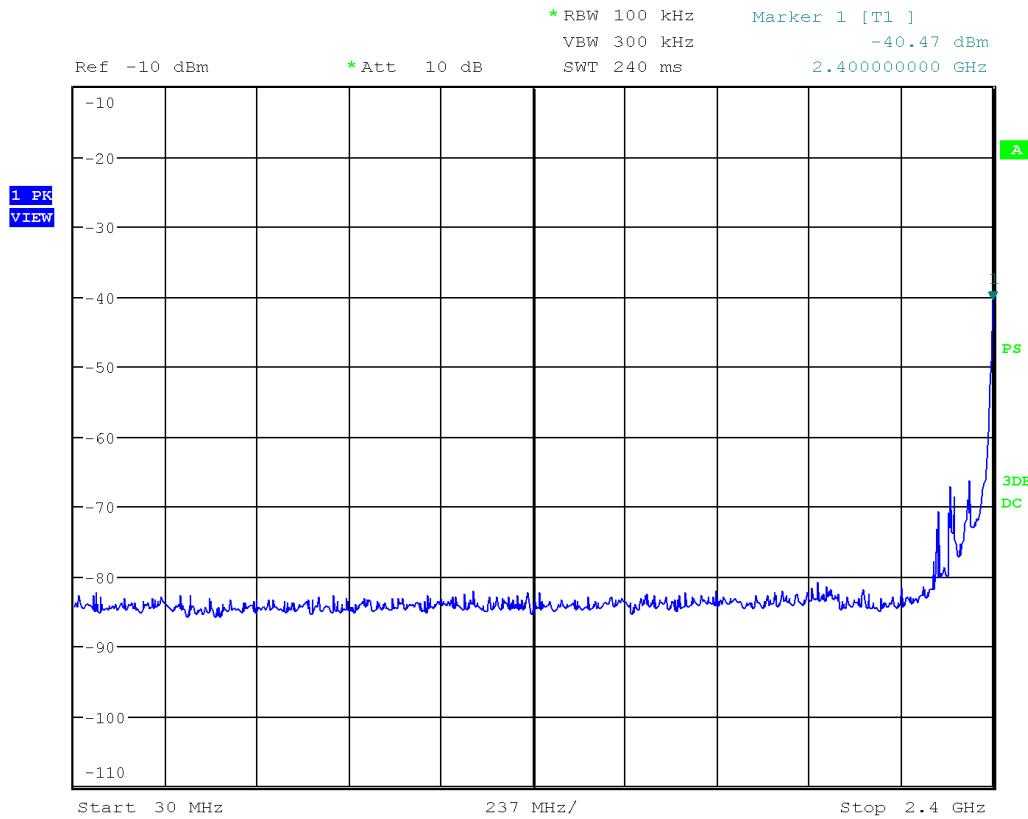
150 kHz to 30 MHz (Low channel, mode G)



Date: 22.SEP.2016 13:58:57

Client	<b>Technologies HumanWare inc.</b>	 Canada
Product	<b>BrailleNote Touch</b>	
Standard(s)	RSS-247 Issue 2 FCC Part 15 Subpart 15.247	

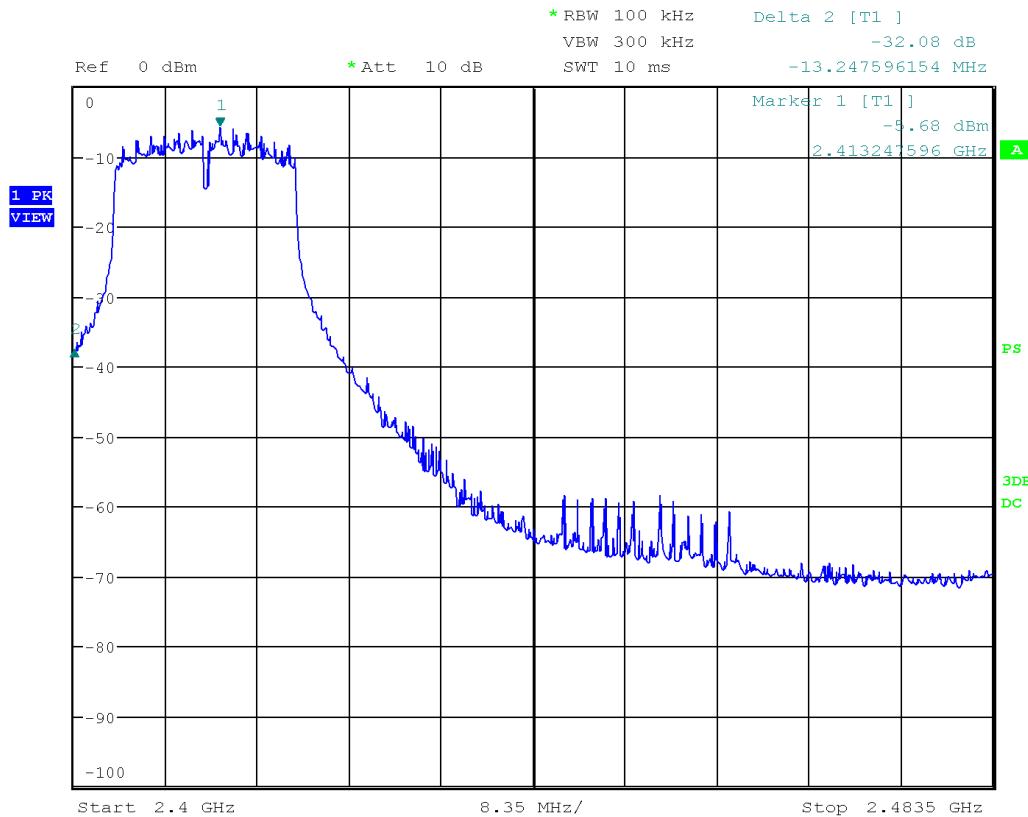
30 MHz to 2.4 GHz (Low channel, mode G)



Date: 22.SEP.2016 14:00:29

Client	Technologies HumanWare inc.	 Canada
Product	BrailleNote Touch	
Standard(s)	RSS-247 Issue 2 FCC Part 15 Subpart 15.247	

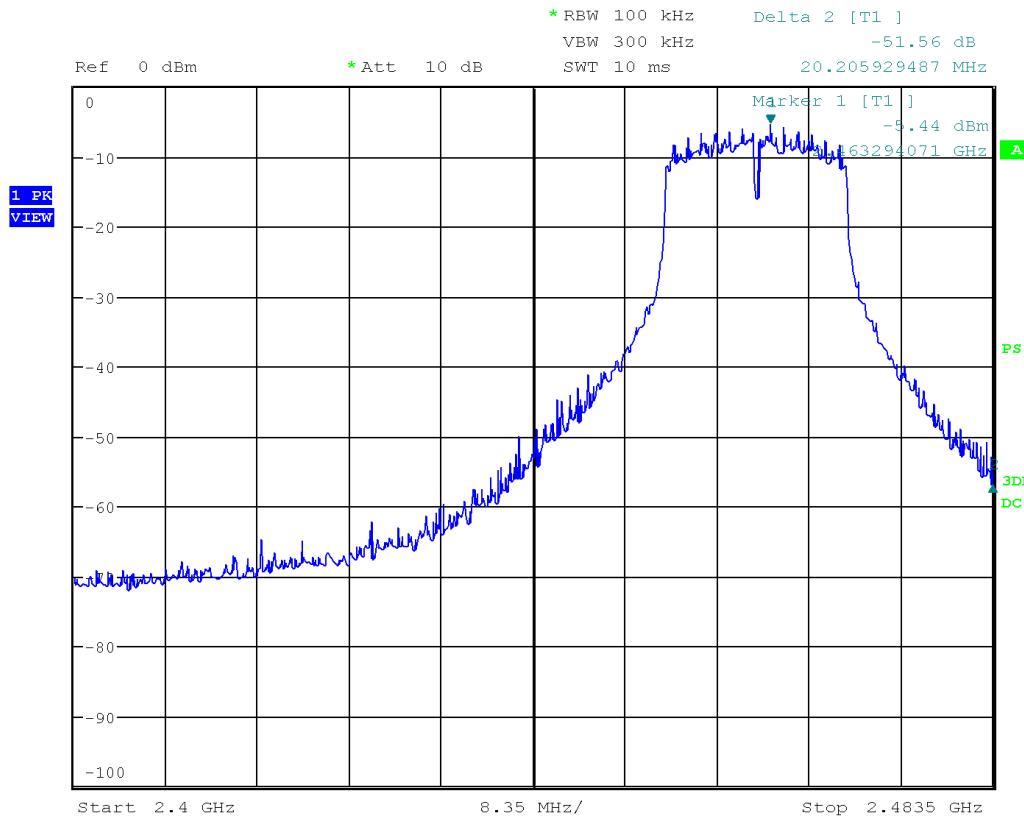
## 2.4 GHz to 2.4835 GHz (Low channel band edge, mode G)



Date: 22.SEP.2016 14:02:28

Client	<b>Technologies HumanWare inc.</b>	 Canada
Product	<b>BrailleNote Touch</b>	
Standard(s)	RSS-247 Issue 2 FCC Part 15 Subpart 15.247	

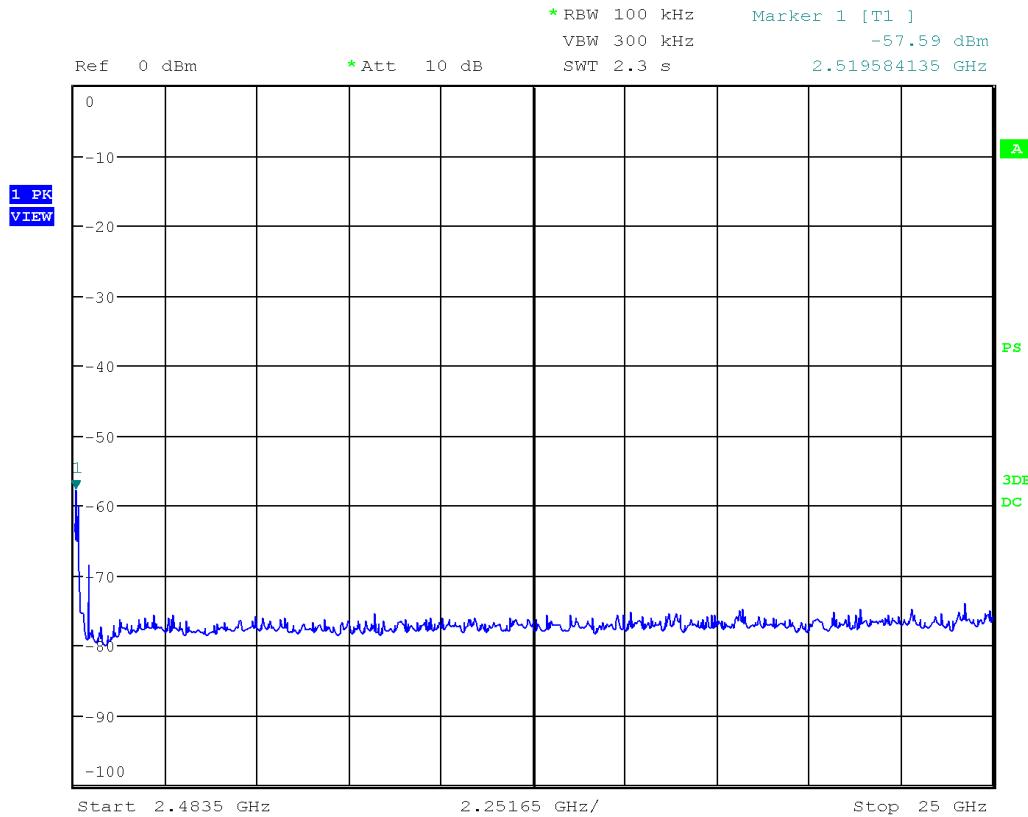
2.4 GHz to 2.4835 GHz (high channel band edge, mode G)



Date: 22.SEP.2016 14:07:00

Client	<b>Technologies HumanWare inc.</b>	 Canada
Product	<b>BrailleNote Touch</b>	
Standard(s)	RSS-247 Issue 2 FCC Part 15 Subpart 15.247	

### 2.4835 GHz to 25 GHz (High channel, mode G)



Date: 22.SEP.2016 14:08:27

See 'Appendix B – EUT and Test Setup Photos' for photos showing the test set-up.

Client	<b>Technologies HumanWare inc.</b>	 Canada
Product	<b>BrailleNote Touch</b>	
Standard(s)	RSS-247 Issue 2 FCC Part 15 Subpart 15.247	

## Test Equipment List

Equipment	Model No.	Manufacturer	Last Calibration Date	Next Calibration Date	Asset #
Spectrum Analyzer	ESU-40	Rohde & Schwarz	Jan 28, 2016	Jan 28, 2018	4092
Attenuator 10 dB	4779-10	narda	NCR	NCR	4096

Client	<b>Technologies HumanWare inc.</b>	 Canada
Product	<b>BrailleNote Touch</b>	
Standard(s)	RSS-247 Issue 2 FCC Part 15 Subpart 15.247	

## **Transmitter Spurious Radiated Emissions**

### **Purpose**

The purpose of this test is to ensure that the RF energy unintentionally emitted from the EUT does not exceed the limits listed below as defined in the applicable test standard, as measured from a receiving antenna. This helps protect broadcast radio services such as television, FM radio, pagers, cellular telephones, emergency services, and so on, from unwanted interference.

### **Limits and Method**

The method is as defined in Section 12.2 of FCC KDB 558074 and ANSI C63.10.

The limits, as defined in 15.247(d) for unintentional radiated emissions, apply for those emissions that fall in the restricted bands, as defined in Section 15.205(a). These emissions must comply with the radiated emission limits specified in Section 15.209(a).

All unintentional emissions must also meet the ‘Spurious Conducted Emissions’ requirements of -20 dBc or greater. See also ‘Antenna Spurious Conducted Emissions (-20dBc)’ for further details.

Frequency	Limit
0.009 MHz – 0.490 MHz	2400/F(kHz) uV/m at 300m <sup>1</sup>
0.490 MHz – 1.705 MHz	24000/F(kHz) uV/m at 30m <sup>1</sup>
1.705 MHz – 30 MHz	30 uV/m at 30m <sup>1</sup>
30 MHz – 88 MHz	100 uV/m (40.0 dBuV/m <sup>1</sup> ) at 3m
88 MHz – 216 MHz	150 uV/m (43.5 dBuV/m <sup>1</sup> ) at 3m
216 MHz – 960 MHz	200 uV/m (46.0 dBuV/m <sup>1</sup> ) at 3m
Above 960 MHz	500 uV/m (54.0 dBuV/m <sup>1</sup> ) at 3m
Above 1000 MHz	500 uV/m (54 dBuV/m <sup>2</sup> ) at 3m
Above 1000 MHz	500 uV/m (74 dBuV/m <sup>3</sup> ) at 3m

<sup>1</sup>Limit is with Quasi Peak detector with bandwidths as defined in CISPR-16-1-1

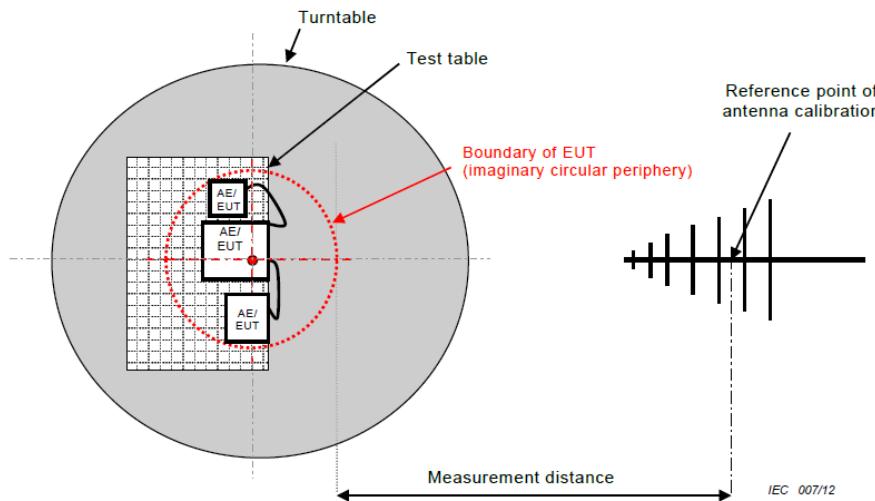
<sup>2</sup>Limit is with 1 MHz measurement bandwidth and using an Average detector

<sup>3</sup>Limit is with 1 MHz measurement bandwidth and using a Peak detector

Based on ANSI C63.4 Section 4.2, if the Peak detector measurements do not exceed the Quasi-Peak limits, where defined, then the EUT is deemed to have passed the requirements.

Client	<b>Technologies HumanWare inc.</b>	 Canada
Product	<b>BrailleNote Touch</b>	
Standard(s)	RSS-247 Issue 2 FCC Part 15 Subpart 15.247	

### Typical Radiated Emissions Setup



### Measurement Uncertainty

The expanded measurement uncertainty is calculated in accordance with CISPR 16-4-2 and is  $\pm 4.25\text{dB}$  for 30MHz – 1GHz and  $\pm 4.93\text{dB}$  for 1GHz – 18GHz with a 'k=2' coverage factor and a 95% confidence level.

### Preliminary Graphs

The graphs shown below are maximized peak measurement graphs measured with a resolution bandwidth greater than or equal to the final required detector over a full 0-360°. This peaking process is done as a worst case measurement and enables the detection of frequencies of concern for final measurement. For final measurements with the appropriate detector, where applicable, please refer to the tables under Final Measurements.

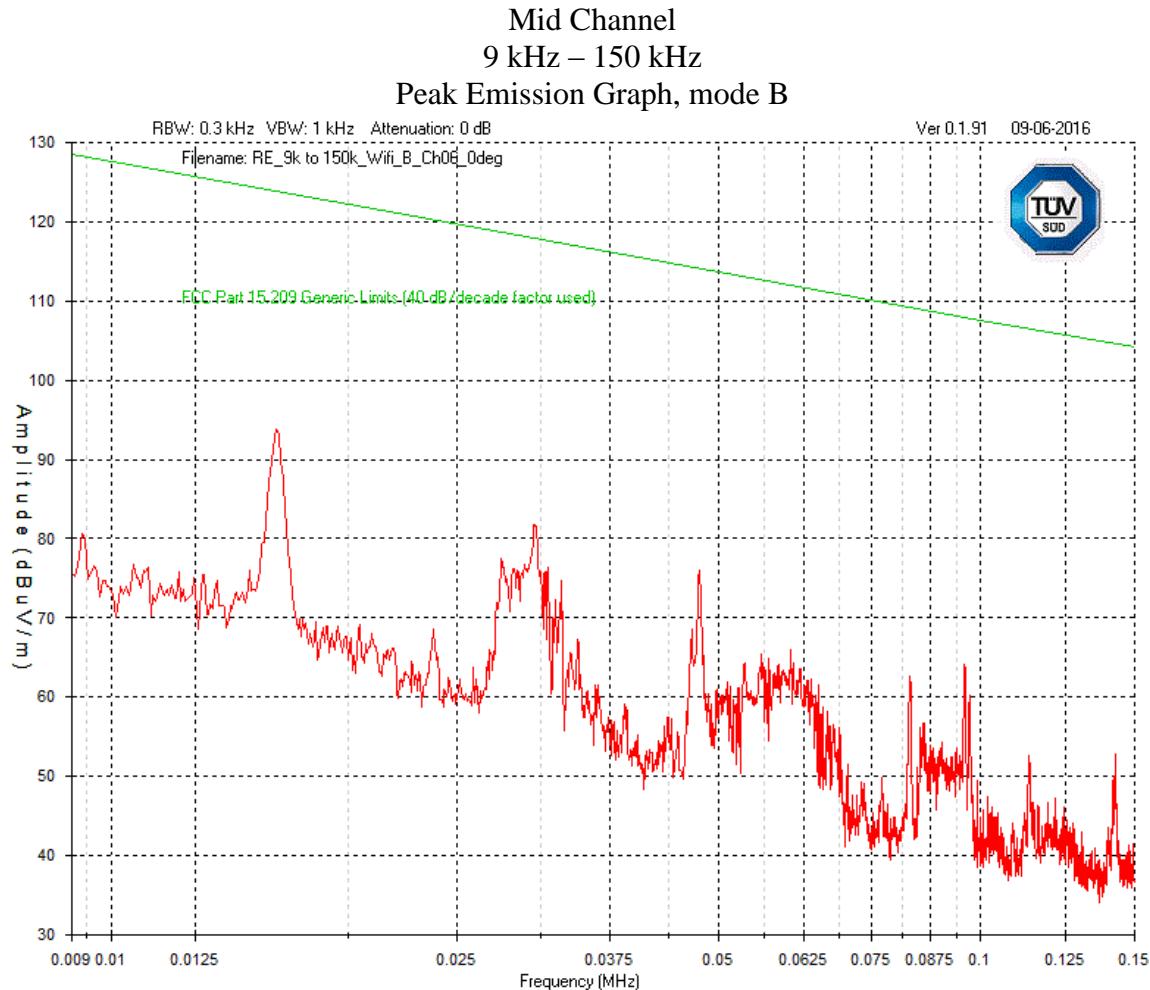
In accordance with FCC Part 15, Subpart A, Section 15.33, the device was scanned to the 10<sup>th</sup> harmonic (a minimum of 24.835 GHz).

Devices scanned may be scanned at alternate test distances and in accordance with FCC Part 15, Subpart A, Section 15.31, an extrapolation factor of 20 dB/decade was used above 30 MHz and 40 dB/decade below 30 MHz. For example for 1 meter measurements, an extrapolation factor 9.5 dB from 20 Log (1m / 3m) is applied.

Low, middle and high channels, each in three orthogonal axis were checked. However, the worst case graphs are presented.

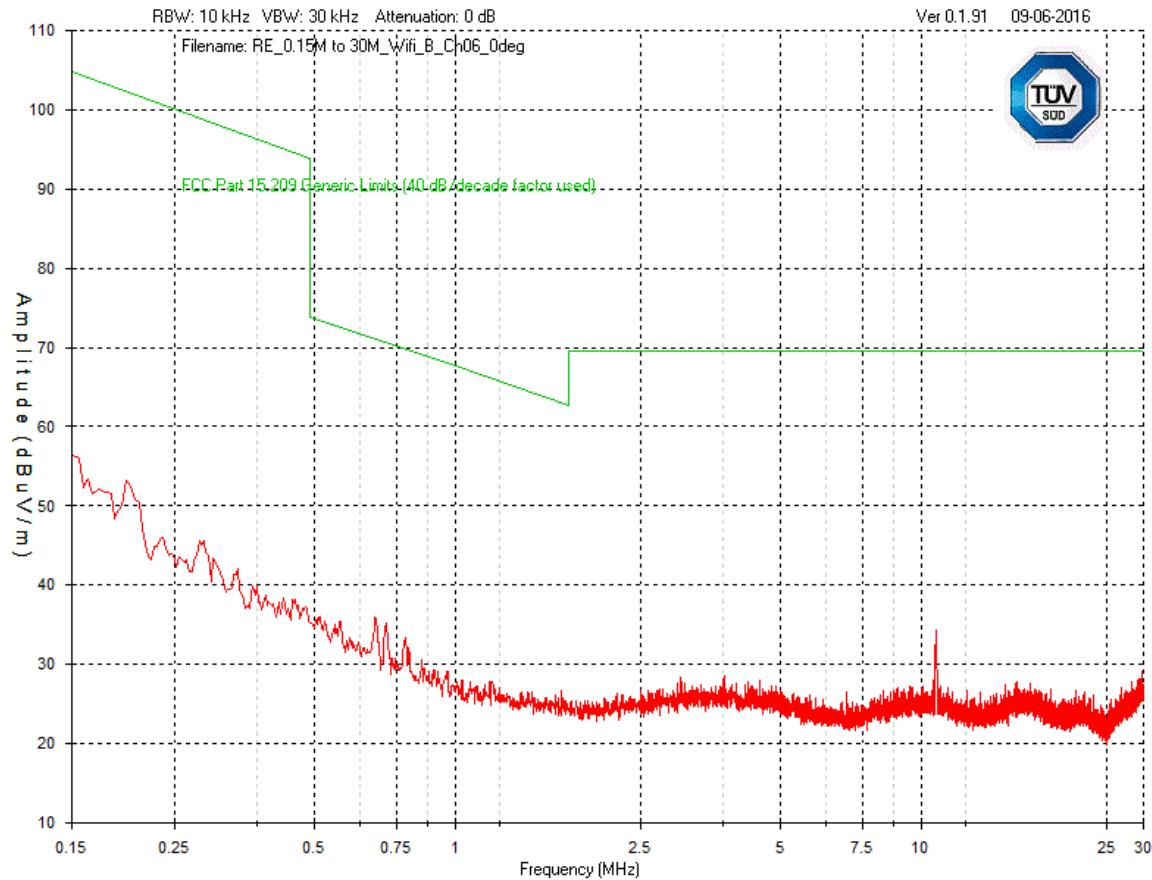
Client	<b>Technologies HumanWare inc.</b>	 Canada
Product	<b>BrailleNote Touch</b>	
Standard(s)	RSS-247 Issue 2 FCC Part 15 Subpart 15.247	

Band-edge measurement graphs are shown for illustration purposes. See final measurement section for all measurements.



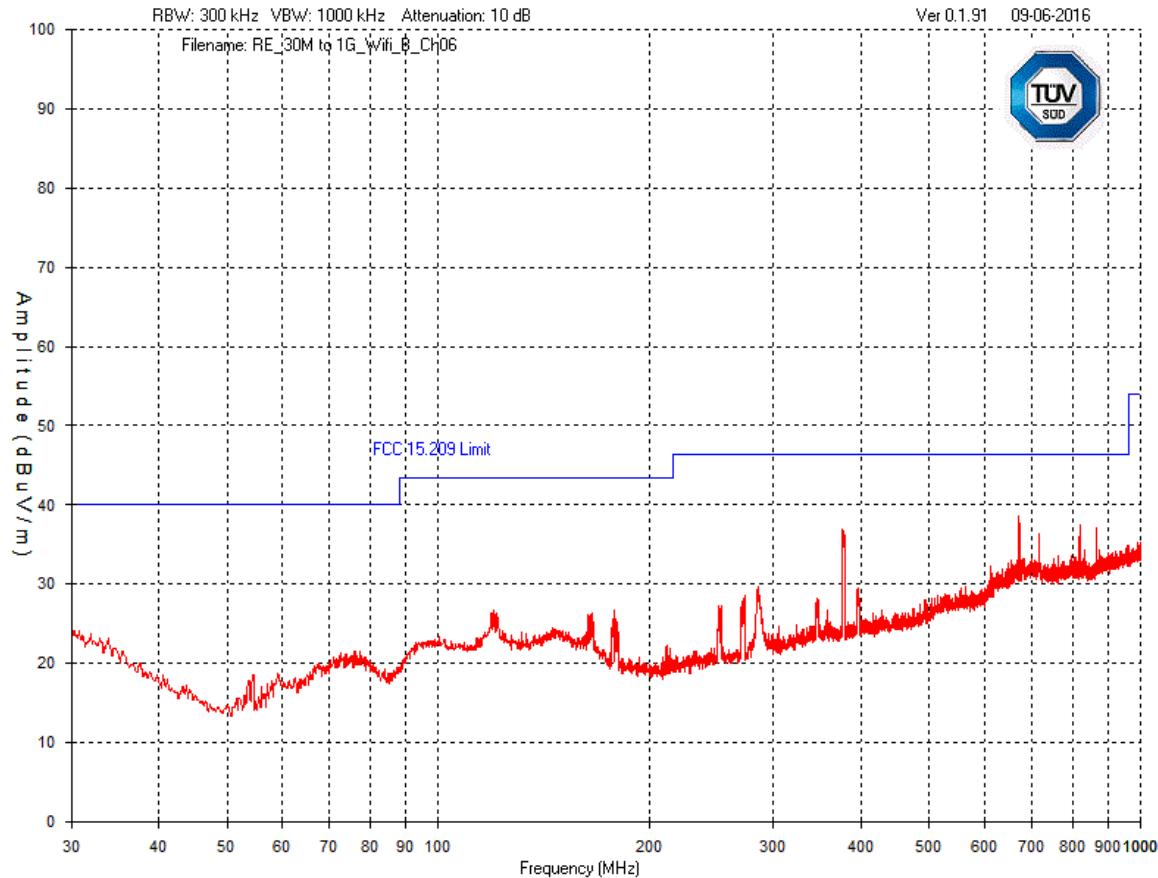
Client	<b>Technologies HumanWare inc.</b>	 Canada
Product	<b>BrailleNote Touch</b>	
Standard(s)	RSS-247 Issue 2 FCC Part 15 Subpart 15.247	

**Mid Channel**  
**150 kHz – 30 MHz**  
**Peak Emission Graph, mode B**



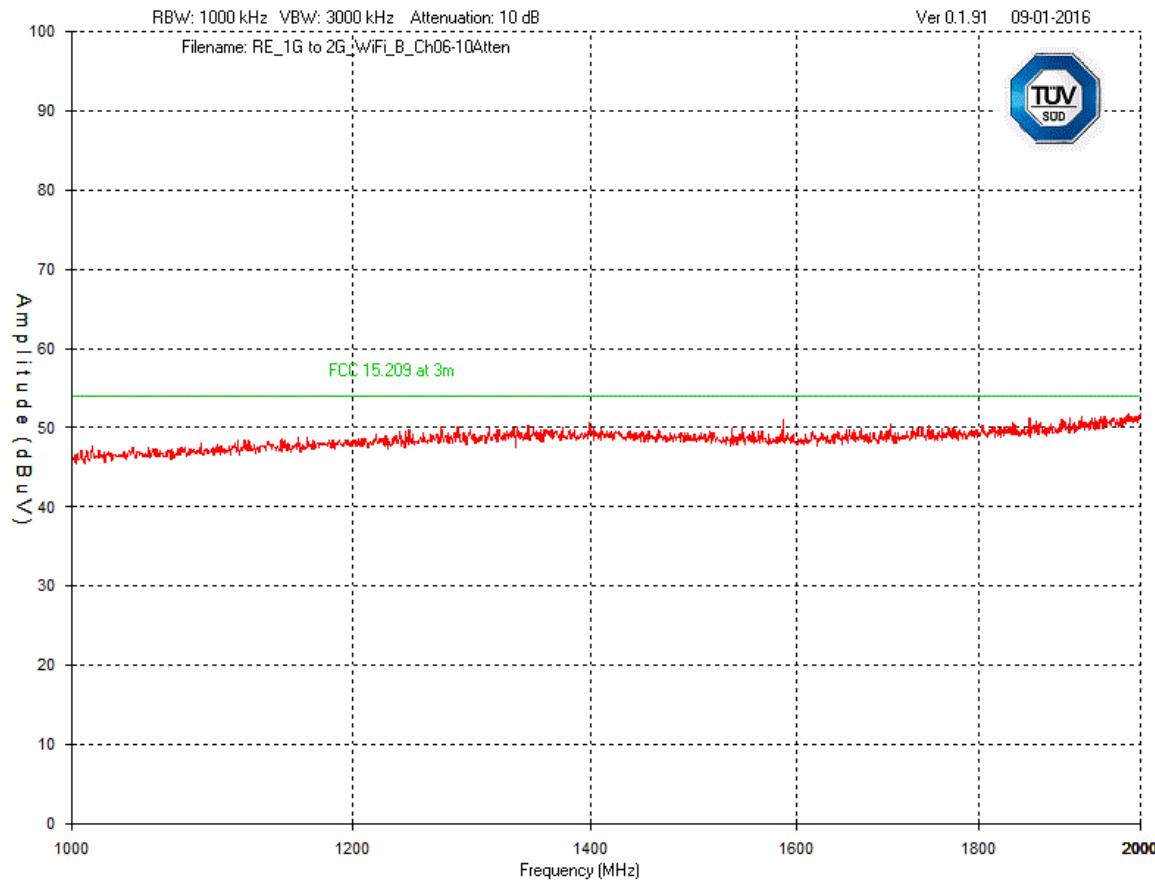
Client	<b>Technologies HumanWare inc.</b>	 Canada
Product	<b>BrailleNote Touch</b>	
Standard(s)	RSS-247 Issue 2 FCC Part 15 Subpart 15.247	

**Mid Channel – 30 MHz – 1 GHz**  
**Horizontal - Peak Emission Graph, mode B**



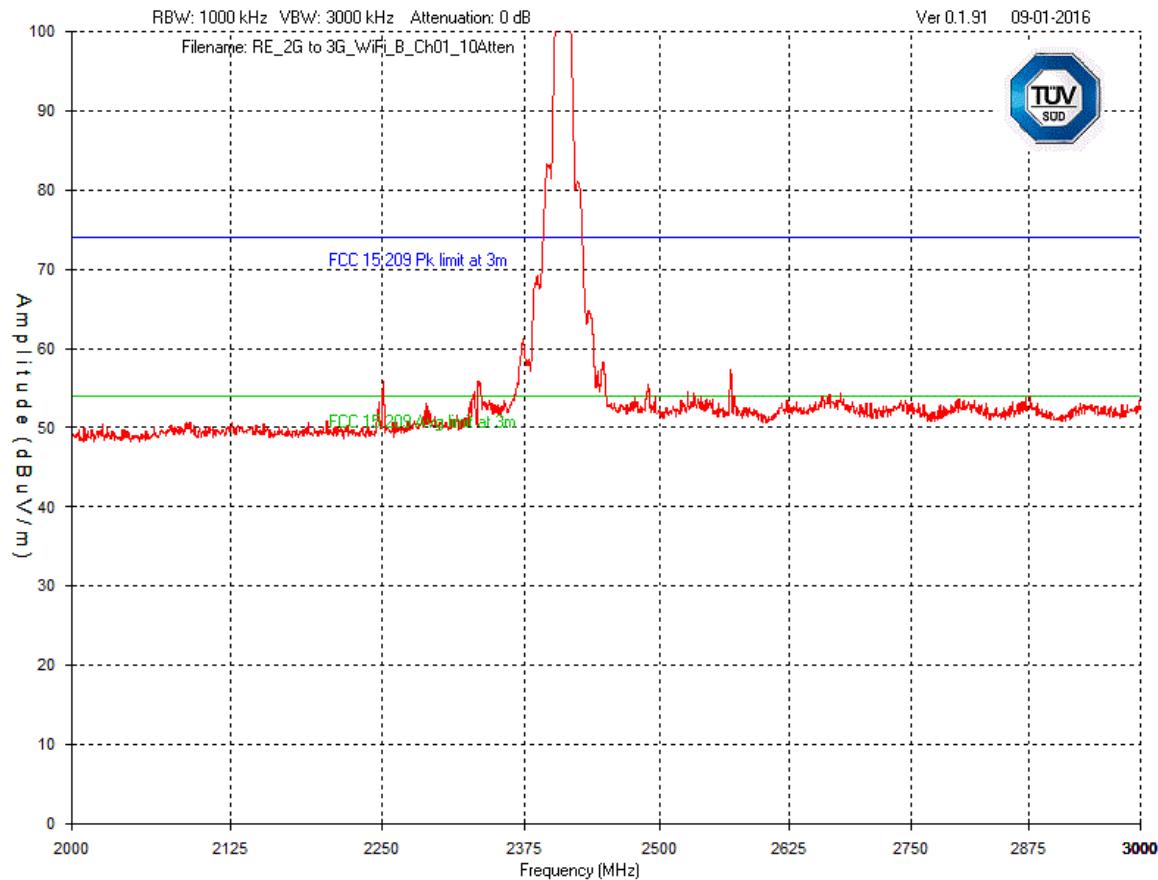
Client	<b>Technologies HumanWare inc.</b>	 Canada
Product	<b>BrailleNote Touch</b>	
Standard(s)	RSS-247 Issue 2 FCC Part 15 Subpart 15.247	

**Mid Channel – 1 GHz – 2 GHz**  
**Horizontal - Peak Emission Graph, mode B – 10dB external attenuator**



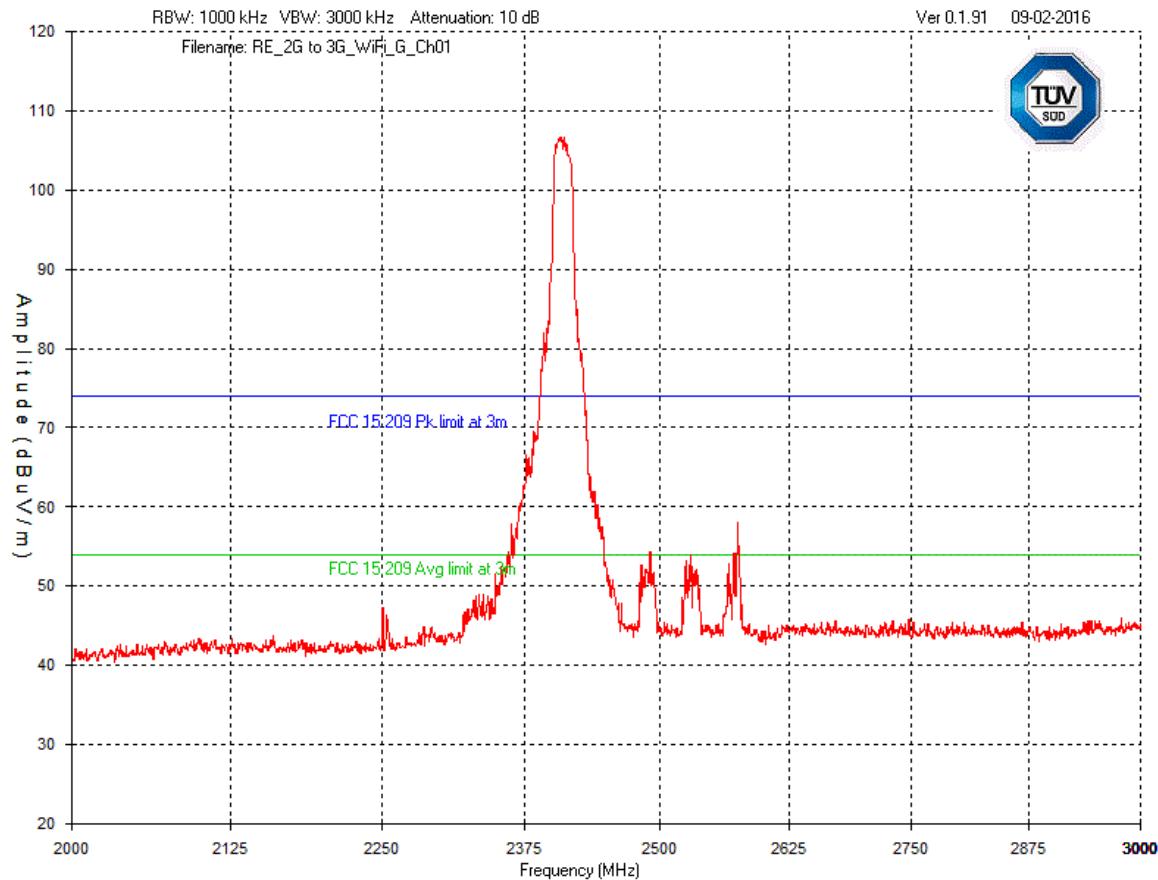
Client	<b>Technologies HumanWare inc.</b>	 Canada
Product	<b>BrailleNote Touch</b>	
Standard(s)	RSS-247 Issue 2 FCC Part 15 Subpart 15.247	

**Low Channel – 2 GHz – 3 GHz**  
**Horizontal - Peak Emission Graph, mode B – 10dB external attenuator**



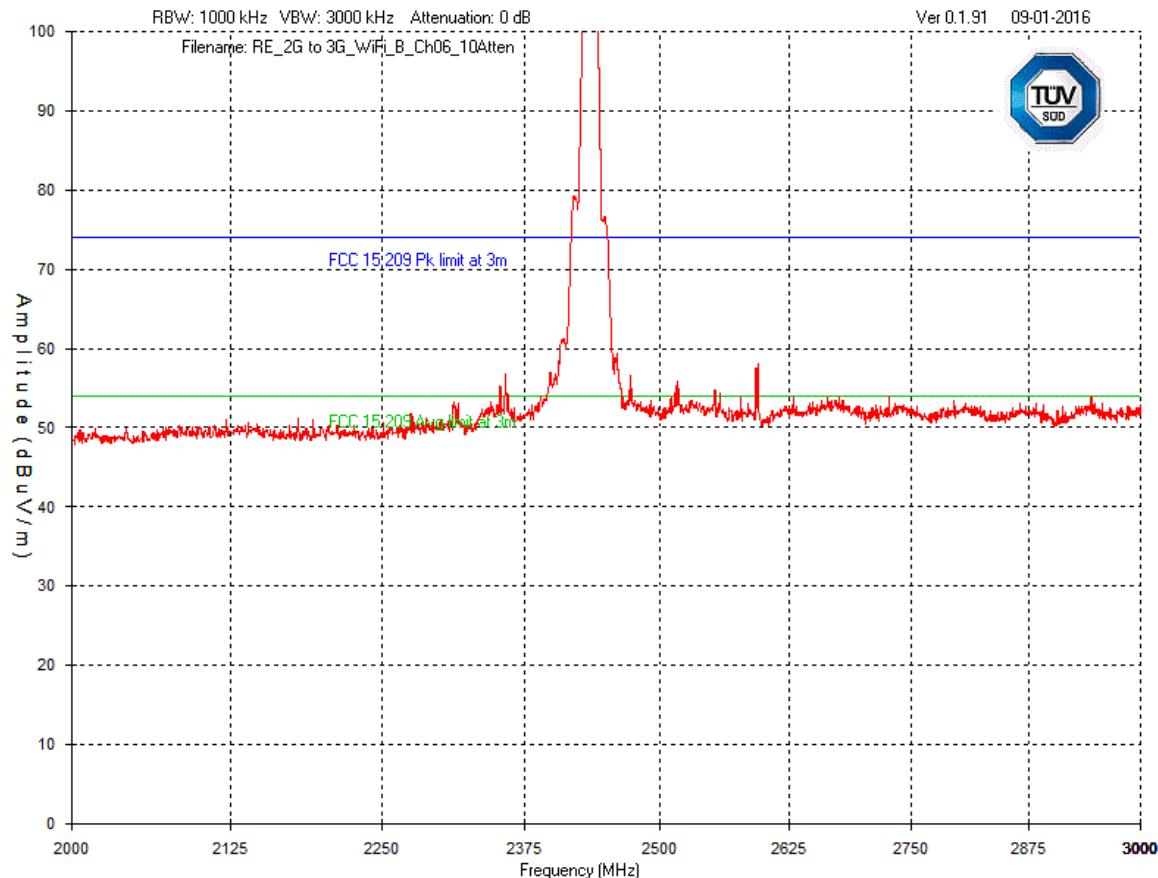
Client	<b>Technologies HumanWare inc.</b>	 Canada
Product	<b>BrailleNote Touch</b>	
Standard(s)	RSS-247 Issue 2 FCC Part 15 Subpart 15.247	

**Low Channel – 2 GHz – 3 GHz**  
**Horizontal - Peak Emission Graph, mode G**



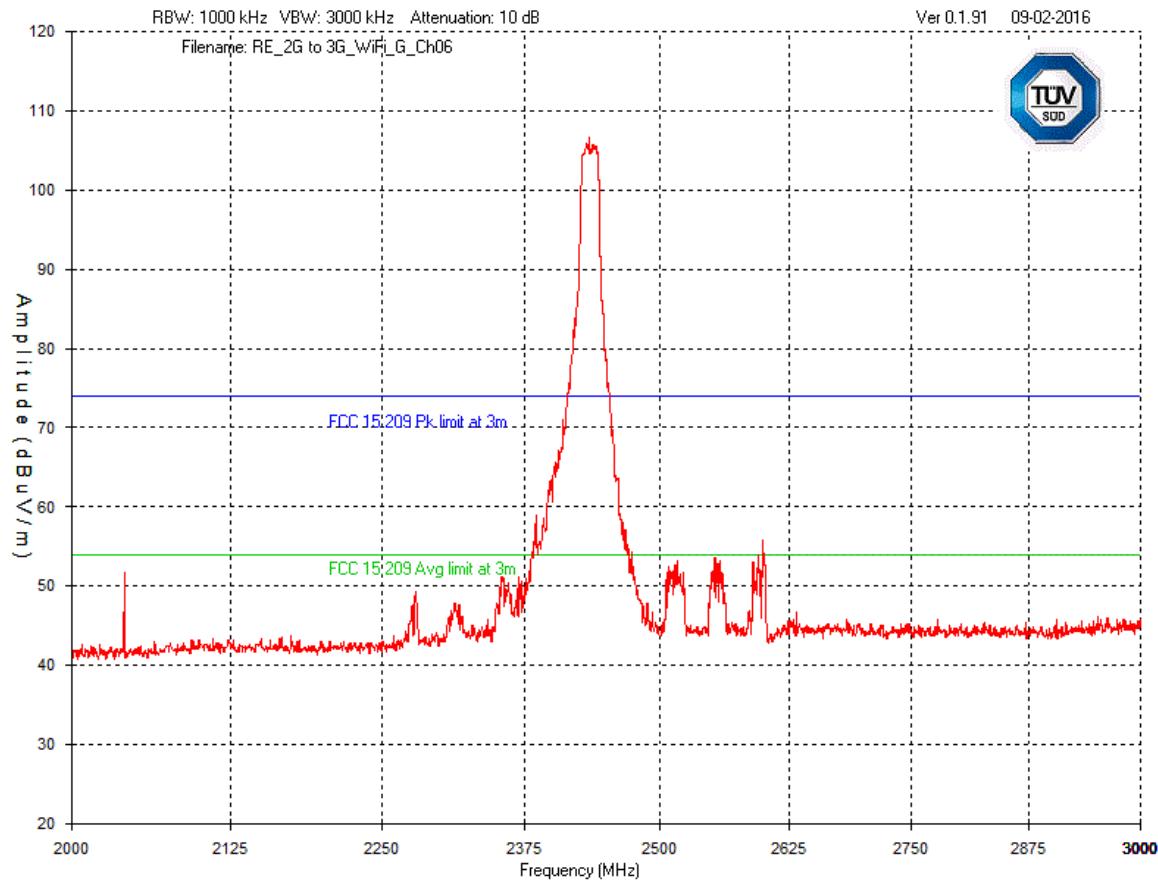
Client	<b>Technologies HumanWare inc.</b>	 Canada
Product	<b>BrailleNote Touch</b>	
Standard(s)	RSS-247 Issue 2 FCC Part 15 Subpart 15.247	

**Mid Channel – 2 GHz – 3 GHz**  
**Horizontal - Peak Emission Graph, mode B – 10dB external attenuator**



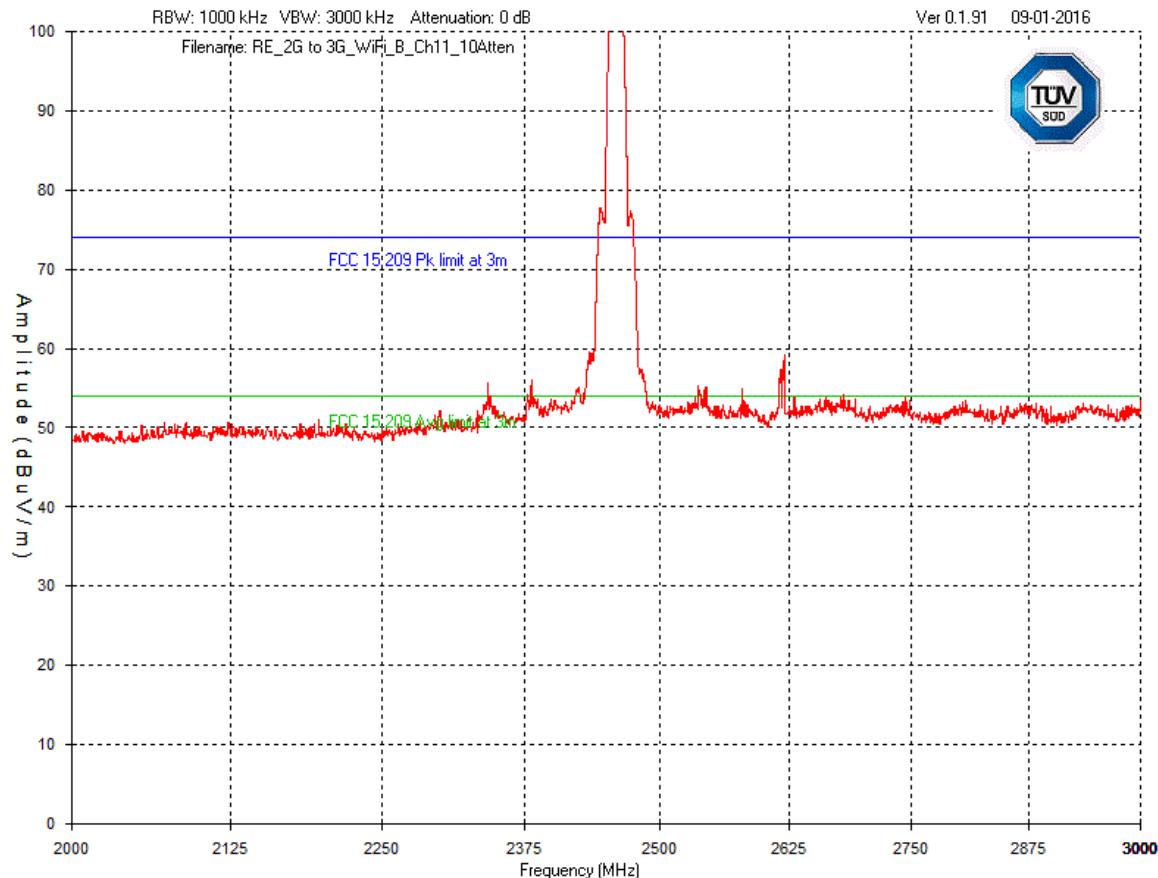
Client	<b>Technologies HumanWare inc.</b>	 Canada
Product	<b>BrailleNote Touch</b>	
Standard(s)	RSS-247 Issue 2 FCC Part 15 Subpart 15.247	

**Mid Channel – 2 GHz – 3 GHz**  
**Horizontal - Peak Emission Graph, mode G**



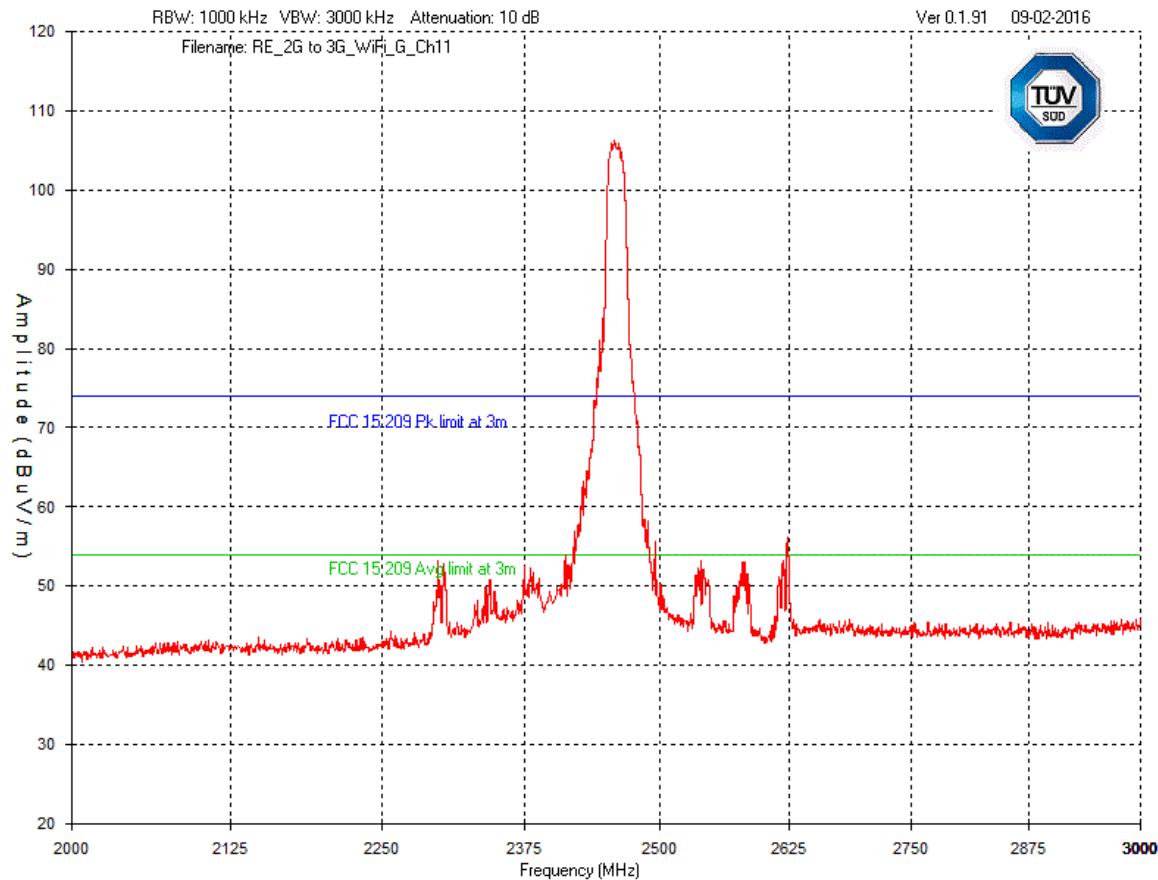
Client	<b>Technologies HumanWare inc.</b>	 Canada
Product	<b>BrailleNote Touch</b>	
Standard(s)	RSS-247 Issue 2 FCC Part 15 Subpart 15.247	

**High Channel – 2 GHz – 3 GHz**  
**Horizontal - Peak Emission Graph, mode B – 10dB external attenuator**



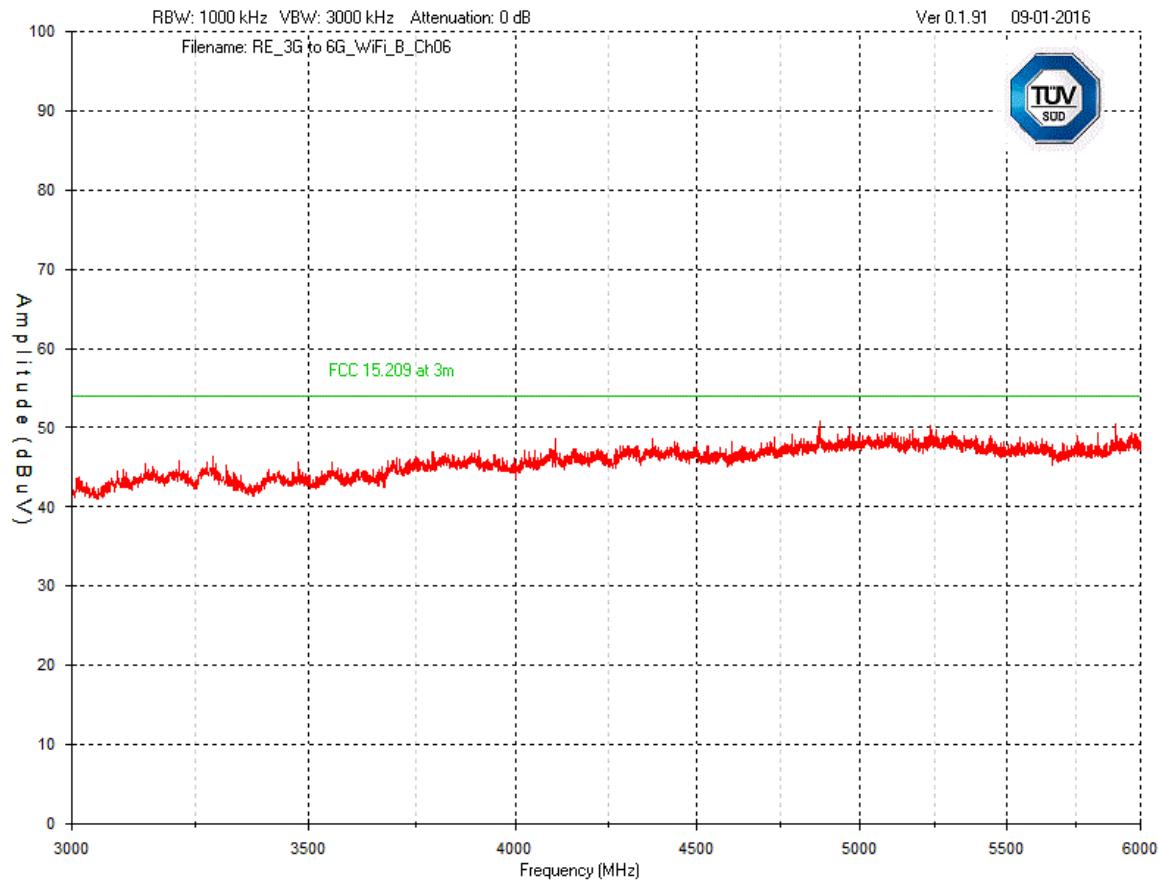
Client	<b>Technologies HumanWare inc.</b>	 Canada
Product	<b>BrailleNote Touch</b>	
Standard(s)	RSS-247 Issue 2 FCC Part 15 Subpart 15.247	

**High Channel – 2 GHz – 3 GHz**  
**Horizontal - Peak Emission Graph, mode G**



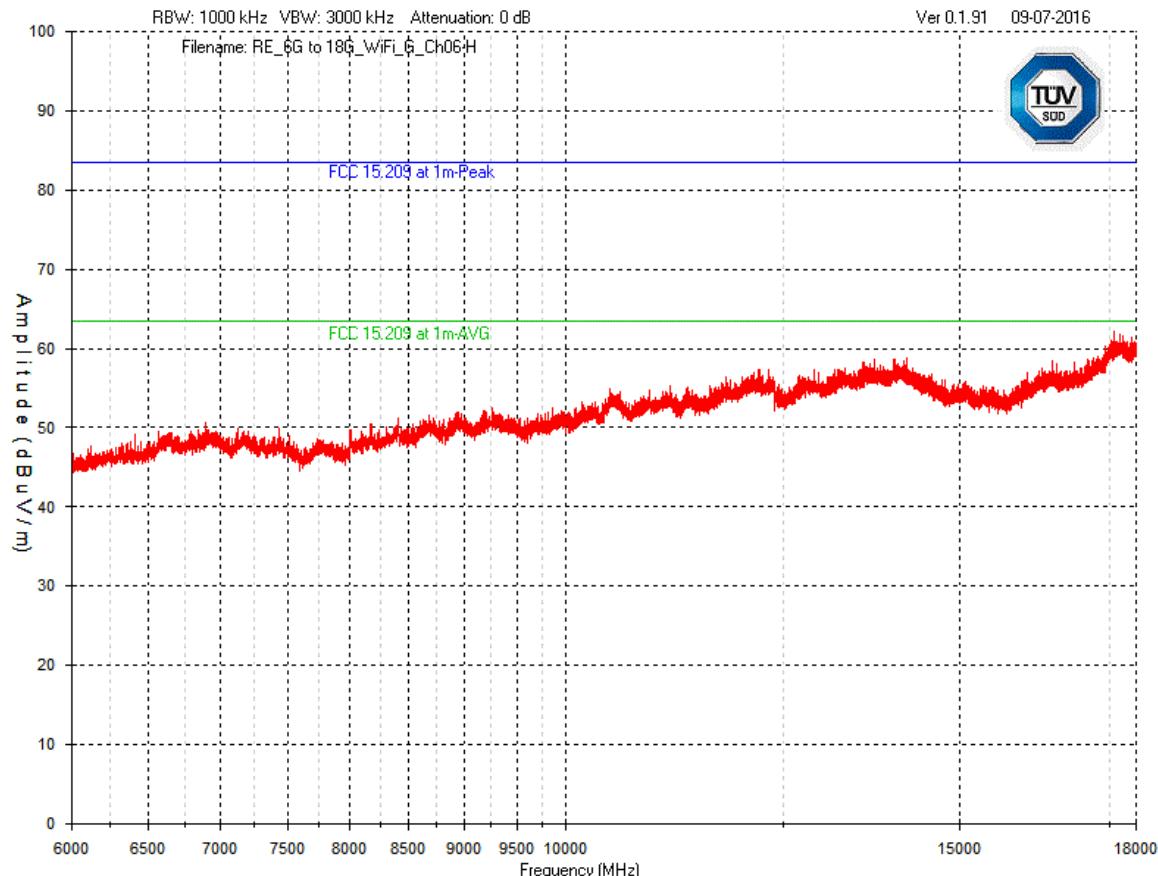
Client	<b>Technologies HumanWare inc.</b>	 Canada
Product	<b>BrailleNote Touch</b>	
Standard(s)	RSS-247 Issue 2 FCC Part 15 Subpart 15.247	

**Mid Channel – 3 GHz – 6 GHz**  
**Horizontal - Peak Emission Graph, mode B**



Client	<b>Technologies HumanWare inc.</b>	 Canada
Product	<b>BrailleNote Touch</b>	
Standard(s)	RSS-247 Issue 2 FCC Part 15 Subpart 15.247	

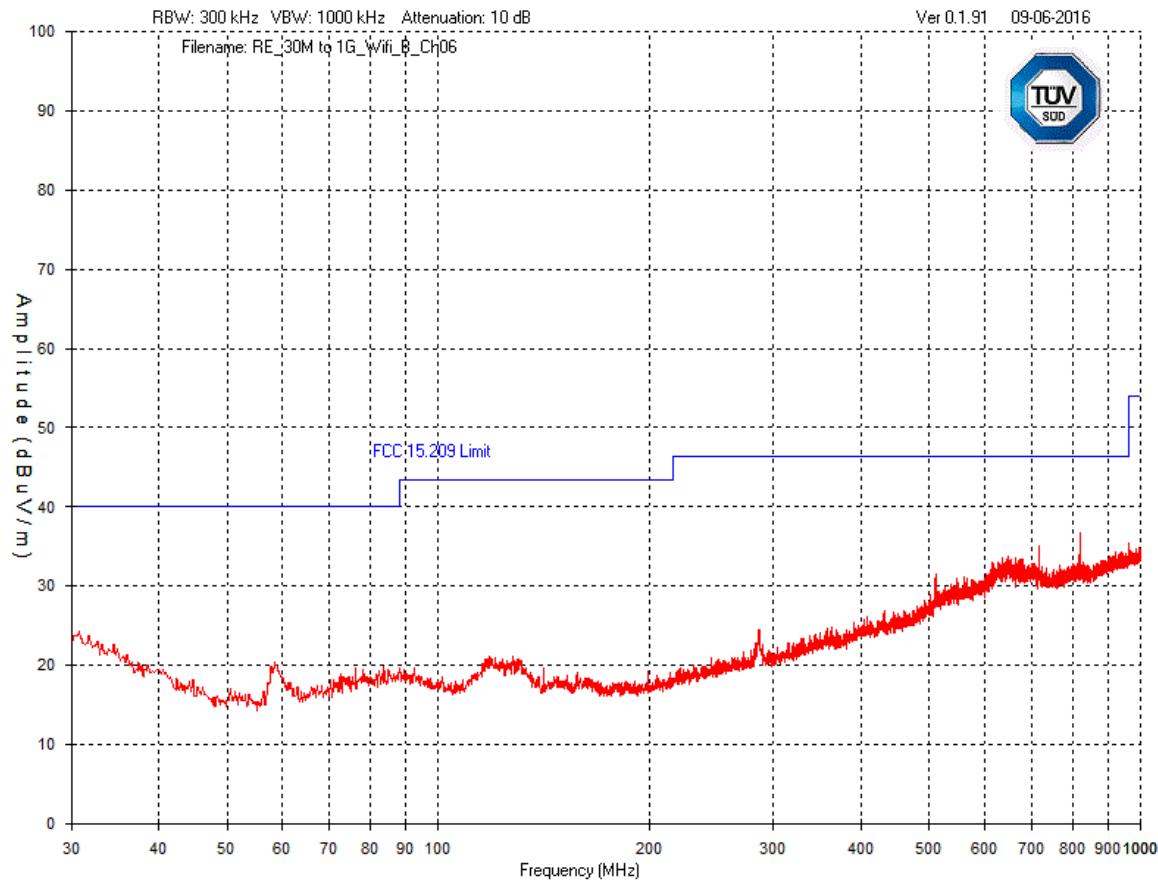
**Mid Channel – 6 GHz – 18 GHz**  
**Horizontal - Peak Emission Graph, mode G**



Plot was taken at a 1 meter distance. All emissions were noise floor of measurement instrument. No emissions were found in this frequency range.

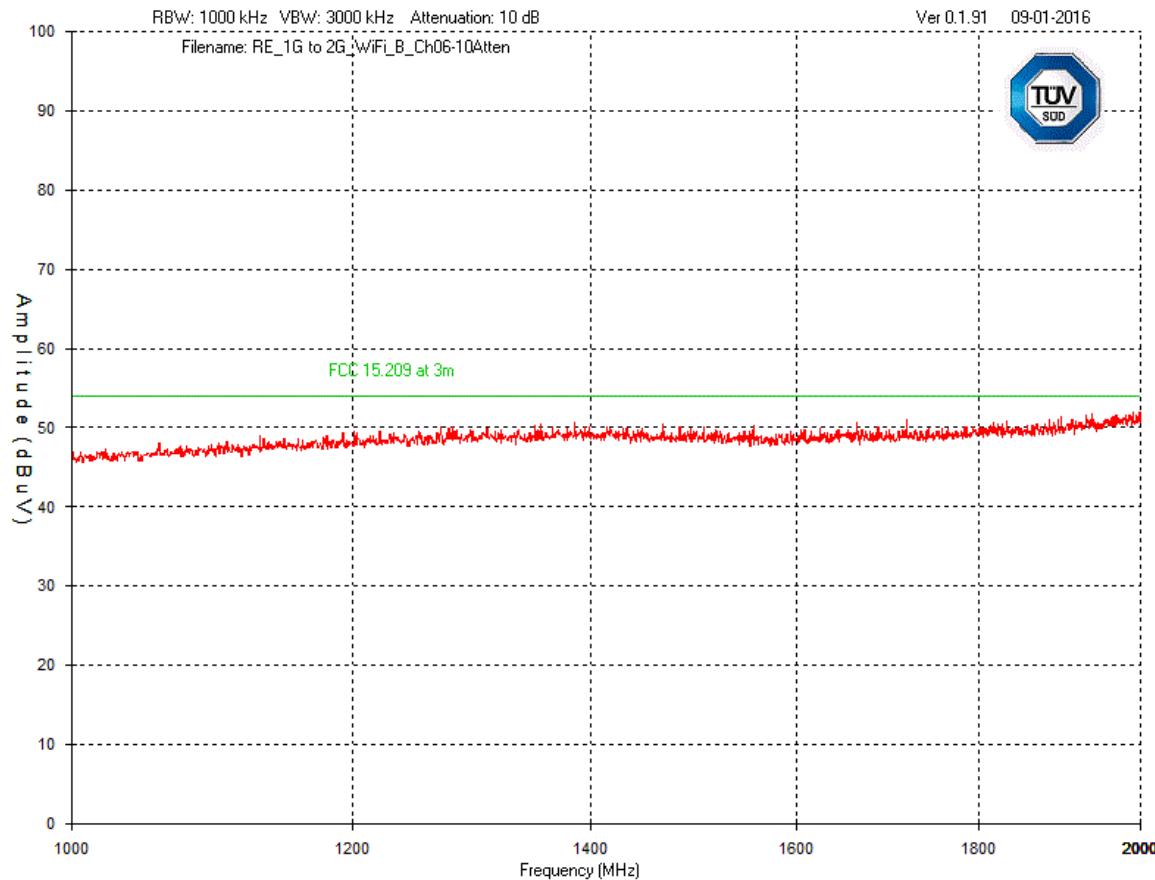
Client	<b>Technologies HumanWare inc.</b>	 Canada
Product	<b>BrailleNote Touch</b>	
Standard(s)	RSS-247 Issue 2 FCC Part 15 Subpart 15.247	

**Mid Channel – 30 MHz – 1 GHz**  
**Vertical - Peak Emission Graph, mode B**



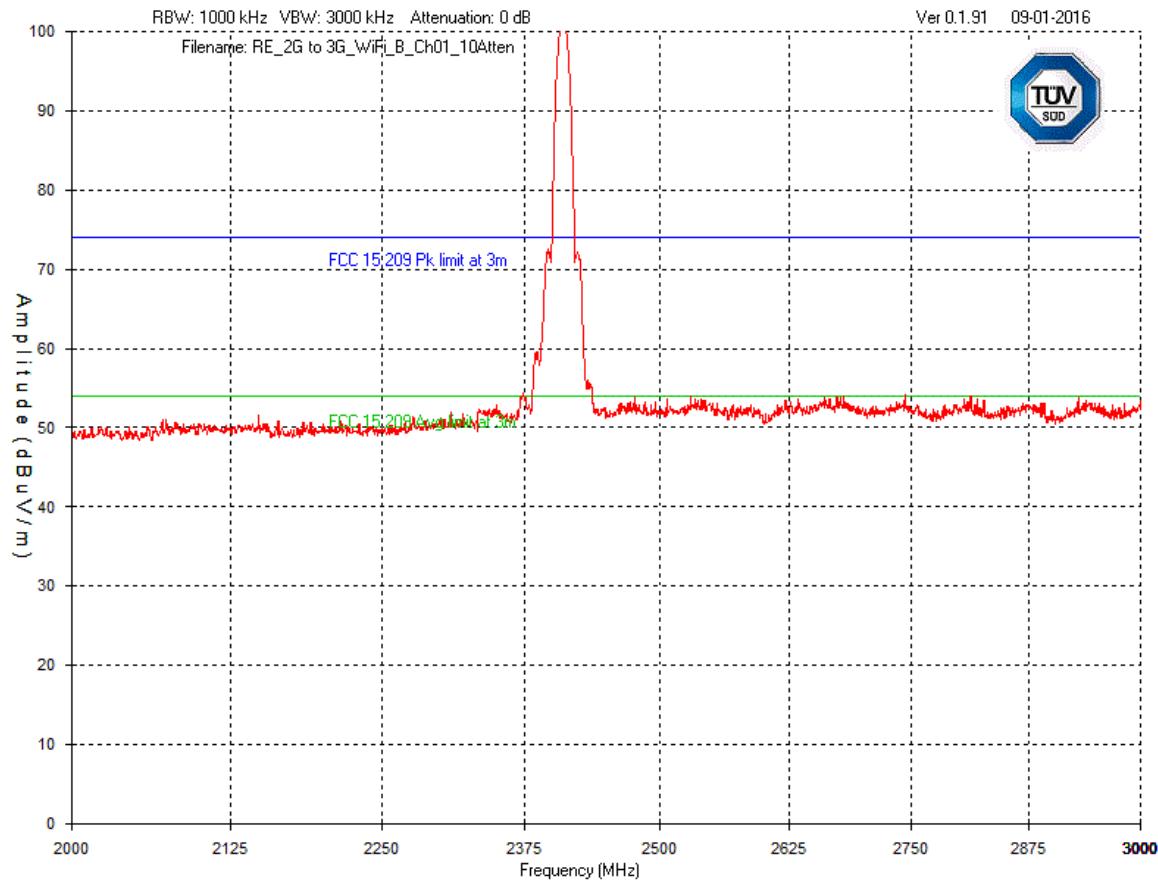
Client	<b>Technologies HumanWare inc.</b>	 Canada
Product	<b>BrailleNote Touch</b>	
Standard(s)	RSS-247 Issue 2 FCC Part 15 Subpart 15.247	

**Mid Channel – 1 GHz – 2 GHz**  
**Vertical - Peak Emission Graph, mode B**



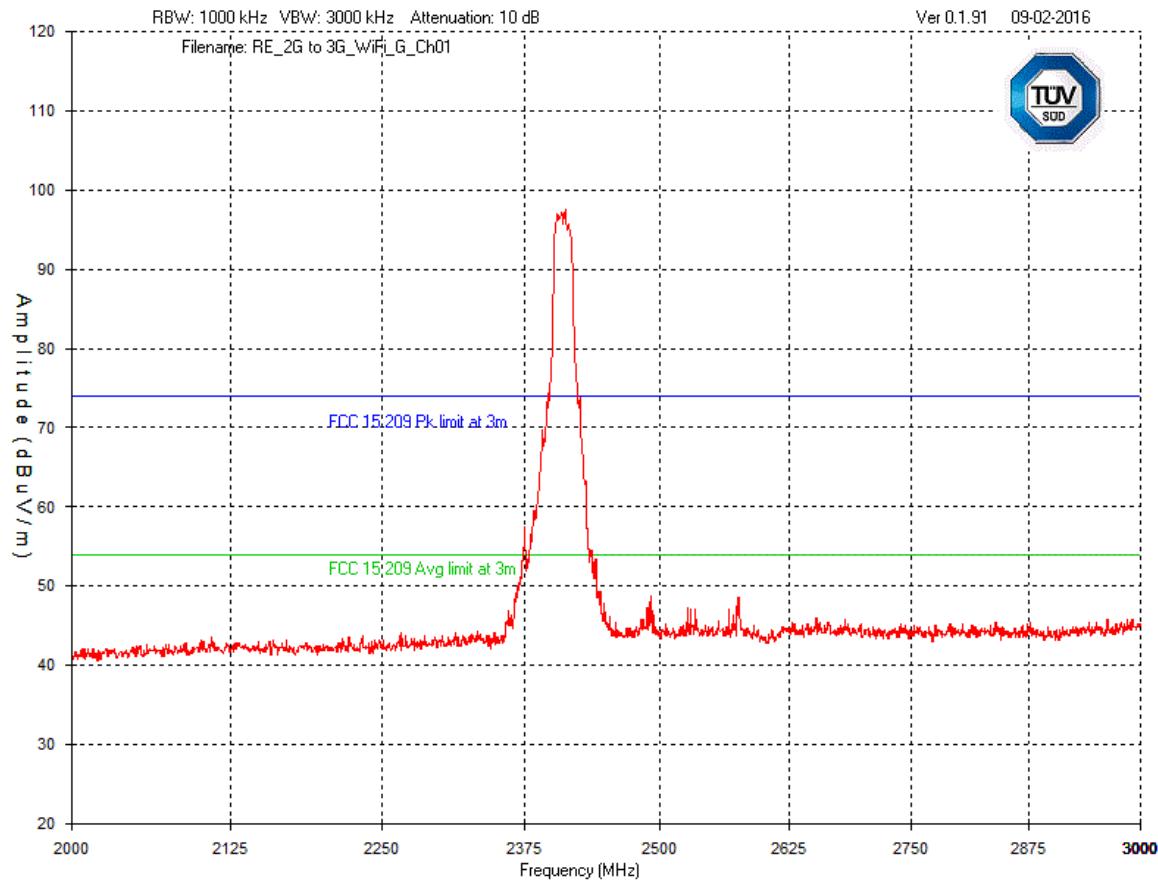
Client	<b>Technologies HumanWare inc.</b>	 Canada
Product	<b>BrailleNote Touch</b>	
Standard(s)	RSS-247 Issue 2 FCC Part 15 Subpart 15.247	

**Low Channel – 2 GHz – 3 GHz**  
**Vertical - Peak Emission Graph, mode B**



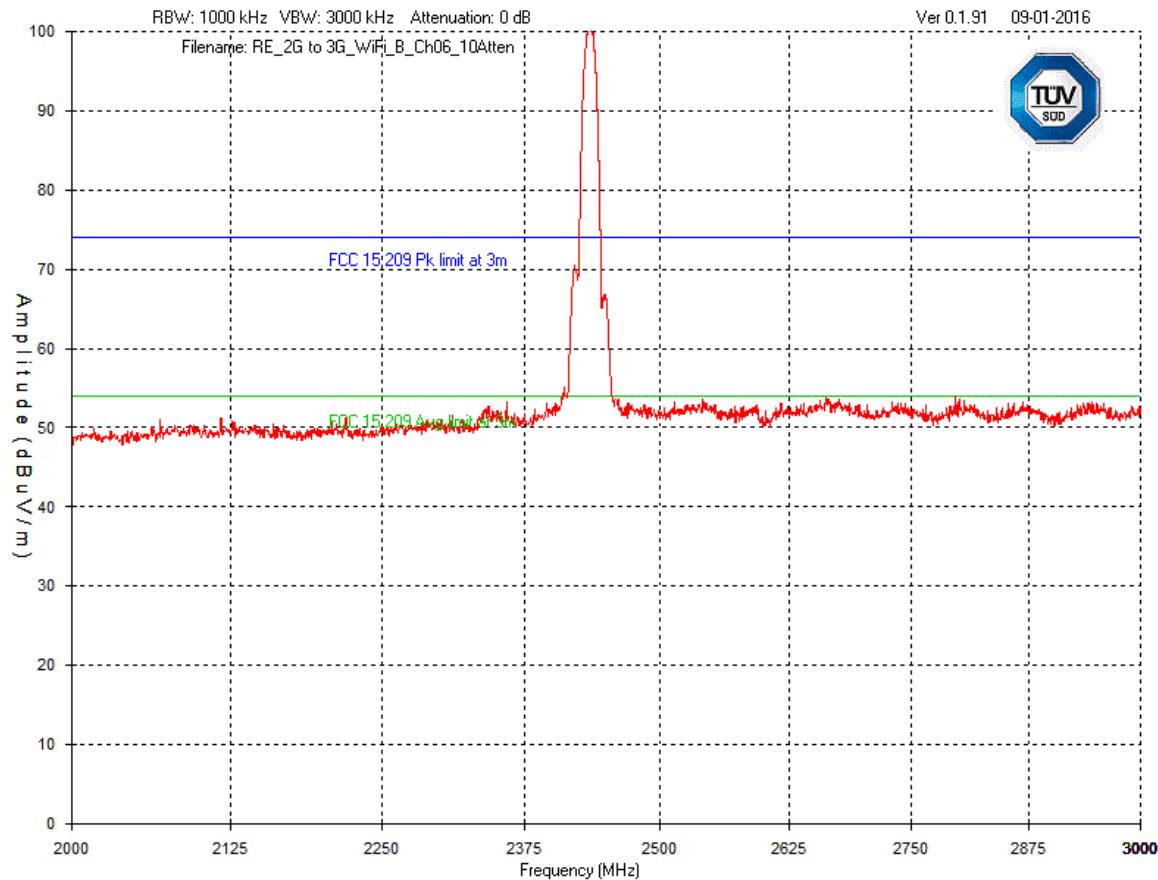
Client	<b>Technologies HumanWare inc.</b>	 Canada
Product	<b>BrailleNote Touch</b>	
Standard(s)	RSS-247 Issue 2 FCC Part 15 Subpart 15.247	

**Low Channel – 2 GHz – 3 GHz**  
**Vertical - Peak Emission Graph, mode G**



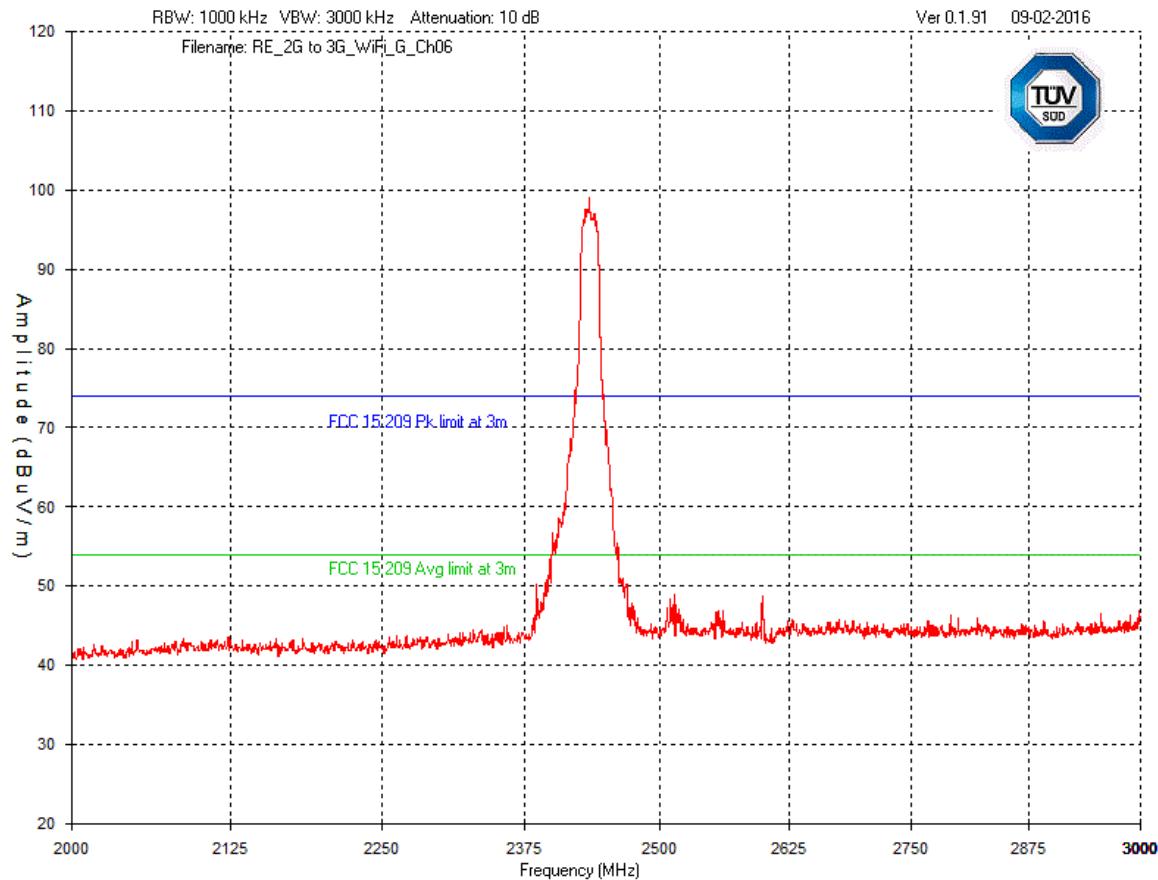
Client	<b>Technologies HumanWare inc.</b>	 Canada
Product	<b>BrailleNote Touch</b>	
Standard(s)	RSS-247 Issue 2 FCC Part 15 Subpart 15.247	

**Mid Channel – 2 GHz – 3 GHz**  
**Vertical - Peak Emission Graph, mode B**



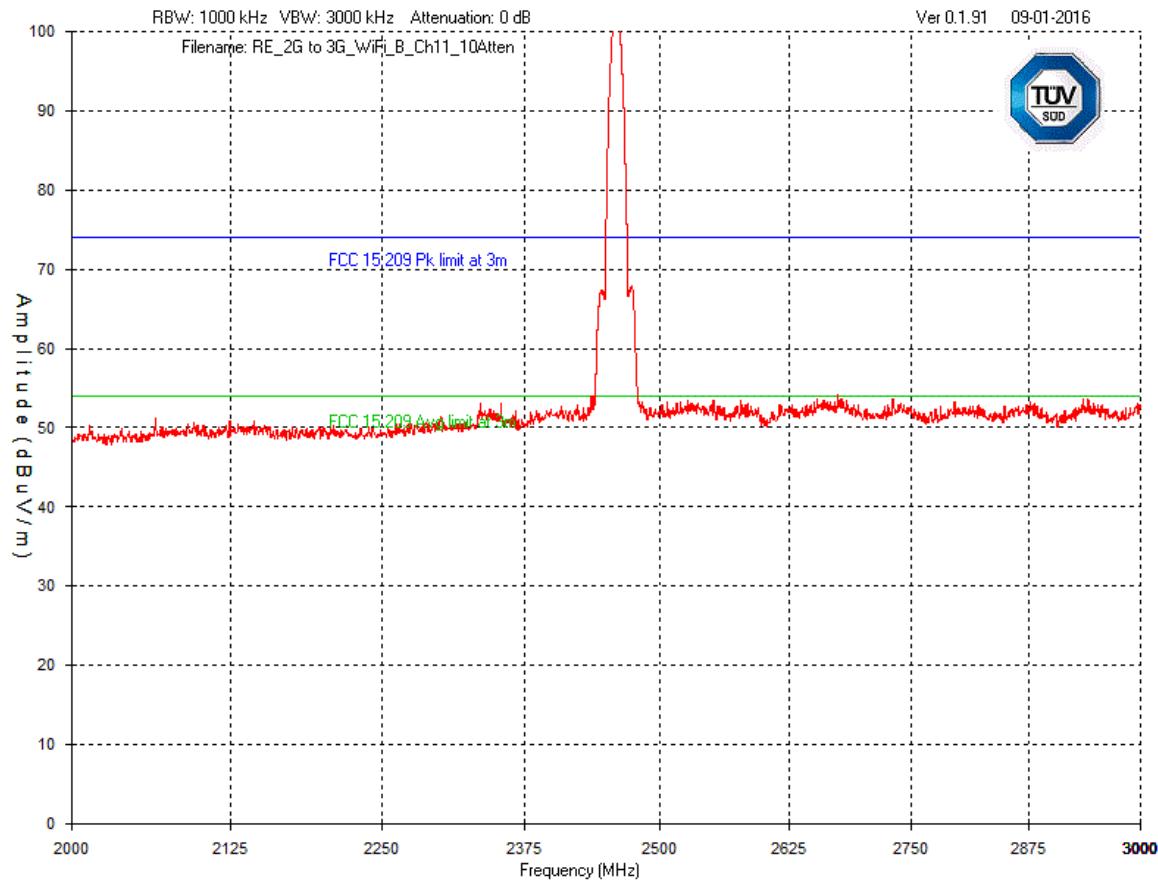
Client	<b>Technologies HumanWare inc.</b>	 Canada
Product	<b>BrailleNote Touch</b>	
Standard(s)	RSS-247 Issue 2 FCC Part 15 Subpart 15.247	

**Mid Channel – 2 GHz – 3 GHz**  
**Vertical - Peak Emission Graph, mode G**



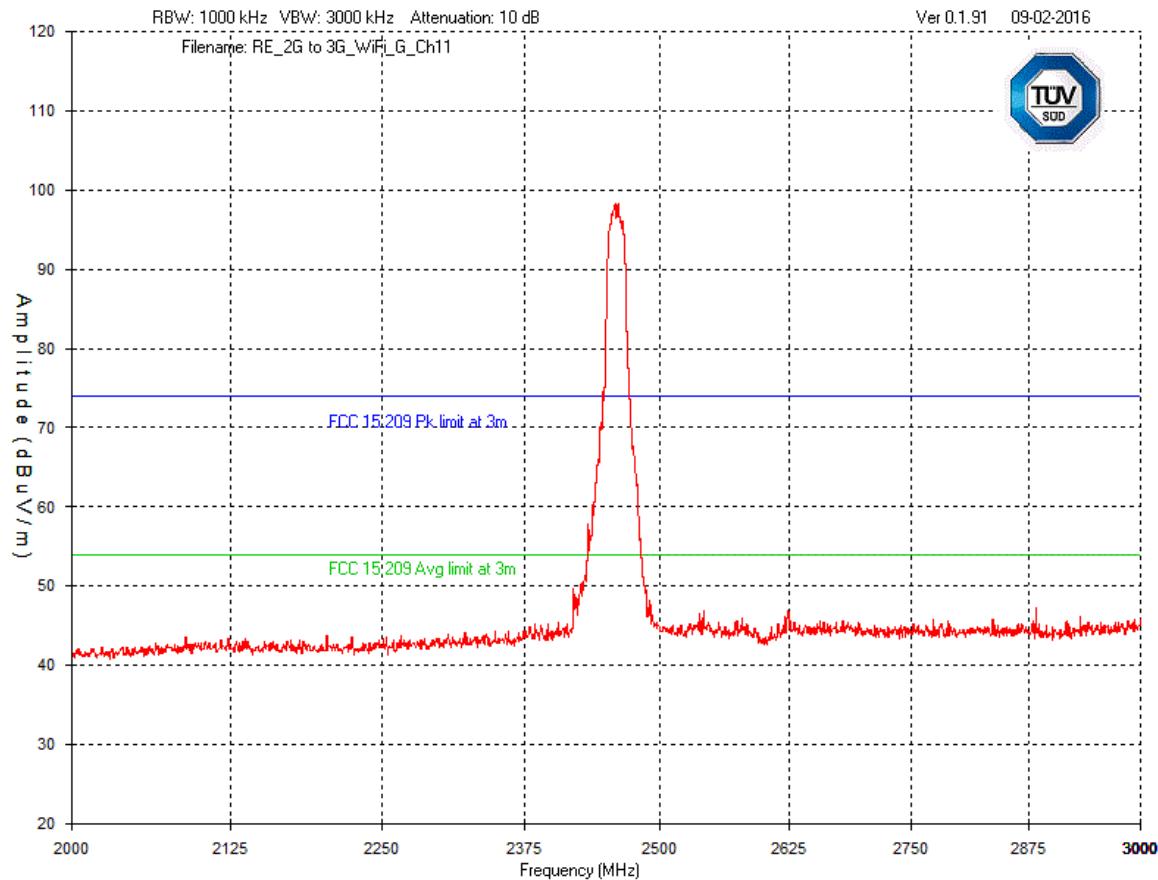
Client	<b>Technologies HumanWare inc.</b>	 Canada
Product	<b>BrailleNote Touch</b>	
Standard(s)	RSS-247 Issue 2 FCC Part 15 Subpart 15.247	

**High Channel – 2 GHz – 3 GHz**  
**Vertical - Peak Emission Graph, mode B**



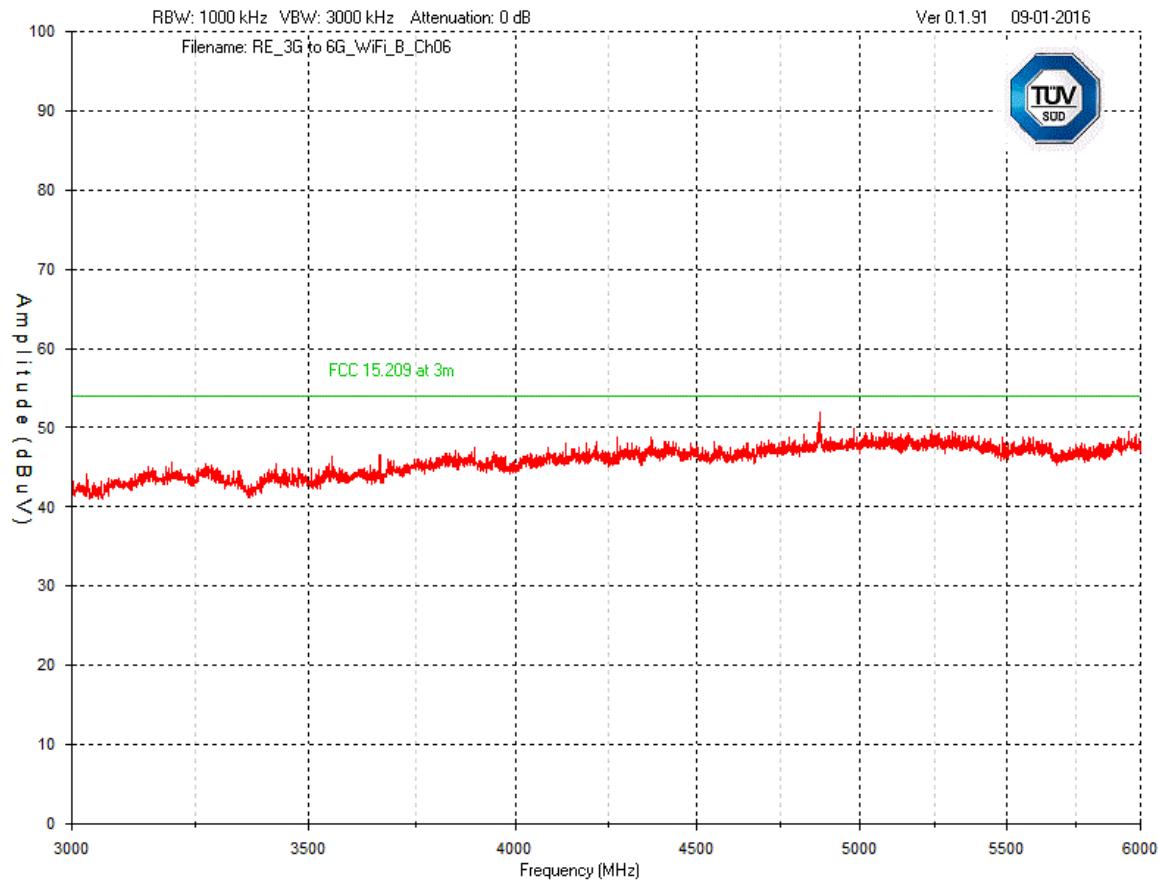
Client	<b>Technologies HumanWare inc.</b>	 Canada
Product	<b>BrailleNote Touch</b>	
Standard(s)	RSS-247 Issue 2 FCC Part 15 Subpart 15.247	

**High Channel – 2 GHz – 3 GHz**  
**Vertical - Peak Emission Graph, mode G**



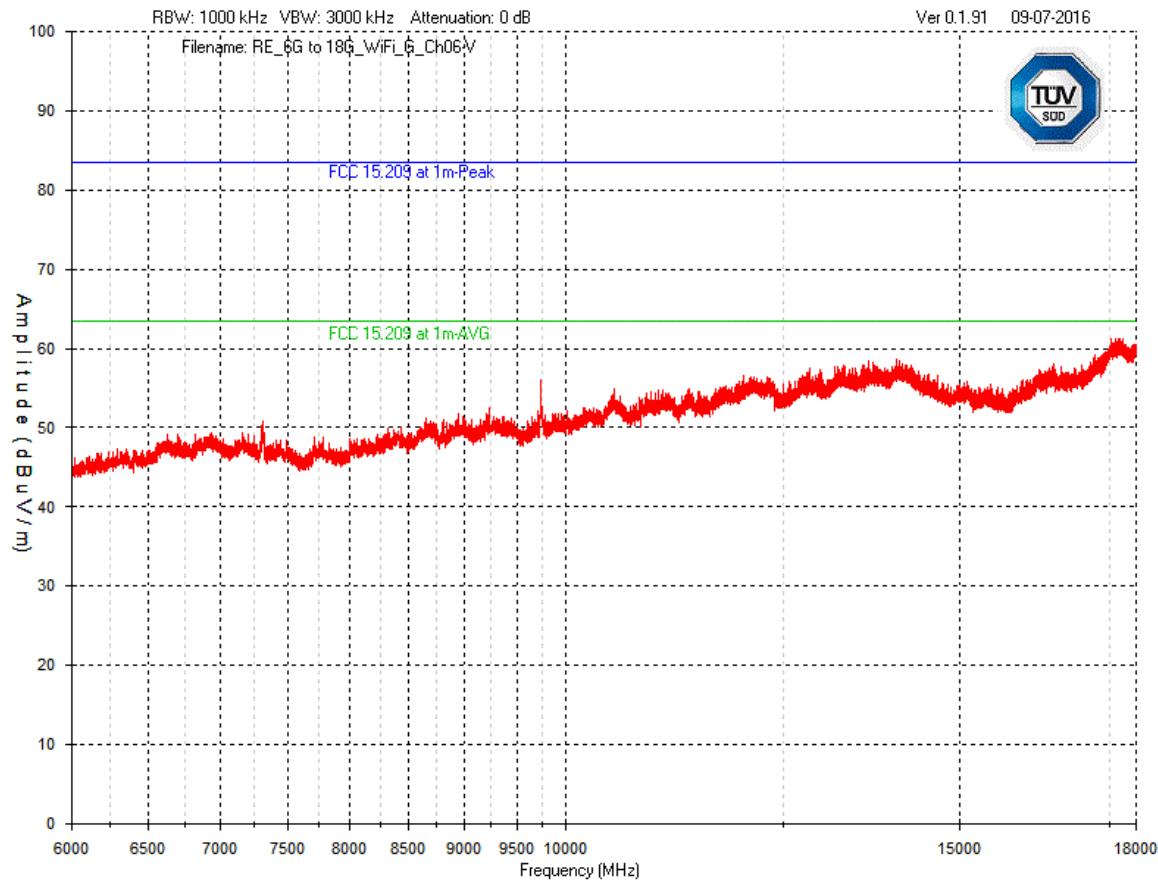
Client	<b>Technologies HumanWare inc.</b>	 Canada
Product	<b>BrailleNote Touch</b>	
Standard(s)	RSS-247 Issue 2 FCC Part 15 Subpart 15.247	

**Mid Channel – 3 GHz – 6 GHz**  
**Vertical - Peak Emission Graph, mode B**



Client	<b>Technologies HumanWare inc.</b>	 Canada
Product	<b>BrailleNote Touch</b>	
Standard(s)	RSS-247 Issue 2 FCC Part 15 Subpart 15.247	

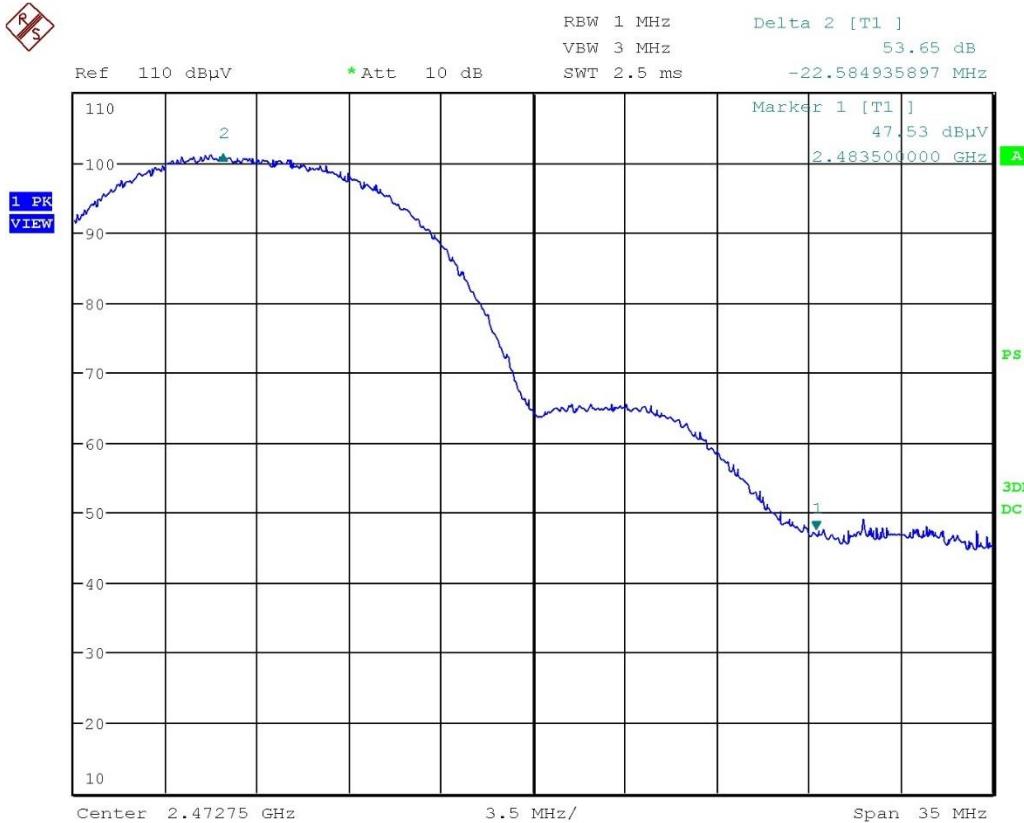
**Mid Channel – 6 GHz – 18 GHz**  
**Vertical - Peak Emission Graph**



Plot was taken at a 1 meter distance. All emissions were noise floor of measurement instrument. No emissions were found in this frequency range.

Client	<b>Technologies HumanWare inc.</b>	 Canada
Product	<b>BrailleNote Touch</b>	
Standard(s)	RSS-247 Issue 2 FCC Part 15 Subpart 15.247	

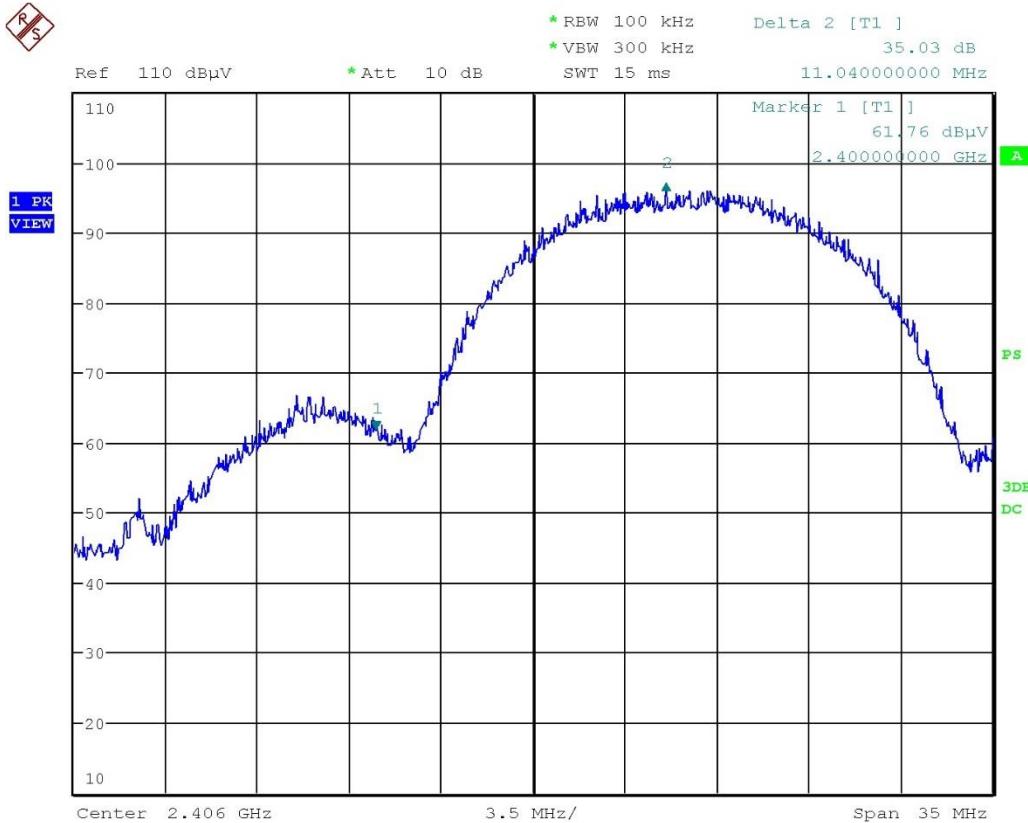
**Band Edge – Low Channel mode B – 10dB External attenuation  
Horizontal - Peak Emission**



Note: Restricted band Band Edge plot was taken at a 3m measurement distance. The marker shows the raw value. See the Final Measurements and Results section below for correct values.

Client	<b>Technologies HumanWare inc.</b>	 Canada
Product	<b>BrailleNote Touch</b>	
Standard(s)	RSS-247 Issue 2 FCC Part 15 Subpart 15.247	

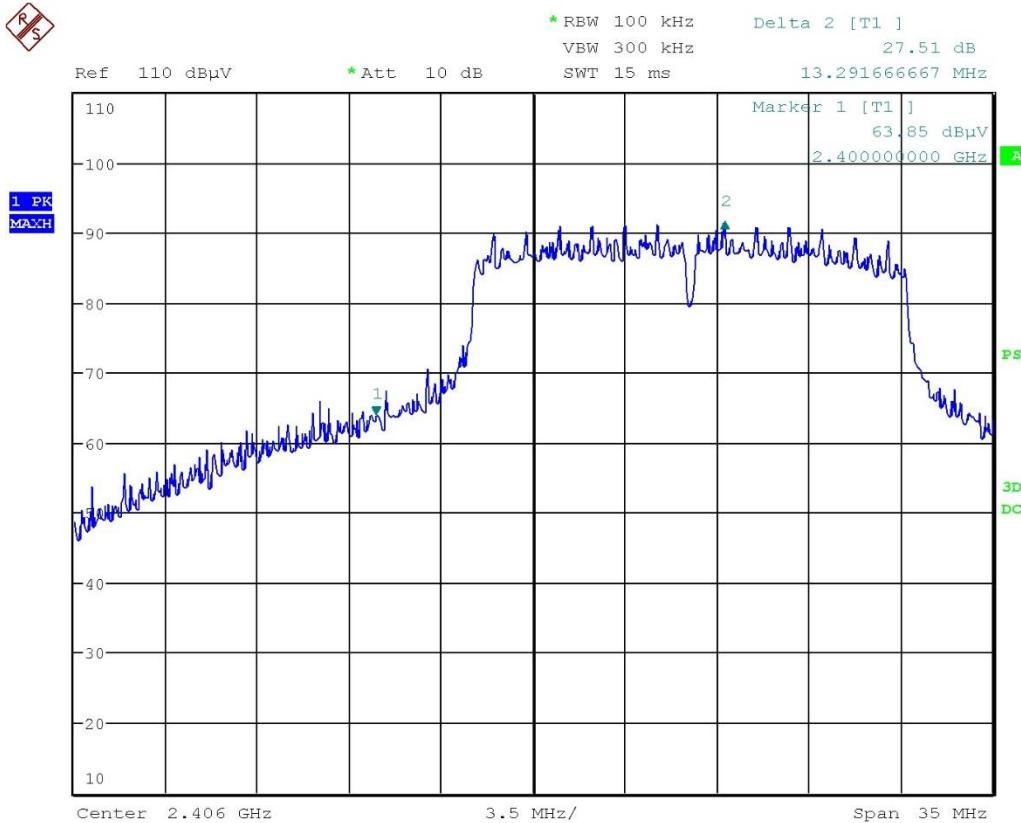
**Band Edge – Hi Channel mode B – 10dB External attenuation  
Horizontal - Peak Emission**



Note: Restricted band Band Edge plot was taken at a 3m measurement distance. The marker shows the raw value. See the Final Measurements and Results section below for correct values.

Client	<b>Technologies HumanWare inc.</b>	 Canada
Product	<b>BrailleNote Touch</b>	
Standard(s)	RSS-247 Issue 2 FCC Part 15 Subpart 15.247	

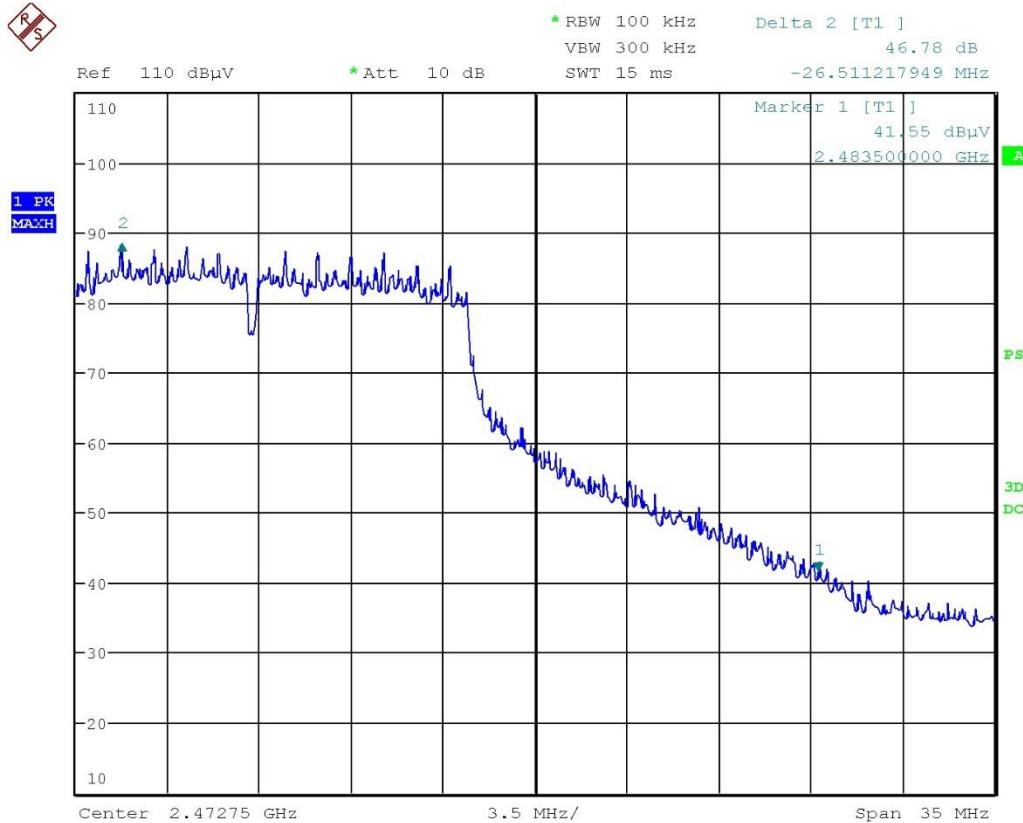
**Band Edge – Low Channel mode G – 10dB External attenuation  
Horizontal - Peak Emission**



Note: Restricted band Band Edge plot was taken at a 3m measurement distance. The marker shows the raw value. See the Final Measurements and Results section below for correct values.

Client	<b>Technologies HumanWare inc.</b>	 Canada
Product	<b>BrailleNote Touch</b>	
Standard(s)	RSS-247 Issue 2 FCC Part 15 Subpart 15.247	

**Band Edge – Hi Channel mode G – 10dB External attenuation  
Horizontal - Peak Emission**



Note: Restricted band Band Edge plot was taken at a 3m measurement distance. The marker shows the raw value. See the Final Measurements and Results section below for correct values.

Client	Technologies HumanWare inc.	 Canada
Product	BrailleNote Touch	
Standard(s)	RSS-247 Issue 2 FCC Part 15 Subpart 15.247	

## Final Measurements and Results

The EUT passed. Low, middle, and high bands were measured.

In accordance with 15.247(d), only frequencies exceeding the 15.209 limit that occur within the bands listed in 15.205 need to be verified with a final detector. Emissions outside the restricted bands were measured for informational purposes.

The measurements were maximized by rotating the turn table over a full 0-360 rotation and the antenna height was varied from 1 m to 4 m.

Product Category			Class B								
Product			BrailleNote Touch (WiFi mode B Channel 06)								
Supply			Battery 5Vdc, 1.5A								
Frequency (MHz)	Detector Peak/QP	Received Signal (dBμV)	Antenna Factor (dB/m)	Atten Factor (dB)	Cable Factor (dB)	Pre-Amp (dB)	Level (dBμV/m)	QP Limit (dB)	QP Margin (dB)	Pass/Fail	
Horizontal Antenna Polarization											
671.267	Peak	44.6	21.7	3	2.4	-33.1	38.6	46.4	7.8	Pass	
818.513	Peak	41.9	22.8	3	2.6	-32.8	37.5	46.4	8.9	Pass	
375.999	Peak	49.7	15.8	3	1.8	-33.3	37	46.4	9.4	Pass	
716.954	Peak	41.7	22.3	3	2.5	-33	36.5	46.4	9.9	Pass	
30.194	Peak	35.6	17.4	3	0.5	-32.4	24.1	40	15.9	Pass	
177.925	Peak	45.7	10.1	3	1.3	-33.3	26.8	43.5	16.7	Pass	
Vertical Antenna Polarization											
818.804	Peak	41.1	22.8	3	2.6	-32.8	36.7	46.4	9.7	Pass	
716.566	Peak	40.3	22.3	3	2.5	-33	35.1	46.4	11.3	Pass	
30.776	Peak	36.2	17	3	0.6	-32.4	24.4	40	15.6	Pass	
30	Peak	33.9	17.5	3	0.5	-32.4	22.5	40	17.5	Pass	
58.518	Peak	43.2	6.8	3	0.8	-33.3	20.5	40	19.5	Pass	
127.873	Peak	42.1	8.5	3	1.1	-33.4	21.3	43.5	22.2	Pass	

Client	Technologies HumanWare inc.	 Canada
Product	BrailleNote Touch	
Standard(s)	RSS-247 Issue 2 FCC Part 15 Subpart 15.247	

Emissions Tables: WiFi mode B.

Test Freq. (MHz)	Detect. mode (Peak QPeak AVG)	Ant. Pol. (Horz/Vert)	Raw signal (dB $\mu$ V)	Ant. factor (dB)	Cable loss + Preselec. (dB)	Atten. (dB)	Pre-Amp Gain (dB)	Receiv. signal (dB $\mu$ V/m)	Emission limit (dB $\mu$ V/m)	Margin (dB)	Result
Low Channel #1 (2.412GHz)											
2412	Peak	Horz	103.6	28.9	5.0	10.0	33.1	114.4			PASS
2412	Avg	Horz	94.8	28.9	5.0	10.0	33.1	105.6			PASS
2412	Peak	Vert	94.5	28.9	5.0	10.0	33.1	105.3			PASS
2412	Avg	Vert	85.7	28.9	5.0	10.0	33.1	96.5			PASS
2390	Peak	Horz	54.2	28.8	5.0	10.0	33.1	64.9	74.0	9.1	PASS
2390	Avg	Horz	43.1	28.8	5.0	10.0	33.1	53.8	54.0	0.2	PASS
2390	Peak	Vert	48.9	28.8	5.0	10.0	33.1	59.6	74.0	14.4	PASS
2390	Avg	Vert	35.9	28.8	5.0	10.0	33.1	46.6	54.0	7.4	PASS
2400	Peak	Horz	71.6	28.9	5.0	10.0	33.1	82.4	94.4	12.0	PASS
2400	Avg	Horz	61.8	28.9	5.0	10.0	33.1	72.6	85.6	13.0	PASS
2400	Peak	Vert	62.2	28.9	5.0	10.0	33.1	73.0	85.3	12.3	PASS
2400	Avg	Vert	52.2	28.9	5.0	10.0	33.1	63.0	76.5	13.5	PASS
4824	Peak	Horz	46.4	33.9	6.9	0.0	32.8	54.4	74.0	19.6	PASS
4824	Avg	Horz	33.8	33.9	6.9	0.0	32.8	41.8	54.0	12.2	PASS
4824	Peak	Vert	48.6	33.9	6.9	0.0	32.8	56.6	74.0	17.4	PASS
4824	Avg	Vert	36.3	33.9	6.9	0.0	32.8	44.3	54.0	9.7	PASS
7236	Peak	Vert	47.9	38.1	4.3	0.0	33.0	57.3	74.0	16.7	PASS
7236	Avg	Vert	35.4	38.1	4.3	0.0	33.0	44.8	54.0	9.2	PASS
7236	Peak	Horz	46.1	38.1	4.3	0.0	33.0	55.5	74.0	18.5	PASS
7236	Avg	Horz	33.5	38.1	4.3	0.0	33.0	42.9	54.0	11.1	PASS
9648	Peak	Horz	47.1	39.0	11.5	0.0	33.6	64.0	74.0	10.0	PASS
9648	Avg	Horz	36.9	39.0	11.5	0.0	33.6	53.8	54.0	0.2	PASS
9648	Peak	Vert	46.2	39.0	11.5	0.0	33.6	63.1	74.0	10.9	PASS
9648	Avg	Vert	34.6	39.0	11.5	0.0	33.6	51.5	54.0	2.5	PASS
Mid channel #6 (2.437GHz)											
2437	Peak	Horz	102.1	29.1	5.1	10.0	33.1	113.2			PASS
2437	Avg	Horz	93.3	29.1	5.1	10.0	33.1	104.4			PASS
2437	Peak	Vert	93.7	29.1	5.1	10.0	33.1	104.8			PASS
2437	Avg	Vert	84.9	29.1	5.1	10.0	33.1	96.0			PASS
4874	Peak	Horz	48.0	34.1	6.9	0.0	32.8	56.2	74.0	17.8	PASS
4874	Avg	Horz	35.1	34.1	6.9	0.0	32.8	43.3	54.0	10.7	PASS
4874	Peak	Vert	50.2	34.1	6.9	0.0	32.8	58.4	74.0	15.6	PASS
4874	Avg	Vert	37.5	34.1	6.9	0.0	32.8	45.7	54.0	8.3	PASS

Client	<b>Technologies HumanWare inc.</b>	 Canada
Product	<b>BrailleNote Touch</b>	
Standard(s)	RSS-247 Issue 2 FCC Part 15 Subpart 15.247	

7311	Peak	Vert	48.1	38.1	4.3	0.0	33.0	57.5	74.0	16.5	PASS
7311	Avg	Vert	35.1	38.1	4.3	0.0	33.0	44.5	54.0	9.5	PASS
7311	Peak	Horz	45.5	38.1	4.3	0.0	33.0	54.9	74.0	19.1	PASS
7311	Avg	Horz	32.6	38.1	4.3	0.0	33.0	42.0	54.0	12.0	PASS

**High channel #11 (2.462GHz)**

2462	Peak	Horz	99.6	29.2	5.1	10.0	33.1	110.8			PASS
2462	Avg	Horz	90.9	29.2	5.1	10.0	33.1	102.1			PASS
2462	Peak	Vert	90.2	29.2	5.1	10.0	33.1	101.4			PASS
2462	Avg	Vert	81.4	29.2	5.1	10.0	33.1	92.6			PASS
2483.5	Peak	Horz	47.8	29.4	5.1	10.0	33.1	59.2	74.0	14.8	PASS
2483.5	Avg	Horz	36.5	29.4	5.1	10.0	33.1	47.9	54.0	6.1	PASS
2483.5	Peak	Vert	44.9	29.4	5.1	10.0	33.1	56.3	74.0	17.7	PASS
2483.5	Avg	Vert	32.4	29.4	5.1	10.0	33.1	43.8	54.0	10.2	PASS
4924	Peak	Horz	47.4	34.2	6.9	0.0	32.8	55.7	74.0	18.3	PASS
4924	Avg	Horz	34.9	34.2	6.9	0.0	32.8	43.2	54.0	10.8	PASS
4924	Peak	Vert	47.9	34.2	6.9	0.0	32.8	56.2	74.0	17.8	PASS
4924	Avg	Vert	35.9	34.2	6.9	0.0	32.8	44.2	54.0	9.8	PASS
7386	Peak	Vert	48.6	38.0	4.3	0.0	33.0	57.9	74.0	16.1	PASS
7386	Avg	Vert	35.8	38.0	4.3	0.0	33.0	45.1	54.0	8.9	PASS
7386	Peak	Horz	46.1	38.0	4.3	0.0	33.0	55.4	74.0	18.6	PASS
7386	Avg	Horz	32.1	38.0	4.3	0.0	33.0	41.4	54.0	12.6	PASS
9848	Peak	Vert	47.3	39.1	11.7	0.0	33.6	64.5	74.0	9.5	PASS
9848	Avg	Vert	36.5	39.1	11.7	0.0	33.6	53.7	54.0	0.3	PASS
9848	Peak	Horz	47.1	39.1	11.7	0.0	33.6	64.3	74.0	9.7	PASS
9848	Avg	Horz	36.1	39.1	11.7	0.0	33.6	53.3	54.0	0.7	PASS

Client	Technologies HumanWare inc.	 Canada
Product	BrailleNote Touch	
Standard(s)	RSS-247 Issue 2 FCC Part 15 Subpart 15.247	

Emissions Tables: WiFi mode G.

Test Freq. (MHz)	Detect. mode (Peak QPeak AVG)	Ant. Pol. (Horz/Vert)	Raw signal (dB $\mu$ V)	Ant. factor (dB)	Cable loss + Preselec. (dB)	Atten. (dB)	Pre-Amp Gain (dB)	Receiv. signal (dB $\mu$ V/m)	Emission limit (dB $\mu$ V/m)	Margin (dB)	Result
Low Channel #1 (2.412GHz)											
2412	Peak	Horz	98.8	28.9	5.0	10.0	33.1	109.6			PASS
2412	Avg	Horz	85.5	28.9	5.0	10.0	33.1	96.3			PASS
2412	Peak	Vert	89.1	28.9	5.0	10.0	33.1	99.9			PASS
2412	Avg	Vert	75.8	28.9	5.0	10.0	33.1	86.6			PASS
2390	Peak	Horz	63.1	28.8	5.0	10.0	33.1	73.8	74.0	0.2	PASS
2390	Avg	Horz	42.3	28.8	5.0	10.0	33.1	53.0	54.0	1.0	PASS
2390	Peak	Vert	59.8	28.8	5.0	10.0	33.1	70.5	74.0	3.5	PASS
2390	Avg	Vert	38.1	28.8	5.0	10.0	33.1	48.8	54.0	5.2	PASS
2400	Peak	Horz	77.7	28.9	5.0	10.0	33.1	88.5	89.6	1.1	PASS
2400	Avg	Horz	60.5	28.9	5.0	10.0	33.1	71.3	76.3	5.0	PASS
2400	Peak	Vert	69.0	28.9	5.0	10.0	33.1	79.8	79.9	0.1	PASS
2400	Avg	Vert	50.6	28.9	5.0	10.0	33.1	61.4	66.6	5.2	PASS
4824	Peak	Horz	44.8	33.9	6.9	0.0	32.8	52.8	74.0	21.2	PASS
4824	Avg	Horz	31.3	33.9	6.9	0.0	32.8	39.3	54.0	14.7	PASS
4824	Peak	Vert	45.6	33.9	6.9	0.0	32.8	53.6	74.0	20.4	PASS
4824	Avg	Vert	31.5	33.9	6.9	0.0	32.8	39.5	54.0	14.5	PASS
7236	Peak	Vert	45.5	38.1	4.3	0.0	35.9	52.0	74.0	22.0	PASS
7236	Avg	Vert	31.8	38.1	4.3	0.0	35.9	38.3	54.0	15.7	PASS
7236	Peak	Horz	44.9	38.1	4.3	0.0	35.9	51.4	74.0	22.6	PASS
7236	Avg	Horz	31.2	38.1	4.3	0.0	35.9	37.7	54.0	16.3	PASS
9648	Peak	Horz	45.3	39.0	11.5	0.0	33.6	62.2	74.0	11.8	PASS
9648	Avg	Horz	32.1	39.0	11.5	0.0	33.6	49.0	54.0	5.0	PASS
9648	Peak	Vert	45.2	39.0	11.5	0.0	33.6	62.1	74.0	11.9	PASS
9648	Avg	Vert	32.1	39.0	11.5	0.0	33.6	49.0	54.0	5.0	PASS
Mid channel #6 (2.437GHz)											
2437	Peak	Horz	97.3	29.1	5.1	10.0	33.1	108.4			PASS
2437	Avg	Horz	84.1	29.1	5.1	10.0	33.1	95.2			PASS
2437	Peak	Vert	88.7	29.1	5.1	10.0	33.1	99.8			PASS
2437	Avg	Vert	75.4	29.1	5.1	10.0	33.1	86.5			PASS
4874	Peak	Horz	45.2	34.1	6.9	0.0	32.8	53.4	74.0	20.6	PASS
4874	Avg	Horz	31.2	34.1	6.9	0.0	32.8	39.4	54.0	14.6	PASS

Client	Technologies HumanWare inc.	 Canada
Product	BrailleNote Touch	
Standard(s)	RSS-247 Issue 2 FCC Part 15 Subpart 15.247	

4874	Peak	Vert	44.9	34.1	6.9	0.0	32.8	53.1	74.0	20.9	PASS
4874	Avg	Vert	31.6	34.1	6.9	0.0	32.8	39.8	54.0	14.2	PASS
7311	Peak	Vert	45.2	38.1	4.3	0.0	33.0	54.6	74.0	19.4	PASS
7311	Avg	Vert	31.4	38.1	4.3	0.0	33.0	40.8	54.0	13.2	PASS
7311	Peak	Horz	44.5	38.1	4.3	0.0	33.0	53.9	74.0	20.1	PASS
7311	Avg	Horz	30.9	38.1	4.3	0.0	33.0	40.3	54.0	13.7	PASS
High channel #11 (2.462GHz)											
2462	Peak	Horz	94.6	29.2	5.1	10.0	33.1	105.8			PASS
2462	Avg	Horz	81.5	29.2	5.1	10.0	33.1	92.7			PASS
2462	Peak	Vert	85.2	29.2	5.1	10.0	33.1	96.4			PASS
2462	Avg	Vert	72.1	29.2	5.1	10.0	33.1	83.3			PASS
2483.5	Peak	Horz	58.7	29.4	5.1	10.0	33.1	70.1	74.0	3.9	PASS
2483.5	Avg	Horz	37.4	29.4	5.1	10.0	33.1	48.8	54.0	5.2	PASS
2483.5	Peak	Vert	52.1	29.4	5.1	10.0	33.1	63.5	74.0	10.5	PASS
2483.5	Avg	Vert	33.1	29.4	5.1	10.0	33.1	44.5	54.0	9.5	PASS
4924	Peak	Horz	45.1	34.2	6.9	0.0	32.8	53.4	74.0	20.6	PASS
4924	Avg	Horz	31.1	34.2	6.9	0.0	32.8	39.4	54.0	14.6	PASS
4924	Peak	Vert	44.6	34.2	6.9	0.0	32.8	52.9	74.0	21.1	PASS
4924	Avg	Vert	31.1	34.2	6.9	0.0	32.8	39.4	54.0	14.6	PASS
7386	Peak	Vert	46.1	38.0	4.3	0.0	33.0	55.4	74.0	18.6	PASS
7386	Avg	Vert	32.6	38.0	4.3	0.0	33.0	41.9	54.0	12.1	PASS
7386	Peak	Horz	45.3	38.0	4.3	0.0	33.0	54.6	74.0	19.4	PASS
7386	Avg	Horz	31.1	38.0	4.3	0.0	33.0	40.4	54.0	13.6	PASS
9848	Peak	Vert	44.9	39.1	11.7	0.0	33.6	62.1	74.0	11.9	PASS
9848	Avg	Vert	32.2	39.1	11.7	0.0	33.6	49.4	54.0	4.6	PASS
9848	Peak	Horz	45.7	39.1	11.7	0.0	33.6	62.9	74.0	11.1	PASS
9848	Avg	Horz	32.7	39.1	11.7	0.0	33.6	49.9	54.0	4.1	PASS

Client	Technologies HumanWare inc.	 Canada
Product	BrailleNote Touch	
Standard(s)	RSS-247 Issue 2 FCC Part 15 Subpart 15.247	

## Test Equipment List

Equipment	Model No.	Manufacturer	Last Calibration / Verification Date	Next Calibration / Verification Date	Asset #
Spectrum Analyzer Display	8566B	HP	1-28-15	1-28-17	4168
Spectrum Analyzer	8566B	HP	1-28-15	1-28-17	4169
Quasi Peak Adapter	85650A	HP	1-28-15	1-28-17	4170
Spectrum Analyzer	FSL6	Rohde & Schwarz	1-28-2016	1-28-2018	4095
Attenuator 10 dB	4779-10	narda	NCR	NCR	4096
BiLog Antenna	3142-C	ETS	9-8-15	9-8-17	8
Horn Antenna	ATH1G18G	AR	4-23-15	4-23-17	4003
Biconical Antenna	EM-6913	Electro-Metrics	4-28-15	4-28-17	4060
Log Periodic Antenna	LPA-25	Electro-Metrics	4-14-15	4-14-17	4087
Attenuator 3 dB	FP-50-3	Trilithic	N/A	N/A	4028
LNA pre-amp	LNA-1450	RF Bay Inc.	7-22-15	7-22-17	4089
1-26.5GHz preamp	8449B	Agilent	9-9-15	9-9-17	6351
RF Cable 10m	LMR-400-10M-50OHM-MN-MN	LexTec	N/A	N/A	4025
RF Cable 7m	LMR-400-7M-50OHM-MN-MN	LexTec	N/A	N/A	4026
Emission software	0.1.93	Global EMC	N/A	N/A	58

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Client	Technologies HumanWare inc.	 Canada
Product	BrailleNote Touch	
Standard(s)	RSS-247 Issue 2 FCC Part 15 Subpart 15.247	

## Power Spectral Density - DM

### Purpose

The purpose of this test is to ensure that the maximum power spectral density to the radiating element does not exceed the limits specified. This ensures that the modulation is significantly wide enough, or low enough in power that it will allow for co-operation of other wireless devices operating within this frequency allocation.

### Limits and Method

The limits are defined in 15.247(e).

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

The method is given in Section 10.2 of FCC KDB 558074.

### Results

The EUT passed. Low, medium, and high bands were tested. The worst case measured values were 6.66dBm for mode B (30 kHz RBW) and 4.23dBm (100 kHz RBW).

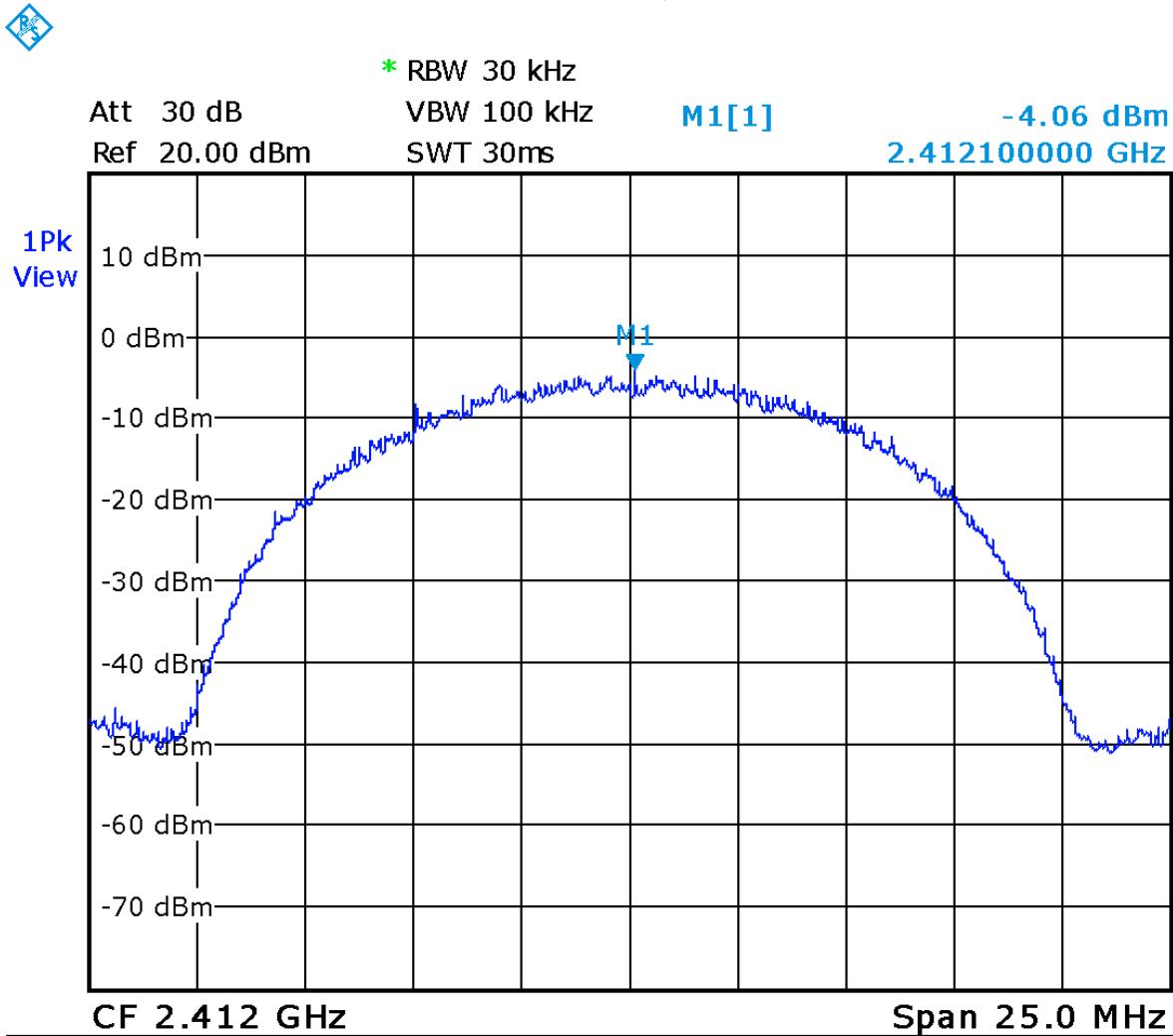
Channel	Frequency (MHz)	Measured PSD (dBm)	External & Cable Attenuation (dB)	Corrected PSD (dBm)	Limit (dBm)	Pass/Fail
Low Channel	2412	-4.06	10	5.94	8	Pass
Mid Channel	2437	-3.34	10	6.66	8	Pass
Hi Channel	2462	-3.86	10	6.14	8	Pass
Low Channel	2412	-5.92	10	4.08	8	Pass
Mid Channel	2437	-5.86	10	4.14	8	Pass
Hi Channel	2462	-5.77	10	4.23	8	Pass

### Graphs

The graphs shown below show the power spectral density of the device during the conducted measurement operation of the EUT. Low, middle, and high channel was investigated.

Client	<b>Technologies HumanWare inc.</b>	 Canada
Product	<b>BrailleNote Touch</b>	
Standard(s)	RSS-247 Issue 2 FCC Part 15 Subpart 15.247	

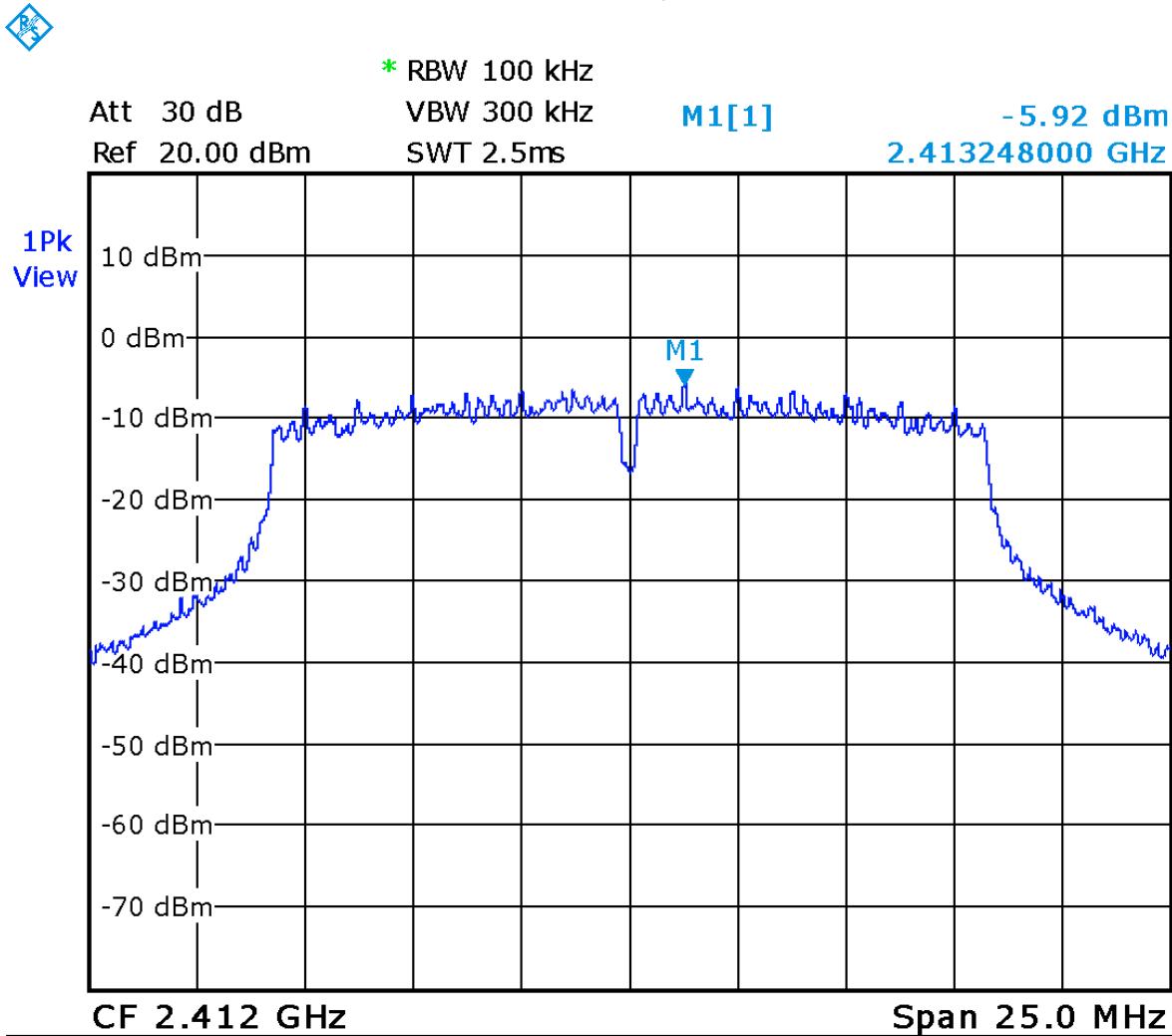
PSD - Low Channel, mode B



Date: 21.SEP.2016 19:44:15

Client	<b>Technologies HumanWare inc.</b>	 Canada
Product	<b>BrailleNote Touch</b>	
Standard(s)	RSS-247 Issue 2 FCC Part 15 Subpart 15.247	

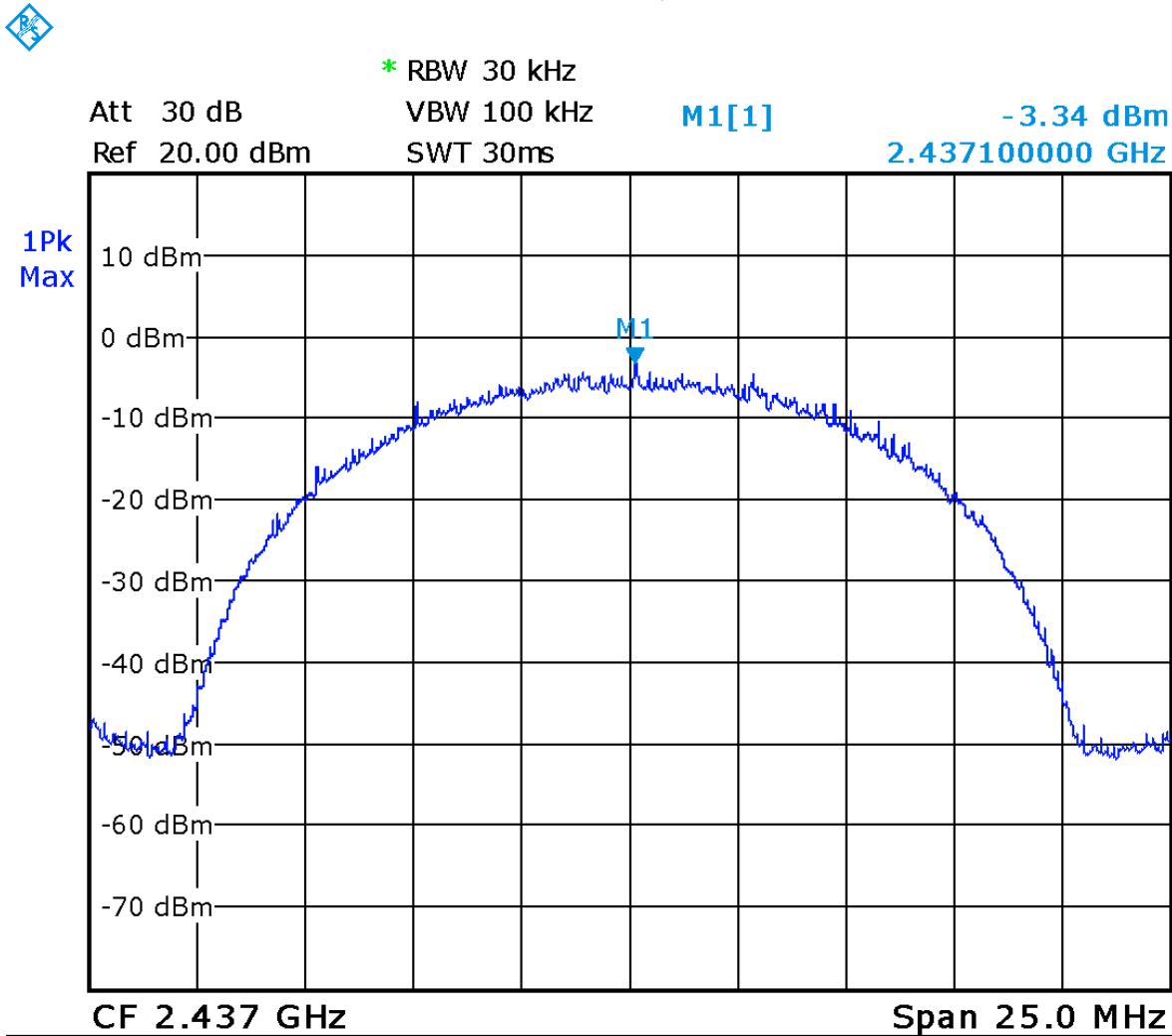
PSD - Low Channel, mode G



Date: 21.SEP.2016 19:23:29

Client	<b>Technologies HumanWare inc.</b>	 Canada
Product	<b>BrailleNote Touch</b>	
Standard(s)	RSS-247 Issue 2 FCC Part 15 Subpart 15.247	

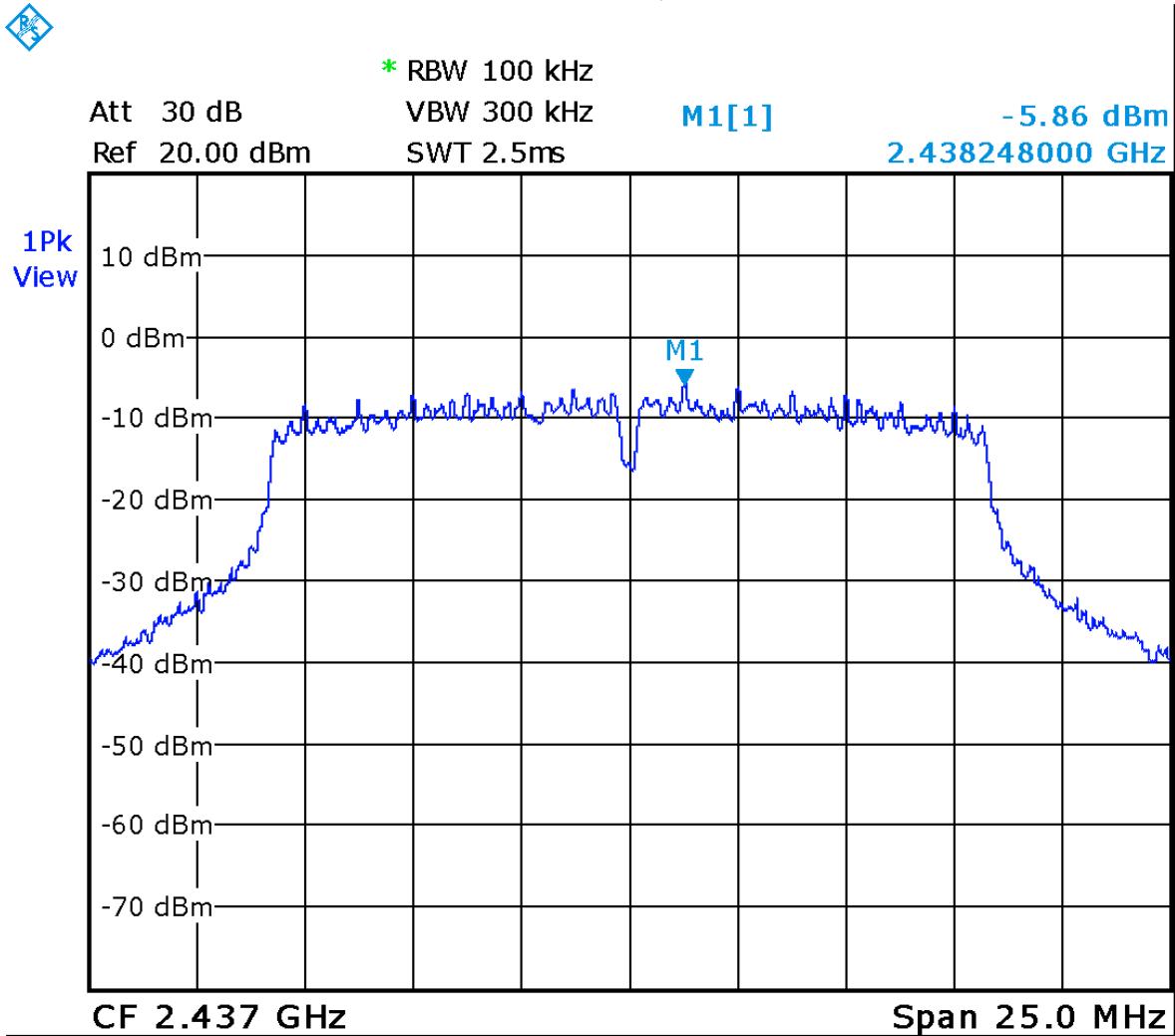
PSD - Mid Channel, mode B



Date: 21.SEP.2016 19:42:26

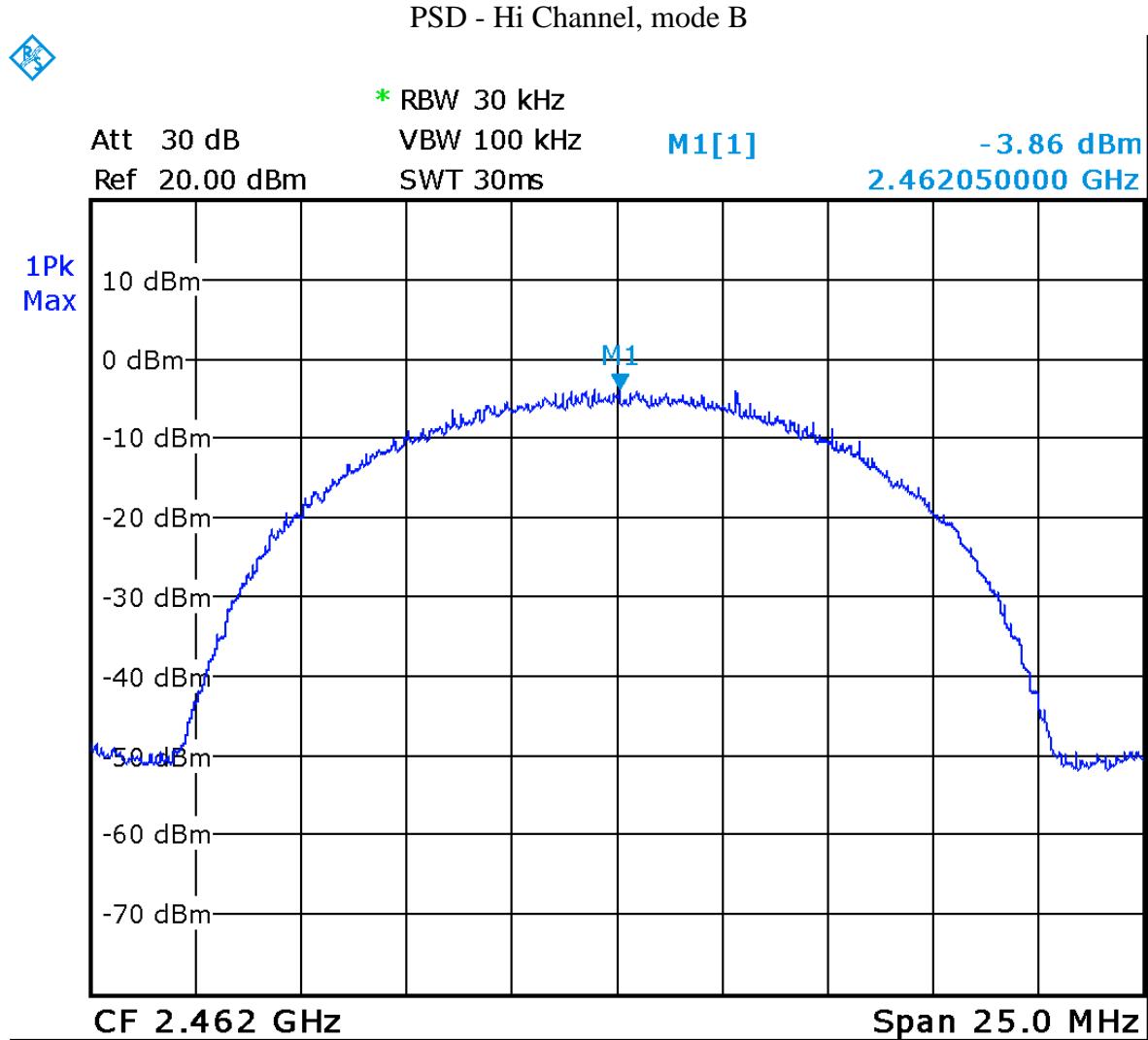
Client	<b>Technologies HumanWare inc.</b>	 Canada
Product	<b>BrailleNote Touch</b>	
Standard(s)	RSS-247 Issue 2 FCC Part 15 Subpart 15.247	

PSD - Mid Channel, mode G



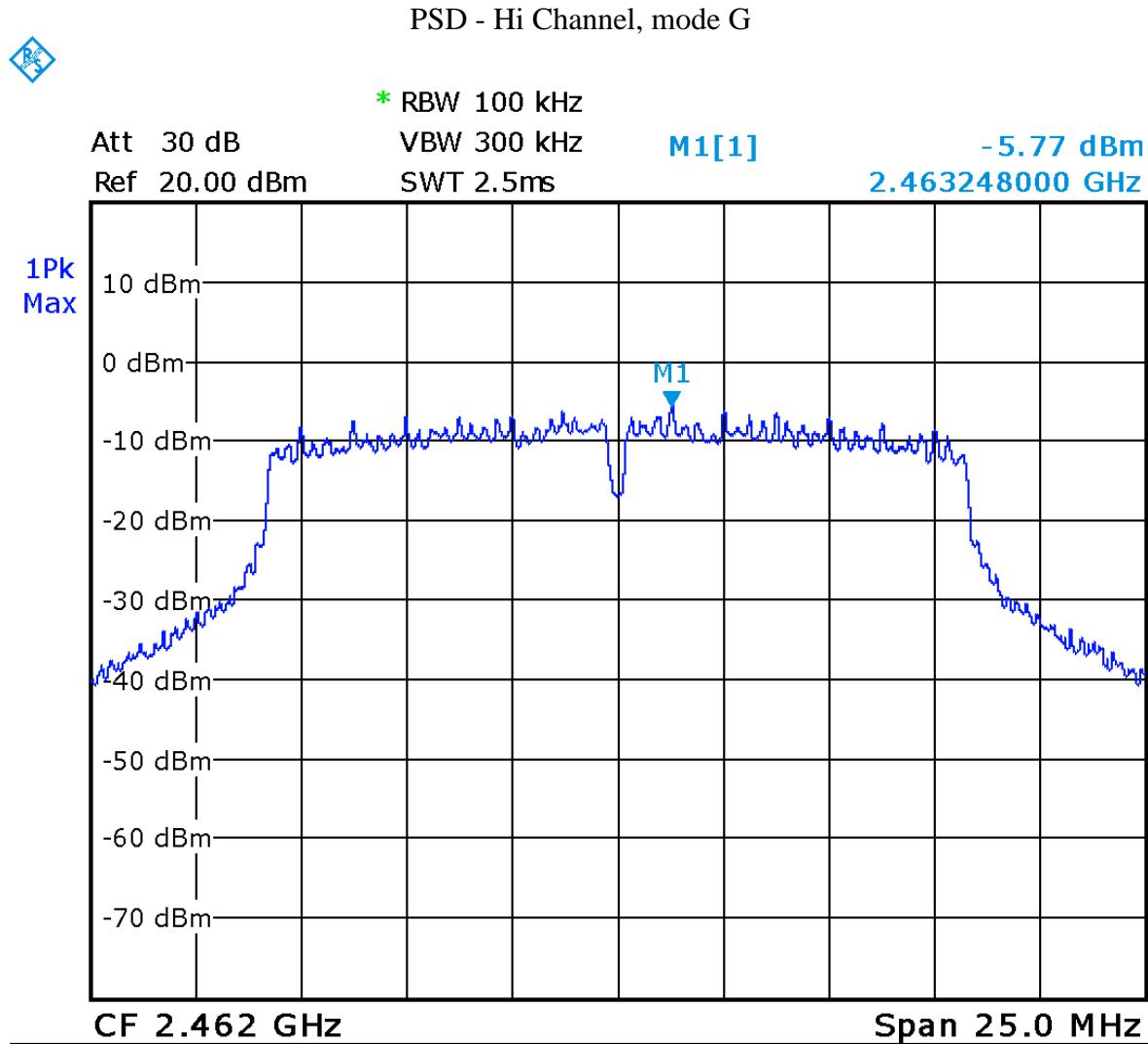
Date: 21.SEP.2016 19:32:57

Client	<b>Technologies HumanWare inc.</b>	 Canada
Product	<b>BrailleNote Touch</b>	
Standard(s)	RSS-247 Issue 2 FCC Part 15 Subpart 15.247	



Date: 21.SEP.2016 19:39:40

Client	<b>Technologies HumanWare inc.</b>	 Canada
Product	<b>BrailleNote Touch</b>	
Standard(s)	RSS-247 Issue 2 FCC Part 15 Subpart 15.247	



Date: 21.SEP.2016 19:35:24

See 'Appendix B – EUT and Test Setup Photos' for photos showing the test set-up.

Client	<b>Technologies HumanWare inc.</b>	 Canada
Product	<b>BrailleNote Touch</b>	
Standard(s)	RSS-247 Issue 2 FCC Part 15 Subpart 15.247	

## Test Equipment List

Equipment	Model No.	Manufacturer	Last Calibration Date	Next Calibration Date	Asset #
Spectrum Analyzer	FSL6	Rohde & Schwarz	Jan 28, 2016	Jan 28, 2018	4095
Attenuator 10 dB	4779-10	narda	NCR	NCR	4096

Client	<b>Technologies HumanWare inc.</b>	 Canada
Product	<b>BrailleNote Touch</b>	
Standard(s)	RSS-247 Issue 2 FCC Part 15 Subpart 15.247	

## **Power Line Conducted Emissions**

### **Purpose**

The purpose of this test is to ensure that the RF energy unintentionally emitted from the EUT's power line does not exceed the limits listed below as defined in the applicable test standard, as measured from a LISN. This helps protect lower frequency radio services such as AM radio, shortwave radio, amateur radio operators, maritime radio, CB radio, and so on, from unwanted interference.

### **Limits and Method**

The limits are as defined in 47 CFR FCC Part 15 Section 15.207

Method is as defined in ANSI C63.4:2014

<b>Average Limits</b>		<b>Quasi-Peak Limits</b>	
150 kHz – 500 kHz	56 to 46* dB $\mu$ V	150 kHz – 500 kHz	66 to 56* dB $\mu$ V
500 kHz – 5 MHz	46 dB $\mu$ V	500 kHz – 5 MHz	56 dB $\mu$ V
5 MHz – 30 MHz	50 dB $\mu$ V	5 MHz – 30 MHz	60 dB $\mu$ V

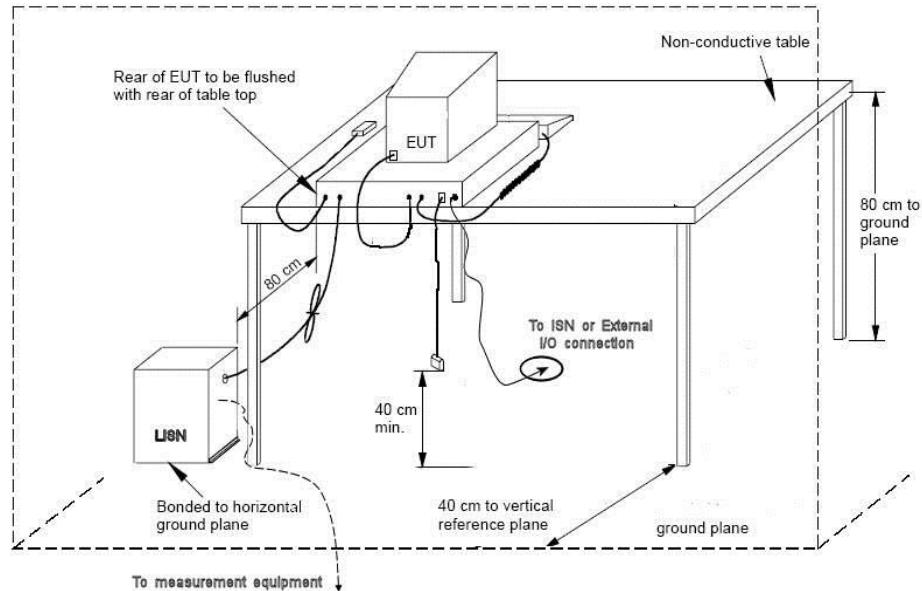
\* Decreases linearly with the logarithm of the frequency

Both Quasi-Peak and Average limits are applicable and each is specified as being measured with a resolution bandwidth of 9 kHz. For Quasi-Peak, a video bandwidth at least three times greater than the resolution bandwidth is used.

Based on ANSI C63.4 Section 4.2, if the Peak or Quasi-Peak detector measurements do not exceed the Average limits, then the EUT is deemed to have passed the requirements.

Client	<b>Technologies HumanWare inc.</b>	 Canada
Product	<b>BrailleNote Touch</b>	
Standard(s)	RSS-247 Issue 2 FCC Part 15 Subpart 15.247	

### Typical Setup Diagram



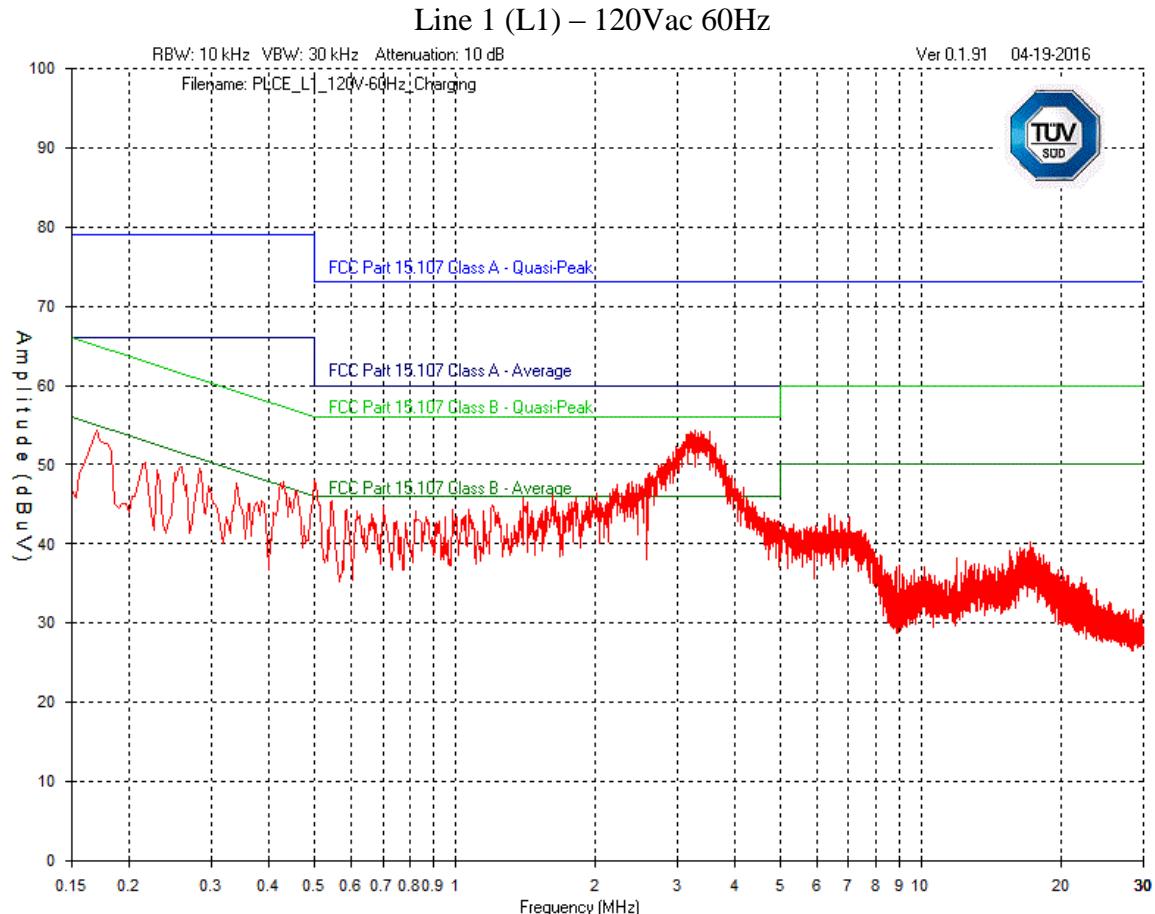
### Measurement Uncertainty

The expanded measurement uncertainty is calculated in accordance with CISPR 16-4-2 and is  $\pm 2.91\text{dB}$  with a 'k=2' coverage factor and a 95% confidence level.

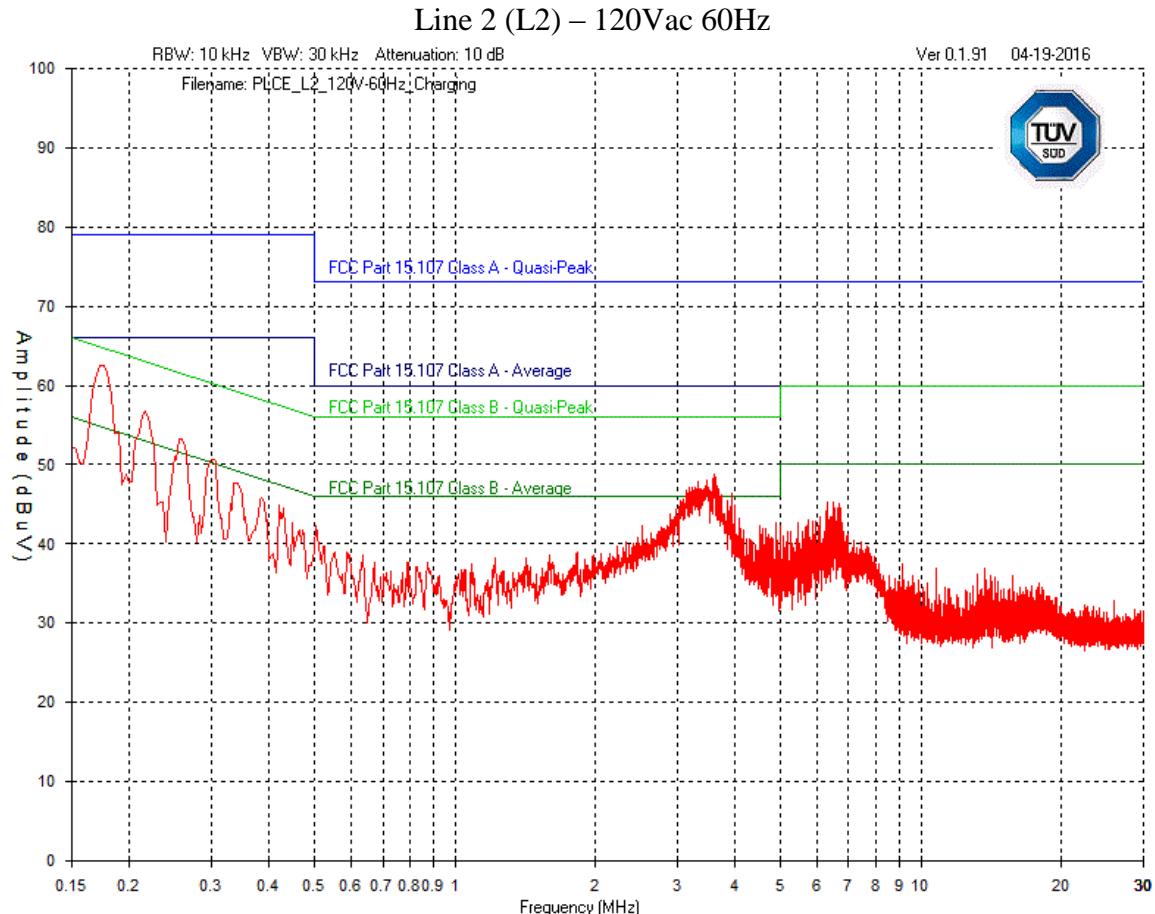
### Preliminary Graphs

The graphs shown below are maximized peak measurement graphs measured with a resolution bandwidth greater than or equal to the final required detector. This peaking process is done as a worst case measurement and enables the detection of frequencies of concern for final measurement. For final measurements with the appropriate detector, where applicable, please refer to the tables under Final Measurements.

Client	<b>Technologies HumanWare inc.</b>	 Canada
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Standard(s)	RSS-247 Issue 2 FCC Part 15 Subpart 15.247	

## Final Measurements

Average Emissions Table vs Quasi-Peak and Average Limits

Product Category			Class B								
Product			BrailleNote Touch								
Supply			120Vac, 60Hz								
Frequency (MHz)	Detector Peak/Avg/QP	Received Signal (dB $\mu$ V)	Atten Factor (dB)	Cable Factor (dB)	LISN Factor (dB)	Level (dB $\mu$ V)	QP Limit (dB)	Avg Limit (dB)	QP Margin (dB)	Avg Margin (dB)	Pass/Fail
Line (L1)											
3.2809	AVG	29.3	10	0.1	0.2	39.6	56	46	16.4	6.4	Pass
2.5745	AVG	24.8	10	0.1	0.2	35.1	56	46	20.9	10.9	Pass
0.5087	AVG	28.8	10	0	0.2	39	56	46	17	7	Pass
2.3987	AVG	24.8	10	0.1	0.2	35.1	56	46	20.9	10.9	Pass
0.4286	AVG	29.3	10	0	0.2	39.5	57.3	47.3	17.8	7.8	Pass
2.0107	AVG	22.7	10	0	0.2	32.9	56	46	23.1	13.1	Pass
Neutral (L2)											
0.1708	AVG	31.6	10	0	1.3	42.9	64.8	54.8	21.9	11.9	Pass
0.2134	AVG	27.8	10	0	0.9	38.7	63	53	24.3	14.3	Pass
3.6126	AVG	26.4	10	0.1	0.2	36.7	56	46	19.3	9.3	Pass
0.2561	AVG	27.1	10	0	0.7	37.8	61.6	51.6	23.8	13.8	Pass
3.941	AVG	21.9	10	0.1	0.2	32.2	56	46	23.8	13.8	Pass
0.2981	AVG	23.8	10	0	0.5	34.3	60.3	50.3	26	16	Pass

Note:

Peak = Peak measurement

Avg = Average measurement

QP = Quasi-Peak measurement

See 'Appendix B – EUT, Peripherals and Test Setup Photos' for photos showing the test set-up for the highest line conducted emission

Client	Technologies HumanWare inc.	 Canada
Product	BrailleNote Touch	
Standard(s)	RSS-247 Issue 2 FCC Part 15 Subpart 15.247	

## Test Equipment List

Equipment	Model No.	Manufacturer	Last Calibration Date	Next Calibration Date	Asset #
Spectrum Analyzer Display	8566B	HP	1-28-15	1-28-17	4168
Spectrum Analyzer	8566B	HP	1-28-15	1-28-17	4169
Quasi Peak Adapter	85650A	HP	1-28-15	1-28-17	4170
LISN	FCC-LISN-50/250-16-2-01	FCC	3-20-15	3-20-17	4005
RF Cable 7m	LMR-400-7M-50OHM-MN-MN	LexTec	NCR	NCR	4025
RF Cable 1m	LMR-400-1M-50OHM-MN-MN	LexTec	NCR	NCR	4026
Attenuator 10 dB	FP-50-10	Trilithic	NCR	NCR	4027
Emissions Software	0.1.91	Global EMC	NCR	NCR	58

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Client	<b>Technologies HumanWare inc.</b>	 Canada
Product	<b>BrailleNote Touch</b>	
Standard(s)	RSS-247 Issue 2 FCC Part 15 Subpart 15.247	

## **Appendix A – EUT Summary**

Client	<b>Technologies HumanWare inc.</b>	 Canada
Product	<b>BrailleNote Touch</b>	
Standard(s)	RSS-247 Issue 2 FCC Part 15 Subpart 15.247	

For further details for filing purposes, refer to filing package.

## General EUT Description

<b>Client</b>	
Organization / Address	Technologies HumanWare inc. 1800, Rue Michaud, Drummondville, QC, J2C 7G7, Canada
Contact	Pierre, Hamel
Phone	1-450-463-1717, ext 350
Email	pierre.hamel@humanware.com
<b>EUT Details</b>	
EUT Name	BrailleNote Touch
FCC ID	XT5BNT432
Industry Canada #	8670A- BNT432
Equipment Category	IT
Basic EUT Functionality	The BrailleNote Touch is an electronic tablet with refreshable Braille display customized for blind persons. Built on Android operating system, this product offer all functionalities available on mainstream tablet with specialize menu to enable the blind user to easily operate the unit.
Input Voltage and Frequency	5Vdc. Adpater: IN:100-240V, 50/60 Hz, 0.3A OUT: 5Vdc, 1.5A
Rated Input Current	1.5A
Connectors available on EUT	Headphone jack, USB Micro-B
Peripherals Required for Test	None
Release type	
Intentional Radiator Frequency	2400 – 2483.5 MHz
EUT Configuration	Wireless configured to transmit continuously.

Note the EUT is considered to have been received the date of the commencement of the first test, unless otherwise stated. For a close-up picture of the EUT, see ‘Appendix B – EUT and Test Setup Photos’.

Client	<b>Technologies HumanWare inc.</b>	 Canada
Product	<b>BrailleNote Touch</b>	
Standard(s)	RSS-247 Issue 2 FCC Part 15 Subpart 15.247	

## **Appendix B – EUT and Test Setup Photos**

Client	<b>Technologies HumanWare inc.</b>	 Canada
Product	<b>BrailleNote Touch</b>	
Standard(s)	RSS-247 Issue 2 FCC Part 15 Subpart 15.247	

Note: These photos are for informational purposes. Also refer to the PDF files which are separate from this test report.

Figure 1 – Radiated Emissions Setup – Photo 1



Client	<b>Technologies HumanWare inc.</b>	 Canada
Product	<b>BrailleNote Touch</b>	
Standard(s)	RSS-247 Issue 2 FCC Part 15 Subpart 15.247	

Figure 2 – Radiated Emissions Setup – Photo 2



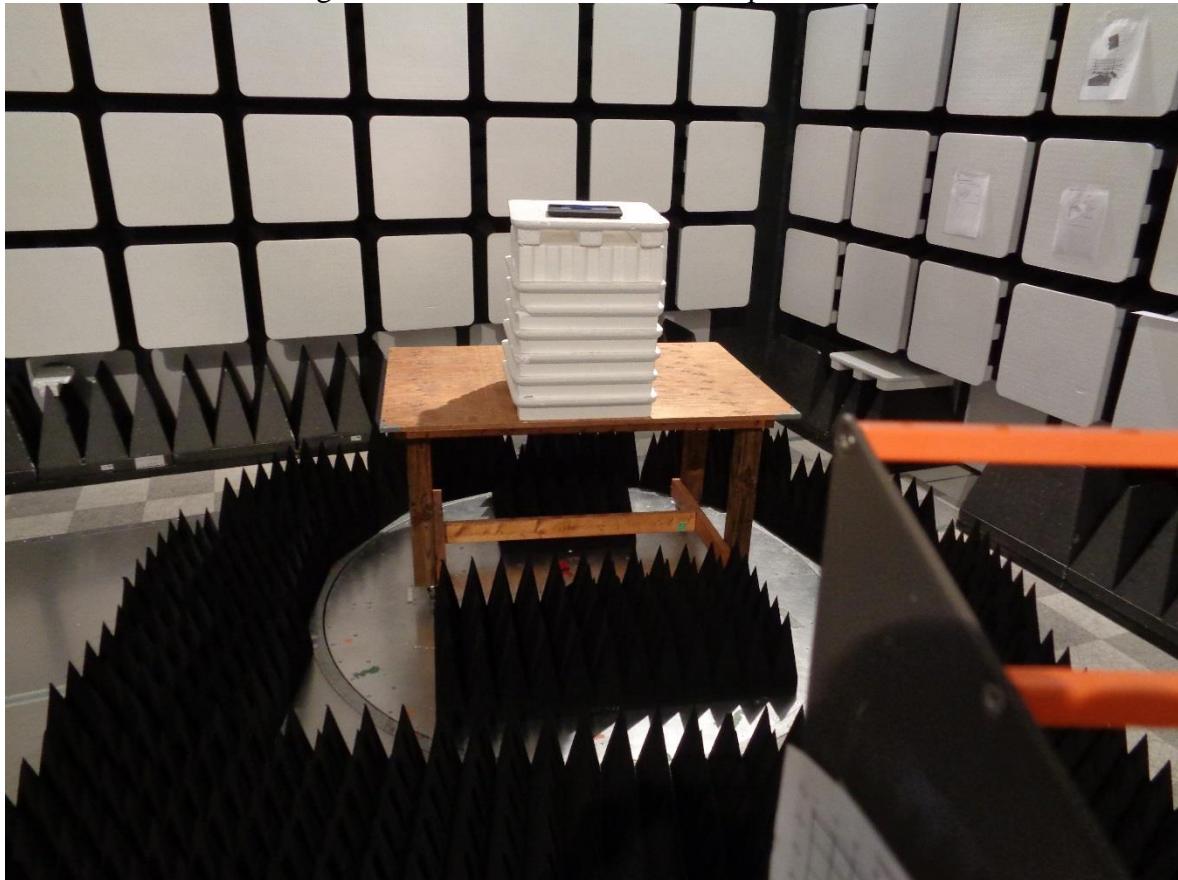
Client	<b>Technologies HumanWare inc.</b>	 Canada
Product	<b>BrailleNote Touch</b>	
Standard(s)	RSS-247 Issue 2 FCC Part 15 Subpart 15.247	

Figure 3 – Radiated Emissions Setup – Photo 3



Client	<b>Technologies HumanWare inc.</b>	 Canada
Product	<b>BrailleNote Touch</b>	
Standard(s)	RSS-247 Issue 2 FCC Part 15 Subpart 15.247	

Figure 4 – Radiated Emissions Setup – Photo 4



Note: As per ANSI C63.10 Clause 6.3.1, below 1GHz, the height of the EUT was set to 80cm. Above 1GHz, the height was raised to 1.5m.

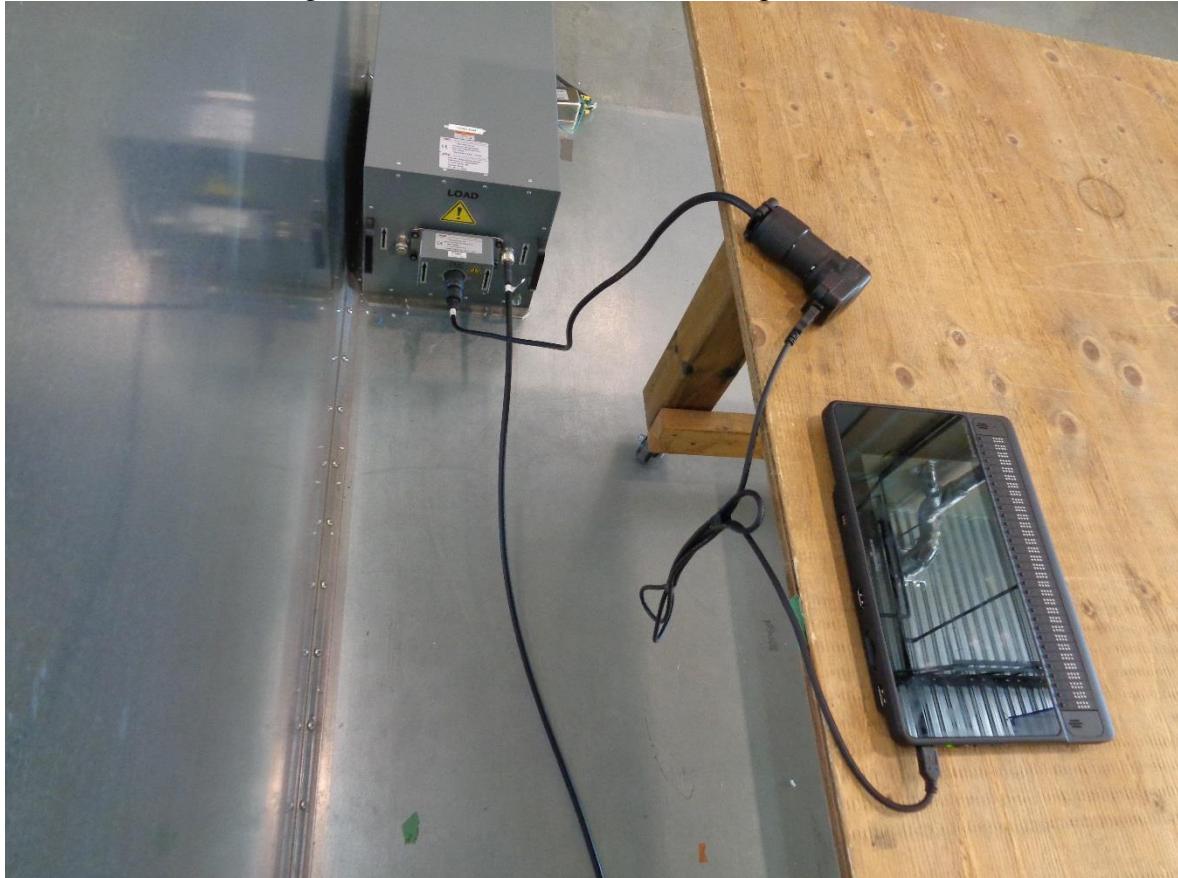
Client	<b>Technologies HumanWare inc.</b>	 Canada
Product	<b>BrailleNote Touch</b>	
Standard(s)	RSS-247 Issue 2 FCC Part 15 Subpart 15.247	

Figure 5 – Conducted Emissions Setup – Photo 5



Client	<b>Technologies HumanWare inc.</b>	 Canada
Product	<b>BrailleNote Touch</b>	
Standard(s)	RSS-247 Issue 2 FCC Part 15 Subpart 15.247	

Figure 6 – Conducted Emissions Setup – Photo 2



Client	<b>Technologies HumanWare inc.</b>	 Canada
Product	<b>BrailleNote Touch</b>	
Standard(s)	RSS-247 Issue 2 FCC Part 15 Subpart 15.247	

Figure 7 – Antenna Port Conducted Emissions Setup – Photo 1



Client	<b>Technologies HumanWare inc.</b>	 Canada
Product	<b>BrailleNote Touch</b>	
Standard(s)	RSS-247 Issue 2 FCC Part 15 Subpart 15.247	

Figure 8 – Antenna Port Conducted Emissions Setup – Photo 2

