

Report on the Exposure Calculation of:

Frontier Smart Technologies Limited
Minuet 2 Module (FS5352)

In accordance with FCC CFR 47 Part 2 and
ISED RSS-102

Prepared for: Frontier Smart Technologies Limited
Ashwell Point
Babraham Road
Sawston
Cambridge
CB22 3LJ
UNITED KINGDOM



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Simon Bennett	Innovations Manager	Authorised Signatory	11 September 2019

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ENGINEERING STATEMENT

The calculation of exposure for this product was found to be compliant at 20 cm with FCC CFR 47 Part 2 and ISED RSS-102.

SIGNATURE

NAME	JOB TITLE	RESPONSIBLE FOR	ISSUE DATE
Peter Dorey	Principal Consultant	Calculation	

FCC Accreditation

90987 Octagon House, Fareham Test Laboratory

Industry Canada Accreditation

IC2932B-1 Octagon House, Fareham Test Laboratory

EXECUTIVE SUMMARY

The calculation of exposure for this product was found to be compliant at 20 cm with FCC CFR 47 Part 2: 2019 and ISED RSS-102: 2019

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Registered in Scotland at East Kilbride,
Glasgow G75 0QF, United Kingdom
Registered number: SC215164

TÜV SÜD Ltd is a
TÜV SÜD Group Company

Phone: +44 (0) 1489 558100
Fax: +44 (0) 1489 558101
www.tuv-sud.co.uk

TÜV SÜD
Octagon House
Concorde Way
Fareham
Hampshire PO15 5RL
United Kingdom

TÜV SÜD

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1 Report Summary

1.1 Report Modification Record

Alterations and additions to this report will be issued to the holders of each copy in the form of a complete document.

Issue	Description of Change	Date of Issue
1	First Issue	12 August 2019
2	To amend the customer address	11 September 2019

Table 1

1.2 Introduction

Objective	To perform electromagnetic field exposure assessment to determine the equipment under test's (EUT's) compliance with the applied specifications.
Applicant	Frontier Smart Technologies Limited
Manufacturer	Frontier Smart Technologies Limited
Model Number(s)	Minuet 2 Module FS5352
Hardware Version(s)	Minuet 2 Module: Rev4
Software Version(s)	NS2
Specification/Issue/Date	• FCC 47 CFR Part 2, Subpart J 2.1091: 2018 • ISED Canada: Health Canada Safety Code 6:2015
Order Number	FS190531
Date	21 May 2019
Related Document(s)	• FCC 47 CFR Part 1.1310: 2018 • OET65:97 Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields • IEEE C95.3:2002 IEEE Recommended Practice for Measurements and Computations of Radio Frequency Electromagnetic Fields with Respect to Human Exposure to Such Fields, 100 kHz–300 GHz • RSS-102 Issue 5 Radio Frequency (RF) Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands)



1.3 Brief Summary of Results

The wireless device described within this report was compliant with the restrictions related to human exposure to electromagnetic fields for both general public and worker/occupational exposures.

The calculations shown in this report were made in accordance with the procedures specified in the applied test specification(s).

1.3.1 Configuration 1 - Single transmitter

Regional Requirement	RAT	Frequency (MHz)	RF Exposure Level at compliance boundary of 0.2 m							
			S Power Density (W/m ²)		E Field (V/m)		H Field (A/m)		B Field (μT)	
			Result	Limit	Result	Limit	Result	Limit	Result	Limit
FCC	Bluetooth	2402	0.02	50.00	2.39	N/A	0.0063	N/A	0.0080	N/A
FCC	WLAN	2412	0.15	50.00	7.54	N/A	0.0200	N/A	0.0251	N/A
FCC	WLAN	5180	0.20	50.00	8.66	N/A	0.0230	N/A	0.0289	N/A
FCC	WLAN	5500	0.26	50.00	9.83	N/A	0.0261	N/A	0.0328	N/A
FCC	WLAN	5755	0.18	50.00	8.27	N/A	0.0219	N/A	0.0276	N/A
CANADA	Bluetooth	2402	0.02	31.64	2.39	109.21	0.0063	0.2897	0.0080	N/A
CANADA	WLAN	2412	0.15	31.70	7.54	109.32	0.0200	0.2900	0.0251	N/A
CANADA	WLAN	5180	0.20	46.46	8.66	132.34	0.0230	0.3511	0.0289	N/A
CANADA	WLAN	5500	0.26	47.87	9.83	134.34	0.0261	0.3564	0.0328	N/A
CANADA	WLAN	5755	0.18	48.97	8.27	135.87	0.0219	0.3604	0.0276	N/A

Table 2 – Worker/Occupational Exposure Results

The calculations show that the EUT complies with the worker/occupational exposure levels described in the listed specifications in Annex A at the point of investigation, 0.2 m.



Regional Requirement	RAT	Frequency (MHz)	RF Exposure Level at compliance boundary of 0.2 m							
			S Power Density (W/m ²)		E Field (V/m)		H Field (A/m)		B Field (μT)	
			Result	Limit	Result	Limit	Result	Limit	Result	Limit
FCC	Bluetooth	2402	0.02	10.00	2.39	N/A	0.0063	N/A	0.0080	N/A
FCC	WLAN	2412	0.15	10.00	7.54	N/A	0.0200	N/A	0.0251	N/A
FCC	WLAN	5180	0.20	10.00	8.66	N/A	0.0230	N/A	0.0289	N/A
FCC	WLAN	5500	0.26	10.00	9.83	N/A	0.0261	N/A	0.0328	N/A
FCC	WLAN	5755	0.18	10.00	8.27	N/A	0.0219	N/A	0.0276	N/A
CANADA	Bluetooth	2402	0.02	5.35	2.39	44.91	0.0063	0.1191	0.0080	N/A
CANADA	WLAN	2412	0.15	5.37	7.54	44.97	0.0200	0.1193	0.0251	N/A
CANADA	WLAN	5180	0.20	9.05	8.66	58.40	0.0230	0.1549	0.0289	N/A
CANADA	WLAN	5500	0.26	9.43	9.83	59.61	0.0261	0.1581	0.0328	N/A
CANADA	WLAN	5755	0.18	9.72	8.27	60.54	0.0219	0.1606	0.0276	N/A

Table 3 – General Public Exposure Results

The calculations show that the EUT complies with the general public exposure levels described in the listed specifications in Annex A at the point of investigation, 0.2 m.

1.3.1 Configuration 2 - Multiple transmitters 2.4 GHz WLAN and Bluetooth

Regional Requirement	Calculated RF exposure level at compliance boundary of 0.2 m as a fraction of the limit			
	S Power Density	E Field	H Field	B Field
	Summation for simultaneous exposure; value to be <1			
FCC	0.0033	N/A	N/A	N/A
CANADA	0.0052	0.0052	0.0052	N/A

Table 4 – Worker/Occupational Exposure Results

The calculations show that the EUT complies with the worker/occupational exposure levels described in the listed specifications in Annex A at the point of investigation, 0.2 m.

Regional Requirement	Calculated RF exposure level at compliance boundary of 0.2 m as a fraction of the limit			
	S Power Density	E Field	H Field	B Field
	Summation for simultaneous exposure; value to be <1			
FCC	0.0166	N/A	N/A	N/A
CANADA	0.0309	0.0309	0.0309	N/A

Table 5 – General Public Exposure Results

The calculations show that the EUT complies with the general public exposure levels described in the listed specifications in Annex A at the point of investigation, 0.2 m.



1.3.2 Configuration 3 - Multiple transmitters 5 GHz WLAN and Bluetooth

Regional Requirement	RAT	Calculated RF exposure level at compliance boundary of 0.2 m as a fraction of the limit			
		S Power Density	E Field	H Field	B Field
		Summation for simultaneous exposure; value to be <1			
FCC	Bluetooth & WLAN (5180 MHz)	0.0043	N/A	N/A	N/A
FCC	Bluetooth & WLAN (5500 MHz)	0.0054	N/A	N/A	N/A
FCC	Bluetooth & WLAN (5755 MHz)	0.0039	N/A	N/A	N/A
CANADA	Bluetooth & WLAN (5180 MHz)	0.0048	0.0048	0.0048	N/A
CANADA	Bluetooth & WLAN (5500 MHz)	0.0058	0.0058	0.0058	N/A
CANADA	Bluetooth & WLAN (5755 MHz)	0.0042	0.0042	0.0042	N/A

Table 6 – Worker/Occupational Exposure Results

The calculations show that the EUT complies with the worker/occupational exposure levels described in the listed specifications in Annex A at the point of investigation, 0.2 m.

Regional Requirement	RAT	Calculated RF exposure level at compliance boundary of 0.2 m as a fraction of the limit			
		S Power Density	E Field	H Field	B Field
		Summation for simultaneous exposure; value to be <1			
FCC	Bluetooth & WLAN (5180 MHz)	0.0214	N/A	N/A	N/A
FCC	Bluetooth & WLAN (5500 MHz)	0.0271	N/A	N/A	N/A
FCC	Bluetooth & WLAN (5755 MHz)	0.0197	N/A	N/A	N/A
CANADA	Bluetooth & WLAN (5180 MHz)	0.0248	0.0248	0.0248	N/A
CANADA	Bluetooth & WLAN (5500 MHz)	0.0300	0.0300	0.0300	N/A
CANADA	Bluetooth & WLAN (5755 MHz)	0.0215	0.0215	0.0215	N/A

Table 7 – General Public Exposure Results

The calculations show that the EUT complies with the general public exposure levels described in the listed specifications in Annex A at the point of investigation, 0.2 m.

1.4 Product Information

1.4.1 Technical Description

Minuet 2 is a module, which when installed in a consumer audio product enables high-quality audio streaming over Wi-Fi, Bluetooth and Ethernet and can be activated via voice commands. Where appropriate the Minuet 2 module is tested in the Minuet 2 Voice Reference Platform.



1.4.2 Transmitter Description

The following radio access technologies and frequency bands are supported by the equipment under test.

Radio Access Technology	Antenna Port	Frequency Band	Minimum Frequency	Output Power	Duty Cycle
		MHz	MHz	dBm	%
Bluetooth	1	2400-2483.5	2402	6.5	100
WLAN	2	2400-2483.5	2412	16.5	100
WLAN	3	5150-5350	5180	16.5	100
WLAN	3	5470-5725	5500	16.5	100
WLAN	3	5725-5875	5755	16.5	100

Table 8 – Transmitter Description

1.4.3 Antenna Description

The following antennas are supported by the equipment under test.

Antenna No	Radio Access Technology	Antenna Model	Gain	Antenna length	Minimum Separation Distance
			dBi	cm	cm
1	Bluetooth	N12-2128-R0A SW700M (SW750M)	2.3	4.9	20
2	WLAN	N12-2128-R0A SW700M (SW750M)	2.3	4.9	20
3	WLAN (5180 MHz)	N12-2128-R0A SW700M (SW750M)	3.5	4.9	20
3	WLAN (5500 MHz)	N12-2128-R0A SW700M (SW750M)	4.6	4.9	20
3	WLAN (5755 MHz)	N12-2128-R0A SW700M (SW750M)	3.1	4.9	20

Table 9 – Antenna description

1.4.4 Equipment Configuration

Simultaneous transmitting is possible in following combinations:

- 1) 2.4GHz WLAN and Bluetooth
- 2) 5GHz WLAN and Bluetooth



2 Assessment Details

2.1 Assessment Method

The assessment method is by calculation of the power density S , electric field strength E , magnetic field strength H or magnetic flux density B .

The calculation uses the spherical model applicable under far field conditions.

$$S = E \times H = \frac{E^2}{\eta} = H^2 \times \eta = \frac{P \times G_i}{4 \times \pi \times r^2}$$

Where:

η - Impedance of free space (377 ohm in far field)

P – Transmitter power W

G_i – Antenna gain ratio relative to isotropic

R – Separation distance m

The magnetic flux density is related to the magnetic field strength by a constant:

$$B = \mu_o \times H$$

Where:

μ_o – Permeability of free space $4\pi \times 10^{-7}$ H/m

Where additional calculations are required by the regional specifications these are detailed below.

The far field region boundary depends on the frequency and wavelength and also on the antenna dimension. The boundary of the far field region is calculated below to demonstrate the validity of using the spherical model.



2.2 Individual Antenna Port Exposure Results

2.2.1 Calculation of Exposure at Specified Separation Distance

The frequencies shown in the tables below have been chosen based on the lowest possible frequency that the EUT can transmit. A full list of the regional requirements is shown in Annex A.

Regional Requirement	Antenna Port	RAT	Frequency (MHz)	RF Exposure Level at compliance boundary of 0.2 m							
				S Power Density (W/m ²)		E Field (V/m)		H Field (A/m)		B Field (μT)	
				Result	Limit	Result	Limit	Result	Limit	Result	Limit
FCC	1	Bluetooth	2402	0.02	50.00	2.39	N/A	0.0063	N/A	0.0080	N/A
FCC	2	WLAN	2412	0.15	50.00	7.54	N/A	0.0200	N/A	0.0251	N/A
FCC	3	WLAN	5180	0.20	50.00	8.66	N/A	0.0230	N/A	0.0289	N/A
FCC	3	WLAN	5500	0.26	50.00	9.83	N/A	0.0261	N/A	0.0328	N/A
FCC	3	WLAN	5755	0.18	50.00	8.27	N/A	0.0219	N/A	0.0276	N/A
CANADA	1	Bluetooth	2402	0.02	31.64	2.39	109.21	0.0063	0.2897	0.0080	N/A
CANADA	2	WLAN	2412	0.15	31.70	7.54	109.32	0.0200	0.2900	0.0251	N/A
CANADA	3	WLAN	5180	0.20	46.46	8.66	132.34	0.0230	0.3511	0.0289	N/A
CANADA	3	WLAN	5500	0.26	47.87	9.83	134.34	0.0261	0.3564	0.0328	N/A
CANADA	3	WLAN	5755	0.18	48.97	8.27	135.87	0.0219	0.3604	0.0276	N/A

Table 10 – Worker/Occupational Individual Transmitter Result

The calculations show that the EUT complies with the worker/occupational exposure levels described in the listed specifications in Annex A at the point of investigation, 0.2 m.

Regional Requirement	Antenna Port	RAT	Frequency (MHz)	RF Exposure Level at compliance boundary of 0.2 m							
				S Power Density (W/m ²)		E Field (V/m)		H Field (A/m)		B Field (μT)	
				Result	Limit	Result	Limit	Result	Limit	Result	Limit
FCC	1	Bluetooth	2402	0.02	10.00	2.39	N/A	0.0063	N/A	0.0080	N/A
FCC	2	WLAN	2412	0.15	10.00	7.54	N/A	0.0200	N/A	0.0251	N/A
FCC	3	WLAN	5180	0.20	10.00	8.66	N/A	0.0230	N/A	0.0289	N/A
FCC	3	WLAN	5500	0.26	10.00	9.83	N/A	0.0261	N/A	0.0328	N/A
FCC	3	WLAN	5755	0.18	10.00	8.27	N/A	0.0219	N/A	0.0276	N/A
CANADA	1	Bluetooth	2402	0.02	5.35	2.39	44.91	0.0063	0.1191	0.0080	N/A
CANADA	2	WLAN	2412	0.15	5.37	7.54	44.97	0.0200	0.1193	0.0251	N/A
CANADA	3	WLAN	5180	0.20	9.05	8.66	58.40	0.0230	0.1549	0.0289	N/A
CANADA	3	WLAN	5500	0.26	9.43	9.83	59.61	0.0261	0.1581	0.0328	N/A
CANADA	3	WLAN	5755	0.18	9.72	8.27	60.54	0.0219	0.1606	0.0276	N/A

Table 11 – General Public Individual Transmitter Result

The calculations show that the EUT complies with the general public exposure levels described in the listed specifications in Annex A at the point of investigation, 0.2 m.



2.3 Combined Antenna Port RF Exposure Results

As the frequency of operation for each transmitter is not the same, in order to evaluate compliance with the limit which is dependent on frequency, the fractional exposure value is calculated: The calculated S power density is divided by the limit to get a fractional exposure value. The calculated E and H fields are divided by the limit and squared to get a fractional exposure value. The summation of the fractional RF exposure results for each transmitter provides the combined result. Any values less than one are compliant with the limit.

2.3.1 2.4 GHz WLAN and Bluetooth

FCC OET 65 specifies the method of summation in clause; Multiple-Transmitter Sites and Complex Environments; with results as follows:

Antenna Port	RAT	Frequency (MHz)	Calculated RF exposure level at compliance boundary of 0.2 m as a fraction of the limit			
			S Power Density	E Field	H Field	B Field
			Summation for simultaneous exposure; value to be <1			
1	Bluetooth	2402	0.0003	N/A	N/A	N/A
2	WLAN	2412	0.0030	N/A	N/A	N/A
Summation			0.0033	N/A	N/A	N/A

Table 12 – FCC Worker/Occupational Combined Exposure

The calculations show that the EUT complies with the worker/occupational exposure levels described in the listed specifications in Annex A at the point of investigation, 0.2 m.

Antenna Port	RAT	Frequency (MHz)	Calculated RF exposure level at compliance boundary of 0.2 m as a fraction of the limit			
			S Power Density	E Field	H Field	B Field
			Summation for simultaneous exposure; value to be <1			
1	Bluetooth	2402	0.0015	N/A	N/A	N/A
2	WLAN	2412	0.0151	N/A	N/A	N/A
Summation			0.0166	N/A	N/A	N/A

Table 13 – FCC General Public Combined Exposure

The calculations show that the EUT complies with the general public exposure levels described in the listed specifications in Annex A at the point of investigation, 0.2 m.



CANADA Health Canada Safety Code 6 specifies the method of summation in clause 2.2.1 Note 6 with results as follows:

Antenna Port	RAT	Frequency (MHz)	Calculated RF exposure level at compliance boundary of 0.2 m as a fraction of the limit			
			S Power Density	E Field	H Field	B Field
			Summation for simultaneous exposure; value to be <1			
1	Bluetooth	2402	0.0005	0.0005	0.0005	N/A
2	WLAN	2412	0.0048	0.0048	0.0048	N/A
Summation			0.0052	0.0052	0.0052	N/A

Table 14 – CANADA Worker/Occupational Combined Exposure

The calculations show that the EUT complies with the worker/occupational exposure levels described in the listed specifications in Annex A at the point of investigation, 0.2 m.

Antenna Port	RAT	Frequency (MHz)	Calculated RF exposure level at compliance boundary of 0.2 m as a fraction of the limit			
			S Power Density	E Field	H Field	B Field
			Summation for simultaneous exposure; value to be <1			
1	Bluetooth	2402	0.0028	0.0028	0.0028	N/A
2	WLAN	2412	0.0281	0.0281	0.0281	N/A
Summation			0.0309	0.0309	0.0309	N/A

Table 15 – CANADA General Public Combined Exposure

The calculations show that the EUT complies with the general public exposure levels described in the listed specifications in Annex A at the point of investigation, 0.2 m.

2.3.2 5 GHz WLAN (5180 MHz) and Bluetooth

FCC OET 65 specifies the method of summation in clause; Multiple-Transmitter Sites and Complex Environments; with results as follows:

Antenna Port	RAT	Frequency (MHz)	Calculated RF exposure level at compliance boundary of 0.2 m as a fraction of the limit			
			S Power Density	E Field	H Field	B Field
			Summation for simultaneous exposure; value to be <1			
1	Bluetooth	2402	0.0003	N/A	N/A	N/A
3	WLAN	5180	0.0040	N/A	N/A	N/A
Summation			0.0043	N/A	N/A	N/A

Table 16 – FCC Worker/Occupational Combined Exposure

The calculations show that the EUT complies with the worker/occupational exposure levels described in the listed specifications in Annex A at the point of investigation, 0.2 m.



Antenna Port	RAT	Frequency (MHz)	Calculated RF exposure level at compliance boundary of 0.2 m as a fraction of the limit			
			S Power Density	E Field	H Field	B Field
			Summation for simultaneous exposure; value to be <1			
1	Bluetooth	2402	0.0015	N/A	N/A	N/A
3	WLAN	5180	0.0199	N/A	N/A	N/A
Summation			0.0214	N/A	N/A	N/A

Table 17 – FCC General Public Combined Exposure

The calculations show that the EUT complies with the general public exposure levels described in the listed specifications in Annex A at the point of investigation, 0.2 m.

CANADA Health Canada Safety Code 6 specifies the method of summation in clause 2.2.1 Note 6 with results as follows:

Antenna Port	RAT	Frequency (MHz)	Calculated RF exposure level at compliance boundary of 0.2 m as a fraction of the limit			
			S Power Density	E Field	H Field	B Field
			Summation for simultaneous exposure; value to be <1			
1	Bluetooth	2402	0.0005	0.0005	0.0005	N/A
3	WLAN	5180	0.0043	0.0043	0.0043	N/A
Summation			0.0048	0.0048	0.0048	N/A

Table 18 – CANADA Worker/Occupational Combined Exposure

The calculations show that the EUT complies with the worker/occupational exposure levels described in the listed specifications in Annex A at the point of investigation, 0.2 m.

Antenna Port	RAT	Frequency (MHz)	Calculated RF exposure level at compliance boundary of 0.2 m as a fraction of the limit			
			S Power Density	E Field	H Field	B Field
			Summation for simultaneous exposure; value to be <1			
1	Bluetooth	2402	0.0028	0.0028	0.0028	N/A
3	WLAN	5180	0.0220	0.0220	0.0220	N/A
Summation			0.0248	0.0248	0.0248	N/A

Table 19 – CANADA General Public Combined Exposure

The calculations show that the EUT complies with the general public exposure levels described in the listed specifications in Annex A at the point of investigation, 0.2 m.



2.3.3 5 GHz WLAN (5500 MHz) and Bluetooth

FCC OET 65 specifies the method of summation in clause; Multiple-Transmitter Sites and Complex Environments; with results as follows:

Antenna Port	RAT	Frequency (MHz)	Calculated RF exposure level at compliance boundary of 0.2 m as a fraction of the limit			
			S Power Density	E Field	H Field	B Field
			Summation for simultaneous exposure; value to be <1			
1	Bluetooth	2402	0.0003	N/A	N/A	N/A
3	WLAN	5500	0.0051	N/A	N/A	N/A
Summation			0.0054	N/A	N/A	N/A

Table 20 – FCC Worker/Occupational Combined Exposure

The calculations show that the EUT complies with the worker/occupational exposure levels described in in the listed specifications in Annex A at the point of investigation, 0.2 m.

Antenna Port	RAT	Frequency (MHz)	Calculated RF exposure level at compliance boundary of 0.2 m as a fraction of the limit			
			S Power Density	E Field	H Field	B Field
			Summation for simultaneous exposure; value to be <1			
1	Bluetooth	2402	0.0015	N/A	N/A	N/A
3	WLAN	5500	0.0256	N/A	N/A	N/A
Summation			0.0271	N/A	N/A	N/A

Table 21 – FCC General Public Combined Exposure

The calculations show that the EUT complies with the general public exposure levels described in in the listed specifications in Annex A at the point of investigation, 0.2 m.

CANADA Health Canada Safety Code 6 specifies the method of summation in clause 2.2.1 Note 6 with results as follows:

Antenna Port	RAT	Frequency (MHz)	Calculated RF exposure level at compliance boundary of 0.2 m as a fraction of the limit			
			S Power Density	E Field	H Field	B Field
			Summation for simultaneous exposure; value to be <1			
1	Bluetooth	2402	0.0005	0.0005	0.0005	N/A
3	WLAN	5500	0.0054	0.0054	0.0054	N/A
Summation			0.0058	0.0058	0.0058	N/A

Table 22 – CANADA Worker/Occupational Combined Exposure

The calculations show that the EUT complies with the worker/occupational exposure levels described in in the listed specifications in Annex A at the point of investigation, 0.2 m.



Antenna Port	RAT	Frequency (MHz)	Calculated RF exposure level at compliance boundary of 0.2 m as a fraction of the limit			
			S Power Density	E Field	H Field	B Field
			Summation for simultaneous exposure; value to be <1			
1	Bluetooth	2402	0.0028	0.0028	0.0028	N/A
3	WLAN	5500	0.0272	0.0272	0.0272	N/A
Summation			0.0300	0.0300	0.0300	N/A

Table 23 – CANADA General Public Combined Exposure

The calculations show that the EUT complies with the general public exposure levels described in the listed specifications in Annex A at the point of investigation, 0.2 m.

2.3.4 5 GHz WLAN (5755 MHz) and Bluetooth

FCC OET 65 specifies the method of summation in clause; Multiple-Transmitter Sites and Complex Environments; with results as follows:

Antenna Port	RAT	Frequency (MHz)	Calculated RF exposure level at compliance boundary of 0.2 m as a fraction of the limit			
			S Power Density	E Field	H Field	B Field
			Summation for simultaneous exposure; value to be <1			
1	Bluetooth	2402	0.0003	N/A	N/A	N/A
3	WLAN	5755	0.0036	N/A	N/A	N/A
Summation			0.0039	N/A	N/A	N/A

Table 24 – FCC Worker/Occupational Combined Exposure

The calculations show that the EUT complies with the worker/occupational exposure levels described in the listed specifications in Annex A at the point of investigation, 0.2 m.

Antenna Port	RAT	Frequency (MHz)	Calculated RF exposure level at compliance boundary of 0.2 m as a fraction of the limit			
			S Power Density	E Field	H Field	B Field
			Summation for simultaneous exposure; value to be <1			
1	Bluetooth	2402	0.0015	N/A	N/A	N/A
3	WLAN	5755	0.0181	N/A	N/A	N/A
Summation			0.0197	N/A	N/A	N/A

Table 25 – FCC General Public Combined Exposure

The calculations show that the EUT complies with the general public exposure levels described in the listed specifications in Annex A at the point of investigation, 0.2 m.

CANADA Health Canada Safety Code 6 specifies the method of summation in clause 2.2.1 Note 6 with results as follows:



Antenna Port	RAT	Frequency (MHz)	Calculated RF exposure level at compliance boundary of 0.2 m as a fraction of the limit			
			S Power Density	E Field	H Field	B Field
			Summation for simultaneous exposure; value to be <1			
1	Bluetooth	2402	0.0005	0.0005	0.0005	N/A
3	WLAN	5755	0.0037	0.0037	0.0037	N/A
Summation			0.0042	0.0042	0.0042	N/A

Table 26 – CANADA Worker/Occupational Combined Exposure

The calculations show that the EUT complies with the worker/occupational exposure levels described in the listed specifications in Annex A at the point of investigation, 0.2 m.

Antenna Port	RAT	Frequency (MHz)	Calculated RF exposure level at compliance boundary of 0.2 m as a fraction of the limit			
			S Power Density	E Field	H Field	B Field
			Summation for simultaneous exposure; value to be <1			
1	Bluetooth	2402	0.0028	0.0028	0.0028	N/A
3	WLAN	5755	0.0187	0.0187	0.0187	N/A
Summation			0.0215	0.0215	0.0215	N/A

Table 27 – CANADA General Public Combined Exposure

The calculations show that the EUT complies with the general public exposure levels described in the listed specifications in Annex A at the point of investigation, 0.2 m.

2.4 Far Field Region Boundary Results

The far field region boundary calculation result is shown in

Near Field / Far Field Boundary (Ref: IEEE C95.3 Annex B.2, Technical Guide for Interpretation and Compliance Assessment of Health Canada's Radiofrequency Exposure Guidelines 7.1)			
RAT Name	Frequency MHz	Reactive Near Field Boundary (Wave Impedance Dependent)	Antennas - on axis Far Field Region
		$\lambda/4$ (m)	$2D^2/\lambda$ (m)
Bluetooth	2402	0.0312	0.0384
WLAN	2412	0.0311	0.0386
WLAN	5180	0.0145	0.0829
WLAN	5500	0.0136	0.0880
WLAN	5755	0.0130	0.0921

Table 28:

Near Field / Far Field Boundary (Ref: IEEE C95.3 Annex B.2, Technical Guide for Interpretation and Compliance Assessment of Health Canada's Radiofrequency Exposure Guidelines 7.1)
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RAT Name	Frequency MHz	Reactive Near Field Boundary (Wave Impedance Dependent)	Antennas - on axis Far Field Region
		$\lambda/4$ (m)	$2D^2/\lambda$ (m)
Bluetooth	2402	0.0312	0.0384
WLAN	2412	0.0311	0.0386
WLAN	5180	0.0145	0.0829
WLAN	5500	0.0136	0.0880
WLAN	5755	0.0130	0.0921

Table 28 – Far Field Boundary

The table below shows the maximum calculated near field / far field region boundaries. The compliance boundary of 0.2 m is in the far field region and therefore, the approach described in section 2.1 is valid.

Field Region	Reactive Near Field Region	Radiating Near Field Region	Far Field Region
Maximum Boundary	< 0.0312 m	0.0312 – 0.0921 m	> 0.0921 m
Validity of Regions	Spherical model potential under-estimate: SAR assessment required	Spherical model over- estimate and conservative	Spherical model valid
Compliance Boundary Location	N/A	N/A	0.2 m

Table 29 – Assessment Method Validity

2.5 Uncertainty

The basic computation formulas presented in section 2.1 are conservative formulas for the estimation of RF field strength or power density. No uncertainty estimations are required when using these formulas but there is clear guidance on where and when these formulas are applicable.

For the estimate of S, E or H to be conservative, the transmitter power P and antenna gain G_i values shall be the upper bounds of uncertainty therefore maximum values are used.

The spherical formula is valid under far field conditions which are established in section 2.4.



ANNEX A

REGIONAL REQUIREMENTS



Frequency Range (MHz)	Power Density (mW/cm ²) ^{Note 1}	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)
0 - 0.3	-	-	-
0.3 - 3	100	614	1.63
3 - 30	$900/f^2$	$1842/f$	$4.89/f$
30 - 300	1	61.4	0.163
300 - 1500	$f/300$	-	-
1500 - 100000	5	-	-

Table A.1 – CFR 47 Pt1.1310 (2019) Worker/Occupational Limits

Frequency Range (MHz)	Power Density (mW/cm ²) ^{Note 1}	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)
0 - 0.3	-	-	-
0.3 - 3	100	614	1.63
3 - 30	$180/f^2$	$824/f$	$2.19/f$
30 - 300	0.2	27.5	0.073
300 - 1500	$f/1500$	-	-
1500 - 100000	1	-	-

Table A.2 – CFR 47 Pt1.1310 (2019) General Public Limits

Note 1: The calculations and limits presented in this report for power density are in units of W/m². The conversion factor is; 1 mW/cm² = 10 W/m².

Frequency Range (MHz)	Power Density (W/m ²)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)
10 - 20	10	61.4	0.163
20 - 48	$44.72/f^{0.5}$	$129.8/f^{0.25}$	$0.3444/f^{0.25}$
48 - 100	6.455	49.33	0.1309
100 - 6000	$0.6455*f^{0.5}$	$15.60*f^{0.25}$	$0.04138*f^{0.25}$
6000 - 150000	50	137	0.364

Table A.3 – Health Canada Safety Code 6 Worker/Occupational Limits

Frequency Range (MHz)	Power Density (W/m ²)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)
10 - 20	2	27.46	0.0728
20 - 48	$8.944/f^{0.5}$	$58.07/f^{0.25}$	$0.1540/f^{0.25}$
48 - 300	1.291	22.06	0.05852
300 - 6000	$0.02619*f^{0.6834}$	$3.142*f^{0.3417}$	$0.008335*f^{0.3417}$
6000 - 15000	10	61.4	0.163

Table A.4 – Health Canada Safety Code 6 General Public Limits