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Report On

RF Exposure Assessment of the
Sorensen Communications Inc
ASD041517 Set Top Box (STB) Videophone

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Document 75930506 Report 05 Issue 1

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SECTION 1

REPORT SUMMARY

RF Exposure Assessment of the
Sorensen Communications Inc
ASD041517 Set Top Box (STB) Videophone



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1.1 INTRODUCTION

The information contained in this report is intended to show verification of the RF Exposure Assessment of the Sorensen Communications Inc ASD041517 Set Top Box (STB) Videophone to the requirements of the applied test specifications.

Objective	To perform RF Exposure Assessment to determine the Equipment Under Test's (EUT's) compliance of the applied rules.
Manufacturer	Sorensen Communications Inc
Manufacturing Description	Set Top Box (STB) Videophone
Model Number(s)	ASD041517
Test Specification/Issue/Date	EN 62311:2008 CFR 47 Pt1.1310 Health Canada Safety Code 6 ARPANSA Radiation Protection Series No.3



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1.2 REGIONAL REQUIREMENTS

The table below shows the regional requirements that are referenced in this test report. A full list of the requirements is shown in Annex A.

Report Reference	Regional Requirement
EU	EN 62311:2008
FCC	CFR 47 Pt1.1310
IC	Health Canada Safety Code 6
AUS	ARPANSA Radiation Protection Series No.3



1.3 PRODUCT INFORMATION

1.3.1 Technical Description

The Equipment under test was a Sorensen Communications Inc ASD041517 Set Top Box (STB) Videophone. A full technical description can be found in the manufacturer's documentation.

All reported calculations were carried out on the relevant information supplied for the ASD041517 Set Top Box (STB) Videophone to demonstrate compliance with the applied test specification(s). The sample assessed was found to comply with the requirements of the applied rules.

1.3.2 Supported Features

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

Radio Access Technology	WLAN 2.4 GHz
	WLAN 5 GHz
	Bluetooth Classic
	Bluetooth Low Energy
Frequency Band	WLAN 2.4 GHz
	WLAN 5 GHz
	Bluetooth

1.3.3 Antennas

The following antennas are supported by the equipment under test.

No.	Model	Gain (dBi)
1	FR05-S1-NO-1-004 2.4GHz	1.8
2	FR05-S1-NO-1-004 5GHz	4.9

1.3.4 EUT Configurations

The unit is capable of simultaneous transmit for the following

- WLAN 2.4 GHz and Bluetooth Classic
- WLAN 2.4 GHz and Bluetooth Low Energy
- WLAN 5 GHz and Bluetooth Classic
- WLAN 5 GHz and Bluetooth Low Energy



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1.4 BRIEF SUMMARY OF RESULTS

The wireless device described within this report has been shown to be capable of compliance with the basic restrictions related to human exposure to electromagnetic fields for both General Public and Occupational. The calculations shown in this report were made in accordance the procedures specified in the applied test specification(s).

Configuration	Required Compliance Boundary (m)	
	Occupational	General Population
WLAN 2.4GHz	0.02	0.03
WLAN 5GHz	0.01	0.03
Bluetooth Classic	0.02	0.03
Bluetooth Low Energy	0.01	0.02
2.4GHz WLAN and Bluetooth Classic	0.03	0.06
2.4GHz WLAN and Bluetooth Low Energy	0.02	0.05
5GHz WLAN and Bluetooth Classic	0.03	0.05
5GHz WLAN and Bluetooth Low Energy	0.02	0.04

Table 1 – Compliance Boundary Results



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1.4.1 Configuration 1 - WLAN 2.4 GHz

Regional Requirement	Calculated RF exposure level at compliance boundary of 0.02 m					
	S Field (W/m ²)		E Field (V/m)		H Field (A/m)	
	Result	Limit	Result	Limit	Result	Limit
EU	12.0429	50.0000	67.3799	137.0000	0.1787	0.3630
FCC*	1.2043	5.0000	N/A	N/A	N/A	N/A
IC	12.0429	31.7019	67.3799	109.3249	0.1787	0.2900
AUS	12.0429	50.0000	67.3799	137.0000	0.1787	0.3640

* Requirement and Result in mW/cm²

Table 2 – Occupational Results

The calculations show that the EUT complies with the occupational exposure levels described in the EN 62311:2008, CFR 47 Pt1.1310, Health Canada Safety Code 6 and ARPANSA Radiation Protection Series No.3 at the point of investigation, 0.02 m.

Regional Requirement	Calculated RF exposure level at compliance boundary of 0.03 m					
	S Field (W/m ²)		E Field (V/m)		H Field (A/m)	
	Result	Limit	Result	Limit	Result	Limit
EU	5.3524	10.0000	44.9200	61.0000	0.1192	0.1620
FCC*	0.5352	1.0000	N/A	N/A	N/A	N/A
IC	5.3524	5.3660	44.9200	44.9743	0.1192	0.1193
AUS	5.3524	10.0000	44.9200	61.4000	0.1192	0.1630

* Requirement and Result in mW/cm²

Table 3 – General Population Results

The calculations show that the EUT complies with the occupational exposure levels described in the EN 62311:2008, CFR 47 Pt1.1310, Health Canada Safety Code 6 and ARPANSA Radiation Protection Series No.3 at the point of investigation, 0.03 m.



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1.4.2 Configuration 2 - WLAN 5 GHz

Regional Requirement	Calculated RF exposure level at compliance boundary of 0.01 m					
	S Field (W/m ²)		E Field (V/m)		H Field (A/m)	
	Result	Limit	Result	Limit	Result	Limit
EU	39.3360	50.0000	121.7757	137.0000	0.3230	0.3630
FCC*	3.9336	5.0000	N/A	N/A	N/A	N/A
IC	39.3360	46.4581	121.7757	132.3448	0.3230	0.3511
AUS	39.3360	50.0000	121.7757	137.0000	0.3230	0.3640

* Requirement and Result in mW/cm²

Table 4 – Occupational Results

The calculations show that the EUT complies with the occupational exposure levels described in the EN 62311:2008, CFR 47 Pt1.1310, Health Canada Safety Code 6 and ARPANSA Radiation Protection Series No.3 at the point of investigation, 0.01 m.

Regional Requirement	Calculated RF exposure level at compliance boundary of 0.03 m					
	S Field (W/m ²)		E Field (V/m)		H Field (A/m)	
	Result	Limit	Result	Limit	Result	Limit
EU	4.3707	10.0000	40.5919	61.0000	0.1077	0.1620
FCC*	0.4371	1.0000	N/A	N/A	N/A	N/A
IC	4.3707	9.0471	40.5919	58.3973	0.1077	0.1549
AUS	4.3707	10.0000	40.5919	61.4000	0.1077	0.1630

* Requirement and Result in mW/cm²

Table 5 – General Population Results

The calculations show that the EUT complies with the occupational exposure levels described in the EN 62311:2008, CFR 47 Pt1.1310, Health Canada Safety Code 6 and ARPANSA Radiation Protection Series No.3 at the point of investigation, 0.03 m.



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1.4.3 Configuration 3 - Bluetooth Classic

Regional Requirement	Calculated RF exposure level at compliance boundary of 0.02 m					
	S Field (W/m ²)		E Field (V/m)		H Field (A/m)	
	Result	Limit	Result	Limit	Result	Limit
EU	9.2730	50.0000	59.1257	137.0000	0.1568	0.3630
FCC*	0.9273	5.0000	N/A	N/A	N/A	N/A
IC	9.2730	31.7019	59.1257	109.3249	0.1568	0.2900
AUS	9.2730	50.0000	59.1257	137.0000	0.1568	0.3640

* Requirement and Result in mW/cm²

Table 6 – Occupational Results

The calculations show that the EUT complies with the occupational exposure levels described in the EN 62311:2008, CFR 47 Pt1.1310, Health Canada Safety Code 6 and ARPANSA Radiation Protection Series No.3 at the point of investigation, 0.02 m.

Regional Requirement	Calculated RF exposure level at compliance boundary of 0.03 m					
	S Field (W/m ²)		E Field (V/m)		H Field (A/m)	
	Result	Limit	Result	Limit	Result	Limit
EU	4.1213	10.0000	39.4171	61.0000	0.1046	0.1620
FCC*	0.4121	1.0000	N/A	N/A	N/A	N/A
IC	4.1213	5.3660	39.4171	44.9743	0.1046	0.1193
AUS	4.1213	10.0000	39.4171	61.4000	0.1046	0.1630

* Requirement and Result in mW/cm²

Table 7 – General Population Results

The calculations show that the EUT complies with the occupational exposure levels described in the EN 62311:2008, CFR 47 Pt1.1310, Health Canada Safety Code 6 and ARPANSA Radiation Protection Series No.3 at the point of investigation, 0.03 m.



1.4.4 Configuration 4 - Bluetooth Low Energy

Regional Requirement	Calculated RF exposure level at compliance boundary of 0.01 m					
	S Field (W/m ²)		E Field (V/m)		H Field (A/m)	
	Result	Limit	Result	Limit	Result	Limit
EU	7.2242	50.0000	52.1868	137.0000	0.1384	0.3630
FCC*	0.7224	5.0000	N/A	N/A	N/A	N/A
IC	7.2242	31.6361	52.1868	109.2114	0.1384	0.2897
AUS	7.2242	50.0000	52.1868	137.0000	0.1384	0.3640

* Requirement and Result in mW/cm²

Table 8 – Occupational Results

The calculations show that the EUT complies with the occupational exposure levels described in the EN 62311:2008, CFR 47 Pt1.1310, Health Canada Safety Code 6 and ARPANSA Radiation Protection Series No.3 at the point of investigation, 0.01 m.

Regional Requirement	Calculated RF exposure level at compliance boundary of 0.02 m					
	S Field (W/m ²)		E Field (V/m)		H Field (A/m)	
	Result	Limit	Result	Limit	Result	Limit
EU	1.8061	10.0000	26.0934	61.0000	0.0692	0.1620
FCC*	0.1806	1.0000	N/A	N/A	N/A	N/A
IC	1.8061	5.3508	26.0934	44.9105	0.0692	0.1191
AUS	1.8061	10.0000	26.0934	61.4000	0.0692	0.1630

* Requirement and Result in mW/cm²

Table 9 – General Population Results

The calculations show that the EUT complies with the occupational exposure levels described in the EN 62311:2008, CFR 47 Pt1.1310, Health Canada Safety Code 6 and ARPANSA Radiation Protection Series No.3 at the point of investigation, 0.02 m.



1.4.5 Configuration 5 - 2.4 GHz WLAN and Bluetooth Classic

The tables below show the summed fractional results from the antenna port summary in section 2.2. Where the result is less than one, the EUT is deemed compliant.

Regional Requirement	Calculated RF exposure level at compliance boundary of 0.03 m as a Fraction of the Limit		
	S Field	E Field	H Field
EU	0.1895	0.6156	0.6163
FCC	0.1895	N/A	N/A
IC	0.2991	0.7718	0.7718
AUS	0.1895	0.6156	0.6146

Table 10 – Occupational Results

The calculations show that the EUT complies with the occupational exposure levels described in the EN 62311:2008, CFR 47 Pt1.1310, Health Canada Safety Code 6 and ARPANSA Radiation Protection Series No.3 at the point of investigation, 0.03 m.

Regional Requirement	Calculated RF exposure level at compliance boundary of 0.06 m as a Fraction of the Limit		
	S Field	E Field	H Field
EU	0.2368	0.6913	0.6904
FCC	0.2368	N/A	N/A
IC	0.4419	0.9382	0.9381
AUS	0.2368	0.6868	0.6862

Table 11 – General Population Results

The calculations show that the EUT complies with the general population exposure levels described in the EN 62311:2008, CFR 47 Pt1.1310, Health Canada Safety Code 6 and ARPANSA Radiation Protection Series No.3 at the point of investigation, 0.06 m.



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1.4.6 Configuration 6 - 2.4 GHz WLAN and Bluetooth Low Energy

The tables below show the summed fractional results from the antenna port summary in section 2.2. Where the result is less than one, the EUT is deemed compliant.

Regional Requirement	Calculated RF exposure level at compliance boundary of 0.02 m as a Fraction of the Limit		
	S Field	E Field	H Field
EU	0.2770	0.6823	0.6830
FCC	0.2770	N/A	N/A
IC	0.4370	0.8553	0.8552
AUS	0.2770	0.6823	0.6812

Table 12 – Occupational Results

The calculations show that the EUT complies with the occupational exposure levels described in the EN 62311:2008, CFR 47 Pt1.1310, Health Canada Safety Code 6 and ARPANSA Radiation Protection Series No.3 at the point of investigation, 0.02 m.

Regional Requirement	Calculated RF exposure level at compliance boundary of 0.05 m as a Fraction of the Limit		
	S Field	E Field	H Field
EU	0.2216	0.6129	0.6122
FCC	0.2216	N/A	N/A
IC	0.4131	0.8317	0.8316
AUS	0.2216	0.6089	0.6084

Table 13 – General Population Results

The calculations show that the EUT complies with the general population exposure levels described in the EN 62311:2008, CFR 47 Pt1.1310, Health Canada Safety Code 6 and ARPANSA Radiation Protection Series No.3 at the point of investigation, 0.05 m.



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1.4.7 Configuration 7 – 5 GHz WLAN and Bluetooth Classic

The tables below show the summed fractional results from the antenna port summary in section 2.2. Where the result is less than one, the EUT is deemed compliant.

Regional Requirement	Calculated RF exposure level at compliance boundary of 0.03 m as a Fraction of the Limit		
	S Field	E Field	H Field
EU	0.1698	0.5840	0.5846
FCC	0.1698	N/A	N/A
IC	0.2244	0.6676	0.6676
AUS	0.1698	0.5840	0.5830

Table 14 – Occupational Results

The calculations show that the EUT complies with the occupational exposure levels described in the EN 62311:2008, CFR 47 Pt1.1310, Health Canada Safety Code 6 and ARPANSA Radiation Protection Series No.3 at the point of investigation, 0.03 m.

Regional Requirement	Calculated RF exposure level at compliance boundary of 0.05 m as a Fraction of the Limit		
	S Field	E Field	H Field
EU	0.3057	0.7870	0.7860
FCC	0.3057	N/A	N/A
IC	0.4512	0.9437	0.9436
AUS	0.3057	0.7818	0.7812

Table 15 – General Population Results

The calculations show that the EUT complies with the general population exposure levels described in the EN 62311:2008, CFR 47 Pt1.1310, Health Canada Safety Code 6 and ARPANSA Radiation Protection Series No.3 at the point of investigation, 0.05 m.



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1.4.8 Configuration 8 – 5 GHz WLAN and Bluetooth Low Energy

The tables below show the summed fractional results from the antenna port summary in section 2.2. Where the result is less than one, the EUT is deemed compliant.

Regional Requirement	Calculated RF exposure level at compliance boundary of 0.02 m as a Fraction of the Limit		
	S Field	E Field	H Field
EU	0.2328	0.6349	0.6356
FCC	0.2328	N/A	N/A
IC	0.2688	0.6990	0.6990
AUS	0.2328	0.6349	0.6338

Table 16 – Occupational Results

The calculations show that the EUT complies with the occupational exposure levels described in the EN 62311:2008, CFR 47 Pt1.1310, Health Canada Safety Code 6 and ARPANSA Radiation Protection Series No.3 at the point of investigation, 0.02 m.

Regional Requirement	Calculated RF exposure level at compliance boundary of 0.04 m as a Fraction of the Limit		
	S Field	E Field	H Field
EU	0.2910	0.7130	0.7121
FCC	0.2910	N/A	N/A
IC	0.3561	0.8118	0.8118
AUS	0.2910	0.7083	0.7077

Table 17 – General Population Results

The calculations show that the EUT complies with the general population exposure levels described in the EN 62311:2008, CFR 47 Pt1.1310, Health Canada Safety Code 6 and ARPANSA Radiation Protection Series No.3 at the point of investigation, 0.04 m.



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SECTION 2

TEST DETAILS



2.1 RATIONALE FOR ASSESSMENT OF THE RF EXPOSURE

The aim of the assessment report is to evaluate the compliance boundary for a set of given input power(s) according to the basic restrictions (directly or indirectly via compliance with reference levels) related to human exposure to radio frequency electromagnetic fields.

The chosen assessment method to establish the compliance boundary in the far-field region is the reference method as defined in the relevant specifications.

The RF exposure assessment is based upon the following criteria:

The ASD041517 Set Top Box (STB) Videophone operates with the following transmitters active on the antenna ports shown in Section 1.3.3. For each transmitter, the Radio Access Technology (RAT), EIRP inclusive of antenna gain and duty cycle, gain of the antenna and lowest frequency of operation are shown as they contribute to the calculation of S Field, E field and H field values according to the following formulas.

The power flux (S Field):

$$S = \frac{PG_{(\theta, \phi)}}{4\pi r^2}$$

The electric field strength (E Field):

$$E = \frac{\sqrt{30PG_{(\theta, \phi)}}}{r}$$

The magnetic field strength (H Field):

$$H = \frac{E}{\eta_0}$$

Where:

P = Average Power (W)

G = Antenna Gain (dBi)

r = Distance (cm) or (m)

$\eta_0 = 377$



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2.2 TEST RESULT DETAILS

The frequencies shown in the tables below have been chosen based on the lowest possible frequency that the EUT can transmit.

2.2.1 Configuration 1 - WLAN 2.4 GHz

Antenna Port	Tx No.	Ant No.	RAT	EIRP (W)	Duty Cycle (%)	Gain (dBi)	Frequency (MHz)	RF Exposure Level at compliance boundary of 0.02 m		
								S Field	E Field	H Field
1	1	1	WLAN 2.4GHz	0.061	100	1.8	2412	12.0429	67.3799	0.1787

Table 18 – Occupational Transmitter Summary

Antenna Port	Tx No.	Ant No.	RAT	EIRP (W)	Duty Cycle (%)	Gain (dBi)	Frequency (MHz)	RF Exposure Level at compliance boundary of 0.03 m		
								S Field	E Field	H Field
1	1	1	WLAN 2.4GHz	0.061	100	1.8	2412	5.3524	44.9200	0.1192

Table 19 – General Population Transmitter Summary



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2.2.2 Configuration 2 - WLAN 5 GHz

Antenna Port	Tx No.	Ant No.	RAT	EIRP (W)	Duty Cycle (%)	Gain (dBi)	Frequency (MHz)	RF Exposure Level at compliance boundary of 0.01 m		
								S Field	E Field	H Field
1	1	2	WLAN 5GHz	0.049	100	4.9	5180	39.3360	121.7757	0.3230

Table 20 – Occupational Transmitter Summary

Antenna Port	Tx No.	Ant No.	RAT	EIRP (W)	Duty Cycle (%)	Gain (dBi)	Frequency (MHz)	RF Exposure Level at compliance boundary of 0.03 m		
								S Field	E Field	H Field
1	1	2	WLAN 5GHz	0.049	100	4.9	5180	4.3707	40.5919	0.1077

Table 21 – General Population Transmitter Summary



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2.2.3 Configuration 3 - Bluetooth Classic

Antenna Port	Tx No.	Ant No.	RAT	EIRP (W)	Duty Cycle (%)	Gain (dBi)	Frequency (MHz)	RF Exposure Level at compliance boundary of 0.02 m		
								S Field	E Field	H Field
1	1	1	Bluetooth Classic	0.047	77	1.8	2412	9.2730	59.1257	0.1568

Table 22 – Occupational Transmitter Summary

Antenna Port	Tx No.	Ant No.	RAT	EIRP (W)	Duty Cycle (%)	Gain (dBi)	Frequency (MHz)	RF Exposure Level at compliance boundary of 0.03 m		
								S Field	E Field	H Field
1	1	1	Bluetooth Classic	0.047	77	1.8	2412	4.1213	39.4171	0.1046

Table 23 – General Population Transmitter Summary



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2.2.4 Configuration 4 - Bluetooth Low Energy

Antenna Port	Tx No.	Ant No.	RAT	EIRP (W)	Duty Cycle (%)	Gain (dBi)	Frequency (MHz)	RF Exposure Level at compliance boundary of 0.01 m		
								S Field	E Field	H Field
1	1	1	Bluetooth Low Energy	0.009	100	1.8	2402	7.2242	52.1868	0.1384

Table 24 – Occupational Transmitter Summary

Antenna Port	Tx No.	Ant No.	RAT	EIRP (W)	Duty Cycle (%)	Gain (dBi)	Frequency (MHz)	RF Exposure Level at compliance boundary of 0.02 m		
								S Field	E Field	H Field
1	1	1	Bluetooth Low Energy	0.009	100	1.8	2402	1.8061	26.0934	0.0692

Table 25 – General Population Transmitter Summary



2.2.5 Configuration 5 - 2.4 GHz WLAN and Bluetooth Classic

Antenna Port	Tx No.	Ant No.	RAT	EIRP (W)	Duty Cycle (%)	Gain (dBi)	Frequency (MHz)	RF Exposure Level at compliance boundary of 0.03 m		
								S Field	E Field	H Field
1	1	1	WLAN 2.4GHz	0.061	100	1.8	2412	5.3524	44.9200	0.1192
2	1	1	Bluetooth Classic	0.047	77	1.8	2402	4.1213	39.4171	0.1046

Table 26 – Occupational Transmitter Summary

Antenna Port	Tx No.	Ant No.	RAT	EIRP (W)	Duty Cycle (%)	Gain (dBi)	Frequency (MHz)	RF Exposure Level at compliance boundary of 0.06 m		
								S Field	E Field	H Field
1	1	1	WLAN 2.4GHz	0.061	100	1.8	2412	1.3381	22.4600	0.0596
2	1	1	Bluetooth Classic	0.047	77	1.8	2402	1.0303	19.7086	0.0523

Table 27 – General Population Transmitter Summary

The following tables show the regional requirements for the frequencies used in the RF exposure calculation. A full list of the requirements is shown in Annex A.

Frequency (MHz)	Occupational Limit			General Population Limit		
	S Field (W/m ²)	E Field (V/m)	H Field (A/m)	S Field (W/m ²)	E Field (V/m)	H Field (A/m)
2412	50.0000	137.0000	0.3630	10.0000	61.0000	0.1620
2402	50.0000	137.0000	0.3630	10.0000	61.0000	0.1620

Table 28 – EN 62311:2008 Limits

Frequency (MHz)	Occupational Limit			General Population Limit		
	S Field (mW/cm ²)	E Field (V/m)	H Field (A/m)	S Field (mW/cm ²)	E Field (V/m)	H Field (A/m)
2412	5.0000	-	-	1.0000	-	-
2402	5.0000	-	-	1.0000	-	-

Table 29 – CFR 47 Pt1.1310 Limits

Frequency (MHz)	Occupational Limit			General Population Limit		
	S Field (W/m ²)	E Field (V/m)	H Field (A/m)	S Field (W/m ²)	E Field (V/m)	H Field (A/m)
2412	31.7019	109.3249	0.2900	5.3660	44.9743	0.1193
2402	31.6361	109.2114	0.2897	5.3508	44.9105	0.1191

Table 30 – Health Canada Safety Code 6 Limits

Frequency (MHz)	Occupational Limit			General Population Limit		
	S Field (W/m ²)	E Field (V/m)	H Field (A/m)	S Field (W/m ²)	E Field (V/m)	H Field (A/m)
2412	50.0000	137.0000	0.3640	10.0000	61.4000	0.1630
2402	50.0000	137.0000	0.3640	10.0000	61.4000	0.1630

Table 31 – ARPANSA Radiation Protection Series No.3 Limits



2.2.6 Configuration 6 - 2.4 GHz WLAN and Bluetooth Low Energy

Antenna Port	Tx No.	Ant No.	RAT	EIRP (W)	Duty Cycle (%)	Gain (dBi)	Frequency (MHz)	RF Exposure Level at compliance boundary of 0.02 m		
								S Field	E Field	H Field
1	1	1	WLAN 2.4GHz	0.061	100	1.8	2412	12.0429	67.3799	0.1787
2	1	1	Bluetooth Low Energy	0.009	100	1.8	2402	1.8061	26.0934	0.0692

Table 32 – Occupational Transmitter Summary

Antenna Port	Tx No.	Ant No.	RAT	EIRP (W)	Duty Cycle (%)	Gain (dBi)	Frequency (MHz)	RF Exposure Level at compliance boundary of 0.05 m		
								S Field	E Field	H Field
1	1	1	WLAN 2.4GHz	0.061	100	1.8	2412	1.9269	26.9520	0.0715
2	1	1	Bluetooth Low Energy	0.009	100	1.8	2402	0.2890	10.4374	0.0277

Table 33 – General Population Transmitter Summary

The following tables show the regional requirements for the frequencies used in the RF exposure calculation. A full list of the requirements is shown in Annex A.

Frequency (MHz)	Occupational Limit			General Population Limit		
	S Field (W/m ²)	E Field (V/m)	H Field (A/m)	S Field (W/m ²)	E Field (V/m)	H Field (A/m)
2412	50.0000	137.0000	0.3630	10.0000	61.0000	0.1620
2402	50.0000	137.0000	0.3630	10.0000	61.0000	0.1620

Table 34 – EN 62311:2008 Limits

Frequency (MHz)	Occupational Limit			General Population Limit		
	S Field (mW/cm ²)	E Field (V/m)	H Field (A/m)	S Field (mW/cm ²)	E Field (V/m)	H Field (A/m)
2412	5.0000	-	-	1.0000	-	-
2402	5.0000	-	-	1.0000	-	-

Table 35 – CFR 47 Pt1.1310 Limits

Frequency (MHz)	Occupational Limit			General Population Limit		
	S Field (W/m ²)	E Field (V/m)	H Field (A/m)	S Field (W/m ²)	E Field (V/m)	H Field (A/m)
2412	31.7019	109.3249	0.2900	5.3660	44.9743	0.1193
2402	31.6361	109.2114	0.2897	5.3508	44.9105	0.1191

Table 36 – Health Canada Safety Code 6 Limits

Frequency (MHz)	Occupational Limit			General Population Limit		
	S Field (W/m ²)	E Field (V/m)	H Field (A/m)	S Field (W/m ²)	E Field (V/m)	H Field (A/m)
2412	50.0000	137.0000	0.3640	10.0000	61.4000	0.1630
2402	50.0000	137.0000	0.3640	10.0000	61.4000	0.1630

Table 37 – ARPANSA Radiation Protection Series No.3 Limits



2.2.7 Configuration 7 – 5 GHz WLAN and Bluetooth Classic

Antenna Port	Tx No.	Ant No.	RAT	EIRP (W)	Duty Cycle (%)	Gain (dBi)	Frequency (MHz)	RF Exposure Level at compliance boundary of 0.03 m		
								S Field	E Field	H Field
1	1	2	WLAN 5GHz	0.049	100	4.9	5180	4.3707	40.5919	0.1077
2	1	1	Bluetooth Classic	0.047	77	1.8	2402	4.1213	39.4171	0.1046

Table 38 – Occupational Transmitter Summary

Antenna Port	Tx No.	Ant No.	RAT	EIRP (W)	Duty Cycle (%)	Gain (dBi)	Frequency (MHz)	RF Exposure Level at compliance boundary of 0.05 m		
								S Field	E Field	H Field
1	1	2	WLAN 5GHz	0.049	100	4.9	5180	1.5734	24.3551	0.0646
2	1	1	Bluetooth Classic	0.047	77	1.8	2402	1.4837	23.6503	0.0627

Table 39 – General Population Transmitter Summary

The following tables show the regional requirements for the frequencies used in the RF exposure calculation. A full list of the requirements is shown in Annex A.

Frequency (MHz)	Occupational Limit			General Population Limit		
	S Field (W/m ²)	E Field (V/m)	H Field (A/m)	S Field (W/m ²)	E Field (V/m)	H Field (A/m)
5180	50.0000	137.0000	0.3630	10.0000	61.0000	0.1620
2402	50.0000	137.0000	0.3630	10.0000	61.0000	0.1620

Table 40 – EN 62311:2008 Limits

Frequency (MHz)	Occupational Limit			General Population Limit		
	S Field (mW/cm ²)	E Field (V/m)	H Field (A/m)	S Field (mW/cm ²)	E Field (V/m)	H Field (A/m)
5180	5.0000	-	-	1.0000	-	-
2402	5.0000	-	-	1.0000	-	-

Table 41 – CFR 47 Pt1.1310 Limits

Frequency (MHz)	Occupational Limit			General Population Limit		
	S Field (W/m ²)	E Field (V/m)	H Field (A/m)	S Field (W/m ²)	E Field (V/m)	H Field (A/m)
5180	46.4581	132.3448	0.3511	9.0471	58.3973	0.1549
2402	31.6361	109.2114	0.2897	5.3508	44.9105	0.1191

Table 42 – Health Canada Safety Code 6 Limits

Frequency (MHz)	Occupational Limit			General Population Limit		
	S Field (W/m ²)	E Field (V/m)	H Field (A/m)	S Field (W/m ²)	E Field (V/m)	H Field (A/m)
5180	50.0000	137.0000	0.3640	10.0000	61.4000	0.1630
2402	50.0000	137.0000	0.3640	10.0000	61.4000	0.1630

Table 43 – ARPANSA Radiation Protection Series No.3 Limits



2.2.8 Configuration 8 – 5 GHz WLAN and Bluetooth Low Energy

Antenna Port	Tx No.	Ant No.	RAT	EIRP (W)	Duty Cycle (%)	Gain (dBi)	Frequency (MHz)	RF Exposure Level at compliance boundary of 0.02 m		
								S Field	E Field	H Field
1	1	2	WLAN 5GHz	0.049	100	4.9	5180	9.8340	60.8879	0.1615
2	1	1	Bluetooth Low Energy	0.009	100	1.8	2402	1.8061	26.0934	0.0692

Table 44 – Occupational Transmitter Summary

Antenna Port	Tx No.	Ant No.	RAT	EIRP (W)	Duty Cycle (%)	Gain (dBi)	Frequency (MHz)	RF Exposure Level at compliance boundary of 0.04 m		
								S Field	E Field	H Field
1	1	2	WLAN 5GHz	0.049	100	4.9	5180	2.4585	30.4439	0.0808
2	1	1	Bluetooth Low Energy	0.009	100	1.8	2402	0.4515	13.0467	0.0346

Table 45 – General Population Transmitter Summary

The following tables show the regional requirements for the frequencies used in the RF exposure calculation. A full list of the requirements is shown in Annex A.

Frequency (MHz)	Occupational Limit			General Population Limit		
	S Field (W/m ²)	E Field (V/m)	H Field (A/m)	S Field (W/m ²)	E Field (V/m)	H Field (A/m)
5180	50.0000	137.0000	0.3630	10.0000	61.0000	0.1620
2402	50.0000	137.0000	0.3630	10.0000	61.0000	0.1620

Table 46 – EN 62311:2008 Limits

Frequency (MHz)	Occupational Limit			General Population Limit		
	S Field (mW/cm ²)	E Field (V/m)	H Field (A/m)	S Field (mW/cm ²)	E Field (V/m)	H Field (A/m)
5180	5.0000	-	-	1.0000	-	-
2402	5.0000	-	-	1.0000	-	-

Table 47 – CFR 47 Pt1.1310 Limits

Frequency (MHz)	Occupational Limit			General Population Limit		
	S Field (W/m ²)	E Field (V/m)	H Field (A/m)	S Field (W/m ²)	E Field (V/m)	H Field (A/m)
5180	46.4581	132.3448	0.3511	9.0471	58.3973	0.1549
2402	31.6361	109.2114	0.2897	5.3508	44.9105	0.1191

Table 48 – Health Canada Safety Code 6 Limits

Frequency (MHz)	Occupational Limit			General Population Limit		
	S Field (W/m ²)	E Field (V/m)	H Field (A/m)	S Field (W/m ²)	E Field (V/m)	H Field (A/m)
5180	50.0000	137.0000	0.3640	10.0000	61.4000	0.1630
2402	50.0000	137.0000	0.3640	10.0000	61.4000	0.1630

Table 49 – ARPANSA Radiation Protection Series No.3 Limits



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2.2.9 Configuration 5 - 2.4 GHz WLAN and Bluetooth Classic

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 calculated RF exposure fields are divided by the limit to get a fractional exposure value. Any values less than one are compliant with the limit. Table 2 shows a summary of each antenna port and the summation of the fractional RF exposure results of each transmitter.

Antenna Port	EIRP (W)	Regional Requirement	Calculated RF exposure level at compliance boundary of 0.03 m as a Fraction of the Limit		
			S Field	E Field	H Field
1	0.061	EU	0.1070	0.3279	0.3282
		FCC	0.1070	N/A	N/A
		IC	0.1688	0.4109	0.4109
		AUS	0.1070	0.3279	0.3273
2	0.047	EU	0.0824	0.2877	0.2880
		FCC	0.0824	N/A	N/A
		IC	0.1303	0.3609	0.3609
		AUS	0.0824	0.2877	0.2872

Table 50 – Occupational Antenna Port Summary

Antenna Port	EIRP (W)	Regional Requirement	Calculated RF exposure level at compliance boundary of 0.06 m as a Fraction of the Limit		
			S Field	E Field	H Field
1	0.061	EU	0.1338	0.3682	0.3678
		FCC	0.1338	N/A	N/A
		IC	0.2494	0.4994	0.4993
		AUS	0.1338	0.3658	0.3655
2	0.047	EU	0.1030	0.3231	0.3227
		FCC	0.1030	N/A	N/A
		IC	0.1926	0.4388	0.4388
		AUS	0.1030	0.3210	0.3207

Table 51 – General Population Antenna Port Summary



2.2.10 Configuration 6 - 2.4 GHz WLAN and Bluetooth Low Energy

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 calculated RF exposure fields are divided by the limit to get a fractional exposure value. Any values less than one are compliant with the limit. Table 2 shows a summary of each antenna port and the summation of the fractional RF exposure results of each transmitter.

Antenna Port	EIRP (W)	Regional Requirement	Calculated RF exposure level at compliance boundary of 0.02 m as a Fraction of the Limit		
			S Field	E Field	H Field
1	0.061	EU	0.2409	0.4918	0.4924
		FCC	0.2409	N/A	N/A
		IC	0.3799	0.6163	0.6163
		AUS	0.2409	0.4918	0.4910
2	0.009	EU	0.0361	0.1905	0.1907
		FCC	0.0361	N/A	N/A
		IC	0.0571	0.2389	0.2389
		AUS	0.0361	0.1905	0.1901

Table 52 – Occupational Antenna Port Summary

Antenna Port	EIRP (W)	Regional Requirement	Calculated RF exposure level at compliance boundary of 0.05 m as a Fraction of the Limit		
			S Field	E Field	H Field
1	0.061	EU	0.1927	0.4418	0.4413
		FCC	0.1927	N/A	N/A
		IC	0.3591	0.5993	0.5992
		AUS	0.1927	0.4390	0.4386
2	0.009	EU	0.0289	0.1711	0.1709
		FCC	0.0289	N/A	N/A
		IC	0.0540	0.2324	0.2324
		AUS	0.0289	0.1700	0.1698

Table 53 – General Population Antenna Port Summary



2.2.11 Configuration 7 – 5 GHz WLAN and Bluetooth Classic

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 calculated RF exposure fields are divided by the limit to get a fractional exposure value. Any values less than one are compliant with the limit. Table 2 shows a summary of each antenna port and the summation of the fractional RF exposure results of each transmitter.

Antenna Port	EIRP (W)	Regional Requirement	Calculated RF exposure level at compliance boundary of 0.03 m as a Fraction of the Limit		
			S Field	E Field	H Field
1	0.049	EU	0.0874	0.2963	0.2966
		FCC	0.0874	N/A	N/A
		IC	0.0941	0.3067	0.3067
		AUS	0.0874	0.2963	0.2958
2	0.047	EU	0.0824	0.2877	0.2880
		FCC	0.0824	N/A	N/A
		IC	0.1303	0.3609	0.3609
		AUS	0.0824	0.2877	0.2872

Table 54 – Occupational Antenna Port Summary

Antenna Port	EIRP (W)	Regional Requirement	Calculated RF exposure level at compliance boundary of 0.05 m as a Fraction of the Limit		
			S Field	E Field	H Field
1	0.049	EU	0.1573	0.3993	0.3988
		FCC	0.1573	N/A	N/A
		IC	0.1739	0.4171	0.4170
		AUS	0.1573	0.3967	0.3963
2	0.047	EU	0.1484	0.3877	0.3872
		FCC	0.1484	N/A	N/A
		IC	0.2773	0.5266	0.5266
		AUS	0.1484	0.3852	0.3849

Table 55 – General Population Antenna Port Summary



2.2.12 Configuration 8 – 5 GHz WLAN and Bluetooth Low Energy

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 calculated RF exposure fields are divided by the limit to get a fractional exposure value. Any values less than one are compliant with the limit. Table 2 shows a summary of each antenna port and the summation of the fractional RF exposure results of each transmitter.

Antenna Port	EIRP (W)	Regional Requirement	Calculated RF exposure level at compliance boundary of 0.02 m as a Fraction of the Limit		
			S Field	E Field	H Field
1	0.049	EU	0.1967	0.4444	0.4449
		FCC	0.1967	N/A	N/A
		IC	0.2117	0.4601	0.4601
		AUS	0.1967	0.4444	0.4437
2	0.009	EU	0.0361	0.1905	0.1907
		FCC	0.0361	N/A	N/A
		IC	0.0571	0.2389	0.2389
		AUS	0.0361	0.1905	0.1901

Table 56 – Occupational Antenna Port Summary

Antenna Port	EIRP (W)	Regional Requirement	Calculated RF exposure level at compliance boundary of 0.04 m as a Fraction of the Limit		
			S Field	E Field	H Field
1	0.049	EU	0.2458	0.4991	0.4985
		FCC	0.2458	N/A	N/A
		IC	0.2717	0.5213	0.5213
		AUS	0.2458	0.4958	0.4954
2	0.009	EU	0.0452	0.2139	0.2136
		FCC	0.0452	N/A	N/A
		IC	0.0844	0.2905	0.2905
		AUS	0.0452	0.2125	0.2123

Table 57 – General Population Antenna Port Summary



Product Service

SECTION 3

DISCLAIMERS AND COPYRIGHT



Product Service

3.1 DISCLAIMERS AND COPYRIGHT

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ANNEX A

REGIONAL REQUIREMENTS



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Frequency Range (MHz)	Power Density (W/m ²)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)
0.065 - 1	-	610/f	1.6/f
1 - 10	-	610/f	1.6/f
10 - 400	10	61	0.162
400 - 2000	f/40	3*f ^{0.5}	0.00796*f ^{0.5}
2000 - 300000	50	137	0.363

Table A.1 – EN 62311:2008 Occupational Limits

Frequency Range (MHz)	Power Density (W/m ²)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)
0.003 - 0.15	-	87	5
0.15 - 1	-	87/f	0.73/f
1 - 10	-	87/f ^{0.5}	0.73/f
10 - 400	2	27	0.071
400 - 2000	f/200	1.375*f ^{0.5}	0.00364*f ^{0.5}
2000 - 300000	10	61	0.162

Table A.2 – EN 62311:2008 General Population Limits

Frequency Range (MHz)	S Field (mW/cm ²)	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.3 – CFR 47 Pt1.1310 Occupational Limits

Frequency Range (MHz)	S Field (mW/cm ²)	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.4 – CFR 47 Pt1.1310 General Population Limits

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.5 – Health Canada Safety Code 6 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.6 – Health Canada Safety Code 6 General Population Limits

Frequency Range (MHz)	Power Density (W/m ²)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)
0.1 - 1	-	614	1.63/f



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1 - 10	$1000/f^2$	614	$1.63/f$
10 - 400	10	61.4	0.163
400 - 2000	$f/40$	$3.07*f^{0.5}$	$0.00814*f^{0.5}$
2000 - 300000	50	137	0.364

Table A.7 – ARPANSA Radiation Protection Series No.3 Occupational Limits

Frequency Range (MHz)	Power Density (W/m^2)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)
0.1 - 0.15	-	86.8	4.86
0.15 - 1	-	86.8	$0.729/f$
1 - 10	-	$86.8/f^{0.5}$	$0.729/f$
10 - 400	2	27.4	0.0729
400 - 2000	$f/200$	$1.37*f^{0.5}$	$0.00364*f^{0.5}$
2000 - 300000	10	61.4	0.163

Table A.8 – ARPANSA Radiation Protection Series No.3 General Population Limits