RADIO FREQUENCY EXPOSURE REPORT

FOR THE

Device: Industrial Booster
Model: Force 5 Industrial 2.0

Report No.: 99971-4

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The test data contained in this report documents the observed testing parameters pertaining to and are relevant for only the sample equipment tested in the agreed upon operational mode(s) and configuration(s) as identified herein. Compliance assessment remains the client's responsibility. This report may not be used to claim product endorsement by A2LA or any government agencies. This test report has been authorized for release under quality control from CKC Laboratories, Inc.

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Purpose:

To demonstrate compliance with United States, Canada and/or European Union RF Exposure requirements for Portable equipment (devices used ≤20cm from the body) or Mobile equipment (devices used >20cm from the body) with power output below exemption levels and Mobile equipment, where Maximum Permissible Exposure (MPE) Calculations apply.

Device and Antenna Operating Configuration:

Booster Portion

Device operating at maximum output power with continuous transmission of modulated data,

Worst case

Outside configuration (Uplink):

Outside antenna gain (OAG) model number *SC-230W*: 10dBi

Cable (30') loss model number *SC- 400-30NN*: -2.05dB

Wifi Portion

The EUT is in continuous transmit mode.

The EUT is setup in typical mounting configuration.

Test Procedure:

Booster Portion

This equipment is evaluated in accordance with the guidelines set forth in OET Guide 65 & ANSI C95.1 for the US, Health Canada Safety Code 6 & RSS 102 for Canada and EN 62479 or EN 62311 for EU.

Other Considerations:

Report considers stand-alone configurations only.

Referenced Test Reports:

The following test reports were referenced in conjunction with this assessment:
96950-14, 96950-15 and 96950-16

RF Exposure Assessment

Applicability:

Limit Used	☒	General Population / Uncontrolled Exposure
	☐	Occupational / Controlled Exposure

Equipment operational details:

Config #	***Operating Frequency (MHz)***	***Measured Output Power (dBm)***	***Antenna Gain (dBi)- Cable Loss (dB)***	***Antenna Type / Configuration***	***EIRP (dBm)***
1 (Uplink)	707MHz	20.7	10, -2.05	Directional / Outside	28.65

MPE Calculation:

$$Power\ Density\ (S) = \frac{EIRP}{4\pi\ d^2}$$ Given: **EIRP** in *mW* or W and **d** in *cm or m*

US MPE Assessment

Power Reported is:	☐ Peak ☐ Average						
Limit Used is:	☐ General Population ☐ Occupational Exposure						
Operating Band MHz	**Power dBm**	**Ant Type/Gain dBi + cable loss**	**EIRP dBm**	**Distance cm**	**MPE mW/cm²**	**Limit mW/cm²**	**Comments**
698-716MHz	20.7	+10, -2.05	28.65	20	0.146	0.4713	Pass

Summary

Exemptions:
In the case the equipment meets compliance requirements by exemption the product is approved for stand-alone use under mobile or portable conditions without further evaluation. Exemption requires any additional collocation or simultaneous transmission requirements (including necessary separation distances) have been met according to the intended use of the equipment.

MPE Calculation Results:
In the case the equipment meets compliance by MPE Calculations the product is approved for use under mobile conditions without further testing under the condition that any additional collocation or simultaneous transmission requirements (including necessary separation distances) have been met. It is assumed that the manufacturer shall design the equipment such that the minimum separation distance of 20cm (or greater, as listed above) is met or that the manufacturer provides a protection guide (or installation instructions) to the end user such that the antenna(s) may be installed in accordance with the manufacturer's instructions in such a manor to maintain the minimum separation distance.

General Comments:
The Absorption and distribution of Electromagnetic energy in the body is a very complex phenomena that depends on the mass, shape and physiological condition of the body; the orientation of the body with respect to the fields; and, the electrical properties of the body and the environment. Variables that may play a substantial role in possible biological effects are those that characterize the environment (including but not limited to: ambient temperature, air velocity, relative humidity and body insulation); and those that characterize the individual (including but not limited to: age, gender, activity level and existing debilitation or disease). Because innumerable factors may interact to determine specific biological effects of exposure to electromagnetic fields, any protection guide should consider both intended and unintended operational environments and provide guidance for installation and use of the product such that proper separation distances can be maintained. (ANSI C95.1)

RF Exposure Limits

United States Compliance Requirements (1.1310):

RF Exposure Evaluation Limits
Occupational / Controlled Exposure

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm^2)	Averaging Time (minutes)
0.3-3.0	614	1.63	*(100)	6
3.0-30	1842/f	4.89/f	*(900/f^2)	6
30-300	61.4	0.163	1	6
300-1500	---	---	f/300	6
1500-100,000	---	---	5.0	6

RF Exposure Evaluation Limits
General Population / Uncontrolled Exposure

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm^2)	Averaging Time (minutes)
0.3-1.34	614	1.63	*(100)	30
1.34-30	824/f	2.19/f	*(180/f^2)	30
30-300	27.5	0.073	0.2	30
300-1500	---	---	f/1500	30
1500-100,000	---	---	1.0	30

** Plane wave equivalent power density*
Limit is calculated based on the mid-band frequency used in the operating frequency range.

Stand-Alone Evaluation Exemption Levels:
In accordance with KDB 447498 D01 v05r02

	Max Output Power at Exemption Limit (mW)	
Frequency (MHz)	***d ≤ 50mm***	***50mm < d ≤ 20cm***
<100	$\frac{1}{2}\cdot\left(\frac{R\cdot 50}{\sqrt{0.1}}\right)\cdot\left(1+LOG\left(\frac{100}{f_{MHz}}\right)\right)$	$\left(\frac{R\cdot 50}{\sqrt{0.1}}+(d-50)\frac{100}{150}\right)\cdot\left(1+LOG\left(\frac{100}{f_{MHz}}\right)\right)$
100-1500	$\left(\frac{R\cdot d}{\sqrt{f_{GHz}}}\right)$	$\left(\frac{R\cdot 50}{\sqrt{f_{GHz}}}+(d-50)\frac{f_{MHz}}{150}\right)$
1500-6000		$\left(\frac{R\cdot 50}{\sqrt{f_{GHz}}}+(d-50)\cdot 10\right)$

R is the allowed ratio: 3 for 1-g SAR and 7.5 for 10-g extremity SAR.
d is distance in mm, rounded to the nearest mm.

Canadian Compliance Requirements (RSS-102):

RF Exposure Evaluation Limits
Occupational / Controlled Exposure

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (W/m^2)	Averaging Time (minutes)
0.003-10	170	180	--	Instantaneous
0.1-10	--	1.6 / f	--	6
1.29-10	$193 / f^{0.5}$	--	--	6
10-20	61.4	0.163	10	6
20-48	$129.8 / f^{0.5}$	$0.3444 / f^{0.25}$	$44.72 / f^{0.5}$	6
48-100	49.33	0.1309	6.455	6
100-6000	$15.60\ f^{0.25}$	$0.04138\ f^{0.25}$	$0.6455\ f^{0.5}$	6
6000-15000	137	0.364	50	6
15000-150,000	137	0.364	50	$616000/ f^{1.2}$
150,000-300,000	$0.354\ f^{0.5}$	$9.40x10^{-4}\ f^{0.5}$	$3.33x10^{-4}\ f$	$616000/ f^{1.2}$

RF Exposure Evaluation Limits
General Population / Uncontrolled Exposure

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (W/m^2)	Averaging Time (minutes)
0.003-10	83	90	--	Instantaneous
0.1-10	--	0.73 / f	--	6
1.1-10	$87 / f^{0.5}$	--	--	6
10-20	27.46	0.0728	2	6
20-48	$58.07 / f^{0.25}$	$0.1540 / f^{0.25}$	$8.944 / f^{0.5}$	6
48-300	22.06	0.05852	1.291	6
300-6000	$3.142\ f^{0.3417}$	$0.008335\ f^{0.3417}$	$0.02619\ f^{0.6834}$	6
6000-15000	61.4	0.163	10	6
15000-150,000	61.4	0.163	10	$616000/ f^{1.2}$
150,000-300,000	$0.158\ f^{0.5}$	$4.21x10^{-4}\ f^{0.5}$	$6.67x10^{-5}\ f$	$616000/ f^{1.2}$

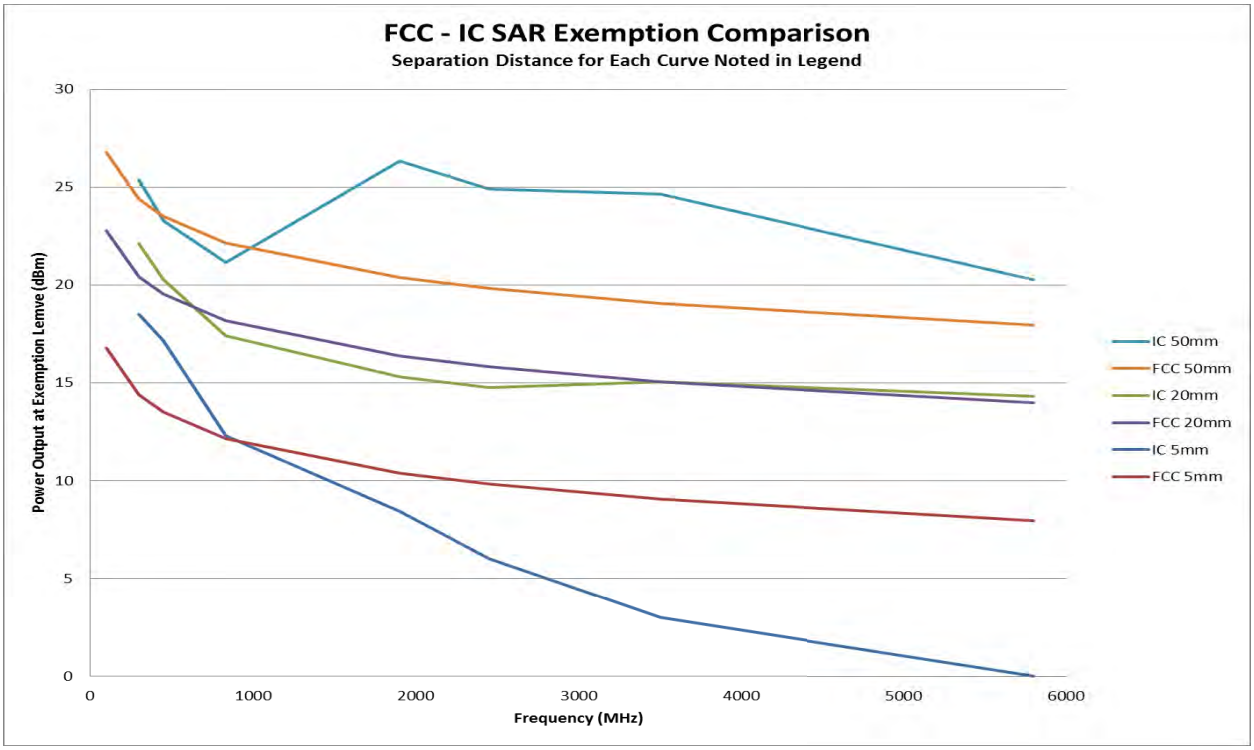
Stand-Alone Evaluation Exemption Levels:

	Exemption Limits (mW) at Separation Distance (mm)									
Freq(MHz)	**≤5**	**10**	**15**	**20**	**25**	**30**	**35**	**40**	**45**	**≥50**
≤300	71	101	132	162	193	223	254	284	315	345
450	52	70	88	106	123	141	159	177	195	213
835	17	30	42	55	67	80	92	105	117	130
1900	7	10	18	34	60	99	153	225	316	431
2450	4	7	15	30	52	83	123	173	235	309
3500	2	6	16	32	55	86	124	170	225	290
5800	1	6	15	27	41	56	71	85	97	106

Stand-alone RF Exposure Exemption Levels:

Frequency (MHz)	RF Exposure Exemption Limit (mW)
<20	1000
20-48	$22480 / f^{0.5}$
48-300	600
300-6000	$1310\ f^{0.6834}$
≥6000	5000

General[1] Comparison of FCC and IC Exemption Limits



[1] Non-Exhaustive

European Union Compliance Requirements (ICNIRP):

RF Exposure Evaluation Limits
Occupational / Controlled Exposure

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (W/m^2)	Averaging Time (minutes)
0.00082-0.065	610	24.4	---	6
0.065-1.0	610	1.6/f	---	
1.0-10	610/f	1.6/f	---	6
10-400	61	0.16	10	6
400-2000	$3.0 * f^{0.5}$	$0.008 * f^{0.5}$	f/40	6
2000-300,000	137	0.36	50	6

RF Exposure Evaluation Limits
General Population / Uncontrolled Exposure

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (W/m^2)	Averaging Time (minutes)
0.003-0.150	87	5.0	---	6
0.150-1.0	87	0.73/f	--	6
1.0-10	$87/f^{0.5}$	0.73/f	---	6
10-400	28	0.073	2	6
400-2000	$1.375\ f^{0.5}$	$0.0037*f^{0.5}$	f/200	6
2000-300,000	61	0.16	10	6

**Power density limit applicable >100MHz*

Stand-Alone Low Power Exemption Level: [2]

Head / Body: 20mW
Extremity: 40mW

[2] EN 62479 Annex A, General Public

References

Federal Communications Commission Knowledge Database (KDB) Publication 447498, "What are the RF exposure requirements and procedures for mobile and portable devices?" As in effect on the issue date of this report.

Federal Communications Commission Bulletin OET 65 Supplement C, "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields" June 2001

Title 47 Code of Federal Regulations, Part 1.1310, "Radiofrequency radiation exposure limits." As in effect on the issue date of this report.

Title 47 Code of Federal Regulations, Part 2.1091, "Radiofrequency radiation exposure evaluation: mobile devices." As in effect on the issue date of this report.

Health Canada Safety Code 6 Limits of Human Exposure to Radiofrequency Electromagnetic Energy in the Frequency Range from 3 kHz to 300 GHz, 2015

Health Canada Safety Code 6 Technical Guide, 2009

Industry Canada RSS-102 Radio Frequency (RF) Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands) Issue 5, March 2015

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European Committee for Electrotechnical Standardization. European Normative, EN 62311 Assessment of electronic and electrical equipment related to human exposure restrictions for electromagnetic fields (0 Hz to 300 GHz) 2008

European Committee for Electrotechnical Standardization. European Normative, EN 62479 Assessment of the compliance of low power electronic and electrical equipment with the basic restrictions related to human exposure to electromagnetic fields (10 MHz to 300 GHz) 2010..