EMC TEST REPORT

NVLAP Lab Code 200033-0

Standard(s):

47 CFR FCC Part 15.225, RSS 210, Issue 9, 2016, ICES 003, Issue 6, 2016

FCC ID:DGFPSDTR602CX1 IC:458A-PSDTR602CX1

Product: 3M[™] Versaflo[™] Powered Air Respirator Model(s): TR-600-CX

> Company Name: 3M Company

Address: 3M Center, Building 235 St. Paul, MN 55144-1000

Report Number: RE1908179-2 Report Issue Date: March 17, 2020

Report Prepared by:

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1.0 Test Summary

Based on the results of our investigation, we have concluded the product tested **comply** with the requirements of the standard(s) indicated. The results obtained in this test report pertain only to the item(s) tested.

	Test Description	Requirement – Test	Result	Comments
4.1	Part 15.207/ RSS-Gen	Conducted Emissions	N/A	
4.2	Part 15.225(d)/ RSS-210 A2.6(d)	Radiated Emissions outside of the specified band	pass	
4.3	Part 2.1049/RSS-Gen	Occupied Bandwidth	pass	
4.4	Part 15.225(a)(b)(c)/ RSS210 A2.6	In Band Radiated Spurious Emissions	pass	
4.5	15.225(e)/RSS210	Frequency Stability	pass	
4.6	2/1093/RSS102	RF Exposure Evaluation	pass	

Note:

Device is battery operated.

1.1 Measurement Uncertainty

The measured value related to the corresponding limit will be used to decide whether the equipment meets the requirements. The measurement uncertainty figures were calculated and correspond to a coverage factor of k=2, providing a confidence level of respectively 95.45 % in the case where the distributions characterizing the actual measurement uncertainties are normal (Gaussian).

Radiated emissions 30MHz to 1000MHz	4.9 dB
Radiated emissions 1GHz to 18GHz	4.6 dB
Conducted emissions 150KHz to 30MHz (AMN)	2.7 dB
Conducted emissions 150KHz to 30MHz (AAN)	1.92 dB



2.0 Equipment Description

2.1	Equipment Under Test				
Description:		Powered Air Purifying Respirator for use in rugged environments such as industrial, demolition, grinding, metal finishing and casting operations.			
Model(s):		TR-600-CX			
	Serial number:	3M TPB-999			
	Contact:	Keith Lyksett			
	Phone:	+16517362009			
	3M Division:	Personal Safety			
Modi	fications and Special Measures:	N/A			
	Frequency Range:	13.56MHz NFC		2402-2480MHz BL	E
Channel No.:		1			
Modulation Type:		ASK			
Maximum Output Power:		N/A			
Antenna Type:		Internal PCB Loop Antenna			
EUT	Highest Internal Frequency (Fx):	<10MHz			
	Test Deviations or Exclusions	Yes	🛛 No		
		Voltage:	120VAC	230VAC	⊠ 11.1VDC
	Poted Power	Phase:	🗌 1ph	🗌 3ph	Battery
	Raleu Power.	Frequency:	🗌 50Hz	🗌 60Hz	
		Current:			
Test Dates:		02/18-02/22/2019			
	Received Date:	02/13/2019			
	Received Conditioner	Poor] Poor 🛛 Good		
	Received Conditions:	Prototype	otype Production		



3.0 EUT Configuration

3.1 System Configuration

No.	Product Type	Manufacturer	Model	Comments
1	Blower Assembly	3M	TR-600CX	
2	Li-Ion battery	ЗМ	TR-632	Support Equipment
3	Battery Charger	3M	TR-640	Support Equipment

3.2 Input/Output Ports of EUT

No.	Description	Туре	Comments
1			
2			

3.3 Cables

No.	Description	Туре	Length	Shielding	Comments
1					
2					

3.4 Measurement Arrangements of EUT

	Intended Operational Arrangement(s)	Comments
\boxtimes	Table-top only	
	Floor-standing only	
	Floor-standing or table-top	
	Other	

3.5 Primary function(s) of EUT

No.	List of Essential Functions
1	Near-field communication (NFC) for RFID tag reading from the filter
2	Transferring of various environmental and functional data via Bluetooth radio using 3M Active Safety Messaging Protocol.

3.6 Exercising of EUT and Interfaces

No.	Mode of Operation
1	Continues transmission of modulated signal at 13.56MHz
2	BLE transmitting at low channels of operation with CW carrier



4.0 Test Conditions and Results

4.1	Conducte	Conducted Emissions Data					
The AMN was placed 0.8 m from the b was between the closest points of the 0.8 m from the AMN. All power was of measurements on mains lines were m			boundary of the unit under test AMN and the EUT. All other u connected to the system throu hade at the output of the AMN.	and bonded to a units of the EUT gh Artificial Mair	a ground reference plane. This distance and associated equipment was at least ns Network (AMN). Conducted voltage		
	All power w connected were made Capacitive	All power was connected to the system through Artificial Mains Network (AMN). All tested telecommunications lines were connected to an Asymmetric Artificial Network (AAN) and conducted voltage measurements on telecommunications lines were made at the output of the ISN. Where an AAN was not appropriate or available measurements were made using a Capacitive Voltage Probe.					
			Laboratory Ambient	Temperature:			
	Test Verifi	ication:	Rela	tive Humidity:			
			Atmosphe	eric Pressure:			
Reference Standard(s):		 FCC 15.207/RSS Gen ANSI C63.4:2014 ANSI C63.10:2013 		Measurement Point Mains Telecommunication ports			
Nominal Voltage:		120VAC 230VAC]				
Test Personnel:				Date:			
			Limits - Class A – AC Ma	iins			
Froquory			Limit dB (µV)				
Frequein	Sy (1011 12)	Quasi-Peak	Average	Result	Comments		
0.15 te	o 0.50	79	66	N/A	AMN		
0.50 to 30 73		60	N/A	AMN			
Limits - Class B – AC Mains							
0.15 to	o 0.50	66 to 56	56 to 46	N/A	AMN		
0.50	to 5	56	46	N/A	AMN		
5 to	30	60	50	N/A	AMN		

Modifications:	
Note:	



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4.2	Radiated Emissions Data						
Method:	ethod: Measurements were made in a 3-meter semi-anechoic chamber that complies to CISPR 16 above 30MHz or either outside or in the chamber below 30MHz. The EUT was rotated 360° about its azimuth with the receive antenna located at various heights in horizontal and vertical polarities. Final measurements (quasi-peak) were then performed by rotating the EUT 360° and adjusting the receive antenna height from 1 to 4 m. All frequencies were investigated in both horizontal and vertical antenna polarity, where applicable. Magnetic field measurements were made in the frequency range of 9 kHz to 30 MHz using a calibrated loop antenna, positioned with its plane vertical at the specified distance from the EUT and rotated about its vertical axis for maximum response at each azimuth about the EUT. The center of the loop was 1 m above the ground.						
		Laboratory	Ambient Tempera	ature:		21°C	
Test	Verification: 🛛		Relative Hum	nidity:		18%	
			Atmospheric Pres	sure:		836.8 mba	Irs
		ANSI C63.4:20	014		Me	easurement D	Distance
	Reference Standard(s):	⊠ ANSI C63.10:2013 ⊠ FCC Part 15.209/RSS Gen			🛛 3 Meters 🗌		
	Frequency Range:	☑ 9KHz to 30MHz☑ 30MHz to 1000KHz					
Nominal Voltage: 🗌 120VAC 🛛 11.1VDC							
	Test Personnel:	Keith Schwartz KS			Date: 02/18/2019		
		Limits – 15.	209 and RSS Gen				
	0.009-0.490		2400/F(KHz)	3	800	300	pass
	0.490-1.705	24000/F(KHz)		;	30	30	pass
	1.705-30	30		:	30	30	pass
30 to 88 40					3	pass	
88 to 216		43.5				3	pass
	216 to 960	46				3	pass
	Above 960		54			3	N/A

Modifications:	
Note:	For emission in the restricted bands, the limit of 15.209 was used. The level of unwanted emissions from an intentional radiator above 30MHz has not exceed 15.209 limit. All radiated emissions above 30MHz listed in the table is associated with unintentional radiation form the device.
	The lower limit applies at the transition frequency. An inverse proportionality factor of 20 dB per decade has been used to normalize the measured data to the specified distance for determining compliance.

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Frequency (MHz)	Pol.	QP Reading dBµV/m	Total CF dB	Net at 3 m dBµV/m	Limit (dBµV/m)	Margin dB
10.38*		-13.6	40.50	26.9	70	-43.1
27.62*		8.5	32.70	24.2	70	-45.8
135.54	Н	9.7	16.3	26	43.5	-17.6
284.74	V	9.9	18.2	28.2	46	-17.8
311.88	V	10.8	18.9	29.7	46	-16.3
338.5	V	12.2	19.3	31.5	46	-14.5
480.33	Н	6.5	23.2	29.7	46	-16.3
528.18	Н	5.9	23.4	29.3	46	-16.7
Notes:	Net Reading (dBuV) = Reading (dBμV)+Total CF(dB) Measurements <30MHz includes Loop Antenna correction factor *Field strength of emissions measurements outside 13.110-14.010MHz band of operation. It is found to be attenuated below Part 15.209 limits (70dBuV/m at 3mters).					

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4.3	Occupied bandy	width			
		Laboratory Ambient Temperature:	23°C		
		Relative Humidity:	18%		
		Atmospheric Pressure:	836.8 mbars		
Reference Standard(s):		⊠ ANSI C63.10:2013 ⊠ RSS-Gen	Measurement Point Conducted Radiated		
Frequency Range:		⊠ 13.553 MHz -13.567 MHz	RBW = 10KHz VBW ≥ 3 x RBW		
Nominal Voltage:		□ 120VAC 🛛 11.1VDC			
Test Personnel:		Yuriy Litvinov youry diviner	Date: 02/22/2019		

Frequency (MHz)	26 dB Bandwidth	99% Bandwidth	Results
(PR-ASK)	(KHz)	(KHz)	
13.553 -13.567	217.7	238.3	pass





4.4	In-Band Radiated	d Spurious Emissions					
Method:	Measurements wa intended to operat	as performed with modulated c	performed with modulated carrier at the highest power level at which the transmitter is . The analyzer offset was adjusted to compensate for the attenuator and other losses.				
		Labora	atory Ambient Temperature:	23°C			
			Relative Humidity:	18%			
			Atmospheric Pressure:	836.8 mbars			
Reference Standard(s):		 ☑ ANSI C63.10:2013 ☑ FCC Part 15.255/RSS210 □ FCC Part 15.109/ICES 003 □ FCC Part 15.209 	Measurement Point				
F	requency Range:	🛛 13.553 MHz -13.567 MHz					
		Frequency (MHz)	Field Strength uV/m at 30m	Field Strength dBuV/m at 3m			
		1.705-13.110	30	69.5			
		13.110-13.410	106	80.5			
		13.410-13.553	334	90.5			
	Limit	13.553-13.567	15848	124.0			
		13.567-13.710	334	90.5			
		13.710-14.010	106	80.5			
		14.010-30.0	30	69.5			
I	Nominal Voltage:	□ 120VAC 🛛 11.1VDC					
	Test Personnel:	Keith Schwartz KS	Keith Schwartz KS Date: 02/18/2				

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Frequency (MHz)	Pol (XYZ)	Net QP Reading dBµV/m	Limit (3m) (dBµV/m)	Margin dB	Antenna Height (m)
13.56	Y	71.3	124	-52.7	1.0
13.57	Y	60.3	90.5	-30.2	1.0
13.64	Y	50.5	80.5	-30	1.0
13.72	Y	39.2	80.5	-41.3	1.0
14.02	Y	38.3	69.5	-31.2	1.0
13.53	Y	54	80.5	-26.5	1.0
13.49	Y	49.4	80.5	-31.1	1.0
13.1	Y	37.5	69.5	-32	1.0
Notes:	Measurements <30MHz includes Loop Antenna correction factor				





4.5	Frequency Stability					
Method:	Measurements was per intended to operate. The The analyzer offset was conditions, both extreme	rements was performed with modulated carrier at the highest power level at which the transmitter is ed to operate. The frequency was measured under normal and extreme test conditions test conditions. halyzer offset was adjusted to compensate for the attenuator and other losses. During extreme test cons, both extreme temperature and voltage apply simultaneously.				
		Laboratory	Ambient Temperature:	23°C		
			Relative Humidity:	18%		
			Atmospheric Pressure:	836.8 mbars		
Reference Standard(s):		⊠ Part 15.225/RSS-210 ⊠ ANSI C63.10:2013		Measurement Point Conducted Radiated		
Frequency Range: 🛛 13.553 MHz -13.567MHz			3.567MHz	Maximum Deviation		
	Limit:	⊠ <u>+</u> 100ppm (<u>+</u> 0.01%)		60 ppm		
	Nominal Voltage:	□ 120VAC ⊠ 1 ⁻	1.1VDC			
		General	⊠ - 20.0 to +55.0C ⁰			
Extreme	Temperature Ranges:	Portable				
		Indoor Use				
		Mains Voltage	□ <u>+</u> 15%			
E	xtreme Test Voltages:	Battery	0.85 🗌 1.15	Test performed with a fully charged battery		
Test Personnel:		Keith Schwartz KS		Date: 02/22/2019		

Channel Frequency (MHz)	Temperature C ⁰	Voltage (VDC)	Measured Frequency (MHz)	Frequency Deviation (ppm)	Result
	55	Battery	13.55918	60	pass
	40	Battery	13.5593	0	pass
	30	Battery	13.5593	0	pass
12 50MU	20	Battery	13.5593	0	pass
13.3000	10	Battery	13.5593	0	pass
	0	Battery	13.5593	0	pass
	-10	Battery	13.5593	0	pass
	-20	Battery	13.55923	56	pass



4.6	RF Exposure Evaluation	ure Evaluation			
Reference Standard(s):		⊠ KDB 447498 ⊠ RSS 102, Issue 5 ⊠	MPE SAR Evaluation SAR Test Exclusion		
Frequency Range:		⊠ 2402-2480.0MHz ⊠ 13.56MHz			
Antenna	a Separation Distance:	>10mm			
Ant	enna Gain (maximum):	1.15dBi (PCB trace)			
BLE Max	imum Output Power at antenna terminal:	0.6mW(-2.45dBm)			
RFID Maximum Power:		M24LR RF Operating Current 0.0002A (50 Ohm load) The power calculation is $P = 0.0002A^2 \times 50$ Ohm = 0.2mW			
RF	Exposure Conditions:	Belt-worn			
	Power Density:	N/A			
		SAR Test Exclusion Threshold			
FC	C Part 2.1093	19mW@ >10mm @2.45GHz			
RSS 1	02, Issue 5, 2015	7mW@ >10mm @2.45GHz			
FC	C Part 2.1093	308mW@ < 50mm @10-50MHz			
RSS 1	02, Issue 5, 2015	71mW@ <5mm @<300MHz			
	Note:				



5.0	Test Equi	Test Equipment						
Test Equipment Used								
Description Manufacturer		Model	Identifier	Last Cal. Date	Check			
Biconilog Ante	enna	Schaffner	CBL6112B	27491	10/20/2018	\boxtimes		
Horn Antenna		A.H. Systems	SAS 571	1010	10/20/2018	\boxtimes		
Loop Antenna	L	A.H. Systems	EHA-51B	1213E	10/20/2018			
Loop Antenna	l	EMCO	ALR25M	1011	10/20/2018	\boxtimes		
Signal Analyz	er	Agilent	N9000A	MY53031040	10/20/2018	\boxtimes		
EMI Receiver		Agilent	E4448A	1530975	10/20/2018	\boxtimes		
LISN		TESEQ	NNB51	1130	10/20/2018			
EMC Software ETS-Lindgren		TILE 7		N/A	\boxtimes			
	Equipmer	nt Calibration Interval:] 12 months	24 months			

6.0	Report revision history					
Revision L	evel	Date	Report Number	Notes		
0		02/28/2020	RE1908179-1	Original Issue		