

EMC TEST REPORT



Standard(s):

**47 CFR FCC Part 15.225
RSS 210, Issue 10, 2019**

**FCC ID: DGFSCOTT41367
IC: 458A-SCOTT41367**

Product: 3M™ Scott™ SCBA Advanced Electronics Console (RFID)

Model (HVIN): 78-8151-4137-5

**Company Name:
3M Company**

**Address:
Fire & SCBA Solutions
4320 Goldmine Road, Monroe, NC 28110**

**Report Number: HRE202307432-3
Report Issue Date: March 14, 2024**

Report Prepared by:

Signature: 
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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.

	Requirement – Test	Test Description	Result	Comments
4.1	FCC Part 2.1049/RSS-Gen (6.7)	Occupied Bandwidth	pass	
4.2	FCC Part 15.209/RSS210 B.6(a) RSS-Gen, 8.9	Radiated Emissions outside of the specified band	pass	
4.3	FCC Part 15.225(a)(b)(c)/ RSS210 B.6(a)	In Band Radiated Spurious Emissions	pass	
4.4	FCC Part 15.225(e)/ RSS210 B.6(b)	Frequency Stability	pass	
4.5	FCC Part 15.207/ RSS-Gen (8.8)	Conducted Emissions	N/A	

Note:

Console 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
RF frequency	$\pm 3 \times 10^{-8}$
RF power, conducted	1.4 dB
RF Power Spectral Density	0.96 dB

1.2 Test Facility

Test Facility Accreditations:	ISO/IEC 17025:2017, NVLAP LAB CODE: 200033-0
	FCC US5320
	ISED Canada CAB identifier: US0012



2.0 Equipment Description

2.1	Equipment Under Test			
Description:	Advanced Electronics Self-Contained Breathing Apparatus (SCBA) Telemetry System Console. It contains LoRa 915MHz, Bluetooth (Low Energy) 2.4GHz and RFID 13.56MHz transmitters.			
Model(s):	78-8151-4137-5			
Serial number:	N/A			
3M Division:	Personal Safety			
Modifications and Special Measures:	none			
Frequency Range:	13.56 MHz			
Channel No.:	1			
Modulation Type:	ASK			
FCC Classification:	Low Power Communication device transmitter			
Output Power EIRP:	N/A			
Antenna Type and Antenna Assembly Gain:	<input type="checkbox"/> External	<input type="checkbox"/> Integral PCB Antenna	<input checked="" type="checkbox"/> Dedicated	
	<input type="checkbox"/> dBi	<input checked="" type="checkbox"/> Declared by the Manufacturer	<input type="checkbox"/> Measured	
Test Deviations or Exclusions	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No		
Rated Power:	Voltage:	<input type="checkbox"/> 120VAC	<input type="checkbox"/> 230VAC	<input checked="" type="checkbox"/> 3.3VDC
	Phase:	<input type="checkbox"/> 1ph	<input type="checkbox"/> 3ph	<input checked="" type="checkbox"/> "AA" Batteries
	Frequency:	<input type="checkbox"/> 50Hz	<input type="checkbox"/> 60Hz	
	Current:			
Test Dates:	08/28-09/01/2023			
Received Date:	08/23/2023			
Received Conditions:	<input type="checkbox"/> Poor	<input checked="" type="checkbox"/> Good		
	<input checked="" type="checkbox"/> Prototype	<input type="checkbox"/> Production		



3.0 EUT Configuration

3.1 System Configuration

No.	Product Type	Manufacturer	Model	Comments
1	Valor 2A Console	3M	78-8151-4137-5	
2	DC Power Supply			Support Equipment

3.2 Input/Output Ports of EUT

No.	Description	Type	Comments
1	DC Power	Round Cable plug	
2			

3.3 Cables

No.	Description	Type	Length	Shielding	Comments
1	DC Power	Twisted pair	1m	No	1
2					

3.4 Measurement Arrangements of EUT

	Intended Operational Arrangement(s)	Comments
<input checked="" type="checkbox"/>	Table-top only	
<input type="checkbox"/>	Floor-standing only	
<input type="checkbox"/>	Floor-standing or table-top	
<input checked="" type="checkbox"/>	Other	Body-worn

3.5 Primary function(s) of EUT

No.	List of Essential Functions
1	Transferring of various data via RFID radio to SCBA telemetry systems.
2	

3.6 Exercising of EUT and Interfaces

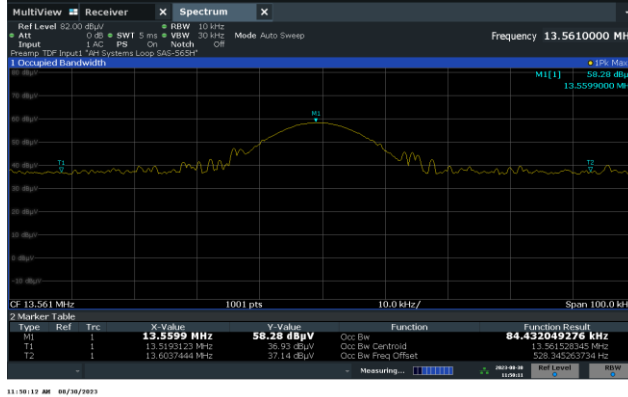
No.	Mode of Operation
1	Continues transmission of modulated signal at 13.56MHz
2	Device programming using Tera Term software for continues transmission at maximum rated RF output power and Duty Cycle.



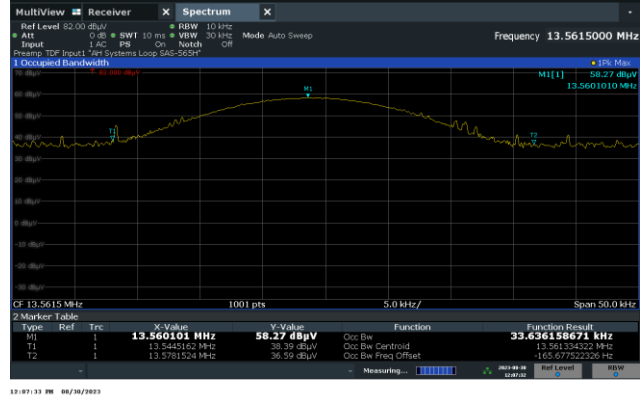
4.0 Test Conditions and Results

4.1 Occupied Bandwidth	
	Laboratory Ambient Temperature: 23°C
	Relative Humidity: 48%
	Atmospheric Pressure: 1011 mbars
Reference Standard(s):	<input checked="" type="checkbox"/> ANSI C63.10:2020 <input checked="" type="checkbox"/> FCC Part 15.225/RSS 210 <input type="checkbox"/>
Frequency Range:	<input checked="" type="checkbox"/> 13.553 -13.567MHz RBW = 10KHz VBW ≥ 3 x RBW
Nominal Voltage:	<input type="checkbox"/> 120VAC <input checked="" type="checkbox"/> 3.3VDC
Test Personnel:	Yuriy Litvinov <i>Yuriy Litvinov</i> Date: 09/01/2023

Frequency (MHz) (PR-ASK)	20 dB Bandwidth (KHz)	99% Bandwidth (KHz)	Results
13.553 -13.567	58.3	58.3	pass



11:30:12 AM 08/30/2023



11:07:33 AM 08/30/2023



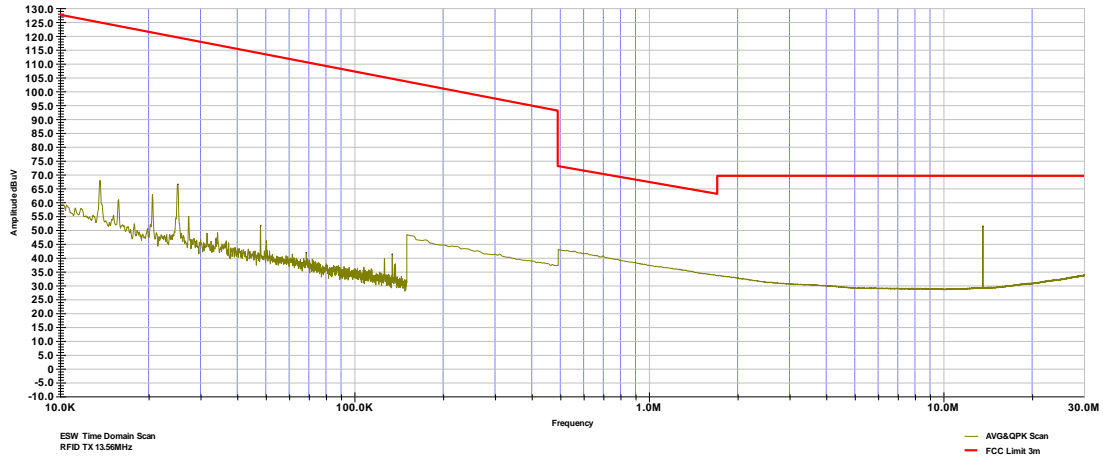
4.2	Radiated Emissions outside of the specified band				
Method:	Measurements were made in a 3-meter semi-anechoic chamber that complies to CISPR 16/ANSI C63.4 standards. EUT was rotated through three orthogonal axes to determine which attitude (orientation) and arrangement produces the highest emission relative to the limit; the attitude and device arrangement that produces the highest emission relative to the limit was used in making final radiated emission measurements. Spurious Radiated emissions measurements were performed with external preamp and a high pass filter. Final measurements 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.				
Test Verification: <input checked="" type="checkbox"/>	Laboratory Ambient Temperature:		23°C		
	Relative Humidity:		55%		
	Atmospheric Pressure:		1011 mbars		
Reference Standard(s):	<input checked="" type="checkbox"/> ANSI C63.10:2020, Section 11.12.1		Measurement Distance		
	<input checked="" type="checkbox"/> FCC Part 15.205/15.209/RSS Gen (8.9) <input type="checkbox"/>				
Frequency Range:	<input checked="" type="checkbox"/> 9KHz to 30MHz		<input checked="" type="checkbox"/> 3 Meters <input type="checkbox"/>		
	<input checked="" type="checkbox"/> 30MHz to 1GHz				
Nominal Voltage:	<input type="checkbox"/> 120VAC <input checked="" type="checkbox"/> 3.3VDC				
Test Personnel:	Keith Schwartz <i>KS</i>			Date: 09/01/2023	
Limits –15.209 and RSS Gen					
Frequency (MHz)	Limit dB (µV/m)			Distance	Results
	Quasi-Peak	Average	Peak		
0.009-0.490		2400/F(KHz)		300	pass
0.490-1.705	24000/F(KHz)			30	pass
1.705-30	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	74	3	N/A

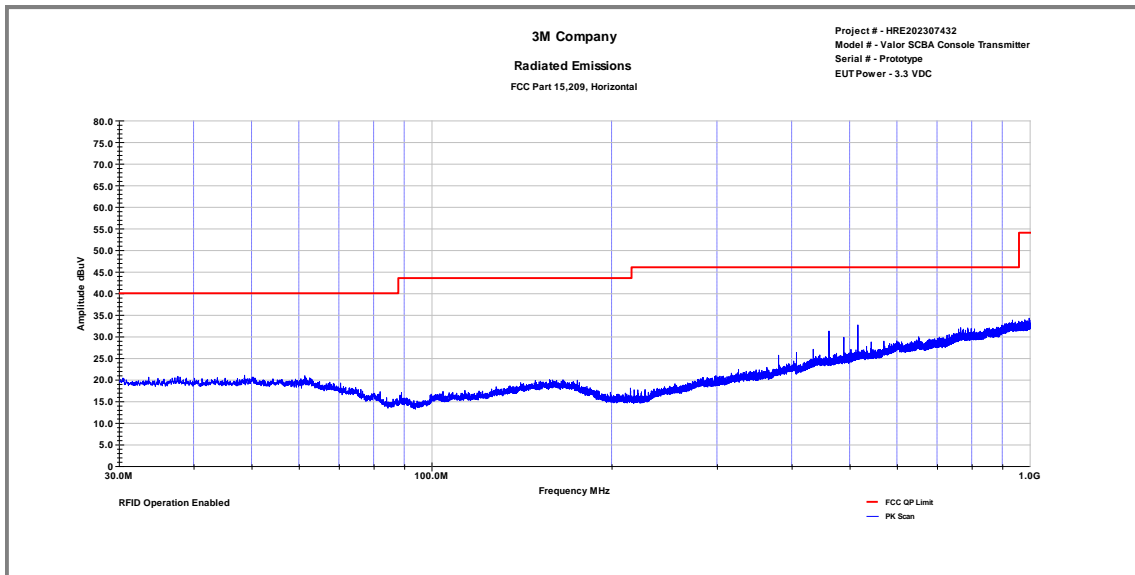
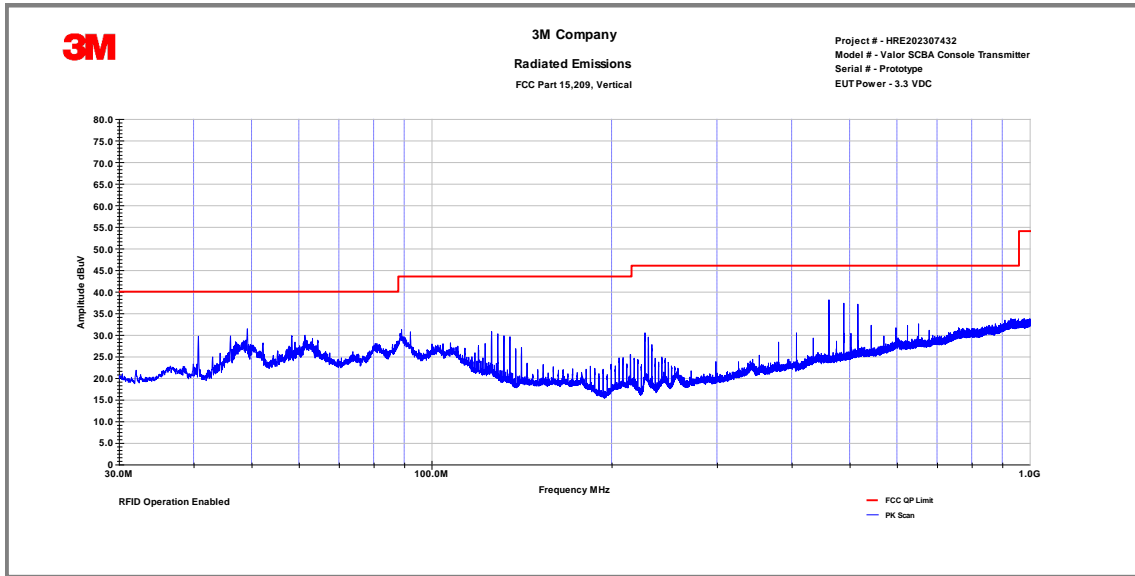
Modifications:	
Note:	<p>The lower limit applies at the transition frequency. An inverse proportionality factor of 20 dB per decade has been used to normalize the measured data to the specified distance for determining compliance</p> <p>For emission in the restricted bands, the limit of 15.209 was used.</p> <p>Measurements <30MHz includes Loop Antenna correction factor. Field strength of emissions measurements outside 13.110-14.010MHz band of operation was found to be attenuated below Part 15.209 limits.</p>



3M Company
FCC Part 15.209, Spurious Emissions Scan
Loop Antenna 10KHz-30MHz, 3 meters

RE Project # - HRE202307432
Model # - Valor SCBA Console Transmitter
Serial # - Prototype
EUT Power - 3.3 VDC

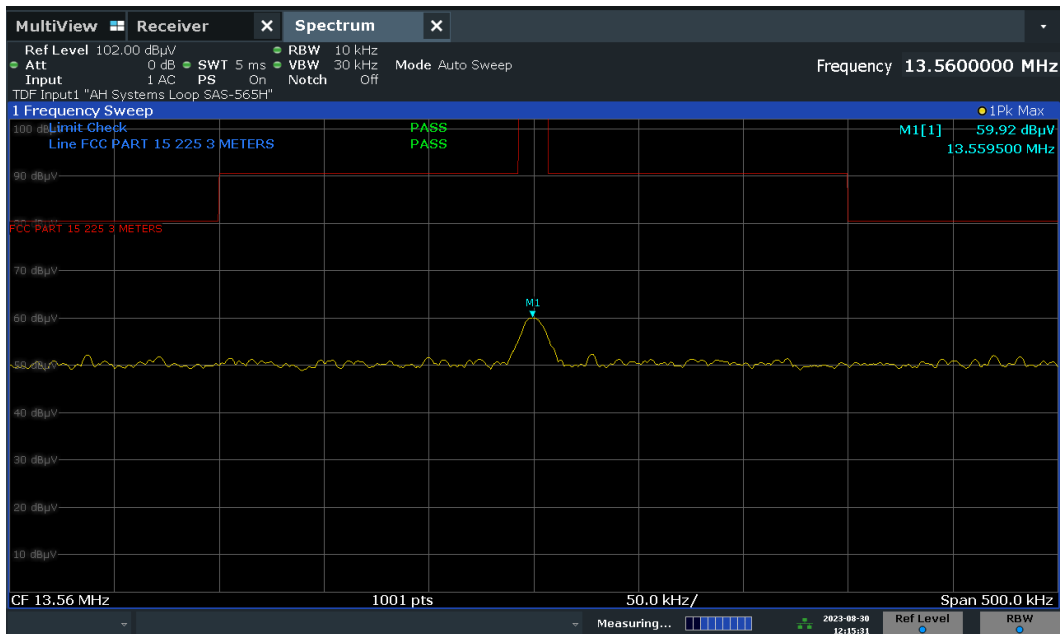




Frequency (MHz)	Pol.	QP Reading (dBµV/m)	Total CF dB	Net at 3 m (dBµV/m)	Limit (dBµV/m)	Margin dB
48.5	V	7.6	18.3	25.8	40	-14.2
88.25	V	11.8	12.5	24.3	43.5	-19.2
125.81	V	12.3	15.9	28.2	43.5	-15.3
227.27	H	3.1	15	18.1	46	-27.9
461.06	V	12.2	22.6	34.8	46	-11.2
514.73	H	4.8	23.5	28.3	46	-17.7
Notes:		Net Reading (dBuV) = Reading (dBµV) + Total CF(dB)				



4.3	In-Band Radiated Spurious Emissions		
Method:	Measurements was performed with modulated carrier at the highest power level at which the transmitter is intended to operate. The analyzer offset was adjusted to compensate for the attenuator and other losses.		
	Laboratory Ambient Temperature:	23°C	
	Relative Humidity:	55%	
	Atmospheric Pressure:	1011 mbars	
Reference Standard(s):	<input checked="" type="checkbox"/> ANSI C63.10:2020, Section 6 <input checked="" type="checkbox"/> FCC Part 15.225/RSS210 <input type="checkbox"/>	Measurement Point	
Frequency Range:	<input checked="" type="checkbox"/> 13.553 MHz -13.567 MHz	<input type="checkbox"/> Conducted <input checked="" type="checkbox"/> Radiated at 3 meters	
	Frequency (MHz)	(uV/m) at 30m	(dBuV/m) at 3m
The field strength Limit:	1.705-13.110	30	69.5
	13.110-13.410	106	80.5
	13.410-13.553	334	90.5
	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
Max. field strength at 3m	59.92dBuV/m		
Nominal Voltage:	<input type="checkbox"/> 120VAC <input checked="" type="checkbox"/> 3.3VDC		
Test Personnel:	Keith Schwartz <i>KS</i>		Date: 09/01/2023





4.4		Frequency Stability	
Method:	Measurements was performed with modulated carrier at the highest power level at which the transmitter is intended to operate. The frequency was measured under normal and extreme test conditions test conditions. The analyzer offset was adjusted to compensate for the attenuator and other losses. During extreme test conditions, both extreme temperature and voltage apply simultaneously.		
	Laboratory Ambient Temperature:	23°C	
	Relative Humidity:	55%	
	Atmospheric Pressure:	1011 mbars	
Reference Standard(s):	<input checked="" type="checkbox"/> FCC Part 15.225/RSS210 <input checked="" type="checkbox"/> ANSI C63.10:2020, Section 6.8	Measurement Point <input type="checkbox"/> Conducted <input checked="" type="checkbox"/> Radiated	
Reference Frequency:	<input checked="" type="checkbox"/> 13.56MHz	Maximum Deviation	
Limit:	<input checked="" type="checkbox"/> ± 100ppm (± 0.01%)	-28.6ppm	
Nominal Voltage:	<input type="checkbox"/> 120VAC (Primary) <input checked="" type="checkbox"/> 3.3VDC		
Extreme Temperature Ranges:	<input checked="" type="checkbox"/> General	<input checked="" type="checkbox"/> - 20.0 to +55.0C ⁰	
	<input type="checkbox"/> Portable	<input type="checkbox"/>	
	<input type="checkbox"/> Indoor Use	<input type="checkbox"/>	
Extreme Test Voltages:	<input type="checkbox"/> Mains Voltage	<input type="checkbox"/> ± 15%	
	<input checked="" type="checkbox"/> Battery	<input checked="" type="checkbox"/> DC PS	
Test Personnel:	Keith Schwartz <i>KS</i>		Date: 09/01/2023

Channel Frequency (MHz)	Temperature C ⁰	Voltage (DC)	Measured Frequency (MHz)	Frequency Deviation (ppm)	Result
13.56MHz	-20	3.3	13.5602729	-20.125	pass
	-10	3.3	13.5603762	-27.743	pass
	0	3.3	13.5603879	-28.606	pass
	10	3.3	13.5603818	-28.156	pass
	20	3.3	13.5603552	-26.195	pass
	30	3.3	13.5603299	-24.329	pass
	40	3.3	13.5602964	-21.858	pass
	55	3.3	13.5602758	-20.339	pass



4.5		Conducted Emissions Data		
Method:	The AMN was placed 0.8 m from the boundary of the unit under test and bonded to a ground reference plane. This distance was between the closest points of the AMN and the EUT. All other units of the EUT and associated equipment was at least 0.8 m from the AMN. All power was connected to the system through Artificial Mains Network (AMN). Conducted voltage measurements on mains lines were made at the output of the AMN.			
	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.			
Test Verification: <input type="checkbox"/>	Laboratory Ambient Temperature:			
	Relative Humidity:			
	Atmospheric Pressure:			
Reference Standard(s):	<input type="checkbox"/> RSS GEN/FCC Part 15.207		Measurement Point <input type="checkbox"/> Mains <input type="checkbox"/> Telecommunication ports <input type="checkbox"/>	
	<input type="checkbox"/> ANSI C63.4:2014			
	<input type="checkbox"/> ANSI C63.10:2013			
Nominal Voltage:	<input type="checkbox"/> 120VAC <input type="checkbox"/>			
Test Personnel:		Date:		
Limits – Part 15.207/RSS Gen – AC Mains				
Frequency (MHz)	Limit dB (µV)			
	Quasi-Peak	Average	Result	Comments
0.15 to 0.50	66 to 56	56 to 46	N/A	
0.50 to 5	56	46	N/A	
5 to 30	60	50	N/A	

Modifications:	
Note:	



5.0	Test Equipment				
Test Equipment Used					
Description	Manufacturer	Model	Identifier	Last Cal. Date	Check
Biconilog Antenna	Schwarzbeck	VULB 9168	9168-1070	10/20/2022	<input checked="" type="checkbox"/>
Horn Antenna	A.H. Systems	SAS 571	1010	10/20/2022	<input checked="" type="checkbox"/>
Loop Antenna	A.H. Systems	EHA-51B	1213E	10/20/2022	<input type="checkbox"/>
EMI Receiver	Rohde & Schwarz	ESW26	101412	10/20/2022	<input checked="" type="checkbox"/>
Signal Analyzer	Agilent	N9000A	MY53031040	10/20/2022	<input checked="" type="checkbox"/>
EMI Receiver	Agilent	E4448A	1530975	10/20/2022	<input checked="" type="checkbox"/>
LISN	TESEQ	NNB51	1130	10/20/2022	<input type="checkbox"/>
Coaxial Cable	Insulated Wire	2803	CBL2039	10/20/2022	<input checked="" type="checkbox"/>
EMC Software	ETS-Lindgren	TILE 7		N/A	<input checked="" type="checkbox"/>
Equipment Calibration Interval:		<input checked="" type="checkbox"/> 12 months		<input type="checkbox"/> 24 months	

6.0	Report revision history		
Revision Level	Date	Report Number	Notes
0	03/14/2024	HRE202307432-3	Original Issue