



Test Report for Assa Abloy Inc.
Report No. EW0790-1 Issue 2



TEST REPORT

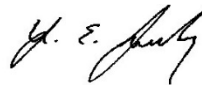
Applicant	Assa Abloy Inc.
Address	110 Sargent Drive New Haven CT USA 06511

FCC ID	U4A-CEX100
ISED Canada IC	6982A-CEX100
Product Marketing Name (PMN)	CEX100
Model Number	52-9127-0000-000
Hardware Version of DUT	52-9127-0000-000
Software Version of DUT	s140_nrf52_6.1.1_softdevice.hex products-regulatorySupport.hex
Host Marketing Name (HMN)	CEB100, CEE100, CEM100
HMN Differences	See Section 3.1
Modular Approval Type	Limited Module
Date of tests	July 21, 2022 to March 9, 2023
FCC Test Firm DN	US1028
Canada CABID	US0106

The tests have been carried out according to the requirements of the following standard:

- ☒ **FCC Part 15, Subpart C, Section 15.225**
- ☒ **ISED Canada RSS-210 Issue 10 Annex B.6**

CONCLUSION: The submitted sample was found to COMPLY with the test requirement

Prepared by Ryan Brown Sr. EMC/Wireless Engineer	Approved by Yunus Faziloglu Wireless Manager
	

Report Issue Date: Apr-25-2023

Issue Number: 2

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TABLE OF CONTENTS

RELEASE CONTROL RECORD	4
1 SUMMARY OF TEST RESULTS	5
2 MEASUREMENT UNCERTAINTY	6
3 GENERAL INFORMATION	7
4.3.4 GENERAL DESCRIPTION OF EUT	7
4.3.4 DESCRIPTION OF TEST MODES	8
4.3.4 MEASUREMENT PROCEDURES USED	10
4.3.4 DESCRIPTION OF SUPPORT EQUIPMENT	10
5 TEST RESULTS	11
4.1 AC LINE CONDUCTED EMISSIONS	11
4.1.1 LIMITS	11
4.1.2 TEST EQUIPMENT USED	11
4.2 FUNDAMENTAL FIELD STRENGTH AND EMISSION MASK	12
4.2.1 LIMITS	12
4.2.2 TEST SETUP	12
4.2.3 TEST EQUIPMENT USED	12
4.2.4 TEST PROCEDURES	13
4.2.5 DEVIATIONS	13
4.2.6 EUT OPERATING CONDITIONS	13
4.2.7 TEST RESULTS	14
4.3 RADIATED SPURIOUS EMISSIONS	16
4.3.1 LIMITS	16
4.3.2 TEST EQUIPMENT USED	17
4.3.3 TEST PROCEDURES	18
4.3.4 DEVIATIONS	19
4.3.5 TEST SETUP	19
4.3.6 EUT OPERATING CONDITIONS	19
4.3.7 TEST RESULTS	20
4.4 99% OCCUPIED BANDWIDTH	35
4.4.1 LIMITS	35
4.4.2 TEST SETUP	35
4.4.3 TEST EQUIPMENT USED	35
4.4.4 TEST PROCEDURES	35
4.4.5 DEVIATIONS	35
4.4.6 EUT OPERATING CONDITIONS	35



Test Report for Assa Abloy Inc.
Report No. EW0790-1 Issue 2



4.4.7	TEST RESULTS	36
4.5	FREQUENCY TOLERANCE	39
4.5.1	LIMITS	39
4.5.2	TEST SETUP	39
4.5.3	TEST EQUIPMENT USED	39
4.5.4	TEST PROCEDURES	39
4.5.5	DEVIATIONS	39
4.5.6	EUT OPERATING CONDITIONS	39
4.5.7	TEST RESULTS	40
5	PHOTOGRAPHS OF THE TEST CONFIGURATION	41
6	APPENDIX A – MODIFICATIONS	42



RELEASE CONTROL RECORD

ISSUE NO.	REASON FOR CHANGE	DATE ISSUED
1	Original release	Apr-7-2023
2	Changed cover page EUT related fields for clarity Header corrected in Section 1	Apr-25-2023

1 SUMMARY OF TEST RESULTS

EUT was tested against the following requirements:

APPLIED STANDARD: FCC PART 15, SUBPART C (SECTION 15.225), RSS-210				
STANDARD SECTION		TEST TYPE AND LIMIT	APPLICABLE	RESULT
47CFR15	RSS			
15.207	Gen 8.8	AC Power Line Conducted Emissions	N/A (Note 1)	PASS
15.205 15.209	Gen 8.9 Gen 8.10	Radiated Spurious Emissions	Y	PASS
15.225(a)	210 Annex B.6 (a)(i)	Fundamental Field Strength	Y	PASS
15.225(b)-(d)	210 Annex B.6 (a)(ii)-(iv)	Emission mask	Y	PASS
15.225(e)	210 Annex B.6 (b)	Frequency Tolerance	Y	PASS
--	Gen 6.7	99% Occupied Bandwidth	Y	PASS
15.203	Gen 6.8	Antenna Requirement	Y	PASS

Note 1: EUT is battery powered only.

2 MEASUREMENT UNCERTAINTY

The listed uncertainties are the worst-case uncertainty for the entire range of measurement. Please note that the uncertainty values are provided for informational purposes only and are not used in determining the PASS/FAIL results. Values for measurement uncertainty are calculated per ETSI TR 100 028 (2001).

Measurement	Expanded Uncertainty k=2	Maximum allowable uncertainty
Radio frequency (@ 2.4GHz)	3.23×10^{-8}	1×10^{-7}
RF power, conducted	0.40dB	0.75dB
Maximum frequency deviation: Within 300Hz and 6kHz of audio frequency / Within 6kHz and 25kHz of audio frequency	3.4% 0.3dB	5% 3dB
Adjacent channel power	1.9dB	3dB
Conducted spurious emission of transmitter, valid up to 12.75GHz	2.39dB	3dB
Conducted emission of receivers	1.3dB	3dB
Radiated emission of transmitter, valid up to 26.5GHz	3.9dB	6dB
Radiated emission of transmitter, valid up to 80GHz	3.3dB	6dB
Radiated emission of receiver, valid up to 26.5GHz	3.9dB	6dB
Radiated emission of receiver, valid up to 80GHz	3.3dB	6dB
Humidity	2.37%	5%
Temperature	0.7°C	1.0°C
Time	4.1%	10%
RF Power Density, Conducted	0.4dB	3dB
DC and low frequency voltages	1.3%	3%
Voltage (AC, <10kHz)	1.3%	2%
Voltage (DC)	0.62%	1%
The above reflects a 95% confidence level		

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of $k = 2$.

3 GENERAL INFORMATION

4.3.4 GENERAL DESCRIPTION OF EUT

NOMINAL VOLTAGE	6VDC Battery
MODULATION TYPES	ASK
DATA RATES	106kbps
OPERATING FREQUENCY	13.56MHz
EUT Power Setting	Default
FUNDAMENTAL FIELD STRENGTH	62.3dBμV/m at 3m
ANTENNA TYPE	PCB trace loop antenna with 1dBi gain

List of Host Models and Differences

Model	Description	Tested
CEB100	(CE) CENTRIOS SERIES (B) BORED LOCK (10) NO KEYPAD (0) KEY OVERRIDE	Yes
CEE100	(CE) CENTRIOS SERIES (E) EXIT TRIM (10) NO KEYPAD (0) KEY OVERRIDE	Yes
CEM100	(CE) CENTRIOS SERIES (M) MORTISE LOCK (10) NO KEYPAD (0) KEY OVERRIDE	Yes

Lowest clock frequency in the device (used/generated): 29KHz

Highest clock frequency in the device (used/generated): 2480MHz

NOTES:

1. For a more detailed description of the EUT, please refer to the manufacturer's specifications or the user's manual.
2. For photos of the EUT, please refer to External and Internal Photos exhibits.

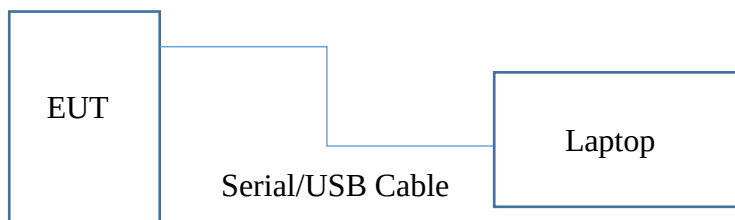
4.3.4 DESCRIPTION OF TEST MODES

EUT operates at a single channel at 13.56MHz. One sample was provided for testing, with a production antenna for all testing. The sample was powered with 6V battery and had a temporary port for a serial to USB cable for connection to a support laptop for putting the radio in necessary test modes.

EUT configuration modes:

TEST MODE	DESCRIPTION
A	Continuous Transmit at 106kbps (Duty-cycle: 58%)

EUT SETUP BLOCK DIAGRAMS





Test Report for Assa Abloy Inc.
Report No. EW0790-1 Issue 2



Following channels/modes were selected for the applicable tests below.

TEST	TEST MODE	AVAILABLE CHANNELS	TESTED CHANNEL	MODULATION TYPE	DATA RATE (Mbps)	Notes
FFS	A	1	1	ASK	106kbps	1
EM	---	---	---	---	---	2
FT	A	1	1	ASK	106kbps	3
OBW	A	1	1	ASK	106kbps	1
RSE<1G	A	1	1	ASK	106kbps	1
PLCE	---	---	---	---	---	4

Note 1: Host models were positioned in their single installation orientation as seen in the Test Setup Photos exhibit.

Note 2: Emission mask measurement was not performed since fundamental and all spurious emissions were below the 15.209 limits.

Note 3: Only performed on Host Model CEE100.

Note 4: Not applicable since EUT is battery powered only.

FFS: Fundamental Field Strength

EM: Emissions Mask

FT: Frequency Tolerance

OBW: 99% Occupied Bandwidth

RSE<1G: Radiated Spurious Emissions Below 1GHz

PLCE: Power Line Conducted Emissions

TEST CONDITIONS:

APPLICABLE TO	ENVIRONMENTAL CONDITIONS	INPUT POWER	TESTED BY	DATE OF TEST
FFS, EM	21.5°C, 36% RH, 1000 mbar 22.7°C, 35.6% RH, 1005.8 mbar	6VDC	MM/RB	11/17/2022 02/06/2023
OBW	22.5°C, 41.5% RH, 1010 mbar	6VDC	RMB	03/09/2023
RSE	21.6°C, 41.8% RH, 1024 mbar 22.8°C, 63.1% RH, 1011 mbar 22.7°C, 35.6% RH, 1005.8 mbar	6VDC	MM/RMB	11/07/2022 11/08/2022 02/06/2023
PLCE	N/A	N/A	N/A	N/A



4.3.4 MEASUREMENT PROCEDURES USED

All tests were performed in accordance with the following measurement procedures:

ANSI C63.10-2013

RSS-Gen Issue 5

4.3.4 DESCRIPTION OF SUPPORT EQUIPMENT

Support Equipment	Model #	Serial #
Dell Precision Laptop	M4800	N/A

5 TEST RESULTS

4.1 AC LINE CONDUCTED EMISSIONS

4.1.1 LIMITS

FREQUENCY OF EMISSION (MHz)	CONDUCTED LIMIT (dBμV)	
	Quasi-peak	Average
0.15 ~ 0.5	66 to 56	56 to 46
0.5 ~ 5	56	46
5 ~ 30	60	50

NOTE: 1. Lower limit applies at the transition frequencies.
2. Limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50MHz.

4.1.2 TEST EQUIPMENT USED

N/A, EUT is battery powered only.



4.2 FUNDAMENTAL FIELD STRENGTH AND EMISSION MASK

4.2.1 LIMITS

Fundamental Field Strength:

The field strength of any emissions within the band 13.553-13.567 MHz shall not exceed 15,848 microvolts/meter at 30 meters.

Emission Mask:

Within the bands 13.410-13.553 MHz and 13.567-13.710 MHz, the field strength of any emissions shall not exceed 334 microvolts/meter at 30 meters.

Within the bands 13.110-13.410 MHz and 13.710-14.010 MHz the field strength of any emissions shall not exceed 106 microvolts/meter at 30 meters.

The field strength of any emissions appearing outside of the 13.110-14.010 MHz band shall not exceed the general radiated emission limits in FCC 15.209 and RSS-Gen.

Limit conversion below 30MHz is done by using the square of an inverse linear distance extrapolation factor (40 dB/decade) as allowed in FCC 15.31(f)(2).

Limit(3m) = Limit(30m) + 40*log(30/3) = Limit(30m) + 40

Limit (3m) = Limit (300m) + 40*log(300/3) = Limit (300m) + 80

4.2.2 TEST SETUP

Same as radiated spurious emissions setup below 30MHz (Section 4.3.5).

4.2.3 TEST EQUIPMENT USED

For test equipment used on 11/17/2022

Rev. 12/2/2022

Spectrum Analyzers / Receivers /Preselectors	Range	MN	Mfr	SN	Asset	Cat	Calibration Due	Calibrated on
2093 MXE EMI Receiver	20Hz-26.5GHz	N9038A	Agilent	MY51210181	2093	I	3/7/2023	3/7/2022
Radiated Emissions Sites	FCC Code	IC Code	VCCI Code	Range	Asset	Cat	Calibration Due	Calibrated on
EMI Chamber 2	719150	2762A-7	A-0015	30-1000MHz	1686	I	11/29/2024	11/29/2022
Preamps /Couplers Attenuators / Filters	Range	MN	Mfr	SN	Asset	Cat	Calibration Due	Calibrated on
8447F Rental PA	9KHz-1.3GHz	84477F	HP	3113A05395		II	10/17/2023	10/17/2022
Antennas	Range	MN	Mfr	SN	Asset	Cat	Calibration Due	Calibrated on
Red-Brown Bilog	30-2000MHz	JB1	Sunol	A0032406	1218	I	4/28/2023	4/28/2021
Small Loop	10kHz-30MHz	PLA-130/A	ARA	1024	755	I	9/12/2024	9/12/2022
Large Loop	20Hz-5MHz	6511	EMCO	9704-1154	67	I	8/22/2024	8/22/2022
Meteorological Meters/Chambers		MN	Mfr	SN	Asset	Cat	Calibration Due	Calibrated on
Weather Clock (Pressure Only)		BA928	Oregon Scientific	C3166-1	831	I	11/23/2022	11/23/2020
Asset #2657		1235C97	Control Company	200435369	2657	I	8/18/2025	8/18/2022
Cables	Range		Mfr			Cat	Calibration Due	Calibrated on
Asset #2468	9KHz-18GHz		MegaPhase			II	11/1/2023	11/1/2022
Asset #2610	9KHz-18GHz		Pasternack			II	3/16/2023	3/16/2022
Asset #2682	9KHz-18GHz		Pasternack			II	10/6/2023	10/6/2022

All equipment is calibrated using standards traceable to NIST or other nationally recognized calibration standard.



**Test Report for Assa Abloy Inc.
Report No. EW0790-1 Issue 2**



For test equipment used on 02/06/2023

Rev. 2/3/2023

Spectrum Analyzers / Receivers /Preselectors		Range	MN	Mfr	SN	Asset	Cat	Calibration Due	Calibrated on
2093 MXE EMI Receiver		20Hz-26.5GHz	N9038A	Agilent	MY51210181	2093	I	3/7/2023	3/7/2022
Radiated Emissions Sites		FCC Code	IC Code	VCCI Code	Range	Asset	Cat	Calibration Due	Calibrated on
EMI Chamber 1		719150	2762A-6	A-0015	30-1000MHz	1685	I	11/29/2024	11/29/2022
Antennas		Range	MN	Mfr	SN	Asset	Cat	Calibration Due	Calibrated on
2615 Active Loop Antenna		9KHz-30MHz	6502	EMCO	2049	2615	I	1/18/2025	1/18/2023
Meteorological Meters/Chambers			MN	Mfr	SN	Asset	Cat	Calibration Due	Calibrated on
Asset 2707			SD700	EXTECH	A.115171	2707	I	1/13/2025	1/13/2023
Cables		Range		Mfr			Cat	Calibration Due	Calibrated on
Asset #2610		9KHz-18GHz		Pasternack			II	3/16/2023	3/16/2022
Asset #2681		9KHz-18GHz		Pasternack			II	12/13/2023	12/13/2022

All equipment is calibrated using standards traceable to NIST or other nationally recognized calibration standard.

4.2.4 TEST PROCEDURES

Same as Section 4.3.3.

4.2.5 DEVIATIONS

No deviations from the standard.

4.2.6 EUT OPERATING CONDITIONS

EUT was operated according to manufacturer's specifications.



Test Report for Assa Abloy Inc.
Report No. EW0790-1 Issue 2



4.2.7 TEST RESULTS

Host Model CEE100

Radiated Emissions Table												
Date: 17-Nov-22			Company: Assa Abloy						Work Order: W0790			
Engineer: Matthew McCarthy			EUT Desc: CEE100						EUT Operating Voltage/Frequency: Battery			
Temp: 21.5°C			Humidity: 36%			Pressure: 1000mBar						
Frequency Range: 13.56MHz							Measurement Distance: 3 m					
Notes:							EUT Max Freq: 2480					
Antenna Polarization (0° - 90°)	Frequency (MHz)	Reading (dBµV)	Preamp Factor (dB)	Antenna Factor (dB/m)	Cable Factor (dB)	Adjusted Reading (dBµV/m)				FCC 15.225		
							Limit (dBµV/m)	Margin (dB)	Result (Pass/Fail)	Limit (dBµV/m)	Margin (dB)	Result (Pass/Fail)
RFID Fundamental			---	---	---	---	---	---	---	---	---	---
Para	13.56	23.4	0.0	38.6	0.3	62.3	---	---	---	124.0	-61.7	Pass
Perp	13.56	21.2	0.0	38.6	0.3	60.1	---	---	---	124.0	-63.9	Pass
Para to floor	13.56	22.3	0.0	38.6	0.3	61.2	---	---	---	124.0	-62.8	Pass
Table Result:		Pass	by		-61.7 dB		Worst Freq:				13.56 MHz	
Test Site: EMI Chamber 2			Cable 1: Asset #2682				Cable 2: Asset #2610			Cable 3: ---		
Analyzer: 2093			Preamp: None				Antenna: Sm Loop (high)			Preselector: ---		
CSsoft Radiated Emissions Calculator v 1.017.222						Copyright Curtis-Straus LLC 2000						
Adjusted Reading = Reading - Preamp Factor + Antenna Factor + Cable Factor												

Emission mask defined in 15.225 (a)-(d) was not necessary since the maximum 13.56MHz fundamental of 62.3dBuV/m at 3m is below the 15.209 limit of 69.5dBuV/m at 3m. In addition, all radiated spurious emissions were below the 15.209 limits.

Host Model CEB100

Radiated Emissions Table												
Date: 06-Feb-23			Company: Assa Abloy						Work Order: W0790			
Engineer: Ryan M. Brown			EUT Desc: CEB100						EUT Operating Voltage/Frequency: Battery			
Temp: 22.7			Humidity: 36%			Pressure: 1005.8						
Frequency Range: 13.56MHz							Measurement Distance: 3 m					
Notes:							EUT Max Freq: 2480					
Antenna Polarization (H / V)	Frequency (MHz)	Reading (dBμV)	Preamp Factor (dB)	Antenna Factor (dB/m)	Cable Factor (dB)	Adjusted Reading (dBμV/m)				FCC 15.225		
							Limit (dBμV/m)	Margin (dB)	Result (Pass/Fail)	Limit (dBμV/m)	Margin (dB)	Result (Pass/Fail)
RFID Fundamental							---	---	---	---	---	---
Para	13.56	48.3	0.0	10.7	0.3	59.3	---	---	---	124.0	-64.7	Pass
Perp	13.56	46.1	0.0	10.7	0.3	57.1	---	---	---	124.0	-66.9	Pass
Para to Floor	13.56	41.2	0.0	10.7	0.3	52.2	---	---	---	124.0	-71.8	Pass
Table Result:			Pass	by		-64.7 dB		Worst Freq:			13.56 MHz	
Test Site: EMI Chamber 1			Cable 1: Asset #2681					Cable 2: Asset #2610			Cable 3: ---	
Analyzer: Asset #2093			Preamp: None					Antenna: Asset 2615 Loop			Preselector: ---	
CSsoft Radiated Emissions Calculator v 1.017.225												
Adjusted Reading = Reading - Preamp Factor + Antenna Factor + Cable Factor												
Copyright Curtis-Straus LLC 2000												

Emission mask defined in 15.225 (a)-(d) was not necessary since the maximum 13.56MHz fundamental of 59.3dBuV/m at 3m is below the 15.209 limit of 69.5dBuV/m at 3m. In addition, all radiated spurious emissions were below the 15.209 limits.



Test Report for Assa Abloy Inc.
Report No. EW0790-1 Issue 2



Host Model CEM100

Radiated Emissions Table

Date: 06-Feb-23		Company: Assa Abloy		Work Order: W0790								
Engineer: Ryan M. Brown		EUT Desc: CEM100		EUT Operating Voltage/Frequency: Battery								
Temp: 22.7		Humidity: 36%		Pressure: 1005.8								
Frequency Range: 13.56MHz				Measurement Distance: 3 m								
Notes:				EUT Max Freq: 2480								
Antenna Polarization (H / V)	Frequency (MHz)	Reading (dBμV)	Preamp Factor (dB)	Antenna Factor (dB/m)	Cable Factor (dB)	Adjusted Reading (dBμV/m)				FCC 15.225		
							Limit (dBμV/m)	Margin (dB)	Result (Pass/Fail)	Limit (dBμV/m)	Margin (dB)	Result (Pass/Fail)
RFID Fundamental			---	---	---	---	---	---	---	---	---	---
Para	13.56	48.3	0.0	10.7	0.3	59.3	---	---	---	124.0	-64.7	Pass
Perp	13.56	45.9	0.0	10.7	0.3	56.9	---	---	---	124.0	-67.1	Pass
Para to Floor	13.56	41.4	0.0	10.7	0.3	52.4	---	---	---	124.0	-71.6	Pass
Table Result: Pass				by -64.7 dB		Worst Freq:				13.56 MHz		
Test Site: EMI Chamber 1		Cable 1: Asset #2681				Cable 2: Asset #2610		Cable 3: ---				
Analyzer: Asset #2093		Preamp: None				Antenna: Asset 2615 Loop		Preselector: ---				
CSsoft Radiated Emissions Calculator v 1.017.225												
Adjusted Reading = Reading - Preamp Factor + Antenna Factor + Cable Factor												
Copyright Curtis-Straus LLC 2000												

Emission mask defined in 15.225 (a)-(d) was not necessary since the maximum 13.56MHz fundamental of 59.3dBuV/m at 3m is below the 15.209 limit of 69.5dBuV/m at 3m. In addition, all radiated spurious emissions were below the 15.209 limits.

4.3 RADIATED SPURIOUS EMISSIONS

4.3.1 LIMITS

Radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emissions limits specified in Section 15.209(a).

FREQUENCIES (MHz)	FIELD STRENGTH (microvolts/meter)	MEASUREMENT DISTANCE (meters)
0.009 ~ 0.490	2400/F(kHz)	300
0.490 ~ 1.705	24000/F(kHz)	30
1.705 ~ 30.0	30	30
30 ~ 88	100	3
88 ~ 216	150	3
216 ~ 960	200	3
Above 960	500	3

NOTE:

- Lower limit applies at the transition frequencies.
- $\text{dB}\mu\text{V/m} = 20 \cdot \log(\mu\text{V/m})$.
- As specified in 15.35(b), for frequencies above 1000MHz, field strength limits are based on the use of measurement instrumentation employing an average detector function. However, there is also a limit on the peak level of the emissions that is 20 dB above the maximum permitted average emission limit.
- Limit conversion below 30MHz is done by using the square of an inverse linear distance extrapolation factor (40 dB/decade) as allowed in FCC 15.31(f)(2).
 $\text{Limit}(3\text{m}) = \text{Limit}(30\text{m}) + 40 \cdot \log(30/3) = \text{Limit}(30\text{m}) + 40$
 $\text{Limit}(3\text{m}) = \text{Limit}(300\text{m}) + 40 \cdot \log(300/3) = \text{Limit}(300\text{m}) + 80$
- RSS-GEN Table 6 H-field limits are 51.5dB lower than FCC 15.209(a) E-field limits. Measurements are performed in terms of magnetic field and converted to electric field using the free space impedance of 377Ω (E-field = H-field +51.5). Therefore resulting pass/fail margin would be the same if an E-field reading is compared to an E-field limit or an H-field reading is compared to an H-field limit.



Test Report for Assa Abloy Inc.
Report No. EW0790-1 Issue 2



4.3.2 TEST EQUIPMENT USED

Test equipment used for test dates: 11/07/2022-11/08/2022

Rev. 12/2/2022

Spectrum Analyzers / Receivers /Preselectors	Range	MN	Mfr	SN	Asset	Cat	Calibration Due	Calibrated on
2093 MXE EMI Receiver	20Hz-26.5GHz	N9038A	Agilent	MY51210181	2093	I	3/7/2023	3/7/2022
-								
Radiated Emissions Sites	FCC Code	IC Code	VCCI Code	Range	Asset	Cat	Calibration Due	Calibrated on
EMI Chamber 2	719150	2762A-7	A-0015	30-1000MHz	1686	I	11/29/2024	11/29/2022
-								
Preamps /Couplers Attenuators / Filters	Range	MN	Mfr	SN	Asset	Cat	Calibration Due	Calibrated on
8447F Rental PA	9KHz-1.3GHz	84477F	HP	3113A05395		II	10/17/2023	10/17/2022
-								
Antennas	Range	MN	Mfr	SN	Asset	Cat	Calibration Due	Calibrated on
Red-Brown Bilog	30-2000MHz	JB1	Sunol	A0032406	1218	I	4/28/2023	4/28/2021
Small Loop	10kHz-30MHz	PLA-130/A	ARA	1024	755	I	9/12/2024	9/12/2022
Large Loop	20Hz-5MHz	6511	EMCO	9704-1154	67	I	8/22/2024	8/22/2022
-								
Meteorological Meters/Chambers		MN	Mfr	SN	Asset	Cat	Calibration Due	Calibrated on
Weather Clock (Pressure Only)		BA928	Oregon Scientific	C3168-1	831	I	11/23/2022	11/23/2020
Asset #2657		1235C97	Control Company	200435389	2657	I	8/18/2025	8/18/2022
-								
Cables	Range		Mfr			Cat	Calibration Due	Calibrated on
Asset #2468	9KHz-18GHz		MegaPhase			II	11/1/2023	11/1/2022
Asset #2610	9KHz-18GHz		Pasternack			II	3/16/2023	3/16/2022
Asset #2682	9KHz-18GHz		Pasternack			II	10/6/2023	10/6/2022

All equipment is calibrated using standards traceable to NIST or other nationally recognized calibration standard.

Test equipment used for test date: 02/06/2023

Rev. 2/3/2023

Spectrum Analyzers / Receivers /Preselectors	Range	MN	Mfr	SN	Asset	Cat	Calibration Due	Calibrated on
2093 MXE EMI Receiver	20Hz-26.5GHz	N9038A	Agilent	MY51210181	2093	I	3/7/2023	3/7/2022
-								
Radiated Emissions Sites	FCC Code	IC Code	VCCI Code	Range	Asset	Cat	Calibration Due	Calibrated on
EMI Chamber 1	719150	2762A-6	A-0015	30-1000MHz	1685	I	11/29/2024	11/29/2022
-								
Antennas	Range	MN	Mfr	SN	Asset	Cat	Calibration Due	Calibrated on
2615 Active Loop Antenna	9KHz-30MHz	6502	EMCO	2049	2615	I	1/18/2025	1/18/2023
Red-White Bilog	30-2000MHz	JB1	Sunol	A091604-1	1105	I	10/25/2023	11/25/2021
-								
Meteorological Meters/Chambers		MN	Mfr	SN	Asset	Cat	Calibration Due	Calibrated on
Asset 2707		SD700	EXTECH	A.115171	2707	I	1/13/2025	1/13/2023
-								
Cables	Range		Mfr			Cat	Calibration Due	Calibrated on
Asset #2610	9KHz-18GHz		Pasternack			II	3/16/2023	3/16/2022
Asset #2681	9KHz-18GHz		Pasternack			II	12/13/2023	12/13/2022
Asset #2474	9KHz-18GHz		MegaPhase			II	11/1/2023	11/1/2022
-								
Preamps /Couplers Attenuators / Filters	Range	MN	Mfr	SN	Asset	Cat	Calibration Due	Calibrated on
8447F Rental PA	9KHz-1.3GHz	84477F	HP	3113A05395		II	10/17/2023	10/17/2022

All equipment is calibrated using standards traceable to NIST or other nationally recognized calibration standard.

4.3.3 TEST PROCEDURES

- a. The EUT was placed on the top of a rotating table 1.5 meters (above 1GHz) and 0.8 meters (below 1GHz) above the ground at a 3 meters semi-anechoic chamber.
- b. For below 30MHz, a loop antenna with its lowest point 1m above the ground was placed 3m away from the EUT and it was rotated 0 and 90 degrees around its vertical axis.
- c. In 30MHz-1GHz range, a BiConiLog antenna was mounted on a variable-height antenna tower and placed 3m away from the EUT. Antenna height was varied from 1 meter to 4 meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna were investigated. The table was rotated 360 degrees to determine the position of the highest radiation.
- d. For battery operated equipment, tests were performed using fresh batteries.
- e. Following bandwidths were used during emissions testing:

Freq. (MHz)	RBW	VBW	Pre-scan	Final
0.009-0.15	200Hz	1kHz	Peak	Quasi Peak
0.15-30	9kHz	30kHz	Peak	Quasi Peak
30-1000	120kHz	300kHz	Peak	Quasi Peak

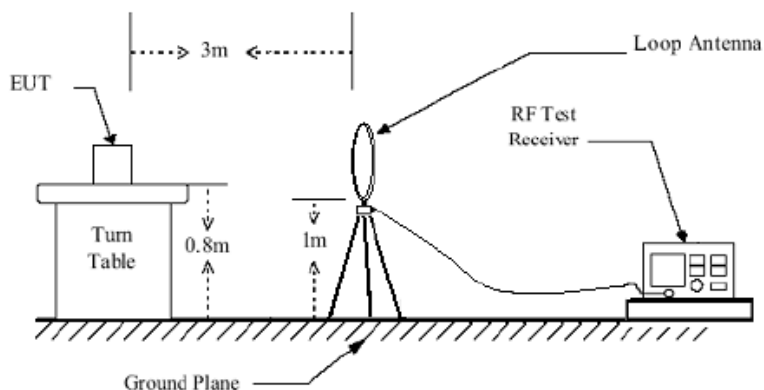
If peak measurements were below the applicable limit, QPk measurements were not performed.

4.3.4 DEVIATIONS

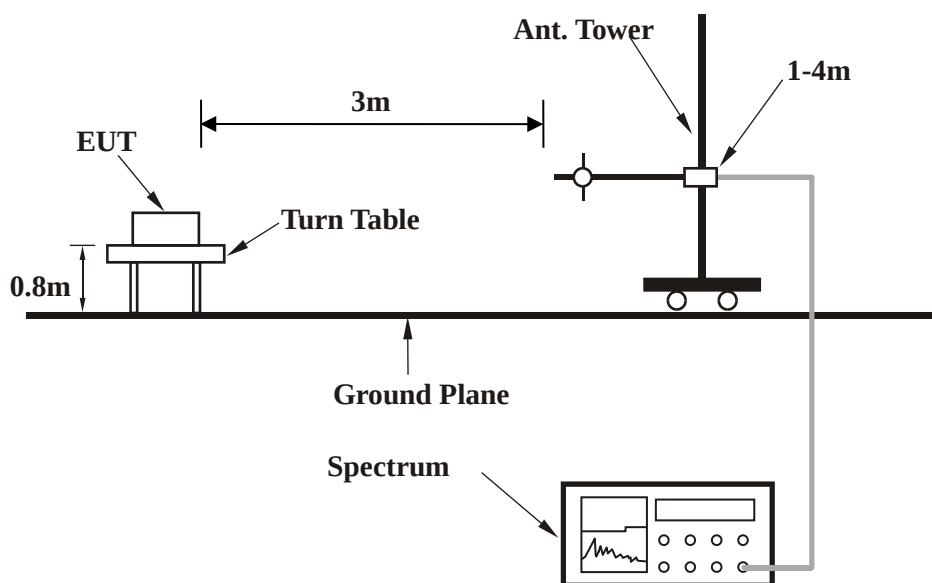
No deviations from the standard.

4.3.5 TEST SETUP

Below 30MHz Test Setup



30MHz - 1GHz Test Setup



Note: For the actual test configuration, please refer to the Test Setup Photos exhibit.

4.3.6 EUT OPERATING CONDITIONS

EUT was operated according to the manufacturer's specifications.



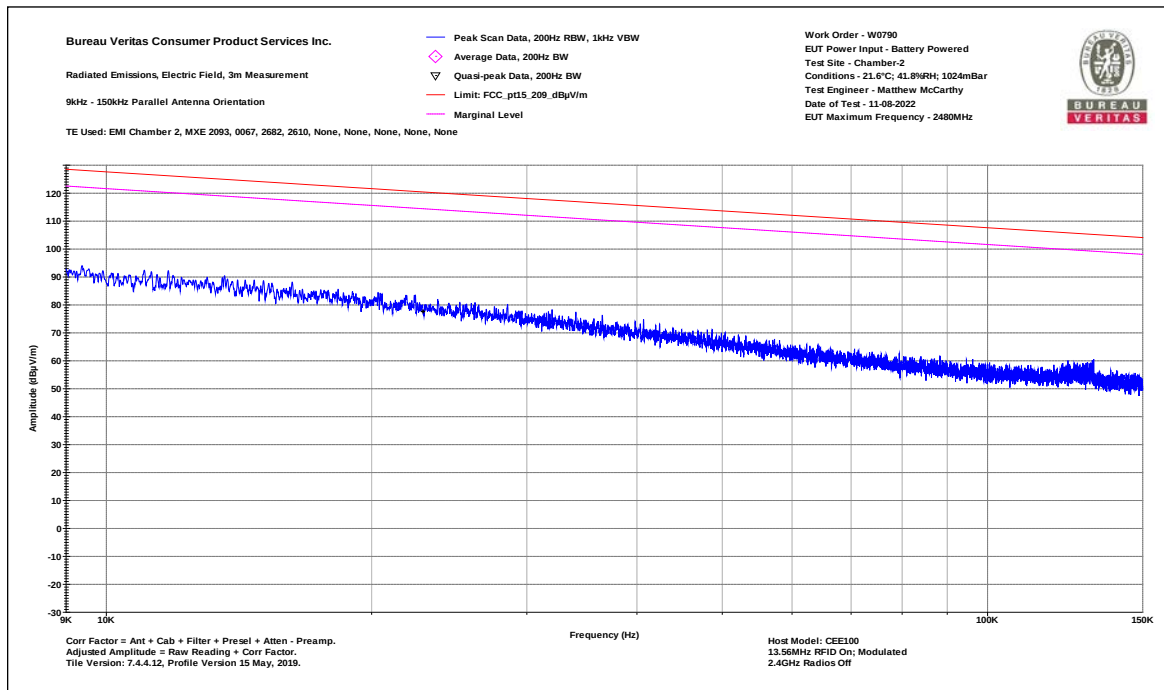
Test Report for Assa Abloy Inc.
Report No. EW0790-1 Issue 2



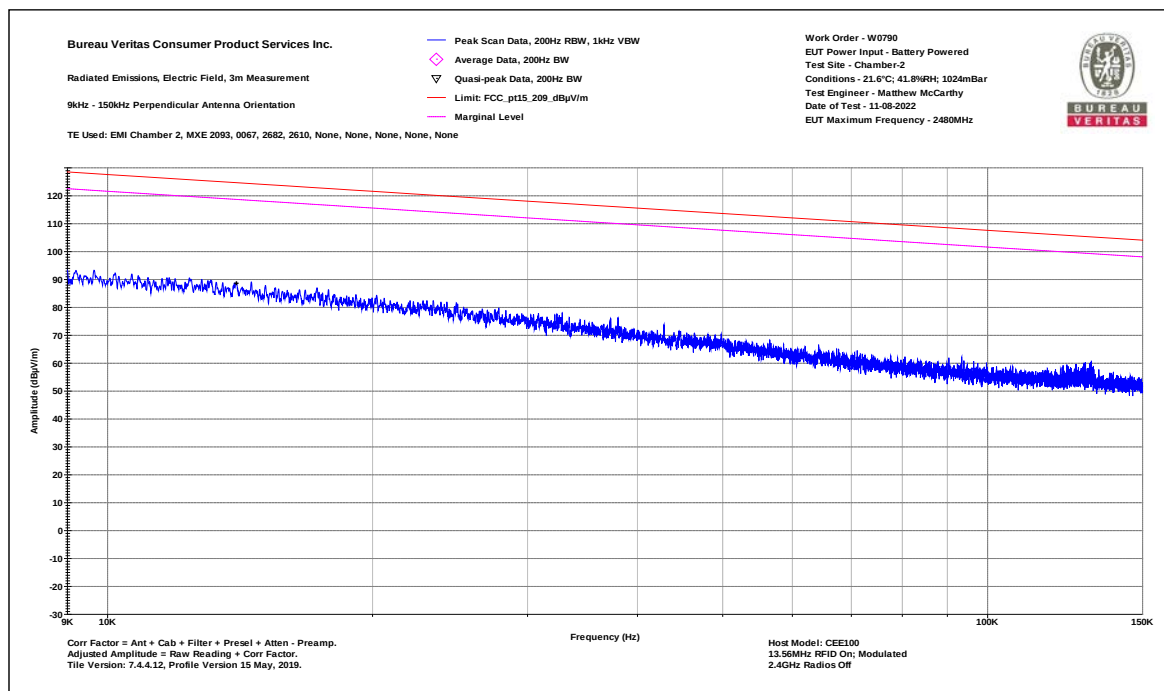
4.3.7 TEST RESULTS

Host Model CEE100

No emissions within 10dB of the limit were identified in 9kHz-30MHz range other than the fundamental. Only plots shown below.



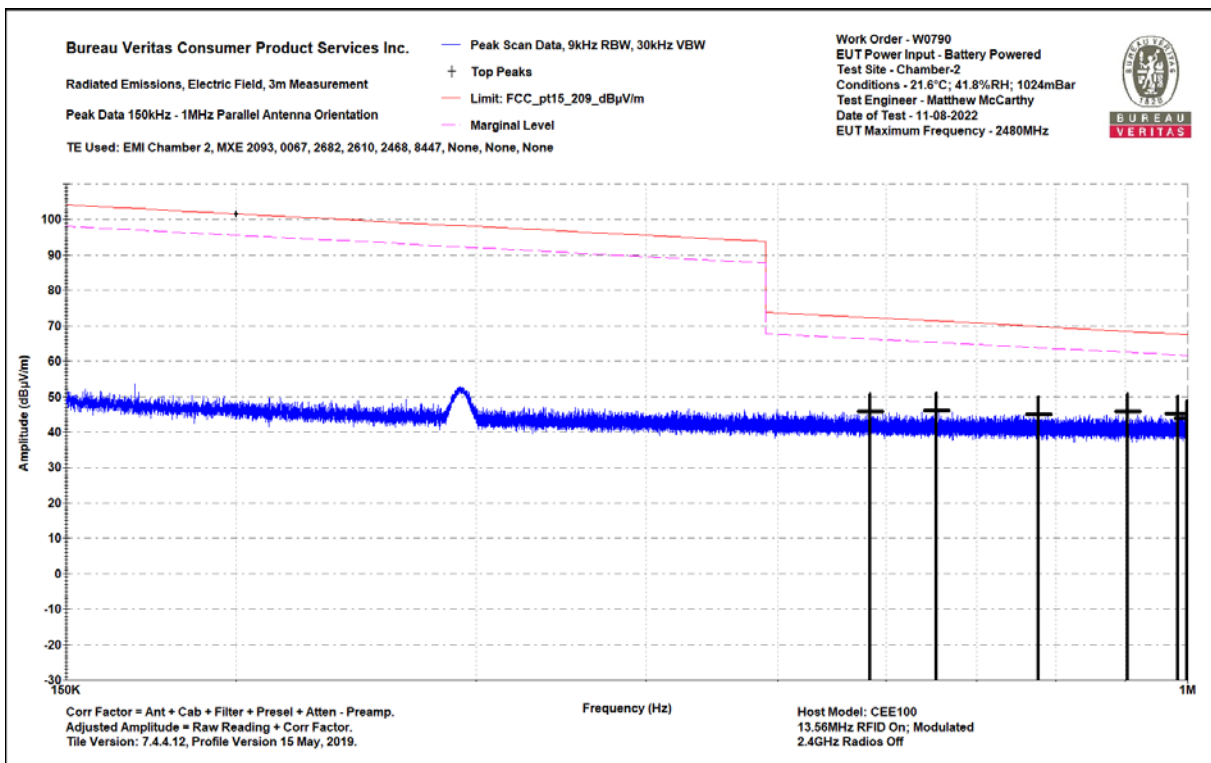
0.009-0.15MHz Parallel



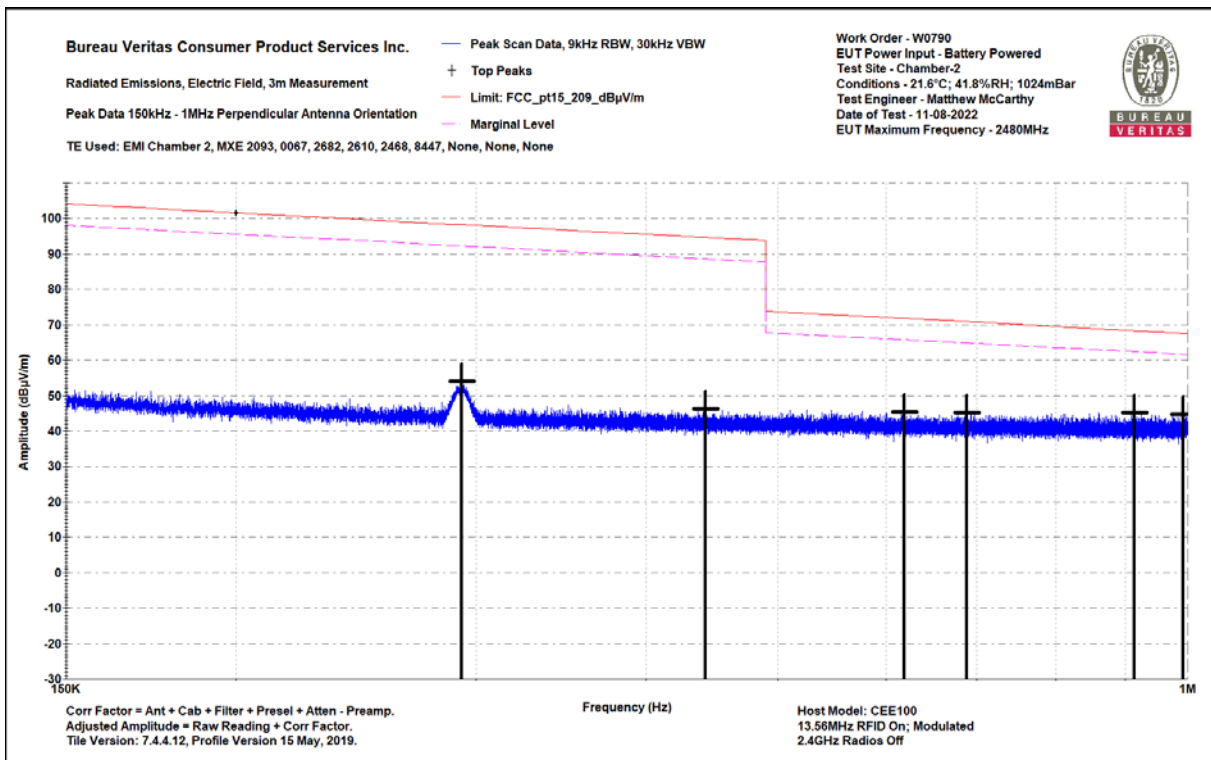
0.009-0.15MHz Perpendicular



Test Report for Assa Abloy Inc.
Report No. EW0790-1 Issue 2



0.15-1MHz Parallel

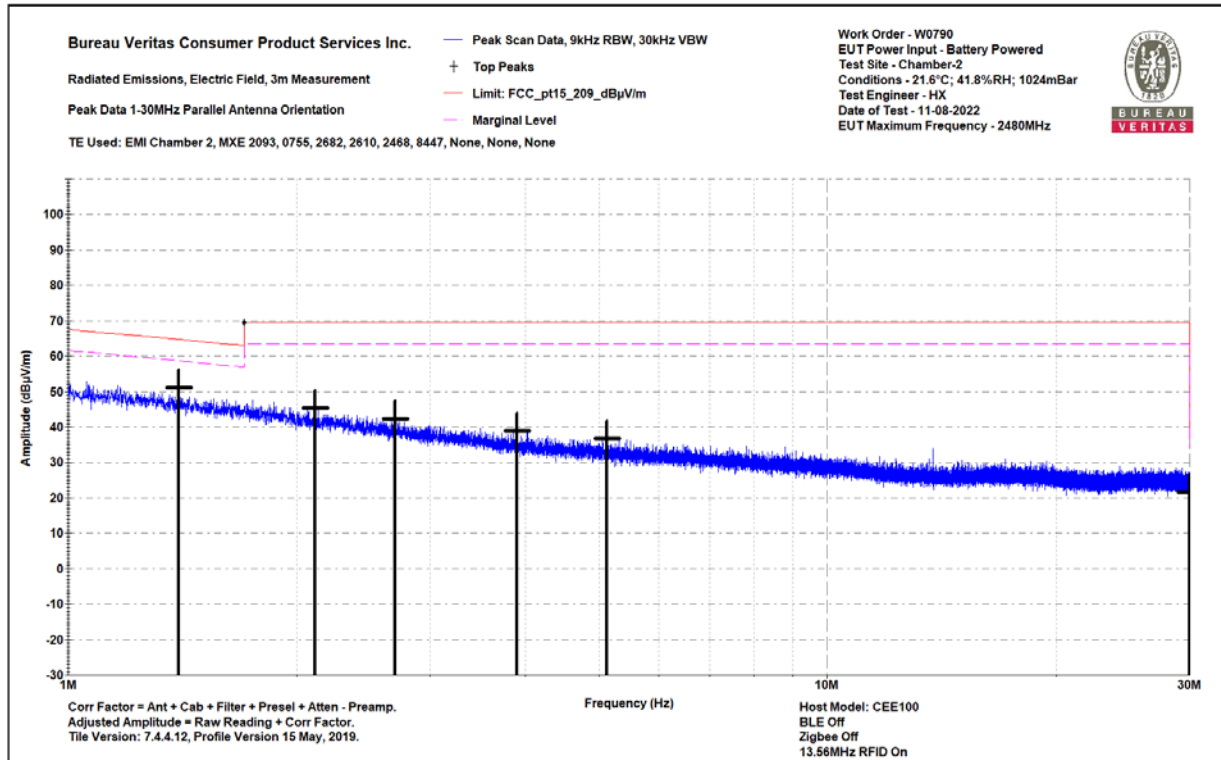


0.15-1MHz Perpendicular

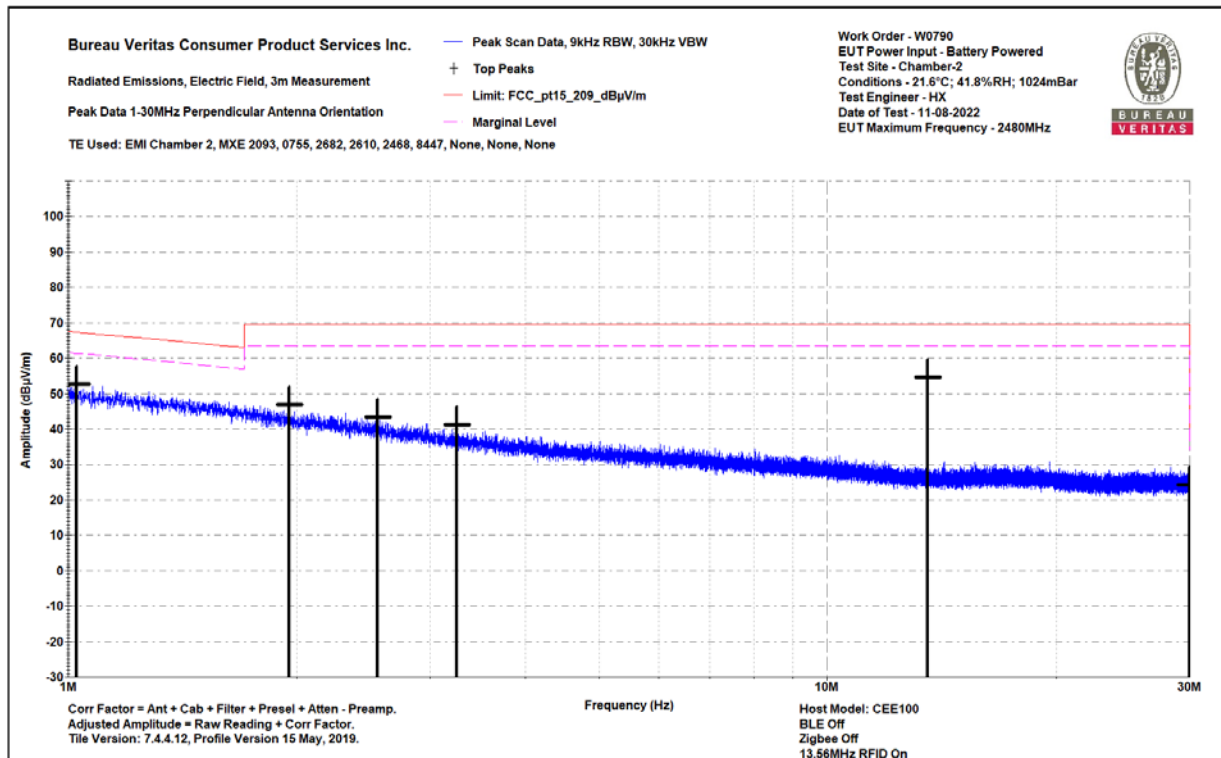


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Test Report for Assa Abloy Inc. Report No. EW0790-1 Issue 2



1-30MHz Parallel



1-30MHz Perpendicular

Bureau Veritas Consumer Product
Services Inc.

One Distribution Center Circle, #1
Littleton, MA

Tel.: (978) 486-8880
Fax: (978) 486-8828



Test Report for Assa Abloy Inc. Report No. EW0790-1 Issue 2

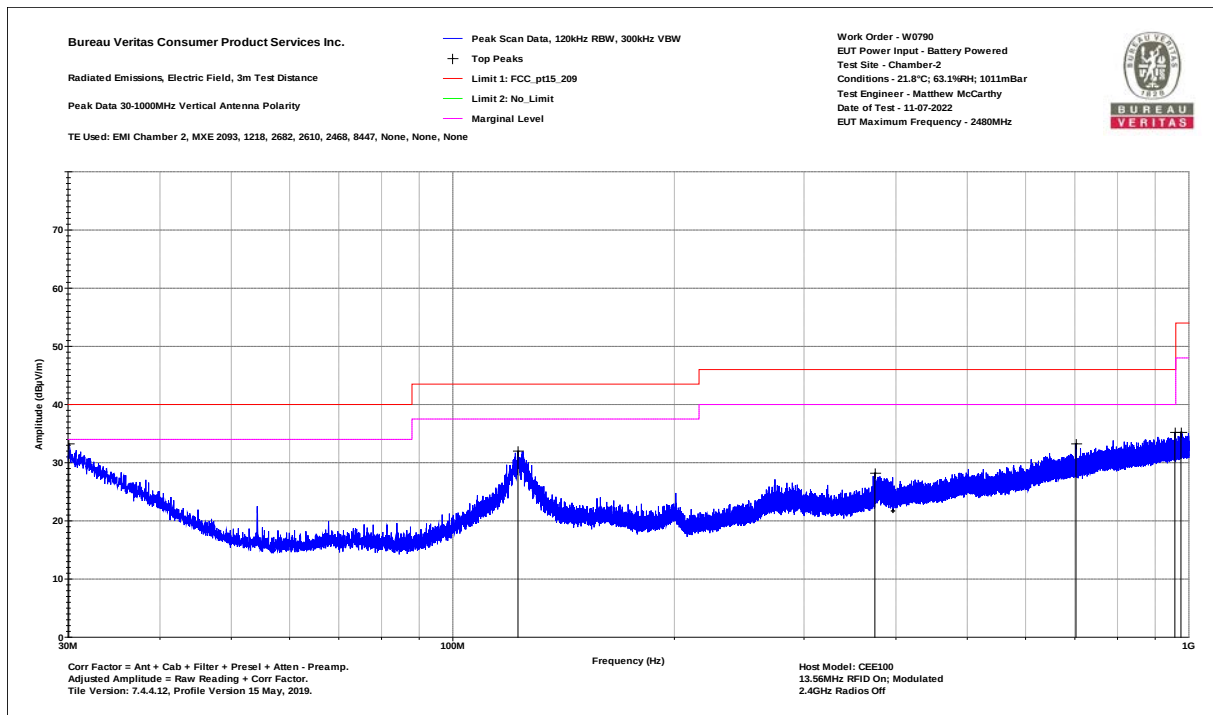


Bureau Veritas Consumer Product Services Inc.
Radiated Emissions Electric Field 3m Distance
Top Peaks Vertical 30-1000MHz
Notes:
Host Model: CEE100
13.56MHz RFID On; Modulated
2.4GHz Radios Off

Work Order - W0790
EUT Power Input - Battery Powered
Test Site - Chamber-2
Conditions - 21.8°C; 63.1%RH; 1011mBar
Test Engineer - Matthew McCarthy
Date of Test - 11-07-2022

Frequency (MHz)	Peak Reading (dBµV)	Correction Factor (dB/m)	Adjusted Peak Amplitude (dBµV/m)	Lim1: FCC_pt15_20 9 (dBµV/m)	Lim1 Margin (dB)	Lim1 Test Results (Pass/Fail)	Worst Margin Lim1 (dB)	Antenna Height (cm)	Turntable Azimuth (degrees)
30.073	31.2	2	33.2	40	-6.8	PASS	-6.8	250	2
122.587	37.1	-5.1	32	43.5	-11.5	PASS		150	270
374.447	31.4	-3.2	28.2	46	-17.8	PASS		150	45
702.549	31.1	2.2	33.3	46	-12.7	PASS		250	90
957.174	28.9	6.3	35.2	46	-10.8	PASS		200	225
975.605	28.7	6.6	35.2	54	-18.8	PASS		200	315

30-1000MHz Vertical Data Table



30-1000MHz Vertical Plot



Test Report for Assa Abloy Inc. Report No. EW0790-1 Issue 2

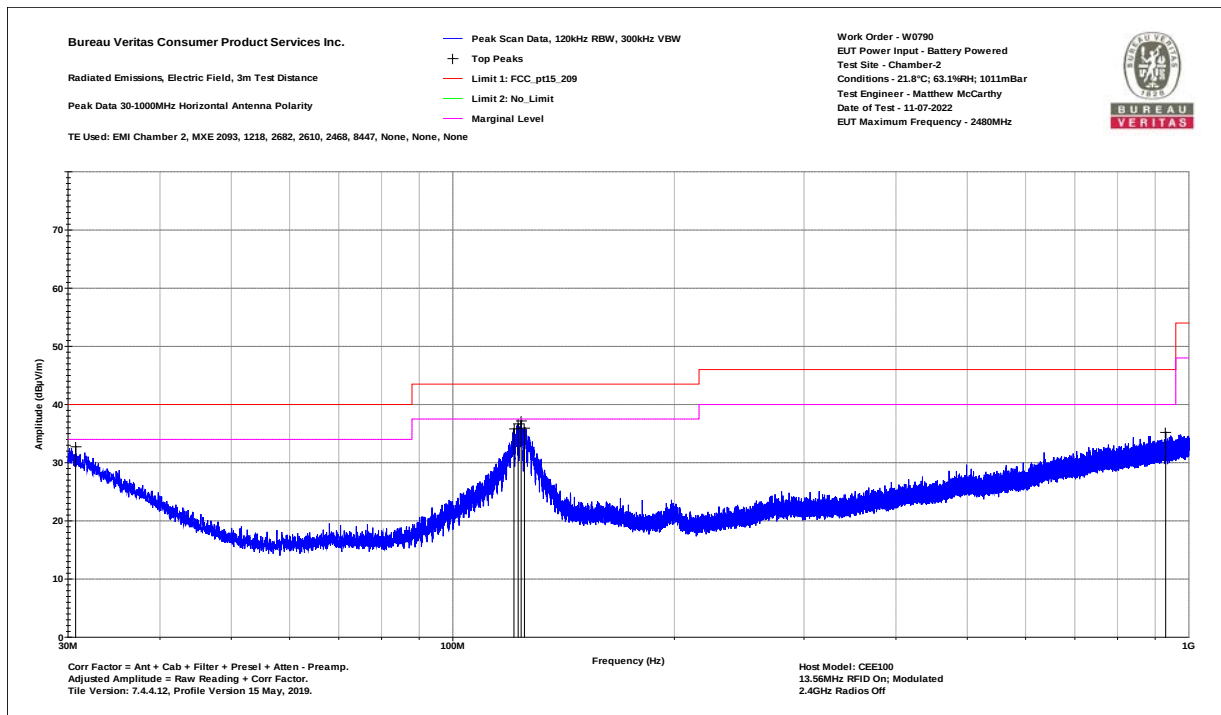


Bureau Veritas Consumer Product Services Inc.
Radiated Emissions Electric Field 3m Distance
Top Peaks Horizontal 30-1000MHz
Notes:
Host Model: CEE100
13.56MHz RFID On; Modulated
2.4GHz Radios Off

Work Order - W0790
EUT Power Input - Battery Powered
Test Site - Chamber-2
Conditions - 21.8°C; 63.1%RH; 1011mBar
Test Engineer - Matthew McCarthy
Date of Test - 11-07-2022

Frequency (MHz)	Peak Reading (dBµV)	Correction Factor (dB/m)	Adjusted Peak Amplitude (dBµV/m)	Lim1: FCC_pt15_209 (dBµV/m)	Lim1 Margin (dB)	Lim1 Test Results (Pass/Fail)	Worst Margin Lim1 (dB)	Antenna Height (cm)	EUT Azimuth (degrees)
30.727	31.4	1.4	32.8	40	-7.2	PASS		250	90
121.083	41	-5.2	35.8	43.5	-7.7	PASS		250	135
122.683	41.8	-5.1	36.6	43.5	-6.9	PASS		250	135
123.823	42.3	-5.1	37.2	43.5	-6.3	PASS	-6.3	250	315
125.109	41	-5	36	43.5	-7.5	PASS		250	180
930.063	29.3	5.9	35.2	46	-10.8	PASS		200	180

30-1000MHz Horizontal Data Table



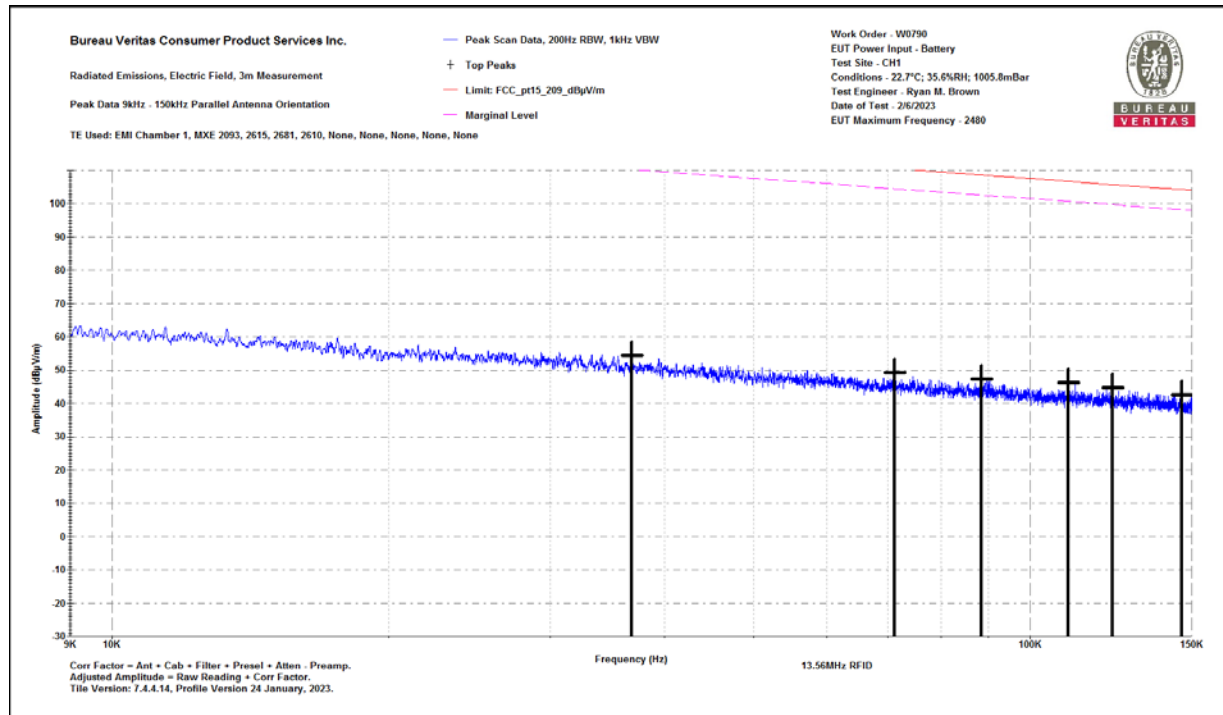
30-1000MHz Horizontal Plot



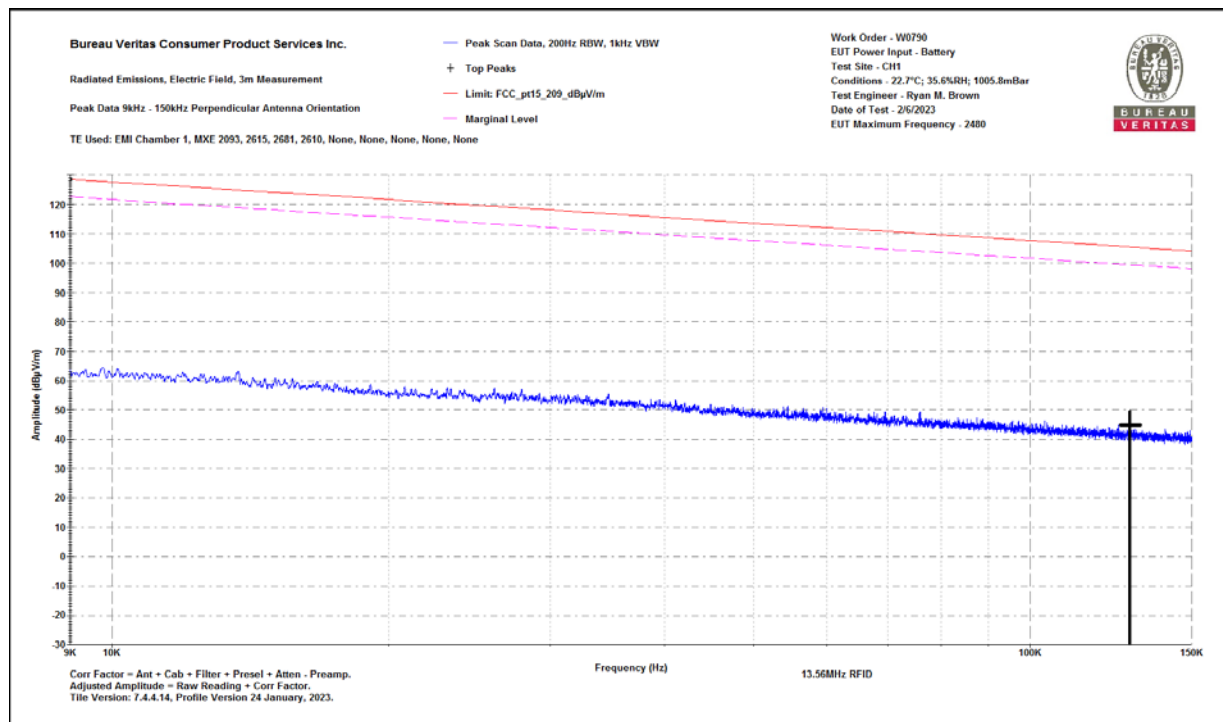
Test Report for Assa Abloy Inc. Report No. EW0790-1 Issue 2



Host Model CEB100



0.009-0.15MHz Parallel



0.009-0.15MHz Perpendicular

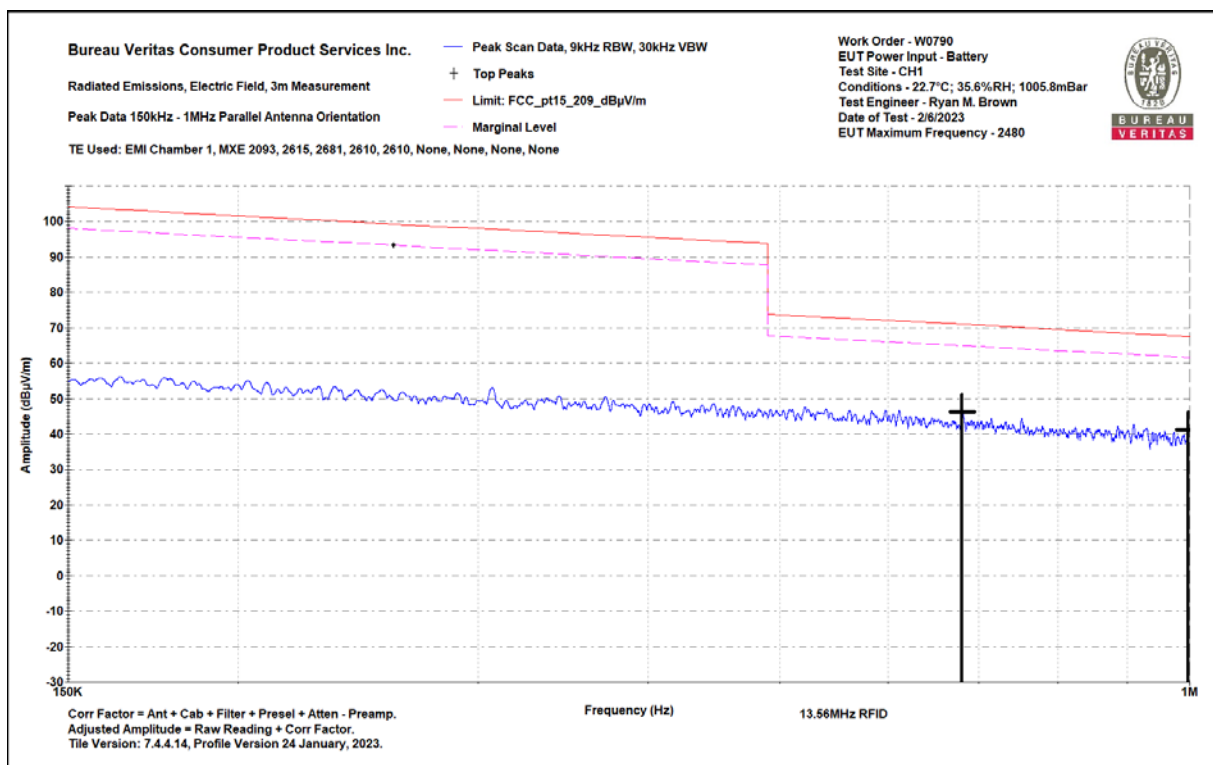
Bureau Veritas Consumer Product
Services Inc.

One Distribution Center Circle, #1
Littleton, MA

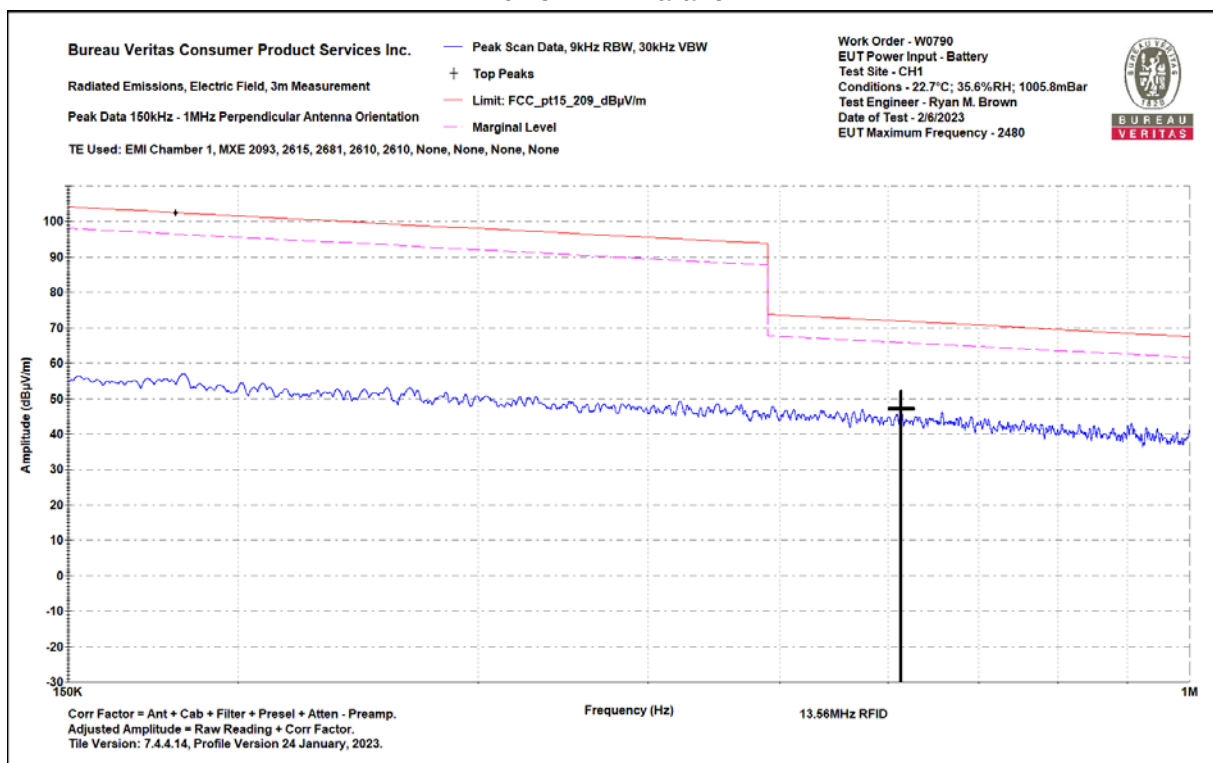
Tel.: (978) 486-8880
Fax: (978) 486-8828



Test Report for Assa Abloy Inc.
Report No. EW0790-1 Issue 2



0.15-1MHz Parallel



0.15-1MHz Perpendicular



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Test Report for Assa Abloy Inc. Report No. EW0790-1 Issue 2



Bureau Veritas Consumer Product Services Inc.

Radiated Emissions, Electric Field, 3m Measurement

Peak Data 1-30MHz Parallel Antenna Orientation

TE Used: EMI Chamber 1, MXE 2093, 2615, 2681, 2610, None, None, None, None

Peak Scan Data, 9kHz RBW, 30kHz VBW

+ Top Peaks

Limit: FCC_pt15_209_dBμV/m

Marginal Level

Work Order - W0790

EUT Power Input - Battery

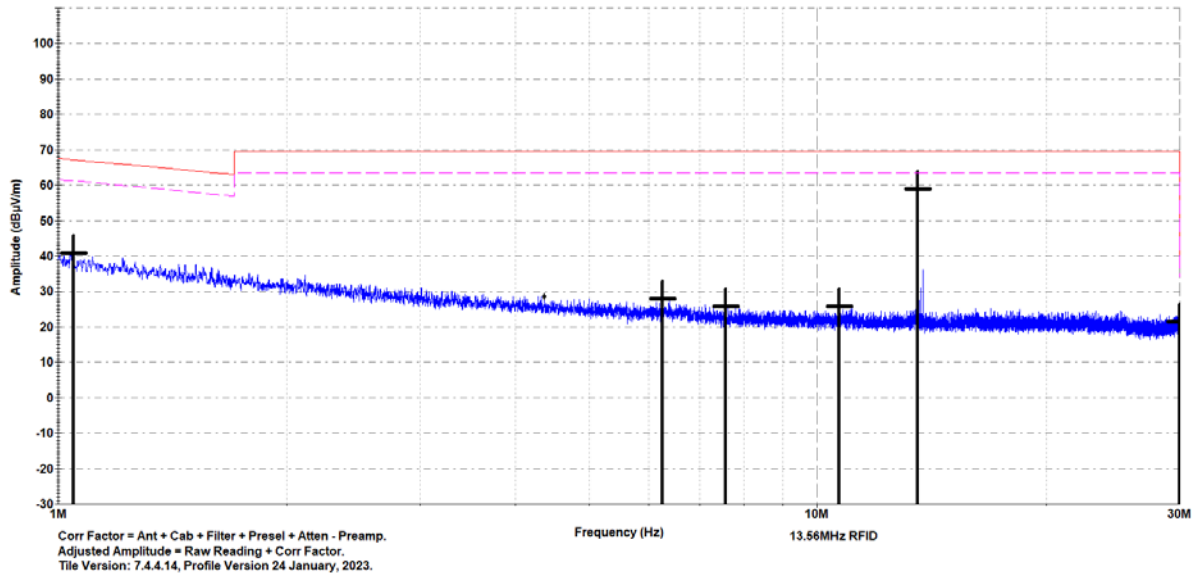
Test Site - CH1

Conditions - 22.7°C; 35.6%RH; 1005.8mBar

Test Engineer - Ryan M. Brown

Date of Test - 2/6/2023

EUT Maximum Frequency - 2480



1-30MHz Parallel

Bureau Veritas Consumer Product Services Inc.

Radiated Emissions, Electric Field, 3m Measurement

Peak Data 1-30MHz Perpendicular Antenna Orientation

TE Used: EMI Chamber 1, MXE 2093, 2615, 2681, 2610, None, None, None, None

Peak Scan Data, 9kHz RBW, 30kHz VBW

+ Top Peaks

Limit: FCC_pt15_209_dBμV/m

Marginal Level

Work Order - W0790

EUT Power Input - Battery

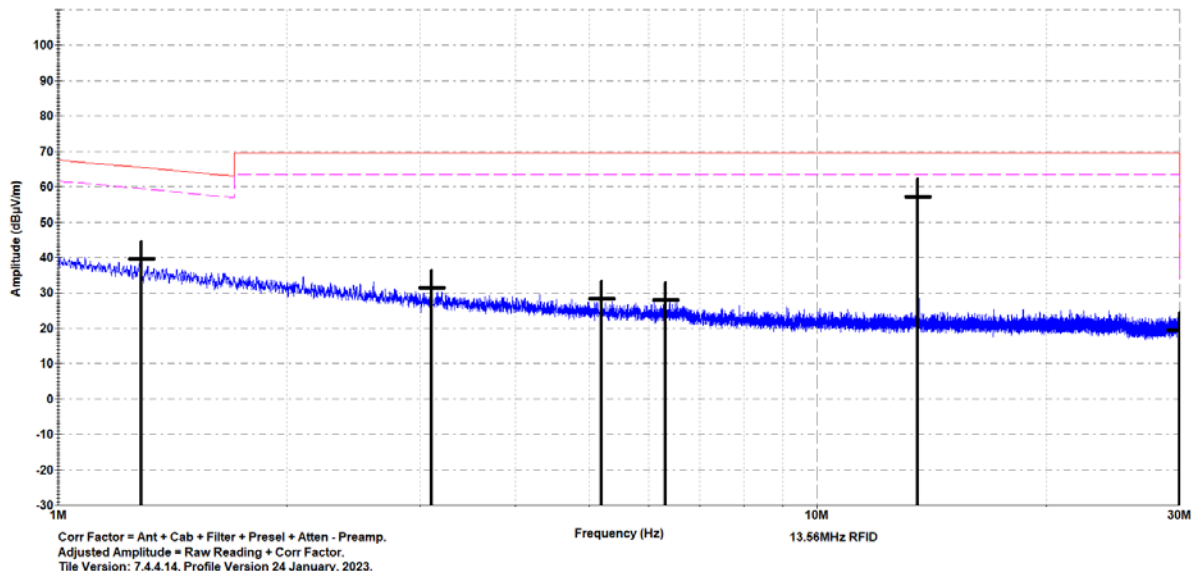
Test Site - CH1

Conditions - 22.7°C; 35.6%RH; 1005.8mBar

Test Engineer - Ryan M. Brown

Date of Test - 2/6/2023

EUT Maximum Frequency - 2480



1-30MHz Perpendicular

Bureau Veritas Consumer Product
Services Inc.

One Distribution Center Circle, #1
Littleton, MA

Tel.: (978) 486-8880
Fax: (978) 486-8828



Test Report for Assa Abloy Inc.
Report No. EW0790-1 Issue 2

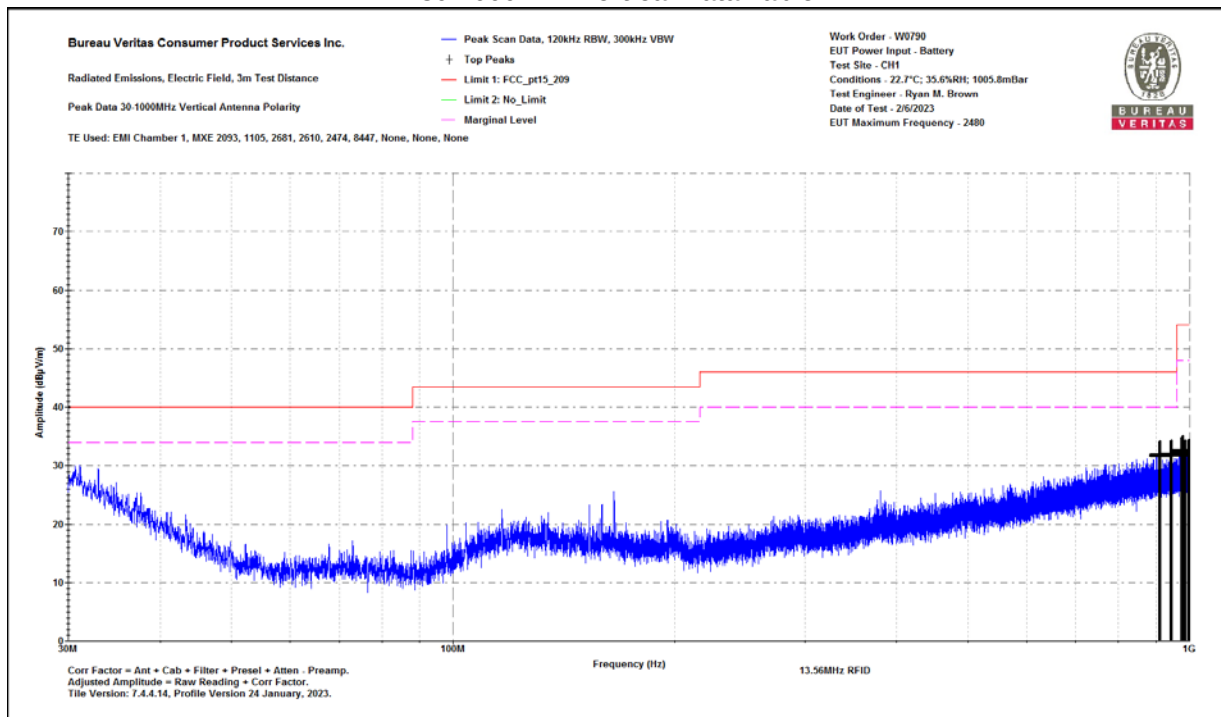


Bureau Veritas Consumer Product Services Inc.
Radiated Emissions Electric Field 3m Distance
Top Peaks Vertical 30-1000MHz
Notes:
13.56MHz RFID
0

Work Order - W0790
EUT Power Input - Battery
Test Site - CH1
Conditions - 22.7°C; 35.6%RH; 1005.8mBar
Test Engineer - Ryan M. Brown
Date of Test - 2/6/2023

Frequency (MHz)	Peak Reading (dBμV)	Correction Factor (dB/m)	Adjusted Peak Amplitude (dBμV/m)	Lim1: FCC_pt15_20 9 (dBμV/m)	Lim1 Margin (dB)	Lim1 Test Results (Pass/Fail)	Worst Margin Lim1 (dB)	Antenna Height (cm)	Turntable Azimuth (degrees)
911.56	28.2	3.6	31.8	46	-14.2	PASS		200	0
943.425	27.7	4.1	31.8	46	-14.2	PASS	-14.2	100	90
976.477	28.1	4.5	32.5	54	-21.5	PASS		200	45
979.509	28	4.6	32.6	54	-21.4	PASS		100	90
986.25	27.1	4.8	31.9	54	-22.1	PASS		100	225
997.405	27	5	32.1	54	-21.9	PASS		200	180

30-1000MHz Vertical Data Table



30-1000MHz Vertical Plot



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Test Report for Assa Abloy Inc. Report No. EW0790-1 Issue 2



Bureau Veritas Consumer Product Services Inc.

Radiated Emissions Electric Field 3m Distance

Top Peaks Horizontal 30-1000MHz

Notes:

13.56MHz RFID

0

Work Order - W0790

EUT Power Input - Battery

Test Site - CH1

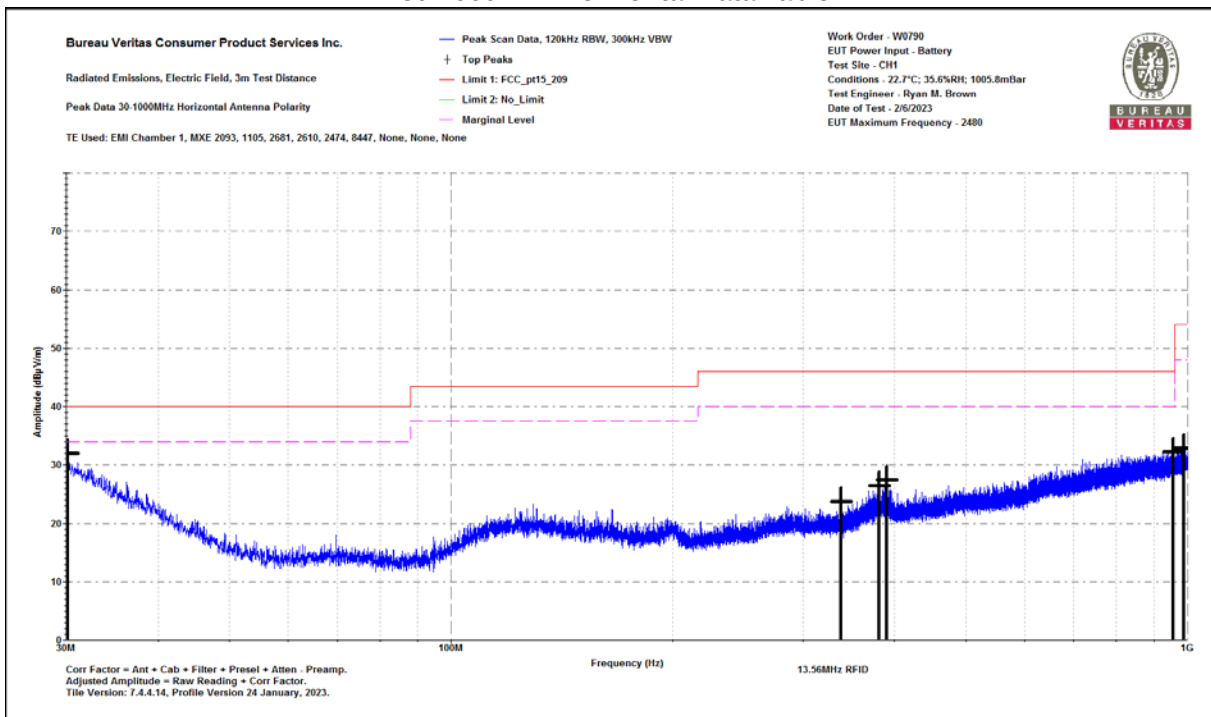
Conditions - 22.7°C; 35.6%RH; 1005.8mBar

Test Engineer - Ryan M. Brown

Date of Test - 2/6/2023

Frequency (MHz)	Peak Reading (dBμV)	Correction Factor (dB/m)	Adjusted Peak Amplitude (dBμV/m)	Lim1: FCC_pt15_20 9 (dBμV/m)	Lim1 Margin (dB)	Lim1 Test Results (Pass/Fail)	Worst Margin Lim1 (dB)	Antenna Height (cm)	EUT Azimuth (degrees)
30.17	31.6	0.4	32	40	-8	PASS	-8	150	270
338.12	29.6	-5.8	23.8	46	-22.2	PASS		100	270
381.164	31.4	-5	26.5	46	-19.5	PASS		250	90
389.894	32.4	-4.9	27.5	46	-18.5	PASS		200	315
956.059	28	4.3	32.3	46	-13.7	PASS		250	135
987.56	28.1	4.8	32.9	54	-21.1	PASS		100	45

30-1000MHz Horizontal Data Table



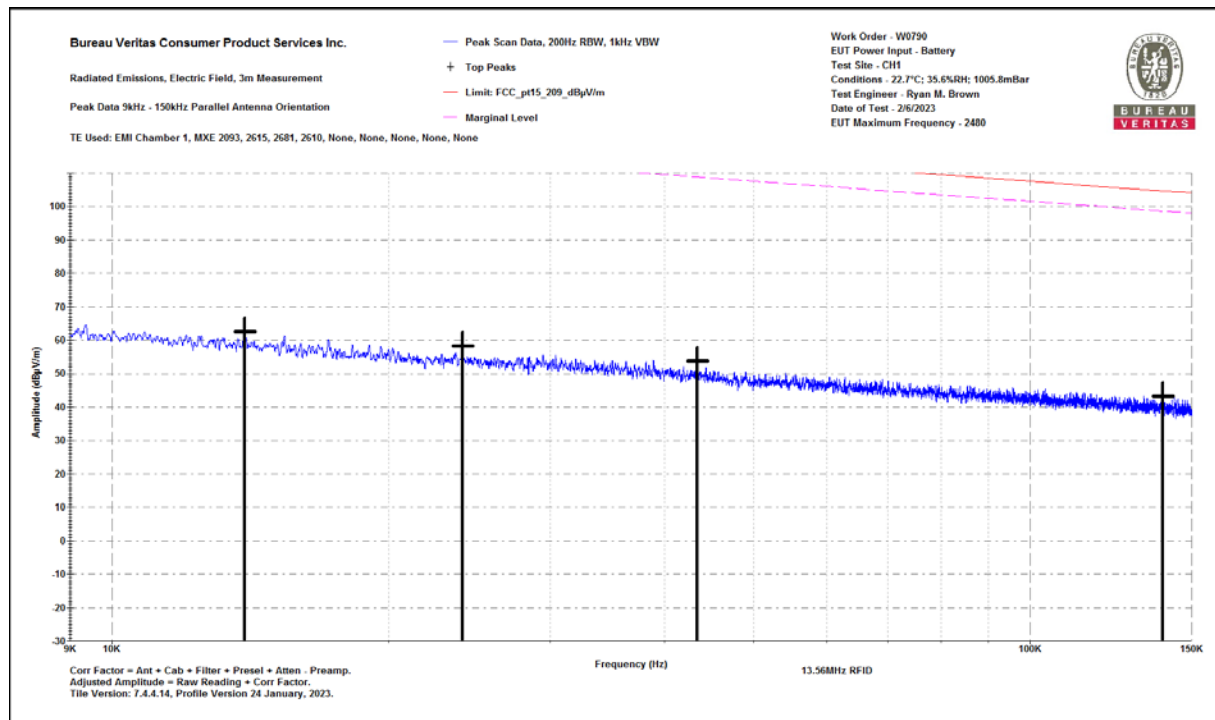
30-1000MHz Horizontal Plot

Bureau Veritas Consumer Product
Services Inc.

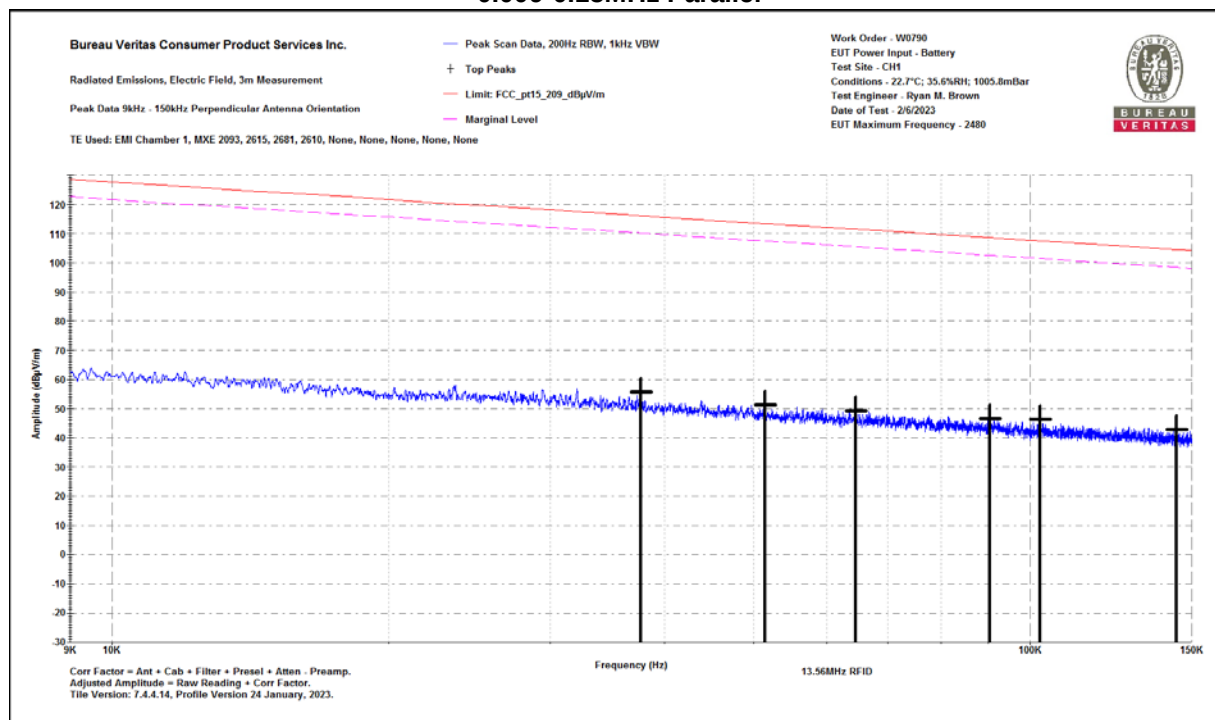
One Distribution Center Circle, #1
Littleton, MA

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Fax: (978) 486-8828

Host Model CEM100



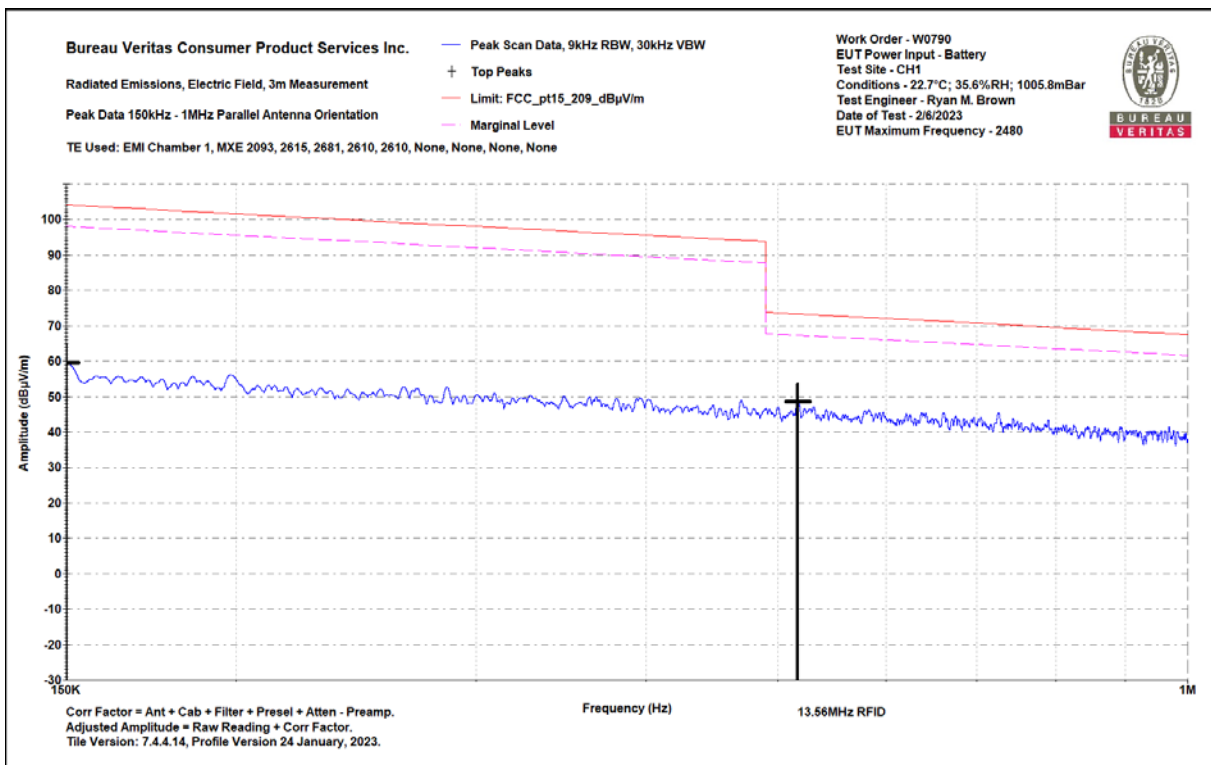
0.009-0.15MHz Parallel



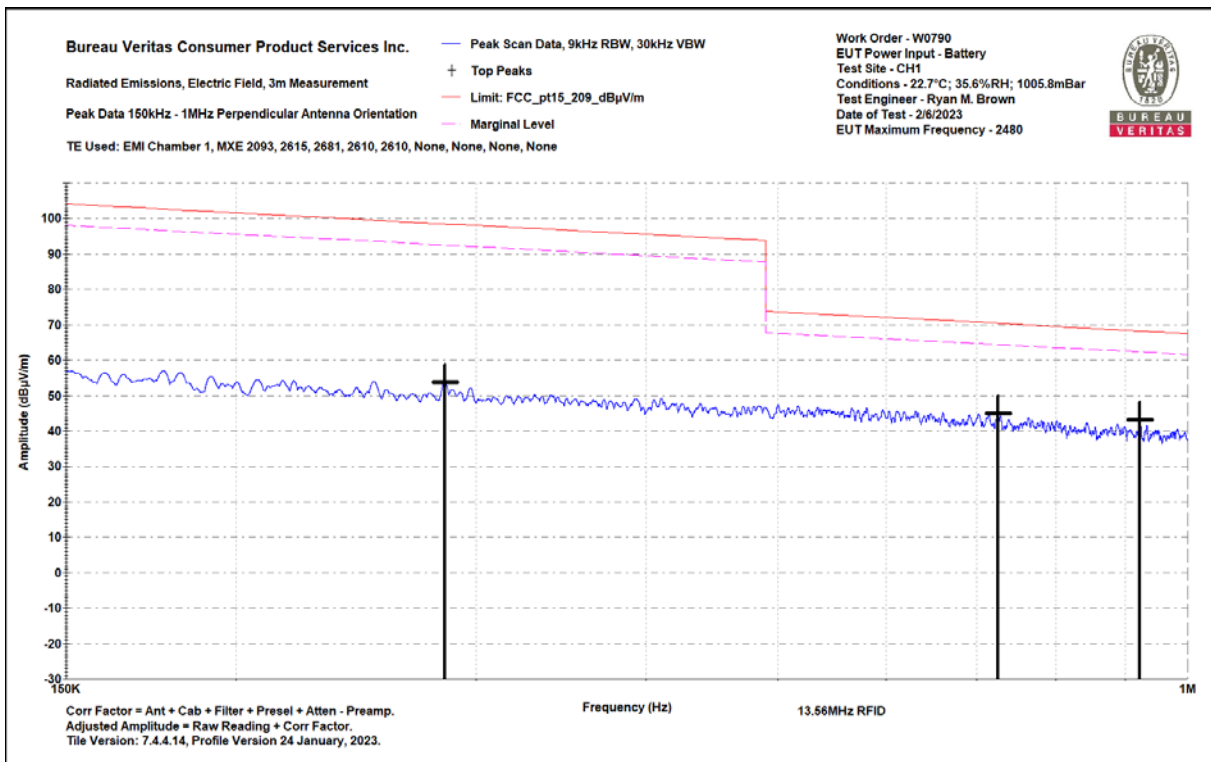
0.009-0.15MHz Perpendicular



Test Report for Assa Abloy Inc.
Report No. EW0790-1 Issue 2



0.15-1MHz Parallel



0.15-1MHz Perpendicular



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Test Report for Assa Abloy Inc. Report No. EW0790-1 Issue 2



Bureau Veritas Consumer Product Services Inc.

Radiated Emissions, Electric Field, 3m Measurement

Peak Data 1-30MHz Parallel Antenna Orientation

TE Used: EMI Chamber 1, MXE 2093, 2615, 2681, 2610, None, None, None, None, None

Peak Scan Data, 9kHz RBW, 30kHz VBW

+ Top Peaks

Limit: FCC_pt15_209_dBμV/m

Marginal Level

Work Order - W0790

EUT Power Input - Battery

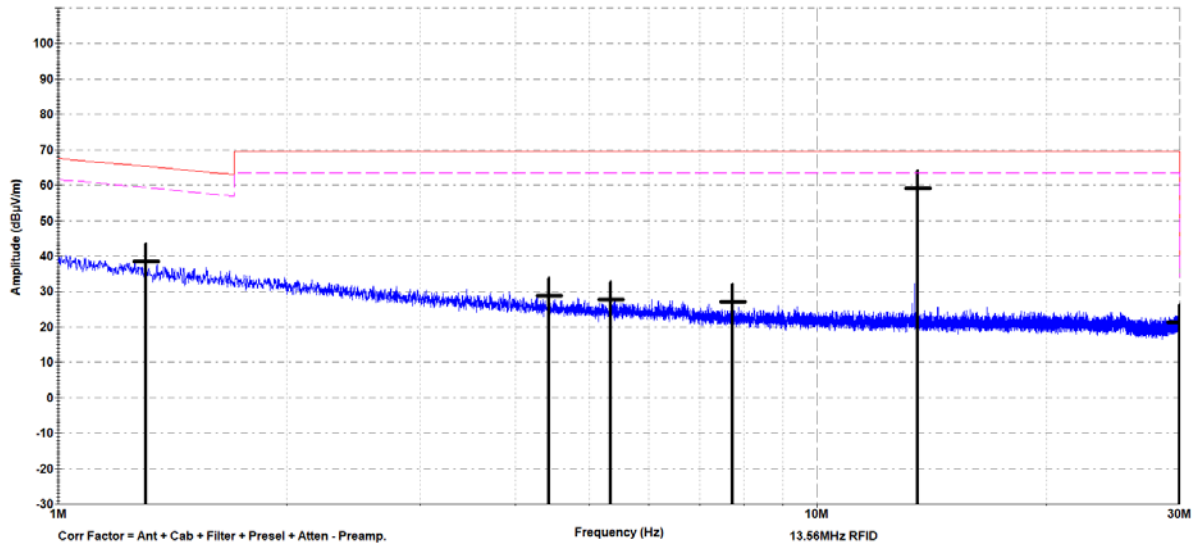
Test Site - CH1

Conditions - 22.7°C; 35.6%RH; 1005.8mBar

Test Engineer - Ryan M. Brown

Date of Test - 2/6/2023

EUT Maximum Frequency - 2480



1-30MHz Parallel

Bureau Veritas Consumer Product Services Inc.

Radiated Emissions, Electric Field, 3m Measurement

Peak Data 1-30MHz Perpendicular Antenna Orientation

TE Used: EMI Chamber 1, MXE 2093, 2615, 2681, 2610, None, None, None, None, None

Peak Scan Data, 9kHz RBW, 30kHz VBW

+ Top Peaks

Limit: FCC_pt15_209_dBμV/m

Marginal Level

Work Order - W0790

EUT Power Input - Battery

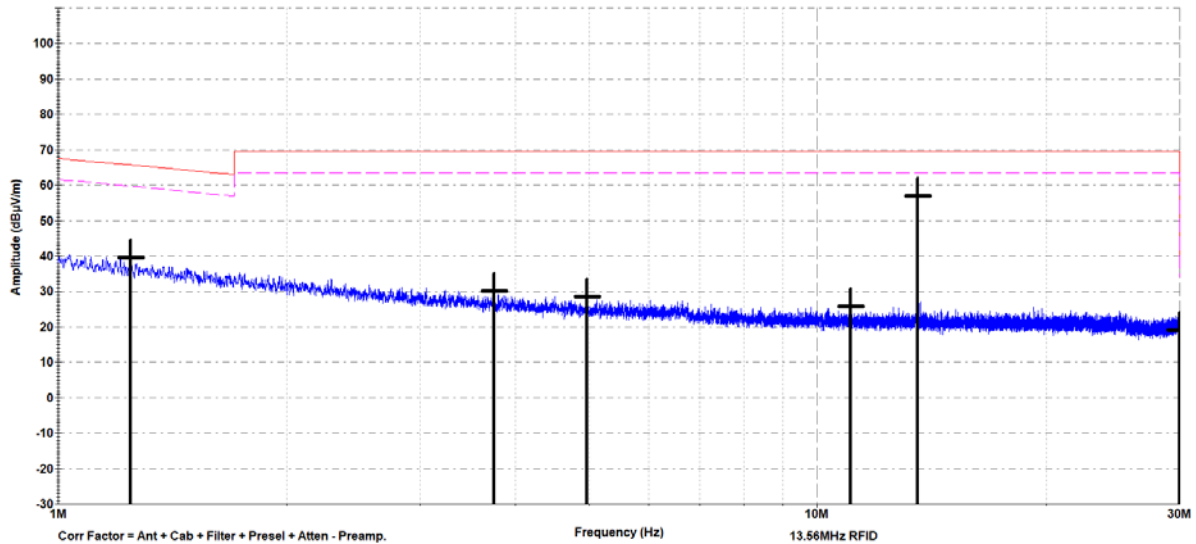
Test Site - CH1

Conditions - 22.7°C; 35.6%RH; 1005.8mBar

Test Engineer - Ryan M. Brown

Date of Test - 2/6/2023

EUT Maximum Frequency - 2480



1-30MHz Perpendicular

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Test Report for Assa Abloy Inc. Report No. EW0790-1 Issue 2

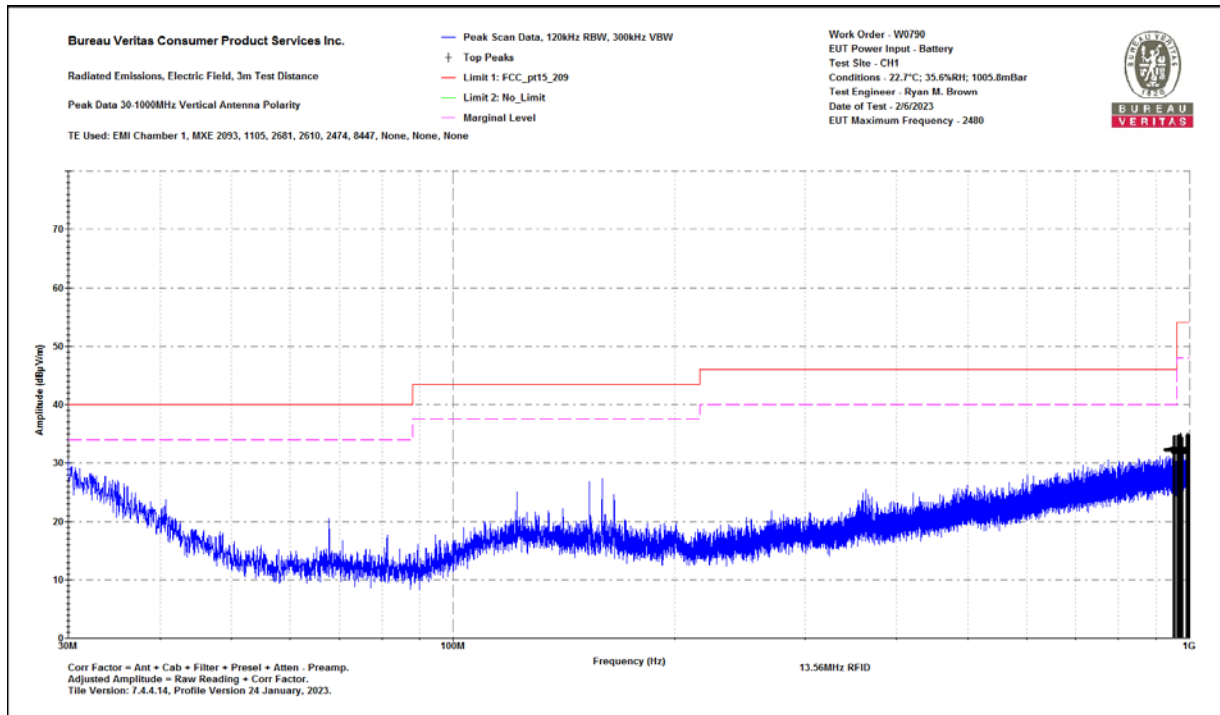


Bureau Veritas Consumer Product Services Inc.
Radiated Emissions Electric Field 3m Distance
Top Peaks Vertical 30-1000MHz
Notes:
13.56MHz RFID
0

Work Order - W0790
EUT Power Input - Battery
Test Site - CH1
Conditions - 22.7°C; 35.6%RH; 1005.8mBar
Test Engineer - Ryan M. Brown
Date of Test - 2/6/2023

Frequency (MHz)	Peak Reading (dBμV)	Correction Factor (dB/m)	Adjusted Peak Amplitude (dBμV/m)	Lim1: FCC_pt15_20 9 (dBμV/m)	Lim1 Margin (dB)	Lim1 Test Results (Pass/Fail)	Worst Margin Lim1 (dB)	Antenna Height (cm)	Turntable Azimuth (degrees)
953.876	28	4.3	32.3	46	-13.7	PASS	-13.7	100	315
965.032	28.1	4.3	32.4	54	-21.6	PASS		150	135
972.767	28	4.4	32.5	54	-21.5	PASS		100	90
975.41	27.4	4.5	31.9	54	-22.1	PASS		250	270
993.307	27.5	5	32.5	54	-21.5	PASS		200	135
998.666	27.4	5	32.3	54	-21.7	PASS		250	270

30-1000MHz Vertical Data Table



30-1000MHz Vertical Plot

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Test Report for Assa Abloy Inc.
Report No. EW0790-1 Issue 2



Bureau Veritas Consumer Product Services Inc.
Radiated Emissions Electric Field 3m Distance
Top Peaks Horizontal 30-1000MHz

Work Order - W0790
EUT Power Input - Battery
Test Site - CH1
Conditions - 22.7°C; 35.6%RH; 1005.8mBar
Test Engineer - Ryan M. Brown
Date of Test - 2/6/2023

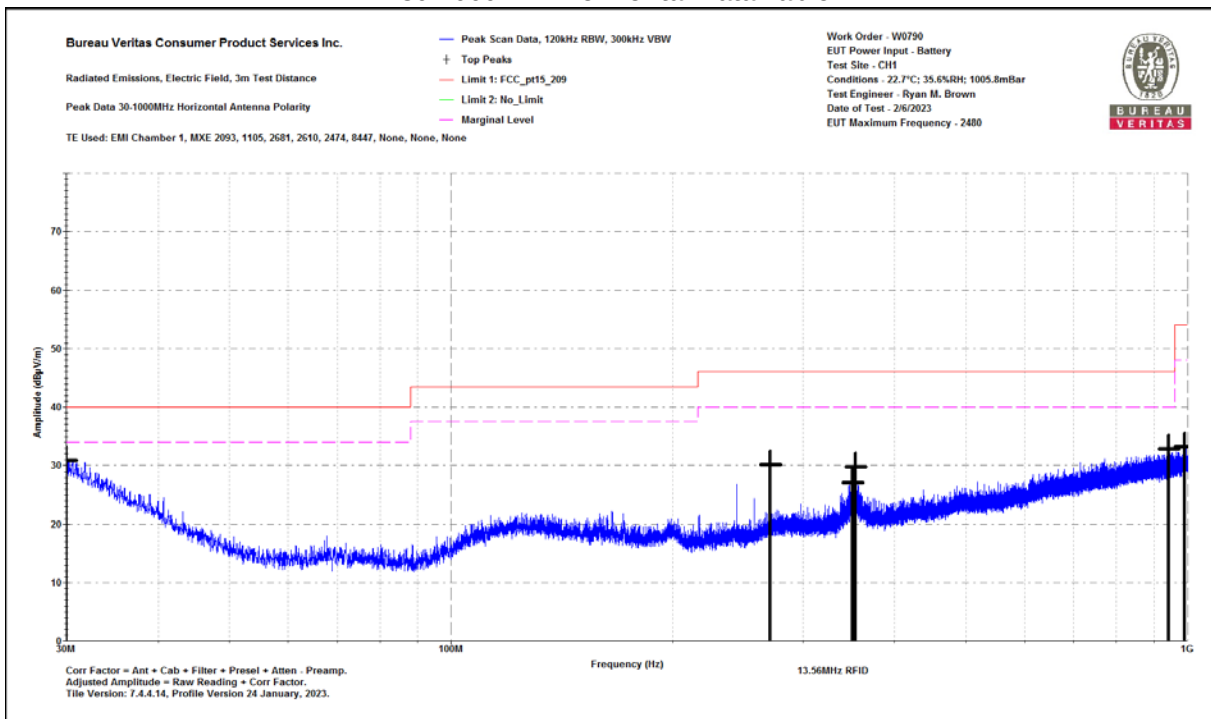
Notes:

13.56MHz RFID

0

Frequency (MHz)	Peak Reading (dBμV)	Correction Factor (dB/m)	Adjusted Peak Amplitude (dBμV/m)	Lim1: FCC_pt15_209 (dBμV/m)	Lim1 Margin (dB)	Lim1 Test Results (Pass/Fail)	Worst Margin Lim1 (dB)	Antenna Height (cm)	EUT Azimuth (degrees)
30	30.4	0.6	30.9	40	-9.1	PASS	-9.1	100	180
271.19	37	-6.8	30.2	46	-15.8	PASS		100	270
350.318	32.6	-5.6	27	46	-19	PASS		100	270
353.786	35.2	-5.4	29.8	46	-16.2	PASS		100	90
943.085	28.7	4.1	32.8	46	-13.2	PASS		100	270
991.634	28.2	4.9	33.2	54	-20.8	PASS		200	90

30-1000MHz Horizontal Data Table



30-1000MHz Horizontal Plot



4.4 99% OCCUPIED BANDWIDTH

4.4.1 LIMITS

When an occupied bandwidth is not specified in the applicable RSS, the transmitted signal bandwidth to be reported is its 99% emission bandwidth, as calculated or measured. [RSS-Gen Issue 5 Section 6.7].

4.4.2 TEST SETUP

Same as radiated spurious emissions setup below 30MHz (Section 4.3.5).
Measurement distance was closer than 3m to increase SNR.

4.4.3 TEST EQUIPMENT USED

Equipment	Manufacturer	Asset No.	Model No.	Serial No.	Last Cal.	Next Cal.
Cable	Carlisle	2595	UTiFLEX	None	1/17/2023	1/17/2024
Signal Analyzer	Rohde-Schwarz	2200	FSV 40	101551	10/11/2022	10/11/2023
Loop Antenna	EMCO	2615	6502	2049	1/18/2023	1/18/2025

Test Date 3/09/2023

4.4.4 TEST PROCEDURES

Per RSS-Gen Issue 5 Section 6.7.

4.4.5 DEVIATIONS

No deviations from the standard.

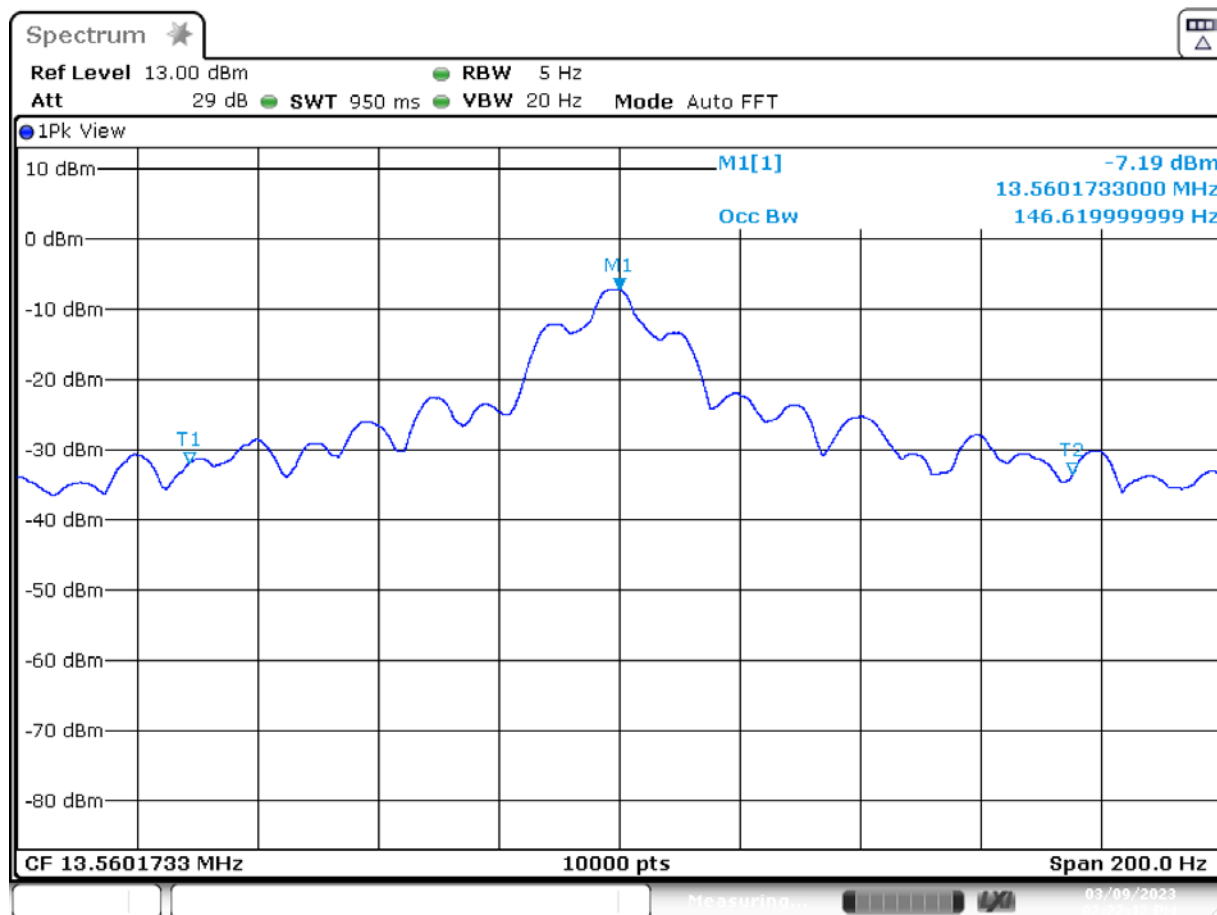
4.4.6 EUT OPERATING CONDITIONS

EUT was operated according to manufacturer's specifications.

4.4.7 TEST RESULTS

Host Model CEE100

Measured 99% OBW: 146.62Hz



Date: 9.MAR.2023 14:22:13

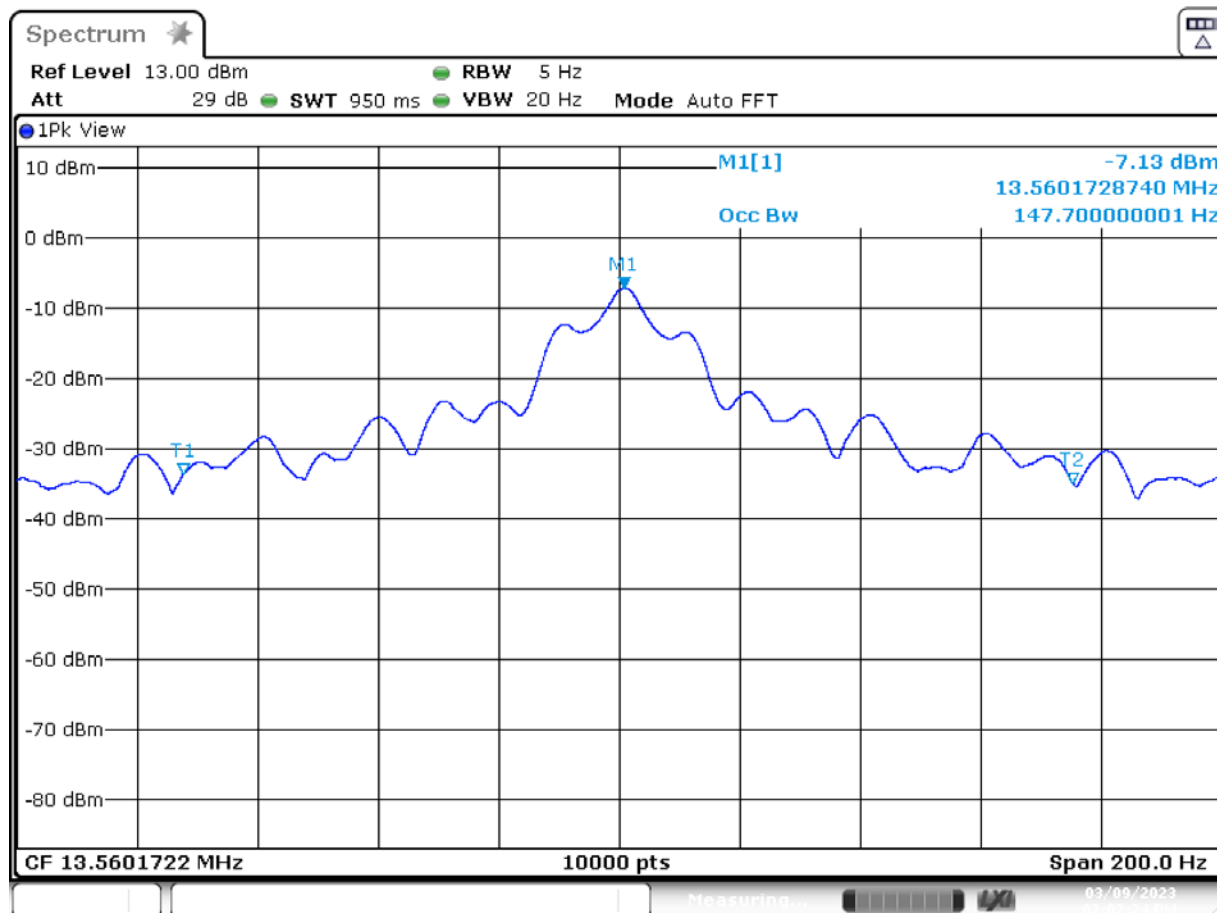


Test Report for Assa Abloy Inc.
Report No. EW0790-1 Issue 2



Host Model CEB100

Measured 99% OBW: 147.70Hz



Date: 9.MAR.2023 14:02:24

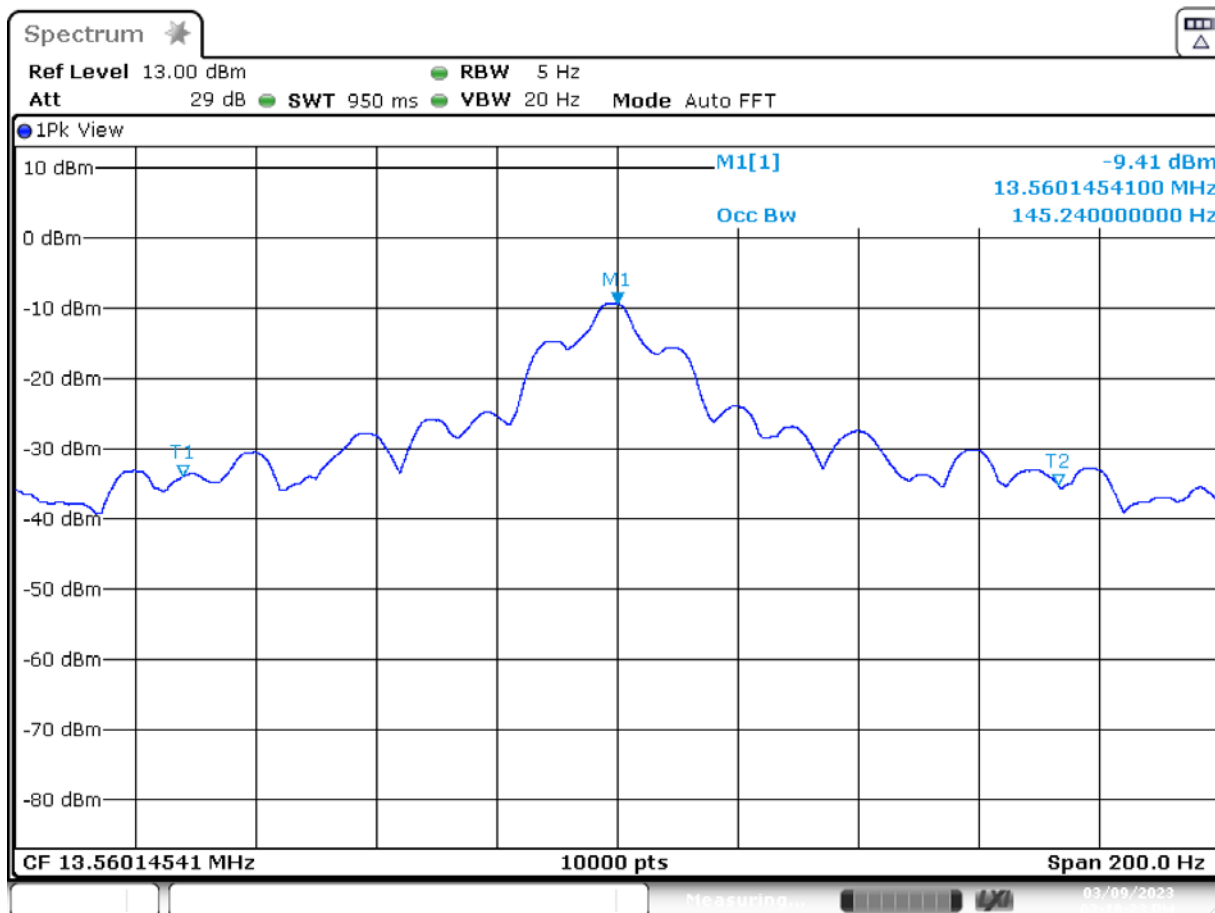


Test Report for Assa Abloy Inc.
Report No. EW0790-1 Issue 2



Host Model CEM100

Measured 99% OBW: 145.24Hz



Date: 9.MAR.2023 14:18:23



4.5 FREQUENCY TOLERANCE

4.5.1 LIMITS

The frequency tolerance of the carrier signal shall be maintained within $\pm 0.01\%$ of the operating frequency over a temperature variation of $-20\text{ }^{\circ}\text{C}$ to $+50\text{ }^{\circ}\text{C}$ at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of $20\text{ }^{\circ}\text{C}$. For battery operated equipment, the equipment tests shall be performed using a new battery.

4.5.2 TEST SETUP

EUT placed in the Temp chamber. Measurement loop placed approximately 15cm away from EUT (inside) the chamber connected to the spectrum analyzer outside the chamber.

4.5.3 TEST EQUIPMENT USED

Test Date 7/21/2022

Rev. 7/25/2022								
Spectrum Analyzers / Receivers / Preselectors	Range	MN	Mfr	SN	Asset	Cat	Calibration Due	Calibrated on
FSV40 Spectrum Analyzer	10Hz-40GHz	FSV40	ROHDE & SCHWARZ	101551	2200	I	10/26/2022	10/26/2021
Meteorological Meters/Chambers		MN	Mfr	SN	Asset	Cat	Calibration Due	Calibrated on
Temp/Humidity Chamber #18		EPX-2H	Espec	137664	1645	I	1/3/2023	1/3/2022
Cables	Range		Mfr			Cat	Calibration Due	Calibrated on
Asset #2595	9KHz-40GHz		Carlisle			II	1/21/2023	1/21/2022
Antennas	Range	MN	Mfr	SN	Asset	Cat	Calibration Due	Calibrated on
Magnetic Loop Prob	DC-3GHz	100C	Beehive Electronics	3038	2347	I	2/23/2024	2/23/2022
All equipment is calibrated using standards traceable to NIST or other nationally recognized calibration standard.								

4.5.4 TEST PROCEDURES

Per ANSI C63.10 - 2013 Section 6.8.

4.5.5 DEVIATIONS

No deviations from the standard.

4.5.6 EUT OPERATING CONDITIONS

EUT was operated according to manufacturer's specifications



Test Report for Assa Abloy Inc.
Report No. EW0790-1 Issue 2



4.5.7 TEST RESULTS

Measurements were recorded at startup, 2 minutes, 5 minutes, and 10 minutes after the EUT was energized. Worst-case measurements are shown in the data table below.

Host Model CEE 100

Frequency Stability Under Extreme Conditions			
Date: 7/21/2022		Work Order: V1795	
Engineer: Ryan M. Brown			
Nominal Voltage:	6	Max Voltage:	6.4
		Min Voltage:	4.2
Temperature	Voltage	Frequency	Frequency Delta
°C	V	(MHz)	(MHz)
-20	6.00	13.560030	0.000030
-10	6.00	13.560720	0.000720
0	6.00	13.560720	0.000720
10	6.00	13.559890	-0.000110
20	6.00	13.560000	0.000000
30	6.00	13.560720	0.000720
40	6.00	13.559280	-0.000720
50	6.00	13.560720	0.000720
20	4.20	13.559280	-0.000720
20	6.40	13.560720	0.000720
Chamber: 18		Antenna: 2347	Analyzer: FSV40
		Cable 1: 2595	DC Supply: 2570

Maximum Frequency Deviation: $\pm 0.000720\text{MHz}$

Limit: $\pm 0.001356\text{MHz}$

Result: PASS



5 PHOTOGRAPHS OF THE TEST CONFIGURATION

Please refer to the Test Setup Photos exhibit.



6 APPENDIX A – MODIFICATIONS

No modifications were made to the EUT during testing.

---END OF REPORT---