
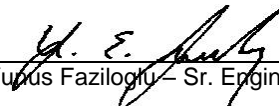




**BUREAU
VERITAS**

Test Report

Curtis-Straus LLC, a wholly owned subsidiary of BV CPS

Report No	ES0408-4
Client	Hologic Inc.
Address	36 Apple Ridge Rd Danbury, CT 06810
Phone	1-508-263-2471
Items tested	RFID Board (MN: PCB-01673)
FCC ID	YUJ-PCB01673
IC	9281A-PCB01673
FRN	0020208542
Equipment Type	Part 15 Low Power Communication Transmitter
Equipment Code	DXX
Emission Designator	207HA1D
Standards	47 CFR Part 15.225, ISED Canada RSS-210 Issue 9 Annex B.6
Test Dates	Apr 20 to Jun 25, 2018
Results	As detailed within this report
Prepared by	 Zachary Johnson – Test Engineer
Authorized by	 Yunus Faziloglu – Sr. Engineer
Issue Date	7/11/2018
Conditions of Issue	This Test Report is issued subject to the conditions stated in the 'Conditions of Testing' section on page 18 of this report.

Curtis-Straus LLC is accredited by the American Association for Laboratory Accreditation for the specific scope of accreditation under Certificate Number 1627-01. This report may contain data which is not covered by the A2LA accreditation.



Curtis-Straus LLC, a wholly owned subsidiary of BV CPS
One Distribution Center Circle, #1 • Littleton, MA • TEL (978) 486-8880 • FAX (978) 486-8828



Contents

Contents.....	2
Summary and Test Methodology.....	3
Product Tested - Configuration Documentation	4
Statement of Conformity	5
Test Results	6
<i>Fundamental Emission</i>	6
<i>Emission Mask</i>	6
<i>Radiated Spurious Emissions</i>	7
<i>Frequency Tolerance</i>	10
<i>Occupied Bandwidth</i>	11
<i>Conducted Emissions</i>	12
Measurement Uncertainty.....	17
Conditions Of Testing.....	18

Form Final Report REV 2-16-07 (DW)



Summary and Test Methodology

This test report supports a limited modular approval certification application for Hologic Inc. RFID Board (MN: PCB-01673) operating under:

47 CFR Part 15.225, ISED Canada RSS-210 Issue 9 Annex B.6

EUT is an RFID reader operating at 13.56MHz. All testing was performed in accordance with ANSI C63.10 2013. Module has a PCB loop antenna and it was tested in the horizontal position (its antenna facing down) in a testing jig supplied by the client. The antenna of the module was not obstructed during testing. This setup represents how the module will be installed in Hologic Inc. host devices.

We found that the product complied with the requirements above without modification. Test sample was received in good condition.

The environmental conditions during testing are documented on the associated data tables.

The following bandwidths were used during emissions testing.

Frequency	RBW	VBW
9kHz-150kHz	200Hz	1kHz
150kHz-30MHz	9kHz	30kHz
30MHz-1GHz	120kHz	1MHz

Issue No.	Reason for change	Date Issued
1	Original Release	July 11, 2018



Curtis-Straus LLC, a wholly owned subsidiary of BV CPS
One Distribution Center Circle, #1 • Littleton, MA • TEL (978) 486-8880 • FAX (978) 486-8828



page 3 of 19

Product Tested - Configuration Documentation

EUT Configuration										
Work Order:	S0408									
Company:	Hologic (CT)									
Company Address:	36 Apple Ridge Rd									
	Danbury, CT, 06810									
Contact:	Mairaj Hussain									
	MN			PN			SN			
EUT:	PCB-01673									
EUT Description:	Hologic RFID Board (MN: PCB-01673)									
EUT Max Frequency:	13.56 MHz									
EUT Min Frequency:	13.56 MHz									
Port Label	Port Type	# ports	# populated	cable type	shielded	ferrites	length (m)	in/out	under test	comment
Power AC	Power AC	1	1	Power AC	Yes	No	1	in	yes	
Software Operating Mode Description:										
Test										
Performance Criteria:										
Monitor 13.56MHz transmission to remain active.										

Clock Frequencies

Clock Frequencies	
frequencies (MHz)	13.56

Issue No.	Reason for change	Date Issued
1	Original Release	July 11, 2018



Curtis-Straus LLC, a wholly owned subsidiary of BV CPS
 One Distribution Center Circle, #1 • Littleton, MA • TEL (978) 486-8880 • FAX (978) 486-8828



Statement of Conformity

RFID Board (MN: PCB-01673) complied with the following requirements:

RSS-GEN	RSP-100	RSS 210	Part 15	Comments
6.3			15.15(b)	There are no controls accessible to the user that varies the output power to operate in violation of the regulatory requirements.
	3.1		15.19	The label is shown in the label exhibit.
	4		15.21	Information to the user is shown in the instruction manual exhibit.
			15.27	No special accessories are required for compliance.
3, 6.1			15.31	The EUT was tested in accordance with the measurement standards in this section.
6.13			15.33	Frequency range was investigated according to this section, unless noted in specific rule section under which the equipment operates.
8.1			15.35	The EUT emissions were measured using the measurement detector and bandwidth specified in this section, unless noted in specific rule section under which the equipment operates.
8.3			15.203	EUT has a PCB loop antenna
8.10			15.205 15.209	The fundamental is not in a Restricted band and the spurious and harmonic emissions in the Restricted bands comply with the general emission limits of 15.209 or RSS-Gen as applicable
8.8			15.207	EUT complies with AC line conducted emissions limits
			15.225	EUT complies with the requirements of 15.225
		Annex B.6		EUT complies with the requirements of RSS-210 Issue 9 Annex B.6
6.6				Occupied Bandwidth measurements were made.

Issue No.

1

Reason for change

Original Release

Date Issued

July 11, 2018



Curtis-Straus LLC, a wholly owned subsidiary of BV CPS
One Distribution Center Circle, #1 • Littleton, MA • TEL (978) 486-8880 • FAX (978) 486-8828



page 5 of 19

Test Results

Fundamental Emission

LIMIT

The field strength of any emissions within the band 13.553-13.567 MHz shall not exceed 15,848 microvolts/meter at 30 meters, (124 dBuV/m at 3m.)
[15.225 (a)]

MEASUREMENTS / RESULTS

Fundamental complies with 15.209 limits.

Radiated Emissions Table													
Date: 20-Jun-18 Engineer: Zac Johnson Temp: 22.9°C			Company: Hologic EUT Desc: RFID Board (High Gain) Humidity: 36%				Work Order: S0408 EUT Operating Voltage/Frequency: 120V / 60Hz Pressure: 1004mBar						
Frequency Range: 13.56MHz							Measurement Distance: 3 m						
Notes:													
Antenna Polarization (0° - 90°)	Frequency (MHz)	Reading (dBuV)	Preamp Factor (dB)	Antenna Factor (dBm)	Cable Factor (dB)	Adjusted Reading (dBuV/m)	---			FCC 15.225			
							Limit (dBuA/m)	Margin (dB)	Result (Pass/Fail)	Limit (dBuV/m)	Margin (dB)	Result (Pass/Fail)	
EUT Straight													
0	13.56	39.3	29.2	39.0	0.2	49.3	---	---	---	69.5	-20.2	Pass	
90	13.56	47.5	29.2	39.0	0.2	57.5				69.5	-12.0	Pass	
Table Result: Pass							by	-12.0 dB			Worst Freq: 13.56 MHz		
Test Site: EMI Chamber 2 Analyzer: 2093 SA			Cable 1: Asset #2051 Preamp: Asset #2443				Cable 2: Asset #2459 Antenna: Sm Loop (high)			Cable 3: --- Preselector: ---			
CSsoft Radiated Emissions Calculator v 1.017.203							Copyright Curtis-Straus LLC 2000						
Adjusted Reading = Reading - Preamp Factor + Antenna Factor + Cable Factor													

Emission Mask

MEASUREMENTS / RESULTS

Not applicable.

Fundamental complies with 15.209 limits.

Radiated Spurious Emissions

LIMITS

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 §15.209.

[15.225(d)]

MEASUREMENTS / RESULTS

Lowest radio frequency signal generated in the device is 8MHz, therefore in accordance with 15.33(a) measurements below 8MHz is not required.

All emissions in the table below except for 27.1MHz at 90 degree polarization are noise floor readings. No emissions detected in "ground-parallel" orientation of the loop antenna. Noise floor readings are more than 20dB below the limit for all 3 loop orientations. Therefore 6 readings for each antenna orientation are not required to be listed per ANSI C63.10-2013 Section 6.4.6.

Radiated Emissions Table												
Date: 20-Jun-18			Company: Hologic				Work Order: S0408					
Engineer: Zac Johnson			EUT Desc: RFID Board (High Gain)				EUT Operating Voltage/Frequency: 120V / 60Hz					
Temp: 22.9°C			Humidity: 36%				Pressure: 1004mBar					
Frequency Range: 1-30MHz							Measurement Distance: 3 m					
Notes: Noise floor readings except 27.1MHz												
Antenna Polarization (0° - 90°)	Frequency (MHz)	Reading (dBµV)	Preamp Factor (dB)	Antenna Factor (dB/m)	Cable Factor (dB)	Adjusted Reading (dBµV/m)	---			FCC Class B		
							Limit (dBµV/m)	Margin (dB)	Result (Pass/Fail)	Limit (dBµV/m)	Margin (dB)	Result (Pass/Fail)
0	5.7	23.4	29.2	43.1	0.1	37.4	---	---	---	69.5	-32.1	Pass
0	16.1	21.6	29.3	38.3	0.3	30.9	---	---	---	69.5	-38.6	Pass
0	19.8	20.9	29.3	37.4	0.3	29.3	---	---	---	69.5	-40.2	Pass
90	11.0	21.3	29.2	39.6	0.3	32.0	---	---	---	69.5	-37.5	Pass
90	23.3	21.5	29.3	37.7	0.3	30.2	---	---	---	69.5	-39.3	Pass
90	27.1	29.9	29.3	37.2	0.4	38.2	---	---	---	69.5	-31.3	Pass
Table Result: Pass by -31.3 dB							Worst Freq: 27.1 MHz					
Test Site: EMI Chamber 2			Cable 1: Asset #2051				Cable 2: Asset #2459			Cable 3: ---		
Analyzer: 2093 SA			Preamp: Asset #2443				Antenna: Sm Loop (high)			Preselector: ---		
CSsoft Radiated Emissions Calculator v 1.017.203							Copyright Curtis-Straus LLC 2000					
Adjusted Reading = Reading - Preamp Factor + Antenna Factor + Cable Factor												

1-30MHz



Curtis Straus - a Bureau Veritas Company
Radiated Emissions Electric Field 3m Distance
Top Peaks Vertical 30-1000MHz
Operator: ZJ
Notes:

Work Order - S0408
EUT Power Input - 120V / 60Hz
Test Site - CH-2
Conditions - 22.9°C; 36%RH; 1004mBar

Data Taken at 06:21:38 PM, Wednesday, June 20, 2018

Frequency (MHz)	Peak Reading (dBμV)	Correction Factor (dB/m)	Adjusted Peak Amplitude (dBμV/m)	Lim1: FCC_pt15_1 09_Class_B (dBμV/m)	Lim1 Margin (dB)	Lim1 Test Results (Pass/Fail)	Worst Margin Lim1 (dB)
40.67	46.2	-10.4	35.8	40	-4.2	PASS	-4.2
149.116	45.9	-10.3	35.7	43.5	-7.8	PASS	
174.991	43.2	-11.2	32.1	43.5	-11.4	PASS	
200.138	44.8	-9.9	34.9	43.5	-8.6	PASS	
203.339	41.5	-10.8	30.7	43.5	-12.8	PASS	
610.133	41.2	-2.1	39.1	46	-6.9	PASS	

Curtis Straus - a Bureau Veritas Company
Radiated Emissions Electric Field 3m Distance
Top Peaks Horizontal 30-1000MHz
Operator: ZJ
Notes:

Work Order - S0408
EUT Power Input - 120V / 60Hz
Test Site - CH-2
Conditions - 22.9°C; 36%RH; 1004mBar

Data Taken at 06:21:38 PM, Wednesday, June 20, 2018

Frequency (MHz)	Peak Reading (dBμV)	Correction Factor (dB/m)	Adjusted Peak Amplitude (dBμV/m)	Lim1: FCC_pt15_1 09_Class_B (dBμV/m)	Lim1 Margin (dB)	Lim1 Test Results (Pass/Fail)	Worst Margin Lim1 (dB)
149.14	46.7	-10.3	36.4	43.5	-7.1	PASS	
162.672	47.5	-10.4	37.1	43.5	-6.4	PASS	
174.991	48.6	-11.2	37.5	43.5	-6	PASS	-6
189.808	47.3	-10.9	36.3	43.5	-7.2	PASS	
200.114	45.9	-9.9	36	43.5	-7.5	PASS	
610.133	40.2	-2.1	38.1	46	-7.9	PASS	

30-1000MHz

Rev. 6/11/2018

Spectrum Analyzers / Receivers/Preselectors
2093 MXE EMI Receiver

Range	MN	Mfr	SN	Asset	Cat	Calibration Due	Calibrated on
20Hz-26.5GHz	N9038A	Agilent	MY51210181	2093	I	11/16/2018	11/16/2017

Radiated Emissions Sites
EMI Chamber 2

FCC Code	IC Code	VCCI Code	Range	Asset	Cat	Calibration Due	Calibrated on
719150	2762A-7	A-0015	30-1000MHz	1686	I	12/21/2018	12/21/2016

Preamps/Couplers Attenuators / Filters
2443 PA

Range	MN	Mfr	SN	Asset	Cat	Calibration Due	Calibrated on
9KHz-6GHz	BBV9744	SCWARZBECK	63	2443	I	2/5/2019	2/5/2018

Antennas
Red-Brown Bilog
Large Loop

Range	MN	Mfr	SN	Asset	Cat	Calibration Due	Calibrated on
30-2000MHz	JB1	Sunol	A0032406	1218	I	1/13/2019	1/13/2017
20Hz-5MHz	6511	EMCO	9704-1154	67	I	7/14/2018	6/14/2016

Meteorological Meters/Chambers
Weather Clock (Pressure Only)
TH A#2080

MN	Mfr	SN	Asset	Cat	Calibration Due	Calibrated on
BA928	Oregon Scientific	C3166-1	831	I	5/15/2020	5/15/2018
HTC-1	HDE		2080	II	3/22/2019	3/22/2018

Cables
Asset #2051
Asset #2459

Range	Mfr	Cat	Calibration Due	Calibrated on
9kHz - 18GHz	Florida RF	II	3/7/2019	3/7/2018
9KHz-18GHz	MegaPhase	II	10/29/2018	10/29/2017

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

Test Equipment Used



Curtis-Straus LLC, a wholly owned subsidiary of BV CPS
One Distribution Center Circle, #1 • Littleton, MA • TEL (978) 486-8880 • FAX (978) 486-8828



Frequency Tolerance

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 degrees to $+ 50$ degrees 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 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

[15.225(e)]

MEASUREMENTS / RESULTS

13.56MHz * 0.01% = 1356Hz allowable tolerance

FCC 15.225 Extreme Conditions					
Date: 20-Apr-18		Company: Hologic		Work Order: S0408	
Engineer: AKZ					
Notes:					
Temperature	Voltage	Amplitude	Amplitude Delta	Frequency	Frequency Delta
°C	AC / 60Hz	(dBm)	(dB)	(Hz)	(Hz)
-30	120	-39.92	1.86	13558865	62
-20	120	-40.22	1.56	13558905	22
-10	120	-40.72	1.06	13558957	-30
0	120	-41.12	0.66	13558962	-35
10	120	-41.57	0.21	13558952	-25
20	102	-41.82	-0.04	13558925	2
20	120	-41.78	Reference	13558927	Reference
20	138	-41.90	-0.12	13558927	0
30	120	-42.44	-0.66	13558897	30
40	120	-42.73	-0.95	13558870	57
50	120	-42.75	-0.97	13558855	72
Test Site: ENV Chamber 18		Antenna Small Loop		Analyzer: #1328	
Cable 1: CEMI-15					

Rev. 4/17/2018

Spectrum Analyzers / Receivers/Preselectors		Range	MN	Mfr	SN	Asset	Cat	Calibration Due	Calibrated on
SA (1328)		9kHz-13.2 GHz	E4405B	Agilent	MY44210241	1328	I	11/18/2018	11/18/2017
Cables		Range	Mfr			Cat		Calibration Due	Calibrated on
REMI-15		9kHz - 2GHz	C-S			II		2/12/2019	2/12/2018
Antennas		Range	MN	Mfr	SN	Asset	Cat	Calibration Due	Calibrated on
Small Loop		10kHz-30MHz	PLA-130/A	ARA	1024	755	I	6/14/2018	6/14/2016
Meteorological Meters/Chambers			MN	Mfr	SN	Asset	Cat	Calibration Due	Calibrated on
Temp/Humidity Chamber #18			EPX-2H	Espec	137664	1645	I	1/5/2019	1/5/2018
RMS Voltmeters/Current Clamp			MN	Mnfr	SN	Asset	Cat	Calibration Due	Calibrated on
DMM			325	Fluke	38120842WS	2428	I	8/2/2018	8/2/2017

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



Curtis-Straus LLC, a wholly owned subsidiary of BV CPS
One Distribution Center Circle, #1 • Littleton, MA • TEL (978) 486-8880 • FAX (978) 486-8828



page 10 of 19

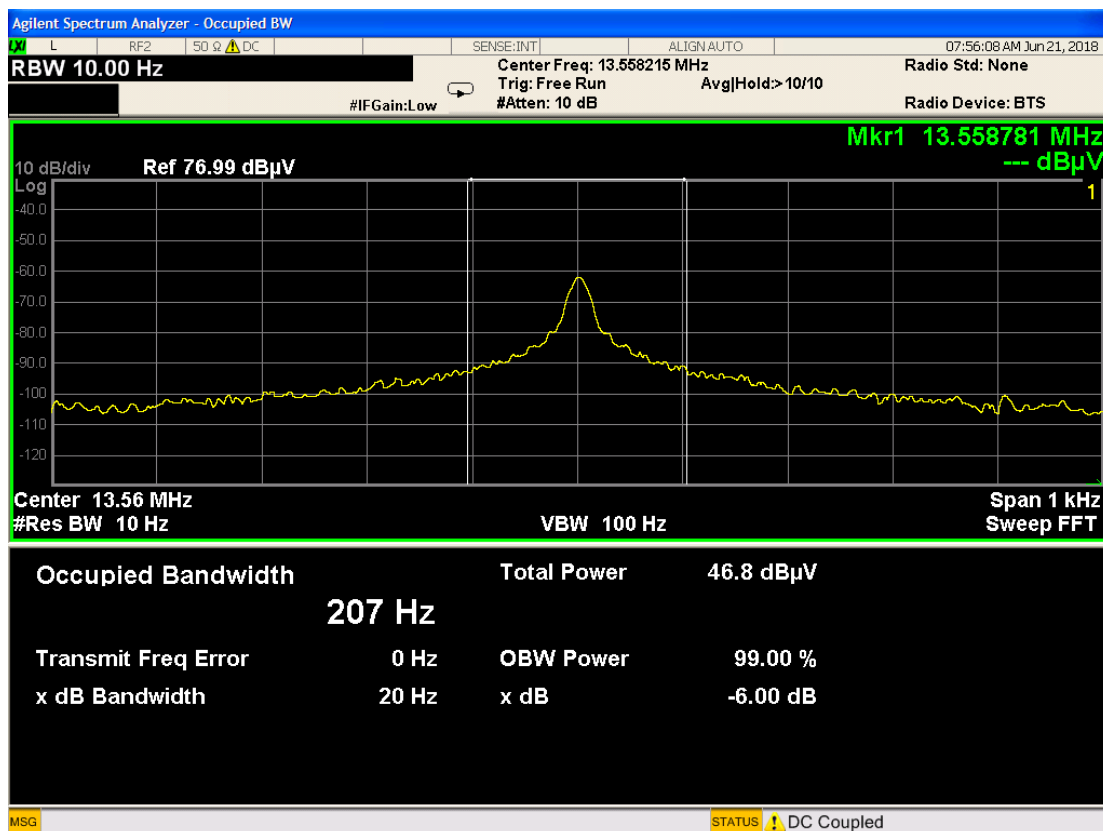
Occupied Bandwidth

REQUIREMENT

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 6.6]

99% Occupied Bandwidth = 207Hz



99% Occupied Bandwidth

Conducted Emissions

MEASUREMENTS / RESULTS

Measurements performed with antenna in place as well as antenna replaced with resistive load. Both sets of readings are presented below:

Curtis Straus - a Bureau Veritas Company
Conducted Emissions per CISPR 16-2-1
Quasi-peak Detector Data
Notes:
EUT Line tested: 120VAC/60Hz;Phase
EUT Mode of Operation: WITH ANTENNA

Work Order # - S0408
EUT Power Input - 120VAC/ 60Hz
Test Site - CEMI-5
Conditions: - 21°C; 31%RH; 1010mBar
Test Engineer - Fatou Faye
0

Data Taken at 10:41:05 PM, Monday, June 25, 2018

Frequency (MHz)	Raw QP Reading (dBμV)	Correction Factor (dB)	Adjusted QP Amplitude (dBμV)	QP Lim: Mains_FCC&CISP R_QP_Class_B (dBμV)	Margin to QP Limit (dB)	QP Limit Results (Pass/Fail)	Worst Margin (QP Limit) (dB)
0.162	22.279	20.8	43.1	65.3	-22.3	PASS	
0.194	20.604	20.8	41.4	63.9	-22.5	PASS	
0.231	18.714	20.8	39.5	62.4	-22.9	PASS	
0.275	18.304	20.8	39.1	61	-21.9	PASS	
13.585	12.859	20.9	33.7	60	-26.3	PASS	
27.116	22.697	21	43.7	60	-16.3	PASS	-16.3

Antenna in place – Line QP

Curtis Straus - a Bureau Veritas Company					Work Order # - S0408		
Conducted Emissions per CISPR 16-2-1, CISPR Average Detector					EUT Power Input - 120VAC/ 60Hz		
Final Average Detector Data					Test Site - CEMI-5		
Notes:					Conditions: - 21°C; 31%RH; 1010mBar		
EUT Line tested: 120VAC/60Hz;Phase					Test Engineer - Fatou Faye		
EUT Mode of Operation: WITH ANTENNA					0		
Data Taken at 10:43:45 PM, Monday, June 25, 2018							
Frequency (MHz)	Raw Avg Reading (dBμV)	Correction Factor (dB)	Adjusted Avg Amplitude (dBμV)	Av Lim: Mains_FCC&CISP R_Avg_Class_B (dBμV)	Avg Margin (dB)	Avg Results (Pass/Fail)	Worst Avg Margin (dB)
0.154	12.5	20.8	33.3	55.8	-22.5	PASS	
0.154	12.5	20.8	33.3	55.8	-22.5	PASS	
0.177	12.5	20.8	33.3	54.6	-21.3	PASS	
0.192	12.6	20.8	33.4	53.9	-20.5	PASS	-20.5
27.098	-3.5	21	17.5	50	-32.5	PASS	

Antenna in place – Line Average



Curtis-Straus LLC, a wholly owned subsidiary of BV CPS
One Distribution Center Circle, #1 • Littleton, MA • TEL (978) 486-8880 • FAX (978) 486-8828



Curtis Straus - a Bureau Veritas Company
 Conducted Emissions per CISPR 16-2-1
 Quasi-peak Detector Data
 Notes:
 EUT Line tested: 120VAC/60Hz;Neutral
 EUT Mode of Operation: WITH ANTENNA

Work Order # - S0408
 EUT Power Input - 120VAC/ 60Hz
 Test Site - CEMI-5
 Conditions: - 21°C; 31%RH; 1010mBar
 Test Engineer - Fatou Faye
 0

Data Taken at 06:39:25 PM, Monday, June 25, 2018

Frequency (MHz)	Raw QP Reading (dBμV)	Correction Factor (dB)	Adjusted QP Amplitude (dBμV)	QP Lim: Mains_FCC&CISPR_QP_Class_B (dBμV)	Margin to QP Limit (dB)	QP Limit Results (Pass/Fail)	Worst Margin (QP Limit) (dB)
0.161	10.167	20.9	31	65.4	-34.4	PASS	
0.337	20.415	20.8	41.2	59.3	-18.1	PASS	
13.54	14.877	20.8	35.7	60	-24.3	PASS	
13.565	33.059	20.8	53.9	60	-6.1	PASS	
27.118	21.493	21	42.5	60	-17.5	PASS	

Antenna in place – Neutral QP

Curtis Straus - a Bureau Veritas Company
 Conducted Emissions per CISPR 16-2-1, CISPR Average Detector
 Final Average Detector Data
 Notes:
 EUT Line tested: 120VAC/60Hz;Neutral
 EUT Mode of Operation: WITH ANTENNA

Work Order # - S0408
 EUT Power Input - 120VAC/ 60Hz
 Test Site - CEMI-5
 Conditions: - 21°C; 31%RH; 1010mBar
 Test Engineer - Fatou Faye
 0

Data Taken at 06:39:25 PM, Monday, June 25, 2018

Frequency (MHz)	Raw Avg Reading (dBμV)	Correction Factor (dB)	Adjusted Avg Amplitude (dBμV)	Av Lim: Mains_FCC&CISPR_Avg_Class_B (dBμV)	Avg Margin (dB)	Avg Results (Pass/Fail)	Worst Avg Margin (dB)
0.337	15.8	20.8	36.6	49.3	-12.7	PASS	-12.7
0.653	1.2	20.8	21.9	46	-24.1	PASS	
13.544	0.7	20.8	21.6	50	-28.4	PASS	
13.581	-2	20.8	18.8	50	-31.2	PASS	
15.063	7.7	20.9	28.6	50	-21.4	PASS	
27.122	10.1	21	31	50	-19	PASS	

Antenna in place – Neutral Average

Curtis Straus - a Bureau Veritas Company

Conducted Emissions per CISPR 16-2-1

Peak Detector Data

Notes:

EUT Line tested: 120VAC/60Hz; Phase - AC Side of DC

EUT Mode of Operation: Antenna Terminated w 26 Ohm Load

Work Order # - S0408

EUT Power Input - 120VAC/ 60Hz

Test Site - CEMI-5

Conditions: - 23.9°C; 38%RH; 1000mBar

Test Engineer - Chris Bramley

Witnessed by - N/A

Data Taken at 06:07:41 PM, Thursday, June 21, 2018

Frequency (MHz)	Raw Pk Reading (dBμV)	Correction Factor (dB)	Adjusted Pk Amplitude (dBμV)	QP Lim: Mains_FCC&CISP R_QP_Class_B (dBμV)	Margin to the QP Limit (dB)	Pk to QP Limit Results (Pass/Fail)	Worst Margin (QP Limit) (dB)
0.161	38.8	20.8	59.6	65.4	-5.8	PASS	-5.8
0.206	33.9	20.8	54.7	63.4	-8.7	PASS	
0.241	32.4	20.8	53.1	62.1	-8.9	PASS	
0.275	29.9	20.8	50.7	61	-10.3	PASS	
0.34	29.4	20.8	50.2	59.2	-9	PASS	
13.559	28.3	20.9	49.3	60	-10.7	PASS	

Antenna replaced with resistive load – Line Peak

Curtis Straus - a Bureau Veritas Company

Conducted Emissions per CISPR 16-2-1, CISPR Average Detector

Quick Average Detector Data

Notes:

EUT Line tested: 120VAC/60Hz; Phase - AC Side of DC

EUT Mode of Operation: Antenna Terminated w 26 Ohm Load

Work Order # - S0408

EUT Power Input - 120VAC/ 60Hz

Test Site - CEMI-5

Conditions: - 23.9°C; 38%RH; 1000mBar

Test Engineer - Chris Bramley

Witnessed by - N/A

Data Taken at 06:07:41 PM, Thursday, June 21, 2018

Frequency (MHz)	Raw Avg Reading (dBμV)	Correction Factor (dB)	Adjusted Avg Amplitude (dBμV)	Av Lim: Mains_FCC&CISP R_Avg_Class_B (dBμV)	Avg Margin (dB)	Avg Results (Pass/Fail)	Worst Avg Margin (dB)
0.153	31.8	20.8	52.6	55.8	-3.3	PASS	
0.189	29.1	20.8	49.9	54.1	-4.2	PASS	
0.233	25.6	20.8	46.4	52.3	-6	PASS	
0.277	21.9	20.8	42.7	50.9	-8.2	PASS	
0.343	21.5	20.8	42.2	49.1	-6.9	PASS	
13.559	27.8	20.9	48.7	50	-1.3	PASS	-1.3

Antenna replaced with resistive load – Line Average

Curtis Straus - a Bureau Veritas Company

Conducted Emissions per CISPR 16-2-1

Peak Detector Data

Notes:

EUT Line tested: 120VAC/60Hz; Neutral - AC Side of DC

EUT Mode of Operation: Antenna Terminated w 26 Ohm Load

Work Order # - S0408

EUT Power Input - 120VAC/ 60Hz

Test Site - CEMI-5

Conditions: - 23.9°C; 38%RH; 1000mBar

Test Engineer - Chris Bramley

Witnessed by - N/A

Data Taken at 06:14:38 PM, Thursday, June 21, 2018

Frequency (MHz)	Raw Pk Reading (dBμV)	Correction Factor (dB)	Adjusted Pk Amplitude (dBμV)	QP Lim: Mains_FCC&CISP R_QP_Class_B (dBμV)	Margin to the QP Limit (dB)	Pk to QP Limit Results (Pass/Fail)	Worst Margin (QP Limit) (dB)
0.156	25.8	20.9	46.7	65.7	-19	PASS	
0.2	18.9	20.8	39.8	63.6	-23.8	PASS	
0.34	24.6	20.8	45.3	59.2	-13.9	PASS	
0.652	10.3	20.8	31.1	56	-24.9	PASS	
2.777	10.7	20.8	31.5	56	-24.5	PASS	
13.559	26	20.9	46.9	60	-13.1	PASS	-13.1

Antenna replaced with resistive load – Neutral Peak

Curtis Straus - a Bureau Veritas Company

Conducted Emissions per CISPR 16-2-1, CISPR Average Detector

Quick Average Detector Data

Notes:

EUT Line tested: 120VAC/60Hz; Neutral - AC Side of DC

EUT Mode of Operation: Antenna Terminated w 26 Ohm Load

Work Order # - S0408

EUT Power Input - 120VAC/ 60Hz

Test Site - CEMI-5

Conditions: - 23.9°C; 38%RH; 1000mBar

Test Engineer - Chris Bramley

Witnessed by - N/A

Data Taken at 06:14:38 PM, Thursday, June 21, 2018

Frequency (MHz)	Raw Avg Reading (dBμV)	Correction Factor (dB)	Adjusted Avg Amplitude (dBμV)	Av Lim: Mains_FCC&CISP R_Avg_Class_B (dBμV)	Avg Margin (dB)	Avg Results (Pass/Fail)	Worst Avg Margin (dB)
0.15	15.7	20.9	36.6	56	-19.4	PASS	
0.339	21.5	20.8	42.2	49.2	-7	PASS	
0.658	6.1	20.8	26.9	46	-19.1	PASS	
2.986	4.4	20.8	25.2	46	-20.8	PASS	
13.559	25.2	20.9	46.1	50	-3.9	PASS	-3.9
15.058	9.3	20.9	30.2	50	-19.8	PASS	

Antenna replaced with resistive load – Neutral Average

Rev. 6/11/2018

Spectrum Analyzers / Receivers /Preselectors	Range	MN	Mfr	SN	Asset	Cat	Calibration Due	Calibrated on
Rental EXA Signal Analyzer(1118472)	9KHz-26.5GHz	N9010A-526;K	AT	MY51170010	1118472	I	7/25/2018	7/25/2017
LISNs/Measurement Probes	Range	MN	Mfr	SN	Asset	Cat	Calibration Due	Calibrated on
LISN Asset 1728	150kHz-30MHz	LI-150A	Com-Power	201084	1728	I	5/16/2019	5/16/2018
LISN Asset 1729	150kHz-30MHz	LI-150A	Com-Power	201085	1729	I	5/16/2019	5/16/2018
Conducted Test Sites (Mains / Telco)	FCC Code		VCCI Code			Cat	Calibration Due	Calibrated on
CEMI 5	719150		A-0015			III	NA	N/A
Meteorological Meters/Chambers		MN	Mfr	SN	Asset	Cat	Calibration Due	Calibrated on
Weather Clock (Pressure Only)		BA928	Oregon Scientific	C3166-1	831	I	5/15/2020	5/15/2018
TH A#2079		HTC-1	HDE		2079	II	3/22/2019	3/22/2018
Cables	Range		Mfr			Cat	Calibration Due	Calibrated on
CEMI-12	9kHz - 2GHz		C-S			II	11/4/2018	11/4/2017
Attenuators	Range	MN	Mfr	SN	Asset	Cat	Calibration Due	Calibrated on
20dB Attenuator-64	9kHz-2GHz			N/A		II	11/6/2018	11/8/2017

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

Test Equipment Used



Curtis-Straus LLC, a wholly owned subsidiary of BV CPS
One Distribution Center Circle, #1 • Littleton, MA • TEL (978) 486-8880 • FAX (978) 486-8828



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.

Measurement	Expanded Uncertainty k=2	Maximum allowable uncertainty
Radiated Emissions (30-1000MHz)		
NIST	5.6dB	N/A
CISPR	4.6dB	5.2dB (Ucisp)
Radiated Emissions (1-26.5GHz)	4.6dB	N/A
Radiated Emissions (above 26.5GHz)	4.9dB	N/A
Magnetic Radiated Emissions	5.6dB	N/A
Conducted Emissions		
NIST	3.9dB	N/A
CISPR	3.6dB	3.6dB (Ucisp)
Telco Conducted Emissions (Current)	2.9dB	N/A
Telco Conducted Emissions (Voltage)	4.4dB	N/A
Electrostatic Discharge	11.5%	N/A
Radiated RF Immunity (Uniform Field)	1.6dB	N/A
Electrical Fast Transients	23.1%	N/A
Surge	23.1%	N/A
Conducted RF Immunity	3dB	N/A
Magnetic Immunity	12.8%	N/A
Dips and Interrupts	2.3V	N/A
Harmonics	3.5%	N/A
Flicker	3.5%	N/A
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		



BUREAU
VERITAS

Curtis-Straus LLC, a wholly owned subsidiary of BV CPS
One Distribution Center Circle, #1 • Littleton, MA • TEL (978) 486-8880 • FAX (978) 486-8828



page 17 of 19

Conditions Of Testing

[Bureau Veritas Consumer Products Services, Inc., a Massachusetts corporation], and/or its affiliates (collectively, the "Company") will conduct, at the request of the Submitter ("Client"), the tests specified on the submitted Test Request Form or equivalent in accordance with, and subject to, the following terms and conditions (collectively, "Conditions"):

1. All orders for tests are subject to acceptance by the Company, and no order will constitute a binding commitment of the Company unless and until such order is accepted by it, as evidenced by the issuance of a written report ("Test Report") by the Company. The Test Report is issued solely by the Company, is intended for the exclusive use of Client and shall not be published, used for advertising purposes, copied or replicated for distribution to any other person or entity or otherwise publicly disclosed without the prior written consent of the Company. By submitting a request for services to the Company, Client consents to the disclosure to accreditation bodies of those records of Client relevant to the accreditation body's assessment of the Company's competence and compliance with relevant accreditation criteria. The Company shall not be liable for any loss or damage whatsoever resulting from the failure of the Company to provide its services within any time period for completion estimated by the Company. If Client anticipates using the Test Report in any legal proceeding, arbitration, dispute resolution forum or other proceeding, it shall so notify the Company prior to submitting the Test Report in such proceeding. The Company has no obligation to provide a fact or expert witness at such proceeding unless the Company agrees in advance to do so for a separate and additional fee.
2. The Test Report will set forth the findings of the Company solely with respect to the test samples identified therein. Unless specifically and expressly indicated in the Test Report, the results set forth in such Test Report are not intended to be indicative or representative of the quality or characteristics of the lot from which a test sample is taken, and Client shall not rely upon the Test Report as being so indicative or representative of the lot or of the tested product in general. The Test Report will reflect the findings of the Company at the time of testing only, and the Company shall have no obligation to update the Test Report after its issuance. The Test Report will set forth the results of the tests performed by the Company based upon the written information provided to the Company. The Test Report will be based solely on the samples and written information submitted to the Company by Client, and the Company shall not be obligated to conduct any independent investigation or inquiry with respect thereto.
3. The Company may, in its sole discretion, destroy samples which have been furnished to the Company for testing and which have not been destroyed in the course of testing. The Company may delegate the performance of all or a portion of the services contemplated hereunder to an affiliate, agent or subcontractor of the Company, and Client consents to such delegation.
4. These Conditions and the Test Report represent the entire understanding of the parties hereto with respect to the subject matter hereof and of the Test Report, and no modification, variance or extrapolation with respect thereto shall be permitted without the prior written consent of the Company.
5. The names, service marks, trademarks and copyrights of the Company and its affiliates, including the names "BUREAU VERITAS," "BUREAU VERITAS CONSUMER PRODUCTS SERVICES," "BVCPS," "MTL," "ACTS," "MTL-ACTS" and "CURTIS-STRAUS" (collectively, the "Marks") are and shall remain the sole property of the Company or its affiliates and shall not be used by Client except solely to the extent that Client obtains the prior written approval of the Company and then only in the manner prescribed by the Company. Client shall not contest the validity of the Marks or take any action that might impair the value or goodwill associated with the Marks or the image or reputation of the Company or its affiliates.
6. Payment in full shall be due 30 days after the date of invoice. Interest shall be due on overdue amounts from the due date until paid at an interest rate of 1.5% per month or, if less, the maximum rate permitted by law. The Company reserves the right, at any time and from time to time, to revoke any credit extended to Client. Client shall reimburse the Company for any costs it incurs in collecting past due amounts, including court costs and fees and expenses of attorneys and collection agencies. The Test Report may not be used or relied upon by Client if and for so long as Client fails to pay when due any invoice issued by the Company or any affiliate of it to Client or any affiliate or subsidiary of Client together with interest and penalties, if any, accrued thereon.
7. The Company disclaims any and all responsibility or liability arising out of or in connection with e-mail transmissions of such information.
8. Client understands and agrees that the Company is neither an insurer nor a guarantor, that the Company does not take the place of Client or any designer, manufacturer, agent, buyer, distributor or transportation or shipping company, and that the Company disclaims all liability in such capacities. Client further understands that if it seeks assurance against loss or damage, it should obtain appropriate insurance.
9. Client agrees that the Company, by providing the services, does not take the place of Client nor any third party, nor does the Company release them from any of their obligations, nor does the Company otherwise assume, abridge, abrogate or undertake to discharge any duty of any third party to Client or any duty of Client or any third party to any other third party, and Client will not release any third party from its obligations and duties with respect to the tested goods.
10. Client shall, on a timely basis, (a) provide adequate instructions to the Company in order to enable the Company to perform properly its services, (b) provide, or cause Client's suppliers and contractors to provide, the Company with all documents necessary to enable the Company to perform its services, (c) furnish the Company with all relevant information regarding Client's intended use and purposes of the tested goods, (d) advise the Company of essential dates and deadlines relevant to the tested goods and (e) fully exercise all rights and remedies available to Client against third parties in respect of the tested goods.
11. The Company shall undertake due care and ordinary skill in the performance of its services to Client, and the Company shall accept responsibility only where such skill has not been exercised and, even in such event, only to the extent of the limitation of liability set forth herein.
12. If Client desires to assert a claim arising from or relating to (i) the performance, purported performance or non-performance of any services by the Company or (ii) the sale, resale, manufacture, distribution or use of any tested goods, it must submit that claim to the Company in a writing that sets forth with particularity the basis for such claim within 60 days from discovery of the potential claim and not more than six months after the date of issuance of the Test Report to Client. Client waives any and all such claims including, without limitation, claims that the Test Report is inaccurate, incomplete or misleading or that additional or different testing is required, unless and then only to the extent that Client submits a written claim to the Company within both such time periods.
13. CLIENT SHALL, EXCEPT TO THE EXTENT OF COMPANY'S LIABILITY TO CLIENT HEREUNDER (WHICH IN NO EVENT SHALL EXCEED THE LIMITATION OF LIABILITY HEREIN), HOLD HARMLESS AND INDEMNIFY THE COMPANY, ITS AFFILIATES AND THEIR RESPECTIVE DIRECTORS, OFFICERS, EMPLOYEES, AGENTS AND SUBCONTRACTORS AGAINST



BUREAU
VERITAS

Curtis-Straus LLC, a wholly owned subsidiary of BV CPS
One Distribution Center Circle, #1 • Littleton, MA • TEL (978) 486-8880 • FAX (978) 486-8828



page 18 of 19

ALL ACTUAL OR ALLEGED THIRD PARTY CLAIMS FOR LOSS, DAMAGE OR EXPENSE OF WHATSOEVER NATURE AND HOWSOEVER ARISING FROM OR RELATING TO (i) THE PERFORMANCE, PURPORTED PERFORMANCE OR NON-PERFORMANCE OF ANY SERVICES BY THE COMPANY OR (ii) THE SALE, RESALE, MANUFACTURE, DISTRIBUTION OR USE OF ANY TESTED GOODS.

14. EXCEPT AS MAY OTHERWISE BE EXPRESSLY AGREED TO IN WRITING BY THE COMPANY AND NOTWITHSTANDING ANY PROVISION TO THE CONTRARY CONTAINED HEREIN OR IN ANY TEST REPORT, NO WARRANTY OR GUARANTEE, EXPRESS OR IMPLIED, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR USE, IS MADE.

15. (A) IN NO EVENT WHATSOEVER SHALL THE COMPANY BE LIABLE FOR ANY CONSEQUENTIAL, SPECIAL, INCIDENTAL, EXEMPLARY OR PUNITIVE DAMAGES IN CONNECTION WITH, RELATING TO OR ARISING OUT OF THE TEST REPORT OR THE SERVICES PROVIDED BY THE COMPANY HEREUNDER, INCLUDING WITHOUT LIMITATION LOSS OF OR DAMAGE TO PROPERTY; LOSS OF INCOME, PROFIT OR USE; OR ANY CLAIMS OR DEMANDS MADE AGAINST CLIENT OR ANY OTHER PERSON BY ANY THIRD PARTY IN CONNECTION WITH, RELATING TO OR ARISING OUT OF THE SERVICES PROVIDED BY THE COMPANY HEREUNDER.

(B) NOTWITHSTANDING ANY PROVISION TO THE CONTRARY CONTAINED HEREIN, AND IN RECOGNITION OF THE RELATIVE RISKS AND BENEFITS TO CLIENT AND THE COMPANY ASSOCIATED WITH THE TESTING SERVICES CONTEMPLATED HEREBY, THE RISKS HAVE BEEN ALLOCATED SUCH THAT UNDER NO CIRCUMSTANCES WHATSOEVER SHALL THE LIABILITY OF THE COMPANY TO CLIENT OR ANY THIRD PARTY IN RESPECT OF ANY CLAIM FOR LOSS, DAMAGE OR EXPENSE, OF WHATSOEVER NATURE OR MAGNITUDE, AND HOWSOEVER ARISING, EXCEED AN AMOUNT EQUAL TO FIVE (5) TIMES THE AMOUNT OF THE FEES PAID TO THE COMPANY FOR THE SPECIFIC SERVICES WHICH GAVE RISE TO SUCH CLAIM OR U.S.\$10,000, WHICHEVER IS THE LESSER AMOUNT.

16. The Company shall not be liable for any loss or damage resulting from any delay or failure in performance of its obligations hereunder resulting directly or indirectly from any event of force majeure or any event outside the control of the Company. If any such event occurs, the Company may immediately cancel or suspend its performance hereunder without incurring any liability whatsoever to Client.

17. Company's services, including these Conditions, shall be governed by, and construed in accordance with, the local laws of the country where the Company performs the tests or, in the case of tests performed in the United States of America, the laws of Massachusetts without regard to conflicts of laws principles. If any aspect(s) of these Conditions is found to be illegal or unenforceable, the validity, legality and enforceability of all remaining aspects of these Conditions shall not in any way be affected or impaired thereby. Any proceeding related to the subject matter hereof shall be brought, if at all, in the courts of the country where the Company performs the tests or, in the case of tests performed in the United States of America, in the courts of Massachusetts. Client waives the right to interpose any counterclaim or setoffs of any nature in any litigation arising hereunder.

Rev.160009121(2)_#684340 v13CS

