Emissions Test Report

EUT Name: SoClean 3

Model No.: SC1400

CFR 47 Part 15.225:2020 and RSS-210: Issue 10

Prepared for:

SoClean Inc.
12 Vose farm road
Petersborough, NH, 03458 U.S.A.

Prepared by:

TUV Rheinland of North America, Inc.
5015 Brandin Ct.
Fremont, CA 94538
Tel: (925) 249-9123
Fax: (925) 249-9124
http://www.tuv.com/

Report/Issue Date:	July 23, 2020
Job Number:	234107543
Report Number:	31965019.001

Testing Cert #3331.02 **US1131** **2932D**

Revisions

Revision No.	Date MM/DD/YYYY	Reason for Change	Author
0	5/14/20	Original Document	OC
1	7/23/20	TCB review	OC
1.1	7/23/20	Customer request	OC

Note: Latest revision report will replace all previous reports.

Statement of Compliance

Manufacturer:	SoClean Inc. 12 Vose farm road Petersborough, NH, 03458
Requester / Applicant:	SoClean Inc.
Name of Equipment:	SoClean 3
Model No.	SC1400
Type of Equipment:	Intentional Radiator
Application of Regulations:	CFR 47 Part 15.225:2020 and RSS-210: Issue 10
Test Dates:	November 1st 2019 to November 12th, 2019, July 22nd, 2020

Guidance Documents:

Emissions: ANSI C63.10: 2013

Test Methods:

Emissions: ANSI C63.10: 2013

The electromagnetic compatibility test and documented data described in this report has been performed and recorded by TUV Rheinland, in accordance with the standards and procedures listed herein. As the responsible authorized agent of the EMC laboratory, I hereby declare that the equipment described above has been shown to be compliant with the EMC requirements of the stated regulations and standards based on these results. If any special accessories and/or modifications were required for compliance, they are listed in the Executive Summary of this report.

This report must not be used to claim product endorsement by A2LA or any agency of the U.S. Government. This report contains data that are not covered by A2LA accreditation. This report shall not be reproduced except in full, without the written authorization of TUV Rheinland of North America.

Osvaldo Casorla

Test Engineer Date July 23, 2020

Rachana Khanduri

Laboratory Signature Date July 23, 2020

Industry Canada

Testing Cert #3331.02 **US5254** **2932M-1**

1 Executive Summary ___ 7
1.1 Scope ___ 7
1.2 Purpose ___ 7
1.3 Summary of Test Results ___ 7
1.4 Special Accessories ___ 7
1.5 Equipment Modifications ___ 7
2 Laboratory Information ___ 8
2.1 Accreditations & Endorsements ___ 8
2.1.1 US Federal Communications Commission ___ 8
2.1.2 NIST / A2LA ___ 8
2.1.3 Canada – Industry Canada ___ 8
2.1.4 Japan – VCCI ___ 8
2.2 Test Facilities ___ 9
2.2.1 Emission Test Facility ___ 9
2.2.2 Immunity Test Facility ___ 9
2.3 Measurement Uncertainty ___ 9
2.3.1 Sample Calculation – radiated & conducted emissions ___ 10
2.3.2 Measurement Uncertainties ___ 10
2.4 Calibration Traceability ___ 11
3 Product Information ___ 12
3.1 Product Description ___ 12
3.2 Equipment Configuration ___ 12
3.3 Operating Mode ___ 12
3.4 Unique Antenna Connector ___ 13
3.4.1 Results ___ 13
4 Emissions ___ 14
4.1 Carrier Field Strength Requirements ___ 14
4.1.1 Test Method ___ 14
4.1.2 Results ___ 15
4.2 Occupied Bandwidth ___ 16
4.2.1 Test Method ___ 16
4.2.2 Results ___ 17
4.3 Out-of-Band Emissions ___ 25
4.3.1 Test Method ___ 25
4.3.2 Test Result ___ 26
4.4 Transmitter Spurious Emissions ___ 30
4.4.1 Test Methodology ___ 30
4.4.2 Transmitter Spurious Emission Limit ___ 31
4.4.3 Test Results ___ 31
4.4.4 Sample Calculation ___ 35

4.5 AC Conducted Emissions 36
4.5.1 Test Methodology 36
4.5.2 Test Results 36
4.6 Frequency Stability 41
4.6.1 Test Methodology 41
4.6.2 Manufacturer Declaration 41
4.6.3 Test results 41
4.7 Voltage Variation 47
4.7.1 Test Methodology 47
4.7.2 Test results 47
5 Test Equipment List 51
5.1 Equipment List 51
6 EMC Test Plan 52
6.1 Introduction 52
6.2 Customer 52
6.3 Equipment Under Test (EUT) 53
6.4 Test Specifications 55

Table 1: Summary of Test Results 7
Table 2: Summary of Uncertainties 10
Table 3: RF Fundamental Field Strength – Test Results 15
Table 4: Occupied Bandwidth – Test Results 17
Table 5: 20 dB Bandwidth Frequency – Test Results 18
Table 6: Out of Band Emissions Limit 21
Table 7: Out of Band Emissions – Test Results 23
Table 8: AC Conducted Emissions – Test Results 30
Table 9: Frequency Stability – Test Results 36
Table 10: Voltage Variation – Test Results 45
Table 11: Customer Information 48
Table 12: Technical Contact Information 48
Table 13: EUT Information 48
Table 14: EUT Specifications 49
Table 15: Interface Specifications 50
Table 16: Supported Equipment 50
Table 17: Description of Sample used for Testing 50
Table 18: Description of Test Configuration used for Radiated Measurement. 51
Table 19: Antenna Information 51
Table 20: Test Specifications 51

1 Executive Summary

1.1 Scope

This report is intended to document the status of conformance with the requirements of the CFR 47 Part 15.225:2020 and RSS-210: Issue 10 based on the results of testing performed on November 1st 2019 to November 12th, 2019, July 22nd, 2020 on the SoClean 3 Model SC1400 manufactured by SoClean Inc.. This report only applies to the specific samples tested under the stated test conditions. It is the responsibility of the manufacturer to assure that additional production units of this model are manufactured with identical or EMI equivalent electrical and mechanical components. This report is further intended to document changes and modifications to the EUT throughout its life cycle. All documentation will be included as a supplement.

1.2 Purpose

Testing was performed to evaluate the EMC performance of the EUT in accordance with the applicable requirements, procedures, and criteria defined in the application of regulations and application of standards listed in this report.

1.3 Summary of Test Results

Table 1: Summary of Test Results

Test	Test Method ANSI C63.4	Test Parameters (from Standard)	Result
Transmitter Spurious Emissions	CFR47 15.209, RSS-GEN Sect.7.2.5	Class B	Complied
Restricted Bands of Operation	CFR47 15.205, RSS 210 Sect.2.6	Class B	Complied
AC Power Conducted Emissions	CFR47 15.207, RSS-GEN Sect.7.2.2	Class B	Complied
Occupied Bandwidth	CFR47 15.215 (c), RSS GEN Sect.4.4.1	N/A	Complied
Carrier Field Strength	CFR47 15.225 (a), RSS 210 Sect. A 2.6 (a)	124 dBuV/m at 3 meter	Complied
Out of Band Emissions	CFR47 15.225 (b), (c) RSS 210 Sect. A 2.6 (b) (c)	Per Standards.	Complied
Frequency Stability	CFR47 15.225 (e), RSS 210 Sect. A 2.6 (d)	100 ppm / +0.01%	Complied
Voltage Variation	CFR47 15.31 (e),	100 ppm / +0.01%	Complied

1.4 Special Accessories

No special accessories were necessary in order to achieve compliance.

1.5 Equipment Modifications

None.

2 Laboratory Information

2.1 Accreditations & Endorsements

2.1.1 US Federal Communications Commission

TUV Rheinland of North America at 1279 Quarry Lane, Ste. A., Pleasanton, CA 94566, is accredited by the commission for performing testing services for the general public on a fee basis. These laboratory test facilities have been fully described in reports submitted to and accepted by the FCC (FRN # US5254). The laboratory scope of accreditation includes: Title 47 CFR Parts 15, 18, and 90. The accreditation is updated every 3 years.

2.1.2 NIST / A2LA

TUV Rheinland of North America is accredited by the A2LA Accreditation Program, which is administered under the auspices of the National Institute of Standards and Technology. The laboratory has been assessed and accredited in accordance with ISO Guide 17025:2017 and ISO 9002 (Testing Cert #3331.02). The scope of laboratory accreditation includes emission and immunity testing. The accreditation is updated annually.

2.1.3 Canada – Industry Canada

TUV Rheinland of North America at the 1279 Quarry Ln, Pleasanton, CA 94566 address is accredited by Industry Canada for performing testing services for the general public on a fee basis. This laboratory test facilities have been fully described in reports submitted to and accepted by Industry Canada (File Number 2932M). This reference number is the indication to the Industry Canada Certification Officers that the site meets the requirements of RSS 212, Issue 1 (Provisional). The accreditation is updated every 3 years.

2.1.4 Japan – VCCI

The Voluntary Control Council for Interference by Information Technology Equipment (VCCI) is a group that consists of Information Technology Equipment (ITE) manufacturers and EMC test laboratories. The purpose of the Council is to take voluntary control measures against electromagnetic interference from Information Technology Equipment, and thereby contribute to the development of a socially beneficial and responsible state of affairs in the realm of Information Technology Equipment in Japan. TUV Rheinland of North America EMC test facilities located at 1279 Quarry Lane, Ste. A, Pleasanton, CA, 94566, and 5015 Brandin Ct, Fremont, CA. 94538, have been assessed and approved in accordance with the Regulations for Voluntary Control Measures.

VCCI Registration No. for Pleasanton: A-0326

VCCI Registration No. for Fremont: A-0327

2.2 Test Facilities

Test facilities are located at 5015 Brandin Ct, Fremont, California, 94538, USA and 1279 Quarry Lane, Pleasanton, California 94566, USA (Fremont is the Pleasanton Annex).

2.2.1 Emission Test Facility

The Semi-Anechoic chamber and AC Line Conducted measurement facility used to collect the radiated and conducted data has been constructed in accordance with ANSI C63.7:1992. The site has been measured in accordance with and verified to comply with the theoretical normalized site attenuation requirements of ANSI C63.4:2009, at test distances of 3 and 5 meters. The site is listed with the FCC and accredited by A2LA (Testing Cert #3331.02). The 3/5-meter semi-anechoic chamber used to collect the radiated data has been verified to comply with the theoretical normalized site attenuation requirements of ANSI C63.4:2009, at test distances of 3 meters and 5 meters. A report detailing this site can be obtained from TUV Rheinland of North America.

2.2.2 Immunity Test Facility

ESD, EFT, Surge, PQF: These tests are performed in an environmentally controlled room with a 3.7 m x 4.8 m x 3.175 mm thick aluminum floor connected to PE ground.

For ESD testing, tabletop equipment is placed on an insulated mat with a surface resistivity of 10^9 Ohms/square on a 1.6 m x 0.8 m x 0.8 m high non-conductive table with a 3.175 mm aluminum top (Horizontal Coupling Plane). The HCP is connected to the main ground plane via a low impedance ground strap through two 470-kΩ resistors. The Vertical Coupling Plane consists of an aluminum plate 50 cm x 50 cm x 3.175 mm thick. The VCP is connected to the main ground plane via a low impedance ground strap through two 470-kΩ resistors.

For EFT, Surge, PQF, the HCP and VCP are removed.

RF Field Immunity testing is performed in a 7.3m x 4.3m x 4.1m anechoic chamber.

RF Conducted and Magnetic Field Immunity testing is performed on a 4.8m x 3.7m x 3.175mm thick aluminum ground plane.

All test areas allow a minimum distance of 1 meter from the EUT to walls or conducting objects.

2.3 Measurement Uncertainty

Two types of measurement uncertainty are expressed in this report, per *ISO Guide To The Expression Of Uncertainty In Measurement*, 1st Edition, 1995.

The Combined Standard Uncertainty is the standard uncertainty of the result of a measurement when that result is obtained from the values of a number of other quantities; it is equal to the positive square root of the sum of the variances or co-variances of these other quantities, weighted according to how the measurement result varies with changes in these quantities. The term *standard uncertainty* is the result of a measurement expressed as a standard deviation.

The Expanded Uncertainty defines an interval about the result of a measurement that may be expected to encompass a large fraction of the distribution of values that could reasonably be attributed to the measured. The fraction may be viewed as the coverage probability or level of confidence of the interval.

2.3.1 Sample Calculation – radiated & conducted emissions

The field strength is calculated by subtracting the Amplifier Gain and adding the Cable Loss and Antenna Correction Factor to the measured reading. The basic equation is as follows:

Field Strength (dBµV/m) = RAW - AMP + CBL + ACF

Where: RAW = Measured level before correction (dBµV)

AMP = Amplifier Gain (dB)

CBL = Cable Loss (dB)

ACF = Antenna Correction Factor (dB/m)

$$\mu V/m = 10^{\frac{dB\mu V/m}{20}}$$

Sample radiated emissions calculation @ 30 MHz

Measurement +Antenna Factor–Amplifier Gain+Cable loss=Radiated Emissions (dBuV/m)

25 dBuV/m + 17.5 dB – 20 dB + 1.0 dB = 23.5 dBuV/m

2.3.2 Measurement Uncertainties

Table 2: Summary of Uncertainties

	U_{lab}	U_{cispr}
Radiated Disturbance		
30 MHz – 25,000 MHz	3.2 dB	5.2 dB
Conducted Disturbance @ Mains Terminals		
150 kHz – 30 MHz	2.4 dB	3.6 dB
Disturbance Power		
30 MHz – 300 MHz	3.92 dB	4.5 dB

Note: U_{lab} is the calculated Combined Standard Uncertainty
U_{cispr} is the measurement uncertainty requirement per CISPR 16.

Measurement Uncertainty Immunity

The estimated combined standard uncertainty for ESD immunity measurements is ± 4.1%.
The estimated combined standard uncertainty for radiated immunity measurements is ± 2.7dB.
The estimated combined standard uncertainty for conducted immunity measurements is ± 1.4dB.
The estimated combined standard uncertainty for damped oscillatory wave immunity measurements is ± 8.8%.
The estimated combined standard uncertainty for harmonic current and flicker measurements is ± 0.45%.

Measurement Uncertainty – Radio Testing

The estimated combined standard uncertainty for frequency error measurements is ± 3.88 Hz
The estimated combined standard uncertainty for carrier power measurements is ± 1.59 dB.
The estimated combined standard uncertainty for adjacent channel power measurements is ± 1.47 dB.
The estimated combined standard uncertainty for modulation frequency response measurements is ± 0.46 dB.
The estimated combined standard uncertainty for transmitter conducted emission measurements is ± 4.01 dB

The expanded uncertainty at a level of 95% confidence is obtained by multiplying the combined standard uncertainty by a coverage factor of 2. Compliance criteria are not based on measurement uncertainty.

2.4 Calibration Traceability

All measurement instrumentation is traceable to the National Institute of Standards and Technology (NIST). Measurement method complies with ANSI/NCSL Z540-1-1994 and ISO Guide 17025:2017.

3 Product Information

3.1 Product Description

The reader is an ASK RFID operating at 13.56 MHz. The SoClean 3 is a CPAP mask-cleaning device.

3.2 Equipment Configuration

A description of the equipment configuration is given in Test Plan Section. The EUT was tested as called for in the test standard and was configured and operated in a manner consistent with its intended use. The EUT was connected to rated power and allowed to reach intended operating conditions. The placement of the EUT system components was guided by the test standard and selected to represent typical installation conditions.

In the case of an EUT that can operate in more than one configuration, preliminary testing was performed to determine the configuration that produced maximum radiation.

The final configuration was selected to produce the worst case radiation for emissions testing and to place the EUT in the most susceptible state for immunity testing.

3.3 Operating Mode

A description of the operation mode is given in Test Plan Section. In the case of an EUT that can operate in more than one state, preliminary testing was performed to determine the operating mode that produced maximum radiation.

The final operating mode was selected to produce the worst case radiation for emissions testing and to place the EUT in the most susceptible state for immunity testing.

3.4 Unique Antenna Connector

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of CFR47 Parts 15.211, 15.213, 15.217, 15.219, or 15.221.

3.4.1 Results

The SoClean 3 Model SC1400 manufactured by SoClean Inc. uses the permanently attached antenna.

- PCB antenna integrated in RFID Reader PCB

4 Emissions

Testing was performed in accordance with CFR 47 Part 15.225:2020 and RSS 210 Annex 2:2019. These test methods are listed under the laboratory's A2LA Scope of Accreditation. This test measures the levels emanating from the EUT, thus evaluating the potential for the EUT to cause radio frequency interference to other electronic devices. Procedures described in ANSI C63.10: 2013 were used.

4.1 Carrier Field Strength Requirements

The RF fundamental field strength requirement is the power radiated in the direction of the maximum level under specified conditions of measurements in the presence of modulation.

The RF fundamental field strengths shall not exceed CFR47 Part 15.225 (a):2020 and RSS 210 A2.6 (a):2010.

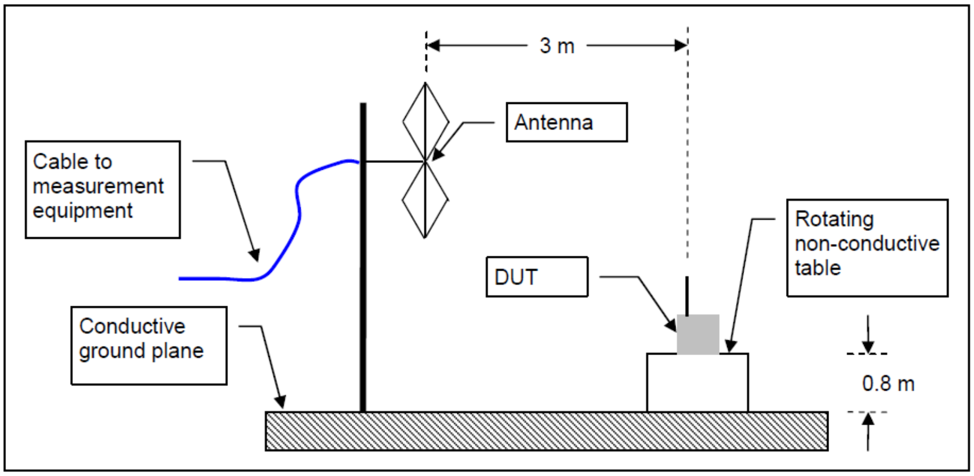
The field strength of any emission in the band of 13.553 and 13.567MHz shall be less than 84 dBuV/m at 30 meter distance; or 124 dBuV/m at 3 meter.

4.1.1 Test Method

The radiated method was used to measure the field strength of the fundamental signal according to ANSI C63.10: 2013 Section 6.3. The measurement was performed with modulation on production sample M/N SC1400. The worst results indicated below.

Test Setup:

30MHz-1GHz



RBW is set to 200 Hz and VBW is set to 1 kHz for 9 kHz-150 kHz.
RBW is set to 9 kHz and VBW is set to 30 kHz for 150 kHz-30 MHz
RBW is set to 100 kHz, VBW is set to 300 kHz for 30 MHz-1 GHz.

4.1.2 Results

As originally tested, the EUT was found to be compliant to the requirements of the test standard(s).

Table 3: RF Fundamental Field Strength – Test Results

Test Conditions: Radiated Measurement, Normal Temperature and Voltage only						
Antenna Type: Integrated				**Power Setting:** 100mW		
Signal State: Modulated				**Duty Cycle:** 100 %		
Ambient Temp.: 21 °C				**Relative Humidity:**42 %		
Operating Frequency:	**Test Results**					
13.56 MHz	**Measured Level [dBuV/m]**	**Loop Position**	**Table [degree]**	**Antenna [cm]**	**Limit [dBuV/m]**	**Margin [dB]**
X-Axis	62.59	0	287	100	124.00	-61.41
	56.55	90	34	100	124.00	-67.44
Note: 1. Measurements was taken at 3-meter distance, and the limit was extrapolated accordingly. Measurement was performed on worst case EUT axis						

4.2 Occupied Bandwidth

The occupied bandwidth is measured at an amplitude level reduced from the reference level by a specified ratio. The reference level is the level of the highest amplitude signal observed from the transmitter at the fundamental frequency.

The 99% bandwidth is the bandwidth in which 99% of the transmitted power occupied.

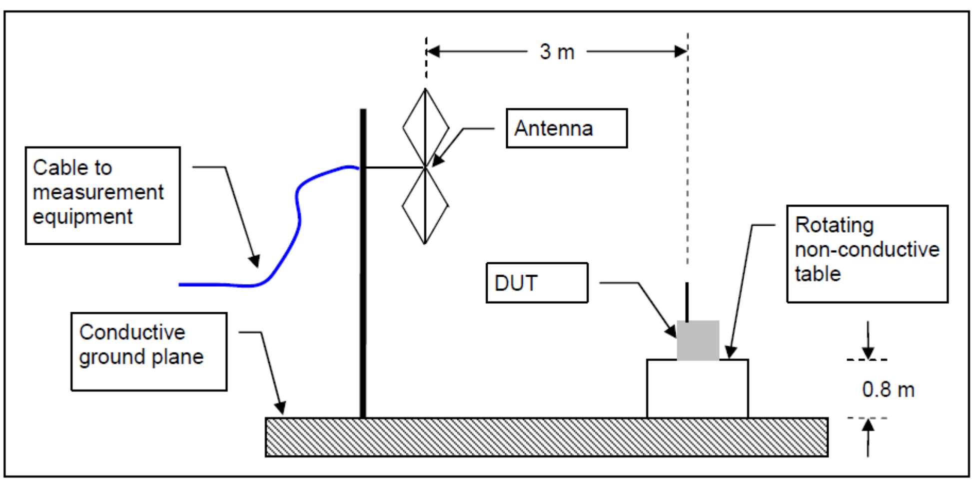
The 20dB bandwidth is defined the bandwidth of 20 dBr from highest transmitted level of the fundamental frequency.

The bandwidth shall be documented per Section CFR47 15.215(c) 2020 and RSS Gen Sect. 4.6: 2010. Intentional radiators operating under the alternative provisions to the general emission limits, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated. The requirement to contain the designated bandwidth of the emission within the specified frequency band includes the effects from frequency sweeping, frequency hopping and other modulation techniques that may be employed as well as the frequency stability of the transmitter over expected variations in temperature and supply voltage. If the frequency stability is not specified in the regulations, it is recommended that the fundamental emission be kept within at least the central 80% of the permitted band in order to minimize the possibility of out-of-band operation.

4.2.1 Test Method

The radiated method was used to measure the occupied bandwidth according to ANSI C63.10:2013. The measurement was performed with modulation. This test was performed on the production sample M/N SC1400. The worst sample result indicated below.

Test Setup:



4.2.2 Results

As originally tested, the EUT was found to be compliant to the requirements of the test standard(s).

Table 4: Occupied Bandwidth – Test Results

Test Conditions: Radiated Measurement, Normal Temperature and Voltage only		
Antenna Type: Integrated	**Power Setting:** 100mW	
Signal State: Modulated	**Duty Cycle:** 100 %	
Ambient Temp.: 21 °C	**Relative Humidity:** 46%	
Occupied Bandwidth for 13.56 MHz RFID		
Limit (kHz)	**99% BW (kHz)**	**20 dB BW (kHz)**
Note 1	2.27	2.69
Note 1: All lower and upper markers of 99% Bandwidth and 20 dB Bandwidth are within the allowable band; 13.553 MHz to 13.567MHz		

Table 5: 20 dB Bandwidth Frequency – Test Results

Test Conditions: Radiated Measurement, Normal Temperature and Voltage only			
Antenna Type: Integrated		**Power Setting:** 100mW	
Signal State: Modulated		**Duty Cycle:** 100 %	
Ambient Temp.: 21 °C		**Relative Humidity:**42%	
20 dB Bandwidth Frequencies for 13.56 MHz RFID			
Occupied Band Limit (MHz)	**Lower Freq. (MHz)**	**Upper Freq. (MHz)**	**Results**
13.553 < X < 13.567	13.560	13.561	Pass
Note: All lower and upper markers of 20 dB Bandwidth are within the allowable band; 13.553 MHz to 13.567MHz; where X is the lower frequency and upper frequency.			

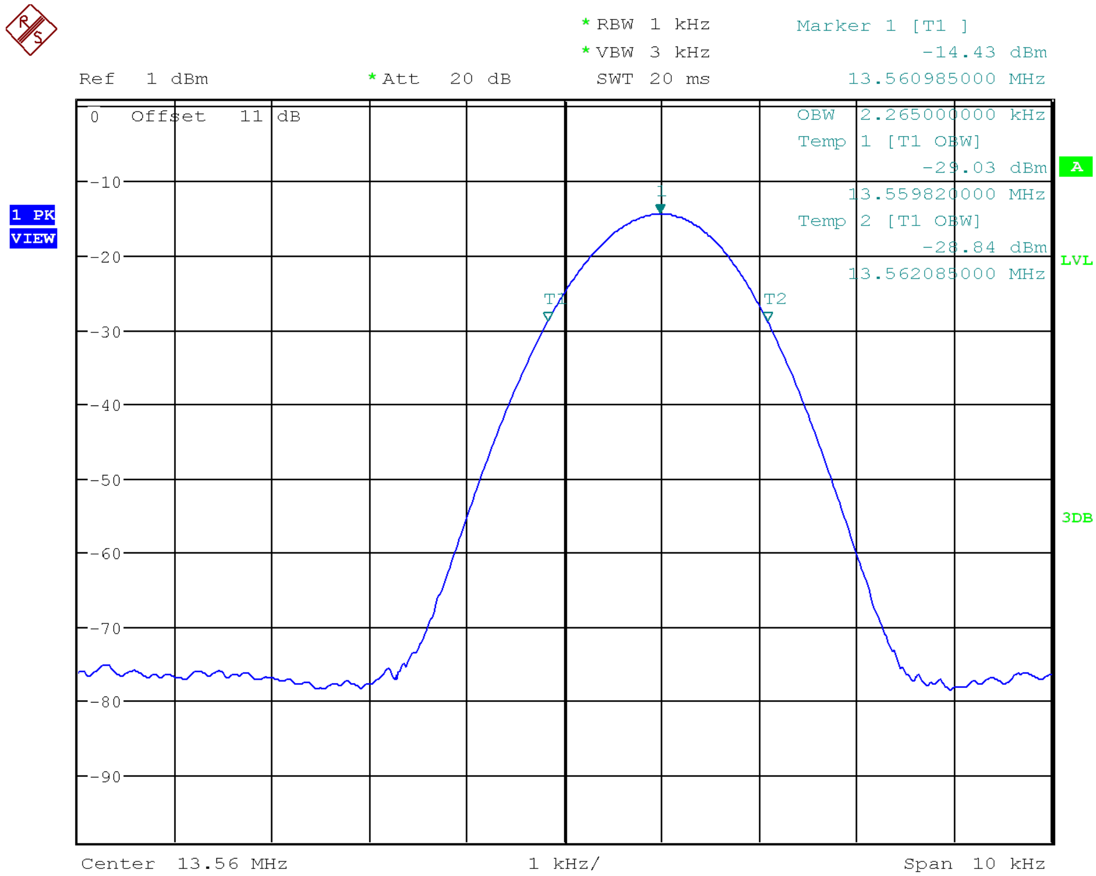


Figure 1: Occupied Bandwidth

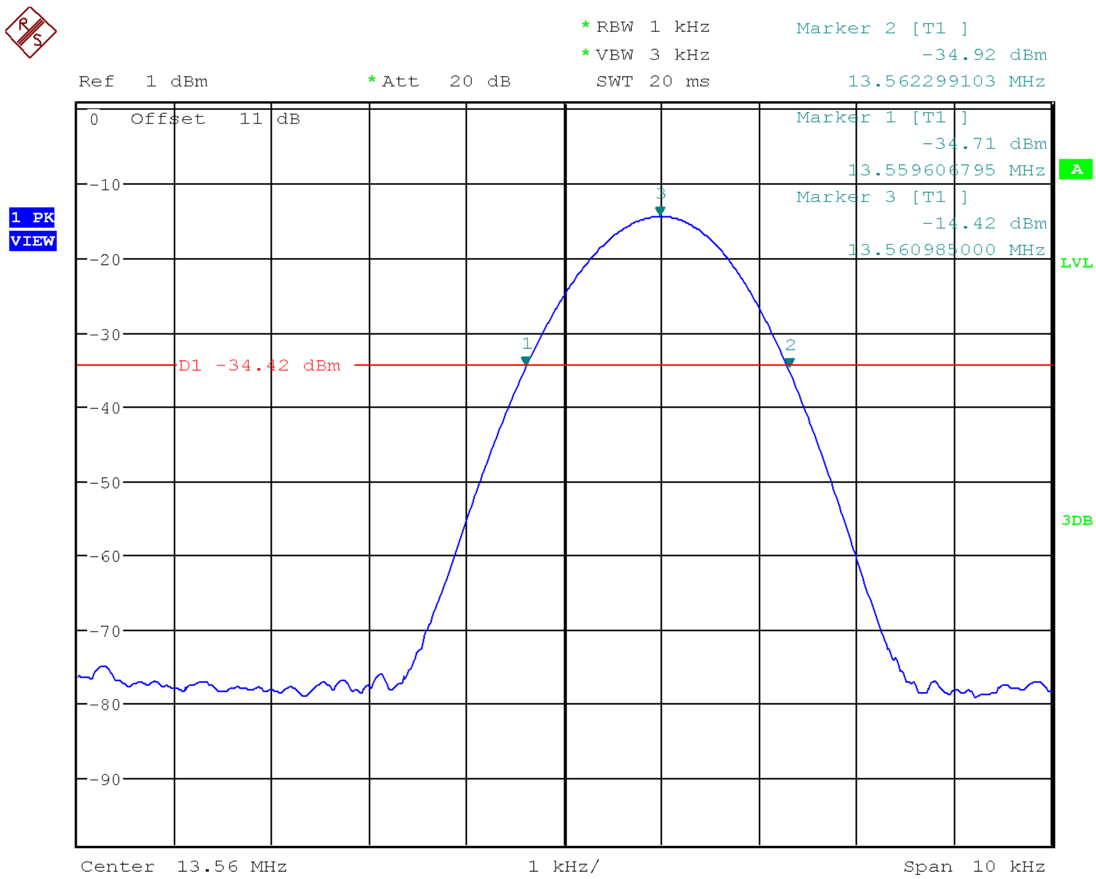


Figure 2: 20dB Occupied Bandwidth

4.3 Out-of-Band Emissions

The out of band emission is leakage measurement of the main carrier outside the allocated operating frequency band; 13.553 MHz to 13.567 MHz.
According to CFR47 Part 15.225: 2010 and RSS210 A2.6: 2010, the out of band emission shall;
-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 (84 dBuV/m) 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 (40.5 dBuV/m) at 30 meters.

Table 6: Out of Band Emissions Limit

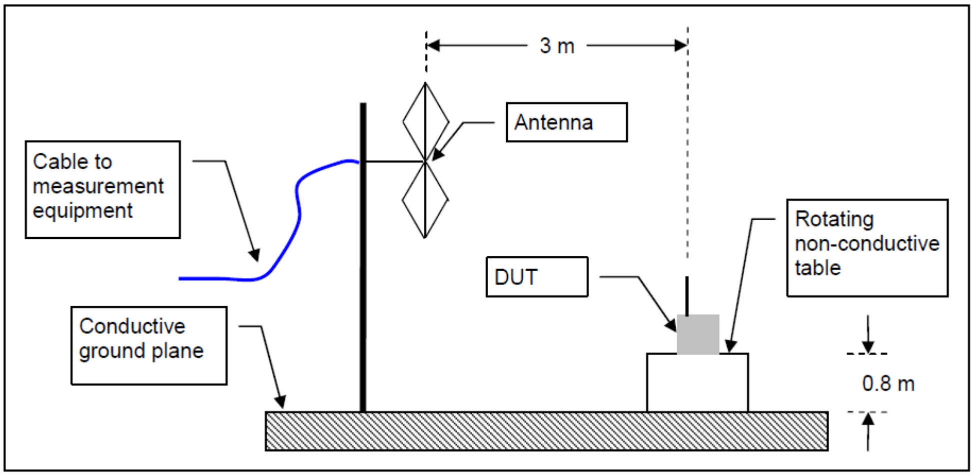
Frequency (MHz)	*Limit at 30m (dBuV/m)*	*Limit at 3m (dBuV/m)*	*Comment*
<13.110	*29.5*	*69.5*	*CFR47 15.225 (d), RSS210 A2.6 (d). Out of Band*
13.110-13.410	*40.5*	*80.5*	*CFR47 15.225 (c), RSS210 A2.6 (c). Out of Band*
13.410-13.533	*50.5*	*90.5*	*CFR47 15.225 (b), RSS210 A2.6 (b). Out of Band*
13.553-13.567	*84.0*	*124.0*	*CFR47 15.225 (a), RSS210 A2.6 (a), Inband (Carrier)*
13.567-13.710	*50.5*	*90.5*	*CFR47 15.225 (b), RSS210 A2.6 (b), Out of Band*
13.710-14.010	*40.5*	*80.5*	*CFR47 15.225 (c), RSS210 A2.6 (c), Out of Band*
>14.010	*29.5*	*69.5*	*CFR47 15.225 (d), RSS210 A2.6 (d), Out of Band*
Note: The limit was extrapolated 40dB/decade per CFR47 Part 15.31 (f)(3).			

4.3.1 Test Method

The radiated method was used to measure the out-of-band emission requirement. The measurement was performed with modulation per CFR47 15.225 (b) (c) 2010 and *RSS 210 A2.6*. (b) (c)*: 2010*. This test was performed on the production sample M/N SC1400. The worst result indicated below.

Test Setup:

30MHz-1GHz



RBW is set to 200 Hz and VBW is set to 1 kHz for 9 kHz-150 kHz.
RBW is set to 9 kHz and VBW is set to 30 kHz for 150 kHz-30 MHz
RBW is set to 100 kHz, VBW is set to 300 kHz for 30 MHz-1 GHz.

4.3.2 Test Result

As originally tested, the EUT was found to be compliant to the requirements of the test standard(s).

Table 7: Out of Band Emissions – Test Results

<table>
<tr><td colspan="5">Test Conditions: Conducted Measurement, Normal Temperature and Voltage only</td></tr>
<tr><td colspan="2">Antenna Type: Integrated</td><td colspan="3">Power Setting: 100mW</td></tr>
<tr><td colspan="2">Signal State: Modulated</td><td colspan="3">Duty Cycle: 100 %</td></tr>
<tr><td colspan="2">Ambient Temp.: 21 °C</td><td colspan="3">Relative Humidity:42%</td></tr>
<tr><th>Orientation</th><th>Antenna Position</th><th>Spectrum Mask (12 to 15MHz)</th><th>Limit</th><th>Result</th></tr>
<tr><td rowspan="2">X-Axis</td><td>0</td><td>Figure #3</td><td rowspan="2">See Table 6</td><td>Pass</td></tr>
<tr><td>90</td><td>Figure #4</td><td>Pass</td></tr>
<tr><td colspan="5">Note: All maximized emissions within 12 MHz to 15 MHz are below the spectrum mask limit per Table 6.</td></tr>
</table>

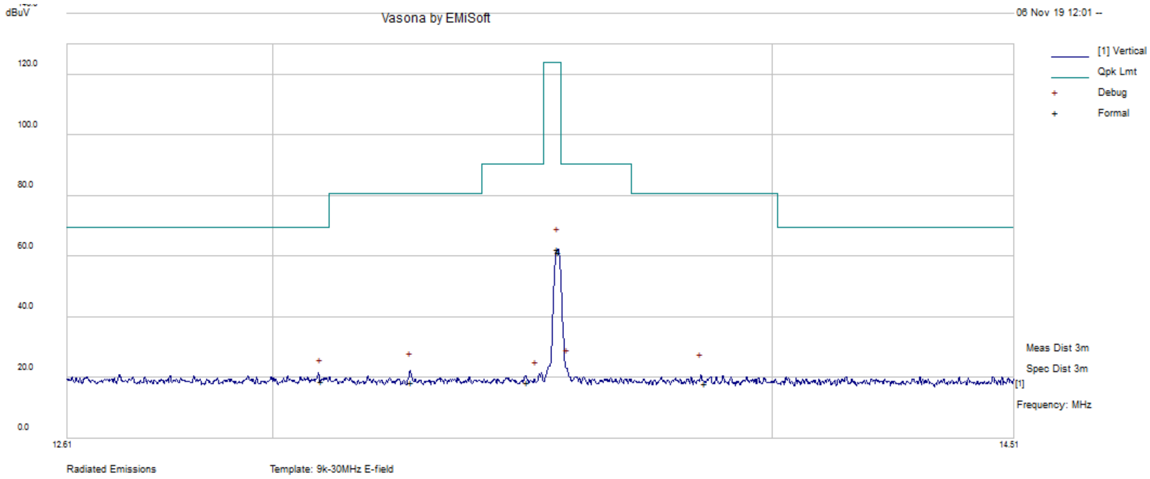


Figure 3: Out of Band Spectrum Mask for RFID Reader – 0 Degree Loop Antenna X-axis

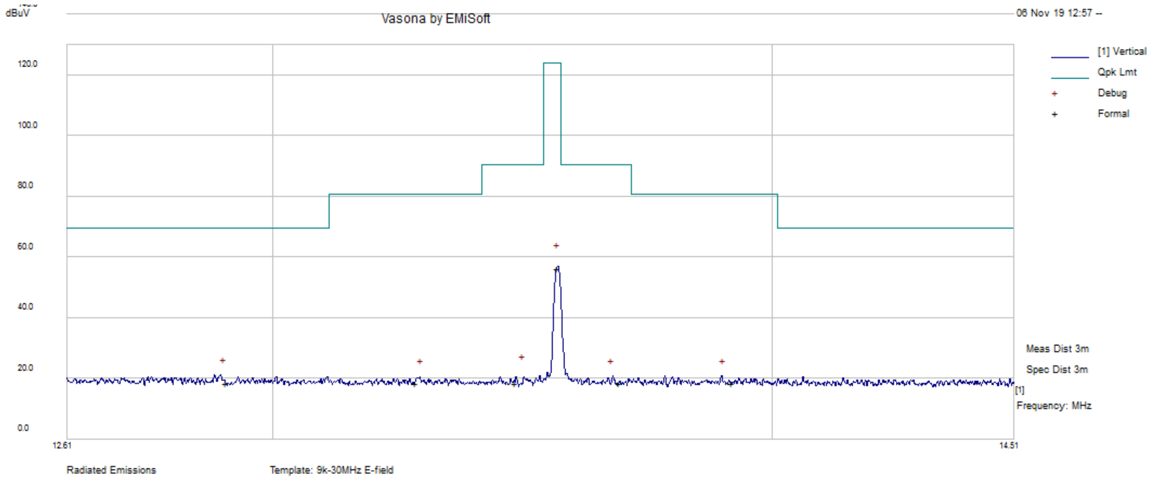


Figure 4: Out of Band Spectrum Mask for RFID Reader – 90 Degree Loop Antenna X-axis

4.4 Transmitter Spurious Emissions

Transmitter spurious emissions are emissions outside the frequency range of the equipment when the equipment is in transmit mode; per requirement of CFR47 15.205, 15.209, 15.225(d), RSS GEN Sect. 6.

4.4.1 Test Methodology

4.4.1.1 Preliminary Test

A test program that controls instrumentation and data logging was used to automate the preliminary RF emission test procedure. The frequency range of interest was divided into sub-ranges to yield a frequency resolution of approximately 120 kHz and provide a reading at each frequency for no more than 12° of turntable rotation. For each frequency sub-range the turntable was rotated 360° while peak emission data was recorded and plotted over the frequency range of interest in horizontal and vertical antenna polarization's.

Preliminary emission profile testing was performed inside the anechoic chamber. The EUT was placed on a 1.0m x 1.5m non-conductive table 80cm above the floor. The EUT was positioned as shown in the setup photographs. The receiving antenna was placed at a distance of 3m at a fixed height of 1m. Measurement equipment was located outside of the chamber. A video camera was placed inside the chamber to view the EUT.

4.4.1.2 Final Test

For each frequency measured, the peak emission was maximized by manipulating the receiving antenna from 1 to 4 meters above the ground plane and placing it at the position that produced the maximum signal strength reading. The turntable was then rotated through 360° while observing the peak signal and placing the EUT at the position that produced maximum radiation. The six highest emissions relative to the limit were measured unless such emissions were more than 20 dB below the limit. If less than six emissions are within 20 dB of the limit, than the noise level of the receiver is measured at frequencies where emissions are expected. Multiples of all oscillator and microprocessor frequencies were also checked.

Final testing was performed on an NSA compliant test site. The EUT was placed on a 1.0m x 1.5m non-conductive table 80cm above the ground plane. The placement of EUT and cables were the same as for preliminary testing and is shown in the setup photographs.

The final spurious emission scans performed on the worst case axis.
RBW is set to 200 Hz and VBW is set to 1 kHz for 9 kHz-150 kHz.
RBW is set to 9 kHz and VBW is set to 30 kHz for 150 kHz-30 MHz
RBW is set to 100 kHz, VBW is set to 300 kHz for 30 MHz-1 GHz.

4.4.1.3 Deviations

None.

4.4.2 Transmitter Spurious Emission Limit

The spurious emissions of the transmitter shall not exceed the values in CFR47 Part 15.205, 15.209: 2020 and RSS GEN 6.1: 2010.

Frequency (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

4.4.3 Sample Calculation

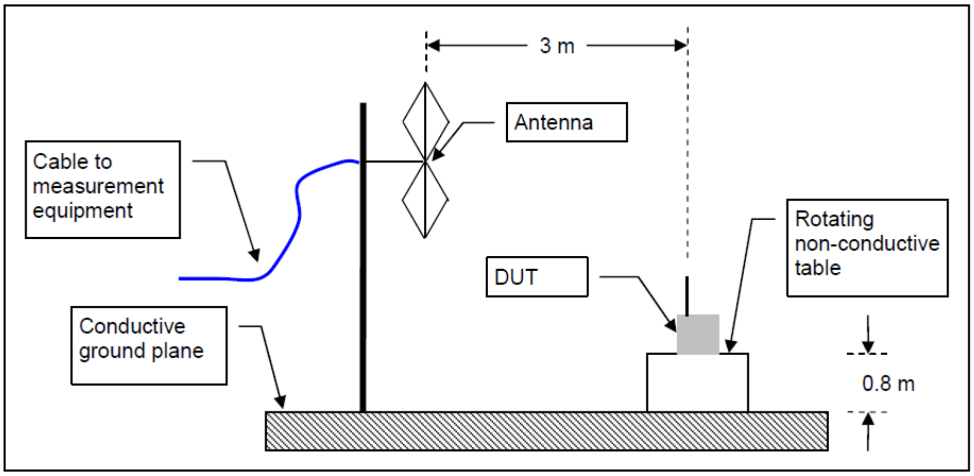
The field strength is calculated by subtracting the Amplifier Gain and adding the Cable Loss and Antenna Correction Factor to the measured reading. The basic equation is as follows:

Field Strength (dBμV/m) = FIM - AMP + CBL + ACF

Where: FIM = Field Intensity Meter (dBμV)
AMP = Amplifier Gain (dB)
CBL = Cable Loss (dB)
ACF = Antenna Correction Factor (dB/m)

$$\mu V/m = 10^{\frac{dB\mu V/m}{20}}$$

Test Setup

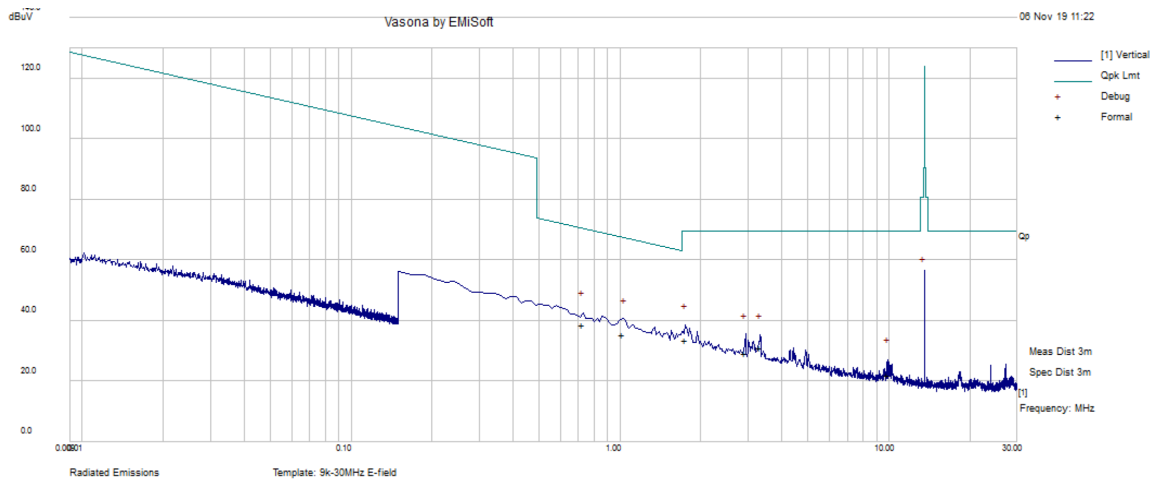


4.4.4 Test Results

The final measurement data was taken under the worst case operating modes, configurations, and/or cable positions. It also reflects the results including any modifications and/or special accessories listed in Sections 1.4 and 1.5.

As originally tested, the EUT was found to be compliant to the requirements of the test standard(s).

SOP 1 Radiated Emissions 9 kHz – 30 MHz			
EUT Name	SoClean 3	**Date**	November 6, 2019
EUT Model	SC1400	**Temp / Hum in**	21°C / 44%rh
EUT Serial	SC140019070110007	**Temp / Hum out**	N/A
EUT Config.	Standalone Module Orientation X axis	**Line AC / Freq**	120 Vac / 60Hz
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	See note 2 below
Dist/Ant Used	3m / Loop Antenna	**Performed by**	Osvaldo Casorla



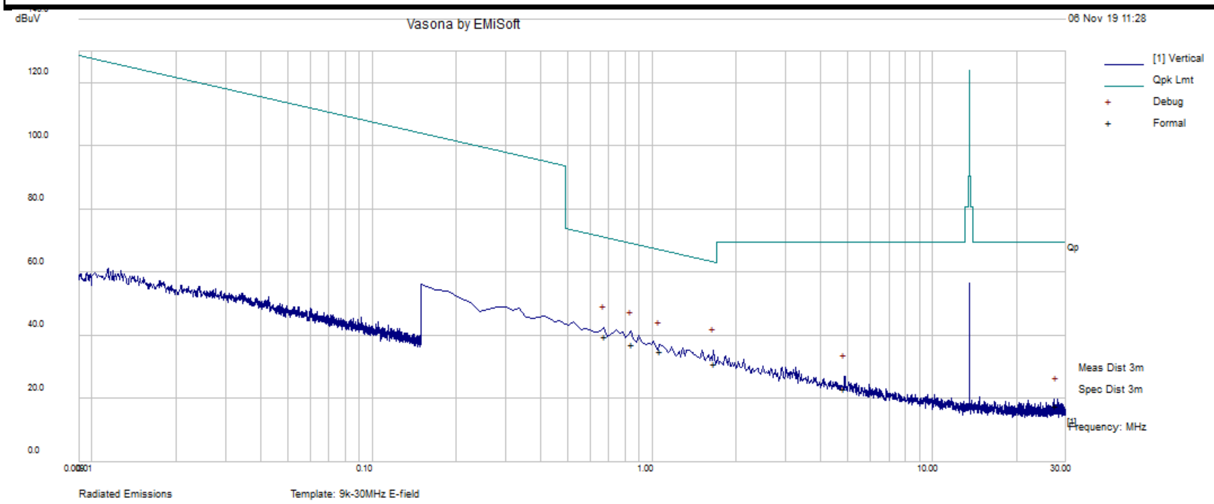
90 degrees

Freq.	Raw	Cable Loss	AF	Level	Det	Pol.	Hgt.	Azt	Limit	Margin	Result
MHz	dBuV/m	dB	dB	dBuV/m		0/90	cm	deg	dBuV/m	dB	
1.67	18.31	1.11	11.63	31.05	Quasi Max	90	100.00	49.00	63.13	-32.08	Pass
0.85	24.87	1.05	11.45	37.37	Quasi Max	90	100.00	25.00	69.04	-31.67	Pass
0.68	27.47	1.04	11.40	39.91	Quasi Max	90	100.00	25.00	70.96	-31.04	Pass
1.07	22.53	1.07	11.69	35.29	Quasi Max	90	100.00	49.00	67.03	-31.74	Pass
4.88	10.86	1.23	11.22	23.31	Quasi Max	90	100.00	24.00	69.54	-46.23	Pass
27.87	7.55	1.59	8.83	17.97	Quasi Max	90	100.00	39.00	69.54	-51.58	Pass

Note:

1. Pre-scan performed on all 3 orientations, the worst case is observed on X-Axis
2. RBW/VBW Setting:
   9 kHz to 150 kHz; RBW = 200Hz, VBW = 1kHz
   150 kHz to 30 MHz; RBW = 9kHz, VBW = 30kHz
   30 MHz - 100 GHz; RBW = 120 kHz, VBW = 3 x RBW
3. The highest emission on the plots is the fundamental signal at 13.56MHz.

SOP 1 Radiated Emissions 9 kHz – 30 MHz			
EUT Name	SoClean 3	**Date**	November 6, 2019
EUT Model	SC1400	**Temp / Hum in**	21°C / 44%rh
EUT Serial	SC140019070110007	**Temp / Hum out**	N/A
EUT Config.	Standalone Module Orientation X axis	**Line AC / Freq**	120 Vac / 60Hz
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	See note 1 below
Dist/Ant Used	3m / Loop Antenna	**Performed by**	Osvaldo Casorla



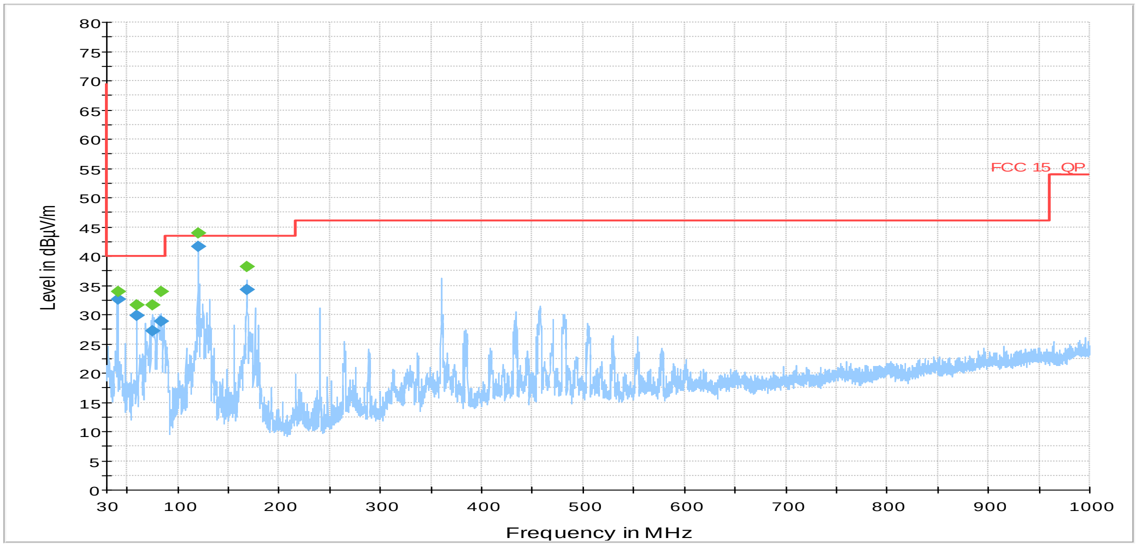
0 degrees

Freq.	Raw	Cbl	AF	Level	Det.	Pol.	Height	Azimuth	Limit	Margin	Result
MHz	dBuV/m	dB	dB	dBuV/m		0/90	cm	deg	dBuV/m	dB	
1.03	22.82	1.07	11.70	35.58	Quasi Max	0	100.00	289.00	67.39	-31.80	Pass
0.73	26.50	1.04	11.40	38.94	Quasi Max	0	100.00	205.00	70.38	-31.44	Pass
1.75	21.19	1.11	11.62	33.92	Quasi Max	0	100.00	19.00	69.54	-35.62	Pass
3.33	18.73	1.18	11.40	31.31	Quasi Max	0	100.00	340.00	69.54	-38.23	Pass
2.92	16.69	1.16	11.41	29.26	Quasi Max	0	100.00	180.00	69.54	-40.28	Pass
9.92	10.02	1.33	10.89	22.24	Quasi Max	0	100.00	305.00	69.54	-47.30	Pass
13.56	41.44	1.40	10.70	53.54	Fundamental	0	100.00	305.00	-	-	Pass

Note:
1. Pre-scan performed on all 3 orientations, the worst case is observed on X-Axis
2. RBW/VBW Setting:
   9 kHz to 150 kHz; RBW = 200Hz, VBW = 1kHz
   150 kHz to 30 MHz; RBW = 9kHz, VBW = 30kHz
   30 MHz - 100 GHz; RBW = 120 kHz, VBW = 3 x RBW
3. The highest emission on the plots is the fundamental signal at 13.56MHz.

SOP 1 Radiated Emissions

EUT Name	SoClean 3	**Date**	November 6, 2019
EUT Model	SC1400	**Temp / Hum in**	21°C / 42%rh
EUT Serial	SC140019070110007	**Temp / Hum out**	N/A
EUT Config.	Standalone Module 90 degrees	**Line AC / Freq**	120 Vac / 60Hz
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	See Below
Dist/Ant Used	3m / 6511 & JB3	**Performed by**	Osvaldo Casorla



Frequency (MHz)	QuasiPeak (dBµV/m)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Comment
40.67	32.70	---	40.00	7.30	1000.00	120.00	100.00	V	-130.00	-14.10	
40.67	---	34.01	---	---	1000.00	120.00	100.00	V	-130.00	-14.10	
59.99	---	31.71	---	---	1000.00	120.00	100.00	V	175.00	-17.10	
59.99	29.83	---	40.00	10.17	1000.00	120.00	100.00	V	175.00	-17.10	
75.34	27.27	---	40.00	12.73	1000.00	120.00	100.00	V	97.00	-18.70	
75.34	---	31.67	---	---	1000.00	120.00	100.00	V	97.00	-18.70	
83.93	---	33.99	---	---	1000.00	120.00	100.00	V	35.00	-20.10	
83.93	28.88	---	40.00	11.12	1000.00	120.00	100.00	V	35.00	-20.10	
120.01	41.58	---	43.51	1.93	1000.00	120.00	100.00	V	-15.00	-10.60	
120.01	---	43.96	---	---	1000.00	120.00	100.00	V	-15.00	-10.60	
167.97	34.27	---	43.51	9.24	1000.00	120.00	154.00	H	-175.00	-13.20	
167.97	---	38.21	---	---	1000.00	120.00	154.00	H	-175.00	-13.20	

Note:
1. Pre-scan performed on all 3 orientations, the worst case is observed on X-Axis
2. RBW/VBW Setting:
   9 kHz to 150 kHz; RBW = 200Hz, VBW = 1kHz
   150 kHz to 30 MHz; RBW = 9kHz, VBW = 30kHz
   30 MHz - 100 GHz; RBW = 120 kHz, VBW = 3 x RBW
3. The highest emission on the plots is the fundamental signal at 13.56MHz.

4.5 AC Conducted Emissions

Testing was performed in accordance with ANSI C63.4: 2003. These test methods are listed under the laboratory's A2LA Scope of Accreditation.

This test measures the levels emanating from the EUT's AC input port, thus evaluating the potential for the EUT to cause radio frequency interference to other electronic devices.

The AC conducted emissions of equipment under test shall not exceed the values in CFR47 Part 15.207: 2010 and RSS 210: 2010.

4.5.1 Test Methodology

A test program that controls instrumentation and data logging was used to automate the AC Power Line Conducted emission test procedure. The frequency range of interest was divided into sub-ranges such as to yield a frequency resolution of 9 kHz. Each phase and neutral of the AC power line were measured with respect to ground. Measurements were performed using a set of 50μH / 50Ω LISNs.

Testing is either performed in 5m Chamber. The setup photographs clearly identify which site was used. The vertical ground plane used in the semi-anechoic chamber is a 2m x 2m solid aluminum frame and panel, and it is bonded to the horizontal ground plane.

In the case of tabletop equipment, the EUT is placed on a 1.0m x 1.5m non-conductive table 80cm above the ground plane and 40cm from a vertical ground reference plane. The rear of the EUT was positioned flush with the backside of the table and directly over the LISNs. The power and I/O cables were routed over the edge of the table and bundled approximately 40cm from the ground plane. Support equipment was powered from a separate LISN.

4.5.1.1 Deviations

There were no deviations from this test methodology.

4.5.2 Test Results

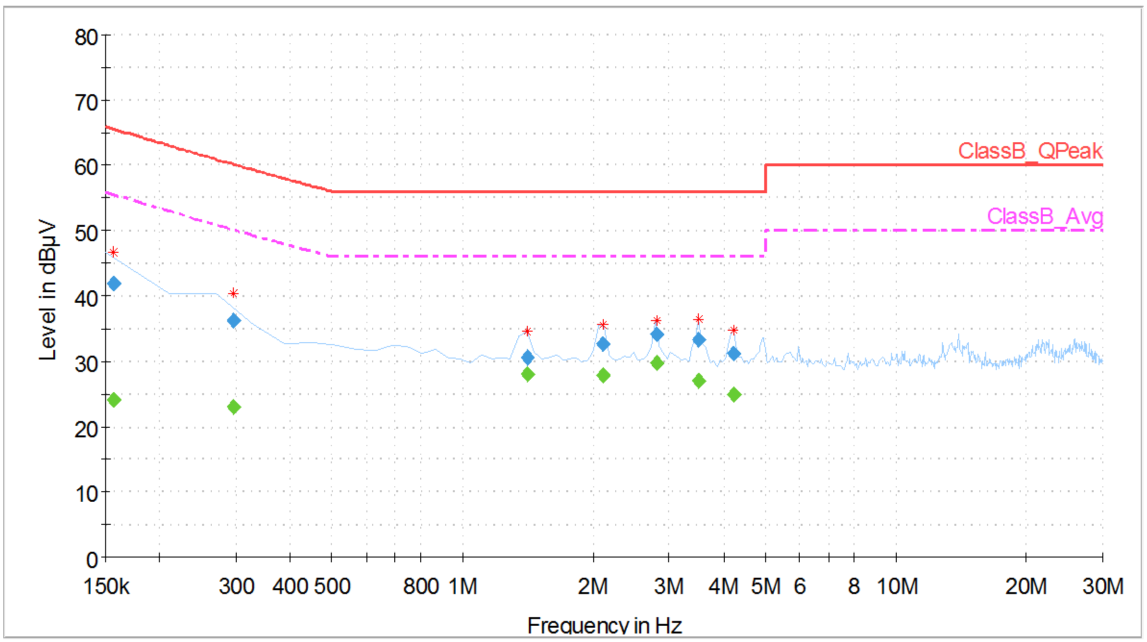
As originally tested, the EUT was found to be compliant to the requirements of the test standard(s).

Table 8: AC Conducted Emissions – Test Results

Test Conditions: Conducted Measurement at Normal Conditions only		
Antenna Type: PCB trace antenna		**Power Level:** 100mW
AC Power: 120 Vac/60 Hz		**Configuration:** Tabletop
Configuration	**Frequency Range**	**Test Result**
Line 1 (Live)	0.15 to 30 MHz	Pass
Line 2 (Neutral)	0.15 to 30 MHz	Pass

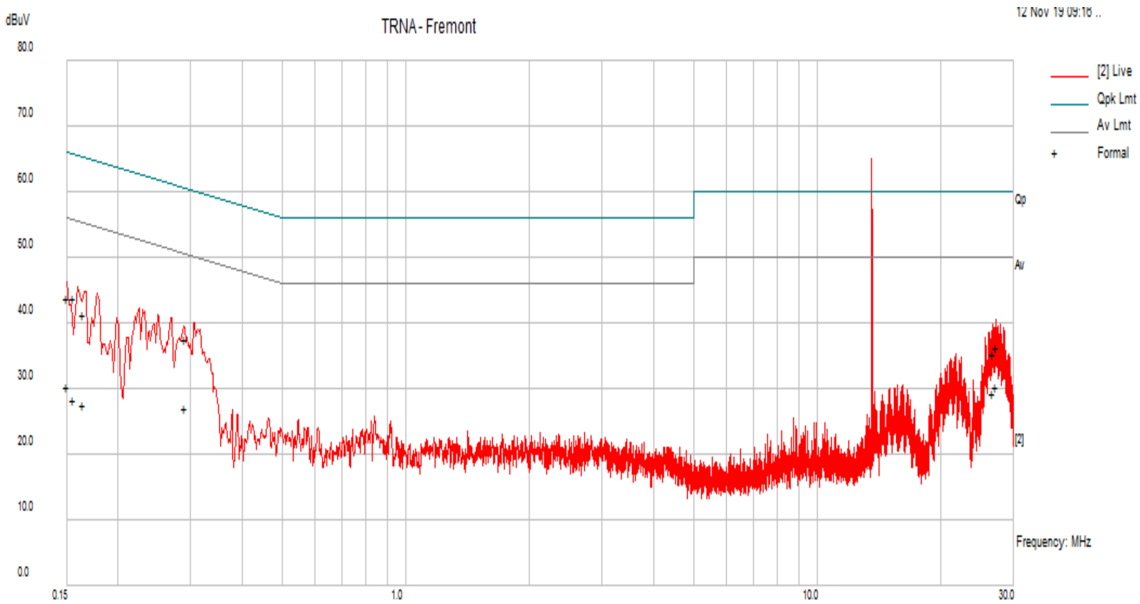
4.5.2.1 Live Line

Frequency (MHz)	QuasiPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	PE	Corr. (dB)	Comment
0.16	---	24.07	55.60	31.53	10000.00	10.00	L1	GND	10.50	
0.16	41.86	---	65.61	23.75	10000.00	10.00	L1	GND	10.50	
0.30	---	22.95	50.13	27.17	10000.00	10.00	L1	GND	9.80	
0.30	36.22	---	60.17	23.94	10000.00	10.00	L1	GND	9.80	
1.41	---	28.06	46.00	17.94	10000.00	10.00	L1	GND	9.70	
1.41	30.61	---	56.00	25.39	10000.00	10.00	L1	GND	9.70	
2.11	---	27.92	46.00	18.08	10000.00	10.00	L1	GND	9.80	
2.11	32.75	---	56.00	23.25	10000.00	10.00	L1	GND	9.80	
2.81	---	29.68	46.00	16.32	10000.00	10.00	L1	GND	9.80	
2.81	34.14	---	56.00	21.86	10000.00	10.00	L1	GND	9.80	
3.51	---	26.92	46.00	19.08	10000.00	10.00	L1	GND	9.80	
3.51	33.33	---	56.00	22.67	10000.00	10.00	L1	GND	9.80	
4.22	---	24.85	46.00	21.15	10000.00	10.00	L1	GND	9.80	
4.22	31.11	---	56.00	24.89	10000.00	10.00	L1	GND	9.80	



Note: The transmitter fundamental 13.56 MHz band antenna was terminated.

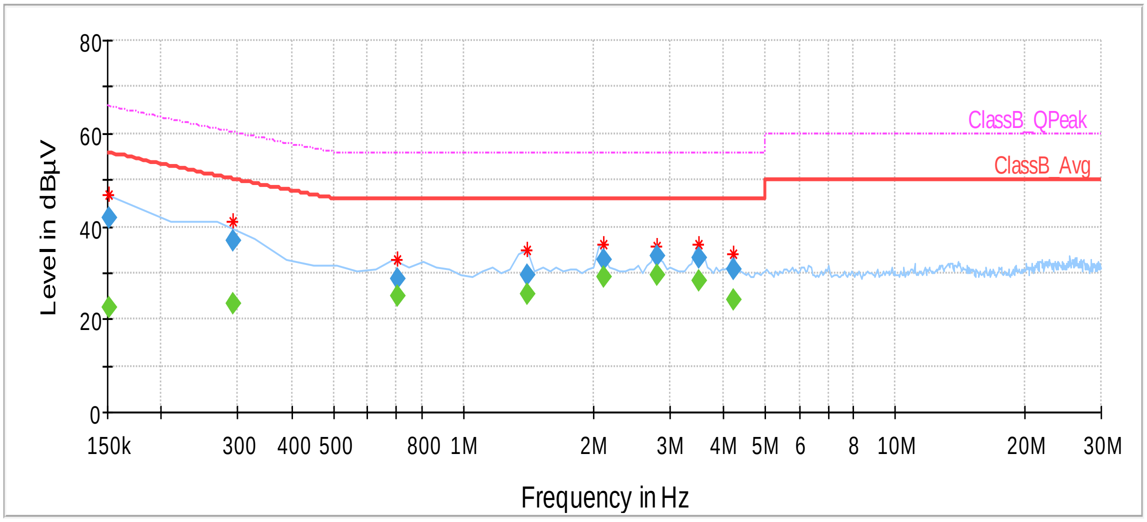
No	Frequency	Raw dBuV	Cable Los	Factors dB	Level dBu	Measurement Type	Line	Limit dBuV	Margin dB	Pass /Fail	Comments
1 (49)	0.15	32.56	11.18	0.09	43.83	Quasi Peak	Live	65.98	-22.15	Pass	
2 (49)	0.15	18.99	11.18	0.09	30.26	Average	Live	55.98	-25.72	Pass	
3 (51)	0.16	32.85	10.88	0.08	43.81	Quasi Peak	Live	65.70	-21.89	Pass	
4 (51)	0.16	17.43	10.88	0.08	28.39	Average	Live	55.70	-27.31	Pass	
5 (52)	0.17	30.61	10.53	0.08	41.22	Quasi Peak	Live	65.21	-23.99	Pass	
6 (52)	0.17	16.88	10.53	0.08	27.49	Average	Live	55.21	-27.72	Pass	
7 (50)	0.29	27.46	10.14	0.05	37.65	Quasi Peak	Live	60.50	-22.86	Pass	
8 (50)	0.29	16.87	10.14	0.05	27.05	Average	Live	50.50	-23.45	Pass	
9 (53)	26.68	18.94	10.62	-0.27	29.29	Average	Live	50.00	-20.71	Pass	
10 (53)	26.68	25.04	10.62	-0.27	35.39	Quasi Peak	Live	60.00	-24.61	Pass	
11 (48)	27.16	25.90	10.63	-0.28	36.25	Quasi Peak	Live	60.00	-23.75	Pass	
12 (48)	27.16	20.01	10.63	-0.28	30.36	Average	Live	50.00	-19.64	Pass	



Notes: The emission over average and quasi peak limit is in-band emission at 13.56 MHz.
Meet FCC Class B limit.

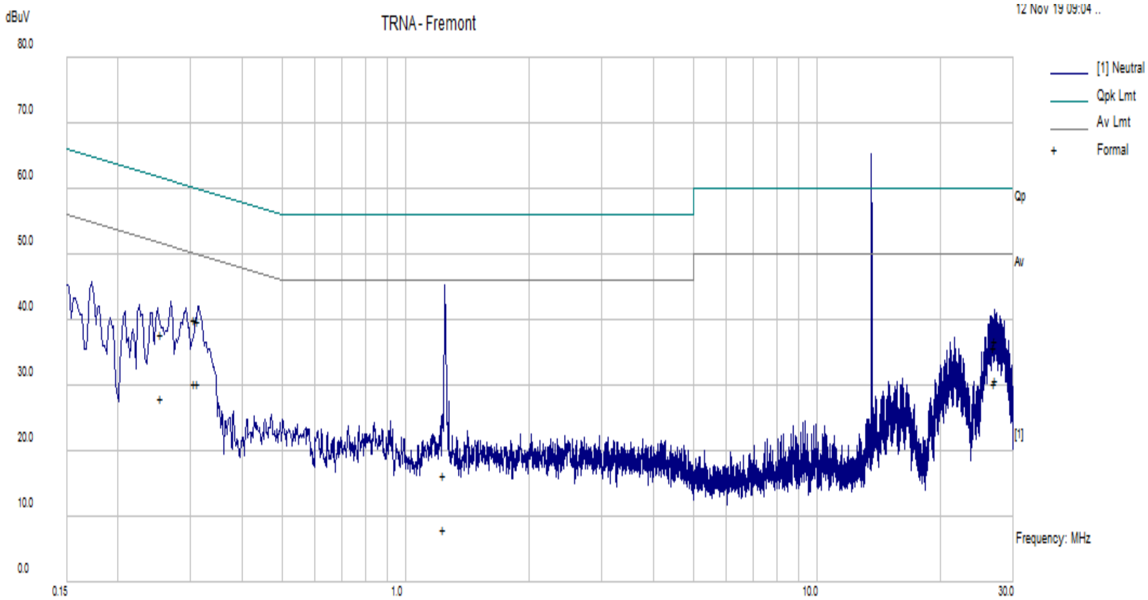
4.5.2.2 Neutral Line

Frequency (MHz)	QuasiPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	PE	Corr. (dB)	Comment
0.15	---	22.55	55.90	33.35	10000.00	10.00	N	GND	10.60	
0.15	41.91	---	65.90	23.99	10000.00	10.00	N	GND	10.60	
0.29	---	23.51	50.23	26.72	10000.00	10.00	N	GND	9.70	
0.29	36.73	---	60.19	23.46	10000.00	10.00	N	GND	9.70	
0.70	---	24.86	46.00	21.14	10000.00	10.00	N	GND	9.70	
0.70	28.75	---	56.00	27.25	10000.00	10.00	N	GND	9.70	
1.40	---	25.39	46.00	20.61	10000.00	10.00	N	GND	9.60	
1.40	29.55	---	56.00	26.45	10000.00	10.00	N	GND	9.60	
2.11	---	29.25	46.00	16.75	10000.00	10.00	N	GND	9.80	
2.11	32.92	---	56.00	23.08	10000.00	10.00	N	GND	9.80	
2.81	---	29.67	46.00	16.33	10000.00	10.00	N	GND	9.70	
2.81	33.46	---	56.00	22.54	10000.00	10.00	N	GND	9.70	
3.52	---	28.14	46.00	17.86	10000.00	10.00	N	GND	9.70	
3.52	33.32	---	56.00	22.68	10000.00	10.00	N	GND	9.70	
4.22	---	24.24	46.00	21.76	10000.00	10.00	N	GND	9.70	
4.22	30.67	---	56.00	25.33	10000.00	10.00	N	GND	9.70	



Note: The transmitter fundamental 13.56 MHz band antenna was terminated.

No	Frequency	Raw dBuV	Cable Los	Factors dB	Level dBu	Measurement Type	Line	Limit dBuV	Margin dB	Pass /Fail	Comments
1 (5)	0.25	27.71	10.17	0.05	37.92	Quasi Peak	Neutral	61.59	-23.67	Pass	
2 (5)	0.25	17.94	10.17	0.05	28.15	Average	Neutral	51.59	-23.44	Pass	
3 (6)	0.31	20.07	10.13	0.05	30.24	Average	Neutral	50.04	-19.79	Pass	
4 (6)	0.31	29.82	10.13	0.05	40.00	Quasi Peak	Neutral	60.04	-20.04	Pass	
5 (3)	0.31	29.71	10.12	0.05	39.88	Quasi Peak	Neutral	59.88	-20.00	Pass	
6 (3)	0.31	20.11	10.12	0.05	30.28	Average	Neutral	49.88	-19.60	Pass	
7 (2)	1.24	6.30	10.13	0.03	16.46	Quasi Peak	Neutral	56.00	-39.54	Pass	
8 (2)	1.24	-2.00	10.13	0.03	8.16	Average	Neutral	46.00	-37.84	Pass	
9 (4)	27.06	25.61	10.63	-0.28	35.96	Quasi Peak	Neutral	60.00	-24.04	Pass	
10 (4)	27.06	19.97	10.63	-0.28	30.32	Average	Neutral	50.00	-19.68	Pass	
11 (7)	27.28	20.46	10.64	-0.29	30.81	Average	Neutral	50.00	-19.19	Pass	
12 (7)	27.28	26.57	10.64	-0.29	36.92	Quasi Peak	Neutral	60.00	-23.08	Pass	



Notes: The emission over average and quasi peak limit is in-band emission at 13.56 MHz.
Meet FCC Class B limit.

4.6 Frequency Stability

In accordance with 47 CFR Part 15.225(e) the frequency stability of RFID devices must be such that an emission is maintained within the band of operation under all conditions of normal operation as specified in the user's manual. The temperatures - 20 º C to +50 º C were used for testeding per 15.225.

4.6.1 Test Methodology

The manufacturer of the equipment is responsible for ensuring that the frequency stability is such that emissions are always maintained within the band of operation under all conditions. This test performs according to ANSI C63.10-2013 Section 6.8

4.6.2 Manufacturer Declaration

The frequency stability of the reference oscillator sets the frequency stability of the RF transceiver signals. Per CFR47 Part 15.225 (e) and RSS 210 Sect. A2.6 (d), all of the RF signal should have ±0.01% or ±100 ppm stability.

This stability accounts for room temp tolerance of the crystal oscillator circuit, frequency variation across temperature, and crystal ageing.

Worst case:

±100 ppm at 13.56 MHz translates to a maximum frequency shift of ±1.356 kHz.

The frequency stability was conducted on the production sample, M/N SC1400.

4.6.3 Test results

As originally tested, the EUT was found to be compliant to the requirements of the test standard(s).

Table 9: Frequency Stability – Test Results

Temperature	Time	PPM	Limit
- 20°C	Start	70.91	±100 ppm
	2 Min.	70.91	
	5 Min	70.91	
	10 min	70.91	
- 10°C	Start	70.97	
	2 Min.	70.91	
	5 Min	70.91	
	10 min	70.91	
0°C	Start	70.91	
	2 Min.	70.91	
	5 Min	70.91	
	10 min	70.91	
10°C	Start	62.05	
	2 Min.	62.05	
	5 Min	63.82	
	10 min	63.82	
20°C	Start	68.50	
	2 Min.	68.50	
	5 Min	67.36	
	10 min	67.36	
30°C	Start	65.59	
	2 Min.	65.59	
	5 Min	65.59	
	10 min	65.59	
40°C	Start	63.82	
	2 Min.	62.05	
	5 Min	62.05	
	10 min	62.05	
50°C	Start	70.91	
	2 Min.	70.91	
	5 Min	70.91	
	10 min	70.87	
Note: All frequency drifts from 13.56 MHz were less than ±100 ppm. Temperature range -20°C to 50°C.			

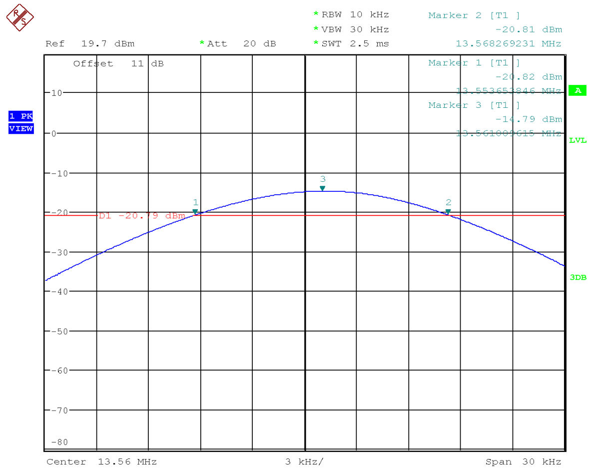


Figure 5: Frequency Stability at -20 °C - Start

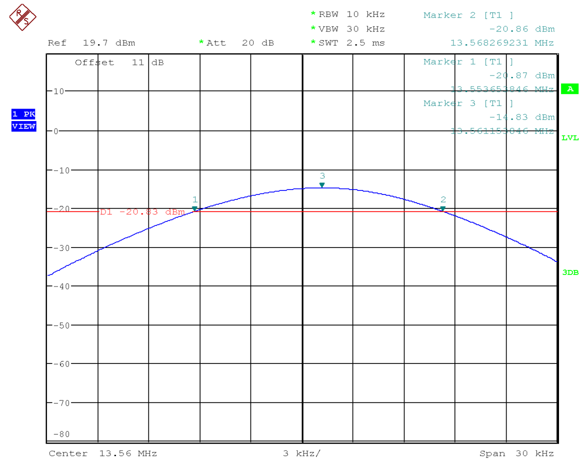


Figure 6: Frequency Stability at -20 °C – 2 min

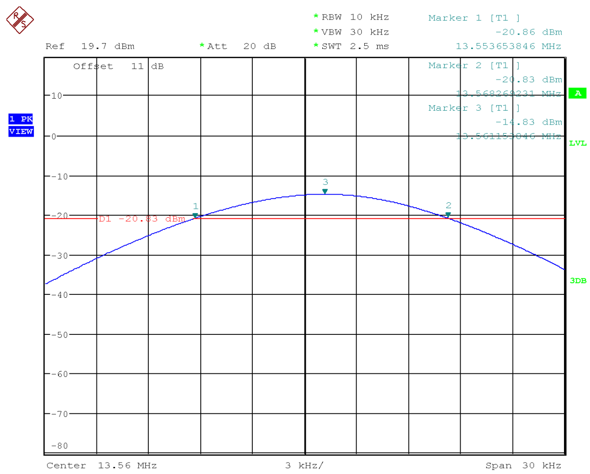


Figure 7: Frequency Stability at -20 °C – 5 min

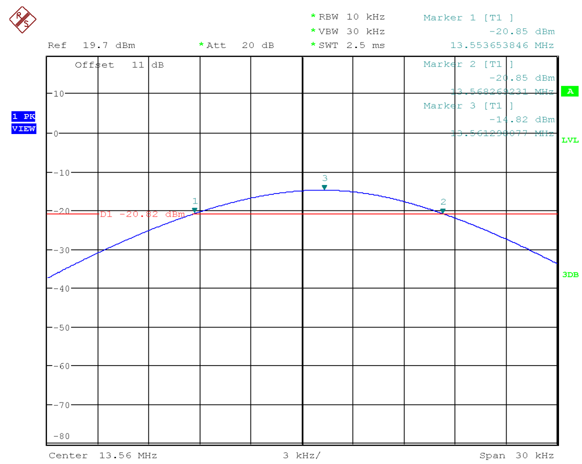


Figure 8: Frequency Stability at -20 °C – 10 min

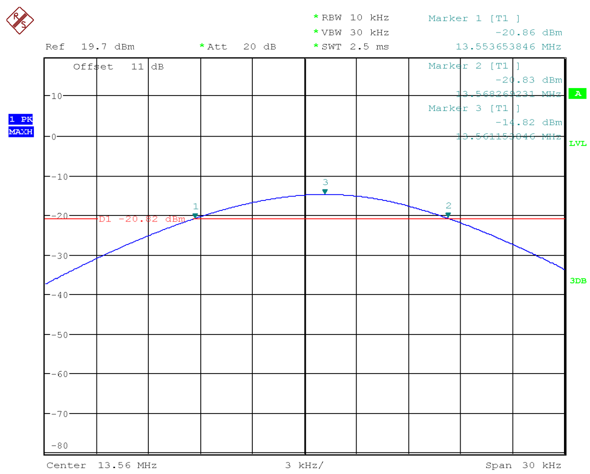


Figure 9: Frequency Stability at -10 °C - Start

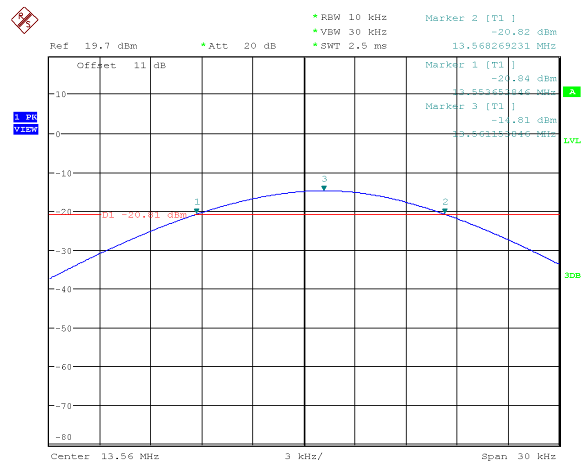


Figure 10: Frequency Stability at -10 °C – 2 min

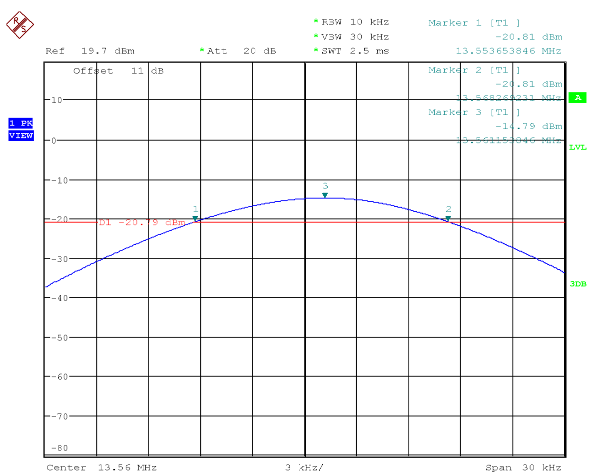


Figure 11: Frequency Stability at -10 °C – 5 min

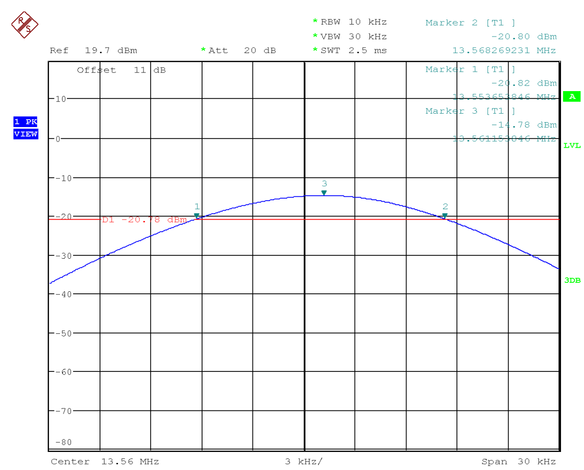


Figure 12: Frequency Stability at -10 °C – 10 min

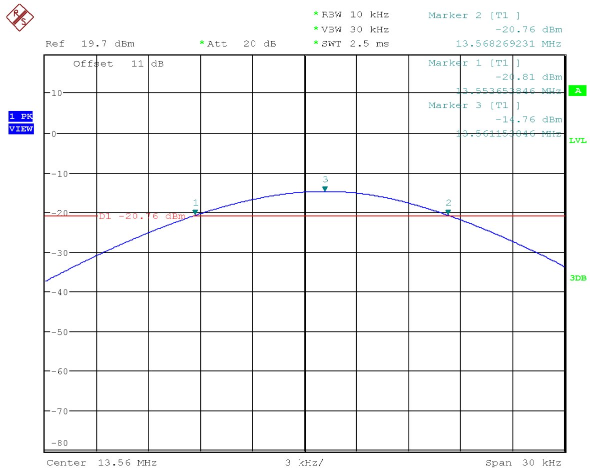


Figure 13: Frequency Stability at 0 °C - Start

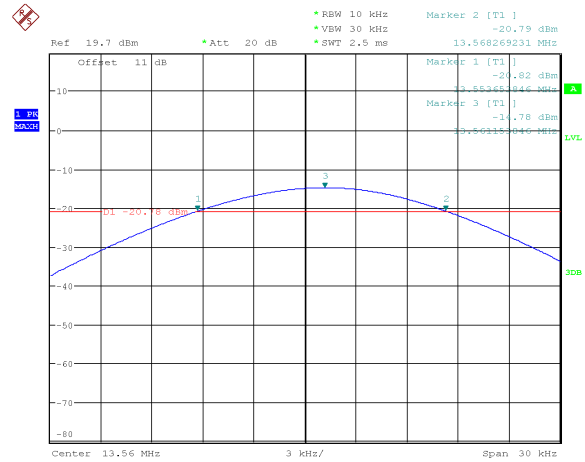


Figure 14: Frequency Stability at 0 °C – 2 min

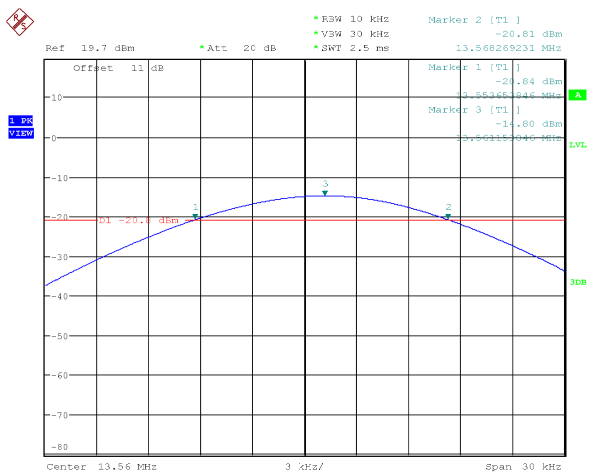


Figure 15: Frequency Stability at 0 °C – 5 min

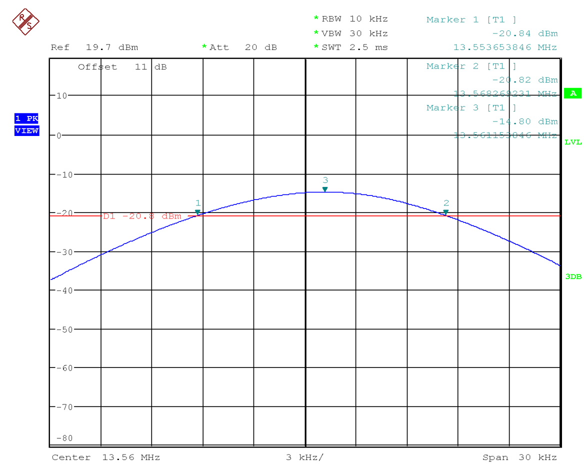


Figure 16: Frequency Stability at 0 °C – 10 min

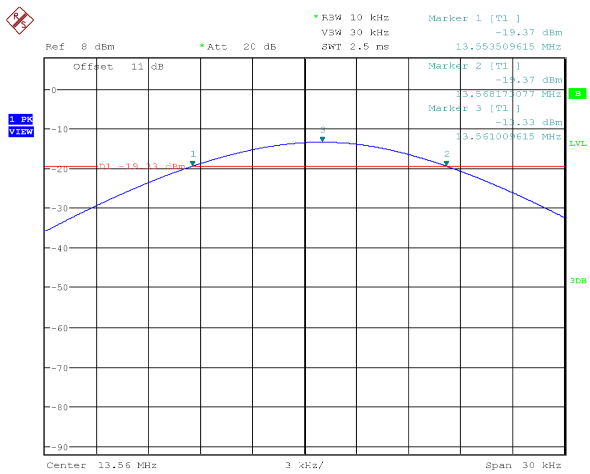


Figure 17: Frequency Stability at 10 °C - Start

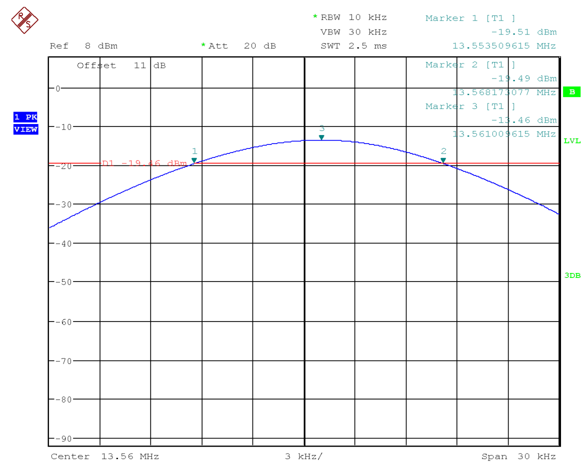


Figure 18: Frequency Stability at 10 °C – 2 min

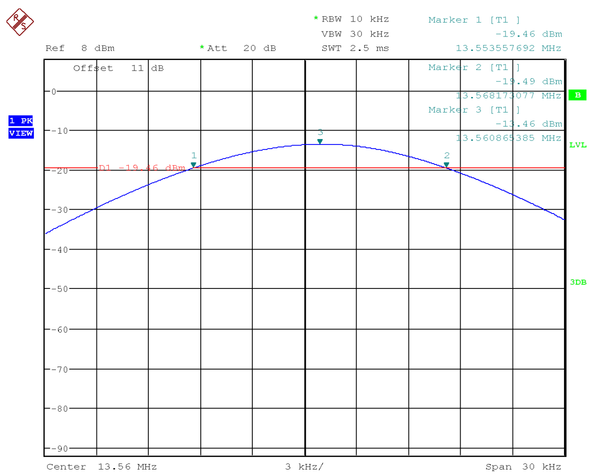


Figure 19: Frequency Stability at 10 °C – 5 min

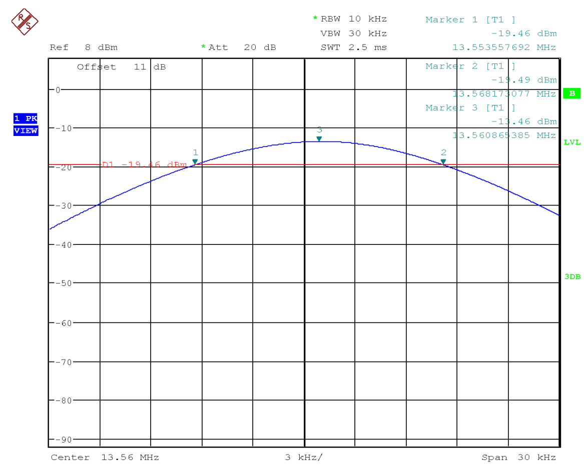


Figure 20: Frequency Stability at 10 °C – 10 min

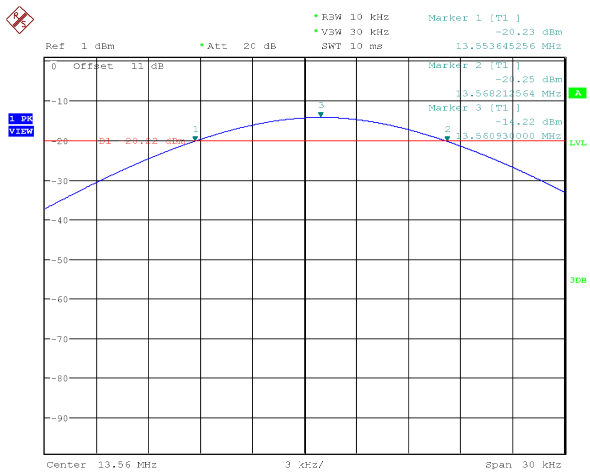


Figure 21: Frequency Stability at 20 °C - Start

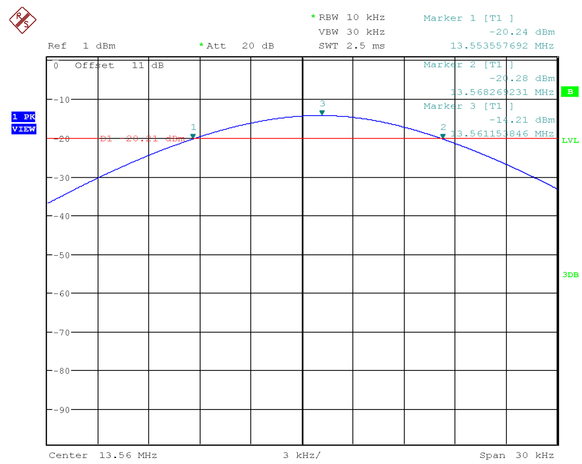


Figure 22: Frequency Stability at 20 °C – 2 min

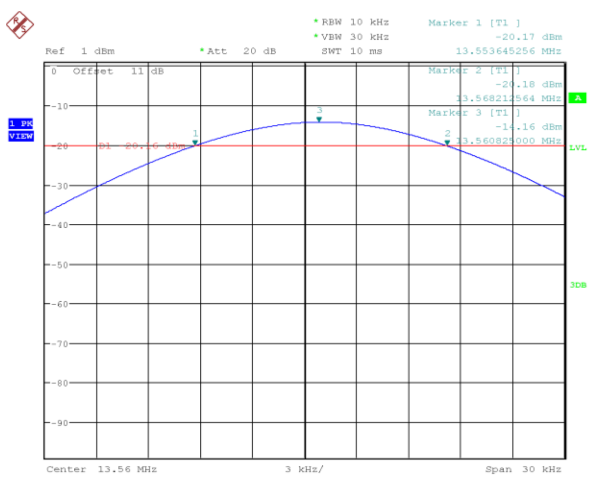


Figure 23: Frequency Stability at 20 °C – 5 min

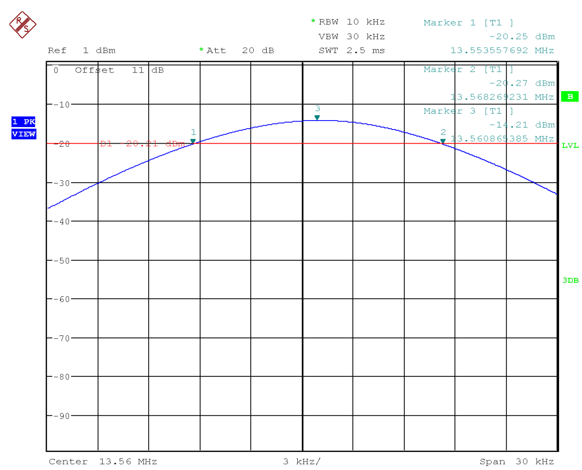


Figure 24: Frequency Stability at 20 °C – 10 min

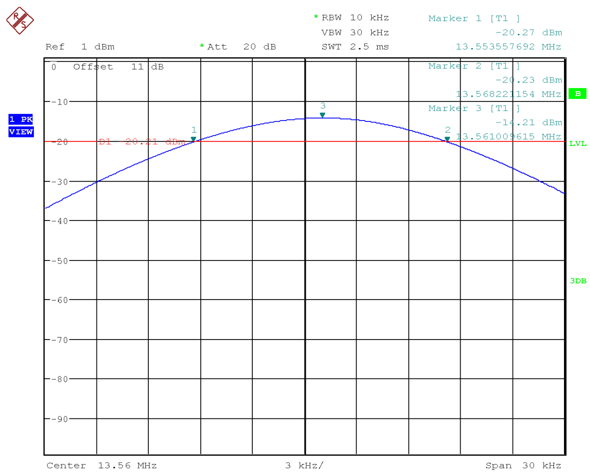


Figure 25: Frequency Stability at 30 °C - Start

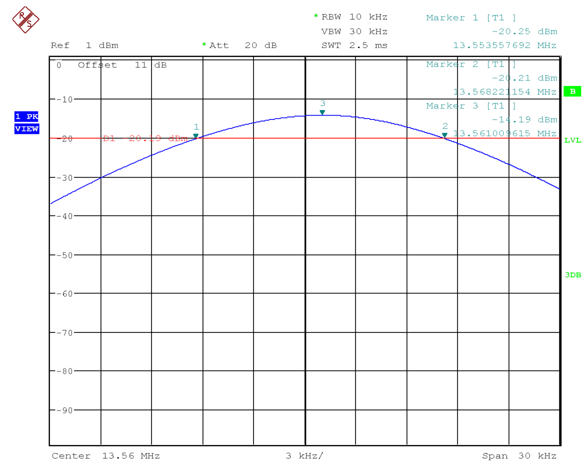


Figure 26: Frequency Stability at 30 °C – 2 min

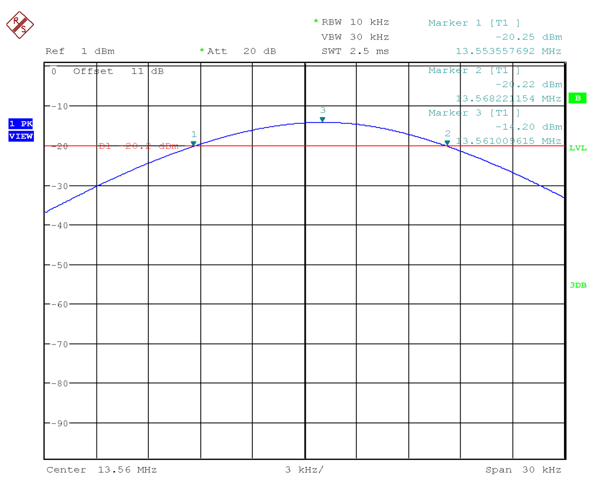


Figure 27: Frequency Stability at 30 °C – 5 min

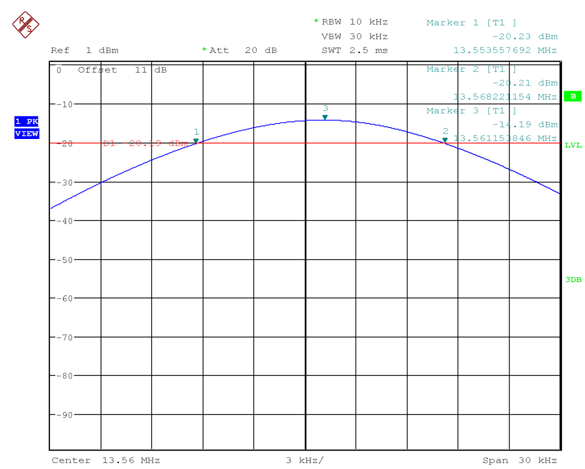


Figure 28: Frequency Stability at 30 °C – 10 min

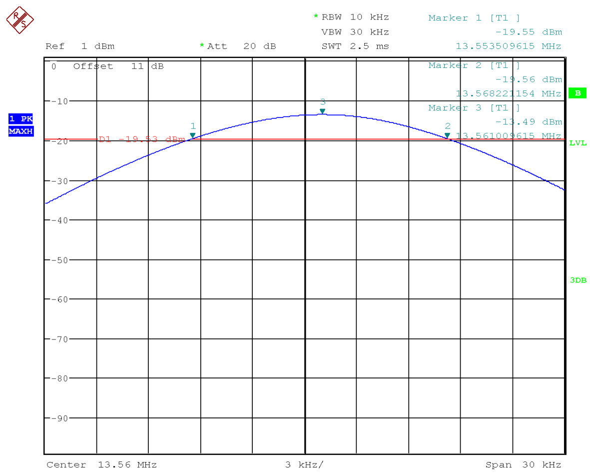


Figure 29: Frequency Stability at 40 °C - Start

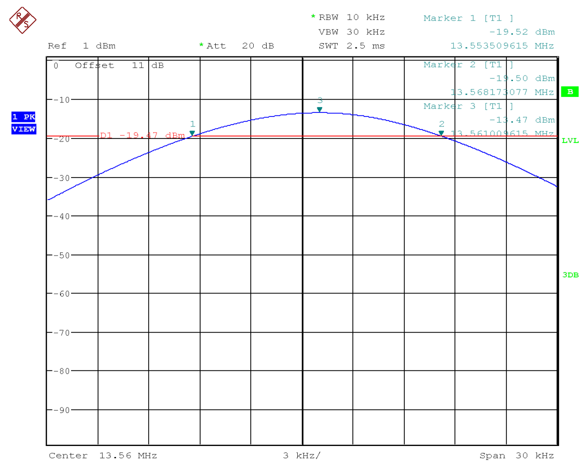


Figure 30: Frequency Stability at 40 °C – 2 min

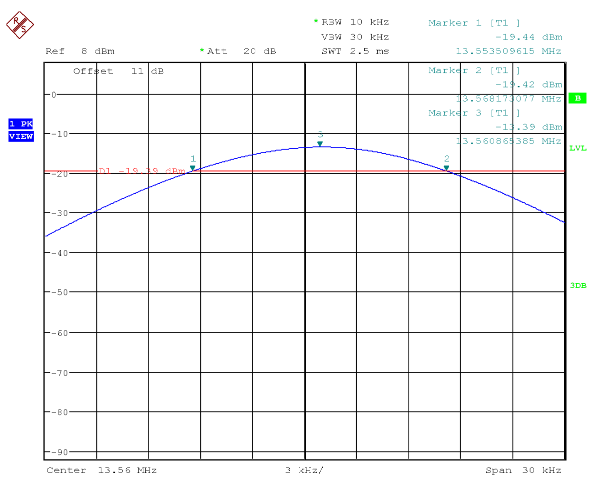


Figure 31: Frequency Stability at 40 °C – 5 min

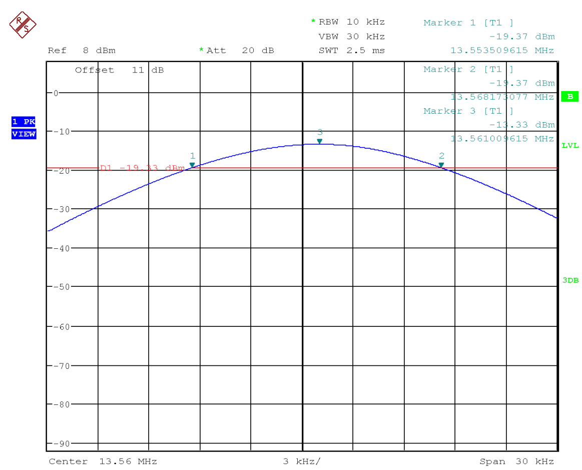


Figure 32: Frequency Stability at 40 °C – 10 min

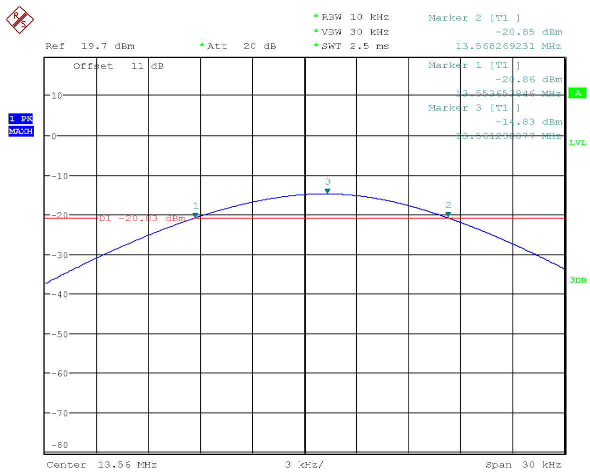


Figure 33: Frequency Stability at 50 °C - Start

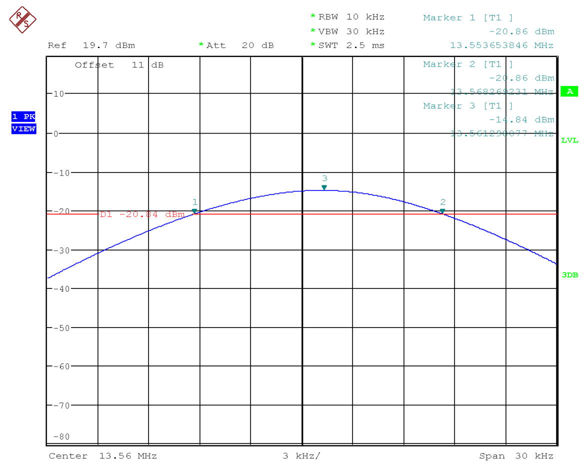


Figure 34: Frequency Stability at 50 °C – 2 min

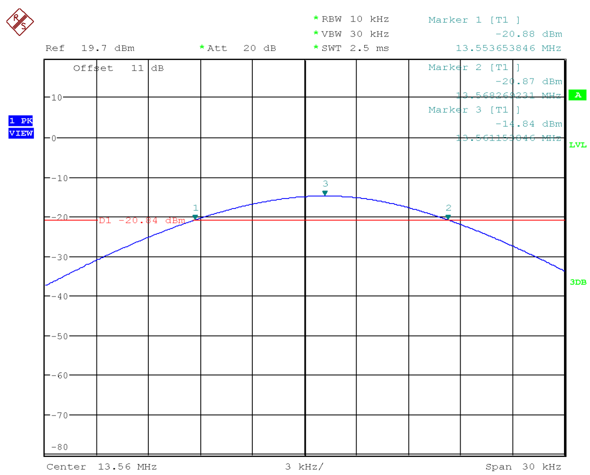


Figure 35: Frequency Stability at 50 °C – 5 min

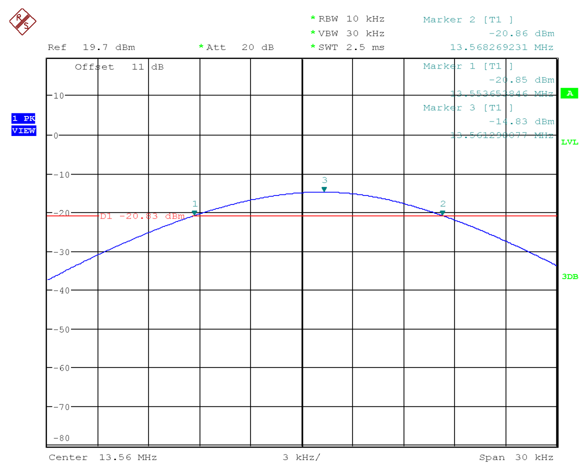


Figure 36: Frequency Stability at 50 °C – 10 min

4.7 Voltage Variation

In accordance with 47 CFR Part 15.31 (e) intentional radiators, measurements of the variation of the input power or the radiated signal level of the fundamental frequency component of the emission, as appropriate, shall be performed with the supply voltage varied between 85% and 115% of the nominal rated supply voltage. For battery operated equipment, the equipment tests shall be performed using a new battery.

4.7.1 Test Methodology

The RFID reader was designed to operating within 102 VAC to 138 VAC. If the battery voltage is outside the voltage range, the reader would shut down. The fundamental frequency was observed during the variation. The RF ID standalone module was powered by 120 VAC by programmable power supply. The voltage was varied from 102 VAC to 138 VAC mean while the fundamental frequencies were observed and recorded for the maximum drift in ppm; part per millions.

The voltage variaion was conducted on the production sample, M/N SC1400.

4.7.2 Test results

As originally tested, the EUT was found to be compliant to the requirements of the test standard(s). The fundamental frequencies drifted less than ±100 ppm.

Table 10: Voltage Variation – Test Results

Voltage	-6 dB Lower Edge (MHz)	+6 dB Upper Edge (MHz)	Center Frequency (Hz)	PPM	Limit PPM
102	13.553653846	13.568269231	13560961.54	70.91	±100
120	13.553701923	13.568317308	13561009.62	74.76	±100
138	13.553653846	13.568269231	13560961.54	70.91	±100
Note: All frequency drifts were less than ±100 ppm from 13.56 MHz No frequency change was observed with time.					

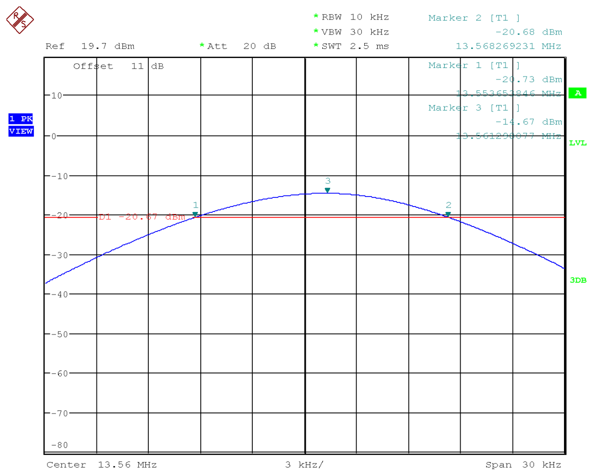


Figure 37: Voltage Variation at 102 VAC

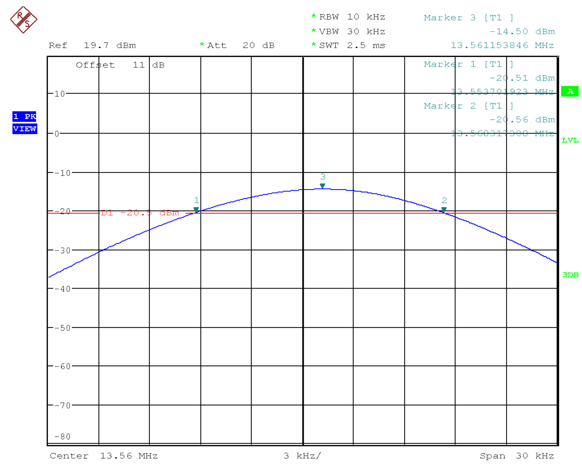


Figure 38: Voltage Variation at 120 VAC

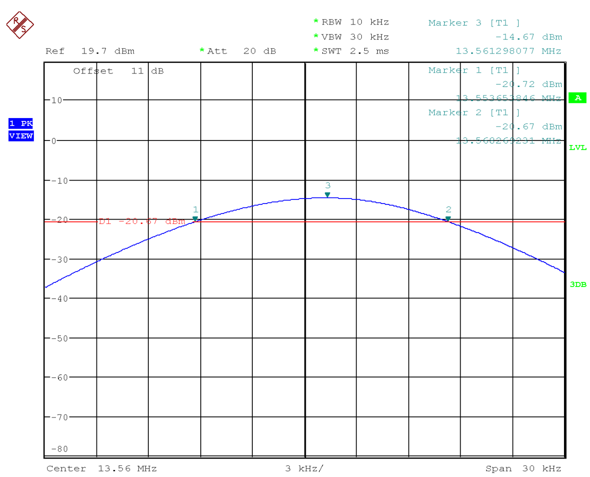


Figure 39: Voltage Variation at 138 VAC

5 Test Equipment List

5.1 Equipment List

Equipment	Manufacturer	Model #	Serial/Inst #	Last Cal mm/dd/yyyy	Next Cal mm/dd/yyyy
EMI Receiver	R&S	ESW, 2Hz-44GHz	838399	1/10/2019	1/10/2021
Preamplifier, 9 kHz – 1 GHz	Sonoma	310N	213221	8/6/2020	8/6/2022
Bilog Antenna	Sunol Sciences	JB3	A061907	12/19/2018	12/19/2020
Preamp, 1-10 GHz	HP	8449B	3008A01013	6/8/2020	6/8/2022
Preamplifier, 1-18GHz	Miteq	AMF-70-01001800-30-10P-L	2074297	1/16/2019	1/16/2021
Pre-Amp/Antenna	Rohde & Schwarz	TS-PR40	100012	6/13/2020	6/13/2022
Pre-Amp/Antenna	Rohde & Schwarz	TS-PR26	100011	6/13/2020	6/13/2022
Horn Antenna	Sunol Sciences	DRh-118	A040806	6/17/2020	6/17/2022
Active Loop Antenna	EMCO	6502	00062531	07/01/2019	07/01/2021
Amplifier	Sonoma	310N	185516	N/A (See Note)	
1.6 GHz Low Pass Filter	K&L Microwave	8L120-X1600-0/09135-0249	UA691-35	N/A (See Note)	
3.5 GHz High Pass Filter	Hewlett Packard	84300-80038	820004	N/A (See Note)	
2.4 GHz Notch Filter	Micro-Tronics	BRM50702	009	01/15/2020	01/15/2021

Calibration of equipment past due for re-calibration will be performed expeditiously. If any equipment is found to be out of tolerance at that time, affected customers will be notified accordingly.

NA = Equipment is characterized before use.

6 EMC Test Plan

6.1 Introduction

This section provides a description of the Equipment Under Test (EUT), configurations, operating conditions, and performance acceptance criteria. It is an overview of information provided by the manufacturer so that the test laboratory may perform the requested testing.

6.2 Customer

Table 11: Customer Information

Company Name	SoClean Inc.
Address	12 Vose farm road
City, State, Zip	Petersborough, NH, 03458
Country	USA

Table 12: Technical Contact Information

Name	Courtney Medeiros
E-mail	cmedeiros@baycomp.com

6.3 Equipment Under Test (EUT)

The information provided in the following table should be listed as it should appear in the final report. For those products that have only a model name, list the model number as *non-applicable* and vice-versa.

Table 13: EUT Information

Product Name	SoClean 3
Model Number	SC1400
System Name	SoClean 3
Product Description	CPAP mask cleaning device

6.4 Equipment Under Test (EUT)

Table 14: EUT Specifications

RFID - EUT Specification	
Dimensions:	7.5 in x 9 in x 4 in
Power Supply:	AC/DC medical wall wart 120VAC-240VAC in 12V nominal 10-14V out
Environment	Indoor home
Operating Temperature Range:	10 °C to 38 °C
Multiple Feeds:	☐ Yes and how many ☒ No.
Hardware Version	Rev 10
RFID Software Version	1.1.5
Operating Mode	ISO14443a
Transmitter Frequency Band	13.56 MHz
Chipset Rated Power Output	100 mW
Power Setting @ Operating Channel	27 mW
Antenna Type	PCB trace coil
Modulation Type	☒ AM (ASK) ☐ FM ☐ Phase Other describe:
Data Rate	106 Kbps
Type of Equipment	☒ Table Top ☐ Wall-mount ☐ Floor standing cabinet ☐ Other:

Table 15: Interface Specifications

Interface Type	Cabled with what type of cable?	Is the cable shielded?	Maximum potential length of the cable?	Metallic (M), Coax (C), Fiber (F), or Not Applicable?
USB	USB	Yes	< 3m	M
Note: None				

Table 16: Supported Equipment

Equipment	Manufacturer	Model	Serial	Used for
Laptop	Dell	Inspiron 15-5548	N/A	Setup EUT operating modes/ channels via a USB connection to pins in EUT
Note: None				

Table 17: Description of Sample used for Testing

Device	Serial Number	Configuration	Used For
SoClean 3	SC140019070110007	Radiated Sample	Max. Carrier Field Strength Occupied Bandwidth Out of Band Emission TX Spurious Radiated Emission RX Spurious Radiated Emission Frequency Stability Voltage Variation
SoClean 3	SC1400200401100002	Radiated Sample	AC Conducted Emission
Note: None			

Table 18: Description of Test Configuration used for Radiated Measurement.

Device	Antenna	Mode	Setup Description
RFID Reader	Integrated coil antenna	Transmit & Receive	EUT all 3 axes
Note: Testing was performed for all 3 orthogonal axes.			

Table 19: Antenna Information

Number	Antenna Type	Description	Max Gain (dBi)
Antenna 0	Integrated coil antenna	RFID	0

6.5 Test Specifications

Testing requirements

Table 20: Test Specifications

Emissions and Immunity	
Standard	**Requirement**
CFR 47 Part 15.225: 2020	All
RSS-210: Issue 10, December 2010	All

END OF REPORT