

06/25/2021

HID Global Corporation  
6533 Flying Cloud Drive  
Eden Prairie, MN 55344

Dear Robert Cresswell,

Enclosed is the EMC test report for compliance testing of the HID Global Corporation, ELEMENT Card Making System SRD Model: X002600, tested to the requirements of Title 47 of the CFR, Part 15.225, Subpart C for Certification as an Intentional Radiator.

Thank you for using the services of Eurofins Electrical and Electronic Testing NA, Inc. If you have any questions regarding these results or if we can be of further service to you, please feel free to contact me.

Sincerely yours,  
EUROFINS ELECTRICAL AND ELECTRONIC TESTING NA, INC.



Joel Huna  
Documentation Department

Reference: (\HID Global Corporation\WIRA112652-FCC225 HF)

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## **Electromagnetic Compatibility Criteria Test Report**

for the

**HID Global Corporation  
ELEMENT Card Marking System  
SRD Model: X002600**

**Tested under**  
the FCC Certification Rules  
contained in  
15.225 Subpart C  
for Intentional Radiators

**Report: WIRA112652-FCC225 HF**

06/25/2021

### **Prepared For:**

**HID Global Corporation  
6533 Flying Cloud Drive  
Eden Prairie, MN 55344**

**Prepared By:**  
**Eurofins Electrical and Electronic Testing NA, Inc.**  
13501 McCallen Pass,  
Austin, TX 78753

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Jonathan Tavira,  
Manager, Electromagnetic Compatibility Lab

**Engineering Statement:** The measurements shown in this report were made in accordance with the procedures indicated, and the emissions from this equipment were found to be within the limits applicable. I assume full responsibility for the accuracy and completeness of these measurements, and for the qualifications of all persons taking them. It is further stated that upon the basis of the measurements made, the equipment tested is capable of operation in accordance with the requirements of the FCC Rules Part 15.225 under normal use and maintenance.

## Report Status Sheet

Revision	Report Date	Reason for Revision
Ø	06/25/2021	Initial Issue.

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## Executive Summary

### A. Purpose of Test

An EMC evaluation was performed to determine compliance of the HID Global Corporation ELEMENT Card Marking System SRD Model: X002600, with the requirements of Part 15, §15.225. All references are to the most current version of Title 47 of the Code of Federal Regulations in effect. In accordance with §2.1033, the following data is presented in support of the Certification of the ELEMENT Card Marking System SRD Model: X002600. HID Global Corporation should retain a copy of this document which should be kept on file for at least two years after the manufacturing of the Element Card Marking System SRD Model: X002600, has been **permanently discontinued**.

### B. Executive Summary

The following tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with Part 15, §15.225, in accordance with HID Global Corporation, purchase order number 005507. All tests were conducted using measurement procedures ANSI C63.10-2013.

FCC Reference 47 CFR Part 15.225	Description	Compliance
Part 15 §15.203	Antenna Requirement	Compliant
Part 15 §15.207(a)	Conducted Emission Limits	Compliant
Part 15 §15.215	20dB Occupied Bandwidth	Compliant
Part 15 §15.225(a)	Field Strength emissions within the band 13.553 – 13.567 MHz	Compliant
Part 15 §15.225(b)	Field Strength emissions within the band 13.410 – 13.553 MHz and 13.567 – 13.710 MHz	Compliant
Part 15 §15.225(c)	Field Strength emissions within the band 13.110 – 13.410 MHz and 13.710 – 14.010 MHz	Compliant
Part 15 §15.225(d)	Outside-Band Field Strength emissions per 15.209 - 13.110 – 14.010 MHz	Compliant
Part 15 §15.225(e)	Frequency Tolerance of the Carrier	Compliant

Table 1. Executive Summary of EMC Part 15.225 Compliance Testing

## Equipment Configuration

### A. Overview

Eurofins Electrical and Electronic Testing NA, Inc. was contracted by HID Global Corporation to perform testing on the ELEMNT Card Marking System SRD Model: X002600, under HID Global Corporation's purchase order number 005507.

This document describes the test setups, test methods, required test equipment, and the test limit criteria used to perform compliance testing of the HID Global Corporation, ELEMENT Card Marking System SRD Model: X002600.

The results obtained relate only to the item(s) tested.

<b>Model(s) Tested:</b>	X002600
<b>Model(s) Covered:</b>	X002500, X002600
<b>EUT Specifications:</b>	Primary Power: 100V - 240V AC, 50/60 Hz
	FCC ID: JQ6-X002600
	Type of Modulation(s): ASK
	Equipment Code: DXX
	Peak Field Strength (OK 5127CK SI): 14.32 dB $\mu$ V/m @30m
	Peak Field Strength (SmartWare): 8.53 dB $\mu$ V/m @30m
	EUT Frequency Ranges: 13.56 MHz
	Antenna Type: Inductive Loop
	Peak Antenna Gain: 1 dBi
	Firmware Version: 1.0.0.1031
<b>Analysis:</b>	Power Setting: Factory Default
	The results obtained relate only to the item(s) tested.
<b>Environmental Test Conditions:</b>	Temperature: 15-35° C
	Relative Humidity: 30-60%
	Barometric Pressure: 860-1060 mbar
<b>Evaluated by:</b>	Adan Arab
<b>Report Date(s):</b>	06/25/2021

**Table 2. EUT Summary Table**

## B. References

<b>CFR 47, Part 15, Subpart C</b>	Federal Communication Commission, Code of Federal Regulations, Title 47, Part 15: General Rules and Regulations, Allocation, Assignment, and Use of Radio Frequencies
<b>ANSI C63.4:2014</b>	Methods and Measurements of Radio-Noise Emissions from Low-Voltage Electrical And Electronic Equipment in the Range of 9 kHz to 40 GHz
<b>ISO/IEC 17025:2017</b>	General Requirements for the Competence of Testing and Calibration Laboratories
<b>ANSI C63.10-2013</b>	American National Standard for Testing Unlicensed Wireless Devices

**Table 3. . References**

## C. Test Site

Eurofins MET Laboratories Inc. (Eurofins Electrical and Electronic Testing NA, Inc.) is part of the Eurofins Electrical & Electronics (E&E) global compliance network.

All testing was performed at Eurofins Electrical and Electronic Testing NA, Inc., 13501 McCallen Pass, Austin, TX 78753. All equipment used in making physical determinations is accurate and bears recent traceability to the National Institute of Standards and Technology.

Radiated Emissions measurements were performed in a 10 meter semi-anechoic chamber (equivalent to an Open Area Test Site). In accordance with §2.948(a)(3), a complete site description is contained at MET Laboratories.

## D. Measurement Uncertainty

Test Method	Typical Expanded Uncertainty	K	Confidence Level
RF Frequencies	$\pm 4.52$ Hz	2	95%
RF Power Conducted Emissions	$\pm 2.97$ dB	2	95%
RF Power Radiated Emissions	$\pm 2.95$ dB	2	95%
Radiated Emissions, (30 MHz – 1 GHz)	$\pm 2.95$	2	95%
Conducted Emission Voltage	$\pm 2.97$	2	95%

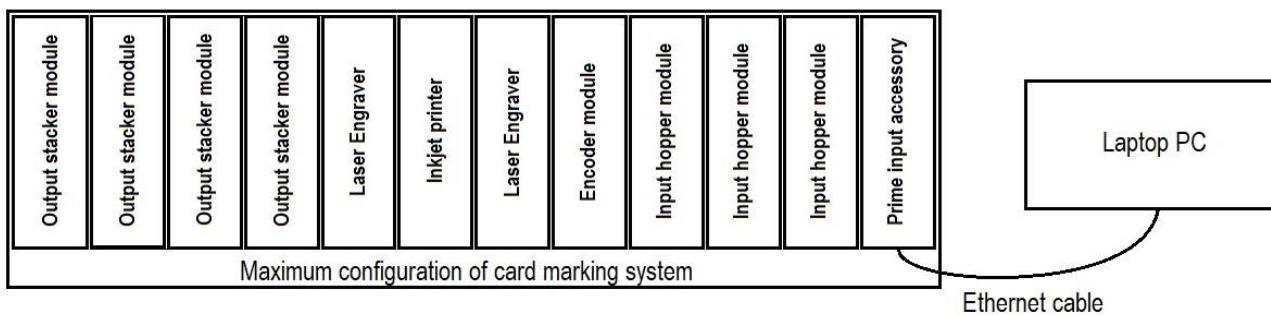
**Table 4. Uncertainty Calculations Summary**

**E. Description of Test Sample**

Name of EUT/Model:	Element Card Marking System SRD Model: X002600/X002500
<b>Description of EUT and its intended use:</b>	The HID ELEMENT card marking system is an industrial card printer/encoder/laser engraver used for high-volume ID and financial card issuance. It is modular and scalable with high-resolution, UV inkjet printing, optional laser engraving and an array of encoding options. It is suited for the high-cycle requirements of large government ID card programs, financial institutions, service bureaus and large enterprises.
<b>Selected Operation Mode(s):</b>	The system has been configured to simulate normal print processes that involves the Prime input accessory with display, 4 input card hoppers, 3W laser engraver, 8W laser engraver, inkjet Printer, and 4 output card stackers. No actual cards are used in the operation.
<b>Rationale for the selection of the Operation Mode(s):</b>	Flashing blue LEDs indicate normal operation of the entire system, RFID encoding devices (5127 CK Mini, 5127CK SI, SmartWare) and Contact encoder OK 5122. HID printer user interface has been designed to simulate normal and flag any erroneous behavior throughout the entire printing process.
<b>Monitoring Method(s):</b>	Monitor Flashing blue LEDS lights during normal operation on 3W and 8W laser engraving units. Monitor ethernet connection with support laptop that is running HID Printer user interface. Ensure there are no errors flagged to the user, during testing.
<b>Emissions Class Declaration:</b>	Class A
<b>Configuration(s):</b>	Representative of the maximum number of optional modules: one (1) non-optional Prime Input accessory with display; four (4) input hopper modules which may contain either OmniKey 5127 CK SI (125 KHz and 13.56MHz) or OmniKey 5127 CK Mini (125kHz and 13.56MHz), three (3) of which are optional; one (1) optional encoder module containing a SmartWare USNIse-1M coupler and matched external antenna board (13.56MHz); one (1) optional UV inkjet printer; one (1) optional 3 watt laser engraver module; one (1) optional 8 watt laser engraver module; and four (4) output stacker modules, all of which are optional.
<b>EUT Power Requirement</b>	
<b>Voltage:</b>	100V - 240V
<b>AC or DC:</b>	AC
<b>Voltage Frequency:</b>	60Hz
<b>Number of Phases:</b>	1
<b>Current:</b>	5.75A maximum
<b>Physical Description</b>	
<b>EUT Arrangement:</b>	Table Top

<b>System with Multiple Chassis?</b>	True
<b>Size (HxWxD - inches):</b>	20x110x25
<b>Weight (lbs):</b>	450
<b>Highest Internal Frequency (MHz):</b>	2400
<b>Other Info</b>	
<b>EUT Software (internal to EUT):</b>	--
	CardBuilder Printing Emulator
<b>Support Software (used by support PC to exercise EUT):</b>	Reader Utility Version 5.0.0.4 (B002) For OK 5127SI Radio SmartCfg Version V4r22i For Smartware Radio
<b>Firmware:</b>	--
Contains Modular Transmitter:	HID OMNIKEY 5127CK MINI (FCC ID: JQ6-OK5127CKMINI)
<b>Transmitter Parameters</b>	
<b>Description of your unit:</b>	RFID
<b>Modulation Type:</b>	Carrier: ASK, FSK
<b>Number of Channels:</b>	1
<b>Frequency range (MHz):</b>	0.125, 13.56
<b>Antenna Type:</b>	Loop
<b>Antenna Gain (db):</b>	Approx. 1
<b>PMN:</b>	HID FARGO ELEMENT Card Marking System
<b>HVIN:</b>	X002600 with additional n
<b>FVIN:</b>	--
<b>HMN:</b>	--
<b>Data Rates:</b>	--
<b>Expected Power Level:</b>	--
<b>Number of Antenna:</b>	3
Number of Intentional Transmitters:	3
Number of Certified Intentional Transmitter Modules:	1 (OK 5127CK Mini: FCC ID: JQ6-OK5127CKMINI)

**Table 5. Equipment Overview and Test Configuration Information**



**Figure 1. Block Diagram of Test Configuration**

## F. Equipment Configuration

Ref. ID	Slot #	Name / Description	Model Number	Part Number	Serial Number	Rev. #
--	--	Card Marking System	X002600	--	--	--

**Table 6. Equipment Configuration**

## G. Support Equipment

Ref. ID	Name / Description	Manufacturer	Model Number
--	Laptop PC	Dell	Inspiron

**Table 7. Support Equipment**

## H. Ports and Cabling Information

Ref. ID	Port name on EUT	Cable Description or reason for no cable	Qty	Length as tested (m)	Max Length (m)	Shielded? (Y/N)	Termination Box ID & Port Name
--	Ethernet	Ethernet	1	<3m	--	N	PC/Ethernet

**Table 8. Ports and Cabling Information**

## I. Modifications

### a) Modifications to EUT

No modifications were made to the EUT.

### b) Modifications to Test Standard

No modifications were made to the test standard.

## J. Disposition of EUT

The test sample including all support equipment submitted to the Electro-Magnetic Compatibility Lab for testing was returned to HID Global Corporation upon completion of testing.

## Electromagnetic Compatibility Criteria for Intentional Radiators

### § 15.203 Antenna Requirement

**Test Requirement:** **§ 15.203:** 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.

The structure and application of the EUT were analyzed to determine compliance with Section 15.203 of the Rules. Section 15.203 states that the subject device must meet at least one of the following criteria:

- a.) Antenna must be permanently attached to the unit.
- b.) Antenna must use a unique type of connector to attach to the EUT.
- c.) Unit must be professionally installed. Installer shall be responsible for verifying that the correct antenna is employed with the unit.

**Results:** Both the OK 5127SI and SmartWare, as evaluated, were compliant as they meet criteria A of §15.203.

The structure and application of the EUT were analyzed to determine compliance with Section 15.203 of the Rules.

Section 15.203 states that the subject device must meet at least one of the following criteria:

- a) The antenna must be permanently attached to the unit.

Results: The EUT as tested is compliant to 15.203. The 1 dBi gain antenna is integrated into the EUT (permanently attached) and is unable to be modified by the end-user.

**Test Engineer(s):** Adan Arab

**Test Date(s):** 04/27/2021

Name/Description	Type	Manufacturer	Model	Gain (dBi)	Impedance ( $\Omega$ )
SmartWare	Shielded 50 $\Omega$ PCB trace loop	SmartWare	SmartWare T73X42X2 antenna	1dBi	--
OK 5127 SI	Inductive	HID	--	1 dBi	--

**Table 9. EUT (s) Antenna Description**

## Electromagnetic Compatibility Criteria for Intentional Radiators

### § 15.207(a) Conducted Emissions Limits

**Test Requirement(s):**

**§ 15.207 (a):** For an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30MHz, shall not exceed the limits in the following table, as measured using a 50  $\mu$ H/50  $\Omega$  line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

Frequency range (MHz)	§ 15.207(a), Conducted Limit (dB $\mu$ V)	
	Quasi-Peak	Average
* 0.15 - 0.5	66 - 56	56 - 46
0.5 - 5	56	46
5 - 30	60	50

**Table 10. Conducted Limits for Intentional Radiators from FCC Part 15 § 15.207(a)**

Note: \*Decreases with the logarithm of the frequency.

**Test Procedure:**

The EUT was placed on a 0.8 m-high non-conducting table above a ground plane. The EUT was situated such that the back of the EUT was 0.4 m from one wall of the vertical ground plane, and the remaining sides of the EUT were no closer than 0.8 m from any other conductive surface. The EUT was powered from a 50  $\Omega$ /50  $\mu$ H Line Impedance Stabilization Network (LISN). The EMC receiver scanned the frequency range from 150 kHz to 30 MHz. Conducted Emissions measurements were made in accordance with *ANSI C63.10-2013 "Procedures for Compliance Testing of Unlicensed Wireless Devices"*. The measurements were performed over the frequency range of 0.15 MHz to 30 MHz using a 50  $\Omega$ /50  $\mu$ H LISN as the input transducer to an EMI receiver. For the purpose of this testing, both transmitters were turned on at full power during the scans.

Measurements were performed with each respective transmitter active at a time.

**Sample Calculation:**

$$Rr - S = M$$

where:

Rr = Receiver Reading in dB $\mu$ V

S = Specification Limit in dB $\mu$ V

M = Margin to Specification in +/- dB

**Sample formula for calculating the Corrected Data for the Conducted Emissions Measurements:**

Line	Freq (MHz)	Uncorrected QP** Amplitude (dB $\mu$ V)	LISN IL (dB)	CBL (dB)	Corrected QP** Amplitude (dB $\mu$ V)	QP** Limit (dB $\mu$ V)	Margin (dB)	Results
XYZ	0.18	42.65	10	0.58	53.23	79	-25.77	Pass

Corrected QP\*\* Amplitude (dB $\mu$ V) = Uncorrected Amplitude (dB $\mu$ V) + LISN IL (dB) + CBL (dB) = 42.65 + 10 + 0.58 = 53.23

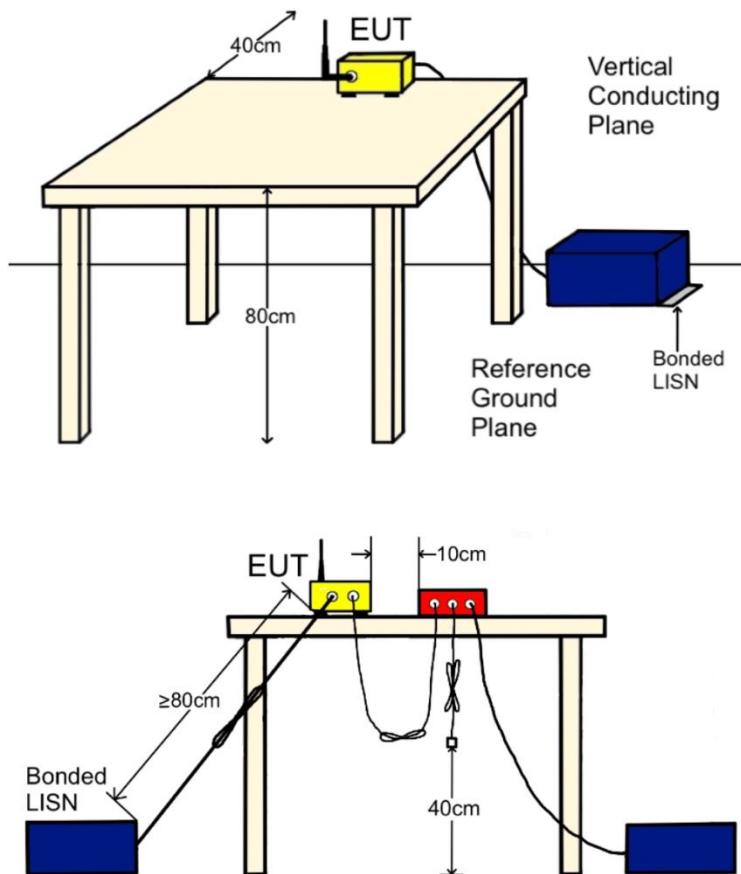
\*\* Same Calculation applies to Corrected Avg. amplitude as well.

**Test Results:** Both the OK 5127SI and SmartWare, as evaluated, were compliant with this requirement § 15.207 (a). See appendices for plots and test setup photos.

**Test Engineer(s):** Adan Arab

**Test Date(s):** 07/28/2020

### Conducted Emissions Voltage Test Setup



**Figure 2. CEV Test Setup**

Measurement Location	Measurement	Limit	Result
Bonding measurement from LISN ground to ground plane	0.9 mΩ	< 2.5 mΩ	Pass

Line Name	Freq (MHz)	QP Amplitude (dB $\mu$ V)	QP Limit (dB $\mu$ V)	Margin (dB)	Result	Average Amplitude (dB $\mu$ V)	Average Limit (dB $\mu$ V)	Margin (dB)	Result
Line 120VAC 60Hz	0.166	52.300	65.160	-12.860	Pass	39.100	55.160	-16.060	Pass
Line 120VAC 60Hz	0.298	53.300	60.314	-7.014	Pass	44.500	50.314	-5.814	Pass
Line 120VAC 60Hz	3.882	52.600	56.000	-3.400	Pass	43.200	46.000	-2.800	Pass
Line 120VAC 60Hz	4.470	54.300	56.000	-1.700	Pass	43.800	46.000	-2.200	Pass
Line 120VAC 60Hz	4.702	52.800	56.000	-3.200	Pass	43.100	46.000	-2.900	Pass
Line 120VAC 60Hz	5.210	52.300	60.000	-7.700	Pass	43.300	50.000	-6.700	Pass
Neutral 120VAC 60Hz	0.170	53.100	64.963	-11.863	Pass	41.600	54.963	-13.363	Pass
Neutral 120VAC 60Hz	0.274	58.500	61.009	-2.509	Pass	47.900	51.009	-3.109	Pass
Neutral 120VAC 60Hz	0.282	58.100	60.771	-2.671	Pass	49.100	50.771	-1.671	Pass
Neutral 120VAC 60Hz	0.298	57.700	60.314	-2.614	Pass	48.500	50.314	-1.814	Pass
Neutral 120VAC 60Hz	0.422	52.000	57.432	-5.432	Pass	40.100	47.432	-7.332	Pass
Neutral 120VAC 60Hz	4.214	53.000	56.000	-3.000	Pass	43.400	46.000	-2.600	Pass

Table 11. Conducted Emissions, OK 5127SI, Test Results.

Line Name	Freq (MHz)	QP Amplitude (dB $\mu$ V)	QP Limit (dB $\mu$ V)	Margin (dB)	Result	Average Amplitude (dB $\mu$ V)	Average Limit (dB $\mu$ V)	Margin (dB)	Result
Line 120VAC 60Hz	0.166	52.300	65.160	-12.860	Pass	39.100	55.160	-16.060	Pass
Line 120VAC 60Hz	0.298	53.300	60.314	-7.014	Pass	44.500	50.314	-5.814	Pass
Line 120VAC 60Hz	3.882	52.600	56.000	-3.400	Pass	43.200	46.000	-2.800	Pass
Line 120VAC 60Hz	4.470	54.300	56.000	-1.700	Pass	43.800	46.000	-2.200	Pass
Line 120VAC 60Hz	4.702	52.800	56.000	-3.200	Pass	43.100	46.000	-2.900	Pass
Line 120VAC 60Hz	5.210	52.300	60.000	-7.700	Pass	43.300	50.000	-6.700	Pass
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Neutral 120VAC 60Hz	0.170	53.100	64.963	-11.863	Pass	41.600	54.963	-13.363	Pass
Neutral 120VAC 60Hz	0.274	58.500	61.009	-2.509	Pass	47.900	51.009	-3.109	Pass
Neutral 120VAC 60Hz	0.282	58.100	60.771	-2.671	Pass	49.100	50.771	-1.671	Pass
Neutral 120VAC 60Hz	0.298	57.700	60.314	-2.614	Pass	48.500	50.314	-1.814	Pass
Neutral 120VAC 60Hz	0.422	52.000	57.432	-5.432	Pass	40.100	47.432	-7.332	Pass
Neutral 120VAC 60Hz	4.214	53.000	56.000	-3.000	Pass	43.400	46.000	-2.600	Pass

**Table 12. Conducted Emissions, SmartWare, Test Results**

Test Name: Conducted Emissions Voltage, Mains Terminals			Test Date(s): 05/03/2021		
MET Asset #	Nomenclature	Manufacturer	Model	Last Cal Date	Cal Due Date
1A1065	EMI Test Receiver	Rohde & Schwarz	ESCI	06/22/2020	06/22/2021
1A1177	Pulse Limiter	Rohde & Schwarz	ESH3-Z2	06/10/2020	06/10/2021
1A1122	LISN	TESEQ	NNB 51	08/21/2020	08/21/2021
1A1227	True RMS Meter	Fluke	114	10/16/2020	10/16/2021
1A1119	Conducted Emissions Ground Plane	N/A	N/A	06/10/2020	06/10/2021
1A1149	DC Milliohm Meter	GW Instek	GOM-802	06/10/2020	06/10/2021
1A1169	Temperature, Humidity and Pressure Recorder	Omega	OM-CP-PRHTEMP2000	02/19/2021	02/19/2022

**Table 13. Conducted Emissions, Test Equipment**

## Electromagnetic Compatibility Criteria for Intentional Radiators

### § 15.215(c) 20 dB Occupied Bandwidth

**Test Requirement(s):** **§ 15.215 (c)** Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§15.217 through 15.257 and in subpart E of this part, 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.

**Test Procedure:** The transmitter was on and transmitting at the highest output power. The bandwidth of the fundamental frequency was measured with the spectrum analyzer using an RBW approximately 1% of the total emission bandwidth. The 20 dB Bandwidth was measured and recorded.

**Test Results:** Both the OK 5127SI and SmartWare, as evaluated, were compliant with this requirement. See appendices for plots and test setup photos.

**Test Engineer(s):** Adan Arab

**Test Date(s):** 05/12/2021

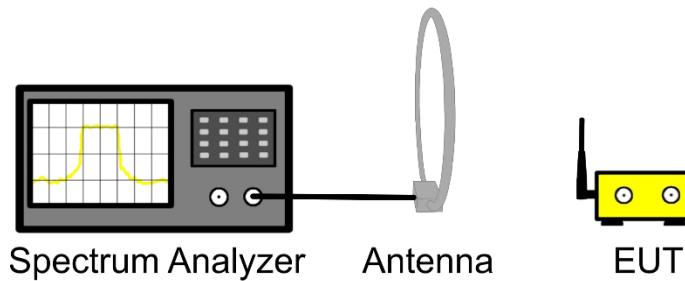


Figure 3. 20 dB Bandwidth Test Setup

Transmitter Name	Channel (MHz)	20 dB Bandwidth (kHz)
SmartWare	13.56	3.662
OK 5127SI	13.56	3.261

Table 14. 20 dB Bandwidth, Test Results

## Electromagnetic Compatibility Criteria for Intentional Radiators

### § 15.225(a) Field Strength, within the band 13.553 – 13.567 MHz

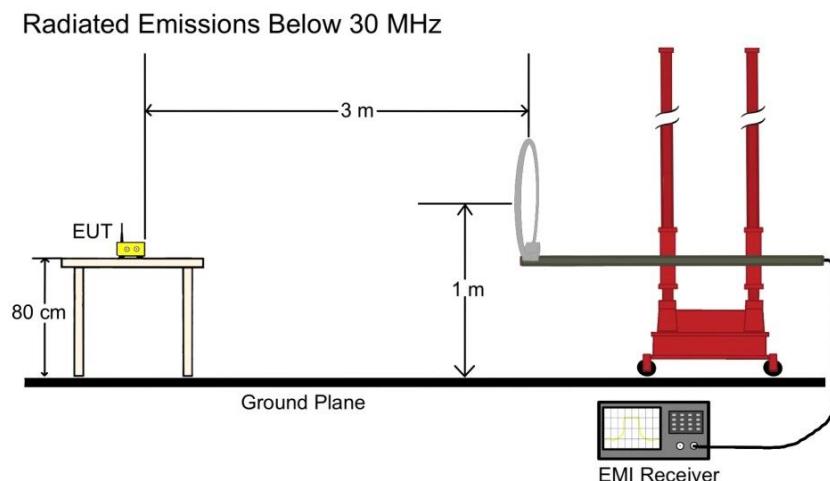
**Test Requirement(s):** **15.225 (a)** The field strength of any emissions within the band 13.553 – 13.567 MHz shall not exceed 15,848 microvolts/meter at 30 meters.

**Test Procedure:** The EUT was set to transmit and placed on a 0.8m-high non-conductive table inside a semi-anechoic chamber. The method of testing and test conditions of ANSI C63.10: 2013 were used. The loop antenna was located 3 m from the EUT and 1m above the ground plane. Measurements were conducted with the loop antenna at coaxial (parallel) and planar (perpendicular) orientations. The Spectrum analyzer. A peak detector was used to perform a pre-scan.

The measurements were made at 3m and then extrapolated to 30m using the following distance correction factor:

$$40\log(3/30) = -40 \text{ dB}$$

The EUT was set to transmit on a factory default setting.



**Figure 4: Radiated Emissions, Test Setup**

**Test Results:** Both the OK 5127SI and SmartWare, as evaluated, were compliant with the requirements of **§15.225(a)**. See appendices for plots and test setup photos.

**Test Engineer(s):** Adan Arab

**Test Date(s):** 04/29/2021

Frequency (MHz)	Uncorrected Amplitude (dB $\mu$ V @ 3m)	Loop Antenna Orientation (Degree)	Distance Correction Factor (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Corrected Amplitude (dB $\mu$ V/m @ 30m)	Limit, FCC 15.225, 30m (dB $\mu$ V/m)	Margin (dB)
13.5600	43.42	0	-40.00	10.64	0.20	14.32	84.00	-69.68
13.5600	42.41	90	-40.00	10.64	0.20	13.25	84.00	-70.75

**Table 15. Field Strength Within the Band 13.553 - 13.567 MHz, OK 5127SI Test Results**

Frequency (MHz)	Uncorrected Amplitude (dB $\mu$ V @ 3m)	Loop Antenna Orientation (Degree)	Distance Correction Factor (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Corrected Amplitude (dB $\mu$ V/m @ 30m)	Limit, FCC 15.225, 30m (dB $\mu$ V/m)	Margin (dB)
13.5600	33.09	0	-40.00	10.64	0.20	3.93	84.00	-80.07
13.5600	37.69	90	-40.00	10.64	0.20	8.53	84.00	-75.47

**Table 16. Field Strength Within the Band 13.553 – 13.567 MHz, SmartWare Test Results**

## Electromagnetic Compatibility Criteria for Intentional Radiators

### § 15.225(b) Field Strength Limits, within the bands 13.410 – 13.553 MHz and 13.567 – 13.710 MHz

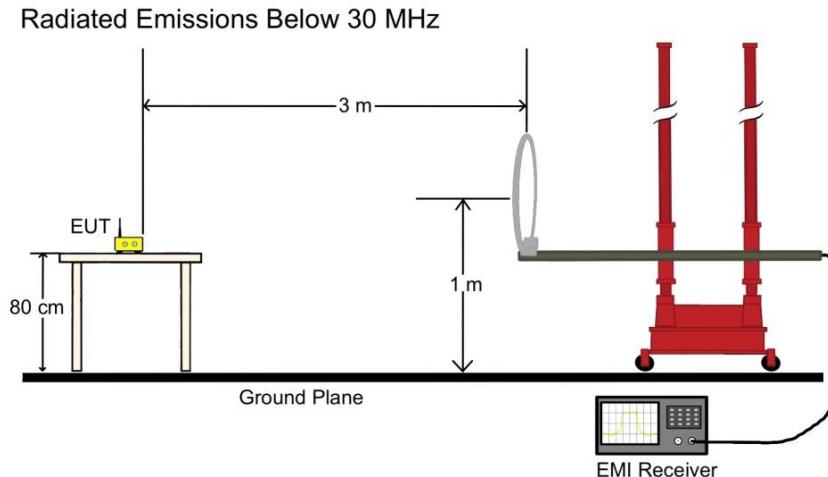
**Test Requirement(s):** **15.225 (b)** Within the bands 13.410–13.553 MHz and 13.567–13.710 MHz, the field strength of any emissions shall not exceed 334 microvolts/meter at 30 meters.

**Test Procedures:** The EUT was set to transmit and placed on a 0.8m-high non-conductive table inside a semi-anechoic chamber. The method of testing and test conditions of ANSI C63.10: 2013 were used. The loop antenna was located 3 m from the EUT and 1m above the ground plane. Measurements were conducted with the loop antenna at coaxial (parallel) and planar (perpendicular) orientations. The Spectrum analyzer. A peak detector was used to perform a pre-scan.

The measurements were made at 3m and then extrapolated to 30m using the following distance correction factor:

$$40\log(3/30) = -40 \text{ dB}$$

The EUT was set to transmit on a factory default setting.



**Figure 5: Radiated Emissions, Test Setup**

**Test Results:** Both the OK 5127SI and SmartWare, as evaluated, were compliant with the requirements of § 15.225(b). All peak spurious emissions measured within the bands 13.410–13.553 MHz and 13.567–13.710 MHz, were at least 20 dB below the Quasi-Peak limit. See appendices for plots and test setup photos.

**Test Engineer(s):** Adan Arab

**Test Date(s):** 04/29/2021

## Electromagnetic Compatibility Criteria for Intentional Radiators

**§ 15.225(c) Field Strength Limits, within the bands 13.110 – 13.410 MHz and 13.710 – 14.010 MHz**

**Test Requirement(s):** **15.225 (c)** Within the bands 13.110–13.410 MHz and 13.710–14.010 MHz the field strength of any emissions shall not exceed 106 microvolts/meter at 30 meters.

**Test Procedures:** The EUT was set to transmit and placed on a 0.8m-high non-conductive table inside a semi-anechoic chamber. The method of testing and test conditions of ANSI C63.10: 2013 were used. The loop antenna was located 3 m from the EUT and 1m above the ground plane. Measurements were conducted with the loop antenna at coaxial (parallel) and planar (perpendicular) orientations. The Spectrum analyzer. A peak detector was used to perform a pre-scan.

The measurements were made at 3m and then extrapolated to 30m using the following correction factor:

$$40\log(3/30) = -40 \text{ dB}$$

The EUT was set to transmit on a factory default setting.

**Test Results:** Both the OK 5127SI and SmartWare, as evaluated, were compliant with the requirements of **§15.225(c)**. All peak spurious emissions measured within the bands bands 13.110–13.410 MHz and 13.710–14.010 MHz, were at least 20 dB below the Quasi-Peak limit. See appendices for plots and test setup photos.

**Test Engineer(s):** Adan Arab

**Test Date(s):** 04/29/2020

## Electromagnetic Compatibility Criteria for Intentional Radiators

### § 15.225(d) Field Strength Limits, outside the bands 13.110 – 14.010 MHz

**Test Requirement(s):** 15.225 (d) 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.

**Test Procedures:** The EUT was set to transmit and placed on a 0.8m-high non-conductive table inside a semi-anechoic chamber. The method of testing and test conditions of ANSI C63.10: 2013 were used. For measurements below 30 MHz a loop antenna placed 3m away from the unit and 1m above the ground plane was used. For measurements above 30 MHz a biconalog antenna placed 10m away from the unit was used. Measurements below 30 MHz were conducted with the loop antenna at coaxial (parallel) and planar (perpendicular) orientations. Measurements above 30 MHz were conducted with the biconalog antenna in the vertical and horizontal polarizations. A peak detector was used to perform a pre-scan from 9 kHz to 140 MHz. Spurious emissions within 20 dB of the applicable limit were measured using a quasi-peak detector and recorded in the subsequent section. Peak emissions that were observed over the applicable limit were determined to be digital emissions subject to the requirements of FCC Part 15B subsection 109 for Class A devices.

The measurements made at 3m with the loop antenna were then extrapolated to 30m or 300 m using the following correction factors.

$$40\log(3/30) = -40 \text{ dB}$$
$$40\log(3/300) = -80 \text{ dB}$$

The measurements made at 10m with the biconilog antenna were then extrapolated to the 3m using the following correction factor.

$$20\log(10/3) = +10.46 \text{ dB}$$

The EUT was set to transmit on a factory default setting.

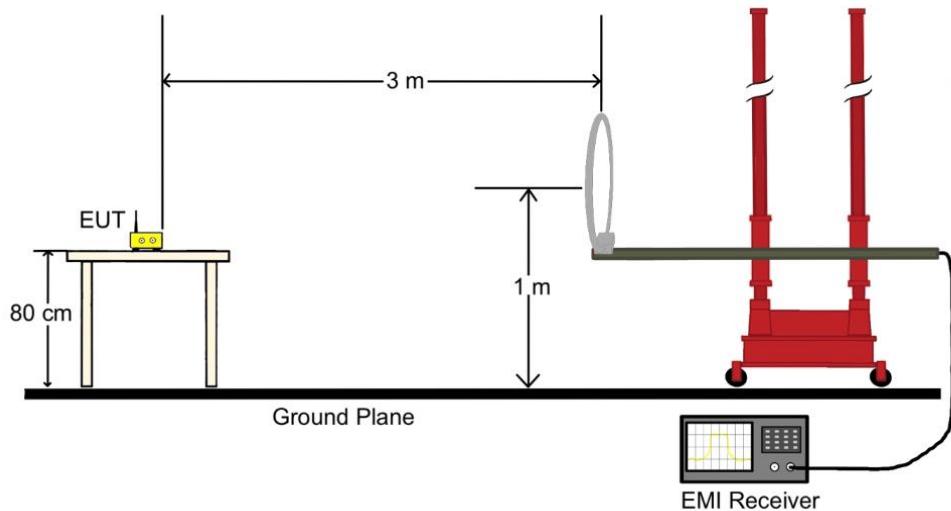
**Test Results:** Both the OK 5127SI and SmartWare, as evaluated, were compliant with requirements of **§ 15.225 (d)**. See appendices for plots and test setup photos.

**Test Engineer:** Adan Arab

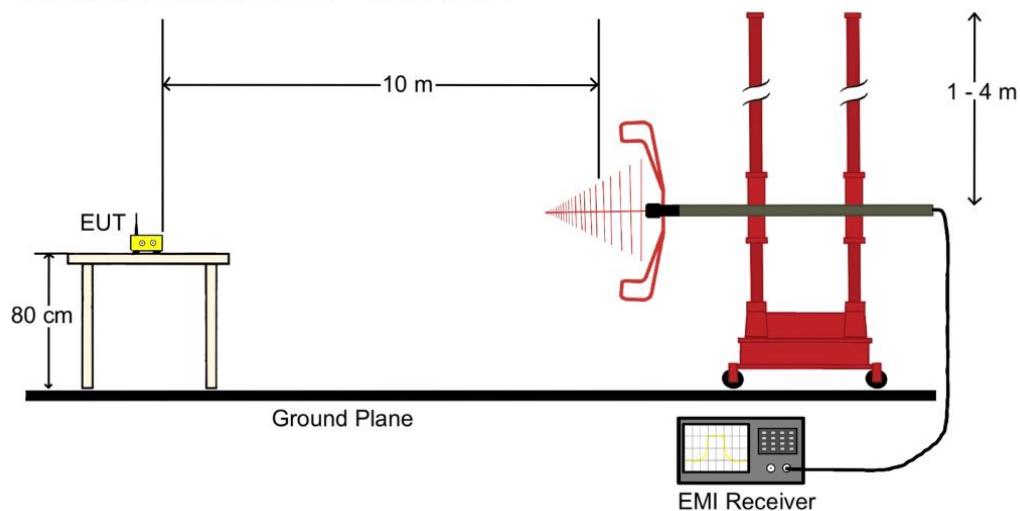
**Test Date:** 04/29/2021

## Radiated Emissions Limits Test Setup

Radiated Emissions Below 30 MHz



Radiated Emissions 30 - 1000 MHz



**Figure 6. Radiated Emissions Test Setup**

Frequency (MHz)	Uncorrected Amplitude (dB $\mu$ V @ 3m)	Loop Antenna Orientation (Degree)	Azimuth (Degrees)	Distance Correction Factor (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Corrected Amplitude (dB $\mu$ V/m @ 30m)	Limit, FCC 15.225, 30m (dB $\mu$ V/m)	Margin (dB)
0.1235	61.14	0	0.60	-80.00	11.28	0.00	-7.58	25.77	-33.35
0.1210	60.05	90	0.60	-80.00	11.28	0.00	-8.67	25.94	-34.61
0.3706	47.66	0	1.70	-80.00	11.03	0.00	-21.31	16.22	-37.53
0.3712	44.55	90	1.70	-80.00	11.03	0.00	-24.42	16.21	-40.63
0.5845	37.59	0	0.30	-40.00	11.20	0.00	8.79	32.27	-23.48
13.5425	38.06	90	0.00	-40.00	10.65	0.18	8.70	29.54	-20.65

**Table 17. Spurious Emissions outside 13.110 – 14.010 MHz band, OK 5127SI, 0.009-30 MHz Test Results**

Frequency (MHz)	Uncorrected Amplitude (dB $\mu$ V @ 10m)	Antenna Polarization (H/V)	Antenna Height (cm)	Azimuth (Degrees)	Distance Correction Factor (dB)	Antenna Factor (dB/m)	Preamp Factor (dB)	Corrected Amplitude (dB $\mu$ V/m @ 3m)	Limit, FCC 15.209 (dB $\mu$ V/m)	Margin (dB)
30.0000	37.76	H	310.00	60.00	10.46	22.80	-24.82	46.20	40.00	6.20
30.0000	38.55	V	310.00	60.00	10.46	22.30	-24.82	46.49	40.00	6.49
31.5545	34.24	H	310.00	60.00	10.46	21.92	-24.72	41.90	40.00	1.90
33.1090	40.72	V	309.00	60.00	10.46	20.17	-24.70	46.65	40.00	6.65
36.2179	42.15	V	298.00	60.00	10.46	18.07	-24.61	46.07	40.00	6.07
79.7436	44.32	H	100.00	0.00	10.46	11.25	-23.94	42.09	40.00	2.09
Note Measurements listed above represent quasi-peak results for spurious Emissions. Spurious emissions above the limit were determined to be sourced from digital devices unrelated to the transmitter. Therefore, are not subject to the requirements of FCC15.209 but shall meet the requirements of FCC 15.109, for a Class A device.										

**Table 18. Spurious Emissions outside 13.110 – 14.010 MHz band, OK 5127SI, 30 – 1000 MHz Test Results**

Frequency (MHz)	Uncorrected Amplitude (dB $\mu$ V @ 3m)	Loop Antenna Orientation (Degree)	Azimuth (Degrees)	Distance Correction Factor (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Corrected Amplitude (dB $\mu$ V/m @ 30m)	Limit, FCC 15.225, 30m (dB $\mu$ V/m)	Margin (dB)
0.1217	57.15	90	176.50	-80.00	11.26	0.00	-11.59	25.89	-37.48
0.1219	61.81	0	179.60	-80.00	11.26	0.00	-6.93	25.88	-32.81
0.3717	44.2	90	179.80	-80.00	11.00	0.00	-24.80	16.20	-41.00
0.3734	47.9	0	179.50	-80.00	11.00	0.00	-21.10	16.16	-37.26
0.5845	38.47	90	180.00	-40.00	11.20	0.09	9.76	32.27	-22.51
1.1048	33.98	0	180.10	-40.00	11.41	0.19	5.58	26.74	-21.16

**Table 19. Spurious Emissions outside 13.110 – 14.010 MHz band, SmartWare, 0.009-30 MHz Test**

Frequency (MHz)	Uncorrected Amplitude (dB $\mu$ V @ 10m)	Antenna Polarization (H/V)	Antenna Height (cm)	Azimuth (Degrees)	Distance Correction Factor (dB)	Antenna Factor (dB/m)	Preamp Factor (dB)	Corrected Amplitude (dB $\mu$ V/m @ 3m)	Limit, FCC 15.209 (dB $\mu$ V/m)	Margin (dB)
30.0000	34.62	H	310.00	60.00	10.46	22.8	-24.82	43.06	40.00	3.06
30.0000	34.77	V	310.00	60.00	10.46	22.3	-24.82	42.71	40.00	2.71
31.5545	30.43	H	310.00	60.00	10.46	21.92	-24.72	38.09	40.00	-1.91
33.1090	31.23	H	309.00	60.00	10.46	21.25	-24.7	38.23	40.00	-1.77
70.4167	46.66	V	100.00	88.00	10.46	9.83	-24.13	42.81	40.00	2.81
79.7436	45.31	V	100.00	122.00	10.46	11.42	-23.94	43.25	40.00	3.25
Note										
Measurements listed above represent quasi-peak results for spurious Emissions. Spurious emissions above the limit were determined to be sourced from digital devices unrelated to the transmitter. Therefore, are not subject to the requirements of FCC15.209 but shall meet the requirements of FCC 15.109, for a Class A device.										

**Table 20. Spurious Emissions outside 13.110 – 14.010 MHz band, SmartWare, 30 – 1000 MHz Test Results**

## Electromagnetic Compatibility Criteria for Intentional Radiators

### § 15.225(e) Frequency Stability

**Test Requirement(s):** **15.225(e)** The frequency tolerance of the carrier signal shall be maintained within +/-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.

**Test Procedure:** Measurements are in accordance with section 6.8 of ANSI C63.10. The EUT was placed in the Environmental Chamber and allowed to reach desired temperature. A spectrum analyzer was used to measure the frequency drift. The EUT was set to transmit in the operating frequency range. Frequency drift was investigated for the extreme temperatures and nominal temperature, until the unit is stabilized then recorded the reading in tabular format with the temperature range of -20° to 50°C.

The EUT is intended to be powered from Prime input Hopper. Voltage variations were applied to the input of the Prime Input Hopper provided with the EUT at the time of testing in accordance with section 5.13 of ANSI C63.10.

**Test Results:** Both the OK 5127SI and SmartWare, as evaluated, were compliant with Part 15.225 (e) requirement(s) of this section. See appendices for test setup photos.

**Test Engineer(s):** Adan Arab

**Test Date(s):** 05/12/2021

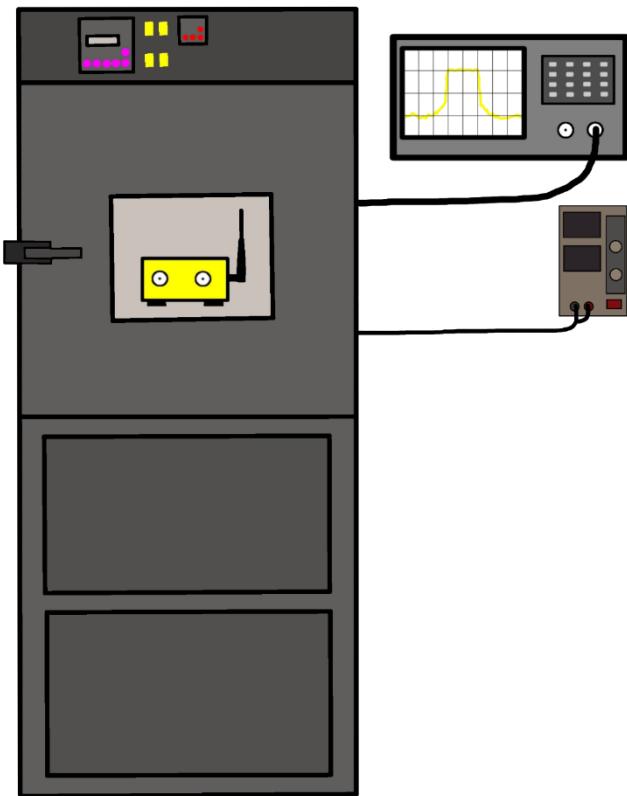


Figure 7. Temperature Stability Test Setup

FCC 15.225	Vnom = 120VAC 60Hz				
Voltage Variation (%)	Temperature (°C)	Nominal Freq (MHz)	Result (MHz)	% Difference	Limit
Vnom	50	13.560000	13.560375	0.002765	<b>±0.01%</b>
	40	13.560000	13.560439	0.003237	
	30	13.560000	13.560493	0.003636	
	20	13.560000	13.560431	0.003178	
	10	13.560000	13.560521	0.003842	
	0	13.560000	13.560543	0.004004	
	-10	13.560000	13.560516	0.003805	
	-20	13.560000	13.560467	0.003444	
	15	20	13.560000	13.560375	
-15	20	13.560000	13.560430	0.003171	

**Table 21. Frequency Stability, Test Results, OK 5127SI**

FCC 15.225	Vnom = 120VAC 60Hz				
Voltage Variation (%)	Temperature (°C)	Nominal Freq (MHz)	Result (MHz)	% Difference	Limit
Vnom	50	13.560000	13.560168	0.001239	<b>±0.01%</b>
	40	13.560000	13.560159	0.001173	
	30	13.560000	13.560153	0.001128	
	20	13.560000	13.560157	0.001158	
	10	13.560000	13.560143	0.001055	
	0	13.560000	13.560144	0.001062	
	-10	13.560000	13.560121	0.000892	
	-20	13.560000	13.560126	0.000929	
	15	20	13.560000	13.560160	
-15	20	13.560000	13.560158	0.001165	

**Table 22. Frequency Stability, Test Results, SmartWare**

## Test Equipment

Calibrated test equipment utilized during testing was maintained in a current state of calibration per the requirements of ISO/IEC 17025:2017.

MET Asset #	Equipment	Manufacturer	Model	Last Cal Date	Cal Due Date
1A1169	Temp, Humidity, and Pressure Recorder	Omega	OM-CP-PRHTemp2000	02/19/2021	02/19/2022
1A1184	Spectrum Analyzer	Agilent Technologies	E4407B	08/24/2020	08/24/2021
1A1083	EMI Test Receiver	Rohde & Schwarz	ESU40	10/16/2020	10/16/2021
1A1176	Active Loop Antenna (9KHz-30MHz)	ETS-Lindgren	6502	06/02/2020	06/02/2021
1A1225	Environmental Chamber	Espec	EXP-2H/New	02/11/2021	02/11/2022
3A3009	PROGRAMABLE POWER SUPPLY	KIKUSUI	PCR2000L	SEE NOTE	
1A1050	Bilog Antenna (30-1000 MHz)	Sunol Sciences Corp	JB3	12/01/2020	12/01/2022
1A1116	Mulitmeter	Fluke	179	02/13/2021	02/13/2022
1A1044	Generator	COM-Power Corp	CG-520	SEE NOTE	
1A1088	PRE-AMP	ROHDE & SCHWARZ	TS-PR1	SEE NOTE	
1A1080	MULTI-DEVICE CONTROLLER	ETS-EMCO	2090	SEE NOTE	
1A1073	MULTI-DEVICE CONTROLLER	ETS-EMCO	2090	SEE NOTE	
1A1106	10M SEMI-ANECHOIC CHAMBER	LINDGREN	N/A	SEE NOTE	
NOTE	FUNCTIONALITY OF EQUIPMENT IS VERIFIED USING THE CALIBRATED INSTRUMENTS LISTED ABOVE AT THE TIME OF TESTING				

**Figure 8. Test Equipment List**

## End of Report