

EMC Test Report

Project Number: 4941423 **Proposal:** SUW-202207003104
Report Number: 4941423EMC01 **Revision Level:** 1
Client: Taylor Commercial Foodservice LLC

Equipment Under Test: Food Service Rinse for Soft Serve machines

Model Name: Hydra Rinse

Model Number: HRF1-12

FCC ID: 2A7XT-0032670887

IC: 4920A-9990341

Applicable Standards: FCC Part 15 Subpart C, §15.225

RSS-210, Issue 10, December 2019

ANSI C63.10: 2013

RSS-GEN, Issue 5, March 2019

Report issued on: 12 September 2022

Test Result: Compliant



FOR THE SCOPE OF ACCREDITATION UNDER CERTIFICATE NUMBER: 3212.01

Report must not be used by the client to claim product certification, approval, or endorsement by A2LA, NIST, or any agency of the Federal Government.

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1 Summary of Test Results

Test Description	Test Specification		Test Result
	FCC	ISED	
Bandwidth	15.215(c)	RSS-GEN 6.7	Reported
Field Strength of the Fundamental	15.225(a)	RSS-210 B.6(a)(i)	Compliant
Radiated Spurious Emissions / Restricted Bands	15.35(b), 15.209, 15.215(b)	RSS-GEN S6.13 RSS-GEN S8.10	Compliant
Antenna Requirement	15.203	RSS-GEN S8.3	Compliant ¹
Frequency Stability	15.225(e)	RSS-210 B.6(b)	Compliant
AC Powerline Conducted Emission	15.207	RSS-GEN S8.8	N/A ²

(1) The RFID antenna is an internal patch antenna.

(2) EUT does not connect to AC mains.

1.1 *Modifications Required to Compliance*

None

2 General Information

2.1 Client Information

Name: Taylor Commercial Foodservice LLC
Address: 750 N. Blackhawk Blvd
City, State, Zip, Country: Rockton, Ill 61072, USA

2.2 Test Laboratory

Name: SGS North America, Inc.
Address: 620 Old Peachtree Road NW, Suite 100
City, State, Zip, Country: Suwanee, GA 30024, USA

Accrediting Body: A2LA
Type of lab: Testing Laboratory
Certificate Number: 3212.01

CAB Identifier: US0186

2.3 General Information of EUT

Type of Product: Food Service Rinse with RFID tag
Model Name: Hydra Rinse
Model Number: HRF1-12
Serial Number: FCC01

RFID Frequency Range: 13.56 MHz
Data Modes: RFID
Antenna(s): Patch Antenna* (P/N - Molex 1462360021)

Rated Voltage: 4.5 VDC (C-type batteries)

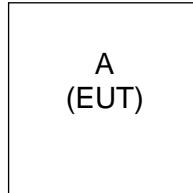
Sample Received Date: 22 July 2022
Dates of testing: 25 July to 1 August 2022

Note*: *Data was not measured by SGS laboratory and therefore not responsible for accuracy. Data obtained via customer, specification sheet, previous regulatory filing or other.*

2.4 Operating Modes and Conditions

During emissions testing, the EUT was powered by 3 alkaline batteries. By depressing the ready button, the 13.56MHz RFID transmitter was activated. Tokens were used to re-engage the RFID.

2.5 EUT Connection Block Diagram – Radiated Measurements



2.6 System Configurations

Device reference	Manufacturer	Description	Model Number	Serial Number
A	Taylor Commercial Foodservice LLC	Food Service Rinsing machine	HRF1-12	FCC01

3 Occupied Bandwidth

3.1 Test Result

Test Description	Basic Standards	Test Result
99% Bandwidth	RSS-GEN 6.7	Reported
20dB Bandwidth	15.215(c)	Compliant

3.2 Test Method

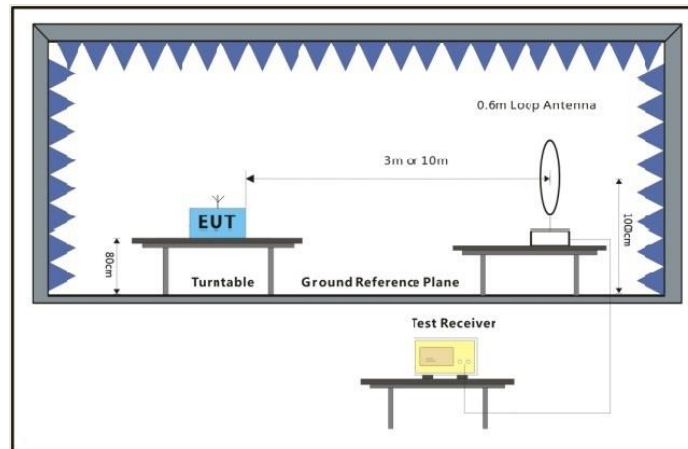
The 99% occupied bandwidth or 20dB down measurement function of the spectrum analyzer was employed.

3.3 Test Site

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature: 23.3 °C
Relative Humidity: 50.4 %
Atmospheric Pressure: 98.43 kPa



Below 30MHz

3.4 Test Equipment

Test End Date: 29-Jul-2022

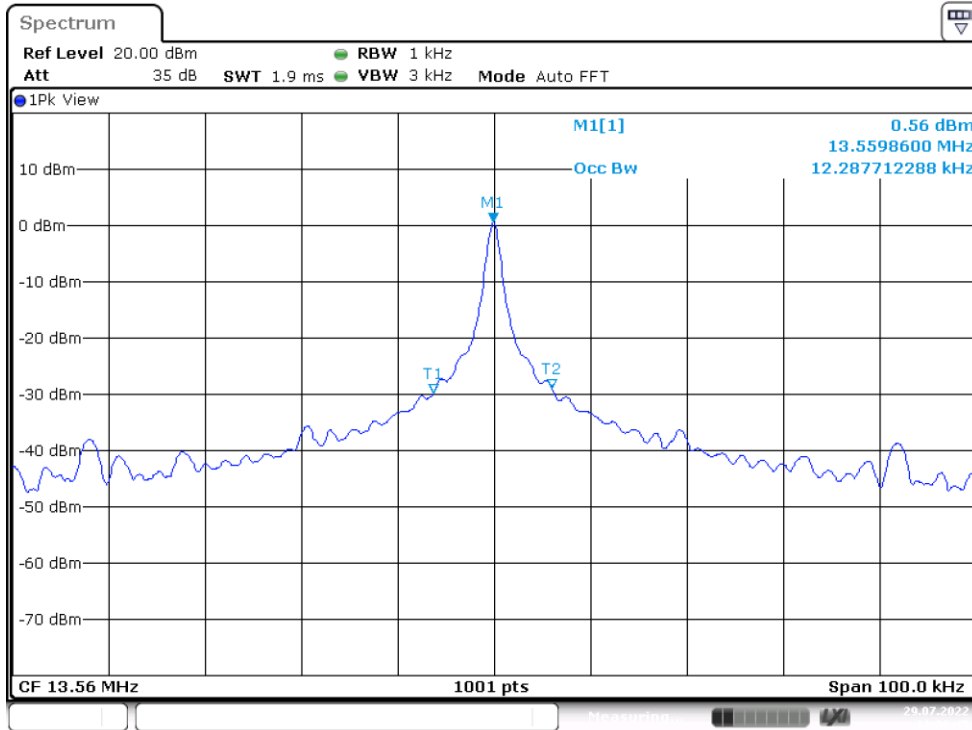
Tester: AB

Equipment	Model	Manufacturer	Asset Number	Cal Date	Cal Due Date
SIGNAL ANALYZER (TS8997)	FSV30	ROHDE & SCHWARZ	B085749	4-Jan-2022	4-Jan-2024
RF CABLE, SMA TO N	LL142	CENTRICRF	19011	16-Mar-2022	16-Mar-2023
NEAR FIELD PROBES	N/A	COM-POWER CORPORATION	16016	CNR	CNR

Note: Refer to the table for calibration intervals.

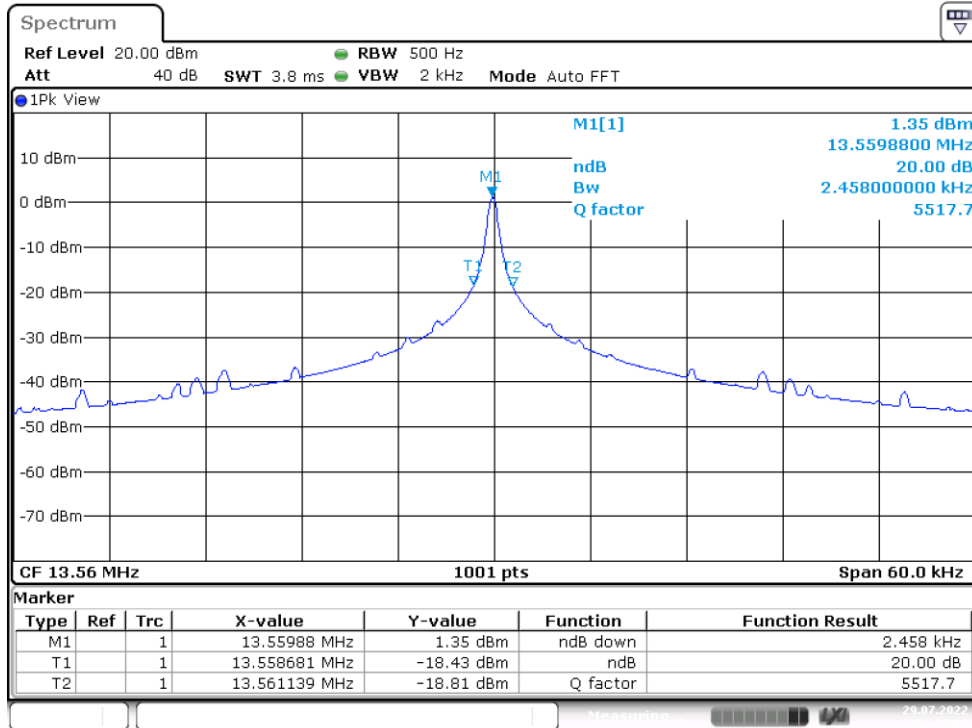
3.5 Test Data

99% Occupied Bandwidth = 12.29kHz



Date: 29.JUL.2022 11:06:46

20dB Bandwidth = 2.458kHz



Date: 29.JUL.2022 11:13:09

4 Field Strength of the Fundamental

4.1 Test Result

Test Description	Basic Standards	Test Result
Radiated Emissions	FCC Part 15, Subpart C RSS-210 ANSI C63.10:2013	Compliant

4.2 Test Method

For measuring the fundamental, the receiver's resolution bandwidth was set to 9kHz. A loop antenna was employed, and peak scans were taken with the loop open towards the EUT (Co-Axial) and with the loop in-line with the EUT (Co-Planar). The antenna height was fixed at 1 m and the EUT was rotated 360° to find the maximum emitting point. The radiated measurements were recorded and compared to the limits indicated in the table below.

Radiated emissions limits

Frequency Range (MHz)	Limits (µV/m) Quasi-Peak or Average	Measurement Distance (m)
13.110 – 13.410	106	30
13.410 – 13.553	334	30
13.553 – 13.567	15,848	30
13.567 – 13.710	334	30
13.710 – 14.010	106	30

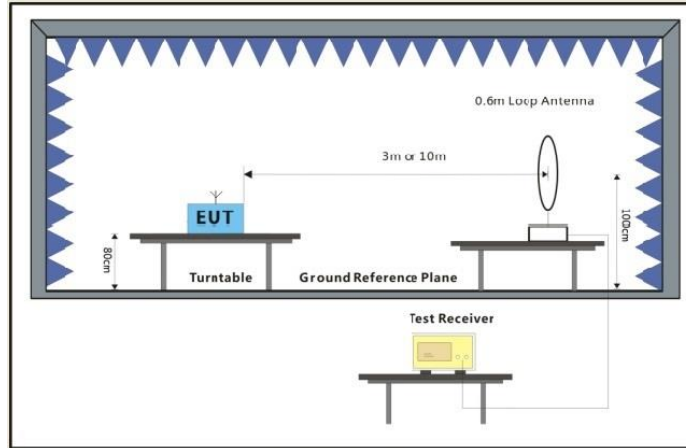
Note: Limits were converted to dBµV/m at a distance of 3m using a 40dB/decade correction per §15.31(f)(2)

Example: at 13.56MHz, the limit is expressed as 15,848µV/m at 30m
 $20 \cdot \log(15,848) = 84 \text{dB}\mu\text{V/m}$
 30 to 3 meters is a single decade, so $84 + 40 = 124 \text{dB}\mu\text{V/m}$

4.3 Test Site

10m Absorber Lined Shielded Enclosure (ALSE), Suwanee, GA

Temperature: 21.9 °C
 Relative Humidity: 55.4 %
 Atmospheric Pressure: 98.45 kPa



Below 30MHz

4.4 Test Equipment

Test End Date: 2-Aug-2022

Tester: AB

Equipment	Model	Manufacturer	Asset Number	Cal Date	Cal Due Date
PASSIVE LOOP ANTENNA, 9KHZ - 30MHZ	6512	ETS LINDGREN	20151	16-Mar-2022	16-Mar-2023
N to N RF Cable	NC12-N1N1-276	MEGAPHASE	22000	10-Jan-2022	10-Jan-2023
BROADBAND PREAMPLIFIER 9KHZ-2GHZ	BBV 9745	SCHWARZBECK MESS ELEKTRONIK	20157	16-Mar-2022	16-Mar-2023
EMI RECEIVER	ESW44	ROHDE & SCHWARZ	101585	26-Oct-2021	12-Mar-2023

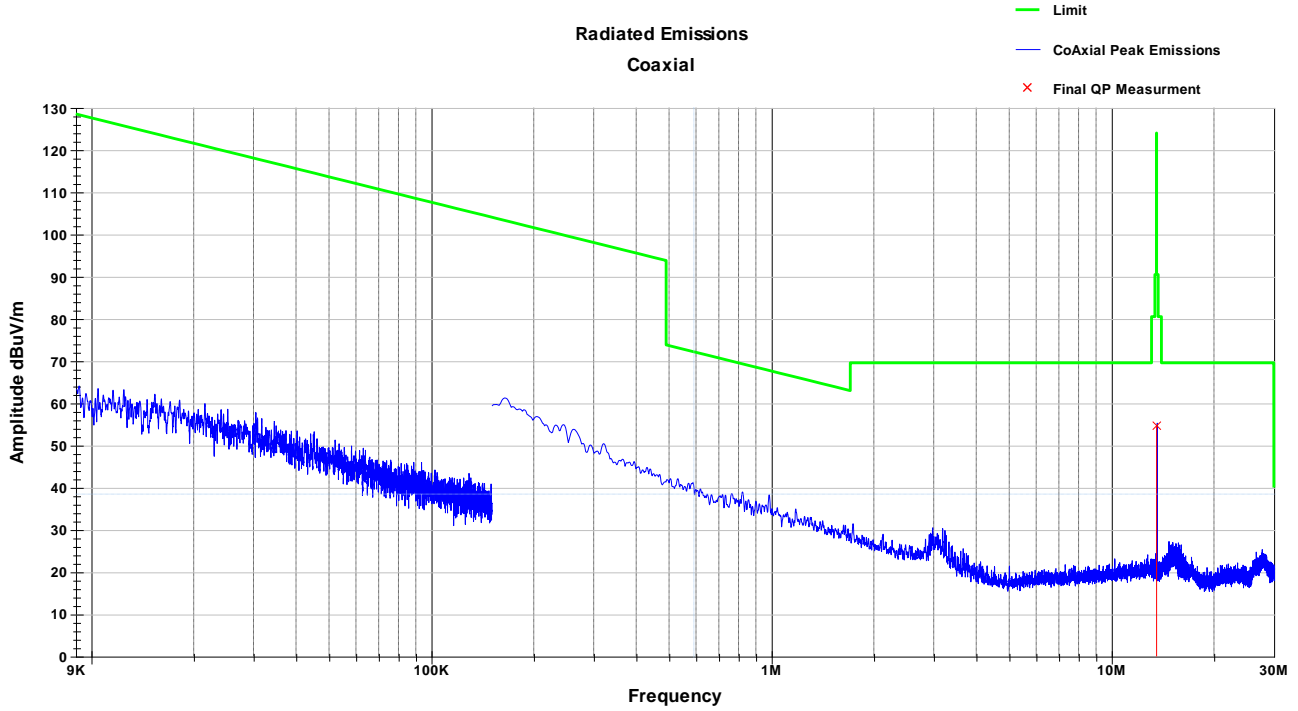
Note: Refer to table for calibration intervals.

Software:

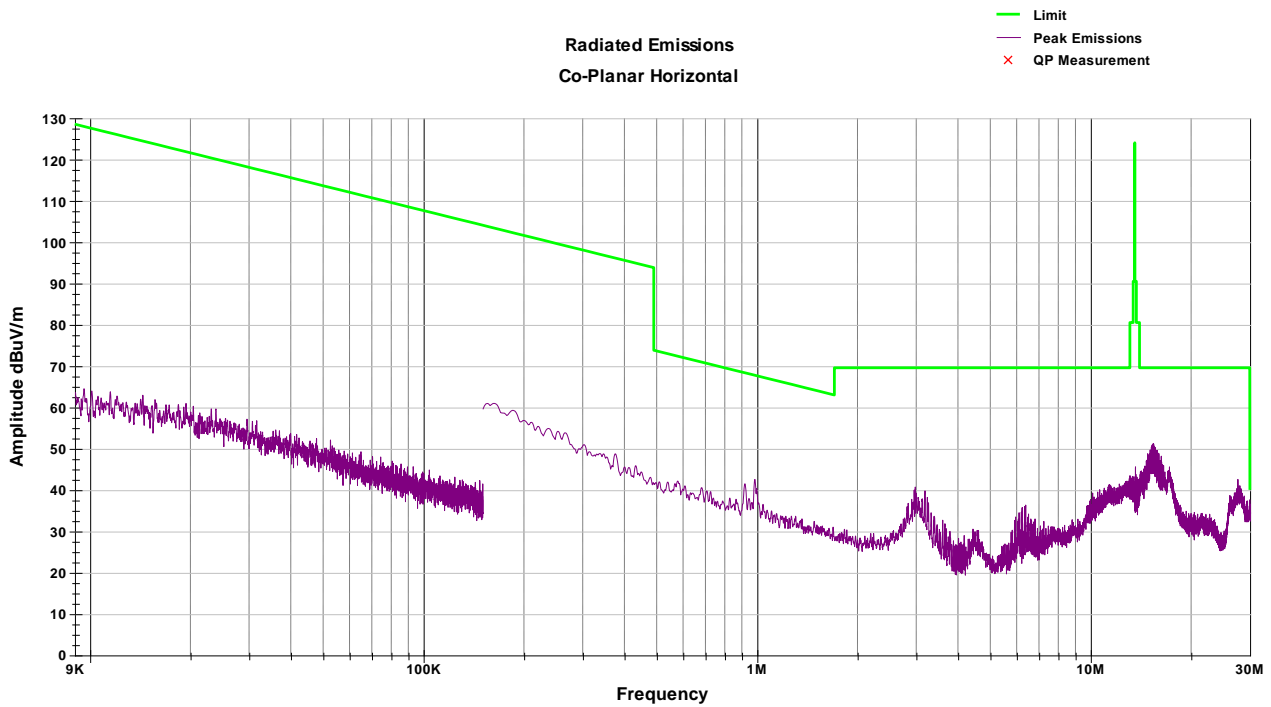
“RSE 9k - 30M Active Red Loop 220419” TILE! profile dated April 19th, 2022

4.5 Test Data

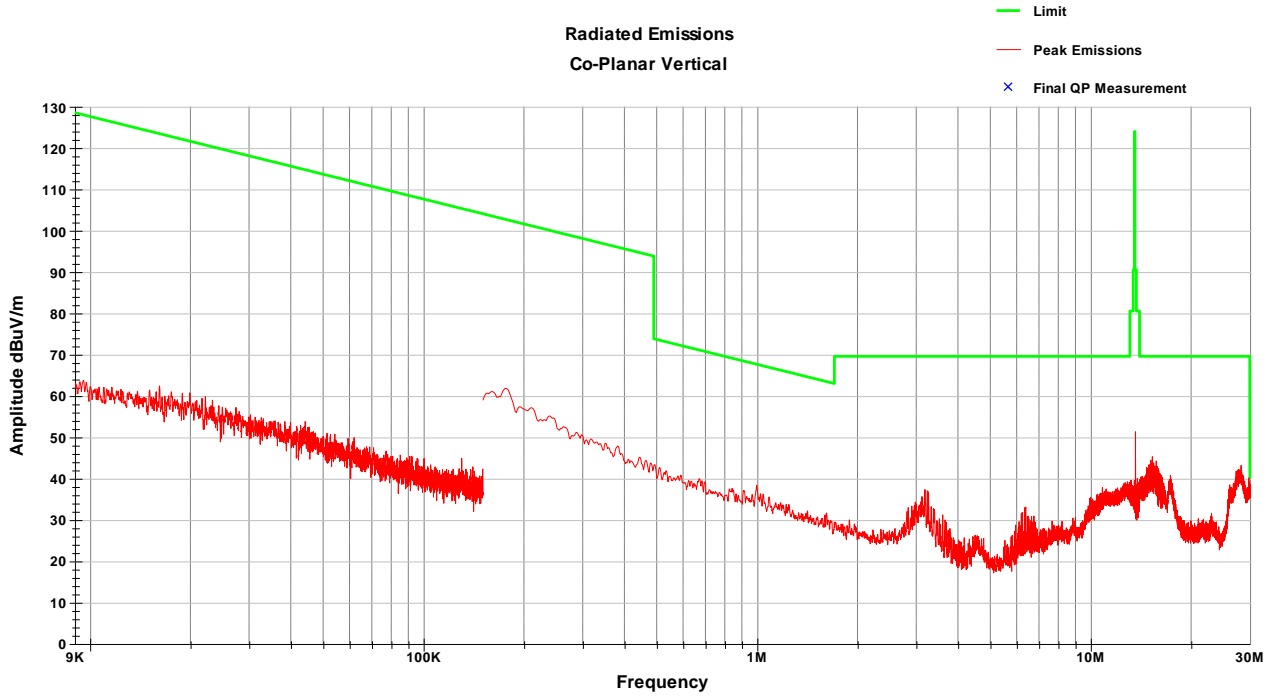
Co-Axial Peak Plot



Co-Planar – Horizontal Peak Plot



Co-Planar – Vertical Peak Plot



Tabular Data – Fundamental

Frequency MHz	Raw QP (dBuV)	Polarity (V/H)	Azimuth (degrees)	Height (cm)	AF (dB/m)	Loss (dB)	Amp (dB)	QP Value (dBuV/m)	Limit (dBuV/m)	Margin (dB)
13.57	51.0	V - Coaxial	6.0	0.0	34.5	0.3	31.0	54.8	90.5	-35.7
Pk Value = Raw Pk + AF + Loss - Amp										
Margin = Pk Value - Limit										

5 Radiated Emissions

5.1 Test Result

Test Description	Basic Standards	Test Result
Radiated Emissions	FCC Part 15, Subpart C ANSI C63.4:2014	Compliant

5.2 Test Method

Exploratory scans were performed over the frequency range as indicated in the tables below using the max hold function and incorporating a Peak detector and using TILE! software. The final test data was measured using a Quasi-Peak detector below 1GHz and a Peak and Average detector above 1GHz. The receiver's resolution bandwidth was set to 1kHz for measurements taken below 150kHz, 9kHz for in the 150kHz to 30MHz range, 120 kHz in the 30MHz to 1GHz frequency range, and 1MHz for measurements of 1GHz and higher. For testing below 30MHz, a loop antenna was employed, and peak scans were taken with the loop open towards the EUT (Co-Axial) and with the loop in-line with the EUT (Co-Planar). Above 30MHz, a biconilog antenna was used and measurements were made with the antenna positioned in both the horizontal and vertical planes of polarization. The antenna height was varied from 1 m to 4 m and the EUT was rotated 360° to find the maximum emitting point for each frequency. The radiated measurements were recorded and compared to the limits indicated in the table below.

Radiated emissions limits

Frequency Range (MHz)	Limits (µV/m) Quasi-Peak or Average	Measurement Distance (m)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

Note: Limits were converted to dBµV/m using the equation $20 \cdot \text{LOG}(x)$. Additionally, for measurements below 30MHz, the limits were adjusted to a distance of 3m using a 40dB/decade correction per §15.31(f)(2)

Example: at 20MHz, the limit is expressed as 30µV/m at 30m

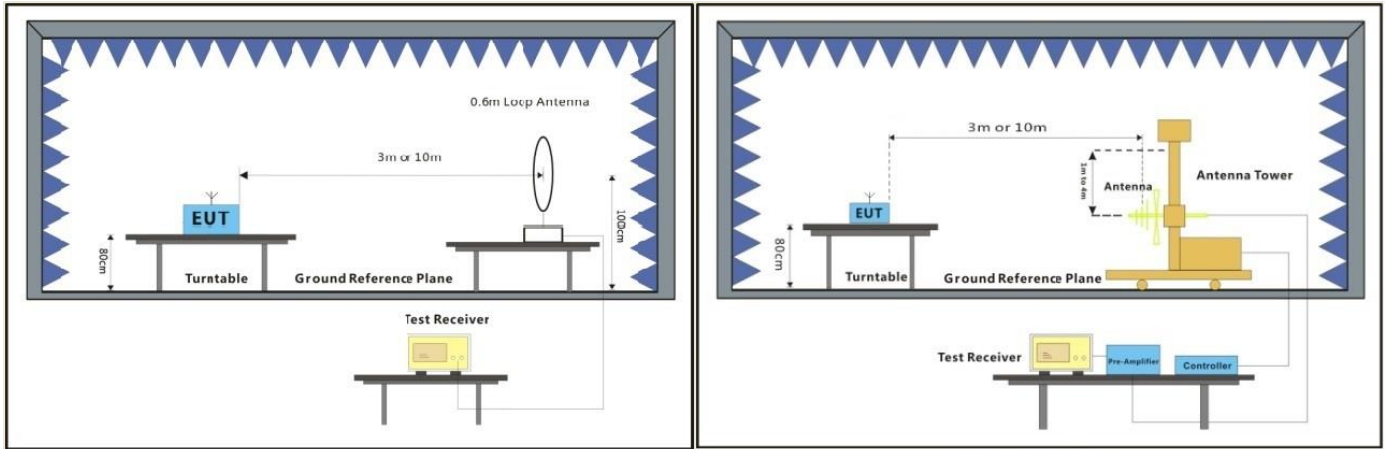
$$20 \cdot \log(30) = 29.5 \text{ dB}\mu\text{V/m}$$

$$30 \text{ to } 3 \text{ meters is a single decade, so } 29.5 + 40 = 69.5 \text{ dB}\mu\text{V/m}$$

5.3 Test Site

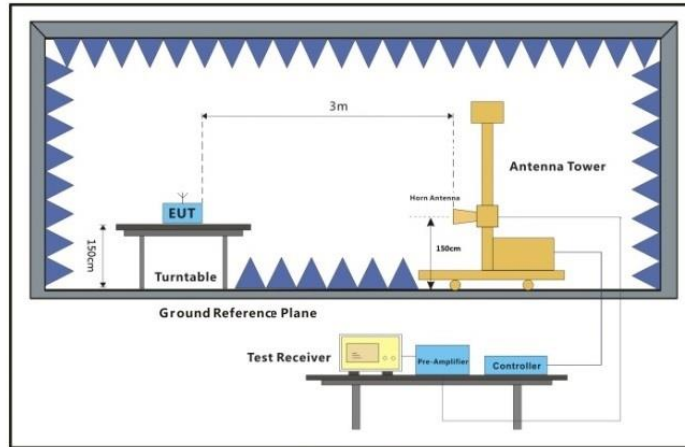
10m Absorber Lined Shielded Enclosure (ALSE), Suwanee, GA

Temperature: 23.5 °C
 Relative Humidity: 47.7 %
 Atmospheric Pressure: 98.53 kPa



Below 30MHz

30MHz-1GHz



Above 1GHz

5.4 Test Equipment

9kHz-30MHz:

Test End Date: 26-Jul-2022

Tester: AB

Equipment	Model	Manufacturer	Asset Number	Cal Date	Cal Due Date
PASSIVE LOOP ANTENNA, 9KHZ - 30MHZ	6512	ETS LINDGREN	20151	16-Mar-2022	16-Mar-2023
N to N RF Cable	NC12-N1N1-276	MEGAPHASE	22000	10-Jan-2022	10-Jan-2023
BROADBAND PREAMPLIFIER 9KHZ-2GHZ	BBV 9745	SCHWARZBECK MESS ELEKTRONIK	20157	16-Mar-2022	16-Mar-2023
EMI RECEIVER	ESW44	ROHDE & SCHWARZ	101585	26-Oct-2021	12-Mar-2023

30-1000MHz:

Test End Date: 25-Jul-2022

Tester: AB

Equipment	Model	Manufacturer	Asset Number	Cal Date	Cal Due Date
ANTENNA, BILOG	JB6	SUNOL	B079690	19-Apr-2022	19-Apr-2024
ROTARY NM TO NF CONNECTOR	18-2120-0	DIAMOND ANTENNA AND MICROWAVE CORP	22008	16-Mar-2022	16-Mar-2023
N to N RF Cable	NC12-N1N1-276	MEGAPHASE	22000	10-Jan-2022	10-Jan-2023
RF CABLE NM TO NM, 0.01-18GHZ	90-195-354	TELEDYNE STORM MICROWAVE	20119	17-Feb-2022	17-Feb-2023
EMI RECEIVER	ESW44	ROHDE & SCHWARZ	101585	26-Oct-2021	12-Mar-2023
RF CABLE NM TO NM, 0.01-18GHZ	90-195-118	TELEDYNE STORM MICROWAVE	20125	25-Aug-2021	25-Aug-2022
LOW NOISE AMPLIFIER	ZKL-2+	MINI-CIRCUITS	B079800	18-Oct-2021	18-Oct-2022
RF CABLE	SUCOFLEX 100	HUBER & SUHNER	B108523	26-Aug-2021	26-Aug-2022

Note: Refer to the table for calibration intervals.

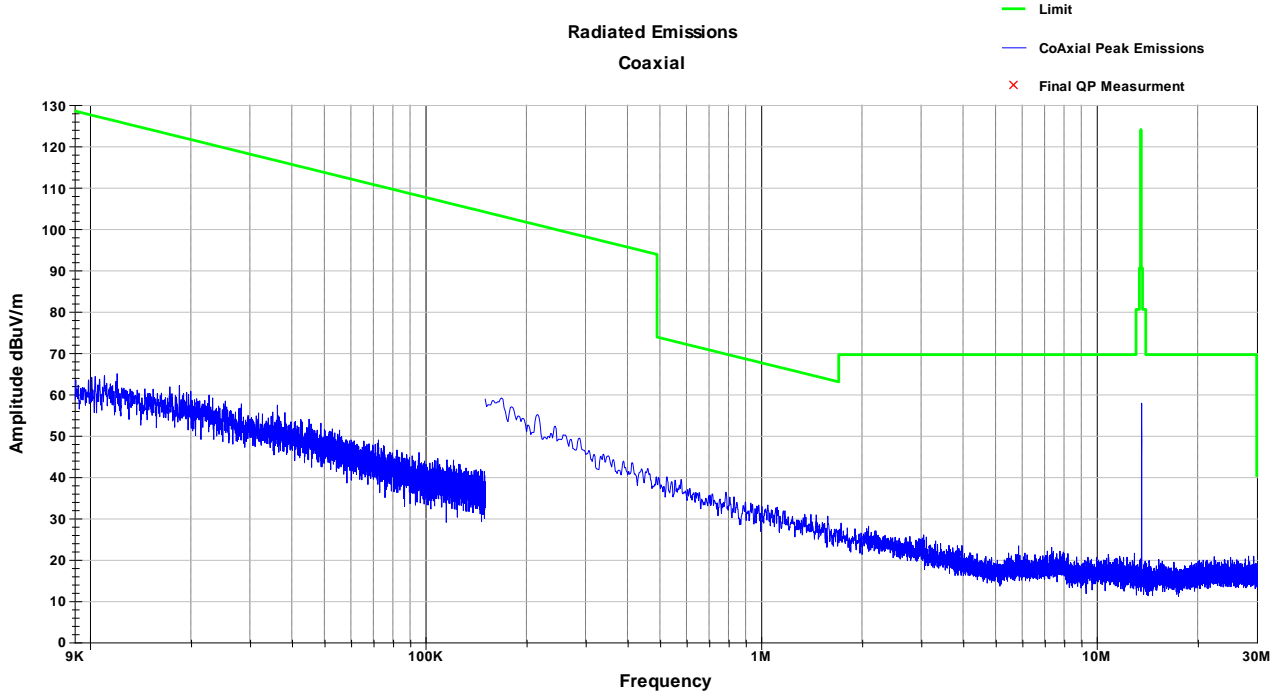
Software:

“RSE 9k - 30M Active Red Loop 220419” TILE! profile dated April 19th, 2022

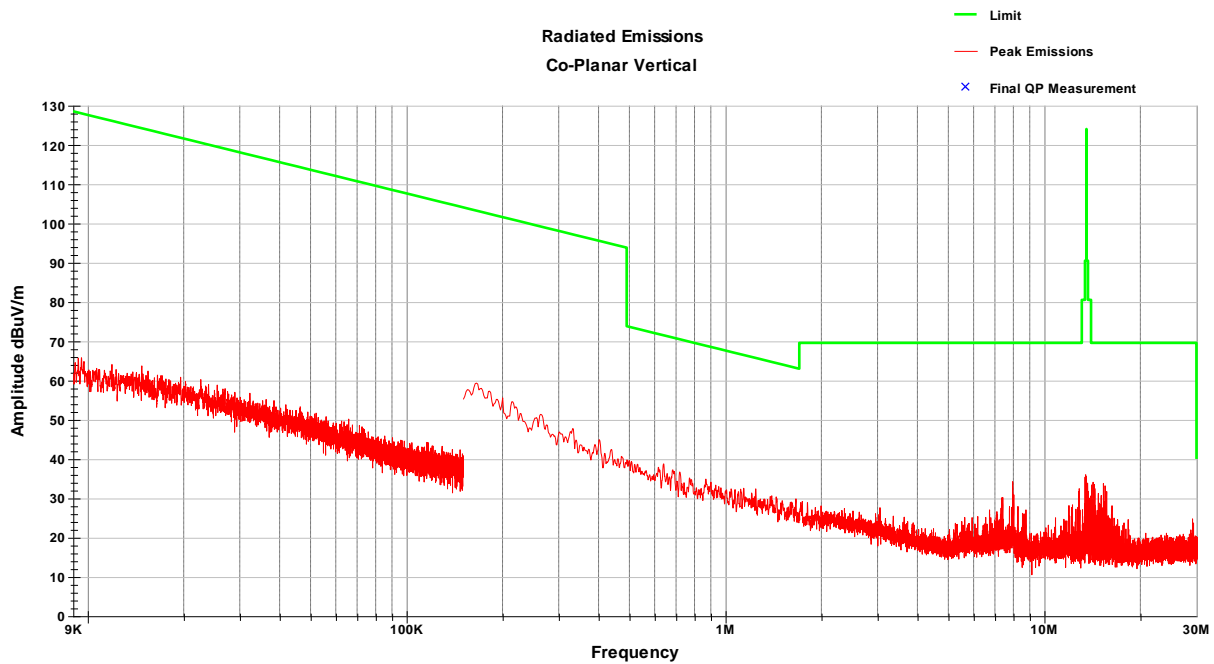
“RE 30-1000 MHz T7 220318” TILE! profile dated March 18th, 2022

5.5 Test Data

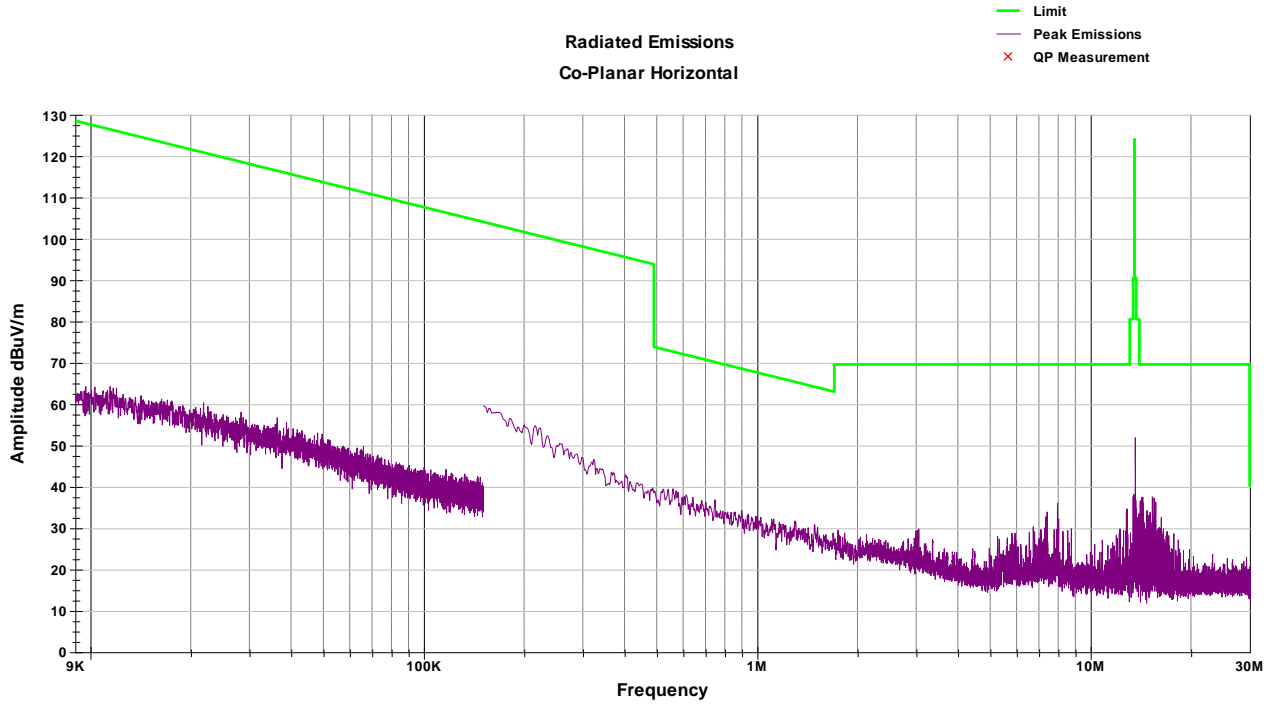
Co-Axial Radiated Emissions Data (9kHz-30MHz) – 3 meters



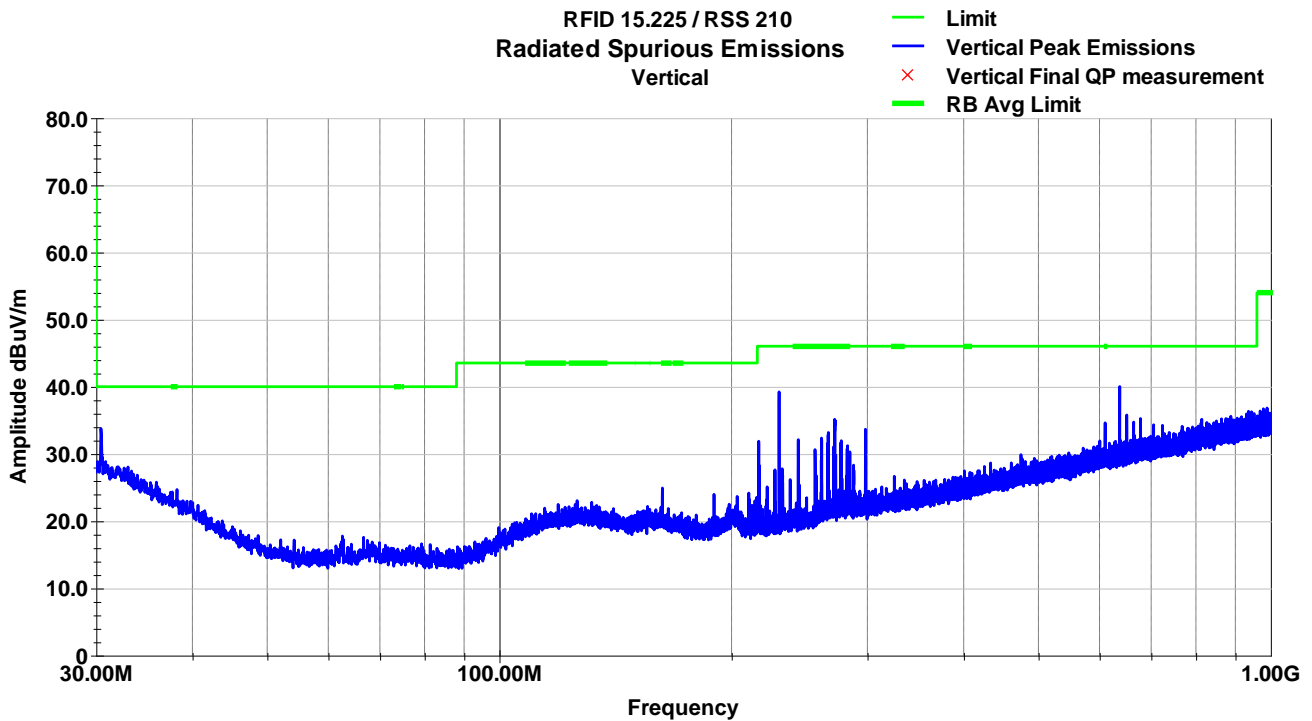
Co-Planar Vertical Radiated Emissions Data (9kHz-30MHz) – 3 meters



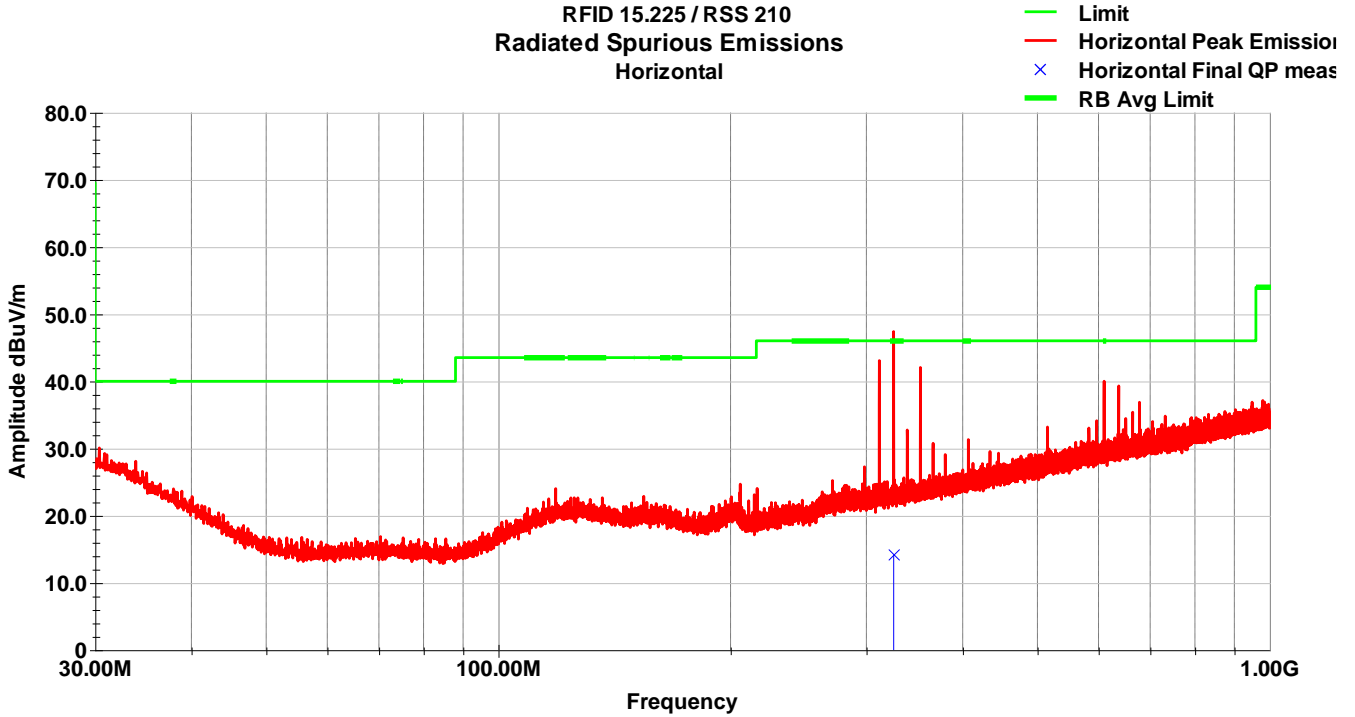
Co-Planar Horizontal Radiated Emissions Data (9kHz-30MHz) – 3 meters



Vertical Radiated Emissions Plot (30-1000MHz) – 3 meters



Horizontal Radiated Emissions Plot (30-1000MHz) – 3 meters



Horizontal Radiated Emissions Data (30-1000MHz) – 3 meters

Frequency MHz	Raw QP (dBuV)	Polarity (V/H)	Azimuth (degrees)	Height (cm)	AF (dB/m)	Loss (dB)	Amp (dB)	QP Value (dBuV/m)	Limit (dBuV/m)	Margin (dB)
325.52	24.2	H	69.0	399.0	18.7	2.7	31.5	14.2	46.0	-31.8
QP Value = Raw QP + AF + Loss - Amp										
Margin = QP Value - Limit										

325.52MHz is the 24th harmonic of 13.56MHz.

6 Frequency Stability

6.1 Test Result

Test Description	Basic Standards	Test Result
Frequency Stability	FCC 15.225(e) RSS-210 B.6(b) ANSI C63.10	Compliant

6.2 Test Method

The EUT was placed inside the Environmental Chamber and allowed to stabilize to each set temperature for a minimum of thirty minutes before any measurements were made. The EUT fundamental transmission was coupled to the spectrum analyzer using a near field probe.

6.3 Test Site

SGS EMC Laboratory, Suwanee, GA

6.4 Test Equipment

Test End Date: 11-Aug-2022

Tester: AB

Equipment	Model	Manufacturer	Asset Number	Cal Date	Cal Due Date
RF CABLE NM TO BNCM, 0.01-4GHZ	90-2476-079	TELEDYNE STORM MICROWAVE	20130	16-Mar-2022	16-Mar-2023
NEAR FIELD PROBES	N/A	COM-POWER CORPORATION	16016	CNR	CNR
SIGNAL ANALYZER (TS8997)	FSV30	ROHDE & SCHWARZ	B085749	4-Jan-2022	4-Jan-2024
ENVIRONMENTAL CHAMBER	S 1.2 C	Thermotron	BAT-ETC-08	22-Nov-2021	22-Nov-2022
DC POWER SUPPLY,	DP711	RIGOL	18027	CNR	CNR
MULTIMETER	87V	FLUKE	B079676	18-Aug-2021	18-Aug-2022

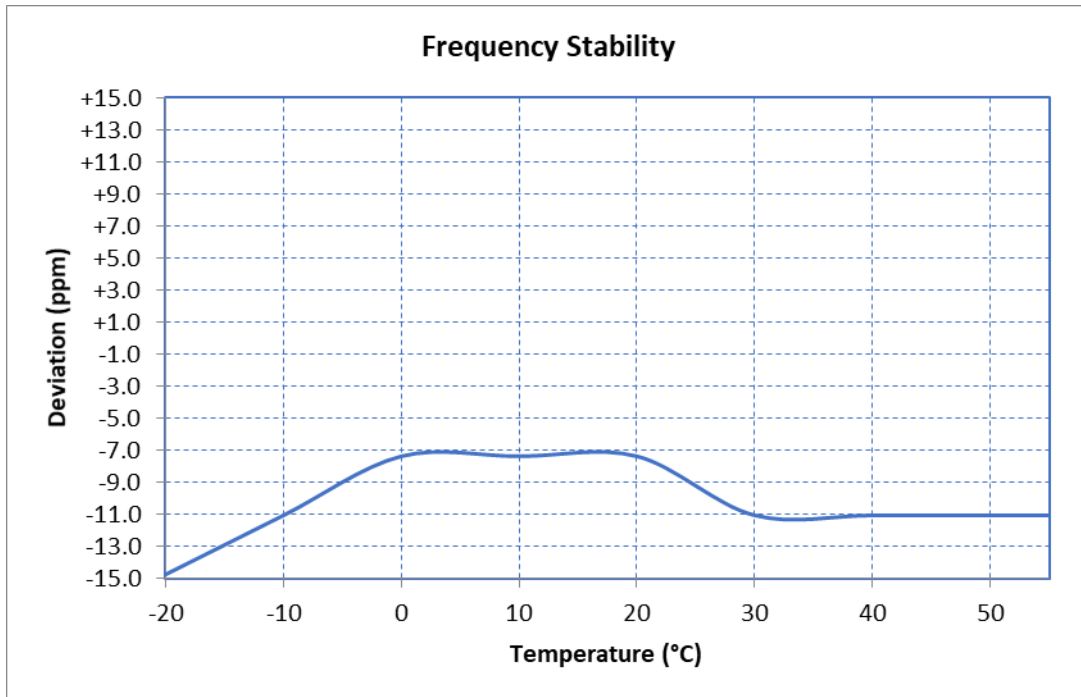
Note: Refer to table for calibration intervals.

6.5 Test Data

The carrier frequency shall not depart from the reference frequency by more than ± 100 ppm.

RFID 13.56 MHz

Voltage %	Power V _{Dc}	Temp °C	Frequency Hz	Freq Dev	Freq Dev ppm	Deviation %
100%	4.50	+20 (Ref)	13,559,900	-100	-7.37	-0.000737
100%	4.50	-20	13,559,800	-200	-14.75	-0.001475
100%	4.50	-10	13,559,850	-150	-11.06	-0.001106
100%	4.50	0	13,559,900	-100	-7.37	-0.000737
100%	4.50	+10	13,559,900	-100	-7.37	-0.000737
100%	4.50	+20	13,559,900	-100	-7.37	-0.000737
100%	4.50	+30	13,559,850	-150	-11.06	-0.001106
100%	4.50	+40	13,559,850	-150	-11.06	-0.001106
100%	4.50	+50	13,559,850	-150	-11.06	-0.001106
100%	4.50	+55	13,559,850	-150	-11.06	-0.001106
115%	5.18	+20	13,559,900	-100	-7.37	-0.000737
85%	3.83	+20	13,559,900	-100	-7.37	-0.000737



7 Measurement Uncertainty

No.	Item	Measurement Uncertainty
1	Radio Frequency	$\pm 7.25 \times 10^{-8}$
2	Duty cycle	$\pm 0.37\%$
3	Occupied Bandwidth	$\pm 3\%$
4	Conduction emission	$\pm 3.0\text{dB}$ (150kHz to 30MHz)
5	RF conducted power	$\pm 0.75\text{dB}$
6	RF power density	$\pm 2.84\text{dB}$
7	Conducted Spurious emissions	$\pm 0.75\text{dB}$
8	RF Radiated power	$\pm 4.5\text{dB}$ (Below 1GHz)
		$\pm 4.8\text{dB}$ (Above 1GHz)
9	Radiated Spurious emission test	$\pm 4.5\text{dB}$ (Below 1GHz)
		$\pm 4.8\text{dB}$ (Above 1GHz)
10	Temperature test	$\pm 1^\circ\text{C}$
11	Humidity test	$\pm 3\%$
12	Supply voltages	$\pm 1.5\%$
13	Time	$\pm 3\%$

8 Revision History

Revision Level	Description of changes	Revision Date
0	Initial release	12 August 2022
1	Updated note in section 2.3	12 September 2022