

RF Test Report

Project Number: 5172414**Proposal: SUW-202312005705****Report Number: 5172414EMC04****Revision Level: 2****Client: Accu-Time Systems, Inc.****Equipment Under Test: RFID Reader****Model: AccuProx****FCC ID: 2BFYF-ACCUPROX****IC ID: 4577A- ACCUPROX****Applicable Standards: FCC Part 15 Subpart C, § 15.209****ANSI C63.10: 2013****RSS-210, Issue 10, December 2019****RSS-GEN Issue 5****Report issued on: 05 August 2024****Report revised on: 13 September 2024****Test Result: Compliant**

FOR THE SCOPE OF ACCREDITATION UNDER CERTIFICATE NUMBER: 3212.01

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1 Summary of Test Results

Test Description	Test Specification	Test Result
Antenna Requirement	47 CFR Part 15, Subpart C 15.203 RSS-GEN Section 8.3	Compliant
Field strength of fundamental	47 CFR Part 15, Subpart C 15.209 ANSI C63.10:2013, Section 6.3	Compliant
Radiated Spurious Emissions	47 CFR Part 15, Subpart C 15.209 ANSI C63.10:2013, Section 6.2 through 6.5	Compliant
Conducted Emissions	47 CFR Part 15, Subpart C 15.207 ANSI C63.10:2013, Section 6.2	Compliant

1.1 Modifications Required for Compliance

None

2 General Information

2.1 Client Information

Name: Accu-Time Systems, Inc.
Address: 20-B International Drive,
City, State, Zip, Country: South Windsor, CN 06095

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
ISED CAB Identifier: US0186
FCC Designation Number: US1126

2.3 General Information of EUT

Product Marketing Name (PMN): AccuProx
Model Number (HVIN): 90-1934-01
Firmware Version ID (FVIN): 4025-511-11
Serial Number: 243423206772
FCC ID: 2BFYF-ACCUPROX
ISED ID: 4577A-ACCUPROX

Frequency Range: 125 kHz
Data Modes: RFID – ASK
Antenna: Wire Wound - Loop antenna*

Rated Voltage: +5 VDC
Test Voltage: +5 VDC

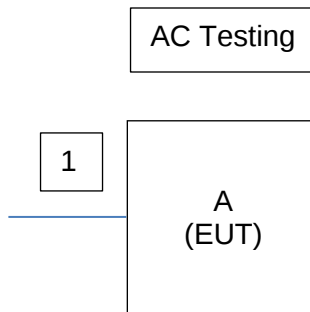
Sample Received Date: 15 April 2024
Dates of testing: 24 April 2024 through 21 June 2024.

**Data was not measured; therefore, the lab is not responsible for accuracy. Data was obtained via customer, specification sheet, previous regulatory filing, or other means.*

2.4 Operating Modes and Conditions

During emissions testing, the EUT was powered and set into a test mode to exercise the product transmitter during testing.

2.5 EUT Connection Block Diagram – Radiated Measurements



2.6 System Configurations

Device reference	Manufacturer	Description	Model Number	Serial Number
A	ATS	RFID Reader	AccuProx	243423206772
B	CUI Inc	External AC Adapter	DSA-24PFS-12CFA	N/A

2.7 Cable List

Cable reference	Port Name	Start	End	Cable Length (m)	Ferrite installed?	Shielded?
1	DC Power Cable	EUT	External AC Adapter	1.8	N	N

3 Antenna Requirement

3.1 Result

Test Description	Test Specification		Test Result
Antenna requirement	FCC 15.203	RSS-GEN S8.3	Compliant

3.2 Requirement

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 an antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit permanently attached antenna or of so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

3.3 Conclusion

External Clamp or Direct coupling accessories are glued to the PCB which does not allow the user to disconnect. This meets the antenna requirements for FCC and ISED.

3.4 Photograph

The photograph of the antenna is shown in a separate exhibit.

4 Field Strength of Fundamental

4.1 Test Result

Test Description	Test Specification		Test Result
Field strength of fundamental	15.209	RSS-210, A.1.2	Compliant
	ANSI C63.10:2013, Section 6.3		

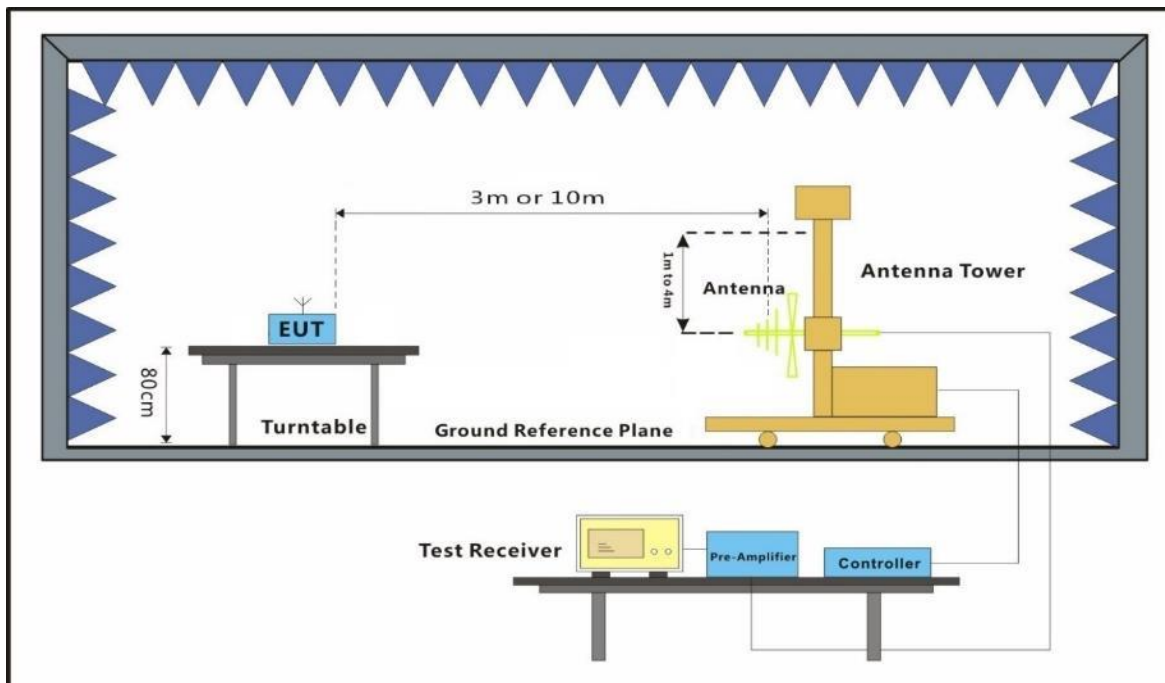
4.2 Test Method

The test data was measured using a Peak detector. Average measurements were made by correcting the peak value with the duty cycle correction factor. The receiver's resolution bandwidth was set to 200 Hz for measurements taken in the 9kHz to 30MHz frequency range and 120kHz for measurements for 30MHz and higher. Measurements were made with the antenna positioned at a 3m distance from the EUT in both the horizontal and vertical planes of polarization. The antenna height 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.

The radiation measurements were performed in X, Y, Z axis positioning.

Calculations: Field Strength = measured value + antenna factor + cable loss – pre-amp factor

4.3 Test Setup Diagram



4.4 Test Site

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

Environmental Conditions

Temperature: 23.54 °C

Relative Humidity: 56.7 %

Atmospheric Pressure: 98.92 kPa

4.5 Test Equipment

	Test End Date: 21-Jun-2024		Tester: SGM	
Equipment	Manufacturer	Model	Asset Number	Cal Due Date
PASSIVE LOOP ANTENNA, 9KHZ - 30MHZ	ETS LINDGREN	6512	20151	13-Feb-2025
N to N RF Cable	ECHOLON	EM-B810NM-276	23007	31-Mar-2025
N-FEMALE TO N-MALE RF CABLE	ECHOLON	EM-B810NMNF-118	23010	17-Apr-2025
RF CABLE NM TO NM, 0.01-18GHZ	TELEDYNE STORM MICROWAVE	90-195-118	20125	8-Aug-2024
BROADBAND PREAMPLIFIER 9KHZ-2GHZ	SCHWARZBECK MESS ELEKTRONIK	BBV 9745	20157	10-Oct-2024
EMI TEST RECEIVER	ROHDE & SCHWARZ	ESW44	22032	15-Nov-2024

Software:

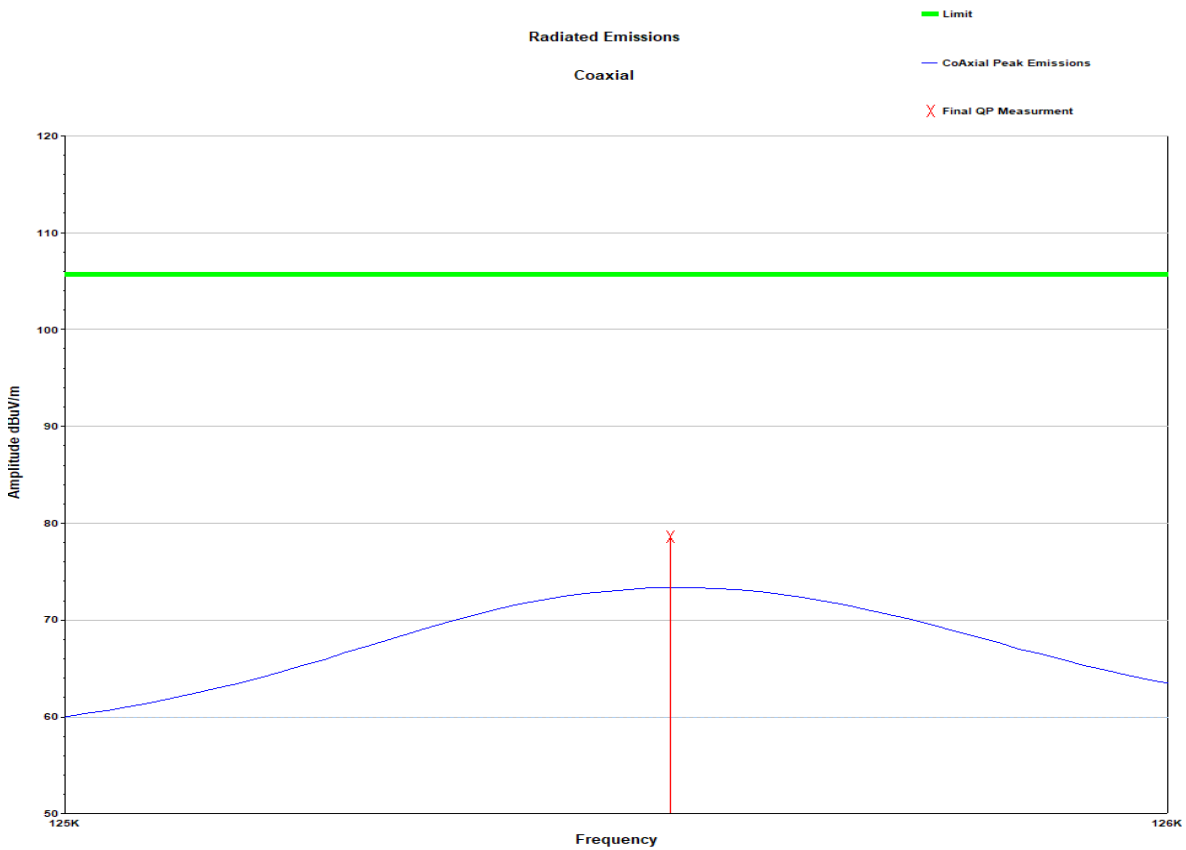
"Radiated Emissions" TILE! profile dated (12- 2015)

4.6 Test Setup Photographs

Photographs are shown in a separate exhibit.

4.7 Test Data:

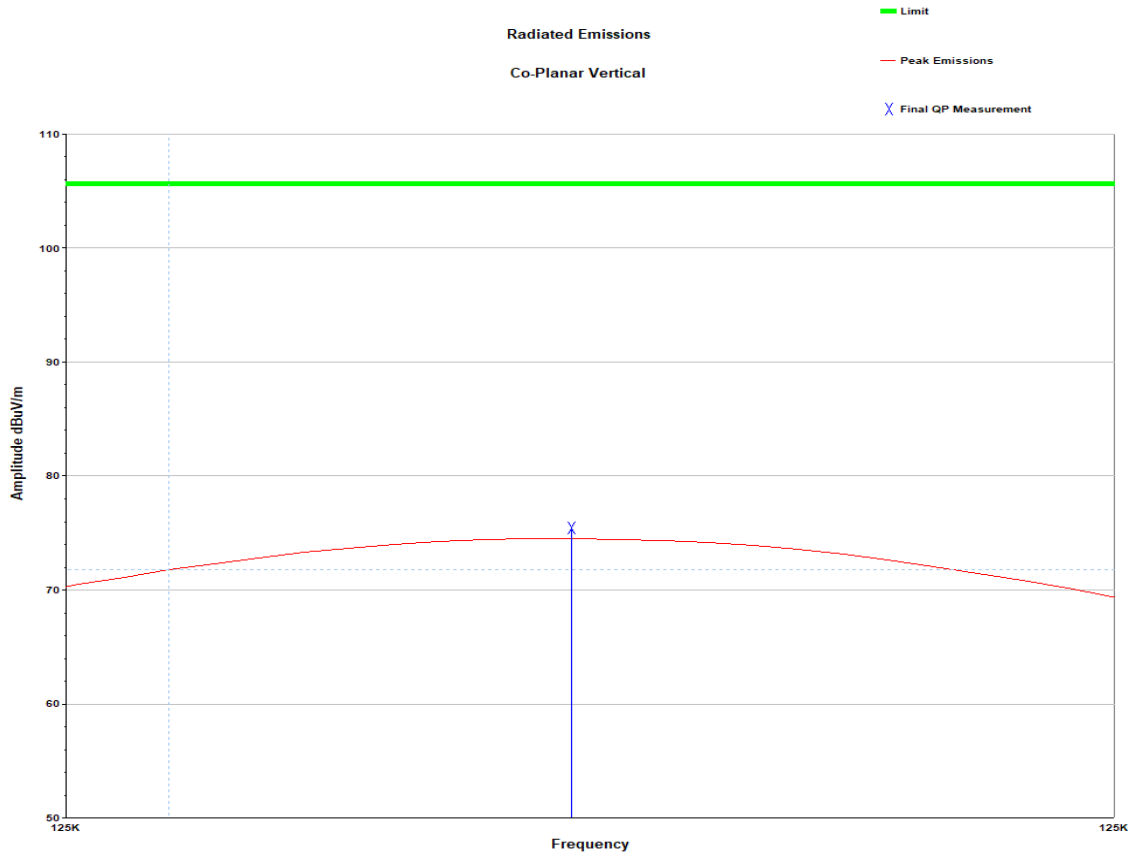
X-Axis Coaxial Plot



X-Axis Coaxial Data

Frequency MHz	Raw QP dBuV	Azimuth degrees	Height cm	AF dB	CL dB	QP Value dBuV/m	Limit dBuV/m	Margin dB
0.125	46.9	361.0	0.0	63.0	0.0	79.0	106.0	-27.0
QP Value = Level + AF + CL - Amp								
Margin = QP Value - Limit								

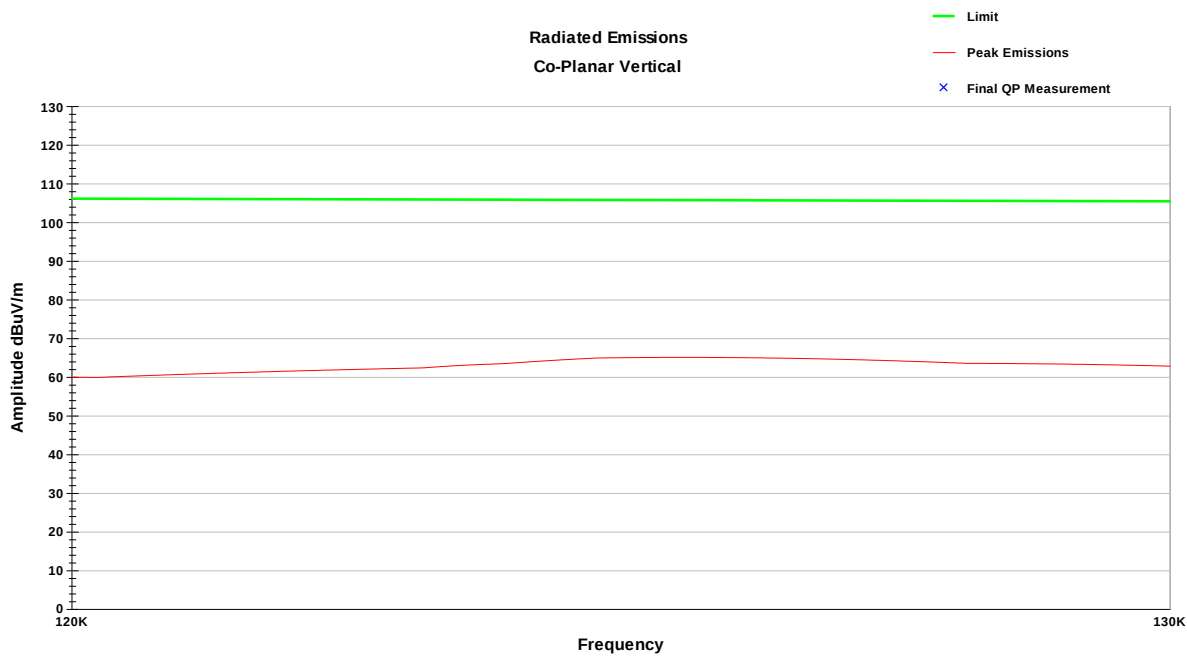
X-Axis Horizontal Co-Planar Plot



X-Axis Coaxial Data

Frequency MHz	Raw QP dBuV	Azimuth degrees	Height cm	AF dB	CL dB	QP Value dBuV/m	Limit dBuV/m	Margin dB
0.125	43.8	78.0	0.0	63.4	0.0	75.4	105.7	-30.2
QP Value = Level + AF + CL - Amp								
Margin = QP Value - Limit								

Y-Axis Co-Planar Plot



Radiated Emissions

4.8 Test Result

Test Description	Basic Standards	Test Result
Radiated Emissions	FCC Part 15, Subpart C, 15.209 RSS-Gen S7.2.5 ANSI C63.10: 2013	Compliant

4.9 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 receivers 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 (testing above 1GHz was not required for this device)

Frequency Range (MHz)	Limits (uV/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 dBuV/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 30uV/m at 30m

$$20 \cdot \log(30) = 29.5 \text{ dBuV/m}$$

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

4.10 Test Site

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

Environmental Conditions

Temperature: 23.54 °C

Relative Humidity: 56.7 %

Atmospheric Pressure: 98.92 kPa

4.11 Test Equipment

	Test End Date: 21-Jun-2024		Tester: SGM	
Equipment	Manufacturer	Model	Asset Number	Cal Due Date
PASSIVE LOOP ANTENNA, 9KHZ - 30MHZ	ETS LINDGREN	6512	20151	13-Feb-2025
N to N RF Cable	ECHOLON	EM-B810NM-276	23007	31-Mar-2025
N-FEMALE TO N-MALE RF CABLE	ECHOLON	EM-B810NMNF-118	23010	17-Apr-2025
RF CABLE NM TO NM, 0.01-18GHZ	TELEDYNE STORM MICROWAVE	90-195-118	20125	8-Aug-2024
BROADBAND PREAMPLIFIER 9KHZ-2GHZ	SCHWARZBECK MESS ELEKTRONIK	BBV 9745	20157	10-Oct-2024
EMI TEST RECEIVER	ROHDE & SCHWARZ	ESW44	22032	15-Nov-2024

Software:

“Radiated Emissions” TILE! profile dated (12- 2015)

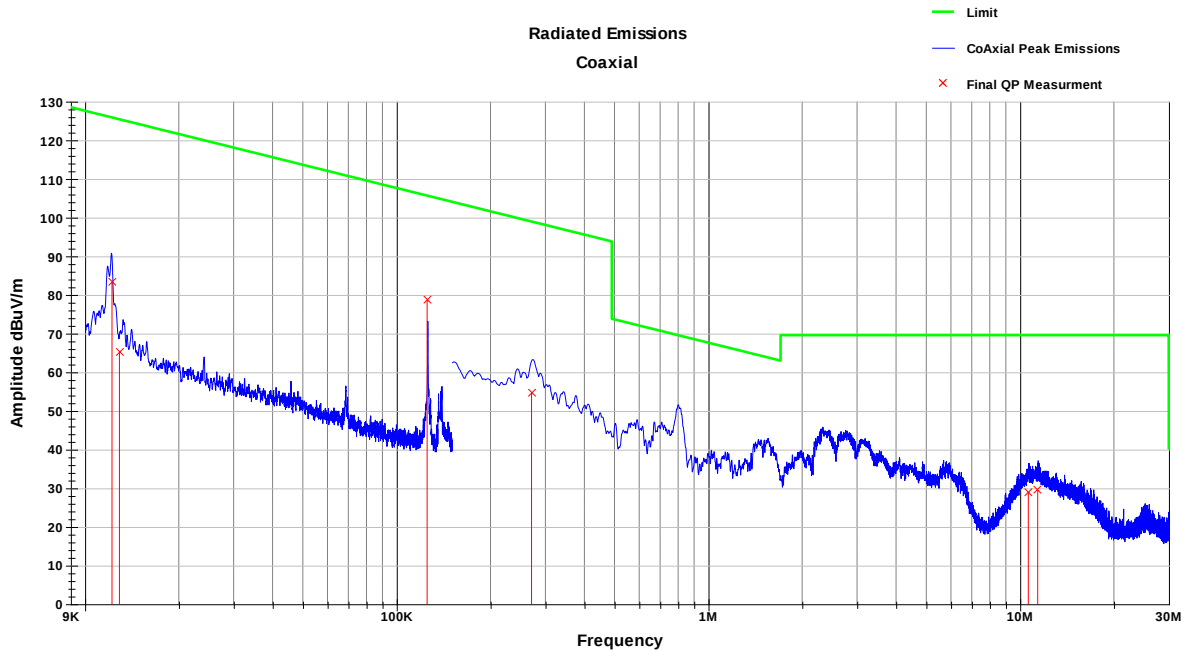
4.12 Test Setup Photographs

Photographs are shown in a separate exhibit.

4.13 9kHz – 30 MHz

No discernable difference in emissions between different modulations. Worst case reported.

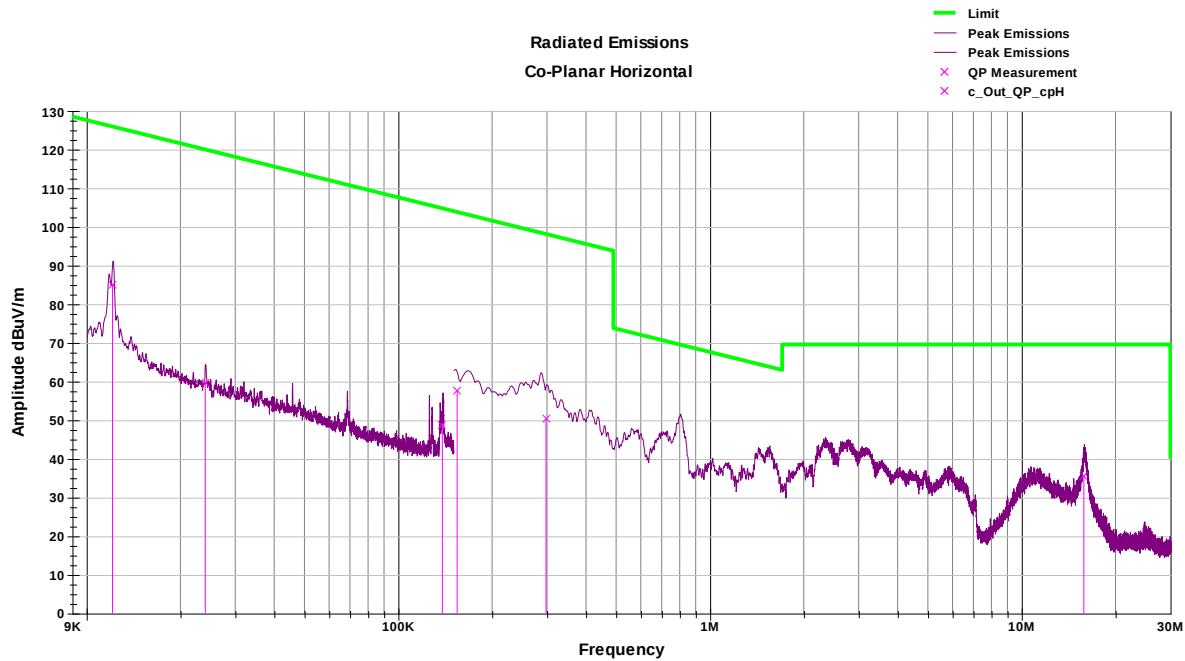
Coaxial Plot



Coaxial Tabular Data

Frequency MHz	Raw QP dBuV	Azimuth degrees	Height cm	AF dB	CL dB	QP Value dBuV/m	Limit dBuV/m	Margin dB
0.01	32.2	85.0	0.0	83.0	0.0	83.0	126.0	-43.0
0.01	14.5	73.0	0.0	83.0	0.0	65.0	125.0	-60.0
0.13	46.9	361.0	0.0	63.0	0.0	79.0	106.0	-27.0
QP Value = Level + AF + CL - Amp								
Margin = QP Value - Limit								
Frequency MHz	Raw QP dBuV	Azimuth degrees	Height cm	AF dB	CL dB	QP Value dBuV/m	Limit dBuV/m	Margin dB
0.27	29.3	26.0	0.0	57.1	0.0	54.7	99.0	-44.2
10.63	25.2	98.0	0.0	34.6	0.2	29.0	69.5	-40.6
11.39	25.7	88.0	0.0	34.5	0.2	29.5	69.5	-40.0
QP Value = Level + AF + CL - Amp								
Margin = QP Value - Limit								

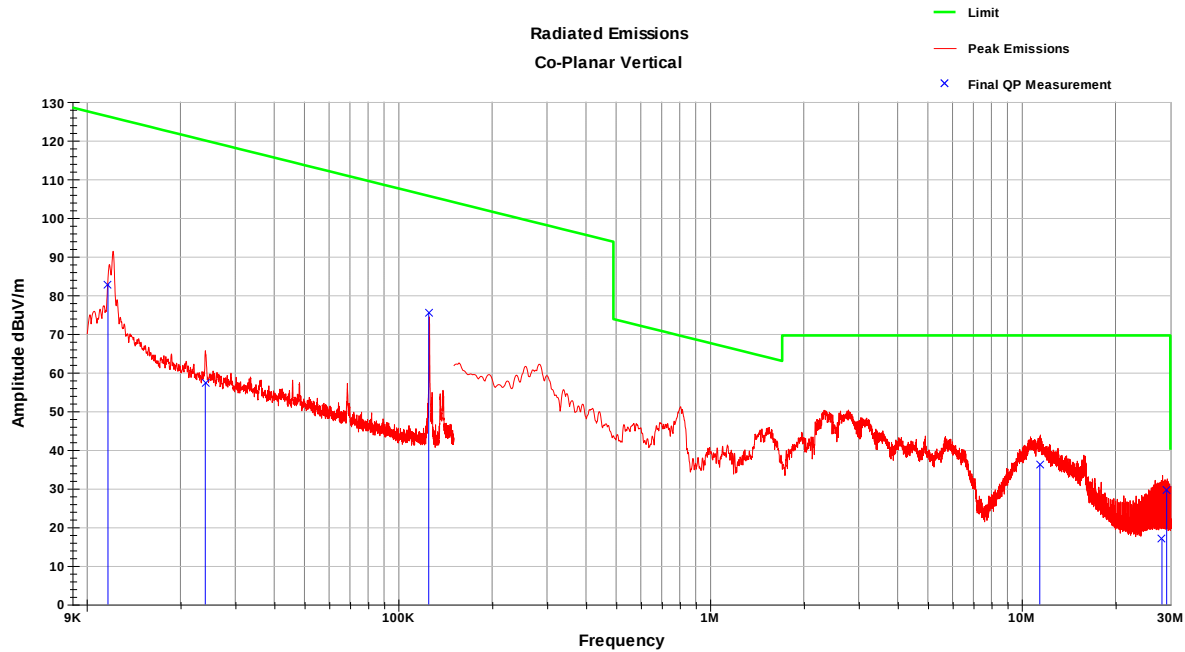
Horizontal Coplanar Plot



Horizontal Coplanar Tabular Data

Frequency MHz	Raw QP dBuV	Azimuth degrees	Height cm	AF dB	CL dB	QP Value dBuV/m	Limit dBuV/m	Margin dB
0.01	34.0	101.7	0.0	82.9	0.0	85.1	125.9	-40.9
0.02	13.1	245.7	0.0	78.4	0.0	59.7	120.0	-60.3
0.14	17.8	332.3	0.0	62.8	0.0	48.8	104.8	-56.0
QP Value = Level + AF + CL - Amp								
Margin = QP Value - Limit								
Frequency MHz	Raw QP dBuV	Azimuth degrees	Height cm	AF dB	CL dB	QP Value dBuV/m	Limit dBuV/m	Margin dB
0.15	27.4	224.0	0.0	61.9	0.0	57.6	103.8	-46.3
0.30	25.9	131.0	0.0	56.2	0.0	50.4	98.1	-47.7
15.83	32.5	148.0	0.0	33.8	0.2	35.6	69.5	-34.0
QP Value = Level + AF + CL - Amp								
Margin = QP Value - Limit								

Vertical Coplanar Plot



Vertical Coplanar Tabular Data

Frequency MHz	Raw QP dBuV	Azimuth degrees	Height cm	AF dB	CL dB	QP Value dBuV/m	Limit dBuV/m	Margin dB
0.01	31.6	58.0	0.0	83.0	0.0	82.8	126.2	-43.4
0.02	10.9	179.0	0.0	78.4	0.0	57.4	120.0	-62.6
0.13	43.8	78.0	0.0	63.4	0.0	75.4	105.7	-30.2
QP Value = Level + AF + CL - Amp								
Margin = QP Value - Limit								
Frequency MHz	Raw QP dBuV	Azimuth degrees	Height cm	AF dB	CL dB	QP Value dBuV/m	Limit dBuV/m	Margin dB
11.44	32.5	189.0	0.0	34.5	0.2	36.2	69.5	-33.3
28.20	14.0	144.0	0.0	33.7	0.3	17.0	69.5	-52.6
29.19	26.5	162.0	0.0	33.8	0.3	29.5	69.5	-40.0
QP Value = Level + AF + CL - Amp								
Margin = QP Value - Limit								

5 Conducted Emissions

5.1 Test Result

Test Description	Classification	Basic Standard	Test Result
Conducted Emissions	FCC Part 15, Subpart C, 15.207 RSS-Gen S7.2.4 ANSI C63.4:2014	ANSI C63.4	Compliant

5.2 Test Method

With the receiver's Resolution Bandwidth (RBW) set to 9 kHz, exploratory scans were performed over the measuring frequency range (0.15MHz to 30MHz) using a max hold mode incorporating a Peak detector and using the TILE! software. The final test data was measured using a 9kHz RBW in conjunction with a Quasi-Peak detector and Average detector and compared against the limits indicated in the table below.

Frequency Range	Class A Limits (dBμV)	Class B Limits (dBμV)
0.15 to 0.5 MHz	Quasi-Peak 79 / Average 66	Quasi-Peak 66 to 56 / Average 56 to 46
0.5 to 5 MHz	Quasi-Peak 73 / Average 60	Quasi-Peak 56 / Average 46
5 to 30 MHz	Quasi-Peak 73 / Average 60	Quasi-Peak 60 / Average 50

5.3 Test Site

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature: 24.27 °C

Relative Humidity: 38.7 %

Atmospheric Pressure: 98.7 kPa

5.4 Test Equipment

Test End Date: 1-May-2024

Tester: PL

Equipment	Model	Manufacturer	Asset	Cal Date	Cal Due Date
LINE IMPEDANCE STABILIZATION NETWORK	NNB 51	TESEQ	B087573	4-Jan-2024	4-Jan-2025
N to N RF Cable	RF280-06SP-06SP-2000	SAMTEC	23013	23-May-2023	23-May-2024
EMI TEST RECEIVER	ESW44	ROHDE & SCHWARZ	22032	15-Nov-2023	15-Nov-2024

Software:

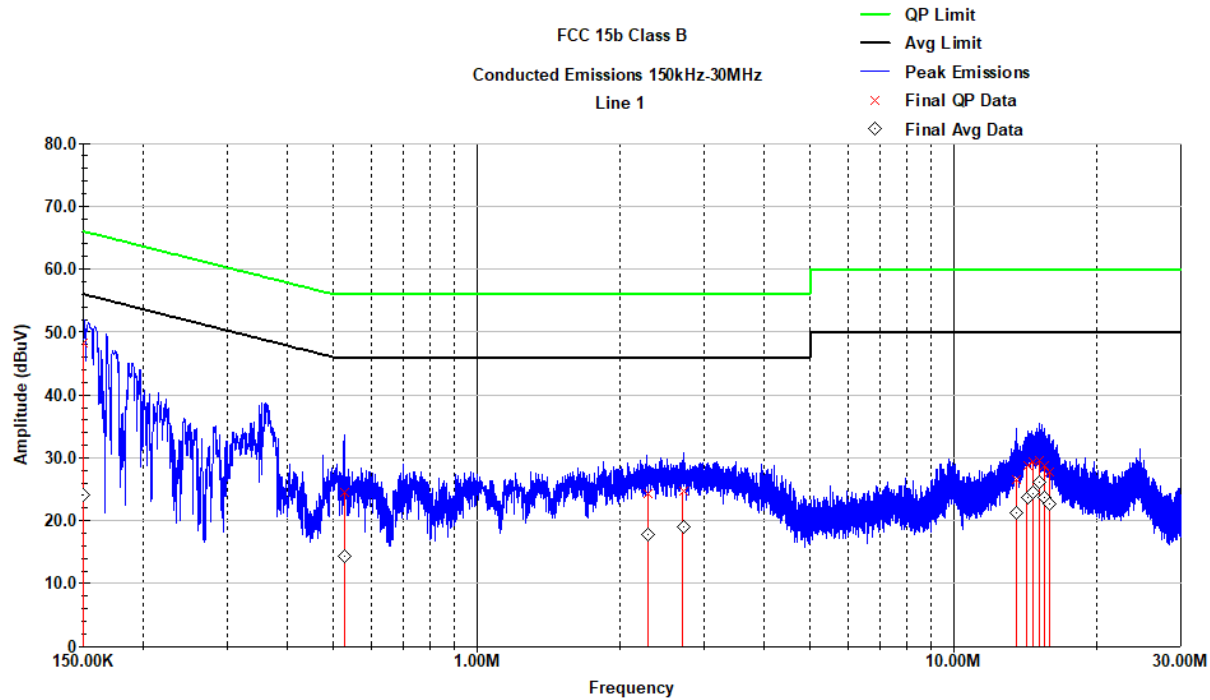
TILE! software profile "Conducted Emissions 231028" dated 22-Nov-2023

5.5 Test Setup Photographs

Photographs are shown in a separate exhibit.

5.6 Test Data

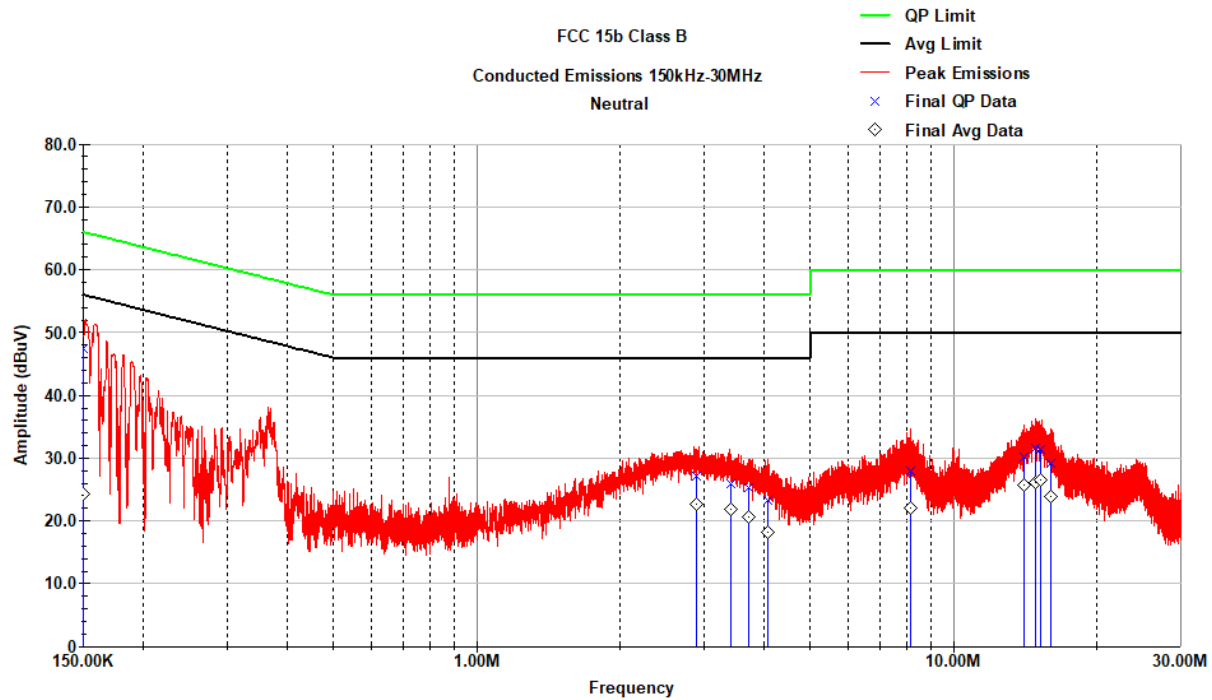
Line 1 Conducted Emissions Plot 150-30MHz



Line 1 Conducted Emissions Data 150-30MHz

Frequency MHz	LISN dB	CF dB	TL dB	Raw Avg dBuV	Final Avg dBuV	Avg Limit dBuV	Avg Margin dB	Raw QP dBuV	Final QP dBuV	QP Limit dBuV	QP Margin dB
0.150	9.8	0.00	0.0	14.3	24.1	56.0	-31.9	38.5	48.3	66.0	-17.7
0.527	9.8	0.00	0.0	4.6	14.4	46	-31.6	14.7	24.5	56.0	-31.5
2.285	9.8	0.00	0.0	7.9	17.7	46	-28.3	14.5	24.3	56.0	-31.7
2.709	9.8	0.00	0.0	9.2	19	46	-27	14.8	24.7	56.0	-31.3
13.546	9.9	0.00	0.0	11.4	21.2	50.0	-28.8	16.6	26.5	60.0	-33.5
14.283	9.9	0.00	0.0	13.9	23.8	50.0	-26.2	18.8	28.7	60.0	-31.3
14.645	9.9	0.00	0.0	14.5	24.4	50.0	-25.6	19.4	29.3	60.0	-30.7
15.126	9.9	0.00	0.0	16.2	26.1	50.0	-23.9	19.7	29.6	60.0	-30.4
15.547	9.9	0.00	0.0	13.7	23.6	50.0	-26.4	19.0	28.9	60.0	-31.1
15.896	9.9	0.00	0.0	12.7	22.6	50.0	-27.4	17.9	27.8	60.0	-32.2
Final QP = Raw QP + LISN + CF + TL											
QP Margin = Final QP - QP Limit											
Final Avg = Raw Avg + LISN + CF + TL											
Avg Margin = Final Avg - Avg Limit											

Neutral Conducted Emissions Plot 150-30MHz



Neutral Conducted Emissions Data 150-30MHz

Frequency MHz	LISN dB	CF dB	TL dB	Raw Avg dBuV	Final Avg dBuV	Avg Limit dBuV	Avg Margin dB	Raw QP dBuV	Final QP dBuV	QP Limit dBuV	QP Margin dB
0.150	9.8	0.00	0.0	14.4	24.2	56.0	-31.8	37.6	47.5	66.0	-18.5
2.893	9.9	0.00	0.0	12.8	22.7	46	-23.3	17.4	27.2	56.0	-28.8
3.416	9.9	0.00	0.0	12.0	21.8	46	-24.2	16.2	26	56.0	-30.0
3.73	9.9	0.00	0.0	10.8	20.7	46	-25.3	15.4	25.2	56.0	-30.8
4.085	9.9	0.00	0.0	8.4	18.3	46.0	-27.7	13.5	23.4	56.0	-32.6
8.120	9.9	0.00	0.0	12.1	22.0	50.0	-28.0	18.2	28.0	60.0	-32.0
14.034	9.9	0.00	0.0	15.8	25.7	50.0	-24.3	20.2	30.1	60.0	-29.9
14.855	9.9	0.00	0.0	16.2	26.1	50.0	-23.9	21.6	31.5	60.0	-28.5
15.261	9.9	0.00	0.0	16.5	26.4	50.0	-23.6	21.4	31.3	60.0	-28.7
16.036	9.9	0.00	0.0	14.0	23.9	50.0	-26.1	19.2	29.2	60.0	-30.8
Final QP = Raw QP + LISN + CF + TL											
QP Margin = Final QP - QP Limit											
Final Avg = Raw Avg + LISN + CF + TL											
Avg Margin = Final Avg - Avg Limit											

6 Measurement Uncertainty

Measurement uncertainty is not used to adjust the measurements to determine compliance.

Measurement uncertainty values in the table below comply with CISPR 16-4-2.

Parameter	Uncertainty
Conducted emissions	± 0.8 dB
Radiated emissions, 9 kHz to 30 MHz	± 3.5 dB
Radiated emissions, 30 to 200 MHz	± 3.1 dB
Radiated emissions, 200 to 1000 MHz	± 4.6 dB
Radiated emissions, 1 to 18 GHz	± 5.4 dB
Radiated emissions, 18 to 40 GHz	± 4.0 dB
Note: The uncertainties provided in this table represent an expanded uncertainty expressed at the ~95% confidence level using a coverage factor of K=2.	

7 Revision History

Revision Level	Description of changes	Revision Date
Draft	Draft Release	28 June 2024
0	Initial Release	05 August 2024
1	Updated section 4.7. FCC & IC IDs.	29 August 2024
2	Updated Section 2.3 HVIN	13 September 2024