



BUREAU
VERITAS

Test Report for RIVIAN
Report No. J23245-CJPT-TNY-P23120007 RIV-305_FCC15.225_Rev4



FCC/IC TEST REPORT

Applicant	Rivian Automotive LLC
Address	14600 Myford Road Irvine CA 92606
FCC ID	2AW3A-2WWG23NDH
ISED Canada IC	26958-2WWG23NDH
Product Description	NFC Door Handle
PMN Model/HVIN FVIN HMN	NFC Door Handle 42
Additional Models	None
Date of tests	02/03/2023 & 12/03/2023
FCC Test Firm DN Canada CABID	US1109 4842D
Issued By:	Bureau Veritas Consumer Products Services, Inc.
Lab Address:	775 Montague Expressway, Milpitas, CA 95035; 815 N. Opdyke Rd #100 Auburn Hills, MI 48326
Test Location (1):	775 Montague Expressway, Milpitas, CA 95035; 815 N. Opdyke Rd #100 Auburn Hills, MI 48326

The tests have been carried out according to the requirements of the following standard:

- FCC Part 15, Subpart C, Section 15.225
- ISED Canada RSS-210 Issue 10 Annex B.6

CONCLUSION: The submitted sample was found to COMPLY with the test requirement

Prepared by Abhijit Patibandla	Approved by Jason Kanakry
Report Issue Date: 12/18/2023	Issue Number: MUS_RIVIAN_2301

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RELEASE CONTROL RECORD

ISSUE NO.	REASON FOR CHANGE	DATE ISSUED
MUS_RIVIAN_2301	Original release	12/18/2023
Rev2	Updated report as per reviewer comments	02/15/2024
Rev3	Updated report as per reviewer comments	03/01/2024
Rev4	Added DC supply calibration	03/18/2024



1 SUMMARY OF TEST RESULTS

EUT was tested against the following requirements:

APPLIED STANDARD: FCC PART 15, SUBPART C (SECTION 15.225), RSS-210				
STANDARD SECTION		TEST TYPE AND LIMIT	APPLICABLE	RESULT
47 CFR	RSS			
15.207	Gen 8.8	AC Power Line Conducted Emissions	N	NA
15.205 15.209	Gen 8.9 Gen 8.10	Radiated Spurious Emissions	Y	PASS
15.225(a)	210 Annex B.6 (a)(i)	Fundamental Field Strength	Y	PASS
15.225(b)-(d)	210 Annex B.6 (a)(ii)-(iv)	Emission mask	Y	PASS
15.225(e)	210 Annex B.6 (b)	Frequency Tolerance	Y	PASS
--	Gen 6.7	99% Occupied Bandwidth	Y	PASS
15.203	Gen 6.8	Antenna Requirement	Y	PASS

Note:

- All Measurements except “99% Occupied Bandwidth” were performed at “ Bureau Veritas Consumer Products Services, Inc. 775 Montague Expressway, Milpitas, CA 95035”
- “99% Occupied Bandwidth” was performed at “Bureau Veritas Consumer Products Services, Inc. 815 N. Opdyke Rd #100 Auburn Hills, MI 48326”



2 MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2:

Measurement	Frequency	Expanded Uncertainty (k=2) (±)
Conducted Emissions at mains ports	150kHz ~ 30MHz	3.51dB
Radiated Emissions up to 1 GHz	30MHz ~ 1GHz	3.73dB
Radiated Emissions above 1 GHz	1GHz ~ 6GHz	4.64dB
	6GHz ~ 18GHz	4.82dB
	18GHz ~ 40GHz	4.91dB

Table 1, Lab Measurement Uncertainty

Parameter	Uncertainty
Radio frequency	±10 ppm
RF power conducted	±1,5 dB
RF power radiated	±6 dB
Spurious emissions, conducted	±3 dB
Spurious emissions, radiated	±6 dB
Humidity	±5 %
Temperature	±2 °C
Time	±10 %

Table 2, EN 301 893 (2017-05), Maximum Measurement Uncertainty

Measurement	Uncertainty (k=2) (±)
Radio Frequency	1 x 10 ⁻⁷
RF power, conducted	0.8dB
RF power density, conducted	2.6dB
spurious emissions, conducted	2.7dB
spurious emissions, radiated	5.4dB
Temperature	0.5°C
Humidity	1 %
DC and low frequency voltages	2%

Table 3, ISO/IEC 17025 Measurement Uncertainty



3 GENERAL INFORMATION

3.1 GENERAL DESCRIPTION OF EUT

NOMINAL VOLTAGE	13.5V
MODULATION TYPES	ASK
DATA RATES	106 kb/s
OPERATING FREQUENCY	13.56MHz
EUT Power Setting	DC powered
ANTENNA TYPE	Integrated onboard

Highest clock frequency in the device (used/generated): Main reference clocks of 27.12 MHz and 40 MHz references. Transmits at 13.5MHz.

NOTES:

1. For a more detailed description of the EUT, please refer to the manufacturer’s specifications or the user’s manual.
2. For photos of the EUT, please refer to External and Internal Photos exhibits.



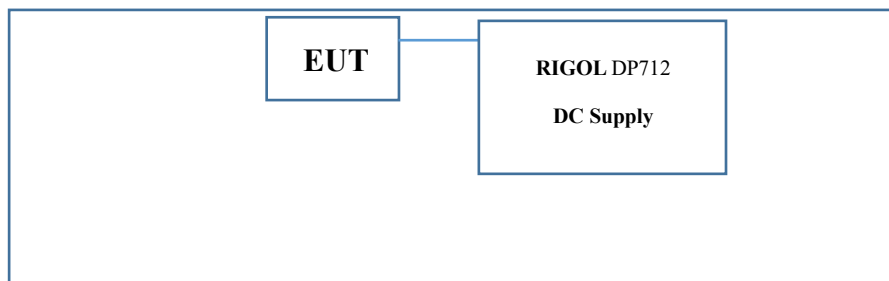
3.2 DESCRIPTION OF TEST MODES

EUT operates at a single channel at 13.56MHz.

EUT configuration modes:

TEST MODE	DESCRIPTION
A	Continuous Transmit at 106kb/s

EUT SETUP BLOCK DIAGRAMS



Note: For Mode A, the client has set the device in such a way that, as soon as the device is powered it automatically goes into continuous transmissions



Following channels/modes were selected for the applicable tests below.

TEST	TEST MODE	AVAILABLE CHANNELS	TESTED CHANNEL	MODULATION TYPE	DATA RATE (kbps)	Notes
FFS	A	1	1	ASK	106	-
EM	A	1	1	ASK	106	-
FT	A	1	1	ASK	106	-
OBW	A	1	1	ASK	106	-
RSE<1G	A	1	1	ASK	106	-

FFS: Fundamental Field Strength

EM: Emissions Mask

FT: Frequency Tolerance

OBW: 99% Occupied Bandwidth

RSE<1G: Radiated Spurious Emissions Below 1GHz

PLCE: Power Line Conducted Emissions



3.3 MEASUREMENT PROCEDURES USED

All tests were performed in accordance with the following measurement procedures:

ANSI C63.10-2013

RSS-Gen Issue 5

3.4 DESCRIPTION OF SUPPORT EQUIPMENT

Support Equipment	Model #	Serial #
-	-	-



4 TEST RESULTS

4.1 AC LINE CONDUCTED EMISSIONS

NA (DC Powered unit)



4.2 FUNDAMENTAL FIELD STRENGTH AND EMISSION MASK

4.2.1 LIMITS

Fundamental Field Strength:

The field strength of any emissions within the band 13.553-13.567 MHz shall not exceed 15,848 microvolts/meter at 30 meters.

Emission Mask:

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.

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.

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 FCC 15.209 and RSS-Gen.

Limit conversion below 30MHz is done by using the square of an inverse linear distance extrapolation factor (40 dB/decade) as allowed in FCC 15.31(f)(2).

Limit (3m) = Limit (30m) + 40*log(30/3) = Limit (30m) + 40

Limit (3m) = Limit (300m) + 40*log(300/3) = Limit (300m) + 80

4.2.2 TEST SETUP

Same as radiated spurious emissions setup below 30MHz (Section 4.3.5).

4.2.3 TEST EQUIPMENT USED

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	DATE OF CALIBRATION	DUE DATE OF CALIBRATION
EMI Receiver Rohde and Schwarz	ESW44	1328.4100K-101662-MH	09/20/2022	09/20/2024
PXA Signal Analyzer Keysight	N9030B	MY57140374	07/20/2022	07/20/2024
Bicon-log Antenna Sunol	JB6	A111717	09/22/2022	09/22/2024
Loop Antenna 9kHz-30MHz	FMZB1519B	146	-	07/13/2024
Loop Antenna 9kHz-30MHz	AL-130R	10160080	02/07/2022	02/07/2023

4.2.4 TEST PROCEDURES

Same as Section 4.3.3.



4.2.5 DEVIATIONS

No deviations from the standard.

4.2.6 EUT OPERATING CONDITIONS

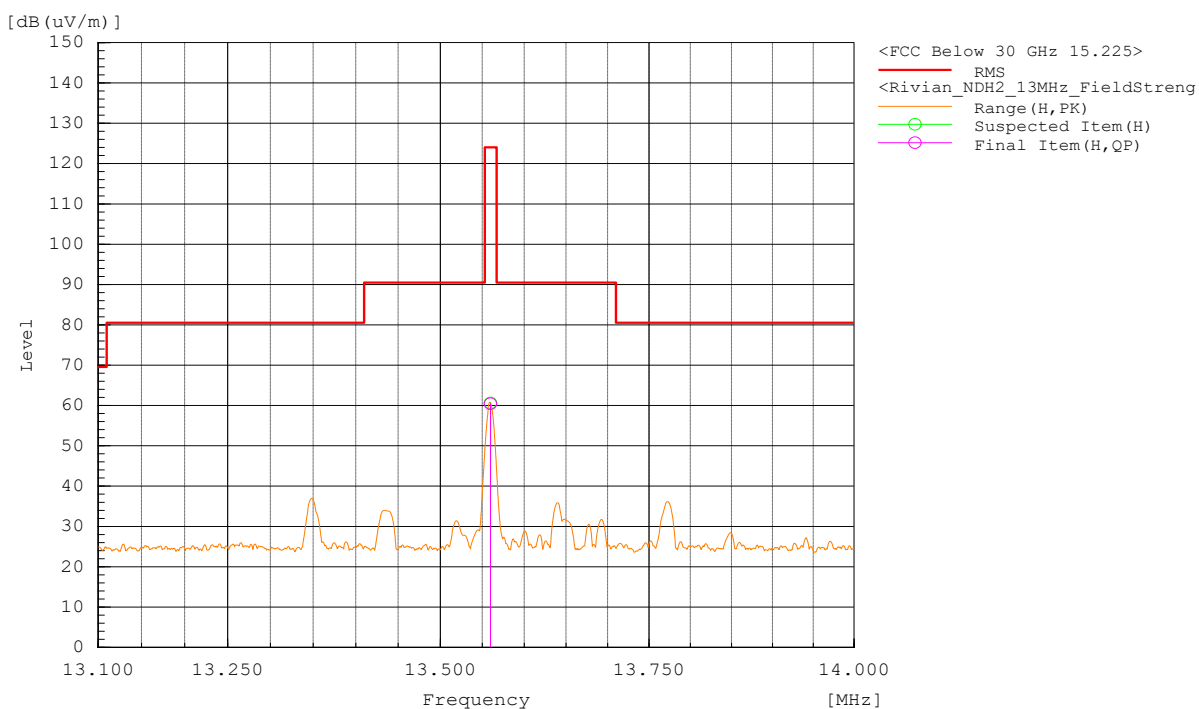
EUT was operated according to manufacturer's specifications.



4.2.7 TEST RESULTS

Input Power	13.5 VDC	Test Location	BV Milpitas CA
Tested by	AP	Test Date	02/03/2023
Test Mode	Mode 1		

5 Horizontal Field at Transmit frequency

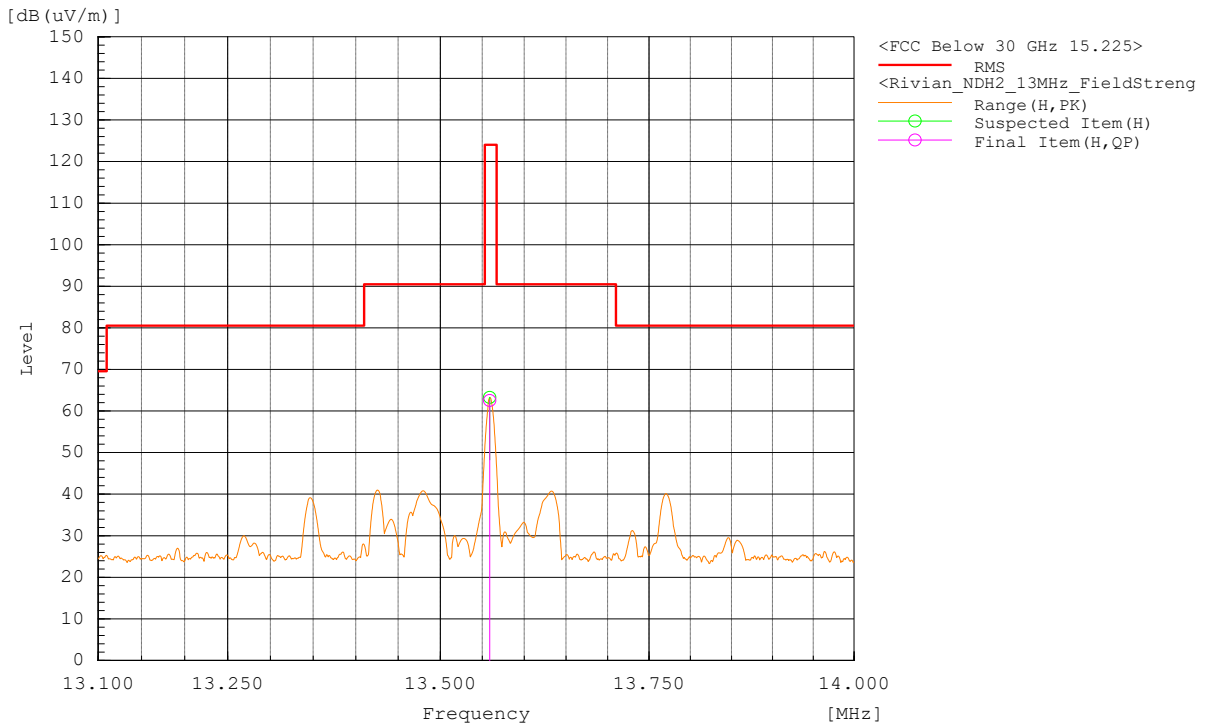


Frequency MHz	Polarization	Reading dB(uV/m)	Factor dB(1/m)	Level dB(uV/m)	Limit dB(uV/m)	Height cm	Angle deg	Margin dB	Pass/Fail
		QP		QP	QP			QP	
13.56	H	45.4	15	60.4	124	99.9	63.8	63.6	Pass

- Emission level (dBuV/m) = Reading Value (dBuV) + Factor (dB)
- AF (dB/m) = Antenna Factor (dB/m) – Pre-amplifier Gain (dB).
- Margin value = Emission level – Limit value.



6 Vertical Field at Transmit frequency



Frequency MHz	Polarization	Reading dB(uV)	Factor dB(1/m)	Level dB(uV/m)	Limit dB(uV/m)	Height cm	Angle deg	Margin dB	Pass/Fail
		QP		QP	QP			QP	
13.559	H	47.5	15	62.5	124	99.9	9.4	61.5	Pass

- Emission level (dBuV/m) = Reading Value (dBuV) + Factor (dB)
- AF (dB/m) = Antenna Factor (dB/m) – Pre-amplifier Gain (dB).
- Margin value = Emission level – Limit value.



4.3 RADIATED SPURIOUS EMISSIONS

4.3.1 LIMITS

Radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emissions limits specified in Section 15.209(a).

FREQUENCIES (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

NOTE:

- Lower limit applies at the transition frequencies.
- $dB\mu V/m = 20 \cdot \log(\mu V/m)$.
- As specified in 15.35(b), for frequencies above 1000MHz, field strength limits are based on the use of measurement instrumentation employing an average detector function. However, there is also a limit on the peak level of the emissions that is 20 dB above the maximum permitted average emission limit.
- Limit conversion below 30MHz is done by using the square of an inverse linear distance extrapolation factor (40 dB/decade) as allowed in FCC 15.31(f)(2).
 $Limit (3m) = Limit (30m) + 40 \cdot \log(30/3) = Limit (30m) + 40$
 $Limit (3m) = Limit (300m) + 40 \cdot \log(300/3) = Limit (300m) + 80$
- RSS-GEN Table 6 H-field limits are 51.5dB lower than FCC 15.209(a) E-field limits. Measurements are performed in terms of magnetic field and converted to electric field using the free space impedance of 377Ω (E-field = H-field +51.5). Therefore resulting pass/fail margin would be the same if an E-field reading is compared to an E-field limit or an H-field reading is compared to an H-field limit.



4.3.2 TEST EQUIPMENT USED

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	DATE OF CALIBRATION	DUE DATE OF CALIBRATION
EMI Receiver Rohde and Schwarz	ESW44	1328.4100K- 101662-MH	09/20/2022	09/20/2024
PXA Signal Analyzer Keysight	N9030B	MY57140374	07/20/2022	07/20/2024
Biconilog Antenna Sunol	JB6	A111717	09/22/2022	09/22/2024
Loop Antenna 9kHz-30MHz	FMZB1519B	146	-	07/13/2024



4.3.3 TEST PROCEDURES

- a. The EUT was placed on the top of a rotating table 1.5 meters (above 1GHz) and 0.8 meters (below 1GHz) above the ground at a 3 meters semi-anechoic chamber.
- b. For below 30MHz, a loop antenna with its lowest point 1m above the ground was placed 3m away from the EUT and it was rotated 0 and 90 degrees around its vertical axis.
- c. In 30MHz-1GHz range, a BiConiLog antenna was mounted on a variable-height antenna tower and placed 3m away from the EUT. Antenna height was varied from 1 meter to 4 meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna were investigated. The table was rotated 360 degrees to determine the position of the highest radiation.
- d. In 1GHz-6GHz range, a horn antenna was mounted on a variable-height antenna tower and placed 3m away from the EUT. Antenna height was varied from 1 meter to 4 meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna were investigated. The table was rotated 360 degrees to determine the position of the highest radiation. Using the same antenna, the measurement distance was reduced to 1m in 6-18GHz range.
- e. In 18-25GHz a smaller horn antenna was used to make measurements at 0.1m away from the EUT.
- f. For battery operated equipment, tests were performed using fresh batteries.
- g. Following bandwidths were used during emissions testing:

Freq. (MHz)	RBW	VBW	Pre-scan	Final
0.009-0.15	200Hz	1kHz	Peak	Quasi Peak and RMS Power Avg
0.15-30	9kHz	30kHz	Peak	Quasi Peak and RMS Power Avg
30-1000	120kHz	300kHz	Peak	Quasi Peak
>1000	1MHz	3MHz	Peak	Peak Max Hold and RMS Power Avg

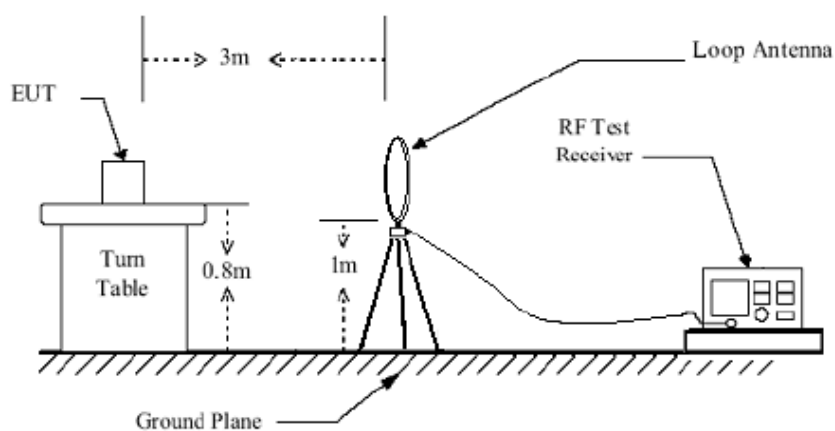
Per FCC §15.209(d), limits §15.209(a) are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9–90 kHz, 110–490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector. If peak measurements in these frequency bands were below the applicable limits, QPk and RMS measurements were not performed.

4.3.4 DEVIATIONS

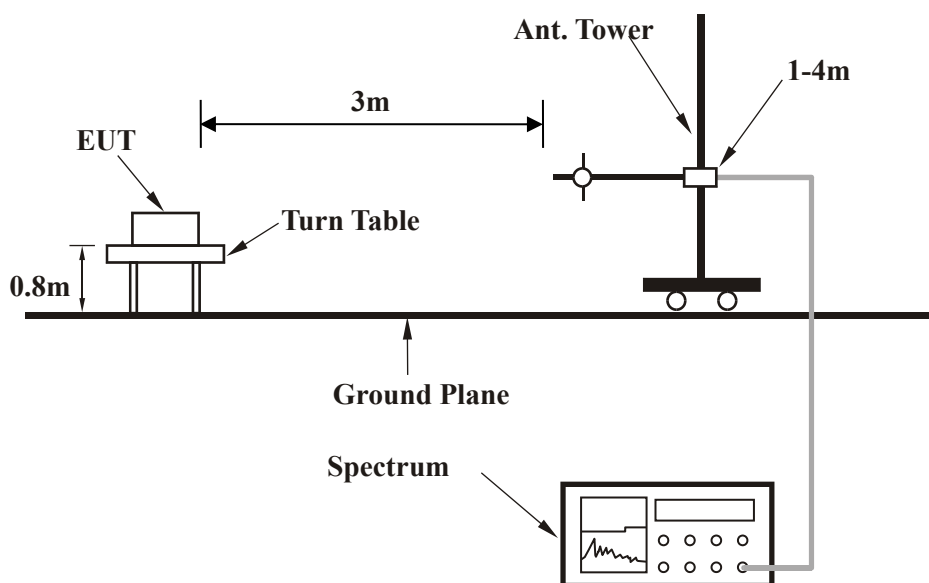
No deviations from the standard.

4.3.5 TEST SETUP

Below 30MHz Test Setup



30MHz - 1GHz Test Setup





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4.3.6 EUT OPERATING CONDITIONS

EUT was operated according to the manufacturer's specifications.

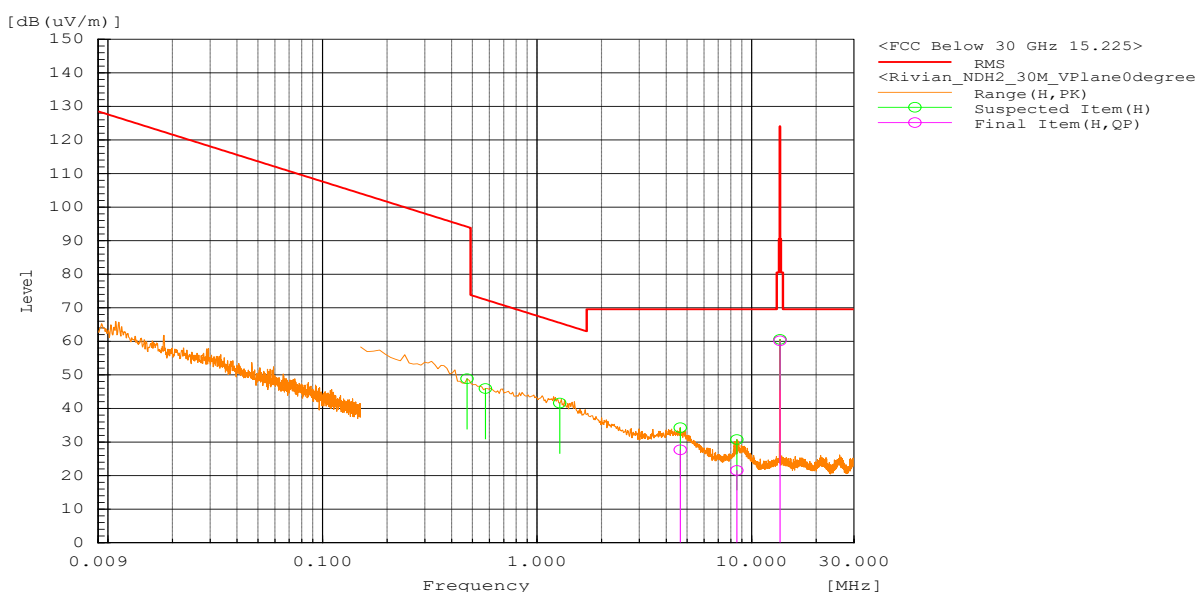


4.3.7 TEST RESULTS

Input Power	13.5 VDC	Test Location	BV Milpitas, CA
Tested by	AP	Test Date	02/03/2023
Test Mode	Mode 1		

Emissions below 1GHz

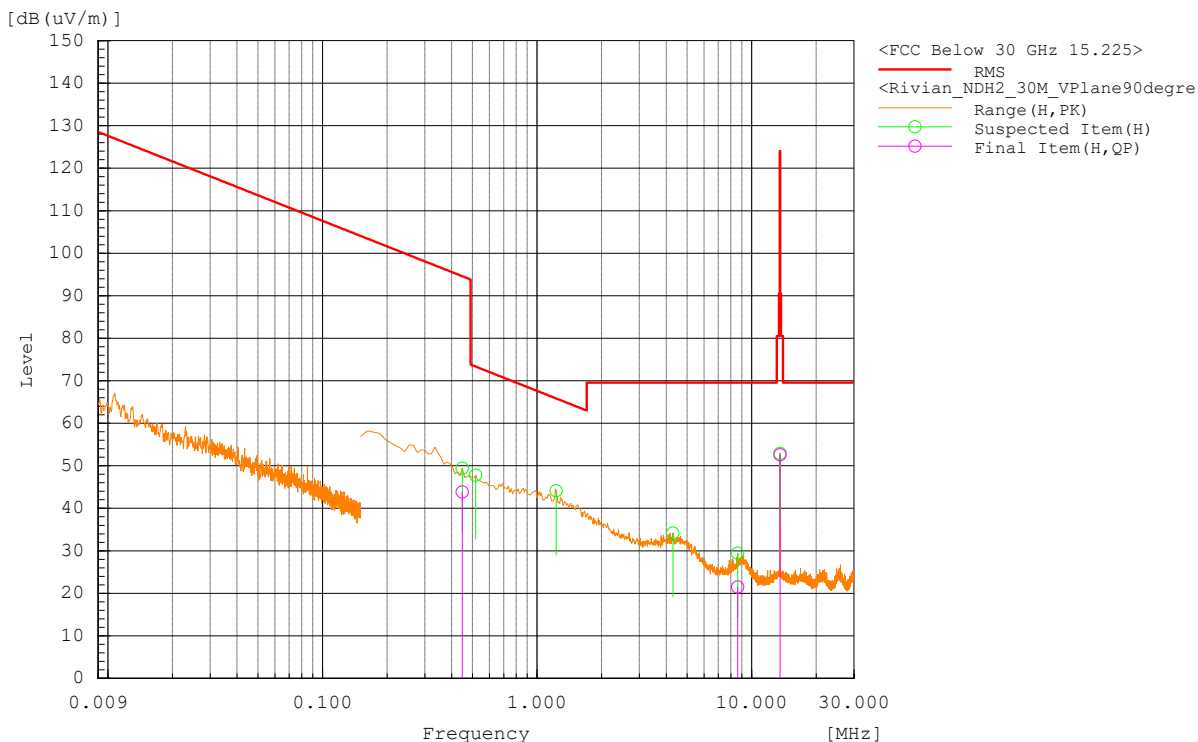
No emissions within 10dB of the limit were identified in 9kHz-30MHz range other than the fundamental.



Frequency MHz	Polarization	Reading dB(uV)	Factor dB(1/m)	Level dB(uV/m)	Limit dB(uV/m)	Height cm	Angle deg	Margin dB	Pass/Fail
					QP			QP	
13.56	H	45.6	15	60.6	124	99.9	65.6	63.4	Pass
0.575	H	32	13.9	45.9	72.4	99.9	344.8	26.5	Pass
1.275	H	27.3	14.3	41.6	65.5	99.9	35.3	23.9	Pass
8.542	H	15.8	14.9	30.7	69.5	99.9	127.2	38.8	Pass

- Emission level (dBuV/m) = Reading Value (dBuV) + Factor (dB)
- AF (dB/m) = Antenna Factor (dB/m) – Pre-amplifier Gain (dB).
- Margin value = Emission level – Limit value.

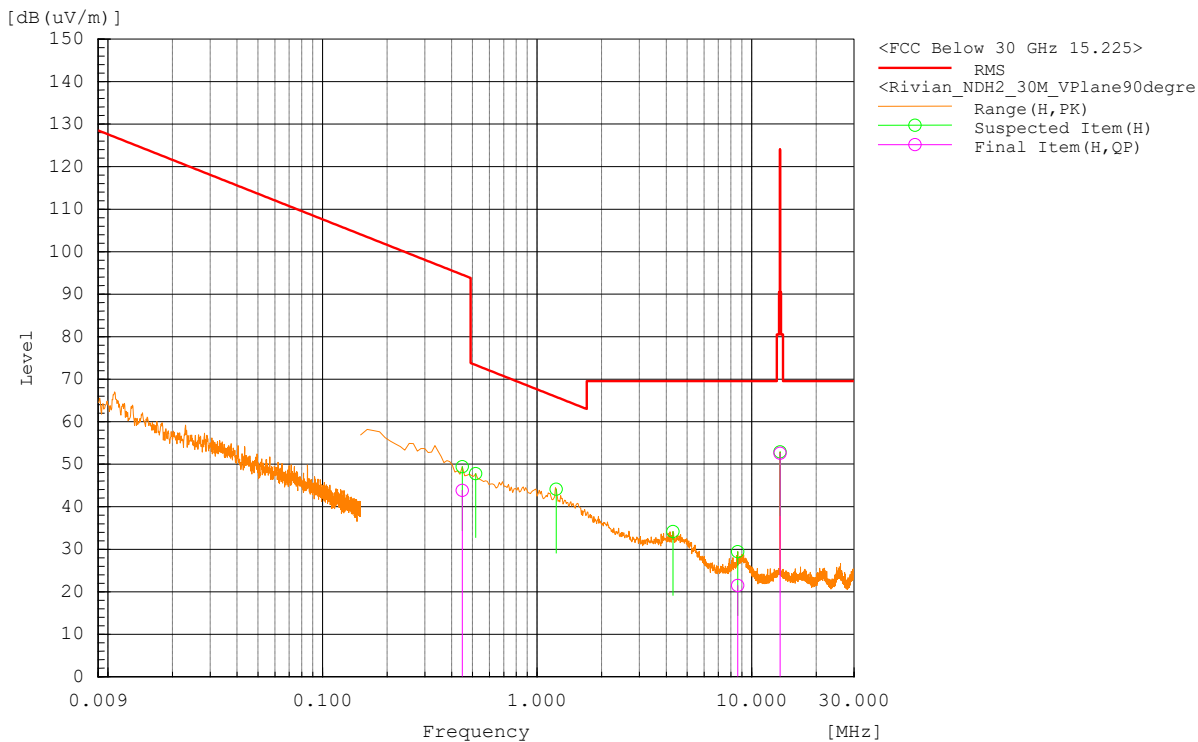
9kHz to 30MHz; Vertical Plane 0degrees



Frequency MHz	Polarization	Reading dB(uV)	Factor dB(1/m)	Level dB(uV/m)	Limit dB(uV/m)	Height cm	Angle deg	Margin dB	Pass/Fail
					QP			QP	
13.56	H	37.9	15	52.9	124	99.9	346.6	71.1	Pass
1.229	H	29.8	14.3	44.1	65.8	99.9	168.4	21.7	Pass
4.295	H	19.3	14.9	34.2	69.5	99.9	246.4	35.3	Pass
0.517	H	33.9	13.9	47.8	73.3	99.9	357.2	25.5	Pass
8.611	H	14.5	14.9	29.4	69.5	99.9	353.1	40.1	Pass

- Emission level (dBuV/m) = Reading Value (dBuV) + Factor (dB)
- AF (dB/m) = Antenna Factor (dB/m) – Preamplifier Gain (dB).
- Margin value = Emission level – Limit value.

9kHz to 30MHz; Vertical Plane 90degrees



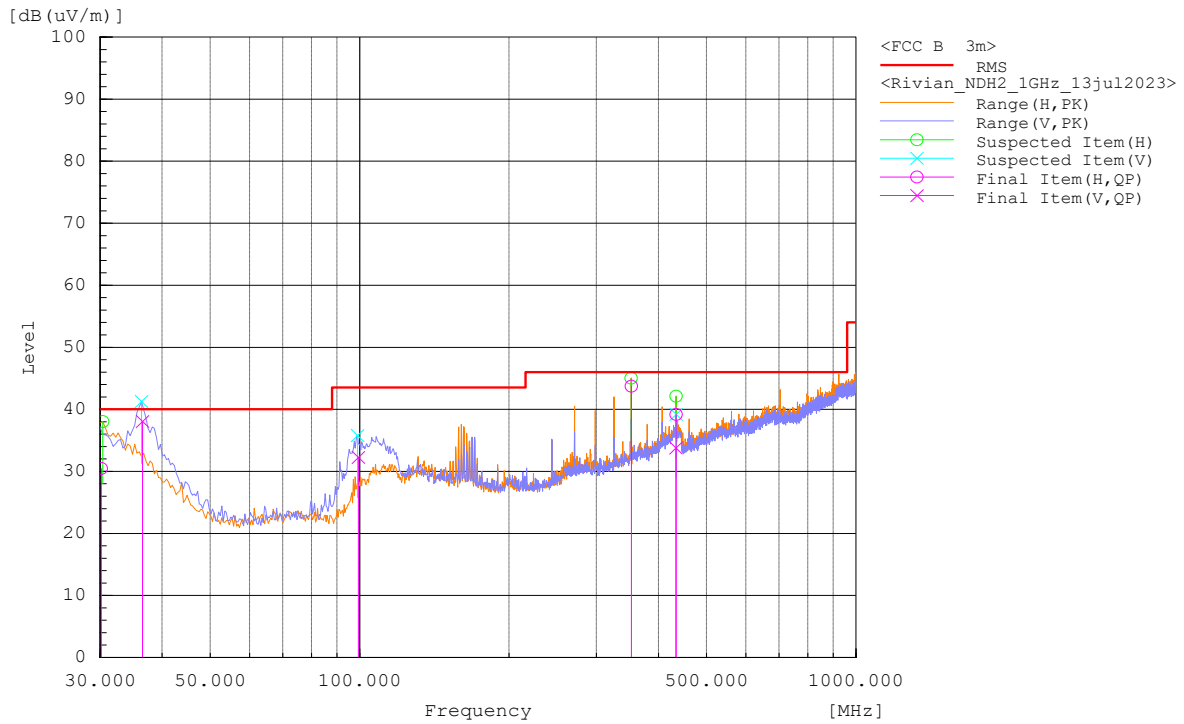
Frequency MHz	Polarization	Reading dB(uV)	Factor dB(1/m)	Level dB(uV/m)	Limit dB(uV/m)	Height cm	Angle deg	Margin dB	Pass/Fail
					QP			QP	
13.56	H	48.1	15	63.1	124	99.9	11.6	60.9	Pass
13.697	H	4.6	15	19.6	90.5	99.9	153.4	70.9	Pass
13.766	H	4.2	15	19.2	80.5	99.9	302.2	61.3	Pass

9kHz to 30MHz; Horizontal Plane

1. Emission level (dBuV/m) = Reading Value (dBuV) + Factor (dB)
2. AF (dB/m) = Antenna Factor (dB/m) – Preamplifier Gain (dB).
3. Margin value = Emission level – Limit value.



Emissions 30MHz to 1GHz



Frequency MHz	Polarization	Reading dB(uV)	Factor dB(1/m)	Level dB(uV/m)	Limit dB(uV/m)	Margin dB	Height cm	Angle deg	Pass/Fail
		QP		QP	QP	QP			
30.179	H	3.1	27.3	30.4	40	9.6	199.9	5.5	Pass
36.512	V	16.7	21.4	38.1	40	1.9	106.4	324.1	Pass
99.407	V	15.2	17.1	32.3	43.5	11.2	105.7	54	Pass
352.555	H	20.4	23.3	43.7	46	2.3	100	137.4	Pass
433.93	H	14	25.2	39.2	46	6.8	200.3	250	Pass
433.901	V	8.8	25	33.8	46	12.2	115.2	185.5	Pass

- Emission level (dBuV/m) = Reading Value (dBuV) + Factor (dB)
- AF (dB/m) = Antenna Factor (dB/m) – Pre-amplifier Gain (dB).
- Margin value = Emission level – Limit value.

30MHz to 1GHz



4.4 99% OCCUPIED BANDWIDTH

4.4.1 LIMITS

When an occupied bandwidth is not specified in the applicable RSS, the transmitted signal bandwidth to be reported is its 99% emission bandwidth, as calculated or measured. [RSS-Gen Issue 5 Section 6.7].

4.4.2 TEST SETUP

Same as radiated spurious emissions setup below 30MHz (Section 4.3.5).

4.4.3 TEST EQUIPMENT USED

ID #	Equipment	Manufacturer	Model #	Serial #	Cal Due
BVD0012	Loop Antenna 9kHz-30MHz	Rohde & Schwarz	FMZB1519B	146	7/13/2024
BVD0226	Spectrum Analyzer 10Hz-44GHz	Rohde & Schwarz	FSV3044	101018	4/14/2024

4.4.4 TEST PROCEDURES

Per RSS-Gen Issue 5 Section 6.7.

4.4.5 DEVIATIONS

No deviations from the standard.

4.4.6 EUT OPERATING CONDITIONS

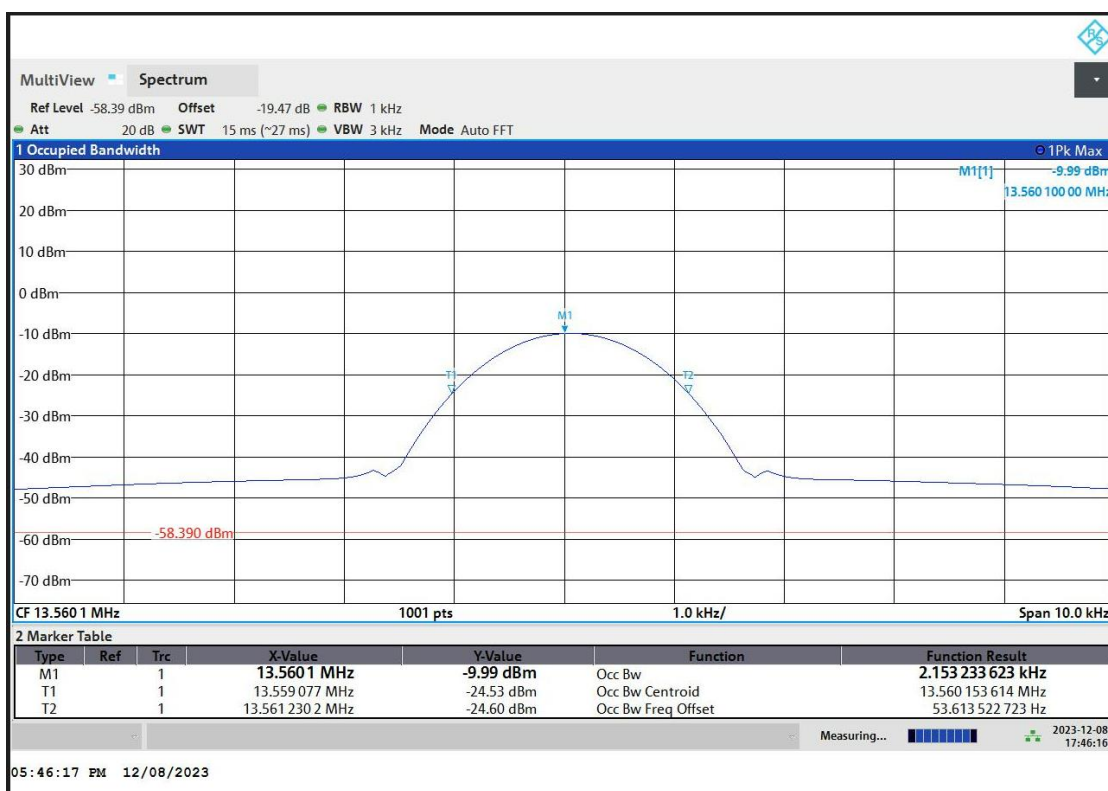
EUT was operated according to manufacturer’s specifications.



4.4.7 TEST RESULTS

Input Power	13.5 VDC	Test Location	BV Auburn Hills, MI
Tested by	AP	Test Date	12/08/2023
Test Mode	Mode 1		

Measured 99% OBW: 2.153kHz





4.5 FREQUENCY TOLERANCE

4.5.1 LIMITS

The frequency tolerance of the carrier signal shall be maintained within $\pm 0.01\%$ of the operating frequency over a temperature variation of $-20\text{ }^{\circ}\text{C}$ to $+50\text{ }^{\circ}\text{C}$ 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 $20\text{ }^{\circ}\text{C}$. For battery operated equipment, the equipment tests shall be performed using a new battery.

4.5.2 TEST SETUP

Device is set to Continuous transmission at 106kb/s.

4.5.3 TEST EQUIPMENT USED

Description	Manufacturer	Model	Serial	Cal Date	Cal. Due
Temperature / Humidity Chamber	TESTEQUITY	1000H Series	10SL0067	11/04/2022	11/04/2023
PXA Signal Analyzer	Keysight	N9030B	MY57140597	12/07/2022	12/07/2023
DC Power Source	Agilent	E3610A	MY40002494	02/25/2022	02/25/2023

4.5.4 TEST PROCEDURES

Per ANSI C63.10 - 2013 Section 6.8.

4.5.5 DEVIATIONS

No deviations from the standard.

4.5.6 EUT OPERATING CONDITIONS

EUT was operated according to manufacturer's specifications



4.5.7 TEST RESULTS

Input Power	13.5 VDC	Test Location	BV Milpitas, CA
Tested by	AP	Test Date	02/03/2023
Test Mode	Mode 1		

Measurements were recorded at startup, 2 minutes, 5 minutes, and 10 minutes after the EUT was energized. Worst-case measurements are shown in the data table below.

Frequency Stability Versus Temp.							
Operating Frequency: 13.56 MHz							
TEMP (°C)	DC Power	2 Minute		5 Minute		10 Minute	
		Measured Frequency (MHz)	Drift %	Measured Frequency (MHz)	Drift %	Measured Frequency (MHz)	Drift %
50	13.5 VDC	13.5600683	0.000503687	13.5600663	0.000488938	13.5600703	0.000518437
40	13.5 VDC	13.5600633	0.000466814	13.5600603	0.00044469	13.5600613	0.000452065
30	13.5 VDC	13.5600673	0.000496313	13.5600633	0.000466814	13.5600573	0.000422566
20	13.5 VDC	13.5600783	0.000577434	13.5600783	0.000577434	13.5600783	0.000577434
10	13.5 VDC	13.5600673	0.000496313	13.5600673	0.000496313	13.5600673	0.000496313
0	13.5 VDC	13.5600753	0.00055531	13.5600783	0.000577434	13.5600763	0.000562684
-10	13.5 VDC	13.5600793	0.000584808	13.5600173	0.000127581	13.5600793	0.000584808
-20	13.5 VDC	13.5600663	0.000488938	13.5600663	0.000488938	13.5600733	0.00054056
-45	13.5 VDC	13.5599713	-0.000211652	13.5599712	-0.000212389	13.5599772	-0.000168142
V=11.45 V							
20	13.5 VDC	13.5600613	0.000452065				
V=14.85 V							
20	13.5 VDC	13.5600583	0.000429941				



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Maximum Frequency Deviation: 0.000584808%

Limit: ± 0.001356 MHz

Result: PASS



5 PHOTOGRAPHS OF THE TEST CONFIGURATION

Please refer to the Test Setup Photos exhibit.

6 APPENDIX A – MODIFICATIONS

No modifications were made to the EUT during testing.



Appendix – Information on the Testing Laboratories

Bureau Veritas is a global leader in testing, inspection and certification (TIC) services. We help businesses improve safety, sustainability and productivity; and our clients include the majority of leading brands in retail, manufacturing and other industries. With a presence in every major country around the world, our quality assurance and compliance solutions are vital in helping our customers enhance product quality and concept-to-consumer journeys. We also assist with increasing speed to market, profitability and brand equity throughout the supply chain. Bureau Veritas is a leading wireless/IoT testing, inspection, audit and certification provider, with a global network of test laboratories to support the IoT industry in areas of connectivity, security, interoperability as well as quality, health & safety, and environmental/chemical requirements.

If you have any comments, please feel free to contact us at the following:

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The address and road map of all our labs can be found in our web site also.

---END OF REPORT---