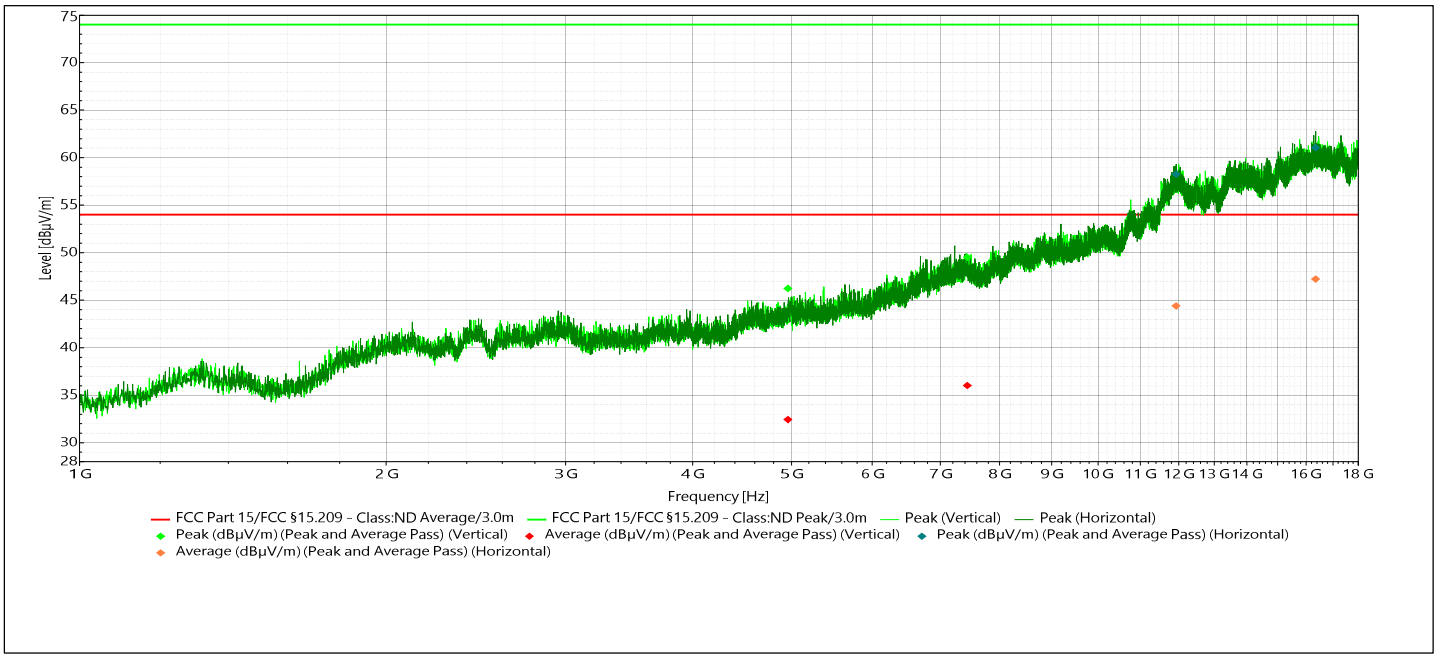
Table 2.8-10 – RE Spurious Emissions 1-18 GHz – Mid Channel – 2Mps

Frequency (MHz)	Peak Level (dBuV/m)	Peak Limit (dBuV/m)	Peak Margin (dB)	Average Level (dBuV/m)	Average Limit (dBuV/m)	Average Margin (dB)	Azimuth (º)	Height (m)	Polarity	Result
16230.111	60.23	74.00	-13.77	46.41	54.00	-7.59	266.00	1.00	Vertical	Pass
4979.889	45.66	74.00	-28.34	31.48	54.00	-22.52	360.00	1.00	Horizontal	Pass
7307.000	48.73	74.00	-25.27	35.35	54.00	-18.65	94.00	4.00	Horizontal	Pass
11847.889	57.83	74.00	-16.17	44.07	54.00	-9.93	132.00	4.00	Horizontal	Pass

Spurious Emissions 1 - 18GHz - high channel 1Mps

Frequency Range	Antenna Distance	Antenna Polarization	RBW	Step Size	Sweep Time
1 GHz - 18 GHz	3m	*Vertical*	1 MHz	*18001 Pts*	*Auto*
1 GHz - 18 GHz	3m	*Horizontal*	1 MHz	*18001 Pts*	*Auto*



Limit:	Test Date:	Test Results:
FCC Part 15/FCC §15.209	12/18/2023	Pass

Test Notes: High Channel 2480MHz, 1Mps

Figure 2-57 – RE Spurious Emissions 1-18 GHz – High Channel – 1Mps

TÜV SÜD America Inc
141 14th Street NW
New Brighton, MN 55112

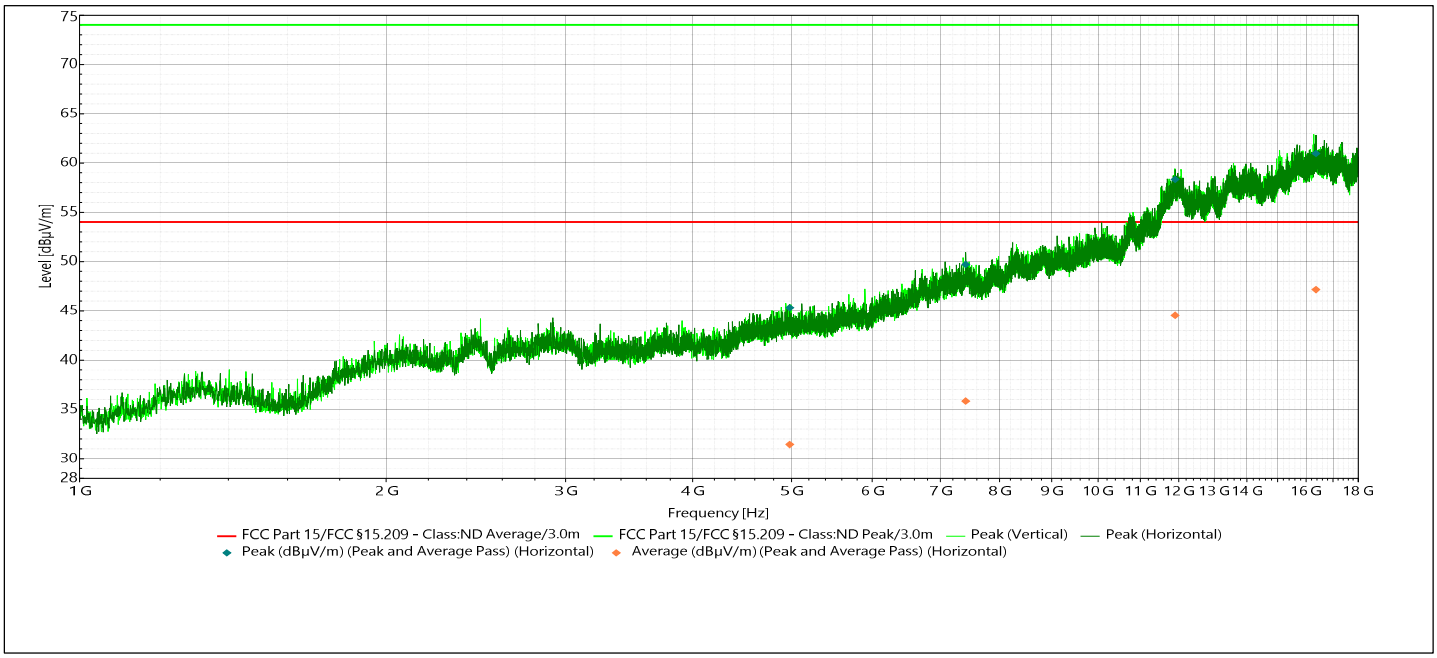
Phone: 651-631-2487
www.tuv-sud-america.com

Table 2.8-11 – RE Spurious Emissions 1-18 GHz – High Channel – 1Mps

Frequency (MHz)	Peak Level (dBuV/m)	Peak Limit (dBuV/m)	Peak Margin (dB)	Average Level (dBuV/m)	Average Limit (dBuV/m)	Average Margin (dB)	Azimuth (º)	Height (m)	Polarity	Result
4960.056	46.24	74.00	-27.76	32.44	54.00	-21.56	266.00	1.00	Vertical	Pass
7440.167	49.52	74.00	-24.48	36.02	54.00	-17.98	0.00	4.00	Vertical	Pass
11925.333	58.26	74.00	-15.74	44.39	54.00	-9.61	360.00	4.00	Horizontal	Pass
16348.167	61.05	74.00	-12.95	47.23	54.00	-6.77	94.00	1.00	Horizontal	Pass

Spurious Emissions 1 - 18GHz - high channel 2Mps

Frequency Range	Antenna Distance	Antenna Polarization	RBW	Step Size	Sweep Time
1 GHz - 18 GHz	3m	*Vertical*	1 MHz	*18001 Pts*	*Auto*
1 GHz - 18 GHz	3m	*Horizontal*	1 MHz	*18001 Pts*	*Auto*



Limit:	Test Date:	Test Results:
FCC Part 15/FCC §15.209	12/18/2023	Pass

Test Notes: High Channel 2480MHz, 2Mps

Figure 2-58 – RE Spurious Emissions 1-18 GHz – High Channel – 2Mps

TÜV SÜD America Inc
141 14th Street NW
New Brighton, MN 55112

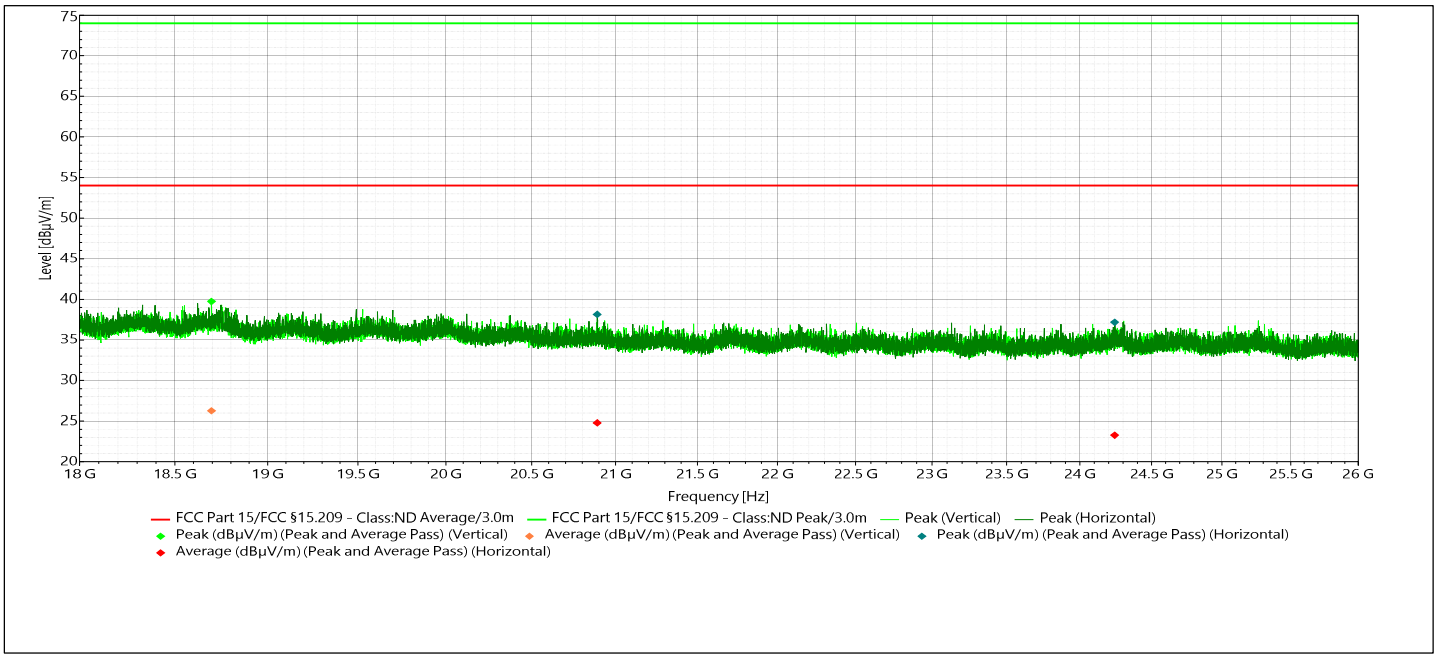
Phone: 651-631-2487
www.tuv-sud-america.com

Table 2.8-12 – RE Spurious Emissions 1-18 GHz – High Channel – 2Mps

Frequency (MHz)	Peak Level (dBuV/m)	Peak Limit (dBuV/m)	Peak Margin (dB)	Average Level (dBuV/m)	Average Limit (dBuV/m)	Average Margin (dB)	Azimuth (º)	Height (m)	Polarity	Result
4979.889	45.31	74.00	-28.69	31.44	54.00	-22.56	266.00	1.00	Horizontal	Pass
7412.778	49.71	74.00	-24.29	35.84	54.00	-18.16	360.00	1.00	Horizontal	Pass
11898.889	58.33	74.00	-15.67	44.54	54.00	-9.46	227.00	1.00	Horizontal	Pass
16358.556	60.96	74.00	-13.04	47.15	54.00	-6.85	94.00	1.00	Horizontal	Pass

Spurious Emissions 18 - 26GHz - low channel 1Mps

Frequency Range	Antenna Distance	Antenna Polarization	RBW	Step Size	Sweep Time
18 GHz - 26 GHz	3m	*Vertical*	1 MHz	*18001 Pts*	*Auto*
18 GHz - 26 GHz	3m	*Horizontal*	1 MHz	*18001 Pts*	*Auto*



Limit:	Test Date:	Test Results:
FCC Part 15/FCC §15.209	12/21/2023	Pass

Test Notes: Low Channel 2402MHz, 1Mps

Figure 2-59 – RE Spurious Emissions 18-26 GHz – Low Channel – 1MPs

TÜV SÜD America Inc
141 14th Street NW
New Brighton, MN 55112

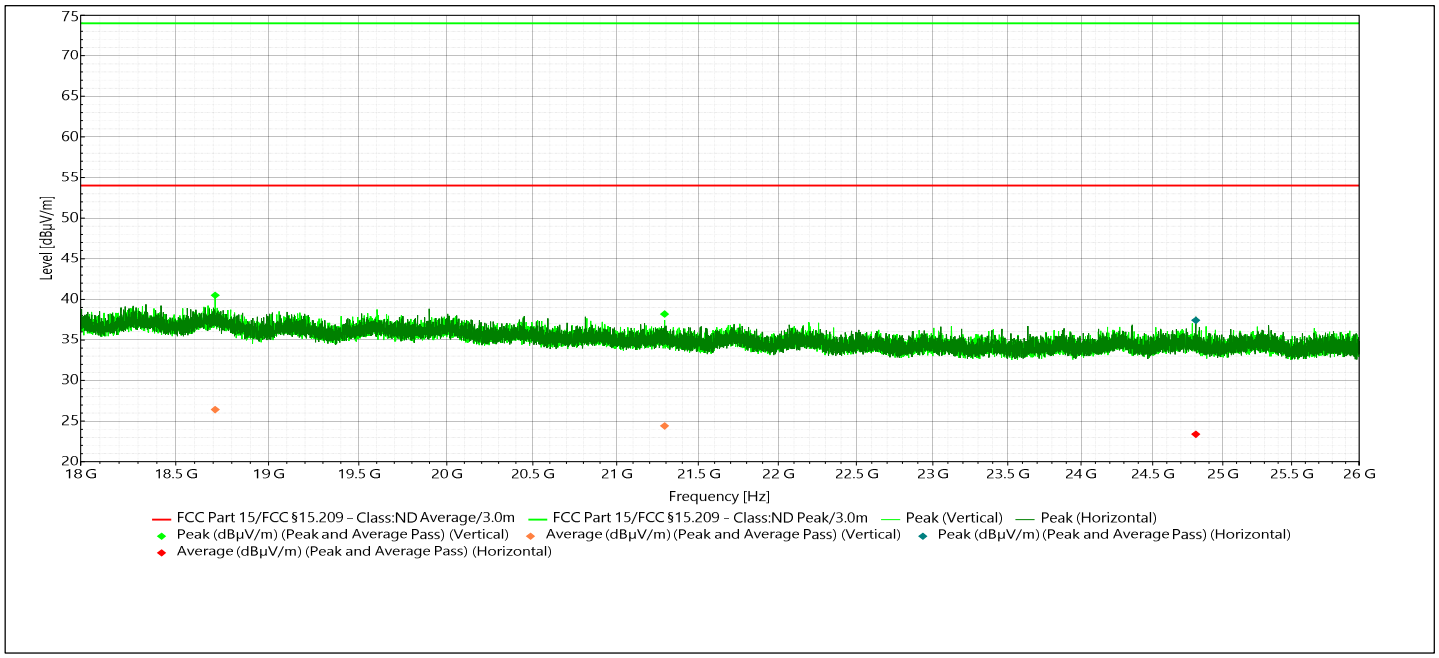
Phone: 651-631-2487
www.tuv-sud-america.com

Table 2.8-13 – RE Spurious Emissions 18-26 GHz – Low Channel – 1MPs

Frequency (MHz)	Peak Level (dBuV/m)	Peak Limit (dBuV/m)	Peak Margin (dB)	Average Level (dBuV/m)	Average Limit (dBuV/m)	Average Margin (dB)	Azimuth (º)	Height (m)	Polarity	Result
18696.000	39.74	74.00	-34.26	26.27	54.00	-27.73	132.00	2.44	Vertical	Pass
20889.333	38.14	74.00	-35.86	24.78	54.00	-29.22	360.00	4.00	Horizontal	Pass
24241.333	37.17	74.00	-36.83	23.27	54.00	-30.73	162.00	3.97	Horizontal	Pass

Spurious Emissions 18 - 26GHz - low channel 2Mps

Frequency Range	Antenna Distance	Antenna Polarization	RBW	Step Size	Sweep Time
18 GHz - 26 GHz	3m	*Vertical*	1 MHz	*18001 Pts*	*Auto*
18 GHz - 26 GHz	3m	*Horizontal*	1 MHz	*18001 Pts*	*Auto*



Limit:	Test Date:	Test Results:
FCC Part 15/FCC §15.209	12/21/2023	Pass

Test Notes: Low Channel 2402MHz, 2Mps

Figure 2-60 – RE Spurious Emissions 18-26 GHz – Low Channel – 2MPs

TÜV SÜD America Inc
141 14th Street NW
New Brighton, MN 55112

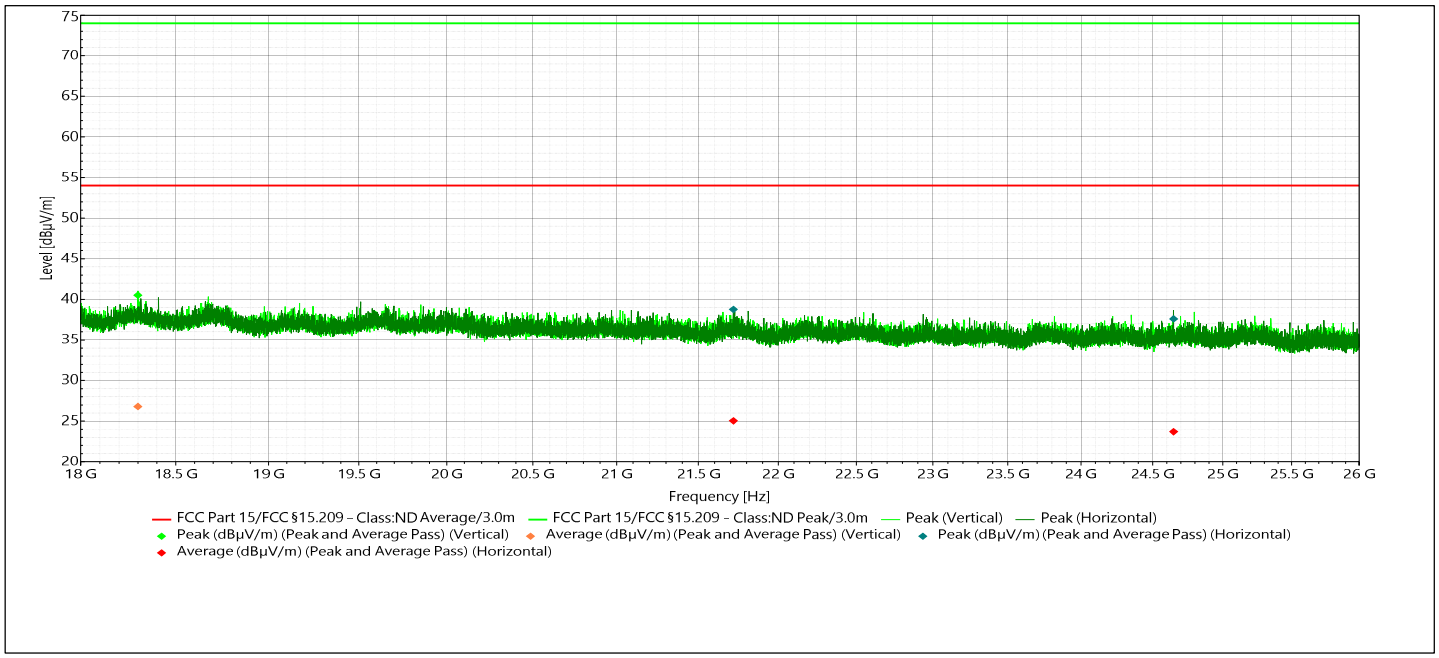
Phone: 651-631-2487
www.tuv-sud-america.com

Table 2.8-14 – RE Spurious Emissions 18-26 GHz – Low Channel – 2MPs

Frequency (MHz)	Peak Level (dBuV/m)	Peak Limit (dBuV/m)	Peak Margin (dB)	Average Level (dBuV/m)	Average Limit (dBuV/m)	Average Margin (dB)	Azimuth (º)	Height (m)	Polarity	Result
18710.222	40.50	74.00	-33.50	26.42	54.00	-27.58	198.00	3.97	Vertical	Pass
21292.444	38.18	74.00	-35.82	24.40	54.00	-29.60	295.00	1.00	Vertical	Pass
24807.111	37.42	74.00	-36.58	23.39	54.00	-30.61	228.00	2.44	Horizontal	Pass

Spurious Emissions 18 - 26GHz - mid channel 1Mps

Frequency Range	Antenna Distance	Antenna Polarization	RBW	Step Size	Sweep Time
18 GHz - 26 GHz	3m	*Vertical*	1 MHz	*18001 Pts*	*Auto*
18 GHz - 26 GHz	3m	*Horizontal*	1 MHz	*18001 Pts*	*Auto*



Limit:	Test Date:	Test Results:
FCC Part 15/FCC §15.209	12/21/2023	Pass

Test Notes: Middle Channel 2440MHz, 1Mps

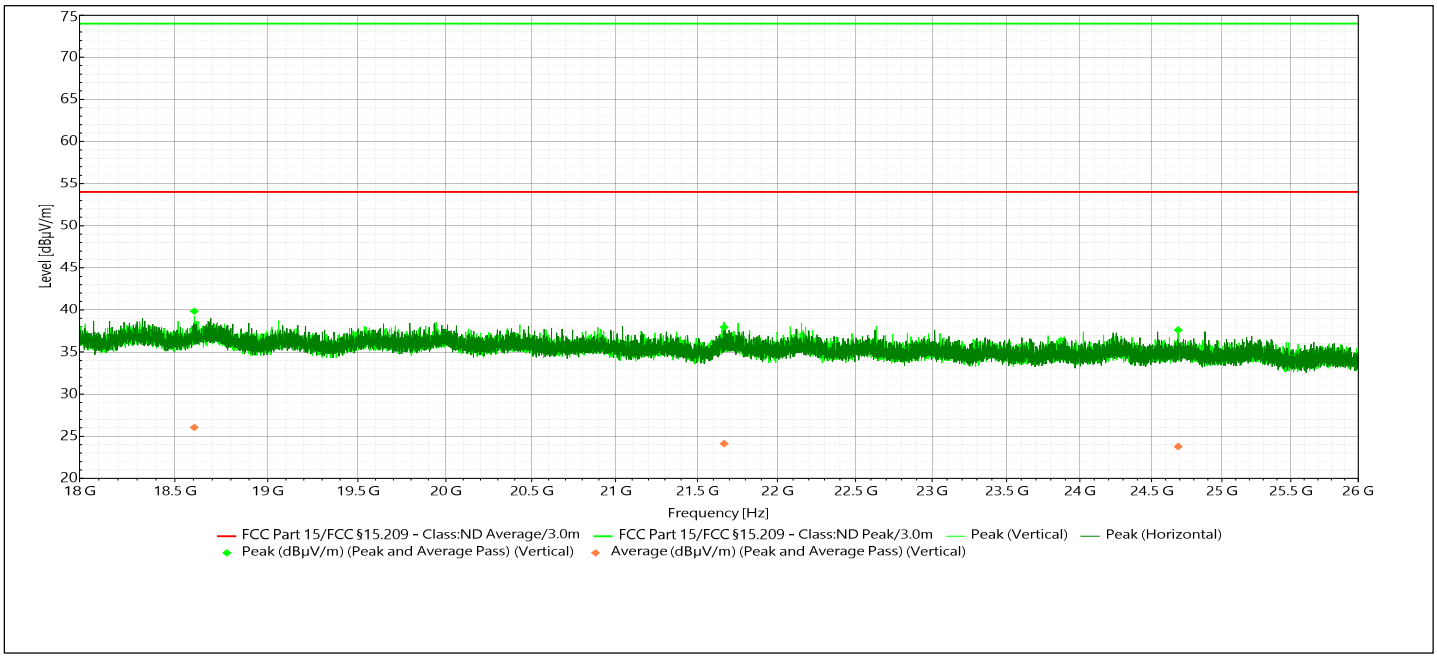
Figure 2-61 – RE Spurious Emissions 18-26 GHz – Mid Channel – 1MPs

Table 2.8-15 – RE Spurious Emissions 18-26 GHz – Mid Channel – 1MPs

Frequency (MHz)	Peak Level (dBuV/m)	Peak Limit (dBuV/m)	Peak Margin (dB)	Average Level (dBuV/m)	Average Limit (dBuV/m)	Average Margin (dB)	Azimuth (°)	Height (m)	Polarity	Result
18299.111	40.51	74.00	-33.49	26.80	54.00	-27.20	265.00	1.00	Vertical	Pass
21717.333	38.75	74.00	-35.25	25.03	54.00	-28.97	0.00	1.00	Horizontal	Pass
24648.444	37.60	74.00	-36.40	23.70	54.00	-30.30	0.00	3.97	Horizontal	Pass

Spurious Emissions 18 - 26GHz - mid channel 2Mps

Frequency Range	Antenna Distance	Antenna Polarization	RBW	Step Size	Sweep Time
18 GHz - 26 GHz	3m	*Vertical*	1 MHz	*18001 Pts*	*Auto*
18 GHz - 26 GHz	3m	*Horizontal*	1 MHz	*18001 Pts*	*Auto*



Limit:	Test Date:	Test Results:
FCC Part 15/FCC §15.209	12/21/2023	Pass

Test Notes: Middle Channel 2440MHz, 2Mps

Figure 2-62 – RE Spurious Emissions 18-26 GHz – Mid Channel – 2MPs

TÜV SÜD America Inc
141 14th Street NW
New Brighton, MN 55112

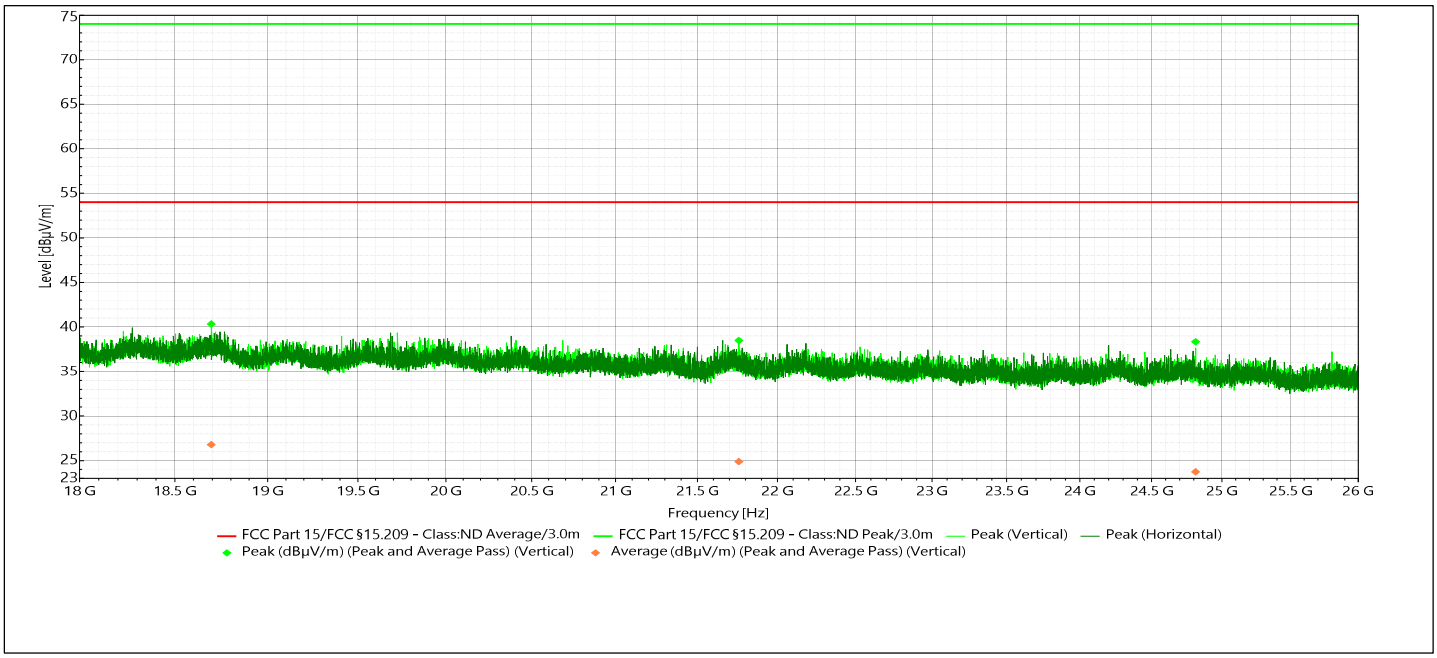
Phone: 651-631-2487
www.tuv-sud-america.com

Table 2.8-16 – RE Spurious Emissions 18-26 GHz – Mid Channel – 2MPs

Frequency (MHz)	Peak Level (dBuV/m)	Peak Limit (dBuV/m)	Peak Margin (dB)	Average Level (dBuV/m)	Average Limit (dBuV/m)	Average Margin (dB)	Azimuth (°)	Height (m)	Polarity	Result
18604.000	39.84	74.00	-34.16	26.05	54.00	-27.95	198.00	3.97	Vertical	Pass
21666.222	37.95	74.00	-36.05	24.12	54.00	-29.88	162.00	1.00	Vertical	Pass
24688.000	37.61	74.00	-36.39	23.78	54.00	-30.22	331.00	1.00	Vertical	Pass

Spurious Emissions 18 - 26GHz - high channel 1Mps

Frequency Range	Antenna Distance	Antenna Polarization	RBW	Step Size	Sweep Time
18 GHz - 26 GHz	3m	*Vertical*	1 MHz	*18001 Pts*	*Auto*
18 GHz - 26 GHz	3m	*Horizontal*	1 MHz	*18001 Pts*	*Auto*



Limit:	Test Date:	Test Results:
FCC Part 15/FCC §15.209	12/18/2023	Pass

Test Notes: High Channel 2480MHz, 1Mps

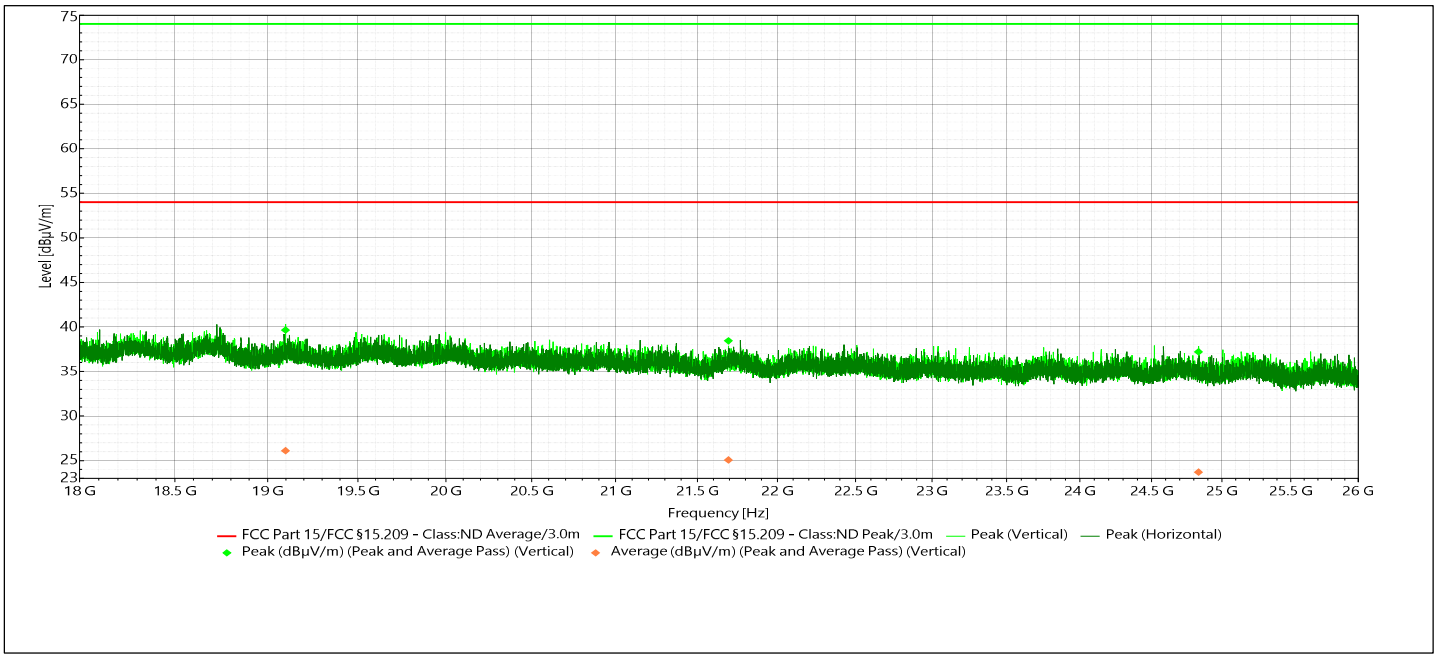
Figure 2-63 – RE Spurious Emissions 18-26 GHz – High Channel – 1MPs

Table 2.8-17 – RE Spurious Emissions 18-26 GHz – High Channel – 1MPs

Frequency (MHz)	Peak Level (dBuV/m)	Peak Limit (dBuV/m)	Peak Margin (dB)	Average Level (dBuV/m)	Average Limit (dBuV/m)	Average Margin (dB)	Azimuth (°)	Height (m)	Polarity	Result
18694.667	40.33	74.00	-33.67	26.79	54.00	-27.21	331.00	3.97	Vertical	Pass
21758.222	38.48	74.00	-35.52	24.88	54.00	-29.12	95.00	1.00	Vertical	Pass
24812.000	38.33	74.00	-35.67	23.73	54.00	-30.27	265.00	4.00	Vertical	Pass

Spurious Emissions 18 - 26GHz - high channel 2Mps

Frequency Range	Antenna Distance	Antenna Polarization	RBW	Step Size	Sweep Time
18 GHz - 26 GHz	3m	*Vertical*	1 MHz	*18001 Pts*	*Auto*
18 GHz - 26 GHz	3m	*Horizontal*	1 MHz	*18001 Pts*	*Auto*



Limit:	Test Date:	Test Results:
FCC Part 15/FCC §15.209	12/18/2023	Pass

Test Notes: High Channel 2480MHz, 2Mps

Figure 2-64 – RE Spurious Emissions 18-26 GHz – High Channel – 2MPs

Table 2.8-18 – RE Spurious Emissions 18-26 GHz – High Channel – 2MPs

Frequency (MHz)	Peak Level (dBuV/m)	Peak Limit (dBuV/m)	Peak Margin (dB)	Average Level (dBuV/m)	Average Limit (dBuV/m)	Average Margin (dB)	Azimuth (°)	Height (m)	Polarity	Result
19098.667	39.65	74.00	-34.35	26.10	54.00	-27.90	331.00	2.44	Vertical	Pass
21692.444	38.45	74.00	-35.55	25.07	54.00	-28.93	295.00	2.44	Vertical	Pass
24832.889	37.20	74.00	-36.80	23.70	54.00	-30.30	360.00	1.00	Vertical	Pass

2.8.9 Test Location and Test Equipment Used

The tests were carried out in New Brighton, MN.
Test Area: 3mSAC

Table 2.8-19 – Radiated Emissions Equipment List

Device #	Manufacturer	Description	Model	Serial #	Cal Code	Cal Date	Cal Due
NBLE11142	Hewlett-Packard	Preamplifier, 0.1 to 1300 MHz	8447D	2727A05370	B	10/19/2023	10/19/2024
WRLE11519	Com-Power Corp.	Preamplifier, 500 MHz-18 GHz	PAM-118A	18040002	B	02/05/2024	02/05/2025
NBLE11630	ETS-Lindgren	Antenna, 1-18 GHz	3117	00218816	G	09/27/2022	09/27/2024
NBLE11645	Schwarzbeck	Antenna, Trilog Broadband, 30-7000 MHz	VULB 9162	0254	G	04/25/2023	04/25/2025
NBLE11689	ATM	Antenna, DRG 18-40 GHz	180-442-KF	102040	G	06/07/2023	06/07/2025
NBLE11688	Rohde & Schwarz	Preamplifier, 18-40 GHz	TRS-PR1840	10006	B	06/26/2023	06/26/2025
NBLE11699	Microwave Circuits	Notch Filter, 2.4-2.4837 GHz	N0324415	502922 DC1947	B	02/28/2024	02/28/2025
NBLE11754	Rohde & Schwarz	Receiver, 1 Hz-44 GHz	ESW44	103037	G	10/02/2023	10/02/2024

Cal Code G = Calibration performed by an accredited outside source.
Cal Code B = Calibration verification performed internally.
Cal Code Y = Passive Device, or Calibration not required when used with other calibrated equipment.

2.9 Radiated Band-Edge

2.9.1 Specification Reference

FCC 47 CFR Part 15 Subpart C, 15.247
RSS-GEN Issue 5

2.9.2 Equipment Under Test and Modification State

As shown in §1.4 with modification state “0”, as noted in §1.6.

2.9.3 Date of Test

18 December 2023

2.9.4 Test Method

The EUT was set up in a semi-anechoic chamber on a remotely controlled turntable and placed on a non-conductive table 1.5 m above a reference ground plane. Measurements were taken at a 3m distance. The fundamental signal was maximized while varying the antenna-to-EUT azimuth and antenna-to-EUT polarization using a peak detector. Band-edge measurements were made with the device in its maximized position using a peak and average detector as described in ANSI C63.10.

The EUT was assessed against the limits specified in FCC 47 CFR Part 15C §15.209.

2.9.5 Environmental Conditions

The EUT was evaluated within the climatic range of the EUT as specified by the manufacturer. When the manufacturer does not specify climatic parameters for the EUT, all tests are performed within the ambient climatic conditions of the laboratory.

2.9.6 Test Results

Test Summary: EUT operated as intended before, during, and after testing. The correction factors were added into the receiver as an offset in order to show corrected data.

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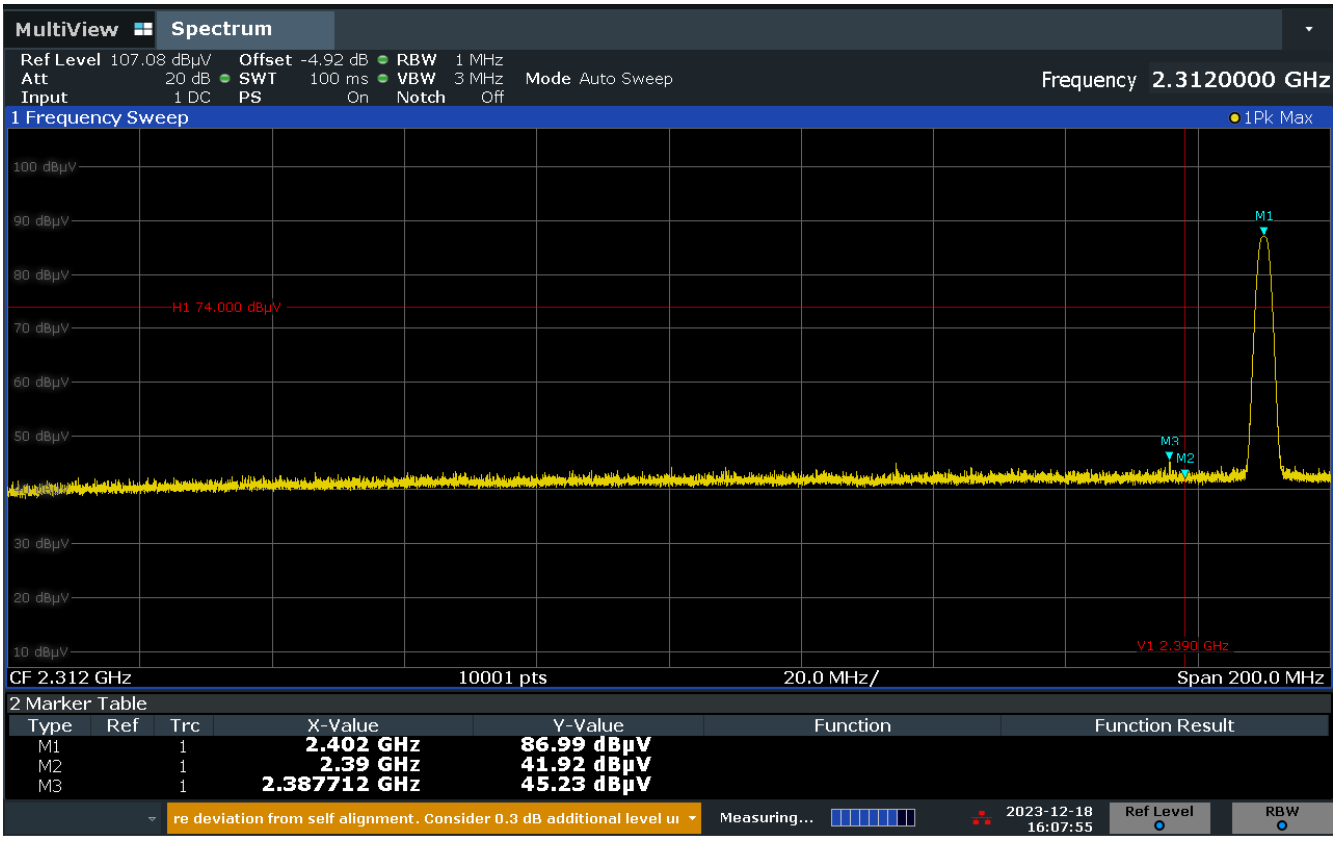
Test Result: Pass

See data below for detailed results.



04:07:55 PM 12/18/2023

Figure 2-65 – Band-Edge, Low Channel – Peak – 1Mps

04:08:56 PM 12/18/2023

Figure 2-66 – Band-Edge, Low Channel – Average – 1Mps

Table 2.9-1 – Restricted Band Edge – Low Channel – Peak – 1Mps

Frequency (MHz)	Peak Level (dBuV/m)	Peak Limit (dBuV/m)	Peak Margin (dB)	Peak Result
2390	41.92	74.00	-32.08	Pass
2387.71	45.23	74.00	-28.77	Pass

Note: Peak level calculation: Final Peak level = analyzer level + correction factor.
Margin Calculation: Peak Margin = Peak Level – Peak Limit.

Table 2.9-2 – Restricted Band Edge – Low Channel – Average – 1Mps

Frequency (MHz)	Average Level (dBuV/m)	Average Limit (dBuV/m)	Average Margin (dB)	Average Result
2390	33.71	54.00	-20.29	Pass
2301.68	35.29	54.00	-18.71	Pass

Note: Peak level calculation: Final Average level = analyzer level + correction factor.
Margin Calculation: Average Margin = Average Level – Average Limit.

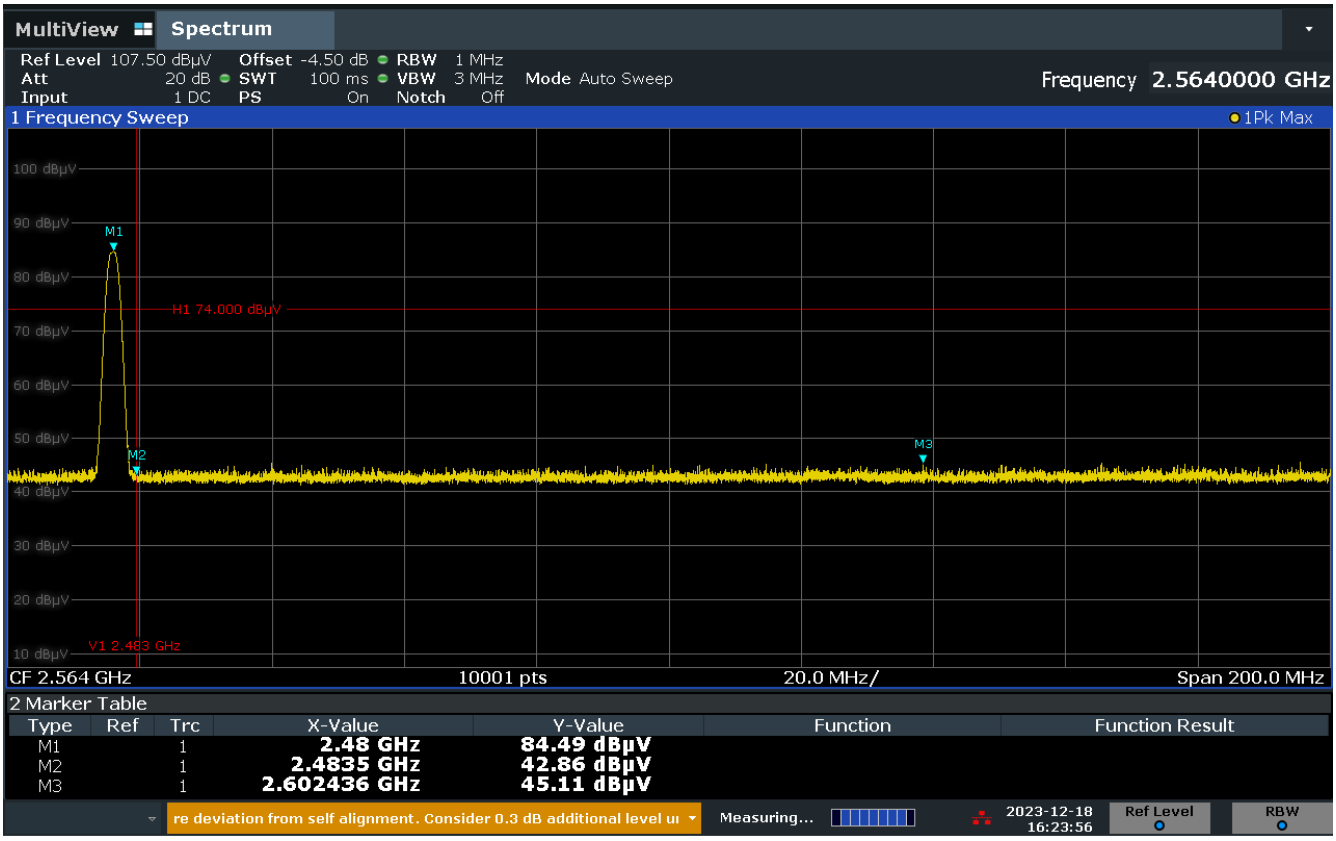


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Figure 2-67 – Band-edge, High Channel – Peak – 1MPs

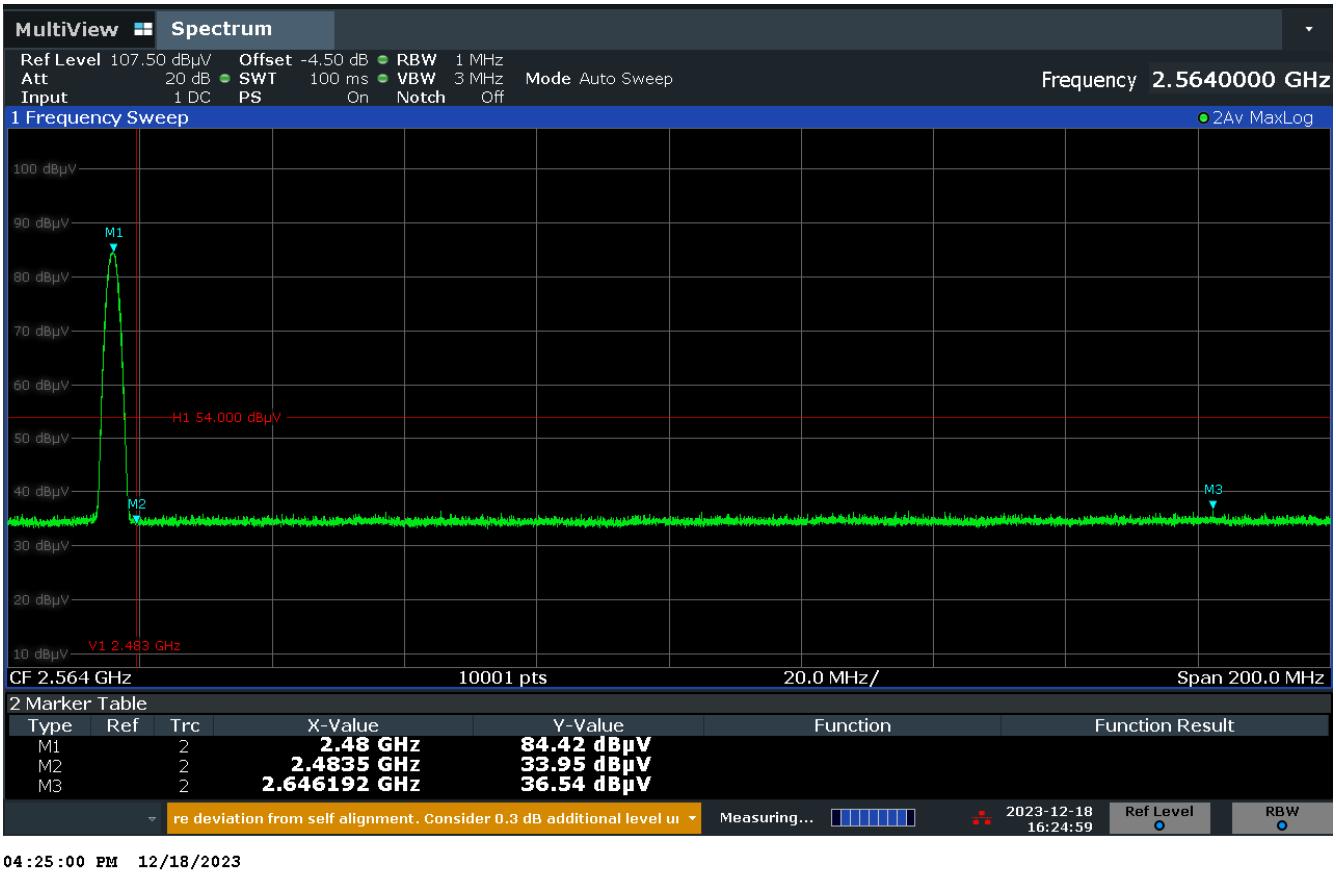

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Figure 2-68 – Band-edge, High Channel – Average – 1MPs

Table 2.9-3 – Restricted Band Edge – High Channel – Peak – 1Mps

Frequency (MHz)	Peak Level (dBuV/m)	Peak Limit (dBuV/m)	Peak Margin (dB)	Peak Result
2483.5	42.86	74.00	-31.14	Pass
2602.43	45.11	74.00	-28.89	Pass

Note: Peak level calculation: Final Peak level = analyzer level + correction factor.
Margin Calculation: Peak Margin = Peak Level – Peak Limit.

Table 2.9-4 – Restricted Band Edge – High Channel – Average – 1Mps

Frequency	Average Level (dBuV/m)	Average Limit (dBuV/m)	Average Margin (dB)	Average Result
2483.5	33.95	54.00	-20.05	Pass
2646.19	36.54	54.00	-17.46	Pass

Note: Peak level calculation: Final Average level = analyzer level + correction factor.
Margin Calculation: Average Margin = Average Level – Average Limit.

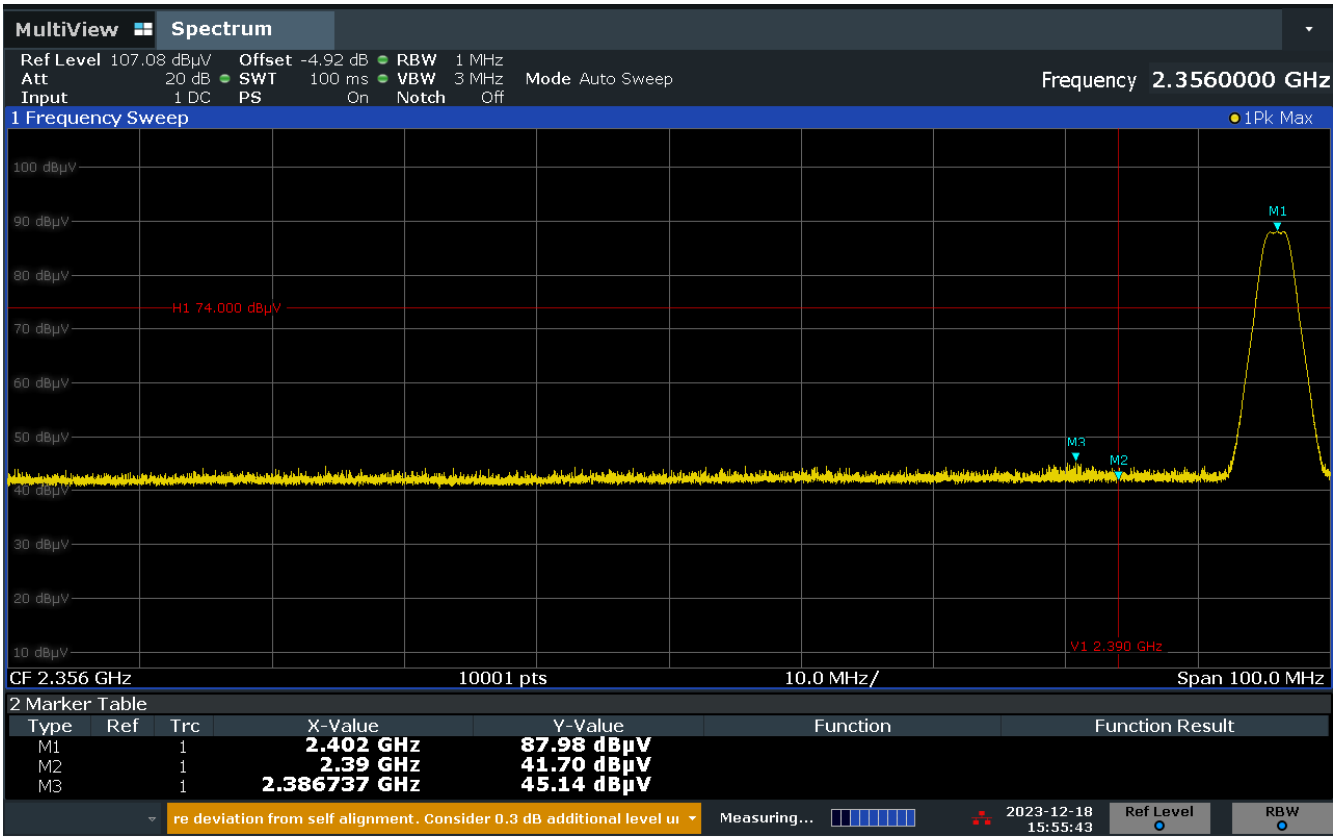

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Figure 2-69 – Band-Edge, Low Channel – Peak – 2Mps

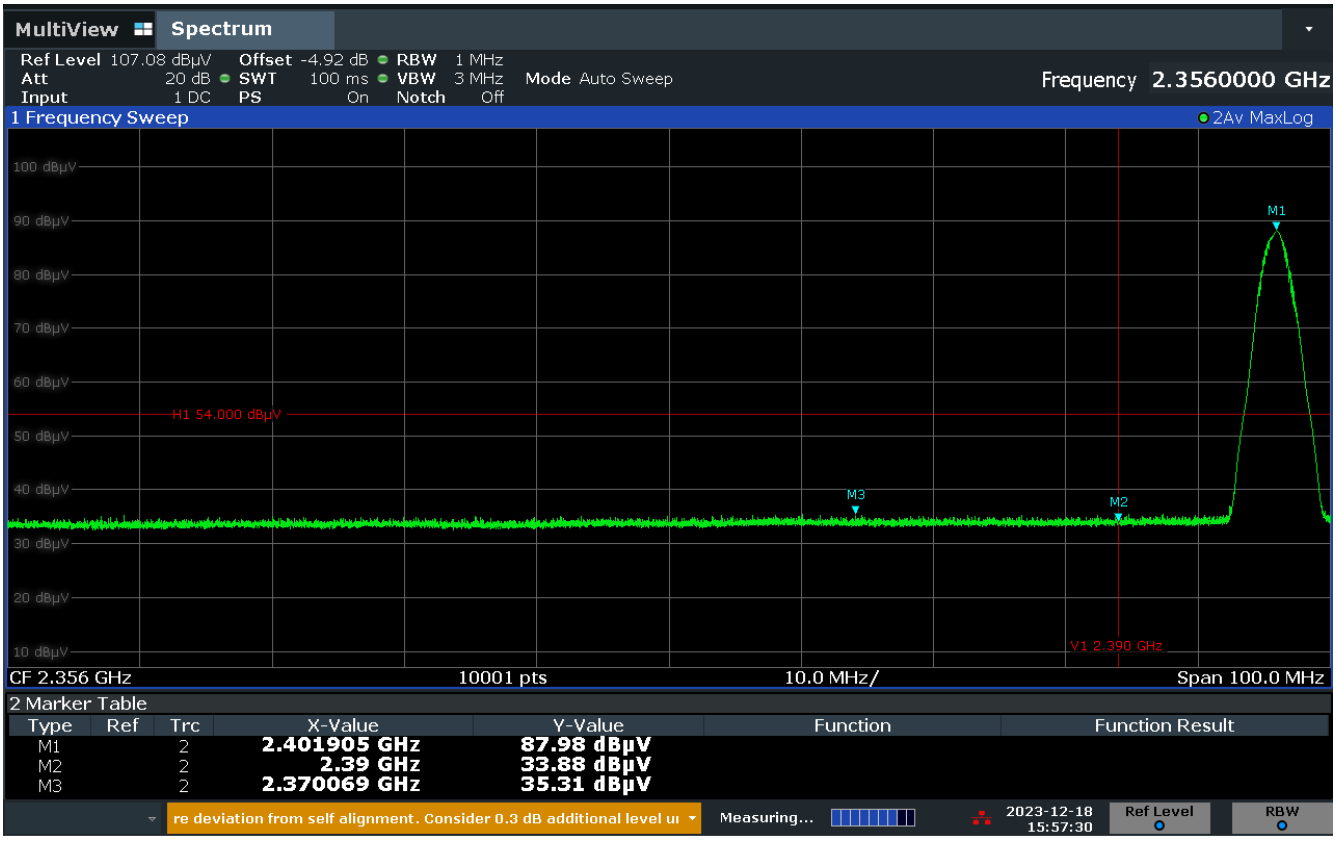

Figure 2-70 – Band-Edge, Low Channel – Average – 2Mps

Table 2.9-5 – Restricted Band Edge – Low Channel – Peak – 2Mps

Frequency (MHz)	Peak Level (dBuV/m)	Peak Limit (dBuV/m)	Peak Margin (dB)	Peak Result
2390	41.70	74.00	-32.30	Pass
2386.73	45.14	74.00	-28.86	Pass

Note: Peak level calculation: Final Peak level = analyzer level + correction factor.
Margin Calculation: Peak Margin = Peak Level – Peak Limit.

Table 2.9-6 – Restricted Band Edge – Low Channel – Average – 2Mps

Frequency (MHz)	Average Level (dBuV/m)	Average Limit (dBuV/m)	Average Margin (dB)	Average Result
2390	33.88	54.00	-20.12	Pass
2370.06	35.31	54.00	-18.69	Pass

Note: Peak level calculation: Final Average level = analyzer level + correction factor.
Margin Calculation: Average Margin = Average Level – Average Limit.

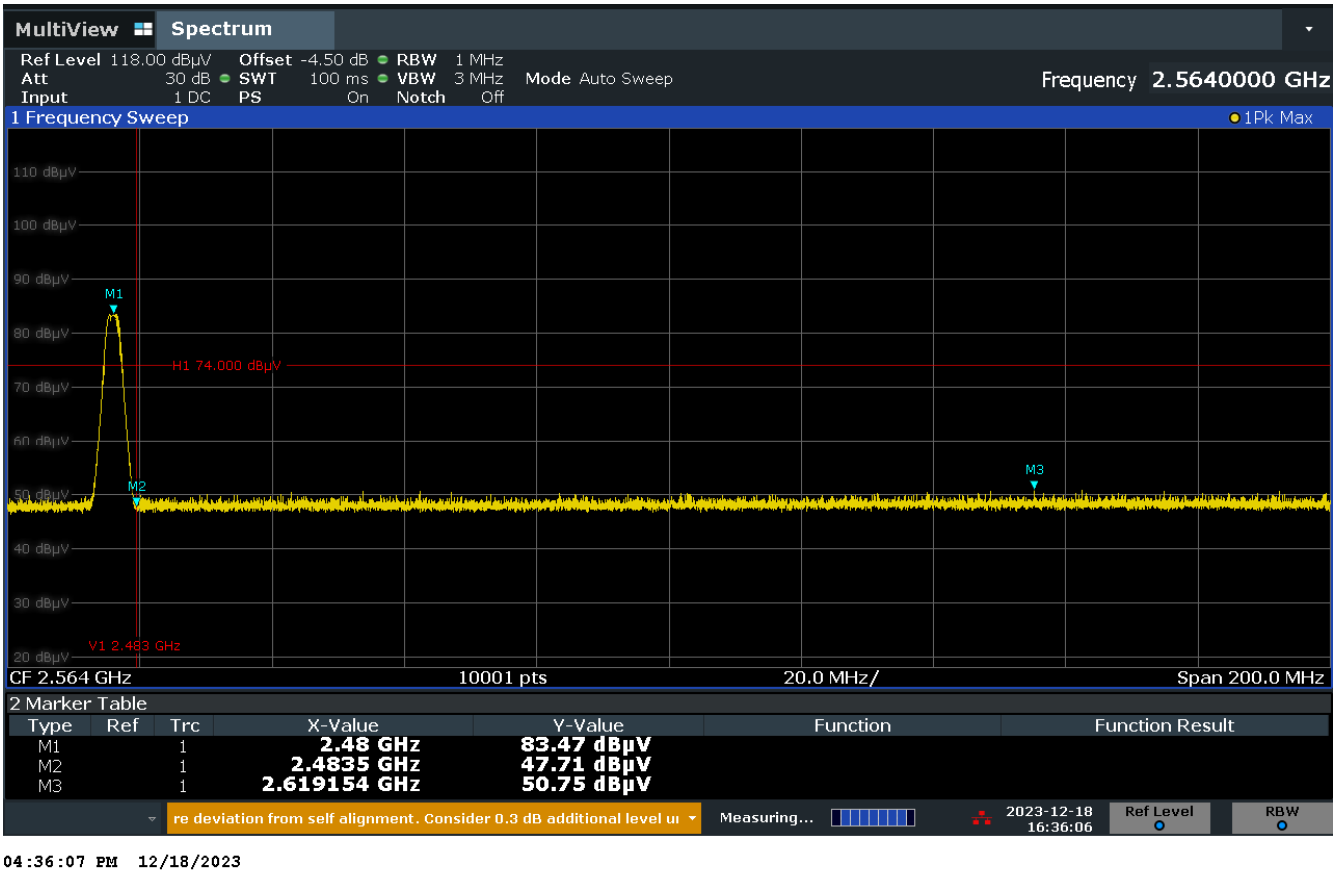

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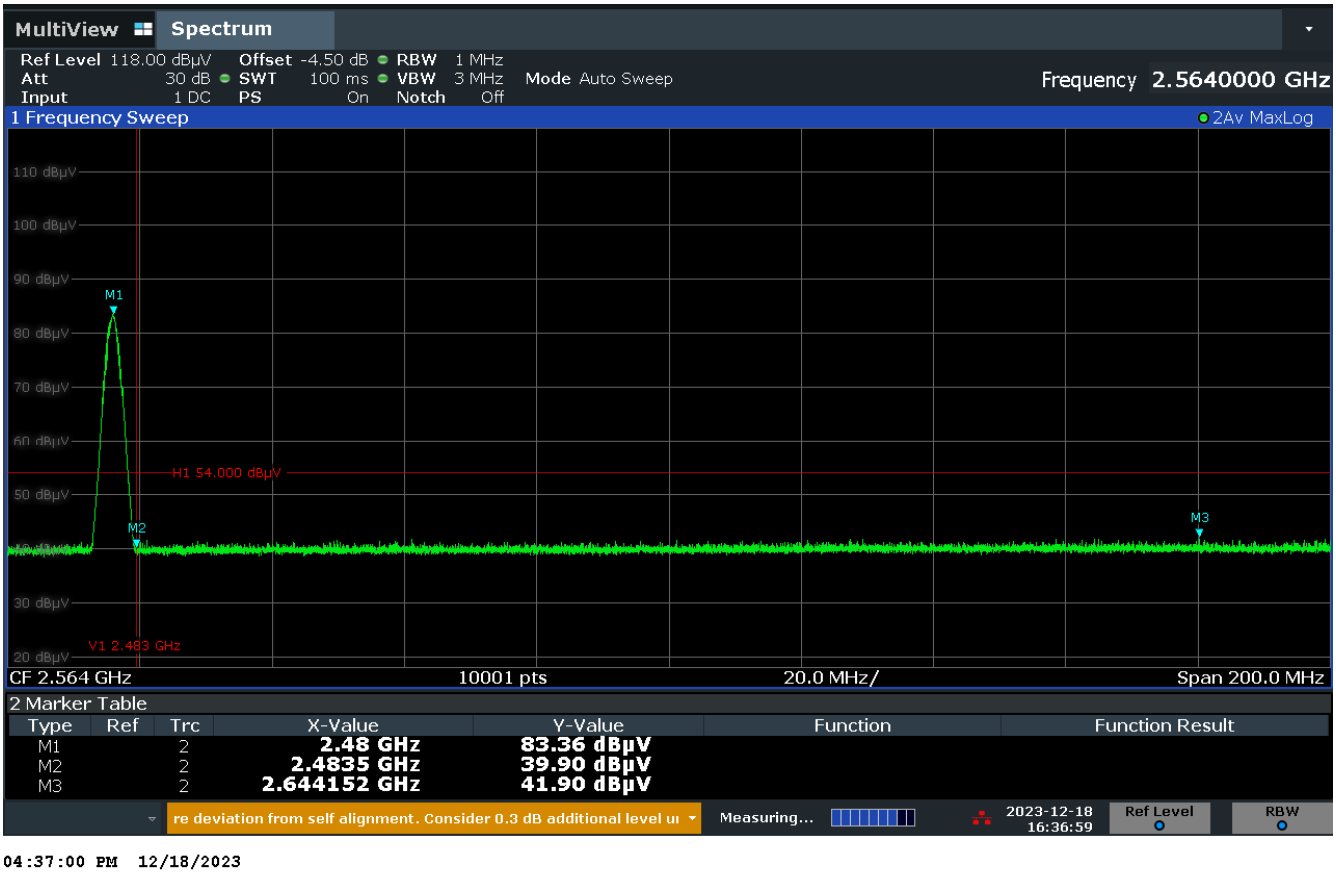
Figure 2-71 – Band-edge, High Channel – Peak – 2MPs



04:37:00 PM 12/18/2023

Figure 2-72 – Band-edge, High Channel – Average – 2MPs

Table 2.9-7 – Restricted Band Edge – High Channel – Peak – 2Mps

Frequency (MHz)	Peak Level (dBuV/m)	Peak Limit (dBuV/m)	Peak Margin (dB)	Peak Result
2483.5	47.71	74.00	-26.29	Pass
2619.15	50.75	74.00	-23.25	Pass

Note: Peak level calculation: Final Peak level = analyzer level + correction factor.
Margin Calculation: Peak Margin = Peak Level – Peak Limit.

Table 2.9-8 – Restricted Band Edge – High Channel – Average – 2Mps

Frequency	Average Level (dBuV/m)	Average Limit (dBuV/m)	Average Margin (dB)	Average Result
2483.5	39.90	54.00	-14.10	Pass
2644.15	41.90	54.00	-12.10	Pass

Note: Peak level calculation: Final Average level = analyzer level + correction factor.
Margin Calculation: Average Margin = Average Level – Average Limit.

2.9.7 Test Location and Test Equipment Used

The tests were carried out in New Brighton, MN.
Test Area: 3mSAC

Table 2.9-9 – Restricted Band Edge Equipment List

Device #	Manufacturer	Description	Model	Serial #	Cal Code	Cal Date	Cal Due
NBLE11142	Hewlett-Packard	Preamplifier, 0.1 to 1300 MHz	8447D	2727A05370	B	10/19/2023	10/19/2024
WRLE11519	Com-Power Corp.	Preamplifier, 500 MHz-18 GHz	PAM-118A	18040002	B	02/05/2024	02/05/2025
NBLE11630	ETS-Lindgren	Antenna, 1-18 GHz	3117	00218816	G	09/27/2022	09/27/2024
NBLE11645	Schwarzbeck	Antenna, Trilog Broadband, 30-7000 MHz	VULB 9162	0254	G	04/25/2023	04/25/2025
NBLE11689	ATM	Antenna, DRG 18-40 GHz	180-442-KF	102040	G	06/07/2023	06/07/2025
NBLE11688	Rohde & Schwarz	Preamplifier, 18-40 GHz	TRS-PR1840	10006	B	06/26/2023	06/26/2025
NBLE11699	Microwave Circuits	Notch Filter, 2.4-2.4837 GHz	N0324415	502922 DC1947	B	02/28/2024	02/28/2025
NBLE11754	Rohde & Schwarz	Receiver, 1 Hz-44 GHz	ESW44	103037	G	10/02/2023	10/02/2024

Cal Code G = Calibration performed by an accredited outside source.
Cal Code B = Calibration verification performed internally.
Cal Code Y = Passive Device, or Calibration not required when used with other calibrated equipment.

3 Diagram of Test Setups

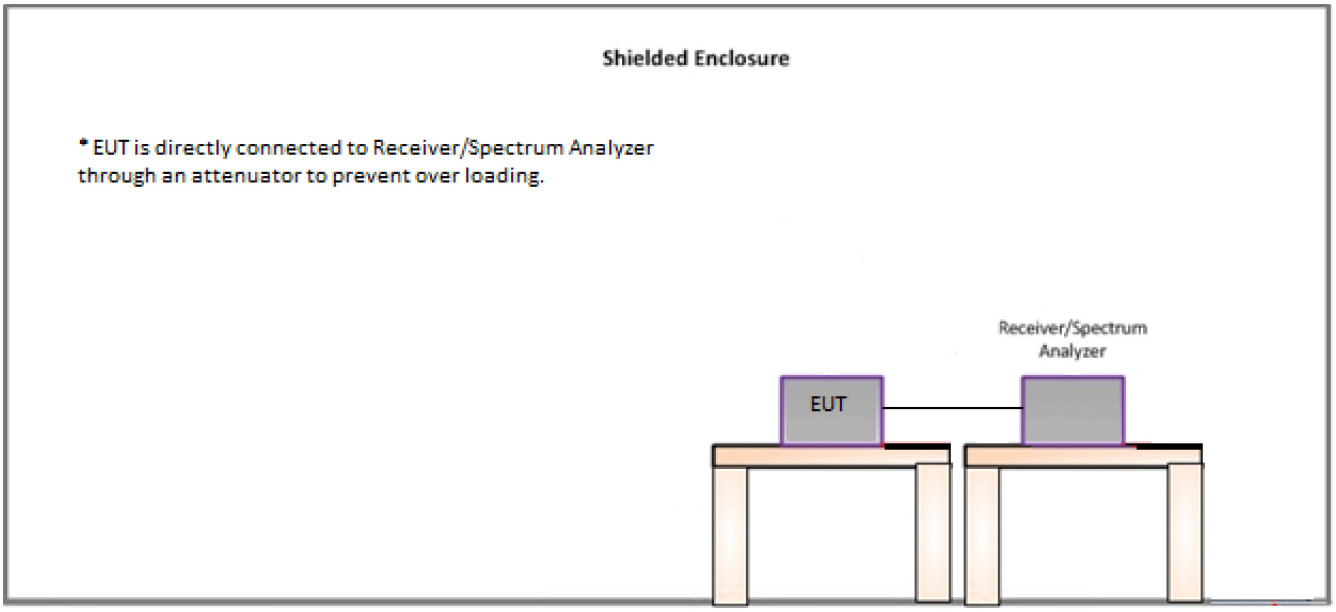


Figure 3-1 – Conducted Test Setup

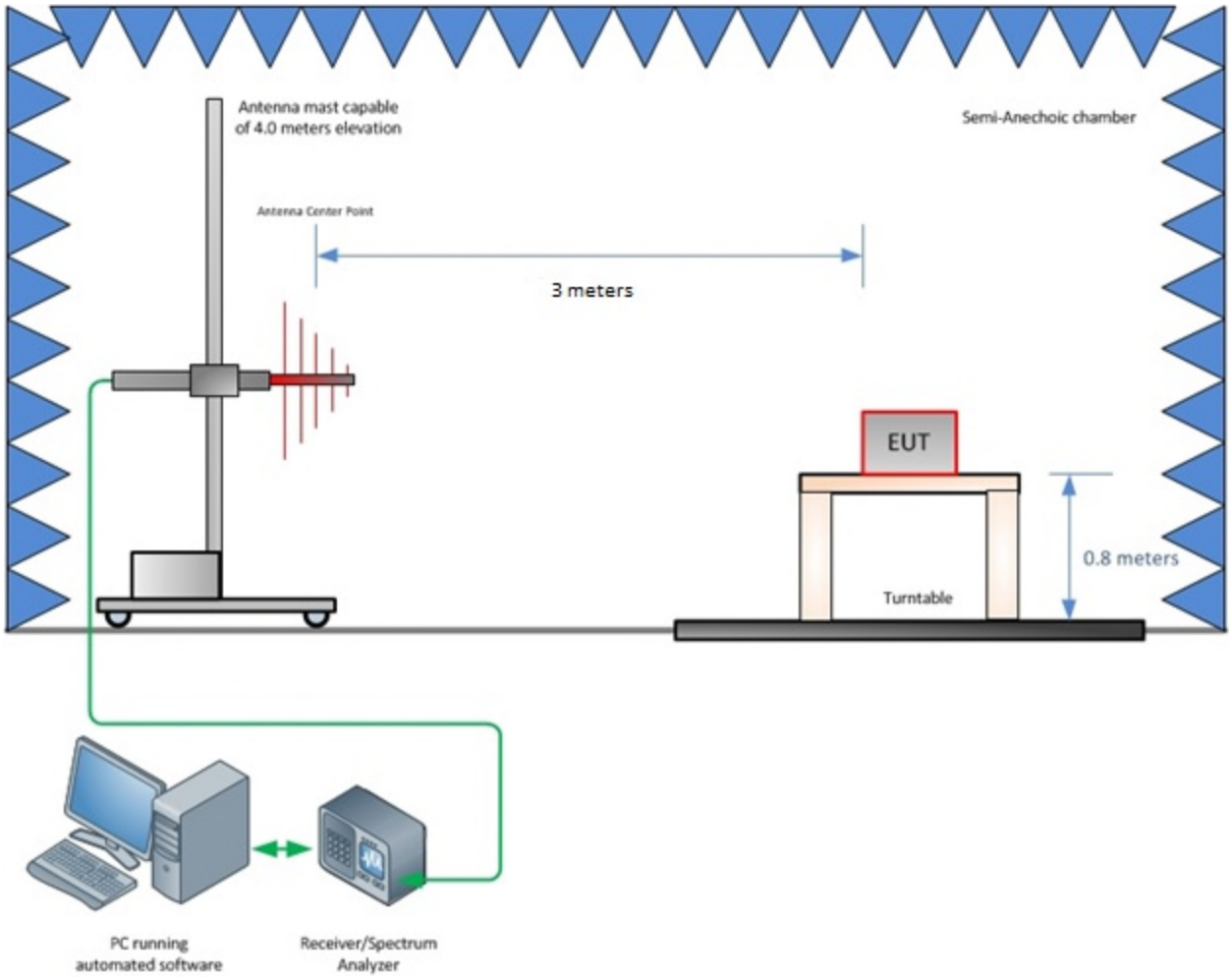


Figure 3-2 – Radiated Emissions Test Setup up to 1 GHz

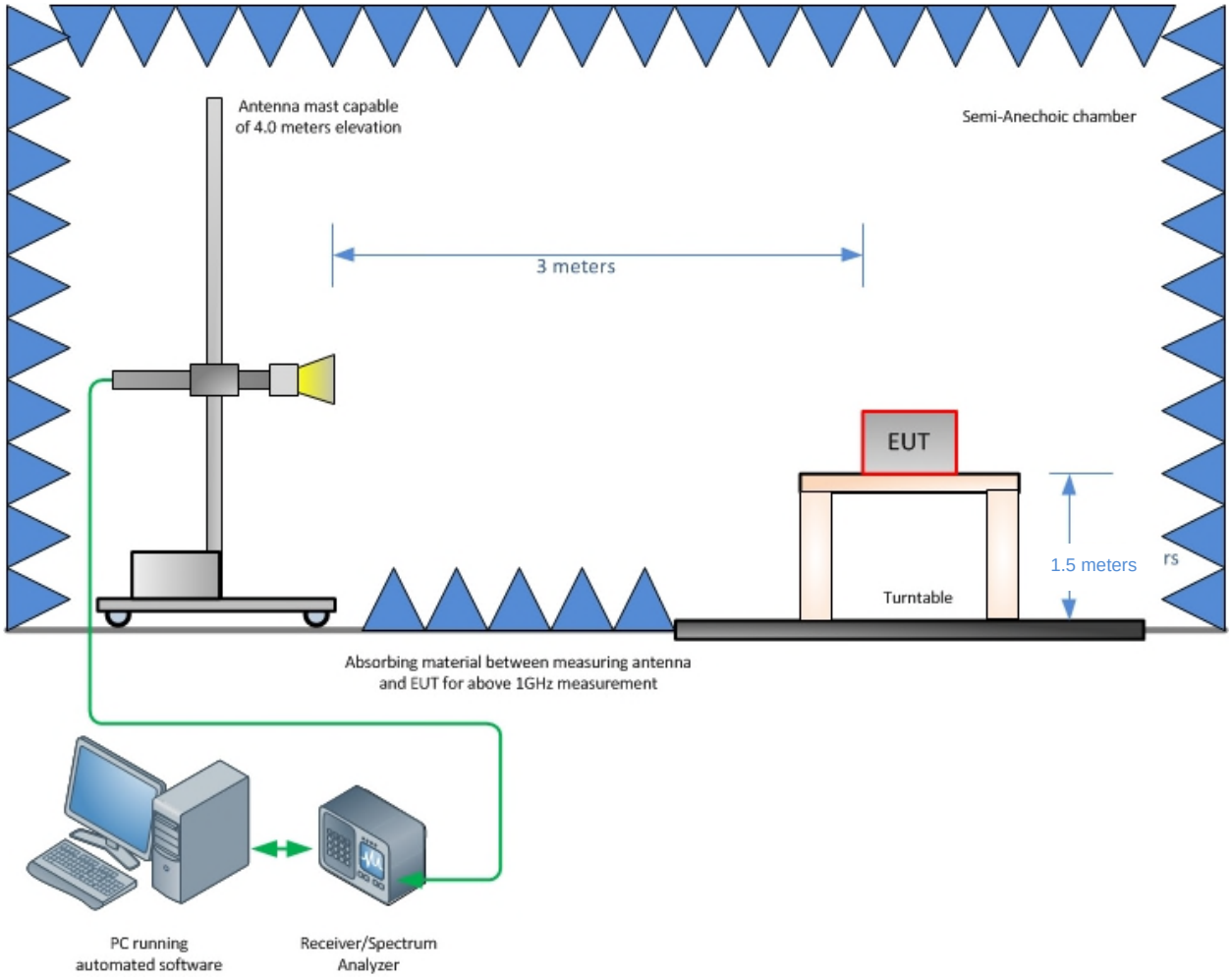


Figure 3-3 – Radiated Emissions Test Setup above 1 GHz

4 Accreditation, Disclaimers and Copyright

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STATEMENT OF MEASUREMENT UNCERTAINTY – Emissions

The test system for conducted emissions is defined as the LISN, tuned receiver or spectrum analyzer, and coaxial cable. This test system has a measurement uncertainty of ±3.30 dB. The test system for radiated emissions is defined as the antenna, the pre-amplifier, the spectrum analyzer and the coaxial cable. This test system for 30 MHz-1000 MHz has a measurement uncertainty of ±5.88 dB and above 1 GHz a measurement uncertainty of ±4.47 dB. The measurement uncertainty values for conducted and radiated emissions meet the requirements as expressed in CISPR 16-4-2. The equipment comprising the test systems is calibrated on an annual basis.

TEST EQUIPMENT

All measurement instrumentation is traceable to the National Institute of Standards and Technology and is calibrated to meet test method standard requirements and/or manufacturer's specifications

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