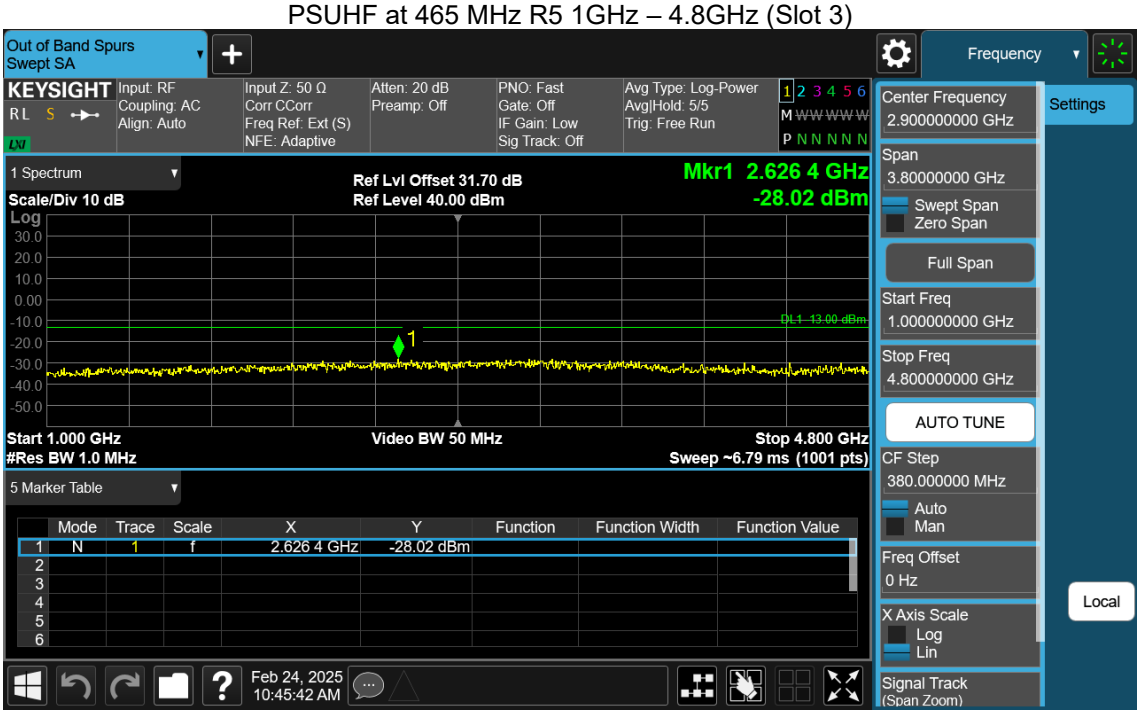
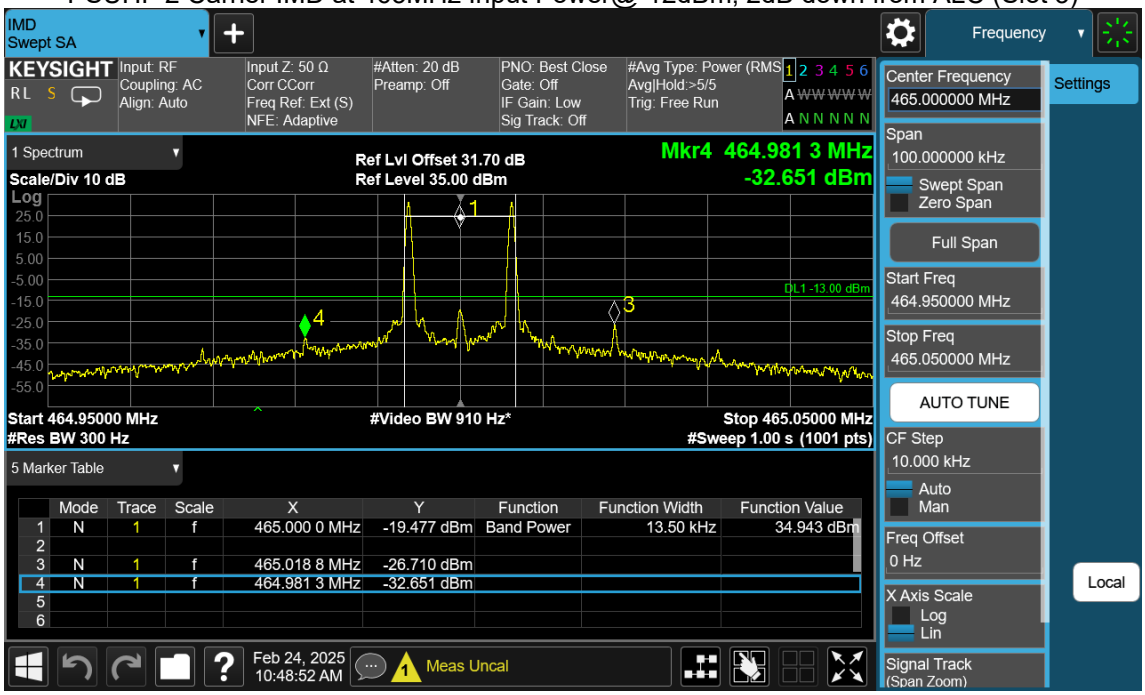
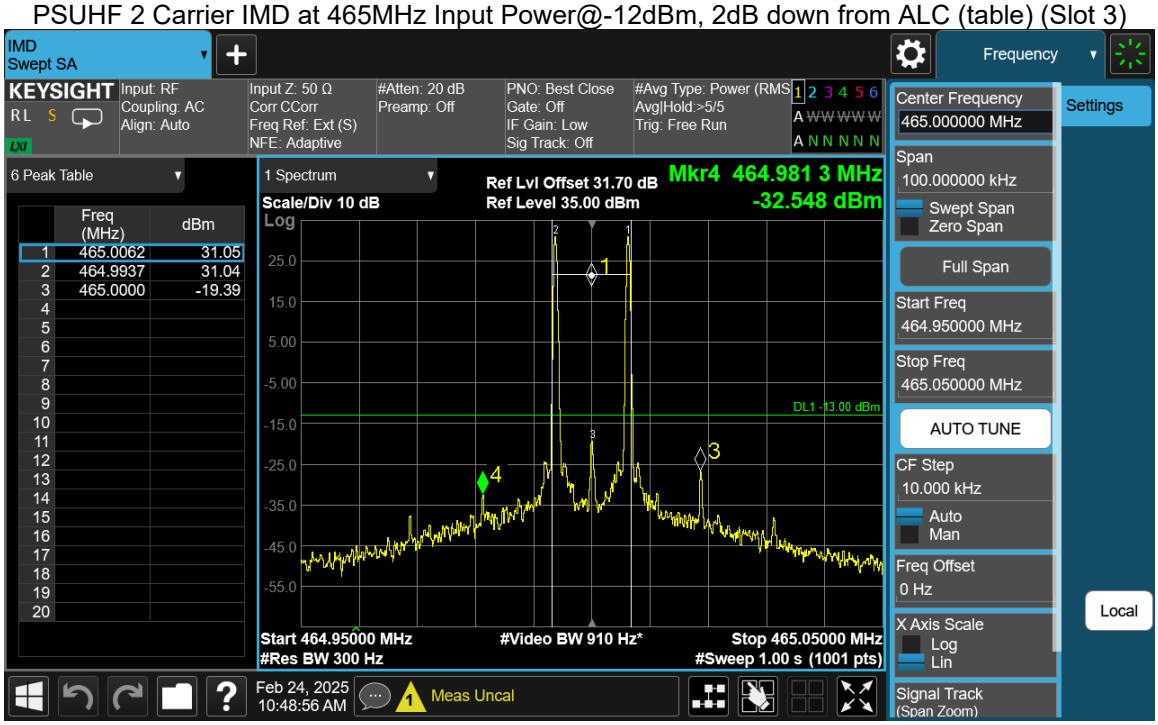
PSUHF at 465 MHz R5 1GHz – 4.8GHz (Slot 3)



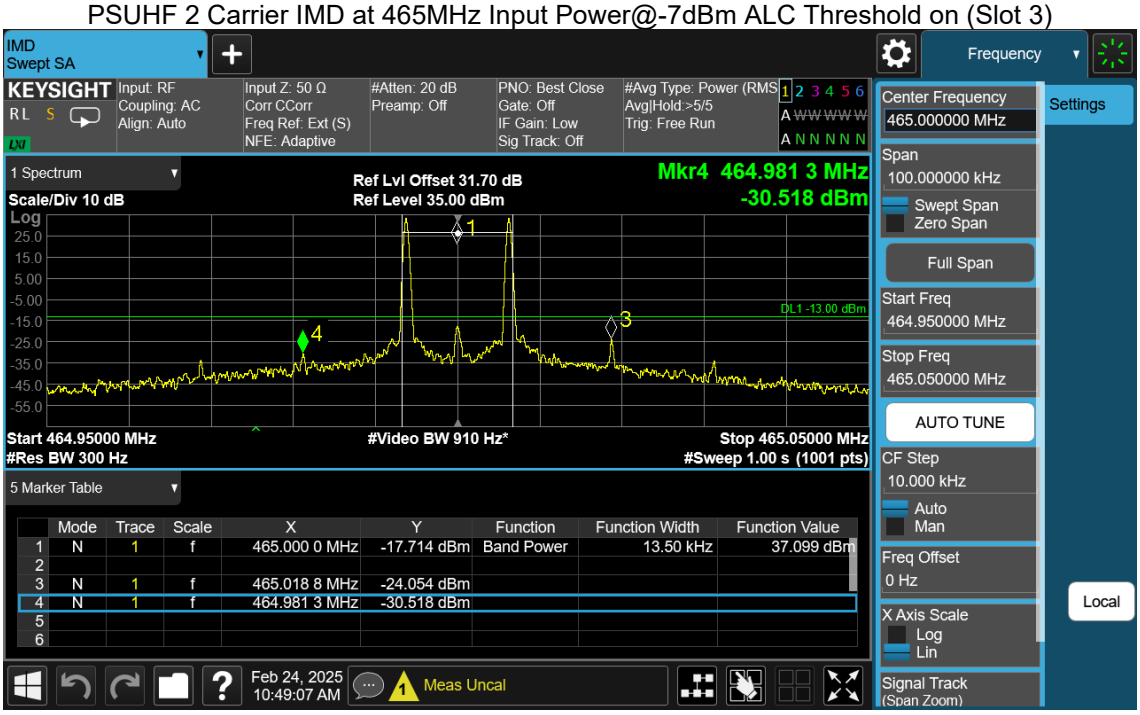
PSUHF 2 Carrier IMD at 465MHz Input Power@-12dBm, 2dB down from ALC (Slot 3)



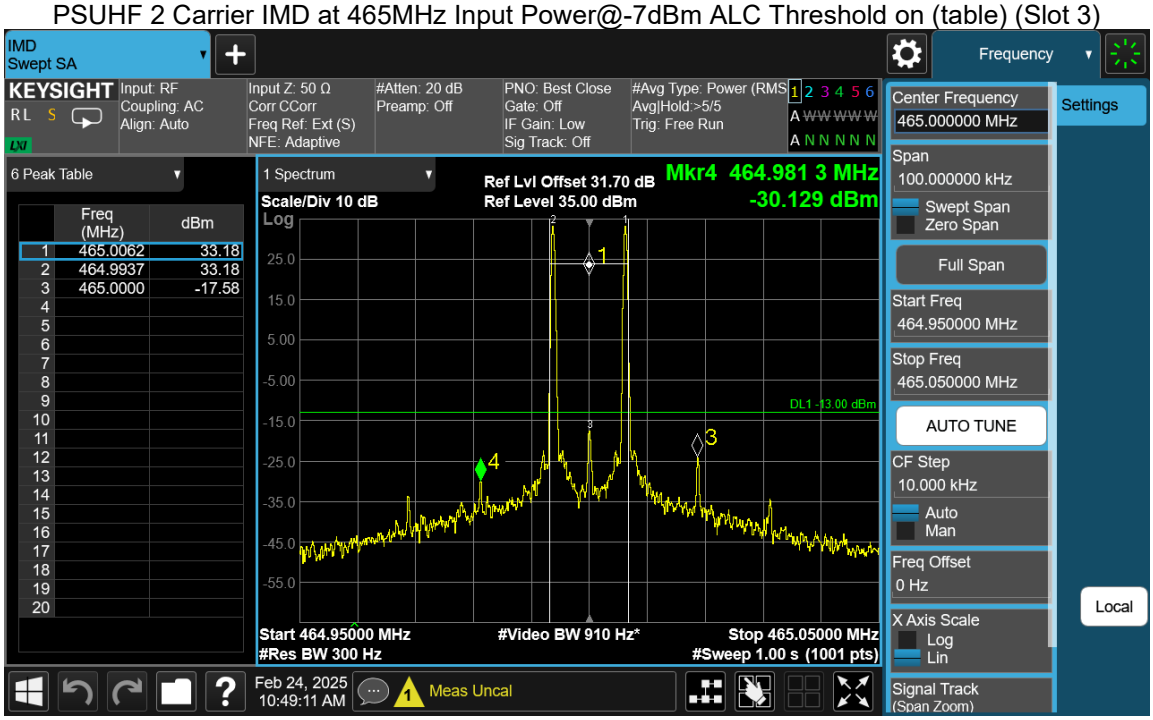
PSUHF 2 Carrier IMD at 465MHz Input Power@-12dBm, 2dB down from ALC (table) (Slot 3)



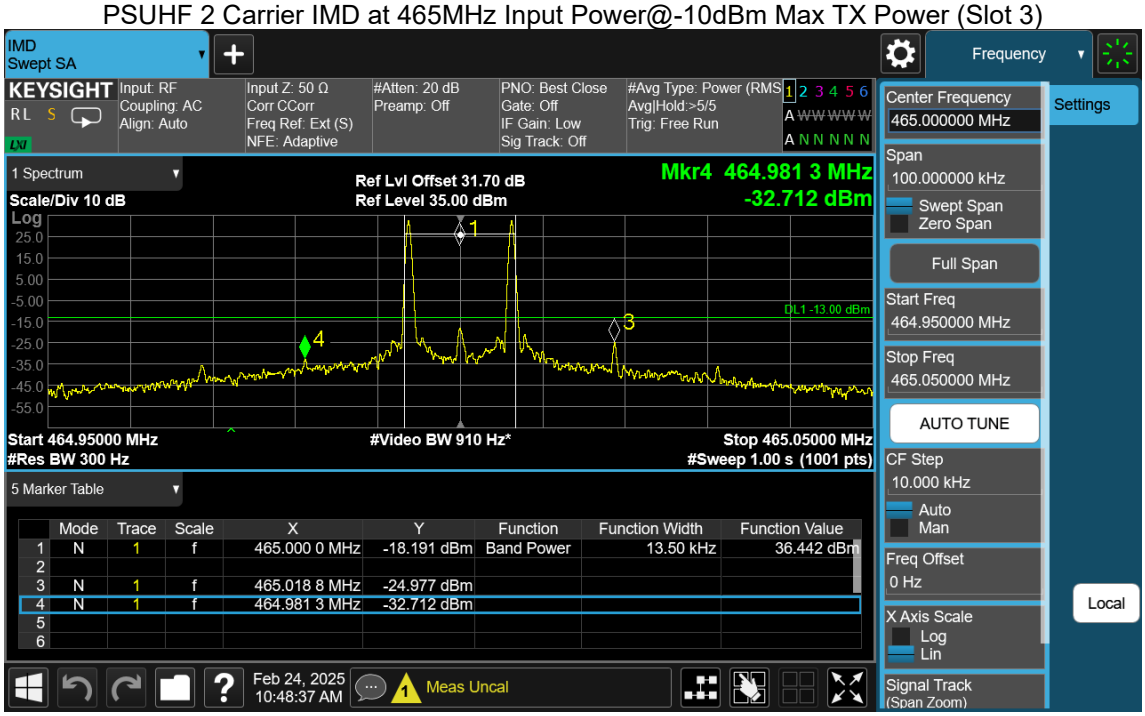
PSUHF 2 Carrier IMD at 465MHz Input Power@-7dBm ALC Threshold on (Slot 3)



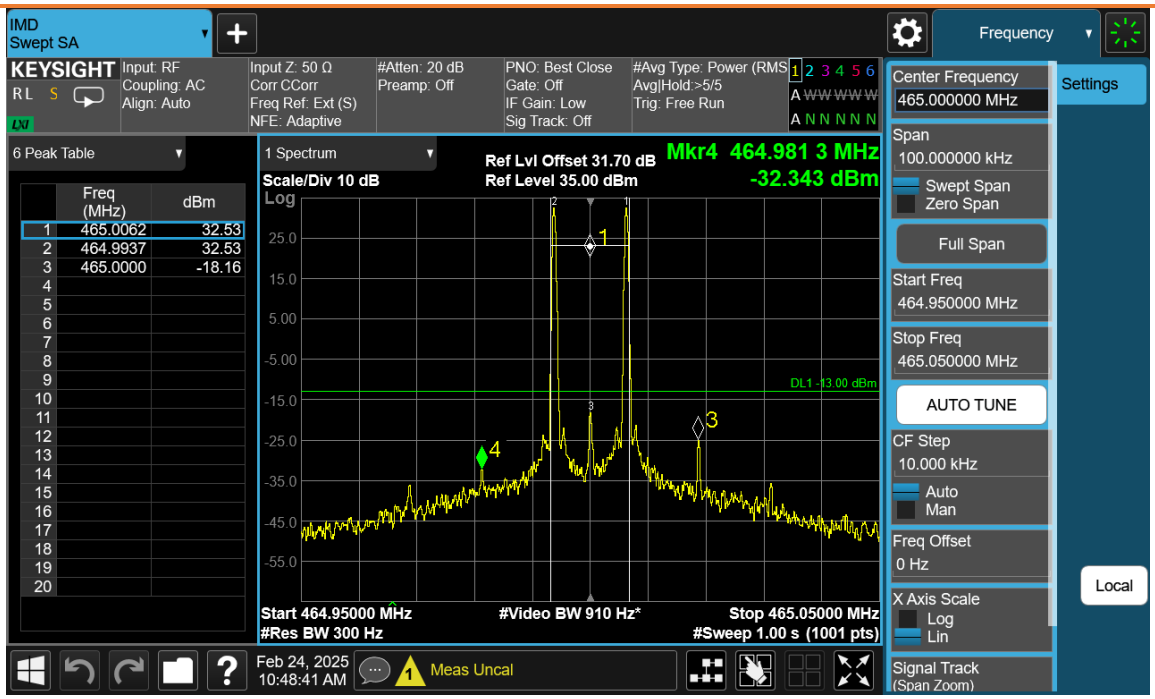
PSUHF 2 Carrier IMD at 465MHz Input Power@-7dBm ALC Threshold on (table) (Slot 3)



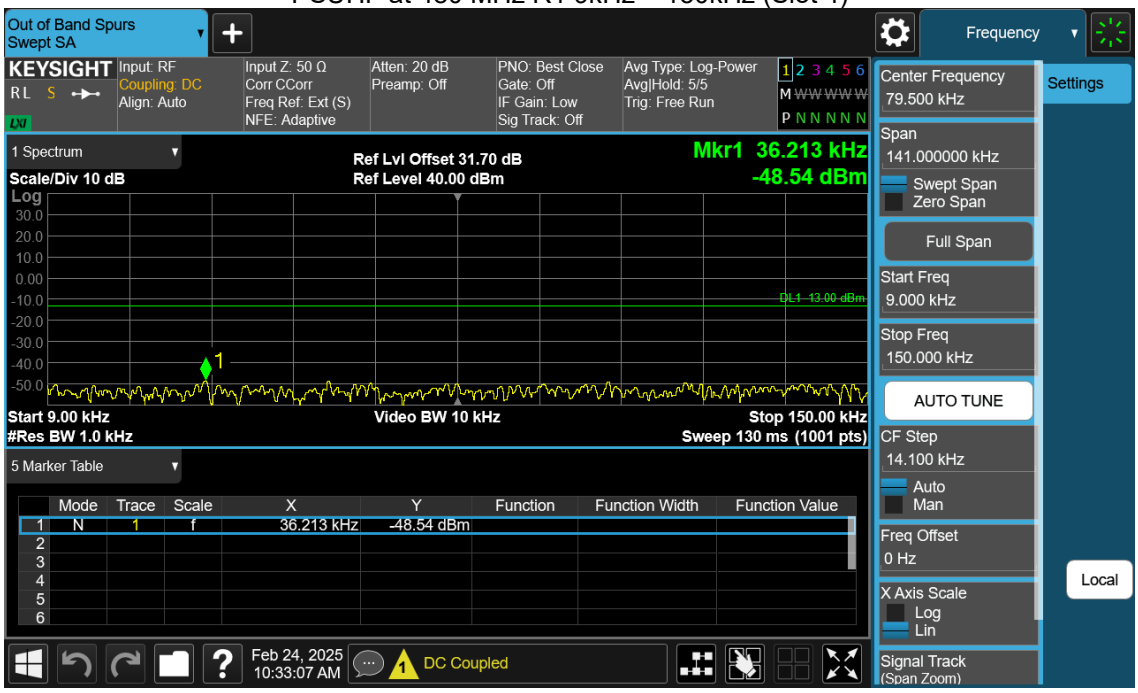
PSUHF 2 Carrier IMD at 465MHz Input Power@-10dBm Max TX Power (Slot 3)



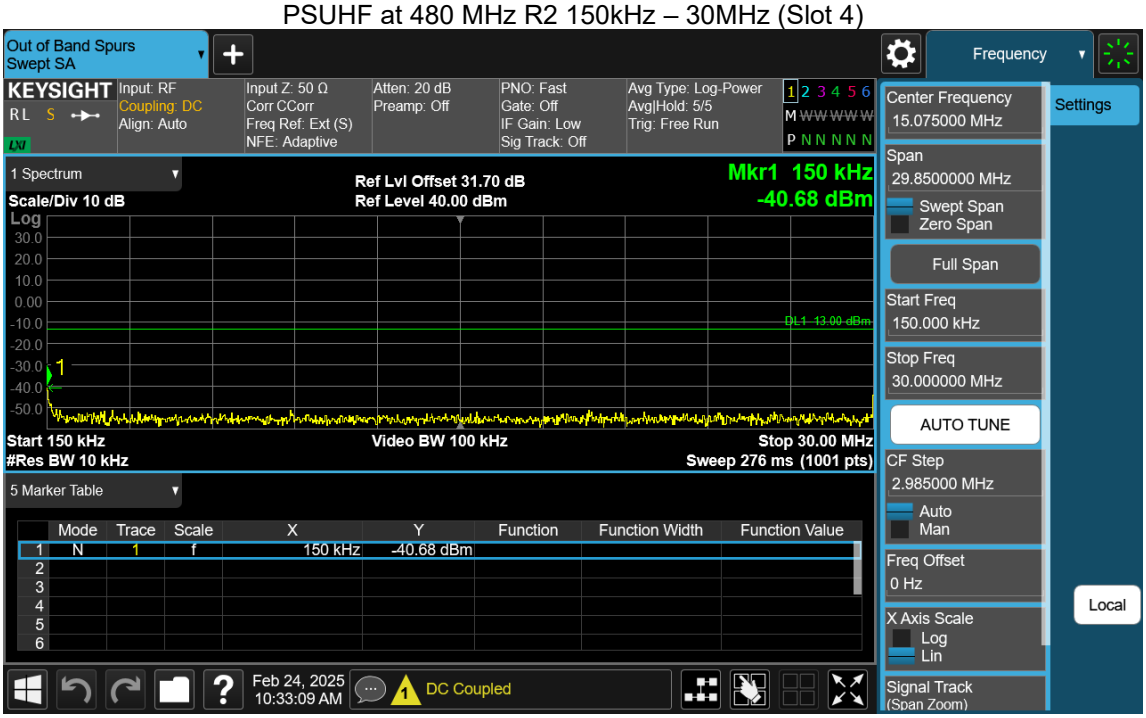
PSUHF 2 Carrier IMD at 465MHz Input Power@-10dBm Max TX Power (table) (Slot 3)



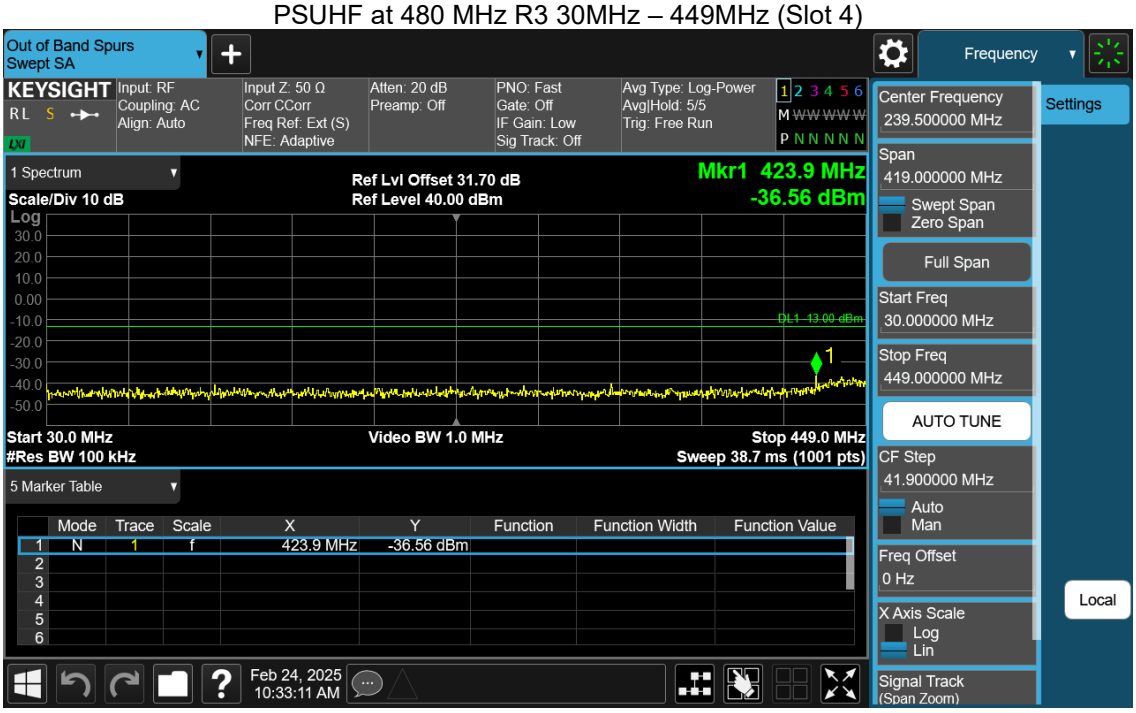
PSUHF at 480 MHz R1 9kHz – 150kHz (Slot 4)



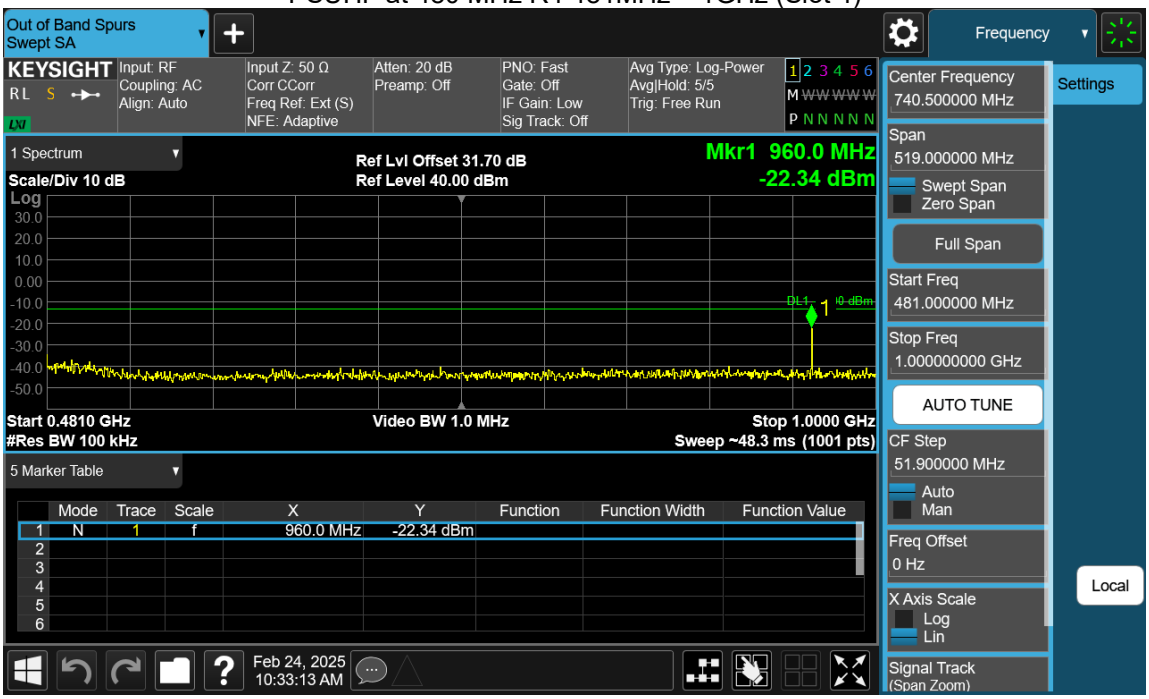
PSUHF at 480 MHz R2 150kHz – 30MHz (Slot 4)



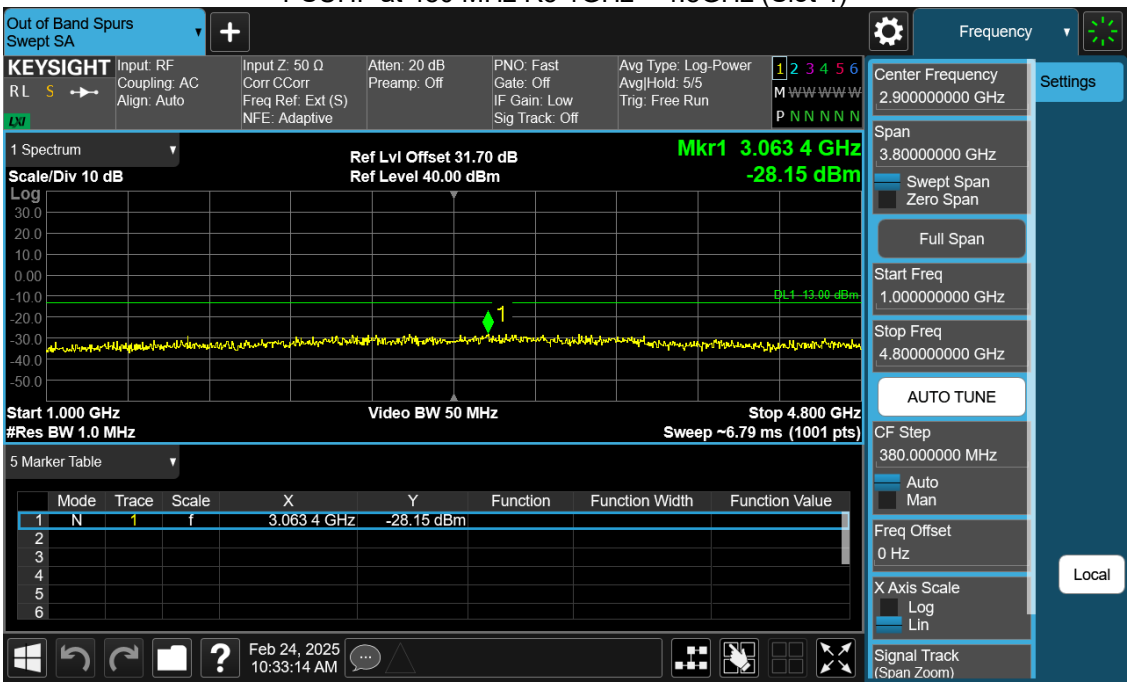
PSUHF at 480 MHz R3 30MHz – 449MHz (Slot 4)



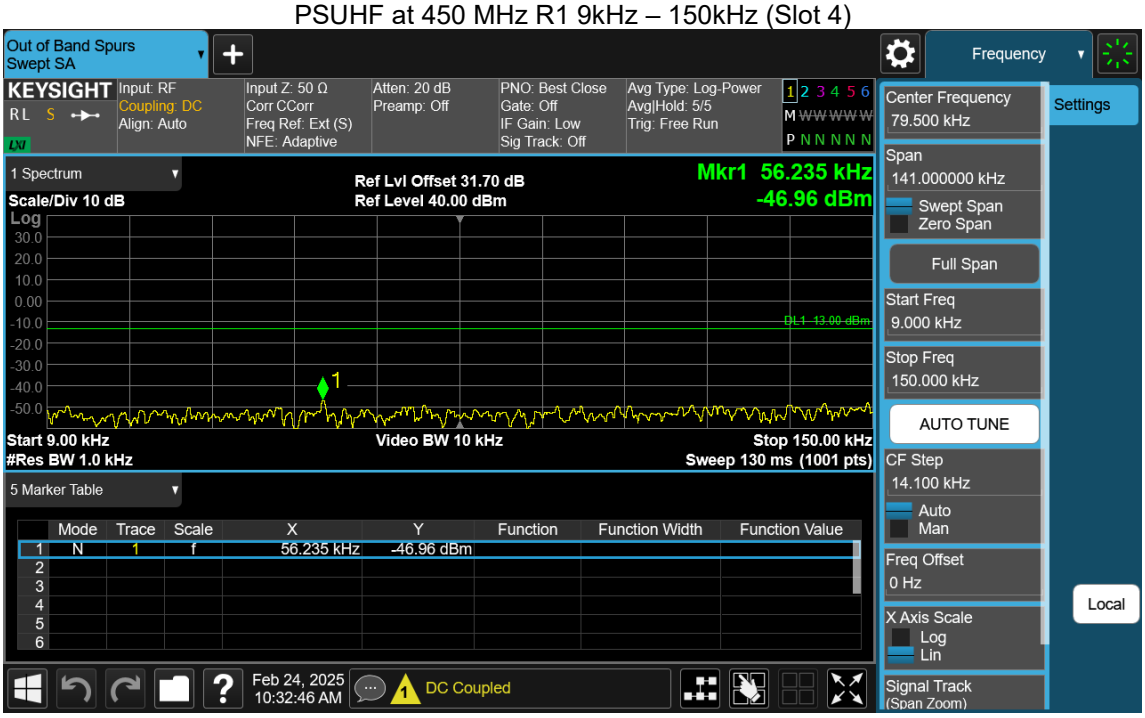
PSUHF at 480 MHz R4 481MHz – 1GHz (Slot 4)



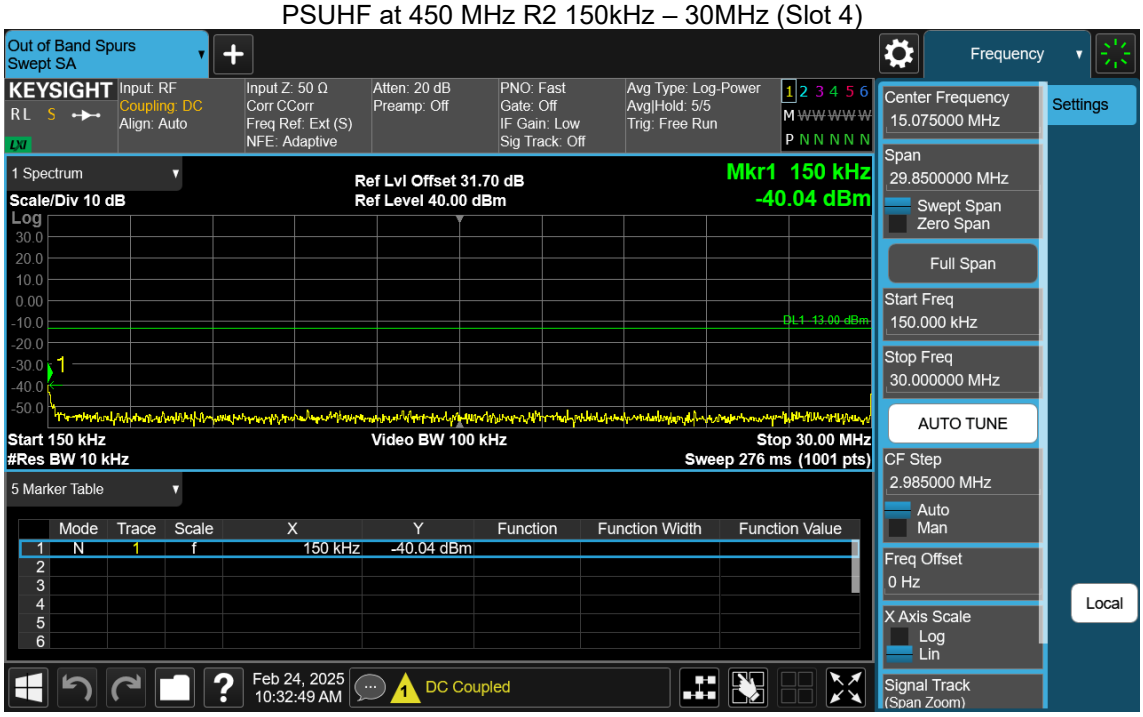
PSUHF at 480 MHz R5 1GHz – 4.8GHz (Slot 4)



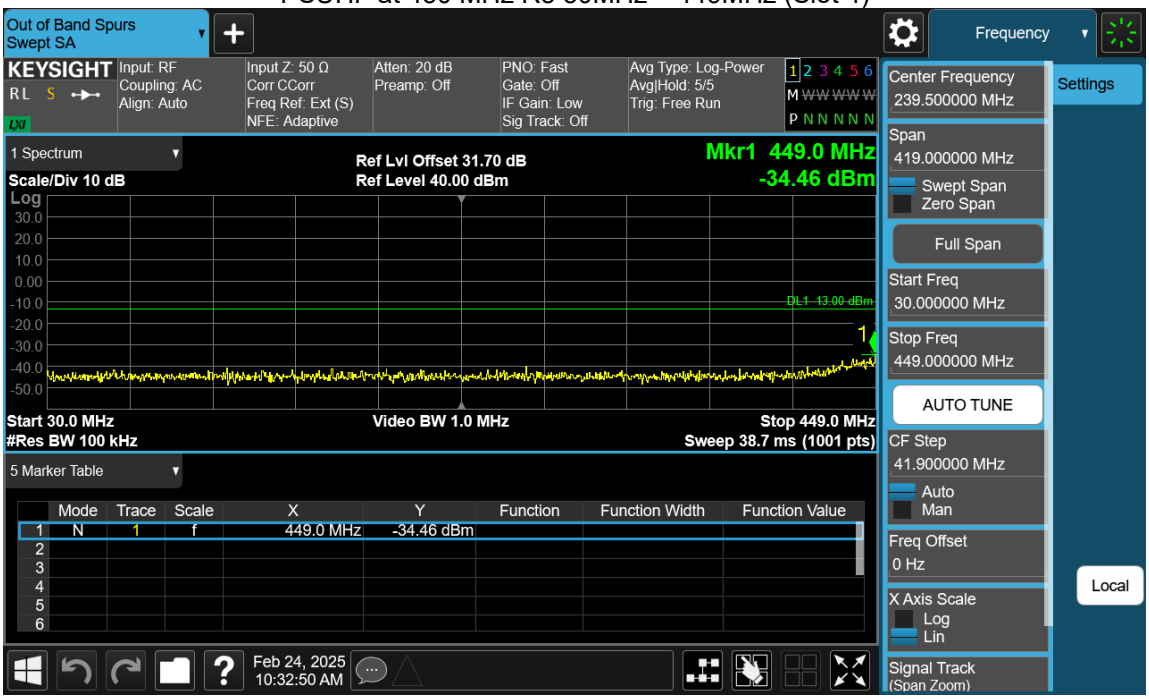
PSUHF at 450 MHz R1 9kHz – 150kHz (Slot 4)



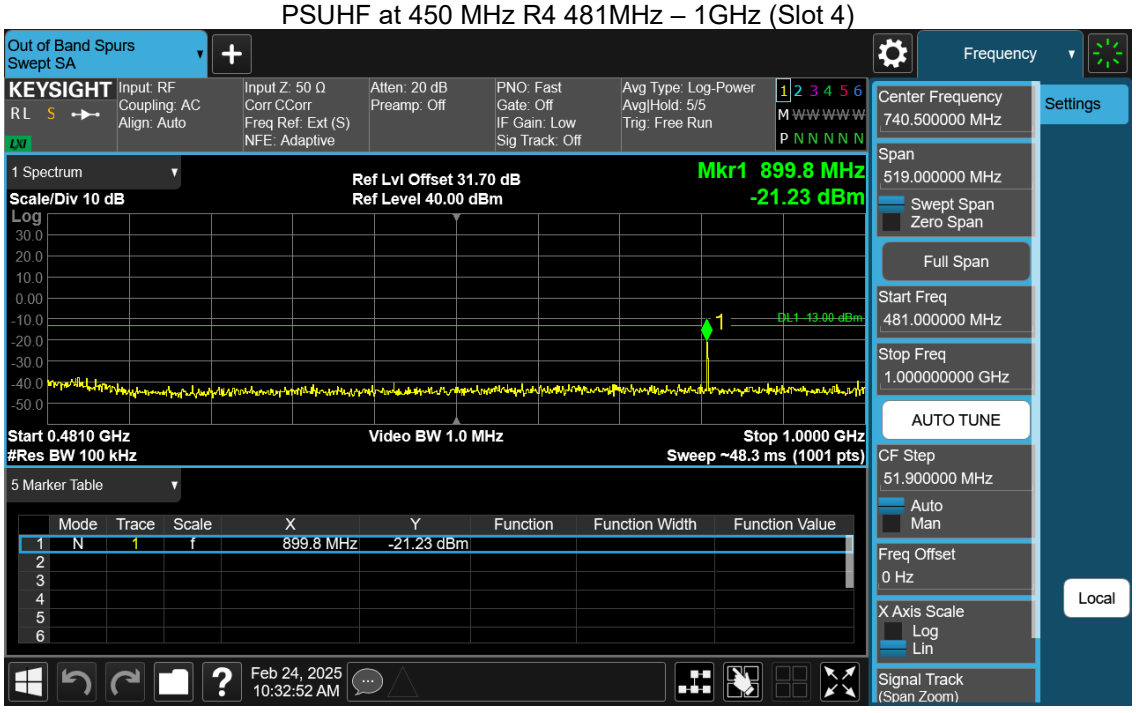
PSUHF at 450 MHz R2 150kHz – 30MHz (Slot 4)



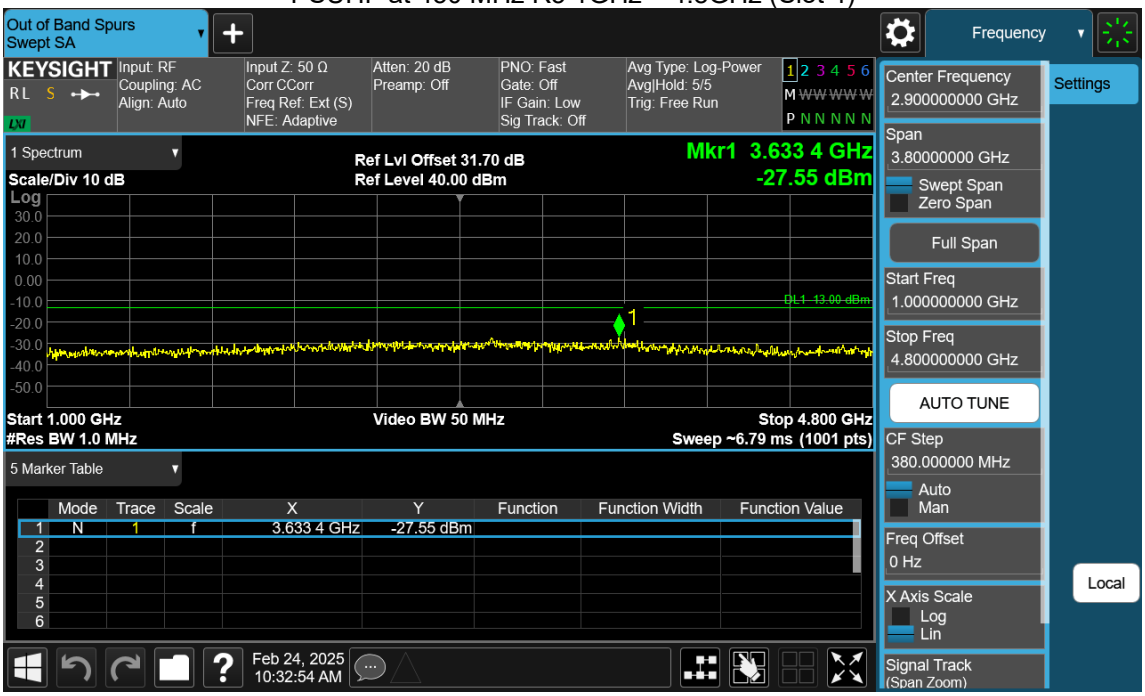
PSUHF at 450 MHz R3 30MHz – 449MHz (Slot 4)



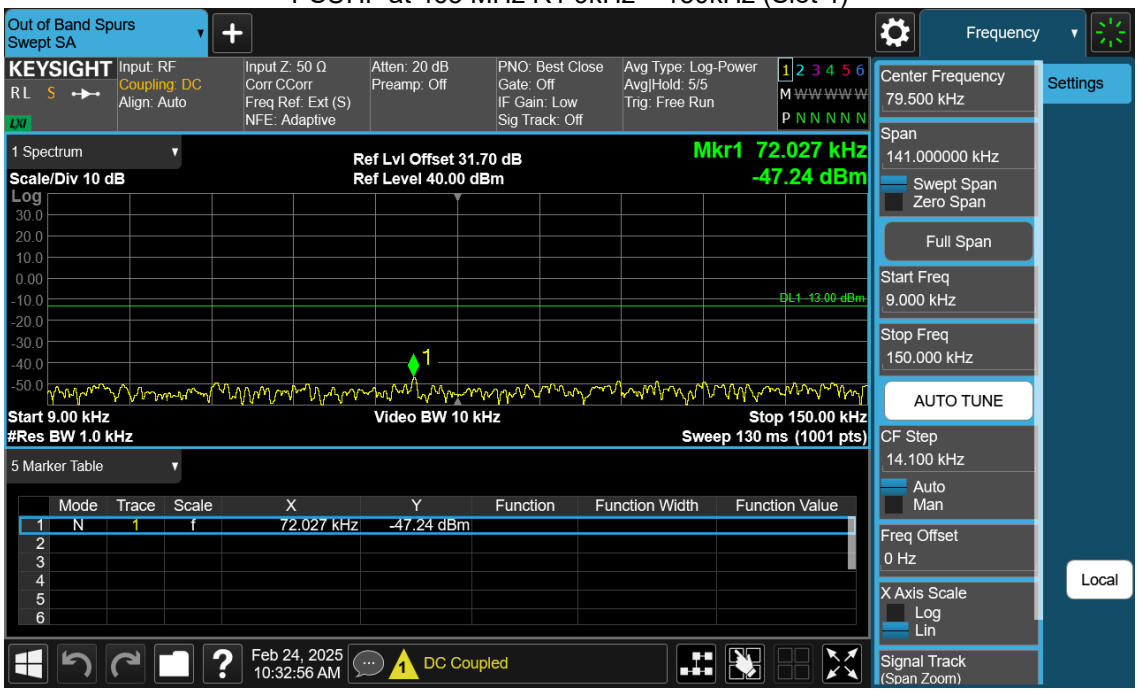
PSUHF at 450 MHz R4 481MHz – 1GHz (Slot 4)



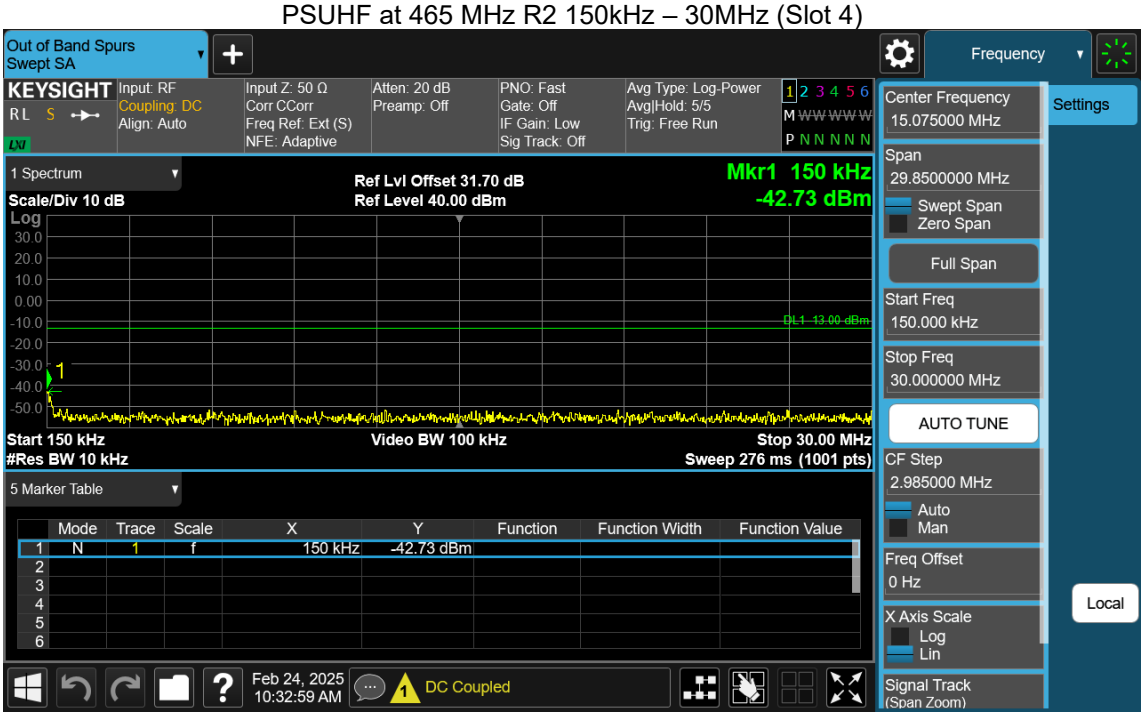
PSUHF at 450 MHz R5 1GHz – 4.8GHz (Slot 4)



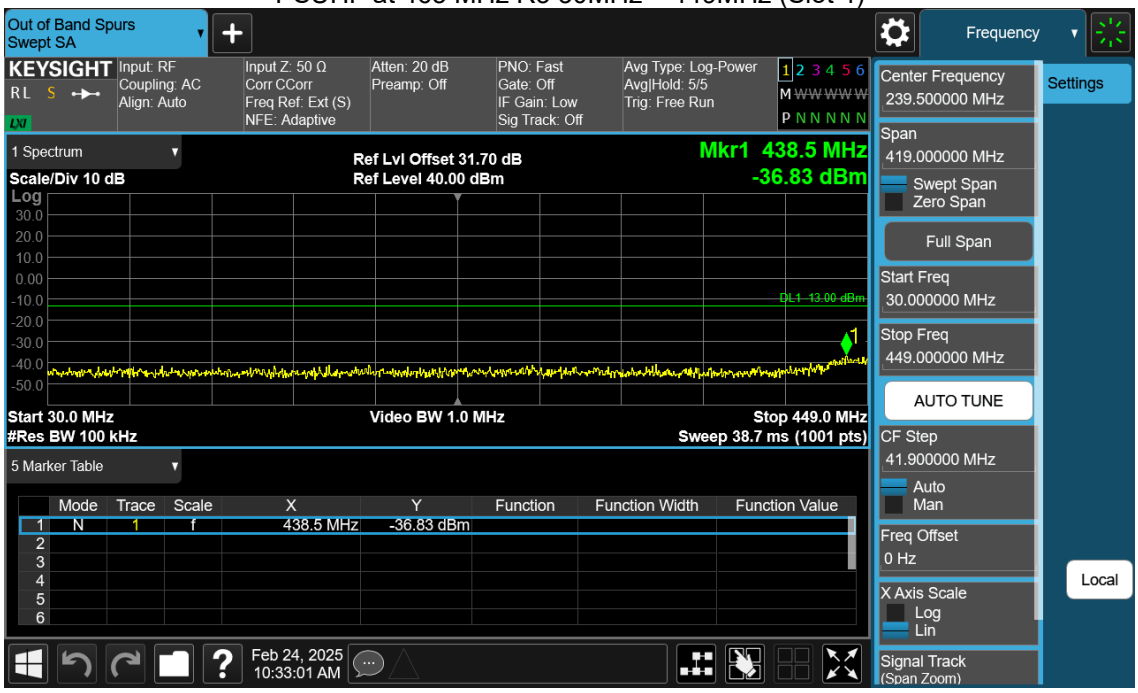
PSUHF at 465 MHz R1 9kHz – 150kHz (Slot 4)



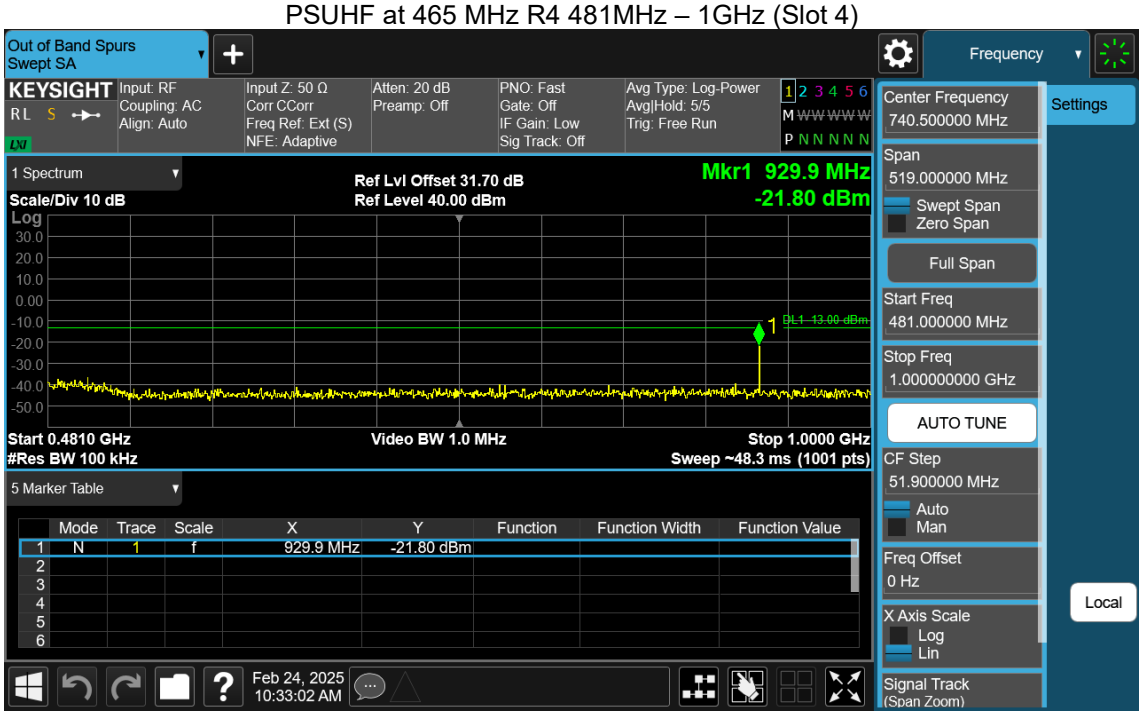
PSUHF at 465 MHz R2 150kHz – 30MHz (Slot 4)



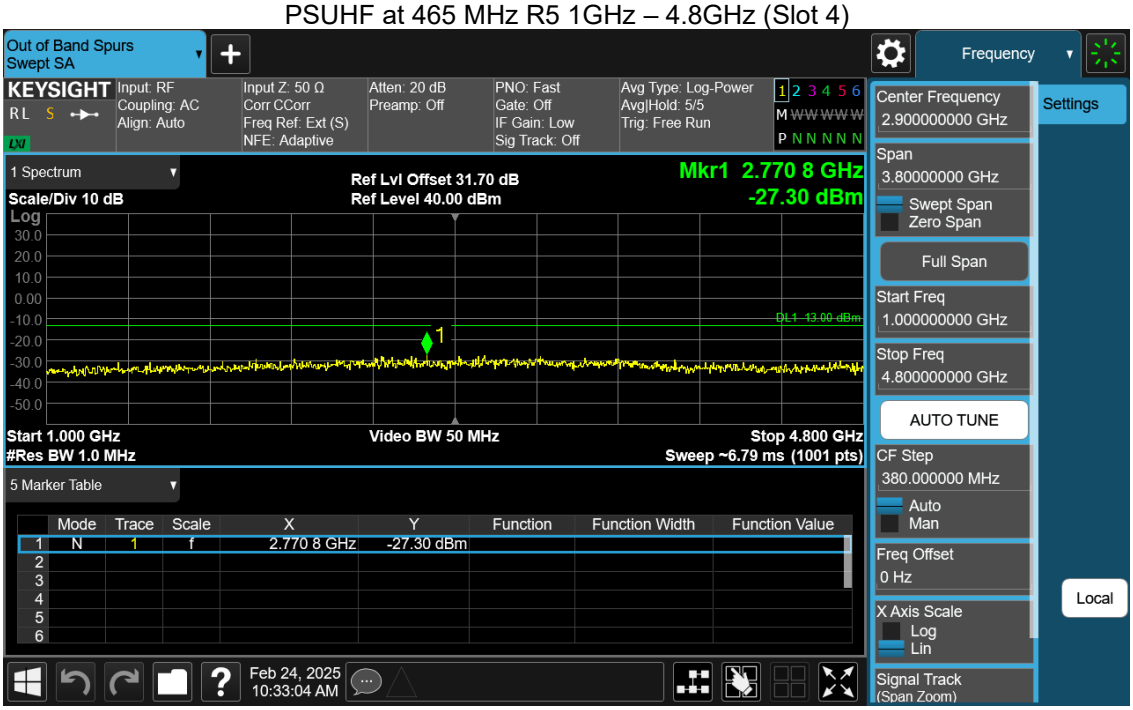
PSUHF at 465 MHz R3 30MHz – 449MHz (Slot 4)



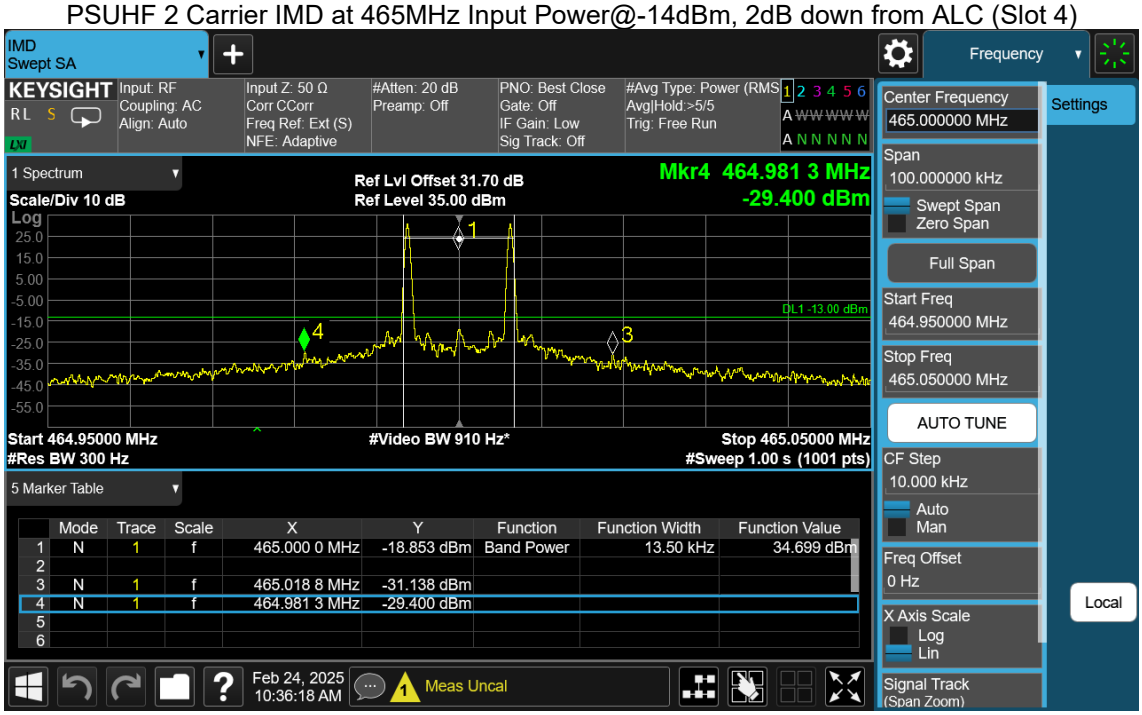
PSUHF at 465 MHz R4 481MHz – 1GHz (Slot 4)



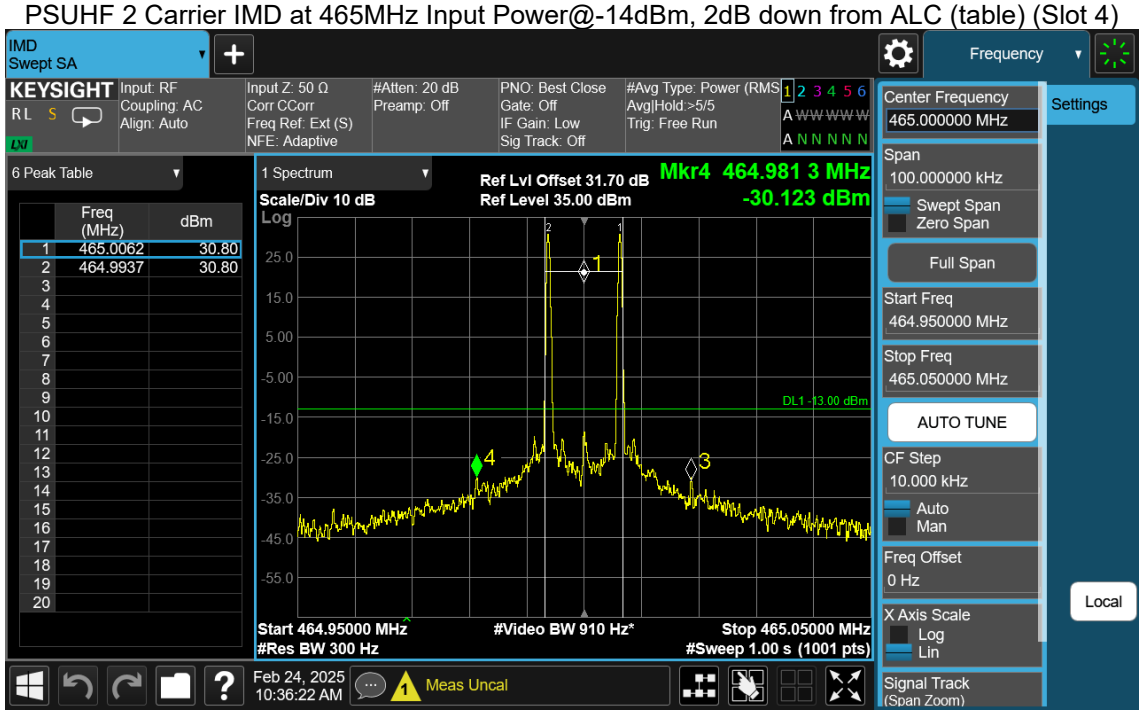
PSUHF at 465 MHz R5 1GHz – 4.8GHz (Slot 4)



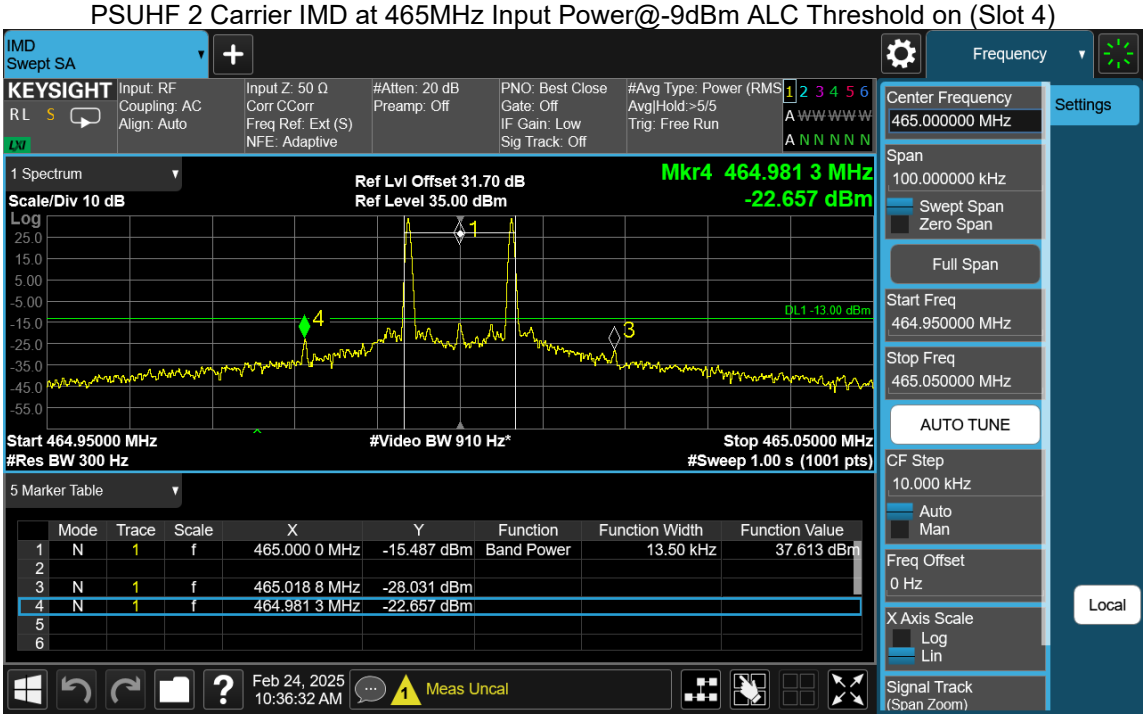
PSUHF 2 Carrier IMD at 465MHz Input Power@-14dBm, 2dB down from ALC (Slot 4)



PSUHF 2 Carrier IMD at 465MHz Input Power@-14dBm, 2dB down from ALC (table) (Slot 4)

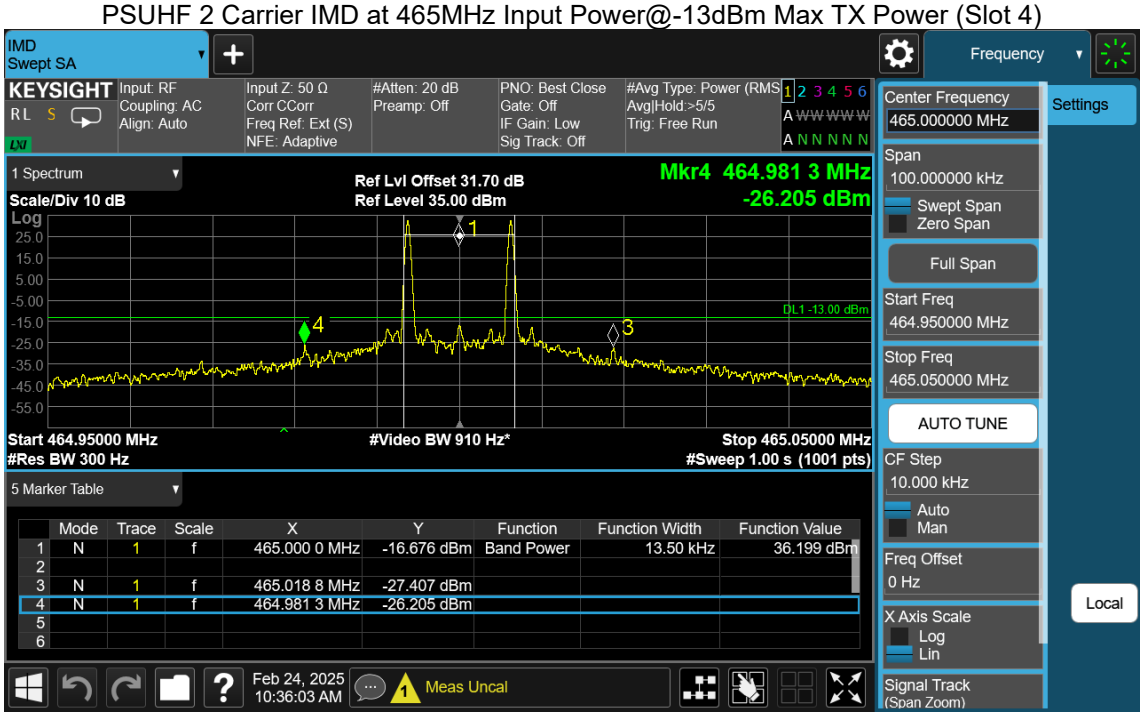


PSUHF 2 Carrier IMD at 465MHz Input Power@-9dBm ALC Threshold on (Slot 4)

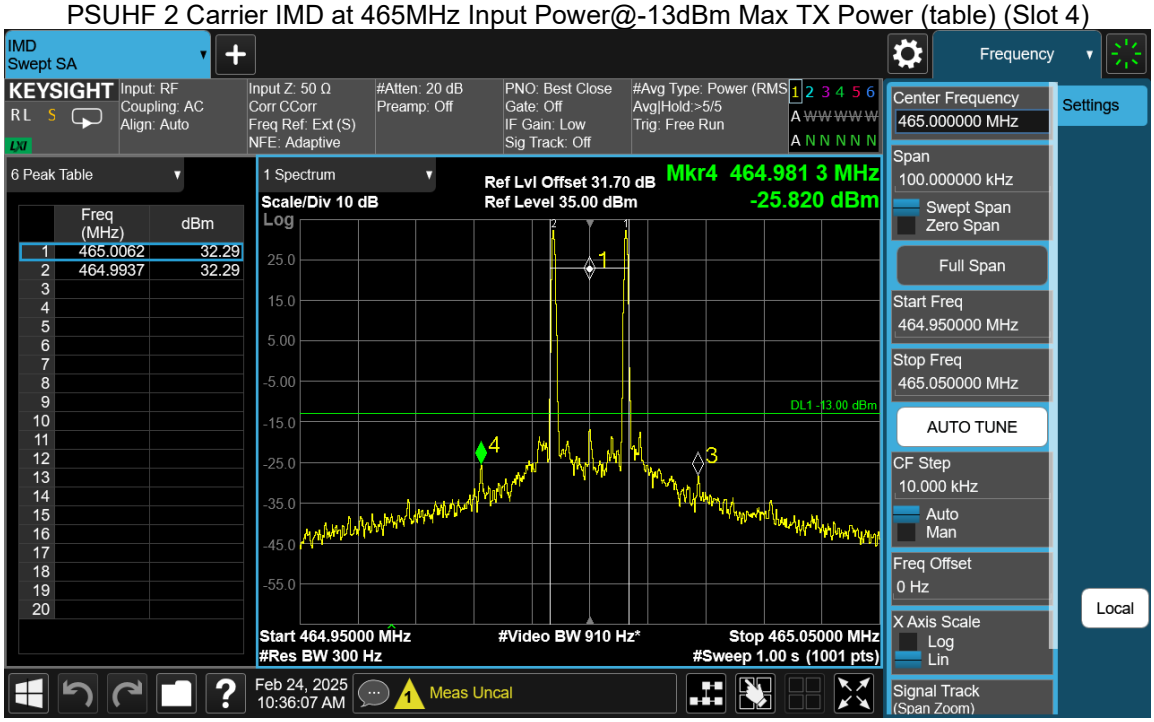


PSUHF 2 Carrier IMD at 465MHz Input Power@-9dBm ALC Threshold on (table) (Slot 4)

PSUHF 2 Carrier IMD at 465MHz Input Power@-13dBm Max TX Power (Slot 4)



PSUHF 2 Carrier IMD at 465MHz Input Power@-13dBm Max TX Power (table) (Slot 4)



7. Noise Figure

Governing Doc	RSS-119, Issue 12 2015, Amendment (April 1, 2022) RSS-Gen, Issue 5 2018 FCC Part 90	Room Temperature (°C)	20.5
Test Procedure	ANSI C63.26-2015, Section 7.2.3.5 KDB 935210 D05, v01r04, Clause 4.6	Relative Humidity (%)	38.6
Test Location	Richmond	Barometric Pressure (kPa)	101.8
Test Engineer	Jack Qin	Date	February 24, 2025
EUT Voltage	☒ +48VDC	☐ 120VAC @ 60Hz	

Test Equipment	Manufacturer	Model	Serial Number	Calibration date	Calibration due
Signal Generator	Keysight	N5172B	MY53050270	Dec 12, 2023	Dec 12, 2026
Spectrum	Keysight	N9020B	MY62153079	Oct 25, 2023	Aug 1, 2025

Frequency Range:	☒ 2 times of the passband on each band
Detector:	☒ Average
RBW:	☒910 kHz
Type of Facility:	☒ Tabletop
Distance:	☒ Direct

Noise Figure on each band is less than the 9 dB required.

Compliant ☒ Non-Compliant ☐ Not Applicable ☐

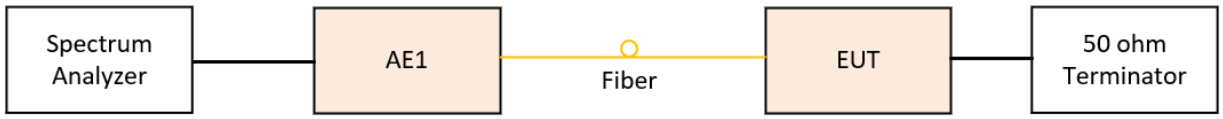
Test setup

Based on FCC KDB 935210 D05 Indus Booster Basic Meas v01r03: 2019, the system maximum gain and the noise density is measured. Measurements were performed within the EUT's passband.

The noise figure is then calculated by NF = NP – Gain + KTB Noise; where NP is in band noise power per Herz,

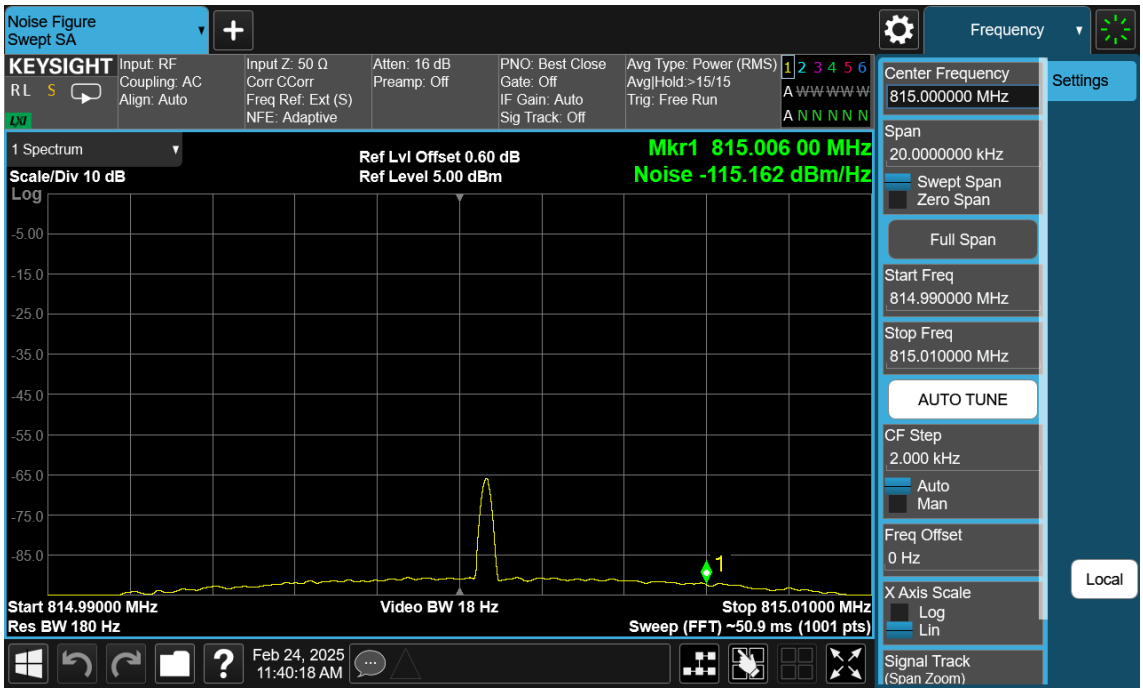
Gain is measured at the maximum noise frequence with -55 dBm input signal in UL. KTB Noise is 174dB/Hz.

The EUT was set to **Operation Mode #1 with configuration Mode #1.**

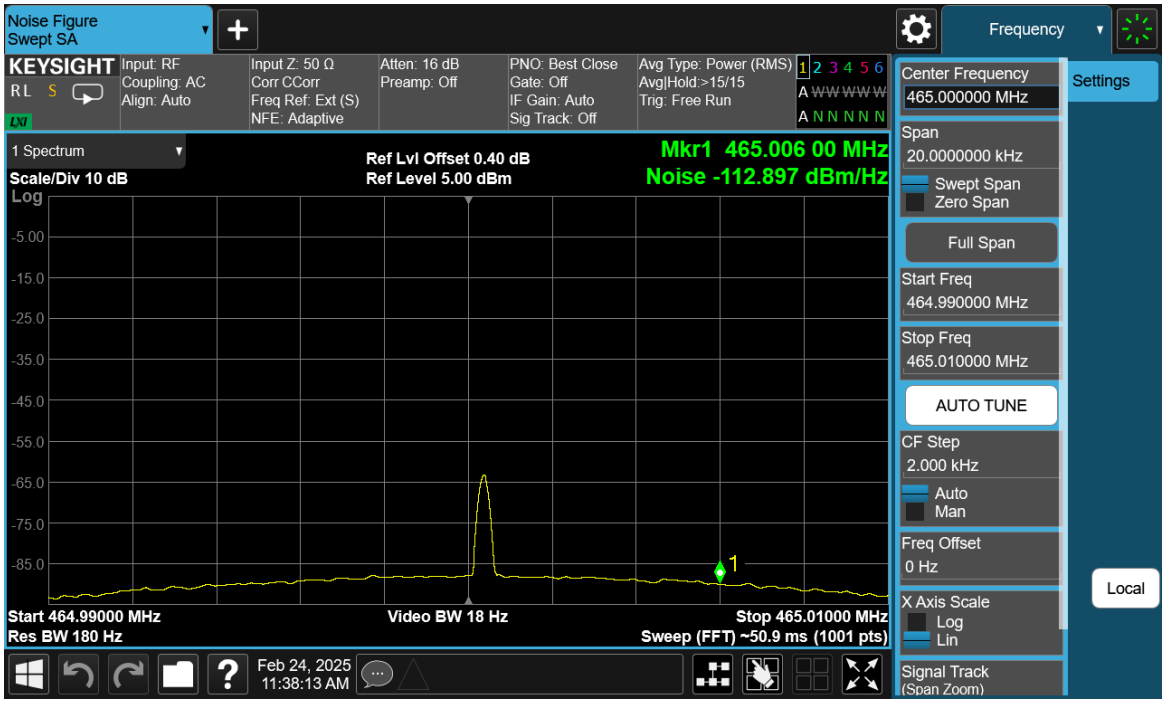


Test results

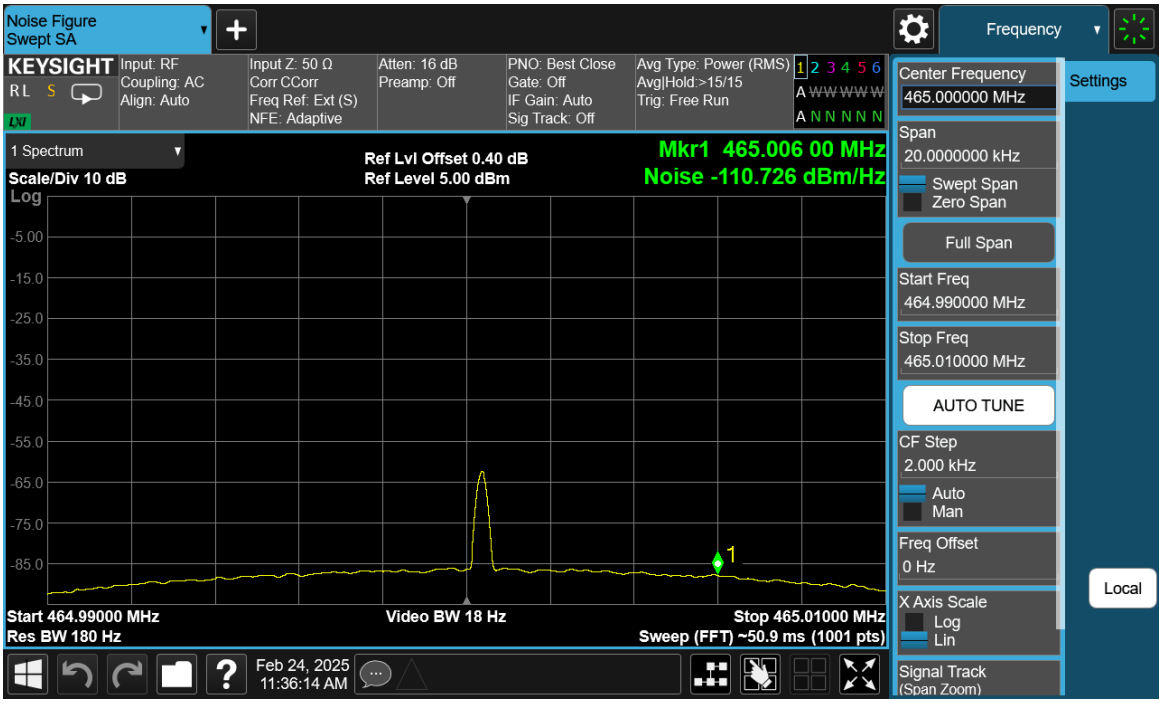
Test Band	Gain (dB)	kTB (dBm/Hz)	Measured Value (dBm/Hz)	Noise Figure (dB)
PSUHF	57.2	174	-110.7	6.09
PSUHF	55.7	174	-112.4	5.9
PS800	54.6	174	-115.1	4.32



800PS



PSUHF 1



PSUHF 2

8. Frequency Stability

The DMU and RU37 are synchronized to the same reference clock. Therefore, there is no frequency error after down and up frequency conversion are performed.

The frequency stability check is not applicable to the EUT.

9. Radiated Spurious Emissions – Enclosure 9 kHz – 30 MHz

Standard	RSS-119, Issue 12 2015, Amendment (April 1, 2022) RSS-Gen, Issue 5 2018 FCC Part 90 FCC Part 2.1053
Test method	ANSI C63.26-2015, Section 5.5 KDB 935210 D05, v01r04, Clause 3.8, 4.9
Tested by	Jack Qin
Test date	2025-02-24
Test location	Richmond lab, stand #2

Applied limit

Radiated Emission FCC/ISED	
Frequency	**Field strength (microvolts/meter)**
9 - 490 kHz	2400/F(kHz) at 300 m
490 - 1705 kHz	24000/F(kHz) at 30 m
1.705 - 30 MHz	30 at 30 m
Note 1. The lower limit shall apply at the transition frequency Note 2. Additional provisions may be required for cases where interference occurs Note 3: The emission limits for the ranges 9-90 kHz and 110-490 kHz are based on measurements employing a linear average detector.	

RSS – Gen, Clause 8.10 Restricted frequency bands

a. The transmit frequency, including fundamental components of modulation, of licence-exempt radio apparatus shall not fall within the restricted frequency bands listed in table 7.
b. Unwanted emissions that fall into restricted frequency bands listed in table 7 shall comply with the limits specified in the above table.
c. Unwanted emissions that do not fall within the restricted frequency bands listed in table 7 shall comply either with the limits specified in the applicable RSS or with those specified in the above table.

Test set-up description	☒	Equipment on a table of 80 cm height
	☐	Equipment on the floor (insulated from ground plane)
	☐	Other:
Test method applied	☒	SAC with measurement distance [m]: ☒3 ☐10
	☐	FAR CISPR 16-2-3 with measurement distance [m]: 3
	☐	FAR IEC 61000-4-22 with measurement distance [m]: 3
	☐	TEM Waveguide according to IEC 61000-4-20

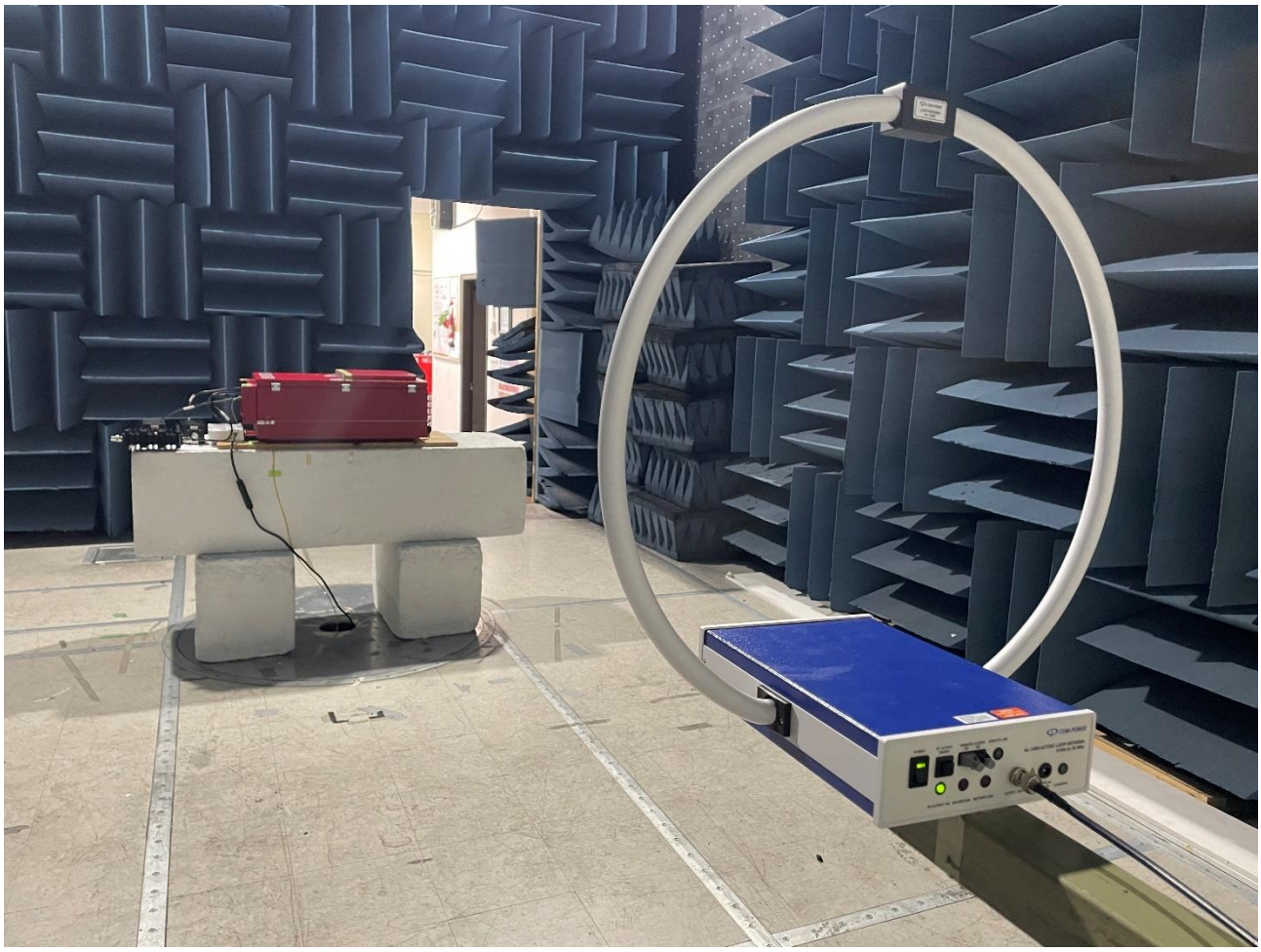
Compliant ☒ Non-Compliant ☐ Not Applicable ☐

Test Method

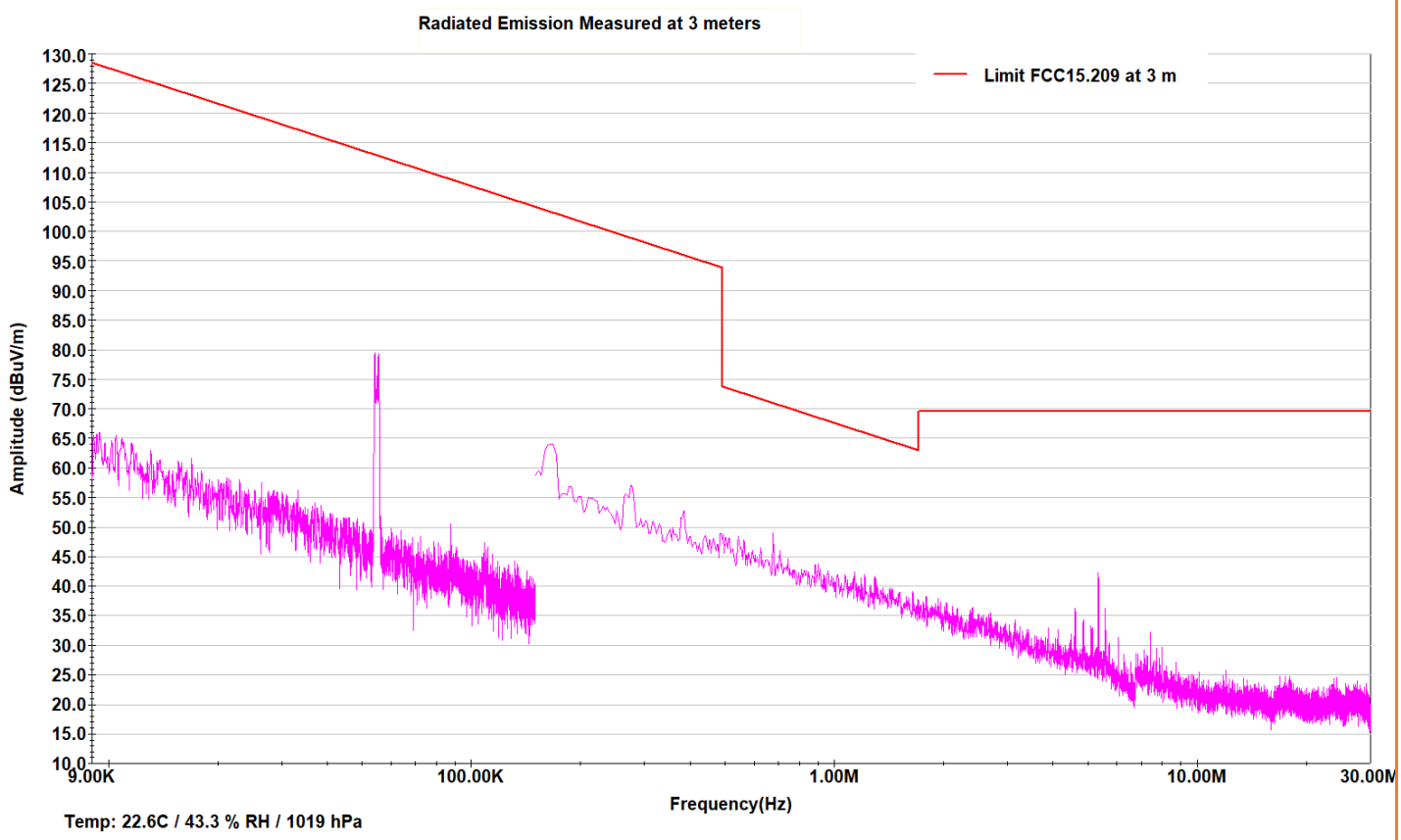
This test measures the radiating levels from the EUT, thus evaluating the potential for the EUT to cause radio frequency interference to other electronic devices. Testing was performed in accordance with the test standard(s) referenced in the test summary section of this report. The Equipment Under Test (EUT) was configured based upon the requirements of the applicable test standard. Initially, the primary emission frequencies are identified by positioning a broadband receive antenna three meter from the EUT.

A scan was made with an EMC Analyzer, controlled by EMC Test Software, Tile7! with the receiver in the peak mode. To ensure that the maximum emission at each discrete frequency of interest is observed, the receive antenna is varied in height from one to four meters with both horizontal and vertical polarities while the turntable is rotated to determine the worst emitting configuration. Measurements were then made using CISPR quasi peak when the peak readings were within 20dB of the limit line. The numerical results are included herein to demonstrate compliance.

Test Setup



Test result



Note: No Qpeak measurements were conducted when the emission was identified as either ambient noise or 20 dB, or more, below the limit line.

10. Radiated Spurious Emissions – Enclosure 30 MHz – 1 GHz

Standard	RSS-119, Issue 12 2015, Amendment (April 1, 2022) RSS-Gen, Issue 5 2018 FCC Part 90 FCC Part 2.1053
Test method	ANSI C63.26-2015, Section 5.5 KDB 935210 D05, v01r04, Clause 3.8, 4.9
Tested by	Jack Qin
Test date	2025-02-24
Test location	Richmond lab, stand #2

Applied limit

Radiated Emission FCC/ISED Class B Limit at 3 Meters	
Frequency (MHz)	**Quasi-peak (dB µV/m)**
30 – 88	40
88 – 216	43.52
216 - 960	46.02
Above 960	53.98
Note 1. The lower limit shall apply at the transition frequency Note 2. Additional provisions may be required for cases where interference occurs Note 3. Additionally, the level of any transmitter unwanted emission shall not exceed the level of the transmitter's fundamental emission.	

RSS – Gen, Clause 8.10 Restricted frequency bands

a. The transmit frequency, including fundamental components of modulation, of licence-exempt radio apparatus shall not fall within the restricted frequency bands listed in table 7.

b. Unwanted emissions that fall into restricted frequency bands listed in table 7 shall comply with the limits specified in the above table.

c. Unwanted emissions that do not fall within the restricted frequency bands listed in table 7 shall comply either with the limits specified in the applicable RSS or with those specified in the above table.

Test set-up description	☒	Equipment on a table of 80 cm height
	☐	Equipment on the floor (insulated from ground plane)
	☐	Other:
Test method applied	☒	SAC with measurement distance [m]: ☒3 ☐10
	☐	FAR CISPR 16-2-3 with measurement distance [m]: 3
	☐	FAR IEC 61000-4-22 with measurement distance [m]: 3
	☐	TEM Waveguide according to IEC 61000-4-20

Compliant ☒ Non-Compliant ☐ Not Applicable ☐

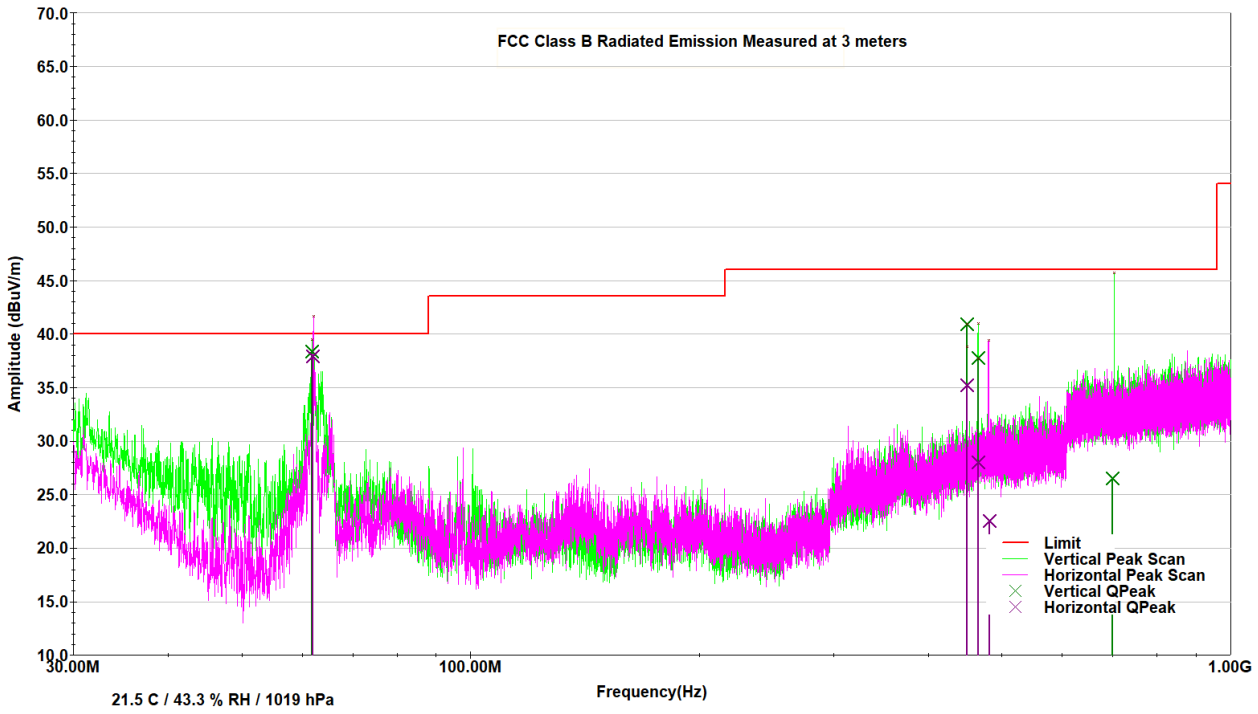
Test Method

This test measures the radiating levels from the EUT, thus evaluating the potential for the EUT to cause radio frequency interference to other electronic devices. Testing was performed in accordance with the test standard(s) referenced in the test summary section of this report. The Equipment Under Test (EUT) was configured based upon the requirements of the applicable test standard. Initially, the primary emission frequencies are identified by positioning a broadband receive antenna three meter from the EUT.

A scan was made with an EMC Analyzer, controlled by EMC Test Software, Tile7! with the receiver in the peak mode. The receiver IF bandwidth was 120 kHz and scan step was less than 30kHz. To ensure that the maximum emission at each discrete frequency of interest is observed, the receive antenna is varied in height from one to four meters with both horizontal and vertical polarities while the turntable is rotated to determine the worst emitting configuration. Measurements were then made using CISPR quasi peak when the peak readings were within 20dB of the limit line. The numerical results are included herein to demonstrate compliance.

Test Setup

Test Result



Frequency	Antenna Polarization	Raw Quasi-peak	Antenna Factor	Correction Factor	QPeak	Margin	Limit
MHz	V/H	dBuV	dB/m	dB	dBuV/m	dB	dBuV/m
61.88692	V	25.9	11.7	0.8	38.4	1.6	40
450.0058	V	18.3	20.6	2.1	40.9	5.1	46
464.9956	V	14.5	21.1	2.1	37.8	8.2	46
699.2731	V	0.3	23.6	2.7	26.5	19.5	46
61.93647	H	25.4	11.7	0.8	37.9	2.1	40
449.95	H	12.5	20.6	2.1	35.2	10.8	46
465.0115	H	4.8	21.1	2.1	28	18	46
482.2572	H	-1.2	21.6	2.2	22.6	23.4	46

Note:
(1) Quasi-peak (dBuV/m) = Raw Quasi-peak (dBuV) + Antenna Factor (dB/m) + Correction Factor (dB)
(2) Only the worst-case frequencies were selected for the final Quasi-peak measurement.

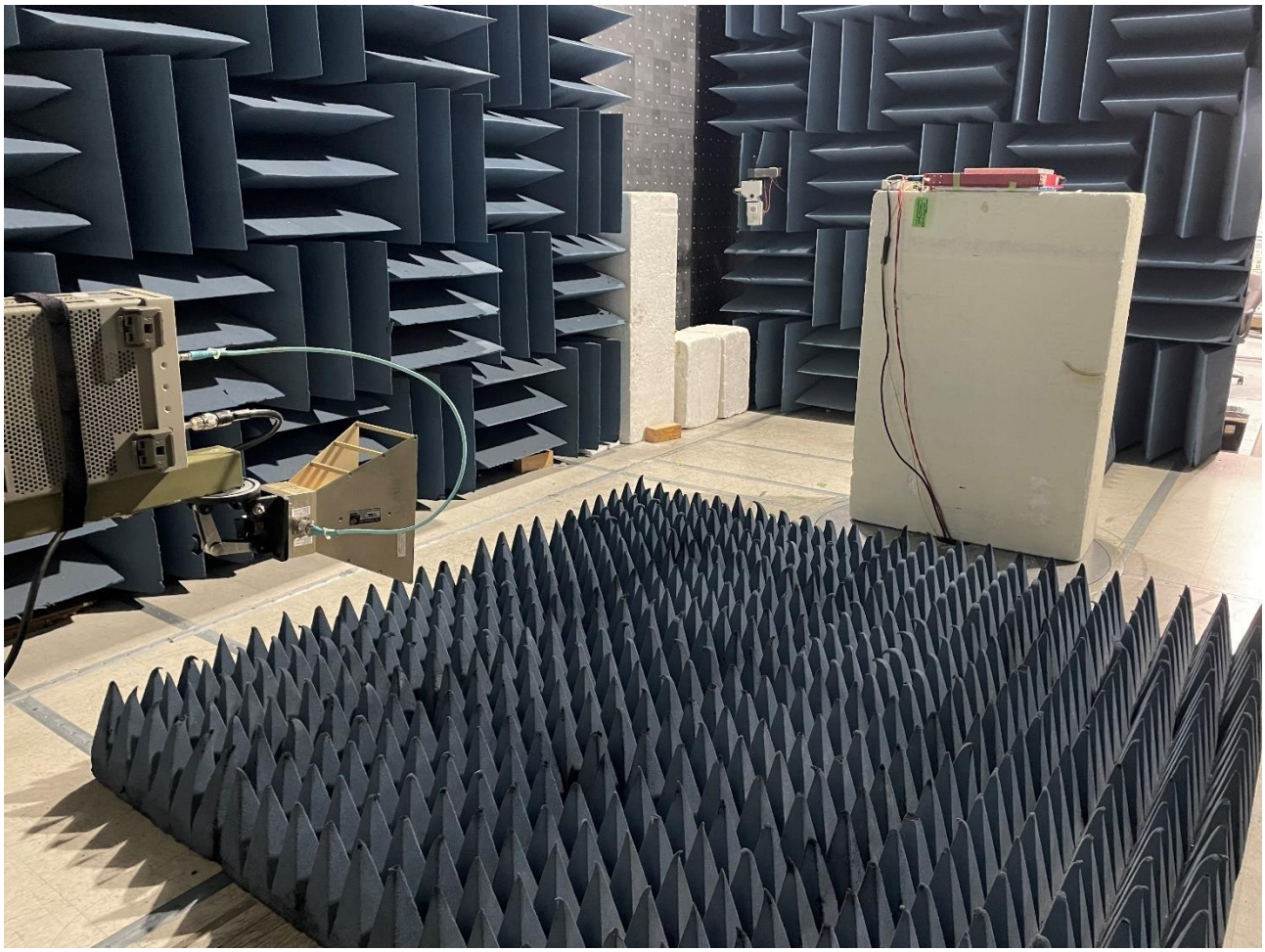
11. Radiated Spurious Emissions – Enclosure above 1 GHz

Standard	RSS-119, Issue 12 2015, Amendment (April 1, 2022) RSS-Gen, Issue 5 2018 FCC Part 90 FCC Part 2.1053
Test Method	ANSI C63.26-2015, Section 5.5 KDB 935210 D05, v01r04, Clause 3.8, 4.9
Tested by	Jack Qin
Test date	2025-02-24
Test location	Richmond, Stand #3
Applied limit	Radiated Emission FCC/ISED Class B Limit at 3 Meters Frequency (GHz) / Average (dBμV/m) / Peak (dBμV/m) > 1 / 54 / 74 **RSS – Gen, Clause 8.10 Restricted frequency bands** a. The transmit frequency, including fundamental components of modulation, of licence-exempt radio apparatus shall not fall within the restricted frequency bands listed in table 7. b. Unwanted emissions that fall into restricted frequency bands listed in table 7 shall comply with the limits specified in the above table. c. Unwanted emissions that do not fall within the restricted frequency bands listed in table 7 shall comply either with the limits specified in the applicable RSS or with those specified in the above table.
Test set-up description	☒ Equipment on a table of 80 cm height ☐ Equipment on the floor (insulated from ground plane) ☐ Other:
Test method applied	☐ OATS or SAC with measurement distance [m]: ☒3 ☐10 ☒ FAR CISPR 16-2-3 with measurement distance [m]: 3 ☐ FAR IEC 61000-4-22 with measurement distance [m]: 3 ☐ TEM Waveguide according to IEC 61000-4-20
Compliant ☒	Non-Compliant ☐ Not Applicable ☐

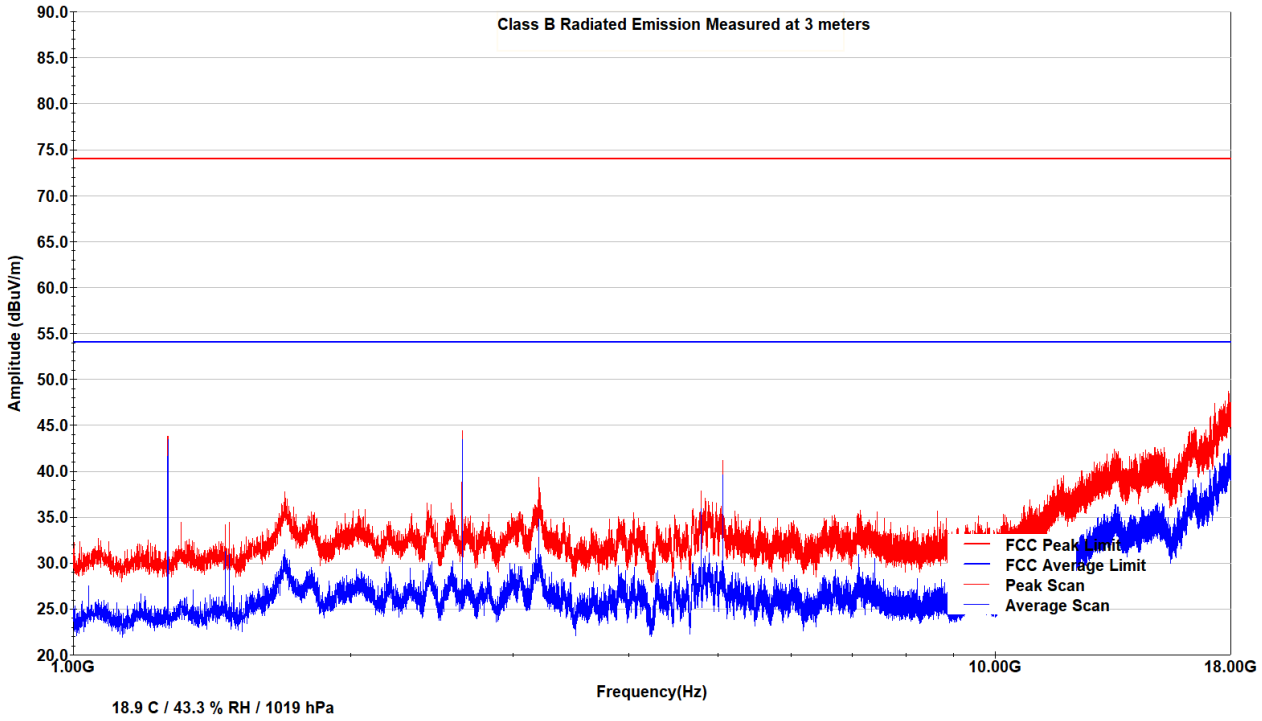
Test Method

This test measures the radiating levels from the EUT, thus evaluating the potential for the EUT to cause radio frequency interference to other electronic devices. Testing was performed in accordance with the test standards referenced in the test summary section of this report. The EUT was configured based upon the requirements of the applicable test standard. Initially, the primary emission frequencies are identified by positioning a broadband receive antenna three meter from the EUT. A scan was made with an EMC Analyzer, controlled by EMC Test Software, Tile7 with the receiver in the peak mode. The receiver IF bandwidth was 1MHz and scan step was about 0.5 MHz. To ensure that the maximum emission at each discrete frequency of interest is observed, the receive antenna is varied in height from one to four meters with both horizontal and vertical polarities while the turntable is rotated to determine the worst emitting configuration. Measurements were then made using CISPR averaging when the peak readings were within 20 dB of the peak limit line. The numerical results are included herein to demonstrate compliance.

Test Setup



Test Result



Note: Only the worst-case frequencies were selected for the final measurement.

12. Conducted Emissions at AC Power Port

Standard	RSS-119, Issue 12 2015, Amendment (April 1, 2022) RSS-Gen, Issue 5 2018 FCC Part 90	
Test Methods	ANSI C63.4: 2014	
Tested by	Jack Qin	
Test date	2024-02-24	
Test location	Richmond Lab, Stand #1	
Applied limit	AC Port Conducted Emission Class B Limit Frequency (MHz) / Quasi-Peak (dBμV) / Average (dBμV) 0.15 - 0.50 / 66 to 56 / 56 to 46 0.50 – 5 / 56 / 46 5-30 / 60 / 50 Note 1. The lower limit shall apply at the transition frequencies. Note 2. The limit decreases linearly with the logarithm of the frequency in the 0.15 to 0.50 MHz	
Test set-up description	☒	Set-up Type B (80 cm distance to horizontal ground plane inside chamber)
	☐	Floor standing equipment set-up (10 cm over ground plane)
	☐	Other:
Voltage/Frequency	120V/60Hz	
Test method applied	☒	Artificial mains network (AMN)
	☐	Voltage Probe
Compliant ☒	Non-Compliant ☐	Not Applicable ☐

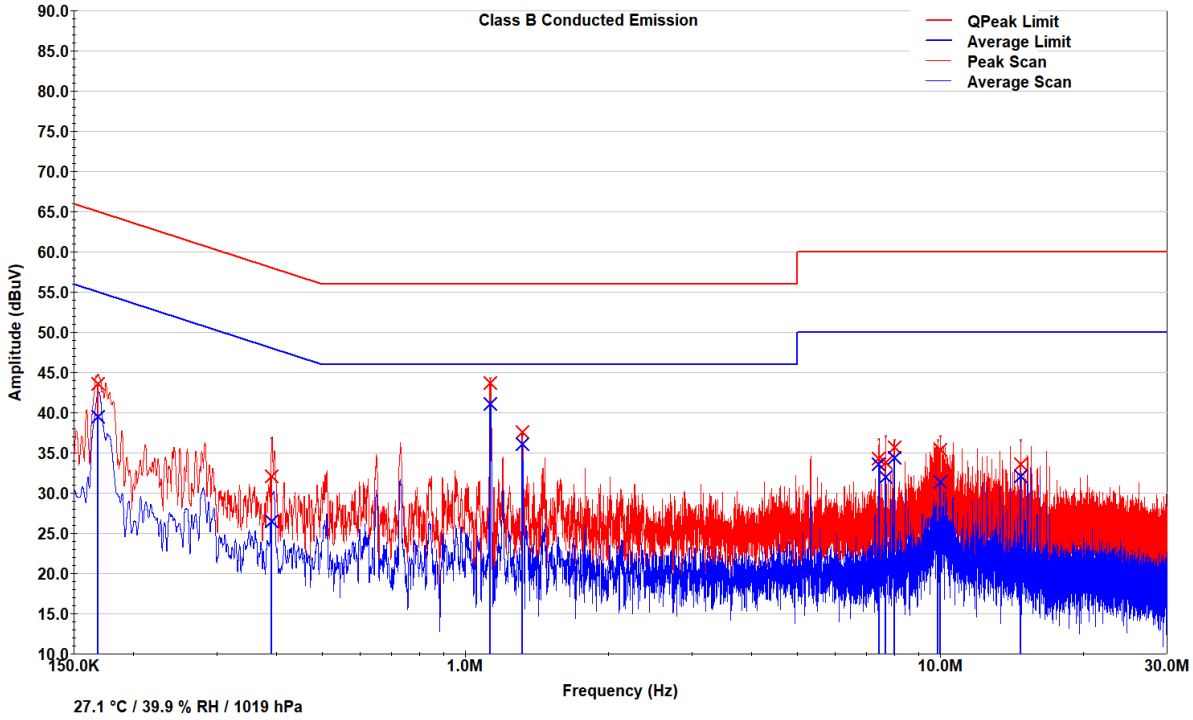
Test Method

This test measures the levels emanating from the EUT, thus evaluating the potential for the EUT to cause radio frequency interference to other electronic devices. Testing was performed in accordance with the test standard(s) referenced in the test summary section of this report. The Equipment Under Test (EUT) was configured based upon the requirements of the applicable test standard. Initially a scan was made with an EMC Analyzer, controlled by EMC Test Software, Tile7!, from 150 kHz to 30 MHz on each phase with the receiver in the peak mode. The measuring bandwidth was set up to 9 kHz. Measurements were then made using CISPR16-1 quasi peak and averaging detectors when the peak readings were within 10dB of the Quasi-peak limit line.

Test Setup

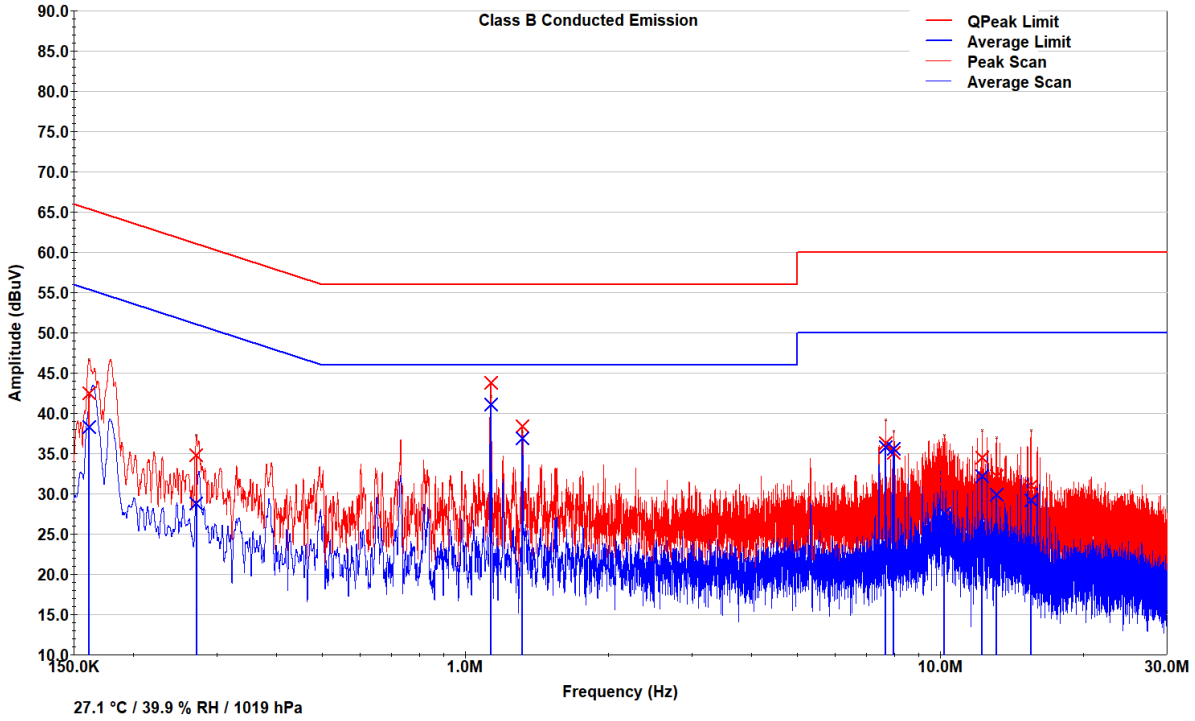
Test Results

Conducted Emission – Line 1



Frequency	Correction Factor	QPeak	QPeak Margin	QPeak Limit	Average	Average Margin	Average Limit
MHz	dB	dBuV	dB	dBuV	dBuV	dB	dBuV
0.169	20.627	43.62	21.41	65.03	39.523	15.51	55.03
0.392	20.582	32.09	25.93	58.02	26.494	21.53	48.02
1.129	20.573	43.71	12.29	56	41.101	4.9	46
1.318	20.571	37.6	18.4	56	36.134	9.87	46
7.423	20.778	34.34	25.66	60	33.559	16.44	50
7.678	20.792	33.8	26.2	60	32.003	18	50
7.995	20.786	35.68	24.32	60	34.379	15.62	50
9.895	20.841	31.17	28.83	60	26.271	23.73	50
10	20.838	35.38	24.62	60	31.427	18.57	50
14.782	20.928	33.65	26.35	60	32.06	17.94	50

Conducted Emission – Line 2



Frequency	Correction Factor	QPeak	QPeak Margin	QPeak Limit	Average	Average Margin	Average Limit
MHz	dB	dBuV	dB	dBuV	dBuV	dB	dBuV
0.161	20.627	42.5	22.89	65.39	38.343	17.05	55.39
0.272	20.615	34.83	26.23	61.06	28.809	22.25	51.06
1.131	20.573	43.77	12.23	56	41.063	4.94	46
1.32	20.571	38.43	17.57	56	36.942	9.06	46
7.68	20.792	36.34	23.66	60	35.765	14.23	50
7.991	20.786	35.07	24.93	60	35.626	14.37	50
10.186	20.852	31.74	28.26	60	27.563	22.44	50
12.261	20.86	34.51	25.49	60	32.233	17.77	50
13.117	20.909	32.19	27.81	60	29.898	20.1	50
15.504	20.935	30.99	29.01	60	29.231	20.77	50

Note:

(1) Conducted Emission (dBuV) = Measured Emission (dBuV) + Correction Factor (dB)
Correction Factor (dB) = LISN Transduce Factor (dB) + Cable loss(dB) + 20 dB limiter(dB)

(2) Only the worst-case frequencies were selected for the final measurement.

Annex

Annex 1 – List of Test Equipment

Equipment	Manufacturer	Model	LabTest ID/SN	Last calibration	Calibration due*
Signal Generator	Keysight	N5172B	MY53050270	Dec 12, 2023	Dec 12, 2026
Spectrum Analyzer	Keysight	N9020B	MY62153079	Oct 25, 2023	Aug 1, 2025
LISN	Com-Power	LIN-120C	920	23-July-2023	23-July-2025
Horn Antenna	A.H Systems	SAS-571	227C	13-Sept-2022	13-Sept-2025
Broadband Antenna	Sunol	JB1	371	25-Oct-2022	25-Oct-2025
EMC Analyzer	Keysight	N9038A	702	26-Apr-2024	26-Apr-2025
RF Preamplifier	Agilent	8449B	273	IHC	IHC
EMC Shielded Enclosure	USC	USC-26	374	IHC	IHC
RF Cable	A.H. Systems	SAC-26G-3	227D	IHC	IHC
RF Cable	MRO	NA	NA	IHC	IHC
Used Software	Tile 7!, v7.3.0.6				

* Calibration interval extended based on enough calibration data and experience of use (see IECEE OD-5011:2015 clause 8.3)

Annex 1 – Measurement Uncertainties

For all measurements where guidance for the calculation of the instrumentation uncertainty of a measurement is specified in CISPR 16-4-2/EN55016-4-2, IEC/EN 61000-4 series or a product standard, the measurement instrumentation uncertainty has been calculated and applied in accordance with these standards.

Uncertainties have been calculated according to the LabTest internal document, DCN. The reported expanded uncertainties are based on a standard uncertainty multiplied by a coverage factor of k=2, providing a level of confidence of approximately 95%

Parameter	Uncertainty
Radio Frequency	± 1 ppm
Conducted RF Power	± 1 dB
Temperature	± 1.0 °C
Humidity	± 5.0 %
Radiated Emission, 30 to 18,000MHz	± 4.93 dB
Conducted Measurements, 0.15 to 30MHz	± 3.52 dB

(Uncertainty figures are valid to a confidence level of 95%.)

Annex 2 - ISO 17025 ACCREDITATION CERTIFICATE

For complete scope of certification use

https://labtestcert.com/wp-content/uploads/2024/04/LabTest-Certification-Inc-Cert-and-Scope-File-03-12-2024_1710259791.pdf

END OF REPORT

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