TEST REPORT

FCC ID: 2ADYY-T16MAPRO
Product: Laptop Computer
Model No.: T16MA Pro
Trade Mark: TECNO
Report No.: WSCT-A2LA-R&E240300015A-Wi-Fi1
Issued Date: 16 April 2024

Issued for:

TECNO MOBILE LIMITED
FLAT N 16/F BLOCK B UNIVERSAL INDUSTRIAL CENTRE 19-25 SHAN MEI STREET FOTAN NT HONGKONG

Issued By:

World Standardization Certification & Testing Group(Shenzhen) Co.,Ltd.
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1. Test Certification

Product:	Laptop Computer
Model No.:	T16MA Pro
Trade Mark:	TECNO
Applicant:	**TECNO MOBILE LIMITED**
Address:	FLAT N 16/F BLOCK B UNIVERSAL INDUSTRIAL CENTRE 19-25 SHAN MEI STREET FOTAN NT HONGKONG
Manufacturer:	**TECNO MOBILE LIMITED**
Address:	FLAT N 16/F BLOCK B UNIVERSAL INDUSTRIAL CENTRE 19-25 SHAN MEI STREET FOTAN NT HONGKONG
Date of Test:	02 April 2024 to 16 April 2024
Applicable Standards:	FCC CFR Title 47 Part 15 Subpart C Section 15.247

The above equipment has been tested by World Standardization Certification & Testing Group(Shenzhen)Co., Ltd. and found compliance with the requirements set forth in the technical standards mentioned above. The results of testing in this report apply only to the product/system, which was tested. Other similar equipment will not necessarily produce the same results due to production tolerance and measurement uncertainties.

Tested By: Wang Xiang **(Wang Xiang)**

Checked By: Chen Xu **(Chen Xu)**

Approved By: Liu Fuxin **(Liu Fuxin)**

Date: 16 Apr 2024

2. Test Result Summary

Requirement	CFR 47 Section	Result
Antenna requirement	§15.203/§15.247 (c)	PASS
AC Power Line Conducted Emission	§15.207	PASS
Conducted Peak Output Power	§15.247 (b)(3) §2.1046	PASS
6dB Emission Bandwidth	§15.247 (a)(2) §2.1049	PASS
Power Spectral Density	§15.247 (e)	PASS
Band Edge	1§5.247(d) §2.1051, §2.1057	PASS
Spurious Emission	§15.205/§15.209 §2.1053, §2.1057	PASS

Note:

1. PASS: Test item meets the requirement.

2. Fail: Test item does not meet the requirement.

3. N/A: Test case does not apply to the test object.

4. The test result judgment is decided by the limit of test standard.

3. EUT Description

Product:	Laptop Computer
Model No.:	T16MA Pro
Trade Mark:	TECNO
Operation Frequency:	2412MHz~2462MHz (802.11b/g/n/ax(HT20)) 2422MHz~2452MHz (802.11n/ax(HT40))
Channel Separation:	5MHz
Modulation type:	DSSS (DBPSK, DQPSK, CCK) for IEEE 802.11b OFDM/OFDMA(BPSK,QPSK,16QAM,64QAM,256QAM,1024QAM) for IEEE 802.11g/n/ax
Antenna Type:	Integral Antenna
Antenna Gain	MAIN:2.40dBi ,AUX:2.70 dBi
Operating Voltage:	Adapter1: A879-200500C-US1 Input: 100-240V~50/60Hz 2.5A Output:PD:5V⎓3A /9V⎓3A /12V⎓3A/15V⎓3.0A /20V⎓5A PPS:3.3-11V⎓5A 55W Max 3.3-21V⎓5A 100W Max Rechargeable Li-ion Battery: N160 Nominal Voltage: 11.61V Rated Capacity: 8612mAh Rated Energy:99.99Wh Limited Charge Voltage: 13.35V
Remark:	N/A.

Configuration differences

Configuration/ Processor	Camera
T16MA Pro (i5)	KANC792
T16MA Pro (i7)	CK2B2B
Note: The prototypes of both configurations have been tested, and the T16MA Pro (i7) has the worst test result, which is the main test model reported	

Operation Frequency each of channel For 802.11b/g/n/ax(HT20)

Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
1	2412MHz	4	2427MHz	7	2442MHz	10	2457MHz
2	2417MHz	5	2432MHz	8	2447MHz	11	2462MHz
3	2422MHz	6	2437MHz	9	2452MHz		

Operation Frequency each of channel For 802.11n/ax (HT40)

Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
--	--	4	2427MHz	7	2442MHz	--	--
--	--	5	2432MHz	8	2447MHz	--	--
3	2422MHz	6	2437MHz	9	2452MHz		

Note:

In section 15.31(m), regards to the operating frequency range over 10 MHz, the Lowest frequency, the middle frequency, and the highest frequency of channel were selected to perform the test, and the selected channel see below:

802.11b/g/n/ax (HT20)

Channel	Frequency
The lowest channel	2412MHz
The middle channel	2437MHz
The Highest channel	2462MHz

802.11n/ax (HT40)

Channel	Frequency
The lowest channel	2422MHz
The middle channel	2437MHz
The Highest channel	2452MHz

4. Genera Information

4.1. Test environment and mode

Operating Environment:	
Temperature:	25.0 °C
Humidity:	56 % RH
Atmospheric Pressure:	1010 mbar
Test Mode:	
Engineering mode:	Keep the EUT in continuous transmitting by select channel and modulations(The value of duty cycle is 98.46%)
The sample was placed (0.8m below 1GHz, 1.5m above 1GHz) above the ground plane of 3m chamber. Measurements in both horizontal and vertical polarities were performed. During the test, each emission was maximized by: having the EUT continuously working, investigated all operating modes, rotated about all 3 axis (X, Y & Z) and considered typical configuration to obtain worst position, manipulating interconnecting cables, rotating the turntable, varying antenna height from 1m to 4m in both horizontal and vertical polarizations. The emissions worst-case are shown in Test Results of the following pages. For the full battery state and The output power to the maximum state.	

We have verified the construction and function in typical operation. All the test modes were carried out with the EUT in transmitting operation, which was shown in this test report and defined as follows:
Per-scan all kind of data rate in lowest channel, and found the follow list which it was worst case.
Mode
802.11b
802.11g
802.11n/ax(H20)
802.11n/ax(H40)

Final Test Mode:	
Operation mode:	Keep the EUT in continuous transmitting with modulation
1. For WIFI function, the engineering test program was provided and enabled to make EUT continuous transmit/receive.2.According to ANSI C63.10 standards, the test results are both the “worst case” and “worst setup” 1Mbps for 802.11b, 6Mbps for 802.11g, 6.5Mbps for 802.11n(H20).Duty cycle setting during the transmission is 98.5% with maximum power setting for all modulations.	

4.2. Description of Support Units

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

Equipment	Model No.	Serial No.	FCC ID	Trade Name
Adapter	A879-200500C-US1		/	TECNO

Note:

1. All the equipment/cables were placed in the worst-case configuration to maximize the emission during the test.

2. Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.

3. For conducted measurements (Output Power, 6dB Emission Bandwidth, Power Spectral Density, Spurious Emissions), the antenna of EUT is connected to the test equipment via temporary antenna connector, the antenna connector is soldered on the antenna port of EUT, and the temporary antenna connector is listed in the Test Instruments.

5. Facilities and Accreditations

5.1. Facilities

All measurement facilities used to collect the measurement data are located at **Building A-B, Baoshi Science & Technology Park, Baoshi Road, Bao'an District, Shenzhen, Guangdong, China of the World Standardization Certification & Testing Group(Shenzhen) CO., LTD**

The sites are constructed in conformance with the requirements of ANSI C63.4 and CISPR Publication 22. All receiving equipment conforms to CISPR Publication 16-1, "Radio Interference Measuring Apparatus and Measurement Methods."

5.2. ACCREDITATIONS

CNAS - Registration Number: L3732

China National Accreditation Service for Conformity Assessment, The test firm Registration Number: L3732

FCC - Designation Number: CN1303

World Standardization Certification & Testing Group(Shenzhen) CO., LTD. has been accredited as a testing laboratory by FCC(Federal Communications Commission). The test firm Designation Number: CN1303.

A2LA - Certificate Number: 5768.01

The EMC Laboratory has been accredited by the American Association for Laboratory Accreditation (A2LA).Certification Number: 5768.01

5.3. Measurement Uncertainty

The reported uncertainty of measurement y ± U, where expended uncertainty U is based on a standard uncertainty multiplied by a coverage factor of k=2, providing a level of confidence of approximately 95 %.

No.	Item	MU
1	Conducted Emission Test	±3.2dB
2	RF power, conducted	±0.16dB
3	Spurious emissions, conducted	±0.21dB
4	All emissions, radiated(<1GHz)	±4.7dB
5	All emissions, radiated(>1GHz)	±4.7dB
6	Temperature	±0.5°C
7	Humidity	±2.0%

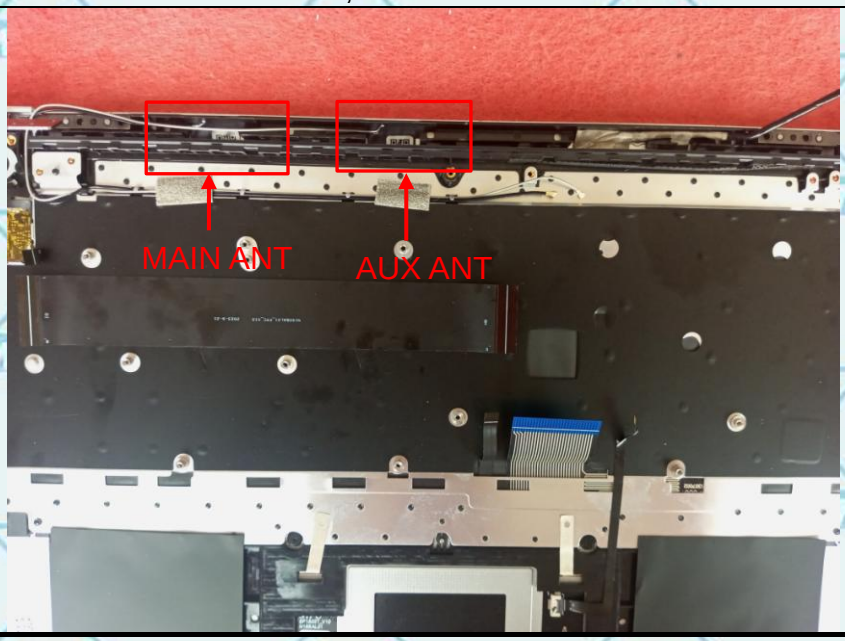
5.4.MEASUREMENT INSTRUMENTS

NAME OF EQUIPMENT	MANUFACTURER	MODEL	SERIAL NUMBER	Calibration Date	Calibration Due.
Test software	--	EZ-EMC	CON-03A	-	-
Test software	--	MTS8310	-	-	-
EMI Test Receiver	R&S	ESCI	100005	11/05/2023	11/04/2024
LISN	AFJ	LS16	16010222119	11/05/2023	11/04/2024
LISN(EUT)	Mestec	AN3016	04/10040	11/05/2023	11/04/2024
Universal Radio Communication Tester	R&S	CMU 200	1100.0008.02	11/05/2023	11/04/2024
Coaxial cable	Megalon	LMR400	N/A	11/05/2023	11/04/2024
GPIB cable	Megalon	GPIB	N/A	11/05/2023	11/04/2024
Spectrum Analyzer	R&S	FSU	100114	11/05/2023	11/04/2024
Pre Amplifier	H.P.	HP8447E	2945A02715	11/05/2023	11/04/2024
Pre-Amplifier	CDSI	PAP-1G18-38	--	11/05/2023	11/04/2024
Bi-log Antenna	SCHWARZBECK	VULB9168	01488	11/05/2023	11/04/2024
9*6*6 Anechoic	--	--	--	11/05/2023	11/04/2024
Horn Antenna	COMPLIANCE ENGINEERING	CE18000	--	11/05/2023	11/04/2024
Horn Antenna	SCHWARZBECK	BBHA9120D	9120D-631	11/05/2023	11/04/2024
Cable	TIME MICROWAVE	LMR-400	N-TYPE04	11/05/2023	11/04/2024
System-Controller	CCS	N/A	N/A	N.C.R	N.C.R
Turn Table	CCS	N/A	N/A	N.C.R	N.C.R
Antenna Tower	CCS	N/A	N/A	N.C.R	N.C.R
RF cable	Murata	MXHQ87WA3000	-	11/05/2023	11/04/2024
Loop Antenna	EMCO	6502	00042960	11/05/2023	11/04/2024
Horn Antenna	SCHWARZBECK	BBHA 9170	1123	11/05/2023	11/04/2024
Power meter	Anritsu	ML2487A	6K00003613	11/05/2023	11/04/2024
Power sensor	Anritsu	MX248XD	--	11/05/2023	11/04/2024
Spectrum Analyzer	Keysight	N9010B	MY60241089	11/05/2023	11/04/2024

6. Test Results and Measurement Data

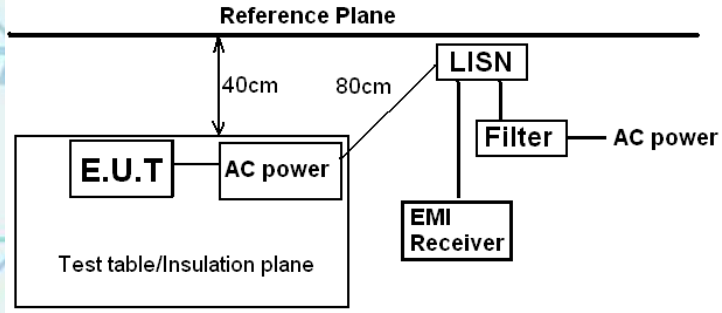
6.1. Antenna requirement

Standard requirement:	FCC Part15 C Section 15.203 /247(c)
15.203 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 a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. 15.247(c) (1)(i) requirement: (i) Systems operating in the 2400-2483.5 MHz band that is used exclusively for fixed. Point-to-point operations may employ transmitting antennas with directional gain greater than 6dBi provided the maximum conducted output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6dBi.	
E.U.T Antenna:	
The Wi-Fi antenna is a Integral Antenna. it meets the standards, and the best case gain of the antenna is “MAIN:2.40dBi ,AUX:2.70 dBi”	



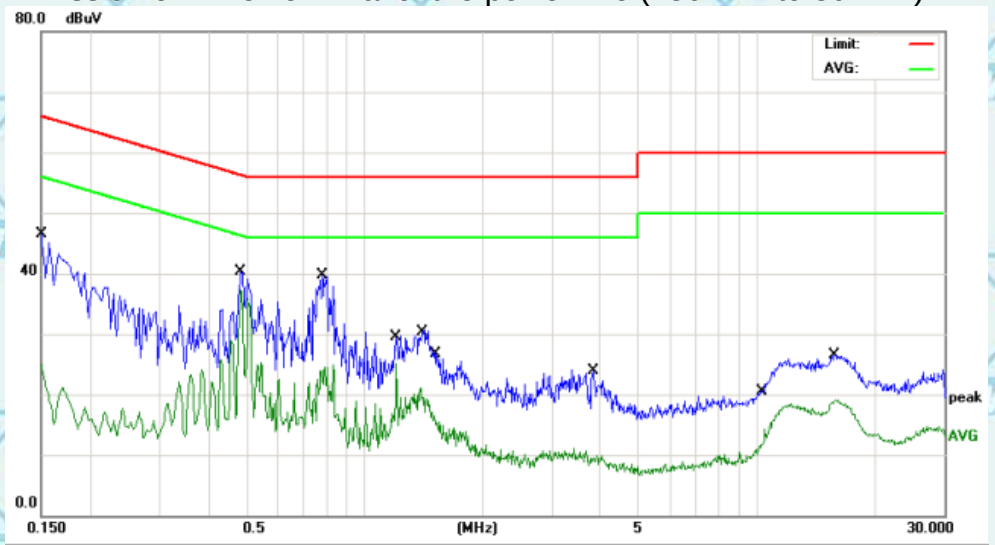
6.2. Conducted Emission

6.2.1. Test Specification

Test Requirement:	FCC Part15 C Section 15.207
Test Method:	ANSI C63.10:2014
Frequency Range:	150 kHz to 30 MHz
Receiver setup:	RBW=9 kHz, VBW=30 kHz, Sweep time=auto
Limits:	Frequency range (MHz) / Limit (dBuV): Quasi-peak / Average 0.15-0.5: 66 to 56* / 56 to 46* 0.5-5: 56 / 46 5-30: 60 / 50
Test Setup:	 *Remark:* *E.U.T: Equipment Under Test* *LISN: Line Impedence Stabilization Network* *Test table height=0.8m*
Test Mode:	Charging + transmitting with modulation
Test Procedure:	1. The E.U.T is connected to the main power through a line impedance stabilization network (L.I.S.N.). This provides a 50ohm/50uH coupling impedance for the measuring equipment. 2. The peripheral devices are also connected to the main power through a LISN that provides a 50ohm/50uH coupling impedance with 50ohm termination. (Please refer to the block diagram of the test setup and photographs). 3. Both sides of A.C. line are checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.10: 2014 on conducted measurement.
Test Result:	PASS

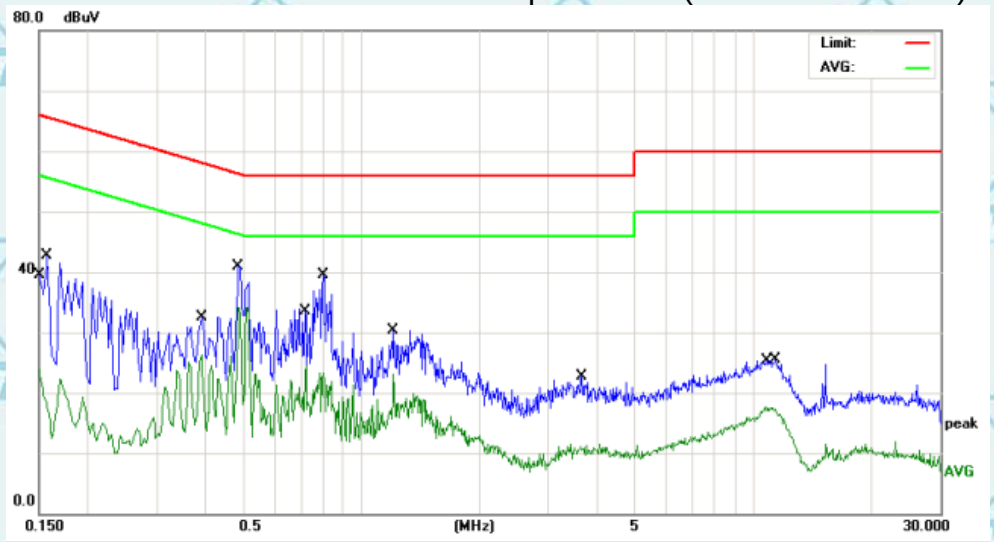
6.2.2. Test data(worst case)

Please refer to following diagram for individual
The worst mode is MIMO 11ax40
Conducted Emission on Line Terminal of the power line (150 kHz to 30MHz)



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector
1		0.1500	36.15	10.41	46.56	65.99	-19.43	QP
2		0.1500	14.66	10.41	25.07	55.99	-30.92	AVG
3		0.4860	29.73	10.47	40.20	56.24	-16.04	QP
4	*	0.4860	26.83	10.47	37.30	46.24	-8.94	AVG
5		0.7820	29.18	10.49	39.67	56.00	-16.33	QP
6		1.2059	14.49	10.54	25.03	46.00	-20.97	AVG
7		1.3940	10.59	10.57	21.16	46.00	-24.84	AVG
8		1.5300	15.50	10.59	26.09	56.00	-29.91	QP
9		3.8340	13.21	10.68	23.89	56.00	-32.11	QP
10		10.2260	0.83	10.80	11.63	50.00	-38.37	AVG
11		15.7900	15.43	11.06	26.49	60.00	-33.51	QP
12		15.8780	8.06	11.06	19.12	50.00	-30.88	AVG

Conducted Emission on Neutral Terminal of the power line (150 kHz to 30MHz)



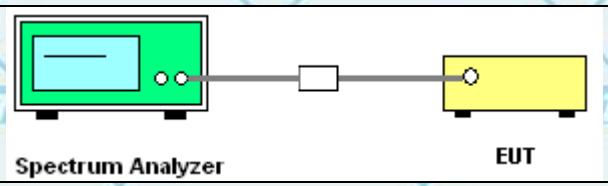
No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector
1		0.1500	13.55	10.41	23.96	55.99	-32.03	AVG
2		0.1580	32.36	10.41	42.77	65.56	-22.79	QP
3		0.3899	15.76	10.45	26.21	48.06	-21.85	AVG
4		0.4860	30.48	10.47	40.95	56.24	-15.29	QP
5	*	0.4860	23.72	10.47	34.19	46.24	-12.05	AVG
6		0.7220	14.07	10.49	24.56	46.00	-21.44	AVG
7		0.7980	29.01	10.49	39.50	56.00	-16.50	QP
8		1.2059	19.78	10.54	30.32	56.00	-25.68	QP
9		1.2059	12.62	10.54	23.16	46.00	-22.84	AVG
10		3.6500	11.93	10.68	22.61	56.00	-33.39	QP
11		10.7340	6.80	10.83	17.63	50.00	-32.37	AVG
12		11.4180	14.59	10.87	25.46	60.00	-34.54	QP

Note1:

Freq. = Emission frequency in MHz
Reading level (dBμV) = Receiver reading
Corr. Factor (dB) = LISN factor + Cable loss
Measurement (dBμV) = Reading level (dBμV) + Corr. Factor (dB)
Limit (dBμV) = Limit stated in standard
Margin (dB) = Measurement (dBμV) – Limits (dBμV)
Q.P. =Quasi-Peak AVG =average
** is meaning the worst frequency has been tested in the frequency range 150 kHz to 30MHz.*

6.2.3. Maximum Conducted (Average) Output Power

6.2.4. Test Specification

Test Requirement:	FCC Part15 C Section 15.247 (b)(3)
Test Method:	KDB 558074
Limit:	30dBm
Test Setup:	
Test Mode:	Transmitting mode with modulation
Test Procedure:	1. The testing follows the Measurement Procedure of FCC KDB No. 558074 DTS D01 Meas. Guidance v04. 2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement. 3. Set to the maximum power setting and enable the EUT transmit continuously. 4. Measure the conducted output power and record the results in the test report.
Test Result:	PASS

(i) If all antennas have the same gain, G_{ANT}:
Directional gain = $G_{ANT} + 10\log(N_{ANT}/N_{SS})$ *dBi*, where N_{SS} = the number of independent spatial streams of data and G_{ANT} is the antenna gain in dBi. (This formula can also be applied when antennas have different gains if the highest antenna gain is substituted for G_{ANT}.)

(ii) If antenna gains are not equal and each transmit antenna is driven by only one spatial stream, directional gain may be calculated by either of the following two formulas.

- *Directional gain* = $G_{ANT\,MAX} + 10\log(N_{ANT}/N_{SS})$ *dBi*, where N_{SS} = the number of independent spatial streams of data and $G_{ANT\,MAX}$ is.the gain of the antenna having the highest gain (in dBi).

Or,

- $$DirectionalGain = 10 \cdot \log\left[\frac{\sum_{j=1}^{N_{SS}}\left\{\sum_{k=1}^{N_{ANT}} g_{j,k}\right\}^2}{N_{ANT}}\right]$$

where
Each antenna is driven by no more than one spatial stream;
N_{SS} = the number of independent spatial streams of data;
N_{ANT} = the total number of antennas
$g_{j,k} = 10^{G_k/20}$ if the kth antenna is being fed by spatial stream j, or zero if it is not;
G_k is the gain in dBi of the kth antenna.

For power measurements on IEEE 802.11 devices, 1,2
Array Gain = 0 dB (i.e., no array gain) for NANT ≤ 4;
Array Gain = 0 dB (i.e., no array gain) for channel widths ≥ 40 MHz for any NANT;
Array Gain = 5 log(NANT/NSS) dB or 3 dB, whichever is less, for 20-MHz channel widths with NANT ≥ 5.
Note: Nant=2, satisfy the condition Nant ≤ 4, so Array gain=0dB, Directional gain=Gant+Array gain=2.70dBi+0dB=2.70dBi, not more than 6, so the power limit is unchanged.

6.2.5. Test Data

MAIN Ant1

Mode	Frequency (MHz)	Total Power (dBm)	Limit (dBm)	Verdict
b	2412	19.49	30	Pass
b	2437	17.61	30	Pass
b	2462	18.66	30	Pass
g	2412	18.66	30	Pass
g	2437	16.95	30	Pass
g	2462	17.72	30	Pass
n20	2412	18.95	30	Pass
n20	2437	17.26	30	Pass
n20	2462	18.04	30	Pass
n40	2422	17.96	30	Pass
n40	2437	17.27	30	Pass
n40	2452	17.76	30	Pass
ax20	2412	19.49	30	Pass
ax20	2437	17.86	30	Pass
ax20	2462	18.73	30	Pass
ax40	2422	18.86	30	Pass
ax40	2437	18.33	30	Pass
ax40	2452	18.67	30	Pass

AUX Ant2

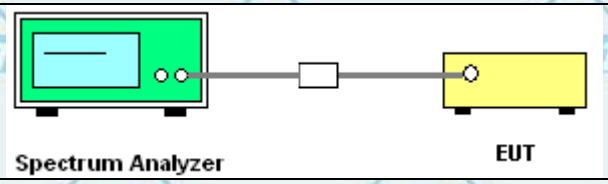
Mode	Frequency (MHz)	Total Power (dBm)	Limit (dBm)	Verdict
b	2412	18.93	30	Pass
b	2437	16.82	30	Pass
b	2462	17.81	30	Pass
g	2412	17.96	30	Pass
g	2437	16.38	30	Pass
g	2462	17.14	30	Pass
n20	2412	18.38	30	Pass
n20	2437	16.76	30	Pass
n20	2462	17.58	30	Pass
n40	2422	17.72	30	Pass
n40	2437	17.02	30	Pass
n40	2452	17.46	30	Pass
ax20	2412	18.91	30	Pass
ax20	2437	17.51	30	Pass
ax20	2462	18.1	30	Pass
ax40	2422	18.46	30	Pass
ax40	2437	17.86	30	Pass
ax40	2452	18.37	30	Pass

MiMO Mode

Mode	Frequency (MHz)	Total Power (dBm)	Limit (dBm)	Verdict
n20	2412	**21.69**	30	Pass
n20	2437	20.03	30	Pass
n20	2462	20.83	30	Pass
n40	2422	20.85	30	Pass
n40	2437	20.16	30	Pass
n40	2452	20.62	30	Pass
ax20	2412	22.22	30	Pass
ax20	2437	20.70	30	Pass
ax20	2462	21.44	30	Pass
ax40	2422	21.67	30	Pass
ax40	2437	21.11	30	Pass
ax40	2452	21.53	30	Pass

6.3. Emission Bandwidth

6.3.1. Test Specification

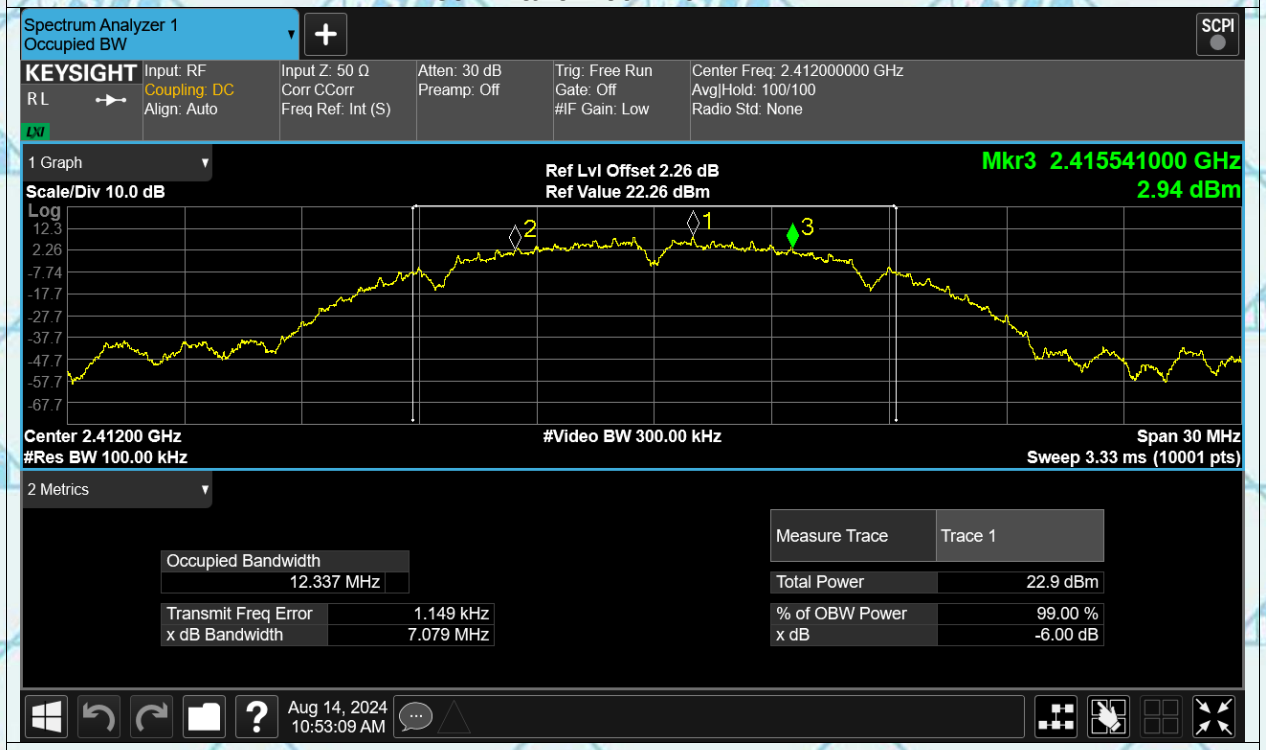
Test Requirement:	FCC Part15 C Section 15.247 (a)(2)
Test Method:	KDB 558074
Limit:	>500kHz
Test Setup:	
Test Mode:	Transmitting mode with modulation
Test Procedure:	1. The testing follows FCC KDB Publication No. 558074 DTS D01 Meas. Guidance v04. 2. Set to the maximum power setting and enable the EUT transmit continuously. 3. Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 100 kHz. Set the Video bandwidth (VBW) = 300 kHz. In order to make an accurate measurement. The 6dB bandwidth must be greater than 500 kHz. 4. Measure and record the results in the test report.
Test Result:	PASS

6.3.2. Test data

Mode	Frequency (MHz)	-6 dB Bandwidth (MHz)	Limit -6 dB Bandwidth (MHz)	Verdict
b	2412	7.08	0.5	Pass
b	2437	8.04	0.5	Pass
b	2462	7.60	0.5	Pass
g	2412	15.91	0.5	Pass
g	2437	15.28	0.5	Pass
g	2462	16.00	0.5	Pass
n20	2412	17.02	0.5	Pass
n20	2437	15.01	0.5	Pass
n20	2462	15.04	0.5	Pass
n40	2422	35.08	0.5	Pass
n40	2437	36.05	0.5	Pass
n40	2452	33.71	0.5	Pass
ax20	2412	17.58	0.5	Pass
ax20	2437	18.17	0.5	Pass
ax20	2462	17.75	0.5	Pass
ax40	2422	34.40	0.5	Pass
ax40	2437	37.58	0.5	Pass
ax40	2452	36.40	0.5	Pass

Test Graphs

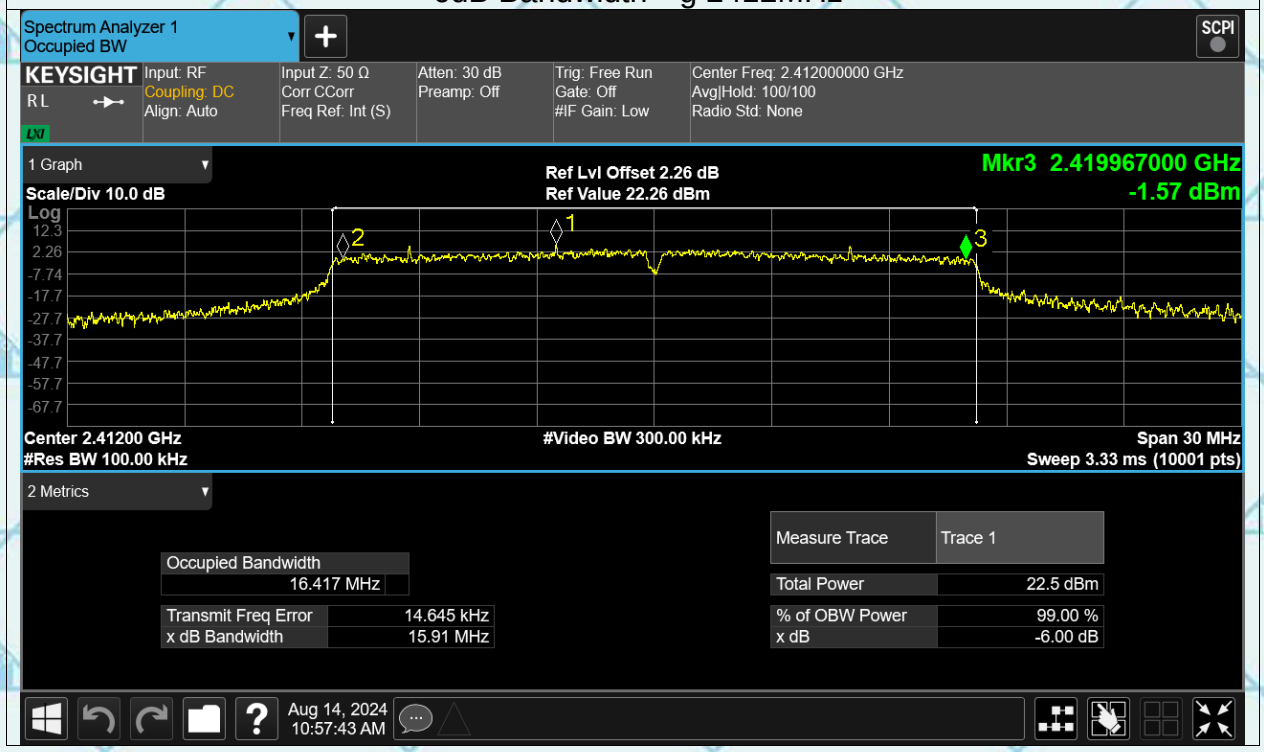
-6dB Bandwidth b 2412MHz



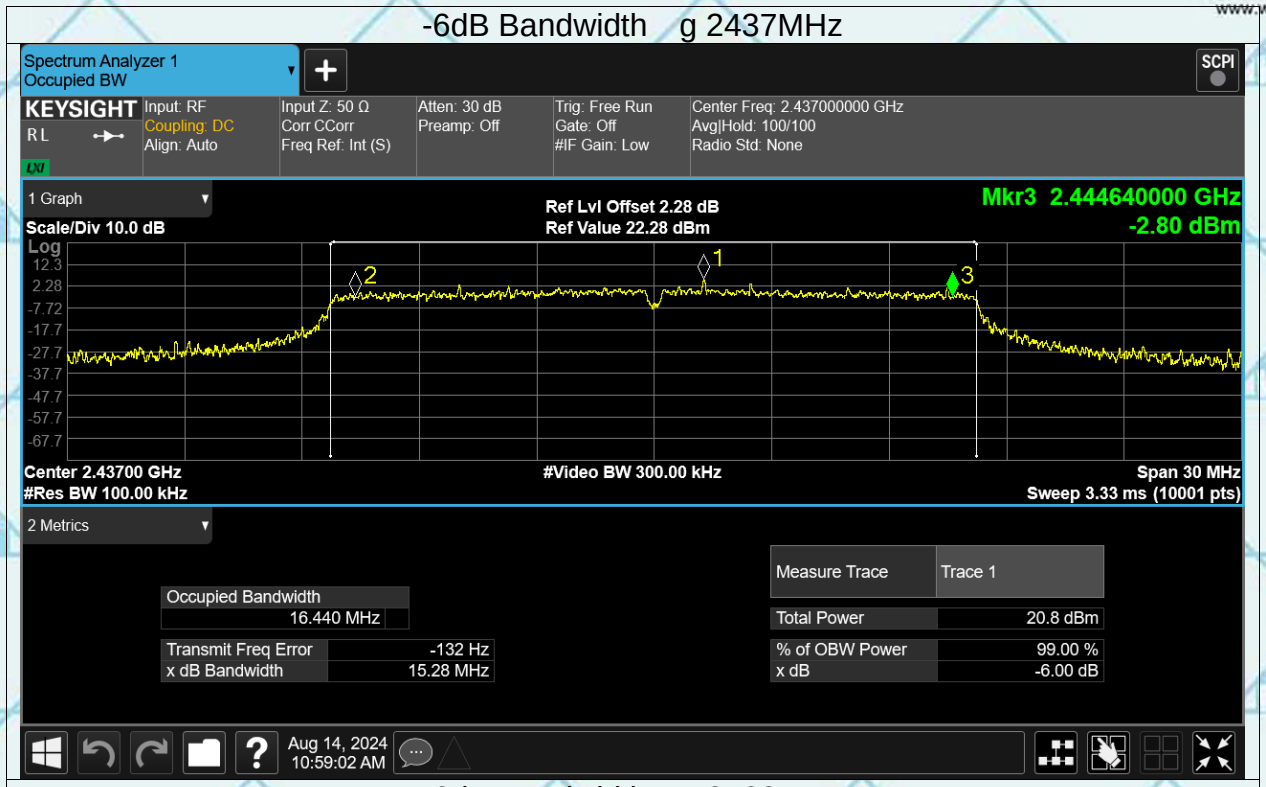
-6dB Bandwidth b 2437MHz

-6dB Bandwidth b 2462MHz

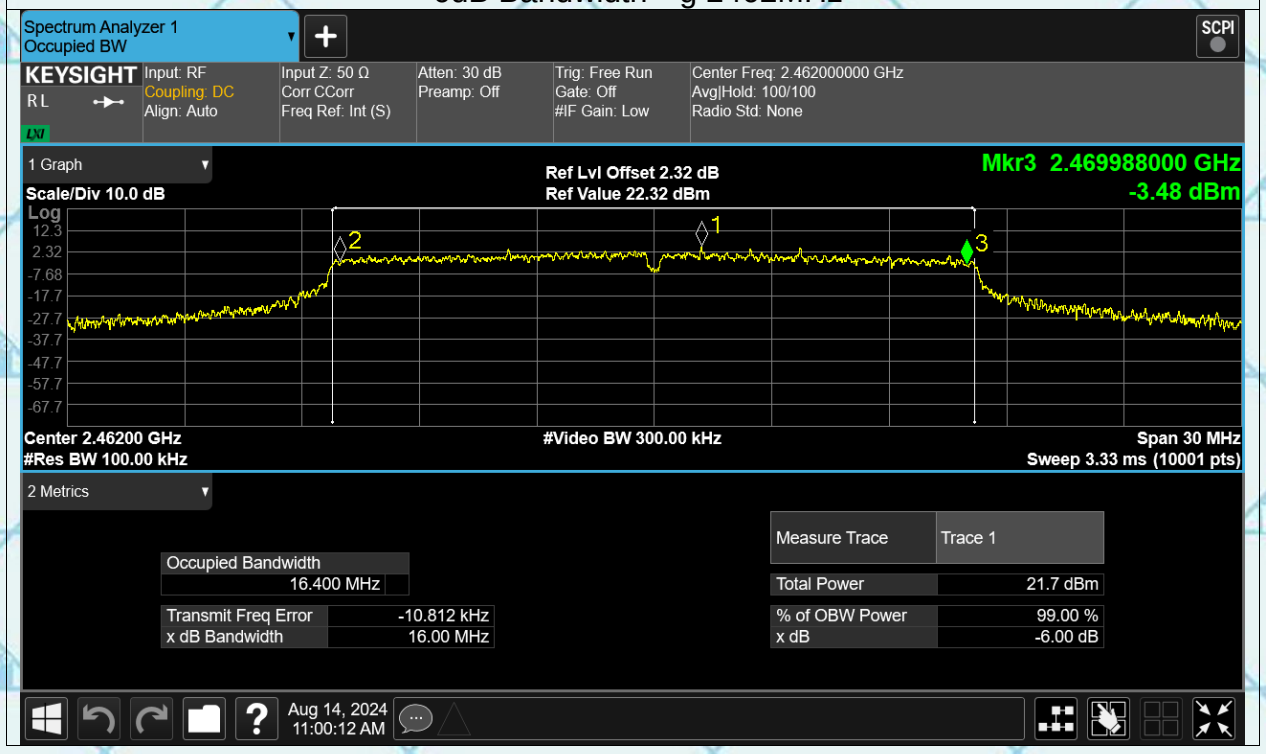
-6dB Bandwidth g 2412MHz



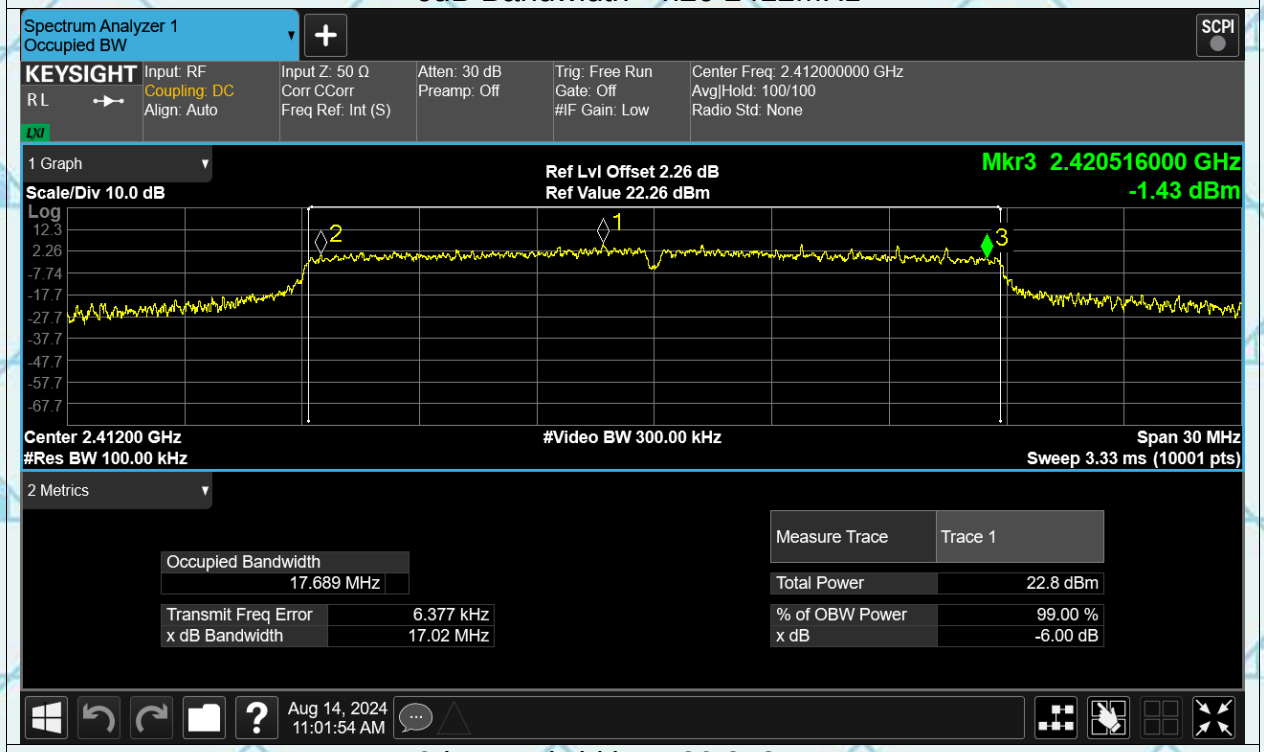
-6dB Bandwidth g 2437MHz



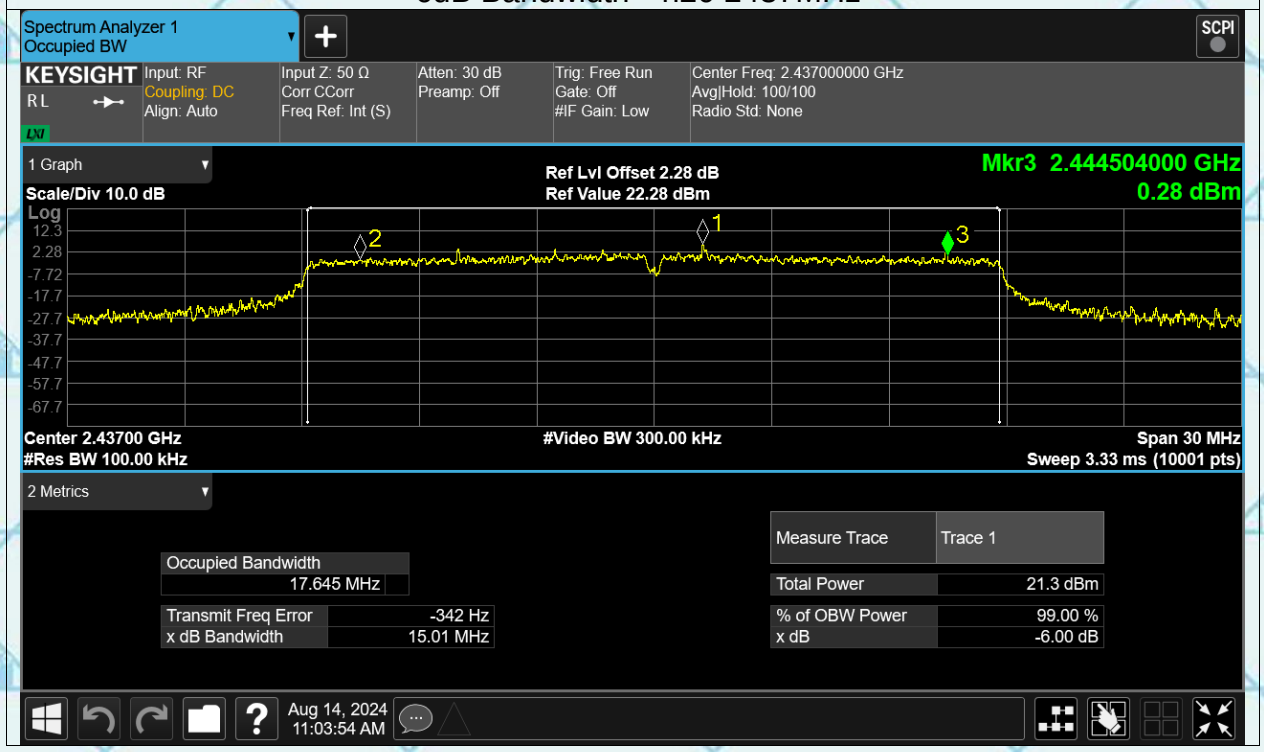
-6dB Bandwidth g 2462MHz



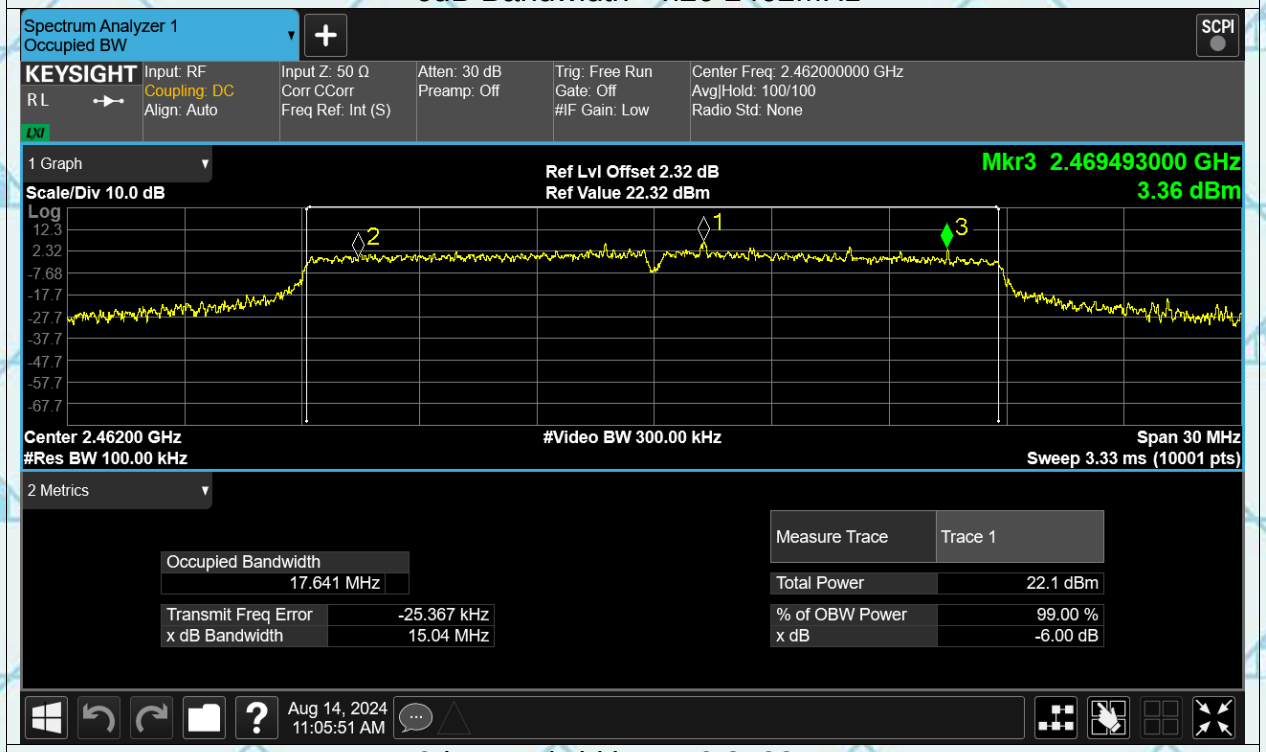
-6dB Bandwidth n20 2412MHz



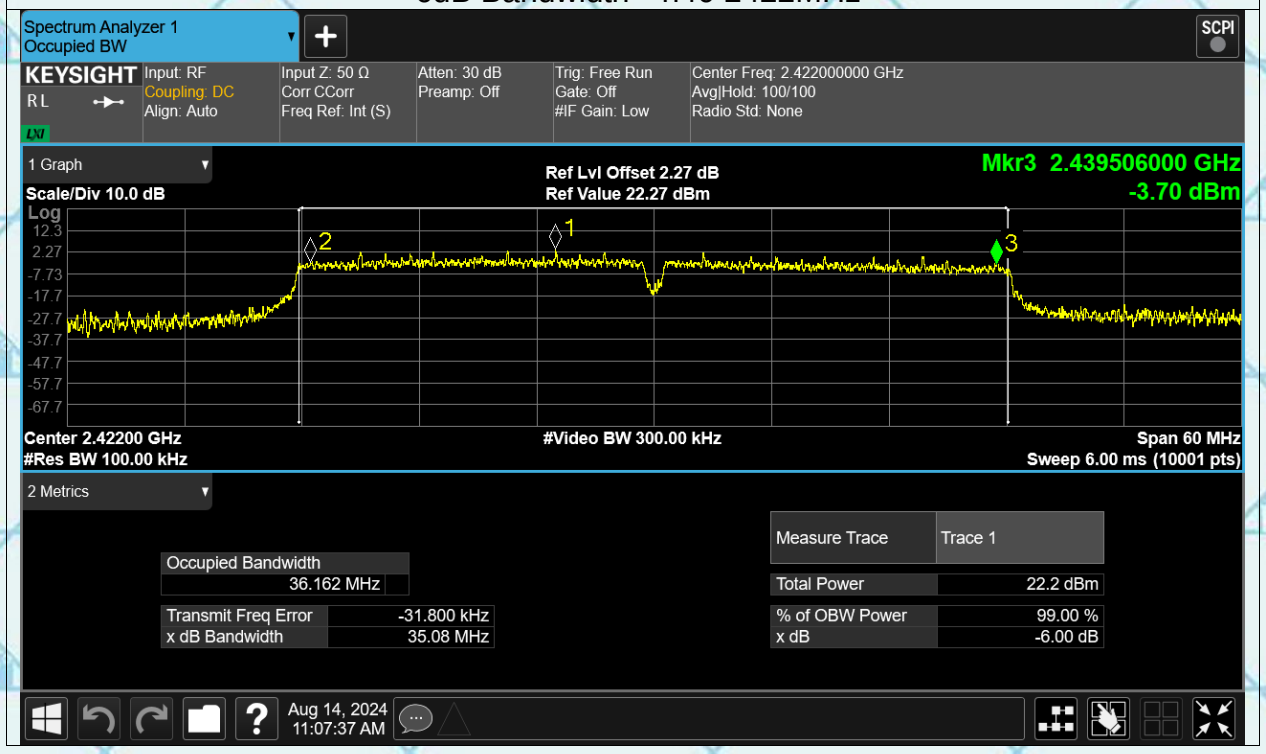
-6dB Bandwidth n20 2437MHz



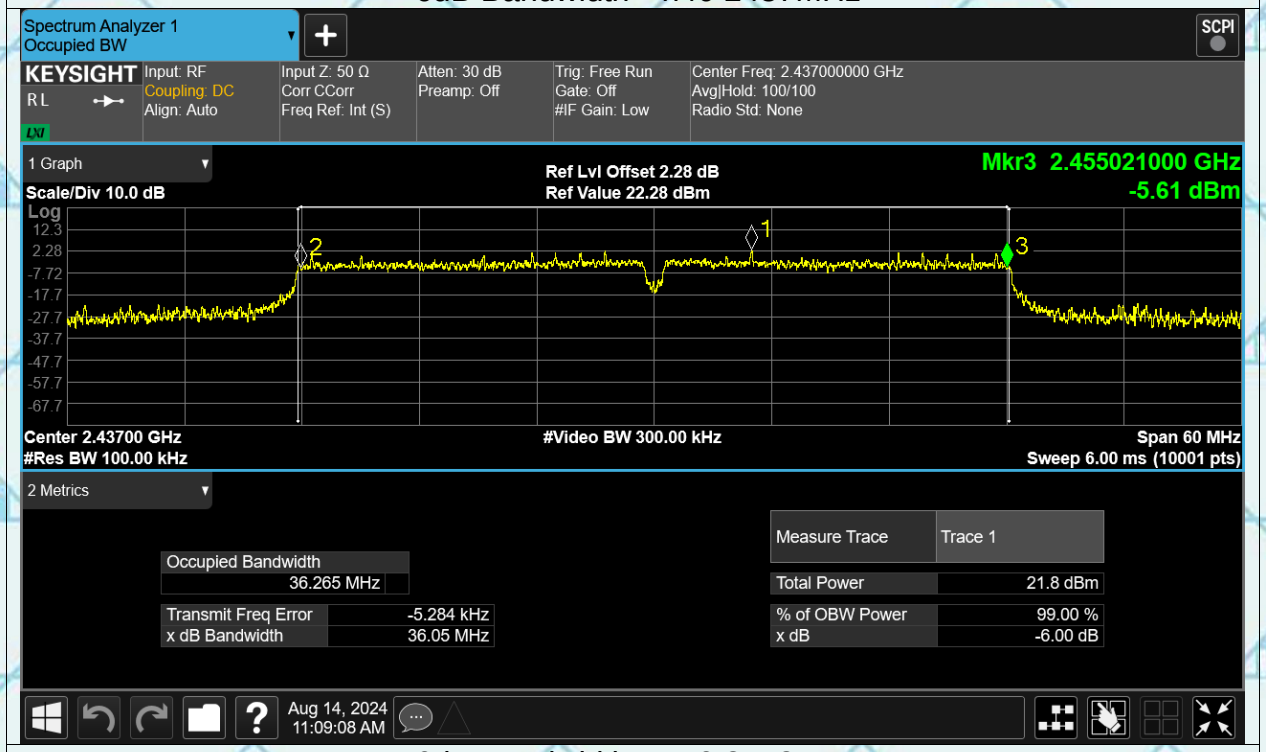
-6dB Bandwidth n20 2462MHz



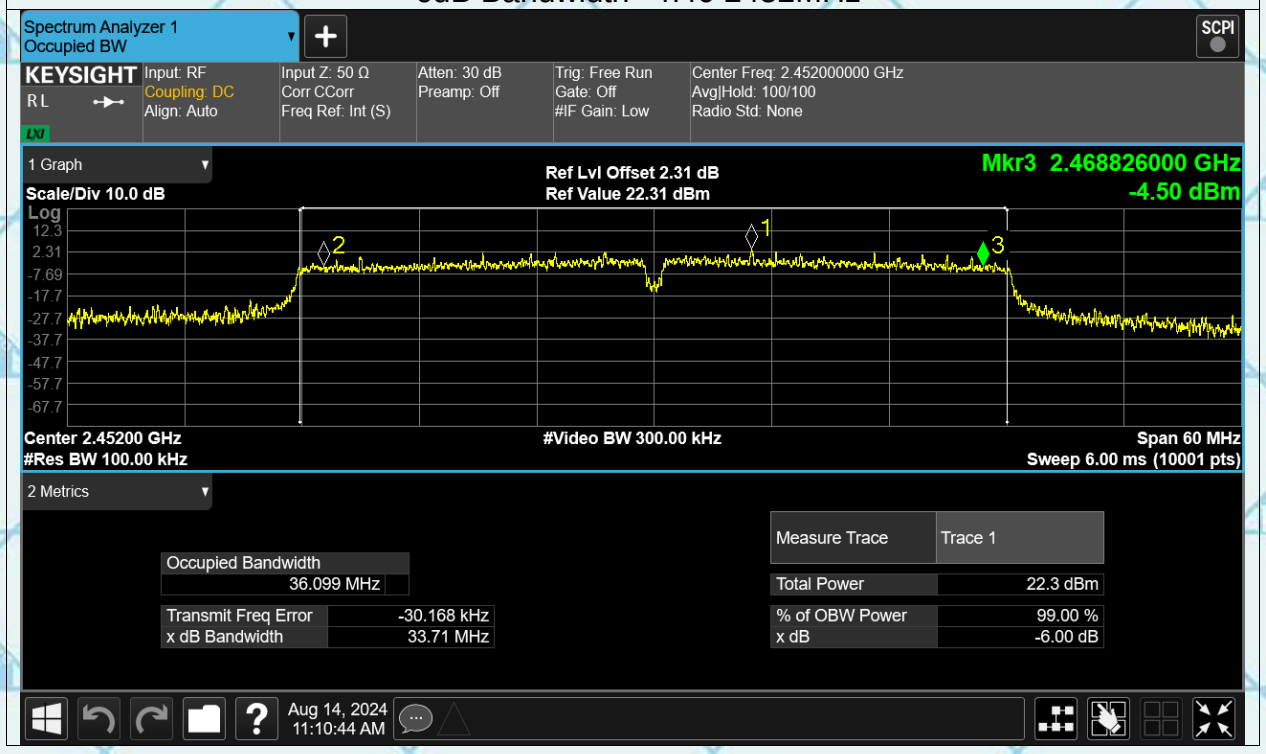
-6dB Bandwidth n40 2422MHz



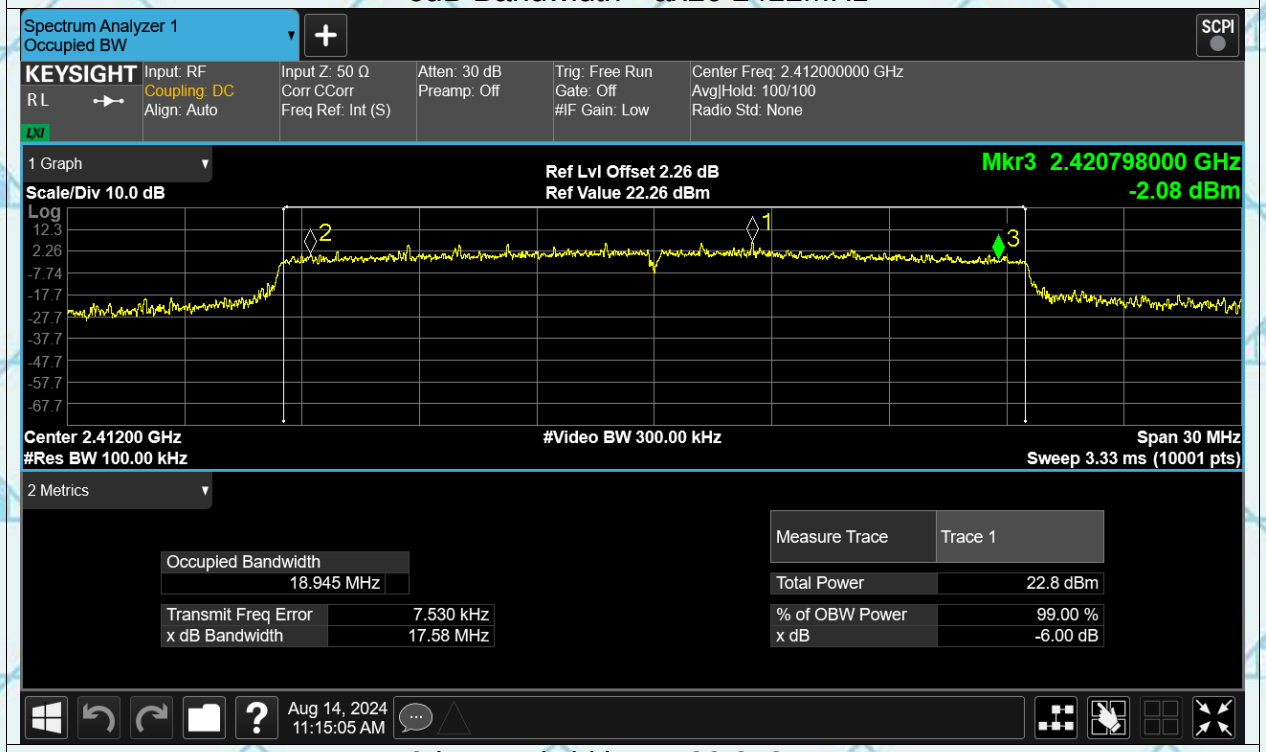
-6dB Bandwidth n40 2437MHz



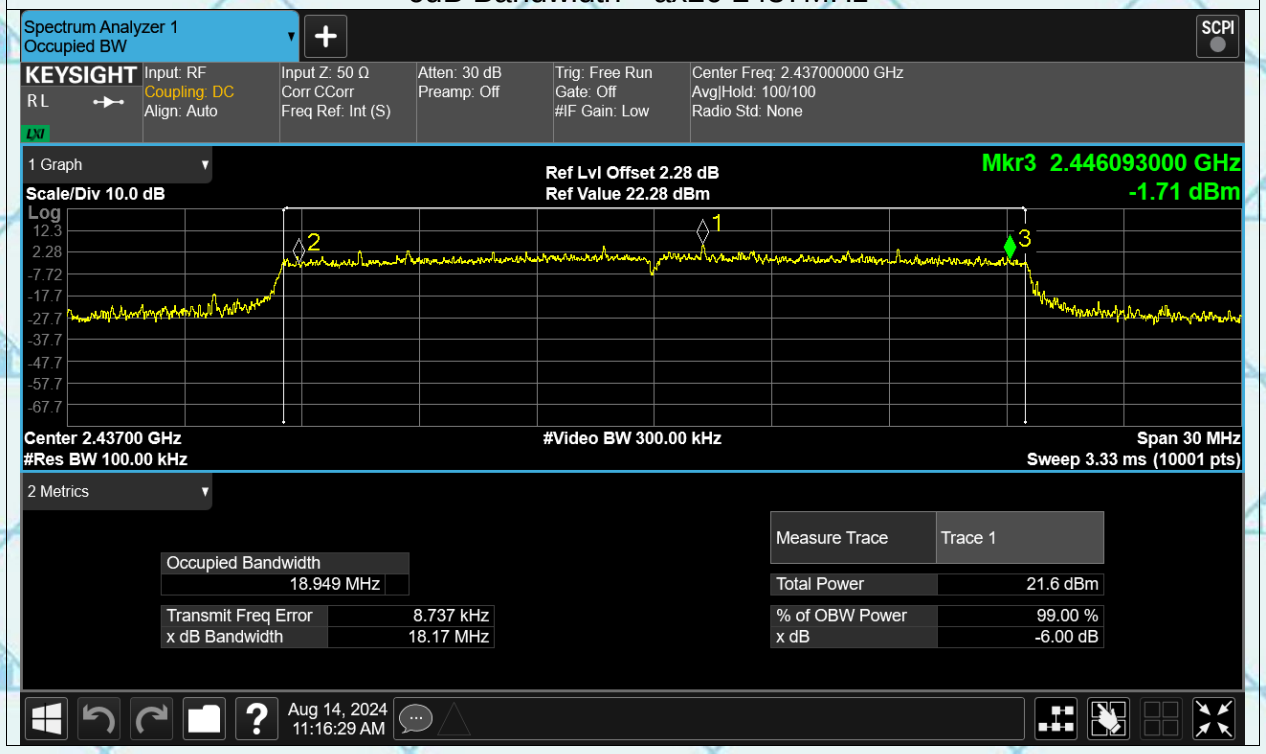
-6dB Bandwidth n40 2452MHz



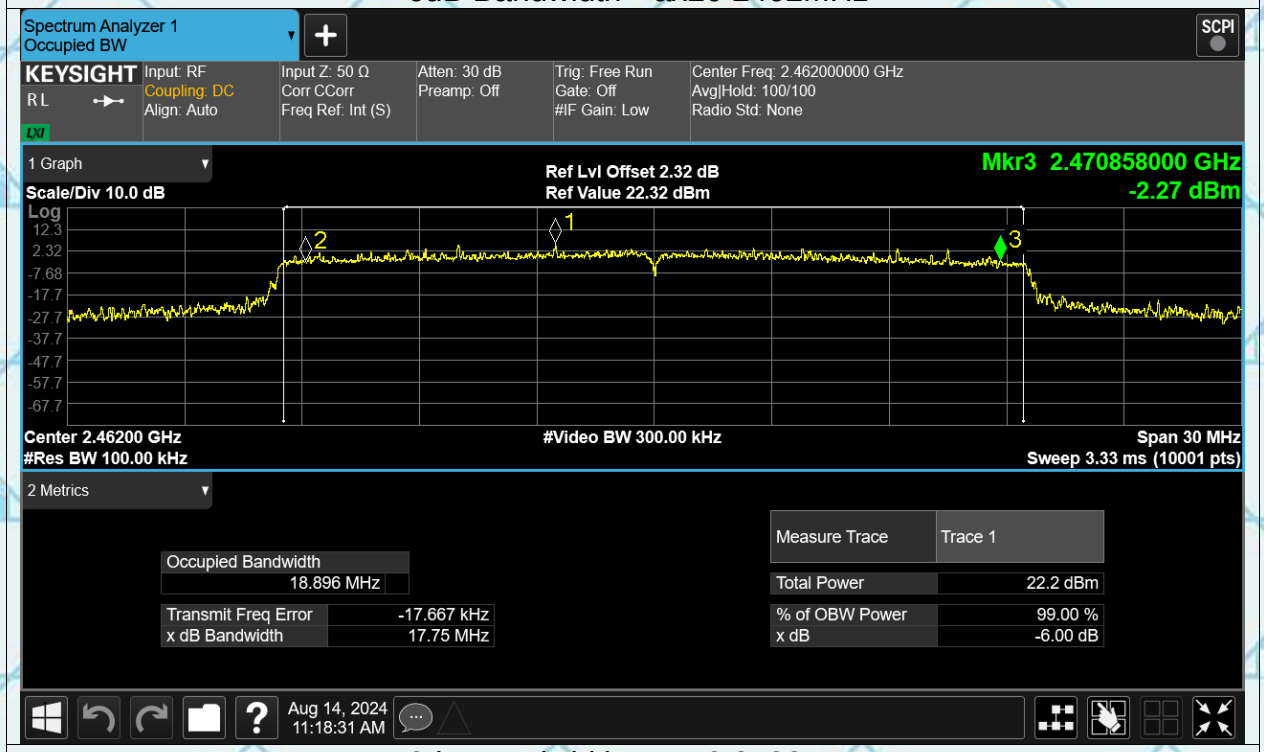
-6dB Bandwidth ax20 2412MHz



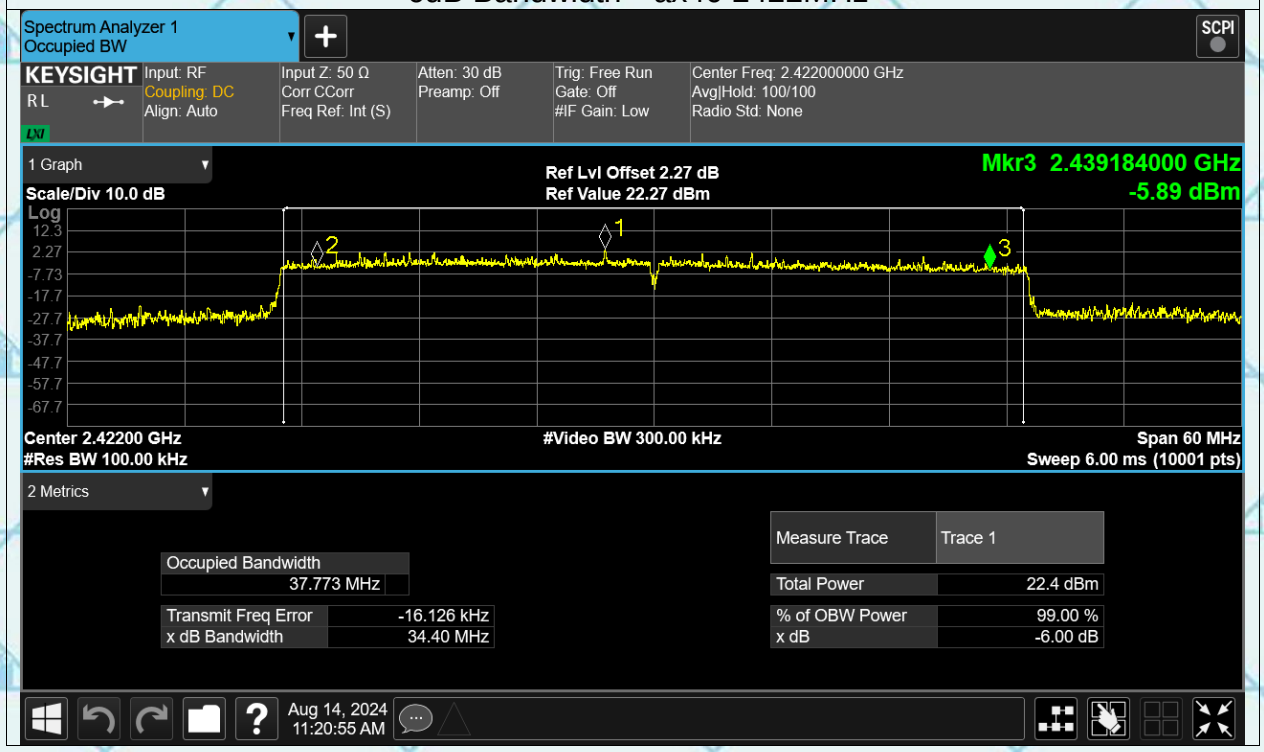
-6dB Bandwidth ax20 2437MHz



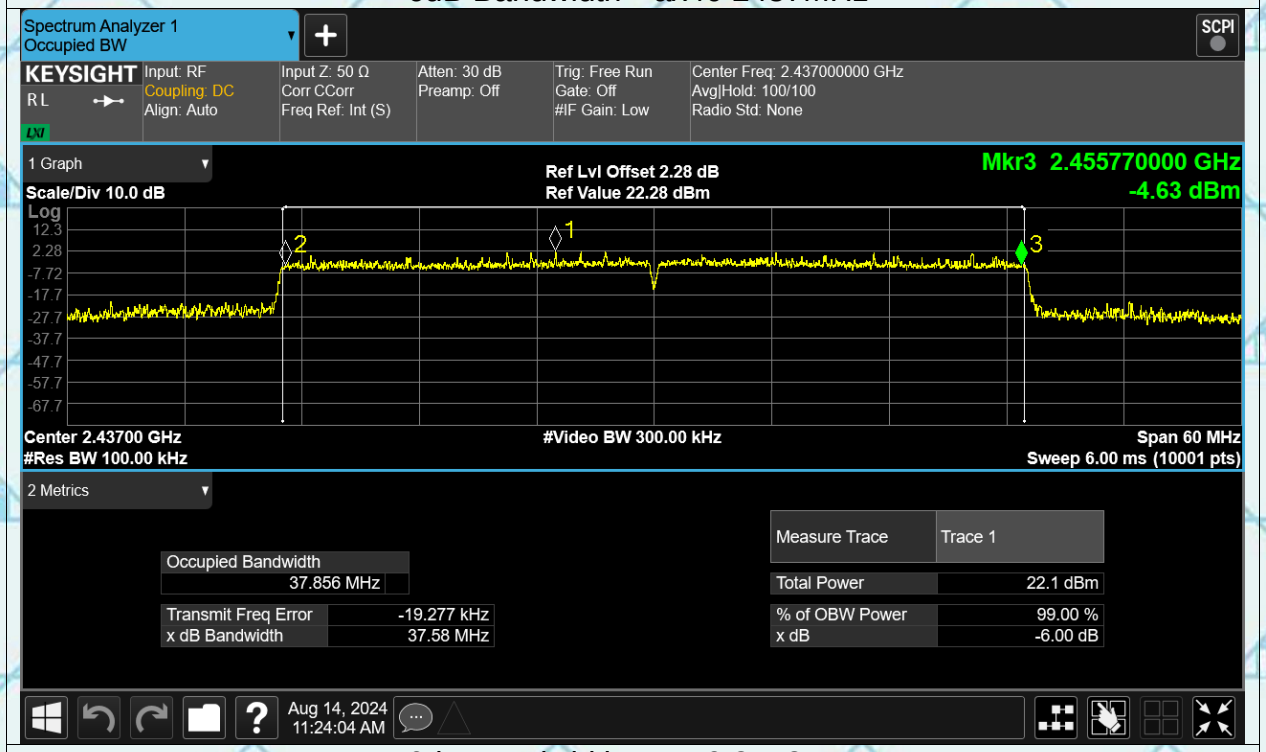
-6dB Bandwidth ax20 2462MHz



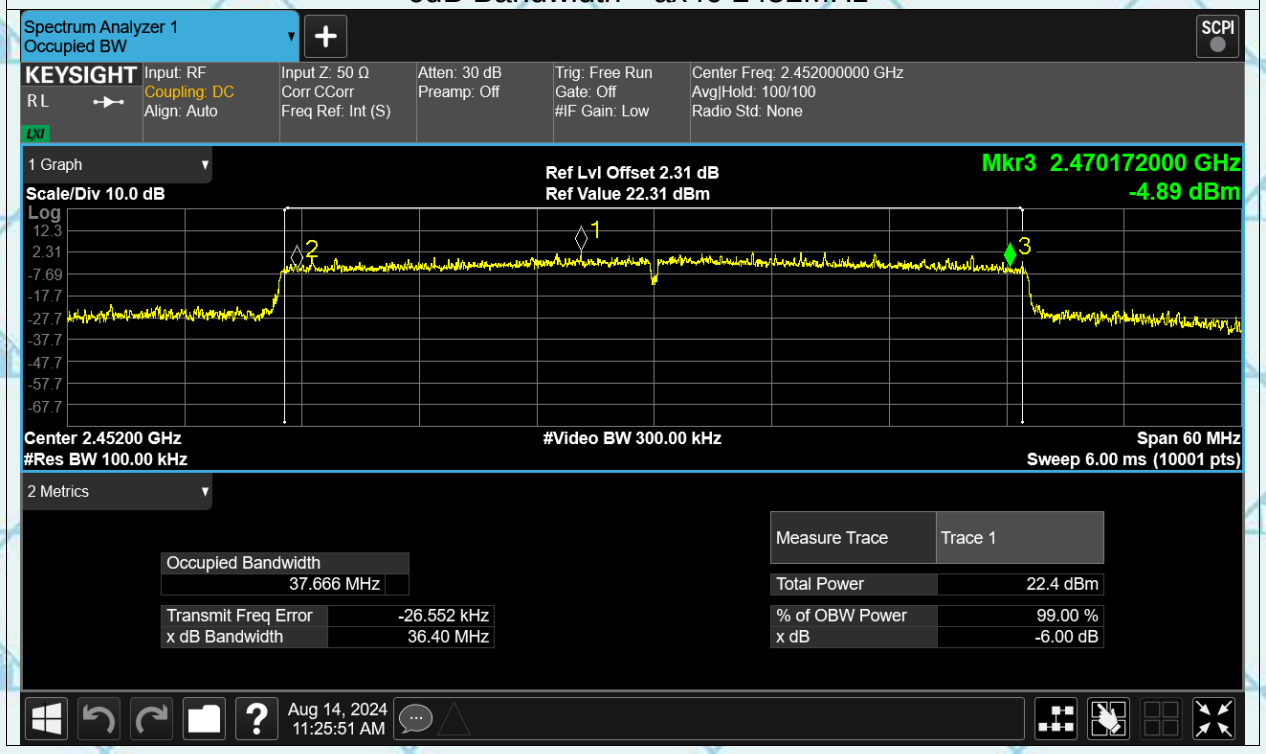
-6dB Bandwidth ax40 2422MHz



-6dB Bandwidth ax40 2437MHz

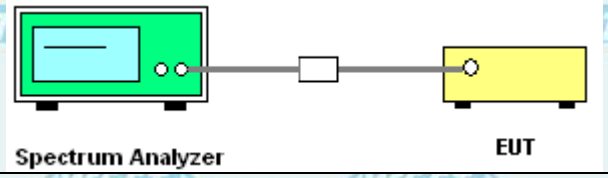


-6dB Bandwidth ax40 2452MHz



6.4. Power Spectral Density

6.4.1. Test Specification

Test Requirement:	FCC Part15 C Section 15.247 (e)
Test Method:	KDB 558074
Limit:	The average power spectral density shall not be greater than 8dBm in any 3kHz band at any time interval of continuous transmission.
Test Setup:	
Test Mode:	Transmitting mode with modulation
Test Procedure:	1. The testing follows Measurement Procedure 10.3 Method AVGPSD of FCC KDB Publication No.558074 D01 DTS Meas. Guidance v04 2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement. 3. Set to the maximum power setting and enable the EUT transmit continuously. 4. Make the measurement with the spectrum analyzer's resolution bandwidth (RBW): 3 kHz ≤ RBW ≤ 100 kHz. Video bandwidth VBW ≥ 3 x RBW. Set the span to at least 1.5 times the OBW. 5. Detector = RMS, Sweep time = auto couple. 6. Employ trace averaging (RMS) mode over a minimum of 100 traces. Use the peak marker function to determine the maximum power level. 6. Measure and record the results in the test report.
Test Result:	PASS

(i) If all antennas have the same gain, G_{ANT}:
Directional gain = G_{ANT} + *10 log*(N_{ANT}/N_{SS}) *dBi*, where N_{SS} = the number of independent spatial streams of data and G_{ANT} is the antenna gain in dBi. (This formula can also be applied when antennas have different gains if the highest antenna gain is substituted for G_{ANT}.)

(ii) If antenna gains are not equal and each transmit antenna is driven by only one spatial stream, directional gain may be calculated by either of the following two formulas.

- *Directional gain* = $G_{ANT\,MAX}$ + *10 log*(N_{ANT}/N_{SS}) *dBi*, where N_{SS} = the number of independent spatial streams of data and $G_{ANT\,MAX}$ is.the gain of the antenna having the highest gain (in dBi).

Or,

- $$DirectionalGain = 10 \cdot \log\left[\frac{\sum_{j=1}^{N_{SS}}\left\{\sum_{k=1}^{N_{ANT}} g_{j,k}\right\}^2}{N_{ANT}}\right]$$

where
Each antenna is driven by no more than one spatial stream;
N_{SS} = the number of independent spatial streams of data;
N_{ANT} = the total number of antennas
$g_{j,k} = 10^{G_k/20}$ if the *k*th antenna is being fed by spatial stream *j*, or zero if it is not;
G_k is the gain in dBi of the kth antenna.

For power spectral density (PSD) measurements on all devices,
Array Gain = 10 log(NANT/NSS) dB.
Note: Nant=2，Array gain=10Log (Nant/Nss)=10log(2/1)=3.01dB, Directional gain=Gant+Array gain=2.70dBi+3.01dB=5.71dBi, not exceeding 6, so psd limits remain unchanged.

6.4.2. Test data

MAIN Ant1

Mode	Frequency (MHz)	Total PSD (dBm/3kHz)	Limit (dBm/3kHz)	Verdict
b	2412	4.12	8	Pass
b	2437	3.12	8	Pass
b	2462	2.68	8	Pass
g	2412	-3.21	8	Pass
g	2437	-5.33	8	Pass
g	2462	0.89	8	Pass
n20	2412	-2.04	8	Pass
n20	2437	-4.08	8	Pass
n20	2462	-2.93	8	Pass
n40	2422	-6.40	8	Pass
n40	2437	-7.64	8	Pass
n40	2452	-6.61	8	Pass
ax20	2412	-3.47	8	Pass
ax20	2437	-5.08	8	Pass
ax20	2462	-4.05	8	Pass
ax40	2422	-6.23	8	Pass
ax40	2437	-8.14	8	Pass
ax40	2452	-7.06	8	Pass

AUX Ant2

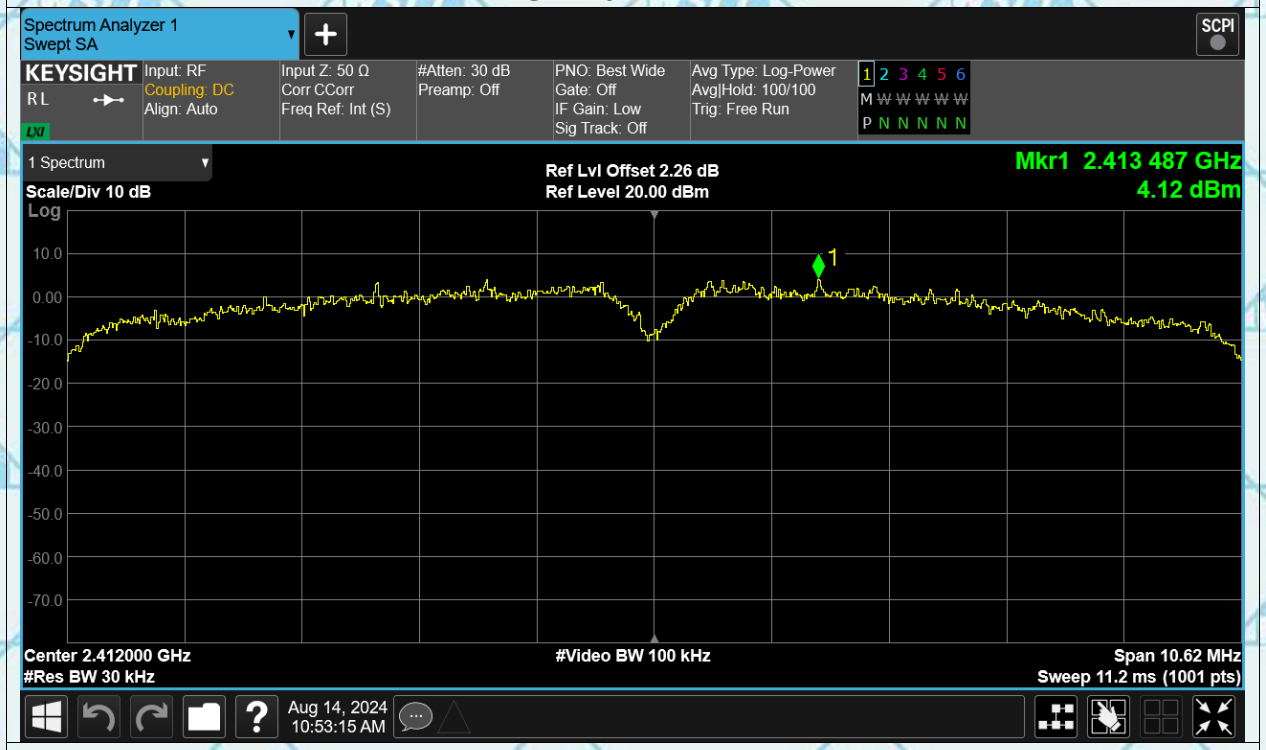
Mode	Frequency (MHz)	Total PSD (dBm/3kHz)	Limit (dBm/3kHz)	Verdict
b	2412	5.22	8	Pass
b	2437	1.76	8	Pass
b	2462	4.26	8	Pass
g	2412	-4.65	8	Pass
g	2437	-5.81	8	Pass
g	2462	-5.11	8	Pass
n20	2412	-2.65	8	Pass
n20	2437	-5.53	8	Pass
n20	2462	-4.06	8	Pass
n40	2422	-6.91	8	Pass
n40	2437	-8.24	8	Pass
n40	2452	-7.32	8	Pass
ax20	2412	-3.9	8	Pass
ax20	2437	-5.63	8	Pass
ax20	2462	-4.64	8	Pass
ax40	2422	-7.16	8	Pass
ax40	2437	-7.83	8	Pass
ax40	2452	-7.28	8	Pass

MIMO

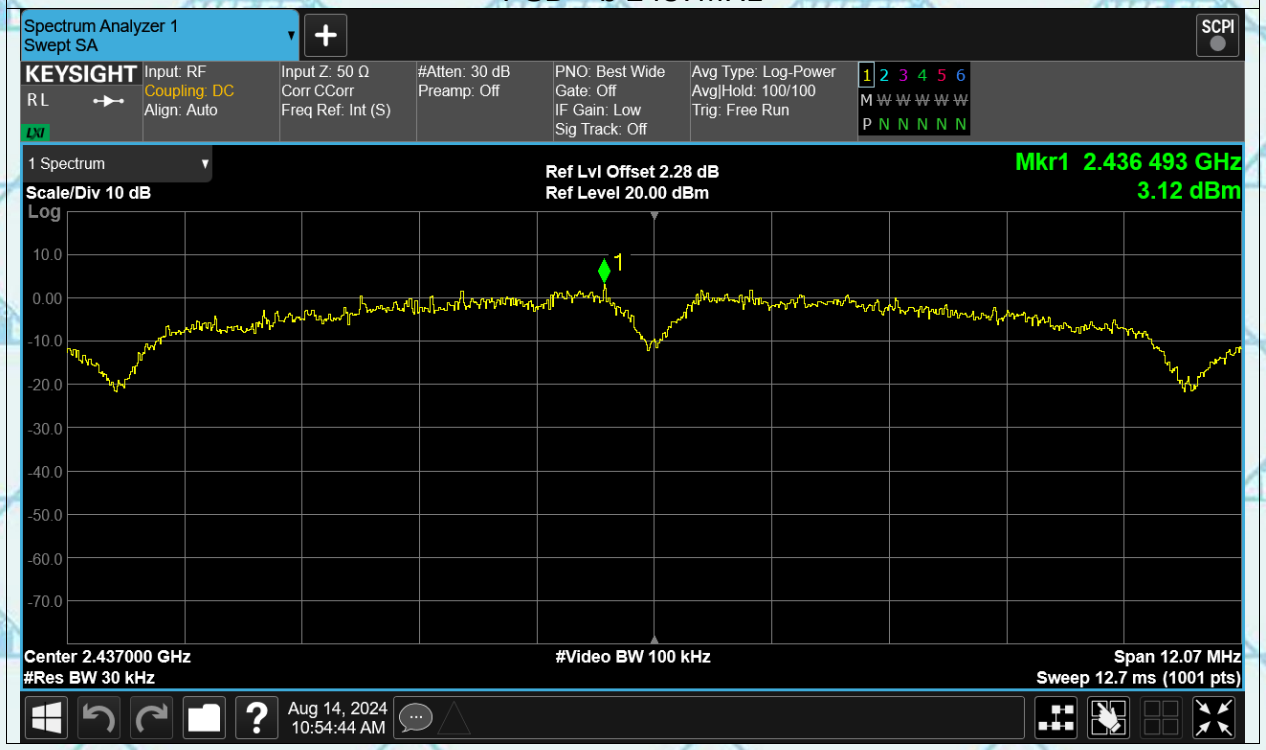
Mode	Frequency (MHz)	Total PSD (dBm/3kHz)	Limit (dBm/3kHz)	Verdict
n20	2412	0.68	8	Pass
n20	2437	-1.73	8	Pass
n20	2462	-0.45	8	Pass
n40	2422	-3.64	8	Pass
n40	2437	-4.92	8	Pass
n40	2452	-3.94	8	Pass
ax20	2412	-0.67	8	Pass
ax20	2437	-2.34	8	Pass
ax20	2462	-1.32	8	Pass
ax40	2422	-3.66	8	Pass
ax40	2437	-4.97	8	Pass
ax40	2452	-4.16	8	Pass

MAIN ANT1 Test Graphs

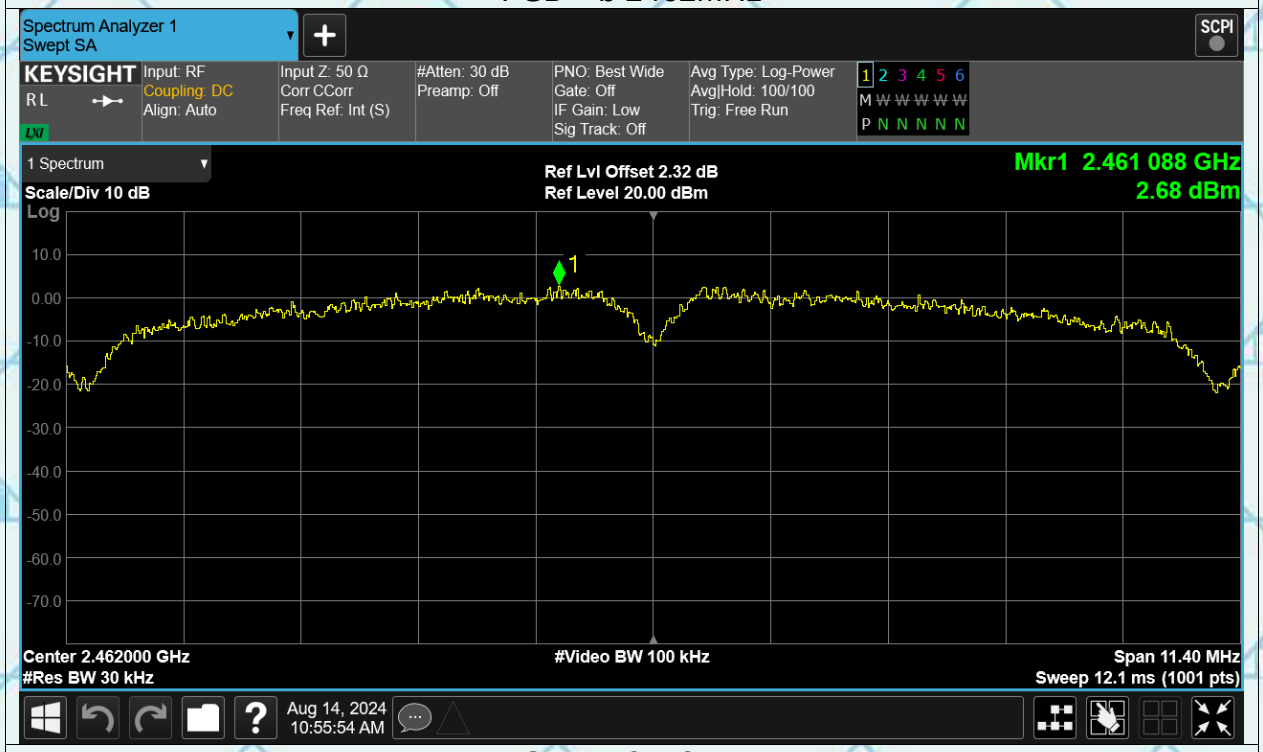
PSD b 2412MHz



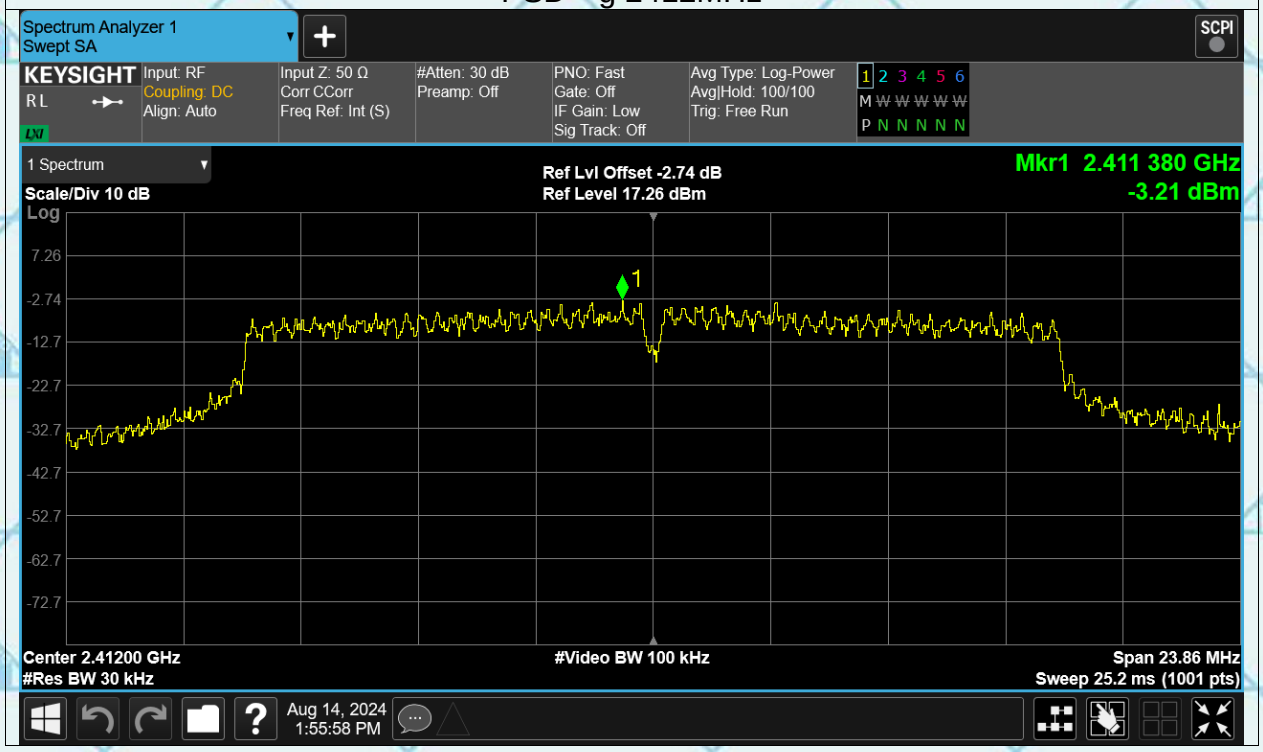
PSD b 2437MHz



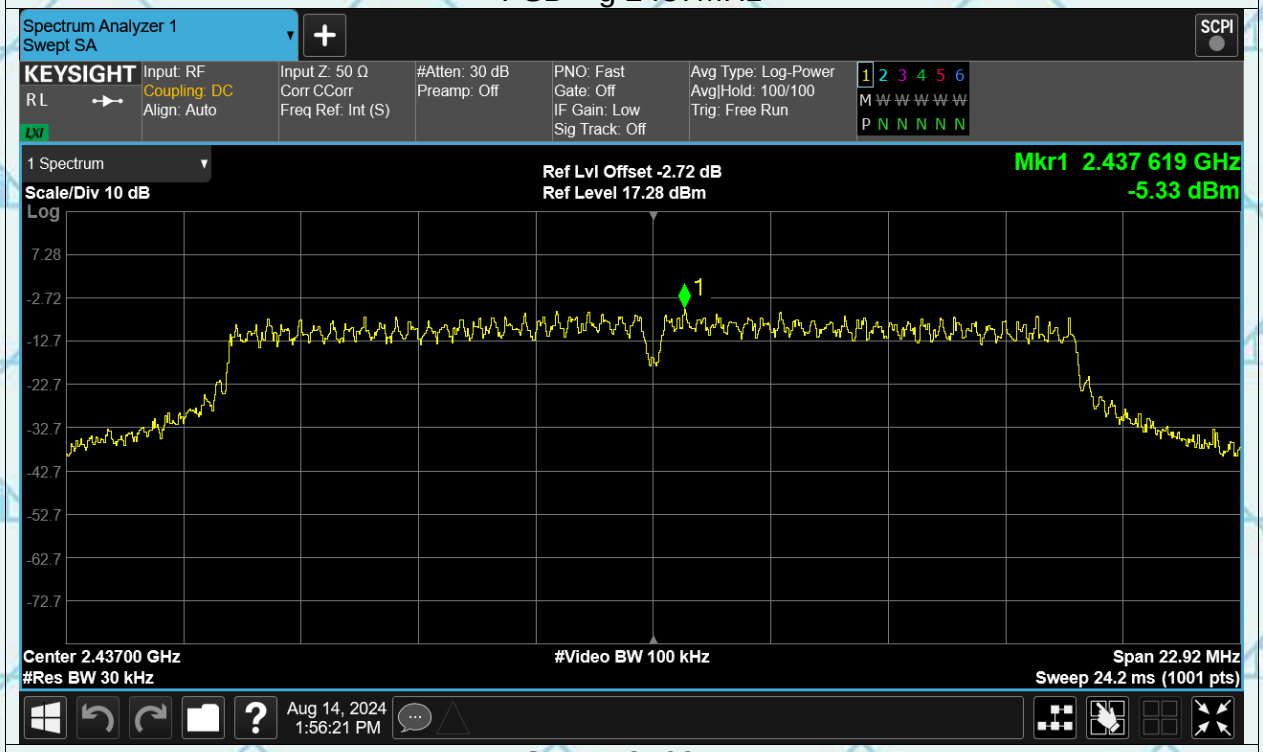
PSD b 2462MHz



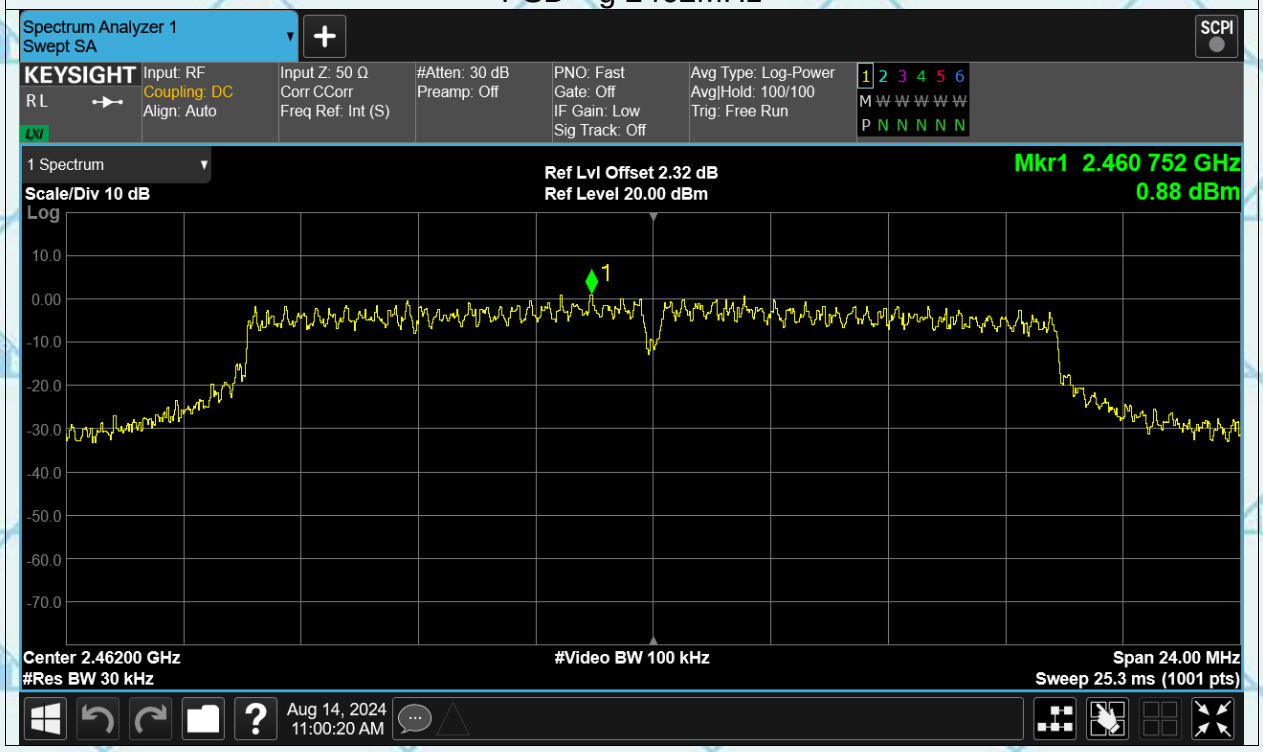
PSD g 2412MHz



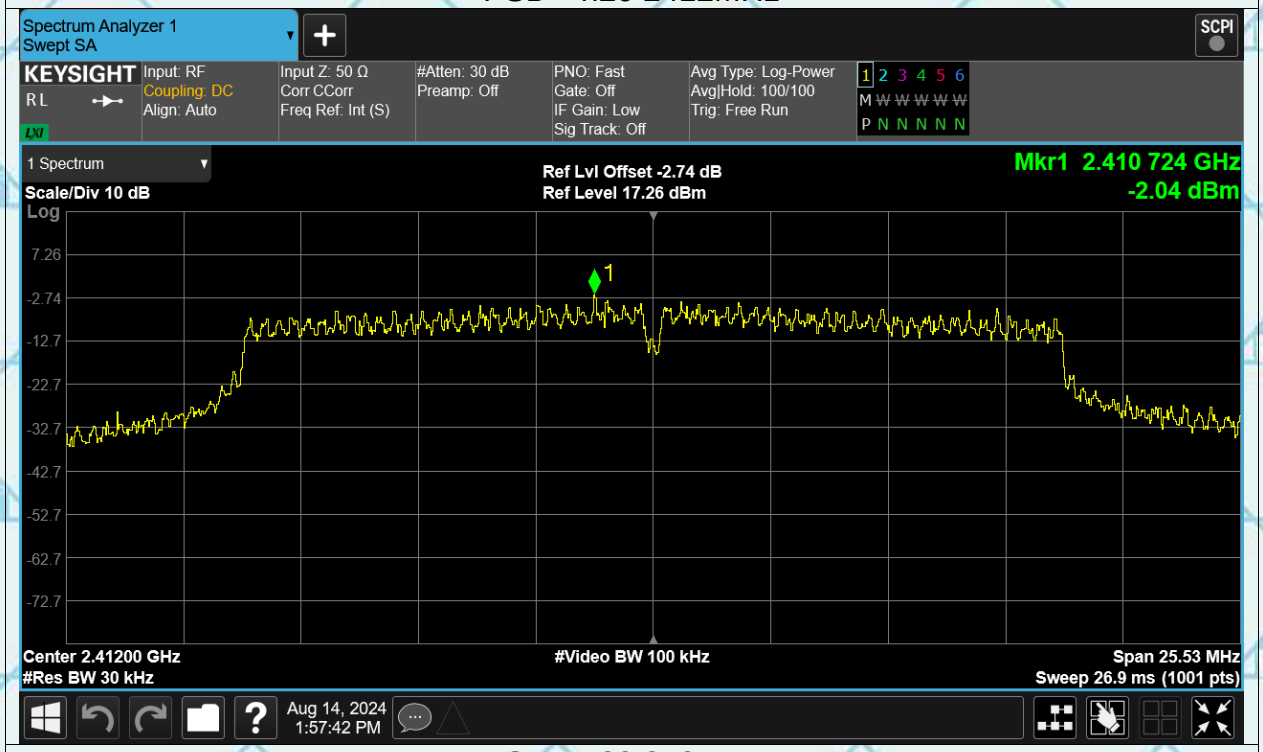
PSD g 2437MHz



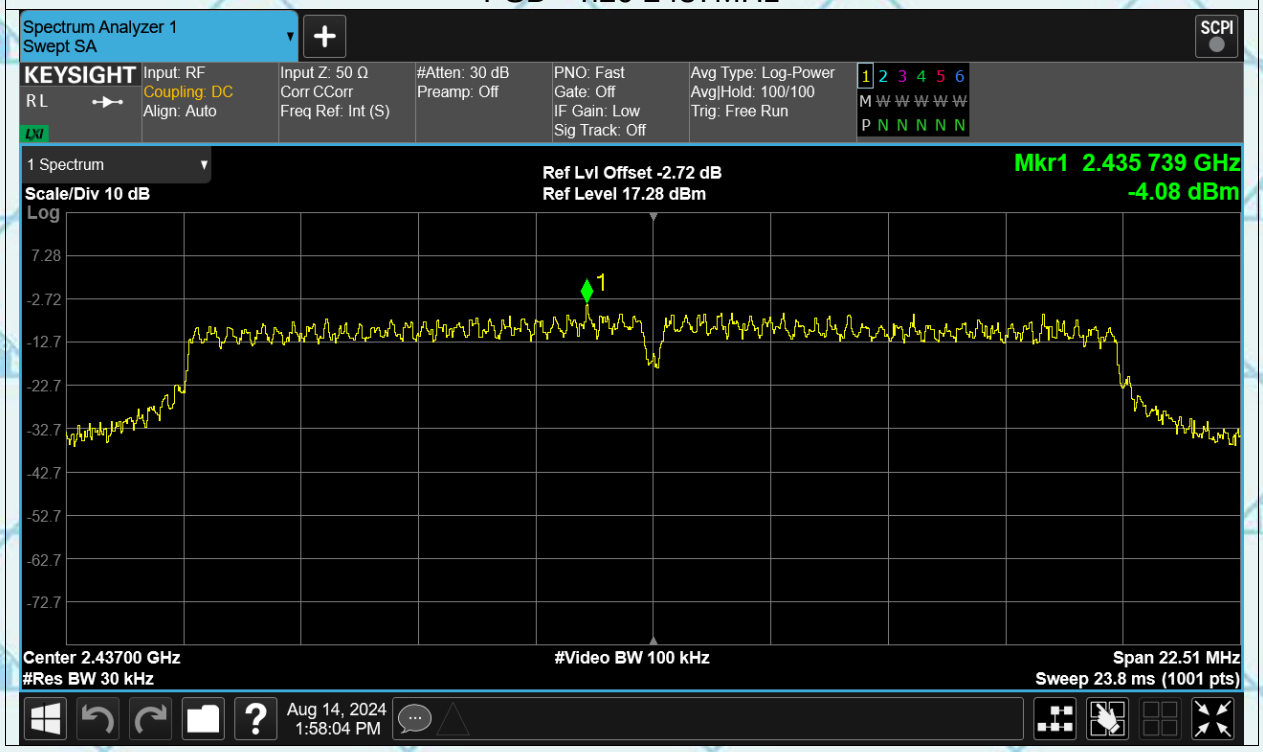
PSD g 2462MHz



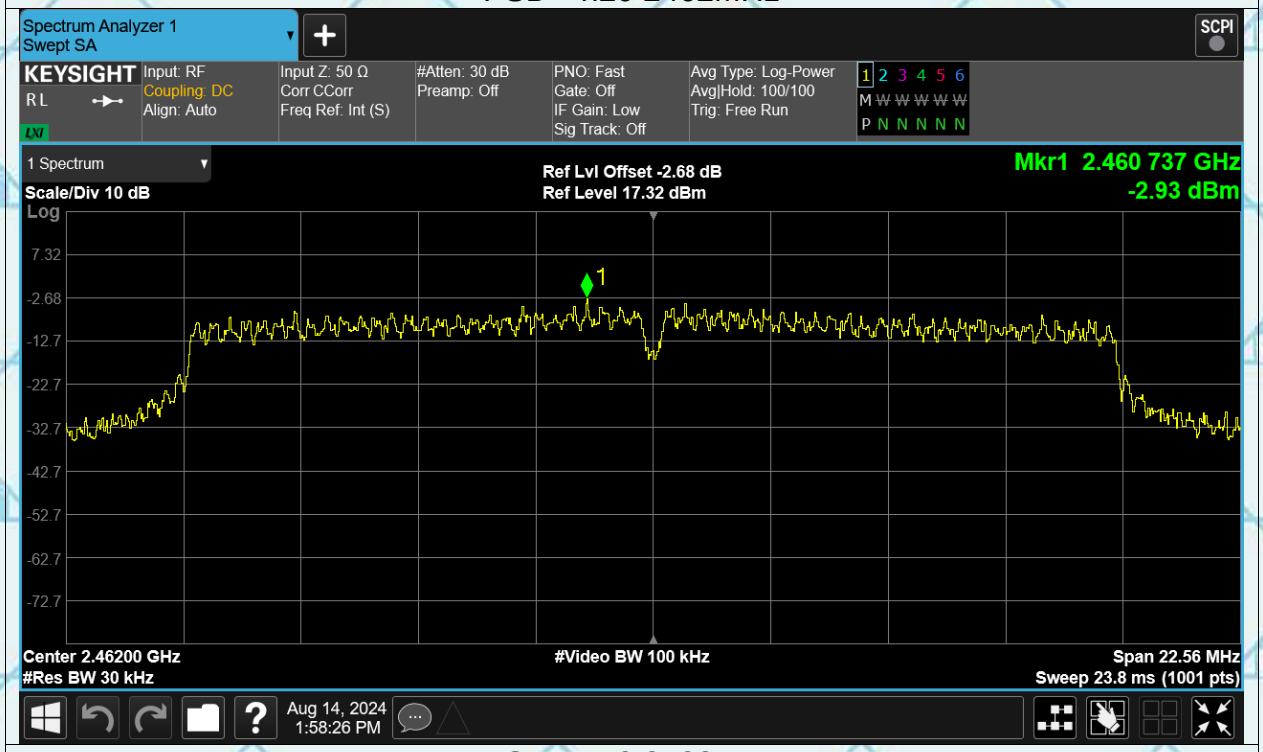
PSD n20 2412MHz



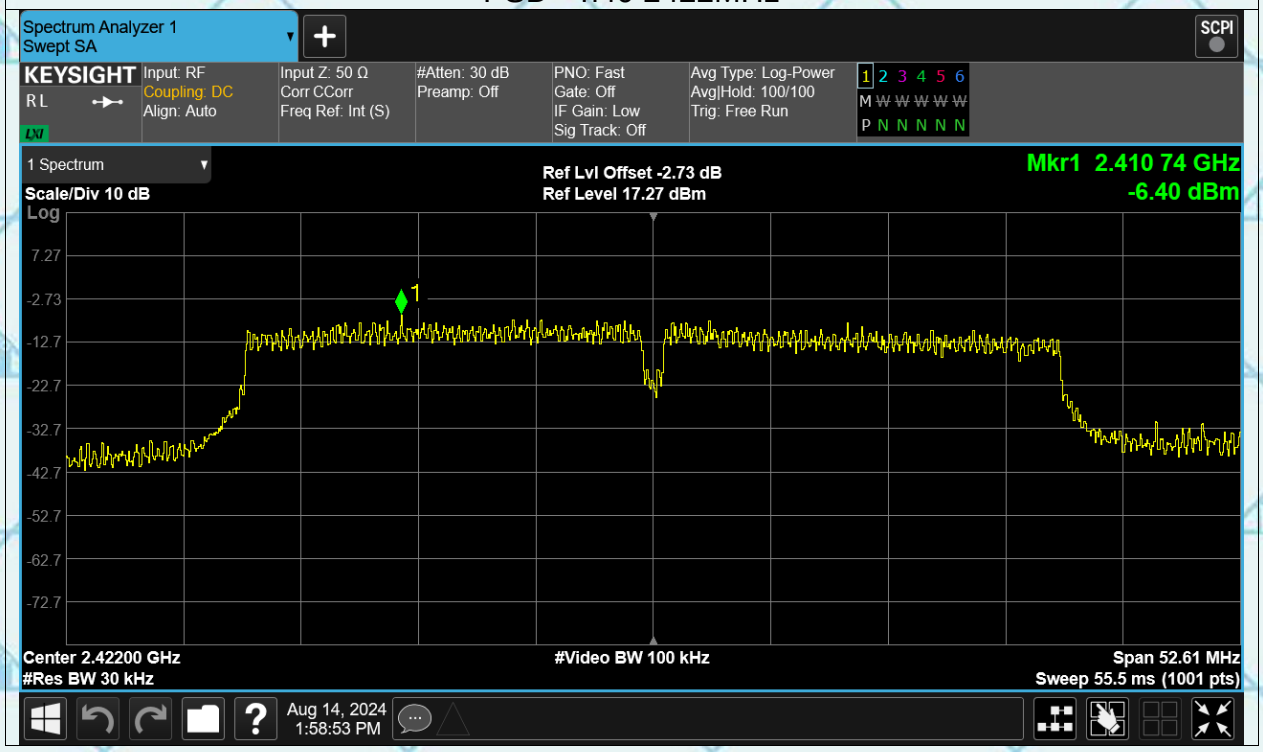
PSD n20 2437MHz



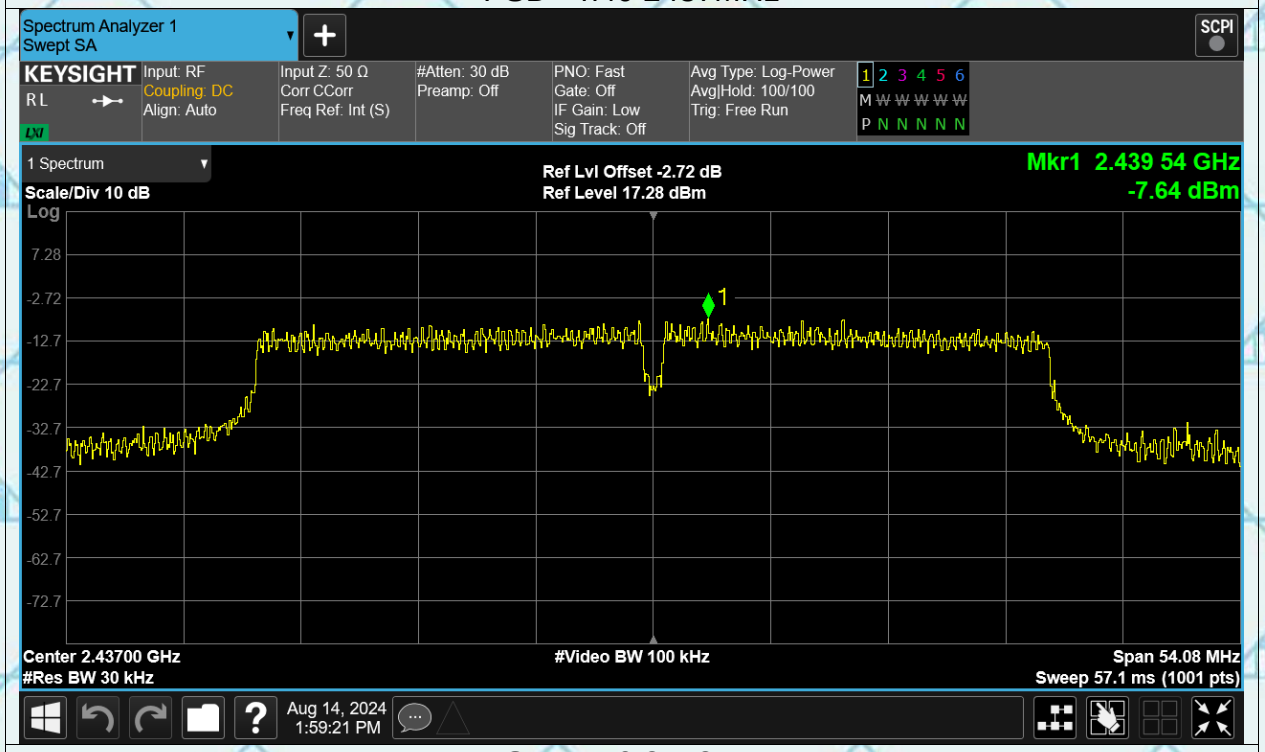
PSD n20 2462MHz



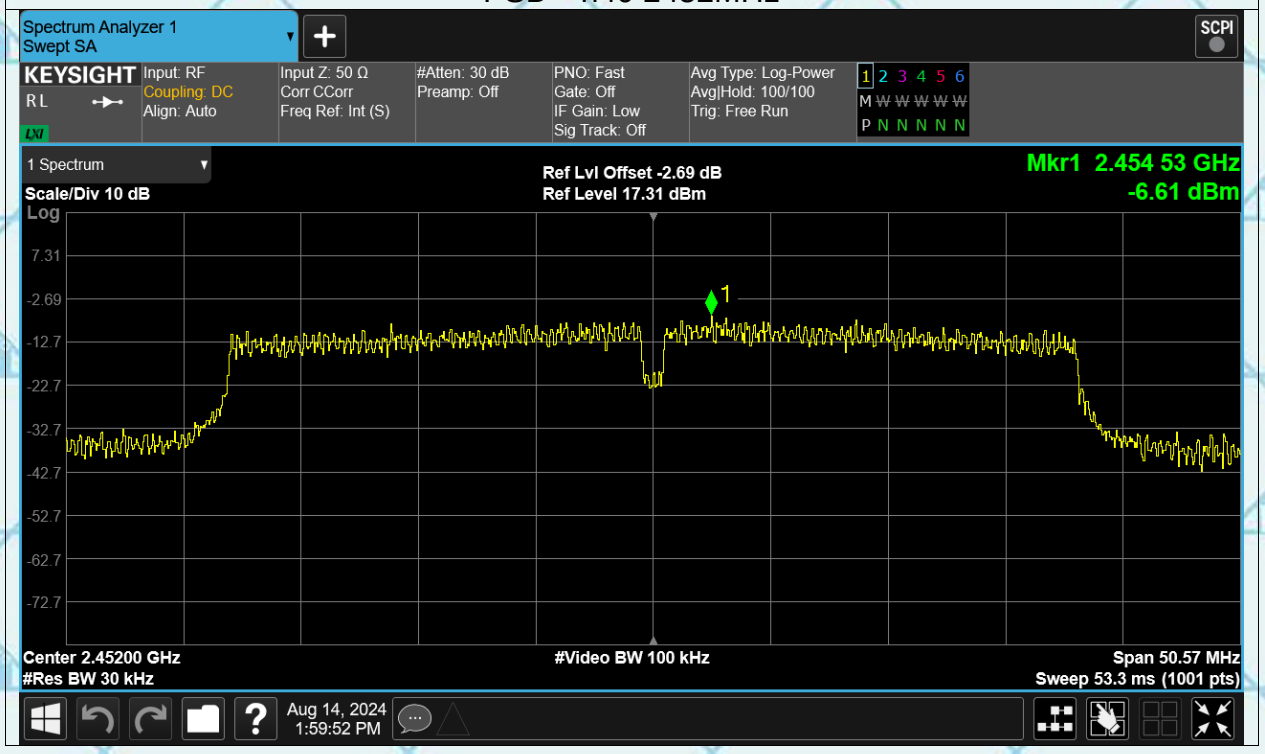
PSD n40 2422MHz



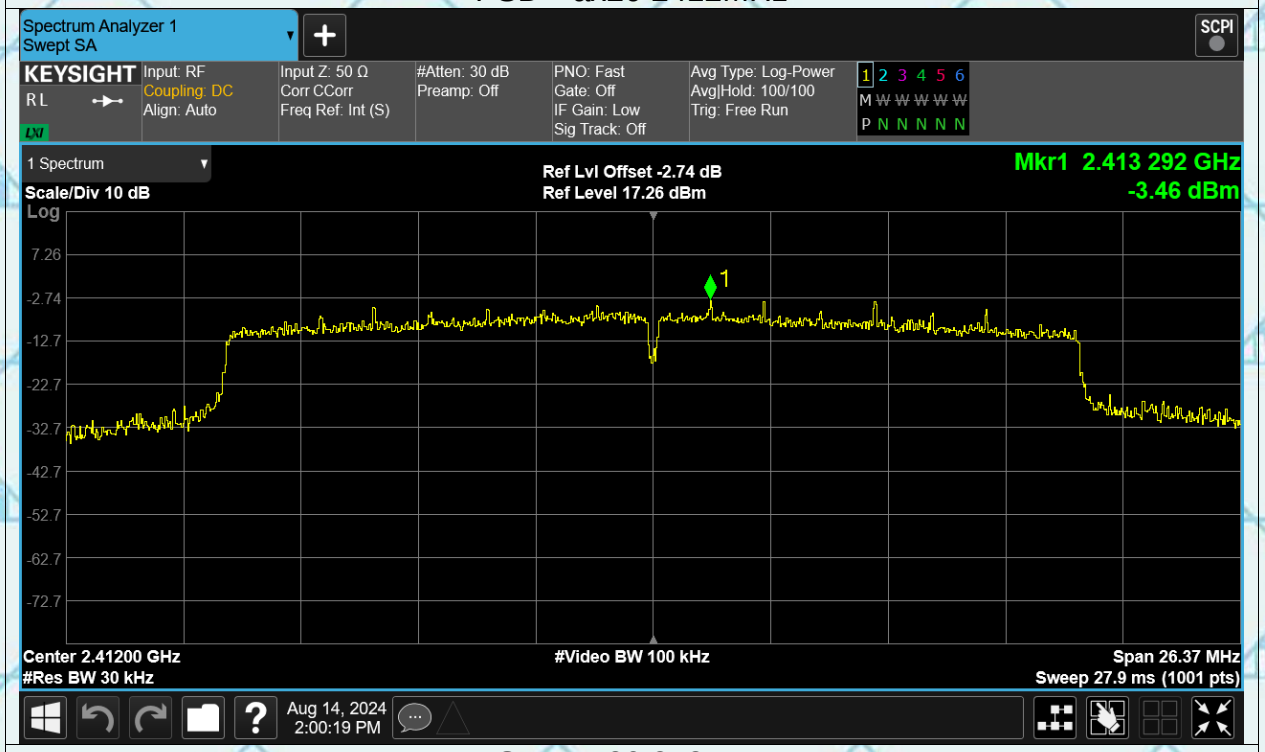
PSD n40 2437MHz



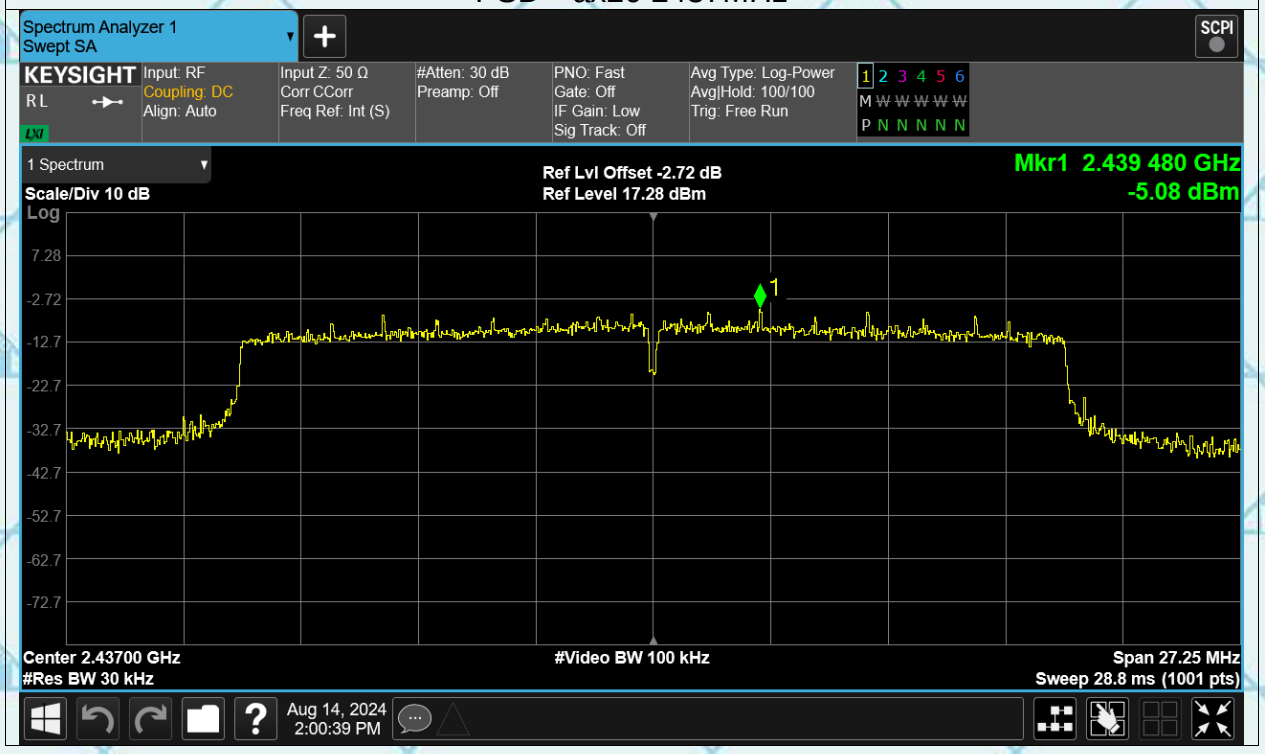
PSD n40 2452MHz



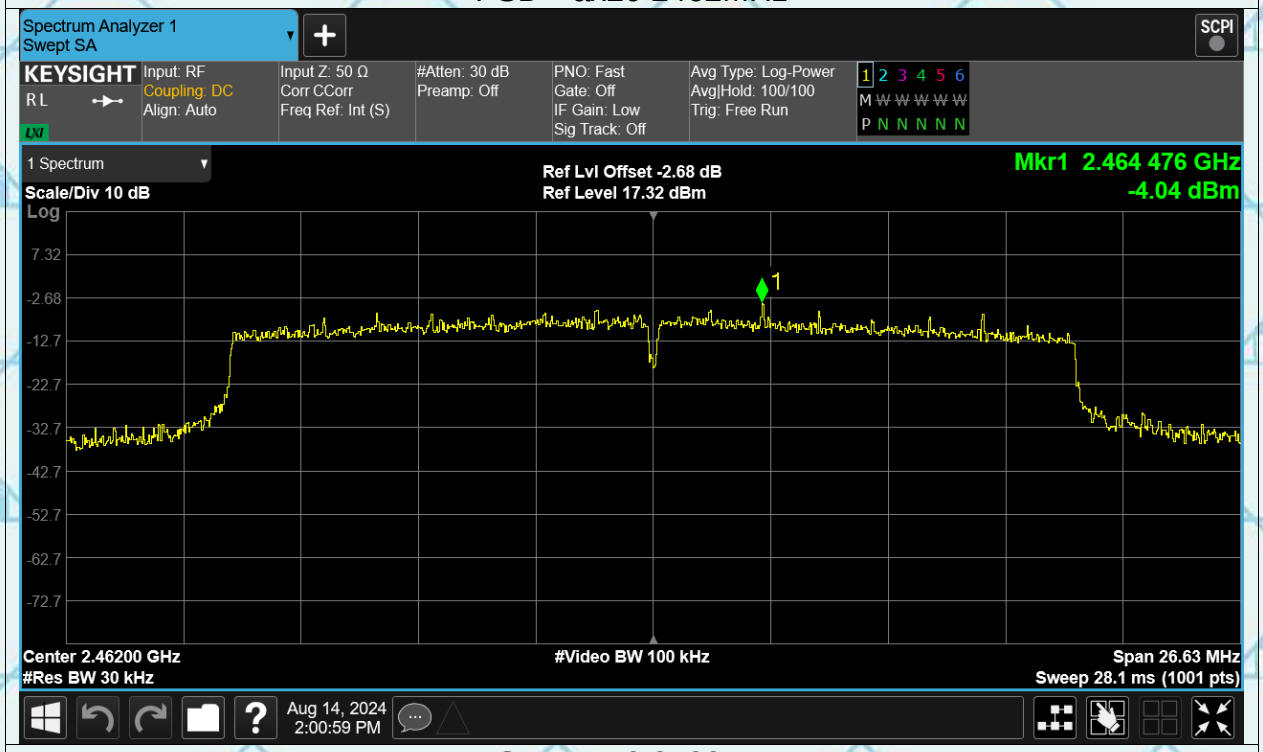
PSD ax20 2412MHz



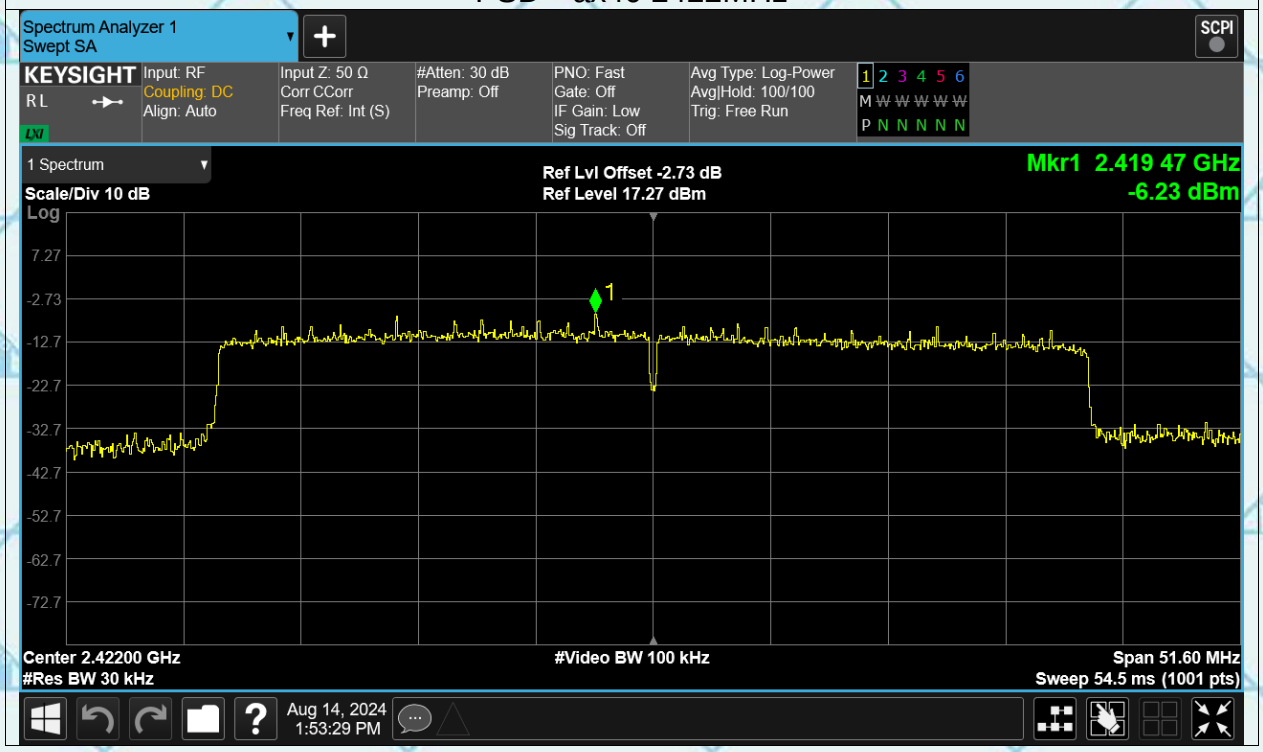
PSD ax20 2437MHz



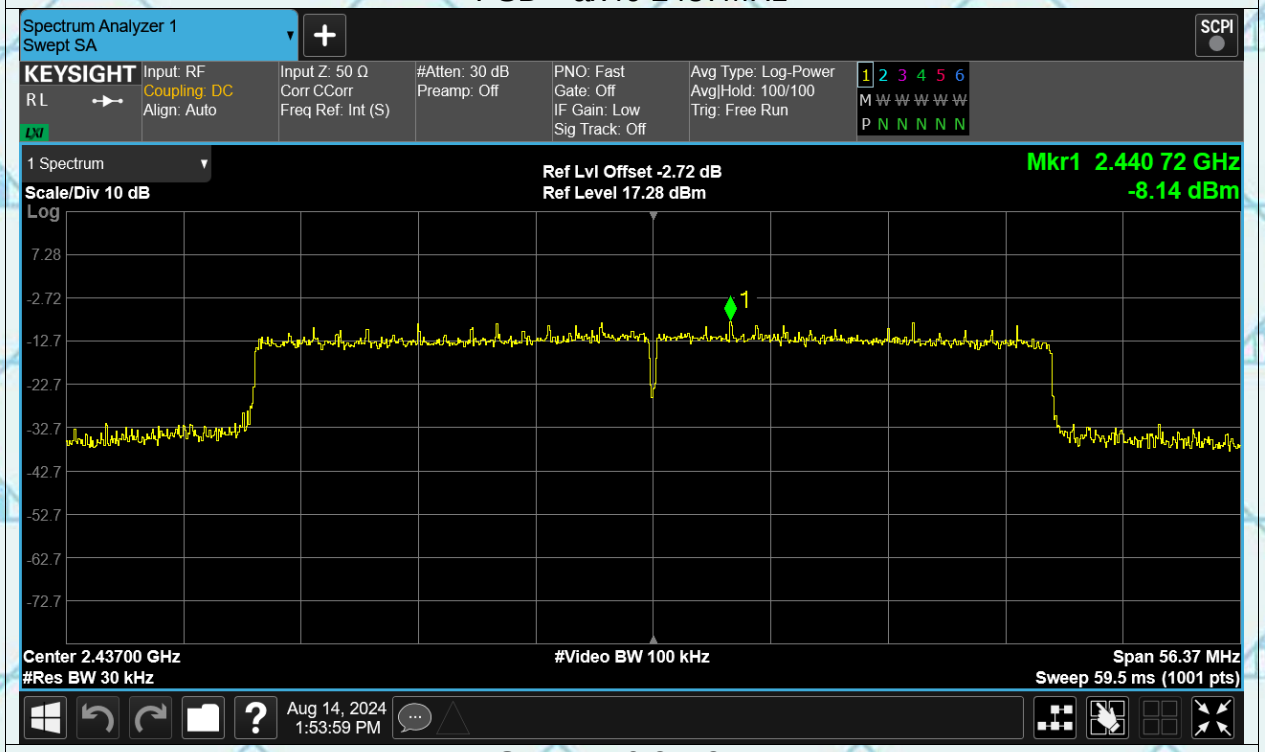
PSD ax20 2462MHz



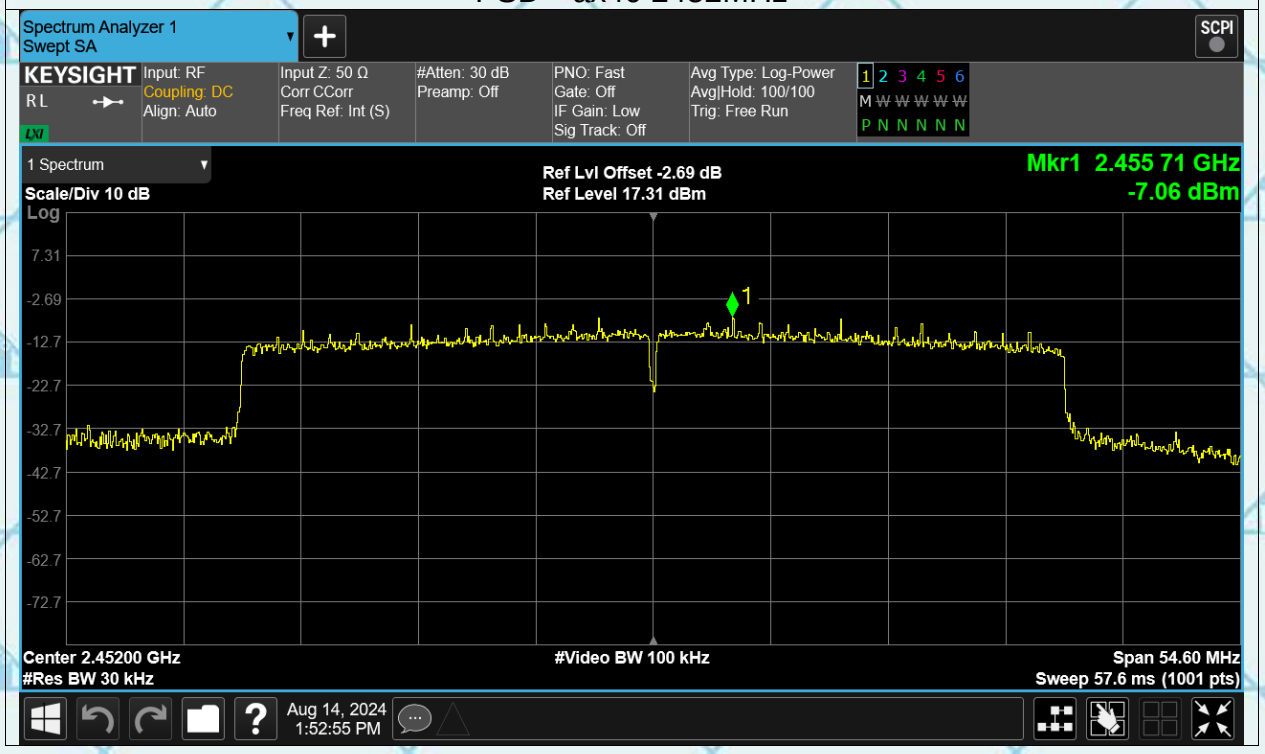
PSD ax40 2422MHz



PSD ax40 2437MHz

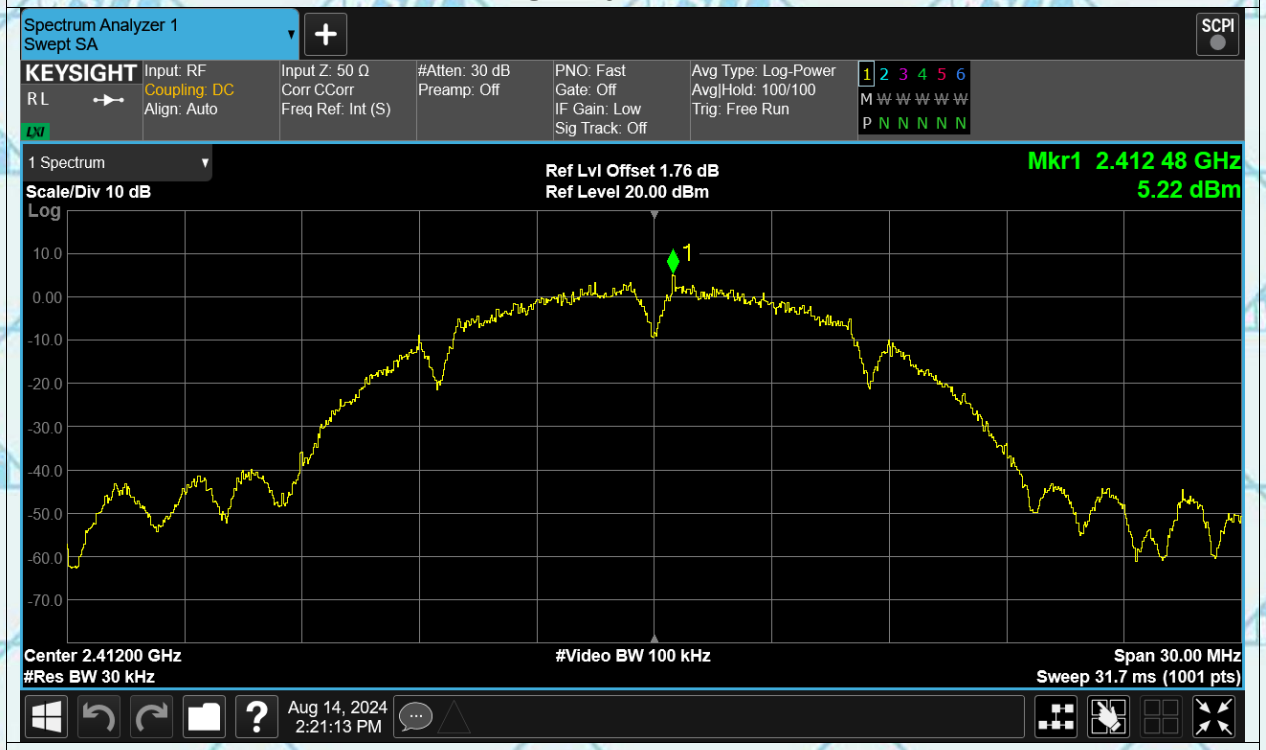


PSD ax40 2452MHz

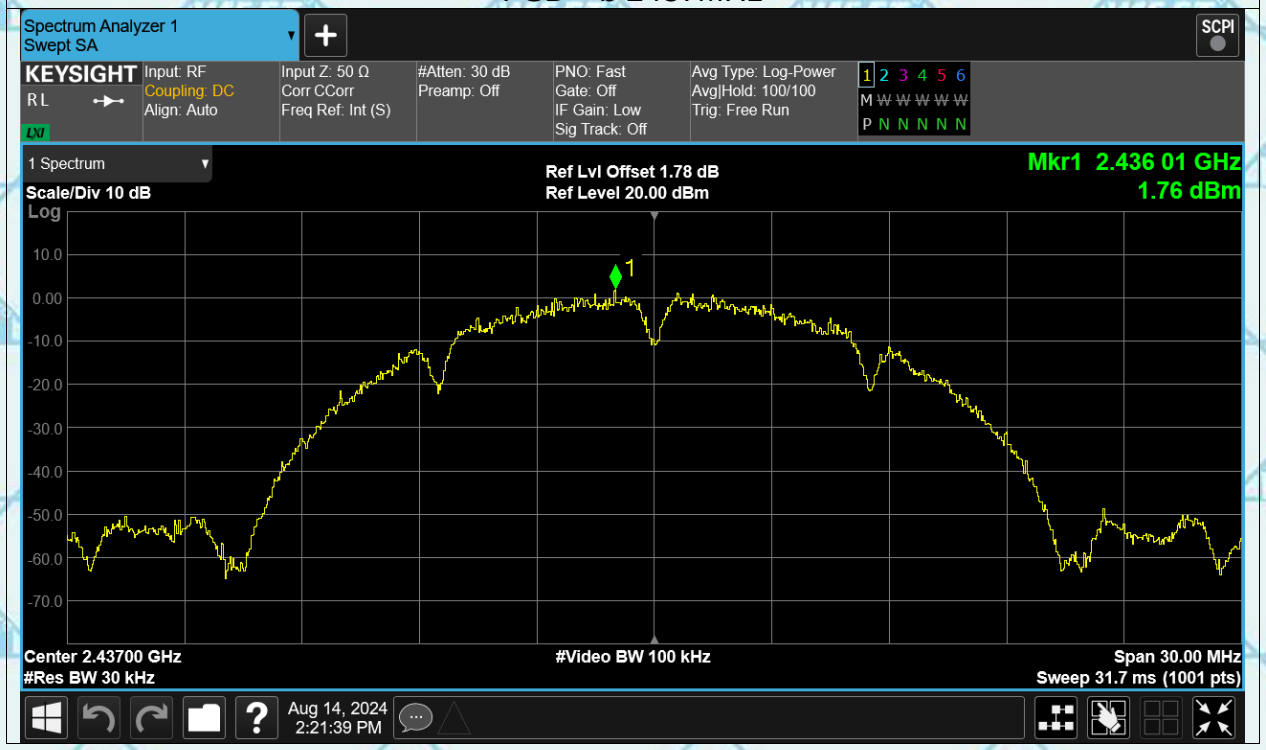


AUX Ant2 Test Graphs

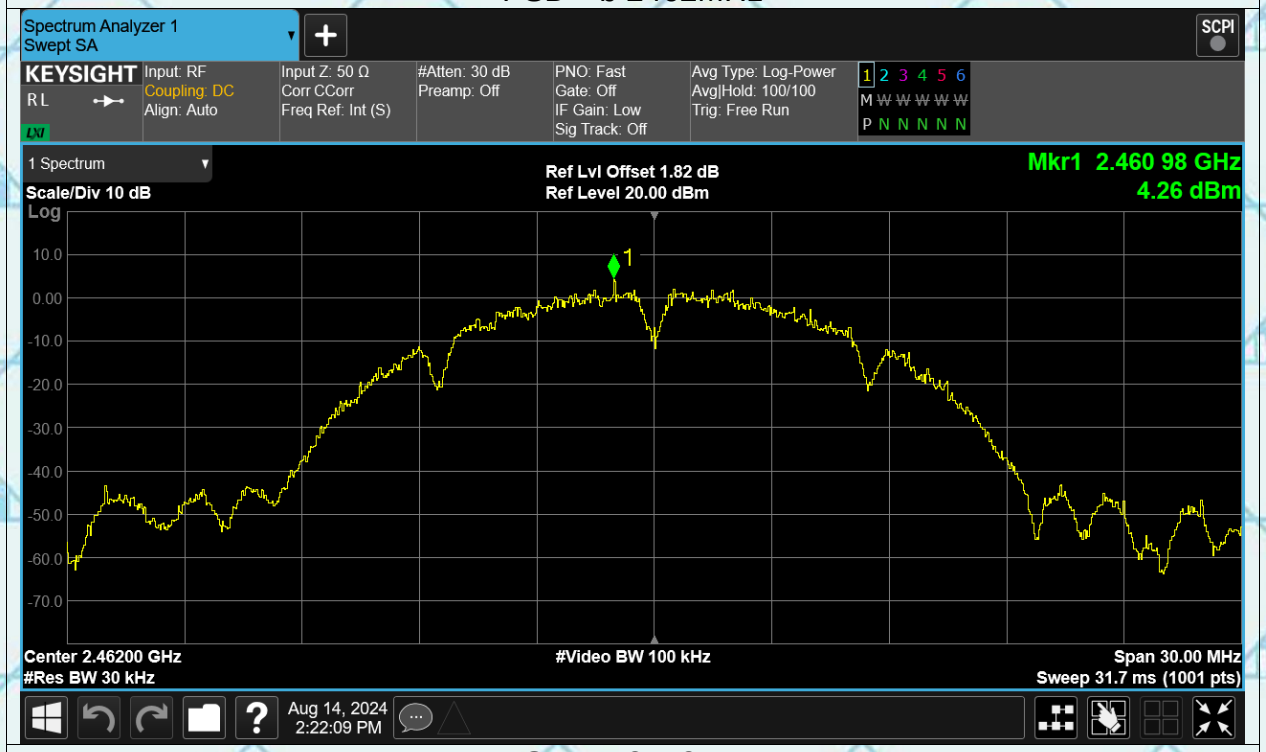
PSD b 2412MHz



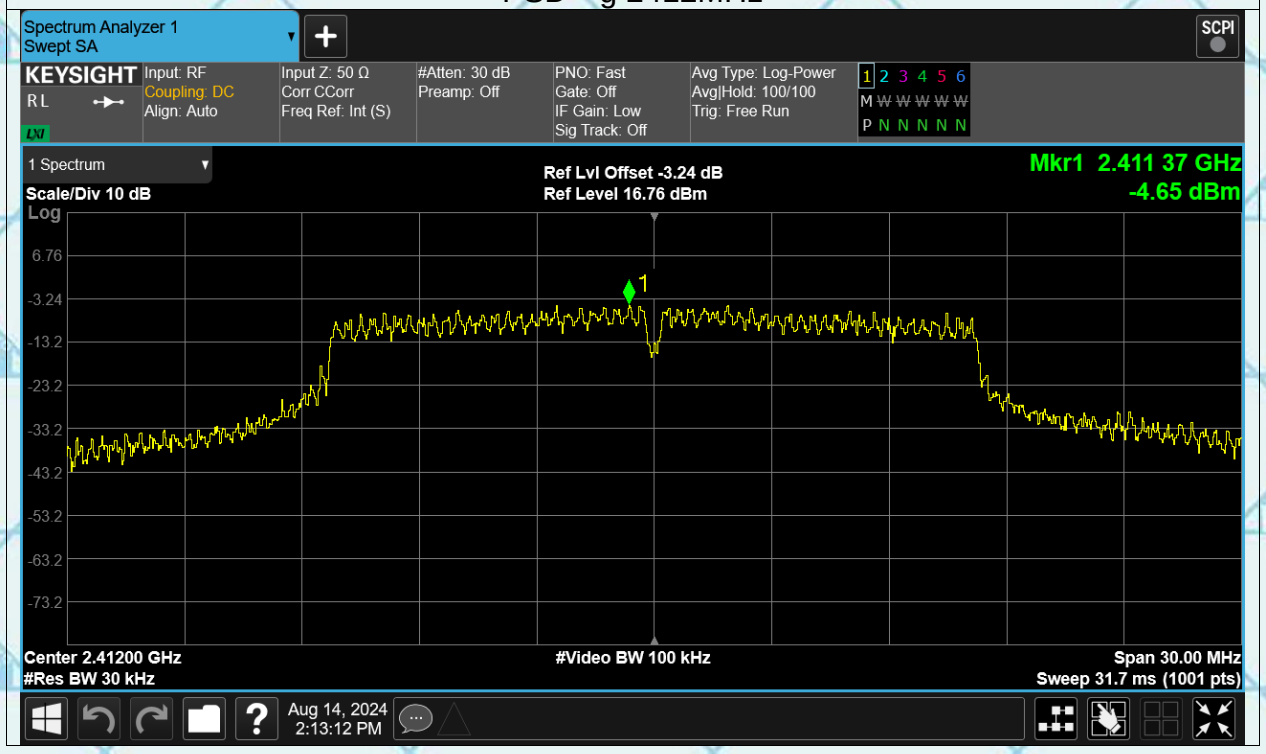
PSD b 2437MHz



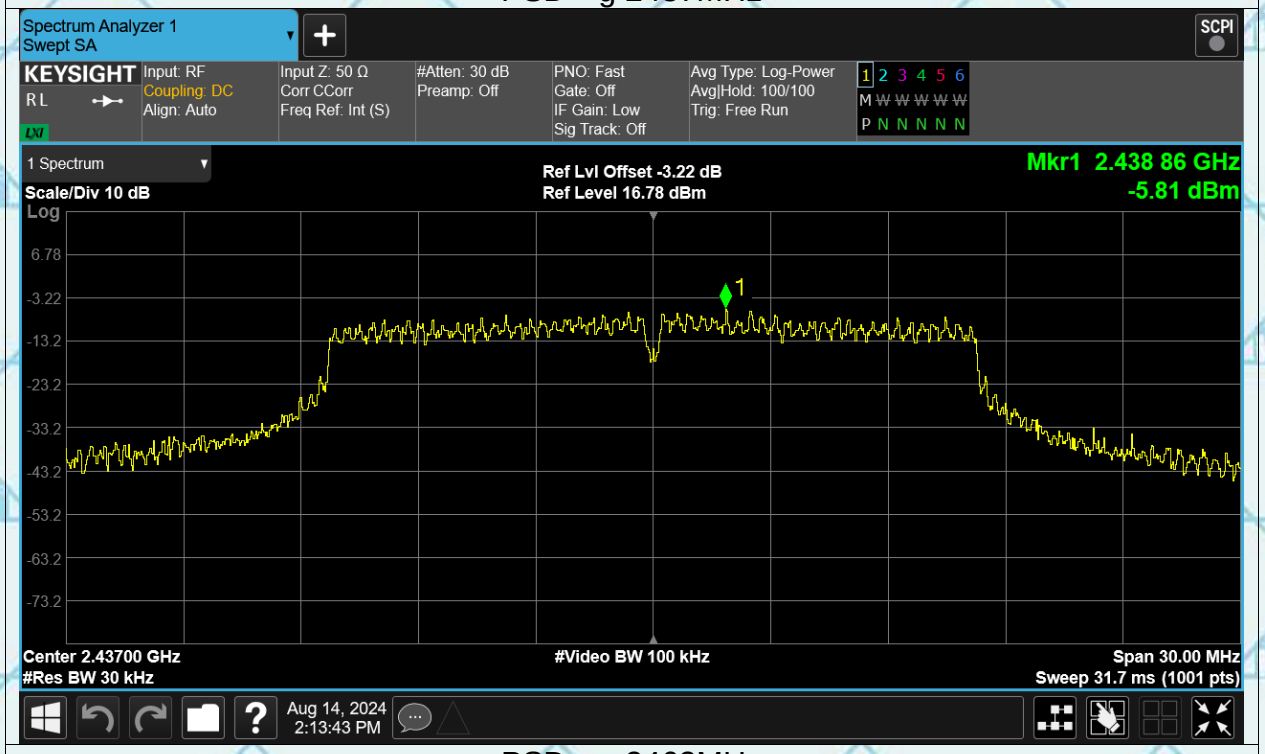
PSD b 2462MHz



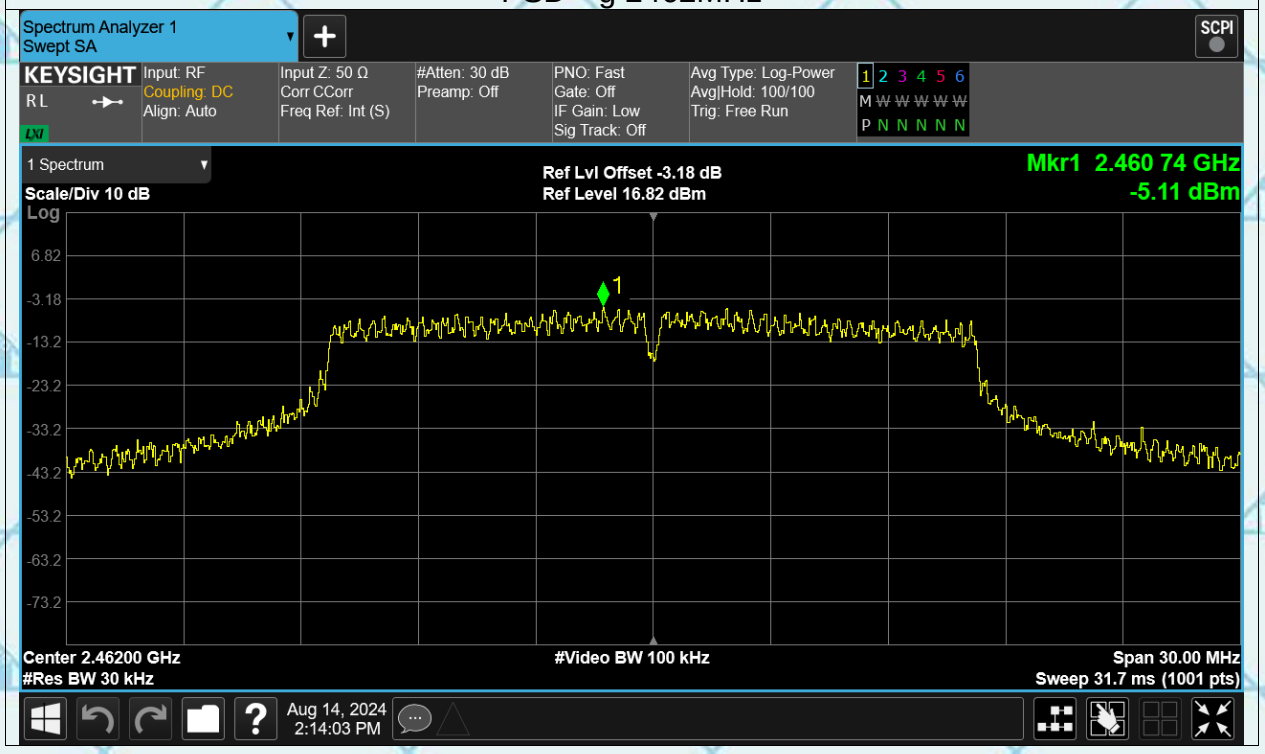
PSD g 2412MHz



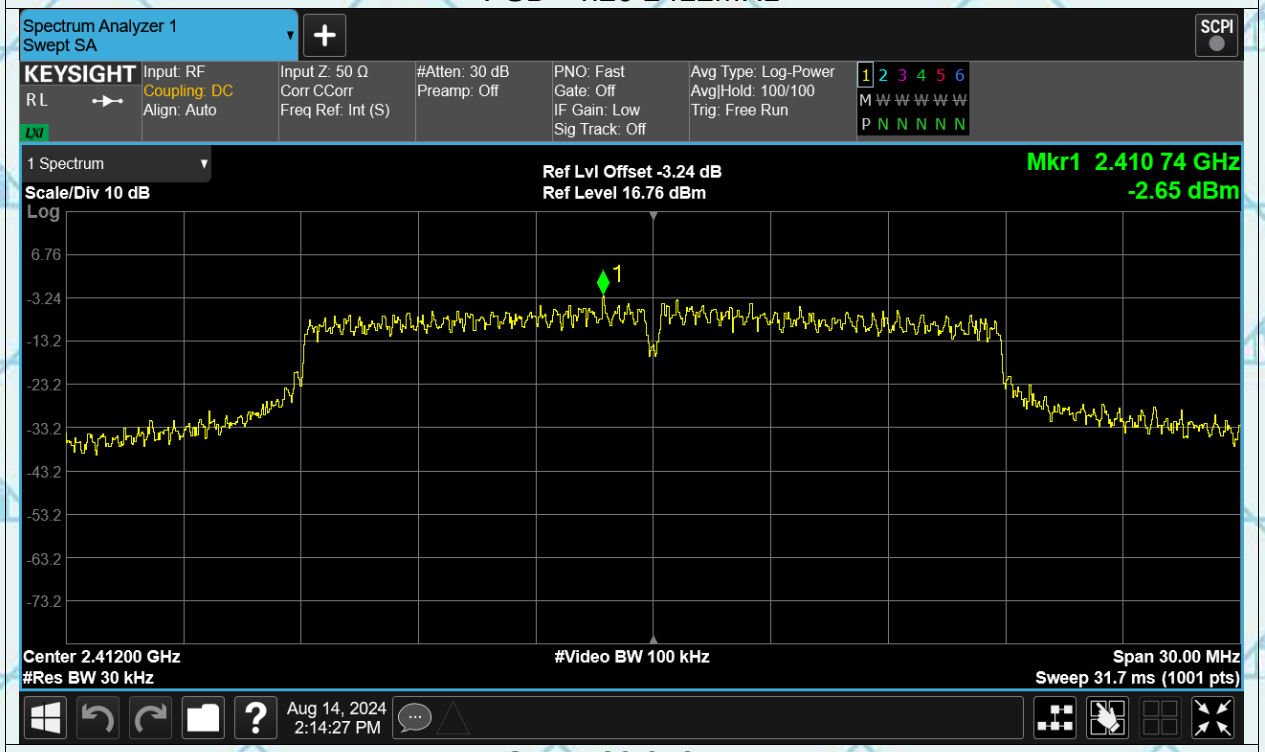
PSD g 2437MHz



PSD g 2462MHz



PSD n20 2412MHz



PSD n20 2437MHz