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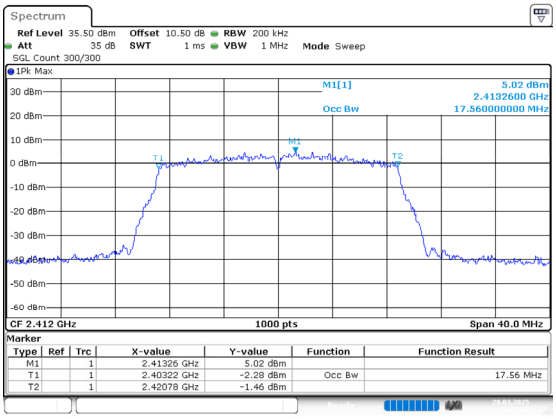
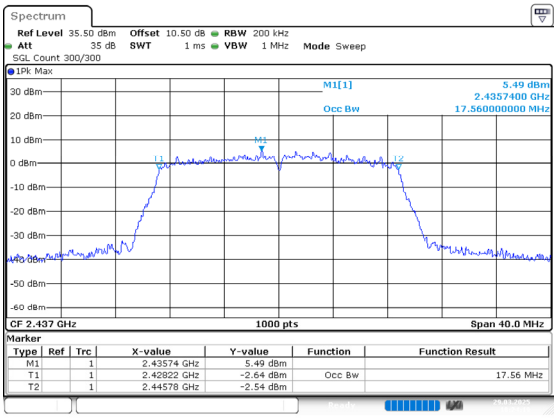


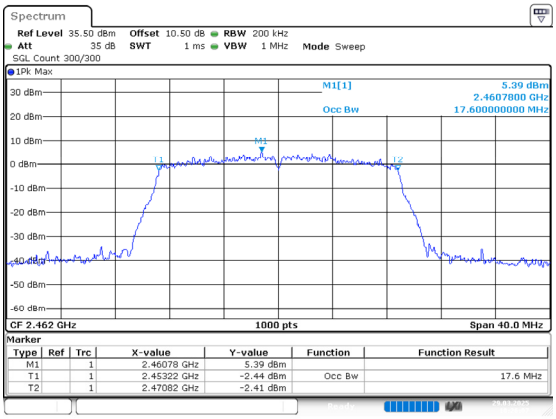
ProjectNo.:2501R26990E-RF Tester:Cheeb Huang
Date: 29.MAR.2025 18:22:11

802.11n20_2437MHz_Chain 0



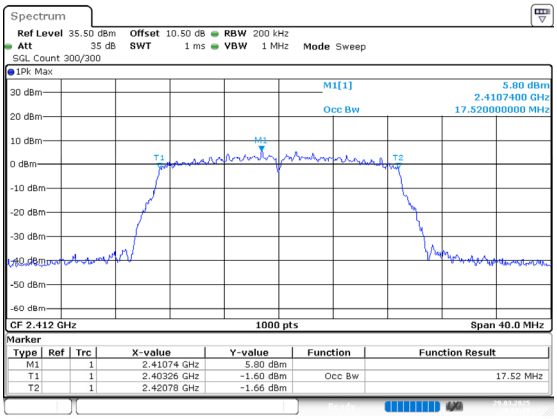
ProjectNo.:2501R26990E-RF Tester:Cheeb Huang
Date: 29.MAR.2025 18:24:20

802.11n20_2462MHz_Chain 0



ProjectNo.:2501R26990E-RF Tester:Cheeb Huang
Date: 29.MAR.2025 18:26:08

802.11n20_2412MHz_Chain 1



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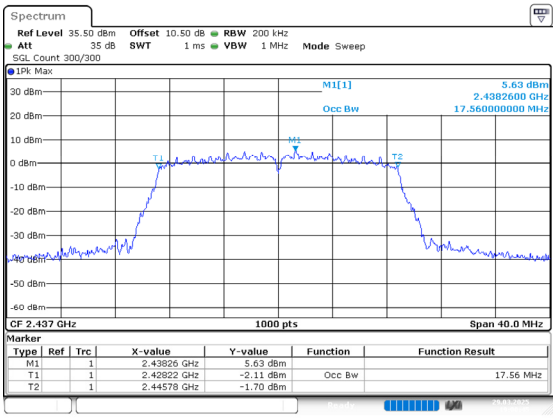
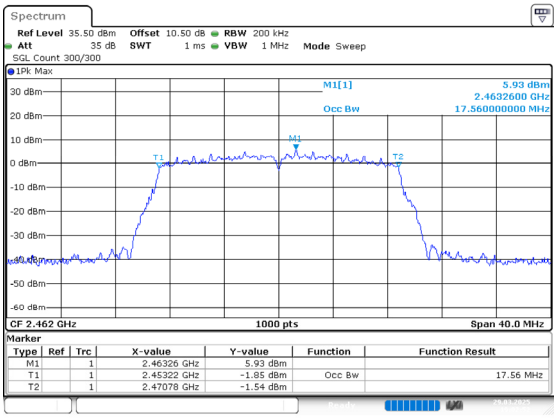
Date: 29.MAR.2025 18:58:16

802.11n20_2437MHz_Chain 1



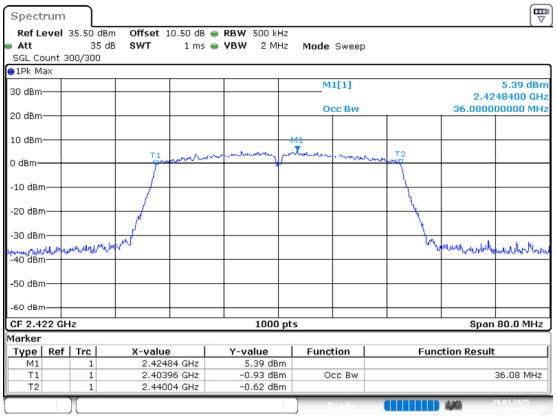
ProjectNo.:2501R26990E-RF Tester:Cheeb Huang
Date: 29.MAR.2025 19:00:45

802.11n20_2462MHz_Chain 1



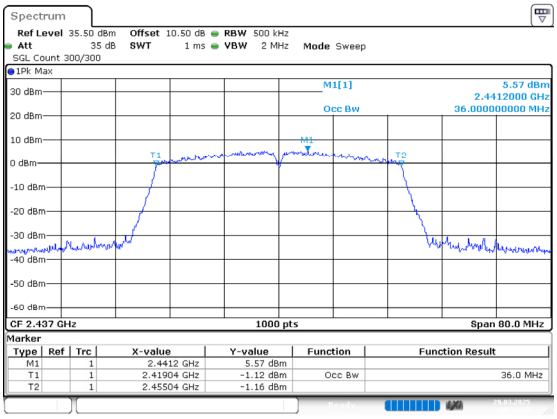
ProjectNo.:2501R26990E-RF Tester:Cheeb Huang
Date: 29.MAR.2025 19:02:52

802.11n40_2422MHz_Chain 0



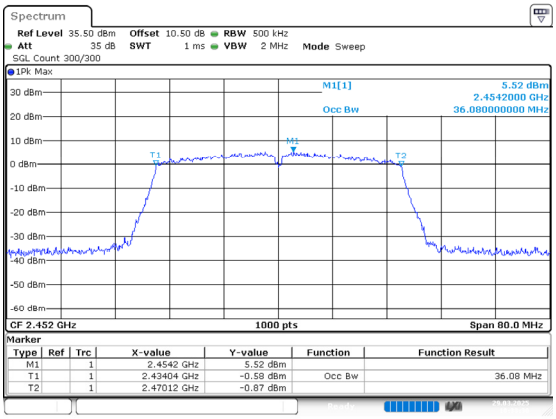
ProjectNo.:2501R26990E-RF Tester:Cheeb Huang
Date: 29.MAR.2025 18:28:33

802.11n40_2437MHz_Chain 0



ProjectNo.:2501R26990E-RF Tester:Cheeb Huang
Date: 29.MAR.2025 18:31:10

802.11n40_2452MHz_Chain 0



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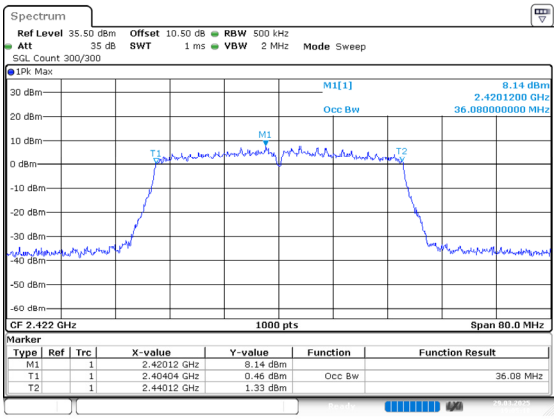
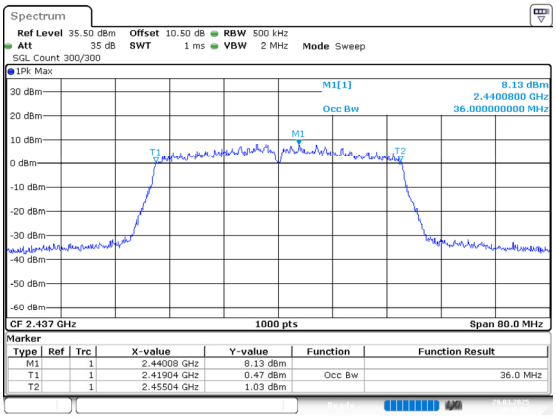
Date: 29.MAR.2025 18:33:30

802.11n40_2422MHz_Chain 1



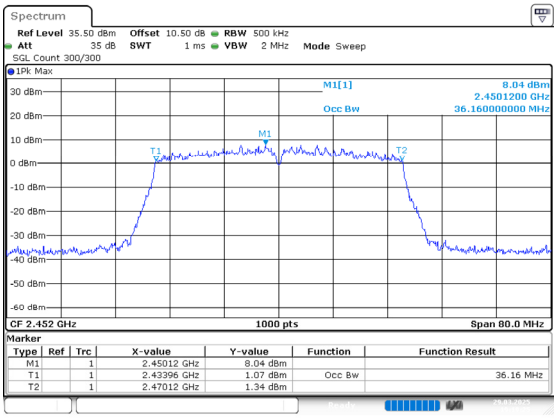
ProjectNo.:2501R26990E-RF Tester:Cheeb Huang
Date: 29.MAR.2025 19:05:19

802.11n40_2437MHz_Chain 1



ProjectNo.:2501R26990E-RF Tester:Cheeb Huang
Date: 29.MAR.2025 19:15:52

802.11n40_2452MHz_Chain 1



ProjectNo.:2501R26990E-RF Tester:Cheeb Huang
Date: 29.MAR.2025 19:19:26

Maximum Conducted Output Power

Test Information:

Sample No.:	2ZEA-9	**Test Date:**	2025/03/29
Test Site:	RF	**Test Mode:**	Transmitting
Tester:	Cheeb Huang	**Test Result:**	Pass

Environmental Conditions:

Temperature: (°C)	25.3	**Relative Humidity: (%)**	35	**ATM Pressure: (kPa)**	101.3

Test Data:

Mode	Antenna	Test Frequency (MHz)	Peak Output Power(dBm)	Average Output Power(dBm)	Limit (dBm)	Verdict
802.11b	Chain 0	2412	19.00	15.98	30	Pass
		2437	19.42	16.36	30	Pass
		2462	19.29	16.32	30	Pass
	Chain 1	2412	19.24	16.18	30	Pass
		2437	19.73	16.67	30	Pass
		2462	19.46	16.44	30	Pass
802.11g	Chain 0	2412	22.87	15.60	30	Pass
		2437	22.74	15.51	30	Pass
		2462	22.90	15.60	30	Pass
	Chain 1	2412	23.19	15.93	30	Pass
		2437	23.03	15.78	30	Pass
		2462	23.27	15.92	30	Pass
802.11n20	Chain 0	2412	21.89	14.35	30	Pass
		2437	21.83	14.22	30	Pass
		2462	21.92	14.39	30	Pass
	Chain 1	2412	22.72	14.83	30	Pass
		2437	22.40	14.60	30	Pass
		2462	22.63	14.76	30	Pass
	Chain 0+Chain 1	2412	25.34	17.61	30	Pass
		2437	25.13	17.42	30	Pass
		2462	25.30	17.59	30	Pass

Mode	Antenna	Test Frequency (MHz)	Peak Output Power(dBm)	Average Output Power(dBm)	Limit (dBm)	Verdict
802.11n40	Chain 0	2422	22.00	14.41	30	Pass
		2437	22.10	14.50	30	Pass
		2452	21.86	14.40	30	Pass
	Chain 1	2422	22.53	14.66	30	Pass
		2437	22.57	14.66	30	Pass
		2452	22.52	14.64	30	Pass
	Chain 0+Chain 1	2422	25.28	17.55	30	Pass
		2437	**25.35**	17.59	30	Pass
		2452	25.21	17.53	30	Pass

Note: For 802.11n modes, the device employed Cyclic Delay Diversity (CDD) for 802.11 MIMO transmitting, per KDB 662911 D01 Multiple Transmitter Output v02r01:

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

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 k_{th} antenna.

Chain0 Gain:	1.19	dBi	Directional gain:	4.12	dBi
Chain1 Gain:	1.02	dBi			

Power Spectral Density

Test Information:

Sample No.:	2ZEA-9	**Test Date:**	2025/03/29~2025/05/11
Test Site:	RF	**Test Mode:**	Transmitting
Tester:	Cheeb Huang	**Test Result:**	Pass

Environmental Conditions:

Temperature: (°C)	25.3-25.9	**Relative Humidity: (%)**	35-39	**ATM Pressure: (kPa)**	101.3-101.5

Test Data:

Mode	Antenna	Test Frequency (MHz)	Result (dBm/3kHz)	Limit (dBm/3kHz)	Verdict
802.11b	Chain 0	2412	5.61	8	Pass
		2437	**5.84**	8	Pass
		2462	4.75	8	Pass
	Chain 1	2412	5.52	8	Pass
		2437	4.93	8	Pass
		2462	5.76	8	Pass
802.11g	Chain 0	2412	-9.40	8	Pass
		2437	-9.79	8	Pass
		2462	-9.22	8	Pass
	Chain 1	2412	-7.66	8	Pass
		2437	-8.73	8	Pass
		2462	-9.97	8	Pass
802.11n20	Chain 0	2412	-9.29	8	Pass
		2437	-10.61	8	Pass
		2462	-9.64	8	Pass
	Chain 1	2412	-8.37	8	Pass
		2437	-9.97	8	Pass
		2462	-9.12	8	Pass
	Chain 0+Chain 1	2412	-5.80	8	Pass
		2437	-7.27	8	Pass
		2462	-6.36	8	Pass

Mode	Antenna	Test Frequency (MHz)	Result (dBm/3kHz)	Limit (dBm/3kHz)	Verdict
802.11n40	Chain 0	2422	-12.89	8	Pass
		2437	-12.77	8	Pass
		2452	-13.36	8	Pass
	Chain 1	2422	-13.55	8	Pass
		2437	-12.40	8	Pass
		2452	-12.64	8	Pass
	Chain 0+Chain 1	2422	-10.20	8	Pass
		2437	-9.57	8	Pass
		2452	-9.97	8	Pass

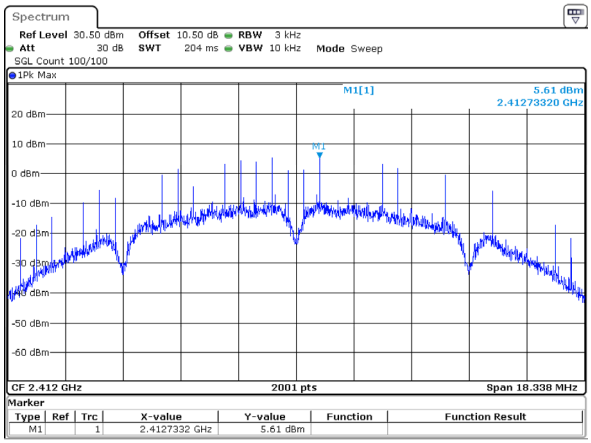
Note: For 802.11n modes, the device employed Cyclic Delay Diversity (CDD) for 802.11 MIMO transmitting, per KDB 662911 D01 Multiple Transmitter Output v02r01:

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

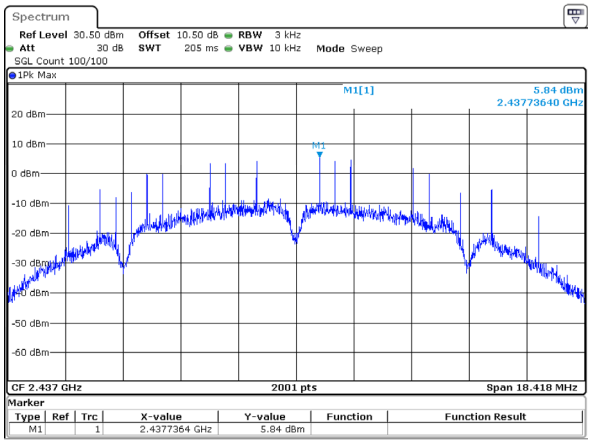
where
Each antenna is driven by no more than one spatial stream;
N_{SS} = the number of independent spatial streams of data;
N_{ANT} = the total number of antennas
$g_{j,k} = 10^{G_k/20}$ if the k_{th} antenna is being fed by spatial stream j, or zero if it is not;
G_k is the gain in dBi of the k_{th}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

Chain0 Gain:	1.19	dBi	Directional gain:	4.12	dBi
Chain1 Gain:	1.02	dBi			

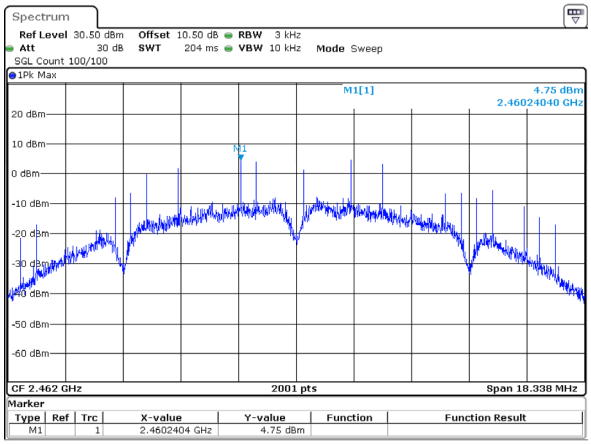
802.11b_2412MHz_Chain 0



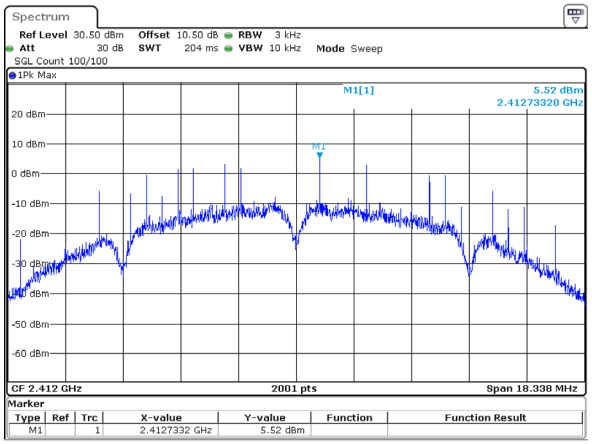
802.11b_2437MHz_Chain 0



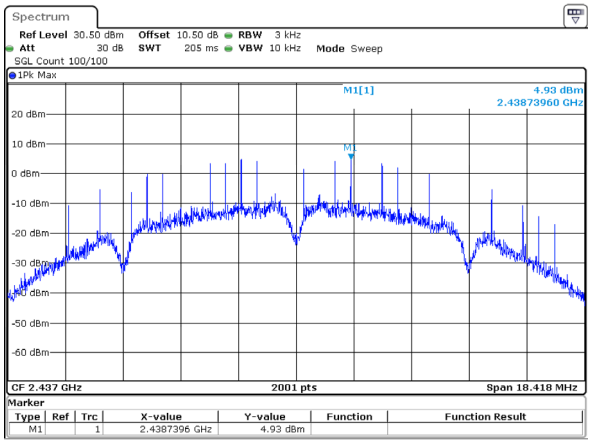
802.11b_2462MHz_Chain 0



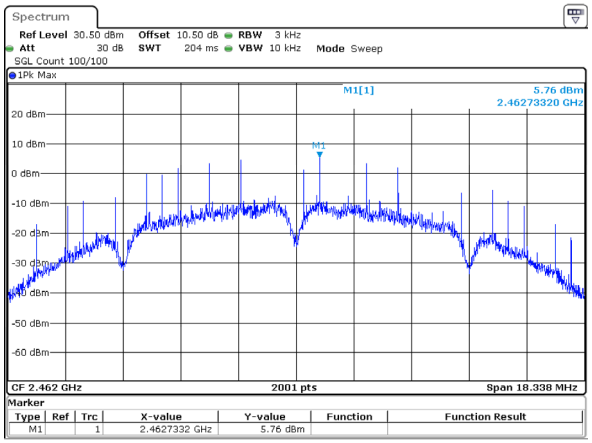
802.11b_2412MHz_Chain 1



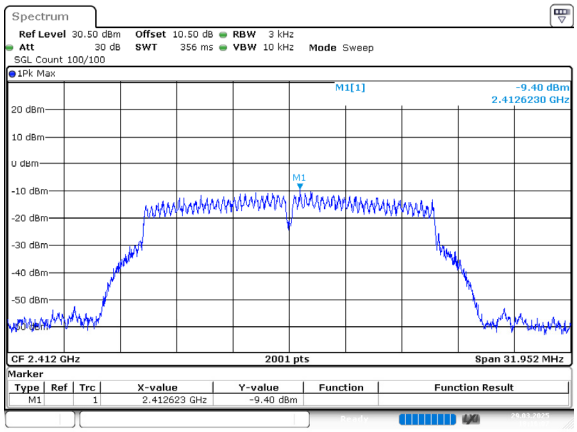
802.11b_2437MHz_Chain 1



802.11b_2462MHz_Chain 1

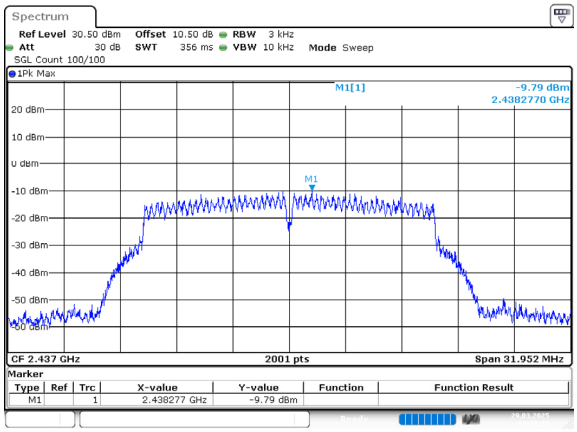


802.11g_2412MHz_Chain 0



ProjectNo.:2501R26990E-RF Tester:Cheeb Huang
Date: 29.MAR.2025 18:16:08

802.11g_2437MHz_Chain 0



ProjectNo.:2501R26990E-RF Tester:Cheeb Huang
Date: 29.MAR.2025 18:18:22

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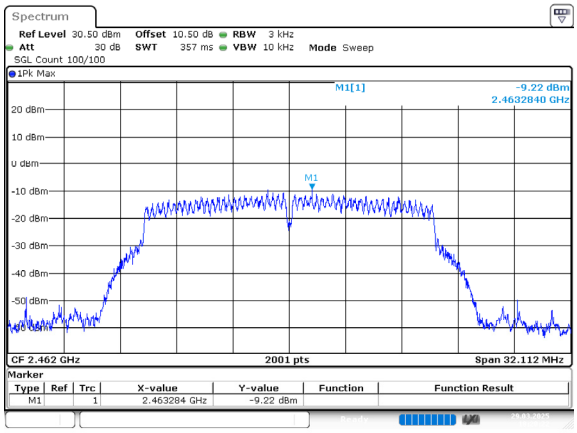
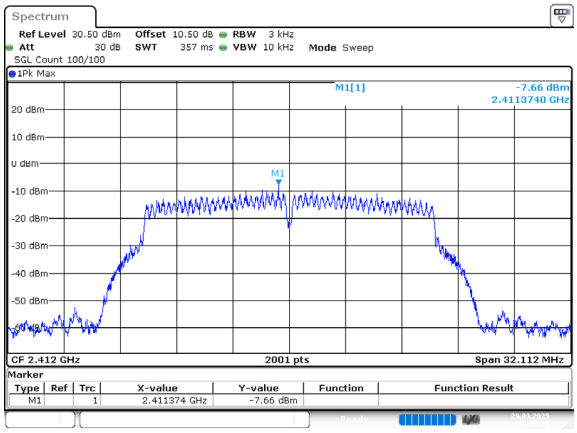


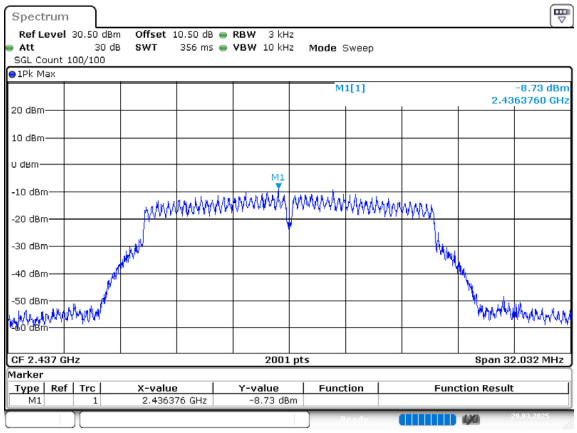
ProjectNo.:2501R26990E-RF Tester:Cheeb Huang
Date: 29.MAR.2025 18:20:23

802.11g_2412MHz_Chain 1



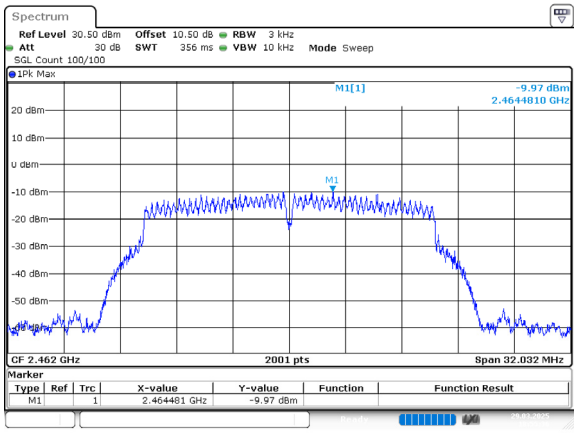
ProjectNo.:2501R26990E-RF Tester:Cheeb Huang
Date: 29.MAR.2025 18:50:11

802.11g_2437MHz_Chain 1



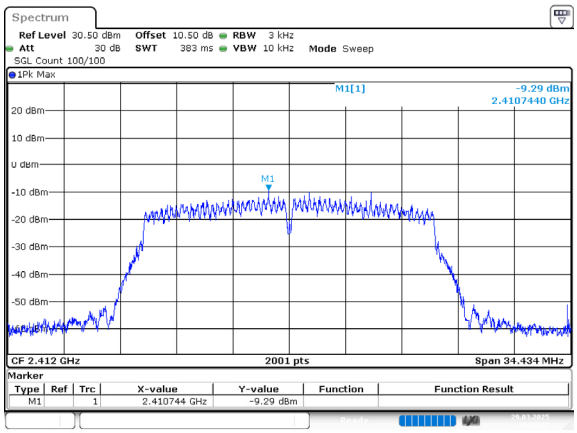
ProjectNo.:2501R26990E-RF Tester:Cheeb Huang
Date: 29.MAR.2025 18:53:16

802.11g_2462MHz_Chain 1



ProjectNo.:2501R26990E-RF Tester:Cheeb Huang
Date: 29.MAR.2025 18:55:36

802.11n20_2412MHz_Chain 0



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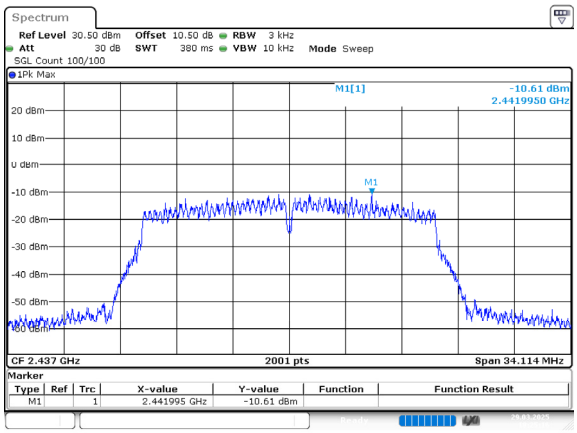
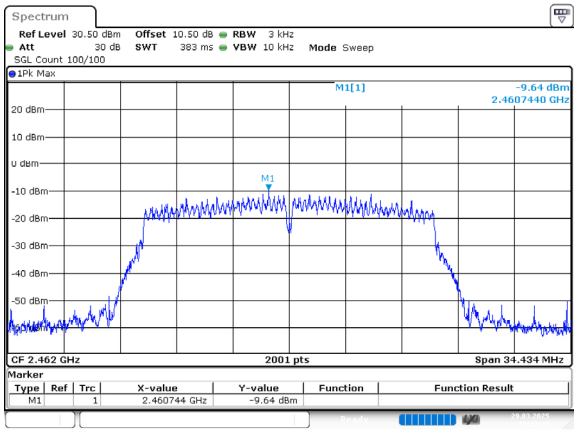
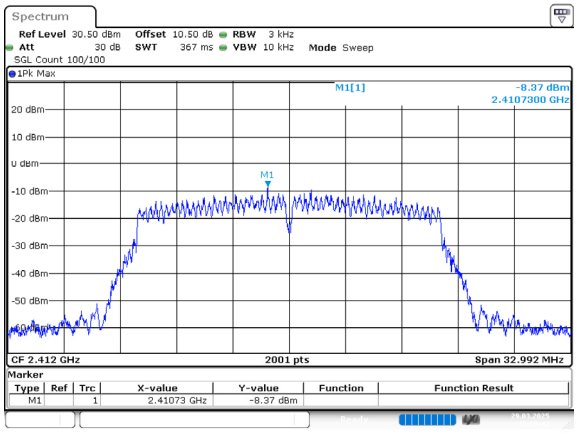


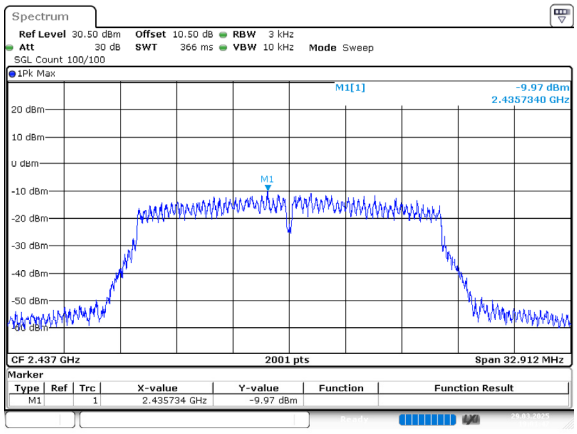
802.11n20_2462MHz_Chain 0



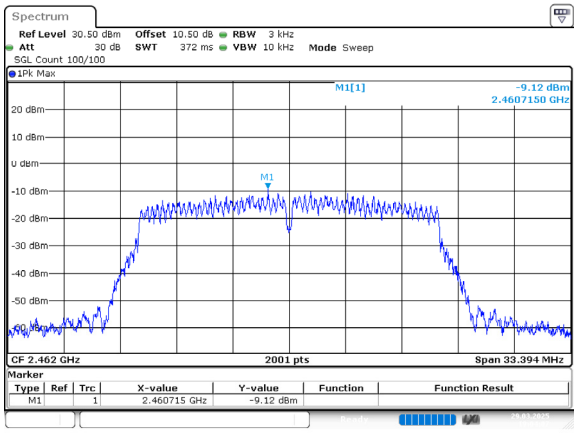
802.11n20_2412MHz_Chain 1



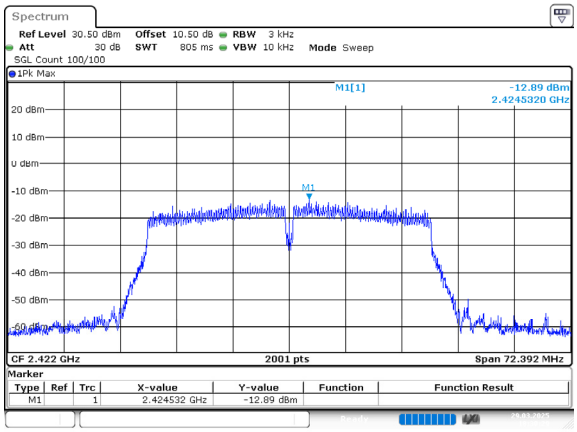
802.11n20_2437MHz_Chain 1



802.11n20_2462MHz_Chain 1

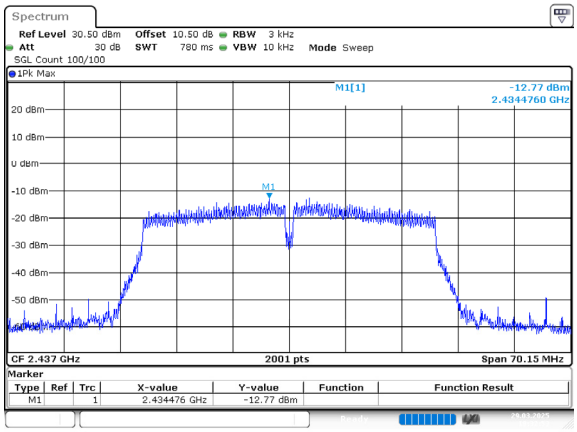


802.11n40_2422MHz_Chain 0



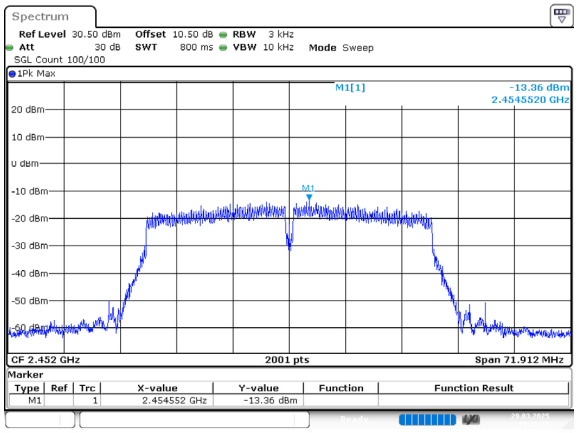
ProjectNo.:2501R26990E-RF Tester:Cheeb Huang
Date: 29.MAR.2025 18:30:30

802.11n40_2437MHz_Chain 0



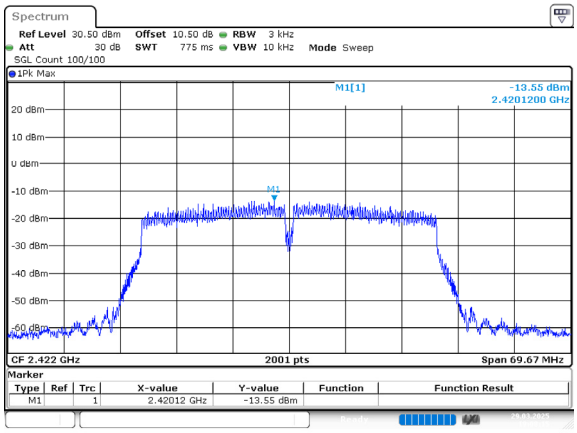
ProjectNo.:2501R26990E-RF Tester:Cheeb Huang
Date: 29.MAR.2025 18:32:54

802.11n40_2452MHz_Chain 0



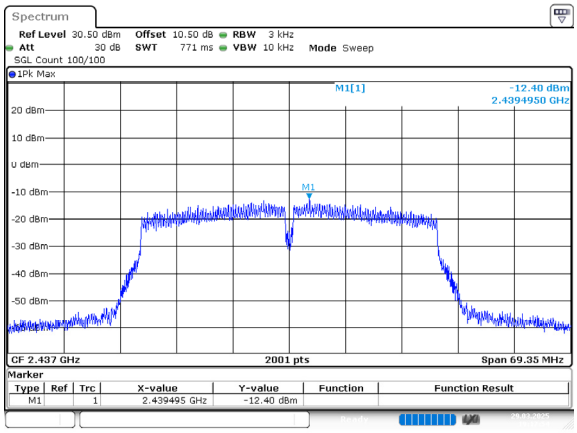
ProjectNo.:2501R26990E-RF Tester:Cheeb Huang
Date: 29.MAR.2025 18:35:26

802.11n40_2422MHz_Chain 1



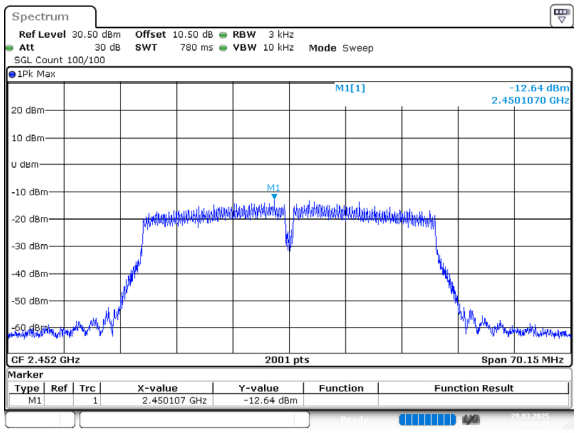
ProjectNo.:2501R26990E-RF Tester:Cheeb Huang
Date: 29.MAR.2025 19:08:15

802.11n40_2437MHz_Chain 1



ProjectNo.:2501R26990E-RF Tester:Cheeb Huang
Date: 29.MAR.2025 19:17:55

802.11n40_2452MHz_Chain 1



ProjectNo.:2501R26990E-RF Tester:Cheeb Huang
Date: 29.MAR.2025 19:21:38

100 kHz Bandwidth of Frequency Band Edge

Test Information:

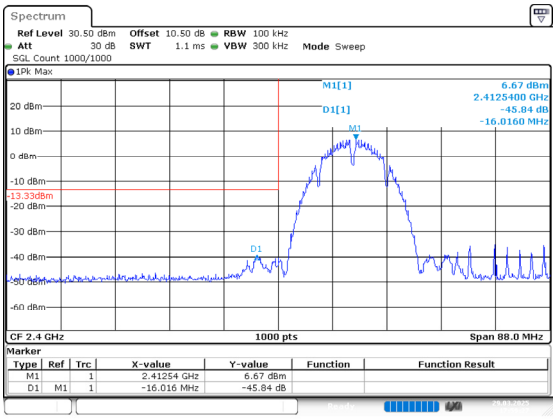
Sample No.:	2ZEA-9	**Test Date:**	2025/03/29
Test Site:	RF	**Test Mode:**	Transmitting
Tester:	Cheeb Huang	**Test Result:**	Pass

Environmental Conditions:

Temperature: (°C)	25.3	**Relative Humidity: (%)**	35	**ATM Pressure: (kPa)**	101.3

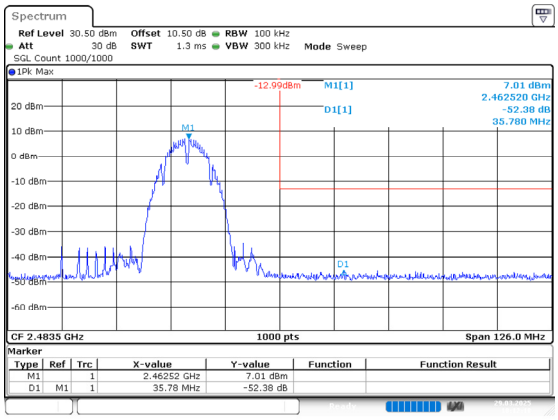
Test Data:

802.11b_2412MHz_Chain 0



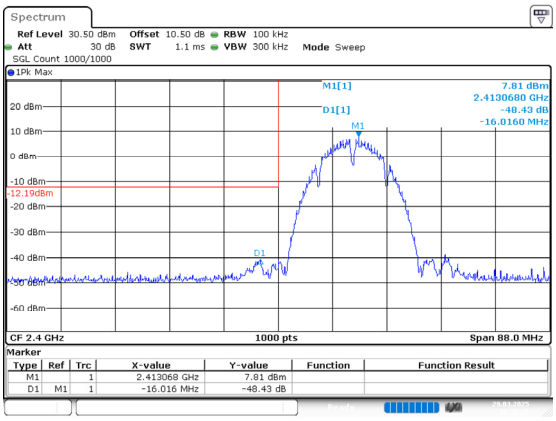
ProjectNo.:2501R26990E-RF Tester:Cheeb Huang
Date: 29.MAR.2025 17:59:28

802.11b_2462MHz_Chain 0



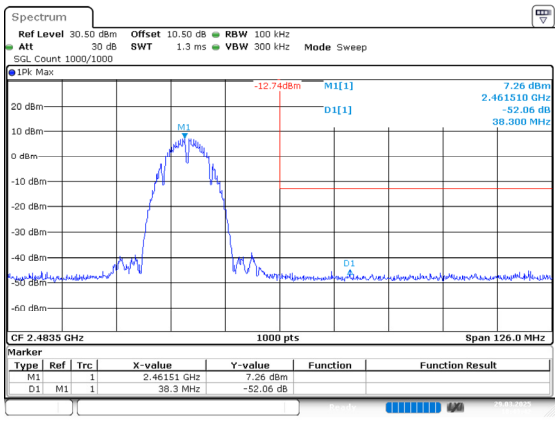
ProjectNo.:2501R26990E-RF Tester:Cheeb Huang
Date: 29.MAR.2025 18:12:19

802.11b_2412MHz_Chain 1



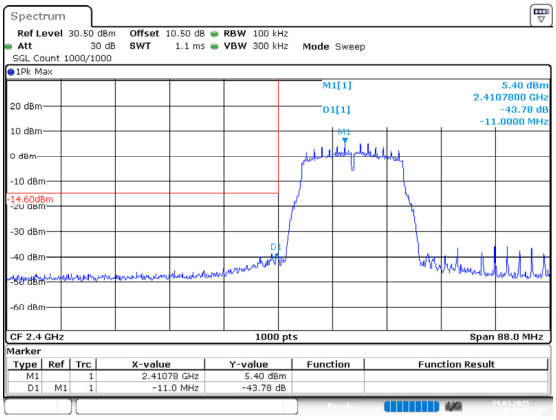
ProjectNo.:2501R26990E-RF Tester:Cheeb Huang
Date: 29.MAR.2025 18:38:16

802.11b_2462MHz_Chain 1



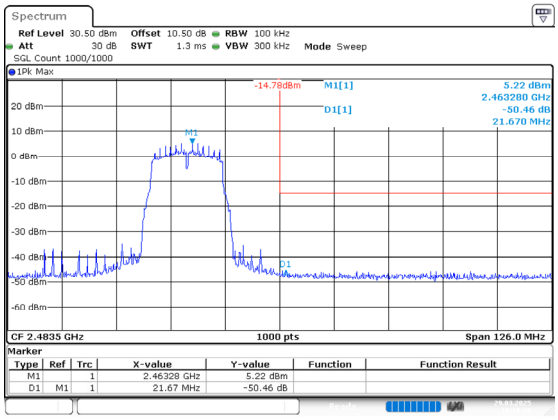
ProjectNo.:2501R26990E-RF Tester:Cheeb Huang
Date: 29.MAR.2025 18:43:43

802.11g_2412MHz_Chain 0



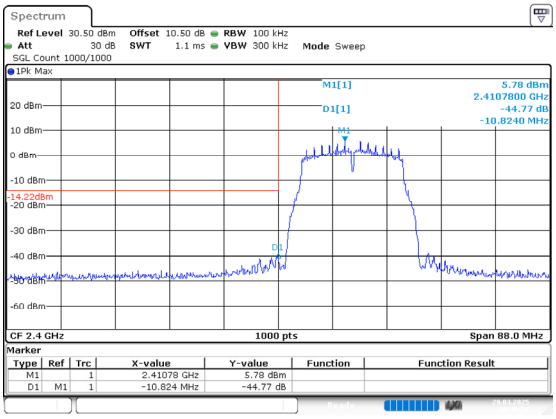
ProjectNo.:2501R26990E-RF Tester:Cheeb Huang
Date: 29.MAR.2025 18:15:23

802.11g_2462MHz_Chain 0



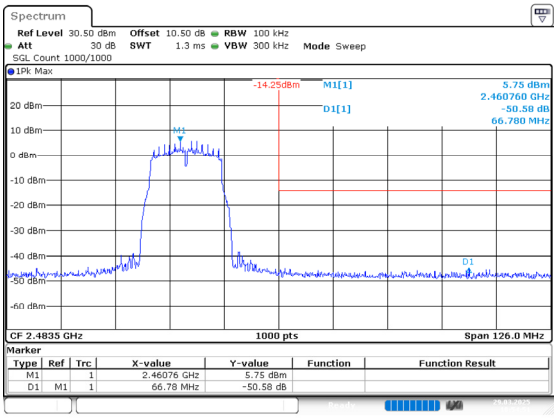
ProjectNo.:2501R26990E-RF Tester:Cheeb Huang
Date: 29.MAR.2025 18:19:38

802.11g_2412MHz_Chain 1



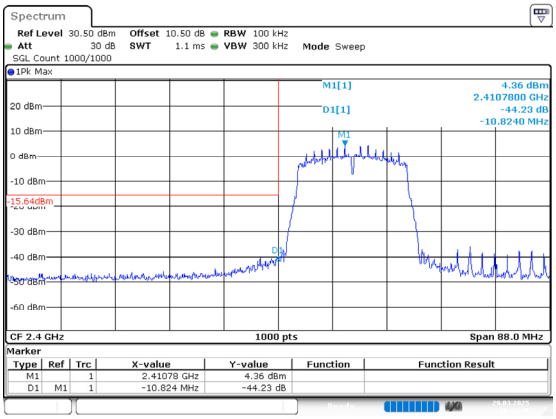
ProjectNo.:2501R26990E-RF Tester:Cheeb Huang
Date: 29.MAR.2025 18:49:26

802.11g_2462MHz_Chain 1



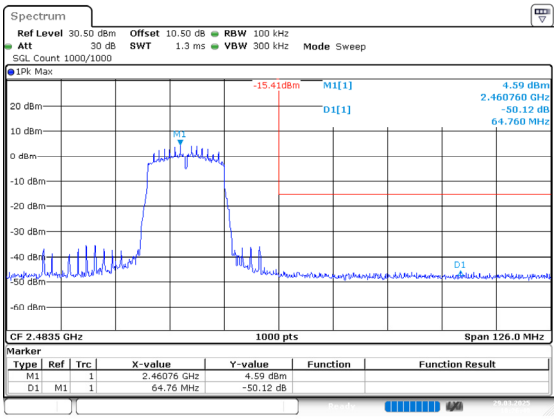
ProjectNo.:2501R26990E-RF Tester:Cheeb Huang
Date: 29.MAR.2025 18:54:52

802.11n20_2412MHz_Chain 0



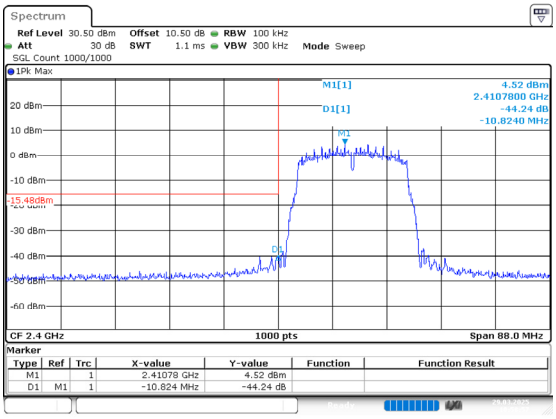
ProjectNo.:2501R26990E-RF Tester:Cheeb Huang
Date: 29.MAR.2025 18:22:46

802.11n20_2462MHz_Chain 0



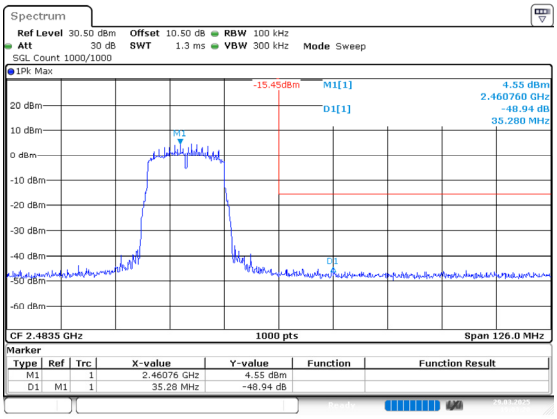
ProjectNo.:2501R26990E-RF Tester:Cheeb Huang
Date: 29.MAR.2025 18:26:49

802.11n20_2412MHz_Chain 1



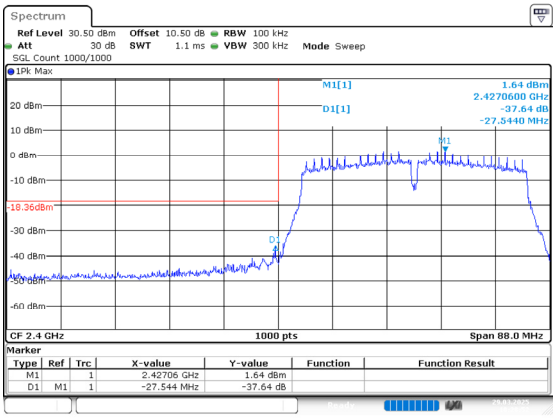
ProjectNo.:2501R26990E-RF Tester:Cheeb Huang
Date: 29.MAR.2025 18:58:57

802.11n20_2462MHz_Chain 1

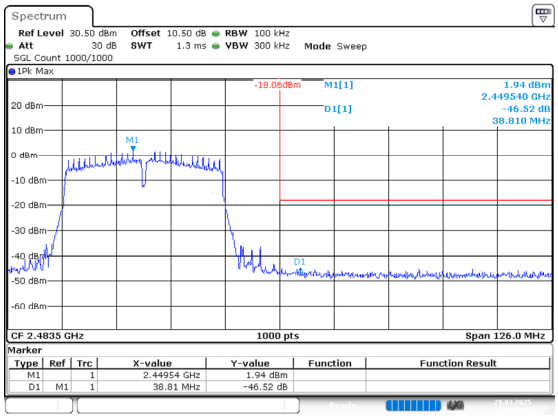


ProjectNo.:2501R26990E-RF Tester:Cheeb Huang
Date: 29.MAR.2025 19:03:21

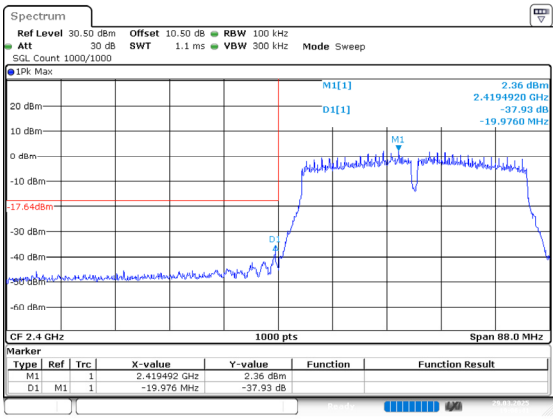
802.11n40_2422MHz_Chain 0



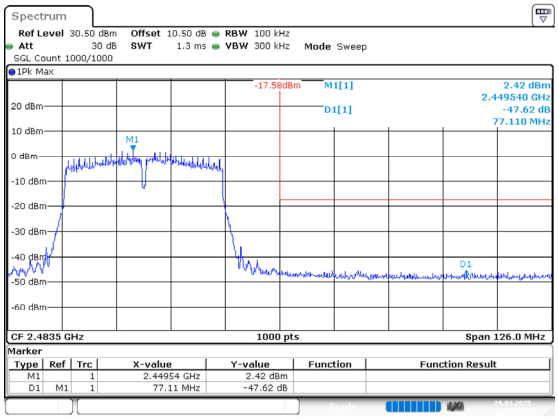
802.11n40_2452MHz_Chain 0



802.11n40_2422MHz_Chain 1



802.11n40_2452MHz_Chain 1



Duty Cycle

Test Information:

Sample No.:	2ZEA-9	**Test Date:**	2025/03/29
Test Site:	RF	**Test Mode:**	Transmitting
Tester:	Cheeb Huang	**Test Result:**	Pass

Environmental Conditions:

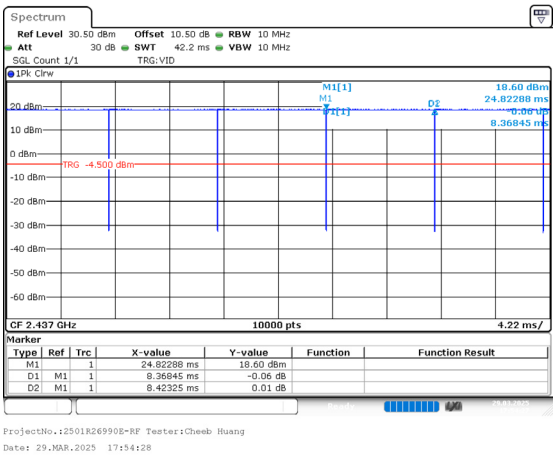
Temperature: (°C)	25.3	**Relative Humidity: (%)**	35	**ATM Pressure: (kPa)**	101.3

Test Data:

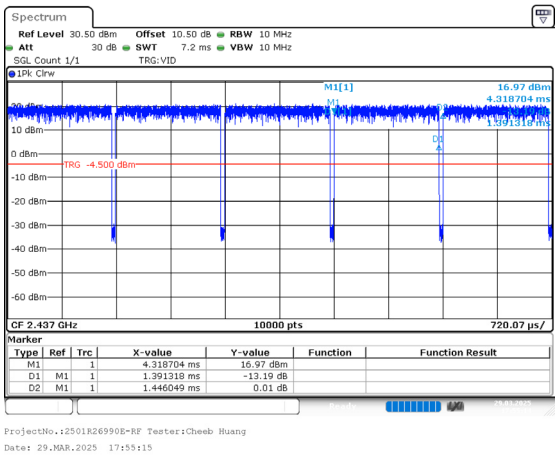
Mode	Antenna	Test Frequency (MHz)	Ton (ms)	Ton+Toff (ms)	Duty Cycle (%)	Duty Cycle Factor(dB)	1/Ton (Hz)	VBW Setting (kHz)
802.11b	Chain 0	2437	**8.368**	8.423	99.35	/	/	0.010
802.11g	Chain 0	2437	1.391	1.446	96.20	0.17	719	1
802.11n20	Chain 0	2437	1.299	1.354	95.94	0.18	770	1
802.11n40	Chain 0	2437	0.647	0.701	92.30	0.35	1546	2

Duty Cycle = Ton/(Ton+Toff)*100%

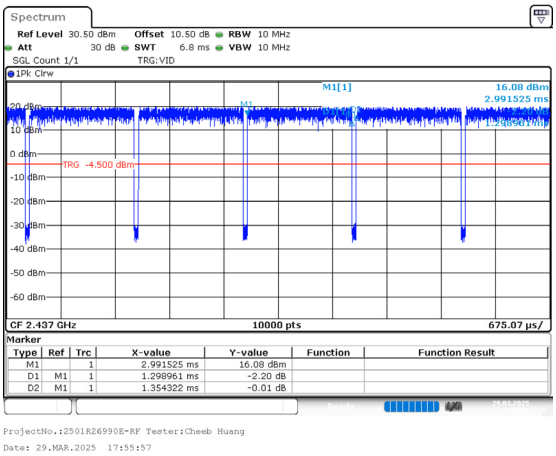
802.11b_2437MHz_Chain 0



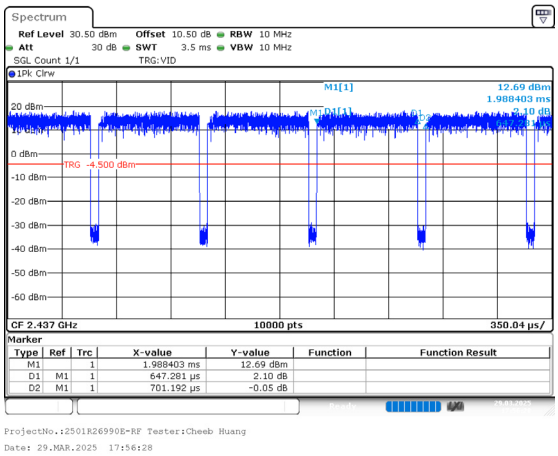
802.11g_2437MHz_Chain 0



802.11n20_2437MHz_Chain 0



802.11n40_2437MHz_Chain 0



RF EXPOSURE EVALUATION

MPE-Based Exemption

Applicable Standard

According to subpart 2.1091 systems operating under the provisions of this section shall be operated in a manner that ensures the public is not exposed to RF energy level in excess of the communication guidelines.

According to KDB 447498 D04 v01 Interim General RF Exposure Guidance

MPE-Based Exemption:
General frequency and separation-distance dependent MPE-based effective radiated power(ERP) thresholds are in Table B.1 [Table 1 of § 1.1307(b)(3)(i)(C)] to support an exemption from further evaluation from 300 kHz through 100 GHz.

Table 1 to § 1.1307(b)(3)(i)(C) - Single RF Sources Subject to Routine Environmental Evaluation

RF Source frequency (MHz)	Threshold ERP (watts)
0.3-1.34	1,920 R^2.
1.34-30	3,450 R^2/f^2.
30-300	3.83 R^2.
300-1,500	0.0128 R^2f.
1,500-100,000	19.2R^2.

R is the minimum separation distance in meters
f = frequency in MHz

For multiple RF sources: Multiple RF sources are exempt if:

in the case of fixed RF sources operating in the same time-averaging period, or of multiple mobile or portable RF sources within a device operating in the same time averaging period, if the sum of the fractional contributions to the applicable thresholds is less than or equal to 1 as indicated in the following equation:

$$\sum_{i=1}^{a} \frac{P_i}{P_{th,i}} + \sum_{j=1}^{b} \frac{ERP_j}{ERP_{th,j}} + \sum_{k=1}^{c} \frac{Evaluated_k}{Exposure\ Limit_k} \leq 1$$

Result

Mode	Frequency (MHz)	Tune up conducted power#(dBm)	Antenna Gain#		ERP		Evaluation Distance (m)	ERP Limit (mW)
			(dBi)	(dBd)	(dBm)	(mW)		
BT	2402-2480	9.0	1.57	-0.58	8.42	6.95	0.2	768
BLE	2402-2480	2.5	1.57	-0.58	1.92	1.56	0.2	768
2.4G Wi-Fi	2412-2462	25.5	4.12	1.97	27.47	558.47	0.2	768
5.2G Wi-Fi	5180-5240	17.0	4.08	1.93	18.93	78.16	0.2	768
5.8G Wi-Fi	5745-5825	18.0	4.01	1.86	19.86	96.83	0.2	768

Note: 1. The tune up conducted power and antenna gain was declared by the applicant.
2. 0dBd=2.15dBi
3. For Wi-Fi, the antenna gain should be the directional gain.
4. The BT and Wi-Fi can transmit at same time, the 2.4G and 5G Wi-Fi cannot transmit at same time.

Simultaneous transmitting consideration (worst case):

The ratio= ERP_{BT} /limit + $ERP_{2.4G\ Wi\text{-}Fi}$/limit = 6.95/768+ 558.47/768 =0.736<1.0

So simultaneous exposure is compliant.

To maintain compliance with the FCC's RF exposure guidelines, place the equipment at least 20cm from nearby persons.

Result: Compliant

EUT PHOTOGRAPHS

Please refer to the attachment 2501R26990E-RF External photo and 2501R26990E-RF Internal photo.

TEST SETUP PHOTOGRAPHS

Please refer to the attachment 2501R26990E-RF-00C Test Setup photo.

******* END OF REPORT *******