5 Power Spectral Density

5.1 *Test Result*

Test Description	Test Specification		Test Result
Power Spectral Density	15.247(e)	RSS-247 S5.2(b)	Compliant

5.2 *Test Method*

Power spectral density measurements were recorded using the procedures from ANSI C63.10: 2013 clause 11.10 and KDB 558074 D01 Measurement Guidance v05r02.

1. Set analyzer center frequency to DTS channel center frequency.
2. The testing follows the Measurement Procedure of FCC KDB 558074 D01 DTS Meas. Guidance .
3. Set the span to 1.5 times the DTS channel bandwidth.
4. Set the RBW = 3 kHz & VBW = 10 kHz.
5. Detector = peak.
6. Sweep time = auto couple.
7. Trace mode = max hold.
8. Allow trace to fully stabilize.
9. Use the peak marker function to determine the maximum amplitude level.

Limit
The limit is 8 dBm.

5.3 *Test Site*

Environmental Conditions

Temperature:	20 – 25 °C
Relative Humidity:	35 – 50 %

5.4 *Test Equipment*

Test Dates: July 31 – December 15, 2024 Tester: Alex Chang / Andreas Gillmeier

Asset No.	Type of Equipment	Model	Serial No.	Manufacturer	Cal Date	Cal Due Date
Conducted Testing						
2003	Signal Analyzer	N9030B	MY61330812	Keysight	01/29/2024	01/29/2025
#2	RF Cable	W60-1524.1195.00	N/A	Unknown	N/A (verified before use)	
-	20 dB Attenuator	3M-20	93495	WEINSCHEL	N/A (verified before use)	
-	Power Splitter	ZN2PD2-63-S+	SUU71801931	Mini-Circuits	N/A (verified before use)	
-	Test Software	Radio Test Software	v.23	SGS Taiwan	N/A	
2036	Temp/Humidity Data Logger	GSP-8	CMA231100002	Elitech	07/09/2024	07/09/2025

5.5 *Test Setup Photographs*

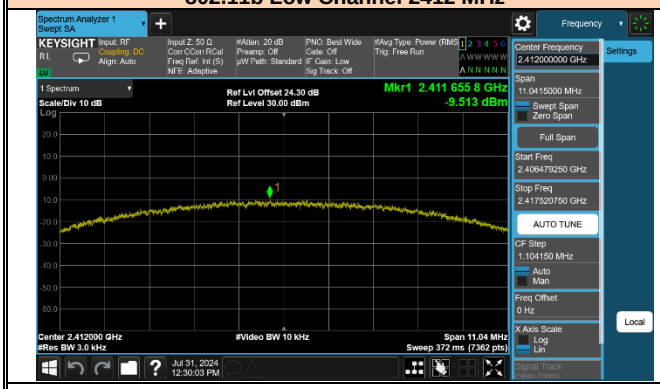
Test setup photographs are located in a separate report (208949-8).

5.6 *Test Data*

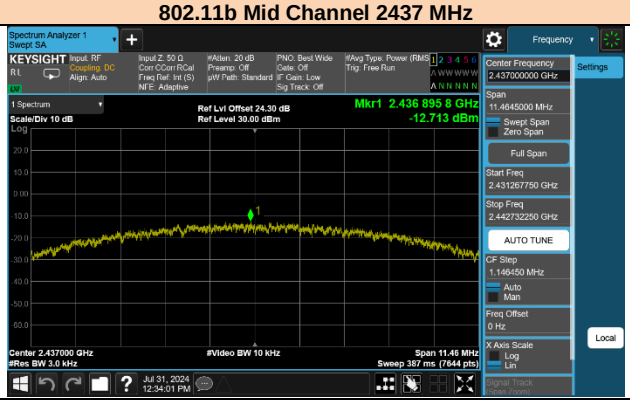
Mode	Frequency (MHz)	Bandwidth (MHz)	Power Level	Data Rate (Mbps) / Modulation	Duty Cycle Correction (dB)	Power Spectral Density (dBm/3 kHz) (both antennas combined)	Limit	Verdict
802.11b	2412	NOHT 20	72	5.5	0	-9.51	8	Pass
	2437		72	11	0	-12.71	8	Pass
	2462		66	1	0	-9.68	8	Pass
802.11g	2412	NOHT 20	62	48	0.12	-11.83	8	Pass
	2437		68	12	0	-9.44	8	Pass
	2462		55	36	0.09	-14.02	8	Pass
802.11n	2412	HT 20	62	mcs 3	0	-15.07	8	Pass
	2437		80	mcs 0	0	-10.39	8	Pass
	2462		57	mcs 5	0	-15.64	8	Pass
802.11ax	2412	HE 20	62	mcs 4	0	-14.08	8	Pass
	2437		76	mcs 0	0	-10.70	8	Pass
	2462		55	mcs 7	0	-17.84	8	Pass

PSD measured screenshot

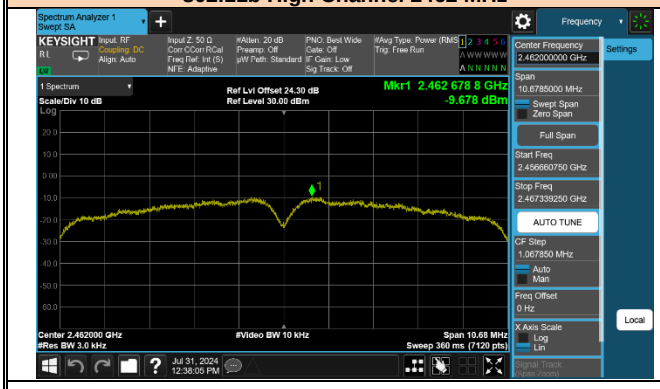
802.11b Low Channel 2412 MHz



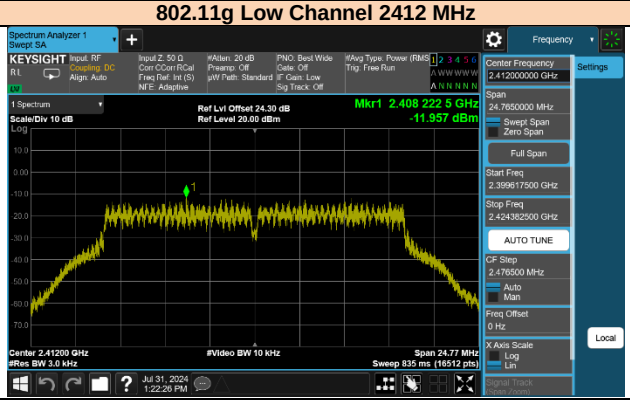
802.11b Mid Channel 2437 MHz



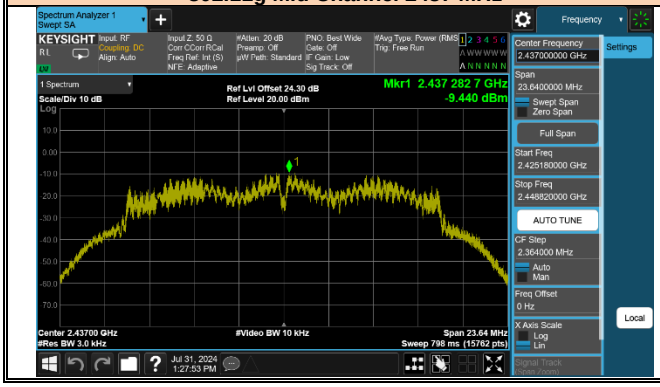
802.11b High Channel 2462 MHz



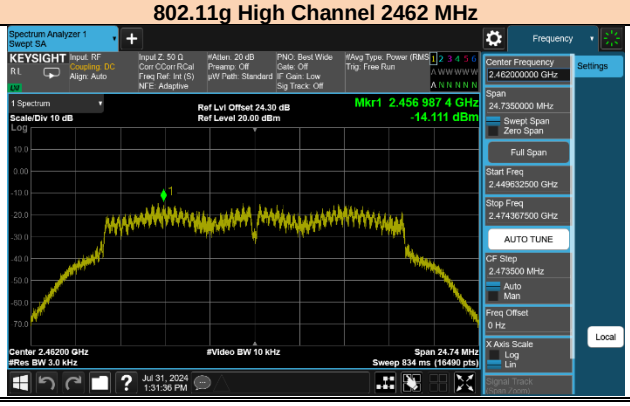
802.11g Low Channel 2412 MHz



802.11g Mid Channel 2437 MHz

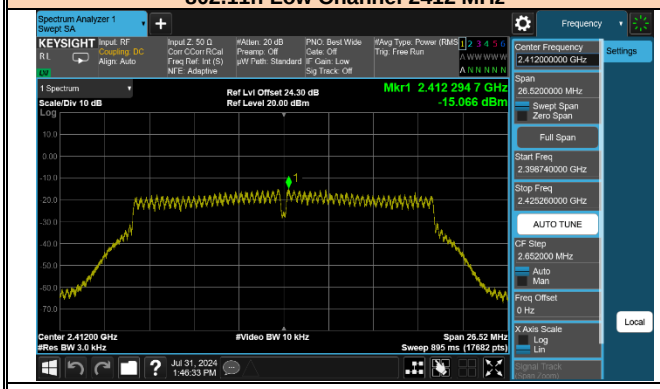


802.11g High Channel 2462 MHz

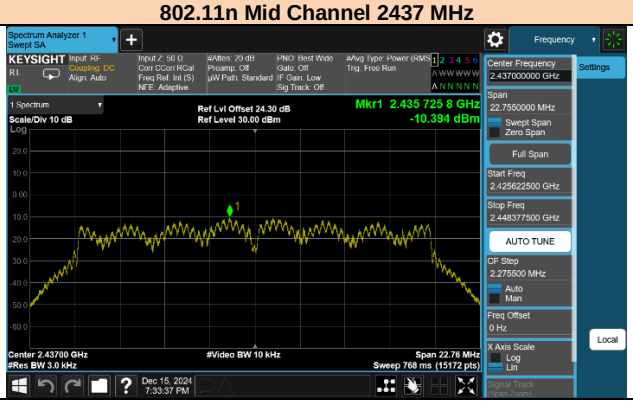


PSD measured screenshot

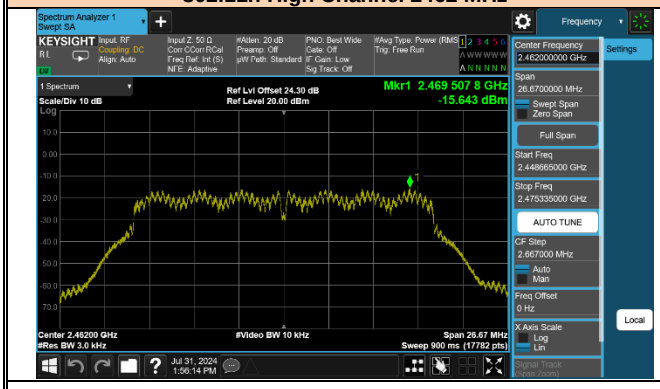
802.11n Low Channel 2412 MHz



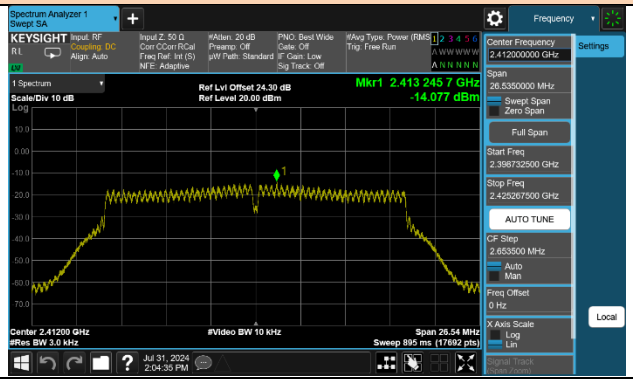
802.11n Mid Channel 2437 MHz



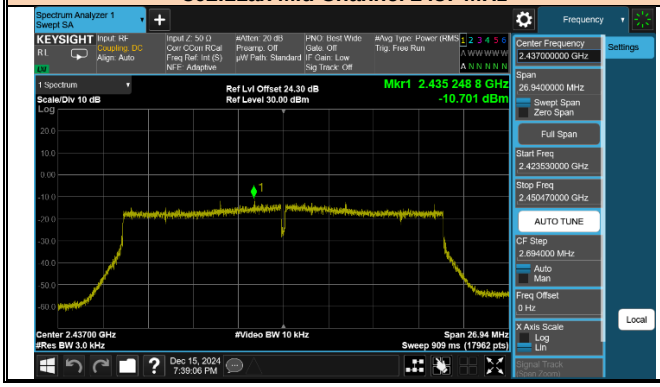
802.11n High Channel 2462 MHz



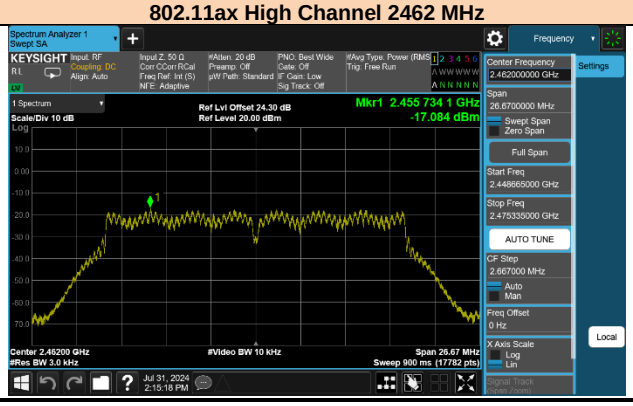
802.11ax Low Channel 2412 MHz



802.11ax Mid Channel 2437 MHz



802.11ax High Channel 2462 MHz



6 Conducted Spurious Emissions / Band Edge

6.1 *Test Result*

Test Description	Test Specification		Test Result
Conducted Spurious Emissions / Band Edge	15.247(d)	RSS-247 S5.5	Compliant

6.2 *Test Method*

Spurious emissions in non-restricted frequency bands were recorded using the methods defined in ANSI C63.10: 2013 clause 11.11 and KDB 558074 D01 Measurement Guidance v05r02.

Lowest, middle, and highest channels were investigated.

Because the maximum conducted average output power was used to determine compliance with the output power limits, the limit in any 100 kHz band outside of the authorized band is 30 dB below the maximum in-band average level.

Reference Level of Emission Limit:

1. Set analyzer center frequency to DTS channel center frequency.
2. The testing follows the Measurement Procedure of FCC KDB 558074 D01 DTS Meas. Guidance.
3. Set the span to 1.5 times the DTS channel bandwidth.
4. Set the RBW = 100kHz & VBW = 300 kHz.
5. Detector = peak.
6. Sweep time = auto couple.
7. Trace mode = max hold.
8. Allow trace to fully stabilize.
9. Use the peak marker function to determine the maximum amplitude level.

6.3 *Test Site*

Environmental Conditions

Temperature: 20 – 25 °C

Relative Humidity: 35 – 50 %

6.4 *Test Equipment*

Test Dates: July 31- December 15, 2024 Tester: Alex Chang / Andreas Gillmeier

Asset No.	Type of Equipment	Model	Serial No.	Manufacturer	Cal Date	Cal Due Date
Conducted Testing						
2003	Signal Analyzer	N9030B	MY61330812	Keysight	01/29/2024	01/29/2025
#2	RF Cable	W60-1524.1195.00	N/A	Unknown	N/A (verified before use)	
-	20 dB Attenuator	3M-20	93495	WEINSCHEL	N/A (verified before use)	
-	Power Splitter	ZN2PD2-63-S+	SUU71801931	Mini-Circuits	N/A (verified before use)	
-	Test Software	Radio Test Software	v.23	SGS Taiwan	N/A	
2036	Temp/Humidity Data Logger	GSP-8	CMA231100002	Elitech	07/09/2024	07/09/2025

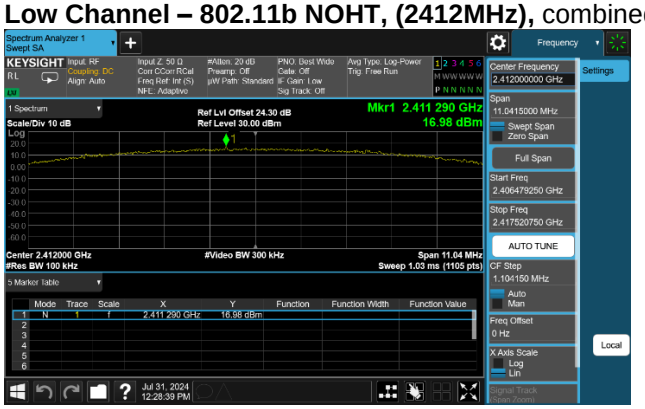
6.5 *Test Setup Photographs*

Test setup photographs are located in a separate report (208949-8).

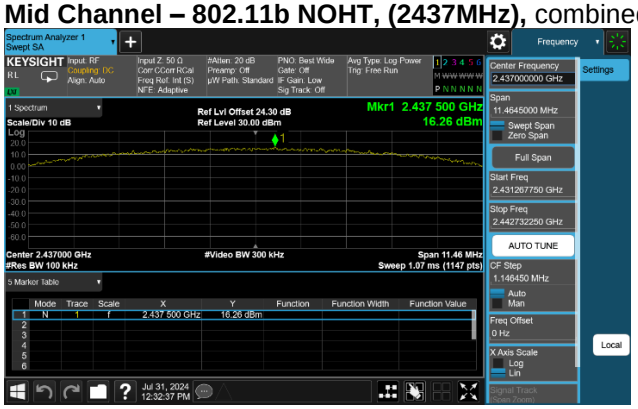
6.6 *Test Data*

Mode	Frequency (MHz)	Power Level	Data Rate (Mbps)	Level of Reference (dBm)		Verdict
				Combined antennas	Limit (dBm)	
802.11b NOHT	2412	72	5.5	16.98	-13.02	Pass
	2437	72	11	16.26	-13.74	Pass
	2462	66	1	14.46	-15.54	Pass
802.11g	2412	62	48	9.76	-20.24	Pass
	2437	68	12	11.28	-18.72	Pass
	2462	55	36	7.36	-22.64	Pass
802.11n (HT20)	2412	62	mcs3	9.51	-20.49	Pass
	2437	80	mcs0	14.72	-15.28	Pass
	2462	57	mcs5	8.45	-21.55	Pass
802.11ax (HE20)	2412	62	mcs4	9.59	-20.41	Pass
	2437	76	mcs0	12.68	-17.32	Pass
	2462	55	mcs7	7.07	-22.93	Pass

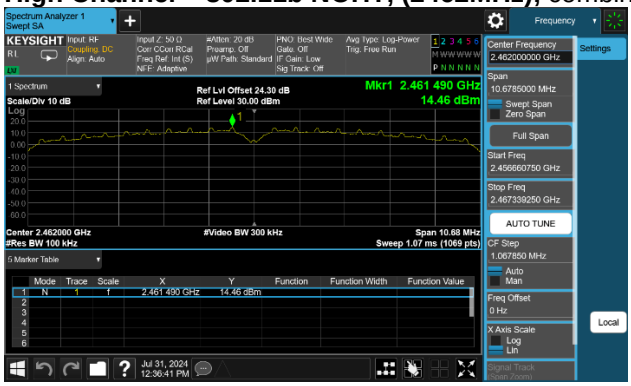
Low Channel – 802.11b NOHT, (2412MHz), combined antennas



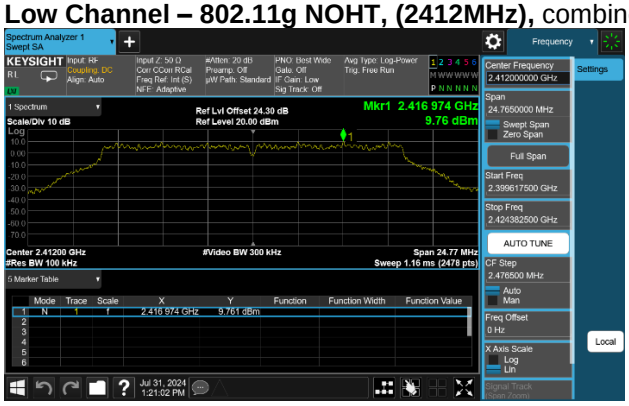
Mid Channel – 802.11b NOHT, (2437MHz), combined antennas

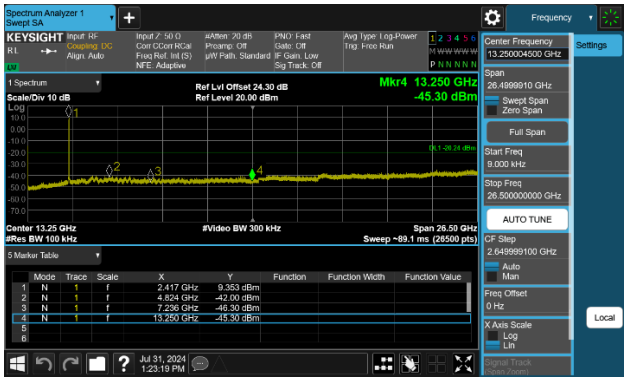


High Channel – 802.11b NOHT, (2462MHz), combined antennas

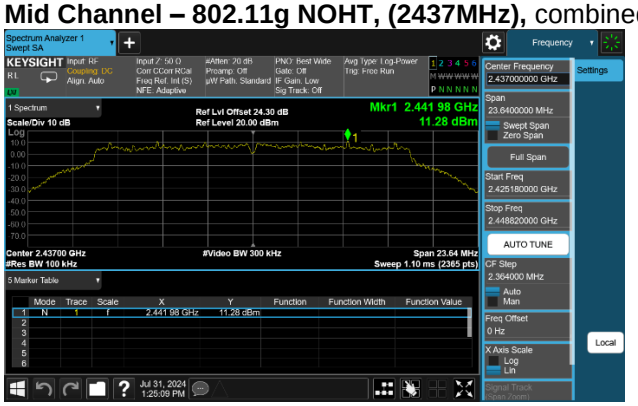


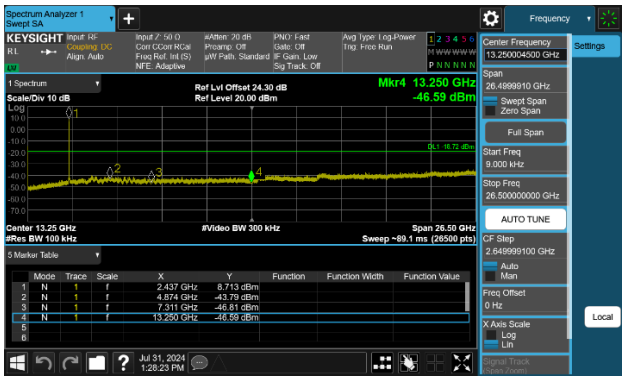
Low Channel – 802.11g NOHT, (2412MHz), combined antennas



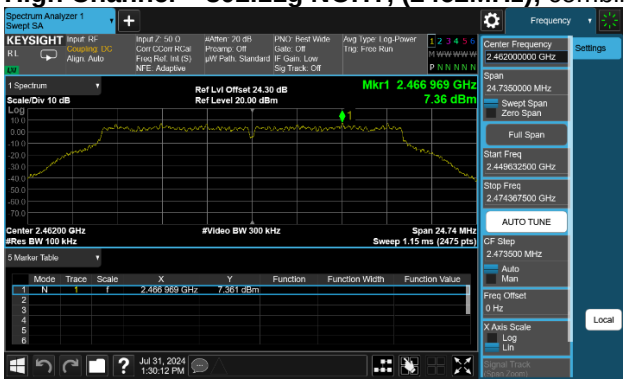


Mid Channel – 802.11g NOHT, (2437MHz), combined antennas

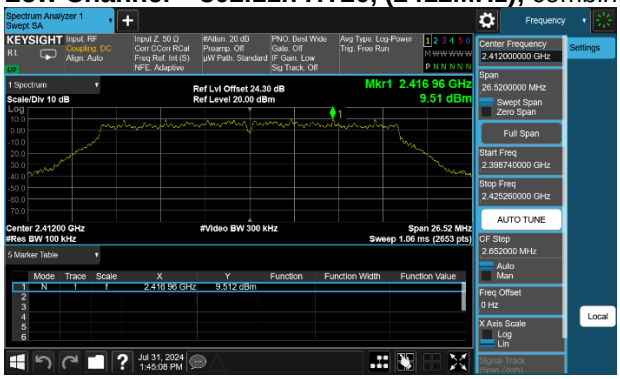


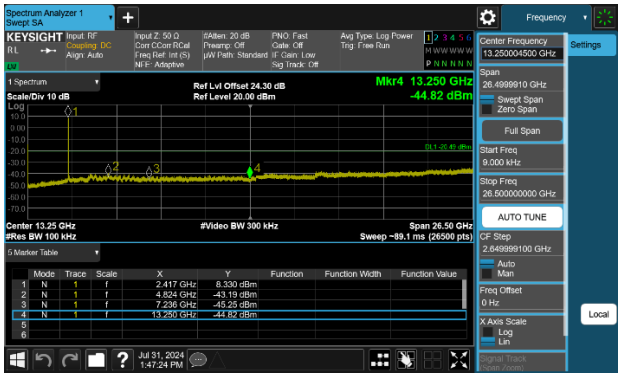


High Channel – 802.11g NOHT, (2462MHz), combined antennas

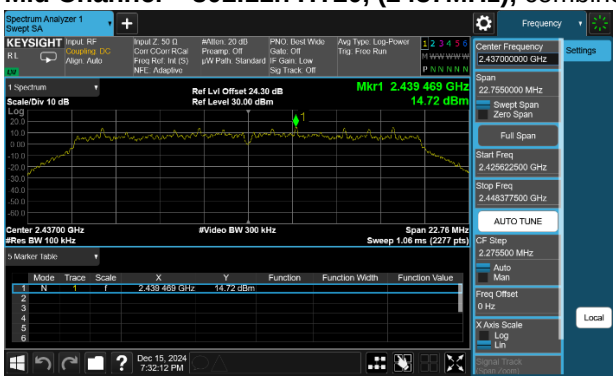


Low Channel – 802.11n HT20, (2412MHz), combined antennas

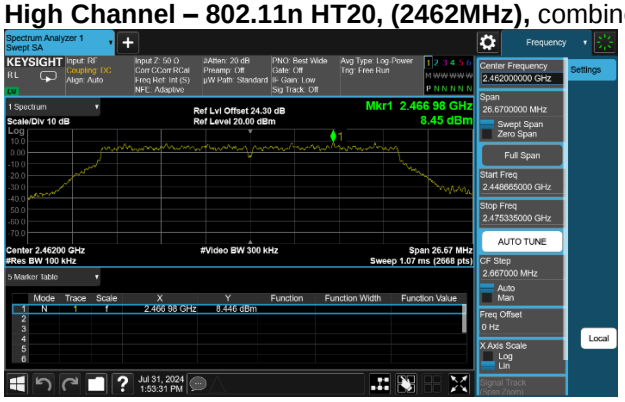


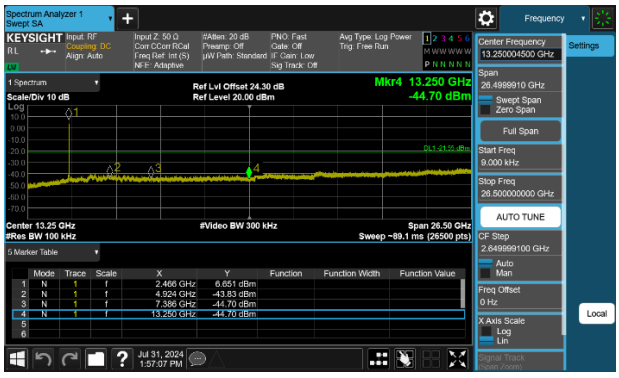


Mid Channel – 802.11n HT20, (2437MHz), combined antennas

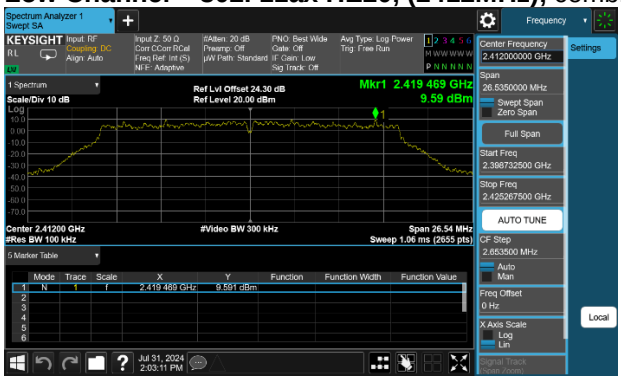


High Channel – 802.11n HT20, (2462MHz), combined antennas

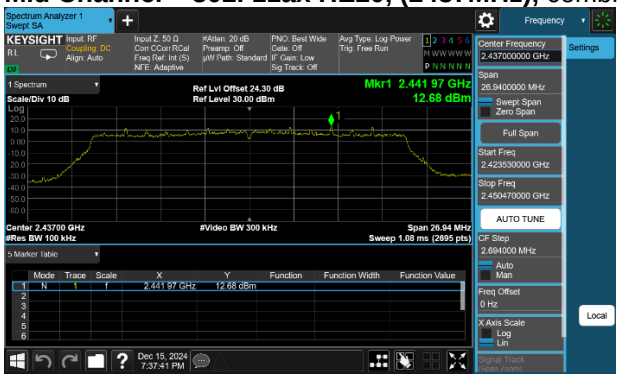


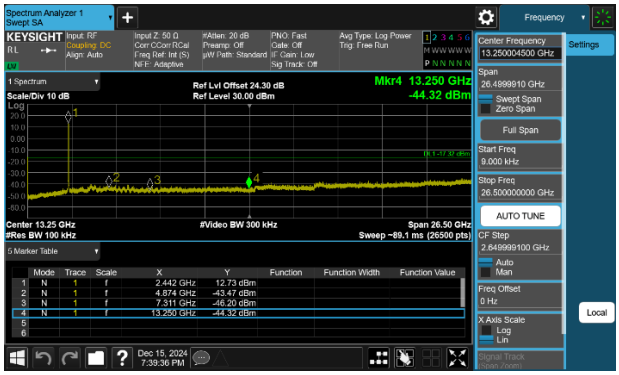


Low Channel – 802. 11ax HE20, (2412MHz), combined antennas



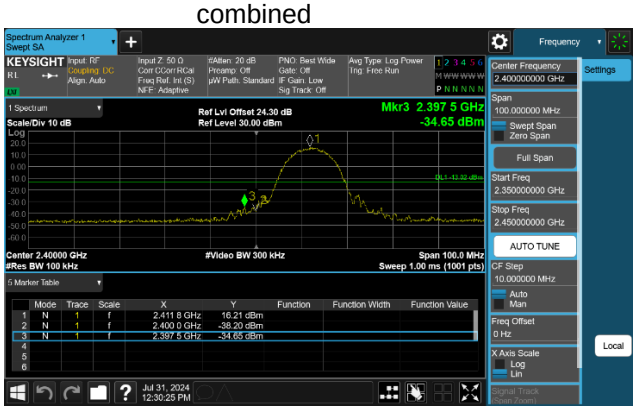
Mid Channel – 802. 11ax HE20, (2437MHz), combined antennas



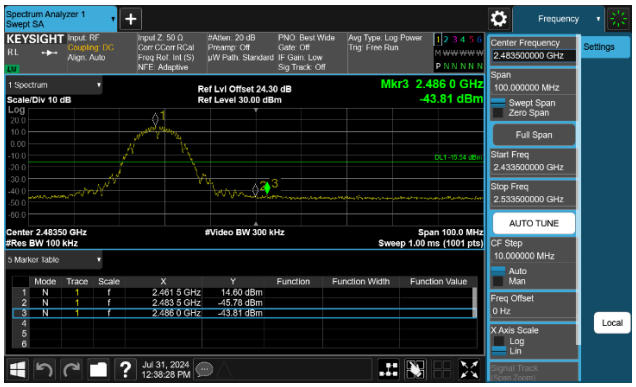


High Channel – 802. 11ax HE20, (2462MHz), combined antennas

Band Edge Low Channel – 802.11b NOHT, (2412MHz)
combined

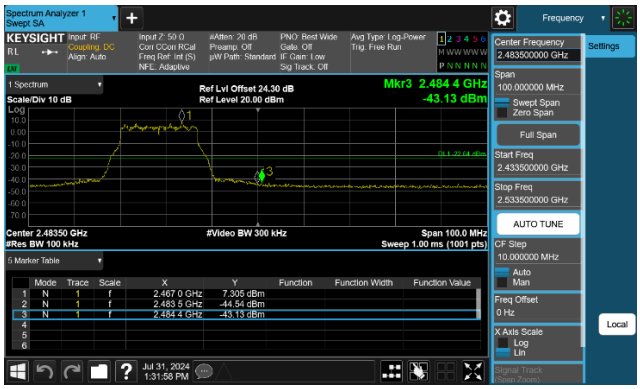


Band Edge High Channel – 802.11b NOHT, (2462MHz)

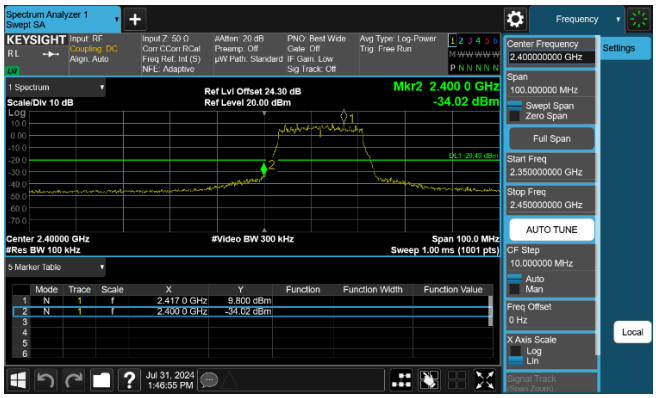


Band Edge Low Channel – 802.11g NOHT, (2412MHz)
combined

Band Edge High Channel – 802.11g NOHT, (2462MHz)

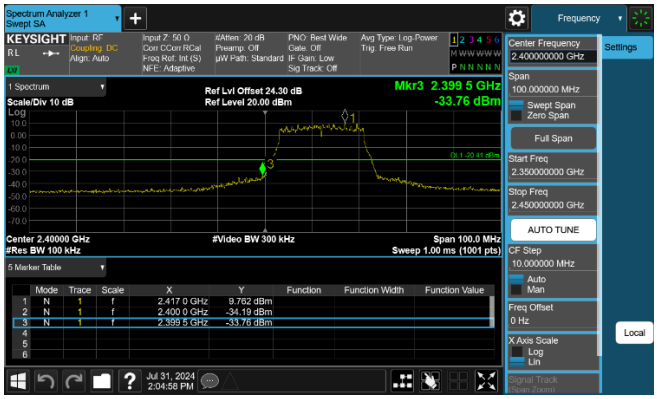


Band Edge Low Channel – 802.11n HT20, (2412MHz)
combined

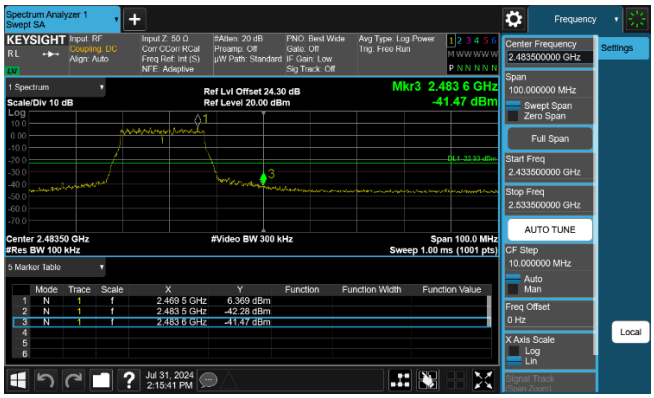


Band Edge High Channel – 802.11n HT20, (2462MHz)

Band Edge Low Channel – 802.11ax HE20, (2412MHz)
combined



Band Edge High Channel – 802.11ax HE20, (2462MHz)



7 Field Strength of Spurious Radiation (Restricted Bands)

7.1 *Test Result*

Test Description	Test Specification		Test Result
Radiated Spurious Emissions	15.247(d) and 15.209	RSS-247 S5.5	Compliant

7.2 *Test Method*

The measurement methods defined in ANSI C63.10: 2013 were used.

Lowest, middle, and highest channels were investigated – the device was commanded to continuously transmit on low, middle, and high channels.

Test distance:

9k to 30 MHz – Near field prescan to determine if there were any emissions
30 to 1000 MHz - The EUT to measurement antenna distance was 3 meters
1 to 18 GHz - The EUT to measurement antenna distance was 3 meters
18 to 26 GHz - The EUT to measurement antenna distance was 3 meters

Limits within restricted bands of operation:

Frequency	Limits(1)		Peak Limits dBuV/m
	Microvolts/m	dBuV/m	
30 - 88 MHz	100	40 (2)	--
88 - 216 MHz	150	43.5 (2)	--
216 - 960 MHz	200	46 (2)	--
960 - 1000 MHz	500	54 (2)	--
1 - 40 GHz	500	54 (3)	74

(1) These limits are applicable to emissions outside of the intentional transmit frequency band.
(2) Quasi-peak limit
(3) Average limit

7.3 *Test Site*

3m Absorber Lined Shielded Enclosure (ALSE), San Diego, CA

Environmental Conditions
Temperature: 20 – 25 °C
Relative Humidity: 35 – 50 %

7.4 *Additional Observation*

- *The low frequency band started from 9kHz to 30MHz was pre-scanned and the results was 20dB lower than the limit per 15.31(o); therefore, no data was presented in this test report.*

- *The high frequency band beyond 18GHz was pre-scanned and the results was 20dB lower than the limit; therefore, no data was presented in this test report.*

7.5 *Test Equipment*

Test Dates: July 23 to September 18, 2024 Tester: Andreas Gillmeier/Alex Chang

Asset No.	Type of Equipment	Model	Serial No.	Manufacturer	Cal Date	Cal Due Date
Radiated Emission < 1 GHz						
2017	EMI Receiver	N9038B	MY59050132	Keysight	10/24/2023	01/24/2025
2029	ETS Lindgren	Loop Antenna, H-Field	6512	00249642	08/31/2022	10/04/2026
2034	Biconilog Antenna 26M-6000MHz	3142E	00243882	ETS Lindgren	06/29/2023	06/29/2025
Radiated Emission > 1 GHz						
2017	EMI Receiver	N9038B	MY59050132	Keysight	10/24/2023	01/24/2025
2026	RF Microwave Systems Amplifier	RAMP00M45GA	00089204010	RF-Lambda	07/09/2024	07/09/2025
-	High Pass Filter	HPM16182	G015	Micro-Tronics	NCR	NCR
2042	DRG Horn Antenna 1G-18GHz	3117	00259209	ETS Lindgren	05/26/2023	05/26/2025
2032	ETS Lindgren	DRG Horn Antenna 10G-40GHz	3116C	00251668	07/23/2024	07/23/2026
Miscellaneous						
2036	Temp/Humidity Data Logger	GSP-8	CMA231100002	Elitech	07/09/2024	07/09/2025
-	Test Software	TILE!	V7.8.1.7	ETS Lindgren	N/A	

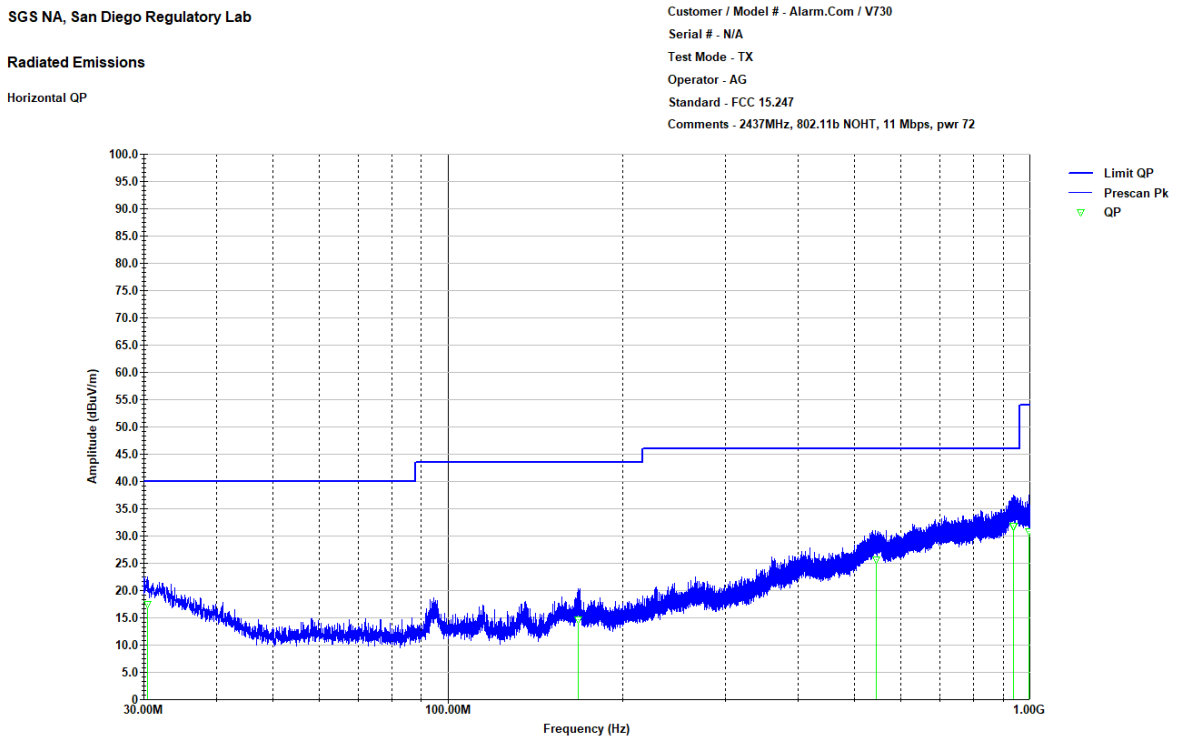
7.6 *Test Setup Photographs*

Test setup photographs are located in a separate report (208949-8).

7.7 *Test Data*

- Radiated Spurious Emissions test performed from 30MHz to 18GHz.
- No emissions beyond 12GHz. 12GHz and up only noise floor figures. No test performed beyond 18GHz.

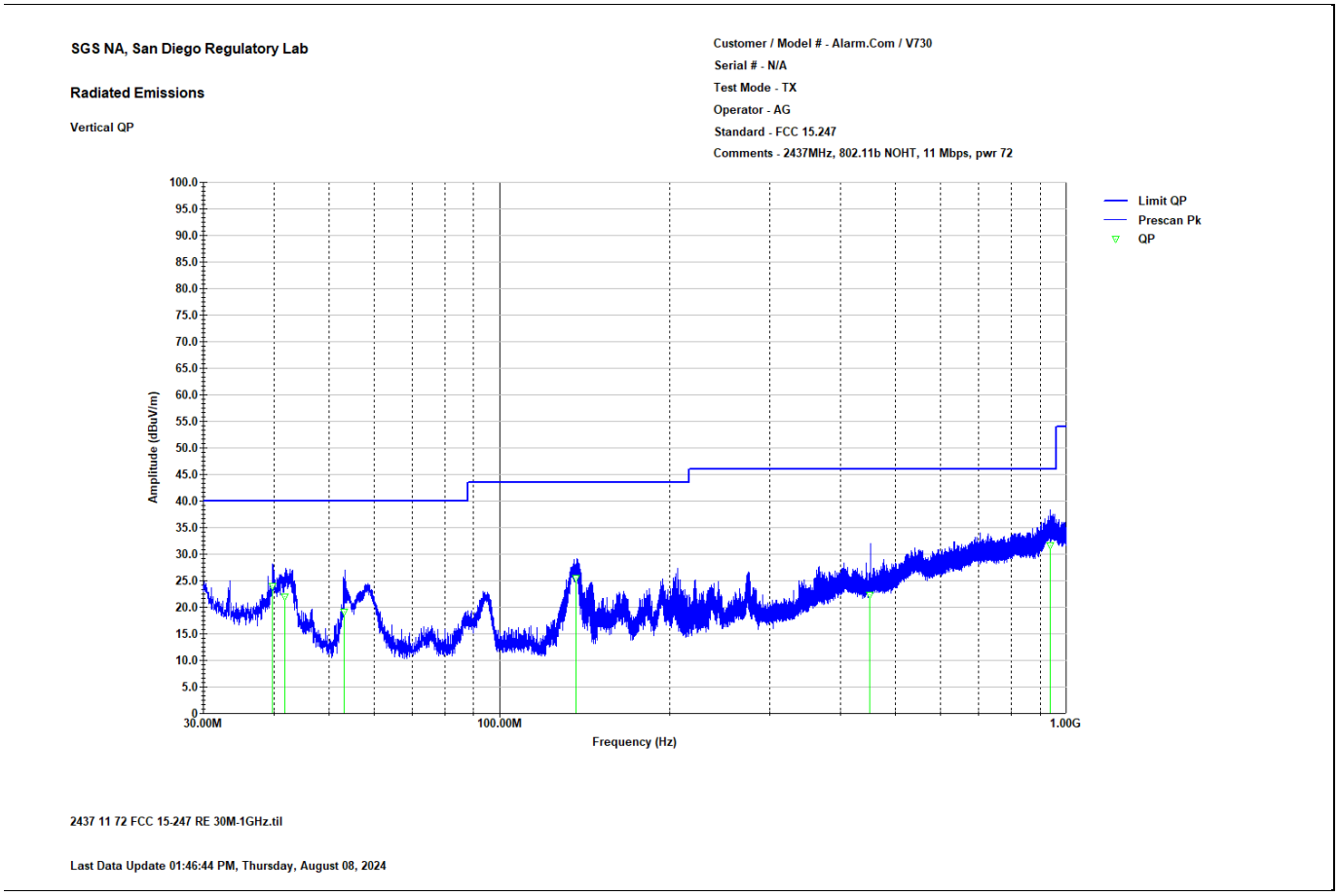
Horizontal Radiated Spurious Emissions Plot – 30 to 1000 MHz (802.11b NOHT, 2437MHz)
Worst-Case presented



Quasi-Peak Data

Freq. (MHz)	Final QP (dBµV/m)	Total Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Ant. Height (cm)	Azimuth (deg.)
30.398446	17.54	-21.58	-22.46	40	255	380
167.410012	14.59	-27.92	-28.93	43.52	113	187
544.060032	25.69	-13.84	-20.33	46.02	288	118
937.76676	31.67	-8.32	-14.35	46.02	295	67
938.667586	31.86	-8.31	-14.16	46.02	100	66
997.202489	30.77	-9.49	-23.21	53.98	303	123

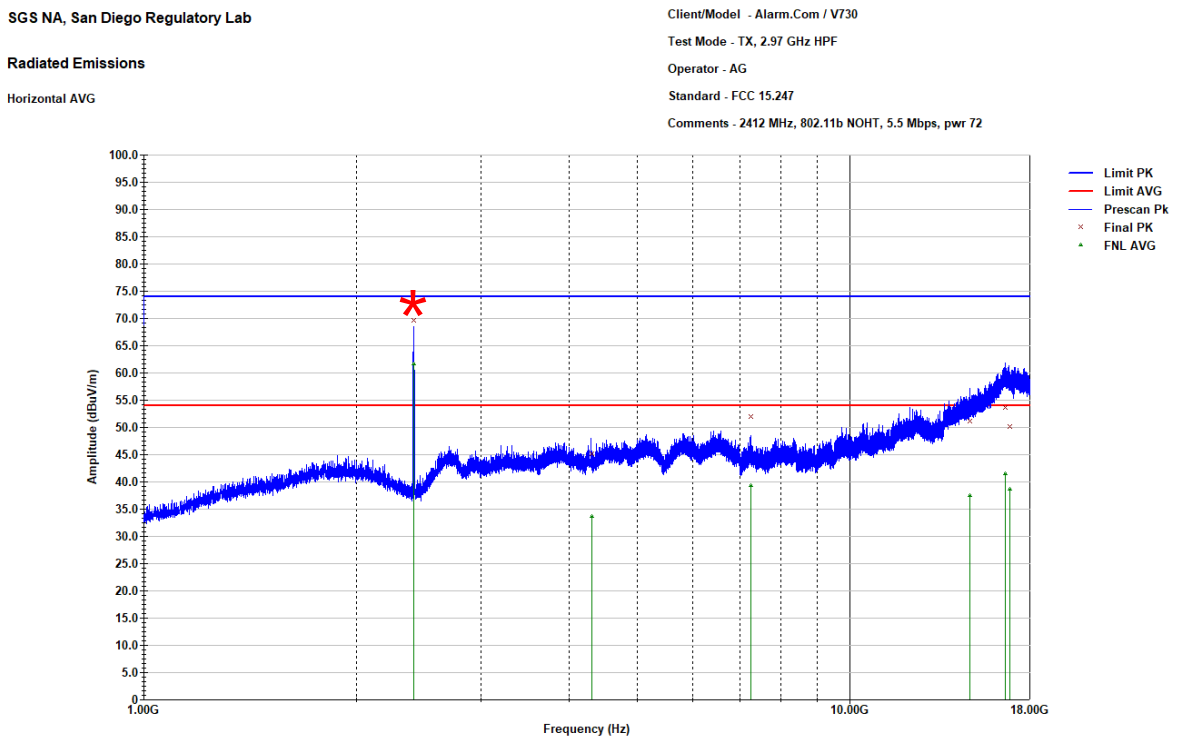
Vertical Radiated Spurious Emissions Plot – 30 to 1000 MHz (802.11b NOHT, 2437MHz)



Quasi-Peak Data

Freq. (MHz)	Final QP (dBµV/m)	Total Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Ant. Height (cm)	Azimuth (deg.)
39.753886	23.96	-26.86	-16.04	40	100	52
41.811345	22.02	-27.96	-17.98	40	130	52
53.110115	19.13	-30.67	-20.87	40	114	45
136.528381	25.5	-29.58	-18.02	43.52	100	268
450.640566	22.35	-18.42	-23.67	46.02	234	98
937.008341	31.67	-8.33	-14.35	46.02	138	337

Horizontal Radiated Spurious Emissions Plot – 1-18GHz (802.11b NOHT, 2412MHz)



(*) marks TX signal from the EUT which are excluded from measurement

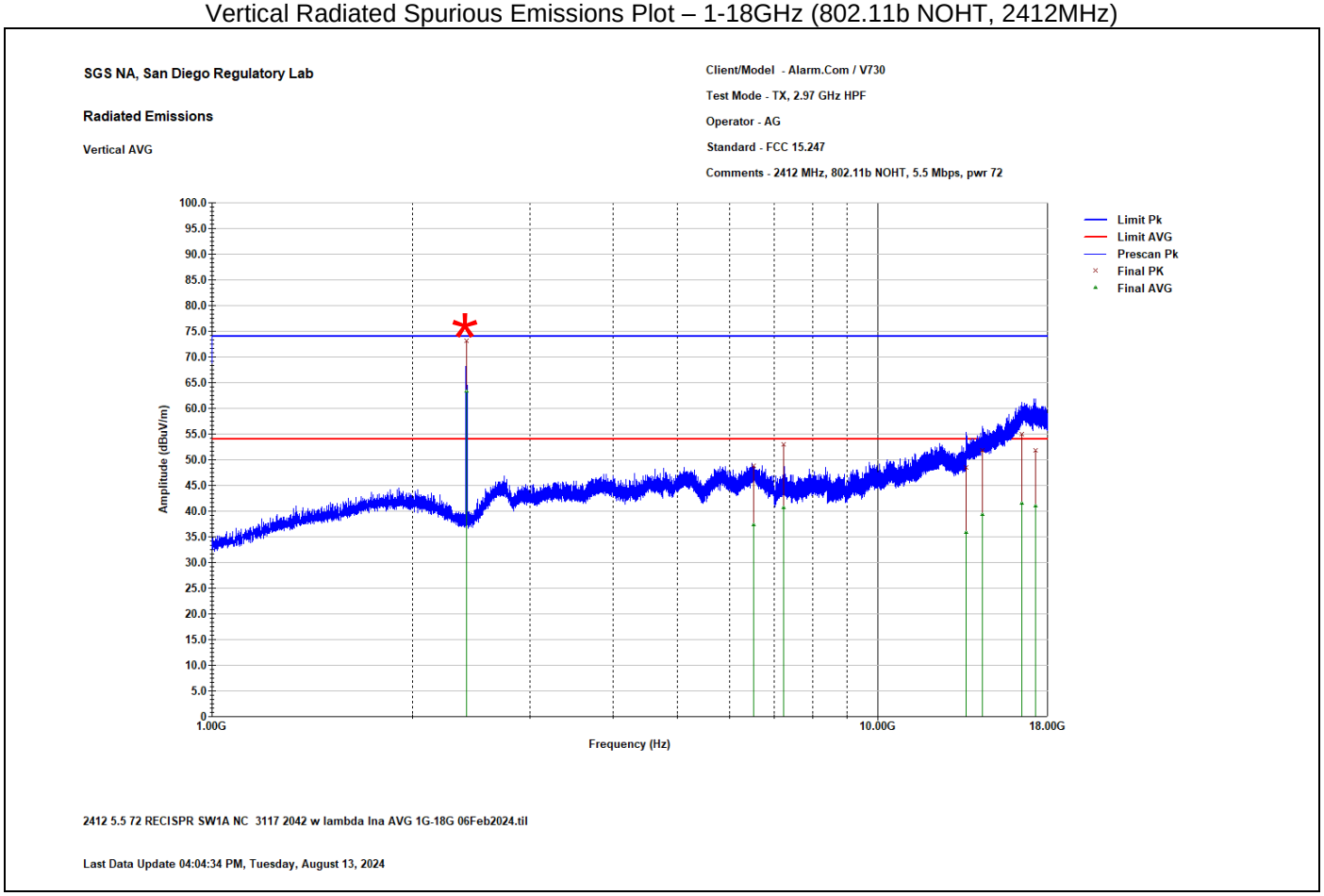
Peak Data

Freq. (MHz)	Final PK (dBµV/m)	Total Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Ant. Height (cm)	Azimuth (deg.)
2411.368	69.68	-0.42	(*)	(*)	244	172
4316.93	45.2	5.36	-28.8	74	186	325
7234.441	51.98	12.51	-22.02	74	217	255
14811.85	51.15	28.03	-22.85	74	400	314
16599.66	53.63	33.53	-20.37	74	301	380
16862.01	50.18	33.48	-23.82	74	325	136

Average

Freq. (MHz)	Final AVG (dBµV/m)	Duty Cycle Corr. (dB)	Total Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Ant. Height (cm)	Azimuth (deg.)
2411.368	61.64	0.0	-0.42	(*)	(*)	244	172
4316.93	33.74	0.0	5.36	-20.26	54	186	325
7234.441	39.31	0.0	12.51	-14.69	54	217	255
14811.85	37.5	0.0	28.03	-16.5	54	400	314
16599.66	41.42	0.0	33.53	-12.58	54	301	380
16862.01	38.69	0.0	33.48	-15.31	54	325	136

Vertical Radiated Spurious Emissions Plot – 1-18GHz (802.11b NOHT, 2412MHz)



(*) marks TX signal from the EUT which are excluded from measurement

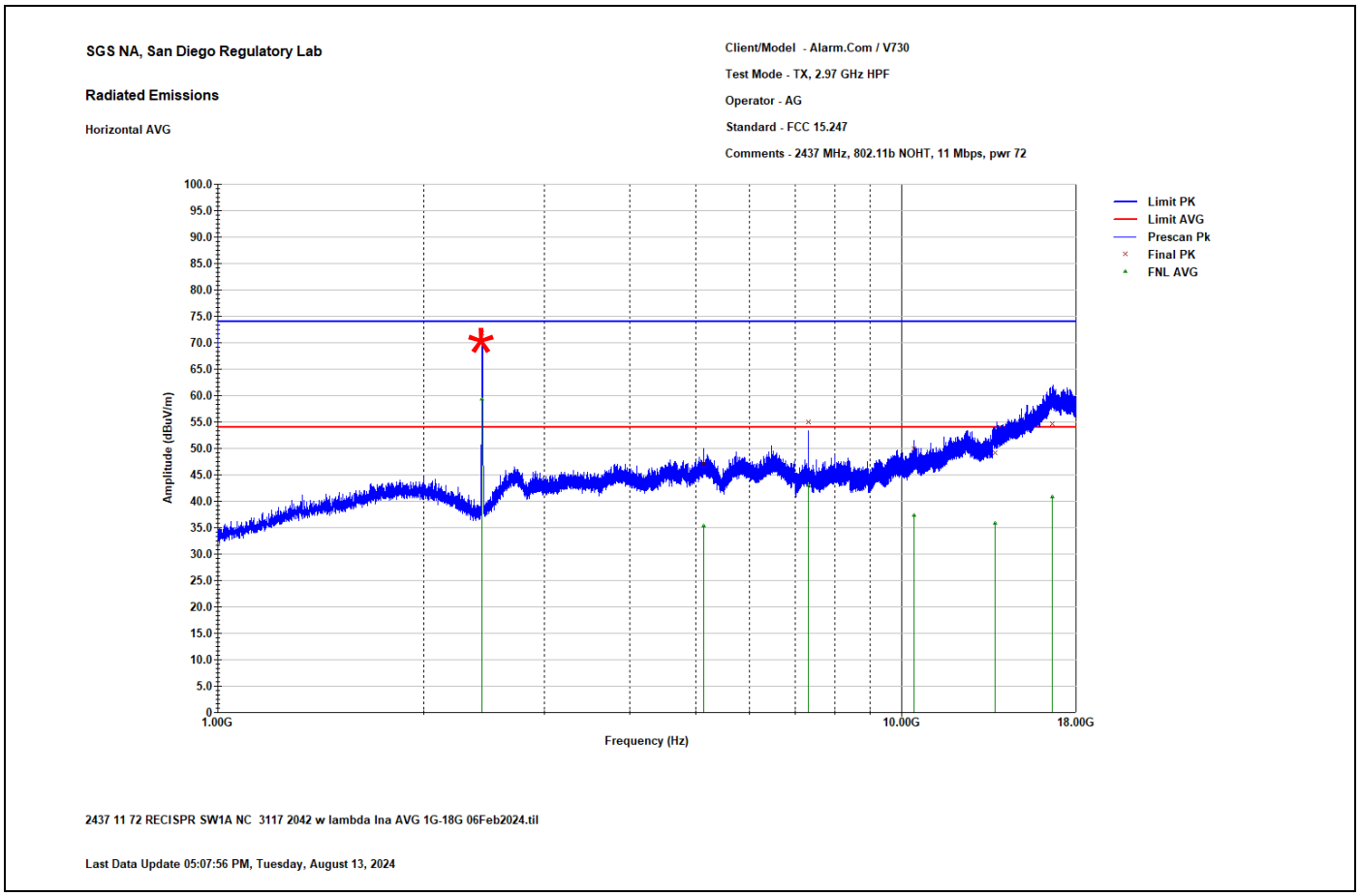
Peak Data

Freq. (MHz)	Final PK (dBµV/m)	Total Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Ant. Height (cm)	Azimuth (deg.)
2411.368	73.14	-0.42	(*)	(*)	150	234
6510.377	48.8	10.96	-25.2	74	333	380
7231.574	53.01	12.5	-20.99	74	156	195
13572.49	48.58	26.25	-25.42	74	387	108
14383	51.88	27.14	-22.12	74	357	178
16473.35	55.05	32.98	-18.95	74	163	76
17286.89	51.78	32.55	-22.22	74	150	114

Average

Freq. (MHz)	Final AVG (dBµV/m)	Duty Cycle Corr. (dB)	Total Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Ant. Height (cm)	Azimuth (deg.)
2411.368	63.25	0.0	(*)	(*)	54	150	234
6510.377	37.31	0.0	10.96	-16.69	54	333	380
7231.574	40.74	0.0	12.5	-13.26	54	156	195
13572.49	35.86	0.0	26.25	-18.14	54	387	108
14383	39.28	0.0	27.14	-14.72	54	357	178
16473.35	41.56	0.0	32.98	-12.44	54	163	76
17286.89	41.05	0.0	32.55	-12.95	54	150	114

Horizontal Radiated Spurious Emissions Plot – 1-18GHz (802.11b NOHT, 2437MHz)



(*) marks TX signal from the EUT which are excluded from measurement

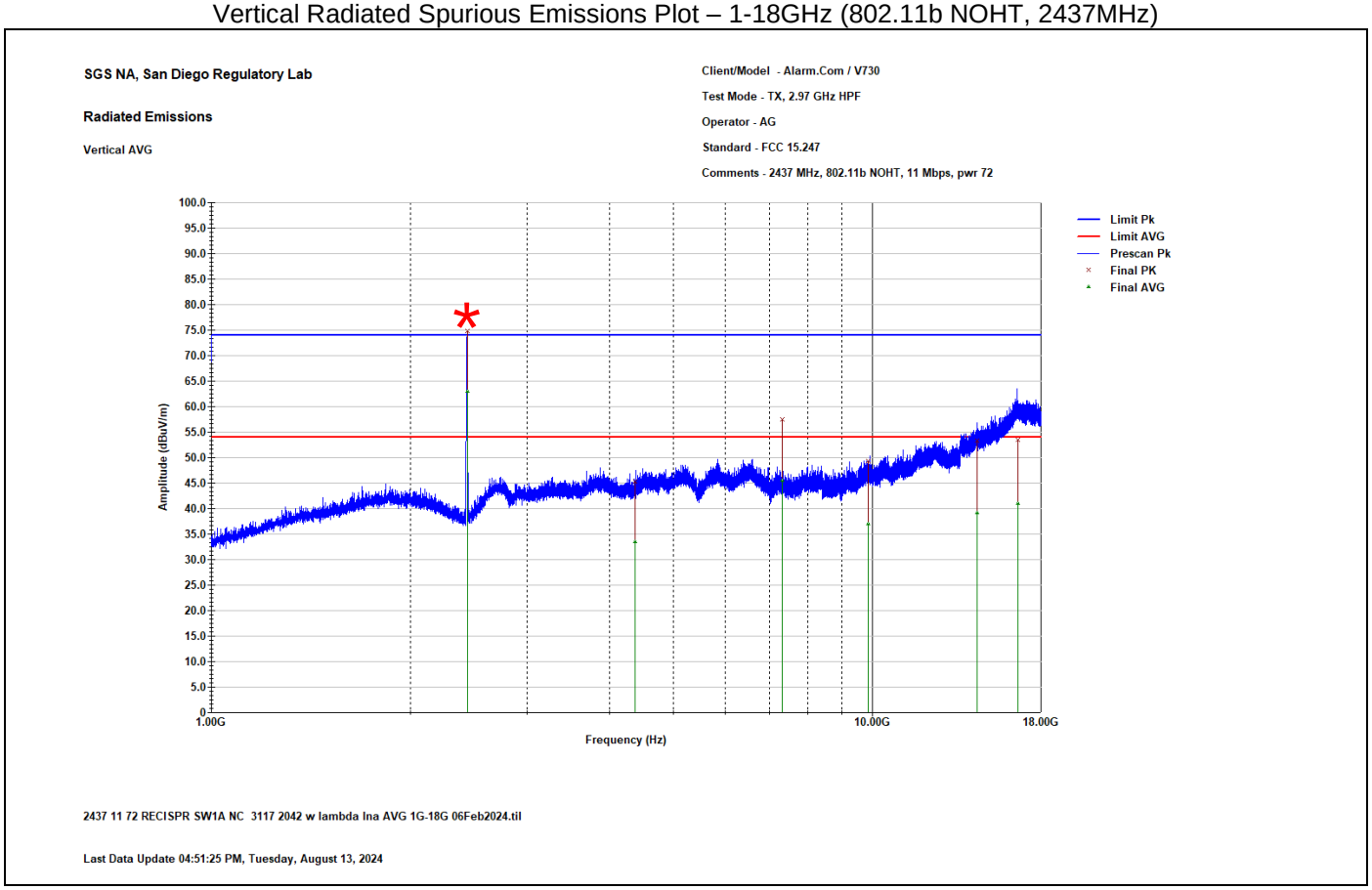
Peak Data

Freq. (MHz)	Final PK (dBµV/m)	Total Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Ant. Height (cm)	Azimuth (deg.)
2436.818	71.75	-0.26	(*)	(*)	150	237
5135.167	47.21	7.1	-26.79	74	271	65
7308.867	54.9	12.7	-19.1	74	186	246
10424.63	50.01	20.45	-23.99	74	301	200
13720.99	49.2	26.38	-24.8	74	248	306
16611.26	54.59	33.58	-19.41	74	252	255

Average

Freq. (MHz)	Final AVG (dBµV/m)	Duty Cycle Corr. (dB)	Total Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Ant. Height (cm)	Azimuth (deg.)
2436.818	59.3	0.0	(*)	(*)	54	150	237
5135.167	35.29	0.0	7.1	-18.71	54	271	65
7308.867	42.96	0.0	12.7	-11.04	54	186	246
10424.63	37.37	0.0	20.45	-16.63	54	301	200
13720.99	35.84	0.0	26.38	-18.16	54	248	306
16611.26	40.88	0.0	33.58	-13.12	54	252	255

Vertical Radiated Spurious Emissions Plot – 1-18GHz (802.11b NOHT, 2437MHz)



(*) marks TX signal from the EUT which are excluded from measurement

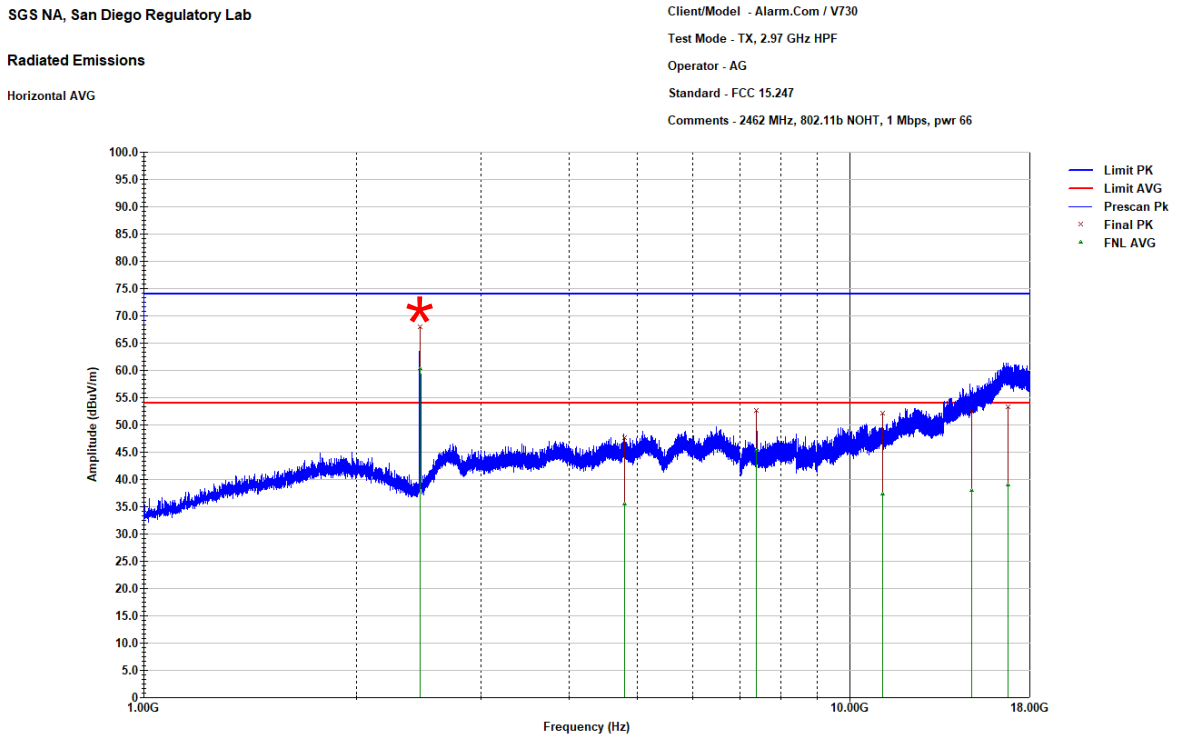
Peak Data

Freq. (MHz)	Final PK (dBµV/m)	Total Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Ant. Height (cm)	Azimuth (deg.)
2437.895	74.86	-0.27	(*)	(*)	150	234
4380.771	45.35	5.52	-28.65	74	357	158
7312.252	57.45	12.71	-16.55	74	150	155
9874.824	49.37	19.08	-24.63	74	163	286
14394.95	53.31	27.14	-20.69	74	381	66
16611.3	53.53	33.58	-20.47	74	334	332

Average

Freq. (MHz)	Final AVG (dBµV/m)	Duty Cycle Corr. (dB)	Total Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Ant. Height (cm)	Azimuth (deg.)
2437.895	62.96	0.0	(*)	(*)	54	150	234
4380.771	33.47	0.0	5.52	-20.53	54	357	158
7312.252	45.58	0.0	12.71	-8.42	54	150	155
9874.824	36.97	0.0	19.08	-17.03	54	163	286
14394.95	39.16	0.0	27.14	-14.84	54	381	66
16611.3	40.99	0.0	33.58	-13.01	54	334	332

Horizontal Radiated Spurious Emissions Plot – 1-18GHz (802.11b NOHT, 2462MHz)



(*) marks TX signal from the EUT which are excluded from measurement

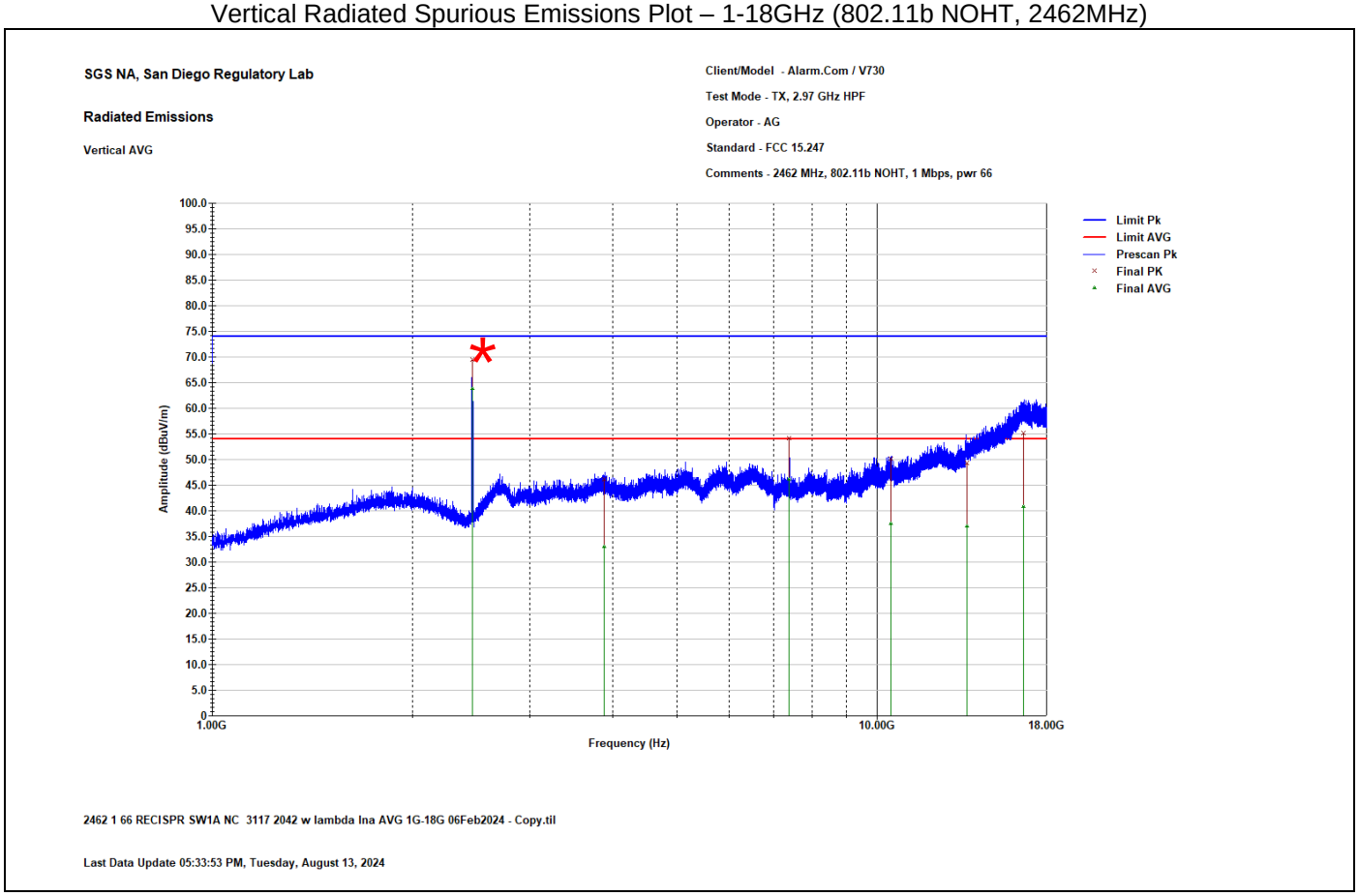
Peak Data

Freq. (MHz)	Final PK (dBµV/m)	Total Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Ant. Height (cm)	Azimuth (deg.)
2461.094	68.02	-0.24	(*)	(*)	276	207
4799.739	47.6	6.58	-26.4	74	240	215
7384.351	52.67	12.96	-21.33	74	171	252
11147.93	52.1	22.69	-21.9	74	270	137
14873.58	52.47	28.17	-21.53	74	362	160
16784.66	53.3	33.55	-20.7	74	186	215

Average

Freq. (MHz)	Final AVG (dBµV/m)	Duty Cycle Corr. (dB)	Total Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Ant. Height (cm)	Azimuth (deg.)
2461.094	60.25	0.0	(*)	(*)	54	276	207
4799.739	35.41	0.0	6.58	-18.59	54	240	215
7384.351	45.32	0.0	12.96	-8.68	54	171	252
11147.93	37.4	0.0	22.69	-16.6	54	270	137
14873.58	38.03	0.0	28.17	-15.97	54	362	160
16784.66	39.06	0.0	33.55	-14.94	54	186	215

Vertical Radiated Spurious Emissions Plot – 1-18GHz (802.11b NOHT, 2462MHz)



(*) marks TX signal from the EUT which are excluded from measurement

Peak Data

Freq. (MHz)	Final PK (dBµV/m)	Total Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Ant. Height (cm)	Azimuth (deg.)
2461.036	69.41	-0.24	(*)	(*)	164	241
3888.18	46.2	3.79	-27.8	74	155	235
7386.37	54.12	12.97	-19.88	74	150	161
10496.82	50.17	20.56	-23.83	74	273	237
13685.31	49.37	26.37	-24.63	74	342	344
16622.39	55.12	33.62	-18.88	74	226	21

Average

Freq. (MHz)	Final AVG (dBµV/m)	Duty Cycle Corr. (dB)	Total Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Ant. Height (cm)	Azimuth (deg.)
2461.036	63.78	0.0	(*)	(*)	54	164	241
3888.18	33	0.0	3.79	-21	54	155	235
7386.37	46.1	0.0	12.97	-7.9	54	150	161
10496.82	37.55	0.0	20.56	-16.45	54	273	237
13685.31	36.91	0.0	26.37	-17.09	54	342	344
16622.39	40.84	0.0	33.62	-13.16	54	226	21