

9. Spurious Emission in Non-restricted & restricted Bands

9.1 Conducted Emission Method

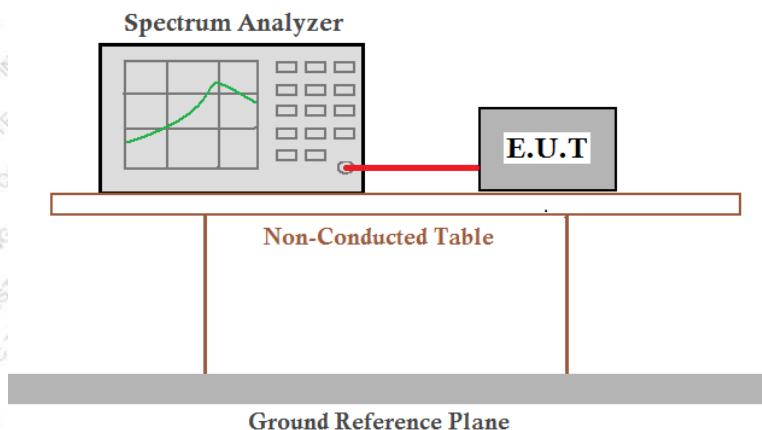
9.1.1 Applicable Standard

FCC Part15 C Section 15.247 (d)

9.1.2 Limit

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.

9.1.3 Test setup



9.1.4 Test Procedure

- Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
- Position the EUT without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
- Set RBW to 100 kHz and VBW of spectrum analyzer to 300 kHz with a convenient frequency span including 100 kHz bandwidth from band edge.
- Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
- Repeat above procedures until all measured frequencies were complete.

9.1.5 Test Data

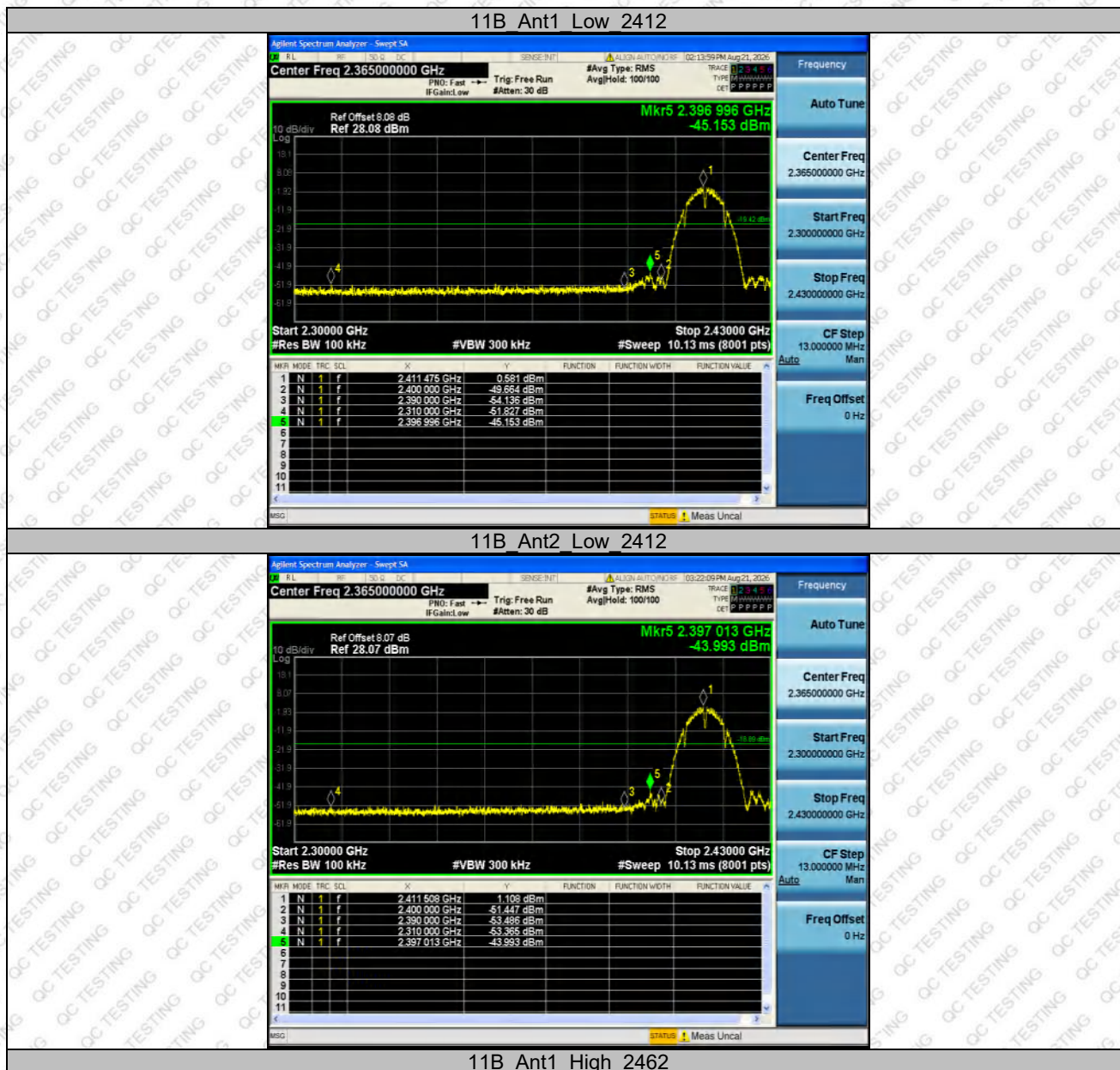
Temperature	23.6 °C	Humidity	55%
ATM Pressure	101.1kPa	Antenna Gain	3.30dBi
Test by	Fan Yang	Test result	PASS

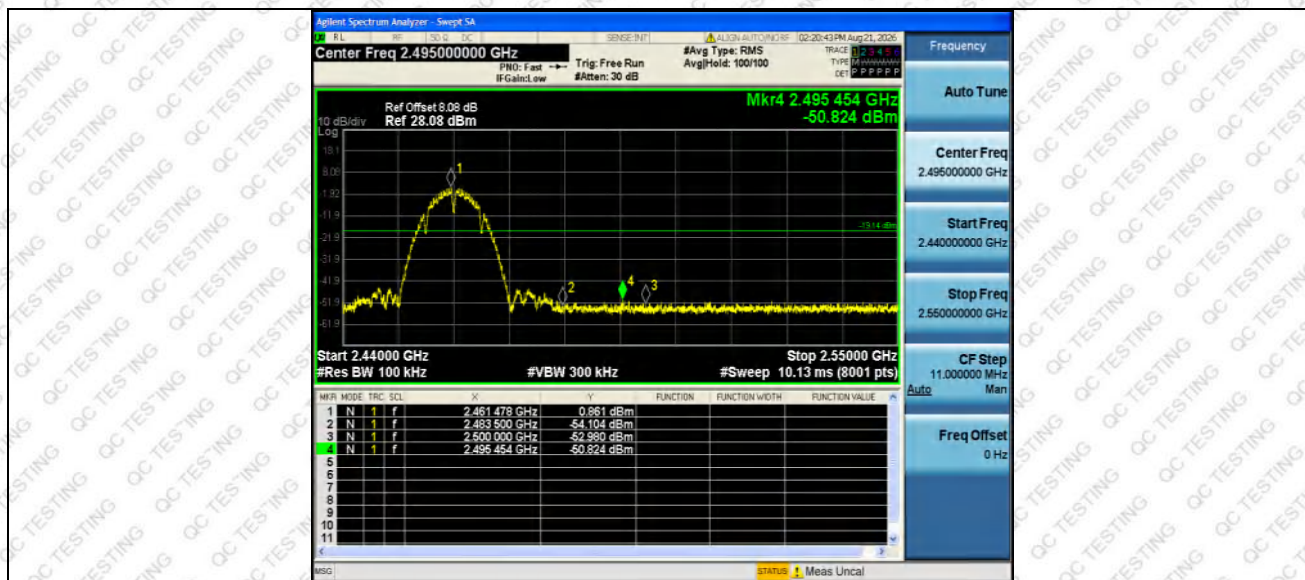
Please refer to following plots.



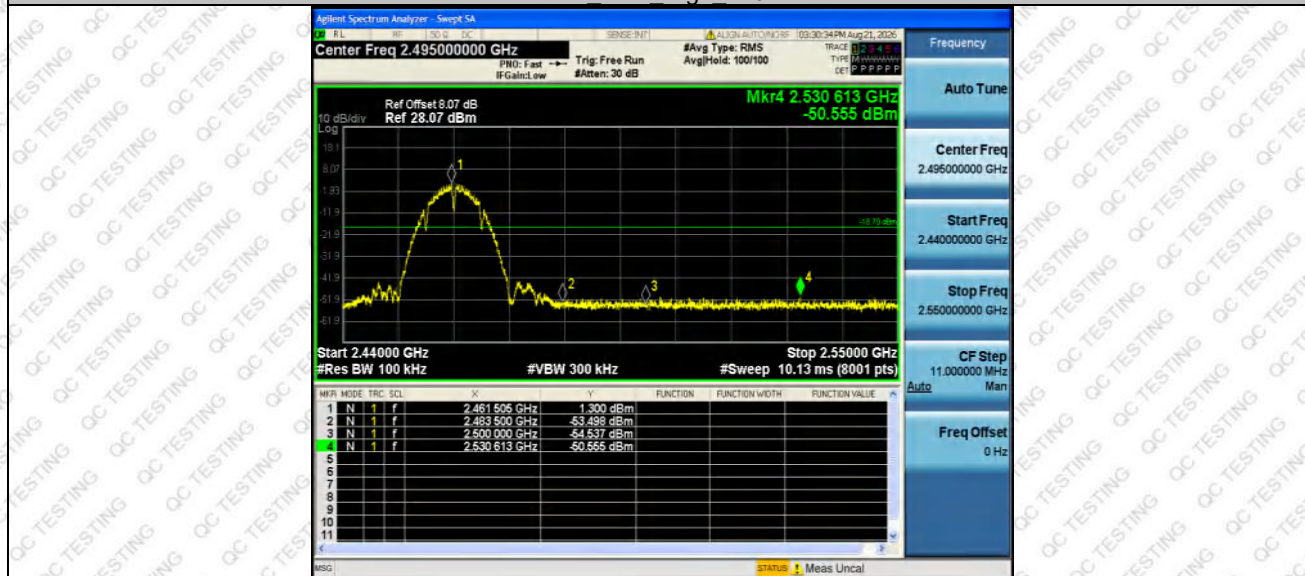
Band Edge:

Modulation	Antenna	Frequency (MHz)	Max Value (dBc)	Limit (dBc)	Verdict
b	Ant1	2412	-45.73	-20	Pass
	Ant2	2412	-45.10	-20	Pass
	Ant1	2462	-51.68	-20	Pass
	Ant2	2462	-51.86	-20	Pass
g	Ant1	2412	-27.04	-20	Pass
	Ant2	2412	-26.37	-20	Pass
	Ant1	2462	-42.66	-20	Pass
	Ant2	2462	-40.64	-20	Pass
n20	Ant1	2412	-26.91	-20	Pass
	Ant2	2412	-26.21	-20	Pass
	Ant1	2462	-40.92	-20	Pass
	Ant2	2462	-40.04	-20	Pass
N40	Ant1	2422	-30.40	-20	Pass
	Ant2	2422	-30.00	-20	Pass
	Ant1	2452	-31.19	-20	Pass
	Ant2	2452	-29.67	-20	Pass





11B Ant2 High 2462



11G Ant1 Low 2412



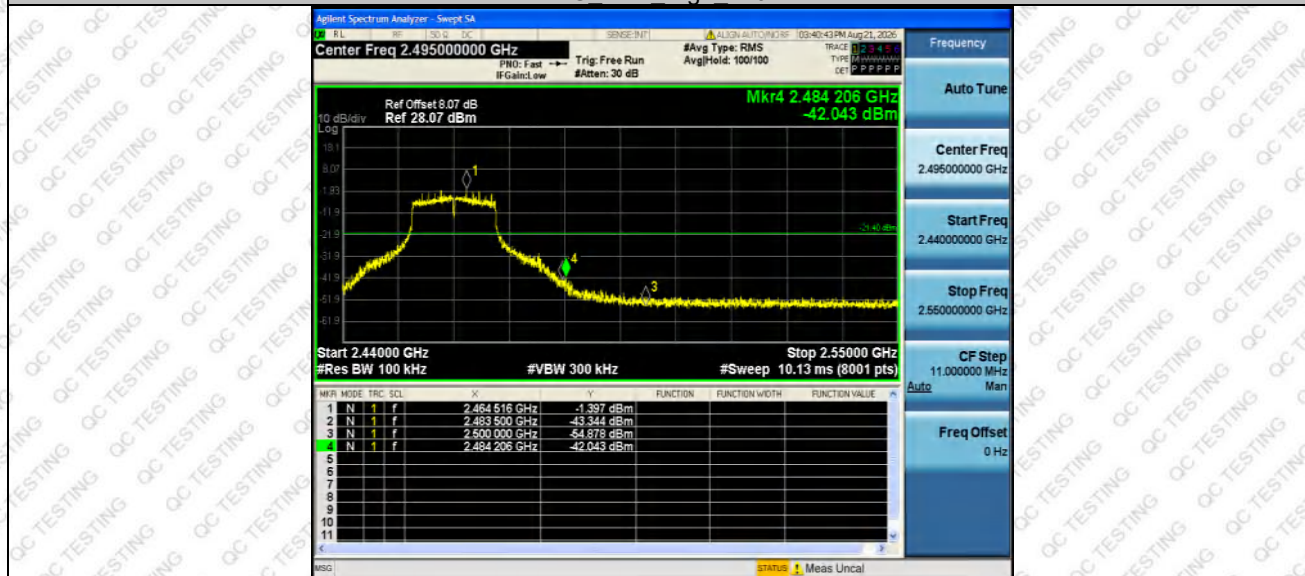
11G Ant2 Low 2412



11G Ant1 High 2462



11G Ant2 High 2462



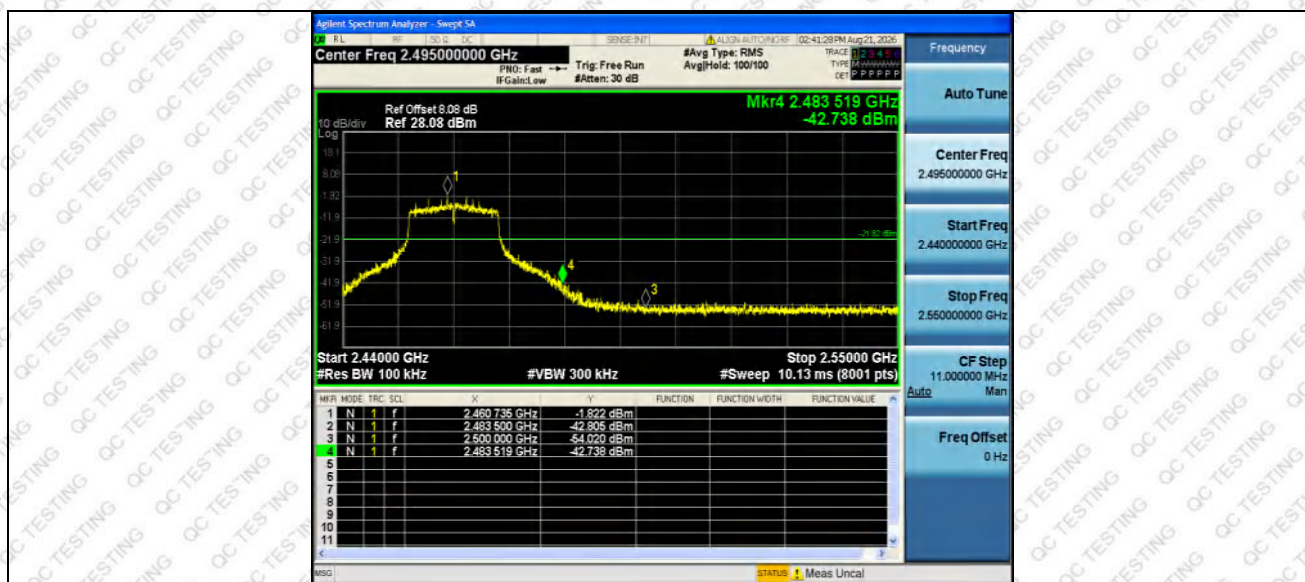
11N20SISO Ant1 Low 2412



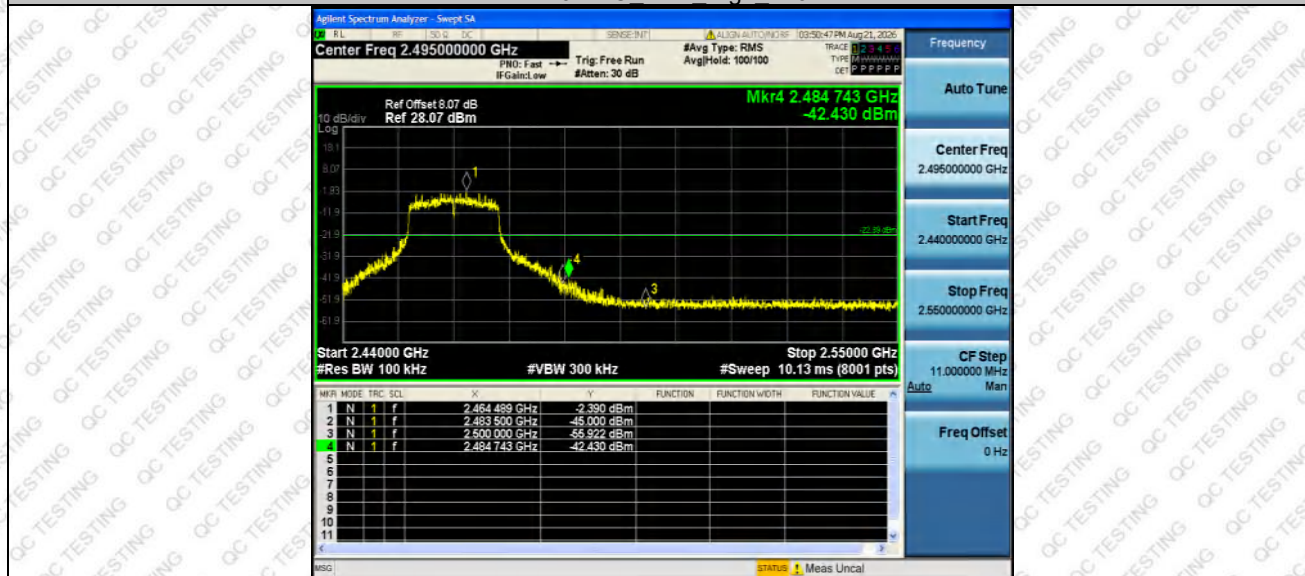
11N20SISO Ant2 Low 2412



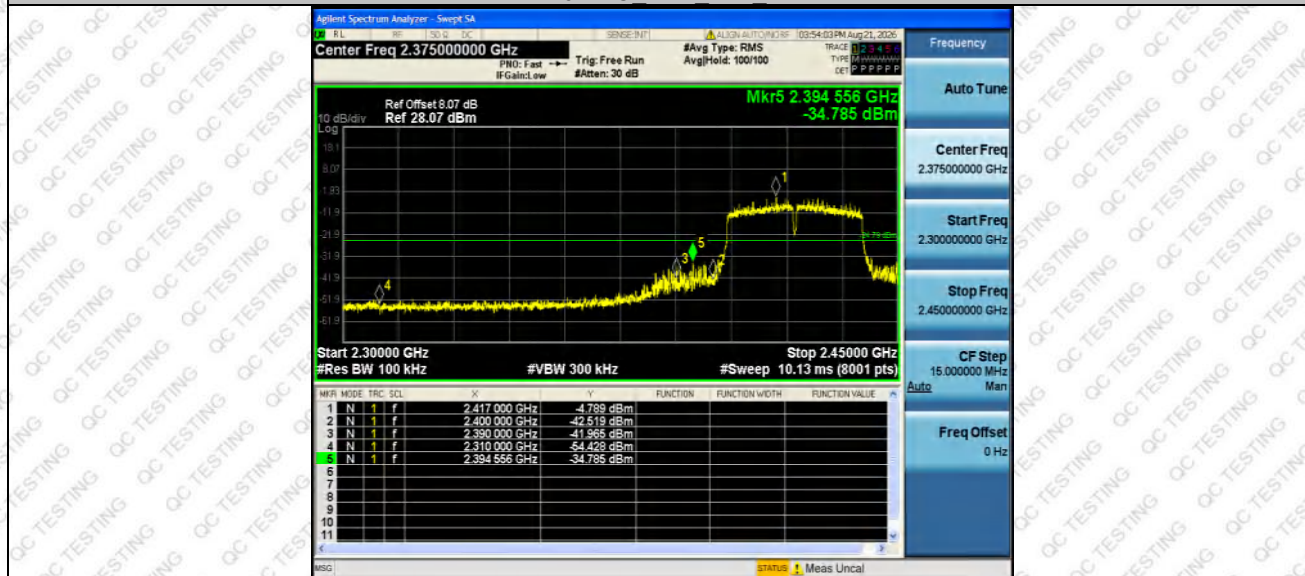
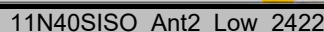
11N20SISO Ant1 High 2462



11N20SISO Ant2 High 2462



11N40SISO Ant1 Low 2422





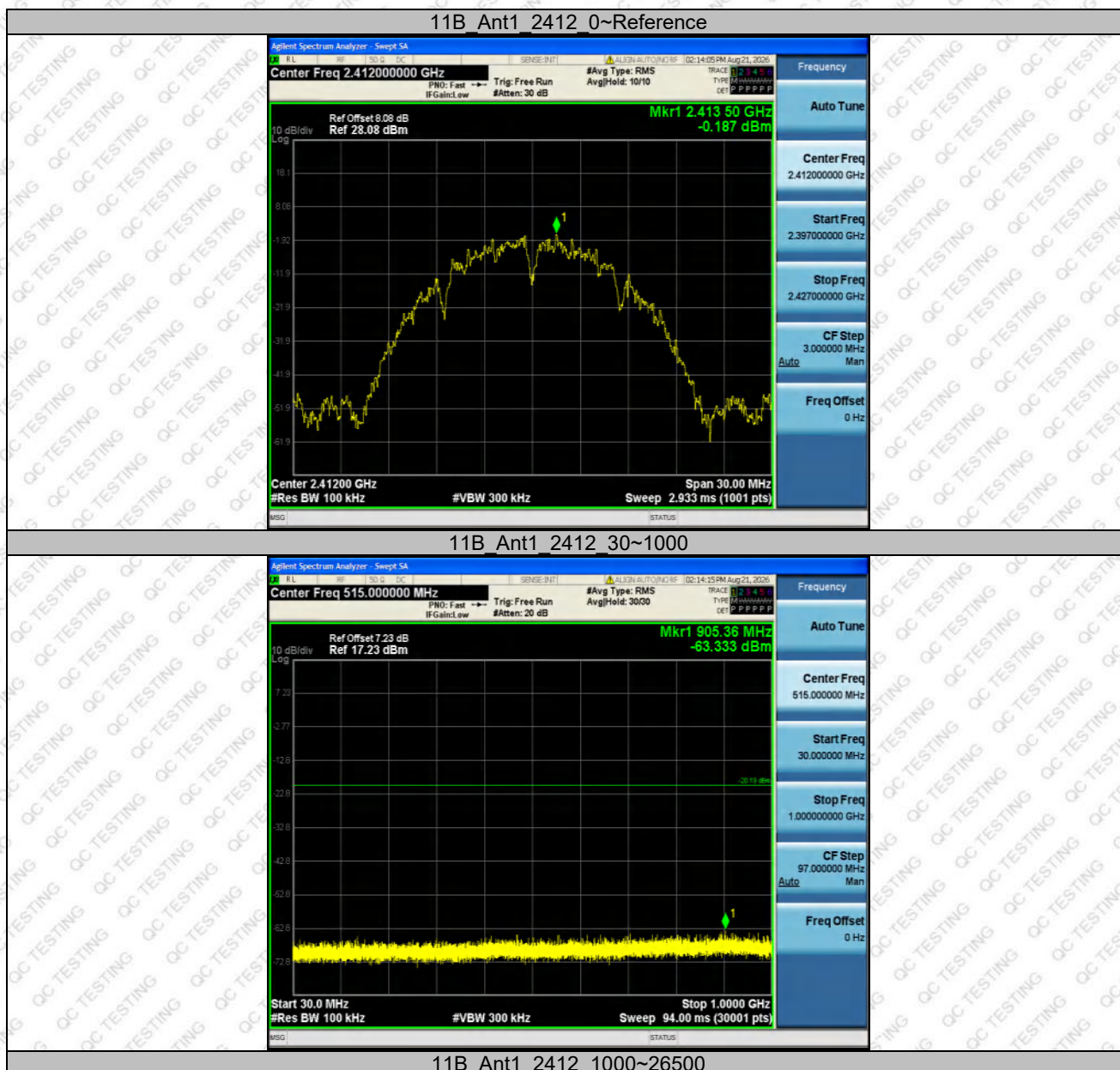


Conducted RF Spurious Emission:

Modulation	Antenna	Frequency (MHz)	FreqRange (MHz)	Max Value (dBc)	Limit (dBc)	Verdict
b	Ant1	2412	30~1000	-63.33	-20	Pass
			1000~26500	-50.20	-20	Pass
	Ant2	2412	30~1000	-63.25	-20	Pass
			1000~26500	-49.89	-20	Pass
	Ant1	2437	30~1000	-63.81	-20	Pass
			1000~26500	-49.46	-20	Pass
	Ant2	2437	30~1000	-63.65	-20	Pass
			1000~26500	-50.28	-20	Pass
	Ant1	2462	30~1000	-63.99	-20	Pass
			1000~26500	-49.55	-20	Pass
	Ant2	2462	30~1000	-63.47	-20	Pass
			1000~26500	-49.16	-20	Pass
g	Ant1	2412	30~1000	-63.76	-20	Pass
			1000~26500	-50.05	-20	Pass
	Ant2	2412	30~1000	-63.16	-20	Pass
			1000~26500	-48.68	-20	Pass
	Ant1	2437	30~1000	-63.81	-20	Pass
			1000~26500	-48.81	-20	Pass
	Ant2	2437	30~1000	-62.97	-20	Pass
			1000~26500	-49.63	-20	Pass
	Ant1	2462	30~1000	-62.86	-20	Pass
			1000~26500	-49.48	-20	Pass
	Ant2	2462	30~1000	-63.58	-20	Pass
			1000~26500	-49.59	-20	Pass



n20	Ant1	2412	30~1000	-63.00	-20	Pass
			1000~26500	-49.78	-20	Pass
	Ant2	2412	30~1000	-63.70	-20	Pass
			1000~26500	-48.41	-20	Pass
	Ant1	2437	30~1000	-63.04	-20	Pass
			1000~26500	-49.15	-20	Pass
	Ant2	2437	30~1000	-63.60	-20	Pass
			1000~26500	-49.81	-20	Pass
	Ant1	2462	30~1000	-62.87	-20	Pass
			1000~26500	-49.45	-20	Pass
	Ant2	2462	30~1000	-63.33	-20	Pass
			1000~26500	-49.56	-20	Pass
N40	Ant1	2422	30~1000	-63.74	-20	Pass
			1000~26500	-49.84	-20	Pass
	Ant2	2422	30~1000	-63.22	-20	Pass
			1000~26500	-50.00	-20	Pass
	Ant1	2437	30~1000	-63.55	-20	Pass
			1000~26500	-49.27	-20	Pass
	Ant2	2437	30~1000	-63.55	-20	Pass
			1000~26500	-49.62	-20	Pass
	Ant1	2452	30~1000	-63.89	-20	Pass
			1000~26500	-49.86	-20	Pass
	Ant2	2452	30~1000	-63.27	-20	Pass
			1000~26500	-49.15	-20	Pass

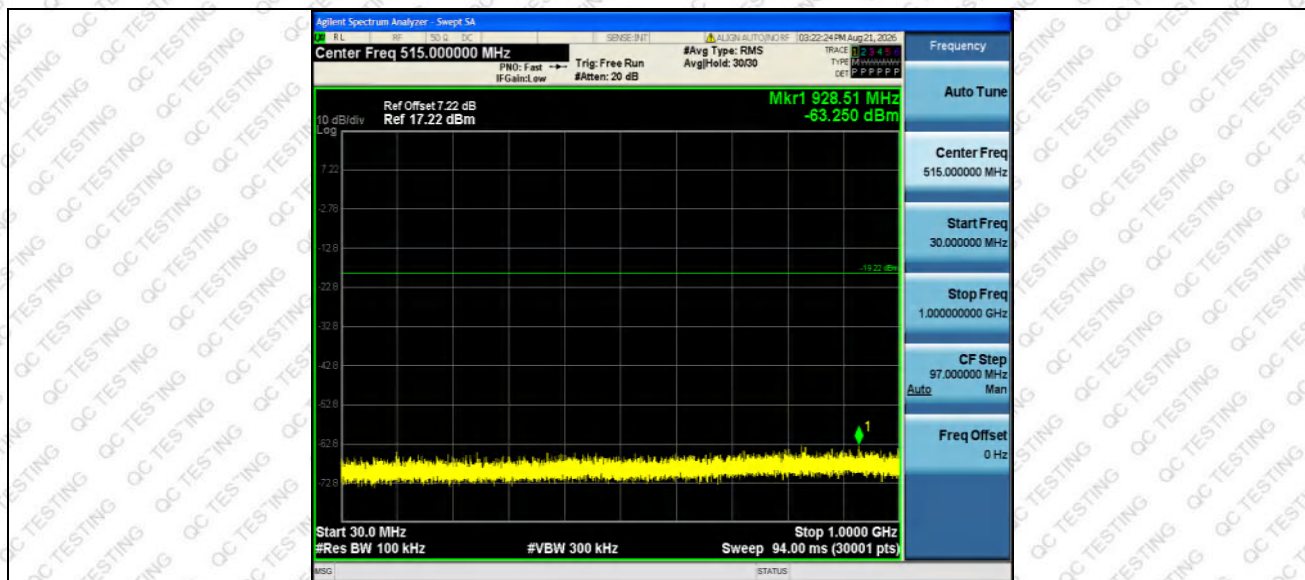




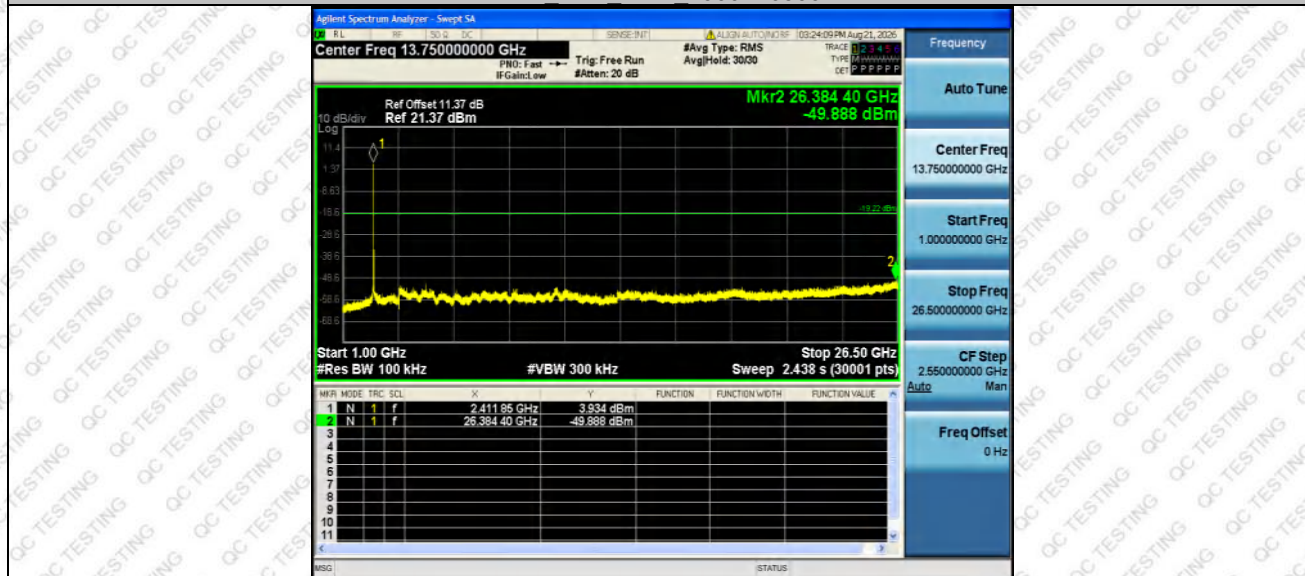
11B Ant2 2412 0~Reference



11B Ant2 2412 30~1000



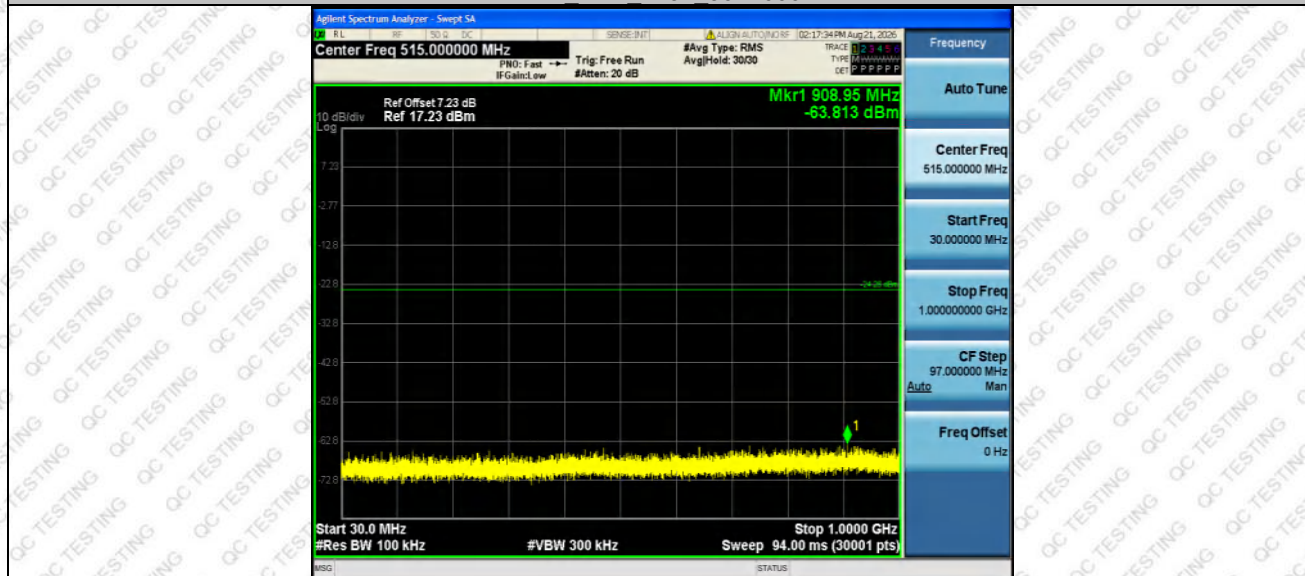
11B Ant2 2412 1000~26500



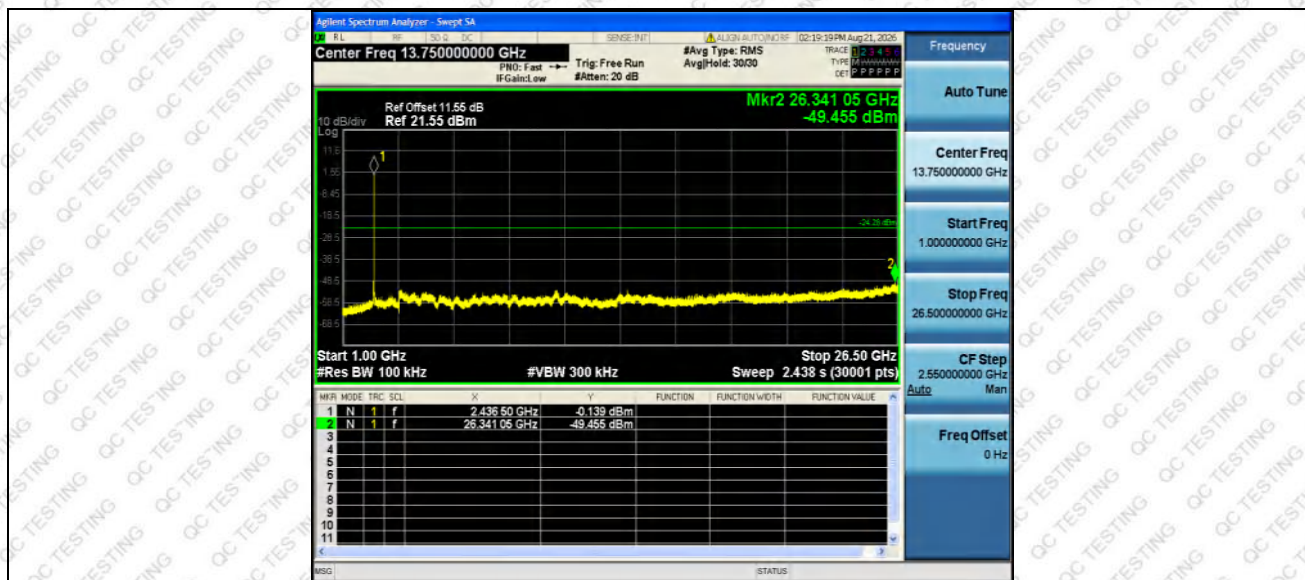
11B Ant1 2437 0~Reference



11B Ant1 2437 30~1000



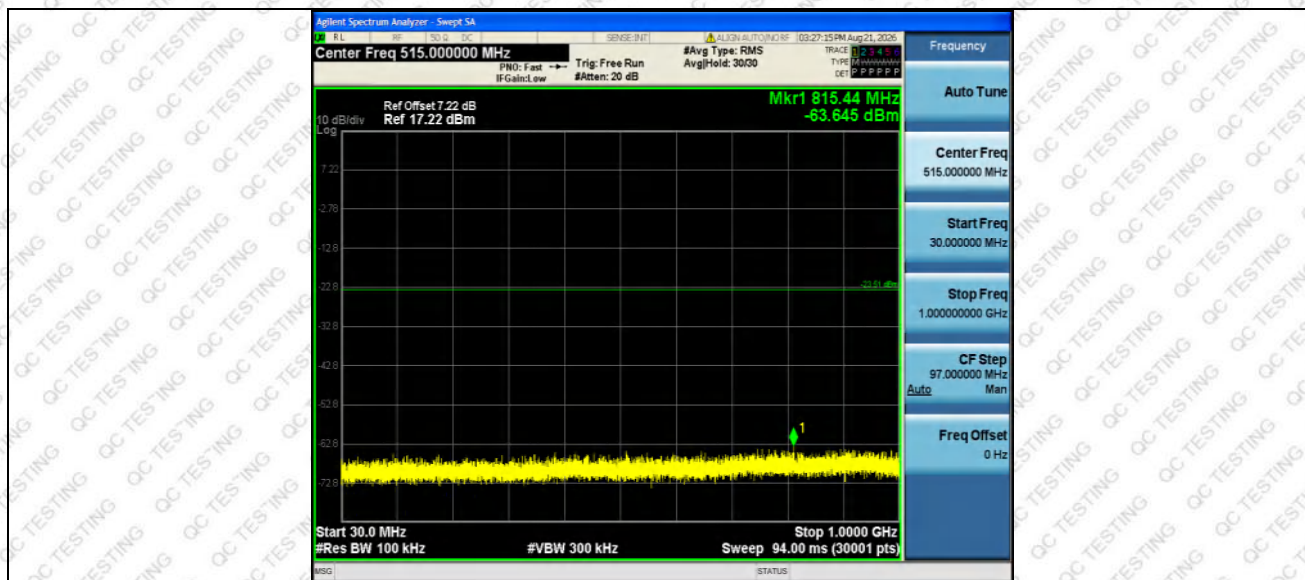
11B Ant1 2437 1000~26500



11B Ant2 2437 0~Reference



11B Ant2 2437 30~1000



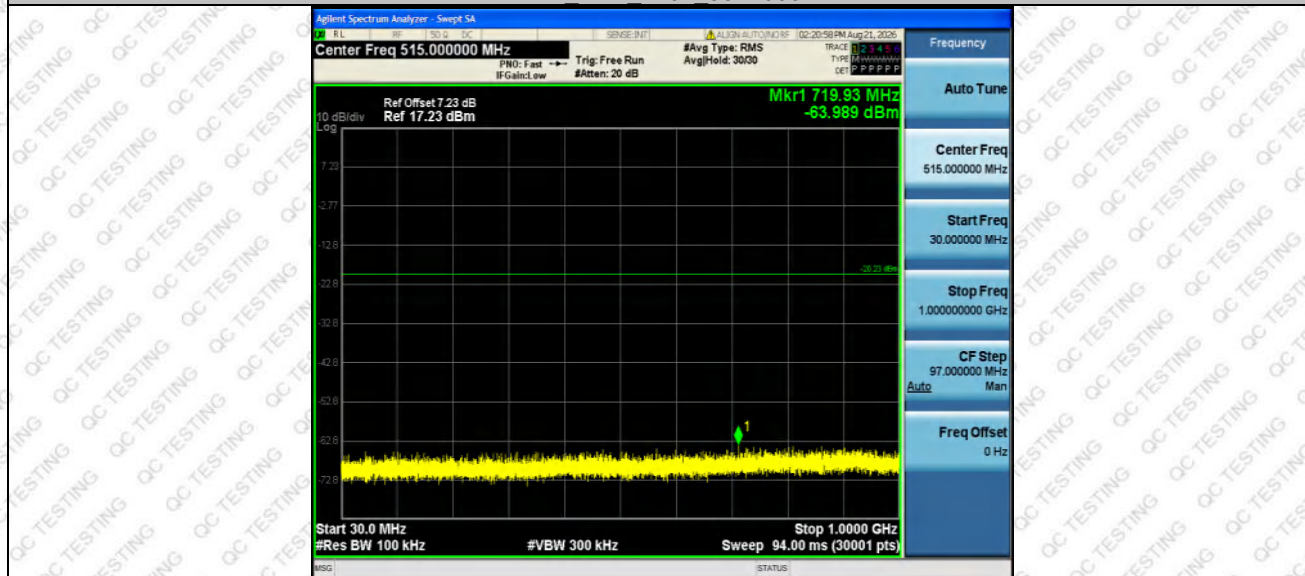
11B Ant2 2437 1000~26500



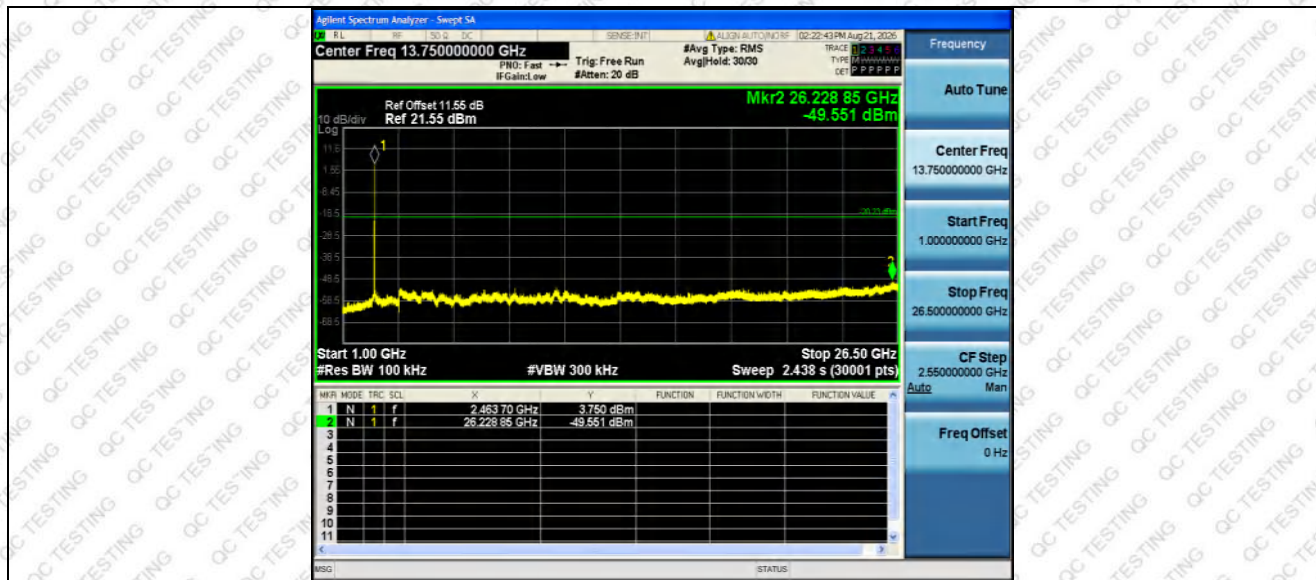
11B Ant1 2462 0~Reference



11B Ant1 2462 30~1000



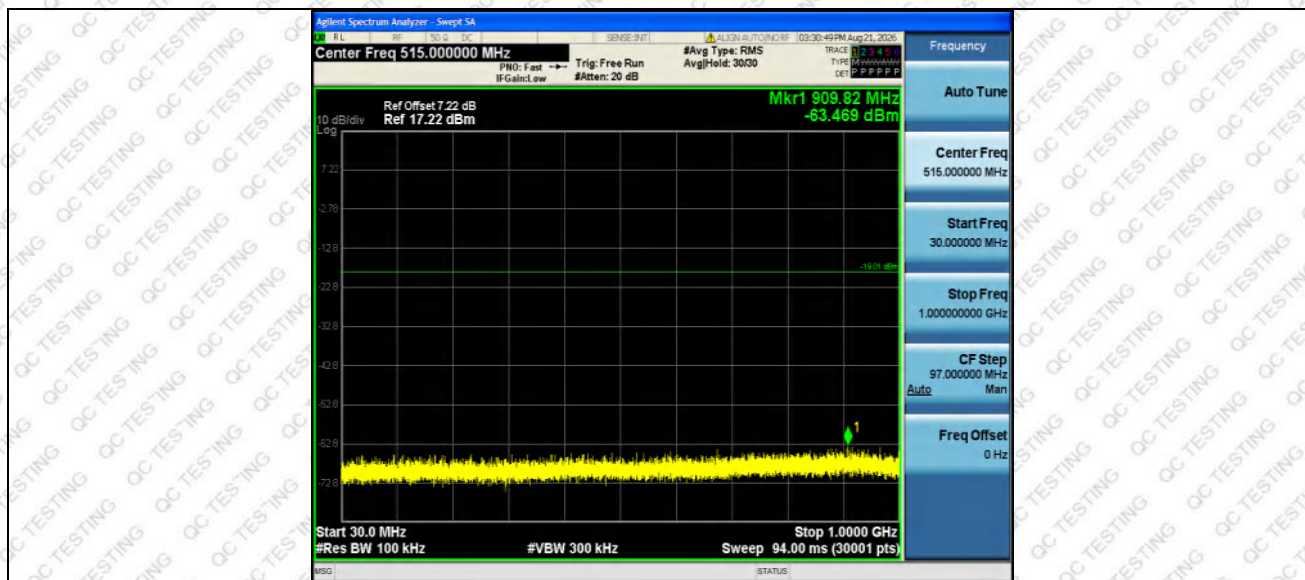
11B Ant1 2462 1000~26500



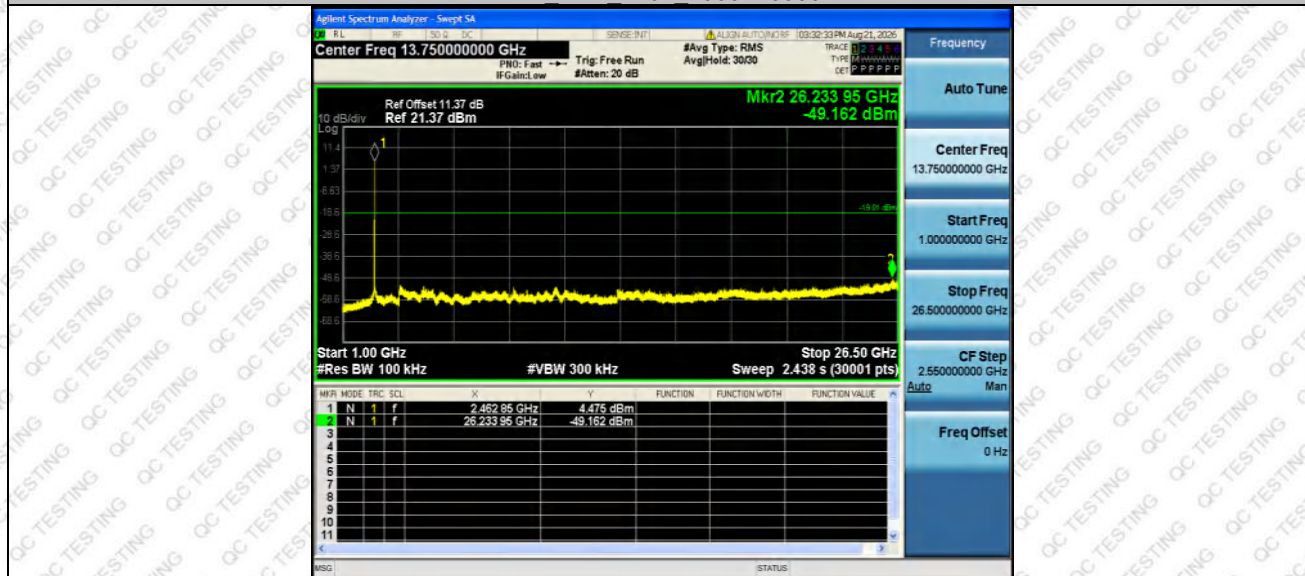
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11B Ant2 2462 30~1000



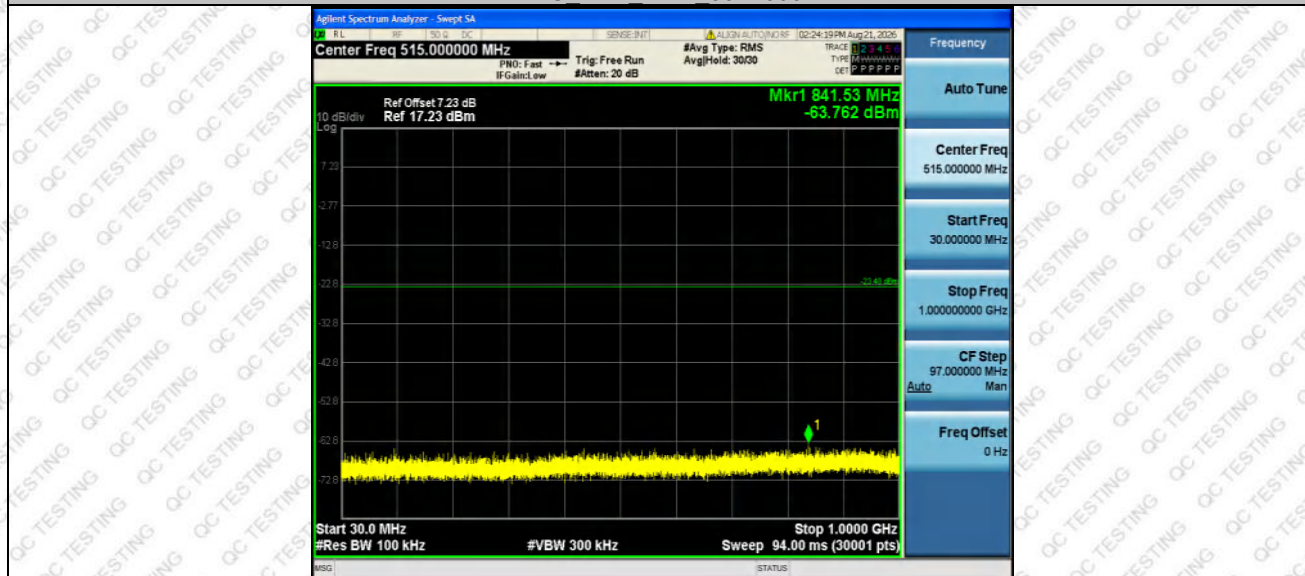
11B Ant2 2462 1000~26500



11G Ant1 2412 0~Reference



11G Ant1 2412 30~1000



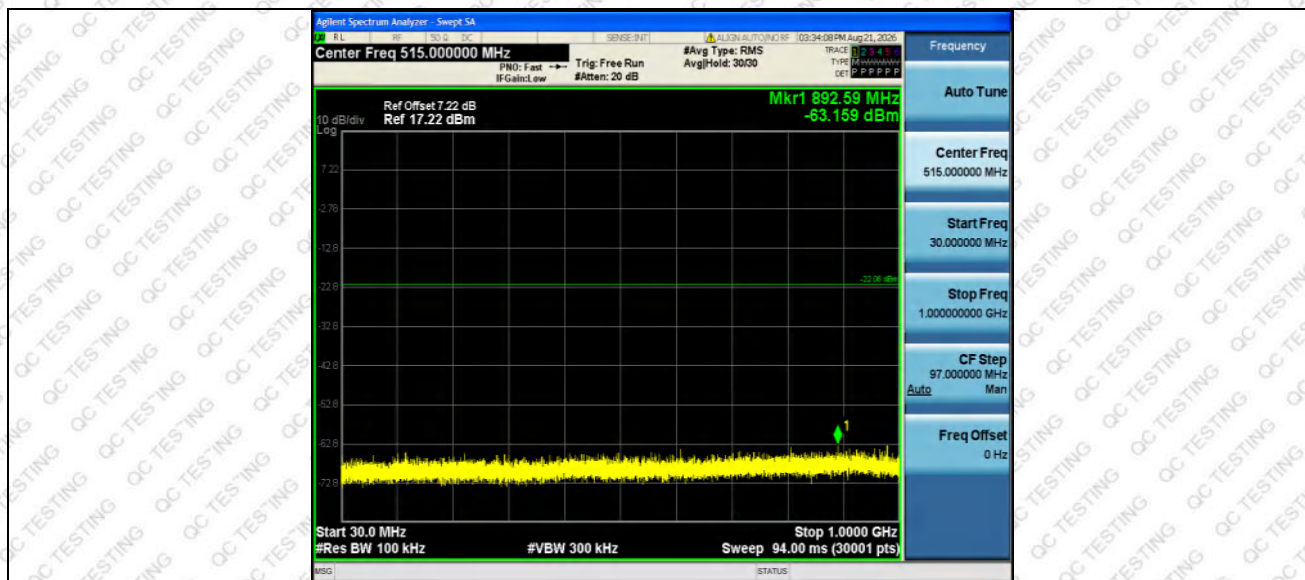
11G Ant1 2412 1000~26500



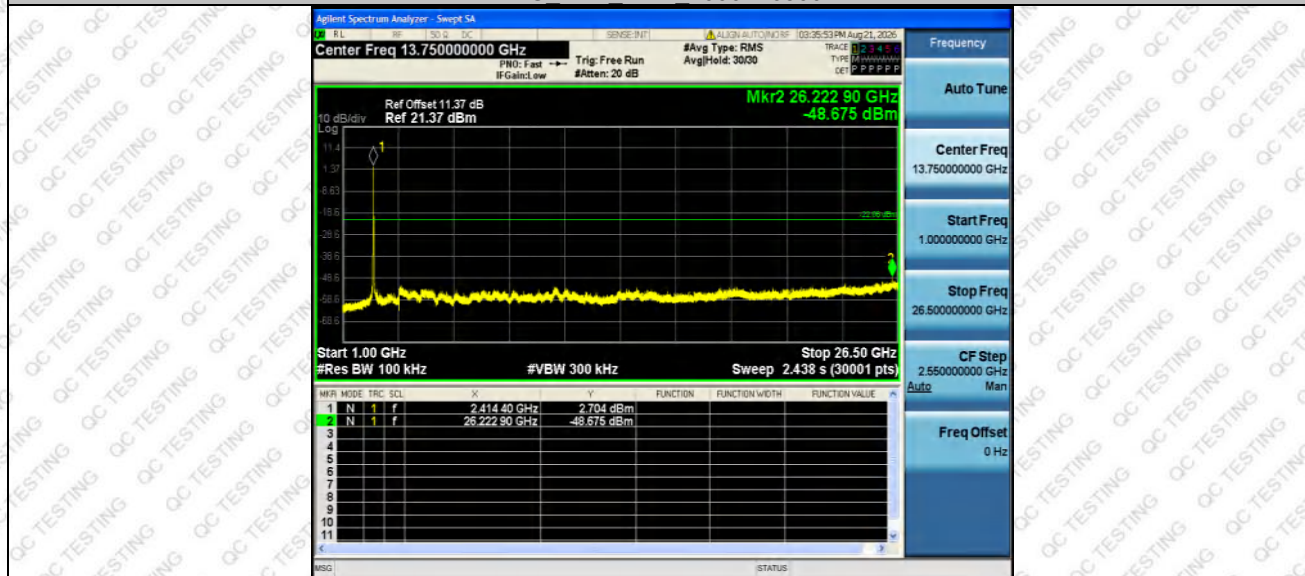
11G Ant2 2412 0~Reference



11G Ant2 2412 30~1000



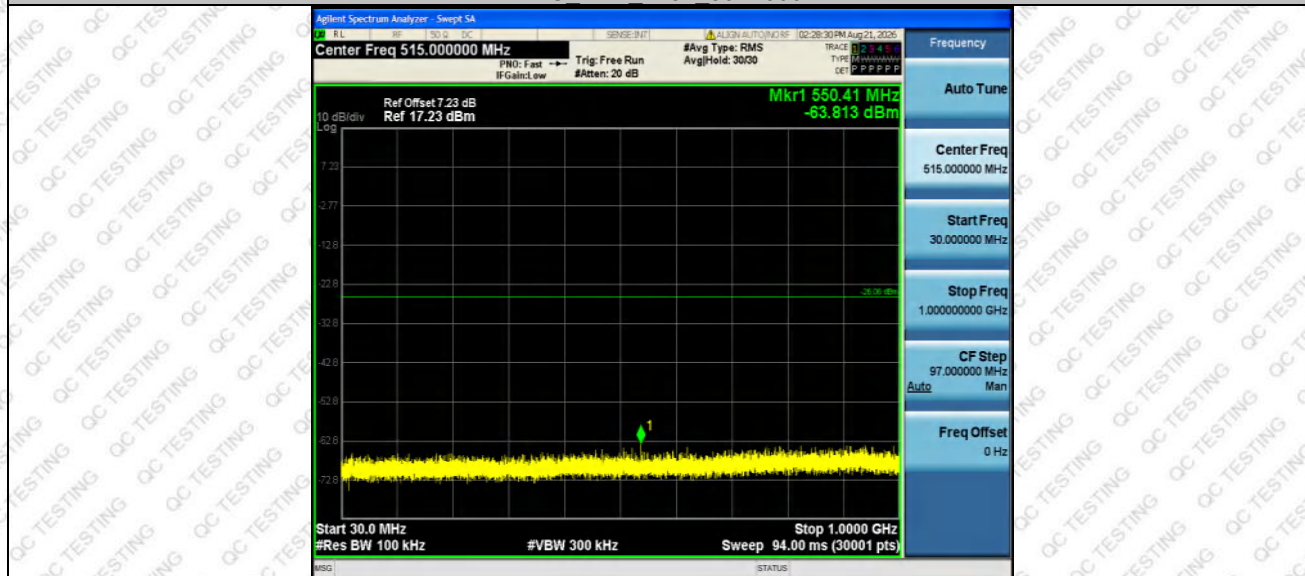
11G_Ant2 2412 1000~26500



11G_Ant1 2437 0~Reference



11G Ant1 2437 30~1000



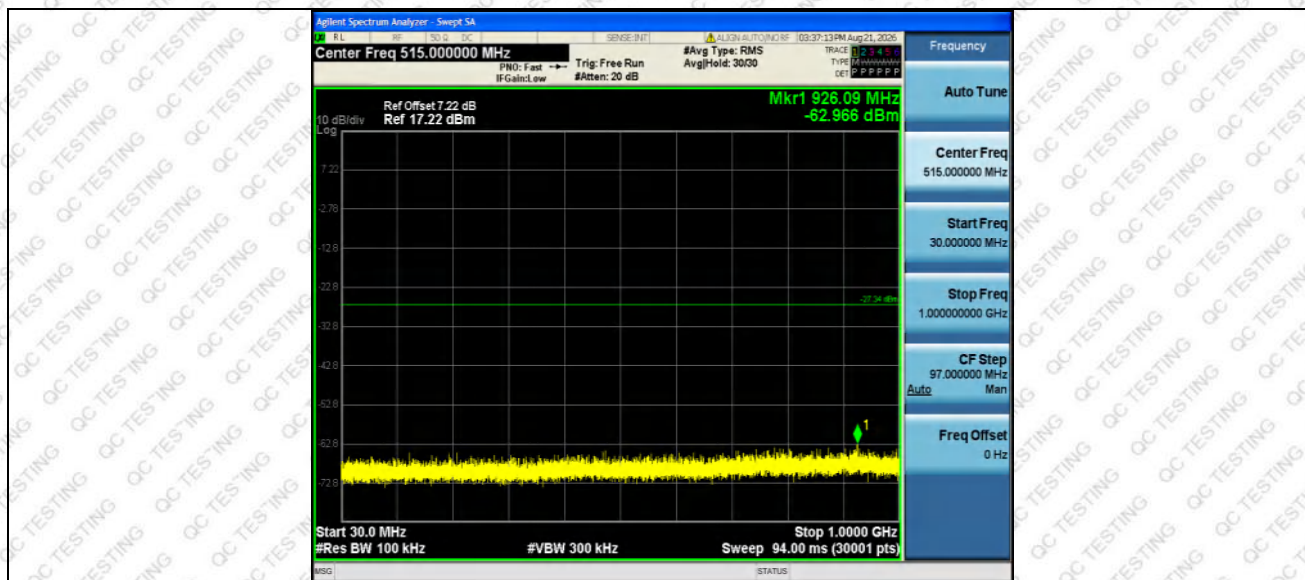
11G Ant1 2437 1000~26500



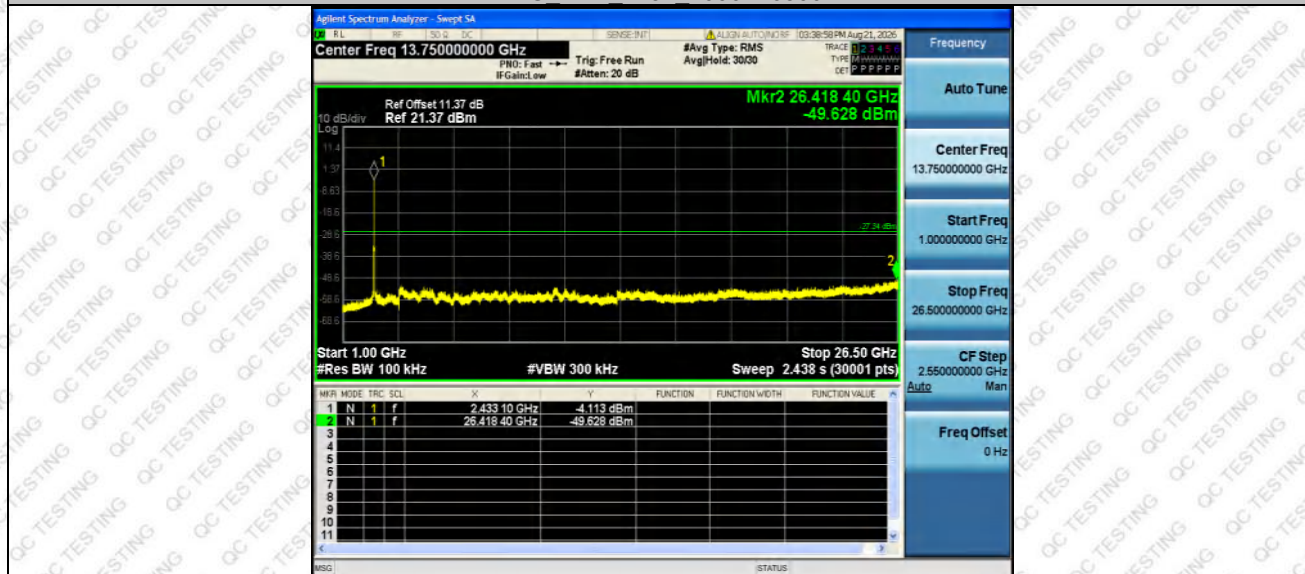
11G Ant2 2437 0~Reference



11G Ant2 2437 30~1000



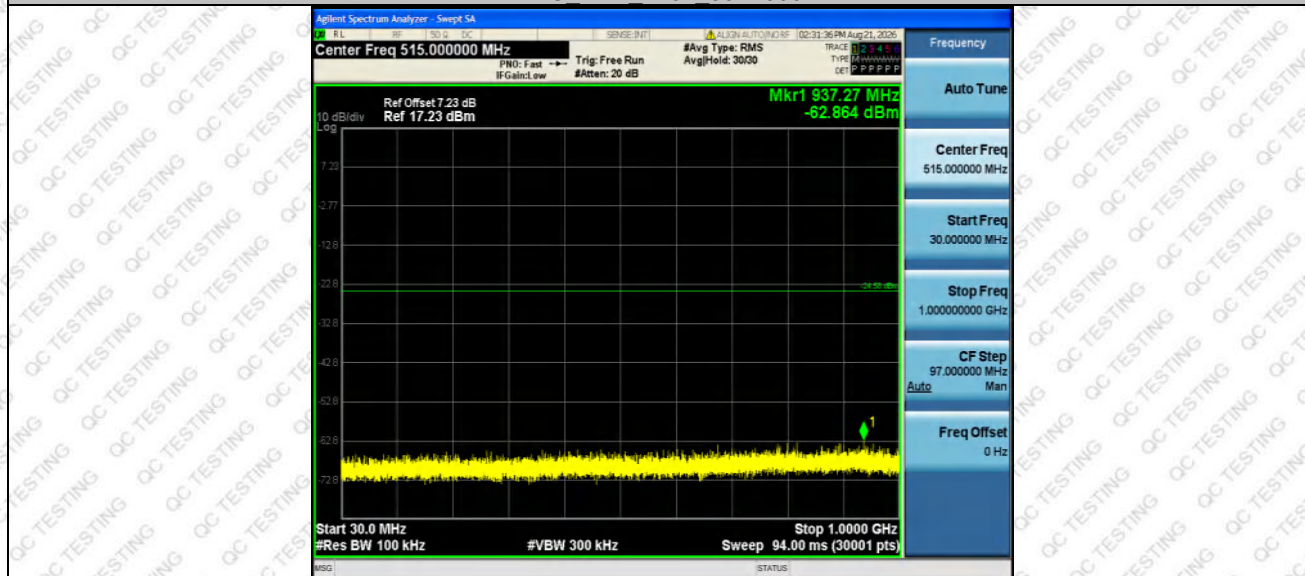
11G_Ant2_2437_1000~26500



11G_Ant1_2462_0~Reference



11G Ant1 2462 30~1000



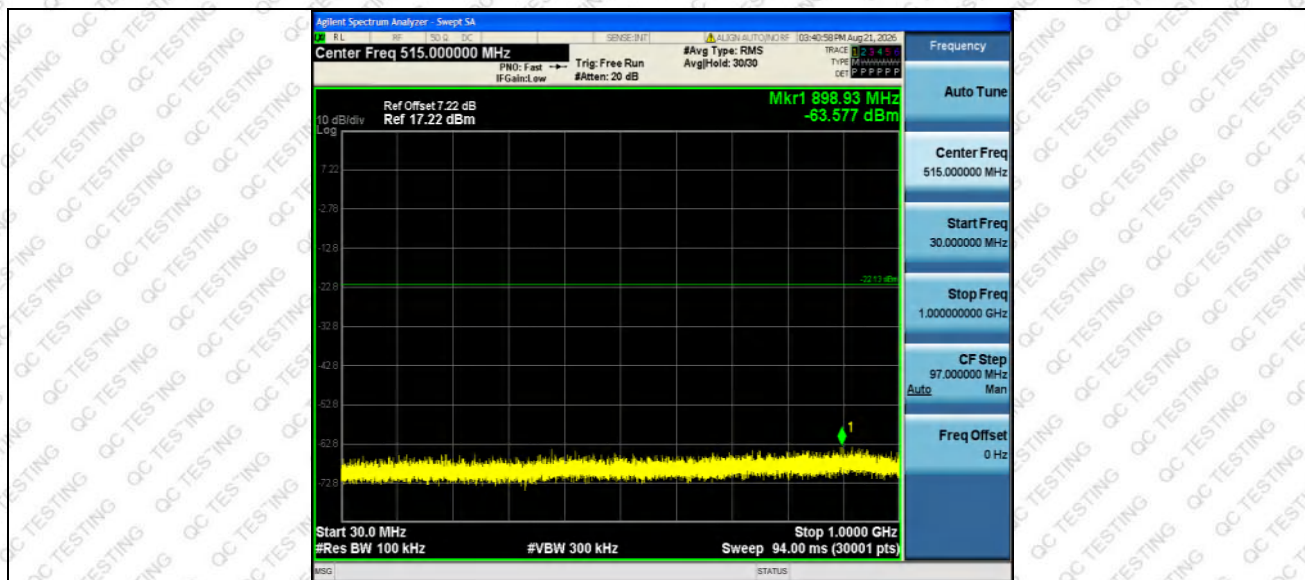
11G Ant1 2462 1000~26500



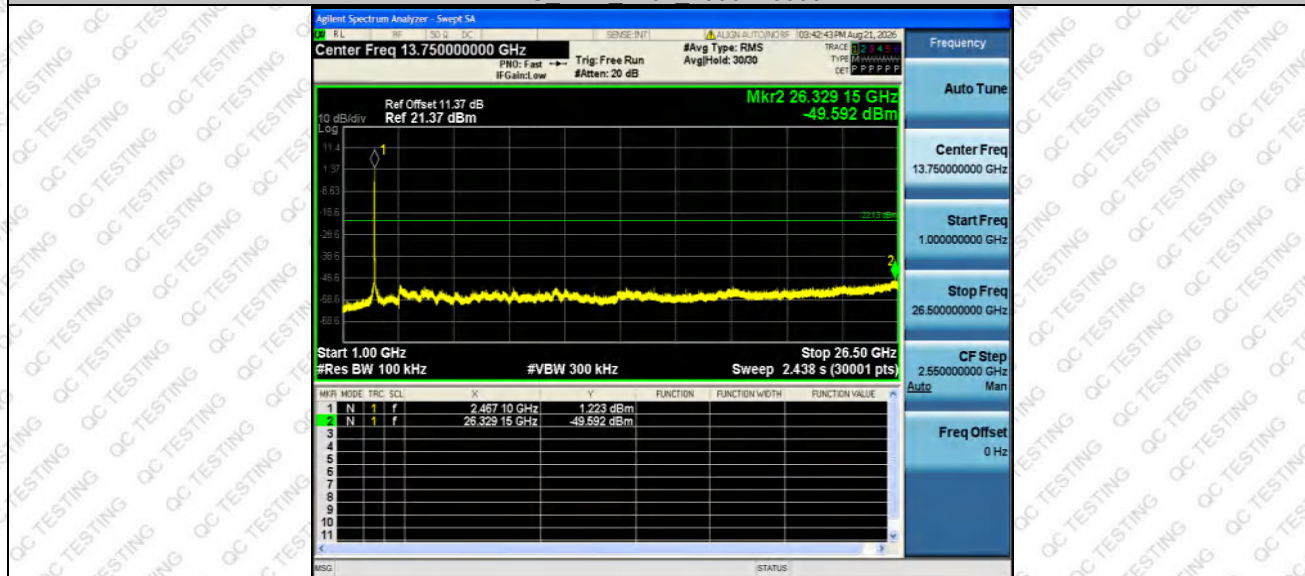
11G Ant2 2462 0~Reference



11G Ant2 2462 30~1000



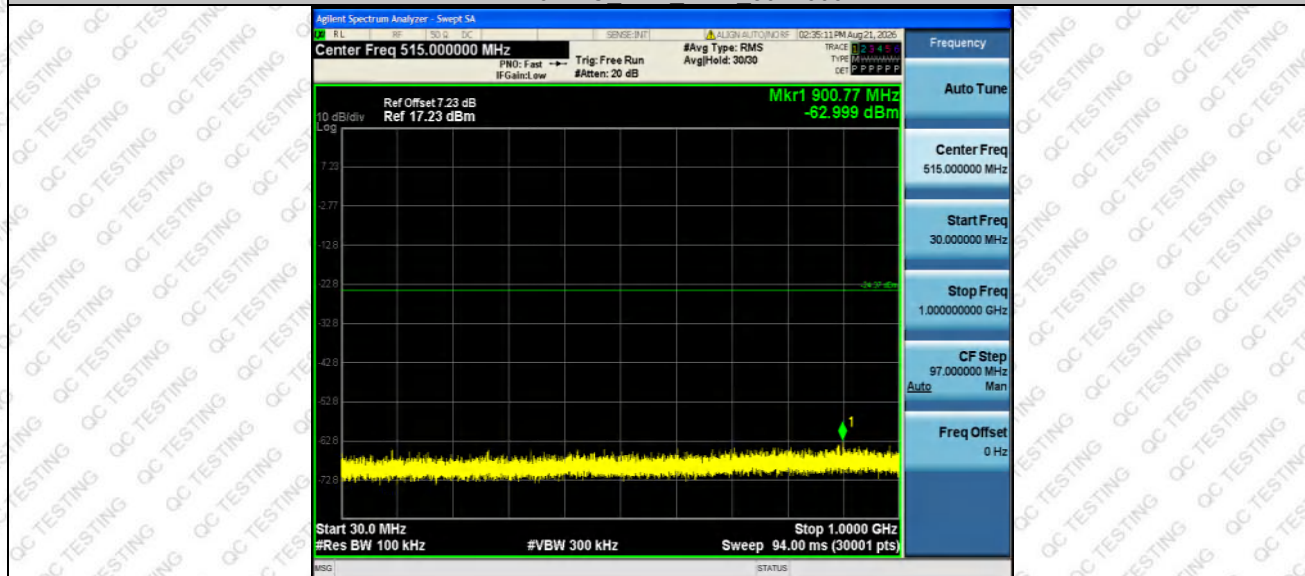
11G Ant2 2462 1000~26500



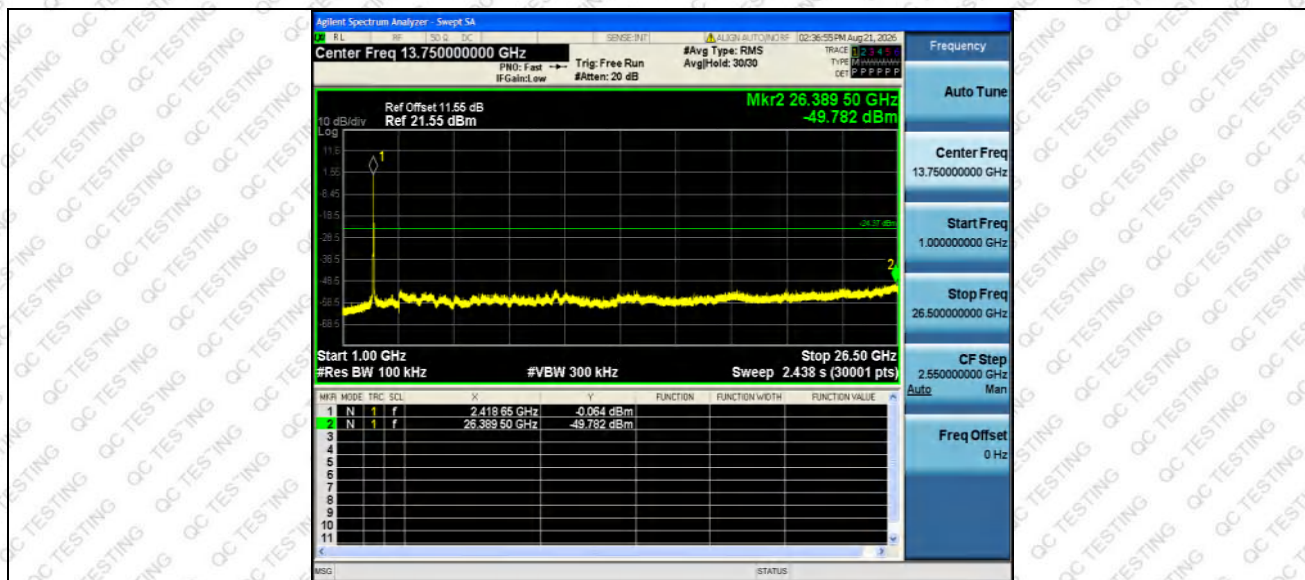
11N20SISO Ant1 2412 0~Reference



11N20SISO Ant1 2412 30~1000



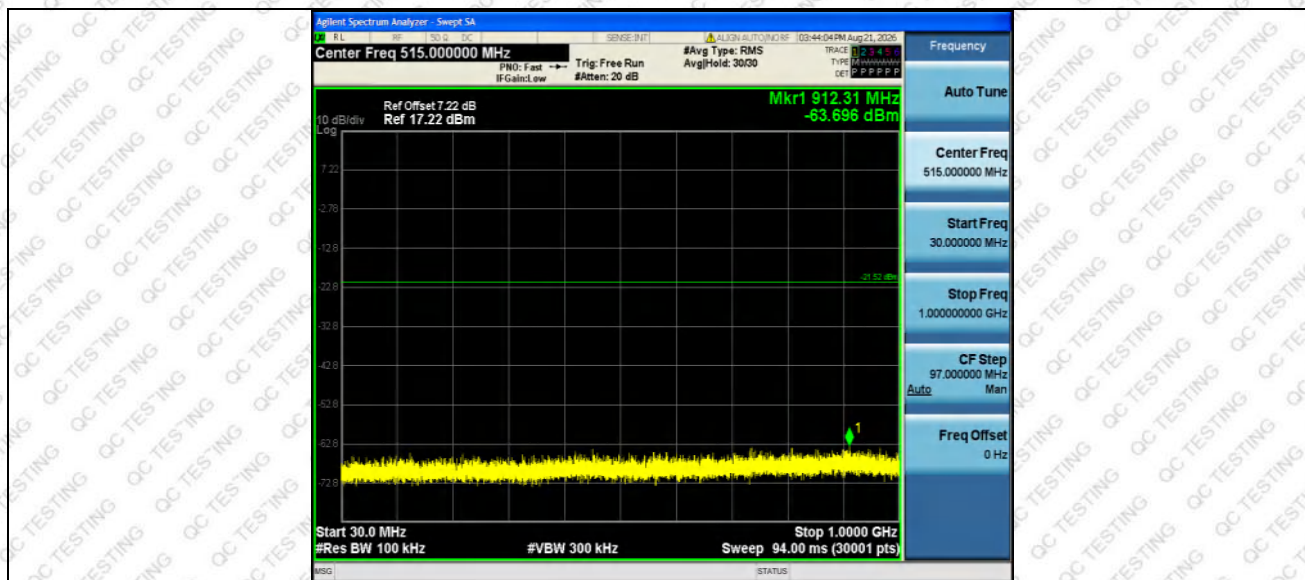
11N20SISO Ant1 2412 1000~26500



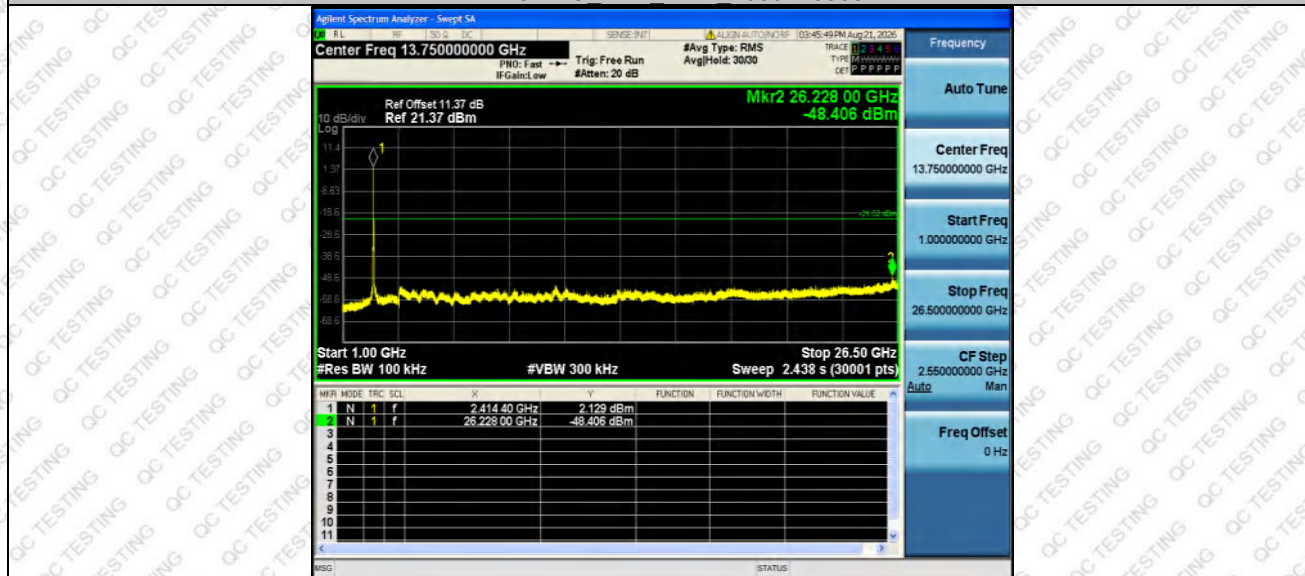
11N20SISO Ant2 2412 0~Reference



11N20SISO Ant2 2412 30~1000



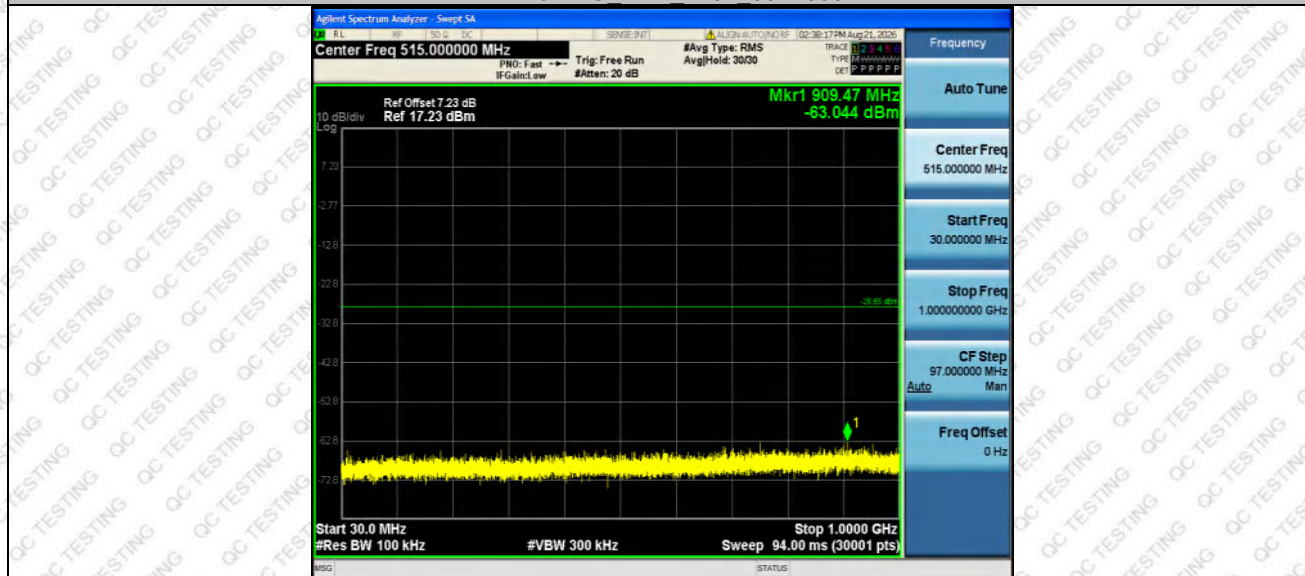
11N20SISO Ant2 2412 1000~26500



11N20SISO Ant1 2437 0~Reference



11N20SISO Ant1 2437 30~1000



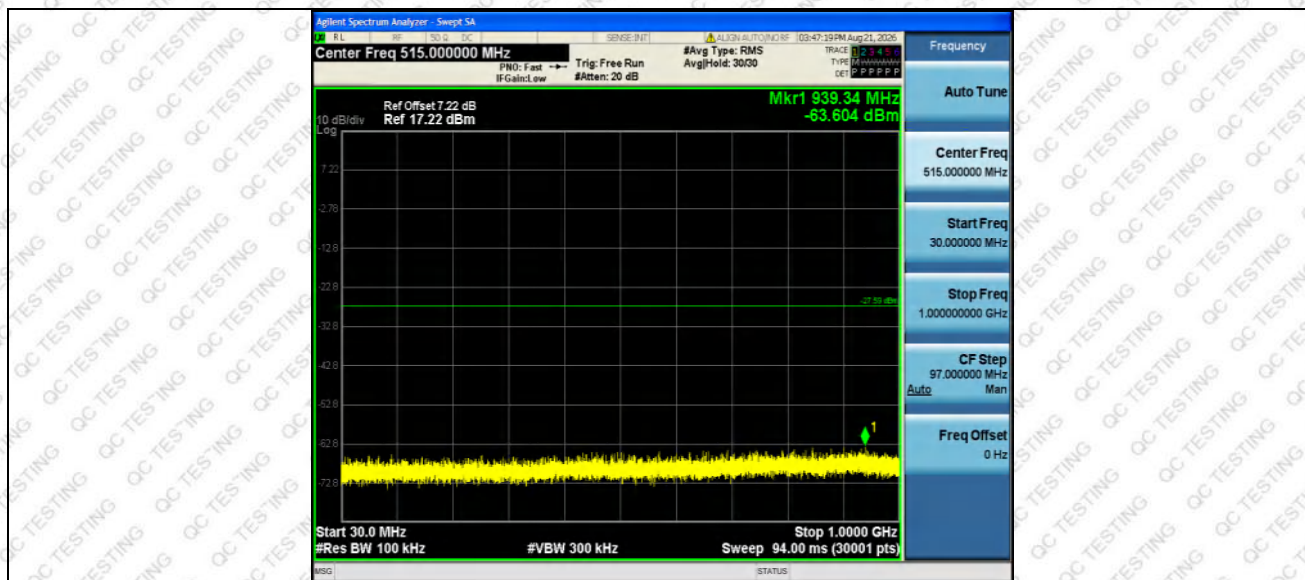
11N20SISO Ant1 2437 1000~26500



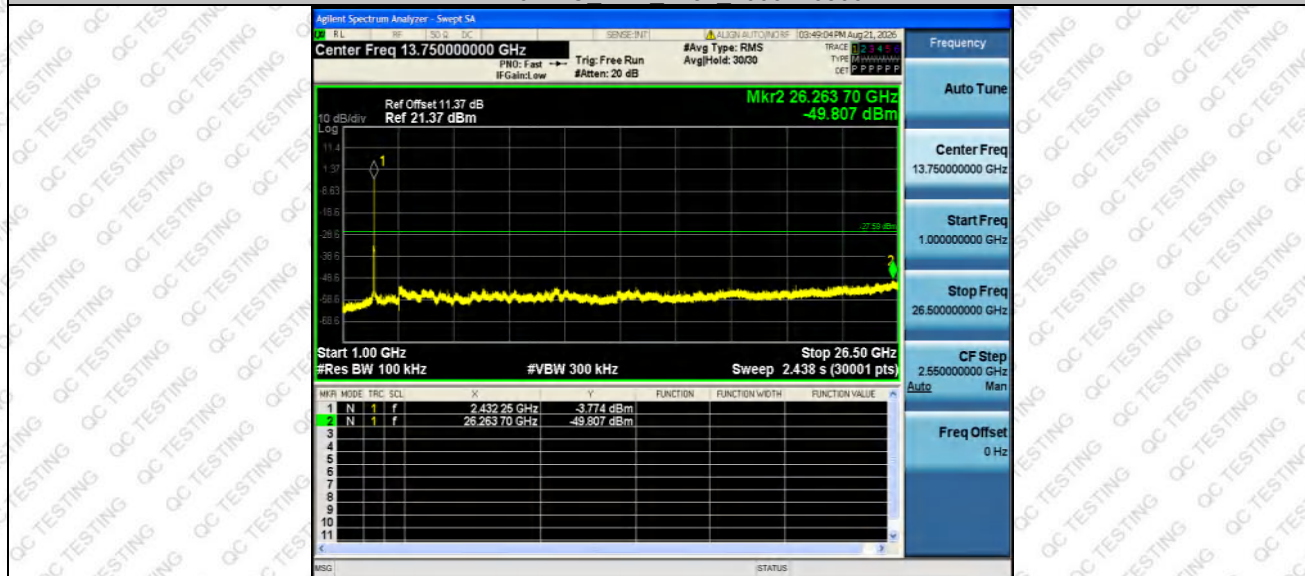
11N20SISO Ant2 2437 0~Reference



11N20SISO Ant2 2437 30~1000



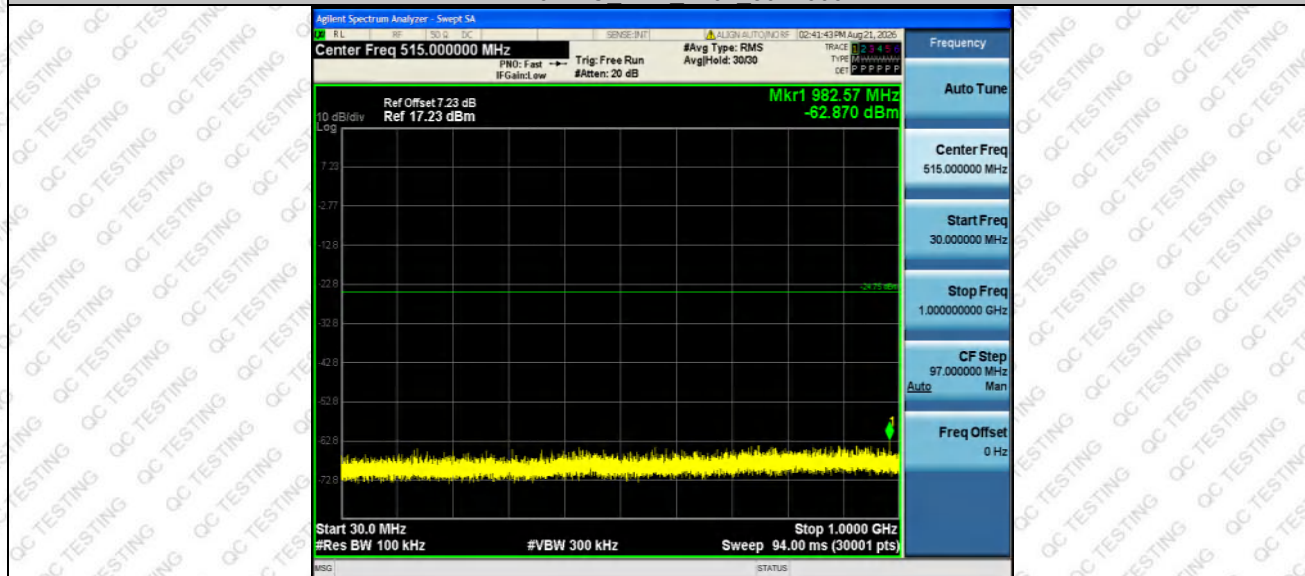
11N20SISO Ant2 2437 1000~26500



11N20SISO Ant1 2462 0~Reference



11N20SISO Ant1 2462 30~1000



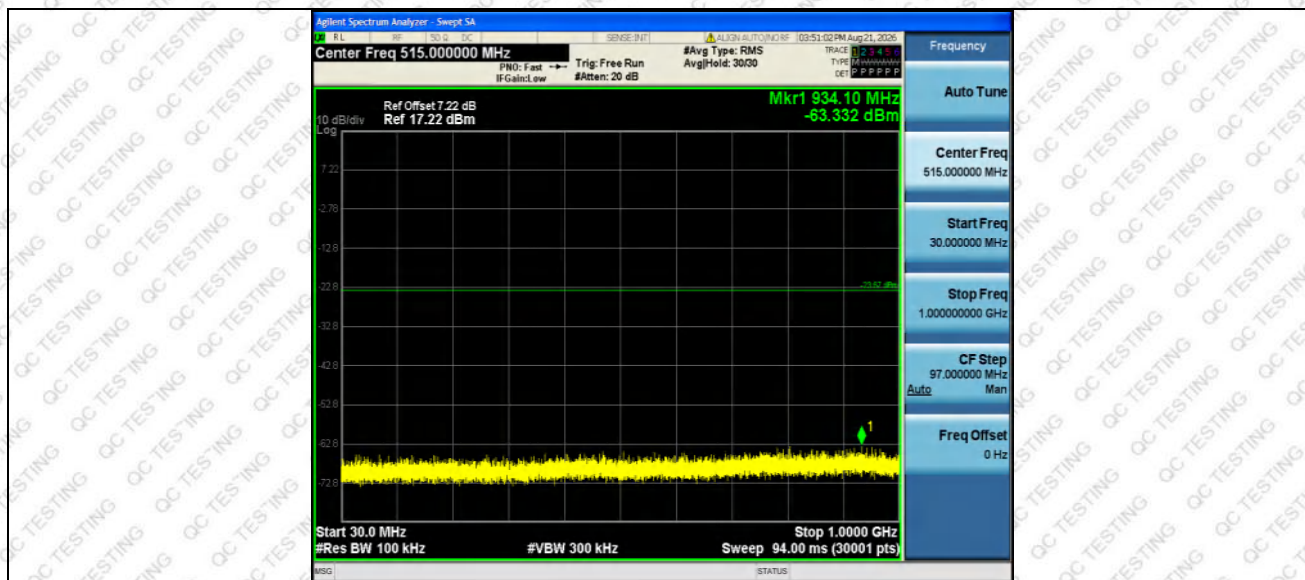
11N20SISO Ant1 2462 1000~26500



11N20SISO Ant2 2462 0~Reference



11N20SISO Ant2 2462 30~1000



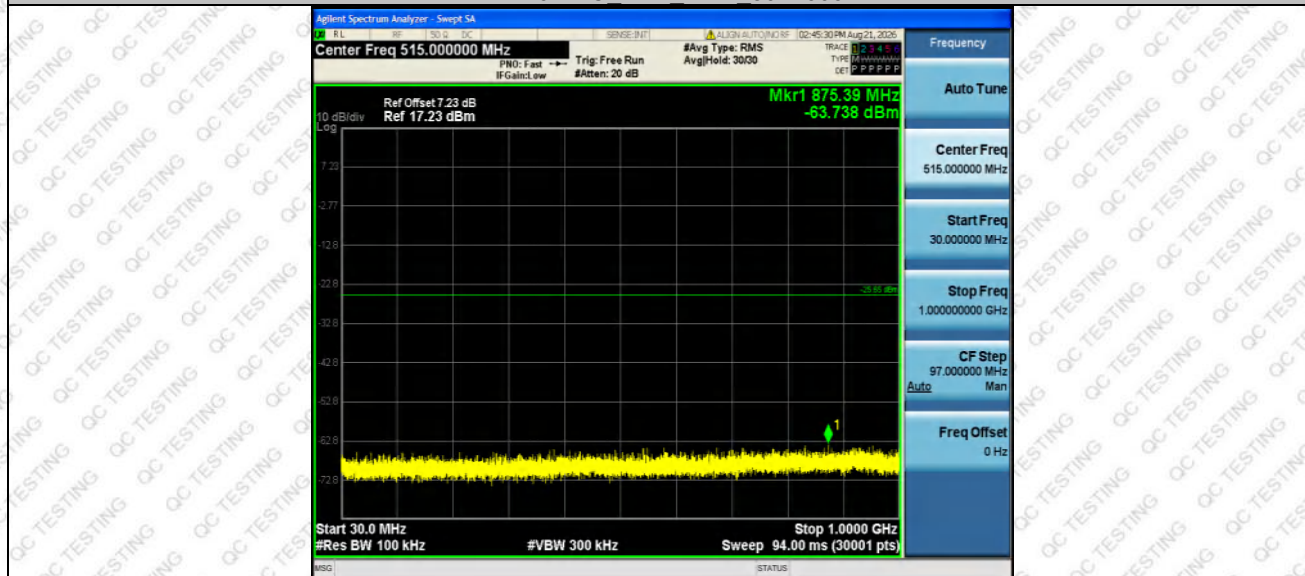
11N20SISO Ant2 2462 1000~26500



11N40SISO Ant1 2422 0~Reference



11N40SISO Ant1 2422 30~1000



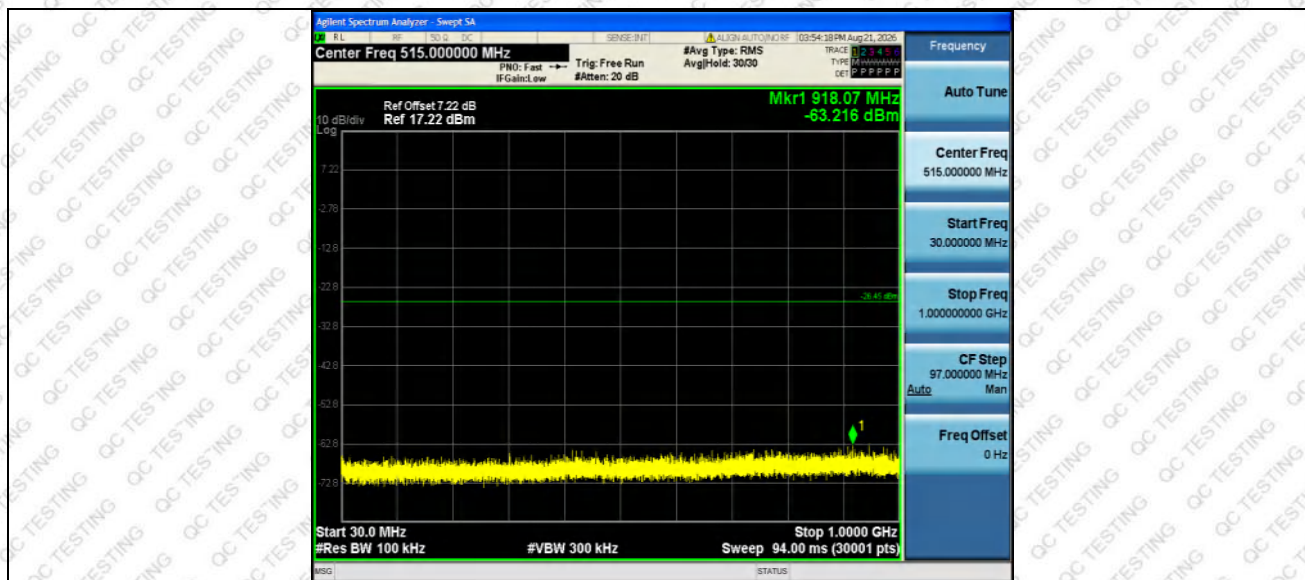
11N40SISO Ant1 2422 1000~26500



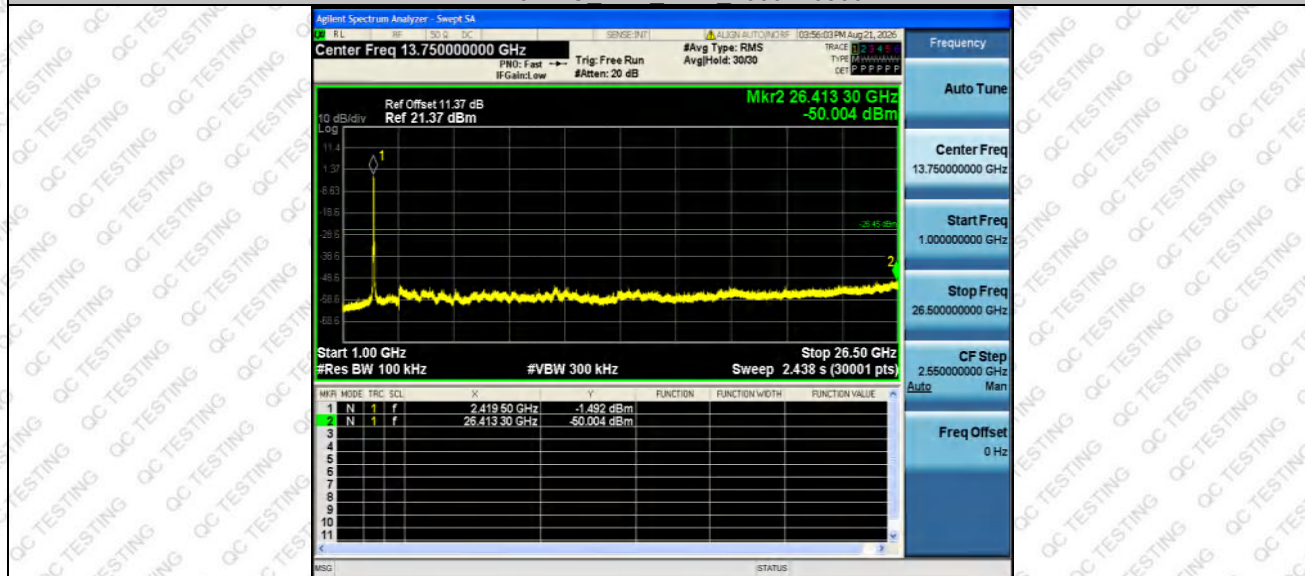
11N40SISO Ant2 2422 0~Reference



11N40SISO Ant2 2422 30~1000



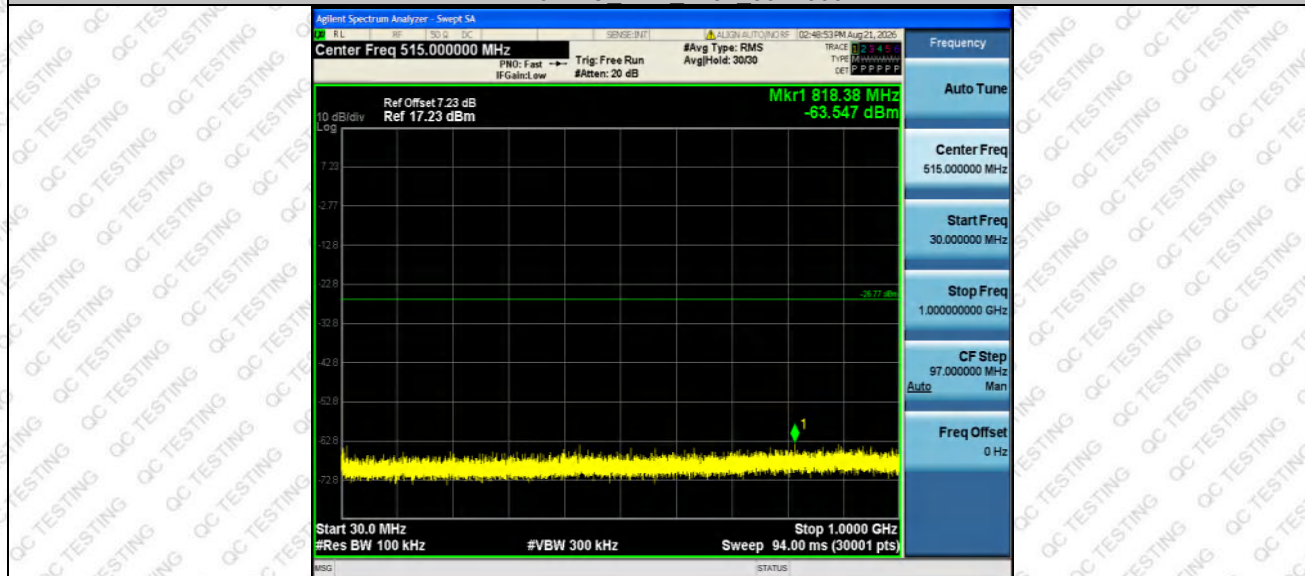
11N40SISO Ant2 2422 1000~26500



11N40SISO Ant1 2437 0~Reference



11N40SISO Ant1 2437 30~1000



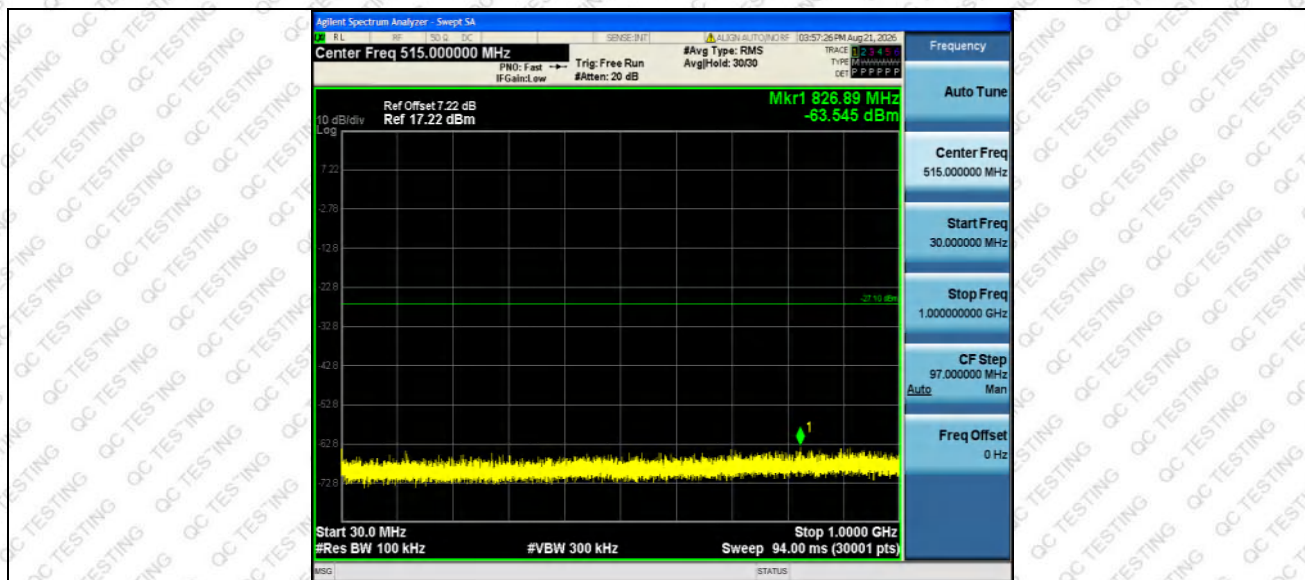
11N40SISO Ant1 2437 1000~26500



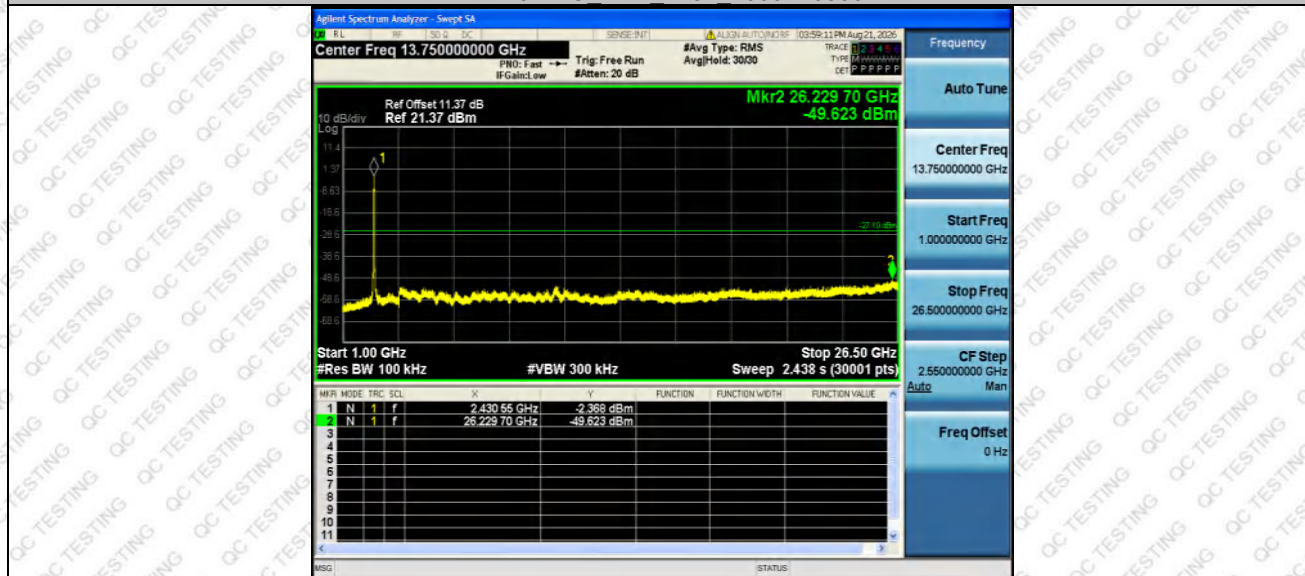
11N40SISO Ant2 2437 0~Reference



11N40SISO Ant2 2437 30~1000



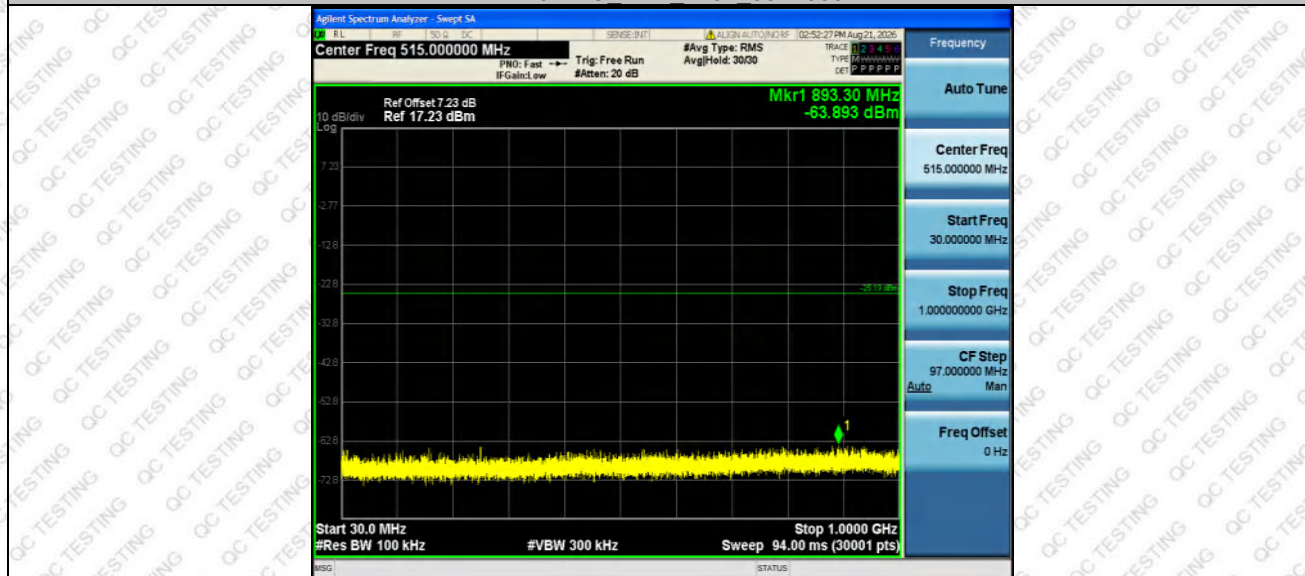
11N40SISO Ant2 2437 1000~26500



11N40SISO Ant1 2452 0~Reference



11N40SISO Ant1 2452 30~1000

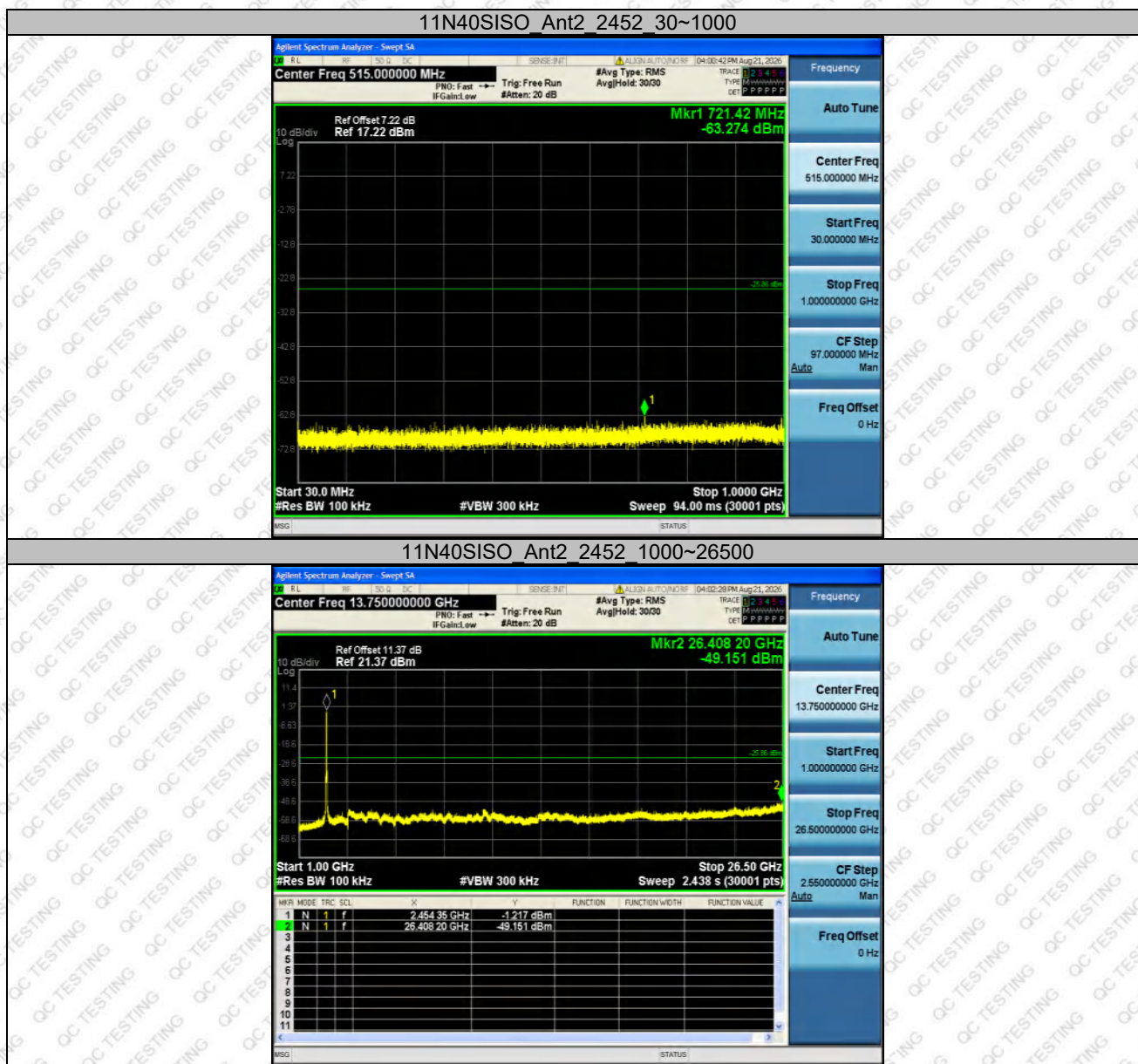


11N40SISO Ant1 2452 1000~26500



11N40SISO Ant2 2452 0~Reference





9.2 Radiated Emission Method

9.2.1 Applicable Standard

FCC Part15 C Section 15.209 and 15.205

9.2.2 Limit

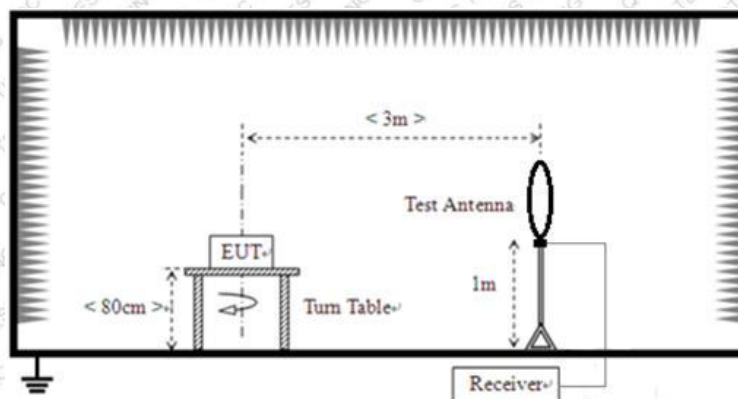
Frequency	Limit (uV/m)	Value	Measurement Distance
0.009MHz-0.490MHz	2400/F(KHz)	QP	300m
0.490MHz-1.705MHz	24000/F(KHz)	QP	30m
1.705MHz-30MHz	30	QP	30m

Frequency	Field Strengths Limits ($\mu\text{V/m}$ at 3 m)	Field Strengths Limits (dB $\mu\text{V/m}$ at 3 m)	Remark
30 – 88	100	40.0	Quasi-peak
88 – 216	150	43.5	Quasi-peak
216 – 960	200	46.0	Quasi-peak
Above 960	500	54.0	Quasi-peak
Above 1GHz	/	54.0	Peak
		74.0	Average

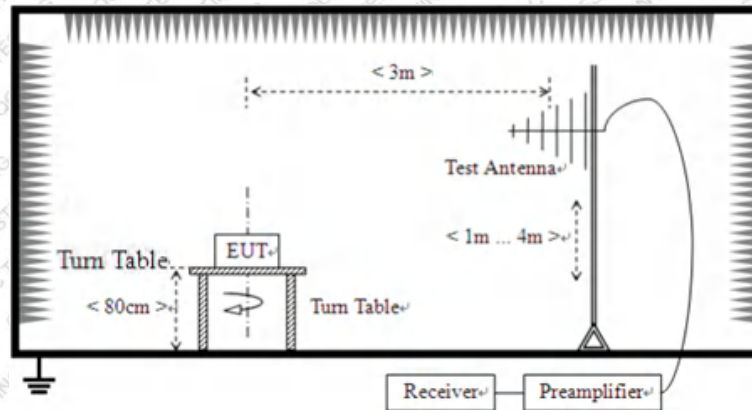
Note: dB $\mu\text{V/m}$ = 20log($\mu\text{V/m}$)

9.2.3 Test setup

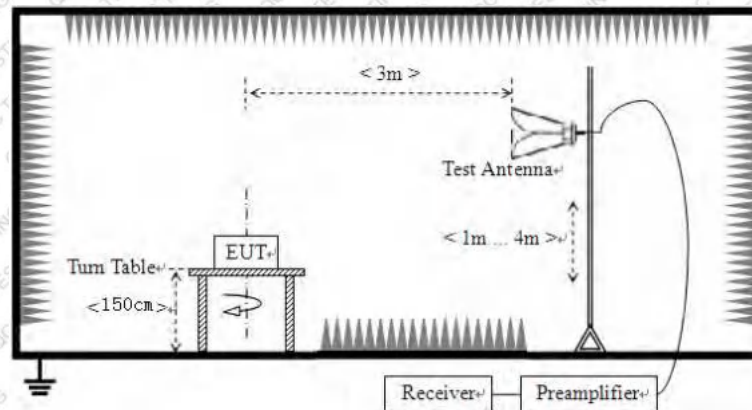
For radiated emissions from 9kHz to 30MHz



For radiated emissions from 30MHz to 1GHz



For radiated emissions above 1GHz



9.2.4 EMI Test Receiver Setup

Frequency	RBW	VBW	IF B/W	Measurement
9KHz-150KHz	200Hz	600Hz	/	QP
150KHz-30MHz	9KHz	30KHz	/	QP
30 MHz – 1000 MHz	100 kHz	300 kHz	120 kHz	QP
Above 1 GHz	1 MHz	3 MHz	/	Peak
	1 MHz	10 Hz	/	Average

Remark: For the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emission test in these three bands are based on measurements employing an average detector.

9.2.5 Test procedure

- The EUT was placed on the top of a rotating table (0.8m for below 1G and 1.5m for above 1G) above the ground at a 3 meter camber. The table was rotated 360 degrees to determine the position of the highest radiation.
- The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna



are set to make the measurement.

For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rota table was turned from 0 degrees to 360 degrees to find the maximum reading.

The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

9.2.6 Test Data

Temperature	25-26 °C	Humidity	49-54 %
ATM Pressure	101.1kPa	Antenna Gain	3.30dBi
Test by	Fan Yang	Test result	PASS

Remarks:

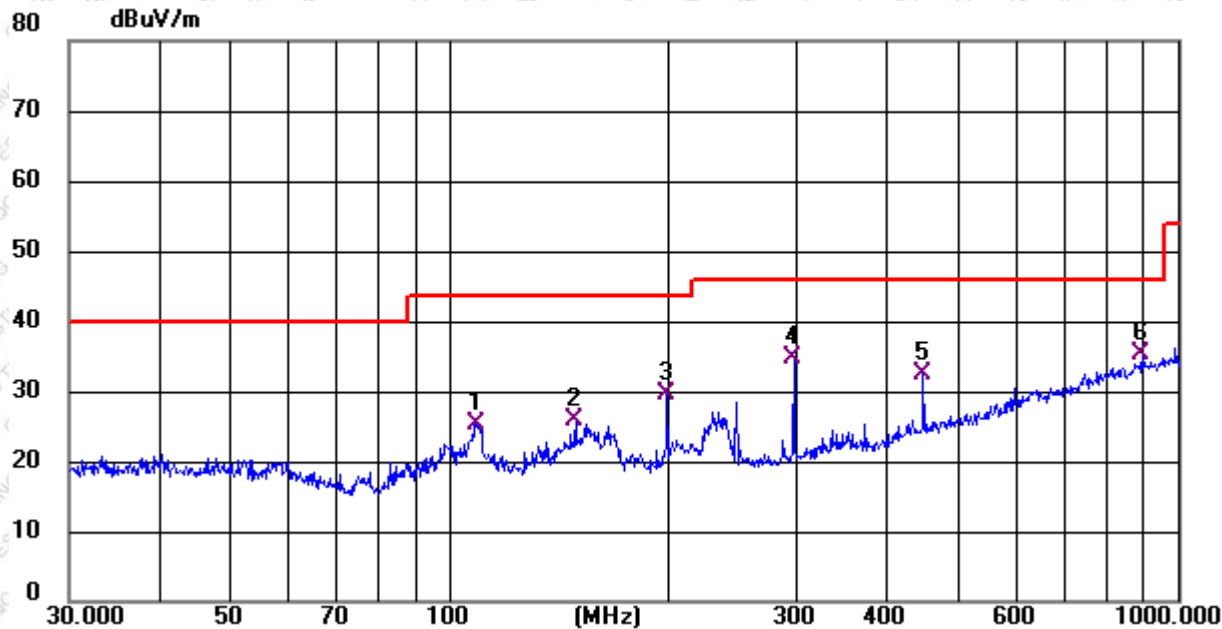
1. Pre-scan all kind of the place mode (X-axis, Y-axis, Z-axis), and found the Y- axis which it is worse case.
2. Data of measurement within frequency range 9kHz-30MHz, 18-26GHz are the noise floor or attenuated more than 20dB below the permissible limits or the field strength is too small to be measured, so test data does not present in this report.



Below 1GHz

Pre-scan all test modes, found worst case at 802.11n20 mode 2462MHz, and so only show the test result of 802.11n20 mode 2462MHz

Horizontal:

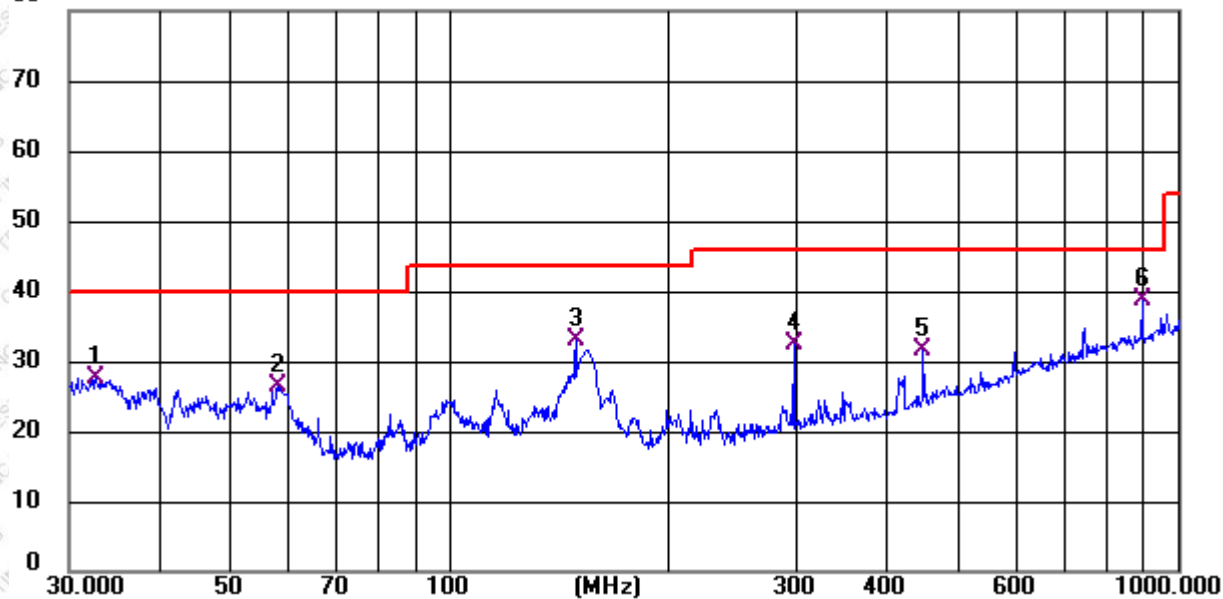


No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	108.6089	42.15	-16.77	25.38	43.50	-18.12	QP
2	148.4931	39.34	-13.59	25.75	43.50	-17.75	QP
3	198.0316	47.19	-17.52	29.67	43.50	-13.83	QP
4	297.0157	48.84	-14.03	34.81	46.00	-11.19	QP
5	445.5540	42.49	-10.20	32.29	46.00	-13.71	QP
6 *	891.0402	37.77	-2.43	35.34	46.00	-10.66	QP



Vertical:

80 dBuV/m



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	32.6340	42.35	-14.76	27.59	40.00	-12.41	QP
2	57.9078	41.90	-15.37	26.53	40.00	-13.47	QP
3	148.4929	46.65	-13.59	33.06	43.50	-10.44	QP
4	297.0156	46.43	-14.03	32.40	46.00	-13.60	QP
5	445.5540	41.88	-10.20	31.68	46.00	-14.32	QP
6 *	891.0401	41.08	-2.43	38.65	46.00	-7.35	QP



Above 1GHz

Frequency (MHz)	Read Level (dBμV)	polarization	Factor (dB/m)	Level (dBμV/m)	Limit Line (dBμV/m)	Margin (dB)	Detector
11b Low Channel							
2390	79.56	V	-20.22	59.34	74	-14.66	peak
2400	81.74	H	-20.22	61.52	74	-12.48	peak
2390	46.88	V	-20.22	26.66	54	-27.34	AVG
2400	47.45	V	-20.22	27.23	54	-26.77	AVG
4824	68.64	H	-18.44	50.20	74	-23.80	peak
4824	65.59	V	-18.44	47.15	74	-26.85	peak
7236	63.77	H	-16.55	47.22	74	-26.78	peak
7236	59.89	V	-16.55	43.34	74	-30.66	peak
9648	55.58	H	-14.15	41.43	74	-32.57	peak
9648	56.68	V	-14.15	42.53	74	-31.47	peak
12060	57.77	H	-10.08	47.69	74	-26.31	peak
12060	56.11	V	-10.08	46.03	74	-27.97	peak
11b Middle Channel							
4874	66.44	H	-18.22	48.22	74	-25.78	peak
4874	65.88	V	-18.22	47.66	74	-26.34	peak
7311	58.99	H	-16.46	42.53	74	-31.47	peak
7311	66.55	V	-16.46	50.09	74	-23.91	peak
9748	58.44	H	-14.02	44.42	74	-29.58	peak
9748	62.85	V	-14.02	48.83	74	-25.17	peak
12185	59.72	H	-9.96	49.76	74	-24.24	peak
12185	59.63	V	-9.96	49.67	74	-24.33	peak
11b High Channel							
2483.5	84.58	H	-22.2	62.38	74	-11.62	peak
2500	80.99	V	-22.2	58.79	74	-15.21	peak
2483.5	48.22	H	-22.2	26.02	54	-27.98	AVG
2500	42.55	V	-22.2	20.35	54	-33.65	AVG
4924	65.83	H	-18.38	47.45	74	-26.55	peak
4924	64.73	V	-18.38	46.35	74	-27.65	peak
7386	50.43	H	-16.49	33.94	74	-40.06	peak
7386	56.33	V	-16.49	39.84	74	-34.16	peak
9848	64.41	H	-14.23	50.18	74	-23.82	peak
9848	65.08	V	-14.23	50.85	74	-23.15	peak
12310	60.44	H	-10.15	50.29	74	-23.71	peak
12310	50.36	V	-10.15	40.21	74	-33.79	peak



11g Low Channel							
2390	77.85	V	-20.22	57.63	74	-16.37	peak
2400	84.44	H	-20.22	64.22	74	-9.78	peak
2390	49.78	V	-20.22	29.56	54	-24.44	AVG
2400	49.23	V	-20.22	29.01	54	-24.99	AVG
4824	64.55	H	-18.44	46.11	74	-27.89	peak
4824	73.24	V	-18.44	54.80	74	-19.20	peak
7236	63.74	H	-16.55	47.19	74	-26.81	peak
7236	60.53	V	-16.55	43.98	74	-30.02	peak
9648	61.83	H	-14.15	47.68	74	-26.32	peak
9648	54.77	V	-14.15	40.62	74	-33.38	peak
12060	56.43	H	-10.08	46.35	74	-27.65	peak
12060	56.65	V	-10.08	46.57	74	-27.43	peak
11g Middle Channel							
4874	77.22	H	-18.22	59	74	-15.00	peak
4874	66.88	V	-18.22	48.66	74	-25.34	peak
7311	62.32	H	-16.46	45.86	74	-28.14	peak
7311	66.14	V	-16.46	49.68	74	-24.32	peak
9748	57.86	H	-14.02	43.84	74	-30.16	peak
9748	58.63	V	-14.02	44.61	74	-29.39	peak
12185	58.55	H	-9.96	48.59	74	-25.41	peak
12185	59.99	V	-9.96	50.03	74	-23.97	peak
11g High Channel							
2483.5	87.51	H	-22.2	65.31	74	-8.69	peak
2500	86.42	V	-22.2	64.22	74	-9.78	peak
2483.5	54.86	H	-22.2	32.66	54	-21.34	AVG
2500	46.35	V	-22.2	24.15	54	-29.85	AVG
4924	64.55	H	-18.38	46.17	74	-27.83	peak
4924	62.55	V	-18.38	44.17	74	-29.83	peak
7386	68.04	H	-16.49	51.55	74	-22.45	peak
7386	59.25	V	-16.49	42.76	74	-31.24	peak
9848	56.55	H	-14.23	42.32	74	-31.68	peak
9848	54.55	V	-14.23	40.32	74	-33.68	peak
12310	57.22	H	-10.15	47.07	74	-26.93	peak
12310	55.56	V	-10.15	45.41	74	-28.59	peak



11n20 Low Channel							
2390	80.16	V	-20.22	59.94	74	-14.06	peak
2400	82.56	H	-20.22	62.34	74	-11.66	peak
2390	48.42	V	-20.22	28.20	54	-25.80	AVG
2400	47.55	V	-20.22	27.33	54	-26.67	AVG
4824	69.65	H	-18.44	51.21	74	-22.79	peak
4824	66.77	V	-18.44	48.33	74	-25.67	peak
7236	66.42	H	-16.55	49.87	74	-24.13	peak
7236	60.45	V	-16.55	43.90	74	-30.10	peak
9648	59.77	H	-14.15	45.62	74	-28.38	peak
9648	57.86	V	-14.15	43.71	74	-30.29	peak
12060	55.42	H	-10.08	45.34	74	-28.66	peak
12060	51.33	V	-10.08	41.25	74	-32.75	peak
11n20 Middle Channel							
4874	67.42	H	-18.22	49.2	74	-24.80	peak
4874	65.13	V	-18.22	46.91	74	-27.09	peak
7311	61.74	H	-16.46	45.28	74	-28.72	peak
7311	64.42	V	-16.46	47.96	74	-26.04	peak
9748	60.76	H	-14.02	46.74	74	-27.26	peak
9748	58.46	V	-14.02	44.44	74	-29.56	peak
12185	56.22	H	-9.96	46.26	74	-27.74	peak
12185	54.58	V	-9.96	44.62	74	-29.38	peak
11n20 High Channel							
2483.5	86.45	H	-22.2	64.25	74	-9.75	peak
2500	84.43	V	-22.2	62.23	74	-11.77	peak
2483.5	50.33	H	-22.2	28.13	54	-25.87	AVG
2500	45.53	V	-22.2	23.33	54	-30.67	AVG
4924	66.75	H	-18.38	48.37	74	-25.63	peak
4924	65.22	V	-18.38	46.84	74	-27.16	peak
7386	53.42	H	-16.49	36.93	74	-37.07	peak
7386	58.43	V	-16.49	41.94	74	-32.06	peak
9848	66.88	H	-14.23	52.65	74	-21.35	peak
9848	62.43	V	-14.23	48.20	74	-25.80	peak
12310	60.09	H	-10.15	49.94	74	-24.06	peak
12310	52.32	V	-10.15	42.17	74	-31.83	peak



11n40 Low Channel							
2390	87.56	V	-20.22	67.34	74	-6.66	peak
2400	84.56	H	-20.22	64.34	74	-9.66	peak
2390	54.52	V	-20.22	34.30	54	-19.70	AVG
2400	48.63	V	-20.22	28.41	54	-25.59	AVG
4844	62.32	H	-18.44	43.88	74	-30.12	peak
4844	64.24	V	-18.44	45.80	74	-28.20	peak
7266	64.43	H	-16.55	47.88	74	-26.12	peak
7266	59.66	V	-16.55	43.11	74	-30.89	peak
9688	59.87	H	-14.15	45.72	74	-28.28	peak
9688	60.44	V	-14.15	46.29	74	-27.71	peak
12110	54.66	H	-10.08	44.58	74	-29.42	peak
12110	54.88	V	-10.08	44.80	74	-29.20	peak
11n40 Middle Channel							
4874	67.11	H	-18.22	48.89	74	-25.11	peak
4874	65.63	V	-18.22	47.41	74	-26.59	peak
7311	61.55	H	-16.46	45.09	74	-28.91	peak
7311	64.45	V	-16.46	47.99	74	-26.01	peak
9748	60.20	H	-14.02	46.18	74	-27.82	peak
9748	58.44	V	-14.02	44.42	74	-29.58	peak
12185	56.53	H	-9.96	46.57	74	-27.43	peak
12185	54.77	V	-9.96	44.81	74	-29.19	peak
11n40 High Channel							
2483.5	86.99	H	-22.2	64.79	74	-9.21	peak
2500	84.42	V	-22.2	62.22	74	-11.78	peak
2483.5	50.77	H	-22.2	28.57	54	-25.43	AVG
2500	45.52	V	-22.2	23.32	54	-30.68	AVG
4904	66.14	H	-18.38	47.76	74	-26.24	peak
4904	65.42	V	-18.38	47.04	74	-26.96	peak
7356	53.42	H	-16.49	36.93	74	-37.07	peak
7356	58.77	V	-16.49	42.28	74	-31.72	peak
9808	66.82	H	-14.23	52.59	74	-21.41	peak
9808	62.03	V	-14.23	47.80	74	-26.20	peak
12260	60.48	H	-10.15	50.33	74	-23.67	peak
12260	52.68	V	-10.15	42.53	74	-31.47	peak

Remarks:

1. Level = Receiver Read level + Factor
2. The emission levels of other frequencies are very lower than the limit and not show in test report.
3. If the peak (or quasi-peak) measured value complies with the average limit, it is unnecessary to perform an average measurement, so AV emission value did not show in above table if the peak value complies with average limit.

----- THE END OF TEST REPORT -----