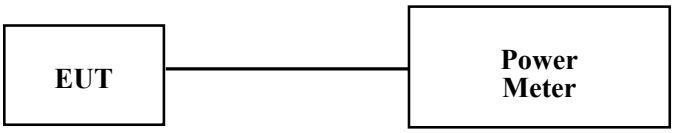
FCC §15.247(b) (3) - MAXIMUM PEAK CONDUCTED OUTPUT POWER

Applicable Standard

According to FCC §15.247(b) (3), for systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.

Test Procedure

1. Place the EUT on a bench and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to test equipment.
3. Add a correction factor to the display.
4. Set the power meter to test average output power, record the result as average power.



Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Agilent	USB Wideband Power Sensor	U2022XA	MY5417006	2020-09-12	2021-09-12
Unknown	Coaxial Cable	C-SJ00-0010	C0010/01	Each time	N/A

*** Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

Test Data

Environmental Conditions

Temperature:	25.8 °C
Relative Humidity:	47%
ATM Pressure:	100.1kPa
Tester:	Tiger Mo
Test Date:	2021-06-15

Test Mode: Transmitting

Test Result: Compliance. Please refer to the following table.

Mode	Channel	Frequency (MHz)	Conducted Peak Output Power (dBm)			Limits (dBm)
			Chain 0	Chain 1	Total	
802.11 b	Low	2412	22.44	19.9	/	30
	Middle	2437	22.07	19.68	/	30
	High	2462	21.65	19.5	/	30
802.11 g	Low	2412	24.68	23.68	/	30
	Middle	2437	24.52	23.31	/	30
	High	2462	24.07	23.17	/	30
802.11n ht20	Low	2412	23.59	21.8	25.8	30
	Middle	2437	22.87	21.61	25.3	30
	High	2462	22.59	21.4	25.05	30
802.11n ht40	Low	2422	23.78	21.99	25.99	30
	Middle	2437	23.67	21.8	25.85	30
	High	2452	21.98	20.61	24.36	30

Note:
The maximum antenna gain is 5dBi in 2.4GHz band. The device employed Cyclic Delay Diversity (CDD) for 802.11 MIMO transmitting, per KDB 662911 D01 Multiple Transmitter Output v02r01, for power measurements on IEEE 802.11 devices:

Array Gain = 0 dB (i.e., no array gain) for $N_{ANT} \leq 4$;

So:

Directional gain = 5dBi

FCC §15.247(d)– 100 kHz BANDWIDTH OF FREQUENCY BAND EDGE

Applicable Standard

According to FCC§15.247(d):In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated 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, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

Test Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. 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.
3. 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.
4. 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.
5. Repeat above procedures until all measured frequencies were complete.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	Spectrum Analyzer	FSV40	101591	2020-06-29	2021-06-28
Unknown	Coaxial Cable	C-SJ00-0010	C0010/01	Each time	N/A

*** Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

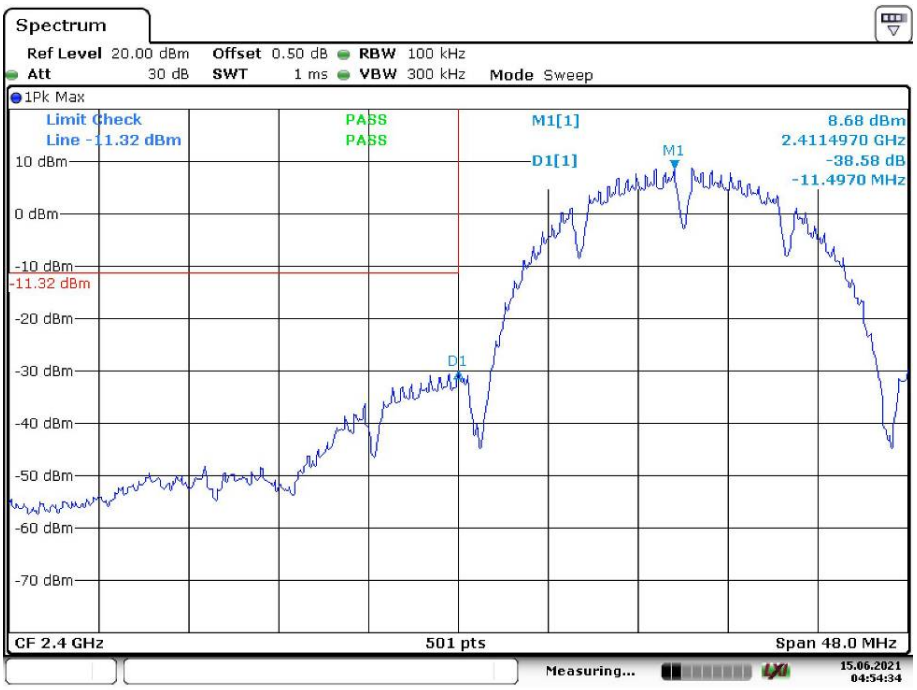
Test Data

Environmental Conditions

Temperature:	25.8 °C
Relative Humidity:	47%
ATM Pressure:	100.1kPa
Tester:	Tiger Mo
Test Date:	2021-06-15

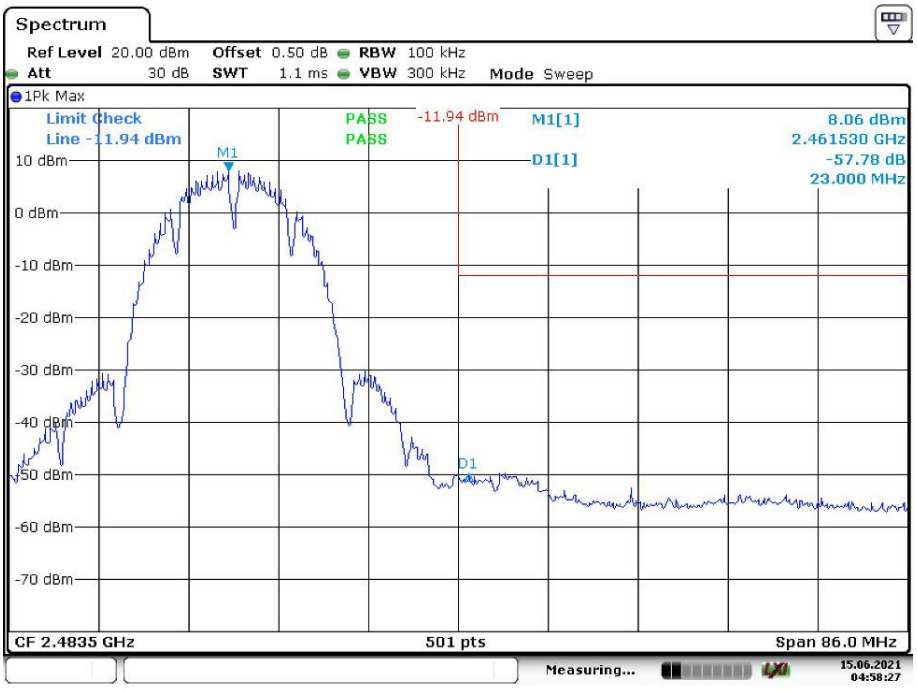
Test mode: Transmitting
Test Result: Compliance. Please refer to following plots.

Chain 0, 802.11b: Band Edge, Left Side



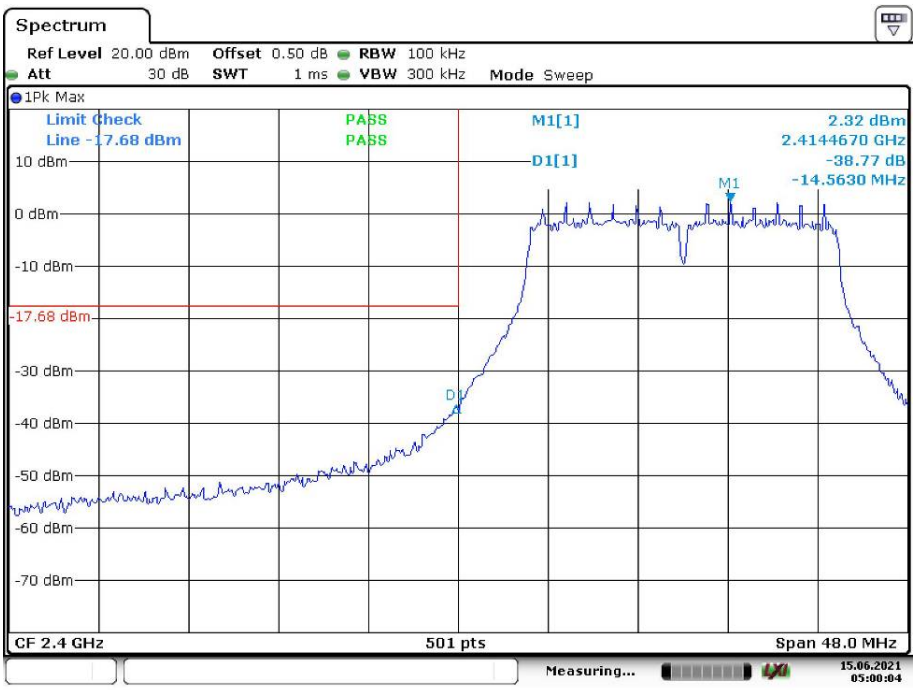
Date: 15.JUN.2021 04:54:34

Chain 0,802.11b: Band Edge, Right Side



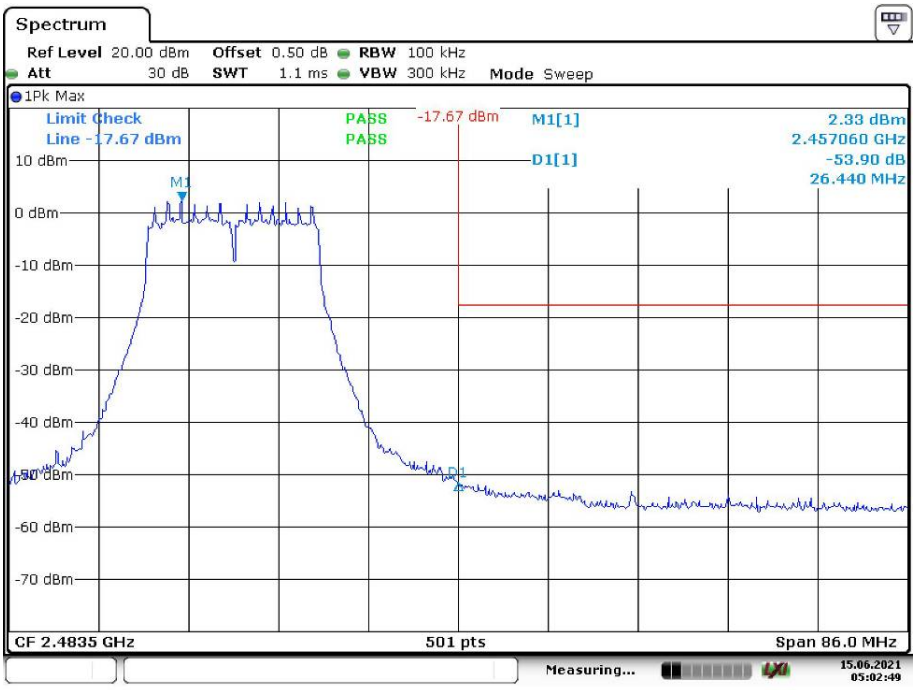
Date: 15.JUN.2021 04:58:27

Chain 0,802.11g: Band Edge, Left Side



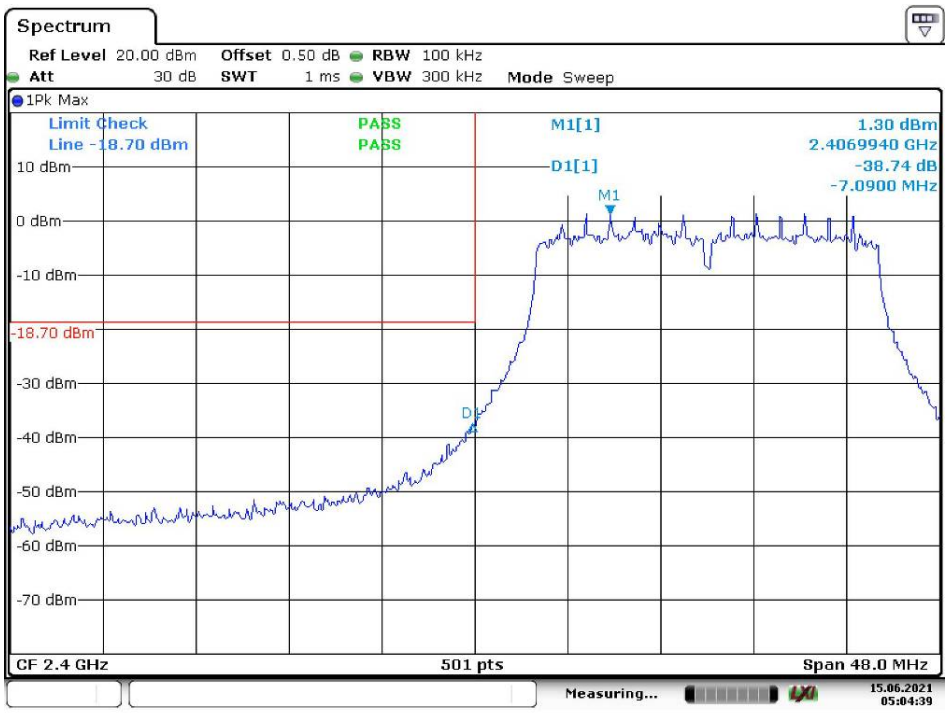
Date: 15.JUN.2021 05:00:04

Chain 0,802.11g: Band Edge, Right Side



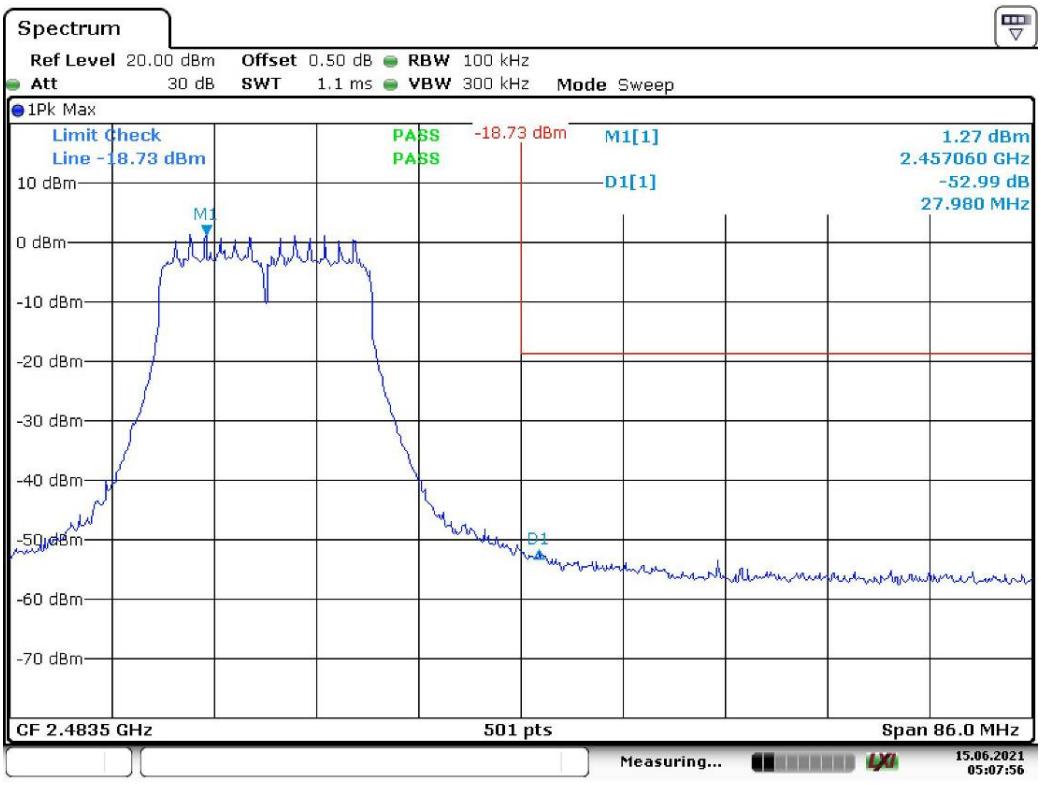
Date: 15.JUN.2021 05:02:49

Chain 0,802.11n ht20 Band Edge, Left Side



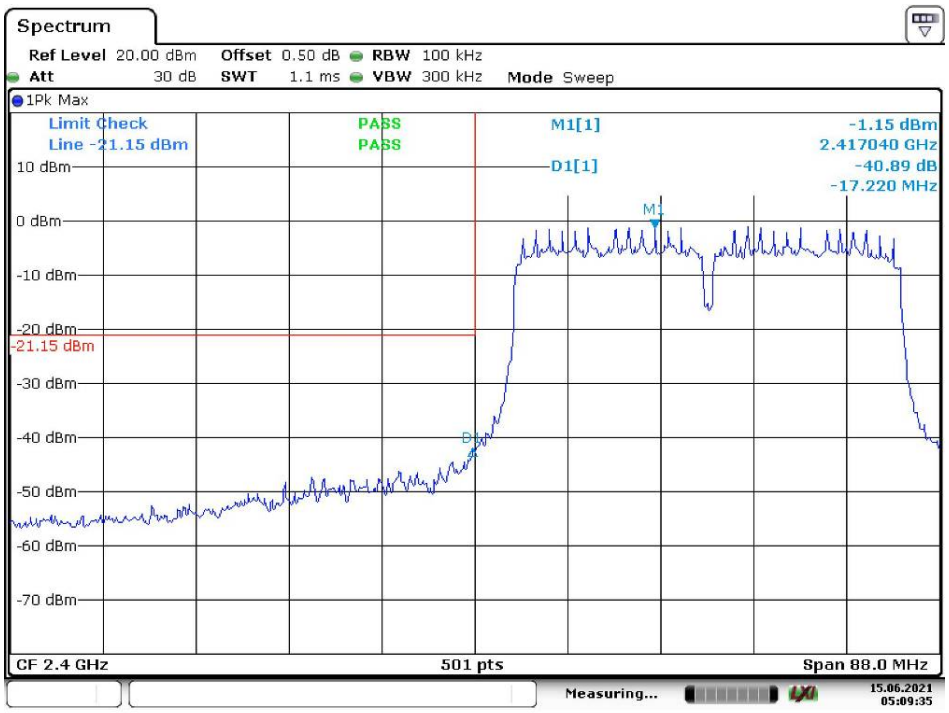
Date: 15.JUN.2021 05:04:39

Chain 0,802.11n ht20 Band Edge, Right Side



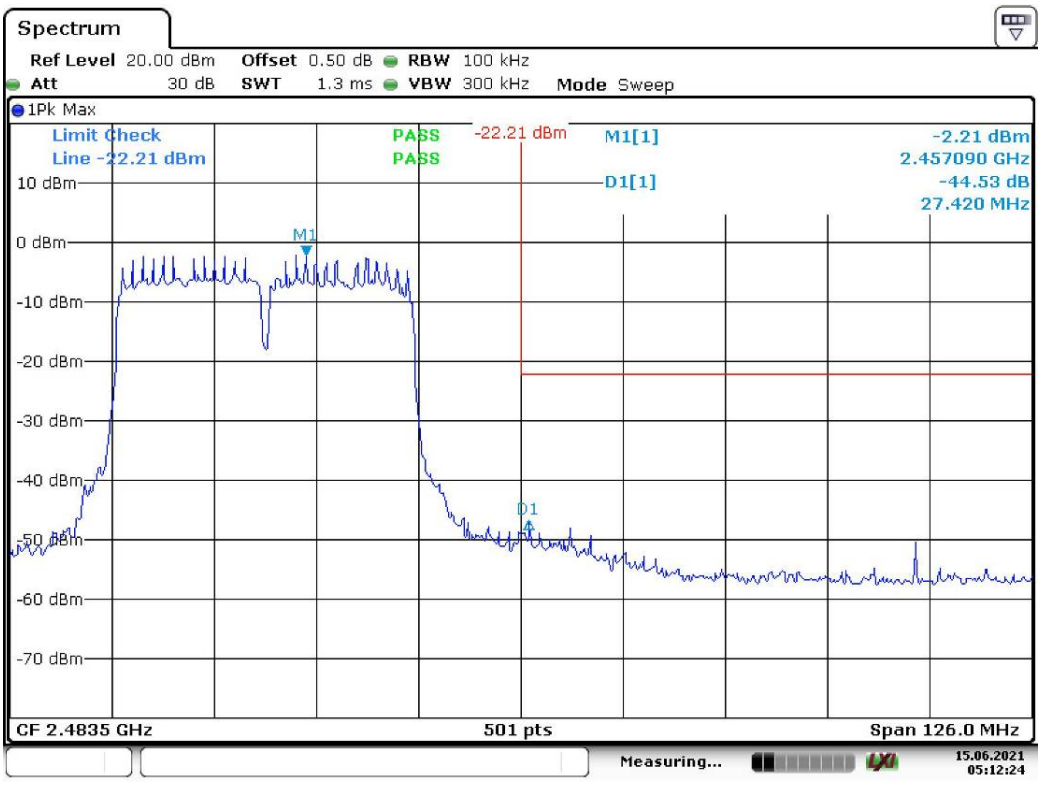
Date: 15.JUN.2021 05:07:56

Chain 0,802.11n ht40 Band Edge, Left Side



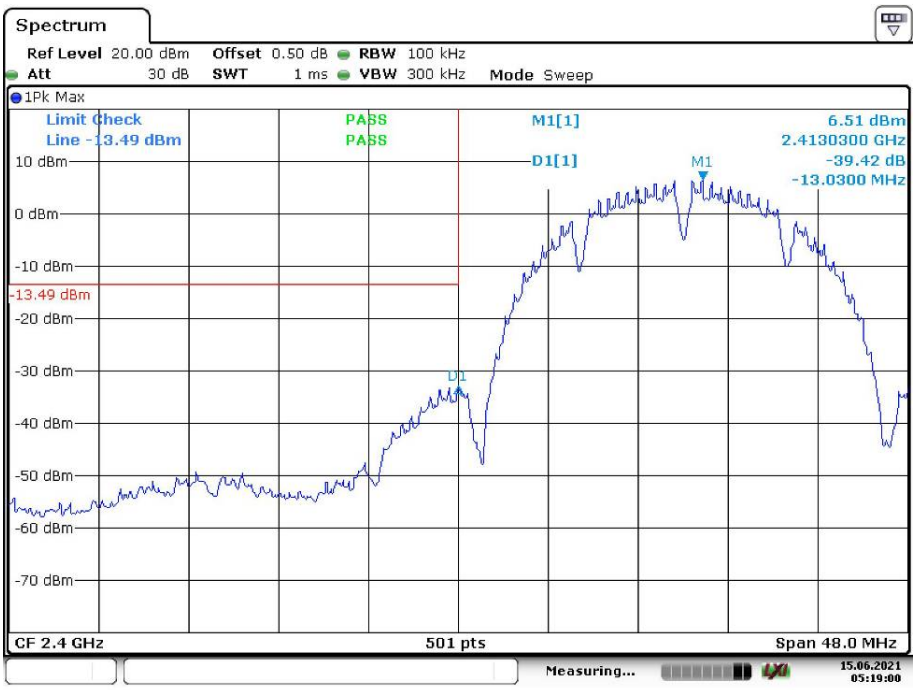
Date: 15.JUN.2021 05:09:35

Chain 0,802.11n ht40 Band Edge, Right Side



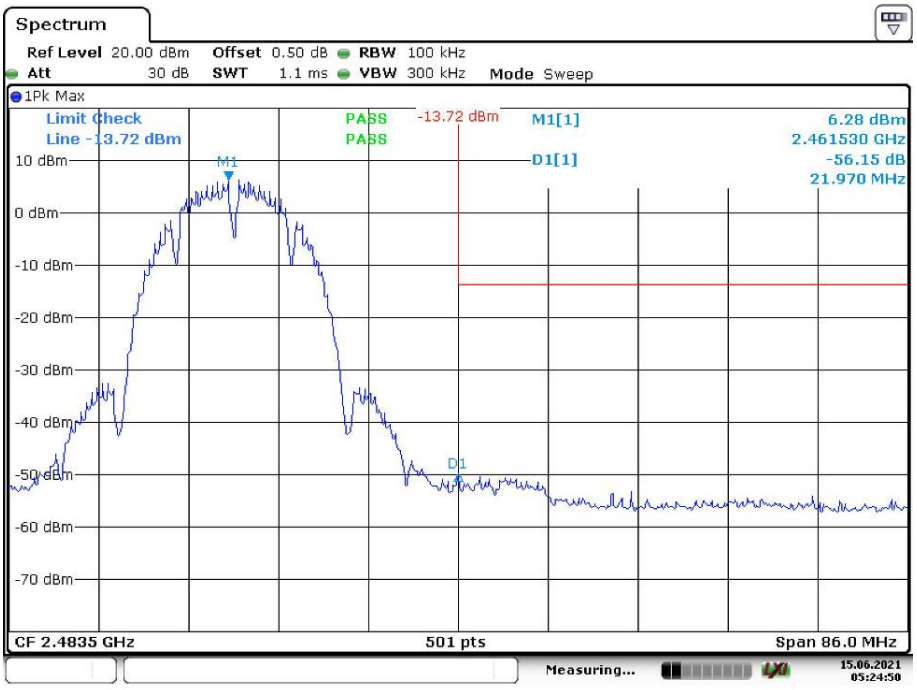
Date: 15.JUN.2021 05:12:24

Chain 1, 802.11b: Band Edge, Left Side



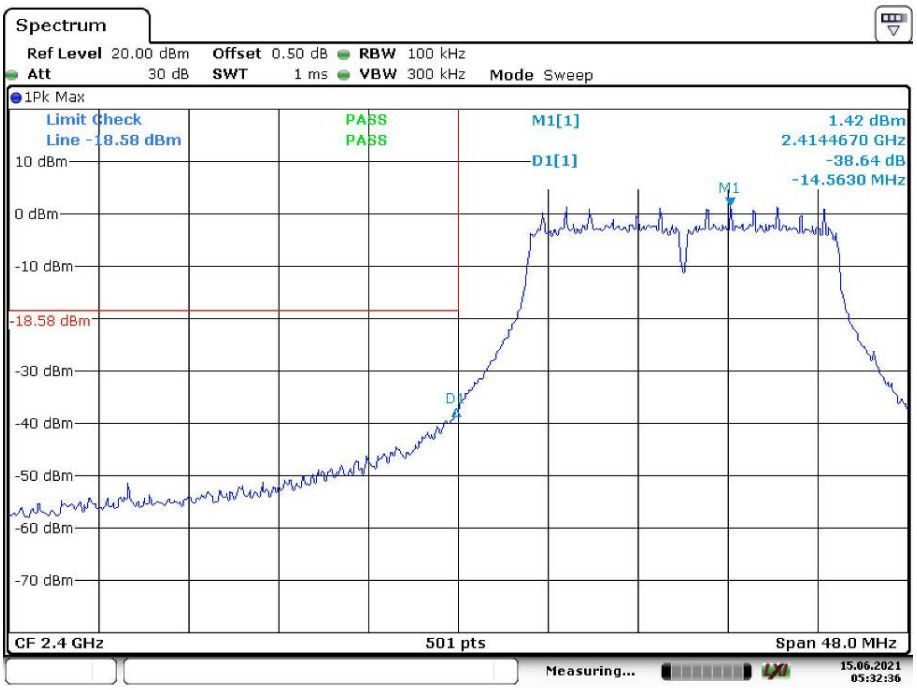
Date: 15.JUN.2021 05:18:59

Chain 1,802.11b: Band Edge, Right Side



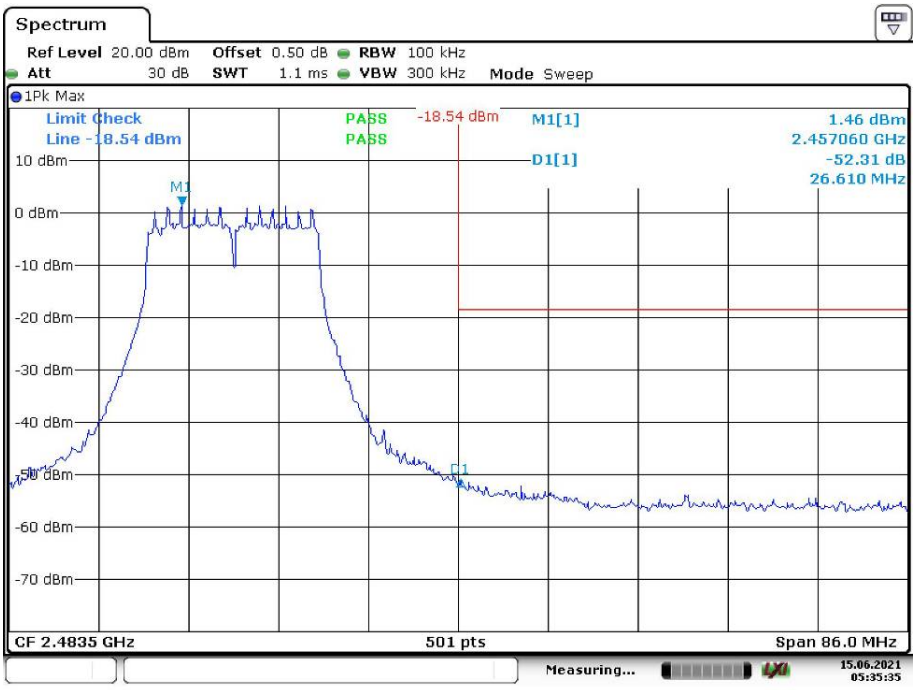
Date: 15.JUN.2021 05:24:50

Chain 1,802.11g: Band Edge, Left Side



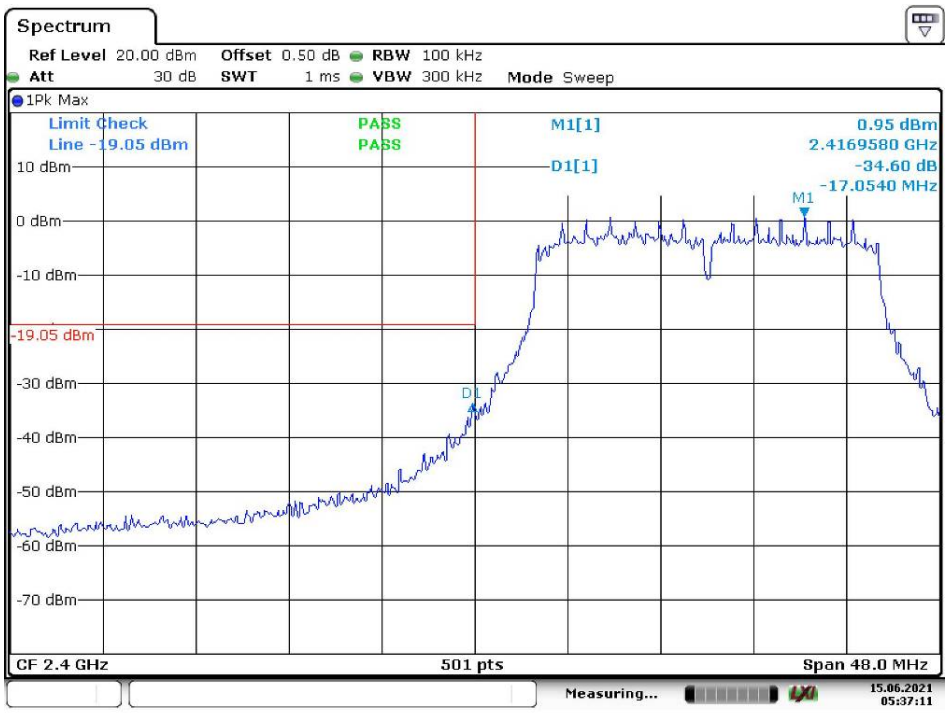
Date: 15.JUN.2021 05:32:36

Chain 1,802.11g: Band Edge, Right Side



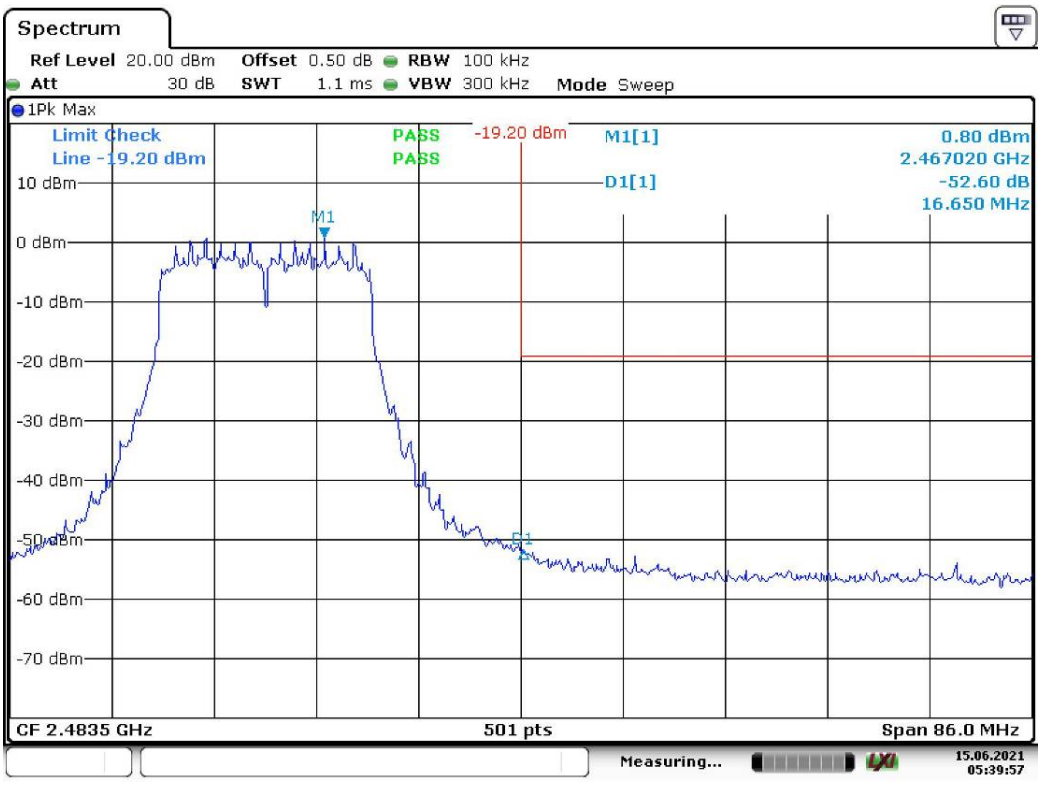
Date: 15.JUN.2021 05:35:35

Chain 1,802.11n ht20 Band Edge, Left Side



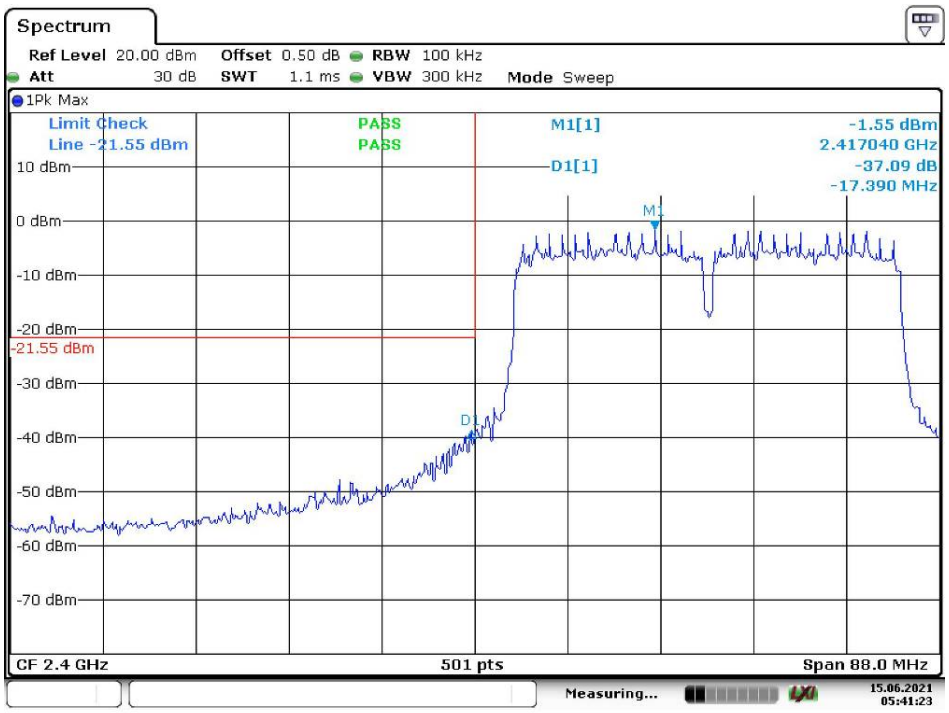
Date: 15.JUN.2021 05:37:12

Chain 1,802.11n ht20 Band Edge, Right Side



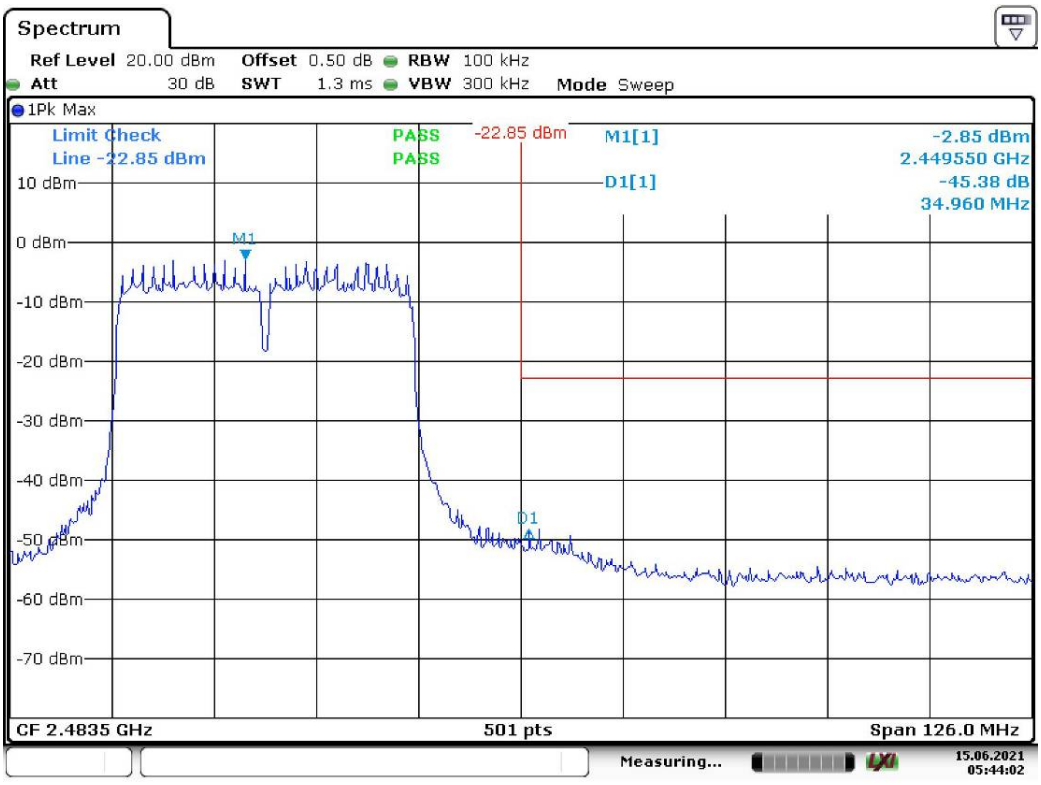
Date: 15.JUN.2021 05:39:57

Chain 1,802.11n ht40 Band Edge, Left Side



Date: 15.JUN.2021 05:41:23

Chain 1,802.11n ht40 Band Edge, Right Side



Date: 15.JUN.2021 05:44:02

FCC §15.247(e) - POWER SPECTRAL DENSITY

Applicable Standard

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

Test Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT was set 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.
3. Set the RBW = 3 kHz, VBW = 10 kHz, Set the span to 1.5 times the DTS bandwidth.
4. Use the peak marker function to determine the maximum amplitude level.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	Spectrum Analyzer	FSV40	101591	2020-06-29	2021-06-28
Unknown	Coaxial Cable	C-SJ00-0010	C0010/01	Each time	N/A

*** Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

Test Data

Environmental Conditions

Temperature:	25.8 °C
Relative Humidity:	47%
ATM Pressure:	100.1kPa
Tester:	Tiger Mo
Test Date:	2021-06-15

Test Result: Compliance. *Please refer to the following table and plots*

Test Mode: Transmitting

Test mode	Channel	Frequency (MHz)	Power Spectral Density (dBm/3kHz)			Limit (dBm/3kHz)
			Chain 0	Chain 1	Total	
802.11b	Low	2412	3.22	0.75	/	8
	Middle	2437	2.88	0.78	/	8
	High	2462	2.42	0.62	/	8
802.11g	Low	2412	-11.96	-13.00	/	8
	Middle	2437	-11.63	-13.26	/	8
	High	2462	-12.95	-13.48	/	8
802.11n ht20	Low	2412	-13.98	-14.28	-11.12	6
	Middle	2437	-14.00	-14.90	-11.42	6
	High	2462	-13.84	-15.53	-11.59	6
802.11n ht40	Low	2422	-16.50	-18.02	-14.18	6
	Middle	2437	-17.14	-17.94	-14.51	6
	High	2452	-19.07	-19.58	-16.31	6

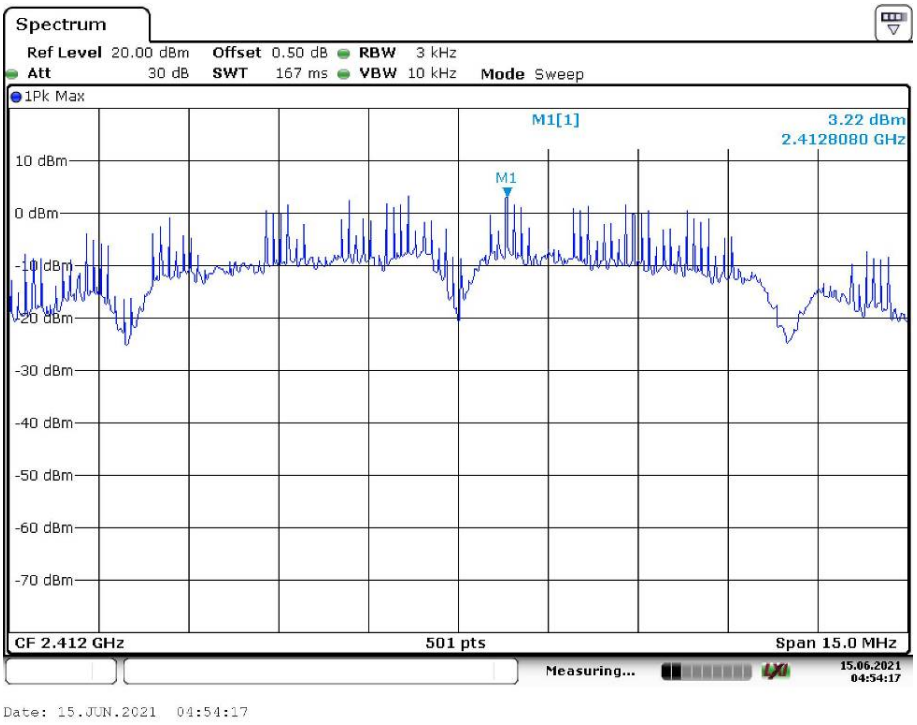
Note:
The maximum antenna gain is 5 dBi. The device employed Cyclic Delay Diversity (CDD) for 802.11 MIMO transmitting, per KDB 662911 D01 Multiple Transmitter Output v02r01, for power spectral density (PSD) measurements on the devices:

Array Gain = 10 log(N_{ANT}/N_{SS}) dB.

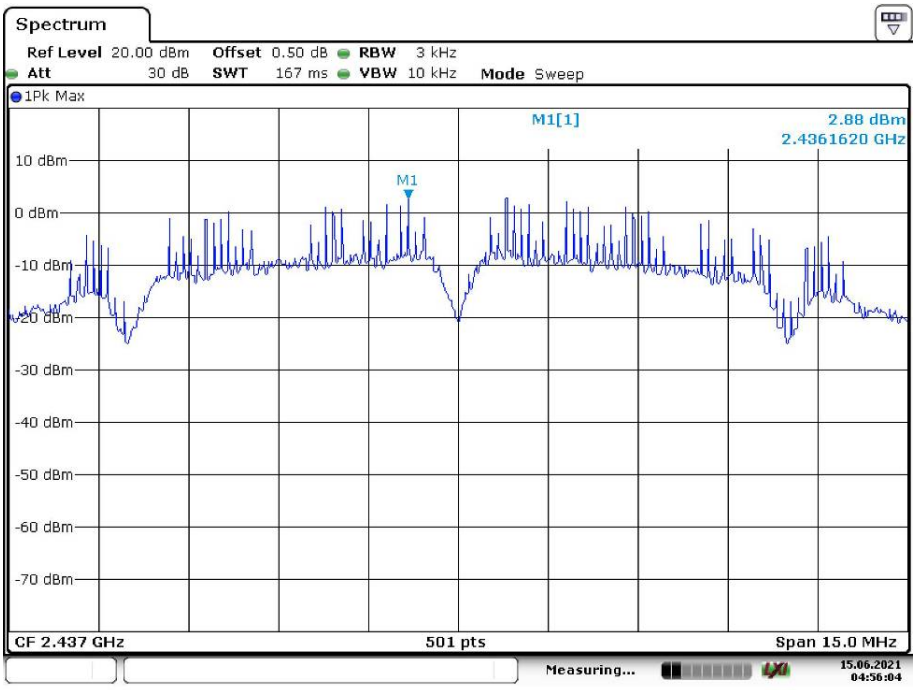
So:

Directional gain = G_{ANT} + Array Gain = 5+10*log(2/1)=8 dBi

Chain 0, Power Spectral Density, 802.11b Low Channel

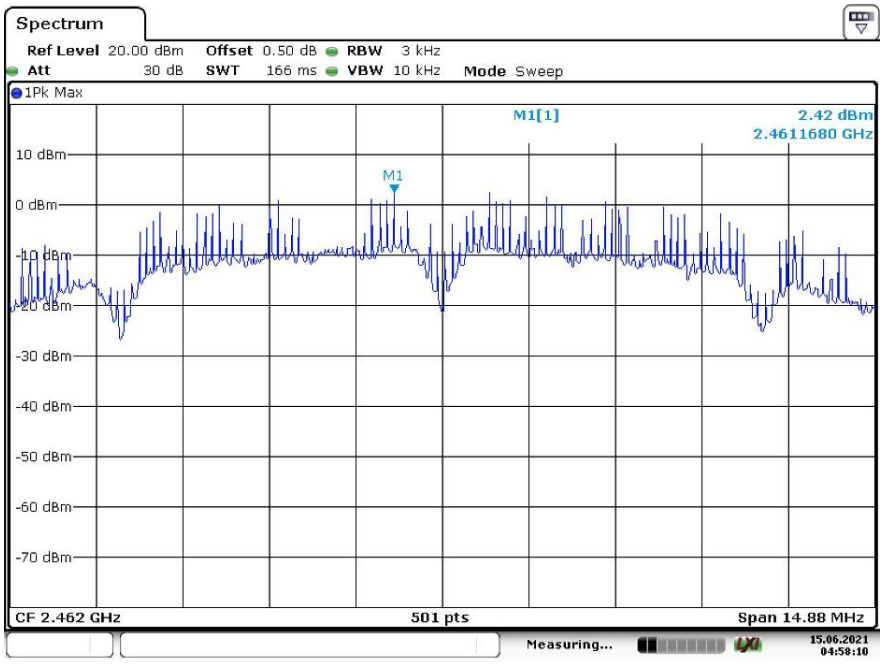


Chain 0,Power Spectral Density, 802.11b Middle Channel



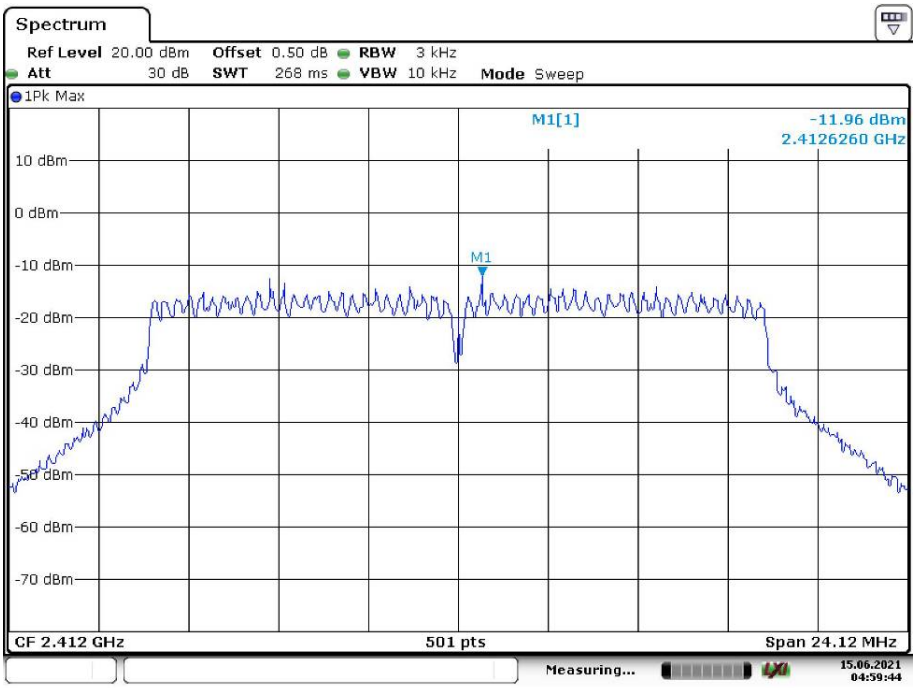
Date: 15.JUN.2021 04:56:04

Chain 0,Power Spectral Density, 802.11b High Channel



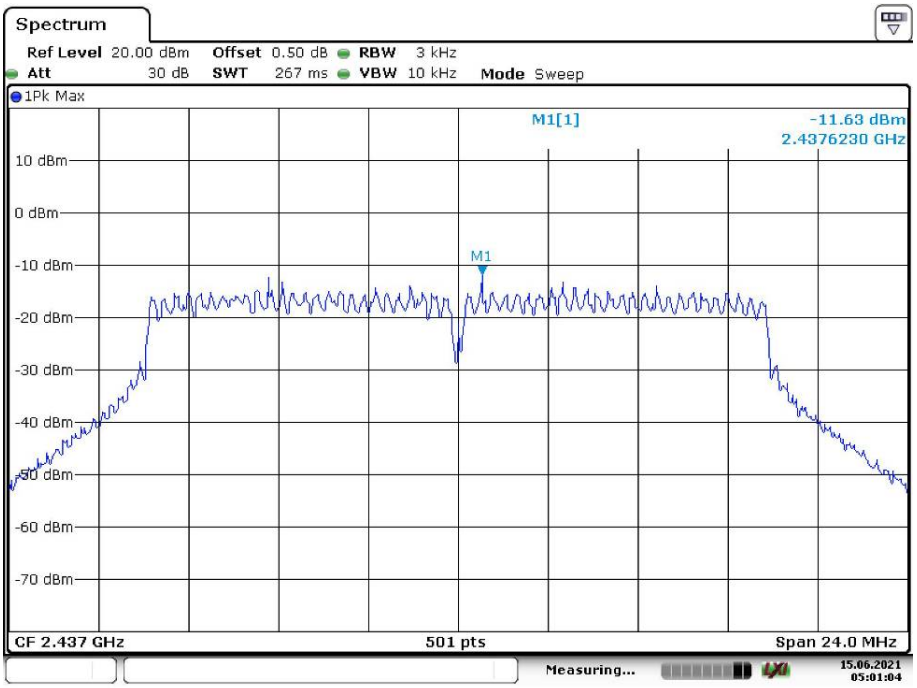
Date: 15.JUN.2021 04:58:10

Chain 0,Power Spectral Density, 802.11g Low Channel



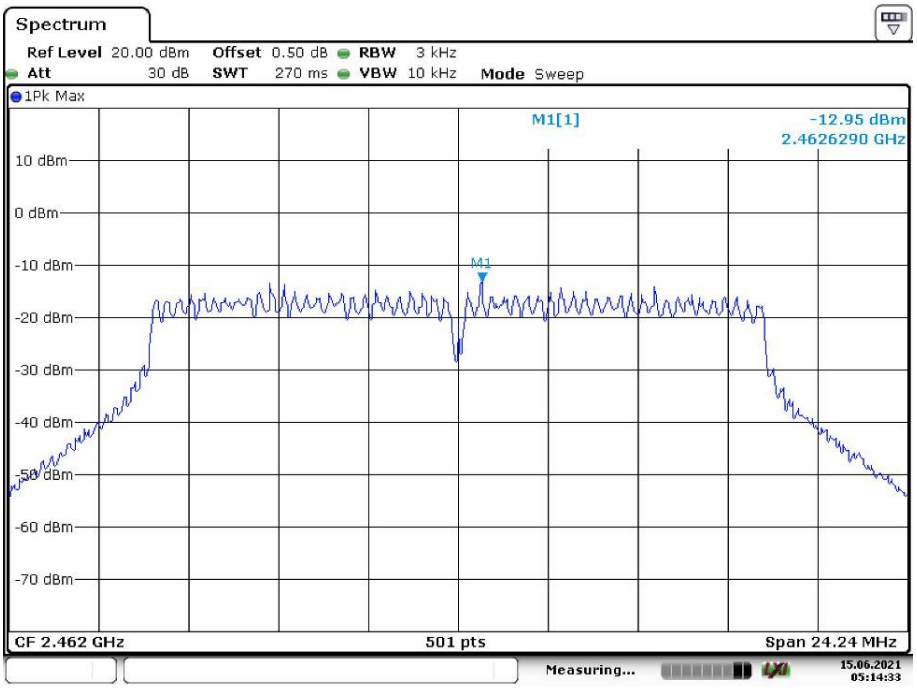
Date: 15.JUN.2021 04:59:44

Chain 0,Power Spectral Density, 802.11g Middle Channel



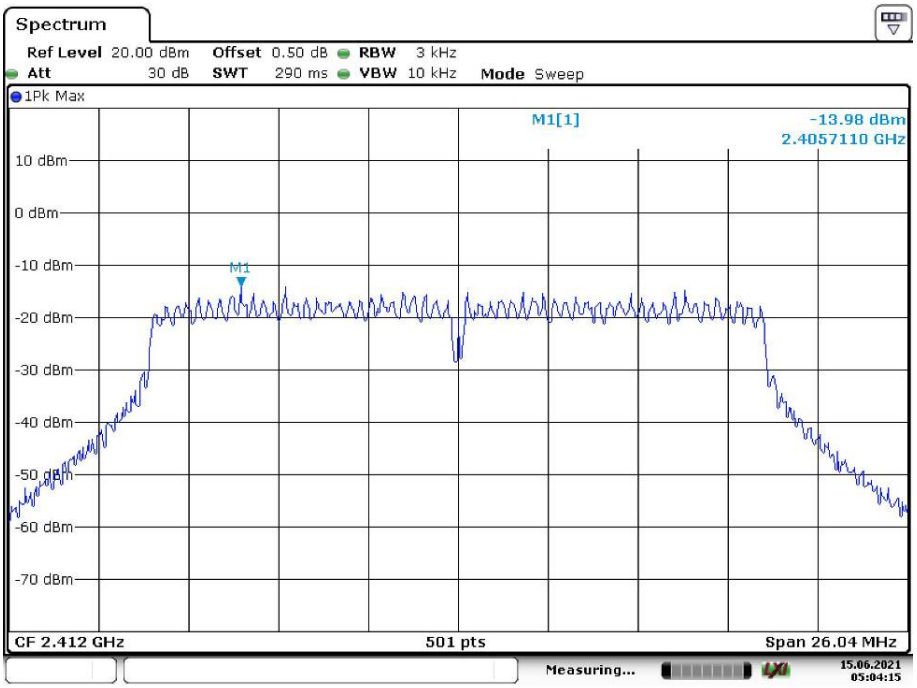
Date: 15.JUN.2021 05:01:04

Chain 0,Power Spectral Density, 802.11g High Channel



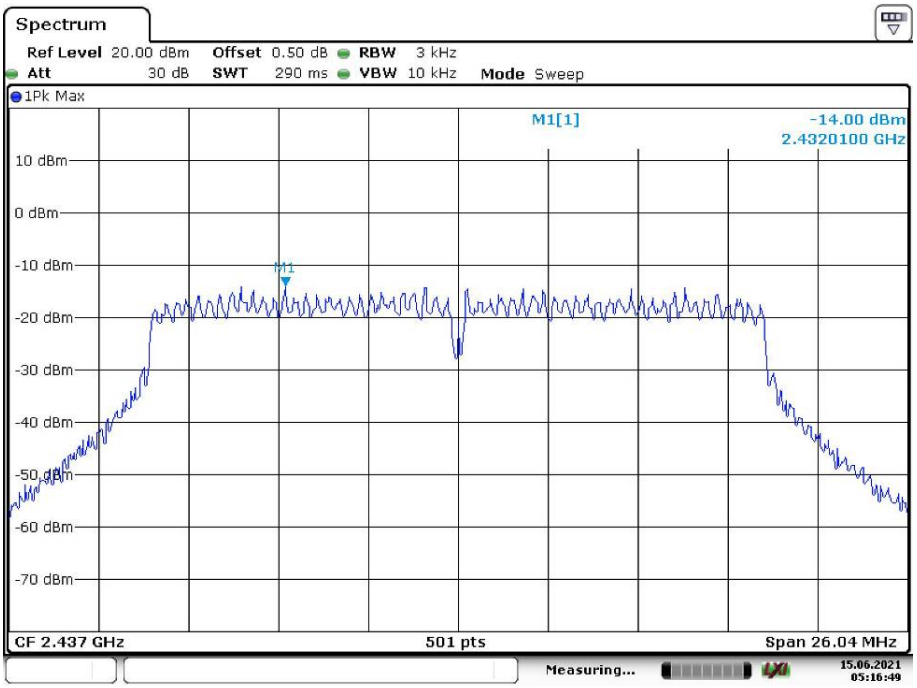
Date: 15.JUN.2021 05:14:33

Chain 0,Power Spectral Density, 802.11n ht20 Low Channel



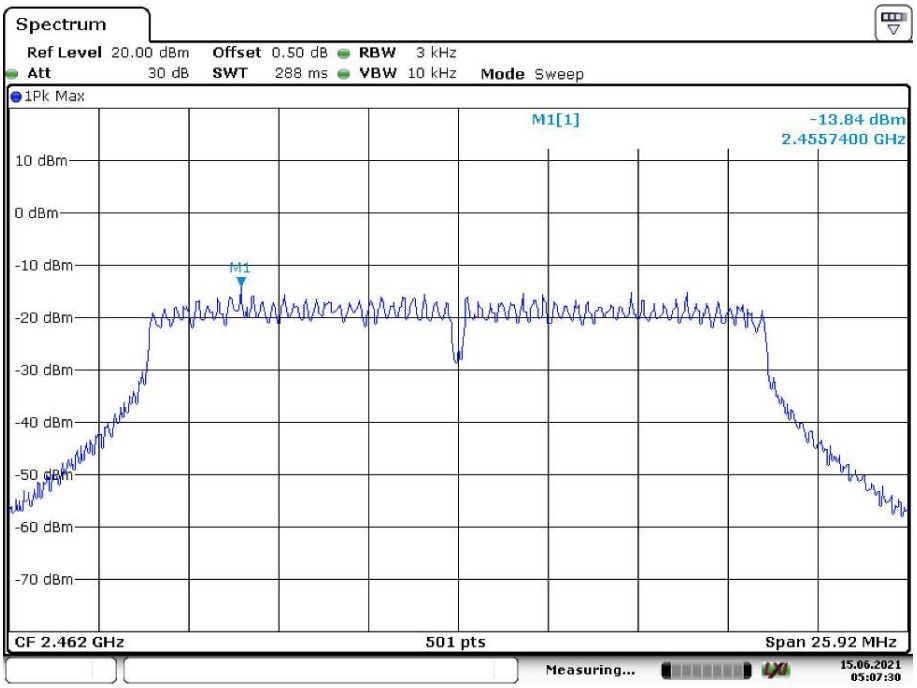
Date: 15.JUN.2021 05:04:15

Chain 0,Power Spectral Density, 802.11n ht20 Middle Channel



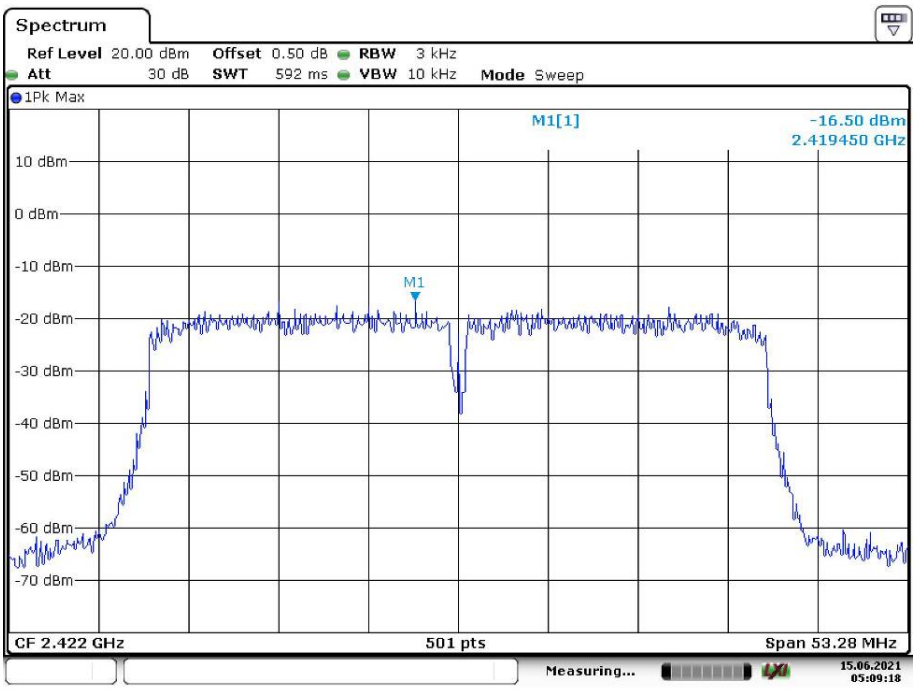
Date: 15.JUN.2021 05:16:49

Chain 0,Power Spectral Density, 802.11n ht20 High Channel



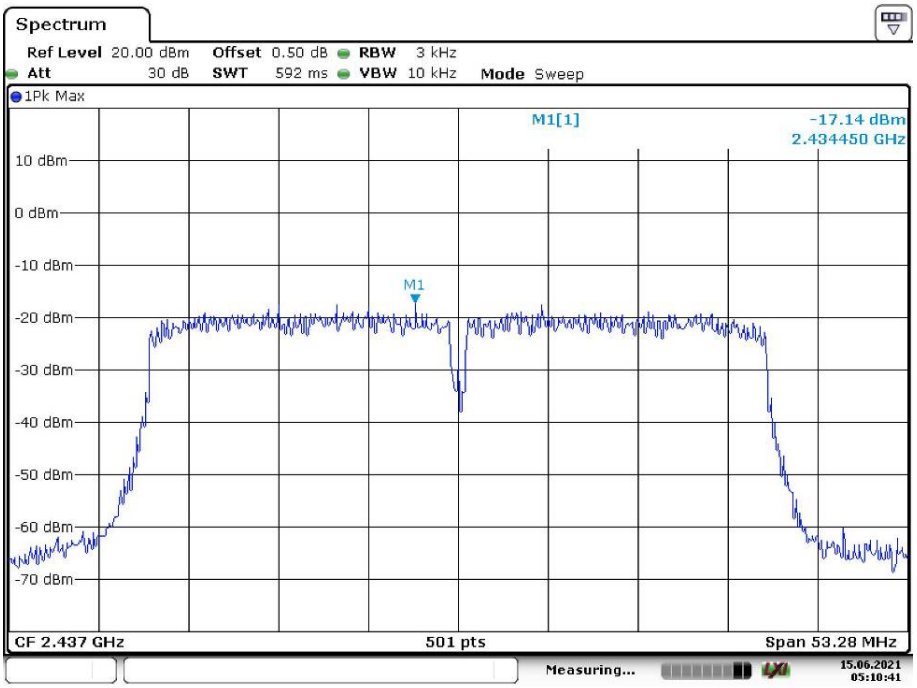
Date: 15.JUN.2021 05:07:30

Chain 0,Power Spectral Density, 802.11n ht40 Low Channel



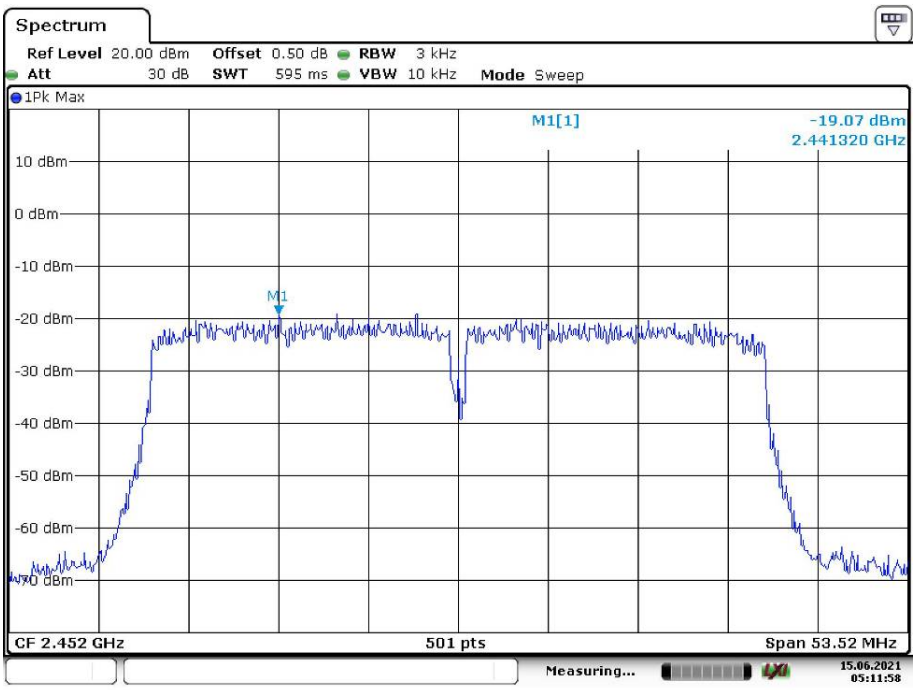
Date: 15.JUN.2021 05:09:18

Chain 0,Power Spectral Density, 802.11n ht40 Middle Channel



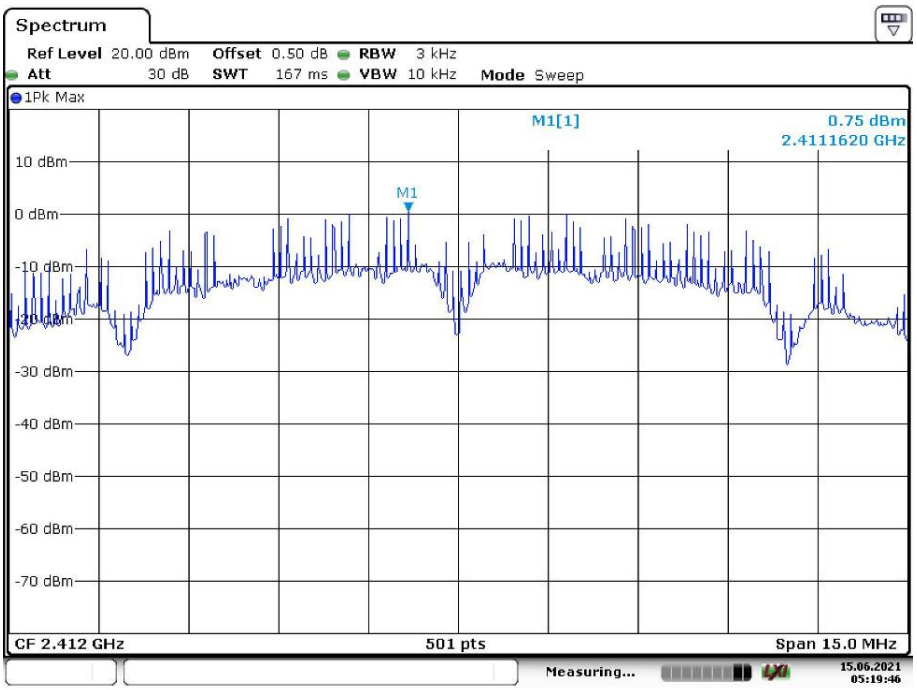
Date: 15.JUN.2021 05:10:41

Chain 0,Power Spectral Density, 802.11n ht40 High Channel



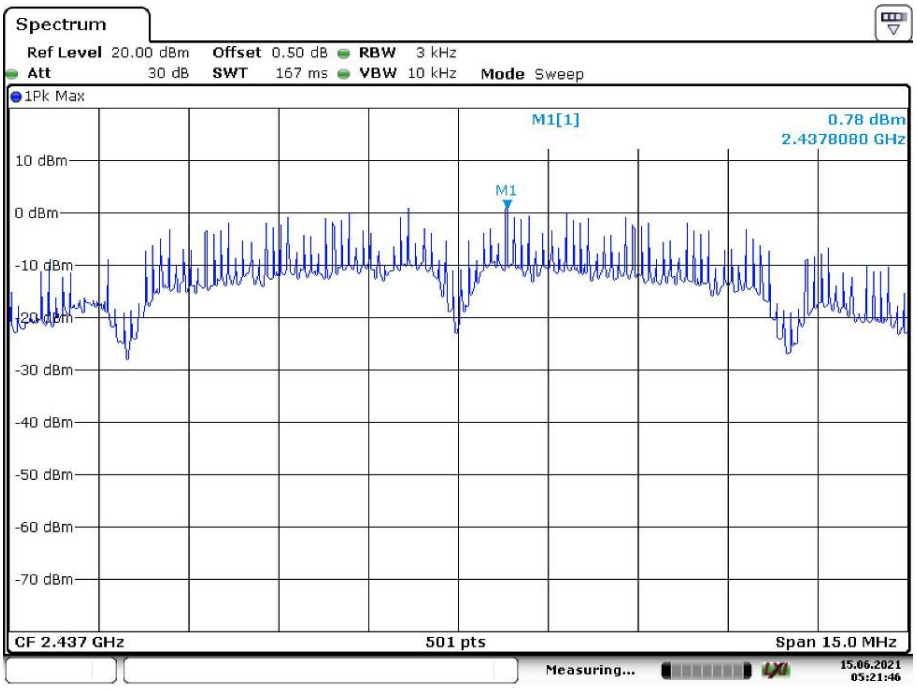
Date: 15.JUN.2021 05:11:58

Chain 1, Power Spectral Density, 802.11b Low Channel



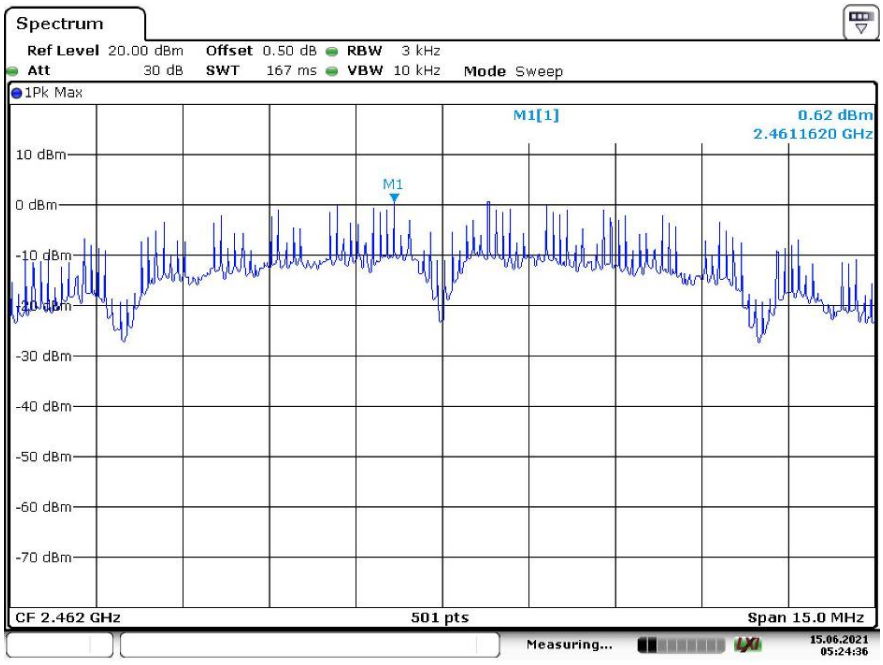
Date: 15.JUN.2021 05:19:46

Chain 1,Power Spectral Density, 802.11b Middle Channel



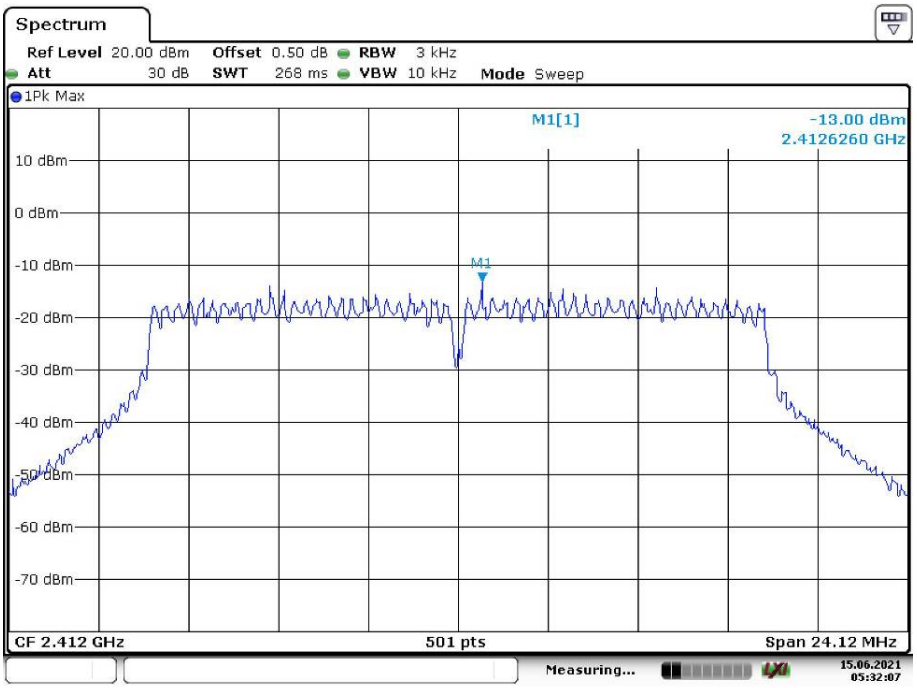
Date: 15.JUN.2021 05:21:46

Chain 1,Power Spectral Density, 802.11b High Channel



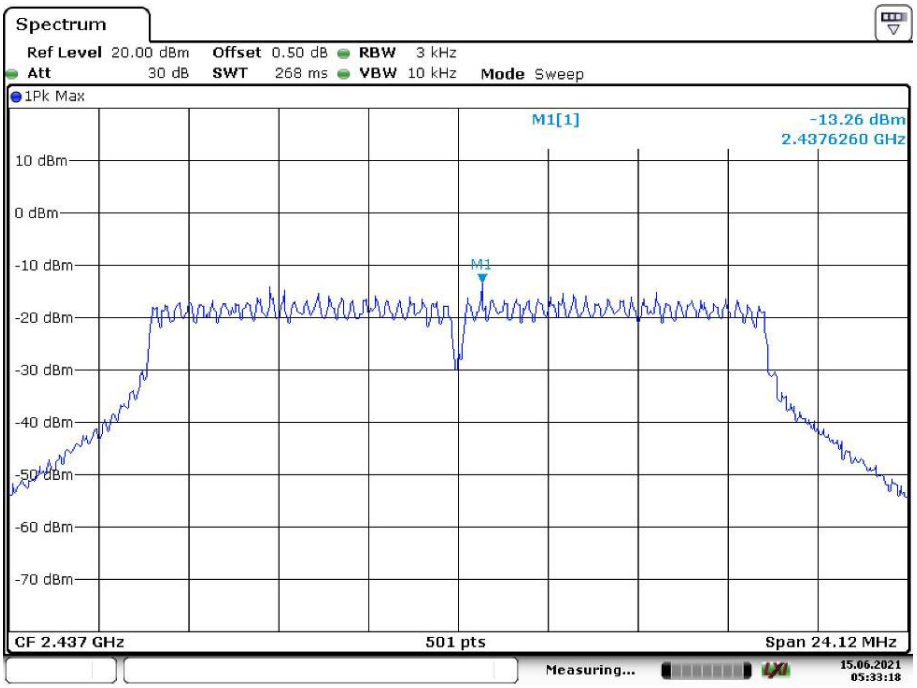
Date: 15.JUN.2021 05:24:36

Chain1,Power Spectral Density, 802.11g Low Channel



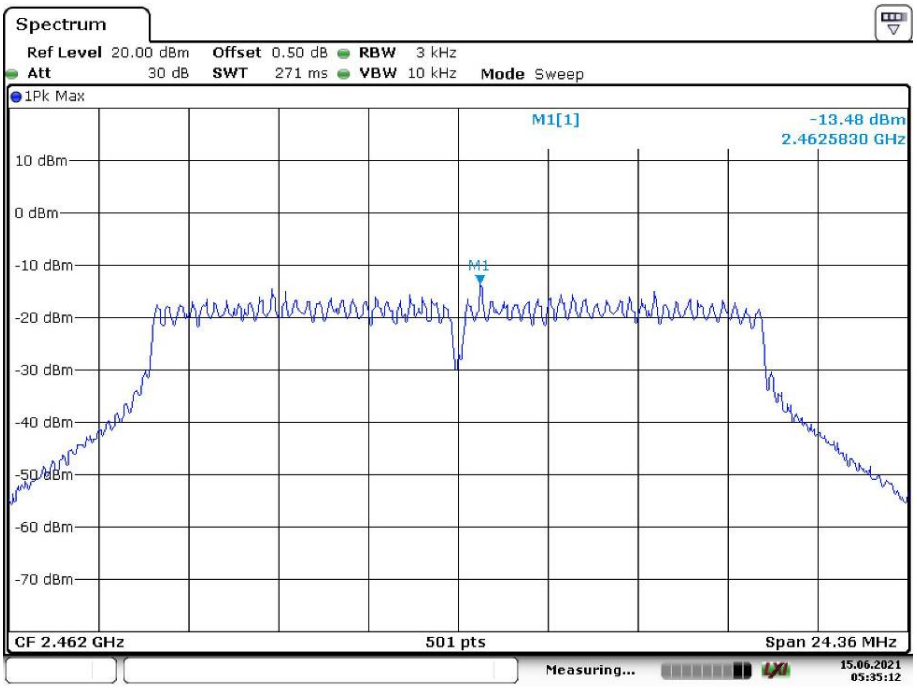
Date: 15.JUN.2021 05:32:07

Chain 1,Power Spectral Density, 802.11g Middle Channel



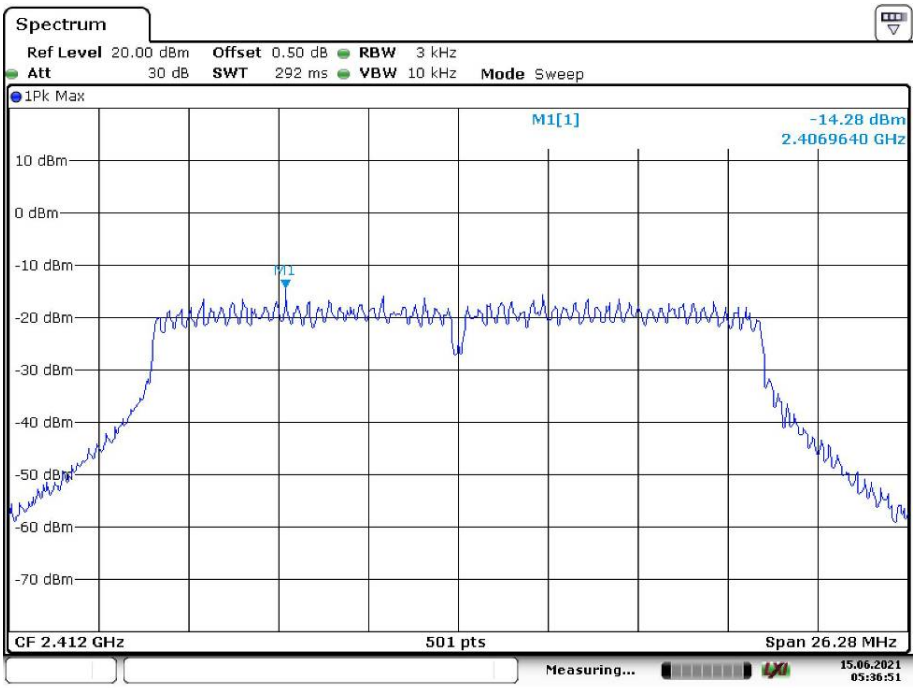
Date: 15.JUN.2021 05:33:18

Chain1,Power Spectral Density, 802.11g High Channel



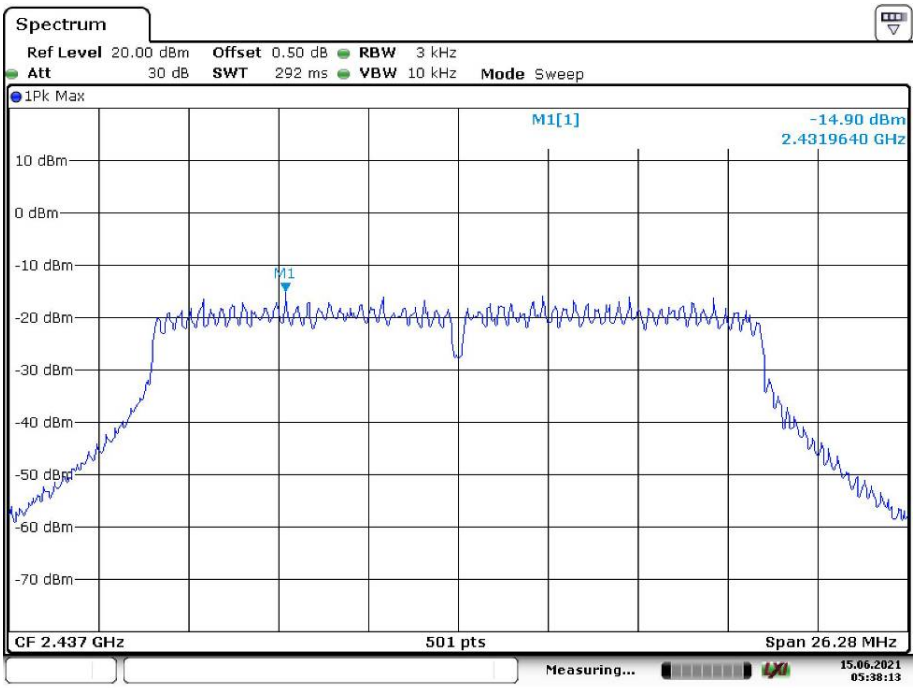
Date: 15.JUN.2021 05:35:12

Chain1,Power Spectral Density, 802.11n ht20 Low Channel



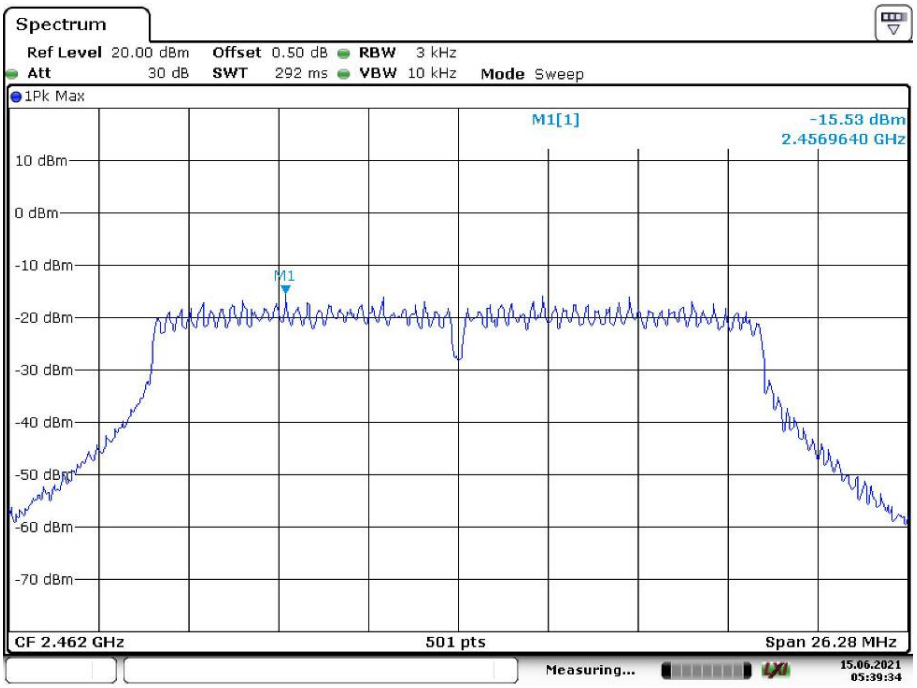
Date: 15.JUN.2021 05:36:51

Chain 1,Power Spectral Density, 802.11n ht20 Middle Channel



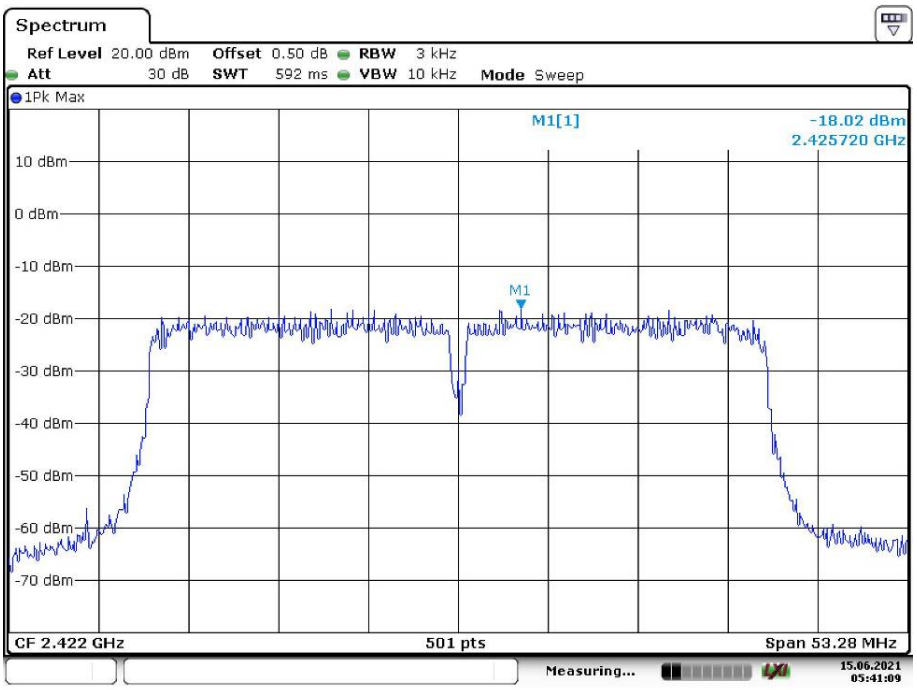
Date: 15.JUN.2021 05:38:13

Chain 1,Power Spectral Density, 802.11n ht20 High Channel



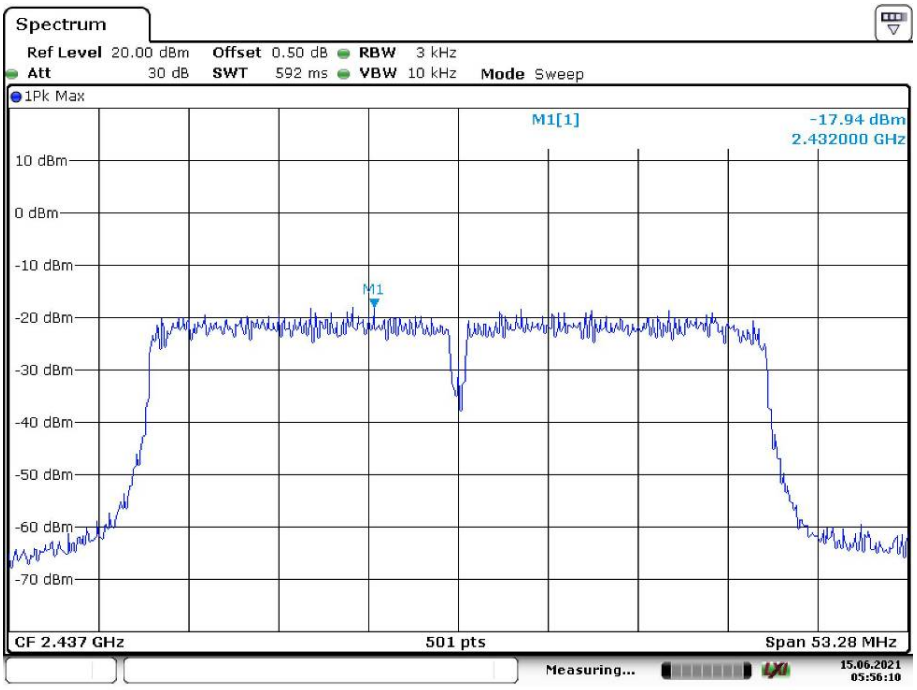
Date: 15.JUN.2021 05:39:34

Chain 1,Power Spectral Density, 802.11n ht40 Low Channel



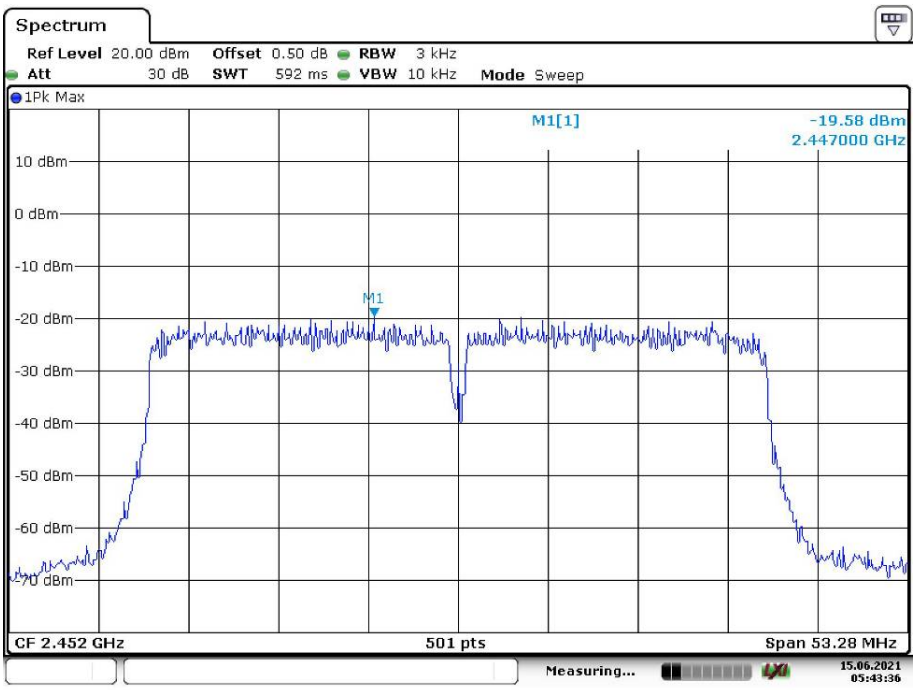
Date: 15.JUN.2021 05:41:09

Chain 1,Power Spectral Density, 802.11n ht40 Middle Channel



Date: 15.JUN.2021 05:56:10

Chain 1,Power Spectral Density, 802.11n ht40 High Channel



Date: 15.JUN.2021 05:43:36

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