



FCC RADIO TEST REPORT

FCC ID : RF41469A

Equipment : Handheld terminal

Brand Name : KEYENCE
Model Name : BT-A700GA
Marketing Name : KEYENCE

Applicant : Keyence Corporation

1-3-14, Higashi-Nakajima,

Higashi-Yodogawa-ku, Osaka, 533-8555, JAPAN

Manufacturer : Keyence Corporation

1-3-14, Higashi-Nakajima,

Higashi-Yodogawa-ku, Osaka, 533-8555, JAPAN

Standard : FCC Part 15 Subpart C §15.247

The product was received on Jan. 17, 2019 and testing was started from Jan. 28, 2019 and completed on Apr. 07, 2019. We, SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory, would like to declare that the tested sample has been evaluated in accordance with the test procedures and has been in compliance with the applicable technical standards.

The report must not be used by the client to claim product certification, approval, or endorsement by TAF or any agency of government.

The test results in this report apply exclusively to the tested model / sample. Without written approval of SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory, the test report shall not be reproduced except in full.

Approved by: Jones Tsai

Inex/sur

SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory

No. 52, Huaya 1st Rd., Guishan Dist., Taoyuan City, Taiwan (R.O.C.)

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Report Template No.: BU5-FR15CWL AC MA Version 2.4

: 01

Report No. : FR911730-01C

History of this test report

Report No. : FR911730-01C

Report No.	Version	Description	Issued Date
FR911730-01C	01	Initial issue of report	Apr. 23, 2019

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Summary of Test Result

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Report Clause	Ref Std. Clause	Test Items	Result (PASS/FAIL)	Remark
3.1	15.247(a)(2)	6dB Bandwidth	Pass	-
3.1	2.1049	99% Occupied Bandwidth	Reporting only	-
3.2	15.247(b)	Power Output Measurement	Pass	-
3.3	15.247(e) Power Spectral Density		Pass	-
0.4	45.047(-1)	Conducted Band Edges	Pass	-
3.4	15.247(d)	Conducted Spurious Emission	Pass	-
3.5 15.247(d)		Radiated Band Edges and Radiated Spurious Emission	Pass	Under limit 1.07 dB at 2387.700 MHz
-	15.207	AC Conducted Emission	Not Required	-
3.6	15.203 & 15.247(b)	Antenna Requirement	Pass	-

Remark: Not required means after assessing, test items are not necessary to carry out.

Declaration of Conformity:

The test results with all measurement uncertainty excluded are presented in accordance with the regulation limits or requirements declared by manufacturers.

Comments and Explanations:

The declared of product specification for EUT presented in the report are provided by the manufacturer, and the manufacturer takes all the responsibilities for the accuracy of product specification.

Reviewed by: Wii Chang

Report Producer: Maggie Chiang

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1 General Description

1.1 Product Feature of Equipment Under Test

Bluetooth, Wi-Fi 2.4GHz 802.11b/g/n/ac, and Wi-Fi 5GHz 802.11a/n/ac.

Product Specification subjective to this standard			
Antenna Type	WLAN: <ant. 1=""> PIFA Antenna <ant. 2=""> PIFA Antenna Bluetooth: PIFA Antenna</ant.></ant.>		

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1.2 Product Specification of Equipment Under Test

Standards-related Product Specification			
Tx/Rx Channel Frequency Range	2412 MHz ~ 2462 MHz		
Maximum (Average) Output Power to antenna	<ant. 1=""> 802.11b : 21.30 dBm (0.1349 W) 802.11g : 20.60 dBm (0.1148 W) 802.11n HT20 : 19.10 dBm (0.0813 W) 802.11n HT40 : 18.10 dBm (0.0646 W) 802.11ac VHT20 : 19.70 dBm(0.0933 W) 802.11ac VHT40 : 18.60 dBm(0.0724 W) <ant. 2=""> 802.11b : 21.00 dBm (0.1259 W) 802.11g : 20.50 dBm (0.1122 W) 802.11n HT20 : 19.20 dBm (0.0832 W) 802.11n HT40 : 18.00 dBm (0.0631 W) 802.11ac VHT20 : 19.60 dBm(0.0912 W) 802.11ac VHT40 : 18.50 dBm(0.0708 W) <mimo +="" 1="" 2="" ant.=""> 802.11b : 24.31 dBm (0.2698 W) 802.11g : 23.66 dBm (0.2323 W) 802.11n HT20 : 22.36 dBm (0.1722 W) 802.11n HT40 : 21.16 dBm (0.1306 W) 802.11ac VHT20 : 22.81 dBm(0.1910 W) 802.11ac VHT40 : 21.66 dBm(0.1910 W) 802.11ac VHT40 : 21.66 dBm(0.1466 W)</mimo></ant.></ant.>		

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Standards-related Product Specification				
99% Occupied Bandwidth	<mimo 1="" ant.=""> 802.11b: 13.28MHz 802.11g: 16.88MHz 802.11ac VHT20: 17.88MHz 802.11ac VHT40: 36.56MHz <mimo 2="" ant.=""> 802.11b: 13.84MHz 802.11g: 16.83MHz 802.11ac VHT20: 17.93MHz 802.11ac VHT40: 36.66MHz</mimo></mimo>			
Antenna Type / Gain	<ant. 1=""> PIFA Antenna with gain 2.54 dBi <ant. 2=""> PIFA Antenna with gain 2.42 dBi</ant.></ant.>			
802.11b : DSSS (DBPSK / DQPSK / CCK) Type of Modulation 802.11g/n : OFDM (BPSK / QPSK / 16QAM / 64QAM) 802.11ac: OFDM (BPSK / QPSK / 16QAM / 64QAM / 256		,	AM)	
Antenna Function Description	Ant. 1 Ant. 2 802.11 b/g/n/ac V V 802.11 b/g/n/ac V V			

Note: MIMO Ant. 1+2 is a calculated result from sum of the power MIMO Ant. 1 and MIMO Ant. 2.

1.3 Modification of EUT

No modifications are made to the EUT during all test items.

1.4 Testing Location

Test Site SPORTON INTERNATIONAL INC.		
Test Site Location	No.52, Huaya 1st Rd., Guishan Dist., Taoyuan City, Taiwan (R.O.C.) TEL: +886-3-327-3456 FAX: +886-3-328-4978	
Test Site No.	Sporton Site No. TH05-HY	

Note: The test site complies with ANSI C63.4 2014 requirement.

Test Site	SPORTON INTERNATIONAL INC.	
Test Site Location	No.58, Aly. 75, Ln. 564, Wenhua 3rd, Rd., Guishan Dist., Taoyuan City, Taiwan (R.O.C.) TEL: +886-3-327-0868 FAX: +886-3-327-0855	
Test Site No.	Sporton Site No.	
rest one No.	03CH12-HY	

Note: The test site complies with ANSI C63.4 2014 requirement.

FCC Designation No. TW1190 and TW0007

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1.5 Applicable Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

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- FCC Part 15 Subpart C §15.247
- FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v05
- FCC KDB 414788 D01 Radiated Test Site v01r01.
- FCC KDB 662911 D01 Multiple Transmitter Output v02r01.
- ANSI C63.10-2013

Remark:

- 1. All test items were verified and recorded according to the standards and without any deviation during the test.
- 2. This EUT has also been tested and complied with the requirements of FCC Part 15, Subpart B, recorded in a separate test report.

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2 Test Configuration of Equipment Under Test

The EUT has been associated with peripherals and configuration operated in a manner tended to maximize its emission characteristics in a typical application. Frequency range investigated: radiation emission (9 kHz to the 10th harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower). For radiated measurement, pre-scanned in EUT with cradle and three orthogonal panels (X, Y, Z) without cradle. The worst cases (EUT with cradle) were recorded in this report.

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2.1 Carrier Frequency and Channel

Frequency Band	Channel	Freq. (MHz)	Channel	Freq. (MHz)
	1	2412	7	2442
	2	2417	8	2447
2400 2492 5 MHz	3	2422	9	2452
2400-2483.5 MHz	4	2427	10	2457
	5	2432	11	2462
	6	2437		

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2.2 Test Mode

Final test modes are considering the modulation and worse data rates as below table.

Single Mode (Covered by MIMO Mode)

Modulation	Data Rate
802.11b	1 Mbps
802.11g	6 Mbps
802.11n HT20	MCS0
802.11n HT40	MCS0
802.11ac VHT20	MCS0
802.11ac VHT40	MCS0

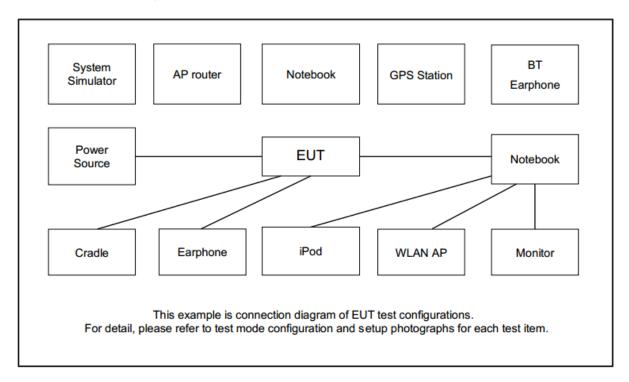
Report No. : FR911730-01C

MIMO Mode

Modulation	Data Rate
802.11b	1 Mbps
802.11g	6 Mbps
802.11n HT20 (Covered by VHT20)	MCS0
802.11n HT40 (Covered by VHT40)	MCS0
802.11ac VHT20	MCS0
802.11ac VHT40	MCS0

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2.3 Connection Diagram of Test System



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2.4 EUT Operation Test Setup

The RF test items, utility "QRCT" was installed in Notebook which was programmed in order to make the EUT get into the engineering modes to provide channel selection, power level, data rate and the application type and for continuous transmitting signals.

2.5 Measurement Results Explanation Example

For all conducted test items:

The offset level is set in the spectrum analyzer to compensate the RF cable loss and attenuator factor between EUT conducted output port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level is exactly the EUT RF output level.

Example:

The spectrum analyzer offset is derived from RF cable loss and attenuator factor.

Offset = RF cable loss + attenuator factor.

Following shows an offset computation example with cable loss 4.2 dB and 10dB attenuator.

 $Offset(dB) = RF \ cable \ loss(dB) + attenuator \ factor(dB).$

= 4.2 + 10 = 14.2 (dB)

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3 Test Result

3.1 6dB and 99% Bandwidth Measurement

3.1.1 Limit of 6dB and 99% Bandwidth

The minimum 6 dB bandwidth shall be at least 500 kHz.

3.1.2 Measuring Instruments

See list of measuring equipment of this test report.

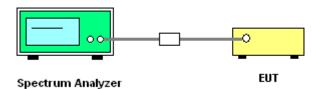
3.1.3 Test Procedures

- 1. The testing follows the ANSI C63.10 Section 6.9.3 (OBW) and 11.8.1 (6dB BW).
- 2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.

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- 3. Set to the maximum power setting and enable the EUT transmit continuously.
- 4. Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 100 kHz. Set the Video bandwidth (VBW) = 300 kHz. In order to make an accurate measurement. The 6 dB bandwidth must be greater than 500 kHz.
- For 99% Bandwidth Measurement, the spectrum analyzer's resolution bandwidth (RBW) is set1-5% of the emission bandwidth and set the Video bandwidth (VBW) ≥ 3 * RBW.
- 6. Measure and record the results in the test report.

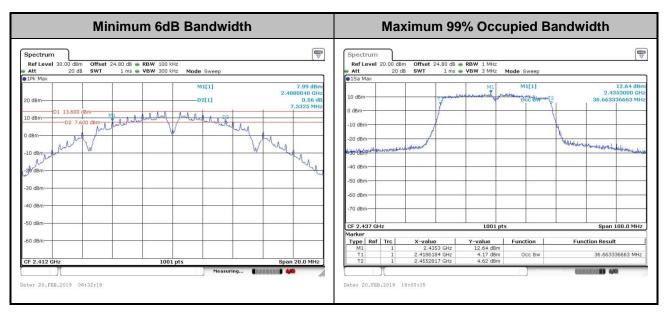
3.1.4 Test Setup



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3.1.5 Test Result of 6dB and 99% Occupied Bandwidth

Please refer to Appendix A.



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Note: The occupied channel bandwidth is maintained within the band of operation for all of the modulations.

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3.2 Output Power Measurement

3.2.1 Limit of Output Power

For systems using digital modulation in the 2400-2483.5MHz, the limit for output power is 30dBm. If transmitting antenna with directional gain greater than 6dBi is used, the output power from the intentional radiator shall be reduced below the above stated value by the amount in dB that the directional gain of the antenna exceeds 6 dBi. In case of point-to-point operation, the limit has to be reduced by 1dB for every 3dB that the directional gain of the antenna exceeds 6dBi.

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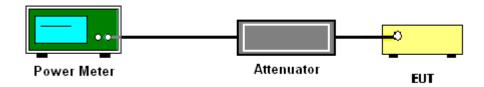
3.2.2 Measuring Instruments

See list of measuring equipment of this test report.

3.2.3 Test Procedures

- For Average Power, the testing follows ANSI C63.10 Section 11.9.2.3.2 Method AVGPM-G.
- 2. The RF output of EUT was connected to the power meter by RF cable and attenuator. The path loss was compensated to the results for each measurement.
- 3. Set to the maximum power setting and enable the EUT transmit continuously.
- 4. Measure the conducted output power and record the results in the test report.
- 5. For MIMO mode, calculation method follows FCC KDB 662911 D01 Multiple Transmitter Output v02r01.

3.2.4 Test Setup



3.2.5 Test Result of Average output Power

Please refer to Appendix A.

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3.3 Power Spectral Density Measurement

3.3.1 Limit of Power Spectral Density

The peak power spectral density shall not be greater than 8dBm in any 3kHz band at any time interval of continuous transmission.

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3.3.2 Measuring Instruments

See list of measuring equipment of this test report.

3.3.3 Test Procedures

- 1. The testing follows the ANSI C63.10 Section 11.10.2 Method PKPSD.
- 2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
- 3. Set to the maximum power setting and enable the EUT transmit continuously.
- 4. Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 3 kHz. Video bandwidth VBW = 10 kHz In order to make an accurate measurement, set the span to 1.5 times DTS Channel Bandwidth. (6dB BW)
- 5. Detector = peak, Sweep time = auto couple, Trace mode = max hold, Allow trace to fully stabilize. Use the peak marker function to determine the maximum power level.
- 6. Measure and record the results in the test report.
- 7. For MIMO mode, calculation method follows FCC KDB 662911 D01 Multiple Transmitter Output v02r01.

If measurements performed using method (2) plus 10 log (N) exceeds the emission limit, the test should choose method (1) before declaring that the device fails the emission limit.

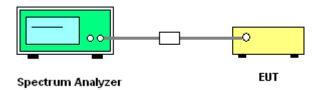
Method (1): Measure and sum the spectra across the outputs.

The total final Power Spectral Density is from a device with 2 transmitter outputs. The spectrum measurements of the individual outputs are all performed with the same span and number of points, the spectrum value in the first spectral bin of output 1 is summed with that in the first spectral bin of output 2 to obtain the value for the first frequency bin of the summed spectrum.

Method (2): Measure and add 10 log (N) dB, where N is the number of outputs. (N=2)

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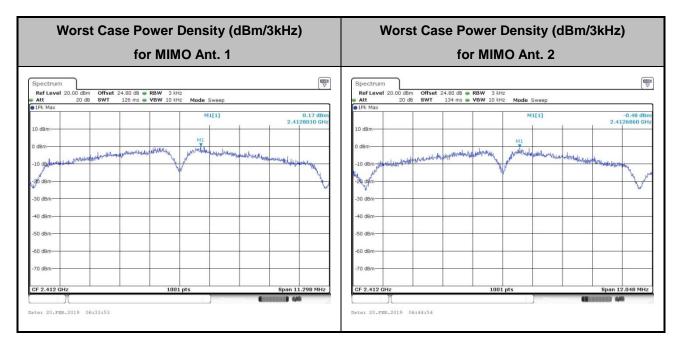
3.3.4 Test Setup



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3.3.5 Test Result of Power Spectral Density

Please refer to Appendix A.



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3.4 Conducted Band Edges and Spurious Emission Measurement

3.4.1 Limit of Conducted Band Edges and Spurious Emission Measurement

In any 100 kHz bandwidth outside of the authorized frequency band, the emissions which fall in the non-restricted bands shall be attenuated at least 20 dB / 30dB relative to the maximum PSD level in 100 kHz by RF conducted measurement.

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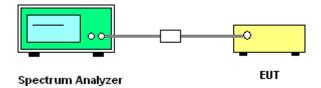
3.4.2 Measuring Instruments

See list of measuring equipment of this test report.

3.4.3 Test Procedures

- 1. The testing follows the ANSI C63.10 Section 11.11.3 Emission level measurement
- 2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
- 3. Set to the maximum power setting and enable the EUT transmit continuously.
- 4. Set RBW = 100 kHz, VBW=300 kHz, Peak Detector. Unwanted Emissions measured in any 100 kHz bandwidth outside of the authorized frequency band shall be attenuated by at least 20 dB relative to the maximum in-band peak PSD level in 100 kHz when maximum peak conducted output power procedure is used. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required under this paragraph shall be 30 dB instead of 20 dB per 15.247(d).
- 5. Measure and record the results in the test report.
- The RF fundamental frequency should be excluded against the limit line in the operating frequency band.

3.4.4 Test Setup



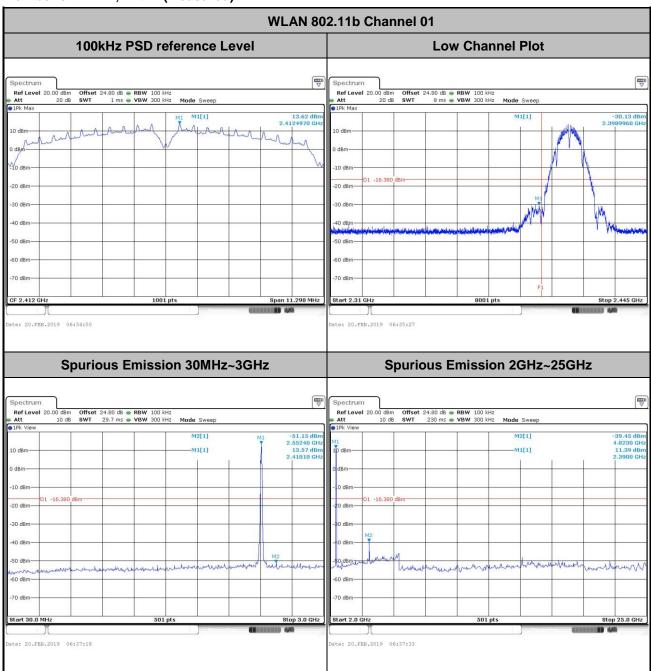
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3.4.5 Test Result of Conducted Band Edges and Spurious Emission

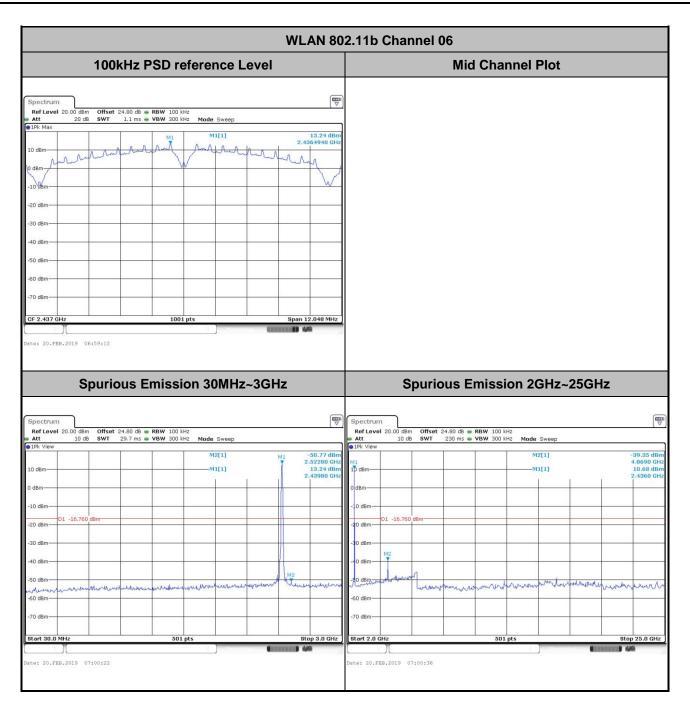
Tost Engineer:	Howard Lin and Shiming Liu	Temperature :	21~25℃
rest Engineer.		Relative Humidity :	51~54%

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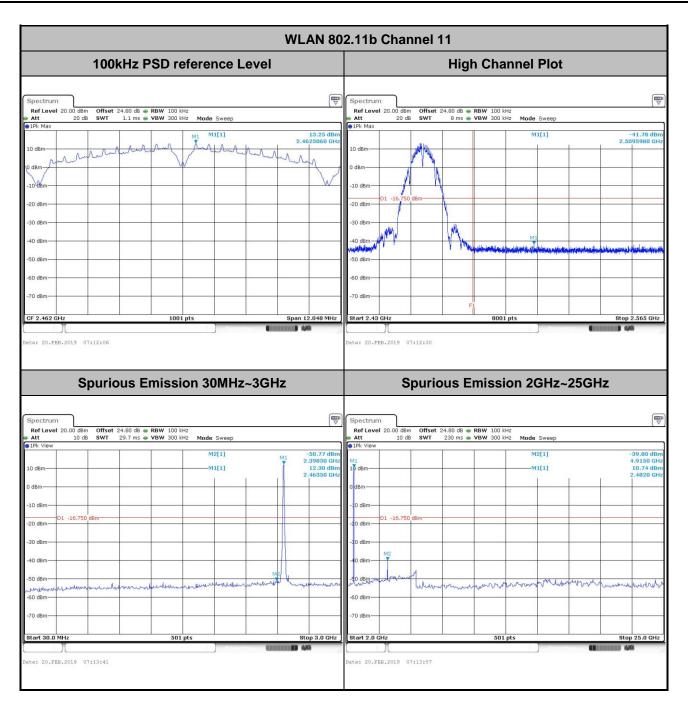
Number of TX = 2, Ant. 1 (Measured)



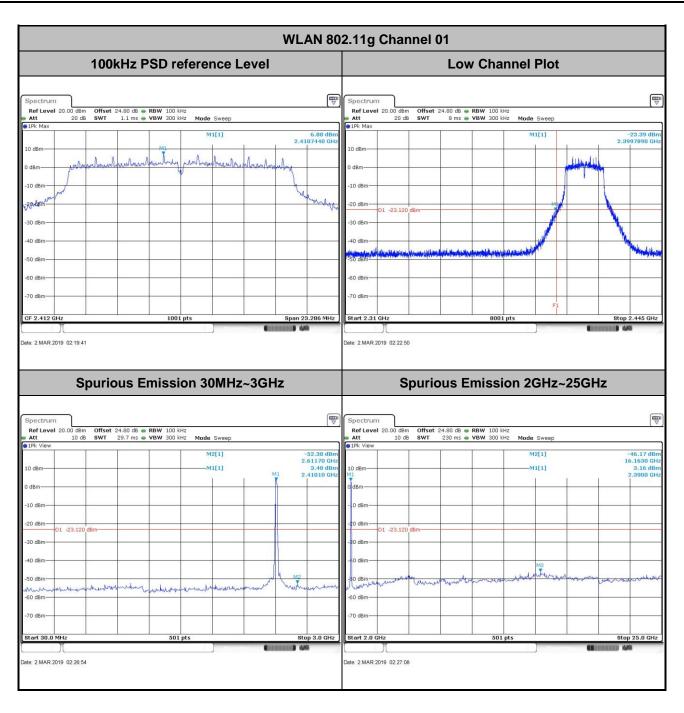
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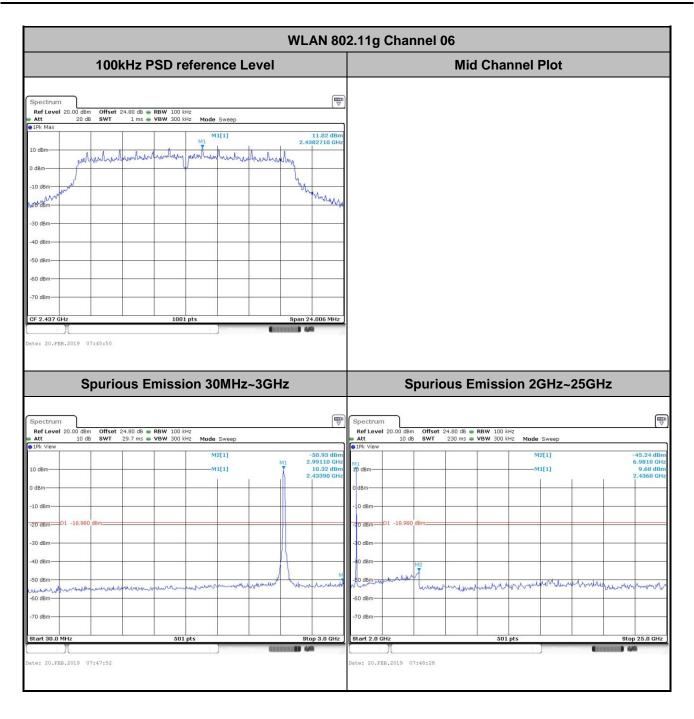
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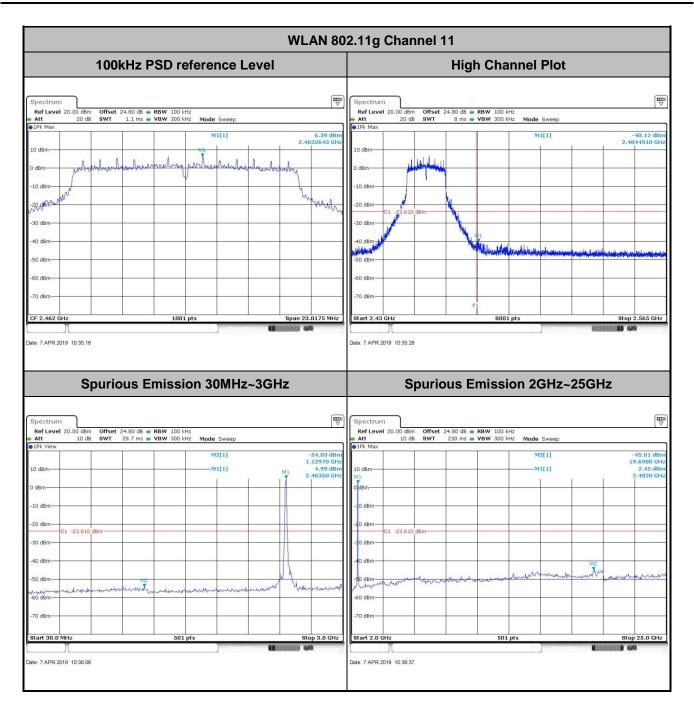
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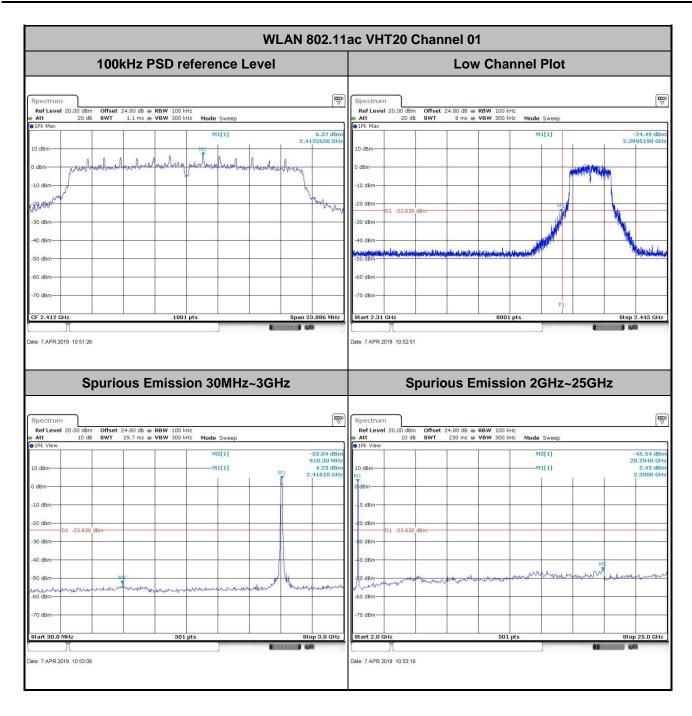
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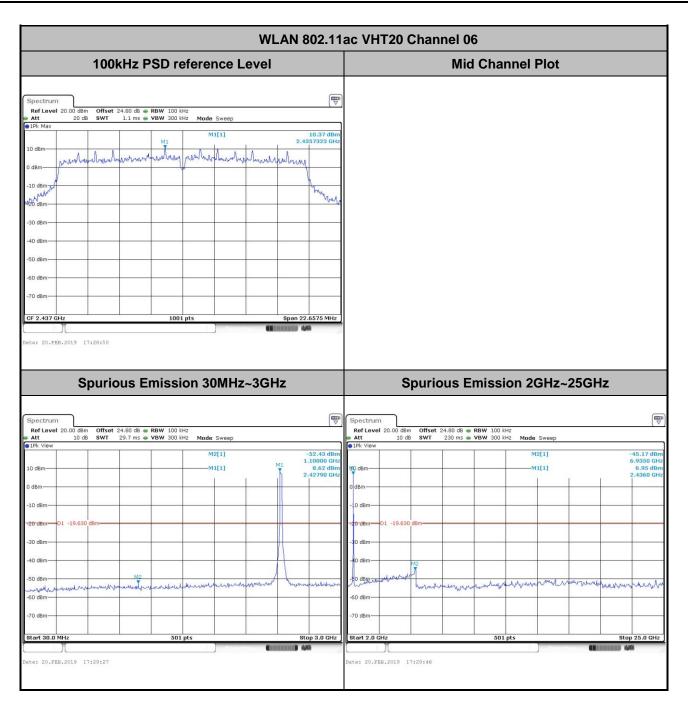
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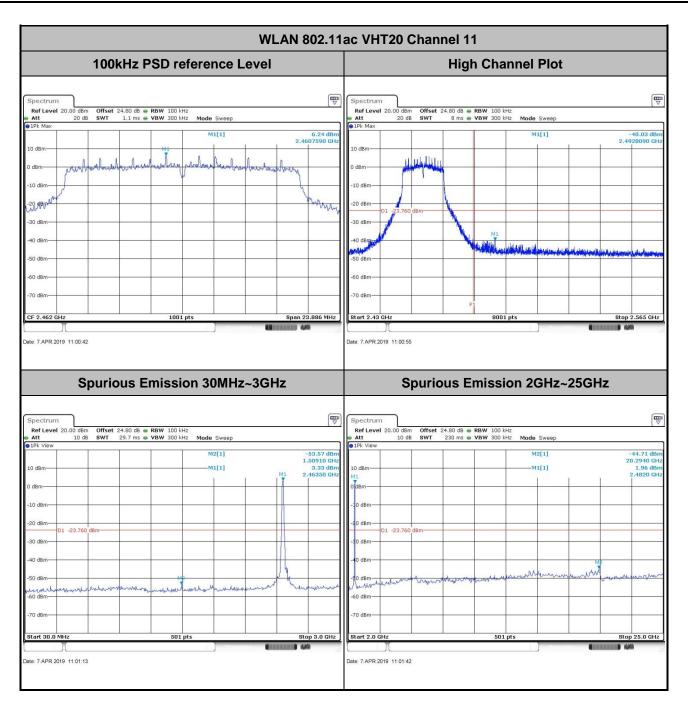
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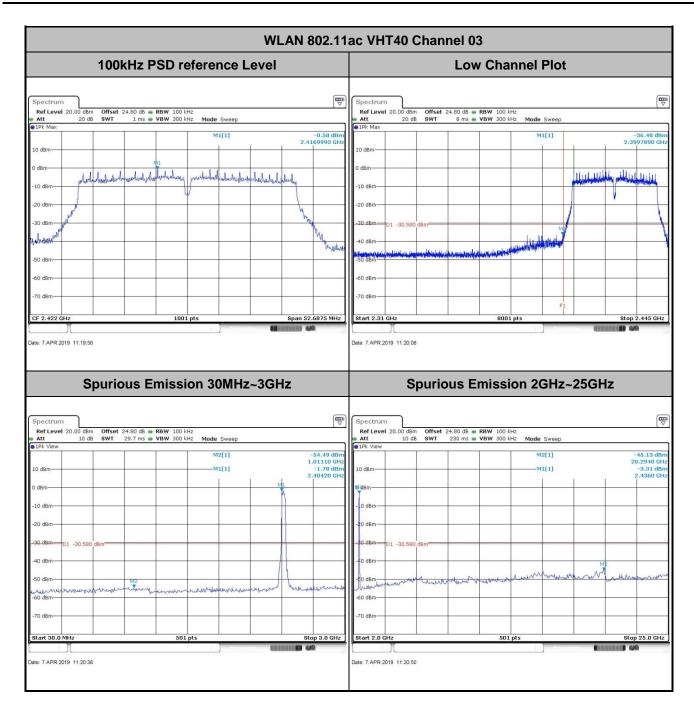
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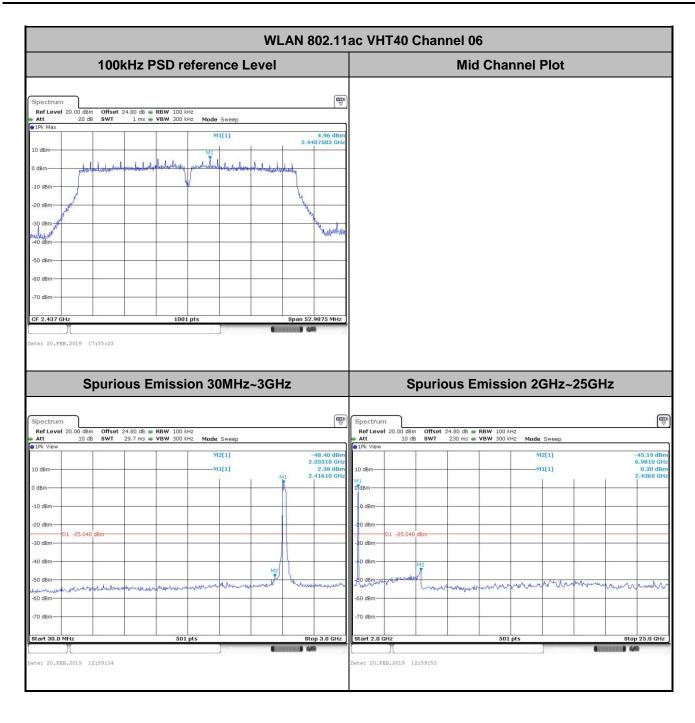
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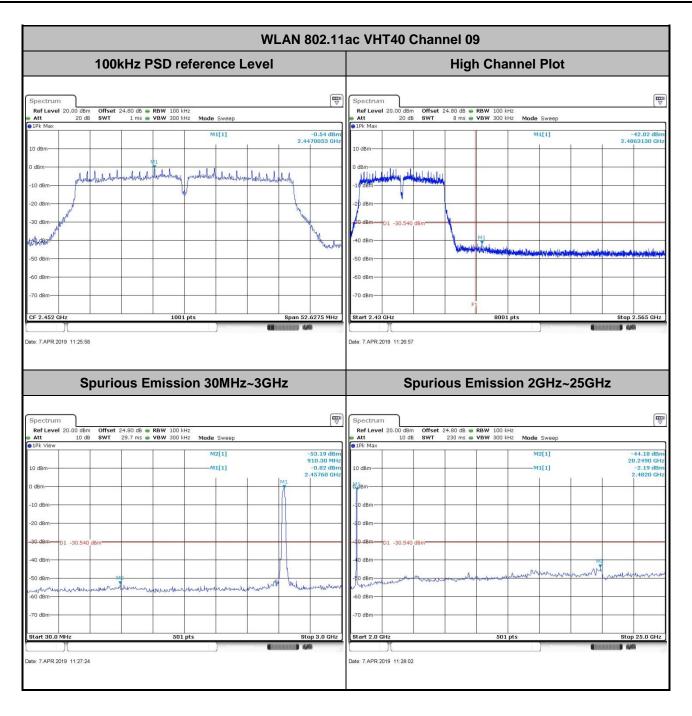
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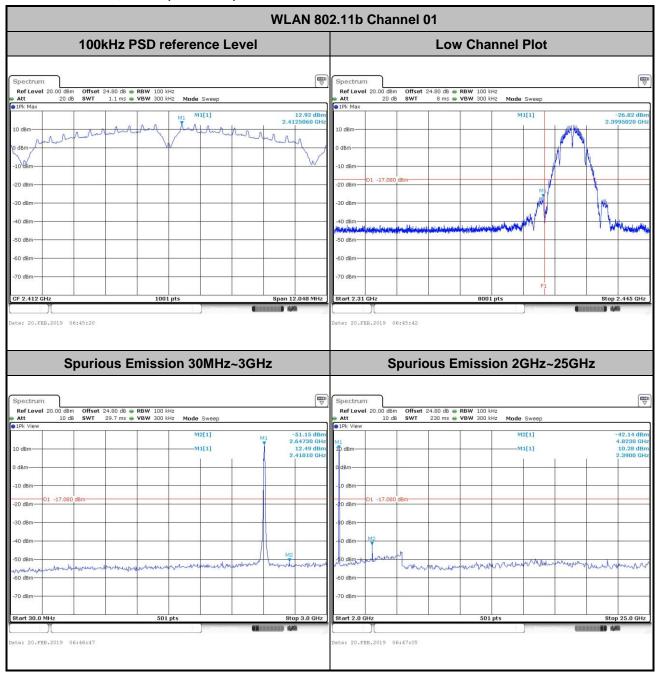


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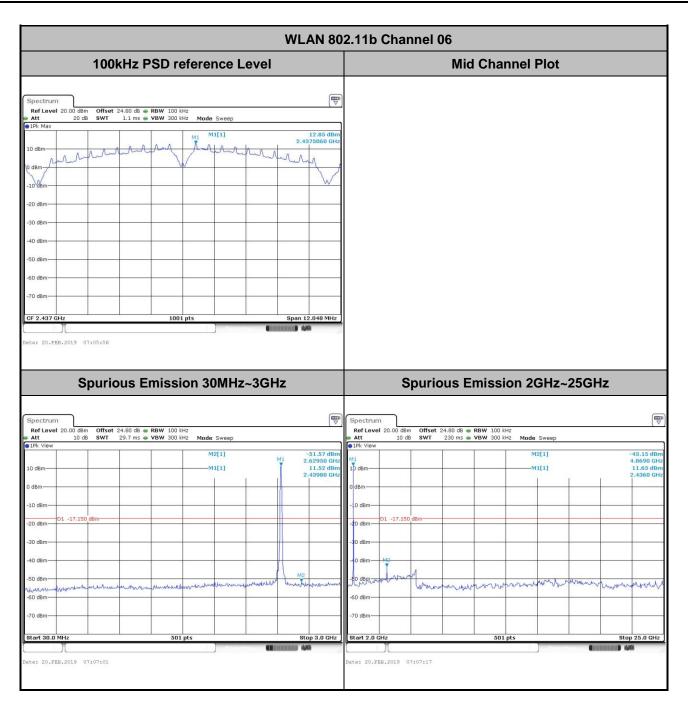
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Number of TX = 2, Ant. 2 (Measured)

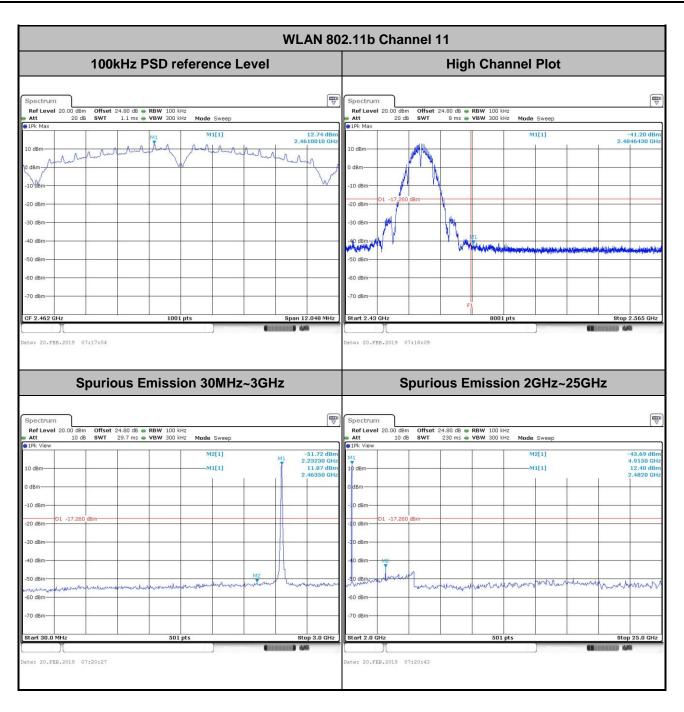


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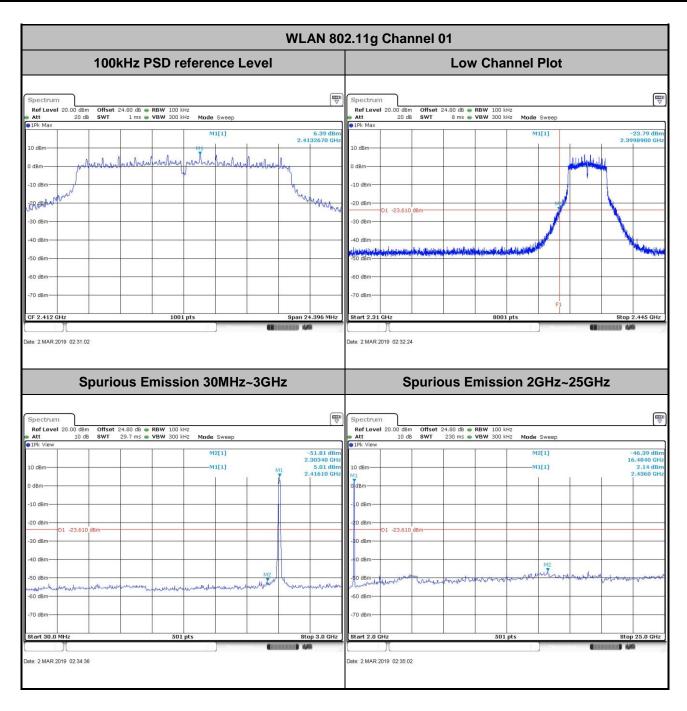
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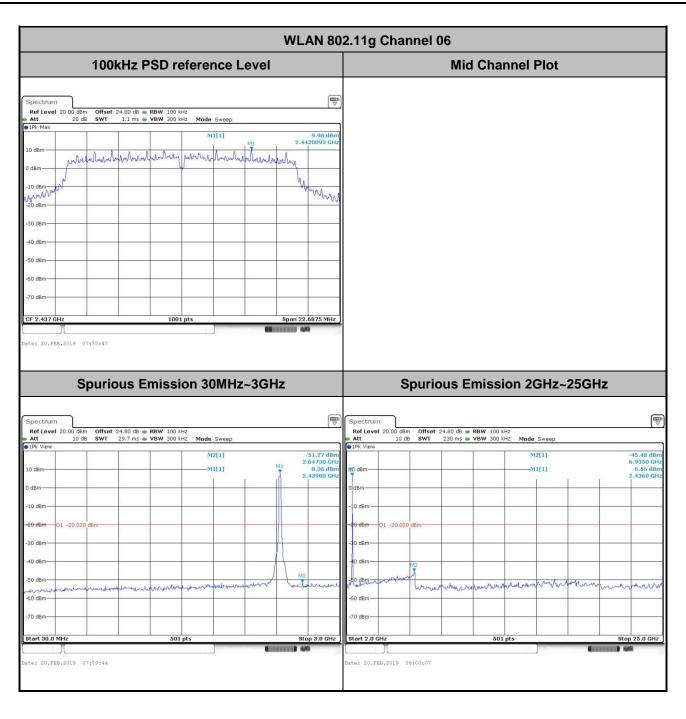
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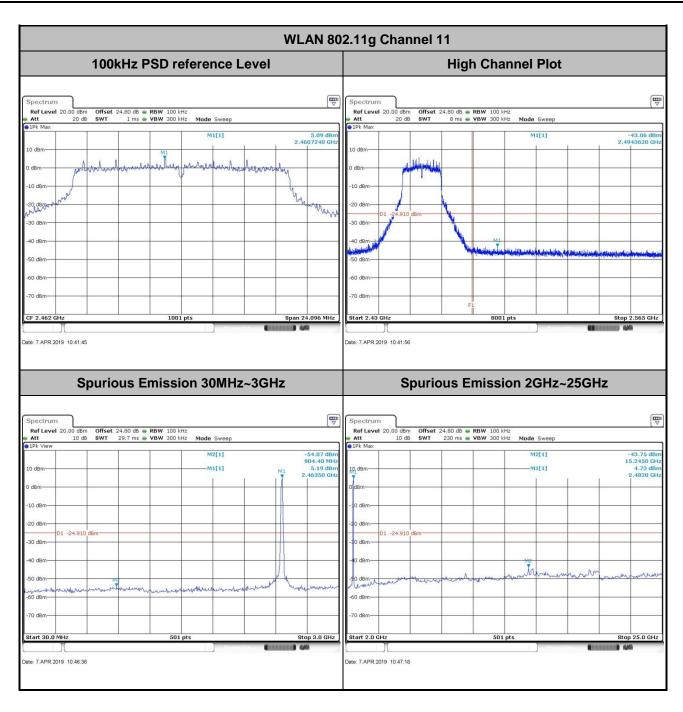
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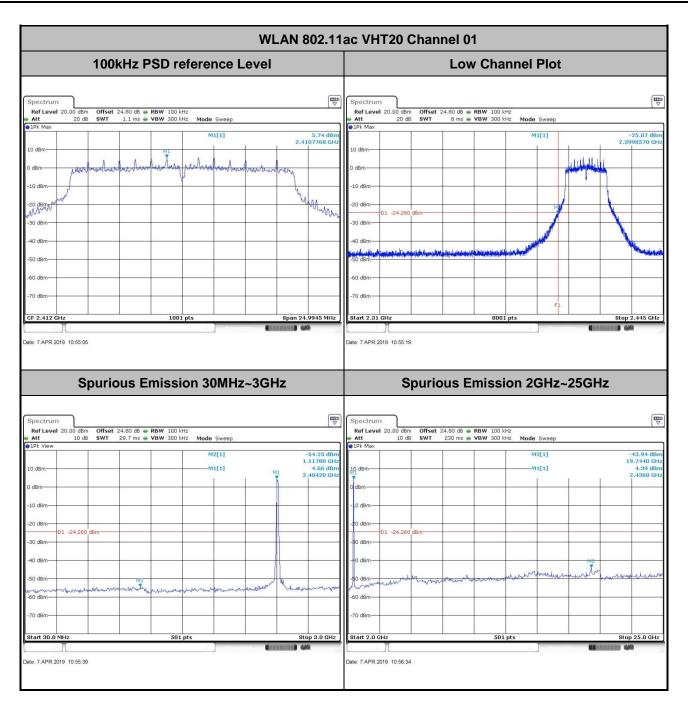
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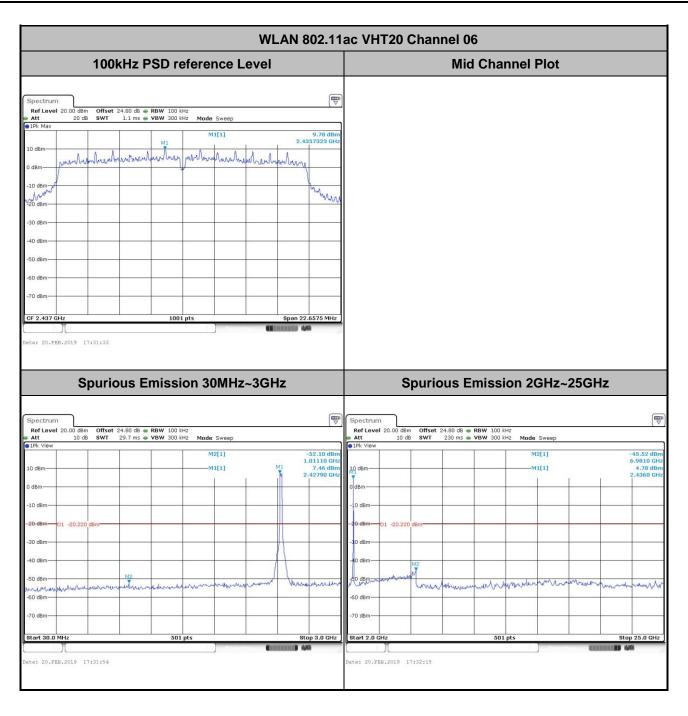
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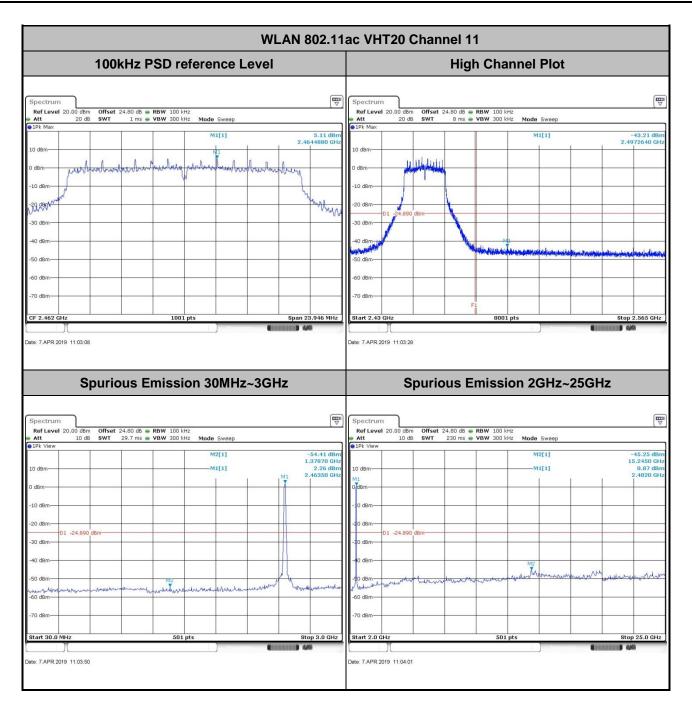
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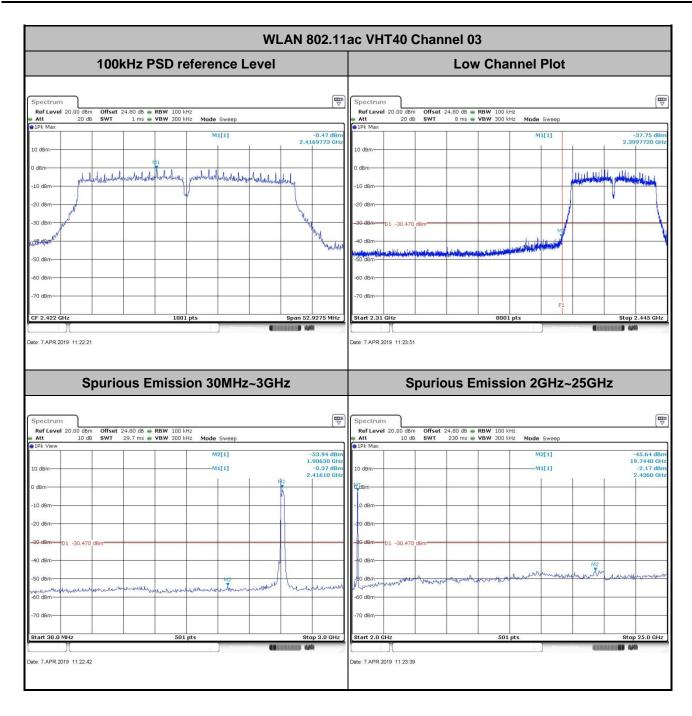
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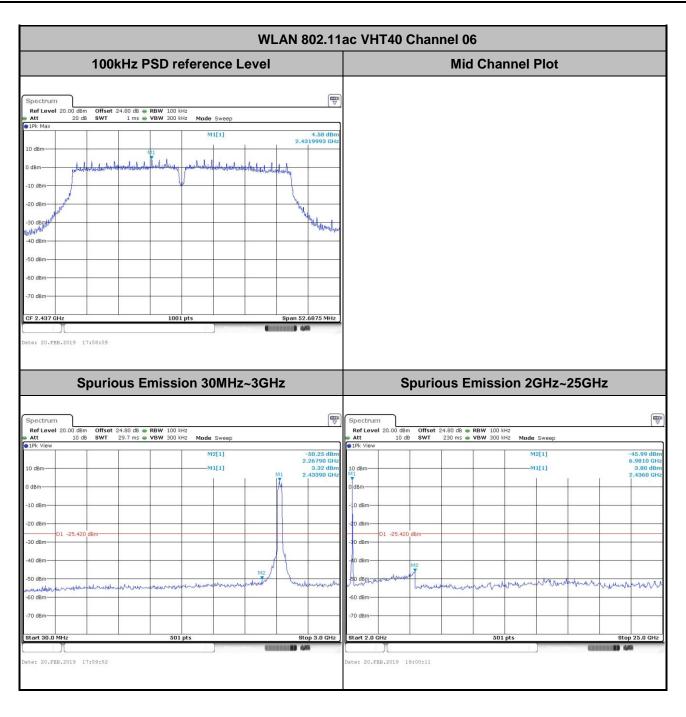
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