Transmitter Minimum 6 dB Bandwidth (5.725-5.85 GHz band) (continued)

Test Equipment Used:

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M2001	Thermohygrometer	Testo	608-H1	45041824	22 Feb 2018	12
M1883	Signal Analyser	Rohde & Schwarz	FSV-30	103084	02 May 2018	12
M260	Signal Generator	Rohde & Schwarz	SMP 02	829076/008	11 Apr 2018	12
A2919	20 dB Attenuator	AtlanTecRF	AN18W5-20	832828#2	Calibrated before use	-
A2920	20 dB Attenuator	AtlanTecRF	AN18W5-20	832828#3	Calibrated before use	-
A2555	50Ω Termination	Micronde	R404610	Not marked or stated	Calibrated before use	-

5.2.5. Transmitter Duty Cycle

Test Summary:

Test Engineer:	Philip Harrison	Test Dates:	05 June 2017 to 11 July 2017
Test Sample Serial Number:	04423851816340100265		

FCC Reference:	Part 15.35(c)
Test Method Used:	KDB 789033 D02 Section II.B.2.b)

Environmental Conditions:

Temperature (°C):	20 to 24
Relative Humidity (%):	45 to 58

Note(s):

1. In order to assist with the determination of the average level of fundamental and spurious emissions field strength, measurements were made of duty cycle to determine the transmission duration and the silent period time of the transmitter. The transmitter duty cycle was measured using a signal analyser in the time domain and calculated by using the following calculation:
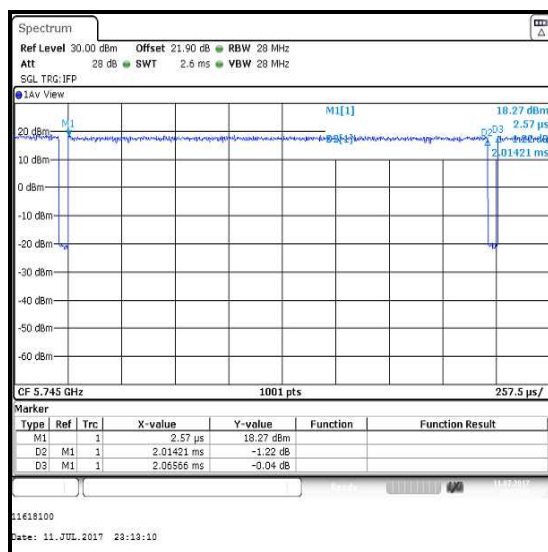
   10 log 1 / (On Time / [Period or 100ms whichever is the lesser]).

2. Plots below are for data rates with a duty cycle less than 98%. Results for all other modes are archived on the UL VS LTD IT server and available for inspection if required.
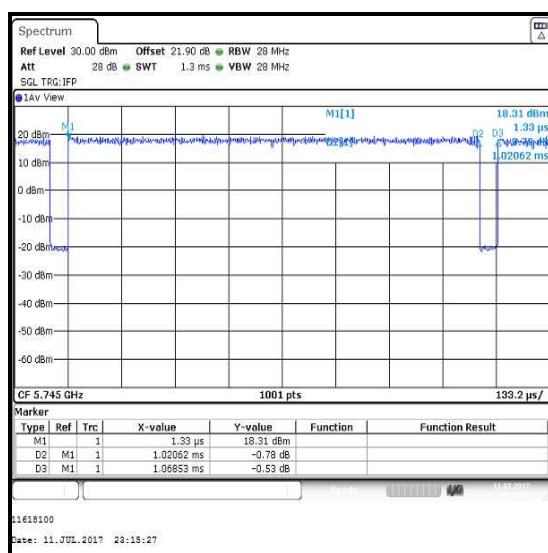
Test setup:

Transmitter Duty Cycle (continued)

Results: 802.11a / 20 MHz / SISO / 6 Mbit/s

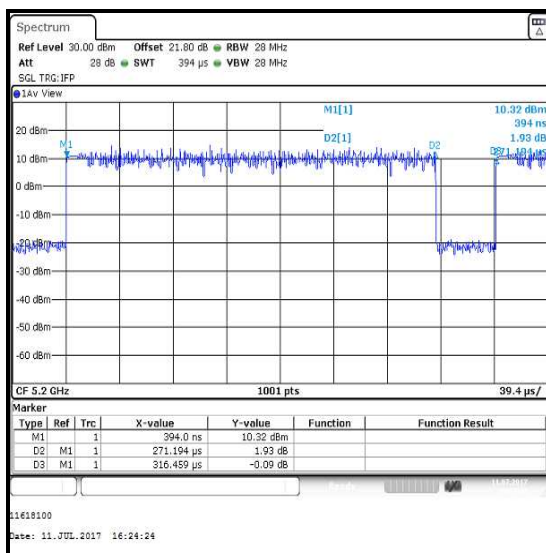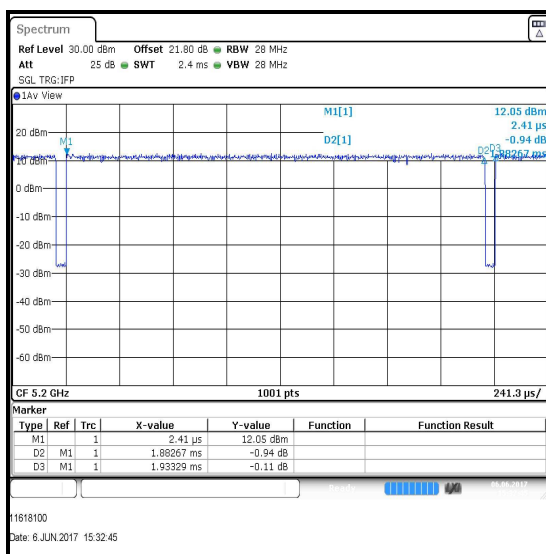| Pulse Duration (ms)	Period (ms)	Duty Cycle Correction Factor (dB)
2.0142	2.0657	0.1

Results: 802.11a / 20 MHz / SISO / 12 Mbit/s

Pulse Duration (ms)	Period (ms)	Duty Cycle Correction Factor (dB)
1.0206	1.0685	0.2

Transmitter Duty Cycle (continued)

Results: 802.11a / 20 MHz / SISO / 48 Mbit/s

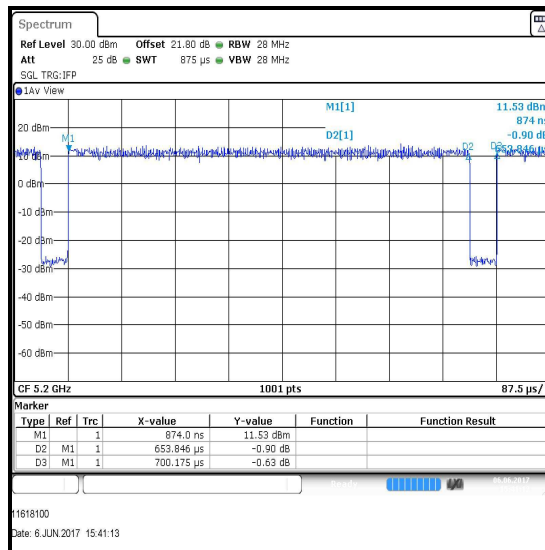| Pulse Duration (ms)	Period (ms)	Duty Cycle Correction Factor (dB)
0.2712	0.3165	0.7

Results: 802.11n / 20 MHz / SISO / 6.5 Mbit/s / MCS0

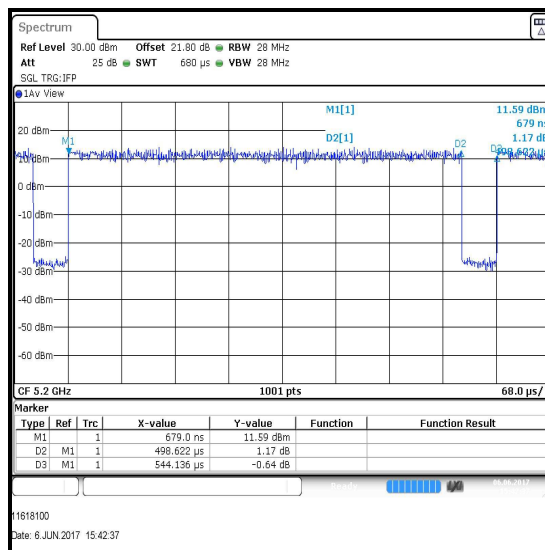| Pulse Duration (ms)	Period (ms)	Duty Cycle Correction Factor (dB)
1.8827	1.9333	0.1

Transmitter Duty Cycle (continued)

Results: 802.11n / 20 MHz / SISO / 19.5 Mbit/s / MCS2

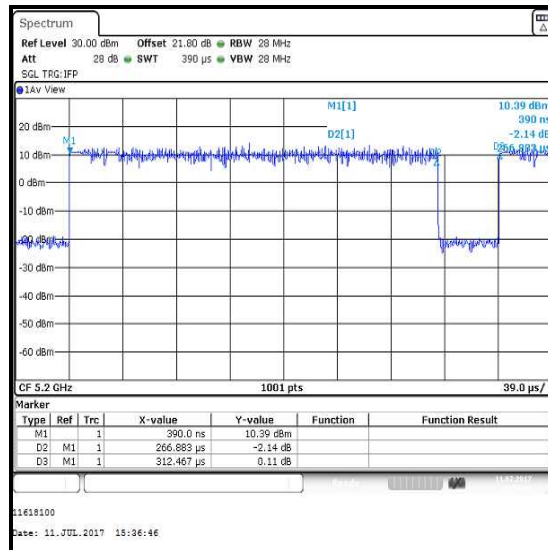| Pulse Duration (ms)	Period (ms)	Duty Cycle Correction Factor (dB)
0.6538	0.7002	0.3

Results: 802.11n / 20 MHz / SISO / 26 Mbit/s / MCS3

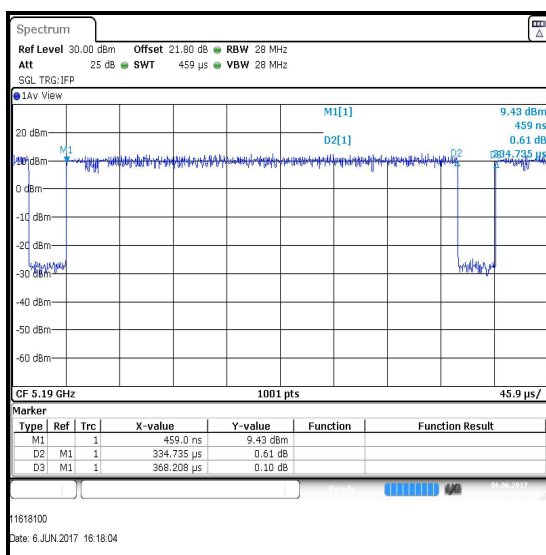| Pulse Duration (ms)	Period (ms)	Duty Cycle Correction Factor (dB)
0.4986	0.5441	0.4

Transmitter Duty Cycle (continued)

Results: 802.11n / 20 MHz / SISO / 52 Mbit/s / MCS5

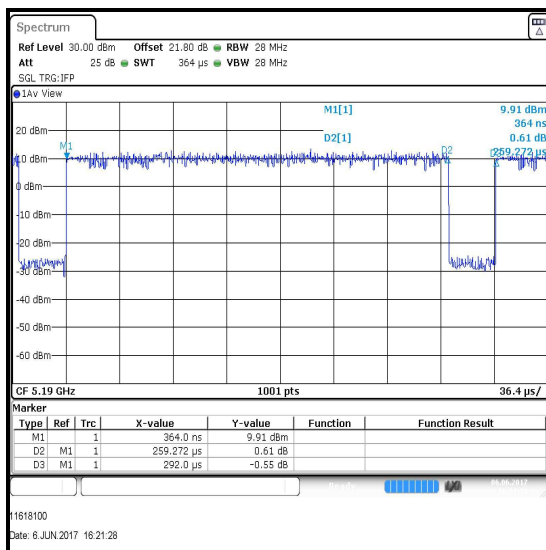| Pulse Duration (ms)	Period (ms)	Duty Cycle Correction Factor (dB)
0.2669	0.3125	0.7

Transmitter Duty Cycle (continued)

Results: 802.11n / 40 MHz / SISO / 40.5 Mbit/s / MCS2

Pulse Duration (ms)	Period (ms)	Duty Cycle Correction Factor (dB)
0.3347	0.3682	0.4

Results: 802.11n / 40 MHz / SISO / 54 Mbit/s / MCS3

Pulse Duration (ms)	Period (ms)	Duty Cycle Correction Factor (dB)
0.2593	0.2920	0.5

Transmitter Duty Cycle (continued)

Results: 802.11n / 40 MHz / SISO / 81 Mbit/s / MCS4

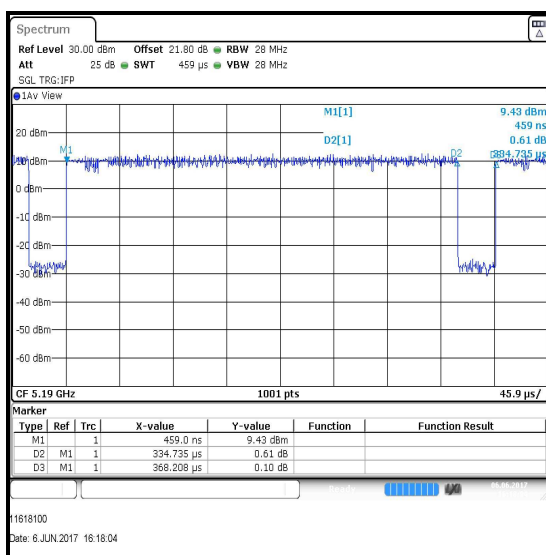| Pulse Duration (ms)	Period (ms)	Duty Cycle Correction Factor (dB)
0.3347	0.3682	0.4

Results: 802.11a / 20 MHz / MIMO / 6 Mbit/s

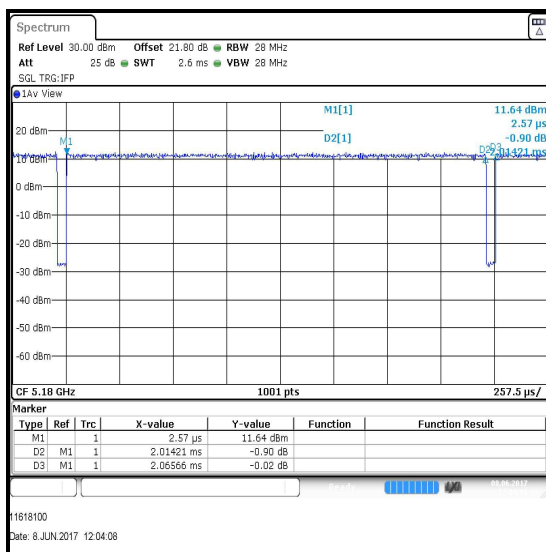| Pulse Duration (ms)	Period (ms)	Duty Cycle Correction Factor (dB)
2.0142	2.0657	0.1

Transmitter Duty Cycle (continued)

Results: 802.11a / 20 MHz / MIMO / 9 Mbit/s

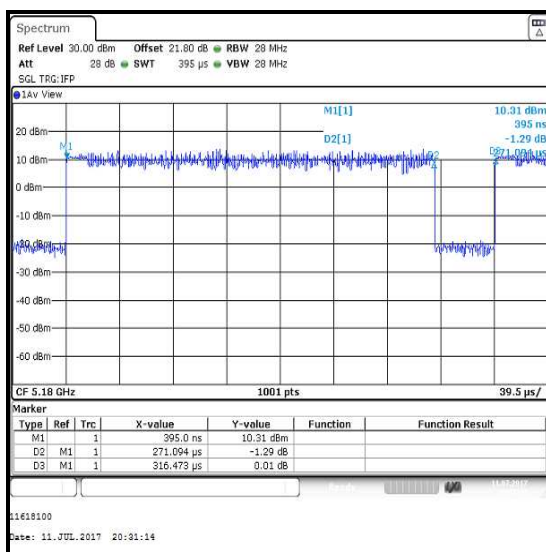| Pulse Duration (ms)	Period (ms)	Duty Cycle Correction Factor (dB)
1.3514	1.4004	0.2

Results: 802.11a / 20 MHz / MIMO / 48 Mbit/s

Pulse Duration (ms)	Period (ms)	Duty Cycle Correction Factor (dB)
0.2711	0.3165	0.7

Transmitter Duty Cycle (continued)

Results: 802.11n / 20 MHz / MIMO / 6.5 Mbit/s / MCS0

Pulse Duration (ms)	Period (ms)	Duty Cycle Correction Factor (dB)
1.8827	1.9333	0.1

Results: 802.11n / 20 MHz / MIMO / 26 Mbit/s / MCS3

Pulse Duration (ms)	Period (ms)	Duty Cycle Correction Factor (dB)
0.4986	0.5441	0.4

Transmitter Duty Cycle (continued)

Results: 802.11n / 20 MHz / MIMO / 52 Mbit/s / MCS5

Pulse Width (ms)	Pulse Period (ms)	Duty Cycle Correction factor (dB)
0.2381	0.2823	0.7

Transmitter Duty Cycle (continued)

Results: 802.11n / 40 MHz / MIMO / 27 Mbit/s / MCS1

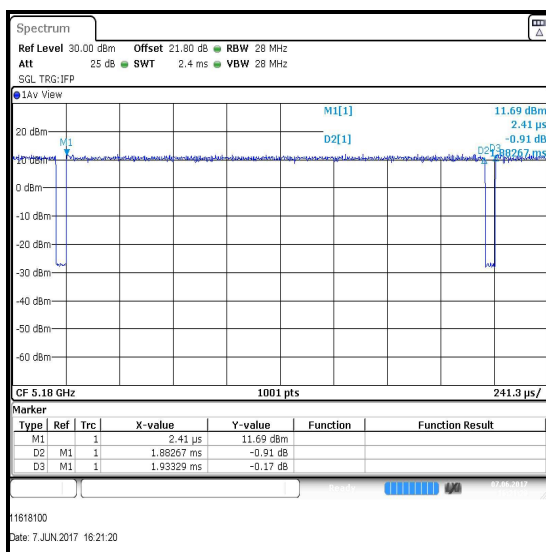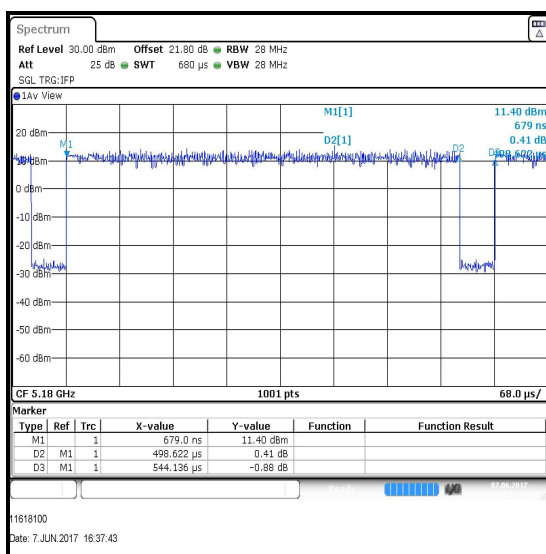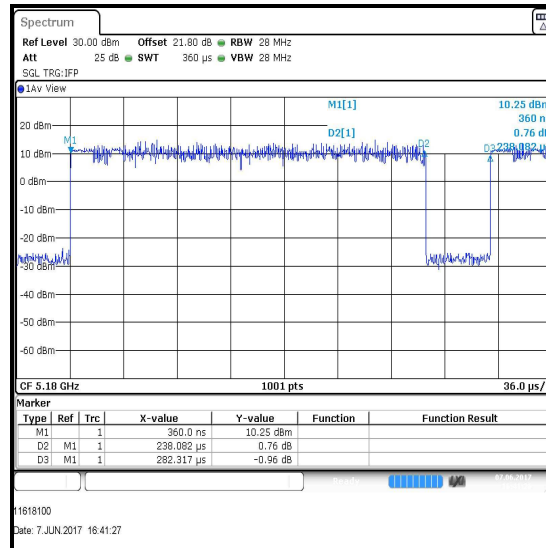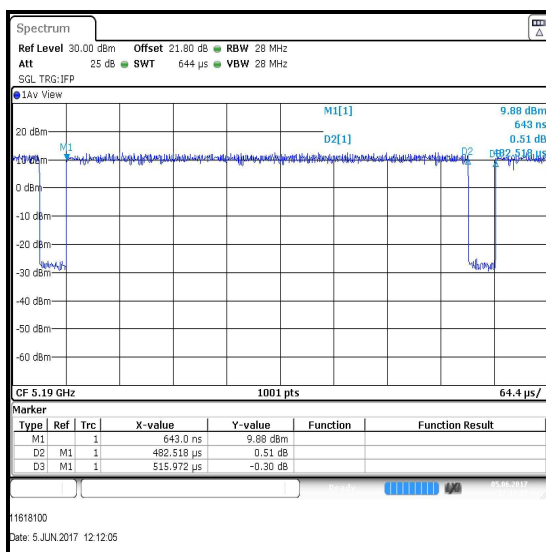| Pulse Duration (ms)	Period (ms)	Duty Cycle Correction Factor (dB)
0.4825	0.5160	0.3

Results: 802.11n / 40 MHz / MIMO / 54 Mbit/s / MCS3

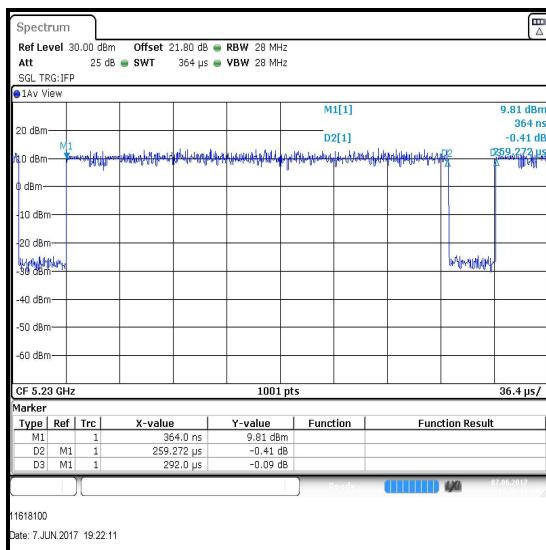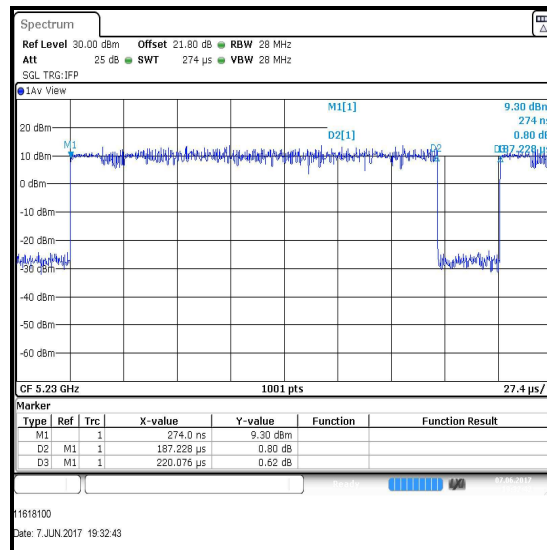| Pulse Duration (ms)	Period (ms)	Duty Cycle Correction Factor (dB)
0.2593	0.2920	0.5

Transmitter Duty Cycle (continued)

Results: 802.11n / 40 MHz / MIMO / 81 Mbit/s / MCS4

Pulse Duration (ms)	Period (ms)	Duty Cycle Correction Factor (dB)
0.1872	0.2201	0.7

Test Equipment Used:

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M2001	Thermohygrometer	Testo	608-H1	45041824	22 Feb 2018	12
M1883	Signal Analyser	Rohde & Schwarz	FSV-30	103084	02 May 2018	12
M260	Signal Generator	Rohde & Schwarz	SMP 02	829076/008	11 Apr 2018	12
A2919	20 dB Attenuator	AtlanTecRF	AN18W5-20	832828#2	Calibrated before use	-
A2920	20 dB Attenuator	AtlanTecRF	AN18W5-20	832828#3	Calibrated before use	-
A2555	50Ω Termination	Micronde	R404610	Not marked or stated	Calibrated Before Use	-

5.2.6. Transmitter Maximum Conducted Output Power (5.15-5.25 GHz band)

Test Summary:

Test Engineer:	Philip Harrison	Test Dates:	02 June 2017 to 18 August 2017
Test Sample Serial Number:	04423851816340100265		

FCC Reference:	Part 15.407(a)(1)(ii)
Test Method Used:	KDB 789033 D02 Section II.E.2.d)

Environmental Conditions:

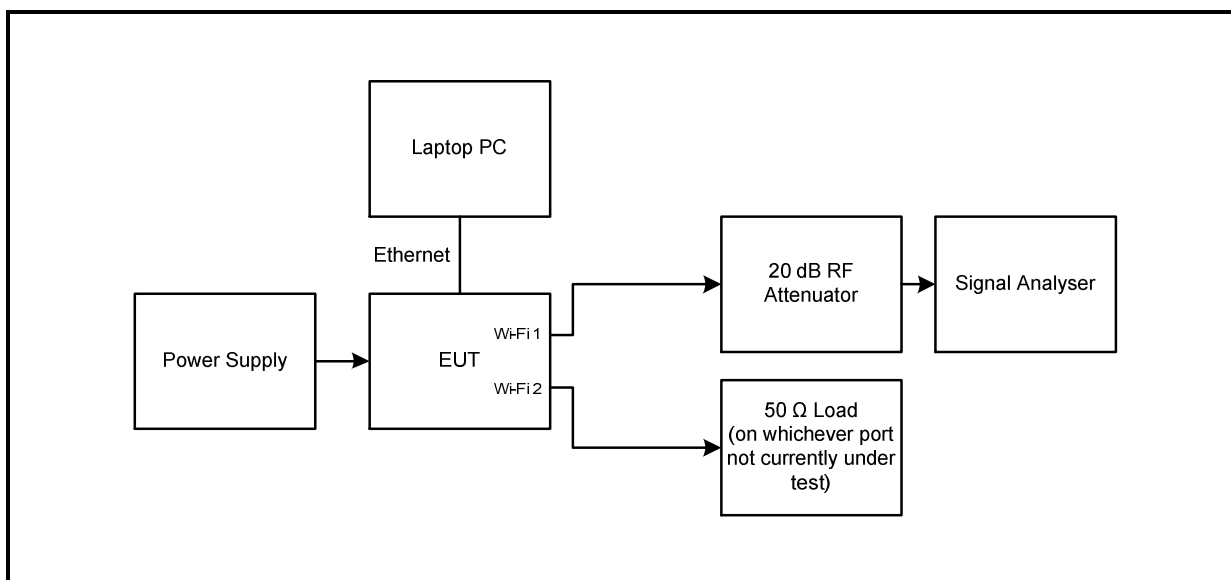| Temperature (°C):	20 to 24
Relative Humidity (%):	45 to 58

Note(s):

1. The measurements were performed in accordance with FCC KDB 789033 II.E.2.d) Method SA-2.

2. All supported modes and channel widths were initially investigated on one channel. The modes that produced the highest power and therefore deemed worst case were:

   o   802.11a SISO – Antenna Wi-Fi 1 / 48 Mbit/s

   o   802.11n HT20 SISO – Antenna Wi-Fi 1 / 52 Mbit/s / MCS5

   o   802.11n HT40 SISO – Antenna Wi-Fi 2 / 81 Mbit/s / MCS4

   o   802.11a MIMO with CDD - 6 Mbit/s

   o   802.11n HT20 MIMO with CDD – 52 Mbit/s / MCS5

   o   802.11n HT40 MIMO with CDD – 81 Mbit/s / MCS4

   Measurements were then performed in these modes on bottom, middle and top channels in all operating bands.

3. For SISO modes only the port which produced the highest output power has been in the tables below.

4. For MIMO modes both ports are recorded in the tables below. They were additionally then combined using the measure-and-sum method stated in FCC KDB 662911.

5. Both EUT antennas have a gain of 2.0 dBi. Therefore the conducted limit was not reduced since the gain is <6 dBi.
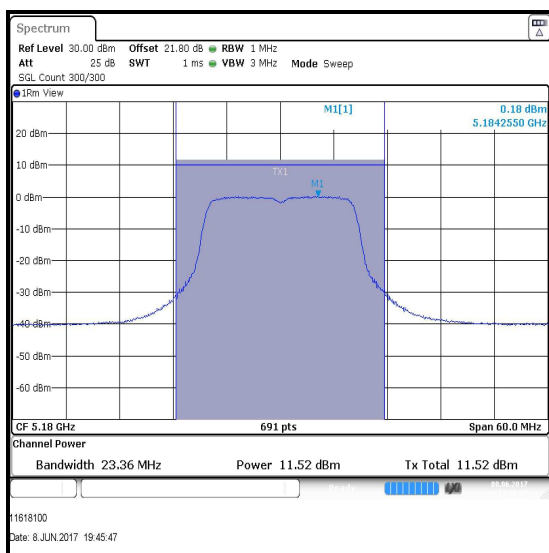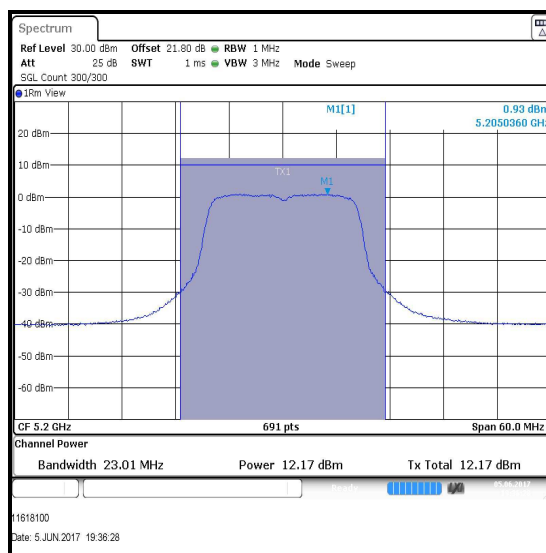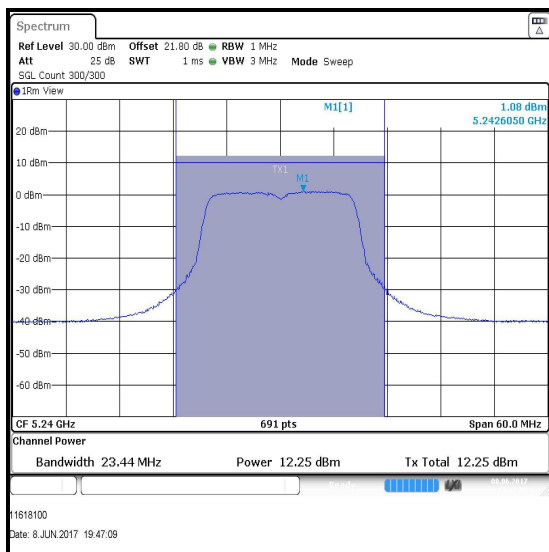
Transmitter Maximum Conducted Output Power (5.15-5.25 GHz band) (continued)

Note(s) continued:

6. For MIMO modes, the worst-case modes were with CDD on. Therefore for these reported modes the data stream is correlated as it is single stream with CDD on. The directional antenna gain has has no additional array gain in accordance with KDB 662911 D01 F) 2) f) i). This is due to being a wideband signal and therefore not simultaneously correlated across the whole bandwidth of the entire signal.

7. The signal analyser was connected to the RF port on the EUT using suitable attenuation and RF cable. An RF level offset was entered on the signal analyser to compensate for the loss of the attenuator and RF cable.

8. The Part 15.407(a)(1)(ii) limit shall not exceed 1W (30.0 dBm).
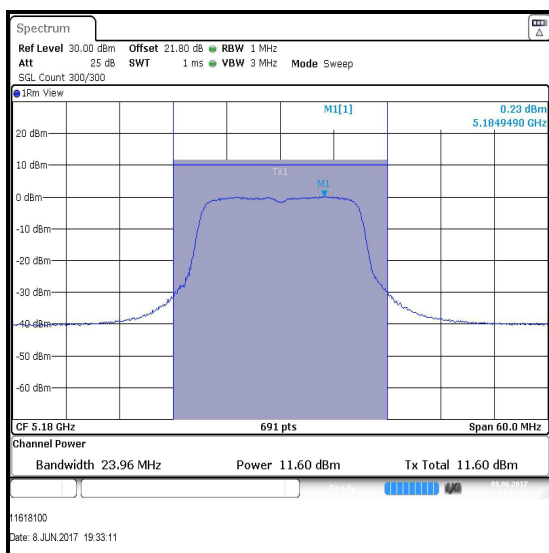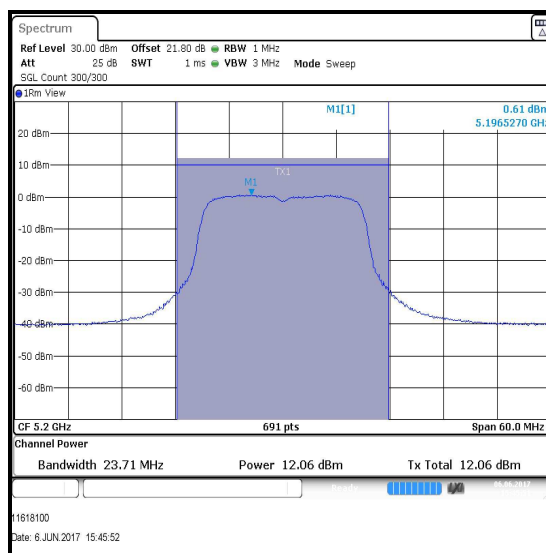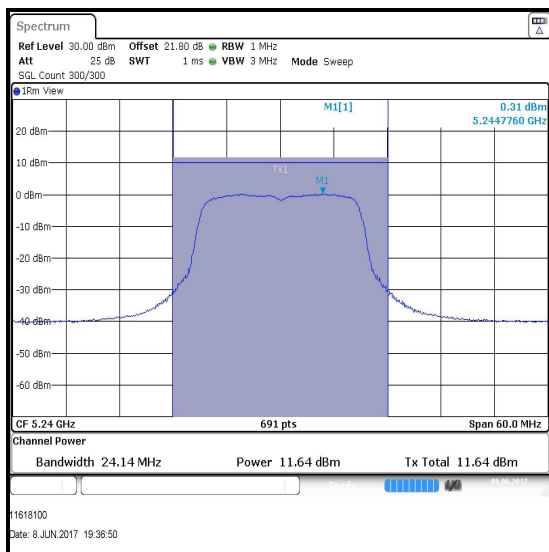
Test setup:

Transmitter Maximum Conducted Output Power (5.15-5.25 GHz band) (continued)

Results: 802.11a / 20 MHz / SISO / 64-QAM / 48 Mbit/s / Port Wi-Fi 1

Channel	Frequency (MHz)	Conducted Power (dBm)	Duty cycle correction factor (dB)	Corrected Conducted Power (dBm)	Limit (dBm)	Margin (dB)	Result
Bottom	5180	11.5	0.7	12.2	30.0	17.8	Complied
Middle	5200	12.2	0.7	12.9	30.0	17.1	Complied
Top	5240	12.2	0.7	12.9	30.0	17.1	Complied

Bottom Channel

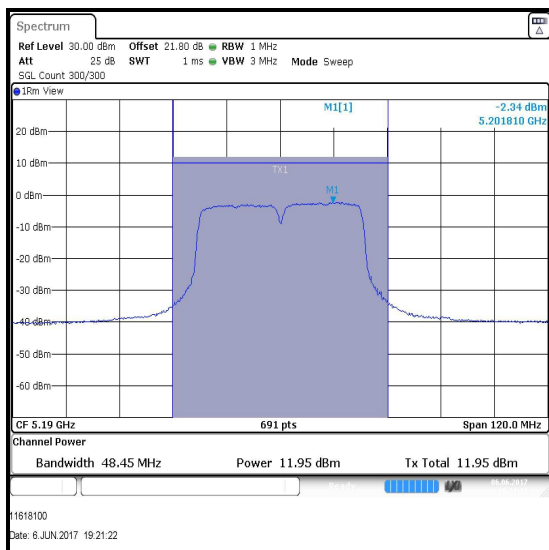**Middle Channel**

Top Channel

Transmitter Maximum Conducted Output Power (5.15-5.25 GHz band) (continued)

Results: 802.11n / 20 MHz / SISO / 64-QAM / MCS5 / Port Wi-Fi 1

Channel	Frequency (MHz)	Conducted Power (dBm)	Duty cycle correction factor (dB)	Corrected Conducted Power (dBm)	Limit (dBm)	Margin (dB)	Result
Bottom	5180	11.6	0.7	12.3	30.0	17.7	Complied
Middle	5200	12.1	0.7	12.8	30.0	17.2	Complied
Top	5240	11.6	0.7	12.3	30.0	17.7	Complied

Bottom Channel

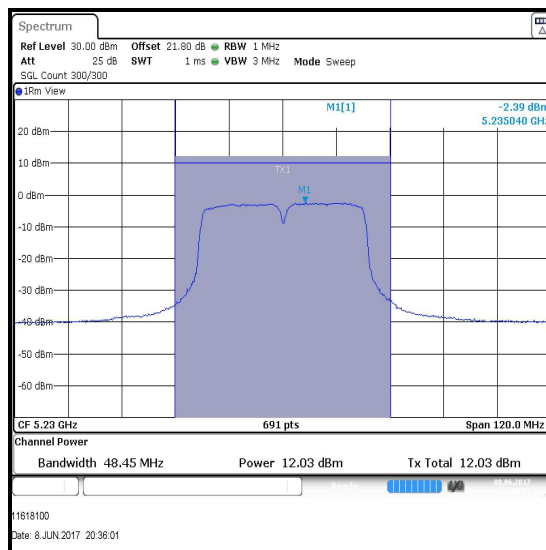**Middle Channel**

Top Channel

Transmitter Maximum Conducted Output Power (5.15-5.25 GHz band) (continued)

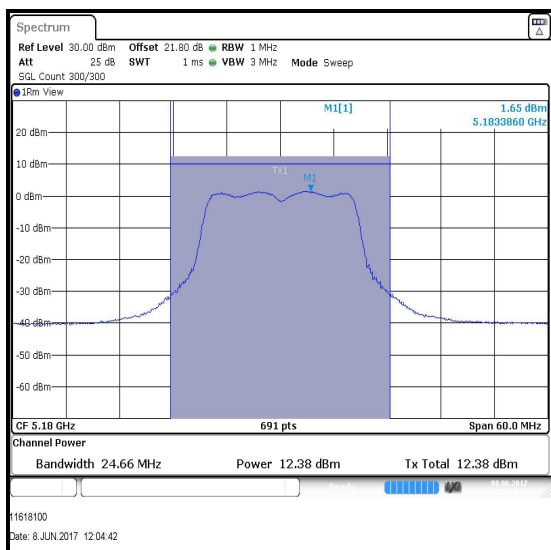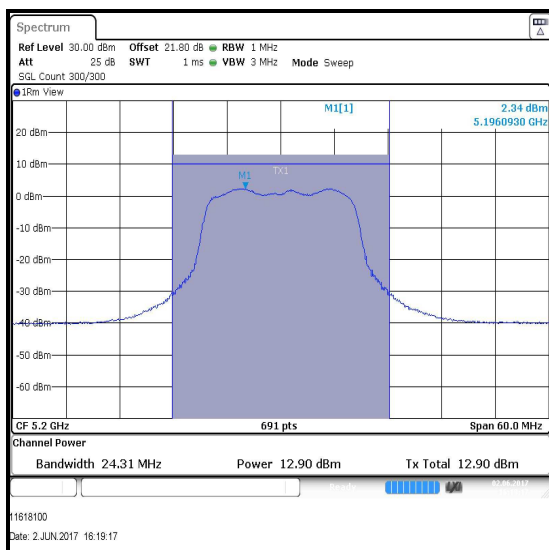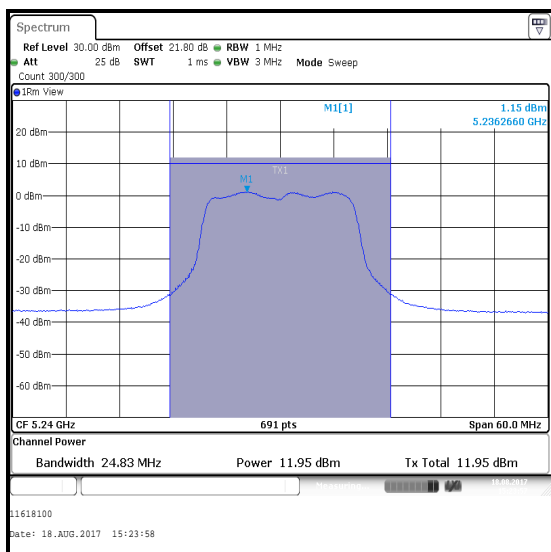**Results: 802.11n / 40 MHz / SISO / 16-QAM / MCS4 / Port Wi-Fi 2**

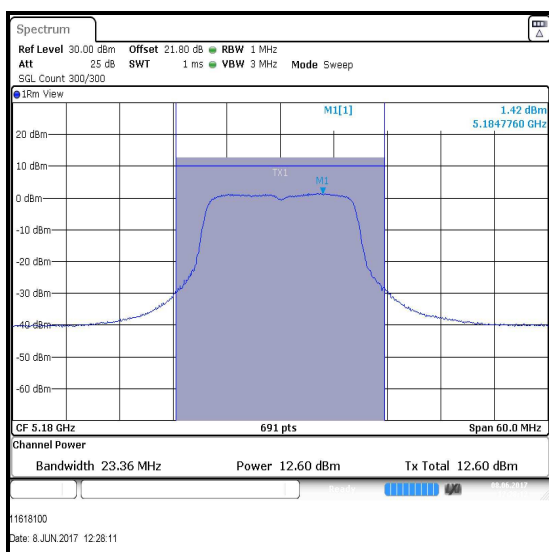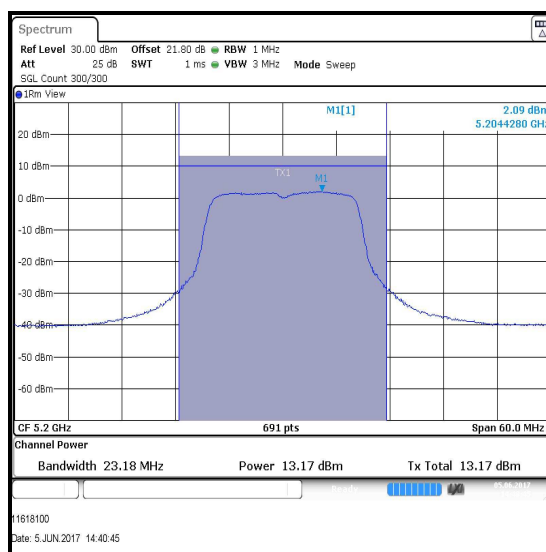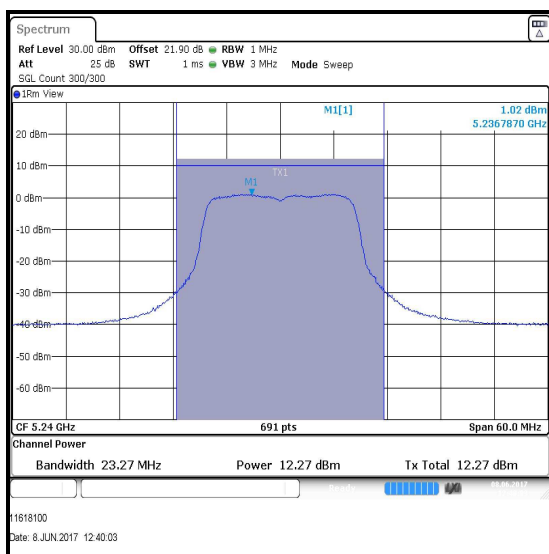| Channel	Frequency (MHz)	Conducted Power (dBm)	Duty cycle correction factor (dB)	Corrected Conducted Power (dBm)	Limit (dBm)	Margin (dB)	Result
Bottom	5190	12.0	0.4	12.4	30.0	17.6	Complied
Top	5230	12.0	0.4	12.4	30.0	17.6	Complied

Bottom Channel

Top Channel

Transmitter Maximum Conducted Output Power (5.15-5.25 GHz band) (continued)

Results: 802.11a / 20 MHz / MIMO / 6 Mbit/s

Channel	Frequency (MHz)	Port WiFi 1			Port WiFi 2		
		Conducted Power (dBm)	Duty cycle correction factor (dB)	Corrected Conducted Power (dBm)	Conducted Power (dBm)	Duty cycle correction factor (dB)	Corrected Conducted Power (dBm)
Bottom	5180	12.4	0.1	12.5	12.6	0.1	12.7
Middle	5200	12.9	0.1	13.0	13.2	0.1	13.3
Top	5240	12.0	0.1	12.1	12.3	0.1	12.4

Channel	Frequency (MHz)	Conducted Power Port Wi-Fi 1 (dBm)	Conducted Power Port Wi-Fi 2 (dBm)	Combined Conducted Power (dBm)	Limit (dBm)	Margin (dB)	Result
Bottom	5180	12.5	12.7	15.6	30.0	14.4	Complied
Middle	5200	13.0	13.3	16.2	30.0	13.8	Complied
Top	5240	12.1	12.4	15.3	30.0	14.7	Complied

Transmitter Maximum Conducted Output Power (5.15-5.25 GHz band) (continued)

Results: 802.11a / 20 MHz / MIMO / 6 Mbit/s / Port Wi-Fi 1

Bottom Channel

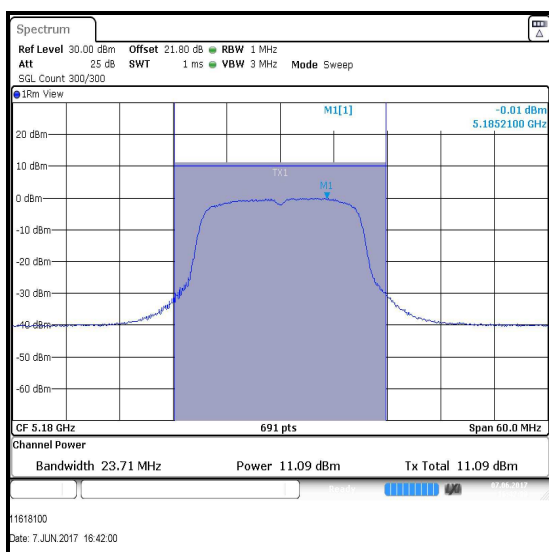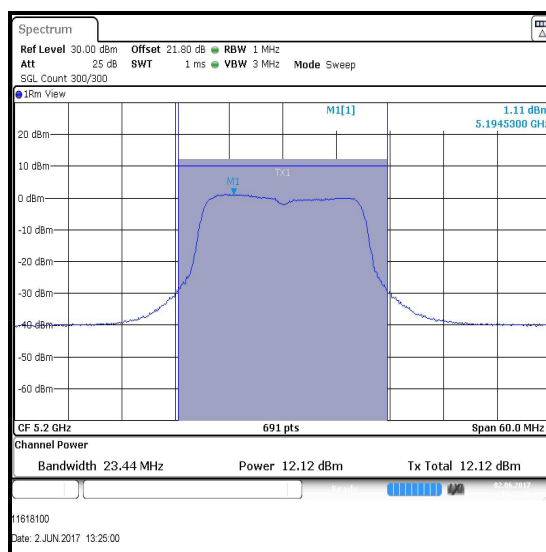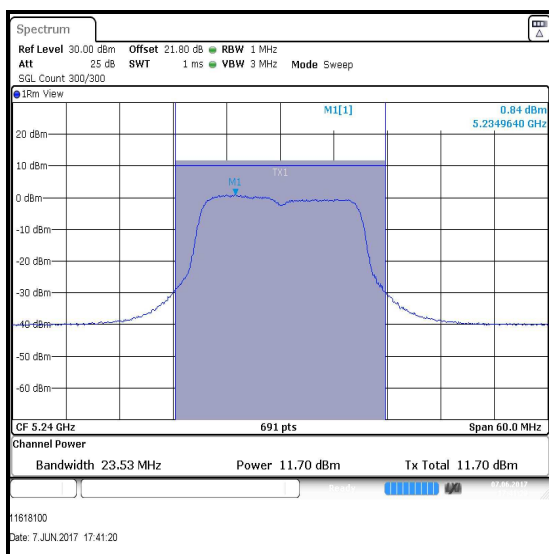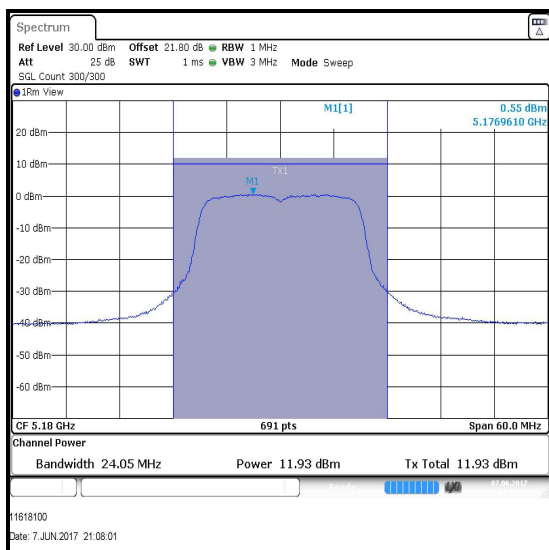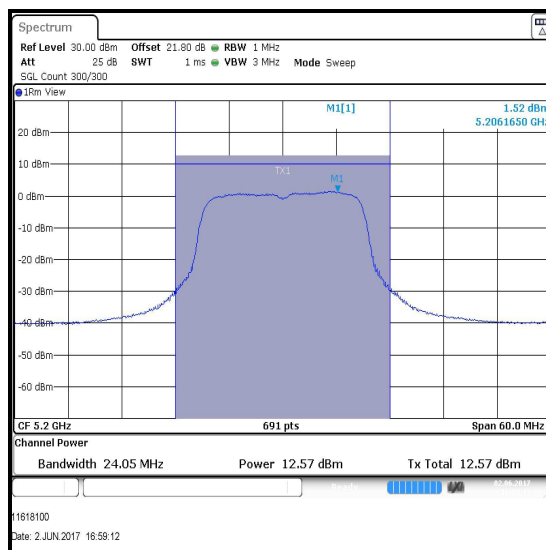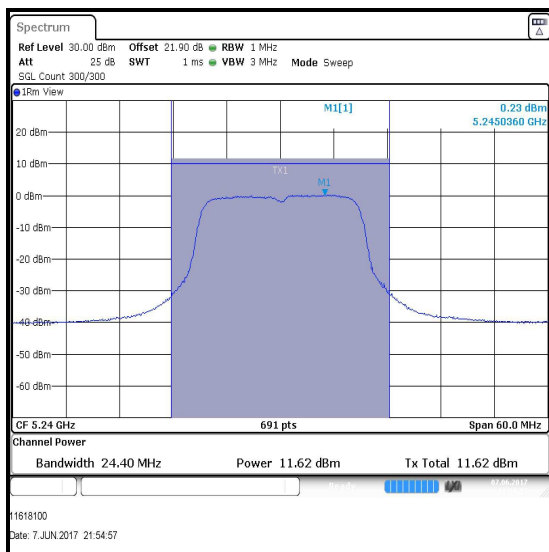**Middle Channel**

Top Channel

Transmitter Maximum Conducted Output Power (5.15-5.25 GHz band) (continued)

Results: 802.11a / 20 MHz / MIMO / 6 Mbit/s / Port Wi-Fi 2

Bottom Channel

Middle Channel

Top Channel

Transmitter Maximum Conducted Output Power (5.15-5.25 GHz band) (continued)

Results: 802.11n / 20 MHz / MIMO / 64-QAM / MCS5

Channel	Frequency (MHz)	Port WiFi 1			Port WiFi 2		
		Conducted Power (dBm)	Duty cycle correction factor (dB)	Corrected Conducted Power (dBm)	Conducted Power (dBm)	Duty cycle correction factor (dB)	Corrected Conducted Power (dBm)
Bottom	5180	11.1	0.7	11.8	11.9	0.7	12.6
Middle	5200	12.1	0.7	12.8	12.6	0.7	13.3
Top	5240	11.7	0.7	12.4	11.6	0.7	12.3

Channel	Frequency (MHz)	Conducted Power Port Wi-Fi 1 (dBm)	Conducted Power Port Wi-Fi 2 (dBm)	Combined Conducted Power (dBm)	Limit (dBm)	Margin (dB)	Result
Bottom	5180	11.8	12.6	15.2	30.0	8.8	Complied
Middle	5200	12.8	13.3	16.1	30.0	7.9	Complied
Top	5240	12.4	12.3	15.4	30.0	8.6	Complied

Transmitter Maximum Conducted Output Power (5.15-5.25 GHz band) (continued)

Results: 802.11n / 20 MHz / MIMO / 64-QAM / MCS5 / Port Wi-Fi 1

Bottom Channel

Middle Channel

Top Channel

Transmitter Maximum Conducted Output Power (5.15-5.25 GHz band) (continued)

Results: 802.11n / 20 MHz / MIMO / 64-QAM / MCS5 / Port Wi-Fi 2

Bottom Channel

Middle Channel

Top Channel

Transmitter Maximum Conducted Output Power (5.15-5.25 GHz band) (continued)

Results: 802.11n / 40 MHz / MIMO / 16-QAM / MCS4

Channel	Frequency (MHz)	Port WiFi 1			Port WiFi 2		
		Conducted Power (dBm)	Duty cycle correction factor (dB)	Corrected Conducted Power (dBm)	Conducted Power (dBm)	Duty cycle correction factor (dB)	Corrected Conducted Power (dBm)
Bottom	5190	12.2	0.7	12.9	12.6	0.7	13.1
Top	5230	11.9	0.7	12.6	12.3	0.7	13.0

Channel	Frequency (MHz)	Conducted Power Port Wi-Fi 1 (dBm)	Conducted Power Port Wi-Fi 2 (dBm)	Combined Conducted Power (dBm)	Limit (dBm)	Margin (dB)	Result
Bottom	5190	12.9	13.1	16.0	30.0	14.0	Complied
Top	5230	12.6	13.0	15.8	30.0	14.2	Complied