

**5.2.4. Transmitter Duty Cycle**

**Test Summary:**

<b>Test Engineer:</b>	Georgios Vrezas	<b>Test Dates:</b>	08 June 2016 & 09 June 2016
<b>Test Sample MAC address:</b>	542AA22F8F19		

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

**Environmental Conditions:**

<b>Temperature (°C):</b>	23 to 25
<b>Relative Humidity (%):</b>	48 to 53

**Note(s):**

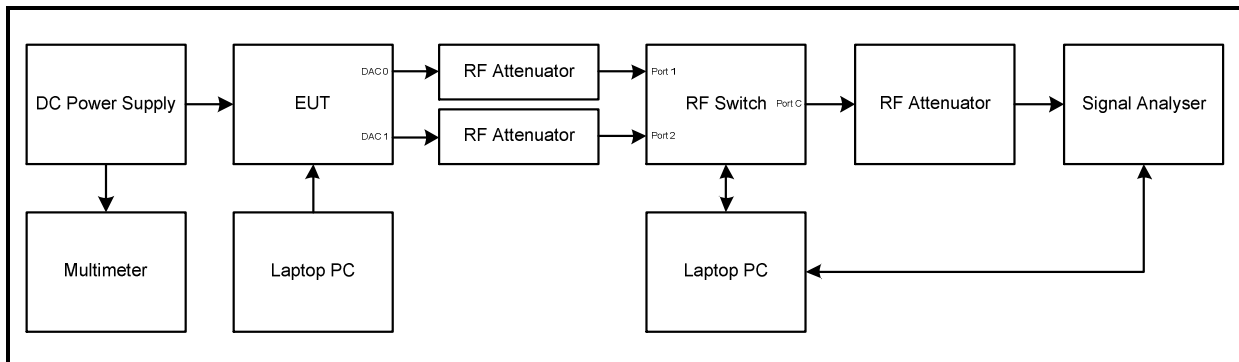
- In order to assist with the determination of the average level of fundamental and spurious emissions field strength, measurements were made of duty cycle to determine the transmission duration and the silent period time of the transmitter. The transmitter duty cycle was measured using a spectrum analyser in the time domain and calculated using the following formula:

$$10 \log 1 / (\text{On Time} / [\text{Period or } 100\text{ms whichever is the lesser}]).$$

- 802.11a SISO / BPSK / 6 Mbps duty cycle:  $10 \log (1 / (1430.240/1639.850)) = 0.6$
- 802.11a CDD / BPSK / 6 Mbps duty cycle:  $10 \log (1 / (1430.240/1641.900)) = 0.6$
- 802.11n HT20 / SISO / BPSK / MCS0 duty cycle:  $10 \log (1 / (1343.630/1554.660)) = 0.6$
- 802.11n HT20 / SISO / 16QAM / MCS3 duty cycle:  $10 \log (1 / (358.490/564.052)) = 2.0$
- 802.11n HT20 / SISO / 64QAM / MCS5 duty cycle:  $10 \log (1 / (198.546/405.702)) = 3.1$
- 802.11n HT40 / SISO / BPSK / MCS0 duty cycle:  $10 \log (1 / (665.800/872.500)) = 1.2$
- 802.11n HT40 / SISO / QPSK / MCS2 duty cycle:  $10 \log (1 / (246.786/451.877)) = 2.6$
- 802.11n HT40 / SISO / 16QAM / MCS3 duty cycle:  $10 \log (1 / (194.914/400.296)) = 3.1$
- 802.11n HT20 / MIMO / BPSK / MCS0 duty cycle:  $10 \log (1 / (1343.630/1554.660)) = 0.6$
- 802.11n HT20 / MIMO / QPSK / MCS1 duty cycle:  $10 \log (1 / (689.340/897.820)) = 1.1$
- 802.11n HT40 / MIMO / BPSK / MCS0 duty cycle:  $10 \log (1 / (665.800/872.500)) = 1.2$
- 802.11n HT40 / MIMO / 16QAM / MCS3 duty cycle:  $10 \log (1 / (194.914/400.296)) = 3.1$
- 802.11ac VHT80 / SISO / QPSK / MCS2 duty cycle:  $10 \log (1 / (138.857/343.714)) = 3.9$
- 802.11ac VHT80 / MIMO / BPSK / MCS0 duty cycle:  $10 \log (1 / (333.970/540.008)) = 2.1$
- 802.11ac VHT80 / MIMO / 16QAM / MCS3 duty cycle:  $10 \log (1 / (112.406/313.301)) = 4.5$

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.

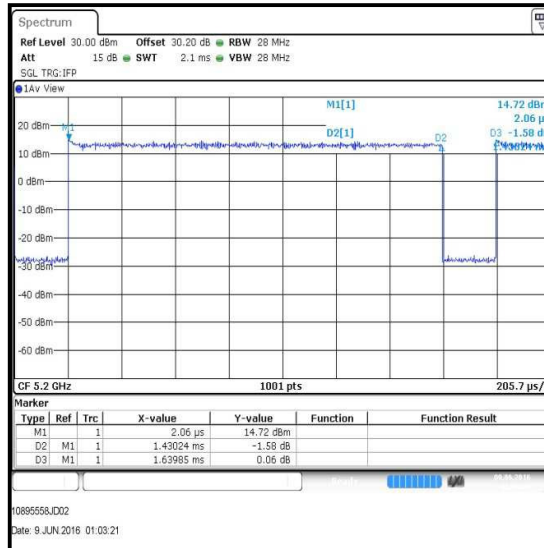
**Test setup:**



**Transmitter Duty Cycle (continued)**

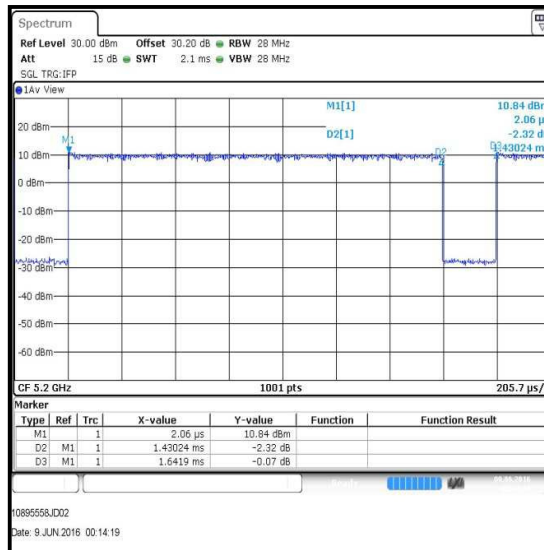
**Results: 802.11a / 20 MHz / SISO / 6 Mbps**

Pulse Duration (µs)	Period (µs)	Duty Cycle (dB)
1430.240	1639.850	0.6



**Results: 802.11a CDD / 20 MHz / 6 Mbps**

Pulse Duration (µs)	Period (µs)	Duty Cycle (dB)
1430.240	1641.900	0.6



**Transmitter Duty Cycle (continued)**

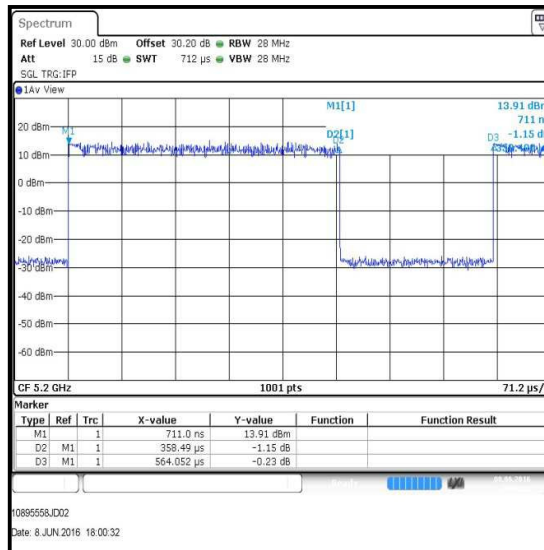
**Results: 802.11n / 20 MHz / SISO / MCS0**

Pulse Duration (µs)	Period (µs)	Duty Cycle (dB)
1343.630	1554.660	0.6



**Results: 802.11n / 20 MHz / SISO / MCS3**

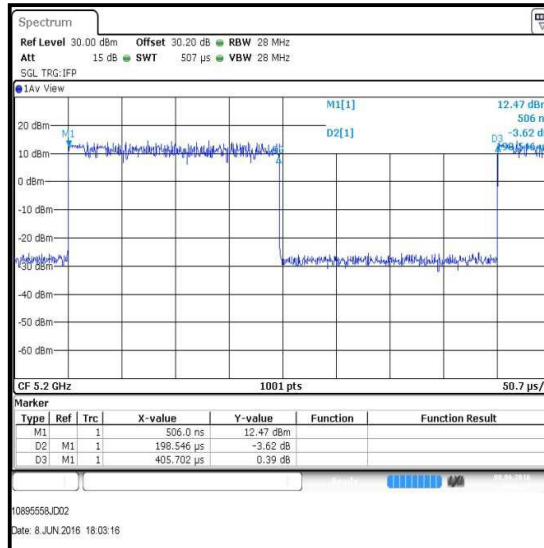
Pulse Duration (µs)	Period (µs)	Duty Cycle (dB)
358.490	564.052	2.0



**Transmitter Duty Cycle (continued)**

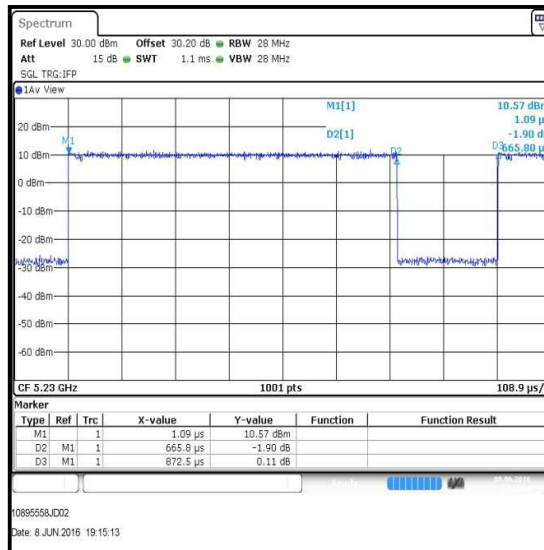
**Results: 802.11n / 20 MHz / SISO / MCS5**

Pulse Duration (µs)	Period (µs)	Duty Cycle (dB)
198.546	405.702	3.1



**Results: 802.11n / 40 MHz / SISO / MCS0**

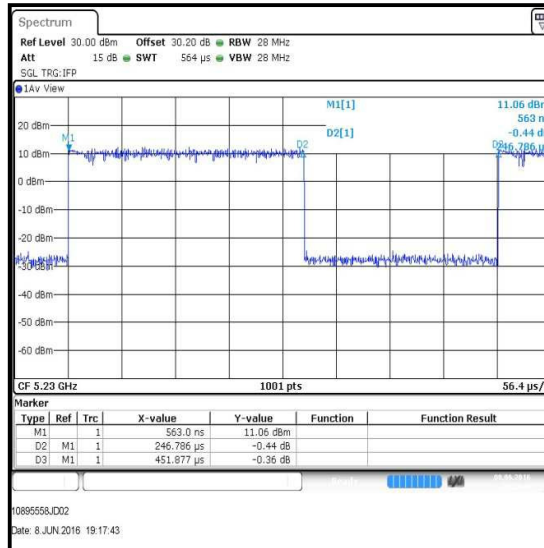
Pulse Duration (µs)	Period (µs)	Duty Cycle (dB)
665.800	872.500	1.2



**Transmitter Duty Cycle (continued)**

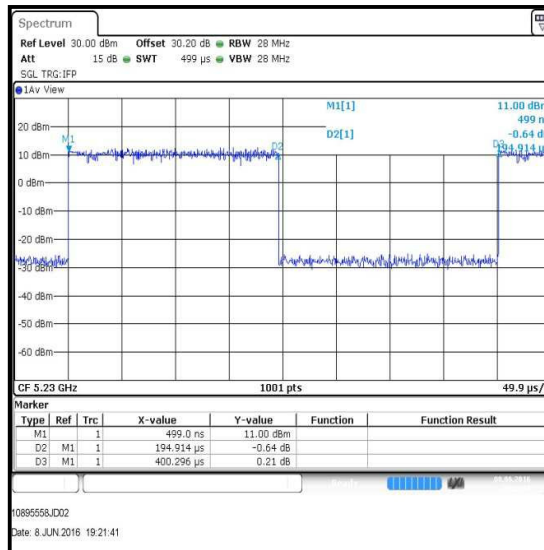
**Results: 802.11n / 40 MHz / SISO / MCS2**

Pulse Duration (µs)	Period (µs)	Duty Cycle (dB)
246.786	451.877	2.6



**Results: 802.11n / 40 MHz / SISO / MCS3**

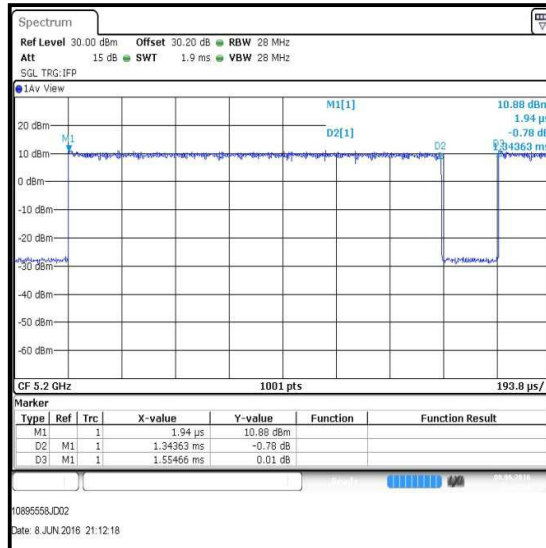
Pulse Duration (µs)	Period (µs)	Duty Cycle (dB)
194.914	400.296	3.1



**Transmitter Duty Cycle (continued)**

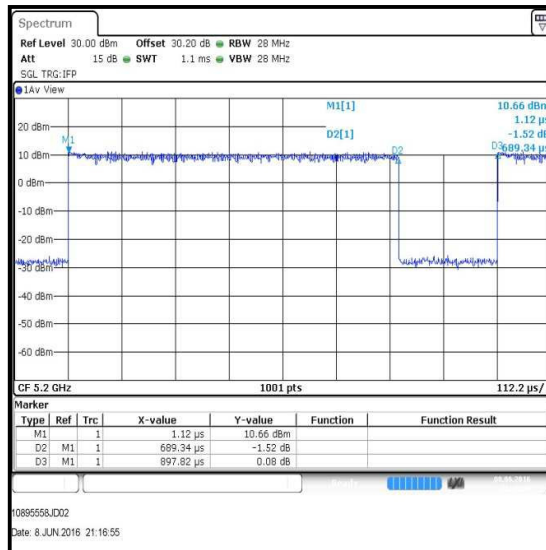
**Results: 802.11n / 20 MHz / MIMO / MCS0**

Pulse Duration (µs)	Period (µs)	Duty Cycle (dB)
1343.630	1554.660	0.6



**Results: 802.11n / 20 MHz / MIMO / MCS1**

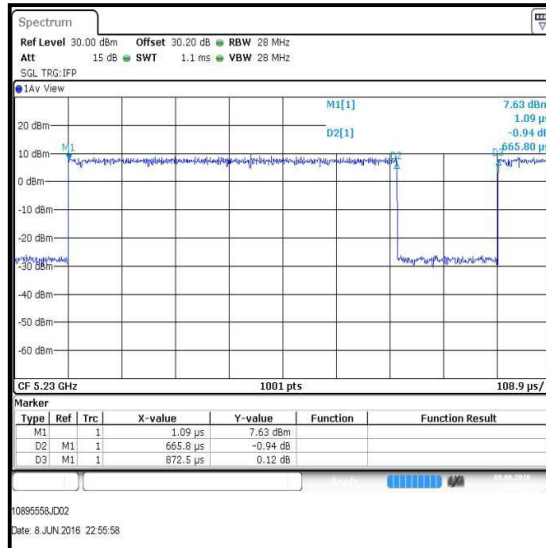
Pulse Duration (µs)	Period (µs)	Duty Cycle (dB)
689.340	897.820	1.1



**Transmitter Duty Cycle (continued)**

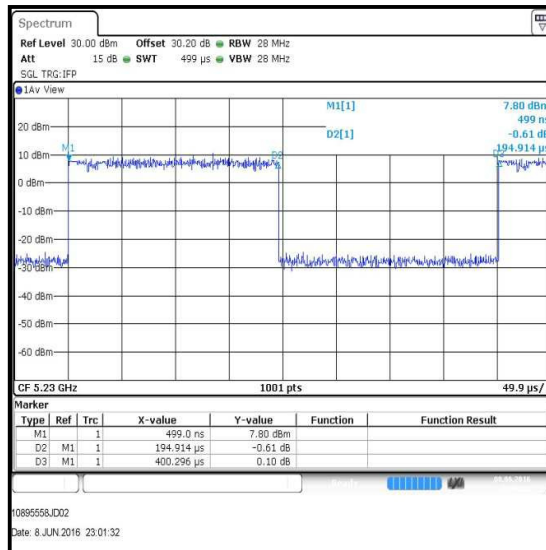
**Results: 802.11n / 40 MHz / MIMO / MCS0**

Pulse Duration (µs)	Period (µs)	Duty Cycle (dB)
665.800	872.500	1.2



**Results: 802.11n / 40 MHz / MIMO / MCS3**

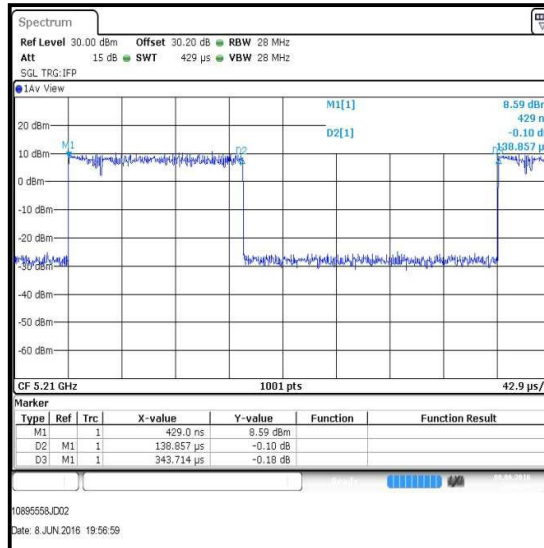
Pulse Duration (µs)	Period (µs)	Duty Cycle (dB)
194.914	400.296	3.1



**Transmitter Duty Cycle (continued)**

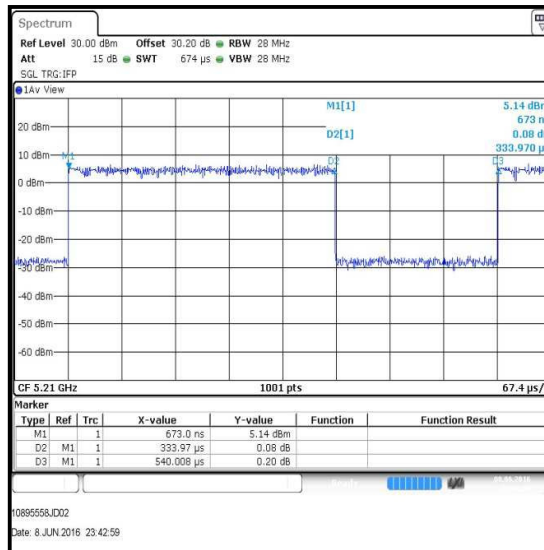
**Results: 802.11ac / 80 MHz / SISO / MCS2**

Pulse Duration (µs)	Period (µs)	Duty Cycle (dB)
138.857	343.714	3.9



**Results: 802.11ac / 80 MHz / MIMO / MCS0**

Pulse Duration (µs)	Period (µs)	Duty Cycle (dB)
333.970	540.008	2.1

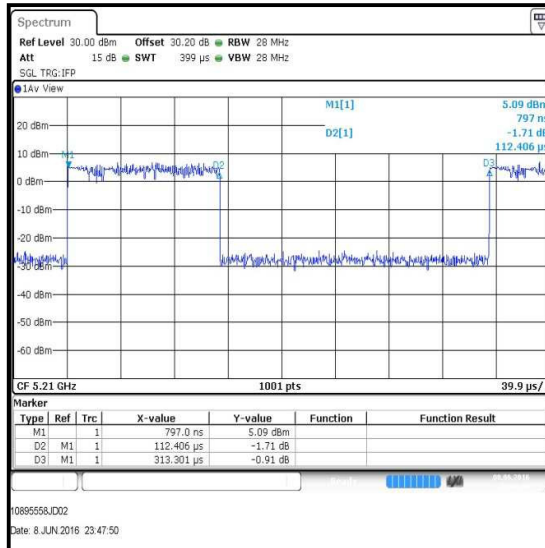




**Transmitter Duty Cycle (continued)**

**Results: 802.11ac / 80 MHz / MIMO / MCS3**

Pulse Duration (µs)	Period (µs)	Duty Cycle (dB)
112.406	313.301	4.5



**Transmitter Duty Cycle (continued)****Test Equipment Used:**

<b>Asset No.</b>	<b>Instrument</b>	<b>Manufacturer</b>	<b>Type No.</b>	<b>Serial No.</b>	<b>Date Calibration Due</b>	<b>Cal. Interval (Months)</b>
M2004	Thermohygrometer	JM Handelspunkt	30.5015.13	Not stated	02 Apr 2017	12
M1835	Signal Analyser	Rohde & Schwarz	FSV30	103050	26 Feb 2017	12
M1867	Attenuator	Huber + Suhner AG	6820.17.B	07101	Calibrated before use	-
A2847	Attenuator	Radiall	R411.820.121	24671450	Calibrated before use	-
A2345	Attenuator	Macom	2082-6043-20	None stated	Calibrated before use	-
A2009	RF Switch	Pickering Interfaces	64-102-002 & 40-881-001	XZ340281 & X311198	Calibrated before use	-
S0538	DC Power Supply	TTi	PL154	250135	Calibrated before use	-
M1818	Multimeter	Fluke	79III	71811580	27 Apr 2017	12
M1252	Signal Generator	Hewlett Packard	83640A	3119A00489	26 Oct 2017	24

**5.2.5. Transmitter Maximum Conducted Output Power****Test Summary:**

<b>Test Engineer:</b>	Georgios Vrezas	<b>Test Dates:</b>	08 June 2016 to 27 July 2016
<b>Test Sample MAC address:</b>	542AA22F8F19		

<b>FCC Reference:</b>	Part 15.407(a)(1)(iv)
<b>Test Method Used:</b>	KDB 789033 D02 Section II.E.2.d)

**Environmental Conditions:**

<b>Temperature (°C):</b>	23 to 25
<b>Relative Humidity (%):</b>	36 to 53

**Note(s):**

- The EUT was transmitting at <98% duty cycle. Measurements were performed using a signal analyser in accordance with FCC KDB 789033 II.E.2.d) Method SA-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:
  - 802.11a – BPSK / 6 Mbps
  - 802.11a CDD – BPSK / 6 Mbps
  - 802.11n HT20 SISO – 16QAM / MCS3
  - 802.11n HT40 SISO – 16QAM / MCS3
  - 802.11n HT20 MIMO – QPSK / MCS1
  - 802.11n HT40 MIMO – 16QAM / MCS3
  - 802.11ac VHT80 SISO – QPSK / MCS2
  - 802.11ac VHT80 MIMO – 16QAM / MCS3

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

- The signal analyser's integration function was used to integrate across the emission bandwidth. The resolution bandwidth was set to 1 MHz and video bandwidth 3 MHz. An RMS detector was used, sweep time was set to auto and 300 traces performed. The span was set to encompass the entire emission bandwidth.
- For SISO modes of operation, power was measured on both ports. DAC 0 produced the highest conducted power and highest e.i.r.p. It was therefore deemed worst case. Results for DAC 0 are recorded in the tables below.
- For MIMO modes of operation, conducted power was measured on both ports and then combined using the measure-and-sum method stated in FCC KDB 662911.
- As the EUT was transmitting at <98% duty cycle, the calculated duty cycle in Section 5.2.4 of this test report was added to the measured power in order to compute the average power during the actual transmission time.
- 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 spectrum analyser to compensate for the loss of the attenuator and RF cable.
- The Part 15.407(a)(1)(iv) limit shall not exceed 250 mW (24.0 dBm).

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

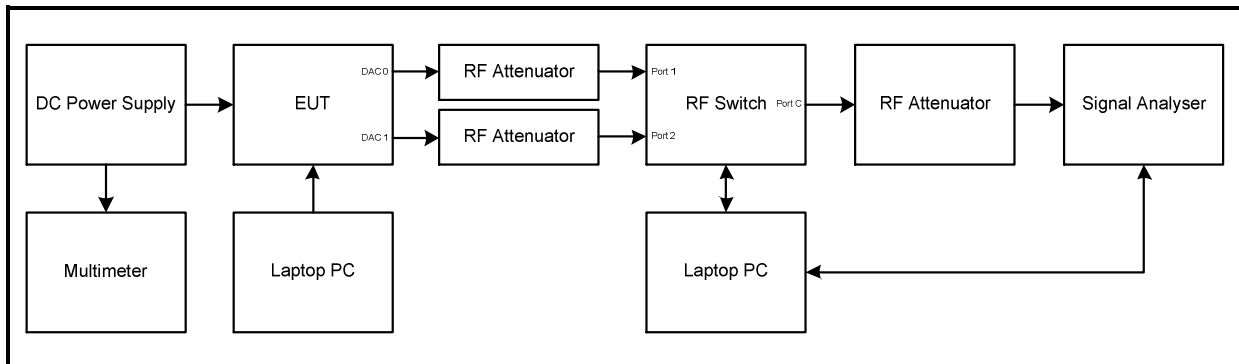
#### **Note(s):**

9. For SISO modes of operation, the EUT has an antenna gain of 6.1 dBi. In accordance with 15.407(a)(1)(iv), the limit was reduced by the amount in dB the antenna gain exceeds 6 dBi. Therefore the limit of 24 dBm has been reduced by 0.1 dB to 23.9 dBm.
10. For MIMO modes of operation presented in this section of the test report, the directional antenna gain has been calculated in accordance with KDB 662911 Section F)2)f(ii):

$$\begin{aligned} \text{Directional Gain} &= 10 \log \left[ \frac{\sum_{j=1}^{N_{SS}} (\sum_{k=1}^{N_{ANT}} g_{j,k})^2}{N_{ANT}} \right] = 10 \log \left[ \frac{\sum_{j=1}^1 (\sum_{k=1}^2 g_{j,k})^2}{2} \right] \\ &= 10 \log \left[ \frac{(g_{1,1} + g_{1,2})^2}{2} \right] = 10 \log \left[ \frac{\left(10^{\frac{6.1}{20}} + 10^{\frac{6.3}{20}}\right)^2}{2} \right] = 10 \log \left[ \frac{\left(10^{\frac{6.1}{20}} + 10^{\frac{6.3}{20}}\right)^2}{2} \right] = 9.2 \text{ dBi} \end{aligned}$$

In accordance with 15.407(a)(1)(iv), the limit was reduced by the amount in dB the antenna gain exceeds 6 dBi. Therefore the limit of 24 dBm has been reduced by 3.2 dB to 20.8 dBm.

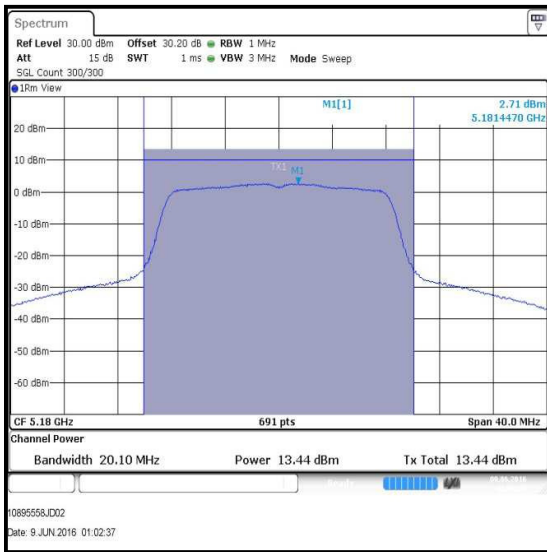
#### **Test setup:**



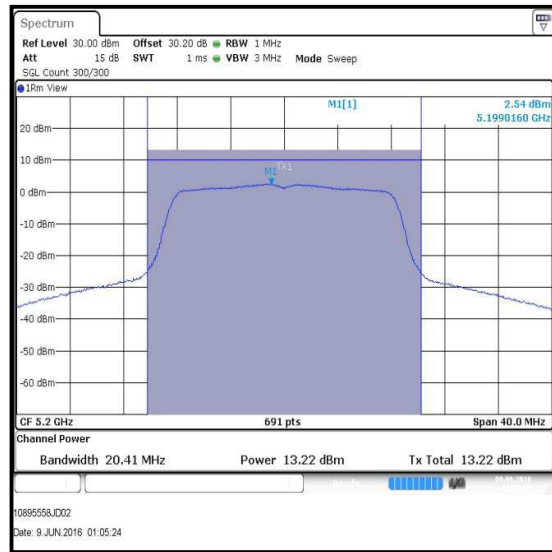
**Transmitter Maximum Conducted Output Power (5.15-5.25 GHz band) (continued)**

**Results: 802.11a / 20 MHz / BPSK / 6 Mbps / DAC 0**

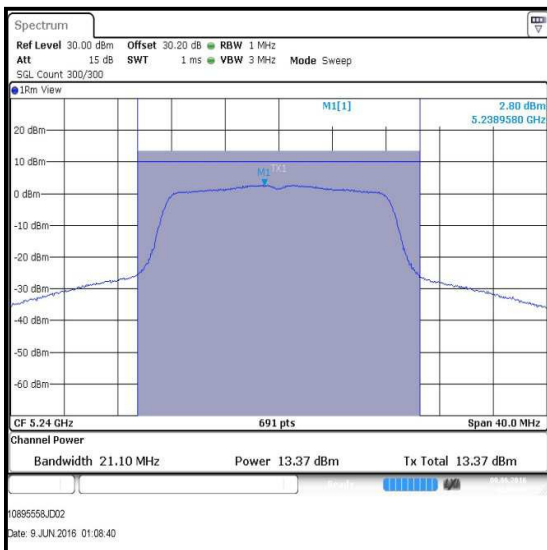
Channel	Frequency (MHz)	Conducted Power (dBm)	Duty cycle correction factor (dB)	Corrected Conducted Power (dBm)	Limit (dBm)	Margin (dB)	Result
Bottom	5180	13.4	0.6	14.0	23.9	9.9	Complied
Middle	5200	13.2	0.6	13.8	23.9	10.1	Complied
Top	5240	13.4	0.6	14.0	23.9	9.9	Complied



**Bottom Channel**



**Middle Channel**



**Top Channel**

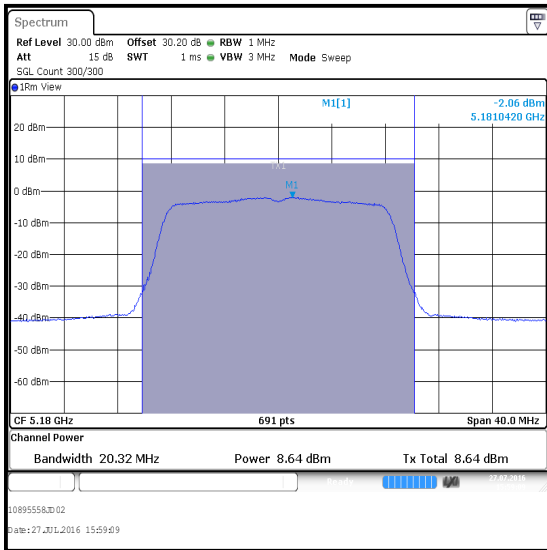
**Transmitter Maximum Conducted Output Power (5.15-5.25 GHz band) (continued)****Results: 802.11a / 20 MHz / CDD / BPSK / 6 Mbps**

Channel	Conducted Power DAC 0 (dBm)	Duty cycle correction factor (dB)	Corrected Conducted Power DAC 0 (dBm)	Conducted Power DAC 1 (dBm)	Duty cycle correction factor (dB)	Corrected Conducted Power DAC 1 (dBm)
Bottom	8.6	0.6	9.2	5.3	0.6	5.9
Middle	8.6	0.6	9.2	5.8	0.6	6.4
Top	8.7	0.6	9.3	5.6	0.6	6.2

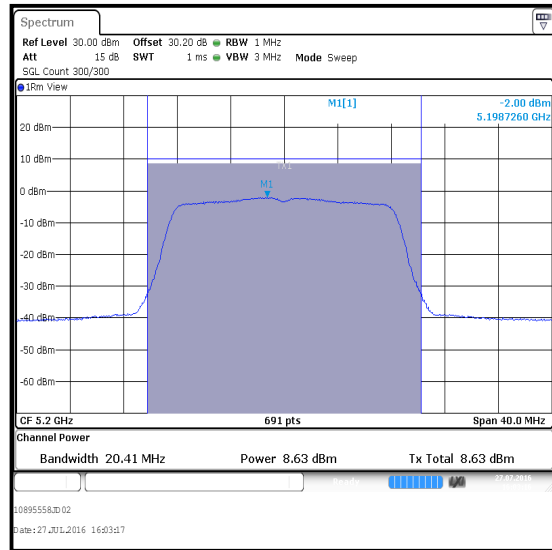
Channel	Combined Conducted Power (dBm)	Limit (dBm)	Margin (dB)	Result
Bottom	10.9	20.8	9.9	Complied
Middle	11.0	20.8	9.8	Complied
Top	11.0	20.8	9.8	Complied

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

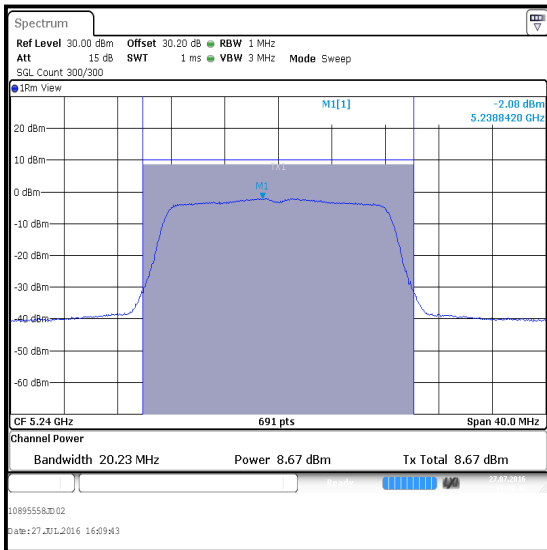
**Results: 802.11a / 20 MHz / CDD / BPSK / 6 Mbps / DAC 0**



**Bottom Channel**



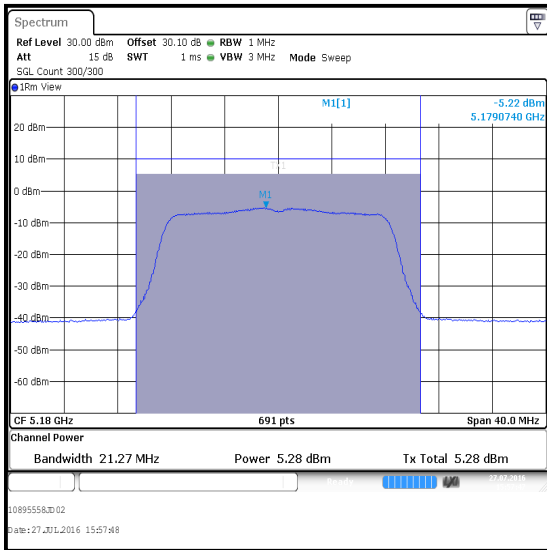
**Middle Channel**



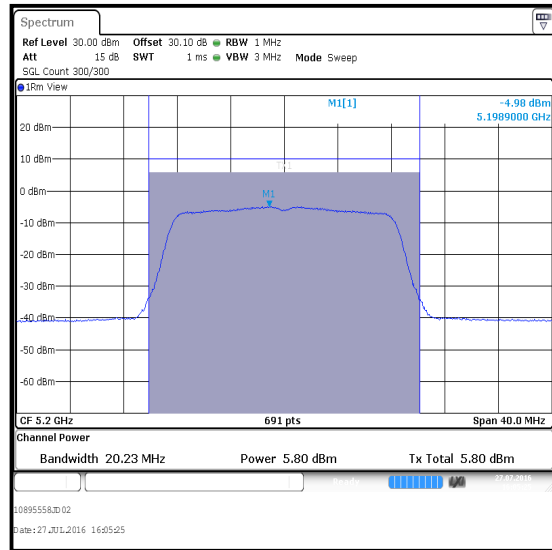
**Top Channel**

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

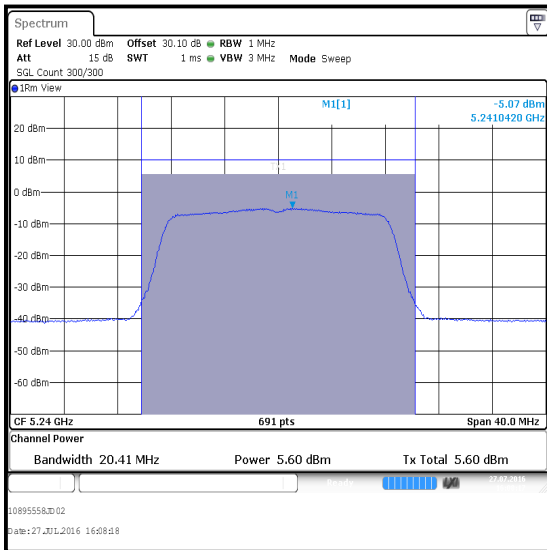
**Results: 802.11a / 20 MHz / CDD / BPSK / 6 Mbps / DAC 1**



**Bottom Channel**



**Middle Channel**



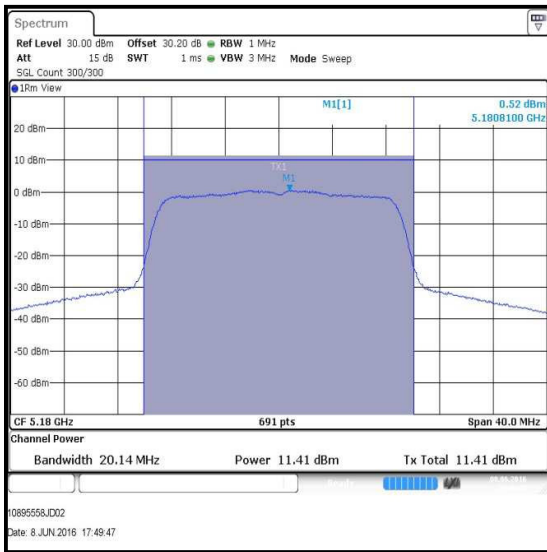
**Top Channel**



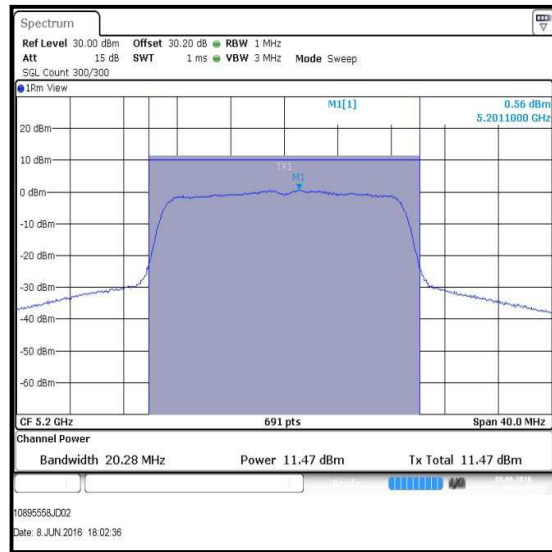
**Transmitter Maximum Conducted Output Power (5.15-5.25 GHz band) (continued)**

**Results: 802.11n / 20 MHz / SISO / 16QAM / MCS3 / DAC 0**

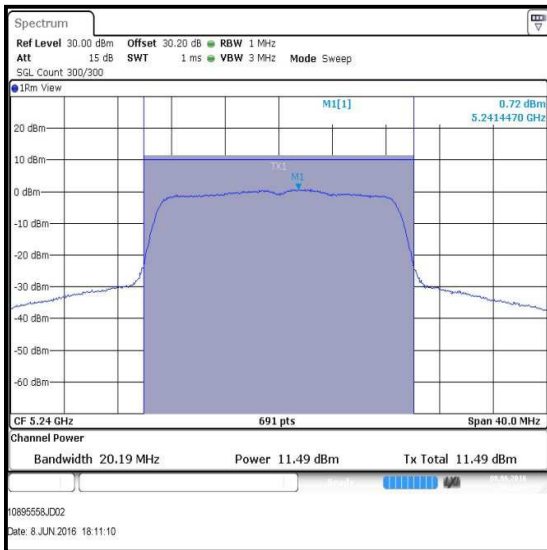
Channel	Frequency (MHz)	Conducted Power (dBm)	Duty cycle correction factor (dB)	Corrected Conducted Power (dBm)	Limit (dBm)	Margin (dB)	Result
Bottom	5180	11.4	2.0	13.4	23.9	10.5	Complied
Middle	5200	11.5	2.0	13.5	23.9	10.4	Complied
Top	5240	11.5	2.0	13.5	23.9	10.4	Complied



**Bottom Channel**



**Middle Channel**



**Top Channel**

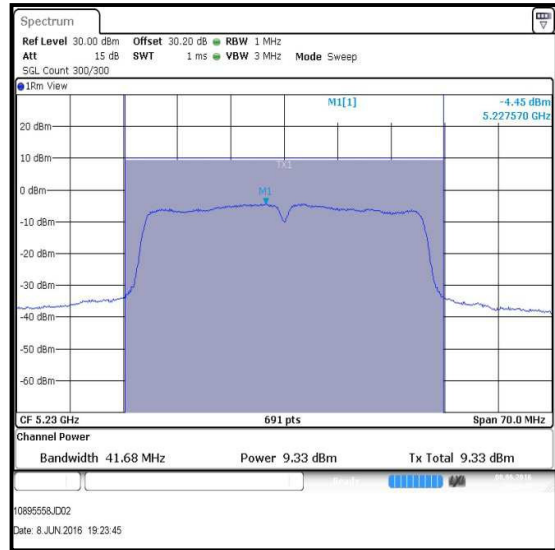
**Transmitter Maximum Conducted Output Power (5.15-5.25 GHz band) (continued)**

**Results: 802.11n / 40 MHz / SISO / 16QAM / MCS3 / DAC 0**

Channel	Frequency (MHz)	Conducted Power (dBm)	Duty cycle correction factor (dB)	Corrected Conducted Power (dBm)	Limit (dBm)	Margin (dB)	Result
Bottom	5190	9.8	3.1	12.9	23.9	11.0	Complied
Top	5230	9.3	3.1	12.4	23.9	11.5	Complied



**Bottom Channel**



**Top Channel**

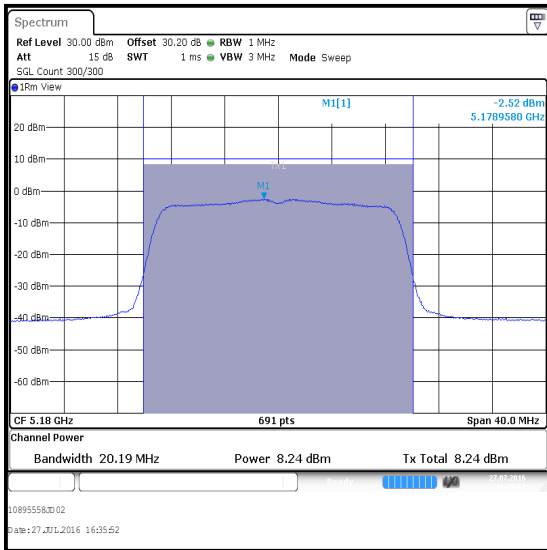
**Transmitter Maximum Conducted Output Power (5.15-5.25 GHz band) (continued)****Results: 802.11n / 20 MHz / MIMO / QPSK / MCS1**

Channel	Conducted Power DAC 0 (dBm)	Duty cycle correction factor (dB)	Corrected Conducted Power DAC 0 (dBm)	Conducted Power DAC 1 (dBm)	Duty cycle correction factor (dB)	Corrected Conducted Power DAC 1 (dBm)
Bottom	8.2	1.1	9.3	5.3	1.1	6.4
Middle	7.9	1.1	9.0	5.1	1.1	6.2
Top	8.0	1.1	9.1	5.2	1.1	6.3

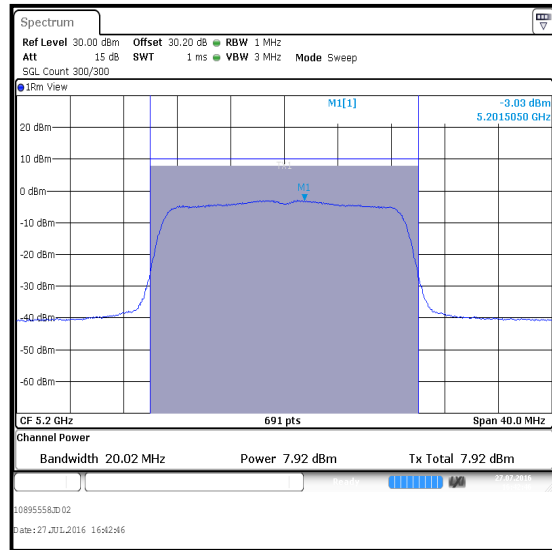
Channel	Combined Conducted Power (dBm)	Limit (dBm)	Margin (dB)	Result
Bottom	11.1	20.8	9.7	Complied
Middle	10.8	20.8	10.0	Complied
Top	10.9	20.8	9.9	Complied

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

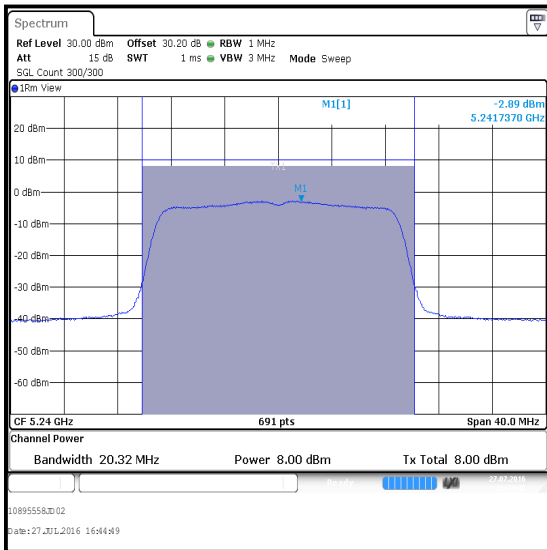
**Results: 802.11n / 20 MHz / MIMO / QPSK / MCS1 / DAC 0**



**Bottom Channel**



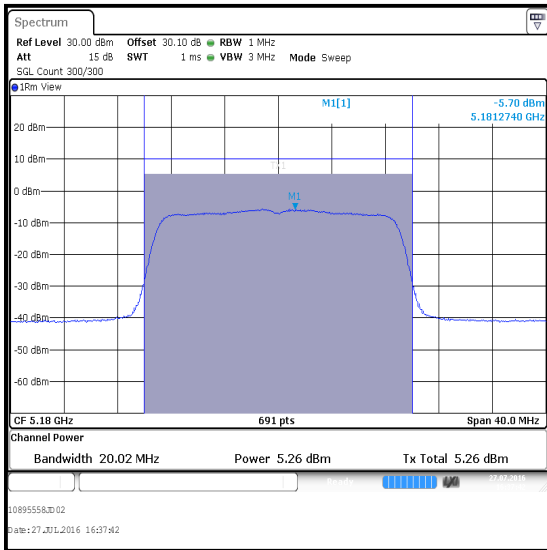
**Middle Channel**



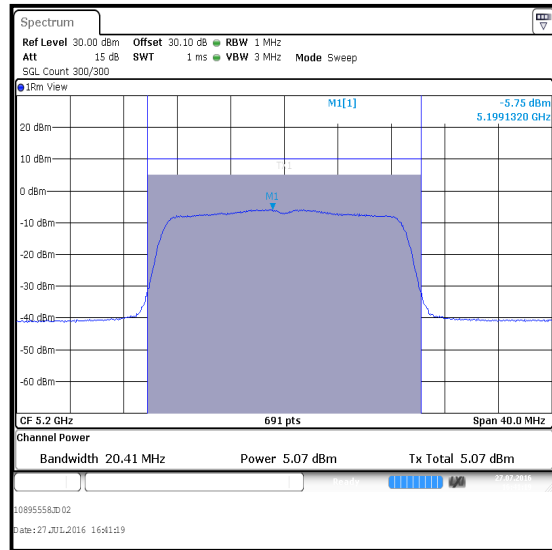
**Top Channel**

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

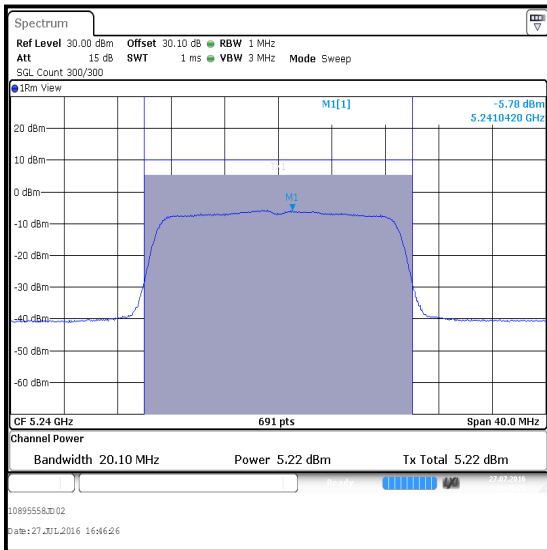
**Results: 802.11n / 20 MHz / MIMO / QPSK / MCS1 / DAC 1**



**Bottom Channel**



**Middle Channel**



**Top Channel**

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

**Results: 802.11n / 40 MHz / MIMO / 16QAM / MCS3**

Channel	Conducted Power DAC 0 (dBm)	Duty cycle correction factor (dB)	Corrected Conducted Power DAC 0 (dBm)	Conducted Power DAC 1 (dBm)	Duty cycle correction factor (dB)	Corrected Conducted Power DAC 1 (dBm)
Bottom	6.9	3.1	10.0	4.7	3.1	7.8
Top	6.2	3.1	9.3	4.8	3.1	7.9

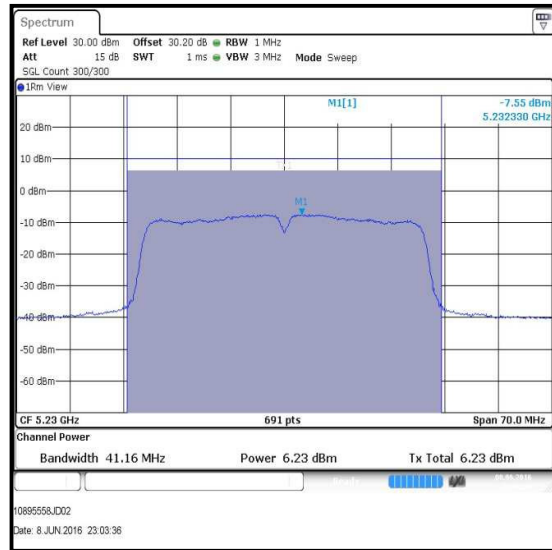
Channel	Combined Conducted Power (dBm)	Limit (dBm)	Margin (dB)	Result
Bottom	12.0	20.8	8.8	Complied
Top	11.7	20.8	9.1	Complied

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

**Results: 802.11n / 40 MHz / MIMO / 16QAM / MCS3 / DAC 0**

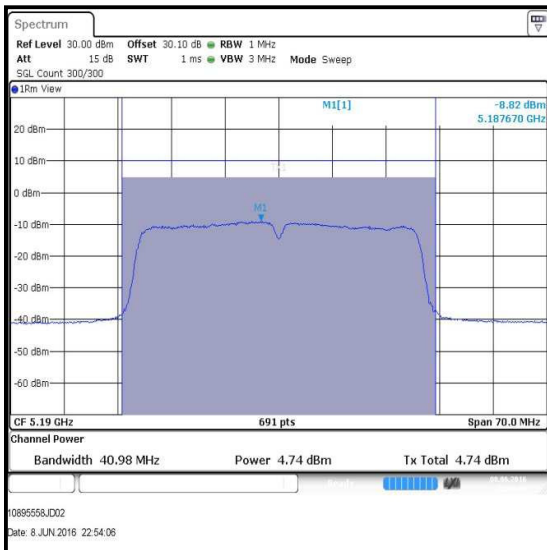


Bottom Channel



Top Channel

**Results: 802.11n / 40 MHz / MIMO / 16QAM / MCS3 / DAC 1**



Bottom Channel

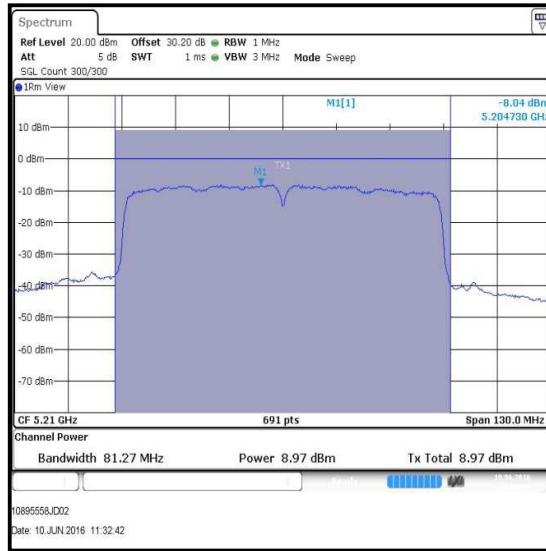


Top Channel

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

**Results: 802.11ac / 80 MHz / SISO / QPSK / MCS2 / DAC 0**

Channel	Frequency (MHz)	Conducted Power (dBm)	Duty cycle correction factor (dB)	Corrected Conducted Power (dBm)	Limit (dBm)	Margin (dB)	Result
Single	5210	9.0	3.9	12.9	23.9	11.0	Complied



**Single Channel / DAC 0**



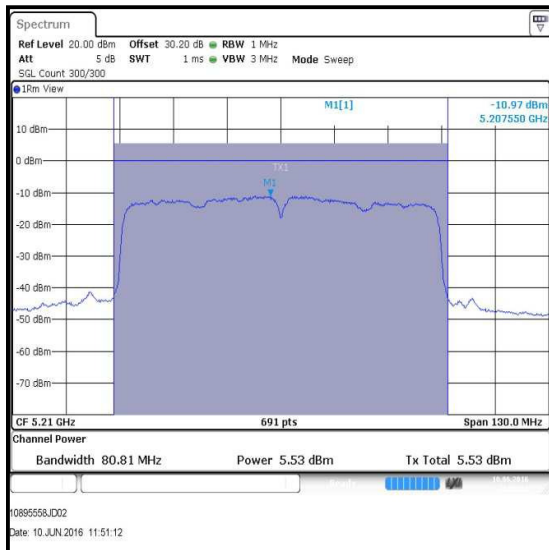
**Transmitter Maximum Conducted Output Power (5.15-5.25 GHz band) (continued)**

**Results: 802.11ac / 80 MHz / MIMO / 16QAM / MCS3**

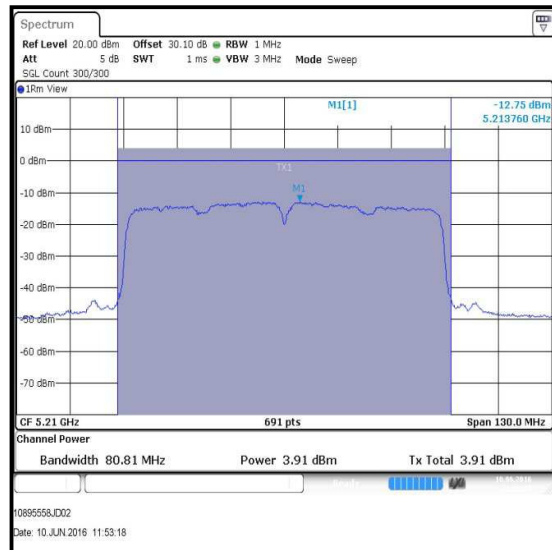
Channel	Conducted Power DAC 0 (dBm)	Duty cycle correction factor (dB)	Corrected Conducted Power DAC 0 (dBm)	Conducted Power DAC 1 (dBm)	Duty cycle correction factor (dB)	Corrected Conducted Power DAC 1 (dBm)
Single	5.5	4.5	10.0	3.9	4.5	8.4

Channel	Combined Conducted Power (dBm)	Limit (dBm)	Margin (dB)	Result
Single	12.3	20.8	8.5	Complied

**Results: 802.11ac / 80 MHz / MIMO / 16QAM / MCS3**



Single Channel / DAC 0



Single Channel / DAC 1

**Transmitter Maximum Conducted Output Power (5.725-5.85 GHz band)****Test Summary:**

<b>Test Engineer:</b>	Georgios Vrezas	<b>Test Dates:</b>	8 June 2016 to 10 June 2016
<b>Test Sample MAC address:</b>	542AA22F8F19		

<b>FCC Reference:</b>	Part 15.407(a)(3)
<b>Test Method Used:</b>	KDB 789033 D02 Section II.E.2.d)

**Environmental Conditions:**

<b>Temperature (°C):</b>	23 to 25
<b>Relative Humidity (%):</b>	36 to 53

**Note(s):**

1. The FCC Part 15.407(a)(3) limit shall not exceed 1 W (30.0 dBm).
2. For SISO modes of operation, the EUT antenna has a gain of <6 dBi.
3. For MIMO modes of operation presented in this section of the test report, the directional antenna gain has been calculated in accordance with Section F)2)f)(ii):

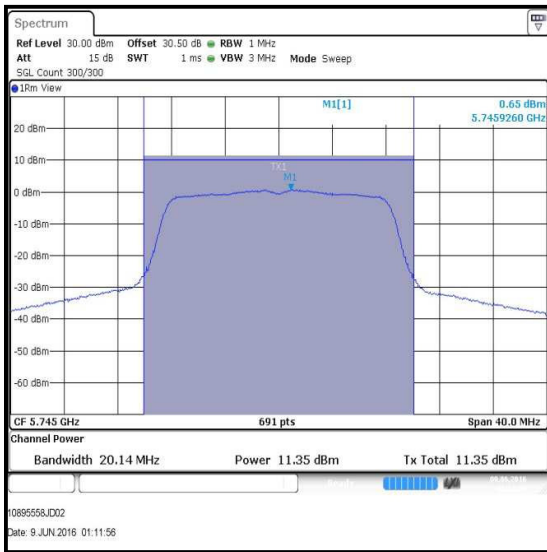
$$\begin{aligned} \text{Directional Gain} &= 10 \log \left[ \frac{\sum_{j=1}^{N_{SS}} \left( \sum_{k=1}^{N_{ANT}} g_{j,k} \right)^2}{N_{ANT}} \right] = 10 \log \left[ \frac{\sum_{j=1}^1 \left( \sum_{k=1}^2 g_{j,k} \right)^2}{2} \right] \\ &= 10 \log \left[ \frac{(g_{1,1} + g_{1,2})^2}{2} \right] = 10 \log \left[ \frac{\left( 10^{\frac{G_1}{20}} + 10^{\frac{G_2}{20}} \right)^2}{2} \right] = 10 \log \left[ \frac{\left( 10^{\frac{4.7}{20}} + 10^{\frac{5.9}{20}} \right)^2}{2} \right] = 8.3 \text{ dBi} \end{aligned}$$

In accordance with 15.407(a)(3), the limit was reduced by the amount in dB the antenna gain exceeds 6 dBi. Therefore the limit of 30 dBm has been reduced by 2.3 dB to 27.7 dBm.

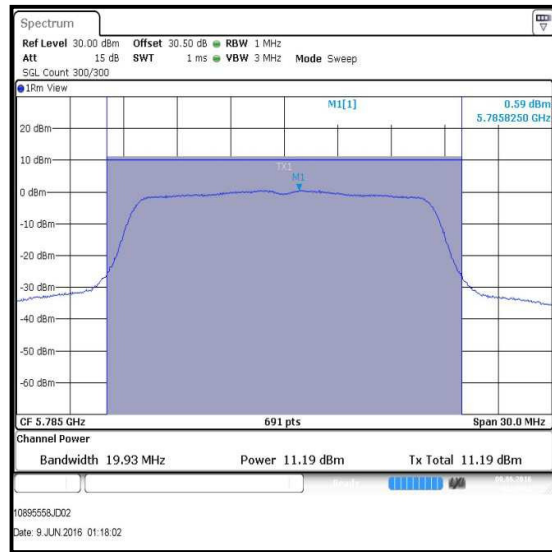
**Transmitter Maximum Conducted Output Power (5.725-5.85 GHz band) (continued)**

**Results: 802.11a / 20 MHz / BPSK / 6 Mbps / DAC 0**

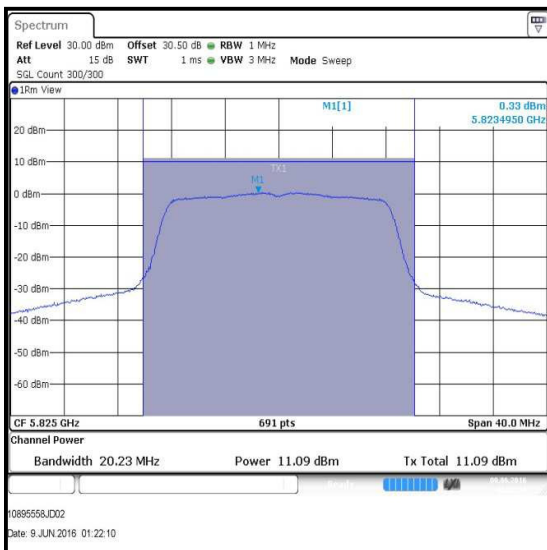
Channel	Frequency (MHz)	Conducted Power (dBm)	Duty cycle correction factor (dB)	Corrected Conducted Power (dBm)	Limit (dBm)	Margin (dB)	Result
Bottom	5745	11.4	0.6	12.0	30.0	18.0	Complied
Middle	5785	11.2	0.6	11.8	30.0	18.2	Complied
Top	5825	11.1	0.6	11.7	30.0	18.3	Complied



**Bottom Channel**



**Middle Channel**



**Top Channel**

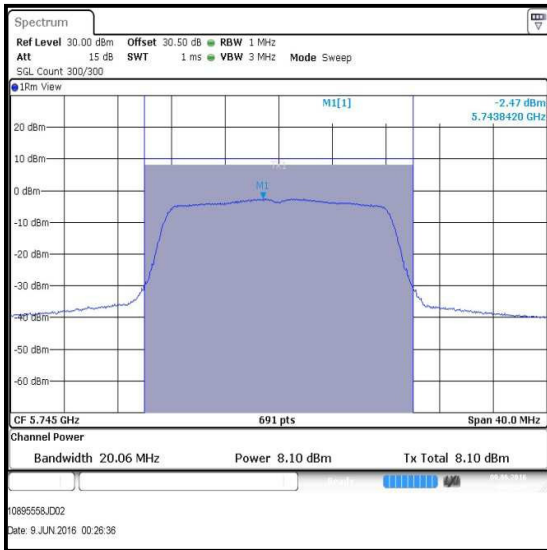
**Transmitter Maximum Conducted Output Power (5.725-5.85 GHz band) (continued)****Results: 802.11a / 20 MHz / CDD / BPSK / 6 Mbps**

Channel	Conducted Power DAC 0 (dBm)	Duty cycle correction factor (dB)	Corrected Conducted Power DAC 0 (dBm)	Conducted Power DAC 1 (dBm)	Duty cycle correction factor (dB)	Corrected Conducted Power DAC 1 (dBm)
Bottom	8.1	0.6	8.7	6.9	0.6	7.5
Middle	8.0	0.6	8.6	7.0	0.6	7.6
Top	7.7	0.6	8.3	7.3	0.6	7.9

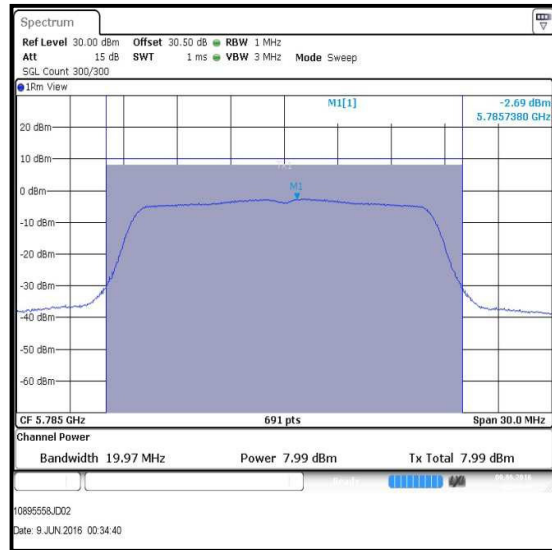
Channel	Combined Conducted Power (dBm)	Limit (dBm)	Margin (dB)	Result
Bottom	11.2	27.7	16.5	Complied
Middle	11.1	27.7	16.6	Complied
Top	11.1	27.7	16.6	Complied

**Transmitter Maximum Conducted Output Power (5.725-5.85 GHz band) (continued)**

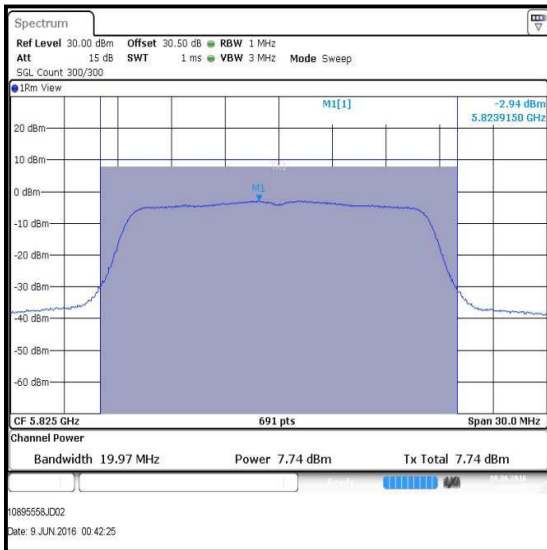
**Results: 802.11a / 20 MHz / CDD / BPSK / 6 Mbps / DAC 0**



**Bottom Channel**



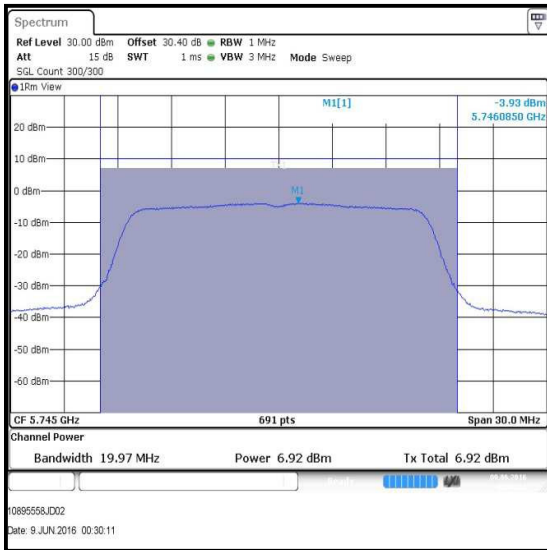
**Middle Channel**



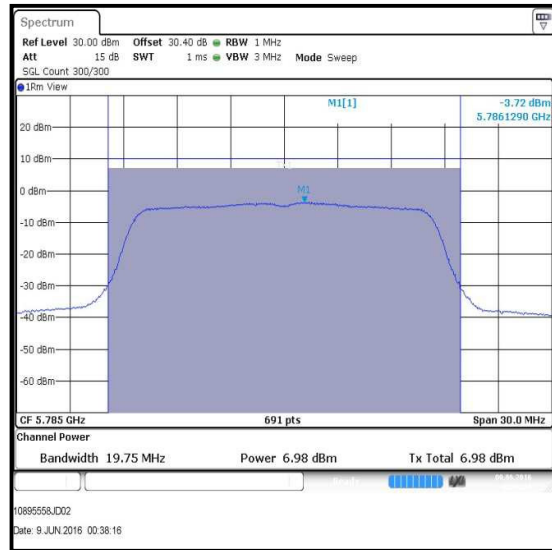
**Top Channel**

**Transmitter Maximum Conducted Output Power (5.725-5.85 GHz band) (continued)**

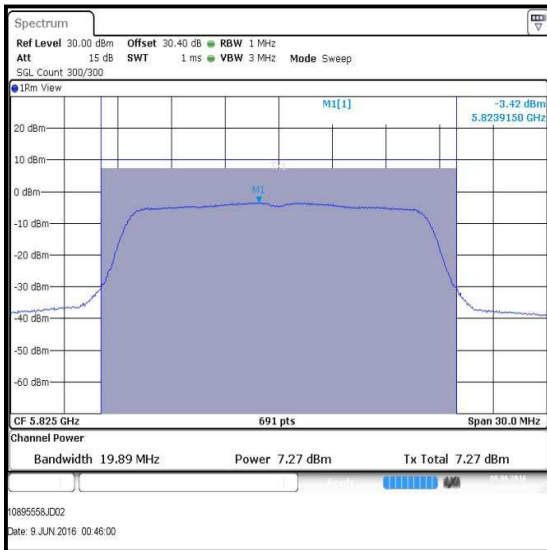
**Results: 802.11a / 20 MHz / CDD / BPSK / 6 Mbps / DAC 1**



**Bottom Channel**



**Middle Channel**



**Top Channel**

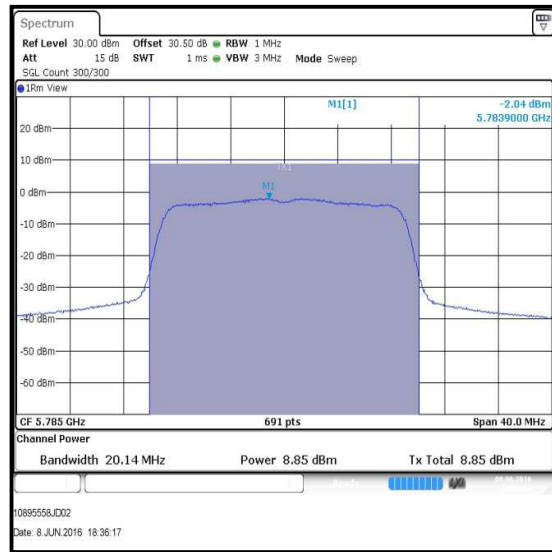
**Transmitter Maximum Conducted Output Power (5.725-5.85 GHz band) (continued)**

**Results: 802.11n / 20 MHz / SISO / 16QAM / MCS3 / DAC 0**

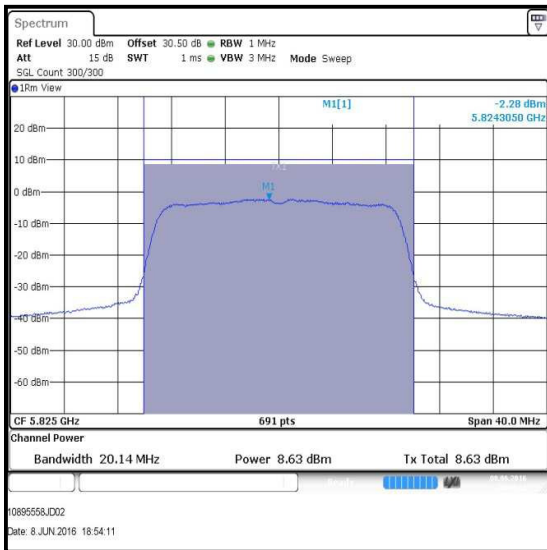
Channel	Frequency (MHz)	Conducted Power (dBm)	Duty cycle correction factor (dB)	Corrected Conducted Power (dBm)	Limit (dBm)	Margin (dB)	Result
Bottom	5745	8.9	2.0	10.9	30.0	19.1	Complied
Middle	5785	8.9	2.0	10.9	30.0	19.1	Complied
Top	5825	8.6	2.0	10.6	30.0	19.4	Complied



**Bottom Channel**



**Middle Channel**



**Top Channel**

**Transmitter Maximum Conducted Output Power (5.725-5.85 GHz band) (continued)****Results: 802.11n / 20 MHz / MIMO / QPSK / MCS1**

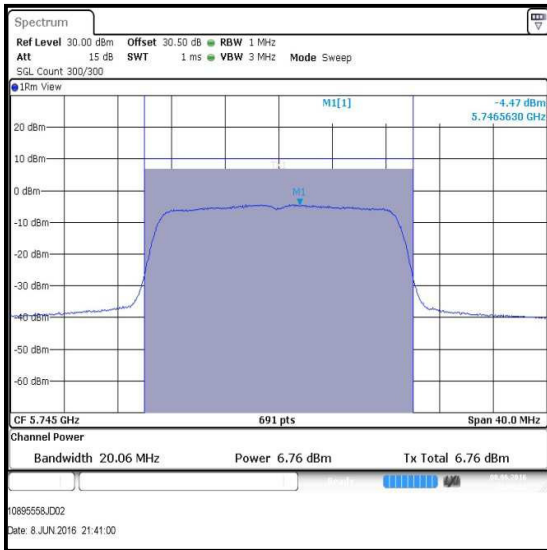
Channel	Conducted Power DAC 0 (dBm)	Duty cycle correction factor (dB)	Corrected Conducted Power DAC 0 (dBm)	Conducted Power DAC 1 (dBm)	Duty cycle correction factor (dB)	Corrected Conducted Power DAC 1 (dBm)
Bottom	6.8	1.1	7.9	6.5	1.1	7.6
Middle	6.7	1.1	7.8	6.3	1.1	7.4
Top	6.6	1.1	7.7	5.9	1.1	7.0

Channel	Combined Conducted Power (dBm)	Limit (dBm)	Margin (dB)	Result
Bottom	10.8	27.7	16.9	Complied
Middle	10.6	27.7	17.1	Complied
Top	10.4	27.7	17.3	Complied

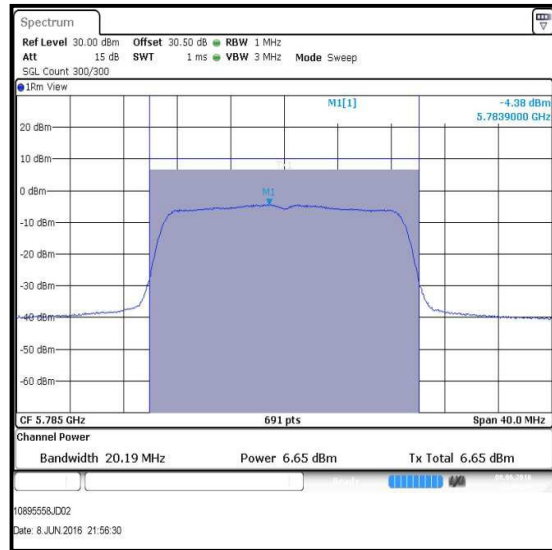


**Transmitter Maximum Conducted Output Power (5.725-5.85 GHz band) (continued)**

**Results: 802.11n / 20 MHz / MIMO / QPSK / MCS1 / DAC 0**



**Bottom Channel**



**Middle Channel**



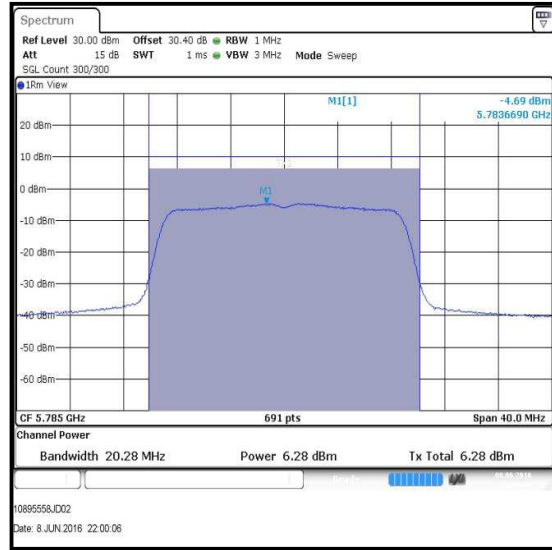
**Top Channel**

**Transmitter Maximum Conducted Output Power (5.725-5.85 GHz band) (continued)**

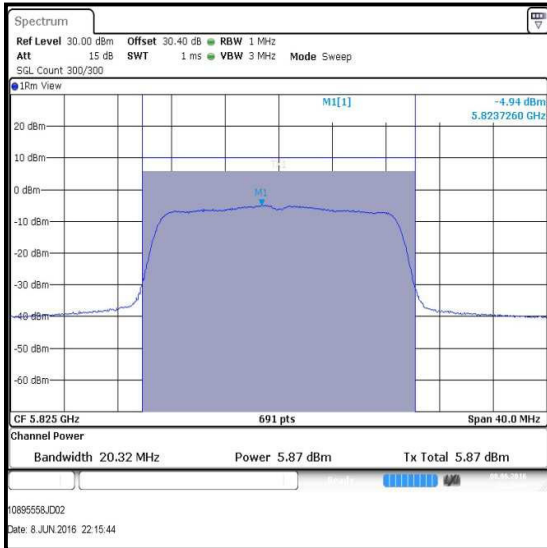
**Results: 802.11n / 20 MHz / MIMO / QPSK / MCS1 / DAC 1**



**Bottom Channel**



**Middle Channel**

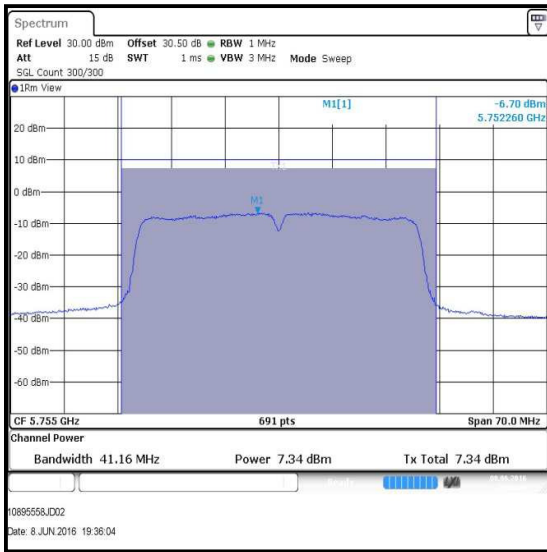


**Top Channel**

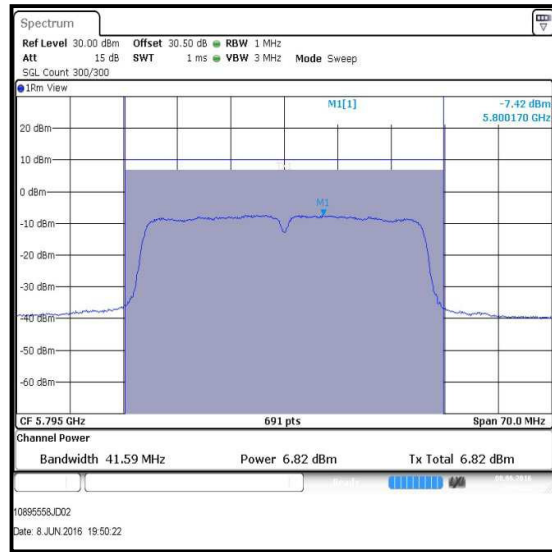
**Transmitter Maximum Conducted Output Power (5.725-5.85 GHz band) (continued)**

**Results: 802.11n / 40 MHz / SISO / 16QAM / MCS3 / DAC 0**

Channel	Frequency (MHz)	Conducted Power (dBm)	Duty cycle correction factor (dB)	Corrected Conducted Power (dBm)	Limit (dBm)	Margin (dB)	Result
Bottom	5755	7.3	3.1	10.4	30.0	19.6	Complied
Top	5795	6.8	3.1	9.9	30.0	20.1	Complied



**Bottom Channel**



**Top Channel**

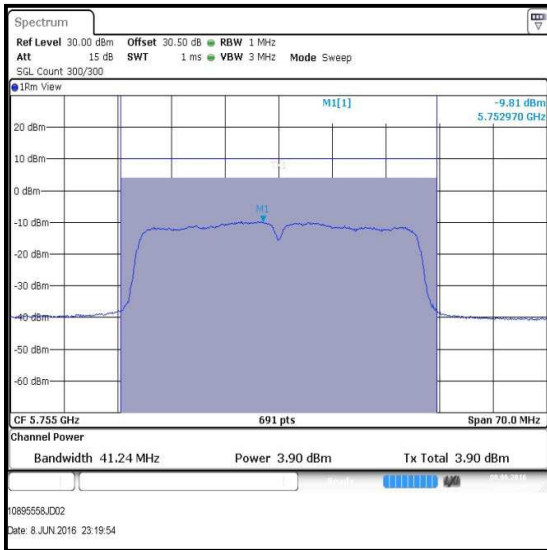
**Transmitter Maximum Conducted Output Power (5.725-5.85 GHz band) (continued)****Results: 802.11n / 40 MHz / MIMO / 16QAM / MCS3**

Channel	Conducted Power DAC 0 (dBm)	Duty cycle correction factor (dB)	Corrected Conducted Power DAC 0 (dBm)	Conducted Power DAC 1 (dBm)	Duty cycle correction factor (dB)	Corrected Conducted Power DAC 1 (dBm)
Bottom	3.9	3.1	7.0	2.3	3.1	5.4
Top	3.7	3.1	6.8	2.0	3.1	5.1

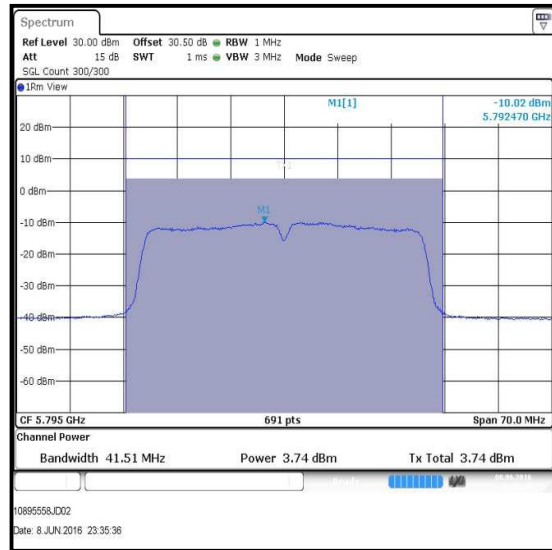
Channel	Combined Conducted Power (dBm)	Limit (dBm)	Margin (dB)	Result
Bottom	9.3	27.7	18.4	Complied
Top	9.0	27.7	18.7	Complied

**Transmitter Maximum Conducted Output Power (5.725-5.85 GHz band) (continued)**

**Results: 802.11n / 40 MHz / MIMO / 16QAM / MCS3 / DAC 0**

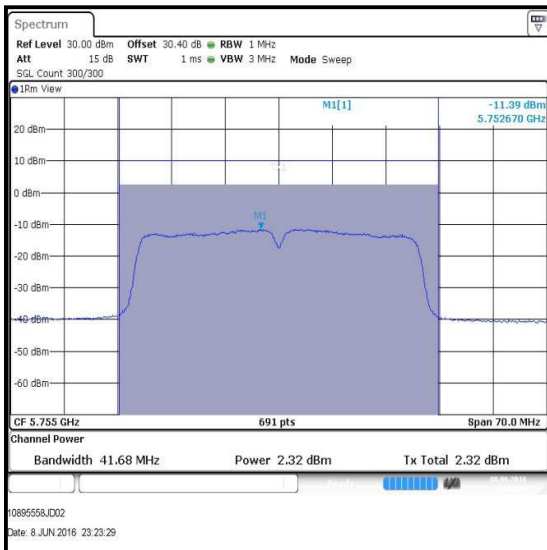


Bottom Channel



Top Channel

**Results: 802.11n / 40 MHz / MIMO / 16QAM / MCS3 / DAC 1**



Bottom Channel

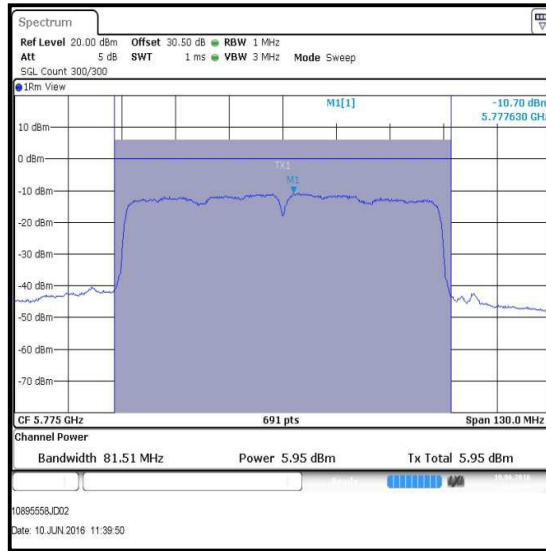


Top Channel

**Transmitter Maximum Conducted Output Power (5.725-5.85 GHz band) (continued)**

**Results: 802.11ac / 80 MHz / SISO / QPSK / MCS2 / DAC 0**

Channel	Frequency (MHz)	Conducted Power (dBm)	Duty cycle correction factor (dB)	Corrected Conducted Power (dBm)	Limit (dBm)	Margin (dB)	Result
Single	5775	6.0	3.9	9.9	27.7	17.8	Complied



**Single Channel / DAC 0**

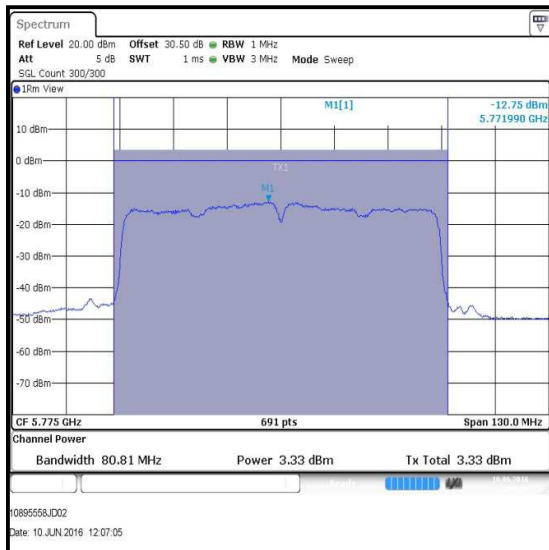
**Transmitter Maximum Conducted Output Power (5.725-5.85 GHz band) (continued)**

**Results: 802.11ac / 80 MHz / MIMO / 16QAM / MCS3**

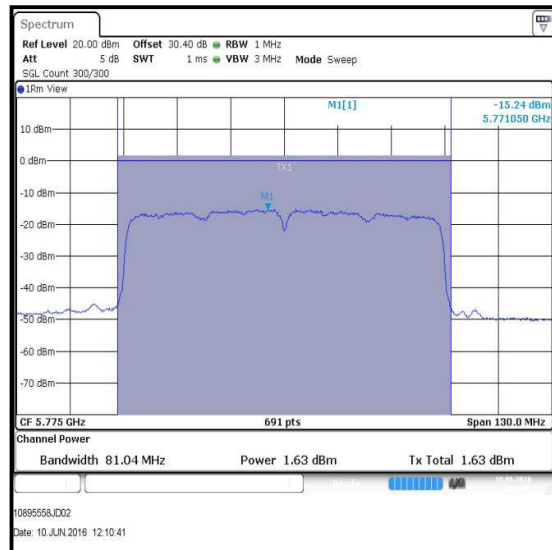
Channel	Conducted Power DAC 0 (dBm)	Duty cycle correction factor (dB)	Corrected Conducted Power DAC 0 (dBm)	Conducted Power DAC 1 (dBm)	Duty cycle correction factor (dB)	Corrected Conducted Power DAC 1 (dBm)
Single	3.3	4.5	7.8	1.6	4.5	6.1

Channel	Combined Conducted Power (dBm)	Limit (dBm)	Margin (dB)	Result
Single	10.0	27.7	17.7	Complied

**Results: 802.11ac / 80 MHz / MIMO / 16QAM / MCS3**



Single Channel / DAC 0



Single Channel / DAC 1

**Transmitter Maximum Conducted Output Power (continued)****Test Equipment Used:**

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M2004	Thermohygrometer	JM Handelspunkt	30.5015.13	Not stated	02 Apr 2017	12
M1835	Signal Analyser	Rohde & Schwarz	FSV30	103050	26 Feb 2017	12
M1867	Attenuator	Huber + Suhner AG	6820.17.B	07101	Calibrated before use	-
A2847	Attenuator	Radiall	R411.820.121	24671450	Calibrated before use	-
A2345	Attenuator	Macom	2082-6043-20	None stated	Calibrated before use	-
A2009	RF Switch	Pickering Interfaces	64-102-002 & 40-881-001	XZ340281 & X311198	Calibrated before use	-
S0538	DC Power Supply	TTi	PL154	250135	Calibrated before use	-
M1818	Multimeter	Fluke	79III	71811580	27 Apr 2017	12
M1252	Signal Generator	Hewlett Packard	83640A	3119A00489	26 Oct 2017	24



**5.2.6. Transmitter Maximum Power Spectral Density****Test Summary:**

<b>Test Engineer:</b>	Georgios Vrezas	<b>Test Dates:</b>	08 June 2016 to 27 July 2016
<b>Test Sample MAC address:</b>	542AA22F8F19		

<b>FCC Reference:</b>	Part 15.407(a)(1)(iv)
<b>Test Method Used:</b>	KDB 789033 D02 Section II.F. referencing II.E.2.d)

**Environmental Conditions:**

<b>Temperature (°C):</b>	23 to 25
<b>Relative Humidity (%):</b>	48 to 53

**Note(s):**

1. Transmitter Maximum Power Spectral Density tests in all bands were performed using a test receiver in accordance with KDB 789033 II. F referencing 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:
  - 802.11a – BPSK / 6 Mbps
  - 802.11a CDD – BPSK / 6 Mbps
  - 802.11n HT20 SISO – 64QAM / MCS5
  - 802.11n HT20 MIMO – QPSK / MCS1
  - 802.11n HT40 SISO – QPSK / MCS2
  - 802.11n HT40 MIMO – BPSK / MCS0
  - 802.11ac VHT80 SISO – QPSK / MCS2
  - 802.11ac VHT80 MIMO – 16QAM / MCS3

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

3. The EUT was transmitting at <98% duty cycle, the calculated duty cycle in Section 5.2.4 of this test report was added to the measured maximum power spectral density in order to compute the average maximum power spectral density during the actual transmission time.
4. For SISO modes of operation, conducted power was measured on both ports, DAC 0 produced the highest power therefore the results have been included below.
5. For MIMO modes of operation, conducted power was measured on both ports and then combined using the *measure and sum spectral maxima across the outputs* method stated in FCC KDB 662911.
6. The spectrum analyser was connected to the RF port on the EUT using suitable attenuation and RF cable. An RF level offset was entered on the spectrum analyser to compensate for the loss of the attenuator and RF cable.
7. For SISO modes of operation, the EUT has an antenna gain of 6.1 dBi. In accordance with 15.407(a)(1)(iv), the limit was reduced by the amount in dB the antenna gain exceeds 6 dBi. Therefore the limit of 11 dBm/MHz has been reduced by 0.1 dB to 10.9 dBm/MHz.

### **Transmitter Maximum Power Spectral Density (5.15-5.25 GHz band) (continued)**

#### **Note(s):**

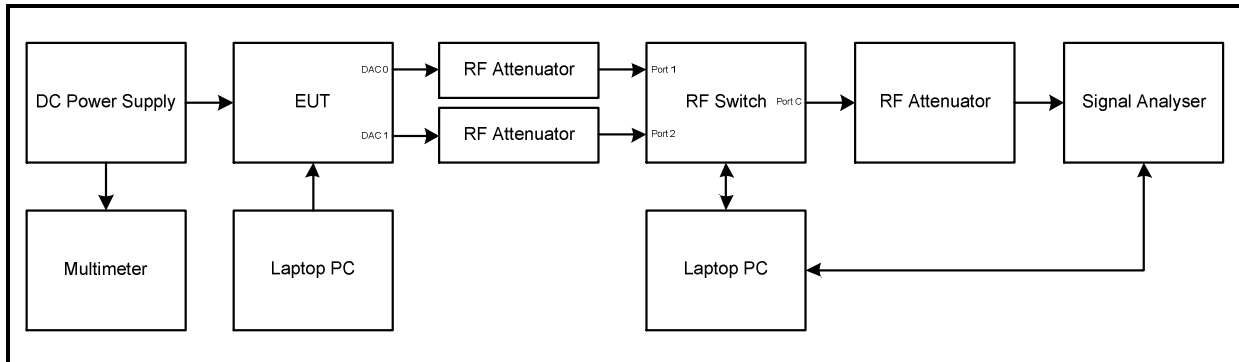
8. For MIMO modes of operation presented in this section of the test report, the directional antenna gain has been calculated in accordance with Section F2)f(ii):

$$\begin{aligned} \text{Directional Gain} &= 10 \log \left[ \frac{\sum_{j=1}^{N_{SS}} (\sum_{k=1}^{N_{ANT}} g_{j,k})^2}{N_{ANT}} \right] = 10 \log \left[ \frac{\sum_{j=1}^1 (\sum_{k=1}^2 g_{j,k})^2}{2} \right] \\ &= 10 \log \left[ \frac{(g_{1,1} + g_{1,2})^2}{2} \right] = 10 \log \left[ \frac{\left(10^{\frac{6.1}{20}} + 10^{\frac{6.2}{20}}\right)^2}{2} \right] = 10 \log \left[ \frac{\left(10^{\frac{6.1}{20}} + 10^{\frac{6.3}{20}}\right)^2}{2} \right] = 9.2 \text{ dBi} \end{aligned}$$

In accordance with 15.407(a)(1)(iv), the limit was reduced by the amount in dB the antenna gain exceeds 6 dBi. Therefore the limit of 11 dBm/MHz has been reduced by 3.2 dB to 7.8 dBm/MHz.

9. As the power spectral density test uses the same test method as the output power test, before the power is integrated across the occupied bandwidth, the conducted power spectral density plots for 802.11a SISO, 802.11a MIMO, 802.11n MIMO, 802.11ac SISO and 802.11ac MIMO, are located in the conducted output power Section 5.2.4 of this test report. The peak spectral density was measured by placing a marker on the peak of the signal and the results entered in the tables below.

#### **Test setup:**



**Transmitter Maximum Power Spectral Density (5.15-5.25 GHz band) (continued)****Results: 802.11a / 20 MHz / BPSK / 6 Mbps / DAC 0**

Channel	Frequency (MHz)	PPSD (dBm /MHz)	Duty cycle correction factor (dB)	Corrected PPSD (dBm /MHz)	Limit (dBm /MHz)	Margin (dB)	Result
Bottom	5180	2.7	0.6	3.3	10.9	7.6	Complied
Middle	5200	2.5	0.6	3.1	10.9	7.8	Complied
Top	5240	2.8	0.6	3.4	10.9	7.5	Complied

**Results: 802.11a / 20 MHz / CDD / BPSK / 6 Mbps**

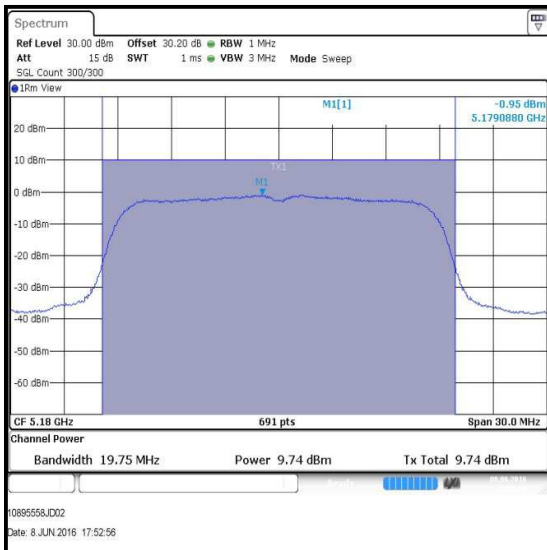
Channel	PPSD DAC 0 (dBm/MHz)	Duty cycle correction factor (dB)	Corrected PPSD DAC 0 (dBm)	PPSD DAC 1 (dBm/MHz)	Duty cycle correction factor (dB)	Corrected PPSD DAC 1 (dBm)
Bottom	-2.1	0.6	-1.5	-5.2	0.6	-4.6
Middle	-2.0	0.6	-1.4	-5.0	0.6	-4.4
Top	-2.1	0.6	-1.5	-5.1	0.6	-4.5

Channel	Combined PPSD (dBm /MHz)	Limit (dBm)	Margin (dB)	Result
Bottom	0.2	7.8	7.6	Complied
Middle	0.4	7.8	7.4	Complied
Top	0.3	7.8	7.5	Complied

**Transmitter Maximum Power Spectral Density (5.15-5.25 GHz band) (continued)**

**Results: 802.11n / 20 MHz / SISO / 64QAM / MCS5 / DAC 0**

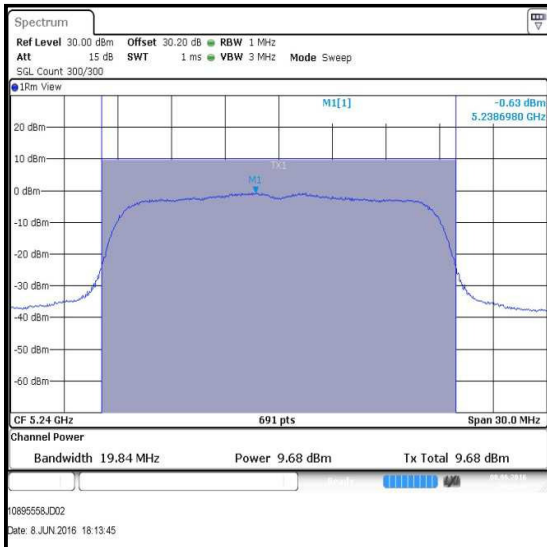
Channel	Frequency (MHz)	PPSD (dBm /MHz)	Duty cycle correction factor (dB)	Corrected PPSD (dBm /MHz)	Limit (dBm /MHz)	Margin (dB)	Result
Bottom	5180	-0.9	3.1	2.2	10.9	8.7	Complied
Middle	5200	-1.1	3.1	2.0	10.9	8.9	Complied
Top	5240	-0.6	3.1	2.5	10.9	8.4	Complied



**Bottom Channel**



**Middle Channel**

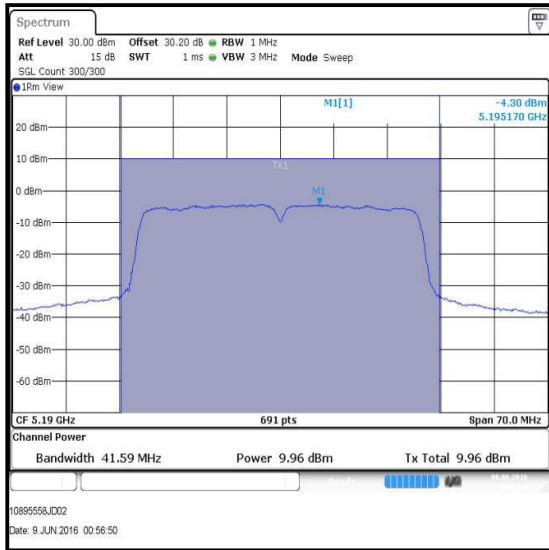


**Top Channel**

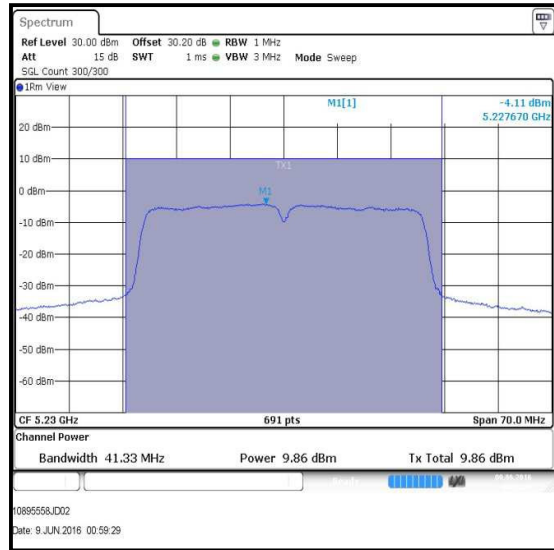
**Transmitter Maximum Power Spectral Density (5.15-5.25 GHz band) (continued)**

**Results: 802.11n / 40 MHz / SISO / QPSK / MCS2 / DAC 0**

Channel	Frequency (MHz)	PPSD (dBm /MHz)	Duty cycle correction	Corrected PPSD (dBm /MHz)	Limit (dBm /MHz)	Margin (dB)	Result
Bottom	5190	-4.3	2.6	-1.7	10.9	12.6	Complied
Top	5230	-4.1	2.6	-1.5	10.9	12.4	Complied



Bottom Channel



Top Channel

**Transmitter Maximum Power Spectral Density (5.15-5.25 GHz band) (continued)****Results: 802.11n / 20 MHz / MIMO / QPSK / MCS1**

Channel	PPSD DAC 0 (dBm/MHz)	Duty cycle correction factor (dB)	Corrected PPSD DAC 0 (dBm)	PPSD DAC 1 (dBm/MHz)	Duty cycle correction factor (dB)	Corrected PPSD DAC 1 (dBm)
Bottom	-2.5	1.1	-1.4	-5.7	1.1	-4.6
Middle	-3.0	1.1	-1.9	-5.7	1.1	-4.6
Top	-2.9	1.1	-1.8	-5.8	1.1	-4.7

Channel	Combined PPSD (dBm /MHz)	Limit (dBm)	Margin (dB)	Result
Bottom	0.3	7.8	7.5	Complied
Middle	0.0	7.8	7.8	Complied
Top	0.0	7.8	7.8	Complied

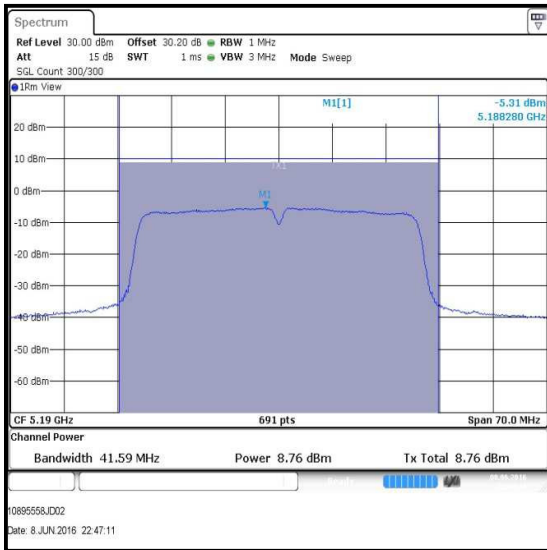
**Results: 802.11n / 40 MHz / MIMO / QPSK / MCS0**

Channel	PPSD DAC 0 (dBm/MHz)	Duty cycle correction factor (dB)	Corrected PPSD DAC 0 (dBm)	PPSD DAC 1 (dBm/MHz)	Duty cycle correction factor (dB)	Corrected PPSD DAC 1 (dBm)
Bottom	-5.3	1.2	-4.1	-7.3	1.2	-6.1
Top	-5.7	1.2	-4.5	-7.4	1.2	-6.2

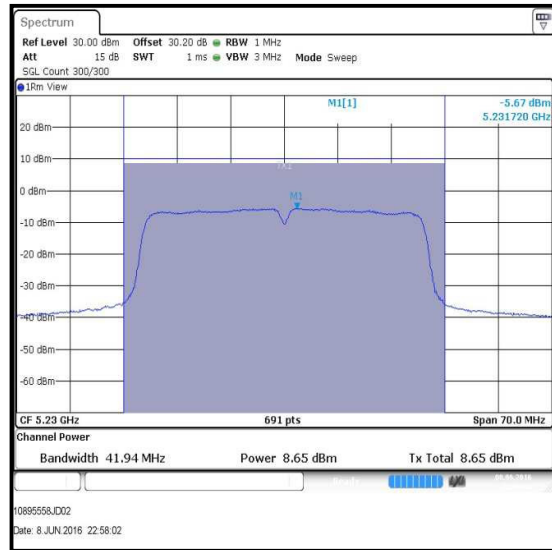
Channel	Combined PPSD (dBm /MHz)	Limit (dBm)	Margin (dB)	Result
Bottom	-2.0	7.8	9.8	Complied
Top	-2.3	7.8	10.1	Complied

**Transmitter Maximum Power Spectral Density (5.15-5.25 GHz band) (continued)**

**Results: 802.11n / 40 MHz / MIMO / QPSK / MCS0 / DAC 0**

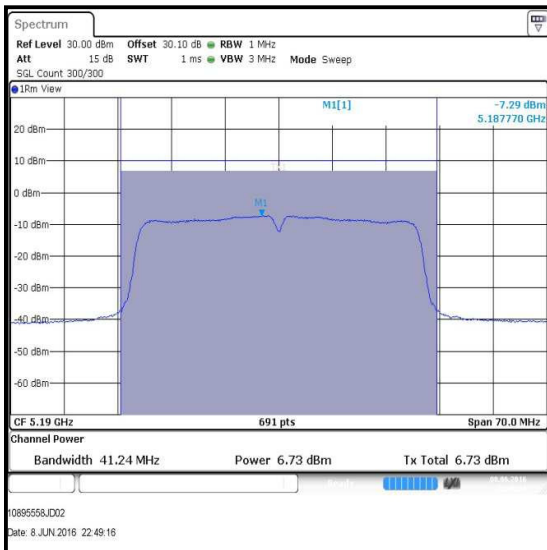


Bottom Channel

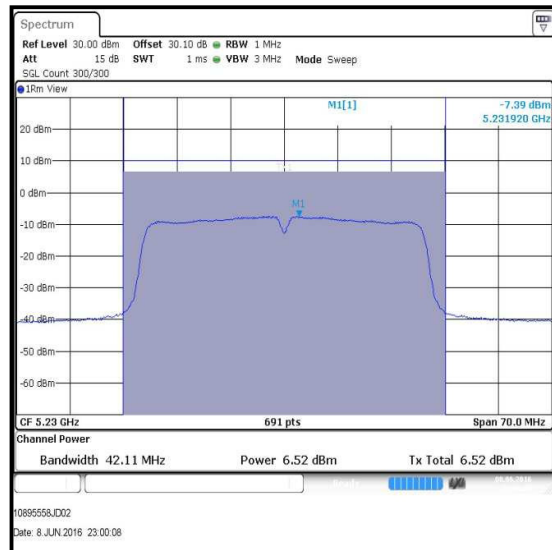


Top Channel

**Results: 802.11n / 40 MHz / MIMO / QPSK / MCS0 / DAC 1**



Bottom Channel



Top Channel

**Transmitter Maximum Power Spectral Density (5.15-5.25 GHz band) (continued)****Results: 802.11ac / 80 MHz / SISO / QPSK / MCS2 / DAC 0**

Channel	Frequency (MHz)	PPSD (dBm /MHz)	Duty cycle correction	Corrected PSD (dBm /MHz)	Limit (dBm /MHz)	Margin (dB)	Result
Single	5210	-8.0	3.9	-4.1	10.9	15.0	Complied

**Results: 802.11ac / 80 MHz / MIMO / 16QAM / MCS3**

Channel	PPSD DAC 0 (dBm/MHz)	Duty cycle correction factor (dB)	Corrected PSD DAC 0 (dBm)	PPSD DAC 1 (dBm/MHz)	Duty cycle correction factor (dB)	Corrected PSD DAC 1 (dBm)
Single	-11.0	4.5	-6.5	-12.7	4.5	-8.2

Channel	Combined PSD (dBm /MHz)	Limit (dBm)	Margin (dB)	Result
Single	-4.3	7.8	12.1	Complied



**Transmitter Maximum Power Spectral Density (5.725-5.85 GHz band)****Test Summary:**

<b>Test Engineer:</b>	Georgios Vrezas	<b>Test Dates:</b>	08 June 2016 & 09 June 2016
<b>Test Sample MAC address:</b>	542AA22F8F19		

<b>FCC Reference:</b>	Part 15.407(a)(3)
<b>Test Method Used:</b>	KDB 789033 D02 Section II.F. referencing II.E.2.d)

**Environmental Conditions:**

<b>Temperature (°C):</b>	23 to 25
<b>Relative Humidity (%):</b>	36 to 53

**Note(s):**

1. FCC Part 15.407(a)(3) limit for PPSD in the 5.725-5.85 GHz operating band is <30 dBm/500 kHz.
2. For SISO modes of operation, the EUT antenna has a gain of <6 dBi.
3. For MIMO modes of operation presented in this section of the test report, the directional antenna gain has been calculated in accordance with KDB 662911 Section F)2)f(ii):

$$\begin{aligned} \text{Directional Gain} &= 10 \log \left[ \frac{\sum_{j=1}^{N_{SS}} \left( \sum_{k=1}^{N_{ANT}} g_{j,k} \right)^2}{N_{ANT}} \right] = 10 \log \left[ \frac{\sum_{j=1}^1 \left( \sum_{k=1}^2 g_{j,k} \right)^2}{2} \right] \\ &= 10 \log \left[ \frac{(g_{1,1} + g_{1,2})^2}{2} \right] = 10 \log \left[ \frac{\left( 10^{\frac{G_1}{20}} + 10^{\frac{G_2}{20}} \right)^2}{2} \right] = 10 \log \left[ \frac{\left( 10^{\frac{4.7}{20}} + 10^{\frac{5.9}{20}} \right)^2}{2} \right] = 8.3 \text{ dBi} \end{aligned}$$

In accordance with 15.407(a)(3), the limit was reduced by the amount in dB the antenna gain exceeds 6 dBi. Therefore the limit of 30 dBm/500 kHz has been reduced by 2.3 dB to 27.7 dBm/ 500 kHz.

4. In accordance with ANSI C63.10 Section 4.1.4.1, use of bandwidths greater than those specified can produce higher readings. Compliance against the applicable limits is shown using a 1 MHz resolution bandwidth. This was deemed worst case.

**Transmitter Maximum Power Spectral Density (5.725-5.85 GHz band) (continued)****Results: 802.11a / 20 MHz / BPSK / 6 Mbps / DAC 0**

Channel	Frequency (MHz)	PPSD (dBm /MHz)	Duty cycle correction factor (dB)	Corrected PPSD (dBm /MHz)	Limit (dBm /500 kHz)	Margin (dB)	Result
Bottom	5745	0.7	0.6	1.3	30.0	28.7	Complied
Middle	5785	0.6	0.6	1.2	30.0	28.8	Complied
Top	5825	0.3	0.6	0.9	30.0	29.1	Complied

**Results: 802.11a / 20 MHz / CDD / QPSK / 6Mbps / DAC 0**

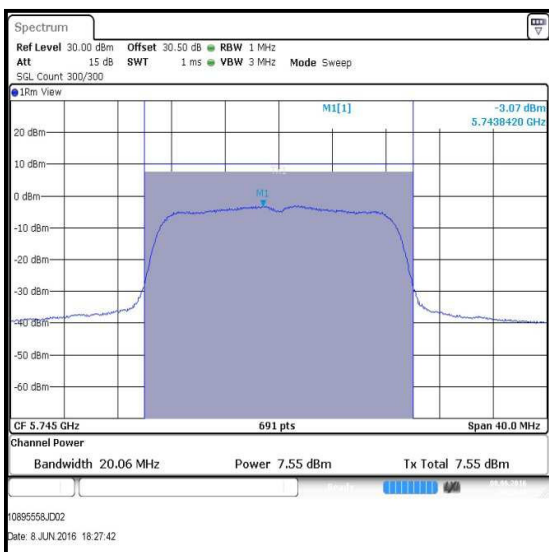
Channel	PPSD DAC 0 (dBm/MHz)	Duty cycle correction factor (dB)	Corrected PPSD DAC 0 (dBm)	PPSD DAC 1 (dBm/MHz)	Duty cycle correction factor (dB)	Corrected PPSD DAC 1 (dBm)
Bottom	-2.5	0.6	-1.9	-3.9	0.6	-3.3
Middle	-2.7	0.6	-2.1	-3.7	0.6	-3.1
Top	-2.9	0.6	-2.3	-3.4	0.6	-2.8

Channel	Combined PPSD (dBm /MHz)	Limit (dBm /500 kHz)	Margin (dB)	Result
Bottom	0.5	27.7	27.2	Complied
Middle	0.4	27.7	27.3	Complied
Top	0.5	27.7	27.2	Complied

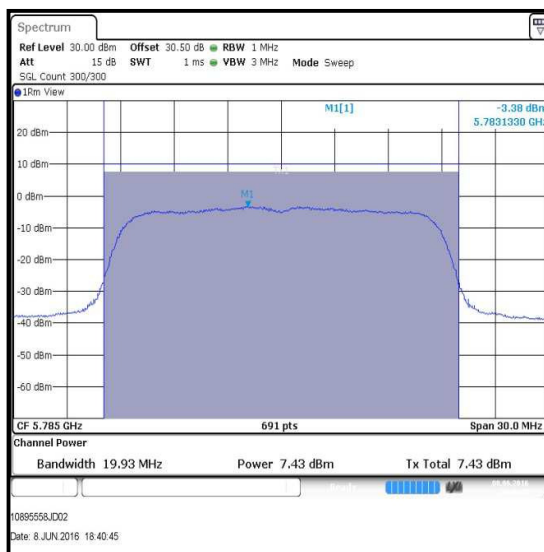
**Transmitter Maximum Power Spectral Density (5.725-5.85 GHz band) (continued)**

**Results: 802.11n / 20 MHz / SISO / 64QAM / MCS5 / DAC 0**

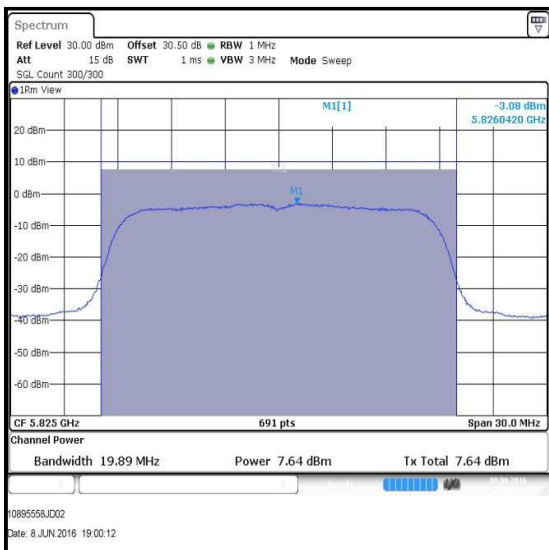
Channel	Frequency (MHz)	PPSD (dBm /MHz)	Duty cycle correction factor (dB)	Corrected PPSD (dBm /MHz)	Limit (dBm /500 kHz)	Margin (dB)	Result
Bottom	5745	-3.1	3.1	0.0	30.0	30.0	Complied
Middle	5785	-3.4	3.1	-0.3	30.0	30.3	Complied
Top	5825	-3.1	3.1	0.0	30.0	30.0	Complied



**Bottom Channel**



**Middle Channel**



**Top Channel**

**Transmitter Maximum Power Spectral Density (5.725-5.85 GHz band) (continued)**

**Results: 802.11n / 20 MHz / MIMO / QPSK / MCS1**

Channel	PPSD DAC 0 (dBm/MHz)	Duty cycle correction factor (dB)	Corrected PPSD DAC 0 (dBm)	PPSD DAC 1 (dBm/MHz)	Duty cycle correction factor (dB)	Corrected PPSD DAC 1 (dBm)
Bottom	-4.5	1.1	-3.4	-4.4	1.1	-3.3
Middle	-4.4	1.1	-3.3	-4.7	1.1	-3.6
Top	-4.2	1.1	-3.1	-4.9	1.1	-3.8

Channel	Combined PPSD (dBm /MHz)	Limit (dBm /500 kHz)	Margin (dB)	Result
Bottom	-0.3	27.7	28.0	Complied
Middle	-0.4	27.7	28.1	Complied
Top	-0.4	27.7	28.1	Complied

**Results: 802.11n / 40 MHz / SISO / QPSK / MCS2 / DAC 0**

Channel	Frequency (MHz)	PPSD (dBm /MHz)	Duty cycle correction	Corrected PPSD (dBm /MHz)	Limit (dBm /500 kHz)	Margin (dB)	Result
Bottom	5755	-6.3	2.6	-3.7	30.0	33.7	Complied
Top	5795	-5.9	2.6	-3.3	30.0	33.3	Complied



Bottom Channel



Top Channel

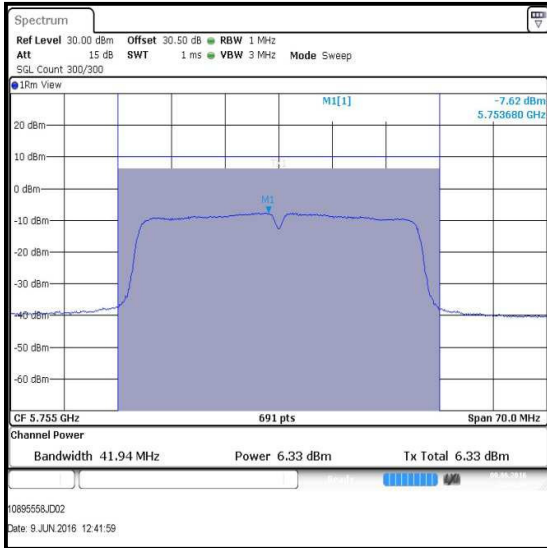
**Transmitter Maximum Power Spectral Density (5.725-5.85 GHz band) (continued)****Results: 802.11n / 40 MHz / MIMO / BPSK / MCS0**

Channel	PPSD DAC 0 (dBm/MHz)	Duty cycle correction factor (dB)	Corrected PPSD DAC 0 (dBm)	PPSD DAC 1 (dBm/MHz)	Duty cycle correction factor (dB)	Corrected PPSD DAC 1 (dBm)
Bottom	-7.6	1.2	-6.4	-10.4	1.2	-9.2
Top	-9.0	1.2	-7.8	-10.8	1.2	-9.6

Channel	Combined PPSD (dBm /MHz)	Limit (dBm /500 kHz)	Margin (dB)	Result
Bottom	-4.6	27.7	32.3	Complied
Top	-5.6	27.7	33.3	Complied

**Transmitter Maximum Power Spectral Density (5.725-5.85 GHz band) (continued)**

**Results: 802.11n / 40 MHz / MIMO / BPSK / MCS0 / DAC 0**

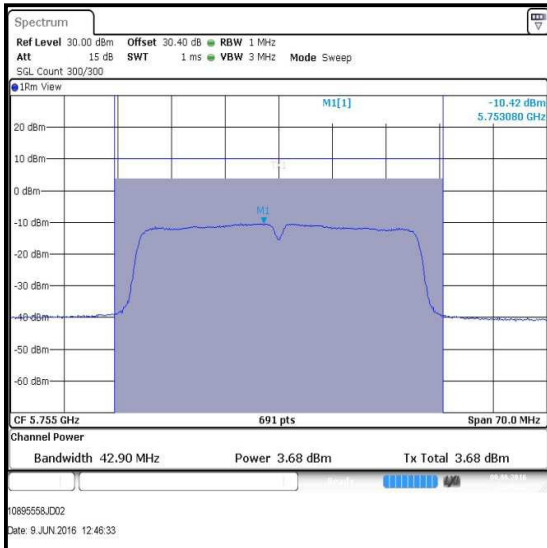


Bottom Channel

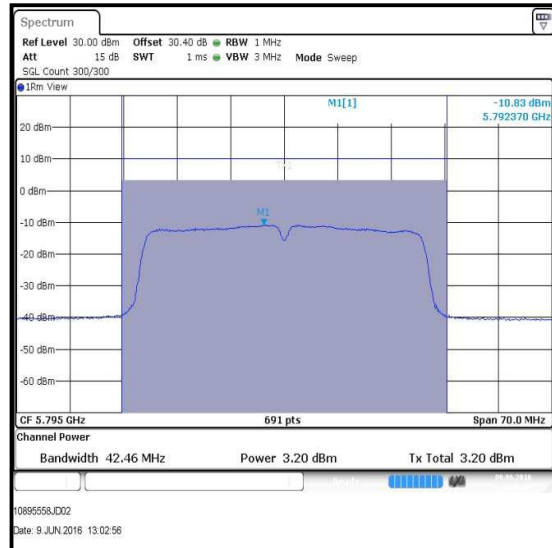


Top Channel

**Results: 802.11n / 40 MHz / MIMO / QPSK / MCS0 / DAC 1**



Bottom Channel



Top Channel

**Transmitter Maximum Power Spectral Density (5.725-5.85 GHz band) (continued)****Results: 802.11ac / 80 MHz / SISO / QPSK / MCS2 / DAC 0**

Channel	Frequency (MHz)	PPSD (dBm /MHz)	Duty cycle correction	Corrected PPSD (dBm /MHz)	Limit (dBm /500 kHz)	Margin (dB)	Result
Single	5775	-10.7	3.9	-6.8	30.0	36.8	Complied

**Results: 802.11ac / 80 MHz / MIMO / 16QAM / MCS3**

Channel	PPSD DAC 0 (dBm/MHz)	Duty cycle correction factor (dB)	Corrected PPSD DAC 0 (dBm)	PPSD DAC 1 (dBm/MHz)	Duty cycle correction factor (dB)	Corrected PPSD DAC 1 (dBm)
Single	-12.7	4.5	-8.2	-15.2	4.5	-10.7

Channel	Combined PPSD (dBm /MHz)	Limit (dBm /500 kHz)	Margin (dB)	Result
Single	-6.3	27.7	34.0	Complied

**Test Equipment Used:**

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M2004	Thermohygrometer	JM Handelspunkt	30.5015.13	Not stated	02 Apr 2017	12
M1835	Signal Analyser	Rohde & Schwarz	FSV30	103050	26 Feb 2017	12
M1867	Attenuator	Huber + Suhner AG	6820.17.B	07101	Calibrated before use	-
A2847	Attenuator	Radiall	R411.820.121	24671450	Calibrated before use	-
A2345	Attenuator	Macom	2082-6043-20	None stated	Calibrated before use	-
A2009	RF Switch	Pickering Interfaces	64-102-002 & 40-881-001	XZ340281 & X311198	Calibrated before use	-
S0538	DC Power Supply	TTi	PL154	250135	Calibrated before use	-
M1818	Multimeter	Fluke	79III	71811580	27 Apr 2017	12
M1252	Signal Generator	Hewlett Packard	83640A	3119A00489	26 Oct 2017	24

**5.2.7. Transmitter Out of Band Radiated Emissions****Test Summary:**

<b>Test Engineer:</b>	Andrew Edwards	<b>Test Date:</b>	17 March 2016
<b>Test Sample Serial Number:</b>	92777		

<b>FCC Reference:</b>	Parts 15.407(b)(1),(6),(7) & 15.209(a)
<b>Test Method Used:</b>	KDB 789033 II.G. & ANSI C63.10 Sections 6.3 and 6.5
<b>Frequency Range:</b>	30 MHz to 1000 MHz

**Environmental Conditions:**

<b>Temperature (°C):</b>	24
<b>Relative Humidity (%):</b>	36

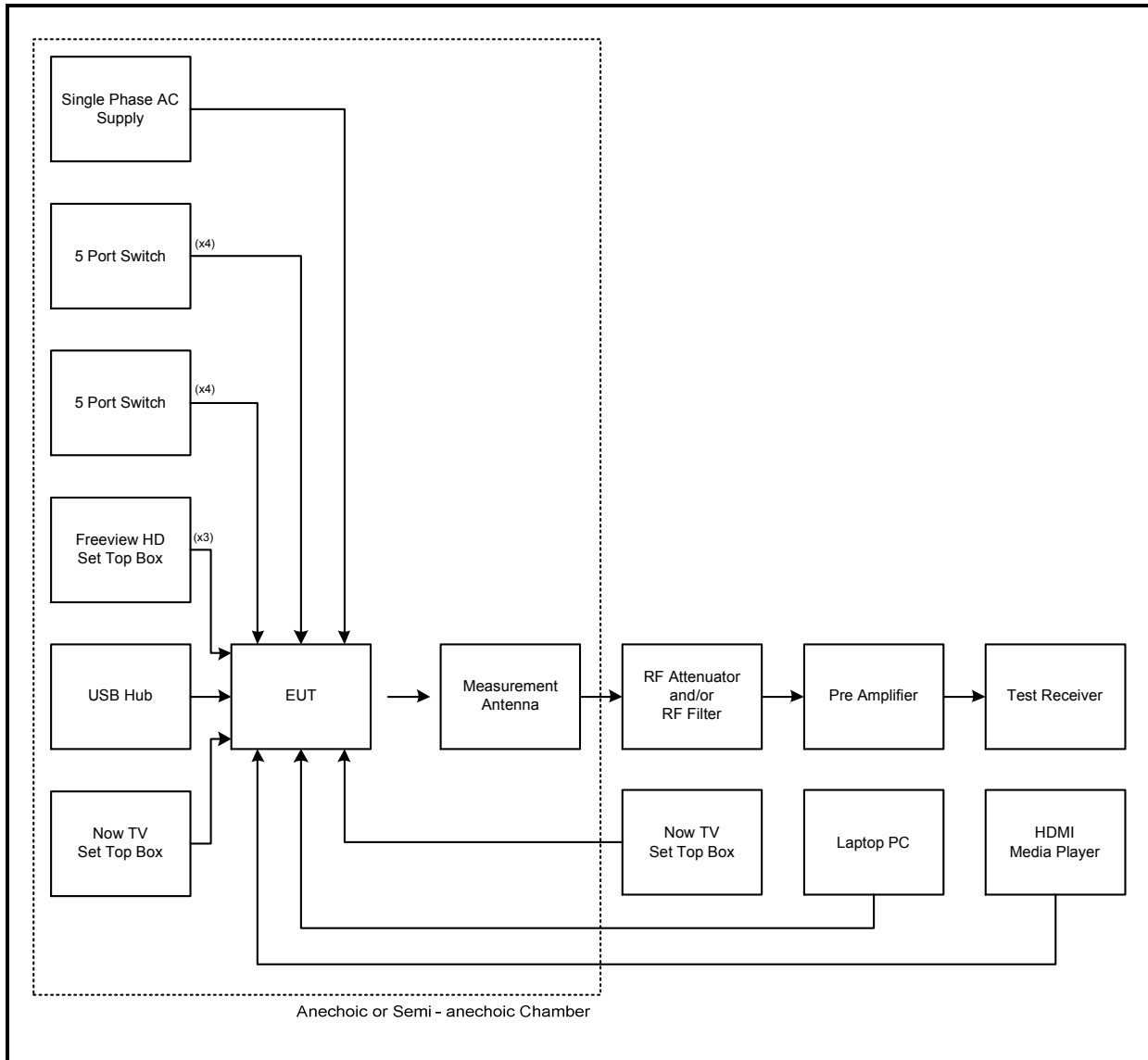
**Note(s):**

1. Pre-scans with the EUT transmitting on the middle channel were measured according to FCC Part 15.407(b)(1) which states for transmitters operating in the band 5.15 to 5.25 GHz: all emissions outside of the band 5.15-5.35 GHz band shall not exceed -27 dBm/MHz. Part(b)(6) states unwanted emissions below 1 GHz must comply with the general field strength limits set forth in 15.209. Part(b)(7) states the provisions of 15.205 apply, e.g. restricted bands of operation.
2. The final measured value, for the given emission in the field strength result tables, incorporates the calibrated antenna factor and cable loss.
3. The preliminary scans showed similar emission levels below 1 GHz, for each channel of operation. Therefore final radiated emissions measurements were performed with the EUT set to the middle channel only.
4. In accordance with ANSI C63.10 Section 6.5.4, the frequency and amplitude of the six highest spurious emissions relative to the limit were recorded in the table below.
5. Measurements below 1 GHz were performed in a semi-anechoic chamber (Asset Number K0001) at a distance of 3 metres. The EUT was placed at a height of 80 cm above the reference ground plane in the centre of the chamber turntable. Maximum emission levels were determined by height searching the measurement antenna over the range 1 metre to 4 metres.



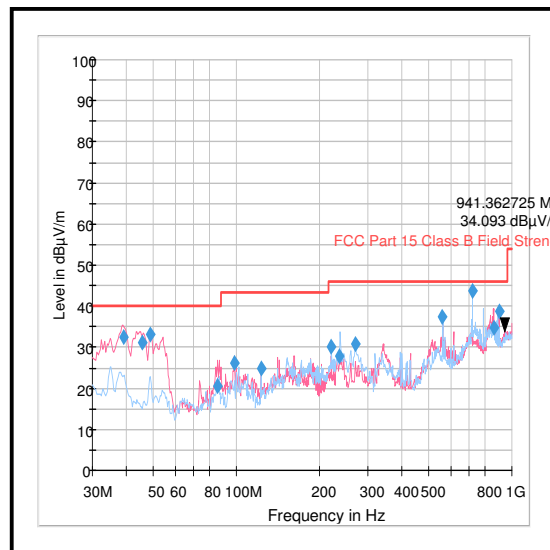
**Transmitter Out of Band Radiated Emissions (continued)**

**Test setup for radiated measurements:**



**Transmitter Out of Band Radiated Emissions (5.15-5.25 GHz band operation) (continued)****Results: Middle Channel / Field Strength**

Frequency (MHz)	Antenna Polarity	Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
38.872	Vertical	32.4	40.0	7.6	Complied
48.921	Vertical	33.1	40.0	6.9	Complied
559.979	Horizontal	37.4	46.0	8.6	Complied
719.984	Horizontal	43.7	46.0	2.3	Complied
858.444	Vertical	34.9	46.0	11.1	Complied
900.092	Vertical	38.7	46.0	7.3	Complied



Note: This plot is a pre-scan and for indication purposes only. For final measurements, see accompanying table.

**Test Equipment Used:**

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M1945	Thermohygrometer	JM Handlungspunkt	30.5015.01	None stated	23 Apr 2016	12
K0001	5m RSE Chamber	Rainford EMC	N/A	N/A	12 Jan 2017	12
M1273	Test Receiver	Rohde & Schwarz	ESIB26	100275	19 Mar 2016	12
G0543	Amplifier	Sonoma	310N	230801	29 May 2016	3
A259	Antenna	Chase	CBL6111	1513	09 Apr 2016	12
A1834	Attenuator	Hewlett Packard	8491B	10444	30 Mar 2017	12

**Transmitter Out of Band Radiated Emissions (5.15-5.25 GHz band operation) (continued)****Test Summary:**

<b>Test Engineers:</b>	Nick Steele & Andrew Edwards	<b>Test Dates:</b>	09 February 2016 to 21 March 2016
<b>Test Sample Serial Number:</b>	92777		

<b>FCC Reference:</b>	Part 15.407(b)(1),(7) & 15.209(a)
<b>Test Method Used:</b>	KDB 789033 II.G. & ANSI C63.10 Sections 6.3 and 6.6
<b>Frequency Range:</b>	1 GHz to 40 GHz

**Environmental Conditions:**

<b>Temperature (°C):</b>	23 to 24
<b>Relative Humidity (%):</b>	30 to 32

**Transmitter Out of Band Radiated Emissions (5.15-5.25 GHz band operation) (continued)****Note(s):**

1. Measurements below 1 GHz were limited to the 5.15-5.25 GHz band, the EUT was transmitting with a data rate of 6 Mbps (802.11a) as it produced the highest EIRP and was therefore deemed worst case
2. FCC Part 15.407(b)(1) states for transmitters operating in the band 5.15 to 5.25 GHz: all emissions outside of the 5.15 to 5.35 GHz band will not exceed -27 dBm/MHz. Part(b)(7) states the provisions of 15.205 apply e.g. restricted bands of operation.
3. Pre-scans were performed with the EUT transmitting on middle channel in the 5.15 to 5.25 GHz band. An inquiry was made to the FCC and the response was pre-scans could be performed in the band with the highest EIRP and all final measurements should be performed on any emissions seen in each band.
4. The final measured value, for the given emission in the result tables, incorporates the calibrated antenna factor and cable loss.
5. Appropriate RF filters and attenuators were used during pre-scans and final measurements. Insertion losses were entered on the spectrum analyser as RF levels offsets.
6. \*In accordance with KDB 789033 Section II.G.1.c) if the peak measurement is below the average limit, it is not necessary to perform a separate average measurement.
7. In accordance with KDB 789033 Section II.G.6.c) Method AD (vi), the average measurements were performed using an increased number of sweeps. The number of sweeps used was 116.
8. In accordance with KDB 789033 Section II.G.6.c) Method AD (iii), pre-scan plots from 1 to 26.5 GHz were performed using an increased number of sweep points as calculated below:
  - o 1 to 4 GHz – 6001 sweep points
  - o 4 to 6 GHz – 4001 sweep points
  - o 4.5 to 5.15 GHz – 1301 sweep points
  - o 5.35 to 5.46 GHz – 301 sweep points
  - o 6 to 8 GHz – 4001 sweep points
  - o 8 to 12.75 GHz – 9501 sweep points
  - o 12.75 to 18 GHz – 10501 sweep points
  - o 18 to 26.5 GHz – 17001 sweep points

All other measurements were performed with the Test Receiver's default setting of 625 sweep points.

9. In accordance with KDB 789033 Section II.G.6.c) Method AD (vii), for average measurements, data rates where the EUT was transmitting <98% duty cycle, the duty cycle correction factor calculated in Section 5.2.4 of this test report was added to the measured result.
10. All other emissions shown on the pre-scan plots were investigated and found to be ambient or >20 dB below the applicable limit or below the measurement system noise floor.
11. Pre-scans above 1 GHz were performed in a fully anechoic chamber (Asset Number K0002) at a distance of 3 metres. The EUT was placed at a height of 1.5 metres above the test chamber floor in the centre of the chamber turntable. All measurement antennas were placed at a fixed height of 1.5 metres above the test chamber floor, in line with the EUT. Final measurements above 1 GHz were performed in a semi-anechoic chamber (Asset Number K0001) at a distance of 3 metres. The EUT was placed at a height of 1.5 m above the reference ground plane in the centre of the chamber turntable. Maximum emission levels were determined by height searching the measurement antenna over the range 1 metre to 4 metres.
12. Radiated measurements were performed under a different UL VS LTD job number. The job number appears on the bottom left of the result plots.

**Transmitter Out of Band Radiated Emissions (5.15-5.25 GHz band operation) (continued)****Results: Bottom Channel / EIRP**

Frequency (MHz)	Antenna Polarity	Level (dBm)	Limit (dBm)	Margin (dB)	Result
1800.282	Vertical	-42.3	-27.0	15.3	Complied
2645.075	Vertical	-42.2	-27.0	15.2	Complied
10358.718	Vertical	-39.5	-27.0	12.5	Complied

**Results: Bottom Channel / Field Strength / Peak**

Frequency (MHz)	Antenna Polarity	Peak Level (dB $\mu$ V/m)	Peak Limit (dB $\mu$ V/m)	Margin (dB)	Result
1048.718	Horizontal	49.7	54.0*	4.3	Complied
1187.865	Horizontal	48.0	54.0*	6.0	Complied
2857.454	Vertical	56.1	74.0	17.9	Complied
7511.809	Horizontal	53.4	54.0*	0.6	Complied
15535.032	Horizontal	63.4	74.0	10.6	Complied

**Results: Bottom Channel / Field Strength / Average**

Frequency (MHz)	Antenna Polarity	Level (dB $\mu$ V/m)	Duty Cycle correction (dB)	Corrected Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
2856.811	Vertical	40.0	0.6	40.6	54.0	13.4	Complied
15540.160	Horizontal	49.1	0.6	49.7	54.0	4.3	Complied

**Transmitter Out of Band Radiated Emissions (5.15-5.25 GHz band operation) (continued)****Results: Middle Channel / EIRP**

Frequency (MHz)	Antenna Polarity	Level (dBm)	Limit (dBm)	Margin (dB)	Result
1800.282	Vertical	-42.3	-27.0	15.3	Complied
2645.075	Vertical	-42.2	-27.0	15.2	Complied
10401.683	Vertical	-39.1	-27.0	12.1	Complied

**Results: Middle Channel / Field Strength / Peak**

Frequency (MHz)	Antenna Polarity	Peak Level (dB $\mu$ V/m)	Peak Limit (dB $\mu$ V/m)	Margin (dB)	Result
1048.718	Horizontal	49.7	54.0*	4.3	Complied
1187.865	Horizontal	48.0	54.0*	6.0	Complied
2857.454	Vertical	56.1	74.0	17.9	Complied
7511.809	Horizontal	53.4	54.0*	0.6	Complied
15600.000	Horizontal	63.0	74.0	11.0	Complied

**Results: Middle Channel / Field Strength / Average**

Frequency (MHz)	Antenna Polarity	Level (dB $\mu$ V/m)	Duty Cycle correction (dB)	Corrected Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
2856.811	Vertical	40.0	0.6	40.6	54.0	13.4	Complied
15600.321	Horizontal	49.0	0.6	49.6	54.0	4.4	Complied

**Transmitter Out of Band Radiated Emissions (5.15-5.25 GHz band operation) (continued)****Results: Top Channel / EIRP**

Frequency (MHz)	Antenna Polarity	Level (dBm)	Limit (dBm)	Margin (dB)	Result
1800.282	Vertical	-42.3	-27.0	15.3	Complied
2645.075	Vertical	-42.2	-27.0	15.2	Complied
10479.760	Vertical	-39.2	-27.0	12.2	Complied

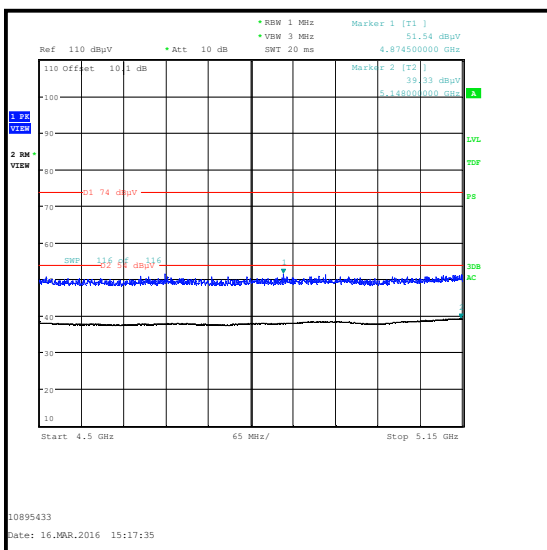
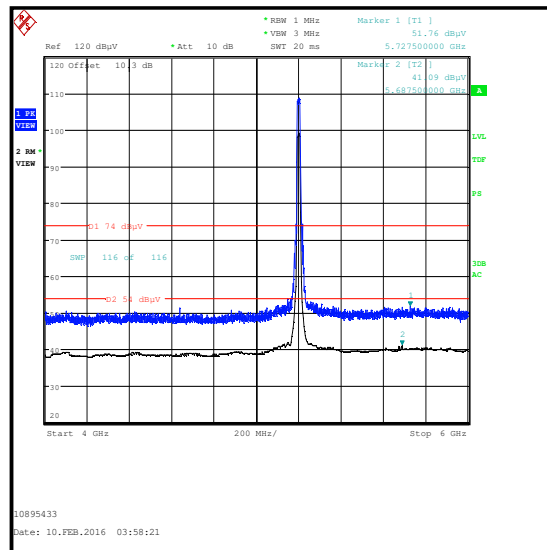
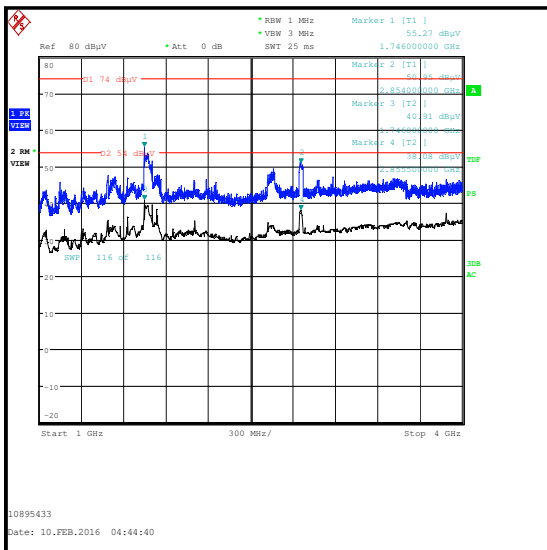
**Results: Top Channel / Field Strength / Peak**

Frequency (MHz)	Antenna Polarity	Peak Level (dB $\mu$ V/m)	Peak Limit (dB $\mu$ V/m)	Margin (dB)	Result
1048.718	Horizontal	49.7	54.0*	4.3	Complied
1187.865	Horizontal	48.0	54.0*	6.0	Complied
2857.454	Vertical	56.1	74.0	17.9	Complied
7511.809	Horizontal	53.4	54.0*	0.6	Complied
15714.872	Horizontal	61.7	74.0	12.3	Complied

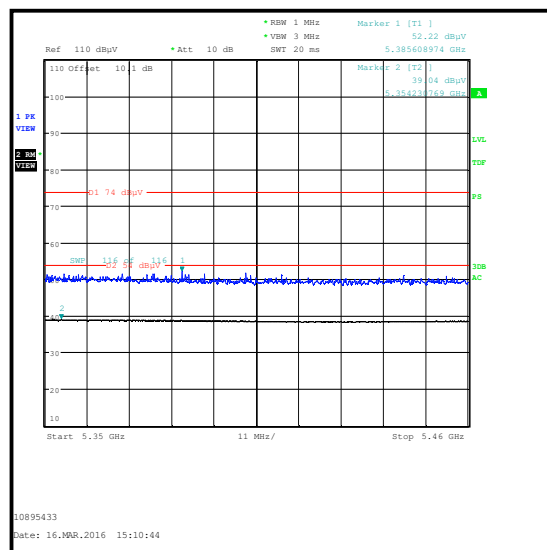
**Results: Top Channel / Field Strength / Average**

Frequency (MHz)	Antenna Polarity	Level (dB $\mu$ V/m)	Duty Cycle correction (dB)	Corrected Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
2856.811	Vertical	40.0	0.6	40.6	54.0	13.4	Complied
15719.038	Horizontal	47.0	0.6	47.6	54.0	6.4	Complied

### Transmitter Out of Band Radiated Emissions (5.15-5.25 GHz band operation) (continued)



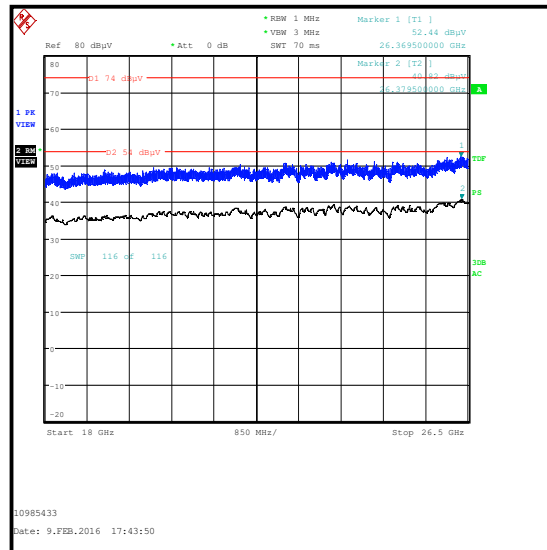
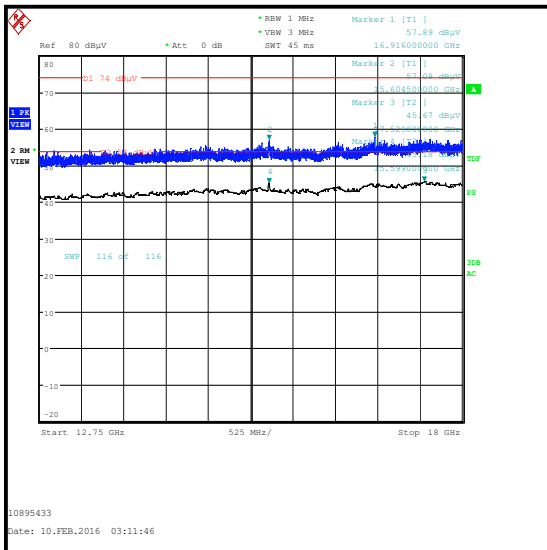
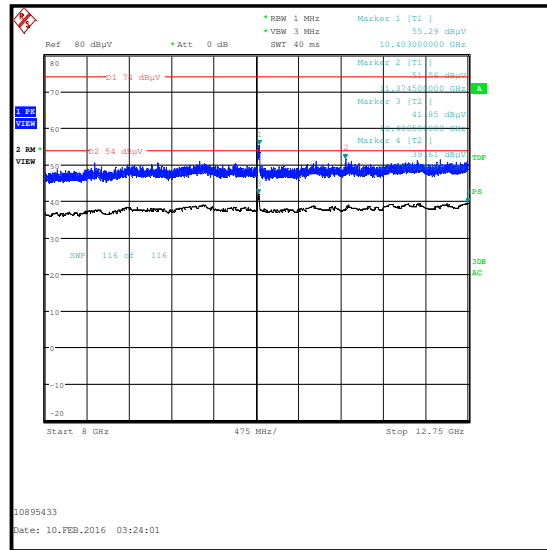
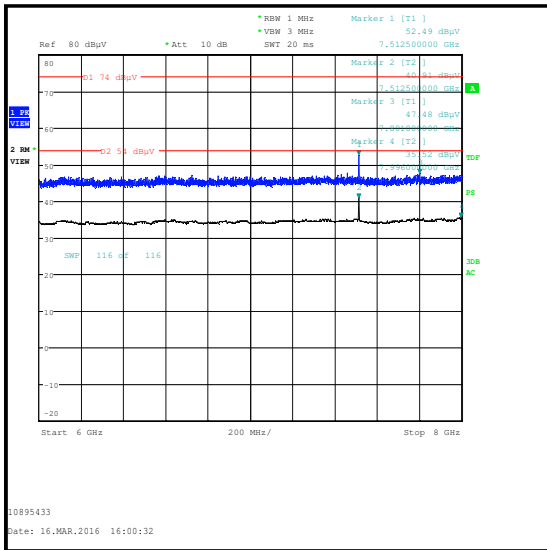
Restricted Band 4.5 GHz to 5.15 GHz



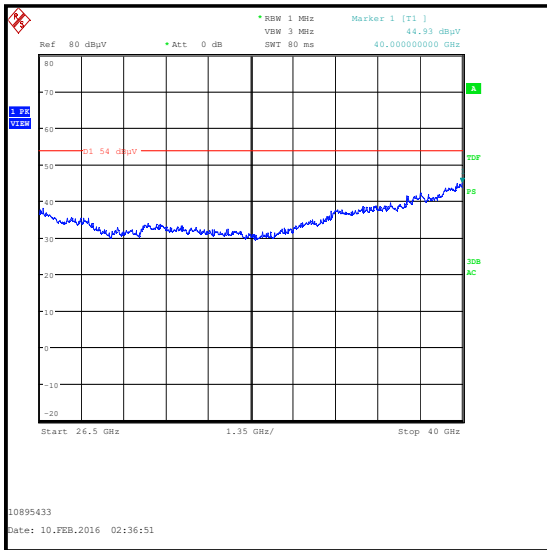
Restricted Band 5.35 GHz to 5.46 GHz



**Transmitter Out of Band Radiated Emissions (5.15-5.25 GHz band operation) (continued)**



**Transmitter Out of Band Radiated Emissions (5.15-5.25 GHz band operation) (continued)**



**Transmitter Out of Band Radiated Emissions (5.725-5.85 GHz band operation) (continued)****Test Summary:**

<b>Test Engineer:</b>	Andrew Edwards	<b>Test Dates:</b>	16 March 2016 & 21 March 2016
<b>Test Sample Serial Number:</b>	92777		

<b>FCC Reference:</b>	Part 15.407(b)(4),(7) & 15.209(a)
<b>Test Method Used:</b>	KDB 789033 II.G. & ANSI C63.10 Sections 6.3 and 6.6
<b>Frequency Range:</b>	1 GHz to 40 GHz

**Environmental Conditions:**

<b>Temperature (°C):</b>	23 to 25
<b>Relative Humidity (%):</b>	29 to 32

**Note(s):**

- FCC Part 15.407(b)(4) states for transmitters operating in the band 5.725 to 5.85 GHz: all emissions within the frequency range from the band edge to 10 MHz above or below the band edge shall not exceed -17 dBm/MHz; for frequencies 10 MHz or greater above or below the band edge will not exceed -27 dBm/MHz. Part(b)(7) states the provisions of 15.205 apply e.g. restricted bands of operation.
- Pre-scans were performed with the EUT transmitting on middle channel in 5.15 to 5.25 GHz band. An inquiry was made to the FCC and the response was pre-scans could be performed in the band with the highest conducted output power and all final measurements should be performed on any emissions seen in each band.
- The final measured value, for the given emission in the result tables, incorporates the calibrated antenna factor and cable loss.
- Appropriate RF filters and attenuators were used during pre-scans and final measurements. Insertion losses were entered on the spectrum analyser as RF levels offsets.
- \*In accordance with KDB 789033 Section II.G.1.c) if the peak measurement is below the average limit, it is not necessary to perform a separate average measurement.
- In accordance with KDB 789033 Section II.G.6.c) Method AD (vii), for average measurements, data rates where the EUT was transmitting <98% duty cycle, the duty cycle correction factor calculated in Section 5.2.4 of this test report was added to the measured result.
- All other emissions shown on the pre-scan plot were investigated and found to be ambient or >20 dB below the applicable limit or below the measurement system noise floor.
- The third harmonic emission was observed on the 12.75 to 18 GHz pre-scan plot when the EUT is transmitting on middle channel in the 5.15 to 5.25 GHz band. This harmonic was investigated in the 5.725 to 5.85 GHz band and emission levels were found to be below the measurement system noise floor on bottom, middle and top channels.
- Pre-scans above 1 GHz were performed in a fully anechoic chamber (Asset Number K0002) at a distance of 3 metres. The EUT was placed at a height of 1.5 metres above the test chamber floor in the centre of the chamber turntable. All measurement antennas were placed at a fixed height of 1.5 metres above the test chamber floor, in line with the EUT. Final measurements above 1 GHz were performed in a semi-anechoic chamber (Asset Number K0001) at a distance of 3 metres. The EUT was placed at a height of 1.5 m above the reference ground plane in the centre of the chamber turntable. Maximum emission levels were determined by height searching the measurement antenna over the range 1 metre to 4 metres.

**Transmitter Out of Band Radiated Emissions (5.725-5.85 GHz band operation) (continued)****Results: Bottom Channel / EIRP**

Frequency (MHz)	Antenna Polarity	Level (dBm)	Limit (dBm)	Margin (dB)	Result
1800.282	Vertical	-42.3	-27.0	15.3	Complied
2645.075	Vertical	-42.2	-27.0	15.2	Complied
11491.010	Vertical	-39.2	-27.0	12.2	Complied

**Results: Bottom Channel / Field Strength / Peak**

Frequency (MHz)	Antenna Polarity	Peak Level (dB $\mu$ V/m)	Peak Limit (dB $\mu$ V/m)	Margin (dB)	Result
1048.718	Horizontal	49.7	54.0*	4.3	Complied
1187.865	Horizontal	48.0	54.0*	6.0	Complied
2857.454	Vertical	56.1	74.0	17.9	Complied
7511.809	Horizontal	53.4	54.0*	0.6	Complied
11491.010	Vertical	56.0	74.0	18.0	Complied

**Results: Bottom Channel / Field Strength / Average**

Frequency (MHz)	Antenna Polarity	Level (dB $\mu$ V/m)	Duty Cycle correction (dB)	Corrected Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
2856.811	Vertical	40.0	0.6	40.6	54.0	13.4	Complied
11489.840	Vertical	43.4	0.6	44.2	54.0	9.8	Complied

**Transmitter Out of Band Radiated Emissions (5.725-5.85 GHz band operation) (continued)****Results: Middle Channel / EIRP**

Frequency (MHz)	Antenna Polarity	Level (dBm)	Limit (dBm)	Margin (dB)	Result
1800.282	Vertical	-42.3	-27.0	15.3	Complied
2645.075	Vertical	-42.2	-27.0	15.2	Complied
11571.843	Vertical	-37.9	-27.0	10.9	Complied

**Results: Middle Channel / Field Strength / Peak**

Frequency (MHz)	Antenna Polarity	Peak Level (dB $\mu$ V/m)	Peak Limit (dB $\mu$ V/m)	Margin (dB)	Result
1048.718	Horizontal	49.7	54.0*	4.3	Complied
1187.865	Horizontal	48.0	54.0*	6.0	Complied
2857.454	Vertical	56.1	74.0	17.9	Complied
7511.809	Horizontal	53.4	54.0*	0.6	Complied
11571.843	Vertical	57.3	74.0	16.7	Complied

**Results: Middle Channel / Field Strength / Average**

Frequency (MHz)	Antenna Polarity	Level (dB $\mu$ V/m)	Duty Cycle correction (dB)	Corrected Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
2856.811	Vertical	40.0	0.6	40.6	54.0	13.4	Complied
11569.920	Vertical	44.0	0.6	44.6	54.0	9.4	Complied

**Transmitter Out of Band Radiated Emissions (5.725-5.85 GHz band operation) (continued)****Results: Top Channel / EIRP**

Frequency (MHz)	Antenna Polarity	Level (dBm)	Limit (dBm)	Margin (dB)	Result
1800.282	Vertical	-42.3	-27.0	15.3	Complied
2645.075	Vertical	-42.2	-27.0	15.2	Complied
11645.833	Vertical	-37.1	-27.0	10.1	Complied

**Results: Top Channel / Field Strength / Peak**

Frequency (MHz)	Antenna Polarity	Peak Level (dB $\mu$ V/m)	Peak Limit (dB $\mu$ V/m)	Margin (dB)	Result
1048.718	Horizontal	49.7	54.0*	4.3	Complied
1187.865	Horizontal	48.0	54.0*	6.0	Complied
2857.454	Vertical	56.1	74.0	17.9	Complied
7511.809	Horizontal	53.4	54.0*	0.6	Complied
11645.833	Vertical	58.1	74.0	15.9	Complied

**Results: Top Channel / Field Strength / Average**

Frequency (MHz)	Antenna Polarity	Level (dB $\mu$ V/m)	Duty Cycle correction (dB)	Corrected Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
2856.811	Vertical	40.0	0.6	40.6	54.0	13.4	Complied
11649.839	Vertical	44.5	0.6	45.1	54.0	8.9	Complied

**Transmitter Out of Band Radiated Emissions (continued)****Test Equipment Used:**

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M1656	Thermohygrometer	JM Handelspunkt	30.5015.13	Not stated	23 Apr 2016	12
K0002	3m RSE Chamber	Rainford EMC	N/A	N/A	21 Dec 2016	12
M1874	Test Receiver	Rohde & Schwarz	ESU26	100553	12 Jun 2016	12
M1630	Test Receiver	Rohde & Schwarz	ESU40	100233	17 Feb 2017	12
A1534	Pre Amplifier	Hewlett Packard	8449B	3008A00405	19 Dec 2016	12
A1785	Pre Amplifier	Farran Technology	FLNA-28-30	FTL 6483	12 Jan 2017	12
A1818	Antenna	EMCO	3115	00075692	17 Dec 2016	12
A253	Antenna	Flann Microwave	12240-20	128	17 Dec 2016	12
A254	Antenna	Flann Microwave	14240-20	139	17 Dec 2016	12
A255	Antenna	Flann Microwave	16240-20	519	17 Dec 2016	12
A256	Antenna	Flann Microwave	18240-20	400	17 Dec 2016	12
A436	Antenna	Flann Microwave	20240-20	330	19 Dec 2016	12
A201	Antenna	Flann Microwave	22240-20	343	19 May 2016	36
A1396	Attenuator	Huber & Suhner	6810.17.B	757987	30 May 2016	12
A2176	High Pass Filter	AtlanTecRF	AFH-07000	800980	17 Apr 2016	12
S0537	DC Power Supply	TTi	EL302D	249928	Calibrated before use	-
M1269	Multimeter	Fluke	179	90250210	26 May 2016	12
M1627	Thermohygrometer	JM Handelspunkt	30.5015.10	Not stated	11 Jan 2017	12
K0001	5m RSE Chamber	Rainford EMC	N/A	N/A	12 Jan 2017	12
M1124	Test Receiver	Rohde & Schwarz	ESIB26	100046	18 Nov 2016	12

**5.2.8. Transmitter Band Edge Radiated Emissions****Test Summary:**

<b>Test Engineers:</b>	David Doyle, Nick Steele & Andrew Edwards	<b>Test Dates:</b>	09 February 2016 & 21 March 2016
<b>Test Sample Serial Number:</b>	92777		

<b>FCC Reference:</b>	Parts 15.407(b)(1),(7), 15.205 & 15.209(a)
<b>Test Method Used:</b>	ANSI C63.10 Section 6.10 & KDB 789033 II.G.

**Environmental Conditions:**

<b>Temperature (°C):</b>	23 to 24
<b>Relative Humidity (%):</b>	30 to 32

**Note(s):**

1. Band edge measurements were performed in the EUT modes that produce the highest power and the widest bandwidths. The modes were:
  - 802.11a - BPSK / 6 Mbps
  - 802.11a CDD - BPSK / 6 Mbps
  - 802.11n HT20 SISO - BPSK / MCS0
  - 802.11n HT20 SISO – 16QAM / MCS3
  - 802.11n HT40 SISO - BPSK / MCS0
  - 802.11n HT40 SISO – 16QAM / MCS3
  - 802.11n HT20 MIMO - BPSK / MCS0
  - 802.11n HT20 MIMO - QPSK / MCS1
  - 802.11n HT40 MIMO - BPSK / MCS0
  - 802.11n HT40 MIMO – 16QAM / MCS3
  - 802.11ac VHT80 SISO - QPSK / MCS2
  - 802.11ac VHT80 MIMO - BPSK / MCS0
  - 802.11ac VHT80 MIMO – 16QAM / MCS3
2. Lower band edge measurements were performed with the EUT transmitting on the bottom channel. Upper band edge measurements were performed with the EUT transmitting on the top channel.
3. For transmitters operating in the 5.15-5.25 GHz band: all emissions outside of the 5.15-5.35 GHz band shall not exceed an EIRP of -27 dBm/MHz. However, there are restricted bands of operation below the lower band edge at 4.5-5.15 GHz and also above the upper band edge at 5.35-5.46 GHz therefore the provisions of FCC Part 15.205 apply.
4. Field strength measurements using peak and average detectors were performed in the restricted bands below 5.15 GHz and above 5.35 GHz. Field strength and EIRP results were found to be compliant with the restricted band limits and Part 15.407 out-of-band limits.
5. In accordance with KDB 789033 Section II.G.1.c) if the peak measurement is below the average limit, it is not necessary to perform a separate average measurement.



**Transmitter Band Edge Radiated Emissions (continued)****Note(s):**

6. In accordance with KDB 789033 Section II.G.6.c) Method AD (vi), the average measurements were performed using a number of sweeps greater than or equal to the number of sweeps calculated below:
  - 802.11a - BPSK / 6 Mbps – 116 sweeps
  - 802.11a CDD - BPSK / 6 Mbps – 115 sweeps
  - 802.11n HT20 SISO - BPSK / MCS0 – 117 sweeps
  - 802.11n HT20 SISO – 16QAM / MCS3 – 165 sweeps
  - 802.11n HT40 SISO - BPSK / MCS0 – 134 sweeps
  - 802.11n HT40 SISO – 16QAM / MCS3 – 206 sweeps
  - 802.11n HT20 MIMO - BPSK / MCS0 – 133 sweeps
  - 802.11n HT20 MIMO - QPSK / MCS1 – 164 sweeps
  - 802.11n HT40 MIMO - BPSK / MCS0 – 158 sweeps
  - 802.11n HT40 MIMO – 16QAM / MCS3 – 272 sweeps
  - 802.11ac VHT80 SISO - QPSK / MCS2 – 247 sweeps
  - 802.11ac VHT80 MIMO - BPSK / MCS0 – 161 sweeps
  - 802.11ac VHT80 MIMO – 16QAM / MCS3 – 323 sweeps
7. In accordance with KDB 789033 Section II.G.6.c) Method AD (vii), for average measurements on data rates where the EUT was transmitting <98% duty cycle, the duty cycle correction factor calculated in section 5.2.4 was added to the measured result.
8. Radiated measurements were performed under a different UL VS LTD job number. The job number appears on the bottom left of the result plots.

**Transmitter Band Edge Radiated Emissions (5.15-5.25 GHz band operation) (continued)****Results: 802.11a / 20 MHz / BPSK / 6 Mbps / Peak**

Frequency (MHz)	Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
5150	56.9	74.0	17.1	Complied

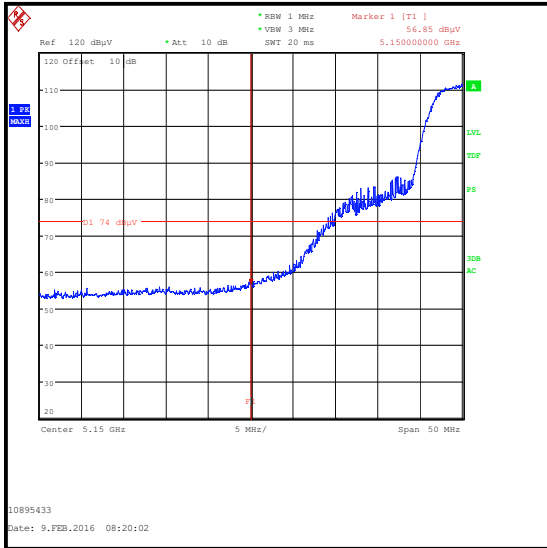
Frequency (MHz)	Peak Level (dB $\mu$ V/m)	Average Limit (dB $\mu$ V/m)	Margin (dB)	Result
5350	52.8	54.0	1.2	Complied
5351.106	53.5	54.0	0.5	Complied

**Results: 802.11a / 20 MHz / BPSK / 6 Mbps / Average**

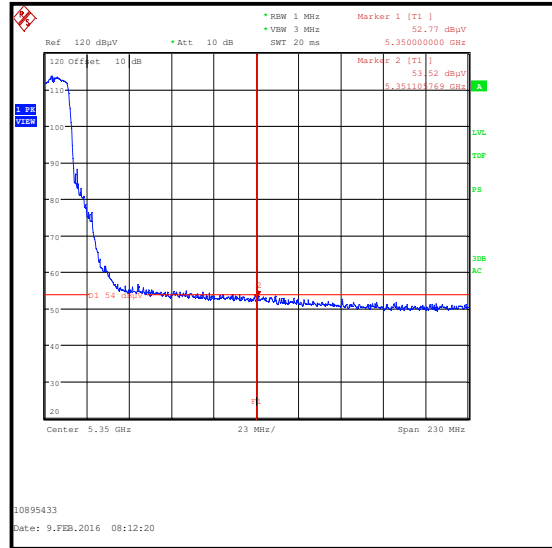
Frequency (MHz)	Level (dB $\mu$ V/m)	Duty Cycle correction (dB)	Corrected Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
5150	43.9	0.6	44.5	54.0	9.5	Complied

**Transmitter Band Edge Radiated Emissions (5.15-5.25 GHz band operation) (continued)**

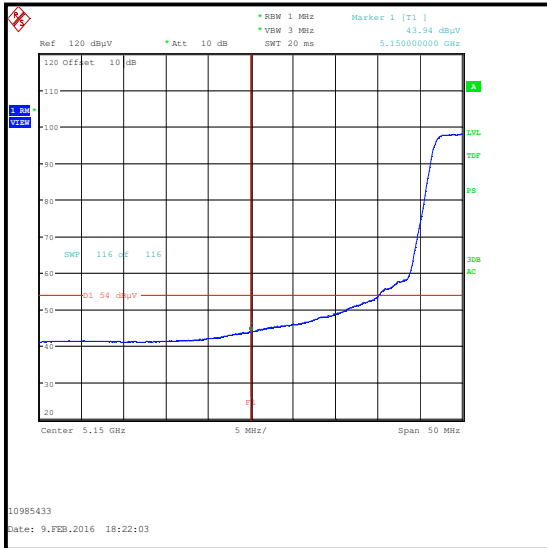
**Results: 802.11a / 20 MHz / BPSK / 6 Mbps**



**Lower Band Edge Peak Measurement**



**Upper Band Edge Peak Measurement**



**Lower Band Edge Average Measurement**

**Transmitter Band Edge Radiated Emissions (5.15-5.25 GHz band operation) (continued)****Results: 802.11a / 20 MHz / CDD / BPSK / 6 Mbps / Peak**

Frequency (MHz)	Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
5147.676	72.8	74.0	1.2	Complied
5150	67.6	74.0	6.4	Complied

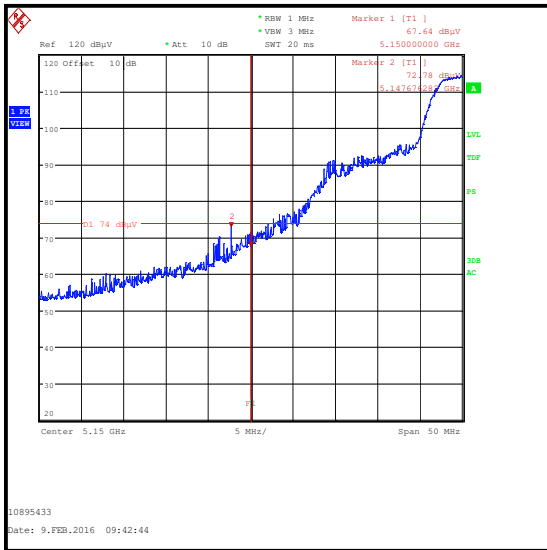
Frequency (MHz)	Peak Level (dB $\mu$ V/m)	Average Limit (dB $\mu$ V/m)	Margin (dB)	Result
5350	51.2	54.0	2.8	Complied
5361.426	52.5	54.0	1.5	Complied

**Results: 802.11a / 20 MHz / CDD / BPSK / 6 Mbps / Average**

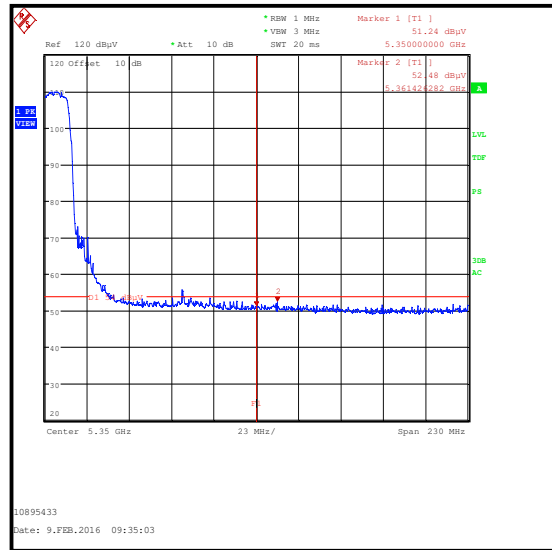
Frequency (MHz)	Level (dB $\mu$ V/m)	Duty Cycle correction (dB)	Corrected Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
5150	42.2	0.6	42.8	54.0	11.2	Complied

**Transmitter Band Edge Radiated Emissions (5.15-5.25 GHz band operation) (continued)**

**Results: 802.11a / 20 MHz / CDD / BPSK / 6 Mbps**



**Lower Band Edge Peak Measurement**



**Upper Band Edge Peak Measurement**



**Lower Band Edge Average Measurement**

**Transmitter Band Edge Radiated Emissions (5.15-5.25 GHz band operation) (continued)****Results: 802.11n / 20 MHz / SISO / BPSK / MCS0 / Peak**

Frequency (MHz)	Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
5150	56.5	74.0	17.5	Complied

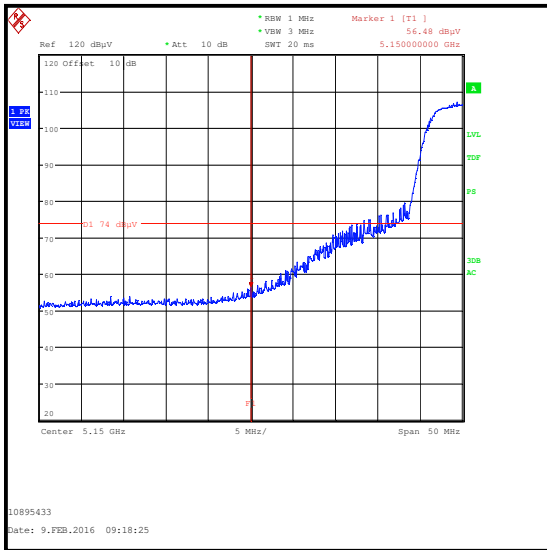
Frequency (MHz)	Peak Level (dB $\mu$ V/m)	Average Limit (dB $\mu$ V/m)	Margin (dB)	Result
5350	50.3	54.0	3.7	Complied
5353.317	52.4	54.0	1.6	Complied

**Results: 802.11n / 20 MHz / SISO / BPSK / 6.5 Mbps / MCS0 / Average**

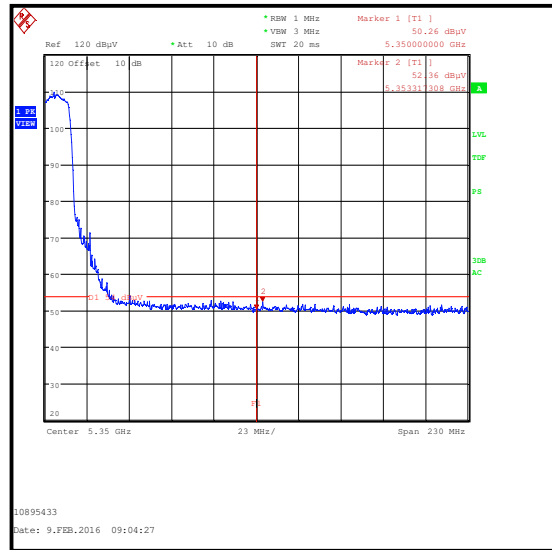
Frequency (MHz)	Level (dB $\mu$ V/m)	Duty Cycle correction (dB)	Corrected Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
5150	44.0	0.6	44.6	54.0	9.4	Complied

**Transmitter Band Edge Radiated Emissions (5.15-5.25 GHz band operation) (continued)**

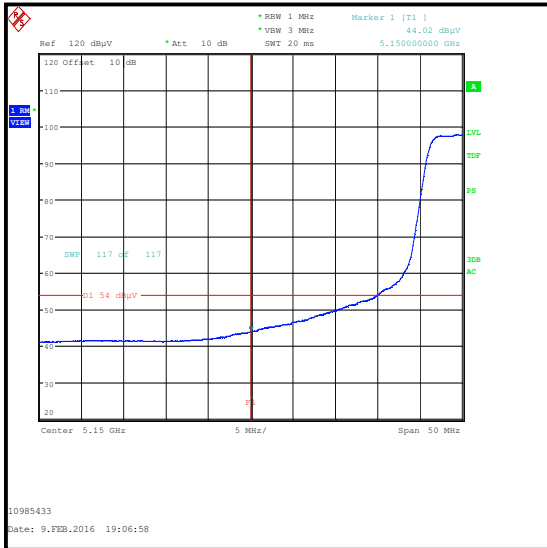
**Results: 802.11n / 20 MHz / SISO / BPSK / MCS0**



**Lower Band Edge Peak Measurement**



**Upper Band Edge Peak Measurement**



**Lower Band Edge Average Measurement**

**Transmitter Band Edge Radiated Emissions (5.15-5.25 GHz band operation) (continued)****Results: 802.11n / 20 MHz / SISO / 16QAM / MCS3 / Peak**

Frequency (MHz)	Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
5148.638	54.4	74.0	19.6	Complied
5150	54.0	74.0	20.0	Complied

Frequency (MHz)	Peak Level (dB $\mu$ V/m)	Average Limit (dB $\mu$ V/m)	Margin (dB)	Result
5350	52.9	54.0	1.1	Complied

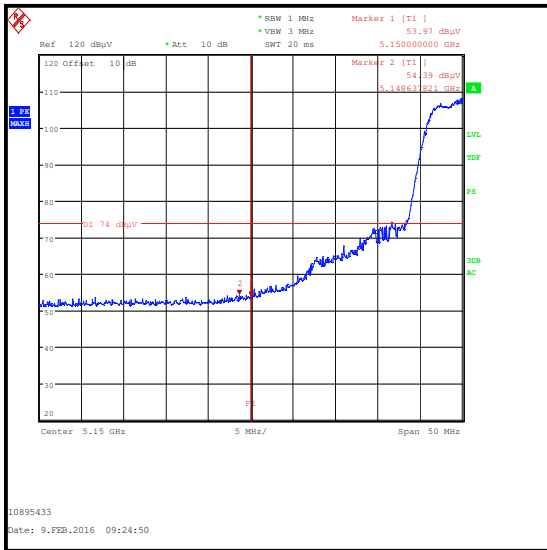
**Results: 802.11n / 20 MHz / SISO / 16QAM / MCS3 / Average**

Frequency (MHz)	Level (dB $\mu$ V/m)	Duty Cycle correction (dB)	Corrected Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
5150	42.4	2.0	44.4	54.0	9.6	Complied

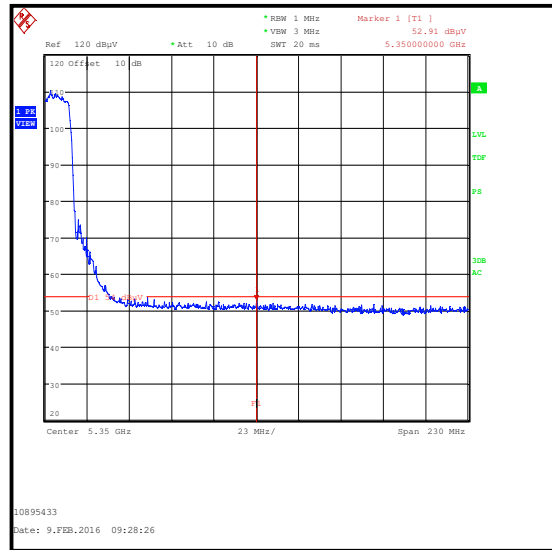


**Transmitter Band Edge Radiated Emissions (5.15-5.25 GHz band operation) (continued)**

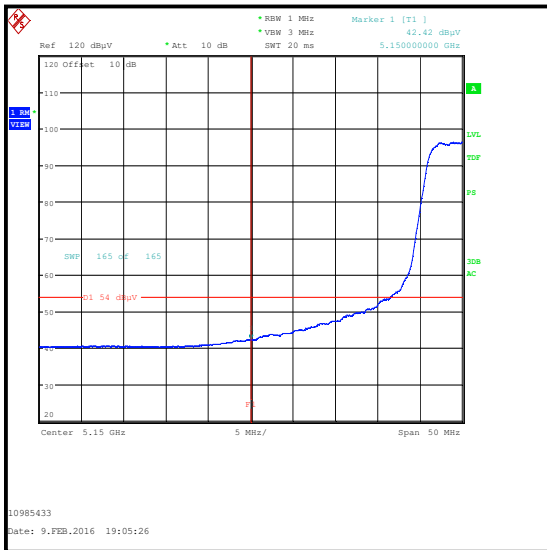
**Results: 802.11n / 20 MHz / SISO / 16QAM / MCS3**



**Lower Band Edge Peak Measurement**



**Upper Band Edge Peak Measurement**



**Lower Band Edge Average Measurement**

**Transmitter Band Edge Radiated Emissions (5.15-5.25 GHz band operation) (continued)****Results: 802.11n / 40 MHz / SISO / BPSK / MCS0 / Peak**

Frequency (MHz)	Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
5149.840	69.0	74.0	5.0	Complied
5150	68.8	74.0	5.2	Complied

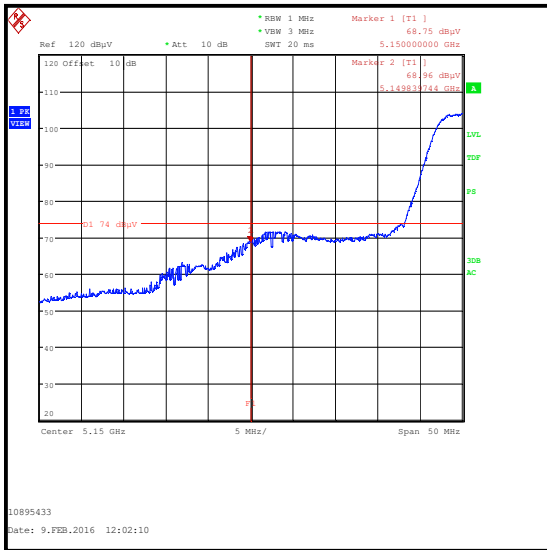
Frequency (MHz)	Peak Level (dB $\mu$ V/m)	Average Limit (dB $\mu$ V/m)	Margin (dB)	Result
5350	51.8	54.0	2.2	Complied
5359.952	53.0	54.0	1.0	Complied

**Results: 802.11n / 40 MHz / SISO / BPSK / MCS0 / Average**

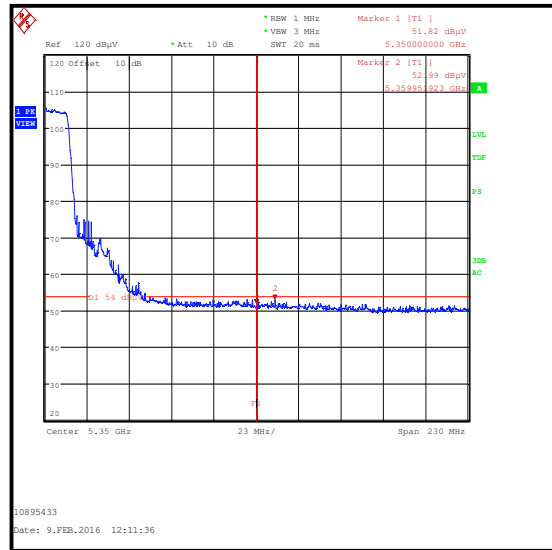
Frequency (MHz)	Level (dB $\mu$ V/m)	Duty Cycle correction (dB)	Corrected Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
5150	49.3	1.2	50.5	54.0	3.5	Complied

**Transmitter Band Edge Radiated Emissions (5.15-5.25 GHz band operation) (continued)**

**Results: 802.11n / 40 MHz / SISO / BPSK / MCS0**



**Lower Band Edge Peak Measurement**



**Upper Band Edge Peak Measurement**



**Lower Band Edge Average Measurement**

**Transmitter Band Edge Radiated Emissions (5.15-5.25 GHz band operation) (continued)****Results: 802.11n / 40 MHz / SISO / 16QAM / MCS3 / Peak**

Frequency (MHz)	Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
5150	63.1	74.0	10.9	Complied

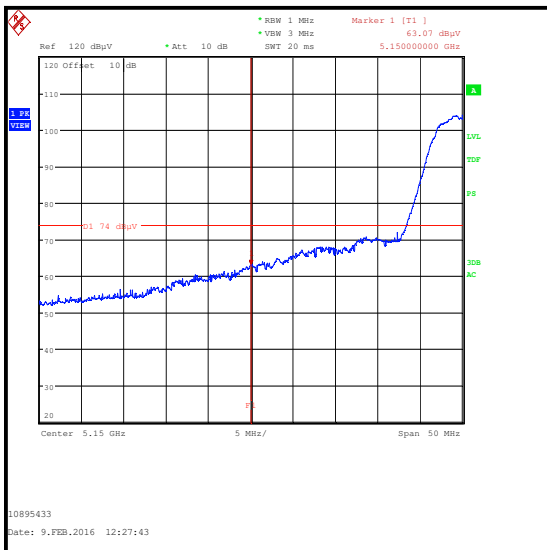
Frequency (MHz)	Peak Level (dB $\mu$ V/m)	Average Limit (dB $\mu$ V/m)	Margin (dB)	Result
5350	50.9	54.0	3.1	Complied
5359.952	52.2	54.0	1.8	Complied

**Results: 802.11n / 40 MHz / SISO / 16QAM / MCS3 / Average**

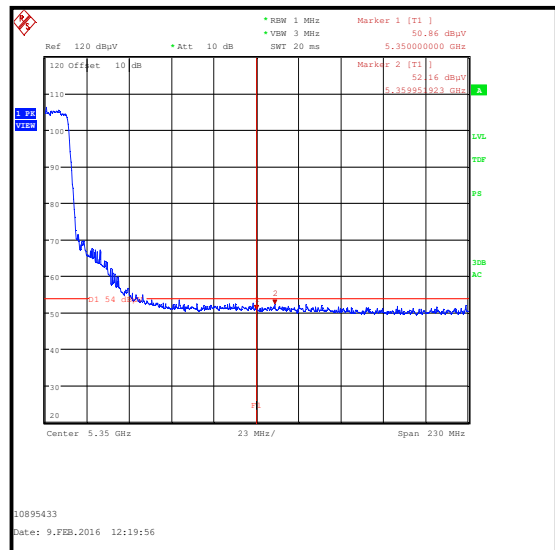
Frequency (MHz)	Level (dB $\mu$ V/m)	Duty Cycle correction (dB)	Corrected Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
5150	46.8	3.1	49.9	54.0	4.1	Complied

**Transmitter Band Edge Radiated Emissions (5.15-5.25 GHz band operation) (continued)**

**Results: 802.11n / 40 MHz / 16QAM / MCS3**



**Lower Band Edge Peak Measurement**



**Upper Band Edge Peak Measurement**



**Lower Band Edge Average Measurement**

**Transmitter Band Edge Radiated Emissions (5.15-5.25 GHz band operation) (continued)****Results: 802.11n / 20 MHz / MIMO / BPSK / MCS0 / Peak**

Frequency (MHz)	Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
5148.237	53.8	74.0	20.2	Complied
5150	53.4	74.0	20.6	Complied

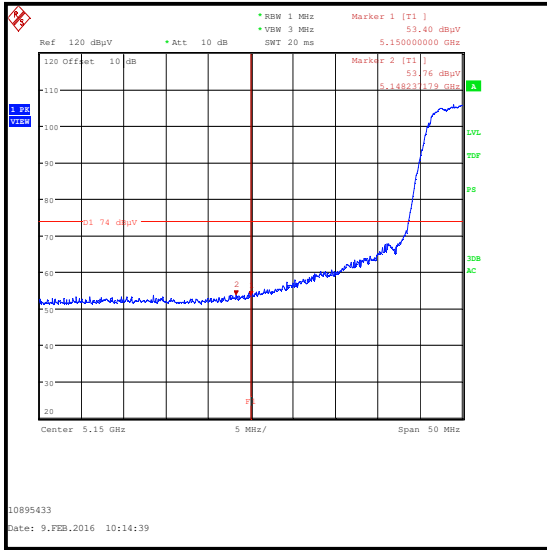
Frequency (MHz)	Peak Level (dB $\mu$ V/m)	Average Limit (dB $\mu$ V/m)	Margin (dB)	Result
5350	49.8	54.0	4.2	Complied
5350.369	52.0	54.0	2.0	Complied

**Results: 802.11n / 20 MHz / MIMO / BPSK / MCS0 / Average**

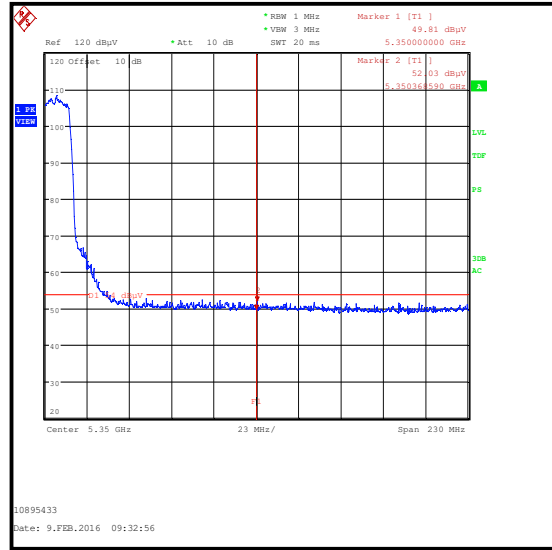
Frequency (MHz)	Level (dB $\mu$ V/m)	Duty Cycle correction (dB)	Corrected Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
5150	42.7	0.6	43.3	54.0	10.7	Complied

**Transmitter Band Edge Radiated Emissions (5.15-5.25 GHz band operation) (continued)**

**Results: 802.11n / 20 MHz / MIMO / BPSK / MCS0**



**Lower Band Edge Peak Measurement**



**Upper Band Edge Peak Measurement**



**Lower Band Edge Average Measurement**

**Transmitter Band Edge Radiated Emissions (5.15-5.25 GHz band operation) (continued)****Results: 802.11n / 20 MHz / MIMO / QPSK / MCS1 / Peak**

Frequency (MHz)	Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
5149.519	54.6	74.0	19.4	Complied
5150	53.6	74.0	20.4	Complied

Frequency (MHz)	Peak Level (dB $\mu$ V/m)	Average Limit (dB $\mu$ V/m)	Margin (dB)	Result
5350	50.5	54.0	3.5	Complied

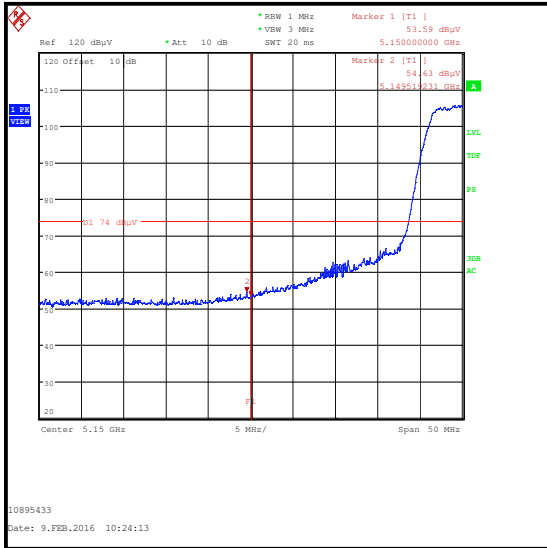
**Results: 802.11n / 20 MHz / MIMO / QPSK / MCS1 / Average**

Frequency (MHz)	Level (dB $\mu$ V/m)	Duty Cycle correction (dB)	Corrected Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
5150	41.7	1.1	42.8	54.0	11.2	Complied

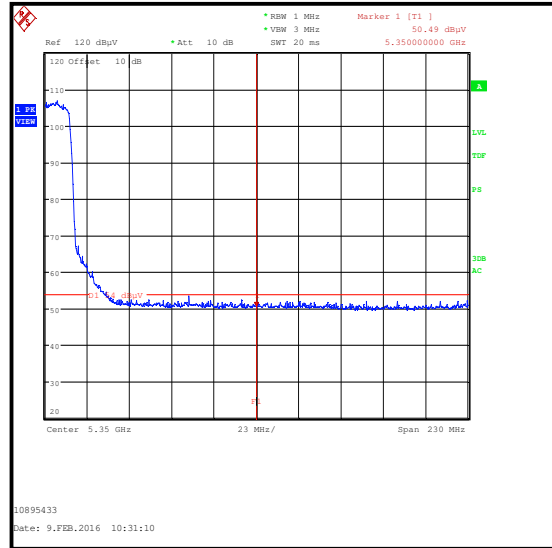


**Transmitter Band Edge Radiated Emissions (5.15-5.25 GHz band operation) (continued)**

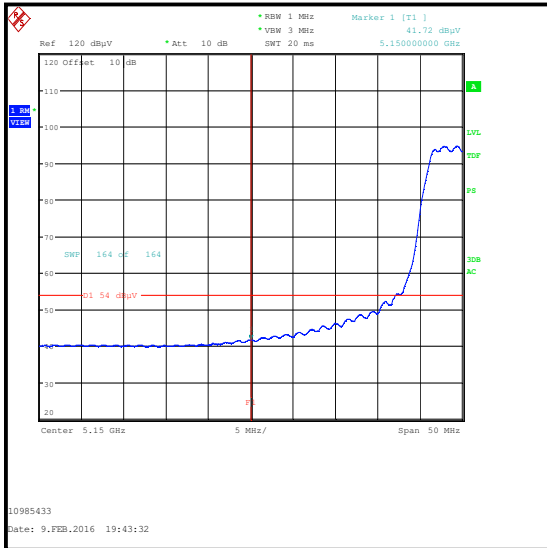
**Results: 802.11n / 20 MHz / MIMO / QPSK / MCS1**



**Lower Band Edge Peak Measurement**



**Upper Band Edge Peak Measurement**



**Lower Band Edge Average Measurement**

**Transmitter Band Edge Radiated Emissions (5.15-5.25 GHz band operation) (continued)****Results: 802.11n / 40 MHz / MIMO / BPSK / MCS0 / Peak**

Frequency (MHz)	Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
5147.276	59.2	74.0	14.8	Complied
5150	58.1	74.0	15.9	Complied

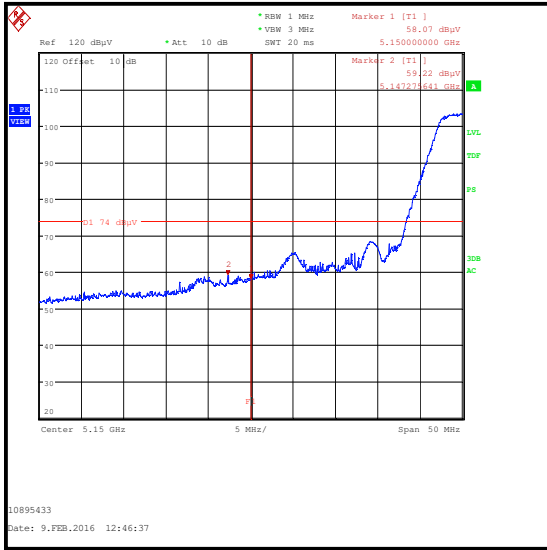
Frequency (MHz)	Peak Level (dB $\mu$ V/m)	Average Limit (dB $\mu$ V/m)	Margin (dB)	Result
5350	51.5	54.0	2.5	Complied
5413.397	52.8	54.0	1.2	Complied

**Results: 802.11n / 40 MHz / MIMO / BPSK / MCS0 / Average**

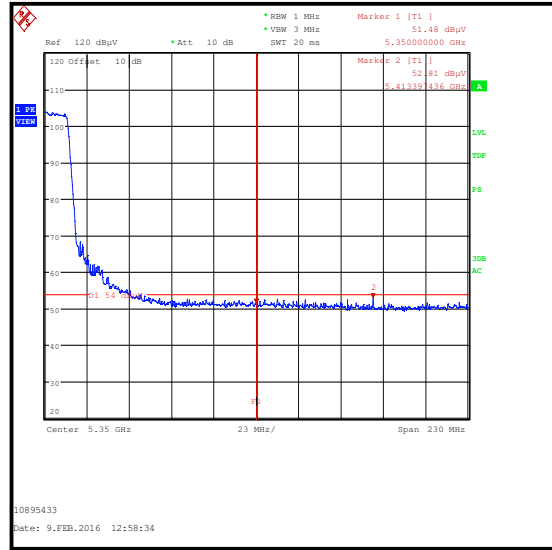
Frequency (MHz)	Level (dB $\mu$ V/m)	Duty Cycle correction (dB)	Corrected Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
5150	45.5	1.2	46.7	54.0	7.3	Complied

**Transmitter Band Edge Radiated Emissions (5.15-5.25 GHz band operation) (continued)**

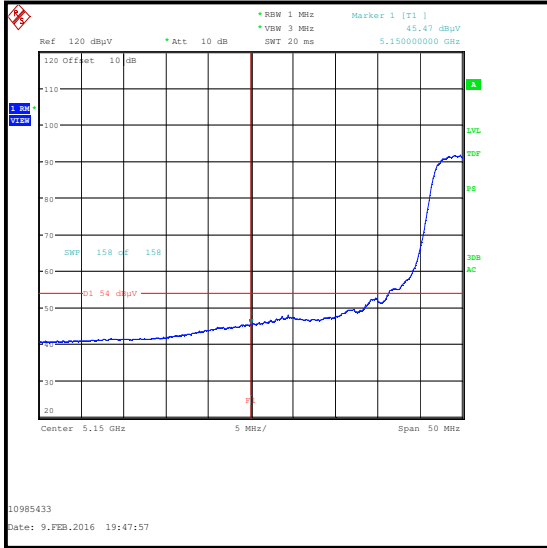
**Results: 802.11n / 40 MHz / MIMO / BPSK / MCS0**



**Lower Band Edge Peak Measurement**



**Upper Band Edge Peak Measurement**



**Lower Band Edge Average Measurement**

**Transmitter Band Edge Radiated Emissions (5.15-5.25 GHz band operation) (continued)****Results: 802.11n / 40 MHz / MIMO / 16QAM / MCS3 / Peak**

Frequency (MHz)	Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
5149.840	58.2	74.0	15.8	Complied
5150	56.2	74.0	17.8	Complied

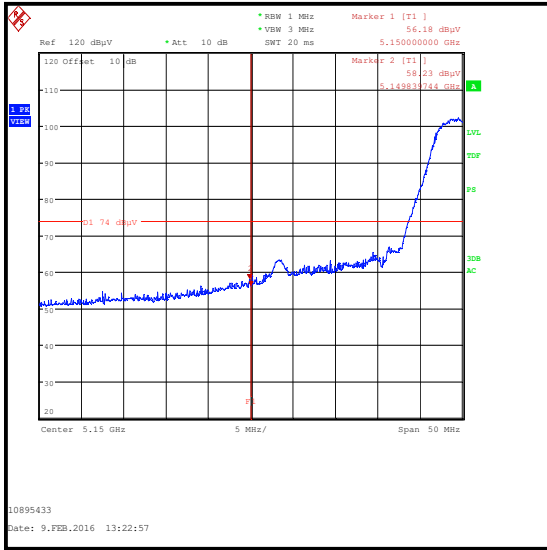
Frequency (MHz)	Peak Level (dB $\mu$ V/m)	Average Limit (dB $\mu$ V/m)	Margin (dB)	Result
5350	51.1	54.0	2.9	Complied
5358.846	51.9	54.0	2.1	Complied

**Results: 802.11n / 40 MHz / MIMO / 16QAM / MCS3 / Average**

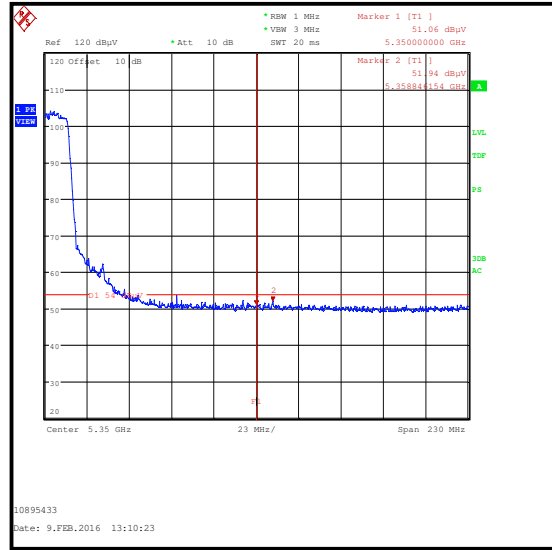
Frequency (MHz)	Level (dB $\mu$ V/m)	Duty Cycle correction (dB)	Corrected Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
5150	46.4	3.1	49.5	54.0	4.5	Complied

**Transmitter Band Edge Radiated Emissions (5.15-5.25 GHz band operation) (continued)**

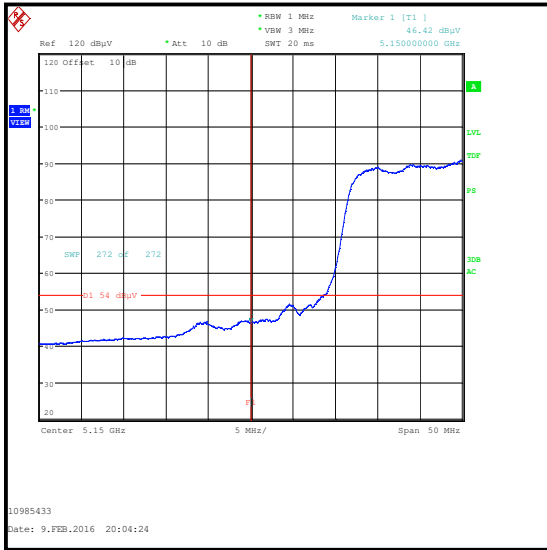
**Results: 802.11n / 40 MHz / MIMO / 16QAM / MCS3**



**Lower Band Edge Peak Measurement**



**Upper Band Edge Peak Measurement**



**Lower Band Edge Average Measurement**

**Transmitter Band Edge Radiated Emissions (5.15-5.25 GHz band operation) (continued)****Results: 802.11ac / 80 MHz / SISO / QPSK / MCS2 / Peak**

Frequency (MHz)	Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
5148.718	65.2	74.0	8.8	Complied
5150	64.0	74.0	10.0	Complied

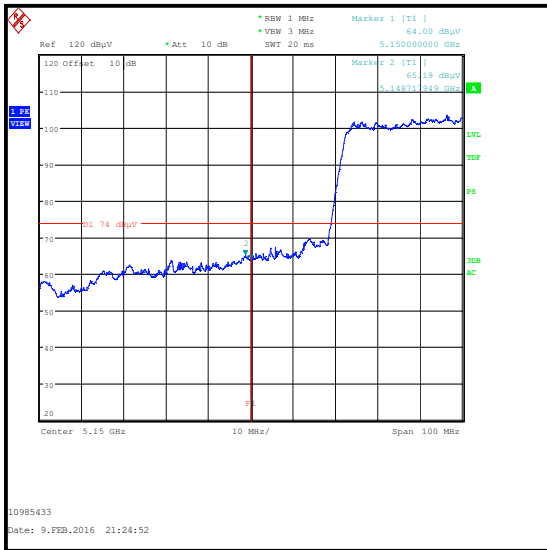
Frequency (MHz)	Peak Level (dB $\mu$ V/m)	Average Limit (dB $\mu$ V/m)	Margin (dB)	Result
5350	51.6	54.0	2.4	Complied
5356.635	52.3	54.0	1.7	Complied

**Results: 802.11ac / 80 MHz / SISO / QPSK / MCS2 / Average**

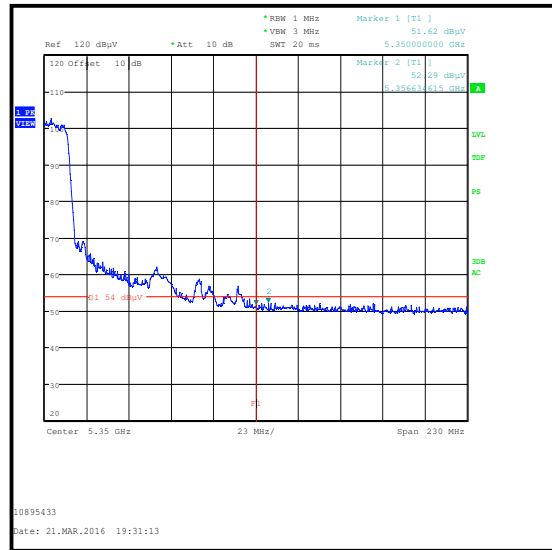
Frequency (MHz)	Level (dB $\mu$ V/m)	Duty Cycle correction (dB)	Corrected Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
5150	47.5	3.9	51.4	54.0	2.6	Complied

**Transmitter Band Edge Radiated Emissions (5.15-5.25 GHz band operation) (continued)**

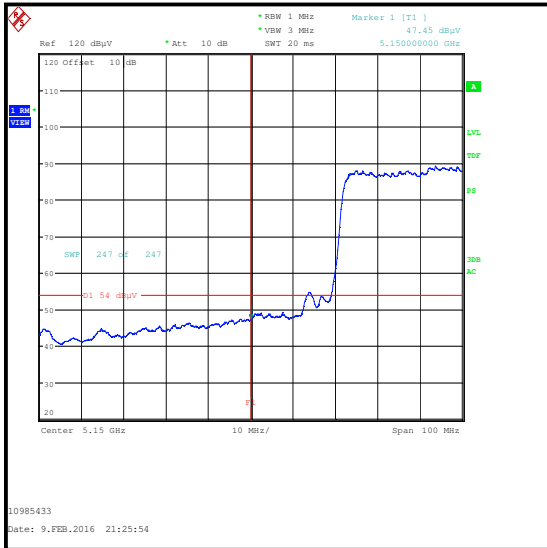
**Results: 802.11ac / 80 MHz / SISO / QPSK / MCS2**



**Lower Band Edge Peak Measurement**



**Upper Band Edge Peak Measurement**



**Lower Band Edge Average Measurement**

**Transmitter Band Edge Radiated Emissions (5.15-5.25 GHz band operation) (continued)****Results: 802.11ac / 80 MHz / MIMO / BPSK / MCS0 / Peak**

Frequency (MHz)	Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
5145.994	62.9	74.0	11.1	Complied
5150	62.8	74.0	11.2	Complied

Frequency (MHz)	Peak Level (dB $\mu$ V/m)	Average Limit (dB $\mu$ V/m)	Margin (dB)	Result
5350	51.4	54.0	2.6	Complied
5373.221	52.5	54.0	1.5	Complied

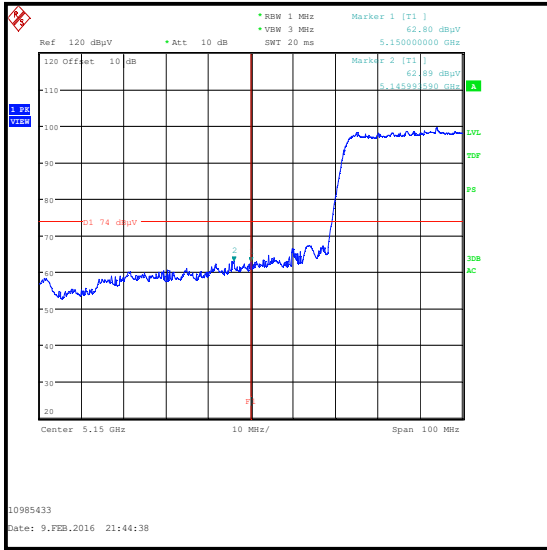
**Results: 802.11ac / 80 MHz / MIMO / BPSK / MCS0 / Average**

Frequency (MHz)	Level (dB $\mu$ V/m)	Duty Cycle correction (dB)	Corrected Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
5150	46.2	2.1	48.3	54.0	5.7	Complied

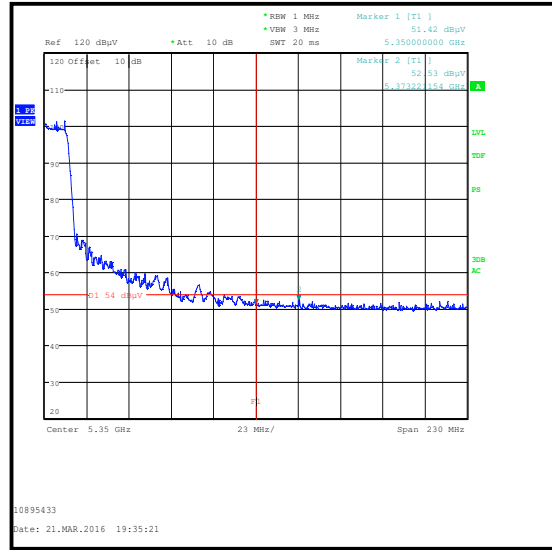


**Transmitter Band Edge Radiated Emissions (5.15-5.25 GHz band operation) (continued)**

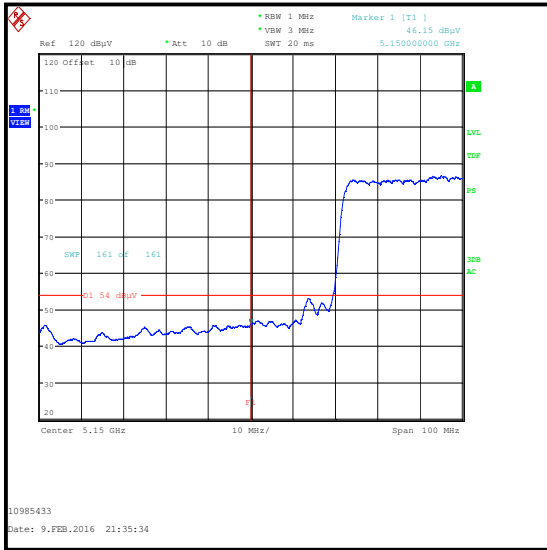
**Results: 802.11ac / 80 MHz / MIMO / BPSK / MCS0**



**Lower Band Edge Peak Measurement**



**Upper Band Edge Peak Measurement**



**Lower Band Edge Average Measurement**

**Transmitter Band Edge Radiated Emissions (5.15-5.25 GHz band operation) (continued)****Results: 802.11ac / 80 MHz / MIMO / 16QAM / MCS3 / Peak**

Frequency (MHz)	Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
5144.231	60.7	74.0	13.3	Complied
5150	60.0	74.0	14.0	Complied

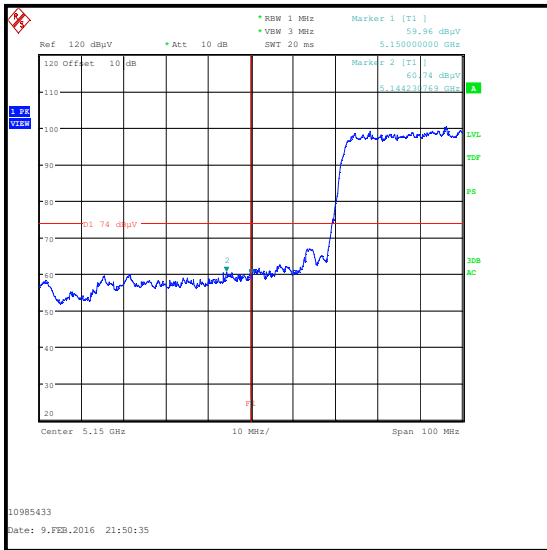
Frequency (MHz)	Peak Level (dB $\mu$ V/m)	Average Limit (dB $\mu$ V/m)	Margin (dB)	Result
5350	51.0	54.0	3.0	Complied
5369.535	52.4	54.0	1.6	Complied

**Results: 802.11ac / 80 MHz / MIMO / 16QAM / MCS3 / Average**

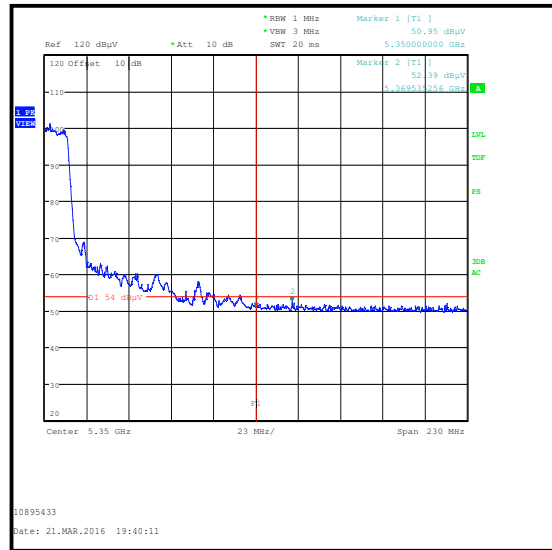
Frequency (MHz)	Level (dB $\mu$ V/m)	Duty Cycle correction (dB)	Corrected Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
5150	42.8	4.5	47.3	54.0	6.7	Complied

**Transmitter Band Edge Radiated Emissions (5.15-5.25 GHz band operation) (continued)**

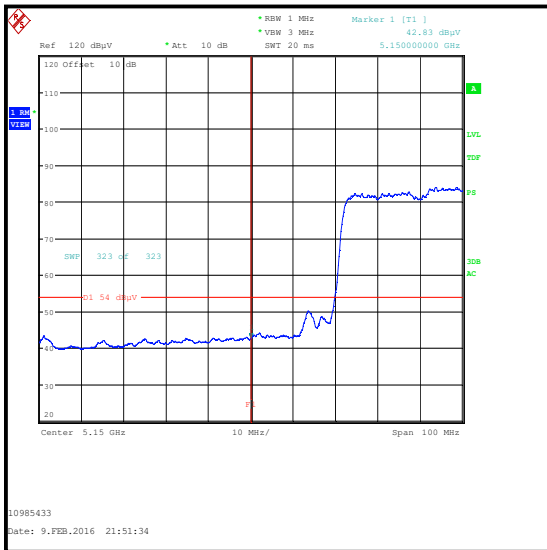
**Results: 802.11ac / 80 MHz / MIMO / 16QAM / MCS3**



**Lower Band Edge Peak Measurement**



**Upper Band Edge Peak Measurement**



**Lower Band Edge Average Measurement**

**Transmitter Band Edge Radiated Emissions (5.725-5.85 GHz band)****Test Summary:**

<b>Test Engineer:</b>	Nick Steele	<b>Test Dates:</b>	09 February 2016 & 10 February 2016
<b>Test Sample Serial Number:</b>	92777		

<b>FCC Reference:</b>	Parts 15.407(b)(4),(7), 15.205 & 15.209(a)
<b>Test Method Used:</b>	ANSI C63.10 Section 6.10.4 & KDB 789033 II.G.

**Environmental Conditions:**

<b>Temperature (°C):</b>	24 to 25
<b>Relative Humidity (%):</b>	32

**Note(s):**

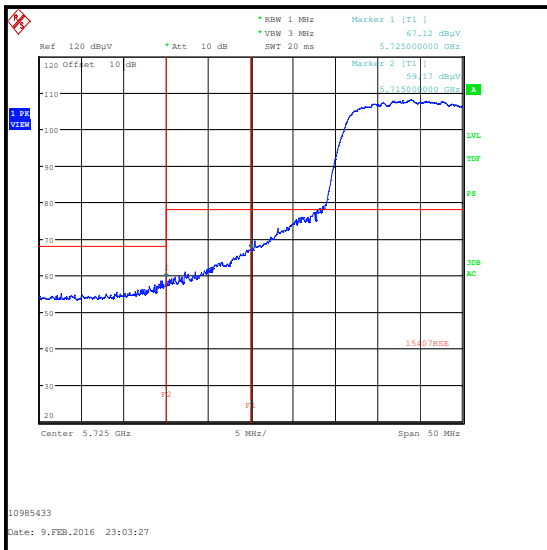
- Band edge measurements were performed in the EUT modes that produce the highest power and the widest bandwidths. The modes were:
  - 802.11a - BPSK / 6 Mbps
  - 802.11a CDD - BPSK / 6 Mbps
  - 802.11n HT20 SISO - BPSK / 6.5 Mbps / MCS0
  - 802.11n HT20 SISO – 16QAM / MCS3
  - 802.11n HT40 SISO - BPSK / MCS0
  - 802.11n HT40 SISO – 16QAM / MCS3
  - 802.11n HT20 MIMO - BPSK / MCS0
  - 802.11n HT20 MIMO - QPSK / MCS1
  - 802.11n HT40 MIMO - BPSK / MCS0
  - 802.11n HT40 MIMO – 16QAM / MCS3
  - 802.11ac VHT80 SISO - QPSK / MCS2
  - 802.11ac VHT80 MIMO - BPSK / MCS0
  - 802.11ac VHT80 MIMO – 16QAM / MCS3
- Lower band edge measurements were performed with the EUT transmitting on the bottom channel. Upper band edge measurements were performed with the EUT transmitting on the top channel.
- For completeness, results are also shown as EIRP in dBm and also as field strength in dB $\mu$ V/m. Measured field strength was converted to EIRP in accordance with KDB 789033 G.2.d)(iii) using a conversion factor of 95.2.
- An amendment of Part 15.407(b)(4) was published on 6<sup>th</sup> April 2016 with effective date 6<sup>th</sup> May 2016. As testing was performed before that date, the former and stricter emission limits were applied to show compliance at band edges. Compliance with those limits is deemed worst case. Therefore the EUT will also comply with the new emission limits. Please refer to Appendix 1 for a comparison graph between the new and former emission limits.

**Transmitter Band Edge Radiated Emissions (5.725-5.85 GHz band operation) (continued)**

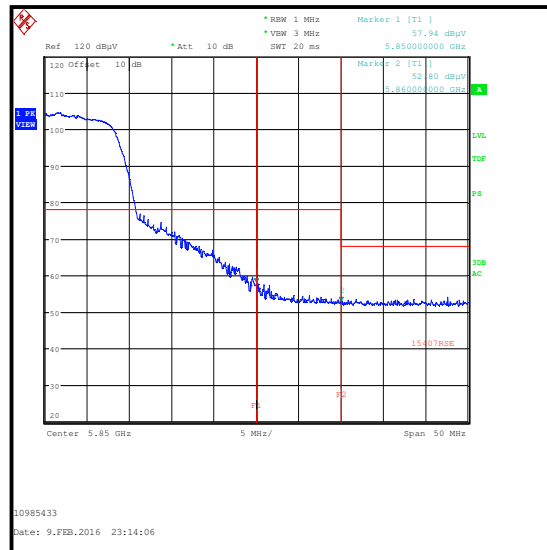
**Results: 802.11a / 20 MHz / BPSK / 6 Mbps / Peak**

Frequency (MHz)	Level (dBm)	Limit (dBm)	Margin (dB)	Result
5715	-36.0	-27.0	9.0	Complied
5725	-28.1	-17.0	11.1	Complied
5850	-37.3	-17.0	20.3	Complied
5860	-42.4	-27.0	15.4	Complied

Frequency (MHz)	Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
5715	59.2	68.2	9.0	Complied
5725	67.1	78.2	11.1	Complied
5850	57.9	78.2	20.3	Complied
5860	52.8	68.2	15.4	Complied



**Lower Band Edge Measurement**



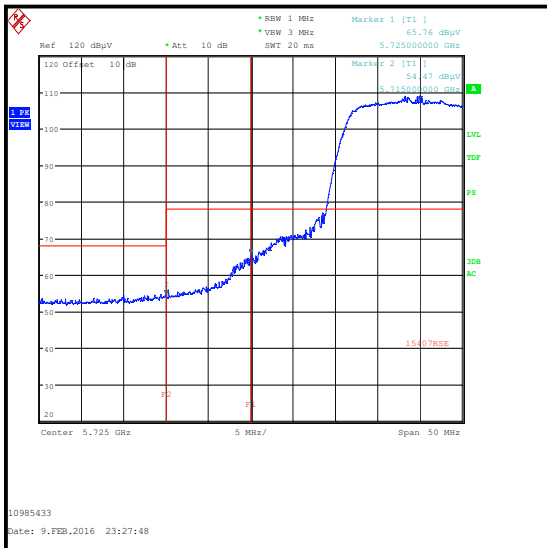
**Upper Band Edge Measurement**

**Transmitter Band Edge Radiated Emissions (5.725-5.85 GHz band operation) (continued)**

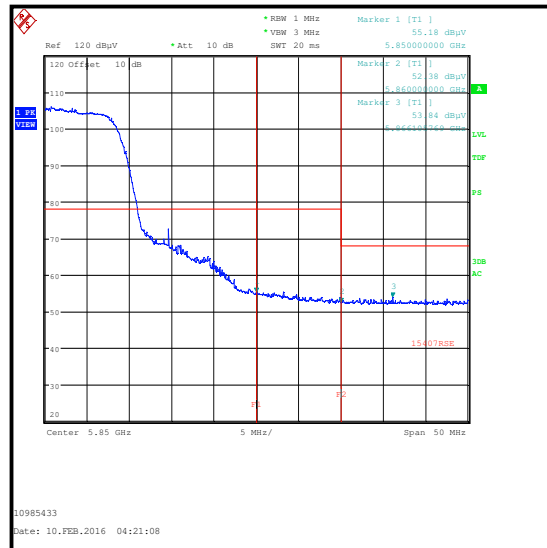
**Results: 802.11a / 20 MHz / CDD / BPSK / 6 Mbps / Peak**

Frequency (MHz)	Level (dBm)	Limit (dBm)	Margin (dB)	Result
5715	-40.7	-27.0	13.7	Complied
5725	-29.4	-17.0	12.4	Complied
5850	-40.0	-17.0	23.0	Complied
5860	-42.8	-17.0	25.8	Complied
5866.106	-41.4	-27.0	14.4	Complied

Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
5715	54.5	68.2	13.7	Complied
5725	65.8	78.2	12.4	Complied
5850	55.2	78.2	23.0	Complied
5860	52.4	78.2	25.8	Complied
5866.106	53.8	68.2	14.4	Complied



Lower Band Edge Measurement



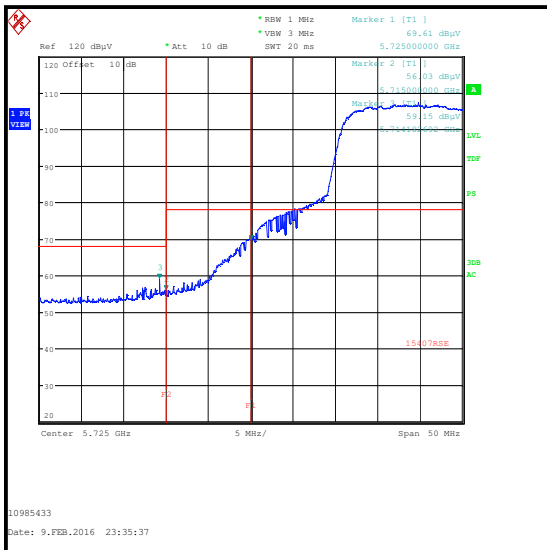
Upper Band Edge Measurement

**Transmitter Band Edge Radiated Emissions (5.725-5.85 GHz band operation) (continued)**

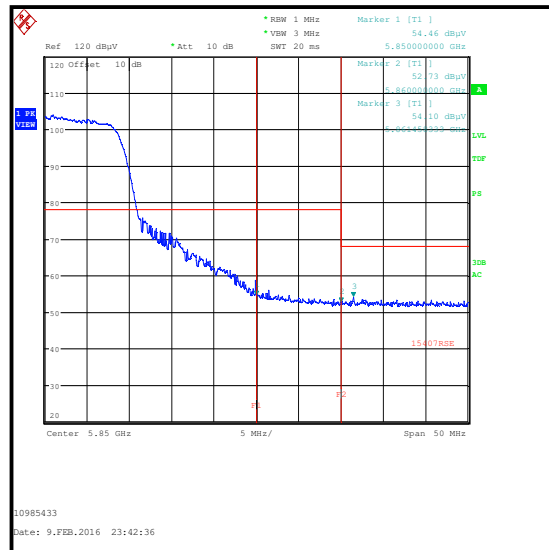
**Results: 802.11n / 20 MHz / SISO / BPSK / MCS0 / Peak**

Frequency (MHz)	Level (dBm)	Limit (dBm)	Margin (dB)	Result
5714.183	-36.0	-27.0	9.0	Complied
5715	-39.2	-27.0	12.2	Complied
5725	-25.6	-17.0	8.6	Complied
5850	-40.7	-17.0	23.7	Complied
5860	-42.5	-27.0	15.5	Complied
5861.458	-41.1	-27.0	14.1	Complied

Frequency (MHz)	Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
5714.183	59.2	68.2	9.0	Complied
5715	56.0	68.2	12.2	Complied
5725	69.6	78.2	8.6	Complied
5850	54.5	78.2	23.7	Complied
5860	52.7	68.2	15.5	Complied
5861.458	54.1	68.2	14.1	Complied



Lower Band Edge Measurement



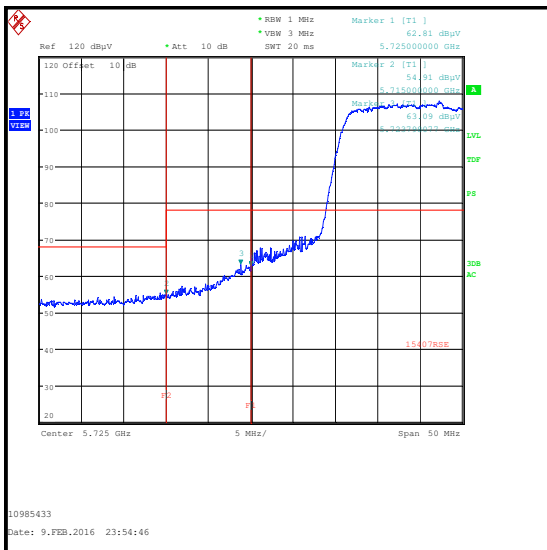
Upper Band Edge Measurement

**Transmitter Band Edge Radiated Emissions (5.725-5.85 GHz band operation) (continued)**

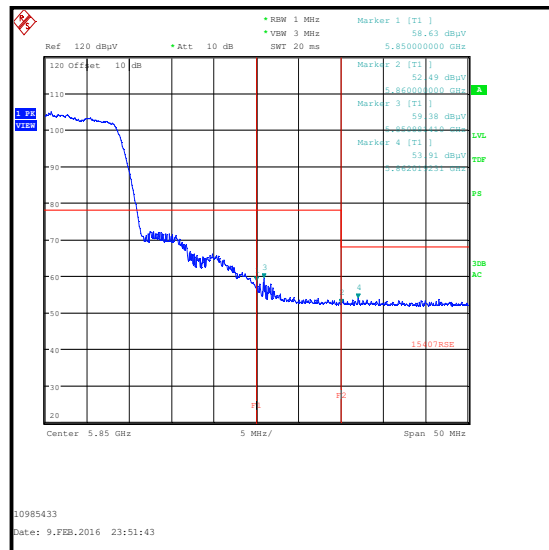
**Results: 802.11n / 20 MHz / SISO / 16QAM / MCS3 / Peak**

Frequency (MHz)	Level (dBm)	Limit (dBm)	Margin (dB)	Result
5715	-40.3	-27.0	13.3	Complied
5723.798	-32.1	-17.0	15.1	Complied
5725	-32.4	-17.0	15.4	Complied
5850	-36.6	-17.0	19.6	Complied
5850.881	-35.8	-17.0	18.8	Complied
5860	-42.7	-27.0	15.7	Complied
5862.019	-41.3	-27.0	14.3	Complied

Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
5715	54.9	68.2	13.3	Complied
5723.798	63.1	78.2	15.1	Complied
5725	62.8	78.2	15.4	Complied
5850	58.6	78.2	19.6	Complied
5850.881	59.4	78.2	18.8	Complied
5860	52.5	68.2	15.7	Complied
5862.019	53.9	68.2	14.3	Complied



Lower Band Edge Measurement



Upper Band Edge Measurement

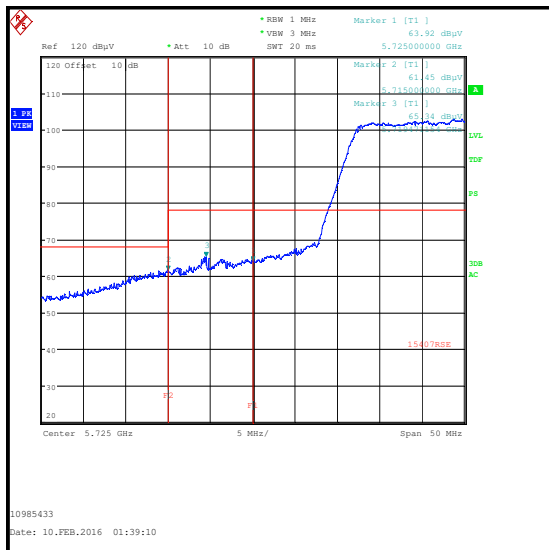


**Transmitter Band Edge Radiated Emissions (5.725-5.85 GHz band operation) (continued)**

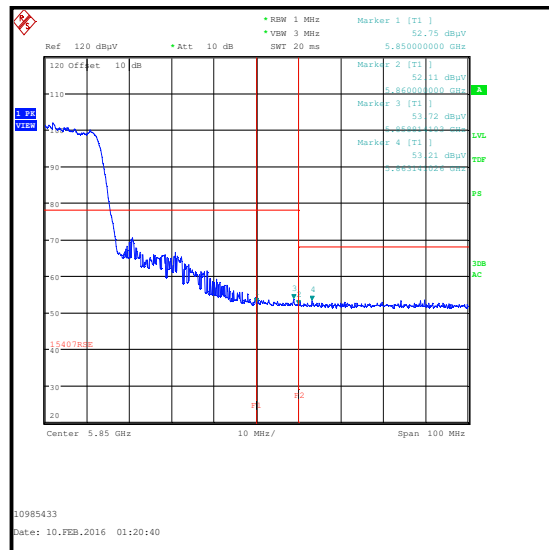
**Results: 802.11n / 40 MHz / SISO / BPSK / MCS0 / Peak**

Frequency (MHz)	Level (dBm)	Limit (dBm)	Margin (dB)	Result
5715	-33.7	-27.0	6.7	Complied
5719.471	-29.9	-17.0	12.9	Complied
5725	-31.3	-17.0	14.3	Complied
5850	-42.4	-17.0	25.4	Complied
5858.814	-41.5	-17.0	24.5	Complied
5860	-43.1	-27.0	16.1	Complied
5863.141	-42.0	-27.0	15.0	Complied

Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
5715	61.5	68.2	6.7	Complied
5719.471	65.3	78.2	12.9	Complied
5725	63.9	78.2	14.3	Complied
5850	52.8	78.2	25.4	Complied
5858.814	53.7	78.2	24.5	Complied
5860	52.1	68.2	16.1	Complied
5863.141	53.2	68.2	15.0	Complied



Lower Band Edge Measurement



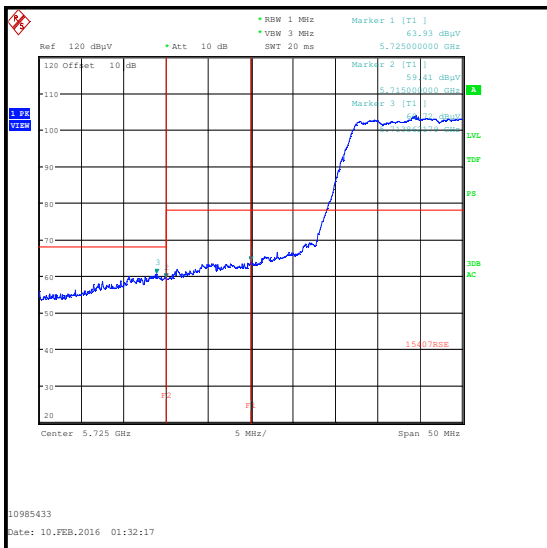
Upper Band Edge Measurement

**Transmitter Band Edge Radiated Emissions (5.725-5.85 GHz band operation) (continued)**

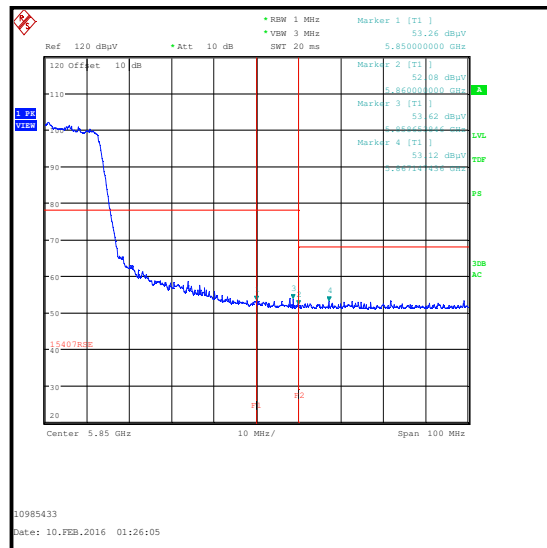
**Results: 802.11n / 40 MHz / SISO / 16QAM / MCS3 / Peak**

Frequency (MHz)	Level (dBm)	Limit (dBm)	Margin (dB)	Result
5713.862	-34.5	-27.0	7.5	Complied
5715	-35.8	-27.0	8.8	Complied
5725	-31.3	-17.0	14.3	Complied
5850	-41.9	-17.0	24.9	Complied
5858.653	-41.6	-17.0	24.6	Complied
5860	-43.1	-27.0	16.1	Complied
5867.147	-42.1	-27.0	15.1	Complied

Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
5713.862	60.7	68.2	7.5	Complied
5715	59.4	68.2	8.8	Complied
5725	63.9	78.2	14.3	Complied
5850	53.3	78.2	24.9	Complied
5858.653	53.6	78.2	24.6	Complied
5860	52.1	68.2	16.1	Complied
5867.147	53.1	68.2	15.1	Complied



Lower Band Edge Measurement



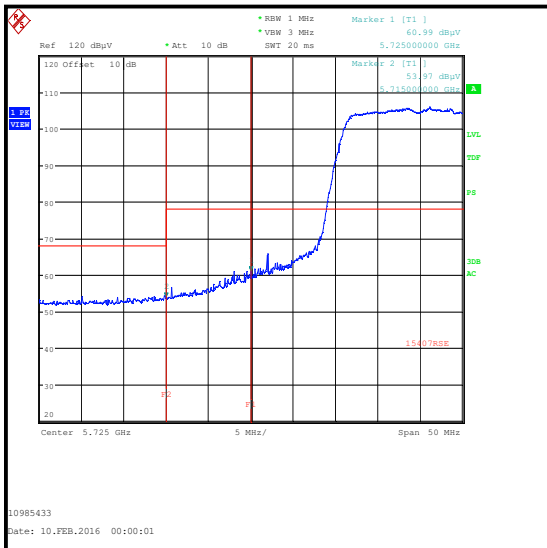
Upper Band Edge Measurement

**Transmitter Band Edge Radiated Emissions (5.725-5.85 GHz band operation) (continued)**

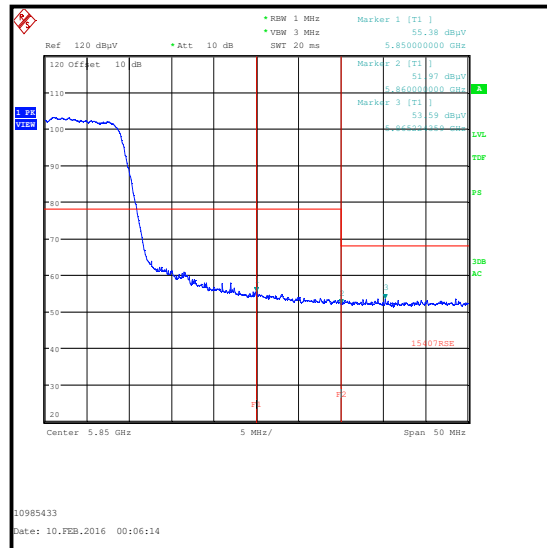
**Results: 802.11n / 20 MHz / MIMO / BPSK / MCS0 / Peak**

Frequency (MHz)	Level (dBm)	Limit (dBm)	Margin (dB)	Result
5715	-41.2	-27.0	14.2	Complied
5725	-34.2	-17.0	17.2	Complied
5850	-39.8	-17.0	22.8	Complied
5860	-43.2	-27.0	16.2	Complied
5865.224	-41.6	-27.0	14.6	Complied

Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
5715	54.0	68.2	14.2	Complied
5725	61.0	78.2	17.2	Complied
5850	55.4	78.2	22.8	Complied
5860	52.0	68.2	16.2	Complied
5865.224	53.6	68.2	14.6	Complied



**Lower Band Edge Measurement**



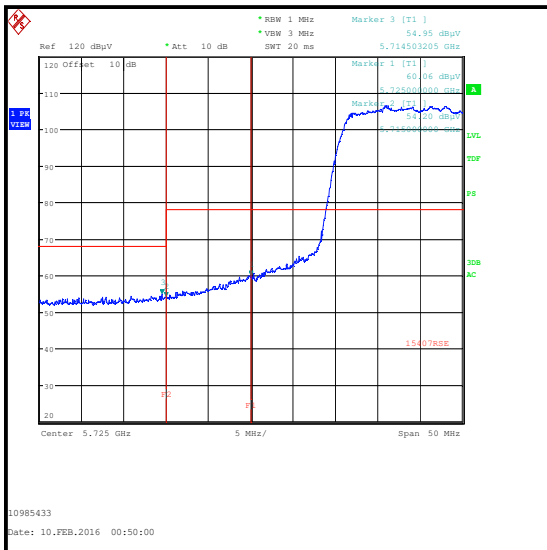
**Upper Band Edge Measurement**

**Transmitter Band Edge Radiated Emissions (5.725-5.85 GHz band operation) (continued)**

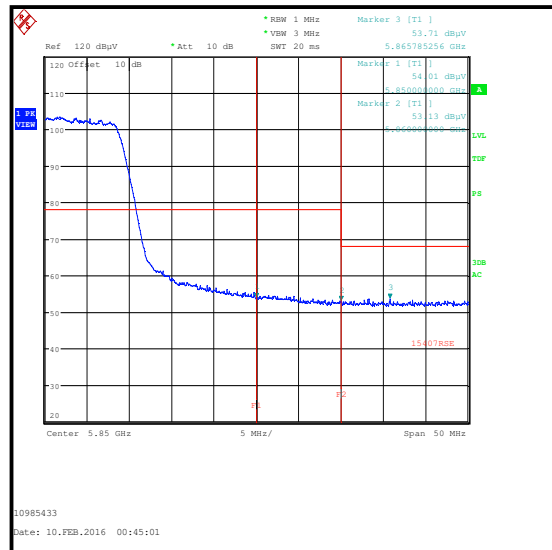
**Results: 802.11n / 20 MHz / MIMO / QPSK / MCS1 / Peak**

Frequency (MHz)	Level (dBm)	Limit (dBm)	Margin (dB)	Result
5714.503	-40.2	-27.0	13.2	Complied
5715	-41.0	-27.0	14.0	Complied
5725	-35.1	-17.0	18.1	Complied
5850	-41.2	-17.0	24.2	Complied
5860	-42.1	-27.0	15.1	Complied
5865.785	-41.5	-27.0	14.5	Complied

Frequency (MHz)	Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
5714.503	55.0	68.2	13.2	Complied
5715	54.2	68.2	14.0	Complied
5725	60.1	78.2	18.1	Complied
5850	54.0	78.2	24.2	Complied
5860	53.1	68.2	15.1	Complied
5865.785	53.7	68.2	14.5	Complied



Lower Band Edge Measurement



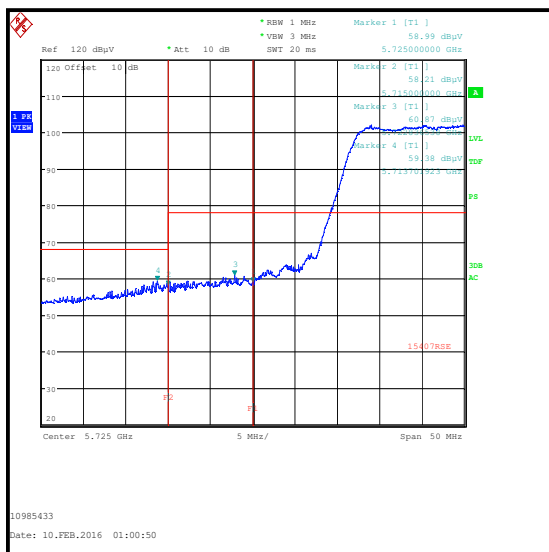
Upper Band Edge Measurement

**Transmitter Band Edge Radiated Emissions (5.725-5.85 GHz band operation) (continued)**

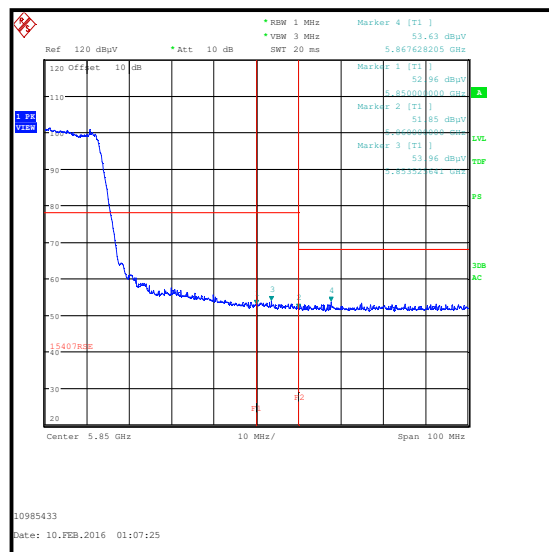
**Results: 802.11n / 40 MHz / MIMO / BPSK / MCS0 / Peak**

Frequency (MHz)	Level (dBm)	Limit (dBm)	Margin (dB)	Result
5713.702	-35.8	-27.0	8.8	Complied
5715	-37.0	-27.0	10.0	Complied
5722.837	-34.3	-17.0	17.3	Complied
5725	-36.2	-17.0	19.2	Complied
5850	-42.2	-17.0	25.2	Complied
5853.526	-41.2	-17.0	24.2	Complied
5860	-43.3	-27.0	16.3	Complied
5867.628	-41.6	-27.0	14.6	Complied

Frequency (MHz)	Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
5713.702	59.4	68.2	8.8	Complied
5715	58.2	68.2	10.0	Complied
5722.837	60.9	78.2	17.3	Complied
5725	59.0	78.2	19.2	Complied
5850	53.0	78.2	25.2	Complied
5853.526	54.0	78.2	24.2	Complied
5860	51.9	68.2	16.3	Complied
5867.628	53.6	68.2	14.6	Complied



Lower Band Edge Measurement



Upper Band Edge Measurement

**Transmitter Band Edge Radiated Emissions (5.725-5.85 GHz band operation) (continued)**

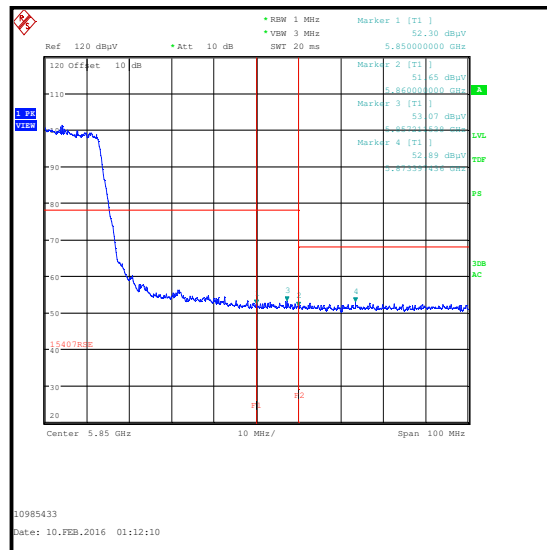
**Results: 802.11n / 40 MHz / MIMO / 16QAM / MCS3 / Peak**

Frequency (MHz)	Level (dBm)	Limit (dBm)	Margin (dB)	Result
5715	-39.4	-27.0	12.4	Complied
5718.590	-35.9	-17.0	18.9	Complied
5725	-37.3	-17.0	20.3	Complied
5850	-42.9	-17.0	25.9	Complied
5857.212	-42.1	-17.0	25.1	Complied
5860	-43.5	-27.0	16.5	Complied
5873.397	-42.3	-27.0	15.3	Complied

Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
5715	55.8	68.2	12.4	Complied
5718.590	59.3	78.2	18.9	Complied
5725	57.9	78.2	20.3	Complied
5850	52.3	78.2	25.9	Complied
5857.212	53.1	78.2	25.1	Complied
5860	51.7	68.2	16.5	Complied
5873.397	52.9	68.2	15.3	Complied



Lower Band Edge Measurement



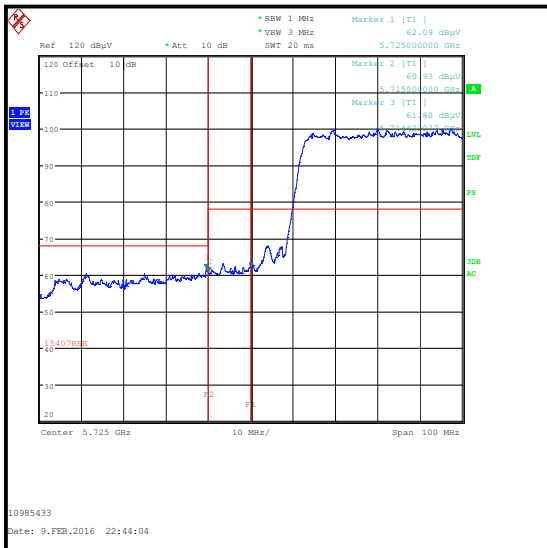
Upper Band Edge Measurement

**Transmitter Band Edge Radiated Emissions (5.725-5.85 GHz band operation) (continued)**

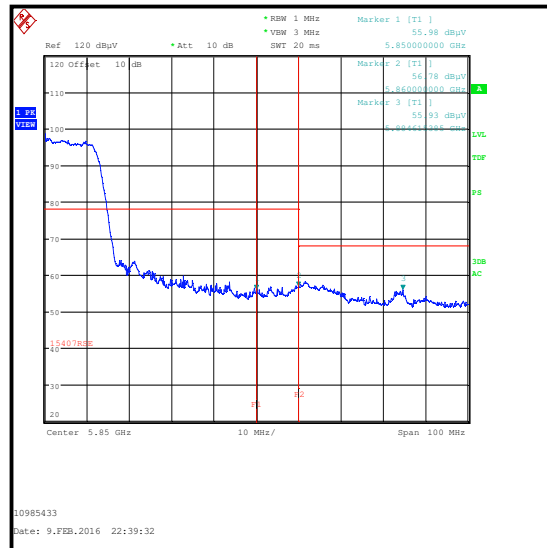
**Results: 802.11ac / 80 MHz / SISO / QPSK / MCS2 / Peak**

Frequency (MHz)	Level (dBm)	Limit (dBm)	Margin (dB)	Result
5714.423	-33.4	-27.0	6.4	Complied
5715	-34.3	-27.0	7.3	Complied
5725	-33.1	-17.0	16.1	Complied
5850	-39.2	-17.0	22.2	Complied
5860	-38.4	-27.0	11.4	Complied

Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
5714.423	61.8	68.2	6.4	Complied
5715	60.9	68.2	7.3	Complied
5725	62.1	78.2	16.1	Complied
5850	56.0	78.2	22.2	Complied
5860	56.8	68.2	11.4	Complied



Lower Band Edge Measurement



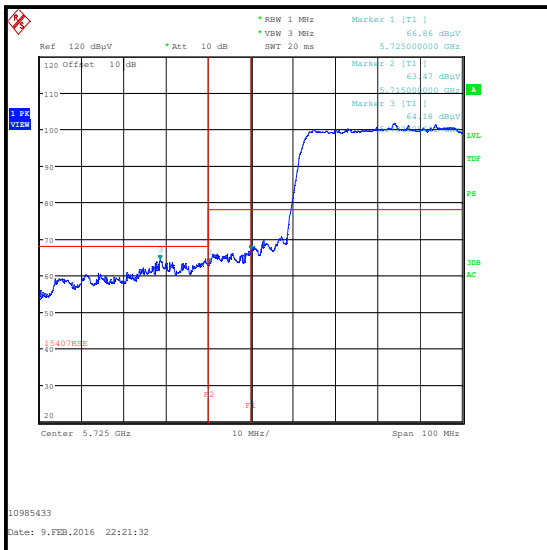
Upper Band Edge Measurement

**Transmitter Band Edge Radiated Emissions (5.725-5.85 GHz band operation) (continued)**

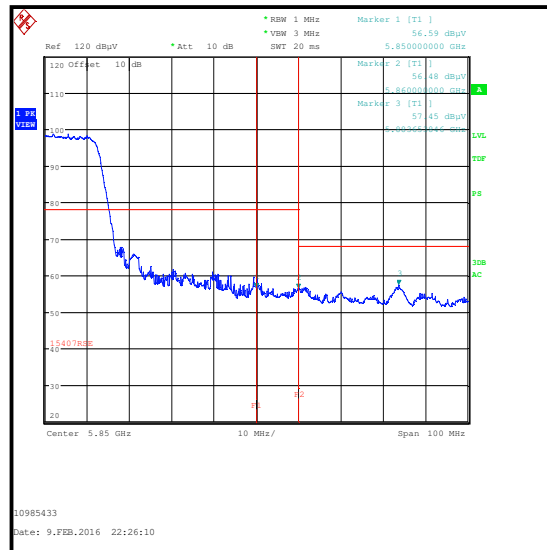
**Results: 802.11ac / 80 MHz / MIMO / BPSK / MCS0 / Peak**

Frequency (MHz)	Level (dBm)	Limit (dBm)	Margin (dB)	Result
5703.526	-31.0	-27.0	4.0	Complied
5715	-31.7	-27.0	4.7	Complied
5725	-28.3	-17.0	11.3	Complied
5850	-38.6	-17.0	21.6	Complied
5860	-38.7	-27.0	11.7	Complied
5883.654	-37.7	-27.0	10.7	Complied

Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
5703.526	64.2	68.2	4.0	Complied
5715	63.5	68.2	4.7	Complied
5725	66.9	78.2	11.3	Complied
5850	56.6	78.2	21.6	Complied
5860	56.5	68.2	11.7	Complied
5883.654	57.5	68.2	10.7	Complied



Lower Band Edge Measurement



Upper Band Edge Measurement

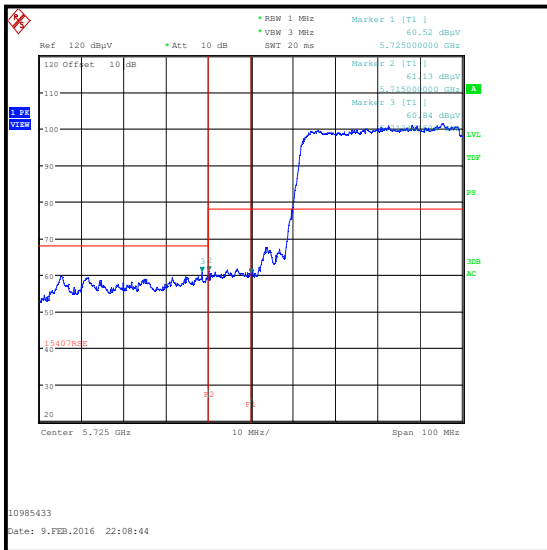


**Transmitter Band Edge Radiated Emissions (5.725-5.85 GHz band operation) (continued)**

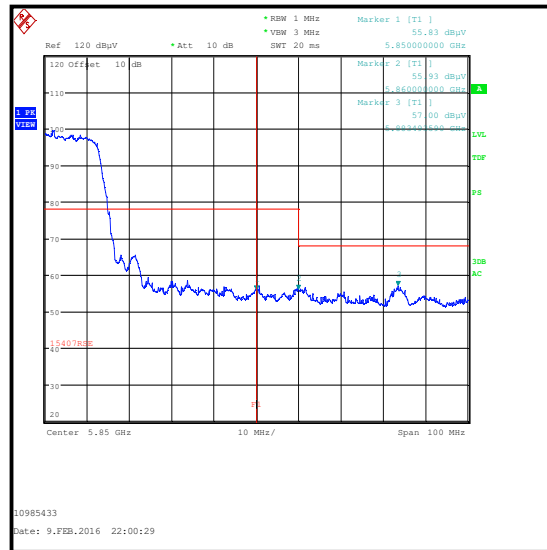
**Results: 802.11ac / 80 MHz / MIMO / 16QAM / MCS3 / Peak**

Frequency (MHz)	Level (dBm)	Limit (dBm)	Margin (dB)	Result
5715	-34.1	-27.0	7.1	Complied
5725	-34.7	-17.0	17.7	Complied
5850	-39.4	-17.0	22.4	Complied
5860	-39.3	-27.0	12.3	Complied
5883.494	-38.2	-27.0	11.2	Complied

Frequency (MHz)	Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
5715	61.1	68.2	7.1	Complied
5725	60.5	78.2	17.7	Complied
5850	55.8	78.2	22.4	Complied
5860	55.9	68.2	12.3	Complied
5883.494	57.0	68.2	11.2	Complied



Lower Band Edge Measurement



Upper Band Edge Measurement

**Transmitter Band Edge Radiated Emissions (continued)****Test Equipment Used:**

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M1656	Thermohygrometer	JM Handelspunkt	30.5015.13	None stated	23 Apr 2016	12
K0002	3m RSE Chamber	Rainford EMC	N/A	N/A	21 Dec 2016	12
M1874	Test Receiver	Rohde & Schwarz	ESU26	100553	12 Jun 2016	12
A1534	Pre Amplifier	Hewlett Packard	8449B	3008A00405	19 Dec 2016	12
A253	Antenna	Flann Microwave	12240-20	128	17 Dec 2016	12
A1396	Attenuator	Huber & Suhner	6810.17.B	757987	30 May 2016	12

## **6. Measurement Uncertainty**

No measurement or test can ever be perfect and the imperfections give rise to error of measurement in the results. Consequently the result of a measurement is only an approximation to the value of the measurand (the specific quantity subject to measurement) and is only complete when accompanied by a statement of the uncertainty of the approximation.

The expression of uncertainty of a measurement result allows realistic comparison of results with reference values and limits given in specifications and standards.

The uncertainty of the result may need to be taken into account when interpreting the measurement results.

The reported expanded uncertainties below are based on a standard uncertainty multiplied by an appropriate coverage factor such that a confidence level of approximately 95% is maintained. For the purposes of this document "approximately" is interpreted as meaning "effectively" or "for most practical purposes".

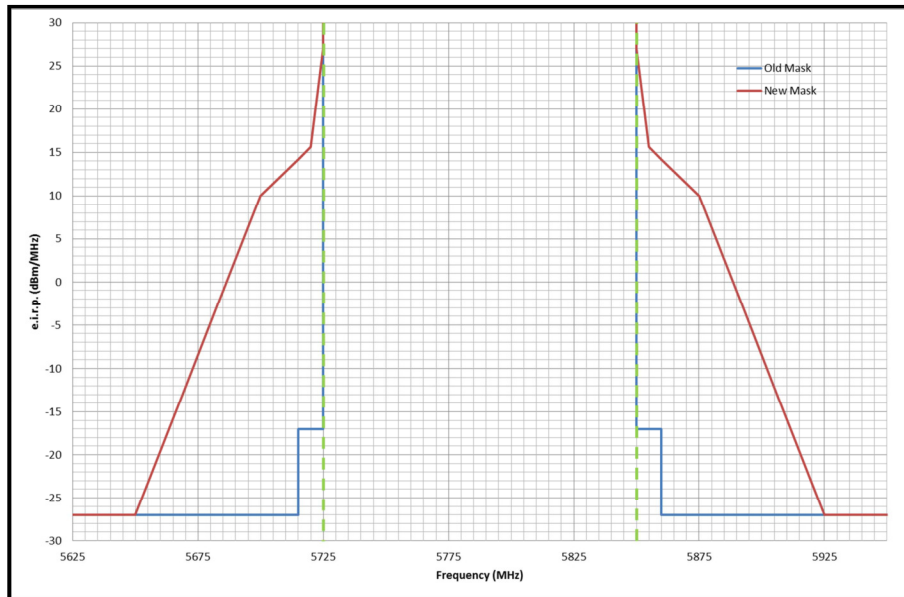
<b>Measurement Type</b>	<b>Range</b>	<b>Confidence Level (%)</b>	<b>Calculated Uncertainty</b>
AC Conducted Spurious Emissions	0.15 MHz to 30 MHz	95%	±4.69 dB
Maximum Conducted Output Power	5.15 GHz to 5.85 GHz	95%	±1.13 dB
Maximum Power Spectral Density	5.15 GHz to 5.85 GHz	95%	±1.13 dB
Duty Cycle	5.15 GHz to 5.85 GHz	95%	±1.14 %
Minimum 6 dB Emission Bandwidth	5.15 GHz to 5.85 GHz	95%	±4.59 %
26 dB Emission Bandwidth	5.15 GHz to 5.85 GHz	95%	±4.59 %
Radiated Spurious Emissions	30 MHz to 1 GHz	95%	±5.65 dB
Radiated Spurious Emissions	1 GHz to 40 GHz	95%	±2.94 dB

The methods used to calculate the above uncertainties are in line with those recommended within the various measurement specifications. Where measurement specifications do not include guidelines for the evaluation of measurement uncertainty the published guidance of the appropriate accreditation body is followed.

## **7. Report Revision History**

<b>Version Number</b>	<b>Revision Details</b>		
	<b>Page No(s)</b>	<b>Clause</b>	<b>Details</b>
1.0	-	-	Initial Version
2.0	-	-	Model Number updated & Section 3.1, 3.2 & 3.5 updated

## Appendix 1. Part 15.407(b)(4) Emission Limits



**Comparison graph of Part 15.407(b)(4) emission limits**

### Note(s):

1. Red line corresponds to the Part 15.407(b)(4) emission limits with effective date 6<sup>th</sup> May 2016.
2. Blue line corresponds to the former Part 15.407(b)(4) emission limits.
3. Green dotted frequency lines are placed at the band edge frequencies.

**--- END OF REPORT ---**