## 5.6. Power line conducted emissions

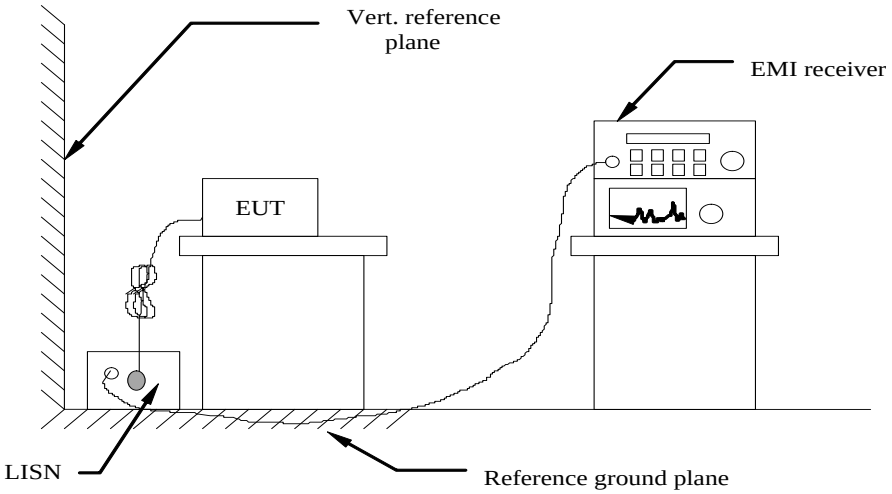
### 5.6.1 Standard Applicable

According to §15.207 (a): For an intentional radiator which is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed 250 microvolts (The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz). The limits at specific frequency range are listed as follows:

| Frequency Range (MHz) | Limits (dBμV) | |
|---|---|---|
| | Quasi-peak | Average |
| 0.15 to 0.50 | 66 to 56* | 56 to 46* |
| 0.50 to 5 | 56 | 46 |
| 5 to 30 | 60 | 50 |

* Decreasing linearly with the logarithm of the frequency

### 5.6.2 Block Diagram of Test Setup

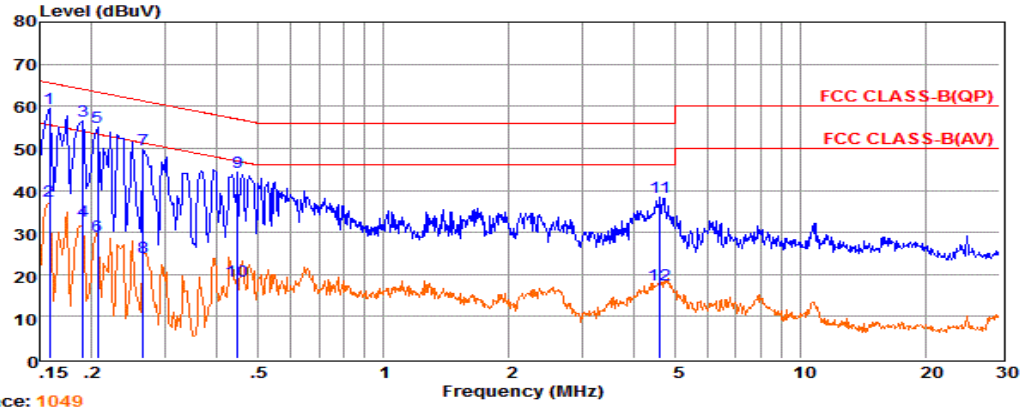



### 5.6.3 Test Results

PASS.

The test data please refer to following page.

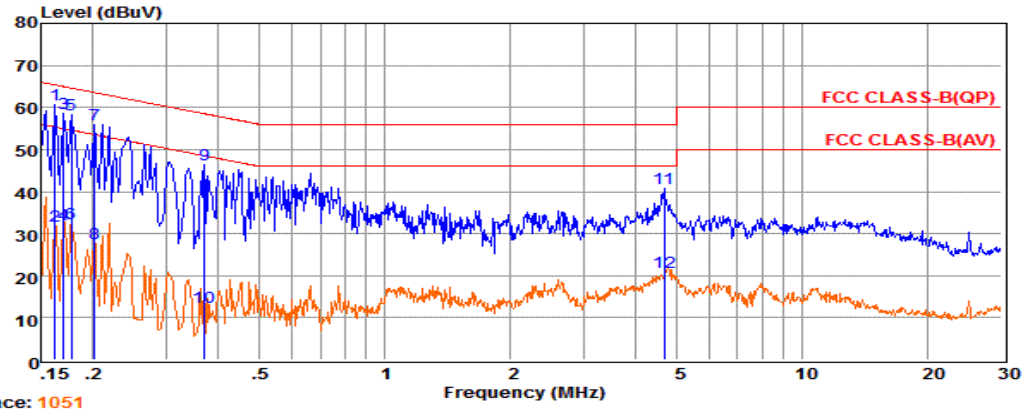
### *AC Conducted Emission of power by adapter @ AC 120V/60Hz @ IEEE 802.11a (worst case)*




Trace: 1049
Power Rating: AC 120V/60Hz
Pol: NEUTRAL

| | Freq | Reading | LISNFac | CabLos | Aux2Fac | Measured | Limit | Over | Remark |
|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV | dB | dB | dB | dB | dBuV | dBuV | dB |
| 1 | 0.16 | 39.76 | 9.68 | 0.02 | 10.00 | 59.46 | 65.56 | -6.10 | QP |
| 2 | 0.16 | 17.81 | 9.68 | 0.02 | 10.00 | 37.51 | 55.55 | -18.04 | Average |
| 3 | 0.19 | 36.93 | 9.61 | 0.02 | 10.00 | 56.56 | 64.02 | -7.46 | QP |
| 4 | 0.19 | 12.98 | 9.61 | 0.02 | 10.00 | 32.61 | 54.02 | -21.41 | Average |
| 5 | 0.21 | 35.25 | 9.59 | 0.03 | 10.00 | 54.87 | 63.36 | -8.49 | QP |
| 6 | 0.21 | 9.60 | 9.59 | 0.03 | 10.00 | 29.22 | 53.36 | -24.14 | Average |
| 7 | 0.27 | 29.91 | 9.60 | 0.03 | 10.00 | 49.54 | 61.25 | -11.71 | QP |
| 8 | 0.27 | 4.56 | 9.60 | 0.03 | 10.00 | 24.19 | 51.24 | -27.05 | Average |
| 9 | 0.45 | 24.62 | 9.62 | 0.04 | 10.00 | 44.28 | 56.93 | -12.65 | QP |
| 10 | 0.45 | -1.27 | 9.62 | 0.04 | 10.00 | 18.39 | 46.93 | -28.54 | Average |
| 11 | 4.60 | 18.62 | 9.66 | 0.06 | 10.00 | 38.34 | 56.00 | -17.66 | QP |
| 12 | 4.60 | -2.20 | 9.66 | 0.06 | 10.00 | 17.52 | 46.00 | -28.48 | Average |

Remarks: 1. Measured = Reading +Cable Loss +Aux2 Fac.
2. The emission levels that are 20dB below the official limit are not reported.

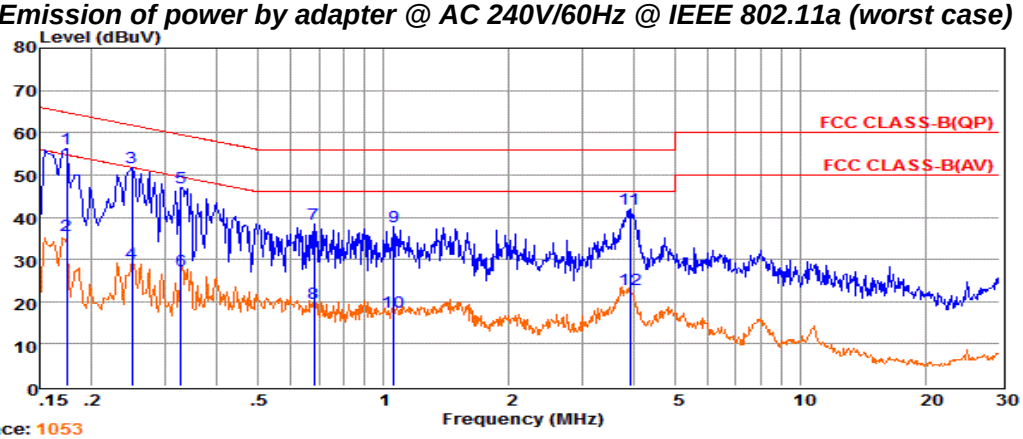



Trace: 1051
Power Rating: AC 120V/60Hz
Pol: LINE

| | Freq | Reading | LISNFac | CabLos | Aux2Fac | Measured | Limit | Over | Remark |
|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV | dB | dB | dB | dB | dBuV | dBuV | dB |
| 1 | 0.16 | 40.97 | 9.59 | 0.02 | 10.00 | 60.58 | 65.34 | -4.76 | QP |
| 2 | 0.16 | 12.08 | 9.59 | 0.02 | 10.00 | 31.69 | 55.33 | -23.64 | Average |
| 3 | 0.17 | 39.03 | 9.60 | 0.02 | 10.00 | 58.65 | 64.94 | -6.29 | QP |
| 4 | 0.17 | 12.55 | 9.60 | 0.02 | 10.00 | 32.17 | 54.94 | -22.77 | Average |
| 5 | 0.18 | 38.78 | 9.61 | 0.02 | 10.00 | 58.41 | 64.59 | -6.18 | QP |
| 6 | 0.18 | 12.93 | 9.61 | 0.02 | 10.00 | 32.56 | 54.59 | -22.03 | Average |
| 7 | 0.20 | 36.37 | 9.63 | 0.02 | 10.00 | 56.02 | 63.54 | -7.52 | QP |
| 8 | 0.20 | 7.93 | 9.63 | 0.02 | 10.00 | 27.58 | 53.53 | -25.95 | Average |
| 9 | 0.37 | 26.87 | 9.62 | 0.03 | 10.00 | 46.52 | 58.52 | -12.00 | QP |
| 10 | 0.37 | -7.10 | 9.62 | 0.03 | 10.00 | 12.55 | 48.52 | -35.97 | Average |
| 11 | 4.67 | 20.97 | 9.65 | 0.06 | 10.00 | 40.68 | 56.00 | -15.32 | QP |
| 12 | 4.67 | 1.16 | 9.65 | 0.06 | 10.00 | 20.87 | 46.00 | -25.13 | Average |

Remarks: 1. Measured = Reading +Cable Loss +Aux2 Fac.
2. The emission levels that are 20dB below the official limit are not reported.

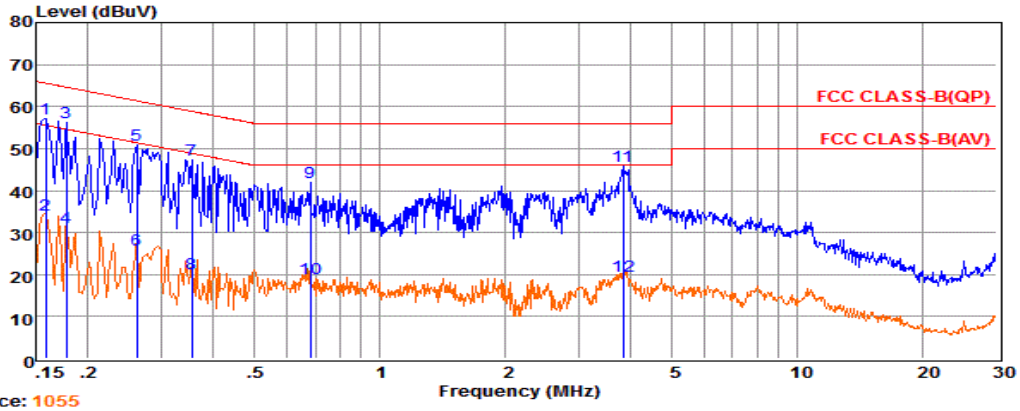
### *AC Conducted Emission of power by adapter @ AC 240V/60Hz @ IEEE 802.11a (worst case)*




Trace: 1053
Power Rating: AC 240V/60Hz
Pol: LINE

| | Freq | Reading | LISNFac | CabLos | Aux2Fac | Measured | Limit | Over | Remark |
|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV | dB | dB | dB | dB | dBuV | dBuV | dB |
| 1 | 0.17 | 36.66 | 9.60 | 0.02 | 10.00 | 56.28 | 64.77 | -8.49 | QP |
| 2 | 0.17 | 15.92 | 9.60 | 0.02 | 10.00 | 35.54 | 54.76 | -19.22 | Average |
| 3 | 0.25 | 31.96 | 9.63 | 0.03 | 10.00 | 51.62 | 61.78 | -10.16 | QP |
| 4 | 0.25 | 9.49 | 9.63 | 0.03 | 10.00 | 29.15 | 51.77 | -22.62 | Average |
| 5 | 0.33 | 27.43 | 9.62 | 0.03 | 10.00 | 47.08 | 59.53 | -12.45 | QP |
| 6 | 0.33 | 7.75 | 9.62 | 0.03 | 10.00 | 27.40 | 49.53 | -22.13 | Average |
| 7 | 0.68 | 18.58 | 9.64 | 0.04 | 10.00 | 38.26 | 56.00 | -17.74 | QP |
| 8 | 0.68 | -0.10 | 9.64 | 0.04 | 10.00 | 19.58 | 46.00 | -26.42 | Average |
| 9 | 1.06 | 18.05 | 9.63 | 0.05 | 10.00 | 37.73 | 56.00 | -18.27 | QP |
| 10 | 1.06 | -2.01 | 9.63 | 0.05 | 10.00 | 17.67 | 46.00 | -28.33 | Average |
| 11 | 3.90 | 22.12 | 9.65 | 0.06 | 10.00 | 41.83 | 56.00 | -14.17 | QP |
| 12 | 3.90 | 3.31 | 9.65 | 0.06 | 10.00 | 23.02 | 46.00 | -22.98 | Average |

Remarks: 1. Measured = Reading +Cable Loss +Aux2 Fac.
2. The emission levels that are 20dB below the official limit are not reported.




Trace: 1055
Power Rating: AC 240V/60Hz
Pol: NEUTRAL

| | Freq | Reading | LISNFac | CabLos | Aux2Fac | Measured | Limit | Over | Remark |
|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV | dB | dB | dB | dB | dBuV | dBuV | dB |
| 1 | 0.16 | 37.54 | 9.68 | 0.02 | 10.00 | 57.24 | 65.56 | -8.32 | QP |
| 2 | 0.16 | 14.54 | 9.68 | 0.02 | 10.00 | 34.24 | 55.55 | -21.31 | Average |
| 3 | 0.18 | 36.45 | 9.64 | 0.02 | 10.00 | 56.11 | 64.59 | -8.48 | QP |
| 4 | 0.18 | 11.64 | 9.63 | 0.02 | 10.00 | 31.29 | 54.59 | -23.30 | Average |
| 5 | 0.26 | 31.15 | 9.60 | 0.03 | 10.00 | 50.78 | 61.38 | -10.60 | QP |
| 6 | 0.26 | 6.34 | 9.60 | 0.03 | 10.00 | 25.97 | 51.38 | -25.41 | Average |
| 7 | 0.35 | 27.63 | 9.61 | 0.03 | 10.00 | 47.27 | 58.87 | -11.60 | QP |
| 8 | 0.35 | 0.68 | 9.61 | 0.03 | 10.00 | 20.32 | 48.87 | -28.55 | Average |
| 9 | 0.68 | 22.29 | 9.63 | 0.04 | 10.00 | 41.96 | 56.00 | -14.04 | QP |
| 10 | 0.68 | -0.52 | 9.63 | 0.04 | 10.00 | 19.15 | 46.00 | -26.85 | Average |
| 11 | 3.82 | 26.11 | 9.65 | 0.06 | 10.00 | 45.82 | 56.00 | -10.18 | QP |
| 12 | 3.82 | -0.23 | 9.65 | 0.06 | 10.00 | 19.48 | 46.00 | -26.52 | Average |

Remarks: 1. Measured = Reading +Cable Loss +Aux2 Fac.
2. The emission levels that are 20dB below the official limit are not reported.

****Note: Pre-scan all modes and recorded the worst case results in this report (IEEE 802.11a).*

## 5.7 Undesirable Emissions Measurement

### 5.7.1 LIMIT

According to ξ15.407 (b) Undesirable emission limits. Except as shown in paragraph (b) (7) of this section, the maximum emissions outside of the frequency bands of operation shall be attenuated in accordance with the following limits:

(a) 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 e.i.r.p. of −27 dBm/MHz.

(b) For transmitters operating in the 5.25-5.35 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of −27 dBm/MHz.

(c) For transmitters operating in the 5.47-5.725 GHz band: All emissions outside of the 5.47-5.725 GHz band shall not exceed an e.i.r.p. of −27 dBm/MHz.

(d) For transmitters operating in the 5.725-5.85 GHz band:

(i) All emissions shall be limited to a level of −27 dBm/MHz at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.

(ii) Devices certified before March 2, 2017 with antenna gain greater than 10 dBi may demonstrate compliance with the emission limits in §15.247(d), but manufacturing, marketing and importing of devices certified under this alternative must cease by March 2, 2018. Devices certified before March 2, 2018 with antenna gain of 10 dBi or less may demonstrate compliance with the emission limits in §15.247(d), but manufacturing, marketing and importing of devices certified under this alternative must cease before March 2, 2020.

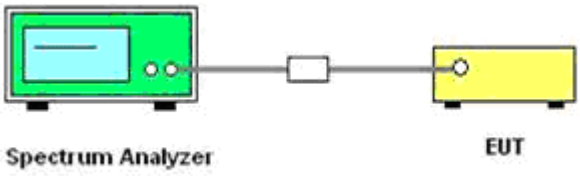
(e) The emission measurements shall be performed using a minimum resolution bandwidth of 1 MHz. A lower resolution bandwidth may be employed near the band edge, when necessary, provided the measured energy is integrated to show the total power over 1 MHz.

(f) Unwanted emissions below 1 GHz must comply with the general field strength limits set forth in §15.209. Further, any U-NII devices using an AC power line are required to comply also with the conducted limits set forth in §15.207.

(g) The provisions of §15.205 apply to intentional radiators operating under this section.

(h) When measuring the emission limits, the nominal carrier frequency shall be adjusted as close to the upper and lower frequency band edges as the design of the equipment permits.

### 5.7.2 TEST CONFIGURATION




### 5.7.3 TEST PROCEDURE

1. The power was monitored at the coupler port with a Spectrum Analyzer. The power level was set to the maximum level.
2. Set the RBW = 1MHz.
3. Set the VBW ≥ 3MHz
4. Number of points in sweep ≥ 2 × span / RBW. (This ensures that bin-to-bin spacing is ≤ RBW/2, so that narrowband signals are not lost between frequency bins.)
5. Manually set sweep time ≥ 10 × (number of points in sweep) × (total on/off period of the transmitted signal).
6. Set detector = power averaging (rms).
7. Sweep time = auto couple.
8. Trace mode = max hold.
9. Allow trace to fully stabilize.

5. 7.4 Test Results

*For Antenna Chain 0*

| IEEE 802.11a | | | | | | | |
|---|---|---|---|---|---|---|---|
| Frequency (MHz) | Conducted Power (dBm) | Antenna Gain (dBi) | EIRP (dBm/1MHz) | Detector | Limit (dBm/1MHz) | Over limit dB | Verdict |
| 5650.000 | -53.901 | 2.000 | -51.901 | Peak | -27.000 | -24.901 | PASS |
| 5700.000 | -50.137 | 2.000 | -48.137 | Peak | 10.000 | -58.137 | PASS |
| 5720.000 | -45.057 | 2.000 | -43.057 | Peak | 15.600 | -58.657 | PASS |
| 5725.000 | -39.050 | 2.000 | -37.050 | Peak | 27.000 | -64.05 | PASS |
| 5850.000 | -40.122 | 2.000 | -38.122 | Peak | 27.000 | -65.122 | PASS |
| 5855.000 | -44.918 | 2.000 | -42.918 | Peak | 15.600 | -58.518 | PASS |
| 5875.000 | -46.298 | 2.000 | -44.298 | Peak | 10.000 | -54.298 | PASS |
| 5925.000 | -50.593 | 2.000 | -48.593 | Peak | -27.000 | -21.593 | PASS |

| IEEE 802.11n HT20 | | | | | | | |
|---|---|---|---|---|---|---|---|
| Frequency (MHz) | Conducted Power (dBm) | Antenna Gain (dBi) | EIRP (dBm/1MHz) | Detector | Limit (dBm/1MHz) | Over limit dB | Verdict |
| 5650.000 | -52.057 | 2.000 | -50.057 | Peak | -27.000 | -23.057 | PASS |
| 5700.000 | -49.432 | 2.000 | -47.432 | Peak | 10.000 | -57.432 | PASS |
| 5720.000 | -45.959 | 2.000 | -43.959 | Peak | 15.600 | -59.559 | PASS |
| 5725.000 | -37.643 | 2.000 | -35.643 | Peak | 27.000 | -62.643 | PASS |
| 5850.000 | -40.379 | 2.000 | -38.379 | Peak | 27.000 | -65.379 | PASS |
| 5855.000 | -47.392 | 2.000 | -45.392 | Peak | 15.600 | -60.992 | PASS |
| 5875.000 | -47.016 | 2.000 | -45.016 | Peak | 10.000 | -55.016 | PASS |
| 5925.000 | -52.292 | 2.000 | -50.292 | Peak | -27.000 | -23.292 | PASS |

| IEEE 802.11ac VHT20 | | | | | | | |
|---|---|---|---|---|---|---|---|
| Frequency (MHz) | Conducted Power (dBm) | Antenna Gain (dBi) | EIRP (dBm/1MHz) | Detector | Limit (dBm/1MHz) | Over limit dB | Verdict |
| 5650.000 | -54.065 | 2.000 | -52.065 | Peak | -27.000 | -25.065 | PASS |
| 5700.000 | -50.831 | 2.000 | -48.831 | Peak | 10.000 | -58.831 | PASS |
| 5720.000 | -48.579 | 2.000 | -46.579 | Peak | 15.600 | -62.179 | PASS |
| 5725.000 | -39.928 | 2.000 | -37.928 | Peak | 27.000 | -64.928 | PASS |
| 5850.000 | -42.484 | 2.000 | -40.484 | Peak | 27.000 | -67.484 | PASS |
| 5855.000 | -49.585 | 2.000 | -47.585 | Peak | 15.600 | -63.185 | PASS |
| 5875.000 | -50.277 | 2.000 | -48.277 | Peak | 10.000 | -58.277 | PASS |
| 5925.000 | -52.411 | 2.000 | -50.411 | Peak | -27.000 | -23.411 | PASS |

| IEEE 802.11n HT40 | | | | | | | |
|---|---|---|---|---|---|---|---|
| Frequency (MHz) | Conducted Power (dBm) | Antenna Gain (dBi) | EIRP (dBm/1MHz) | Detector | Limit (dBm/1MHz) | Over limit dB | Verdict |
| 5650.000 | -54.840 | 2.000 | -52.840 | Peak | -27.000 | -25.840 | PASS |
| 5700.000 | -51.393 | 2.000 | -49.393 | Peak | 10.000 | -59.393 | PASS |
| 5720.000 | -44.077 | 2.000 | -42.077 | Peak | 15.600 | -57.677 | PASS |
| 5725.000 | -40.475 | 2.000 | -38.475 | Peak | 27.000 | -65.475 | PASS |
| 5850.000 | -48.595 | 2.000 | -46.595 | Peak | 27.000 | -73.595 | PASS |
| 5855.000 | -49.978 | 2.000 | -47.978 | Peak | 15.600 | -63.578 | PASS |
| 5875.000 | -50.938 | 2.000 | -48.938 | Peak | 10.000 | -58.938 | PASS |
| 5925.000 | -54.437 | 2.000 | -52.437 | Peak | -27.000 | -25.437 | PASS |

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| IEEE 802.11ac VHT40 | | | | | | | |
|---|---|---|---|---|---|---|---|
| Frequency (MHz) | Conducted Power (dBm) | Antenna Gain (dBi) | EIRP (dBm/1MHz) | Detector | Limit (dBm/1MHz) | Over limit dB | Verdict |
| 5650.000 | -54.357 | 2.000 | -52.357 | Peak | -27.000 | -25.357 | PASS |
| 5700.000 | -51.978 | 2.000 | -49.978 | Peak | 10.000 | -59.978 | PASS |
| 5720.000 | -45.410 | 2.000 | -43.410 | Peak | 15.600 | -59.010 | PASS |
| 5725.000 | -41.986 | 2.000 | -39.986 | Peak | 27.000 | -66.986 | PASS |
| 5850.000 | -49.529 | 2.000 | -47.529 | Peak | 27.000 | -74.529 | PASS |
| 5855.000 | -50.611 | 2.000 | -48.611 | Peak | 15.600 | -64.211 | PASS |
| 5875.000 | -50.967 | 2.000 | -48.967 | Peak | 10.000 | -58.967 | PASS |
| 5925.000 | -53.600 | 2.000 | -51.600 | Peak | -27.000 | -24.600 | PASS |

| IEEE 802.11ac VHT80 | | | | | | | |
|---|---|---|---|---|---|---|---|
| Frequency (MHz) | Conducted Power (dBm) | Antenna Gain (dBi) | EIRP (dBm/1MHz) | Detector | Limit (dBm/1MHz) | Over limit dB | Verdict |
| 5650.000 | -53.216 | 2.000 | -51.216 | Peak | -27.000 | -24.216 | PASS |
| 5700.000 | -50.573 | 2.000 | -48.573 | Peak | 10.000 | -58.573 | PASS |
| 5720.000 | -47.918 | 2.000 | -45.918 | Peak | 15.600 | -61.518 | PASS |
| 5725.000 | -46.330 | 2.000 | -44.330 | Peak | 27.000 | -71.330 | PASS |
| 5850.000 | -51.569 | 2.000 | -49.569 | Peak | 27.000 | -76.569 | PASS |
| 5855.000 | -50.074 | 2.000 | -48.074 | Peak | 15.600 | -63.674 | PASS |
| 5875.000 | -52.787 | 2.000 | -50.787 | Peak | 10.000 | -60.787 | PASS |
| 5925.000 | -54.847 | 2.000 | -52.847 | Peak | -27.000 | -25.847 | PASS |

*For Antenna Chain 1*

| IEEE 802.11a | | | | | | | |
|---|---|---|---|---|---|---|---|
| Frequency (MHz) | Conducted Power (dBm) | Antenna Gain (dBi) | EIRP (dBm/1MHz) | Detector | Limit (dBm/1MHz) | Over limit dB | Verdict |
| 5650.000 | -51.807 | 2.000 | -49.807 | Peak | -27.000 | -22.807 | PASS |
| 5700.000 | -48.020 | 2.000 | -46.020 | Peak | 10.000 | -56.020 | PASS |
| 5720.000 | -46.004 | 2.000 | -44.004 | Peak | 15.600 | -59.604 | PASS |
| 5725.000 | -41.154 | 2.000 | -39.154 | Peak | 27.000 | -66.154 | PASS |
| 5850.000 | -47.557 | 2.000 | -45.557 | Peak | 27.000 | -72.557 | PASS |
| 5855.000 | -47.082 | 2.000 | -45.082 | Peak | 15.600 | -60.682 | PASS |
| 5875.000 | -49.949 | 2.000 | -47.949 | Peak | 10.000 | -57.949 | PASS |
| 5925.000 | -52.492 | 2.000 | -50.492 | Peak | -27.000 | -23.492 | PASS |

| IEEE 802.11n HT20 | | | | | | | |
|---|---|---|---|---|---|---|---|
| Frequency (MHz) | Conducted Power (dBm) | Antenna Gain (dBi) | EIRP (dBm/1MHz) | Detector | Limit (dBm/1MHz) | Over limit dB | Verdict |
| 5650.000 | -54.423 | 2.000 | -52.423 | Peak | -27.000 | -25.423 | PASS |
| 5700.000 | -49.114 | 2.000 | -47.114 | Peak | 10.000 | -57.114 | PASS |
| 5720.000 | -46.027 | 2.000 | -44.027 | Peak | 15.600 | -59.627 | PASS |
| 5725.000 | -36.863 | 2.000 | -34.863 | Peak | 27.000 | -61.863 | PASS |
| 5850.000 | -43.706 | 2.000 | -41.706 | Peak | 27.000 | -68.706 | PASS |
| 5855.000 | -46.536 | 2.000 | -44.536 | Peak | 15.600 | -60.136 | PASS |
| 5875.000 | -47.393 | 2.000 | -45.393 | Peak | 10.000 | -55.393 | PASS |
| 5925.000 | -53.704 | 2.000 | -51.704 | Peak | -27.000 | -24.704 | PASS |

| IEEE 802.11ac VHT20 | | | | | | | |
|---|---|---|---|---|---|---|---|
| Frequency (MHz) | Conducted Power (dBm) | Antenna Gain (dBi) | EIRP (dBm/1MHz) | Detector | Limit (dBm/1MHz) | Over limit dB | Verdict |
| 5650.000 | -53.216 | 2.000 | -51.216 | Peak | -27.000 | -24.216 | PASS |
| 5700.000 | -48.208 | 2.000 | -46.208 | Peak | 10.000 | -56.208 | PASS |
| 5720.000 | -46.785 | 2.000 | -44.785 | Peak | 15.600 | -60.385 | PASS |
| 5725.000 | -42.421 | 2.000 | -40.421 | Peak | 27.000 | -67.421 | PASS |
| 5850.000 | -46.717 | 2.000 | -44.717 | Peak | 27.000 | -71.717 | PASS |
| 5855.000 | -48.815 | 2.000 | -46.815 | Peak | 15.600 | -62.415 | PASS |
| 5875.000 | -49.476 | 2.000 | -47.476 | Peak | 10.000 | -57.476 | PASS |
| 5925.000 | -53.104 | 2.000 | -51.104 | Peak | -27.000 | -24.104 | PASS |

| IEEE 802.11n HT40 | | | | | | | |
|---|---|---|---|---|---|---|---|
| Frequency (MHz) | Conducted Power (dBm) | Antenna Gain (dBi) | EIRP (dBm/1MHz) | Detector | Limit (dBm/1MHz) | Over limit dB | Verdict |
| 5650.000 | -54.569 | 2.000 | -52.569 | Peak | -27.000 | -25.569 | PASS |
| 5700.000 | -51.852 | 2.000 | -49.852 | Peak | 10.000 | -59.852 | PASS |
| 5720.000 | -41.246 | 2.000 | -39.246 | Peak | 15.600 | -54.846 | PASS |
| 5725.000 | -40.496 | 2.000 | -38.496 | Peak | 27.000 | -65.496 | PASS |
| 5850.000 | -50.535 | 2.000 | -48.535 | Peak | 27.000 | -75.535 | PASS |
| 5855.000 | -49.211 | 2.000 | -47.211 | Peak | 15.600 | -62.811 | PASS |
| 5875.000 | -50.980 | 2.000 | -48.980 | Peak | 10.000 | -58.980 | PASS |
| 5925.000 | -54.225 | 2.000 | -52.225 | Peak | -27.000 | -25.225 | PASS |

| IEEE 802.11ac VHT40 | | | | | | | |
|---|---|---|---|---|---|---|---|
| Frequency (MHz) | Conducted Power (dBm) | Antenna Gain (dBi) | EIRP (dBm/1MHz) | Detector | Limit (dBm/1MHz) | Over limit dB | Verdict |
| 5650.000 | -55.181 | 2.000 | -53.181 | Peak | -27.000 | -26.181 | PASS |
| 5700.000 | -50.286 | 2.000 | -48.286 | Peak | 10.000 | -58.286 | PASS |
| 5720.000 | -44.906 | 2.000 | -42.906 | Peak | 15.600 | -58.506 | PASS |
| 5725.000 | -43.512 | 2.000 | -41.512 | Peak | 27.000 | -68.512 | PASS |
| 5850.000 | -49.751 | 2.000 | -47.751 | Peak | 27.000 | -74.751 | PASS |
| 5855.000 | -49.361 | 2.000 | -47.361 | Peak | 15.600 | -62.961 | PASS |
| 5875.000 | -51.332 | 2.000 | -49.332 | Peak | 10.000 | -59.332 | PASS |
| 5925.000 | -53.027 | 2.000 | -51.027 | Peak | -27.000 | -24.027 | PASS |

| IEEE 802.11ac VHT80 | | | | | | | |
|---|---|---|---|---|---|---|---|
| Frequency (MHz) | Conducted Power (dBm) | Antenna Gain (dBi) | EIRP (dBm/1MHz) | Detector | Limit (dBm/1MHz) | Over limit dB | Verdict |
| 5650.000 | -53.950 | 2.000 | -51.950 | Peak | -27.000 | -24.950 | PASS |
| 5700.000 | -52.521 | 2.000 | -50.521 | Peak | 10.000 | -60.521 | PASS |
| 5720.000 | -48.570 | 2.000 | -46.570 | Peak | 15.600 | -62.170 | PASS |
| 5725.000 | -48.363 | 2.000 | -46.363 | Peak | 27.000 | -73.363 | PASS |
| 5850.000 | -50.035 | 2.000 | -48.035 | Peak | 27.000 | -75.035 | PASS |
| 5855.000 | -51.901 | 2.000 | -49.901 | Peak | 15.600 | -65.501 | PASS |
| 5875.000 | -50.855 | 2.000 | -48.855 | Peak | 10.000 | -58.855 | PASS |
| 5925.000 | -54.846 | 2.000 | -52.846 | Peak | -27.000 | -25.846 | PASS |

## For Combined Antenna Chain 0 and Antenna Chain 1

| IEEE 802.11n HT20 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Frequency (MHz) | Conducted Power (dBm) | | | Directional Gain (dB) | EIRP (dBm/1MHz) | Detector | Limit (dBm/1MHz) | Over limit dB | Verdict |
| | Antenna 0 | Antenna 1 | Sum | | | | | | |
| 5650.000 | -52.057 | -54.423 | -50.071 | 5.010* | -45.061 | Peak | -27.000 | -18.061 | PASS |
| 5700.000 | -49.432 | -49.114 | -46.260 | 5.010* | -41.250 | Peak | 10.000 | -51.250 | PASS |
| 5720.000 | -45.959 | -46.027 | -42.983 | 5.010* | -37.973 | Peak | 15.600 | -53.573 | PASS |
| 5725.000 | -37.643 | -36.863 | -34.225 | 5.010* | -29.215 | Peak | 27.000 | -56.215 | PASS |
| 5850.000 | -40.379 | -43.706 | -38.721 | 5.010* | -33.711 | Peak | 27.000 | -60.711 | PASS |
| 5855.000 | -47.392 | -46.536 | -43.933 | 5.010* | -38.923 | Peak | 15.600 | -54.523 | PASS |
| 5875.000 | -47.016 | -47.393 | -44.190 | 5.010* | -39.180 | Peak | 10.000 | -49.180 | PASS |
| 5925.000 | -52.292 | -53.704 | -49.931 | 5.010* | -44.921 | Peak | -27.000 | -17.921 | PASS |

| IEEE 802.11ac VHT20 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Frequency (MHz) | Conducted Power (dBm) | | | Directional Gain (dB) | EIRP (dBm/1MHz) | Detector | Limit (dBm/1MHz) | Over limit dB | Verdict |
| | Antenna 0 | Antenna 1 | Sum | | | | | | |
| 5650.000 | -54.065 | -53.216 | -50.609 | 5.010* | -45.599 | Peak | -27.000 | -18.599 | PASS |
| 5700.000 | -50.831 | -48.208 | -46.314 | 5.010* | -41.304 | Peak | 10.000 | -51.304 | PASS |
| 5720.000 | -48.579 | -46.785 | -44.580 | 5.010* | -39.570 | Peak | 15.600 | -55.170 | PASS |
| 5725.000 | -39.928 | -42.421 | -37.988 | 5.010* | -32.978 | Peak | 27.000 | -59.978 | PASS |
| 5850.000 | -42.484 | -46.717 | -41.094 | 5.010* | -36.084 | Peak | 27.000 | -63.084 | PASS |
| 5855.000 | -49.585 | -48.815 | -46.173 | 5.010* | -41.163 | Peak | 15.600 | -56.763 | PASS |
| 5875.000 | -50.277 | -49.476 | -46.848 | 5.010* | -41.838 | Peak | 10.000 | -51.838 | PASS |
| 5925.000 | -52.411 | -53.104 | -49.733 | 5.010* | -44.723 | Peak | -27.000 | -17.723 | PASS |

| IEEE 802.11n HT40 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Frequency (MHz) | Conducted Power (dBm) | | | Directional Gain (dB) | EIRP (dBm/1MHz) | Detector | Limit (dBm/1MHz) | Over limit dB | Verdict |
| | Antenna 0 | Antenna 1 | Sum | | | | | | |
| 5650.000 | -54.840 | -54.569 | -51.692 | 5.010* | -46.682 | Peak | -27.000 | -19.682 | PASS |
| 5700.000 | -51.393 | -51.852 | -48.606 | 5.010* | -43.596 | Peak | 10.000 | -53.596 | PASS |
| 5720.000 | -44.077 | -41.246 | -39.424 | 5.010* | -34.414 | Peak | 15.600 | -50.014 | PASS |
| 5725.000 | -40.475 | -40.496 | -37.475 | 5.010* | -32.465 | Peak | 27.000 | -59.465 | PASS |
| 5850.000 | -48.595 | -50.535 | -46.447 | 5.010* | -41.437 | Peak | 27.000 | -68.437 | PASS |
| 5855.000 | -49.978 | -49.211 | -46.567 | 5.010* | -41.557 | Peak | 15.600 | -57.157 | PASS |
| 5875.000 | -50.938 | -50.980 | -47.949 | 5.010* | -42.939 | Peak | 10.000 | -52.939 | PASS |
| 5925.000 | -54.437 | -54.225 | -51.319 | 5.010* | -46.309 | Peak | -27.000 | -19.309 | PASS |

| IEEE 802.11ac VHT40 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Frequency (MHz) | Conducted Power (dBm) | | | Directional Gain (dB) | EIRP (dBm/1MHz) | Detector | Limit (dBm/1MHz) | Over limit dB | Verdict |
| | Antenna 0 | Antenna 1 | Sum | | | | | | |
| 5650.000 | -54.357 | -55.181 | -51.739 | 5.010* | -46.729 | Peak | -27.000 | -19.729 | PASS |
| 5700.000 | -51.978 | -50.286 | -48.040 | 5.010* | -43.030 | Peak | 10.000 | -53.030 | PASS |
| 5720.000 | -45.410 | -44.906 | -42.140 | 5.010* | -37.130 | Peak | 15.600 | -52.730 | PASS |
| 5725.000 | -41.986 | -43.512 | -39.672 | 5.010* | -34.662 | Peak | 27.000 | -61.662 | PASS |
| 5850.000 | -49.529 | -49.751 | -46.628 | 5.010* | -41.618 | Peak | 27.000 | -68.618 | PASS |
| 5855.000 | -50.611 | -49.361 | -46.931 | 5.010* | -41.921 | Peak | 15.600 | -57.521 | PASS |
| 5875.000 | -50.967 | -51.332 | -48.135 | 5.010* | -43.125 | Peak | 10.000 | -53.125 | PASS |
| 5925.000 | -53.600 | -53.027 | -50.294 | 5.010* | -45.284 | Peak | -27.000 | -18.284 | PASS |

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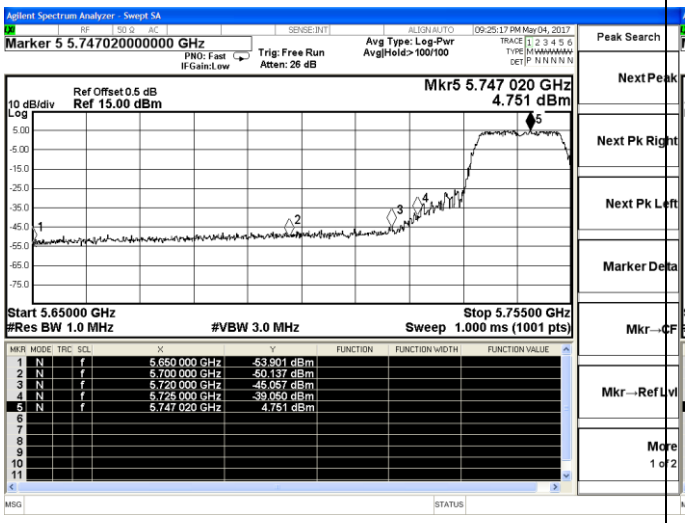
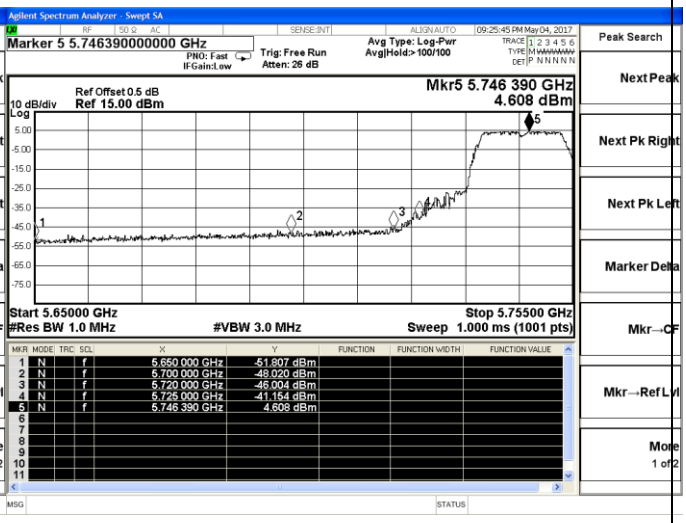
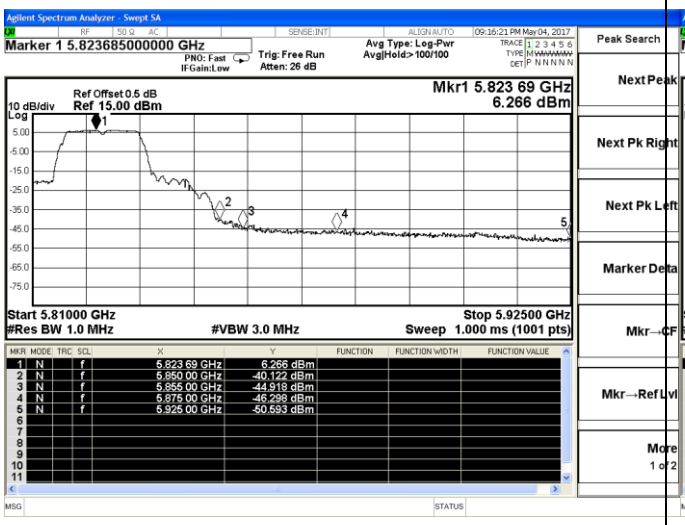
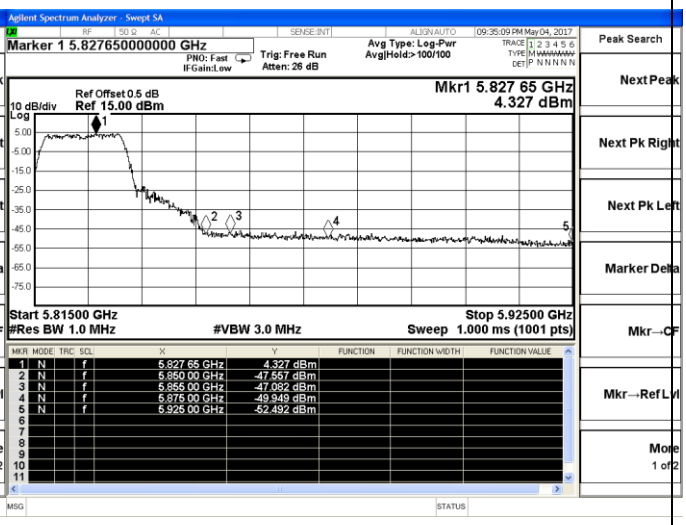
| IEEE 802.11ac VHT80 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Frequency (MHz) | Conducted Power (dBm) | | | Directional Gain (dB) | EIRP (dBm/1MHz) | Detector | Limit (dBm/1MHz) | Over limit dB | Verdict |
| | Antenna 0 | Antenna 1 | Sum | | | | | | |
| 5650.000 | -53.216 | -53.95 | -50.557 | 5.010* | -45.547 | Peak | -27.000 | -18.547 | PASS |
| 5700.000 | -50.573 | -52.521 | -48.428 | 5.010* | -43.418 | Peak | 10.000 | -53.418 | PASS |
| 5720.000 | -47.918 | -48.57 | -45.221 | 5.010* | -40.211 | Peak | 15.600 | -55.811 | PASS |
| 5725.000 | -46.330 | -48.363 | -44.218 | 5.010* | -39.208 | Peak | 27.000 | -66.208 | PASS |
| 5850.000 | -51.569 | -50.035 | -47.724 | 5.010* | -42.714 | Peak | 27.000 | -69.714 | PASS |
| 5855.000 | -50.074 | -51.901 | -47.882 | 5.010* | -42.872 | Peak | 15.600 | -58.472 | PASS |
| 5875.000 | -52.787 | -50.855 | -48.704 | 5.010* | -43.694 | Peak | 10.000 | -53.694 | PASS |
| 5925.000 | -54.847 | -54.846 | -51.836 | 5.010* | -46.826 | Peak | -27.000 | -19.826 | PASS |

*Remark:*

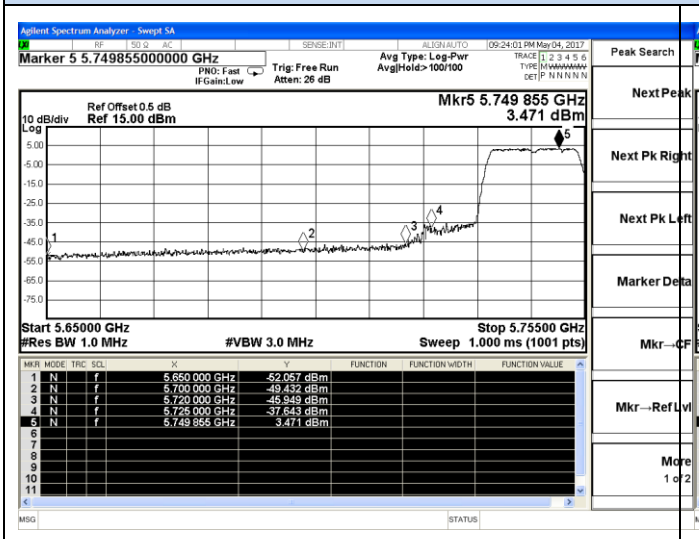
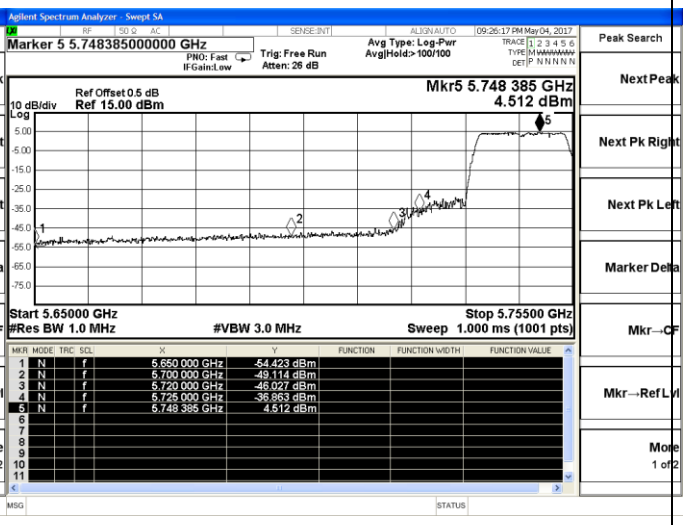
1. *Measured unwanted emission at difference data rate for each mode and recorded worst case for each mode.*
2. *Test results including cable loss;*
3. *Worst case data at 6Mbps at IEEE 802.11a; MCS0 at IEEE 802.11n HT20, IEEE 802.11n HT40, IEEE 802.11a VHT20, IEEE 802.11ac VHT40 and IEEE 802.11ac VHT80;*
4. *For MIMO with CCD technology device, The Directional Gain= Gain of individual transmit antennas (dBi) + Array gain;*
   *Array gain = 10 log ($N_{ant}$), where $N_{ant}$ is the number of transmit antennas.*
5. **5.010=2.00+10*log(2).*
6. *E.I.R.P = Conducted power + Directional Gain*
7. *Please refer to following test plots;*

## Unwanted emission

### IEEE 802.11a

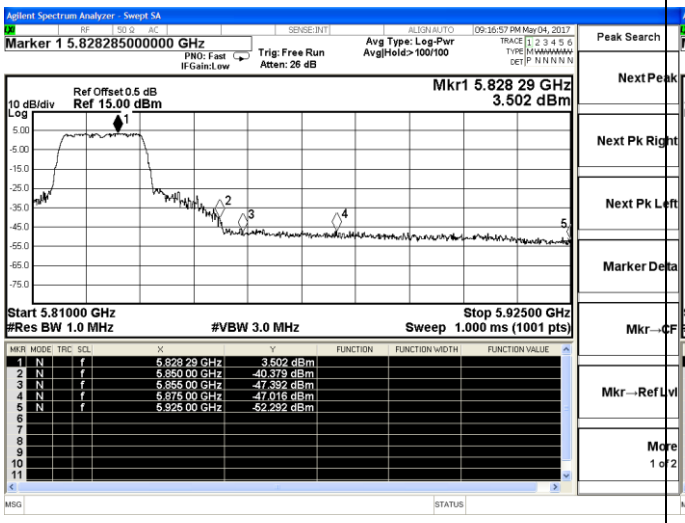
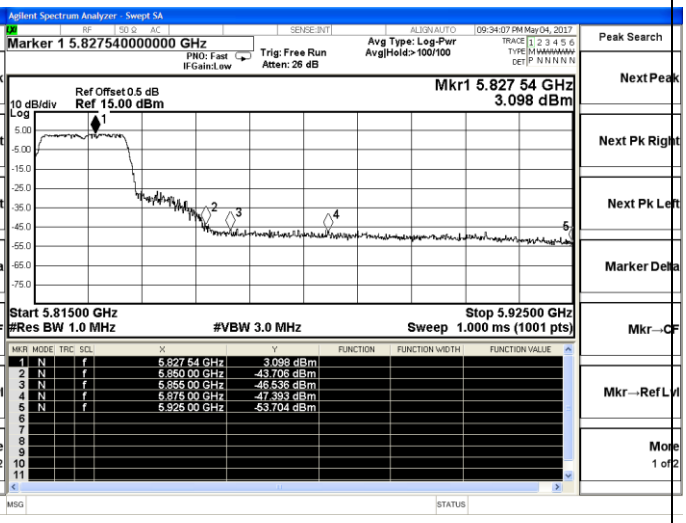
| Antenna Chain 0 | Antenna Chain 1 |
|---|---|
|  |  |
| Channel 149 / 5745 MHz – Peak | Channel 149 / 5745 MHz – Peak |
|  |  |
| Channel 165 / 5825 MHz – Peak | Channel 165 / 5825 MHz – Peak |

### IEEE 802.11n HT20

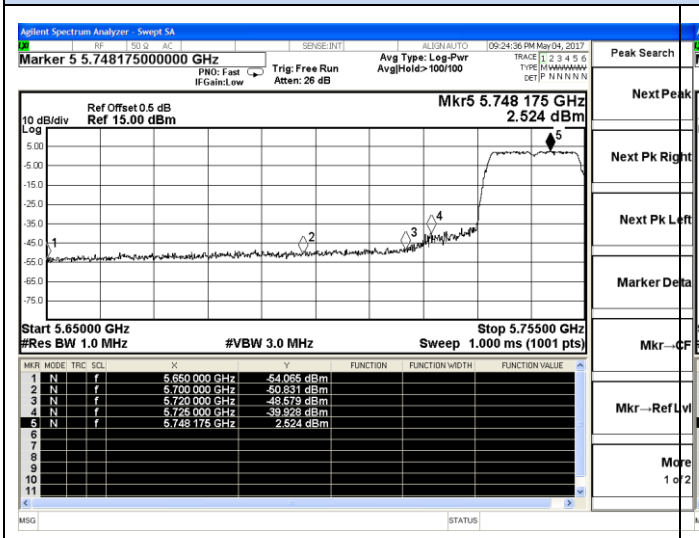
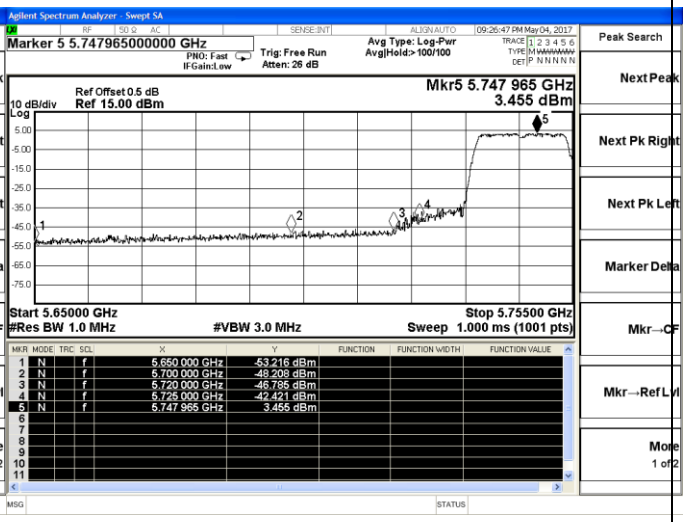
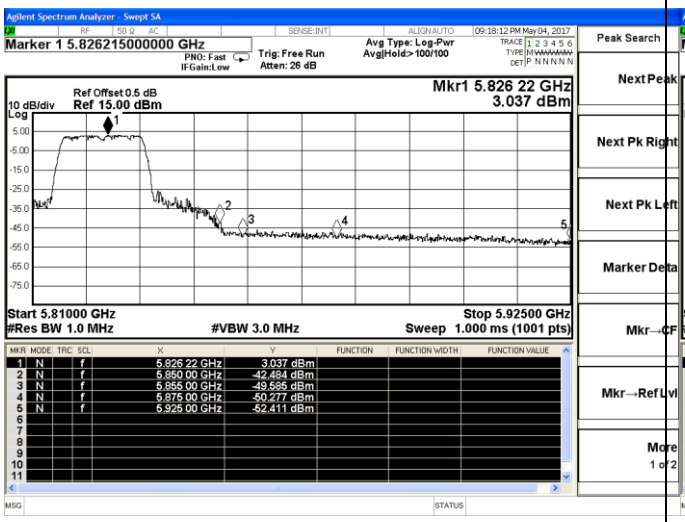
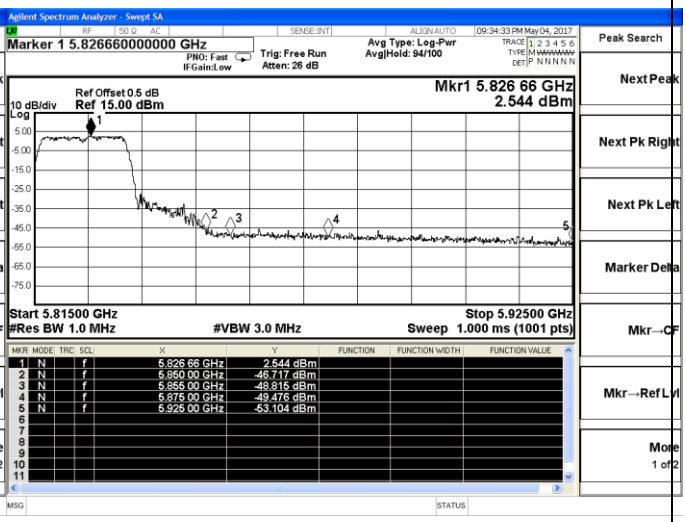
| | |
|---|---|
|  |  |
| Channel 149 / 5745 MHz – Peak | Channel 149 / 5745 MHz – Peak |

## Unwanted emission

### IEEE 802.11n HT20

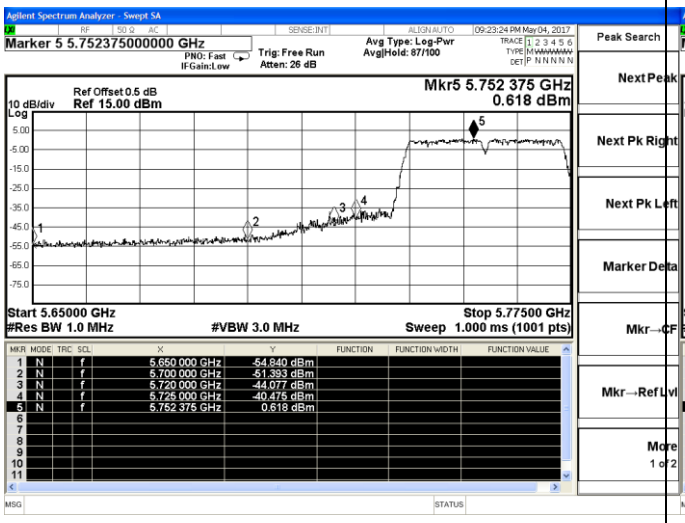
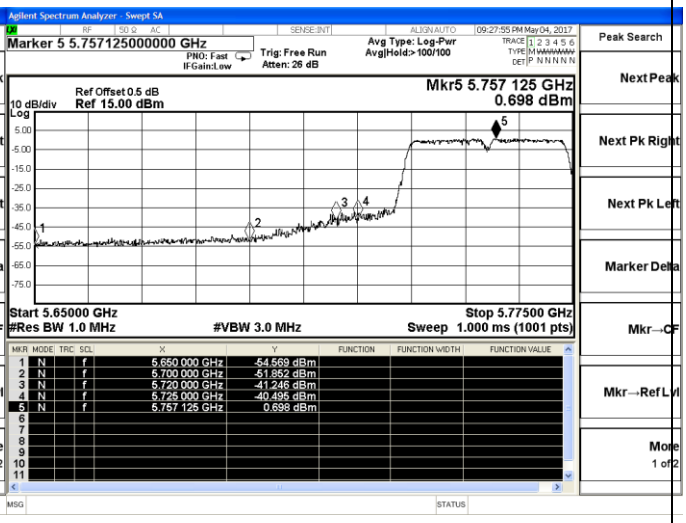
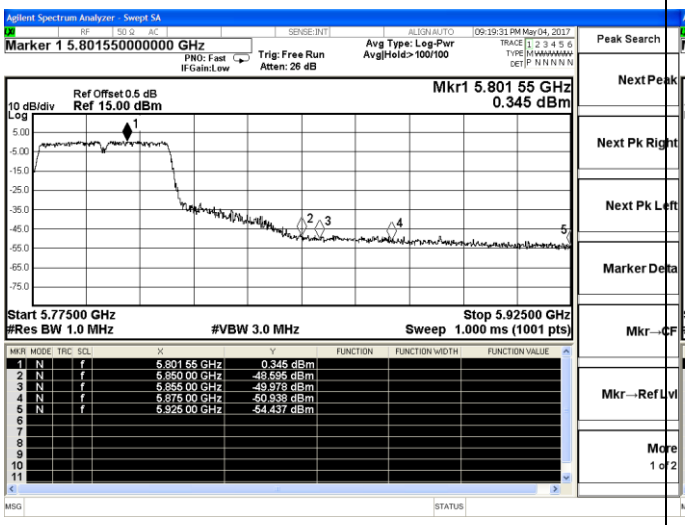
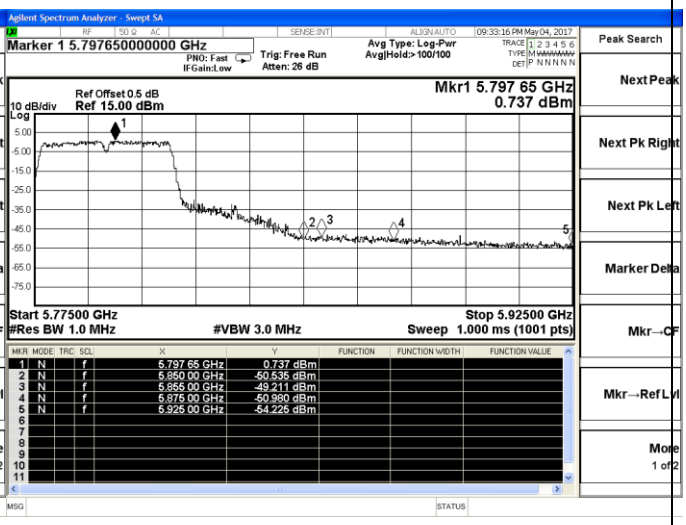
| Antenna Chain 0 | Antenna Chain 1 |
|---|---|
|  |  |
| Channel 165 / 5825 MHz – Peak | Channel 165 / 5825 MHz – Peak |

### IEEE 802.11ac VHT20

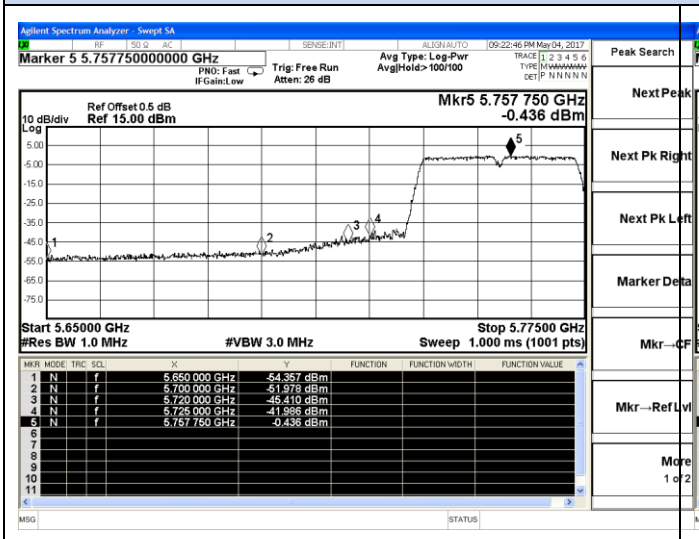
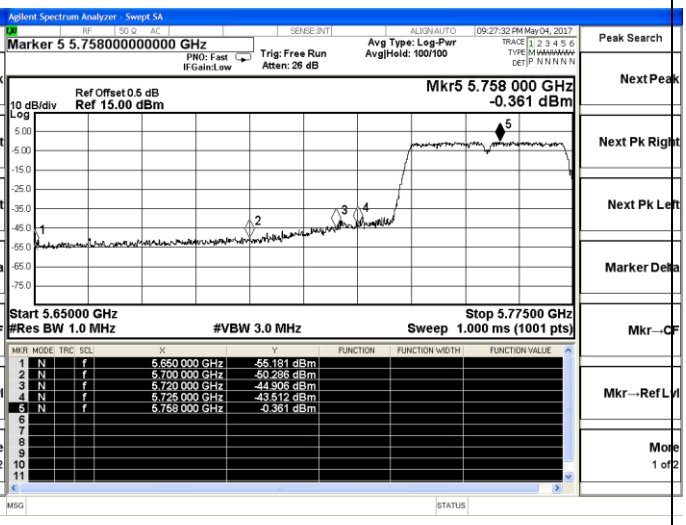
| | |
|---|---|
|  |  |
| Channel 149 / 5745 MHz – Peak | Channel 149 / 5745 MHz – Peak |
|  |  |
| Channel 165 / 5825 MHz – Peak | Channel 165 / 5825 MHz – Peak |

## Unwanted emission

### IEEE 802.11n HT40

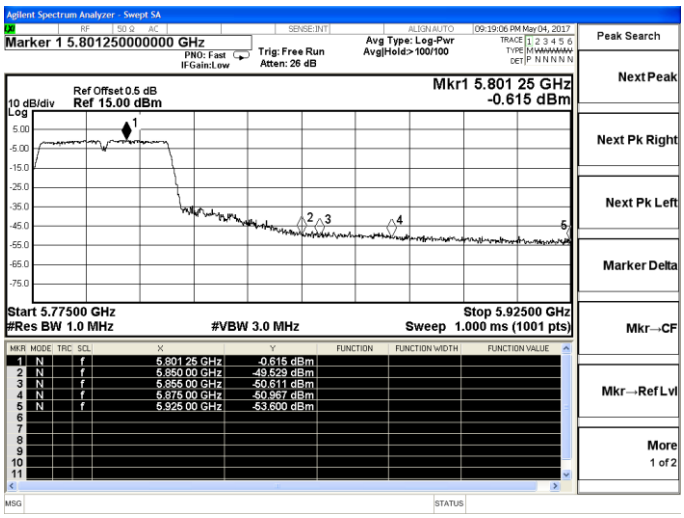
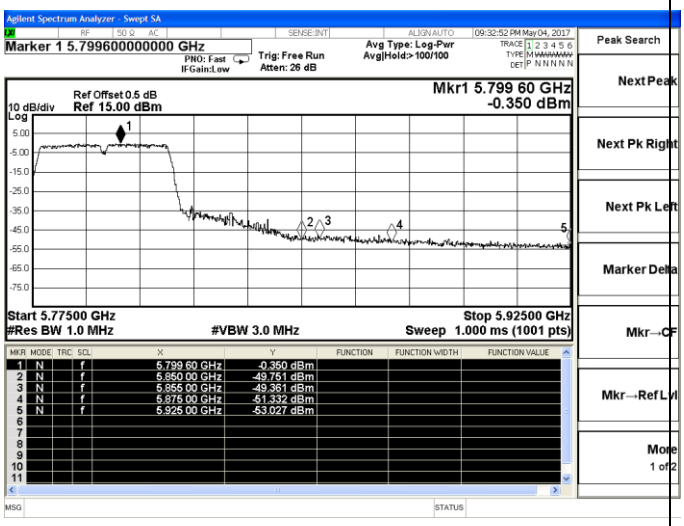
| Antenna Chain 0 | Antenna Chain 1 |
|---|---|
|  |  |
| Channel 151 / 5755 MHz – Peak | Channel 151 / 5755 MHz – Peak |
|  |  |
| Channel 159 / 5795 MHz – Peak | Channel 159 / 5795 MHz – Peak |

### IEEE 802.11ac VHT40

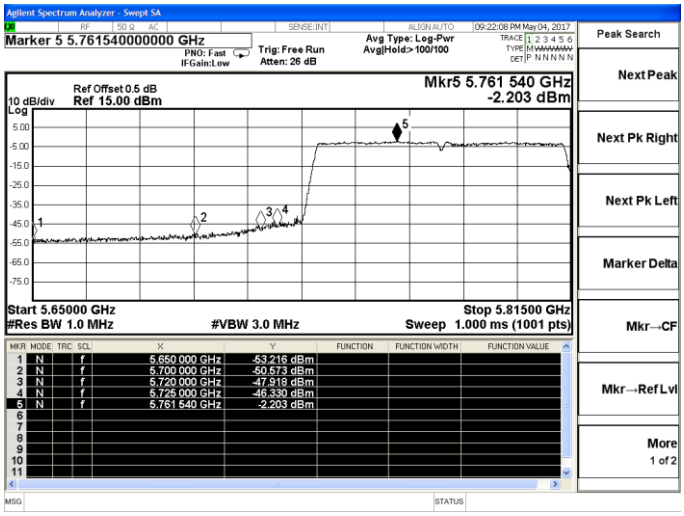
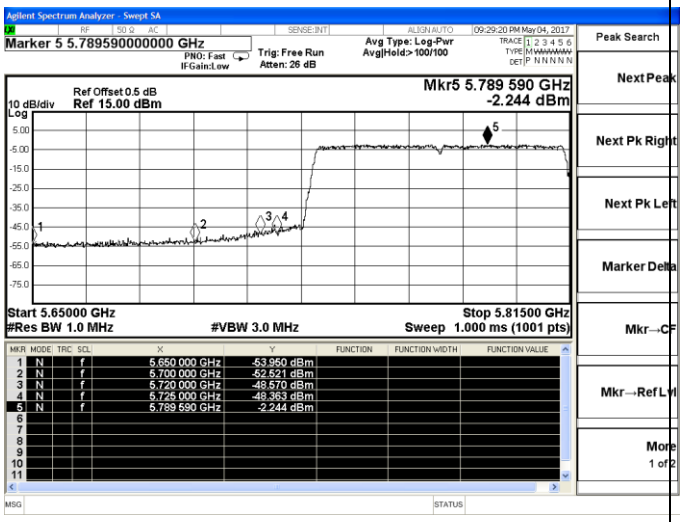
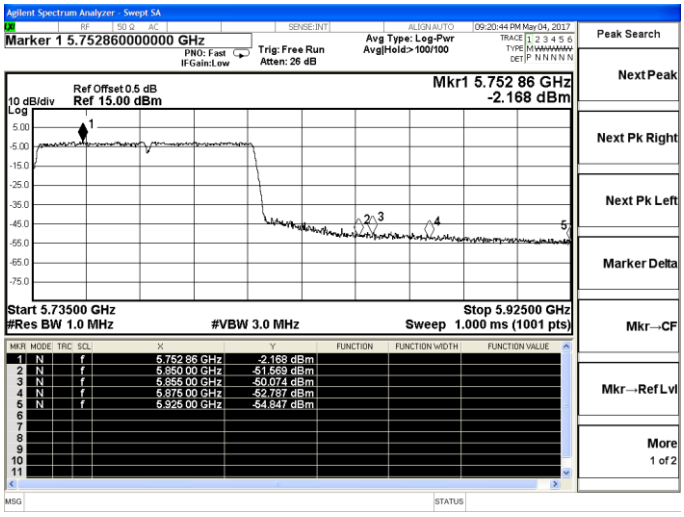
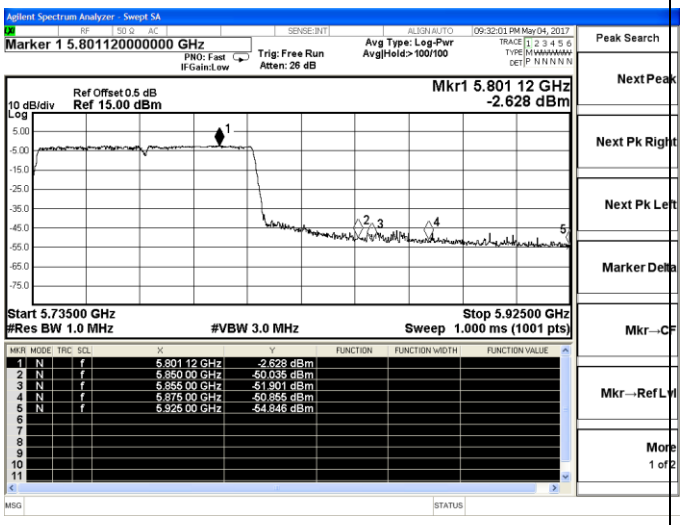
| | |
|---|---|
|  |  |
| Channel 151 / 5755 MHz – Peak | Channel 151 / 5755 MHz – Peak |

## Unwanted emission

### IEEE 802.11ac VHT40

| Antenna Chain 0 | Antenna Chain 1 |
|---|---|
|  |  |
| Channel 159 / 5795 MHz – Peak | Channel 159 / 5795 MHz – Peak |

### IEEE 802.11ac VHT80

| | |
|---|---|
|  |  |
| Channel 155 / 5775 MHz – Peak | Channel 155 / 5775 MHz – Peak |
|  |  |
| Channel 155 / 5775 MHz – Peak | Channel 155 / 5775 MHz – Peak |

## 5.8. Antenna Requirements

### 5.8.1. Standard Applicable

**For intentional device, according to FCC 47 CFR Section 15.203:**

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited

And according to FCC 47 CFR Section 15.407 (a), if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

### 5.8.2. Antenna Connector Construction

The directional gains of antenna used for transmitting is 2.0dBi which is a PIFA antenna and no consideration of replacement. Please see EUT photo for details.

### 5.8.3. Results: Compliance.

# 6. LIST OF MEASURING EQUIPMENTS

| Instrument | Manufacturer | Model No. | Serial No. | Characteristics | Cal Date | Due Date |
|---|---|---|---|---|---|---|
| EMC Receiver | R&S | ESCS 30 | 100174 | 9kHz – 2.75GHz | June 18, 2016 | June 17, 2017 |
| Signal analyzer | Agilent | E4448A(External mixers to 40GHz) | US44300469 | 9kHz~40GHz | July 16, 2016 | July 15, 2017 |
| Signal analyzer | Agilent | N9020A | MY50510140 | 9kHz~26.5GHz | October 27, 2017 | October 27, 2017 |
| LISN | MESS Tec | NNB-2/16Z | 99079 | 9KHz-30MHz | June 18, 2016 | June 17, 2017 |
| LISN (Support Unit) | EMCO | 3819/2NM | 9703-1839 | 9KHz-30MHz | June 18, 2016 | June 17, 2017 |
| RF Cable-CON | UTIFLEX | 3102-26886-4 | CB049 | 9KHz-30MHz | June 18, 2016 | June 17, 2017 |
| ISN | SCHAFFNER | ISN ST08 | 21653 | 9KHz-30MHz | June 18, 2016 | June 17, 2017 |
| 3m Semi Anechoic Chamber | SIDT FRANKONIA | SAC-3M | 03CH03-HY | 30M-18GHz 3m | June 18, 2016 | June 17, 2017 |
| Amplifier | SCHAFFNER | COA9231A | 18667 | 9kHz-2GHzz | June 18, 2016 | June 17, 2017 |
| Amplifier | Agilent | 8449B | 3008A02120 | 1GHz-26.5GHz | July 16, 2016 | July 15, 2017 |
| Amplifier | MITEQ | AMF-6F-260400 | 9121372 | 26.5GHz-40GHz | July 16, 2016 | July 15, 2017 |
| Loop Antenna | R&S | HFH2-Z2 | 860004/001 | 9k-30MHz | June 18, 2016 | June 17, 2017 |
| By-log Antenna | SCHWARZBEC | VULB9163 | 9163-470 | 30MHz-1GHz | June 10, 2016 | June 09, 2017 |
| Horn Antenna | EMCO | 3115 | 6741 | 1GHz-18GHz | June 10, 2016 | June 09, 2017 |
| Horn Antenna | SCHWARZBEC | BBHA9170 | BBHA9170154 | 15GHz-40GHz | June 10, 2016 | June 09, 2017 |
| RF Cable-R03m | Jye Bao | RG142 | CB021 | 30MHz-1GHz | June 18, 2016 | June 17, 2017 |
| RF Cable-HIGH | SUHNER | SUCOFLEX 106 | 03CH03-HY | 1GHz-40GHz | June 18, 2016 | June 17, 2017 |
| Power Meter | Anritsu | ML2495A | 1204011 | N/A | June 18, 2016 | June 17, 2017 |
| Power Sensor | Anritsu | MA2411B | 1126166 | N/A | June 18, 2016 | June 17, 2017 |
| AC Power Source | HPC | HPA-500E | HPA-9100024 | AC 0~300V | June 18, 2016 | June 17, 2017 |
| DC power source | GW | GPC-6030D | C671845 | DC 1V-60V | June 18, 2016 | June 17, 2017 |
| Temp. and Humidify Chamber | Giant Force | GTH-225-20-S | MAB0103-00 | N/A | June 18, 2016 | June 17, 2017 |
| RF CABLE-1m | JYE Bao | RG142 | CB034-1m | 20MHz-7GHz | June 18, 2016 | June 17, 2017 |
| RF CABLE-2m | JYE Bao | RG142 | CB)35-2m | 20MHz-1GHz | June 18, 2016 | June 17, 2017 |
| EMC Test | Audix | E3 | N/A | N/A | N/A | N/A |
| *Note: All equipment through GRGT EST calibration* | | | | | | |

# 7. TEST SETUP PHOTOGRAPHS OF EUT

Please refer to separated files for Test Setup Photos of the EUT.

# 8. EXTERIOR PHOTOGRAPHS OF THE EUT

Please refer to separated files for External Photos of the EUT.

# 9. INTERIOR PHOTOGRAPHS OF THE EUT

Please refer to separated files for Internal Photos of the EUT.

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