



**FCC 47 CFR PART 15 SUBPART E**

**CERTIFICATION TEST REPORT**

**FOR**

**GSM/WCDMA/LTE + BLUETOOTH + DTS/UNII a/b/g/n/ac + ANT+ and NFC**

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**NVLAP LAB CODE 200065-0**

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## TABLE OF CONTENTS

|                                                             |           |
|-------------------------------------------------------------|-----------|
| <b>1. ATTESTATION OF TEST RESULTS .....</b>                 | <b>7</b>  |
| <b>2. TEST METHODOLOGY .....</b>                            | <b>8</b>  |
| <b>3. FACILITIES AND ACCREDITATION .....</b>                | <b>8</b>  |
| <b>4. CALIBRATION AND UNCERTAINTY .....</b>                 | <b>8</b>  |
| 4.1. MEASURING INSTRUMENT CALIBRATION .....                 | 8         |
| 4.2. SAMPLE CALCULATION .....                               | 8         |
| 4.3. MEASUREMENT UNCERTAINTY .....                          | 8         |
| <b>5. EQUIPMENT UNDER TEST .....</b>                        | <b>9</b>  |
| 5.1. DESCRIPTION OF EUT .....                               | 9         |
| 5.2. MAXIMUM OUTPUT POWER .....                             | 9         |
| 5.3. DESCRIPTION OF AVAILABLE ANTENNAS .....                | 13        |
| 5.4. WORST-CASE CONFIGURATION AND MODE .....                | 15        |
| 5.5. DESCRIPTION OF TEST SETUP .....                        | 16        |
| <b>6. TEST AND MEASUREMENT EQUIPMENT .....</b>              | <b>18</b> |
| <b>7. SUMMARY TABLE .....</b>                               | <b>19</b> |
| <b>8. ON TIME, DUTY CYCLE AND MEASUREMENT METHODS .....</b> | <b>20</b> |
| 8.1. ON TIME AND DUTY CYCLE RESULTS .....                   | 20        |
| 8.2. DUTY CYCLE PLOTS .....                                 | 20        |
| <b>9. MEASUREMENT METHOD .....</b>                          | <b>21</b> |
| <b>10. ANTENNA PORT TEST RESULTS .....</b>                  | <b>22</b> |
| 10.1. 6 dB BANDWIDTH .....                                  | 22        |
| 10.1.1. 802.11a MODE IN THE 5.8 GHz BAND .....              | 22        |
| 10.1.2. 802.11n HT20 MODE IN THE 5.8 GHz BAND .....         | 22        |
| 10.1.3. 802.11n HT40 MODE IN THE 5.8 GHz BAND .....         | 22        |
| 10.1.4. 802.11ac HT80 MODE IN THE 5.8 GHz BAND .....        | 22        |
| 10.1.5. 802.11a MODE THE CHANNEL 144 .....                  | 22        |
| 10.1.6. 802.11n HT20 MODE THE CHANNEL 144 .....             | 23        |
| 10.1.7. 802.11n HT40 MODE THE CHANNEL 142 .....             | 23        |
| 10.1.8. 802.11ac HT80 MODE IN THE 5.8 GHz BAND .....        | 23        |
| 10.1.9. 6 dB BANDWIDTH MID CH PLOTS .....                   | 23        |
| 10.2. 26 dB BANDWIDTH .....                                 | 24        |
| 10.2.1. 802.11a MODE IN THE 5.2 GHz BAND .....              | 24        |
| 10.2.2. 802.11n HT20 MODE IN THE 5.2 GHz BAND .....         | 24        |
| 10.2.3. 802.11n HT40 MODE IN THE 5.2 GHz BAND .....         | 24        |
| 10.2.4. 802.11ac HT80 MODE IN THE 5.2 GHz BAND .....        | 24        |
| 10.2.5. 802.11a MODE IN THE 5.3 GHz BAND .....              | 24        |

|          |                                              |    |
|----------|----------------------------------------------|----|
| 10.2.6.  | 802.11n HT20 MODE IN THE 5.3 GHz BAND .....  | 24 |
| 10.2.7.  | 802.11n HT40 MODE IN THE 5.3 GHz BAND .....  | 24 |
| 10.2.8.  | 802.11ac HT80 MODE IN THE 5.3 GHz BAND ..... | 24 |
| 10.2.9.  | 802.11a MODE IN THE 5.5 GHz BAND .....       | 25 |
| 10.2.10. | 802.11n HT20 MODE IN THE 5.5 GHz BAND .....  | 25 |
| 10.2.11. | 802.11n HT40 MODE IN THE 5.5 GHz BAND .....  | 25 |
| 10.2.12. | 802.11ac HT80 MODE IN THE 5.5 GHz BAND ..... | 25 |
| 10.2.13. | 802.11a MODE IN THE 5.8 GHz BAND .....       | 25 |
| 10.2.14. | 802.11n HT20 MODE IN THE 5.8 GHz BAND .....  | 25 |
| 10.2.15. | 802.11n HT40 MODE IN THE 5.8 GHz BAND .....  | 25 |
| 10.2.16. | 802.11ac HT80 MODE IN THE 5.8 GHz BAND ..... | 25 |
| 10.2.17. | 26 dB BANDWIDTH PLOTS .....                  | 25 |
| 10.3.    | 99% BANDWIDTH .....                          | 26 |
| 10.3.1.  | 802.11a MODE IN THE 5.2 GHz BAND .....       | 26 |
| 10.3.2.  | 802.11n HT20 MODE IN THE 5.2 GHz BAND .....  | 26 |
| 10.3.3.  | 802.11n HT40 MODE IN THE 5.2 GHz BAND .....  | 26 |
| 10.3.4.  | 802.11ac HT80 MODE IN THE 5.2 GHz BAND ..... | 26 |
| 10.3.5.  | 802.11a MODE IN THE 5.3 GHz BAND .....       | 26 |
| 10.3.6.  | 802.11n HT20 MODE IN THE 5.3 GHz BAND .....  | 26 |
| 10.3.7.  | 802.11n HT40 MODE IN THE 5.3 GHz BAND .....  | 26 |
| 10.3.8.  | 802.11ac HT80 MODE IN THE 5.3 GHz BAND ..... | 26 |
| 10.3.9.  | 802.11a MODE IN THE 5.5 GHz BAND .....       | 27 |
| 10.3.10. | 802.11n HT20 MODE IN THE 5.5 GHz BAND .....  | 27 |
| 10.3.11. | 802.11n HT40 MODE IN THE 5.5 GHz BAND .....  | 27 |
| 10.3.12. | 802.11ac HT80 MODE IN THE 5.5 GHz BAND ..... | 27 |
| 10.3.13. | 802.11a MODE IN THE 5.8 GHz BAND .....       | 27 |
| 10.3.14. | 802.11n HT20 MODE IN THE 5.8 GHz BAND .....  | 27 |
| 10.3.15. | 802.11n HT40 MODE IN THE 5.8 GHz BAND .....  | 27 |
| 10.3.16. | 802.11ac HT80 MODE IN THE 5.8 GHz BAND ..... | 27 |
| 10.3.17. | 99% BANDWIDTH PLOTS .....                    | 27 |
| 10.4.    | OUTPUT POWER AND PPSD .....                  | 28 |
| 10.4.1.  | 802.11a MODE IN THE 5.2 GHz BAND .....       | 31 |
| 10.4.2.  | 802.11n HT20 MODE IN THE 5.2 GHz BAND .....  | 31 |
| 10.4.3.  | 802.11n HT40 MODE IN THE 5.2 GHz BAND .....  | 31 |
| 10.4.4.  | 802.11ac HT80 MODE IN THE 5.2 GHz BAND ..... | 31 |
| 10.4.5.  | 802.11a MODE IN THE 5.3 GHz BAND .....       | 31 |
| 10.4.6.  | 802.11n HT20 MODE IN THE 5.3 GHz BAND .....  | 31 |
| 10.4.7.  | 802.11n HT40 MODE IN THE 5.3 GHz BAND .....  | 31 |
| 10.4.8.  | 802.11ac HT80 MODE IN THE 5.3 GHz BAND ..... | 31 |
| 10.4.9.  | 802.11a MODE IN THE 5.5 GHz BAND .....       | 31 |
| 10.4.10. | 802.11n HT20 MODE IN THE 5.5 GHz BAND .....  | 31 |
| 10.4.11. | 802.11n HT40 MODE IN THE 5.5 GHz BAND .....  | 32 |
| 10.4.12. | 802.11ac HT80 MODE IN THE 5.5 GHz BAND ..... | 32 |
| 10.4.13. | 802.11a MODE STRADDLE CHANNEL 144 .....      | 32 |
| 10.4.14. | 802.11n HT20 MODE STRADDLE CHANNEL 144 ..... | 32 |
| 10.4.15. | 802.11n HT40 MODE STRADDLE CHANNEL 142 ..... | 33 |
| 10.4.16. | 802.11ac80 MODE STRADDLE CHANNEL 138 .....   | 33 |
| 10.4.17. | 802.11a MODE IN THE 5.8 GHz BAND .....       | 34 |
| 10.4.18. | 802.11n HT20 MODE IN THE 5.8 GHz BAND .....  | 34 |
| 10.4.19. | 802.11n HT40 MODE IN THE 5.8 GHz BAND .....  | 34 |
| 10.4.20. | 802.11ac HT80 MODE IN THE 5.8 GHz BAND ..... | 34 |
| 10.4.21. | OUTPUT POWER AND PPSD PLOTS .....            | 34 |

|                                                                    |           |
|--------------------------------------------------------------------|-----------|
| <b>11. TRANSMITTER ABOVE 1 GHz.....</b>                            | <b>35</b> |
| 11.1. 5.2 GHz.....                                                 | 36        |
| 11.1.1. TX ABOVE 1 GHz 802.11a MODE IN THE 5.2 GHz BAND .....      | 36        |
| 11.1.2. TX ABOVE 1 GHz 802.11n HT20 MODE IN THE 5.2 GHz BAND.....  | 36        |
| 11.1.3. TX ABOVE 1 GHz 802.11n HT40 MODE IN THE 5.2 GHz BAND.....  | 36        |
| 11.1.4. TX ABOVE 1 GHz 802.11ac HT80 MODE IN THE 5.2 GHz BAND..... | 36        |
| 11.2. 5.3 GHz.....                                                 | 36        |
| 11.2.1. TX ABOVE 1 GHz 802.11a MODE IN THE 5.3 GHz BAND .....      | 36        |
| 11.2.2. TX ABOVE 1 GHz 802.11n HT20 MODE IN THE 5.3 GHz BAND.....  | 36        |
| 11.2.3. TX ABOVE 1 GHz 802.11n HT40 MODE IN THE 5.3 GHz BAND.....  | 36        |
| 11.2.4. TX ABOVE 1 GHz 802.11ac HT80 MODE IN THE 5.3 GHz BAND..... | 36        |
| 11.3. 5.5-5.6 GHz.....                                             | 37        |
| 11.3.1. TX ABOVE 1 GHz 802.11a MODE IN THE 5.5 GHz BAND .....      | 37        |
| 11.3.2. TX ABOVE 1 GHz 802.11n HT20 MODE IN THE 5.5 GHz BAND.....  | 37        |
| 11.3.3. TX ABOVE 1 GHz 802.11n HT40 MODE IN THE 5.5 GHz BAND.....  | 37        |
| 11.3.4. TX ABOVE 1 GHz 802.11ac HT80 MODE IN THE 5.5 GHz BAND..... | 37        |
| 11.4. 5.8 GHz.....                                                 | 37        |
| 11.4.1. TX ABOVE 1 GHz 802.11a MODE IN THE 5.8 GHz BAND .....      | 37        |
| 11.4.2. TX ABOVE 1 GHz 802.11n HT20 MODE IN THE 5.8 GHz BAND.....  | 37        |
| 11.4.3. TX ABOVE 1 GHz 802.11n HT40 MODE IN THE 5.8 GHz BAND.....  | 37        |
| 11.4.4. TX ABOVE 1 GHz 802.11ac HT80 MODE IN THE 5.8 GHz BAND..... | 37        |
| <b>12. WORST-CASE BELOW 1 GHz (in the 5.3 GHz Band).....</b>       | <b>37</b> |
| <b>13. AC POWER LINE CONDUCTED EMISSIONS.....</b>                  | <b>38</b> |
| <b>14. DYNAMIC FREQUENCY SELECTION.....</b>                        | <b>39</b> |
| 14.1. OVERVIEW.....                                                | 39        |
| 14.1.1. LIMITS.....                                                | 39        |
| 14.1.2. TEST AND MEASUREMENT SYSTEM .....                          | 43        |
| 14.1.3. SETUP OF EUT.....                                          | 46        |
| 14.1.4. DESCRIPTION OF EUT .....                                   | 47        |
| 14.2. RESULTS FOR 20 MHz BANDWIDTH.....                            | 49        |
| 14.2.1. TEST CHANNEL .....                                         | 49        |
| 14.2.2. RADAR WAVEFORM AND TRAFFIC.....                            | 49        |
| 14.2.3. OVERLAPPING CHANNEL TESTS.....                             | 49        |
| 14.2.4. MOVE AND CLOSING TIME .....                                | 49        |
| 14.3. RESULTS FOR 40 MHz BANDWIDTH.....                            | 50        |
| 14.3.1. TEST CHANNEL .....                                         | 50        |
| 14.3.2. RADAR WAVEFORM AND TRAFFIC.....                            | 50        |
| 14.3.3. OVERLAPPING CHANNEL TESTS.....                             | 50        |
| 14.3.4. MOVE AND CLOSING TIME .....                                | 50        |
| 14.3.5. 10-MINUTE BEACON MONITORING PERIOD .....                   | 50        |
| 14.4. RESULTS FOR 80 MHz BANDWIDTH.....                            | 51        |
| 14.4.1. TEST CHANNEL .....                                         | 51        |
| 14.4.2. RADAR WAVEFORM AND TRAFFIC.....                            | 51        |
| 14.4.3. OVERLAPPING CHANNEL TESTS.....                             | 51        |
| 14.4.4. MOVE AND CLOSING TIME .....                                | 51        |
| 14.4.5. 10-MINUTE BEACON MONITORING PERIOD .....                   | 52        |

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|                              |           |
|------------------------------|-----------|
| <b>15. SETUP PHOTOS.....</b> | <b>53</b> |
|------------------------------|-----------|

## 1. ATTESTATION OF TEST RESULTS

**COMPANY NAME:** SONY MOBILE COMMUNICATIONS, INC.

**EUT DESCRIPTION:** GSM/WCDMA/LTE + BLUETOOTH, DTS/UNII a/b/g/n/ac + ANT+ and NFC

**SERIAL NUMBER:** CB5A23QZE2 (Conducted), CB5A246Q9P (Radiated)

**DATE TESTED:** MARCH 17 - 25, 2015

| APPLICABLE STANDARDS     |              |
|--------------------------|--------------|
| STANDARD                 | TEST RESULTS |
| CFR 47 Part 15 Subpart E | Pass         |

UL Verification Services Inc. tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by UL Verification Services Inc. based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

**Note:** The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL Verification Services Inc. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL Verification Services Inc. will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of any government.

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## 2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with FCC CFR 47 Part 2, FCC CFR 47 Part 15, ANSI C63.4-2009. 789033 D02 General UNII Test Procedures New Rules v01

## 3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 47173 and 47266 Benicia Street, Fremont, California, USA. Line conducted emissions are measured only at the 47173 address. The following table identifies which facilities were utilized for radiated emission measurements documented in this report. Specific facilities are also identified in the test results sections.

| 47173 Benicia Street                          | 47266 Benicia Street               |
|-----------------------------------------------|------------------------------------|
| <input checked="" type="checkbox"/> Chamber A | <input type="checkbox"/> Chamber F |
| <input type="checkbox"/> Chamber B            | <input type="checkbox"/> Chamber G |
| <input checked="" type="checkbox"/> Chamber C | <input type="checkbox"/> Chamber H |

UL Verification Services Inc. is accredited by NVLAP, Laboratory Code 200065-0. The full scope of accreditation can be viewed at <http://ts.nist.gov/standards/scopes/2000650.htm>.

## 4. CALIBRATION AND UNCERTAINTY

### 4.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

### 4.2. SAMPLE CALCULATION

Where relevant, the following sample calculation is provided:

$$\begin{aligned}\text{Field Strength (dBuV/m)} &= \text{Measured Voltage (dBuV)} + \text{Antenna Factor (dB/m)} + \\ &\text{Cable Loss (dB)} - \text{Preamp Gain (dB)} \\ 36.5 \text{ dBuV} + 18.7 \text{ dB/m} + 0.6 \text{ dB} - 26.9 \text{ dB} &= 28.9 \text{ dBuV/m}\end{aligned}$$

### 4.3. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

| PARAMETER                             | UNCERTAINTY |
|---------------------------------------|-------------|
| Conducted Disturbance, 0.15 to 30 MHz | 3.52 dB     |
| Radiated Disturbance, 30 to 40000 MHz | 4.94 dB     |

Uncertainty figures are valid to a confidence level of 95%.

## 5. EQUIPMENT UNDER TEST

### 5.1. DESCRIPTION OF EUT

The EUT is a GSM/WCDMA/LTE + BLUETOOTH, DTS/UNII a/b/g/n/ac + ANT+ and NFC

The model FCC ID: PY7-PM0794 shares the same enclosure and circuit board as mode FCC ID: PY7-PM0793. The unlicensed radios (WLAN/BT/NFC/ANT+) including antenna and GPS receiver, are identical between the two units.

After confirming through preliminary radiated emissions that the performance of the FCC ID: PY7-PM0793 data remains representative of this model (FCC ID: PY7-PM0794), FCC ID: PY7-PM0794 leveraged test data from FCC ID: PY7-PM0793.

### 5.2. MAXIMUM OUTPUT POWER

The transmitter has a maximum total conducted output power as follows:

| Frequency Range<br>(MHz) | Mode          | Total Output Power<br>(dBm) | Total Output Power<br>(mW) |
|--------------------------|---------------|-----------------------------|----------------------------|
| 5180-5240                | 802.11a       | 14.34                       | 27.16                      |
| 5180-5240                | 802.11n HT20  | 14.11                       | 25.76                      |
| 5190-5230                | 802.11n HT40  | 14.1                        | 25.70                      |
| 5210                     | 802.11ac HT80 | 14.2                        | 26.30                      |
| 5260-5320                | 802.11a       | 14.44                       | 27.80                      |
| 5260-5320                | 802.11n HT20  | 14.43                       | 27.73                      |
| 5270-5310                | 802.11n HT40  | 14.4                        | 27.54                      |
| 5290                     | 802.11ac HT80 | 14.26                       | 26.67                      |
| 5500-5700                | 802.11a       | 14.83                       | 30.41                      |
| 5720                     | 802.11a       | 13.524                      | 22.51                      |
| 5500-5700                | 802.11n HT20  | 15.07                       | 32.14                      |
| 5720                     | 802.11n HT20  | 13.324                      | 21.50                      |
| 5510-5670                | 802.11n HT40  | 14.81                       | 30.27                      |
| 5710                     | 802.11n HT40  | 13.568                      | 22.74                      |
| 5530                     | 802.11ac HT80 | 14.12                       | 25.82                      |
| 5690                     | 802.11ac HT80 | 14.37                       | 27.35                      |
| 5745-5825                | 802.11a       | 14.9                        | 30.90                      |
| 5745-5825                | 802.11n HT20  | 14.88                       | 30.76                      |
| 5755-5795                | 802.11n HT40  | 14.54                       | 28.44                      |
| 5775                     | 802.11ac HT80 | 14.65                       | 29.17                      |

The transmitter has average conducted output power (measured by power meter) as follows:

| Band (GHz) | Mode             | Data Rate | Ch # | Freq. (MHz) | Avg Pwr C0 (dBm) | Avg Pwr C1 (dBm) |
|------------|------------------|-----------|------|-------------|------------------|------------------|
| UNII-1     | 802.11a          | 6 Mbps    | 36   | 5180        | 10.7             | 9.7              |
|            |                  |           | 40   | 5200        | 10.7             | 10.0             |
|            |                  |           | 44   | 5220        | 10.9             | 9.7              |
|            |                  |           | 48   | 5240        | 10.9             | 9.7              |
|            | 802.11n (HT20)   | 6.5 Mbps  | 36   | 5180        | 10.8             | 9.6              |
|            |                  |           | 40   | 5200        | 10.8             | 9.9              |
|            |                  |           | 44   | 5220        | 10.8             | 10.0             |
|            |                  |           | 48   | 5240        | 10.7             | 9.7              |
|            | 802.11n (HT40)   | 13.5 Mbps | 38   | 5190        | 10.8             | 10.0             |
|            |                  |           | 46   | 5230        | 10.8             | 9.7              |
|            | 802.11ac (VHT20) | 6.5 Mbps  | 36   | 5180        | 10.8             | 9.7              |
|            |                  |           | 40   | 5200        | 10.9             | 9.7              |
|            |                  |           | 44   | 5220        | 10.8             | 10.0             |
|            |                  |           | 48   | 5240        | 10.8             | 9.8              |
|            | 802.11ac (VHT40) | 13.5 Mbps | 38   | 5190        | 10.6             | 9.9              |
|            |                  |           | 46   | 5230        | 10.7             | 9.8              |
|            | 802.11ac (VHT80) | 29.3 Mbps | 42   | 5210        | 10.9             | 9.9              |
| UNII-2A    | 802.11a          | 6 Mbps    | 52   | 5260        | 10.9             | 10.0             |
|            |                  |           | 56   | 5280        | 10.8             | 9.8              |
|            |                  |           | 60   | 5300        | 10.9             | 9.6              |
|            |                  |           | 64   | 5320        | 10.7             | 9.5              |
|            | 802.11n (HT20)   | 6.5 Mbps  | 52   | 5260        | 11.0             | 10.1             |
|            |                  |           | 56   | 5280        | 10.6             | 9.5              |
|            |                  |           | 60   | 5300        | 10.7             | 9.8              |
|            |                  |           | 64   | 5320        | 10.8             | 9.6              |
|            | 802.11n (HT40)   | 13.5 Mbps | 54   | 5270        | 11.0             | 10.0             |
|            |                  |           | 62   | 5310        | 10.7             | 9.6              |
|            | 802.11ac (VHT20) | 6.5 Mbps  | 52   | 5260        | 10.8             | 10.0             |
|            |                  |           | 56   | 5280        | 10.7             | 9.5              |
|            |                  |           | 60   | 5300        | 10.6             | 9.4              |
|            |                  |           | 64   | 5320        | 10.9             | 9.5              |
|            | 802.11ac (VHT40) | 13.5 Mbps | 54   | 5270        | 11.0             | 10.0             |
|            |                  |           | 62   | 5310        | 10.7             | 9.7              |
|            | 802.11ac (VHT80) | 29.3 Mbps | 58   | 5290        | 10.6             | 9.3              |
| UNII-2C    | 802.11a          | 6 Mbps    | 100  | 5500        | 11.0             | 10.1             |
|            |                  |           | 104  | 5520        | 11.0             | 10.0             |
|            |                  |           | 108  | 5540        | 11.3             | 10.0             |
|            |                  |           | 112  | 5560        | 11.4             | 10.0             |

|  |                     |           |     |      |      |      |
|--|---------------------|-----------|-----|------|------|------|
|  |                     |           | 116 | 5580 | 11.5 | 9.8  |
|  |                     |           | 120 | 5600 | 11.5 | 9.7  |
|  |                     |           | 124 | 5620 | 11.4 | 9.5  |
|  |                     |           | 128 | 5640 | 11.4 | 9.3  |
|  |                     |           | 132 | 5660 | 11.4 | 9.4  |
|  |                     |           | 136 | 5680 | 11.4 | 9.3  |
|  |                     |           | 140 | 5700 | 11.4 | 9.3  |
|  |                     |           | 144 | 5720 | 11.4 | 9.4  |
|  | 802.11n<br>(HT20)   | 6.5 Mbps  | 100 | 5500 | 11.4 | 9.7  |
|  |                     |           | 104 | 5520 | 11.2 | 10.0 |
|  |                     |           | 108 | 5540 | 11.4 | 10.1 |
|  |                     |           | 112 | 5560 | 11.4 | 10.1 |
|  |                     |           | 116 | 5580 | 11.4 | 9.8  |
|  |                     |           | 120 | 5600 | 11.5 | 9.7  |
|  |                     |           | 124 | 5620 | 11.3 | 9.5  |
|  |                     |           | 128 | 5640 | 11.4 | 9.5  |
|  |                     |           | 132 | 5660 | 11.3 | 9.5  |
|  |                     |           | 136 | 5680 | 11.3 | 9.3  |
|  |                     |           | 140 | 5700 | 11.2 | 9.2  |
|  |                     |           | 144 | 5720 | 11.2 | 9.2  |
|  | 802.11n<br>(HT40)   | 13.5 Mbps | 102 | 5510 | 11.2 | 9.8  |
|  |                     |           | 110 | 5550 | 11.3 | 9.9  |
|  |                     |           | 118 | 5590 | 11.4 | 9.7  |
|  |                     |           | 126 | 5630 | 11.4 | 9.4  |
|  |                     |           | 134 | 5670 | 11.4 | 9.4  |
|  |                     |           | 142 | 5710 | 11.4 | 9.4  |
|  | 802.11ac<br>(VHT20) | 6.5 Mbps  | 100 | 5500 | 11.2 | 9.6  |
|  |                     |           | 104 | 5520 | 11.2 | 10.0 |
|  |                     |           | 108 | 5540 | 11.3 | 10.0 |
|  |                     |           | 112 | 5560 | 11.4 | 10.0 |
|  |                     |           | 116 | 5580 | 11.3 | 9.8  |
|  |                     |           | 120 | 5600 | 11.4 | 9.7  |
|  |                     |           | 124 | 5620 | 11.4 | 9.4  |
|  |                     |           | 128 | 5640 | 11.4 | 9.3  |
|  |                     |           | 132 | 5660 | 11.4 | 9.3  |
|  |                     |           | 136 | 5680 | 11.5 | 9.2  |
|  |                     |           | 140 | 5700 | 11.3 | 9.2  |
|  |                     |           | 144 | 5720 | 11.1 | 9.2  |
|  | 802.11ac<br>(VHT40) | 13.5 Mbps | 102 | 5510 | 11.3 | 10.0 |
|  |                     |           | 110 | 5550 | 11.4 | 10.0 |
|  |                     |           | 118 | 5590 | 11.4 | 9.6  |
|  |                     |           | 126 | 5630 | 11.5 | 9.4  |
|  |                     |           | 134 | 5670 | 11.5 | 9.2  |
|  |                     |           | 142 | 5710 | 11.4 | 9.2  |

|                         |                     |           |     |      |      |      |
|-------------------------|---------------------|-----------|-----|------|------|------|
| UNII-3<br>or<br>§15.247 | 802.11ac<br>(VHT80) | 29.3 Mbps | 106 | 5530 | 11.2 | 10.0 |
|                         |                     |           | 122 | 5610 | 11.3 | 9.4  |
|                         |                     |           | 138 | 5690 | 11.1 | 9.1  |
|                         | 802.11a             | 6 Mbps    | 149 | 5745 | 10.8 | 9.0  |
|                         |                     |           | 153 | 5765 | 10.8 | 9.1  |
|                         |                     |           | 157 | 5785 | 10.8 | 9.3  |
|                         |                     |           | 161 | 5805 | 10.6 | 9.2  |
|                         |                     |           | 165 | 5825 | 10.8 | 9.4  |
|                         | 802.11n<br>(HT20)   | 6.5 Mbps  | 149 | 5745 | 11.0 | 9.2  |
|                         |                     |           | 153 | 5765 | 10.9 | 9.2  |
|                         |                     |           | 157 | 5785 | 11.0 | 9.5  |
|                         |                     |           | 161 | 5805 | 10.6 | 9.1  |
|                         |                     |           | 165 | 5825 | 10.9 | 9.5  |
|                         | 802.11n<br>(HT40)   | 13.5 Mbps | 151 | 5755 | 10.8 | 9.2  |
|                         |                     |           | 159 | 5795 | 10.9 | 9.2  |
|                         | 802.11ac<br>(VHT20) | 6.5 Mbps  | 149 | 5745 | 11.0 | 9.1  |
|                         |                     |           | 153 | 5765 | 11.0 | 9.2  |
|                         |                     |           | 157 | 5785 | 10.9 | 9.2  |
|                         |                     |           | 161 | 5805 | 10.8 | 9.3  |
|                         |                     |           | 165 | 5825 | 10.9 | 9.4  |
|                         | 802.11ac<br>(VHT40) | 13.5 Mbps | 151 | 5755 | 10.8 | 9.2  |
|                         |                     |           | 159 | 5795 | 10.9 | 9.3  |
|                         | 802.11ac<br>(VHT80) | 29.3 Mbps | 155 | 5775 | 10.7 | 9.0  |

### 5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes an FPCB antenna, please refer to section 10.4 for antenna gain information.

#### List of test reduction and modes covering other modes:

| Authorized Frequency Band (Antenna port & Radiated Testing) |                                   |                        |
|-------------------------------------------------------------|-----------------------------------|------------------------|
| Frequency Range (MHz)                                       | Mode                              | Covered by             |
| 5180 - 5240                                                 | 802.11a legacy 1TX/STBC 2TX       | 802.11a 2TX CDD        |
| 5180 - 5240                                                 | 802.11HT20 1TX                    | 802.11n HT20 2TX CDD   |
| 5180 - 5240                                                 | 802.11HT20 2TX STBC/SDM           | 802.11n HT20 2TX CDD   |
| 5180 - 5240                                                 | 802.11ac VHT20 1TX                | 802.11n HT20 2TX CDD   |
| 5180 - 5240                                                 | 802.11ac VHT20 2TX STBC/SDM       | 802.11n HT20 2TX CDD   |
| 5180 - 5240                                                 | 802.11ac VHT20 2TX CDD/Tx BF      | 802.11n HT20 2TX CDD   |
| 5190 - 5230                                                 | 802.11n HT40 1TX                  | 802.11n HT40 2TX CDD   |
| 5190 - 5230                                                 | 802.11n HT40 2TX STBC/SDM         | 802.11n HT40 2TX CDD   |
| 5190 - 5230                                                 | 802.11ac VHT40 1TX                | 802.11n HT40 2TX CDD   |
| 5190 - 5230                                                 | 802.11ac VHT40 2TX STBC/SDM       | 802.11n HT40 2TX CDD   |
| 5190 - 5230                                                 | 802.11ac VHT40 2TX CDD/Tx BF      | 802.11n HT40 2TX CDD   |
| 5210                                                        | 802.11ac VHT80 1TX                | 802.11ac VHT80 2TX CDD |
| 5210                                                        | 802.11ac VHT80 2TX STBC/SDM/Tx BF | 802.11ac VHT80 2TX CDD |

| Authorized Frequency Band (Antenna port & Radiated Testing) |                                   |                        |
|-------------------------------------------------------------|-----------------------------------|------------------------|
| Frequency Range (MHz)                                       | Mode                              | Covered by             |
| 5260 - 5320                                                 | 802.11a legacy 1TX/STBC 2TX       | 802.11a 2TX CDD        |
| 5260 - 5320                                                 | 802.11HT20 1TX                    | 802.11n HT20 2TX CDD   |
| 5260 - 5320                                                 | 802.11HT20 2TX STBC/SDM           | 802.11n HT20 2TX CDD   |
| 5260 - 5320                                                 | 802.11ac VHT20 1TX                | 802.11n HT20 2TX CDD   |
| 5260 - 5320                                                 | 802.11ac VHT20 2TX STBC/SDM       | 802.11n HT20 2TX CDD   |
| 5260 - 5320                                                 | 802.11ac VHT20 2TX CDD/Tx BF      | 802.11n HT20 2TX CDD   |
| 5270 - 5310                                                 | 802.11n HT40 1TX                  | 802.11n HT40 2TX CDD   |
| 5270 - 5310                                                 | 802.11n HT40 2TX STBC/SDM         | 802.11n HT40 2TX CDD   |
| 5270 - 5310                                                 | 802.11ac VHT40 1TX                | 802.11n HT40 2TX CDD   |
| 5270 - 5310                                                 | 802.11ac VHT40 2TX STBC/SDM       | 802.11n HT40 2TX CDD   |
| 5270 - 5310                                                 | 802.11ac VHT40 2TX CDD/Tx BF      | 802.11n HT40 2TX CDD   |
| 5290                                                        | 802.11ac VHT80 1TX                | 802.11ac VHT80 2TX CDD |
| 5290                                                        | 802.11ac VHT80 2TX STBC/SDM/Tx BF | 802.11ac VHT80 2TX CDD |

| Authorized Frequency Band (Antenna port & Radiated Testing) |                                   |                        |
|-------------------------------------------------------------|-----------------------------------|------------------------|
| Frequency Range (MHz)                                       | Mode                              | Covered by             |
| 5500 - 5720                                                 | 802.11a legacy 1TX/STBC 2TX       | 802.11a 2TX CDD        |
| 5500 - 5720                                                 | 802.11HT20 1TX                    | 802.11n HT20 2TX CDD   |
| 5500 - 5720                                                 | 802.11HT20 2TX STBC/SDM           | 802.11n HT20 2TX CDD   |
| 5500 - 5720                                                 | 802.11ac VHT20 1TX                | 802.11n HT20 2TX CDD   |
| 5500 - 5720                                                 | 802.11ac VHT20 2TX STBC/SDM       | 802.11n HT20 2TX CDD   |
| 5500 - 5720                                                 | 802.11ac VHT20 2TX CDD/Tx BF      | 802.11n HT20 2TX CDD   |
| 5510 - 5710                                                 | 802.11n HT40 1TX                  | 802.11n HT40 2TX CDD   |
| 5510 - 5710                                                 | 802.11n HT40 2TX STBC/SDM         | 802.11n HT40 2TX CDD   |
| 5510 - 5710                                                 | 802.11ac VHT40 1TX                | 802.11n HT40 2TX CDD   |
| 5510 - 5710                                                 | 802.11ac VHT40 2TX STBC/SDM       | 802.11n HT40 2TX CDD   |
| 5510 - 5710                                                 | 802.11ac VHT40 2TX CDD/Tx BF      | 802.11n HT40 2TX CDD   |
| 5530-5690                                                   | 802.11ac VHT80 1TX                | 802.11ac VHT80 2TX CDD |
| 5530-5690                                                   | 802.11ac VHT80 2TX STBC/SDM/Tx BF | 802.11ac VHT80 2TX CDD |

| Authorized Frequency Band (Antenna port & Radiated Testing) |                                   |                        |
|-------------------------------------------------------------|-----------------------------------|------------------------|
| Frequency Range (MHz)                                       | Mode                              | Covered by             |
| 5745 - 5825                                                 | 802.11a legacy 1TX/STBC 2TX       | 802.11a 2TX CDD        |
| 5745 - 5825                                                 | 802.11HT20 1TX                    | 802.11n HT20 2TX CDD   |
| 5745 - 5825                                                 | 802.11HT20 2TX STBC/SDM           | 802.11n HT20 2TX CDD   |
| 5745 - 5825                                                 | 802.11ac VHT20 1TX                | 802.11n HT20 2TX CDD   |
| 5745 - 5825                                                 | 802.11ac VHT20 2TX STBC/SDM       | 802.11n HT20 2TX CDD   |
| 5745 - 5825                                                 | 802.11ac VHT20 2TX CDD/Tx BF      | 802.11n HT20 2TX CDD   |
| 5755 - 5795                                                 | 802.11n HT40 1TX                  | 802.11n HT40 2TX CDD   |
| 5755 - 5795                                                 | 802.11n HT40 2TX STBC/SDM         | 802.11n HT40 2TX CDD   |
| 5755 - 5795                                                 | 802.11ac VHT40 1TX                | 802.11n HT40 2TX CDD   |
| 5755 - 5795                                                 | 802.11ac VHT40 2TX STBC/SDM       | 802.11n HT40 2TX CDD   |
| 5755 - 5795                                                 | 802.11ac VHT40 2TX CDD/Tx BF      | 802.11n HT40 2TX CDD   |
| 5775                                                        | 802.11ac VHT80 1TX                | 802.11ac VHT80 2TX CDD |
| 5775                                                        | 802.11ac VHT80 2TX STBC/SDM/Tx BF | 802.11ac VHT80 2TX CDD |

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## 5.4. WORST-CASE CONFIGURATION AND MODE

Radiated emission and power line conducted emission were performed with the EUT set to transmit at the channel with highest output power as worst-case scenario.

The fundamental of the EUT was investigated in three orthogonal orientations X,Y,Z, it was determined that the X orientation was worst-case orientation; therefore, all final radiated testing was performed with the EUT in the X orientation.

Based on the baseline scan, the worst-case data rates were:

802.11a mode: 6 Mbps

802.11n HT20mode: MCS0

802.11n HT40mode: MCS0

802.11ac VHT80mode: MCS0

## 5.5. DESCRIPTION OF TEST SETUP

### SUPPORT EQUIPMENT

| Support Equipment List |              |        |                 |        |
|------------------------|--------------|--------|-----------------|--------|
| Description            | Manufacturer | Model  | Serial Number   | FCC ID |
| AC Adapter             | SONY         | EP880  | 3514W 01 S08328 | N/A    |
| Earphone               | SONY         | MH410C | N/A             | N/A    |

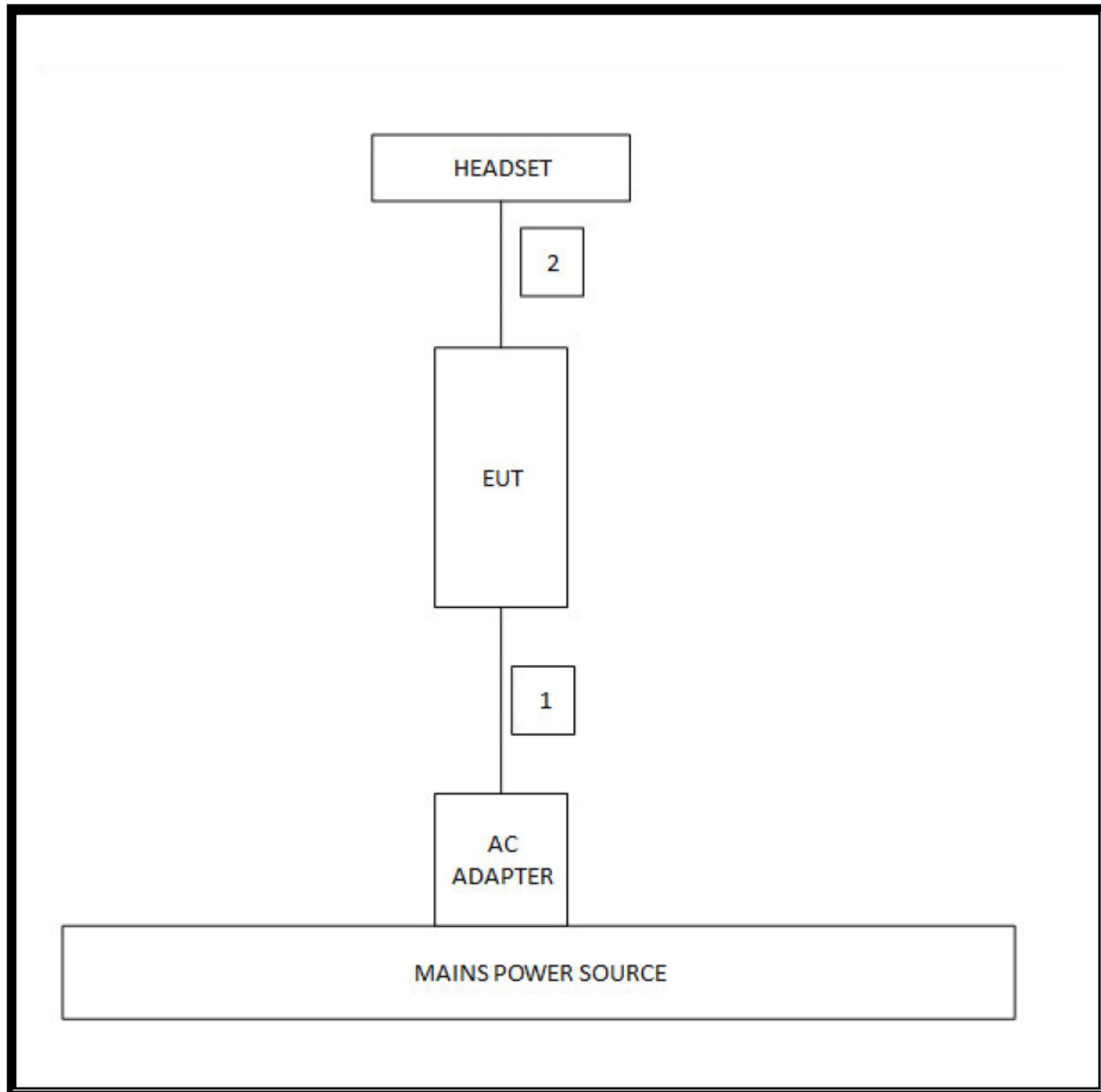
### I/O CABLES

| I/O Cable List |          |                      |                |            |                  |         |
|----------------|----------|----------------------|----------------|------------|------------------|---------|
| Cable No       | Port     | # of identical ports | Connector Type | Cable Type | Cable Length (m) | Remarks |
| 1              | DC Power | 1                    | Mini-USB       | Shielded   | 1.2m             | N/A     |
| 2              | Audio    | 1                    | Mini-Jack      | Unshielded | 1.0m             | N/A     |

### TEST SETUP

The EUT is setup as a stand-alone device.

**SETUP DIAGRAM FOR TESTS**



## 6. TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment was utilized for the tests documented in this report:

| Test Equipment List                |                |                        |         |          |
|------------------------------------|----------------|------------------------|---------|----------|
| Description                        | Manufacturer   | Model                  | Asset   | Cal Due  |
| Spectrum Analyzer, 44 GHz          | Agilent / HP   | E4446A                 | C01069  | 12/20/15 |
| Spectrum Analyzer, 9KHz-40GHz      | HP             | 8564E                  | C00986  | 04/01/15 |
| EMI Test Receiver, 9 kHz-7 GHz     | R & S          | ESCI 7                 | 100773  | 08/15/15 |
| Peak Power Meter                   | Agilent / HP   | E4416A                 | C00963  | 12/13/15 |
| Peak / Average Power Sensor        | Agilent / HP   | E9327A                 | C00964  | 12/13/15 |
| Antenna, Horn, 18GHz               | EMCO           | 3115                   | C00783  | 10/25/15 |
| Antenna, Horn, 18- 26 GHz          | ARA            | MWH-1826/B             | C00946  | 11/12/15 |
| Antenna, Horn, 26-40 GHz           | ARA            | MWH-2640               | C00891  | 06/28/15 |
| Antenna, Bilog, 30MHz-1 GHz        | Sunol Sciences | JB1                    | T243    | 12/08/15 |
| RF Preamplifier, 100KHz -> 1300MHz | HP             | TBD                    | C00825  | 06/01/15 |
| RF Preamplifier, 1GHz - 18GHz      | Miteq          | NSP4000-SP2            | 924343  | 09/03/15 |
| RF Preamplifier, 1GHz - 26.5GHz    | HP             | 8449B                  | F00351  | 06/27/15 |
| AC Power Supply, 2,500VA 45-500Hz  | Elgar-Ametek   | CW2501M                | F00013  | CNR      |
| RF Preamplifier, 1GHz - 18GHz      | Miteq          | AFS42-00101800-25-S-42 | 1818466 | 05/09/15 |
| Attenuator / Switch driver         | HP             | 11713A                 | F00204  | CNR      |
| Low Pass Filter 3GHz               | Micro-Tronics  | LPS17541               | F00219  | 05/23/15 |
| High Pass Filter 5GHz              | Micro-Tronics  | HPS17542               | F00222  | 05/22/15 |
| High Pass Filter 6GHz              | Micro-Tronics  | HPM17543               | F00224  | 05/22/15 |

| Test Software List    |              |        |                          |
|-----------------------|--------------|--------|--------------------------|
| Description           | Manufacturer | Model  | Version                  |
| Radiated Software     | UL           | UL EMC | Version 9.5, 07/22/14    |
| Conducted Software    | UL           | UL EMC | Version 9.5, 05/17/14    |
| CLT Software          | UL           | UL RF  | Version 1.0, 02/02/15    |
| Antenna Port Software | UL           | UL RF  | Version 2.1.1.1, 1/20/15 |

## 7. SUMMARY TABLE

| FCC Part Section    | Test Description                                 | Test Limit               | Test Condition       | Test Result | Worst Case    |
|---------------------|--------------------------------------------------|--------------------------|----------------------|-------------|---------------|
| 15.407 (a)          | Occupied Band width (26dB)                       | N/A                      | Conducted            | Pass        | 82.5MHz       |
| 14.407              | 6dB Band width                                   | >500KHz                  |                      | Pass        | 76.08MHz      |
| 15.407 (a)(2)       | TX Cond. Power 5.15-2.25, 5.25-5.35 & 5.47-5.725 | <24dBm or 11+10Log(OBW)  |                      | Pass        | 15.07dBm      |
| 15.407 (a)(3)       | TX Cond. Power 5.725-5.850                       | < 30dBm or 17+10Log(OBW) |                      | Pass        | 14.88dBm      |
| 15.407 (a)(5)       | PSD (5.2,5.3,5.5GHz)                             | <11dBm                   |                      | Pass        | 3.49dBm       |
| 15.407 (a)(5)       | PSD                                              | 30dBm per 500kHz         |                      | Pass        | 1.25dBm       |
| 15.207 (a)          | AC Power Line conducted emissions                | Section 10               | Radiated             | Pass        | 44.76dBuV(AV) |
| 15.407 (b) & 15.209 | Radiated Spurious Emission                       | < 54dBuV/m               |                      | Pass        | 49.66dBuV/m   |
| 15.407 (h)(2)       | Dynamic Frequency Selection                      | N/A                      | Radiated / Conducted | Pass        | N/A           |

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## 8. ON TIME, DUTY CYCLE AND MEASUREMENT METHODS

### LIMITS

None; for reporting purposes only.

### PROCEDURE

KDB 789033 Zero-Span Spectrum Analyzer Method.

#### **8.1. ON TIME AND DUTY CYCLE RESULTS**

Please refer to UNII test report of FCC ID: PY7-PM0793.

#### **8.2. DUTY CYCLE PLOTS**

Please refer to UNII test report of FCC ID: PY7-PM0793.

## 9. MEASUREMENT METHOD

789033 D02 General UNII Test Procedures New Rules v01

The Duty Cycle is less than 98% and consistent therefore KDB 789033 Method SA-2 is used for power and PPSD

The Duty Cycle is less than 98% and consistent, KDB 789033 Method AD with Power RMS Averaging and duty cycle correction is used.

Straddle Channels: KDB 644545 D01 v01r02

MIMO Device: KDB 662911 v02r01

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## **10. ANTENNA PORT TEST RESULTS**

### **10.1. 6 dB BANDWIDTH**

#### **LIMITS**

FCC §15.407

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

#### **TEST PROCEDURE**

Reference to 789033 D02 General UNII Test Procedures New Rules v01: The transmitter output is connected to a spectrum analyzer with the RBW set to 100kHz, the VBW  $\geq 3 \times$  RBW, peak detector and max hold.

#### **RESULTS**

##### **10.1.1. 802.11a MODE IN THE 5.8 GHz BAND**

Please refer to UNII test report of FCC ID: PY7-PM0793.

##### **10.1.2. 802.11n HT20 MODE IN THE 5.8 GHz BAND**

Please refer to UNII test report of FCC ID: PY7-PM0793.

##### **10.1.3. 802.11n HT40 MODE IN THE 5.8 GHz BAND**

Please refer to UNII test report of FCC ID: PY7-PM0793.

##### **10.1.4. 802.11ac HT80 MODE IN THE 5.8 GHz BAND**

Please refer to UNII test report of FCC ID: PY7-PM0793.

##### **10.1.5. 802.11a MODE THE CHANNEL 144**

Please refer to UNII test report of FCC ID: PY7-PM0793.

**10.1.6. 802.11n HT20 MODE THE CHANNEL 144**

Please refer to UNII test report of FCC ID: PY7-PM0793.

**10.1.7. 802.11n HT40 MODE THE CHANNEL 142**

Please refer to UNII test report of FCC ID: PY7-PM0793.

**10.1.8. 802.11ac HT80 MODE IN THE 5.8 GHz BAND**

Please refer to UNII test report of FCC ID: PY7-PM0793.

**10.1.9. 6 dB BANDWIDTH MID CH PLOTS**

Please refer to UNII test report of FCC ID: PY7-PM0793.

## **10.2. 26 dB BANDWIDTH**

### **LIMITS**

None; for reporting purposes only.

### **RESULTS**

#### **10.2.1. 802.11a MODE IN THE 5.2 GHz BAND**

Please refer to UNII test report of FCC ID: PY7-PM0793.

#### **10.2.2. 802.11n HT20 MODE IN THE 5.2 GHz BAND**

Please refer to UNII test report of FCC ID: PY7-PM0793.

#### **10.2.3. 802.11n HT40 MODE IN THE 5.2 GHz BAND**

Please refer to UNII test report of FCC ID: PY7-PM0793.

#### **10.2.4. 802.11ac HT80 MODE IN THE 5.2 GHz BAND**

Please refer to UNII test report of FCC ID: PY7-PM0793.

#### **10.2.5. 802.11a MODE IN THE 5.3 GHz BAND**

Please refer to UNII test report of FCC ID: PY7-PM0793.

#### **10.2.6. 802.11n HT20 MODE IN THE 5.3 GHz BAND**

Please refer to UNII test report of FCC ID: PY7-PM0793.

#### **10.2.7. 802.11n HT40 MODE IN THE 5.3 GHz BAND**

Please refer to UNII test report of FCC ID: PY7-PM0793.

#### **10.2.8. 802.11ac HT80 MODE IN THE 5.3 GHz BAND**

Please refer to UNII test report of FCC ID: PY7-PM0793.

**10.2.9. 802.11a MODE IN THE 5.5 GHz BAND**

Please refer to UNII test report of FCC ID: PY7-PM0793.

**10.2.10. 802.11n HT20 MODE IN THE 5.5 GHz BAND**

Please refer to UNII test report of FCC ID: PY7-PM0793.

**10.2.11. 802.11n HT40 MODE IN THE 5.5 GHz BAND**

Please refer to UNII test report of FCC ID: PY7-PM0793.

**10.2.12. 802.11ac HT80 MODE IN THE 5.5 GHz BAND**

Please refer to UNII test report of FCC ID: PY7-PM0793.

**10.2.13. 802.11a MODE IN THE 5.8 GHz BAND**

Please refer to UNII test report of FCC ID: PY7-PM0793.

**10.2.14. 802.11n HT20 MODE IN THE 5.8 GHz BAND**

Please refer to UNII test report of FCC ID: PY7-PM0793.

**10.2.15. 802.11n HT40 MODE IN THE 5.8 GHz BAND**

Please refer to UNII test report of FCC ID: PY7-PM0793.

**10.2.16. 802.11ac HT80 MODE IN THE 5.8 GHz BAND**

Please refer to UNII test report of FCC ID: PY7-PM0793.

**10.2.17. 26 dB BANDWIDTH PLOTS**

Please refer to UNII test report of FCC ID: PY7-PM0793.

### **10.3. 99% BANDWIDTH**

#### **LIMITS**

None; for reporting purposes only.

#### **RESULTS**

##### **10.3.1. 802.11a MODE IN THE 5.2 GHz BAND**

Please refer to UNII test report of FCC ID: PY7-PM0793.

##### **10.3.2. 802.11n HT20 MODE IN THE 5.2 GHz BAND**

Please refer to UNII test report of FCC ID: PY7-PM0793.

##### **10.3.3. 802.11n HT40 MODE IN THE 5.2 GHz BAND**

Please refer to UNII test report of FCC ID: PY7-PM0793.

##### **10.3.4. 802.11ac HT80 MODE IN THE 5.2 GHz BAND**

Please refer to UNII test report of FCC ID: PY7-PM0793.

##### **10.3.5. 802.11a MODE IN THE 5.3 GHz BAND**

Please refer to UNII test report of FCC ID: PY7-PM0793.

##### **10.3.6. 802.11n HT20 MODE IN THE 5.3 GHz BAND**

Please refer to UNII test report of FCC ID: PY7-PM0793.

##### **10.3.7. 802.11n HT40 MODE IN THE 5.3 GHz BAND**

Please refer to UNII test report of FCC ID: PY7-PM0793.

##### **10.3.8. 802.11ac HT80 MODE IN THE 5.3 GHz BAND**

Please refer to UNII test report of FCC ID: PY7-PM0793.

**10.3.9. 802.11a MODE IN THE 5.5 GHz BAND**

Please refer to UNII test report of FCC ID: PY7-PM0793.

**10.3.10. 802.11n HT20 MODE IN THE 5.5 GHz BAND**

Please refer to UNII test report of FCC ID: PY7-PM0793.

**10.3.11. 802.11n HT40 MODE IN THE 5.5 GHz BAND**

Please refer to UNII test report of FCC ID: PY7-PM0793.

**10.3.12. 802.11ac HT80 MODE IN THE 5.5 GHz BAND**

Please refer to UNII test report of FCC ID: PY7-PM0793.

**10.3.13. 802.11a MODE IN THE 5.8 GHz BAND**

Please refer to UNII test report of FCC ID: PY7-PM0793.

**10.3.14. 802.11n HT20 MODE IN THE 5.8 GHz BAND**

Please refer to UNII test report of FCC ID: PY7-PM0793.

**10.3.15. 802.11n HT40 MODE IN THE 5.8 GHz BAND**

Please refer to UNII test report of FCC ID: PY7-PM0793.

**10.3.16. 802.11ac HT80 MODE IN THE 5.8 GHz BAND**

Please refer to UNII test report of FCC ID: PY7-PM0793.

**10.3.17. 99% BANDWIDTH PLOTS**

Please refer to UNII test report of FCC ID: PY7-PM0793.

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## 10.4. OUTPUT POWER AND PPSD

### LIMITS

FCC §15.407 (a) (1) (2) (3)

For the band 5.15–5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 250 mW or  $11 \text{ dBm} + 10 \log B$ , where B is the 26-dB emission bandwidth in MHz. In addition, the peak power spectral density shall not exceed 4 dBm in any 1-MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

For the 5.25-5.35 GHz and 5.47-5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or  $11 \text{ dBm} + 10 \log B$ , where B is the 26 dB emission bandwidth in megahertz. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

For the band 5.725-5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. In addition, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz band.

# DIRECTIONAL ANTENNA GAIN

The TX chains are uncorrelated and the antenna gain is unequal among the chains. The directional gain is:

5180-5320MHz

| Chain 0<br>Antenna<br>Gain<br>(dBi) | Chain 1<br>Antenna<br>Gain<br>(dBi) | Uncorrelated Chains<br>Directional<br>Gain<br>(dBi) |
|-------------------------------------|-------------------------------------|-----------------------------------------------------|
| -0.50                               | -2.50                               | -1.39                                               |

The TX chains are correlated and the antenna gain is unequal among the chains. The directional gain is:

5180-5320MHz

| Chain 0<br>Antenna<br>Gain<br>(dBi) | Chain 1<br>Antenna<br>Gain<br>(dBi) | Correlated Chains<br>Directional<br>Gain<br>(dBi) |
|-------------------------------------|-------------------------------------|---------------------------------------------------|
| -0.50                               | -2.50                               | 1.57                                              |

5500-5700MHz

| Chain 0<br>Antenna<br>Gain<br>(dBi) | Chain 1<br>Antenna<br>Gain<br>(dBi) | Uncorrelated Chains<br>Directional<br>Gain<br>(dBi) |
|-------------------------------------|-------------------------------------|-----------------------------------------------------|
| -1.10                               | -1.60                               | -1.34                                               |

The TX chains are correlated and the antenna gain is unequal among the chains. The directional gain is:

5500-5700MHz

| Chain 0<br>Antenna<br>Gain<br>(dBi) | Chain 1<br>Antenna<br>Gain<br>(dBi) | Correlated Chains<br>Directional<br>Gain<br>(dBi) |
|-------------------------------------|-------------------------------------|---------------------------------------------------|
| -1.10                               | -1.60                               | 1.66                                              |

5725-5850MHz

| Chain 0<br>Antenna<br>Gain<br>(dBi) | Chain 1<br>Antenna<br>Gain<br>(dBi) | Uncorrelated Chains<br>Directional<br>Gain<br>(dBi) |
|-------------------------------------|-------------------------------------|-----------------------------------------------------|
| -3.00                               | -4.50                               | -3.69                                               |

The TX chains are correlated and the antenna gain is unequal among the chains. The directional gain is:

5725-5850MHz

| Chain 0<br>Antenna<br>Gain<br>(dBi) | Chain 1<br>Antenna<br>Gain<br>(dBi) | Correlated Chains<br>Directional<br>Gain<br>(dBi) |
|-------------------------------------|-------------------------------------|---------------------------------------------------|
| -3.00                               | -4.50                               | -0.71                                             |

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**RESULTS**

**10.4.1. 802.11a MODE IN THE 5.2 GHz BAND**

Please refer to UNII test report of FCC ID: PY7-PM0793.

**10.4.2. 802.11n HT20 MODE IN THE 5.2 GHz BAND**

Please refer to UNII test report of FCC ID: PY7-PM0793.

**10.4.3. 802.11n HT40 MODE IN THE 5.2 GHz BAND**

Please refer to UNII test report of FCC ID: PY7-PM0793.

**10.4.4. 802.11ac HT80 MODE IN THE 5.2 GHz BAND**

Please refer to UNII test report of FCC ID: PY7-PM0793.

**10.4.5. 802.11a MODE IN THE 5.3 GHz BAND**

Please refer to UNII test report of FCC ID: PY7-PM0793.

**10.4.6. 802.11n HT20 MODE IN THE 5.3 GHz BAND**

Please refer to UNII test report of FCC ID: PY7-PM0793.

**10.4.7. 802.11n HT40 MODE IN THE 5.3 GHz BAND**

Please refer to UNII test report of FCC ID: PY7-PM0793.

**10.4.8. 802.11ac HT80 MODE IN THE 5.3 GHz BAND**

Please refer to UNII test report of FCC ID: PY7-PM0793.

**10.4.9. 802.11a MODE IN THE 5.5 GHz BAND**

Please refer to UNII test report of FCC ID: PY7-PM0793.

**10.4.10. 802.11n HT20 MODE IN THE 5.5 GHz BAND**

Please refer to UNII test report of FCC ID: PY7-PM0793.

**10.4.11. 802.11n HT40 MODE IN THE 5.5 GHz BAND**

Please refer to UNII test report of FCC ID: PY7-PM0793.

**10.4.12. 802.11ac HT80 MODE IN THE 5.5 GHz BAND**

Please refer to UNII test report of FCC ID: PY7-PM0793.

**10.4.13. 802.11a MODE STRADDLE CHANNEL 144**

**UNII-2C BAND**

Please refer to UNII test report of FCC ID: PY7-PM0793.

**UNII-3 BAND**

Please refer to UNII test report of FCC ID: PY7-PM0793.

**AVERAGE OUTPUT POWER (WHOLE FUNDAMENTAL)**

**Results**

Please refer to UNII test report of FCC ID: PY7-PM0793.

**10.4.14. 802.11n HT20 MODE STRADDLE CHANNEL 144**

**UNII-2C BAND**

Please refer to UNII test report of FCC ID: PY7-PM0793.

**UNII-3 BAND**

Please refer to UNII test report of FCC ID: PY7-PM0793.

**AVERAGE OUTPUT POWER (WHOLE FUNDAMENTAL)**

**Results**

Please refer to UNII test report of FCC ID: PY7-PM0793.

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**10.4.15. 802.11n HT40 MODE STRADDLE CHANNEL 142**

**UNII-2C BAND**

Please refer to UNII test report of FCC ID: PY7-PM0793.

**UNII-3 BAND**

Please refer to UNII test report of FCC ID: PY7-PM0793.

**AVERAGE OUTPUT POWER (WHOLE FUNDAMENTAL**

**Results**

Please refer to UNII test report of FCC ID: PY7-PM0793.

**10.4.16. 802.11ac80 MODE STRADDLE CHANNEL 138**

**UNII-2C BAND**

Please refer to UNII test report of FCC ID: PY7-PM0793.

**UNII-3 BAND**

Please refer to UNII test report of FCC ID: PY7-PM0793.

**AVERAGE OUTPUT POWER (WHOLE FUNDAMENTAL**

**Results**

Please refer to UNII test report of FCC ID: PY7-PM0793.

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**10.4.17. 802.11a MODE IN THE 5.8 GHz BAND**

Please refer to UNII test report of FCC ID: PY7-PM0793.

**10.4.18. 802.11n HT20 MODE IN THE 5.8 GHz BAND**

Please refer to UNII test report of FCC ID: PY7-PM0793.

**10.4.19. 802.11n HT40 MODE IN THE 5.8 GHz BAND**

Please refer to UNII test report of FCC ID: PY7-PM0793.

**10.4.20. 802.11ac HT80 MODE IN THE 5.8 GHz BAND**

Please refer to UNII test report of FCC ID: PY7-PM0793.

**10.4.21. OUTPUT POWER AND PPSD PLOTS**

Please refer to UNII test report of FCC ID: PY7-PM0793.

## 11. TRANSMITTER ABOVE 1 GHz

### LIMITS

FCC §15.205 and §15.209

| Frequency Range (MHz) | Field Strength Limit (uV/m) at 3 m | Field Strength Limit (dBuV/m) at 3 m |
|-----------------------|------------------------------------|--------------------------------------|
| 30 - 88               | 100                                | 40                                   |
| 88 - 216              | 150                                | 43.5                                 |
| 216 - 960             | 200                                | 46                                   |
| Above 960             | 500                                | 54                                   |

### TEST PROCEDURE

The EUT is placed on a non-conducting table 80 cm above the ground plane. The antenna to EUT distance is 3 meters.

For measurements below 1 GHz the resolution bandwidth is set to 100 kHz for peak detection measurements or 120 kHz for quasi-peak detection measurements. Peak detection is used unless otherwise noted as quasi-peak.

Reference to KDB 789033 UNII part H) 6) d) Method AD:

For measurements above 1 GHz the resolution bandwidth is set to 1 MHz; the video bandwidth is set to 3 MHz for peak measurements and add duty cycle factor to the reading offset for average measurements.

The spectrum from 30 MHz to 40 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in each applicable band.

The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized in both the vertical and the horizontal positions.

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## **11.1. 5.2 GHz**

### **11.1.1. TX ABOVE 1 GHz 802.11a MODE IN THE 5.2 GHz BAND**

Please refer to UNII test report of FCC ID: PY7-PM0793.

### **11.1.2. TX ABOVE 1 GHz 802.11n HT20 MODE IN THE 5.2 GHz BAND**

Please refer to UNII test report of FCC ID: PY7-PM0793.

### **11.1.3. TX ABOVE 1 GHz 802.11n HT40 MODE IN THE 5.2 GHz BAND**

Please refer to UNII test report of FCC ID: PY7-PM0793.

### **11.1.4. TX ABOVE 1 GHz 802.11ac HT80 MODE IN THE 5.2 GHz BAND**

Please refer to UNII test report of FCC ID: PY7-PM0793.

## **11.2. 5.3 GHz**

### **11.2.1. TX ABOVE 1 GHz 802.11a MODE IN THE 5.3 GHz BAND**

Please refer to UNII test report of FCC ID: PY7-PM0793.

### **11.2.2. TX ABOVE 1 GHz 802.11n HT20 MODE IN THE 5.3 GHz BAND**

Please refer to UNII test report of FCC ID: PY7-PM0793.

### **11.2.3. TX ABOVE 1 GHz 802.11n HT40 MODE IN THE 5.3 GHz BAND**

Please refer to UNII test report of FCC ID: PY7-PM0793.

### **11.2.4. TX ABOVE 1 GHz 802.11ac HT80 MODE IN THE 5.3 GHz BAND**

Please refer to UNII test report of FCC ID: PY7-PM0793.

### **11.3. 5.5-5.6 GHz**

#### **11.3.1. TX ABOVE 1 GHz 802.11a MODE IN THE 5.5 GHz BAND**

Please refer to UNII test report of FCC ID: PY7-PM0793.

#### **11.3.2. TX ABOVE 1 GHz 802.11n HT20 MODE IN THE 5.5 GHz BAND**

Please refer to UNII test report of FCC ID: PY7-PM0793.

#### **11.3.3. TX ABOVE 1 GHz 802.11n HT40 MODE IN THE 5.5 GHz BAND**

Please refer to UNII test report of FCC ID: PY7-PM0793.

#### **11.3.4. TX ABOVE 1 GHz 802.11ac HT80 MODE IN THE 5.5 GHz BAND**

Please refer to UNII test report of FCC ID: PY7-PM0793.

### **11.4. 5.8 GHz**

#### **11.4.1. TX ABOVE 1 GHz 802.11a MODE IN THE 5.8 GHz BAND**

Please refer to UNII test report of FCC ID: PY7-PM0793.

#### **11.4.2. TX ABOVE 1 GHz 802.11n HT20 MODE IN THE 5.8 GHz BAND**

Please refer to UNII test report of FCC ID: PY7-PM0793.

#### **11.4.3. TX ABOVE 1 GHz 802.11n HT40 MODE IN THE 5.8 GHz BAND**

Please refer to UNII test report of FCC ID: PY7-PM0793.

#### **11.4.4. TX ABOVE 1 GHz 802.11ac HT80 MODE IN THE 5.8 GHz BAND**

Please refer to UNII test report of FCC ID: PY7-PM0793.

## **12. WORST-CASE BELOW 1 GHz (in the 5.3 GHz Band)**

Please refer to UNII test report of FCC ID: PY7-PM0793.

## 13. AC POWER LINE CONDUCTED EMISSIONS

### LIMITS

FCC §15.207 (a)

| Frequency of Emission (MHz) | Conducted Limit (dBuV) |                       |
|-----------------------------|------------------------|-----------------------|
|                             | Quasi-peak             | Average               |
| 0.15-0.5                    | 66 to 56 <sup>*</sup>  | 56 to 46 <sup>*</sup> |
| 0.5-5                       | 56                     | 46                    |
| 5-30                        | 60                     | 50                    |

<sup>\*</sup> Decreases with the logarithm of the frequency.

### TEST PROCEDURE

The EUT is placed on a non-conducting table 40 cm from the vertical ground plane and 80 cm above the horizontal ground plane. The EUT is configured in accordance with ANSI C63.4.

The receiver is set to a resolution bandwidth of 9 kHz. Peak detection is used unless otherwise noted as quasi-peak or average.

Line conducted data is recorded for both NEUTRAL and HOT lines.

### RESULTS

**Please refer to UNII test report of FCC ID: PY7-PM0793.6 WORST EMISSIONS**

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## 14. DYNAMIC FREQUENCY SELECTION

### 14.1. OVERVIEW

#### 14.1.1. LIMITS

##### INDUSTRY CANADA

IC RSS-210 is closely harmonized with FCC Part 15 DFS rules. The deviations are as follows:

RSS-210 Issue 8 A9.3

**Note:** For the band 5600–5650 MHz, no operation is permitted.

Until further notice, devices subject to this annex shall not be capable of transmitting in the band 5600–5650 MHz. This restriction is for the protection of Environment Canada weather radars operating in this band.

##### FCC

§15.407 (h), FCC KDB 905462 D02 “COMPLIANCE MEASUREMENT PROCEDURES FOR UNLICENSED-NATIONAL INFORMATION INFRASTRUCTURE DEVICES OPERATING IN THE 5250-5350 MHz AND 5470-5725 MHz BANDS INCORPORATING DYNAMIC FREQUENCY SELECTION” and KDB 905462 D03 “U-NII CLIENT DEVICES WITHOUT RADAR DETECTION CAPABILITY”.

**Table 1: Applicability of DFS requirements prior to use of a channel**

| Requirement                     | Operational Mode |                                  |                               |
|---------------------------------|------------------|----------------------------------|-------------------------------|
|                                 | Master           | Client (without radar detection) | Client (with radar detection) |
| Non-Occupancy Period            | Yes              | Not required                     | Yes                           |
| DFS Detection Threshold         | Yes              | Not required                     | Yes                           |
| Channel Availability Check Time | Yes              | Not required                     | Not required                  |
| U-NII Detection Bandwidth       | Yes              | Not required                     | Yes                           |

**Table 2: Applicability of DFS requirements during normal operation**

| Requirement                       | Operational Mode |                      |                   |
|-----------------------------------|------------------|----------------------|-------------------|
|                                   | Master           | Client (without DFS) | Client (with DFS) |
| DFS Detection Threshold           | Yes              | Not required         | Yes               |
| Channel Closing Transmission Time | Yes              | Yes                  | Yes               |
| Channel Move Time                 | Yes              | Yes                  | Yes               |
| U-NII Detection Bandwidth         | Yes              | Not required         | Yes               |

| Additional requirements for devices with multiple bandwidth modes                                                                                                                                                                                                                                                                                                                | Master Device or Client with Radar DFS | Client (without DFS)                                 |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------|------------------------------------------------------|
| <i>U-NII Detection Bandwidth and Statistical Performance Check</i>                                                                                                                                                                                                                                                                                                               | All BW modes must be tested            | Not required                                         |
| <i>Channel Move Time and Channel Closing Transmission Time</i>                                                                                                                                                                                                                                                                                                                   | Test using widest BW mode available    | Test using the widest BW mode available for the link |
| <i>All other tests</i>                                                                                                                                                                                                                                                                                                                                                           | Any single BW mode                     | Not required                                         |
| <b>Note:</b> Frequencies selected for statistical performance check (Section 7.8.4) should include several frequencies within the radar detection bandwidth and frequencies near the edge of the radar detection bandwidth. For 802.11 devices it is suggested to select frequencies in all 20 MHz channel blocks and a null frequency between the bonded 20 MHz channel blocks. |                                        |                                                      |

**Table 3: Interference Threshold values, Master or Client incorporating In-Service Monitoring**

| Maximum Transmit Power                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Value<br>(see notes) |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|
| E.I.R.P. $\geq$ 200 mill watt                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | -64 dBm              |
| E.I.R.P. < 200 mill watt and<br>power spectral density < 10 dBm/MHz                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | -62 dBm              |
| E.I.R.P. < 200 mill watt that do not meet power spectral<br>density requirement                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | -64 dBm              |
| <p><b>Note 1:</b> This is the level at the input of the receiver assuming a 0 dBi receive antenna</p> <p><b>Note 2:</b> Throughout these test procedures an additional 1 dB has been added to the amplitude of the test transmission waveforms to account for variations in measurement equipment. This will ensure that the test signal is at or above the detection threshold level to trigger a DFS response.</p> <p><b>Note 3:</b> E.I.R.P. is based on the highest antenna gain. For MIMO devices refer to KDB publication 662911 D01.</p> |                      |

**Table 4: DFS Response requirement values**

| Parameter                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Value                                                                                                       |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------|
| <i>Non-occupancy period</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 30 minutes                                                                                                  |
| <i>Channel Availability Check Time</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 60 seconds                                                                                                  |
| <i>Channel Move Time</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 10 seconds (See Note 1)                                                                                     |
| <i>Channel Closing Transmission Time</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 200 milliseconds +<br>approx. 60 milliseconds<br>over remaining 10 second<br>period.<br>(See Notes 1 and 2) |
| <i>U-NII Detection Bandwidth</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Minimum 100% of the U-<br>NII 99% transmission<br>power bandwidth.<br>(See Note 3)                          |
| <p><b>Note 1:</b> <i>Channel Move Time</i> and the <i>Channel Closing Transmission Time</i> should be performed with Radar Type 0. The measurement timing begins at the end of the Radar Type 0 burst.</p> <p><b>Note 2:</b> The <i>Channel Closing Transmission Time</i> is comprised of 200 milliseconds starting at the beginning of the <i>Channel Move Time</i> plus any additional intermittent control signals required to facilitate a <i>Channel</i> move (an aggregate of 60 milliseconds) during the remainder of the 10 second period. The aggregate duration of control signals will not count quiet periods in between transmissions.</p> <p><b>Note 3:</b> During the <i>U-NII Detection Bandwidth</i> detection test, radar type 0 should be used. For each frequency step the minimum percentage of detection is 90 percent. Measurements are performed with no data traffic.</p> |                                                                                                             |

**Table 5 – Short Pulse Radar Test Waveforms**

| Radar Type                                                                                                                                                        | Pulse Width (usec) | PRI (usec)                                                                                                                                                    | Pulses                                                                      | Minimum Percentage of Successful Detection | Minimum Trials |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------|--------------------------------------------|----------------|
| 0                                                                                                                                                                 | 1                  | 1428                                                                                                                                                          | 18                                                                          | See Note 1                                 | See Note 1     |
| 1                                                                                                                                                                 | 1                  | Test A: 15 unique PRI values randomly selected from the list of 23 PRI values in table 5a                                                                     | Roundup:<br>$\{(1/360) \times (19 \times 10^6 \text{ PRI}_{\text{usec}})\}$ | 60%                                        | 30             |
|                                                                                                                                                                   |                    | Test B: 15 unique PRI values randomly selected within the range of 518-3066 usec. With a minimum increment of 1 usec, excluding PRI values selected in Test A |                                                                             |                                            |                |
| 2                                                                                                                                                                 | 1-5                | 150-230                                                                                                                                                       | 23-29                                                                       | 60%                                        | 30             |
| 3                                                                                                                                                                 | 6-10               | 200-500                                                                                                                                                       | 16-18                                                                       | 60%                                        | 30             |
| 4                                                                                                                                                                 | 11-20              | 200-500                                                                                                                                                       | 12-16                                                                       | 60%                                        | 30             |
| Aggregate (Radar Types 1-4)                                                                                                                                       |                    |                                                                                                                                                               |                                                                             | 80%                                        | 120            |
| <b>Note 1:</b> Short Pulse Radar Type 0 should be used for the <i>Detection Bandwidth</i> test, <i>Channel Move Time</i> , and <i>Channel Closing Time</i> tests. |                    |                                                                                                                                                               |                                                                             |                                            |                |

**Table 6 – Long Pulse Radar Test Signal**

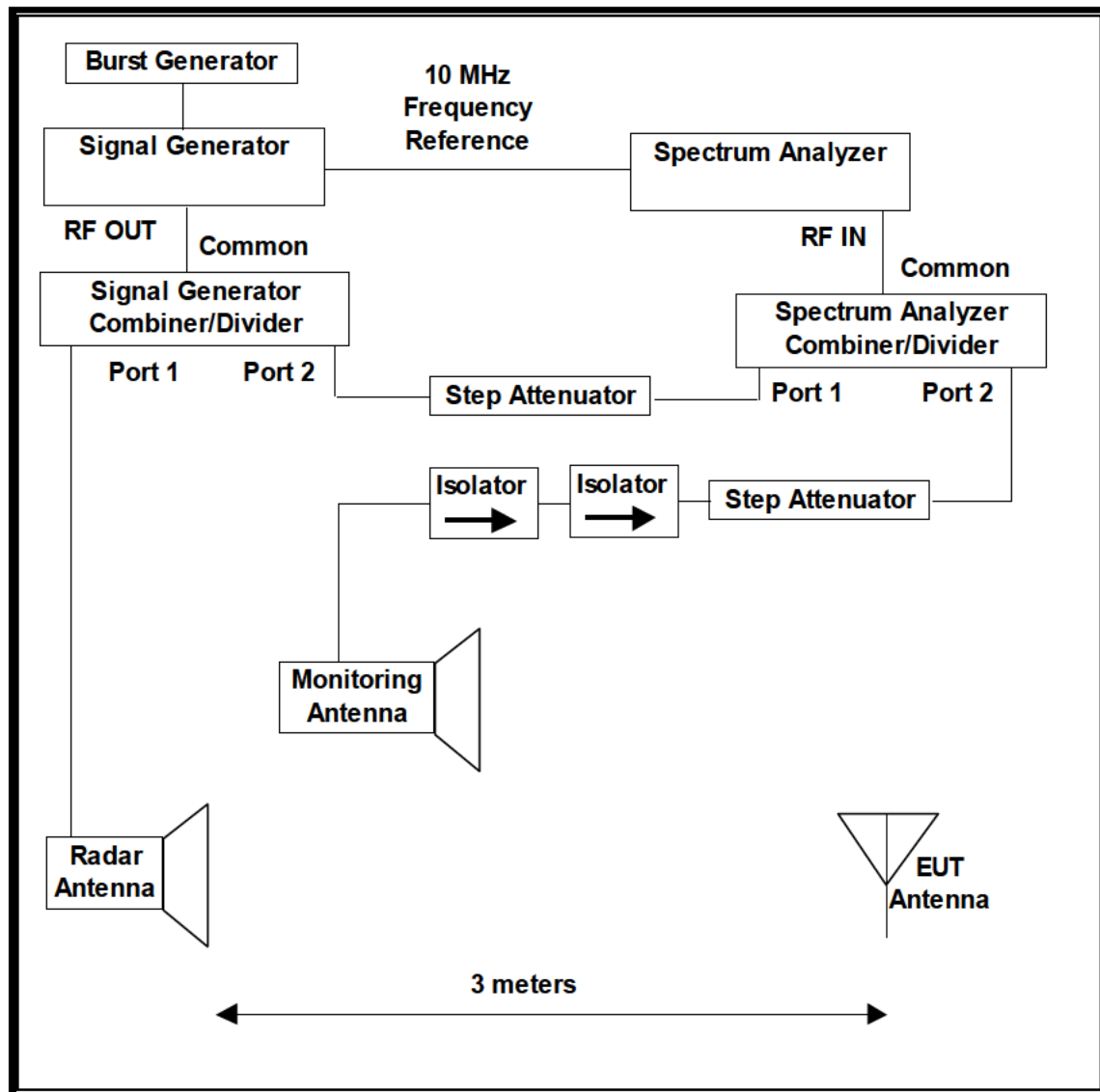
| Radar Waveform Type | Pulse Width (μsec) | Chirp Width (MHz) | PRI (μsec) | Pulses per Burst | Number of Bursts | Minimum Percentage of Successful Detection | Minimum Trials |
|---------------------|--------------------|-------------------|------------|------------------|------------------|--------------------------------------------|----------------|
| 5                   | 50-100             | 5-20              | 1000-2000  | 1-3              | 8-20             | 80%                                        | 30             |

**Table 7 – Frequency Hopping Radar Test Signal**

| Radar Waveform Type | Pulse Width (μsec) | PRI (μsec) | Pulses per Hop | Hopping Rate (kHz) | Hopping Sequence Length (msec) | Minimum Percentage of Successful Detection | Minimum Trials |
|---------------------|--------------------|------------|----------------|--------------------|--------------------------------|--------------------------------------------|----------------|
| 6                   | 1                  | 333        | 9              | 0.333              | 300                            | 70%                                        | 30             |

## 14.1.2. TEST AND MEASUREMENT SYSTEM

### RADIATED METHOD SYSTEM BLOCK DIAGRAM



## **SYSTEM OVERVIEW**

The short pulse and long pulse signal generating system utilizes the NTIA software. The Vector Signal Generator has been validated by the NTIA. The hopping signal generating system utilizes the CCS simulated hopping method and system, which has been validated by the DoD, FCC and NTIA. The software selects waveform parameters from within the bounds of the signal type on a random basis using uniform distribution.

The short pulse types 1, 2, 3 and 4, and the long pulse type 5 parameters are randomized at run-time.

The hopping type 6 pulse parameters are fixed while the hopping sequence is based on the August 2005 NTIA Hopping Frequency List. The initial starting point randomized at run-time and each subsequent starting point is incremented by 475. Each frequency in the 100-length segment is compared to the boundaries of the EUT Detection Bandwidth and the software creates a hopping burst pattern in accordance with Section 7.4.1.3 Method #2 Simulated Frequency Hopping Radar Waveform Generating Subsystem of KDB 905462 D02. The frequency of the signal generator is incremented in 1 MHz steps from  $F_L$  to  $F_H$  for each successive trial. This incremental sequence is repeated as required to generate a minimum of 30 total trials and to maintain a uniform frequency distribution over the entire Detection Bandwidth.

The signal monitoring equipment consists of a spectrum analyzer. The aggregate ON time is calculated by multiplying the number of bins above a threshold during a particular observation period by the dwell time per bin, with the analyzer set to peak detection and max hold.

## **SYSTEM CALIBRATION**

A 50-ohm load is connected in place of the spectrum analyzer, and the spectrum analyzer is connected to a horn antenna via a coaxial cable, with the reference level offset set to (horn antenna gain – coaxial cable loss). The signal generator is set to CW mode. The amplitude of the signal generator is adjusted to yield a level of –64 dBm as measured on the spectrum analyzer.

Without changing any of the instrument settings, the spectrum analyzer is reconnected to the Common port of the Spectrum Analyzer Combiner/Divider. The Reference Level Offset of the spectrum analyzer is adjusted so that the displayed amplitude of the signal is –64 dBm.

The spectrum analyzer displays the level of the signal generator as received at the antenna ports of the Master Device. The interference detection threshold may be varied from the calibrated value of –64 dBm and the spectrum analyzer will still indicate the level as received by the Master Device.

### **ADJUSTMENT OF DISPLAYED TRAFFIC LEVEL**

A link is established between the Master and Slave and the distance between the units is adjusted as needed to provide a suitable received level at the Master and Slave devices. The video test file is streamed to generate WLAN traffic. The monitoring antenna is adjusted so that the WLAN traffic level, as displayed on the spectrum analyzer, is at lower amplitude than the radar detection threshold.

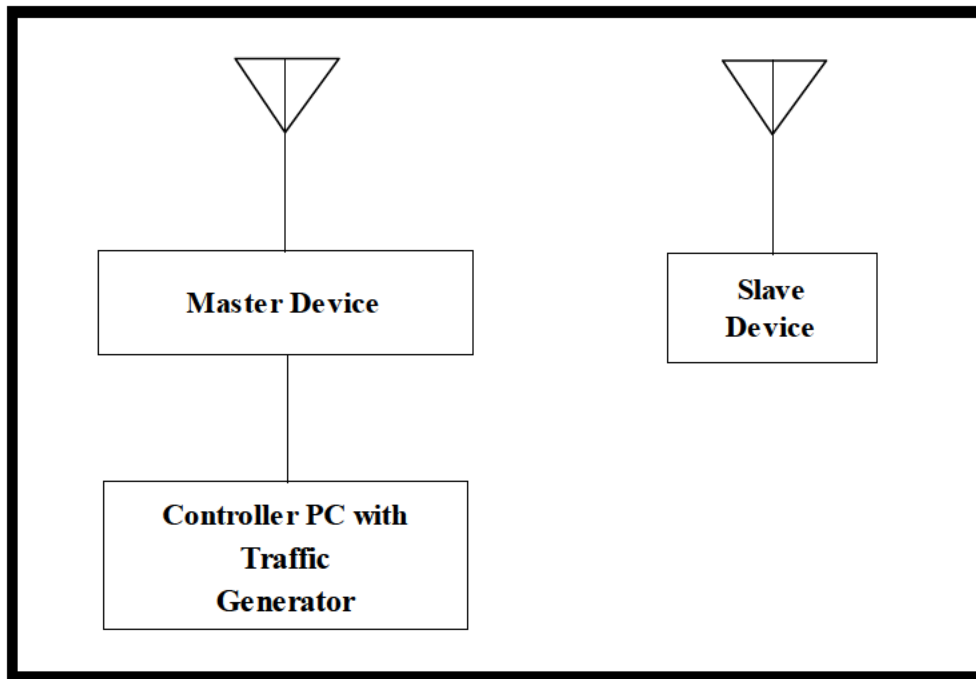
### **TEST AND MEASUREMENT EQUIPMENT**

The following test and measurement equipment was utilized for the DFS tests documented in this report:

| TEST EQUIPMENT LIST            |              |        |              |          |
|--------------------------------|--------------|--------|--------------|----------|
| Description                    | Manufacturer | Model  | Asset Number | Cal Due  |
| Spectrum Analyzer, 26.5 GHz    | Agilent / HP | E4440A | C01178       | 09/05/15 |
| Vector Signal Generator, 20GHz | Agilent / HP | E8267C | C01066       | 09/03/15 |

### 14.1.3. SETUP OF EUT

#### RADIATED METHOD EUT TEST SETUP



#### SUPPORT EQUIPMENT

The following support equipment was utilized for the DFS tests documented in this report:

| PERIPHERAL SUPPORT EQUIPMENT LIST                        |              |                   |                            |           |
|----------------------------------------------------------|--------------|-------------------|----------------------------|-----------|
| Description                                              | Manufacturer | Model             | Serial Number              | FCC ID    |
| 802.11ac Dual Band Wireless Access Point (Master Device) | Cisco        | AIR-CAP3702E-A-K9 | FTX181570A6                | LDK102087 |
| P.O.E. Injector (Master)                                 | Phihong      | POE30U-560(G)     | PHI170102N2                | DoC       |
| Notebook PC (Controller)                                 | Lenovo       | Type 4236-B92     | PB-HEX04 12/05             | DoC       |
| AC Adapter (Controller PC)                               | Lenovo       | 42T4418           | 11S42T4418Z1ZG<br>WG08R90M | DoC       |

#### **14.1.4. DESCRIPTION OF EUT**

For FCC the EUT operates over the 5250-5350 MHz and 5470-5725 MHz ranges.

The EUT is a Slave Device without Radar Detection.

The highest power level within these bands is 11.74 dBm EIRP in the 5250-5350 MHz band and 12.27 dBm EIRP in the 5470-5725 MHz band.

The highest gain antenna assembly utilized with the EUT has a gain of -2.7 dBi in the 5250-5350 MHz band and -2.8 dBi in the 5470-5725 MHz band. The lowest gain antenna assembly utilized with the EUT has a gain of -2.7 dBi in the 5250-5350 MHz band and -2.8 dBi in the 5470-5725 MHz band.

Two identical antennas are utilized to meet the diversity and MIMO operational requirements.

The rated output power of the Master unit is > 23dBm (EIRP). Therefore the required interference threshold level is -64 dBm. After correction for procedural adjustments, the required radiated threshold at the antenna port is  $-64 + 1 = -63$  dBm.

The calibrated radiated DFS Detection Threshold level is set to -64 dBm. The tested level is lower than the required level hence it provides a margin to the limit.

The EUT uses two transmitter/receiver chains, each connected to an antenna to perform radiated tests.

WLAN traffic that meets or exceeds the minimum required loading was generated by transferring a data stream from the controller/server PC to the EUT using iPerf version 2.0.5 software package.

TPC is not required since the maximum EIRP is less than 500 mW (27 dBm).

The EUT utilizes the 802.11ac architecture. Three nominal channel bandwidths are implemented: 20 MHz, 40 MHz and 80 MHz.

The software installed in the access point is AP3G2-K9W7-M version 15.2(4)JB4.

#### **UNIFORM CHANNEL SPREADING**

This is requirement not applicable to Slave Devices.

#### **OVERVIEW OF MASTER DEVICE WITH RESPECT TO §15.407 (h) REQUIREMENTS**

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The Master Device is a Cisco Access Point, FCC ID: LDK102087. The minimum antenna gain for the Master Device is 6 dBi.

The rated output power of the Master unit is  $> 23\text{dBm}$  (EIRP). Therefore the required interference threshold level is  $-64\text{ dBm}$ . After correction for procedural adjustments, the required radiated threshold at the antenna port is  $-64 + 1 = -63\text{ dBm}$ .

The calibrated radiated DFS Detection Threshold level is set to  $-64\text{ dBm}$ . The tested level is lower than the required level hence it provides a margin to the limit.

## **14.2. RESULTS FOR 20 MHz BANDWIDTH**

### **14.2.1. TEST CHANNEL**

All tests were performed at a channel center frequency of 5500 MHz.

### **14.2.2. RADAR WAVEFORM AND TRAFFIC**

Please refer to UNII test report of FCC ID: PY7-PM0793

#### **CHANNEL LOADING**

Please refer to UNII test report of FCC ID: PY7-PM0793.

### **14.2.3. OVERLAPPING CHANNEL TESTS**

#### **RESULTS**

These tests are not applicable.

### **14.2.4. MOVE AND CLOSING TIME**

#### **REPORTING NOTES**

The reference marker is set at the end of last radar pulse.

The delta marker is set at the end of the last WLAN transmission following the radar pulse. This delta is the channel move time.

The aggregate channel closing transmission time is calculated as follows:

Aggregate Transmission Time =  
(Number of analyzer bins showing transmission) \* (dwell time per bin)

The observation period over which the aggregate time is calculated begins at (Reference Marker + 200 msec) and ends no earlier than (Reference Marker + 10 sec).

#### **RESULTS**

Please refer to UNII test report of FCC ID: PY7-PM0793.

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### **14.3. RESULTS FOR 40 MHz BANDWIDTH**

#### **14.3.1. TEST CHANNEL**

All tests were performed at a channel center frequency of 5510 MHz.

#### **14.3.2. RADAR WAVEFORM AND TRAFFIC**

Please refer to UNII test report of FCC ID: PY7-PM0793.

#### **14.3.3. OVERLAPPING CHANNEL TESTS**

##### **RESULTS**

These tests are not applicable.

#### **14.3.4. MOVE AND CLOSING TIME**

##### **REPORTING NOTES**

The reference marker is set at the end of last radar pulse.

The delta marker is set at the end of the last WLAN transmission following the radar pulse. This delta is the channel move time.

The aggregate channel closing transmission time is calculated as follows:

Aggregate Transmission Time =  
(Number of analyzer bins showing transmission) \* (dwell time per bin)

The observation period over which the aggregate time is calculated begins at (Reference Marker + 200 msec) and ends no earlier than (Reference Marker + 10 sec).

##### **RESULTS**

Please refer to UNII test report of FCC ID: PY7-PM0793.

#### **14.3.5. 10-MINUTE BEACON MONITORING PERIOD**

##### **RESULTS**

Please refer to UNII test report of FCC ID: PY7-PM0793.

## **14.4. RESULTS FOR 80 MHz BANDWIDTH**

### **14.4.1. TEST CHANNEL**

All tests were performed at a channel center frequency of 5530 MHz.

### **14.4.2. RADAR WAVEFORM AND TRAFFIC**

Please refer to UNII test report of FCC ID: PY7-PM0793

### **14.4.3. OVERLAPPING CHANNEL TESTS**

#### **RESULTS**

These tests are not applicable.

### **14.4.4. MOVE AND CLOSING TIME**

#### **REPORTING NOTES**

The reference marker is set at the end of last radar pulse.

The delta marker is set at the end of the last WLAN transmission following the radar pulse. This delta is the channel move time.

The aggregate channel closing transmission time is calculated as follows:

Aggregate Transmission Time =  
(Number of analyzer bins showing transmission) \* (dwell time per bin)

The observation period over which the aggregate time is calculated begins at (Reference Marker + 200 msec) and ends no earlier than (Reference Marker + 10 sec).

#### **RESULTS**

Please refer to UNII test report of FCC ID: PY7-PM0793

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**14.4.5. 10-MINUTE BEACON MONITORING PERIOD**

**RESULTS**

Please refer to UNII test report of FCC ID: PY7-PM0793.