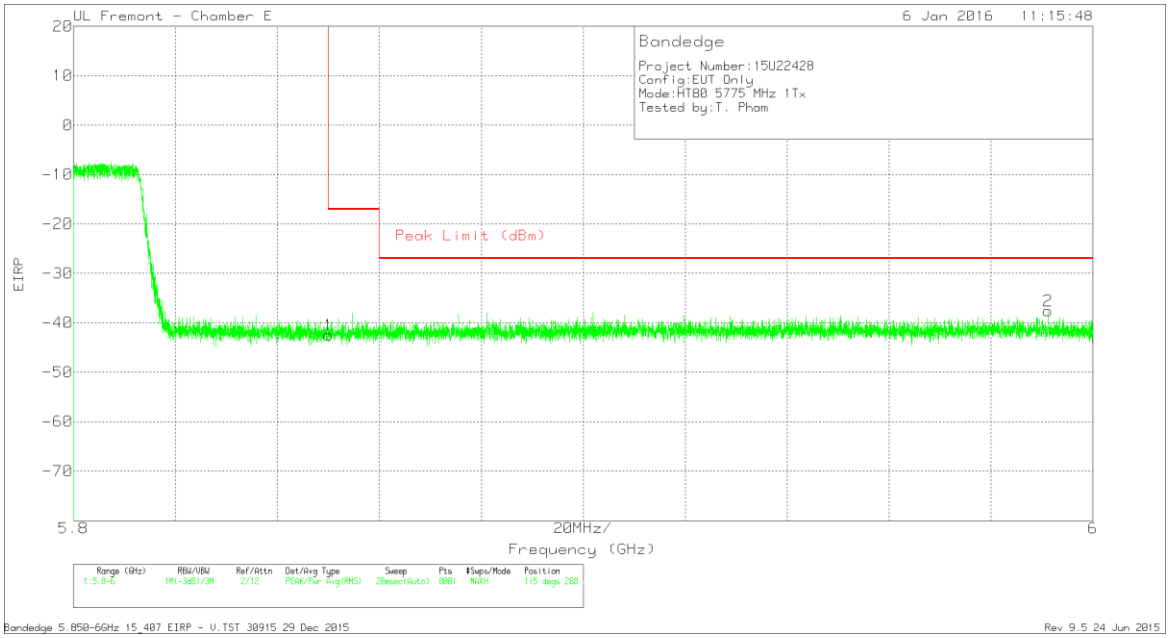
HIGH CHANNEL VERTICAL PLOT




## DATA

| Marker | Frequency (GHz) | Meter Reading (dBm) | Det | AF T346 (dB/m) | Amp/Cbl/Fltr/Pad (dB) | DC Corr (dB) | Conversion Factor (dB) | Corrected Reading EIRP | Peak Limit (dBm) | PK Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 5.85 | -69.17 | Pk | 34.9 | -20 | 0 | 11.8 | -42.47 | -17 | -25.47 | 115 | 268 | V |
| 2 | 5.991 | -65.14 | Pk | 35.1 | -19.3 | 0 | 11.8 | -37.54 | -27 | -10.54 | 115 | 268 | V |

Pk - Peak detector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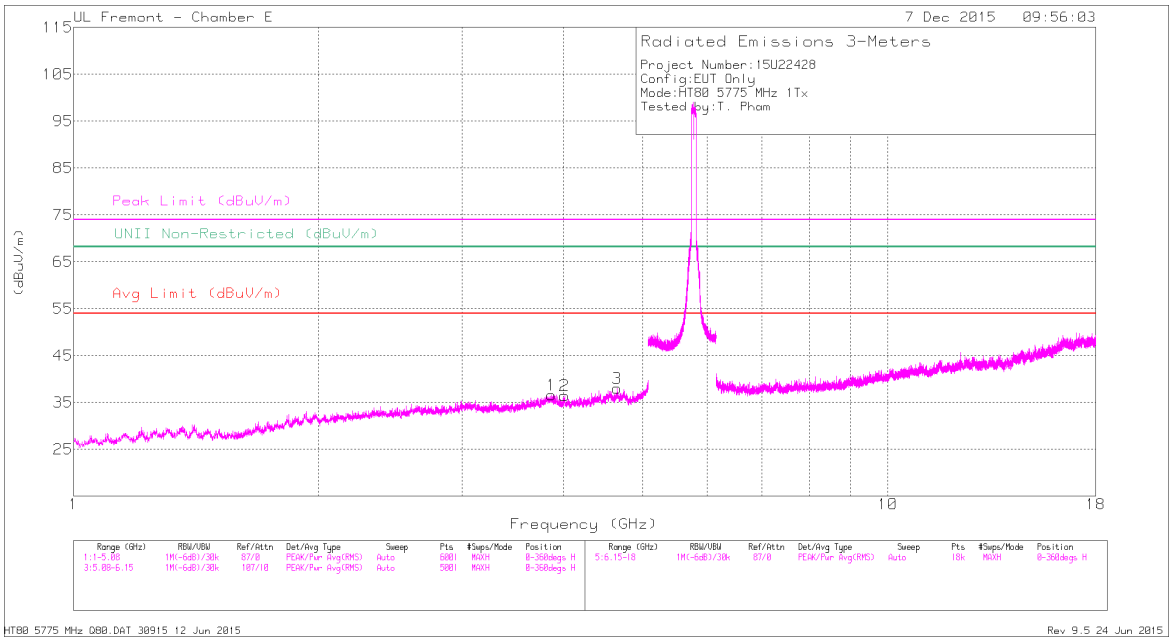
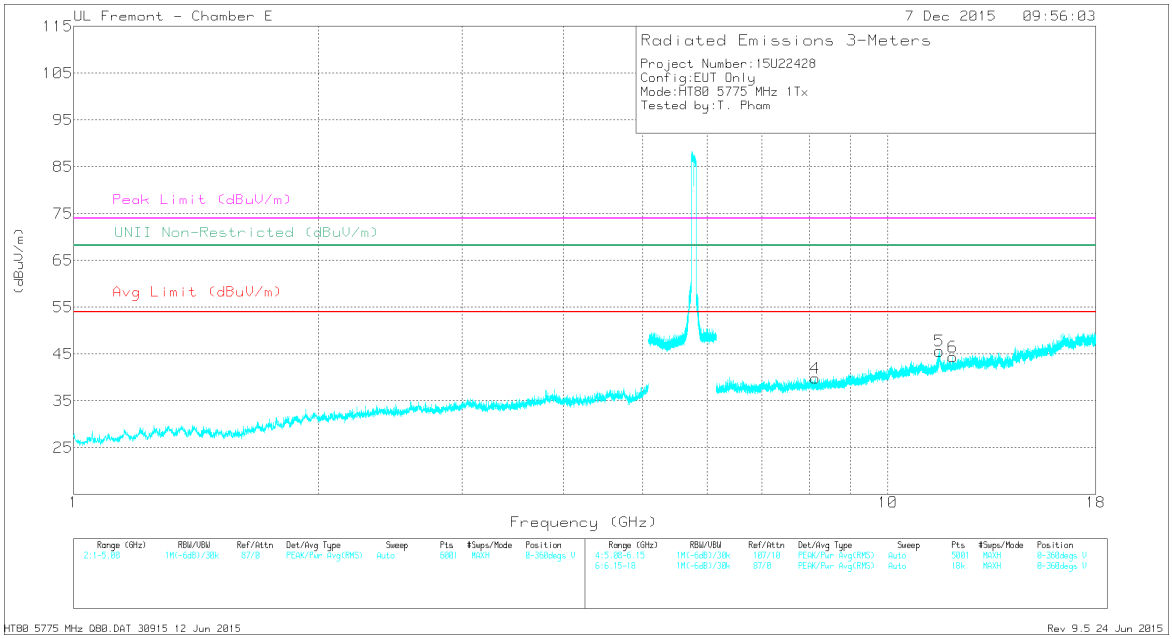
## CHANNEL 155 HARMONICS AND SPURIOUS EMISSIONS

CHANNEL 155 HORIZONTAL PLOT




CHANNEL 155 VERTICAL PLOT





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**DATA**

| Markers | Frequency (GHz) | Meter Reading (dBuV) | Det | AF T346 (dB/m) | Amp/Cbl/Fltr/Pad (dB) | DC Corr (dB) | Corrected Reading (dBuV/m) | Avg Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | PK Margin (dB) | UNII Non-Restricted (dBuV/m) | PK Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | * 3.863 | 40.79 | PK-U | 33.5 | -29.9 | 0 | 44.39 | - | - | 74 | -29.61 | - | - | 157 | 150 | H |
| | * 3.861 | 29.71 | ADR | 33.5 | -29.9 | .16 | 33.47 | 54 | -20.53 | - | - | - | - | 157 | 150 | H |
| 2 | * 4.007 | 40.18 | PK-U | 33.4 | -29.9 | 0 | 43.68 | - | - | 74 | -30.32 | - | - | 235 | 152 | H |
| | * 4.009 | 29.22 | ADR | 33.4 | -29.8 | .16 | 32.98 | 54 | -21.02 | - | - | - | - | 235 | 152 | H |
| 3 | * 4.653 | 40.52 | PK-U | 34.1 | -30 | 0 | 44.62 | - | - | 74 | -29.38 | - | - | 226 | 170 | H |
| | * 4.654 | 29.62 | ADR | 34.1 | -30 | .16 | 33.88 | 54 | -20.12 | - | - | - | - | 226 | 170 | H |
| 4 | * 8.15 | 37.87 | PK-U | 35.7 | -26.5 | 0 | 47.07 | - | - | 74 | -26.93 | - | - | 213 | 160 | V |
| | * 8.148 | 26.78 | ADR | 35.7 | -26.5 | .16 | 36.14 | 54 | -17.86 | - | - | - | - | 213 | 160 | V |
| 5 | * 11.564 | 38.17 | PK-U | 38.1 | -22.3 | 0 | 53.97 | - | - | 74 | -20.03 | - | - | 226 | 170 | V |
| | * 11.564 | 26.31 | ADR | 38.1 | -22.3 | .16 | 42.27 | 54 | -11.73 | - | - | - | - | 226 | 170 | V |
| 6 | * 12.004 | 36.35 | PK-U | 38.6 | -24.1 | 0 | 50.85 | - | - | 74 | -23.15 | - | - | 213 | 160 | V |
| | * 12.002 | 25.71 | ADR | 38.6 | -24.1 | .16 | 40.37 | 54 | -13.63 | - | - | - | - | 213 | 160 | V |

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

PK-U - U-NII: Maximum Peak

ADR - U-NII AD primary method, RMS average


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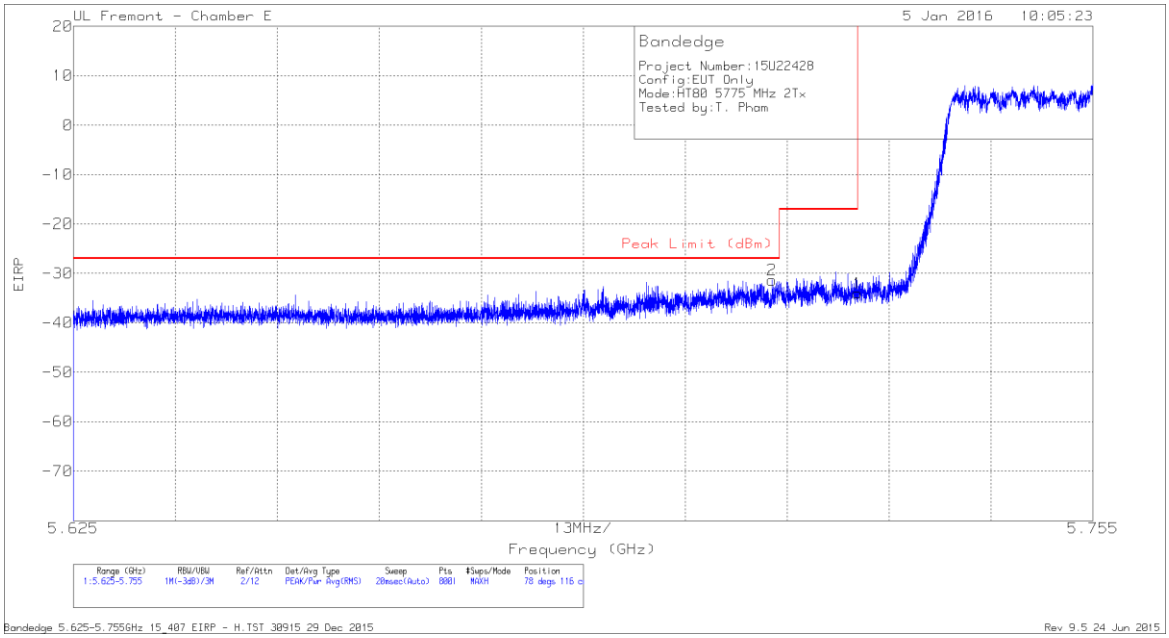
## 9.25. 802.11ac VHT80 2Tx CDD MODE IN THE 5.8 GHz BAND

**RESTRICTED BANDEDGE (LOW)**

LOW CHANNEL HORIZONTAL PLOT




**DATA**

| Marker | Frequency (GHz) | Meter Reading (dBm) | Det | AF T346 (dB/m) | Amp/Cbl/Fltr/Pad (dB) | Conversion Factor (dB) | Corrected Reading EIRP | Peak Limit (dBm) | PK Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | 5.714 | -58.06 | Pk | 34.7 | -19.8 | 11.8 | -31.36 | -27 | -4.36 | 78 | 116 | H |
| 1 | 5.725 | -60.71 | Pk | 34.7 | -19.8 | 11.8 | -34.01 | -17 | -17.01 | 78 | 116 | H |

Pk - Peak detector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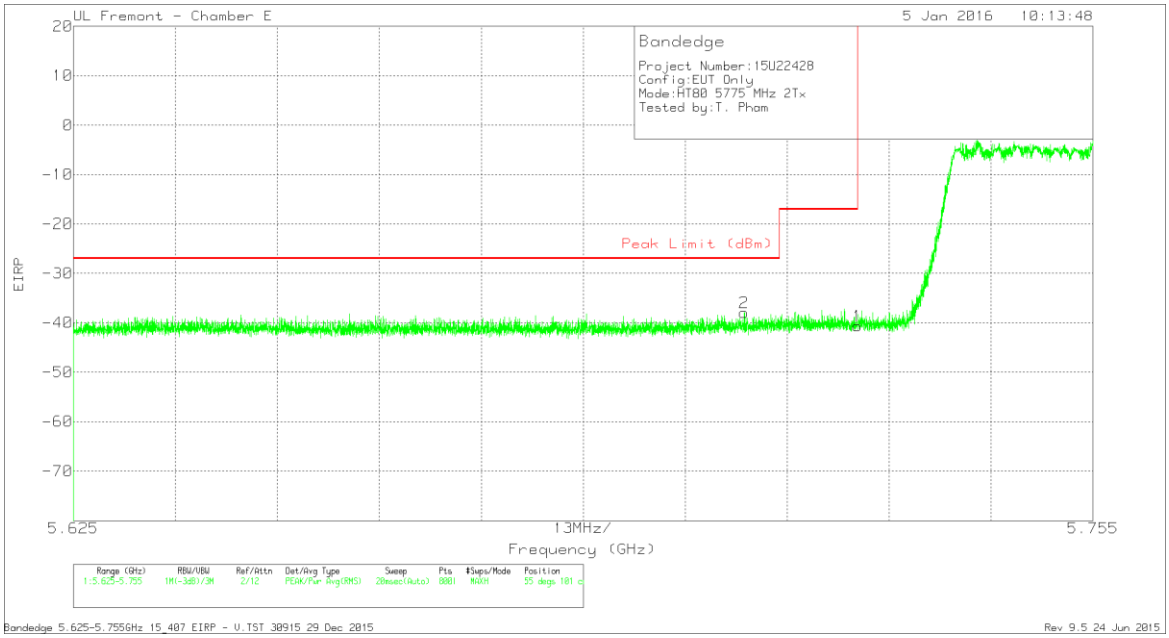
LOW CHANNEL VERTICAL PLOT




## DATA

| Marker | Frequency (GHz) | Meter Reading (dBm) | Det | AF T346 (dB/m) | Amp/Cbl/Filtr/Pad (dB) | Conversion Factor (dB) | Corrected Reading EIRP | Peak Limit (dBm) | PK Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | 5.711 | -64.63 | Pk | 34.7 | -19.8 | 11.8 | -37.93 | -27 | -10.93 | 55 | 101 | V |
| 1 | 5.725 | -67.33 | Pk | 34.7 | -19.8 | 11.8 | -40.63 | -17 | -23.63 | 55 | 101 | V |

Pk - Peak detector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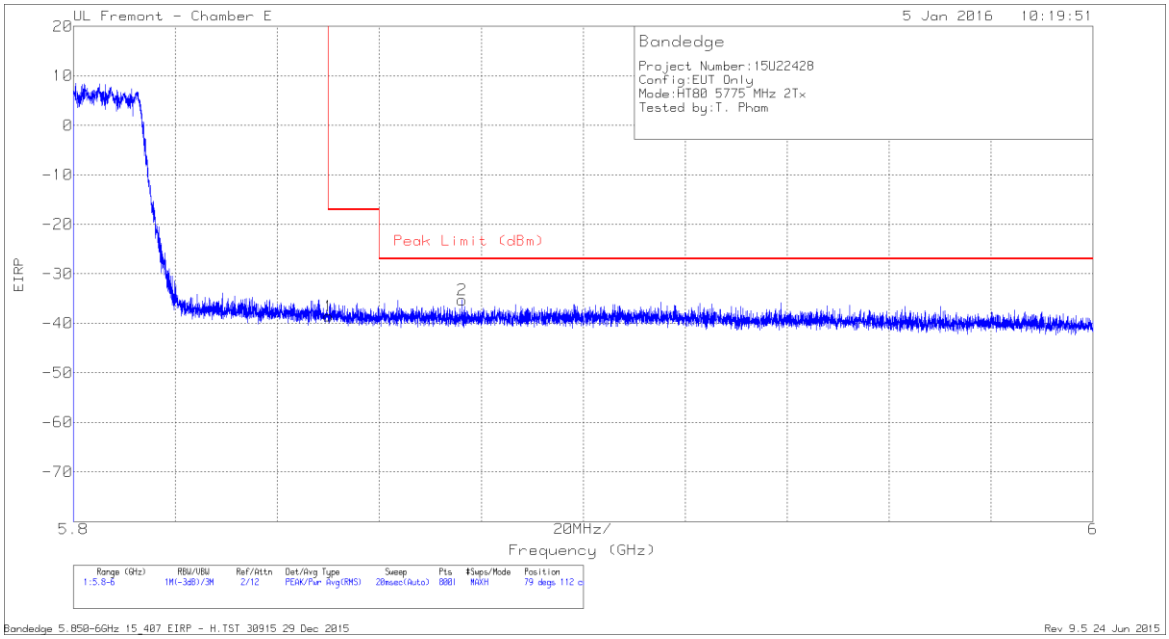
## RESTRICTED BANDEDGE (HIGH)

HIGH CHANNEL HORIZONTAL PLOT




## DATA

| Marker | Frequency (GHz) | Meter Reading (dBm) | Det | AF T346 (dB/m) | Amp/Cbl/Filtr/Pad (dB) | Conversion Factor (dB) | Corrected Reading EIRP | Peak Limit (dBm) | PK Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 5.85 | -65.21 | Pk | 34.9 | -20 | 11.8 | -38.51 | -17 | -21.51 | 79 | 112 | H |
| 2 | 5.876 | -62.19 | Pk | 34.9 | -19.8 | 11.8 | -35.29 | -27 | -8.29 | 79 | 112 | H |

Pk - Peak detector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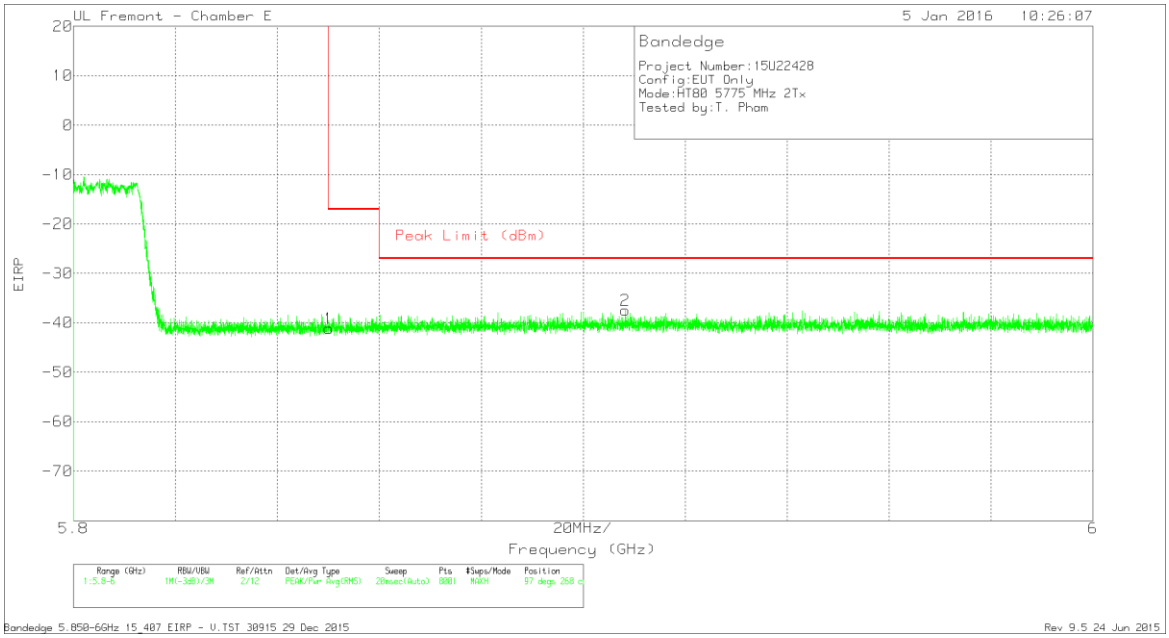
HIGH CHANNEL VERTICAL PLOT




## DATA

| Marker | Frequency (GHz) | Meter Reading (dBm) | Det | AF T346 (dB/m) | Amp/Cbl/Filtr/Pad (dB) | Conversion Factor (dB) | Corrected Reading EIRP | Peak Limit (dBm) | PK Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 5.85 | -67.88 | Pk | 34.9 | -20 | 11.8 | -41.18 | -17 | -24.18 | 97 | 268 | V |
| 2 | 5.908 | -64.64 | Pk | 34.9 | -19.5 | 11.8 | -37.44 | -27 | -10.44 | 97 | 268 | V |

Pk - Peak detector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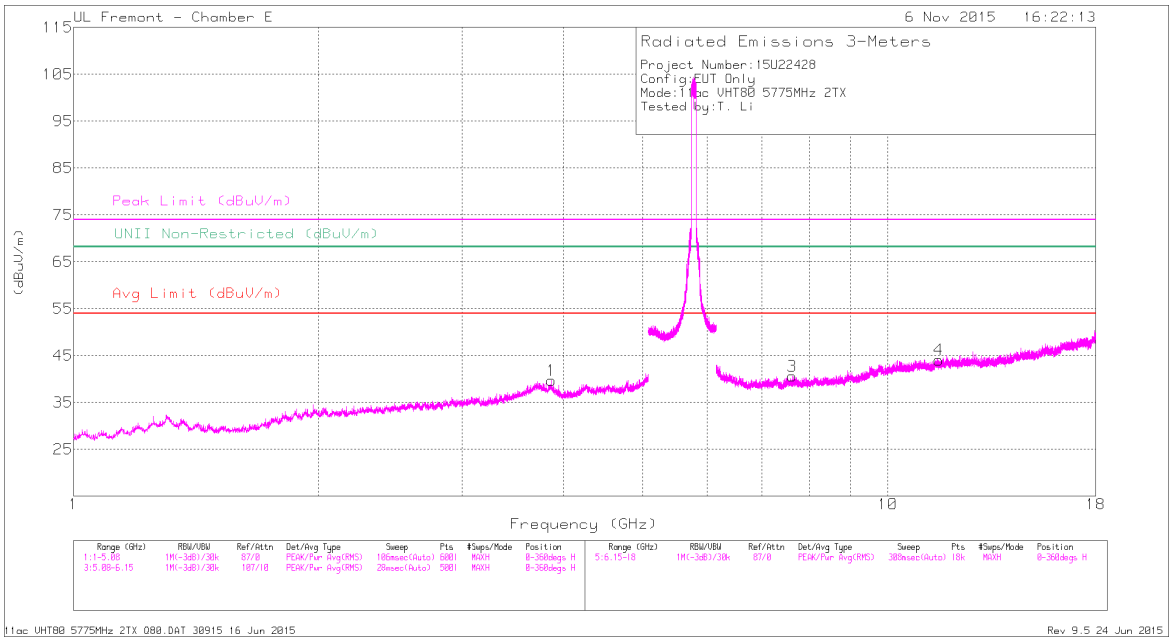
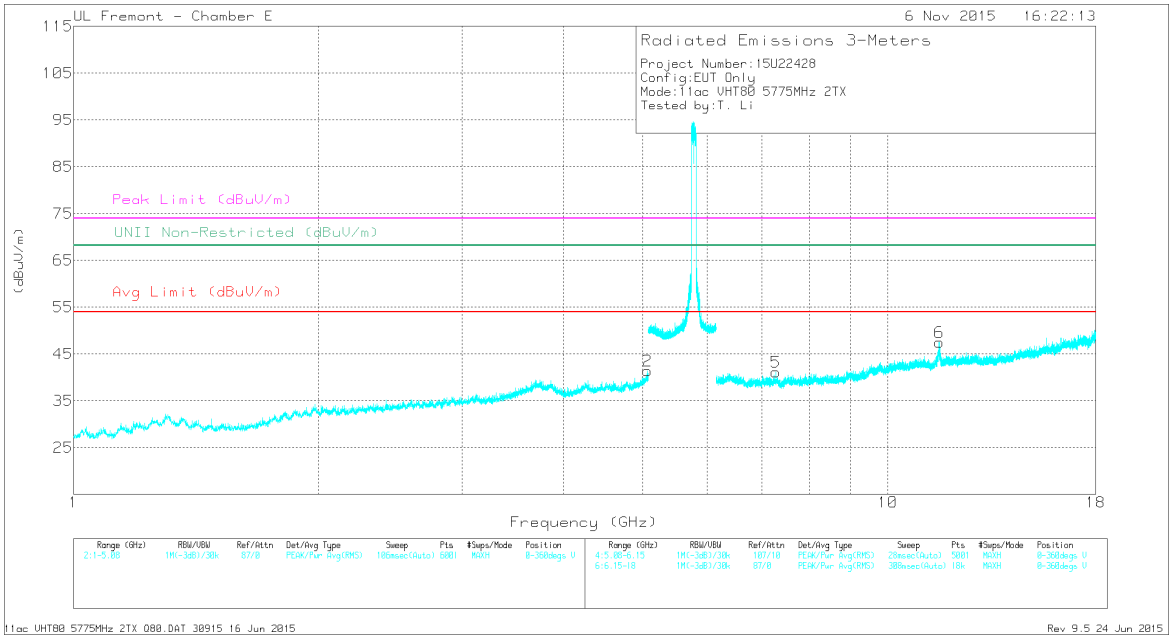
## CHANNEL 155 HARMONICS AND SPURIOUS EMISSIONS

CHANNEL 155 HORIZONTAL PLOT




CHANNEL 155 VERTICAL PLOT





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**DATA**

| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | AF T120 (dB/m) | Amp/Cbl/Fltr/Pad (dB) | DC Corr (dB) | Corrected Reading (dBuV/m) | Avg Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | PK Margin (dB) | UNII Non-Restricted (dBuV/m) | PK Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | * 3.863 | 39.13 | PK-U | 33.9 | -28.6 | 0 | 44.43 | - | - | 74 | -29.57 | - | - | 97 | 129 | H |
| | * 3.863 | 27.53 | ADR | 33.9 | -28.6 | .2 | 33.03 | 54 | -20.97 | - | - | - | - | 97 | 129 | H |
| 2 | * 5.073 | 38.65 | PK-U | 34.2 | -26.3 | 0 | 46.55 | - | - | 74 | -27.45 | - | - | 299 | 346 | V |
| | * 5.074 | 27.32 | ADR | 34.2 | -26.3 | .2 | 35.42 | 54 | -18.58 | - | - | - | - | 299 | 346 | V |
| 3 | * 7.635 | 36.82 | PK-U | 35.8 | -25.6 | 0 | 47.02 | - | - | 74 | -26.98 | - | - | 176 | 209 | H |
| | * 7.635 | 25.24 | ADR | 35.8 | -25.6 | .2 | 35.64 | 54 | -18.36 | - | - | - | - | 176 | 209 | H |
| 4 | * 11.545 | 35.89 | PK-U | 38.6 | -22.6 | 0 | 51.89 | - | - | 74 | -22.11 | - | - | 261 | 276 | H |
| | * 11.545 | 23.61 | ADR | 38.6 | -22.6 | .2 | 39.81 | 54 | -14.19 | - | - | - | - | 261 | 276 | H |
| 5 | * 7.281 | 36.26 | PK-U | 35.7 | -25.4 | 0 | 46.56 | - | - | 74 | -27.44 | - | - | 194 | 177 | V |
| | * 7.283 | 25.62 | ADR | 35.7 | -25.5 | .2 | 36.02 | 54 | -17.98 | - | - | - | - | 194 | 177 | V |
| 6 | * 11.571 | 39.13 | PK-U | 38.6 | -22.8 | 0 | 54.93 | - | - | 74 | -19.07 | - | - | 131 | 139 | V |
| | * 11.571 | 27.08 | ADR | 38.6 | -22.8 | .2 | 43.08 | 54 | -10.92 | - | - | - | - | 131 | 139 | V |

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

PK-U - U-NII: Maximum Peak

ADR - U-NII AD primary method, RMS average


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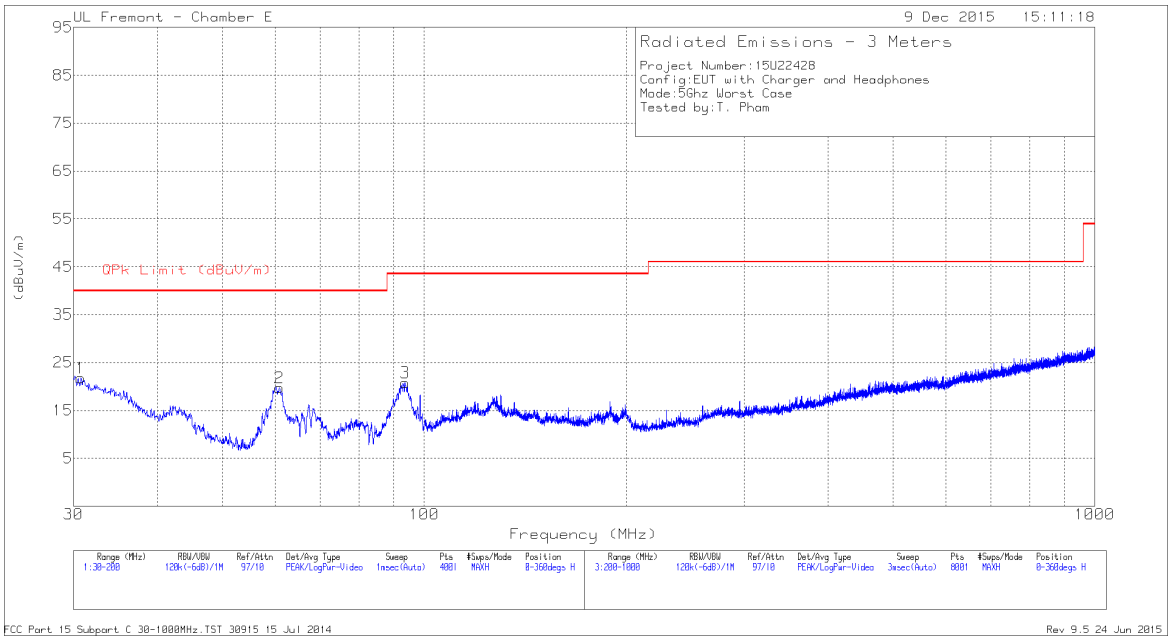
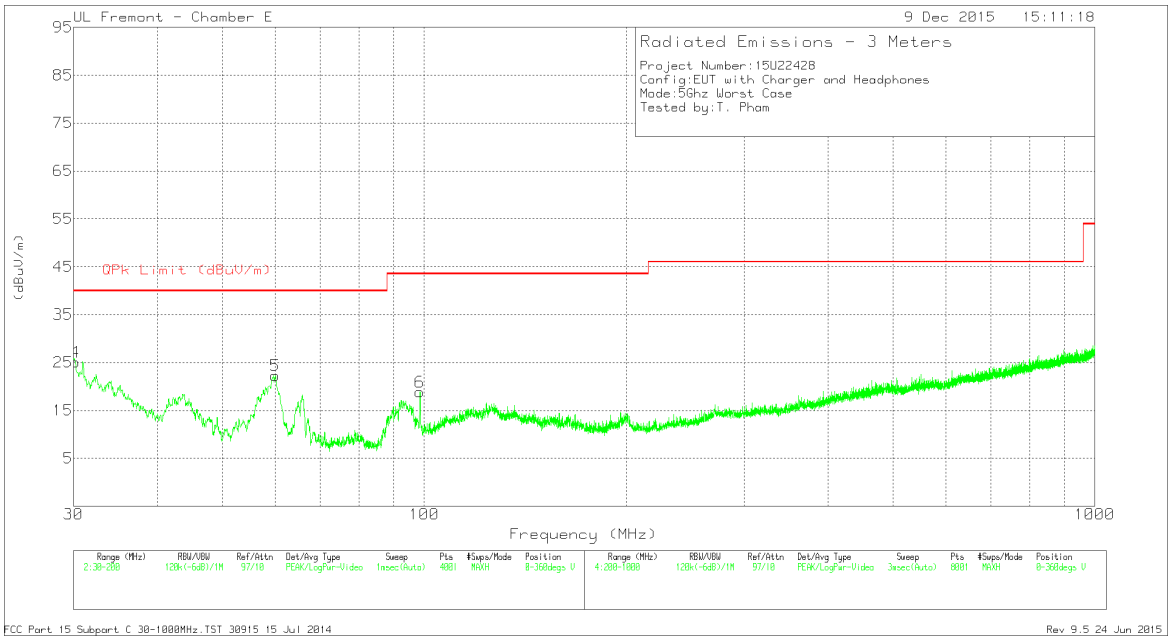
## 9.26. WORST-CASE BELOW 1 GHz

**SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION, HORIZONTAL & VERTICAL)**

HORIZONTAL PLOT




VERTICAL PLOT





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## HORIZONTAL AND VERTICAL DATA

| Marker | Frequency (MHz) | Meter Reading (dBuV) | Det | AF T243 (dB/m) | Amp/Cbl (dB) | Corrected Reading (dBuV/m) | QPk Limit (dBuV/m) | Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 4 | 30.17 | 31.83 | Pk | 25.1 | -31.8 | 25.13 | 40 | -14.87 | 0-360 | 100 | V |
| 1 | 30.765 | 28.94 | Pk | 24.6 | -31.8 | 21.74 | 40 | -18.26 | 0-360 | 301 | H |
| 5 | 60.005 | 42.46 | Pk | 11.4 | -31.6 | 22.26 | 40 | -17.74 | 0-360 | 100 | V |
| 2 | 60.8125 | 39.86 | Pk | 11.5 | -31.6 | 19.76 | 40 | -20.24 | 0-360 | 401 | H |
| 3 | 93.6225 | 39.84 | Pk | 12.4 | -31.4 | 20.84 | 43.52 | -22.68 | 0-360 | 301 | H |
| 6 | 98.5525 | 36.53 | Pk | 13.8 | -31.4 | 18.93 | 43.52 | -24.59 | 0-360 | 100 | V |

Pk - Peak detector


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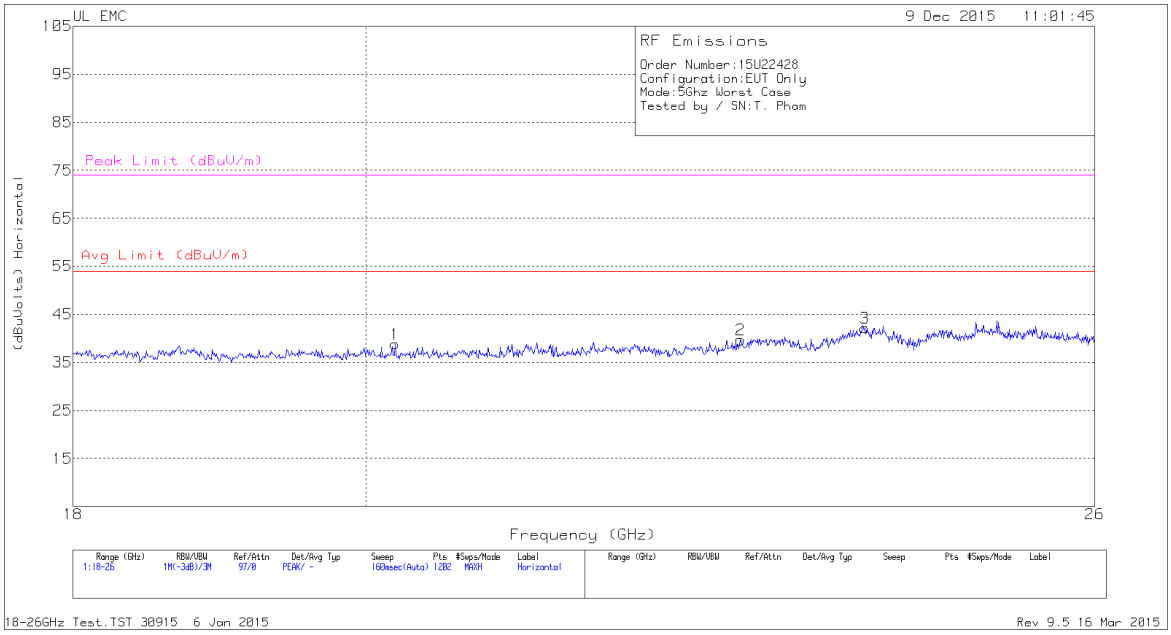
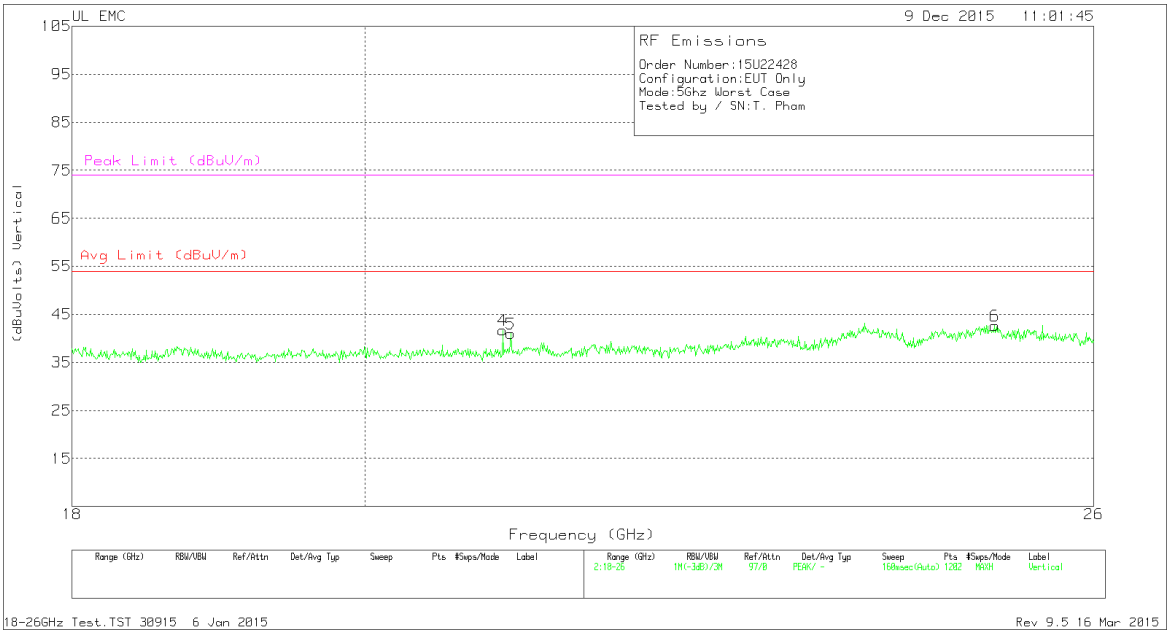
## 9.27. WORST-CASE ABOVE 18 GHz

**SPURIOUS EMISSIONS 18000 TO 26000 MHz (WORST-CASE CONFIGURATION)**

HORIZONTAL PLOT




VERTICAL PLOT





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## HORIZONTAL AND VERTICAL DATA

| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | T89 AF (dB/m) | Amp/Cbl (dB) | Dist Corr (dB) | Corrected Reading (dBuVolts) | Avg Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | PK Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 20.211 | 41.03 | Pk | 32.6 | -25.3 | -9.5 | 38.833 | 54 | -15.167 | 74 | -35.167 |
| 2 | 22.886 | 40.67 | Pk | 33.4 | -24.9 | -9.5 | 39.667 | 54 | -14.3333 | 74 | -34.333 |
| 3 | 23.935 | 42.37 | Pk | 33.4 | -24.1 | -9.5 | 42.167 | 54 | -11.833 | 74 | -31.833 |
| 4 | 21.017 | 44.27 | Pk | 32.4 | -25.5 | -9.5 | 41.667 | 54 | -12.333 | 74 | -32.333 |
| 5 | 21.077 | 43.2 | Pk | 32.6 | -25.3 | -9.5 | 41 | 54 | -13 | 74 | -33 |
| 6 | 25.087 | 42.67 | Pk | 34 | -24.5 | -9.5 | 42.667 | 54 | -11.333 | 74 | -31.333 |

Pk - Peak detector


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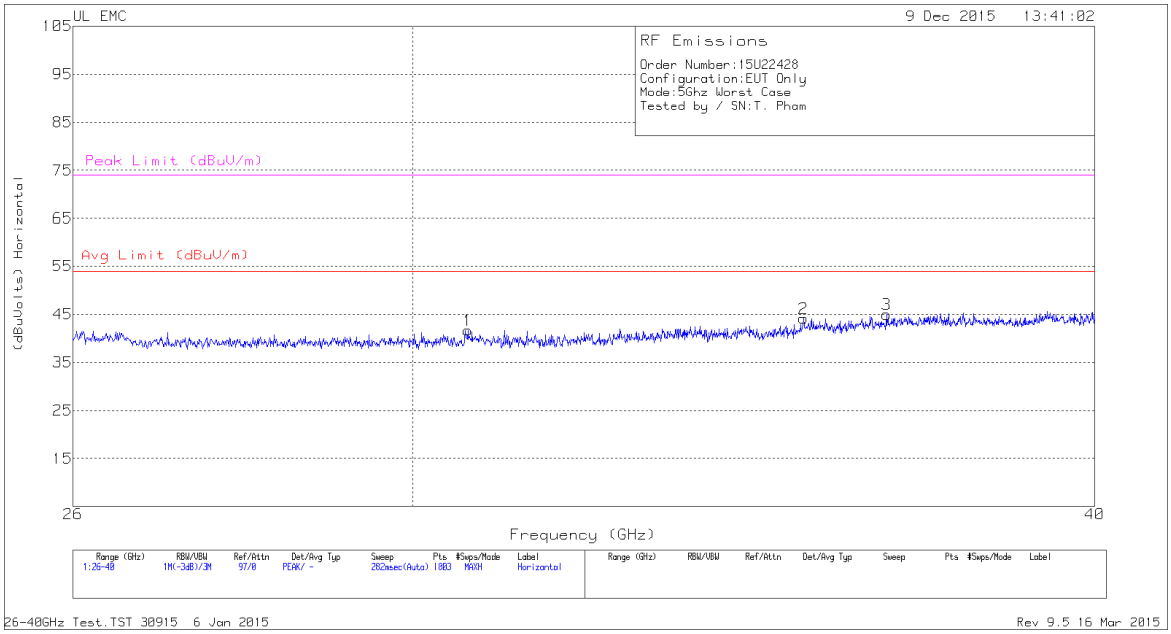
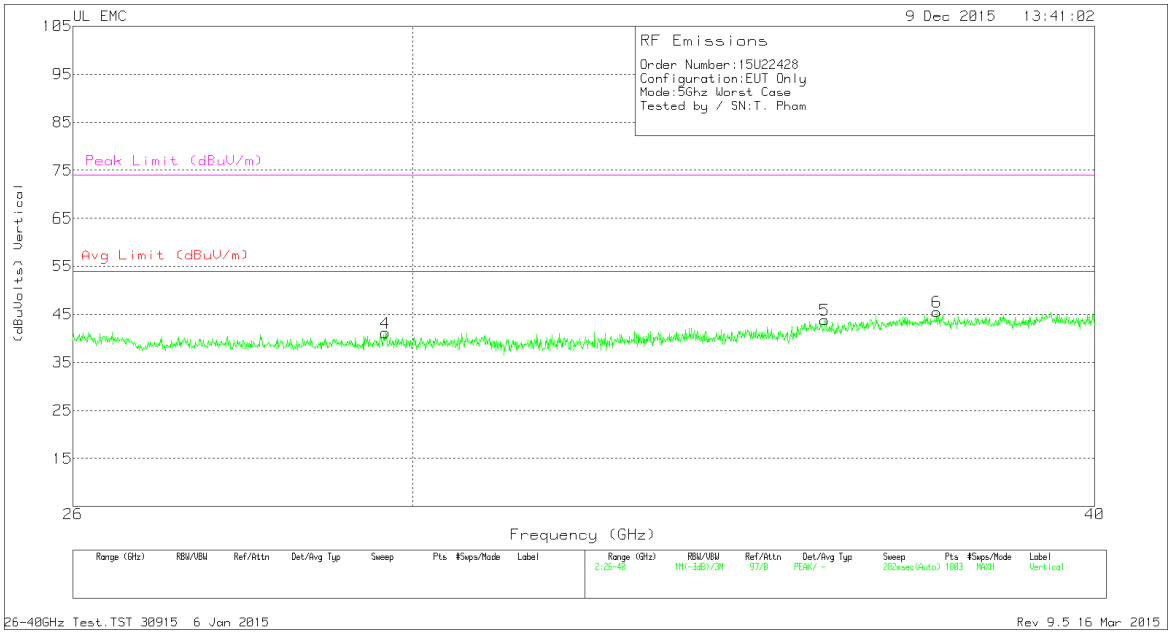
**SPURIOUS EMISSIONS 26000 TO 40000 MHz (WORST-CASE CONFIGURATION)**

HORIZONTAL PLOT




VERTICAL PLOT





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## HORIZONTAL AND VERTICAL DATA

| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | T90 AF (dB/m) | Amp/Cbl (dB) | Dist Corr (dB) | Corrected Reading (dBuVolts) | Avg Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | PK Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 30.708 | 47.67 | Pk | 36.1 | -32.6 | -9.5 | 41.667 | 54 | -12.333 | 74 | -32.333 |
| 2 | 35.377 | 49.27 | Pk | 37.8 | -33.4 | -9.5 | 44.167 | 54 | -9.833 | 74 | -29.833 |
| 3 | 36.636 | 50.5 | Pk | 37.1 | -33.1 | -9.5 | 45 | 54 | -9 | 74 | -29 |
| 4 | 29.659 | 46.97 | Pk | 36 | -32.3 | -9.5 | 41.167 | 54 | -12.833 | 74 | -32.833 |
| 5 | 35.696 | 49.23 | Pk | 37.4 | -33.3 | -9.5 | 43.833 | 54 | -10.167 | 74 | -30.167 |
| 6 | 37.421 | 50.8 | Pk | 37.3 | -33.1 | -9.5 | 45.5 | 54 | -8.5 | 74 | -28.5 |

Pk - Peak detector


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# 10. AC POWER LINE CONDUCTED EMISSIONS

**LIMITS**

FCC §15.207 (a)

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

*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 C63.10-2013

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**


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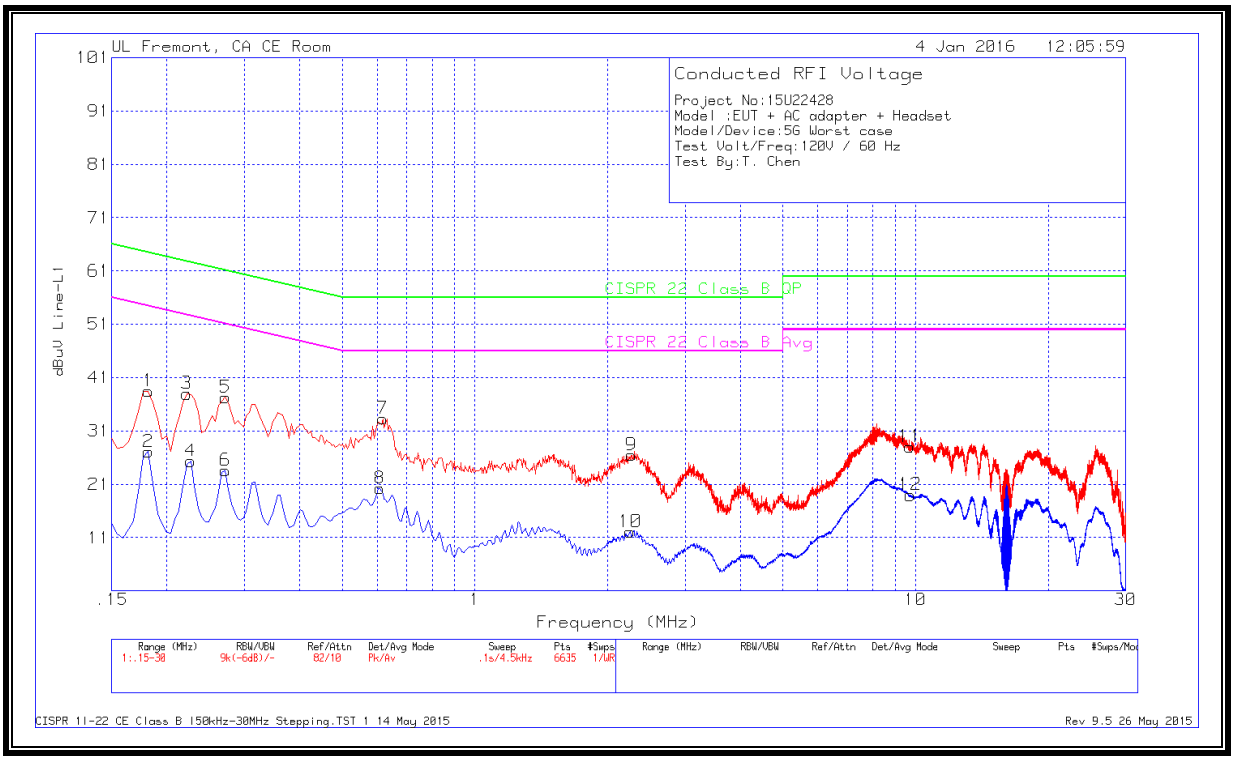
# 10.1. EUT POWERED BY AC ADAPTER

## LINE 1 RESULTS




## WORST EMISSIONS

| Range 1: Line-L1 .15 - 30MHz | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Marker | Frequency (MHz) | Meter Reading (dBuV) | Det | T24 IL L1 | LC Cables 1&3 | Corrected Reading dBuV | CISPR 22 Class B QP | Margin (dB) | CISPR 22 Class B Avg | Margin (dB) |
| 1 | .1815 | 37.37 | Pk | 1.1 | 0 | 38.47 | 64.42 | -25.95 | - | - |
| 2 | .1815 | 26 | Av | 1.1 | 0 | 27.1 | - | - | 54.42 | -27.32 |
| 3 | .222 | 37.16 | Pk | .8 | 0 | 37.96 | 62.74 | -24.78 | - | -- |
| 4 | .2265 | 24.53 | Av | .8 | 0 | 25.33 | - | - | 52.58 | -27.25 |
| 5 | .2715 | 36.7 | Pk | .6 | 0 | 37.3 | 61.07 | -23.77 | - | - |
| 6 | .2715 | 22.95 | Av | .6 | 0 | 23.55 | - | - | 51.07 | -27.52 |
| 7 | .618 | 32.97 | Pk | .3 | 0 | 33.27 | 56 | -22.73 | - | - |
| 8 | .609 | 19.93 | Av | .3 | 0 | 20.23 | - | - | 46 | -25.77 |
| 9 | 2.265 | 26.13 | Pk | .2 | .1 | 26.43 | 56 | -29.57 | - | - |
| 10 | 2.2515 | 11.77 | Av | .2 | .1 | 12.07 | - | - | 46 | -33.93 |
| 11 | 9.717 | 27.62 | Pk | .2 | .2 | 28.02 | 60 | -31.98 | - | - |
| 12 | 9.7305 | 18.57 | Av | .2 | .2 | 18.97 | - | - | 50 | -31.03 |

Pk - Peak detector
Av - Average detection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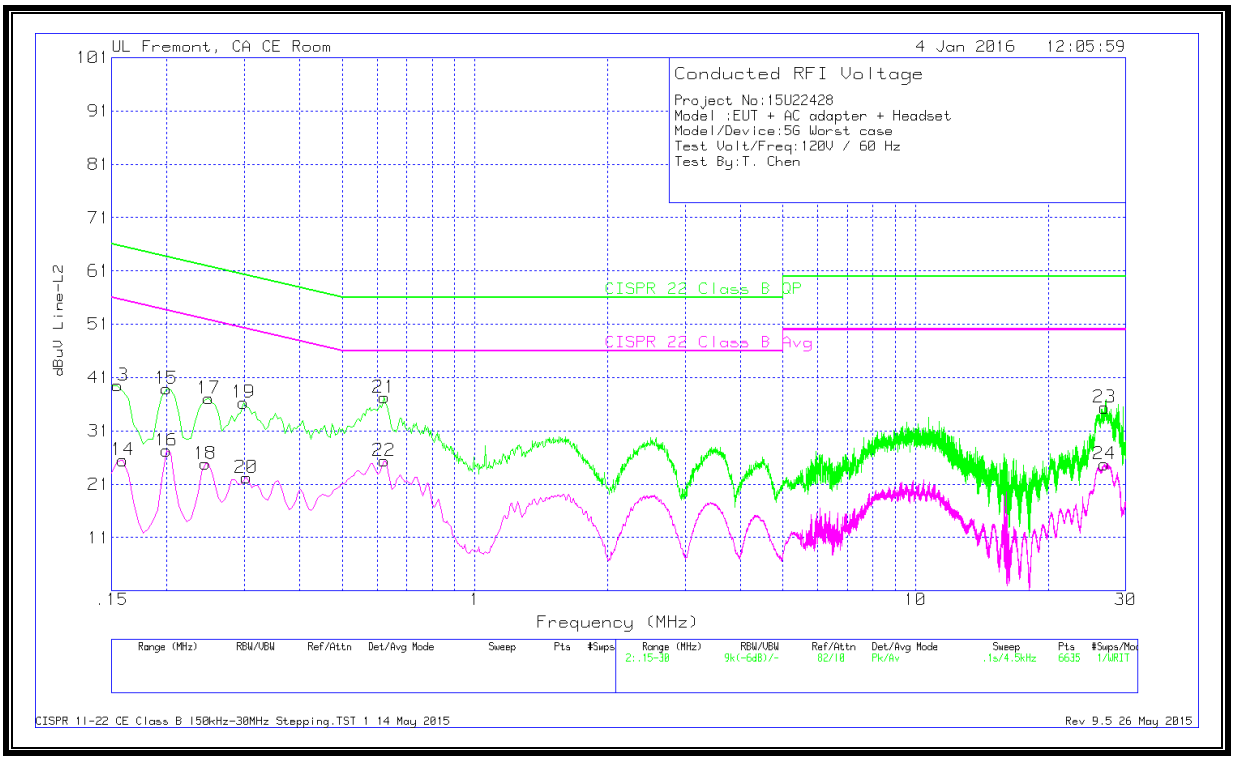
## LINE 2 RESULTS




## WORST EMISSIONS

| Range 2: Line-L2 .15 - 30MHz | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Marker | Frequency (MHz) | Meter Reading (dBuV) | Det | T24 IL L2 | LC Cables 2&3 | Corrected Reading dBuV | CISPR 22 Class B QP | Margin (dB) | CISPR 22 Class B Avg | Margin (dB) |
| 13 | .1545 | 38.1 | Pk | 1.4 | 0 | 39.5 | 65.75 | -26.25 | - | - |
| 14 | .159 | 24.1 | Av | 1.4 | 0 | 25.5 | - | - | 55.52 | -30.02 |
| 15 | .1995 | 37.93 | Pk | 1 | 0 | 38.93 | 63.63 | -24.7 | - | - |
| 16 | .1995 | 26.3 | Av | 1 | 0 | 27.3 | - | - | 53.63 | -26.33 |
| 17 | .249 | 36.37 | Pk | .7 | 0 | 37.07 | 61.79 | -24.72 | - | - |
| 18 | .2445 | 24.03 | Av | .8 | 0 | 24.83 | - | - | 51.94 | -27.11 |
| 19 | .2985 | 35.68 | Pk | .6 | 0 | 36.28 | 60.28 | -24 | - | - |
| 20 | .303 | 21.67 | Av | .6 | 0 | 22.27 | - | - | 50.16 | -27.89 |
| 21 | .6225 | 36.97 | Pk | .3 | 0 | 37.27 | 56 | -18.73 | - | - |
| 22 | .6225 | 25.11 | Av | .3 | 0 | 25.41 | - | - | 46 | -20.59 |
| 23 | 26.862 | 34.78 | Pk | .3 | .3 | 35.38 | 60 | -24.62 | - | - |
| 24 | 26.8215 | 24.13 | Av | .3 | .3 | 24.73 | - | - | 50 | -25.27 |

Pk - Peak detector
Av - Average detection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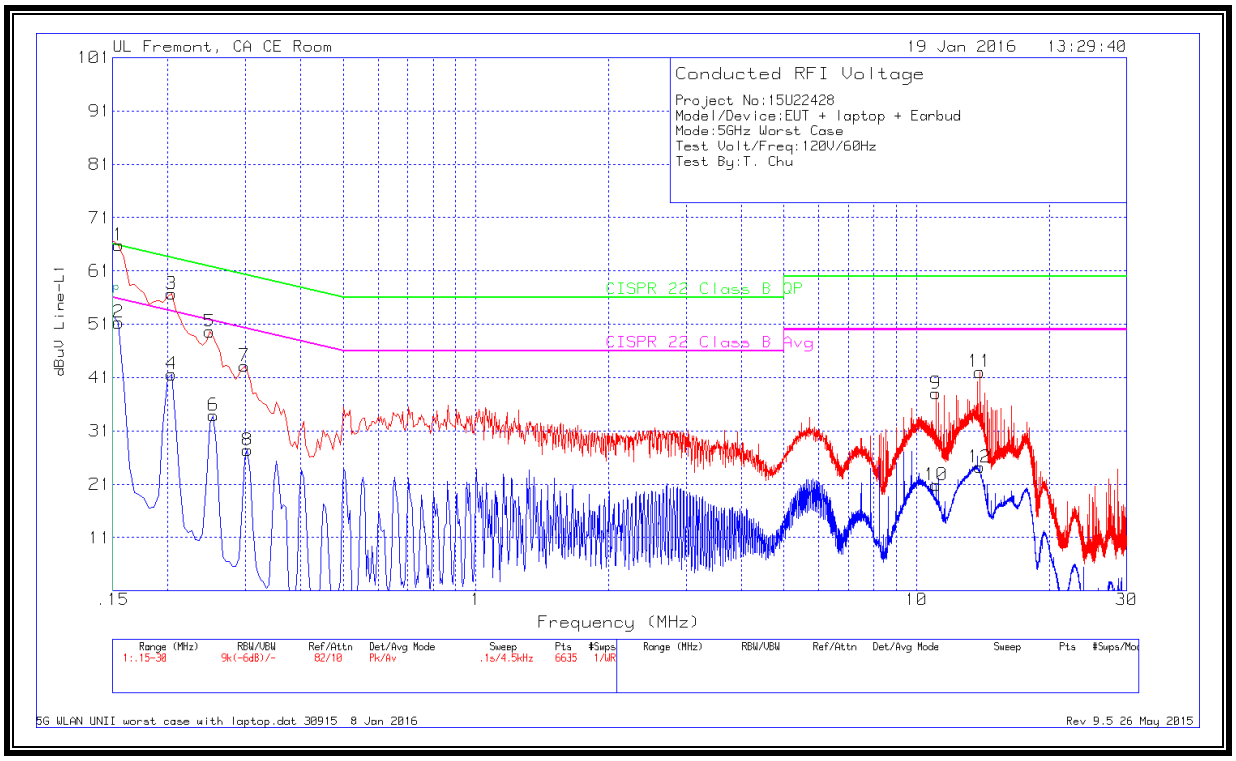
## 10.2. EUT POWERED BY HOST PC VIA USB CABLE

**LINE 1 RESULTS**




**WORST EMISSIONS**

| Range 1: Line-L1 .15 - 30MHz | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Marker | Frequency (MHz) | Meter Reading (dBuV) | Det | T1310 IL L1 | LC Cables 1&3 | Corrected Reading dBuV | CISPR 22 Class B QP | Margin (dB) | CISPR 22 Class B Avg | Margin (dB) |
| 1 | .15 | 56.9 | Qp | .1 | 0 | 57 | 66 | -9 | - | - |
| 2 | .1545 | 51.32 | Av | 0 | 0 | 51.32 | - | - | 55.75 | -4.43 |
| 3 | .204 | 56.72 | Pk | 0 | 0 | 56.72 | 63.45 | -6.73 | - | - |
| 4 | .204 | 41.59 | Av | 0 | 0 | 41.59 | - | - | 53.45 | -11.86 |
| 5 | .249 | 49.63 | Pk | 0 | 0 | 49.63 | 61.79 | -12.16 | - | - |
| 6 | .2535 | 33.91 | Av | 0 | 0 | 33.91 | - | - | 51.64 | -17.73 |
| 7 | .2985 | 43.18 | Pk | 0 | 0 | 43.18 | 60.28 | -17.1 | - | - |
| 8 | .303 | 27.39 | Av | 0 | 0 | 27.39 | - | - | 50.16 | -22.77 |
| 9 | 11.0805 | 37.83 | Pk | 0 | .2 | 38.03 | 60 | -21.97 | - | - |
| 10 | 11.0805 | 20.62 | Av | 0 | .2 | 20.82 | - | - | 50 | -29.18 |
| 11 | 13.92 | 41.76 | Pk | .1 | .2 | 42.06 | 60 | -17.94 | - | - |
| 12 | 13.92 | 23.91 | Av | .1 | .2 | 24.21 | - | - | 50 | -25.79 |

Pk - Peak detector
Av - Average detection
Qp - Quasi-Peak detector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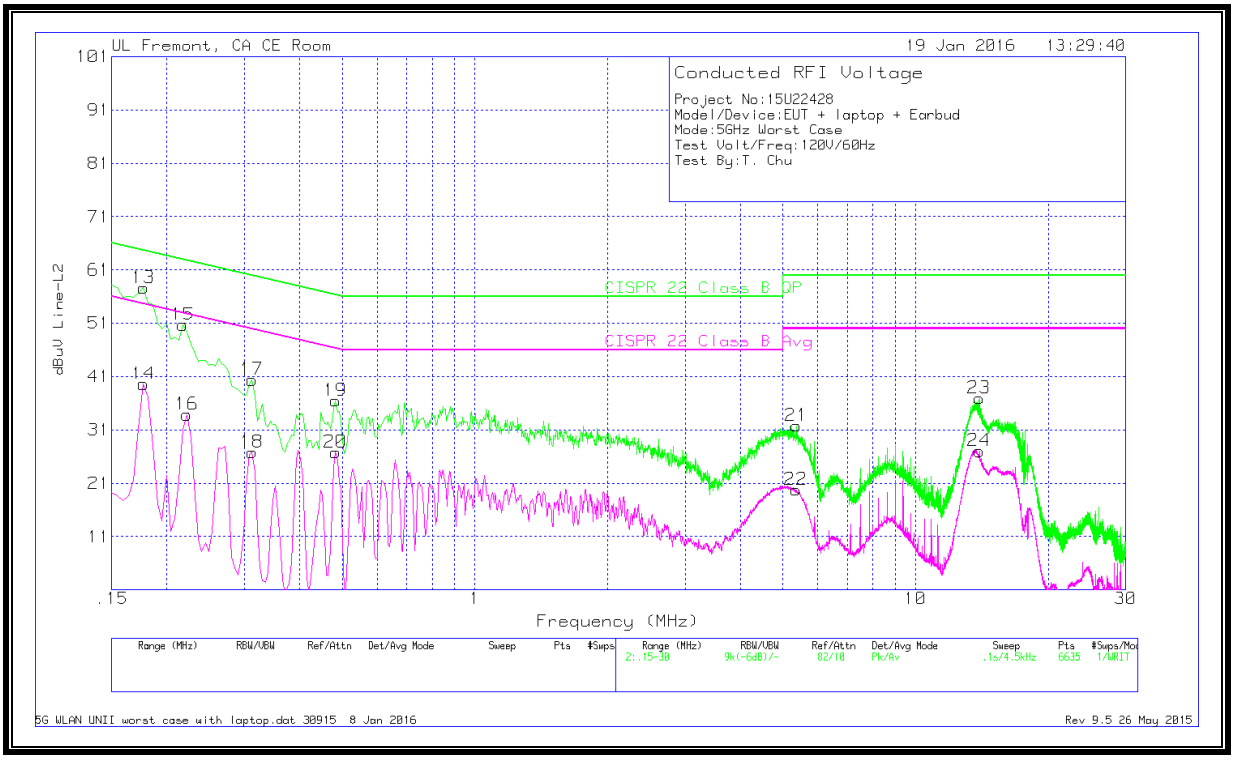
## LINE 2 RESULTS




## WORST EMISSIONS

| Range 2: Line-L2 .15 - 30MHz | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Marker | Frequency (MHz) | Meter Reading (dBuV) | Det | T1310 IL L2 | LC Cables 2&3 | Corrected Reading dBuV | CISPR 22 Class B QP | Margin (dB) | CISPR 22 Class B Avg | Margin (dB) |
| 13 | .177 | 57.63 | Pk | 0 | 0 | 57.63 | 64.63 | -7 | - | - |
| 14 | .177 | 39.61 | Av | 0 | 0 | 39.61 | - | - | 54.63 | -15.02 |
| 15 | .2175 | 50.7 | Pk | 0 | 0 | 50.7 | 62.91 | -12.21 | - | - |
| 16 | .222 | 33.85 | Av | 0 | 0 | 33.85 | - | - | 52.74 | -18.89 |
| 17 | .312 | 40.38 | Pk | 0 | 0 | 40.38 | 59.92 | -19.54 | - | - |
| 18 | .312 | 26.81 | Av | 0 | 0 | 26.81 | - | - | 49.92 | -23.11 |
| 19 | .483 | 36.46 | Pk | 0 | 0 | 36.46 | 56.29 | -19.83 | - | - |
| 20 | .483 | 26.81 | Av | 0 | 0 | 26.81 | - | - | 46.29 | -19.48 |
| 21 | 5.37 | 31.65 | Pk | 0 | .1 | 31.75 | 60 | -28.25 | - | - |
| 22 | 5.3565 | 19.68 | Av | 0 | .1 | 19.78 | - | - | 50 | -30.22 |
| 23 | 13.956 | 36.65 | Pk | .1 | .2 | 36.95 | 60 | -23.05 | - | - |
| 24 | 13.956 | 26.72 | Av | .1 | .2 | 27.02 | - | - | 50 | -22.98 |

Pk - Peak detector
Av - Average detection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# 11. DYNAMIC FREQUENCY SELECTION

## 11.1. OVERVIEW

### 11.1.1. LIMITS

**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”.


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**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) |
|---|---|---|
| *U-NII Detection Bandwidth and Statistical Performance Check* | All BW modes must be tested | Not required |
| *Channel Move Time and Channel Closing Transmission Time* | Test using widest BW mode available | Test using the widest BW mode available for the link |
| *All other tests* | Any single BW mode | Not required |
| **Note:** 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. | | |


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

| Maximum Transmit Power | Value (see notes) |
|---|---|
| E.I.R.P. ≥ 200 milliwatt | -64 dBm |
| E.I.R.P. < 200 milliwatt and power spectral density < 10 dBm/MHz | -62 dBm |
| E.I.R.P. < 200 milliwatt that do not meet power spectral density requirement | -64 dBm |

**Note 1:** This is the level at the input of the receiver assuming a 0 dBi receive antenna
**Note 2:** 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.
**Note 3:** E.I.R.P. is based on the highest antenna gain. For MIMO devices refer to KDB publication 662911 D01.

**Table 4: DFS Response requirement values**

| Parameter | Value |
|---|---|
| *Non-occupancy period* | 30 minutes |
| *Channel Availability Check Time* | 60 seconds |
| *Channel Move Time* | 10 seconds (See Note 1) |
| *Channel Closing Transmission Time* | 200 milliseconds + approx. 60 milliseconds over remaining 10 second period. (See Notes 1 and 2) |
| *U-NII Detection Bandwidth* | Minimum 100% of the U-NII 99% transmission power bandwidth. (See Note 3) |

**Note 1:** *Channel Move Time* and the *Channel Closing Transmission Time* should be performed with Radar Type 0. The measurement timing begins at the end of the Radar Type 0 burst.
**Note 2:** The *Channel Closing Transmission Time* is comprised of 200 milliseconds starting at the beginning of the *Channel Move Time* plus any additional intermittent control signals required to facilitate a *Channel* 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.
**Note 3:** During the *U-NII Detection Bandwidth* 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.


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**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: {(1/360) x (19 x $10^6$ $PRI_{usec}$)} | 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 |

**Note 1:** Short Pulse Radar Type 0 should be used for the *Detection Bandwidth* test, *Channel Move Time*, and *Channel Closing Time* 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 |


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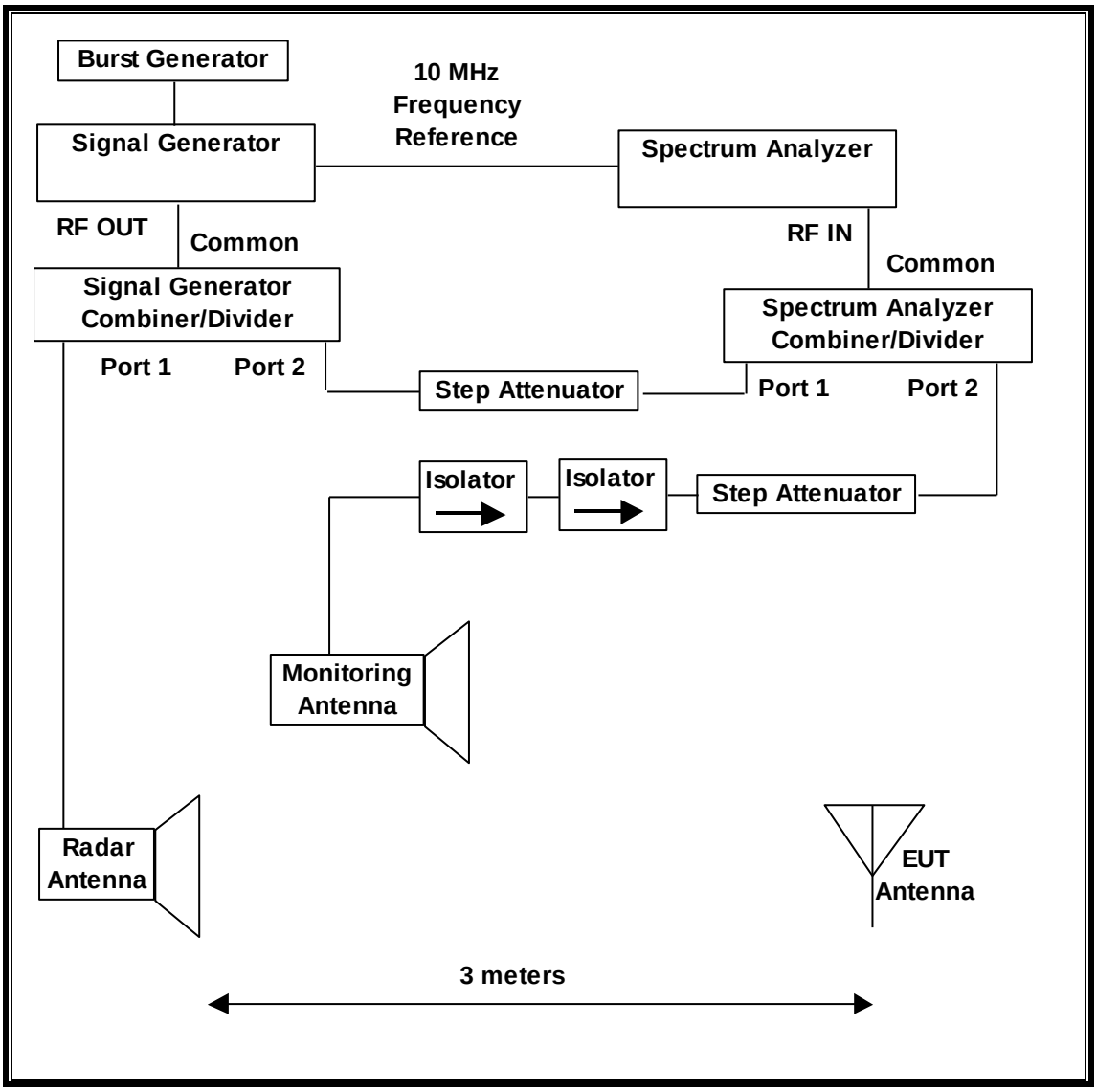
### 11.1.1. TEST AND MEASUREMENT SYSTEM

**RADIATED METHOD SYSTEM BLOCK DIAGRAM**





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**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 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.


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## 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, PXA, 3Hz to 44GHz | Keysight | N9030A | US51350187 | 06/01/16 |
| Signal Generator, MXG X-Series RF Vector | Agilent | N5172B | MY51350337 | 02/17/16 |


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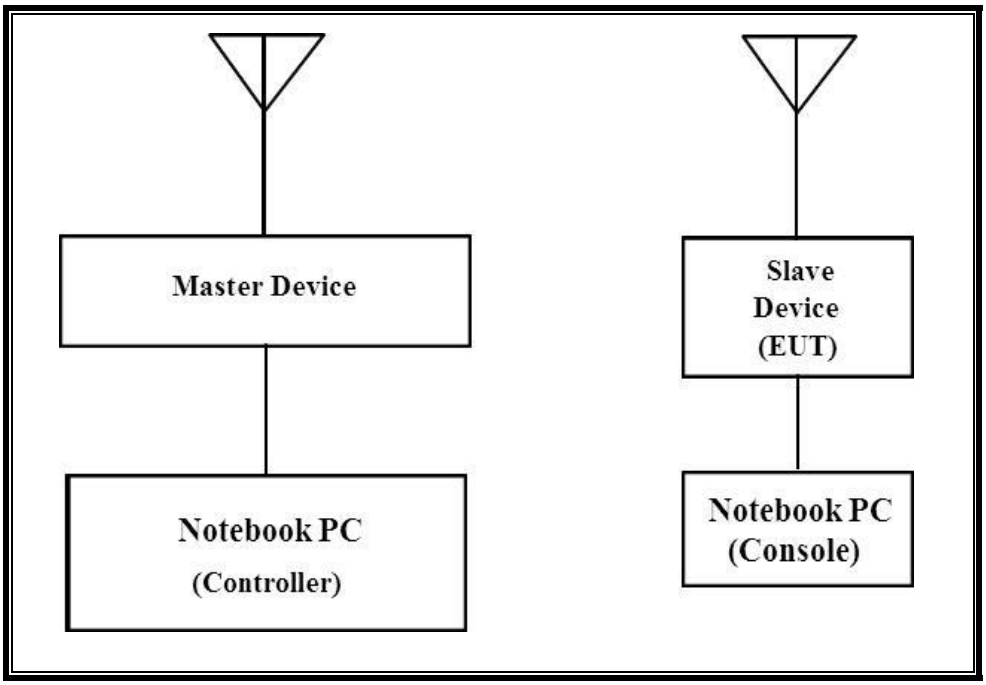
### 11.1.2. SETUP OF EUT (CLIENT MODE)

**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** |
| 3X3 mimo Base Station (Master Device) | Apple | A1521 | C86LCE5GFJ1R | BCGA1470 |
| Notebook PC (Controller) | Apple | A1278 | C02HJ0A7DTY4 | DoC |
| Notebook PC (Console) | Apple | A1502 | C02LRLKYFH00 | DoC |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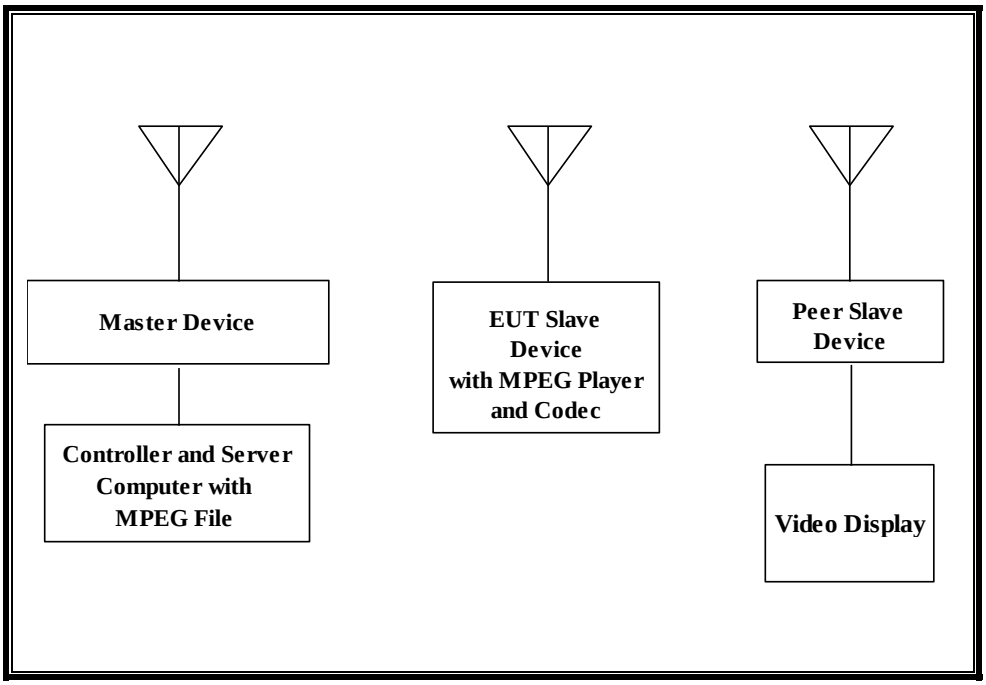
### 11.1.3. SETUP OF EUT (CLIENT-TO-CLIENT COMMUNICATIONS MODE)

**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** |
| 3x3 MIMO Base Station (Master Device) | Apple | A1521 | C86LCE5GFJ1R | BCGA1470 |
| Notebook PC (Controller/Server) | Apple | A1278 | C02HJ0A7DTY4 | DoC |
| AC Adapter (Controller/Server PC) | Dongguan Samsung Electro Mechanics | A1344 | RR008012YAL3A | DoC |
| Apple TV (Peer Slave Device) | Apple | A1469 | C07K202CFFF1 | BCGA1469 |
| Video Display | Polaroid | TLX-01511C | 02006 | DoC |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### 11.1.4. DESCRIPTION OF EUT

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

For IC the EUT operates over the 5250-5350 MHz and 5470-5725 MHz ranges, excluding the 5600-5650 MHz range.

The EUT is a Slave Device without Radar Detection.

The highest power level within these bands is 22.58 dBm EIRP in the 5250-5350 MHz band and 22.73 dBm EIRP in the 5470-5725 MHz band.

The highest gain antenna assembly utilized with the EUT has a gain of 3.02 dBi in the 5250-5350 MHz band and 4.03 dBi in the 5470-5725 MHz band. The lowest gain antenna assembly utilized with the EUT has a gain of 2.23 dBi in the 5250-5350 MHz band and 2.83 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 chain connected to an antenna to perform radiated tests.

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

In Client to Client Communications Mode, WLAN traffic is generated by streaming the video file TestFile.mp2 “6 ½ Magic Hours” from the Master to the Slave in full motion video mode using OPlayer HD Lite media player.

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

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

In Client-to-Client Communications Mode the EUT utilizes the 802.11ac architecture between the EUT and the Master Device where three nominal channel bandwidths are implemented: 20 MHz, 40 MHz and 80 MHz. However, 802.11a/n architecture is utilized between the EUT and the Peer Slave Device in Client-to Client Communications Mode where only two nominal channel bandwidths are implemented: 20 MHz and 40 MHz. .

The software installed in the EUT is 13E146.


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**UNIFORM CHANNEL SPREADING**

This requirement is not applicable to Slave Devices.

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

The Master Device is an Apple, Inc. Access Point, FCC ID: BCGA1470. The minimum antenna gain for the Master Device is 1.4 dBi.

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 software installed in the access point is 7.7 D2.dev.


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## 11.2. CLIENT MODE RESULTS FOR 20 MHz BANDWIDTH

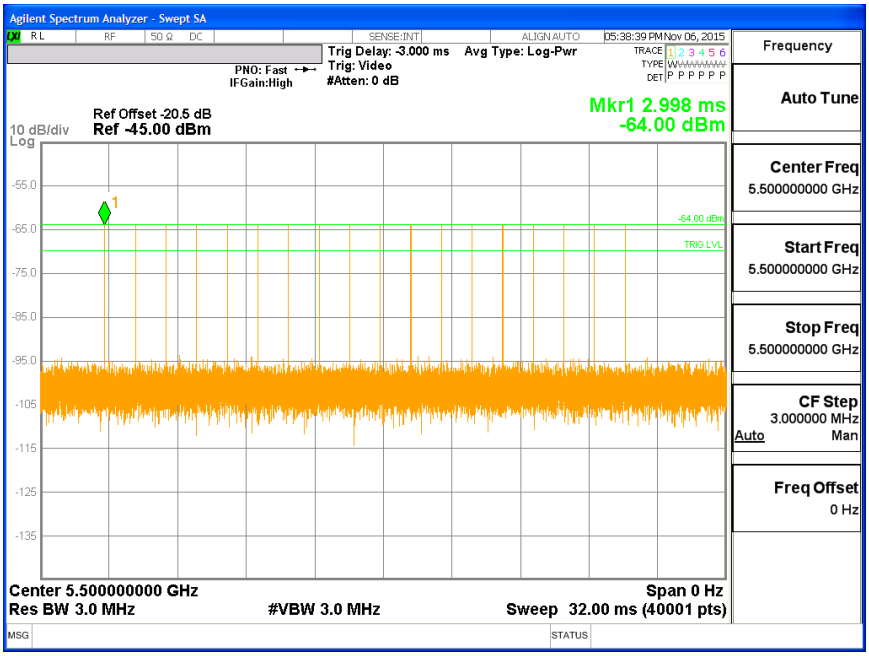
### 11.2.1. TEST CHANNEL

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

### 11.2.2. RADAR WAVEFORM AND TRAFFIC

**RADAR WAVEFORM**

SHORT PULSE RADAR TYPE 0 AT MASTER





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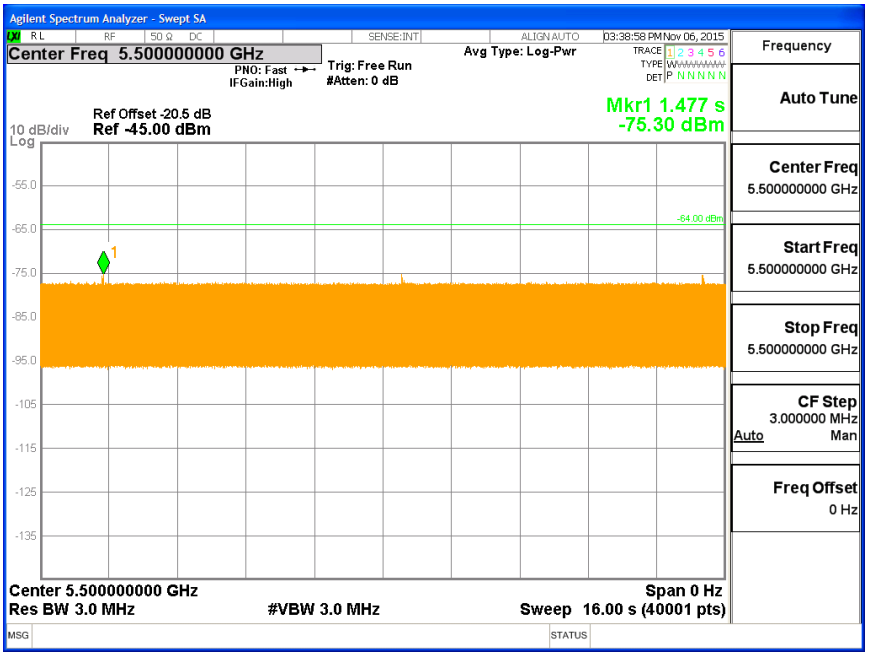
**TRAFFIC**

SLAVE TRAFFIC





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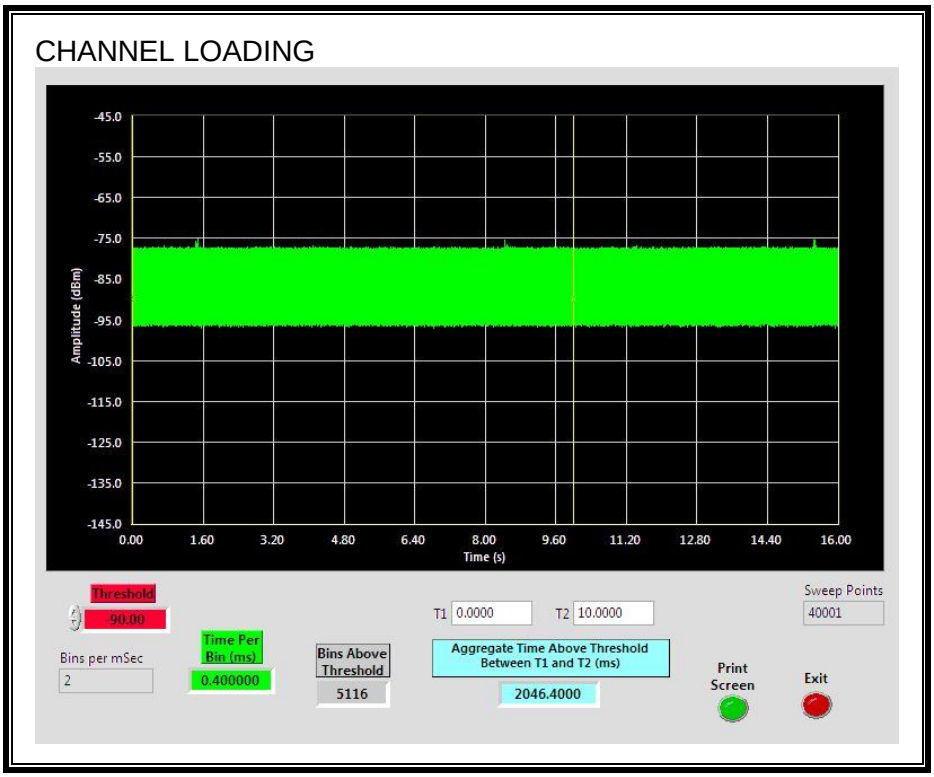
**CHANNEL LOADING**




The level of traffic loading on the channel by the EUT is 20.46%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### 11.2.3. OVERLAPPING CHANNEL TESTS

**RESULTS**

These tests are not applicable.

### 11.2.4. 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**

| Channel Move Time (sec) | Limit (sec) |
|---|---|
| 0.1324 | 10 |

| Aggregate Channel Closing Transmission Time (msec) | Limit (msec) |
|---|---|
| 0.0 | 60 |


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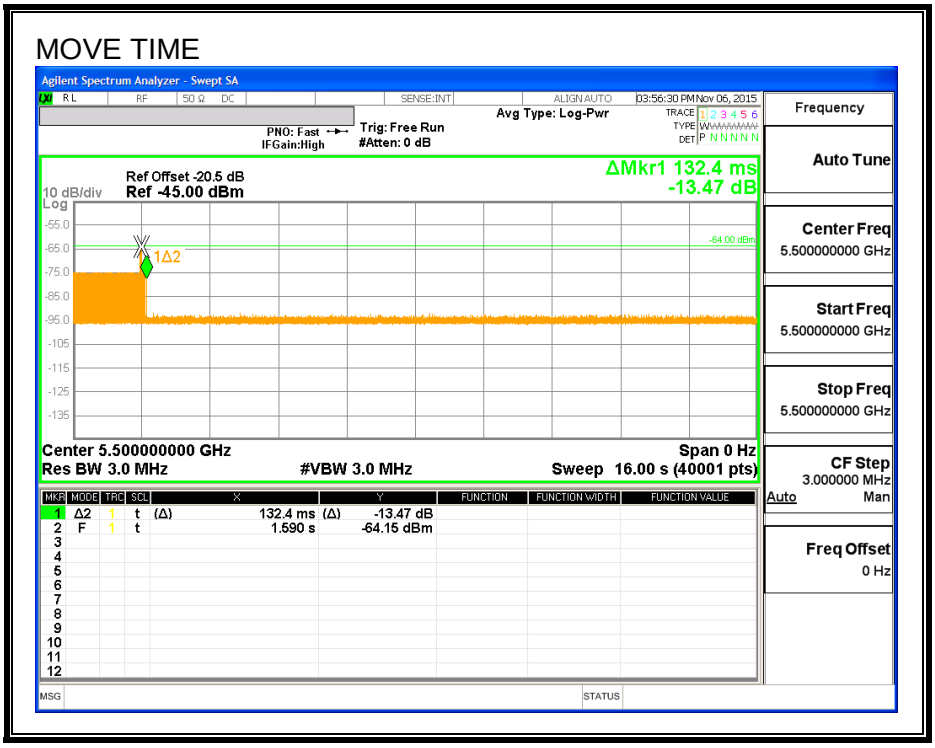
**MOVE TIME**





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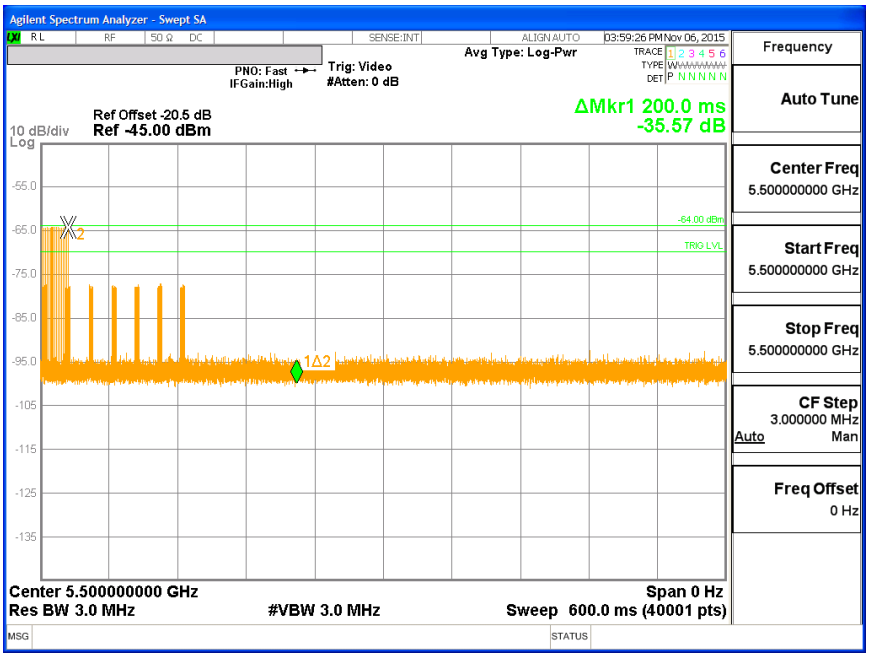
**CHANNEL CLOSING TIME**

CLOSING TIME





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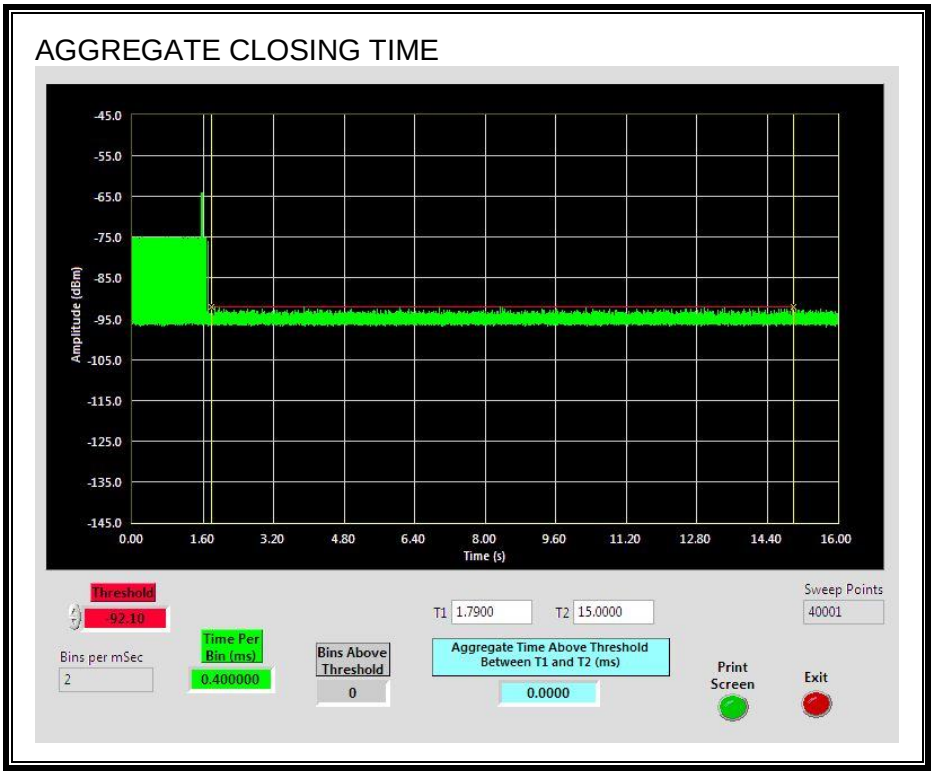
**AGGREGATE CHANNEL CLOSING TRANSMISSION TIME**

No transmissions are observed during the aggregate monitoring period.





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## 11.3. CLIENT MODE RESULTS FOR 40 MHz BANDWIDTH

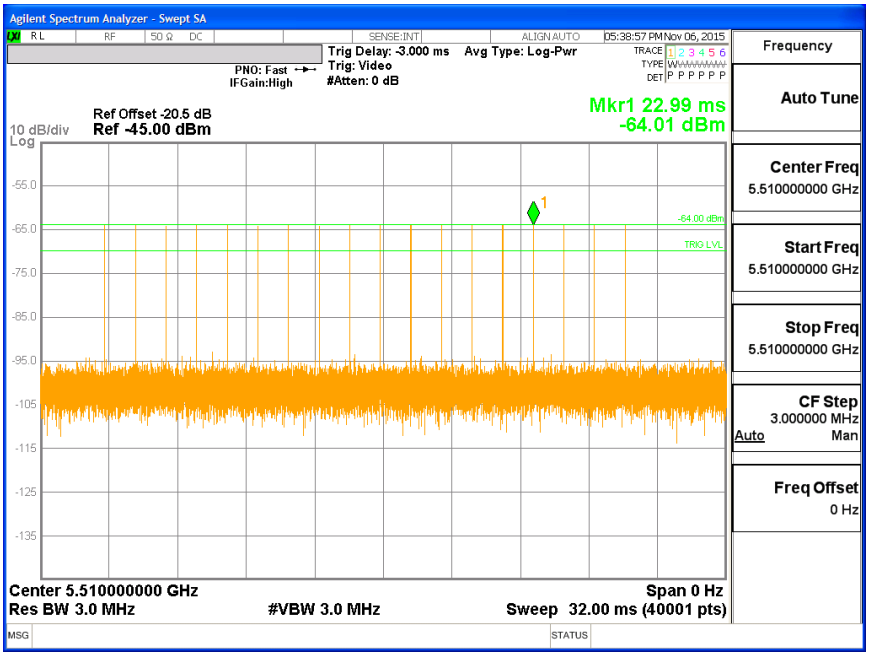
### 11.3.1. TEST CHANNEL

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

### 11.3.2. RADAR WAVEFORM AND TRAFFIC

**RADAR WAVEFORM**

SHORT PULSE RADAR TYPE 0 AT MASTER





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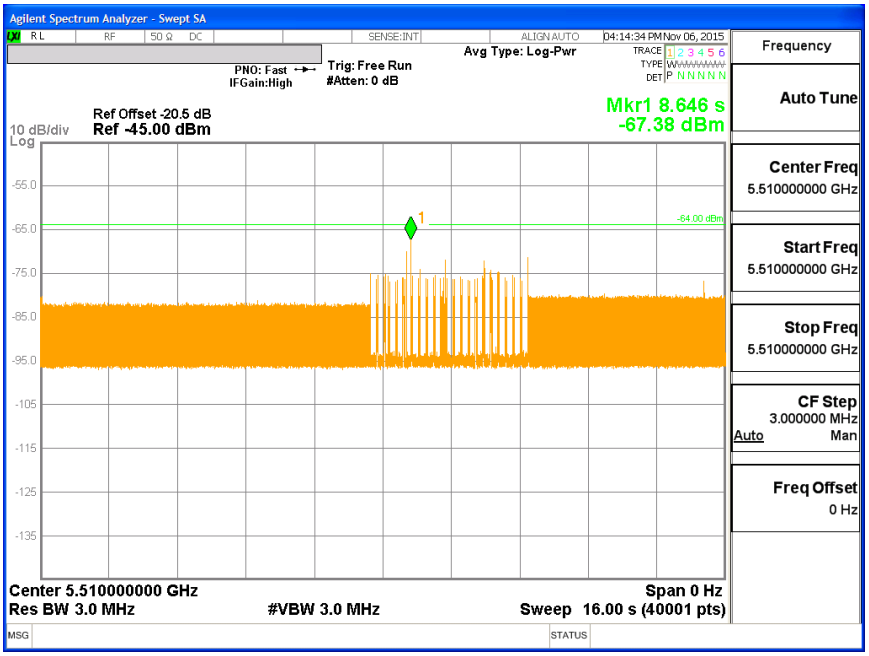
**TRAFFIC**

SLAVE TRAFFIC





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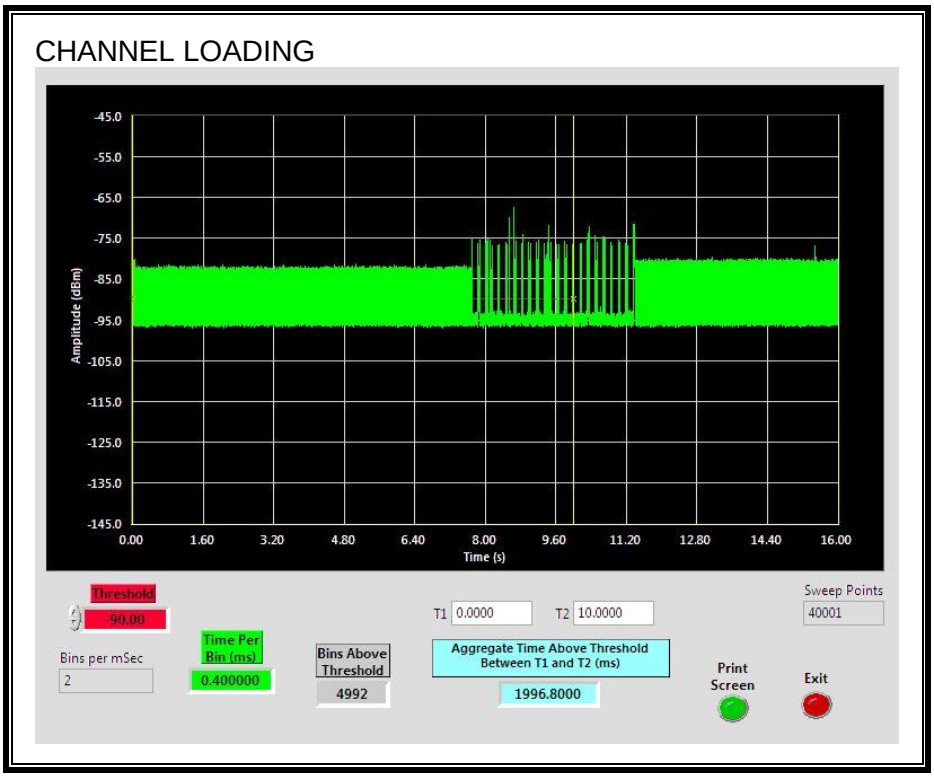
**CHANNEL LOADING**




The level of traffic loading on the channel by the EUT is 19.968%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### 11.3.3. OVERLAPPING CHANNEL TESTS

**RESULTS**

These tests are not applicable.

### 11.3.4. 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**

| Channel Move Time (sec) | Limit (sec) |
|---|---|
| 0.115 | 10 |

| Aggregate Channel Closing Transmission Time (msec) | Limit (msec) |
|---|---|
| 0.0 | 60 |


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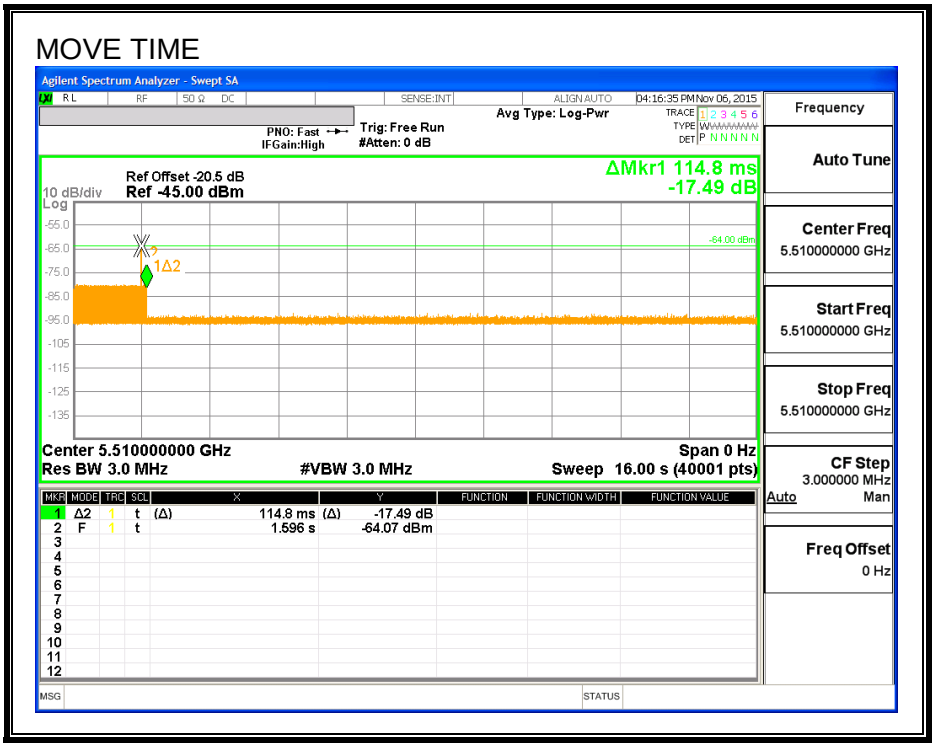
**MOVE TIME**





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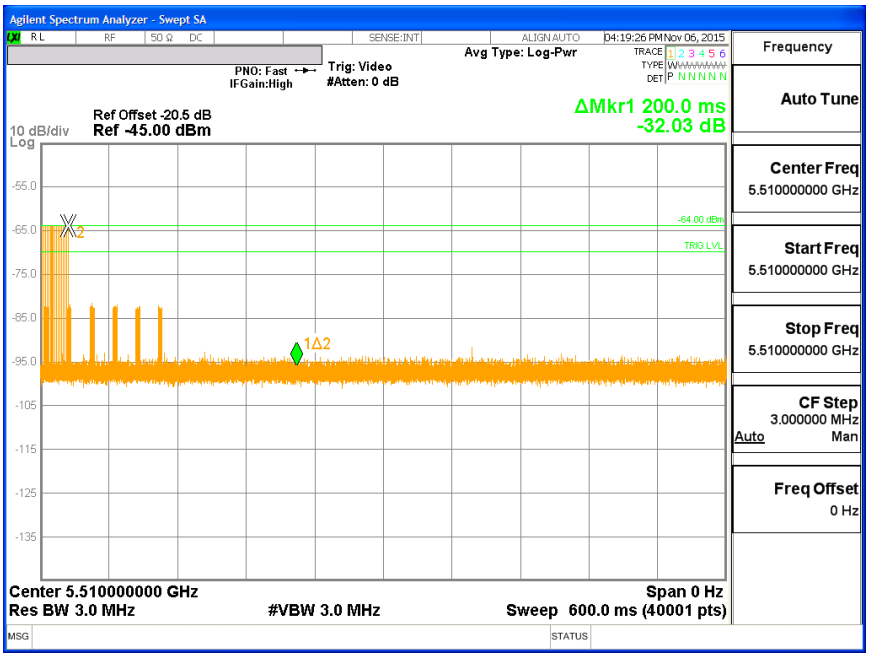
**CHANNEL CLOSING TIME**

CLOSING TIME





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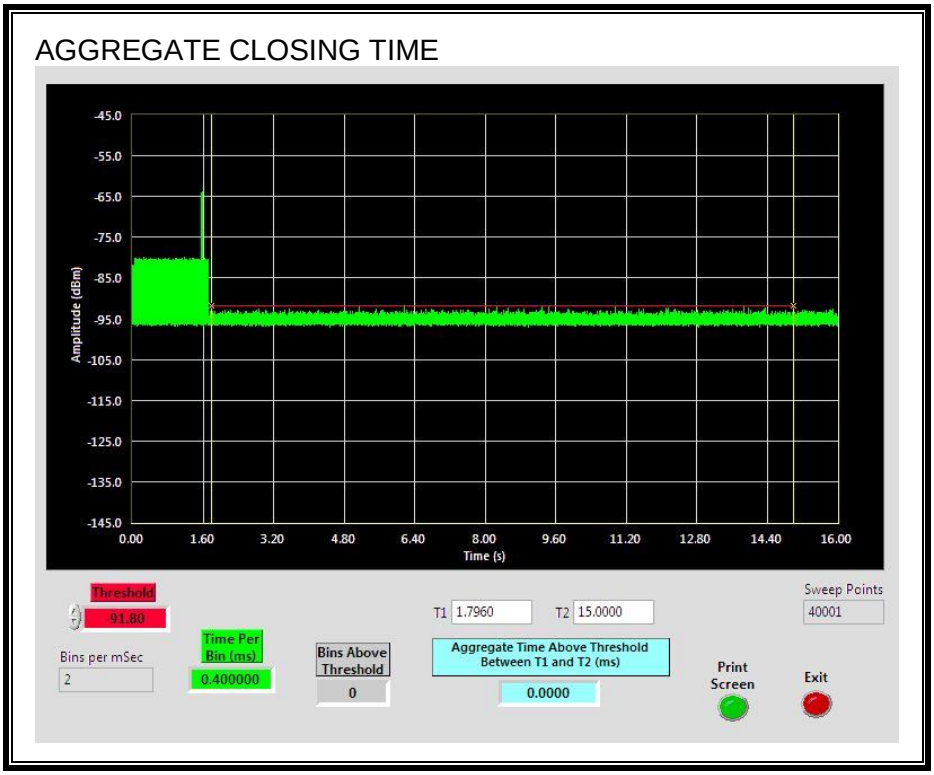
**AGGREGATE CHANNEL CLOSING TRANSMISSION TIME**

No transmissions are observed during the aggregate monitoring period.





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## 11.4. CLIENT MODE RESULTS FOR 80 MHz BANDWIDTH

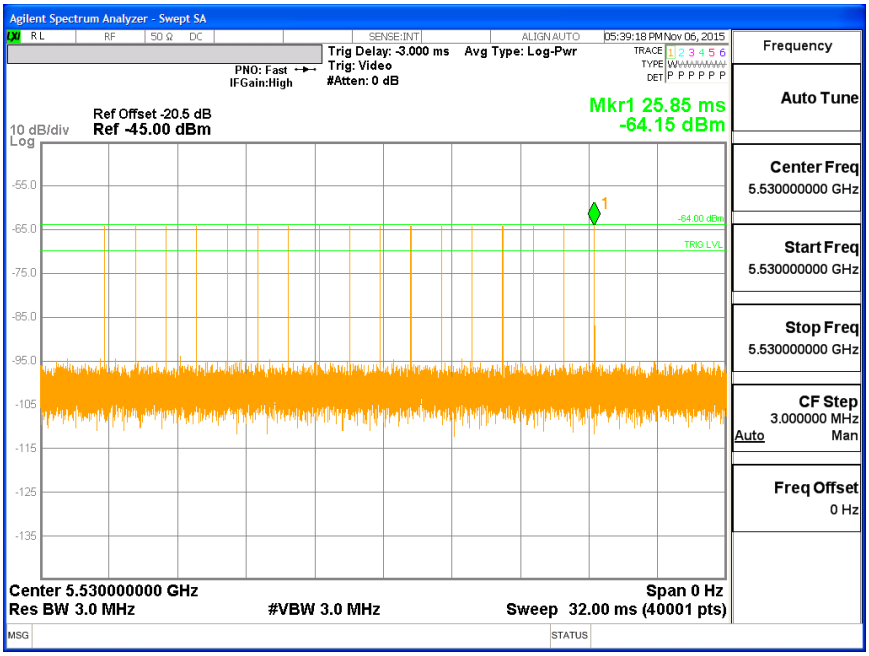
### 11.4.1. TEST CHANNEL

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

### 11.4.2. RADAR WAVEFORM AND TRAFFIC

**RADAR WAVEFORM**

SHORT PULSE RADAR TYPE 0 AT MASTER





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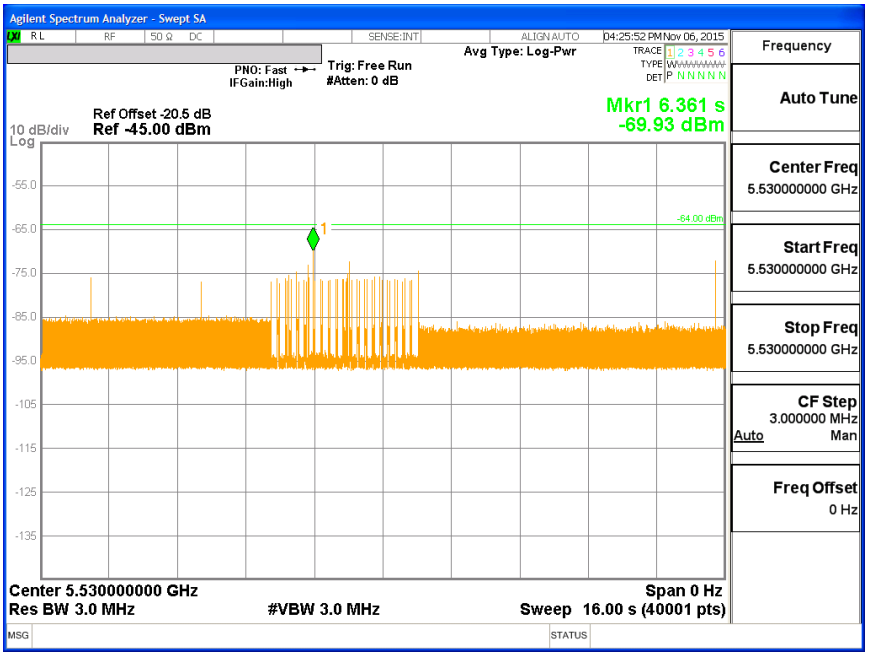
**TRAFFIC**

SLAVE TRAFFIC





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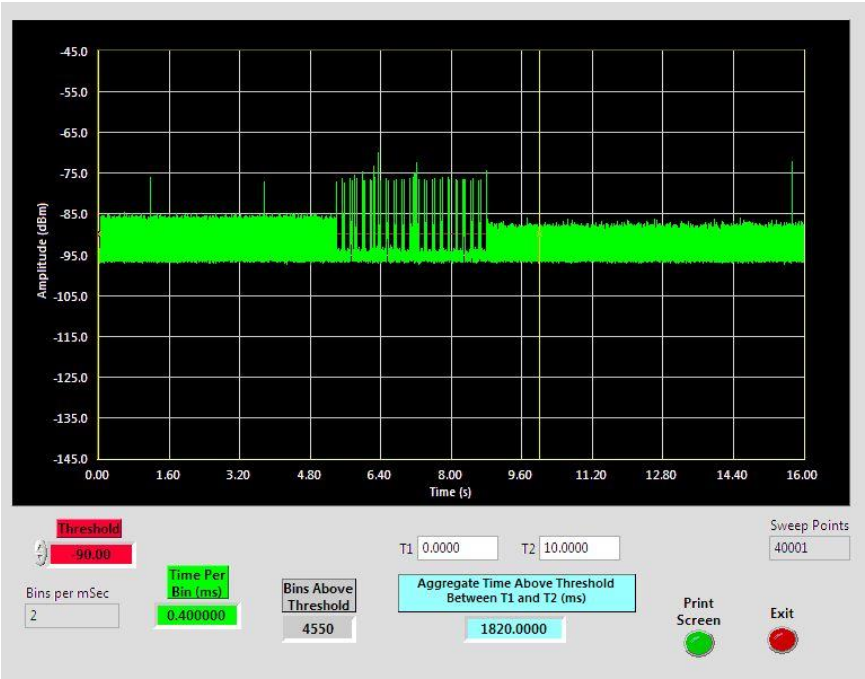
**CHANNEL LOADING**

CHANNEL LOADING




The level of traffic loading on the channel by the EUT is 18.2%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### 11.4.3. OVERLAPPING CHANNEL TESTS

**RESULTS**

These tests are not applicable.

### 11.4.4. 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**

| Channel Move Time (sec) | Limit (sec) |
|---|---|
| 0.137 | 10 |

| Aggregate Channel Closing Transmission Time (msec) | Limit (msec) |
|---|---|
| 0.0 | 60 |


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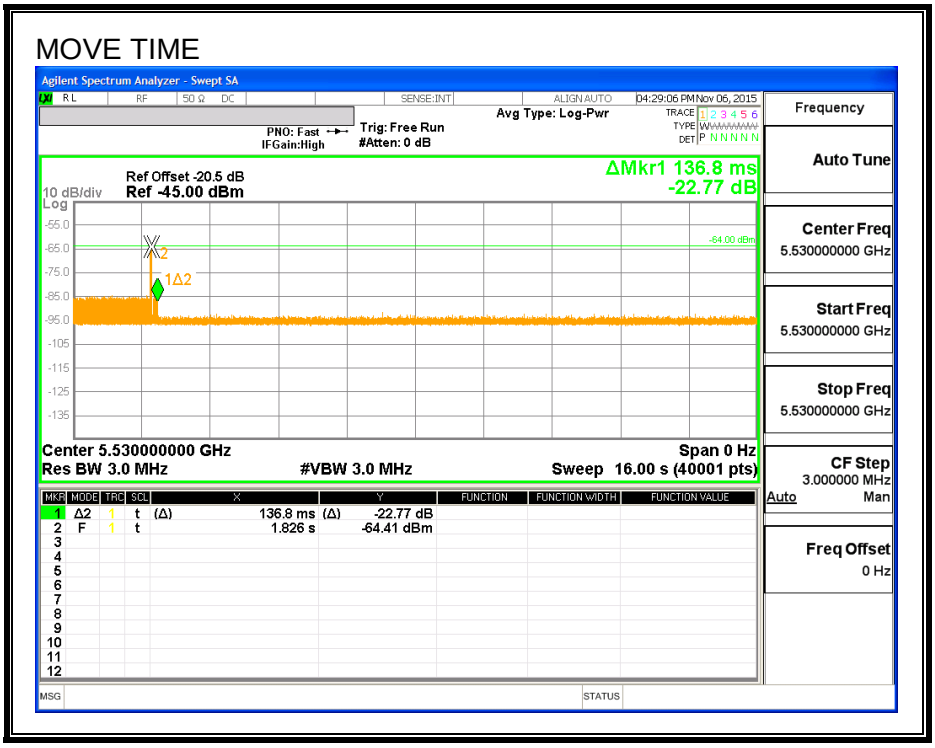
**MOVE TIME**





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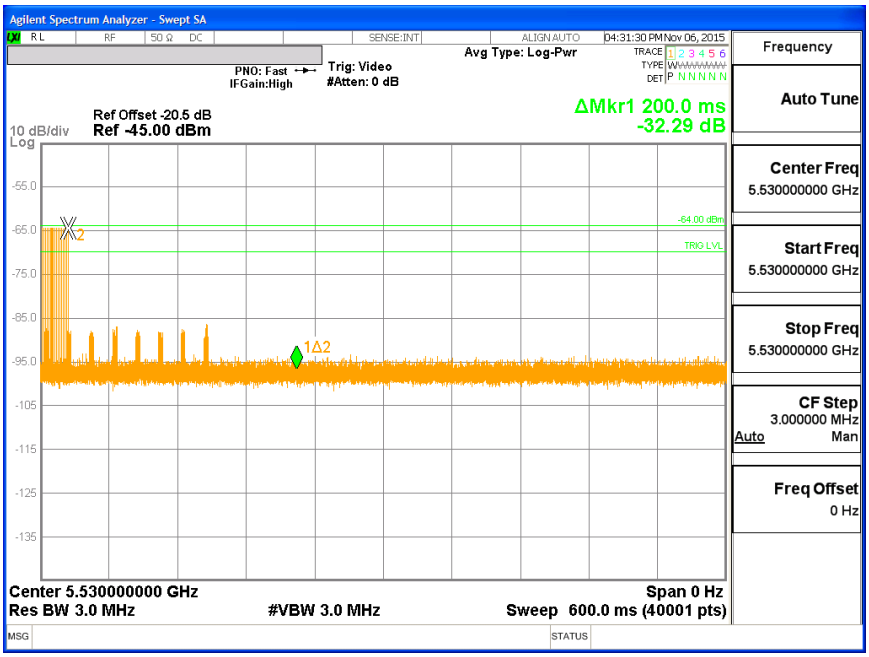
**CHANNEL CLOSING TIME**

CLOSING TIME





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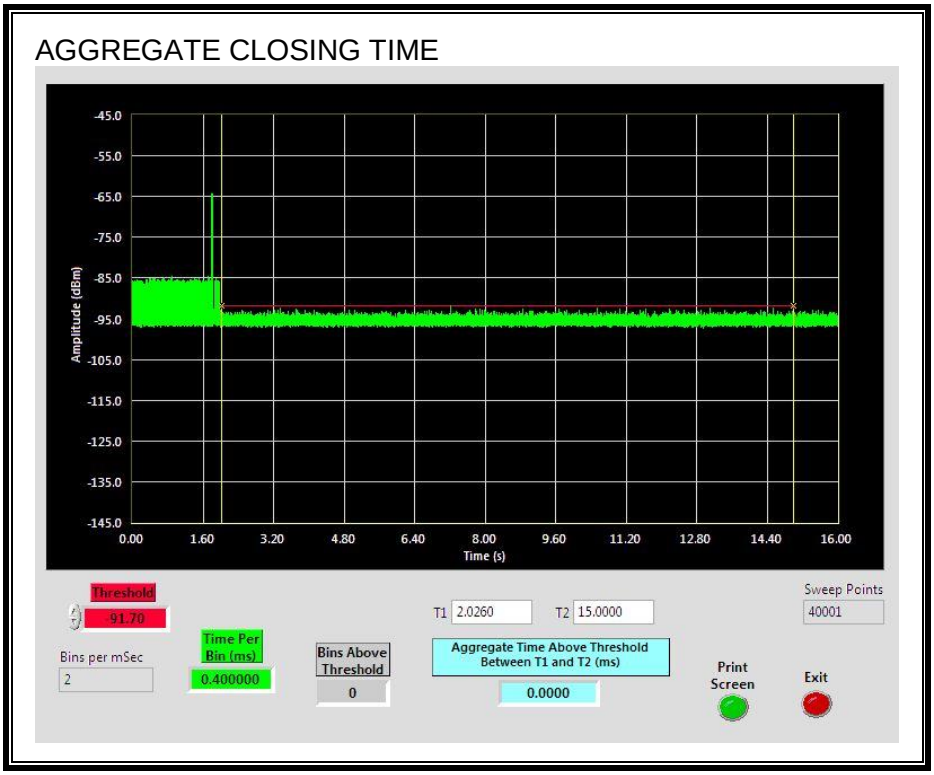
**AGGREGATE CHANNEL CLOSING TRANSMISSION TIME**

No transmissions are observed during the aggregate monitoring period.





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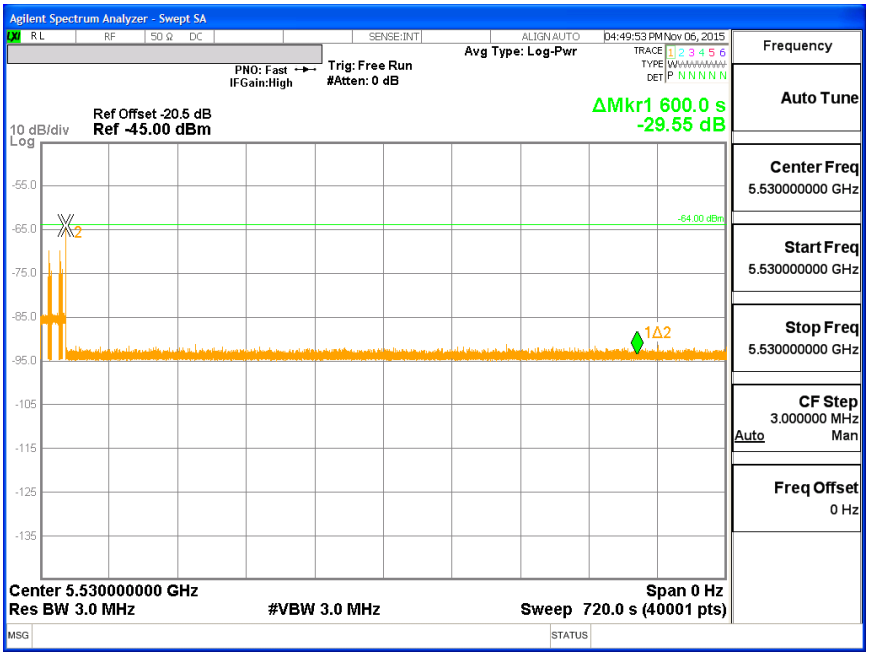
### 11.4.5. 10-MINUTE CLIENT Tx MONITORING PERIOD

**RESULTS**

No EUT transmissions were observed on the test channel during the 10-minute observation time.

10-MINUTE CLIENT Tx MONITORING PERIOD





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# 11.5. CLIENT-TO-CLIENT COMMUNICATIONS MODE RESULTS FOR 20 MHz BANDWIDTH

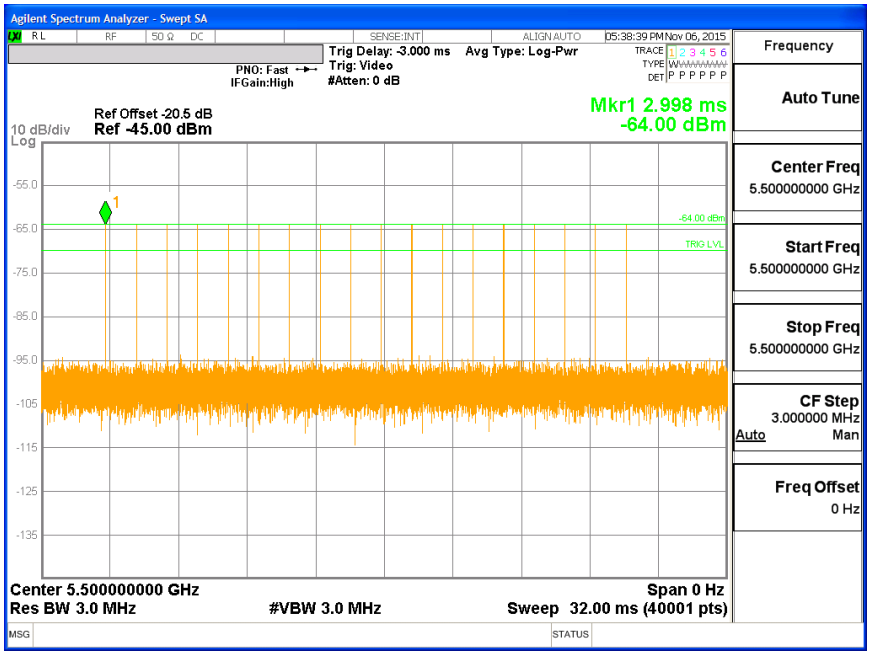
## 11.5.1. TEST CHANNEL

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

## 11.5.2. RADAR WAVEFORM AND TRAFFIC

**RADAR WAVEFORM**

SHORT PULSE RADAR TYPE 0 AT MASTER





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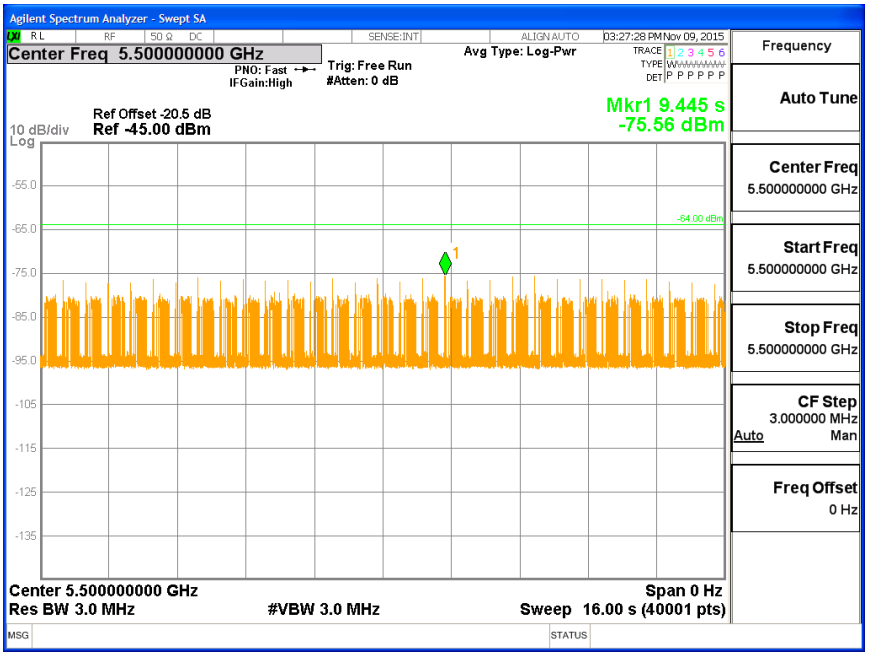
**TRAFFIC**

SLAVE TRAFFIC





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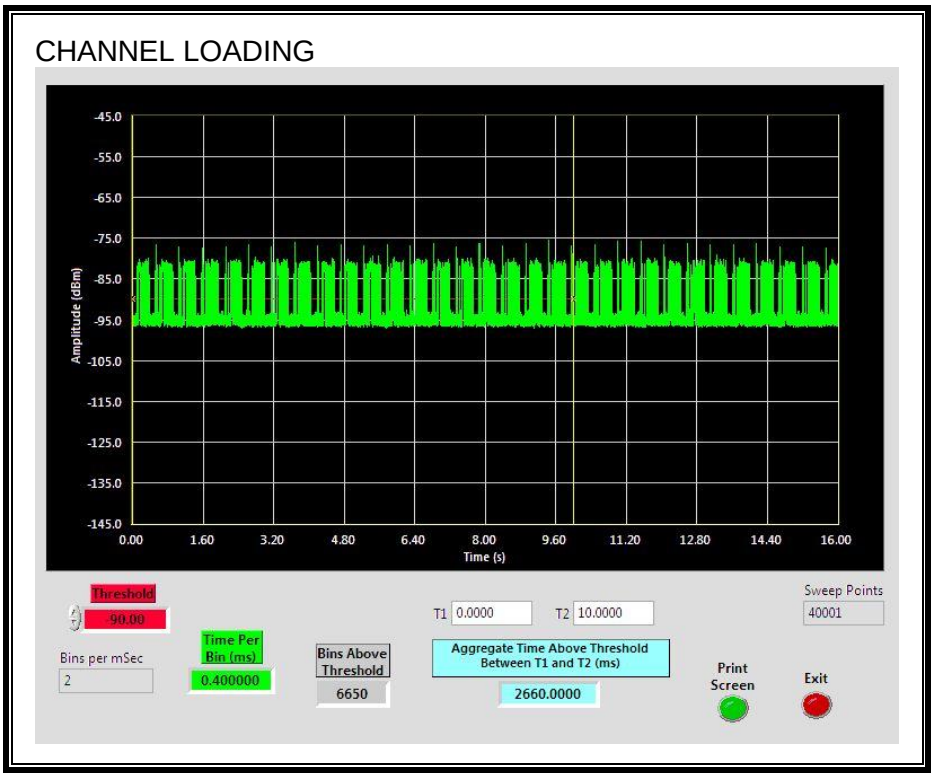
**CHANNEL LOADING**




The level of traffic loading on the channel by the EUT is 26.6%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### 11.5.3. OVERLAPPING CHANNEL TESTS

**RESULTS**

These tests are not applicable.

### 11.5.4. 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**

| Channel Move Time (sec) | Limit (sec) |
|---|---|
| 0.176 | 10 |

| Aggregate Channel Closing Transmission Time (msec) | Limit (msec) |
|---|---|
| 0.0 | 60 |


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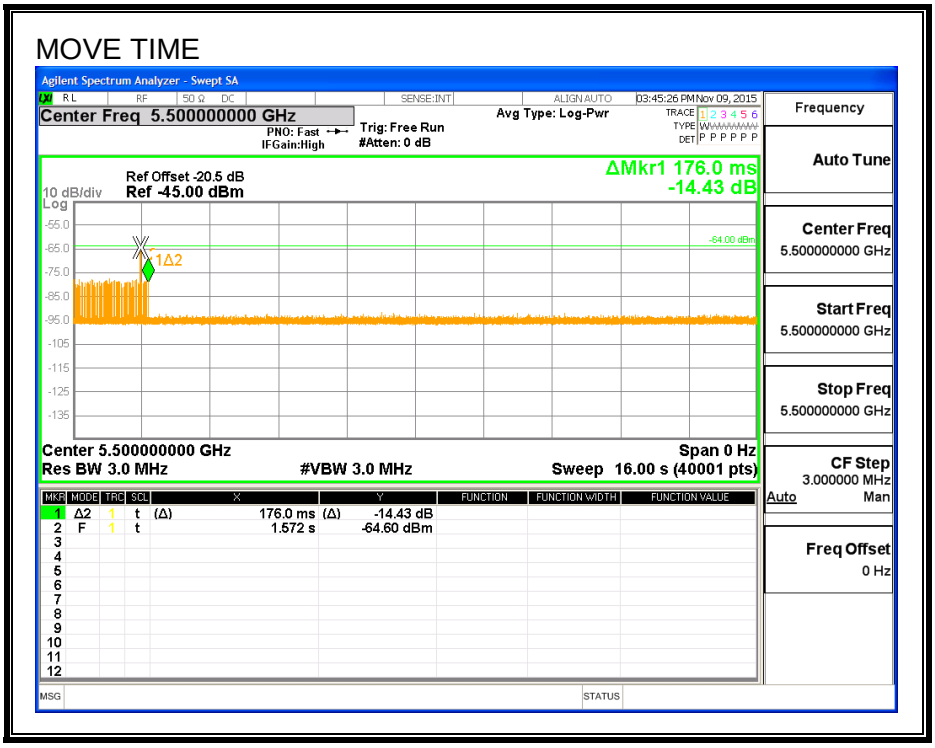
**MOVE TIME**





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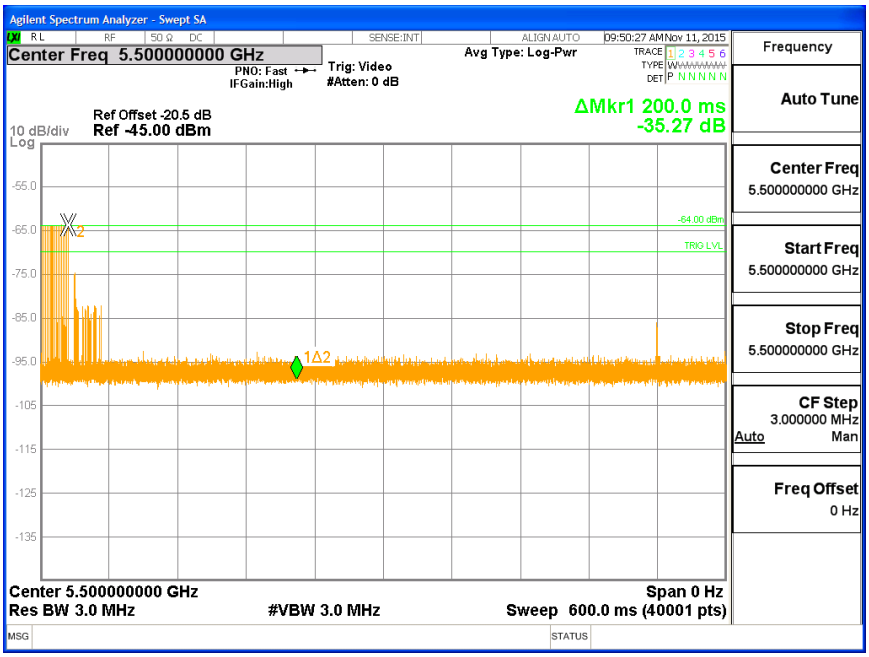
**CHANNEL CLOSING TIME**

CLOSING TIME





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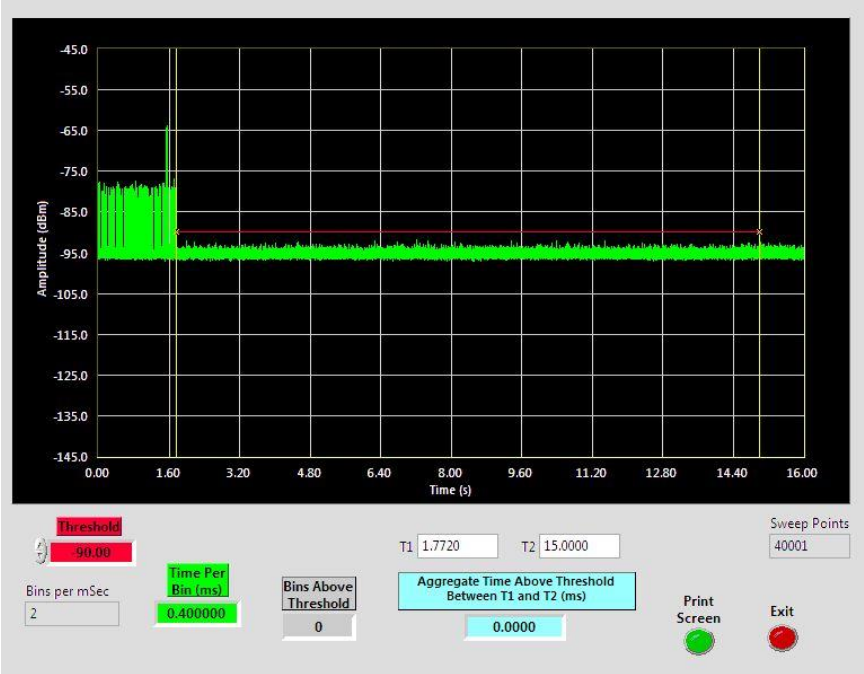
**AGGREGATE CHANNEL CLOSING TRANSMISSION TIME**

No transmissions are observed during the aggregate monitoring period.

AGGREGATE CLOSING TIME





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# 11.6. CLIENT-TO-CLIENT COMMUNICATIONS MODE RESULTS FOR 40 MHz BANDWIDTH

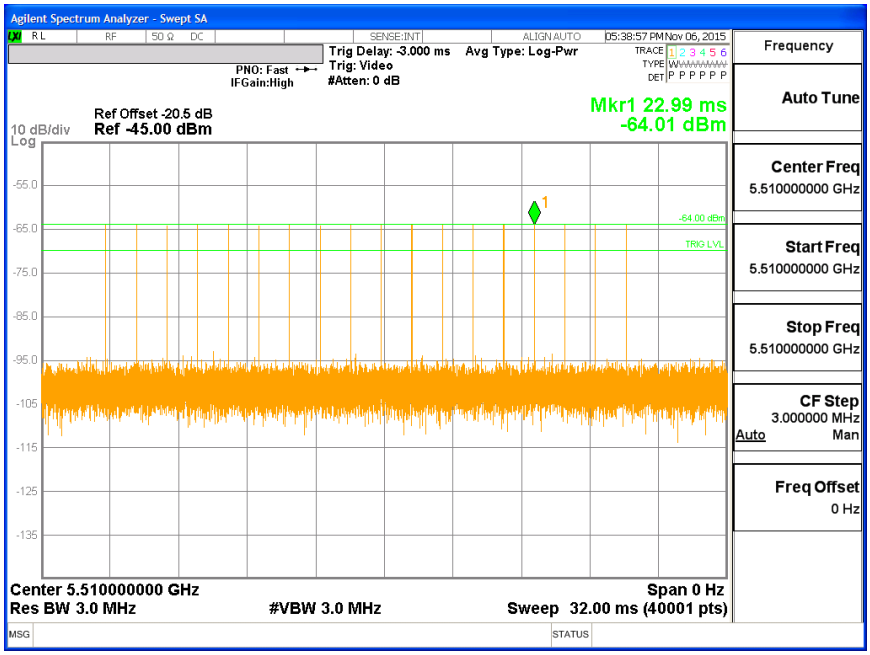
## 11.6.1. TEST CHANNEL

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

## 11.6.2. RADAR WAVEFORM AND TRAFFIC

**RADAR WAVEFORM**

SHORT PULSE RADAR TYPE 0 AT MASTER





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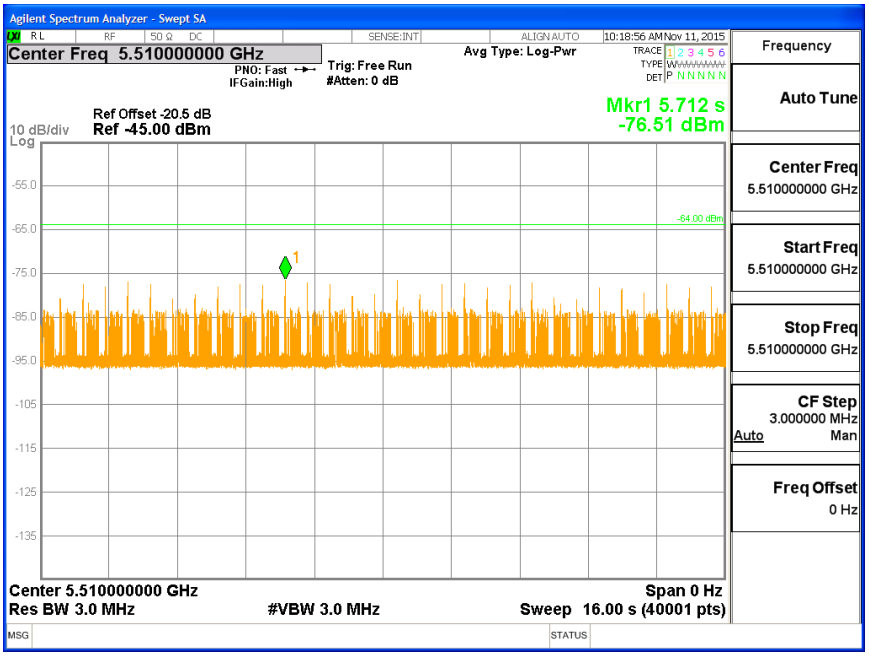
**TRAFFIC**

SLAVE TRAFFIC





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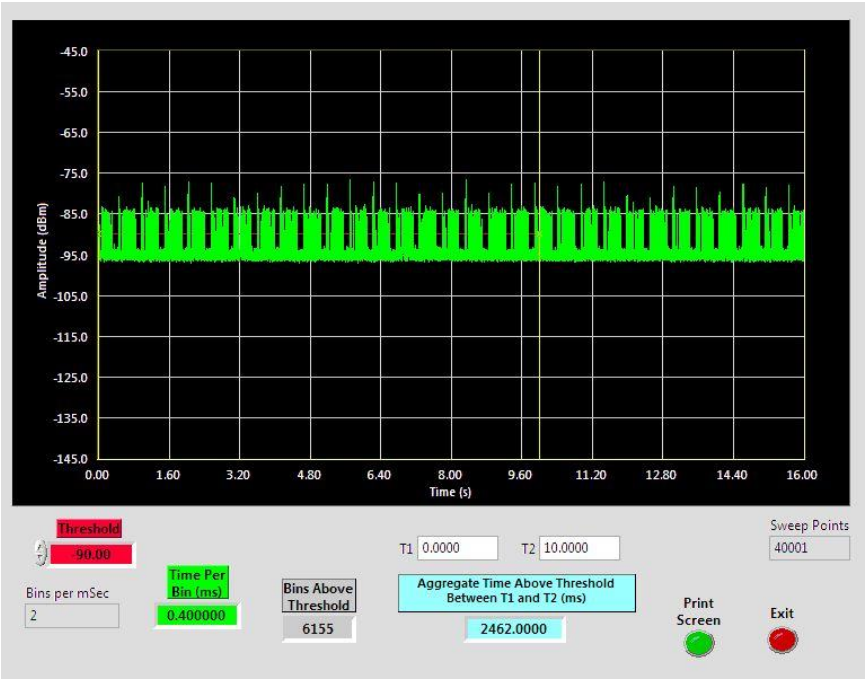
**CHANNEL LOADING**

CHANNEL LOADING




The level of traffic loading on the channel by the EUT is 24.62%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### 11.6.3. OVERLAPPING CHANNEL TESTS

**RESULTS**

These tests are not applicable.

### 11.6.4. 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**

| Channel Move Time (sec) | Limit (sec) |
|---|---|
| **3.789** | **10** |

| Aggregate Channel Closing Transmission Time (msec) | Limit (msec) |
|---|---|
| **7.6** | **60** |


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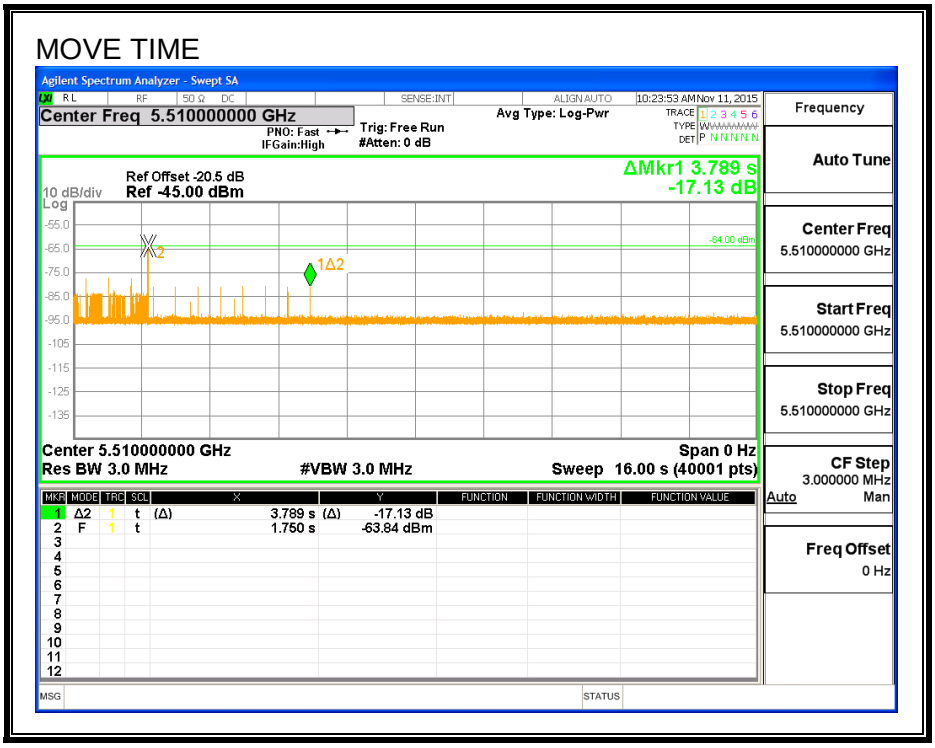
**MOVE TIME**





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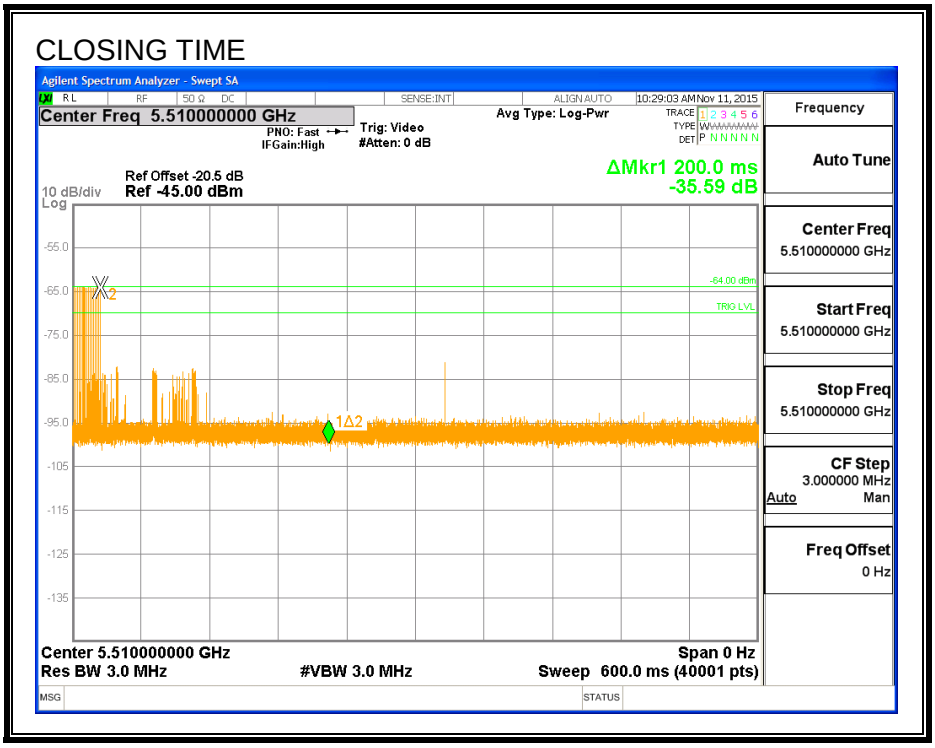
**CHANNEL CLOSING TIME**





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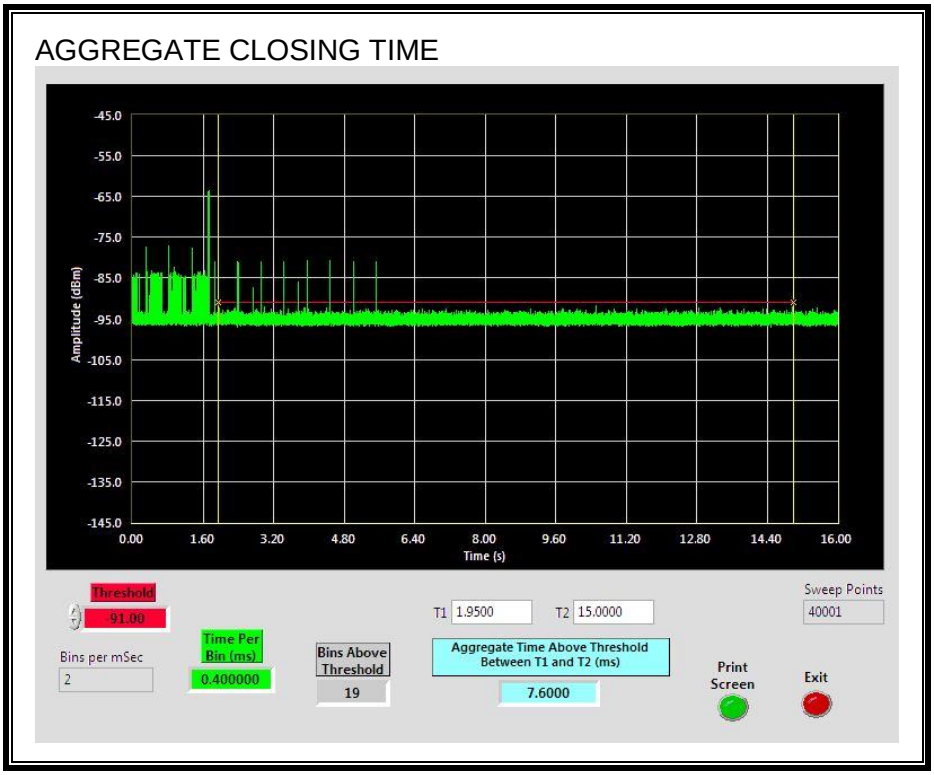
**AGGREGATE CHANNEL CLOSING TRANSMISSION TIME**

Only intermittent transmissions are observed during the aggregate monitoring period.





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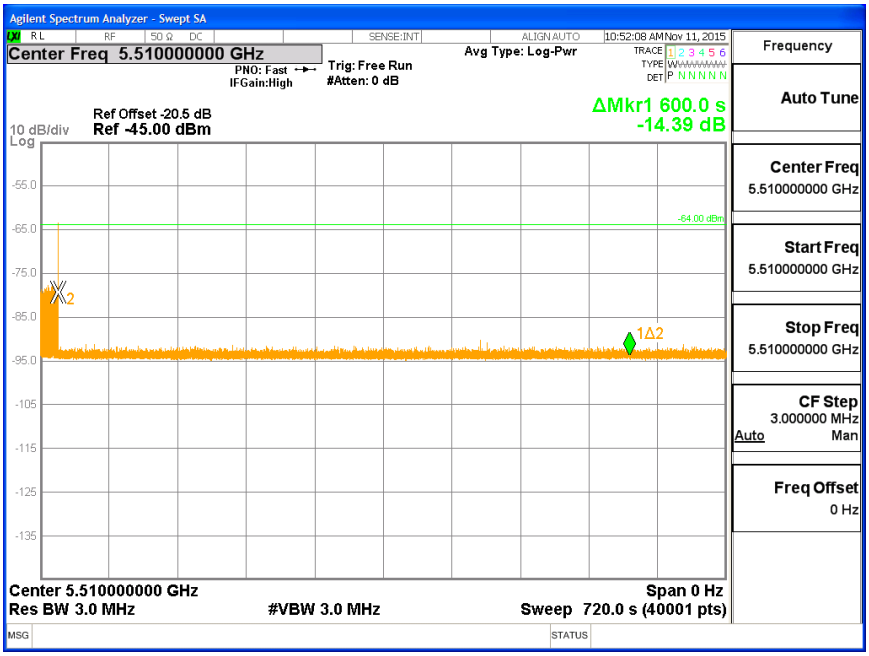
### 11.6.5. 10-MINUTE CLIENT Tx MONITORING PERIOD

**RESULTS**

No EUT transmissions were observed on the test channel during the 10-minute observation time.

10-MINUTE CLIENT Tx MONITORING PERIOD





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# 11.7. CLIENT-TO-CLIENT COMMUNICATIONS MODE RESULTS FOR 80 MHz BANDWIDTH

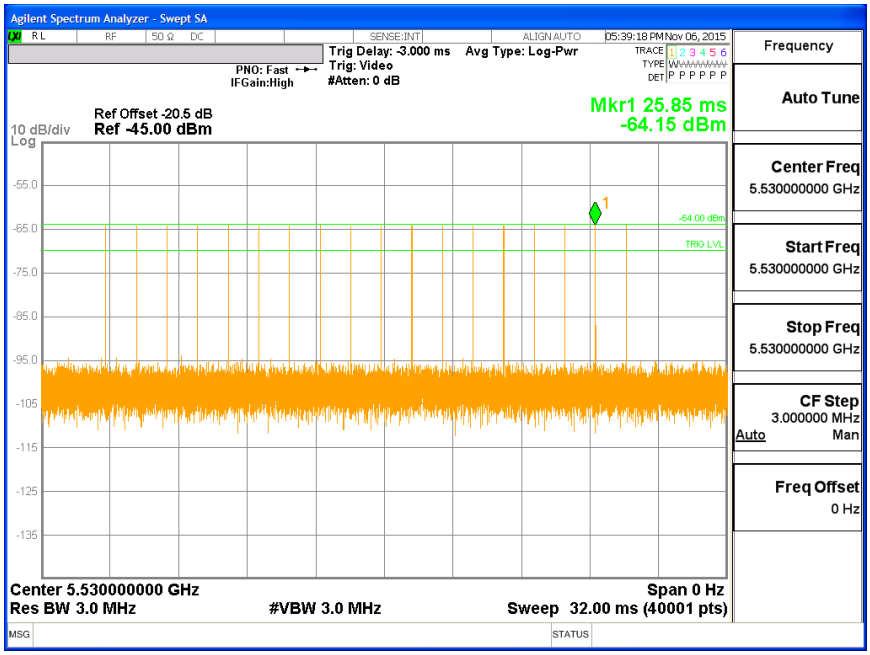
## 11.7.1. TEST CHANNEL

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

## 11.7.2. RADAR WAVEFORM AND TRAFFIC

**RADAR WAVEFORM**

SHORT PULSE RADAR TYPE 0 AT MASTER





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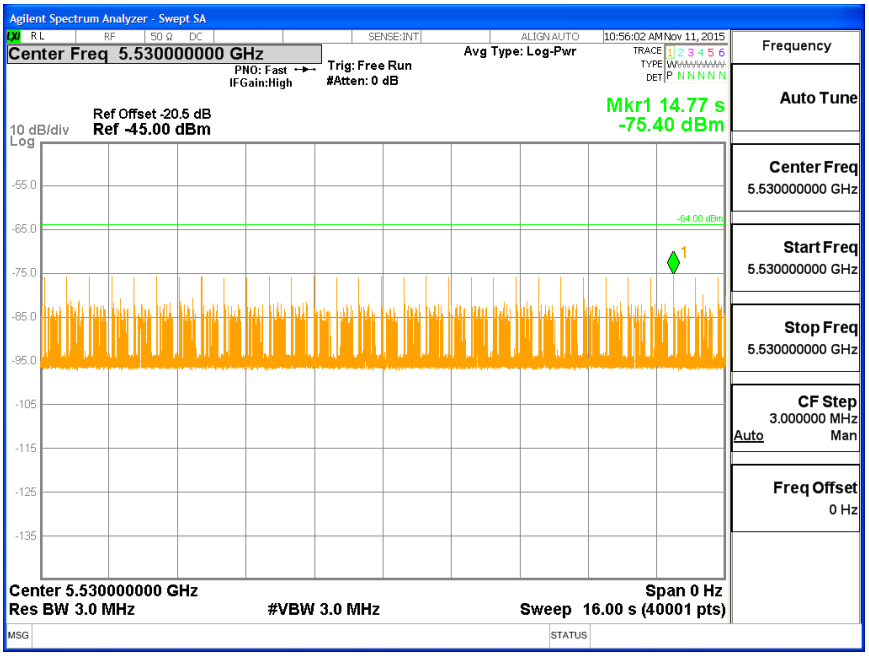
**TRAFFIC**

SLAVE TRAFFIC





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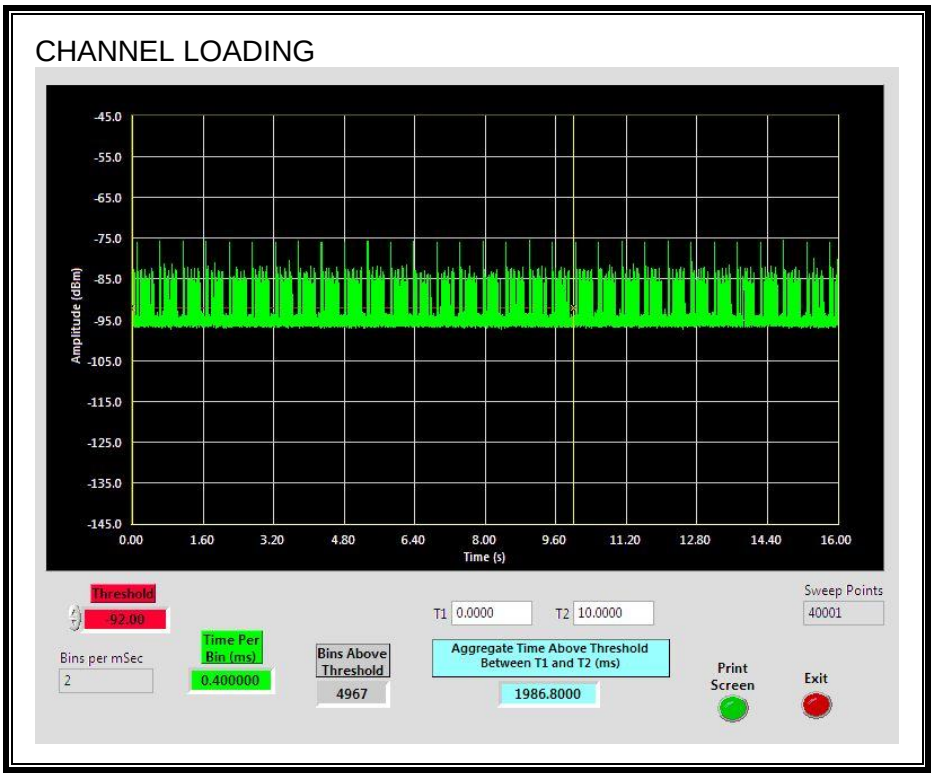
**CHANNEL LOADING**




The level of traffic loading on the channel by the EUT is 19.86%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### 11.7.3. OVERLAPPING CHANNEL TESTS

**RESULTS**

These tests are not applicable.

### 11.7.4. 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**

| Channel Move Time (sec) | Limit (sec) |
|---|---|
| 0.060 | 10 |

| Aggregate Channel Closing Transmission Time (msec) | Limit (msec) |
|---|---|
| 0.0 | 60 |


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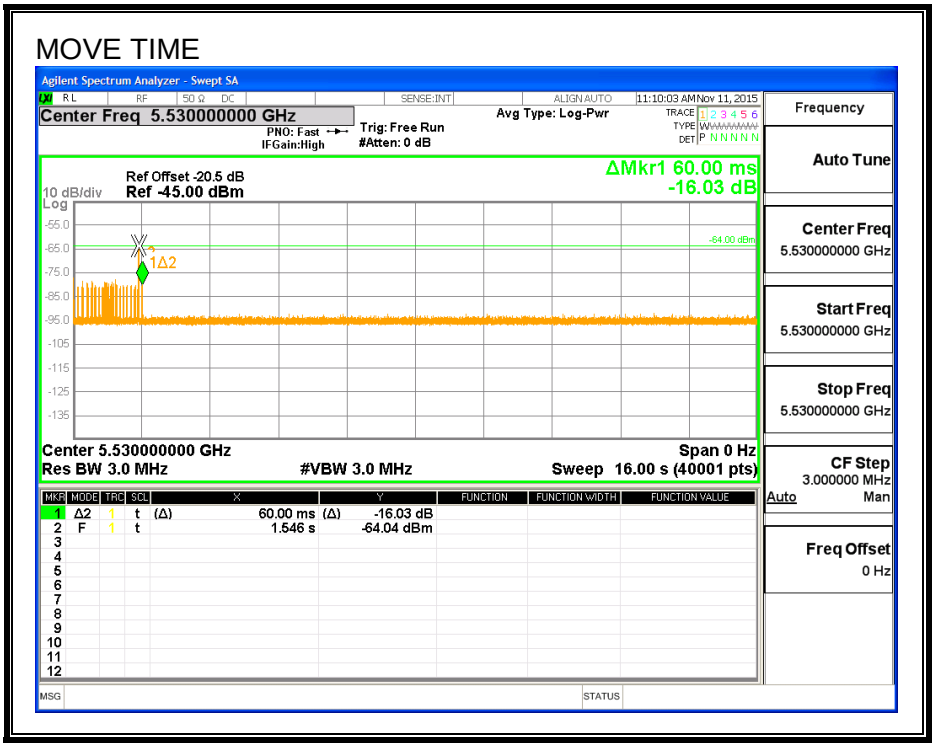
**MOVE TIME**





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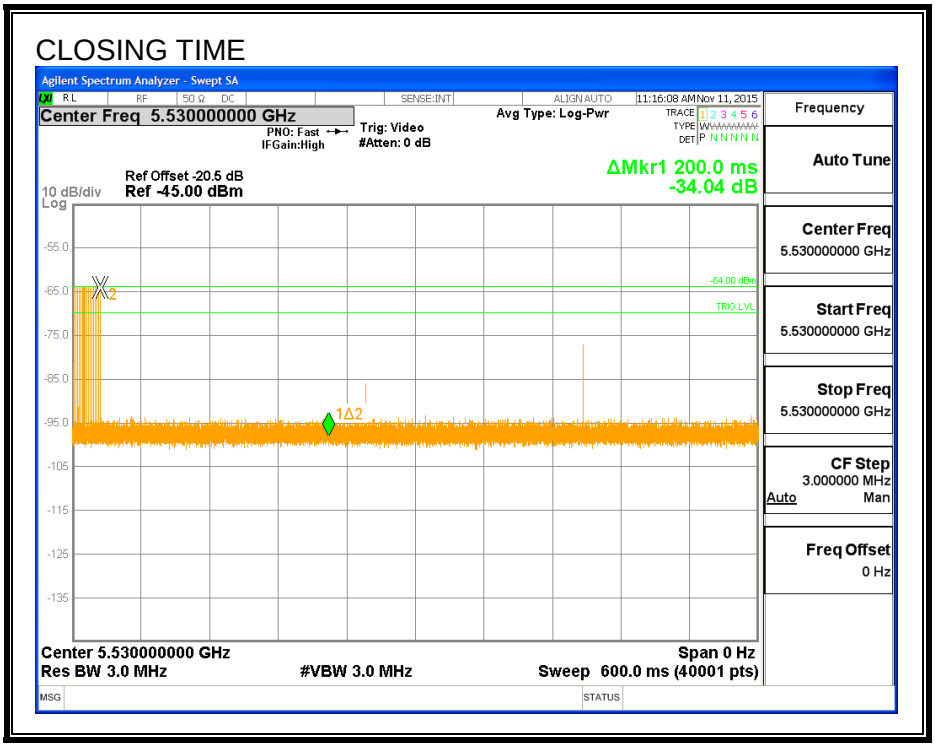
**CHANNEL CLOSING TIME**





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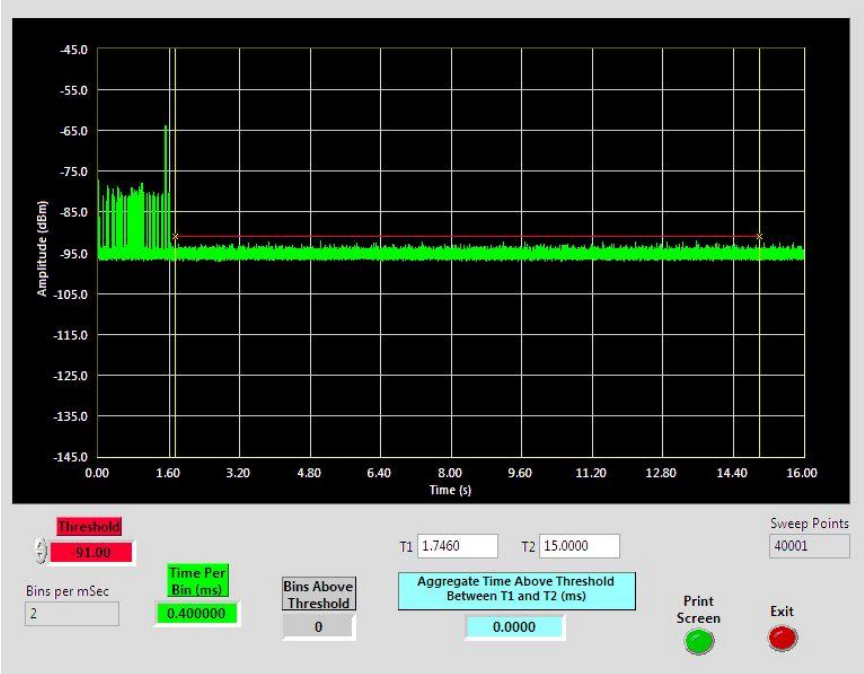
**AGGREGATE CHANNEL CLOSING TRANSMISSION TIME**

No transmissions are observed during the aggregate monitoring period.

AGGREGATE CLOSING TIME





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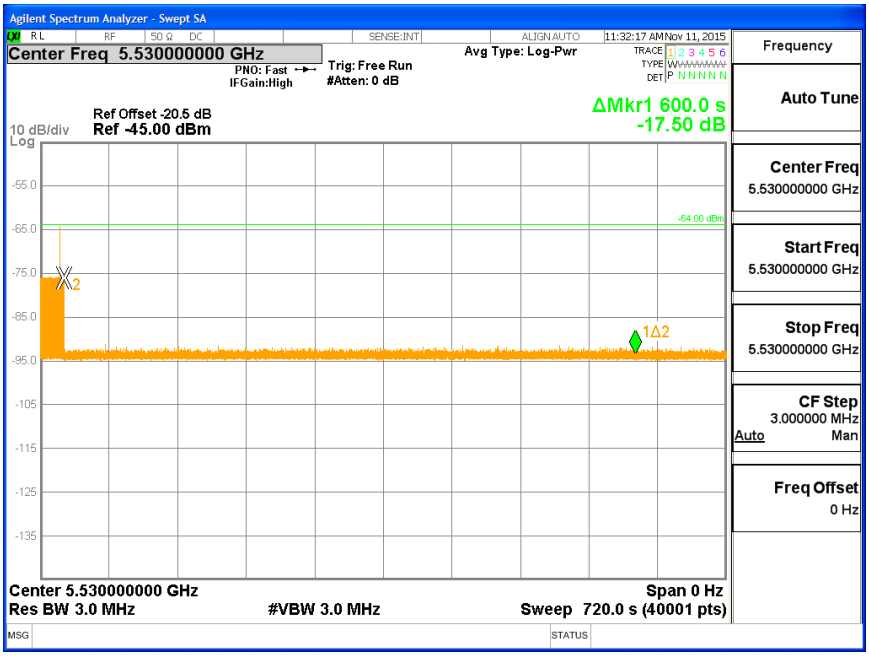
### 11.7.5. 10-MINUTE CLIENT Tx MONITORING PERIOD

**RESULTS**

No EUT transmissions were observed on the test channel during the 10-minute observation time.

10-MINUTE CLIENT Tx MONITORING PERIOD





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