

Title: Conducted Test Setup



Conducted Bandedge

Radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

Connect the antenna port(s) to the spectrum analyzer input. Place the radio in continuous transmit mode. Be sure to enter all losses between the transmitter output and the spectrum analyzer.

Reference Level: 10 dBm
Attenuation: 4 dB
Sweep Time: Coupled
Resolution Bandwidth: 1MHz
Video Bandwidth: 1 MHz for peak, 100 Hz for average
Detector: Peak

Save 2 plots: 1) Average Plot (Vertical and Horizontal), Limit= -41.25 dBm eirp (54dBuV @3m)
2) Peak plot (Vertical and Horizontal), Limit = -21.25 dBm eirp (74dBuV @3m)

Place a marker at the end of the restricted band closest to the transmit frequency to show compliance.
Also measure any emissions in the restricted bands.

802.11a Bandedge Average Test Results:

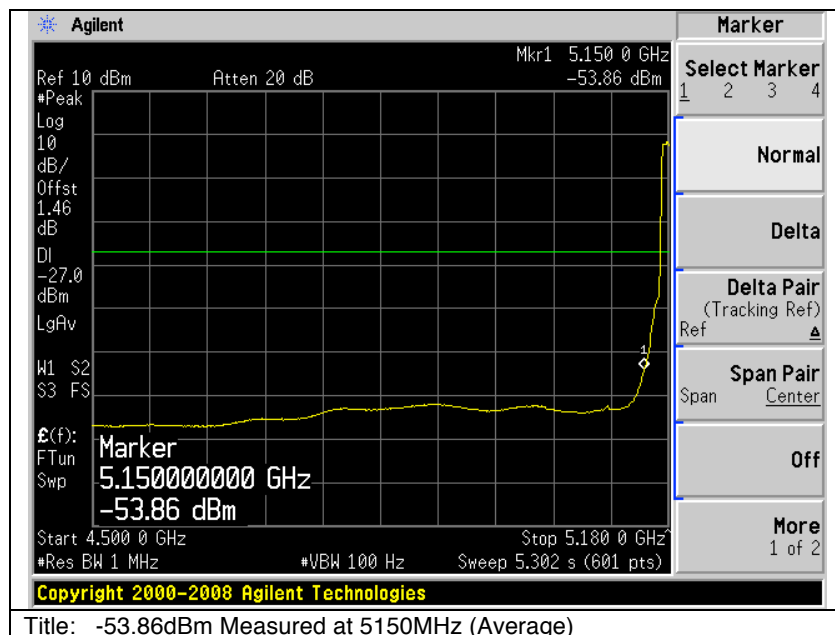
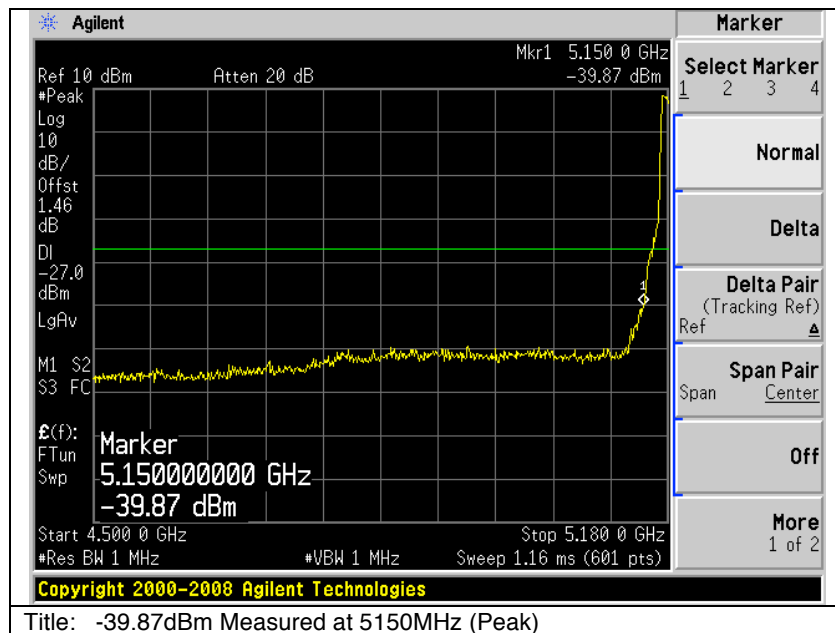
| Frequency (MHz) | Data Rate (Mbps) | Bandedge Level (dBm) | Limit (dBm) | Margin (dB) |
|-----------------|------------------|----------------------|-------------|-------------|
| 5180 | 6 | -53.86 | -41.25 | 12.61 |
| 5250 | 6 | -55.36 | -41.25 | 14.11 |

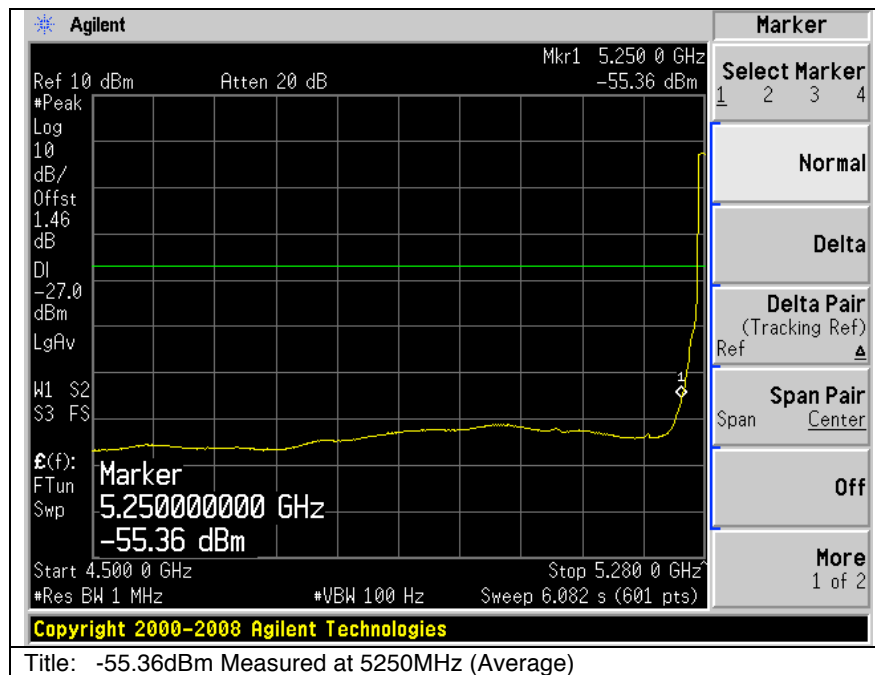
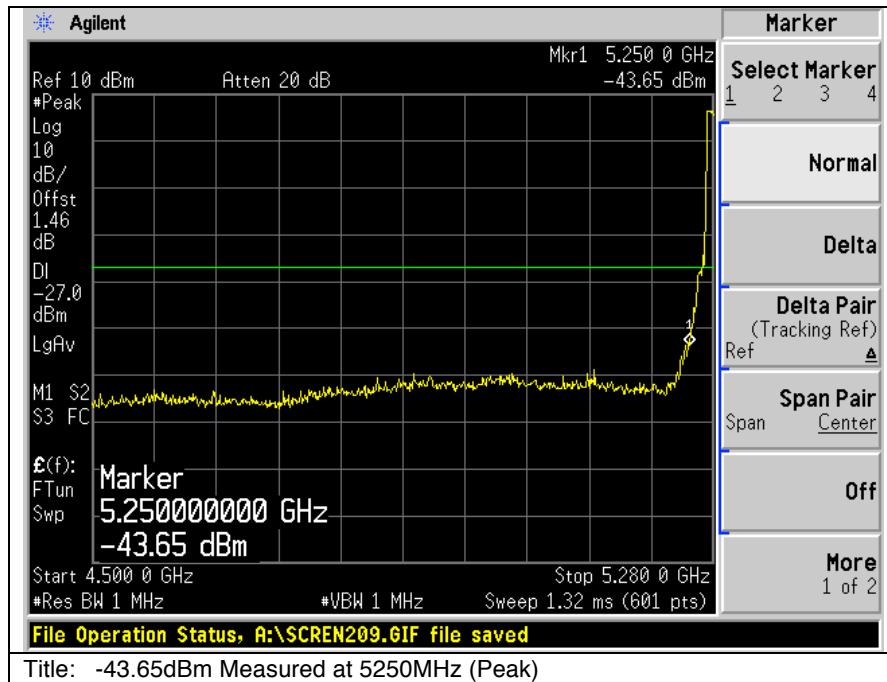
802.11a Bandedge Peak Test Results:

| Frequency (MHz) | Data Rate (Mbps) | Bandedge Level (dBm) | Limit (dBm) | Margin (dB) |
|-----------------|------------------|----------------------|-------------|-------------|
| 5180 | 6 | -39.87 | -21.25 | 18.62 |
| 5250 | 6 | -43.65 | -21.25 | 22.4 |

Graphical Test Results for 802.11A:

Note that the data displayed on the plots detailed in this appendix were measured using a 'Peak Detector'. Please refer to the results table for the detectors used during formal measurements







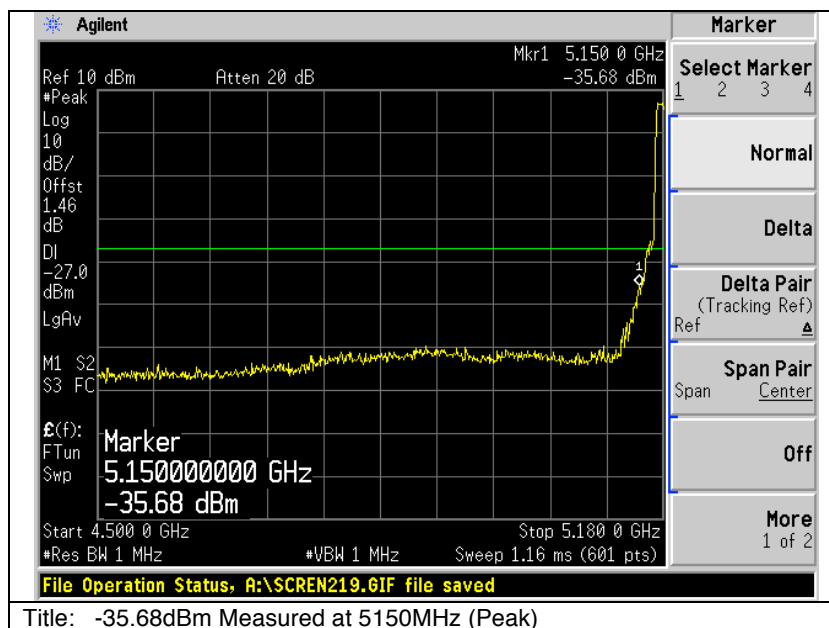
802.11an (HT-20) Bandedge Average Test Results:

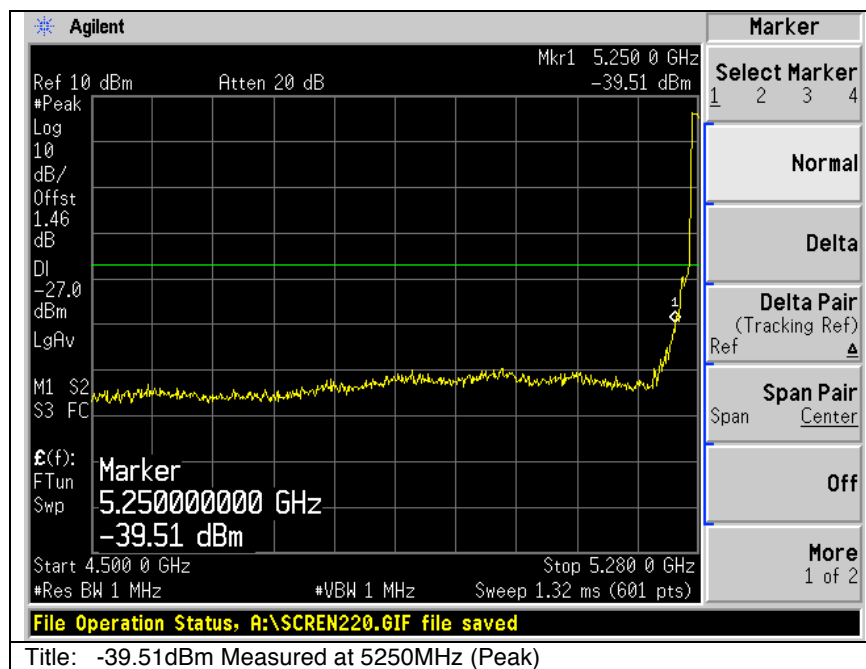
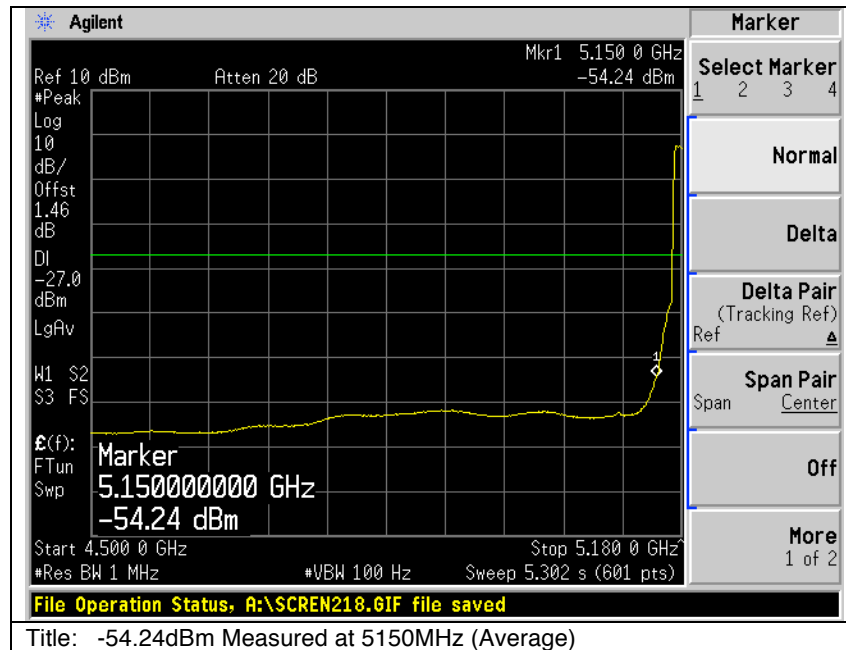
| Frequency (MHz) | Data Rate (Mbps) | Bandedge Level (dBm) | Limit (dBm) | Margin (dB) |
|-----------------|------------------|----------------------|-------------|-------------|
| 5180 | M0 | -53.86 | -41.25 | 12.61 |
| 5250 | M0 | -54.87 | -41.25 | 13.62 |

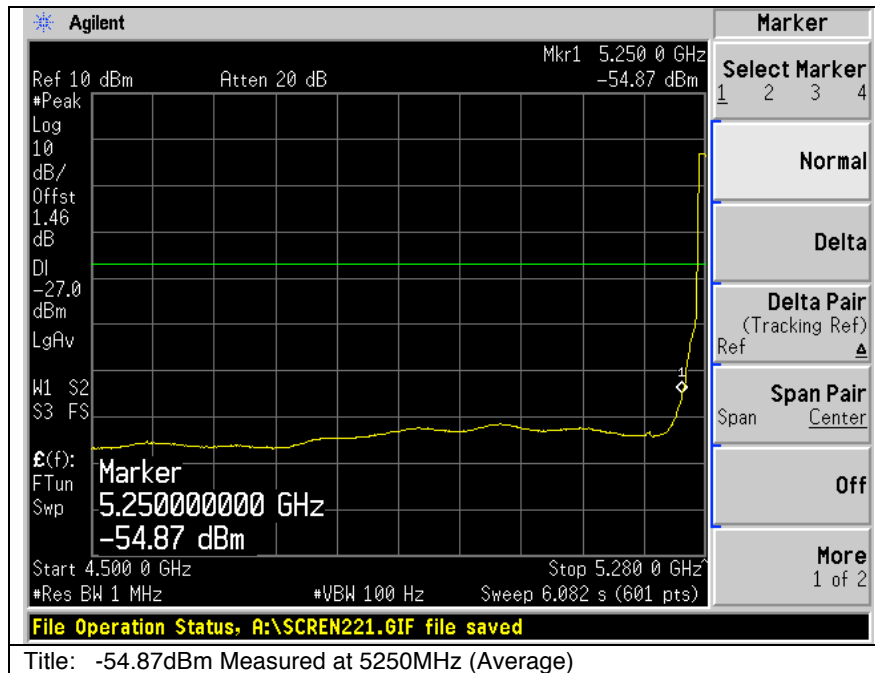
802.11an (HT-20) Bandedge Peak Test Results:

| Frequency (MHz) | Data Rate (Mbps) | Bandedge Level (dBm) | Limit (dBm) | Margin (dB) |
|-----------------|------------------|----------------------|-------------|-------------|
| 5180 | M0 | -35.68 | -21.25 | 14.43 |
| 5250 | M0 | -39.51 | -21.25 | 18.26 |

Graphical Test Results for 802.11A – HT20 Mode:





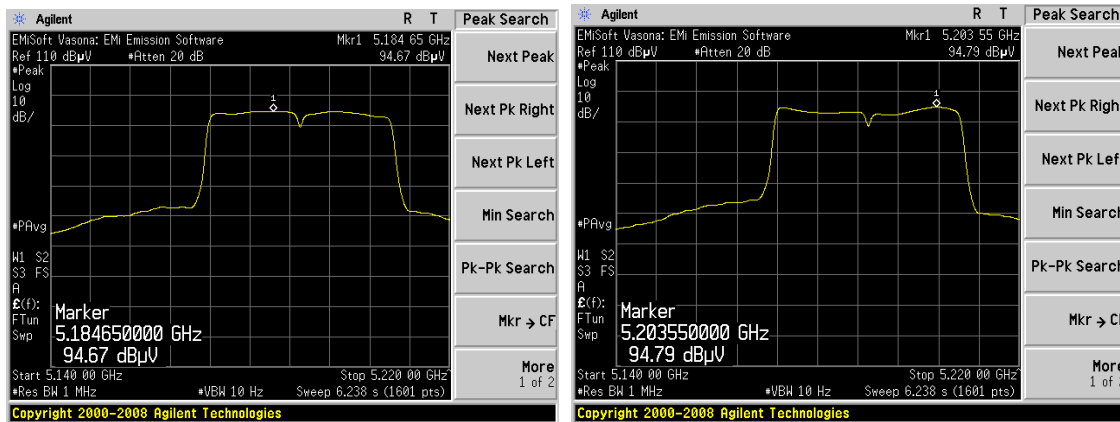


802.11an (HT-40) Marker-Delta Test Results:

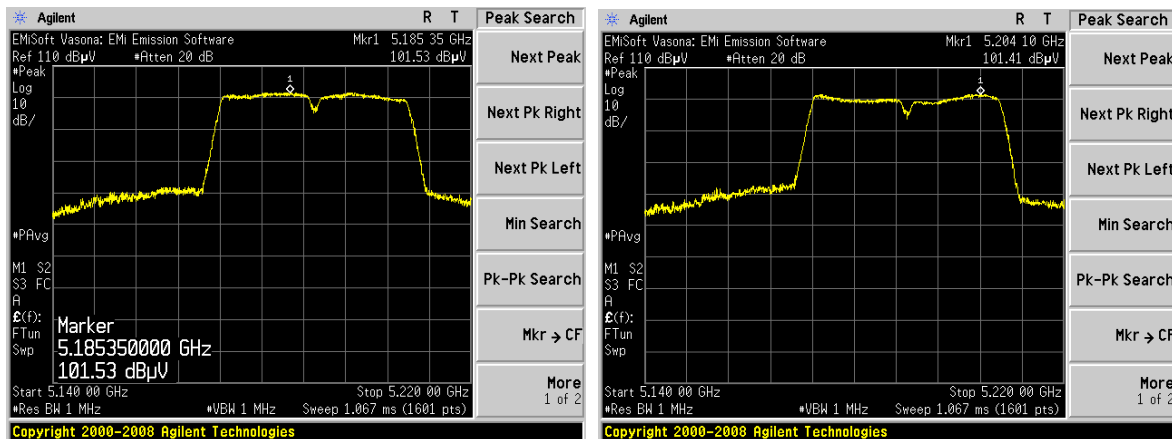
| Frequency Tested | Radiated Pk Measurement | Radiated Ave Measurement | Conducted Delta Measurement | Limit (dBm) | Margin (dBm) |
|------------------|-------------------------|--------------------------|-----------------------------|-------------|--------------|
| 5190 (Hertz) | 101.53 | 94.67 | -34.35 | -74 | -39.65 |
| 5190 (Vert) | 101.41 | 94.79 | -34.35 | -54 | -19.65 |



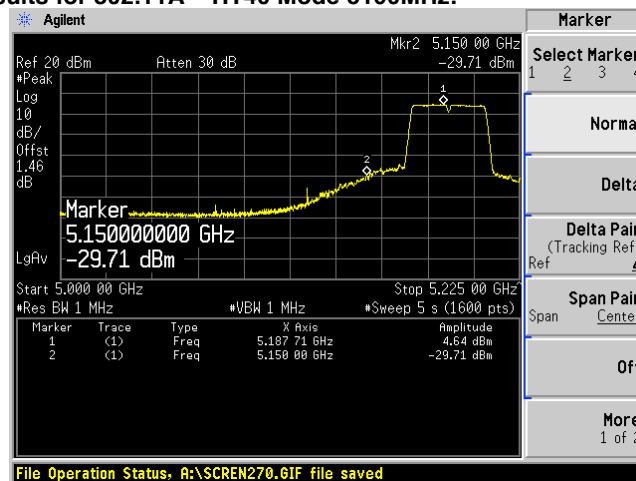
Radiated Graphical Test Results for 802.11A – HT40 Mode 5190MHz (Average):



Radiated Graphical Test Results for 802.11A – HT40 Mode 5190MHz (Peak):



Conducted Graphical Test Results for 802.11A – HT40 Mode 5190MHz:





Appendix B: Emission Test Results

Testing Laboratory: Cisco Systems, Inc., 170 West Tasman Drive, San Jose, CA 95134, USA

Radiated Spurious Emissions

Radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

Using Vasona, configure the spectrum analyzer as shown below (be sure to enter all losses between the transmitter output and the spectrum analyzer). Place the radio in continuous transmit mode.

| | |
|-----------------------|-----------------------------------|
| Span: | 1GHz – 15 GHz |
| Reference Level: | 80 dBuV |
| Attenuation: | 10 dB |
| Sweep Time: | Coupled |
| Resolution Bandwidth: | 1MHz |
| Video Bandwidth: | 1 MHz for peak, 10 Hz for average |
| Detector: | Peak |

Maximize Turntable (find worst case table angle), Maximize Antenna (find worst case height)

Save 2 plots: 1) Average Plot (Vertical and Horizontal), Limit= 54dBuV @3m
 2) Peak plot (Vertical and Horizontal), Limit = 74dBuV @3m

Place a marker at the end of the restricted band closest to the transmit frequency to show compliance.
Also measure any emissions in the restricted bands.

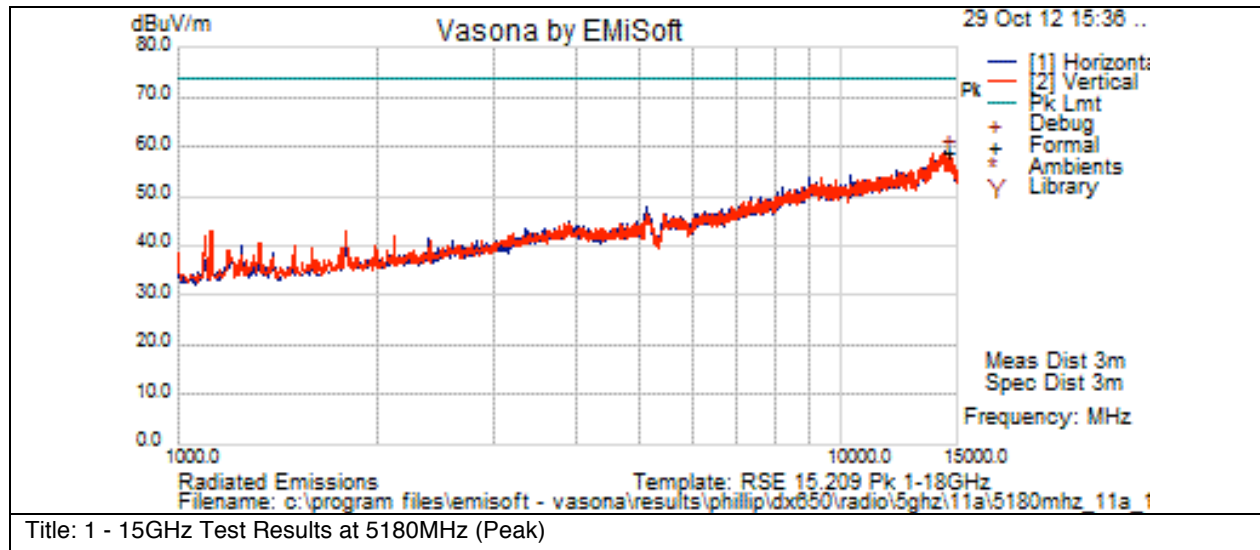
This report represents the worst case data for all supported operating modes and antennas. System was evaluated up to 40GHz but there were no measurable emissions above 15 GHz.

Note: A Notch Filter was used during formal testing from 1 – 15GHz to help prevent the front end of the analyzer from over loading. The Notch filters used are designed to suppress Tx fundamental frequency but do not effect harmonics of the fundamental frequency from being measured



Graphical Test Results 802.11A: 1 – 15GHz (5180MHz – Peak)

Note that the data displayed on the plots detailed in this appendix were measured using a 'Peak Detector'. Please refer to the results table for the detectors used during formal measurements



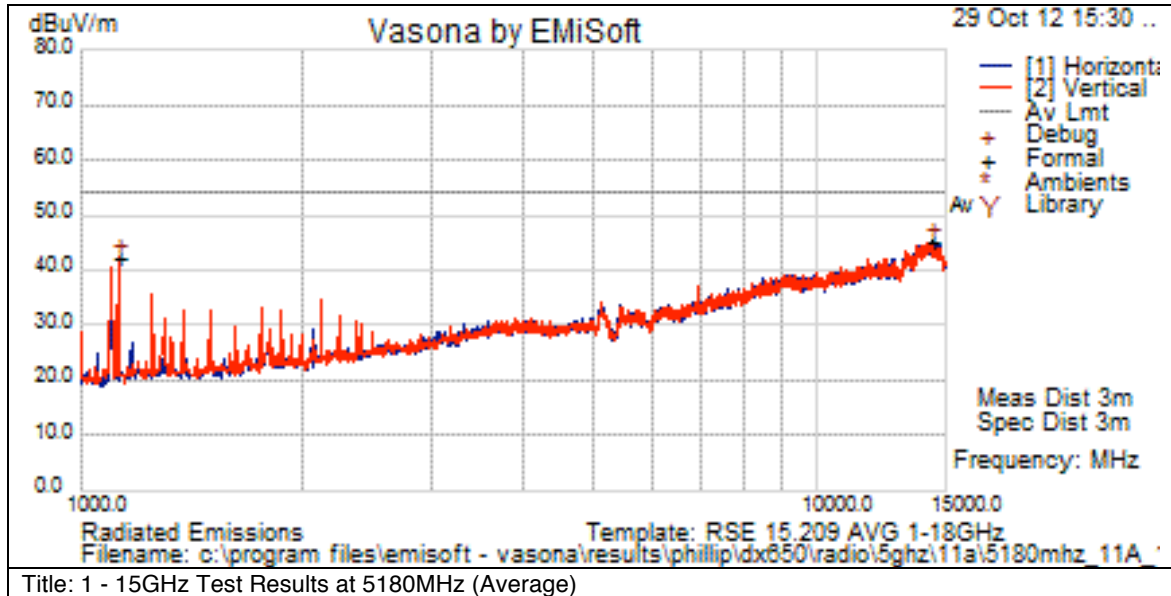
Test Results Table

| Frequency MHz | Raw dBuV | Cable Loss | AF dB | Level dBuV/m | Measurement Type | Pol | Hgt cm | Azt Deg | Limit dBuV/m | Margin dB | Pass /Fail | Comments |
|------------------|-------------|---------------|-------|-----------------|---------------------|-----|-----------|------------|-----------------|--------------|------------|-------------|
| 14472.5 | 39.5 | 12.5 | 6.9 | 58.9 | Pk | H | 100 | 0 | 74 | -15.1 | Pass | Noise Floor |



Graphical Test Results 802.11A: 1 – 15GHz (5180MHz – Average)

Note that the data displayed on the plots detailed in this appendix were measured using a 'Peak Detector'. Please refer to the results table for the detectors used during formal measurements



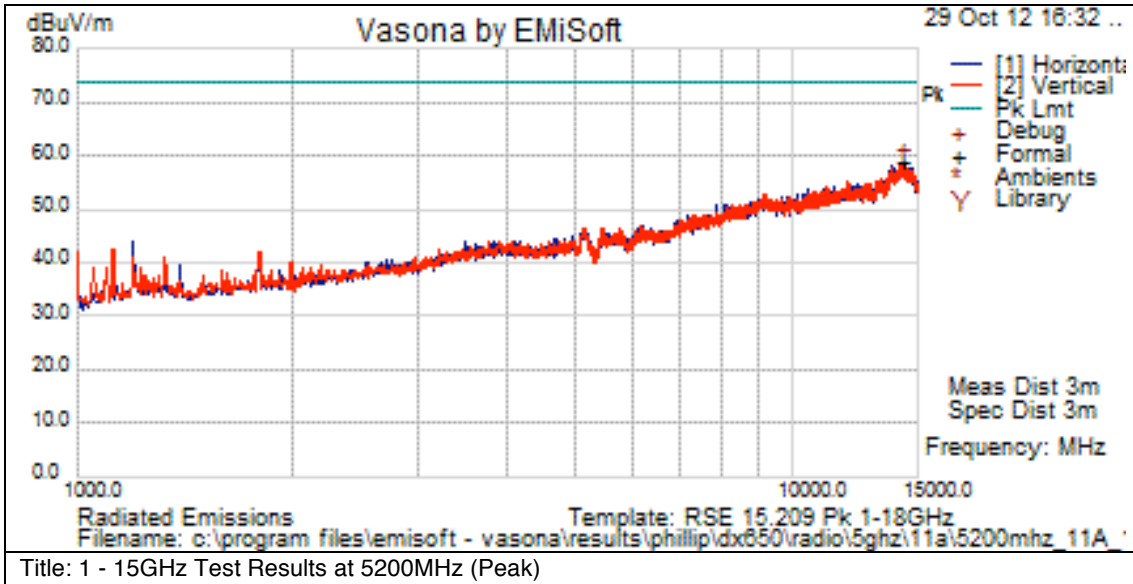
Test Results Table

| Frequency MHz | Raw dBuV | Cable Loss | AF dB | Level dBuV/m | Measurement Type | Pol | Hgt cm | Azt Deg | Limit dBuV/m | Margin dB | Pass /Fail | Comments |
|---------------|----------|------------|-------|--------------|------------------|-----|--------|---------|--------------|-----------|------------|---------------|
| 14392.813 | 25.8 | 12.4 | 7.1 | 45.3 | Av | H | 100 | 0 | 54 | -8.7 | Pass | Noise Floor |
| 1127.5 | 47 | 3.2 | -8 | 42.2 | Av | V | 100 | 0 | 54 | -11.8 | Pass | Support Equip |



Graphical Test Results 802.11A: 1 – 15GHz (5200MHz – Peak)

Note that the data displayed on the plots detailed in this appendix were measured using a 'Peak Detector'. Please refer to the results table for the detectors used during formal measurements



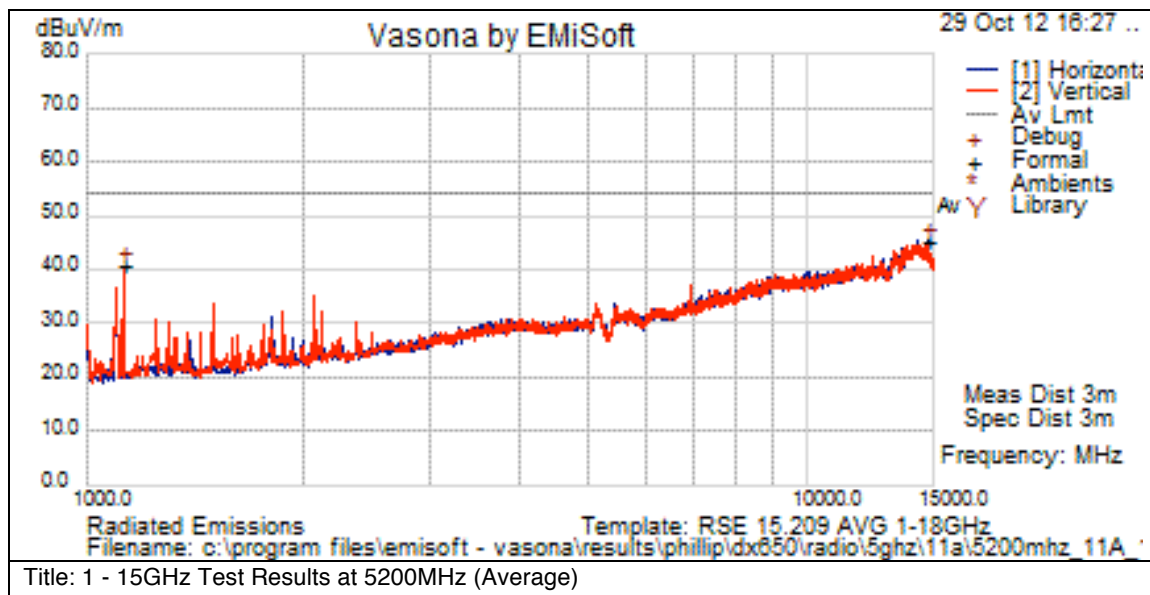
Test Results Table

| Frequency MHz | Raw dBuV | Cable Loss | AF dB | Level dBuV/m | Measurement Type | Pol | Hgt cm | Azt Deg | Limit dBuV/m | Margin dB | Pass /Fail | Comments |
|------------------|-------------|---------------|-------|-----------------|---------------------|-----|-----------|------------|-----------------|--------------|------------|-------------|
| 14185.625 | 39.3 | 12.3 | 7.2 | 58.8 | Pk | H | 100 | 0 | 74 | -15.2 | Pass | Noise Floor |



Graphical Test Results 802.11A: 1 – 15GHz (5200MHz – Average)

Note that the data displayed on the plots detailed in this appendix were measured using a 'Peak Detector'. Please refer to the results table for the detectors used during formal measurements



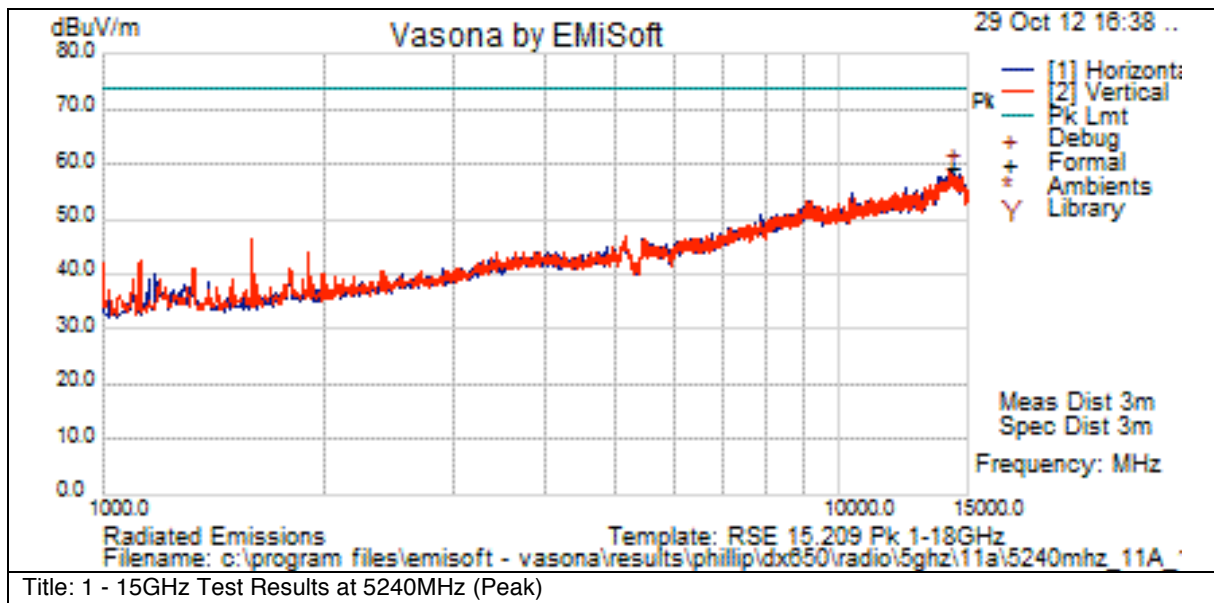
Test Results Table

| Frequency MHz | Raw dBuV | Cable Loss | AF dB | Level dBuV/m | Measurement Type | Pol | Hgt cm | Azt Deg | Limit dBuV/m | Margin dB | Pass /Fail | Comments |
|---------------|----------|------------|-------|--------------|------------------|-----|--------|---------|--------------|-----------|------------|-------------|
| 14780.625 | 26.5 | 12.6 | 6.1 | 45.2 | Av | H | 100 | 0 | 54 | -8.8 | Pass | Noise Floor |
| 1127.5 | 45.4 | 3.2 | -8 | 40.6 | Av | V | 100 | 0 | 54 | -13.4 | Pass | |



Graphical Test Results 802.11A: 1 – 15GHz (5240MHz – Peak)

Note that the data displayed on the plots detailed in this appendix were measured using a 'Peak Detector'. Please refer to the results table for the detectors used during formal measurements



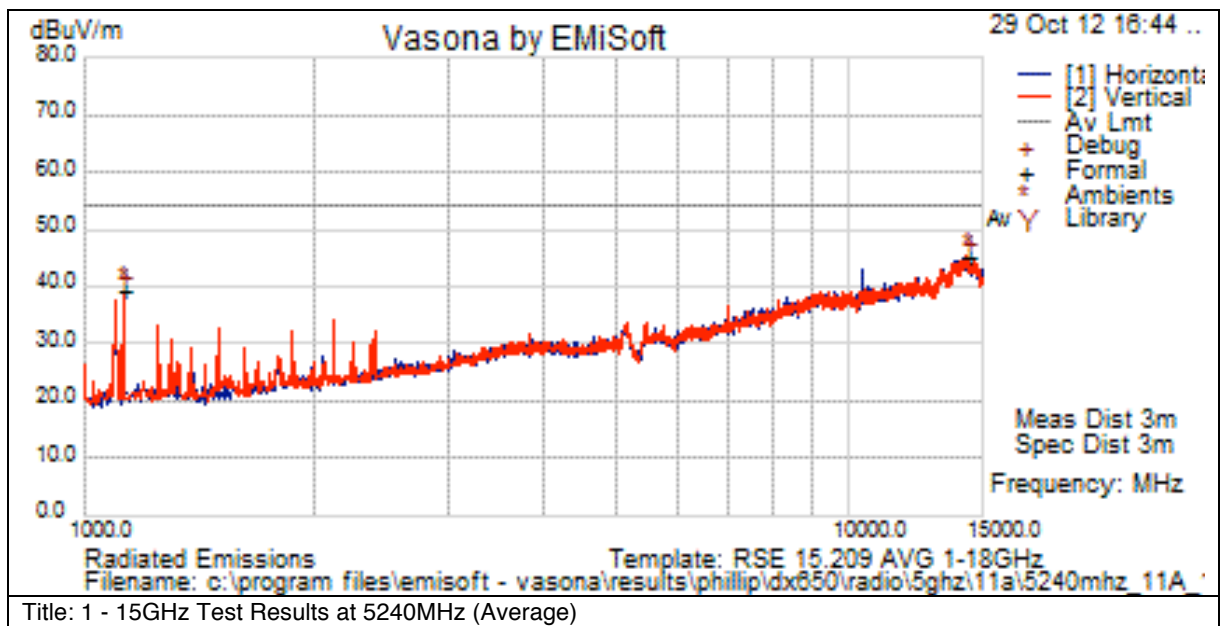
Test Results Table

| Frequency MHz | Raw dBuV | Cable Loss | AF dB | Level dBuV/m | Measurement Type | Pol | Hgt cm | Azt Deg | Limit dBuV/m | Margin dB | Pass /Fail | Comments |
|------------------|-------------|---------------|-------|-----------------|---------------------|-----|-----------|------------|-----------------|--------------|------------|-------------|
| 14228.125 | 39.4 | 12.4 | 7.3 | 59.2 | Pk | V | 100 | 0 | 74 | -14.8 | Pass | Nosie Floor |



Graphical Test Results 802.11A: 1 – 15GHz (5240MHz – Average)

Note that the data displayed on the plots detailed in this appendix were measured using a 'Peak Detector'. Please refer to the results table for the detectors used during formal measurements



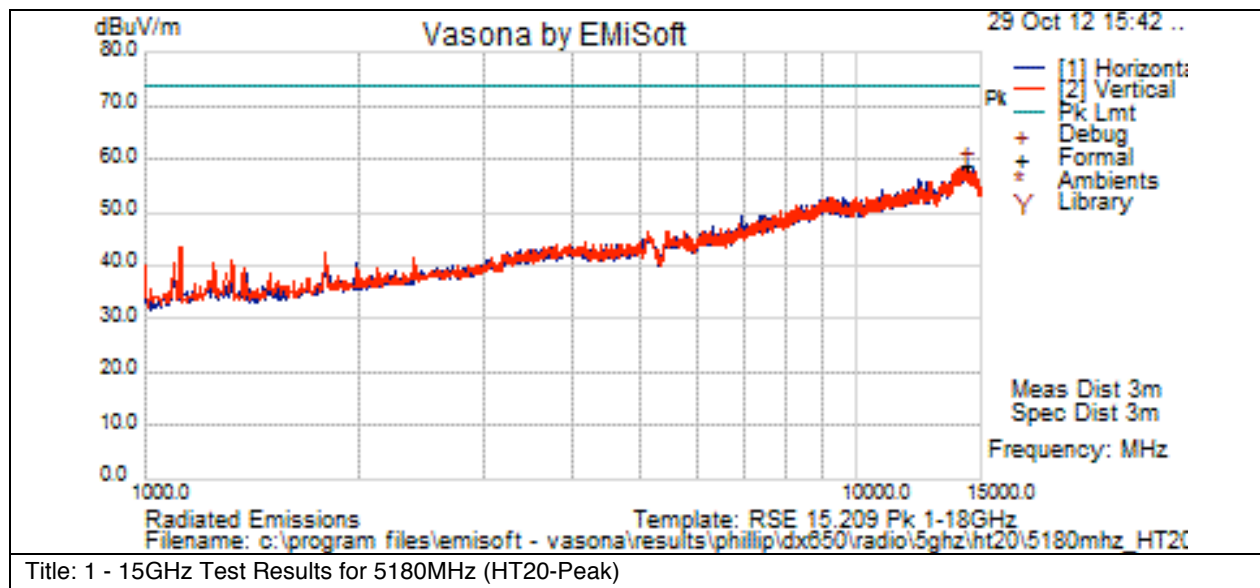
Test Results Table

| Frequency MHz | Raw dBuV | Cable Loss | AF dB | Level dBuV/m | Measurement Type | Pol | Hgt cm | Azt Deg | Limit dBuV/m | Margin dB | Pass /Fail | Comments |
|------------------|-------------|---------------|-------|-----------------|---------------------|-----|-----------|------------|-----------------|--------------|------------|-------------|
| 14323.75 | 25.4 | 12.5 | 7.3 | 45.1 | Av | V | 100 | 0 | 54 | -8.9 | Pass | Noise Floor |
| 1127.5 | 44 | 3.2 | -8 | 39.2 | Av | V | 100 | 0 | 54 | -14.8 | Pass | |



Graphical Test Results HT20: 1 – 15GHz (5180MHz – Peak)

Note that the data displayed on the plots detailed in this appendix were measured using a 'Peak Detector'. Please refer to the results table for the detectors used during formal measurements



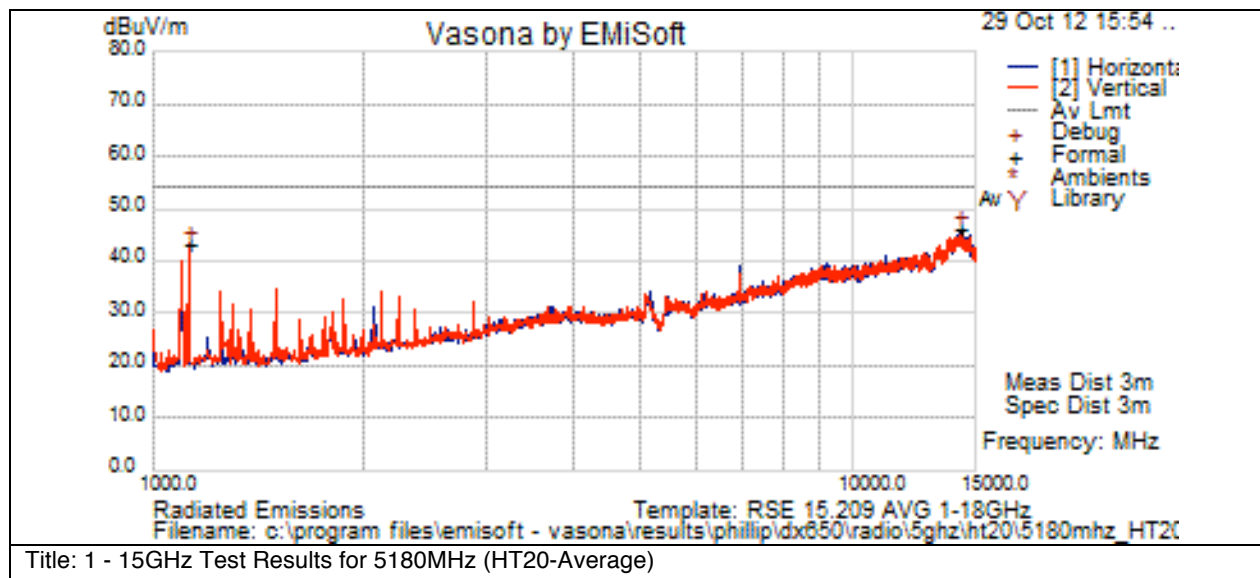
Test Results Table

| Frequency MHz | Raw dBuV | Cable Loss | AF dB | Level dBuV/m | Measurement Type | Pol | Hgt cm | Azt Deg | Limit dBuV/m | Margin dB | Pass /Fail | Comments |
|------------------|-------------|---------------|-------|-----------------|---------------------|-----|-----------|------------|-----------------|--------------|------------|-------------|
| 14244.063 | 39.1 | 12.4 | 7.2 | 58.7 | Pk | V | 100 | 0 | 74 | -15.3 | Pass | Noise Floor |



Graphical Test Results HT20 (5180MHz – Average)

Note that the data displayed on the plots detailed in this appendix were measured using a 'Peak Detector'. Please refer to the results table for the detectors used during formal measurements



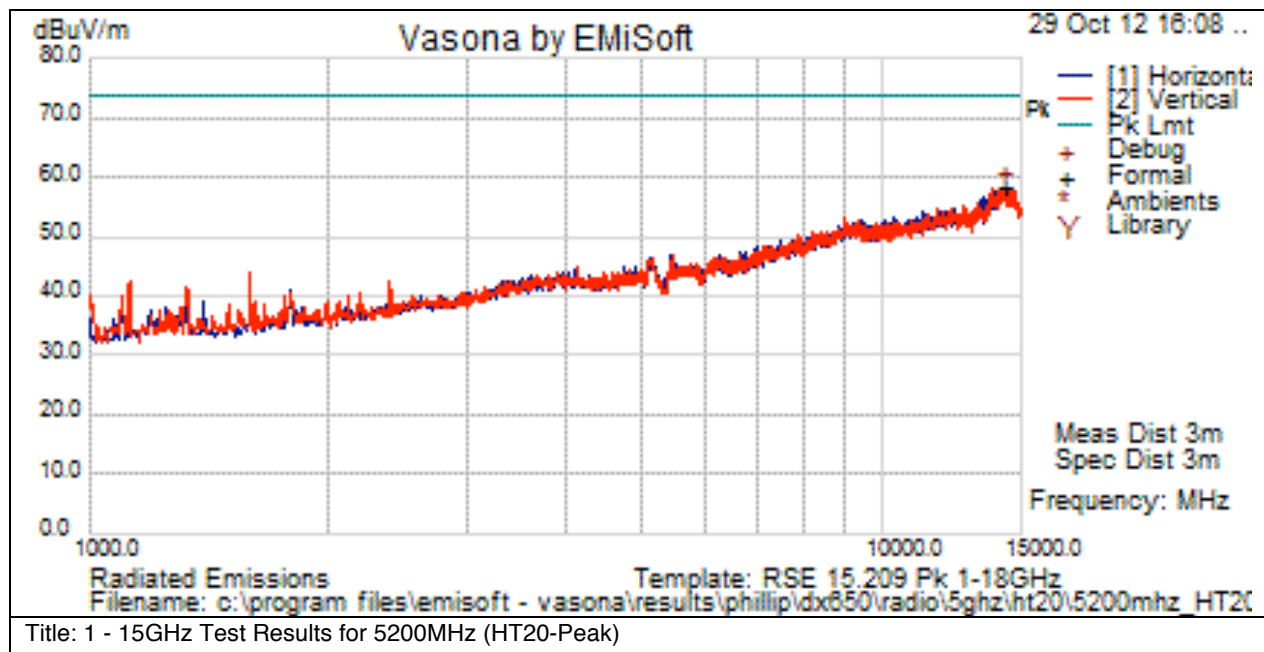
Test Results Table

| Frequency MHz | Raw dBuV | Cable Loss | AF dB | Level dBuV/m | Measurement Type | Pol | Hgt cm | Azt Deg | Limit dBuV/m | Margin dB | Pass /Fail | Comments |
|---------------|----------|------------|-------|--------------|------------------|-----|--------|---------|--------------|-----------|------------|---------------|
| 14286.563 | 26.3 | 12.4 | 7.3 | 46 | Av | H | 100 | 0 | 54 | -8 | Pass | Noise Floor |
| 1127.5 | 48.1 | 3.2 | -8 | 43.3 | Av | V | 100 | 0 | 54 | -10.7 | Pass | Support Equip |



Graphical Test Results HT20: 1 – 15GHz (5200MHz – Peak)

Note that the data displayed on the plots detailed in this appendix were measured using a 'Peak Detector'. Please refer to the results table for the detectors used during formal measurements

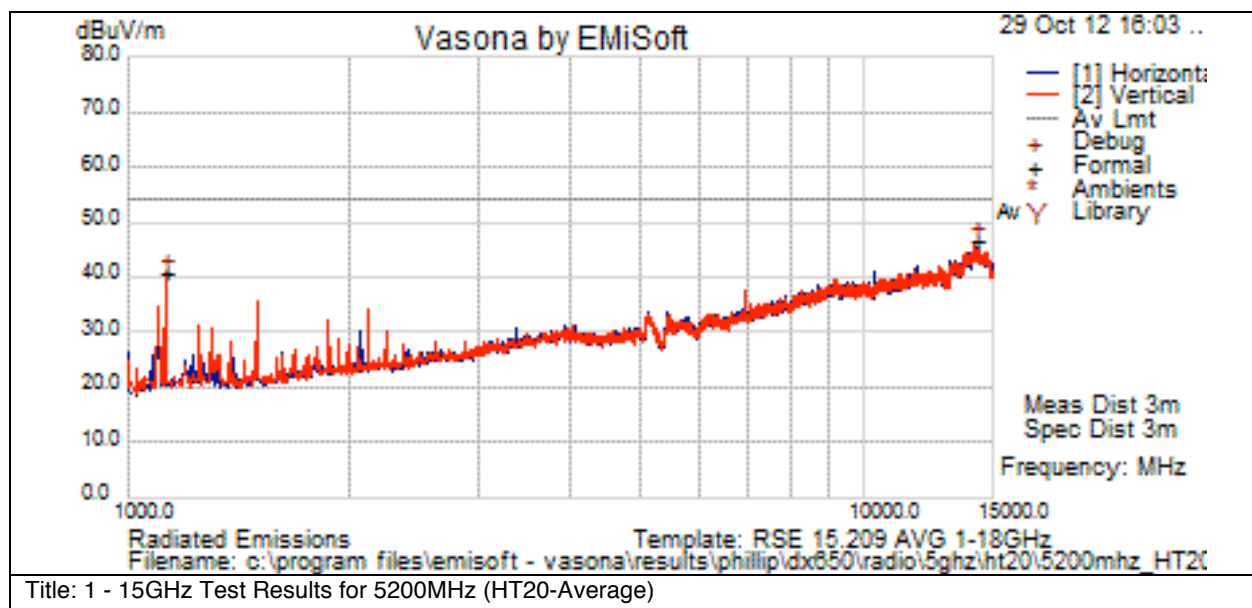


Test Results Table

| Frequency MHz | Raw dBuV | Cable Loss | AF dB | Level dBuV/m | Measurement Type | Pol | Hgt cm | Azt Deg | Limit dBuV/m | Margin dB | Pass /Fail | Comments |
|------------------|-------------|---------------|-------|-----------------|---------------------|-----|-----------|------------|-----------------|--------------|------------|-------------|
| 14254.688 | 38.7 | 12.5 | 7.2 | 58.3 | Pk | V | 100 | 0 | 74 | -15.7 | Pass | Noise Floor |

Graphical Test Results HT20: 1 – 15GHz (5200MHz – Average)

Note that the data displayed on the plots detailed in this appendix were measured using a 'Peak Detector'. Please refer to the results table for the detectors used during formal measurements



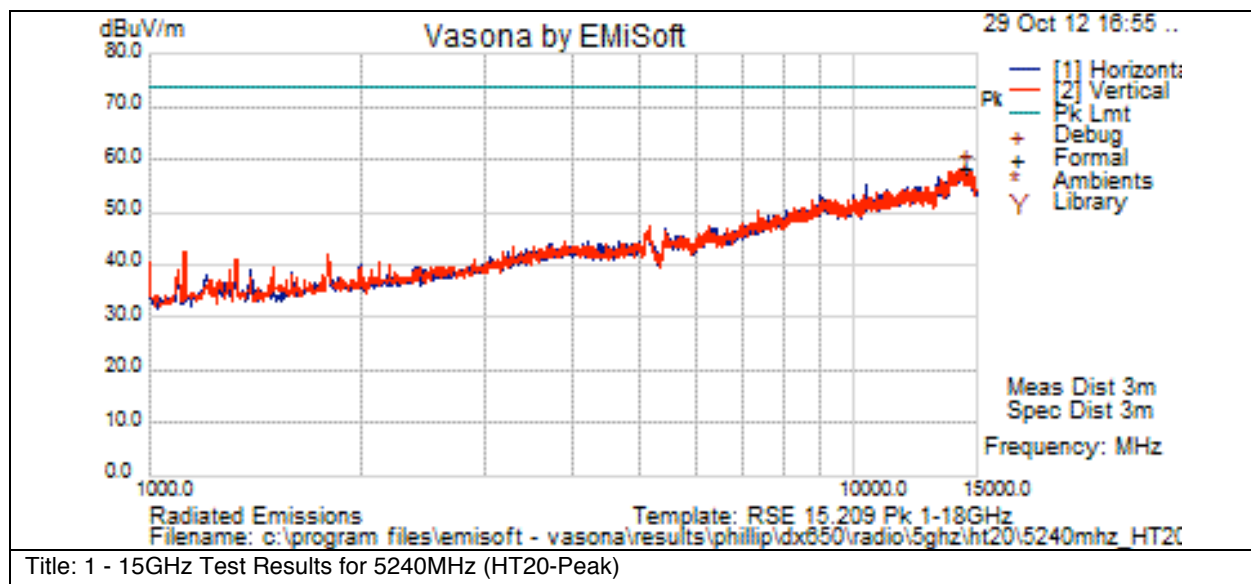
Test Results Table

| Frequency MHz | Raw dBuV | Cable Loss | AF dB | Level dBuV/m | Measurement Type | Pol | Hgt cm | Azt Deg | Limit dBuV/m | Margin dB | Pass /Fail | Comments |
|------------------|-------------|---------------|-------|-----------------|---------------------|-----|-----------|------------|-----------------|--------------|------------|-------------|
| 14217.5 | 26.7 | 12.4 | 7.4 | 46.5 | Av | V | 100 | 0 | 54 | -7.5 | Pass | Noise Floor |
| 1127.5 | 45.5 | 3.2 | -8 | 40.7 | Av | V | 100 | 0 | 54 | -13.3 | Pass | |



Graphical Test Results HT20: 1 – 15GHz (5240MHz – Peak)

Note that the data displayed on the plots detailed in this appendix were measured using a 'Peak Detector'. Please refer to the results table for the detectors used during formal measurements



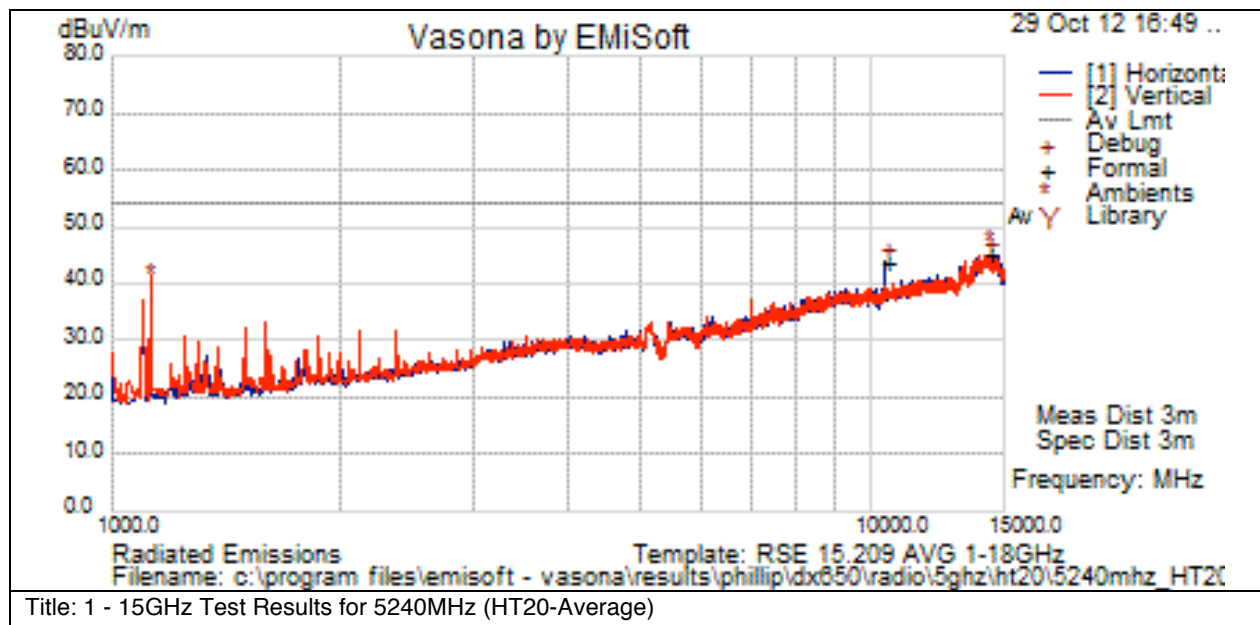
Test Results Table

| Frequency MHz | Raw dBuV | Cable Loss | AF dB | Level dBuV/m | Measurement Type | Pol | Hgt cm | Azt Deg | Limit dBuV/m | Margin dB | Pass /Fail | Comments |
|------------------|-------------|---------------|-------|-----------------|---------------------|-----|-----------|------------|-----------------|--------------|------------|-------------|
| 14398.125 | 39 | 12.4 | 7.1 | 58.4 | Pk | V | 100 | 0 | 74 | -15.5 | Pass | Nosie Floor |



Graphical Test Results HT20: 1 – 15GHz (5240MHz – Average)

Note that the data displayed on the plots detailed in this appendix were measured using a 'Peak Detector'. Please refer to the results table for the detectors used during formal measurements



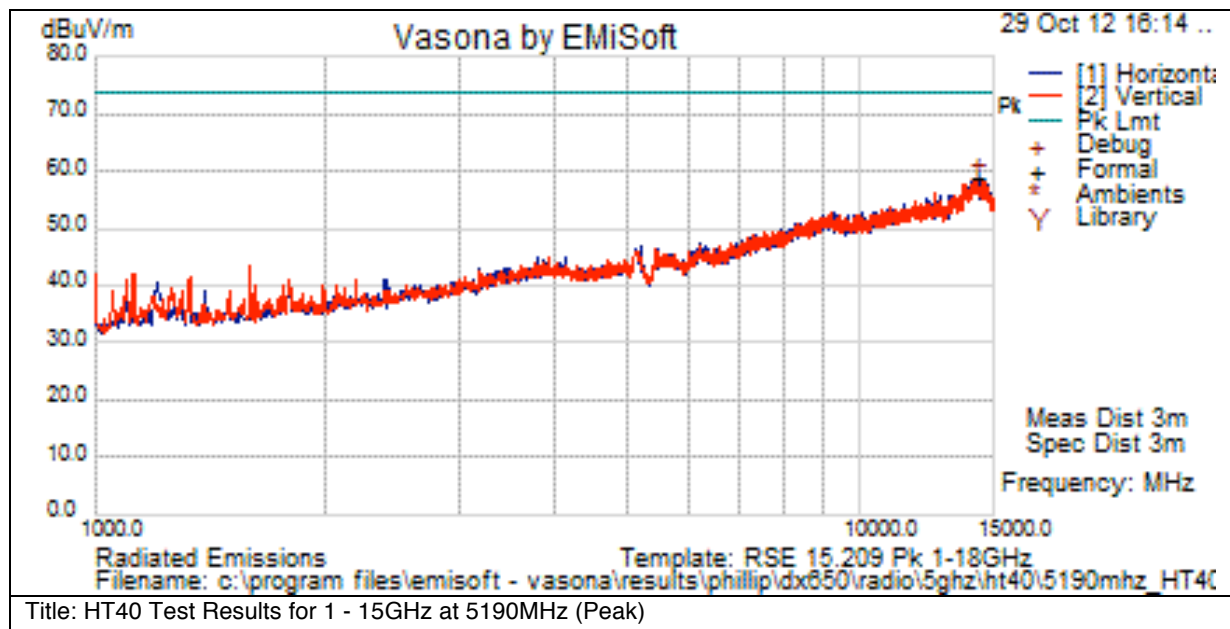
Test Results Table

| Frequency MHz | Raw dBuV | Cable Loss | AF dB | Level dBuV/m | Measurement Type | Pol | Hgt cm | Azt Deg | Limit dBuV/m | Margin dB | Pass /Fail | Comments |
|---------------|----------|------------|-------|--------------|------------------|-----|--------|---------|--------------|-----------|------------|-------------|
| 14392.813 | 25.4 | 12.4 | 7.1 | 44.9 | Av | V | 100 | 0 | 54 | -9.1 | Pass | Noise Floor |
| 10477.5 | 27.9 | 10.5 | 5.4 | 43.9 | Av | H | 100 | 0 | 54 | -10.1 | Pass | |



Graphical Test Results HT40: 1 – 15GHz (5190MHz – Peak)

Note that the data displayed on the plots detailed in this appendix were measured using a 'Peak Detector'. Please refer to the results table for the detectors used during formal measurements

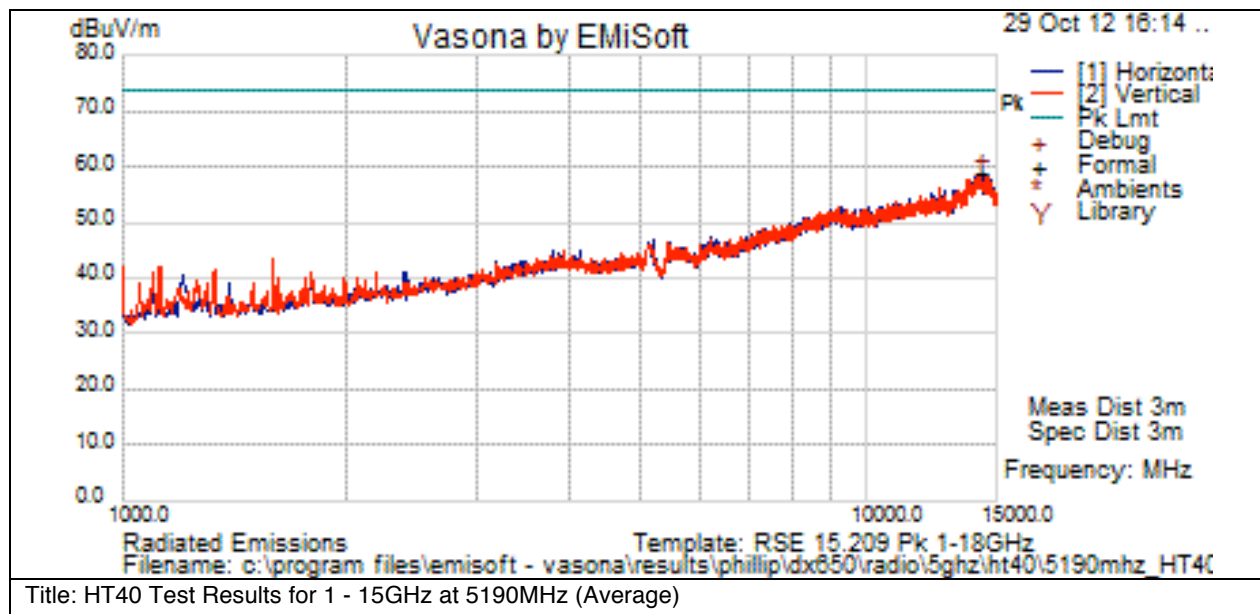


Test Results Table

| Frequency MHz | Raw dBuV | Cable Loss | AF dB | Level dBuV/m | Measurement Type | Pol | Hgt cm | Azt Deg | Limit dBuV/m | Margin dB | Pass /Fail | Comments |
|---------------|----------|------------|-------|--------------|------------------|-----|--------|---------|--------------|-----------|------------|-------------|
| 14244.063 | 39 | 12.4 | 7.2 | 58.7 | Pk | H | 100 | 0 | 74 | -15.3 | Pass | Noise Floor |

Graphical Test Results HT40: 1 – 15GHz (5190MHz – Average)

Note that the data displayed on the plots detailed in this appendix were measured using a 'Peak Detector'. Please refer to the results table for the detectors used during formal measurements



Test Results Table

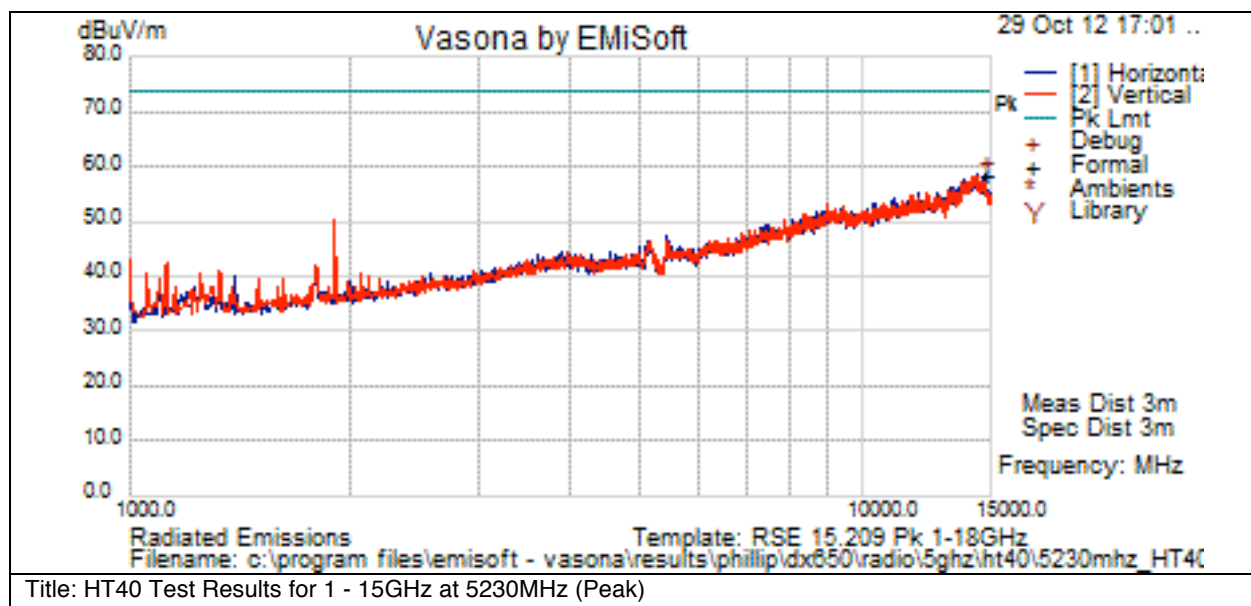
| Frequency MHz | Raw dBuV | Cable Loss | AF dB | Level dBuV/m | Measurement Type | Pol | Hgt cm | Azt Deg | Limit dBuV/m | Margin dB | Pass /Fail | Comments |
|---------------|----------|------------|-------|--------------|------------------|-----|--------|---------|--------------|-----------|------------|-------------|
| 14350.313 | 25.5 | 12.5 | 7.1 | 45.1 | Av | H | 100 | 0 | 54 | -8.9 | Pass | Noise Floor |



| Frequency MHz | Raw dBuV | Cable Loss | AF dB | Level dBuV/m | Measurement Type | Pol | Hgt cm | Azt Deg | Limit dBuV/m | Margin dB | Pass /Fail | Comments |
|---------------|----------|------------|-------|--------------|------------------|-----|--------|---------|--------------|-----------|------------|----------|
| 6918.125 | 31.7 | 8.1 | -1.1 | 38.6 | Av | H | 100 | 0 | 54 | -15.3 | Pass | |

Graphical Test Results HT40: 1 – 15GHz (5230MHz – Peak)

Note that the data displayed on the plots detailed in this appendix were measured using a 'Peak Detector'. Please refer to the results table for the detectors used during formal measurements



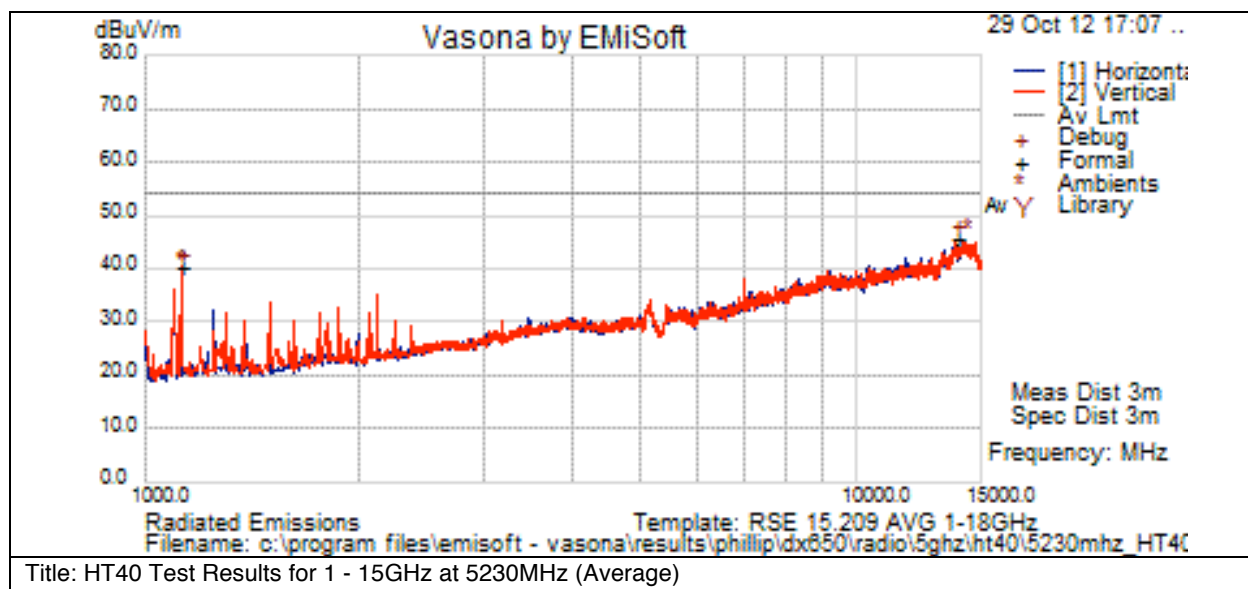
Test Results Table



| Frequency MHz | Raw dBuV | Cable Loss | AF dB | Level dBuV/m | Measurement Type | Pol | Hgt cm | Azt Deg | Limit dBuV/m | Margin dB | Pass /Fail | Comments |
|---------------|----------|------------|-------|--------------|------------------|-----|--------|---------|--------------|-----------|------------|-------------|
| 14732.813 | 39.6 | 12.6 | 6.3 | 58.5 | Pk | H | 100 | 0 | 74 | -15.5 | Pass | Noise Floor |

Graphical Test Results HT40: 1 – 15GHz (5230MHz – Average)

Note that the data displayed on the plots detailed in this appendix were measured using a 'Peak Detector'. Please refer to the results table for the detectors used during formal measurements

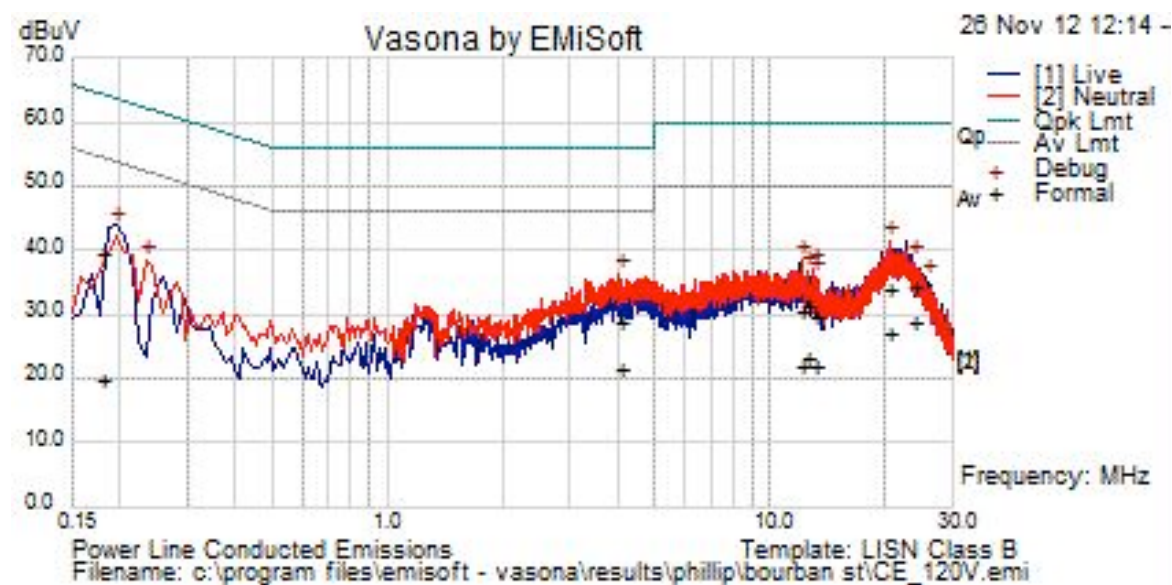


Test Results Table



| Frequency MHz | Raw dBuV | Cable Loss | AF dB | Level dBuV/m | Measurement Type | Pol | Hgt cm | Azt Deg | Limit dBuV/m | Margin dB | Pass /Fail | Comments |
|---------------|----------|------------|-------|--------------|------------------|-----|--------|---------|--------------|-----------|------------|-------------|
| 13856.25 | 26.5 | 12.2 | 6.7 | 45.4 | Av | V | 100 | 0 | 54 | -8.6 | Pass | Noise Floor |
| 1127.5 | 45 | 3.2 | -8 | 40.2 | Av | V | 100 | 0 | 54 | -13.8 | Pass | |

Conducted emissions

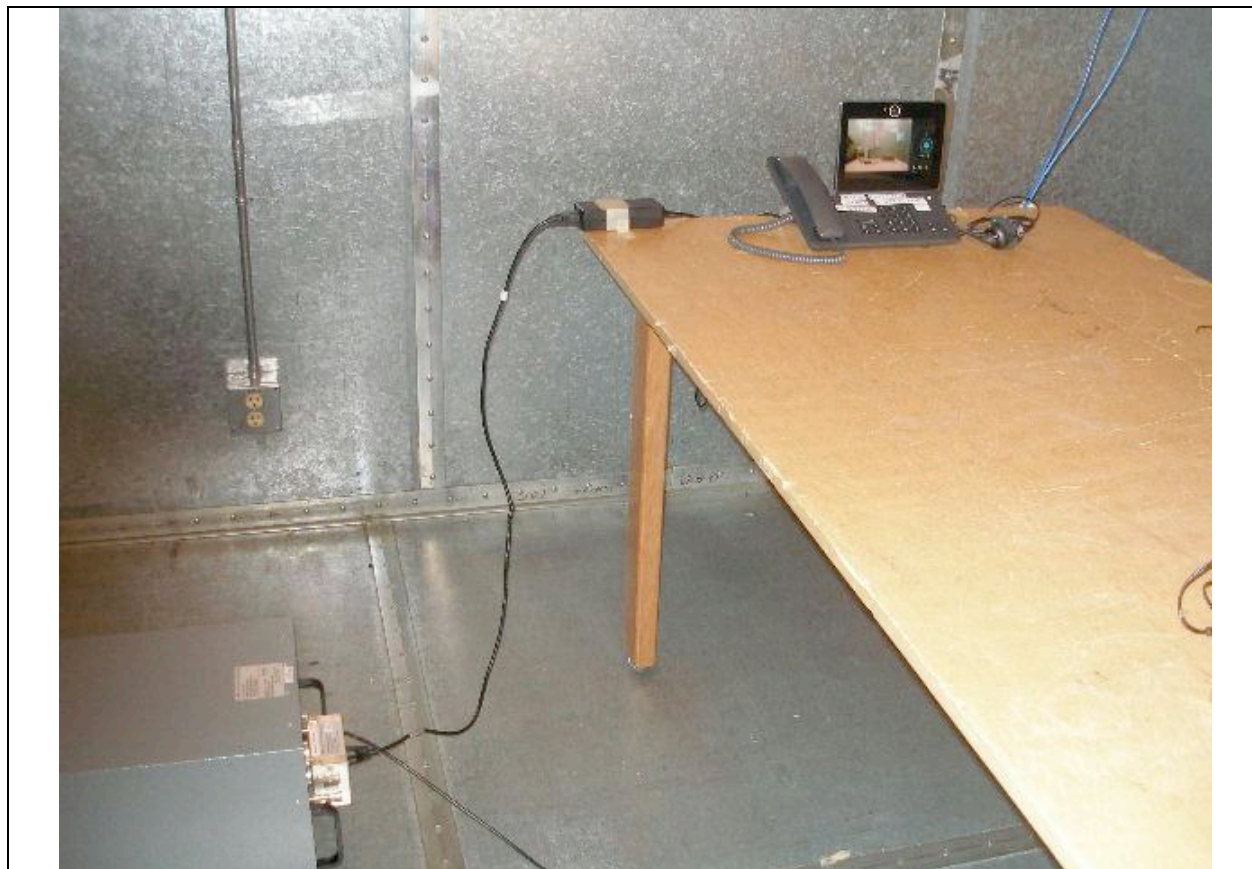


Test Results Table

| Frequency MHz | Raw dBuV | Cable Loss | Factors dB | Level dBuV | Measurement Type | Line | Limit dBuV | Margin dB | Pass /Fail | Comments |
|---------------|----------|------------|------------|------------|------------------|------|------------|-----------|------------|----------|
| 23.664 | 7.5 | 21 | 0.2 | 28.6 | Av | L | 50 | -21.4 | Pass | |
| 20.566 | 6.5 | 20.4 | 0.2 | 27.1 | Av | N | 50 | -22.9 | Pass | |
| 4.035 | 1.5 | 20 | 0 | 21.6 | Av | N | 46 | -24.4 | Pass | |



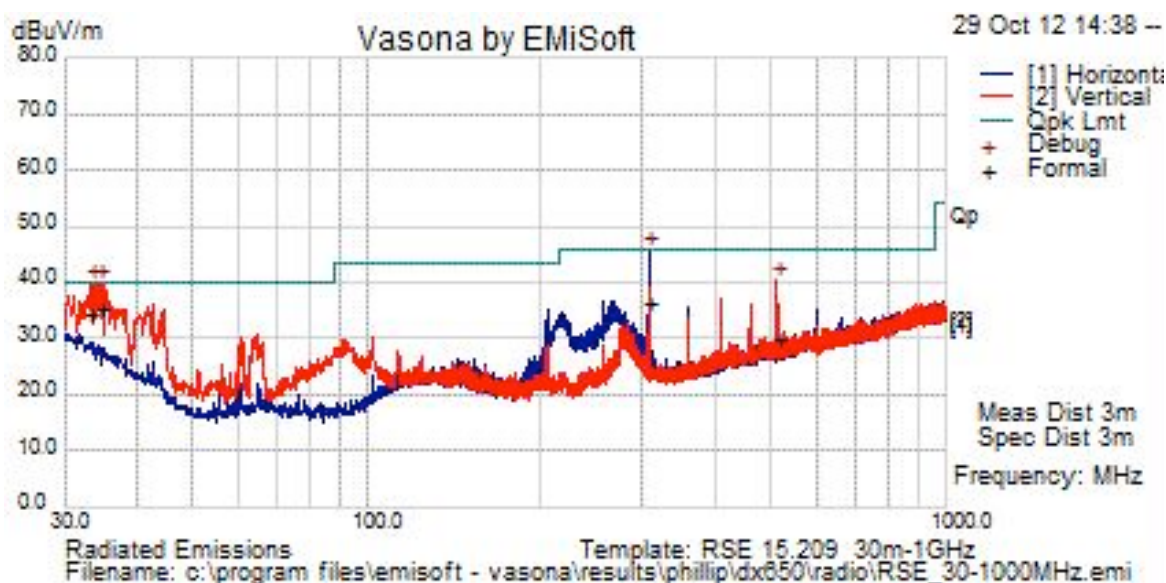
| Frequency MHz | Raw dBuV | Cable Loss | Factors dB | Level dBuV | Measureme nt Type | Line | Limit dBuV | Margin dB | Pass /Fail | Comments |
|------------------|-------------|---------------|---------------|---------------|----------------------|------|---------------|--------------|------------|----------|
| 0.1799 | 18.6 | 21 | 0 | 39.6 | Qp | L | 64.5 | -24.9 | Pass | |
| 23.664 | 13.4 | 21 | 0.2 | 34.5 | Qp | L | 60 | -25.5 | Pass | |
| 20.566 | 13.2 | 20.4 | 0.2 | 33.8 | Qp | N | 60 | -26.2 | Pass | |
| 12.47 | 2.7 | 20.2 | 0.1 | 23.1 | Av | N | 50 | -26.9 | Pass | |
| 4.035 | 8.5 | 20 | 0 | 28.6 | Qp | N | 56 | -27.4 | Pass | |
| 13.054 | 1.4 | 20.3 | 0.1 | 21.8 | Av | N | 50 | -28.2 | Pass | |
| 12.136 | 1.5 | 20.2 | 0.1 | 21.8 | Av | N | 50 | -28.2 | Pass | |
| 12.47 | 10.8 | 20.2 | 0.1 | 31.2 | Qp | N | 60 | -28.8 | Pass | |
| 12.136 | 10 | 20.2 | 0.1 | 30.3 | Qp | N | 60 | -29.7 | Pass | |
| 13.054 | 9.1 | 20.3 | 0.1 | 29.5 | Qp | N | 60 | -30.5 | Pass | |
| 0.1799 | -1.2 | 21 | 0 | 19.8 | Av | L | 54.5 | -34.7 | Pass | |



Title: Conducted Emissions Configuration Photograph

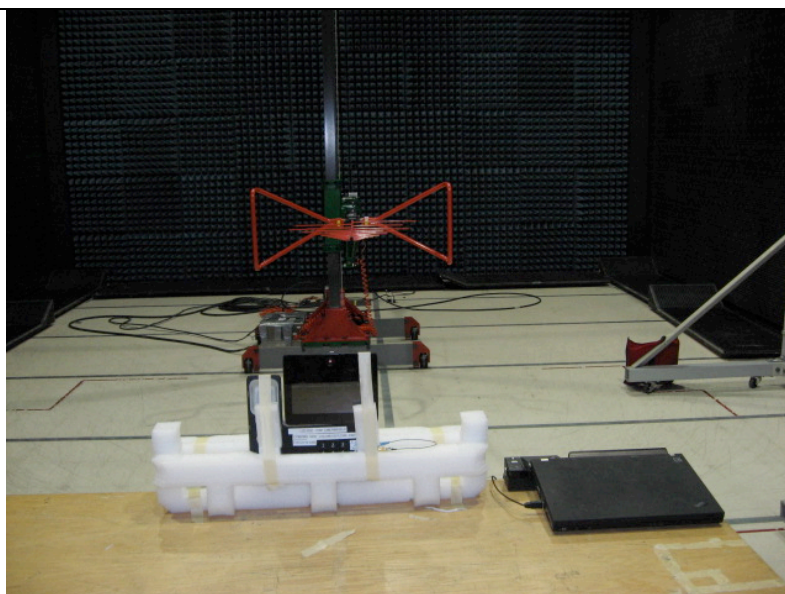


Radiated emissions

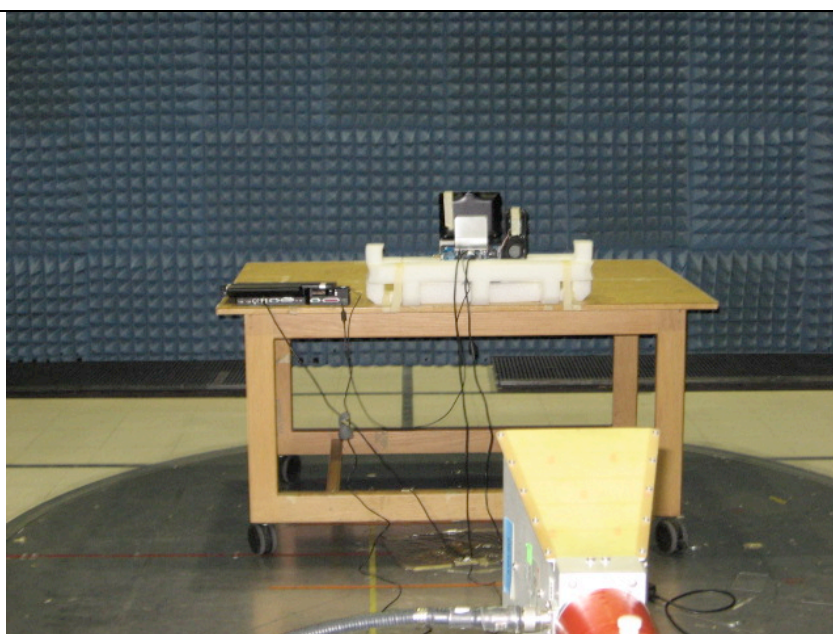


Test Results Table

| Frequency MHz | Raw dBuV | Cable Loss | AF dB | Level dBuV/m | Measurement Type | Pol | Hgt cm | Azt Deg | Limit dBuV/m | Margin dB | Pass /Fail | Comments |
|---------------|----------|------------|-------|--------------|------------------|-----|--------|---------|--------------|-----------|------------|----------|
| 34.38 | 16.9 | 0.5 | 18 | 35.4 | Qp | V | 110 | 66 | 40 | -4.6 | Pass | |
| 33.179 | 14.9 | 0.5 | 18.9 | 34.3 | Qp | V | 105 | 38 | 40 | -5.7 | Pass | |
| 307.047 | 21.2 | 1.6 | 13.6 | 36.4 | Qp | H | 103 | 97 | 46 | -9.6 | Pass | |
| 511.908 | 10 | 2.1 | 17.8 | 29.8 | Qp | V | 101 | 148 | 46 | -16.2 | Pass | |

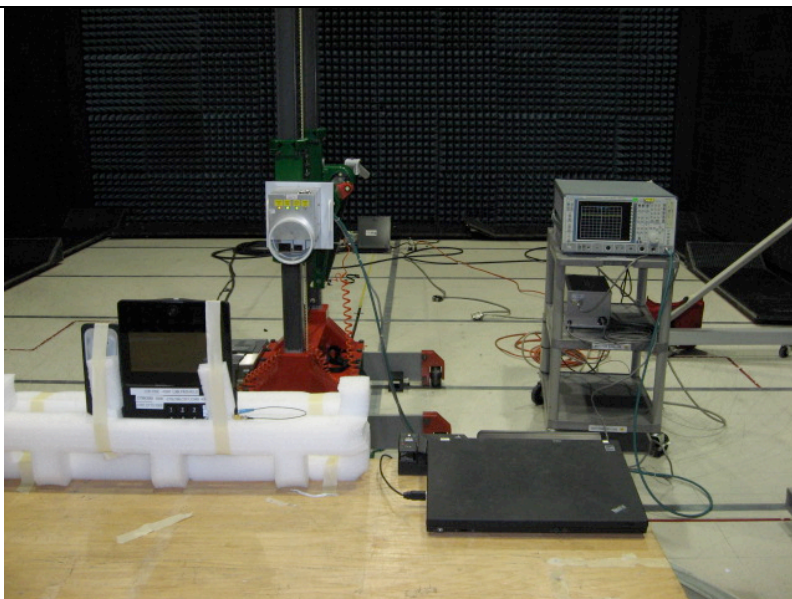


Title: Radiated Spurious Emissions Test Configuration from 30M to 1000MHz



Title: Radiated Spurious Emissions 1G to 18GHz Test Configuration

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Title: Radiated Spurious Emissions 18 – 40GHz Test Configuration

Maximum Permissible Exposure (MPE) Calculations

15.407: U-NII devices are subject to the radio frequency radiation exposure requirements specified in Sec. 1.1307(b), Sec. 2.1091 and Sec. 2.1093 of this chapter, as appropriate. All equipment shall be considered to operate in a "general population/uncontrolled" environment. Applications for equipment authorization of devices operating under this section must contain a statement confirming compliance with these requirements for both fundamental emissions and unwanted emissions. Technical information showing the basis for this statement must be submitted to the Commission upon request.

Given

$$E = \sqrt{(30 \cdot P \cdot G)/d} \text{ and } S = E^2/3770$$

where

E=Field Strength in Volts/meter

P=Power in Watts

G=Numerical Antenna Gain

d=Distance in meters

S=Power Density in mW/cm²

Combine equations and rearrange the terms to express the distance as a function of the remaining variables:

$$d = \sqrt{((30 \cdot P \cdot G)/(3770 \cdot S))}$$

Changing to units of power in mW and distance in cm, using:

$$P(\text{mW}) = P(\text{W})/1000 \quad d(\text{cm}) = 100 \cdot d(\text{m})$$

yields

$$d = 100 \cdot \sqrt{((30 \cdot (P/1000) \cdot G)/(3770 \cdot S))}$$

$$d = 0.282 \cdot \sqrt{(P \cdot G/S)}$$

where

d=Distance in cm

P=Power in mW

G=Numerical Antenna Gain

S=Power Density in mW/cm²

Substituting the logarithmic form of power and gain using:

$$P(\text{mW}) = 10^{(P(\text{dBm})/10)} \quad G(\text{numeric}) = 10^{(G(\text{dBi})/10)}$$

yields

$$d = 0.282 \cdot 10^{((P+G)/20)} / \sqrt{S} \quad \text{Equation (1)}$$

and

$$S = ((0.282 \cdot 10^{((P+G)/20)})/d)^2 \quad \text{Equation (2)}$$

where

d=MPE distance in cm

P=Power in dBm

G=Antenna Gain in dBi

S=Power Density in mW/cm²



Equation (1) and the measured peak power are used to calculate the MPE distance. Note that for mobile or fixed location transmitters such as an access point, the minimum separation distance is 20 cm even if the calculations indicate that the MPE distance may be less.

$S=1\text{mW/cm}^2$ maximum. Using the peak power levels recorded in the test report along with Equation 1 above, the MPE distances are calculated as follows.

| Frequency (MHz) | Bit Rate (Mbps) | Power Density (mW/cm ²) | Peak Transmit Power (dBm) | Antenna Gain (dBi) | MPE Distance (cm) | Limit (cm) | Margin (cm) |
|-----------------|-----------------|-------------------------------------|---------------------------|--------------------|-------------------|------------|-------------|
| 5180 | 6 | 1 | 14.76 | 2.4 | 2.03 | 20 | 17.97 |
| 5230 | M0 | 1 | 14.53 | 2.4 | 1.98 | 20 | 18.02 |
| 5240 | M0 | 1 | 14.52 | 2.4 | 1.98 | 20 | 18.02 |

MPE Calculations

To maintain compliance, installations will assure a separation distance of at least 20cm.

Using Equation 2, the MPE levels (s) at 20 cm are calculated as follows:

| Frequency (MHz) | Bit Rate (Mbps) | MPE Distance (cm) | Peak Transmit Power (dBm) | Antenna Gain (dBi) | Power Density (mW/cm ²) | Limit (mW/cm ²) | Margin (mW/cm ²) |
|-----------------|-----------------|-------------------|---------------------------|--------------------|-------------------------------------|-----------------------------|------------------------------|
| 5180 | 6 | 20 | 14.76 | 2.4 | 0.010 | 1 | 0.99 |
| 5230 | M0 | 20 | 14.53 | 2.4 | 0.010 | 1 | 0.99 |
| 5240 | M0 | 20 | 14.52 | 2.4 | 0.010 | 1 | 0.99 |



Appendix C: Test Equipment/Software Used to perform the test

| Equip# | Manufacturer/ Model | Description | Last Cal | Next Due |
|--------|---|---|-------------|-------------|
| 041986 | Murata Electronics MXGS83RK3000 | Special Radio Test Adaptor Cable | 29-MAY-2012 | 29-MAY-2013 |
| 034974 | Midwest Microwave ATT-0640-20-29M-02 | Attenuator, 20dB, DC-40GHz | 25-MAY-2012 | 25-MAY-2013 |
| 035609 | Micro-Tronics BRC50703-02 | Notch Filter, SB: 5.150-5.350 GHz, to 11 GHz | 06-JUL-2012 | 06-JUL-2013 |
| 033988 | Agilent E4446A | Precision Spectrum Analyzer | 27-NOV-2012 | 27-NOV-2013 |
| 008024 | Huber + Suhner SF106A | 3 meter Sucoflex cable | 05-NOV-2012 | 05-NOV-2013 |
| 030443 | Micro-Coax UFB311A-0-1560-520520 | RF Coaxial Cable, to 18GHz, 156 In. | 05-NOV-2012 | 05-NOV-2013 |
| 033602 | Midwest Microwave CSY-NMNM-80-273001 | RF Coaxial Cable, 27ft. to 18GHz | 05-NOV-2012 | 05-NOV-2013 |
| 045588 | Sunol Sciences JB1 | Combination Antenna | 14-DEC-2011 | 14-DEC-2012 |
| 045051 | Rohde & Schwarz ESCI | EMI Test Receiver | 02-NOV-2012 | 02-NOV-2013 |
| 002119 | EMC Test Systems/ 3115 | Double Ridged Guide Horn Antenna | 07-AUG-2012 | 07-AUG-2013 |
| 008022 | Huber + Suhner SF106A | 1m Sucoflex cable | 16-DEC-2011 | 16-DEC-2012 |
| 005691 | Miteq NSP1800-25-S1 | Broadband Preamplifier (1-18GHz) | 31-JAN-2012 | 31-JAN-2013 |
| 035613 | Micro-Tronics BRM50702-02 | Notch Filter, SB: 2.4 - 2.5 GHz, to 18 GHz | 30-MAY-2012 | 30-MAY-2013 |
| 042000 | Agilent E4440A | Spectrum Analyzer | 29-JUN-2012 | 29-JUN-2013 |
| 024201 | Rohde & Schwarz FSEK30 | EMI Test Receiver | 30-NOV-2012 | 30-NOV-2013 |
| 028072 | CISCO 1840 | 18-40GHz EMI Test Fixture | 15-FEB-2012 | 15-FEB-2013 |
| 035095 | Micro-Coax UFA147A-0-0180-110200 | RF Coax Cable to 40 GHz, 18in | 25-OCT-2012 | 25-OCT-2-13 |
| 043023 | Anritsu MT8852B | Bluetooth Test Set | 14-SEP-2012 | 14-SEP-2013 |
| 035639 | Micro-Tronics BRC50704-02 | Notch Filter, SB: 5.470-5.725 GHz, to 12 GHz | 09-AUG-2012 | 09-AUG-2013 |
| 031700 | Micro-Tronics BRC50705 | Notch Filter, SB: 5.725-5.875 GHz, to 12 GHz | 30-MAY-2012 | 30-MAY-2013 |
| 008097 | Huber + Suhner/ RG-223 | RG-233 Cable 9m | 24-JUL-2012 | 24-JUL-2013 |
| 004924 | Rohde & Schwarz/ ESHS30 | EMI Receiver (9KHz-30MHz) | 29-NOV-12 | 29-NOV-13 |
| 008185 | Fischer Custom Communications/ FCC-450B-2.4-N | Instrumentation Limiter | 01-AUG-2012 | 01-AUG-2013 |
| 008197 | TTE/ H613-150K-50-21378 | Hi Pass Filter - 150KHz cutoff | 10-APR-2012 | 10-APR-2013 |
| 008394 | Coleman/ RG-223 | RG-223 Cable 6 ft | 23-MAY-2012 | 23-MAY-2013 |



| | | | | |
|--------|--|--|---------------------|-------------|
| 008490 | Bird/ 5-T-MN | 5W 50 Ohm Terminator | 01-JUN-2012 | 01-JUN-2013 |
| 007036 | HP/ E7401A | Spectrum Analyzer | 12-SEP-2012 | 12-SEP-2013 |
| 018981 | Fischer Custom Communications/ FCC-801-M2-32A | Power Line Coupling/Decoupling Network | 03-MAY-2012 | 03-MAY-2013 |
| 020767 | Fischer Custom Communications/ FCC-450B-2.4-N | Instrumentation Limiter | 01-AUG-2012 | 01-AUG-2013 |
| 023874 | Fischer Custom Communications/ FCC-LISN-PA-NEMA-5-15 | Power Adaptor, Polarized 120VAC | 07-SEP-2012 | 07-SEP-2013 |
| 036033 | York/ CNE V | Comparison Noise Emitter | Cal Not Required | N/A |
| 044940 | Rohde & Schwarz/ ESU40 | EMI Test Receiver, 20Hz-40GHz | 08-MAY-12 | 08-MAY-13 |

Appendix D: Test Procedures

Measurements were made in accordance with

- KDB Publication No. 789033
- Measurement method of spurious emission tolerance to the International Telecommunication Union (ITU) Recommendation SM329.
- ANSI C63.4
- ANSI C63.10/D8

Test procedures are summarized below

| | |
|---------------------------------|-----------------|
| 6dB Bandwidth | EDCS # - 422115 |
| 26dB Bandwidth | EDCS # - 422115 |
| Average Output Power | EDCS # - 422117 |
| Co-Located Transmitter | EDCS # - 422118 |
| Conducted Spurious Test | EDCS # - 422119 |
| Peak Transmit Power Measurement | EDCS # - 422123 |
| Power Spectral Density | EDCS # - 422113 |
| Peak Excursion Test | EDCS # - 422121 |
| Radiated Band Edge | EDCS # - 422124 |
| Radiated Spurious Test | EDCS # - 422125 |