LTE5 Channel Bandwidth _ 64QAM _ Middle Channels (1962.5MHz and 2155MHz) Simultaneously:

9kHz to 150kHz



20MHz to 3GHz



6GHz to 10GHz



14GHz to 18GHz



150kHz to 20MHz



3GHz to 6GHz



10GHz to 14GHz





LTE5 Channel Bandwidth _ 256QAM _ Middle Channels (1962.5MHz and 2155MHz) Simultaneously:

9kHz to 150kHz



20MHz to 3GHz



6GHz to 10GHz



14GHz to 18GHz



150kHz to 20MHz



3GHz to 6GHz



10GHz to 14GHz





LTE10 Channel Bandwidth _ QPSK _ Middle Channels (1962.5MHz and 2155MHz) Simultaneously:

9kHz to 150kHz



20MHz to 3GHz



6GHz to 10GHz



14GHz to 18GHz



150kHz to 20MHz



3GHz to 6GHz



10GHz to 14GHz





LTE10 Channel Bandwidth _ 16QAM _ Middle Channels (1962.5MHz and 2155MHz) Simultaneously:

9kHz to 150kHz



20MHz to 3GHz



6GHz to 10GHz



14GHz to 18GHz



150kHz to 20MHz



3GHz to 6GHz



10GHz to 14GHz





LTE10 Channel Bandwidth _ 64QAM _ Middle Channels (1962.5MHz and 2155MHz) Simultaneously:

9kHz to 150kHz



20MHz to 3GHz



6GHz to 10GHz



14GHz to 18GHz



150kHz to 20MHz



3GHz to 6GHz



10GHz to 14GHz





LTE10 Channel Bandwidth _ 256QAM _ Middle Channels (1962.5MHz and 2155MHz) Simultaneously:

9kHz to 150kHz



20MHz to 3GHz



6GHz to 10GHz



14GHz to 18GHz



150kHz to 20MHz



3GHz to 6GHz



10GHz to 14GHz





LTE15 Channel Bandwidth _ QPSK _ Middle Channels (1962.5MHz and 2155MHz) Simultaneously:

9kHz to 150kHz



20MHz to 3GHz



6GHz to 10GHz



14GHz to 18GHz



150kHz to 20MHz



3GHz to 6GHz



10GHz to 14GHz





LTE15 Channel Bandwidth _ 16QAM _ Middle Channels (1962.5MHz and 2155MHz) Simultaneously:

9kHz to 150kHz



20MHz to 3GHz



6GHz to 10GHz



14GHz to 18GHz



150kHz to 20MHz



3GHz to 6GHz



10GHz to 14GHz





LTE15 Channel Bandwidth _ 64QAM _ Middle Channels (1962.5MHz and 2155MHz) Simultaneously:

9kHz to 150kHz



20MHz to 3GHz



6GHz to 10GHz



14GHz to 18GHz



150kHz to 20MHz



3GHz to 6GHz



10GHz to 14GHz





LTE15 Channel Bandwidth _ 256QAM _ Middle Channels (1962.5MHz and 2155MHz) Simultaneously:

9kHz to 150kHz



20MHz to 3GHz



6GHz to 10GHz



14GHz to 18GHz



150kHz to 20MHz



3GHz to 6GHz



10GHz to 14GHz





LTE20 Channel Bandwidth _ QPSK _ Middle Channels (1962.5MHz and 2155MHz) Simultaneously:

9kHz to 150kHz



20MHz to 3GHz



6GHz to 10GHz



14GHz to 18GHz



150kHz to 20MHz



3GHz to 6GHz



10GHz to 14GHz





LTE20 Channel Bandwidth _ 16QAM _ Middle Channels (1962.5MHz and 2155MHz) Simultaneously:

9kHz to 150kHz



20MHz to 3GHz



6GHz to 10GHz



14GHz to 18GHz



150kHz to 20MHz



3GHz to 6GHz



10GHz to 14GHz





LTE20 Channel Bandwidth _ 64QAM _ Middle Channels (1962.5MHz and 2155MHz) Simultaneously:

9kHz to 150kHz



20MHz to 3GHz



6GHz to 10GHz



14GHz to 18GHz



150kHz to 20MHz



3GHz to 6GHz



10GHz to 14GHz





LTE20 Channel Bandwidth _ 256QAM _ Middle Channels (1962.5MHz and 2155MHz) Simultaneously:

9kHz to 150kHz



20MHz to 3GHz



6GHz to 10GHz



14GHz to 18GHz



150kHz to 20MHz



3GHz to 6GHz



10GHz to 14GHz





Transmitter Radiated Spurious Emissions

During radiated emission testing all antenna ports of the base station were terminated with 50ohm termination blocks via the external RF notch filter as shown in the diagram below.



Based on antenna port conducted spurious emissions tests results, preliminary scans for radiated spurious emissions were performed in 30MHz – 22GHz frequency range. One radiated emission test configuration (with the external notch filter and cooling fan) was used to prove compliance for both the AWS and PCS frequency bands. The 3GPP Band 25 and the 3GPP Band 66 transmitters were enabled simultaneously at maximum power using QPSK modulation on all four ports for this test. The test includes channel bandwidth with the highest spectral density (LTE5) for both frequency bands. The bottom, middle and top frequency channels for each band were enabled. The carrier configuration for the radiated emission testing is provided below. Final maximized peak radiated emissions were measured in these modes.

| Frequency Band | Antenna Port | RF Bandwidth | EARFCN | Transmit Frequency |
|-------------------|-----------------|--------------|-----------------------------|-----------------------|
| PCS | 1 | 5 MHz | 8065 (Bottom Channel) | 1932.5 MHz |
| PCS | 2 | 5 MHz | 8365 (Middle Channel) | 1962.5 MHz |
| PCS | 3 | 5 MHz | 8365 (Middle Channel) | 1962.5 MHz |
| PCS | 4 | 5 MHz | 8665 (Top Channel) | 1992.5 MHz |
| AWS | 1 | 5 MHz | 66461 (Bottom Channel) | 2112.5 MHz |
| AWS | 2 | 5 MHz | 66886 (Middle Channel) | 2155.0 MHz |
| AWS | 3 | 5 MHz | 66886 (Middle Channel) | 2155.0 MHz |
| AWS | 4 | 5 MHz | 67261 (Top Channel with NF) | 2192.5 MHz |

| Frequency | Peaks Raw | Polarity | Antenna | Pre Amp | Cableloss | Peaks | Limit | Margin | Tower | Turntable |
|-----------|-----------|----------|---------|---------|-----------|--------|--------|---------|-------|-----------|
| MHz | dBuV/m | V/H | dB | dB | dB | dBuV/m | dBuV/m | dB | cm | Degrees |
| 4224.86 | 52.876 | V | 32.083 | -31.948 | 4.353 | 57.364 | 82.2 | -24.836 | 99.9 | 0 |
| 18719.8 | 71.154 | V | 44.715 | -46.421 | -3.921 | 65.527 | 91.7 | -26.173 | 100 | 0.9 |
| 18587.78 | 71.064 | Н | 44.82 | -46.676 | -3.938 | 65.27 | 91.7 | -26.43 | 100 | 287.9 |
| 20198.87 | 51.965 | Н | 44.61 | -28.043 | -3.777 | 64.755 | 91.7 | -26.945 | 100 | 360.1 |
| 8943.59 | 40.741 | V | 37.817 | -31.636 | 8.031 | 54.953 | 82.2 | -27.247 | 97.9 | 0.8 |
| 18723.7 | 69.681 | V | 44.717 | -46.405 | -3.92 | 64.073 | 91.7 | -27.627 | 100 | 154.1 |
| 20170.7 | 52.21 | V | 44.616 | -29.111 | -3.779 | 63.936 | 91.7 | -27.764 | 100 | -0.1 |
| 17942.45 | 39.116 | Н | 46.3 | -28.872 | 6.852 | 63.396 | 91.7 | -28.304 | 199.1 | 0 |
| 18730.28 | 68.787 | V | 44.72 | -46.379 | -3.919 | 63.209 | 91.7 | -28.491 | 100 | -0.1 |
| 17932.4 | 37.823 | V | 46.257 | -28.863 | 6.851 | 62.068 | 91.7 | -29.632 | 199.1 | 0 |
| 9991.16 | 36.687 | Н | 38.29 | -30.88 | 8.465 | 52.562 | 82.2 | -29.638 | 200 | 360 |
| 8797.91 | 37.996 | Н | 37.764 | -31.219 | 7.496 | 52.037 | 82.2 | -30.163 | 99.9 | 360 |
| 9656.96 | 38.638 | V | 37.861 | -32.07 | 7.116 | 51.545 | 82.2 | -30.655 | 97 | 0 |
| 18502.27 | 66.38 | V | 44.821 | -46.505 | -3.95 | 60.746 | 91.7 | -30.954 | 100 | 167 |
| 4224.71 | 46.421 | Н | 32.083 | -31.948 | 4.352 | 50.908 | 82.2 | -31.292 | 128.9 | 293.8 |
| 5898.4 | 41.568 | V | 34.161 | -31.827 | 6.465 | 50.367 | 82.2 | -31.833 | 98.8 | 159.1 |
| 14232.45 | 39.974 | V | 41.877 | -29.315 | 6.115 | 58.651 | 91.7 | -33.049 | 199.9 | 0 |
| 18893.09 | 63.371 | Н | 44.855 | -45.728 | -3.896 | 58.602 | 91.7 | -33.098 | 100 | 211.8 |
| 7269.82 | 37.072 | Н | 36.41 | -31.5 | 6.609 | 48.591 | 82.2 | -33.609 | 100.2 | 360 |
| 14250.72 | 38.826 | Н | 41.867 | -29.27 | 6.133 | 57.556 | 91.7 | -34.144 | 199.1 | 0 |
| 18724.41 | 63.074 | Н | 44.717 | -46.402 | -3.92 | 57.469 | 91.7 | -34.231 | 100 | 360.2 |
| 18745.88 | 62.745 | V | 44.726 | -46.316 | -3.917 | 57.238 | 91.7 | -34.462 | 100 | 132.9 |
| 3931.97 | 42.381 | V | 32.58 | -32.199 | 4.966 | 47.728 | 82.2 | -34.472 | 100.2 | 0 |
| 17054.37 | 38.145 | V | 41.848 | -29.507 | 6.685 | 57.171 | 91.7 | -34.529 | 199.1 | -0.1 |
| 2949.07 | 47.045 | V | 29.587 | -33.732 | 4.173 | 47.073 | 82.2 | -35.127 | 100.1 | 0 |
| 18889.83 | 61.256 | Н | 44.851 | -45.741 | -3.897 | 56.469 | 91.7 | -35.231 | 100 | 360 |
| 2948.93 | 46.512 | Н | 29.586 | -33.733 | 4.173 | 46.538 | 82.2 | -35.662 | 148.1 | 49.2 |
| 13255.31 | 37.31 | V | 41.342 | -28.284 | 5.662 | 56.03 | 91.7 | -35.67 | 200.1 | 0.9 |
| 14966.04 | 38.694 | Н | 39.989 | -29.199 | 6.172 | 55.656 | 91.7 | -36.044 | 199.1 | 0 |
| 14847.71 | 38.619 | V | 40.413 | -29.778 | 6.109 | 55.363 | 91.7 | -36.337 | 199.1 | 0 |

A three meter measurement distance was used for radiated emission less than 10GHz. A one meter measurement distance was used for radiated emission greater than 10GHz. The highest radiated emissions detected were more than 20dB below the three meter limit of 82.2dBuV/m and the one meter limit of 91.7dBuV/m (equivalent to -13dBm EIRP). Since all maximized measurements were more than 20dB below these levels, substitution measurements were not performed. TILE software was used for all preliminary scans and plots that are included on the following pages.



Radiated Emissions – 30-1000MHz – Horizontal at 3m



Radiated Emissions - 30-1000MHz - Vertical at 3m







Radiated Emissions - 1-10GHz - Vertical at 3m



Radiated Emissions - 10-18GHz - Horizontal at 1m



Radiated Emissions – 10-18GHz – Vertical at 1m







Radiated Emissions - 18-22GHz - Vertical at 1m

Frequency Stability/Accuracy

Carrier frequency stability at extreme temperatures and voltages, frequency error was measured as follows:

- (1) Transmitting in 5MHz-QPSK-LTE mode at center channel (1962.5MHz) on port 2.
- (2) The EUT temperature was stabilized at each temperature step (for a minimum of 30 minutes) prior to frequency accuracy measurement.

Nominal operating voltage of the product is declared as 48VDC.

Frequency error results are listed below for extreme voltages and temperatures.

Extreme Voltages:

| Percentage of Rated Supply | DC Voltage (VDC) | Frequency Error (Hz) at 20°C |
|----------------------------|------------------|------------------------------|
| 85% | 40.8 | 0.029 |
| 100% | 48.0 | 0.042 |
| 115% | 55.2 | 0.104 |

Extreme Temperatures:

| Temperature | Frequency Error (Hz) at 48VDC |
|-------------|-------------------------------|
| -30 °C | 2.731 |
| -20 °C | 3.146 |
| -10 °C | 3.274 |
| 0 °C | 2.782 |
| 10 °C | 2.387 |
| 20 °C | 0.042 |
| 30 °C | 0.088 |
| 40 °C | 0.121 |
| 50 °C | 0.126 |

Based on the results above, highest recorded frequency error (3.274Hz or 0.0017ppm) ensures that the transmitted signal remains in its authorized frequency block at extreme voltages and temperatures. The results above are deemed sufficient to demonstrate carrier frequency stability for all other channel bandwidth modes and modulations since all carriers are controlled by the same frequency stabilization circuitry that was subjected to the extreme conditions under this test.

APPENDIX B: ANTENNA PORT TEST DATA FOR THE AWS BAND W/O NOTCH FILTER

All conducted RF measurements for this test effort in this section were made at AHFIB antenna ports for the AWS band measurements. Antenna port RF conducted measurements in this section were made without the external notch filter. The test setup used is provided below.



Test Setup Used for Conducted RF Measurements on AHFIB without External Notch Filter

RF Output Power

RF output power has been measured in both Peak and RMS Average terms for each AWS transmit chain at the middle channel for 256QAM modulation and LTE5 bandwidth. Peak to average power ratio (PAPR) has been calculated as described in Section 5.7.2 of KDB971168 D01 v02r02 and all results are presented in tabular form below.

| Antonna | ITE Dandwidth | LTE - 256QAM | | | | |
|--------------------------|---------------|--------------|---------------|-----------|--|--|
| Antenna | | Peak (dBm) | Average (dBm) | PAPR (dB) | | |
| Port 1 Middle Channel | 5M | 53.59 | 45.67 | 7.92 | | |
| Port 2 Middle Channel | 5M | 53.65 | 45.77 | 7.88 | | |
| Port 3 Middle Channel | 5M | 53.65 | 45.78 | 7.87 | | |
| Port 4 Middle Channel | 5M | 53.69 | 45.80 | 7.89 | | |

The variation in RMS output power levels between the antenna ports is 0.13 dB per data sample provided above. Pre-compliance testing (and testing of similar EUTs) shows that the output power variation between antenna ports is small (the output ports are essentially electrically identical).

Pre-compliance testing has shown that the output power variation between modulation types is small. Antenna port 2 power output measurements for the LTE5 bandwidth for all modulation types on the middle (center) channel are provided below.

| | Modulation Type | | | | | | | |
|--|-----------------|--------------|---------------|--------------|---------------|--------------|---------------|--------------|
| | QPSK | | 16QAM | | 64QAM | | 256QAM | |
| | Peak (dBm) | Ave (dBm) | Peak (dBm) | Ave (dBm) | Peak (dBm) | Ave (dBm) | Peak (dBm) | Ave (dBm) |
| Antenna Port 2 Middle Channel LTE5 | 53.64 | 45.77 | 53.60 | 45.83 | 53.70 | 45.80 | 53.70 | 45.78 |

The output power variation between modulation types is small in this measurement snapshot (and from past efforts on similar hardware as well). The variation of average power output versus modulation type is 0.06dB for the data snapshot provided. The variation of peak power output versus modulation type is 0.10dB for the data snapshot provided. All power measurements in this report (except the sample test noted above) were performed with the EUT operating with 256QAM modulation.

Based on the AWS band results above and the PCS band power output, Port 2 had the highest combined RMS average power (for the AWS + PCS band) and therefore it was selected for all the remaining antenna port tests.

Subsequently output power levels on bottom, middle, and top channels in all 4 LTE channel bandwidths and 256QAM modulation type were tested only at Port 2 and the results presented below. The highest measured values are highlighted.

| Antenna | | LTE - 256QAM | | | | | |
|--------------------------|---------------|--------------|---------------|-----------|--|--|--|
| LTE Channel | LIE Bandwidth | Peak (dBm) | Average (dBm) | PAPR (dB) | | | |
| | 5M | 53.63 | 45.75 | 7.88 | | | |
| Port 2 | 10M | 53.92 | 45.85 | 8.07 | | | |
| Bottom Channel | 15M | 53.96 | 45.91 | 8.05 | | | |
| | 20M | 53.91 | 45.85 | 8.06 | | | |
| | 5M | 53.65 | 45.77 | 7.88 | | | |
| Port 2 Middle Channel | 10M | 53.84 | 45.82 | 8.02 | | | |
| | 15M | 53.84 | 45.84 | 8.00 | | | |
| | 20M | 53.91 | 45.78 | 8.13 | | | |
| | 5M | 53.68 | 45.78 | 7.90 | | | |
| Port 2 | 10M | 53.84 | 45.84 | 8.00 | | | |
| Top Channel | 15M | 53.87 | 45.85 | 8.02 | | | |
| | 20M | 53.92 | 45.90 | 8.02 | | | |

The data provided in the table shows (and testing of similar EUTs) that the output RMS power variation between channel bandwidths at the center frequency channel is small (0.07dB).

All measurement results are provided in the following pages. The total measurement RF path loss of the test setup (attenuator and test cables) was 40.2 dB and is accounted for by the spectrum analyzer reference level offset.

LTE5 Channel Power Plots at Middle Channel and 256QAM Modulation:





Port 2 - LTE5_Middle Channel_Peak



Port 3 - LTE5_ Middle Channel_Peak







Port 1 - LTE5_ Middle Channel_Average



Port 2 - LTE5_Middle Channel_Average







Port 4 - LTE5_ Middle Channel_Average



LTE5 Channel Power Plots for Antenna Port 2 at Middle Channel and all Modulation Types: LTE5_Middle Channel_QPSK_Peak Port 1 - LTE5_Middle Channel_QPSK_Average



LTE5_Middle Channel_16QAM_Peak



LTE5_ Middle Channel_64QAM_Peak



LTE5_Middle Channel_256QAM_Peak





LTE5_Middle Channel_16QAM_Average





LTE5_Middle Channel_256QAM_Average



LTE5_ Middle Channel_64QAM_Average

LTE5 Channel Power Plots for Antenna Port 2 and 256QAM Modulation:

LTE5_Bottom Channel_Peak



LTE5_Middle Channel_Peak



LTE5_Top Channel_Peak



LTE5_Bottom Channel_Average



LTE5_Middle Channel_Average



LTE5_Top Channel_Average

