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| 1 | Federal Communications Commission  Steve Jones  301-362-3056  [steve.jones@fcc.gov](mailto:steve.jones@fcc.gov) | 429-442 | 19,20 | 3&4 | A | [There appears to be over-representation of some UE manufacturers (i.e., Apple and Samsung) while other popular brands are not included (i.e., LG).](#Column7" \o "If any material is classified, follow DoDM 5200.01 guidance for marking the document.) | Noted – but current list is sufficient to provided needed measurements. Additional devices could be tested using this methodology by other organizations. | P |
| 2 | Federal Communications Commission  Steve Jones  301-362-3056  [steve.jones@fcc.gov](mailto:steve.jones@fcc.gov) | 477 | 22 | Fig 7 | S | Figure 7 alludes to “an array of LNAs”. How is this array to be configured? Are the LNA’s to be cascaded? What is the effective gain and insertion loss associated with the array? | Test is not cascading LNAs.  Will update figure in test report. | P |
| 3 | Federal Communications Commission  Steve Jones  301-362-3056  [steve.jones@fcc.gov](mailto:steve.jones@fcc.gov) | 477 | 22 | Fig 7 | S | Extreme care should be exercised when utilizing an LNA (or array of LNAs) to measure LTE emissions due to the inherent high peak-to-average power ratio (PAPR). Adequate “head room” must be observed to prevent the peak excursions from overdriving the LNA(s). In addition, the fact that the power can be spread over a bandwidth that can be significantly wider than the measurement resolution bandwidth must also be considered so as to prevent saturation of the LNA(s). Strongly recommend that periodic linearity checks are performed so as to preclude such saturation. | Care will be exercised to keep LNA power level below LNA saturation point.  Will do linearity checks during test. | A |
| 4 | Federal Communications Commission  Steve Jones  301-362-3056  [steve.jones@fcc.gov](mailto:steve.jones@fcc.gov) | 485-486 | 22 | 3 | S | It is stated that the “exact dwell time will be determined during the measurement and may be affected by the time needed for a peak measurement”. Given that an LTE signal is “noise-like”, the true peak power is a random variable and theoretically can be of infinite amplitude albeit on a very low probability basis. Thus, it’s not clear how the “time needed” is to be quantified. | Test will watch LTE emissions long enough to verify dwell time is picking up peak power. | A |
| 5 | Federal Communications Commission  Steve Jones  301-362-3056  [steve.jones@fcc.gov](mailto:steve.jones@fcc.gov) | 495 | 22 | 4 | S | “…the peak and RMS power levels of those samples are computed and those peak and RMS power levels are plotted…” As stated above, the true peak power of a noise-like LTE signal is a random value. It seems that what is really being measured here is the peak-detected power over a specified time period; however, that doesn’t really come across when reference is made to “peak power”. This is a global issue within the document, but this appears to be the first instance. | Will clarify and use term peak detected power in test report. | A |
| 6 | Federal Communications Commission  Steve Jones  301-362-3056  [steve.jones@fcc.gov](mailto:steve.jones@fcc.gov) | 493 and 500 | 22,23 | 4&5 | S | Several references are made to the use of a sample detector for performing the measurement, from which it appears that an RMS average will be determined over some unspecified integration time. However, in various other places in the document reference is made to the use of the RMS detector (e.g., Table 2). Thus, it’s not clear which of these two display detector options is actually being utilized. The FCC specifies the use of an RMS power averaging detector when performing compliance measurements on noise-like LTE emissions. | Average power will be determined by RMS detector.  Will clarify text in test report. | A |
| 7 | Federal Communications Commission  Steve Jones  301-362-3056  [steve.jones@fcc.gov](mailto:steve.jones@fcc.gov) | 495 | 22 | 5 | S | Will RMS average power (measured or calculated) include the quiescent time between transmission bursts? | FDMA devices have no quiescent time.  Additionally, test will force continuous transmission. | A |
| 8 | Federal Communications Commission  Steve Jones  301-362-3056  [steve.jones@fcc.gov](mailto:steve.jones@fcc.gov) | 541 | 25 | 1 | S | “The UE devices being measured will use OFDM modulation…”  OFDM is a multiple access scheme, not a modulation scheme. The individual subcarriers of an OFDM access structure utilize variants of two basic modulation types – PSK and QAM. Also, technically, the LTE UE’s do not utilize OFDM access techniques. Rather, the LTE uplink actually utilizes an SC-FDMA access scheme, whereas the eNB (downlink) utilizes OFDMA. | Agree – will clarify text in test report. | A |
| 9 | Federal Communications Commission  Steve Jones  301-362-3056  [steve.jones@fcc.gov](mailto:steve.jones@fcc.gov) | 545 & 557 | 25 & 26 | Fig 9 & Par 3 | S | The figure and the discussion assigns a 4 dB insertion loss to the RF splitter. Why is this 4 dB instead of the traditional 3 dB associated with dividing the signal power in half? | 3dB is the theoretical value, however 4dB is more realistic for total measured loss. | A |
| 10 | Federal Communications Commission  Steve Jones  301-362-3056  [steve.jones@fcc.gov](mailto:steve.jones@fcc.gov) | 566-570 | 26 | 3 & 4,  Also Fig A-5 | S | Regarding the performance of radiated measurements in those cases where an antenna port conducted measurement cannot be performed. A radiated measurement will provide the received power (or field strength) at a defined distance from the transmitter. How will the result be correlated to an equivalent conducted power level (i.e., what assumptions regarding transmit antenna gain and propagation path loss will be made)? Also, will antenna near field/far field conditions be considered? Most EMC equations and equivalencies presume that the measurement is performed in the far field regions of both the transmit and receive antennae. | Spectrum measurement plots are measuring power, normalized to 0dB, and not converted back to ERP. | A |
| 11 | Federal Communications Commission  Steve Jones  301-362-3056  [steve.jones@fcc.gov](mailto:steve.jones@fcc.gov) | 586 | 27 | 2 | S | “For pulsed transmitter emissions this variation goes to ….”  LTE emissions are not pulsed, at least not in the conventional sense. The emissions are often “bursted” but the duty cycle associated with such bursts is not typically periodic. | Agree that LTE emissions are not pulsed. Ratio is 10log. | A |
| 12 | Federal Communications Commission  Steve Jones  301-362-3056  [steve.jones@fcc.gov](mailto:steve.jones@fcc.gov) | 626-649 | 29 & 30 | 2 & 3 | S | The “coffin corner problem” is one that is often experienced in these types of measurements, particularly when attempting to measure band-edge emissions. Although the proposed methodology for dealing with this issue does help to mitigate the problem, it does not eliminate it (i.e., there will still be some leakage from the fundamental emission into the measurement). | Off-tuned YIG approach minimizes problem and allows a linear measurement. | A |
| 13 | Federal Communications Commission  Steve Jones  301-362-3056  [steve.jones@fcc.gov](mailto:steve.jones@fcc.gov) | 672 & Appendix A | 31 & 43 | Table3 | S | LTE emissions can dynamically assign one of several modulation/coding schemes depending on prevailing channel conditions. The test plan seems to allude to the use of only one modulation scheme - QPSK (coding rate does not seem to be considered, and from an RF standpoint, can be technically justified). QPSK (and BPSK) is what is known as a “constant envelope” emission. However, the other basic modulation scheme utilized by LTE, QAM, constitutes a non-constant envelope emission. Thus, focusing solely on the PSK modulation variant and not considering QAM may miss some potential effects. | Will compare QAM in one of the modes to QPSK modulation in the same mode for a pair of comparative spectra.  Will document result in the final test report. | A |
| 1 | T-Mobile  John Hunter | Gen’l |  |  |  | Suggest notch filters be used at the UE and eNodeB center frequencies in order to extend the dynamic range. | For this test, the YIG bandpass works better than the notch filter and provides 100dB dynamic range. | A |
| 2 | T-Mobile  John Hunter | Gen’l |  |  |  | We calculate that NASCTN in Phase I was able to measure down to -170 dBm/Hz which is very close to the KT noise floor. | Test approach provides appx -168dBm/Hz, which is close enough for test measurements. | A |
| 3 | T-Mobile | Gen’l |  |  |  | There is interest to see if in the CMW500 (eNodeB) OOBE noise floor measurements of specifications that they are not limiting the dynamic range. Further, there is only one circulator worth of isolation (~20 dB) between the CMW500 and the UE measurement spectrum analyzer. | Testing determined CMW500 does not limit dynamic range. | A |
| 4 | T-Mobile  John Hunter |  |  |  |  | It seems that in Phase I the eNodeB is attenuated about 40 dB at the input of the spectrum analyzer to measure down close to the -174 dBm/Hz KT limit. Phase I data is shown only for the adjacent 20 MHz band below the AMT S Band. If eNodeB OOBE data is needed in the AMT S Band itself (> 20 MHz), then dynamic range needs further extension. | Test method provides 100dB dynamic range. More information is needed if that is deemed insufficient. | A |
| 1 | AFMC 412 TW/ENI  Kenneth Temple |  |  | Table 2 & 3 |  | Modulation mode was not discussed. Even though your preliminary measurements indicated no difference in OOBE with respect to modulation mode (QPSK vs 16-QAM), I think it is important we at least include a discussion in the test plan about this. I am of the opinion that if RBs near the 1780MHz boundary are allocated, modulation mode on those RB's may affect OOBE. | 1) The OOBE at and around 1780 MHz will be measured once with QPSK on a full set of RBS and once with 16 QAM on the same RBs. The difference, if any, will be plotted in the data analysis phase.  2) Test execution will first lock transmitter into a single mode (e.g., 16 QAM) with all RBs running and measure the full spectrum. Then the test will lock it into a QPSK or BPSK mode and run the spectrum measurement one more time. Analysis will compare the results of the two spectra to see how much difference results. | A |
| 2 | AFMC 412 TW/ENI  Kenneth Temple |  |  | Table 2 & 3 |  | Location within the 50RB in the 10MHz channel are not mentioned in either Table, which is considered to be a pretty large oversight. OOBE will certainly be different between allocating RB=1 and RB=50. Perhaps another column for each Table is required identifying the RB's being allocated for allocations <50. | In normal, real-world, operations, RBs are not used from the edges towards the center in the presence of interference. That is how the test is constructed. There is no obvious benefit to testing a condition that is not applicable to normal operations. | A |
| 3 | AFMC 412 TW/ENI  Kenneth Temple | Gen’l |  |  |  | There should be some general OOBE test results to be gathered in this test, but the AMT community cares about the OOBE from the uplink above 1780MHz and downlink above 2180MHz starting at 220MHz. Since AMT is mentioned throughout the document, this goal should be clearly stated somewhere in the test plan. | Will specifically mention AMT community frequency objectives in test report. | A |