**3GPP TSG-RAN4 Meeting #116R4-2509106**

**Bengaluru, India, 25 – 29, August 2025**

**Agenda item:** 7.22.5

**Source:** Huawei, HiSilicon

**Title:** Text proposal for clause 8.4 in 38.191

**Document for:** approval

**<<< START OF CHANGES >>>**

### 8.4 Anechoic Chamber method

**8.4.1 General**

Test frequency band in clause 8.1.1 is used for tests described in this clause. A device shall be positioned according to the positioning guideline in clause 8.3. Device manufacturers shall declare direction of maximum backscattering to enable efficient measurement as this eliminates the need for spherical scan to find the direction of maximum backscattering.

During tests, device is placed on a platform with either combined axis or distributed axis at the origin of a Cartesian coordinate. Test antenna with two linear orthogonal polarizations supports both CW and Reader, namely CW and Reader share the same antenna with CW and Reader using both polarizations.

Declaration of maximum backscattering direction by device manufacturers can only made in 15 degree step size in both $θ$- and $ϕ$-direction in the coordinate system with reference to (0º, 0º) shown in Table 8.3.1-1 of clause 8.3.

**8.4.2 Backscattering measurement procedure**

Backscattered power is only measured at the direction of maximum backscattering declared by device manufacturers with two CW incident power levels.

The measurement procedure includes the following steps:

1. Place the DUT inside the QZ following the UE positioning guidelines defined in clause 8.3.
2. Position the measurement antenna such that the DUT direction of maximum backscattering faces the measurement antenna according to the declaration from device manufacturers.
3. DUT must be fully charged before the measurement according to device declaration on the required energy conditions.
4. Set the signal generator (i.e. R2D signal) and the CW generator to transmit at the target test frequency with θ-polarization. The transmit power of the signal generator shall be set such that the received power at DUT’s antenna is larger than minimum reference sensitivity requirement of the DUT. The transmit power of the CW generator shall be such that the CW incident power at the device antenna is [-27]dBm as given in clause 7.
5. Measure the power received in both θ-polarization and ϕ-polarization, either simultaneously or sequentially, and calculate $EIRP\_{DUT}(Pol\_{CW}=θ)$ by adding the composite loss of the entire transmission path, then summing up the power received in θ-polarization and ϕ-polarization.
6. Repeat step 4) and 5) setting the signal generator and the CW generator to transmit in ϕ-polarization and calculate $EIRP\_{DUT}(Pol\_{CW}=ϕ)$ by adding the composite loss of the entire transmission path, then summing up the power received in θ-polarization and ϕ-polarization.
7. Calculate the backscattered power at the direction declared by device manufacturers as:

$$P\_{backscatter}=\left(EIRP\_{DUT}\left(Pol\_{CW}=θ\right)\right)+\left(EIRP\_{DUT}\left(Pol\_{CW}=ϕ\right)\right)$$

Where

$EIRP\_{DUT}(Pol\_{CW}=θ)$ and $EIRP\_{DUT}(Pol\_{CW}=ϕ)$ are measured backscatter power at the device antenna when incident CW power is in θ-polarization and the ϕ-polarization, respectively.

1. Repeat step 4) to 7) with the CW incident power at the device antenna set to [-10]dBm as given in clause 7.

**8.4.3 Sensitivity**

Sensitivity is measured at 4 edge points of a partial sphere of [45º] degrees in elevation or θ-direction, namely ($θ$=45º, $ϕ$=0º), ($θ$=45º, $ϕ$=90º), ($θ$=45º, $ϕ$=180º), ($θ$=45º, $ϕ$=270º).

The measurement procedure includes the following steps:

1. Place DUT inside the QZ following the UE positioning guidelines defined in clause 8.3.
2. DUT must be fully charged before the measurement according to device declaration on the required energy conditions.
3. Set the CW generator to transmit at the target test frequency with θ-polarization. The transmit power of the CW generator shall be set such that the CW incident power at the device antenna is [x]dB higher than the receiver sensitivity requirement.
4. Set the signal generator (i.e. R2D signal) to transmit at the target test frequency with θ-polarization. The transmit power of the signal generator shall be set such that the received power at DUT’s antenna is at least [10]dB above minimum reference sensitivity requirement of the DUT.
5. Confirm that the DUT can send correct response in D2R channel within correct timing relationship and the test equipment is able to decode the responses by measuring the power received in both θ-polarization and ϕ-polarization either simultaneously or sequentially.
6. Determine $EIS\_{DUT}(Pol\_{Meas}=θ;Pol\_{CW}=θ)$, i.e. by sweeping the transmit power level for the signal generator (i.e. R2D signal), until 90% response decode success rate is achieved, determined by whether DUT can send correct response in D2R channel within correct timing relationship and the test equipment is able to decode 90% of the responses.
7. Repeat step 5) for all grid points and record $EIS\_{DUT}(Pol\_{Meas}=θ;Pol\_{CW}=θ)$.
8. Switch the signal generator (i.e. R2D signal) to transmit at the target test frequency with ϕ-polarization.
9. Calculate the EIS at every grid point using linear values:

$$EIS\_{total}(Pol\_{CW}=θ)=\left[\frac{1}{EIS\_{DUT}(Pol\_{Meas}=θ;Pol\_{CW}=θ)}+\frac{1}{EIS\_{DUT}(Pol\_{Meas}=ϕ;Pol\_{CW}=θ)}\right]^{-1}$$

1. Switch the CW generator to transmit at the target test frequency with ϕ-polarization and repeat step 4) to 8), and calculate the EIS under CW with ϕ-polarization

$$EIS\_{total}(Pol\_{CW}=ϕ)=\left[\frac{1}{EIS\_{DUT}(Pol\_{Meas}=θ;Pol\_{CW}=ϕ)}+\frac{1}{EIS\_{DUT}(Pol\_{Meas}=ϕ;Pol\_{CW}=ϕ)}\right]^{-1}$$

1. For each grid point, select the minimum $EIS\_{total}$:

$$EIS\_{total}\left(θ,ϕ\right)=min\left\{EIS\_{total}\left(θ,ϕ,Pol\_{CW}=θ\right),EIS\_{total}\left(θ,ϕ,Pol\_{CW}=ϕ\right)\right\} $$

1. Select the worst result from all grid points and compare with the core requirement in clause 7.2.

The sensitivity at peak direction is measured at the first position of the measurement antenna in the maximum performance direction declared by device manufacturers, then use the above test procedure without step 7).

**8.4.4 Unwanted emission measurement procedure**

Unwanted emission power is only measured at the direction of maximum backscattering declared by device manufacturers.

The measurement procedure includes the following steps:

1. Place the DUT inside the QZ following the UE positioning guidelines defined in clause 8.3.
2. Position the measurement antenna such that the DUT direction of maximum backscattering faces the measurement antenna according to the declaration from device manufacturers.
3. DUT must be fully charged before the measurement according to device declaration on the required energy conditions.
4. Set the CW generator to transmit at the target test frequency with θ-polarization.
5. Use a spectrum analyser to measure unwanted power.
6. Repeat step 4) and 5) setting the CW generator to transmit in ϕ-polarization

7) Calculate the backscattered emission power at the direction declared by device manufacturers:

$$P\_{emission}=\left(EIRP\_{DUT}\left(Pol\_{CW}=θ\right)\right)+\left(EIRP\_{DUT}\left(Pol\_{CW}=ϕ\right)\right)$$

 8）Compare measurement results with core requirements in clause 6.4

**<<< END OF CHANGES >>>**