**3GPP TSG RAN WG4 Meeting #98e-bis R4-210xxxx**

**Online, 12th – 20th April 2021**

**Source:** Rohde & Schwarz

**Title:** Text proposal to TR38.884: Fast Spherical Coverage Method

**Agenda Item:** 9.1.6

**Document for:** Approval

# Introduction

In the last RAN4 meeting the fast spherical coverage method described in [1] was agreed to be a test time improvement as part of the WF [2]. In this paper, we add the text proposal to TR 38.884 to include the method in the TR.

# References

1. R4-210: Discussion on test time reduction methods ; Rohde & Schwarz; RAN4#98e #81; February 2021
2. R4-2103920: WF on ETC and test time reduction; vivo; RAN4#98e #81; February 2021

# Text Proposal to TR 38.884

**-------------- Start of text proposal 1 -------------**

8 Test time reduction

*Editor’s note: outcome of SI Objective 6 is captured in this clause. This objective may potentially impact RF, RRM, and demodulation test setups.*

8.1 Fast Spherical Coverage Method

8.1.1 General

The Fast Spherical Coverage Method is a test method providing an optimized test time for Tx and Rx spherical coverage measurements.

Instead of measuring all grid points as defined in Annex M of TS 38.521-2 [6] as required by the current test procedure as defined in Annex K.1.5 and Annex K.1.6 of TS 38.521-2 [6], the Fast Spherical Coverage Method requires only a reduced number of grid points to be measured.

For test systems where the device repositioning approach outlined in Annex N of TS 38.521-2 [6] is applied, the grid points of up to a zenith of [90]° are allowed to be measured in the first hemisphere before the device needs to be placed in the second orientation.

This method is applicable to Constant Density grid type. The applicability to Constant Step is FFS.

8.1.2 Tx Fast Spherical Coverage Method

The measurement procedure for an EIRP Fast Spherical Coverage Method includes the following steps:

1) Select any of the three Alignment Options (1, 2, or 3) from Tables N.2-1 through N.2-3 [6] to mount the DUT inside the QZ.

2) Position the DUT in DUT Orientation 1 or 2 from Tables N.2-1 through N.2-3 [6].

3) Connect the SS (System Simulator) with the DUT through the measurement antenna with PolLink= polarization to form the TX beam towards the measurement antenna.

4) Send continuously uplink power control "up" commands in every uplink scheduling information to the UE.

5) For beam correspondence, DUT refines its TX beam toward that direction depending on DUT’s beam correspondence capability which shall match OEM declaration.

6) Lock the beam using the UE beamlock function.

7) Measure the mean power Pmeas (PolMeas= PolLink=) of the modulated signal arriving at the power measurement equipment (such as a spectrum analyser, power meter, or gNB emulator).

8) Calculate EIRP (PolMeas= PolLink=) by adding the composite loss of the entire transmission path for utilized signal path, LEIRP,θ, and frequency to the measured power Pmeas(PolMeas= PolLink=).

9) Measure the mean power Pmeas (PolMeas= PolLink=) of the modulated signal arriving at the power measurement equipment.

10) Calculate EIRP (PolMeas= PolLink=) by adding the composite losses of the entire transmission path for utilized signal path, LEIRP,φ, and frequency to the measured power Pmeas (PolMeas= PolLink=).

11) Calculate total EIRP(PolLink=) = EIRP(PolMeas= PolLink=) + EIRP(PolMeas= PolLink=).

12) Unlock the beam using the UE beamlock function.

13) Connect the SS (System Simulator) with the DUT through the measurement antenna with PolLink= polarization to form the TX beam towards the measurement antenna and repeat steps 4 through 12.

14) Calculate the EIRP result for the grid point as EIRPspherical = Max(EIRP(PolLink=), EIRP(PolLink=)). If the EIRPspherical value is above the Min EIRP spherical coverage limit increase Ngrid, meas, PASS by 1.

15) Calculate the percentage of total grid points measured so far above the EIRP spherical coverage requirement limit Ngrid, meas, PASS compared to the total number of grid points on the measurement grid Ngrid,total.

16) If the percentage calculated in step 15 is equal to or higher than (100 - nth percentile for EIRP spherical coverage)%, pass the device, otherwise continue to step 17. If all grid points have been measured, calculate the CDF for all grid points and pass the UE if the derived %-tile EIRP in measurement distribution exceeds the requirement. Otherwise fail the UE.

17) Advance to the next grid point and repeat steps 3 through 16 until measurements within zenith range 0º≤≤[90]º have been completed

18) After the measurements within zenith range 0º≤≤[90]º have been completed and

a) if the re-positioning concept is applied to the TX test cases, position the device in the corresponding second DUT Orientation from Tables N.2-1 through N.2-3 [6] for the Alignment Option selected in Step 1 and DUT Orientation selected in Step 2. For the TX spherical coverage measurement in the second hemisphere, perform steps 3 through 16 for the range of zenith angles [90]º<≤0º.

b) if the re-positioning concept is not applied to the TX test cases, continue steps 3 through 16 for the range of zenith angles [90]º<≤180º.

8.1.3 Rx Fast Spherical Coverage Method

The measurement procedure for an EIS Fast Spherical Coverage Method includes the following steps:

1) Select any of the three Alignment Options (1, 2, or 3) from Tables N.2-1 through N.2-3 [6] to mount the DUT inside the QZ.

2) Position the DUT in DUT Orientation 1 or 2 from Tables N.2-1 through N.2-3 [6].

3) Connect the SS (System Simulator) with the DUT through the measurement antenna with PolLink= polarization to form the RX beam towards the RX beam peak direction.

4) Determine EIS(PolMeas= PolLink= for θ-polarization, i.e., the power level for the θ-polarization at which the throughput exceeds the requirements for the specified reference measurement channel. The downlink power step size shall be no more than 0.2 dB when the RF power level is near the sensitivity level.

5) Connect the SS (System Simulator) with the DUT through the measurement antenna with PolLink= polarization to form the RX beam towards the RX beam peak direction.

6) Determine EIS(PolMeas= PolLink= for φ-polarization, i.e., the power level for the -polarization at which the throughput exceeds the requirements for the specified reference measurement channel. The downlink power step size shall be no more than 0.2 dB when the RF power level is near the sensitivity level.

7) Calculate the resulting averaged EIS as: EIS = 2\*[1/EIS(PolMes= PolLink= +1/EIS(PolMeas= PolLink=]-1.If the EISvalue is below the EIS spherical coverage limit increase Ngrid, meas, PASS by 1.

8) Calculate the percentage of total grid points measured so far below the EIS spherical coverage requirement limit Ngrid, meas, PASS compared to the total number of grid points on the measurement grid Ngrid,total.

9) If the percentage calculated in step 8 is equal to or higher than (100 - nth percentile for EIS spherical coverage)%, pass the device, otherwise continue to step 10. If all grid points have been measured, calculate the CCDF for all grid points and pass the UE if the derived %-tile EIS in measurement distribution is lower than the requirement. Otherwise fail the UE.

10) Advance to the next grid point and repeat steps 3 through 16 until measurements within zenith range 0º≤≤[90]º have been completed

11) After the measurements within zenith range 0º≤≤[90]º have been completed and

a) if the re-positioning concept is applied to the TX test cases, position the device in the corresponding second DUT Orientation from Tables N.2-1 through N.2-3 [6] for the Alignment Option selected in Step 1 and DUT Orientation selected in Step 2. For the RX spherical coverage measurement in the second hemisphere, perform steps 3 through 9 for the range of zenith angles [90]º<≤0º.

b) if the re-positioning concept is not applied to the RX test cases, continue steps 3 through 9 for the range of zenith angles [90]º<≤180º.