**3GPP TSG-RAN WG4 Meeting # 104-e R4-22**

**Electronic Meeting, 15– 26 August, 2022**

**Agenda item:** 11.4.2

**Source:** Huawei, HiSilicon

**Title:** WF on investigation of mmWave multi-band BS

**Document for:** Approval

# Background

On investigation of mmWave multi-band BS, the following contributions have been discussed in RAN4#104-e 1st round discussion.

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Title** |
| [R4-2211658](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104-e/Docs/R4-2211658.zip) | CATT | General consideration on mmWave multi-band BS |
| [R4-2211775](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104-e/Docs/R4-2211775.zip) | Huawei, Hisilicon | General consideration on mmWave multi-band BS |
| [R4-2211811](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104-e/Docs/R4-2211811.zip) | Nokia, Nokia Shanghai Bell | Proposals on topics for investigation of mmWave multi-band BS |
| [R4-2211812](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104-e/Docs/R4-2211812.zip) | Nokia, Nokia Shanghai Bell | Discussion on possible issues on performance of wideband RF and antenna architectures |
| [R4-2212622](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104-e/Docs/R4-2212622.zip) | Ericsson | Multi-band BS in mm wave |
| [R4-2213700](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104-e/Docs/R4-2213700.zip) | ZTE Corporation | Discussion on FR2 multi-band operation |

And the status summary of 1st round can be found in following table [R4-2214174].

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| --- | --- |
|  | **Status summary** |
| **Issue 2-1: FR1 multi-band BS methods and exceptions** | Based on 1st round discussion, companies are ok with the proposed list as a starting point. |
| **Issue 2-2: Definition of multi-band BS** | Based on 1st round discussion of the two options, it is proposed to further discuss the following proposals.   * To investigate if the FR1 definition of multi-band RIB can be re-used for FR2 * To revisit the definition of multi-band BS for FR2, and clarify whether the following scenarios should be considered as multi-band BS   1) Multi-band transmitter and/or receiver with common active RF components  2) Single-band transmitter and receiver  3) Configurable BS for different bands with the same hardware  4) BS covers full-band or sub-band of band A and band B  5) BS covers consecutive spectrums with different band number, for example, n258+n261  6) BS covers overlapping spectrums with different band number, for example, n258+n257 |
| **Issue 2-3: Feasibility of FR2 multi-band BS** | Based on 1st round discussion, it is premature to have a conclusion on the feasibility study. Moderator suggest to discuss next step for future meetings. It is proposed to further discuss the following proposals.   * The following technical challenges need to be studied for FR2 multi-band BS   + RF front-end   + Antenna array   + Phase shifters   + Beamforming architectures   + Others are not excluded |

# Way forward

## FR1 multi-band BS methods and exceptions

The following topics should be considered for investigation of FR2 multi-band BS:

1) Additional declarations for FR2 multi-band BS

2) The applicability of multi-band requirements

3) OTA transmitter OFF power

4) OTA Adjacent Channel Leakage Power Ratio (ACLR)

5) OTA operating band unwanted emissions

6) OTA transmitter spurious emissions

7) OTA adjacent channel selectivity

8) OTA in-band blocking

9) OTA out-of-band blocking

10) OTA receiver spurious emissions

11) OTA receiver intermodulation

12) OTA EVM

13) EIRP accuracy

## Definition of FR2 multi-band BS

* To investigate if the FR1 definition of multi-band RIB can be re-used for FR2
* To revisit the definition of multi-band BS for FR2, and clarify whether the following scenarios should be considered as multi-band BS

1) Multi-band transmitter and/or receiver with common active RF components

2) Single-band transmitter and receiver

3) Configurable BS for different bands with the same hardware

4) BS covers full-band or sub-band of band A and band B

5) BS covers consecutive spectrums with different band number, for example, n258+n261

6) BS covers overlapping spectrums with different band number, for example, n258+n257

## Feasibility of FR2 multi-band BS

The following technical challenges need to be studied for FR2 multi-band BS

* + RF front-end
  + Antenna array
  + Phase shifters
  + Beamforming architectures
  + Others are not excluded

The largest feasible bandwidth for an FR2 multi-band BS should be decided in the SI. As a first step, the feasibility of supporting bands at both around 28 and around 40GHz should be decided, in particular whether the following multi-band combinations are feasible:

* + - * 28+39 GHz: n257/n261 + n260
      * 26+40 GHz: n258 + n259/n262
      * 28+40 GHz: n257/n261 + n259/n262

~~The following requirements may need further study for FR2 multi-band BS (taking into account whether the requirement level and definition is feasible for FR2 wideband):~~

* ~~EIRP accuracy~~
* ~~EVM~~
* ~~ACLR and OBUE levels~~
* ~~Spurious emissions~~
* ~~RX sensitivity~~
* ~~Demodulation requirements~~
* ~~In-band blocking levels~~
* ~~RX IM~~