# H. Modulation Interference Factor (MIF) Measurements using MAIA and DASY6

## H.1. Introduction

The DUT supports 5G NR TDD Power Class 2. Manufacturer/OEM declares operating duty cycle to be 50% for 5G NR (FR1) TDD Power Class 2. The UID Summary only shows MIF values for 5G NR TDD bands operating at 100% duty cycle. Therefore, the test lab performed MIF measurements for 5G NR TDD Power Class 2 at the lower duty cycle of 50%.
Please refer to §H.3 for *MIF Measured Results* and §H.4 for *Duty Cycle Measurements*. These Duty cycles will be used for HAC $RF_{AIPL}$ and $RF_{AIL}$ evaluations.

## H.2. Test Setup

Modulation Interference Factor (MIF) measurements were performed in accordance with ANSI C.63.19 2019 Annex D §D.7. SPEAG software and test equipment was used to perform the MIF measurements. MIF measurements test procedure using SPEAG SW and equipment is outlined in *SPEAG DASY6 Module HAC System Handbook §7.1 MIF Measurements with MAIA.* Details of test equipment and test procedure used for MIF measurements are detailed below.

### H.2.1. Modulation and Interference Analyzer (MAIA)

MAIA is a hardware interface for evaluating the modulation and audio interference characteristics of RF signals in the frequency range 698–6000 MHz. DASY6 evaluates the time-domain and frequency-domain properties of the uplink signal transmitted by the DUT during SAR measurement with MAIA. It uses USB-powered active electronics to identify the modulation of the DUT. It can be operated with the over-the-air interface using the built-in ultra-broadband planar log spiral antenna (698–6000 MHz) or in the conducted mode using the coaxial SMA 50W connector (300–6000 MHz).

**Figure 1: Modulation and Interference Analyzer (MAIA)**

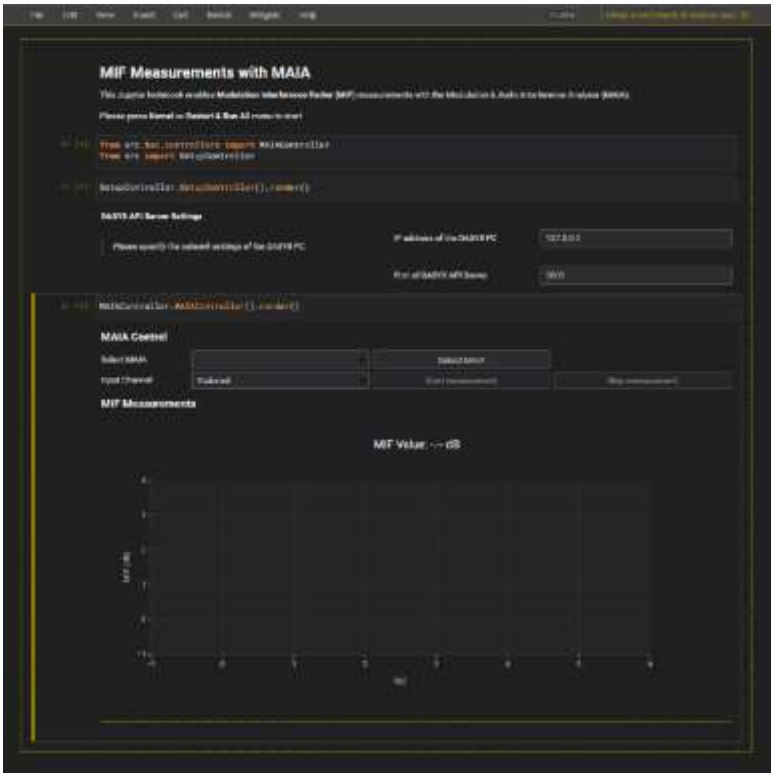
## H.2.2. MIF Measurements using DASY6

Measurements of the MIF value is conducted using the MAIA in conjunction with DASY6 HAC Module Notebook. The MAIA supports two modes of measurement: radiated and conducted. The radiated option uses the built in wide-band antenna and the conducted uses the SMA connector input on the rear of the MAIA.

MIF measurements were taken using the conducted option. Test procedure to measure MIF vale is as follows:

1. Measurements with MAIA are done in a separate HAC notebook module. This module can be started from within DASY6 Module HAC by clicking the HAC Notebook drop-down and choosing "MIF Measurements".
2. The active MAIA can be set in the drop-down list of available MAIA's. Should the MAIA not be available, the "Detect MAIA" button can be clicked which will trigger a search for connected hardware in DASY6.
3. The measurement can be started by clicking "Start measurement" which will continuously measure the MIF. The MIF will take a while to stabilize from which point the MIF can be noted. To stop the measurement the "Stop measurement" button is used.

**Figure 2: MIF Measurements in DASY6**



## H.3. MIF Measured Results

| Measured MIF (dB) | | | | | | |
|---|---|---|---|---|---|---|
| BW (MHz) | SCS (kHz) | OFDM Modulation Scheme | Mode | RB Allocation | RB Offset | PC2 |
| | | | | | | 518598.00 |
| | | | | | | 2592.99 MHz |
| 100 | 30 | DFT-s | π/2 BPSK | 1 | 1 | -4.62 |
| | | | | 135 | 69 | -5.13 |
| | | | QPSK | 1 | 1 | -4.55 |
| | | | | 135 | 69 | **-4.49** |
| | | CP | QPSK | 1 | 1 | -4.86 |
| | | | | 137 | 68 | -5.12 |
| BW (MHz) | SCS (kHz) | OFDM Modulation Scheme | Mode | RB Allocation | RB Offset | PC2 |
| | | | | | | 518598.00 |
| | | | | | | 2592.99 MHz |
| 90 | 30 | DFT-s | π/2 BPSK | 1 | 1 | -4.62 |
| | | | | 120 | 63 | -5.15 |
| | | | QPSK | 1 | 1 | -4.55 |
| | | | | 120 | 63 | -4.54 |
| | | CP | QPSK | 1 | 1 | **-4.81** |
| | | | | 123 | 61 | -5.08 |
| BW (MHz) | SCS (kHz) | OFDM Modulation Scheme | Mode | RB Allocation | RB Offset | PC2 |
| | | | | | | 518598.00 |
| | | | | | | 2592.99 MHz |
| 80 | 30 | DFT-s | π/2 BPSK | 1 | 1 | **-4.54** |
| | | | | 108 | 54 | -5.06 |
| | | | QPSK | 1 | 1 | -4.58 |
| | | | | 108 | 54 | -4.51 |
| | | CP | QPSK | 1 | 1 | -4.87 |
| | | | | 109 | 54 | -5.15 |
| BW (MHz) | SCS (kHz) | OFDM Modulation Scheme | Mode | RB Allocation | RB Offset | PC2 |
| | | | | | | 518598.00 |
| | | | | | | 2592.99 MHz |
| 70 | 30 | DFT-s | π/2 BPSK | 1 | 1 | -4.60 |
| | | | | 90 | 50 | -5.12 |
| | | | QPSK | 1 | 1 | -4.56 |
| | | | | 90 | 50 | -4.53 |
| | | CP | QPSK | 1 | 1 | -4.90 |
| | | | | 95 | 47 | -5.06 |
| BW (MHz) | SCS (kHz) | OFDM Modulation Scheme | Mode | RB Allocation | RB Offset | PC2 |
| | | | | | | 518598.00 |
| | | | | | | 2592.99 MHz |
| 60 | 30 | DFT-s | π/2 BPSK | 1 | 1 | -4.62 |
| | | | | 81 | 40 | -5.10 |
| | | | QPSK | 1 | 1 | -4.53 |
| | | | | 81 | 40 | -4.50 |
| | | CP | QPSK | 1 | 1 | -4.84 |
| | | | | 81 | 40 | -5.08 |
| BW (MHz) | SCS (kHz) | OFDM Modulation Scheme | Mode | RB Allocation | RB Offset | PC2 |
| | | | | | | 518598.00 |
| | | | | | | 2592.99 MHz |
| 50 | 30 | DFT-s | π/2 BPSK | 1 | 1 | -4.64 |
| | | | | 64 | 35 | -5.14 |
| | | | QPSK | 1 | 1 | -4.52 |
| | | | | 64 | 35 | -4.54 |
| | | CP | QPSK | 1 | 1 | -4.86 |
| | | | | 67 | 33 | -5.05 |
| BW (MHz) | SCS (kHz) | OFDM Modulation Scheme | Mode | RB Allocation | RB Offset | PC2 |
| | | | | | | 518598.00 |
| | | | | | | 2592.99 MHz |
| 40 | 30 | DFT-s | π/2 BPSK | 1 | 1 | -4.59 |
| | | | | 50 | 28 | -5.15 |
| | | | QPSK | 1 | 1 | -4.52 |
| | | | | 50 | 28 | -4.53 |
| | | CP | QPSK | 1 | 1 | -4.84 |
| | | | | 53 | 26 | -5.12 |
| BW (MHz) | SCS (kHz) | OFDM Modulation Scheme | Mode | RB Allocation | RB Offset | PC2 |
| | | | | | | 518598.00 |
| | | | | | | 2592.99 MHz |
| 30 | 30 | DFT-s | π/2 BPSK | 1 | 1 | -4.62 |
| | | | | 36 | 21 | -5.09 |
| | | | QPSK | 1 | 1 | -4.52 |
| | | | | 36 | 21 | -4.53 |
| | | CP | QPSK | 1 | 1 | -4.88 |
| | | | | 39 | 19 | -5.08 |
| BW (MHz) | SCS (kHz) | OFDM Modulation Scheme | Mode | RB Allocation | RB Offset | PC2 |
| | | | | | | 518598.00 |
| | | | | | | 2592.99 MHz |
| 20 | 30 | DFT-s | π/2 BPSK | 1 | 1 | -4.60 |
| | | | | 25 | 13 | -5.15 |
| | | | QPSK | 1 | 1 | -4.59 |
| | | | | 25 | 13 | -4.53 |
| | | CP | QPSK | 1 | 1 | -4.93 |
| | | | | 25 | 13 | -5.06 |
| BW (MHz) | SCS (kHz) | OFDM Modulation Scheme | Mode | RB Allocation | RB Offset | PC2 |
| | | | | | | 518598.00 |
| | | | | | | 2592.99 MHz |
| 15 | 30 | DFT-s | π/2 BPSK | 1 | 1 | -4.57 |
| | | | | 18 | 10 | -5.08 |
| | | | QPSK | 1 | 1 | -4.54 |
| | | | | 18 | 10 | -4.60 |
| | | CP | QPSK | 1 | 1 | -4.87 |
| | | | | 19 | 9 | -4.99 |
| BW (MHz) | SCS (kHz) | OFDM Modulation Scheme | Mode | RB Allocation | RB Offset | PC2 |
| | | | | | | 518598.00 |
| | | | | | | 2592.99 MHz |
| 10 | 30 | DFT-s | π/2 BPSK | 1 | 1 | -4.60 |
| | | | | 12 | 6 | -5.12 |
| | | | QPSK | 1 | 1 | -4.56 |
| | | | | 12 | 6 | -4.62 |
| | | CP | QPSK | 1 | 1 | -4.90 |
| | | | | 12 | 6 | -5.02 |

**Notes:**

- 5G NR TDD band n41 was used for Power Class 2 measurements.
  - FTM was used for 5G NR TDD MIF measurements to ensure correct operating Duty Cycle was used for measurements.
- Worst Case measured MIF values will be used HAC $RF_{AIPL}$ and $RF_{AIL}$ evaluations.
  - Worst Case MIF vales for Power Class 2:
    - DFT-s-OFDM π/2 BPSK: -4.54 dB
    - DFT-s-OFDM QPSK: -4.49 dB
    - CP-OFDM QPSK: -4.81 dB

## H.4. Duty Cycle Measurements

Duty cycle measurements were performed for 5G NR TDD Power Class 2 to confirm DUTs operating duty cycle for these respective power classes. Measured Duty cycles will be used for HAC $RF_{AIPL}$ and $RF_{AIL}$ evaluations.

**Figure 3: 5G NR TDD Power Class 2, 1% RB**

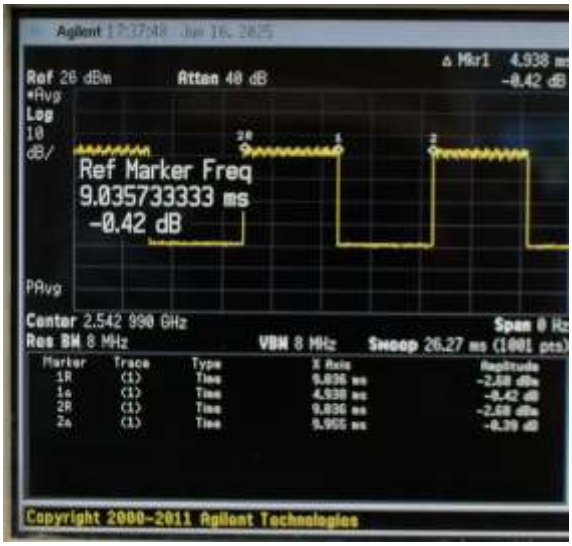
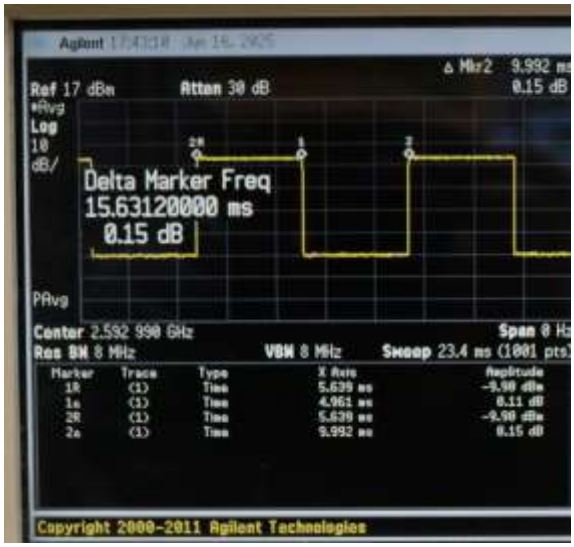



**Figure 3: 5G NR TDD Power Class 2, 50% RB**




**Duty Cycle Measured Results**

| Technology | Mode | RB Allocation | Time On (ms) | Period (ms) | Measured Duty Cycle |
|---|---|---|---|---|---|
| 5G NR TDD PC2 | OFDM | 1% | 4.938 | 9.955 | 49.6% |
| 5G NR TDD PC2 | OFDM | 50% | 4.961 | 9.992 | 49.6% |

**Notes:**

Duty Cycle = (Time on / period) * 100%.