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

H.1. Introduction

The DUT supports 5G NR TDD Power Class 2 and Power Class 1.5. Manufacturer/OEM declares operating duty cycle to be 50% and 25% for 5G NR (FR1) TDD Power Class 2 and Power Class 1.5 respectively. 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 and Power Class 1.5 at the lower duty cycles of 50% and 25%. Please refer to §H.3 for *MIF Measured Results* and §H.4 for *Duty Cycle Measurements*. These Duty cycles will be used for HAC RFAIPL and RFAIL 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)

Page 1 of 6

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.

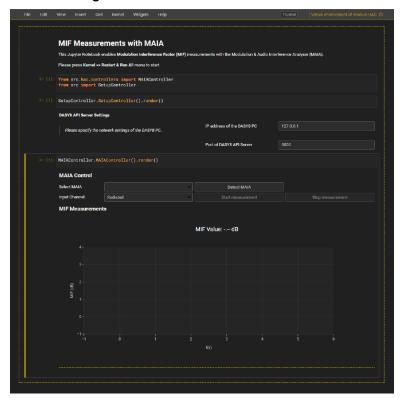


Figure 2: MIF Measurements in DASY6

H.3. MIF Measured Results

	Measured MIF (dB)								
DIM	SCS (kHz)	OFDM Modulation Scheme	Mode	DD	RB Offset	PC2	PC1.5		
BW (MHz)				RB Allocation		518598.00	518598.00		
						2592.99 MHz	2592.99 MHz		
100			π/2 BPSK	1	1	-1.16	1.05		
		DFT-s		135	69	-1.34	1.03		
	30	DI 1-3	QPSK	1	1	-1.39	0.94		
	30			135	69	-1.53	0.86		
		СР	QPSK	1	1	-1.81	0.53		
		OF .		137	68	-2.11	0.32		
BW	SCS (kHz)	OFDM		RB Allocation	RB Offset	PC2	PC1.5		
(MHz)		Modulation Scheme	Mode			518598.00	518598.00		
(2592.99 MHz	2592.99 MHz		
			π/2 BPSK	1	1	-1.21	1.34		
90		DFT-s		120	63	-1.39	1.05		
	30	DI 1-3	QPSK	1	1	-1.26	1.01		
30	30			120	63	-1.54	0.87		
		СР	QPSK	1	1	-1.85	0.48		
		OI .		123	61	-2.01	0.27		
D)4/	000	OFDM Modulation	Mode	RB Allocation	RB Offset	PC2	PC1.5		
BW (MHz)	SCS (kHz)					518598.00	518598.00		
(2)	()	Scheme			0001	2592.99 MHz	2592.99 MHz		
			π/2 BPSK QPSK	1	1	-1.20	1.06		
		DFT-s		108	54	-1.38	0.95		
80	30	DF1-S		1	1	-1.28	0.98		
60	30			108	54	-1.61	0.80		
			ODOK	1	1	-1.71	0.57		
		CP	QPSK	109	54	-2.12	0.28		
	SCS (kHz)	OFDM	Mode	RB Allocation		PC2	PC1.5		
BW		Modulation Scheme			RB Offset	518598.00	518598.00		
(MHz)						2592.99 MHz	2592.99 MHz		
			/O DDO!/	1	1	-1.16	1.44		
	30	DFT-s	π/2 BPSK	90	50	-1.42	0.96		
70			QPSK QPSK	1	1	-1.14	0.99		
70				90	50	-1.97	0.75		
				1	1	-1.62	0.56		
				95	47	-2.12	0.23		
	SCS (kHz)	OFDM		RB Allocation	RB Offset	PC2	PC1.5		
BW (MHz)		Modulation	Mode			518598.00	518598.00		
(1711 12)		Scheme				2592.99 MHz	2592.99 MHz		
	20	DET a	π/2 BPSK	1	1				
					'	-1.14	1.05		
				81	40	-1.14 -1.27			
60	20	DFT-s	ODCK	81 1			1.05		
60	30	DFT-s	QPSK		40	-1.27	1.05 1.08		
60	30			1	40 1	-1.27 -1.26	1.05 1.08 0.96		
60	30	DFT-s	QPSK QPSK	1 81	40 1 40	-1.27 -1.26 -1.48	1.05 1.08 0.96 0.88		
				1 81 1 81	40 1 40 1 40	-1.27 -1.26 -1.48 -1.66	1.05 1.08 0.96 0.88 0.33		
BW	SCS	CP OFDM Modulation		1 81 1 81 RB	40 1 40 1 40 RB	-1.27 -1.26 -1.48 -1.66 -2.06	1.05 1.08 0.96 0.88 0.33		
		CP OFDM	QPSK	1 81 1 81	40 1 40 1 40	-1.27 -1.26 -1.48 -1.66 -2.06 PC2	1.05 1.08 0.96 0.88 0.33 0.34 PC1.5		
BW	SCS	CP OFDM Modulation	QPSK Mode	1 81 1 81 RB	40 1 40 1 40 RB	-1.27 -1.26 -1.48 -1.66 -2.06 PC2 518598.00	1.05 1.08 0.96 0.88 0.33 0.34 PC1.5 518598.00		
BW	SCS	CP OFDM Modulation Scheme	QPSK	1 81 1 81 RB Allocation	40 1 40 1 40 RB Offset	-1.27 -1.26 -1.48 -1.66 -2.06 PC2 518598.00 2592.99 MHz	1.05 1.08 0.96 0.88 0.33 0.34 PC1.5 518598.00 2592.99 MHz		
BW (MHz)	SCS (kHz)	CP OFDM Modulation	QPSK Mode π/2 BPSK	1 81 1 81 RB Allocation	40 1 40 1 40 RB Offset	-1.27 -1.26 -1.48 -1.66 -2.06 PC2 518598.00 2592.99 MHz -1.18	1.05 1.08 0.96 0.88 0.33 0.34 PC1.5 518598.00 2592.99 MHz		
BW	SCS	CP OFDM Modulation Scheme	QPSK Mode	1 81 1 81 RB Allocation 1 64	40 1 40 1 40 RB Offset 1 35	-1.27 -1.26 -1.48 -1.66 -2.06 PC2 518598.00 2592.99 MHz -1.18 -1.32	1.05 1.08 0.96 0.88 0.33 0.34 PC1.5 518598.00 2592.99 MHz 1.02		
BW (MHz)	SCS (kHz)	CP OFDM Modulation Scheme DFT-s	QPSK Mode π/2 BPSK QPSK	1 81 1 81 RB Allocation 1 64	40 1 40 1 40 RB Offset 1 35	-1.27 -1.26 -1.48 -1.66 -2.06 PC2 518598.00 2592.99 MHz -1.18 -1.32 -1.29	1.05 1.08 0.96 0.88 0.33 0.34 PC1.5 518598.00 2592.99 MHz 1.02 1.05		
BW (MHz)	SCS (kHz)	CP OFDM Modulation Scheme	QPSK Mode π/2 BPSK	1 81 1 81 RB Allocation 1 64 1	40 1 40 1 40 RB Offset 1 35 1	-1.27 -1.26 -1.48 -1.66 -2.06 PC2 518598.00 2592.99 MHz -1.18 -1.32 -1.29 -1.57	1.05 1.08 0.96 0.88 0.33 0.34 PC1.5 518598.00 2592.99 MHz 1.02 1.05 0.93		
BW (MHz)	SCS (kHz)	CP OFDM Modulation Scheme DFT-s	QPSK Mode π/2 BPSK QPSK	1 81 1 81 RB Allocation 1 64 1 64 1 67	40 1 40 1 40 RB Offset 1 35 1 35 1 33	-1.27 -1.26 -1.48 -1.66 -2.06 PC2 518598.00 2592.99 MHz -1.18 -1.32 -1.29 -1.57 -1.68	1.05 1.08 0.96 0.88 0.33 0.34 PC1.5 518598.00 2592.99 MHz 1.02 1.05 0.93 0.95 0.63		
BW (MHz)	SCS (kHz)	CP OFDM Modulation Scheme DFT-s CP OFDM Modulation	QPSK Mode π/2 BPSK QPSK	1 81 1 81 RB Allocation 1 64 1 64 1 67	40 1 40 1 40 RB Offset 1 35 1 35 1 35 1 88	-1.27 -1.26 -1.48 -1.66 -2.06 PC2 518598.00 2592.99 MHz -1.18 -1.32 -1.29 -1.57 -1.68 -2.03	1.05 1.08 0.96 0.88 0.33 0.34 PC1.5 518598.00 2592.99 MHz 1.02 1.05 0.93 0.95 0.63 0.32		
BW (MHz)	SCS (kHz)	CP OFDM Modulation Scheme DFT-s CP OFDM	QPSK Mode π/2 BPSK QPSK QPSK	1 81 1 81 RB Allocation 1 64 1 64 1 67	40 1 40 1 40 RB Offset 1 35 1 35 1 33	-1.27 -1.26 -1.48 -1.66 -2.06 PC2 518598.00 2592.99 MHz -1.18 -1.32 -1.29 -1.57 -1.68 -2.03 PC2	1.05 1.08 0.96 0.88 0.33 0.34 PC1.5 518598.00 2592.99 MHz 1.02 1.05 0.93 0.95 0.63 0.32 PC1.5		
BW (MHz)	SCS (kHz)	CP OFDM Modulation Scheme DFT-s CP OFDM Modulation	QPSK Mode π/2 BPSK QPSK QPSK Mode	1 81 1 81 RB Allocation 1 64 1 64 1 67	40 1 40 1 40 RB Offset 1 35 1 35 1 35 1 88	-1.27 -1.26 -1.48 -1.66 -2.06 PC2 518598.00 2592.99 MHz -1.18 -1.32 -1.29 -1.57 -1.68 -2.03 PC2 518598.00	1.05 1.08 0.96 0.88 0.33 0.34 PC1.5 518598.00 2592.99 MHz 1.02 1.05 0.93 0.95 0.63 0.32 PC1.5 518598.00		
BW (MHz)	SCS (kHz)	CP OFDM Modulation Scheme DFT-s CP OFDM Modulation Scheme	QPSK Mode π/2 BPSK QPSK QPSK	1 81 1 81 RB Allocation 1 64 1 67 RB Allocation	40 1 40 1 40 RB Offset 1 35 1 35 1 33 RB Offset	-1.27 -1.26 -1.48 -1.66 -2.06 PC2 518598.00 2592.99 MHz -1.18 -1.32 -1.29 -1.57 -1.68 -2.03 PC2 518598.00 2592.99 MHz	1.05 1.08 0.96 0.88 0.33 0.34 PC1.5 518598.00 2592.99 MHz 1.02 1.05 0.93 0.95 0.63 0.32 PC1.5 518598.00 2592.99 MHz		
BW (MHz)	SCS (kHz) 30 SCS (kHz)	CP OFDM Modulation Scheme DFT-s CP OFDM Modulation	QPSK Mode π/2 BPSK QPSK QPSK Mode π/2 BPSK	1 81 1 81 RB Allocation 1 64 1 67 RB Allocation 1	40 1 40 1 40 1 40 RB Offset 1 35 1 35 1 37 RB Offset 1	-1.27 -1.26 -1.48 -1.66 -2.06 PC2 518598.00 2592.99 MHz -1.18 -1.32 -1.29 -1.57 -1.68 -2.03 PC2 518598.00 2592.99 MHz	1.05 1.08 0.96 0.88 0.33 0.34 PC1.5 518598.00 2592.99 MHz 1.02 1.05 0.93 0.95 0.63 0.32 PC1.5 518598.00 2592.99 MHz		
BW (MHz)	SCS (kHz)	CP OFDM Modulation Scheme DFT-s CP OFDM Modulation Scheme	QPSK Mode π/2 BPSK QPSK QPSK Mode	1 81 1 81 81 81 81 81 81 81 81 81 81 81	40 1 40 1 40 1 40 RB Offset 1 35 1 35 1 37 RB Offset 1 28	-1.27 -1.26 -1.48 -1.66 -2.06 PC2 518598.00 2592.99 MHz -1.18 -1.32 -1.29 -1.57 -1.68 -2.03 PC2 518598.00 2592.99 MHz -1.24 -1.39	1.05 1.08 0.96 0.88 0.33 0.34 PC1.5 518598.00 2592.99 MHz 1.02 1.05 0.93 0.95 0.63 0.32 PC1.5 518598.00 2592.99 MHz		
BW (MHz)	SCS (kHz) 30 SCS (kHz)	CP OFDM Modulation Scheme DFT-s CP OFDM Modulation Scheme	QPSK Mode π/2 BPSK QPSK QPSK Mode π/2 BPSK	1 81 1 81 81 81 81 81 81 81 81 81 81 81	40 1 40 1 40 1 40 RB Offset 1 35 1 35 1 35 1 28 1	-1.27 -1.26 -1.48 -1.66 -2.06 PC2 518598.00 2592.99 MHz -1.18 -1.32 -1.29 -1.57 -1.68 -2.03 PC2 518598.00 2592.99 MHz -1.24 -1.39 -1.37	1.05 1.08 0.96 0.88 0.33 0.34 PC1.5 518598.00 2592.99 MHz 1.02 1.05 0.93 0.95 0.63 0.32 PC1.5 518598.00 2592.99 MHz 1.07 1.09 0.89		

	SCS (kHz)	OFDM Modulation Scheme	Mode	RB Allocation	RB Offset	PC2	PC1.5
BW (MHz)						518598.00	518598.00
(IVIITZ)	(KHZ)					2592.99 MHz	2592.99 MHz
30			π/2 BPSK	1	1	-1.18	1.04
		DFT-s		36	21	-1.38	1.03
	30		QPSK	1	1	-1.34	0.88
				36	21	-1.55	0.88
		СР	QPSK	1	1	-1.92	0.49
				39	19	-2.11	0.32
BW (MHz)		OFDM	Mode	RB Allocation	RB Offset	PC2	PC1.5
	SCS (kHz)	Modulation Scheme				518598.00	518598.00
						2592.99 MHz	2592.99 MHz
	30	DFT-s	π/2 BPSK	1	1	-1.23	1.01
20				25	13	-1.34	1.09
			QPSK	1	1	-1.38	0.90
20				25	13	-1.55	0.92
		СР	QPSK	1	1	-1.87	0.33
				25	13	-2.05	0.32
BW (MHz)	SCS (kHz)	OFDM Modulation Scheme	Mode	RB Allocation	RB Offset	PC2	PC1.5
						518598.00	518598.00
						2592.99 MHz	2592.99 MHz
			#/2 DDSK			ZOOZ.OO WII IZ	2092.99 WI IZ
			π/2 RDSK	1	1	-1.28	1.02
		DET	π/2 BPSK	1 18	1 10		
15	30	DFT-s		-		-1.28	1.02
15	30	DFT-s	π/2 BPSK	18	10	-1.28 -1.36	1.02 1.08
15	30		QPSK	18 1	10	-1.28 -1.36 -1.41	1.02 1.08 0.85
15	30	DFT-s		18 1 18	10 1 10	-1.28 -1.36 -1.41 -1.52	1.02 1.08 0.85 0.89
			QPSK	18 1 18 1 19	10 1 10 1 9	-1.28 -1.36 -1.41 -1.52 -1.92	1.02 1.08 0.85 0.89 0.47
BW	scs	CP OFDM Modulation	QPSK	18 1 18 1 19	10 1 10 1 9	-1.28 -1.36 -1.41 -1.52 -1.92 -1.99	1.02 1.08 0.85 0.89 0.47
		CP OFDM	QPSK QPSK	18 1 18 1 19	10 1 10 1 9	-1.28 -1.36 -1.41 -1.52 -1.92 -1.99 PC2	1.02 1.08 0.85 0.89 0.47 0.34
BW	scs	CP OFDM Modulation	QPSK QPSK Mode	18 1 18 1 19	10 1 10 1 9	-1.28 -1.36 -1.41 -1.52 -1.92 -1.99 PC2 518598.00	1.02 1.08 0.85 0.89 0.47 0.34 PC1.5 518598.00
BW	scs	CP OFDM Modulation Scheme	QPSK QPSK	18 1 18 1 19 RB Allocation	10 1 10 1 9 RB Offset	-1.28 -1.36 -1.41 -1.52 -1.92 -1.99 PC2 518598.00 2592.99 MHz	1.02 1.08 0.85 0.89 0.47 0.34 PC1.5 518598.00 2592.99 MHz
BW (MHz)	SCS (kHz)	CP OFDM Modulation	QPSK QPSK Mode π/2 BPSK	18 1 18 1 19 RB Allocation	10 1 10 1 9 RB Offset	-1.28 -1.36 -1.41 -1.52 -1.92 -1.99 PC2 518598.00 2592.99 MHz -1.26	1.02 1.08 0.85 0.89 0.47 0.34 PC1.5 518598.00 2592.99 MHz
BW	scs	CP OFDM Modulation Scheme	QPSK QPSK Mode	18 1 18 1 19 RB Allocation 1 12	10 1 10 1 9 RB Offset	-1.28 -1.36 -1.41 -1.52 -1.92 -1.99 PC2 518598.00 2592.99 MHz -1.26 -1.32	1.02 1.08 0.85 0.89 0.47 0.34 PC1.5 518598.00 2592.99 MHz 1.02 1.11
BW (MHz)	SCS (kHz)	CP OFDM Modulation Scheme	QPSK QPSK Mode π/2 BPSK	18 1 18 1 19 RB Allocation 1 12 1	10 1 10 1 9 RB Offset 1 6	-1.28 -1.36 -1.41 -1.52 -1.92 -1.99 PC2 518598.00 2592.99 MHz -1.26 -1.32 -1.41	1.02 1.08 0.85 0.89 0.47 0.34 PC1.5 518598.00 2592.99 MHz 1.02 1.11 0.86

Notes

- 5G NR TDD band n41 was used for Power Class 2 Power Class 1.5 MIF measurements.
 - o 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 ${\sf RF}_{\sf AIPL}$ and ${\sf RF}_{\sf AIL}$ evaluations.
 - Worst Case MIF vales for Power Class 2:
 - DFT-s-OFDM π/2 BPSK: -1.14 dB
 - DFT-s-OFDM QPSK: -1.14 dB
 - CP-OFDM QPSK: -1.62 dB
 - Worst Case MIF vales for Power Class 1.5:
 - DFT-s-OFDM π/2 BPSK: 1.44 dB
 - DFT-s-OFDM QPSK: 1.01 dB
 - CP-OFDM QPSK: .63 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

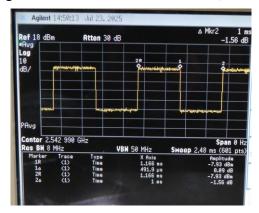


Figure 4: 5G NR TDD Power Class 2, 50% RB

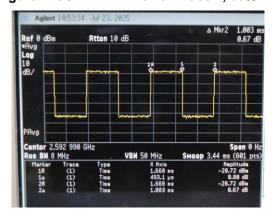
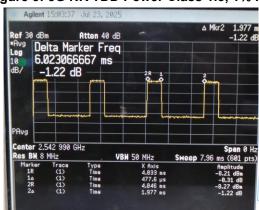


Figure 5: 5G NR TDD Power Class 1.5, 1% RB



Page 5 of 6

Figure 6: 5G NR TDD Power Class 1.5, 50% RB



Duty Cycle Measured Results

Technology	Mode	RB Allocation	Time On (ms)	Period (ms)	Measured Duty Cycle
5G NR TDD PC2	OFDM	1%	0.4919	1.000	49.2%
5G NR TDD PC2	OFDM	50%	0.4931	1.003	49.2%
5G NR TDD PC1.5	OFDM	1%	0.4776	1.977	24.2%
5G NR TDD PC1.5	OFDM	50%	0.4941	2.006	24.6%

Notes:

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