Zeughausstrasse 43, 8004 Zurich, Switzerland
Phone +41 44 245 9700, Fax +41 44 245 9779
info@speag.com, http://www.speag.com

Declaration of Conformity / Evaluation Method

Item	Modulation Interference Factor (MIF)
Type No	SPEAG Communication Systems
Series No	n/a
Manufacturer / Origin	Schmid & Partner Engineering AG Zeughausstrasse 43 CH-8004 Zürich Switzerland

Summary
The Modulation Interference Factor (MIF) is used to convert the power averaged field measurement for HAC measurements according to [2] to the desired quantity, the RF Interference Potential. The MIF is characteristic for a given waveform envelope and can be used as a constant conversion factor if the probe has been PMR calibrated.
Probe Modulation Response (PMR) calibration linearizes the probe response over its dynamic range for specific modulations which are characterized by their UID and result in an uncertainty specified in [5]. The modulation characteristics of the waveforms used for the calibration are available from [4].

DASY52 uses the indirect method of [2] 5.2 using the MIF evaluation and verification according to [2] D.7. DASY52 field measurements and required settings are described in [3], probe data for PMR are available from the probe configuration files documented in [5]. The MIF data are contained in the file "Communication_Systems_SPEAG.xml" which is provided with the probe configuration file of the probe.

This document describes the evaluation and verification method for the MIF.

References
[1] ANSI-C63.19-2007 draft 3.3 (final), “American National Standard for Methods of Measurement of Compatibility between Wireless Communication Devices and Hearing Aids”
[2] ANSI-C63.19-2011, “American National Standard for Methods of Measurement of Compatibility between Wireless Communication Devices and Hearing Aids”
[3] DASY52 manual
[4] Communication Systems specification sheets: http://www.speag.com/services/cal-lab/communication-system-support-page/3gpp/
[5] Probe calibration certificate
[6] Audio Interference Analyzer, SE UMS 170 A

Evaluation
The MIF spectral and temporal filtering is defined in [1] and [2].
The waveforms used for calibration are uniquely defined by their UID [4] and are generated by an Anritsu MG3700A signal generator, with the amplified levels controlled by calibrated RMS power meters.
The evaluation of the MIF has been done by numerical means from a down-converted and sampled RF signal:

- Sampling of the RF waveform with a NI 5663E vector signal analyzer
- Numerical evaluation (digital filtering) with MATLAB
- FFT, Spectral filtering using the formula [1] D.1, inverse FFT
- Temporal filtering and scaling

Numerical values have also been determined for the test waveforms in [2] tables D.3 and D.4

Numerical results for some UID:

UID	Communication System Name	MIF (dB)
10011	UMTS-FDD (WCDMA)	-20.49
10021	GSM-FDD (TDMA, GMSK)	3.60
10081	CDMA2000 (1xRTT, RC3)	-19.77

Verification
For the verification of the MIF, an Audio Interference Analyzer (AIA) [6] has been used. This hardware can be operated with DASY52 [3] section 24.9 and works as follows:

- Wired connection from generator to the AIA RMS detector
- Digitizer for detected RMS (96 kHz) and for internal test signal with USB output for digital processing
- Digital filtering with IIR spectral and temporal filters and scaling
- Graphical and numerical display of result and stability

Results
The numerically evaluated MIF values were verified successfully by the measurement with different digital evaluation. Deviations are within the expected uncertainty if fundamental modulation frequency and at least 2 harmonics are within the nominal passband of 100 Hz - 10 kHz.
0.2 dB for MIF: -7 to +5 dB,
0.5 dB for MIF: -13 to +11 dB
1 dB for MIF: > -20 dB

Conformity
Based on the described evaluation and verification, we confirm that the MIF provided with the probe modulation calibration (PMR) fulfills the requirements from the standard [2].

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