UMS Application Note for Evaluation Board (EVB)

Introduction

This document provides information and recommendations related to the UMS evaluation board (EVB) and its use to evaluate the performance of a given product.

General description

A representative photograph of the evaluation board is shown in *Figure 1*. The exact description of different options are given below.

Equipment needed

- RF cables with appropriate connectors (SSMA, K, V)
- Appropriate 8mm torque wrench
- Wire to BNC adaptor
- M2 allen wrench

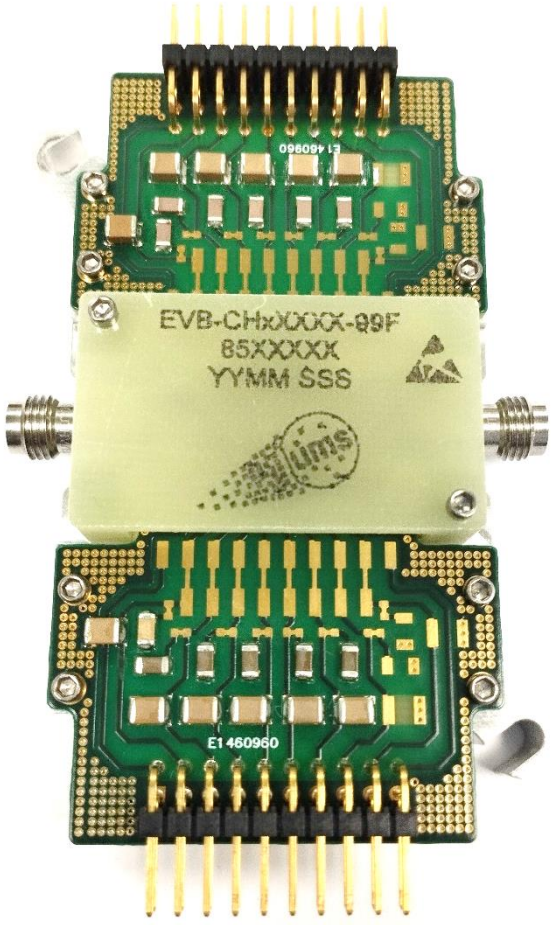

Figure 1 : Evaluation Board (EVB) Photograph

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Table of contents

Revision history

4/2023: Revision 1: Initial Version

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1. Evaluation Board (EVB) description

1.1. RF line layout

The input and output RF line stackup is described in Figure 2. It is a microstrip structure with 310µm line width.

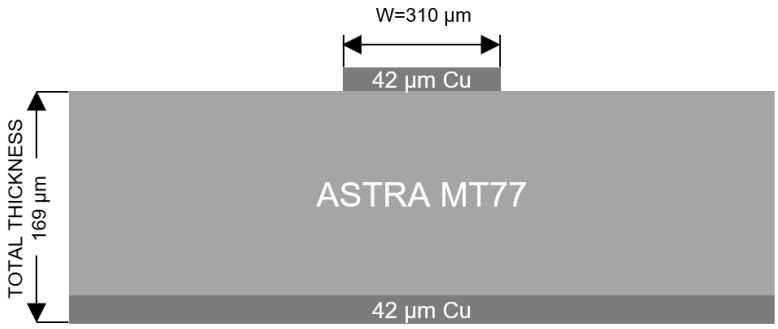

Figure 2: Evaluation Board (EVB) RF line stack-up

Lines are designed to be 50Ω matched with a return loss better than -15dB (Figure 3).

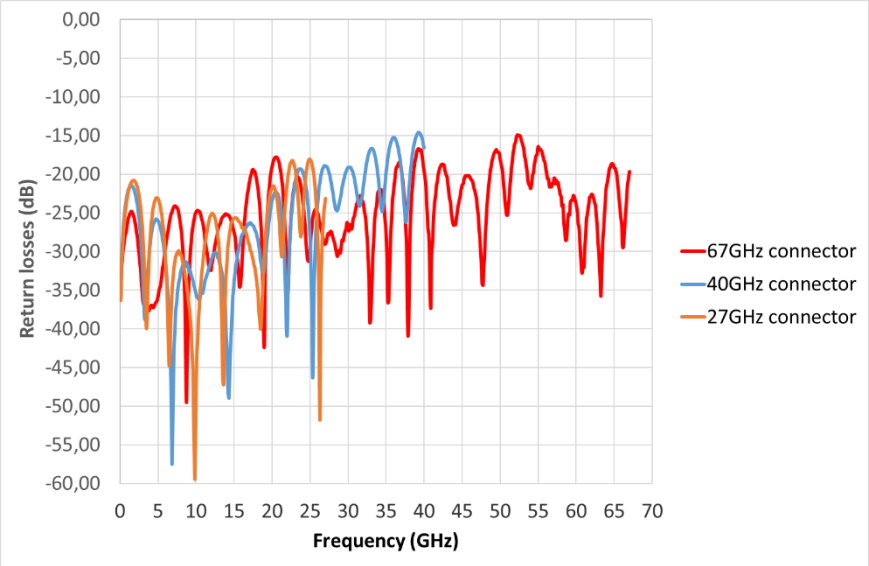

Figure 3: Thru line return loss

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1.2. Power supply and RF input and output

The DC connectors are double row 2.54mm pitch terminal strips.
The lower row is connected to the ground and the upper row is used to route the DC or pulsed signal to the die.
To avoid any oscillation, we recommend to connect the terminal strips by brazing with an adapter to coaxial connectors (example shown in Figure 4).

Figure 4: Wire to BNC interconnector

The RF access (RF_{in} and RF_{out}) are marked on the base of the evaluation board (EVB).

The evaluation board can be delivered with SMA, K or V RF connectors depending on the product frequency range. The appropriate connector must be used, otherwise it could damage the demonstrator.

The board can be configured for both CW or pulsed measurements (wire loop compatible with Hall Effect, current probe and appropriate decoupling).

Figure 5 gives an example for a CW measurement configuration and Figure 6 for a pulsed measurement configuration.

1.3. Measurement considerations

The evaluation board is suitable for characterization in a temperature range from -60°C up to 125°C. For measurements below the dew point, we recommend to use dry air to prevent the formation of dew or frost on the surface of the die or the PCB.

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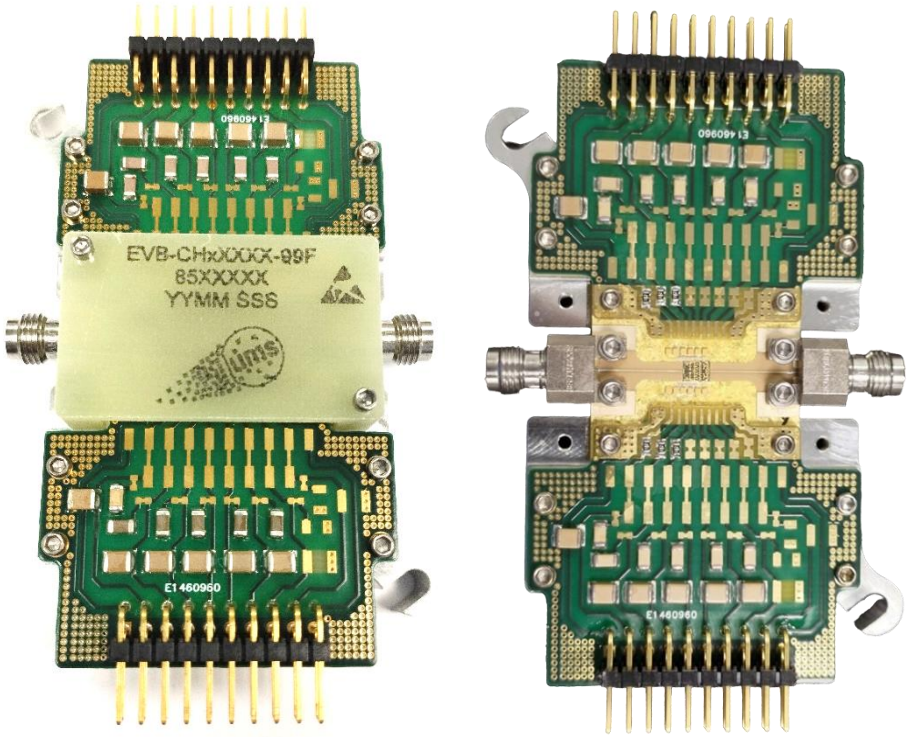

Figure 5: Evaluation mode in CW mode configuration with and without a lid

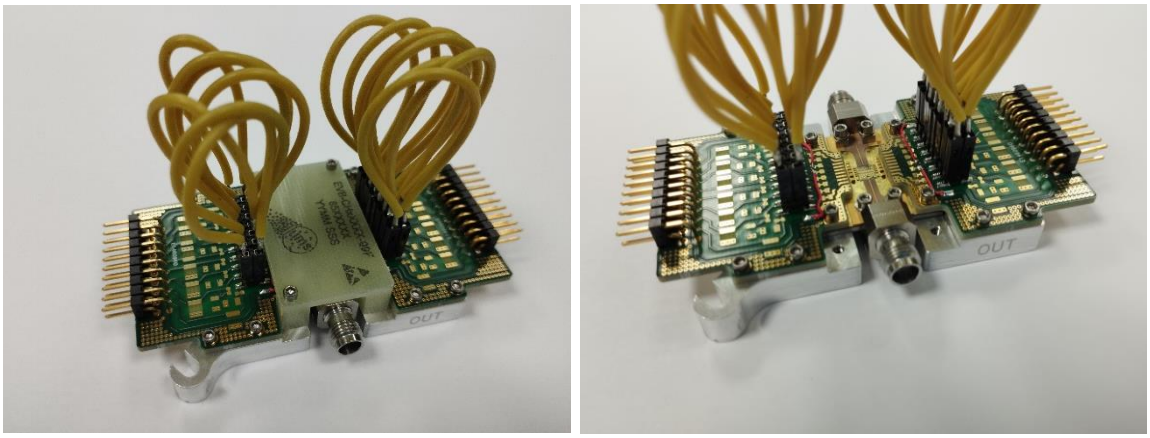

Figure 6: Evaluation board (EVB) in pulsed mode configuration (wire loops compatible with Hall Effect, current probe and appropriate decoupling) with and without a lid

1.4. Preparation of the test

The evaluation board is delivered with a lid for mechanical protection. We recommend to remove the lid with a 2mm Allen wrench for the measurement to avoid any influence on the results.

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1.5. Thermal information

The temperature can be measured close to the die by using a thermocouple placed in the mechanical base shown in Figure 7. We recommend to use a thermocouple with a diameter between 1mm and 1.5mm.

The information about the correspondence of the thermocouple temperature in the evaluation board and the backside of the die is given in the product datasheet.
We recommend to use a cooling plate to regulate the temperature and to improve the thermal contact between the base of the evaluation board and the cooling plate by a thermal paste.

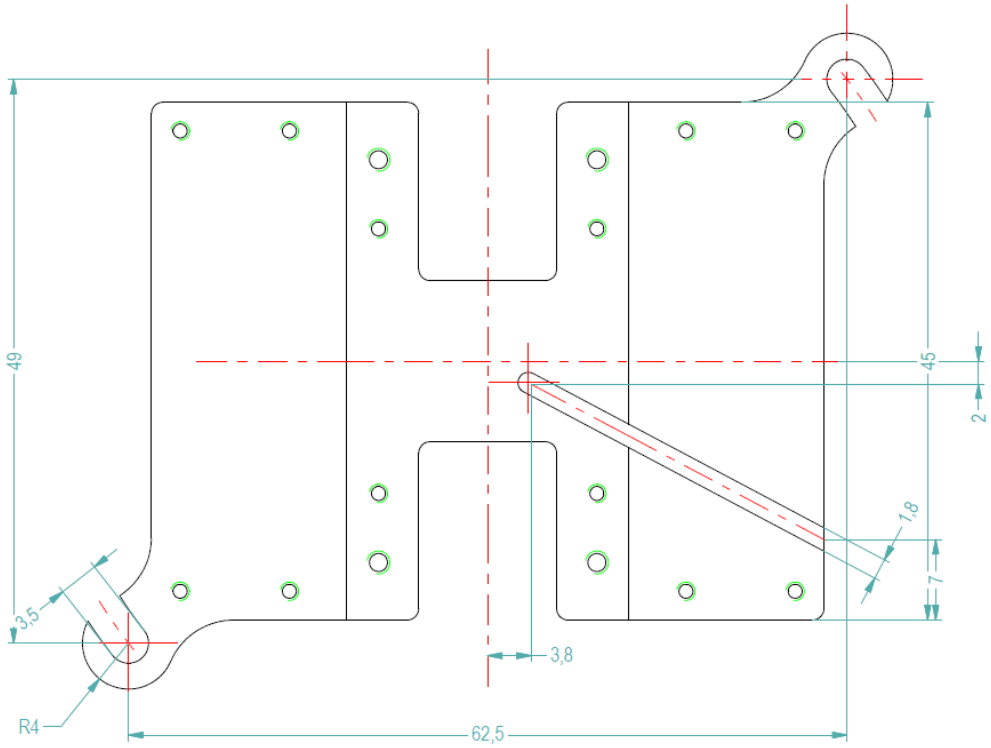

Figure 7: Evaluation board (EVB) base drawing

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1.6. Calibration and de-embedding

Figure 8 shows the environment close to the die. When measuring the evaluation board, the input and output line loss have to be removed. The distance between the input and output is 28mm.

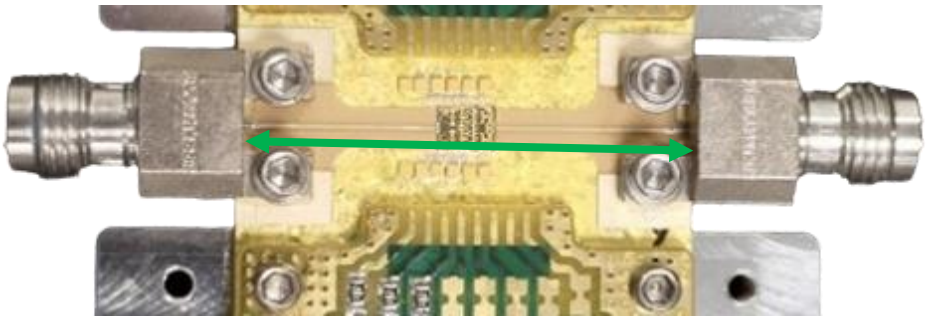

Figure 8: RF lines, distance between input and output is 28mm

We recommend to perform a calibration in the connector plane with an appropriate calibration kit (SOLT or TRL).

The example below explains how to evaluate the correction to be applied on raw measurement data at room temperature by using the curves of Figure 9 and Figure 10.

Example
If the die is 4 mm long, the input line length will be approximatively (28mm-4mm)/2= 12mm.

Figure 9 gives the insertion loss for a 27mm long line equipped with 2 RF connectors. At 50GHz for example, the loss is L=2.4dB.

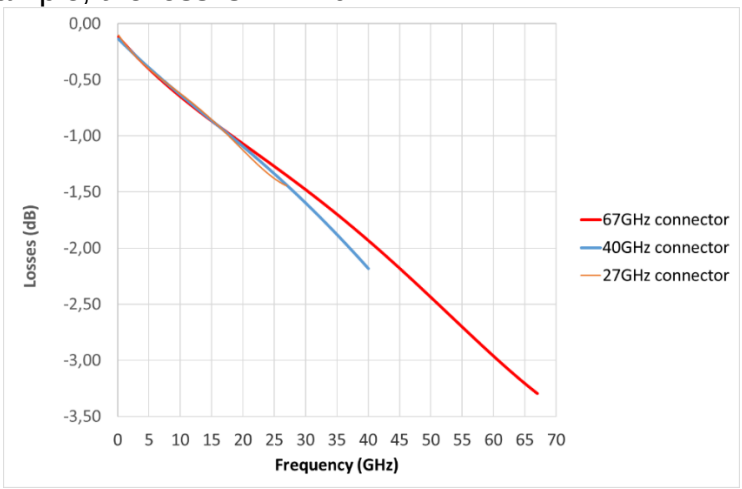

Figure 9: Insertion loss for a 1mm long die (RF lines 27mm) at room temperature

Half of the loss is HL=1.2dB and represent one connector and a 13.5mm long line.

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Figure 10 gives the line loss per millimetre. At 50GHz, the loss is LL=0.08 dB/mm.

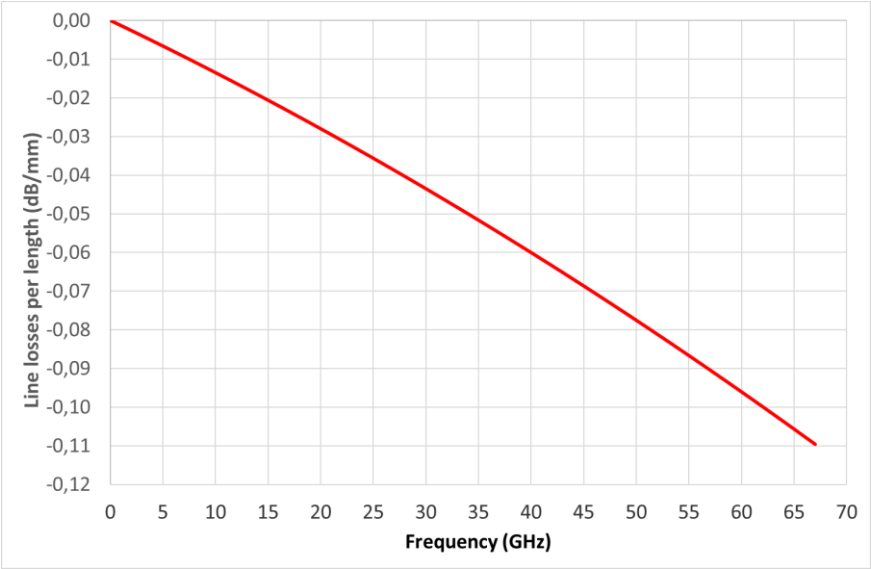

Figure 10: Line loss/mm

The extra length to be removed on both the input and output line is 1.5mm. The corresponding loss is LC=1.5*LL= 0.12dB.

The correction to be applied is Corr= HL-LC=1.2 dB-0.12dB = 1.08dB

Hence, at 50GHz the de-embedding to be applied on both the input and output is 1.08dB.

1.7. Biasing sequence

The detailed biasing sequence of the product is given in its datasheet.

1.8. Expected results

See the product datasheet for the expected results.

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2. Notes

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Recommended ESD management

Refer to the application note AN0020 available at https://www.ums-rf.com for ESD sensitivity and handling recommendations for the UMS products.

Recommended environmental management

UMS products are compliant with the regulation in particular with the directives RoHS N°2011/65 and REACh N°1907/2006. More environmental data are available in the application note AN0019 also available at https://www.ums-rf.com.

3. Ordering information

Product commercial reference:

- EVB-XXXXXXX-99F
- EVB-XXXXXXX-98F

Contacts:

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