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RG-110
HUM-A-900-PRO PCB Trace Layout Reference Guide

3/29/17

For proper integration of the HUM-A-900-PRO module in end products the following requirements must be met. A host product incorporating the HUM-A-900-PRO module cannot take advantage of the pre-existing certification of the component transmitter without conformity to the specific requirements in these instructions.

Contents

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1. Approved RF Connections for HUM-A-900-PRO-UFL

The HUM-A-900-PRO-UFL module employs an integrated u.FL RF connector. Therefore, the design and layer stackup of the host PCB does not need to meet any special requirements to maintain the validity of the module's pre-certified status.

2. Approved RF Connections for HUM-A-900-PRO-CAS

2.1. Edge Mount RP-SMA Connection

This is the preferred RF connection design for the HUM-A-900-PRO-CAS module and is approved with all operating modes of the module. This design uses a PCB microstrip to connect the HUM-A-900-PRO-CAS module's Antenna castellation to an edge mount reverse polarity SMA connector Linx Part number CONREVSMA003.062. A four layer PCB is used in this design. The Top layer 24mil wide RF trace and Mid-Layer 1 ground plane form an RF microstrip.

- Table 1 shows the required host PCB layer stackup for the Edge Mount RP-SMA connection. This layer stackup must be matched precisely including material type, dielectric constant, dielectric thickness, and copper thickness.
- Figure 1 shows the trace dimensions that must be followed precisely, including trace width, and routing
- The Ground plane on Mid-layer 1 must not have any cutouts in the area under the RF trace or the area between the module and the connector.

Layer	Name	Material	Thickness	Constant	Board Layer Stack
1	Top Overlay				
2	Top Solder	Solder Resist	0.40mil	3.5	
3	Top Layer	Copper	1.40mil		
4	Dielectric1	FR-4	14.00mil	4.6	
5	Mid-Layer 1	Copper	1.40mil		
6	Dielectric2	FR-4	28.00mil	4.6	
7	Mid-Layer 2	Copper	1.40mil		
8	Dielectric3	FR-4	14.00mil	4.6	
9	Bottom Layer	Copper	1.40mil		
10	Bottom Solder	Solder Resist	0.40mil	3.5	
11	Bottom Overlay				

Table 1 – PCB Stackup for Edge Mount RP-SMA Connection

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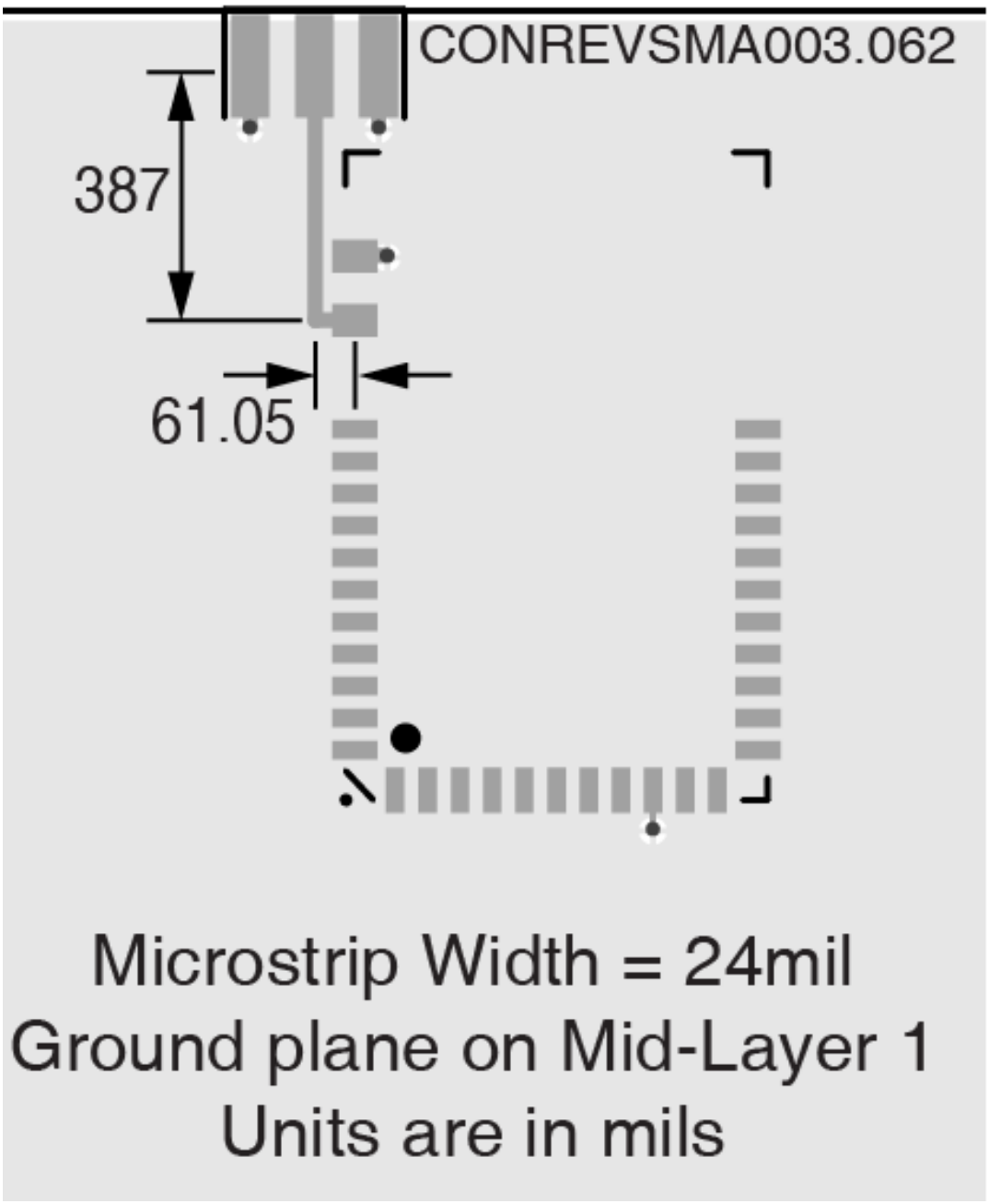

Figure 1 - Trace Dimensions for Edge Mount RP-SMA Connection

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2.2. MicroSplatch Antenna Connection

This RF connection is approved with all operating modes of the module. This design uses a PCB microstrip to connect the HUM-A-900-PRO-CAS module's Antenna castellation to a PCB mount antenna Linx Part number ANT-916-uSP. A four layer PCB is used in this design. The Top layer 24mil wide RF trace and Mid-Layer 1 ground plane form an RF microstrip.

- Table 2 shows the required host PCB layer stackup for the MicroSplatch Antenna connection. This layer stackup must be matched precisely including material type, dielectric constant, dielectric thickness, and copper thickness.
- Figure 2 shows the trace dimensions that must be followed precisely, including trace width, and routing
- The Ground plane on Mid-layer 1 must not have any cutouts in the area under the RF trace or the area between the module and the connector.

Layer	Name	Material	Thickness	Constant	Board Layer Stack
1	Top Overlay				
2	Top Solder	Solder Resist	0.40mil	3.5	
3	Top Layer	Copper	1.40mil		
4	Dielectric1	FR-4	14.00mil	4.6	
5	Mid-Layer 1	Copper	1.40mil		
6	Dielectric2	FR-4	28.00mil	4.6	
7	Mid-Layer 2	Copper	1.40mil		
8	Dielectric3	FR-4	14.00mil	4.6	
9	Bottom Layer	Copper	1.40mil		
10	Bottom Solder	Solder Resist	0.40mil	3.5	
11	Bottom Overlay				

Table 2 - PCB Stackup for MicroSplatch Antenna Connection

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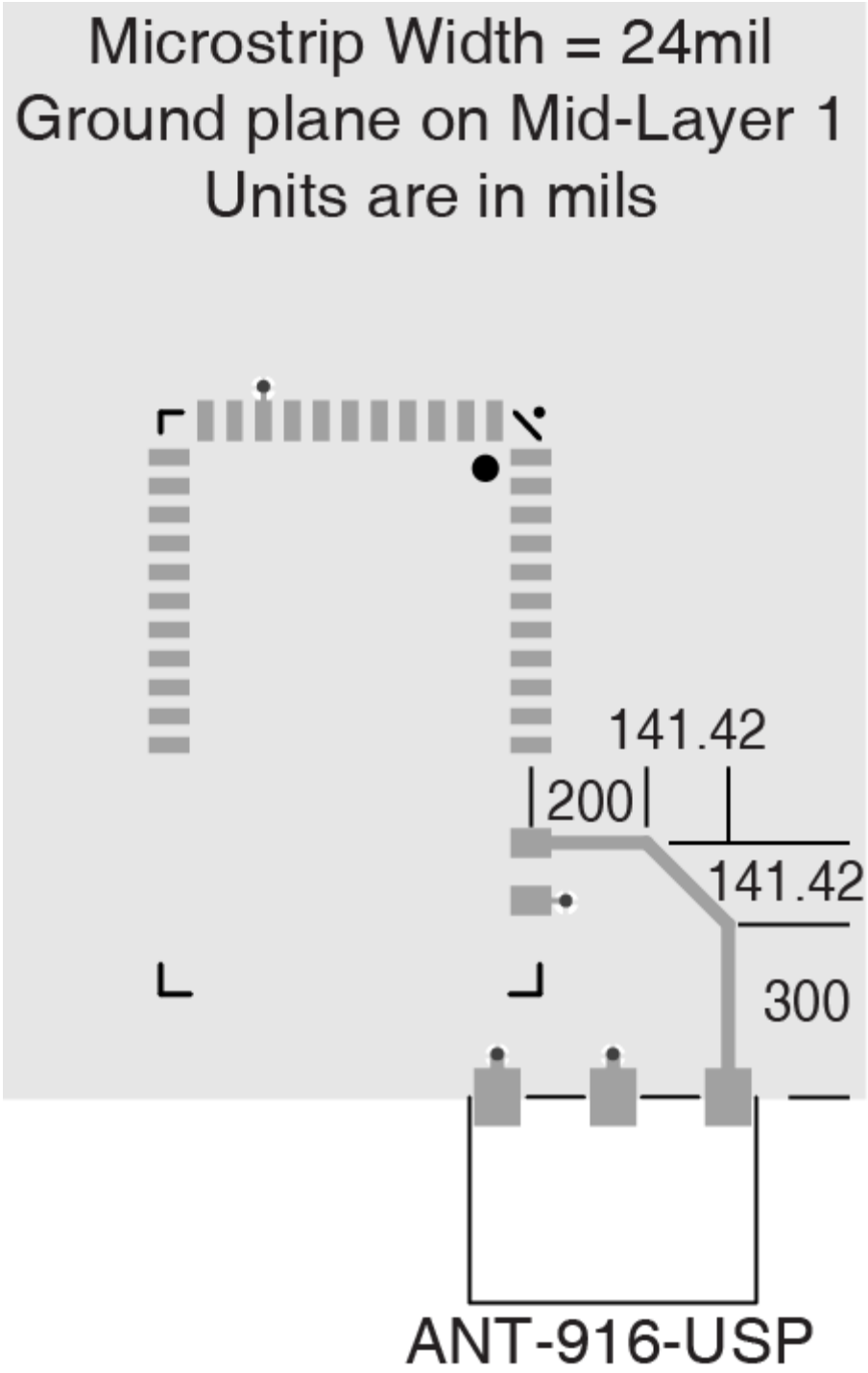

Figure 2 - Trace Dimensions for MicroSplatch Antenna Connection

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2.3. Vertical Mount RP-SMA connection

The Vertical Mount RP-SMA RF connection is approved only for operation at the Low RF Data Rate (19.2kbps) This design uses a PCB microstrip to connect the HUM-A-900-PRO module's Antenna castellation to an edge mount reverse polarity SMA connector Linx Part number CONREVSMA001. A four layer PCB is used for this design. The Top layer 14mil wide RF trace and Mid-Layer 1 ground plane form an RF microstrip.

- Table 3 shows the required host PCB layer stackup for the Vertical Mount RP-SMA connection. This layer stackup must be matched precisely including material type, dielectric constant, dielectric thickness, and copper thickness.
- Figure 3 shows the trace dimensions that must be followed precisely, including trace width, routing, and RF matching components. A 15pF series capacitor (Murata GRM0335C1H150GA01D) is located between the module and the RP-SMA connector for RF matching. A 10mil wide microstrip connects the center post of the RP-SMA connector to a 100nH inductor (Bourns CW201212-R10J) for RF matching.
- The Ground plane on Mid-layer 1 must not have any cutouts in the area under the RF trace, in the area between the module and the connector, or under the RF matching components.

Layer	Name	Material	Thickness	Constant	Board Layer Stack
1	Silkscreen Top				
2	Solder Mask Top	Solder Resist	0.40mil	3.5	
3	Top	Copper	0.70mil		
4	Dielectric1	FR-4	6.70mil	4.6	
5	Inner Layer 2	Copper	0.70mil		
6	Dielectric2	FR-4	46.00mil	4.6	
7	Inner Layer 3	Copper	0.70mil		
8	Dielectric3	FR-4	6.70mil	4.6	
9	Bottom	Copper	0.70mil		
10	Solder Mask Bottom	Solder Resist	0.40mil	3.5	
11	Silkscreen Bottom				

Table 3 - PCB Stackup for Vertical Mount RP-SMA Connection

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Note: The vertical SMA connector is a through-hole mount component. The connector must be installed on the bottom of the PCB. Figure 3 shows the top side of the PCB were the HUM-A-900-PRO-CAS module is mounted and the solder side of the RP-SMA connector is visible.

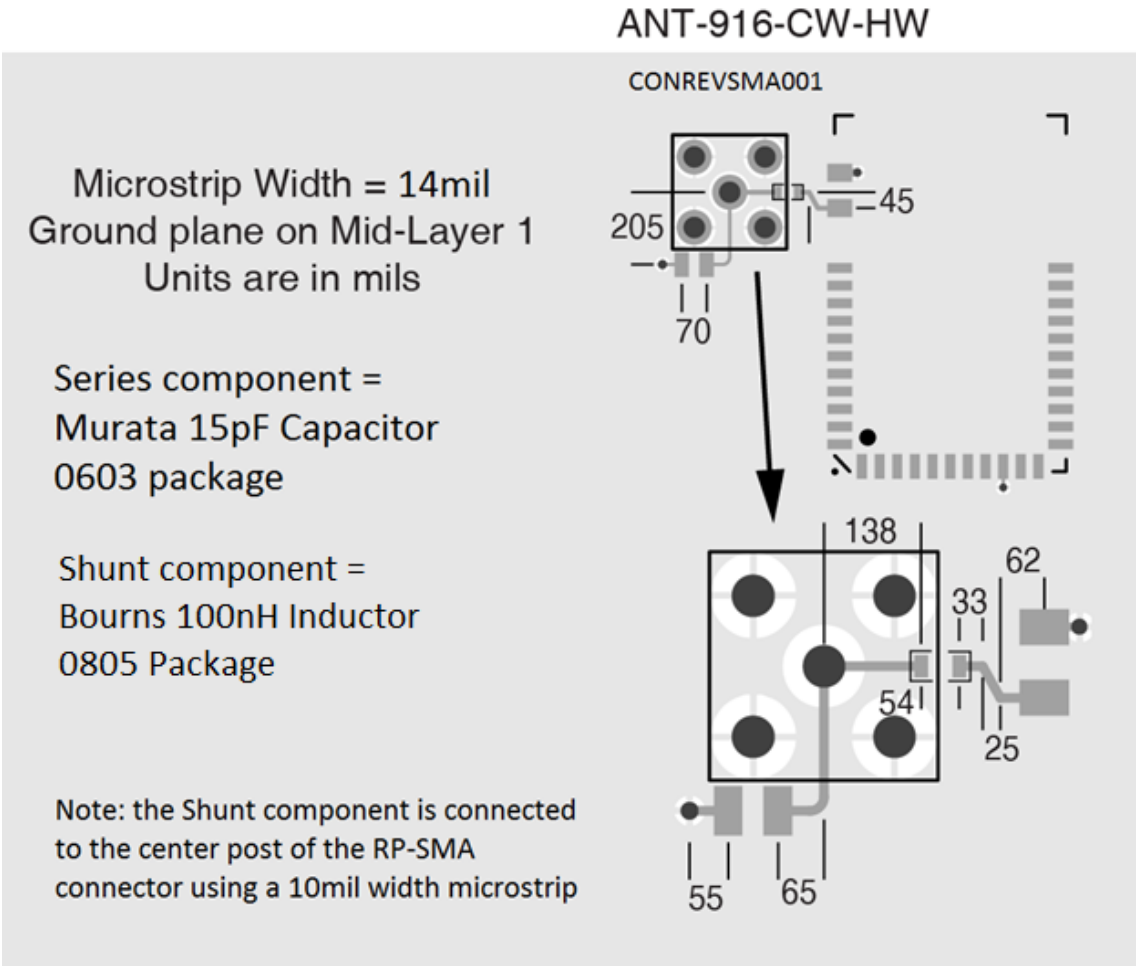

Figure 3 - Trace Dimensions and RF Matching Component Placement for Vertical Mount RP-SMA Connection

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3. Approved Antennas

The antennas in Table 1 are tested and approved for use with the HUM-A-900-PRO Module. According to the FCC Permissive Change Policy (178919 D01) "Additional antennas that are equivalent may be substituted, and then marketed without a Class II permissive change… Equivalent antennas must be of the same type (e.g., yagi, dish, etc.), must be of equal or less gain than an antenna previously authorized under the same grant of certification (FCC ID), and must have similar in-band and out-of-band characteristics (consult specification sheet for cutoff frequencies). Contact Linx for information about other antennas that meet these requirements and may be used with the HUM-A-900-PRO module.

Antennas / Antennes				
Linx Part Number Référence Linx	Type	Gain	Impedance Impédance	Valid For
Tested Antennas				
ANT-916-CW-HWR-RPS	½ Wave Dipole Helical	1.2dBi	50Ω	Both
ANT-916-USP	¼ Wave Planar	0.3dBi	50Ω	–CAS
Antennas of the same type and same or lesser gain				
ANT-916-CW-HW	½ Wave Dipole Helical	1.2dBi	50Ω	Both

Cable Assemblies / Assemblages de Câbles	
Linx Part Number Référence Linx	Description
CSI-RSFB-300-UFFR*	RP-SMA Bulkhead to U.FL with 300mm cable
CSI-RSFE-300-UFFR*	RP-SMA External Mount Bulkhead to U.FL with 300mm cable

* Also available in 100mm and 200mm cable length

Table 4 - Approved Antennas

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4. Design Verification Test Procedures

After the design is fabricated the following measurements should be executed to verify the design:

1. Mechanical measurement of dimensions specified in the Microstrip Dimensions diagrams above
2. Obtain and review the detailed layer stackup solution used for the build from the PCB manufacturer that specifies dielectric thicknesses and target dielectric constants for substrate materials.

Note: Linx Applications Engineers are available to review Layout designs to ensure compliance and optimal RF performance.

5. Production Test Procedures for Ensuring Compliance

During production test for the host device, The HUM-A-900-PRO module is to be activated in maximum power transmit mode and the conducted RF output power at the RP-SMA connector is to be measured using a Spectrum Analyzer, RF Power Meter or other appropriate RF measurement equipment. The conducted output power should not exceed the output power specified in the HUM-A-900-PRO Data Guide. If a conducted output power test is not possible on the host device, an equivalent radiated output power test may be used.