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# Antenna Switch Module: BGSF1717MN26

Antenna Switch Module with integrated MIPI RFFE Interface, 2 GSMTX Ports for multi-mode GSM/EDGE, WCDMA or LTE Applications and Carrier Aggregation

Application Note AN384

## About this document

### Scope and purpose

This application note describes Infineon's Antenna Switch Module BGSF1717MN26 as main antenna switch module for multi-mode GSM/EDGE, WCDMA or LTE Applications and Carrier Aggregation applications.

1. This application notes gives an overview about main purpose of this SP7T Low Band + SP7T High Band Antenna Switch Module.
2. Multi-mode GSM/EDGE, WCDMA or LTE Applications and Carrier Aggregation are the primary application of this document.
3. The Printed Circuit Board (PCB) design as well as antenna matching network proposed in this note provides a customer oriented approach where a single ASM enables multi-mode GSM/EDGE, WCDMA or LTE and Carrier Aggregation applications
4. Key performance parameters include higher Isolation between input channels (~32dB), integrated SAW Filter for LB and HB GSM Tx inputs, very low IL of the TX channels (0.5dB), integration of SP7T LB and SP7T HB in one module and an integrated MIPI RFFE Interface.

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# 1 Introduction of BGSF1717MN26

For RF Front-End solutions that integrate new features such as downlink inter-band carrier aggregation to increase Downlink data rates, Antenna Switch Modules (ASMs) are facing new challenges. Two RF signals being transmitted in different frequency bands have to be routed from two different antennas – one dedicated for low frequency band and one for high frequency band - to the RF Transceiver at the same time. For this kind of application, the new switch which combines two SP7T ICs and the MIPI control interface, the so-called DP14T, have been introduced to the market.

The BGSF1717MN26 is a double Pole Fourteen Throw (DP14T / SP7T+SP7T) ASM optimized for wireless applications up to 2.7 GHz. It is a perfect solution for multi-mode handsets based on quad-band GSM, WCDMA, LTE and ideal for carrier aggregation solutions. TRX10 is designed to achieve ultra-high linearity. The ASM configuration is shown in the [Figure 2](#).

The module comes in a miniature TSNP package shown in the [Figure 1](#) and comprises of two high power SP7T switches with integrated MIPI RFFE interface and harmonic filters for GSM high and low band transmitter signal paths. The on-chip MIPI RFFE interface supports both 1.2 V and 1.8 V supply voltages. No external DC blocking capacitors are required in typical applications as long as no DC is applied to any RF port. The pin assignment can be found in the [Figure 3](#).

## 1.1 Main Features

- Suitable for multi-mode GSM / EDGE / C2K / WCDMA / LTE applications and carrier aggregation
- Operating from 0.1 to 2.7 GHz coverage
- Ultra-low insertion loss and harmonics generation
- Integrated GSM transmit filters
- 12 interchangeable, high-linearity WCDMA TRX ports
- Port TRX10 designed for ultra-high linearity
- 2 high-linearity GSM TX paths
- High port-to-port isolation
- Integrated MIPI RFFE interface
- No decoupling DC capacitors required, if no DC applied on RF lines
- Small form factor: 3.2 mm x 2.8 mm x 0.73 mm



**Figure 1** BGSF1717MN26 package in TSNP-26-3

### 1.2 Functional Diagram

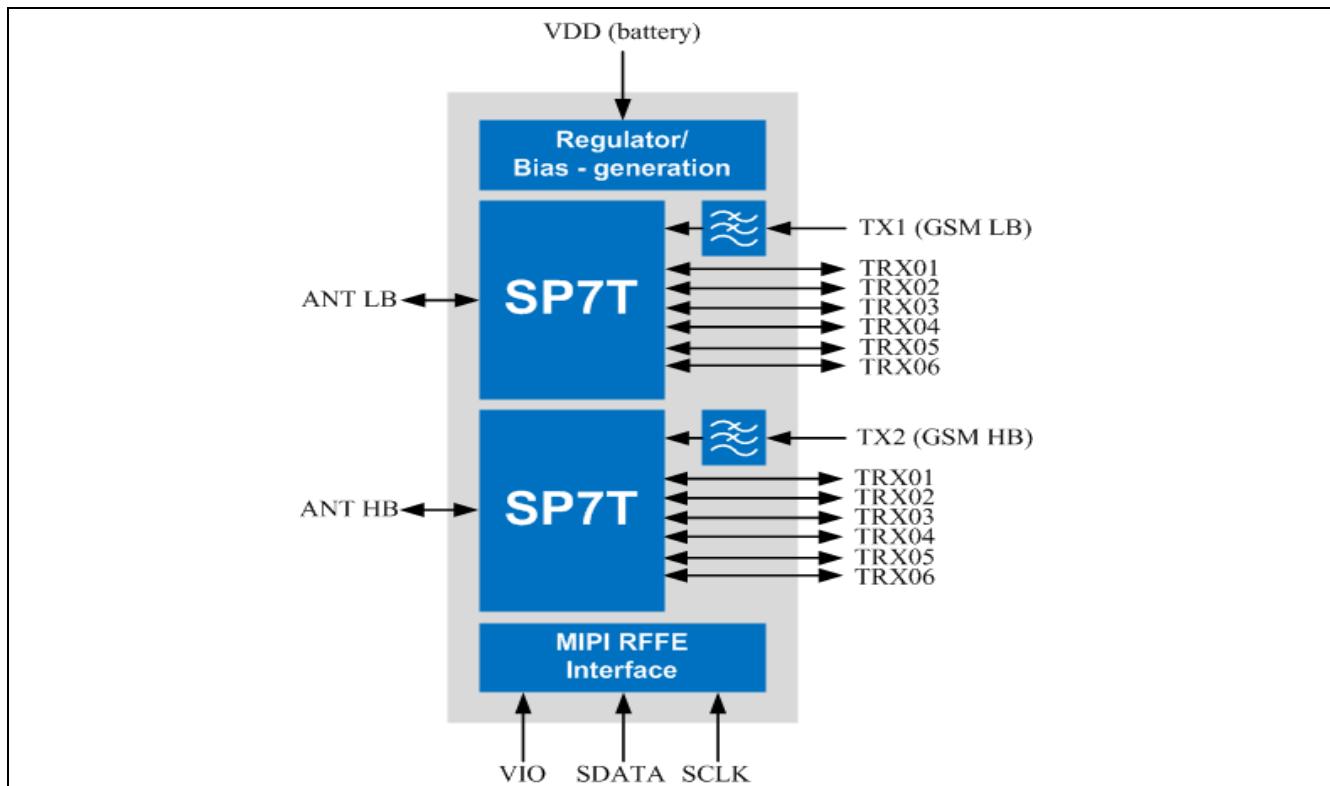


Figure 2 BGSF1717MN26 Functional Diagram

### 1.3 Pin Configuration

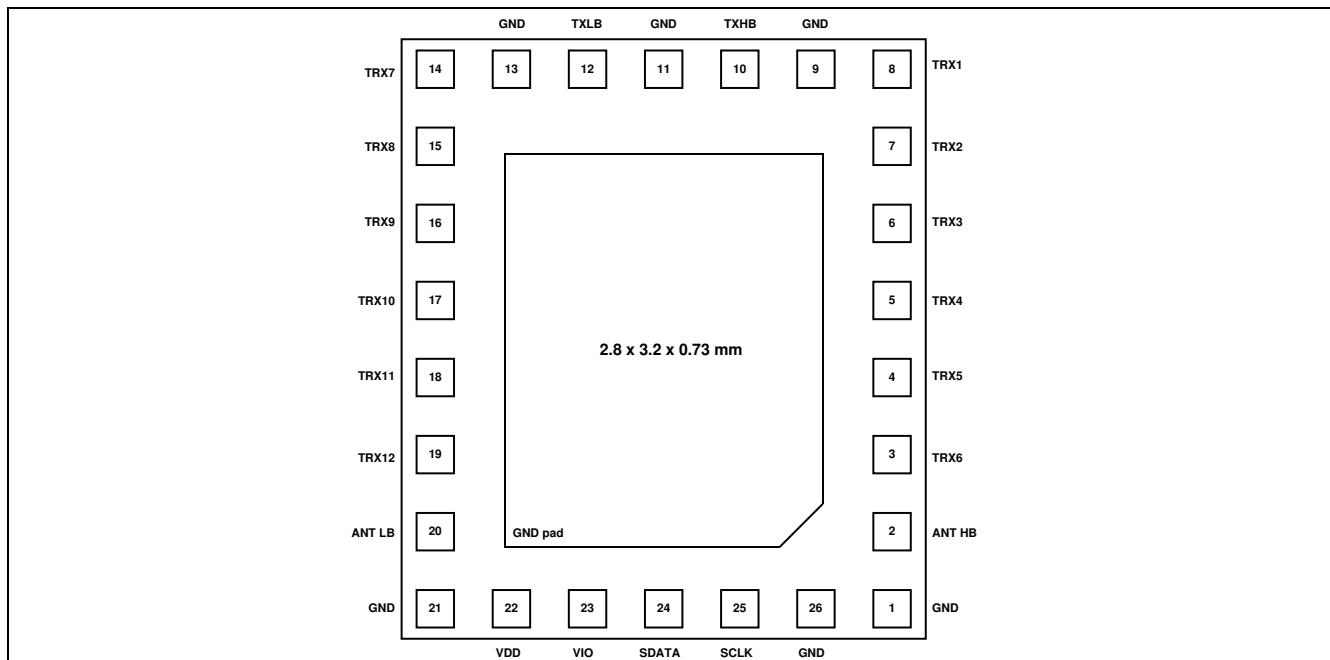


Figure 3 BGSF1717MN26 Pin Configuration

### 1.4 Pin Description

Table 1 Pin Description (top view)

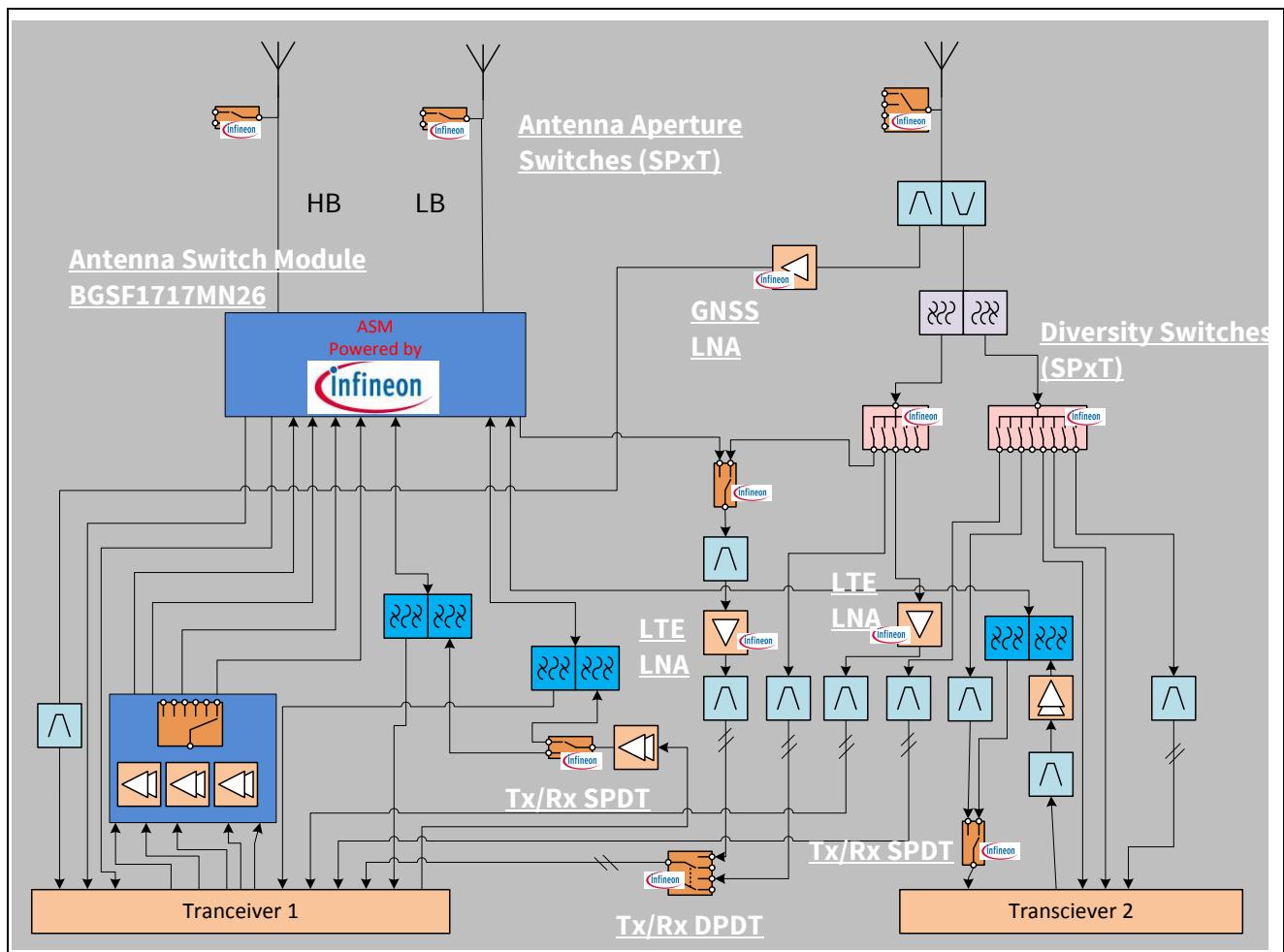
Pin NO	Name	Pin Type	Function
0	GND	GND	Ground, die pad
1	GND	GND	DC ground
2	ANT HB	I/O	High band antenna port
3	TRX6	I/O	WCDMA TRX port
4	TRX5	I/O	WCDMA TRX port
5	TRX4	I/O	WCDMA TRX port
6	TRX3	I/O	WCDMA TRX port
7	TRX2	I/O	WCDMA TRX port
8	TRX1	I/O	WCDMA TRX port
9	GND	GND	RF ground
10	TXHB	I	GSM HB port
11	GND	GND	RF ground
12	TXLB	I	GSM LB port
13	GND	GND	RF ground

**Table 1 Pin Description (top view)**

Pin NO	Name	Pin Type	Function
14	TRX7	I/O	WCDMA TRX port
15	TRX8	I/O	WCDMA TRX port
16	TRX9	I/O	WCDMA TRX port
17	TRX10	I/O	WCDMA TRX port
18	TRX11	I/O	WCDMA TRX port
19	TRX12	I/O	WCDMA TRX port
20	ANT LB	I/O	Low band antenna port
21	GND	GND	DC ground
22	VDD	PWR	Supply Voltage
23	VIO	PWR	RFFE supply voltage
24	SDATA	I/O	Data
25	SCLK	I	Clock
26	GND	GND	DC ground

## 2 Application

A typical application of BGSF1717MN26 ASM in a mobile phone is shown in the [Figure 4](#). At the main antenna path of the RF Front-End the BGSF1717MN26 switches signals from the high band and low band antenna to the different transceiver IC input and outputs. For the diversity path different Infineon RF switches can be used e.g. BGS16MN14, BGS18MN14. Infineon offers also besides ASMs, general purpose RF Switches and a broad portfolio of **Low Noise Amplifiers** and Antenna Tuner Devices. All of Infineon Products concerning mobile phone applications can be found in our newest [Application Guide for RF & Protection Devices/ Mobile Communication](#).



**Figure 4** BGSF1717MN26 in mobile phone cellular frontend (typical discrete LTE-A feature set)

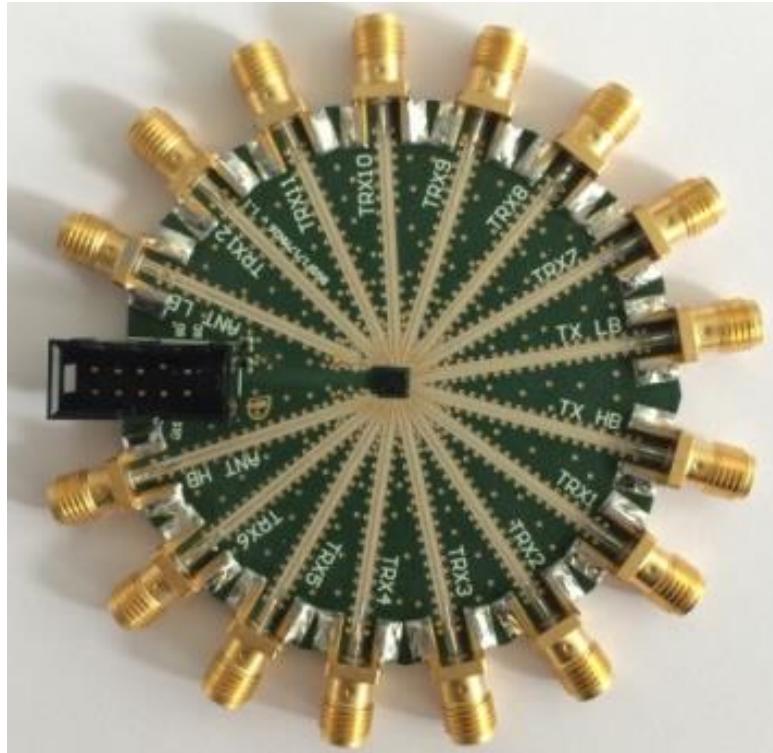
### 3 Application Circuit of BGSF1717MN26

In this chapter the evaluation board with application circuit including matching passive elements is presented. Afterwards, the deembedding process required for S-Parameter measurements is described.

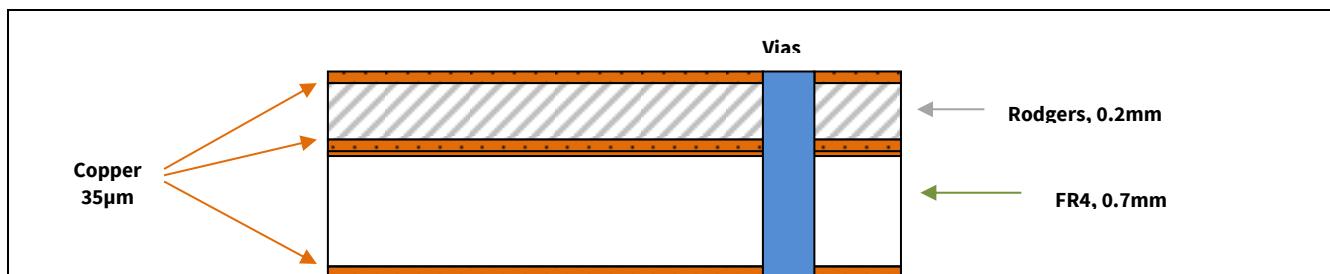
**Device:** **BGSF1717MN26**  
**Application:** **Antenna Switch Module**  
**PCB Marking:** **BGSF1717MN26 v1.1**  
**EVB Order No.:** **BGSF1717MN26 BOARD SP001136296**

#### 3.1 Application Board

The Evaluation Board (EVB) used for the RF measurements is shown in the [Figure 5](#). The EVB is designed so that every 50 Ohm signal lines have the same length. The layer stack-up of the PCB is presented in [Figure 6](#).



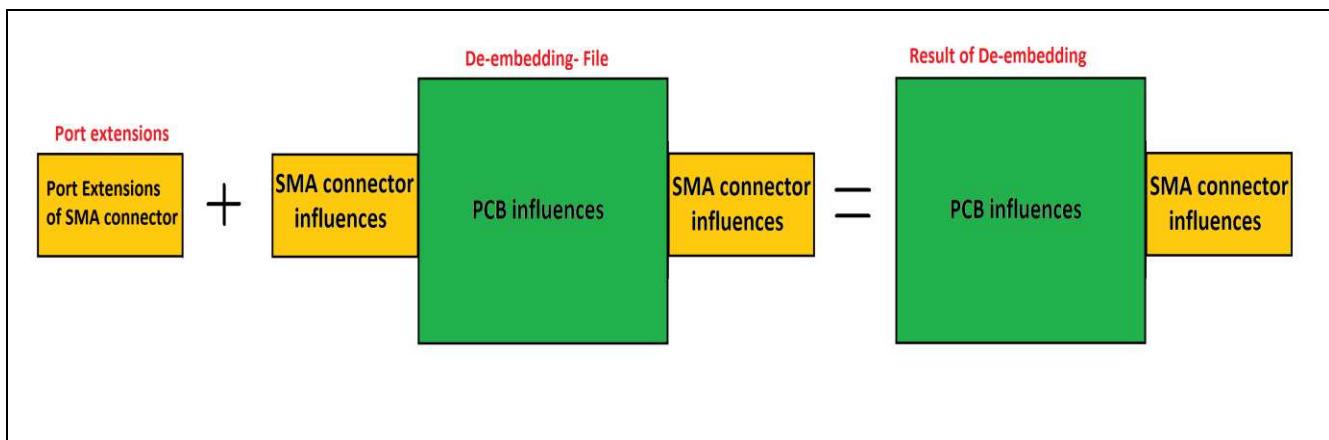
**Figure 5 Layout of the application board**



**Figure 6 PCB cross section with layer stack-up**

### 3.2 Deembedding

The device (BGSF1717MN26) is deembedded from influence of the application circuit and coaxial connectors by at first measuring a coaxial connector and a “half-board” micro strip line and then by loading this data in the fixture simulator of the network analyzer. In the [Figure 7](#) this deembedding concept is given. The deembedding of this RF device is performed in several steps explained in the next subchapters.

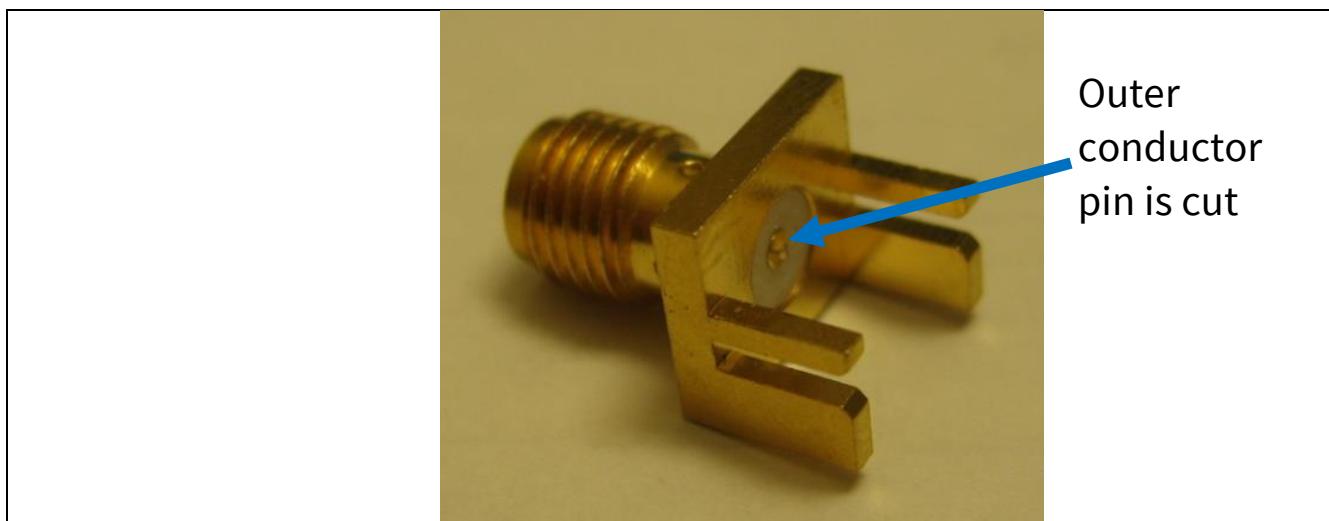


**Figure 7 Deembedding concept with a “prepared” SMA connector and a “Half-Thru” board**

#### 3.2.1 Port Extension

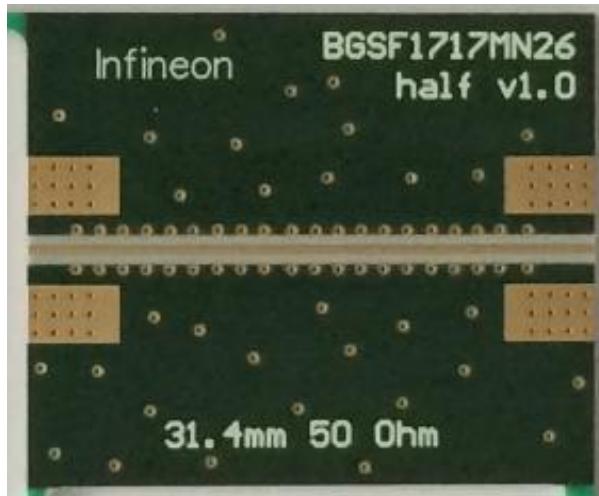
In order to shift the reference plane of the network analyzer to the PCB signal line connect a SMA connector with a cut pin of the inner conductor to one port of the Vector Network Analyzer (VNA) and measure port extensions at this port.

[Figure 8](#) shows such a “prepared” SMA connector with an outer pin cut with a wire cutter.



**Figure 8 SMA connector with cut inner pin**

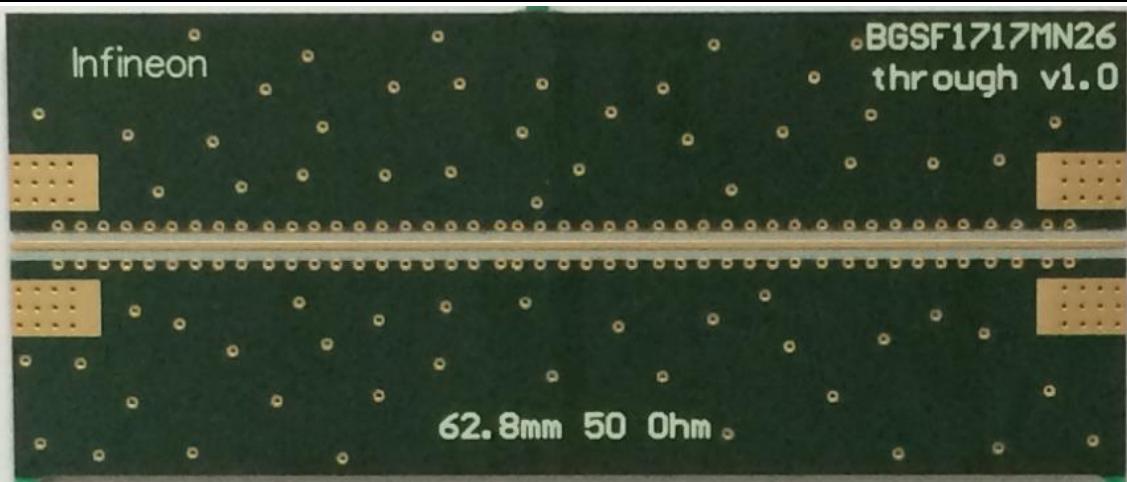
After the measurement of the S21 of the half-thru board (given in [Figure 9](#)) with port extension turned on is completed, the s2p-data ought to be loaded in the fixture simulator. This measurement result includes the insertion loss and the phase shift of the one SMA connector and the transmission line to the chip. After all the port extension has to be deactivated.



**Figure 9 “Half-Thru” deembedding board**

### 3.2.2 Deembedding control process

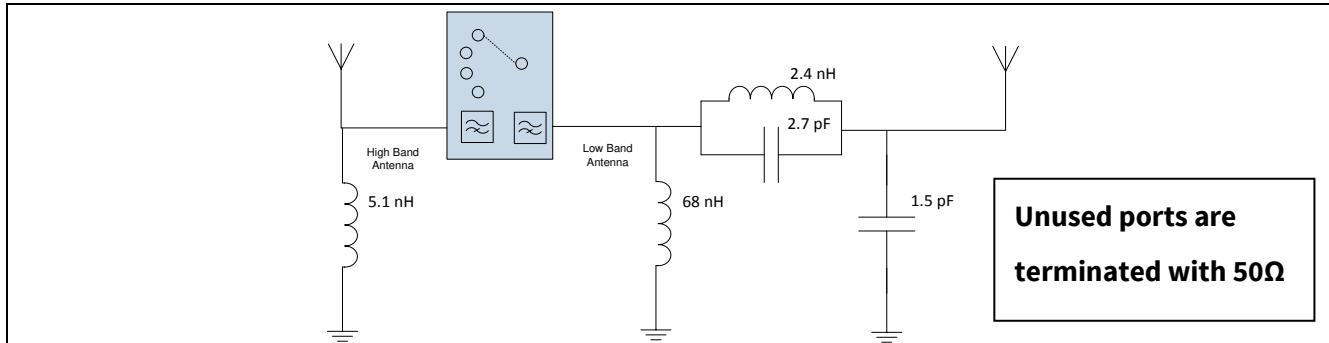
Measure this full-thru PCB (given in the [Figure 10](#)) to verify your deembedding having the fixture simulator turned on for each port of the VNA, whereas port extension must be off. If the insertion loss is close to 0 dB and S11 reflection has a considerable value, further RF measurements can be done.



**Figure 10 “Full-Thru” deembedding board**

## 4 Small Signal Characteristics of BGSF1717MN26

The S-Parameters are measured at 25 °C with a VNA in an application circuit shown in **Figure 11**.



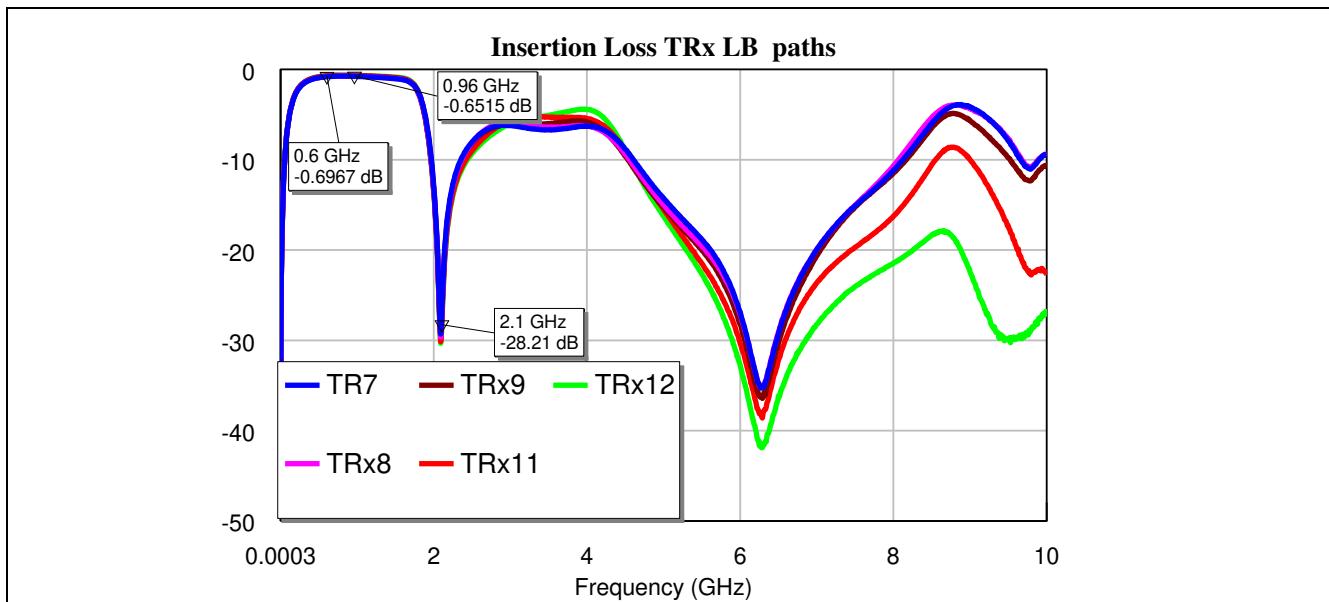
**Figure 11 Application circuit BGSF1717MN26**

### 4.1 Small Signal Parameters LB switch

#### 4.1.1 Insertion Loss from LB Antenna to the respective RF TRX Port

**Table 2 Insertion Loss from LB Antenna to TX LB port**

Frequency (MHz)	704	716	740	751	824	881	915	942
TRx7	-0.76	-0.76	-0.74	-0.74	-0.75	-0.75	-0.75	-0.76
TRx8	-0.74	-0.74	-0.72	-0.73	-0.73	-0.74	-0.74	-0.74
TRx9	-0.72	-0.71	-0.69	-0.7	-0.7	-0.71	-0.71	-0.71
TRx11	-0.67	-0.66	-0.64	-0.65	-0.66	-0.66	-0.66	-0.66
TRx12	-0.65	-0.65	-0.63	-0.64	-0.64	-0.64	-0.64	-0.64

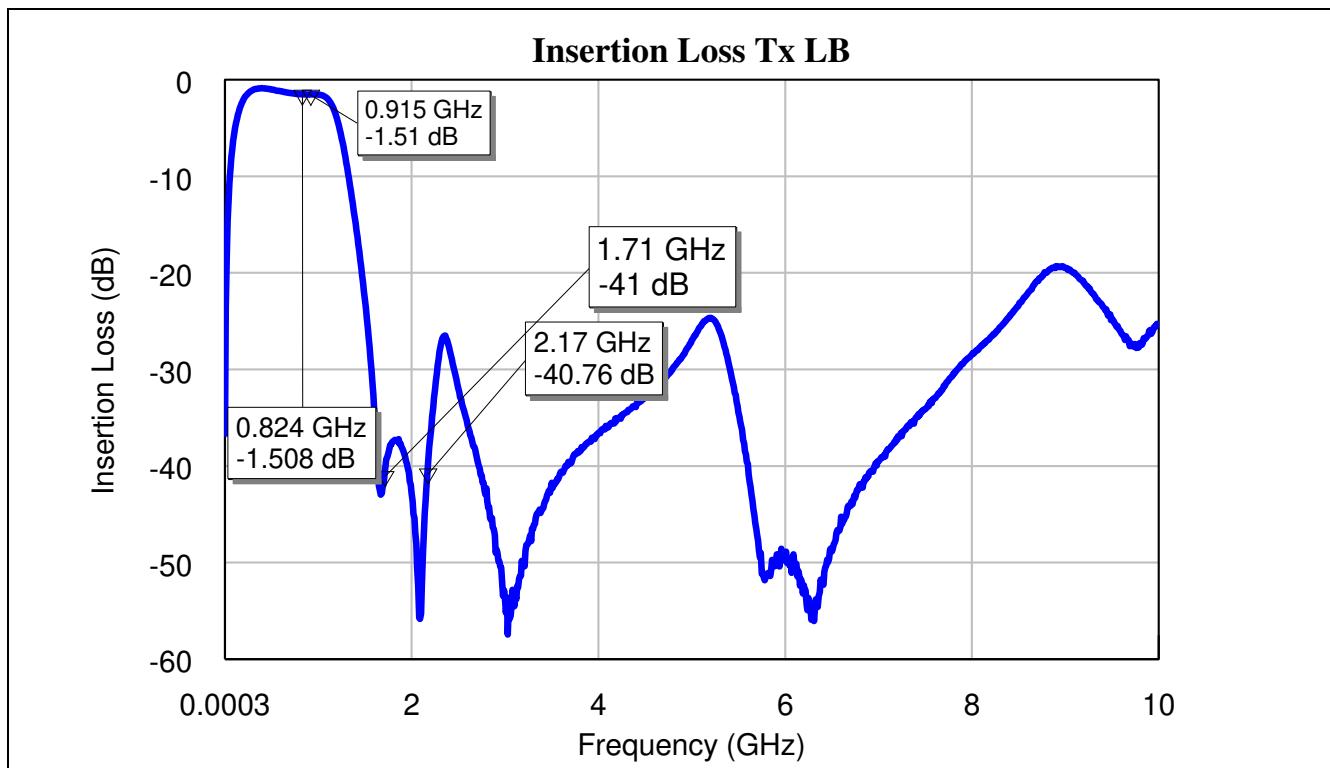


**Figure 12 Forward transmission from LB Antenna to TX LB port**

#### 4.1.2 Insertion Loss TX LB port

**Table 3** Insertion loss from LB Antenna to TX LB port

Frequency (MHz)	704	716	740	751	824	881	915	942
TR LB	-1.37	-1.39	-1.42	-1.45	-1.51	-1.52	-1.51	-1.51

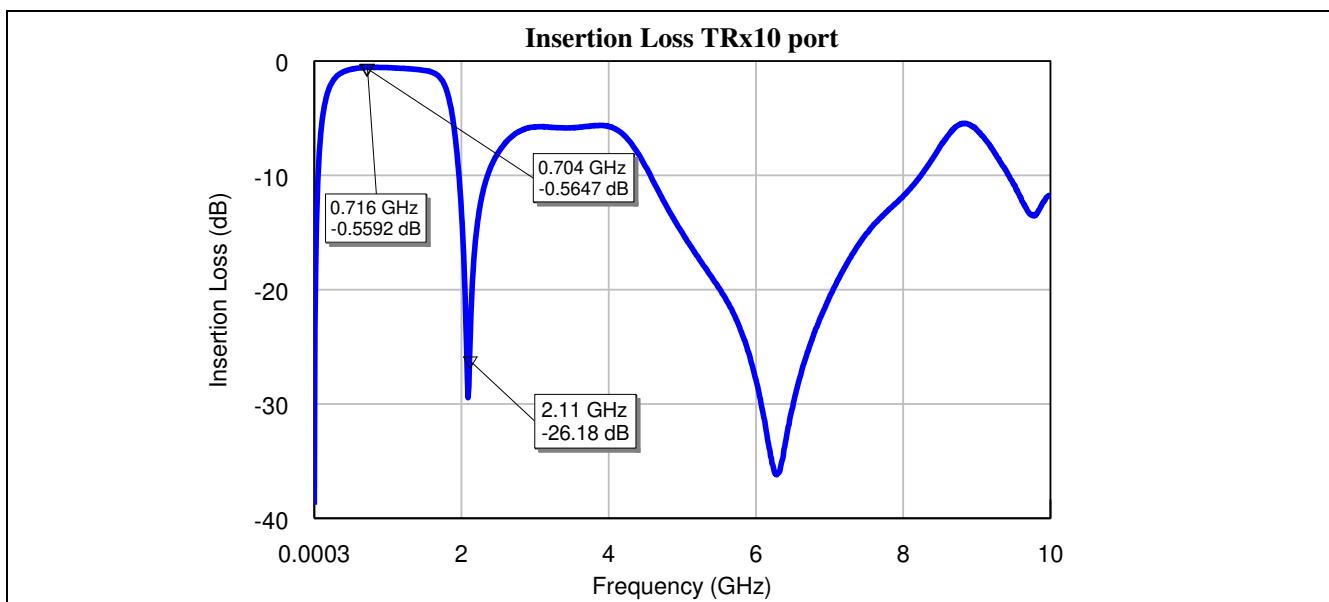


**Figure 13** Forward transmission from LB Antenna to TX LB port

#### 4.1.3 Insertion Loss high linearity ultra-low IL TRx10 port

**Table 4** Insertion loss from LB Antenna to TRx10 port

Frequency (MHz)	704	716	740	751	824	881	915	942
TR LB	-0.56	-0.56	-0.54	-0.55	-0.55	-0.56	-0.55	-0.56

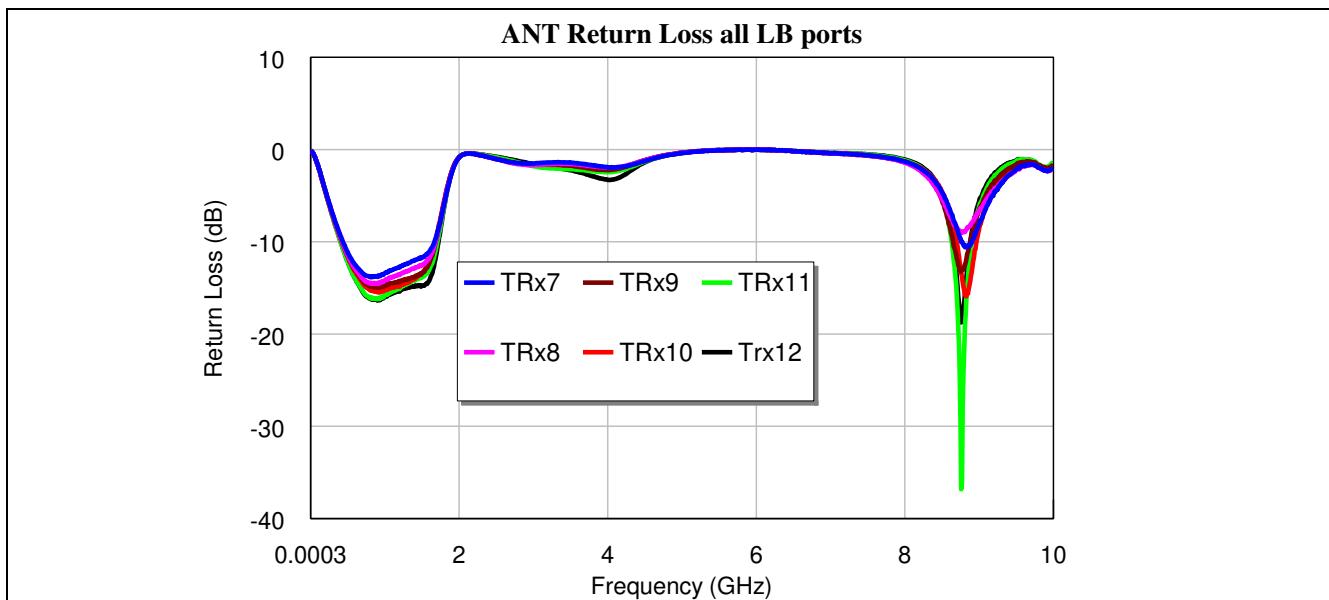


**Figure 14 Forward transmission from LB Antenna to TRX10 port**

#### 4.1.4 Return Loss from LB Antenna to the respective RF Port

**Table 5 Return loss from LB Antenna to the respective TRX LB RF port**

Frequency (MHz)	704	716	740	751	824	881	915	942
TRx7	-13.4	-13.5	-13.7	-13.7	-13.8	-13.8	-13.7	-13.6
TRx8	-14	-14.1	-14.3	-14.4	-14.5	-14.5	-14.4	-14.4
TRx9	-14.2	-14.4	-14.6	-14.6	-14.8	-14.9	-14.9	-14.9
TRx10	-14.5	-14.6	-14.9	-15	-15.2	-15.4	-15.4	-15.4
TRx11	-15.4	-15.5	-15.7	-15.8	-16.1	-16.1	-16.1	-16.1
TRx12	-15.5	-15.6	-15.8	-15.9	-16.2	-16.2	-16.2	-16.2

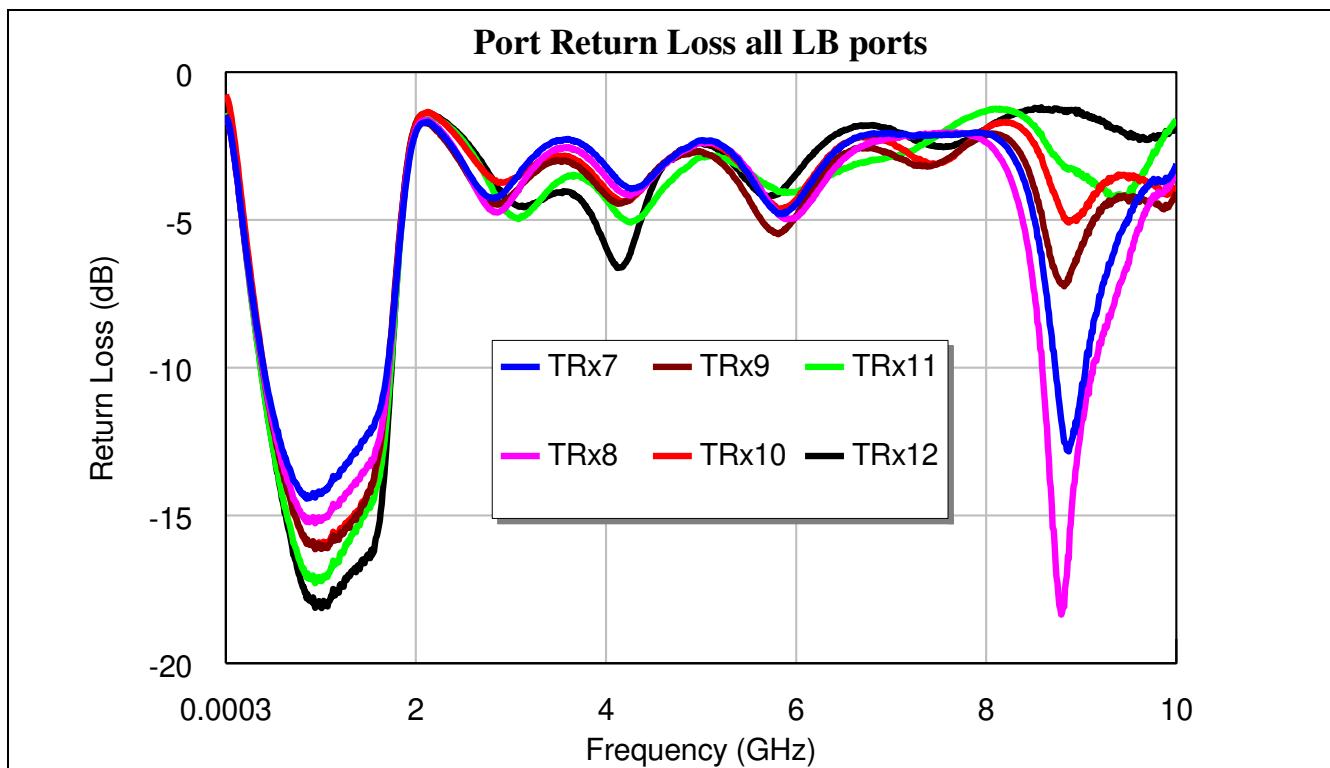


**Figure 15 Return Loss from LB Antenna to the respective TRX LB RF port**

#### 4.1.5 Return Loss of LB TRX RF ports to LB Antenna

**Table 6** Return loss from respective TRX LB RF port to LB Antenna

Frequency (MHz)	704	716	740	751	824	881	915	942
TRx7	-13.7	-13.8	-13.9	-14	-14.3	-14.4	-14.3	-14.4
TRx8	-14.3	-14.5	-14.6	-14.6	-15	-15.2	-15.1	-15.3
TRx9	-14.8	-14.9	-15.1	-15.2	-15.7	-16	-15.9	-16.1
TRx10	-14.8	-15	-15.1	-15.2	-15.8	-16	-15.9	-16.1
TRx11	-15.8	-15.9	-16.1	-16.2	-16.9	-17.2	-17.1	-17.3
TRx12	-16.2	-16.4	-16.6	-16.8	-17.5	-17.9	-17.9	-18.1

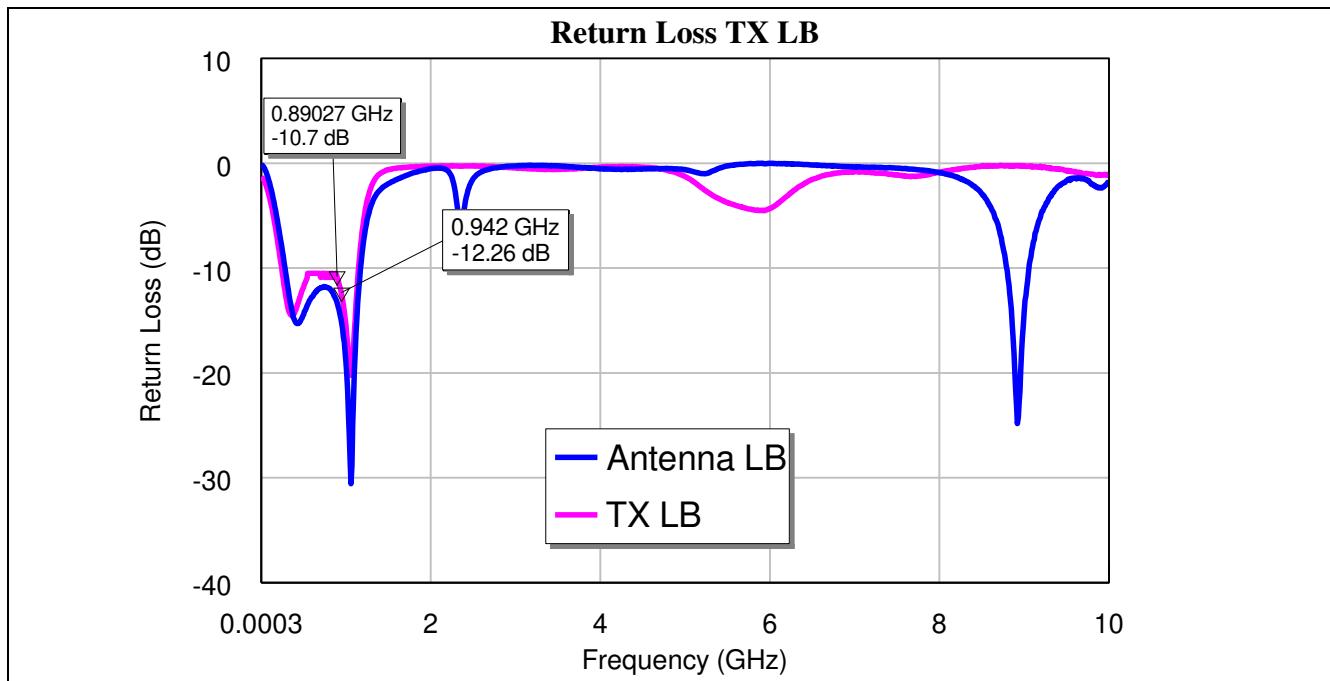


**Figure 16** Return Loss of LB TRX RF ports to LB Antenna

#### 4.1.6 Return Loss TX LB RF port

**Table 7** Return loss from TR LB RF port

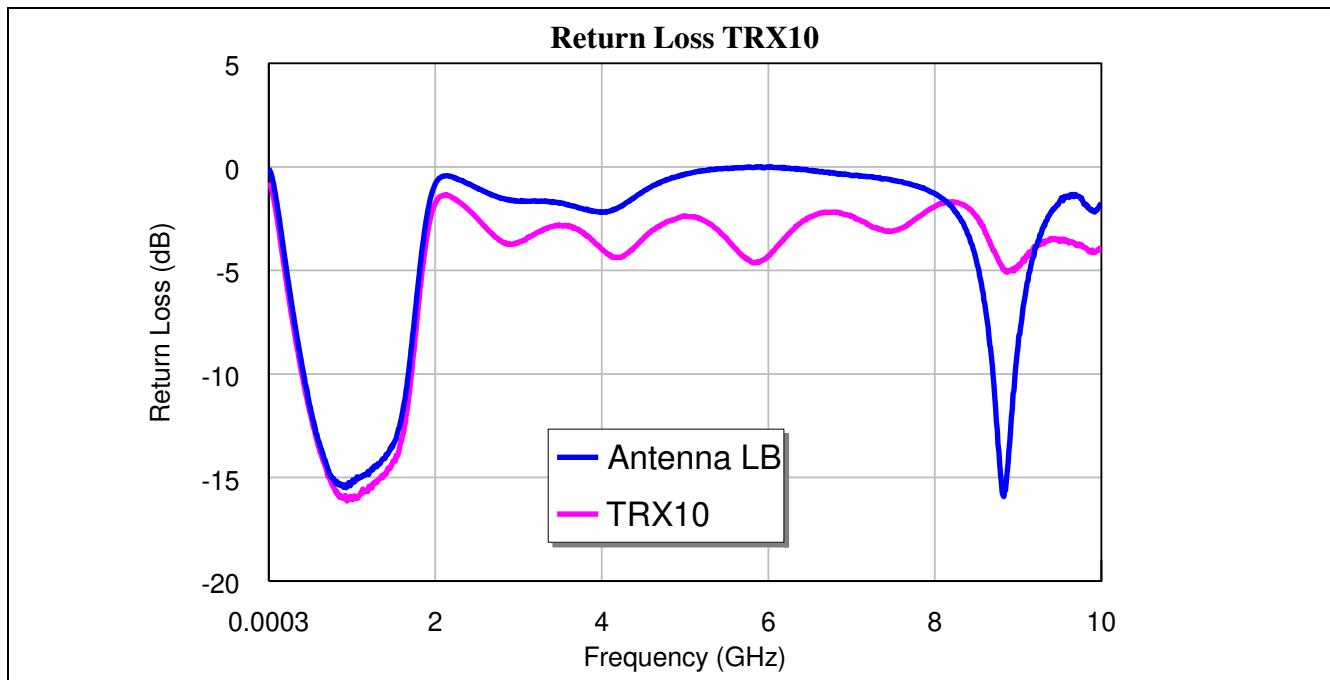
Frequency (MHz)	704	716	740	751	824	881	915	942
ANT LB port	-11.9	-11.8	-11.8	-11.8	-12.1	-13	-13.9	-14.9
TX LB port	-10.1	-10.1	-10.1	-10.1	-10.1	-10.7	-11.4	-12.3



**Figure 17** Return Loss port TX LB RF port

**Table 8** Return loss from TRX10 RF port

Frequency (MHz)	704	716	740	751	824	881	915	942
ANT LB port	-14.5	-14.6	-14.9	-15	-15.2	-15.4	-15.4	-15.4
TRX10 port	-14.8	-15	-15.1	-15.2	-15.8	-16	-15.9	-16.1



**Figure 18** Return Loss of high linearity ultra-low IL TRX10 RF port

#### 4.1.7 Antenna to port and Port to Port Isolation LB path

Apply to the [Table 9](#) and [Table 10](#) on the next page.

**Table 9 Worst case Antenna to Port Isolation High Band part<sup>1</sup>**

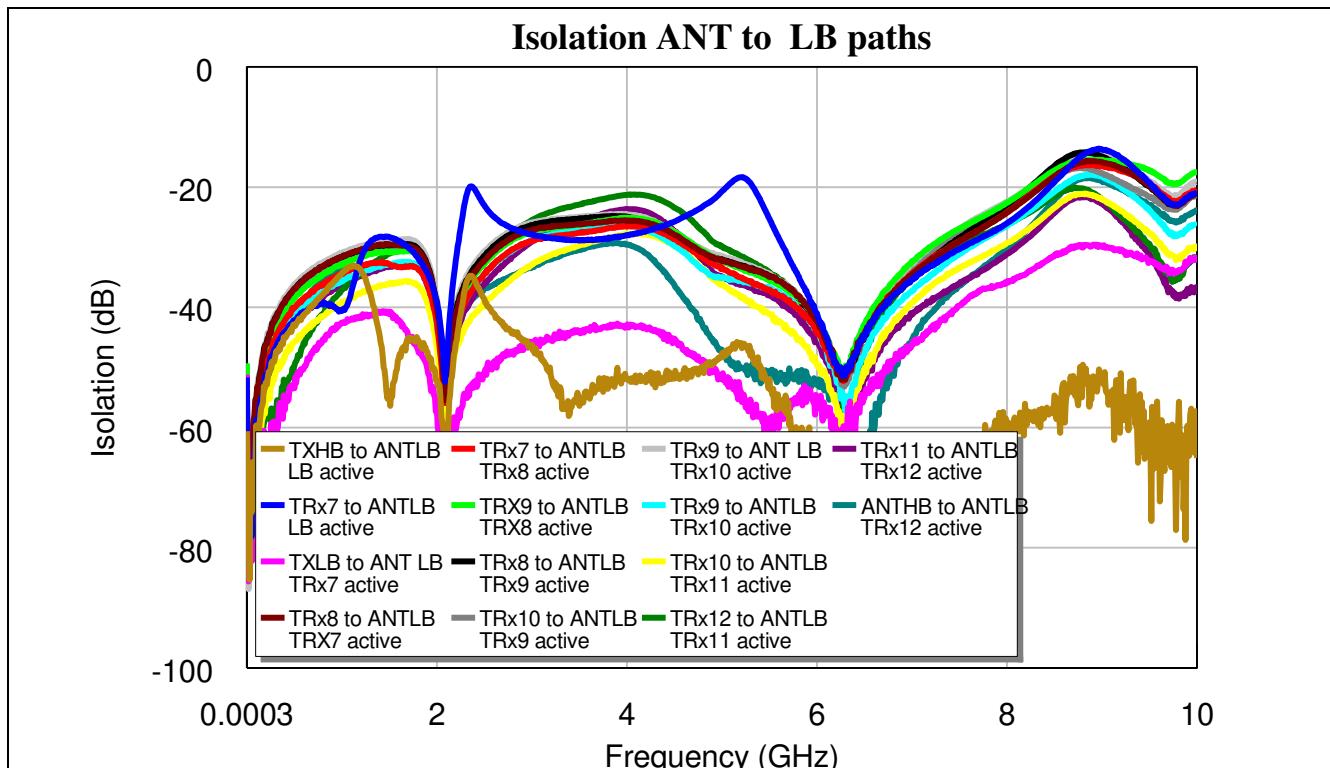
Frequency (GHz)	TX HB active		TRX1 active		TRX2 active		TRX3 active		TRX4 active		TRX5 active		TRX6 active	
	ANTHB TRX1	ANTHB TX LB	ANTHB TRX2	ANTHB TX HB	ANTHB TRX3	ANTHB TRX1	ANTHB TRX4	ANTHB TRX2	ANTHB TRX5	ANTHB TRX3	ANTHB TRX6	ANTHB TRX4	ANTHB ANT LB	ANTHB TRX5
0.704	-39.5	-39.7	-47.2	-34.2	-37.3	-35.5	-34.1	-35	-33.4	-38.3	-42.7	-43.2	-39.3	-37
0.716	-39.3	-39.6	-46.9	-33.9	-37.1	-35.4	-34	-34.8	-33.3	-38.4	-42.3	-42.9	-39.1	-36.8
0.74	-38.9	-39.8	-47	-33.8	-36.6	-35.2	-33.8	-34.6	-33	-38	-42.3	-42.6	-39	-36.5
0.751	-38.6	-39.6	-46.4	-33.7	-36.7	-35.1	-33.7	-34.4	-32.9	-37.9	-42	-42.1	-38.7	-36.2
0.824	-37.4	-39.3	-45.2	-32.9	-35.9	-34.3	-32.9	-33.8	-32.3	-37.1	-41.3	-40.5	-37.9	-35.3
0.881	-36.3	-39.4	-44.1	-32.5	-35.2	-33.9	-32.5	-33.4	-31.8	-36.6	-40.5	-39.2	-37.3	-34.5
0.915	-35.8	-39.9	-43.6	-32.2	-35.1	-33.5	-32.2	-33.1	-31.5	-36.3	-40.2	-38.6	-36.9	-34.1
0.942	-35.4	-40.2	-43.5	-31.9	-34.8	-33.2	-32	-32.8	-31.3	-36	-39.8	-38.2	-36.8	-33.8
1.71	-45.4	-30.2	-45	-29.9	-33.1	-30.6	-29.5	-30	-28.6	-32.4	-35.7	-29.8	-32.7	-29.1
1.842	-46.5	-32.7	-48	-31.3	-34.3	-32	-31	-31.5	-30.2	-34	-37.1	-30.9	-34.3	-31.1
1.96	-50	-36.8	-53.3	-36.5	-39.6	-37.3	-36.3	-36.8	-35.3	-39.3	-42.9	-36.7	-40	-37.5
1.97	-50.2	-37.2	-54.5	-37.3	-40.2	-38	-37	-37.5	-36	-39.9	-43.8	-37.4	-40.5	-38.4
2.017	-52.8	-40.4	-60.7	-41.8	-44.9	-42.2	-41.4	-41.8	-40.5	-44.2	-48.9	-42.4	-45.4	-42.9
2.14	-54.6	-41.1	-61.9	-46.5	-48.6	-47	-46.2	-47.1	-45.3	-48.9	-51.4	-44.1	-49.7	-48.2
2.17	-49.8	-36	-63.9	-43.7	-46	-44.1	-43.1	-43.2	-41.9	-45.8	-49.1	-41.5	-46.6	-45.6
2.35	-34.7	-19.9	-53.2	-35.1	-37.6	-36	-34.6	-35.1	-33.7	-37.5	-42.2	-34.5	-39.2	-38.8
2.593	-40.9	-24.8	-49.3	-30.7	-32.9	-31.3	-29.9	-30.5	-29.3	-33.1	-38	-30.1	-34.5	-36.3
2.69	-42.4	-26	-47.9	-29.5	-31.5	-29.9	-28.7	-29.2	-28.1	-31.6	-36.5	-28.9	-33.1	-35.6
3.5	-56.4	-28.9	-44.2	-26.2	-27.6	-26.2	-25.2	-25.5	-24.9	-27	-29.7	-22.9	-25.6	-30.4

<sup>1</sup> Worst case isolation: Isolation between neighbor port of the active port, any other port have better (higher) Isolation

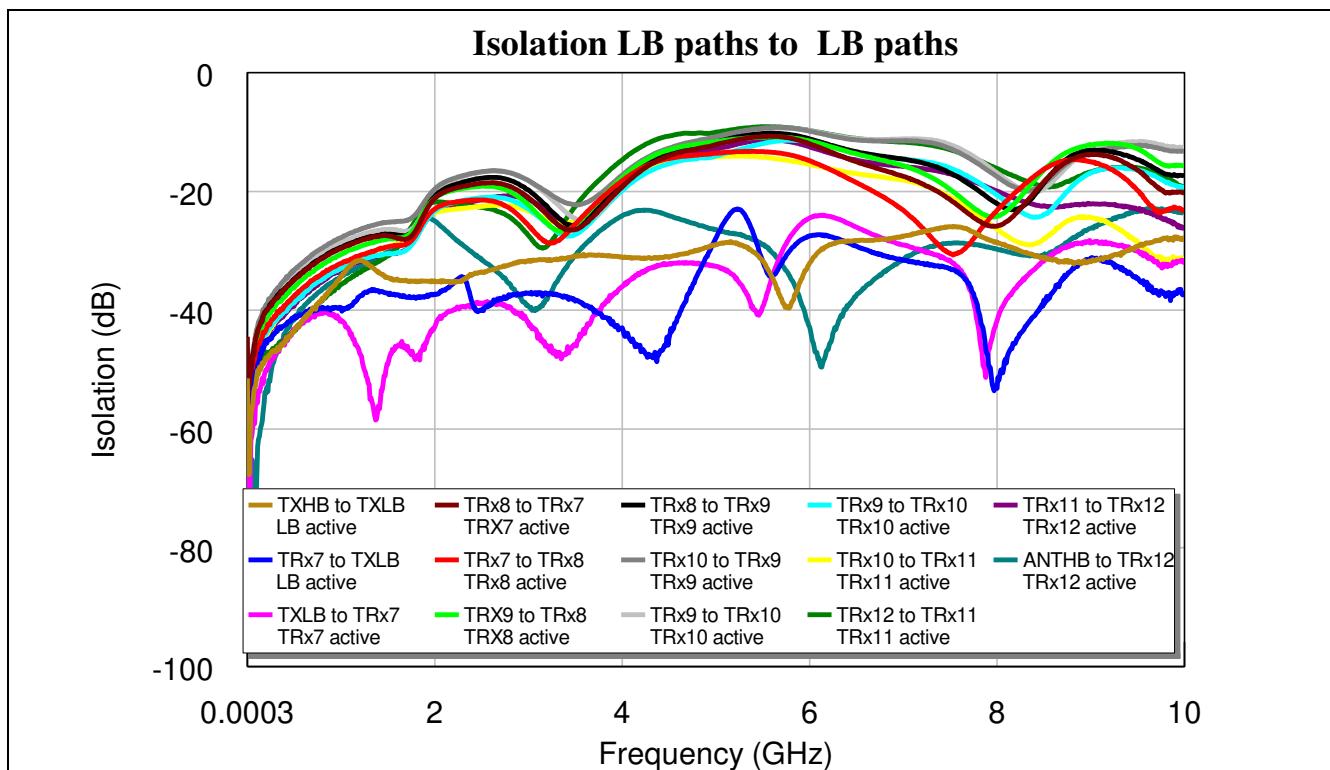
**Table 10 Worst case Port to Port Isolation Low Band part<sup>1</sup>**

Frequency (GHz)	TX LB active		TRX7 active		TRX8 active		TRX9 active		TRX10 active		TRX11 active		TRX12 active	
	ANTLB TX HB	ANTLB TRX7	ANTLB TX LB	ANTLB TRX8	ANTLB TRX7	ANTLB TRX9	ANTLB TRX8	ANTLB TRX10	ANTLB TRX9	ANTLB TRX11	ANTLB TRX10	ANTLB TRX12	ANTLB TRX11	ANTLB ANTHB
0.704	-39.6	-39.8	-40.9	-32.3	-34.9	-33.5	-32.1	-30.5	-31.4	-35.8	-35.2	-39.7	-36.2	-37.8
0.716	-39.6	-39.9	-41.1	-32.2	-34.7	-33.3	-31.9	-30.4	-31.3	-35.7	-35	-39.8	-36.2	-37.6
0.74	-39	-39.8	-40.5	-31.9	-34.4	-33	-31.7	-30.1	-31	-35.3	-34.8	-39.2	-35.9	-37.3
0.751	-39	-39.9	-40.5	-31.7	-34.4	-32.9	-31.7	-30	-30.9	-35.3	-34.7	-39.1	-35.8	-37.1
0.824	-37.8	-39.7	-40.4	-31.1	-33.7	-32.1	-30.9	-29.3	-30.2	-34.6	-33.9	-38	-34.9	-36.2
0.881	-36.7	-39.8	-40.7	-30.5	-33.1	-31.6	-30.3	-28.7	-29.6	-33.9	-33.4	-37.2	-34.2	-35.6
0.915	-36	-39.6	-40.8	-30.2	-32.7	-31.3	-30	-28.4	-29.3	-33.6	-33.1	-36.7	-33.9	-35.3
0.942	-35.6	-39.5	-41.2	-30.1	-32.6	-31.1	-29.8	-28.2	-29.1	-33.4	-32.8	-36.2	-33.7	-34.9
1.71	-35	-37.8	-46.1	-28	-28.8	-27.4	-27.3	-24.9	-26.7	-29.7	-28	-27.2	-29.5	-26.8
1.842	-35.2	-37.7	-48.1	-25.3	-26.3	-24.7	-24.9	-22.9	-24.5	-26.8	-25.8	-23.7	-26.6	-24.7
1.96	-35.2	-37.4	-43.4	-21.9	-23.5	-21.8	-21.6	-20.2	-21	-23.9	-23.9	-21.9	-24	-24.6
1.97	-35	-37.3	-43.5	-21.7	-23.4	-21.6	-21.4	-20.1	-20.8	-23.7	-23.9	-21.9	-23.9	-24.7
2.017	-35.2	-37.3	-42.2	-21	-22.8	-20.9	-20.5	-19.3	-19.9	-23.1	-23.5	-21.8	-23.4	-25.1
2.14	-35.1	-36.2	-40.3	-19.8	-22	-20	-19.3	-18.2	-18.4	-22.1	-23.1	-21.9	-22.6	-26.8
2.17	-35.4	-35.8	-40.2	-19.7	-21.9	-19.9	-19.1	-18	-18.2	-22	-23.1	-22	-22.5	-27.3
2.35	-34.3	-35.9	-39.2	-19	-21.5	-19.4	-18.2	-17.1	-17.3	-21.4	-22.7	-22.4	-21.9	-29.7
2.593	-33.2	-39.2	-38.8	-18.5	-21.6	-19.2	-17.6	-16.5	-16.5	-21	-22.4	-22.9	-21.1	-32.5
2.69	-32.8	-38.2	-38.9	-18.7	-21.9	-19.3	-17.7	-16.6	-16.5	-21	-22.3	-23.4	-20.8	-33.9
3.5	-30.9	-38.5	-45.8	-26.4	-25.5	-25.7	-25.8	-22.2	-24.6	-27.2	-24.9	-22.5	-26.3	-30.8

<sup>1</sup> Worst case isolation: Isolation between neighbor port of the active port, any other port have better (higher) Isolation



**Figure 19** Worst case Antenna to Port Isolation Low Band part<sup>1</sup>



**Figure 20** Worst case Port to Port Isolation Low Band part<sup>1</sup>

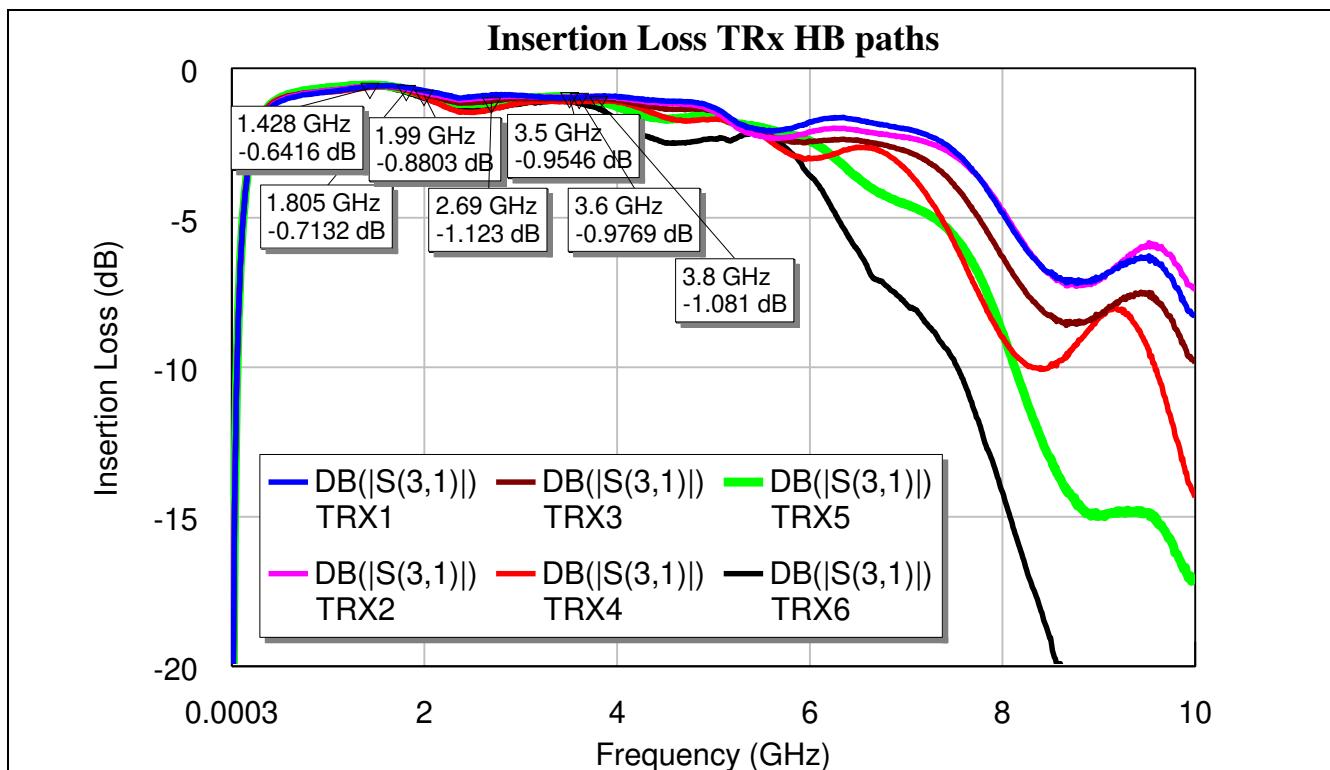
<sup>1</sup> Worst case isolation: Isolation between neighbor port of the active port, any other port have better (higher) Isolation

## 4.2 Small Signal Parameters HB switch

### 4.2.1 Insertion Loss from HB Antenna to the respective TRX HB RF Port

**Table 11 Insertion Loss from HB Antenna to the respective TRX HB RF port**

Frequency (MHz)	1710	1842	1960	1970	2017	2140	2170	2350	2593	2690	3500
TRx1	-0.6	-0.66	-0.72	-0.72	-0.76	-0.82	-0.86	-0.99	-0.92	-0.89	-0.98
TRx2	-0.63	-0.71	-0.78	-0.79	-0.82	-0.9	-0.93	-1.1	-0.99	-0.96	-0.95
TRx3	-0.64	-0.73	-0.81	-0.83	-0.87	-0.97	-1	-1.2	-1.1	-1.1	-1
TRx4	-0.66	-0.78	-0.92	-0.93	-0.99	-1.2	-1.2	-1.5	-1.4	-1.4	-1.1
TRx5	-0.64	-0.75	-0.85	-0.86	-0.9	-1	-1	-1.2	-1.2	-1.1	-0.95
TRx6	-0.71	-0.84	-0.96	-0.96	-1	-1.1	-1.2	-1.4	-1.4	-1.3	-1.1

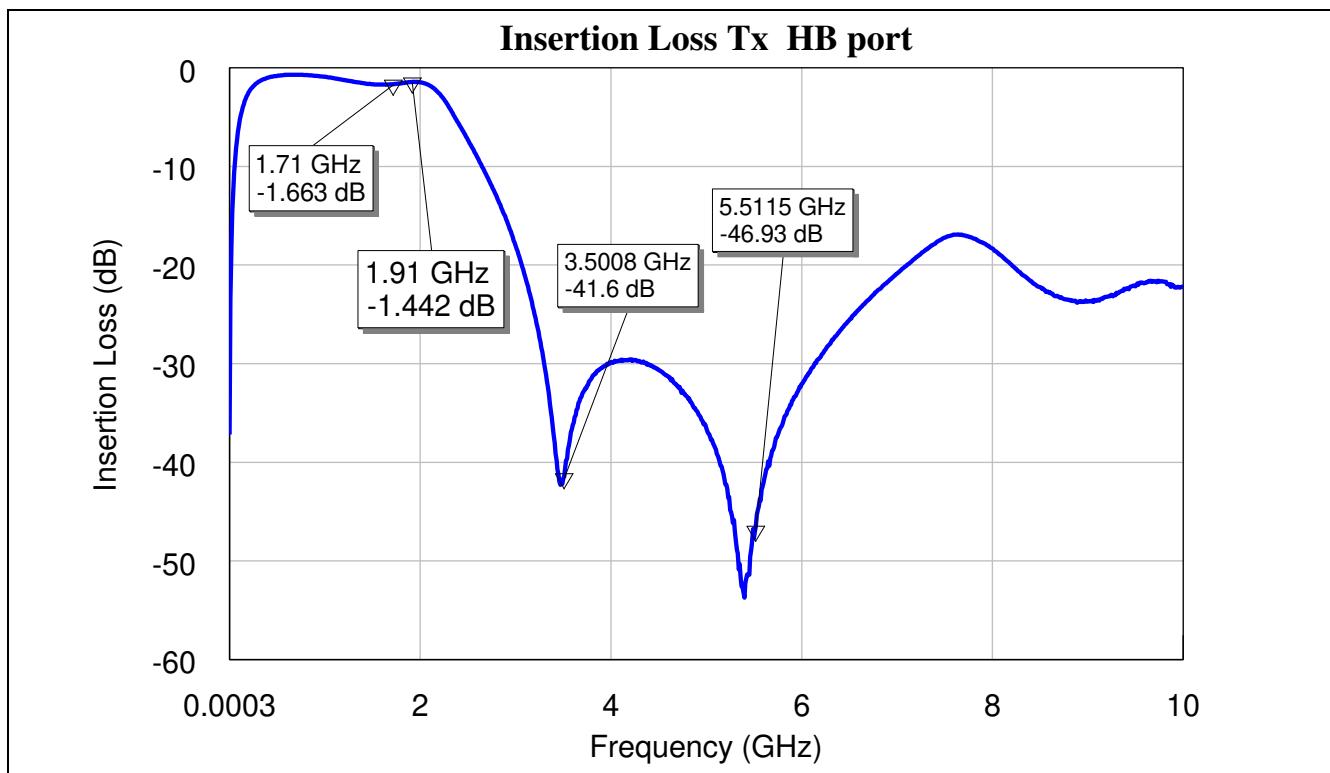


**Figure 21 Forward transmission from HB Antenna to the respective TRX HB RF port**

#### 4.2.2 Insertion Loss TX HB port

**Table 12 Insertion Loss from HB Antenna to the respective TX HB RF**

Frequency (MHz)	1710	1842	1960	1970	2017	2140	2170	2350	2593	2690	3500
TRx1	-1.7	-1.5	-1.4	-1.4	-1.5	-	-	-	-	-	-

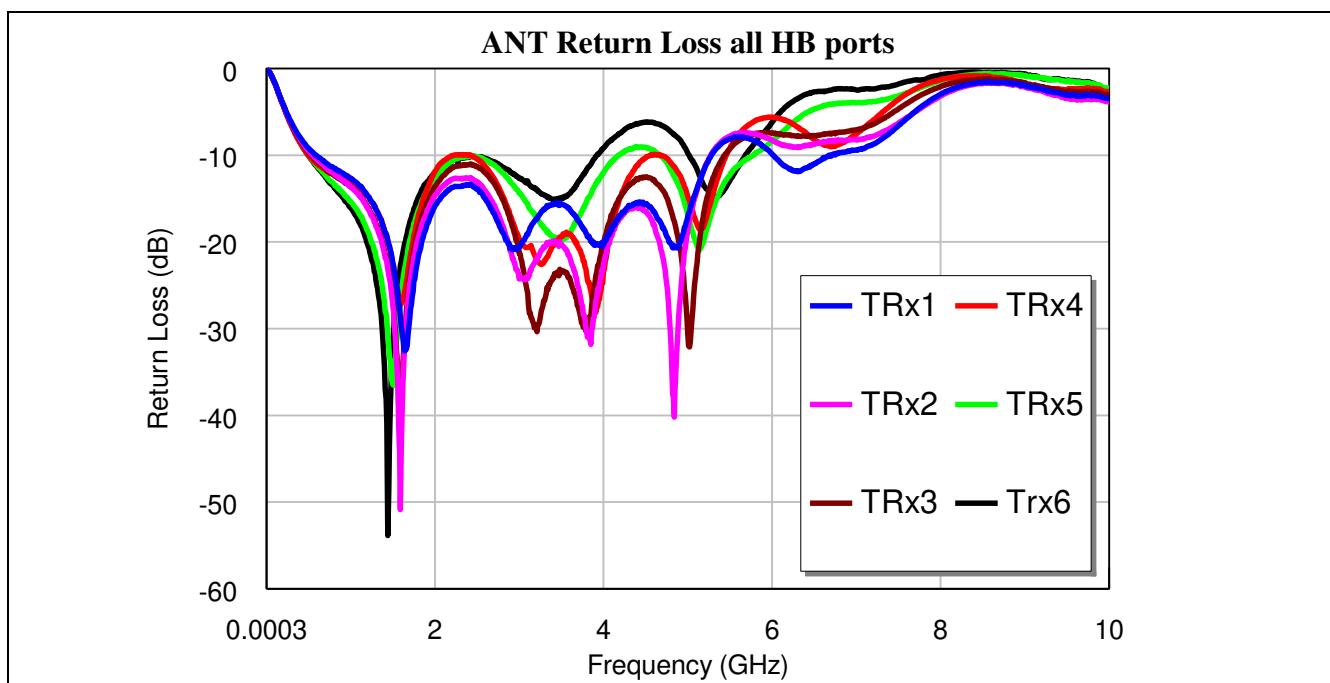


**Figure 22 Forward transmission from HB Antenna to the respective TX HB RF port**

#### 4.2.3 Return Loss from HB Antenna to the respective TRX HB RF Port

**Table 13** Return Loss from HB Antenna to the respective TRX HB RF port

Frequency (MHz)	1710	1842	1960	1970	2017	2140	2170	2350	2593	2690	3500
TRx1	-27.8	-20	-16.6	-16.5	-15.6	-14.2	-14	-13.5	-15	-16.6	-15.6
TRx2	-24.3	-18.1	-15.3	-15.2	-14.5	-13.2	-13	-12.7	-14.1	-15.6	-20.3
TRx3	-23.4	-17.2	-14.3	-14.2	-13.4	-12	-11.7	-11.1	-12	-13.1	-23.4
TRx4	-21.4	-15.7	-12.6	-12.5	-11.6	-10	-10	-10	-10	-10	-19.4
TRx5	-19.5	-15.3	-13.1	-13	-12.4	-11.1	-10.9	-10.2	-10.5	-11	-19.5
TRx6	-17.5	-14	-12	-11.9	-11.3	-10.2	-10	-10	-10	-10	-14.9

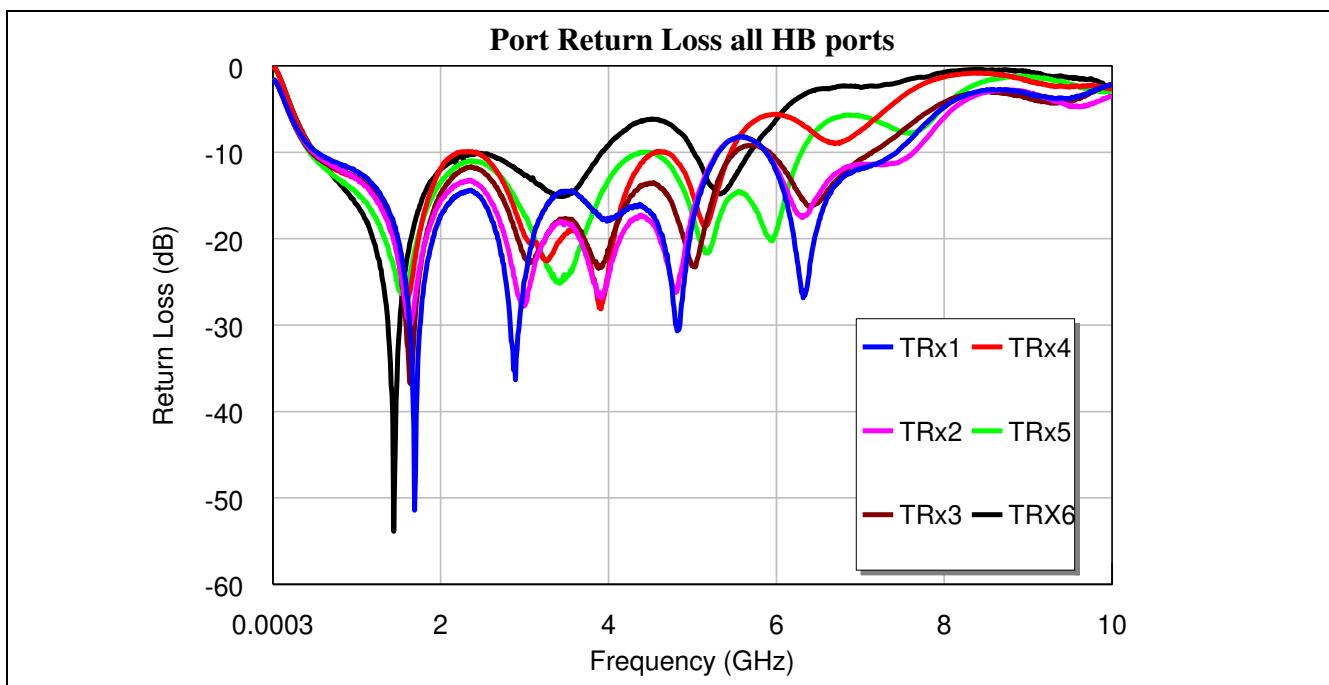


**Figure 23** Return Loss from HB Antenna to the respective TRX HB RF port

#### 4.2.4 Return Loss of HB TRX RF Ports

**Table 14** Return Loss from HB TRX RF ports to HB Antenna

Frequency (MHz)	1710	1842	1960	1970	2017	2140	2170	2350	2593	2690	3500
TRx1	-40.6	-22.7	-18.3	-18.1	-17.1	-15.5	-15.2	-14.4	-17.4	-20.2	-14.5
TRx2	-25.8	-19.4	-16.4	-16.2	-15.4	-14.2	-13.9	-13.3	-15.6	-17.5	-18.2
TRx3	-27.5	-19.1	-15.6	-15.4	-14.5	-13	-12.6	-11.7	-13.1	-14.4	-17.7
TRx4	-24.6	-17	-13.4	-13.1	-12.2	-10.4	-10	-10	-10	-10	-13.1
TRx5	-20.5	-16.4	-14	-13.9	-13.3	-12.1	-11.8	-11	-11.8	-12.5	-24.4
TRx6	-18.2	-14.7	-12.6	-12.5	-11.9	-10.8	-10.5	-10	-10.2	-10.7	-18.1

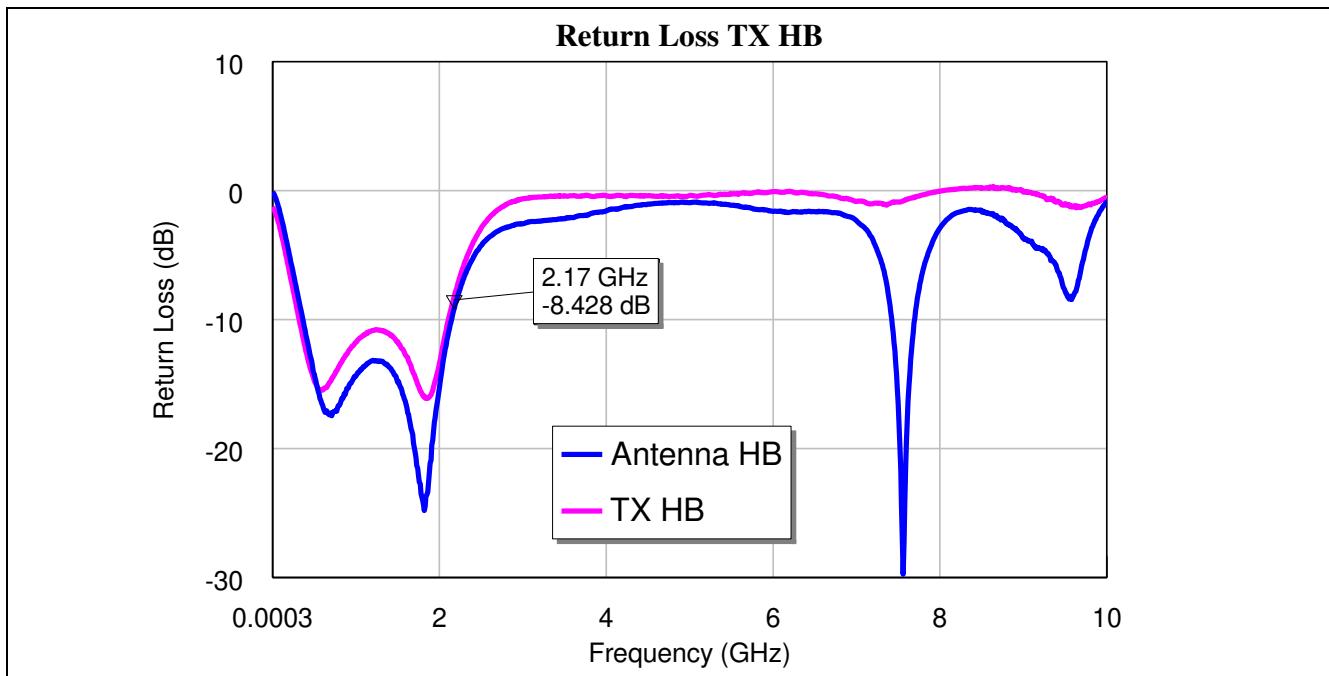


**Figure 24** Return Loss from HB TRX RF ports to HB Antenna

#### 4.2.5 Return Loss of HB TX RF Port

**Table 15** Return Loss of HB TX RF port

Frequency (MHz)	1710	1842	1960	1970	2017	2140	2170	2350	2593	2690	3500
ANTHB	-20.1	-23.7	-17	-16.6	-14.5	-	-	-	-	-	-
TX HB	-24.5	-16.1	-14.5	-14.2	-12.9	-	-	-	-	-	-



**Figure 25** Return Loss of HB TX RF port

#### 4.2.6 Antenna to port and Port to Port Isolation HB path

Apply to the [Table 16](#) and [Table 17](#) on the next page.

**Table 16 Worst case Antenna to Port Isolation High Band part<sup>1</sup>**

Frequency (GHz)	TX HB active		TRX1 active		TRX2 active		TRX3 active		TRX4 active		TRX5 active		TRX6 active	
	ANTHB TRX1	ANTHB TX LB	ANTHB TRX2	ANTHB TX HB	ANTHB TRX3	ANTHB TRX1	ANTHB TRX4	ANTHB TRX2	ANTHB TRX5	ANTHB TRX3	ANTHB TRX6	ANTHB TRX4	ANTHB ANT LB	ANTHB TRX5
0.704	-39	-41	-35	-45	-35	-37	-34	-33	-41	-34	-43	-38	-43	-38
0.716	-39	-41	-34	-45	-35	-37	-34	-33	-41	-34	-42	-37	-43	-38
0.74	-39	-41	-34	-45	-34	-36	-34	-32	-40	-34	-42	-37	-43	-38
0.751	-39	-40	-34	-45	-34	-36	-34	-32	-40	-33	-42	-37	-43	-38
0.824	-38	-38	-33	-44	-33	-36	-33	-32	-39	-33	-40	-36	-42	-37
0.881	-37	-37	-33	-43	-33	-35	-33	-31	-38	-32	-39	-36	-41	-37
0.915	-37	-36	-32	-43	-33	-35	-32	-31	-38	-32	-38	-35	-40	-36
0.942	-37	-36	-32	-43	-32	-35	-32	-31	-38	-32	-38	-35	-40	-36
1.71	-31	-39	-29	-37	-29	-31	-29	-27	-31	-29	-29	-32	-39	-31
1.842	-30	-39	-29	-37	-28	-31	-29	-27	-30	-28	-28	-32	-40	-30
1.96	-29	-40	-28	-38	-28	-30	-29	-26	-30	-28	-27	-31	-44	-30
1.97	-29	-39	-28	-38	-28	-30	-29	-26	-30	-28	-27	-31	-45	-30
2.017	-29	-40	-28	-38	-28	-30	-29	-26	-30	-28	-26	-31	-48	-30
2.14	-30	-40	-27	-39	-27	-29	-28	-26	-29	-28	-26	-31	-47	-29
2.17	-30	-41	-27	-40	-27	-29	-28	-26	-29	-28	-25	-31	-42	-29
2.35	-33	-35	-26	-39	-26	-28	-27	-25	-29	-28	-24	-30	-26	-28
2.593	-50	-33	-25	-40	-25	-26	-26	-23	-28	-26	-23	-28	-31	-26
2.69	-46	-32	-24	-40	-24	-26	-25	-23	-28	-26	-22	-27	-32	-25
3.5	-26	-32	-22	-44	-22	-26	-20	-20	-23	-21	-18	-23	-32	-21

<sup>1</sup> Worst case isolation: Isolation between neighbor port of the active port, any other port have better (higher) Isolation