MOD6210/MOD6211/MOD6212/MOD6213 Transceiver Module

Data Sheet

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Glossary

A glossary of terms used in this document.

Acronym	Definition
AC	Alternating Current
DS	Downstream facing USB port
EMI	Electromagnetic Interference
EU	The European Union
FCC	Federal Communications Commission
FS	USB2 Full Speed
HS	USB2 High Speed
IC	Integrated Circuit
I^2C	Inter-Integrated Circuit
LED	Light Emitting Diode
LS	Low Speed
OOK	On/Off Key Modulation
RF	Radio Frequency
SS	Super Speed
TELEC	Telecommunication
US	Upstream facing USB port
U0/W0	Snap active wireless link data transfer state
U2	USB 3.0 link idle, slow exit
U3	USB 3.0 suspend mode

1. General Description

The MOD6210/MOD6211/MOD6212/MOD6213 transceiver modules use SiBEAM Snap™ technology to make an ultra-short-range, close alignment, high speed, full duplex wireless link operating in the 60 GHz band. The transceiver modules support USB 2.0/USB 3.0 compatible data and I^2C-compatible control and status information transfers.

Intelligent power management reduces the transceiver power consumption according the wireless and USB link state.

The transceiver modules ease integration into a variety of products by simplifying the design. The transceiver modules have received modular certification, which reduces the burden of regulatory approval for the product.

1.1. Key Features

- Simultaneous USB 3.0 and USB 2.0 connections through USB hub (SS, HS, FS, LS supported)
- Up to 6 Gbps full duplex
- Short range wireless link
- No host driver required
- Intelligent power management automatically drops power based on USB link power state (U0 through U3)
- Low power consumption during scan mode when the transceivers are not in range
- I^2C tunneling over wireless link
- Built-in antenna
- Small form factor 10 mm × 26 mm × 3 mm
- Full regulatory certified modules (TELEC, EU, FCC, and IC)
- Single 3.3 V power rail
- Debug and remote debug function tool suite
- RF performance measurement tool suite

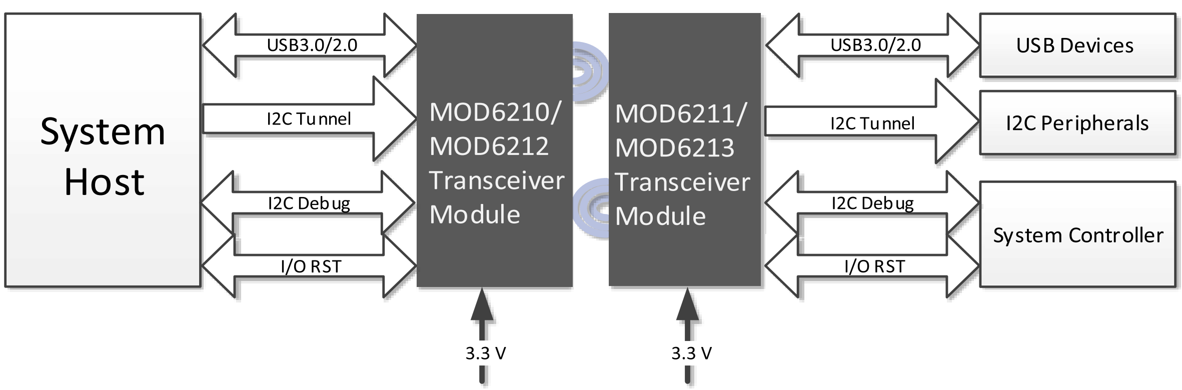

Figure 1.1. Wireless Connector System Diagram

2. Product Family

Transceiver Module	Link Side	Link Orientation
MOD6210	Host	Edge (parallel to package plane)
MOD6211	Device	Edge (parallel to package plane)
MOD6212	Host	Broad (perpendicular to package plane)
MOD6213	Device	Broad (perpendicular to package plane)
SK621011	—	Edge (parallel to package plane)
SK621213	—	Broad (perpendicular to package plane)

3. Module Block Diagram and Pinout Descriptions

This section describes the module block diagram and the detail pinout.

3.1. Block Diagram

Figure 3.1 is the block diagram of the Transceiver Module. The Pinout Descriptions section describes the functions of each pin.

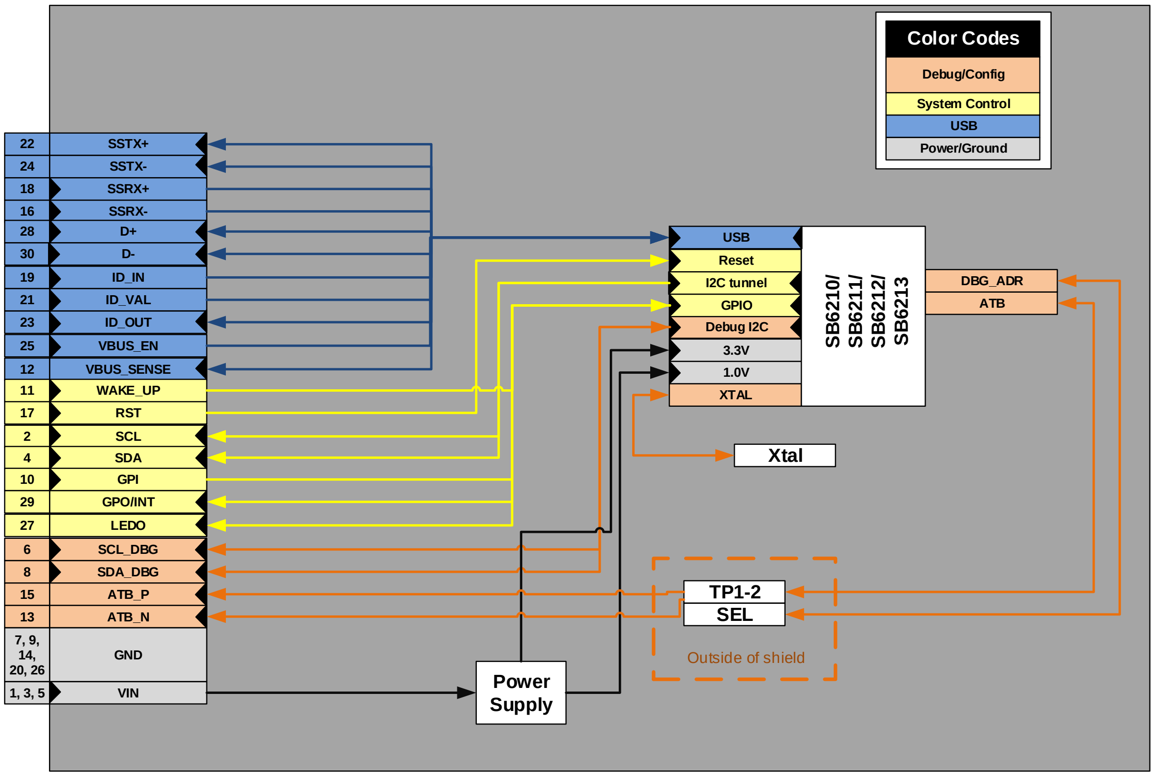

Figure 3.1. Transceiver Module Block Diagram

3.2. Pinout Descriptions

Table 3.1. Signal Pinout

Pin	Name	Type	Dir	Group	Description
1	3V3	Power	Input	Power	3.3 V ±5% power supply
2	SCL	Digital	In/Out O.D.	I²C	I²C clock, tunneling port. MOD6210/MOD6212 transceiver module connects to Host board; MOD6211/MOD6213 transceiver module connects to Device board
3	3V3	Power	Input	Power	3.3 V ±5% power supply
4	SDA	Digital	In/Out O.D.	I²C	I²C data, tunneling port. MOD6210/MOD6212 transceiver module connects to Host board; SB6211/SB6213 transceiver module connects to Device board
5	3V3	Power	Input	Power	3.3 V ±5% power supply
6	SCL-DBG	Analog	Bi-Dir	USB	I²C clock, debug port. Connection to debug controller. Not required for normal operation.
7	GND	Power	Input	Power	Ground
8	SDA-DBG	I²C	In/Out O.D.	Debug	I²C data, debug port. Connection to debug controller. Not required for normal operation.

Pin	Name	Type	Dir	Group	Description
9	GND	Power	Input	Power	Ground
10	GPI	Digital	Input	GPIO	General purpose input. Status of this input is reflected on the GPO pin on the opposite side of an active wireless link.
11	WAKE_UP	Digital	Input	Control	Force the link to W0 state. This is useful to bypass USB states, when I^2C tunnel or GPI signal needs to be used, while the link is in low power states. Active High. Optional.
12	VBUS_SENSE	Digital	Input	USB	USB VBUS status input , 3V3
13	ATB_N	Analog	Output	Debug	Differential analog test bus – negative terminal
14	GND	Power		Power	Ground
15	ATB-P	Analog	Output	Debug	Differential analog test bus – positive terminal
16	SSRX-	Analog	Input	USB	USB super speed receiver differential pair negative input
17	RST	Digital	Input	Config	Reset Input, active HIGH
18	SSRX+	Analog	Input	USB	USB super speed receiver differential pair positive input
19	ID_IN	Digital	Input	USB	USB ID input
20	GND	Ground	Input	SS isolation	Ground
21	ID-VAL	Digital	Input	USB	USB ID valid input
22	SSTX+	Analog	Output	USB	USB super speed transmitter differential pair positive output
23	ID_OUT	Digital	Output	USB	USB ID output
24	SSTX-	Analog	Output	USB	USB super speed transmitter differential pair negative output
25	VBUS_EN	Digital	Output	USB	USB VBUS status output, 3V3
26	GND	Ground	Input	SS isolation	Ground
27	LEDO	Digital	Output	Config	LED output
28	D+	Analog	Bi-Dir	USB	USB high speed/full speed/low speed positive I/O
29	GPO/INT	Digital	Output	GPIO	General purpose output. When a wireless link is active, the status of this output reflects the GPI pin on the opposite side of the wireless link. Also used as I^2C tunnel interrupt.
30	D–	Analog	Bi-Dir	USB	USB high speed/full speed/low speed negative I/O

4. Transceiver Module Dimensions

This section describes the dimensions of the module and the PCB layout floor plan.

System integrators can use the module dimensions to start the board layout and enclosure design. Each module PCB silkscreen includes FCC/IC regulatory ID, module name and other PCB related information.

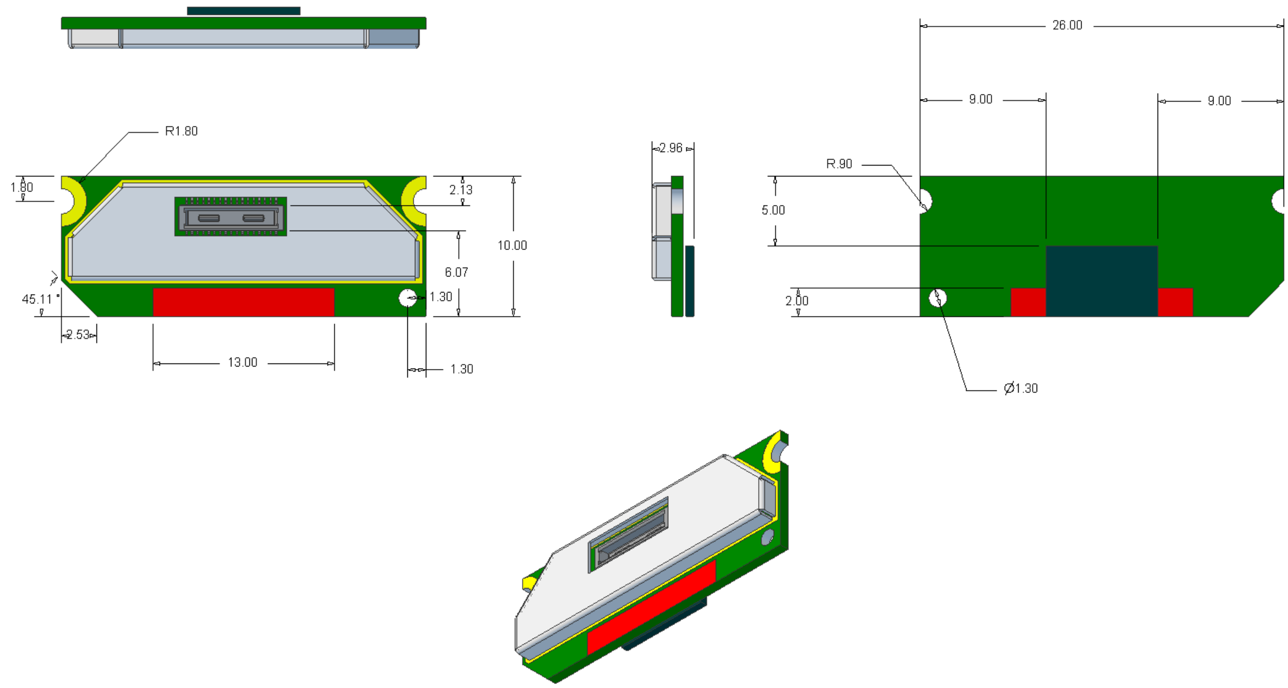

Figure 4.1. Transceiver Module Dimensions (in mm)

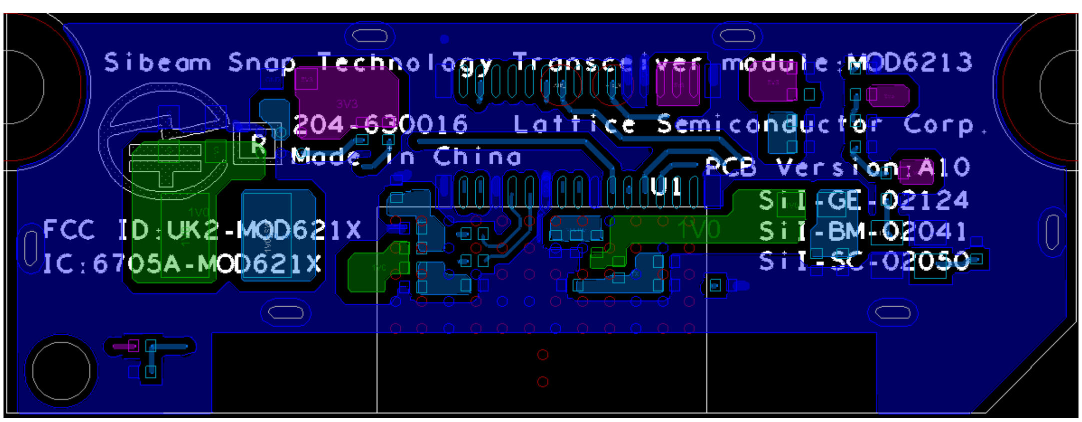

Figure 4.2. MOD6213 Transceiver Module Layout Floorplan

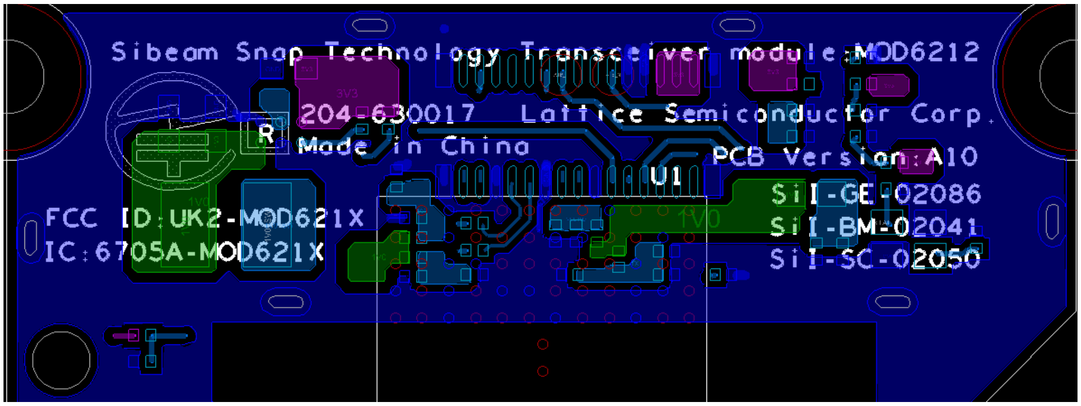

Figure 4.3. MOD6212 Transceiver Module Layout Floorplan

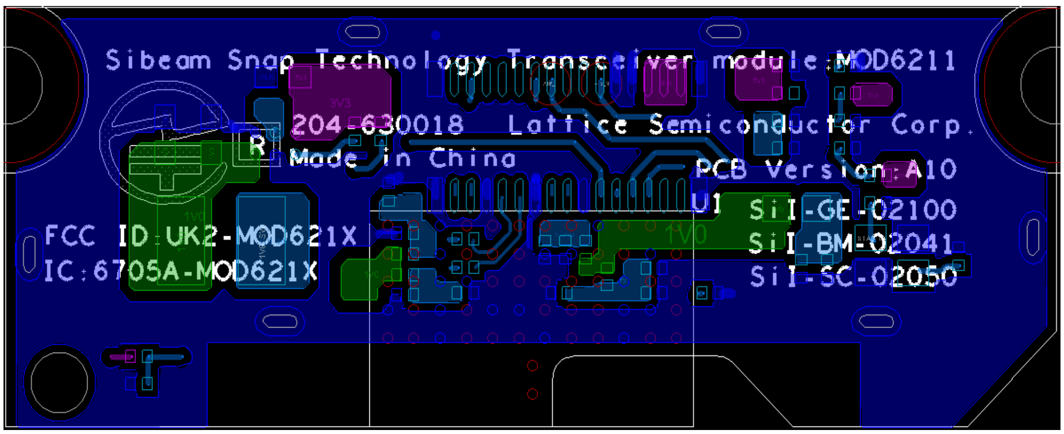

Figure 4.4. MOD6211 Transceiver Module Layout Floorplan

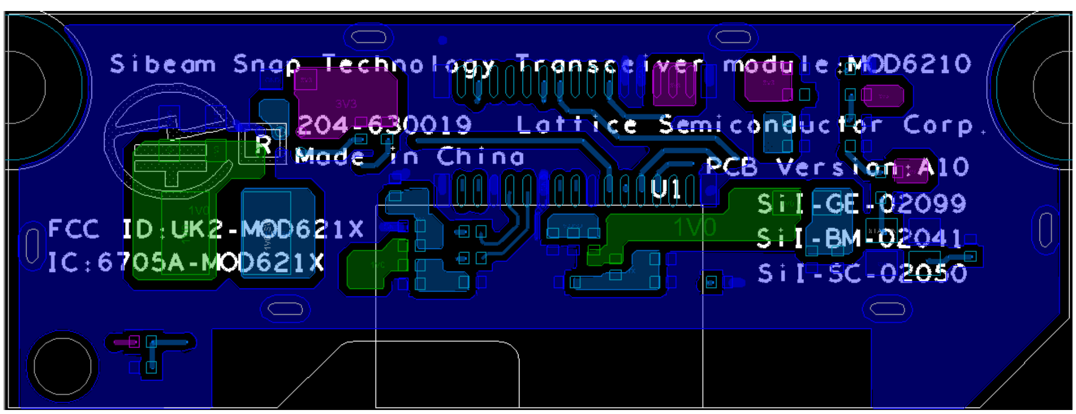

Figure 4.5. MOD6210 Transceiver Module Layout Floorplan

5. Transceiver Module Connector

This module is designed to be connected to the system board through a single board-to-board connector. This module uses the following connector (Figure 5.1) to mate with the connector on the system side:

- Connector type : DF40 from Hirose
- Part number: DF40C-30DP-0.4V (51)
- Description: Dual Row Board to Board Receptacle (Plug), 0.4 pitch, 30 pins
- A=7.52 mm, B=5.6 mm, C =1.5 mm

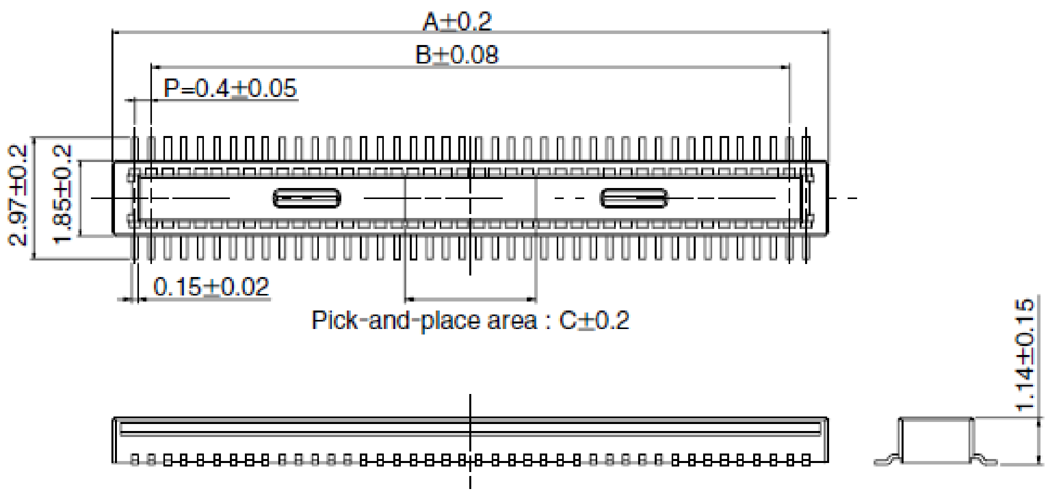

Figure 5.1. Module Side Connector

On the system side, the following connector (Figure 5.2) should be used to mate with the module:

- Connector type is: DF40 from Hirose
- Part number: DF40C-30DS-0.4V (51)
- Description: Dual row Board-to-Board Socket, 0.4 pitch, 30 pins
- A=8.6 mm, B=5.6 mm, C =1.5 mm

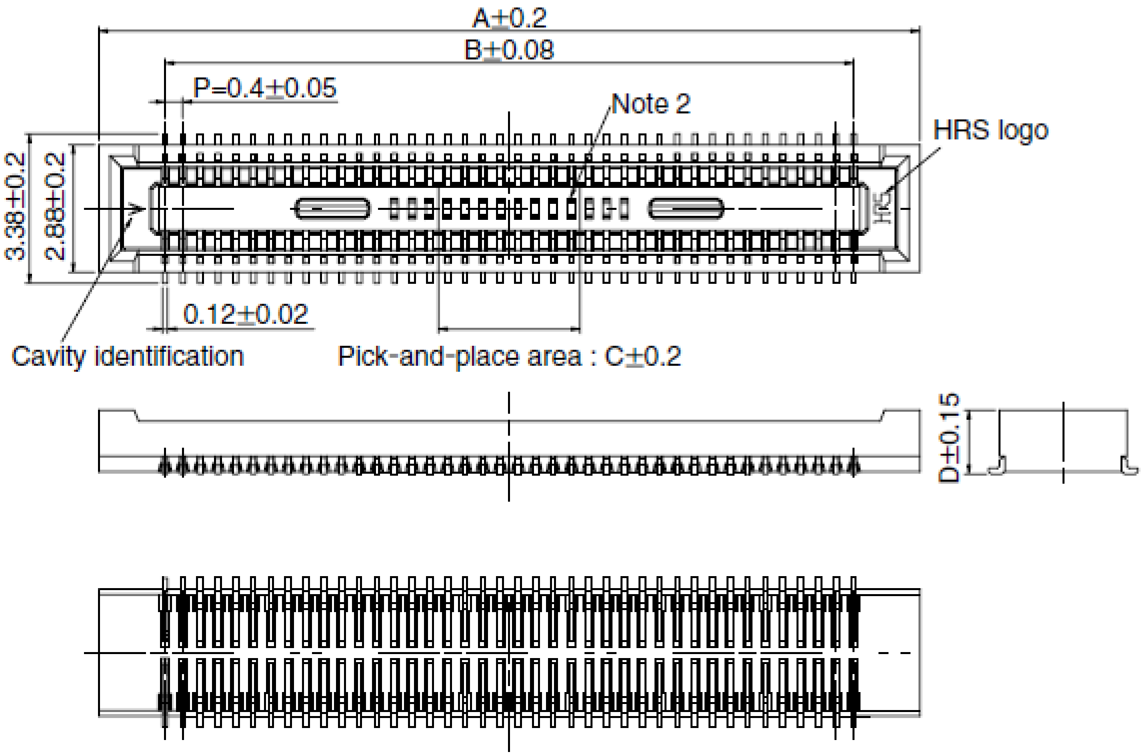

Figure 5.2. System Side Connector

6. Transceiver Module System Application

The following diagram shows the module connected to the host or device. In addition, it shows how to connect a debug micro for system performance measurements.

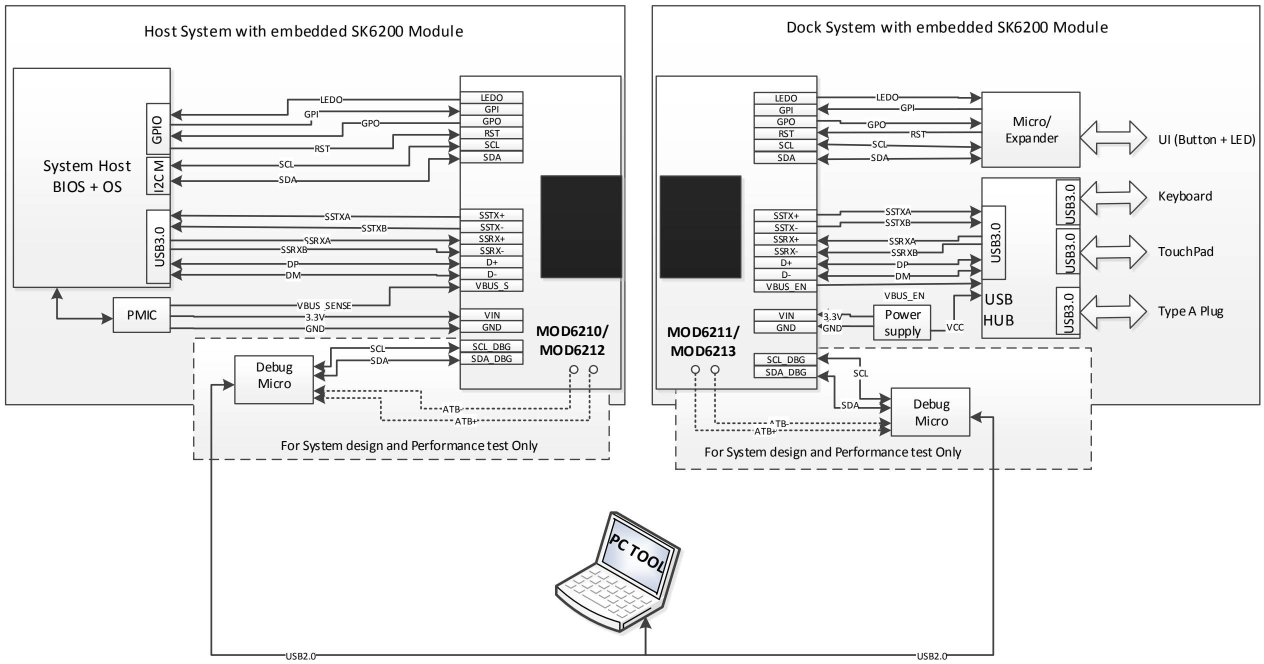

Figure 6.1. System Level Integration and Test

7. Transceiver Module Functional Description

7.1. USB 3.0 Interface

The transceiver module interfaces directly with a USB 3.0 port without requiring any additional control or interface logic. ID_IN and ID_VAL strapping pins on the MOD621x transceiver module are used along with wireless communication to establish the USB port personality as either upstream facing or downstream facing. The ID_OUT signal from each transceiver to the attached USB port indicates the upstream or downstream facing transceiver operation.

Table 7.1. Transceiver Personality Based on Pair Configuration

Pin Configuration				Transceiver Personality						Application Example
SB6210/SB6212		SB6211/SB6213		SB6210 /SB6212	SB6211 /SB6213	SB6210 /SB6212	SB6211 /SB6213	SB6210 /SB6212	SB6211 /SB6213	
ID_IN	ID_VAL	ID_IN	ID_VAL	ID_OUT	ID_OUT	Facing	Facing	VBUS_En	VBUS_En	
1	1	0	1	0	Z	US	DS	0	1	2 in 1 Laptop
0	1	1	1	Z	0	DS	US	1	0	Sport Camera/ Storage
X	0	1	1	Z	0	DS	US	1	0	Mobile Phone (as Device)
X	0	0	1	0	Z	US	DS	0	1	Mobile Phone (as Host)

The VBUS supply from the upstream USB port is used as a VBUS_SENSE input to the transceiver. Note that a resistor divider or equivalent circuit should be used to reduce the +5 V VBUS voltage level to a +3.3 V voltage level that is compatible with the VBUS_SENSE input. The VBUS status is sent to the downstream facing transceiver, where the VBUS_EN signal is used to control the local VBUS status at the downstream USB connection.

When an SB6210/SB6212-based module transceiver is located in close proximity to a SB6211/SB6213-based module transceiver, the two transceivers automatically establish a wireless connection, enabling high bandwidth communication with the devices on the other side of the link. Establishing a wireless link is analogous to plugging in a USB cable. Once connected, the link behaves the same as a wired USB 3.0 interface. The ID_OUT signal emulates the proper grounding of the ID pin that would be seen when attaching a USB cable between devices. The VBUS_EN signal can be used to drive a VBUS logic input to actually switch the VBUS power to the downstream facing USB interface.

7.2. I²C Tunneling

I²C tunneling is a key feature of the transceiver module. It allows an I²C master on the MOD6210/MOD6212 transceiver module (Figure 7.1) to communicate with I²C devices connected to the MOD6211/MOD6213 transceiver module. The key elements of this feature are highlighted below:

- 400 kHz interface. Sub-SCL latency, ~100 ns
- Applications can include I/O expander, EPROM, low-speed peripherals, and others.

The transceiver module has an internal power management state machine that follows USB-defined states. It is possible that the first I²C transaction happens when the wireless link is turned OFF (for power saving while USB is inactive). This transaction wakes up the wireless link, but it is also possible for this first transaction to fail while the wireless link is being restored. For this reason, designers should make sure that they have a retry mechanism with an appropriate timeout period.

There is also an auto timeout after which, if there is no transaction on USB, WAKE_UP pin or I²C tunnel, the system returns to power saving state and the link is shut off again.

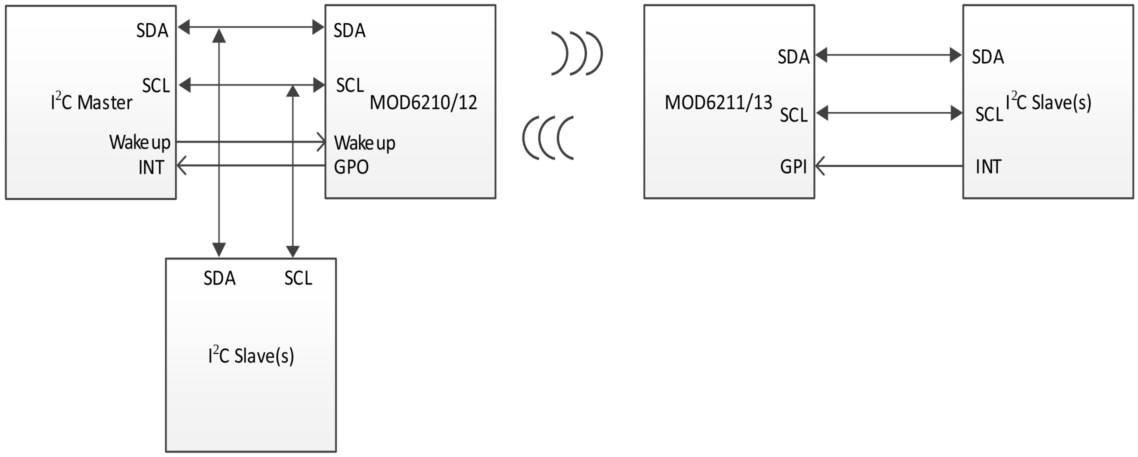

Figure 7.1. Transceiver Module I²C System Diagram

7.3. Debug Port

An optional I²C debug port may be used to access the internal I²C debug registers of the transceiver module. The debug interface uses slave address 0x7C (Figure 7.2).

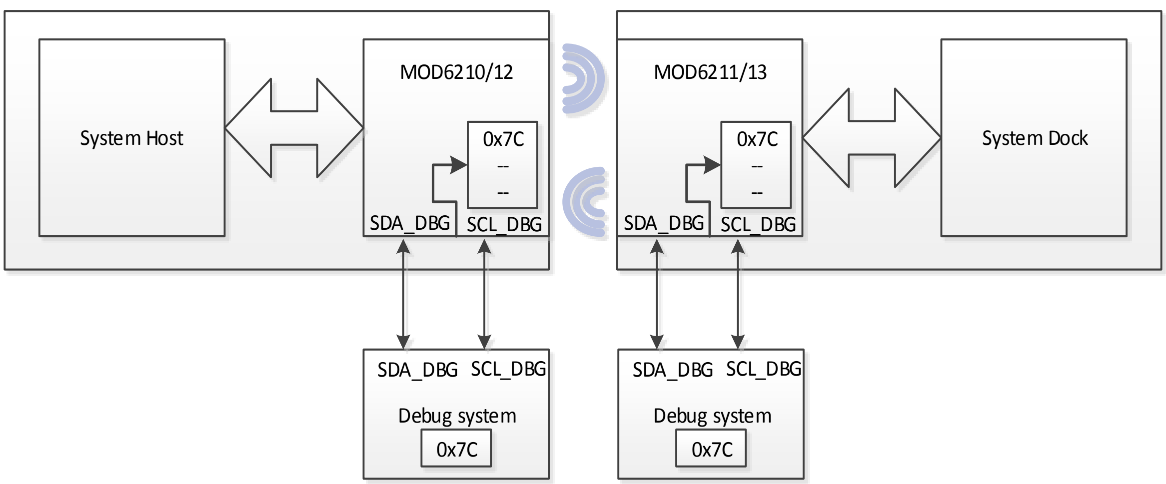

Figure 7.2. Transceiver Module I²C Debug Interface

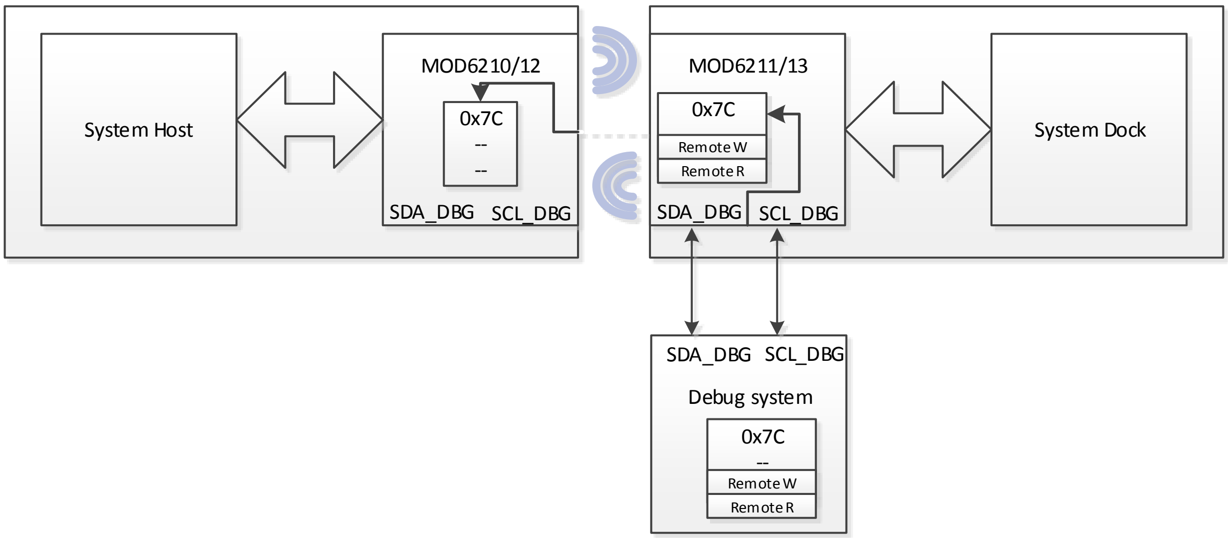

Figure 7.3. Transceiver Module Remote I²C Debug Principle

A unique feature of the transceiver module is the ability to perform remote debug. The bottom four registers of each register bank are used to allow remote I²C read and write. These remote debug operations are executed in the local I²C register bank by proxy (Figure 7.3).

A remote I²C debug command is executed by writing a command in register 0x7FC, followed by writing the remote register address in register 0x7FD. Data from remote I²C read operation is read back from register 0x7FF, whereas data for remote I2C write operation is written in register 0x7FE.

Table 7.2. Remote Debug Registers Description

Reg	Name	7	6	5	4	3	2	1	0
7FC	Remote command	—	—	—	t.out	err	busy	rd	wr
7FD	Remote address	A[7]	A[6]	A[5]	A[4]	A[3]	A[2]	A[1]	A[0]
7FE	Remote WR	D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]
7FF	Remote RD	D[7]	D[6]	D[5]	D[4]	D[3]	A[2]	D[1]	D[0]

7.4. GPI, GPO, and LEDO

The transceiver module contains a general purpose input (GPI), a general purpose output (GPO), as well as a dedicated LED output (LEDO) pin.

The LEDO indicates the state of the wireless link. A persistent low (OFF state) indicates that the SK621x transceiver module is powered down or being held in reset. A periodic high (blinking) indicates that the device is scanning for a connection. An active high (ON state) indicates that a link is established.

Without a link present, GPO stays low (OFF state). When a link is established and the transfer is in full speed mode (W0 state), the GPO reflects the state of the GPI pin on the opposite side of the link. If the GPI pin on the opposite side of the link is left high, the GPO output can be used to indicate that wireless RF link is established. If the device goes into a "Detached State"—link is established but no data is being transferred—the GPO signal periodically goes high (blinking).

Each GPI pin can be used to control the state of the GPO pin on the opposite side of the link, but only when the link is in a Full Speed mode (W0 state).

GPI on SK6211/13-MOD to GPO on SK6210/12-MOD can also be used as interrupt function along with the WAKE_UP pin to wake up the wireless link and I²C host for service (as shown in Figure 7.4). Asserting WAKE_UP forces the wireless link to W0 state or stops the link from entering low power modes (W2, W3, IDLE). This combination of WAKE_UP pin and GPO/INT works together with the I²C tunnel function to prevent the need for polling on the I²C tunnel from the master side.

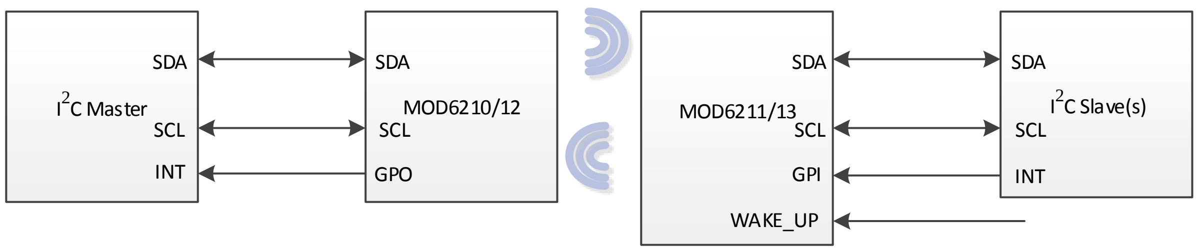

Figure 7.4. Transceiver Module Interrupt Based I^{2}C Tunnel

7.5. Reset

The transceiver module has an RST input pin that keeps the device in standby. The module includes a power-on-reset circuit in case an RST signal is not available. If the RST signal is not connected, this pin should be tied to GND to avoid spurious resets during normal operation.

7.6. Power States

The transceiver module has automatic power state management that does not require external host supervision or control, as shown in Figure 7.5.

A simple dock detection mechanism can trigger transceiver module standby mode and reach a power consumption level in the mobile device of about 10 µW.

It is assumed, in most typical use cases, that the W0 state is only reached when the mobile device is docked to an AC powered accessory.

To comply with some regulations, “Flight mode”, all radio OFF, is supported in hardware reset state.

The transceiver module takes full advantage of advanced power profiles defined by USB specifications such as Super Speed U2/U3 and USB2.0 SUSPEND/LPM.

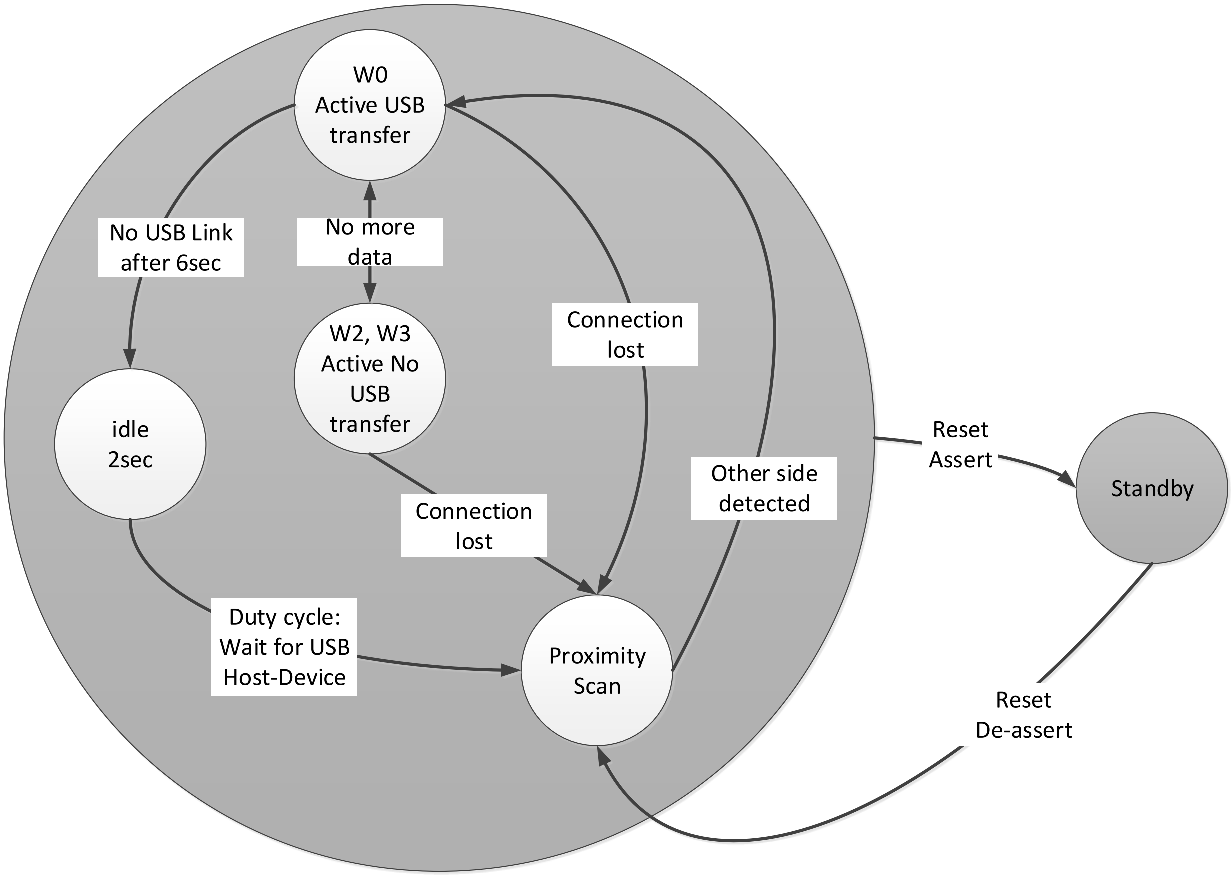

Figure 7.5. Module Power States

7.7. SNAP VBUS_SENSE and VBUS_EN Function

The VBUS supply from the upstream USB port is used as a VBUS_SENSE input to the transceiver. Note that a resistor divider or equivalent circuit should be used to reduce the +5 V VBUS voltage level to a +3.3 V voltage level that is compatible with the VBUS_SENSE input as shown in Figure 7.6. The VBUS status is sent to the downstream facing transceiver, where the VBUS_EN signal is used to control the local VBUS status at the downstream USB connection. The system designer should use the VBUS_EN signal to control the 5 V power to the downstream device, as shown in Figure 7.7. This ensures that USB enumeration starts after the wireless link is established and hence avoids device enumeration retries.

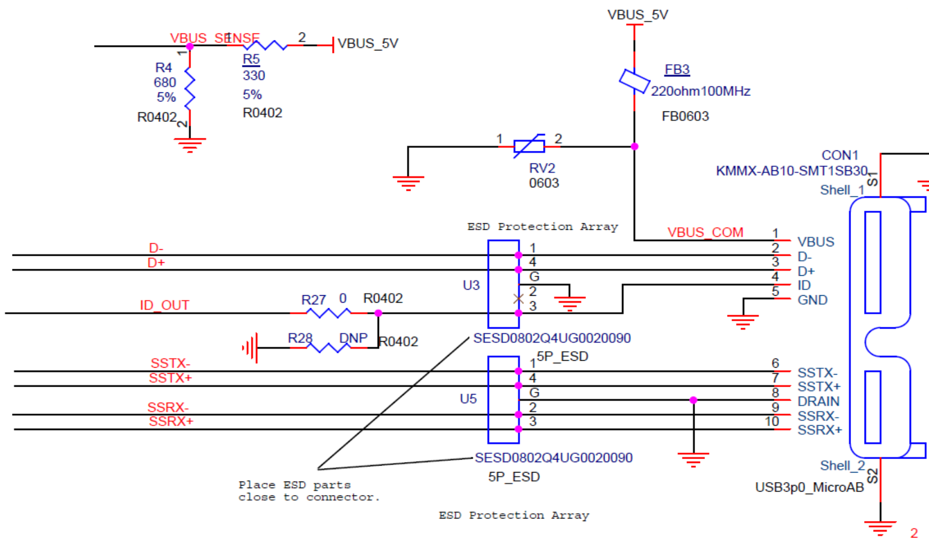

Figure 7.6. VBUSE_SENSE Circuit Example

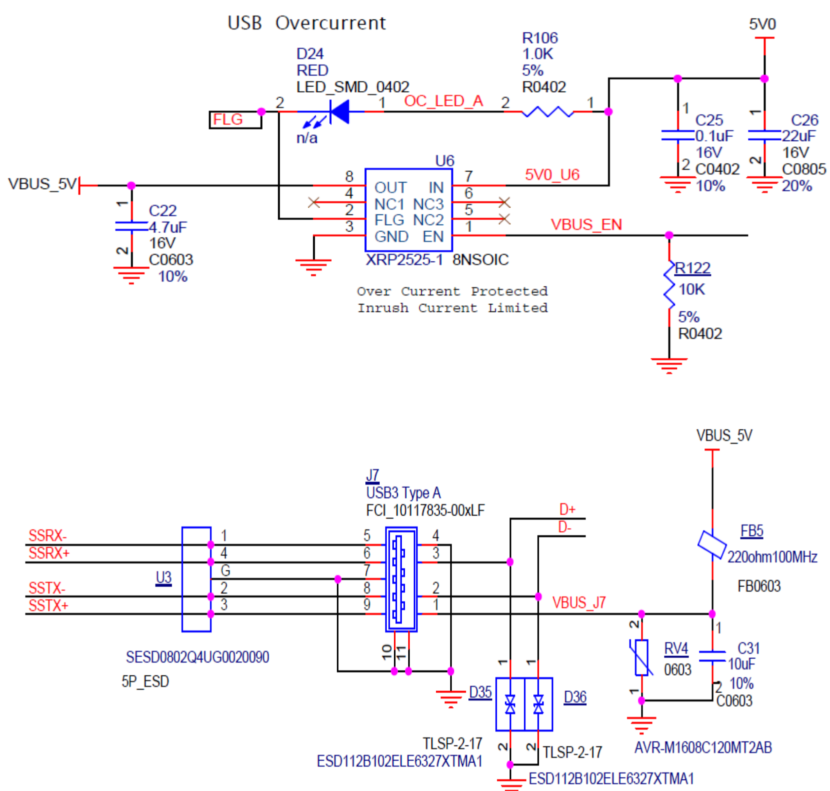

Figure 7.7. Use VBUS_EN Signal to Control the Power On/Off for Downstream Device

8. Mechanical Placement

8.1. General Consideration

- The transceiver module operates between 59 GHz and 65 GHz.
- Modulation scheme is OOK which provides 2 isolated wireless links of 6 Gbps maximum bitrate.
- Package size is 10 mm × 26 mm × 3 mm.
- Operating on the model of Plug/Receptacle of physical connectors, an odd part can only be connected to an even part. For example, MOD6210 device automatically connects to MOD6211 device but does not connect to MOD6212 device.

8.2. Antenna Configuration

There are two antenna configurations:

- MOD6210 and MOD6211 contain edge fire antenna, as shown in Figure 8.1.
- MOD6212 and MOD6213 contain broad side antenna, as shown in Figure 8.2.

Edge fire antenna radiates with the main lobe parallel to the chip package surface pointing out of the long edge of the package.

Figure 8.1. Edge Fire Antenna Configuration

Broad side antenna radiates with the main lobe perpendicular to the chip package surface pointing out from the mounting PCB.

Figure 8.2. Broad Side Antenna Configuration

8.3. Module Integration and Enclosure Design Guides

Integration of the wireless transceiver requires careful design of the system PCB and enclosure to maximize RF performance. The following sections provide design guidelines for system integrators. Failure to follow these guidelines may result in a system with degraded RF performance.

8.3.1. Keep-out Area

To minimize RF interference, a keep-out volume is recommended around the transceiver module. The Keep-out definition for the MOD6210/MOD6211 transceiver module is shown in Figure 8.3 and the keep-out volume for MOD6212/MOD6213 transceiver module is shown in Figure 8.4.

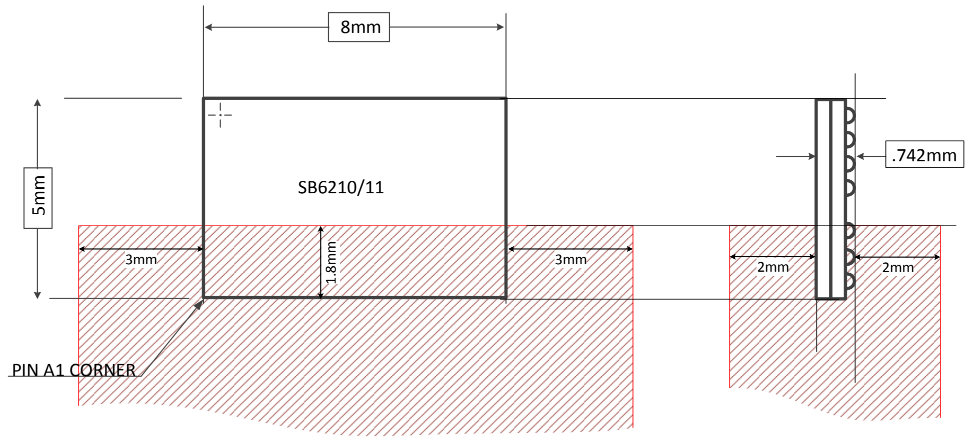

Figure 8.3. MOD6210/MOD6211 Keep-Out Perimeter

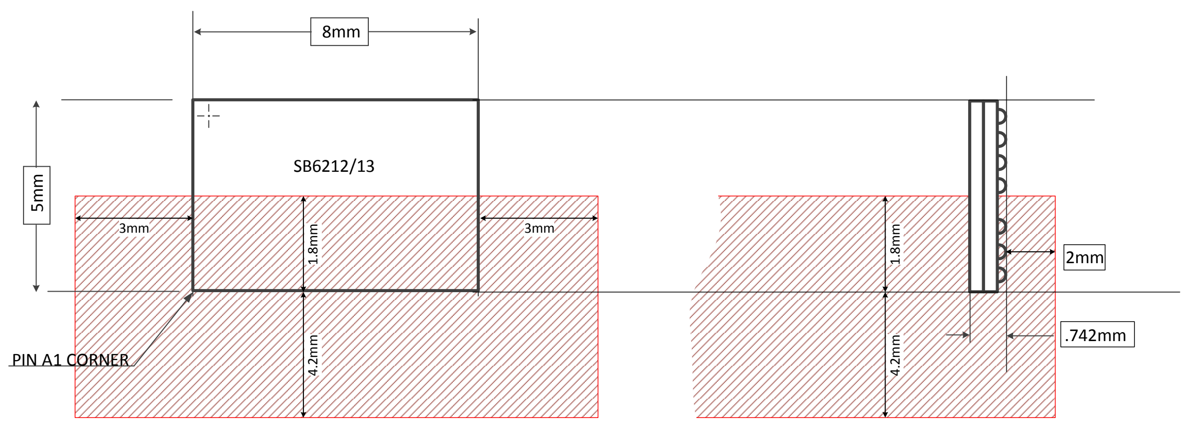

Figure 8.4. MOD6212/MOD6213 Keep-Out Perimeter

Within the Keep-out area, the guidelines below should be followed:

- Keep ground plane under the transceiver module.
- No electronic should be placed under the transceiver module.
- No metal parts, metal paints, fasteners nor screws should be placed under the transceiver module.
- Place 60 GHz RF absorber under the transceiver module to decrease RF interference.

8.3.2. Enclosure

The system enclosure design can increase RF interference as well as increase signal path loss. The guidelines below should be followed when designing the system enclosure:

- Avoid using an enclosure material with a dielectric constant greater than 10 at 60 GHz. ABS, PE, PC, which are generally low loss at materials at 60 GHz are good choices.
- A flat surface perpendicular to the main lobe is preferred. Avoid ribbing, multi-layering or creating complex assemblies containing several compounds.

- Avoid high incidence angle at the material surface.
- An enclosure thickness of 2 mm or less is preferred.
- Chip-to-chip separation should be less than 5 mm.
- A PORON gasket placed between the transceiver module and the enclosure can be used to minimize link degradation.

8.4. 60 GHz RF Absorber

Judicious use of a 60 GHz RF absorber is an effective method of reducing unwanted signal in design. The following recommendations need apply:

- Reduce crosstalk by adding a strip of RF absorber offset towards the RX antenna on the integrated circuit of the MOD6211/MOD6213 transceiver module (Figure 8.5).
- Reduce unwanted reflections by adding RF absorber on any large metallic structures, such as EMI shields, that are placed in proximity to the integrated circuit.

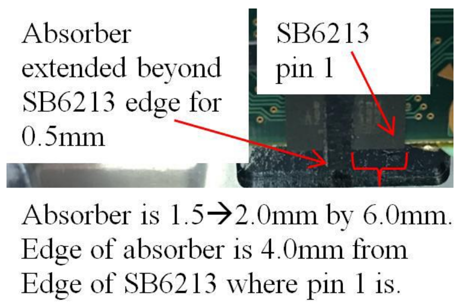

Figure 8.5. RF Absorber Placement

We recommend using the following RF absorber:

- 60 GHz 0.25mm thick RF absorber:
- JCS-9/SS6M .010*12*12
- ECCOSORB
- P/N 85000164

8.5. PORON© Gasket

If the air gap between the integrated circuit on the wireless transceiver and the enclosure is larger than 0.5 mm, add the PORON above the SB621x chip to eliminate the air gap and improve the link performance.

Example PORON part number:

Rogers Corporation PORON

P/N = 4701-60-25031-04

Thickness = 0.79 mm, density = 400

9. Module Placement and Enclosure Design

9.1. MOD6212 to MOD6213 Transceiver Module

For a MOD6212 to MOD6213 connection, a simplified system integration material stack should look like the figure below (Figure 9.1). Some of the dimension are fixed by design, for instance chip thickness and board to board connector height. Some other dimensions are decided at system level and have impact on the RF link quality, for example, the air gaps and the enclosure thickness. Other dimension are system driven but do not seem to affect the RF link condition, such as the frame or chassis design when it is below the main PCB.

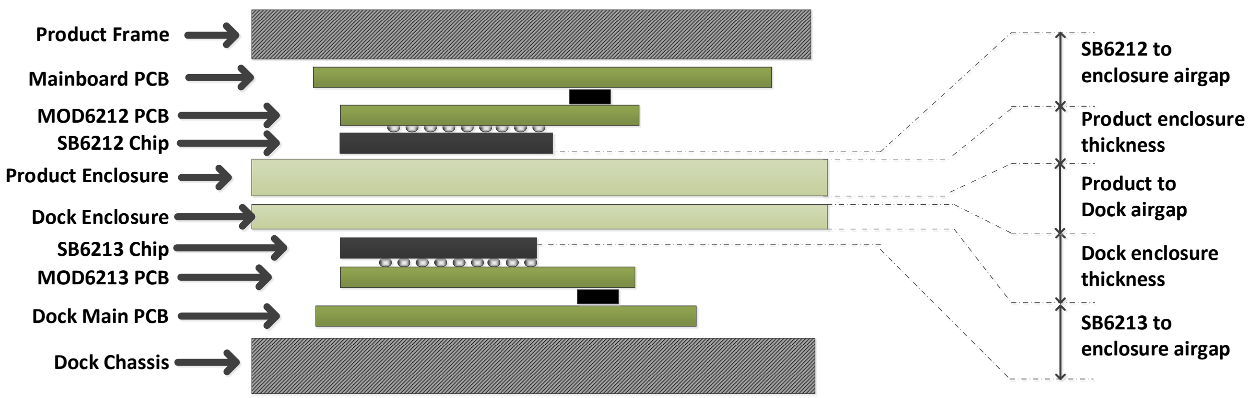

Figure 9.1. Broad Fire (MOD6212/MOD6213) Enclosure Design

9.2. MOD6210 to MOD6211 Transceiver Module

For a MOD6210 to MOD6211 configuration, a simplified system integration material stack should look like the figure below (Figure 9.2).

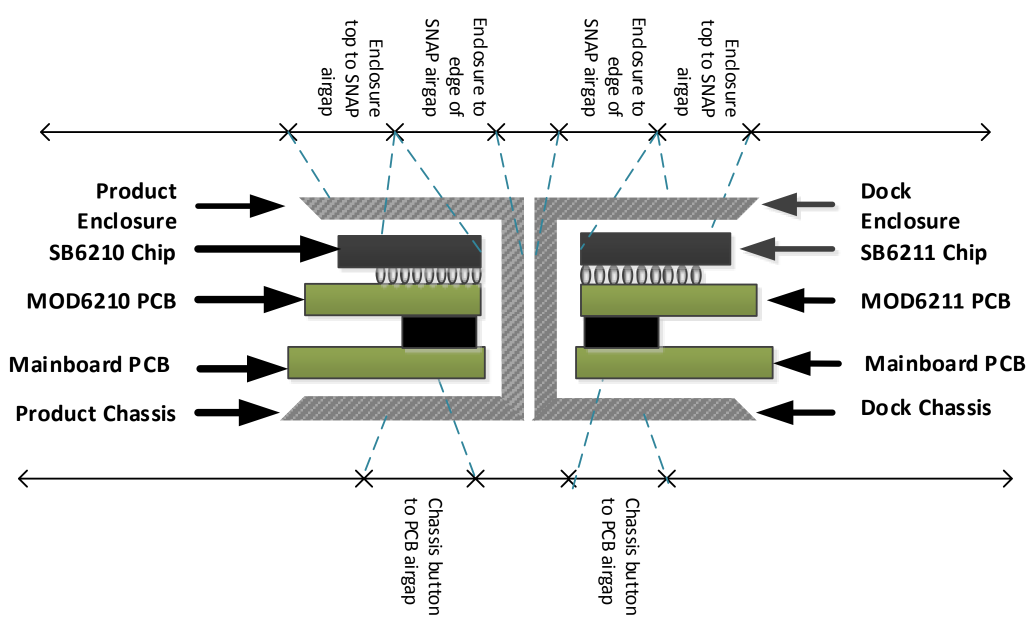

Figure 9.2. Edge Fire (MOD6210/MOD6211) Enclosure Design

9.2.1. Recommendations for Enclosure Design

The table below lists the recommendations for the enclosure design.

Table 9.1. Recommendations for Enclosure Design

Enclosure Design Requirement	MOD6212 + MOD6213 Enclosure Design	MOD6210 + MOD6211 Enclosure Design
Product enclosure + dock enclosure total thickness	< 3.5 mm	< 3.5 mm
Air gap between product enclosure and dock enclosure	< 0.1 mm	< 0.1 mm
Distance from the top of the SB6212/13 chip surface to enclosure	< 0.5 mm	—
Total distance between the top surface of SB6212 chip to top surface of SB6213 chip	< 5 mm	—
Total distance between the edge of SB6210 chip to edge of SB6211 chip	—	< 5 mm
If possible, add 60 GHz absorber between Main PCB and MOD621x device to reduce the crosstalk.	Yes	Yes
If there is an air gap larger than 0.5 mm between enclosure and Snap, add PORON to improve the RF link performance.	Yes	—
Follow the keep out area rules defined in the Keep-out Area section.	Yes	Yes

10. RF Link Margin Measurement

After integrating transceiver module into a system, it is important to verify that the RF link is performing adequately. A PC-based tool is provided to report critical RF performance parameters when host PC is connected to the transceiver module debug port. This tool is typically used under the following circumstances:

1. Initial design bring-up and performance tuning.
2. Validation of manufacturing design across system manufacturing tolerances.
3. Production test.

Refer to the Snap™ Development Kit User Guide (SB-UG-02006) included in the reference kit package for the installation instructions. After the snap_tool software is installed, the user guide can also be downloaded from the Help pull-down menu.

The Throughput Test and RF Link Info functions can be used to verify the RF performance (Figure 10.1).

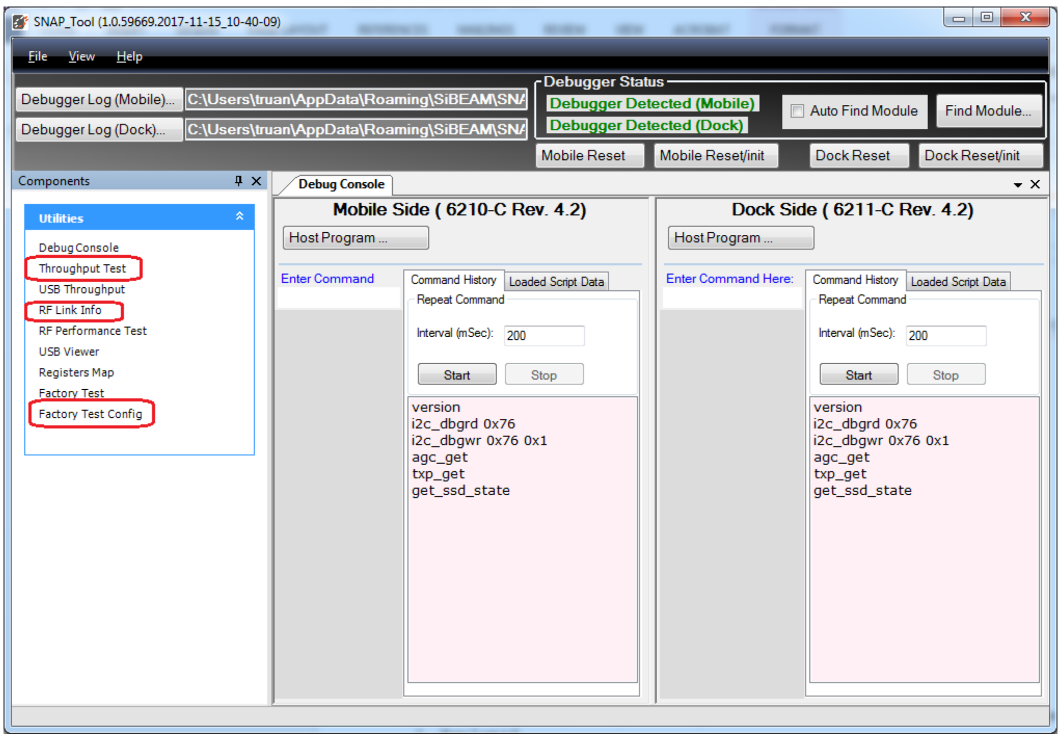

Figure 10.1. Snap_tool Debug Console Window (Main Window)

Check RF throughput through Snap_tool Throughput Test function to make sure the RF link is at the stable stage (Figure 10.2):

- Sync Lost = 0
- Package throughput = ~5.5Gb/s
- BCH Error Rate <= 6 /sec
- BCH2 Error rate = 0

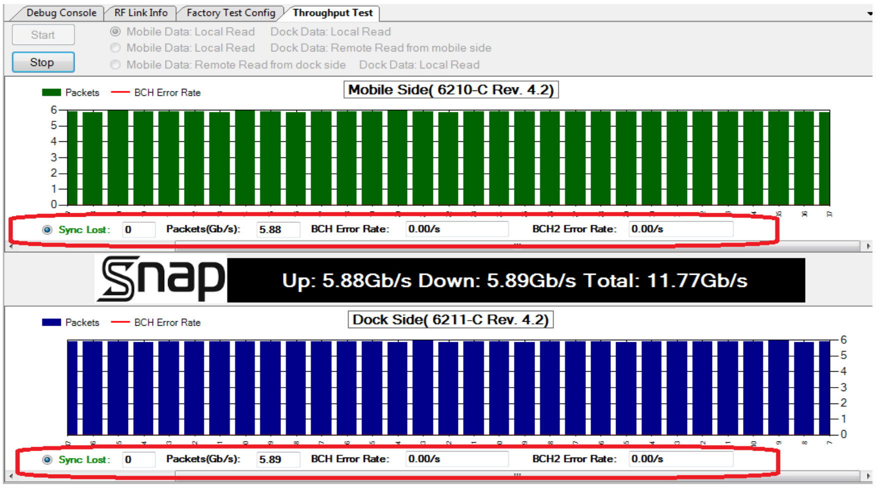

Figure 10.2. Snap_tool RF Throughput Test Page

Use the Snap_tool RF Link Info page (Figure 10.4) to get more details on the RF link status:

1. Before running any test cases from the RF_Link_Info page, the Factory Test Config page (Figure 10.3) should be used to configure RF link testing options.
   a. Select **Allow Keyboard To Trigger Test** to start RF Margin testing without entering the device bar code. Press **Enter** on each bar code input box to start the testing.
   b. Un-check **Use Margin Limit** to allow the application to perform complete RF margin checking during the initial stage design phase. After verifying that a large pool of systems has the same RF link status, select this feature to perform sanity check with the defined high/low margin.
   c. Keep the **BCH Test Interval** as it is. Snap_tool collects RF data based on the interval defined here to analyze the BCH results for RF link status.
   d. Keep the **BCH High/BCH Low** value set to the restricted limit for the initial testing.

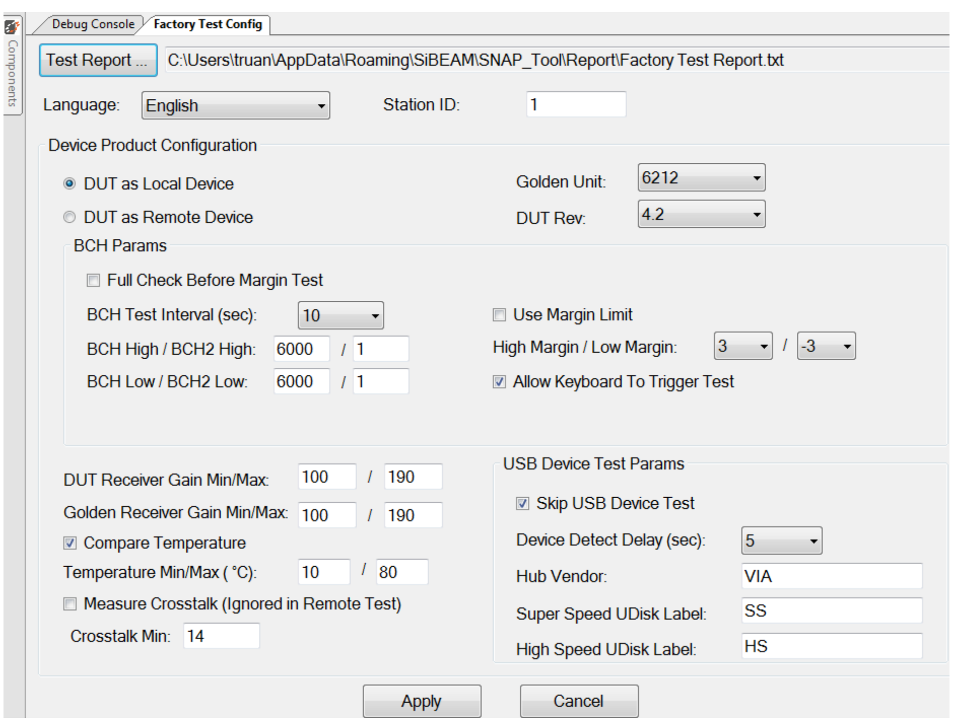

Figure 10.3. Snap_tool Factory Test Config Page

2. Use the RF link status function to check RF link status in real time (Figure 10.4):
   a. **Bit_Rate** should be greater 5.5 Gb/s.
   b. **Sync_Lost**, **BCH_ERR_CNT**, **BCH_1_ERR_CNT** and **BCH_2_ERR_CNT** should stay constant meaning that the RF link is in a healthy state.
   c. **AGC_Current** should be greater than 110 for both sides of the link.
   d. Select device as local or remote to start the testing. If you define a device as remote, the snap_tool queries the remote SNAP device registers through the SNAP remote debug registers.

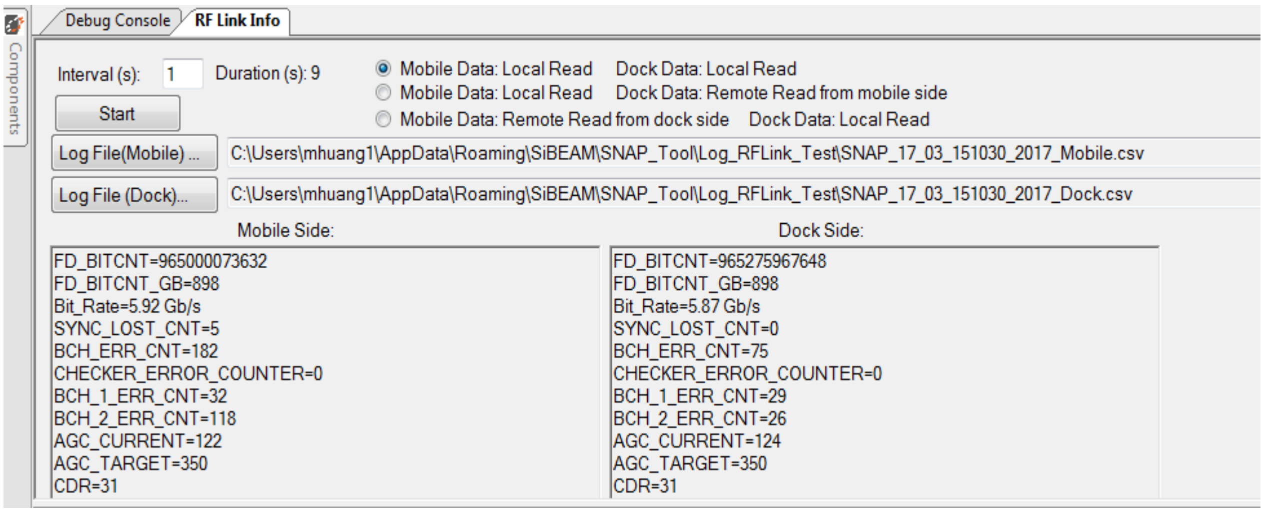

Figure 10.4. Snap_tool RF Link Info Page Current RF Status

3. Use RF Link Margin function (Figure 10.5) to check the RF link margin.
   a. Margin is reported in this format: 4db/–4db
      4db is the maximum margin for the local side.
      –4db is the maximum margin for the remote side.
   b. The minimum targeted margin for a design should be 2db/–1db. Measured margins lower than this threshold require design changes. Ideally you should target a margin of 4db/–4db.
   c. Test condition is defined from the Factory Test Config page.

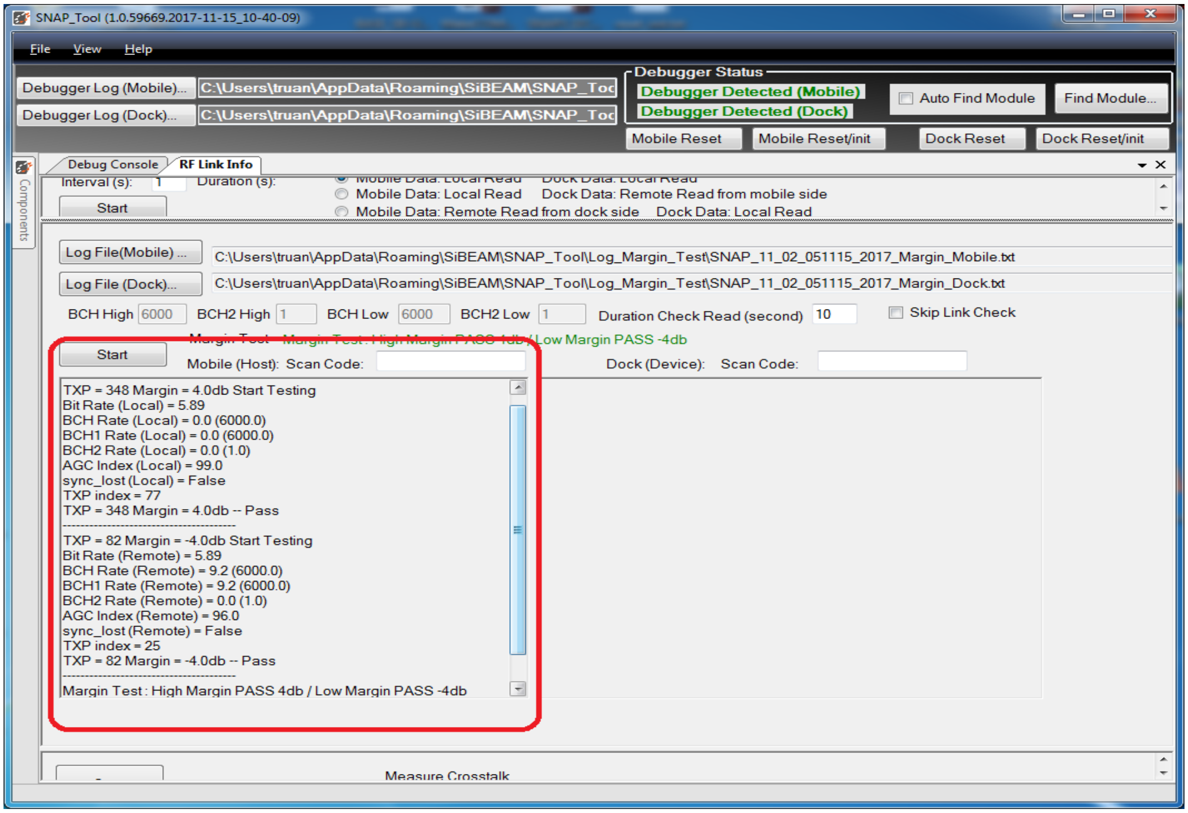

Figure 10.5. Snap_tool RF Link Info Page RF Link Margin

4. Crosstalk ratio from the **RF Link Info** page (Figure 10.6) is used to check the unwanted signal level.
    a. With a good design, the crosstalk ratio should be greater than 15 db on both sides of the link. The higher the crosstalk value, the lower the unwanted signal.
    b. To run this test, the Snap_tool must detect both sides as a local device which means both devices are connected to the test PC USB2 port.

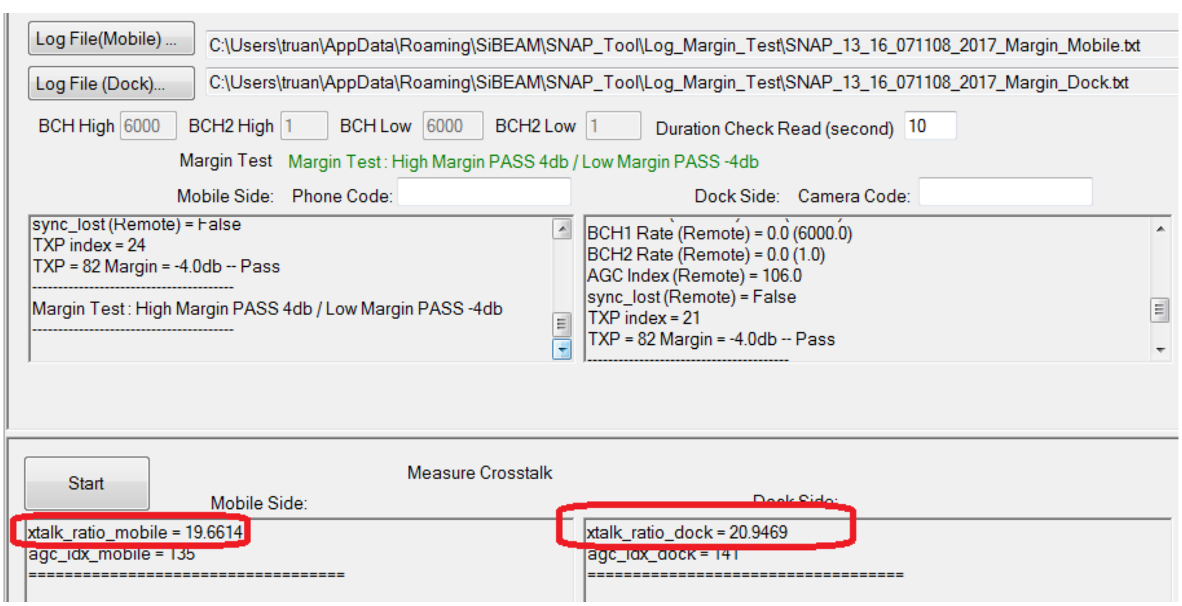

Figure 10.6. Snap_tool RF Link Info Page Crosstalk Result

11. 60 GHz Regulatory Certification

The transceiver modules have received a 60 GHz regulatory grant for FCC/IC/CE/EU/AU/NE. System integrators do not need to repeat 60 GHz regulatory certification, but will need to perform system level EMI testing. If the system is sold into the US market, Lattice Semiconductor will need to collect the system test results in accordance with the FCC limited modular grant requirement.

New Chinese government regulations waive the requirement for 60 GHz certification testing since the module runs on low power short-distance radio transmission.

If the region is not included on the above mentioned regions, the system integrator can use the FCC ID as a reference to apply for the particular regional certification.

12. Transceiver Module Specification

Table 12.1. Module Specification

Parameter	Value
Mechanical	
Dimensions (mm)	X = 10, Y= 26, Z = 3
Mounting Screw half hole(x 2)	M1.6: ISO 7045:1994 – Pan head screws with type H or type Z
Mounting post diameter (mm)	1
Max Module Case Temperature	90 °C at 60 °C ambient
System Connector	B2B, 0.4 mm pitch, 30 pin
Electrical	
Power Input VIN	3.3 V ±5% DC, 200 mA
Max Input Voltage Ripple	<10% of VIN peak to peak
Control Serial Port	I^2C 400 kHz, 3.3 V
Max Power	500 mW (max)
Connected Power	350 mW (typical)
Disconnected Power	5 mW
OFF, Disable Power	<10 mA (max)
Radio Frequencies	
Operating Frequency	59–65 GHz
Channel Bandwidth	6 GHz
Radiated Power (EIRP)	3 dBm (average)
Transmit Antenna Gain	0 dBi
Compliance and Regulation (not submitted FCC/IC)	
FCC	Part 15 subpart C
IC	Part 15 subpart C
EU	Host independent approval (modular): • EN305550 • EN301489-28 • EN62311 • EN55022

Ordering Information

Production Part Numbers

Module	Part Number
MOD6210 Transceiver Module mobile side edge	MOD6210
MOD6211 Transceiver Module dock side edge	MOD6211
MOD6212 Transceiver Module mobile side broad	MOD6212
MOD6213 Transceiver Module dock side broad	MOD6213
SK621011 Module development kit edge to edge configuration	SK621011
SK621213 Module development kit broad to board configuration	SK621213

References

Standards Documents

This is a list of the abbreviations used in this document. Contact the responsible standards groups for more information on these specifications.

Abbreviation	Standards Publication, Organization, and Date
USB 3.0	*Universal Serial Bus Specification Version 3.0 Revision 1,* Copyright © 2011, Texas Instruments, Hewlett-Packard Company, Intel Corporation, Microsoft Corporation, Renesas Corporation, ST-Ericsson.
USB 2.0	*Universal Serial Bus Specification Version 2.0 Revision 2,* Copyright © 2000, Compaq, Hewlett-Packard Company, Intel Corporation, Lucent, Microsoft Corporation, NEC, Phillips.
I2C	*I^2C Bus Specification, Revision 5*, 9 Oct 2012, Copyright NXP Semiconductors

Revision History

Revision A, January 2018

First production release.

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