Integration Guide

ST Engineering

SMB3315 Satellite Modem Board

Version 1.4

June 29, 2023

powered by Newtec iDirect

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Revision History

The following table shows all revisions for this document.

Revision	Date	Updates
1.0	June 2021	Initial version.
1.1	February 2022	Added explanation for P1 and P3 of the I/O Header.
1.2	June 2022	Added section "Power Dissipation of Components", minimally reorganized document.
1.3	March 13, 2023	• Added support for Evolution. • Updated *Introduction*. • Updated Table 3-9. • Updated bottom of *Hardware Integration Checklist*.
1.4	May 2023	• Updated *Introduction*. • Updated images in *Physical Specifications* section. • Updated *Power Dissipation of Components* section. • Updated *Thermal Characterization Test* section. • Updated **HWMON** command description.

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About

Purpose

The SMB3315 Integration Guide provides information for third-party integrators and equipment manufacturers to develop a VSAT terminal based on the SMB3315. The guide provides specifications, and hardware integration information for the SMB3315.

Audience

The guide is intended for use by systems engineering and terminal integration personnel. It is assumed that the reader is familiar with the basics of satellite communication system technology in addition to related software, hardware, radio-frequency, and mechanical engineering principles.

Document Conventions

The following conventions are used in this document.

NOTE - A statement or notification that adds to, emphasizes, or clarifies essential information of special importance or interest.

CAUTION: A statement that highlights an essential operating or maintenance procedure, practice, condition, or statement that if not strictly observed, may result in damage to or destruction of equipment, or a condition that adversely affects system operation.

WARNING - *A statement that highlights an essential operating or maintenance procedure, practice, condition or statement that if not strictly observed, may result in injury or death or long term health risks.*

TIP - A tip message indicates advice.

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Software user guides, installation procedures, FAQs, and other documents that support iDirect and iDirect Government products are available on the respective TAC Web site. The iDirect Technical Assistance Center (TAC) and the iDirect Government Technical Assistance Center (TAC) are available for assistance 24 hours a day, 365 days a year.

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1 Introduction

The SMB3315 Satellite Modem Board is a high-throughput board for integration into compact VSAT terminals that can operate in a Dialog®, Evolution®, or a Velocity™ VSAT network.

NOTE - The network of operation is specified in the SMB3315 purchase order.

The SMB3315 is suited for integration in highly mobile and rugged terminals due to the following design decisions:

- Compact size
- SMA connectors for compact integration
- Extended temperature range
- 24 VDC with locking connector
- Signaling connector with locking mechanism

SMB3315 Key Features

Feature	Dialog	Evolution	Velocity
Forward technology	DVB-S2X wideband, up to 500 Mbaud	• DVB-S2, up to 45 Mbaud DVB-S2X, up to 64 Mbaud	DVB-S2, up to 45 Mbaud
Return technolog	Mx-DMA, up to 20 Mbuad SCPC, up to 64 Mbaud	A-TDMA, up to 29 Mbaud	A-TDMA, up to 7.5 Mbaud

Feature	Dialog	Evolution	Velocity
Throughput	120 Mbps inbound, 48 Mbps outbound	DVB-S2 • 150 Mbps inbound • 48 Mbps outbound DVB-S2X • 65 Mbps inbound • 48 Mbps outbound	140Mbps inbound 14Mbps outbound
Release	Dialog R2.4.1 or higher	Evolution R4.3.0 or higher.	Velocity R3.3.1 or higher

For information on using the SMB3315, refer to the system documentation for the corresponding product line.

1 Specifications

This chapter provides the physical, environmental, electrical, transmitter, and receiver IF specifications of the SMB3315 Satellite Modem Board. It contains the following sections:

- Physical Specifications on page 4
- Environmental Specifications on page 7
- Electrical Specifications on page 8
- Transmitter IF Specifications on page 9
- Receiver IF Specifications on page 11

The term "operational" in this chapter indicates compliance with all performance and functional parameters listed in this specification as they apply to the SMB3315. The term "storage" indicates the capability for long-term exposure to the specified environment and subsequent recovery, without damage, to a fully "operational" condition; units in storage are assumed to be in a power-off state.

1.1 Physical Specifications

Table 1-1 lists the physical specifications of the SMB3315 Satellite Modem Board.

Table 1-1. SMB3315 Physical Specifications

Category	Description
Dimensions	W 234.7 mm (9.24") x H 20.0 mm (0.79") x D 182.0 mm (7.17")
Weight	330 g

The PCB overview is shown in 2D in Figure 1-1 and in 3D in Figure 1-2 and Figure 1-3.

Figure 1-1. PCB overview in 2D

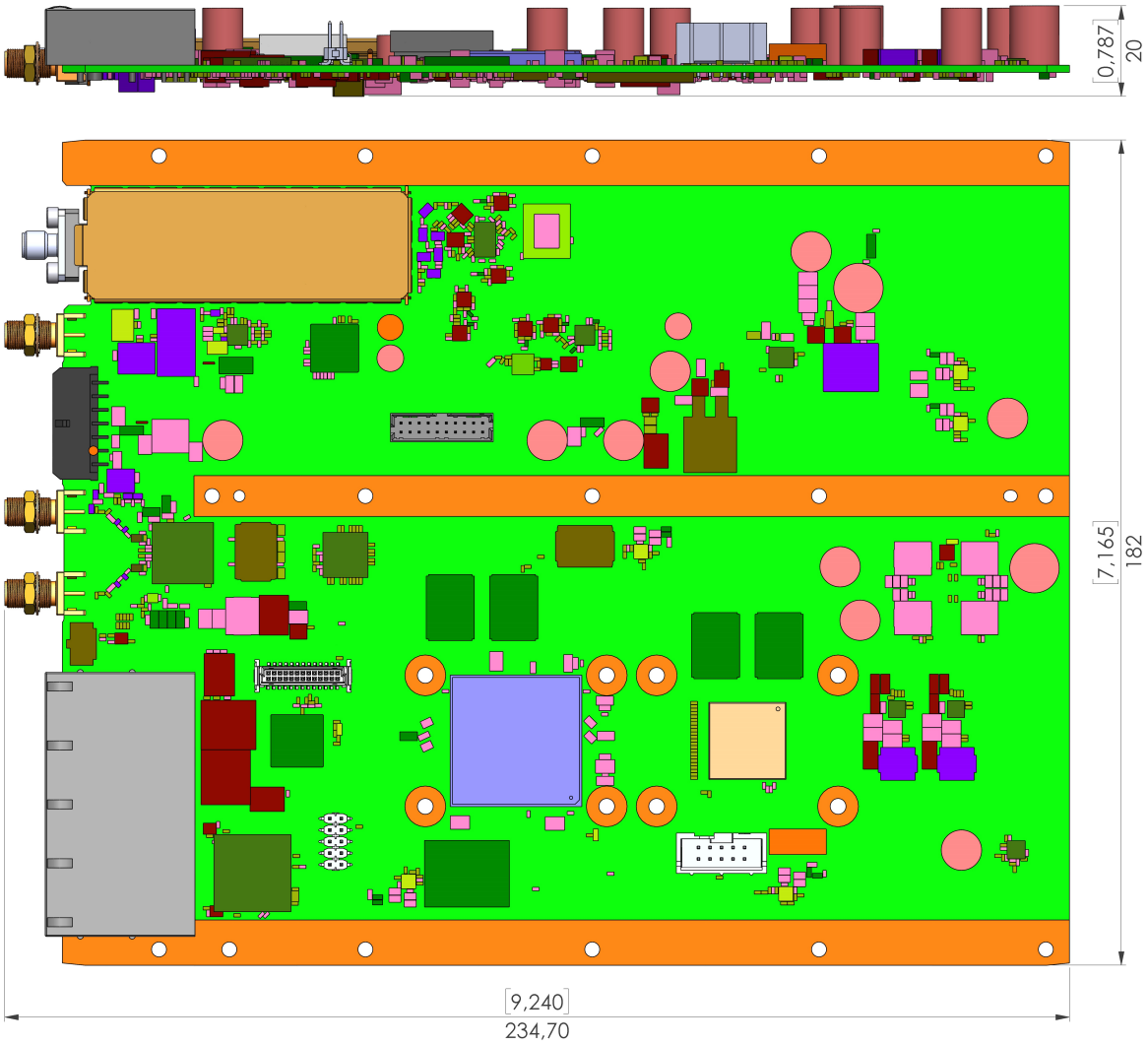


Figure 1-2. PCB overview in 3D - View 1

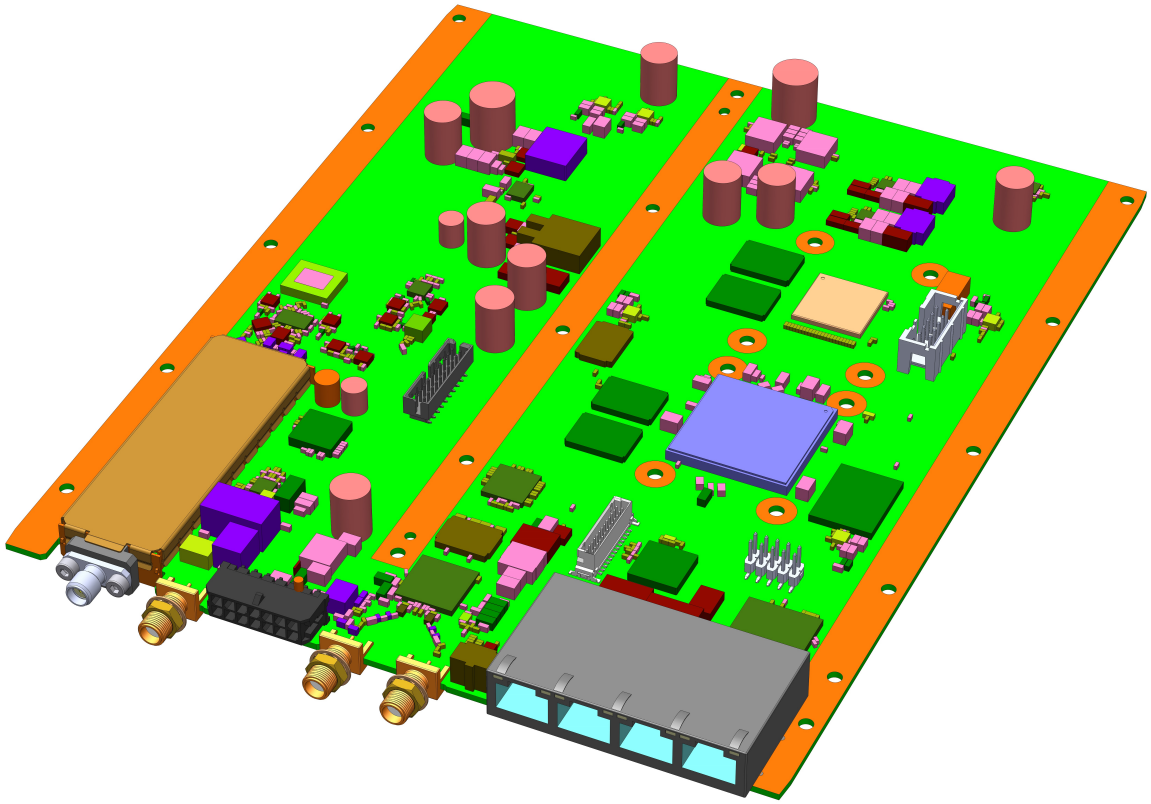
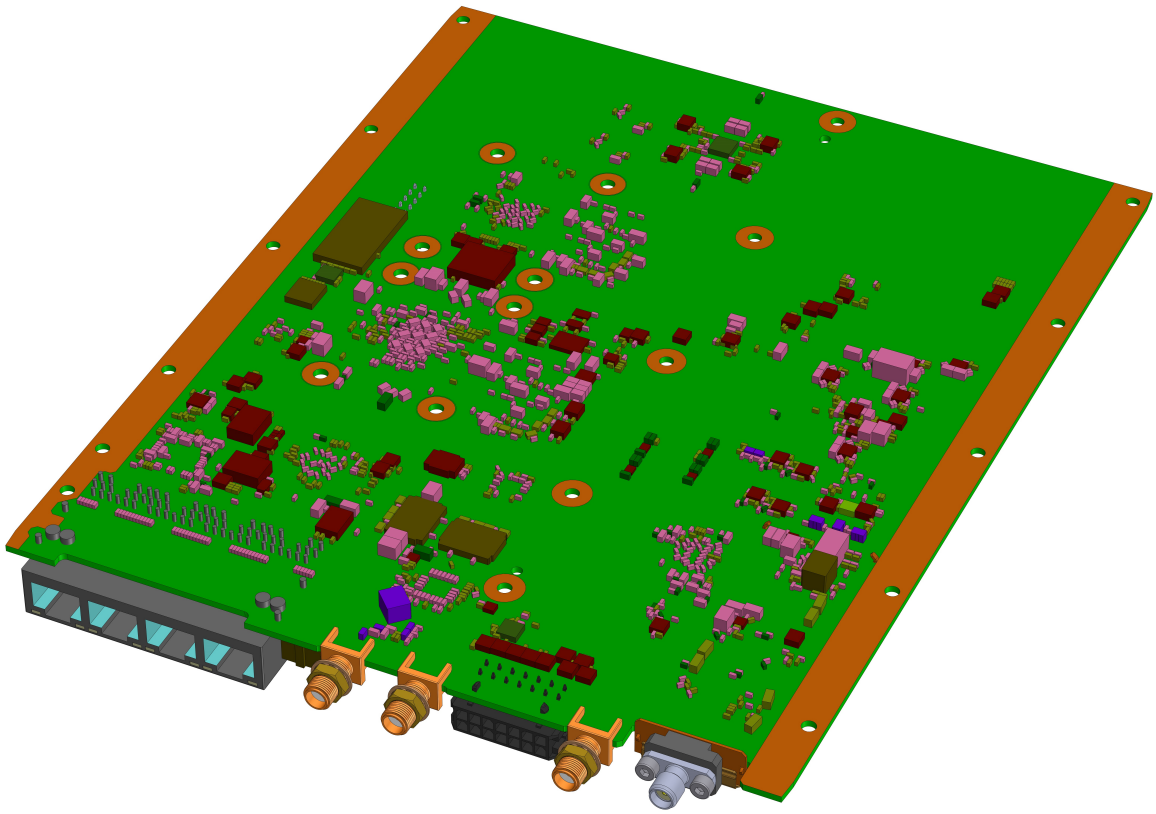


Figure 1-3. PCB overview in 3D - View 2



1.2 Environmental Specifications

The SMB3315 was successfully tested against the following environmental specifications using the reference chassis. Integrators must develop a mechanical and thermal management solution to meet their mechanical and environmental requirements.

Table 1-2. SMB2215 Environmental Specifications

Requirement	Test Level	Test Standard	Test Method
Operating temperature	-25.0°C to +55°C	ETSI EN 300-019-2-3, T3.1	IEC 60068-2-1, and IEC 60068-2-2
Operating temperature change	-25.0°C to +55°C, at 0.5°C/minute ramp	ETSI EN 300-019-2-3, T3.1	IEC 60068-2-14
Operating humidity	95% RH, +30°C	ETSI EN 300-019-2-6, T6.2	IEC 60068-2-56
Operating altitude	1,829 m (6,000 ft) @ 55°C	GR-63-CORE, section 4.1.3	GR-63-CORE, section 5.1.3
Storage and transportation temperature	-40°C to +85°C	ETSI EN 300-019-2-1, T1.1, and ETSI EN 300-019-2-2, T2.3	IEC 60068-2-1, and IEC 60068-2-2
Storage and transportation humidity	93% RH, +40°C	ETSI EN 300-019-2-2, T2.3	IEC 60068-2-78
Operational vibration	• 5-10 Hz, +12 dB/Oct • 10-50 Hz, 0.04 m^2/s^3 • 50-100 Hz, -12 dB/Oct	ETSI EN 300 019-2-3, T3.2	IEC 60068-2-64
	• 5-13 Hz, 1 mm peak • 13-80 Hz, 0.7 G	ETSI EN 300 019-2-6, T6.1	IEC 60068-2-6
Operational shock and bump	3 G, 11 ms, half sine	ETSI EN 300 019-2.3, T3.1	IEC 60068-2-27
	25 G, 6 ms, have sine, 200 bumps	ETSI EN 300 019-2.6, T6.1	IEC 60068-2-29
Packaged vibration	5-200 Hz, 0.78 Grms	ETSI EN 300 019-2-2, T2.3	IEC 60068-2-64
Packaged drop	1 m drop, all corners and faces	ETSI EN 300 019-2-2, T2.3	IEC 60068-2-31

For more information about the reference enclosure, see Reference Enclosure on page 49.

1.3 Electrical Specifications

Table 1-3 lists the electrical specifications of the SMB3315 Satellite Modem Board.

Table 1-3. SMB3315 Electrical Specifications

Category	Minimum Value	Nominal Value	Maximum Value
DC input voltage (VDCin) *	22.8 VDC	24.0 VDC	25.2 VDC
DC input current with BUC	N/A	N/A	6.0 A
DC input current without BUC	N/A	N/A	1.2 A
Input voltage ripple	N/A	N/A	200 mVp-p
BUC DC output voltage	VDCin - 0.7 V	N/A	VDCin
BUC DC output current limit	3.8 A	4.5 A	4.8 A
LNB output voltage	N/A	Selectable for 13 VDC or 18 VDC	Selectable up to 19 VDC
LNB output current	N/A	N/A	500 mA
LNB 22 kHz	N/A	22 kHz	N/A

* It is recommended to use a PSU with monotonic ramp-up and ramp-down.

1.4 Transmitter IF Specifications

Table 1-4 lists the transmitter IF specifications of the SMB3315 Satellite Modem Board.

Table 1-4. SMB3315 Transmitter IF Specifications

Category		Value
Type		SMA
Impedance (Zo)		50 Ohm
Frequency range		950 MHz to 2400 MHz
Tuning step size		The step size when configuring the MOD shall be better than 1 Hz (DVB-S2), 10 Hz (4CPM), 100 Hz (HRC)
Output power step size		0.1 dB
IF output power adjustment range		-55 dBm to +5 dBm
Output power uncertainty		+/- 2 dB
Modulation error ratio		> 32 dB
SSB phase noise	*10 Hz*	-42 dBc/Hz
	100 Hz	-72 dBc/Hz
	1 kHz	-81 dBc/Hz
	10 kHz	-90 dBc/Hz
	100 kHz	-90 dBc/Hz
	1 MHz	-106 dBc/Hz
	10 MHz	-130 dBc/Hz
TX frequency settling time (240 MHz jump)		250 µs
Carrier suppression		Better than -41 dBc
Sideband suppression		Better than -41 dBc
TX mute		Output power less than -80 dBm when output is muted

Table 1-4. SMB3315 Transmitter IF Specifications (Cont.)

Category		Value
Out-of-band spurious		< -50 dBc signal related < -80 dBc non signal related at 5 dBm
In-band spurious		< -35 dBc
TX disabled spurious		< -80 dBm/4kHz
TX diplexer	*Return loss*	> 14 dB
	50/10 MHz level	3 dBm +/- 2 dB
	50/10 MHz mute isolation	-60 dBm
50/10 MHz reference, stability		< +/- 2 ppm over temperature < +/- 1 ppm over first year
	OOK tone frequency	27 MHz
	OOK tone power	3 dBm +/- 2 dB
10 MHz reference, phase noise	*10 Hz*	-100 dBc/Hz
	100 Hz	-129 dBc/Hz
	1 kHz	-150 dBc/Hz
	10 kHz	-160 dBc/Hz
	100 kHz	-160 dBc/Hz
	1 MHz	-160 dBc/Hz
50 MHz reference, phase noise	*10 Hz*	-82 dBc/Hz
	100 Hz	-115 dBc/Hz
	1 kHz	-140 dBc/Hz
	10 kHz	-150 dBc/Hz
	100 kHz	-150 dBc/Hz
	1 MHz	-150 dBc/Hz

1.5 Receiver IF Specifications

Table 1-5 lists the receiver IF specifications of the SMB3315 Satellite Modem Board.

Table 1-5. SMB3315 Receiver IF Specifications

Category	Value
Type	SMA
LNB power supply	13/18 VDC 500mA
LNB band/polarization selection	13/18 V or 22 kHz tone, programmable
Impedance (Zo)	50 Ohm
Frequency range	950 MHz to 2150 MHz
Minimum single-carrier input power	• (-70 + Es/N0(thr) + 10log(f)) dBm: Optimal Performance QEF degradation < 0.1 dB • (-80 + Es/N0(thr) + 10log(f)) dBm: degradation < 0.3 dB • (-90 + Es/N0(thr) + 10log(f)) dBm: degradation < 3.0 dB where f = baud rate in Mbaud and Es/N0(thr) = Es/N0 value in dB for QEF reception
Composite wide-band input power	-10 dBm
Noise figure	< 11 dB at maximum gain
Group delay ripple	No data available
Acquisition range (MHz)	min(5, 1.5 * SR), where SR is the symbol rate in Mbaud
Return loss at SMA connector	> 14 dB

1 Hardware Integration Information

This chapter provides detailed information on integrating the SMB3315 Satellite Modem Board into an enclosure. It contains the following sections:

- Mechanical Information on page 14
- Physical Interfaces Overview on page 15
- Power and Status Connector on page 16
- I/O Header on page 18
- Thermal Management on page 24
- Mounting Recommendations on page 40

1.1 Mechanical Information

Contact ST Engineering iDirect Terminal Integration Services at terminalintegration@idirect.net to request the 2D (PDF) and 3D (STEP/IGES/x_T) files.

1.2 Physical Interfaces Overview

Figure 1-1 and Table 1-1 provide an overview of the physical interfaces on the SMB3315 Satellite Modem Board.

NOTE - The connectors on the board that are not listed are for internal use only and should not be connected.

Figure 1-1. SMB3315 Physical Interfaces

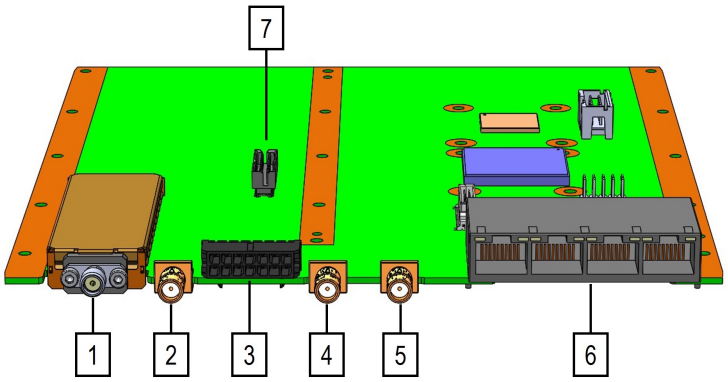


Table 1-1. SMB3315 Physical Interfaces

Number	Interface	Type	Info
1	L-band transmit TX 950 - 2400 MHz	SMA (50 Ohm)	Radiall R125.461.211 Torque 0.8 - 1.13 Nm
2	BUC reference clock IN 10 / 50 MHz	SMA (50 Ohm)	Johnson 142-0701-871 Torque 0.8 - 1.13 Nm
3	Power and status signaling (See Power and Status Connector on page 16 for more information.)	14 pin Molex	Molex 43045-1400 With latch
4	L-band receive RX1 950 - 2150 MHz (Future Use)	SMA (50 Ohm)	Johnson 142-0701-871 Torque 0.6 - 0.8 Nm
5	L-band receive RX2 950 - 2150 MHz	SMA (50 Ohm)	Johnson 142-0701-871
6	4x LAN Ethernet interface 100/1000 TX	RJ45	Bel L826-1X4T-43-F
7	I/O header	2 mm Milli-grid	Molex 87832-2020

1.3 Power and Status Connector

The 14 pin Molex connector (interface 3 described in Physical Interfaces Overview on page 15) provides power to the board and status signaling from the SMB3315.

Figure 1-2. SMB3315 Power and Status Connector Pin Locations

NOTE - All LED outputs are implemented as open-collector outputs, capable of sinking up to 20 mA.

Table 1-2. SMB3315 Power and Status Connector Pin Definitions

Pin	Function	Description
1	RESET_N	Resets the device when pulled low. See Reset on page 21 for more information.
2	~RX status LED	Pulled low when receive is active
3	~TX status LED	Pulled low when transmit is active
4	~Ethernet 1 activity LED	Pulled low when activity is detected on LAN port 1
5	~Ethernet 2 activity LED	Pulled low when activity is detected on LAN port 2
6	~Ethernet 3 activity LED	Pulled low when activity is detected on LAN port 3
7	~Ethernet 4 activity LED	Pulled low when activity is detected on LAN port 4
8	5 VDC output	5 VDC supply capable of driving external LEDs; limited to 500 mA.
9	GND	Board ground
10	Power in	24 VDC power supply input, referenced to GND (P9/P12)
11	Power in	24 VDC power supply input, referenced to GND (P9/P12)

Table 1-2. SMB3315 Power and Status Connector Pin Definitions (Cont.)

Pin	Function	Description
12	GND	Board ground
13	~Warning LED	Pulled low when a device failure is detected.
14	~Power LED	Pulled low when the device is on.

1.4 I/O Header

The I/O header (interface 7 of Physical Interfaces Overview on page 15) provides the input and output signaling of the system.

NOTE - The I/O header is only applicable when using the SMB3315 in a Velocity™ VSAT network.

This section contains the following topics:

- I/O Header Overview on page 18
- Maintenance Console TXD and RXD on page 19
- POWER_GOOD Signal on page 20
- BUC TX and RX on page 21
- Reset on page 21
- BUC Keyline Interface on page 22

1.4.1 I/O Header Overview

Figure 1-3 and Table 1-3 show the I/O header pin locations, their descriptions and their functions.

Figure 1-3. SMB3315 I/O Header Pin Locations

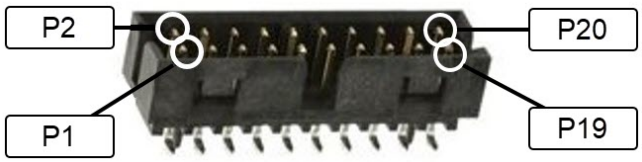


Table 1-3. SMB3315 I/O Header Pin Descriptions

Pin	Function	Description
P1	RS232 TXD	Maintenance console for ST Engineering iDirect authorized personnel only, RS-232 transmit output. Refer to Maintenance Console TXD and RXD on page 19 for more information.
P2	GND	Board ground

Table 1-3. SMB3315 I/O Header Pin Descriptions (Cont.)

Pin	Function	Description
P3	RS232 RXD	Maintenance console for ST Engineering iDirect authorized personnel only, RS-232 receive input. Refer to Maintenance Console TXD and RXD on page 19 for more information.
P4	GND	Board ground
P5	PWR_GOOD_P	RS-422 compatible output indicating that power has been applied to SMB3315; see POWER_GOOD Signal on page 20.
P6	PWR_GOOD_N	
P7	GND	Board ground
P8	KEYLINE_B (N)	RS-422 compatible output for Transmit Keyline feature; see BUC Keyline Interface on page 22.
P9	KEYLINE_A (P)	
P10	GND	Board ground
P11	BUC_RXD_N	RS-422 input for receiving serial data from BUC; see BUC TX and RX on page 21.
P12	BUC_RXD_P	
P13	GND	Board ground
P14	BUC_TXD_N	RS-422 output for transmitting serial data to BUC; see BUC TX and RX on page 21.
P15	BUC_TXD_P	
P16	GND	Board ground
P17	CM_RESET_P	RS-422 input for reset function, see Reset on page 21.
P18	CM_RESET_N	
P19	GND	Board ground
P20	ENABLE_N (SEL1)	Pull to GND to enable the RS232 maintenance interface (P1/P3) and CM_RESET signals (P17/P18)

1.4.2 Maintenance Console TXD and RXD

Table 1-4 describes I/O header pins P1 (RS232 TXD) and P3 (RS232 RXD).

NOTE - I/O connector pins P1 and P3 are only active when ENABLE_N signal (pin P20) is connected to GND.

CAUTION: The maintenance console port provides a serial data connection for ST Engineering iDirect factory authorized personnel. Consult the ST Engineering iDirect TAC team before use.

Table 1-4. SMB3315 I/O Header Pins P1 and P3 Descriptions

Pin	Signal	Levels	Direction	Details
P1	RS232 TXD	RS-232	Output from SMB3315	Maintenance console RS-232 output from SMB3315
P3	RS232 RXD	RS-232	Input to SMB3315	Maintenance console RS-232 input from SMB3315

1.4.3 POWER_GOOD Signal

Table 1-5 describes I/O header pin P5 (PWR_GOOD_P) and P6 (PWR_GOOD_N). Table 1-6 describes the POWER_GOOD signal characteristics.

- The POWER_GOOD signals are discrete. The POWER_GOOD signal is active high (logic 1) for normal conditions and active low (logic 0) for no DC power.
- The POWER_GOOD circuit is generated by a resistive network with RS-422 compliant electrical levels. The circuit requires an RS-422 receiver with no load.

Table 1-5. SMB3315 I/O Header Pins P1 and P3 Descriptions

Pin	Signal	Levels	Direction	Details
P5	PWR_GOOD_P	RS-422 compatible	Output from SMB3315	Indicates if power is applied to the SMB3315 board or not.
P6	PWR_GOOD_N			

Table 1-6. POWER_GOOD Signal Characteristics

State	Signal Description
Power On:	[Open inputs] or (POWER_GOOD_P - POWER_GOOD_N) > 0.2 V (200 mV)
Power Off:	(POWER_GOOD_P - POWER_GOOD_N) < -0.2 V (200 mV) where POWER_GOOD_P is +Input (or logic 1) , POWER_GOOD_N is –Input (or logic 0)

1.4.4 BUC TX and RX

The serial I/O port provides serial data communications between the SMB3315 and a BUC via an RS-422 serial interface. Table 1-7 describes I/O header pins P11, P12, P14, and P15.

Table 1-7. SMB3315 I/O Header Pins P11, P12, P14, and P15 Descriptions

Pin	Signal	Levels	Direction	Details
P11	BUC_RXD_N	RS-422	Input from SMB3315	BUC OpenBMIP serial communication receives input data used for managing certain BUC types.
P12	BUC_RXD_P			
P14	BUC_TXD_N	RS-422	Output from SMB3315	BUC OpenBMIP serial communication transmits output data used for managing certain BUC types.
P15	BUC_TXD_P			

Table 1-8 describes the BUC TX and RX signaling characteristics.

Table 1-8. BUC TX and RX Signaling Characteristics

State	Signal Description
Receiving serial data from BUC:	(BUC_RXD_P - BUC_RXD_N) > 0.2V (200 mV)
No data from BUC:	(BUC_RXD_P - BUC_RXD _N) < -0.2V (200 mV) where BUC_RXD_P is +Input (or logical “1” (one)) , BUC_RXD _N is –Input (or logical “O” (zero))
Transmitting serial data to BUC:	(BUC_TXD_P - BUC_TXD_N) > 0.2V (200 mV)
No data transmitting to BUC:	(BUC_TXD_P - BUC_TXD _N) < -0.2V (200 mV) where BUC_TXD_P is +Input (or logical “1” (one)) , BUC_TXD_N is –Input (or logical “O” (zero))

1.4.5 Reset

This section describes I/O header pin P17 (CM_RESET_P) and P18 (CM_RESET_N). It also describes power and status connector pin P1 (RESET_N, refer to Power and Status Connector on page 16

NOTE - I/O connector pins P17 and P18 are only active when ENABLE_N signal (pin P20) is connected to GND.

The SMB3315 board has two types of reset functions: level 0 and level 1. Each type has a different effect on the SMB3315. Resets can be initiated by either the CM_RESET or the RESET_N signal.

The SMB3315 board reset is activated when the signal is low:

- No reset signal is asserted when CM_RESET_P is greater than CM_RESET_N.
- When CM_RESET_P is less than CM_RESET_N or RESET_N is pulled low (connected to GND), reset is asserted.

The two levels of reset are described below.

CAUTION: Level 1 reset must not be used unless there is an intent to return to the factory default. There is no recovery once this reset occurs.

Table 1-9. SMB3315 Two Levels of Reset

	Level 0	**Level 1**
Function	Basic reset function	The function depends on the VSAT network in which the SMB3315 will be deployed. • *Evolution/Velocity:* boot into the Unified Recovery mode (default options file, software, and passwords), access to the Unified Recovery Program is available at 192.168.0.1 or 192.168.1.1 • *Dialog:* boot with the factory default configuration
Initiated by	• Powering on the SMB3315 • Asserting the CM_RESET or RESET_N signal for > 0.3 ms and < 800 ms	Asserting the CM_RESET or RESET_N signal for more than 15 seconds
Recovery	Level 0 reset	No recovery! • *Evolution/Velocity*: new options file, software, and configuration must be loaded with the Unified Recovery Program • *Dialog*: settings have to be reconfigured

1.4.6 BUC Keyline Interface

This section describes I/O header pin P8 (KEYLINE_B (N)) and P9 (KEYLINE_A (P)).

1.4.6.1 Transmit Keyline Feature

NOTE - This feature is only applicable when using the SMB3315 in a Velocity™ VSAT network.

The Transmit Keyline feature allows the SMB3315 to reduce the BUC heat dissipation and power consumption by turning off the BUC Power Amplifier (PA) when the SMB3315 is not transmitting. When enabled, the SMB3315 may assert a Keyline signal when the SMB3315 is idle, as determined from data in the signaling message for the return channel (TX).

NOTE - The Transmit Keyline featureis only available if the SMB3315 has been properly integrated with a BUC that supports the Transmit Keyline signal.
The feature can be software enabled/disabled. It is by default disabled..

1.4.6.2 Transmit Keyline Signals

The Transmit Keyline feature uses a pair of differential hardware lines to indicate when the SMB3315 is transmitting on a burst-by-burst basis.

The Transmit Keyline outputs a differential RS-422 compatible signal to the BUC. The logic of KEYLINE signaling is described in Figure 1-4 and Table 1-10. The KEYLINE signal is active low. The BUC PA is enabled when there is a negative differential between KEYLINE_A and KEYLINE_B. Often the KEYLINE_A is referred to as the positive (P) and KEYLINE_B as the negative (N) signals.

Figure 1-4. Transmit Keyline Signals

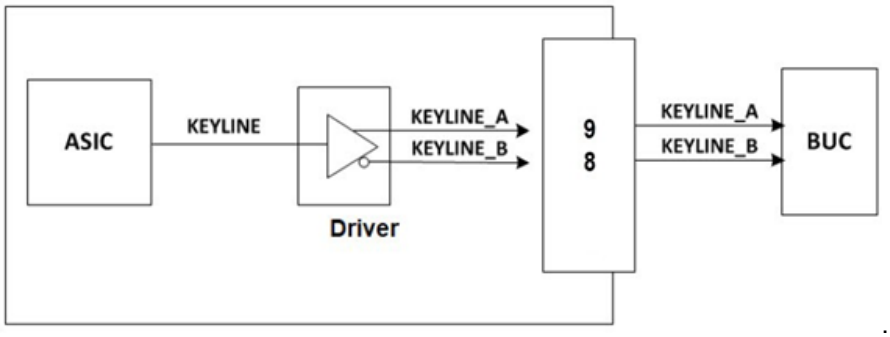


Table 1-10. Transmit Keyline Signal Descriptions

State of PA	Signal Description
PA On:	(KEYLINE_A - KEYLINE_B) > 0.2V
PA Standby:	(KEYLINE_A - KEYLINE_B) < -0.2V

1.5 Thermal Management

This section describes the thermal characteristics of the SMB3315 components and materials. It also presents guidelines for providing adequate cooling and thermal management. Integrators must review the data in this guide and perform thermal analysis based on their own system to determine appropriate thermal management methods.

This section contains the following topics:

- PCB Stackup Information on page 25
- PCB Material Information - Thermal on page 27
- Thermal Conductivity Numbers on page 28
- Thermal Characterization Test on page 31
- Power Dissipation of Components on page 29
- Using Soft Thermal Gap Pads on page 36
- Thermal Mounting Guidelines on page 37
- Reference Example on page 38

1.5.1 PCB Stackup Information

The PCBA is 1.6 mm +/- 0.2 mm thick and according to IPC-A-600 Class 2.

Table 1-11. PCB Stackup Information

Layer		Est. Final Thickness (um)	Usage	Material Thickness (um)	Cloth Style	Material	TG 170	Req. Dk (Er) @1 GHz
	soldermask	20		20		Sun Chemical	XV501T	3.3
L1	cu: foil 18 um + plating	40	SMD, signal&planes	18				
	prepreg: 1 x 2116	106		112	2116	Panasonic	R-1650V	4.4
L2	cu: 35 um	32	solid plane	35				
	core: 0.100 mm; 2116	100		100	2116	Panasonic	R-1755V	4.4
L3	cu: 35 um	32	solid plane	35				
	prepreg: 1 x 2116	105		112	2116	Panasonic	R-1650V	4.4
L4	cu: 18 um	15	signal&planes	18				
	core: 0.150 mm; 1501	150		150	1501	Panasonic	R-1755V	4.5
L5	cu: 18 um	32	signal&planes	18				
	prepreg: 1 x 2116	105		112	2116	Panasonic	R-1650V	4.4
L6	cu: 35 um	32	solid plane	35				
	core: 0.100 mm; 2116	100		100	2116	Panasonic	R-1755V	4.4
L7	cu: 35 um	32	solid plane	35				

Table 1-11. PCB Stackup Information (Cont.)

Layer		Est. Final Thickness (um)	Usage	Material Thickness (um)	Cloth Style	Material	TG 170	Req. Dk (Er) @1 GHz
	prepreg: 1 x 2116	105		112	2116	Panasonic	R-1650V	4.4
L8	cu: 18 um	15	signal&planes	18				
	core: 0.150 mm; 1501	150		150	1501	Panasonic	R-1755V	4.5
L9	cu: 18 um	15	signal&planes	18				
	prepreg: 1 x 2116	105		112	2116	Panasonic	R-1650V	4.4
L10	cu: 35 um	32	solid plane	35				
	core: 0.100 mm; 2116	100		100	2116	Panasonic	R-1755V	4.4
L11	cu: 35 um	32	solid plane	35				
	prepreg: 1 x 2116	106		112	2116	Panasonic	R-1650V	4.4
L12	cu: foil 18 um + plating	40	SMD, signal&planes	18				
	soldermask	20		20		Sun Chemical	XV501T	3.3

1.5.2 PCB Material Information - Thermal

The PCB material type is Panasonic R-1755V (FR4).

Table 1-12. Thermal PCB Material Information

Property		Unit	Test Method	Condition	Value
Glass transition temp. (Tg)		°C	DSC	As Received	173
			TMA		165
			DMA		190
Thermal decomposition temp. (Td)		°C	TGA	As Received	350
Time to Delam (T288)	Without Cu	Min.	IPC TM-650 2.4.24.1	As Received	>120
	With Cu				20
CTE: α1	X-axis	ppm/°C	IPC TM-650 2.4.24	< Tg	11-13
	Y-axis				13-15
	Z-axis				44
CTE: α2	Z-axis	ppm/°C	IPC TM-650 2.4.24	> Tg	255

1.5.3 Thermal Conductivity Numbers

Table 1-13 shows the thermal conductivity factors on the SMB3315 Satellite Modem Board.

Table 1-13. SMB3315 Thermal Conductivity Factors

Material	K (W/mK)
Copper	355.00
Aluminum	175.00
FR4	0.25

1.5.4 Power Dissipation of Components

This section describes part numbers and thermal parameters for the SMB3315 can be used in a thermal analysis. Figure 1-5 identifies the thermal dissipating critical components and Table 1-14 identifies their rmaximum power dissipation.

- The maximum allowable component temperatures are maximum operating temperatures from component datasheets.
- The maximum listed board total power dissipation includes an additional 2.7W dissipation which can be considered spread across components under the RF Can.

Figure 1-5. SMB3315 Thermal Dissipating Critical Components

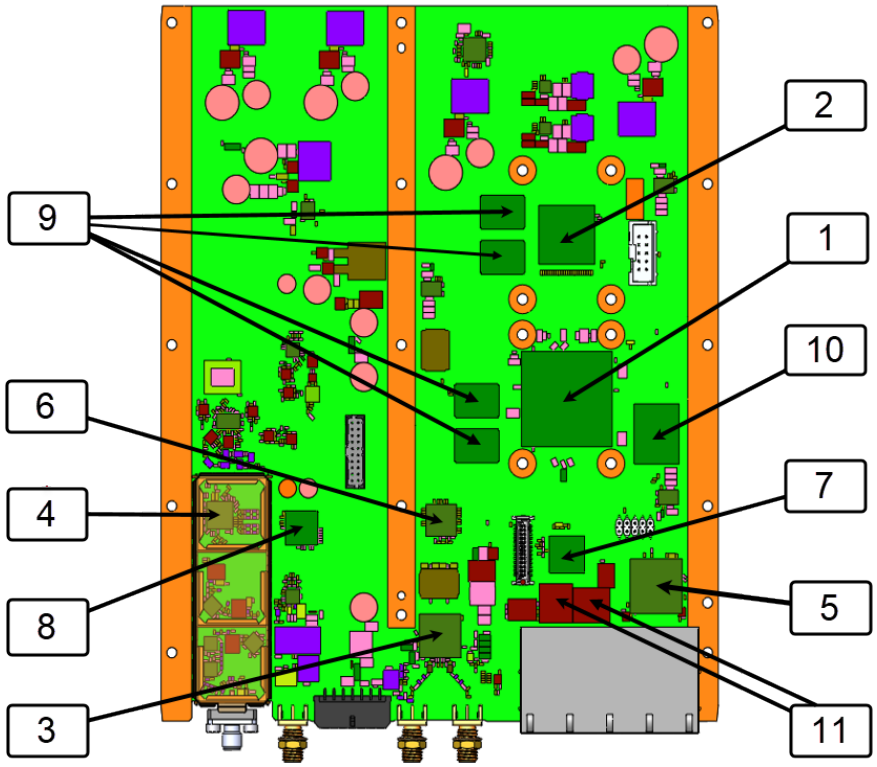


Table 1-14. Descriptions of SMB3315 Thermal Dissipating Critical Components

Ref Num	Ref Designator	Device	Part Number	Max Power dissipation (W)	Tja (no airflow)	Rjc K/W	Rjb K/W	Tj min & max	Ta min & max
1	U201	CPU/FPGA	10AS016E3F29I2SG	5.8		0.42	2.7	-40 to 100°c	
2	U400	CPU	88F6820-XX-BRT4I160	4.4		2.57	6.86	-40 to 115°c	
3	U2801	Demodulator	STID135WB	3.5		4.13	6.96		-40 to 85°c
4	U209	Modulator	ADRF6755ACPZ	2.1				max 125°c	-40 to 85°c
5	U3101	Ethernet switch	88E6352-XX-TFJ2I000	2.0	24.8	7.7	15.5	max 125°c	-40 to 85°c
6	U301	Clock Generator	SI5341A-D-GM	1.0	22	9.5	9.3	125°c max	-40 to 85°c
7	U7	MAX10 FPGA	10M08SAU169I7	1.0	41.6	11.2	24.8	-40 to 125°c	
8	U2991	DAC	DAC37J82	0.8	31.4	1.8	12.6	-40 to 105°c	-40 to 85°c
9	U301/ U302/ U401/ U402	DDR3 DRAM	MT41K256M16TW-107 IT	0.3	34.3	6.4	15		-40 to 95°c
10	U2401	EMMC Flash Memory	MTFC4GACAAAM-1M-WT	0.3		(*)	(*)		-40 to 85°c
11	U2403/ U2405	QSPI Flash memory	MX66L1G45GMI-10G	0.2		(*)	(*)		-40 to 85°c

(*) low to none cooling requirements

Total Component Power Dissipation 21.3W
Maximum Total Power Dissipation 24.0W

1.5.5 Thermal Characterization Test

The following test setup was used:

- Thermal characterization was performed on the SMB3315 as a standalone board without enclosure
- Thermocouples were attached to measure the case temperatures of the most critical components as determined by DFMEA
- A box was placed over the unit under test to minimize airflow and mimic natural convection
- The temperature inside the box was set to the desired temperature by controlling the temperature of the chamber

The board was put into Velocity and Dialog networks and was sending and receiving traffic.

Velocity

- Upstream:8PSK6/7, 7.5 Mbaud, and 6.1 Mbps/2.5 kpps
- Downstream: 16APSK, 8/9 45 Mbaud, and 25 Mbps/6.1 kpps

Dialog

Forward:

- Bitrates: Full auto bitrate
- MODCOD: 64APSK 4/5
  Symbol Rate: 43
- MODCOD: 32APSK 9/10
  Symbol Rate: 40

Figure 1-6, Figure 1-7 and Table 1-15 show temperatures that were recorded on the most critical components of the standalone board.

Figure 1-6. Locations of Recorded Case Temperatures - Top Side of Board

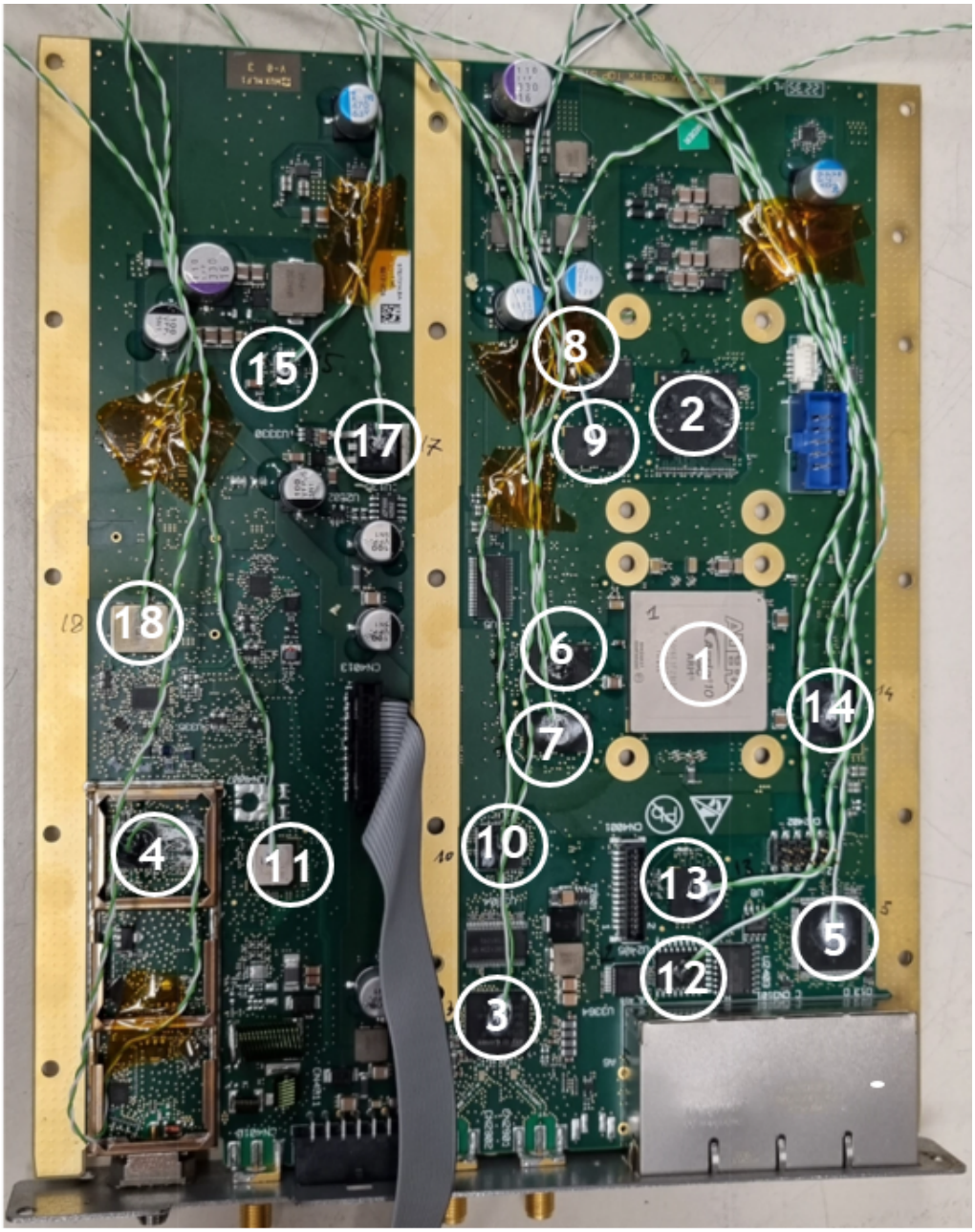


Figure 1-7. Locations of Recorded Case Temperatures - Bottom Side of Board

Table 1-15. Recorded Case Temperatures

Reference Number	Reference Description and Component	Temperature (°C) in Velocity Network		Temperature (°C) in Dialog Network
		Board only	Mounted in Enclosure (Ambient: 25°C)	Mounted in Enclosure (Ambient: ~48°C)
1 (thermocouples not visible in photos)	U201 Arria 10	92.6	50	73.7
2 (thermocouples not visible in photos)	U400'Dual-core ARM CPU	63.2	42.5	72.2
3	U2801 Demodulator	44.3	43.6	81.2
4	U209 Modulator	60.3	48.7	82
5	U3101 Ethernet transceiver/switch	34.5	38.7	73.8
6	U301 DRAM 4G DDR3	54.4	38.8	74
7	U302 DRAM 4G DDR3	52.6	38.1	74.7
8	U401 DRAM 4G DDR3	49.6	39.8	72.6
9	U402 DRAM 4G DDR3	49.5	39.0	72.8
10	U3301 Clock generator	48.0	45.0	83.2
11	U2991 16-bit DAC	48.1	48.5	73.2
12	U2405 1 GB flash memory	39.6	38.7	74.3

Table 1-15. Recorded Case Temperatures (Cont.)

Reference Number	Reference Description and Component	Temperature (°C) in Velocity Network		Temperature (°C) in Dialog Network
		Board only	Mounted in Enclosure (Ambient: 25°C)	Mounted in Enclosure (Ambient: ~48°C)
13	U7 MAX 10 field FPGA	60.3	41.9	79.4
14	U2401 eMMc	45.0	36.2	71.2
15	U3328 24/12 V downconverter	45.8	39.9	76.3
16	U18 12 V downconverter	43.4	38.4	72.5
17	U134 MOSFET	42.4	36.8	78.9
18	CR3 TCOCX	43.6	36.8	72.2

1.5.6 Using Soft Thermal Gap Pads

The optimal orientation for thermal contact is the top side of the board (top cooled).

When large tolerances cannot be avoided, soft thermal gap pads provide an effective solution. The thickness (and resistance) should be kept as small as possible. Many thermal gap pads need a 25% +/- 5% compression to function correctly.

> ***CAUTION:*** ST Engineering iDirect strongly advises that gap pads should NOT be reused after disassembly.

Consider the theoretical tolerances and the physical parts that can vary due to CNC setting material warp behavior or contaminations. St Engineering iDIrect recommends visualizing the correct compression by prototyping and disassembly.

Figure 1-8. Example of Pad Local Deformation and Compression

Where thermal interface materials are needed, we have obtained good results with the following soft thermal gap pads.

Table 1-16. Soft Thermal Gap Pads

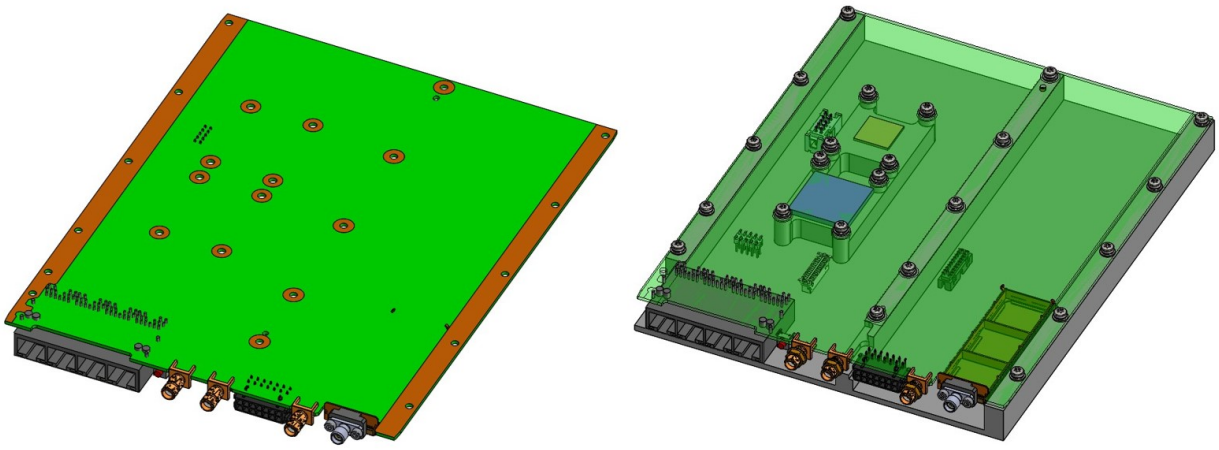
Soft Thermal Gap Pad	Thermal Phase Change	Thermal Grease	Thermal Gap Filler
Tflex 740 (5 W/mK) *	Tmate 2905c *	KP97 (5 W/mK)	Tputty 607 (6.4 W/mK)
XPHTTF-S1865 (6 W/mK)		KP98 (6 W/mK) *	
Shin Etsu TC-CAD- 10 (3.2 W/mK)		G-751 (4.5 W/mK)	

* These materials are commonly used within ST Engineering iDirect.

1.5.7 Thermal Mounting Guidelines

The best thermal results are obtained with a proper mounting sequence and torque. Refer to Mounting Recommendations on page 40 for more information.

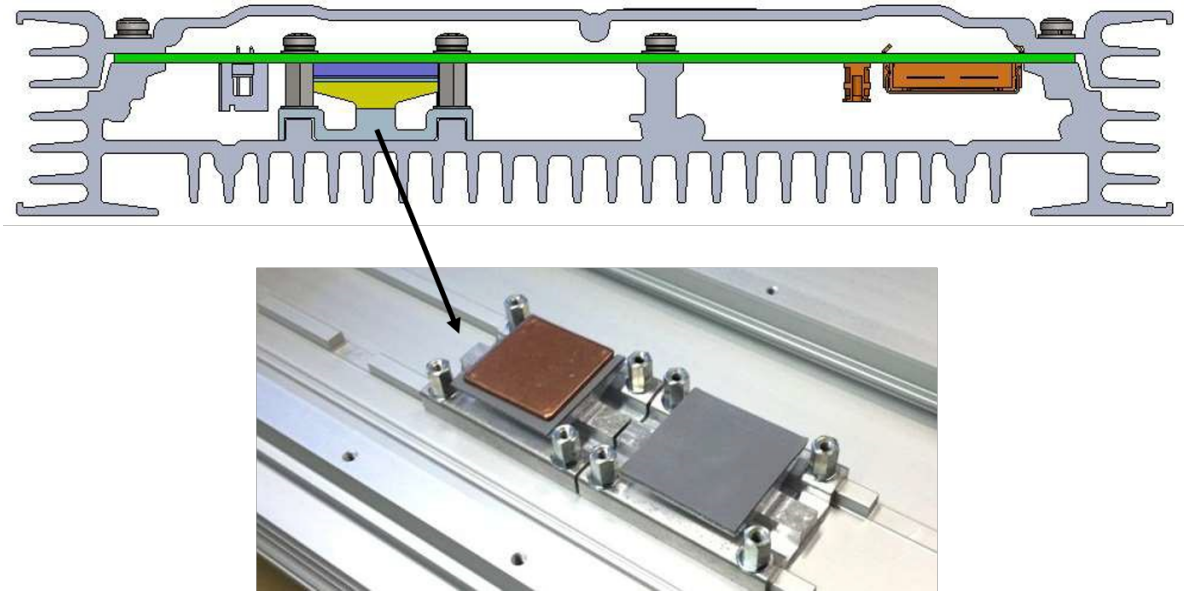
Figure 1-9. Thermal Mounting Guidelines



1.5.8 Reference Example

A reference example of integration is shown in Figure 1-10. The aluminum heatsink has soft gap pads to catch basic tolerances. A copper spreader distributes the heat on top of the processor.

Figure 1-10. Reference Example of Integration



1.5.8.1 FPGA to Heatsink

The dimensions of the FPGA are:

- W x D = 29 mm x 29 mm
- H (package + BGA) = 2.50 mm with a +/- 0.15 mm tolerance

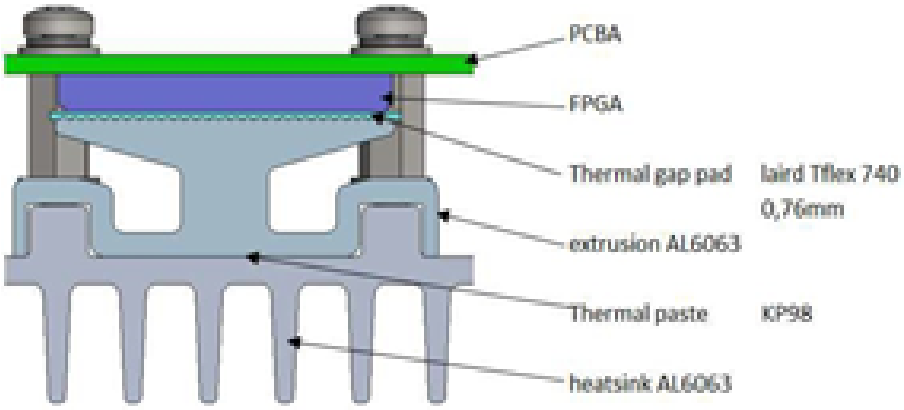
Due to general mechanical tolerances and the variation of the FPGA total height we recommend using a soft thermal gap pad with the following specifications:

- Thickness = 1.00 mm; in assembly this should correspond with a compression of 25% +/- 5%.
- Minimum thermal conductivity = 4.50 W/mK; we recommend 6.00 W/mK.

1.5.8.2 Reference Example

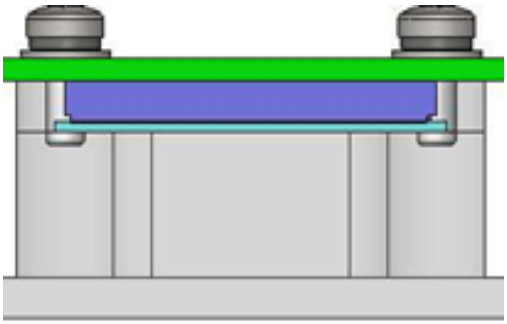
The wave structure in the 6063 aluminum extruded housing aims to overcome possible tolerances from mechanical parts, PCB warpage, and physical package height.

Figure 1-11. Wave Structure in Aluminum Extruded Housing



1.5.8.3 Integration Example

Figure 1-12. Integration Example



1.6 Mounting Recommendations

This section includes the following information:

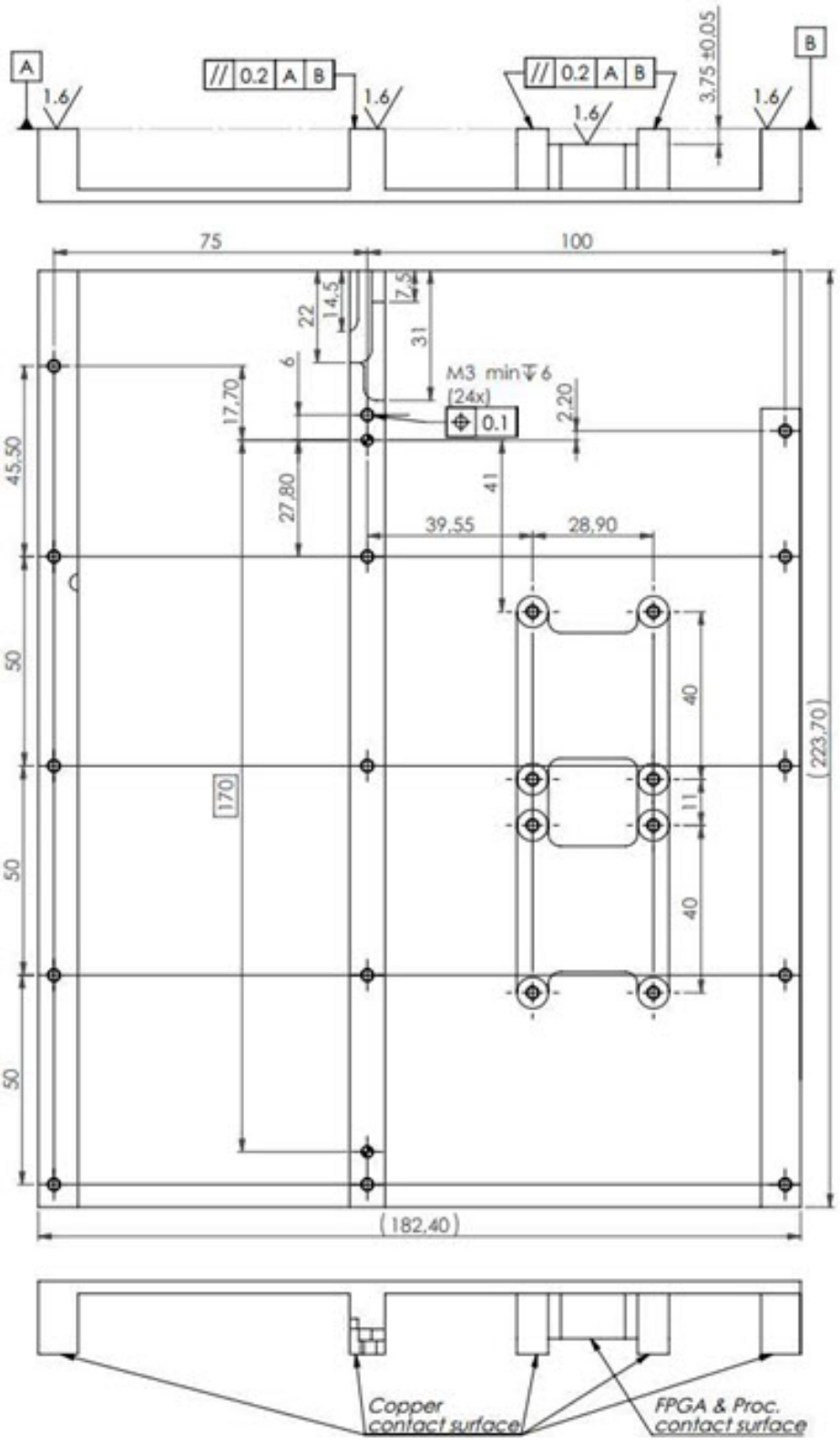
- PCB Surface Contact on page 40
- Mounting Holes and Tolerances on page 42
- Recommended Mounting Sequence on page 43
- Securing RF Connections on page 45

1.6.1 PCB Surface Contact

To have good thermal contact with the three copper strips, we recommend an enclosure with a surface roughness of Ra 1.6. Keeping the many surfaces of the PCBA within tolerances will reduce the possible thermal resistance and deviations between different integrations.

NOTE - The 3.75 mm dimension between the PCBA level and the thermal gap pad is a guide value. The correct dimension for your integration should be chosen carefully and physically verified.

Figure 1-13. PCB Surface Contact



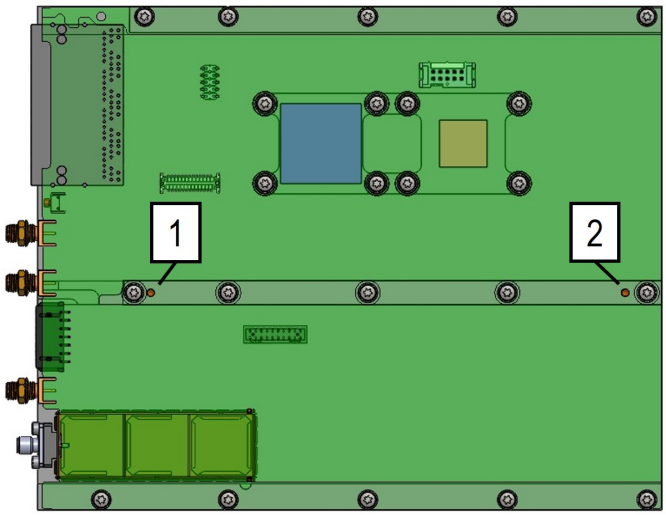
1.6.2 Mounting Holes and Tolerances

Standard mounting holes M3 can be used. We advise to foresee a minimum depth of 2x D (6 mm) in soft materials. The maximum position tolerance is 0.15 mm; most CNC machines can obtain 0.1 mm. To mount each PCBA in the same position, there are two holes in the PCBA for alignment purposes using DIN7 / DIN6325 dowel pins:

1 1x D 2.55 mm

2 1x D 2.55 x 0.5 mm (slotted)

Figure 1-14. Mounting Holes



To fix the PCBA, we recommend using:

- M3 metric screw, min. 8 mm long, min. class 8.8,
    - Minimum torque = 0.75 Nm
    - Recommended torque = 1.2 Nm
- Spring washer DIN127,
- Flat washer DIN125A.

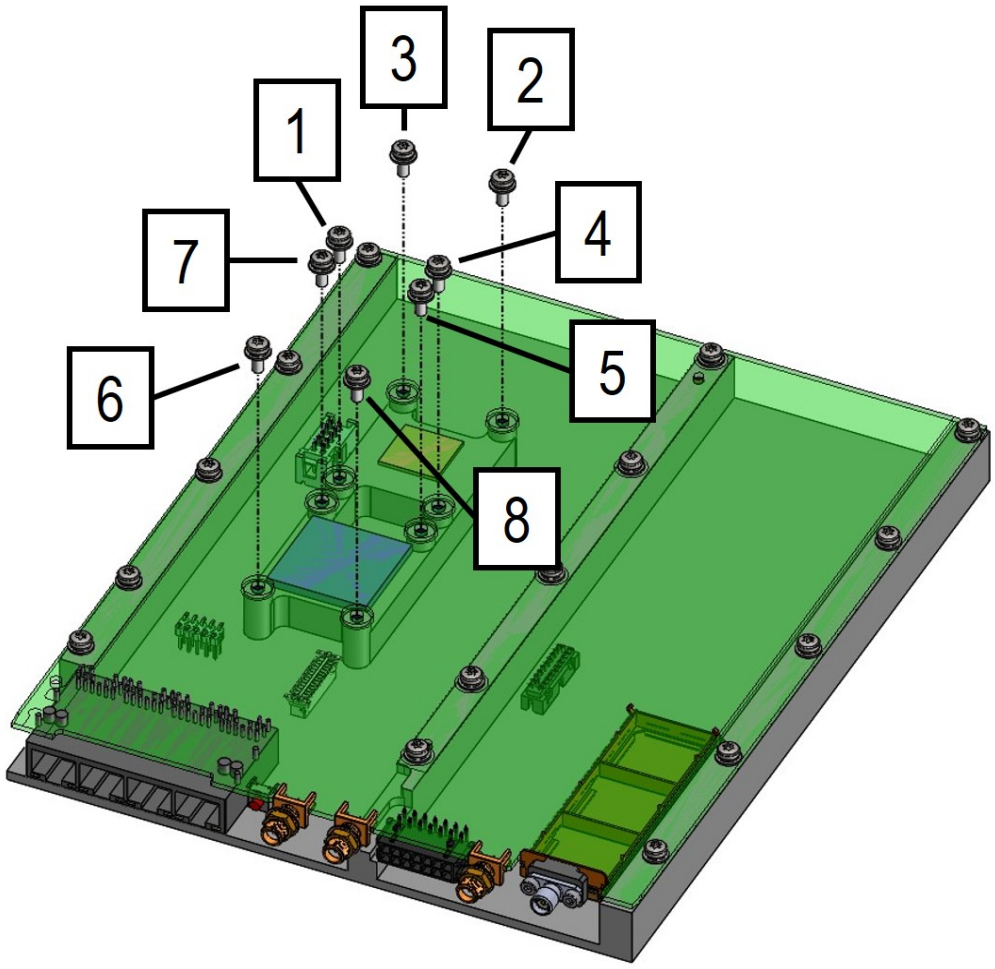
The screw and washers are shown in the following picture:

1.6.3 Recommended Mounting Sequence

The recommended sequence to mount the PCBA is shown below.

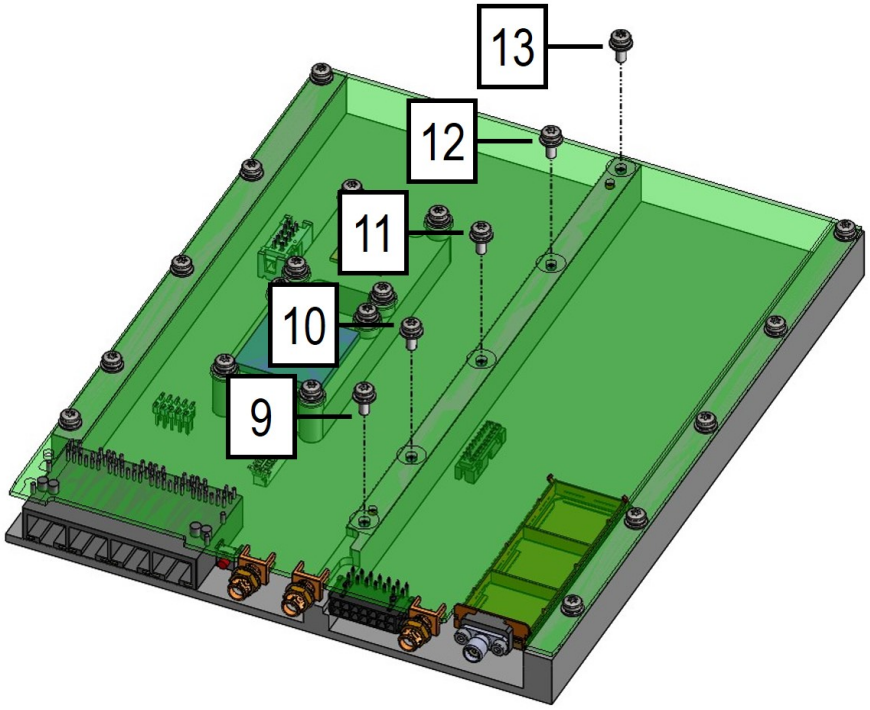
1 Fix the eight screws of the FPGA and processor in diagonal order to obtain good thermal contact.

Figure 1-15. Fix Eight Screws of the FPGA and Processor



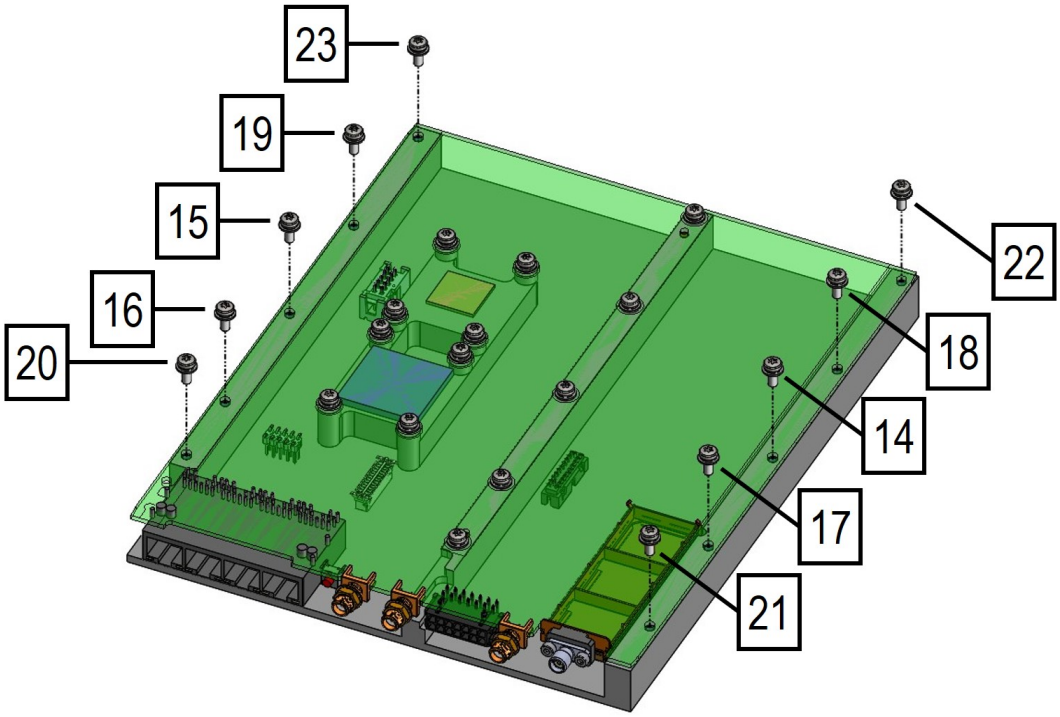
2 Fix the five screws in the middle of the board (rib). The order of fixing the screws is shown in Figure 1-16.

Figure 1-16. Fix Five Screws in Middle of the Board



3 Fix the ten screws at the side of the board in diagonal order to distribute the forces over the PCBA.

Figure 1-17. Fix TenScrews at Side of the Board

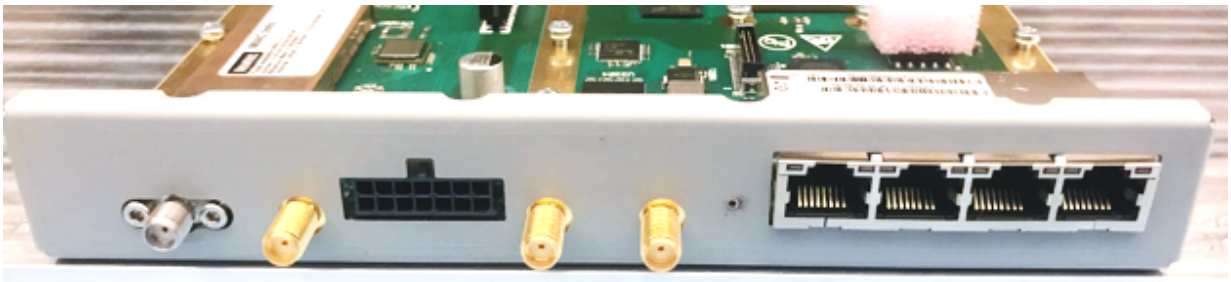


1.6.4 Securing RF Connections

The RF connectors should be secured onto the enclosure's rear panel into which the SMB3315 is integrated. Fix the connectors with a washer and nut, applying a torque of 0.9 Nm.

If the RF connectors cannot be secured onto the rear panel, they should be secured onto the base of the enclosure with a bracket like the one in Figure 1-18. The bracket must be secured onto the base of the enclosure.

Figure 1-18. Example of RF Connectors Secured Onto Enclosure Base With Bracket



1 Hardware Integration Checklist

The following provides a brief checklist to help with integrating an SMB3315 Satellite Modem Board in a terminal system:

1. Discuss the implementation with ST Engineering iDirect representatives. Ensure the use cases and service plans are consistent with the hardware and software capabilities of the SMB3315 Satellite Modem Board. See Getting Help on page viii.

2. Ensure the facilities, area, vehicle, or craft, where the terminal will be installed matches the specifications of the SMB3315 Satellite Modem Board. See Specifications on page 3.

3. Determine whether the SMB3315 Satellite Modem Board will be:

   • Stationary - always in one place;

   • Itinerant (Communications-on-the-Pause (COTP)) - in a mobile building, maritime platform, news, laboratory, military, or medical/dental facilities/vehicles, as examples; where the SMB3315 Satellite Modem Board and housing will periodically move; or

   • Moving vehicle (Communications-on-the-Move (COTM)) - typically, moving on land or sea; a chassis must be provided that will secure the SMB3315 Satellite Modem Board.

4. Implement an appropriate enclosure or chassis to house and protect the SMB3315 Satellite Modem Board, for example:

   • IP67 weatherproof enclosure in damp/maritime/non-equipment room locations;

   • Case for desktop mounting for an office location;

   • Rack mounting for a teleport/data center location; and

   • Proper chassis grounding.

5. Verify all interface connectors are properly connected and configured to power and support the board. See Physical Interfaces Overview on page 15.

6. When testing the product, ensure the appropriate ST Engineering iDirect release of software is used on the SMB3315 Satellite Modem Board. See Getting Help on page viii.

7. When a pre-release software and hardware is requested, it is the responsibility of the integrator's System Engineer to work with ST Engineering iDirect. See Getting Help on page viii.

8. Data communication test equipment and/or other test devices may be required to complete and test an integration, depending on the use of the terminal, VSAT network, satellite simulators, and so on.

For information on using the SMB3315, refer to the system documentation for the corresponding product line.

A Reference Enclosure

The reference enclosure used is a 6063 aluminum extruded housing that has:

- A large finned top cover making contact with the PCBA and the top of the FPGA and processor
- A bottom cover pressing the PCBA side strips against the top housing
- A rear panel securing the RF connectors
- A front panel

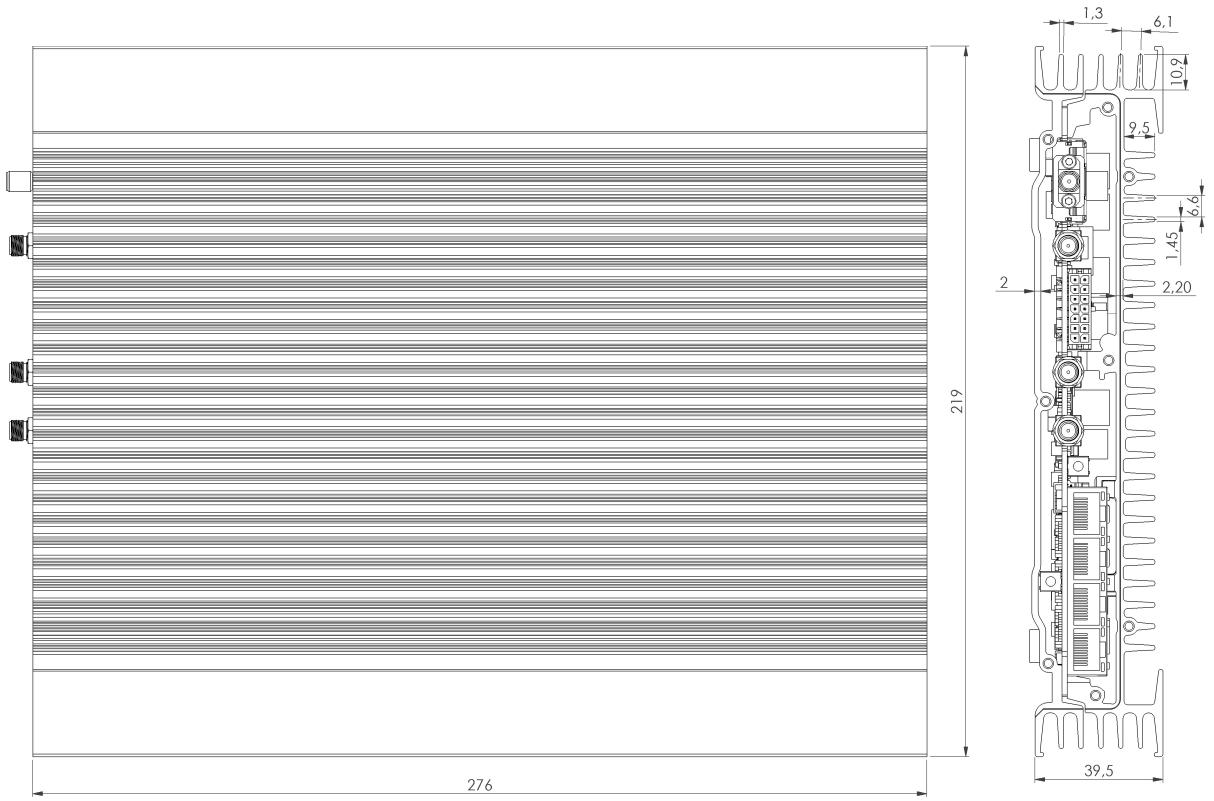
Figure A-1. Reference Enclosure - Top VIew

Figure A-2. Reference Enclosure - Side VIew

NOTE - The flat cable is connected to the I/O header.

The dimensions of the reference enclosure are shown in Figure A-3.

Figure A-3. Reference Enclosure DImensions



A CTEAR Verification Support Commands

CTEAR verification support commands enable integrators to test the I/O functionality and thermal performance of an SMB3315 board for integration and manufacturing test of their terminal components.

NOTE - The CTEAR Verification Support Commands are only applicable when using the SMB3315 in a Velocity™ VSAT network.
Ensure the SMB3315 is installed in an environment that is compliant with the integration guide installation requirements.

This chapter contains the following sections:

- Logging into the Remote on page 52
- Enabling CTEAR Support Commands on page 53
- CTEAR Support Commands on page 54
- CTEAR Tx Commands on page 55
- CTEAR Rx Commands on page 57
- CTEAR BERT Commands on page 58
- CTEAR BUC Commands on page 60
- CTEAR GPIO Commands on page 61
- CTEAR HWMON Command on page 62
- CTEAR LED Commands on page 63
- CTEAR Stress Test Commands on page 64

A.1 Logging into the Remote

Once the remote is powered up, the user will see the boot process displayed on the console screen.

Log in to the remote using the following credentials:

- iDirectCM login: root
- Password: P@55w0rd!

A standard Linux command prompt is displayed once the user logs in.

A.2 Enabling CTEAR Support Commands

Start CTEAR from the Linux console.

1 From the Linux prompt, type the following:

```
startctear.sh.
```

2 Login as follows:

- User: admin
- Password: iDirect

A standard Linux command prompt is displayed once the user logs in.

NOTE - On the CTEAR console, type **help** to view the complete list of available commands with their parameters.

Table A-1. Enable CTEAR Command and Description

Command	Description
On	Feature enabled
Off	Feature disabled
0	Logic low
1	Logic high
Mod	Modulation scheme
FrqM	Frequency in MHz
SR	Symbol rate
Frequency	Select frequency from 950-1950
Thres	Threshold
Int	Log-base-10 of the bits per interval
BW	Bandwidth

A.3 CTEAR Support Commands

Table A-2. CTEAR Support Commands

Signal	Level	Direction	Description	Test	Console Commands and Arguments	Expected Result
+15 to +32 VDC	+24 VDC Nominal	Input to SMB3315	Power	Board provides function to maximize power dissipation for thermal testing or analysis.	None	Board boots.
Reset	Open Drain with Pull-Up	Input to SMB3315	Depending on duration of assertion, this signal can trigger a reset or factory default initialization.	Trigger a reset when this is pulled low; observe reset behavior on console.	None	Short reset (< 10 seconds) triggers a normal cold boot. Long reset (>15 seconds) triggers factory reset.
LAN 1 - 4	1000 Base-T	Input & Output	Data and control interface.	Connect Ethernet cable.	None	Ping to and from remote.

A.4 CTEAR Tx Commands

CTEAR TX commands, which are shown in Table A-3, provide control of the transmitter. Table A-4 contains a glossary of TX command parameters.

NOTE - The DVB-S2 and DVB-S2x commands entered by themselves display a list of supported MODCODs, frame length, and pilot combinations.

Table A-3. CTEAR TX Commands

Command	Description
tx cw [on/off]	Set transmitter simple carrier on or pn (cw off).
tx freq [freq]	Set transmitter frequency in MHz.
tx ifl [freq] on	Enable 10 or 50 MHz reference from transmit IFL.
tx ifl off	Disable reference signal from transmit IFL.
tx mute	Get state of combined mute inputs.
tx power [pwrval]	Set transmit power.
tx atten [A] [V]	Set transmitter attenuator bits.
tx dvbs2 [Mod] [Cod] [FL] [PC] [SR] [RO]	Begin transmitting a DVB-S2 modulated carrier with given parameters.
tx dvbs2x [Mod] [Cod] [FL] [PC] [SR] [RO]	Begin transmitting a DVB-S2X modulated carrier with given parameters.
tx pn [bpsk/qpsk/8psk] [SR]	Set transmit pseudo-random carrier to the given modulation and symbol rate.

Table A-4. Glossary of TX Command Parameters

Command	Description
Mod	Modulation type: qpsk, 8psk, 16apsk, and so on.
Cod	Error coding: 1/4, 1/3, 2/5 and so on.
FL	Frame length: normal, short.
PC	Pilot config: non-pilot, pilot.

Table A-4. Glossary of TX Command Parameters (Cont.)

Command	Description
SR	Symbol rate: # in Symbols/second.
RO	Roll-off percentage: 3, 5, 10, 15, 20, 25, 35

A.5 CTEAR Rx Commands

CTEAR RX commands provide control of the SMB3315 receivers. There are two receivers, each of which has a single tuner. The commands interact with one receiver at a time through the selected command.

Table A-5. CTEAR Rx Commands

Command	Description
tx cw [on/off]	Set transmitter simple carrier on or pn (cw off).
rx select [rx] [tuner] [demod]	Select a receiver and activate the given tuner and demodulator. The selection of a different receiver/tuner/demodulator combination does not disable the previous selection.
rx freq	Set the search frequency in MHz.
rx ifl [idx] [freq] on	Enable 10 or 50 MHz reference for the given IFL (1 or 2).
rx ifl [ids] off	Disable reference signal on given IFL.
rx iflrx [ifl] [rx]	Connect the given IFL (1 or 2) to the given receiver (1 - 4).
rx sr [sr]	Set the search symbol rate in SPS.
rx power	Read receive signal strength. The receiver should be locked on a carrier first.
rx search [start/state]	Start search for a signal or provide status of search.
rx peek [address]	Raw read of a receiver register.
rx poke [address] [value]	Raw write to a receiver register.
rx status	Read overall receiver status.
rx temp [all]	Read the temperature of this or all receivers.
rx lock1 [0/1]	Set state of RX_LOCK1 line.
rx lock2 [0/1]	Set state of RX_LOCK2 line.
rx tsmode [on/off]	Turn transport stream on or off. Only one receiver at a time can feed the BERT. This command is used to ensure all but the BERT receiver do not produce data.

A.6 CTEAR BERT Commands

The Bit Error Rate Test (BERT) commands, which are shown in Table A-6, are a tool to validate operation of the transmitter and receivers. Table A-7 shows the glossary of BERT command parameters.

Table A-6. CTEAR BERT Commands

Command	Description
bert pls [type] [mod] [coding]	Set Physical Layer Signaling. Entering **bert pls** by itself will produce a list of valid DVB-S2 and DVB-S2X PLS combinations.
bert rf [freq] [sr] [rx] [ifl]	Configure transmitter and receiver for BER Testing. A default frequency of 1200 MHz, symbol rate of 2 MSPS, Rx 1 and IFL 1 will be used if **bert rf** is entered without arguments.
bert init	Start the actual BER test. The transmitter and receiver must have been set up via tx and rx commands or via the **bert rf** command above.
bert lock	Check BERT lock status.
bert stats	Display statistics from the present BER test.
bert stop	Stop the present BER test.
bert info	Display the present BERT configuration. This command is a convenient way to retrieve board information such as remote serial number, MAC address, and basic build data.

Table A-7. Glossary of BERT Command Parameters

Command	Description
coding	Error coding: 1/4, 1/3, 2/5 and so on.
err_thresh	Error Threshold or number of errors allowed before SYNC drop.
freq	Transmit/Receive frequency in MHz.
interval	10 ^ interval is the number of bits in an interval.
mod	Modulation type: qpsk, 8psk, 16apsk, and so on.
pls	Physical Layer Signaling code.

Table A-7. Glossary of BERT Command Parameters (Cont.)

Command	Description
rx	Receiver (1 - 4).
sr	Symbol Rate in MSPS.
type	Modulation type: DVBS2 or DVBS2x.

A.7 CTEAR BUC Commands

CTEAR BUC commands provide access to the BUC control signals.

Table A-8. CTEAR BUC Commands

Command	Description
buc filter [on/off] [27]	Set BUC filter control lines.
buc keyline [on/off] [inv]	Set state of key line signal to BUC. The sense can be inverted using the optional inv argument.

A.8 CTEAR GPIO Commands

CTEAR GPIO commands are not supported by the SMB3315.

A.9 CTEAR HWMON Command

This CTEAR HWMON command provides access to the hardware monitor, which in this case is the temperature status.

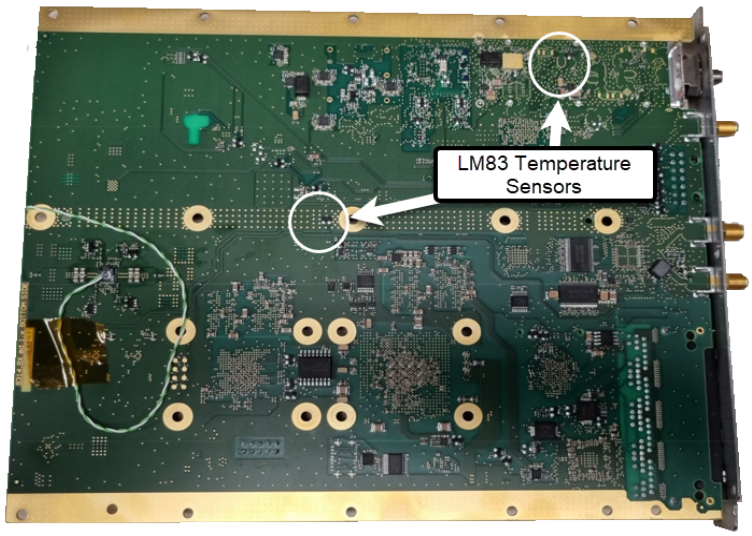
Table A-9. CTEAR HWMON Command

Command	Description
hwmon temp	Collects the readings from all available temperature sensors.

Table A-10. CTEAR HWMON Command Field Descriptions

Field	Description
LM83	These temperature sensors read the approximate temperature of the PCB. The temperature range for this device is -25 to 125C. See Figure A-1 for the location of these sensors.
Modulator	Refer to U209 inTable 1-14 in Power Dissipation of Components.
Heatsink	This refers to a temperature sensor, T2712, near the heatsink. The T2712 temperature sensor is near the center of the board on the bottom side and is used for development. This is simply a transistor used as a sensor an has no applicable power dissipation or temperature range.
Arria10	Refer to U201 inTable 1-14 in Power Dissipation of Components.
Exar	This sensor reads the junction temperature in the range of -40 to 125C.

Figure A-1. Locations of LM83 Sensors



A.10 CTEAR LED Commands

CTEAR LED commands allow control of each individual front panel LED and control the chase sequence.

Table A-11. CTEAR LED Commands

Command	Description
led all [on/off]	Turns all front panel LEDS on or off.
led power [on/off]	Control power LED.
led rx [on/off]	Control rx LED.
led tx [on/off]	Control tx LED.
led eth1 [on/off]	Control Ethernet 1 LED.
led eth2 [on/off]	Control Ethernet 2 LED.
led eth3 [on/off]	Control Ethernet 3 LED.
led eth 4 [on/off]	Control Ethernet 4 LED.
led warning [on/off]	Control Warning LED.
led chase [on/off]	Enable or disable LED chase sequence.

A.11 CTEAR Stress Test Commands

CTEAR Stress Test commands start processor stress tests.

Table A-12. CTEAR Stress Test Commands

Command	Description
stresstest [on/off]	Starts/stops Stress Test.
stresstest status	Displays the Stress Test running status.
stresstest result	Displays the output of Stress Test commands.
stresstest thermal-sensor-report	Displays the Stress Test thermal sensor report.

A Updating the Software using the Command Line

When the Web UI is not operational or is inaccessible, a software package can be manually loaded to the remote using the command line.

NOTE - This procedure is only applicable when using the SMB3315 in a Velocity™ VSAT network.

A.1 Prerequisites

- PC running a terminal emulator (TeraTerm 4.98 or equivalent)
- TFTP server (Tftpd64 or equivalent running on a PC). In this example, the TFTP server address is 192.168.1.100
- Serial console port cable
- Ethernet cable
- Power supply
- Software package. For example: v3315_SMB3315_rootfs_urt_3.3.1.0-7156.pkg

A.2 Configuration

1 Open terminal emulator and configure it for 115200 BPS, 8 bits, no parity, and no handshaking.

2 Connect the console cable between the remote and the PC.

3 Connect the power supply to the remote.

4 Connect the Ethernet cable between the PC and remote.

NOTE - There are two Ethernet Ports that can be accessed externally as LAN1 and LAN2. Connect to LAN1 which corresponds to eth0 at the Linux level.

5 Copy the software package to the /tmp directory using WinSCP or a TFTP server.

6 Power cycle the remote.

7 Wait for the boot to complete.

8 Log into the console using the following credentials:

- user: root
- Password: iDirect

9 Determine the active partition using the following command from Linux. The output indicates the active partition.In the example, this is partition 5.
rdev

10 Select the installation partition. Partition 5 or 6 can be active and backup partitions depending on which partition is active. In the example, partition 5 is active.

A.3 Installation

1 Download the software package to /tmp directory using the following commands:

```
cd /tmp
tftp -g 192.168.1.100 -r v3315_SMB3315_rootfs_urt_3.3.1.0-7156.pkg
```

2 Decompress the install package using the following commands:

```
mkdir temp cd temp
package -mx -a ../v3315_SMB3315_rootfs_urt_3.3.1.0-7156.pkg
```

3 Install the package on Partition 5 (/dev/mmcblk0p5), the backup partition, using the following command:

```
sh package_install.sh /dev/mmcblk0p6 cd /tmp
```

4 Switch to the new partition using the following command:

```
flashdbmgr --set 6 5
```

5 Reboot the remote using the following command:

```
reboot
```

Once the remote is rebooted, the updated software is ready for use.

A.4 Example

```
iDirect v3315 remote iDirectRMT /dev/ttyS0

iDirectRMT login: root Password:

root@iDirectRMT:p5 ~ # cd /tmp

root@iDirectRMT:p5 tmp # tftp -g 192.168.1.100 -r v3315_SMB3315_rootfs_urt_
3.3.1.0-7156.pkg

v3315_SMB3315_rootfs 100%

|**************************************************| 69.1M 0:00:00 ETA
root@iDirectRMT:p5 tmp # mkdir temp

root@iDirectRMT:p5 tmp # cd temp

root@iDirectRMT:p5 temp # package -mx -a

../v3315_SMB3315_rootfs_urt_3.3.1.0-7156.pkg

SavePackage: [2FE2] boardModel.xlate (24)...Saved. SavePackage: [13A9]
package_summary.xml (1087)...Saved. SavePackage: [0BB3] install_file_map
(327)...Saved.

SavePackage: [181E] version (29)...Saved. SavePackage: [CFF5] sw_compat
(2)...Saved. SavePackage: [E707] postinstall.sh (472)...Saved.

SavePackage: [247F] SMB3315_rootfs.tar.bz2 (58147357)...Saved.

SavePackage: [7394] package_install.sh (41962)...Saved. SavePackage: [1D43]
image.bin (14352838)...Saved.

SavePackage: [4152] idirect-release (34)...Saved. SavePackage: [7EAB]
package.signatures (5980)...Saved. SavePackage: [45B3] package.sig
(5940)...Saved.

SUCCESS saved package contents to ./

root@iDirectRMT:p5 temp # sh package_install.sh /dev/mmcblk0p6

========= Base Rootfs Package Installation script starting =========
Skipping unmount of /dev/mmcblk0p6 partition: DONE Preparing mount point for
/dev/mmcblk0p6 partition: DONE Determining board model/hardware family: DONE

Ensure we have all required files: DONE Partition name is mmcblk0p6

Delete /common/pkgDb/mmcblk0p6: DONE

Recreating filesystem at /dev/mmcblk0p6: DONE

Mounting /dev/mmcblk0p6 partition: DONE

Checking free space: DONE
```

```
Installing tar archive: SMB3315_rootfs.tar.bz2: DONE Running flashdbmr to
collect the current database

Create directories in /tmp/temp/mntPoint.Z21Ns9. NONE Installing files in
/tmp/temp/mntPoint.Z21Ns9.

/etc/idirect-release DONE

/pkg/v3315_SMB3315_rootfs_urt_3.3.1.0-7156/version DONE

/pkg/v3315_SMB3315_rootfs_urt_3.3.1.0-7156/package_summary.xml DONE Create
required sym-links: NONE

Setting up SSH keys: DONE

Copying user SSH config: DONE

Enabling Unified Recovery Partition: DONE Running package postinstall
scriptlet:

Board Model: 176

Selected Remote type is 3315 Updating SPI flash FPGA image with

/tmp/temp/mntPoint.Z21Ns9/opt/share/Fpga_smb3310_00.rbf.mkimage.bz2.

Writing /tmp/idirect_flash_updater-XXXXoAJAYo/Fpga_smb3310_00.rbf.mkimage to
/dev/mtd11

Validating

/tmp/idirect_flash_updater-XXXXoAJAYo/Fpga_smb3310_00.rbf.mkimage written to
/dev/mtd11


Writing /tmp/temp/image.bin to /dev/mtd13

Validating /tmp/temp/image.bin written to /dev/mtd13

Saving install_file_map: DONE

Update /common/pkgDb/mmcblk0p6: DONE

========= Base Rootfs Package Installation script complete =========
root@iDirectRMT:p5 temp # cd /tmp

root@iDirectRMT:p5 tmp # flashdbmgr --set 6 5

Environment OK, copy 0 root@iDirectRMT:p5 tmp # reboot

...
```

A Glossary

This list may contain acronyms and abbreviations not found in this manual. Some terms may not be defined based on industry standards.

Acronym	Definition
2D	Two-Dimensional
3D	Three-dimensional
A	Ampere
AC	Alternating Current
ACM	Adaptive Coding Modulation
ACU	Antenna Control Unit
AIBS	Automated Initial Beam Selection
APSK	Amplitude Phase Shift Keying
ASN	Abstract Syntax Notation
BGA	Ball Grid Array
BTP	Burst Time Plan
BUC	Block Up Converter
CCM	Constant Coding Modulation
CE	Conformité Européenne
CNC	Computer Numerical Control
CNI	Carrier to Noise Interference
CPE	Customer Premises Equipment
CPM	Continuous Phase Modulation
CPU	Central Processing Unit

Acronym	Definition
CTE	Thermal Expansion
D	Depth
DAC	Digital-to-Analogue Converter
DC	Direct Current
DFMEA	Design Failure Mode and Effect Analysis
DHCP	Dynamic Host Configuration Protocol
DMA	Dynamic Mechanical Analysis
DNS	Domain Name Service
DSC	Differential Scanning Calorimetry
DVB-S	Open standard for Digital Video Broadcasting over Satellite
DVB-S2	Improved version of DVB-S standard
DVB-S2X	Extension of DVB-S2 satellite digital broadcasting standard.
FPGA	Field-Programmable Gate Array
GHz	GigaHertz
GND	Ground
GUI	Graphical/Graphics User Interface
GXT	File format used for satellite beam contour data (according ITU standard)
H	Height
HTTP	Hyper Text Transfer Protocol
ID	Identifier
IF	Intermediate Frequency
IGES	Initial Graphics Exchange Specification
IGMP	Internet Group Management Protocol

Acronym	Definition
IP	Internet Protocol (IETF)
IPC	IPC is a trade association whose aim is to standardize the assembly and production requirements of electronic equipment and assemblies.
IR	Infrared
FPGA	Field-Programmable Gate Array
LAN	Local Area Network
LED	Light Emitting Diode
LNB	Low Noise Blocker
LO	Local Oscillator
MAC	Media Access Control (IEEE 802)
MHz	MegaHertz
MIB	Management Information Base
MODCOD	Modulation and Coding scheme
MODEM	Modulator/Demodulator
NCR	Network Clock Reference
NMS	Network Management System
ODU	Outdoor Unit
OID	Object Identifier
PA	Power Amplifier
PC	Personal Computer
PCB	Printed Circuit Board
PCBA	Printed Circuit Board Assembly
PSU	Power Supply Unit
QoS	Quality of Service

Acronym	Definition
QPSK	Quadrature Phase Shift Keying (DQDB)
RF	Radio Frequency
RoHS	Restriction of Hazardous Substances
RX	Receive
SCE7000	Satellite Channel Emulator 7000
SMA	Subminiature version A
SMB	Satellite Modem Board
SMD	Surface-Mounted Device
SNMP	Simple Network Management Protocol
STEP	Standard for the Exchange of Product data
TCP	Transport Control Protocol
TFTP	Trivial File Transfer Protocol
TGA	Thermogravimetric Analysis
TMA	Thermo mechanical Analysis
TX	Transmit
UDP	User Datagram Protocol (IETF)
um	Micrometer
URL	Universal Resource Locator (WWW)
USB	Universal Serial Bus
V	Volt
VAC	Volts Alternating Current
VDC	Volts Direct Current
Vp-p	Peak-to-Peak Voltage

Acronym	Definition
VSAT	Very Small Aperture Terminal
W	Width
W/mK	Watts per meter-Kelvin
WEEE	Waste Electrical and Electronic Equipment

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