AN1337: RS9116 Regulatory Certification Application Note

Version 1.2

August 08, 2024

Table of Contents

ABOUT THIS DOCUMENT **3**

1 INTRODUCTION **4**

2 CERTIFICATION PROCESS **5**

2.1 RS9116 Modules - AA0/AA1, B00 and CC0/CC1 5
2.1.1 RS9116 Qualified Antennas 5
2.1.2 Customer Antenna 7
2.1.3 Gain Table 7
2.2 RS9116 SoC – QMS 8
2.2.1 Calibration Requirement 8
2.2.2 Shield Requirement 8
2.2.3 Gain Table 8
2.3 Regulatory Test – Software Procedure 9
2.3.1 RS9116W Wi-Fi - AT Command Guide 9
2.3.2 RS9116W BT – AT Command and SAPI Guide 9
2.3.3 RS9116N BT & Wi-Fi - GUI Guide 9

3 EXISTING CERTIFICATION REFERENCE **10**

3.1 RS9116 Certification Cross Reference Guide 10
3.2 Certification Number and Version 11

4 GAIN TABLE UPDATE **13**

4.1 About Gain Table 13
4.1.1 WLAN 14
4.1.2 BT/BLE 18

5 APPENDIX **20**

5.1 Reference Documents 20
5.1.1 AN1048: Regulatory RF Module Certifications 20
5.1.2 Module Certification Documents 20
5.2 RF Power Table 21
5.2.1 RS9116 – CC0/CC1 Module, Silicon Version – 1.3, Standard – FCC and IC 21
5.2.2 RS9116 – CC0/CC1 Module, Silicon Version – 1.3, Standard - CE 22
5.2.3 RS9116 – CC0/CC1 Module, Silicon Version – 1.3, Standard – TELEC 24
5.2.4 RS9116 – CC0/CC1 Module, Silicon Version – 1.4, Standard – FCC and IC 26
5.2.5 RS9116 – CC0/CC1 Module, Silicon Version – 1.4, Standard – CE 28
5.2.6 RS9116 – CC0/CC1 Module, Silicon Version – 1.4, Standard – TELEC 33
5.2.7 RS9116 – B00 Module, Silicon Version – 1.4, Standard – FCC 36
5.2.8 RS9116 – B00 Module, Silicon Version – 1.4, Standard – CE 37
5.2.9 RS9116 – B00 Module, Silicon Version – 1.4, Standard – TELEC 39
5.2.10 RS9116 – B00 Module, Silicon Version – 1.5, Standard – FCC 41
5.2.11 RS9116 – B00 Module, Silicon Version – 1.5, Standard – CE 43
5.2.12 RS9116 – B00 Module, Silicon Version – 1.5, Standard – TELEC 45
5.2.13 RS9116 – AA0/AA1 Module, Silicon Version – 1.3, Standard – FCC and IC 47
5.2.14 RS9116 – AA0/AA1 Module, Silicon Version – 1.3, Standard – CE 48
5.2.15 RS9116 – AA0/AA1 Module, Silicon Version – 1.3, Standard – TELEC 50

6 REVISION HISTORY **52**

About this Document

This document provides information on the regulatory certification process to be followed with RS9116 modules and SoC for different regulatory domains like FCC, IC, ETSI, UKCA and TELEC. This document also describes the procedure to aid Silicon Labs' customers to configure, test, and pass regulatory certification.

Note: Additional certification information will be added to this document when it becomes available.

Note: This document may contain offensive terminology that is now obsolete. Silicon Labs is replacing these terms with inclusive language wherever possible. For more information, visit www.silabs.com/about-us/inclusive-lexicon-project.

1 Introduction

Regulatory testing is mandated by various governmental and non-governmental organizations around the world e.g., FCC (USA), IC (CANADA), CE/ETSI/RED (EUROPE), UKCA (UK) and TELEC (JAPAN). Legally, to market and sell products in these regions, most electronic hardware manufacturers must jump over the regulatory testing hurdle. There are various regulatory testing procedures that can apply to electronic products. Primarily, these are EMC, Safety, and RF (Radio Frequency aka Wireless). CE, ETSI and RED refer to the same European regulatory standards, and these names are used interchangeably in the document below.

EMC and Safety is common across all electronic products; therefore, this document will focus more on RF testing. It is a comprehensive test suite to check for performance across different frequency, power outputs, band and spurious emissions, and immunity to interference. A lot of these tests require the transmit power to be configured correctly. The transmit power is configured with certain parameters in the module, which is translated to variables in driver code/firmware. Apart from transmit power, regulatory certification also requires checking power spectral density (PSD), occupied channel bandwidth, out of band and spurious emissions, spectrum sharing, adaptivity, and receiver blocking (ETSI).

2 Certification Process

This section describes the certification process to be followed with RS9116 modules and SoC, including the list of qualified antennas, process required for the calibration and gain settings, and the software test application to perform the certification.

2.1 RS9116 Modules - AA0/AA1, B00 and CC0/CC1

2.1.1 RS9116 Qualified Antennas

The table below shows the list of antennas that are certified with RS9116 modules – AA0/AA1, B00, and CC0/CC1. Refer to latest Certification reports for the more recent qualified antennas list. If a customer uses an antenna not from our specified list as per the selected modules or an antenna which will have the equivalent specification, then the customer needs to follow Class I Permissive Change (This is only if the antenna chosen is not in our list).

A Class I Permissive Change filing may be done for the following scenarios:

- When the new antenna is of the same type, same specifications, and has the same or lower gain than the antenna(s) originally approved, and new tests show that the emission levels or reported RF safety levels are not increased
- When the antenna is a different type, has a lower gain than an originally approved antenna and tests show that the spurious emission levels or reported RF safety levels are not increased, then a Class I Permissive change is permitted. Although a Class II Permissive Change filing is not required in this case, it is recommended that a Class II Permissive change be filed in order to keep a complete list of approved antenna(s) in the filing
- When the specifications and gain are the same as an antenna originally approved but is made by a different manufacturer

Listed above are brief points from the FCC. Refer to the following sections of AN1048: Regulatory RF Module Certifications for more details on the applicable standards for your design:

- CE (ETSI) - Section 3.4
- FCC – Section 3.5
- ISED – Section 3.6
- TELEC – Section 3.7

Qualified Antenna Types for M7DB6 Model – Silicon Version 1.3				
Module Name	**Antenna Model**	**Antenna Type**	**Gain**	**Qualified Region**
RS9116 CC0/CC1	RSIA7	PCB Trace Antenna	0.712 dBi (2.4GHz)	FCC/IC, CE, UKCA, TELEC
			1.25 dBi (5GHz)	
	GW.71.5153	Dipole Antenna	3.3 dBi (Straight)	FCC/IC, TELEC
			3.8 dBi (Bent)	
	AEM6P-100000	Dipole Antenna	2 dBi	TELEC
	AEM6P-100001	Dipole Antenna	2 dBi	TELEC
	AEEE0-000000	Multilayer ceramic Antenna	2.13 dBi	TELEC
	AEEE0-000001	Chip Antenna	4 dBi	TELEC
	AEEE0-000002	Chip Antenna	4 dBi	TELEC
	AEP6P-100006X	PIFA Antenna	3 dBi	TELEC
	AEP6P-100008X	PIFA Antenna	3 dBi	TELEC

Qualified Antenna Types for M7DB Model – Silicon Version 1.4				
Module Name	**Antenna Model**	**Antenna Type**	**Gain**	**Qualified Region**
RS9116 CC0/CC1	RSIA7	PCB Trace Antenna	0.71 dBi – 2.4GHz 1.25 dBi – 5GHz	FCC/IC, CE, UKCA, TELEC
	GW.71.5153	Dipole Antenna	3.8 dBi - 2.4GHz 5.5 dBi – 5GHz	FCC/IC, CE, UKCA, TELEC
	Inside WLAN PRO-IS-299	Dipole Antenna	2.5 dBi - 2.4GHz 1.6 dBi – 5GHz	FCC/IC, CE, UKCA, TELEC
	SMARTEQ 4211613980	PIFA Antenna	0 dBi – 2.4GHz 2.0 dBi – 5GHz	FCC/IC, CE, UKCA, TELEC
	MARS-31A8	PIFA Antenna	2 dBi - 2.4GHz 2 dBi – 5GHz	FCC/IC, CE, UKCA, TELEC
	M7R1229C	PIFA Antenna	-1.0 dBi	TELEC
	M7R1277A	PCB Trace Antenna	1.0 dBi	TELEC
	M7R1314A	PCB Trace Antenna	2.5 dBi	TELEC
	HW-TABG3-RSMA-En	Dipole Antenna	2.0 dBi	TELEC
	T13-047-1085(1019-012A)	Dipole Antenna	2.14 dBi	TELEC
	T13-047-1086(1019-014A)	Dipole Antenna	2.14 dBi	TELEC
	TCF-6840RSXX-999	Dipole Antenna	3.0 dBi	TELEC
	TWF-HP01RS2X-999	Dipole Antenna	2.0 dBi	TELEC
	PRO-EX-286	Dipole Antenna	3.0 dBi	TELEC
	TE 2195630-1	Dipole Antenna	-2.0 dBi	TELEC

Qualified Antenna Types for RS9116-B0014 model – Silicon Version 1.4				
Module Name	**Antenna Model**	**Antenna Type**	**Gain**	**Qualified Region**
RS9116 B0014	FR05-S1-N-0-102	Chip Antenna	1.70 dBi – 2.4GHz	FCC/IC, CE, UKCA, TELEC
	GW.34.5153	Dipole Antenna	5.89 dBi - 2.4GHz	FCC/IC, CE, UKCA, TELEC
	RFPCA500609IMAB301	External PCB antenna	4.53 dBi – 2.4GHz	TELEC

Qualified Antenna Types for RS9116-B00 model – Silicon Version 1.5				
Module Name	**Antenna Model**	**Antenna Type**	**Gain**	**Qualified Region**
RS9116 B00	FR05-S1-N-0-102	Chip Antenna	1.70 dBi – 2.4GHz	FCC/IC, CE, UKCA, TELEC
	GW.34.5153	Dipole Antenna	5.89 dBi - 2.4GHz	FCC/IC, CE, UKCA, TELEC
	RFPCA500609IMAB301	External PCB antenna	4.53 dBi – 2.4GHz	TELEC

Qualified Antenna Types for M15SB Model – Silicon Version 1.3				
Module Name	**Antenna Model**	**Antenna Type**	**Gain**	**Qualified Region**
RS9116 AA0/AA1	RSIA15	PCB Trace Antenna	0.99 dBi	FCC/IC, CE, UKCA, KCC, TELEC
	WS.01.B.305151	Heavy Duty Screw Mount Antenna	4.1 dBi	FCC/IC, CE, UKCA, TELEC
	AEM6P-100000	Dipole Antenna	2 dBi	TELEC
	AEM6P-100001	Dipole Antenna	2 dBi	TELEC
	AEEE0-000000	Multilayer ceramic Antenna	2.13 dBi	TELEC
	AEEE0-000001	Chip Antenna	4 dBi	TELEC
	AEEE0-000002	Chip Antenna	4 dBi	TELEC
	AEP6P-100006X	PIFA Antenna	3 dBi	TELEC
	AEP6P-100008X	PIFA Antenna	3 dBi	TELEC

2.1.2 Customer Antenna

If a customer uses an antenna with specifications not equivalent to those of any of the qualified antennas, then the customer needs to follow a Class II Permissive Change:

Class II Permissive Change: The following are the scenarios that require a Class II permissive change filing when a new antenna is added:

- When the antenna gain of the new antenna of the same type as the originally approved antenna is greater than the antenna gain of the originally tested antenna
- When the emission levels or reported RF safety levels of the same antenna type increases
- If the antenna is a different type, has a lower gain than the originally approved antenna and tests show that the spurious emission levels or reported RF safety levels have increased.
- If the antenna is a different type, then “world wide” region need to be chosen for the gain validation.

Listed above are brief points from the FCC. Refer to the following sections of AN1048: Regulatory RF Module Certifications for more details on the applicable standards for your design:

- CE (ETSI) - Section 3.4
- FCC – Section 3.5
- ISED – Section 3.6
- TELEC – Section 3.7

While certifying with own antenna, Customer has to use “Worldwide” region setting, and obtain the list of Power Indices for each channel and data rate that passes the regulatory standard. Once this Power indices are available, those values have to be arranged in a Gain table format. This Gain table has to be programmed in the module, for further usage with that specific antenna. Refer to the below section for details about Gain table.

2.1.3 Gain Table

In general, the goal is to ensure maximum possible power while maintaining a required EVM on the transmitted signal. In some channels that are at the edge of their respective bands, transmitted power may be limited by the need to meet regulatory compliance.

All the modules that are shipped out are calibrated and have the calibrated values inside Flash. The module may be certified using the existing Gain table within the module, or you can modify the Gain table to pass the regulatory standard.

For details about Gain table and updating it, refer to Section 4 of this document.

2.2 RS9116 SoC – QMS

For SoC-based design (with QMS package), the customer needs to do full certification as per the applicable regulatory standard. Below are the RS9116 related requirements that the customer needs to follow to pass certification along with performance.

2.2.1 Calibration Requirement

SoC design circuit involves discrete components in RF path and 50-ohm PCB traces. There can be variations in manufacturing tolerances in this circuit from one board to another, and these variations can cause variations in power level and frequency. To avoid variations in performance of the product across various units, calibration of Carrier frequency and Tx gain offsets must be performed and this will compensate those board to board variations.

The document AN1336: RS9116 QMS Calibration Application Note describes the procedure for RS9116 SoC customers to implement manufacturing flow. The document explains the below procedures.

- Calibration of carrier frequency offset & Tx gain offset.
- Burn the flash content (that includes MBR (Main boot record), PUF activation code, FMC (flash memory controller/index table for firmware) and firmware image).

2.2.2 Shield Requirement

For the SoC-based design, provide options for mounting the shield. Shield must cover the QMS circuitry until the antenna termination point. Product testing is usually done initially without shield. The shield would be mounted only if any EMI/EMC issues are observed from the RS9116 QMS circuitry. Shield design must be optimized based on EMI/EMC issues observed.

2.2.3 Gain Table

SoCs (n-Link™, WiSeConnect™) must be factory calibrated on-board for maximum transmit power based on the regulatory domain. SoC's Flash must be written at the end of manufacturing test procedure, with a list of values that include the GC value for maximum allowed power for a channel or set of channels, and for a set of data rates, so as to pass the regulatory standard.

In general, the goal is to ensure maximum possible power while maintaining a required EVM on the transmitted signal. In some channels that are at the edge of their respective bands, transmitted power may be limited by the need to meet regulatory compliance.

Customer has to use "Worldwide" region setting and obtain the list of Power Indices for each channel and data rate that passes the regulatory standard with suitable antenna. Once this Power indices are available, those values must be arranged in a Gain table format. This Gain table must be programmed in the module, for further usage with that specific antenna. For details about Gain table and updating it, refer to Section 4 of this document.

2.3 Regulatory Test – Software Procedure

Various test applications must be run based on the regulatory testing of n-Link/WiSeConnect modules/SoC related to Wi-Fi/Bluetooth. The test procedures for running these applications are explained in this section.

2.3.1 RS9116W Wi-Fi - AT Command Guide

For the products using Wi-Fi in WiSeConnect mode, AT commands or SAPI is used. The details of the procedure, steps, and requirements for these commands using a UART interface is explained in the document RS9116W Wi-Fi AT Command Regulatory Test Application Note. This document also describes the description of each command. The device under test uses the UART interface for communicating with the External Application such as Dock light, for configuring the Wireless System and for logging the Wireless performance. PER mode is used to perform regulatory certifications (FCC, ETSI, etc.). The procedure using a SPI interface is explained in the document Transmit Performance and Regulatory Testing.

2.3.2 RS9116W BT – AT Command and SAPI Guide

For the products using BT/BLE in WiSeConnect mode, either AT command or SAPIs (Software APIs) must be run. The details of the procedure, steps, and requirements for AT commands and SAPIs usage is described in the document RS9116W BT Regulatory Test Application Note. The device under test must use the UART interface for communicating with the Main (External Application such as Dock light) for configuring the Wireless System and for logging the Wireless performance. PER mode is used to perform regulatory certifications (FCC, ETSI, etc.).

2.3.3 RS9116N BT & Wi-Fi - GUI Guide

For the products using n-Link, a GUI Interface (called as PER application) can be used (if you are testing using EVK or Linux) or you can run the ioctl commands. PER software provides a means to test RS9116 Performance in both Transmit and Receive directions. The GUI interface eases the effort for the user in evaluating the product (GUI

Refer to the document AN1305: RS9116N Regulatory Test Application Note for more details on the procedure to run PER application.

3 Existing Certification Reference

3.1 RS9116 Certification Cross Reference Guide

The table below is a cross-reference guide for RS9116 modules, indicating the corresponding certification model numbers, certification IDs, and the associated directories with the appropriate documents. It also lists various HW and SW versions used for certification of various silicon versions.

S. No	Part Number	Product Family	Model Number Printed on Module	FCC ID	IC ID	CE/ ETSI/RED, UKCA	KCC	TELEC	Silicon Version	RoHS/ REACH	FCC, IC, CE/ETSI/RED ,UKCA,KCC, TELEC, ROHS, REACH Certifications & Declarations Directory
1	RS9116N-SBX0-AA0	RS9116 n-Link	M15SB	XF6-M15SB	8407A-M15SB	Yes	**Yes**	201-190234	1.3	Yes	M15SB
2	RS9116W-SBX0-AA0	RS9116 WiSeConnect	M15SB	XF6-M15SB	8407A-M15SB	Yes	**Yes**	201-190234	1.3	Yes	M15SB
3	RS9116N-DBX0-CC0	RS9116 n-Link	M7DB6	XF6-M7DB6	8407A-M7DB6	Yes	**No**	201-190292	1.3	Yes	M7DB6
4	RS9116W-DBX0-CC0	RS9116 WiSeConnect	M7DB6	XF6-M7DB6	8407A-M7DB6	Yes	**No**	201-190292	1.3	Yes	M7DB6
5	RS9116N-SBX0-AA1	RS9116 n-Link	M15SB	XF6-M15SB	8407A-M15SB	Yes	**Yes**	201-190234	1.3	Yes	M15SB
6	RS9116W-SBX0-AA1	RS9116 WiSeConnect	M15SB	XF6-M15SB	8407A-M15SB	Yes	**Yes**	201-190234	1.3	Yes	M15SB
7	RS9116N-DBX0-CC1	RS9116 n-Link	M7DB6	XF6-M7DB6	8407A-M7DB6	Yes	**No**	201-190292	1.3	Yes	M7DB6
8	RS9116W-DBX0-CC1	RS9116 WiSeConnect	M7DB6	XF6-M7DB6	8407A-M7DB6	Yes	**No**	201-190292	1.3	Yes	M7DB6
9	RS9116N-DBX0-CC0	RS9116 n-Link	M7DB	XF6-M7DB	8407A-M7DB	Yes	**No**	211-210212	1.4	Yes	M7DB
10	RS9116W-DBX0-CC0	RS9116 WiSeConnect	M7DB	XF6-M7DB	8407A-M7DB	Yes	**No**	211-210212	1.4	Yes	M7DB
11	RS9116N-DBX0-CC1	RS9116 n-Link	M7DB	XF6-M7DB	8407A-M7DB	Yes	**No**	211-210212	1.4	Yes	M7DB
12	RS9116W-DBX0-CC1	RS9116 WiSeConnect	M7DB	XF6-M7DB	8407A-M7DB	Yes	**No**	211-210212	1.4	Yes	M7DB
13	RS9116N-SBX0-B00	RS9116 n-Link	RS9116-B0014	XF6-B001P4V2P1	8407A-B001P4V2P1	Yes	**No**	211-210209	1.4	Yes	M4SB
14	RS9116W-SBX0-B00	RS9116 WiSeConnect	RS9116-B0014	XF6-B001P4V2P1	8407A-B001P4V2P1	Yes	**No**	211-210209	1.4	Yes	M4SB
15	RS9116N-SBX0-B00	RS9116 n-Link	RS9116-B00	XF6-B001P5V2P1	8407A-B001P5V2P1	Yes	**No**	211-210210	1.5	Yes	M4SB
16	RS9116W-SBX0-B00	RS9116 WiSeConnect	RS9116-B00	XF6-B001P5V2P1	8407A-B001P5V2P1	Yes	**No**	211-210210	1.5	Yes	M4SB

3.2 Certification Number and Version

RS9116 modules with different models are certified for FCC, IC, TELEC, ETSI standards. The table below lists the standards and versions that the modules are certified for. Refer to latest Certification reports for the more details about certified standards.

Sr. No.	Model Number Printed on Module	Standard	Certification Name	Version
1	M15SB	FCC	FCC 47 CFR PART 15 SUBPART C	ANSI C63.10:2013
2		IC	Canada RSS-247 Issue 2 Canada RSS-Gen Issue 5	ANSI C63.10:2013
3		ETSI	ETSI EN 300 328	V2.1.1 (2016-11) V2.2.2 (2019-07)
4		UKCA	UK Radio Equipment Regulations 2017	S.I. 2017/1206
5		KCC	Radio Waves Act, Article 58-2, Clause 3	KS X 3123:2019
6		TELEC	MIC notification. No.88 of 2004, Annex 43 2.4 GHz band wide-band low power data communication system	Item 19 of Article 2 Paragraph 1
7	M7DB6	FCC	FCC 47 CFR PART 15 SUBPART C	ANSI C63.10:2013
8			FCC 47 CFR PART 15 SUBPART E	ANSI C63.10:2013
9		IC	Canada RSS-247 Issue 2 Canada RSS-Gen Issue 5	ANSI C63.10:2013
10		ETSI	ETSI EN 300 328	V2.1.1 (2016-11) V2.2.2 (2019-07)
11			ETSI EN 301 893	V2.1.1 (2017-05)
12		UKCA	UK Radio Equipment Regulations 2017	S.I. 2017/1206
13		TELEC	MIC notification. No.88 of 2004, Annex 43 2.4 GHz band wide-band low power data communication system	Item 19 of Article 2 Paragraph 1
14			MIC notification. No.88 of 2004, Annex 45 5 GHz band wide-band low power data communication system	(Item 19 of Article 2 Paragraph 1 Item 19-3-2 of Article 2 Paragraph 1
15			MIC notification. No.88 of 2004, Annex 47 Test method for Land mobile station and portable station for 5GHz band wireless access system	Article 2 Paragraph 1 of Item 19-11
16	M7DB	FCC	FCC Part 15.247	
17			FCC Part 15.407	
18		IC	RSS-247 Issue 2, Feb 2017 RSS-Gen Issue 5, Mar 2019	
19		ETSI	ETSI EN 300 328	V2.1.1 (2016-11) V2.2.2 (2019-07)
20			ETSI EN 301 893	V2.1.1 (2017-05)

21			ETSI EN 300 440	V2.1.1 (2018-07)
22		UKCA	UK Radio Equipment Regulations 2017	S.I. 2017/1206
23		TELEC	MIC Notice No. 88 Appendix No. 43	Article 2 Paragraph 1 of Item 19
24			MIC Notice No. 88 Appendix No. 43	Article 2 Paragraph 1 of Item 19-3
25	RS9116-B0014	FCC	FCC Part 15.247	
26		IC	RSS-247 Issue 2, Feb 2017 RSS-Gen Issue 5, Mar 2019	
27		ETSI	ETSI EN 300 328	V2.2.2 (2019-07)
28		UKCA	UK Radio Equipment Regulations 2017	S.I. 2017/1206
29		TELEC	MIC notification. No.88 of 2004, Annex 43 2.4 GHz band wide-band low power data communication system	Article 2 Paragraph 1 of Item 19
30	RS9116-B00	FCC	FCC Part 15.247	
31		IC	RSS-247 Issue 2, Feb 2017 RSS-Gen Issue 5, Mar 2019	
32		ETSI	ETSI EN 300 328	V2.2.2 (2019-07)
33		UKCA	UK Radio Equipment Regulations 2017	S.I. 2017/1206
34		TELEC	MIC notification. No.88 of 2004, Annex 43 2.4 GHz band wide-band low power data communication system	Article 2 Paragraph 1 of Item 19

4 Gain Table Update

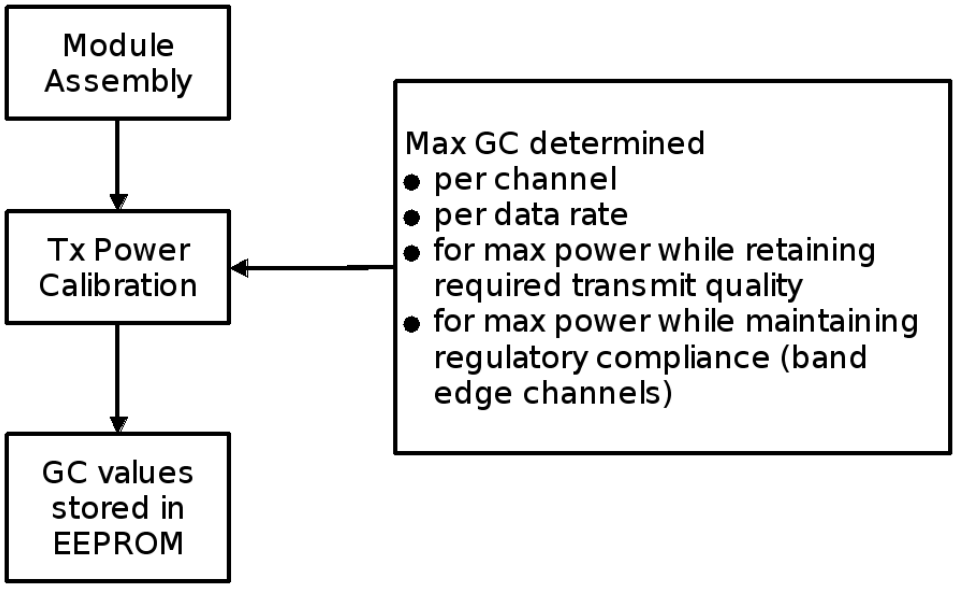
4.1 About Gain Table

All the modules (n-Link™, WiSeConnect™) are factory-calibrated for maximum transmit power based on the regulatory domain. SoCs (n-Link™, WiSeConnect™) must be factory calibrated on-board for maximum transmit power based on the regulatory domain.

At the end of the manufacturing test procedure, the module's Flash is written with a list of values that include the GC value for maximum allowed power for a channel or set of channels, and for a set of data rates. Any module that is shipped out is calibrated and has those calibrated values inside Flash. Product may be certified using the existing Gain table within the module, or user can modify the Gain table to pass the regulatory standard.

For SoC, its Flash must be written at the end of manufacturing test procedure, with a list of values that include the GC value for maximum allowed power for a channel or set of channels, and for a set of data rates, to pass the regulatory standard.

Refer to RS9116W SAPI Programming Reference to update the final certification RF Tx power data into the module/SoC.



Refer to the following APIs in the RS9116W SAPI Programming Reference to update the gain table.

1. WLAN: rsi_wlan_update_gain_table
2. BT/BLE: rsi_bt_cmd_update_gain_table_offset_or_max_pwr

More info about the above APIs can be found in the sections below.

Software release folders ("…/resources/gain_tables") have Gain tables of various certifying modules (CC0/CC1, B00, AA0/AA1) for each antenna and region. For the Antennas that are in certification reports/certificates, but their Gain tables are not provided, it is recommended using Gain table of an equivalent certified antenna having lower or equal Gain, and considering equivalent Type of antenna. Customer/lab must ensure such antenna characteristics are meeting as earlier approved antenna. Also refer to section 2.1.1.

4.1.1 WLAN

For WLAN, “rsi_wlan_update_gain_table” API assigns the user configurable channel gain values in different RS9116Ws to the module from user. This method is used for overwriting default gain tables that are present in firmware. User can load all the gain tables (i.e., 2.4GHz-20MHz, 5GHz-20MHz) one after other by changing band and bandwidth values.

Example :

status = rsi_wlan_update_gain_table (band, bandwidth, payload, payload_len);

Band	0 → 2.4GHz
	1 → 5GHz
Bandwidth	0 → 20 MHz
Payload	Pass channel gain values for different regions in any given array format
Payload_len	Max payload length (table size) in 2.4GHz is 128 bytes
	Max payload length (table size) in 5GHz is 64 bytes

Pre-condition : rsi_radio_init() API needs to be called before this API.

Inappropriate use of this frame may result in violation of FCC/ETSI/TELEC or any certifications and Silicon Labs is not liable for that.

Internally firmware maintains two tables : Worldwide table & Region based table. Worldwide table is populated by firmware with Max power values that chip can transmit that meets target IEEE specs like EVM. Region based table has default gain value set.

- When certifying with user antenna, Region must be set to Worldwide and sweep the power from 0 to 21 dBm. Arrive at max power level that is passing certification especially band-edge.
- These FCC/ETSI/TELEC max power level must be loaded in end-to-end mode via WLAN User Gain table. This must be called during every boot-up since this information is not saved inside the flash. Region based user gain table sent by application is copied onto Region based table. Module/SoC uses this table in FCC/ETSI/TELEC to limit power and not to violate allowed limits.
- For Worldwide region, firmware uses Worldwide table for Tx. For other regions (FCC/ETSI/TELEC), Firmware uses min value out of Worldwide & Region based table for Tx. Also, there will be part to part variation across chips, and offsets are estimated during manufacturing flow which will be applied as correction factor during normal mode of operation.
- As there is no certification for Worldwide, gain table for worldwide is not applicable.
- In 2.4 GHz, 5GHz band, 40 MHz is not supported.
- Max table size in 2.4 GHz is 128 bytes and Max table size in 5 GHz is 64 bytes.
- Length of the payload should match with payload_len parameter value.

Gain Table Payload Format

1. Gain table Format

   In 2.4 GHz, Max Gain/Power obtained from certification should be doubled and loaded. Each entry of the table is 1 byte.

```
<TABLE NAME>[] = {
                    <NO.of Regions>,
                    <REGION NAME 1>, <CHANNEL_CODE_2G>,
                    <CHANNEL NUMBER 1>, <2 * MAX POWER FOR b RATE>, <2 * MAX POWER
FOR g RATE>, <2 * MAX POWER FOR n RATE>,
                    <CHANNEL NUMBER 2>, <2 * MAX POWER FOR b RATE>, <2 * MAX POWER
FOR g RATE>, <2 * MAX POWER FOR n RATE>,
                      .
                      .                          .
                    <CHANNEL NUMBER m-1>, <2 * MAX POWER FOR b RATE>, <2 * MAX
POWER FOR g RATE>, <2 * MAX POWER FOR n RATE>,
                    <CHANNEL NUMBER m>, <2 * MAX POWER FOR b RATE>, <2 * MAX POWER
FOR g RATE>, <2 * MAX POWER FOR n RATE>,
                    <REGION NAME 2>, <CHANNEL_CODE_2G>,
                    <CHANNEL NUMBER 1>, <2 * MAX POWER FOR b RATE>, <2 * MAX POWER
FOR g RATE>, <2 * MAX POWER FOR n RATE>,
                    <CHANNEL NUMBER 2>, <2 * MAX POWER FOR b RATE>, <2 * MAX POWER
FOR g RATE>, <2 * MAX POWER FOR n RATE>,
                    .
                    .
                    <CHANNEL NUMBER m-1>, <2 * MAX POWER FOR b RATE>, <2 * MAX
POWER FOR g RATE>, <2 * MAX POWER FOR n RATE>,
                    <CHANNEL NUMBER m>, <2 * MAX POWER FOR b RATE>, <2 * MAX POWER
FOR g RATE>, <2 * MAX POWER FOR n RATE>,

                    };
```

   In 5 GHz, Max Gain/Power obtained from certification must be loaded. Each entry of the table is 1 byte.

```
 <TABLE NAME>[] = {
                   <NO.of Regions>,
                   <REGION NAME 1>, <CHANNEL_CODE_5G>,
                   <CHANNEL NUMBER IN BAND 1 IF ANY>, <MAX POWER FOR 11a RATE>,
<MAX POWER FOR n RATE>,
                   <BAND_NUMBER 1>, <MAX POWER FOR 11a RATE>, <MAX POWER FOR n
RATE>,
                   <CHANNEL NUMBER IN BAND 2 IF ANY>, <MAX POWER FOR 11a RATE>,
<MAX POWER FOR n RATE>,
                   <BAND_NUMBER 2>, <MAX POWER FOR 11a RATE>, <MAX POWER FOR n
RATE>,
                   <CHANNEL NUMBER IN BAND 3 IF ANY>, <MAX POWER FOR 11a RATE>,
<MAX POWER FOR n RATE>,
                   .
                   .
                   <REGION NAME y>, <CHANNEL_CODE_5G>,
   };
```

2. Supported Region names

   The following are the regions and their corresponding values.

Region	Macro Value
FCC	0
ETSI	1
TELEC	2

   For KCC, Macro is 4.

   If user wants to certify for a new region, then he can use one of the above regions based on Scan channels. For example, if Scan channels of the new Region is same as ETSI, then Macro value of 1 can be used. If Scan channels are different compared to any of the above regions, then a support request has to be raised for adding new region in the Firmware. User must load appropriate Gain table that passes required regulatory standard.

3. <CHANNEL_CODE_2G>

   <CHANNEL_CODE_2G> is an 8-bit value that is encoded as below.
   - If Tx powers of all the channels are same, then use CHANNEL_CODE_2G as 17. In this case, mention channel number as 255.
   - If Tx power is not same for all channels, then indicate CHANNEL_CODE_2G as no-of channels and specify Tx power values for all the channels indicated.

4. <CHANNEL_CODE_5G>

   <CHANNEL_CODE_5G> is a 8 bit value encoded as number of rows in a region for 5G band.
   a) 5G is divided into 4 sub bands:
      band 1: channel number <= 48
      band 2: channel number > 48 and channel number <= 64
      band 3: channel number > 64 and channel number <= 144
      band 4: channel number > 144
   b) If any channel in a band has different set of power values, specify the channel number followed by power values.
   c) If all the channels in a band 1 has same power values, specify the band number as 1 followed by power value.
   d) If all the channels in a band 2 has same power values, specify the band number as 2 followed by power value.
   e) If all the channels in a band 3 has same power values, specify the band number as 3 followed by power value.
   f) If all the channels in a band 4 has same power values, specify the band number as 4 followed by power value.

Example - payload formats

1. 2.4 GHz in 20 MHz bandwidth

```
{3, //NUM_OF_REGIONS
    FCC, 13, //NUM_OF_CHANNELS
    //rate, 11b, 11g, 11n
```

```
            1,  34,  20,  20,
            2,  34,  28,  28,
            3,  34,  32,  32,
            4,  34,  36,  36,
            5,  34,  38,  38,
            6,  34,  40,  40,
            7,  34,  38,  38,
            8,  34,  36,  36,
            9,  34,  32,  32,
            10, 34,  32,  32,
            11, 34,  24,  24,
            12, 34,  16,  24,
            13, 34,  12,  12,
        ETSI, 17,
            255, 25,  32, 32,
        TELEC, 17,
            255, 20,  16, 16,
    }; //}}}
```

2. 5 GHz in 20 MHz bandwidth

```
    {3,  //NUM_OF_REGIONS
    FCC, 6,   //NUM_OF_CHANNELS
    //rate,11a,11n,
        1,  9, 10, //band 1
        2,  8,  9, //band 2
      100,  4,  4, //band 3
        3,  6,  8, //band 3
      149,  3,  3, //band 4
        4,  6,  7, //band 4
    ETSI, 4,
        1, 11, 11, //band 1
        2, 11, 11, //band 2
        3, 12, 12, //band 3
        4, 12, 12, //band 4
    TELEC, 4,
        1,  9, 10, //band 1
        2,  8, 10, //band 2
        3,  6,  8, //band 3
        4,  6,  7, //band 4
    };
```

Example - command usage with Payload

This example shows 2.4GHz band, 20MHz bandwidth, same Payload as above 1st example, and 67bytes of Payload length.

rsi_wlan_update_gain_table(0,0,3,0,13,1,34,20,20,2,34,28,28,3,34,32,32,4,34,36,36,5,34,38,38,6,34,40,40,7,34,38,38,8,34,36,36,9,34,32,32,10,34,32,32,11,34,24,24,12,34,16,24,13,34,12,12,1,17,255,25,32,32,2,17,255,20,16,16,67);

4.1.2 BT/BLE

"rsi_bt_cmd_update_gain_table_offset_or_max_pwr" API is used to set BT/BLE protocol and Tx power. Here is the explanation of the command.

rsi_bt_cmd_update_gain_table_offset_or_max_pwr (Node_ID, Payload_Len, Payload, Req_type);

Node_ID	0 – BLE
	1 – BT Classic
Payload_Len	Gain table payload length. It must be equal to the size of payload.
Payload	Gain table payload data consist of channel power values for different regions in the below mentioned format.
Req_type	Request type to select appropriate gain table 0 - Update gain table with max power values 1 - Update gain table with offset values

Inappropriate use of this frame may result in violation of FCC/ETSI/TELEC or any certifications, and Silicon Labs is not liable for that.

Gain Table Payload Format

1. Gain table holding Max Tx power values : (Each entry of the table is 1 byte)

```
<TABLE NAME>[] = {
                  <REGION NAME 1>, <MAX POWER>,
                  <REGION NAME 1>, <MAX POWER>,
                  .
                  .
                  <REGION NAME N>, <MAX POWER>
                  };
```

2. Gain table with Max power vs offset values : (Each entry of the table is 1 byte)

```
<TABLE NAME>[] = {
                  <Number Of Regions - 'r'>,
                    <REGION NAME 1>, <Number Of Channels - 'm'>,
                      <CHANNEL NUMBER 1>, <OFFSET>,
                      <CHANNEL NUMBER 2>, <OFFSET>,
                      .
                      .
                      <CHANNEL NUMBER m>, <OFFSET>,
                    <REGION NAME 2>, <No Of Channels - 'n'>,
                      <CHANNEL NUMBER 1>, <OFFSET>,
                      <CHANNEL NUMBER 2>, <OFFSET>,
                      .
                      .
                      <CHANNEL NUMBER n>, <OFFSET>,
                     .
```

```
  .
  <REGION NAME r>, <No Of Channels - 'n'>,
    <CHANNEL NUMBER 1>, <OFFSET>,
    <CHANNEL NUMBER 2>, <OFFSET>,
    .
    .
    <CHANNEL NUMBER n>, <OFFSET>,
};
```

3. Supported Region names:

   The following are the regions and their values have to be passed instead of macros in the example.

Region	Macro Value
FCC	0
ETSI	1
TELEC	2
WORLDWIDE	3

   For KCC, Macro is 4.

   If user wants to certify for a new region, then he can use one of the above regions based on Scan channels. For example, if Scan channels of the new Region is same as ETSI, then Macro value of 1 can be used. If Scan channels are different compared to any of the above regions, then a support request has to be raised for adding new region in the Firmware. User must load appropriate Gain table that passes required regulatory standard.

   In the above, Worldwide setting involves Max power values that chip can transmit that meets target IEEE specs like EVM. User must not change these max power values.

4. If Tx powers of all the channels are same, then mention channel number as 255. If Tx power is not same for all channels, then indicate number of channels and specify Tx power values for all the channels indicated.

   Here is an example of using particular Tx power for BT/BLE. There are many Gain tables listed in Software release folders ("…/resources/gain_tables"). An example gain table is below.

```
{ FCC, 17,   //All Channels, data rates in FCC region has to use 17 Power
  ETSI, 6,   //All Channels, data rates in ETSI region has to use 6 Power
  TELEC, 16, //All Channels, data rates in TELEC region has to use 16 Power
}
```

Example - command usage with Payload

- Update BT Maxpower
  rsi_bt_cmd_update_gain_table_offset_or_max_pwr (1,10,0,17,1,10,2,14,3,20,4,12,0)

- Update BT Offset
  rsi_bt_cmd_update_gain_table_offset_or_max_pwr (1,55,5,0,4,255,0,0,0,39,0,78,2,1,4,255,0,0,0,39,0,78,0,2,4,255,3,12,0,15,5,26,1,3,6,255,0,0,0,3,0,39,1,75,2,78,0,4,4,255,3,2,2,5,5,7,1,1)

5 Appendix

5.1 Reference Documents

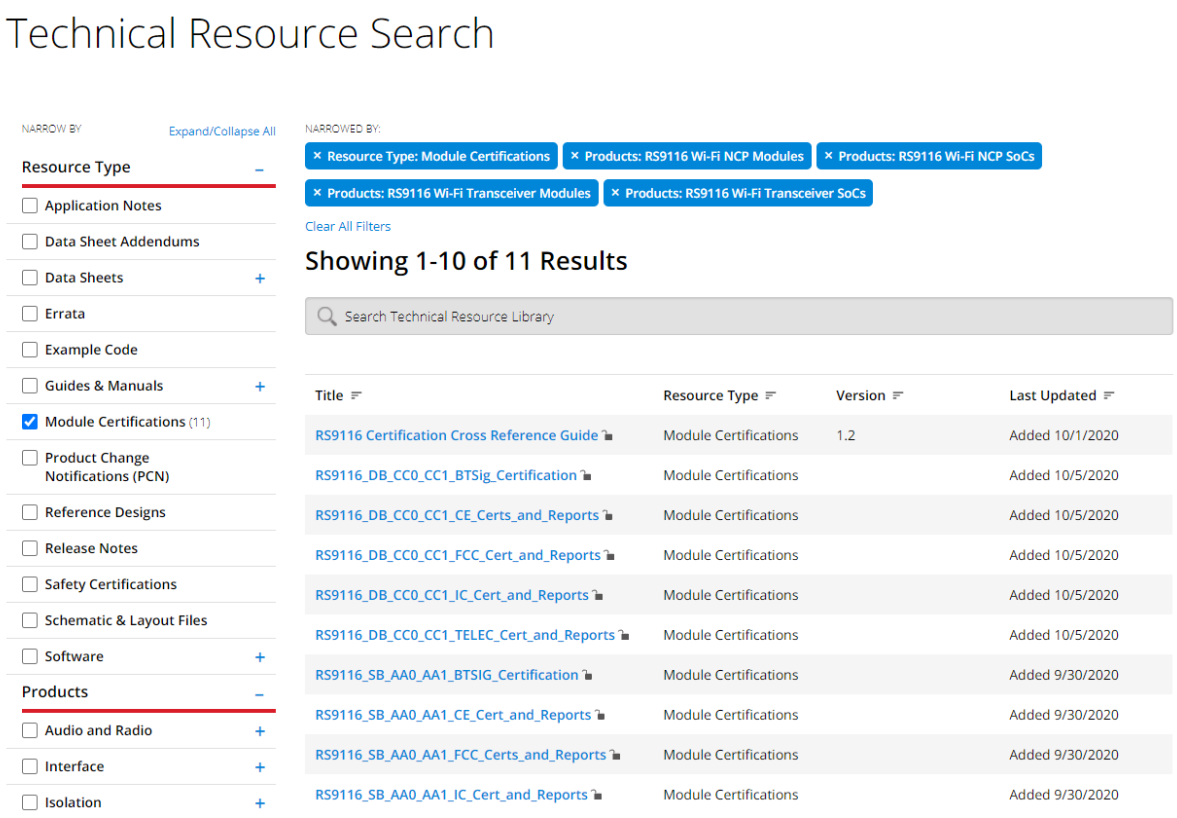
5.1.1 AN1048: Regulatory RF Module Certifications

Silicon Labs RF modules are certified to meet the requirements of the Federal Communications Commission (FCC), Innovation, Science, and Economic Development (ISED), European Conformity (CE), and other regulatory bodies. When using Silicon Labs pre-certified modules, customers can refer to these certifications and related test reports to achieve regulatory compliance.

Certification requirements depend on regions and modules. The document AN1048: Regulatory RF Module Certifications highlights the main differences between the different modules, module types, and certification requirements between different countries. It also describes a list of requirements that the pre-certified module must meet to get a full modular certification as well as differences between the FCC and CE and other countries.

5.1.2 Module Certification Documents

Compliance tests reports, DoC, and certificate documents for all Silicon Labs modules are publicly available under the Technical Resource Search page of www.silabs.com.



5.2 RF Power Table

This section briefly lists down certification test results of various RS9116 modules covering various antennas, channel configurations (data rate and mode), channel numbers, and average power data for different regulatory regions like FCC/CE, ETSI and TELEC. Each sub-section covers details for each silicon module and the regulatory standard. Refer to latest certification reports, for more details and latest info about the test results.

5.2.1 RS9116 – CC0/CC1 Module, Silicon Version – 1.3, Standard – FCC and IC

Note: For a few channels, power reduction is done to pass the band edge requirement.

BT RF Power – M7DB6				
Antenna Type, Model No., and Gain	**Configuration**	**Measured Average Output Power (dBm)**		
		Low CH 2402 MHz	**Mid CH 2441 MHz**	**High CH 2480 MHz**
Dipole Antenna TAOGLAS GW.71.5153 Gain: 3.80 dBi	BR-1Mbps	8.64	8.51	8.09
	EDR-2Mbps	8.32	8.55	7.98
	EDR-3Mbps	8.56	8.54	8.06
PCB Antenna Redpine Signals RSIA7 Gain: 0.71 dBi	BR-1Mbps	9.11	9.19	8.94
	EDR-2Mbps	9.92	8.95	8.85
	EDR-3Mbps	9.94	9.1	8.87

BLE RF Power – M7DB6				
Antenna Type, Model No., and Gain	**Configuration**	**Measured Average Output Power (dBm)**		
		Low CH 2402 MHz	**Mid CH 2440 MHz**	**High CH 2480 MHz**
Dipole Antenna TAOGLAS GW.71.5153 Gain: 3.80 dBi	BLE - 1Mbps	9.61	9.86	9.68
	BLE - 2Mbps	9.66	9.94	7.39
PCB Antenna Redpine Signals RSIA7 Gain: 0.71 dBi	BLE - 1Mbps	11.32	11.56	11.43
	BLE - 2Mbps	11.35	10.54	9.19

Wi-Fi 2.4GHz Band – M7DB6				
Antenna Type, Model No., and Gain	**Configuration**	**Measured Average Output Power (dBm)**		
		Low CH HT 20 - 2412 MHz	**Mid CH HT 20 - 2437 MHz**	**High CH HT 20 - 2462 MHz**
Dipole Antenna TAOGLAS GW.71.5153 Gain: 3.80 dBi	IEEE 802.11b	19.18	18.26	18.85
	IEEE 802.11g	19.27	24.5	15.45
	IEEE 802.11n HT 20	16.98	25.15	14.38
PCB Antenna Redpine Signals RSIA7 Gain: 0.71 dBi	IEEE 802.11b	16.55	16.02	16.14
	IEEE 802.11g	14.37	17.39	11.29
	IEEE 802.11n HT 20	13.82	17.6	10.44

Wi-Fi 5GHz Band RF Power – M7DB6					
Antenna Type, Model No., and Gain	**Configuration**	**Measured Average Output Power (dBm)**			**UNII Band**
		Low CH UNII - 1: 5180 MHz UNII - 2a: 5260 MHz UNII - 2c: 5500 MHz UNII - 3: 5745 MHz	**Mid CH UNII - 1: 5200 MHz UNII - 2a: 5300 MHz UNII - 2c: 5580 MHz UNII - 3: 5785 MHz**	**High CH UNII - 1: 5240 MHz UNII - 2a: 5320 MHz UNII - 2c: 5700 MHz UNII - 3: 5825 MHz**	
Dipole Antenna TAOGLAS GW.71.5153 Gain: 5.50 dBi	IEEE 802.11a	11.37	12.05	11.95	UNII - 1
		12.11	12.08	12.12	UNII - 2a
		12.05	12.85	13.26	UNII - 2c
		13.65	13.4	13.54	UNII - 3
	IEEE 802.11n HT 20	11.15	11.81	11.8	UNII - 1
		12.08	12.38	12.19	UNII - 2a
		11.18	13.72	8.87	UNII - 2c
		13.29	13.37	13.45	UNII - 3
		9.72	-	6.6	UNII - 2a
		7.19	11.2	11.14	UNII - 2c
		11.33	-	11.52	UNII - 3
PCB Antenna Redpine Signals RSIA7 Gain: 1.25 dBi	IEEE 802.11a	11.46	11.83	11.55	UNII - 1
		11.63	11.36	10.82	UNII - 2a
		12.42	13.48	13.41	UNII - 2c
		14.34	14.55	14.61	UNII - 3
	IEEE 802.11n HT 20	11.3	12	11.75	UNII - 1
		12.16	12.75	11.1	UNII - 2a
		10.89	13.86	13.63	UNII - 2c
		14.38	14.56	14.68	UNII - 3
		9.4	-	5.36	UNII - 2a
		7.57	11.67	12.54	UNII - 2c
		12.5	-	12.67	UNII - 3

5.2.2 RS9116 – CC0/CC1 Module, Silicon Version – 1.3, Standard - CE

Note: The module delivers less RF output power at high temperature.

BT RF Power – M7DB6					
Antenna Type, Model No. and Gain	**Configuration**	**CH Freq.**	**Measured Average Output Power (dBm)**		
			Tmin (-40°C)	**Tnom (25°C)**	**Tmax (85°C)**
PCB Antenna Redpine Signals RSIA7 Gain: 0.71 dBi	BR - 1Mbps	Hopping 2402 - 2480 MHz	9.12	5.39	1.30
	EDR - 3Mbps	Hopping 2402 - 2480 MHz	9.02	4.97	0.93

BLE RF Power – M7DB6					
Antenna Type, Model No. and Gain	**Configuration**	**CH Freq.**	**Measured Average Output Power (dBm)**		
			Tmin (-40°C)	**Tnom (25°C)**	**Tmax (85°C)**
PCB Antenna Redpine Signals RSIA7 Gain: 0.71 dBi	BLE - 1Mbps	Low CH 2402 MHz	8.3	4.68	0.48
		Mid CH 2440 MHz	8.06	4.02	-0.26
		High CH 2480 MHz	8.59	4.45	0.40
	BLE - 2Mbps	Low CH 2402 MHz	8.99	4.99	0.94
		Mid CH 2440 MHz	8.66	4.59	0.30
		High CH 2480 MHz	9.13	5.03	0.59

Wi-Fi 2.4GHz Band RF Power – M7DB6					
Antenna Type, Model No. and Gain	**Configuration**	**CH Freq.**	**Measured Average Output Power (dBm)**		
			Tmin (-40°C)	**Tnom (25°C)**	**Tmax (85°C)**
PCB Antenna Redpine Signals RSIA7 Gain: 0.71 dBi	IEEE 802.11b	Low CH 2412 MHz	18.34	15.49	10.39
		Mid CH 2442 MHz	18.96	15.82	10.37
		High CH 2472 MHz	18.36	15.59	10.16
	IEEE 802.11g	Low CH 2412 MHz	18.81	15.66	10.36
		Mid CH 2442 MHz	18.91	15.67	10.14
		High CH 2472 MHz	18.33	15.38	9.72
	IEEE 802.11n HT 20	Low CH 2412 MHz	18.89	15.82	10.5
		Mid CH 2442 MHz	19.01	15.7	10.43
		High CH 2472 MHz	18.49	15.41	10.6
		Mid CH 2442 MHz	18.75	14.05	8.21
		High CH 2462 MHz	18.43	14.1	9.01

Wi-Fi 5GHz Band RF Power – M7DB6						
Antenna Type, Model No. and Gain	**Configuration**	**CH Freq.**	**Measured Average Output Power (dBm)**			**UNII Band**
			Tmin (-40°C)	**Tnom (25°C)**	**Tmax (85°C)**	
PCB Antenna Redpine Signals RSIA7 Gain: 1.25 dBi	IEEE 802.11a	5180 MHz	18.05	13.11	7.96	UNII - 1
		5320 MHz	17.73	12.8	7.41	UNII - 2a
		5500 MHz	17.53	13.6	8.49	UNII - 2c
		5700 MHz	17.55	14.19	9.38	

	IEEE 802.11n HT 20	5180 MHz	17.77	12.71	7.68	UNII - 1
		5320 MHz	17.88	12.96	7.94	UNII - 2a
		5500 MHz	16.63	12.69	7.73	UNII - 2c
		5700 MHz	16.73	13.14	8.31	
		5310 MHz	16.01	10.27	5.29	UNII - 2a
		5510 MHz	16.57	12.19	7.44	UNII - 2c
		5670 MHz	15.96	11.95	7.02	

5.2.3 RS9116 – CC0/CC1 Module, Silicon Version – 1.3, Standard – TELEC

BT RF Power – M7DB6				
Antenna Type, Model No. and Gain	**Configuration**	**Measured Average Output Power (dBm)**		
		Low CH 2402 MHz	**Mid CH 2441 MHz**	**High CH 2480 MHz**
RSIA17 PCB Trace Antenna 0.712 dBi GW.71.5153 Heavy Duty Screw Mount Antenna 3.8 dBi AEM6P-100000 Dipole Antenna 2 dBi AEM6P-100001 Dipole Antenna 2 dBi AEEE0-000000 Multilayer ceramic Antenna 2.13 dBi AEEE0-000001 Chip Antenna 4 dBi AEEE0-000002 Chip Antenna 4 dBi AEP6P-100006X PIFA Antenna 3 dBi AEP6P-100008X PIFA Antenna 3 dBi	BR-1Mbps	17.05	17.06	17.04
	EDR-2Mbps	16.82	16.88	16.90
	EDR-3Mbps	17.07	17.12	17.10
	BR-1Mbps - AFH	17.92	17.95	17.91
	EDR-2Mbps - AFH	17.91	17.86	17.88
	EDR-3Mbps - AFH	17.92	17.96	17.86

BLE RF Power – M7DB6				
Antenna Type, Model No. and Gain	**Configuration**	**Measured Average Output Power (dBm)**		
		Low CH 2402 MHz	**Mid CH 2440 MHz**	**High CH 2480 MHz**
RSIA17 PCB Trace Antenna 0.712 dBi GW.71.5153 Heavy Duty Screw Mount Antenna 3.8 dBi AEM6P-100000 Dipole Antenna 2 dBi AEM6P-100001 Dipole Antenna 2 dBi AEEE0-000000 Multilayer ceramic Antenna 2.13 dBi AEEE0-000001 Chip Antenna 4 dBi AEEE0-000002 Chip Antenna 4 dBi AEP6P-100006X PIFA Antenna 3 dBi AEP6P-100008X PIFA Antenna 3 dBi	BLE - 1Mbps	7.8	7.37	7.48
	BLE - 2Mbps	7.43	7.75	7.89

Wi-Fi 2.4GHz Band RF Power - M7DB6				
Antenna Type, Model No. and Gain	**Configuration**	**Measured Average Output Power (dBm)**		
		Low CH HT 20 - 2412 MHz	**Mid CH HT 20 - 2437 MHz**	**High CH HT 20 - 2462 MHz**
RSIA17 PCB Trace Antenna 0.712 dBi GW.71.5153 Heavy Duty Screw Mount Antenna 3.8 dBi AEM6P-100000 Dipole Antenna 2 dBi AEM6P-100001 Dipole Antenna 2 dBi AEEE0-000000 Multilayer ceramic Antenna 2.13 dBi AEEE0-000001 Chip Antenna 4 dBi AEEE0-000002 Chip Antenna 4 dBi AEP6P-100006X PIFA Antenna 3 dBi AEP6P-100008X PIFA Antenna 3 dBi	IEEE 802.11b	15.00	15.11	15.19
	IEEE 802.11g	14.38	14.94	15.07
	IEEE 802.11n HT 20	14.79	15.07	15.19

Wi-Fi 5GHz Band RF Power - M7DB6 20MHz System: 4920MHz – 4980MHz				
Antenna Type, Model No. and Gain	**Configuration**	**Measured Average Output Power (dBm)**		
		Low CH HT 20 - 4920MHz	**Mid CH HT 20 - 4940 MHz**	**High CH HT 20 - 4980 MHz**
AEP6P-100008X PIFA Antenna 3 dBi	20MHz System Continuous Tx mode	10.18	10.34	10.43

Wi-Fi 5GHz Band RF Power - M7DB6 5180MHz-5240MHz and 5260MHz-5320MHz				
Antenna Type, Model No. and Gain	**Configuration**	**Measured Average Output Power (dBm)**		
		Low CH HT 20 W52 5180MHz W53 5260MHz	**Mid CH HT 20 W52 5200MHz W53 5280MHz**	**High CH HT 20 W52 5240MHz W53 5320MHz**
RSIA17 PCB Trace Antenna 1.25 dBi GW.71.5153 Heavy Duty Screw Mount Antenna 5.5 dBi AEM6P-100001 Dipole Antenna 2 dBi AEEE0-000001 Chip Antenna 4 dBi AEEE0-000002 Chip Antenna 4 dBi AEP6P-100008X PIFA Antenna 3 dBi	IEEE 802.11a W52	10.87	10.81	10.93
	IEEE 802.11a W53	11.26	11.20	10.94
	IEEE 802.11n 20MHz W52	8.68	8.58	8.94
	IEEE 802.11n 20MHz W53	9.39	9.24	9.34

Wi-Fi 5GHz Band RF Power - M7DB6 5500MHz-5700MHz				
Antenna Type, Model No. and Gain	**Configuration**	**Measured Average Output Power (dBm)**		
		Low CH HT 20 5500MHz	**Mid CH HT 20 5560MHz**	**High CH HT 20 5700MHz**
RSIA17 PCB Trace Antenna 1.25 dBi GW.71.5153 Heavy Duty Screw Mount Antenna 5.5 dBi AEM6P-100001 Dipole Antenna 2 dBi AEEE0-000001 Chip Antenna 4 dBi AEEE0-000002 Chip Antenna 4 dBi AEP6P-100008X PIFA Antenna 3 dBi	IEEE 802.11a W56	11.42	11.38	10.63
	IEEE 802.11n 20MHz W56	10.40	10.51	10.09

5.2.4 RS9116 – CC0/CC1 Module, Silicon Version – 1.4, Standard – FCC and IC

Note: For a few channels, power reduction is done to pass the band edge requirement.

BT RF Power – M7DB				
Antenna Type, Model No. and Gain	**Configuration**	**Measured Average Output Power (dBm)**		
		Low CH 2402 MHz	**Mid CH 2441 MHz**	**High CH 2480 MHz**
Dipole Antenna TAOGLAS GW.71.5153 Gain: 3.80 dBi	BR-1Mbps	15.8	15.57	15.25
	EDR-2Mbps	15.77	16.45	17.4
	EDR-3Mbps	17.01	16.75	17.13
Dipole Antenna Inside WLAN PRO-IS-299 Gain: 2.50 dBi	BR-1Mbps	19.49	18.3	17.79
	EDR-2Mbps	18.79	18.08	17.4
	EDR-3Mbps	18.31	17.81	17.13
PCB Antenna Redpine Signals RSIA7 Gain: 0.71 dBi	BR-1Mbps	15.01	15.57	15.9
	EDR-2Mbps	18.87	17.65	17.4
	EDR-3Mbps	18.55	18.08	17.36
PIFA Antenna SMARTEQ 4211613980 Gain: 0.00 dBi	BR-1Mbps	18.99	16.4	15.9
	EDR-2Mbps	18.45	16.45	15.87
	EDR-3Mbps	18.27	16.75	16.99
PIFA Antenna MARS-31A8 Gain: 2.00 dBi	BR-1Mbps	13.47	14.03	16.35
	EDR-2Mbps	14.01	14.7	17.32
	EDR-3Mbps	14.71	15.07	17.46

BLE RF Power - M7DB				
Antenna Type, Model No. and Gain	**Configuration**	**Measured Average Output Power (dBm)**		
		Low CH 2402 MHz	**Mid CH 2440 MHz**	**High CH 2480 MHz**
Dipole Antenna TAOGLAS GW.71.5153 Gain: 3.80 dBi	BLE - 1Mbps	15.65	15.63	12.91
	BLE - 2Mbps	17.63	17.26	10.81
Dipole Antenna Inside WLAN PRO-IS-299 Gain: 2.50 dBi	BLE - 1Mbps	18.77	18.11	17.36
	BLE - 2Mbps	18.26	17.79	18.28

PCB Antenna Redpine Signals RSIA7 Gain: 0.71 dBi	BLE - 1Mbps	14.65	14.21	11.84
	BLE - 2Mbps	15.57	15.13	8.38
PIFA Antenna SMARTEQ 4211613980 Gain: 0.00 dBi	BLE - 1Mbps	17.45	16.94	16.27
	BLE - 2Mbps	18.52	18.21	17.32
PIFA Antenna MARS-31A8 Gain: 2.00 dBi	BLE - 1Mbps	13.44	13.63	15.84
	BLE - 2Mbps	14.07	14.93	16.06

Wi-Fi 2.4GHz Band RF Power - M7DB				
Antenna Type, Model No. and Gain	**Configuration**	**Measured Average Output Power (dBm)**		
		Low CH HT 20 - 2412 MHz	**Mid CH HT 20 - 2437 MHz**	**High CH HT 20 - 2462 MHz**
Dipole Antenna TAOGLAS GW.71.5153 Gain: 3.80 dBi	IEEE 802.11b	14.38	14.06	15.31
	IEEE 802.11g	12.83	17.75	13.25
	IEEE 802.11n HT 20	11.76	18.03	12.51
Dipole Antenna Inside WLAN PRO-IS-299 Gain: 2.50 dBi	IEEE 802.11b	15.02	14.82	16.84
	IEEE 802.11g	17.84	17.51	13.54
	IEEE 802.11n HT 20	17.81	18.03	17.93
PCB Antenna Redpine Signals RSIA7 Gain: 0.71 dBi	IEEE 802.11b	14.38	14.06	12.98
	IEEE 802.11g	12.83	17.87	9.84
	IEEE 802.11n HT 20	11.59	18.03	9.01
PIFA Antenna SMARTEQ 4211613980 Gain: 0.00 dBi	IEEE 802.11b	14.38	14.82	15.31
	IEEE 802.11g	17.84	17.75	16.05
	IEEE 802.11n HT 20	11.76	18.03	16.56
PIFA Antenna MARS 31A8 Gain: 2.00 dBi	IEEE 802.11b	14.14	15.11	14.33
	IEEE 802.11g	16.53	14.49	15.96
	IEEE 802.11n HT 20	15.26	17.61	15.32

Wi-Fi 5GHz Band RF Power - M7DB					
Antenna Type, Model No. and Gain	**Configuration**	**Measured Average Output Power (dBm)**			**UNII Band**
		Low CH UNII - 1: 5180 MHz UNII - 2a : 5260 MHz UNII - 2c : 5500 MHz UNII - 3 : 5745 MHz	**Mid CH UNII - 1: 5200 MHz UNII - 2a : 5300 MHz UNII - 2c : 5580 MHz UNII - 3 : 5785 MHz**	**High CH UNII - 1: 5240 MHz UNII - 2a : 5320 MHz UNII - 2c : 5700 MHz UNII - 3 : 5825 MHz**	
Dipole Antenna TAOGLAS GW.71.5153 Gain: 5.50 dBi	IEEE 802.11a	8.31	7.58	7.44	UNII - 1
		12.31	11.93	11.81	UNII - 2a
		13.08	13.18	10.02	UNII - 2c
		13.71	13.65	13.98	UNII - 3
	IEEE 802.11n HT 20	7.87	7.79	7.71	UNII - 1
		12.55	12.12	11.91	UNII - 2a
		13.14	13.03	9.25	UNII - 2c
		13.75	14.02	14.18	UNII - 3

		9.53	-	8.58	UNII - 2a
		10.71	10.75	11.59	UNII - 2c
		11.55	-	11.82	UNII - 3
Dipole Antenna Inside WLAN PRO-IS-299 Gain: 1.60 dBi	IEEE 802.11a	8.31	7.58	7.44	UNII - 1
		12.31	11.93	11.81	UNII - 2a
		13.08	13.18	10.02	UNII - 2c
		13.71	13.65	13.98	UNII - 3
	IEEE 802.11n HT 20	7.87	7.79	7.71	UNII - 1
		12.55	12.12	11.91	UNII - 2a
		13.14	13.03	9.25	UNII - 2c
		13.75	14.02	14.18	UNII - 3
		9.53	-	8.58	UNII - 2a
		10.71	10.75	11.59	UNII - 2c
		11.55	-	11.82	UNII - 3
PCB Antenna Redpine Signals RSIA7 Gain: 1.25 dBi	IEEE 802.11a	8.31	7.58	7.44	UNII - 1
		12.31	11.93	11.81	UNII - 2a
		13.08	13.18	10.02	UNII - 2c
		13.71	13.65	13.98	UNII - 3
	IEEE 802.11n HT 20	7.87	7.79	7.71	UNII - 1
		12.55	12.12	11.91	UNII - 2a
		13.14	13.03	9.25	UNII - 2c
		13.75	14.02	14.18	UNII - 3
		9.53	-	8.58	UNII - 2a
		10.71	10.75	11.59	UNII - 2c
		11.55	-	11.82	UNII - 3
PIFA Antenna SMARTEQ 4211613980 Gain: 2.00 dBi	IEEE 802.11a	8.31	7.58	7.44	UNII - 1
		12.31	11.93	11.81	UNII - 2a
		13.08	13.18	10.02	UNII - 2c
		13.71	13.65	13.98	UNII - 3
	IEEE 802.11n HT 20	7.87	7.79	7.71	UNII - 1
		12.55	12.12	11.91	UNII - 2a
		13.14	13.03	9.25	UNII - 2c
		13.75	14.02	14.18	UNII - 3
		9.53	-	8.58	UNII - 2a
		10.71	10.75	11.59	UNII - 2c
		11.55	-	11.82	UNII - 3

5.2.5 RS9116 – CC0/CC1 Module, Silicon Version – 1.4, Standard – CE

Note: Less RF power is observed at high temperature.

BT RF Power - M7DB					
Antenna Type, Model No. and Gain	**Configuration**	**CH Frequency**	**Measured Average Output Power (dBm)**		
			Tmin (0°C)	**Tnom (20°C)**	**Tmax (75°C)**
Dipole Antenna TAOGLAS GW.71.5153 Gain: 3.80 dBi	BR-1Mbps	Hopping Mode	6.19	2.4	1.26
	EDR-2Mbps		5.92	2.42	0.66
	EDR-3Mbps		5.62	2.39	0.74
Dipole Antenna Inside WLAN PRO-IS-299 Gain: 2.50 dBi	BR-1Mbps		7.29	5.5	1.71
	EDR-2Mbps		7.23	5.56	1.84
	EDR-3Mbps		6.94	5.61	1.54
PCB Antenna Redpine Signals RSIA7 Gain: 0.71 dBi	BR-1Mbps		8.39	5.54	0.58
	EDR-2Mbps		8.17	5.62	3.12
	EDR-3Mbps		9.05	5.75	4.12

PIFA Antenna SMARTEQ 4211613980 Gain: 0.00 dBi	BR-1Mbps		9.54	5.72	1.65
	EDR-2Mbps		9.3	5.73	4.11
	EDR-3Mbps		9.05	5.75	4.12
PIFA Antenna MARS-31A8 Gain: 2.00 dBi	BR-1Mbps		7.29	5.5	1.71
	EDR-2Mbps		7.23	5.56	1.84
	EDR-3Mbps		6.94	5.61	1.54

BLE RF Power - M7DB					
Antenna Type, Model No. and Gain	**Configuration**	**CH Frequency**	**Measured Average Output Power (dBm)**		
			Tmin (0°C)	**Tnom (20°C)**	**Tmax (75°C)**
Dipole Antenna TAOGLAS GW.71.5153 Gain: 3.80 dBi	BLE - 1Mbps	Low CH 2402 MHz	5.79	2	-1.72
		Mid CH 2440 MHz	5.64	1.96	-1.75
		High CH 2480 MHz	5.38	1.71	-1.95
	BLE - 2Mbps	Low CH 2402 MHz	5.16	1.49	-2.18
		Mid CH 2440 MHz	5.04	1.41	-2.27
		High CH 2480 MHz	4.75	1.17	-2.52
Dipole Antenna Inside WLAN PRO-IS-299 Gain: 2.50 dBi	BLE - 1Mbps	Low CH 2402 MHz	6.87	3.12	-0.56
		Mid CH 2440 MHz	6.79	3.03	-1.05
		High CH 2480 MHz	6.56	2.83	-1.59
	BLE - 2Mbps	Low CH 2402 MHz	6.31	2.55	-1.1
		Mid CH 2440 MHz	6.23	2.53	-1.17
		High CH 2480 MHz	5.94	2.31	-1.65
PCB Antenna Redpine Signals RSIA7 Gain: 0.71 dBi	BLE - 1Mbps	Low CH 2402 MHz	9.26	5.44	1.2
		Mid CH 2440 MHz	9.27	5.43	1.25
		High CH 2480 MHz	9.09	5.26	1.12
	BLE - 2Mbps	Low CH 2402 MHz	8.75	4.89	0.86
		Mid CH 2440 MHz	8.73	4.87	0.83
		High CH 2480 MHz	8.71	4.69	0.65
PIFA Antenna SMARTEQ 4211613980 Gain: 0.00 dBi	BLE - 1Mbps	Low CH 2402 MHz	9.26	5.44	1.2
		Mid CH 2440 MHz	9.27	5.43	1.25
		High CH 2480 MHz	9.09	5.26	1.12

	BLE - 2Mbps	Low CH 2402 MHz	8.75	4.89	0.86
		Mid CH 2440 MHz	8.73	4.87	0.83
		High CH 2480 MHz	8.71	4.69	0.65
PIFA Antenna MARS-31A8 Gain: 2.00 dBi	BLE - 1Mbps	Low CH 2402 MHz	6.87	3.12	-0.56
		Mid CH 2440 MHz	6.79	3.03	-1.05
		High CH 2480 MHz	6.56	2.83	-1.59
	BLE - 2Mbps	Low CH 2402 MHz	6.31	2.55	-1.1
		Mid CH 2440 MHz	6.23	2.53	-1.17
		High CH 2480 MHz	5.94	2.31	-1.65

Wi-Fi 2.4GHz Band RF Power - M7DB					
Antenna Type, Model No. and Gain	**Configuration**	**CH Frequency**	**Measured Average Output Power (dBm)**		
			Tmin (0°C)	**Tnom (20°C)**	**Tmax (75°C)**
Dipole Antenna TAOGLAS GW.71.5153 Gain: 3.80 dBi	IEEE 802.11b	Low CH 2412 MHz	11.3	14.08	15.77
		Mid CH 2442 MHz	10.5	13.57	15.28
		High CH 2472 MHz	10.62	13.87	15.62
	IEEE 802.11g	Low CH 2412 MHz	14.13	15.24	14.7
		Mid CH 2442 MHz	14.65	16.1	14.12
		High CH 2472 MHz	14.1	15.11	14.4
	IEEE 802.11n HT 20	Low CH 2412 MHz	14.37	15.51	14.9
		Mid CH 2442 MHz	14	15.1	14.39
		High CH 2472 MHz	14.24	15.34	14.71
Dipole Antenna Inside WLAN PRO-IS-299 Gain: 2.50 dBi	IEEE 802.11b	Low CH 2412 MHz	12.48	15.42	16.34
		Mid CH 2442 MHz	12.55	15.16	15.91
		High CH 2472 MHz	12.58	15.44	16.27
	IEEE 802.11g	Low CH 2412 MHz	15.06	16.57	14.29
		Mid CH 2442 MHz	15.58	17.12	14.2
		High CH 2472 MHz	14.91	16.41	14.42

	IEEE 802.11n HT 20	Low CH 2412 MHz	16.19	17.26	14.91
		Mid CH 2442 MHz	15.58	17.29	14.44
		High CH 2472 MHz	15.17	16.67	14.7
PCB Antenna Redpine Signals RSIA7 Gain: 0.71 dBi	IEEE 802.11b	Low CH 2412 MHz	13.82	16.72	16.64
		Mid CH 2442 MHz	14.3	17.29	15.96
		High CH 2472 MHz	13.52	16.58	16.29
	IEEE 802.11g	Low CH 2412 MHz	15.91	17.59	14.8
		Mid CH 2442 MHz	15.58	17.12	14.2
		High CH 2472 MHz	15.82	17.72	14.43
	IEEE 802.11n HT 20	Low CH 2412 MHz	16.19	17.26	14.91
		Mid CH 2442 MHz	15.58	17.29	14.44
		High CH 2472 MHz	16.05	17.87	14.71
PIFA Antenna SMARTEQ 4211613980 Gain: 0.00 dBi	IEEE 802.11b	Low CH 2412 MHz	15.2	17.61	16.33
		Mid CH 2442 MHz	14.3	17.29	15.9
		High CH 2472 MHz	14.32	17.57	16.26
	IEEE 802.11g	Low CH 2412 MHz	15.91	17.59	14.8
		Mid CH 2442 MHz	15.58	17.12	14.2
		High CH 2472 MHz	15.82	17.72	14.43
	IEEE 802.11n HT 20	Low CH 2412 MHz	16.19	17.26	14.91
		Mid CH 2442 MHz	15.58	17.29	14.44
		High CH 2472 MHz	16.05	17.87	14.71
PIFA Antenna MARS 31A8 Gain: 2.00 dBi	IEEE 802.11b	Low CH 2412 MHz	12.48	15.42	16.34
		Mid CH 2442 MHz	12.55	15.16	15.91
		High CH 2472 MHz	12.58	15.44	16.27
	IEEE 802.11g	Low CH 2412 MHz	15.06	16.57	14.29
		Mid CH 2442 MHz	15.58	17.12	14.2
		High CH 2472 MHz	14.91	16.41	14.42

	IEEE 802.11n HT 20	Low CH 2412 MHz	16.19	17.26	14.91
		Mid CH 2442 MHz	15.58	17.29	14.44
		High CH 2472 MHz	15.17	16.67	15.7

Wi-Fi 5GHz Band RF Power - M7DB						
Antenna Type, Model No. and Gain	**Configuration**	**CH Frequency**	**Measured Average Output Power (dBm)**			**UNII Band**
			Tmin (0°C)	**Tnom (20°C)**	**Tmax (75°C)**	
Dipole Antenna TAOGLAS GW.71.5153 Gain: 5.50 dBi	IEEE 802.11a	5180 MHz	17.49	13.83	6.4	UNII - 1
		5320 MHz	13.23	12.14	6.34	UNII - 2a
		5500 MHz	12.92	11.97	8.87	UNII - 2c
		5700 MHz	12.46	12.01	9.5	
		5745 MHz	7.25	7.82	4.62	UNII - 3
		5785 MHz	7.96	8.15	4.83	
		5825 MHz	8.44	8.27	4.64	
	IEEE 802.11n HT 20	5180 MHz	16.62	13.83	6.59	UNII - 1
		5320 MHz	13.47	12.18	6.2	UNII - 2a
		5500 MHz	11.29	12.13	9.03	UNII - 2c
		5700 MHz	13.02	11.84	9.73	
		5745 MHz	7.62	7.81	4.7	UNII - 3
		5785 MHz	8.34	7.51	4.86	
		5825 MHz	7.78	8.04	4.13	
Dipole Antenna Inside WLAN PRO-IS-299 Gain: 1.60 dBi	IEEE 802.11a	5180 MHz	18.13	13.63	6.7	UNII - 1
		5320 MHz	17.11	12.62	6.44	UNII - 2a
		5500 MHz	16.39	14.94	8.97	UNII - 2c
		5700 MHz	15.75	14.99	9.89	
		5745 MHz	11.74	11.12	8.94	UNII - 3
		5785 MHz	11.97	10.84	7.61	
		5825 MHz	12.15	10.99	8.81	
	IEEE 802.11n HT 20	5180 MHz	18.37	13.73	6.72	UNII - 1
		5320 MHz	17.35	12.76	6.41	UNII - 2a
		5500 MHz	13.2	14.52	8.72	UNII - 2c
		5700 MHz	15.04	13.84	9.82	
		5745 MHz	12.3	11.28	8.73	UNII - 3
		5785 MHz	11.77	10.81	7.88	
		5825 MHz	12.03	11.18	8.54	
PCB Antenna Redpine Signals RSIA7 Gain: 1.25 dBi	IEEE 802.11a	5180 MHz	18.13	13.63	6.7	UNII - 1
		5320 MHz	17.11	12.62	6.44	UNII - 2a
		5500 MHz	16.39	14.94	8.97	UNII - 2c
		5700 MHz	15.75	14.99	9.89	
		5745 MHz	11.74	11.12	8.94	UNII - 3
		5785 MHz	12.3	11.28	8.73	
		5825 MHz	12.63	11.31	8.67	
	IEEE 802.11n HT 20	5180 MHz	18.37	13.73	6.72	UNII - 1
		5320 MHz	17.35	12.76	6.41	UNII - 2a
		5500 MHz	13.2	14.52	8.72	UNII - 2c
		5700 MHz	15.04	13.84	9.82	
		5745 MHz	12.15	10.99	8.81	UNII - 3
		5785 MHz	12.54	11.31	8.81	
		5825 MHz	12.03	11.18	8.54	

PIFA Antenna SMARTEQ 4211613980 Gain: 2.00 dBi	IEEE 802.11a	5180 MHz	18.13	13.63	6.7	UNII - 1
		5320 MHz	17.11	12.62	6.44	UNII - 2a
		5500 MHz	16.39	14.94	8.97	UNII - 2c
		5700 MHz	15.75	14.99	9.89	
		5745 MHz	11.11	10.69	7.53	UNII - 3
		5785 MHz	11.4	10.52	7.92	
		5825 MHz	11.67	10.11	6.96	
	IEEE 802.11n HT 20	5180 MHz	18.37	13.73	6.72	UNII - 1
		5320 MHz	17.35	12.76	6.41	UNII - 2a
		5500 MHz	13.2	14.52	8.72	UNII - 2c
		5700 MHz	15.04	13.84	9.82	
		5745 MHz	11.21	10.76	7.42	UNII - 3
		5785 MHz	11.77	10.78	7.88	
		5825 MHz	11.92	10.48	6.87	
PIFA Antenna MARS 31A8 Gain: 2.00 dBi	IEEE 802.11a	5180 MHz	18.13	13.63	6.7	UNII - 1
		5320 MHz	17.11	12.62	6.44	UNII - 2a
		5500 MHz	16.39	14.94	8.97	UNII - 2c
		5700 MHz	15.75	14.99	9.89	
		5745 MHz	11.11	10.69	11.08	UNII - 3
		5785 MHz	11.4	10.52	7.92	
		5825 MHz	11.67	10.11	6.96	
	IEEE 802.11n HT 20	5180 MHz	18.37	13.73	6.72	UNII - 1
		5320 MHz	17.35	12.76	6.41	UNII - 2a
		5500 MHz	13.2	14.52	8.72	UNII - 2c
		5700 MHz	15.04	13.84	9.82	
		5745 MHz	11.21	10.76	7.42	UNII - 3
		5785 MHz	11.77	10.78	7.88	
		5825 MHz	11.92	10.48	6.87	

5.2.6 RS9116 – CC0/CC1 Module, Silicon Version – 1.4, Standard – TELEC

BT RF Power – M7DB				
Antenna Type, Model No. and Gain	**Configuration**	**Measured Avg. Output Power (dBm)**		
		Low CH 2402 MHz	**Mid CH 2441 MHz**	**High CH 2480 MHz**
Dipole Antenna TAOGLAS GW.71.5153 Gain: 3.80 dBi	BR-1Mbps	18.55	18.35	17.28
	EDR-2Mbps	16.25	15.54	14.34
	EDR-3Mbps	16.31	15.63	14.41
Dipole Antenna Inside WLAN PRO-IS-299 Gain: 2.50 dBi	BR-1Mbps	20.57	20.05	19.43
	EDR-2Mbps	15.99	15.12	14.09
	EDR-3Mbps	16.30	15.59	14.37
PCB Antenna Redpine Signals RSIA7 Gain: 0.71 dBi	BR-1Mbps	20.69	20.18	19.55
	EDR-2Mbps	16.07	15.24	14.18
	EDR-3Mbps	16.47	15.75	14.54
PIFA Antenna SMARTEQ 4211613980 Gain: 0.00 dBi	BR-1Mbps	20.52	20.07	19.45
	EDR-2Mbps	15.97	15.15	14.11
	EDR-3Mbps	16.39	15.68	14.41

PIFA Antenna MARS-31A8 Gain: 2.00 dBi	BR-1Mbps	20.51	20.06	19.48
	EDR-2Mbps	16.19	15.32	14.26
	EDR-3Mbps	16.58	15.82	14.66

BLE RF Power – M7DB				
Antenna Type, Model No. and Gain	**Configuration**	**Measured Avg. Output Power (dBm)**		
		Low CH 2402 MHz	**Mid CH 2440 MHz**	**High CH 2480 MHz**
Dipole Antenna TAOGLAS GW.71.5153 Gain: 3.80 dBi	BLE - 1Mbps	7.16	7.98	7.05
	BLE - 2Mbps	7.91	7.70	6.56
Dipole Antenna Inside WLAN PRO-IS-299 Gain: 2.50 dBi	BLE - 1Mbps	9.41	9.21	8.43
	BLE - 2Mbps	7.89	7.63	9.06
PCB Antenna Redpine Signals RSIA7 Gain: 0.71 dBi	BLE - 1Mbps	9.45	9.19	8.46
	BLE - 2Mbps	7.86	7.65	9.08
PIFA Antenna SMARTEQ 4211613980 Gain: 0.00 dBi	BLE - 1Mbps	9.48	9.15	8.5
	BLE - 2Mbps	8.12	7.61	9.04
PIFA Antenna MARS-31A8 Gain: 2.00 dBi	BLE - 1Mbps	9.36	9.21	8.40
	BLE - 2Mbps	7.93	7.73	9.02

Wi-Fi 2.4GHz Band RF Power - M7DB				
Antenna Type, Model No. and Gain	**Configuration**	**Measured Avg. Output Power (dBm)**		
		Low CH 2412 MHz	**Mid CH 2437 MHz**	**High CH 2462 MHz**
Dipole Antenna TAOGLAS GW.71.5153 Gain: 3.80 dBi	IEEE 802.11b	15.26	14.45	15.94
	IEEE 802.11g	18.41	17.70	17.93
	IEEE 802.11n HT 20	18.37	17.72	17.98
Dipole Antenna Inside WLAN PRO-IS-299 Gain: 2.50 dBi	IEEE 802.11b	17.45	18.02	17.62
	IEEE 802.11g	19.30	18.78	17.93
	IEEE 802.11n HT 20	19.45	18.92	18.05
PCB Antenna Redpine Signals RSIA7 Gain: 0.71 dBi	IEEE 802.11b	18.65	18.05	17.58
	IEEE 802.11g	19.34	18.81	17.95
	IEEE 802.11n HT 20	19.44	18.94	18.02

PIFA Antenna SMARTEQ 4211613980 Gain: 0.00 dBi	IEEE 802.11b	18.47	17.99	17.52
	IEEE 802.11g	19.30	18.78	17.98
	IEEE 802.11n HT 20	19.47	18.95	17.98
PIFA Antenna MARS-31A8 Gain: 2.00 dBi	IEEE 802.11b	18.61	18.06	17.52
	IEEE 802.11g	19.38	18.77	17.99
	IEEE 802.11n HT 20	19.43	18.92	18.05

Wi-Fi 5GHz Band RF Power - M7DB							
Antenna Type, Model No. and Gain	**Configuration**	**Measured Avg. Output Power (dBm)**					
		5180MHz	**5200MHz**	**5240MHz**	**5500MHz**	**5600MHz**	**5700MHz**
Dipole Antenna TAOGLAS GW.71.5153 Gain: 5.50 dBi	IEEE 802.11a	11.65	11.78	11.03	13.23	14.17	13.52
	IEEE 802.11n HT20	11.92	11.46	11.28	12.45	13.45	12.46
Dipole Antenna Inside WLAN PRO-IS-299 Gain: 1.60 dBi	IEEE 802.11a	11.69	11.74	11.09	13.25	14.10	13.52
	IEEE 802.11n HT20	11.95	11.46	11.31	12.38	13.48	12.42
PCB Antenna Redpine Signals RSIA7 Gain: 1.25 dBi	IEEE 802.11a	11.68	11.76	11.08	13.24	14.15	13.53
	IEEE 802.11n HT20	11.96	11.51	11.26	12.43	13.49	12.48
PIFA Antenna SMARTEQ 4211613980 Gain: 2.00 dBi	IEEE 802.11a	11.67	11.74	11.10	13.26	14.14	13.57
	IEEE 802.11n HT20	11.94	11.50	11.27	12.40	13.47	12.49
PIFA Antenna MARS 31A8 Gain: 3.02 dBi	IEEE 802.11a	11.72	11.79	11.11	13.27	14.18	13.58
	IEEE 802.11n HT20	11.99	11.53	11.28	12.42	13.45	12.49

5.2.7 RS9116 – B00 Module, Silicon Version – 1.4, Standard – FCC

BT RF Power - RS9116-B0014				
Antenna Type, Model No., and Gain	**Configuration**	**Measured Average Output Power (dBm)**		
		Low CH	**Mid CH**	**High CH**
		2402 MHz	**2440 MHz**	**2480 MHz**
Chip Antenna FR05-S1-N-0-102 Gain: 1.7 dBi Voltage: 1.8Vdc	BR-1Mbps	17.11	16.60	15.88
	EDR-2Mbps	16.72	16.35	15.51
	EDR-3Mbps	16.94	16.51	14.33
Chip Antenna FR05-S1-N-0-102 Gain: 1.7 dBii Voltage: 3.3Vdc	BR-1Mbps	18.87	18.57	20.60
	EDR-2Mbps	17.13	18.93	18.76
	EDR-3Mbps	16.98	18.78	18.61
Dipole Antenna GW.34.5153 Gain: 5.89 dBi Voltage: 1.8Vdc	BR-1Mbps	16.60	16.06	15.47
	EDR-2Mbps	16.34	15.98	15.13
	EDR-3Mbps	16.56	16.12	15.08
Dipole Antenna GW.34.5153 Gain: 5.89 dBi Voltage: 3.3Vdc	BR-1Mbps	18.83	18.53	20.37
	EDR-2Mbps	17.17	18.93	18.67
	EDR-3Mbps	16.99	18.83	18.59

BLE RF Power - RS9116-B0014				
Antenna Type, Model No., and Gain	**Configuration**	**Measured Average Output Power (dBm)**		
		Low CH 2402 MHz	**Mid CH 2440 MHz**	**High CH 2480 MHz**
Chip Antenna FR05-S1-N-0-102 Gain: 1.7 dBii Voltage: 1.8Vdc	BLE - 1Mbps	16.88	16.35	15.66
	BLE - 2Mbps	16.73	16.22	9.51
Chip Antenna FR05-S1-N-0-102 Gain: 1.7 dBi Voltage: 3.3Vdc	BLE - 1Mbps	21.23	20.86	17.71
	BLE - 2Mbps	20.78	20.50	12.00
Dipole Antenna GW.34.5153 Gain: 5.89 dBi Voltage: 1.8Vdc	BLE - 1Mbps	16.83	16.31	15.62
	BLE - 2Mbps	16.75	16.24	9.60
Dipole Antenna GW.34.5153 Gain: 5.89 dBi Voltage: 3.3Vdc	BLE - 1Mbps	21.21	20.80	17.84
	BLE - 2Mbps	20.64	20.40	11.81

Wi-Fi 2.4GHz Band Power - RS9116-B0014				
Antenna Type, Model No., and Gain	**Configuration**	**Measured Average Output Power (dBm)**		
		Low CH HT 20 - 2412 MHz	**Mid CH HT 20 - 2437 MHz**	**High CH HT 20 - 2462 MHz**
Chip Antenna FR05-S1-N-0-102 Gain: 1.7 dBi Voltage: 1.8Vdc	IEEE 802.11b	14.24	15.23	12.94
	IEEE 802.11g	9.27	15.20	8.13
	IEEE 802.11n HT20	7.25	14.46	6.28

Chip Antenna FR05-S1-N-0-102 Gain: 1.7 dBi Voltage: 3.3Vdc	IEEE 802.11b	17.49	17.75	15.68
	IEEE 802.11g	10.96	18.60	10.94
	IEEE 802.11n HT20	10.11	17.73	10.98
Dipole Antenna GW.34.5153 Gain: 5.89 dBi Voltage: 1.8Vdc	IEEE 802.11b	14.70	15.10	12.88
	IEEE 802.11g	10.50	15.01	8.16
	IEEE 802.11n HT20	9.45	15.04	8.15
Dipole Antenna GW.34.5153 Gain: 5.89 dBi Voltage: 3.3Vdc	IEEE 802.11b	17.84	17.60	15.64
	IEEE 802.11g	11.76	18.51	10.75
	IEEE 802.11n HT20	10.97	17.47	9.86

5.2.8 RS9116 – B00 Module, Silicon Version – 1.4, Standard – CE

BT RF Power - RS9116-B0014					
Antenna Type, Model No., and Gain	**Configuration**	**CH Frequency**	**Measured Average Output Power (dBm)**		
			Tmin (-40°C)	**Tnom (20°C)**	**Tmax (85°C)**
Chip Antenna FR05-S1-N-0-102 Gain: 1.7 dBi Voltage: 1.8Vdc	BR-1Mbps	Hopping Mode	8.03	7.99	6.82
	EDR-2Mbps		7.52	7.21	6.18
	EDR-3Mbps		7.87	7.77	6.62
Chip Antenna FR05-S1-N-0-102 Gain: 1.7 dBi Voltage: 3.3Vdc	BR-1Mbps		5.52	8.18	7.19
	EDR-2Mbps		5.22	8.13	6.6
	EDR-3Mbps		5.3	8.22	6.37
Dipole Antenna GW.34.5153 Gain: 5.89 dBi Voltage : 1.8Vdc	BR-1Mbps		3.84	3.03	2.31
	EDR-2Mbps		3.13	2.87	2.07
	EDR-3Mbps		3.9	3.01	2.38
Dipole Antenna GW.34.5153 Gain: 5.89 dBi Voltage: 3.3Vdc	BR-1Mbps		2.17	1.21	2.52
	EDR-2Mbps		1.65	1.12	2.46
	EDR-3Mbps		2.65	1.47	2.88

BLE RF Power - RS9116-B0014					
Antenna Type, Model No. and Gain	**Configuration**	**CH Frequency**	**Measured Average Output Power (dBm)**		
			Tmin (-40°C)	**Tnom (20°C)**	**Tmax (85°C)**
Chip Antenna FR05-S1-N-0-102 Gain: 1.7 dBi Voltage: 1.8Vdc	BLE - 1Mbps	Low	7.79	7.37	6.42
		Mid	7.37	7.26	6.31
		High	8.02	7.93	7.16
	BLE - 2Mbps	Low	7.39	6.98	6.05
		Mid	8.11	7.87	6.98
		High	7.41	7.49	6.48
Chip Antenna FR05-S1-N-0-102 Gain: 1.7 dBi	BLE - 1Mbps	Low	4.45	7.55	5.54
		Mid	4.13	7.25	5.52
		High	4.82	7.75	6.34

Voltage: 3.3Vdc	BLE - 2Mbps	Low	6.59	6.02	7.24
		Mid	6.29	5.64	7.28
		High	5.79	5.15	6.99
Dipole Antenna GW.34.5153 Gain: 5.89 dBi Voltage: 1.8Vdc	BLE - 1Mbps	Low	3.51	3.2	2.58
		Mid	3.22	2.91	2.26
		High	2.83	2.42	1.74
	BLE - 2Mbps	Low	3.5	2.53	1.93
		Mid	3.15	2.15	1.83
		High	3.73	2.72	2.45
Dipole Antenna GW.34.5153 Gain: 5.89 dBi Voltage: 3.3Vdc	BLE - 1Mbps	Low	2.56	1.38	3.81
		Mid	0.68	3.89	2.46
		High	0.06	3.56	2
	BLE - 2Mbps	Low	3.97	3.84	3.79
		Mid	3.65	3.58	3.83
		High	3.22	3.13	3.92

Wi-Fi 2.4GHz Band RF Power - RS9116-B0014					
Antenna Type, Model No. and Gain	**Configuration**	**CH Frequency**	**Measured Average Output Power (dBm)**		
			Tmin (-40°C)	**Tnom (20°C)**	**Tmax (85°C)**
Chip Antenna FR05-S1-N-0-102 Gain: 1.7 dBi Voltage: 1.8Vdc	IEEE 802.11b	Low CH	16.8	16.08	13.53
		Mid CH	16.52	15.78	13.09
		High CH	17.17	16.06	12.76
	IEEE 802.11g	Low CH	16.1	16.24	15.29
		Mid CH	17.47	17.32	14.75
		High CH	15.46	15.25	14.29
	IEEE 802.11n HT 20	Low CH	16.04	16.06	15.38
		Mid CH	17.48	17.31	15.01
		High CH	15.49	15.27	14.3
Chip Antenna FR05-S1-N-0-102 Gain: 1.7 dBi Voltage: 3.3Vdc	IEEE 802.11b	Low CH	13.09	15.97	13.6
		Mid CH	12.39	15.77	13.07
		High CH	12.02	15.74	12.84
	IEEE 802.11g	Low CH	15.85	18.12	15.9
		Mid CH	15.12	17.56	15.43
		High CH	14.68	17.21	15
	IEEE 802.11n HT 20	Low CH	16.03	18.13	15.94
		Mid CH	15.19	17.59	15.36
		High CH	14.66	17.33	15.02
Dipole Antenna GW.34.5153 Gain: 5.89 dBi Voltage: 1.8Vdc	IEEE 802.11b	Low CH	12.08	11.92	11.48
		Mid CH	11.41	11.72	11.05
		High CH	11.03	11.64	10.8
	IEEE 802.11g	Low CH	14.07	13.16	13.06
		Mid CH	13.63	12.98	12.37

		High CH	13.68	12.57	11.63
	IEEE 802.11n HT 20	Low CH	13.96	13.38	13.02
		Mid CH	13.72	12.83	12.44
		High CH	13.63	12.7	11.87
Dipole Antenna GW.34.5153 Gain: 5.89 dBi Voltage: 3.3Vdc	IEEE 802.11b	Low CH	9.15	11.85	10.13
		Mid CH	8.56	11.64	9.71
		High CH	8.2	11.69	9.39
	IEEE 802.11g	Low CH	11.49	13.55	10.31
		Mid CH	11.67	13.73	10.79
		High CH	11.35	13.58	10.39
	IEEE 802.11n HT 20	Low CH	11.31	13.64	10.59
		Mid CH	11.76	13.87	10.76
		High CH	11.22	13.49	10.14

5.2.9 RS9116 – B00 Module, Silicon Version – 1.4, Standard – TELEC

BT RF Power - RS9116-B0014				
Antenna Type, Model No. and Gain	**Configuration**	**Measured Avg. Output Power (dBm)**		
		Low CH 2402 MHz	**Mid CH 2441 MHz**	**High CH 2480 MHz**
Chip Antenna FR05-S1-N-0-102 Gain: 1.7 dBi Voltage: 1.8Vdc	BR-1Mbps - AFH	17.04	16.8	16.41
	EDR-2Mbps - AFH	9.23	16.34	16.17
	EDR-3Mbps - AFH	11.96	16.32	16.30
Chip Antenna FR05-S1-N-0-102 Gain: 1.7 dBi Voltage: 3.3Vdc	BR-1Mbps - AFH	18.65	21.70	21.32
	EDR-2Mbps - AFH	11.96	19.55	19.59
	EDR-3Mbps - AFH	12.26	19.37	19.56
Dipole Antenna GW.34.5153 Gain: 5.89 dBi Voltage: 1.8Vdc	BR-1Mbps - AFH	16.91	16.78	16.42
	EDR-2Mbps - AFH	9.11	16.45	16.20
	EDR-3Mbps - AFH	11.84	16.39	16.44
Dipole Antenna GW.34.5153 Gain: 5.89 dBi Voltage: 3.3Vdc	BR-1Mbps - AFH	17.99	18.29	18.31
	EDR-2Mbps - AFH	11.70	17.53	17.51
	EDR-3Mbps - AFH	12.12	17.29	17.33
PCB Antenna RFPCA500609IMAB301 Gain: 4.53dBi Voltage: 1.8Vdc	BR-1Mbps - AFH	17.05	16.83	16.45
	EDR-2Mbps - AFH	9.22	16.44	16.22
	EDR-3Mbps - AFH	11.91	16.41	16.45
PCB Antenna RFPCA500609IMAB301 Gain: 4.53dBi Voltage: 3.3Vdc	BR-1Mbps - AFH	18.64	18.73	18.62
	EDR-2Mbps - AFH	11.69	18.57	18.61
	EDR-3Mbps - AFH	12.05	18.56	18.41

BLE RF Power - RS9116-B0014				
Antenna Type, Model No. and Gain	**Configuration**	**Measured Avg. Output Power (dBm)**		
		Low CH 2402 MHz	**Mid CH 2440 MHz**	**High CH 2480 MHz**
Chip Antenna FR05-S1-N-0-102 Gain: 1.7 dBi Voltage: 1.8Vdc	BLE - 1Mbps	9.91	9.97	9.99
	BLE - 2Mbps	3.24	9.92	9.96
Chip Antenna FR05-S1-N-0-102 Gain: 1.7 dBi Voltage: 3.3Vdc	BLE - 1Mbps	9.96	9.54	9.81
	BLE - 2Mbps	2.7	9.95	9.98
Dipole Antenna GW.34.5153 Gain: 5.89 dBi Voltage: 1.8Vdc	BLE - 1Mbps	6.12	5.51	5.64
	BLE - 2Mbps	2.2	5.94	6.09
Dipole Antenna GW.34.5153 Gain: 5.89 dBi Voltage: 3.3Vdc	BLE - 1Mbps	5.46	6.05	6.21
	BLE - 2Mbps	2.2	5.39	5.59
PCB Antenna RFPCA500609IMAB301 Gain: 4.53dBi Voltage: 1.8Vdc	BLE - 1Mbps	7.21	6.66	6.81
	BLE - 2Mbps	2.21	7.08	7.24
PCB Antenna RFPCA500609IMAB301 Gain: 4.53dBi Voltage: 3.3Vdc	BLE - 1Mbps	7.54	7.16	7.41
	BLE - 2Mbps	2.24	7.53	6.66

Wi-Fi 2.4GHz Band RF Power - RS9116-B0014				
Antenna Type, Model No. and Gain	**Configuration**	**Measured Avg. Output Power (dBm)**		
		Low CH 2412 MHz	**Mid CH 2442 MHz**	**High CH 2472 MHz**
Chip Antenna FR05-S1-N-0-102 Gain: 1.7 dBi Voltage: 1.8Vdc	IEEE 802.11b	16.70	16.55	16.07
	IEEE 802.11g	14.06	17.56	15.77
	IEEE 802.11n HT 20	14.16	17.58	14.87
Chip Antenna FR05-S1-N-0-102 Gain: 1.7 dBi Voltage: 3.3Vdc	IEEE 802.11b	19.16	19.18	19.11
	IEEE 802.11g	19.35	20.61	18.45
	IEEE 802.11n HT 20	19.41	20.52	18.41
Dipole Antenna GW.34.5153 Gain: 5.89 dBi Voltage: 1.8Vdc	IEEE 802.11b	15.53	15.41	15.22
	IEEE 802.11g	14.18	17.06	14.96
	IEEE 802.11n HT 20	14.23	17.65	15.01
Dipole Antenna GW.34.5153 Gain: 5.89 dBi Voltage: 3.3Vdc	IEEE 802.11b	15.81	15.85	15.85
	IEEE 802.11g	16.91	17.88	17.15
	IEEE 802.11n HT 20	18.18	17.91	17.18
PCB Antenna RFPCA500609IMAB301 Gain: 4.53dBi Voltage: 1.8Vdc	IEEE 802.11b	16.61	16.49	16.18
	IEEE 802.11g	14.27	17.65	15.85
	IEEE 802.11n HT 20	14.26	17.65	14.91

PCB Antenna RFPCA500609IMAB301 Gain: 4.53dBi Voltage: 3.3Vdc	IEEE 802.11b	16.85	16.87	17.85
	IEEE 802.11g	19.28	19.08	18.33
	IEEE 802.11n HT 20	18.18	19.15	17.21

5.2.10 RS9116 – B00 Module, Silicon Version – 1.5, Standard – FCC

BT RF Power - RS9116-B00				
Antenna Type, Model No., and Gain	**Configuration**	**Measured Average Output Power (dBm)**		
		Low CH 2402 MHz	**Mid CH 2440 MHz**	**High CH 2480 MHz**
Chip Antenna FR05-S1-N-0-102 Gain: 1.7 dBi Voltage: 1.8Vdc	BR-1Mbps	16.44	16.09	15.65
	EDR-2Mbps	15.84	15.81	15.49
	EDR-3Mbps	16.16	16.07	15.41
Chip Antenna FR05-S1-N-0-102 Gain: 1.7 dBi Voltage: 3.3Vdc	BR-1Mbps	17.02	16.91	16.72
	EDR-2Mbps	17.91	18.24	18.15
	EDR-3Mbps	17.66	18.06	17.99
Dipole Antenna GW.34.5153 Gain: 5.89 dBi Voltage: 1.8Vdc	BR-1Mbps	16.66	16.27	15.47
	EDR-2Mbps	16.21	16.05	15.36
	EDR-3Mbps	16.52	16.29	12.71
Dipole Antenna GW.34.5153 Gain: 5.89 dBi Voltage: 3.3Vdc	BR-1Mbps	18.08	18.21	20.53
	EDR-2Mbps	17.62	18.01	18.15
	EDR-3Mbps	17.42	17.81	17.99

BLE RF Power - RS9116-B00				
Antenna Type, Model No., and Gain	**Configuration**	**Measured Average Output Power (dBm)**		
		Low CH 2402 MHz	**Mid CH 2440 MHz**	**High CH 2480 MHz**
Chip Antenna FR05-S1-N-0-102 Gain: 1.7 dBi Voltage: 1.8Vdc	BLE - 1Mbps	15.96	15.63	15.21
	BLE - 2Mbps	15.69	15.41	6.69
Chip Antenna FR05-S1-N-0-102 Gain: 1.7 dBi Voltage: 3.3Vdc	BLE - 1Mbps	20.27	20.42	14.84
	BLE - 2Mbps	15.38	19.68	9.45
Dipole Antenna GW.34.5153 Gain: 5.89 dBi Voltage: 1.8Vdc	BLE - 1Mbps	16.49	16.12	12.47
	BLE - 2Mbps	16.32	15.98	6.49
Dipole Antenna GW.34.5153 Gain: 5.89 dBi Voltage: 3.3Vdc	BLE - 1Mbps	20.27	20.42	12.47
	BLE - 2Mbps	15.38	19.68	8.42

Wi-Fi 2.4GHz Band Power - RS9116-B00				
Antenna Type, Model No., and Gain	**Configuration**	**Measured Average Output Power (dBm)**		
		Low CH HT 20 - 2412 MHz	**Mid CH HT 20 - 2437 MHz**	**High CH HT 20 - 2462 MHz**
Chip Antenna FR05-S1-N-0-102 Gain: 1.7 dBi Voltage: 1.8Vdc	IEEE 802.11b	13.06	15.26	13.77
	IEEE 802.11g	8.01	15.18	9.73
	IEEE 802.11n HT20	6.67	15.21	8.46
Chip Antenna FR05-S1-N-0-102 Gain: 1.7 dBi Voltage: 3.3Vdc	IEEE 802.11b	16.98	17.02	16.58
	IEEE 802.11g	12.23	19.38	14.09
	IEEE 802.11n HT20	10.36	19.53	13.57
Dipole Antenna GW.34.5153 Gain: 5.89 dBi Voltage: 1.8Vdc	IEEE 802.11b	14.34	15.49	13.25
	IEEE 802.11g	9.88	15.31	10.01
	IEEE 802.11n HT20	7.19	15.42	8.87
Dipole Antenna GW.34.5153 Gain: 5.89 dBi Voltage: 3.3Vdc	IEEE 802.11b	16.98	17.02	16.58
	IEEE 802.11g	12.23	19.38	13.75
	IEEE 802.11n HT20	12.76	19.55	13.57

To meet FCC emission limits, Tx powers across the channels must be reduced as below compared to Channel-6. These are based on limited sample size testing in conducted mode. The radiated power is a strong function of the antenna properties.

Power Back-off (dB)												
Data Rate / Channel		**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
802.11b	1 Mbps	2	1	0	0	0	0	0	1	1	3	3
	11 Mbps	1	1	0	0	0	0	0	0	1	2	3
802.11g	6 Mbps	7	5	3	1	1	0	2	2	3	4	7
	54 Mbps	6	4	3	1	0	0	1	1	3	4	6
802.11n HT20	MCS0	7	5	3	2	1	0	1	2	3	4	7
	MCS7	7	4	3	1	0	0	1	2	3	5	7

5.2.11 RS9116 – B00 Module, Silicon Version – 1.5, Standard – CE

BT RF power - RS9116-B00					
Antenna Type, Model No., and Gain	**Configuration**	**CH Freq.**	**Measured Avg. Output Power (dBm)**		
			Tmin (-40°C)	**Tnom (20°C)**	**Tmax (85°C)**
Chip Antenna FR05-S1-N-0-102 Gain: 1.7 dBi Voltage: 1.8Vdc	BR-1Mbps	Hopping Mode	6.22	8.06	6.41
	EDR-2Mbps		4.65	7.17	6.06
	EDR-3Mbps		6.04	7.89	5.49
Chip Antenna FR05-S1-N-0-102 Gain: 1.7 dBi Voltage: 3.3Vdc	BR-1Mbps		5.89	7.98	6.64
	EDR-2Mbps		5.95	7.87	6.03
	EDR-3Mbps		5.83	8.09	6.31
Dipole Antenna GW.34.5153 Gain: 5.89 dBi Voltage : 1.8Vdc	BR-1Mbps		1.14	3.43	1.28
	EDR-2Mbps		1.23	3.41	2.12
	EDR-3Mbps		2.26	3.52	2.42
Dipole Antenna GW.34.5153 Gain: 5.89 dBi Voltage: 3.3Vdc	BR-1Mbps		1.52	3.84	2.78
	EDR-2Mbps		1.22	3.49	2.32
	EDR-3Mbps		-0.8	3.92	2.88

BLE RF Power - RS9116-B00					
Antenna Type, Model No. and Gain	**Configuration**	**CH Freq**	**Measured Avg. Output Power (dBm)**		
			Tmin (-40°C)	**Tnom (20°C)**	**Tmax (85°C)**
Chip Antenna FR05-S1-N-0-102 Gain: 1.7 dBi Voltage: 1.8Vdc	BLE - 1Mbps	Low	4.54	7.72	5.2
		Mid	4.73	7.43	5.04
		High	5.45	8.07	5.81
	BLE - 2Mbps	Low	5.58	8.28	5.92
		Mid	5.22	8.02	5.77
		High	0.3	3.11	1.16
Chip Antenna FR05-S1-N-0-102 Gain: 1.7 dBi Voltage: 3.3Vdc	BLE - 1Mbps	Low	6.09	7.77	6.48
		Mid	6.3	8.08	6.81
		High	6.35	8.26	7.01
	BLE - 2Mbps	Low	5.51	7.38	5.96
		Mid	5.74	7.68	6.34
		High	5.76	7.81	6.53
Dipole Antenna GW.34.5153 Gain: 5.89 dBi Voltage: 1.8Vdc	BLE - 1Mbps	Low	1.25	3.7	1.18
		Mid	1.24	3.58	1.92
		High	0.92	3.19	1.52
	BLE - 2Mbps	Low	1.1	3.66	1.66
		Mid	0.69	3.27	1.47
		High	-0.96	2.03	-0.13
Dipole Antenna GW.34.5153 Gain: 5.89 dBi	BLE - 1Mbps	Low	1.65	3.9	2.09
		Mid	0.79	3.07	1.75

Voltage: 3.3Vdc		High	0.81	3.26	2.02
	BLE - 2Mbps	Low	1.29	3.38	1.62
		Mid	1.38	3.71	1.91
		High	1.34	3.89	2.11

Wi-Fi 2.4GHz Band RF Power - RS9116-B00					
Antenna Type, Model No. and Gain	**Configuration**	**CH Freq.**	**Measured Avg. Output Power (dBm)**		
			Tmin (-40°C)	**Tnom (20°C)**	**Tmax (85°C)**
Chip Antenna FR05-S1-N-0-102 Gain: 1.7 dBi Voltage: 1.8Vdc	IEEE 802.11b	Low CH	11.62	16.44	14.06
		Mid CH	13.67	16.97	14.63
		High CH	14	16.99	13.57
	IEEE 802.11g	Low CH	10.93	15.35	12.87
		Mid CH	12.67	17.63	14.83
		High CH	10.68	14.9	10.73
	IEEE 802.11n HT 20	Low CH	11.11	16.74	13.12
		Mid CH	12.7	17.88	14.87
		High CH	10.89	14.88	10.53
		Mid CH	12.43	17.06	13.73
		High CH	9.65	14.51	10.16
Chip Antenna FR05-S1-N-0-102 Gain: 1.7 dBi Voltage: 3.3Vdc	IEEE 802.11b	Low CH	14.61	16.62	12.71
		Mid CH	13.72	15.22	11.07
		High CH	14.01	15.87	11.5
	IEEE 802.11g	Low CH	16.24	17.78	13.3
		Mid CH	16.17	17.76	13.25
		High CH	16.24	17.83	13.07
	IEEE 802.11n HT 20	Low CH	16.27	17.82	13.23
		Mid CH	16.16	17.85	13.31
		High CH	16.2	17.92	13.29
		Mid CH	16.17	16.68	12.92
		High CH	15.15	16.64	12.54
Dipole Antenna GW.34.5153 Gain: 5.89 dBi Voltage: 1.8Vdc	IEEE 802.11b	Low CH	11.07	12.53	9.74
		Mid CH	9.73	12.28	9.04
		High CH	9.93	12.65	9.27
	IEEE 802.11g	Low CH	12.82	13.37	9.48
		Mid CH	11.88	13.21	9.53
		High CH	10.96	12.99	9.49
	IEEE 802.11n HT 20	Low CH	12.83	13.63	9.19
		Mid CH	12.09	13.28	9.48
		High CH	12.15	12.89	9.37
		Mid CH	12.09	14.01	10.64
		High CH	10.28	12.27	9.13
Dipole Antenna GW.34.5153	IEEE 802.11b	Low CH	10.9	12.56	8.66

Gain: 5.89 dBi Voltage: 3.3Vdc		Mid CH	9.79	11.57	7
		High CH	10.09	11.74	7.07
	IEEE 802.11g	Low CH	12.01	13.93	8.82
		Mid CH	11.54	13.66	9
		High CH	12.16	13.75	8.64
	IEEE 802.11n HT 20	Low CH	12.12	13.72	9.3
		Mid CH	12.07	13.56	9.09
		High CH	12.1	13.74	8.83
		Mid CH	12.24	13.35	8.83
		High CH	11.99	13.69	9.05

5.2.12 RS9116 – B00 Module, Silicon Version – 1.5, Standard – TELEC

BT RF Power - RS9116-B00				
Antenna Type, Model No. and Gain	**Configuration**	**Measured Avg. Output Power (dBm)**		
		Low CH 2402 MHz	**Mid CH 2441 MHz**	**High CH 2480 MHz**
Chip Antenna FR05-S1-N-0-102 Gain: 1.7 dBi Voltage: 1.8Vdc	BR-1Mbps - AFH	17.35	16.87	16.17
	EDR-2Mbps - AFH	11.50	15.78	15.05
	EDR-3Mbps - AFH	11.08	15.7	14.99
Chip Antenna FR05-S1-N-0-102 3Gain: 1.7 dBi Voltage: 3.3Vdc	BR-1Mbps - AFH	20.62	21.41	20.83
	EDR-2Mbps - AFH	12.02	19.28	19.15
	EDR-3Mbps - AFH	12.2	19.08	19.04
Dipole Antenna GW.34.5153 Gain: 5.89 dBi Voltage: 1.8Vdc	BR-1Mbps - AFH	17.39	16.88	16.19
	EDR-2Mbps - AFH	11.59	15.81	15.09
	EDR-3Mbps - AFH	11.18	15.75	15.03
Dipole Antenna GW.34.5153 Gain: 5.89 dBi Voltage: 3.3Vdc	BR-1Mbps - AFH	17.08	18.29	18.20
	EDR-2Mbps - AFH	12	17.88	17.75
	EDR-3Mbps - AFH	12.13	17.73	17.66
PCB Antenna RFPCA500609IMAB301 Gain: 4.53dBi Voltage: 1.8Vdc	BR-1Mbps - AFH	17.37	16.90	16.20
	EDR-2Mbps - AFH	11.6	15.79	15.09
	EDR-3Mbps - AFH	11.15	15.75	15.02
PCB Antenna RFPCA500609IMAB301 Gain: 4.53dBi Voltage: 3.3Vdc	BR-1Mbps - AFH	19.52	19.24	19.20
	EDR-2Mbps - AFH	12.01	19.25	19.10
	EDR-3Mbps - AFH	12.23	19.19	19.18

BLE RF Power - RS9116-B00				
Antenna Type, Model No. and Gain	**Configuration**	**Measured Avg. Output Power (dBm)**		
		Low CH 2402 MHz	**Mid CH 2440 MHz**	**High CH 2480 MHz**
Chip Antenna FR05-S1-N-0-102 Gain: 1.7 dBi Voltage: 1.8Vdc	BLE - 1Mbps	9.94	9.91	9.44
	BLE - 2Mbps	2.82	9.99	9.44
Chip Antenna FR05-S1-N-0-102	BLE - 1Mbps	9.56	9.56	9.98

Gain: 1.7 dBi Voltage: 3.3Vdc	BLE - 2Mbps	3.52	9.88	9.54
Dipole Antenna GW.34.5153 Gain: 5.89 dBi Voltage: 1.8Vdc	BLE - 1Mbps	5.39	5.30	6.16
	BLE - 2Mbps	2.79	5.41	5.89
Dipole Antenna GW.34.5153 Gain: 5.89 dBi Voltage: 3.3Vdc	BLE - 1Mbps	5.92	5.15	5.29
	BLE - 2Mbps	2.44	6.19	5.68
PCB Antenna RFPCA500609IMAB301 Gain: 4.53dBi Voltage: 1.8Vdc	BLE - 1Mbps	6.92	6.90	7.41
	BLE - 2Mbps	2.80	7.26	6.82
PCB Antenna RFPCA500609IMAB301 Gain: 4.53dBi Voltage: 3.3Vdc	BLE - 1Mbps	6.91	6.79	7.31
	BLE - 2Mbps	2.44	6.59	7.42

Wi-Fi 2.4GHz Band RF Power - RS9116-B00				
Antenna Type, Model No. and Gain	**Configuration**	**Measured Avg. Output Power (dBm)**		
		Low CH 2412 MHz	**Mid CH 2437 MHz**	**High CH 2462 MHz**
Chip Antenna FR05-S1-N-0-102 Gain: 1.7 dBi Voltage: 1.8Vdc	IEEE 802.11b	16.16	16.05	15.73
	IEEE 802.11g	13.82	16.88	15.25
	IEEE 802.11n HT 20	13.88	16.89	14.56
Chip Antenna FR05-S1-N-0-102 Gain: 1.7 dBi Voltage: 3.3Vdc	IEEE 802.11b	18.54	18.61	18.71
	IEEE 802.11g	18.25	18.21	17.06
	IEEE 802.11n HT 20	16.20	18.39	17.11
Dipole Antenna GW.34.5153 Gain: 5.89 dBi Voltage: 1.8Vdc	IEEE 802.11b	15.07	15.12	15.37
	IEEE 802.11g	13.91	16.86	14.49
	IEEE 802.11n HT 20	13.85	16.86	14.68
Dipole Antenna GW.34.5153 Gain: 5.89 dBi Voltage: 3.3Vdc	IEEE 802.11b	14.94	14.14	14.31
	IEEE 802.11g	17.21	17.25	17.19
	IEEE 802.11n HT 20	17.34	18.41	17.21
PCB Antenna RFPCA500609IMAB301 Gain: 4.53dBi Voltage: 1.8Vdc	IEEE 802.11b	16.02	15.89	15.62
	IEEE 802.11g	13.79	16.83	14.49
	IEEE 802.11n HT 20	15.06	16.98	14.53
PCB Antenna RFPCA500609IMAB301 Gain: 4.53dBi Voltage: 3.3Vdc	IEEE 802.11b	16.24	17.39	15.61
	IEEE 802.11g	16.23	18.42	15.88
	IEEE 802.11n HT 20	17.58	18.69	16.02

5.2.13 RS9116 – AA0/AA1 Module, Silicon Version – 1.3, Standard – FCC and IC

Note: For a few channels, power reduction is done to pass the band edge requirement.

BT RF Power - M15SB				
Antenna Type, Model No. and Gain	**Configuration**	**Measured Average Output Power (dBm)**		
		Low CH 2402 MHz	**Mid CH 2441 MHz**	**High CH 2480 MHz**
Dipole Antenna WS.01.B.305151 Gain : 4.1 dBi	BR-1Mbps	15.62	15.91	14.13
	EDR-2Mbps	15.03	15.25	13.6
	EDR-3Mbps	15.13	15.27	13.62
PCB Antenna Redpine Signals RSIA15 Gain: 0.99 dBi	BR-1Mbps	15.62	15.91	14.13
	EDR-2Mbps	15.03	15.25	13.6
	EDR-3Mbps	15.13	15.27	13.62

BLE RF Power - M15SB				
Antenna Type, Model No. and Gain	**Configuration**	**Measured Average Output Power (dBm)**		
		Low CH 2402 MHz	**Mid CH 2440 MHz**	**High CH 2480 MHz**
Dipole Antenna WS.01.B.305151 Gain : 4.1 dBi	BLE - 1Mbps	11.36	11.04	9.21
	BLE - 2Mbps	15.59	16.68	10.53
PCB Antenna Redpine Signals RSIA15 Gain: 0.99 dBi	BLE - 1Mbps	17.08	17.1	13.7
	BLE - 2Mbps	15.52	16.53	11.66

Wi-Fi 2.4GHz Band RF Power - M15SB				
Antenna Type, Model No. and Gain	**Configuration**	**Measured Average Output Power (dBm)**		
		Low CH HT 20 - 2412 MHz	**Mid CH HT 20 - 2437 MHz**	**High CH HT 20 - 2462 MHz**
Dipole Antenna WS.01.B.305151 Gain : 4.1 dBi	IEEE 802.11b	14.39	16.17	15.57
	IEEE 802.11g	7.44	17.04	7.2
	IEEE 802.11n HT 20	7.56	17.38	6.56
PCB Antenna Redpine Signals RSIA15 Gain : 0.99 dBi	IEEE 802.11b	16.36	16.17	16.53
	IEEE 802.11g	9.46	17.04	11.52
	IEEE 802.11n HT 20	8.91	17.38	10.86

5.2.14 RS9116 – AA0/AA1 Module, Silicon Version – 1.3, Standard – CE

Note: Less RF power is observed at high temperature.

BT RF Power - M15SB					
Antenna Type, Model No. and Gain	**Configuration**	**CH Frequency**	**Measured Average Output Power (dBm)**		
			Tmin (-40°C)	**Tnom (25°C)**	**Tmax (85°C)**
PCB Antenna Redpine Signals RSIA15 Gain : 0.99 dBi	BR - 1Mbps	Low CH 2402 MHz	8.78	5.23	0.90
		Mid CH 2441 MHz	8.82	5.24	1.00
		High CH 2480 MHz	8.91	5.40	1.13
	EDR - 3Mbps	Low CH 2402 MHz	8.30	4.68	0.38
		Mid CH 2441 MHz	8.38	4.74	0.49
		High CH 2480 MHz	8.50	4.79	0.53
Dipole Antenna WS.01.B.305151 Gain : 4.1 dBi	BR - 1Mbps	Low CH 2402 MHz	4.88	1.32	-2.90
		Mid CH 2441 MHz	4.92	1.39	-2.86
		High CH 2480 MHz	5.11	1.53	-2.72
	EDR - 3Mbps	Low CH 2402 MHz	5.22	1.53	-2.79
		Mid CH 2441 MHz	5.81	1.73	-2.26
		High CH 2480 MHz	5.82	1.78	-2.17

BLE RF Power - M15SB					
Antenna Type, Model No. and Gain	**Configuration**	**CH Frequency**	**Measured Average Output Power (dBm)**		
			Tmin (-40°C)	**Tnom (25°C)**	**Tmax (85°C)**
PCB Antenna Redpine Signals RSIA15 Gain: 0.99 dBi	BLE - 1Mbps	Low CH 2402 MHz	8.52	5.01	0.80
		Mid CH 2440 MHz	8.91	5.04	0.79
		High CH 2480 MHz	8.32	4.30	0.24
	BLE - 2Mbps	Low CH 2402 MHz	8.00	4.20	0.24
		Mid CH 2440 MHz	8.41	4.41	0.31
		High CH 2480 MHz	8.93	4.88	0.81
	BLE – 500Kbps	Low CH 2402 MHz	8.45	4.90	0.75
		Mid CH 2440 MHz	8.83	4.92	0.73

		High CH 2480 MHz	8.28	4.25	0.17
	BLE – 125Kbps	Low CH 2402 MHz	8.48	4.92	0.77
		Mid CH 2440 MHz	8.84	4.94	0.75
		High CH 2480 MHz	8.22	4.22	0.20
Dipole Antenna WS.01.B.305151 Gain : 4.1 dBi	BLE - 1Mbps	Low CH 2402 MHz	5.18	1.76	-2.36
		Mid CH 2440 MHz	5.58	1.98	-2.33
		High CH 2480 MHz	5.72	1.84	-2.46
	BLE - 2Mbps	Low CH 2402 MHz	5.73	2.28	-1.92
		Mid CH 2440 MHz	5.02	1.46	-2.66
		High CH 2480 MHz	5.49	1.86	-2.50
	BLE – 500Kbps	Low CH 2402 MHz	5.10	1.70	-2.40
		Mid CH 2440 MHz	5.52	1.91	-2.37
		High CH 2480 MHz	5.69	1.76	-2.50
	BLE – 125Kbps	Low CH 2402 MHz	5.11	1.72	-2.38
		Mid CH 2440 MHz	5.52	1.93	-2.36
		High CH 2480 MHz	5.65	1.73	-2.53

Wi-Fi 2.4GHz Band RF Power - M15SB					
Antenna Type, Model No. and Gain	**Configuration**	**CH Frequency**	**Measured Average Output Power (dBm)**		
			Tmin (-40°C)	**Tnom (25°C)**	**Tmax (85°C)**
PCB Antenna Redpine Signals RSIA15 Gain: 0.99 dBi	IEEE 802.11b	Low CH 2412 MHz	18.99	15.55	12.26
		Mid CH 2442 MHz	18.57	14.79	10.86
		High CH 2472 MHz	18.97	14.85	10.38
	IEEE 802.11g	Low CH 2412 MHz	18.3	14.2	10.42
		Mid CH 2442 MHz	18.25	14.07	9.9
		High CH 2472 MHz	18.58	14.02	9.77
	IEEE 802.11n HT 20	Low CH 2412 MHz	18.34	14.95	10.76
		Mid CH 2442 MHz	18.32	14.4	10

		High CH 2472 MHz	18.72	14.03	9.58
Dipole Antenna WS.01.B.305151 Gain : 4.1 dBi	IEEE 802.11b	Low CH 2412 MHz	15.85	12.03	7.89
		Mid CH 2442 MHz	15.86	11.39	6.96
		High CH 2472 MHz	15.7	11.29	7.17
	IEEE 802.11g	Low CH 2412 MHz	15.56	11.21	7.47
		Mid CH 2442 MHz	15.78	11.23	6.67
		High CH 2472 MHz	15.8	11.01	6.36
	IEEE 802.11n HT 20	Low CH 2412 MHz	15.76	11.78	7.17
		Mid CH 2442 MHz	15.86	11.51	6.66
		High CH 2472 MHz	15.64	11.49	6.82

5.2.15 RS9116 – AA0/AA1 Module, Silicon Version – 1.3, Standard – TELEC

BT RF Power - M15SB				
Antenna Type, Model No. and Gain	**Configuration**	**Measured Average Output Power (dBm)**		
		Low CH 2402 MHz	**Mid CH 2441 MHz**	**High CH 2480 MHz**
RSIA15 PCB Trace Antenna 0.99 dBi WS.01.B.305151 Heavy Duty Screw Mount Antenna 4.1 dBi AEM6P-100000 Dipole Antenna 2 dBi AEM6P-100001 Dipole Antenna 2 dBi AEEE0-000000 Multilayer ceramic Antenna 2.13 dBi AEEE0-000001 Chip Antenna 4 dBi AEEE0-000002 Chip Antenna 4 dBi AEP6P-100006X PIFA Antenna 3 dBi AEP6P-100008X PIFA Antenna 3 dBi	BR-1Mbps	15.73	16.95	17.16
	EDR-2Mbps	15.58	17.18	17.3
	EDR-3Mbps	15.73	17.46	17.66
	BR-1Mbps - AFH	15.66	17.34	17.63
	EDR-2Mbps - AFH	15.5	17.16	17.29
	EDR-3Mbps - AFH	15.61	17.19	17.33

BLE RF Power - M15SB				
Antenna Type, Model No. and Gain	**Configuration**	**Measured Average Output Power (dBm)**		
		Low CH 2402 MHz	**Mid CH 2440 MHz**	**High CH 2480 MHz**
RSIA15 PCB Trace Antenna 0.99 dBi WS.01.B.305151 Heavy Duty Screw Mount Antenna 4.1 dBi AEM6P-100000 Dipole Antenna 2 dBi	BLE - 1Mbps	7.95	7.73	7.89

AEM6P-100001 Dipole Antenna 2 dBi AEEE0-000000 Multilayer ceramic Antenna 2.13 dBi AEEE0-000001 Chip Antenna 4 dBi AEEE0-000002 Chip Antenna 4 dBi AEP6P-100006X PIFA Antenna 3 dBi AEP6P-100008X PIFA Antenna 3 dBi	BLE - 2Mbps	7.26	7.25	7.29

Wi-Fi 2.4GHz Band RF Power - M15SB				
Antenna Type, Model No. and Gain	**Configuration**	**Measured Average Output Power (dBm)**		
		Low CH HT 20 - 2412 MHz	**Mid CH HT 20 - 2437 MHz**	**High CH HT 20 - 2462 MHz**
RSIA15 PCB Trace Antenna 0.99 dBi WS.01.B.305151 Heavy Duty Screw Mount Antenna 4.1 dBi AEM6P-100000 Dipole Antenna 2 dBi AEM6P-100001 Dipole Antenna 2 dBi AEEE0-000000 Multilayer ceramic Antenna 2.13 dBi AEEE0-000001 Chip Antenna 4 dBi AEEE0-000002 Chip Antenna 4 dBi AEP6P-100006X PIFA Antenna 3 dBi AEP6P-100008X PIFA Antenna 3 dBi	IEEE 802.11b	14.81	14.75	14.98
	IEEE 802.11g	13.68	13.97	14.12
	IEEE 802.11n HT 20	13.82	14.15	14.34

6 Revision History

Revision No	Version No	Date	Changes
1	1.0	Aug 2021	Initial version
2	1.1	Feb 2022	1. Updated the data related to TELEC certification in Qualified Antenna Types 2. Included information about Gain table info 3. Updated the Existing Certification Reference section with latest data 4. Removed 40MHz data as it is not supported in both 2.4 GHz and 5 GHz
3	1.2	Aug 2024	1. Added power back-off info in section 5.2.10 2. Added UKCA compliance 3. Added KCC compliance for AA0/AA1 module in sections 2 & 3

Simplicity Studio

One-click access to MCU and wireless tools, documentation, software, source code libraries & more. Available for Windows, Mac and Linux!

IoT Portfolio
www.silabs.com/IoT

SW/HW
www.silabs.com/simplicity

Quality
www.silabs.com/quality

Support & Community
www.silabs.com/community

SILICON LABS

Silicon Laboratories Inc.
400 West Cesar Chavez
Austin, TX 78701
USA

www.silabs.com