



LM812 WiFi and Bluetooth® 4.2 Dual Mode USB Module

Host Controller Interface (HCI) via USB Interface

Revised

8/MAR/2021

Datasheet Version

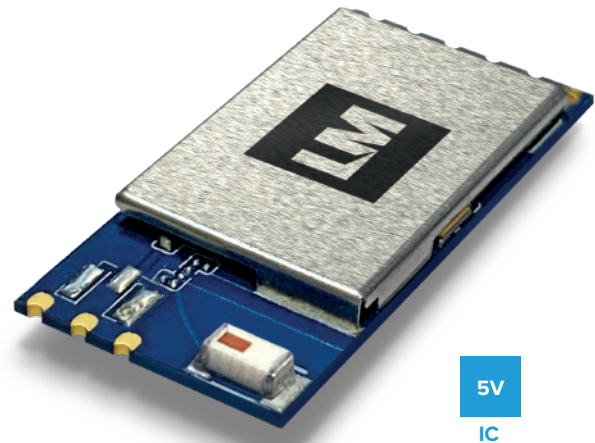
1.1

Ordering Options

See last page



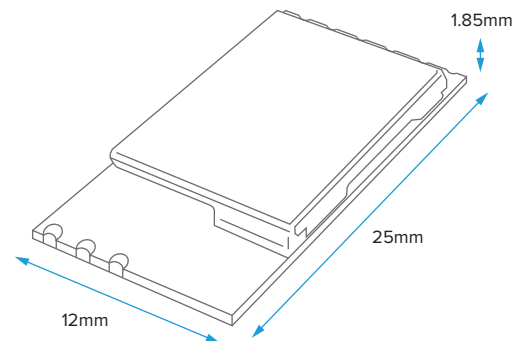
3.3V
IPEX



5V
IC

Features

- WiFi 802.11 b/g/n/e/i
- Bluetooth® v4.2
(Backward compatible with Bluetooth® v2.0, v2.1, v3.0, v4.0)
- WPA, WPA-PSK, WPA2, WPA2 -PSK and WEP (64bit & 128bit) encryption schemes
- Full speed Bluetooth® Piconet and Scatternet
- 5V IC Antenna or 3.3V IPEX Connector module options
- USB 2.0
- Supports sophisticated WiFi / Bluetooth® coexistence to enhance performance
- Supports Bluetooth® adaptive power management



- 25mm x 12mm x 1.85mm
- Linux (Kernel v2.6.24 - v5.1), Android 9.x and Windows XP – 10 compatible
- See our website for this products certifications. RoHS, REACH and WEEE compliant.

Overview

The LM812 combination module offers coexistence for Bluetooth® (Dual Mode) and WiFi operations, allowing the host computer to wirelessly communicate with other Bluetooth® and WiFi enabled devices. This cost-effective module saves valuable PCB space within your product.

The LM812 module supports IEEE 802.11b/g/n/e/i and Bluetooth® v2.0, v2.1, v3.0, v4.0 and v4.2 standards.

Compatible with Linux (Kernel v5.1), Android 9.x and Windows XP – 10 platforms.

The LM812 module also offers low power consumption and an intelligent coexistence mechanism, ideal for communicating with many wireless devices such as tablets, smart phones and laptops.





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General Specification

Wireless Standard	WiFi: 802.11 b/g/n/e/i Bluetooth®: v2.1+EDR/v3.0/v4.0/v4.2
Module Type	Host Controller Interface (HCI)
OS Compatibility	Linux (Kernel v2.6.24 - v5.1), Android 1.6 – 2.3, Android 4.0 – 9.x, Windows XP – 10
Security	WiFi: WPA, WPA-PSK, WPA2, WPA2 -PSK, WEP (64bit & 128bit) ,IEEE 802.11x, ,IEEE 802.11i Bluetooth®: Simple Paring
Chipset	Realtek
Antenna	Onboard Chip Antenna or IPEX Connector
Interfaces	USB 2.0



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General Specification (Continued)

Power Consumption	Average: TBA Peak: TBA
Range (in open space)	WiFi: Up to 180m Bluetooth®: Up to 10m
Data Transfer Rate	WiFi: 802.11b: 11, 5.5, 2, 1 Mbps 802.11g: 54, 48, 36, 24, 18, 12, 9, 6 Mbps 802.11n: MCS0 to 7 for HT20MHz 802.11n: MCS0 to 7 for HT40MHz Bluetooth®: Basic rate: 1Mbps Enhanced data rate: 2, 3 Mbps Low Energy: 1Mbps
Frequency	2.4GHz to 2.4835 GHz
Modulation Scheme	WiFi: 802.11b: CCK, DQPSK, DBPSK 802.11g: 64QAM, 16QAM, QPSK, BPSK 802.11n: 64QAM, 16QAM, QPSK, BPSK Bluetooth®: 8DPSK, $\pi/4$ DQPSK, GFSKFSK
Spread Spectrum	WiFi: IEEE 802.11b: DSSS (Direct Sequence Spread Spectrum) IEEE 802.11g/n: OFDM (Orthogonal Frequency Division Multiplexing) Bluetooth®: FHSS (Frequency Hopping Spread Spectrum)
Operating Channels	WiFi (2.4GHz): 11: (Ch. 1-11) – United States 13: (Ch. 1-13) – Europe 14: (Ch. 1-14) – Japan Bluetooth® (2.4GHz): Ch. 0 to 78

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Host Controller Interface (HCI) via USB Interface

General Specification (Continued)

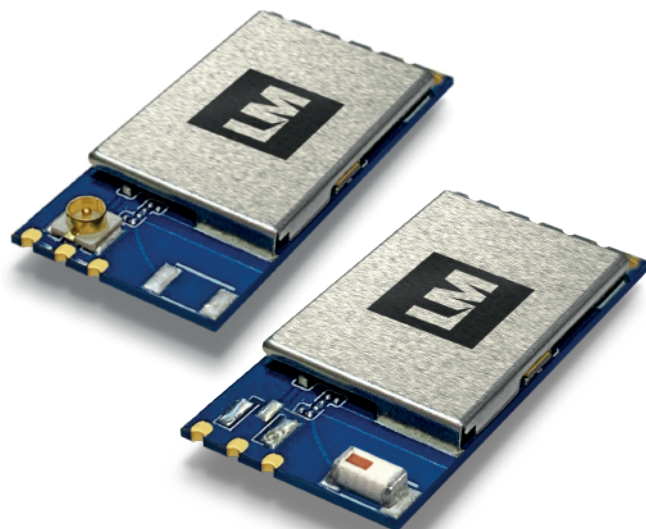
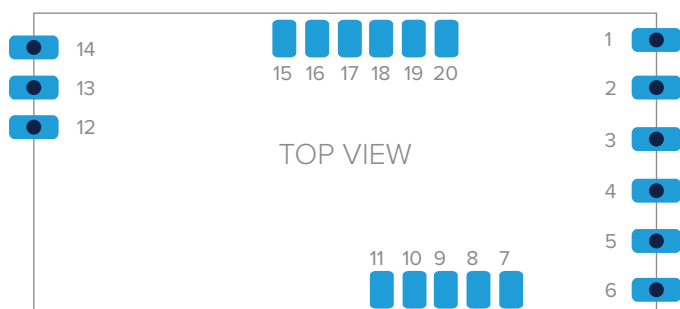
Physical Characteristics

Operating Temperature	-20°C to +80°C ambient temperature 0 to 95 % (non-condensing)
Storage Temperature	-30°C to +85°C ambient temperature 0 to 95 % (non-condensing)
Dimensions (L x W x H)	25mm x 12mm x 1.85mm
Weight	1.10g +/- 0.25g tolerance
Certifications	See our website for this products certifications.
Compliance	RoHS, REACH and WEEE

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Host Controller Interface (HCI) via USB Interface

Pin Outs



Pin Assignments

Pin Signal Type Description

1	HOST_WAKE_BT	Input	Shared with GPIO 13.
2	VDD	Power	Supply DC 3.3V for LM812 (IPEX Connector Module) / Supply DC 5V for LM812 (IC Antenna Module).
3	HSDM	I/O	USB D+ signal
4	HSDP	I/O	USB D- signal.
5	GND	-	Ground.
6	BT_WAKE_HOST	Output	Shared with GPIO 14. Bluetooth® device wake up host.
7	NC	-	Do not connect to ground (IC pin GPIO3).
8	NC	-	Do not connect to ground (IC pin GPIO2).
9	NC	-	Do not connect to ground (IC pin GPIO1).
10	NC	-	Do not connect to ground (IC pin GPIO0).
11	EXT_XIN	-	No connection, leave floating.
12	GND	-	Ground.
13	ANT	RF	WiFi / Bluetooth® RF port (if you are NOT using the IPEX connector).
14	GND	-	Ground.
15	WL_WAKE_HST	Output	WLAN device wake up host (IC pin GPIO8).
16	WL_WAKE_WL	Input	Host wake up WLAN device (IC pin BT_GPIO14).
17	NC	-	No Connection. Do not connect to ground.
18	BT_DIS#	Input	Bluetooth disable. Default pull high, external pull low disable BT.
19	WL_DIS#	Input	WLAN disable. Default pull high, external pull low disable WLAN.
20	3DD_SEL	-	No Connection. Do not connect to ground (IC pin GPIO6).

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Host Controller Interface (HCI) via USB Interface

DC Power Input

Module	Min	Typical	Max	Unit
DC 3.3V (IPEX Connector)	3.135	3.3	3.465	V

Important Warning

Do **NOT** use the wrong voltage on your module.

3.3V IPEX connector products must only use 3.3V

5V IC Antenna products must only use 5V

Power Consumption

DC power for 5V

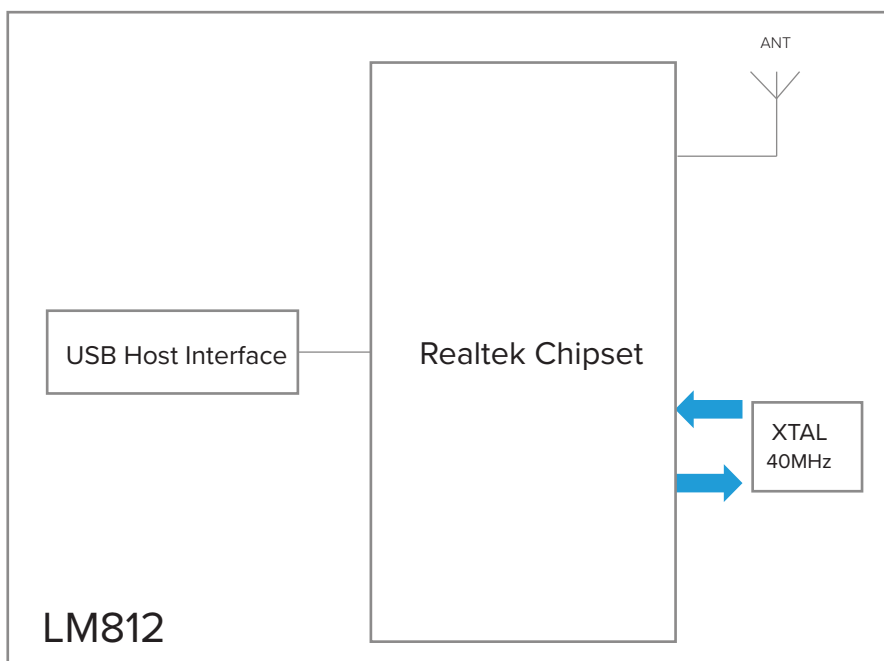
Description	Performance	
	Typical	Units
Off	10	uA
Unassociated idle	40	mA
Associated idle for 2.4GHz band	70	mA
Data transfer for 2.4GHz	103	mA

DC power for 3.3V

Description	Performance	
	Typical	Units
Off	16	uA
Unassociated idle	90	mA
Associated idle for 2.4GHz band	141	mA
Data transfer for 2.4GHz	168	mA

NB: Data transfer test using the Linux driver: Linux_v4.3.6_1184.20140714

Module Block Diagram



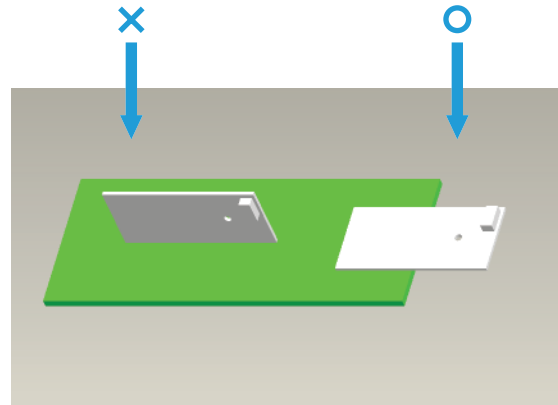
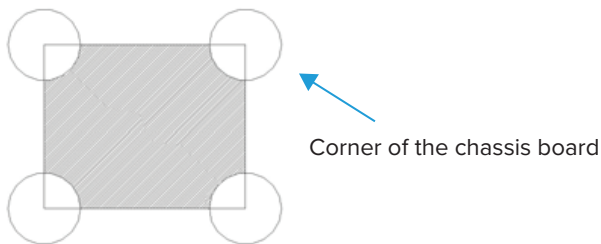
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Host Controller Interface (HCI) via USB Interface

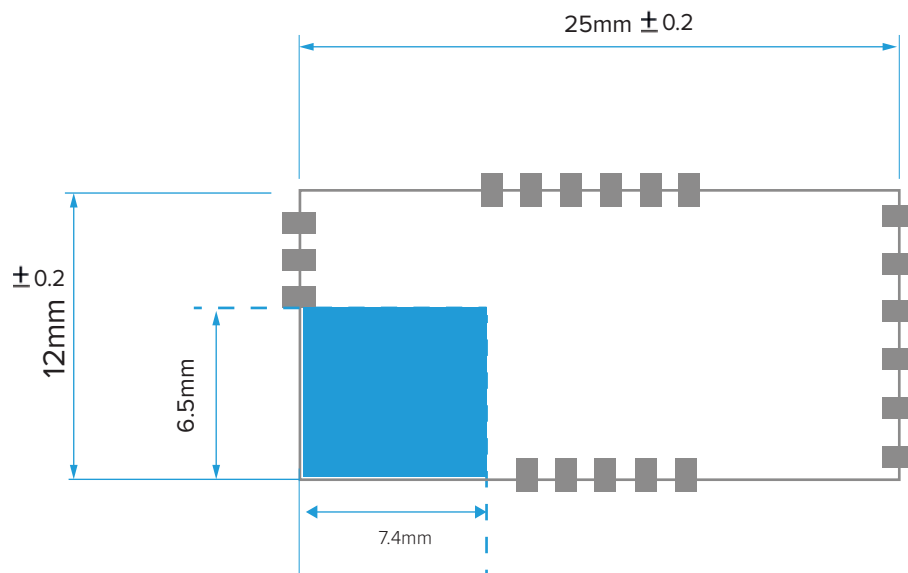
Module Placement Notes

In order to get a better performance please don't put any metal shielding in the surrounding area of module and try to leave the module placed in the corner of chassis board as close as possible.

Considering antenna field pattern it is better to put the module in horizontal way with the chassis board.



PCB Footprint

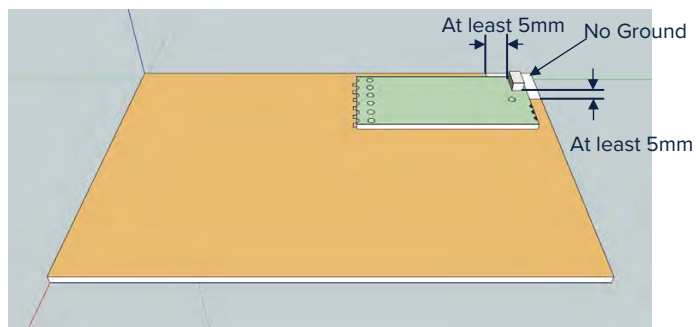


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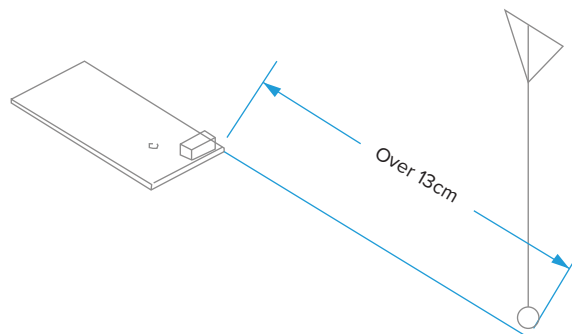
Host Controller Interface (HCI) via USB Interface

Chip Antenna

The antenna area in the module should protrude outside the Ground at least 5mm

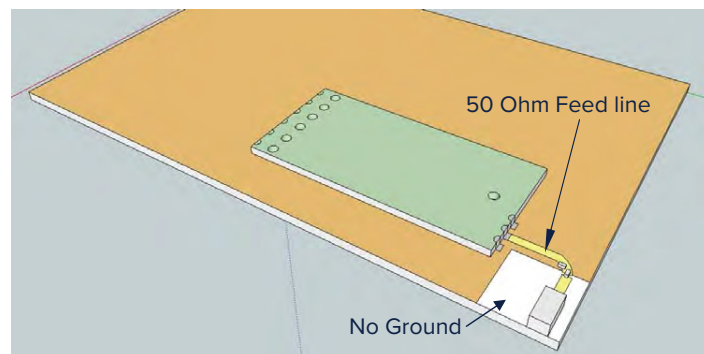
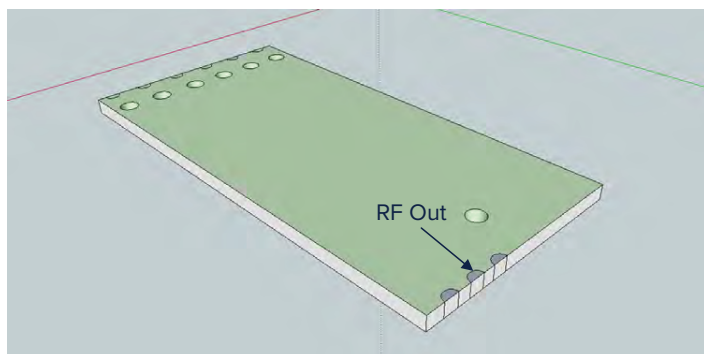


Keep the distance at least 13cm long with WLAN or another antenna of the same frequency band, to avoid the interference or deteriorate the performance.

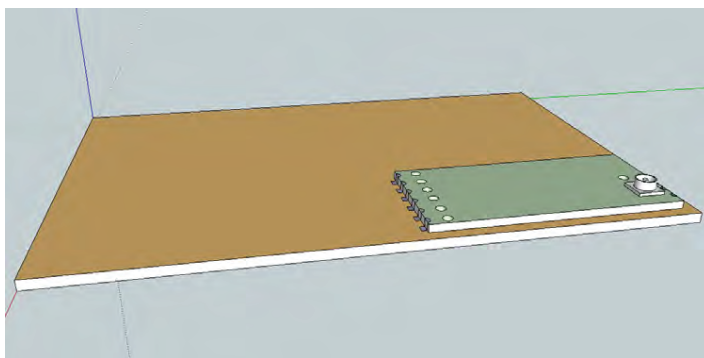


RF Out

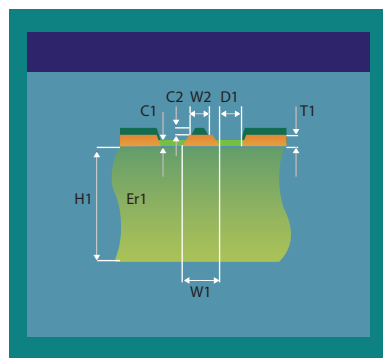
This RF out pin needs the input impedance of 50 Ohm



RF Connector



50 Ohm Feed Line



Er1	4.2
W2	20 mil
C1	0.7 mil
T1	1.4 mil (1 oz)

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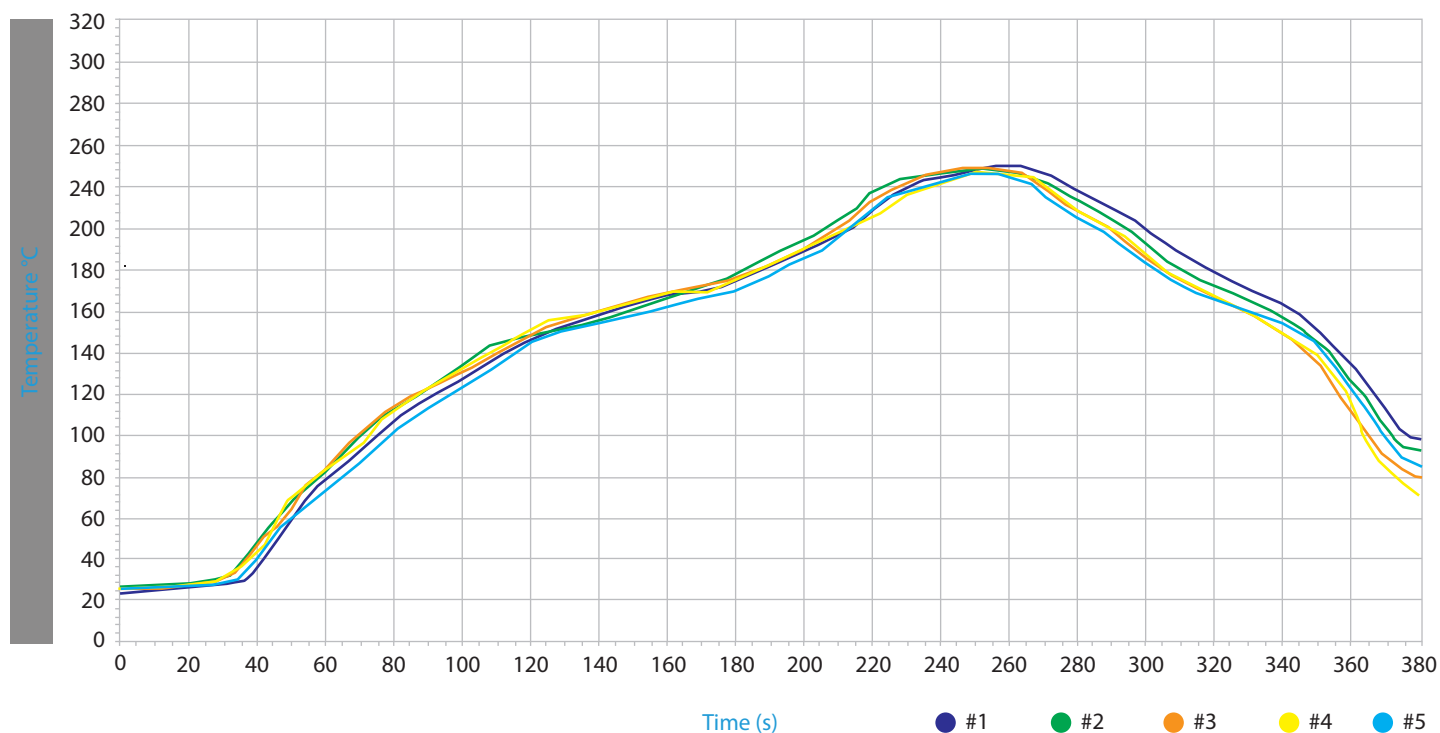
PCB Drying Conditions

Please refer below to the conditions for drying before the solder reflow processes. (Extracted from IPC/JEDEC J-STD-033B.1)

1. If the system PCBA is double side design please reflow the side without this module first.
2. Don't let the solder machine temperature over 250 °C or follow solder paste vender's recommended temperature.
3. The Ramp-up temperature speed is 1~4 °C per second, the Ramp-down temperature speed is 1~4 °C per second.
4. This temperature reflow chart is for reference only, it depends on the manufacturing machine's characters requirement.

Bake @ 125 °C		Bake @ 90 °C		Bake @ 40 °C	
Exceeding floor Life by > 72h	Exceeding floor Life by ≤ 72h	Exceeding floor Life by > 72h	Exceeding floor Life by ≤ 72h	Exceeding floor Life by > 72h	Exceeding floor Life by ≤ 72h
9 hours	7 hours	33 hours	23 hours	13 days	9 days

Soldering Reflow Chart



Name	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7	Zone 8
Max	180.0	180.0	170.0	170.0	180.0	210.0	260.0	245.0
Min	180.0	180.0	170.0	170.0	180.0	210.0	260.0	245.0
Length	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0

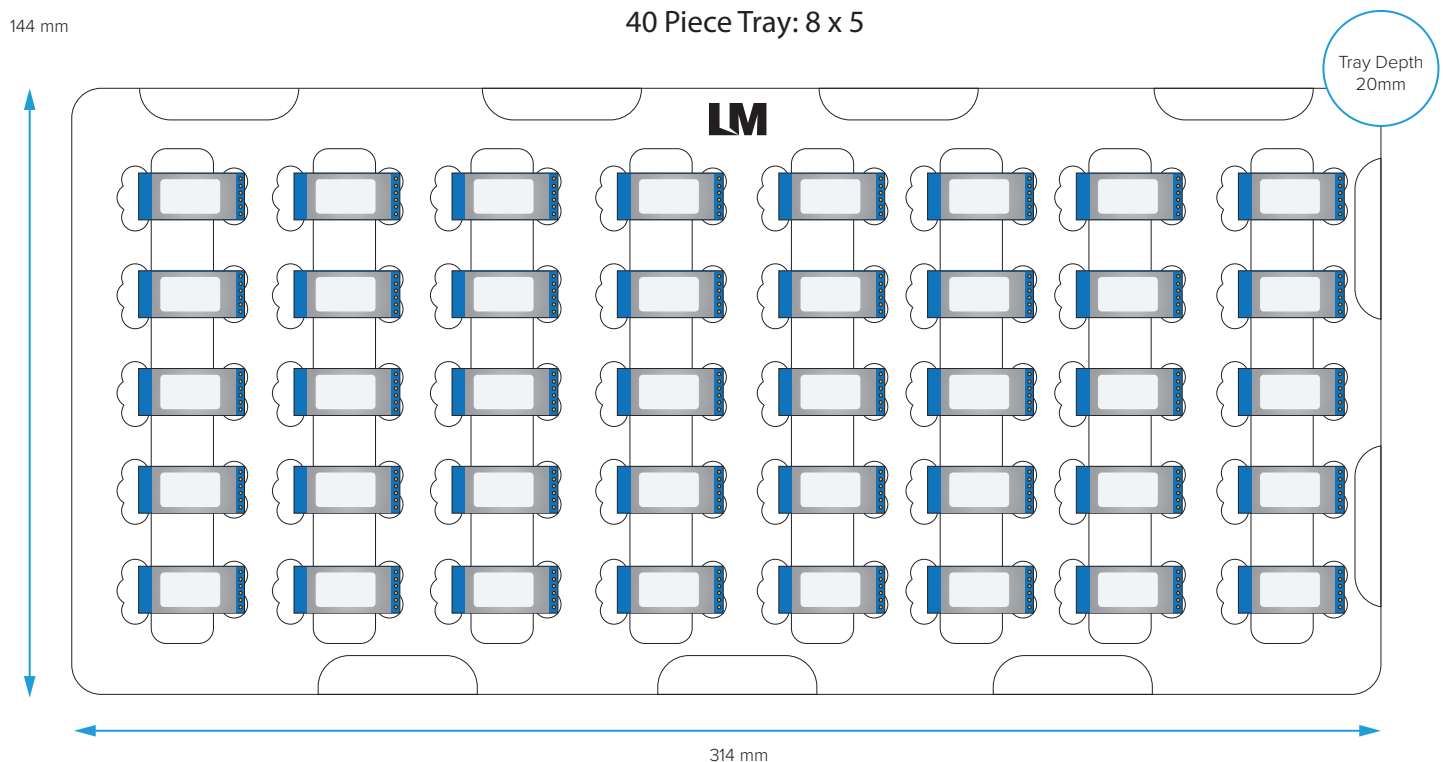
Probe	Liquidus Line		Maximum / Minimum		Slope	
	Rising 110.00-190.00	Above 230.0	Max	Min	Positive	Negative
#1	119.00	47.50	245.50	27.30	2.56	-1.69
#2	116.50	49.00	247.10	27.70	2.69	-1.60
#3	116.00	46.50	245.80	29.30	2.04	-1.57
#4	117.00	46.50	244.90	29.20	2.60	-1.31
#5	119.50	50.00	248.10	29.60	2.44	-1.64

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Tray Packaging

Tray Dimensions



Quantities

- 40 modules per Tray
- 3 Trays per Inner Box
- 120 modules per Inner Box
- 8 Inner Boxes per Outer Carton
- 960 modules per Outer Carton

Notes

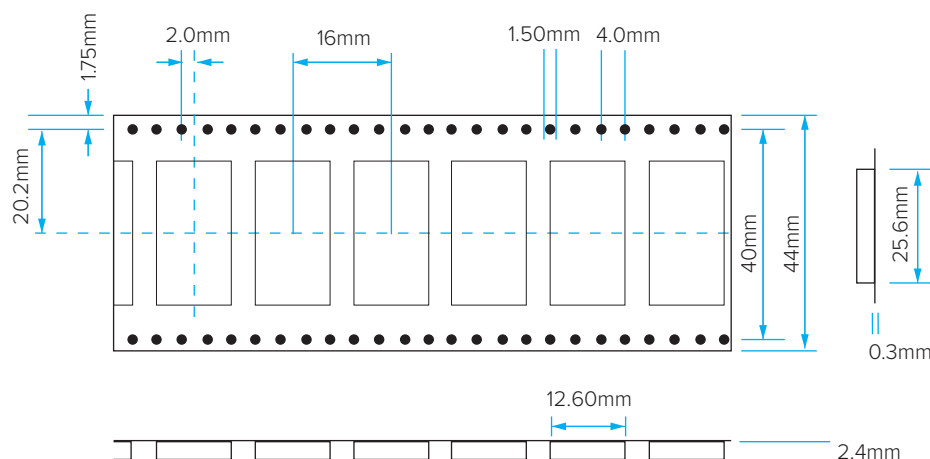
- Anti-Static PS Tray, Black.
- Material Thickness: 1mm
- Height of Tray: 20mm
- Carton Dimensions (L x W x H):
340mm x 290mm x 385mm

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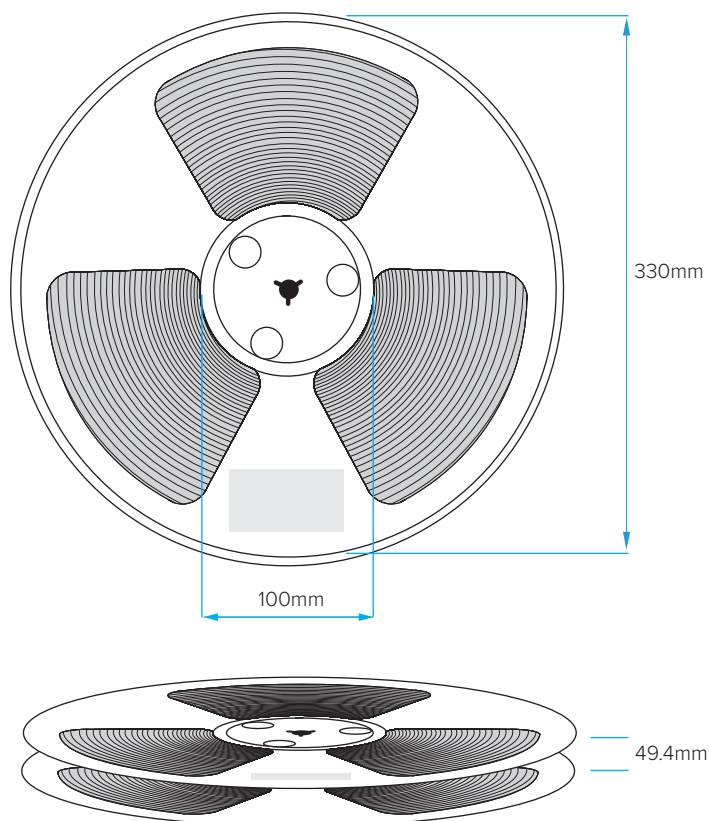
Host Controller Interface (HCI) via USB Interface

Tape and Reel Packaging

Tape Dimensions



Reel Dimensions



Quantities

- 1500 modules per Tape & Reel
- 1 Tape & Reel per Inner Box
- 5 Inner Boxes per Outer Carton
- 7500 modules per Outer Carton

Notes

- Inner Box Dimensions (L x W x H):
360mm x 360mm x 60mm
- Outer Carton Dimensions (L x W x H):
395mm x 360mm x 305mm

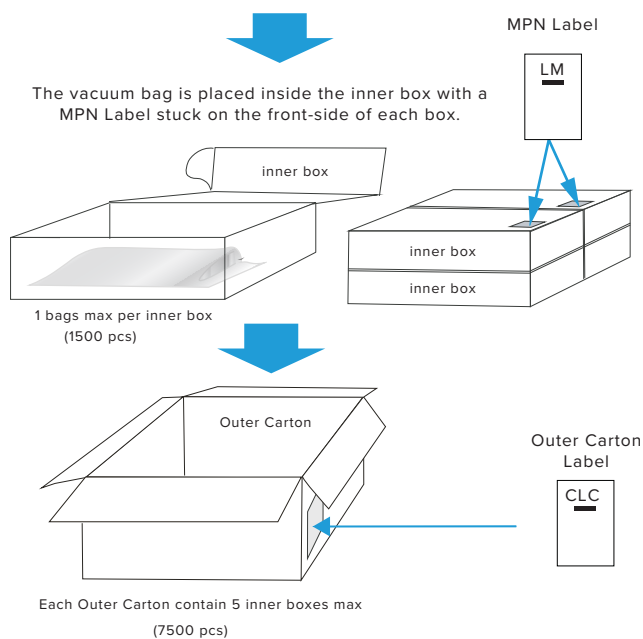
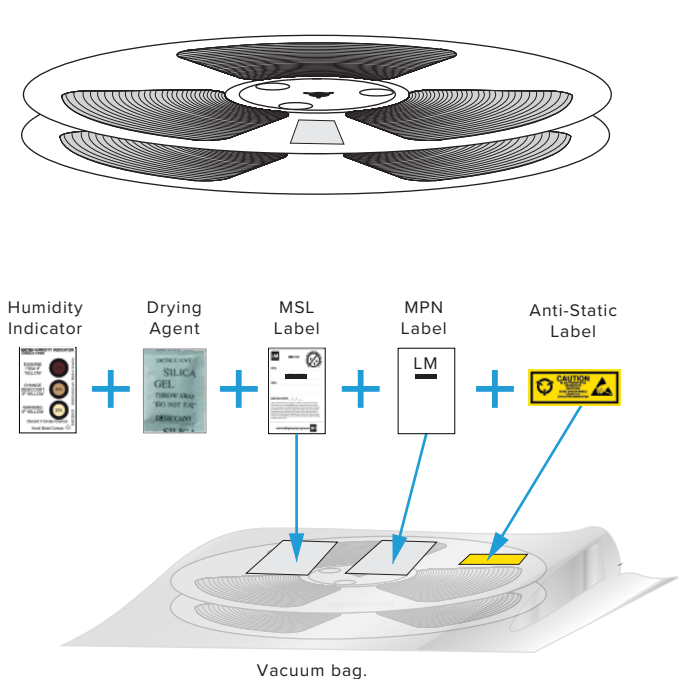
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Packaging for Tape & Reel / Tray

The Tape & Reel / Tray are inserted into an anti-static vacuum bag with a Humidity Indicator Card and Drying Agent. On the outside of the vacuum bag are MSL (Moisture Sensitivity Levels), MPN and an Anti-Static Labels.

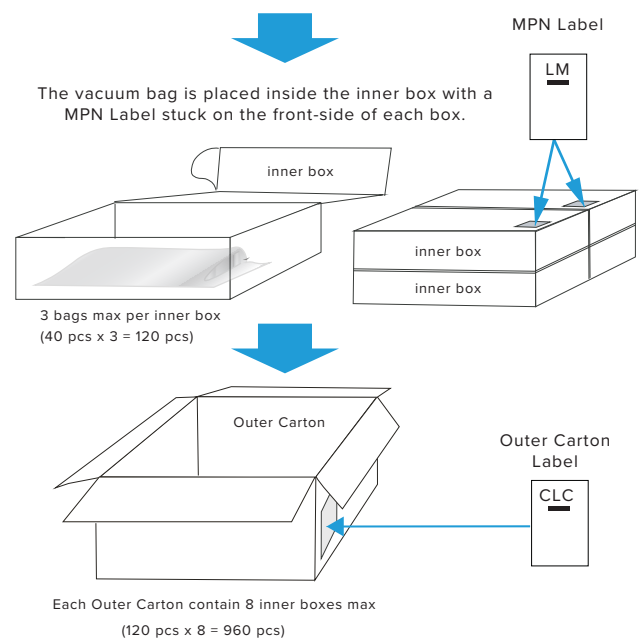
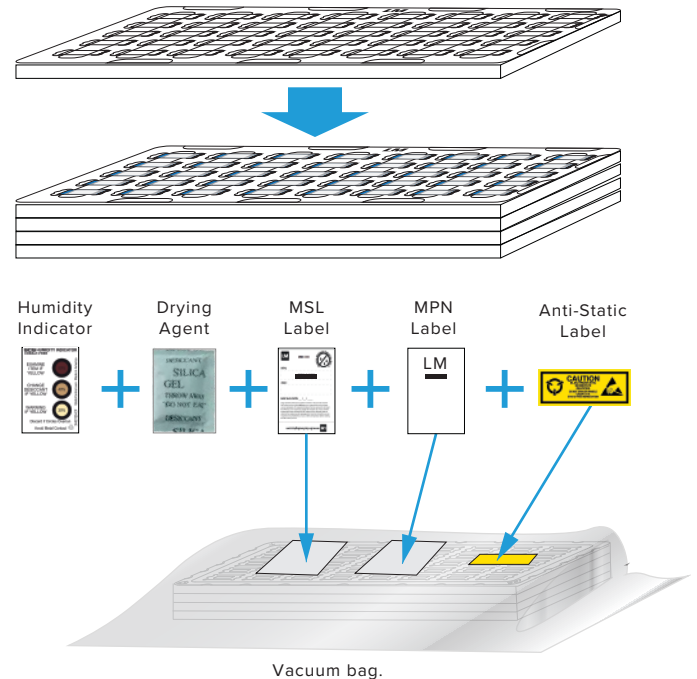
Tape & Reel

Reels are placed within a vacuum bag.



Tray

Trays are stacked with an empty tray on the top and placed within a vacuum bag.





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Datasheet Version Notes

v1.0	5 MAR 2021	Initial datasheet release.
v1.1	8 MAR 2021	Power Consumption and Packing information added.



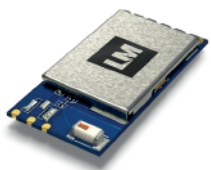
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Host Controller Interface (HCI) via USB Interface

Ordering Options

RF Country Bands

Our default radio region is ETSI. Unless specified otherwise when ordering, units will be shipped using the ETSI radio bands.



5V
IC

Ordering Code

812-8121-000

812-8121-001

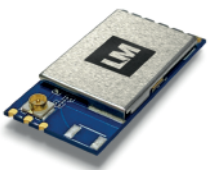
812-8121-002

5V Module with IC Antenna

MOD SMT HCI 802.11n BT4.2 -20c 5v IC ANT D-Type SP

MOD SMT HCI 802.11n BT4.2 -20c 5v IC ANT D-Type TRAY

MOD SMT HCI 802.11n BT4.2 -20c 5v IC ANT D-Type T&R



3.3V
IPEX

Ordering Code

812-8120-000

812-8120-001

812-8120-002

3.3V Module with IPEX Connector

MOD SMT HCI 802.11n BT4.2 -20c 3.3V IPEX SP

MOD SMT HCI 802.11n BT4.2 -20c 3.3V IPEX TRAY

MOD SMT HCI 802.11n BT4.2 -20c 3.3V IPEX T&R

• Product User Guides, Manuals and Configuration Software can be downloaded via our website - <http://www.lm-technologies.com/downloads>

FCC Statement

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:

- (1) This device may not cause harmful interference, and
- (2) this device must accept any interference received, including interference that may cause undesired operation.

Any Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

The device has been evaluated to meet general RF exposure requirement. The device can be used in portable exposure condition without restriction.

Any company of the host device which install this modular with Single modular approval should perform the test of radiated emission and spurious emission according to FCC part 15C : 15.247 and 15.209 requirement, Only if the test result comply with FCC part 15C : 15.247 and 15.209 requirement, then the host can be sold legally.

OEM INTEGRATION INSTRUCTIONS:

This device is intended only for OEM integrators under the following conditions:

The module must be installed in the host equipment such that 20 cm is maintained between the antenna and users, and the transmitter module may not be co-located with any other transmitter or antenna. The module shall be only used with the internal on-board antenna that has been originally tested and certified with this module. External antennas are not supported. As long as these 3 conditions above are met, further transmitter test will not be required.

However, the OEM integrator is still responsible for testing their end-product for any additional compliance requirements required with this module installed (for example, digital device emissions, PC peripheral requirements, etc.). The end-product may need Verification testing, Declaration of Conformity testing, a Permissive Class II Change or new Certification. Please involve a FCC certification specialist in order to determine what will be exactly applicable for the end-product.

Validity of using the module certification:

In the event that these conditions cannot be met (for example certain laptop configurations or co-location with another transmitter), then the FCC/IC authorization for this module in combination with the host equipment is no longer considered valid and the FCC ID/IC of the module cannot be used on the final product. In these circumstances, the OEM integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate FCC authorization. In such cases, please involve a FCC/IC certification specialist in order to determine if a Permissive Class II Change or new Certification is required.

Upgrade Firmware:

The software provided for firmware upgrade will not be capable to affect any RF parameters as certified for the FCC/IC for this module, in order to prevent compliance issues.

End product labeling:

This transmitter module is authorized only for use in device where the antenna may be installed such that 20 cm may be maintained between the antenna and users. The final end product must be labeled in a visible area with the following: "Contains IC: 10531A-LM961".

Information that must be placed in the end user manual:

The OEM integrator has to be aware not to provide information to the end user regarding how to install or remove this RF module in the user's manual of the end product which integrates this module. The end user manual shall include all required regulatory information/warning as show in this manual.

2.2 List of applicable FCC/IC rules

List the FCC/IC rules that are applicable to the modular transmitter. These are the rules that specifically establish the bands of operation, the power, spurious emissions, and operating fundamental frequencies.

DO NOT list compliance to unintentional-radiator rules (Part 15 Subpart B/ICES-003) since that is not a condition of a module grant that is extended to a host manufacturer. See also Section 2.10 below concerning the need to notify host manufacturers that further testing is required.

Explanation: This module meets the requirements of FCC part 15C(15.247).

2.3 Summarize the specific operational use conditions

Describe use conditions that are applicable to the modular transmitter, including for example any limits on antennas, etc. For example, if point-to-point antennas are used that require reduction in power or compensation for cable loss, then this information must be in the instructions. If the use condition limitations extend to professional users, then instructions must state that this information also extends to the host manufacturer's instruction manual. In addition, certain information may also be needed, such as peak gain per frequency band and minimum gain, specifically for master devices in 5 GHz DFS bands.

Explanation: The EUT has a Monopole and Chip antenna, and the antenna use a permanently attached antenna which is not replaceable.

2.4 Limited module procedures

If a modular transmitter is approved as a "limited module," then the module manufacturer is responsible for approving the host environment that the limited module is used with. The manufacturer of a limited module must describe, both in the filing and in the installation instructions, the alternative means that the limited module manufacturer uses to verify that the host meets the necessary requirements to satisfy the module limiting conditions.

A limited module manufacturer has the flexibility to define its alternative method to address the conditions that limit the initial approval, such as: shielding, minimum signaling amplitude, buffered modulation/data inputs, or power supply regulation. The alternative method could include that the limited module manufacturer reviews detailed test data or host designs prior to giving the host manufacturer approval.

This limited module procedure is also applicable for RF exposure evaluation when it is necessary to demonstrate compliance in a specific host. The module manufacturer must state how control of the product into which the modular transmitter will be installed will be maintained such that full compliance of the product is always ensured. For additional hosts other than the specific host originally granted with a limited module, a Class II permissive change is required on the module grant to register the additional host as a specific host also approved with the module.

Explanation: The Module is not a limited module.

2.5 Trace antenna designs

For a modular transmitter with trace antenna designs, see the guidance in Question 11 of KDB Publication 996369 D02 FAQ – Modules for Micro-Strip Antennas and traces. The integration information shall include for the TCB review the integration instructions for the following aspects: layout of trace design, parts list (BOM), antenna, connectors, and isolation requirements.

a) Information that includes permitted variances (e.g., trace boundary limits, thickness, length, width, shape(s),

dielectric constant, and impedance as applicable for each type of antenna);

b) Each design shall be considered a different type (e.g., antenna length in multiple(s) of frequency, the wavelength, and antenna shape (traces in phase) can affect antenna gain and must be considered); c)

The parameters shall be provided in a manner permitting host manufacturers to design the printed circuit (PC) board layout;

- d) Appropriate parts by manufacturer and specifications;
- e) Test procedures for design verification; and
- f) Production test procedures for ensuring compliance.

The module grantee shall provide a notice that any deviation(s) from the defined parameters of the antenna trace, as described by the instructions, require that the host product manufacturer must notify the module grantee that they wish to change the antenna trace design. In this case, a Class II permissive change application is required to be filed by the grantee, or the host manufacturer can take responsibility through the change in FCC ID (new application) procedure followed by a Class II permissive change application.

Explanation: Yes, The module with trace antenna designs, and This manual has been shown the layout of trace design, antenna, connectors, and isolation requirements.

2.6 RF exposure considerations

It is essential for module grantees to clearly and explicitly state the RF exposure conditions that permit a host product manufacturer to use the module. Two types of instructions are required for RF exposure information: (1) to the host product manufacturer, to define the application conditions (mobile, portable – xx cm from a person’s body); and (2) additional text needed for the host product manufacturer to provide to end users in their end-product manuals. If RF exposure statements and use conditions are not provided, then the host product manufacturer is required to take responsibility of the module through a change in FCC ID/IC (new application).

Explanation: This module complies with FCC RF radiation exposure limits set forth for an uncontrolled environment, This equipment should be installed and operated with a minimum distance of 20 centimeters between the radiator and your body." This module is designed to comply with the FCC statement, “Contains Transmitter Module FCC ID: VVXLM812 Or Contains FCC ID: VVXLM812”.

2.7 Antennas

A list of antennas included in the application for certification must be provided in the instructions. For modular transmitters approved as limited modules, all applicable professional installer instructions must be included as part of the information to the host product manufacturer. The antenna list shall also identify the antenna types (monopole, PIFA, dipole, etc. (note that for example an “omni-directional antenna” is not considered to be a specific “antenna type”)).

For situations where the host product manufacturer is responsible for an external connector, for example with an RF pin and antenna trace design, the integration instructions shall inform the installer that unique antenna connector must be used on the Part 15 authorized transmitters used in the host product. The module manufacturers shall provide a list of acceptable unique connectors.

Explanation: The EUT has a Monopole and Chip antenna, and the antenna use a permanently attached antenna which is unique.

Brand	Model Name	Antenna Type	Connector	Gain (dBi)	Note
LM	LM256	Monopole	N/A	2.0	N/A
ACX	AT3216	Chip	N/A	2.0	N/A

2.8 Label and compliance information

Grantees are responsible for the continued compliance of their modules to the FCC/IC rules. This includes advising host product manufacturers that they need to provide a physical or e-label stating “Contains FCC ID” with their finished product. See Guidelines for Labeling and User Information for RF Devices – KDB Publication 784748.

Explanation: The host system using this module, should have label in a visible area indicated the following texts: “Contains Transmitter Module FCC ID: VVXLM812 Or Contains FCC ID: VVXLM812”.

2.9 Information on test modes and additional testing requirements⁵

Additional guidance for testing host products is given in KDB Publication 996369 D04 Module Integration Guide. Test modes should take into consideration different operational conditions for a stand-alone modular transmitter in a host, as well as for multiple simultaneously transmitting modules or other transmitters in a host product.

The grantee should provide information on how to configure test modes for host product evaluation for different operational conditions for a stand-alone modular transmitter in a host, versus with multiple, simultaneously transmitting modules or other transmitters in a host.

Grantees can increase the utility of their modular transmitters by providing special means, modes, or instructions that simulates or characterizes a connection by enabling a transmitter. This can greatly simplify a host manufacturer’s determination that a module as installed in a host complies with FCC/IC requirements.

Explanation: Top band can increase the utility of our modular transmitters by providing instructions that simulates or characterizes a connection by enabling a transmitter.

2.10 Additional testing, Part 15 Subpart B/ICES-003 disclaimer

The grantee should include a statement that the modular transmitter is only FCC authorized for the specific rule parts (i.e., FCC/IC transmitter rules) listed on the grant, and that the host product manufacturer is responsible for compliance to any other FCC/IC rules that apply to the host not covered by the modular transmitter grant of certification. If the grantee markets their product as being Part 15 Subpart B/ICES-003 compliant (when it also contains unintentional-radiator digital circuitry), then the grantee shall provide a notice stating that the final host product still requires Part 15 Subpart B/ICES-003 compliance testing with the modular transmitter installed.

Explanation: The module without unintentional-radiator digital circuitry, so the module does not require an evaluation by FCC Part 15 Subpart B/ICES-003. The host should be evaluated by the FCC Subpart B/ICES-003.