

Emergent Solutions Inc. (ESI)

EBR100MODX

Module Integration Manual

TVWS Module Platform

Version: 0.4

Date: 2025-09-07

Status: Preliminary

PRIVATE & CONFIDENTIAL

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<http://www.emergent-sol.com/support/technical.htm>. Or email us at: support@emergent-sol.com.

About the Document

This manual provides information on the integration, configuration, operation, and maintenance of the radio module. It is intended for OEM engineers and technical personnel responsible for integrating or managing the device. The document includes technical specifications, safety guidelines, interface descriptions, and software configuration procedures to ensure proper and efficient use of the module. It should be used in conjunction with any release notes or application guides specific to the firmware version installed. Readers are encouraged to follow the procedures outlined to ensure regulatory compliance and optimal system performance.

Revision History

Version	Date	Author	Description
0.1	2025-07-30	RC	Initial release.
0.2	2025-08-15	RC	Updated RF exposure limits
0.3	2025-08-20	RC	Added TCB feedback
0.4	2025-09-07	RC	Add the 9-dBi antenna to Pg.8 and removed the 5-dBi antenna on Pg.9 Add the FCC antenna professional install compliance statement to Pg.7 Add security measures and functionality on Pg.11 Add TDMA with ATPC operation on Pg.12

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7. Safety Precautions

Installation and service must be done by personnel having technical training and experience necessary to be aware of hazards during installation and/or service of RF equipment. The installation and/or service must be done using procedures designed to minimize any danger to technical personnel or any other person.

8. Radio Frequency Safety

The installer of this radio equipment must ensure that the antenna is located or pointed such that it does not emit RF fields in excess of the general population limits as defined by FCC CFR 47, Part 2.1091 and OET Bulletin 65, Radio frequency radiation exposure evaluation for fixed devices & Health Canada limits for the general population; consult Safety Code 6, obtainable from Health Canada's website:

[CFR-2009-title47-vol1-sec2-1091.pdf](#)

[RevisedSuppC-0622-FINAL.PDF](#)

[Understanding Safety Code 6: Health Canada's radiofrequency exposure guidelines - Canada.ca](#)

Refer to the regulatory statements included in this document.

9. Cyber Security

IMPORTANT:

Always change the factory default administrator password before connecting your 6Harmonics system to an open Ethernet network or activating the wireless interface.

Also change the SNMP community strings from factory default.

Use strong passwords for enhanced security.

10. FCC Regulatory Notice

FCC Compliance Statement – Class A Device

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense. 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.

Please note that changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

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

FCC RF Exposure Statement

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter. In order to avoid the possibility of exceeding the FCC radio frequency exposure limits, this equipment should be installed and operated with minimum distance 26 cm (10.24 inches) between the antenna and your body during normal operation. Users must follow the specific operating instructions for satisfying RF exposure compliance.

FCC Part 15H TV Band Device Notice

This equipment has been tested and found to comply with the rules for white space devices, pursuant to part 15 of the FCC rules. These rules are designed to provide reasonable protection against harmful interference. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

1. Reorient or relocate the receiving antenna.
2. Increase the separation between the equipment and receiver.
3. Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
4. Consult the manufacturer, dealer, or an experienced technician for help.

FCC Antenna Location Requirement for WGF Equipment Class (Fixed Whitespace Devices)

Above ground level. The transmit antenna height shall not exceed 10 meters above ground level in any area for fixed white space devices operating in the TV bands at 40 mW EIRP or less or operating across multiple contiguous TV channels at 100 mW EIRP or less.

Height above average terrain (HAAT). For devices operating in the TV bands below 602 MHz, the transmit antenna shall not be located where its height above average terrain exceeds 250 meters generally, or 500 meters in less congested areas. For devices operating in all other bands the transmit antenna shall not be located where its height above average terrain exceeds 250 meters.

The HAAT is to be calculated by the white space database using the methodology in § 73.684(d) of this chapter. For HAAT greater than 250 meters the following procedures are required:

- (A) The installing party must contact a white space database and identify all TV broadcast station contours that would be potentially affected by operation at the planned HAAT and EIRP. A potentially affected TV station is one where the protected service contour is within the applicable separation distance for the white space device operating at an assumed HAAT of 50 meters above the planned height at the proposed power level.
- (B) The installing party must notify each of these licensees and provide the geographic coordinates of the white space device, relevant technical parameters of the proposed deployment, and contact information.
- (C) No earlier than four calendar days after the notification in paragraph (g)(1)(ii)(B) of this section, the installing party may commence operations.
- (D) Upon request, the installing party must provide each potentially affected licensee with information on the time periods of operations.
- (E) If the installing party seeks to modify its operations by increasing its power level, by moving more than 100 meters horizontally from its location, or by making an increase in the HAAT or EIRP of the white space device that results in an increase in the minimum required separation distances from co-channel or adjacent channel TV station contours, it must conduct a new notification.
- (F) All notifications required by this section must be in written form (including email). In all cases, the names of persons contacted, and dates of contact should be kept by the white space device operator for its records and supplied to the Commission upon request.

FCC Expert Installer Requirement

To comply with FCC interference protection requirements for TV Band Devices this equipment should only be installed by an expert installer.

Furthermore, the EBR100MODX is a radio frequency (RF) module intended for integration by qualified professionals. Installation must be performed within the host device, and the antenna must be mounted externally, such as on a tower structure. For detailed installation procedures and compliance requirements, please refer to the installation guide. Only the following antennas are approved for use to ensure regulatory compliance:

- 12 dBi Dipole antenna
- 9 dBi Log-periodic antenna

Use of any other antenna type may invalidate compliance.

Label and Compliance information

The end product must carry a physical label or shall use e-labeling followed KDB 784748 D01 and KDB 784748 stating:

“Contains Transmitter Module FCC ID 2BOHX-EBR100MODX, IC: 33834-EBR100MODX”
or “Contains FCC ID 2BOHX-EBR100MODX, IC: 33834-EBR100MODX”

Approved Components

Only the following components in the table below are approved for use.

Approved Power Sources

EBR100 Module	Approved Power Supplies
EBR100MODX	To be provided at system level at which time AC conducted emissions testing will be required.

Approved Antennas

EBR100 Module	Approved Antennas
EBR100MODX	470-700 MHz Dual Polarization Directional Panel Dipole Antenna 12 dBi PN: MT006D12VH/RB/A
EBR100MODX	470-698 MHz Dual Polarization Directional Yagi Antenna 9 dBi PN: KP-TWDPY9

11. ISED Regulatory Notice

ISED non-interference disclaimer

This device contains licence-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada's licence-exempt RSS(s). Operation is subject to the following two conditions:

- (1) This device may not cause interference.
- (2) This device must accept any interference, including interference that may cause undesired operation of the device.

This device complies with the Canadian ICES-003 Class B specifications. CAN ICES-003(B) / NMB-003 (B).

L'émetteur/récepteur exempt de licence contenu dans le présent appareil est conforme aux CNR d'Innovation, Sciences et Développement économique Canada applicables aux appareils radio exempt de licence. L'exploitation est autorisée aux deux conditions suivantes :

- (1) L'appareil ne doit pas produire de brouillage;
- (2) L'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Cet appareil numérique de la classe B est conforme à la norme NMB-003 du Canada.

RSS-Gen Transmit antenna statement

This radio transmitter IC: 33834-EBR100MODX has been approved by Innovation, Science and Economic Development Canada to operate with the antenna types listed below, with the maximum permissible gain indicated. Antenna types not included in this list that have a gain greater than the maximum gain indicated for any type listed are strictly prohibited for use with this device.

Le présent émetteur radio IC: 33834-EBR100MODX a été approuvé par Innovation, Sciences et Développement économique Canada pour fonctionner avec les types d'antenne énumérés ci-dessous et ayant un gain admissible maximal. Les types d'antenne non inclus dans cette liste, et dont le gain est supérieur au gain maximal indiqué pour tout type figurant sur la liste, sont strictement interdits pour l'exploitation de l'émetteur.

Under Innovation, Science and Economic Development regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by ISED. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication.

Conformément à la réglementation d'Innovation, Sciences et Développement économique Canada, le présent émetteur radio peut fonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pour l'émetteur par Innovation, Sciences et Développement économique Canada. Dans le but de réduire les risques de brouillage radioélectrique à l'intention des autres utilisateurs, il faut choisir le type d'antenne et son gain de sorte que la puissance isotrope rayonnée équivalente (p.i.r.e.) ne dépasse pas l'intensité nécessaire à l'établissement d'une communication satisfaisante.

Approved Antenna Types:

	Antenna type 1	Antenna type 2
Maximum gain:	12 dBi	9.0 dBi
Antenna type:	Dipole	Log-periodic
Radiation pattern:	Directional	Directional
Impedance:	50 Ohm	50 Ohm
Connector type:	N-type	N-Type

Label and Compliance information

The end product must carry a physical label or shall use e-labeling followed KDB 784748 D01 and KDB 784748 stating:

“Contains Transmitter Module FCC ID 2BOHX-EBR100MODX, IC: 33834-EBR100MODX” or

“Contains FCC ID 2BOHX-EBR100MODX, IC: 33834-EBR100MODX”

ISED RF Exposure statement

This equipment complies with ISED RSS-102 radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 36 cm (14.17 in) between the radiator and any part of your body. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

Cet équipement est conforme aux limites d'exposition aux radiations ISED CNR-102 établies pour un environnement non contrôlé. Une distance de séparation d'au moins 36 cm (14.17 in) doivent être maintenue entre l'antenne de cet appareil et toutes les personnes. Lanceurs ou ne peuvent pas coexister cette antenne ou capteurs avec d'autres.

ISED Fixed WSD Antenna Requirements

The antenna height above ground shall be determined by the installer or operator of the fixed device, or by automatic means. This information shall be stored internally in the white space device. If the fixed device is moved, the operator shall re-establish the device's antenna height above ground level and also update the device's registration with the white space database.

La hauteur au-dessus du sol de l'antenne doit être déterminée par l'installateur ou l'opérateur du dispositif fixe, ou par des dispositifs automatiques. Cette information doit être enregistrée dans le dispositif d'espaces blancs. Si ce dispositif est déplacé, l'opérateur devra rétablir la hauteur au-dessus du sol de l'antenne et mettre à jour l'enregistrement de l'appareil dans la base de données d'espaces blancs.

12. Product Overview

The EBR100MODX Radio Module Fixed TVBD is a high-performance digital radio system comprising a Host Compute Module (HCM100) and a Frequency Translation Module (FTM550), built around a Qualcomm 802.11ax SoC. It supports 2x2 MIMO in both uplink and downlink, operating in Time Division Duplexing (TDD) mode and leveraging Orthogonal Frequency Division Multiple Access (OFDMA) for efficient spectrum utilization. With modulations level from BPSK through to 1024QAM (MCS 0-11).

The EBR100MODX can be used in different modes of operation – as a PMP sector-controller, as a PMP subscriber-station or as a PTP master/client.

The HCM100 features a quad-core ARM processor designed for edge computing applications, with provisions for expanded memory and storage to support demanding workloads. Integrated within the module is a GNSS SoC, providing accurate date/time synchronization, timing, and location services essential for coordinated wireless deployments.

The EBR100MODX is engineered for extended temperature operation, contingent upon adherence to the provided thermal design guidelines to ensure reliable performance under harsh environmental conditions.

The module is typically installed in outdoor-rated enclosures and powered through GbE IEEE 802.3af/at/bt PoE PD with a second port as an 802.3af/at PSE or out-of-band management. There is also 12VDC input.

The integrated TVWS WSDB (White Space Database) agent in the EBR100MODX module ensures regulatory compliance with both the FCC (USA) andISED (Canada) for operation in the TV White Space spectrum. The agent adheres to the PAWS (Protocol to Access White Space) standard as defined in RFC 7475, enabling secure and automated communication with certified spectrum databases. It is fully certified and interoperable with the RED Technologies (USA and Canada) and PHNX (Canada only) database systems, approved authorities for managing TVWS spectrum availability in the United States and Canada. This built-in functionality allows dynamic channel allocation and transmitter power control, ensuring non-interference with licensed services while maximizing spectrum efficiency.

Communications between the EBR100MODX and the White Space Database (WSDB) are conducted using Hypertext Transfer Protocol Secure (HTTPS) secured by SSL/TLS encryption with RSA-based key exchange. During registration, the WSDB issues a unique license token and access token per device.

The EBR100MODX is designed and manufactured to prevent end users from modifying the device to operate outside the parameters authorized under FCC rules. The hardware does not include removable straps, traces, header pins, or accessible components that could be altered to change the device's operating frequencies, output power, or regulatory domain. All RF parameters are permanently controlled through secure firmware and hardware design, and there are no user-accessible methods to bypass these safeguards.

The EBR100MODX implements a secure boot process that validates firmware images using a manufacturer-issued digital signature. Only firmware signed with the grantee's private key can be executed. This prevents unauthorized third parties from loading or executing non-compliant code. The regulatory domain is enforced by using region-specific, digitally signed configuration files embedded in firmware at time of manufacturing. These files are cryptographically verified during boot and cannot be altered by end users or third parties. The regulatory domain is locked to the certified region, and domain changes cannot occur without a signed update issued by the grantee.

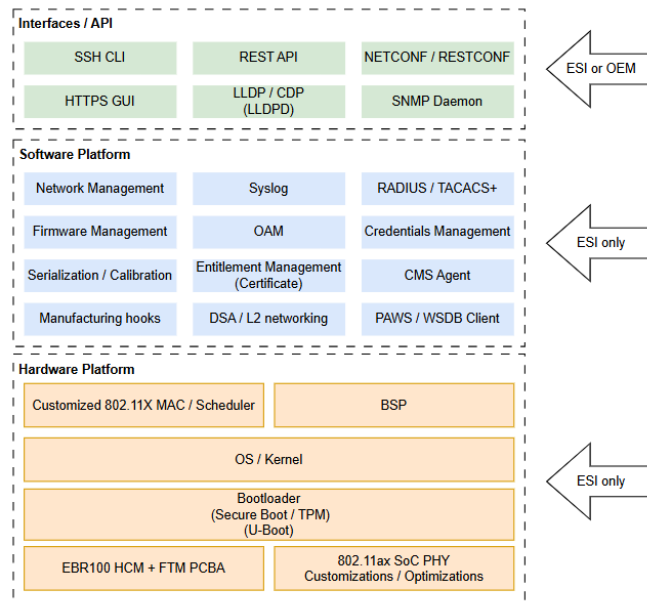
All RF control code, including transmit power, frequency, channel sizes and modulation settings, is located in a secure partition of firmware that is inaccessible to users or third-party applications. User-configurable functions (e.g., networking, monitoring, or non-RF services) are logically separated and do not have access to RF compliance controls.

Software/firmware updates are distributed exclusively by the grantee through firmware binaries that are signed and validated using PKC (Public Key Cryptography) over-the-air (OTA) process or via

secure wired update. The device verifies the integrity and authenticity of updates before installation. Unsigned or altered updates are rejected automatically.

As the EBR100MODX module is intended for different deployment use cases, the software has been architected for ease of integration. The following diagram is a high-level block diagram:

EBR100 Block Diagram



The EBR100MODX module is not designed for stand-alone operation. The module is sold as one component of a packaged system which includes a suitable enclosure for the module connectors for required external components including a power supply and antenna system. This is afterwards referred to as the system. The final product may be designed and manufactured by Emergent Solutions or a licensed third party.

Permissible frequency settings and transmitter power levels are enforced through the secure Entitlement Certificate to being compliant with regulatory agency requirements in the region of deployment.

USA: EBR100MODX: 470 - 602 MHz band
Canada: EBR100MODX: 470 - 602 MHz band

In Canada, the EBR100MODX meets both Class A and Class B per RSS-222 iss.4

The EBR100MODX utilizes Time Division Multiple Access (TDMA) with Automatic Transmit Power Control (ATPC) to ensure efficient and reliable communication in its multipoint operation. TDMA organizes transmissions into dedicated time slots, eliminating collisions and providing predictable performance for all connected subscriber stations. When combined with ATPC, each subscriber station automatically adjusts its transmit power so that signals arrive at the base station sector controller within an optimal range. This prevents the “near-far” problem, reduces unnecessary interference, and balances link quality across all users. For the operator, the benefits include more stable throughput, improved spectrum efficiency, and minimizing unnecessary emissions. For end users, TDMA with ATPC delivers consistent performance, lower latency, and dependable connectivity even in networks with subscribers located at different distances from the base station. The current implementation of ATPC allows for 0.1 dB steps to adjust the remote (UL) transmit power to the defined receive signal level threshold controlled by the sector controller.

This manual is provided as a supplement to technical and operational documentation and training provided by Emergent Solutions and its agents. Any operation or use of the EBR100MODX in any manner not expressly specified within this manual or approved in writing by Emergent Solutions (or its

agents) is expressly forbidden and voids the user's right to operate the module. This includes, but is not limited to, any modification of the module hardware or software, installation of the module in a non-approved enclosure, and use with non-approved antennas.

Important: Read this entire document prior to installing or operating the EBR100MODX module.

13. Module Installation and Service

Emergent Solutions shall retain complete control over the final installation of the module and will ensure compliance of the end product to all applicable FCC and ISSED regulations. The module must be installed only into an approved enclosure and only at an approved manufacturing facility or service depot.

Emergent Solutions licensing of the modular wireless system includes monitoring to ensure compliance in the operation and use of the EBR100MODX as expressly specified within this manual. This includes restrictions against modification of the module hardware, approval of the final enclosure, operational restrictions for installers and end-users, and approval of power sources and antennas provided for use with the product.

Operation of the final product requires the Entitlement Certificate to be controlled exclusively by the manufacturer. The Entitlement Certificate must be unique to each module and must be installed and activated before the radio operates. The Entitlement Certificate must contain sufficient security features for the professional installer and operator cannot decode, modify, substitute, or otherwise circumvent the operational restrictions imposed by the Entitlement Certificate.

The software Entitlement Certificate must limit the transmit power, operating frequency range, and channel bandwidth per the regulator domain governing the location where the radio will be deployed. The operator does not have the option to select the country or regulatory region of operation.

The software Entitlement Certificate must limit the mode of operation as a sector-controller, subscriber-station or PTP master/client. The subscriber station or PTP-client mode is 'passive listener' and while in this mode the module cannot initiate any transmission without first receiving and decoding a valid authorization message from the sector-controller or PTP-master. A module with the Entitlement Certificate for subscriber-station cannot be changed by the installer to enable sector-controller mode operation.

To operate in the TV Whitespaces frequency range, the final product must be capable of contacting and registering with the approved WSDB database server. The final product is not allowed to transmit on any channels before registering with the WSDB database server and obtaining a list of available channels or after the expiry time has elapsed.

Following WSDB registration, the final product is restricted to transmitting only on channels indicated as 'available' by the WSDB database. In congested areas, the number of available channels may be zero. Channel assignments are temporary, and the final product must periodically contact the WSDB to refresh the channel list. It is recommended to review the intended location for TVWS channel availability using the online tools from Emergent Solutions.

The WSDB server URL is selectable by the operator network administrator. To register, the final product must be registered in the FCC or ISSED approved devices based on the model number. The registration process will fail if the request is submitted with any blank, incomplete or invalid mandatory fields.

Emergent Solutions will review all final products for compliance with regulatory restrictions. The manufacturer must meet all labeling requirements.

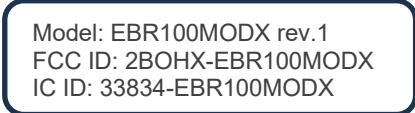
Warning: The EBR100MODX is susceptible to damage from electrostatic charge. Electrostatic Discharge (ESD) must be avoided to prevent damaging or destroying the module. The module must always be stored in an anti-static container/bag prior to installation and following removal from the product for servicing. Observe ESD precautions when handling the module.

The EBR100MODX is not intended to be field serviceable and contains no field serviceable or field replaceable parts. The module must be serviced only at an approved manufacturing facility or service depot.

Product Labeling

Module Label (on PCB)

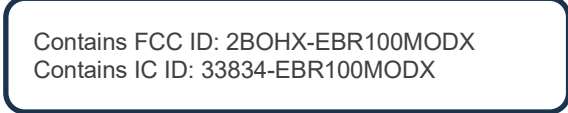
The EBR100MODX modular transceiver will display a label referring to FCC ID 2BOHX-EBR100MODX, and IC: 33834-EBR100MODX registration numbers. An information label is applied directly to the modular transmitter (example shown below).



Model: EBR100MODX rev.1
FCC ID: 2BOHX-EBR100MODX
IC ID: 33834-EBR100MODX

System Label (external)

An information label is applied to the outside of the enclosure of the final system device into which the module is installed. This label will display the FCC ID: 2BOHX-EBR100MODX, IC ID: 33834-EBR100MODX registration numbers (example shown below).



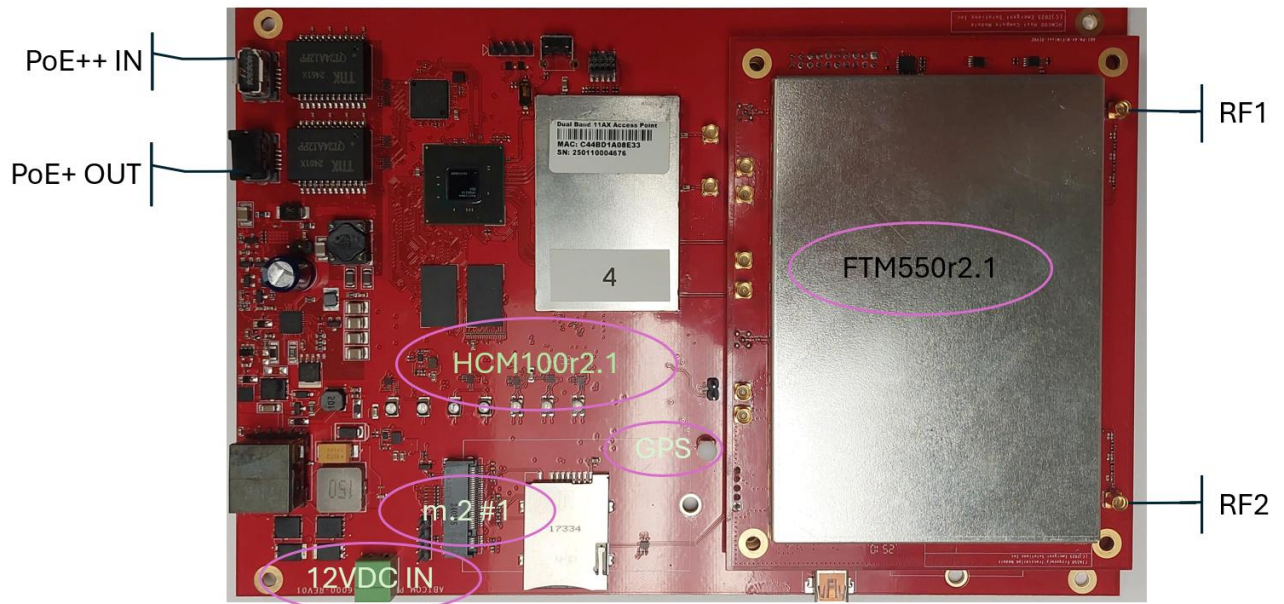
Contains FCC ID: 2BOHX-EBR100MODX
Contains IC ID: 33834-EBR100MODX

14. Channel Band Plan

6 MHz Channel Size				12 MHz Channel Size				18 MHz Channel Size				24 MHz Channel Size			
ATSC Channel	Frequency MHz			ATSC Channels	Frequency MHz			ATSC Channels	Frequency MHz			ATSC Channels	Frequency MHz		
	Lower edge	Upper edge	Center		Lower edge	Upper edge	Center		Lower edge	Upper edge	Center		Lower edge	Upper edge	Center
14	470	476	473	14,15	470	482	476	14,15,16	470	488	479	14,15,16,17	470	494	482
15	476	482	479	15,16	476	488	482	15,16,17	476	494	485	15,16,17,18	476	500	488
16	482	488	485	16,17	482	494	488	16,17,18	482	500	491	16,17,18,19	482	506	494
17	488	494	491	17,18	488	500	494	17,18,19	488	506	497	17,18,19,20	488	512	500
18	494	500	497	18,19	494	506	500	18,19,20	494	512	503	18,19,20,21	494	518	506
19	500	506	503	19,20	500	512	506	19,20,21	500	518	509	19,20,21,22	500	524	512
20	506	512	509	20,21	506	518	512	20,21,22	506	524	515	20,21,22,23	506	530	518
21	512	518	515	21,22	512	524	518	21,22,23	512	530	521	21,22,23,24	512	536	524
22	518	524	521	22,23	518	530	524	22,23,24	518	536	527	22,23,24,25	518	542	530
23	524	530	527	23,24	524	536	530	23,24,25	524	542	533	23,24,25,26	524	548	536
24	530	536	533	24,25	530	542	536	24,25,26	530	548	539	24,25,26,27	530	554	542
25	536	542	539	25,26	536	548	542	25,26,27	536	554	545	25,26,27,28	536	560	548
26	542	548	545	26,27	542	554	548	26,27,28	542	560	551	26,27,28,29	542	566	554
27	548	554	551	27,28	548	560	554	27,28,29	548	566	557	27,28,29,30	548	572	560
28	554	560	557	28,29	554	566	560	28,29,30	554	572	563	28,29,30,31	554	578	566
29	560	566	563	29,30	560	572	566	29,30,31	560	578	569	29,30,31,32	560	584	572
30	566	572	569	30,31	566	578	572	30,31,32	566	584	575	30,31,32,33	566	590	578
31	572	578	575	31,32	572	584	578	31,32,33	572	590	581	31,32,33,34	572	596	584
32	578	584	581	32,33	578	590	584	32,33,34	578	596	587	32,33,34,35	578	602	590
33	584	590	587	33,34	584	596	590	33,34,35	584	602	593				
34	590	596	593	34,35	590	602	596								
35	596	602	599												

	Tx Pwr / Channel Size			
	6	12	18	24
FCC	+21 dBm	+21 dBm	na	+21 dBm
ISED Class B	+21 dBm	+21 dBm	na	+21 dBm
ISED Class A	+27 dBm	+27 dBm	na	+27 dBm

15. Interfaces



16. Configuration – CLI/SSH

This section is intended for the OEM to integrate their API software layer to the EBR100MODX module software stack including the WSDB agent.

The following commands are specific for the FCC/ISED testing given some test cases associated with conducted emissions are outside normal operations.

Firmware branch code name: FccTester (pre-installed by Emergent)

1. Syntax:

- FccTester (-h) (-vvv) (-f file)
 - -h: this message
 - -v(vv): increase agent verbosity from none to 3
 - -f: use file as default agent config, tvws-sandbox.conf(default), tvws-red-usa.conf, tvws-red-canada.conf
 - -s: Force a channel change after spectrum update(20min), will ignore current channel and use next best one after initial response, test takes 20 min to run.

2. Command options:

- help command
- General form: cmd (key) (value1) (value2)...
- Supported commands: help: this message
- Supported commands: start: active wsdb agent
- Supported commands: stop: stop agent
- Supported commands: quit: exit tester
- Supported commands: get <key> :get value of key from uci
- Supported get commands: get url :return paws url()
- Supported get commands: get token :return auth token()
- Supported get commands: get owner :return owner info()
- Supported get commands: get operator :return operator info()
- Supported get commands: get device :serial number, Manufacturer Id, Model Id, rulesetId, FccId Fcc Dev Type
- Supported get commands: get location :longitude latitude
- Supported get commands: get antenna :height

- Supported commands: set <key> <value> :set value for key
- Supported set commands: set url <paws url> :set url for paws server
- Supported set commands: set token <auth token> : set auth token
- Supported set commands: set device sn <serial number> fccid <fccid>: set serial number and/or fccid
- Supported set commands: set location longitude <longitude> latitude <latitude>: set longitude and latitude
- Supported set commands: set antenna height <height> : set antenna height
- Supported set commands: set default :reset everything to default values from tvws file
- Supported set commands: set txpower <power> : set tx power
- Supported set commands: set gain <gain> : set antenna gain
- Supported set commands: set freq <freq> : set freq
- Supported set commands: set bw <bw> : set channel bandwidth
- Supported set commands: set owner name <name>
 - org <org> address1 <address1> address2 <address2>
 - city <city> prov <prov> postal <postal>
 - country <country> telephone <telephone>
 - email <email> url <url> : set owner contact info(any or all fields)
- Supported set commands: set operator name <name>
 - org <org> address1 <address1> address2 <address2>
 - city <city> prov <prov> postal <postal>
 - country <country> telephone <telephone>
 - email <email> url <url> : set owner contact info(any or all fields)

17. Thermal Dissipation

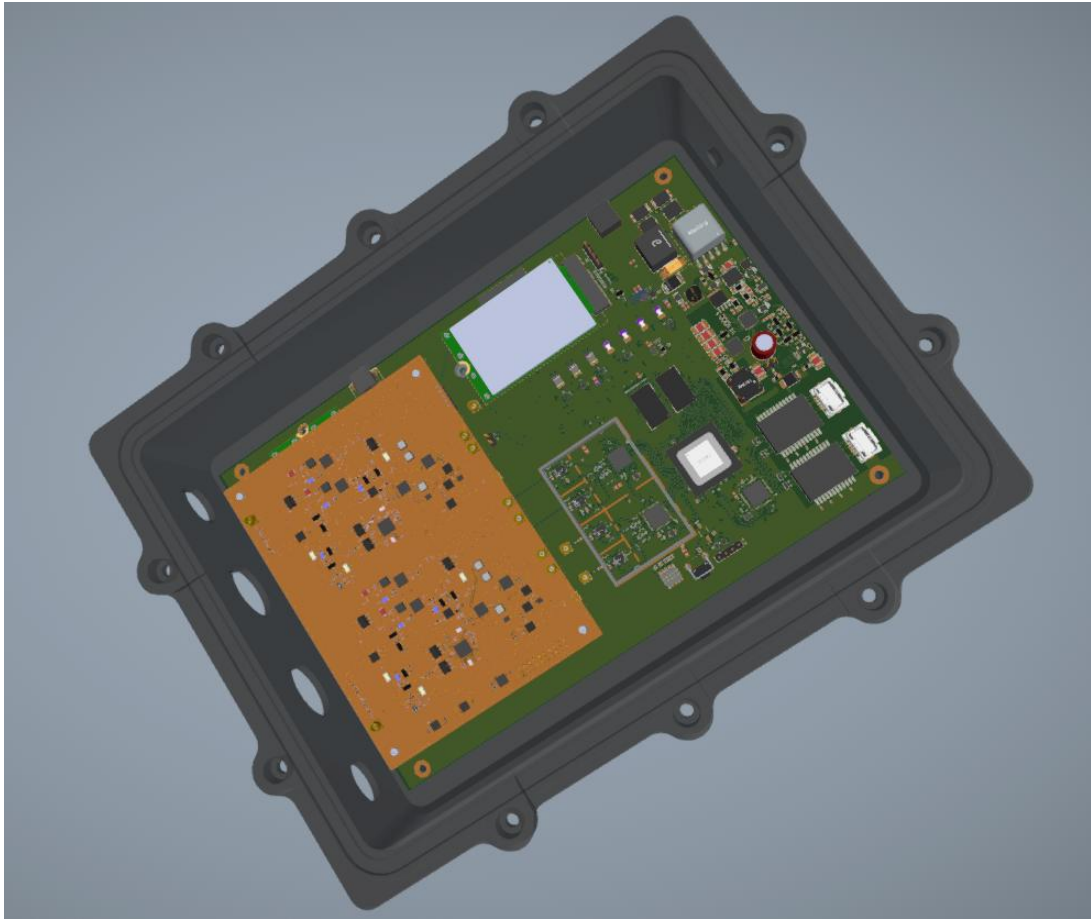
The module offers the best performance when all IC chips are working within their specified operating temperatures. When the IC chip reaches or exceeds the maximum junction temperature, the module may still work but the performance and function (such as RF output power, data rate, etc.) will be affected to a certain extent. Therefore, the thermal design should be maximally optimized to ensure all IC chips always work within the recommended operating temperature range.

1. Module Mounting (Conduction Cooling)
 - Mount the transceiver module ****directly to a thermally conductive enclosure surface**** (typically aluminum).
 - Ideal thermal conductivity: Aluminum (>150 W/m·K).
 - Ensure flatness of mounting surface to minimize gaps (recommended flatness ≤0.1 mm per 100 mm).
 - Use a mounting scheme providing consistent mechanical pressure (e.g., screws, clamps) evenly distributed across the module's thermal interface area.
2. Thermal Interface Material (TIM)
 - Apply ****gap-filler thermal pads**** between the PCBA hotspots (e.g., RF power amplifier, regulators, SoC) and enclosure inner surface:
 - Typical pad conductivity: ≥ 3 W/m·K (higher is better).
 - Thickness: Choose a pad slightly thicker than measured gap to ensure good compression (typically 0.5–1.5 mm thick).
 - Ensure full pad coverage of thermal hot spots per the module's thermal guidelines to maximize conduction.
3. Module Orientation & Enclosure Positioning
 - Position the enclosure/module to enhance passive convective cooling:
 - Vertical orientation**** is preferred** (hot air rises naturally).
 - Place the hottest part of the module at the bottom to leverage natural convection upwards.
 - If vertical mounting isn't possible, ensure enough internal clearance (≥10–20 mm) above and below the module to support convection-driven air movement.

4. External Heat Dissipation (Enclosure Design for Outdoor Use)
 - Increase external surface area to enhance passive heat dissipation:
 - Incorporate external fins or ribs on enclosure surfaces.
 - Recommended fin thickness: ~2–5 mm; spacing: ~5–10 mm.
 - Choose a high-emissivity enclosure finish:
 - White finish
 - Consider a solar shield
5. Ventilation and Internal Airflow
 - For sealed/IP-rated enclosures (typical OEM application):
 - Internal free-air volume should be large enough to encourage convection within the sealed enclosure (avoid excessive component crowding).
6. Component Clearance and Thermal Isolation
 - Maintain clearance from other internal enclosure surfaces/components:
 - Recommended clearance ≥ 10 mm to support passive air circulation internally.
 - Avoid placing thermally sensitive parts (battery packs, oscillators, sensitive ICs) immediately above or next to the hottest module areas.
7. Temperature Monitoring
 - The EBR100MODX has temperature sensor on the PCB in critical areas.
 - Software is designed to shut down IC's that approach operational limits.
8. Operating Environment Guidance
 - Operating conditions ambient: -40°C to $+75^{\circ}\text{C}$
9. Thermal Validation
 - OEM integrators will perform their own thermal validation tests within the final product enclosure:
 - Thermal imaging or temperature measurement under worst-case operating conditions.
 - Verify temperatures remain within module-specified limits.

Following these specific thermal management guidelines will ensure that OEM integration effectively maintains the module's thermal performance and reliability in the final enclosed product.

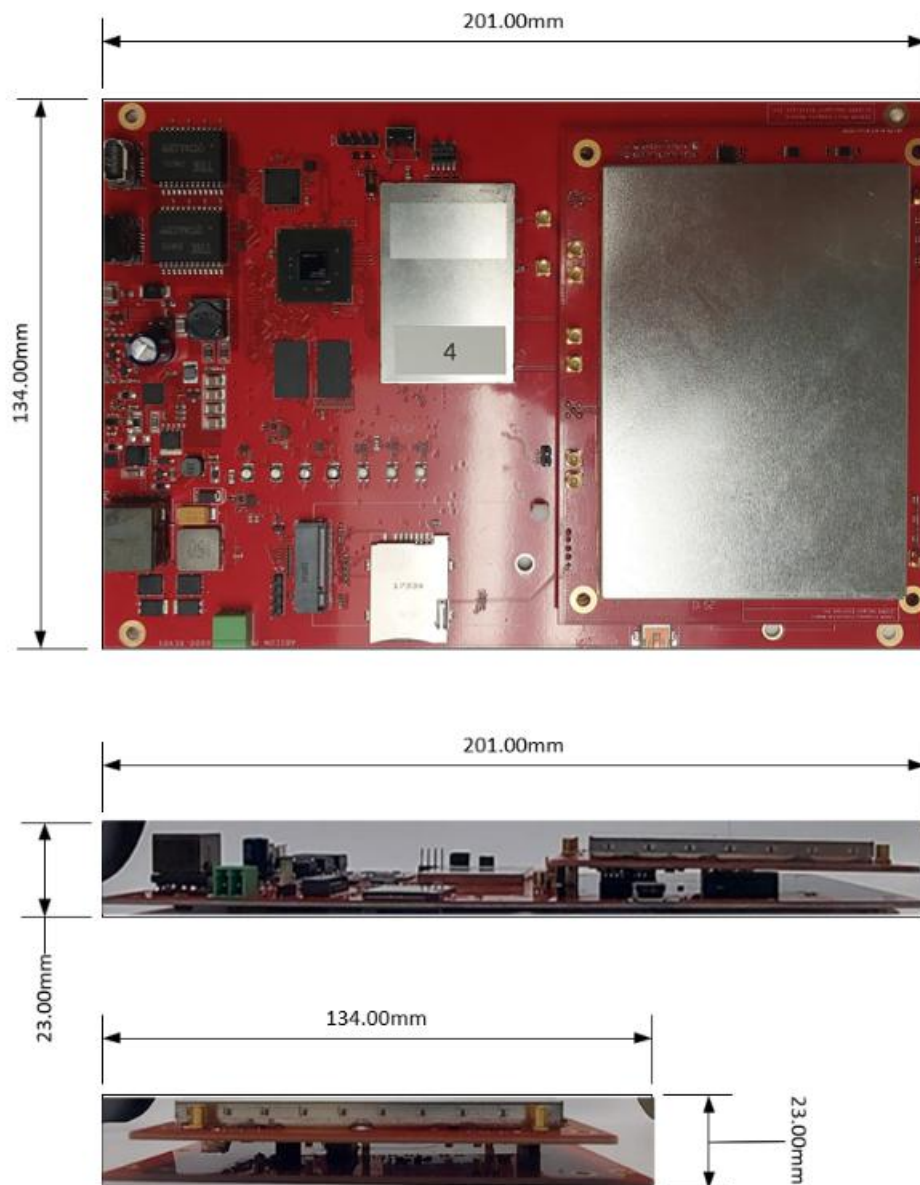
Example of mounting in enclosure:



18. Mechanical Information

Mechanical Dimensions

201 L x 134 W x 23 H mm



19. Radio, Network/OAM, Electrical Specifications

RADIO	Deployment	Line-of-Sight LOS, NLOS
	Topology	PMP Sector Controller + Subscriber Stations (1+128) PTP Master + Client (1+1) Product Order Code Specific Unit
	Antennas	Directional: Dual-pol V/H or Slant-45 or 2xSingle-pol Omni-Directional: Dual-pol or 2xSingle-pol
	Frequencies	470MHz - 602MHz (US & Canada) 470MHz - 698MHz (ATSC Countries) 470MHz - 694MHz (UK, EU, Africa, DVB-T Countries)
	Channel Size	6, 12, 18, 24MHz (US, Canada & ATSC Countries) 8, 16, 24MHz (UK, EU, Africa, DVB-T Countries)
	Transmit Power	Up to +27dBm per Tx Chain, Total Conducted +30 dBm (regulatory limited by region)
	Receive Sensitivity	-104dBm typical @ 6MHz
	Modulation / Coding	Automatic MCS (0-11) selection from BPSK to 1024QAM
	Transmission	OFDMA, TDD, 2x2 MU-MIMO, DPD, High-rejection Tx/Rx filtering
	Throughput TCP	Up to 225 Mbps @ 24MHz Channel Size
	Wireless Link Security	128-bit AES Encryption WPA2 8-63 Character Passphrase
	Location & Timing	GNSS - GPS, QZSS, GLONASS
NETWORK	Deployment	Line-of-Sight LOS, NLOS
	Throughput UDP	Up to 225 Mbps @ 24MHz Channel Size
	Wireless Link Security	128-bit AES Encryption WPA2 8-63 Character Passphrase
OAM&P	Management Interface	In-band or Out-of-Band 2 ETH Ports SNMP v2c/v3, HTTP/HTTPS (Web), Management VLAN tagging, NETCONF, RESTCONF
	Software Upgrades	Over-the-Air OTA, Dual-bank
	Provisioning	Channel Scanning, SSID-Password, Emergent CMS
	TVWS WSDB	RFC 7545 PAWS Interface; FCC & ISED Approved
ELECTRICAL	Input Power Power Consumption	Port 1: PoE ++ 802.3af/at/bt IN Port 2: PoE+ 802.3af/at OUT 20W typ. 26W peak
	Surge & ESD Suppression All Ports Protected	Ethernet: IEC 61000-4-2 Level 4 ESD Protection +/- 15-kV Contact Discharge +/- 15-kV Air-Gap Discharge IEC 61000-4-4 EFT Protection – 80 A (5/50 ns) IEC 61000-4-5 Surge Protection – 3 A (8/20 μ s) RF: IEC 61000-4-2 Contact Discharge (typical) - 30KV IEC 61000-4-2 Air Discharge (typical) - 30 KV DC Gnd

20. Troubleshooting Module Level

Scenario 1: No Power LED

- **Possible Causes:**
 - No PoE detected from PSE.
 - Incorrect 12 VDC wiring or insufficient supply.
- **Actions:**
 - Verify PoE injector/switch outputs correct voltage (44–57 VDC).
 - Measure DC input with multimeter (should be $12.0 \pm 5\%$ VDC).
 - Replace power source or cable if faulty.

Scenario 2: Stuck on Red or Amber LED

- **Possible Causes:**
 - Bootloader issue or corrupted firmware.
- **Actions:**
 - Power-cycle module.
 - Access **serial console** for bootloader logs.
 - Reflash firmware using recovery procedure.

Scenario 3: LAN LED Off

- **Possible Causes:**
 - Ethernet cable unplugged or faulty.
 - Switch port down or VLAN misconfiguration.
- **Actions:**
 - Test cable (Cat5e/6).
 - Confirm switch port enabled and correct VLAN tagging.

Scenario 4: RF LED Off or Blinking (No Link)

- **Possible Causes:**
 - Misconfigured RF channel or WSDB query failed.
 - Remote base station unavailable or out of range.
- **Actions:**
 - Verify geolocation and TVWS database connection.
 - Confirm base station operational and correct frequency.
 - Check antenna alignment and cabling.

Scenario 5: FAULT LED On (Red)

- **Possible Causes:**
 - Overcurrent, thermal shutdown, or software fault.
- **Actions:**
 - Inspect module temperature and airflow.
 - Review system logs (System > Logs).
 - Perform firmware reload or factory reset if needed.

Recovery Methods

- **Soft Reboot:** Via WebUI/CLI.
- **Factory Reset:** Press reset button (hold 10 seconds) until PWR LED blinks red.
- **Firmware Recovery:** Firehose + TFTP image load.

21. Warranty

All equipment purchased from Emergent Solutions is guaranteed for a period of one year (12 months) from the date of shipment.

OEM partners should contact Emergent for any type of failure.

Before shipping the defective device, the OEM partner must obtain a Return Material Authorization (RMA) number from Emergent.

22. Appendix A – Acronyms

Abbreviation	Description
(U)SIM	(Universal) Subscriber Identity Module
2T2R	Two Transmit Two Receive
AP	Access Point
BLE	Bluetooth Low Energy
BPSK	Binary Phase Shift Keying
BR	Basic Rate
EBR	Emergent Bridge Rugged
EDR	Enhanced Data Rate
eSCO	Extended Synchronous Connection-Oriented
ESD	Electrostatic Discharge
EVB	Evaluation Board
EVM	Error Vector Magnitude
FTM	Frequency Translation Module
GFSK	Gauss Frequency Shift Keying
GND	Ground
GNSS	Global Navigation Satellite System
GPIO	General-Purpose Input/Output
GPS	Global Positioning System
HCI	Host Controller Interface
HCM	Host Compute Module
HE	High Efficiency
HT	High Throughput
I/O	Input/Output
IEEE	Institute of Electrical and Electronics Engineers
LCC	Leadless Chip Carrier (package)
LSB	Least Significant Bit
Mbps	Million Bits Per Second
MCS	Modulation and Coding Scheme
MIMO	Multiple Input Multiple Output
MSB	Most Significant Bit
NM	Not Mounted
PCB	Printed Circuit Board
PCBA	Printed Circuit Board Assembly
PCM	Pulse Code Modulation
PMP	Point-to-Multipoint
PTP	Point-to-Point
QAM	Quadrature Amplitude Modulation
QPSK	Quadrature Phase Shift Keying
RF	Radio Frequency
RoHS	Restriction of Hazardous Substances
RTS	Request to Send
Rx	Receive
SCO	Synchronous Connection-Oriented
SCU	Sector-controller Unit

SDIO	Secure Digital Input/Output
SDR	Single Data Rate
SMD	Surface Mount Device
SMT	Surface Mount Technology
SSU	Subscriber-station Unit
STA	Station
TBD	To Be Determined
TVBD	TV Band Device
TVS	Transient Voltage Suppressor
Tx	Transmit
UART	Universal Asynchronous Receiver/Transmitter
VAC	Voltage Alternating Current
VDC	Voltage Direct Current
VHT	Very High Throughput
VIH	High-level Input Voltage
VIL	Low-level Input Voltage
Vmax	Maximum Voltage
Vmin	Minimum Voltage
Vnom	Nominal Voltage
VOH	High-level Output Voltage
VOL	Low-level Output Voltage
VSWR	Voltage Standing Wave Ratio
WPA	Wi-Fi Protected Access