Instruction for FCC/IC compliant use

Stream1955
Network Audio Streaming Module

Version: 2.1

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Date: 02 Aug. 21

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1. Document History

No.	Primary Author(s)	Description of Version	Date Completed
1.0	C. Apel	Initial version	2019-11-14
1.1	C. Apel	Update conditions for referring to modular certification	2020-01-10
2.0	C. Arnardi	Initial version AP6275S	2021-05-14
2.1	C. Apel	Changed FCC/IC IDs for AP6275S, updated antenna list	2021-06-14
2.2	C.Arnardi	Adding antenna configuration example and new specifications Adding applicable FCC/IC rule list	2021-06-30

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Copyright Notice

Document Version Management Notice

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2. Granted certificates

FCC *47 CFR Part 15*	
FCC Part 15.247	DTS WIFI 2.4 GHz 802.11 b/g/n/ax
FCC Part 15.407	UNII WIFI 5GHz 802.11 a/n/ac/ax
FCC Part 15.247	DSS Bluetooth 4.2/ BLE

IC	
RSS-247	802.11 a/c/g/n/ac/ax
	Bluetooth 4.2 / Bluetooth Low-energy

ETSI	
EN 301 893 V2.1.1	WIFI 5 GHz 802.11 a/n/ac/ax
EN 300 440 V2.1.1	
	WIFI 2.4 GHz 802.11 b/g/n/ax
EN 300 328 V2.2.2	Bluetooth 4.2 / Bluetooth Low-energy

Additional Testing, Part 15 Subpart B Disclaimer :

The module is only FCC authorized for the specific rule parts listed on the grant. The host product manufacturer is responsible for compliance to any other FCC rules that apply to the host not covered by the modular transmitter grant of certification. The final host product still requires Part 15 Subpart B compliance testing with the modular transmitter installed.

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3. Conditions for re-use of modular certification

To make use of modular certification, product level MUST comply with ALL rules mentioned below. If these conditions cannot be met, then the FCC authorization is no longer considered to be valid and StreamUnlimited's FCC ID may not be used on the final product. In these circumstances the host integrator is responsible for evaluating the final product and obtaining a separate FCC authorization.

1. ONLY antennas listed under section 4 are used.
   Equivalent antennas of same type and of equal or lower gain and similar in-band and out-of-band characteristics can be included in the modular certification.
   Costs for compliance testing and formal approval process will need to be covered.
2. Antennas must be oriented **orthogonally to each other and spaced at a minimum distance of 18 cm** [see "Antenna testing configuration" for detailed arrangement].
3. The antenna(s) used for this transmitter must not transmit simultaneously with any other antenna or transmitter, except in accordance with FCC multi-transmitter product procedures.
4. All equipment shall be considered to operate in a "general population/uncontrolled" environment.
5. In order to comply with SAR requirements, host integrator must ensure that the final device is for mobile use and that the antennas are at least 20 cm from the end user.
6. The WiFi output power configurations which are stored in "NVRAM file" must remain unchanged.
7. Regulatory domain is set to world-wide or set to "US".
8. Regulatory domain configuration is not accessible for end-user (StreamSDK Software does not allow such access).
9. The Bluetooth output power which is hard-coded in firmware to 6dB remains unchanged.
10. Product labelling requirements are met (see section 3.1).
11. Instructions for use requirements are met (see section 3.2).
12. The product is secured against tampering with the software via local access or by changing the software update image.

Additional notes:

Ad 3):
The integrator should check for emissions that may occur due to the intermixing of emissions with the other transmitters, digital circuitry, or due to physical properties of the host product (enclosure). This investigation is especially important when integrating multiple modular transmitters where the certification is based on testing each of them in a stand-alone configuration. It is important to note that host product manufacturers should not assume that because the modular transmitter is certified that they do not have any responsibility for final product compliance.

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Additional Testing, Part 15 Subpart B Disclaimer :

The module is only FCC authorized for the specific rule parts listed on the grant, and that the host product manufacturer is responsible for compliance to any other FCC rules that apply to the host not covered by the modular transmitter grant of certification. The final host product still requires Part 15 Subpart B compliance testing with the modular transmitter installed.

Please refer to the following document for test modes :

- Stream1955 Certification Guidelines_V01_8

Can be obtained by contacting your contact at StreamUnlimited

See SAR GUIDANCE FOR IEEE 802.11 (Wi-Fi) TRANSMITTERS
https://apps.fcc.gov/kdb/GetAttachment.html?id=ARcyvK1h4uoKj8FLtKtPkQ%3D%3D&desc=248227%20D01%20802%2011%20Wi-Fi%20SAR%20v02r02&tracking_number=28238

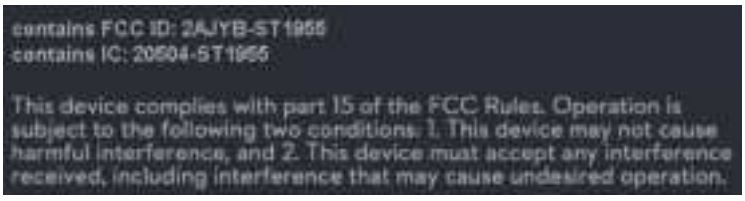
Ad 6):
StreamUnlimited provide NVRAM files for “CE” and for “FCC” configurations. Region is selected during end-product configuration prior to product encasing. In the same step, also the country which the product is intended for should be configured.
In the case that no region is configured, the NVRAM for “CE” will be selected as default and “worldwide” will be selected as country. This will result in the most restricted configuration.
Note that those configurations must not be exposed to the end user. When used with StreamSDK Software stack, this requirement is met.

Ad 12):
A secure update mechanism is used by StreamUnlimited to prevent modification of the update image. Tools for locking the SoC after product-level testing are provided. This prevents local access to the software. If not using software of StreamUnlimited, a similar approach must be taken to prevent tampering with the system either via direct access of by modification of the update software image.

3.1 Product labelling requirements

If the FCC identification number of the module is not visible when the module is installed inside another device, then the outside of the device into which the module is installed must also display a label referring to the enclosed module.
Product label must contain following text:
“contains FCC ID: 2AJYB-ST1955”
“contains IC: 20504-ST1955”

See below example for reference



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3.2 Instruction for use requirements

To comply with the FCC and ISED rules the OEM/host integrator shall include the following statements on the device, packaging and in the user manual, as applicable.

3.2.1 USA :

The device shall bear the following statement in a conspicuous location on the device.

When the device is so small or for such use that it is impracticable to label it with the statement in a font that is four-point or larger, and the device does not have a display that can show electronic labeling, then the information required by this paragraph shall be placed in the user manual and must also either be placed on the device packaging or on a removable label attached to the device.

Where a device is constructed in two or more sections connected by wires and marketed together, the statement is required to be affixed only to the main control unit.

Declaration of Conformity
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.
This product does not contain any user serviceable components. Any unauthorized product changes or modifications will invalidate warranty and all applicable regulatory certifications and approvals, including authority to operate this device.

The user manual shall contain the following statements.

Warning
This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation.

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.

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However, there is no guarantee that interference will not occur in a particular installation. 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:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio /TV technician for help.

Caution:
Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.
Operations in the 5.15 – 5.25GHz band are restricted to indoor usage only.

RF Exposure Requirements

Radiofrequency radiation exposure Information:
This equipment complies with radiation exposure limits prescribed for an uncontrolled environment for fixed and mobile use conditions.This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter except as authorized in the certification of the product.
To comply with FCC requirements, a minimum separation distance of **20cm** (8 inches) is required between the equipment and the body of the user or nearby persons.

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3.2.2 Canada:

User manuals shall contain the following text, or an equivalent notice, that shall be displayed in a conspicuous location, either in the user manual or on the device, or both.
The statements must be included in both English and French.

This Class B digital apparatus complies with Canadian ICES-003 and RSS-247.
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.
The installer of this radio equipment must ensure that the product is located such that it does not emit RF field in excess of Health Canada limits for the general population: consult Safety Code 6, obtainable from Health Canada´s We site www.hc-sc.gc.ca/rpb.
As mentioned before, the installer cannot control the antenna orientation. However, they could place the complete product in a way that causes the problem mentioned above.
The device for operation in the band 5150-5250 MHz is only for indoor use to reduce the potential for harmful interference to co-channel mobile satellite systems.
Be advices that high-power radars are allocated as primary users (i.e. priority users) of the bands 5250-5350MHz and 5650-5850MHz and that these radars could cause interference and/or damage to LE-LAN devices.
Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Cet appareil numérique de classe B est conforme aux normes NMB-003 et CNR-247 en vigueur au Canada.
Son fonctionnement est soumis aux deux conditions suivantes : (1) Cet appareil ne doit pas créer d'interférences nuisibles. (2) Cet appareil doit tolérer toutes les interférences reçues, y compris les interférences pouvant entraîner un fonctionnement indésirable. L'installateur du présent matériel radio doit veiller à ce que le produit soit placé ou orienté de manière à n'émettre aucun champ radioélectrique supérieur aux limites fixées pour le grand public par le ministère fédéral Santé Canada ; consultez le Code de sécurité 6 sur le site Web de Santé Canada à l'adresse : www.hc-sc.gc.ca/rpb. Comme indiqué auparavant, l'installateur ne peut pas contrôler l'orientation de l'antenne. Il peut néanmoins placer le produit tout entier de manière à provoquer le problème décrit ci-dessus.

Les dispositifs fonctionnant dans la bande 5150-5250 MHz sont réservés uniquement pour une utilisation à l'intérieur afin de réduire les risques de brouillage préjudiciable aux systèmes de satellites mobiles utilisant les mêmes canaux. Les utilisateurs de radars de haute puissance sont désignés utilisateurs principaux (c.-à-d., qu'ils ont la priorité) pour les bandes 5250-5350 MHz et 5650-5850 MHz et que ces radars pourraient causer du brouillage et/ou des dommages aux dispositifs LAN-EL.

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4. Antenna type and connections

Stream1955 provides two antenna ports via microwave coaxial connectors.
Antennas with 50 Ohm characteristic impedance must be connected to each microwave coaxial connector via a coaxial RF cable.
No external amplifier or tuning circuitry must be used.
Stream1955 was certified for FCC and IC compliance using following antennas only:

Manufacturer and Part Number:	**Molex 1461530XXX (recommended)**	
Type of antenna:	Flex Balanced Dipole	
Frequency band:	2400 – 2500 MHz	5150 – 5850 MHz
Peak Gain:	3 dBi	4 dBi
Average Total Efficiency:	> 75%	> 75%
Cable Length :	100mm, 150mm, 200mm, 250mm, 300mm	
Manufacturer and Part Number:	**Molex 2042810XXX**	
Type of antenna:	Flex Balanced Dipole	
Frequency band:	2400 – 2500 MHz	5150 – 5850 MHz 5925 – 7125 MHz
Peak Gain:	2 dBi	3.3 dBi 4.5dBi
Average Total Efficiency:	> 65%	> 68% > 50%
Cable Length :	100mm, 150mm, 200mm, 250mm, 300mm	
Manufacturer and Part Number:	**PulseLarsen Antennas W5098**	
Type of antenna:	External Swivel dipole	
Frequency band:	2400 – 2500 MHz	5150 – 7125 MHz
Peak Gain:	3.5 dBi	3.8 dBi
Average Total Efficiency:	> 75%	> 71%
Manufacturer and Part Number:	**2J-Antennas 2JMAS05c**	
Type of antenna:	Rigid Balanced Dipole	
Frequency band:	2400 – 2500 MHz	5100 – 5900 MHz
Peak Gain:	3 dBi	
Cable Length:	150mm	

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Manufacturer and Part Number:	**Tekfun F04A-SR-V2**	
Type of antenna:	External Swivel dipole	
Frequency band:	2400 – 2500 MHz	5150 – 7125 MHz
Peak Gain:	2.5 dBi	2.9dBi
Average Total Efficiency:	> 72%	> 53%
Manufacturer and Part Number:	**Tekfun F50**	
Type of antenna:	External Swivel dipole	
Frequency band:	2400 – 2500 MHz	5150 – 7125 MHz
Peak Gain:	2.73 dBi	3.89dBi
Average Total Efficiency:	> 62%	> 62%

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4.1 Antenna's valid configurations

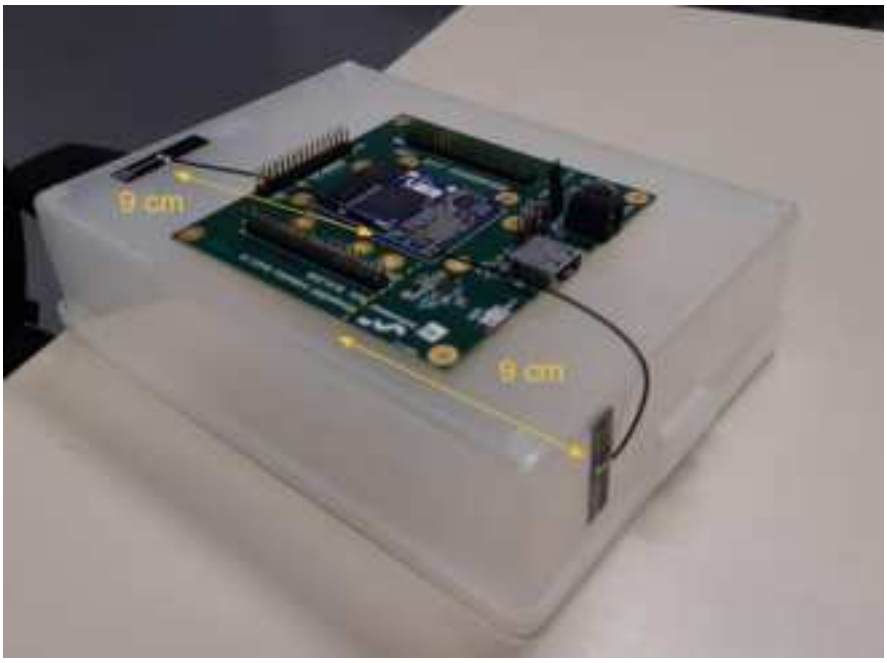

Figure 1 Flex Balanced Dipole

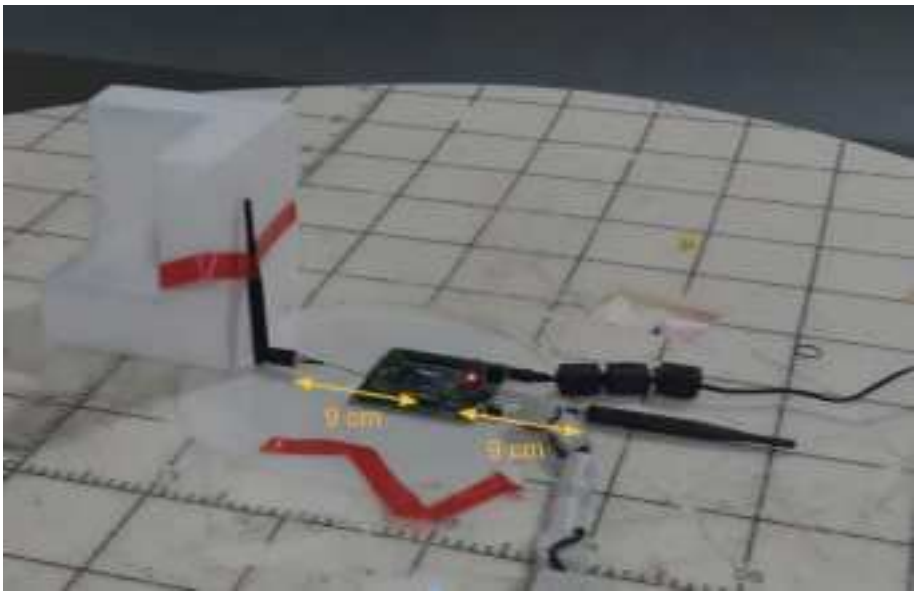

Figure 2 External Swivel Dipole

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5. EMC application notes

Stream1955 is optimized for low radiation.
Consider following recommendations when designing application boards:

- Use a GND plane underneath the module.
- Use series resistors in all low-speed interface lines, values need to be chosen depending on signal frequency and length of signal lines on application board.
- Use common mode signal filters in USB data lines, e.g. Wuerth 744232161.
- Prevent using vias in high-speed interface lines such as MIPI, USB and Ethernet
- Route high speed interface lines differentially and leave several mm gaps to other signal lines when possible
- Make sure any interface which is not needed for your application is disabled in software.

Other application hints

- Decouple the module supply from functional blocks, which are sensitive to supply ripple. The WLAN subsystem will draw up to 1200mA (Peak) while transmitting at high data rate but switch to low power mode rapidly whenever idle. A large low-ESR capacitor (100uF) is recommended to be placed close to the module with a ferrite bead or inductor towards sensitive circuitry such as audio ADCs or DACs. Using 3x47µF ceramic capacitors in parallel will reduce disturbance currents further.
- Use of an external 5V AC/DC adapter is not recommended, since current peaks of WLAN subsystem would cause high voltage drops across the D.C. cable and connector which may cause malfunction of USB ports. It is recommended to use a 12V AC/DC adapter and local 5V DC/DC converter or internal SMPS.

Antennas considerations:

- When using adhesive antennas, they must not be mounted directly onto conductive material such as metallic parts. Advised surface for best performance is plastic PC/ABS with a minimum thickness of 1.5mm.
- Put antennas as far as possible from other radiating elements such as power supplies or transmitters.
- In case a large metal object (speakers, heatsink, printed circuit board...) inside the product blocks the radiation from/to one antenna in one direction, the second antenna must be placed at the other side of that object to cover 360° around the product.
- Increasing distance between the antennas will improve WiFi/Bluetooth coexistence since Bluetooth antenna may receive a signal while WiFi antenna is transmitting. An isolation of 25dB is recommended.
- Keep antenna cables as short as possible while meeting above requirements since longer antenna cables will attenuate RF signals.
- Note that antennas and antenna cables carry RF energy which can influence analog circuitry such as Audio input and output stages and infra-red receivers.

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