BTIR3

The NGTC-BTIR3 is a universal Bluetooth® AES67 enabled audio interface for the Genesis Technologies™ audio distribution solution.

It features an API for navigation, configuration and management.

The NGTC-BTIR2 is a Bluetooth 5.0 to AES67 audio gateway that can be used in sink or source mode. It supports all current audio codes and it is compatible with all the different Bluetooth sources and sinks. It has 2x2 AES67 channels with an interface for audio processing by the NGTC digital signal processor.

It can be easily interfaced with 3rd party control systems via the API on the communication control network port.

It is powered by POE on the AES67 port. Its own web UI is used to configure the AES67 interface. The additional LAN port is only used for control and can be configured by web UI.

Installation

The NGTC-BTI Bluetooth interface is working in the 2.4Ghz band. It is essential to mount it as “free” are possible in the space to not reduce reception. Any metal shielding should be avoided!

The BTI should be mounted on a flat surface with it’s two mounting brackets

1. AES67 network interface (POE)
2. Control network interface
3. Blutooth Area, keep clear!
4. Mounting Bracket Positions

Note

All connections to the NGTC-BTI should be made before power is applied

• Attach the LAN network port to the control network switch, using an UTP CAT-5 cable
• Attach the AES67 network port to the AES67/Dante POE network switch, using an UTP CAT-5 cable.

Configuration

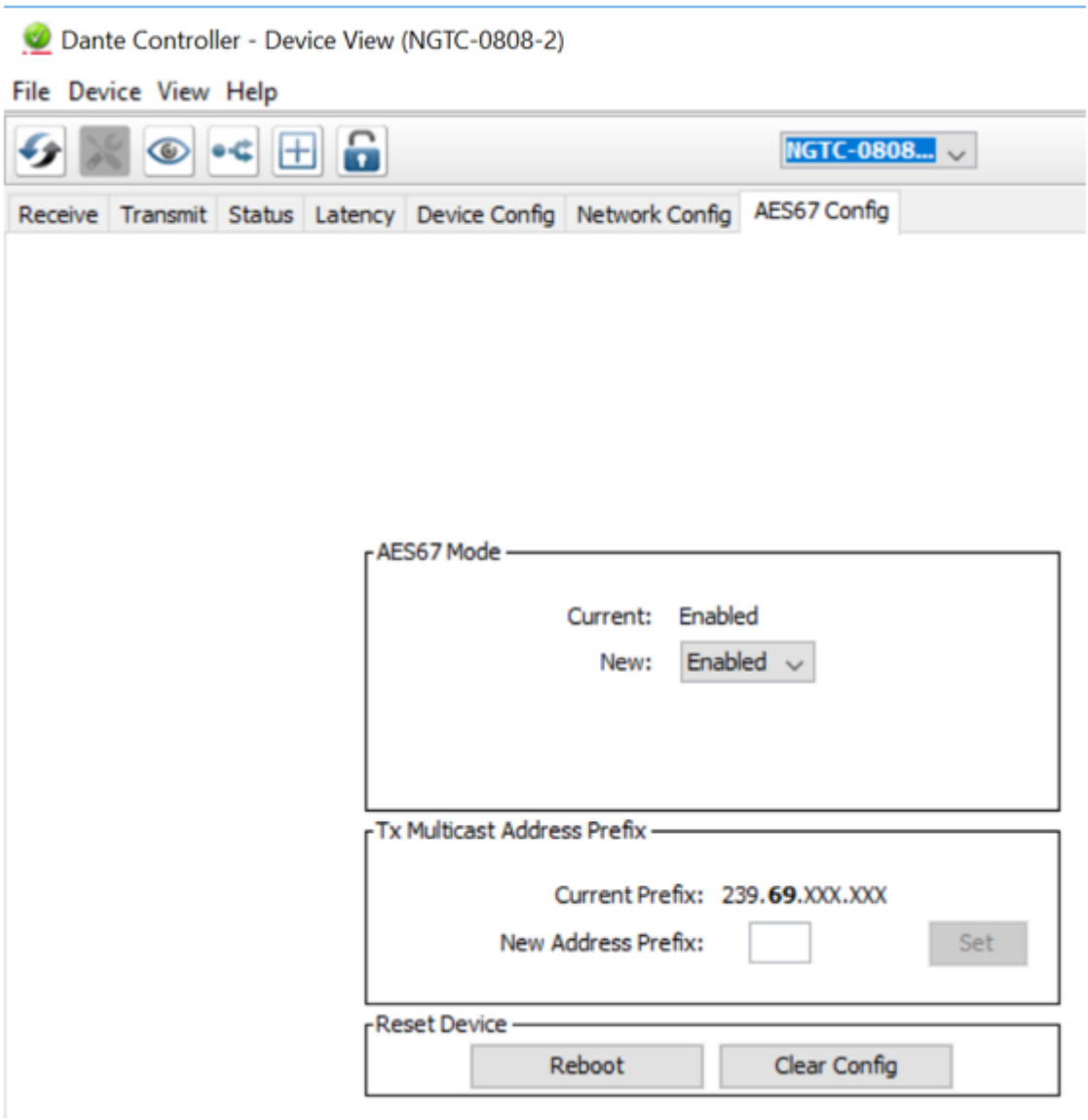
Setup interoperability between BTI and Dante devices

Caution
AES67 interoperability settings are required for every Dante device that should receive a AES67 stream

To enable your Dante devices to receive an AES67 stream, AES67 interoperability must be enabled. This is done by using Audinate's Dante Controller, which can be obtained from the Audinate website or any other manufacturer specific software tool.

In Dante controller all your Dante devices that are connected to the network will show up automatically.

1. Start the Dante Controller Software and wait for it to be synchronized with the network
2. Select the "device info" tab in the software
3. Double click on the DSP you would like to configure for AES67, a new window will open
4. Select the "AES67 config" tab
5. Enable AES67 mode and make a note of the Tx multicast prefix. You will need this number later, even if you are not using the DSP as a transmitter. This must be the same for all DSP's that are ready for AES67.
6. Reboot the Dante device
7. This needs to be done with every Dante device that will receive an AES67 stream



Control Network Setup

Control Network Address Setup

The setup of the control network of the BTI will be done via it's Web UI. It is self-explaining

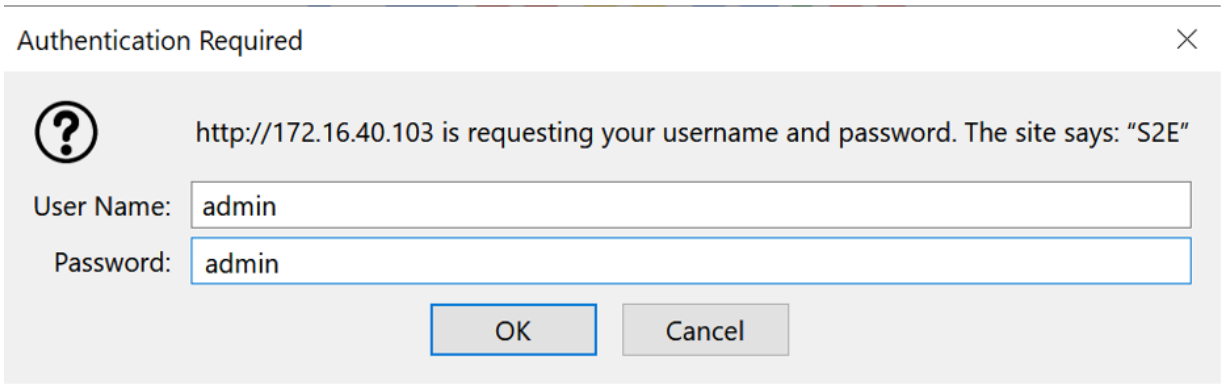
Info
By default the interface is set to DHCP

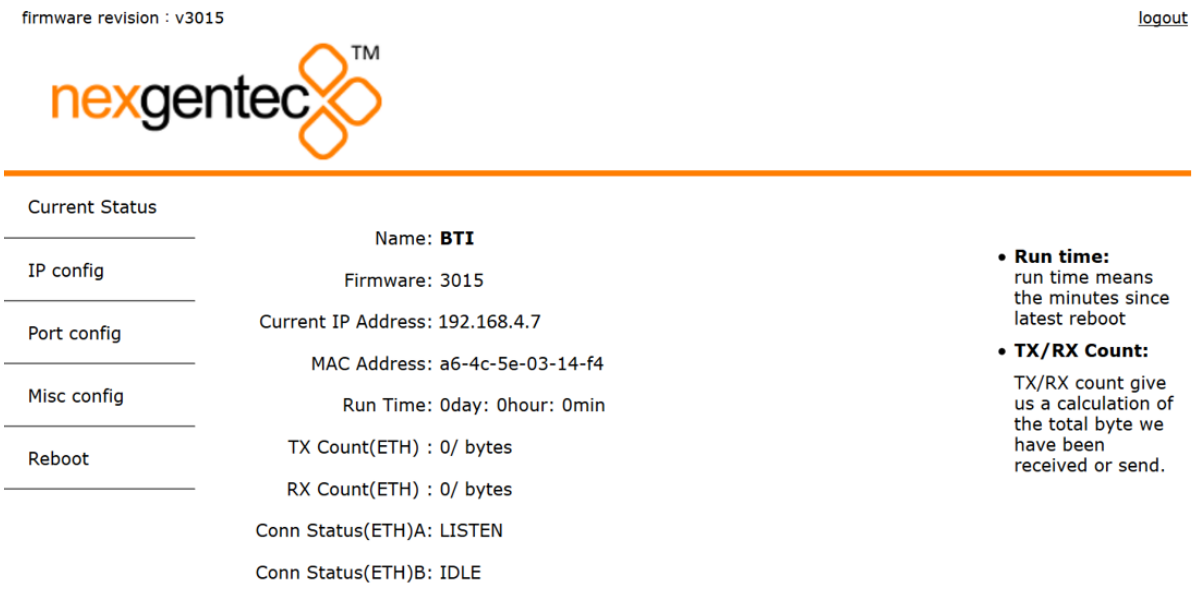
Please make sure your computer network address is in the same network range to access the setup pages

Info

Default web UI username and password

admin





Refer to the MAC address if multiple MCP's are in the network to identify the right unit. The MAC address is also printed on each units bottom cover as QR Code.

Info

To reset the control network address use the USR IOT tool

The tool does allow you to search and reset the network settings

USR Tool

- USR-TCP232-M4K3 Setup Software V2.3.3.97.exe (1 MB)

AES67 Network Setup

To configure the AES67 download latest generation Audio Grid Controller Software. Your PC needs to be connected to the AES67 network and have its addressing set in the same IP range.

AudioGridController

- AudioGridController_V4.0.6.exe (2 MB)

AES67 Network Address Setup

Start the software and go to the “Device Config” tab

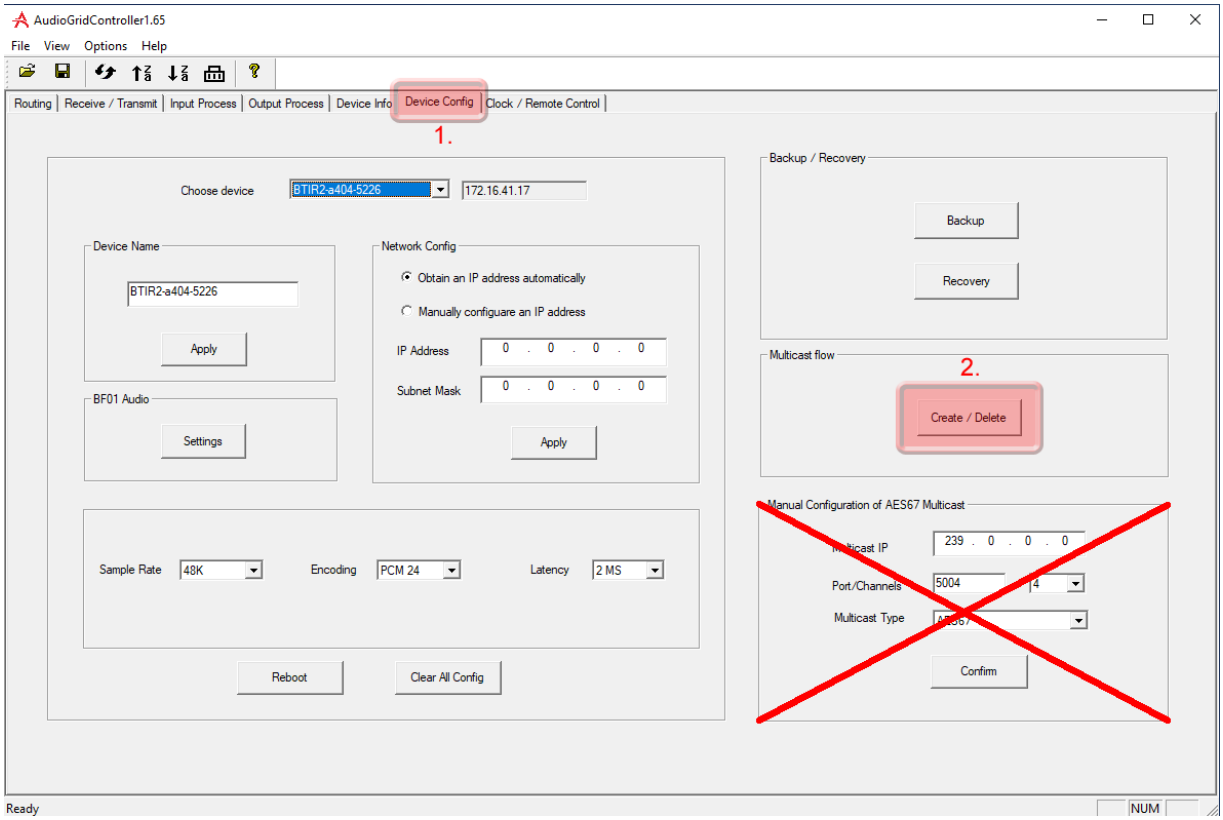
1. Select the device to be configured
2. Enter “IP Address” and “Subnet Mask”
3. Hit “Apply”

AES67 Stream Address Setup

Caution
The AES67 stream of each device needs to be configured to be received by the Dante/AES67 devices

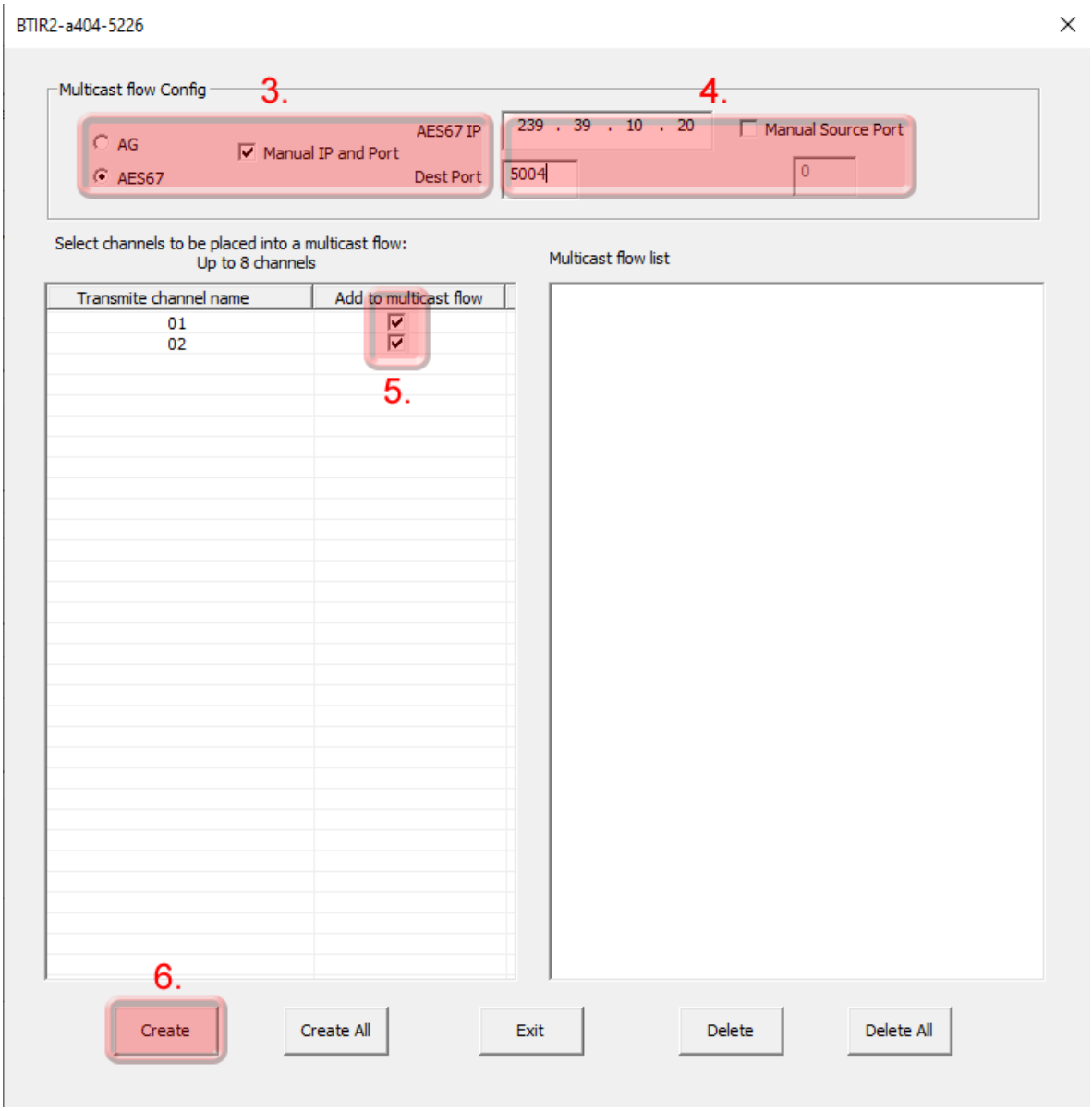
Start the software and go to the “Device Config” tab

1. Select the device to be configured
2. Select “Create / Delete” in the “Multicst flow” selection



3. In the Multicast flow config, click on “AG” first and then on “AES67”. Next, select the “Manual IP and Port” option.

4. You can set your desired multicast IP. Typically in combination with Dante Audio products, the multicast IP starts with “239.69.”, port 5004.
5. Select the channels that should be multicast.
6. Click on “Create”.



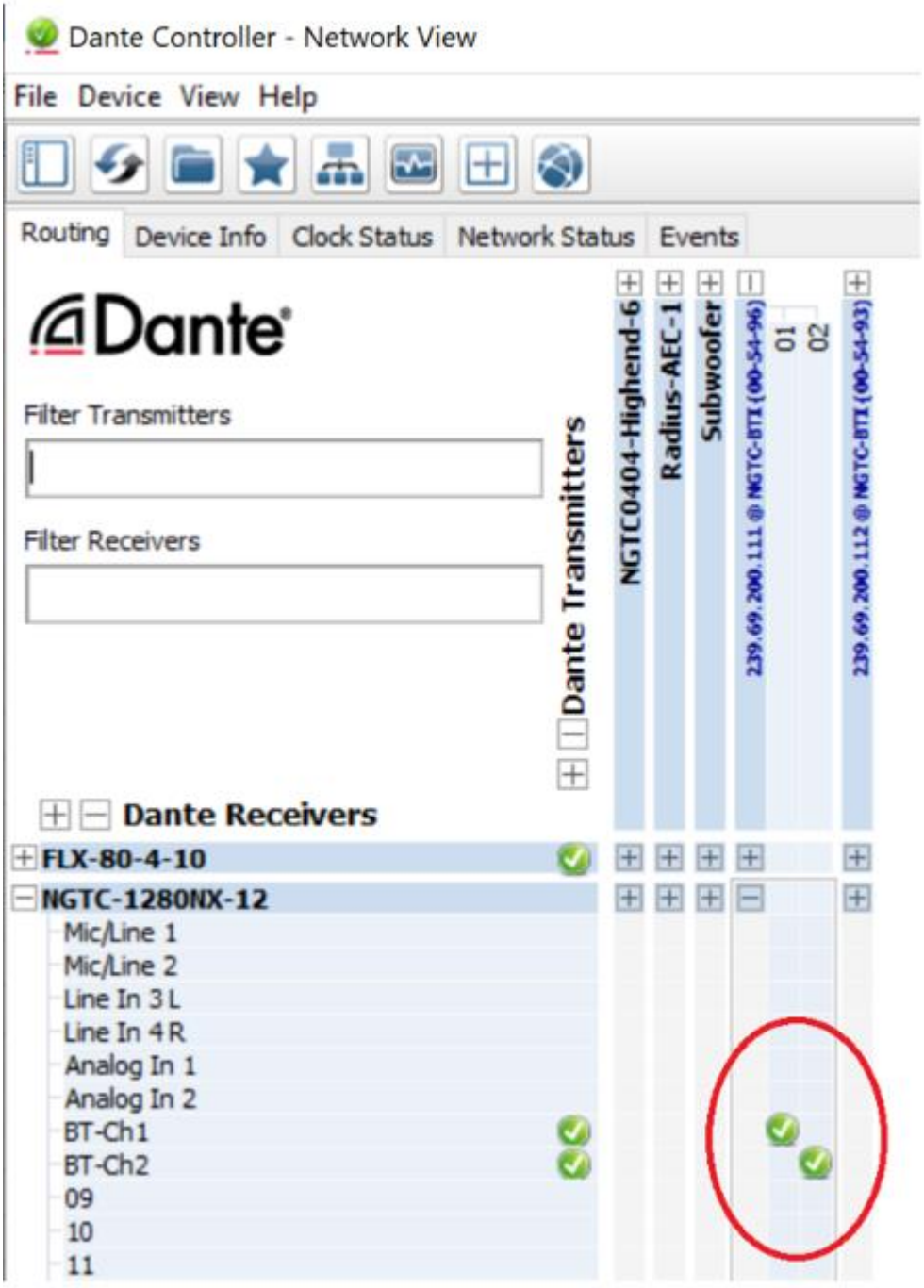
Audio Routing using Audinate’s Dante Controller

Natively the audio routing can be done by using Audinate’s Dante Controller in case if its not auto configured by the DSP’s management software. In Dante Controller all your Dante and AES67 devices that are connected to the network will show up automatically.

The BTI will be shown at the ‘‘Dante Transmitters’’ part, using its multicast address@hostname-HH-HH-HH where ‘‘HH-HH-HH’’ are the last three bytes of the devices MAC address.

Channel assignment

- Make the audio connections in the Dante controller



Control API

This section describes the communication protocol between the control system and the BTI

The BTI Configurator does use the same protocol, see its debug window for more information

Caution

Please use >80ms between each command sent

Connection	TCP (NGTC-BTI is server), Port 20108
Command Format	AT+ Command {=Param1{, Param2{, Param3…}}}<CR><LF>
Reply Format	<CR><LF>+reply {=Param1{, Param2{, Param3…}}} <CR><LF>

<CR> stands for “carriage return”, corresponding hex is 0x0D
<LF> stands for “line feed”, corresponding hex is 0x0A

Notice

Command Format Details

All commands start with “AT”, end with <CR><LF>
If a command has a parameter, the parameter is behind the “=”
If a command has multiple parameters, the parameters must be separated by “,”

Notice

Reply Format Details

All replies start with <CR><LF> and end with <CR><LF>
If a reply has a parameter, the parameter is behind the “=”
If a reply has multiple parameters, the parameters must be separated by “,”
The interface will always report the execution result using “OK” for success or “ERROR” for failure

Examples

Read BTI’s Bluetooth name

Communication	**Command**	**Parameter**	**Example**
Request	AT+NAME<CR><LF>		AT+NAME<CR><LF>
Reply #1	<CR><LF>+NAME=NGTC-BTI<CR><LF>		
Reply #2	<CR><LF>OK<CR><LF>		

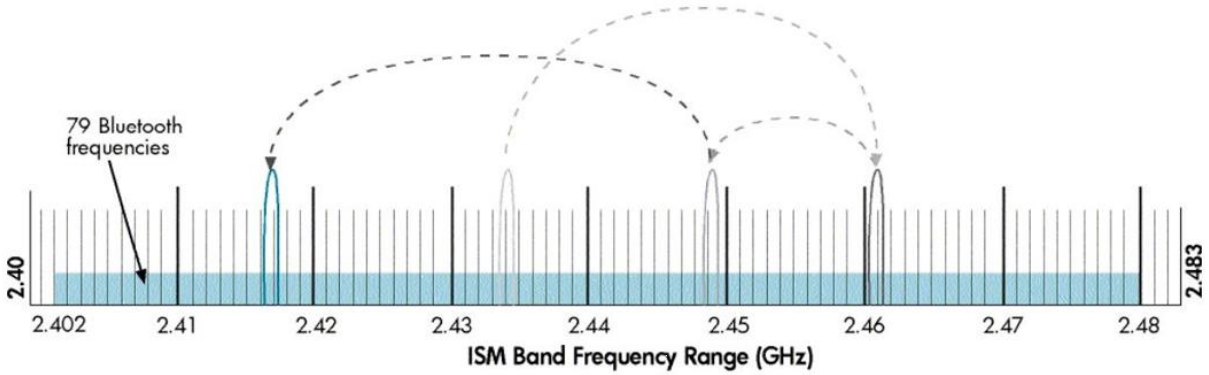
Set BTI’s Bluetooth name

Communication	Command	Parameter	Example
Request	AT+NAME=Parameter<CR><LF>		
		NGTC-BTI	
			AT+NAME=NGTC-BTI<CR><LF>
Reply	<CR><LF>OK<CR><LF>		

Bluetooth facts and figures

How does Bluetooth work

The simplest explanation for how Bluetooth works is that data/audio is continuously transferred from a paired Bluetooth transmitter to a paired receiver. Pairing is just the bonding procedure between devices so that you don’t have to enter access or security information, like passwords or passkeys, each time the devices need to establish a connection. Bluetooth operates in the frequency range of (2.402 -2.480GHz). Once a secure connection is established between a transmitter and receiver, data is split into small packets, which are then transferred at alternating frequencies. The type of Bluetooth and profiles may vary, but the core architecture remains the same. To avoid interference with other devices that may also use the ISM (industrial, science, and medical) bandwidth of 2.4Ghz, Bluetooth devices randomly hop between frequencies 1600 times per second until all the packets are transferred.



Bluetooth version and profiles

The NGTC-BTI supports Bluetooth 5.x, the most recent iteration of Bluetooth. It has twice the bandwidth of V4.x. The NGTC-BTI supports only audio related transmission, no data communication or phone/handsfree functionality.

A2DP- Advanced Audio Distribution Profile
Stereo audio transmission. This is the most important profile for Bluetooth as mono audio is not suited for listening to music.
AVRCP - Audio/Video Remote Control Profile
Adds control for media playback such as skipping tracks, play/pause, and meta data.

Which Bluetooth Codec is the best?

Codecs are encoding and decoding algorithms that compress audio into manageable data packets for faster or wireless transmission. The efficiency of the codec will determine the quality and rate at which the audio data is sent. SBC is the default sub-band coding for most Bluetooth devices. However, since this codec has a relatively high latency and may be a bit lossy, companies have developed their own encoding algorithms.

SBC – Sub-band Coding
The mandatory and default codec for all stereo Bluetooth headphones with the Advanced Audio Distribution Profile (A2DP). It is capable of bit rates up to 328 kbps with a sampling rate of 44.1kHz. It provides fairly good audio quality without requiring a lot of processing power to encode or decode. However, the audio quality can be a bit inconsistent at times. This is especially noticeable with a cheap Bluetooth transmitter.
AAC – Advanced Audio Coding
Similar to SBC, but with better sound quality. This codec is mostly popular with Apple's iTunes platform and some other non-wireless applications. However, it's not very common, especially for headphones.
aptX - A proprietary and optional codec designed by CSR
It's ideal for demanding audio applications since it encodes audio more efficiently and at a slightly higher rate than SBC. There are also two additional variations, aptX Low Latency and aptX HD, that either drastically reduces the latency of the connection or significantly improves its audio quality. However, it's a bit limiting, as both the Bluetooth transmitter and receiver must have aptX or its variations for the codec to work.

Latency

Codecs have a bigger impact on latency than on sound quality for most listeners. The default SBC connection typically has more than 100ms of latency, which is noticeable when listening to music but may be severe enough to ruin your movie experience. To fix some of the sync issues caused by latency, CSR developed the aptX and subsequently the aptX Low Latency codec. Regular aptX does somewhat improve latency due to its more efficient encoding algorithm than SBC. However, aptX-LL has the most noticeable impact on latency.

Codec	Latency
SBC	173ms
aptX	166ms
aptx LL	34ms

Conclusion

Codecs are the algorithms that compress data for easier and faster transmission. Better encoding and decoding algorithms mean less lossy transmission which can help with audio quality. We have noticed that codecs have a bigger impact on latency than on audio quality. The subtle changes in audio quality due to a codec like aptX are negligible when compared to the reduced latency aptX Low Latency connection. However, since both Bluetooth devices (source/sink) have to support the codec for it to work, you will most often rely on the default sub-band coding (SBC), as there are not many Bluetooth devices that support aptX and even less for aptX-LL.

Firmware

Known Firmware issues

- V4.0.3: AT+PLIST command is faulty, No Audio in Master/Source mode
- V4.04: AT+PLIST command is faulty
- V4.05: Module does turn off after 10min if no source connected

Audio Card

Audio Card Firmware Update

The latest generation of BTIR2 features an AES67 daughter board that fully supports AES67, ensuring compatibility with Dante™. Additionally, these devices have mDNS discovery enabled, allowing them to be detected in the Dante Controller, similar to a Dante product.

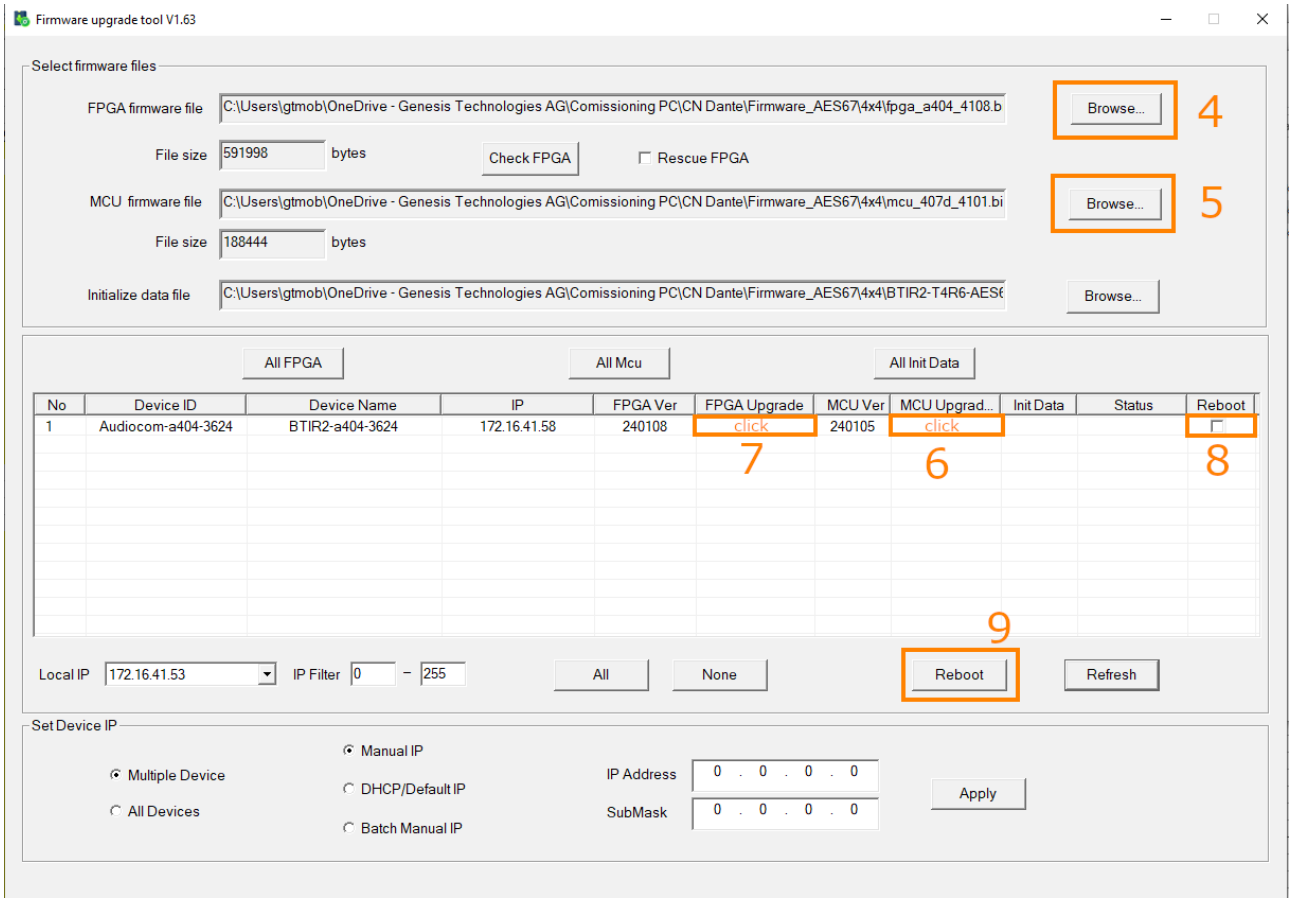
However, starting with Dante Controller V12, a pop-up message may appear indicating that unlicensed Dante™ products are being used. To address this, the new firmware will disable Dante™ discovery, and all R2 units will be recognized as AES67 devices.

Update to the Latest AES67 only Firmware Release

Files

- BTI-FW_4101-4108.zip (651 KB)
- Fdt_factory1.63.exe (3 MB)

1. Download the latest programmer and firmware files
2. Unzip the firmware files (BTI-FW_4101-4108.zip) into a folder.
3. Run the updater tool (Fdt_factory1.63.exe). Note that the discovery function works for up to 10 units. If you have more units, use the IP address filter for efficient navigation.
4. Open the FPGA firmware file with the updater tool (fpga_a404_4108.bit).
5. Open the MCU firmware file with the updater tool (mcu_407d_4101.bin).

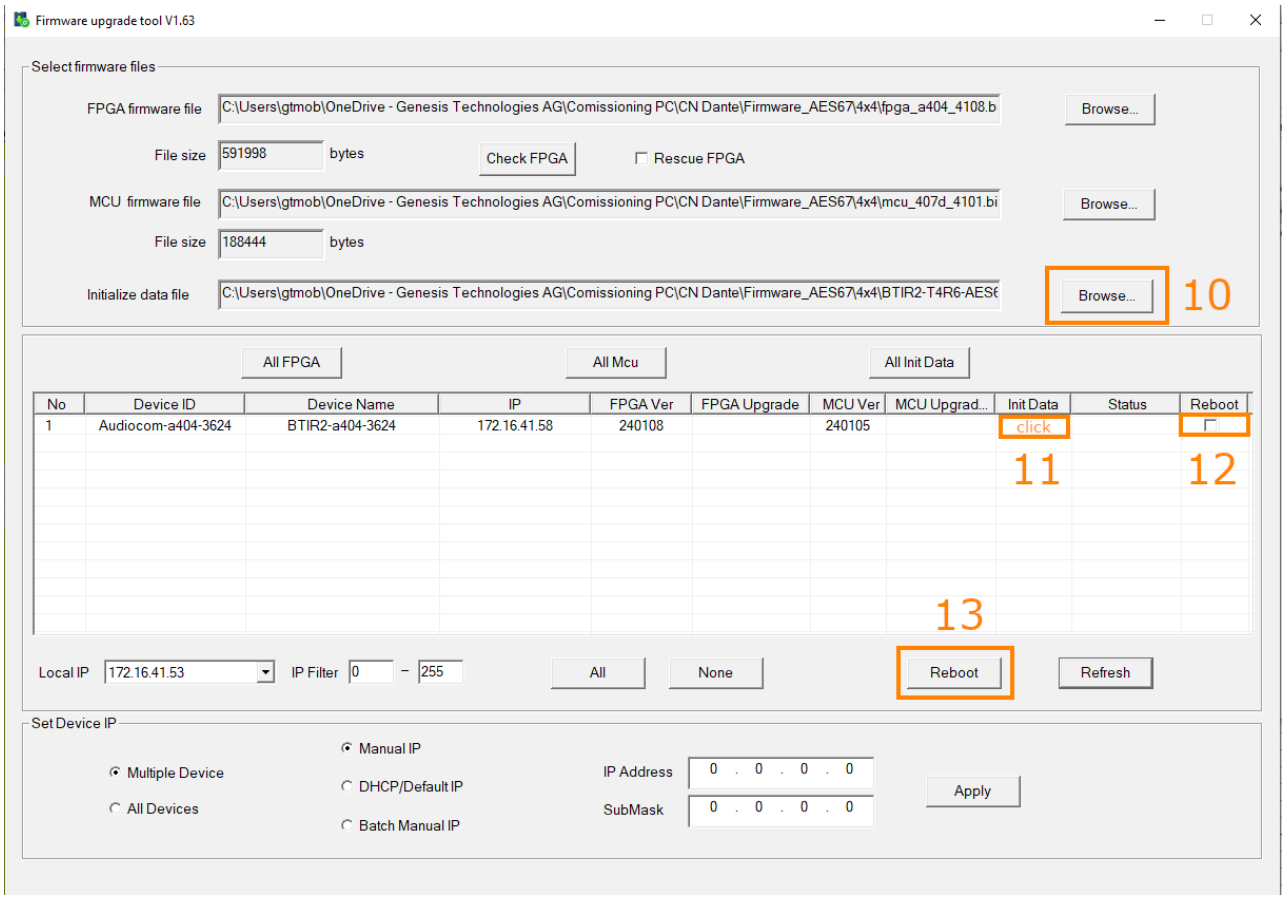


6. Update all units with the new **MCU** by clicking in the field **MCU Upgrade**.
7. Update all units with the new **FPGA** by clicking in the field **FPGA Upgrade**.
8. Select all updated units in the latest row for reboot.
9. Click “Reboot”.

Notice

After the reboot, click “Refresh” to update the device list. If the devices appear as expected, you can proceed with the update process.

10. Open the Initialize data file with the updater tool (BTIR2-T4R6-AES67.c).



11. Update all units with the new Init data fle by clicking in the field **Init Data**.
12. Select all updated units in the latest row for reboot.
13. Click “Reboot”.

Notice

After the reboot, you need to set the multicast address for AES67 to work. Use the Audio Grid Controller to do this.

Refer to the following instructions to configure it with the AudioGrid controller

Software

Configuration Software

BTI Configurator

- NGTC-BTI Setup.exe (11 MB)

Control4 Bluetooth Experience Button driver

Experience Button Driver

- nocontrol_bluetooth.c4z (133 KB)

FCC Warning Statement:

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. 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 whichthe receiver is connected.

•Consult the dealer or an experienced radio/TV technician for help.

Caution: Any changes or modifications to this device not explicitly approved by manufacturer could void your authority to operate this equipment.

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.

The device has been evaluated to meet general RF exposure requirement.

FCC Warning Statement:

IC warning statements:

-English Warning Statement:

“This device contains licence-exempt transmitter(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." The digital apparatus complies with Canadian CAN ICES-3 (B)/NMB-3(B).

-French Warning Statement:

“Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de 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.

This equipment complies with IC radiation exposure limits set forth for an uncontrolled environment and meets RSS-102 of the IC radio frequency (RF) Exposure rules. This equipment has very low levels of RF energy that are deemed to comply without testing of specifc absorption ratio (SAR).Cet équipement est conforme aux limites d’exposition aux rayonnements énoncées pour un environnement non contrôlé et respecte les règles d’exposition aux fréquences radioélectriques (RF) CNR-102 de l’IC. Cet équipement émet une énergie RF très faible qui est considérée conforme sans évaluation du débit d’absorption spécifque (DAS).