

VARIABLES REGARDING MASTER AUDIO FILES IN 2017

This is an overview of master audio file formats you'll need depending on how you plan to distribute your music, and how well you want to optimize your audio for a given format.

- **iTunes (standard), Spotify, and other online stores - 16-bit/44.1k WAV files**

From your mastering engineer, request WAV files directly from the mastering session, that have never been on an audio CD. These files will be submitted to an aggregator such as CD Baby, Tunecore, or The Orchard, to distribute your music to a variety of channels chosen by you. Be aware that if proper headroom is not present, some loud masters can clip or contain overs when converted from WAV to AAC, mp3, and other compressed formats used by most online stores. More info on this is below on page 2 and beyond.

- **Mastered For iTunes - 24-bit/96k, 88.2k, 48k, or 44.1k sample rate WAV files**

Some aggregators are now offering Mastered For iTunes versions of releases. This means you can submit 24-bit WAV files, at sample rates higher than 44.1k to the iTunes Store/Apple Music. Mastered For iTunes is not a completely separate master, it's based on your main digital master with a few adjustments to optimize for the iTunes Store/Apple Music AAC format. The master files must follow other guidelines specified by Apple that certified "Mastered For iTunes" mastering studios are aware of. **You must use an approved Mastered For iTunes mastering studio in order to be eligible for an official Mastered For iTunes release.** You may have to setup and pay for a separate Mastered For iTunes version of your release. Check with your online distributor/aggregator for specific details.

- **Bandcamp and SoundCloud - 24-bit WAV files (sample rates above 44.1k)**

Files uploaded to [Bandcamp](#) and [SoundCloud](#) can be 24-bit, and a higher sampler rate than 44.1k if available from the mastering engineer, which could make for better sound quality on the resulting compressed files such as mp3s. You can allow users to download your original higher resolution masters, or compressed mp3s of smaller size. Be aware of possible clipping and overs that can occur after conversion by these websites and services to mp3 and other compressed formats. More info on this below.

- **Compact Disc - DDP image or audio CD-R master**

A DDP image is the best, quickest, and easiest to work with from a mastering engineer's standpoint. A DDP master can be easily sent via Internet, but some small duplication orders may require a physical audio CD-R master. A CD-R master is ideally burned by your mastering engineer and tested for burn/write errors before shipping to the CD manufacturer. Check with your CD manufacturer to see if DDP works for them, or if a physical CD-R master is needed. More info on DDP is found below.

- **Vinyl - 24-bit WAV files (sample rates higher than 44.1k if available)**

The WAV files for your vinyl pre-master can be at the native sample rate of your original mixes and/or mastering session (meaning higher than 44.1k/CD quality). Creating a single WAV for each side of the record will ensure that no changes with the space and timing between songs can occur at the lacquer cutting stage. Sonic adjustments are often made to optimize for the vinyl format before sending it off the pressing plant or lacquer cutter. This can make or break the sound quality of your vinyl. Your original mastering engineer should be familiar with how to optimize the audio of your vinyl pre-master for lacquer cutting. If not, finding a mastering engineer that has this experience would be

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beneficial. There are a lot of variables related to your vinyl audio quality, so working with engineers familiar with the process is highly recommended.

- **Cassette - 16-bit WAV files (sample rates higher than 44.1k in some cases)**

Most cassette manufacturers usually ask for 16-bit/44.1k audio though some boutique manufactures may be able to work with higher resolution audio files. Creating a single WAV for each side of the cassette (or “program”) will help ensure that no changes with the space and timing between songs can occur. You may wish to optimize audio for the cassette format, as it may not need to be as loud and compressed, and sibilance can be an issue with certain types of tape. Check with the manufacturer for their specs.

- **Download Cards - mp3 (or whatever you want users to download)**

This is one situation where mp3 files are usually welcomed when it comes to delivering your masters. Most download card services simply host the files you deliver to them, and don’t do any further conversions or data compression. Check your service for specifics.

- **Music Licensing - 48k WAV files (with 320kbps reference mp3)**

The proper format needed for licensing your music will ultimately depend on who licenses the music, and how you plan to distribute it. However, the most common audio format for video use is 48k WAV, though 24-bit/96k is becoming more common for Blu-Ray releases. Although the audio can be resampled down the line as needed, if you’re serious about submitting your music to be licensed in video productions you’ll want to ask your mastering engineer for 48k WAV versions of your masters. This is especially true if you have also mastered instrumental versions of your songs, which most commonly get licensed. Acquiring 48k versions of your masters and instrumentals from your mastering engineer should ensure the best sound quality as the audio is less likely to be resampled or converted down the line, potentially with subpar sample rate conversion software. It’s also useful to have reference mp3s of your instrumentals for easy sending and auditioning by potential licensing clients and users.

Exceptions And Notes

*** Always start with the highest resolution file available and acceptable for the format in which you are distributing your music. Up-sampling a 44.1k WAV file to 96k does not add any audio quality to your file and can actually make it sound worse if done using non-mastering grade software. Converting an mp3 to WAV does not “add the full resolution back”. Once a file size is reduced and encoded to mp3 or AAC, you must go back to the source to retain the quality of your original master.**

You should not convert mp3s into WAV files in order for them to be used for online distribution. Once a WAV file has been reduced to mp3 or AAC, the integrity and sound quality is gone forever. An mp3 is to audio as a grainy, pixilated image is to photography. Once the data is stripped from a high-resolution file, it cannot be brought back. Even though you can technically convert an mp3 back into a WAV file, you will still have a loss in quality compared to the original WAV file. This loss of quality is particularly noticeable in the high frequencies, resulting in a swirly, underwater sound depending on the size and bit-rate of the mp3. Even if you don’t notice these artifacts on well encoded mp3 or AAC files, you will certainly notice problems when the mp3 or AAC file you converted to

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WAV gets converted back to mp3 or AAC again by Bandcamp, SoundCloud, or the iTunes Store/Apple Music.

The same is true regarding 24 and 16-bit files. Once a file is reduced to 16-bit, it can't be successfully converted back to 24-bit. The missing bits are gone for good.

*** File tagging and online distribution:** WAV & AIFF files don't support the large amount of metadata that an mp3 or AAC file can contain. Technically, WAV & AIFF files can contain a fair amount of metadata but the ability for most consumer playback software to read that metadata is limited. If your mastering engineer provides WAV files for uploading to online distribution services, expect to submit the artwork and other metadata separately as you submit the audio files for online distribution. The distribution service you use will handle the metadata tagging that is seen by the end user based on the info you enter, and what is supported by the end file format.

When you purchase a song on the iTunes store for example, it is delivered to you as an AAC file (also called MPEG-4) which is considered a compressed file format similar to an mp3 but the AAC file is generated from a 16-bit/44.1k WAV file.

Each individual store and streaming service has it's own file specs for files that the end user purchases or streams from any given service, but they are all usually generated from the same 16-bit/44.1k WAV file that you submit to your aggregator. With most aggregators, you can choose to distribute your music via iTunes Store/Apple Music, Amazon, Google Play, Spotify, TIDAL, and the list keeps growing. There's no reasonable way to optimize your audio uniquely for them all, but you can take care to be sure your mastered WAVs are optimized for the main stores which should translate well to nearly all.

Some popular aggregators in the US are [The Orchard](#), [CD Baby](#), and [Tunecore](#). You upload your audio files and project details to the aggregator just one time, and they take care of the details regarding getting your music into the distribution channels you choose.

*** DDP:** A DDP image is basically a digital image of a compact disc that contains all the audio, track IDs, CD-Text, and ISRC codes. DDP is not prone to errors that can occur with physical CDs (and CD-Rs) such as skips, scratches, and read/write errors. This is in part why it's best to use a DDP image for your CD production master rather than a physical CD-R. Most professional mastering software can export a mastered project to DDP format. The DDP can be sent in for CD production via the Internet, either by uploading to the website/FTP of the CD manufacturer, or by providing a direct download link to your sales person.

DDP is also useful for auditioning a final master to be sure you're hearing the exact sound quality, and song/track sequencing as intended by the mastering engineer, because it rules out any errors that can often occur when working with individual WAV or mp3 files, and manually assembling them in iTunes or other consumer audio software. Most audio playback and CD burning software programs have settings for adding extra space between tracks, and some programs have settings that can alter the sound quality

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and overall levels which can be easy for users to overlook, resulting in an inaccurate listening experience.

It is not recommended to submit individual WAV files for CD production. This can lead to problems with song sequencing, incorrect CD-Text, lack of CD-Text, and in some cases the audio itself can be altered if files are handled improperly.

It's easy these days for mastering studios and engineers to provide a complimentary DDP Player with a DDP master in order for clients audition and approve a master. This is ideal because the listener will be listening to the exact same file that would be used for CD replication and most online distribution services as of now.

HOFA makes a DDP Player that can be purchased for \$9.99 (USD) which is suggested if the mastering engineer can only supply a DDP image, but not a complimentary player for you to audition the DDP. DDP is especially useful when the mastering engineer and client are not in the same location because a DDP file can be transmitted via Internet quite easily.

*** ISRC codes:** An ISRC code is a digital fingerprint for each of your songs which helps keep track of airplay and other ways your music can generate royalties and credits. ISRC codes are not essential for CD and vinyl releases, but your songs will need ISRC codes in order to be sold on the iTunes Store, as well as most other online distribution channels.

Some aggregators can generate ISRC codes for you if needed when you setup online distribution. However, if you are also doing a CD release, you may want to have the ISRC codes generated before finalizing your CD master so the codes can also exist on the physical CDs. Some mastering studios offer ISRC code generation, and you can apply via the [ISRC website](#) to be able to generate your own ISRC codes if you prefer. Fees may apply depending on your method of operation.

*** Vinyl & Cassette:** Ideally, your vinyl pre-master is one WAV file for each side of the record, at the native sample rate of your mastering session. Some vinyl and cassette manufacturers may request that your audio masters be sent on an audio CD-R. Audio CD-R is limited to 16-bit/44.1k sample rate, and is generally not a good way to submit, transfer, or store a master. Only use an audio CD-R for a master if absolutely necessary due to manufacturing limitations. It's recommended to use a manufacturer that can work directly with your 24-bit WAV files for vinyl projects.

*** For vinyl projects:** Using a 3rd party lacquer cutter can improve your final product greatly. Lacquer cutting is the first and arguably the most important step in the vinyl process after your master leaves the original mastering studio. You typically have a more open line of communication with a 3rd party lacquer cutter vs. an in-house lacquer cutter at a pressing plant. This is a big reason of why results are typically better when using a 3rd party lacquer cutter. It's also much cheaper and quicker to fix issues with your vinyl pre-master at the lacquer cutting stage rather than at the test pressing stage if problems arise.

Typically, when working directly with a pressing plant for your entire vinyl order, you don't get to hear anything until the test pressing is ready, which is essentially the last

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1/3 of the vinyl process. This means that any fixes will likely require major back tracking and could be costly and delay your order. When using a 3rd party lacquer cutter, once you approve the reference lacquer, the production lacquer(s) are shipped off to the pressing plant of your choice for the remainder of the process, possibly with a stop in between for metal plating depending on who you are working with for the actual pressing. Using a “one-stop shop” or broker for vinyl can certainly be easier and less overwhelming, but you tend to see a wider variety of audio quality depending on who you choose to work with. If using a broker for a vinyl order, it’s a good idea to ask who is doing the lacquer cutting and record pressing to be sure they are using one of good quality.

You will also want to be aware of how long your sides are for vinyl releases. Depending on the size of the record (7”, 10”, or 12”), and the speed (RPM), you will be limited to how long each side can be before the sound quality starts to be compromised. With vinyl, there are no hard time limits as we have with a compact disc. Each pressing plant and lacquer cutter has their own suggested maximum times for sides, but generally speaking, sides will sound better the shorter they are, and short sides can usually be cut louder than long sides. Long sides are susceptible to distortion (inner groove distortion), graininess near the end of the sides, and the overall level of the sides will likely be on the quiet side. Some manufactures will not guarantee sound quality after exceeding a certain time.

For the vinyl pre-master, it may be worth removing songs from your album, or shortening some songs to avoid long sides. The longest side usually determines the overall level and tone of the entire record, so creating the shortest, most even sides will produce the best results in most cases. Low-frequency content also plays a role in how loud the record can be cut. Most digital mastering engineers are knowledgeable about what will work and what won’t when it comes to low-frequency content and will usually make adjustments to the low end as well as any high-frequency problems such as vocal sibilance or overly bright cymbals.

Skilled lacquer cutters can sometimes produce good sounding records at long lengths, but the results usually vary depending on the source material and person doing the cutting work. Maximum times for sides are posted for a reason and should be taken seriously if you care about the sound quality of your vinyl.

You can read an article I wrote about the importance of lacquer cutting for vinyl by [CLICKING HERE](#).

***Mastered For iTunes:** Only mastering studios that have been certified by Apple are allowed to provide masters for Mastered For iTunes releases. What Mastered For iTunes means is that you are submitting your mastered WAV files to the iTunes Store/Apple Music at 24-bit, and the highest sample rate available for your project. Up-sampling a 16-bit/44.1k master to 24-bit/96k will not be beneficial, but if your mastering engineer can provide high sample rate, 24-bit masters, it’s something to be ready for when Apple opens up the Mastered For iTunes program up to everybody, hopefully in the near future.

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The other important step in the Mastered For iTunes process is that the master is auditioned through a special encoder to be sure that it will not clip or contain overs when converted to AAC for distribution in the iTunes Store/Apple Music. Without leaving the proper amount of headroom on loud digital masters (as most are these days), it's fairly easy for clipping or overs to occur when your loud mastered WAV files are converted to AAC, or other compressed formats such as mp3.

The severity of the clipping that occurs depends on the material, how loud it's mastered, and other variables controlled by the mastering engineer. This is why careful testing must take place for each song within each project to qualify as Mastered For iTunes compatible. Every second of every song must be analyzed through the encoder to test for overs and the proper headroom must be set to avoid these overs throughout the course of the song, or complete album. Offline encode checking via Sonnox ProCodec is in my opinion the best way to check for post-encoding overs with repeatable results. Using tools that run in real-time on playback do not provide repeatable results when it comes to overs.

The most common method to prevent clipping and overs when your mastered WAV files are converted to a compressed format, is lowering the output ceiling of the final limiter in the mastering session to a certain point in order to leave enough headroom for the file conversion and data compression process. Back when CDs were the main digital format, the standard setting for a digital limiter's output ceiling was -0.2dB, to prevent distortion with cheaper CD players and playback components. It was eventually discovered that -0.2dB is not enough headroom to prevent clipping when loud masters are converted to compressed formats such as mp3 and AAC. It's becoming more popular to lower the final limiter output ceiling as low as -1.0dB to prevent clipping and overs when the file is converted to a compressed format. Again, the actual clipping instances will depend on the variables of the material and how it's mastered. Typically, you want to lower your output ceiling as little as needed, but just enough to prevent these overs when converted to mp3 or AAC. The optimal setting is dependent on your specific material and the target compressed format. Lower quality mp3s tend to clip more easily than higher quality mp3s.

There are a variety of tools that a mastering engineer can use to know how a master will react to a certain mp3 or AAC encoding. Some popular options are [Sonnox Fraunhofer Pro-Codec](#), [Sonnox Codec Toolbox](#), the Encoder Checker that is now built into [WaveLab 9](#), [Ozone 7](#), [NUGEN MasterCheck Pro](#), as well as [tools and droplets](#) provided for free by Apple. However, the tools provided by Apple are Mac/OSX only. The Sonnox ProCodec plugin comes in in VST, AAX, RTAS, and AU formats so they can run within a number of audio software applications on both Windows and Mac OSX. [Sonnox Codec Toolbox](#) has standalone version as well that can run on it's own outside of any other audio software. This is my preferred method of testing because of the offline encoding option which gives you 100% repeatable results.

If you do not wish to do an official Mastered For iTunes release, it doesn't hurt to comply with as many of the guidelines as possible. Even if you only choose to submit 16-bit/44.1k WAV files to your iTunes aggregators, you can still have your mastering engineer be sure that there is enough headroom in the WAV files you submit to avoid clipping and overs after the lossy encoding process. This can result in a more pleasing sounding file

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for the end user that purchases your music via iTunes, as well as other stores and streaming services.

The Mastered For iTunes theory can be applied to most of the online distribution channels as well. However, it's not always clear what format your WAV file gets converted to after you upload it. There is not a realistic way to test exclusively for all the various encoders your music could encounter. It's important to communicate to your mastering engineer, how and where you plan to distribute your music, and read the fine print on the file specifications for any given distribution service.

Why doesn't iTunes recognize my CD info?

If you're wondering why iTunes or other music playback software on your computer will not recognize song titles, artist name, album name, cover art and other info when you insert your audio CD, it's because your audio CD is not registered with the Gracenote database (for iTunes support) and/or All Music (for Windows Media Player support). It's also possible for iTunes to believe your CD is of another artist if the total track numbers and times happen to match, which is more common with CDs with lower track totals.

The information embedded on your audio CD (self-burned, duplicated, or professionally replicated) is called CD-Text, and can only be displayed by CD players that support CD-Text. This usually includes car stereos and high-end home CD players. Most music playback software such as iTunes, Windows Media Player, and Winamp can't read or display the CD-Text embedded on your audio CD though there is a script that can be used to allow iTunes to read CD-Text.

Because of the way Gracenote and All Music databases work, your computer needs to be connected to the Internet to match and retrieve data for any given audio CD that is inserted. For example, even if you insert a popular CD that is registered with the databases into your computer, it will only automatically retrieve the CD info if the computer is connected to the Internet (or if the device is pre-loaded with existing data). It is not currently possible to embed the artwork or any other metadata info directly onto a burned audio CD or the production master for your CD. CD-Text and Gracenote/All Music metadata are two separate things.

Until the CD's info is submitted to Gracenote and All Music, your computer's software will only read the songs/tracks as Track 01, Track 02, etc. This is normal.

The way that Gracenote and All Music identify an audio CD is by analyzing the number of tracks, their exact lengths, and finding a match in their database. This is why it's not uncommon to see a few possible matches when you insert a CD with only a few tracks. The odds of the number of tracks and their respective lengths matching an existing CD are much greater for CDs with fewer tracks. It's important to wait until you have a final master to submit the info to Gracenote and All Music, as sometimes track lengths can change slightly throughout the mastering process as changes are made.

Once you have a final master, you can submit the info to Gracenote via Internet using iTunes. [CLICK HERE](#) for instructions on how to submit the info.

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Submissions to All Music must be done by mailing them a physical copy of your CD. More info [HERE](#):

Once the info is submitted, it can take roughly 48 hours to be active via Gracenote, and 4-6 weeks for All Music (Windows Media Player).