Review: Marantz PMD-300CP Cassette Tape Recorder

Mike Rivers

After having this cassette deck around for a few weeks, I moved all my notes, test data, screen shots, and photos from the workshop to the writing office and sat down to a blank screen thinking about how I could start this review. I came up with three ideas: I could give you a description, tell you what it sounds like and how it works, and verify its specs. I could dive right into my "Trust But Verify" mode and explain the various lab tests I performed on it, leading into a detailed discussion of how the test results agreed or not with the published specs and how they help to explain how it sounds. But I decided that the best place to start is to address the problem for which this cassette deck is a potential solution.

The Problem

Unless you're part of the culture (or more likely, the cult) that has a special fondness for the sound of cassettes, you might wonder why anyone would be interested in buying a new cassette deck in 2019. You probably haven't listened to a cassette in years, or maybe you're young enough never to have been exposed to the medium at all except in on-line discussions about how horrid they sound, which often dovetails with a discussion about how horrid MP3 files sound.

Musicians and music lovers who came of age between the mid 1960s and up into the '90s are the ones with *the problem.* You know that box of cassettes in a closet that you haven't listened to in more than 20 years, but you never had the heart to throw them away? Nostalgia catches up with you and you wonder if there's any good music there – after all, you must have enjoyed it at one time. Perhaps there are recordings of your high school or college bands, "car tapes," or pre-recorded cassettes of hit albums that you loved and never got around to getting on CD. There might be recordings of concerts you attended or favorite radio programs, or some family history like grandpa telling stories or playing the accordion. You have the cassettes, but your last cassette deck, working or not, went to Goodwill or the dump years ago. Or you rescue that forgotten player from the basement, only to discover that it no longer works. Long periods of idle time take a toll on the mechanical tape transports.

In June of 2018 I attended a three-day workshop on audio and video archiving, restoration, and preservation. While much of the focus was on the technology of playing obsolete media like cylinders and lacquer disks with the surface flaking off, there was plenty of attention paid to analog tape. The focus there was both on preservation of historically important recordings and re-releasing near-contemporary major label material as means to make new money from old projects. Those are expensive projects that are usually funded by grants or the record labels that own the masters. But a few of us got to talking after hours about "the rest of us" with personal collections of recordings, too long dormant,

that may have some personal or even historical value. These analog tapes, reel-to-reel or cassette, rarely have sufficient tangible value to warrant paying a professional to transfer them to digital media, but wouldn't it be fun to enjoy them again, and perhaps share them with others, let your kids or grandkids hear the music you played when you were their age, or maybe even put a few of your original tunes up for grabs on your Facebook page.

So, to get started on your archive digging, you need a cassette player. Ten years or so ago, it was easy to find a working one in a thrift store for twenty bucks or less. While it might be a bit worn and not up to its original performance specs, it would work well enough for you to assess your collection. Those days are pretty much gone, though. While you can still find used cassette decks for sale on eBay or Reverb.com, on a recent browse of the sales, mostly what I saw were high grade models selling for near-new prices of $500 to $2,000. I own a working broadcast-quality workhorse TASCAM 122 Mk2 which, despite its nearly 30 years of age, I've managed to keep in decent working condition with love, care, and a shop full of tools and test equipment. To keep it company, there are three non-working, fairly high-grade cassette decks on my shelf of things too good to throw away that maybe I'll fix some day. Yeah, right!

A couple of months ago, a friend came to me for advice about digitizing a couple of hundred cassettes. She's a blues collector, documenter, and performing artist, and wants to start a new project in which she wants to use material from these recordings. Much of this collection is oral history – interviews and stories from friends and family members, along with music casually recorded in living rooms - not up to "release quality," but valuable for its content. She no longer has a functional cassette deck and wanted to get one suitable for her digitizing project. She's not a techie so I thought it would be best to buy something new rather than take a chance on a used machine.

Cassettes aren't a branch of recording technology that I keep up with, so I went in search of something to recommend and I was shocked to find how few new cassette decks are on the market today. I was able to find only two new models that seemed worth considering, the Marantz PMD-300CP ($150) that I'll be reviewing here, and the TASCAM 202mkVII ($500). Given the price differential, I decided to take a look at the less expensive Marantz first to see if it would be a good recommendation for budget-minded friends and clients.

The Marantz name and trademark has a long history of top quality products in the hi-fi field, but it's been bounced around from company to company in recent years and Marantz Professional is now under the InMusic brand umbrella. It's in pretty good company, with other brands you're likely familiar with – Akai Professional, Alesis, Denon Professional, M-Audio, Rane, and, among others, the ION brand of low cost consumer grade home audio equipment. Here I discovered another budget priced cassette deck, the ION TAPE 2 PC, which, for about $30 less, appears, from the web site photo and specs, to be identical to the

Marantz Professional PMD-300CP. It's been around since 2015 and appears to be out of stock everywhere, so perhaps ION simply decided to revive it under a new brand and name.

What It Is, and Isn't

OK, so let's get started with the review. The Marantz Professional PMD-300CP ("Marantz" or "300CP" for shot) is a two-deck cassette player/recorder that follows the form and function of many others that have come and gone. Deck A on the left is playback-only, while Deck B on the right offers both playback and recording. There's a convenient cassette-to-cassette dubbing feature should you desire to preserve and enhance the low-fidelity qualities of the cassette medium. For extra-lo-fi and saving time, it will copy a tape at double speed. I did check out the recording capability, though if your project is to digitize tapes, think of the second deck as a backup for when the first deck wears out and you still have a batch to go.

A key feature of the 300CP is plug-and-play cassette digitizing with no additional hardware except a computer. A USB-A cable is included, along with a download link to a very simple recording program, making this a very attractive package for those with a closet full of cassettes and little or no knowledge of computer audio interfacing. Whichever deck is used for playing the tape will be fed to the USB output. I found no significant difference between Decks A and B, not surprising since both transports appear to be identical except for an erase head on Deck B.

The rack ears are included, but are packed separately, along with screws to attach them, should you want to rack mount the recorder.

The rear panel is pretty sparse - RCA jacks for input and output, a USB-B socket, and a record level control to adjust the signal level between tape playback and

the A-to-D converter. Since tape levels tend to be all over the place, it's an important control for optimizing the level of the digital recording.

Overall dimensions are 16½"W x 8½"D x 5¼"H. It's quite a lightweight according to my kitchen scale - 7 pounds, 4 ounces without the rack ears. When it comes to electromechanical devices, I find that weight is often a fair indication of quality. Given that my TASCAM 122mk2 weighs in at 16 pounds, 10 ounces, I was on my guard when checking out the Marantz.

The LED meters have six segments, four green and two red. They display the playback level when playing a tape in either deck, and the record level when recording on Deck B. The first segment $[-\infty]$ turns on with the power switch and remains on, serving as the pilot light and not really a level indicator.

The Noise Reduction switch engages a decoder for playback. All but the oldest and crudest cassette decks offer Dolby B noise reduction, and when Dolby C came along, it was included as a choice on better grade cassette decks. Since the 300CP has no Dolby B/C switch, I asked Tech Support about it. Dolby no longer makes the encoder/decoder chips that were standard (and the only way to use the Dolby name and trademark) during the long run of cassette deck production, so Marantz had to come up with a substitute. I didn't test this extensively, but it appears to be reasonably accurate with the couple of Dolby B tapes I tried. Without going too far astray here, I'll tell you that it's all too common to find Dolby-encoded tapes in a collection that aren't annotated as such. If you flip the Noise Reduction switch in order to decide whether an unmarked tape is Dolby or not, intuition will usually lead you to leave noise reduction off in playback because it sounds brighter that way - and you could be wrong. This is a problem high on the tape archivist's list.

The first thing I did after unpacking the deck was put it on the bench, fire it up, load up a nicely recorded cassette that I knew pretty well, and started to plug in a set of headphones to give it a listen. Surprise! There's no headphone jack! There's no end to what cost-cutting a manufacturer will do in order to meet a price point, and a half-dollar's worth of parts can increase the end price by ten to fifteen times that. Of course the analog outputs can be connected to an outboard amplifier or powered speakers for monitoring or listening. Still, this might be a bit of an inconvenience as there's no on-board playback volume control.

A related quirk is that when recording on Deck B, whether the source is from Deck A or the analog inputs, the analog outputs are muted. If you want to monitor

what you're recording (and you should), you'll need to monitor the USB output via your computer's audio outputs.

The Marantz accommodates two different tape types, ferric oxide (standard) and chromium dioxide (CrO_2, sometimes called "chrome"). These refer to the compounds used to make the tape's oxide coating (the recording surface). The two oxide formulations require different bias and equalization settings in order to obtain optimum performance. There's a third tape type, metal particle, which this deck doesn't accommodate. There are individual tape type buttons, labeled CRO2, for playback (on either deck) and Deck B recording – in for chrome tape, out for standard. Most original tape labels include the oxide type so you determine the proper switch setting, crossing your fingers that the tape was recorded with the proper setting, and if you're recording a cassette, set the tape type in accordance with the label. Cassette shells have notches in the top edge to indicate the oxide type and some decks have a sensor that detects the oxide type to set EQ and bias automatically, but on the Marantz, you need to set it manually.

These are "soft" switches that default to "off" (standard) on power-up. The appropriate author-thing to say here is "Don't ask me how I know this" so I'll tell you. I was making some measurements with a chrome tape and was puzzled by unrepeatable results until I noticed that the CRO2 indicator LED was off after coming back to the bench after powering down for lunch.

There's a tape position indicator. It's a counter rather than a time display, and it only functions for Deck B. It doesn't provide sufficient resolution to cue up a song in the middle of the cassette, but will get you in the ballpark. For no particular reason, I gravitated toward using Deck A for most playback, and it would have been useful to have the counter active. A dime's worth of parts could automatically switch the counter to the deck in use, with a default to one or the other when copying a tape.

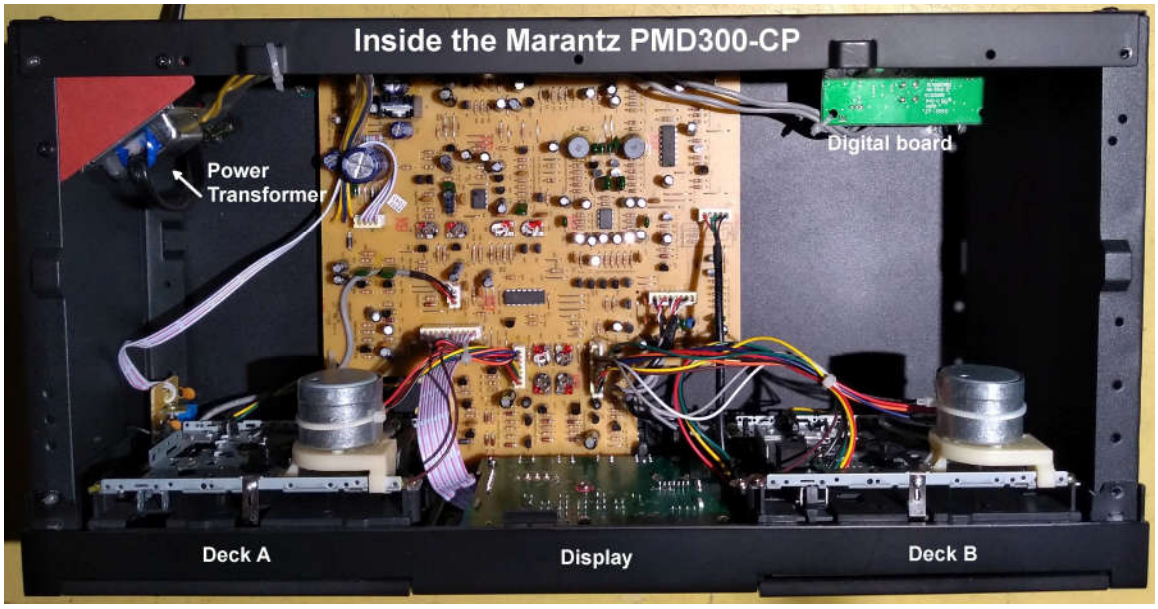
A few words about the digital USB output: The converter (actually classified as a codec) is a single IC, a Burr Brown (TI) PCM2900C, combining a 16-bit converter with an internal USB2.0 interface. It's clocked from the USB stream, and operates at either 44.1 or 48 kHz sample rate as set by the recording program. It's a class-compliant audio device and it requires no special driver for Mac or Windows operating systems. I tried using the almost-universal Windows ASIO driver ASIO4ALL, which didn't recognize the device. The chief benefit of using an ASIO driver is lower (and adjustable) latency, which is unimportant for playback. Marantz' goal was to make digitizing tapes simple for the non-tech user, and that's what you get.

Although the PCM2900C is bi-directional (it's a D/A converter as well as an A/D converter), you can't use the Marantz as an audio interface. The analog inputs go only to Deck B, with no signal path from the analog inputs to the USB output.

On the practical side, the noise and distortion in the digital signal path is better than a cassette will ever be, so there's nothing lost with the "CD quality" digitizing. I would prefer 24-bit resolution, though, so I could be more conservative when setting the digital record level. Furthermore, if cleaning up the digital transfer is in your plans, some software processing tools work better with a higher resolution file, and at 2x sample rates. Bottom line - the USB digital output is for convenience. If you plan to do some serious rescue work on your recordings, I'd suggest using the Marantz' analog to feed an outboard computer audio interface for flexibility in setting sample rate and resolution. But remember that the best interface money can buy won't get you a better digital copy than what comes out of the tape deck.

Under The Hood

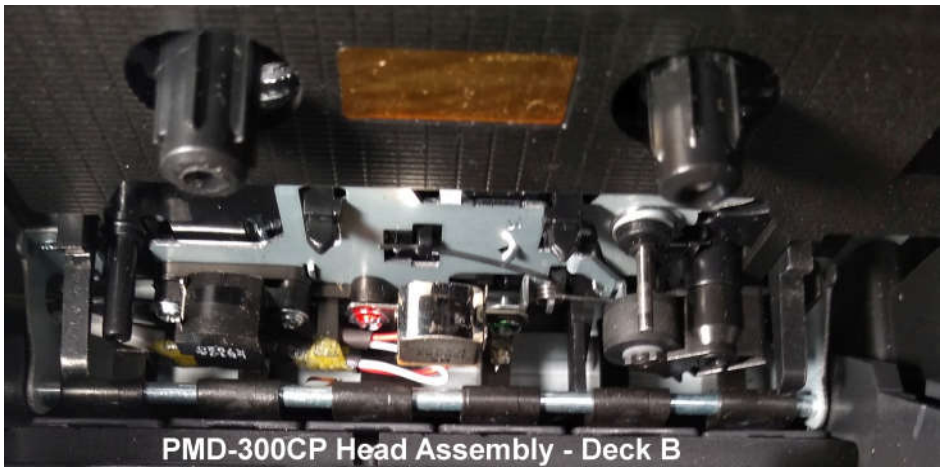
There isn't a whole lot of there, there – the two tape transports, a power transformer, a fairly sparsely populated main circuit board, the front panel board with its switches and meter display, and a small digital board for the analog-to-digital-to- USB conversion.



Decent quality Chinese-made components populate the cleanly laid out main circuit board. Circuitry is largely discrete (note the plethora of transistors) with a couple of dual op-amps and FET switching ICs.

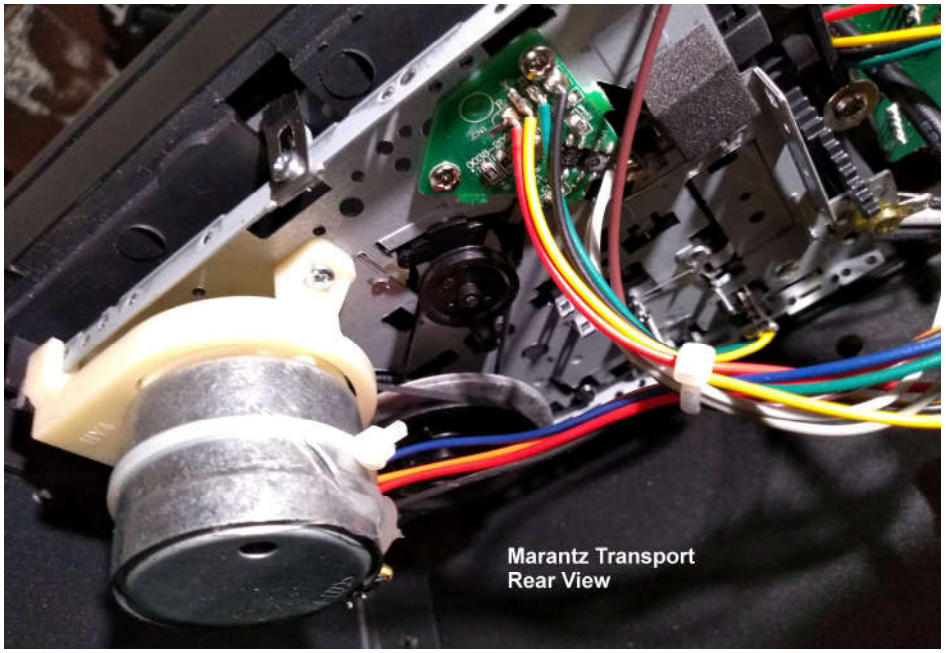
Tape recording and playback electronics isn't terribly complicated, and today's low-noise analog ICs make it relatively easy to achieve a good signal-to-noise ratio. What's important is how the circuit and mechanical design are integrated into the final product. Sometimes, here, cost cutting takes its toll.

The most important part of analog tape deck design (and maintenance, as well) is to assure that the tape makes perfect contact with the heads and moves across them in a very precise manner. The PMD-300CP's transports are pretty light-duty, built from stamped metal and plastic parts that don't give a lot of confidence in this area. It uses a single brushless DC motor with belts, plastic pulleys, and clutches to drive the capstan and reel spindles.



PMD-300CP Head Assembly - Deck B

Note the erase head to the left on Deck B, and the lack of guides in the head area (of either transport).



Marantz Transport
Rear View

The rather skinny drive belts are evident in the rear view.

Transport control buttons are mechanical and feel rather stiff to operate, but they do what they're supposed to do.

Overall build quality is good, fit and finish are pretty good – things that I've come to expect from Chinese factory-made electronics today. Had Marantz chosen a more robust transport, I expect that overall performance would have been noticeably better, but I understand how that would affect the price. In the field of consumer and even some pro audio products, there are always decisions about component choice, and some are made with cost in mine. The engineering department might be able to sell the marketing department on spending an extra dime for a low-noise version of an

IC, but not an extra $25 for a tape transport with a robust cast frame and machined guides.

In Use

To be honest, I haven't listened to a cassette in probably 10 years other than in the car or when making a digital copy for a friend or client, so I started out by conditioning my ears. I picked out a cassette copy of a recording that I made of one of The Newgrass Revival's last shows in 1989 before disbanding. This copy was made on my (now defunct) Sony TCM-5M, a high quality portable cassette recorder, as a secondary backup to a DAT. I loaded it into my TASCAM 122 Mk2 deck, hit Play, and sat back to listen. I was actually rather impressed - it sounded better than I thought a cassette could sound. Good cassettes can *sometimes* sound pretty good when recorded with good equipment.

Then I loaded the tape into the Marantz, started it playing, matched the level to the TASCAM playback as best I could using an SPL meter, and thought "gee, this sounds like a cassette" – overall not as good as when played in the TASCAM. The Marantz wasn't missing any highs or lows, it wasn't clipping, nor suffering from audible wow and flutter, and didn't have the brittle sound of high order harmonic distortion, but it was missing some clarity. Not horrid, but not impressive like the TASCAM. I thought that what I was hearing could be intermodulation (IM) distortion, a form of distortion that I can't immediately recognize by ear.

Turning to what I expect to be its likely application - digitizing a cassette collection - I connected the USB port to a computer (Windows) and, just as advertised, it was promptly recognized as an audio playback device. With the idea in mind that I might want to recommend this cassette deck to someone who had a digitizing job ahead but didn't have any experience with computer recording, I fired up a copy of Audacity, a free and very capable recording program that I'd recommend to a novice on a tight budget.

I copied about half an hour of the Newgrass Revival tape to the computer, then rewound the tape and started both the Marantz and Audacity playing in close-as-I-could-get-it sync. Switching the monitors back and forth between the analog playback from the Marantz and the output from my shop computer's interface, a Mackie Satellite, they sounded very much alike. I attributed the occasional difference to the fact that cassette playback is never exactly the same twice due to its mechanical nature, while the digital playback is completely repeatable. I have no quibbles with the Marantz' digital output, except on general principle that it's only 16-bit at standard sample rates.

The rear panel playback level control is a very worthwhile addition. Since it's in the audio path ahead of the A/D converter, by watching the recording program's

meters, the digital record level can be set properly to avoid clipping while keeping a healthy program level. I really wish they had put it on the front panel, however. I fear many users will ignore it, ending up with either clipped or wimpy digital dubs. It could be ganged to the front panel Record Level control, with the same knob used to adjust both the digital (USB) and analog (Deck B) record level, whichever you're using. This would be a good update if there were a Mark 2 version.

Knowing that there will be some users looking for a no-brainer solution to digitize their tapes, I downloaded and fired up the EZ Vinyl/Tape Converter application that's offered for the PMD-300CP. It's the same program that ION provides with other audio products such as their USB turntables. The Windows version saves recordings as WAV files only, while the Mac version gives you a choice of several compressed formats (MP3, AAC, etc.) as well as WAV. Instructions are included for using iTunes to convert WAV files to other formats.

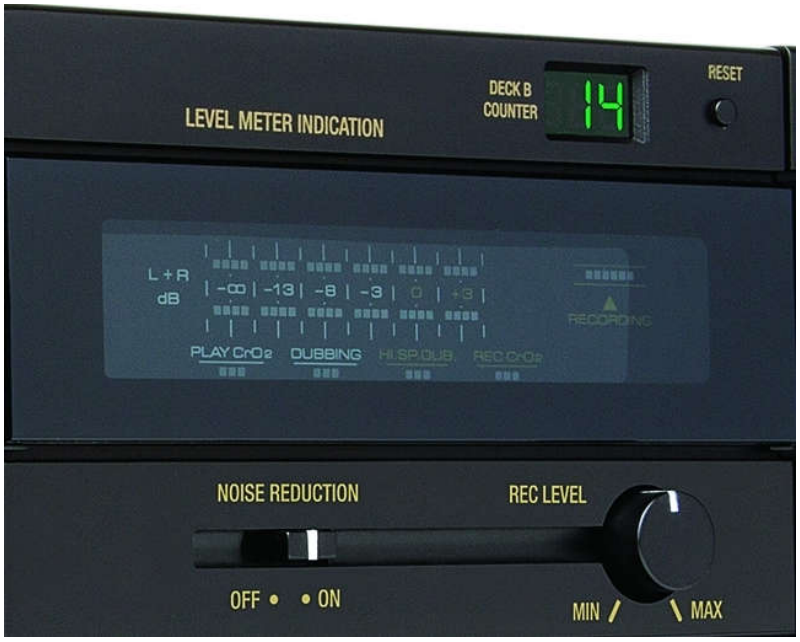
This program is really simple and straightforward, with the only one option – recording a tape from beginning to end in a single file, or splitting the recording into individual files when the program detects a period of silence. This could be useful when transferring a tape of a record album, though it may be more of a nuisance if the material is a live show or spoken word. With automatic track splitting turned off, you can split tracks manually while recoding by clicking a button in the program. The program does what it claims and it'll work fine for the user who just wants to make a digital transfer and doesn't plan to get any more involved with computer audio production.

Recording from the analog inputs to Deck B is straightforward. The front panel REC LEVEL control allows you to adjust the record level using the meters as a guide. This control and the meters work whether the recording source is Deck A or the analog inputs. The DUBBING button internally patches the output of Deck A through the record level control to Deck B. The HI SPEED DUB button doubles the speed of both transports for double-speed copying. I only tried this to verify that it worked and didn't make a critical comparison between the original and the copy.

One gripe I had with operation, and this is clearly a personal bias, is that I just couldn't get my brain to accept a PLAY button at the left end of the transport controls. I've spent too many years using tape recorders with the PLAY

button near the middle of the controls and the REC button safely out of reach of a careless finger. I'd probably get used to it after copying 100 cassettes or so, though force of habit had me hitting STOP instead of PLAY, usually ejecting the tape. Another minor gripe with the transport controls is that the buttons require quite a bit of force to operate. I had to put a hand on the case when pressing the PLAY button in order to keep the deck from sliding across the top of the bench

I was unable to take a good photo of the meters in action, but here's a close-up of the Marantz stock picture. The leftmost [– ∞] segment serves only as a



power indicator and is always on, leaving five steps of metering. When recording to tape, the last green segment, [-3 dB] is as high as you ever want to go. When the level reaches the first red segment, [0 dB], THD (total harmonic distortion) is greater than 10%. This isn't the "warm analog tape sound," rather, it's the "crappy cassette sound." Use the REC LEVEL control and pay attention to the level when recording on to a

Recording Levels

A ¼" half-track analog tape deck running at 15 ips is typically calibrated for 1 to 3 percent THD at the reference fluxivity indicated by 0 VU on its meter. Reference fluxivity, expressed in Nanowebers per meter (nW/m), is a measure of the strength of the magnetic field of the record head when fed with a standard signal level.

The original Ampex standard is 185 nW/M, though with the improvement in magnetic tape, higher flux levels, which improve signal-to-noise ratio, can be used. In the latter years, a reference level of as great as 6 dB higher than the Ampex level was common.

A narrow track cassette running at 1-7/8 ips distorts very badly at elevated flux levels, though for the sake of providing a good signal-to-noise specification, the Standard IEC/DIN reference fluxivity for cassettes was established as 250 nW/m.

When playing a reference tape at standard level, the Marantz meters just tickle [-3 dB] segment, where the analog output level is -10 dBV, the common "consumer" operating level. THD measures around 8% on playback, which is why: (a) When recording to tape, you should keep the meters below –3 dB, and (b) Why a "hot" tape played on this deck will probably sound distorted.

cassette! See the sidebar for the geeky explanation of why recording levels are important.

The bar at the upper right corner of the display illuminates red when Deck B is recording. The four bars at the bottom of the display panel illuminate when the CRO2 switches are engaged, and when the normal or High Speed DUBBING mode is engaged.

The Gory Technical Details

When I write a review, rather than paraphrase the manufacturer's sell sheet that you can read on their web site, I fire up the test equipment and compare my measurements with both the published performance parameters and what's reasonable for the device I'm testing. One of the basic tools for measuring an analog tape decks' performance and adjusting it for best performance is a reference, or calibration tape. My cassette reference tape is 30 years old, so any measurements that I make with it need to be granted some wiggle room to compensate for the tape's wear and degradation. When a measurement seemed questionable, I duplicated the measurement on my TASCAM 122mk2 using the same calibration tape to validate (or not) the results.

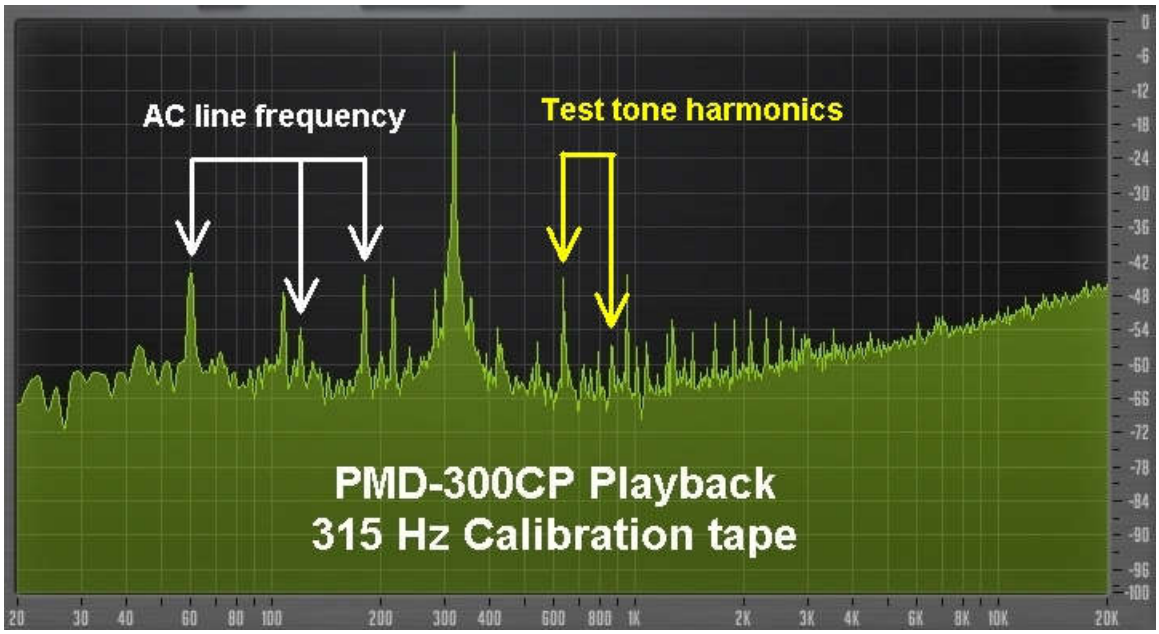
Frequency response as measured with the calibration tape was ±2.5 dB from 30 Hz to 15 kHz with a 2.5 dB rise at 30 Hz and a 2 dB drop at 15 kHz. The two channels tracked within 0.5 dB. This is quite good considering that a new calibration tape would probably play closer to flat at the high frequency end of the range. It's not unusual to find a low frequency hump when using a calibration tape due to the magnetic field fringing effect. It occurs when recording, too, and, while there's sometimes a low frequency equalization adjustment, it's rarely perfect. This rise around 50 Hz adds some extra oomph to the low end, often desirable when recording certain kinds of music – "analog warmth," you know. Frequency response tones on the calibration tape are recorded 20 dB below the 250 nW/m reference fluxivity level so as to avoid making measurements with "tape compression," a different anomaly that's loved by many engineers.

Recording tones on Deck B and measuring the frequency response of the playback yielded results quite similar to the calibration tape playback with exception of the low frequency behavior. Here, there was about a 2.5 dB dip at around 60 Hz where the calibration tape showed a boost around 50 Hz. To be consistent with the playback frequency response measurements, I recorded my test tones at the same level as the calibration tape. With the same head used for recording and playback, the low frequency fringing effect should be minimal, so I suspect that the dip around 60 Hz might be due to AC line frequency hum being recorded and then partially cancelled by residual AC hum in the playback electronics. There's a fair amount of line frequency hum that I'll address further on.

When it comes to noise, a bulk-erased tape plays back at about –50 dB referenced to the maximum output level. The output is muted when a tape isn't running, so quiescent noise when stopped is essentially zero.

Distortion measurement was tricky. I have two hardware distortion analyzers, an old Hewlett-Packard 334A and a relatively modern NTI Minilyzer ML1. For record/playback at the –20 dB record level, the H-P measured around 0.05% THD, which seems unrealistically low. The Minilyzer measured 6.5%, which seemed unrealistically high. THD (not including noise) calculated from the amplitude of the 2nd and 3rd harmonics read off the spectrum plot of the 315 Hz test tone at 250 nW/M comes to around 1.5%, which is a bit above the manufacturer's stated THD of "<1% @ 1 kHz" but believable and not unreasonable.

Since the frequency response and THD seemed acceptable, I started looking for what made the Marantz not sound as good, when playing music, as my reference TASCAM. I looked at the Marantz' output with a spectrum analyzer and that's where things got interesting. Here's a spectrum plot of the 315 Hz tone on the calibration tape, using Sound Forge along with the spectrum analyzer plug-in SPAN from Voxengo Software:



Great Googly Moogly! Look at all that garbage!

In a perfect world, the big spike at 315 Hz sould be the only pronounced peak present in the spectrum, but nothing's perfect. The 60 Hz AC power line frequency is visible here, along with several of its harmonics. I've annotated the 2nd and 3rd harmonics, but they're visible above the noise floor up to around the 6th harmonic. Given that this 315 Hz tone is recorded near maximum level, some

harmonics are to be expected, however, there are also spikes at frequencies not related to either the AC line or test tone frequencies. Most of this spurious noise is 40 dB or less below the level of the test tone, but it all contributes to the THD+N figure.

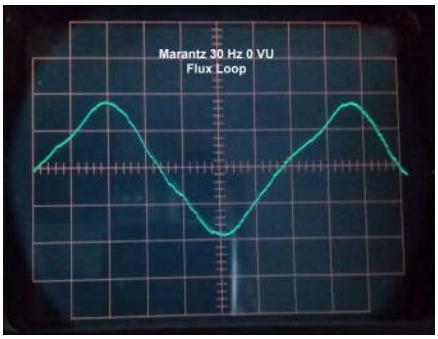
For comparison, here's a shot of the same tape played on my TASCAM 122mk2 deck, which measures substantially lower THD+N than the Marantz. This plot is zoomed in to show more detail where it matters. The overall noise of floor of the TASCAM is 10 dB lower than the Marantz, and only the 3rd and 5th harmonics of the test frequency are of significant amplitude. Cleaner spectrum equals cleaner sound.

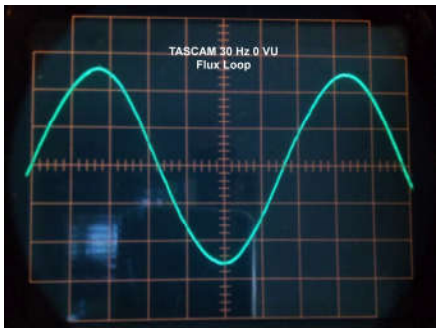
So where are all those spurious frequencies in the Marantz coming from? And how much do they matter? The relatively clean TASCAM spectrum demonstrates that they aren't coming off the tape, so to eliminate the tape from the Marantz measurements, I used a tool called a "flux loop." It simulates the varying magnetic field as a recorded portion of tape crosses the playback head gap. This allows testing of a tape deck's signal path, independent of the heads and tape path. Other than one that Ampex sold which mates perfectly with the AG-440 head assembly, this isn't a commercially available tool. The one I use is home-made, from about 30 turns of #24 enamel wire wound around a scrap of perforated circuit breadboard material. It's driven by an oscillator with a resistor in series to maintain constant current through the coil at all test frequencies. It's important to keep the coil in a fixed position while making measurements, hence the spring clamp you see in this photo. If you one a tape deck, I encourage you to make and experiment with a flux loop. You can learn a lot from it.

In order to use the flux loop, the tape deck needs to think that there's actually a tape being played. In the PMD-300CP, the output is muted until a cassette is loaded and the Play button is pressed, so with a piece of tape, I fooled the mechanical sensor that tells the electronics that a cassette is ready to play. There are a couple of other switches on the rear of the transport chassis that operate when the Play button is pressed – one un-mutes the output, the other starts the motor. With everything in place, the coil of wire couples the signal generator's output to the playback head and it appears at the deck's audio output.

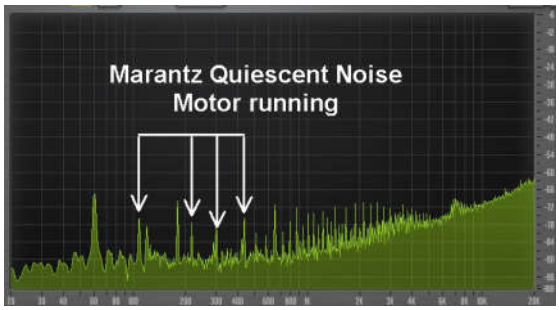
Using the flux loop, I ran a frequency response check in both the standard oxide and CRO_2 modes. Because the signal isn't actually coming off tape, what you see with a constant amplitude frequency sweep is the reciprocal of the equalization curve. By using a table of frequency versus amplitude values for the standard equalization curves, I confirmed that the equalizer section of the playback electronics is doing its job properly. To avoid distortion in the electronics, I set the generator level so that at the peak of the EQ curve, the output level was –20 dBu.

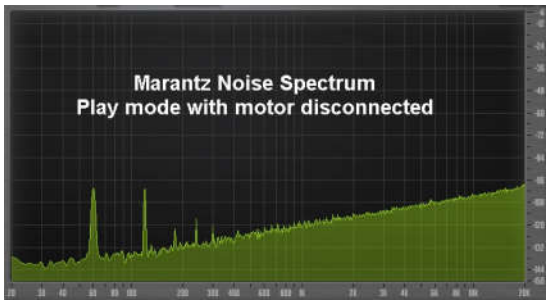
By raising the amplitude of the signal feeding the flux loop and looking at the output waveform with an oscilloscope, I was able to correlate the recorder's VU meter reading with the point where distortion begins. Here's what a 30 Hz sine wave from the flux loop at 0 dB on the VU meter looks like at the output of the Marantz, and for comparison, the TASCAM. The Marantz has a lot of harmonic distortion at the lowest frequencies. It's not nearly as horrid looking above about 100 Hz. To put a positive spin on what looks like substantial distortion, for recordings heavy on the bass (did they have EDM 30 years ago?) you might actually like the punch that the harmonic distortion gives it. But it's still distortion.





With the flux loop setup, I was able to put the Marantz into Play mode without actually playing a tape, and by jiggering the motor switch, I could look at the noise spectrum with and without the motor running. With the motor running, there's a spike at around 107 Hz, with its harmonics up to around 3 kHz visible above the noise floor. I've annotated the fundamental and its first three harmonics here. Then I opened the motor switch and all of those spikes went away, leaving only the power line frequency and a few of its harmonics.





Well, we have an “AHA!” moment here. All of those mysterious noise spikes going well up the spectrum is coming from the motor. It’s at a low enough level so that its inaudible on its own, but it contributes to the THD+N measurement, and provides plenty of frequencies to contribute intermodulation distortion to the tape playback.

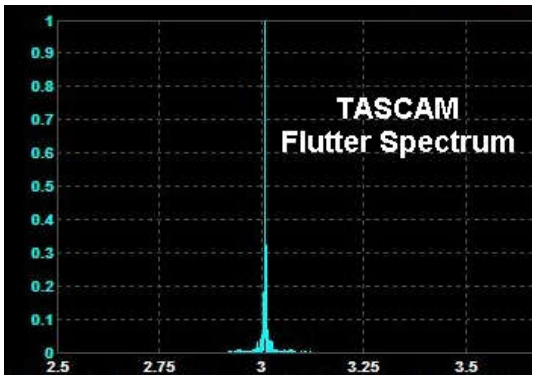
Interestingly, the fundamental frequency of the motor noise follows the speed of the motor, which is why I said the frequency was “about” 107 Hz. Putting a finger on a pulley or the pinch roller to put more drag on the motor causes the motor noise frequency to drop.

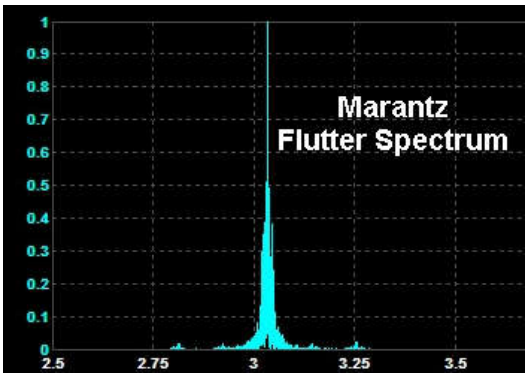
Still, the frequency response, noise, and harmonic distortion measurements don’t suggest why a tape played on the Marnatz PMD-300CP doesn’t sound as good as when it’s played on my TASCAM 122mk2. When playing the test tape, the spectrum shows some close-in sidebands around the test frequencies that aren’t present with when introducing those same frequencies with the flux loop. This suggests that the sidebands are a product of frequency modulation of the playback – “flutter,” in common lingo. A certain amount of flutter is present in all tape decks; in fact some think that this is part of the analog sound that they love, though in professional tape decks, it can be extremely low.

I’ve been using common and mostly free software tools (Room EQ Wizard, the Voxengo SPAN spectrum analysis plug-in - Audacity, and Sound Forge) in conjunction with bench test equipment - but I don’t have a tool for measuring flutter other than to make a rough estimate from the spread and amplitude of the spectrum of a single tone.

A web search for a software application that quantitatively measures flutter turned up only source, the Virtins Technology Multi-Instrument program. Unfortunately the only version that includes wow and flutter measurement costs $500, more that I can justify for the little work I do on analog tape decks these days. However, there’s a fully functional trial version that did the trick, presuming that you have a speed/flutter test tape (I do – a 3 kHz tone). The program performs a spectrum analysis of the tone when playing the tape, crunches numbers, and comes out with a number for both weighted and unweighted flutter.

Here are the Virtins spectrum plots for the Marantz and my reference TASCAM decks side by side for comparison.





Notice the difference in the width of the spectrum spike and the height of the widened portion, which represent sidebands surrounding the test frequency created by speed fluctuations as the tape moves through the guides and across the heads.

The common flutter specification that you'll find published for a tape deck (or turntable, for that matter) is a bandwidth-limited measurement that measures the amount of frequency deviation, but measures the frequency modulation only up to 250 Hz. This is the kind of flutter that causes a steady tone like a piano note to warble. It's typically caused by bad bearings, a dirty or out-of-round drive wheel, tape dragging on a reel flange or cassette shell, motor speed variations, or irregular tape tension.

Unweighted flutter is calculated on the full bandwidth of the detected modulation frequency, usually up to 5 kHz. It's typically the result of inadequately supported tape in the head path, tape scraping on guides, or not making perfect contact with the head, all of which results in high-speed vibration of the tape in its travels. This has a special name – "scrape flutter." It's the mechanical equivalent of digital jitter, and has similar audible effects.

The Marantz weighted flutter clocked in at 0.25%, close enough to its specified "<0.2%," allowing for the stability of my test tape and the program's method of calculation. In comparison, under the same test conditions, the TASCAM's weighted flutter measured 0.08%. Unweighted (full bandwidth) flutter, however, is a different story. Here, the Marantz measured 0.9% while the TASCAM measured 0.15%.

Having observed and commented previously on the rather lightweight tape transport design and build, I believe that excessive scrape flutter is what gives the Marantz playback a tendency toward murky sound.

The Wrap

So here's the deal. This is an inexpensive cassette deck. Build quality appears to be decent with the exception of the light-duty tape transports. Unfortunately, when it comes to tape, the transport is the make-or-break part of the playback system. This one is OK, far from exceptional, decent living room quality, but nothing "professional." I think it's a good buy for the price as long as you understand and accept what it is. I expect that most people interested in buying one will be using it for a DIY cassette-digitizing project. The scope of such a project can vary widely, mostly with the size of the collection and what you intend to do with the digital copies. If you're willing to accept that the playback (and hence your digital copy) of your cassette won't be as good as it could possibly be, you might be satisfied with a Marantz PMD-300CP. But if you have some high quality cassette recordings, they're probably worth playing on a better machine than this.

What it will certainly be fine for, if you have a large collection of tapes that you haven't heard in years, is to catalog them. You can listen, at least with one ear open, while copying them to digital format, take note of any exceptional ones, and also weed out the ones that you can't figure out why you ever saved. You'll get listenable digital copies, and if you discover a small number of gems that deserve to be preserved with the best fideleit, you can take those to a professional.

I can't guess how the current generation of cassette fans will accept the Marantz as far as making new cassette recordings. It's not hi-fi, that's for sure - it's cassette-fi, but it may be sufficiently low-fi to appeal to those in the movement. That's not intended to be judgmental, just the best reason I can think of why anyone would want to record a cassette today. But if that's what you want, the Marantz will do it.

I knew pretty much what to expect when I undertook this review, and while the PMD-300CP didn't completely disappoint me, I wasn't enthusiastic enough about it to keep it for my own shop. Working with it for several weeks was a good reality check for me. Since most of my analog tape experience has been with professional-grade tape decks, both cassette and reel-to-reel, working with this one was a bit of a revelation, and it provided opportunity to dig into the causes for distortion that's clearly audible but that you won't find within published performance specifications. It's easy to find reasons for never wanting to deal with tape again, but you have that closet full of cassettes, and the Marantz PMD-300CP could be a cost-effective way to preserve them in digital form as long as if you're satisfied with the sound of the playback.

What I'd like to see for the purpose is a cassette deck with a well built and robust tape transport (which the Marantz lacks), and solid electronics to support it (which, mostly, the Marantz has). It could playback-only, with the cost saved by

eliminating an erase head and record electronics put into more precise mechanical design and implementation. I think that incorporating the USB interface is a good feature, as it simplifies the digitizing process for the non-technical user. I've seen sweat break out when I tell someone "Just buy a cable and connect the output of your cassette deck to the line input on your computer." However, I'd like to see higher resolution available for the analog-to-digital conversion. I suspect that Marantz assumed that users would be making CDs from their cassettes, so "CD quality" was sufficient, but I there will be a fair number of users will want to experiment with digital processing to do some cleanup work, and starting out with a higher resolution file often gets the best results.

If Marantz or TEAC gets hold of this article, perhaps they'll consider building a less compromised and dedicated cassette transfer machine, if it's not already too late. If I hear about it, I'll give it a good workout.

Finally, here are some useful related links:

An article all about flutter, from the too-soon-late Dale Manquen, one of the most knowledgeable folks when it comes to what makes a good tape deck good.
http://www.manquen.net/audio/index.php?page=17

SPAN from Voxengo Software, my go-to spectrum analyzer. This is a free DAW plug-in available in formats to work with just about any audio recording program more advanced than the simple "voice recorder" or "CD maker," including Audacity (below)
https://www.voxengo.com/product/span/

Audacity – a fine and free open source and multi-platform (it even runs on Linux systems) audio recording and editing program for when you want to tweak your digitized copies of your cassettes. It comes with a slew of tools, many of which are useful for cleaning up hum and other noises.
https://www.audacityteam.org/

Using A Flux Loop – The original Ampex training document that includes information about the different equalization curves that have become standards (and some not-so standard). Make a flux loop and check out your tape deck.
http://www.brianroth.com/library/flux.pdf

Virtins Multi-Instrument – This is the software I used for flutter measurements, and it's capable of measuring just about anything about an audio signal. The full version is quite expensive, though you can have fun with the free trial version that works for a month. You'll need test tapes in order to establish playback

baselines accurately, but there's a lot you can learn even if you have to make your own test tape by recording and then measuring the playback characteristics.
https://www.virtins.com/multi-instrument.shtml

Standard test tapes – These are expensive but I'm including a good resource for those not faint of heart or budget. You'll also find cassette test tapes of varying quality for sale on eBay.
https://www.gennlab.com/alignment_cassettes.html