Whole House 3.0 Field Test 08-30-2015

I spent nearly 3 hours out in an open field yesterday running tests on the Whole House 3.0 transmitter.

I purchased this transmitter at retail from a seller on Amazon, so what I tested was one as sold to the general public, not one handpicked by the maker or importer.

Tests were taken with an accurately calibrated Potomac FIM-71, the same as the units used by the FCC in the field, and also used by most broadcast engineers who need to do work with FM broadcast stations. The readings then were also taken with a ZTechnology R-506 which is used by a wide variety of RF engineers in dozens of applications and is also the "new" technology often used by the FCC for tracking down illegal operators because it can output to a laptop and also synchronize with a GPS unit and compute exact field strength from varying distances, etc. Needless to say I just use mine for manual field strength readings. BTW, if you were to buy a new R-506 with its calibrated antenna the price is $13,000. Each device was used with it's own calibrated half-wave dipole antenna. Antenna factors were applied as appropriate, as well as cable loss, etc. All readings were so close between units the differences were negligible.

Documentation on this very forum has shown FCC documents where these exact devices are used and referenced in filed complaints.

The test site was a large open field. The nearest building as at least half a mile away, the nearest trees were many hundreds of feet away. The Whole House transmitter and the FIM-71 receiving antenna were at 7 feet above the ground as specified by Potomac. It is worth noting that the receive antenna on the FIM-71 was horizontal for all tests (it's a half wave dipole adjusted in length for the frequency) as this is what it is calibrated for, I did however take readings with the transmitt antenna both vertical and horizontal. You will see that, at least at 3 meters, antenna orientation has a huge effect on signal. I am posting all readings in uV. You may convert to mV if you like. I was testing at 92.7 MHz, the frequency that showed a nearly imperceptable reading of background noise effect, somewhere around 1.5 uV/m (so technically you might subtract 1.5 uV/m from my numbers but it really won't matter.

Here are the results, followed by some more comments.

At three meters, transmitter in "US power setting":

With Transmitter antenna vertical: 382 uV/m

With transmitter antenna horizontal: 1102 uV/m

At three meters with transmitter in "Canada power setting" (lightning bolt icon showing)

With transmitter antenna vertical: 4950 uV/m

With transmitter antenna horizontal 17775 uV/m

There are your basic tests at three meters between transmit and receive antennas. I then did a quick range test using the Tecsun PL310 as long as I was in an open area. I didn't have the ambition to run a marathon to various points so I went out to 220 feet. At US power at 220 feet signal was readable only by positioning the radio for the "hot spot" where the signal was strong and clear. Now, this was directly broadside to the transmit antenna in a horizontal position. As I walked around so I was at an end of the antenna (e.g. with the transmit antenna pointed at me) the signal was gone by about 100 feet. So in horizontal position, as expected, the signal is quite directional. The above tests were all done with just the transmitter on, running on new alkaline batteries, with no other cables connected to it. But I noticed something a couple weeks ago while playing around with this transmitter out in the yard that I was curious to test out here in the open.

Apparently connecting any cable to the transmitter increases it's RF output. I'm guessing that connecting, say, an audio cable to the line in jack, the common (ground) of the audio cable acts as a counterpoise to the antenna, as there's quite an RF output jump just by simply plugging in an audio cable. Per haps it's one of the other leads in the cable acting as additional antenna, I don't know. And it also seemed to somewhat negate the effects of the horizontal or vertical antenna. With the FIM-71 reading 382 uV/m with the transmitter in low (US) power and the antenna vertical, I plugged in a 4 foot audio cable -- 1/8 inch stereo to 1/8 inch stereo, and the output jumped to 4050 uV/m and this is just with the audio cable hanging down from the

transmitter. I was able to vary the output greatly just by changing the position of the audio cable in relation to the antenna. I then tried it with the external power cable. This is a short USB power cable provided with the transmitter. Same effect, except not quite so dramatic of an increase.

Then I though, what might the field strength readings be at 10 meters? In high power, the secret "Canadian" setting, with the antenna horizontal it was 11475 uV/m. Switching it to low "US" power the readings at 10 meters were 360 uV/m with the transmit antenna horizontal, and 112 uV/m with the transmit antenna vertical. Just in case you're curious, with the provided long wire antenna (that has the warning not to use it in the USA) the field strength went to 17775 uV/m in the high power Canadian setting. Although I wasn't really prepared to test this as I had no way to hold the antenna wire in the air so I just let it hang down from the transmitter. Also as it was a breezy day the field strength varied as the antenna swayed in the breeze. Had I been thinking I could have plugged the audio cable back in to see what I got! Probably if the antenna were held up above the transmitter and the audio cable was straight down as a counterpoise I could really have had some power going!

My conclusion has to be that there's simply no way this is legal in the USA. Although, it's certified. Makes me wonder exactly what the certification process involves. Now, the Potomac FIM-71 indicates the margin of error for these tests at 7 feet above ground level is 18%. So, in US mode, with the antenna vertical, and no audio or power cables plugged into the transmitter the reading is 382 uV/m. Allowing an 18% error in favor of the transmitter being legal (FCC documentation on this site shows the FCC always factors maximum margin of error in favor of the station) that still leaves us with 325 uV/m which is still above the limit of 250 uV/m. Then again, the margin of error could easily go the other way and be 439 uV/m, or somewhere in between. Whole different ball game if you flip the antenna to horizontal. Then it depends on if you're reading off the null ends of the antenna, or broadside. I didn't take any null end readings but I'm sure those readings would easily be legal.

Then, just for fun I took the transmitter up to my studio (second floor, old wood house, easily 20 feet above ground level) and set it in a window. Then I set up the FIM in the backyard. I was just sort of goofing around here so I didn't take any real readings, I just wanted to be able to see relative changes in field strength, but I was completely amazed at the HUGE difference in

signal strength that could be induced by simply plugging in the audio cable, and the differences between plugging it into an iPod compared to plugging it into a CD player (RF was quite a bit higher plugged into the iPod than a CD player). Or how simply moving the transmitter a foot to the left or right, moving the antenna to various positions horizontal, diagonal, vertical. Setting my wire glasses next to the transmitter even made a difference. I tried probably 20 different things. Moving the transmitter, moving the antenna, setting different things next to it, plugging it in to the ipod, then the CD player, moving the cable around, etc. Every thing I changed changed the field strength. Now, clearly I could have been simply been changing the direction of the signal, as well as varying the output by providing a counterpoise. I finally quit because I had to run up two and a half flights of stairs from the studio out to the backyard and back and I got pooped.

Trying to predict results, effectiveness, coverage, etc from this transmitter, and I suspect all Part 15 FM transmitters is a shot in the dark as a countless number of variables will effect virtually everything.

So of course now I can think of a thousand different test combinations, but I'm done with this transmitter now. So if anyone would like to buy a slightly used Whole House 3.0 at half price let me know :)

It will be interesting to see what the Decade CM-10 has in store for me.

Tim in Bovey

Decade CM-10 Field Test 09-11-2015

My first question is: How do I know that I actually received a Decade CM-10 for the USA market? I bought it right from them, they shipped it to me in the USA, so I assume they sent me the right unit. However, today's tests do not lead me to that conclusion. Is there a way I can actually tell?

I set up exactly as I did in the Whole House 3.0 test. Same field, same equipment, etc. So read that write up if you're concerned about the setup. I used the Potomac FIM-71 meter and corroborated my readings with the Z-Technology R-506. Not nearly as many tests as with the WH 3.0, as fewer options to experiment with (Have to have a power cable, and no power level switching).

Note that the power supply with the CM-10 is required for use, no adapters, batteries, etc are provided. The WH 3.0 I tested with batteries. So any effect caused by having a power cord attached is a requirement with the CM-10. Adding any cord to the WH 3.0 greatly increased it's output, whether audio or power cord, even when not connected to an audio source or power.

All tests taken with the receiving antennas in horizontal polarization.

At three meters the CM-10 gave me 3375 uV/m with the transmit antenna in a vertical position. With the transmit antenna in a horizontal position the field strength at three meters was 6300 uV/m. Clearly both are well over the legal limit of 250 uV/m at three meters.

The power cable for the CM-10 does have a ferrite choke on it an inch or so from the plug that goes into the transmitter. Also the power supply itself is not a wall wart as such, but a lightweight switching supply that has about 3 feet of cord on either side, one to the outlet, on side to the transmitter. There is no continuity from the plug for the transmitter to the power outlet plug. So any counterpoise effect would be with the three feet of cable I imagine.

I did notice that the output varied quite a bit depending on the location of the power cable. By moving it out diagonally from the transmitter the field strength would vary. The readings above are taken with the power cable hanging straight down from the transmitter. Remember, transmitter and receiving antennas are at 7 feet above ground as specified in the meter manuals.

I was clearly expecting this unit to give me much more close to legal limits. I couldn't remember the Canadian limits or I would have tested for them. These readings are not that far off from the WH 3.0 when it has an audio or power cable connected to it. Adding an audio cable to the CM-10 didn't make a noticeable difference, but then again it already had a power cable. And adding either cable to the WH 3.0 made a big difference but once one was added, adding the other cable didn't change things much.

I took my first reading with the FIM-71 and was so surprised I doubled checked the batteries (they're new) and calibration three times, and took the readings three times, all the same, before setting up the R-506 to corroborate. Same readings.

This is why I wondered if perhaps I received a Canadian unit. How do I determine this?

TIB

Extremely Legal FM Transmitter 09-18-2015

Suddenly it dawned on me last night that I had another Part 15 FM transmitter. About 10 years ago we bought one of those little transmitters for the sole purpose of plugging it into the stereo in my home office, where I could play Christmas records on the turntable and transmit them to the radio in the kitchen while we were making cookies! And sure enough, the little transmitter was in the drawer where I left it back then.

It's a General Electric EWT-950 FCC ID NZTSF-140. I'll attach a photo if I can figure out how to do it again.

I thought, what the heck, I'll take this out to the test field and set up all my gear again and see what kind of poop this little bugger puts out. Besides, I wanted to do tests again on the Whole House 3.0 simply because I have a hard time believing it's THAT far over the limits.

Anyway, got everything set up "by the book" as before in a wide open field. This little GE unit runs on two "AAA" batteries. Has no jacks, connectors, or any sockets in it, just a 15 inch built in audio cable with a 1/8" stereo plug on the end. It's got the power button and a frequency select switch with thess "zones" 88-92, 92098, and 98-108. After you set the range switch there's a tiny tuning dial on the side. I used the Tecsun to lock it on frequency.

So, what's the field strength you say? At the standard 3 meter test range output was 61 uV/m. As you know the limit is 250 uV/m at three meters. This is so legal it's ridiculous! This does explain why it had a hard time getting clear music to the kitchen from my office, through one wooden wall, and a distance of maybe 20 feet. LOL.

As long as I had the gear out I thought I'd double check the results for the Whole House 3.0. Yup. It's just as illegal as it was a couple weeks ago. More so, actually. I tested at 99.5 (I used 92.7 last time) another very dead spot on the dial. Readings were consistently higher. I'm not figuring and typing them all out, but they were all higher. Which I guess makes sense as with the little antenna on this transmitter, the higher you go in frequency the closer the match for the small antenna.

I was still going over in my head how the two certified transmitters I tested were so far over the limit, and trying to figure out if there was some

anomoly that would have made my tests inaccurate so I was itching to do it again. Same results.

So, FWIW, TYG.

TIB

C. Crane FM Transmitter 2 Field Test 10-22-2015

By a stroke of luck, today we were blessed with a sunny 58 degree day, just what I needed to schlep out into the test field once again with the C. Crane FM 2 transmitter that arrived over the weekend while we were in Kansas visiting my Son and his family. The rest of the week is forecast for 30's and rain. So I had to jump at the chance.

Same identical test setup as the previous tests. Same field, same location, same calibrated (by Potomac) Potomac FIM-71 field intensity meter. Same setup, 3 meters between receive and transmit antennas, both antennas exactly 7 feet above ground as outlined in the Potomac manual, etc.. etc.. Tests were run operating the transmitter on brand new "AA" alkaline batteries. Here are the results.

The C.Crane website, other sellers websites, and the included manual state that the coverage for this transmitter is "between 30 and 75 feet, line of sight with no obstructions". Well, this is exactly right. As delivered, in " out of the box" stock condition, the field strength at three meters was 110 uV/m. This is of course EXTREMELY LEGAL. In fact this is less than half the legal limit of 250 uV/m. This was with both antennas horizontal. If I changed the transmitter antenna to vertical it dropped to 43 uV/m, but that is to be expected. I brought the Tecsun PL-310et radio with me to see what sort of actual distance I got, and the receivers dBu scale dropped to zero at a measured 35 feet but I was still able to hear the signal by carefully orienting the radio antenna for best reception, although with noticeable hiss. By 40 feet away I couldn't hear the signal at all. So, quite literally, the transmitter as shipped covered to about 35 feet. This is in wide open space, line of sight.

You may know (or not) that inside this transmitter there is a power output control potentiometer. You can find all sorts of websites and even YouTube videos showing how you can turn up the power for "better results". Of course none of these posters have any clue if their transmitters remain legal once they turn this control. So, there I was, standing in a field wondering..... I didn't bring any tools with me at all. But I did have the small Swiss Army knife that I always carry, and darned if the screwdriver blade didn't fit just right to remove the screws to access the inside of the transmitter! There are two screws under the little rubber "feet" on the transmitter bottom, and one inside the battery compartment. Remove the back carefully making sure to clear the input level control and the power adapter jack. Now, I didn't

want to get into a complicated testing routine here, I just wanted to turn it up to full power and see what she'd do. I watched the FIM as I turned the control and verified that COUNTERCLOCKWISE increases the power. I gently turned it all the way CCW, put the back on, and returned it to test position and manned the meter. With the output turned to full, the field strength at three meters was now at 5850 uV/m! That's a heck of a jump and over 23 TIMES the legal USA limit.

Naturally I thought.... wonder if this would be legal in Canada! So I hoofed the FIM out to 30 meters (98.4 feet) hoping it would come in under 100 uV/m. Nope. Full power at 30 meters gave me a solid 270 uV/m, nearly three times the legal limit in Canada.

Just for the heck of it I did a quick reception test with the Tecsun with the transmitter on full power -- I was out well past 250 feet with clear signal and about 4 dBu on the meter. I got tired of walking. I'm sure I could have gone quite a bit further.

So, the result is... The C.Crane FM 2 is clearly legal as shipped, and by a wide margin. Access to the "secret" power output control is pretty easy and if you had access to an accurate FIM you could indeed readily adjust it to full legal US output level limits.

The audio input cable is built into this transmitter. So any testing or use would have to include the audio cable. You've seen how plugging the cable into other transmitters greatly increased their output. This one is clearly built with setup done with the built in cable at the factory. It also tunes down to .5 steps, e.g. 92.75 mHz. Which seems silly to me unless you're receiving it on an old school "dial" type radio.

I didn't do any serious testing for audio quality -- what I heard on the FIM and the Tecsun sounded just fine. I also didn't set up the Spectrum Analyzer to test either. Perhaps when I have more time and I'm stuck indoors over our 6 month winter :) I rather like this transmitter. It's solid, sits well on a table, comes with an AC adapter and is easy to operate. I just might hang on to this one to use to distribute station audio around the studio.

TIB