Transcript – Episode 87 – Ashhar Farhan VU2ESE
Commissioned by: Brent Putnam W1NCH

Eric 4Z1UG: QSO Today Episode 87, Ashhar Farhan, VU2ESE.

Welcome to the QSO Today Podcast. I'm Eric Guth, 4Z1UG, your host. When it comes to homebrew single-sideband transceivers and test equipment, Ashhar Farhan, VU2ESE, is the master of building amateur radio equipment on a budget with common parts. Ashhar has an international reputation and is referred to as the Homebrew Hero by Bill and Pete at the SolderSmoke Podcast. Ashhar Farhan, VU2ESE, is my QSO today.

VU2ESE, this is Eric 4Z1UG. Are you there, Ashhar?

Farhan VU2ESE: Absolutely, 4Z1UG. This is VU2ESE. Hi. Good to catch up with you. Been a follower of your podcast for a long time and it's a pleasure getting in touch with you today on the podcast itself.

Eric 4Z1UG: Ashhar, the pleasure is mine, absolutely. I was introduced to you by Bill Meara, N2CQR, of the SolderSmoke podcast. He seems to be driving a lot of my guests these days from his guest suggestions. Anyway, thanks for joining me on the QSO Today Podcast. Can we start at the very beginning of your ham radio story? When and how did it start for you?

Farhan VU2ESE: All right. Usually, it's a whole series of accidents which happened one or the other, but it actually begins with the loss of my kitten. I lost a kitten and I was completely inconsolable. I don't know why, but my uncle handed me over a book, which was called [Having Fun with Transistors by Len Buckwalter](). I've been actually trying to trace this book down for years now. I found it on Amazon.in a couple of times, but I really couldn't buy the book back, which had a couple of really interesting transistor projects.

Among them, there were two which were to do with transmitting. One was an end transmitter and another was this talking skull, which was essentially a magnetic loop around the room which would be picked up by a magnetic pickup, which is mounted inside the skull, human skull. Boris, the talking skull and it was something which would really catch the imagination of 11-year-old. I was completely sold to building that. I never managed to do any of those projects, but that actually sparked me off with the wireless.

Surprisingly, a couple of months down the line, there was a ham radio demonstration at my school, and a couple of people, who are very close to me now, they turn up there. I still remember the evening. It was a summer evening and there was a table with white linen on it, and there was an HRO, which was usually the object of desire for all the Indian hams as I later found out, and a homebrew

AM CW transmitter.

The 40 was just opening and there were signals from all around India and some Russians. There were some "Ruskies". These people were just working them and they actually found out our names, and those people would call us back and say hi to us in their various accents. I was entirely hooked. That evening, I followed Suri back to his shack, which was surprisingly about a kilometer from where I lived from my neighborhood. I would hang around with them for a while and there was this small club at school, although it didn't do much.

There were a bunch of kids out of them, I think. I and Abizar, another friend of mine, both of us hung on long enough to get our call signs, because getting call signs is really, really tough in India. It takes almost a year or more to get your call sign. You have to go through the intelligence clearance, the security clearances, et cetera. Anyway, that started me off, but I did not get a call sign then. Nevertheless, I was hanging around with them. I was also underage. In those days, 14 years was the age for getting the license and I was still about 11 or 12.

The other really significant thing which happened was that, India has been pretty close to Russia in those days, the USSR, because India more or less belonged to the Russian Bloc. We'd get these really cheap books, inexpensive books meant for self-study, very entertainingly written. One of them was this book called Entertaining Electronics, which really dumbed down electronics, the typical thing, electrons drawn as stick figures which are running around, being cooked in a frying pan and jumping up to the anode, et cetera. It helped me visualize a lot of electronics.

There were a bunch of hams, but most of them were not technically competent people, but more of hanging out, building small stuff, modifying their radios, that sort of thing. This actually completely catapulted me into the world of radio. I didn't have any equipment. In fact, I didn't even have a multimeter, but somehow I rigged together one FET oscillator which would run off a 9-volt battery working at 7 megahertz, because I managed to get my hands on an FET from somewhere and put a coil and a capacitor along with that, and made a Hartley oscillator.

That could tune on to 7 megahertz through the slug. You had to use a screwdriver to put the slug in and out, and I could hear that on my short-wave radio, on my broadcast short-wave radio, and I would use that to beat the SSB signals to resolve, and I could start. I started listening to the local nets. That was the first time, actually, I started listening to radio hams from my own QTH.

That really was my first project. I still think about it. This was at the height of sun spot activity, probably mid '80s this was, and that was a really wonderful time. I remember that I've copied Whiskeys. I've copied Zulu-Alphas all on a broadcast radio with about 6 or 7 feet of wire. That really was the start of ham radio for me.

Eric 4Z1UG: What kind of broadcast receiver you're using? Do you remember?

Farhan VU2ESE: I still have it. I'm still using it, actually. It's in my shack. I don't use it too often, but it

still works perfectly well. It was a modified Megs, a German thing, and my father bought it off his first salary. It's a four-wall thing, the self-oscillating mixer, the IF amplifier detector and the audio amplifier. It's just a four-valve, four-band thing, medium-wave plus three short-wave bands. It's in perfect working order. In fact, I can send you a picture of that. I think the picture is there somewhere, but I can send you a picture of it. It's got a magic eye tuning, which is what I really like about this one.

Eric 4Z1UG: I'd love to see it. I'd love the picture. Did you have to wait until 14 years of age to get your first license?

Farhan VU2ESE: Yes. In fact, what I did was that I applied for the license when I was 13 and by time they finished the paperwork, I was already 14. I did get the license. I was probably one of the youngest hams around that time, because as I turned 14, I got my license. In fact, I remember this. This was December 1982, I think 7th or 8th of December, because that's when the Asian Games were kicking off in Delhi.

I was the net control and my first broadcast as my own call sign, which was then VU2FAX as a net control for the Asian Games where the hams were doing all the communications. The wireless communications was being handled by the radio hams, because Rajiv Gandhi, prime minister, was himself a radio ham, VU2RG, radio golf.

Eric 4Z1UG: Can you talk a little bit about what the grades of licenses are in India? Did you get the first grade of license or did you go in mid-level?

Farhan VU2ESE: Things are very rapidly changing. In fact, as we speak, I got a notification a couple of days ago that they've completely removed the restriction of the entire process of going through the Intelligence Bureau's clearance now, so the Wireless Planning Commission can itself give the licenses. Back in the day, there were two grades of license. There was a grade 1 and a grade 2. In fact, there were three grades. There was advanced. There was grade 1 and grade 2.

For grade 2, you had to pass the same technical test which was in two parts. One was the operating procedures and there was a technical part, and five words per minute of Morse code receiving and sending for five minutes. The grade 1 required 12 words per minute and the advanced grade was given to you only after you had been a grade 1 for two years, which allowed you to do satellite work and allowed you to use more than 200 watts of power on VHF. Those were the three grades around that time.

After that, they rejigged did and there is a restricted grade now, which is completely without requiring the Morse code at all, and there is the advanced grade where you're required to be able to do eight words per minutes, which opens up more bands for you. For example, you get 10 megahertz and 50 megahertz only if you are on advanced grade. Otherwise, the restricted grade is VHF and voice segments of the HF bands.

Eric 4Z1UG:	In those restrictions in the HF band, are those also by mode as well, CW only, or can you do a single-sideband in CW?
Farhan VU2ESE:	No, you can actually do a CW if you would like to, but there are certain bands, like the 10 megahertz and 50 megahertz, which are not available to the restricted radio hams. Technically speaking, you are not allowed to do satellite work, because the license says that this is meant for terrestrial VHF work.
Eric 4Z1UG:	You're a new ham at 14 years of age. What was your first rig?
Farhan VU2ESE:	The first rig was actually the same broadcast radio and a friend of mine, Amir had put together a two-valve job. It was an EF89 as a VFO and a 6L6 as a power amplifier, put out about 7 to 8 watts on 40 meters. I would use this and keep the VFO continuously on so that that would beat with incoming signal on the broadcast radio to resolve the signals. I have spent many happy hours and days and nights, including afternoons chatting away on this rig with a lot of local hands.
	I had a lamp cord for the antenna feed because I just didn't have the money for coax around that time, but I had read this in the British library. The local British library actually would get practical wireless and it had a lot of Pat Hawker's books, Amateur Radio Techniques, et cetera. I had read that a quarter wave of any wire actually gives the same impedance at both ends, so I use that. Happily for me, it actually worked.
	That was my setup. It was an inverted V on my house, a broadcast radio, and a two-valve, what was called as a MOPA, the master oscillator power amplifier as my first rig.
Eric 4Z1UG:	How did the ham radio play a part in the choices that you made for your education and career?
Farhan VU2ESE:	I would guess that I've been entirely driven by ham radio at various parts. What happened was, once I finished my 10th grade, I had a choice to either continue in the school or do my 11th and 12th grade, after which I could directly join college, or I could come out and do what's called as junior college. I was at the time so interested in radio that I convinced my parents that I should drop out of the school. The school was one of those public schools where it's largely a boarding school. I was still a day-scholar. I would schlep to and from the school. It was really a school where you couldn't do anything else apart from being in the school.
	I came out of the school and joined a very small community college here to do my intermediate so that I had time to do radio. Actually, really speaking that those two years where I spent myself entirely, I spent all my waking hours fooling around with radios, doing one thing or the other, that really built up my soldering skills more than anything else, because I was doing a lot without really understanding what I was doing. It's just fooling around.
	There was some amount of junk available, very hard to come by, but there was

some junk which these hams would once in a while would toss out to me. I remember one of the things that I did make was, there were these boards available for broadcast radios for short wave and medium wave, and I bought one of these boards and I added an external VFO to this. It was a 455 kilohertz IF board, added a BF1. Finally made the receiver, which would properly be able to tune on 7 megahertz band. Then I would use it with my baby transmitter. Then I made a QRP transmitter as well during my intermediate years.

All this time, by the way, I still did not have a license. My license would come in 1983. I would use the club call sign VU2APR, which is a local club here, the Andhra Pradesh, which was my state, Andhra Pradesh, Andhra Pradesh Radio Society, APRS. They had the call sign VU2APR. I would operate using their call sign, which was illegal, of course, around that time, but it was great fun.

This continued for a little while. After that, I knew that I would want to pursue a career in electronics, and I joined the engineering college here. Around that time, I met my Elmer, who'd be my Elmer for the rest of my life, VU2OZ, Arun Kumar. When I met Arun Kumar, it was really an entirely life-altering experience for me, because here was a guy who would just take on a project and deliver it. I have yet to meet another person like that.

The first time I met him, he declared to me that we are going to see the Halley's Comet through a telescope that we are going to build together. We actually sat down and ground a 6-inch reflector and he had what I later realized was a Heathkit trainer, an 8-bit microprocessor trainer which had a 6,800 CPU with just 128 bytes of RAM. You're not even talking about kilobytes of RAM, on which he had written a tracker which would do the tracking of the telescope to adjust for the Earth's rotation. Come 1986, we actually did manage to see the Halley's Comet through that.

He had done a lot of other stuff as well. He had worked on India's first satellite, Aryabhata. An incredibly talented guy, very, very skilled with his own hands. He would be able to just about build anything that he'd set himself to build, set out to build. He opened up for me the whole idea of taking on some really ambitious things even if you failed to do them. For instance, I build a diode modulator, then I stole some crystals from somebody else's rig and built a whole SSB filter with that. Of course, it wouldn't work because I had no tools to really align it.

Then he taught me how to use the oscilloscope [inaudible 00:16:39]. He was fairly phenomenal for me because he was very close ... His modeling QTH where he basically assembled computers. He hand-assembled 8-bit computers of the Indian corporates. Those were being assembled there and I would hang out at his morning QTH all the time. That's how I got involved with computers. That became my profession later on in life.

The day I graduated from the college, that evening I walked in and joined his company. I also worked with Arun for a while. It was a very interesting time. Past 5 p.m., the customer or whoever would leave you. Finish the morning QTH work and

we'd pull out radio stuff and solder things together or build rigs. I was really lucky to have the time both in my college as well as during my school days to be able to work with a couple of hams who are extremely talented.

Eric 4Z1UG: Your Elmer really did make a huge difference in your technical ability.

Farhan VU2ESE: Absolutely. More than that, he also taught me debugging, which was really the key thing. We all are able to build circuits or devices and machines, but if something doesn't work, he always says to me that, "You need to know what to look for." There's a process of arriving at what's gone wrong with your project, which is not really logical, because if you look at the possibilities and start listing what would go wrong, it would be an infinite list.

How do you mellow down and say that this seems to be the problem? That is really a skill that I admired him for, where he would walk in to whatever was happening and he would know exactly what was going wrong with something. He always encouraged me to develop that ability, which is actually a knack. You really cannot write a book about it. You need to know what could possibly go wrong. At times he would say, "Back off. You're trying too hard. Go back. Sleep over it."

That works for me at times. Something doesn't work and you're on the shower or you're driving around and, suddenly, something hits you saying that, "That's the problem. That's what I need to go and fix." Then you go back to your bench or your computer or whatever and do what it takes to fix it.

Eric 4Z1UG: What is a morning QTH?

Farhan VU2ESE: A morning QTH is where you work.

Eric 4Z1UG: It's a workplace.

Farhan VU2ESE: Yeah, a morning QTH is a workplace and your QTH is your regular place.

Eric 4Z1UG: That's very interesting. What do you do for a living now?

Farhan VU2ESE: I don't. I've been in the software business for a long time and I sold my last business about five years ago. Now, I'm sort of retired. Very premature retirement, but I'm sort of retired from business, per se. I am involved in a couple of startups, but I have my own one new startup of late, which is in the natural and organic foods. We are basically trying to get farmers food directly to customers in the cities.

Eric 4Z1UG: That's great. You're gainfully unemployed.

Farhan VU2ESE: Yes.

Eric 4Z1UG: That gives you a lot of time to work on radios.

Farhan VU2ESE: Yeah, I have not too much time. I do have time to work on radios.

Eric 4Z1UG:	Or it allows you to work on your music, on your cultural center and on radios?
Farhan VU2ESE:	Yeah. You could actually go and check that out as well. It's called Lamakaan. It's on Facebook, too. It's a very packed place. We have about three or four cultural events every day.
Eric 4Z1UG:	Ashhar, you have an international reputation for being the consummate homebrewer now, thanks to your Elmer. Your Bill Meara, N2CQR's Homebrew Hero, and that's how he describes you on these SolderSmoke Podcast website. Can you talk a little bit about what resources are actually available to you and what drives the homebrew urge in you?
Farhan VU2ESE:	All right. The thing is that, times have really changed. The BITX is now more than 12 years old. I was quite surprised, but Bill actually gave me a heads up saying that you must have missed it, but it's been more than 10 years since you designed the BITX. Around that time, Internet hadn't been so pervasive in India that you could order stuff online so easily. We had to work with certain constraints around it.
	I have actually a lot of friends, in fact, most of my friends have now migrated to the U.S. or other places and they keep coming back every year. I have more or less a personal courier service of these people who can bring back these parts in case I do need them. I thought that I should put some constraint around myself. It's like Hitchcock. In every movie of his, he has a constraint. For example, he says that I'm going to shoot this particular movie entirely through a window or whatever.
	I put a constraint on myself saying that I will design stuff which is available in India. You actually catalog what's available in India and you say, "I'm going to somehow manage within this." For instance, in the BITX transceiver, it was designed so that everything which was required for this is available inside the country. I improvised on the coils using top washers. At times, the PCBs were not available, so I go broaden the Ugly method of construction, et cetera.
	Really, one very important thing which a lot of people miss out in my designs is that, we are within the shadow of EMRFD. It's really a seminal work. It's really a seminal work that goes unappreciated in the homebrew community. Everything that I do is actually derived from that one really incredible text. It's been more than 12 years and still I pick up some chapter there, and I find something really fabulous and fascinating, and a deep insight which I had missed in the previous readings of that book.
Eric 4Z1UG:	Tell me the book again.
Farhan VU2ESE:	This is the Experimental Methods in Radio Frequency Design. It's an AARL Publication by Wes Hayward, Bob Larkin, and Rick Campbell. It's really a fabulous book. I really can't say how important this book has been and how important even Wes Hayward has been for most of our homebrewers, because almost everything that we do has been something which has been founded by Wes Hayward in one

way or the other.

Eric 4Z1UG: You write on your website the Homebrewer's Lab and, obviously, the lab is the most important place to do homebrewing. You write a whitepaper on this. Can you explain what the minimal homebrewer's lab is?

Farhan VU2ESE: Yeah. It was actually inspired by a fairly grainy picture I had once seen in this book called the Solid State Design, again, by Wes Hayward and Doug. It's probably the last picture on that book. It shows Wes Hayward's shack with all his equipment, in which he writes that everything in the shack has been homebrewed. I really took on that as a challenge to say that everything in my lab, too, should be completely homebrewed.

There were certain challenges, for example, what do you do about an oscilloscope, et cetera. I came out with this challenge for myself to set up a minimal homebrew lab and what all it should have and I stuck my neck out there saying that the oscilloscope is one big ticket investment that one has to make in a way if you want to do any serious homebrewing. It's all right to do kit-building, et cetera.

That and the multimeter are two things. The rest can actually be improvised. Again, this is something which if you actually do a critical reading of the Experimental Methods in RF Design where Wes Hayward talks about, and there was a whole chapter, too, test and measurement. Most of our homebrewing fails actually because we fail to measure each and to test out each module separately before we do the big integration of all these together.

You do require at least an oscilloscope and a multimeter, but that apart, you require to build a signal generator. When I talk about a signal generator, it's not a phenomenal thing. Everybody cannot have an HP-8640B, but something much simpler. A crystal oscillator, a two-transistor crystal oscillator is actually all you need with a handful of crystals. It will give you an extremely low phase noise, clean signal. Of course it will have harmonics, but harmonics is not the thing.

The main thing is that they are going to be stable signals. They are going to be clean from phase noise and these actually can be used or a VFO can be used to sweep your filters, to find out the frequency response of your amplifiers. That's one thing. The other is that, when you feed these signals into whatever circuit you have built, you need to also measure them on the other side. One way of doing it is through the oscilloscope itself. The other is to have a power meter.

Really, the granddaddy of it all is the spectrum analyzer, but spectrum analyzers are traditionally pretty hard to build. I would imagine that a power meter could also be used. Again, there is a power meter built by Hayward, which is used by a lot of people. It uses a log amp device. It can be sewn together in about half an hour's time. It's just an 8-pin IC which you have to put down onto a PCB and you're done.

You require a way of measuring the power output. You require a way of varying the frequency and the amplitude, which is a third component, which is a step

attenuator. I think you do need or require a step attenuator as well, but this is when you're designing and investigating new stuff. Really, if all you're interested in is, for example, replicating the BITX, it can probably align itself and you really do not require all these things. You could probably align it by the year.

Eric 4Z1UG: In your first paragraph of the whitepaper that you wrote, you said really all you need is a soldering iron and a pair of fingernail scissors.

Farhan VU2ESE: Yes, because that's what I worked on for a very long time. What I had done was, in fact this is a trick which Arun taught me, you take a nail cutter and make it bite on a very small sewing needle. Because a sewing needle is made of hard steel, it would actually cut a notch between the blades of the nail cutter, and that would become your wire stripper. I had that. I had a really terrible soldering iron, which it was completely carbonized. It was a hand-me-down from my uncle.

I just had these two things when I had built my first VFO. I wouldn't recommend it to anybody else, but really if you're really looking for doing something minimally, those two and a battery or something should be more than enough to get you started.

Eric 4Z1UG: You had a frequency counter later. What would you recommend for someone starting out as a frequency counter? Would you recommend that they build one now with an Arduino or something like that or would you try to find something and that you can buy online?

Farhan VU2ESE: I'm using this frequency counter less and less. In fact, now, I don't even know when I had last used a frequency counter. I have stopped using the frequency counter. The reason is this, most of the frequency counters that are based on microprocessors are actually quite noisy. To buffer your circuit from that noise actually requires a fairly detailed circuit, which will be probably as complicated as the frequency counter, which is just a PIC processor which is added to a display.

The second thing is that the LED is off which are used in my frequency counter themselves and emit quite a bit of noise, so I don't do that. What I do instead now is actually something for simpler, which is I use a radio or I use my spectrum analyzer, which is essentially a radio with a waterfall display of sorts. A spectrum analyzer is really nothing more than a general coverage radio which can sweep the entire spectrum very quickly.

Since I have built my spectrum analyzer, I use both my oscilloscope as well as the frequency counter less and less, because once one gets used to the idea of looking at everything on the frequency domain, doing the same signal as frequency domain, it's far more rich in the way it communicates things. For example, a frequency counter will never tell you what the sidebands are like or what the harmonics are like, what the amplitude of that particular signal is, et cetera. I wouldn't recommend the frequency counter as much as, for example, I would recommend either a wave meter or just a regular radio to find out your frequencies.

Eric 4Z1UG: The spectrum analyzer that you built, did you build that out of a software-defined radio?

Farhan VU2ESE: No. This is actually an analog design that I have adopted to work with Arduino. The original spectrum analyzer that I've built, which is there on my blog, is actually a reboot of a spectrum analyzer which Terry White and Wes Hayward had built in 1998. This is the first time they actually brought the cost of a spectrum analyzer drastically down. Before that, if you wanted to buy a spectrum analyzer, it would cost tens of thousands of dollars. Here was a spectrum analyzer which you could build in your own home lab. The best part of that design is that, it aligns itself. You do not require any other test instrument to align and build a spectrum analyzer itself.

It took me a very long time. It was one of the most long-drawn projects for me because I had no capability at all of building filters on the VHF domain or any of the other things. By and by, building one block at a time, it's essentially a double super heterodyne receiver with a cutoff at 70 megahertz. The first IF is at 112 megahertz and then it mixes with the 100 megahertz local oscillator and it comes down to 12 megahertz. At 12 megahertz, I have two bandwidths for it. There's a 12 megahertz crystal filter with 500 hertz bandwidth and I have an LC filter with about 300 kilohertz bandwidth, and these feed to the power meter, the power meter and the tuning.

The tuning is controlled by an Si570 as a first oscillator and the power meter is actually read out through an AD8307, which is the log amp. Both of them are controlled by an Arduino. It's really an Arduino-controlled double superhet receiver. It's as simple as that. Actually, if you look at the circuit, it's simpler than the BITX.

Eric 4Z1UG: From your website, you like to build your projects on discarded chassis. I do too. If it's a steel chassis from a router or a switch, or something like that, I tend to pull those out of the trash and separate the parts. Can you speak about building from what you have and what you can find?

Farhan VU2ESE: Yeah. The idea of building it over plain copper boards was actually inspired by this political novel called the Ugly American. That is a phrase that Hayward had picked up. He wrote an article, along with his son, Rick, called the Ugly Weekender, which was how you build a very small transmitter together with your son. This is surprisingly one of the most robust ways of building radios. If you look at the optimized transceiver of Roy, W7EL, the optimized 40-meter transmitter, he's really stuffed a lot of radio into a very small space using the Ugly method.

The only thing is it looks ugly, but actually I really enjoyed doing this, because I do not draw circuit diagram before sitting down to solder something. It's in my mind and there's a fair amount of impatience in me when I'm trying to build these circuits, so I am really engaged in it and I don't have the time to lay it out properly. The Ugly way of building it really allows me to quickly prototype, change things

around, et cetera.

That said and done, I'm always looking out for cases that I can salvage and use as basis of something or the other. I have a couple of friends too who keep looking out for cases saying, "Maybe I'm going to do something out of this, so why don't we bring it to the next club meeting or something like that?" There's a friend of mine, Patty, VU2PEP, who has been my testbed for most of my radios, and he has a fairly elaborate junk box that I always keep dipping into and pulling things out.

I've really never tried salvaging things out of all radios. I just keep them with me. I have a couple of BC348s which I actually picked up, thinking I would use the slow-motion drive or the HROs, but it really breaks my heart to scavenge out of those. I have turned them into some long-term restoration projects. They all work. They don't look good enough, but all these radios are working radios.

I manage to start collecting them. I've started collecting a lot of variable capacitors because they are increasingly unavailable. In fact, in my designs, that's one of the things that I'm now faced with, which is one can no longer casually throw a VFO in a rig because tuning capacitors are no longer available, and we'll have to keep improvising on that.

This is a secret project that I've been working on, but probably I can talk about it. I really am interested in seeing whether one could build a fully functional SSB transceiver inside an Altoid box. That would really be something which would completely stretch the limits of what I can do with my hands.

Eric 4Z1UG: In terms of looking for variable capacitors, one other guest I had on the QSO Today Podcast who you might have heard was Phil Anderson, W0XI, in Episode 61. He has home company that he actually does order fulfillment out of his kitchen. He has a company that builds crystal sets for schools and he has variable capacitors made a thousand at a time. I'll put that up as a resource. Not only you can use it, but anybody else that is looking for a supply of new variable capacitors. He has them.

That's one of the benefits of being the host of the QSO Today Podcast, is that, I somehow remember these little tidbits from previous guests. Maybe I can help you with your variable capacitors there.

Farhan VU2ESE: Wow. That would really be something. This reminds me that I did run a workshop for children a couple of summers ago, just introducing them to electronics. It was spread over 10 days and I didn't use any electronic component into the fifth day, until the fifth day. We improvised on everything including building a whole crystal set. At the end of it, we had to use an earphone.

I'm really impressed by the work of H.P. Friedrichs. I don't know if you've seen the Voice of Crystal, his book in which he builds a whole radio without using any electronics at all, a whole crystal radio where he builds his own tuning capacitor, he builds his own earphone, he even builds his own detector. It's really inspiring work. He has come out with his new book in which he builds his own amplifying devices

including transistors in vacuum tubes in his own home lab.

Eric 4Z1UG: His name again was?

Farhan VU2ESE: H.P. Friedrichs, AC7ZL.

Eric 4Z1UG: I saw an article that you wrote about building a 25-watt linear amplifier for HF. You buck some of the conventions like supply voltage of even the power level itself. Can you speak to the reasoning behind some of the building decisions that you make that perhaps go against the common wisdom?

Farhan VU2ESE: I have always tried to find out if there are ways of redoing something that we have classically learned and getting it back to radio. I was actually really inspired by Rick Campbell's two issues. Just let me remember this. I think it was in QST that Rick Campbell did this article, two articles about building linear amplifiers. They are really amazing articles and I would recommend them to anybody. I'll actually pass on the links to you.

This, if I remember it right, was I think a QST of 80s where he talks about how to bring up an amplifier from scratch. That's what started me on the spot of building this 25-watt linear amplifier, by upping the voltages, because I was reading in the experimental methods of radio design that the regular IRF510s do not give good distortion. Rather, they do not provide good fidelity of signals at lower voltages and you have to go for higher voltages.

Then I found that you had these 24 volts as MPS supply is available to charge bike and car batteries, and they were pretty cheap in the local shop here. It was less than 1,000 rupees, which is about $15. I carried this power supply home one day from the shop here and then I started playing around with this. Most of the time, what I'm doing is, I'm not really trying to do anything in particular, but we just try out to see whether you can get more power or less power, what the distortion levels are going to be like. You finally hit up on something, then you say, "Maybe this is something that will interest people around the world," and you put those out.

There are a lot of things which I also look at that I believe that people may not be interested in, and I drop the ball on those and I do not really document that, which is why I started the blog. The whole idea of blog was to quickly put things out, which are not too sure require a completely cleaned up article to be published as such, but something of a rambling, more like the QRP-POP's website, where whatever he experiments, he puts onto the website.

Eric 4Z1UG: Bill and Pete in the SolderSmoke Podcast speak a lot of the BITX transceiver. I think Bill built a few of them. Can you tell us about what the BITX was or is? It's now, as you say, 12 years old, how you came to design it and what was unique about it as a homebrew project.

Farhan VU2ESE: All right. See, what had happened was that I was in Sweden. I had a morning QTH

shared with the SM-0MFC, Anil, who's been my business partner for a couple years. There are other business partner who's not a radio ham, Esan, who's flying in from the U.S. and experimented methods of radio design. This book had just been released and I had asked him to get a copy. He actually got us two copies, one for Anil and one for me.

I was completely excited by this text. It is really opening up completely new ways of thinking about circuits, completely new approach to how we build and design our radios. For the first time since the Solid State Design, we had another book which is completely updated with the technology and the approach. I really wanted to build some radio inspired by this book.

We had a very long flight from Frankfurt coming back to Hyderabad and it's actually on that flight with my calculator built into my phone that I sketched out this entire transceiver on the flight. I came back here and I put this together. The most surprising part is that it worked with very little coaxing at all. You just had to switch it on and it worked, and I was completely blown away. I think the entire credit goes to the fact that it used feedback amplifiers, which do not oscillate, which are completely stable, where the gain is from entirely new control. It doesn't matter which transistor you're using, et cetera.

The other thing was that I tried eliminating as many coils as was possible, because personally I have a great problem winding coils. My problem meaning I just do not like to waste my time winding a coil. I wanted to cut that down and I have an attention deficiency. If I'm winding the coil, at times I skip the number of turns, then I have to go back. I have to count them again. I have a personal dislike with winding coils. I tried keeping the number of coils really down to as few as possible.

The only things we changed here from what our design there was that I use top washers because I thought that a toroid is a toroid. You could have an air toroid as much as you have a ferrite or an iron powder toroid. I tried using it and it surprisingly worked, but it didn't work too well, by the way. After a while, a couple of folks including Wes did evaluation of the entire substances available, for instance, the nylon and Teflon, et cetera, and found out that these toroids did not work so well wound over a top washer, but all the same.

They were really crucial to the spread of BITX because we did not acquire any parts from Amazon or any of the big guys. Everything was available in your corner shop, which is the constraint that I was working with as well. The design is really held for such a long time. I'm really surprised that the design has been as stable as it was. I really give a lot of credit to just pure luck. A lot of people imagine that the design was really thought of very well and deeply researched and all. Nothing of the sort. It just came together. I just lucked out with the BITX.

Eric 4Z1UG: I guess from my limited knowledge of the BITX and looking at the schematic, it seems to be that the design is also amazingly adaptable. You could make it into a multi-band rig if you're willing to switch in and out the filter sections. You can add a synthesizer to it and an Arduino to it to bring it into the 21st plus century. It looks

	like it's quite a robust and flexible design.
Farhan VU2ESE:	It is. People have adopted it to various bands, et cetera. I keep coming back to the design. I have a new version of the same classic BITX without much change, but everything fits onto a single board now. I'm looking at being able to provide this as a goodwill kit around the world for kids and people who would like to build their own radio at a fairly cheap cost. In fact, I'm trying to see to it that for a couple of dollars, I should be able to put together a bag of parts and the PCB as a foundation which could then be used by the hams around the world, especially in Africa and Asia, in these places.
Eric 4Z1UG:	Is that the HF transceiver you called the Minima?
Farhan VU2ESE:	No. That's different. That's a general coverage transceiver. Here, I'm talking about the same good old analog BITX which works on a single band, the idea being that it should be easy to comprehend, the Minima and the HF1 need an Arduino. You need to know a little bit of software really to figure out how the entire thing works. They are not going to be as much of an educational process as a BITXs.
	The BITX is much easier to comprehend because all the amplifiers are exactly the same design. Once you know how once works, all the other six will work exactly the same way. You can test them with the same voltages and the audio chain is also pretty simple. There's just one mic amplifier, an audio preamplifier, and an LMP86. That's just about the entire transceiver, really speaking. It's very easy to figure out what's going on.
	Whereas, the Minima or the HF1, which are two, actually, separate transceivers, we can talk about them separately, are actually much of an evolved design. They are general coverage. They have CW or Charlie Willy. There's an Arduino which is controlling it. There is VFOA. There's VFOB. There's sideband switching. There's a whole lot of other stuff which is actually not minimal when you come to radio design, but the BITX really is minimal.
	I do wish that we had better foresight, for example, the RF amplifier in the front end is entirely unnecessary. One could remove it and it would work just the same. Probably it will work much better because the IP3 will improve. Nevertheless, I don't want to release a new BITX with an update, but let that be. Let people themselves worry about and think about modifying it.
	The other important thing was that, the BITX was the first open-source radio. I had disclaimed any permissions to be required to produce PCBs or kits, or even to reproduce the design, translate it, et cetera. What happened is that it evolved into a number of other designs, and some of them are really interesting designs. For example, there is a Milton Keynes Amateur Radio Society who have an 80-meter transceiver that is not really very well-known, but it's an incredibly well-designed kit. It has got a huff and puff stabilizer. It works on 80 meters. It's got everything built together, fabulously written, manual.

I have very little contact with these people. I just got one email, one saying that "We are doing this. I hope you're all right." I said, "Yeah, I'd love to see how it's come up." That's it. They don't really have to come back to me and negotiate any royalties, et cetera. That actually is an important part of how the BITX evolve, because it allowed and it gave people the leeway to do whatever they would want to do with their design.

Eric 4Z1UG: Let's go back to the Minima. You created this all band HF transceiver. Are there some design imperatives that drove the project that were different than the BITX?

Farhan VU2ESE: Certainly. I was actually now looking for a replacement of a rig which I have in my shack, which is the FT-817. I have a love and hate relationship with this rig, really. It's a rig which does absolutely everything that as a QRP, you would like a rig to do. It's DC to daylight. I can work on one 60 meters and I can work on 70 centimeters just the same. It's got every possible mold, et cetera. My personal trip was really to not have any commercial rig in my shack at all and I wanted a replacement for the FT-817ND.

                   I thought that if I could replace at least this within all HF rig, that would really be wonderful. I was essentially casting around to see what's new and what's exciting. Chris Trask came up with this thing called the KISS Mixer, which is the Keep It Simple, Stupid. It's a British acronym for minimal design. I actually threw a receiver together with a 12 megahertz IF using this and using two N7000s in the front end.

                   It's really very simple. It's just a transformer which is connected to the antenna where you use two of these FETs as switches to just keep switching the polarity of the winding, and thereby achieving a mixer action. That really worked fabulously well. From there on, I just added an IF to that and that became the Minima.

                   The Minima, actually, is a very weird design and it doesn't work very well. Let me also tell you that. It doesn't work well because it's got an IF which is right in the middle of the passband. This is supposed to work from 0 to 30 megahertz and the IF is actually 20 megahertz which is right in between the passband, and we have a notch filter which notches out the 20 megahertz IF response.

                   The Minima, here, I was trying to also show off my lab because now I could measure the IP3. I had the instrumentation for that. I build a spectrum analyzer to figure out how the spurious responses of the transceiver were. I had a sweeper now which I could sweep to figure out how the receiver was responding, et cetera. Minima was really a part of a larger project to completely build a new generation, homebrew lab, which had a spectrum analyzer, which had a sweep generator, which could do IP3 measurements, et cetera.

                   Personally, for me, it was a cog in that entire thing. What has happened is, with the Minima, I'm not too happy with the transmission part of it because there are spurious outputs coming out from there, which is why I actually left the project. I have not really completely done the project, but I started another one called HF1, which is a double conversion transceiver, which again works 0 to 30 megahertz. By

now, I had learned, while making the spectrum analyzer, as to how to design a double conversion transceiver and what are the challenges of it, of an up-converting double-conversion radio.

That's the HF1. HF1 is actually not as minimal as the Minima, but it's actually easier to design. More often than not, minimal designs are extremely challenging to get them to work. HF1 is really a very easy to build transceiver which works 0 to 30 megahertz. It's got extremely good performance. Of course, it uses more parts than the Minima does, but on the other hand, I would actually recommend people who are just looking for a good general coverage transceiver to build, to try out the HF1. It's my personal favorite. Finally, the FT-817 has been retired and now I'm using the HF1 as a general coverage transceiver and as the bench rig in the shack.

Eric 4Z1UG: I saw a video of you online. You're quite the articulate orator. I also understand that you are also many things, including musician and poet. It says that you were a rock star in a previous avatar. Do you still like performing in this life's avatar?

Farhan VU2ESE: I think the note that you picked on was a little too kind. I have never been a poet. All things one could accuse me of, I've never been a poet. Actually, as a kid, I was thankfully rescued from being a complete radio head when I ran into a bunch of kids who met every Saturday and just debated and talked about various things. It completely opened a whole new way of looking at the world for me, as completely a guy with a very severe case of knack.

They were these bunch of kids, teenage kids who were talking about existentialism, Marx, and Ayn Rand every Saturday, tea cups over tea cups of tea, kept arguing with each other, debating about stuff, reading a lot of literature. This was during my college days and that actually got me involved in literature and in literary activities. My family, actually, I'm the only person who's ever strayed into science from my family. Both my parents are writers. I'm the odd guy out.

Somehow, the Young Editors Club, which was the name of this debating society, it still exists, helped me go back and connect to these roots. Of course, if you're growing up in the '80s, it was very difficult to miss music at all. Those are the days of Beatles and Pink Floyd and stuff like that. Actually, I did not pick up any music instrument around that, but far much later and a couple of my friends and I decided to start playing for fun and we did a couple of gigs, but that's all.

I'm not really anything more than that, but we did a couple of gigs. We didn't even have a name for the bands. The band, actually, they called the band as a band with no name. That's what the band started being called as. We really did just a couple of covers here and there. Then after that, most of us went away. Some left the town or some got busy with something or the other, being in touch with the musicians around the town.

I do even now once in a while drop in to one of their practices or strum the guitar sometime when I have to take a break from other stuff. Really, I'm not an accomplished guitarist. Off later, I also started learning Hindustani classical music,

the Indian classical tradition, which is a very strong tradition of different type of classical music from the Western classical music, which is a vocal tradition. I'm training with Aradhnaji who is my guru.

The traditional Indian classical music follows a tradition of guru and disciple that is, you become somebody's disciple and you completely learn under that person's tutelage. I've been learning that for the last couple of years. This is all actually also in large part due to another large part of my life, which is that I run a cultural center in my city called the Lamakaan, which is an open space. It's an open space, which is where our radio station is also based.

The Lamakaan Amateur Radio Station is also part of that, which is a cultural hub where a lot of plays and music, et cetera, happen. I also handle that in my spare time. I mostly take care of the technicals there, the sound and light, et cetera.

Eric 4Z1UG: You have an Elmer for Indian traditional music. That's pretty cool. I'm putting it into ham radio terms. It's amazing, don't you think, how a mentor and Elmer in any discipline can actually bring you a long way very quickly.

Farhan VU2ESE: Absolutely. In fact, I'm very, very convinced that it's a large part of how well you do something depends on who's Elmer-ing you and if you have a bunch of great guys to hang out with. Since we started the Lamakaan Amateur Radio Club, the same thing has happened here. We were just a bunch of ordinary guys and we all got together. There is a professor physiology who teaches at a medical college here. He started figuring out a little more about SDR and actually he and a couple of other guys took on this entire project and delivered something called a VUSDR, the Indian SDR.

It's a fabulous software-defined radio. I personally do not like software-defined radios. I prefer working with the analog radios. People who use it say that it's a really wonderful radio. These are just a bunch of ordinary guys. It's just that they get together and they experiment. They throw circuits around. They figure out what's going on.

Once in a while, we need to reach out to somebody and there are certain groups, for instance, I think that the Yahoo group of EMRFD has some of the best Elmers you can find in the world for radio design. There is Rick Campbell. There is Allison. There's of course Wes Hayward himself who's on the group. These people are accessible. I'm really blown away at how easy it is now to be Elmered as opposed to when it was when we were growing up.

I think it's vital that people who are interested in radio design and homebrewing use these technologies to reach out to these people. I could never imagine about 15 years or 20 years ago that I would be able to have a personal correspondence with Wes Hayward. He's a guy who literally redefined what the modern radios do and look like and are designed. These are like rock stars. It's like being friends with Paul McCartney or John Lennon. It's the same thing for me to be a friend of Wes Hayward, to be able to use his advice in your radios. I think it's a fabulous time to

be a radio ham, really.

Eric 4Z1UG: You made a speech, a very passionate speech on YouTube and you made a distinction between being moral or conventional. What's the different between being moral and conventional?

Farhan VU2ESE: I think those are orthogonal to each other, really speaking. When we are making moral choices, I think we are more driven by our own world view of how we think that the world ought to be, and what we ought to be doing within that world. I think the whole idea of being conventional while simultaneously being with the flow or not really disturbing too many things out, it's also confirming to certain standard types. I won't even say stereotypes, but certain standard types that there are certain normals being defined that you would like to confirm to.

These are not really always a moral choice that you would make and we are increasingly facing these in the times that, for example, my own country is going through, that there is a move towards radicalization on every side. It's very difficult to really choose any convention at all. You have to figure certain things out, even the values. What do you do when your values themselves at times appear to be very fluid or you're learning new stuff and you're learning to engage with problems that you've never thought would exist in the world? Frankly, it's a terrifying thought.

One of the things that I would do when I was in the '80s and there were a lot of riots in my city is find refuge in radio. I remember quite a few times when there were these communal riots happening in my city and I would get into my radio shack and switch on the radio and just listen to the static, because really there was little else that a teenager could do, except to get out on the streets.

Eric 4Z1UG: What advice would you give to new or returning hams to the hobby?

Farhan VU2ESE: For the new hams, I think this is one of the best times to be in the radio hobby. I think it's important for them to build small primitive radios. It's very easy to succumb to a KX3, really. That is my advice. Stay away. The tuna tin is still far more fun than the KX3. There is very little which matches the excitement of a radio receiver that you've build coming alive. Even today, my heart skips a beat when whatever is on my bench receives its first signal, even if you had built a circuit 15 times over, or the first time you were able to transmit your own voice or your own signal. It's really something very, very fabulous.

Yesterday, I was building a very primitive small transmitter and somebody had passed on a link of a WebSDR. In fact, it's www.WebSDR.in. I fired up this rig and I actually tuned to my own signal on the Web. It was such a fabulous thing to know that there was a WebSDR, which was about 1,000 kilometers away, which was picking up my QRP signals. I think very little matches the excitement of building something yourself. It doesn't have to be something elaborate.

This is the time when you can go onto the Net, buy parts, throw this thing together.

If you have a problem, you could reach out to people over the Internet. I think that will be my advice. Go primitive, build something, and get on the air.

Eric 4Z1UG: Ashhar Farhan, it is really such a pleasure to finally have you and to speak to you about homebrewing and about the stuff that you're doing, and especially after the request from Bill that I get you on the QSO Today Podcast. I want to wish you 73 and thank you so much for joining me.

Farhan VU2ESE: Thanks. I'll be looking forward to more of your QSO Todays. My only complaint with them is that they aren't too frequent. We like to have ...

Eric 4Z1UG: They are too frequent.

Farhan VU2ESE: They aren't too frequent. I need more fresh meat every day.

Eric 4Z1UG: A once-a-week podcast is a lot of work, but wouldn't that be great to be able to do it every day.

Farhan VU2ESE: Yeah.

Eric 4Z1UG: Thanks so much, and 73.

Farhan VU2ESE: 73.

Eric 4Z1UG: That concludes this episode of QSO Today. I hope that you enjoyed this QSO with Ashhar Farhan. Please be sure to check out the Show Notes page that includes links and information about the topics that we discussed. Go to www.QSOToday.com and put in VU2ESE in the search box at the top of the page. QSO Today is available in the iTunes Store and the Stitcher Podcast app for both iPhone and Android. There are links to these places on the QSO Today website.

                Of course, there are many podcast managers now for smartphones. If you have one that you particularly like, please let me know by email. Please take the time to join the QSO Today community. Our community at this time receives my weekly blog post as an email introducing the next episode and we have a Facebook page where many of our QSO Today guests are available for questions. There are buttons on the website and on the Show Notes pages. I promise not to spam you or share your email address with anyone.

                Until next time, this is Eric, 4Z1UG, 73.