
VHF/UHF – An Expanding World

David Smith VK3HZ

Weak Signal

David Smith - VK3HZ

Early January produced some good propagation and contacts across the Bight, not the least of which was the new 10 GHz World Record contact, already reported last month.

On the morning of January 5th, the VK6RST 2 m beacon in Albany was heard weakly by a number of VK3 stations – the furthest being Jim VK3II at 2415 km. Rob VK6LD/P's portable station in Albany got a workout on 2 m working a number of VK3 stations.

The next morning - January 6th – at about 2100Z, Ian VK3AXH reported hearing VK6RST at 5x7 with lots of QSB, later peaking to 5x9. He worked Rob VK6LD/P on 70 cm with a 5x7 report – a distance of 2340 km. That evening, Mark VK6BSA, to the east of Esperance, worked Colin VK5DK in Mt Gambier on 70 cm. Colin's IC-910H was playing up and not indicating any output. Nevertheless, he received a 4x1 report from Mark. After some quick repairs coaxing some output from the radio, he was up to 5x7.

144MHz and Above Activity from Mt Gambier

Colin VK5DK has kindly submitted this piece about his recent activities:

Activity on 144MHz and above since the early part of December 2014 has been reasonable with some very good contacts being made.

Most mornings at 0800 CST time Robin VK5TN, Gary VK5JR and myself VK5DK have a regular contact with Gordon VK3EJ on 144.100 MHz This is a 480 km distance contact which is quite regularly enhanced by aircrafts on their descent into Tullamarine airport. Signals are usually quite good and with aircraft enhancement are up to 5/9 on a regular basis. Also regular contacts are had with Jim VK3II and Ian VK3AXH when beaming in the Melbourne direction

On the 19th December, I was able to work Rob VK6LD/R on 144 MHz with his remote station in Albany. Rob has set up this station which he remotely operates from his Perth QTH. Rob also can operate on 432MHz with this setup

On the 23rd of December, there was a Sporadic E 144 MHz opening to Rockhampton area from Mt Gambier with a contact to Ray VK4BLK and at the same time Adelaide stations were working into the Brisbane area. This has been the only Sporadic E opening on 144 MHz that has happened this DX season that I am aware of to date

There was a good opening to the east from Mt Gambier on the morning of 31st December (30th Dec UTC) with several Gippsland stations being worked as well as the 432 MHz, 1296 MHz and 2403 MHz VK3RGI Beacons being very strong into Mt Gambier.

On the 4th of January 2015, conditions were good with contacts to Ralph VK3WRE and Jim VK3ZYC in Gippsland, followed the next day by good signals to the west with contacts to Mark VK6BSA near Esperance and Rob VK6LD/R from his remote station in Albany.

At this time, Owen VK5HOS and myself (VK5DK) decided to go to Mt Burr (highest

location in the S.E.) to attempt a contact with David VK5KK on 10 GHz and 24 GHz with success on 10 GHz over the 360 km path, but no signals detected on 24GHz. It was during our QSO on 10 GHz that David VK5KK advised that Rex VK7MO/P was having a successful Digital QSO with Derek VK6DZ/P on 10 GHz and later an SSB contact for a new World 10 GHz record. Congratulation Rex and Derek. When I turned my 10 GHz dish to the West I could quite easily hear the WSJT tones on 10368.225 MHz from Derek VK6DZ/P although he was beaming some distance to the south of our location. I advised David VK5KK of this who in turn passed a message via the VK Logger to Derek VK6DZ/P. Derek turned his 10GHz dish towards my location and a very easy two way SSB contact was completed over a distance of 2066 km, which is a new VK5/VK6 10GHz State record. Signals were 5 x 7 at my location and 5 x 2 at Derek's location.

Also that evening, with conditions still favourable to the west, VK6BSA was worked on 144 MHz plus VK6LD/R being contacted on both 144 MHz and 432 MHz SSB. Conditions still very good the next evening with VK6BSA, VK6VOX and VK6NB being worked with VK6BSA being contacted as well on 432MHz.

Conditions have not been as good over the past couple of weeks although the Hepburn Charts suggest conditions may improve in the next few days (early Feb).

One thing Colin didn't mention is that Derek VK6DZ/P was using 70 cm as a liaison for the 10 GHz contacts. Signals were extremely strong on 70 cm. After the 10 GHz contact, Colin switched off the transverter and disconnected the FT-817 IF radio. However, he then heard WSJT tones coming from the FT-817 – with no antenna connected. It turned out to be Derek working Rex VK7MO on 70 cm!

VK7RAE Beacons now GPS-Locked

Thanks to a lot of hard work by Joe VK7JG, the VK7RAE 6 m, 2 m, 70 cm and 23 cm beacons located on Don Hill near Devonport are now all GPS-locked. The beacons key once per minute with callsign and gridsquare. As before, the 70 cm beacon when "keyed down" runs dits instead of continuous carrier so that a nearby garage door can still be operated with its 433 MHz Remote Control.

For technical reasons, the 2 m, 70 cm and 23 cm beacons are not precisely on the nominated xxx.474 frequency. However, the difference is less than 10 Hz. The actual frequencies are the subject of an FMT (Frequency Measurement Test) challenge, currently running on the VK Logger.

Please have a listen for the beacons and give your best estimate of the actual frequencies, which will also provide Joe with feedback on coverage.

Please send any Weak Signal reports to David VK3HZ

Digital DX Modes

Rex Moncur – VK7MO

24 GHz EME World Record Extended

On 31 December 2014, Rex, VK7MO, extended the World 24 GHz EME record to 17464 km with G3WDG. On the same date VK7MO also extended the Czech Republic 24 GHz EME distance record to 16438 km with OK1KIR.

The key issue in operating at long distances for 24 GHz EME is the loss due to water vapour absorption. In the case of long distances both stations must beam close to

the horizon and thus the signal goes through much more water vapour. For the previous World Record VK7MO operated from Mount Wellington at 1270 metres to reduce the amount of atmosphere through which the signal propagated and thus the losses due to water vapour. In order to increase the distance it was necessary to go further South- East to Tasman Peninsular where there are no high mountains and thus absorption losses were increased by around 2 dB. This additional loss was overcome by both stations phasing up two of the 10 watt PAs they previously used to achieve around 20 watts. The result was about 1 dB improvement which allowed relatively easy QSOs compared to the earlier QSO from Mount Wellington. A more detailed report is at:

http://www.ok2kkw.com/next/vk7mo/24ghz_tests_vk7mo_ok1kir_q3wdg.pdf

Please send any Digital DX Modes reports to Rex VK7MO

Meteor Scatter

Dr Kevin Johnston – VK4UH

Achieving and Surviving your first M/S contact

Over the recent Christmas holiday it was good to see a number of new callsigns appearing on the activity sessions. Since the “learning curve” can be quite steep and indeed daunting at the start I thought it might be helpful to go back and run through some basic information and tips about MS operation with the hope of encouraging others to give it a try. This is not intended to be a comprehensive M/S operating manual, just enough information to get going and survive that first Meteor Scatter contact. In this context I will be talking about FSK441 digital M/S operating on 144 MHz.

Firstly – Why Bother? Meteor Scatter propagation will allow contacts to be easily made on 144 MHz out to distances of about 2300 km, way beyond the normal range on 2 m except under the most exceptional conditions. QSOs are possible therefore between the eastern and southern state capital cities and across to ZL. QSOs can be achieved on almost any day of the week under flat-band conditions.

So what’s needed? The basic entry-level setup is already to be found in many modest 2 m SSB stations. Almost any basic transceiver running about 50 watts or more will suffice. GPS frequency locking is not required, “ordinary” frequency accuracy and stability is adequate. FSK441 mode is designed to allow for a degree of Doppler shift of signals and can decode signals even 200-300Hz off-frequency (which would render an SSB signal completely unintelligible). Even operating SSB, most operators will recognise a small frequency offset between their rigs and the stations they are working. It’s easy with a little practice to compensate for this in each particular radio. For an antenna, a 6-8 element Yagi beam above 10 m in height is close to ideal. Antenna elevation control is not required; most signals will be received at low angles. Masthead pre-amplifiers are not required either. Unlike EME communication, signals received by M/S are frequently loud, well above the noise floor and are easily heard in the loudspeaker. Received pings are generally strong, they are just very brief. While it is possible to achieve contacts with lower power or even with vertical antennas this is going to be hard and frustrating work at both ends of the QSO.

On the digital side, any station already set up to run any of the computer generated modes will likely already have all the hardware required. These including WSPR, JT65, PSK31, SSTV, RTTY, packet etc. The computing power required to run FSK441 is very modest and easily achievable by most desk or laptops, with just about any OS likely to be still in use. In common with most computer-generated

digital modes, FSK441/WSJT is based around audio signals generated and decoded in the computer being transmitted and received via the normal microphone/earphone path of an ordinary SSB transceiver, using only the normal SSB voice bandwidth. As with the other digital modes, some form of interface is required to transfer the audio in and out between the transceiver and computer at an appropriate level and without interference from RF, mains hum or other sources. Also, the interface has to allow the computer to operate the PTT of the transceiver during transmission. For stations not already set up for digital operation, there are many homebrew and commercially available solutions including off-the-shelf options including the Signalink and Rigblaster modules.

Software

The WSJT suite of software, written by Prof. Joe Taylor K1JT, is available off the net and free of charge for amateur use. It may be found at <http://physics.princeton.edu/pulsar/k1jt/> In general it has proven easy to install and run. It is worth downloading and printing out the comprehensive user manuals for the various modes for future reference, from the same site. Take the time to print out and read the instructions about configuring the software to arrange the audio in and out paths and levels and the PTT control. In my own experience, using the Signalink type interfaces, which are effectively outboard USB soundcards in their own right, the software configured itself with no user input at all. The only catch was setting the right playback level (to maximum) in the audio mixer panel on the computer to allow the PTT to operate. It is worth taking the time to familiarise yourself with the various screens and on-screen controls. For most digital modes it is usually possible to try everything out with a local station while you find your way around the various software and hardware. This may not work with FSK441 and it is common to decode either garbage or nothing at all on strong constant signals. Bear in mind, FSK441 was designed to decode short bursts of signal and it frequently performs very poorly on local stations.

Next you will need a basic understanding of how a Meteor Scatter QSO runs, what exchanges will occur and what the reports used in FSK441 mean.

The exchanges

As with any other mode, most FSK441 M/S QSOs will start with a CQ :

CQ VK4UH

i.e. the string (the transmitted message) "CQ VK4UH" is typed in and is transmitted for 30 seconds out of each minute and will continue for as long as necessary for someone to respond.

To be clear the " " symbols are not typed in the string, They are just here in this article to show the format. When the CQ is received by a distant station, say VK1ABC, he would respond by transmitting :

VK4UH/26 VK1ABC

The report 26 (see Reports below) is separated from the destination callsign by the "/" symbol and no spaces. This clearly defines the report 26 as being intended for VK4UH. The callsign of the transmitting station always has a "space" at either end for clarity. This string is again transmitted for 30 seconds out of every minute until it is received.

When decoded by VK4UH, the string would be changed to:

VK1ABC/R26 VK4UH

Again the callsign of the transmitting station, now VK4UH, has a space at either end for clarity and VK1ABC is being sent the report R26 – separated by the “/” symbol. “R” in this context means “Roger – I have received my report- and my report to you is also “26”. The report 26 is the equivalent of 5/9 on SSB and is the commonest exchange. This is certainly what you will use as a new user. Again this string is transmitted for as long as necessary until it is received by VK1ABC

When decoded by VK1ABC, his string would be changed to:

VK4UH/RRR VK1ABC

The same format confirms who is transmitting. “RRR” (Roger Roger Roger) indicates that all required information has been exchanged i.e. both callsigns and reports in both directions. When the RRR string is decoded by VK1ABC the QSO is actually complete. However VK4UH cannot know that and would keep on transmitting the previous report. Once RRR is received by VK1ABC he would then, as a courtesy, change his string to:

VK4UH/73 VK1ABC

When VK4UH sees his 73 report he would go back to CQ or to call another station.

The Report

FSK441 M/S reports consist of a two digit number.

The first digit indicates the length or duration of the ping received:

0	<40ms
1	40 – 100ms
2	100 – 1000ms
3	>1000ms

The second digit indicates the signal strength:

6	0 - 10dB (above noise)
7	11 – 16dB
8	17 – 22dB
9	>22dB

As above “26” is the commonest report used and “26 and 27” will account for virtually all reports. Pings with a duration of less than 100ms (i.e. 0 or 1) rarely give complete decodes.

To make this QSO process simple, the WSJT programme provides six pre-populated transmitting fields (Tx1 to Tx6) on the main operating screen. These contain all of the usual steps for both sides of a QSO. Each individual operator needs only to alternate down the steps, his starting point determined by which station called CQ. The callsign of the station to be called can be manually entered in the “To Radio” box or this will happen automatically if the cursor is clicked over a “clear” callsign on the received data screen. Once the callsign is in the “To radio” the messages are populated by pressing the “GenStdMsgs” (Generate Standard Messages) box.

The report protocol used by VK stations is slightly different (and improved) compared to that used in some other countries. Once you have the WSJT programme installed and running for the first time, it is recommended that the VK protocol be adopted by modifying the OPTIONS screen. Click “Setup” in the pulldown menu. It will be necessary to insert your own callsign and gridsquare into “Station Parameters” and it may be necessary to alter the audio and PTT parameters depending on the interface in use. Then update the message templates for TX 1 to TX 6 to match those in Fig 1 below. Ensure that the transcription is exactly as written, especially the positions of

the spaces etc. These settings are then held indefinitely.

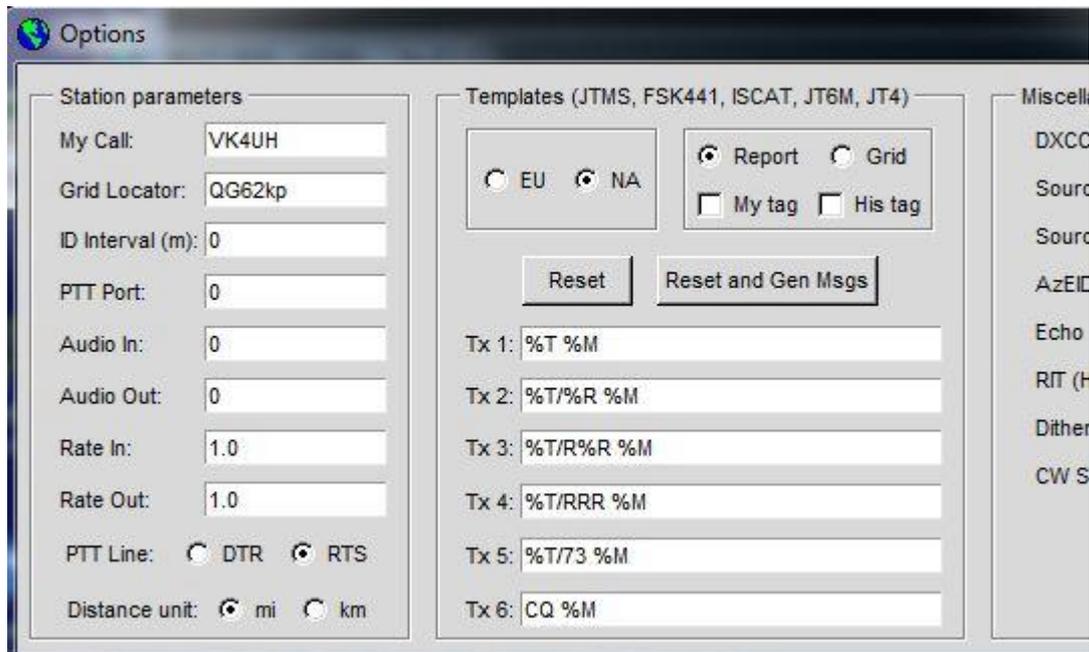


Fig.1 – WSJT Setup Screen

The When and Where and the Timing – the last few jigsaw puzzle pieces!

Meteor Scatter can be used at any time. However in VK there are two regular weekend activity periods on 144MHz. These are where most new operators will achieve their first QSO.

The activity periods run early in the mornings on Saturday and Sunday between 07:00 and 08:00 am NSW/Vic clock times (20:00 and 21:00 UTC in summer) when Meteor activity is most conducive to good propagation. Activity often starts from 19:00 in the summer months as the northern states are already well past dawn by 20:00.

The primary M/S operating frequency in VK and ZL is 144.230MHz with the radio set to USB. To get going, FSK441 is selected from the "Mode" box in the pull-down menu. Start with "S" (sensitivity) parameter set at 2 and the "Tol" (tolerance) set at 400. "S" can be set from -9 to +9. The lower the setting, the more on-screen garbage will be seen; higher settings reduce this problem but also block decoding of weaker pings.

Background noise should be seen on the horizontal waterfall display on SpecJT screen and the level bargraph showing around 0 dB on background noise. If not, adjust levels appropriately and ensure the "Monitor" bar is on. It is good practice to receive only for the first few complete periods. Received pings are usually clearly heard in the loudspeaker and appear as a coloured area on the SpecJT screen. The software will automatically attempt a decode on received pings at the end of each receiving period. Decodes can be forced on-the-fly however at any time, by clicking the left mouse button with the cursor placed over the ping on the SpecJT screen. Multiple decodes can be attempted if required changing the "S" setting find the best level for your own system.

Which Period for Transmission?

Each minute is divided into two transmitting periods. The First Period runs from the top of the minute (0 seconds) until 30 seconds. The Second Period then runs from 30 seconds back up to 60 seconds. This is selected by the operator by checking (ticking) the "TX First" box on the main WSJT screen. Clearly two stations must be transmitting in the opposite periods in order to hear one another and achieve a QSO. To make this work properly the computer clocks at either end of the QSO must be accurately set to within a second or two of each other. There are many ways this can be achieved, the easiest of which is by the use of Internet time servers. There are many applications to achieve this, some automatic, or just a manual time-sync by the operator every 30 mins or so. This needs to be practiced and confirmed in advance of appearing on the activity sessions. If not correct, then you risk transmitting when your close neighbours are trying to receive and this "isn't popular"

During the normal weekend activity sessions, a convention has evolved in VK to determine the the appropriate operating period. Northern stations, i.e. VK4, always transmit 2nd Period and beam south. Southern stations i.e. VK3 and VK5 always transmit 1st Period and beam north. Stations in the middle i.e. VK2 and VK1 change period depending on the day. On Saturday mornings they will operate 2nd Period and will beam south to work into VK3 and VK5 etc. On Sundays they operate 1st Period and beam north to work into VK4.

Obviously where two stations are in range of each other by tropospheric or other propagation modes, then they must be transmitting in the same period otherwise they will cause QRM to each other. This can be a problem for stations operating away from the major capital cities and towards state border lines. In such circumstances, the usual Call-Area protocols may have to be reversed. Best to seek advice from a local and follow what they do. As a general rule when you start out, you should not be hearing loud continuous FSK441 signals while you are receiving. If you can then something is wrong, most likely you are transmitting in the wrong period. Loud signals at the beginning or end of a period suggest that either you or a station local to you have clock timing issues. Remember you will potentially be sharing the single operating frequency with several other operators. Good operating practice requires us all to do everything possible avoid interference to other stations.

Bear in mind also that when your system is live, any audio from your computer that you would normally hear in the speakers will key the transmitter and will go to air. During Meteor Scatter activity periods there will be many stations operating on the same frequency, some distant and some local. Any audio unintentionally transmitted out of turn or in the wrong period will deafen you neighbours. Take the time to disable all other computer sounds in the mixer panel and switch off applications such as e-mail or VK-Logger notifications, Itunes and Skype etc. which will otherwise go to air. Likewise, when operating any digital mode, ensure that the normal station microphone is closed otherwise shack sounds will also go to air during transmission and can corrupt the transmitted signal.

Where to point the Antenna.

In general you point your antenna in the direction of the stations you are trying to work. In reality however the meteor trails giving rise to pings we hear can occur over a wide arc extending on either side of the direct path. This phenomenon gives rise to two "hot-spots", one on either side of the direct beam heading. Depending on the time of day and season, one or other of the hot-spots statistically produces more reflections than the other. This can be the best direction to aim the antenna. The WSJT/FSK441 software provides information for optimum beam heading. When a callsign is placed in the "To radio" box and the "Lookup" button clicked, the software looks in a data base for the grid-square of that station. If the gridsquare is known

then the software calculates the distance, azimuth and the likely elevation of the direct path from your station. In addition the software also indicates which of the two Hotspots (A or B) and their corresponding azimuth (beam heading) is likely to be best at that time. Look for this on the main screen. If the gridsquare is not found in the data base then this can be added manually and saved for another occasion.

Checklist for the first QSO

Install the software, RT-M, set up the radio and interface and get it all working in advance. I recommend users monitor the outgoing "machine-gun" FSK441 audio. This helps you to recognise the incoming pings and frequency offsets etc.

Set up and test computer clock syncing. Insert your callsign and messages into "options"

Set the alarm clock for early and take coffee to the shack by 19:30 UTC for one of the weekend activity session. (Allow the rig time to warm up and the frequency to stabilise)

Select 144.230MHz USB mode. Point the beam. Connect to the VKLogger

Run WSJT software and select FSK441 mode. Ensure "Monitor" is on. "AUTO" off at this stage.

Set basic parameters and audio levels as above. Background noise should be visible on the SpecJT screen, the level set to about 0 dB. Select the period you wish to operate. Check computer clock is synchronised.

Wait and be patient. Meteor pings come in random order. Sometimes there is nothing for several periods followed by multiple pings in the next. As you are not yet transmitting, you will be receiving both periods. Signals from any stations local to you will be heard for the whole of one period, remember you may not be able to decode these.

Listen now for "pings" in the other period. These will give a "Pzzzzit" sound in the speaker and will leave a coloured trace on SpecJT. Move the cursor onto the coloured area and click the mouse to force a decode. Decoded signals will appear in the text window. If you can identify the source callsign (space at each end) transfer this call to the "To radio" window. It doesn't matter if that station is already in QSO, you can call them. With experience it is possible to be working more than one station at a time – but just try one at a time initially. When ready to transmit select "Auto on" and you are away!

If you are hearing pings but not getting decodes, then there are a number of possibilities. The sounds you are hearing may not be FSK441. Maybe static or birdies etc., just keep listening. You may be too far off frequency. In this case the pings will not sound like your transmitted signal and the "DF" indicated in the data screen may give you a clue. If both stations are exactly on the same frequency then DF=0. If the DF is above 200-300Hz on all the stations heard then decoding may become erratic. Rule of thumb if DF is indicating large negative values move your rig LF in frequency by this amount, if large positive DF values move HF by this amount, and try again. Worth checking too that your RIT or shift is not turned on.

Hopefully this will have given you enough background information and some advice on the common pitfalls of MS operation for you to confidently attempt your first M/S QSO. This was only intended to get started with this truly fascinating aspect of the hobby. Once you succeed with your first completed QSO you will probably be hooked!

A Strategy for Managing Poor Conditions

There are days when conditions for Meteor Scatter communication make it hard going to complete even a single QSO. Days characterised by meteor returns being weak, short and infrequent. The Triple-Cripple. Days such as this make you wish you had stayed in bed for that "lie-in". Even under these poor conditions however there are things worth trying to improve the success rate. Consider the following strategies:

Making the Most of what you receive

Using the FSK441 mode, when conditions are good, it is possible to just sit back and let the computer do all the work. At the end of each receive period the programme itself will identify pings of FSK441 signals, apply a red marker on the waterfall, and a decode appears in the receive text window. You could even do this with the speaker volume turned down! This however is never the way to get good results, particularly when conditions are poor. Firstly, left to its devices, the programme will only ever attempt to decode one, usually the loudest, ping from each period. Where there are multiple pings, even if loud, the remainder will be ignored. On weaker pings, the programme may not even identify them as FSK441 and again will ignore them. A far more effective way to operate, especially as conditions worsen, is to turn the speaker well up, turn the AGC off where possible and manually force decodes by mouse clicking on each and every ping heard. It will also improve success to have multiple attempts on weaker pings with different settings of the threshold "S" parameter. The range of possible "S" settings is from -9 to +9. Lower settings produce more on-screen garbage, higher settings will eventually prevent all decode attempts. Remember also that on longer burns from hyper-dense meteor trails, there may be signals from more than one station in each ping. It is worthwhile scrolling very carefully across these, forcing multiple decodes particularly at each end of the burn.

Be realistic – common sense works

It is neither possible nor necessary to have a perfect decode each time for every step of a QSO. We wouldn't require that on SSB or CW either. A degree of corruption of the received string can be accepted. A single character missed or corrupted can be accepted – just like on phone. Eg "JK4UH/RRR VK3AMX". This is clearly a report to me with loss of certainty at the ends of the string as the meteor ping is fading. There is no JK prefix and I am in the middle of working VK3AMZ – hence the RRR report. What about "\$%4UH/RRR VK*76". This too can be OK if I am only at the RRR stage with one station or I can identify the source of the report by another means. For example if VK3AMZ consistently has a "DF" frequency offset of 42 Hz on all previous pings and this partial string has the same frequency offset, this too is valid. Bear in mind that acceptable protocols in other modes, such as JT65 or CW EME, do not require callsigns at all for some steps of a QSO, only OOO, RO or RRR reports being transmitted. Remember too that the QSO is considered complete when the RRR report is received. The 73 is really just a courtesy to advise the sending station to stop sending RRR and to move on. The same is obvious if the receiving station changes back to CQ or starts reporting to another station.

Shorten the String

The fundamental advantage of digital communication for all weak signal communication, including for MS, is repetition and redundancy. The same transmitted "message" is repeated time and time again by the transmitting station until the essentially random meteor return conducts it to the receiving station. Using FSK441 mode, a transmitted message, the "string", is encoded using one of four audio tones at 882, 1323, 1764 and 2205 Hz being transmitted at a rate of 441 Baud and transmitted for a precise period of 30 seconds from each minute. Each letter or character in the available 43 character alphabet is represented by a sequence of three tone transitions requiring 2.3ms for transmission. Each specific audio tone,

when transmitted through an SSB transmitter, produces a single carrier frequency on air which gives the frequency shift keying (FSK) as the audio tone changes. In the SSB receiver at the other end the four carrier frequencies are transposed back to the four audio tones.

Using the FSK441 format in WSJT allows for a maximum string length of 28 characters thereby allowing the entire string to be conducted on an average meteor return of 100ms duration or greater. Typical strings include the callsigns of both transmitting and target stations and one of a number of reports or signals. Examples might include "VK3AMZ/26 VK4UH", "VK3AMZ/RRR VK4UH" or "CQ VK4UH QG62" etc.

In this VK/ZL designed protocol, the use of the "/" character is used between a callsign and a report to designate the target station. This improves clarity, particularly when conditions are poor, where there are multiple stations operating and where partial decodes are common. The callsign of the transmitting station will always have a clear space at either end while the target station(s) will always have a "/" at the end.

When conditions are very favourable, with long and loud pings being received, then it is possible to be conducting QSOs with two or even three stations simultaneously by carefully using the maximum 28 characters. Eg. "VK3AMZ/26 VK3HY/R26 VK4UH" or "VK2BLS/73 VK5PJ/R26 VK4UH". Pushing even further and stripping out the prefixes "2AMS/26 3HY/R26 4EA/73 9NA". This of course is a trade-off, the longer the string the less statistical chance there is of a complete decode being received. When conditions are poor, the shorter the pings and the weaker the returns, it is common to lose more than is gained by operating in this way. This is compounded in meteor scatter work as the received signal is not of constant strength through each ping. At either end of a ping the signal is weaker leading to more uncertainty and more on screen "garbage" at each end of the string. The key to success under these conditions is to shorten the string as far as possible, removing all unnecessary characters and spaces and to abandon attempts to work multiple stations e.g. "3AMZ/R26 4UH". If you imagine the logical extrapolation to where only a single letter "R" with no spaces was transmitted then the chance of a decode would be very high indeed. Be quite clear - the more characters sent in the string, the lower becomes the statistical likelihood of decoding.

MSRX – parallel decoding

MSRX (Meteor Scatter Receiver) is an alternative software programme. Like WSJT, MSRX is freely distributed for amateur use. This is a receive-only system capable of decoding both FSK441 and PSK2K meteor scatter signals. Operating with this programme is quite different from WSJT. The first thing to know is that MSRX does not monitor off air, it can only decode from existing captured audio files. When configured appropriately, at the end of each receive period, the WSJT programme writes a .wav file to the computer hard drive containing the raw audio signal as received during the last period.

MSRX can however be left running in the background, even on the authors modest shack laptop, and can be configured to read the WSJT .wav files and effectively have a "second go" at decoding any received pings. The decoding process is fundamentally different between the two programmes in a number of ways. Firstly, unlike WSJT, MSRX automatically attempts to separately decode all received pings irrespective of received signal strength. There is no equivalent of the threshold or "S" setting in WSJT and it is not possible to manually force a decode. MSRX indicates the level of confidence in decoding by changing the density of the typeface on screen characters. More importantly, the programme seeks repetition of character sequences across multiple pings and will frequently produce a complete and

accurate decoded string, by stitching together sequences decoded across a number of pings within a single receive frame where only partial or corrupted decodes were found in WSJT. MSRX can also be configured to highlight specific sequences such as specific callsigns or just suffixes as a further aid to reception. By virtue of this process MSRX is not decoding in real time and its output does not usually appear on screen until well into the next Tx period. However, it is a very useful aid to success particularly when conditions are poor.

Consider Alternative Modes

There are alternative digital modes, other than FSK441 for Meteor Scatter. ISCAT and PSK2K are unlikely to help when conditions are poor. The former is more suited to 6m MS operation and the latter useful when conditions are enhanced. In the authors experience, the only serious contender for use during poor conditions is JTMS (Joe Taylor Meteor Scatter). This mode is available in the later versions of WSJT, from the mode options pull-down box, and was present as a hidden file in earlier versions. On screen the JTMS mode appears essentially identical to FSK441 and the transmitted audio is indistinguishable by ear. The decoding process is quite different however and cannot be covered in detail here. Suffice to say that the mode appears to give an advantage when conditions are poor and appears to provide decodes on very short pings below 100ms where FSK441 struggles. On the downside the setting of the "S" parameter is critical and has to be varied between loud and weak pings in order to get decodes. Also there is significantly more on-screen garbage at either end of received pings. More importantly the two modes FSK441 and JTMS are entirely incompatible; neither mode can be decoded by the other receiver. Consequently they should not be used concurrently on the same working frequency while other stations are operating. In VK or ZL it would be advisable to move to the secondary MS frequency 144.330 to use JTMS during activity sessions at least. Another drawback is that the current version of MSRX suite is unable to decode JTMS for the "second go" as above.

Another very valuable tool in the MS Armoury is the "ST" (Short-Text or Single-Tone) mode. This mode is available from within FSK441 and is activated by checking (ticking) the Rx ST and Tx ST Boxes on the WSJT working panel. In this mode, one (only) of the four basic audio tones is transmitted constantly during the transmit cycle. The four tones are used to signify (code for) the four possible reports 882 Hz = R26, 1323 Hz = R27, 1764 Hz = RRR, and 2205 Hz = 73. Each specific audio tone produces a specific on-air blank carrier of course, only its frequency carries the information as there is no other modulation to be detected. Even the shortest detectable ping, well below 100ms, will be decoded as one of the reports, will show as a bright spot against the corresponding calibration lines on both of the WSJT panels and can easily be distinguished by pitch with the unaided ear.

There are a few provisos when considering this mode. Only one of the four reports as above can be transmitted. There is no information to identify either the source or destination station. Before use therefore there must have already been an exchange of callsigns and in practice therefore the first normal report sequence ie. VK3HY/26 VK4UH must have been received. Secondly only one pair of stations can be using the ST on a particular frequency at the same time. Realistically this limits the use of this mode during normal activity sessions except by arrangement

It is reasonable to wonder if this is a valid exchange. It should be remembered however that in a digital EME QSOs using JT65 and also in a CW EME QSOs that once callsigns are exchanged, then the subsequent confirmation reports RO, RRR and 73 are also sent by an alternating single tone sequence in JT65 or plain CW in that mode without any other information indicating source or destination stations.

Experienced MS operators will frequently switch to ST mode to complete an

established but difficult QSO when conditions are poor. Single tones are easily distinguishable by ear to indicate that this course of action has been taken. On a practical note, when using ST, it is necessary to have only the required report in the Transmit message window. No callsigns or other characters. When working correctly, the on-screen message in WSJT will change from yellow to blue to indicate ST is operating. Monitoring the transmitted signal will produce a single audio tone, useful to train the ear to the tones to be listened for.

Is it reasonable to indicate that this action has been taken using facilities such as the VK Logger? Well this operator at least believes this to be an acceptable practice, as long as the report itself is not disclosed by any means other than reception on-air.

Other common sense tactics apply including pre-arranged operating times, activity sessions and fair use of resources such as the VK Logger. Be persistent, get up earlier, get as much power as possible up to the antenna feed point and encourage others to try this mode of propagation. The more stations on-air the more chance of a successful QSO!

Please send any reports, questions or enquiries about Meteor Scatter in general or the digital modes used to Kevin VK4UH