MARS-ALE Radio Control

"The Road Ahead"

DRAFT 1.04

All HF SSB Transceivers and Receivers are **NOT** created equal. As such they are **NOT** all suitable for 2G ALE (or future 3G ALE support) using MARS-ALE. This too is true of MIL-STD and STANAG data modem application via MARS-ALE or MS-DMT or with a hardware modem.

However the hardcoded radio support provided by MARS-ALE has been extremely liberal in the past, where virtually all make/model HF SSB transceivers and receivers in extant were supported to give everyone ALE access. That will change with new ALE tools coming along.

The list of currently supported radios in MARS-ALE v3.00 is quite long, it includes Amateur, Marine, Land Mobile and Military grade transceivers. Many make/models were manufactured as far back as the 1980's. In the past it made sense to support every HF radio under the sun so to speak. It provided the new MARS-ALE user an immediate means of working with MARS-ALE in full multi-channel ALE operation vs. single channel only.

However many of the supported transceivers, especially Amateur Radio grade models are not really suitable in one or more areas to include not being robust enough for all aspects of 2G ALE operation. The transceiver requirements are especially critical when it comes to follow on digital communications using Military serial tone waveforms such as MS110A/STANAG 4415.

The use of long serial tone modem data transmissions can really take a toll on the radio as to potential overheating and distortion as well as Power Amplifier stage damage and also frequency drift when no TXCO is installed.

Almost all HF SSB transceivers make use of relay selection of spectral purity filters. This is even true HF-ALE transceivers where the ALE controller holds those pesky spectral filter relays in bypass during ALE scanning. Some HF radios that use relays for TX and or RX filtering, such as in high end receivers, provide for bypass when using the radios build in scanning features. In one way or another a user developed modification could be applied to bypass those PA filter relays for ALE scanning in any transceiver. However many never transceivers are using relays in other areas having to do with the receiver section.

The new radio criteria for MARS-ALE will create three transceiver classes for supporting a radio for remote control; Preferred Class, Minimally Preferred Class and Acceptable Class. One main issue of contention will be that of Spectral Purity Filter selection in multi-channel 2G ALE operation as detailed later herein. The best results with MARS-ALE v4.0 and other developing ALE tools off MS-Windows in 2G ALE multi-channel operation will be had using a radio that meets the Preferred Class criteria.

A future refined set of criteria will come about to address STANAG 4538 (S4538), the 3G ALE standard when/if implemented within the ALE toolbox. S4538 in a single channel Asynchronous

implementation would come first, followed by the same in a multi-channel implementation along with the option of 2G ALE at the same time locked into the 3G ALE 1.5 ch/sec scan rate. The final step would be implementation of GPS based Synchronous S4538.

In time MARS will need to be 4G ALE capable as well, however that level of interoperability goes beyond the current approaches, it will required an all HF-SDR transceiver approach. A class of HF-SDR transceivers with features beyond what is currently on the Amateur Radio market will be required.

The time has come for a change in radio criteria as we need to raise the bar in on-the-air performance. This requires removing support for less than suitable radios and approaches to radio control support which shall begin with the next new ALE tool, where there will be no hard coded radio support. Under MS-Windows the MARS-ALE v3.nn tool as to radio control will remain pretty much "AS IS" currently. However a few required minor changes will be made as shall be detailed herein.

As MARS-ALE v3.nn will be up to date (when/if a MARS-ALE v4.00 debuts) continuing its use for some amount of time shall be an option for the user that does not have a transceiver that meets the new radio criteria. However when new features are added to the ALE toolbox, regardless of the ALE tool in question, that are required in support of the MARS mission, that will not be implemented in the then current MARS-ALE v3.nn it will then be time to migrate to MARS-ALE v4.00 or whatever new ALE tool(s) are being provided.

The biggest change to existing MARS-ALE v3.nn radio control is that of the hardcoded Split VFO QS/S support. It will require that the radio in Split VFO operate at **9600 baud** minimum. The custom port parameters configuration dialog already starts at 9600 baud. A user selection shall be provided at first to manually disable hard coded Split VFO operation. This will enable better 4800 baud operation. This support also provides for continued use of older 4800 baud only radio (e.g. many Kenwood models) when they are hardware modified for QS/S operation. The issue being that QS/S does not work 100% using Split VFO at 4800 baud at the 2 ch/sec. scan rate, let alone faster, especially with Kenwood radios due to all the CAT command overhead required. At a later date all radios that operate at less than 9600 baud will be removed from MARS-ALE v3.nn prior to the final update of the tool.

Any make/model radio that is not hard coded into MARS-ALE v3.nn for support can be used via the "MMI-RADIO" or the new "DLL-RADIO" driver support to be implemented. As long as the make/model radio(s) in question can operate at the **9600 baud** minimum requirement. The use of DLL-RADIO is the best way develop a radio control driver.

There will be no hardcoded radio control support provided in new ALE tools on MS-Windows and beyond. All HF Radio Remote Control (ARS CAT) in future ALE tools that I provide, regardless of PC, SBC or Embedded host based will be external driver based only.

The focus of all drivers shall be shared libraries on Windows (.DLL) and Linux (.SO) which I shall create for HF transceivers that I am able to test and validate for their application use. Under Windows using MARS-ALE the naming convention of the .DLL can be anything as its GUI

driven. Thus more than one driver can exist for selection. However on future Linux based hosts where the ALE tool will not have a GUI as it shall be a black box, a common naming convention shall be used for all radio drivers or the user will need enter the desired driver into a configuration file.

The radio control driver will not only provide for the needed remote control of the radio but also the selection for the remote control method, serial or TCP/IP, the authorized use of the radio within the ALE tool (ALE standard, data modem standard, data link protocol etc.) and whatever else is required.

In some, possibly all ALE tools, I will likely provide a public driver framework for anyone to develop a radio control driver. However as any radio could be supported in so doing, I will place limits on what the driver can be used to achieve as it will be an un-certified driver.

Any late model radio that has USB Codec support and or other desirable features for which owners of said radio develop and test their driver can submit them to me for certification and distribution as certified if written with tools that I use, such as MS-Visual Studio, GNU Compiler etc. for the target operating system.

For example, an un-certified driver will not provide serial support less than 9600 or perhaps 19,200 baud. An un-certified driver will only allow 2G ALE and MS110A PSK as we are using radios for now. Whereas certified drivers will support whatever comes along next, e.g. STANAG 4538 and MS110B PSK etc.

In the existing MARS-ALE v3.nn the hard coded radio selections will be retained with the exception of the really obsolete radios that will be dropped. The DLL-RADIO support shall be added to MARS-ALE v3.nn to support new radios that have come and will come along.

In the following section items 2, 3, 4 and 7 may come to pass as requirements of MARS-ALE v3.nn in due time predicated on other developments that may take place.

FUTURE ALE TOOL REQUIRED RADIO FEATURES

The basic requirements for inclusion RADIO-DLL as a certified radio driver under the new criteria are that the transceiver must be relatively rugged as to its RF section rating and heavy duty as to its heat sink/chassis construction for cooling without the use of fans. A good example with respect to acceptable Amateur Radio grade equipment is that of the ICOM IC-7200. Not all users of MIL-STD/STANAG Data Modem modes will be transmitting long messages or nearly constantly. However some radios are just too lite duty to be considered moving forward. Even the heavy duty transceiver like the IC-7200 and heavier duty radios made for Marine, Land Mobile and Military application will require additional external fan cooling when they are used in high duty cycle transmitting operation.

1. The **Preferred Class** of HF SSB transceiver is one that:

    a. Uses PIN diodes for spectral purity filter selection.

One current example that I am sure uses PIN diodes for spectral filter selection are the MICOM HF SSB transceivers.

NOTE: I had to laugh recently when I read "The IC-7851 incorporates high-grade, long-term reliable mechanical relays rather than PIN diodes for switching the Band Pass. Filters"! There are very few HF transceivers in any class that use PIN diodes. Most use relays as they are cheaper, even COTS and Military ALE transceivers use relays, which are bypassed under signal control of the ALE modem/controller for scanning.

b. Automatically will bypass spectral purity filter relay switching during scanning due to design or modification of the radio.

c. Has no band specific spectral filters to select being a QRP class transceiver where its power output only requires the use of a single broad band spectral purity filter on transmit.

NOTE: An option will be provided for this class of radio in MARS-ALE v3.nn only, to enable use of an SDRplay RSP receiver in a T/R configuration where only the RSP will scan in multi-channel operation. The transceiver will only change frequency when it is time to transmit on a new channel.

2. The **Acceptable Class** of HF SSB transceiver is one that meets all the criteria herein except for that of the **Preferred Class** transceiver. Such radios will be coded for support regardless of no known modification for dealing with the radios spectral purity filter relay issue. Thus the PA spectral relays will bang away during ALE scanning.

   At any time this class of transceiver can undergo a QS/S hardware modification that requires no signaling from MAR-ALE. Such modification have been proven and published for the IC-78, IC-718 and IC-7200. When such modification to the radio is made by the user it can be considered a **Preferred Class** transceiver.

   NOTE: An option will be provided for this class of radio to enable use of an SDRplay RSP receiver in a T/R configuration in MARS-ALE v3.nn where only the RSP will scan in multi-channel operation. The transceiver will only change frequency when it is time to transmit on a new channel.

   NOTE: Future ALE tools will NOT support Split VFO as a QS/S method.

3. The **Minimally Acceptable Class** of HF SSB transceiver is one that meets all the criteria herein but requires signaling from ALE to achieve spectral filter relay BYPASS.

   NOTE: An option will be provided for this class of radio to enable use of an SDRplay RSP receiver in MARS-ALE v3.nn only, to provide a T/R configuration where only the RSP will scan in multi-channel operation. The transceiver will only change frequency when it is time to transmit on a new channel. When the RSP option is enabled the means of BYPASS listed below are disabled. The transceiver will only change frequency when it is time to transmit on a new channel.

The following means in the best configuration order shall be supported to address a transceiver with spectral purity filters via relay selection to achieve spectral filters relay BYPASS:

a. PA Spectral Filter BYPASS via a single CAT command for BYPASS enable and disable. As no hardware interfacing is required, this QS/S approach is simple to use vs. other QS/S signaling. In addition there is minimal CAT command overheard.

NOTE: There are only a handful of existing radios that provide remote control BYPASS selection. It is unlikely that this situation will change without a very large number of customers demanding such support in firmware updates or new radio developments.

b. PA Spectral Filter D.C. signal and return to Ground Auxiliary Port BYPASS signal line interface with the ALE tool. This will require transceiver hardware modification where a D.C. signal line or return to ground via isolated relay contacts will be provided by the ALE tool signaling via one or more user selected means to achieve BYPASS with user provided interfacing. One example is RS232 RTS/DTR line signaling. Another example is the use of inexpensive USB port COTS I/O driver and relay boards, where such devices can be used for other purposes as well, e.g. ATU and ANT SW interfacing.

NOTE: A means to disable the QS/S D.C. signaling will be provided for use when/if a Preferred Class hardware modification comes about for the radio being used.

c. Split VFO QS/S operation in MARS-ALE v3.nn only where the particular make/model transceiver when in split VFO operation will effectively BYPASS the PA Spectral Purity relays during scanning.

NOTE: The worst case example of Split VFO timing overhead is that of KENWOOD transceivers due to the large number of CAT commands required. A baud rate of twice that required for a given scan rate is required for Split VFO QS/S with Kenwood radios. For example, the 2 ch/sec scan rate requires 9600 baud minimum vs. 4800 baud when not using Split VFO.

A means to disable the QS/S Split VFO operation will be provided for use in MARS-ALE v3.nn when/if a Preferred Class hardware modification comes about for the radio being used. When the QS/S Split VFO operation is disabled the user will be able to select 4800 baud operation vs. the otherwise 9600 baud minimum.

NOTE: QS/S via Split VFO support will not be provided in future ALE tools. Hardware modification of the radio will become a must using either QS/S signaling or a stand alone modification such as those for the IC-718, IC-7200 and other radios now in place.

4. The radio (transceiver or receiver) shall support serial I/O remote control at a minimum of 4800 baud where 9600 baud or better or TCP/IP remote control shall be preferred.

NOTE: QS/S Split VFO operation requires 9600 baud or better deal with the CAT overhead in MARS-ALE v3.nn.

NOTE: This requirement shall also apply to MMI-RADIO and DLL-RADIO interfacing, with the exception that MMI-RADIO will not support TCP/IP remote control.

NOTE: MMI-RADIO support will not be implemented in new ALE tools.

5. A transceiver shall support being interrogated in one or more ways as to the specific radio model ID (much in the way a person is finger printed for ID) to validate that the proper model radio is being utilized and that another one is not substituted which may support the same basic remote control protocol. For example KENWOOD and ICOM radios return radio ID information that cannot be user changed.

   NOTE: DLL-RADIO shall provide the means for supporting this requirement, however it will not be mandated for use by third party developers unless they are looking to have their driver certified.

6. Any transceiver meeting the above requirements shall be factory TCXO equipped as standard with an accuracy of at least ±1.0ppm frequency stability, where ±0.5ppm is more desirable.

   NOTE: In future ALE tools, a radio where a factory TCXO option exists vs. included standard, does not qualify unless there is a means to interrogate via remote control that the TCXO is actually installed. A feature which is not known to exist in any radio. As such not radio control driver will be certified unless it contains a TCXO from the factory.

7. Any transceiver meeting the above requirements shall support remote control command interrogation of the transmit state prior to the application of the audio signal waveform to provide for an initial key down ALC settling time delay to become a certified driver.

   NOTE: This requirement is not the approach used to preclude use of VOX based PTT.

NOTE: Some existing radios in MARS-ALE v3.nn that do not meet most of the above parameters may be excluded from compliance due to their otherwise outstanding features. For example a transceiver that can provide embedded 2G ALE when an optional ALE board is installed, also Marine, Land Mobile and Military transceivers due to their known robust construction, SSB filter characteristics or other outstanding features.

It will only be the radios that are provided to the developers for evaluation, driver development and testing that will become a certified DLL-RADIO class the fastest if the pass all requirements. All user created DLL-RADIO class drivers must meet the minimum requirements about, be tested by the user community having the radio in question where it is agreed that the radio performs as desired. The radio class must be submitted to the development team for review prior to being certified and included in the DLL-RADIO class library. The source code must meet formatting and commenting requirements for a DLL-RADIO class to be published as an example class.

In the future the author will continue to request support from the various radio manufacturers and big radio dealers as well as from the MARS member for the loan of radio equipment for development when it appears the radio will provide excellent 2G/3G ALE and MIL-STD serial

tone data modem operation. However MARS member supplied radios will likely account for the bulk of such loans.

The requirement of return postage must be paid by the equipment provider shall continue to be required. The development team members will work with the equipment to determine its suitability and develop the needed support ASAP taking into account available time for other development tasks by scheduling each loan of equipment.

NOTE: The development team shall only provide limited support for radios that we test during the certified driver process unless we shall have access to the radio for testing or unless one is again provided as needed. The user developed drivers, certified or not, shall be supported by the driver developer.

DESIRABLE FEATURES

The following features are desirable but not required at present.

- A 2.8kHz or greater TX/RX IF SSB filter bandwidth regarding analog SSB radios and 3.0kHz or more for SDR radios on RX due to brick wall DSP filters.

  NOTE: The best results using MIL-STD/STANAG data modem communications will only be had using a 2.8kHz filter on TX.

- An internal USB Audio Codec where it and remote control support are provided by a single USB cable solution or SDR transceiver with Virtual Audio Cable (VAC) approach. The USB combination makes for a cleaner interface with less chance of RFI issues due the lack of analog cable wiring. It also provides for better modem audio characteristics than external COTS radios interfaces due the better impedance matching and all the audio being in the digital domain. The SDR/VAC approach eliminates all the issues with the analog sound device approach, however attention to latency is a must.

  NOTE: VB-CABLE is recommended at this time for a VAC requirement.

- TCP/IP radio interfacing.

- GPS support over the HF radio remote control port. Not required for anything at this time. The need for GPS support should not come about until STANAG 4528 (3G ALE) is provided. However various uses for GPS may come along sooner, e.g. 2G ALE Link Protection, the need for automated Geo-Location reporting.

- Fast tuning, wide tuning range internal Automatic Antenna Tuner (AATU).

- Up front speaker with 2 watts audio output.

PREFERRED CLASS TRANCEIVER EXAMPLES

Even the older Alinco DX-70 used PIN diode selection, I wish all HF SSB transceivers did. This approach gets my vote for use in all HF SSB transceivers as compared to electromechanical relays, even when relays are being bypassed via CAT commands or D.C. signaling, as there are no moving components that will eventually fail as with relays.

NOTE: Most all HF SSB transceivers use relays for spectral purity filter selection simply as matter of the cost of high power RF switching diodes compared to that of a relay. They use diodes to select IF filters but those by comparison are cheaper than the relays that would be required. The use of diodes vs. relays depends on the circuit and the cost involved. For example, the IC-9500 HF receiver uses relays instead of diodes in its mixer selection to minimize IMD distortion with diode use, then too they went to relays vs. diodes for their bandpass filters, go figure.

For a long time now and still to this day, the rugged ICOM IC-7200 in my opinion is the best Amateur Radio grade make/model for use with MARS-ALE.

The IC-7200 qualifies as a **Preferred Class** transceiver for MARS-ALE when the QS/S hardware modification to automatically bypass the PA spectral filter relays has been made. Such modification is preferred over any other means of dealing with those pesky relays.

NOTE: It is my opinion that most if not all transceivers can be so modified with some time and effort. Such modification will likely void the warranty however unless it is performed as factory authorized modification similar to the MARS/CAP out of band TX modification process. However at this time I am not aware of any manufacturer offering a QS/S hardware modification.

The IC-7200 sells for about $900USD while they are still available as the last production run has been made. Hopefully when they are no longer available new, ICOM will have an even better model available.

I think the IC-7200 would have made a good hardware ALE transceiver should ICOM have chosen to also offer a LMR version with firmware support and a physical PCB header to accept a RapidM TC4 modem board internally. The TC4 can be configured to provide a transceiver with 2G ALE, 3G ALE, MIL-STD and STANAG data modem capability. However ICOM at the time had their flawed IC-F7000 ALE transceiver on the market and the not much better IC-F8100 in the works.

NOTE: The IC-7200 when hardware modified for QS/S support can be used with an external RapidM modem configured for ALE, such as the RM-2. Any of the external RapidM modems configured for optional ALE modem/controller operation could be used to make the IC-7200 into HW ALE system. The benefit being an inexpensive radio to maintain a backup of when needed and still have an operational ALE solution vs. having to send out an ALE transceiver for repairs and wait for its return.

Preferred Class features met or exceeded by the IC-7200:

Proven QS/S hardware modification for Preferred Class adherence.

±0.5ppm frequency stability exceeds minimal TXCO requirement.

Remote control via RS-232 that exceeds 9600 baud.

NOTE: Both conventional as well as USB port interfacing are provided.

A unique radio ID can be read over the CIV remote control port.

Desirable features for ALE provided by the IC-7200:

A 100w power amplifier with excellent heat sinking design and quiet yet stout dual fans cooling built in.

SSB IF BW adjustable in excess of 3.0kHz.

USB Audio Codec.

Up front speaker with 2 watts+ of audio output.

Rugged, heavy duty construction. In my opinion the IC-7200 is nearly as rugged as COTS embedded hardware ALE transceivers.

It is actually more rugged and more resistant to water intrusion than a Kenwood TK-90 LMR in side-by-side comparison. Both radios are excellent for use with MARS-ALE and priced about the same, the TK-90 even provides an optional ALE modem/controller board for about $500USD that works properly. However its covers are not as rugged and there are large points of egress on the read for water instruction, especially when the pig tail cables are installed for RS-232 remote control and Auxiliary I/O which are required for data modem and computer controlled PTT.

NOTE: The IC-7200 is water resistant to a large extent, a consideration for those choosing they radio with "GoKit" considerations. However an IC-7200 NOT waterproof. An IC-F8101E ALE transceiver can be submerged into water due to its physical o-ring seals, pigtail cabling and speaker less design.

* IC-7200 is NOT waterproof.

Only missing desirable features:

No internal GPS

No internal ATU

EXTERNAL RADIO DRIVERS

The hard coding of radio support into MARS-ALE without having the radio in hand to develop and test with has been the practice in the past. However the best results cannot be achieved with that approach when it comes to validating remote control commands and radio specific timing considerations. Then too the use or more sophisticated radio specific remote control features cannot be utilized.

As the best results can only be had when developing and testing with the make/model radio of interest, certified and limited supported DLL-RADIO drivers by the development team will only be undertaken for a radio model made available for hands on evaluation by a team member. A DLL-RADIO driver developed by anyone else can be submitted for certification if a late model radio meeting the requirements stated herein, after being tested by a number of users has been completed.

MARS-ALE v3.nn will retain MMI-RADIO class support when the DLL-RADIO support is added. Both MMI-RADIO and DLL-RADIO interfaces are being reviewed for enhanced capabilities moving forward. The use of MMI-RADIO will always be treated as un-certified in MARS-ALE v3.nn and shall not be supported in future ALE tools.

In addition new driver class types are being considered for developed in support of auxiliary devices of both known (AATU, GPS) and unknown device types for access to any serial or TCP/IP port for command and control of said device(s). The user will be able to create drivers to support up to n number of unknown device types.

MMI-RADIO

The MMI-RADIO approach is flexible as to controlling most any HF radio by use of simple ASCII MACRO file creation using the radios remote control commands in accordance with the MMI-RADIO framework requirements. However MMI-RADIO is limited in some ways, such as when radio control requires polling.

MMI-RADIO also complicates configuration and management of .QRG files as MMI Radio Class files are required to match all the .QRG file channel information.

MMI-RADIO shall always be considered un-certified.

DLL-RADIO

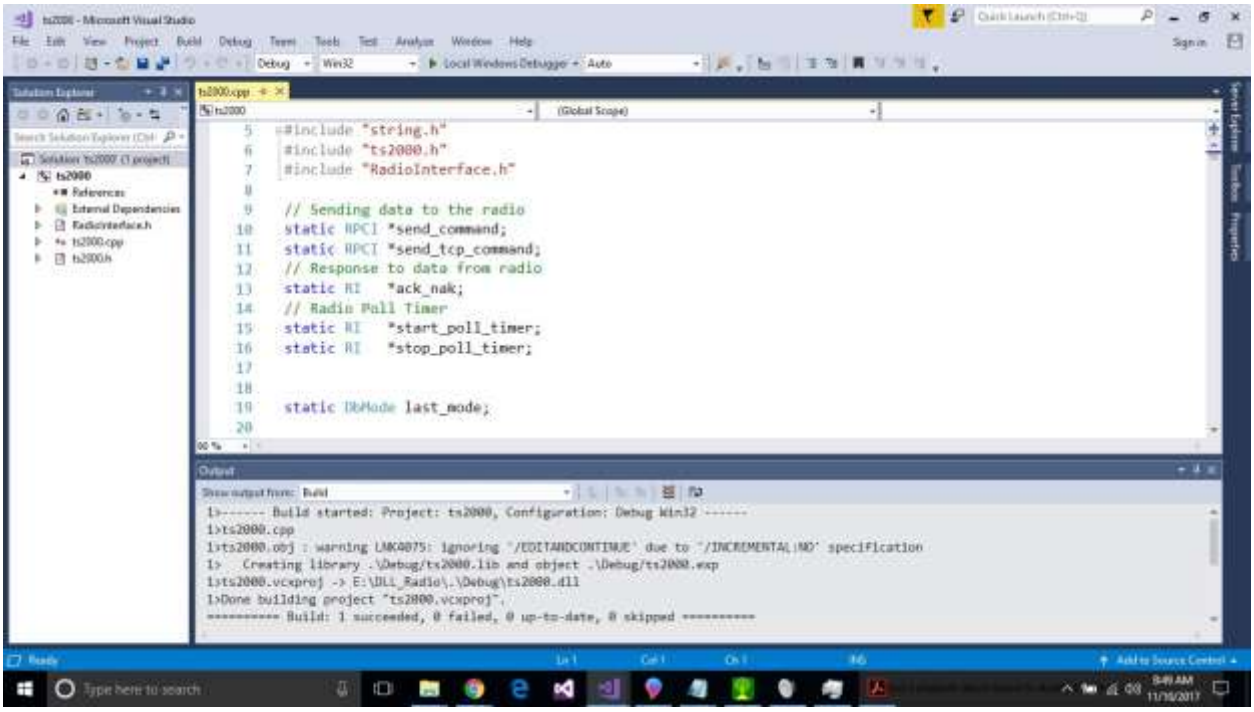
The DLL-RADIO support which has been developed and proven in PC-ALE, shall be enhanced and implemented in MARS-ALE v3.nn in the near future and shall be the only means of radio control support in all future ALE tools.

DLL-RADIO provides much more radio control than does MMI-RADIO and more seamless integration as to scan groups. MARS-ALE basically treats the .DLL as if it were part of the hard coded radio control framework approach.

NOTE: An exception to DLL-RADIO only support may be potential "Hybrid" support of suitable 2G ALE transceivers which is currently planned as being hard coded only. This hybrid support would be to provide extended life to the HW ALE transceiver for AQC-ALE and 3G ALE operation that the radio does not provide and is not available as a firmware update.

NOTE: AQC-ALE may not be supported beyond MARS-ALE v3.nn due to lack of use.

DLL-RADIO requires creation of MS-Windows Dynamic Link Library (.DLL) in the programming language of the developer's choice using the simple .DLL format that has been implemented. It's really easy to do as one can start with an existing DLL-RADIO example template and just change/delete/add radio specific commands as required for the results desired. The DLL frame work will be the model for Linux Dynamic Link Library (.SO) in support of new ALE tools.



There are many good free compilers these days as well, where I now recommend the use of Visual Studio 2019 Community compiler. A DLL-RADIO project is currently a 32 bit project, as is MARS-ALE itself at this time. In the future there may be a 64 bit version of MARS-ALE, which may require 64 bit DLL-RADIO versions as well.

For a DLL-RADIO class to be endorsed and provided in distributions for a new make/model radio not yet supported it will need to include the source code with a statement of adherence to the "**GNU GENERAL PUBLIC LICENSE Version 3, 29 June 2007"**. As DLL-RADIO projects created and submitted shall be open source and available for re-use as will be the examples I shall provide

created with Visual Studio in C/C++, there will in time be a good library for developers to build upon. However the re-use of an existing .DLL project to create a new one in support of a new radio will require a full walk-through/edit by the developer to ride the project of any code that does not pertain to the new radio being supported.

The DLL-RADIO support will position MARS-ALE v3nn tool as a test bed for anyone wishing to develop their own full featured .DLL driver(s) for continued use of an existing or new HF SSB transceiver or receiver in MARS-ALE v3.nn or new ALE tools. This should be especially of interest to those with an existing make/model radio that does not meet the new radio requirements and will not be supported. However it highly recommended that only radios meeting the specified requirements be used in MARS communications moving forward.

The use of DLL-RADIO with any radio type selection will support use of the SDRplay checkbox found in MARS-ALE v3.nn only. An RSP receiver used in a T/R configuration where only the RSP will scan in multi-channel operation will extend the usefulness of older HF transceivers. The transceiver will only change frequency when it is time for transmit, thus there are no QS/S issues involved. The existence of this feature will not prevent eventual deletion of radio models that operate at less than 9600 baud.

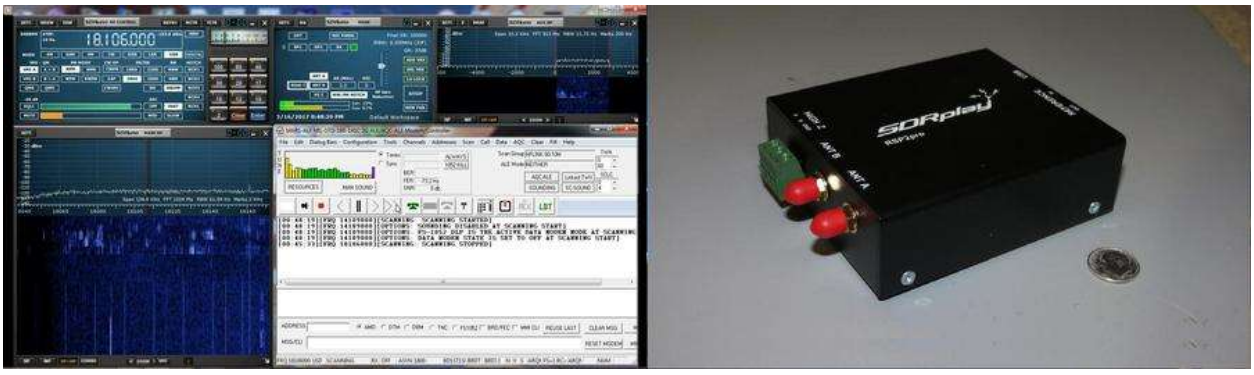
RSP RECEIVERS

Both transceivers and receivers have been supported in MARS-ALE from the beginning and this shall continue. The receiver support has typically been for standalone use for the most part. However there has been coded for pairing with exciters and transceivers in the past, e.g. the ICOM-ICOM selection.

The pairing with transceivers provides for a means to overcome the PA spectral filter selection by relay issue. However most HF communications receivers suitable for MARS-ALE use, even just for standalone use are rather expensive, regardless of being purchased used or as surplus. Many MARS members many have asked me for recommendations as to what inexpensive current make/model receivers to purchase for use with MARS-ALE. Until recently I have not had a good answer.

However after recently purchasing a relatively new on the scene "SDRplay RSP2/RSP2pro" receiver earlier this year for under $200USD shipped to my doorstep has changed my ability to provide such a recommendation. The SDRplay RSP2pro is a very capable 12-bit ADC based SDR Radio Spectrum Processor (RSP) introduced in late 2016 as a further evolution of the popular RSP1 receiver.

The very capable yet inexpensive SDRplay Radio Spectrum Processor (RSP) models RSP2 and RSP2pro receivers are relatively new SDR receivers as of late 2016 which evolved from the proven RSP1 receiver. The RSP2pro is housed in a heavy duty metal chassis which makes it better suited for 2-way communications. The MARS member on a budget can bring new life and capability to an existing analog HF SSB transceiver or just add a separate intercept capability with the addition of an RSP2pro.



The RSP series of SDR receiver are interfaced and powered over the USB 2.0 bus. The RSP series are compact and light weight units. The RSP2pro is just the thing to take along when on travel or in a "GoKit" for use with a laptop or tablet and length of wire on its Hi-Z port. The new as of November 2017 and even less expensive RSP1A 14 bit capable receiver is also a contender for MARS-ALE use, however like the RSP2, it lacks the metal case found on the RSP2pro. The RSP1A also lacks the additional antenna ports of the RSP2 series.

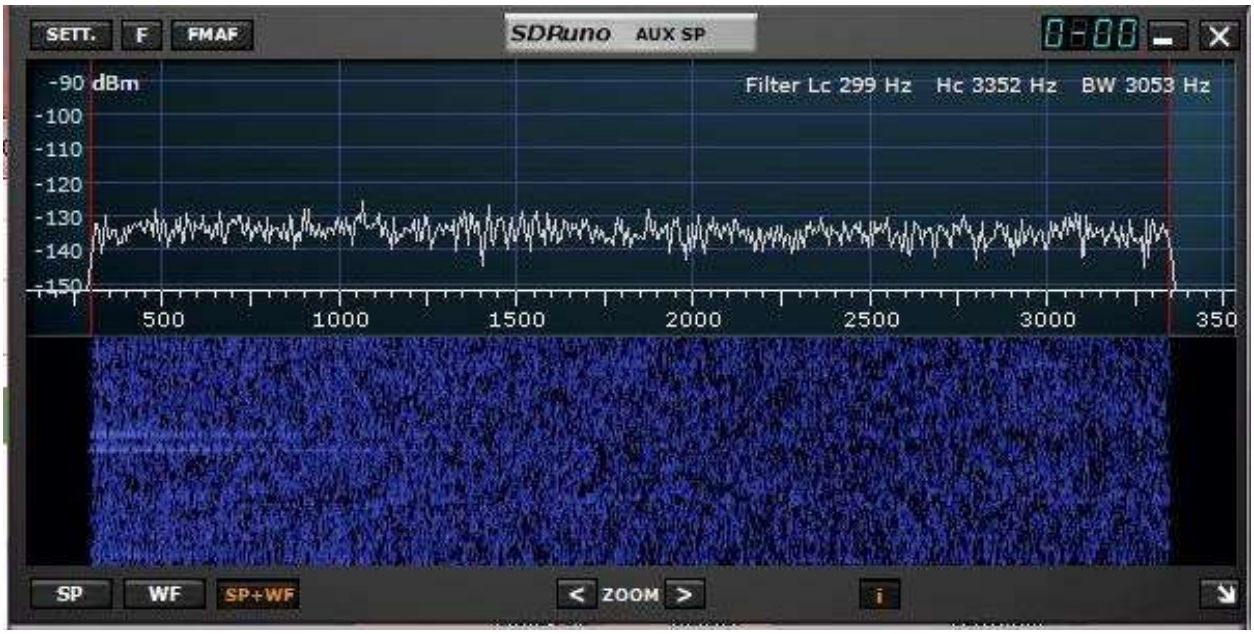
Beginning with MARS-ALE v3.00 support for the SDRplay RSP series shall become available for both standalone receiver use and for 2-way T/R switch coupled use with any supported transceiver

or emitter as to the transmitting component. For 2-way operation use of the RSP2pro is highly recommended. A section providing more details on the RSP2 series is provided at the end of this document. I see the RSP2pro as a valuable addition to any MARS station as will be detailed to some extent herein and in developing documentation in greater detail.

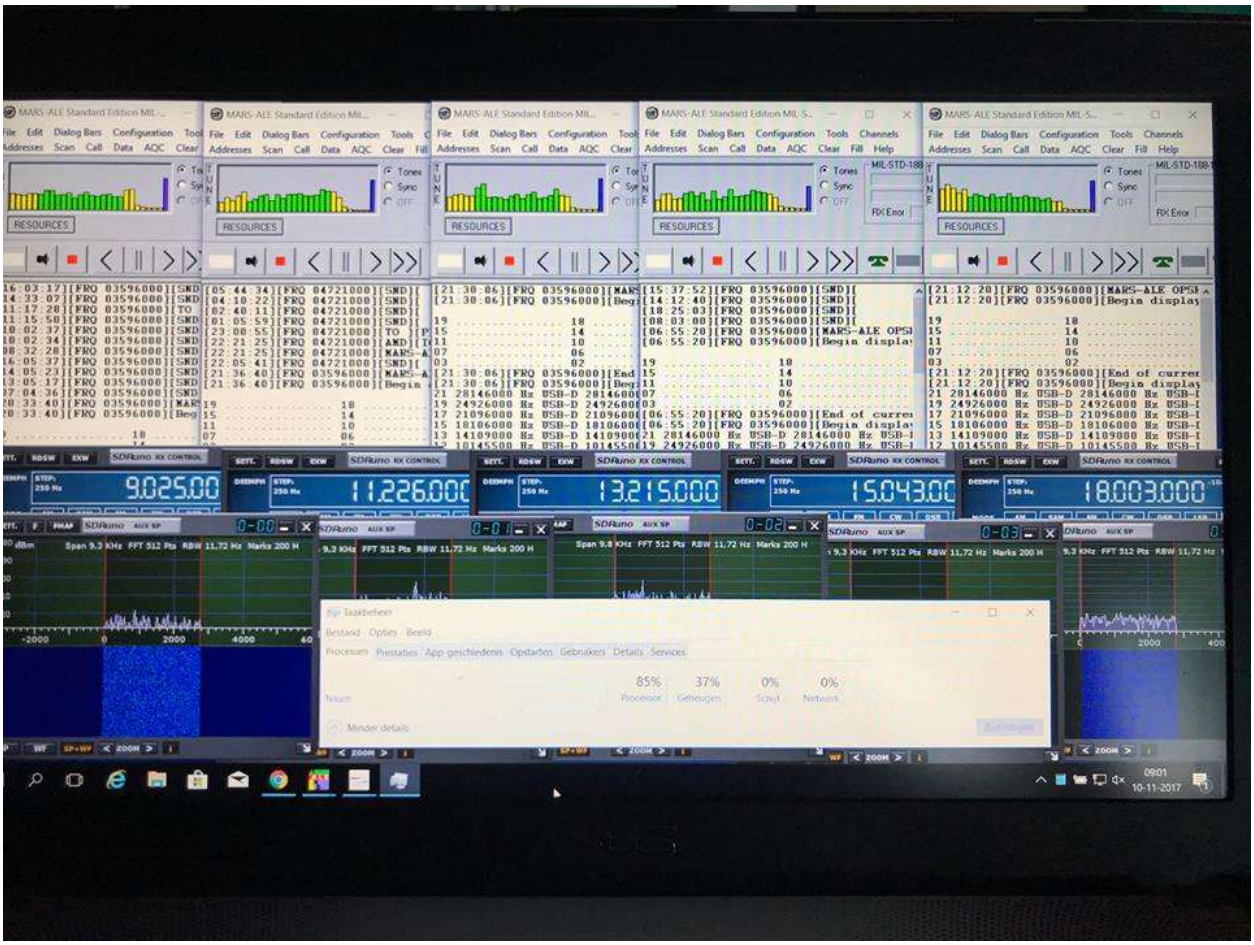
NOTE: Support for external T/R switch operation using the RSP2pro in MS-DMT will be relegated to use of an enhanced DMT-RADIO interface in time. The use of an AUX RX antenna port supported transceiver can immediately be made.

The list of hard coded radios supported in MARS-ALE v3.00 shall remain mostly "AS IS" moving forward. However it will be severely reduced in MARS-ALE v4.00 due to adhering to a new set of requirements to induce better on-the-air performance. There shall be exceptions to these requirements regarding existing radios currently supported in MARS-ALE v3.0 which shall come into partial compliance with the new HF SSB radio requirements by the end of 2018 or sooner.

The RSP2pro will provide the MARS-ALE use a number of advantages as to 2G ALE application and follow on data reception that are being detailed separate documentation. In short, when used with a non-Preferred Class transceiver, it eliminates the spectral filter relay issue with standalone use of the transceiver. Even if there is a means to do via MARS-ALE signaling control, the use of the RSP2pro represents a better approach.

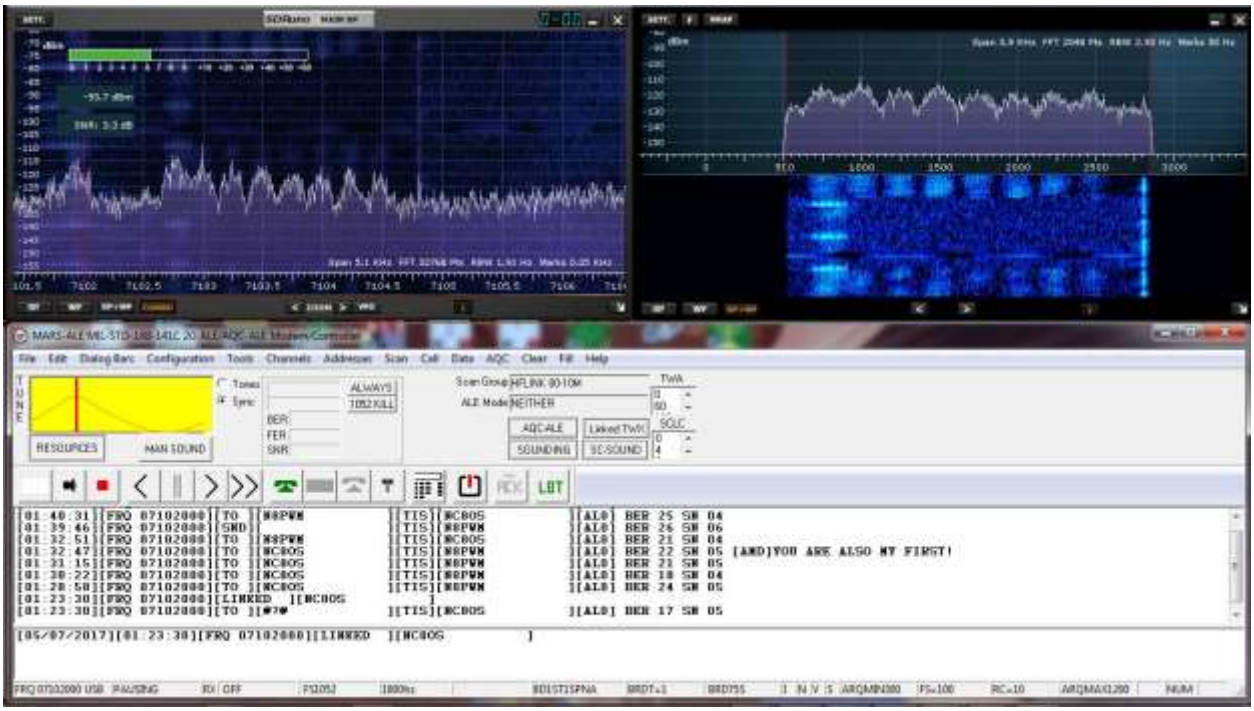


The RSP2pro will more economically in most cases provide for the required IF BW that an older analog radio would require one or more expensive crystal filters to achieve. Then too the RSP2pro provides multiple virtual receivers that can be taken advantage with enough computer resources if required or desired. However using multiple VRX receivers and instances of MARS-ALE requires a lot of computer and lots of screen display space or multiple monitors on the PC, neither of which this guy has!



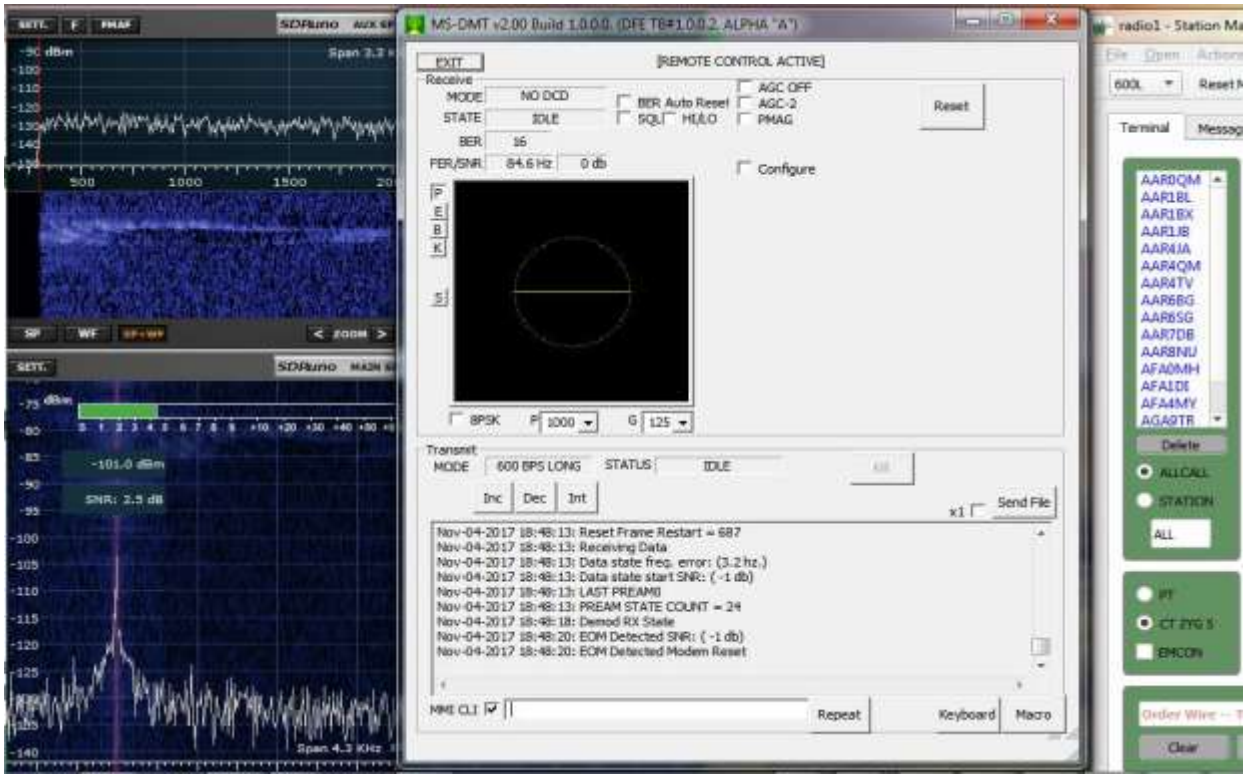
When used as a standalone receiver only, the low cost RSP2pro ($192USD) can be used 24/7 unattended for 2G ALE ALL CALL based follow on data modem broadcasts with the more expensive transceiver physically taken out of the loop so as to protect it from lightening related damage.

When configured for Communications use vs. wideband monitoring, the RSP2pro is a very capable receiver, with many features, to include the capability of simultaneously monitoring multiple ALE networks with multiple instances of MARS-ALE and or multiple discrete channels with just MS-DMT if one has enough computer resources.



The RSP2pro and its SDRuno software can be used for intercept of multiple 2G ALE networks at the same time by configuring multiple virtual receivers (VRX) and VSP pairs for CAT control, enough VAC channels for RX audio with multiple instances of MARS-ALE.

Then too just one 2G ALE network and multiple single channel frequency networks like J0G and state traffic nets and or message centers with one instance of MARS-ALE and multiple instances of MS-DMT if one has enough computer resources.



Then too the RSP2pro and laptop or even tablet PC makes for a perfect on the go portable station with an appropriate antenna, where the Hi-Z antenna port makes using just a length of wire easy.

The use of the RSP2pro and its ability to record real-time RF spectrum to IQ .wav files have been invaluable in MS-DMT development efforts when channel conditions challenged the ability of MS-DMT modem performance.

The ability to re-play those IQ .wav files over and over in a loop just as if it were being intercepted live while tweaking the MS110A modem resulted in large improvement in MS110A modem core performance and lead to meeting STANAG 4415 (S4415) requirements as well as a hardware modem vendor that publishes their claimed S4415 performance. A document on using the SDRuno software Recording feature to IQ .wav files alone is being created.

I have proven to myself the value of the RSP2 in MARS application with 7 months of intercept of multi-channel 2G ALE ALL CALL based MS110A broadcasts and various NVIS and Skywave based MARS MS110A communications to include Region and State traffic nets and J0G monitoring.

T/R USING SDRPLAY

Next comes developing MARS-ALE (and MS-DMT) to support 2-way communications with the RSP2pro. The approach in MARS-ALE will be as simple as single “SDRplay RSP” checkbox on the in the “Radio Selection” panel as seen below. When any hard coded, MMI-RADIO or DLL-RADIO selection is in effect, the “SDRplay RSP” will instead select your RSP device as the active receiver.

To keep the SDRplay RSP T/R support as simple as possible, the SDRplay RSP required VSP COM ports are specified as COM 20 for use in SDRuno and COM 255 in MARS-ALE. As such a Virtual Serial Port (VSP) Null Modem pair of COM 20 and COM 255 must exist.

To make use of an SDRplay receiver in a T/R configuration your HF SSB transceiver must either have an Auxiliary RX Antenna port or an external T/R switch will be required.

The addition of one resistor on the spare set of relay contacts on the T/R switch to ground the antenna input of the RPS2pro is all that is required. The 150w DIY T/R switch kit ($20USD) that will be used in development as seen below can be found at:

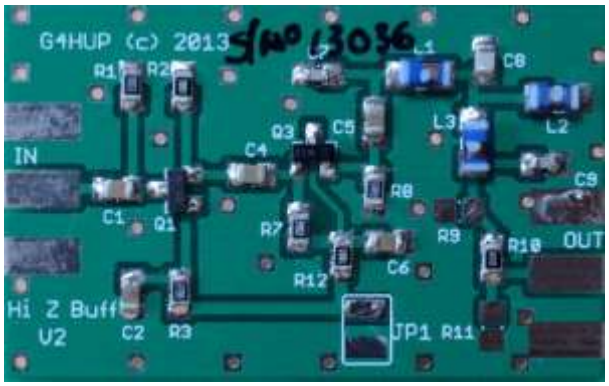
http://www.qrpkits.com/ezseries.html#eztrsw

Less than $1.00USD for a metal tin with thru hole installation of double shielded RF pigtail cabling will provide for the next stage of development and testing with the RSP2pro. One such outfit that offers these enclosures is:

https://www.specialtybottle.com/metal-tin-containers/hinged

Depending on the size of the radio as to available space internally, the T/R board could possibly be installed internally within the radio as well.

The RSP2 series receivers can also be used as a Panadapter by tapping into the IF section of the HF SSB transceiver or stand alone receiver. More information on such use will become available as the support page for use of the RSP2pro with MARS-ALE and MS-DMT is hosted at:



https://groups.io/g/MARS-RSP2pro

At this site all things RSP2/RSP2pro shall be open for discussion and all reference materials and software will be located in the files section. Speaking of software, the quite capable SDRuno software is constantly being enhanced with new features and for better performance.


RSP2pro
1 kHz—2 GHz SDR Receiver
SDRplay
RSP2pro
Radio Spectrum Processor 2pro
1 kHz—2 GHz SDR Receiver
•Continuous RF spectrum coverage from 1 kHz to 2 GHz
•Up to 10 MHz receiver bandwidth
•Powers over USB cable with type B socket
•Rugged black painted steel case
•10 high selectivity preselection front-end filters + 12 bit ADC
•3 software selectable antenna ports (2 SMA + High Z)
•0.5PPM TCXO trimmable to 0.01PPM
•24 MHz clock input/output connections
•4.7V Bias T for powering external antenna amplifiers
•Includes SDRuno high performance SDR software with up to 16 individual channels within any given 10 MHz bandwidth
•Calibrated S-meter and power measurement to +1dB accuracy
•Also works with popular 3rd party software
• Multiplatform support including Windows, Linux, MAC, Android and Raspberry Pi 2/3
•Software selectable MW/FM notch filters
•Full documentation, software and support available via www.SDRplay.com
SDRplay Ltd., 6 Thornes Office Park, Monkton Road, Wakefield, WF2 7AN, UK. Reg. in England #09035244