FlexRadio Systems®
Software Defined Radios

FLEX-6000 SIGNATURE SERIES

SMARTSDR CAT SOFTWARE USER'S GUIDE

SmartSDR CAT version 3.0.19

25 April 2019

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1 INTRODUCTION

1.1 DESCRIPTION OF THE SMARTSDR CAT INTERFACE

The SmartSDR CAT interface bridges the legacy COM port interface used by many amateur radio systems to that of the FlexRadio Systems Signature Series radios. This allows third party programs such as loggers and digital mode clients that don't communicate directly with the radio using our Ethernet API to communicate without changes.

The FlexRadio CAT command set is based upon the Kenwood format. Therefore, any program that supports Kenwood models should work with our radio. In addition to the CAT protocol SmartSDR CAT also supports the Open Two Radio Switching Protocol (OTRSP) for SO2R automation, Winkeyer emulation, and PTT Port capabilities.

Because of the limitations in a legacy system like CAT, the SmartSDR CAT feature set is limited. Common features like tuning a VFO, transmitting, etc., are included. However, this means that many advanced features in a Signature Series radio will not be available via the CAT interface. Developers seeking additional access to such features should explore the API resources available at the Flex Application Developer Program (ADP) web page.

The Signature Series are a radio "server" platform that multiple "clients" can communicate with. SmartSDR for Windows is one such client and the SmartSDR CAT interface is a separate client, both of which can communicate concurrently with Signature Series radios.

1.2 OPERATIONAL NOTES

Most third-party CAT enabled programs are designed to control VFO A and possibly VFO B based on a 1 or 2 VFO legacy radio architecture.

With the Signature Series, the concept of a VFO maps very closely to a Slice Receiver. For this reason, a Slice Receiver Index (e.g. Slice A) is a required setup parameter for any protocol that utilizes the concept of a VFO. The selected Slice is *logically* mapped to the third-party CAT program's VFO A.

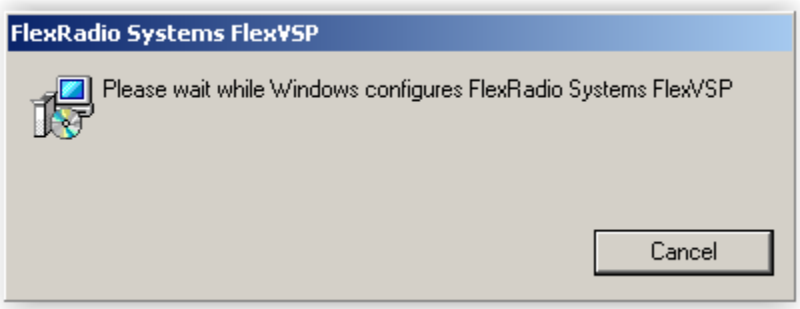
In the CAT protocol, the first time a split command such as 'FT1;' or 'ZZSW1;' is encountered, the SmartSDR CAT application will create a new "Split Slice" and set that Slice's Transmit flag (the typical Split configuration with a Signature Series Radio). This allows listening to either the receive and transmit frequencies or both. From that point forward, that Slice will be *logically* mapped to the third-party CAT program's VFO B. Commands that access VFO B information before one of the commands mentioned above is issued or after the Split Slice is manually closed will receive a '?;' response.

2 SmartSDR CAT INSTALLATION MANAGEMENT

The following sections describe how install, upgrade or remove SmartSDR CAT from your PC.

2.1 SMARTSDR CAT INSTALLATION PROCEDURE

During the installation of SmartSDR for Windows you may see the following informational dialog box as the FlexRadio Systems FlexVSP virtual serial port driver is installed. It may take a few minutes for the FlexVSP drivers to completely install. Please do not press the Cancel button if it appears that the installation has stopped as this will prevent SmartSDR CAT from operating properly.



When SmartSDR for Windows finishes installing and configuring the FlexRadio Systems FlexVSP software component, the new version of SmartSDR CAT will be started and an icon will be placed on the Desktop for easy subsequent starts.

2.2 UPGRADING SMARTSDR CAT

The SmartSDR CAT upgrade process is as simple as installing a newer version of SmartSDR for Windows. The installer will optionally include SmartSDR CAT and the virtual serial port driver (FlexRadio Systems FlexVSP), only upgrading required components when necessary.

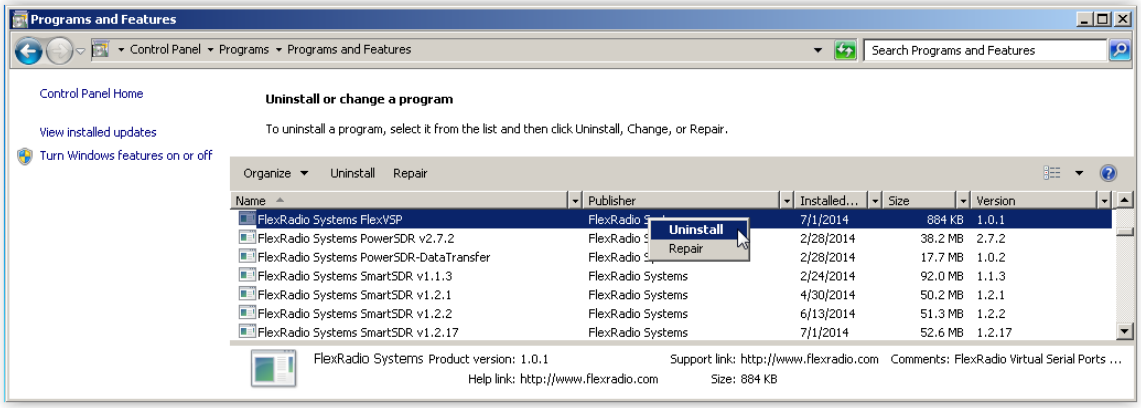
2.3 REMOVING SMARTSDR CAT

Note: If you have SmartSDR CAT v1.2.10 or earlier installed on your PC, see Appendix A.

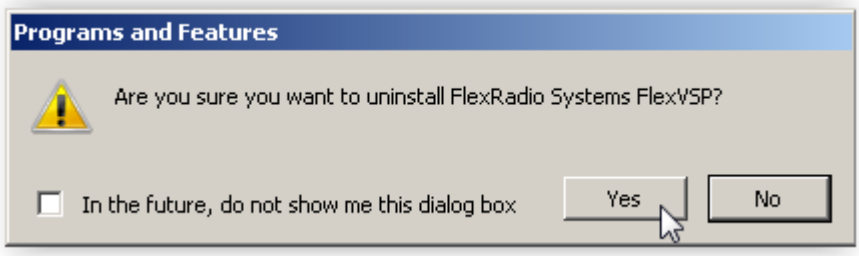
The SmartSDR CAT application component is uninstalled automatically when you run the SmartSDR for Windows uninstaller. However, the virtual serial port driver, **FlexRadio Systems FlexVSP** must be uninstalled manually using the procedure described below. Note that it is not necessary to uninstall FlexVSP when upgrading SmartSDR and/or SmartSDR CAT.

CAUTION: UNINSTALLING THE FLEXRADIO SYSTEMS FLEXVSP DRIVER WITHOUT UNINSTALLING THE SMARTSDR CAT APPLICATION WILL RESULT IN AN ERROR WHEN THE SMARTSDR CAT APPLICATION IS STARTED. YOU SHOULD ONLY UNINSTALL THE FLEXRADIO SYSTEMS FLEXVSP DRIVER WHEN INSTRUCTED TO DO SO BY UPGRADE INSTRUCTIONS OR BY A FLEXRADIO SYSTEM TECHNICAL SUPPORT ENGINEER.

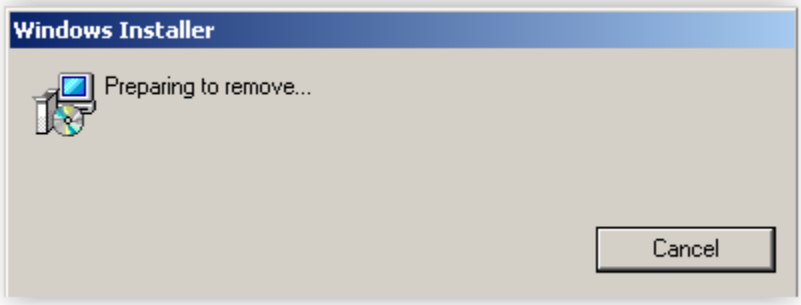
1. Close the **SmartSDR CAT** application.
2. Open the **Windows Control Panel** and select **Uninstall a Program**
3. Click on the **FlexRadio Systems FlexVSP** program entry.



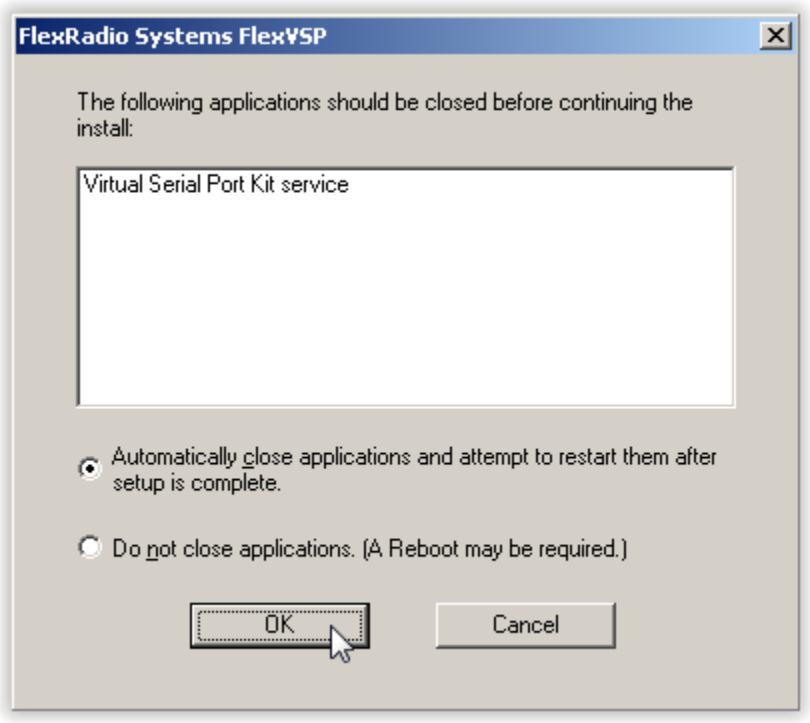
4. Click the **Uninstall** option above the list (or right click on the entry and select the **Uninstall** option).
5. Answer **Yes** to the prompt *"Are you sure you want to uninstall FlexRadio Systems FlexVSP"* as shown below.



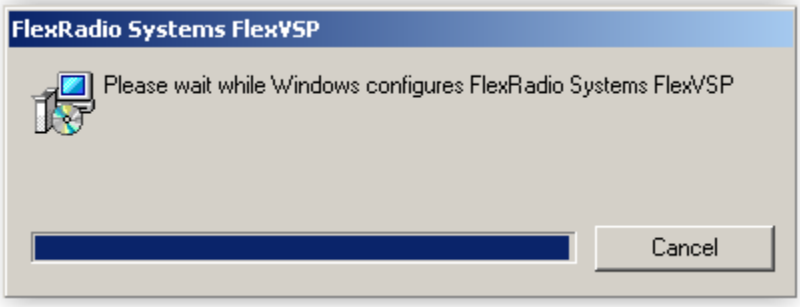
6. The Windows Installer *Preparing to Remove* dialog box is displayed as shown below.



7. If you receive a prompt to "*Automatically close applications and attempt to restart them after setup is complete*", click on **OK** to continue. See image below.



8. A progress dialog box will be displayed as shown below as the FlexRadio Systems FlexVSP driver is being uninstalled.



9. After FlexVSP has finished uninstalling, manually reboot your PC if not prompted to do so.

3 USING SmartSDR CAT INTERFACE

3.1 STARTING THE SMARTSDR CAT INTERFACE

SmartSDR CAT is started by two methods described below. Usually SmartSDR CAT is started by the Auto Start Up method and is never closed, so it is always communicating with the configured FlexRadio Signature Series radio.

Note: SmartSDR CAT must be able to connect to a Signature Series radio to work properly.

3.1.1 Auto Start Up

SmartSDR CAT will start automatically when SmartSDR starts, if the **Autostart CAT with SmartSDR** option is selected in SmartSDR. When selected, SmartSDR CAT starts and stops with SmartSDR. If the SmartSDR CAT application window was minimized that last time it ran, it will start minimized when SmartSDR is restarted. It will remain running unless closed by the user. Clicking on the SmartSDR CAT icon will open the SmartSDR CAT User Interface for configuration.

3.1.2 Manual Start Up

You can manually start SmartSDR CAT by double clicking on the **SmartSDR CAT** program icon located on your Desktop or in the Windows Start Menu under the FlexRadio Systems program folder. If the application is already running, its window will appear.

3.2 CONFIGURING SMARTSDR CAT

When SmartSDR CAT starts the first time, it will create a Serial CAT port automatically at the lowest open port (COM4 or above) and a TCP CAT Port on port 5002.

If the FlexVSP driver is not loaded or has not fully started at the time the SmartSDR CAT user interface starts, an error message will be displayed. This condition in which the VSP driver has not fully started can exist on systems that utilize a solid state hard drive allowing Windows to run the Startup applications before the FlexVSP service has started. If this occurs, wait 15-30 seconds and then manually restart SmartSDR CAT.

3.2.1 Main Window

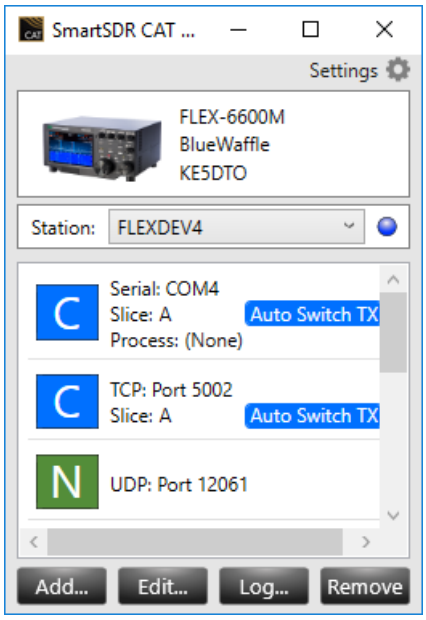


Figure 1 SmartSDR CAT Main Window

Near the top of the Main Window, an indicator shows whether SmartSDR CAT has connected to a radio and if it is using a SmartLink connection to a radio. Once a connection has been made, hovering the mouse cursor over this indicator will show the Model and Nickname (or Serial Number) of the connected radio. When no connection is present, this indicator will be shown as follows:

Figure 2 Main Window - Radio Not Connected

To select which radio to connect, click on the connection status box at the top of the window. It may also show a blue SmartLink indicator. This will bring up the radio chooser.

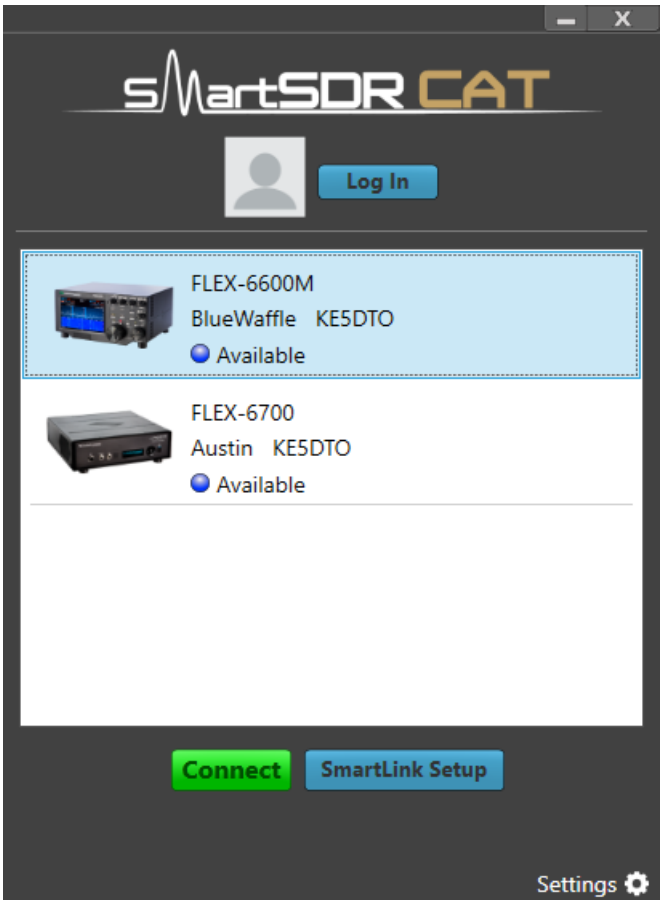


Figure 3 Radio Chooser

From this screen, the SmartLink Setup allows the user to verify the SmartLink settings and select a radio from the list. Once a radio is chosen, auto-connect settings are applied when starting up. These settings can be accessed by clicking on the settings icon in the SmartSDR CAT main window. Unchecking the **Auto Connect SmartLink** option will prevent automatically connecting to a remote radio which could cause unintended network bandwidth to be used.

Right clicking a radio in the radio chooser opens a menu selection that allows you to copy the detailed information about the selected radio to the clipboard, as shown below:

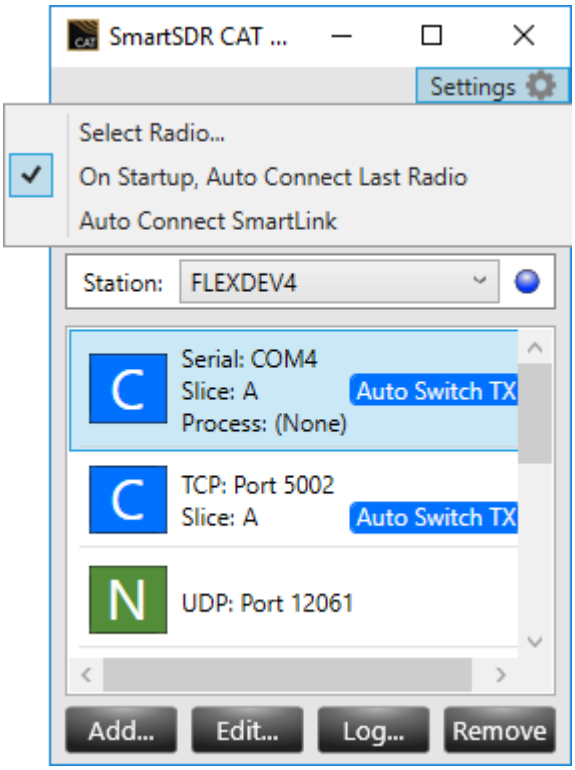


Figure 4 Auto Connect options

The **On Startup, Auto Connect Last Radio** option allow SmartSDR CAT to automatically connect to the last radio that was used if the radio is available on the network. The **Auto Connect SmartLink** does the same if the last radio was connected via SmartLink. This may not be desirable depending on bandwidth issues if operating remote via a mobile connection, for example.

The **Station** selection will initially show the last selected Station and an indication of whether that Station is currently connected to the Radio. The dropdown list will show any other Stations available on the connected radio. The Station selection is necessary to resolve which context to use when fielding CAT commands. For example, FA; asks what frequency Slice A is on. To answer this question, the Station must be known.

The Port list is the primary component of the Main Window. Each item in the list represents a single Port showing the relevant details of the port including the Protocol (CAT, OTRSP, PTT, or Winkeyer), the Port type (e.g. COM1 or TCP port 60000), and the associated Slice (A-H). The colored icon on the left side denotes the first letter of the protocol (C for CAT, O for OTRSP, etc.) Hover the mouse cursor over the indicator to display the Port Protocol.

NOTE:For Virtual Serial Port (VSP) pairs, only the Client side (the side to be used by the third-party application) of the VSP is shown in the Main Window.

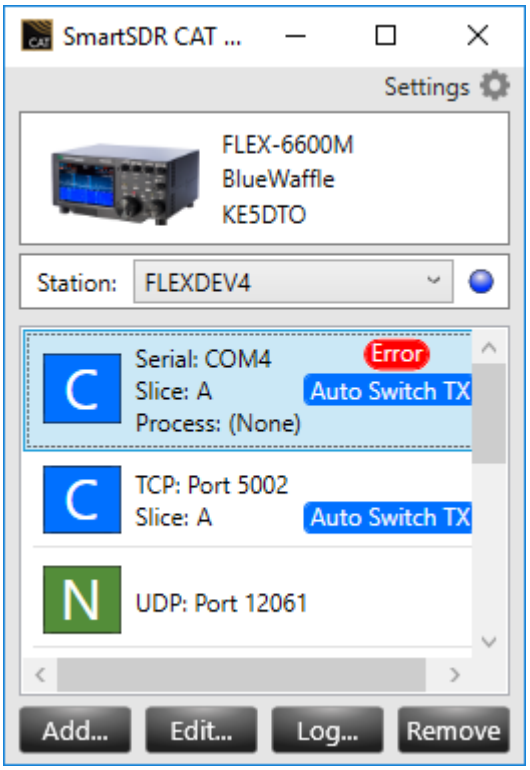


Figure 5 Main Window - Port Error

If there is a problem opening the Port (Serial or TCP), a red Error indicator will appear to the right of the Serial/TCP line. Hovering the mouse cursor over the error will produce a message that should help to shed some light on the source of the problem. If the Port is in conflict as a result of another program using it or if it is a hardware Serial port (perhaps a USB to Serial adapter) that is powered down or unplugged, simply closing the program, powering up the device and/or plugging the device in should resolve the problem. When the problem is resolved, the red Error indicator will disappear.

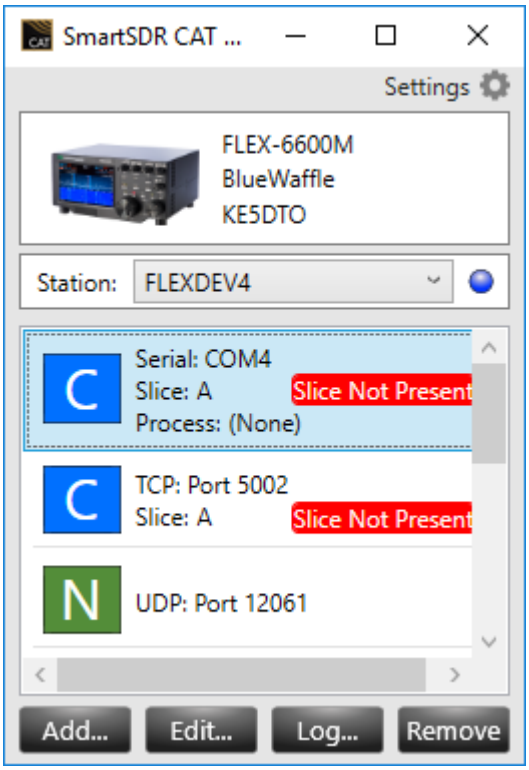


Figure 6 Main Window - Slice Not Present

If a Port's selected Slice is not found in the radio, a red indicator reading "Slice Not Present" will be shown. Creating a Slice using a Radio Client like SmartSDR for Windows will resolve this issue and cause the indicator to disappear.

The **Add** button allows the user to add an additional Port to the list. See the Port Edit Window description below for more information.

The **Edit** button allows the user to change Port settings. See the Port Edit Window description below for more information.

The **Log** button allows the user to open a diagnostic window. See the Log Window description below for more information.

The **Remove** button allows the user to remove a Port. Ctrl and Shift keys may be used to select multiple Ports for faster removal. Multiple selection does not apply to the Edit or Log buttons. Note that removing a FlexVSP Serial Port will result in those ports being removed from the system and may take several seconds to complete the device removal process. Right-clicking on the Remove button reveals a **Reset FlexVSP Port** option. Clicking this option will cause the system to remove all FlexVSP ports and then add back the pairs as defined in the Port list. This can help to recover a situation where the FlexVSP ports have been disassociated from the defined Ports.

To close the SmartSDR CAT application, click the red X in the upper right corner of the Main Window. A prompt to confirm avoids accidental disconnecting of all of the Ports with the radio.

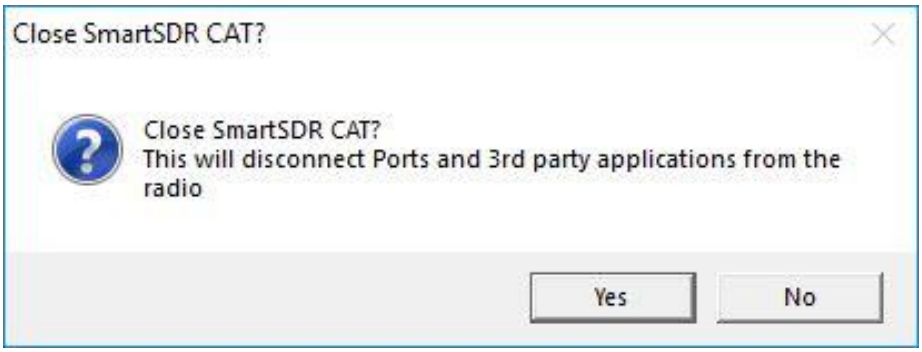


Figure 7 Close Dialog

3.2.2 Port Edit Window

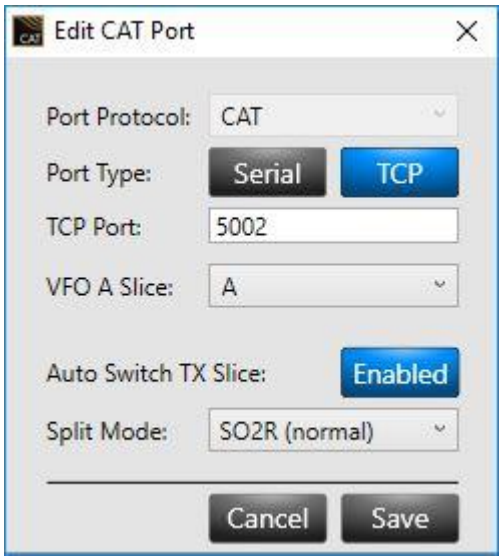


Figure 8 Port Edit Window

The Port Edit Window allows the user to set Port details when adding or editing a Port.

Before describing the various controls on this Window, it is appropriate to explain that the screenshots shown in the manual were taken in **Advanced mode**. To enable Advanced Mode, right click anywhere on the Port Edit Window and click the Advanced menu option.

Note: The screen image examples shown below are in Advanced Mode in order to display all of the possible options.

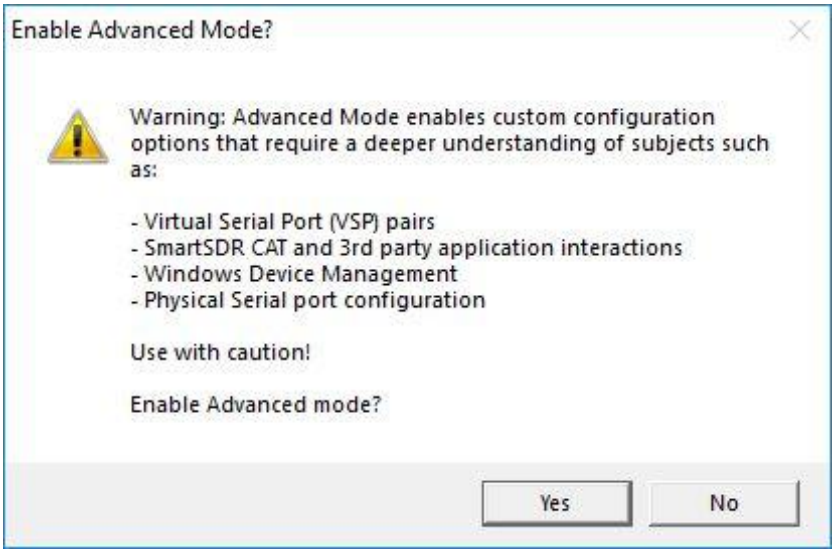


Figure 9 Advanced Mode Warning

A warning dialog as shown above will require confirmation that the user wants to use this mode. Using the Advanced Mode is not necessary for operation of SmartSDR CAT, but simply provides another degree of freedom in configuration for the Advanced user. In particular, when Advanced Mode is off, the CAT sides of VSP ports are not shown and the Serial Port to use for the Client side is chosen for the User. If any of this is confusing, leave Advanced Mode off.

The **Port Protocol** is the selected language of the Port. This can be CAT, OTRSP, PTT or Winkeyer. Note that while editing a Port, this field cannot be changed. To change the protocol on a Port, it is necessary to Remove the port from the Main Window and then set the new protocol when Adding the Port.

Protocol Descriptions:

CAT: Computer Aided Transceiver (CAT) was developed as a way to communicate with a radio through a serial interface. Commands are sent in text and are terminated with a semicolon. The command set varies depending on the transceiver make and model. The SmartSDR CAT implementation is based on the Kenwood command set including compatibility commands (2-character commands) and specialized FlexRadio specific commands (4-character commands beginning with ZZ).

Note: While the CAT protocol exposes many common radio operations, it is a dated interface and thus does not implement the entire set of features possible on a FlexRadio Signature Series radio. For more functionality and control, see the Flex Application Developer Program (ADP) web page.

OTRSP: The Open Two Radio Switching Protocol (OTRSP) was developed in order to facilitate and simplify Single Operator, 2 Radio (SO2R) configurations. Details on the protocol can be found here: http://www.k1xm.org/OTRSP/.

PTT: The Push-To-Talk (PTT) protocol to enables serial port control of the Transmit mode. This allows for easy hardware configurations for triggering transmit.

Winkeyer: The Winkeyer port type emulates a subset of the Winkeyer functionality for easy integration with logging applications such as N1MM. The Winkeyer spec can be found here: http://k1el.tripod.com/files/Winkey10.pdf.

The **Port Type** allows the Port to be setup for Serial or TCP connections. Note that PTT ports can only be setup in Serial mode.

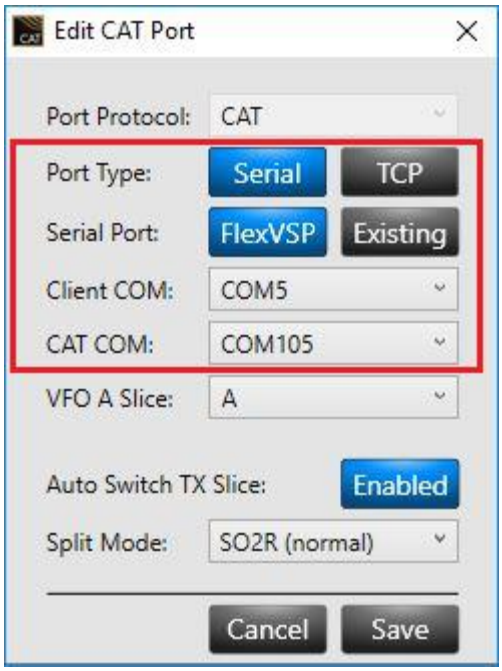


Figure 10 Serial FlexVSP Port Configuration

When **Serial** is selected, the Serial Port can be one of two types: FlexVSP or Existing.

A **FlexVSP** port will create a pair of Virtual Serial Ports (VSP) using the FlexVSP driver. One end of this pair is opened by the SmartSDR CAT application (the **CAT COM**) and the other end is opened by the 3rd party application (the **Client COM**). When creating or editing a FlexVSP Serial Port, note that it will take several seconds for the changes to take place due to delays in the driver.

When in Advanced Mode, when selecting a FlexVSP com port, all available or free com ports will be shown. This list is extensive since Windows can define up to 265 com ports.

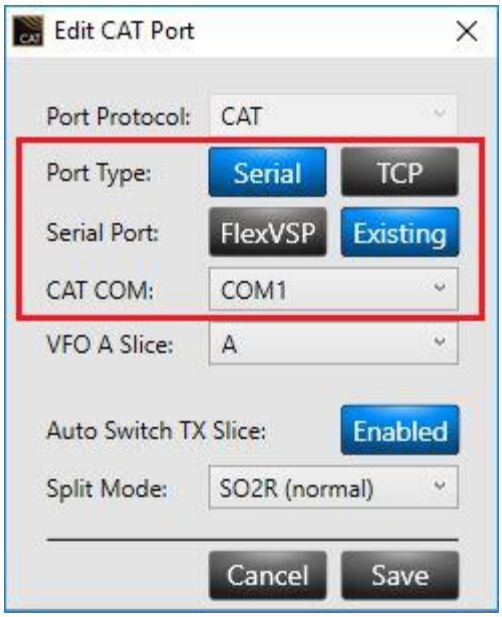


Figure 11 Serial Existing Port Configuration

When choosing an **Existing** Serial Port, the **CAT COM** specifies an existing COM port already present on the system. This is ideal for interfacing to hardware ports that speak the CAT language natively.

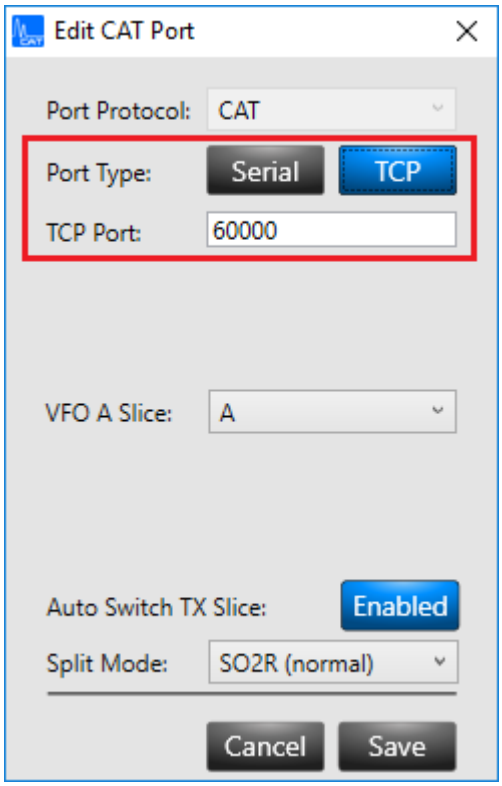


Figure 12 TCP Port Configuration

A **TCP** port requires only the TCP Port number to be specified. Connecting to this port will allow an application to communicate using the specified protocol (CAT, OTRSP, etc.) to the radio. Note that TCP is not available with the PTT protocol.

The **VFO A Slice** specifies which Slice will be used for the logical VFO A in the protocol. (not used with Winkeyer)

When enabled **Auto Switch TX Slice** automatically switches the Transmit Slice to the VFO A Slice selected above when a CAT TX command is sent on the com port. This feature allows multiple digital mode applications to operate at the same time on different VFO A Slice assigned slices by dynamically making the slice the transmit slice when the digital mode application is transmitting. If this option is not enabled, the operator will have to manually designate the Transmit Slice.

Note that PTT type ports will not show a VFO A Slice selection if this feature is disabled and the Main Window will show "TX" for the Slice.

The **Split Mode** determines whether a split Slice will be removed when coming out of Split mode (FT0; or ZZSW0; commands). In SO2R (normal) mode, the split Slice will be closed. In SO2V mode, the split Slice will be left open, allowing the user to continue using it in the typical VFO A/VFO B configuration. Note that going into Split mode (FT1;

or ZZSW1; commands) in either setting will still create a split Slice in the event that one is not already in place.

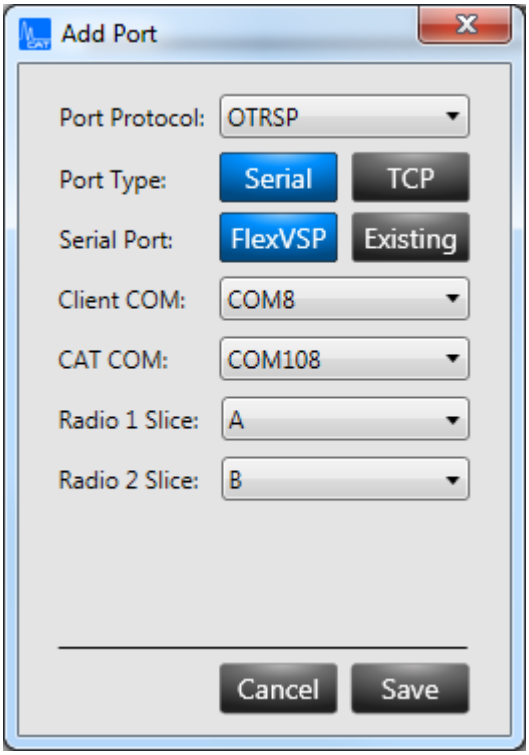


Figure 13 OTRSP Port Configuration

The OTRSP protocol has several unique fields.

The **Radio 1 Slice** is the Slice to be used when OTRSP commands reference the Radio 1 object. Similarly, **Radio 2 Slice** is the Slice to be used when OTRSP commands reference the Radio 2 object.

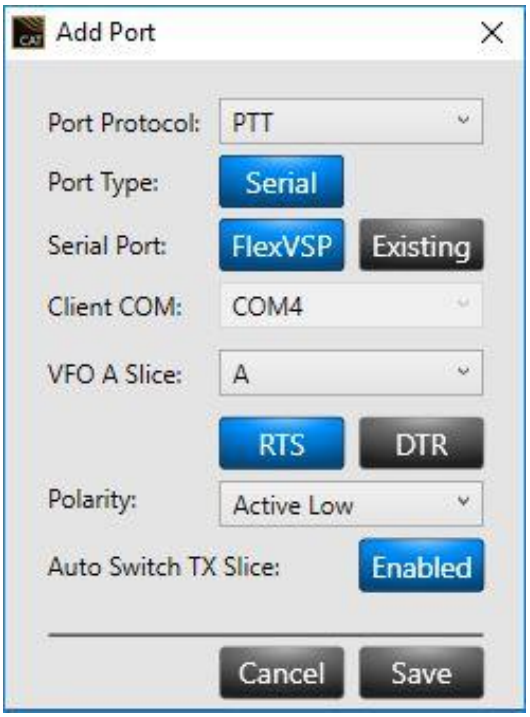


Figure 14 PTT Port Configuration

The PTT Protocol has several unique fields.

The **RTS** and **DTR** controls indicate whether to use the RTS or DTR Pins to signal PTT changes on the radio. Note that either or both of these can be used in a wired OR configuration (i.e. if both are enabled, then if either signal is asserted, PTT is signaled).

The **Polarity** indicates whether Transmit (PTT) should be active on a pin transition to Ground (Active Low) or when the pin is pulled up (Active High).

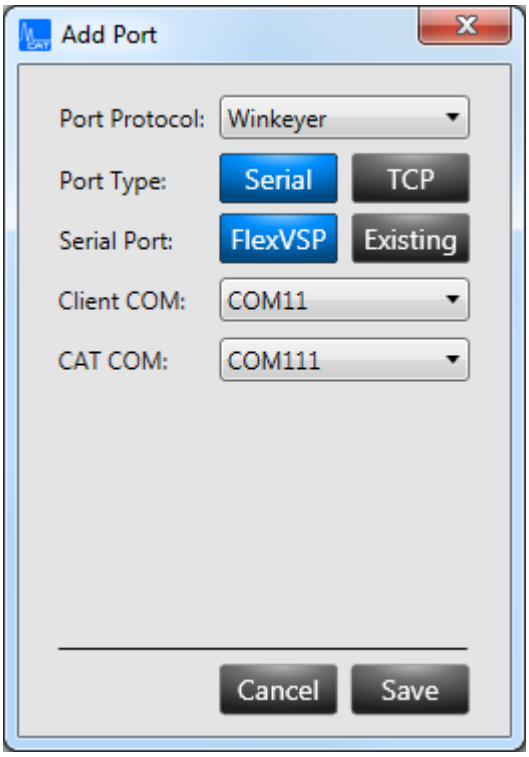


Figure 15 Winkeyer Port Configuration

The **Winkeyer** protocol has no unique fields.

The **Cancel** button will close the Window and cancel any changes on an Edit, or simply not execute an Add depending on how the Window was opened.

The **Save** button will execute any necessary changes to the Port on an Edit and will create the Port on an Add. Note that changes to the FlexVSP Serial Ports can take several seconds to complete.

3.2.3 Log Window

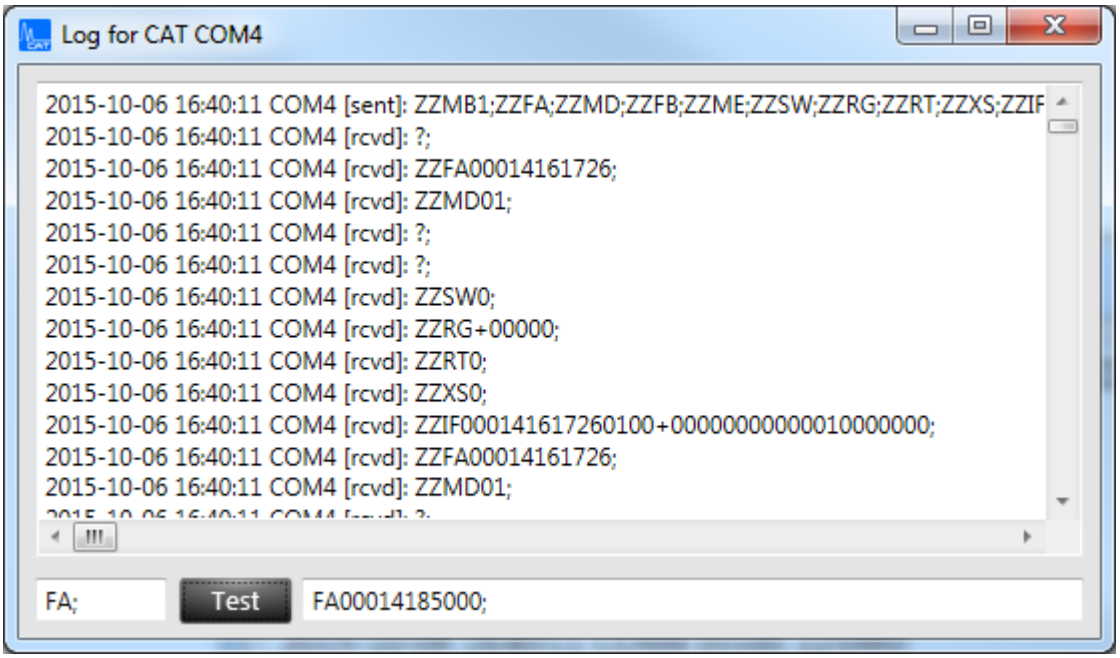


Figure 16 Log Window

The **Log Window** is primarily a diagnostic interface. It shows the stream of data being transferred across the Port in real time with date and timestamps to facilitate debugging of commands or connections. A test interface is also included that allows commands to be entered in the lower left Text Box. Commands can be executed by pressing Enter or by clicking on the Test button. The reply will be shown in the Text Box in the lower right corner.

Multiple Log Windows may be opened to view traffic on more than one port.

The traffic from all Ports is also logged to:

%appdata%\FlexRadio Systems\LogFiles\CAT.log for further debugging. Once a file grows larger than 5 Megabytes (MB), the file will be renamed CAT.log.1, then CAT.log.2, etc. and a new CAT.log will be created. A maximum of 5 log files are kept.

4 CAT COMMANDS

The following are the CAT commands supported in SmartSDR CAT. There are FlexRadio (ZZ) CAT commands and a subset of the Kenwood TS-2000 CAT command set for compatibility with older third-party CAT-enabled programs that do not support the FlexRadio CAT command set.

If a third-party CAT-enabled program does not have a FLEX-6000 or FlexRadio CAT option, then use the Kenwood TS-2000 configuration.

4.1 SUPPORTED CAT COMMANDS

ZZAG Reads / Sets VFO A Audio Gain (0-100)
ZZAI Auto Information State (on/off)
ZZAR Reads / Sets VFO A AGC Threshold (0-100)
ZZAS Reads / Sets VFO B AGC Threshold (0-100)
ZZBI Reads / Sets Binaural RX State (On / Off)
ZZDE Reads / Sets VFO A Diversity (DIV) state (On / Off) [FLEX-6700 only]
ZZFA Reads / Sets VFO A Frequency (11 digit Hz)
ZZFB Reads / Sets VFO B Frequency (11 digit Hz)
ZZFI Reads / Sets VFO A DSP Filter Index
ZZFJ Reads / Sets VFO B DSP Filter Index
ZZFR Toggle VFO A/B Active
ZZFT Toggle VFO A/B Transmit
ZZGT Reads / Sets VFO A AGC Mode
ZZIF Reads Transceiver Status
ZZLB Reads / Sets VFO A Audio Pan (0-100, Left to Right)
ZZLE Reads / Sets VFO B Audio Gain (0-100)
ZZLF Reads / Sets VFO B Audio Pan (0-100, Left to Right)
ZZMA Reads / Sets VFO A Mute (On / Off)
ZZMD Reads / Sets VFO A DSP Mode
ZZME Reads / Sets VFO B DSP Mode
ZZMG Reads / Sets Transmitter Mic Gain (0-100)
ZZNL Reads / Sets VFO A Wide Noise Blanker (WNB) Threshold (0-100)
ZZNR Reads / Sets VFO A Noise Reduction (NR) State (On / Off)
ZZPC Reads / Sets the RF Power Drive Level (0-100)
ZZRC Clears RIT
ZZRD Decrements RIT frequency
ZZRG Reads / Sets VFO A RIT Frequency (+/- 5 digit Hz)
ZZRT Reads / Sets VFO A RIT State (On / Off)
ZZRU Increments the RIT frequency
ZZRW Reads / Sets VFO B RIT Frequency (+/- 5 digit Hz)

ZZRX	Reads Receive State (On / Off) [inverse of MOX]
ZZRY	Reads / Sets VFO B RIT Frequency (+/- 5 digit Hz)
ZZSM	Read the S-Meter
ZZSW	Set Transmit VFO (0=A, 1=B)
ZZTX	Set MOX State (On / Off)
ZZXC	Clear XIT Frequency
ZZXG	Read / Set VFO A XIT Frequency (+/- 5 digit Hz)
ZZXS	Reads / Sets XIT State (On / Off)

4.2 SUPPORTED KENWOOD CAT COMMANDS

AI	Auto Information State (On / Off)
FA	Reads / Sets VFO A Frequency (11 digit Hz)
FB	Reads / Sets VFO B Frequency (11 digit Hz)
FR	Reads / Sets Active VFO (0=A, 1=B)
FT	Reads / Sets Transmit VFO (0=A, 1=B)
GT	Reads / Sets VFO A AGC Mode (0-Off, 2-Slow, 3-Medium, 4-Fast)
ID	Reads the transceiver ID number
IF	Reads Transceiver Status
KS	Reads / Sets CW Keyer Speed (5-100 WPM)
KY	Sends Text Morse Code
MD	Reads / Sets VFO A DSP Mode
NB	Reads / Sets VFO A Wide Noise Blanker State (On / Off)
PC	Reads / Sets RF Power Level (0-100)
PT	Reads / Sets CW Pitch Frequency (3 digit Hz)
RC	Clears RIT
RD	Decrements RIT frequency
RT	Reads / Sets VFO A RIT State (On / Off)
RU	Increments VFO A RIT Frequency
RX	Sets Receive State (TX Off)
SH	Reads / Sets VFO A Filter High Cut Frequency Index
SL	Reads / Sets VFO A Filter Low Cut Frequency Index
SM	Reads the S-Meter
TX	Sets Transmit State (On / Off)
XT	Reads / Sets VFO A XIT State (On / Off)

4.3 FLEXRADIO CAT COMMAND SYNTAX DETAIL

The following tables describe the FlexRadio CAT Command Syntax used with SmartSDR CAT.

ZZAG Sets or reads VFO A Audio Gain									
Get	ZZAG	;							
Set	ZZAG	P1	P1	P1	;				
Answer	ZZAG	P1	P1	P1	;				
Notes: P1 Values: Values 000 to 100.									

ZZAI Sets or reads the Auto Information mode for a Slice									
Get	ZZAI	;							
Set	ZZAI	P1	;						
Answer	ZZAI	P1	;						
Notes: P1 = 0 Auto Information disabled, P1 = 1 Auto Information enabled. When enabled, CAT will actively send any frequency change (VFO A or B) formatted as an 'FA;' or 'FB;' response.									

ZZAR Sets or reads VFO A AGC Threshold									
Get	ZZAR	;							
Set	ZZAR	P1	P1	P1	;				
Answer	ZZAR	P1	P1	P1	;				
Notes: P1 Values: Values 000 to 100.									

ZZAS Sets or reads VFO B AGC Threshold									
Get	ZZAS	;							
Set	ZZAS	P1	P1	P1	;				
Answer	ZZAS	P1	P1	P1	;				
Notes: P1 Values: Values 000 to 100.									

ZZBI Sets or reads Binaural Receive									
Get	ZZBI	;							
Set	ZZBI	P1	;						
Answer	ZZBI	P1	;						
Notes: P1 Values: 0 = Off, 1 = On									

ZZDE Sets or reads Diversity (DIV) Button [FLEX-6700 ONLY]									
Get	ZZDE	;							
Set	ZZDE	P1	;						
Answer	ZZDE	P1	;						
Notes: P1 Values: 0 = Off, 1 = On									

ZZFA Sets or reads VFO A Frequency									
Get	ZZFA	;							
Set	ZZFA	P1	P1	P1	P1	P1	P1	P1	P1
		P1	P1	P1	;				
Answer	ZZFA	P1	P1	P1	P1	P1	P1	P1	P1
		P1	P1	P1	;				
Notes: P1 = frequency in Hz (11 digits). Blank digits must be filled with 0. Example: 14.150.000 = 00014150000. May switch to 8 digit mode by doing an 8 digit set.									

ZZFB Sets or reads VFO B Frequency									
Get	ZZFB	;							
Set	ZZFB	P1	P1	P1	P1	P1	P1	P1	P1
		P1	P1	P1	;				
Answer	ZZFB	P1	P1	P1	P1	P1	P1	P1	P1
		P1	P1	P1	;				
Notes: P1 = frequency in Hz (11 digits). Blank digits must be filled with 0. Example: 14,150.000 = 00014150000. May switch to 8 digit mode by doing an 8 digit set.									

ZZFI Sets or reads VFO A DSP Filter									
Get	ZZFI	;							
Set	ZZFI	P1	P1	;					
Answer	ZZFI	P1	P1	;					
Notes: P1 value represents a Filter index from 0 to 7 for decreasing bandwidth. Example: If you are in LSB mode and your filter bandwidth is greater than 2.7K but less than or equal to 2.9K, ZZFI; will return 'ZZFI02;'. If your bandwidth were 2.901K, it would return 'ZZFI01;'.									

ZZFJ Sets or reads VFO B DSP Filter									
Get	ZZFJ	;							
Set	ZZFJ	P1	P1	;					
Answer	ZZFJ	P1	P1	;					
Notes: Similar to ZZFI for VFO B									

ZZFR Toggle VFO A/B Active									
Set	ZZFR	;							
Notes: If VFO B is not defined, this command just toggles VFO A Active on/off. Otherwise, if the radio is in "split mode" (ZZSW1) it will toggle between VFO A Active and VFO B Active.									

ZZFT Toggle VFO A/B Transmit									
Set	ZZFT	;							
Notes: If VFO B is not defined, will just toggle VFO A Transmit on/off. Otherwise will toggle between VFO A Transmit and VFO B Transmit.									

ZZGT Sets or reads VFO A AGC Mode									
Get	ZZGT	;							
Set	ZZGT	P1	;						
Answer	ZZGT	P1	;						
Notes: P1 Values: 0 = Off, 2 = Slow, 3 = Med, 4 = Fast									

ZZIF Transceiver status query									
Get	ZZIF	;							
Answer	ZZIF	P1	P1	P1	P1	P1	P1	P1	P1
		P1	P1	P1	P2	P2	P2	P2	P3
		P3	P3	P3	P3	P3	P4	P5	P6
		P7	P7	P8	P9	P9	P10	P11	P12
		P13	P14	P14	P15	;			
Notes	P1 (11 characters) VFO A frequency in Hz. Same as ZZFA; P2 (4 characters) Frequency step size (0001 = 10 Hz/1000 = 50 Hz) P3 (6 characters) RIT/XIT frequency (+nnnnn or –nnnnn). * P4 (1 character) RIT status. 0 = off, 1 = on. * P5 (1 character) XIT status. 0 = off, 1 = on. * P6 (1 character) Channel bank number. Not used, defaulted to 0. P7 (2 characters) Channel bank number. Not used, defaulted to 00. P8 (1 character) MOX button status. 0 = off, 1 = on (transmitting). P9 (2 character) Operating mode. See ZZMD for settings. P10 (1 character) VFO Split status. Same as FR. P11 (1 character) Scan status. Not used, defaulted to 0. P12 (1 character) VFO Split status. Same as FT. P13 (1 character) CTCSS tone. Not used, defaulted to 0. P14 (2 characters) More tone controls. Not used, defaulted to 00. P15 (1 character) Shift status. Not used, defaulted to 0. * Feature not available currently, defaulted to zeros.									

ZZLB Sets or reads VFO A Audio Pan									
Get	ZZLB	;							
Set	ZZLB	P1	P1	P1	;				
Answer	ZZLB	P1	P1	P1	;				
Notes: P1 Values: Values 000 (full left) to 100 (full right).									

ZZLE Sets or reads VFO B Audio Gain									
Get	ZZLE	;							
Set	ZZLE	P1	P1	P1	;				
Answer	ZZLE	P1	P1	P1	;				
Notes: P1 Values: Values 000 to 100.									

ZZLF Sets or reads VFO B Audio Pan									
Get	ZZLF	;							
Set	ZZLF	P1	P1	P1	;				
Answer	ZZLF	P1	P1	P1	;				
Notes: P1 Values: Values 000 (full left) to 100 (full right).									

ZZMA Sets or reads VFO A Mute									
Get	ZZMA	;							
Set	ZZMA	P1	;						
Answer	ZZMA	P1	;						
Notes: P1 Values: 0 = Off, 1 = On									

ZZMB Sets or reads VFO B Mute									
Get	ZZMB	;							
Set	ZZMB	P1	;						
Answer	ZZMB	P1	;						
Notes: P1 Values: 0 = Off, 1 = On									

ZZMD	Sets or reads VFO A DSP Mode								
Get	ZZMD	;							
Set	ZZMD	P1	P1	;					
Answer	ZZMD	P1	P1	;					

P1 Values:

00	LSB
01	USB
03	CWL (Mode is CW, Lower Sideband style tuning)
04	CWU (Mode is CW, Upper Sideband style tuning)
05	FM
06	AM
07	DIGU
09	DIGL
10	SAM
11	NFM
12	DFM
20	FDV
30	RTTY (ASKF – requires third-party RTTY software)
40	DSTR (D-STAR requires ThumbDV waveform and dongle)

ZZME	Sets or reads VFO B DSP Mode								
Get	ZZME	;							
Set	ZZME	P1	P1	;					
Answer	ZZME	P1	P1	;					

Notes: See ZZMD for values.

ZZMG	Sets or reads the Transmitter Mic Gain Level								
Get	ZZMG	;							
Set	ZZMG	P1	P1	P1	;				
Answer	ZZMG	P1	P1	P1	;				

Notes: P1 Values: Values 000 to 100.

ZZNL Sets or reads VFO A Wide Noise Blanker (WNB) Level									
Get	ZZNL	;							
Set	ZZNL	P1	P1	P1	;				
Answer	ZZNL	P1	P1	P1	;				
Notes: P1 Values: Values 000 to 100.									

ZZNR Sets or reads Slice Noise Reduction (NR) State									
Get	ZZNR	;							
Set	ZZNR	P1	;						
Answer	ZZNR	P1	;						
Notes: P1 Values: 0 = Off, 1 = On									

ZZPA Sets the Panadapter data IP Address:Port									
Set	ZZPC	<IP>	:	<Port>					

ZZPC Sets or reads RF Power Drive Level									
Get	ZZPC	;							
Set	ZZPC	P1	P1	P1	;				
Answer	ZZPC	P1	P1	P1	;				
Notes: P1 Values: 000 to 100									

ZZPE Sets whether the Panadapter data is Enabled									
Set	ZZPE	P1	;						
Notes: P1 Values: 0 = Disabled, 1 = Enabled									

ZZRC Clear Slice A RIT Frequency									
Set	ZZRC	;							
Notes: Sets the RIT Frequency to zero.									

ZZRD	Decrement the RIT frequency								
Set	ZZRD	P1	P1	P1	P1	P1	;		
Set	ZZRD	;							
Notes: ZZRD without parameter P1 will decrement the RIT frequency 10 Hz in CW, DIGU, and DIGL modes; 50 Hz in USB, LSB, and AM modes. P1 (00000 to 99999) will decrement the VFO A RIT Frequency by the amount entered.									

ZZRG	Sets or reads VFO A RIT Frequency								
Get	ZZRG	;							
Set	ZZRG	P1	P2	P2	P2	P2	P2	;	
Answer	ZZRG	P1	P2	P2	P2	P2	P2	;	
Notes: P1 = Polarity (+ or -) P2 = 00000 to 99999									

ZZRT	Sets or reads VFO A RIT State								
Get	ZZRT	;							
Set	ZZRT	P1	;						
Answer	ZZRT	P1	;						
Notes: P1: 1 = On, 0 = Off.									

ZZRU	Increment VFO A RIT frequency								
Set	ZZRU	P1	P1	P1	P1	P1	;		
Set	ZZRU	;							
Notes: ZZRU without parameter P1 will increment the RIT frequency 10 Hz in CW, DIGU, and DIGL modes; 50 Hz in USB, LSB, and AM modes. P1 (00000 to 99999) will increment the VFO A RIT Frequency by the amount entered.									

ZZRW	Sets or reads VFO B RIT Frequency								
Get	ZZRW	;							
Set	ZZRW	P1	P2	P2	P2	P2	P2	;	
Answer	ZZRW	P1	P2	P2	P2	P2	P2	;	
Notes: P1 = Polarity (+ or -) P2 = 00000 to 99999									

ZZRX	Sets or reads the Receive state (can only set to RX)								
Get	ZZRX	;							
Set	ZZRX	1	;						
Answer	ZZRX	P1	;						
Notes: P1 Answer Values: 0 = Off, 1 = On. 'ZZRX0;' is not supported.									

ZZRY	Sets or reads VFO B RIT State								
Get	ZZRY	;							
Set	ZZRY	P1	;						
Answer	ZZRY	P1	;						
Notes: P1: 1 = On, 0 = Off.									

ZZSM	Read the S-Meter								
Get	ZZSM	;							
Answer	ZZSM	P1	P1	P1	;				
This command will read the S-Meter value for the slice that is assigned to the CAT port P1 = 000 to 260 ZZSM reads the received signal strength in dBm where S9 = -73 dBm. The range is -140 dBm to -10 dBm with a scale factor of 2 (P2 max = 260). The actual signal strength, in dBm, is the value of ZZSM divided by 2 minus 140.									

ZZSW	Sets or reads the Transmit Flag (VFO A or B)								
Get	ZZSW	;							
Set	ZZSW	P1	;						
Answer	ZZSW	P1	;						
Notes: P1 = 0 VFO A Transmit flag is set, P1 = 1 VFO B Transmit flag is set. If VFO B has not been created, and ZZSW1; is sent, VFO B will be created near VFO A. Note that logical VFO B is not necessarily Slice B, and could be any Slice depending on which Slices already exist. The Split Slice will be shown on the Main Window on the Slice line for the Port when one is defined. The Split Slice will be removed (if it exists) when processing the ZZSW0; command.									

ZZTX	Sets or reads Transmit State (MOX)								
Get	ZZTX	;							

Set	ZZTX	P1	;						
Answer	ZZTX	P1	;						
Notes: P1 = 0 Radio is in receive mode, P1 = 1 Radio is in transmit mode									

ZZXC Clear VFO A XIT Frequency									
Set	ZZXC	;							
Notes: Sets the XIT frequency to zero.									

ZZXG Sets or reads VFO A XIT Frequency									
Get	ZZXG	;							
Set	ZZXG	P1	P2	P2	P2	P2	P2	;	
Answer	ZZXG	P1	P2	P2	P2	P2	P2	;	
Notes: P1 = Polarity (+ or -) P2 = 00000 to 99999									

ZZXS Sets or reads VFO A XIT State									
Get	ZZXS	;							
Set	ZZXS	P1	;						
Answer	ZZXS	P1	;						
Notes: P1: 0 = Off, 1 = On.									

4.4 KENWOOD CAT COMMAND SYNTAX DETAIL

The following tables describe the Kenwood CAT Command Syntax used with SmartSDR CAT

AI Sets or reads the Auto Information mode									
Get	AI	;							
Set	AI	P1	;						
Answer	AI	P1	;						
Notes: P1 = 0 Auto Information disabled, P1 = 1 Auto Information enabled. When enabled, CAT will actively send any frequency change (VFO A or B) formatted as an 'FA;' or 'FB;' response.									

AG Sets or reads VFO A Audio Gain									
Get	AG	;							
Set	AG	P1	P1	P1	;				
Answer	AG	P1	P1	P1	;				
Notes	P1 = 000 to 100.								

FA Sets or reads Slice A frequency									
Get	FA	;							
Set	FA	P1	P1	P1	P1	P1	P1	P1	P1
		P1	P1	P1	:				
Answer	FA	P1	P1	P1	P1	P1	P1	P1	P1
		P1	P1	P1	;				
Notes: P1 = frequency in Hz (11 digits). Blank digits must be filled with 0. Example: 14,150.000 = 00014150000. May switch to 8 digit mode by doing an 8 digit set.									

FB Sets or reads Slice B frequency									
Get	FB	;							
Set	FB	P1	P1	P1	P1	P1	P1	P1	P1
		P1	P1	P1	;				
Answer	FB	P1	P1	P1	P1	P1	P1	P1	P1
		P1	P1	P1	;				
Notes: P1 = frequency in Hz (11 digits). Blank digits must be filled with 0. Example: 14,150.000 = 00014150000. May switch to 8 digit mode by doing an 8 digit set.									

FR Sets or reads VFO A/B Active flags									
Get	FR	;							
Set	FR	P1	;						
Answer	FR	P1	;						
Notes: P1 will be "0" when VFO A Active flag is set. P1 will be "1" when VFO B Active flag is set. Setting 'FR1;' without VFO B will result in ';'									

FT Sets or reads VFO A/B Transmit flags									
Get	FT	;							
Set	FT	P1	;						
Answer	FT	P1	;						
Notes: P1 = "0" sets VFO A Transmit flag. P1 = "1" sets VFO B Transmit flag. If VFO B has not been created, and FT1; is sent, VFO B will be created near VFO A. Note that logical VFO B is not necessarily Slice B, and could be any Slice depending on which Slices already exist. The Split Slice will be shown on the Main Window on the Slice line for the Port when one is defined. The Split Slice will be removed (if it exists) when processing the FT0; command.									

GT Sets or reads VFO A AGC Mode									
Get	GT	;							
Set	GT	P1	P1	P1	;				
Answer	GT	P1	P1	P1	;				
Notes: P1 Values: 000 = Off, 002 = Slow, 003 = Med, 004 = Fast									

ID Reads the transceiver ID number									
Get	ID	;							
Answer	ID	P1	P1	P1	;				
Notes: P1 Values: 904 = Flex-6700, 905 = Flex-6500, 906 = Flex-6700R, 907=Flex-6300									

IF Transceiver status query									
Get	IF	;							
Answer	IF	P1	P1	P1	P1	P1	P1	P1	P1
		P1	P1	P1	P2	P2	P2	P2	P3
		P3	P3	P3	P3	P3	P4	P5	P6
		P7	P7	P8	P9	P10	P11	P12	P13
		P14	P14	P15	;				
Notes	P1 (11 characters) VFO A frequency in Hz. Same as FA; P2 (4 characters) Frequency step size (0001 = 10 Hz/1000 = 50 Hz) P3 (6 characters) RIT/XIT frequency (+nnnnn or –nnnnn). P4 (1 character) RIT status. 0 = off, 1 = on. P5 (1 character) XIT status. 0 = off, 1 = on. P6 (1 character) Channel bank number. Not used, defaulted to 0. P7 (2 characters) Channel bank number. Not used, defaulted to 00. P8 (1 character) MOX button status. 0 = off, 1 = on (transmitting). P9 (1 character) Operating mode. See MD for settings. P10 (1 character) VFO Split status. Same as FR. P11 (1 character) Scan status. Not used, defaulted to 0. P12 (1 character) VFO Split status. Same as FT. P13 (1 character) CTCSS tone. Not used, defaulted to 0. P14 (2 characters) More tone controls. Not used, defaulted to 00. P15 (1 character) Shift status. Not used, defaulted to 0.								

KS Sets or reads the CW keying speed									
Get	KS	;							
Set	KS	P1	P1	P1	;				
Answer	KS	P1	P1	P1	;				
Notes	P1 = 005 to 100.								

KY Sends text to CWX for conversion to Morse									
Get	KY	;							
Set	KY	P1	P2	P2	P2	P2	P2	P2	P2
		P2	P2	P2	P2	P2	P2	P2	P2
		P2	P2	P2	P2	P2	P2	P2	P2
		P2	;						
Answer	KY	P1	;						
Notes: P1 = character buffer available; 0=YES/1=NO (SmartSDR is not buffer limited so P1 will always return a "0". P2 = Any of the 56 printable ASCII characters. Empty character positions in P2 must contain a space. SmartSDR CAT will accept the Kenwood protocol as shown above but it is not limited to the same strict formatting. The number of P2 characters is limited to 256.									

MD Sets or reads VFO A DSP mode									
Get	MD	;							
Set	MD	P1	;						
Answer	MD	P1	;						
Notes	P1 = 1 LSB 2 USB 3 CW 4 FM (NFM, DFM, FDV) 5 AM (SAM) 6 DIGL (RTTY) 9 DIGU								

NB Sets or reads VFO A Wide Noise Blanker (WNB)									
Get	NB	;							
Set	NB	P1	;						
Answer	NB	P1	;						
Notes: P1 0 = Off, 1 = On									

PC Sets or reads the RF Power Drive Level									
Get	PC	;							
Set	PC	P1	P1	P1	;				
Answer	PC	P1	P1	P1	;				
Notes: P1 Values: 000 to 100									

PT Sets or reads the CW Pitch Frequency									
Get	PT	;							
Set	PT	P1	P1	P1	;				
Answer	PT	P1	P1	P1	;				
Notes: P1 Values: 000 to 999									

RC Clear VFO A RIT Frequency									
Set	RC	;							
Notes: Sets the RIT frequency to zero.									

RD Decrement VFO A RIT Frequency									
Set	RD	P1	P1	P1	P1	P1	;		
Notes: RD without parameter P1 will decrement the RIT frequency 10 Hz in CW, DIGU, and DIGL modes; 50 Hz in USB, LSB, and AM modes. P1 (00000 to 99999) will decrement the VFO A RIT Frequency by the amount entered.									

RT Sets or reads VFO A XIT State									
Get	RT	;							
Set	RT	P1	;						
Answer	RT	P1	;						
Notes: P1: 0 = Off, 1 = On.									

RU Increment VFO A RIT frequency									
Set	RU	P1	P1	P1	P1	P1	;		
Notes: RU without parameter P1 will increment the RIT frequency 10 Hz in CW, DIGU, and DIGL modes; 50 Hz in USB, LSB, and AM modes. P1 (00000 to 99999) will increment the VFO A RIT Frequency by the amount entered.									

RX Sets Receive mode									
Set	RX	;							
Notes: RX is a write only command.									

SH Sets or reads VFO A DSP Filter High Cut Index									
Get	SH	;							
Set	SH	P1	P1	;					
Answer	SH	P1	P1	;					
Notes	LSB/USB/CW/DIGU/DIGL 00 = 1400 01 = 1600 02 = 1800 03 = 2000 04 = 2200 05 = 2400 06 = 2600 07 = 2800 08 = 3000 09 = 3400 10 = 4000 11 = 5000		AM 2500 3000 4000 5000						

SL Sets or reads VFO A DSP Filter Low Cut Index									
Get	SL	;							
Set	SL	P1	P1	;					
Answer	SL	P1	P1	;					
Notes	LSB/USB/CW/DIGU/DIGL 00 = 0 01 = 50 02 = 100 03 = 200 04 = 300 05 = 400 06 = 500 07 = 600 08 = 700 09 = 800 10 = 900 11 = 1000			AM 0 100 200 500					

SM Reads VFO A S-Meter									
Get	SM	;							
Answer	SM	P2	P2	P2	P2	;			
This command will read the S-Meter value for the slice that is assigned to the CAT port Notes: Read-only P1 = 0, P2 = 0000 - 0030 Reads S9 approximately equal to 0015. Use ZZSM if possible.									

TX Sets Transmit Mode (MOX)									
Set	TX	P1	P1	;					
Note: TX is a write only command.									

XT Sets or reads XIT State									
Get	XT	;							
Set	XT	P1	;						
Answer	XT	P1	;						
Notes: P1: 1 = On, 2 = Off.									

5 OTRSP COMMANDS

The following are the OTRSP commands supported in SmartSDR CAT. The full OTRSP command set can be found here: http://www.k1xm.org/OTRSP/.

5.1 SUPPORTED OTRSP COMMANDS

RX1 Connect Radio 1 to both headphones
RX2 Connect Radio 2 to both headphones
RX1S Connect Radio 1 to Left, Radio 2 to Right (focus Radio 1)
RX2S Connect Radio 1 to Left, Radio 2 to Right (focus Radio 2)
RX1R Connect Radio 1 to Right, Radio 2 to Left (focus Radio 1)
RX2R Connect Radio 1 to Right, Radio 2 to Left (focus Radio 2)

TX1 Set Radio 1 as the transmitter
TX2 Set Radio 2 as the transmitter

6 WINKEYER COMMANDS

The following are the Winkeyer commands supported in SmartSDR CAT. The full Winkeyer command set can be found here: http://k1el.tripod.com/files/Winkey10.pdf.

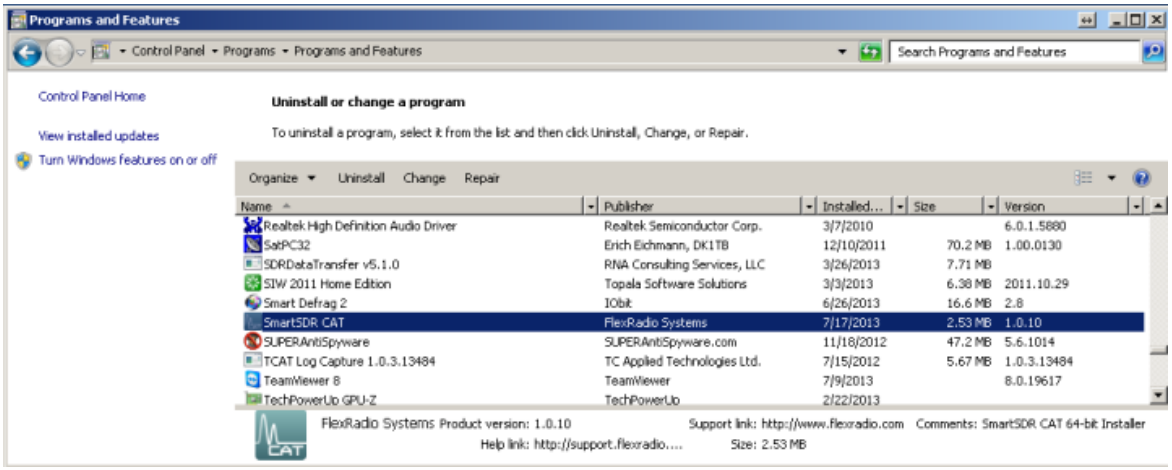
6.1 SUPPORTED WINKEYER COMMANDS

<0x00> Admin Command
<0x02> Set CW sending speed
<0x08> Backup input pointer (backspace)
<0x0A> Clear input buffer
<0x0F> Load Defaults (speed only)
<0x1C> Buffered Speed Change (implemented as immediate for now)

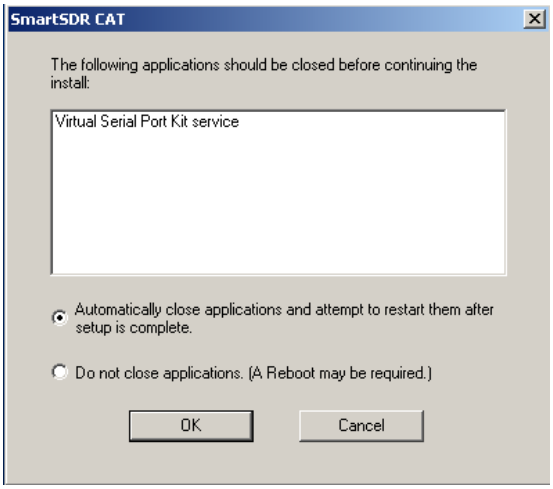
APPENDIX A: Uninstalling SmartSDR CAT versions prior to v1.2.11

THIS PROCEDURE IS NOT REQUIRED IF YOU HAVE INSTALLED SMARTSDR V1.2.17 OR GREATER

1. Close the **SmartSDR CAT** application and any programs that connect to the FLEX-6000 via CAT. This includes DDUtil.
2. Open the **Windows Control Panel** and select **Uninstall a Program**
3. Look for the **SmartSDR CAT**, **CAT_32** or **CAT_64** program entries and right click on them to display the Uninstall menu



4. Left click on the Uninstall option.
5. Answer **Yes** to the prompt *"Are you sure you want to uninstall SmartSDR CAT"*
6. SmartSDR CAT will begin to uninstall.
7. If you receive a prompt to "*Automatically close applications and attempt to restart them after setup is complete*", click on **OK** to continue. See image below.



8. After SmartSDR CAT has finished uninstalling, reboot your PC.

APPENDIX B: KEY TERMS

The following table provides definitions for terms relevant to this document.

Term	Definition
AGC	Automatic Gain Control
CAT	Computer Assisted Transceiver
DSP	Digital Signal Processing
LAN	Local Area Network
MOX	Manually Operated switch
NR	Noise Reduction
OTRSP	Open Two Radio Switching Protocol
PA	Power Amplifier
RIT	Receiver Incremental Tuning
RX	Receive or Receiver
SO2R	Single Operator, 2 radios
TCP/IP	Transmission Control Protocol / Internet Protocol
XIT	transmitter Incremental Tuning
TX	Transmit or Transmitter
VFO	Variable Frequency Oscillator