# ProScan Settings - A Simplified Guide

The most commonly misunderstood concept for the ProScan site scanning algorithm it that it is NOT a function to switch RF sites in a Trunked Radio System, but it is actually a function to PREVENT switching between RF sites. It retards the shifting to other sites.

PROSCAN: FIXED vs. DYNAMIC

This control determines what site scanning lists the radio will use for site transition.

In **FIXED ProScan**, the radio only used the information that has been preprogrammed into it. The only other systems being considered are those listed in the SYSTEMS BEING SCANNED box. If an ADJACENCY TABLE is being transmitted in the Control Channel data stream, originating from the radio system's IMC, a radio in FIXED ProScan mode ignores this additional data.
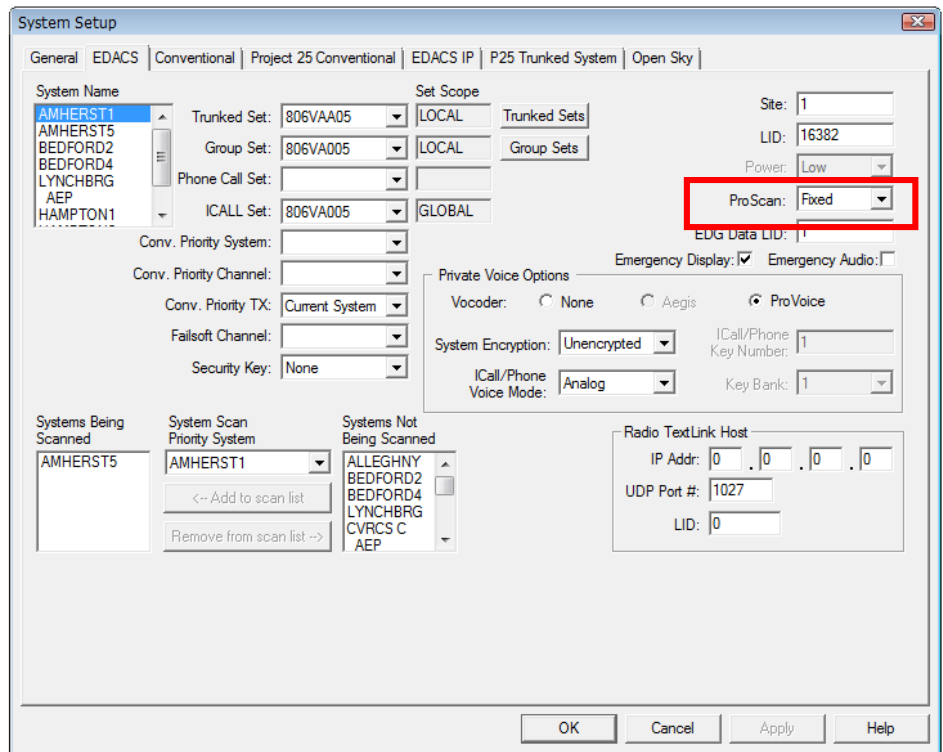
In **DYNAMIC ProScan**, the radio first uses the ADJACENCY TABLE is being transmitted in the Control Channel data stream, originating from the radio system's IMC. The ADJACENCY TABLE information not only contains the available adjacent RF sites, it also indicates which RF channel on the RF site is the Control Channel. Thereby saving time by not being required to scan all RF channels on the site to find, acquire, and interrogate the data stream for the required information. As a back-up function in DYNAMIC ProScan, if the ADJACENCY TABLE is missing from the control channel, the radio will then revert to the Fixed ProScan data pre-programmed into the radio, as listed in the SYSTEMS BEING SCANNED box.

SENSITIVITY:

This value controls the radio's sensitivity to fluctuations in signal quality levels. The lower the value in this control, the higher the sensitivity.

- Type a numeric value in the range from 0 to 15.
- Default Value = 3

While the radio is locked onto the control channel, it will begin to determine the signal quality level of the current control channel. The signal quality metric used is dependent on the algorithm in use. *For* ==the ProScan algorithm the signal quality is determined based on a combination of both Received Signal Strength Indicator (RSSI) and Control Channel Verification (CCV) measurements).== As the radio roams toward the outer range of the system's coverage, the control channel signal quality begins to deteriorate. If the calculated signal quality level drops below the programmed system transition level, the radio will enter the **Transition Scan Mode**.

For example, radios with low values in this control (high sensitivity) will enter **Transition Scan Mode** quickly upon detecting the selected system's signal quality level falling below the system transition level. Low values in this control provide high sensitivity and quick access to the **Transition Scan Mode**, but there is a chance of falsing on a temporary fade. However, a radio set to a higher value (which corresponds to lower sensitivity), will only enter **Transition Scan Mode** after detecting the selected system's signal quality level has fallen below the system transition level many consecutive times.
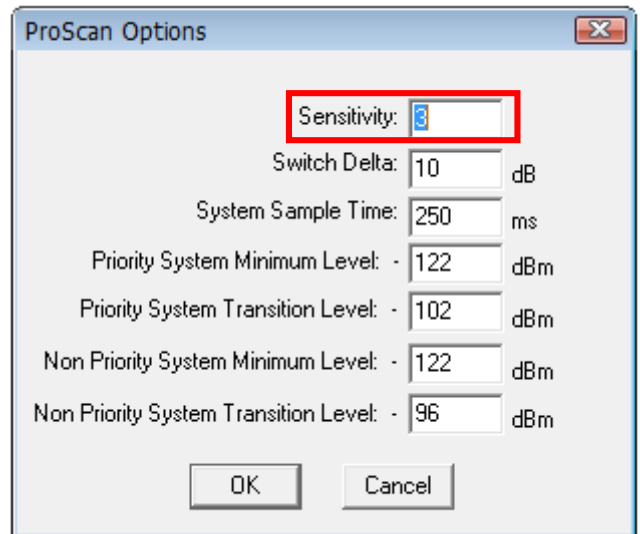
SWITCH DELTA:

This control determines how much improvement the best scanned system must be over the current selected system for the radio to switch control channels.

If the signal quality level of the best scanned site is better than the signal quality of the current control channel, and the value that this control corresponds to, then the radio will switch to the better system.
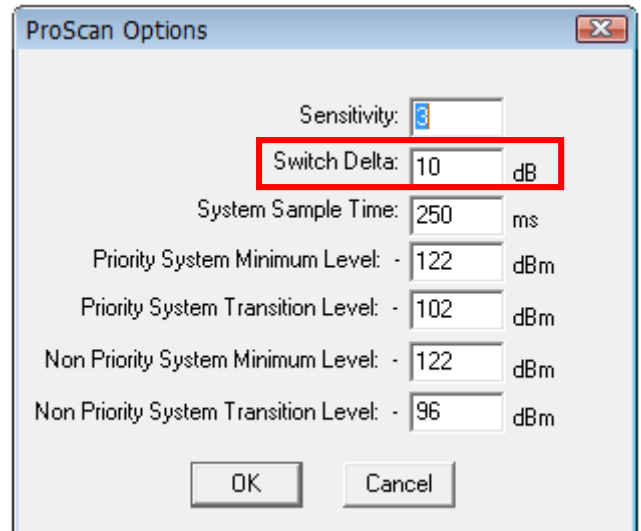
- Switch Delta value range of adjust from Ø to 15.   (Ø dB to 30 dB signal difference)
- For the LPE-200 and ORION family of products, the default value is "5" (10 dB difference).

In the **Transition Scan Mode**, the radio monitors the control channel signal of each site listed in the adjacency table. For each control channel, the radio calculates the signal quality level and compares the value to the current control channel's signal quality level. The signal quality metric used is dependent on the algorithm in use. The signal quality is determined based on a combination of both *Received Signal Strength Indicator* (RSSI) and *Control Channel Verification* (CCV) measurements.

If the signal quality level of the <u>best scanned site</u> is better than the <u>current control channel's</u> signal quality level, and the difference between them is equal to or greater than the value that this control corresponds, then the radio will switch to the better system.
In the ProScan algorithm the switch delta parameter is referenced to an RF signal difference quantized in 2 dB steps. Therefore the operating range for this parameter is as follows:

- Switch Delta: 1- is equivalent to a   2 dB signal difference.
- Switch Delta: 2 - is equivalent to a   4 dB signal difference.
- Switch Delta: 3 - is equivalent to a   6 dB signal difference.
- Switch Delta: 5 - is equivalent to a 10 dB signal difference.
- Switch Delta: 10 - is equivalent to a 20 dB signal difference.
- Switch Delta: 15 - is equivalent to a 30 dB signal difference.

Therefore choosing a Switch Delta of "5", will force the radio to remain on the selected system, until the signal difference between the selected system and an adjacent system is equal to or greater than 10 dB assuming a Non-Priority System.

NOTE: When using the ProScan algorithm, it is <u>not</u> recommended to set the Switch Delta value below "3". This is due to the changes made to the scanning algorithm and the fading effects of the environment.

This parameter controls the difference that has to exist between the current system and the adjacent system – how much "better" it is. Generally, the smaller the value, the faster the radio will decide to switch system but this will also cause the radio to "dither" and switch from one system and back again. Ideally, this parameter value should be larger in a multi-pathed, urban type environment where multiple systems are available and smaller in a spread out rural area. It also should be slightly larger for portables since they tend to encounter more situations where the dithering becomes a problem.

To calculate this in dB, the conversion is: ***RF offset* = (2 * Switch Delta) *dB***

NOTE:

- In older **Radio Programmer** software application, the values are Ø to 15. (Ø dB to 30 dB signal difference).
- In the current **Radio Personality Manager** (RPM) software application, the values are directly referenced in Ø dB to 30 dB signal difference.

If the signal quality level of the best scanned site is better than the signal quality of the current control channel, or the value that this control corresponds to (ProScan), then the radio will switch to the better system.

In the Transition Scan Mode, the radio monitors the control channel signal of each site listed in the adjacency table. For each control channel, the radio calculates the signal quality level and compares the value to the current control channel's signal quality level. The signal quality metric used is dependent on the algorithm in use. For the ProScan algorithm the signal quality is determined based on the Received Signal Strength Indicator (RSSI).

If the signal quality level of the best scanned site is better than the current control channel's signal quality level or the value that this control corresponds (ProScan), then the radio will switch to the better system. This control determines how much improvement the best scanned system must be over the current selected system for the radio to switch control channels.

SYSTEM SAMPLE TIME

The value in this control represents the amount of time between sampling the adjacent systems.

- System Sample Time value range of adjust from 150 – 6,350 milliseconds.
- For the LPE-200 and ORION family of products, the default value is 250ms.

In the Transition Scan Mode, the radio continuously monitors the selected control channel's signal and compares the calculated signal quality level to user programmable threshold values. The signal quality metric used is dependent on the algorithm in use. The signal quality is determined based on a combination of both *Received Signal Strength Indicator* (RSSI) and *Control Channel Verification* (CCV) measurements.

The radio will always sample the adjacent system, and then return to the selected system and pause (for the amount of time entered in this control), before sampling another scan system. The higher the value in this control, the more time the radio spends monitoring the selected system's control channel and the longer it will take to find a better system. The lower the value in this control, the less time the radio spends monitoring the selected system's control channel and the less time it will take to find a better system.

This time (in ms) is the period BETWEEN adjacent system scans. Since a system scan takes approximately 70 ms, if this parameter is set to 300 ms then adjacent systems will be examined in turn every 370 ms.

This parameter directly affects the speed of ProScan decision making. It has an adverse effect in that not only will a larger proportion of call assignments be missed (leading to an increase in late entries), but (there is) also an increase in the probability of missing both the assignment and subsequent channel updates for channel late entry (leading to missed audio). If the default of 250ms is used the radio will miss approximately 70/(250+70) of the control channel messages or 21%. When this parameter is reduced to the minimum of 150 ms, this becomes   70/(150+70) of the control channel messages or 32%.
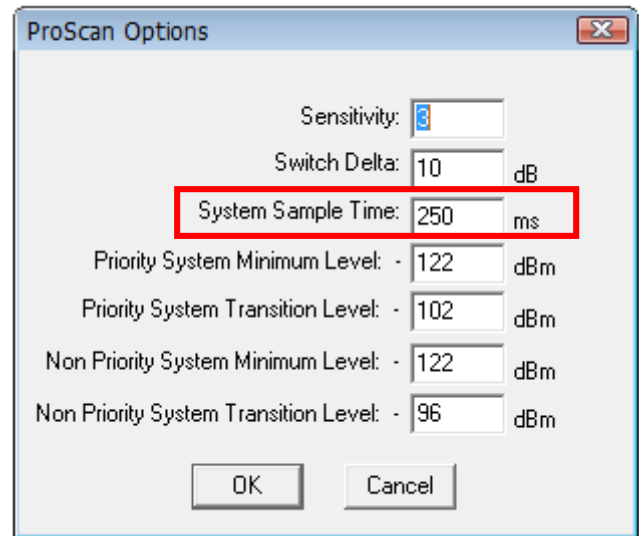
Priority System Minimum Level

If the selected priority systems' control channel signal quality level deteriorates to a level equal to or below the value this control corresponds with (ProScan), then the radio switches to the full time or Adjacent System Scan Mode (Wide Area System Scan Mode).
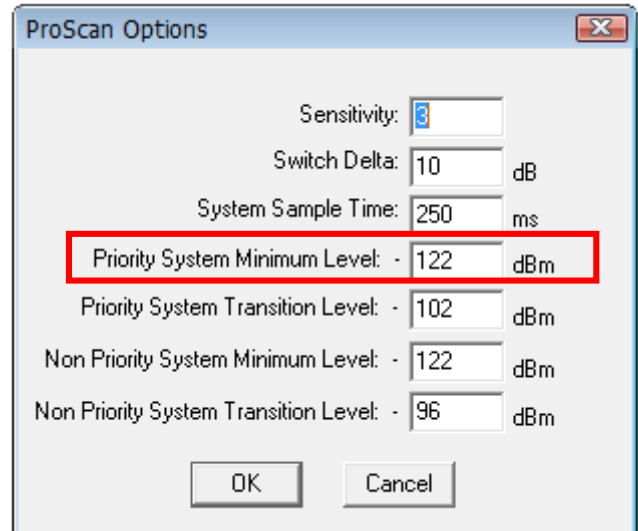
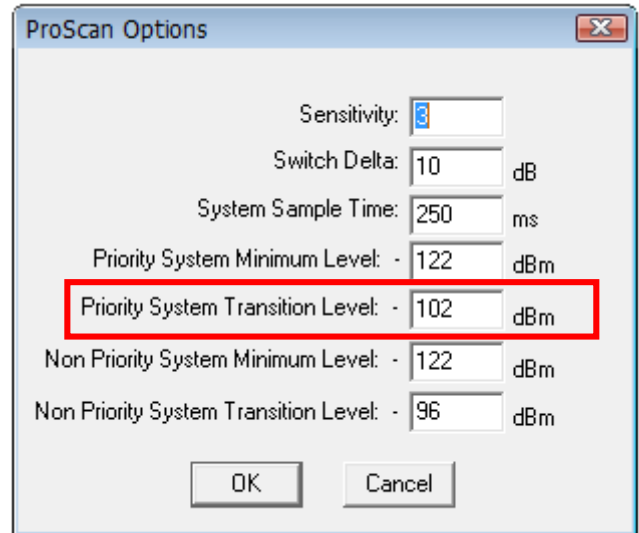- Type a numeric value in the range from -60 to -122 dBm.

The radio continuously monitors the selected control channel's <u>signal</u> and compares the calculated signal quality level to the value programmed in the <u>Priority System Transition Level</u> control. The signal quality metric used is dependent on the algorithm in use. For the ProScan algorithm the signal quality is determined based on the Received Signal Strength Indicator (RSSI). If the signal quality level drops below the value set in the Priority System Transition Level control, the radio enters the Transition Scan Mode and will start monitoring the adjacent systems identified in its adjacency table. If the signal quality level of an adjacent non-priority system is an improvement that equals or exceeds the <u>Switch Delta</u> value, the radio will switch to the scanned site. Otherwise, the radio will remain on its current site. If the selected control channel's signal quality level deteriorates to a level equal to or below the value set in this control, then the radio switches to the full time or Adjacent System Scan Mode (Wide Area System Scan Mode).

In Adjacent System Scan Mode, the radio will begin searching for a <u>control channel</u> on the first system in the system scan table. The radio will check the programmed number of channels within the scanned system for a control channel. If a control channel is not found, the radio switches to the next system and repeats the procedure. This process will continue until a control channel is found.

Priority System Transition Level

The value in this control is used by the radio in <u>two different scenarios</u> to determine when to enter the Transition Scan Mode or when to switch to the priority system.

- Type a numeric value in the range from Ø to -31.

The first scenario, applies when the current or selected system is designated as a priority system.

> The radio continuously monitors the selected sites' control channel signal and compares the calculated signal quality level to the value defined in this control.   For the ProScan algorithm the signal quality is determined based on a combination of both *Received Signal Strength Indicator* (RSSI) and *Control Channel Verification* (CCV) measurements.

> If the signal quality drops below the level defined in this control, the radio enters the <u>Transition Scan Mode</u> and will start monitoring the adjacent systems identified in its adjacency table. If the signal quality level of an adjacent non-priority system is an improvement that equals or exceeds the **Switch Delta** value, the radio will switch to the scanned site. Otherwise, the radio will remain on its current site. If the selected control channel's signal quality deteriorates to a level equal to or below the value set in the **Priority System Minimum Level** control, then the radio switches to the full time or Adjacent System Scan Mode (Wide Area System Scan Mode) and seeks out any available control channel.

The second scenario occurs when the radio's current control channel is a non-priority system and has a priority system in its scan list.

> The radio will sample the priority system at the rate set in the **System Sample Time** control. If the calculated signal quality level for the priority system is greater than the value in this control, the radio will switch to the priority system.

This parameter gives the received control channel RF level at which the radio will begin ProScan adjacent system scans when it is on the priority system. To calculate this RF level, the conversion is:

ScanStartLevel = -(60+(Priority system transition level - Switch Delta)*2)) *dBm*

For example, if the parameter is set to 12 the radio will begin to ProScan when the level falls to –(60+24) dBm or -84 dBm.

It also gives the point at which the radio will switch TO the priority system regardless of the current (non priority) control channel RF level reading. This RF level is given by:

SwitchLevel = -(60+(Priority system transition level - Switch Delta)*2) *dBm*

For the above example of –84 dBm (the transition level is set to 12 in RPM), assuming an 8 dB switch delta (the parameter in RPM is 4), the radio will switch to the priority system irrespective of the current control channel RF level when the priority system measures **–(60 + ((12-4) *2) dBm** , or –72 dBm.

Non Priority System Minimum Level

If the selected non-priority systems' control channel signal quality level deteriorates to a level equal to or below or the value this control corresponds with, then the radio switches to the full time or Adjacent System Scan Mode (Wide Area System Scan Mode).

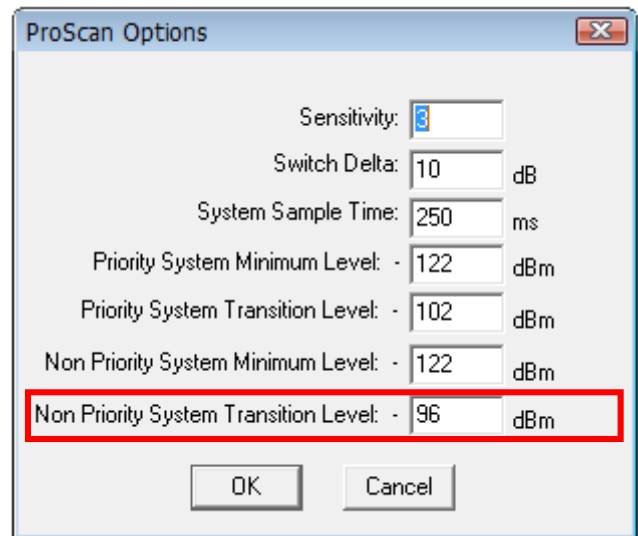- Value in the range from 60 to 122.

           Default : 122 dBm
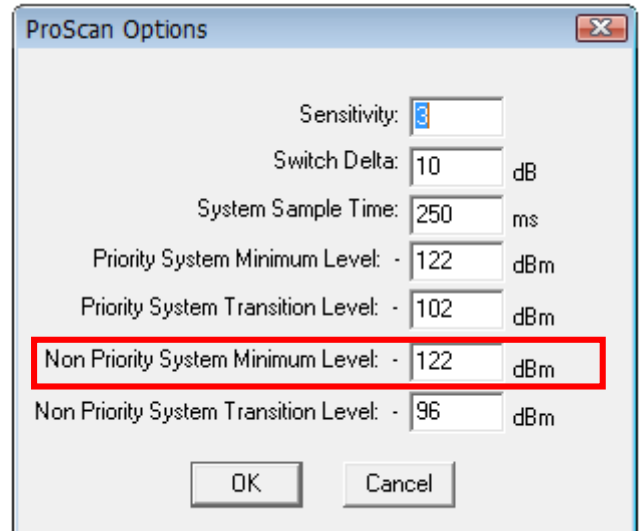
The radio continuously monitors the selected control channel's signal and compares the calculated signal quality level to the value programmed in the **Non Priority System Transition Level** control. The signal quality metric used is dependent on the algorithm in use. *For the ProScan algorithm the signal quality is determined based on the Received Signal Strength Indicator (RSSI).* If the signal quality level drops below the value set in the Non Priority System Transition Level control, the radio enters the **Transition Scan Mode** and will start monitoring the adjacent systems identified in its adjacency table. If the signal quality level of an adjacent non-priority system is an improvement that equals or exceeds the Switch Delta value, the radio will switch to the scanned site. If the signal quality level of an adjacent priority system is greater than the Priority System Transition Level, the radio will switch to the scanned priority system. For radios using the new ProScan algorithm, the signal quality level must be greater than the ***Priority System Transition Level*** plus the ***Switch Delta*** (in terms of an RF signal level).

Otherwise, the radio will remain on its current site. If the selected control channel's signal quality level deteriorates to a level equal to or below the value set in this control, then the radio switches to the full time or **Adjacent System Scan Mode** (**Wide Area System Scan Mode**).

In the **Adjacent System Scan Mode**, the radio will begin searching for a control channel on the first system in the system scan table. The radio will search the programmed number of channels within the scanned system for a control channel. If a control channel is not found, then the radio will switch to the next system and repeat the procedure. This process will continue until a control channel is found.

Non-Priority System Transition Level

If the selected non priority systems' control channel signal quality level drops below the value that this control corresponds to, the radio enters the Transition Scan Mode and will start monitoring the adjacent systems identified in its adjacency table.

- Type a numeric value in the range from Ø to -31.
- For the M7100 and P7100 family of products, the default value is -18.

The radio continuously monitors the selected systems control channel's signal and compares the calculated signal quality level to the value defined in this control. The ProScan algorithm signal quality is determined based on a combination of both *Received Signal Strength Indicator* (RSSI) and *Control Channel Verification* (CCV) measurements).

If the signal quality level drops below the value set in this control, the radio enters the Transition Scan Mode and will start monitoring the adjacent systems identified in its adjacency table.

If the signal quality level of an adjacent non-priority system is an improvement that equals or exceeds the **Switch Delta** value, the radio will switch to the scanned site. Otherwise, the radio will remain on its current site.

If there is a priority system in the scan list, the radio will sample that priority system at the rate set in the System Sample Time control. If the calculated signal quality level for the priority system is greater than the value in the **Priority System Transition Level** control, the radio will switch to the priority system. For radios using the ProScan algorithm, the calculated signal level for the priority system must be greater than the **Priority System Transition Level** plus the **Switch Delta**, (in terms of an RF signal level), before the radio will switch to the priority system.

If the selected control channel's signal quality level deteriorates to a level equal to or below the value set in the Non Priority System Minimum Level control, then the radio switches to the full time or adjacent system scan mode and seeks out any available control channel.

This parameter determines the RF level of the current system's control channel at which the radio will turn on ProScans for adjacent systems on a non priority system. This RF level is found using the conversion:

$$RFLevel = -(60+(NonPriority\ system\ transition\ level *2))\ dBm$$

It is worth noting that if priority system scanning is enabled, and the RF level of the current control channel is above this level, then the radio will ProScan the specified priority system only (ignoring any other adjacent systems).