



Smart Coil™ Deployment Guidelines White Paper

Topic: Smart Coil Deployment Guidelines for ADSL and Voice Transmission

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Summary

This technical service bulletin is being issued to provide guidelines for the use and deployment of Smart Coil.

Smart Coil is Charles Industries patented device that provides the line conditioning benefit of a common load coil for POTS traffic while being transparent to ADSL. With the installation of Smart Coil, a loop that was providing either POTS or ADSL exclusively can instead handle both services on a single copper pair.



SMART COIL™

ADSL

Smart Coil is designed to be transparent to ADSL. Smart Coil will permit ADSL to travel the same distance as ADSL would normally travel if the loop were a non-conditioned pair. Prior to the development of Smart Coil, the distance limit that both ADSL and POTS could go on the same pair was not to ADSL's full capability, but rather was limited by the POTS loop length limit without load coils. Smart Coil allows ADSL and POTS on the same pair to go a farther distance as it removes POTS loop length limits. A common misconception is that Smart Coil will extend the distance ADSL can be deployed. Technically, it does not extend ADSL's achievable distance, but rather allows ADSL to reach its full distance – an impossibility when common load coils are used in the loop.

While Smart Coil is designed to be transparent to ADSL, field use has shown instances where Smart Coil has actually increased the speed and/or distance of ADSL transmission. This improvement is due to Smart Coil reducing the interference on the pair. Likewise, some installations have reported that Smart Coil slightly reduces the ADSL deployment speed. This is primarily due to the slight loss ADSL encounters in the components of the Smart Coil. Most installations report no change in the ADSL rates or deployment distance.

Smart Coil is designed to work on any version of ADSL that supports base-band POTS. A quick test to determine if Smart Coil will work is: "Does this version of ADSL allow for base-band POTS?" If yes, Smart Coil will operate correctly. Note that some versions of ADSL incorporate the POTS channel digitally into the data stream. For these versions of ADSL, Smart Coil should not be used.

Installing Smart Coil does not relieve the need for conditioning the pair. The process is the same as installing ADSL alone on a pair...remove all the bridge taps, build-out capacitors, lattice networks and common load coils, etc. Prepare the cable pair for the ADSL to be as close to an ideal non-conditioned pair as possible.

Deployment

The design of the Smart Coil allows for flexible placement. Smart Coil actually senses the pair and adjusts automatically. This allows for ease of installation on almost any system. The Smart Coil may be deployed in either 66 mH (4500 ft) or 88 mH (6000 ft) standard spacing. Spacing of 3000-8500 feet between Smart Coils results in proper operation. Reduce the distance by $\frac{1}{2}$ for the 1st Smart Coil from the Central Office.

It is important that all bridge taps be removed from the loop when using Smart Coil. The Smart Coil will sense the distance of the bridge tap and add the bridge tap distance to the assumed cable length. A bridge tap will adversely affect the Smart Coil's ability to adjust properly, significantly reducing the effectiveness of the Smart Coil.

Due to the flexible placement of the Smart Coil, build-out capacitors of any type are not needed. Simply place the Smart Coil in the location of convenience. As long as the previous criteria are met, the Smart Coil will operate properly.

Smart Coils may be deployed in the same pair as common load coils. When Smart Coils are deployed with common load coils, POTS traffic is unaffected. However, ADSL will not be optimally transmitted until all common load coils on the pair are replaced with Smart Coils. In addition, the pair should be conditioned for ADSL when ADSL traffic is applied.

POTS Traffic (and Dial-up modems)

Smart Coil, just like common load coils, provides gain in the POTS band. This improvement is similar to the gain improvement experienced with common load coils.

The Smart Coil is designed to be CLASS compatible. All the functions of CLASS services pass through the Smart Coil.

Once the Smart Coil is inserted into the loop, it is common to experience an increased loss of 1 to 2 dB additional loss (measured at 2,500 Hz) compared to a common load coil. This is normal for the Smart Coil and should not be a concern, as this minimal increase in loop loss will be transparent to the typical subscriber.

The great majority of FAX and dial-up modems work correctly with the Smart Coil, although Smart Coil typically caps the top data transmission speed attainable to 33 kbs on these devices. This speed limitation is a function of the position of the Smart Coil and the cable type. Some loops have slower modem speeds while others have faster modem speeds. The slower speed is a result of the limited energy available for POTS gain. To obtain sufficient POTS gain without affecting ADSL transmission, the POTS bandwidth is reduced.

Most VFRs (Voice Frequency Repeaters) work with Smart Coil. However, a few VFRs are not compatible. Since there are several manufactures of VFRs, the customer should test Smart Coils with their particular brand/model of VFR prior to a full scale Smart Coil deployment.

The Smart Coil does not measure the same impedance with an ohmmeter as compared to a common load coil. The circuitry in the Smart Coil is designed to adapt and correctly compensate the loop. A simple ohmmeter test does not correctly measure the impedance of the internal Smart Coil circuitry.

Services other than ADSL

Smart Coil may be deployed without interference to transmission on pairs transporting T1, E1, or VDSL. However, there is no benefit realized from the use of Smart Coil on these pairs.

Smart Coil is not recommended for deployment on pairs transporting HDSL, HDSL2, HDSL4, G.SHDSL, or ISDN. While some of these formats may somewhat successfully transmit through Smart Coil, typically the maximum deployment distance is reduced by about 33%.

Interference

By design, Smart Coil do not introduce cross talk or other interference in the line. Likewise, Smart Coils are designed to reject cross talk and incoming interference. The Smart Coil can be treated as a standard load coil when making interference calculations.

Temperature Range

Smart Coil perform reliably in an operating temperature range of –40 to +85 C.

Reliability

Smart Coils are designed for the harshest of environmental conditions. They are sealed from the elements to keep out rain, dust, and corrosion. Multiple unit canisters may be mounted on a pole or in a manhole. Single units should be housed in a Pedlock® pedestal or appropriately protected external closure.

Packaging

Smart Coils are available in single units or multiple unit Kwik Kases™ and environmentally sealed cases. Consult your sales advisor for more information.

SMART COIL™

For more information on Smart Coil and other Access/Transmission and Outside Plant solutions from Charles Industries, please visit our website at www.charlesindustries.com or call (847) 806-6300.

Smart Coil™ Deployment Summary Guide

Type Service	Deployment	Interference	Temperature Range	Cautions
ADSL	Condition Cable Pair: <ul style="list-style-type: none"> Remove all Bridge Taps Remove Build-outs Remove Lattice Network Remove common load coils 	None	-40 to +85C	<ul style="list-style-type: none"> Will not work with ADSL where POTS channel is digitally inserted into data stream Smart coil will sense the distance at a bridge tap and add this distance to the assumed cable length
POTs Traffic (Dial-up modem)	<ul style="list-style-type: none"> Smart Coil is designed to be Class compatible Like common load coils, provides gain in the POTS band 	None	-40 to +85C	<ul style="list-style-type: none"> Typically lowers top speed attainable to 33KBps on dial-up Once Smart Coil is inserted, a 1-2dB greater loss could be measured
T1, E1 or VDSL	No benefit perceived from the use of Smart Coil	None	-40 to +85C	
HDSL, HDDSL2, HDSL4, G.SHDSL, ISDN	Not Recommended	None	-40 to +85C	Typically the maximum deployment distance is reduced by about 33%
Voice Frequency Repeaters	Most VFRs will operate with Smart Coil, however a few will not.	None	-40 to +85C	Several VFR manufacturers – customer should test compatibility prior to mass deployment