

To,

29th April, 2016

Mr. S.K. Singhal
Advisor (B&CS)
Telecom Regulatory Authority of India
Mahanagar Doorsanchar Bhawan
Jawahar Lal Nehru Marg
New Delhi-110 002

Ref:- Pre-Consultation Paper on Set Top Box Interoperability dated 4th April 2016

Dear Sir,

At the outset we would like to state that going by our experience the issue of technical interoperability seems to be unending, un-resolvable and impenetrable due to various technical and commercial factors which have been consistently brought to the fore not only by us but also by other stake holders. Both, Ministry of Information and Broadcasting as well as this Authority have also been dealing with this issue of technical interoperability in the midst of all such restrictive technical and commercial factors since many years without any breakthrough.

As the Authority is aware the Direct to Home Service industry came into vogue in the country in 2002-2003. In the License Agreement between the Ministry of Information and Broadcasting and the Direct to Home Service Provider Clauses 7.1 and 7.2 pertaining to the STB compatibility and Technical Interoperability has been in place since beginning but the same have remained on paper ever since, due to various reasons and restraints of numerous types.

At the time of inception and thereafter for a few years of the industry there was minimum regulatory governance with regard to many aspects of the industry, including the aspect of compatibility and technical interoperability. There was no concept of commercial interoperability, which was for the first time introduced by the Authority in the year 2007 through a Standards of Quality Regulations. As things stand today we can see that customers are easily migrating from one DTH operator to the other due to commercial interoperability. On

failure of technical interoperability, commercial interoperability has sustained the consumer interests and protected them.

As the Authority is aware the Ministry of Information and Broadcasting vide its letter dated 28th September 2007 has expressed that the interoperability of set top boxes between two DTH operators was practically not feasible to the level of completeness and that the imposition of technical interoperability would increase the cost of set top boxes which the consumers have to bear. Consequently the Authority came out with its detailed recommendations on 30th January 2008. These recommendations were basically meant for compliance by DTH operators and keep their STBs as per specifications laid down and revised by Government of India from time to time.

Again whilst coming out with recommendations on Issues related to New DTH Licenses on 23rd July 2014, the Authority recommended as under:-

“Interoperability of DTH STBs

3.14 The license condition prescribed at clause 7.1 of the existing DTH Guidelines should be replaced with the following clause:-

“The Set Top Box offered by a DTH service provider shall have such specifications as laid down by the BIS from time to time”.

3.15 BIS should come out with updated specifications for STBs from time to time and while doing so, BIS shall consult TRAI.

3.16 The license conditions should mandate the licensee to comply with the tariff order/scheme prescribed by TRAI for commercial interoperability.”

These recommendations were once again reiterated in the Authority's Report on Activities between 1st January 2014 and 31st December 2014. As the Authority is aware the above recommendations are pending for consideration with the Ministry.

Whilst discussing various aspects of technical interoperability in its recommendations dated 23rd July 2014, the Authority has dealt with the issue very deeply. The Authority has opined that interoperability can be achieved either through technical interoperability or commercial interoperability and that technical interoperability as envisaged in the DTH Guidelines has so far not proved to be effective due to various techno-commercial issues. The Authority has also observed that commercial interoperability has the advantage that it does not involve any technological issues and that it also has the advantage that a consumer has a wider choice in terms of operators consumers can migrate to operators across the platforms. Thus, the Authority itself has recommended doing away with the requirement of technical interoperability in the aforesaid recommendations. If 7.1 is to be substituted along with 7.2 by inserting the aforesaid 3.15 and 3.16, then for all practical purposes the concept of technical interoperability itself ceases to exist, which is in the best interest of all stakeholders as the recommended clauses 3.15 and 3.16 would be potent enough measures to ensure the end consume interests.

As the Authority is well aware that today commercial interoperability has been achieved through various options given the consumers with a choice to migrate to any other operator across the platforms and as such the need of having technical interoperability still remains questionable. We must appreciate that any customer subscribing to the DTH services of any particular DTH service provider does not have any intention to necessarily move out from such DTH service provider and migrate to another. Normally a customer does not migrate unless and until he has experienced the services of a DTH service provider for a longish period of time and even in case if he decides to migrate commercial interoperability takes sufficient care to protect his interests under various schemes drawn by the DTH service provider. Additionally, the Authority must appreciate that as the technical interoperability will entail DTH service providers

to have their respective CAM, it will be a commercial burden on the end subscriber who will have to invest additional amount of money in buying such CAM. Thus, the belief that technical interoperability will help customers from any additional investment for viewing services of another DTH service provider is a myth.

It will not be out of place to mention here that Tamil Nadu Progressive Consumer Centre had initiated proceedings before the Telecom Disputes Settlement & Appellate Tribunal (TDSAT) by filing a petition with regard to technical interoperability. TDSAT by its Judgment and Order dated 3rd June 2011 had passed certain orders in that matter out of which we would like to reproduce verbatim one such order as follows:-

“(iv) The Central Government with that end in view, unless any other or further policy decision is taken, must issue appropriate directions upon the Bureau of Indian Standards to lay down the standards for MPEG-4 technology at the earliest and not later than two months from date, if any occasion arises therefor.”

We understand that this Judgment and Order of TDSAT has been impugned by the Petitioner in the Special Leave Petition before the Hon. Supreme Court and as such the issue is sub-judice.

Thus, as things stand today, there is no crystallization of the policy on technical interoperability with either one or the other issue emanating from the concerns about the feasibility of the same. As is evident even from the international experience in this regard, the success of technical interoperability in developed countries like US and other European countries is also very limited and therefore to entertain hope of success of technical interoperability in our country would be fallacious.

Additionally, even from the commercial point of view the proposition of technical interoperability would be anti-consumer in as much as the cost of the CAM would be more than

the cost of the STB itself. This would naturally lead to passing on the entire cost of the STB to the consumer, whereas in the present scenario the STBs are provided at a subsidized rate.

Furthermore, we would like to state that presently technical interoperability is not in vogue in the telecom sector and complete freedom is given to telecommunication mobile handset providers in terms of compatibility pertaining to the different services provided by telecom operators. To illustrate: A customer having a mobile handset which is compatible to 3G services only, will have no option but to buy a new phone which is compatible to 4G services, if such a customer decides to migrate to other telecom operator who provides 4G services. Similarly, there are various platforms such as ios, android, windows, etc which are compatible only to one particular mobile phone model. E.g: Nokia is Windows based, Samsung is android based, iPhone is ios based.

Additionally, a STB provided by a DTH or Cable operator is equivalent to the various Applications which are available in Mobile Telecommunication space, as besides the broadcast receiving via satellite or cable, there is also service specific descrambling, CAS, service information and other VAS services which the operator provides. We would like to state that even in the mobile Application space, there is no framework for the Applications to work seamlessly across platforms. For e.g: Application developed for Android phones will not work on iOS or Apple platforms and vice versa.

These Major mobile frameworks are rapidly changing by constantly adding new features and upgrades. Over a period of time these frameworks don't support older phones and applications. The users are then forced to buy newer phones to access the applications. This happens at a huge outlay of cost. In case of STBs firstly there are no widely deployed open platforms available and such depreciation of platforms will cost the networks and users huge losses. Presently Satellite and Cable service operators ensure their older platforms are upgraded and maintained, but in case of retail interoperable boxes, the sheer number of models by itself will make this effort a non-starter.

We are of the sincere opinion that similar freedom needs to be kept between various DPOs since each DPO has its own set of value added services which completely defer from one operator to other.

However, without prejudice to the above facts we would like to proceed to give our views on various questions raised by the Authority as follows:-

1. In your opinion, what are the concerns that should be taken care of at the time of development of framework of interoperable of STBs?

STB is a complex device, whose main functions are listed below. It is important to segregate and understand the functions, as each of these pose a different set of challenges

1. Ability to tune to Service operators carrier on which the service is being broadcasted
2. Demodulate the signal and extract the Transport Streams (TS) in which the channels or programs are being sent
3. Descramble the TS packets based on a complex combination of EMM and ECM processing
4. Decode the descrambled TS packets and display on the output ports

First let's take a look at the functions 1 and 2. In the case of tuning and demodulation we are looking at a Myriad of existing technologies like DVB-S, DVB-S2, DVB-C, DVB-C2. These technologies are not mutually compatible in nature. It is also important to understand there is a drive to adopt further to newer technologies DVB-S2X for further maximizing the bandwidth utilization in the existing networks.

The flip side of the issue is that a DVB-S STB cannot receive or demodulate the signals from DVB-S2 based Ku-Band transmission. So while the technologies try to remain backward compatible, the forward compatibility cannot be ensured.

Today different DTH operators have diversity in the way of transmission, which make the interoperability difficult unless all the boxes upgrade to highest common denominator, which

leads to an increase the cost, and will render the existing DVB-S boxes useless, and will lead to scrapping of such inventory.

Further at Cable operator side, DVB-C based STBs are designed with lower cost frontend, loading the cost of additional DVB-S2 to them will render them expensive for the cable end users. Right now universal demodulators are not commercially available in existing STB Main Silicon solutions.

Moving on to the next important function, which STB is expected to perform, Protect the content and allow only authorized customers to access channels and programs.

As indicated by the TRAI pre-consultation papers, there have been multiple efforts by different standard bodies to provide for solutions for interoperability. As rightly highlighted all of these solutions have been not successful and not achieved the goals specified to be reached.

DVB-CI is the closest to get to the solution, but there are challenges even here, which have not been effectively addressed.

STB is the seen as the weakest link by a potential pirate or hacker, as it is the device they can easily access and try to manipulate. So the security technologies used in these devices have to:

1. Protect and ensure the integrity of the software running on the STBs.
 - a. STB security architecture ensures that with CAS system that the software is tamper proof and cannot be compromised. Unlike the Smartphone world, where there have been multiple cases of jail breaks, we cannot afford a single such instance in the Service network to happen.
 - b. If the STB software is compromised by the Hacker/Pirate, they get access to content from the channels. If that happens even once for a network, the entire service network can be compromised as ECMs for one channel or program is common for all STBs.

- c. In order to ensure the integrity of this software, very strict signing, encryption and verification algorithms are in place, which are derived from Keys or secrets stored in the STBs OTP (One time Programmable) store.
- d. These algorithms, while get derived from standard open algorithms, are further fortified by proprietary logic from the CAS vendors for obfuscation and protection. This information is not shared typically outside very strict security NDAs.
- e. If the ECM extraction happens it can be supplied to pirate devices leading to serious and uncontrolled revenue leaks. This is serious concern to VideoconD2H and other service providers.
- f. An attempt to make it openly available as well as having an open framework of softwares can potentially compromise the chain of trust in the device, leading to potential Malware getting installed in the STBs.
- g. Once a Malware software gets installed in a STB it cannot be dislodged or identified in one way networks. Any standardization has to take serious consideration with this respect. A weak CAS system in the chain of interoperability can lead to complete break down of the security paradigm.
- h. Again we would like to reiterate one breach in the service network, will render the entire network service compromised completely. This has serious ramifications for VideoconD2H as an operator, as the responsibility for the protection of broadcaster content is key responsibility of the Service provider
- i. We would request TRAI and affiliated/allied standard bodies to study this issue in all its seriousness and any solution proposed has to address this effectively

- j. CAS vendors typically upgrade their security algorithms incrementally in form of patches. This means that in case of interoperable paradigm, the retails devices in the market have to validated and upgraded from a platform driver and software point of view across the all STBs in the network with these patches.
 - k. Right now the ownership of the same lies between the Service provider and the CAS companies, who work on incremental upgrades with the OEMs to deploy the same. These changes might not be backward compatible, and have to applied to all devices in the network at the same time.
 - l. To understand the magnitude of the exercise in the case of interoperable boxes, lets say an CAS vendor is providing a solution for 2 DTH operators. There is an upgrade required due to security considerations, they will have to work with both the operators simultaneously and all the interoperable STB vendors at the same time to complete this exercise. The scale of this exercise is multiplied significantly.
2. Protect the DDR (RAM) from content copying:
- a. DDR or the RAM of the device is on the PCB. It is not very difficult to rework the hardware to access RAM, and hence hack into the content.
 - b. DDR obfuscation algorithms are developed in conjunction to CAS and Silicon Vendors to secure the RAM, and make it resilient to such attacks
 - c. Again, an open standards will make such algorithms available in the open domain. So it is important any interoperability solution effectively addresses this, as this is seen as the one of the weakest links in the security as RAM probing can be installed easily.

- d. This can then be the single point of failure in the chain of trust. Any solution has to effectively ensure that the DDR or RAM data cannot be hijacked by Pirates
3. Protect and secure the smart card interface:
- a. The Main CPU chip communicates with smart cards using external I/O interfaces. These are essentially data and address buses routed from the STB to the smartcard. These are routed on the STB's PCB. The PCB can be reworked to tap these lines.
 - b. All Tier #1 CAS system ensure that this link protection is secure based on public, private key solutions or symmetric solutions. In all cases the algorithms used have typically not been compromised
 - c. Any solution which allows for interoperability has to ensure that transactions between the STB and Smart card cannot be snooped or hijacked by Malware on the STB.
 - d. It also has to ensure that any hardware based snooping does not compromise the same
 - e. Again it is important to appreciate at this point that the actual implementation of these algorithms are not available in the open domain, and are administered in strict NDAs typically between the Silicon Vendor and CAS companies.
 - f. There are long drawn certification processes involved with a CAS. Our concern in case of interoperable boxes is that the certification has to be repeated across multiple CAS vendors, leading to very long cycles for deployments. This is a

operational and deployment consideration which has to be addressed in any solution leading to interoperability.

4. Extract the Programming information from DVB tables:

- a. While DVB tables are supposed to be standardized, however in practice they have posed limitations in the Service providers desire to provide richer meta data for the programs, enabling interactive services and other revenue streams
- b. The Head solutions use DVB allowed Private descriptors to extend and cater to the limitations in the DVB standards.
- c. This diversity and non-compatibility in the PSI/SI available in Major networks, will lead to customer who so chooses to go to an specific network dissatisfied as the standard open device might not support these extensions, leading to service issues and churn.
- d. For these extension services and apps in the DVB to be deployed and tested across all retail platforms have its own challenges. Due the shear diversity of potential devices which will be present in the networks the service provider will have no control on these devices.
- e. Service providers are also leading typically in innovative engagement technologies, which now will grind to a halt because the effort to deploy these will be prohibitive

5. Decode the Transport Stream:

- a. Decoding involves typically decoding Audio, Video and Subtitles.

- b. Coming to Video itself, there are multiple DVB standards getting used in the networks today, namely MPEG-2, MPEG-4/H.264, HEVC/H.265.
- c. The cost of the chips vary with the technology chosen.
- d. Interoperability will end up mandating the super set of technology be used in every device, leading to substantial increase in the system cost.
- e. It is not just the MPEG chip which is getting talked here, it is the speed and capacity of the DDRs, Licenses which have to be deployed depending on the definition of the minimum requirements
- f. This in itself will make the STB costs move up from the current typical sub \$25 dollars to higher values, as the IP validation costs on these solutions will get amortized in the cost of the STBs by the OEMs
- g. We request TRAI to give proper consideration when deciding the minimum requirements which will satisfy interoperability across service providers

The below table presents different technologies getting used by Operators, to highlight the diversity which any interoperable solution has to effectively address.

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CIN : U92100MH2002PLC137947

SRno	DTH/MSO	Demodulation	Compression standards	CAS
1.	Dish TV	DVB-S	MPEG-2, H.264 for HD	Conax
2.	DD Free Dish	DVB-S	MPEG-2	FTA
3.	Videocon D2H	DVB-S2	H.264/HEVC	Irdeeto/Cisco
4.	Airtel	DVB-S2	H.264	Cisco
5.	Sun DTH	DVB-S2	H.264	Irdeeto
6.	Tata Sky	DVB-S2	H.264	Cisco
7.	Hathway	DVB-C	MPEG-2, H.264 for HD	Cisco

2. What are the techno-commercial reasons for non-interoperability of STBs other than those mentioned above? Please provide reasons with full details.

1. The increase in STB costs

- In India the average cost of STBs getting deployed are less than \$25
- These prices are the lowest in the world. They have been achieved because of volume purchases handled by the Operators
- These are optimized systems, with lower memory requirements
- Interoperability requires a substantial increase capabilities in the STBs to handle multiple CASes and multiple network requirements

- e. These increase will cascade to requirements of longer cycles of certification of STBs with multiple CASs, multiple networks to ensure proper deployment of these devices
- f. In the different parts of the world where interoperable solutions have been explored and subsequently failed, they have essentially targeted in majority two way connected devices.
- g. In India the STBs are mainly one way devices. Additional cost of two way connectivity will make these boxes expensive for the end consumers.
- h. Given the internet penetration levels in India, the service providers will not be able to address significant part of its current customers in future
- i. We request TRAI to ensure that there are additional requirement of two way connectivity imposed as a result of interoperability as this will just make DTH operators at a disadvantage when compared to the competition from OTT service providers.

2. Longer Testing and Validation

- a. as each set top box model / software configuration would need to be tested against all six existing DTH platforms and DD Direct Plus, as opposed to one licensed DTH platform
- b. This will increase the cost of the platform, as the model introductions will become a long drawn procedure, requiring a large scale coordination for the OEM

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- c. There will be a requirement to for setting up a independent certification agency, with the scale and velocity to ensure that certification does not hinder the pace of deployment as well introduction of new models in the market
3. Revenue and Service leakage for Service providers and Broadcasters:
- a. CAS systems have gone to great extent to provide proprietary security algorithms (EMM and ECM) is to ensure Service leakage does not happen.
 - b. These technologies are strictly limited right now between CAS, Silicon Vendors, OEMs and Operators mainly in a strict NDA regime.
 - c. Open platforms have their own challenges which have to be seriously addressed in any possible interoperability solution.
 - d. Issues like box spoofing, Man in the middle attack, Malware installation have to effectively addressed. They have been over the years addressed in two way networks, but on single way networks effectively solutions leading to interoperability do not address this in a scenario of multiple CAS providers and multiple Service providers.
 - e. Today the responsibility to ensure that Service leakage does not happen is a prime responsibility of the Service provider, who is also responsible for the STBs getting deployed in their networks. In the interoperability paradigm it is important to ascertain who is responsible in case of such an event happens. The service providers will have no control over the devices getting used in their networks.
 - f. With accountabilities not clear we could see examples of malintended usages for eg: we could potentially have a situation a dubious service provider could

potentially set up “ghost” CAS systems which can enable service to their customers, as they can easily say that the box doing this is not distributed by them. This will lead to serious revenue leakage for the Operator. Today this situation can be taken up with the Service provider directly in case of this event. But as in the interoperability paradigm, they don’t have any ownership or responsibility it is difficult to ascertain responsibilities and corrective actions.

4. Stifling of innovation:

- a. Interoperability paradigm could potentially lead to longer product life cycles and also strict adherence to standards
- b. This will stifle the innovation velocity in these markets as any new technology will require clearances as well acceptance across the board
- c. This will be detrimental to the current service providers, who already are geared with innovative ideas to make their services competitive to the OTT and other Internet Video services
- d. Any market place thrives only once we allow for innovation and adoption of newer technologies. The interoperability paradigm could significantly slow down this velocity

3. What are the plausible solutions for technical interoperability of STBs and their impact on the sector growth?

VideoconD2H as an operator has repeatedly demonstrated that we are one of the early adopters of technologies which benefit our subscribers as well optimize the networks. In this direction the adoption of DVB-S2, H.264 and HEVC are examples of being an early adopter of emerging technologies.

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We have been following international trends for interoperability and multi-cas solutions. The salient of those are already mentioned in the Pre-consultation paper of TRAI.

We like other DTH operators are in the space of one-way addressable STBs, in which there is no back channel in the STBs. While we recognize there have been efforts to address interoperability, but they have failed in actual deployment due to Myriad of practical deployment reasons.

1. STBs will become more complicated

- a. While there are big players in the Smart phone world with Operating systems or platforms which allow for third party applications to be installed, there are no large scale accepted frameworks for STBs
- b. Smart Mobile phones have significantly higher h/w specifications and hence as an extension higher costs as compared to current STBs
- c. Even in Mobile phones there is no way an application from one framework can work in another framework for eg: IOS apps don't work on Android Frameworks and vice-versa
- d. All the major mobile frameworks have been comprised time to time
- e. In case of STBs it is important to understand even if one STB in the network becomes compromised, it will lead to uncontrolled piracy of the content via supplying the clear ECM
- f. This is a serious consideration when the CAS based systems were developed and designed

- g. The applications on these STBs have to be secured, verified and have to prevent Malwares from getting installed. This is today achieved by the stringent root of trust paradigm which is enforced in STBs.
 - h. The Applications are typically verified, signed and encrypted by the CAS technologies. They are stringent clauses in agreements which don't allow for functions to be implemented which can compromise the security. A lot of due-diligence is done with certification cycles. In an open Paradigm, there is a big concern of these steps getting compromised, leading to service leakage.
2. Cost of overall solution is high and does not achieve desired goals
- a. Interoperability will require for standardization of platform, standardization across service delivery, service Applications
 - b. These level of standardization is not available today even in Mobile, Television space
 - c. This calls for a serious investment in Operating system framework, Application framework beyond what DVB has developed over a period of years
 - d. The cost of such solutions as it needs high end platforms to run such frameworks, which take care of multiple use cases the operators want to deploy
 - e. Today the entry level STBs run on small foot print RTOS, and achieve the cost targets which are acceptable by the customers.

- f. Such open frameworks would mean Linux based systems, with open frameworks like HTML, VM environments. All of these while will take years to specify and stabilize. Eventually lead to substantial cost escalations as mentioned before in this response.

3. Serious concern of Revenue leakage

- a. CAS systems have gone to great extent to provide proprietary protections (EMM and ECM) is to ensure Service leakage does not happen.
- b. These technologies are strictly limited right now between CAS, Silicon Vendors, OEMs and Operators mainly in a strict NDA regime.
- c. Open platforms have their own challenges which have to be seriously addressed in any possible interoperability solution.
- d. Issues like box spoofing, Man in the middle attack, Malware installation have to effectively addressed. They have been over the years addressed in two way networks, but on single way networks effectively solutions leading to interoperability do not address this in a scenario of multiple CAS providers and multiple Service providers
- e. Today the responsibility to ensure that Service leakage does not happen is a prime responsibility of the Service provider, who is also responsible for the STBs getting deployed in their networks. In the interoperability paradigm it is important to ascertain who is responsible in case of such a event happens. The service providers will have no control over the devices getting used in their networks.

4. Any other issue which you feel will be relevant for development of technical interoperability of the set top boxes.

We would like to summarize the challenges and issues which are relevant for development of technical interoperability of STBs:

1. Diversity of technologies in play

- a. The services are delivered uses myriad of technologies like DVB-S/S2/C/C2, H.264, MPEG-2, H.265/HEVC etc
- b. Solutions right now fine tuned to the networks optimizing the cost
- c. Interoperable solutions would have to a super set of all specifications, leading to higher cost of the STBs

2. Long cycles of development and added cost of ownership of STBs

- a. Qualifying a product which can interoperate in multiple DTH networks and potentially cable networks would require long qualification cycles
- b. These certifications would have to handled by a independent agency and also would mean added cost to the OEMs to develop these products

3. Slower velocity of innovation

- a. With stringent requirements for innovation the Service providers will find it difficult to deploy new innovative services as the retail boxes will have to support those requirements
- b. It will lead to a fragmented market space, which over a period of time will be

4. Service and revenue leakage

- a. The interoperable framework has to ensure that the software on the STB cannot be compromised with Malware.
- b. Any compromise on a single box will render the network to uncontrolled revenue leak
- c. This is taken care right now in CAS based products, but with a interoperable solution certifying and verifying the solution will become the responsibility of an independent agency, which has to deal with any proposed software upgrades from OEMs or operators

5. Absence of framework or solutions available by Standard bodies

- a. This is the key issue right now the worldwide standard bodies are facing
- b. There are no STB frameworks, solutions which can meet the multiple deployment goals, simplicity of deployment, lower cost of ownership
- c. There have been attempts on this, and as indicated in the paper all of them have not been mass deployed

6. Education and SLA compliance:

- a. The right solution for better user experience is education of the end customers about their rights and privileges

- b. Education about the products available in the markets, the pro-cons of different solutions
- c. Enforcement of better SLA compliance from the service operators

Trust the Authority would take the above in its proper perspective and do away with the requirement of CI slot and CAM module for reasons discussed above. In this background we have reason to believe that there is no need for any consultative process any further in this regard.

Thanking you

Yours faithfully,

for Videocon d2h Limited


Shivendra Krishna Singh
Head-regulatory & Compliance