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Briefing Paper: C-band TVROs

1. Introduction

The preferred way of distributing TV signals is via the Fixed-Satellite Service (FSS) C-band since there is no significant degradation of the signal even in heavy rain. The TV signal is distributed to terrestrial TV stations for re-broadcast, to cable head-ends and directly to the consumer (TVROs). In most countries TVROs are unlicensed but there are exception (e.g. Singapore, Australia). Even though a TVRO may be unlicensed the owner of the installation expects interference-free reception.

2. Scope of Report

The purpose of this report is to show the extensive use of the FSS C-band for the distribution and reception of satellite TV signals. Certainly the supply of C- band FSS satellites is very large as confirmed by the Lyngsat web site, www.lyngsat.com. This site lists of over one hundred satellites carrying C-band TV signals throughout the world.

This report does not address direct-to-home (DTH) broadcast in the Ku- and Ka-bands.

3. Television Receive-Only (TVRO)

Television Receive-Only, TVRO, is an earth station used for the reception of TV signals from FSS-type satellites, generally operating in the C-band. The C-band TVRO earth station may be either licensed or unlicensed. On a worldwide basis the vast majority of C-band TVROs are unlicensed; however, some TVROs may be licensed; for example, some cable head-ends.

Since TVRO is an unlicensed application in most countries and since there are many manufacturers of C-band TVRO earth station antennas it is difficult to obtain reliable information on the number of TVROs in a given country. Even in countries where a license is required there are often many unlicensed TVROs and therefore even in these countries it is difficult to determine the actual number of TVROs. In a country where a license is required a licensed TVRO installation can claim protection from interference. In other countries where a license is not required owners of a TVRO installation expect interference-free reception. For example, in Fiji where a TVRO license is not required the government some years ago introduced WiMAX in the 3.4 – 3.6 GHz band. This caused interference to a large number of TVROs. As a result Fiji-TV sued the government.

4. Numbers of C-band TVROs

The number of C-band TVRO earth stations is underestimated for several reasons:

1) In most countries there is no requirement to license C-band TVROs and individual consumer earth stations constitute by far the largest number of C-band TVROs.

As an example, the following text is from Report ITU-R M.2109 (2007):
"In **Brazil**, in the band 3 700-4 200 MHz, there are more than 8 000 nationally registered earth stations pointing to one of the Brazilian satellites and 12 000 nationally registered earth stations pointing to one of the non-Brazilian satellites that cover the country plus an equal number of earth stations in the 3 625-3 700 MHz band. There are also an estimated **20 million** TVRO terminals deployed across the country."

From the above it can be seen that there are approximately 20,000 registered C-band earth stations in Brazil in the band 3.7 – 4.2 GHz and an estimated 20 million TVRO terminals deployed across the country. Therefore, in Brazil in the 3.7 – 4.2 GHz band there are about 1000 times more TVROs than registered earth stations in the C-band i.e. the number of registered C-band earth stations is 0.1% of the of the total number of C-band installations. Another way to express this is to say that in Brazil, 99.9 % of C-band installations are not registered. It is expected that this ratio holds for many other countries in South America, Middle East, Africa and Asia. This makes the TVRO the most popular (by number) FSS C-band application and their numbers should be included in any survey of FSS C-band utilization.

2) When there is no requirement to license C-band TVROs only a small percentage of TVROs are licensed. Some cable companies may register (license) their C-band cable head-end in order to obtain protection.
3) In some countries where a license is required for a C-band TVRO there are often large numbers of unlicensed installations.

5. Number of TVROs in Various Countries

The following sections examine the number of TVROs in various countries:

5.1 Brazil

Report ITU-R M.2109 (2007) has the following text:

"In Brazil, in the band 3 700-4 200 MHz, there are more than 8 000 nationally registered earth stations pointing to one of the Brazilian satellites and 12 000 nationally registered earth stations pointing to one of the non-Brazilian satellites that cover the country plus an equal number of earth stations in the 3 625-3 700 MHz band (see Fig. A7 of Annex A). There are also an estimated 20 million TVRO terminals deployed across the country."

Note: In 2007 the number of TVROs was estimated in Brazil at 20 million. Now the estimate is 22 million.

From:
http://www.sia.org/wp-content/uploads/2012/12/C-band_CITEL_Submission_on_C-band_Usage_in_ITU_Region_2.pdf

"In addition to those registered earth stations previously mentioned, ABERT (**Brazilian Radio and TV Broadcasters Association)** estimates that currently in Brazil around 72 million people enjoy C band domestic and end user applications (TVRO terminals)."

"It is also noteworthy that through the use of satellite C-band ABERT estimates that about **22 million** homes receive radio and TV network programming free of charge, and that the TVRO application has been, over the decades, an important instrument for national integration, education, entertainment and building a national identity."

5.2 China

The Chinese State Administration of Radio, Film and Television (SARFT) falls under the direct supervision of the State Council and its responsibilities include the regulation of radio and TV. The SARFT policy on the TVROs stipulates that all TVROs (including C- and Ku-band) must be licensed. There is also regulation that states that "for those areas which cannot be reached by Cable TV, TVRO (not for community reception) is permitted". There is some ambiguity in the licensing of TVROs since, in practice, it is difficult to tell which areas can or cannot be reached by cable TV. As a result, there are many unlicensed TVROs across the country. Reports from two different reliable sources in China estimate the number of C-band TVROs in China to be over **20 million**.

5.3 Russia

Russian media reports estimate the number of C-band TVROs in Russia to be about **11 million.**

5.4 India

India has a vibrant domestic space industry both building and launching satellites. The LyngSat web site shows Indian satellites carry C-band transponders at 74°E, 83°E and 93.5°E. In spite of this there will still be a shortage of C-band transponders as indicated in the article in Via Satellite dated April 1, 2013:
http://www.satellitetoday.com/publications/2013/04/01/satellite-capacity-constraints-in-india/

"The demand for C-band transponders from Indian TV broadcasters is expected to almost double from about 30 in 2012 to approximately 55 in 2017."

In India C-band TVROs are being used by cable head-ends, DTH head-ends, IPTV providers, over-the-top (OTT) head-ends, social organizations that provide educational channels, public broadcasters for VHF or UHF terrestrial re-transmission and private individuals. In spite of such widespread use there are relatively few C-band TVROs in India. From the Euroconsult Report (page 60) entitled *Assessment of C-Band Usage in Asian Countries* found at:
http://www.casbaa.com/CBandAssessment:

"Manufacturer Space Link estimates that a total of about 500,000 C-band antennas are currently installed throughout India … at least 450,000 C-band antennas are still being used by individual consumers, as well as hotels and various businesses."

The main reasons for relatively few TVROs in India are:

1) The extensive penetration of cable TV
2) The inexpensive cost of connecting to a cable TV provider
3) The relative extensive penetration of DTH TV at Ku-band.

5.5 Indonesia

On page 26 of the Euroconsult report dated 10 June and entitled *Assessment of C-Band Usage in Asian Countries* the number of C-band TVROs in Indonesia is given as **12-17 million.** The Euroconsult report and slide presentation can be found at:

http://www.casbaa.com/CBandAssessment

5.6 Thailand

Thailand is in the footprint of several of the satellites serving Asia. In addition, Thailand has its own satellite operator, Thaicom Public Company Limited (Thaicom) which operates several satellites providing both domestic and regional service. See:

http://en.wikipedia.org/wiki/Thaicom

At the C-band Thaicom operates Thaicom 5 and Thaicom 6 from 78.5°E. Thaicom 6 was successfully launched on January 6, 2014. Later in 2014 Thaicom 7 will be launched into 120°E to provide more C-band capacity. From the LyngSat listing it can be seen that neighboring countries such as Laos, Nepal, Maldives and Cambodia receive TV programs in their own languages at C-band on Thaicom 5. According to Thaicom there are about **11 million** C-band TVRO terminals in Thailand.

PSI Holding Company Limited (PSI)

In Thailand the largest C-band satellite TV platform provider is PSI providing service from the Thai satellites, Thaicom 5 and 6, located at 78.5°E. PSI offers both free and subscription satellite TV channels at C-band and manufactures, sells and installs satellite antennas and set-top boxes. There is an initial one-time charge of about THB 2000 (about US$67) for the installation of a PSI antenna and receiver. PSI has been operating in Thailand for 20 years and reports that it has more than **12 million** C-band TVRO installations.

From the web site:

http://www.nationmultimedia.com/business/RS-PSI-jointly-offer-new-receiver-for-internationa-30210213.html

“PSI is very dedicated to bringing affordable satellite television to Thai viewers, maintaining its position as the largest C-band satellite TV platform provider with more than 12 million subscribers across the country.”

See Annex 1 for photos of C-band TVROs deployed in Thailand. From these photos it can be seen that there are C-band antennas looking at more than one orbital location. Therefore, the number of TVRO installations in Thailand may be greater than the number reported by PSI.

5.7 United States of America

In 1994 there were over 3 million C-band TVROs in the US. By 2013 this number had decreased to about 1.75 million. To see the reference click here.

In the case of the USA the increase in penetration of DTH TV (Ku- and/or Ka-band) has caused a decrease in the number of C-band TVROs. This trend could be expected in other countries where Ku-band DTH systems are an alternative; as the disposable income increases the penetration of DTH TV would be expected to increase. However, C-band DTH remains a viable alternative in some areas particularly where tropical rainfalls are a problem.

5.8 Vietnam

No license is required for a C-band TVRO in Vietnam. According to the Vietnamese telecommunication administration there are about 8-9 million C- band TVROs in Vietnam.

Summary Table of Number of C-band TVROs

Country	Population in 2013	Number of TV Households in 2012	Number of TVROs in 2014	Number of End Users
Brazil	199	58	22	72
China	1,354	404	20	100
India	1,270	155	0.5	
Indonesia	242	49	12-17	
Russia	143	51	11	
Thailand	70	21	11-12	
USA	316	112	1.75	
Vietnam	90	20	8-9	

All data in millions

Notes

1) The vast majority of *Number of TVROs* consists of unlicensed TVROs but may also include licensed TVROs
2) Some of the largest TV markets are located in the so-called BRIC countries (Brazil, Russia, India and China)
3) Population statistics are obtained from: http://www.worldpopulationstatistics.com/
4) The number of TV households is obtained from: http://www.generatorresearch.com/tekcarta/databank/full/30/

From the above table reliable estimates give the number of TVROs in the above mentioned countries as being between 86 – 93 million.

6. Interference into FSS C-band Applications

6.1 Background

It is well established that the co-existence of FSS and IMT applications is not feasible if the terminals of both services are ubiquitous. The obvious solution is of course to not allocate IMT frequencies to the C-band (3.4 – 4.2 GHz) used by satellites.

6.2 Attractiveness of C-band to IMT Interests

IMT interests would very much like access to C-band frequencies where relatively large contiguous new bandwidth could be available. The reason that "new" is important is that the new IMT technologies are more efficient if large (say, 20-30 MHz) contiguous spectrum is available and in the case of "new" spectrum there would be no need to work around previous channel plans that may have been used by earlier technologies. One "new" frequency range that is being studied under WRC-15 agenda item 1.1 is the 3.3 – 3.4 GHz band. This frequency range is not used by satellites and has already been successfully used for IMT by three administrations in Asia (See: link to AsiaSat papers on 3.3 – 3.4 GHz band posted on CASBAA web site, *C-band Invasion*):

http://www.casbaa.com/regulatory/satellite-issues/c-band-invasion

6.3 Compatibility between IMT and FSS in C-band

IMT interests like the large bandwidths potentially available at C-band and have done a lot of work since WRC-07. Presently a lot of traffic at the edge of the cellular network is off-loaded on WiFi. The cellular operators are forced to do this since their networks are congested due mainly to the large demand for data. Cellular operators do not make money on off-loaded traffic and have no control over the quality of the WiFi connection. Small IMT cells in new frequency bands (with greater range than present day WiFi) could solve both the congestion problem and the revenue problem for cellular operators. One way that IMT interests want to reduce the separation distance is by using small (pico and micro-cells) where the required separation distances are smaller. The latest ITU studies in JTG 4-5-6-7 have shown that even small indoor IMT cells do not share well with FSS C-band applications. See pages 18-19 of Annex 3 of JTG document 584, 13 March, 2014:

"In the case of IMT-Advanced small-cell indoor deployment scenarios:

The required protection distance for an indoor small cell deployment was smaller relative to small cell outdoor due to the fact that some degree of building attenuation was assumed, as well as lower base station e.i.r.p and antenna height.

For the long-term interference criterion, the required separation distances vary from about 5 kilometres to tens of kilometres. For the short-term interference criterion, the required separation distances vary from about 5 kilometres to tens of kilometres, and in some instances up to 120 kilometres. Both the long-term and short-term interference criteria would have to be met.

The wide range of distances is a consequence of earth stations in a variety of terrain conditions, assumed clutter loss, and different assumptions for the building penetration loss (0 to 20 dB)."

6.4 Interference into Unlicensed C-band TVROs

Just because a service is unlicensed does not mean that it can be disregarded in interference studies. It has de facto rights due to its existence. In ITU studies the impact of a change in the Table of Frequency Allocations on secondary services is always taken into account even though, in theory, a secondary service has no rights.

Jorn Christensen, Ph.D., P.Eng.
Consultant to CASBAA

Annex 1
Examples of C-band TVROs

In Thailand

In Thailand

In Cyprus

A Residential Building, in Myanmar

An SME Cable Company Head-End, in the Philippines