



**Relatório Técnico**  
**PD.33.10.92A.0317A-RT-42-AE**

**Especificação técnica**  
**Conversor Digital Ginga NCL**  
**Digital TV Converter – Ginga NCL**  
**Specifications Ver.6**

Cotação: 38702/16

**Cliente:** EAD  
**Contato:** Gunnar Bedicks **E-mail:** [gunnar.bedicks@sejadigital.com.br](mailto:gunnar.bedicks@sejadigital.com.br)  
**Endereço:** Rua George Ohm 230, Torre A, 17o. andar – São Paulo - SP

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## 1 Introduction

### 1.1 Scope

This document describes the technical specification and requirements for the ISDB-Tb High Definition Set-Top-Box, GINGA-NCL, to support Brazilian analog TV switch-off.

The general product requirements to be considered for this STB platform are described in the below sections as well as the specifics hardware requirements, including tolerable ranges and/or minimums/maximums as appropriate.

### 1.2 Terminologies

- Shall (Mandatory): means that the item is mandatory.
- Should (Recommended): means that the item is not mandatory, but is highly recommended.

### 1.3 References

|           |                                                                                                                                                                                                                                       |
|-----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>1</b>  | Anatel - REQUISITOS TÉCNICOS E PROCEDIMENTOS DE ENSAIOS APLICÁVEIS À CERTIFICAÇÃO DE PRODUTOS PARA TELECOMUNICAÇÃO DE CATEGORIA I, anexos às Resoluções nº 442(Compatibilidade Eletromagnética) e 529 (Segurança Elétrica).           |
| <b>2</b>  | ABNT NBR15601 Digital terrestrial television – Transmission system December 2007                                                                                                                                                      |
| <b>3</b>  | ABNT NBR 15602-1 Digital terrestrial television – Video coding, audio coding and Multiplexing Part 1: Video coding April 2008                                                                                                         |
| <b>4</b>  | ABNT NBR 15602-2 Digital terrestrial television – Video coding, audio coding and Multiplexing Part 2: Audio coding April 2008                                                                                                         |
| <b>5</b>  | ABNT NBR 15602-3 Digital terrestrial television – Video coding, audio coding and Multiplexing Part 3: Signal multiplexing systems April 2008                                                                                          |
| <b>6</b>  | ABNT NBR 15603-1 Digital terrestrial television – Multiplexing and service information (SI) Part 1: SI for digital broadcasting systems August 2008                                                                                   |
| <b>7</b>  | ABNT NBR 15603-2 Digital terrestrial television – Multiplexing and service information (SI) Part 2: Data structure and definition of basic information of SI September 2008                                                           |
| <b>8</b>  | ABNT NBR 15603-3 Digital terrestrial television – Multiplexing and service information (SI) Part 3: Syntaxes and definitions of extension information of SI September 2008                                                            |
| <b>9</b>  | ABNT NBR 15604 Digital terrestrial television – Receivers December 2016                                                                                                                                                               |
| <b>10</b> | ABNT NBR 15605-1 Digital terrestrial television – Security issues Part 1: Copy control July 2009                                                                                                                                      |
| <b>11</b> | ABNT NBR 15606-1 Digital terrestrial television – Data coding and transmission specification for digital broadcasting Parte1: Data coding specification April 2008                                                                    |
| <b>12</b> | ABNT NBR 15606-2 Digital terrestrial television – Data coding and transmission specification for digital broadcasting – Part 2: Ginga-NCL for fixed and mobile receivers – XML application language for application coding April 2009 |

|           |                                                                                                                                                                                                                             |
|-----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>13</b> | ABNT NBR 15606-3 Digital terrestrial television – Data coding and transmission specification for digital broadcasting Part 3: Data transmission specification August 2008                                                   |
| <b>14</b> | ABNT NBR 15606-4 Digital terrestrial television – Data coding and transmission specification for digital broadcasting Part 5: Ginga-NCL for portable receivers – XML application language for application coding April 2009 |
| <b>15</b> | ABNT NBR 15607-1 Digital terrestrial television – Digital terrestrial television – Interactive channel Part 1: Protocols, physical interfaces and software interfaces April 2008                                            |
| <b>16</b> | ABNT NBR 15608-1 Digital terrestrial television – Operational guideline Part 1: Transmission system – Guideline for ABNT NBR 15601:2007 implementation August 2008                                                          |
| <b>17</b> | ABNT NBR 15608-2 Digital terrestrial television – Operational guideline Part 2: Video coding, audio coding and multiplexing – Guideline for ABNT NBR 15602:2007 implementation September 2008                               |
| <b>18</b> | ABNT NBR 15608-3 Digital terrestrial television – Operational guideline Part 3: Multiplexing and service information (SI) – Guideline for ABNT NBR 15603:2007 implementation July 2009                                      |
| <b>19</b> | HDMI Licensing LLC – High-Definition Multimedia Interface Specification Version 1.3a November 2006                                                                                                                          |
| <b>20</b> | IEC 60169-24 International Standard IEC 60169-24 RF connectors, Part 24:RF coaxial connectors with screw coupling, typically for use in 75 ohm cable distribution systems (Type F)                                          |
| <b>21</b> | ISO/IEC 11172-3 Information technology – Coding of moving pictures and associated audio for digital storage media at up to about 1.5 Mbit/s – Part 3: Audio April 1996                                                      |
| <b>22</b> | ISO/IEC 13818-1 Information technology — Generic coding of moving pictures and associated audio information: Systems 3rd Edition, October 2007, Amendment 1: November 2007                                                  |
| <b>23</b> | ISO/IEC 13818-2 Information technology – Generic coding of moving pictures and associated audio information: Video December 2000                                                                                            |
| <b>24</b> | ISO/IEC 13818-3 Information Technology – Generic coding of moving pictures and associated audio information – Part 3: Audio April 1998                                                                                      |
| <b>25</b> | ISO/IEC 14496-3 Information Technology – Coding of audio-visual objects- Part 3: Audio Second Edition, December 2001, including Amendment 2                                                                                 |
| <b>26</b> | HDCP Digital Content Protection LLC High-bandwidth Digital Content Protection System Revision 1.2, June 2006                                                                                                                |
| <b>27</b> | ISO/IEC 13818-7 Information Technology – Generic coding of moving pictures and associated audio information – Part 7: Advanced Audio Coding November 2007, including Amendment 1: Transport of MPEG Surround in AAC         |
| <b>28</b> | CEA-0708 CEA Standard Digital Television (DTV) Closed Captioning July 2006, Revision C                                                                                                                                      |
| <b>29</b> | USB 2.0 Universal Serial Bus Specification Revision 2.0, 27 April 2000 (base document)                                                                                                                                      |
| <b>30</b> | EIA-770.1 Analog 525 Line Component Video Interface – Three Channels November 2001, Revision C                                                                                                                              |

|           |                                                                                                                                                                                 |
|-----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>31</b> | EIA-770.2 Standard Definition TV Analog Component Video Interface November 2001, Revision C                                                                                     |
| <b>32</b> | EIA-770.3 High Definition TV Analog Component Video Interface November 2001, Revision C                                                                                         |
| <b>33</b> | ABNT NBR 14136 AC Outlets Standards for domestic equipment until 20A/250V October 2007                                                                                          |
| <b>34</b> | TS 101 154 V1.8.1 Implementation guidelines for the use of MPEG-2 Systems, Video and Audio in satellite, cable and terrestrial broadcasting applications July 2007              |
| <b>35</b> | TS 102 154 V1.2.1 Implementation Guidelines for the use of MPEG-2 Systems, Video and Audio in Contribution Applications, May 2004                                               |
| <b>36</b> | Anexo à Resolução nº 284, de 7 de dezembro de 2001Regulamento técnico para a prestação do serviço de radiodifusão de sons e imagens e do Serviço de retransmissão de televisão. |
| <b>37</b> | Relatório de Teste Laboratorial de Interferência do LTE na faixa de 700 MHz no ISDB-T<br>ANATEL (04/2014)                                                                       |
| <b>38</b> | ABNT NBR 15610-1 Digital terrestrial television - Accessibility - Part 1: Text tools, Implementation December 2011                                                              |
| <b>39</b> | ABNT NBR 15610-2 Digital terrestrial television - Accessibility - Part 2: Sound functionalities, implementation July 2012                                                       |
| <b>40</b> | ABNT NBR 15610-3 Digital terrestrial television - Accessibility - Part 3: Sign language (LIBRAS), implementation December 2016                                                  |

## 1.4 List of Acronyms and Abbreviations

|         |                                                                                                                                                          |        |                                                               |
|---------|----------------------------------------------------------------------------------------------------------------------------------------------------------|--------|---------------------------------------------------------------|
| STB     | Set-Top-Box                                                                                                                                              | HDD    | Hard Disk Drive                                               |
| HD      | High Definition                                                                                                                                          | HDMI   | High Definition Multimedia Interface                          |
| ISDB-T  | Integrated Services Digital Broadcasting Terrestrial                                                                                                     | HDTV   | High Definition Television                                    |
| ISDB-Tb | acronym from Integrated Services Digital Broadcasting Terrestrial Brazil due audio, video and interactivity improvements implemented at ISDB-T in Brazil | HE-AAC | High Efficiency Advanced Audio Coding                         |
|         |                                                                                                                                                          | I/O    | Input/output                                                  |
| MPEG    | Moving Picture Experts Group                                                                                                                             | IRD    | Integrated Receiver Decoder                                   |
| FTA     | Free-To-Air                                                                                                                                              | IRE    | Institute of Radio Engineers (composite video measuring unit) |
| IRD     | Integrated Receiver Decoder                                                                                                                              | LATM   | Low overhead audio transport multiplex                        |
| OTA     | Over-The-Air                                                                                                                                             | LOAS   | Low Overhead Audio Stream                                     |
| OTT     | Over-The-Top                                                                                                                                             | MP     | Mass Production                                               |
| AAC     | Advanced Audio Coding                                                                                                                                    | MPEG   | Motion Picture Experts Group                                  |
| AV      | Audio and Video                                                                                                                                          | NIT    | Network Information Table                                     |
| AVC     | Advanced Video Coding                                                                                                                                    | OFDM   | Orthogonal Frequency Division Multiplexing                    |
| BER     | Bit Error Ratio                                                                                                                                          | PAL-M  | Phase Alternation Line – standard M                           |
| C/N     | Carrier-to-Noise Ratio                                                                                                                                   | PAT    | Program Association Table                                     |
| CVBS    | Composite Video Blanking and Sync                                                                                                                        | PES    | Packetized Elementary Stream                                  |
| D/A     | Digital-to-Analog                                                                                                                                        | PID    | Packet Identifier                                             |
| DQPSK   | Differential Quadrature Phase Shift Keying                                                                                                               | PiP    | Picture in Picture                                            |
| DRM     | Digital Right Management                                                                                                                                 | PMT    | Program Map Table                                             |
| EIT     | Event Information Table                                                                                                                                  | PSU    | Power Supply Unit                                             |
| EPG     | Electronic Program Guide                                                                                                                                 | QPSK   | Quadrature Phase-Shift Keying                                 |
| FEC     | Forward Error Correction                                                                                                                                 | RF     | Radio Frequency                                               |
| FFT     | Fast Fourier Transform                                                                                                                                   | RS     | Reed-Solomon                                                  |
| IF      | Intermediate Frequency                                                                                                                                   | SAP    | Second Audio Program                                          |

## 2 Product Definition

The STB shall be fully compliant with all the requirements defined at “Portaria nº 481, de 9 de Julho de 2014”, from Ministério das Comunicações:

I – Compliant with ABNT NBR 15604:2007 - Digital terrestrial television – Receivers and its updates.

II – Compliant with ABNT NBR 15606-1, 15606-2, 15606-3, 15606-4 and 15606-6.

III – Compliant with accessibility features as per “Norma Complementar MC nº 01, de 2006, aprovada pela Portaria nº 310, de 27 de junho de 2006”.

Additionally, it shall be compliant with all hardware and software requirements here defined; including all Brazilian’s applicable laws and applied certifications.

Shall be compliant with 1.3 References above listed:

- 36 to analog system
- 2 to 18 to ISDB-Tb

It shall implement a secure bootloader with software update capability from: USB and Ethernet.

The STB mechanical and cosmetic design can be proposed by the manufacturer, but must be approved by EAD prior to manufacturing.

The STB manufacturer shall manage all the software development and integration, including middleware, drivers, and U.I. as specified at the specific sections.

All the software and hardware integration expenses shall be covered by the manufacturer as well all the certification and testing reports. It is not required the manufacturer to hire external support integration during the STB development, this being a free manufacturer's option.

The STB manufacturer shall allocate resources to generate the official software releases and execute the test procedures to ensure the STB will be delivered stable and bug-free. At the end, EAD’s technical team will perform acceptance tests to double check that the hardware and software requirements and performance has no problem, meaning the STB can be deployed into the field.

The manufacturer shall consider the possibility of being required update Middleware and Firmware and modem drivers while the product is in production.

If the manufacturer complies with all the proposed submission steps, it can be ranked. However, this does not guarantee to be hired because depend on the outcome of the approval tests that will be conducted by EAD at laboratory to be nominated.

### **3 STB Project Integration and Development**

All the STB development and integration shall be done by the manufacturer; it shall assume the responsibility of the System Integrator and shall manage the complete project.

The STB manufacturer is responsible to make sure all hardware and software requirements are accomplished and its product shall pass to all certifications required.

All the royalties applied to this product shall be described in a list and the manufacturer shall consider it at the commercial proposal.

The manufacturer shall provide project management professional resources to execute the project, shall provide bug tracking tool during product development and after during the whole product lifetime in order to keep project history, providing all required reports when necessary. It shall present the project schedule and shall provide progress and status reports on a weekly basis.

The project manager shall consider PMBoK good practices and define the project methodology to manage the complete project agreed with EAD.

The System Integrator shall specify all product test cases as well as provides all need resources to execute the ATR (Acceptance Test Report), including professional engineering resources and all laboratory equipment and infrastructure, like:

- Measurement equipments: oscilloscope, spectrum analyzer, stream analyzer, multimeter, etc.;
- Multiviewers, IR configurable transmitters to simulate RCU commands, remote power control, RF distribution cabling infrastructure;
- Head end equipment: encoders, multiplexers, modulators and other equipments to simulate all broadcasting environment during STB validations.

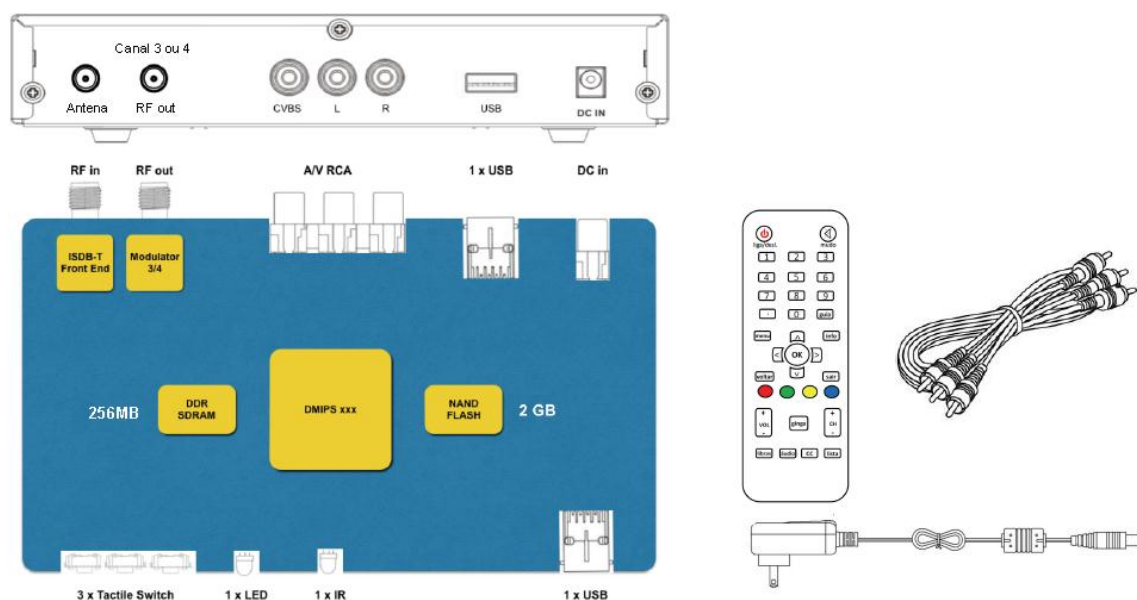
## 4 Requirements

The STB shall be fully compliant to ABNT NBR15604, ABNT NBR15601 and ABNT NBR15608 Part 1 and also additional requirements. Some requirements specify better performance than the standards; others repeat exactly what is in ABNT15604.

Licenses and rights: The manufacturer shall submit a list of all licenses and rights used in the product

Property rights: The cost of all used rights and licenses shall be included in the commercial proposal

### 4.1 Footprint and accessories



### 4.2 General requirements

| 00   | STB General requirements - Mandatory |                      |                                                                                   |
|------|--------------------------------------|----------------------|-----------------------------------------------------------------------------------|
| Item | ABNT NBR 15604                       | Requirement          | Specified functionalities                                                         |
| 01   | All mandatory requirements           | Compliance Standards | The STB shall be fully compliant to ABNT NBR15604, and also to below requirements |

#### 4.3 STB ISDB-Tb VHF/UHF Tuner requirements

| 100  | ISDB-Tb Front End      |                            |                                                                             |
|------|------------------------|----------------------------|-----------------------------------------------------------------------------|
| Item | ABNT NBR 15604         | Requirement                | Specified functionalities                                                   |
| 101  | 7.2.1.2                | Digital converter          | RF in (Antena) – 75 $\Omega$ F-type connector female                        |
|      |                        |                            | RF out (RF out) – 75 $\Omega$ F-type connector female                       |
| 102  | 7.2.2.1                | Reception devices          | Fixed Reception (full-seg) only                                             |
| 103  | Additional Requirement | Number of tuners           | 1 (one) silicon tuner                                                       |
| 104  | 7.2.4<br>Table 2       | VHF input frequency range  | High VHF channel 7 ~ channel 13 (174~216 MHz)                               |
| 105  | 7.2.4<br>Table 3       | UHF input frequency range  | UHF channel 14 ~ channel 69 (470~806 MHz)                                   |
| 106  | 7.2.3                  | Channel Bandwidth          | 5,70 MHz                                                                    |
| 107  | 7.2.4                  | Central carrier frequency  | Center of the channel + 1/7 MHz                                             |
| 108  | 7.2.5.a                | Minimum signal input level | $\leq -82$ dBm This requirement provides better performance than ABNT 15604 |
| 109  | 7.2.5.b                | Maximum signal input level | $\geq -3$ dBm This requirement provides better performance than ABNT 15604  |

|     |                                                                                               |                                                     |                                                                                                  |
|-----|-----------------------------------------------------------------------------------------------|-----------------------------------------------------|--------------------------------------------------------------------------------------------------|
| 110 | <b>Signal processing</b>                                                                      |                                                     |                                                                                                  |
| 111 | 7.2.10                                                                                        | Receivers signal processing                         | Full-seg                                                                                         |
| 112 |                                                                                               | Modulation Type                                     | BST-OFDM (Segmented structure OFDM - 13 segments)                                                |
| 113 |                                                                                               | Guard interval                                      | 1/32, 1/16, 1/8, 1/4                                                                             |
| 114 |                                                                                               | Transmission Modes FFT                              | Mode 1 (2K), Mode 2 (4K), Mode 3 (8K)                                                            |
| 115 |                                                                                               | Modulation Scheme                                   | 64QAM, 16QAM, QPSK-OFDM, DQPSK                                                                   |
| 116 |                                                                                               | Hierarchical transmission                           | 3 Layers                                                                                         |
| 117 |                                                                                               | Inner channel code                                  | Convolutional code, mother code rate = 1/2 with 64 states Puncturing to rate 2/3, 3/4, 5/6, 7/8. |
| 118 |                                                                                               | Reed Solomon Decoding                               | RS Decoding (204, 188)                                                                           |
| 120 | <b>Selectivity (TV Protection Ratio - PR) - Analog to Digital Interference. VHF and UHF.</b>  |                                                     |                                                                                                  |
|     | Test conditions: Mode 3, Layer A, 13 segment, 64QAM, CR = 3/4, GI = 1/8, I = 0                |                                                     |                                                                                                  |
| 121 | 7.2.6<br>Table 5                                                                              | CCI (Co-Channel Interference)                       | $\leq +5\text{dB}$ . This requirement provides better performance than ABNT 15604.               |
| 122 | 7.2.6<br>Table 5                                                                              | ACI (Adjacent Channel Interference): $N\pm 1$       | $\leq -40\text{dB}$ . This requirement provides better performance than ABNT NBR 15604.          |
| 123 | Additional Requirement                                                                        | PR to ACI (Adjacent Channel Interference): $N\pm 2$ | $\leq -45\text{dB}$ .                                                                            |
| 130 | <b>Selectivity (TV Protection Ratio - PR) - Digital to Digital Interference. VHF and UHF.</b> |                                                     |                                                                                                  |
|     | Test conditions: Mode 3, Layer A, 13 segment, 64QAM, CR = 3/4, GI = 1/8, I = 0                |                                                     |                                                                                                  |
| 131 | 7.2.6<br>Table 5                                                                              | CCI (Co-Channel Interference)                       | $\leq +18\text{dB}$ . TABLE 5 ABNT 15604                                                         |

|     |                                                                                  |                                                |                                                                                                                             |
|-----|----------------------------------------------------------------------------------|------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------|
| 132 | 7.2.6<br>Table 5                                                                 | ACI (Adjacent Channel Interference): $N \pm 1$ | $\leq -40\text{dB}$ . This requirement provides a better performance than ABNT NBR 15604.                                   |
| 133 | Additional Requirement                                                           | ACI (Adjacent Channel Interference): $N \pm 2$ | $\leq -45\text{dB}$ .                                                                                                       |
| 140 | <b>Selectivity (TV Protection Ratio - PR) LTE to Digital Interference</b>        |                                                |                                                                                                                             |
|     | Test conditions: Mode 3, Layer A, 13 segment, 64QAM, CR = 3/4, GI = 1/8, I = 0   |                                                |                                                                                                                             |
| 141 | Additional Requirement                                                           | LTE uplink immunity                            | $\leq -45\text{dB}$ to LTE BW 10MHz, from 708MHz to 718MHz, burst mode 10% of 10ms frame with all Resource Blocks occupied. |
| 142 | Additional Requirement                                                           | LTE downlink immunity                          | $\leq -55\text{dB}$ to LTE BW 10MHz, from 763MHz to 773MHz with Load 100%                                                   |
| 150 | <b>SFN Operability</b>                                                           |                                                |                                                                                                                             |
|     | Test conditions only Mode 3, layer A 13 segments, 64 QAM, CR= 3/4, GI= 1/16, I=2 |                                                |                                                                                                                             |
| 151 | Additional Requirement                                                           | Pre-echo inside the guard interval             | $C/N \leq 24.5\text{ dB}$                                                                                                   |
| 152 |                                                                                  | Post-echo inside the guard interval            | $C/N \leq 24.5\text{ dB}$                                                                                                   |

|                                                        |             |          |                 |           |   |
|--------------------------------------------------------|-------------|----------|-----------------|-----------|---|
| 153                                                    | Multipath   |          | See table below |           |   |
| Pre-echo and post-echo attenuation must be better than |             |          |                 |           |   |
| Delay (μs)                                             |             | GI = 1/4 | GI = 1/8        | GI = 1/16 |   |
| Pre - echo                                             | -350        | -20      | -20             | -20       |   |
|                                                        | -300        | -6,5     | -6,5            | -6,5      |   |
|                                                        | -252        | 0        | -6,5            | -6,5      |   |
|                                                        | -250        | 0        | -5,5            | -5,5      |   |
|                                                        | -200        | 0        | -4,5            | -4,5      |   |
|                                                        | -150        | 0        | -3,5            | -3,5      |   |
|                                                        | -126        | 0        | 0               | -3,5      |   |
|                                                        | -100        | 0        | 0               | -3,5      |   |
|                                                        | -90         | 0        | 0               | -3,5      |   |
|                                                        | -85         | 0        | 0               | -3,5      |   |
|                                                        | -80         | 0        | 0               | -3,5      |   |
|                                                        | -75         | 0        | 0               | -3,5      |   |
|                                                        | -70         | 0        | 0               | -3,5      |   |
|                                                        | -65         | 0        | 0               | -3,5      |   |
|                                                        | -63         | 0        | 0               | 0         |   |
|                                                        | -40         | 0        | 0               | 0         |   |
|                                                        | -20         | 0        | 0               | 0         |   |
|                                                        |             | 0        | 0               | 0         | 0 |
|                                                        | Post - echo | 20       | 0               | 0         | 0 |
| 40                                                     |             | 0        | 0               | 0         |   |
| 63                                                     |             | 0        | 0               | 0         |   |
| 65                                                     |             | 0        | 0               | -3,5      |   |
| 70                                                     |             | 0        | 0               | -3,5      |   |
| 75                                                     |             | 0        | 0               | -3,5      |   |
| 80                                                     |             | 0        | 0               | -3,5      |   |
| 85                                                     |             | 0        | 0               | -3,5      |   |
| 90                                                     |             | 0        | 0               | -3,5      |   |
| 100                                                    |             | 0        | 0               | -3,5      |   |
| 126                                                    |             | 0        | 0               | -3,5      |   |
| 150                                                    |             | 0        | -3,5            | -3,5      |   |
| 200                                                    |             | 0        | -4,5            | -4,5      |   |
| 250                                                    |             | 0        | -5,5            | -5,5      |   |
| 252                                                    |             | 0        | -6,5            | -6,5      |   |
| 300                                                    |             | -6,5     | -6,5            | -6,5      |   |
| 350                                                    |             | -20      | -20             | -20       |   |

#### 4.4 Transport Stream

| Item | ABNT NBR<br>15604       | Requirement                                                                                                                                          | Specified functionalities                                                                                                                                                                                                                          |
|------|-------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 200  | <b>Transport stream</b> |                                                                                                                                                      |                                                                                                                                                                                                                                                    |
| 201  | 7.2.17                  | Transport processing.<br>Shall have a section filtering function to support four types of section formats for the data stipulated in ISO/IEC 13818-1 | <p>a) each section composed by one TS packet;</p> <p>b) multiple sections composed by one TS packet;</p> <p>c) maximum number of PMT section in a single TS packet is limited to 4;</p> <p>d) Each section composed by two or more TS packets.</p> |

#### 4.5 Video Decoding Processing

| Item | ABNT NBR<br>15604                | Requirement               | Specified functionalities                                                                                                                                   |
|------|----------------------------------|---------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 300  | <b>Video Decoding processing</b> |                           |                                                                                                                                                             |
| 301  | 8.1.1                            | Video decoding processing | The receiver shall be capable to decode a H.264/AVC video stream specified by ISO/IEC 14496-10, compatible with parameters defined in the ABNT NBR 15602-1. |
| 302  | 8.1.2.2                          | Profiles and levels       | ISO/IEC 14496-10 H.264/AVC HP @ L4.0 - Full-seg only.                                                                                                       |
| 303  |                                  |                           | ISO/IEC 11172-1 H.261 - For Ginga applications only.                                                                                                        |

#### 4.6 Video output format, aspect ratio, resolution and display features

| Item | ABNT NBR 15604                                                                                                                                                  | Requirement               | Specified functionalities |            |
|------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|---------------------------|------------|
| 310  | Video format decoding, aspect ratio and resolution                                                                                                              |                           |                           |            |
|      | The full-seg receivers shall support at least the video decoding in the 525i, 525p, 750p and 1125i formats, according to the specified in the ABNT NBR 15602-1. |                           |                           |            |
|      |                                                                                                                                                                 | Format                    | Aspect Ratio              | Resolution |
| 311  | 8.1.4.2                                                                                                                                                         | 525i (480i)               | 4:3                       | 720 x 480  |
| 312  |                                                                                                                                                                 | 525i (480i)               | 16:9                      | 720 x 480  |
| 313  |                                                                                                                                                                 | 525p (480p)               | 16:9                      | 720 x 480  |
| 314  | 8.1.5.1                                                                                                                                                         | Frame rate                | 30/1,001 Hz               |            |
|      |                                                                                                                                                                 |                           | 60/1,001 Hz               |            |
| Item | ABNT NBR 15604                                                                                                                                                  | Requirement               | Specified functionalities |            |
| 320  | Display Features                                                                                                                                                |                           |                           |            |
| 321  |                                                                                                                                                                 |                           |                           |            |
| 322  |                                                                                                                                                                 | Full Screen               | Supported                 |            |
| 323  |                                                                                                                                                                 | Letter Box                | Supported                 |            |
| 324  |                                                                                                                                                                 | PanScan                   | Supported                 |            |
| 325  |                                                                                                                                                                 | Zoom                      | Supported                 |            |
| 326  | 8.1.3.5                                                                                                                                                         | Multiple services support | Supported                 |            |

#### 4.7 Audio Processing

| Item | ABNT NBR 15604                                                                                                      | Requirement                                                                                   | Specified functionalities      |
|------|---------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|--------------------------------|
| 400  | <b>Audio Decoding</b>                                                                                               |                                                                                               |                                |
|      | The receiver shall be able to decode audio stream in the MPEG-4 AAC standard, and comply with the ABNT NBR 15602-2. |                                                                                               |                                |
| 401  | 8.2.1                                                                                                               | a) MPEG-4 AAC standard                                                                        |                                |
|      |                                                                                                                     | b) dynamic range control metadata support                                                     |                                |
|      |                                                                                                                     | c) dialog normalization metadata support                                                      |                                |
|      |                                                                                                                     | d) support to explicit signaling of the non-backward compatible for SBR without PES alignment |                                |
|      |                                                                                                                     | e) downmixing                                                                                 |                                |
|      |                                                                                                                     | f) sampling frequency: 32 kHz, 44,1 kHz or 48 kHz                                             |                                |
|      |                                                                                                                     | g) quantization: 16 bits or 20 bits                                                           |                                |
|      |                                                                                                                     | h) audio transport multiplexation and synchronization: LATM/LOAS                              |                                |
|      |                                                                                                                     | i) number of audio channels: up to 5.1 per LATM/LOAS                                          |                                |
|      |                                                                                                                     | j) number of LATM/LOAS: up to 8 streams associated to one same program                        |                                |
|      |                                                                                                                     | k) Decoding modes                                                                             | Mono (1/0)                     |
|      |                                                                                                                     |                                                                                               | Stereo (2/0)                   |
|      |                                                                                                                     |                                                                                               | Stereo multi-channel (3/2+LFE) |

|     |       |                                               |                                                                                                                 |
|-----|-------|-----------------------------------------------|-----------------------------------------------------------------------------------------------------------------|
| 402 | 8.2.2 | Audio profiles and levels<br>( Full-seg only) | LC AAC @ L2                                                                                                     |
|     |       |                                               | LC AAC @ L4                                                                                                     |
|     |       |                                               | HE-AAC+SBR v.1 @ L2                                                                                             |
|     |       |                                               | HE-AAC+SBR v.1 @ L4                                                                                             |
| 403 | 8.2.3 | Primary audio stream<br>decoding              | Play multiple audio streams in a single<br>event and when there is more than<br>one audio component descriptor. |
| 404 | 8.2.7 | Audio mode discrimination<br>and indication   | The audio mode shall comply with the<br>specified in ABNT NBR 15602-<br>2:2007, Clause 8.                       |

#### 4.8 AV Output

| Item | ABNT NBR<br>15604             | Requirement       | Specified functionalities                                          |
|------|-------------------------------|-------------------|--------------------------------------------------------------------|
| 500  | AV Output                     |                   |                                                                    |
| 510  | Composite video output (CVBS) |                   |                                                                    |
| 511  | 8.1.7.1.1                     | Standard          | M                                                                  |
| 512  |                               | Color system      | PAL and NTSC                                                       |
| 513  |                               | Signal level      | 140 IRE ( $\approx 1$ Vpp)                                         |
| 514  |                               | Synchronism level | 40 IRE $\pm 20\%$ ( $\approx 286$ mVpp) –<br>Negative polarization |
| 515  |                               | Burst level       | 40 IRE $\pm 10\%$ ( $\approx 286$ mVpp)                            |
| 516  |                               | Output Impedance  | 75 $\Omega$                                                        |
| 517  |                               | Output Connector  | RCA yellow                                                         |
| 520  | Audio Output                  |                   |                                                                    |
| 521  | 8.2.4.1                       | Level             | 250 mV rms $\pm 3$ dB                                              |
| 522  |                               | Impedance         | 2,2 k $\Omega$ or lower                                            |
| 523  |                               | Load Impedance    | 10 k $\Omega$                                                      |
| 524  |                               | Output Connector  | 2 x RCA (Left audio white color and<br>Right audio red color).     |

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#### 4.9 Modulated RF output

The HSTB shall implement an analog RF modulated output compliant with the same setting (brightness, colors, sharpness and etc.) as composite video interfaces.

| Item | ABNT NBR 15604                                                                                                                                                                                                                                                | Requirement                | Specified functionalities                                         |
|------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|-------------------------------------------------------------------|
| 600  | <b>RF modulator</b>                                                                                                                                                                                                                                           |                            |                                                                   |
|      | The RF output connector must be combined with the antenna pass through. When the STB is “on” the PAL-M or NTSC-M modulated signal must be send to the RF output connector. When the STB is “stand by” the antenna signal must be send to RF output connector. |                            |                                                                   |
| 601  | 8.1.7.1.2                                                                                                                                                                                                                                                     | Standard                   | PAL-M and NTSC-M                                                  |
| 602  |                                                                                                                                                                                                                                                               | Video modulation           | AM-VSB or AM DSB                                                  |
| 603  |                                                                                                                                                                                                                                                               | Sound modulation           | FM                                                                |
| 604  |                                                                                                                                                                                                                                                               | Channels number            | VHF channel 3 (default) and VHF channel 4, selectable by software |
| 605  |                                                                                                                                                                                                                                                               | Output level               | 60 dBμV ± 3 dBμV                                                  |
| 606  |                                                                                                                                                                                                                                                               | Output connector impedance | 75 Ω                                                              |
| 607  |                                                                                                                                                                                                                                                               | Output connector type      | F-type connector Female.                                          |

#### 4.10 Features and interfaces of the Panels

| Item | ABNT NBR 15604                 | Requirement           | Specified functionalities                                      |
|------|--------------------------------|-----------------------|----------------------------------------------------------------|
| 700  | <b>Features and interfaces</b> |                       |                                                                |
| 710  | <b>Front Panel Features</b>    |                       |                                                                |
| 711  | Additional Requirement         | Front panel button    | ON/OFF                                                         |
| 712  |                                |                       | CH+ and CH-                                                    |
| 713  |                                | Led                   | Bicolor LED for power indication (ON = Green, stand by = Red). |
| 714  |                                | Infrared receiver- IR | 940 nm (GaAlAs / GaAs) AGC4 class type, Carrier 36 KHz ± 2%    |

|            |                            |                          |                                                                                                 |
|------------|----------------------------|--------------------------|-------------------------------------------------------------------------------------------------|
| 715        |                            | USB Interface            | 1 x USB 2.0, type A connector<br>@ 500 mA                                                       |
| <b>720</b> | <b>Back Panel Features</b> |                          |                                                                                                 |
| 721        | Additional Requirement     | RF input "Antena"        | RF IN 75 $\Omega$ F-type connector Female                                                       |
| 722        |                            | RF pass through "RF out" | RF out 75 $\Omega$ F-type connector Female. Standby: RF pass through<br>On: RF modulator active |
| 723        |                            | A/V RCA "CVBS", "L", "R" | Video Yellow, Left audio White and Right Audio Red                                              |
| 724        |                            | USB Interface "USB"      | 1 x USB 2.0, type A connector<br>@ 500 mA                                                       |
| 725        |                            | DC Power Input "DC IN"   | P4 type connector, to external PSU<br>AC/DC adapter (12V/1A)                                    |

#### 4.11 Middleware and Graphics User Interface

| Item       | ABNT NBR<br>15604                             | Requirement                   | Specified functionalities                                              |
|------------|-----------------------------------------------|-------------------------------|------------------------------------------------------------------------|
| <b>800</b> | <b>Middleware and Graphics User Interface</b> |                               |                                                                        |
| 801        |                                               | Operating System - OS         | Linux based                                                            |
| 802        |                                               | Graphics User Interface - GUI | The GUI must comply the EAD specifications PD.33.10.92A.0317A-RT-39-AA |
| 803        |                                               | Middleware                    | Ginga-NCL in compliance with ABNT NBR 15060-1, 15606-2 and 15606-3     |
| 804        |                                               |                               | Profile C in compliance with ABNT NBR 15604, 15606-1, 15606-2, 15606-3 |

|     |  |                     |                                                                                                      |
|-----|--|---------------------|------------------------------------------------------------------------------------------------------|
| 805 |  |                     | Run embedded Ginga applications and via broadcast channel, internet connection or USB external drive |
| 806 |  |                     | Support full interactivity according ABNT NBR 15604: 14.1.2, 14.1.2a, 14.1.2b and 15                 |
| 807 |  | Application Update  | OTA - Over the Air                                                                                   |
|     |  |                     | Internet                                                                                             |
|     |  |                     | USB port                                                                                             |
| 808 |  | Firmware update     | USB port and Internet                                                                                |
| 809 |  | 3G Modem Drivers    | Installed drivers to support minimum of 5(five) USB 3G Modem                                         |
| 810 |  | Wi-Fi Modem Drivers | Installed drivers to support minimum of 3(three) USB Wi-Fi Modem                                     |

#### 4.12 Accessibility Requirements

| Item | ABNT NBR 15604             | Requirement       | Specified functionalities                                                                                                                               |
|------|----------------------------|-------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|
| 900  | Accessibility Requirements |                   |                                                                                                                                                         |
| 901  | 7.2.24 a)                  | Closed Caption    | The closed caption (CC) information shall always be present at the videos outputs (AV, RF Modulator). The text shall be rendered into the video signal. |
| 902  | 7.2.24 b)                  | Audio Description | Locution in Portuguese language, overlapped to the program's original sound.                                                                            |
| 903  | 7.2.24 c)                  | Audio Locution    | Enable insertion of locution in Portuguese to describe the UI actions                                                                                   |
| 904  | 7.2.24 e)                  | LIBRAS            | Brazilian Signal Language                                                                                                                               |

#### 4.13 Facilities

| Item | ABNT NBR<br>15604         | Requirement          | Specified functionalities                                                                     |
|------|---------------------------|----------------------|-----------------------------------------------------------------------------------------------|
| 1000 | <b>Facilities</b>         |                      |                                                                                               |
| 1001 | Additional<br>Requirement | Zapping channels     | Through all primary and secondary channels.                                                   |
| 1002 |                           | Re-scan DTV channels | The UI menu shall provide an option to re-scan DTV channels at the first level of navigation. |

#### 4.14 Hardware Requirements

| Item | ABNT NBR<br>15604            | Requirement        | Specified functionalities                                                                                                                                            |
|------|------------------------------|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1100 | <b>Hardware Requirements</b> |                    |                                                                                                                                                                      |
| 1101 | Additional<br>Requirement    | Processor          | CPU $\geq$ 1100 DMIPS                                                                                                                                                |
| 1102 |                              | Memory             | RAM $\geq$ 256 Mbytes<br><br>FLASH $\geq$ 2Gbytes (Minimum of 1.2Gbytes for Ginga portal applications and minimum of 0.5 Gbytes for Ginga broadcasting applications) |
| 1103 |                              | ISDB-T Tuner       | Must be in compliance with SBTVD standards and additional requirements                                                                                               |
| 1104 |                              | ISDB-T Demodulator | Must be in compliance with SBTVD standards and pass the LTE, SFN and Multipath tests                                                                                 |

#### 4.15 Accessories

| Item | ABNT NBR 15604         | Requirement               | Specified functionalities                                                                             |
|------|------------------------|---------------------------|-------------------------------------------------------------------------------------------------------|
| 1200 | <b>Accessories</b>     |                           |                                                                                                       |
| 1201 | Additional Requirement | Remote control unit - RCU | The RCU must include batteries and must comply with the EAD specification PD.33.10.92A.0317A-RT-20-AD |
| 1202 |                        | Power Supply Unit -PSU    | The PSU must comply the EAD specifications PD.33.10.92A.0317A-RT-38-AB                                |
| 1203 |                        | RCA Cable                 | Cable with Red, White and Yellow RCA connectors 1.5 meters                                            |
| 1204 |                        | User Manual               | The user manual must be in Portuguese language only                                                   |

#### 4.16 Operating Parameters

| Item | ABNT NBR 15604            | Requirement                                                                                         | Specified functionalities                                |
|------|---------------------------|-----------------------------------------------------------------------------------------------------|----------------------------------------------------------|
| 1300 | Operating Parameters      |                                                                                                     |                                                          |
| 1301 | Additional Requirement    | Operating temperature range                                                                         | 5°C to 50°C                                              |
| 1302 |                           | Operating humidity                                                                                  | 5% to 95%                                                |
| 1303 |                           | Storage temperature range and humidity                                                              | -25°C to 70°C                                            |
|      |                           |                                                                                                     | 5% to 95%                                                |
| 1304 |                           | Top cover external temperature                                                                      | 35°C @ 25°C (environment)                                |
|      |                           |                                                                                                     | 40°C @ 30°C (environment)                                |
| 1305 |                           | Design life                                                                                         | 5 years @T=25° C                                         |
|      |                           |                                                                                                     | HASS (Highly Accelerated Stress Screen) REPORT REQUIRED. |
| 1306 | Mechanical Housing Design | The STB shall include a mechanical structure to electronics and the layout shall be approved by EAD |                                                          |

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|      |  |         |                                                                                                                                                                                         |
|------|--|---------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1307 |  | Cooling | The enclosure shall provide sufficient cooling to prevent the receiver from overheating                                                                                                 |
|      |  |         | Casing shall not consider usage of a fan in the hardware design; it shall consider usage of heatsink for thermal control.                                                               |
|      |  |         | Enclosure may have numerous small holes to improve ventilation. The holes shall be sized and located to minimize damage from liquids and directly contacts to the internals components. |

#### 4.17 STB Environmental and Mechanical Requirements

| Item | ABNT NBR 15604 | Requirement                                         | Specified functionalities                                                       |
|------|----------------|-----------------------------------------------------|---------------------------------------------------------------------------------|
| 1400 |                | <b>Environmental and Mechanical Requirements</b>    |                                                                                 |
| 1401 |                | Operating Temperature:<br>Cold And Heat Test        | -10°C Minimum specified for 2 hours and recovery in 2 hours                     |
|      |                |                                                     | + 55°C Maximum specified for 16 hours and recovery in 2 hours                   |
| 1402 |                | Storage Temperature:<br>Cold and Heat Test          | -20°C Minimum specified for 24 hours. (Packaged STB with accessories included). |
|      |                |                                                     | 70°C Maximum specified for 24 hours. (Packaged STB with accessories included).  |
| 1403 |                | Temperature Cycling<br>Test (Operating Temperature) | Minimum specified for 2 hours                                                   |
|      |                |                                                     | Maximum specified for 2 hours                                                   |
|      |                |                                                     | Ramp: as fast as possible                                                       |
|      |                |                                                     | Cycle(s): 12                                                                    |

|      |  |                                                                                                     |                                                                            |
|------|--|-----------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------|
| 1404 |  | Thermal Shock (Storage Temperature)                                                                 | Minimum specified for 2 hours                                              |
|      |  |                                                                                                     | Maximum specified for 2 hours                                              |
|      |  |                                                                                                     | Ramp: $\leq 15$ seconds                                                    |
|      |  |                                                                                                     | Cycle(s): 100                                                              |
| 1405 |  | Heat Damp Test                                                                                      | 70°C / 85% RH for 1000h                                                    |
| 1406 |  | Salt Fog                                                                                            | 5% Sodium Chloride (NaCl) maintained at a temperature of 35°C for 48 hours |
| 1407 |  | Salt Spray Test – white oxidation (NBR 8094)                                                        | > 100 hours                                                                |
| 1408 |  | Salt Spray Test – red oxidation (NBR 8094)                                                          | > 100 hours                                                                |
| 1409 |  | Random Vibration (unit)                                                                             | 20 to 1000 Hz: 0.04 g <sup>2</sup> /Hz                                     |
|      |  |                                                                                                     | 1000 Hz to 2000 Hz: -6 dB/oct                                              |
|      |  |                                                                                                     | 3 axes (1 hour per axis)                                                   |
| 1410 |  | Drop Test (packaged STB with accessories). No damage is expected for any accessories including STB. | Height: 76 cm (1 cycle)                                                    |
|      |  |                                                                                                     | 6 surfaces                                                                 |
|      |  |                                                                                                     | 12 edges                                                                   |
|      |  |                                                                                                     | 8 corners                                                                  |
| 1411 |  | Drop Test (STB unit). No permanent damage is expected.                                              | Height: 76 cm (1 cycle)                                                    |
|      |  |                                                                                                     | Shall keep fully operational after testing                                 |
|      |  |                                                                                                     | 6 surfaces                                                                 |

**4.18 Certification, compliances, reliability, safty and quality assurance**

| Item | ABNT NBR 15604                                                              | Requirement       | Specified functionalities                                                                                                                                                                              |
|------|-----------------------------------------------------------------------------|-------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1500 | <b>Certification, compliances, reliability, safty and quality assurance</b> |                   |                                                                                                                                                                                                        |
| 1501 |                                                                             | STB Certification | The receiver must comply with the ABNT SBTVD standards, SFN and Multipath tests. The report must be issued by an laboratory recognized in Brazil with activities in the specific area of knowlegement. |
| 1502 |                                                                             | EMC Compliance    | Electromagnetic compatibility and electrical safety certifications is required. Certificate must be valid for the product                                                                              |
| 1503 |                                                                             | Safety Compliance | The receiver must comply with safety standards ABNT NBR IEC 60065:2009. Certificate must be valid for the product                                                                                      |
| 1504 |                                                                             | Reliability       | The receiver must have a lifetime longer than 5 years after de production date                                                                                                                         |
| 1505 |                                                                             | Replacement parts | The manufacturer must guarantee replacement parts at least for 6 years                                                                                                                                 |
| 1506 |                                                                             | Quality Assurance | The manufacturer must have a quality process assurance report                                                                                                                                          |

**5 Remote control unit – RCU**

Relatório Técnico/Consultoria PD.33.10.92A.0317A-RT-20-AD Especificação Técnica Controle Remoto STB

**6 Power Supply Unit -PSU**

Relatório Técnico PD.33.10.92A.0317A-RT-38-AB Especificação Técnica Fonte de alimentação STB

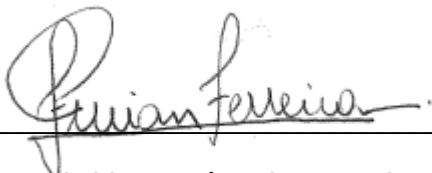
**7 Graphics User Interface - GUI**

Relatório Técnico PD.33.10.92A.0317A-RT-39-AA Especificação User Interface Conversor EAD – Ginga NCL

**8 Histórico de alterações do documento consolidado**

| Data de emissão | Versão | Descrições das alterações realizadas                |
|-----------------|--------|-----------------------------------------------------|
| 17/jan/17       | AA     | Versão Inicial                                      |
| 20/jan/17       | AB     | Alteração na numeração de itens e informações de HW |
| 07/mar/17       | AC     | Complemento de informação para Flash Memory         |
| 27/abr/17       | AD     | Inclusão de multipath SFN                           |
| 10/mai/17       | AE     | Citação ABNT NBR15608                               |

**9 Execução e aprovação**

|                                                                                                                                                                                              |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Executado por:</b>                                                                                                                                                                        |
| <p>Marcus Aurélio Ribeiro Manhaes</p> <p>Yasuaki Ito</p>                                                                                                                                     |
| <b>Aprovado por:</b>                                                                                                                                                                         |
| <p></p> <p>Aristides José Furian Ferreira<br/>Gerente<br/>Gerência de Engenharia de Redes e Sistemas</p> |

Data da emissão: 10/mai/17