Spectrum Plan for the Accommodation of Radio and Television Broadcast Auxiliary Services

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TABLE OF CONTENTS

EXECUTIVE SUMMARY

Broadcast Auxiliary Services or BAS[1] are used for relaying broadcast aural and television signals from the studio to transmitter, or between two points, such as a main studio and an auxiliary studio. In addition to Studio-to-Transmitter Links (STLs), BAS also include outside broadcasting (OB) links or remote pickup units (RPUs) which relay signals from a remote location, back to the studio.

A spectrum audit conducted in 2011 of all BAS frequency bands revealed:

(1) Much more spectrum usage than that authorized by the Authority, particularly in the frequency range of 900 – 960 MHz,

(2) Broadcasters are operating in frequency bands that do not comply with the Trinidad and Tobago Frequency Allocation Table (TTFAT) and the International Telecommunication Union, Radiocommunications Bureau (ITU-R) region 2 countries for BAS, and

(3) With the advent of Digital Terrestrial Television (DTT) and its signal distribution architecture, broadcasters in Trinidad and Tobago are disinclined to relinquish noncompliant frequencies and migrate to the recommended bands.

This document seeks firstly to identify the various technologies and their respective frequency bands used for BAS according to the Trinidad and Tobago Frequency Allocation Table (TTFAT) and ITU-R Region 2 countries. Secondly, it summarizes the results of an analysis of the current spectrum occupancy for the associated frequency bands in Trinidad and Tobago. Finally, the above information is used to propose frequency

[1] As defined by the FCC

bands for the provision of BAS (STLs and OBs) and gives an indication of the appropriate licensing process for the assignment of spectrum to users.

Table 1 below summarizes the proposed frequency band plans and the respective licensing approach for the provision of BAS.

Table 1: Summary of proposed BAS Operating Frequency Ranges and their Application for Trinidad and Tobago

Frequency Band (MHz)	Application	Licensing Approach
225 – 322	Fixed or Mobile Broadcasting, ENG /OBs	This band is favoured for the establishment of radio Outside Broadcasting Links (OBs) Available spectrum will be assigned on a first come, first served basis.
940 – 960	Radio BAS, STL, ICR	This frequency band is favoured for the establishment of FM Radio Studio-to-Transmitter Links and Outside Broadcasting Links. Available spectrum will be assigned on a first come, first served basis.
2025 – 2110	Fixed or Mobile Broadcasting ENG /OBs	This frequency band accommodates Television Outside Broadcasting activities. It is favoured by broadcasters in Trinidad and Tobago for Television STL across long hops. A ***moratorium*** shall be placed on the licensing process pending the completion of a position paper entitled, "Licensing of TVOBs"
2200 – 2300	Fixed or Mobile Broadcasting STL, ENG /OBs	The preferred channel arrangement defined in this spectrum plan provides for the development of TV pick-up systems transmitting up to twelve 8 MHz one-way RF channels. Available spectrum will be assigned on a first come, first served basis. Due to the limited spectrum available, a spectrum cap of two channels per broadcaster shall be imposed.

Frequency Band (MHz)	Application	Licensing Approach
2360 – 2400	Broadcasting ENG/ TVOBs	Currently congested, no new Television Outside Broadcasting Links (TVOBs) will be authorized in this band. Coordination will be required with existing users when refarming this band for new services.
6430 – 7110	Television Studio-to-Transmitter Links (STLs).	This frequency band is favoured by broadcasters for the establishment of television Studio-to-Transmitter Links Available spectrum will be assigned on a first come, first served basis. A competitive licensing process is not warranted at this time.

Note: The frequency ranges 450 – 451 MHz and 455 – 456 MHz falls within the frequency band 450 – 470 MHz. According to footnote **TT14** in the TTFAT; "Studio Transmitter Links (STL's) will not be licensed in the band 450 - 470 MHz; however, Electronic News Gathering (ENG)/Outside Broadcasting (OB) activities may be licensed in the bands 450 – 451 and 455 – 456 MHz." Due to the allocation of the band 450 – 470 MHz for the provision of Broadband Wireless Access (BWA) services, no new BAS users will be licensed in the above stated frequency ranges.

1. INTRODUCTION

Broadcast Auxiliary Services or BAS are used for relaying broadcast aural and television signals from the studio to transmitter, or between two points, such as a main studio and an auxiliary studio. In addition to STLs, BAS also include outside broadcasting (OB) links or remote pickup units (RPUs) which relay signals from a remote location, back to the studio.

In keeping with international standards, Studio to Transmitter link or STL is defined in this band plan as, "*a fixed service which transmits a radio or television station programme material from a broadcasting studio to a transmitter in another location.*" Broadcasters employing STLs usually have Transmitter-to-Studio links (TSLs) to return telemetry information.

Definitions for Electronic News Gathering (ENG) and Outside Broadcasting (OB) are not mutually exclusive; that is, as stated in ITU-R Report BT.2069-5, ENG/OB can be defined as; "*the collection of video and/or sound material without the use of film or tape recorder, using small, often handheld, electronic cameras and/or microphones with radio links to the news room and/or to the portable tape or other recorders*". Additionally, video and/or sound reporting is usually unpredictable both in terms of their timing and locations. They often require that links be established quickly, allowing very little time for frequency co-ordination and licensing.

This document is a subset of the National Spectrum Plan and should be considered as part of the entire National Spectrum Plan. The National Spectrum Plan provides a framework to regulate the efficient use of spectrum, in an orderly manner, in accordance with the Authority's mandate.

2. OBJECTIVES

The principal objectives of this band plan are:

1. To identify the frequency ranges which will be allocated for the accommodation of BAS, in accordance with the TTFAT and ITU-R Region 2 Countries;
2. To specify the maximum technical operating conditions and specifications to be imposed on the licensed radiocommunications systems in the proposed frequency ranges; and
3. To indicate the licensing process to be implemented for the allocated frequency ranges, including any specific licensing conditions.

3. REVIEW CYCLE

This document will be modified periodically by the Authority, with a view to adapt to the needs of the Broadcasting Industry, and to meet changing and unforeseen circumstances. When such a need arises, the Authority will announce its intention to review the document thereby allowing for input from personnel in the telecommunications sector or any other pertinent stakeholder.

Questions or concerns regarding the maintenance of this spectrum plan should be directed to the Authority via email at technical@tatt.org.tt.

4. CONSULTATION PROCESS

The Authority will seek the views and opinions of the general public and other stakeholders regarding the proposals made in this document in accordance with its "Procedures for Consultation in the Telecommunications and Broadcasting Sectors of Trinidad and Tobago". The document will be revised with considerations given to the comments and recommendations made during the consultation process.

This document will be made available for public consultation for a duration of four (4) weeks, in keeping with organization policy.

5. NORMATIVE REFERENCES

In addition to the National Spectrum Plan, the following relevant policies, plans and regulations prepared by the Authority contain provisions, which, through reference in this text constitute the provisions of this band plan:

- Trinidad and Tobago Frequency Allocation Table (8.3 kHz – 3000 GHz).
- Authorization Framework for the Telecommunications and Broadcasting Sectors of Trinidad and Tobago;
- Spectrum Management Policy;
- Spectrum Plan for the Accommodation of Point-to-Point Radiocommunications Systems;
- Draft Radio Spectrum Regulations;
- Fee Methodology; and
- European Radiocommunications Committee (ERC) Report, 1995

6. CONSIDERATIONS FOR THE PROVISION OF BROADCAST AUXILIARY SYSTEMS (STLS AND OBS)

The following information was taken into consideration by the Authority to efficiently allocate and plan the use of specified frequency bands to accommodate broadcast auxiliary services:-

1. The frequency bands allocated to STLs and OBs, in accordance with the International Telecommunications Union, Radiocommunications Bureau (ITU-R) Region 2 Table of Frequency Allocations and the Trinidad and Tobago Frequency Allocation Table (TTFAT);
2. The current licensed spectrum bands used by broadcasters for broadcast auxiliary systems in Trinidad and Tobago;
3. The availability of spectrum in Trinidad and Tobago to accommodate STLs and OBs systems;
4. The Spectrum Plan for the Accommodation of Broadband Wireless Access Services (BWA);
5. The appropriate licensing methods for the assignment of spectrum to users; and
6. The Spectrum Plan for the Accommodation of Point-to-Point Radiocommunications Systems

A summary of the proposed frequency ranges for broadcast auxiliary services which can be considered for licensing in Trinidad and Tobago is provided in **Table 3** below:

Table 3: Summary of the proposed frequency ranges for broadcast auxiliary services which can be considered for licensing in the Republic of Trinidad and Tobago.

Service Applications[2]	Frequency Range of Operation	Trinidad and Tobago Frequency Allocation Table (TTFAT)	Current Spectrum Availability and Appropriate Licensing Method
Broadcasting/ Auxiliary Service (Radio OBs only)	225 – 322 MHz	The frequency range 225 – 322 MHz spans across seven (7) frequency allocations in the TTFAT, all of which are allocated to the Fixed and Mobile services on a co-primary basis. The frequency assignment plan for broadcast auxiliary systems in this band comprises the entire range 225 – 322 MHz all of which have been allotted to fixed services.	According to a spectrum audit conducted in 2011, this band is mostly unused and was specifically allocated to radio OBs in the Authority's Spectrum Plan. The assignment of available spectrum will be issued on a first come, first served basis.
AM and FM radio broadcast auxiliary services (STLs)	940 – 960 MHz	Footnote **TT22** in the TTFAT states, "The band 942 – 960 MHz is intended for Radio Broadcast Studio Transmitter Links (STL's). All other uses will be considered secondary." Due to a high demand for spectrum and in keeping with the TTFAT, this band was extended to 940 – 960 MHz for fixed services on a co-primary basis.	Approximately 50% of the frequencies in this band have been assigned and re-assigned multiple times primarily for the provision of low capacity links. The assignment of available spectrum will be issued on a first come, first served basis.

[2] All services are primary unless otherwise noted. Stations of secondary service: *a)* shall not cause harmful interference to stations of primary services to which frequencies are already assigned or to which frequencies may be assigned at a later date; *b)* cannot claim protection from harmful interference from stations of a primary service to which frequencies are already assigned or may be assigned at a later date; and *c)* can, however, claim protection from harmful interference from stations of the same service or from other secondary service(s) to which frequencies may be assigned at a later date.

Service Applications[2]	Frequency Range of Operation	Trinidad and Tobago Frequency Allocation Table (TTFAT)	Current Spectrum Availability and Appropriate Licensing Method
Broadcasting ENG / TVOBs	1990 – 2110 MHz	Footnote **TT27** in the TTFAT states, "In the bands 1990 – 2025 MHz and 2160 – 2200 MHz, a moratorium has been placed on the licensing of new systems in the fixed service. Existing fixed service systems operating in these bands will be displaced to enable the implementation of mobile-satellite service systems in certain sub-bands." According to footnote **TT28** in the TTFAT; "The band 2025 – 2110 MHz is intended for Electronic News Gathering (ENG) and Outside Broadcast (OB) activities. Studio Transmitter Links (STL's) and other fixed services will not be authorized in this band."	This frequency band accommodates Electronic News Gathering (ENG) and Television Outside Broadcast (TVOB) activities. A moratorium shall be placed on the licensing process pending the completion of a position paper entitled, "Licensing of TVOBs" In keeping with the spectrum classification and valuation principles in the Authority's Fee Methodology, assignment of available spectrum shall be on a first come, first served basis.
Broadcasting /Auxiliary Service (ENG/OB)	2200 – 2300 MHz	The TTFAT allows for fixed and mobile systems; however, according to footnote **TT31** in the TTFAT, "The band 2200 – 2300 MHz is intended for fixed point-to-point systems only."	This frequency band is unoccupied and will be used to accommodate Electronic News Gathering (ENG) and Television Outside Broadcast (TVOB) activities. The assignment of available spectrum will be issued on a first come, first served basis. Due to the limited spectrum available, a spectrum cap of two channels per broadcaster shall be imposed.
Broadcasting ENG / TVOBs	2360 – 2400 MHz	The TTFAT allocates this frequency range to Fixed, Mobile (except aeronautical mobile), and Broadcasting services on a co-primary basis.	This band is currently congested; as such a moratorium shall be placed on the licensing, until such time that the Authority deems it necessary to conduct a refarming exercise, making spectrum available in the band.

Service Applications[2]	Frequency Range of Operation	Trinidad and Tobago Frequency Allocation Table (TTFAT)	Current Spectrum Availability and Appropriate Licensing Method
Television Studio-to-Transmitter Links (STLs)	6430 – 7110 MHz	The frequency range 6430 – 7110 MHz spans across three (3) frequency allocations in the TTFAT, all of which are allocated to Fixed service on a co-primary basis. The frequency assignment plan for Broadcast auxiliary systems in the Upper 6 GHz band comprises a portion of the 5925 – 6700 MHz the entire range 6700 – 7075 MHz and a portion of the 7075 – 7145 MHz range.	In the Upper 6 GHz band, all of the frequencies will be assigned and re-assigned multiple times primarily for the provision of Low, Medium and High capacity links. The licensing of spectrum in this band shall be done on a first come, first served basis. This recommended Licensing approach will be implemented with immediate effect for broadcasters upgrading their services.

7. Frequency Assignment Principles

The following principles apply to the frequency assignment plans developed for the provision of broadcast auxiliary services (BAS) in Trinidad and Tobago:

1. The adopted frequency assignment plan for a specified band shall follow the relevant ITU-R recommendations and take into consideration the principal frequency assignment plan utilized for broadcast auxiliary systems currently operating in Trinidad and Tobago.
2. All Frequency Assignment Plans shall have a reference channel bandwidth, which serves as the minimum channel bandwidth assignment. Frequency channels that require larger bandwidths can be achieved by concatenating multiple consecutive frequency channels of the reference channel bandwidth.
3. Frequency assignments shall be made in accordance with the selected licensing process, as established by the Authority.
4. A Frequency Assignment Plan shall be used for the assignment of a single frequency channel, for a simplex mode of operation, or a frequency pair (i.e. an upper and a lower frequency channel separated by a duplex spacing) for a duplex mode of operation.
5. The notional antenna for Broadcast Auxiliary Service is specified as that which has technical characteristics similar to those of a two-meter grid parabolic. Operators should upgrade their antenna systems to the notional antenna specifications if:
    1. their use of a lower performance antenna inhibits necessary assignments that would have been possible if the notional antenna were in use; or

2. there is a possibility of interference to or from other services.

6. OBs are spectrum Licenses and shall be granted for the assignment of a frequency channel or channel pair. STLs are stationed licenses and shall be granted for the assignment of a frequency channel or channel pair. Frequency re-use shall be considered when the spectrum utilization in the specified band exceeds spectrum availability in that band.
7. Unless otherwise stated, the frequency spectrum blocks or frequency channels in the Frequency Assignment Plan shall incorporate any necessary guard bands; therefore, all necessary guard bands for entities authorized to use adjacent blocks or channels will be determined at such time when the licensees and the respective technologies to be deployed have been determined.
8. OBs normally operate on a short-term secondary, non-interference basis to regularly authorized stations and may be discontinued immediately upon notification that perceptible interference is being caused to the operation of a regularly authorized station. OB station operators shall, to a practical extent, use only the effective radiated power and antenna height necessary for satisfactory system performance.
9. The ***protection ratio*** values required to protect a Radio STL from unacceptable interference from another STL, OB and other links are based on the following criteria developed in other countries and in consultation with the broadcast industry.

Relationship	**Protection Ratio**
Co-channel	50 dB
Adjacent channel	0 dB

Table 4: Protection Ratio

8. Proposed Frequency Assignment Plans for Broadcast Auxiliary Services (STLs and OBs)

The various frequency bands allocated for the accommodation of broadcast auxiliary services can be further sub-divided into frequency channels or block assignments, predicated on the type(s) of technologies which can be employed using the allocated spectrum. These frequency assignment plans are aimed at maximizing the efficient use of the allocated spectrum, and the promotion of the efficient re-use of assigned frequencies.

The following sub-sections illustrate, for the various frequency ranges under consideration, the frequency assignment plan inclusive of its rationale, the recommended licensing process and conditions, and the technical operating conditions and specifications for all radiocommunications systems operating in the stated frequency band.

NOTE: The actual availability of frequency channels for broadcast auxiliary systems will be determined subject to the availability of unlicensed channels, successful coordination of frequencies for new channel assignments or the ability of the system to re-use a previously licensed frequency channel (successful co-channel coordination).

8.1 250 MHz Band: 225 – 322 MHz

Frequency Assignment Plan

8.1.1 This band is currently used for OB links associated with FM radio broadcasting services in Trinidad and Tobago. The Frequency Assignment Plan for BAS in this band comprises the entire range 225 – 322 MHz, all of which have been allotted to fixed services in the TTFAT.

8.1.2 The frequency range 225 – 322 MHz is divided into frequency channel bandwidth of 200 KHz for the operation of radio OBs systems.

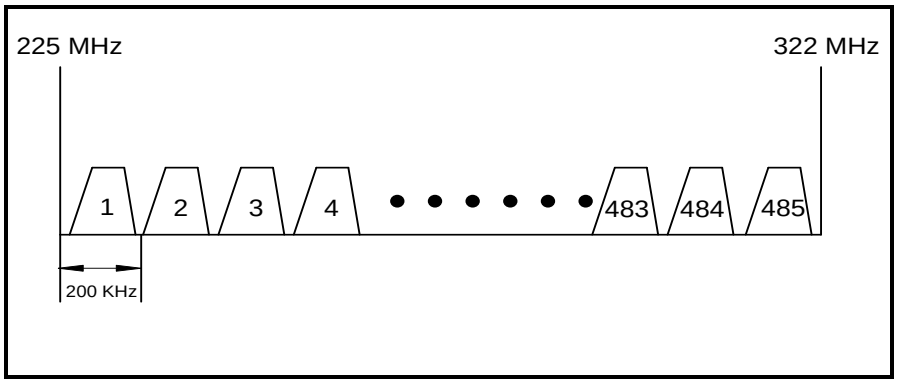


Figure 1: Channel Plan for 225 – 322 MHz Range

8.1.3 *Antenna Directivity and Polarization* — all fixed point to point links shall use directional antennas with a minimum gain with respect to half wave dipole of 9 dB in the VHF band (30–300 MHz) and 12 dB in the UHF band (above 300 MHz).

8.1.4 *Number of Hops* — there are no restrictions on the number of hops to be authorized. This is based on the proposed system configuration and availability of spectrum; however, systems requiring multiple hops should be designed to optimize spectrum utilization.

8.1.5 *Effective Radiated Power and Antenna Height* — "the effective radiated power (ERP) will be limited to what is necessary to provide the required service as governed by the system requirements" (SRSP-512). To this end, restrictions will be applied to the ERP, antenna polarization/antenna directivity and antenna height above ground level (ERC Report 38, 1995).

Recommended Licensing Process

8.1.6 The Authority shall licence a single frequency channel or a frequency channel pair in accordance with the channel assignment plan.

8.1.7 Frequency assignments will be issued on demand, provided that the frequency requested will not cause harmful interference to existing users. The Authority reserves the right to assign frequencies other than those requested if, in its opinion, such action is warranted.

8.1.8 A frequency channel or channel pair shall only be spectrum licensed by the Authority in the 225 – 322 MHz band.

8.1.9 A licence for ENG/OB link will be issued to: - the licensee of an AM, FM, non-commercial FM, low power FM or international broadcast station.

8.1.10 The licensing of a frequency channel or channel pair in this band for the accommodation of a radio OB system shall be on a first come, first served basis, via the licence application process as determined by the Authority.

8.1.11 An increase in transmitter power over the specified limits in table 5 may be permitted if technical justification is provided. In no event shall the power delivered to the antenna be permitted to exceed 10 watts (+10 dBW) per RF carrier.

Technical Operating Conditions and Specifications

8.1.12 All licensed broadcasting auxiliary systems shall not exceed the maximum technical operating conditions and specifications identified in the following table, in order to operate in the stated band.

Parameters	Maximum Value	Comments
Maximum Transmitter Output Power delivered to the Antenna	10 dBW	The EIRP designed for and used by a system shall be the minimum amount necessary to achieve the desired link and shall under no circumstance exceed the maximum value required.
Channel Bandwidth	200 kHz	Channels are allocated based on the requirement of equipment used for broadcast auxiliary systems.

Table 5: Technical Specifications for 225 – 322 MHz band

Notwithstanding the parameters identified in the table above, amended or additional technical operating conditions may be instituted and identified in the respective schedule of the licence document for the specific radiocommunications system deployed. All technical operating specifications are based on standards adopted from the FCC, Industry Canada, ETSI, ACMA and ITU.

8.2 450 – 451 MHz and 455 – 456 MHz

Broadcasters in the ITU-R Region 2 countries utilized these bands for STLs, broadcast pickup (OB/ENG) and mobile operations associated with broadcasting undertakings; however, due to the allocation of these bands for the provision of BWA services, no new BAS users will be licensed in the stated frequency ranges.

Recommended Licensing Process

8.2.1 In keeping with the Authority's National Spectrum Plan, no new OB system for AM and/or FM shall be authorized in these bands.

8.2.2 All existing broadcasters operating in these bands shall be allowed to continue operation until such time that the Authority deems it necessary for broadcasters to migrate to the recommended bands.

8.2.3 Existing broadcasters wishing to migrate to the Authority's recommended bands shall be required to relinquish any existing 450 MHz or 455 MHz assigned frequency and replace it with an assignment in the 250 MHz band.

8.2.4 Broadcasters operating auxiliary services other than that indicated by TTFAT footnote TT14, shall be required to migrate to the respective band.

8.3 900 MHz Band: 940 – 960 MHz

Frequency Assignment Plan

8.3.1 This band is designated for AM and FM radio broadcasting auxiliary services, specifically radio studio-to-transmitter link (STL), transmitter-to-studio link (TSL) and transmitter-to-transmitter link (TTL).

8.3.2 Typically, STL channel bandwidths are 300 kHz for equipment using digital modulation and range from 60 kHz to 500 kHz for broadcasters using analogue equipment, inclusive of a guard band of 50 kHz. Although most STLs are still analog, a 2011 audit to date shows a 30% conversion to digital technologies.

8.3.3 Considering the above, the frequency channel arrangements defined in the assignment plan (figure 2) provides for 300 kHz STL links, which can be concatenated to allow a bandwidth of 600 kHz.

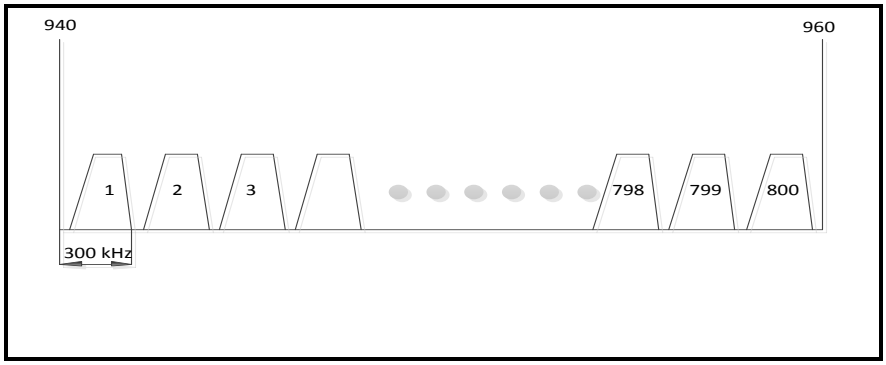


Figure 2: Frequency Assignment Channel Plan for 940 – 960 MHz Band

Recommended Licensing Process and Conditions

8.3.4 A single broadcast auxiliary station may be authorized up to a maximum of two channels (600 kHz total bandwidth) for transmission of program material between a single origin and one or more fixed points.

8.3.5 The use of two links operating on different frequencies and carrying the same program over the same path is not permitted. System back-up (Redundancy / Diversity) can be achieved by using hot standby configurations. Note that "dual mono" STL use is permitted, provided that each transmitter carries different information (for example, one transmits the left channel and the other the right channel of a stereo audio signal).

8.3.6 Each radio STL will be licensed for a specified transmitter location to communicate with a specified receiving location, and such STL shall not operate at any other location without prior written approval from the Authority. The directivity of the main radiation lobe shall be a term of the station authorization.

8.3.7 *Channel Sharing* – the assignment of a frequency or frequencies to a holder of an authorized FM Station does not confer a monopoly on the use of the frequency or frequencies, nor shall a radio authorization be construed as conferring any right of continuing tenure in respect of the frequency or frequencies.

8.3.8 Stations must employ antennas that meet the performance standards in Appendix 1, figure 1, except that, subject to technical justifications, antennas meeting other standards may be employed. Note, however, that the use of high performance

antennas (appendix 1, figure 1) or better will be required where problems due to interference can be resolved by their use.

Technical Operating Conditions and Specifications

8.3.9 All licensed broadcasting auxiliary systems shall not exceed the maximum technical operating conditions and specifications identified in the following table, when operating in the stated band.

Parameters	Maximum Value	Comments
Maximum Transmitter Output Power delivered to the Antenna	10 dBW[3]	The EIRP designed for and used by a system shall be the minimum amount necessary to achieve the desired link and shall under no circumstance exceed the maximum value required. An increase in EIRP limits may be permitted, if technical justification is provided.
Channel Bandwidth	300 kHz	Channels are allocated based on the requirement of equipment used for broadcast auxiliary systems.

Table 6: Technical Specifications for 940 – 960 MHz band

Notwithstanding the parameters identified in the table above, amended or additional technical operating conditions may be instituted and identified in the respective schedule of the licence document for the specific radiocommunications system deployed. All technical operating specifications are based on standards adopted from the FCC, Industry Canada, ETSI, ACMA and ITU.

[3] Adopted from Industry Canada SRSP-300.953

8.4 2 GHz Band: 2025 – 2110 MHz

Frequency Assignment Plan

8.4.1 This band is allocated on a primary basis for TVOB services and is shared with fixed point-to-point systems. Specific systems include fixed point-to-point video links, TTL and mobile links for electronic news gathering (ENG) equipment.

8.4.2 Currently, the frequency range 1990 – 2110 MHz is divided into seven channels; one with bandwidth 18 MHz and six with bandwidth 17 MHz. These channels are used by broadcasters for the operation of TVOBs in analog mode.

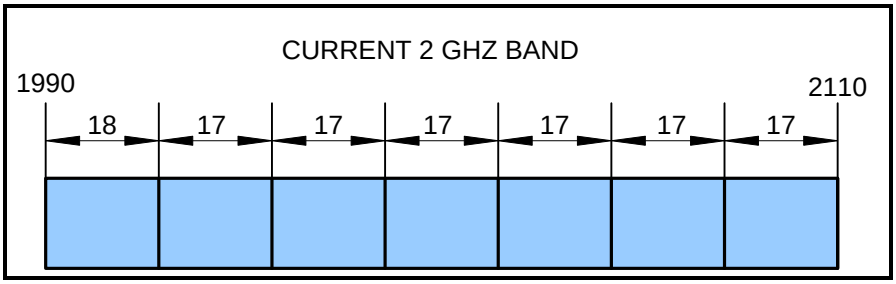


Figure 3: Channel Plan for 2 GHz Band (Source: FCC)

- Total Spectrum: 120 MHz (1990 – 2110 MHz)
- 7 Channels: Six 17 MHz and One 18 MHz; all analog channels
- Used for ENG/OBs

8.4.3 With the introduction of digital technology into the market, and in keeping with TTFAT footnotes TT27 and TT28; this band shall be re-farmed for digital operation with a bandwidth of 8 MHz, thus freeing spectrum for the emerging Mobile Satellite Service (MSS) and Advanced Wireless Services (AWS) if desired.

8.4.4 This band shall be further re-farmed in accordance with future changes and availability of equipment.

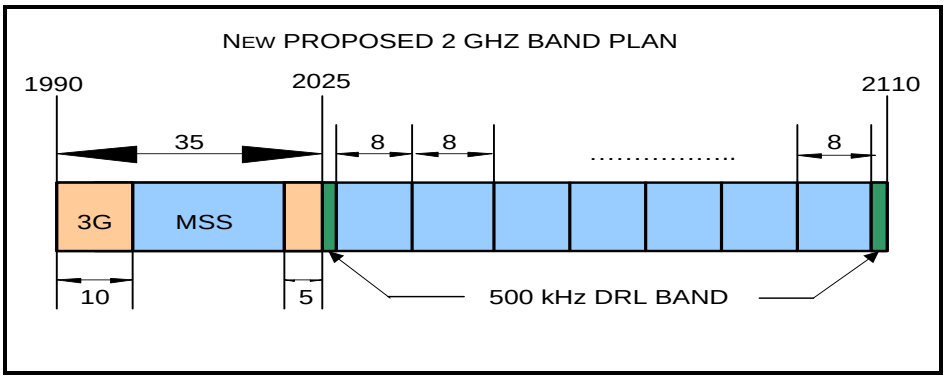


Figure 4: New Proposed 2 GHz Band Plan (Source: FCC)

- Total Spectrum: 85 MHz (2025 – 2110 MHz)
- 10 Channels: Each 8 MHz; all Digital channels
- DRL is used for return bit error rate (BER) information, etc.
- Used for ENG/OBs.

8.4.5 Notwithstanding the above, should the need arise for additional spectrum; the entire band of 120 MHz shall be implemented for digital operation thus increasing the number of channels available for TVOBs.

Recommended Licensing Process and Conditions

8.4.6 All applications for spectrum in this band shall indicate the TV broadcast station with which it is to be operated and shall specify the area in which the proposed operation is intended.

8.4.7 TV pickup services shall be authorized to operate on one channel only according to the following relationship (see Appendix 2 figure 2 for detailed channel plan):

Lower half of the band G(n) = 2021.5 + 8n

Where: n = 1 to 10, and G(n) is the centre frequency of the channel

8.4.8 Licensees of TV broadcast stations may be authorized to operate one or more TVOB and TV relay stations for the purpose of relaying signals over a path that cannot be covered with a single station.

8.4.9 The centre frequency of the emission shall be maintained within ± 0.001% of the assigned frequency.

8.4.10 TV pick-up systems shall use a highly directive antenna system. The co-polarized radiation pattern envelope in the horizontal plane of the antenna must remain within envelope B shown in Appendix 2 Figure 1 for both vertical and horizontal polarizations.

8.4.11 Notwithstanding the above, licensing of new systems shall be prohibited pending the completions of a position paper entitled "Licensing of TVOBs".

Technical Operating Conditions and Specifications

8.4.12 All licensed radiocommunications systems shall not exceed the maximum technical operating conditions and specifications identified in the following table.

Parameter	Maximum Value	Comments
Maximum Transmitter Output Power delivered to the Antenna	13 dBW	In no event will the power delivered to the antenna input be permitted to exceed 20 watts (+13dBW) per channel

Parameter	Maximum Value	Comments
Maximum Equivalent Isotropic Radiated Power (EIRP)	55 dBW	The EIRP[4] designed for and used by a system shall be the minimum amount necessary to achieve the desired link and shall under no circumstance exceed the maximum value of 55 dBW.
Channel Bandwidth	8 MHz	Digital Channels
Modulation scheme	Digital	Any digital modulation technique e.g. QPSK

Table 7: Technical Specifications for 2025 – 2110 MHz

Notwithstanding the parameters identified in the above table, amended or additional technical operating conditions may be instituted and identified in the respective schedule of all existing licences for the specific radiocommunications system deployed. All technical operating specifications are based on standards adopted from the FCC, Industry Canada, ETSI, ACMA and ITU.

[4] Adopted from Industry Canada SRSP-302

8.5 2.2 GHz Band: 2200 – 2300 MHz

8.5.1 This band is proposed for the operation of TV pick-up systems transmitting up to twelve 8MHz one-way RF channels.

Frequency Assignment Plan

8.5.2 With the introduction of digital technology and availability of equipment, this band shall be licensed for digital operation with a bandwidth of 8 MHz.

8.5.3 The preferred radio-frequency channel arrangement for up to twelve one-way channels, each accommodating digital medium capacity systems, shall be expressed by the following relationship:

Upper half of the band: $f_n = 2196.5 + 8n$ MHz

Where, n = frequency channel no. = 1, 2, 3,.....12

f_n = centre frequency of each channel respectively

In cases where a pair is required, the frequency separation between Go and Return channels is 175 MHz.

Recommended Licensing Process

8.5.4 Licensees of TV broadcast stations may be authorized to operate one or more TVOB and TV relay stations for the purpose of relaying signals over a path that cannot be covered with a single station. Notwithstanding this, due to the limited spectrum available, a spectrum cap of two channels per broadcaster shall be imposed.

8.5.5 Frequency assignments will normally be made as requested. The Authority reserves the right to assign frequencies other than those requested if, in its opinion, such action is warranted.

8.5.6 For TV pick-up systems, the use of highly directive antenna systems is encouraged.

Technical Operating Conditions and Specifications

8.5.7 All licensed radiocommunications systems shall not exceed the maximum technical operating conditions and specifications identified in the following table:

Parameter	Maximum Value	Comments
Maximum Transmitter Output Power delivered to the Antenna	10 dBW	In no event will the power delivered to the antenna input be permitted to exceed 20 watts (+10dBW) per channel
Maximum Equivalent Isotropic Radiated Power (EIRP)	55 dBW	The EIRP[5] designed for and used by a system shall be the minimum amount necessary to achieve the desired link and shall under no circumstance exceed the maximum value of 55 dBW.
Channel Bandwidth	8 MHz	Digital Channels
Modulation scheme	Digital	Any digital modulation technique e.g. QPSK

Table 8: Technical Specifications for 2200 – 2300 MHz

Notwithstanding the parameters identified in the above table, amended or additional technical operating conditions may be instituted and identified in the respective schedule of all existing licences for the specific radiocommunications system deployed. All technical operating specifications are based on standards adopted from the FCC, Industry Canada, ETSI, ACMA and ITU.

[5] Adopted from Industry Canada SRSP-302

8.6 2.3 GHz Band: 2360 – 2400 MHz

8.6.1 This band is favoured for the operation of television OB links. In keeping with the Authority's National Spectrum Plan, a moratorium shall be placed on the licensing process. No new OB systems shall be authorized in this band.

Recommended Licensing Process

8.6.2 It is recognized that presently, there exists point-to-point systems in this band, other than those used for broadcast auxiliary services. These incumbent point-to-point links shall be allowed to continue operation until the Authority deems it necessary for all to migrate.

8.6.3 The Authority shall consult with Licensees and other relevant stakeholders in this band, in the development of migration plans, to align the frequencies assigned for point-to-point systems to their respective spectrum plan. A migration process will be undertaken only when deemed necessary by the Authority.

8.6.4 Existing broadcasters wishing to migrate to the Authority's recommended bands shall be required to relinquish all assigned frequencies.

8.7 Upper 6 GHz Band: 6430 – 7110 MHz

8.7.1 This frequency band is used by ITU Region 2 Countries for broadcast auxiliary services, such as, television STLs, TTL, and ENG. Cable Television Studio-headend links and Television Inter-studio Program links are also permitted on a secondary basis.

Frequency Assignment Plan

8.7.2 In keeping with the TTFAT, this band is allocated for television STLs on a primary basis. Use of this spectrum for direct delivery of video programs to the general public is not permitted.

8.7.3 This upper 6 GHz (6425 – 7125 MHz) band shall be made entirely available in support of the Authority's DTT transition plan. On completion of the transition to DTT, broadcasters shall be required to relinquish all assigned frequencies and lease capacity from signal distributors.

8.7.4 The assignment of a frequency or frequencies to a holder of an authorized television station in this band does not confer a monopoly on the use of the frequency or frequencies. The frequency may be assigned to more than one system in the same area where feasible.

8.7.5 The ITU-R Recommendation ***F.384-10*** (***09/07***) defines the necessary radio-frequency channel arrangements for fixed wireless systems operating in the upper 6 GHz (6425 – 7125 MHz) band, which may be used for High, Medium, and Low-

capacity fixed systems. A 20 MHz channel separations is recommended with the interleaved arrangements and possible use of the co-channel arrangements.

8.7.6 The preferred radio-frequency channel arrangement for up to 16 Go and 16 Return channels, each accommodating plesiochronous digital or synchronous medium capacity rates, should be obtained by interleaving additional channels between those of the main pattern and shall be expressed by the following relationship:

Lower half of the band: $f_n = f_0 - 350 + 20\,n$ MHz

Upper half of the band: $f_{n2} = f_0 - 10 + 20\,n$ MHz

Where,

n = frequency channel no. = 1, 2, 3,.....16

f_0 = frequency band centre frequency = 6770 MHz

f_n and f_{n2} = centre frequency of lower and upper frequency channel respectively

The upper and lower frequency channels (i.e. frequency channel pairs) are illustrated in the following table.

ITU-R Rec. F.384-10 **6430 – 7110 MHz**				
fo (MHz):				6770
Reference Channel Bandwidth (MHz):				20
Duplex Spacing(MHz):				340
fn = fo - 350 + (20) n & fn2= fo - 10 + 20 n				
Channel	***Lf*(MHz)**	**Channel**	***Hf*(MHz)**	***Polarization***
1	6440.000	1’	6780.000	Horizontal
2	6460.000	2’	6800.000	Vertical
3	6480.000	3’	6820.000	Horizontal
4	6500.000	4’	6840.000	Vertical
5	6520.000	5’	6860.000	Horizontal
6	6540.000	6’	6880.000	Vertical
7	6560.000	7’	6900.000	Horizontal
8	6580.000	8’	6920.000	Vertical
9	6600.000	9’	6940.000	Horizontal
10	6620.000	10’	6960.000	Vertical
11	6640.000	11’	6980.000	Horizontal
12	6660.000	12’	7000.000	Vertical

13	6680.000	13’	7020.000	Horizontal
14	6700.000	14’	7040.000	Vertical
15	6720.000	15’	7060.000	Horizontal
16	6740.000	16’	7080.000	Vertical

Table 9: Frequency Assignment Plan for BAS in the upper 6 GHz Band

Recommended Licensing Process and Conditions

8.7.7 The Authority shall licence a single frequency channel or a frequency channel pair in accordance with the Frequency Assignment Plan in the Table 7 above.

8.7.8 The licensing of a frequency channel or channel pair in the upper 6 GHz band for the accommodation of broadcast auxiliary service shall be on a first come, first served basis, via the Authority’s licensing process.

8.7.9 Use of improved digital modulation techniques that increase channel loading capacity is encouraged and will be given priority in frequency assignment.

8.7.10 Technical characteristics of equipment used in this band shall conform to all applicable Trinidad and Tobago standards, international standards, and the International Telecommunications Union (ITU) and its radio regulations as agreed upon and adopted by Trinidad and Tobago.

8.7.11 Different channel bandwidth is essentially applicable for those systems deployed or purchased prior to this revision. The usage of different channel bandwidth is limited until the end of the system lifespan of the apparatus. The usages include redeployment to different locations and/or upgrading of said apparatus for additional capacity with minimal changes of the system. The licensed necessary

bandwidth (video, audio and subscriber channels) shall not exceed the channel spacing of 20 MHz.

8.7.12 Each TV Broadcast Auxiliary Station will be licensed for a specified transmitter location to communicate with a specified receiving location, and the directivity of the main radiation lobe of the antenna shall be a term of the station authorization.

8.7.13 For FM systems, the maximum peak-to-peak deviation of the RF carrier by composite video baseband signal shall not exceed 8 MHz. Sub-carriers with sound program channels may be multiplexed with the video signal. The carriage of AM/FM STL's as a sub-carrier of TV STL's will be encouraged in order to conserve spectrum.

Technical Operating Conditions and Specifications

8.7.14 All licensed broadcast auxiliary systems shall not exceed the maximum technical operating conditions and specifications identified in the following table, in order to operate in the upper 6 GHz band.

Parameter	Maximum Value	Comments
Maximum Transmitter Power delivered to the antenna.	10 dBW	In no event will the power delivered to the antenna be permitted to exceed 10 watts (10 dBW) per RF channel.
Maximum Equivalent Isotropic Radiated Power (EIRP)[6]	55 dBW	The EIRP designed for and used by a TVSTL system shall be the minimum amount necessary to achieve the desired link and shall under no circumstances exceed the maximum value of 55 dBW.

[6] Adopted from Industry Canada SRSP-306.5

Parameter	Maximum Value	Comments
Channel Bandwidth	20 MHz	
Modulation scheme	Digital	Any digital modulation technique e.g. QPSK

Table 10: Technical Specifications

Notwithstanding the parameters identified in the above table, additional technical operating conditions may be instituted and identified in the respective schedule of the licence document. All technical operating specifications are based on standards adopted from the FCC, Industry Canada, ETSI, ACMA and ITU.

9. Glossary

- **Adjacent Channel:**

  Two systems are deemed to be adjacent if their emissions do not overlap.

- **Co-Channel**:

  Overlapping emissions are considered as co-channel.

- **Data Return Link (DRL):**

  Data Return link is used for return bit error rate (BER) information. The DRL channels permit a "feedback" or "return" link to be established from an ENG receive only (ENG-RO) site to an originating TV pickup station (commonly referred to as ENG truck).

- **Federal Communications Commission (FCC):**

  Federal Communications Commission (FCC) regulates interstate and international communications by radio, television, wire, satellite and cable in all 50 states, the District of Columbia and U.S. territories.

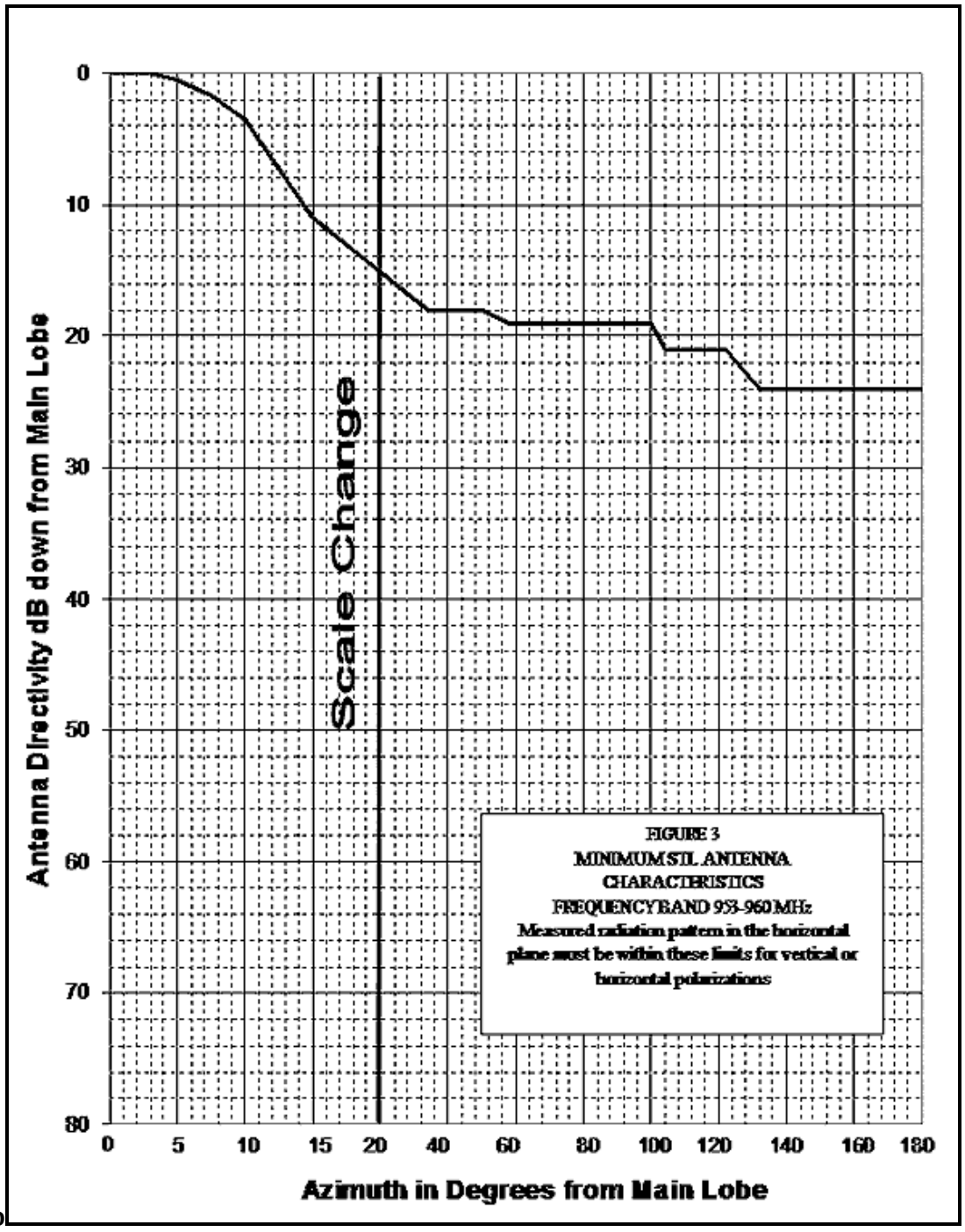
- **Transmitter-to-Transmitter Link (TTL):**

  Radio TTL is authorized to transmit radio program material between broadcasting transmitters, for example between an FM broadcast radio station transmitters in two separate cities.

10. References

- Industry Canada, "*SRSP-300.953 — Technical Requirements for Radio Systems in the Fixed Service Operating in the Band 953-960 MHz*", 2009.
- Australia Communications and Media Authority, "*Television Outside Broadcast Service (1980–2110 MHz and 2170–2300 MHz) Frequency Band Plan 2012*", Federal Register of Legislative Instruments F2012L00731, 2012
- Industry Canada, "*SRSP-302.0 – Technical Requirements for Fixed Line-of-Sight Radio Systems Operating in the Bands 2025-2110 MHz and 2200-2285 MHz*", 2000
- ITU-R, "*Rec. ITU-R F.384-10: Radio-frequency channel arrangements for medium- and high capacity digital fixed wireless systems operating in the upper 6 GHz (6 425-7 125 MHz) band*", 2007
- Industry Canada, "*SRSP-306.4 – Technical Requirements for Fixed Line-of-Sight Radio Systems Operating in the Band 6425-6930 MHz*", 2006
- Industry Canada, "*SRSP-306.5 — Technical Requirements for Line-of-sight Radio Systems Operating in the Fixed Service and Providing Television Auxiliary Services in the Bands 6590-6770 and 6930-7125 MHz*", 1990
- European Radiocommunications Committee (ERC); *Handbook on Radio Equipment and Systems Video Links for ENG/OB Use*; Stockholm, 1995

APPENDIX 1: TECHNICAL SPECIFICATIONS FOR 940 – 960 MHZ



BAND

Figure 1: STL Antenna Characteristics (Industry Canada SRSP-300.953)

APPENDIX 2: TECHNICAL SPECIFICATIONS FOR 2025 – 2110 MHZ BAND

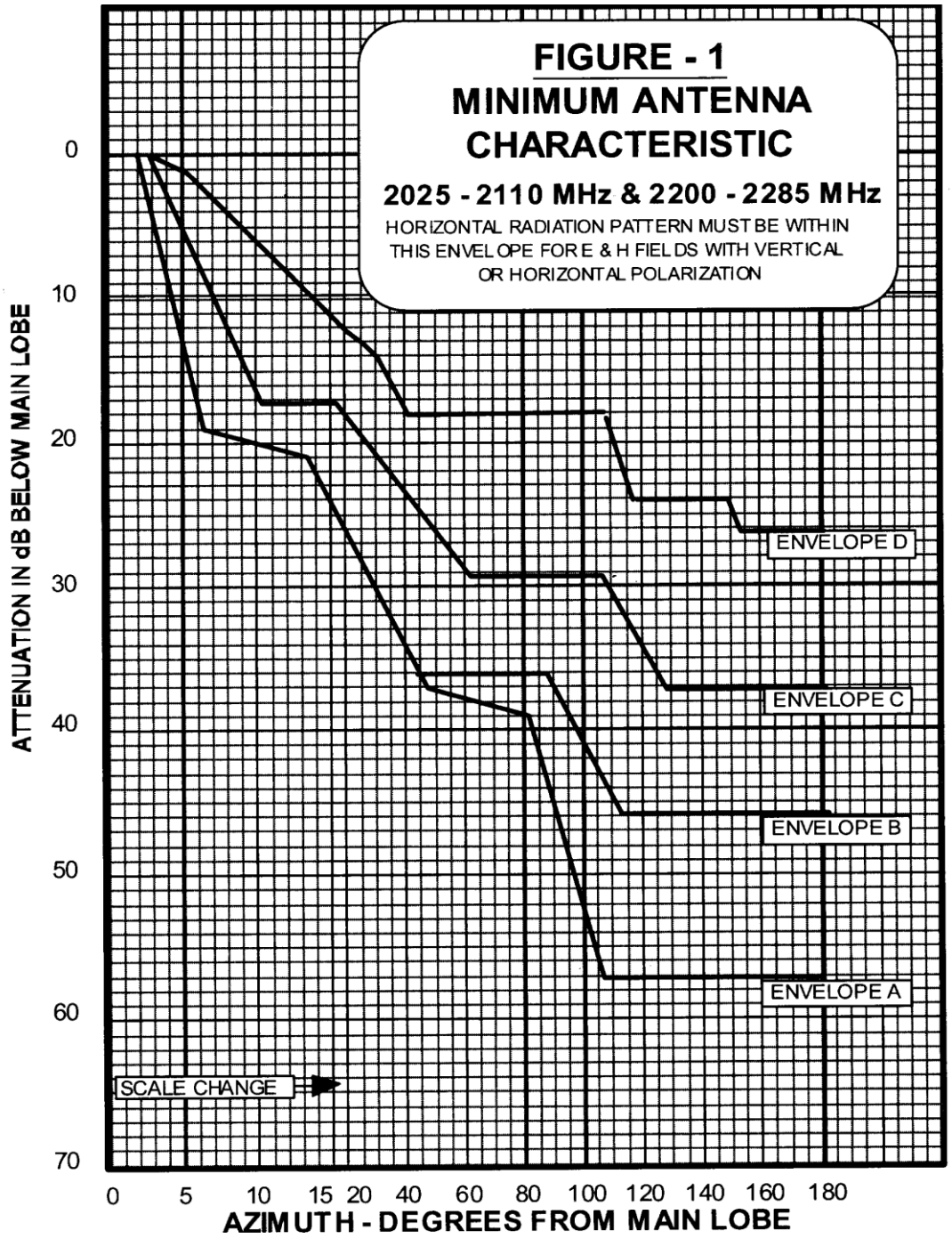


Figure 1: Antenna Characteristics (Industry Canada SRSP-302.0)

TV PICK-UP CHANNELS (MHZ)
G1: 2029.50
G2: 2037.50
G3: 2045.50
G4: 2053.50
G5: 2061.50
G6: 2069.50
G7: 2077.50
G8: 2085.50
G9: 2093.50
G10: 2101.50

Figure 2: TV Pick-Up Frequency Plan (Industry Canada SRSP-302.0)