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Spectrum Management and Telecommunications

Database Specifications

Automated Frequency Coordination (AFC) System Specifications for the 6 GHz (5925-6875 MHz) Frequency Band

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Preface

Database Specification DBS-06, issue 1, *Automated Frequency Coordination (AFC) System Specifications for the 6 GHz (5925-6875 MHz) Frequency Band*, sets out the technical requirements for the designation of an automated frequency coordination system administrator and for the operation of an AFC system capable of identifying available frequencies and associated maximum power levels for use by standard-power radio local area network devices operating in the 6 GHz frequency band, specifically in the 5925-6875 MHz frequency band.

Issued under the authority of
the Minister of Innovation, Science and Industry

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Martin Proulx
Director General
Engineering, Planning and Standards Branch

Contents

List of acronyms

AFC	Automated frequency coordination
AFCSA	Automated frequency coordination system administrator
AGL	Above ground level
AMSL	Above mean sea level
AP	Access point
DEM	Digital elevation model
DSA	Dynamic spectrum access
DSM	Digital surface model
e.i.r.p.	Equivalent isotropically radiated power
IC ID	Innovation, Science and Economic Development Canada Identification Number
ISED	Innovation, Science and Economic Development Canada
ITM	Irregular Terrain Model
ITU	International Telecommunication Union
LOS	Line-of-sight
NF	Noise figure
NLOS	Non-line-of-sight
OOCE	Out-of-channel-emission
RLAN	Radio local area network
SMS	Spectrum Management System
WINNER II	Wireless World Initiative New Radio phase II

1. Scope

Database Specification DBS-06, issue 1, *Automated Frequency Coordination (AFC) System Specifications for the 6 GHz (5925-6875 MHz) Frequency Band*, sets out the technical requirements for the designation of an automated frequency coordination system administrator (AFCSA) and for the operation of an AFC system capable of identifying available frequencies and associated maximum power levels for use by standard-power radio local area network (RLAN) devices operating in the 5925-6875 MHz frequency band.

2. Coming into force

This document will come into force upon its publication on Innovation, Science and Economic Development Canada's (ISED) Spectrum Management and Telecommunications website. AFCSA designation applications may be submitted at any time once the document has come into force.

3. AFCSA designation

AFCSA applicants seeking an ISED designation shall be required to comply with the requirements of this standard. Upon reception of an AFCSA designation application, ISED will review and assess compliance with this standard in accordance with the procedures set out in Client Procedures Circular CPC-4-1-02, *Application Procedures for Automated Frequency Coordination System Administrators (AFCSAs)*.

In order to maintain its designation, an AFCSA shall comply at all times with the terms and conditions of its designation agreement with ISED. In the event of any non-compliance, ISED may take action as laid out under the terms of this agreement, up to and including revoking the AFCSA's designation status.

Inactive and revoked AFC systems are prohibited from providing any available frequencies and associated maximum power levels in response to queries from standard-power RLAN devices.

The application and approval status of AFCSAs are shown on ISED's online list of designated AFCSAs, available on ISED's Dynamic spectrum access (DSA) website.

4. Purpose and application

DBS-06 was developed following the publication of Spectrum Management Spectrum Engineering SMSE-006-21, *Decision on the Technical and Policy Framework for Licence-Exempt Use in the 6 GHz Band*.

An AFC system is a database-driven system that automatically determines a list of available frequencies and associated maximum power levels for use by standard-power RLAN devices. Standard-power RLAN devices are licence-exempt wireless devices that operate on a no-protection, no-interference basis in the 5925-6875 MHz frequency band.

An AFC system uses information from the protected licensed systems in the 5925-6875 frequency band, along with information from a standard-power RLAN device, to dynamically manage the device's access to the spectrum. The protected licensed systems operating in the 5925-6875 MHz frequency band include licensed fixed service stations and radio astronomy observatories.

5. AFC system calculation methodologies

This technical standard provides a specific methodology through which an AFC system calculates the list of available frequencies and associated maximum power levels available to standard-power RLAN devices. In particular, sections 11 to 13 of this document describe the calculations that ensure the protection of licensed fixed service stations and radio astronomy observatories.

5.1 Alternative AFC system calculation methodology

In order to provide maximum flexibility for AFC system implementation that is consistent with the protection of licensed systems, ISED may, on a case-by-case basis and at its discretion, allow an AFC system to implement an alternative calculation methodology different from the one described in this technical standard. This alternative method can be used as long as the AFCSA demonstrates to ISED that this methodology ensures the level of protection to licensed systems specified by the protection criterion in sections 11 and 12 of this standard. Regardless of the methodology implemented, an AFC system shall apply the same calculation methodology to all standard-power RLAN devices for which it is providing a list of available frequencies.

If a designated AFCSA would like to make any subsequent changes to its calculation methodology for its AFC system, it shall first obtain written approval from ISED and may be required to submit a new designation application that uses an updated calculation methodology.

6. Definitions

The following terms are used in this document.

Adjacent channel exclusion zone
An exclusion zone where a standard-power RLAN device is not permitted to operate if its out-of-channel-emissions (OOCE) on its adjacent channel frequencies do not meet an established protection criterion. Adjacent channel frequencies are those frequencies ranging from the standard-power RLAN device's channel edges up to one and a half times the channel bandwidth away from its channel centre frequency where those frequencies overlap with any portion of the occupied bandwidth of the protected licensed system.

Automated frequency coordination (AFC) system
An ISED-designated database-driven system that maintains records of protected licensed systems operating in the 5925-6875 MHz frequency band. The AFC system determines a list of available frequencies and associated maximum power levels for use by a standard-power RLAN device at a specific time and geographic location.

Automated frequency coordination system administrator (AFCSA)
A service provider designated by ISED to administer an AFC system within Canada.

Available frequencies
A range of frequencies and/or channels that are deemed by the AFC system as available for use by standard-power RLAN devices at a specific time and geographic location.

Channel
A portion of spectrum defined by an upper and lower frequency limit, i.e. channel edges, or by a channel centre frequency and a channel bandwidth. A channel can also be defined by a number that identifies the channel in a standardized channel plan. For the purpose of AFC system calculations, a standard-power RLAN device's channel edges, channel centre frequencies and channel bandwidths refer to the edges, centre frequencies and bandwidths of the frequencies and/or channels used for intentional emissions.

Co-channel exclusion zone
An exclusion zone where a standard-power RLAN device is not permitted to operate if its emissions on its co-channel frequencies do not meet an established protection criterion. Co-channel frequencies are those frequencies ranging over the standard-power RLAN's channel bandwidth that overlap with any portion of the occupied bandwidth of the protected licensed system.

Dynamic spectrum access (DSA)
A technique by which a radio system dynamically adapts to the local radio spectrum environment in order to determine, and then access, available spectrum at specific locations and at a specific time.

Exclusion zone
An AFC system generated geographic area surrounding a protected licensed system operating in the 5925-6875 MHz frequency band where a standard-power RLAN device is not permitted to operate at particular frequencies and power levels.

Fixed client device
A client device intended as a customer premise equipment, with geolocation capability, that is permanently attached to a structure, that operates in the 5925-6875 MHz frequency band as directed by an AFC system, and that is only capable of connecting to a standard-power access point (AP). The certification requirements for fixed client devices are set out in RSS-248 (see section 7).

Geolocation capability
The ability of a standard-power RLAN device to determine its geographic coordinates and location uncertainty, in metres, with a confidence level of 95%.

Height above ground level (AGL)
The height of the centre of radiation of the antenna above the ground directly below the antenna.

Innovation, Science and Economic Development Canada Identification Number (IC ID)
The ISED certification number of a standard-power RLAN device.

Network element device
A network entity communicating with an AFC system as a proxy for one standard-power RLAN device or multiple standard-power RLAN devices operating on the same network.

Non-disclosed station
A secure fixed service station for which information is not currently disclosed in the publicly available ISED Spectrum Management System (SMS) data.

Protected licensed systems
Include licensed fixed service stations (i.e. fixed microwave stations and studio-to-transmitter links) and licensed radio astronomy observatories that are protected, by the AFC system, from interference by the operation of standard-power RLAN devices in the 5925-6875 MHz frequency band.

Separation distance
The distance between a standard-power RLAN device and a protected licensed system.

Standard-power access point (AP)
An AP with geolocation capability that operates in the 5925-6875 MHz frequency band as directed by an AFC system. The certification requirements for standard-power APs are set out in RSS-248 (see section 7).

Standard-power RLAN devices
A term that collectively encompasses standard-power APs and fixed client devices, which can operate indoors and outdoors.

7. Related documents

All ISED publications related to spectrum management and telecommunications are available on the Spectrum Management and Telecommunications website. Refer to the following documents as needed:

CPC-4-1-02	*Application Procedures for Automated Frequency Coordination System Administrators (AFCSAs)*
RSS-248	*Radio Local Area Network (RLAN) Devices Operating in the 5925-7125 MHz Band*
SMSE-006-21	*Decision on the Technical and Policy Framework for Licence-Exempt Use in the 6 GHz Band*
SRSP-305.9	*Technical Requirements for Fixed Line-of-Sight Radio Systems Operating in the Band 5925-6425 MHz*
SRSP-306.4	*Technical Requirements for Fixed Line-of-Sight Radio Systems Operating in the Band 6425-6930 MHz*
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*

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CPC: Client Procedures Circular
RSS: Radio Standards Specification
SMSE: Spectrum Management Spectrum Engineering
SRSP: Standard Radio System Plan

8. Data extract for protected licensed systems in the 6 GHz Band

During development, the AFC system operated by an AFCSA applying for designation shall access the publicly available data extract from ISED's Spectrum Management System (SMS) database in the "6 GHz Band Data Extract for AFC systems" section of the Spectrum Management System Data web page.

However, upon designation, the AFC system operated by a designated AFCSA shall access the secure version of the "6 GHz Band Data Extract for AFC systems," which may also include data for non-disclosed stations, but otherwise has the same data and format. The AFC system shall then incorporate in its calculations the information for the entire set of licensed fixed service stations operating in the 5925-6875 MHz frequency band, including any non-disclosed stations.

8.1 Data extract for 6 GHz band information update

An AFC system shall retrieve, at least once every 24 hours, the most up to date "6 GHz Band Data Extract for AFC systems" from the ISED SMS database.

8.2 Information required for the protection of licensed systems in the 6 GHz frequency band

An AFC system shall use the information from the "6 GHz Band Data Extract for AFC systems" to ensure that licensed services operating in the band are protected from standard-power RLAN devices operating in the 5925-6875 MHz frequency band.

The "6 GHz Band Data Extract for AFC systems" contains the following information:

- station data for licensed fixed service stations
    - microwave receiver stations
    - passive reflector stations
    - passive repeater stations
    - antenna patterns
- station data for radio astronomy observatories
- list of certified standard-power RLAN devices

The specifics of the information fields in the "6 GHz Band Data Extract for AFC systems" are provided in the associated Spectrum Management System (SMS) Authorization Data Extract – Field Descriptions glossary.

8.2.1 Geographical reference datum

If the geographic reference datum for coordinates of stations differs from the datum used by the AFC system's internal calculations and/or the datum used to obtain the

geographic coordinates of standard-power RLAN devices, the AFC system shall ensure that the appropriate conversion calculations are incorporated.

8.2.2 Antenna pattern interpolation

The AFC system shall interpolate dB units between the provided antenna pattern data points in the “6 GHz Band Data Extract for AFC systems” using linear interpolation.

8.3 AFC system failure to access ISED’s SMS database

Should the “6 GHz Band Data Extract for AFC systems” not be accessible, additional attempts to retrieve licensing information from the ISED SMS database shall be made at least once every 4 hours. If more than 12 hours has elapsed without the AFC system being able to retrieve this information, the AFCSA shall contact ISED (see section 17) regarding the unsuccessful access to the ISED SMS database.

Thereafter, an AFC system may continue to operate for seven days from the last successful access, unless otherwise indicated by ISED. After those seven days, the AFC system shall operate only in accordance with instructions provided by ISED.

Following unsuccessful attempts to access the ISED SMS database, and thereafter obtaining a successful connection, the AFCSA shall notify ISED of the successful access.

9. Registration of standard-power RLAN devices and points of contact

An AFC system shall have a registration and authentication process for standard-power RLAN devices and a registration process for points of contact responsible for resolving interference issues related to the operation of registered standard-power RLAN devices, according to the criteria set out in this section and its subsections.

9.1 Registration and authentication of standard-power RLAN devices

An AFC system shall securely register and authenticate a standard-power RLAN device individually or through a network element device prior to the device initiating service or immediately after the device changes its location. An AFC system shall only provide available frequencies and associated maximum power levels to standard-power RLAN devices that have been registered and authenticated with the AFC system.

9.1.1 Device registration

An AFC system shall obtain and register the following device information directly from standard-power RLAN devices or through network element devices:

- geographic coordinates (latitude and longitude) that lie in Canada
- location uncertainty in metres with a confidence level of 95% or greater
- antenna height above ground level (AGL) or above mean sea level (AMSL) in metres
- Innovation, Science and Economic Development Canada identification number (IC ID)
- manufacturer's serial number

An AFC system shall ensure that the registered standard-power RLAN device information is accurate, complete and kept up-to-date (e.g. the AFC system shall ensure that the registration is updated when any of the registered information changes).

The provision of accurate information for registration by a standard-power RLAN device to an AFC system is mandatory. An AFC system shall discontinue service to a standard-power RLAN device if it determines that the device has failed to provide accurate information for registration. The AFC system shall only resume service to the standard-power RLAN device once the device provides updated accurate information.

9.1.2 Device authentication

An AFC system shall authenticate the registration of a standard-power RLAN device by:

a. Ensuring that the obtained IC ID reflects a valid certification as a standard-power RLAN device under Radio Standards Specification RSS-248, *Radio Local Area Network (RLAN) Devices Operating in the 5925-7125 MHz Band*. A list of certified devices with IC IDs is provided in the "6 GHz Band Data Extract for AFC systems."
b. Ensuring that the device is associated with a registered point of contact (see section 9.2).

9.2 Registration of points of contact

An AFC system shall securely register the following information for points of contact responsible for resolving interference issues related to the operation of specific standard-power RLAN devices registered with the AFC system:

- the name of the contact individual, department or business
- the mailing address for the contact
- a phone number for the contact
- a verified email address for the contact

An AFC system shall have a method of associating a registered point of contact with the specific registered standard-power RLAN devices they are responsible for (e.g. using a combination of the IC ID and the manufacturer's serial number). The AFC system shall only provide available frequencies and associated maximum power levels to standard-power RLAN devices that have been associated with a registered point of contact.

9.3 Storing and disclosing registered information

An AFCSA shall store registered standard-power RLAN device information and the associated point of contact information in a secure database for a duration of at least 90 calendar days after the device's last contact with the AFC system.

An AFCSA shall disclose the standard-power RLAN device information and the associated point of contact information registered with its AFC system to ISED upon request.

For the purpose of investigating interference cases and as directed by ISED, the AFCSA shall be able to disclose to a licensee the registered standard-power RLAN device information, excluding any personal information, pertaining to the protection of licensed systems of that licensee.

10. AFC system determination of available frequencies and associated maximum power levels

When a registered and authenticated standard-power RLAN device contacts an AFC system to obtain a list of available frequencies, the AFC system shall provide to the standard-power RLAN device a list of available frequencies and associated maximum power levels according to the criteria set out in this section and its subsections.

10.1 Determination of available frequencies and associated maximum power levels

An AFC system shall be capable of determining available frequencies and associated maximum power levels for a given standard-power RLAN device based on:

- the protected licensed systems' information retrieved from ISED's "6 GHz Band Data Extract for AFC systems" (see section 8)
- the device information obtained during registration (see section 9)
- using the required interference protection criterion and propagation models (see sections 11 to 13)

The AFC system shall determine the maximum power levels associated with available frequencies in steps of no greater than 3 dB below the maximum permissible equivalent

isotropically radiated power (e.i.r.p.) of 36 dBm, and down to at least a minimum e.i.r.p. of 21 dBm.

An AFC system shall not discriminate in the calculation of available frequencies and associated maximum power levels between indoor or outdoor standard-power RLAN devices, i.e. the consideration of building entry propagation losses is not permitted.

10.2 Device information for the determination of available frequencies and associated maximum power levels

An AFC system shall use the geographic coordinates, the location uncertainty and the antenna height AGL of the registered standard-power RLAN device in its calculation of available frequencies and associated maximum power levels.

10.2.1 Treatment of the antenna height

If a standard-power RLAN device reported its antenna height as a height AMSL during the registration process, the AFC system shall convert the height AMSL to a height AGL. To perform the conversion, the AFC system shall determine the ground elevation at the standard-power RLAN device's geographic coordinates and subtract its value from the reported height AMSL to produce the equivalent antenna height AGL.

If the antenna height AGL reported by the standard-power RLAN device during registration or resulting from the conversion of a reported height AMSL to a height AGL is less than 1.5 meters, the AFC system shall set the antenna height AGL to a value of 1.5 meters.

10.2.2 Treatment of the location uncertainty

An AFC system shall take into consideration the entire location uncertainty volume around a standard-power RLAN device to determine available frequencies and the associated maximum power levels. The AFC system shall provide the standard-power RLAN device with the most restrictive available frequencies and associated maximum power levels determined over a series of evaluation points completely encompassing the entirety of the location uncertainty volume.

The evaluation points completely encompassing the location uncertainty volume shall be determined based on a grid superimposed on the standard-power RLAN device's reported and registered location uncertainty volume and sampled at intervals no greater than 1 arc-second on the horizontal plane and no greater than 5 m on the vertical elevation.

11. Exclusion zones for the protection of licensed fixed service stations

An AFC system shall protect all licensed fixed service stations operating in the 5925-6875 MHz frequency band from harmful interference by standard-power RLAN devices operating in the same frequency range according to the criteria set out in this section and its subsections.

To ensure the protection of licensed fixed service stations, the AFC system shall establish co-channel and adjacent channel exclusion zones around the locations of the licensed fixed service receiver stations, using the information obtained from the "6 GHz band Data Extract for AFC systems," and shall take into consideration passive reflector and repeater stations linked to licensed fixed service receiver stations.

11.1 Protection criterion for licensed fixed service receiver stations

In determining the size of the exclusion zone, an AFC system shall implement an I/N protection criterion of -6 dB, where:

- I (interference) is the received signal from the standard-power RLAN device at the licensed fixed service receiver station and
- N (noise) is the background noise level at the input of the licensed fixed service receiver station (noise level determination is outlined in section B1 of annex B)

In determining the size of the co-channel exclusion zone, I is the co-channel signal from the standard-power RLAN device at the receiver input of the licensed fixed service receiver station.

In determining the size of the adjacent channel exclusion zone, I is the OOCE of the standard-power RLAN device at the receiver input of the licensed fixed service receiver station. The value of I shall be calculated based on the unwanted emission limits for standard-power RLAN devices specified in RSS-248.

11.2 Propagation models to generate exclusion zones for licensed fixed service receiver stations

To determine the size of co-channel and adjacent channel exclusion zones, an AFC system shall implement the stipulated propagation model based on the separation distance between the standard-power RLAN device and the licensed fixed service receiver station, according to the criteria set out in this section and its subsections.

11.2.1 Propagation model for separation distances up to 30 metres

For separation distances up to and including 30 metres, the AFC system shall use the free space path loss model.

11.2.2 Propagation model for separation distances above 30 metres and up to 1 kilometre

For separation distances above 30 metres and up to and including 1 kilometre, the AFC system shall use the Wireless World Initiative New Radio phase II (WINNER II) model to determine the path loss.

The AFC system shall use the WINNER II C2, C1 and D1 propagation scenarios to represent urban, suburban and rural paths, respectively. The AFC system shall use site-specific information, as outlined in section B.3.1 of Annex B, to determine the appropriate propagation scenario to apply over the path between a standard-power RLAN device and a licensed fixed service receiver station.

The AFC system shall use site-specific information as outlined in section B.3.2 of annex B, where such data is available, to determine the line-of-sight (LOS) or non-line-of-sight (NLOS) condition over the path between a standard-power RLAN device and a licensed fixed service receiver station and calculate the appropriate path loss component. For propagation loss calculations between a 30 metre and 50 metre separation distance, only the LOS path loss component shall be used.

For evaluating path loss where site-specific information is not available, the AFC system shall use the D1 propagation scenario and a weighted average path loss, combining the LOS and NLOS path loss components into a single path loss, as follows:

$$Total\ Path\ Loss\ (dB) = P_{LOS} * L_{LOS} + P_{NLOS} * L_{NLOS}$$

where L_{LOS} and L_{NLOS} are the LOS and NLOS path loss components, respectively, expressed in dB, P_{LOS} is the probability of a LOS condition, and P_{NLOS} is the probability of a NLOS condition and is equal to $(1 - P_{LOS})$. The AFC system shall use the formula included in the WINNER II model for determining P_{LOS} as a function of distance for the D1 scenario.

11.2.3 Propagation model for separation distances above 1 kilometre

For separation distances above 1 kilometre, the AFC system shall use the Irregular Terrain Model (ITM) with the point-to-point configuration combined with the appropriate clutter model to determine the path loss.

The AFC system shall use the appropriate ITM parameters along with digital elevation terrain data, as outlined in section B.4 of annex B, to match the propagation conditions along the path between a standard-power RLAN device and a licensed fixed service receiver station.

The AFC system shall use site-specific information to combine the ITM path loss with the clutter loss of the appropriate clutter model, as outlined in section B.5 of annex B and its subsections. The AFC system shall use the clutter model defined in Recommendation ITU-R P.2108 for urban and suburban environments and in Recommendation ITU-R P.452 for rural environments.

For evaluating clutter loss where site-specific information is not available, the AFC system shall use the ITU-R P.452 clutter model with the “Village Centre” clutter category.

11.3 Protection of licensed fixed service receiver stations linked with a passive reflector or repeater station

AFC systems shall protect licensed fixed service receiver stations linked with a passive reflector or repeater station by taking into consideration the linked passive reflector or repeater station and its parameters. The methods and calculation procedures by which these are taken into consideration shall provide a similar level of protection to that provided when adopting standard engineering practices.

A detailed description of the methods and calculation procedures used by an AFC system to account for passive reflectors and repeaters stations shall be submitted to ISED during the AFCSA’s designation application. The methods and calculation procedures used will be subject to ISED’s approval and will be considered on a case-by-case basis.

12. Exclusion zones for the protection of radio astronomy observatories

Radio astronomy observatories operate in the 6650-6675.2 MHz frequency range. An AFC system shall enforce exclusion zones around radio astronomy observatories identified in the 6 “GHz data extract for AFC systems” to ensure they are protected from standard-power RLAN devices. Within the exclusion zones, the AFC system shall not permit the operation of standard-power RLAN devices at any power levels on frequencies which overlap with the radio astronomy observatories’ occupied bandwidths.

The exclusion zone size shall be determined using the following formula:

$$d = 4.12 * \left(\sqrt{H_{Tx}} + \sqrt{H_{Rx}}\right)$$

where d is the radius of the exclusion zone centred at the radio astronomy observatory in kilometres, H_{Tx} is the height AGL of the standard-power RLAN device in metres, and H_{Rx} is the height AGL of the radio astronomy antenna in metres.

13. International border protection

An AFC system shall comply with the international protection requirements outlined in this section and its subsections.

13.1 Protection of United States (US) licensed fixed services

An AFC system shall protect operating US fixed service receiver stations and radio astronomy observatories according to the same criteria specified for Canadian protected licensed stations in sections 11 and 12 above.

An AFC shall access the information required for the protection of US fixed service receiver stations and radio astronomy observatories, available on the website of the Federal Communications Commission.

13.2 Protection of Canadian licensed fixed services from a US AFC system

A US AFC system can access the publicly available “6 GHz Band Data Extract for AFC systems” to protect Canadian disclosed fixed service receiver stations and radio astronomy observatories located near the border.

14. Interference response

Interference cases resulting from incorrect licence information will be the sole responsibility of the licensee, which is responsible for providing accurate and current data under the terms of their license.

Other interference cases stemming from the operation of standard-power RLAN devices remain ISED’s responsibility and AFCSAs shall provide requested information to ISED following a formal request. In order to facilitate the request and for the purposes of resolving cases of potentially harmful interference, an AFCSA shall implement capabilities according to the criteria set out in this section and its subsections.

Anyone with interference concerns or issues is encouraged to contact the respective district office.

14.1 Detailed log files

An AFCSA shall retain detailed logs of all standard-power RLAN device registrations and authentications with its AFC system.

An AFCSA shall retain detailed logs of all standard-power RLAN device communications, i.e. queries and responses, with its AFC system. These logs shall include a reference to the registered information of the associated standard-power RLAN device.

An AFCSA shall retain all detailed logs for a duration of at least 90 calendar days after a device's last contact with its AFC system and shall make all such information available to ISED upon request.

14.2 Spectrum availability check

Following a request from ISED, an AFCSA shall be able to provide ISED with a method of querying its AFC system for available frequencies and associated maximum power levels at a given location and for a given set of standard-power RLAN device parameters. The AFC system shall be able to return a response to such a query as if it were being queried by a standard-power RLAN device.

15. Enforcement instructions from ISED

Even if an AFC system meets the requirements of this document, ISED may impose corrective measures and provide enforcement instructions to AFCSAs whenever harmful interference to protected licensed systems is caused by the operation of standard-power RLAN devices. An AFCSA shall abide by any corrective measures and comply with enforcement instructions from ISED.

15.1 List of denied devices

Following a request from ISED, an AFC system shall deny the provision of available frequencies and associated maximum power levels to particular standard-power RLAN devices that are no longer authorized by ISED to operate under the control of the AFC system. These denied devices may be identified by ISED using the device IC ID or using a combination of the device IC ID and the manufacturer's serial number. If an AFCSA uses additional parameters to identify devices registered with its AFC system, ISED may also use these additional parameters to identify denied devices. Devices shall only be added to or removed from the list of denied devices after receiving formal direction from ISED.

15.2 List of denied geographic areas

Following a request from ISED, an AFC system shall deny the provision of specific frequency ranges and associated maximum power levels to all standard-power RLAN devices located in particular geographic areas. These denied geographic areas, along with the associated denied frequency ranges, may be identified by ISED using a geographic point and radius or using a quadrilateral area defined by four geographic points connected with great circle arcs. Geographic areas shall only be added to or removed from the list of denied geographic areas after receiving formal direction from ISED.

16. Security

An AFC system shall incorporate reasonable and reliable communication and information security measures. An AFC system shall employ both of the following measures to protect the security of operational and/or client data:

- implementation of reasonably secure methods for data transmission and authentication that are designed to ensure that all communications between the AFC system and the standard-power RLAN device are accurate and secure, and to prevent corruption or unauthorized modification of data during communication
- implementation of reasonable information security standards to protect the data in the AFC system from unauthorized access, input, manipulation or the deliberate extraction of operational and/or client data

Furthermore, the AFC system security protocols for communication and information security shall be updated in a timely manner to ensure protection against any new and emerging security threats. ISED reserves the right to review and request information on the security features implemented by an AFC system and may, at its discretion, direct the AFCSA to make adjustments.

17. Contact information

All enquiries concerning the technical requirements for the designation of an AFCSA and for the operation of an AFC system should be directed to the following address:

Directorate of Coordination and Terrestrial Engineering (DCTE)
Innovation, Science and Economic Development Canada
235 Queen Street
Ottawa ON K1A 0H5
Email: dynamicspectrumaccess-accesdynamiqueauspectre@ised-isde.gc.ca

Annex A: AFC system interface evaluation tests

A1. AFC system interface test to connect with a standard-power RLAN device

Before initializing a standard-power radio local area network (RLAN) device, an automated frequency coordination (AFC) system shall validate the information provided by confirming the following:

- The certification number (i.e. Innovation, Science and Economic Development Canada Identification Number [IC ID]) for the standard-power RLAN device reflects a valid certification number under RSS-248 as a standard-power device. Innovation, Science and Economic Development Canada (ISED) maintains a list of certified standard-power RLAN devices in the '6 GHz Band Data Extract for AFC systems' section of the Spectrum Management System Data webpage.
- The standard-power RLAN device is not on the list of denied devices.
- The geographic coordinates are within Canada and not in a denied geographic area.
- The antenna height above ground level (AGL) or above mean sea level (AMSL) is provided.
- The geographic coordinates' location uncertainty has a 95% confidence level.

A2. AFC system available frequencies

An AFC shall confirm the available frequencies and associated maximum power levels that can be assigned to a standard-power RLAN device under test.

Annex B: Normative parameters and use of datasets

This annex provides implementation details on acceptable normative parameters and datasets for use by automated frequency coordination (AFC) systems. An AFC system may be allowed to use alterative parameters and methodologies, as outlined in section 5.1, which differ from those outlined in this annex.

B1. Receiver noise level determination

The AFC system shall use the following equation to compute the receiver noise level at the input of a licensed fixed service receiver station:

$$N = -114\ dBm/MHz + NF$$

where NF is the noise figure at the receiver input. NF shall be set to 4 dB if the center frequency of the receiver is equal to or below 6425 MHz and to 4.5 dB otherwise, i.e. if the center frequency of the receiver is above 6425 MHz.

B2. Land cover, digital surface and digital elevation datasets

The AFC system shall use the datasets referenced below to extract land cover, digital surface and/or digital elevation data at a given location when implementing the guidelines described in sections B.3 to B.5. When using the datasets to determine land cover, digital surface and/or digital elevation data over a path, the AFC system shall sample the datasets at intervals of 100 m or less along the path.

Land cover datasets:

In Canada: The 2020 Land Cover of Canada produced by Natural Resources Canada, or alternatively, the 2015 North American Land Cover produced by the Commission for Environmental Cooperation.

Digital surface model (DSM) dataset:

In Canada: The Natural Resources Canada Canadian Digital Surface Model (CDSM), 2000 at the highest available resolution

Digital elevation model (DEM) datasets:

In Canada: The Natural Resources Canada Canadian Digital Elevation Model (CDEM), 1945-2011 at the highest available resolution

In the United States: The United States Geological Survey 3D Elevation Program (3DEP) 1 arc-second data for the contiguous US and 2 arc-second data for Alaska, or the highest available resolution

Innovation, Science and Economic Development Canada (ISED) may, on a case-by-case basis and at its discretion, allow an AFC system to use alternate datasets than those mentioned above as long as the selection and use of these alternate datasets is based on standard engineering practices and ensures a conservative determination of propagation characteristics in comparison to the real world. The automated frequency coordination system administrator (AFCSA) shall provide to ISED a detailed explanation of the use of the alternate datasets for the determination of propagation characteristics in its designation application and shall additionally, if required, provide ISED with access to the proposed alternate datasets for testing purposes.

B3. Use of datasets for the WINNER II model

The AFC system shall determine the appropriate Wireless World Initiative New Radio phase II (WINNER II) propagation scenario and line-of-sight (LOS) condition according to the criteria set out in this section and its subsections.

B3.1 Determination of the WINNER II propagation scenario

The AFC system shall use the land cover dataset (see section B2) to determine the appropriate land cover category at the location of the standard-power radio local area network (RLAN) device. The AFC system shall use the corresponding WINNER II propagation scenario based on the mapping between land cover categories and WINNER II propagation scenarios as outlined in table B1.

Table B1: Land cover category to WINNER II propagation scenario mapping

Land cover category	**WINNER II propagation scenario**
Urban and built-up	C1 (suburban)
All other categories	D1 (rural)

An AFC system may, subject to ISED approval, use an alternate dataset, which allows it to associate paths to the WINNER II C2 scenario (urban) in addition to the C1 and D1 scenarios.

B3.2 Determination of the LOS condition

The AFC system shall use digital surface data to determine the LOS condition of the path between a standard-power RLAN device and a licensed fixed service receiver station. The AFC system shall use the digital surface model (DSM) dataset (see section B2) along the path and the antenna heights AGL of the RLAN device and the licensed fixed service receiver to determine the LOS condition. For determining the LOS condition where digital surface data is not available, the AFC system may use digital elevation data and the digital elevation model (DEM) dataset (see section B2) instead.

B4. Appropriate Irregular Terrain Model (ITM) Parameters

The AFC system shall use the appropriate ITM parameters as specified in table B2 below. To determine the terrain profile required for the ITM, the AFC system shall use the DEM dataset (see section B2) to extract digital elevation data along the path between a standard-power RLAN device and a licensed fixed service receiver station.

Table B2: Appropriate ITM parameters

Parameter name	Appropriate parameter values
Polarization	Horizontal or vertical
Climactic zone	Continental temperate
Surface refractivity (N-units)	301
Ground dielectric constant	25
Ground conductivity (S/m)	0.02
Mode of variability	13
Confidence*	5%
Reliability*	20%

* With probability 5% (confidence) the attenuation will not exceed a given ITM output for at least 20% (reliability) of the time.

The AFC system may determine and use more accurate values for the climactic zone, surface refractivity, ground dielectric constant and ground conductivity parameters to better match the path between a standard power RLAN device and a licensed fixed service receiver station. The AFC system shall refer to the appropriate ITU-R recommendations, as outlined in table B3, and determine the more accurate values according to the data provided in these recommendations and/or according to appropriate datasets, based on standard engineering practices and subject to ISED approval.

Table B3: Appropriate ITU-R recommendations for determining more accurate values

Parameter name	Appropriate ITU-R recommendation
Climactic zone	ITU-R P.617 (latest version)
Surface refractivity (N-units)	ITU-R P.452 (latest version)
Ground dielectric constant	ITU-R P.527 (latest version)
Ground conductivity (S/m)	ITU-R P.527 (latest version)

B5. Appropriate clutter model and clutter model parameters

The AFC system shall use land cover data to determine the appropriate clutter model to combine with the ITM based on the location of the standard-power RLAN device. The AFC system shall determine the land cover category at the location of the standard-power RLAN device using the land cover dataset (see section B2) and use the corresponding ITU-R clutter model based on the mapping outlined in table B4.

Table B4: Land cover category to appropriate clutter model mapping

Land cover category	Appropriate clutter model
Urban and built-up	ITU-R P.2108-0 §3.2
All other categories	ITU-R P.452-16 §4.5

B5.1 Applying the clutter model

The AFC system shall apply clutter loss, as outlined in the appropriate clutter model, only at the location of the standard-power RLAN device. Where a frequency input is required to compute the clutter loss, the AFC system shall use either the frequency of 6400 MHz or the centre frequency of the considered licensed fixed service receiver station.

B5.2 Appropriate value for ITU-R P.2108-0 percentage of locations parameter

The AFC system shall use the ITU-R P.2108-0 clutter model with a “percentage of locations” parameter of 10%.

B5.3 Determination of the appropriate ITU-R P.452-16 clutter category

The AFC system shall use land cover data to determine the appropriate clutter category for the use of the ITU-R P.452-16 clutter model. The AFC system shall determine the land cover category at the location of the standard-power RLAN device using the land cover dataset (see section B2). The AFC system shall only apply clutter loss for the land cover categories outlined in table B5 and shall apply clutter loss using the corresponding clutter category based on the mapping in table B5.

Each clutter category is associated with nominal clutter height and distance values. The distance is relative to the location of an antenna. The values are used in the calculation of the clutter loss. The AFC system can use more accurate values for the clutter (height and distance) when available. However, the AFC system shall only apply the clutter loss if the standard-power RLAN device height AGL is below the clutter height. The DSM dataset (see section B2) shall be used when necessary to validate this information.

Table 5: Land cover category to ITU-R P.452-16 clutter category mapping

Land cover category	**ITU-R P.452-16 clutter category**
Temperate or sub-polar shrubland Cropland	High crop fields Park land Irregularly spaced sparse trees Orchard (regularly spaced) Sparse houses
Temperate or sub-polar broadleaf deciduous forest Mixed forest	Deciduous trees (irregularly spaced) Deciduous trees (regularly spaced) Mixed tree forest
Temperate or sub-polar needleleaf forest Sub-polar taiga needleleaf forest	Coniferous trees (irregularly spaced) Coniferous trees (regularly spaced)