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Title: U-NII 6 GHz devices operating in the 5.925-7.125 GHz band

Short Title: U-NII 6 GHz

Reason: Guidance for Certification 15, Subpart E

Notes for this Draft for public Comment:

Phase 1 of this draft provides guidance for low power indoor (LPI) access points, subordinates and indoor clients. Phase 1 sections of this draft may be used for submitting applications for equipment authorization under the Pre-Approval Guidance (PAG) Procedure (See Publication 388624).

Phase 2 of this publication will provide guidance for standard power access points and clients under control of a standard power access point afer the Automated Frequency Coordination (AFC) specifications are finalized. Low power indoor devices already certified in phase 1, that qualify, will be permitted to file applications to add equipment classes that operate with standard power access points under the same FCCID (see section V below). Phase 2 devices are noted * red.

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Keyword/Subject: U-NII 6 GHz, U-NII 5, U-NII 6, U-NII 7, U-NII 8, U-NII 5-8, 5.925-7.125 GHz band, 15E

First Category: Unlicensed Service Rules and Procedures

Second Category: U-NII devices- 15.401----------

Question: What are the requirements for obtaining a Certification for U-NII 6 GHz devices operating in the 5.925-7.125 GHz band under Part 15, Subpart E?

Answer: The following attachments provide guidance for obtaining Certification for devices operating in the 5.925-7.125 GHz band under Part 15, Subpart E:

987594 D01 General Requirements. Form 731 and supporting information requirements for all types of devices.

987594 D02 EMC Measurement. Test report, exhibits and RF Measurement Procedures for demonstrating: EIRP, Bandwidth, Channel Mask, Out of Band Emissions, Contention Based Protocol (Listen Before Talk) , Automatic Power Control (APC) as applicable to 6 GHz devices.

987594 D03 Q&A General Questions and Answers.

987594 D04 AFC demonstration requirements. This attachment is not currently available. Updated guidance will be published in a phase 2.

Attachment List:

987594 D01 General Requirements
987594 D02 EMC Measurement
987594 D03 Q&A

987594 D01 General Requirements

Part 15 Subpart E U-NII 6 GHz
General Guidance Bands 5, 6 ,7 ,8

Table of Contents:

I. Introduction

This Knowledge Data Base (KDB) Publication 987594 provides guidance for obtaining an equipment authorization under the certification procedure for products and modules that operate under Part 15 Subpart E within the U-NII 6 GHz Bands (U-NII Bands 5-8). It is assumed that the reader is familiar with Equipment Authorization (EA) procedures and FCC regulations.[1]

The 6 GHz U-NII radio bands are regulated under the technical and operational requirements of CFR Title 47, Part 15, Subpart E—UNLICENSED NATIONAL INFORMATION INFRASTRUCTURE DEVICES[2] and under the Equipment Authorization procedures of CFR Title 47, Part 2, Subpart J.

[1] Equipment Authorizations under the certification procedure require an approval issued by an FCC-recognized Telecommunication Certification Body (TCB). Parties not familiar with FCC Equipment Authorization procedures and FCC Rules should consult with Telecommunications Certification Bodies listed in the Equipment Authorization General guidance page http://www.fcc.gov/oet/ea. to ensure a full understanding of the process and steps necessary to obtain an FCC equipment approval.

[2] The 6 GHz rules are effective as of July 27, 2020. *See* Electronic Code of Federal Regulations (e-CFR) at: https://www.ecfr.gov/cgi-bin/text-idx?SID=030ead6f70c7478807b86d3c5697ac3c&mc=true&node=sp47.1.15.e&rgn=div6

Table 1 Overview of U-NII Rules

Band	Band GHz	Rules	Notes	KDB Pub
U-NII 1	5.15-5.25	15.407(a)(1)	Indoor Use/Outdoor Restrictions	789033 (U-NII)
U-NII 2A	5.25-5.35	15.407(a)(2)	Indoor/Outdoor/DFS	789033 (U-NII) 905462 (DFS)
U-NII 2B	5.35-5.47	Not Available		
U-NII 2C	5.47-5.725	15.407(a)(2)	Indoor/Outdoor/DFS	789033 (U-NII) 905462 (DFS)
U-NII 3	5.725-5.85	14.407(a)(3)	Indoor/Outdoor	789033 (U-NII) 926956 (*)
DSRC	5.85-5.925	95 Subpart L and 90 Subpart M	On-Board Units (OBU) must transmit signals to other OBUs and Roadside Units (RSU).	
U-NII 5	5.925-6.425	15.407(a)(4) – (8)	Low Power Indoor AP, Subordinates, Indoor Clients Standard Power AP, Fixed & Standard Clients	789033 (U-NII) 987594 (6 GHz Band)
U-NII 6	6.425-6.525	15.407(a)(5), (6), (8)	Low Power Indoor AP, Subordinates, Indoor Clients	
U-NII 7	6.525-6.875	15.407(a)(4) – (8)	Low Power Indoor AP, Subordinates, Indoor Clients Standard Power AP, Fixed & Standard Clients	
U-NII 8	6.875 - 7.125	15.407(a)(5), (6), (8)	Low Power Indoor AP, Subordinates, Indoor Clients	
* Transition period ended March 2, 2020 for marketing DTS in the 5 GHz Band, as stated in 15.408(b)(4)(ii)				

II. U-NII 5, 6, 7, 8 6-GHz Bands Overview

There are seven equipment classes[3] that are applicable to a Form-731 for U-NII 6 GHz device certifications, as illustrated in Figure 1:

1. 6ID: 15E 6 GHz Low power indoor access point.
2. 6PP: 15E 6 GHz Subordinate indoor device. These devices are under control of a Low power indoor access point (P1).
3. 6XD: 15E 6 GHz Low power Indoor client. These devices are under control of a low power indoor access point (P1).
4. 6SD*: 15E 6 GHz Standard power access point. These devices are managed by the Automatic Frequency Coordination (AFC) system.
5. 6CD*: 15E 6 GHz Dual client. These devices are under control of either a low power indoor access point (6ID) (P1) or Standard power access point (P2).*
6. 6FX*: 15E 6 GHz Standard client. These devices are under control of a Standard power access point (P2).

[3]Multiple equipment classes can apply to one FCC ID. Equipment classes categorize the certification record by the different technical rules that apply. See section V, below for discussion on adding equipment classes to already authorized devices when phase 2 becomes available

7. 6FC*: 15E 6 GHz Fixed client. These devices are associated with a standard power access point (P3).

* Applications accepted in phase 2.

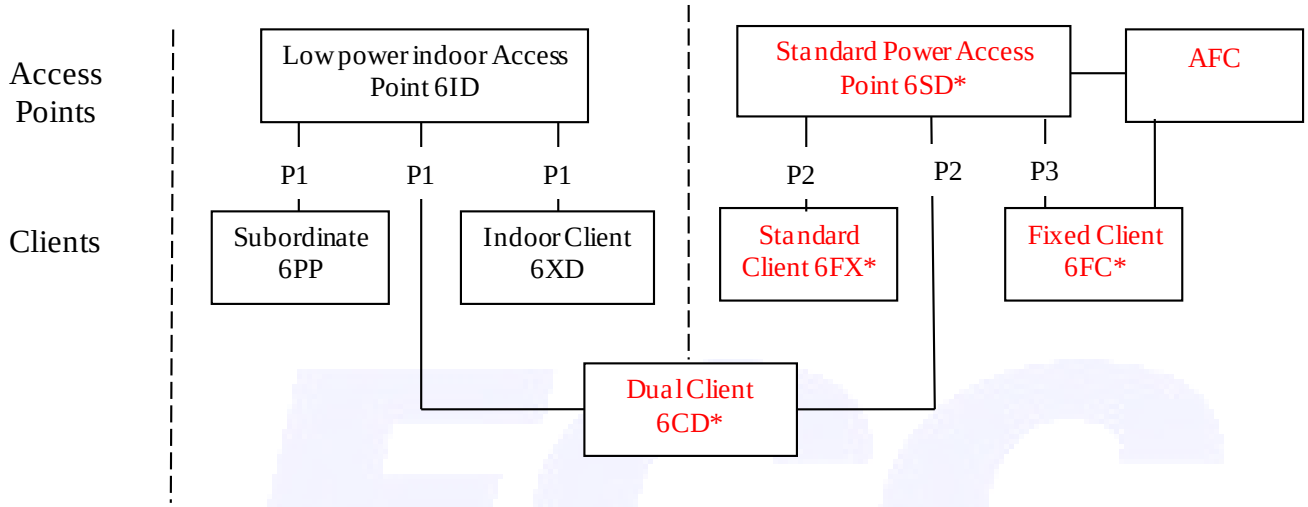

Figure 1 – Equipment Classes Overview

III. Indoor Devices (6ID, 6PP, 6XD) operating in the 5.925-7.125 GHz band

These devices must use a contention-based protocol (CBP) such as "listen before talk" that provides interference protection for incumbent services. The contention-based protocol can allow multiple users to share the same spectrum among low power indoor access points, subordinates and clients. The contention based protocol "listen before talk" compliance must be demonstrated in the test report to the requirements of attachment D02 of this publication. [1] [4]

A Security description is required (15.407(i), Device Security) for all U-NII devices to demonstrate protection of unauthorized software modification by third parties[5] (see KDB Pub. 789033).[5]

A. Low power indoor access points (6ID) operating in the 5.925-7.125 GHz band

A low power indoor access point (6ID) is a device that operates in a master mode as defined in Section 15.202 which has the capability to transmit without receiving an enabling signal. In this mode, it can select a channel and initiate a network by sending enabling signals to client devices. A low power indoor-only access point must provide an indoor identification broadcast beacon [6] or identification to enable a subordinate or client to passively scan or listen for establishing a connection with a low power indoor

[4] [N] designates Form-731 Application exhibits and information required - indicated in sections D and Appendix A.

[5] Third parties include: end-users, professional installers, and authorized distributors. Non third parties are only the Grantee or Contactors working on behalf of the Grantee. The Grantee remains the responsible party.

access point 6ID. If a client detects an indoor AP Equipment Class 6ID, the client may then initiate a brief probe request to associate and establish a connection.

These devices may operate as a bridge, as a peer-to-peer connection, as a connector between the wired and wireless segments of the network, or as a relay between wireless network segments.

These devices are limited to indoor locations, and must have an integrated antenna, and cannot use a weatherized enclosure [2].

Low power indoor access points devices are prohibited on oil platforms, cars, trains, boats, and aircraft, except large aircraft while flying above 10,000 feet.

Low power indoor access points must be powered by a wired connection and cannot be battery powered.[7] Battery backup is permitted for use during power outages. The backup battery power is always connected and isn't removed when there is power.

Label information required in the exhibit types ID Label/Location Info

FCC ID
Indoor Use only [3]
E-labelling is permitted on devices qualifying for e-labelling.

Manual must contain the following information [4] and required to be demonstrated in the user manual exhibit location.

- The operation of this device is prohibited on oil platforms, cars, trains, boats, and aircraft, except that operation of this device is permitted in large aircraft while flying above 10,000 feet.
- Operation of transmitters in the 5.925-7.125 GHz band is prohibited for control of or Communications with unmanned aircraft systems.

B. Subordinate device (6PP) operating in the 5.925-7.125 GHz band

A Subordinate device includes equipment such as Wi-Fi extenders and mesh networking with the additional requirement that it must be under the control of a low power indoor access point (6ID) to share the same propagation channel path.

Being under the control of a low power indoor access point is an association process where the subordinate passively scans or listens in the 6 GHz band for a low power indoor access point (6ID) available channel. The subordinate may initiate a brief probe message requesting to join a low power indoor access point network and request to be associated with a specific access point.

A subordinate device may wirelessly connect to other access points, subordinate devices, and/or client devices when associated with a low power indoor access point (6ID).

These devices are limited to indoor locations, must have an integrated antenna and cannot have or use a weatherized enclosure [2]. These devices are prohibited on oil platforms, cars, trains, boats, and aircraft, except large aircraft while flying above 10,000 feet. Exhibits are required to be filed for both the label information ID Label/Location and in the user manual, demonstrating the following:

Label information required in the exhibit types ID Label/Location Info

FCC ID
Indoor Use only [3]
E-labelling is permitted on devices qualifying for e-labelling.
Manual must contain the following information [4] and required to be demonstrated in the user manual exhibit location.

- The operation of this device is prohibited on oil platforms, cars, trains, boats, and aircraft, except that operation of this device is permitted in large aircraft while flying above 10,000 feet.
- Operation of transmitters in the 5.925-7.125 GHz band is prohibited for control of or Communications with unmanned aircraft systems.

Applications for a subordinate device must demonstrate in the test report that device can only operate under control of a low power indoor access point [9].

A subordinate device must be powered by a wired connection [7] and cannot be battery powered. Battery backup is permitted only during power outages. The backup battery power is always connected and isn't removed when there is power.

Subordinate devices cannot have a direct connection to the internet [8].

C. Indoor Clients (6XD) operating in the 5.925-7.125 GHz band

An indoor client is limited to indoor locations[6] and is defined in Sec. 15.202 as a device operating in a mode in which its transmissions are under control of a low power indoor access point (6ID).

A client, after passively scanning to determine if a low power indoor access point (6ID) is available, may then initiate a request to associate and establish a connection. After being associated with a low power indoor access point, the indoor client can only initiate transmission with that access point. Indoor client devices (6XD) are prohibited from making a direct air interface connection to other clients.

An application for an indoor client device must demonstrate in the test report that the device itself can only operate under control of a low power indoor access point [9].

[6] Indoor client (6XD) devices are limited to indoor locations by 15.407(b)(3) by the requirement to be under control and associated with a low power indoor access point and limited to a maximum EIRP. of 24 dBm 15.407(a)(8).

D. Application Requirements (6ID,6PP,6XD)

Exhibit Notes			Low Power Indoor AP	Subordinate	Indoor Only Client
			Limits dBm <=		
			6ID	6PP	6XD
[1]	Contention-based protocol.	Test Report/ D02	X	X	X
[2]	Weatherized enclosure Prohibited	Op Desc/external photos	X	X	
[3]	Label Indoor Only Info	Label Exhibit	X	X	
[4]	Restriction Statement in manual	Manual Exhibit	X	X	
[5]	Security SDR/security	Security Exhibit	X	X	X
[6]	Indoor AP identification broadcast beacon	Op Desc/Test Report	X		
[7]	Wired Power Connection not battery powered	Op Desc	X	X	
[8]	No direct connection to the internet	Op Desc/Test report		X	
[9]	Demonstrate under control of low power indoor access point	Test Report/ D02		X	X
[10]	Fundamental Maximum EIRP (dBm)	Test Report/ D02	30	30	24
[11]	Fundamental power spectral density in any 1-megahertz band. (dBm/MHz)	Test Report/ D02	5	5	-1
[12]	Fundamental bandwidth	Test Report/ D02	<= 320 MHz		
[13]	Emissions outside of 6 GHz Band any 1-megahertz band (EIRP).	Test Report/ D02	-27 dBm		
[14]	Channel Mask	Test Report/ D02	Compliance to DO2 Channel Mask		

IV. Standard Power Access Device and Associated Clients (6SD,6CD,6FX,6FC)

Grants of certification for equipment classes (6SD, 6CD, 6FX, 6FC) will be in phase 2 when the AFC specifications are finalized. The following information is introductory and is subject to change and further clarification.

The operation of these devices is prohibited on oil platforms, cars, trains, boats, and aircraft.

Operation of transmitters in the 5.925-7.125 GHz band is prohibited for control of or Communications with unmanned aircraft systems.

A Security description is required (15.407(i), Device Security) for all U-NII devices to protect against software modification by unauthorized parties (see KDB 789033).

A. Standard Power Access Points (6SD*)

Operates in the 5.925-6.425 GHz and 6.525-6.875 GHz Band.

Is managed by an Automated Frequency Coordination System.

A standard power access point must provide relevant information to an associated client so that the client can adjust its EIRP 6 dB lower.

B. Dual Client devices (6CD*)

6CD[7] is an equipment class for a client devices under the control of either a low power indoor access point or a standard power access point. Dual client devices must demonstrate operation under the respective requirements for both low power indoor and standard power access points.

- Operates in the 5.925-7.125 GHz band when under control of a low power indoor access point.
- Operates in the 5.925-6.425 GHz and 6.525-6.875 GHz bands when under control of a standard power access point.

These devices must use a contention-based protocol (CBP) such as "listen before talk" that provides interference protection for Incumbent services. The contention-based protocol can also allow multiple users to share the same spectrum among low power indoor access points, subordinates and clients. The contention-based protocol "listen before talk" compliance must be demonstrated in the test report exhibits to the requirements of attachment D02 of this publication. [1]

C. Standard Client Device (6FX*)[8]

A device that only associates with a standard power access point.

D. Fixed Client (6FC*)

A device intended as customer premise equipment that is permanently attached to a structure, operates only on channels provided by an AFC, has a geolocation capability, complies with antenna pointing angle requirements, and can only connect with a standard power access point.

[7] A dual client (6CD) differs from a standard client (6FX) and an indoor client (6XD) in that it must demonstrate that it automatically adapts its power when under control of a standard power access point 15.407(a)(7) and limits its maximum power when under the control of a low power indoor access point. *See* 15.407(a)(8).

[8] A standard client device (6FX) differs from a dual client device (6CD) and an indoor client device (6XD) in that it only needs to demonstrate that it auto adapts its power under control from a standard power access point. *See* 15.407(a)(7).

E. Application Requirements (6SD, 6CD, 6FX, 6FC)

D02 EMC Test Report Requirements		Standard Power Access Point	Dual Client		Standard Client	Fixed Client
			Indoor Control	Std AP control		
		Limits dBm <=				
		6SD*	6CD*		6FX*	6FC*
Fundamental Maximum EIRP	Document Actual Measured Result D02	36	24	30 max & 6dB below AP	30 max & 6dB below AP	36
Fundamental power spectral density in any 1-MHz EIRP		23	-1	17 max & 6dB below AP	17 max & 6dB below AP	23
EIRP above 30-degree antenna elevation angel		21				21
Fundamental bandwidth		<= 320 MHz				
Emissions outside of 6 GHz Band any 1-MHz band (EIRP)		-27 dBm				
Channel Mask		Compliance to DO2 Channel Mask				
6 dB below AP control		TBD				

V. Multiple Rule Parts (Composite devices)

We expect 6 GHz devices to include transmitters that require certification under multiple rule sections, rule parts and equipment classes [9]. These devices are considered composites and are required to demonstrate compliance to all rule parts.

Since low power indoor access points (6ID) and subordinate devices (6PP) have Product Form Factor (PFF) restrictions (i.e. wired power, no batteries, no weatherized enclosure), a composite device that includes a low power indoor access point (6ID) and/or a subordinate device (6PP) will necessitate that the entire product meet these same PFF restrictions.

There are two points to consider for composite devices with 6 GHz U-NII equipment classes:

1. A product can have end users/configuration selections (options).
2. PFF restrictions apply to the entire product such as those required for low power indoor access points (6ID) and Subordinate devices (6PP).

[9] It is common for today's wireless products to be under multiple rule parts incorporate transmitters and unintentional radiators under part 15B. As a rule, transmitters require certification and unintentional radiators can use the SDoC or Certification procedures. These devices are referred to as a composite and can have two meanings: A Form 731 composite refers to a type of filing for multiple equipment classes certified under one FCC ID. The second meaning, Under paragraph (f) of §2.947 Measurement procedure, refers to the compliance responsibilities under multiple rules including both SDoC and/or Certification.

When the FCC allows Phase II devices to file applications, it will be permitted to add a new equipment class or classes under the same FCCID to already approved devices as a new original grant[10]. If the approved device is already a composite device then the TCB can directly submit the new application. If the approved device is not already a composite device and was granted more than 30 days ago, the TCB will need to submit a KDB inquiry to request the original grant be modified to a composite. If the devices still require pre-approval guidance (PAG), then the new equipment classes will require PAG. If the original application was approved as a Software Defined Radio (SDR) the new equipment classes should be submitted as Class III permissive changes.

The table below is an example of various options for a composite device under one FCC ID.

Composite		Low power indoor AP	Subordinate device	Client Indoor Only	Dual Client	Standard AP	Standard Client	Fixed Client
Equipment Class		6ID*	6PP*	6XD	6CD**	6SD**	6FX**	6FC**
Product 1 *	Indoor with Restrictions	PFF option	PFF option	PFF option				
Product 2	Indoor/outdoor				option	option	option	option
Product 3 *, **	Indoor Only With AFC With Restrictions	PFF option	PFF option	PFF option	PFF option	PFF option	PFF option	PFF option
	Entire product restricted to * PFF ; ** phase 2							

- Product 1: is restricted * to indoor properties with selections for being a low power access point, subordinate device or client device.
- Product 2: is not limited** to indoor properties but limited to the requirement that it be managed by the AFC or controlled by a standard power access point managed by the AFC.
- Product 3: is limited* to indoor properties and can be selected to operate under all equipment classes.

[10] This procedure is not a Class II permissive change under section 2.1043 and will allow grants at higher power then what was filled in phase 1.

VI. Modules

Not all equipment classes are permitted to be a module under Sec. 15.212. Furthermore, different modules can be a composite under one FCC ID as indicated above.

Composite device	Low power indoor AP	Subordinate device	Client Indoor Only	Dual Client	Standard power AP	Standard Client	Fixed Client
	6ID	6PP	6XD	6CD*	6SD*	6FX*	6FC*
Module permitted	Yes	No[11]	Yes	Yes	Yes	Yes	Yes
Phase 1	X		X				
Phase 2	X		X	X	X	X	X

Equipment classes (6SD, 6CD, 6FX, 6FC) to be addressed in phase 2.

Host controls and/or configuration settings (selections, scripts interface protocol) cannot be used or take part in setting, configuring, or adjusting the parameters of the air interface RF emission to meet the conditions as granted. The module must demonstrate in the certification application that the RF emission is met as a self-contained standalone module. Restriction for modifying or controlling these parameters include the host manufacturer or any third party under the U-NII security restrictions.

The manufacturer, on a case by case basis, may demonstrate by means of a PAG an alternative restrictive method[12] that is specific for a host or host types to qualify as a limited module.

For other non-air interface RF requirements, (labelling, indoor use, power, restrictions, etc.), the grantee must extend these requirements in the integration instructions (See Publication KBB 996369 D03) in sufficient detail so that the host manufacturer is obligated to adhere to these requirements and restrictions as a condition for using the module's certification.

[11] A subordinate device may not be certified as a module (15.403).
[12] Depending on the PAG proposed method for shared host responsibility a C2PC may be required for each specific host or host type.

VII. General Summary Table

Type	Eq Class		U-NII Bands				Contention Based Protocol	Under control of	Antenna	Max EIRP (dBm)	APC 6 dB Below AP	Module	Restrictions
			5	6	7	8							
Low power indoor access point	6ID	Indoor	X	X	X	X	X	NA	Integral	30	NA	X	a c d
Subordinate	6PP		X	X	X	X	X	Indoor AP 6ID	Integral	30	NA	Not Permitted	a c d e g
Indoor Client	6XD		X	X	X	X	X	Indoor AP 6ID	Integral	24	NA	X	a c d g
Dual Client	6CD *		X	X	X	X	X	Indoor AP 6ID	Integral	24	NA	X	a g
		Indoor outdoor	X		X		NA	Standard AP 6SD		30	Yes		a h
Standard power Access Point	6SD *		X		X		NA	AFC	Any Type	36	NA	X	a b
Standard Client	6FX *		X		X		NA	Standard AP 6SD	Any Type	30	Yes	X	a h
Fixed Client	6FC *		X		X		NA	Standard AP 6SD/AFC	Any Type	36	NA	X	a b f h

Restrictions

a. Prohibited for control of or Communications with unmanned aircraft systems.
b. Prohibited on oil platforms, cars, trains, boats, and aircraft,
c. Prohibited on oil platforms, cars, trains, boats, and small aircraft, and large aircraft under 10,000 feet.
d. Indoor only, powered by wired connection, has an integrated antenna, is not battery powered, and does not have a weatherized enclosure
e. No direct internet connection permitted.
f. Limited to be installed on fixed infrastructures.
g. limited to indoor use by low power indoor access point association.
h. limited to standard access association with standard power access point.

* Phase 2 devices.

VI. RF Exposure

Per Sec. 15.407(f) application filings for all U-NII devices must address RF exposure compliance, as in accordance with KDB Pub. 447498 and other KDB publications referenced therein. For U-NII 6-7 GHz band portable devices (subject to MPE power density limits, not SAR limits), until specific additional exposure evaluation guidance is published by FCC, applicants and test labs must submit a KDB inquiry for review of the RF exposure evaluation plan before completing testing and submitting to a TCB, consistent with KDB Pub. 388624 PAG requirements.

Appendix A
Exhibits Reference Guide

The table Exhibits Reference Guide below provides a Reference Guide for uploading exhibits for U-NII 6 GHz applications. The "Y" Indicates exhibits that are required and the notes number[13] [N] indicates specific type of compliance information related to the U-NII 6 GHz applications . A blank indicates exhibits not related to the U-NII 6 GHz applications but may be uploaded and required for other reasons[14].

The * indicates an equipment class for phase 2 that requires managed connections to the Automatic Frequency Coordination (AFC) system, or that is a client specifically under control of an AFC (applications are not being accepted at this time).

For all equipment classes, the test laboratory and TCB Scope is: A4- U-NII Devices & low power transmitters using spread spectrum techniques.

The frequency range for the Form 731 and listed on the grant shall be the contiguous frequency span of operation as authorized for that equipment class from the channel center frequency of the lowest-frequency channel to the channel center frequency of the highest-frequency channel. 99% of the occupied bandwidth must be contained within all the U-NII sub bands authorized for that equipment class.

Table Exhibits Reference Guide

Exhibit Type	Application Type	LPI AP	Subordinate device	LPI Client	Dual Client	Std pwr AP	Std pwr Client	Fixed Client
		6ID	6PP	6XD	6CD	6SD	6FX	6FC
ID Label/Location	Original Equipment	Y[3]	Y[3]	Y[3]	*	*	*	*
	Change in ID	Y[3]	Y[3]	Y[3]	*	*	*	*
	Class II PC							
	Class III PC							

Exhibit Type	Application Type	LPI AP	Subordinate	Client indoor	Dual Client	Std AP	Client	Fixed Client
		6ID	6PP	6XD	6CD	6SD	6FX	6FC
Attestation	Original Equipment							
	Change in ID							
	Class II PC							
	Class III PC							

[13] The "Y[N]" denotes information associated with this guidance. "Y" without a number, indicate exhibits general required but are not the subject of this publication. "Blank" indicates an exhibit may or may not be reuired for other reasons not the subject of this piblication. For example: portable devices requiring RF exposure evaluation and or testing of handsets requiring Hearing Aid Compatibility are not the subject of this publication but exhibits are required.

Exhibit Type	Application Type	LPI AP	Subordinate	Client indoor	Dual Client	Std AP	Client	Fixed Client
		6ID	6PP	6XD	6CD	6SD	6FX	6FC
External Photos	Original Equipment	Y[2]	Y[2]	Y[2]	*	*	*	*
	Change in ID	Y[2]	Y[2]	Y[2]	*	*	*	*
	Class II PC							
	Class III PC							

Exhibit Type	Application Type	LPI AP	Subordinate	Client indoor	Dual Client	Std AP	Client	Fixed Client
		6ID	6PP	6XD	6CD	6SD	6FX	6FC
Block Diagram	Original Equipment	Y	Y	Y	*	*	*	*
	Change in ID							
	Class II PC							
	Class III PC							

Exhibit Type	Application Type	LPI AP	Subordinate	Client indoor	Dual Client	Std AP	Client	Fixed Client
		6ID	6PP	6XD	6CD	6SD	6FX	6FC
Schematics	Original Equipment	Y	Y	Y	*	*	*	*
	Change in ID							
	Class II PC							
	Class III PC							

Exhibit Type	Application Type	LPI AP	Subordinate	Client indoor	Dual Client	Std AP	Client	Fixed Client
		6ID	6PP	6XD	6CD	6SD	6FX	6FC
Test Reports	Original Equipment	Y[1] [6] [10][11] [12][13] [14]	Y[1] [9][10] [11][12][13] [14]	Y[1] [9] [10] [11, [12] [13] [14]	*	*	*	*
	Change in ID							
	Class II PC							
	Class III PC	Y	Y	Y				

Exhibit Type	Application Type	LPI AP	Subordinate	Client indoor	Dual Client	Std AP	Client	Fixed Client
		6ID	6PP	6XD	6CD	6SD	6FX	6FC
Test Set UP Photos	Original Equipment	Y	Y	Y	*	*	*	*
	Change in ID							
	Class II PC				*	*	*	*
	Class III PC				*	*	*	*

Exhibit Type	Application Type	LPI AP	Subordinate	Client indoor	Dual Client	Std AP	Client	Fixed Client
		6ID	6PP	6XD	6CD	6SD	6FX	6FC
Internal Photos	Original Equipment	Y	Y	Y	*	*	*	*
	Change in ID							
	Class II PC							
	Class III PC							

Exhibit Type	Application Type	LPI AP	Subordinate	Client indoor	Dual Client	Std AP	Client	Fixed Client
		6ID	6PP	6XD	6CD	6SD	6FX	6FC
Parts List/Tune Up Info	Original Equipment							
	Change in ID							
	Class II PC							
	Class III PC							

Exhibit Type	Application Type	LPI AP	Subordinate	Client indoor	Dual Client	Std AP	Client	Fixed Client
		6ID	6PP	6XD	6CD	6SD	6FX	6FC
User Manual	Original Equipment	Y[4] [7]	Y[4] [7] [8]	Y[4]	*	*	*	*
	Change in ID	Y[4][7]	Y[4][7][8]	Y[4]	*	*	*	*
	Class II PC							
	Class III PC							

Exhibit Type	Application Type	LPI AP	Subordinate	Client indoor	Dual Client	Std AP	Std Client	Fixed Client
		6ID	6PP	6XD	6CD	6SD	6FX	6FC
RF Exposure	Original Equipment							
	Change in ID							
	Class II PC							
	Class III PC							
Exhibit Type	Application Type	LPI AP	Subordinate	Client indoor	Dual Client	Std AP	Std Client	Fixed Client
		6ID	6PP	6XD	6CD	6SD	6FX	6FC
Operational Description	Original Equipment	Y	Y	Y	*	*	*	*
	Change in ID							
	Class II PC							
	Class III PC	Y	Y	Y				

Exhibit Type	Application Type	LPI AP	Subordinate	Client indoor	Dual Client	Std AP	Std Client	Fixed Client
		6ID	6PP	6XD	6CD	6SD	6FX	6FC
Cover Letter	Original Equipment							
	Change in ID	Y	Y	Y	*	*	*	*
	Class II PC	Y	Y	Y	*	*	*	*
	Class III PC	Y	Y	Y	*	*	*	*

Exhibit Type	Application Type	LPI AP	Subordinate	Client indoor	Dual Client	Std AP	Std Client	Fixed Client
		6ID	6PP	6XD	6CD	6SD	6FX	6FC
SDR Software/ Security Info	Original Equipment	Y[5]	Y[5]	Y[5]	*	*	*	*
	Change in ID	Y[5]	Y[5]	Y[5]	*	*	*	*
	Class II PC							
	Class III PC	Y	Y					

[1] Contention-based protocol. Products and Modules: test report per D02.
[2] Indoor only (wired pwr, prohibits devices using a weatherized enclosure). Products: External Photos; Modules: extended to host Manufacturers in integration instructions.
[3] Indoor Only label, 15.407(d)(4). Products: ID Label/Location; Modules: extended to host manufacturers by integration instructions.
[4] Restriction statement in manual “The operation of this device is prohibited on oil platforms, cars, trains, boats, and aircraft, except that operation of this device is permitted in large aircraft while flying above 10,000 feet”. Products: User Manual; Modules: extended to host manufacturers by integration instructions.

[5] Security description, 15.407(i). Publication 594280 D02 U-NII Device Security, 442812 D01 SDR Apps Guide. Folder SDR Software: Security Info: Products and Modules.
[6] LPI AP identification method (beacon). An Indoor only access point must provide an indoor identification broadcast beacon or method of identification. A statement in the Test Report and a description in the operational description. Products and Modules.
[7] Wired power connection required; battery power prohibited. Products: User Manual; Modules: extended to host manufacturers in integration instructions.
[8] Cannot have a direct connection to the internet: Products: User Manual; Modules: extended to host manufacturers in integration instructions.
[9] Demonstrate under control of low power Access Point. Products and Modules: test report per D02.
[10] Fundamental Emission. Products and Modules: test report per D02.
[11] Fundamental power spectral density in any 1-megahertz band. Products and Modules: test report per D02.
[12] Fundamental bandwidth. Products and Modules: test report per D02.
[13] Emissions outside of 6 GHz band, Products and Modules: test report per D02.
[14] Channel Mask. Products and Modules: test report per D02.

987594 D02 EMC Measurement

Federal Communications Commission
Office of Engineering and Technology
Laboratory Division

GUIDELINES FOR COMPLIANCE TESTING OF UNLICENSED NATIONAL INFORMATION INFRASTRUCTURE 6 GHz (U-NII) DEVICES PART 15, SUBPART E

I. INTRODUCTION

This document provides guidance for determining 6 GHz U-NII devices emissions compliance under Part 15, Subpart E of the FCC rules.

This document includes acceptable procedures for measuring emission bandwidth, maximum conducted output power, power spectral density, and unwanted emissions both in and out of the restricted bands, in-band emissions and contention-based protocol. For equipment under test (EUT) that can transmit on multiple outputs simultaneously (e.g., MIMO or beamforming devices), *see* KDB Publication 662911 for additional guidance.

All EUT operating modes and data rates must satisfy all requirements. The operating mode and data rate that is the worst case for one test may not be the worst case for another test. Data rate settings may have a significant effect on test results.

Note that average emission measurements in the restricted bands are based on continuous transmission by the U-NII device during the measurement interval. Downward adjustment of test data based on actual operational duty cycle of the device is not permitted.

II. MEASUREMENT PROCEDURES

A. General Guidance

Refer to KDB 789033

1. Frequency Stability

Refer to KDB 789033

B. Duty Cycle (x), Transmission Duration (T), and Maximum Power Control Level

Refer to KDB 789033 or as specified in this section where applicable.

C. Emission Bandwidth (EBW)

Refer to KDB 789033

D. 99% Occupied Bandwidth

Refer to KDB 789033

E. Maximum Conducted Output Power

Refer to KDB 789033. Any of the methods in this section of 789033 for conducted power can be used.

F. Maximum Power Spectral Density (PSD)

Refer to KDB 789033

G. Unwanted Emission Measurement

Use guidance in KDB 789033 for measurements below 1000 MHz and above 1000 MHz

H. Measurement of emission at elevation angle higher than 30° from horizon

For an outdoor standard power access point and fixed client device operating in the 5.925-6.425 GHz and 6.525-6.875 GHz bands, the maximum EIRP at any elevation angle above 30 degrees as measured from the horizon must not exceed 125 mW (21 dBm). This restriction leads to a general requirement for the antenna pattern: if the EIRP within the 3 dB elevation beamwidth of any radiation lobe is higher than 125 mW, this lobe must be controlled, either mechanically or electrically, so that the 3 dB elevation beamwidth of this lobe is below the 30° elevation angle relative to the horizon.

For compliance purposes , information for all the antenna types must be included in the filing. For antennas to be considered of similar type, the antenna patterns as well as other characteristics of the antenna must also be similar.

Note: Elevation angle is defined as 0° is horizontal and 90° is straight-up.

1. For fixed infrastructure, not electrically or mechanically steerable beam antenna

a) If elevation plane radiation pattern is available:

i) Determine the device intended mounting elevation angle and define 0° reference angle on the elevation plane radiation pattern.

ii) Indicate any radiation pattern between 30° and 90° which has the highest gain.

iii) Calculate the EIRP based on this highest gain and conducted output power.

iv) Compare to the 125 mW limit to establish compliance.

v) Include the elevation pattern data in the application filing with the test report to show how the calculations are made.

Note: For MIMO devices, take the maximum gain of each antenna and apply the guidance in KDB Publication 662911 for calculating the overall gain including directional gain for the maximum EIRP calculation.

b) If the elevation plane radiation pattern is not available, but the antenna type (such as dipole omnidirectional, Yagi, parabolic, or sector antenna) has a symmetrical elevation plane pattern referenced at the main beam and all lobes on the main beam elevation plane have highest gains, then the following measurement method is acceptable to determine compliance:

(i) Determine the device's intended mounting elevation angle referenced to the horizon.

(ii) Rotate the EUT antenna by 90° around the main beam axis in a horizontal position to transform the measurement in elevation angle into an azimuth angle and define a 0° reference angle based on the device's intended mounting elevation angle.

(iii) Move the test antenna along the horizontal arc, or rotate the turntable with the EUT antenna placed at the center, between 30° and 90° relative to the 0° reference angle, and then continuing down from 90° to 30° on the other side of the pattern, while maintaining the test antenna pointing with constant distance to the EUT antenna. Search for the spot which has the highest measured emission. Both horizontal and vertical polarization shall be investigated to determine the maximum radiated emission level.

Note: Moving the test antenna along the horizontal arc, or rotating the turntable, shall be performed in an angular step size as small as possible, but not larger than 3°.

(iv) Calculate the EIRP based on the highest measured emission. Compare to the limit of 125 mW to determine compliance.

(v) The antenna pattern measurements must be included in the filing.

2. For All Other Antenna Types

For all other antenna types (such as patch antennas, array antennas, antennas with irregular radiator shapes, etc.) which have any combination of following characteristics:

- Asymmetrical, complex radiation patterns
- 2-D or 3-D steerable beam
- Portable/mobile, not fixed infrastructure device

Provide the following information in the report:

a) Describe what type of antenna is used.

b) Determine by calculation, measurement or simulation, all radiation lobes/beams, which have EIRP higher than 125 mW within a 3-dB elevation beamwidth.

c) Provide an explanation of how these antenna beams are controlled to be kept below the 30° elevation angle. The explanation should include device installation instructions, mechanical control, electro-mechanical control or software algorithms, if the beams are electrically controlled by software.

I. Contention Based Protocol

Indoor access points, subordinate devices and client devices operating in the 5.925-7.125 GHz band (herein referred to as unlicensed devices) are required to use technologies that include a contention-based protocol to avoid

co-channel interference with incumbent devices sharing the band. To ensure incumbent co-channel operations are detected in a technology-agnostic manner, unlicensed devices are required to detect co-channel radio frequency energy (energy detect) and avoid simultaneous transmission.

Unlicensed indoor low-power devices must detect co-channel radio frequency power that is at least -62 dBm or lower. Upon detection of energy in the band, unlicensed low power indoor devices must vacate the channel and stay off the channel as long as detected radio frequency power is equal to or greater than the threshold (-62 dBm). The -62 dBm (or lower) threshold is referenced to a 0 dBi antenna gain.

To ensure incumbent operations are reliably detected in the band, low power indoor devices must detect RF energy throughout their intended operating channel. For example, an 802.11 device that plans to transmit a 40 MHz- wide signal (on a primary 20 MHz channel and a secondary 20 MHz channel) must detect energy throughout the entire 40 MHz channel. Additionally, indoor low-power devices must detect co-channel energy with 90% or greater certainty.

TEST PROCEDURE

a) Simulating Incumbent Signal

The incumbent signal is assumed to be noise-like. One example of such transmission could be Digital Video Broadcasting (DVB) systems that use Orthogonal Frequency Division Multiplexing (OFDM). Incumbent systems may also use different bandwidths for their transmissions. A 10 MHz-wide additive white Gaussian noise (AWGN) signal is selected to simulate and represent incumbent transmission.

b) Required number of tests

Incumbent and EUT (access point, subordinate or client) signals may occupy different portions of the channel. Depending on the EUT transmission bandwidth and incumbent signal center frequency (simulated by a 10 MHz-wide AWGN signal), the center frequency of the EUT signal f_{c1} may fall within the incumbent's occupied bandwidth (Figure 1.a), or outside of it (Figure 1.b).

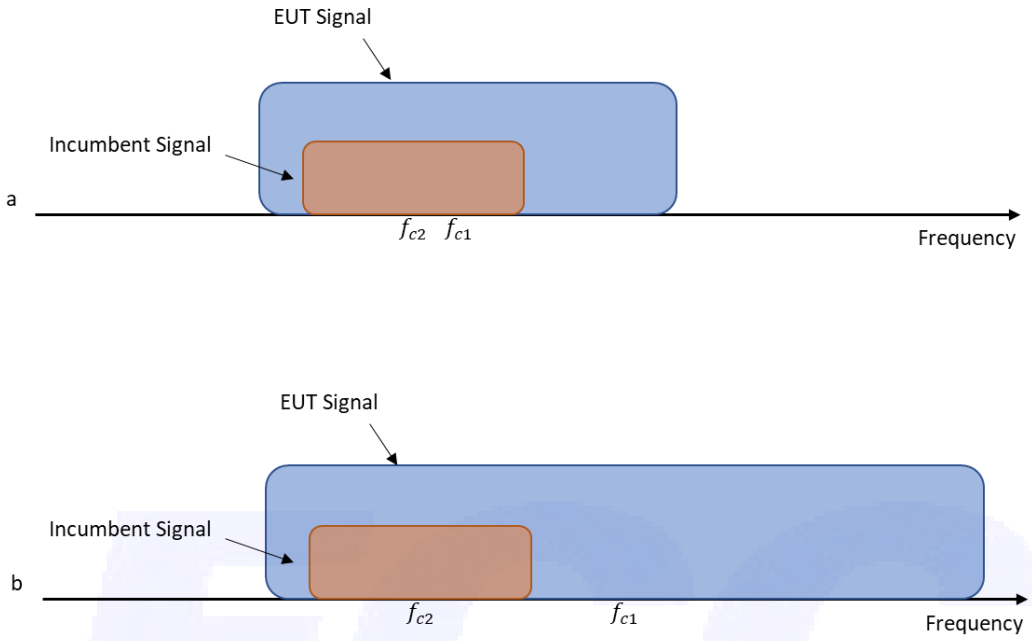

Figure 1. Two possible scenarios where a) center frequency of EUT transmission falls within incumbent's bandwidth, or b) outside of it

To ensure EUT reliably detects an incumbent signal in both scenarios shown in Figure 1, the detection threshold test may be repeated more than once with the incumbent signal (having center frequency f_{c2}) tuned to different center frequencies within the UT transmission bandwidth. The criteria specified in Table 1 determines how many times the detection threshold test must be performed;

Table 1. Criteria to determine number of times detection threshold test may be performed

If	Number of Tests	Placement of Incumbent Transmission
$BW_{EUT} \leq BW_{Inc}$	Once	Tune incumbent and EUT transmissions ($f_{c1} = f_{c2}$)
$BW_{Inc} < BW_{EUT} \leq 2BW_{Inc}$	Once	Incumbent transmission is contained within BW_{EUT}
$2BW_{Inc} < BW_{EUT} \leq 4BW_{Inc}$	Twice. Incumbent transmission is contained within BW_{EUT}	Incumbent transmission is located as closely as possible to the lower edge and upper edge, respectively, of the EUT channel
$BW_{EUT} > 4BW_{Inc}$	Three times	Incumbent transmission is located as closely as possible to the lower edge of the EUT channel, in the middle of EUT channel, and as closely as possible to the upper edge of the EUT channel

where:

BW_{EUT}: Transmission bandwidth of EUT signal
BW_{Inc}: Transmission bandwidth of the simulated incumbent signal (10 MHz wide AWGN signal)
f_{c1}: Center frequency of EUT transmission
f_{c2}: Center frequency of simulated incumbent signal

c) Test Setup

To ensure EUT is capable of detecting co-channel energy, the first step is to configure the EUT to transmit with a constant duty cycle[15]. To simulate an incumbent signal, a signal generator (or similar source) that is capable of generating band-limited additive white Gaussian noise (AWGN) is required. Depending on the EUT antenna configuration, the AWGN signal can be provided to the EUT receiver via a conducted method (Figure 2) or a radiated method (Figure 3). Figure 2 shows the conducted test setup where a band-limited AWGN signal is generated at a very low power level and injected into the EUT's antenna port. The AWGN signal power level is then incrementally increased while the EUT transmission is monitored on a signal analyzer 2 to verify if the EUT can sense the AWGN signal and can subsequently cease its transmission. A triggered measurement, as shown in Figure 2, is optional, and assists with determining the time it takes the EUT to cease transmission (or vacate the channel) upon detecting RF energy. If the EUT has only one antenna port, then an AWGN signal source can be connected to the same antenna port.

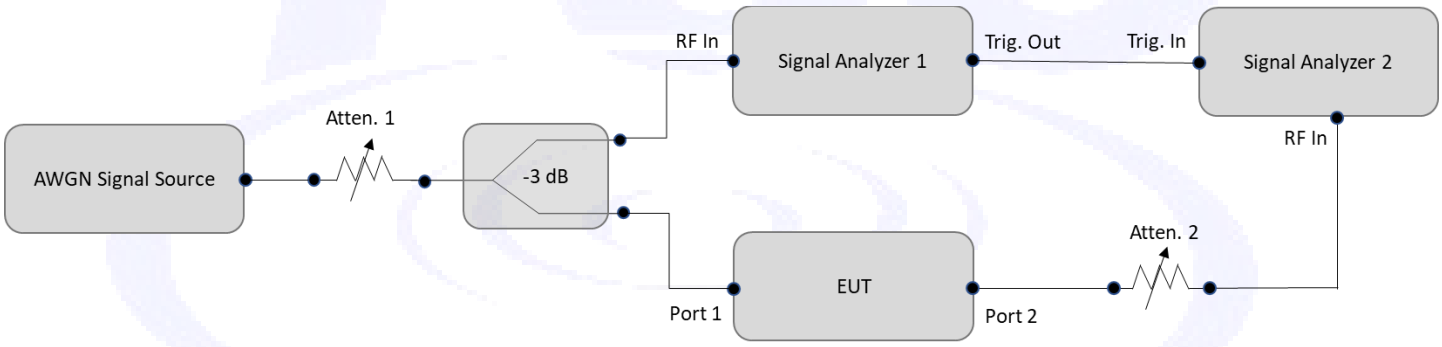

Figure 2. Contention-based protocol test setup, conducted method Step-by-Step Procedure, Conducted Setup

1. Configure the EUT to transmit with a constant duty cycle.
2. Set the operating parameters of the EUT including power level, operating frequency, modulation and bandwidth.
3. Set the signal analyzer center frequency to the nominal EEUT channel center frequency. The span range of the signal analyzer shall be between two times and five times the OBW of the EUT. Connect the output port of the EUT to the signal analyzer 2, as shown in Figure 2. Ensure that the attenuator 2 provides enough attenuation to not overload the signal analyzer 2 receiver.

[15] The EUT does not have to be configured to transmit with constant duty cycle if the sole purpose of the test is to verify whether the EUT can detect the incumbent signal and cease transmission upon detection. However, if it is desired to also determine the time it takes the EUT to cease transmission, then having a constant duty cycle will help with accurate measurement of the time it takes the EUT to detect incumbent signal and cease transmission.

4. Monitoring the signal analyzer 2, verify the EUT is operating and transmitting with the parameters set at step two.
5. Using an AWGN signal source, generate (but do not transmit, i.e., RF OFF) a 10 MHz-wide AWGN signal. Use Table 1 to determine the center frequency of the 10 MHz AWGN signal relative to the EUT's channel bandwidth and center frequency.
6. Set the AWGN signal power to an extremely low level (more than 20 dB below the -62 dBm threshold). Connect the AWGN signal source, via a 3-dB splitter, to the signal analyzer 1 and the EUT as shown in Figure 2.
7. Transmit the AWGN signal (RF ON) and verify its characteristics on the signal analyzer 1.
8. Monitor the signal analyzer 2 to verify if the AWGN signal has been detected and the EUT has ceased transmission. If the EUT continues to transmit, then incrementally increase the AWGN signal power level until the EUT stops transmitting.
9. (Including all losses in the RF paths) Determine and record the AWGN signal power level (at the EUT's antenna port) at which the EUT ceased transmission. Repeat the procedure at least 10 times to verify the EUT can detect an AWGN signal with 90% (or better) level of certainty.
10. Refer to Table 1 to determine number of times the detection threshold testing needs to be repeated. If testing is required more than once, then go back to step 5, choose a different center frequency for the AWGN signal and repeat the process.

d) Step-by-Step Procedure, Radiated Setup

To perform the same test in a radiated fashion, it is imperative to ensure that the AWGN signal can be radiated in a controlled environment, the AWGN radiated signal can illuminate the EUT antenna entirely, and the AWGN signal power level can be accurately measured at the EUT antenna's exact location. Figure 3 shows the radiated test setup where the AWGN signal is generated and transmitted via antenna 1. It should be noted that antenna 1 must be selected such that its 3 dB beamwidth can illuminate the EUT entirely. To ensure the AWGN signal level can be accurately measured at the EUT location, the EUT is initially replaced by antenna 2 which has a known gain, as shown in Figure 3. The radiated signal level is then measured using antenna 2. Antennas 1 and 2 are aligned and placed at a distance R which is greater than the far field distances of both antenna 1 and antenna 2. The AWGN signal power level is measured by the signal analyzer 1. The measured power P_{meas} is then corrected by the gain of antenna 2, G_2, and by all cable losses and attenuations L, to determine the AWGN signal power level at antenna 2, P_2, according to

$$P_2 = P_{meas} + L - G_2 \quad (1)$$

The EUT is then placed exactly where antenna 2 was, as shown in Figure 4.

Figure 3. Contention-based protocol test setup, radiated method, power measurement

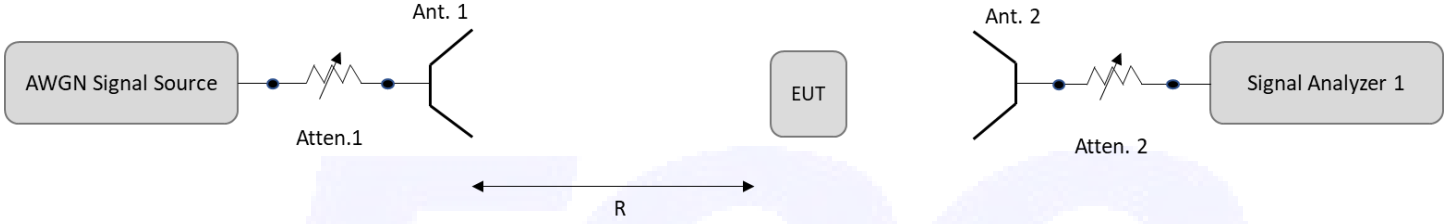

Figure 4. Contention-based protocol test setup, radiated method, detection threshold measurement

The following is a step-by-step procedure for testing the contention-based protocol using the radiated setup described above:

1. Using the AWGN signal source, generate (but do not transmit, i.e., RF OFF) a 10 MHz-wide AWGN signal. Use Table 1 to determine the center frequency of the 10 MHz AWGN signal relative to the EUT's channel bandwidth and center frequency.
2. Connect the AWGN signal source to antenna 1, as shown in Figure 3, and transmit the signal (RF ON).
3. Using signal analyzer 1 and antenna 2, measure the AWGN signal power level. Align antenna 2 and antenna 1 to maximize emission.
4. Using equation 1, correct the measured power P_{meas} by the gain of antenna 2, G_2 and all cable losses and attenuations L to obtain the AWGN signal power level at antenna 2, P_2.
5. Set the corrected power P_2 to an extremely low level (more than 20 dB below the -62 dBm threshold).
6. Place the EUT exactly where antenna 2 was. Configure the EUT to transmit a constant duty cycle.
7. Set the operating parameters of the EUT including power level, operating frequency, modulation and bandwidth.
8. Set the signal analyzer 1 center frequency to the nominal EUT channel center frequency. The span range of the signal analyzer shall be between two times and five times the OBW of EUT.
9. Monitor the signal analyzer 1 to verify if AWGN signal has been detected and EUT has ceased transmission. If the EUT continues to transmit, then incrementally increase the AWGN signal power level until the EUT stops transmitting.
10. Determine and record the AWGN signal power level at which the EUT ceased transmission. Repeat the procedure at least 10 times to verify the EUT can detect the AWGN signal with 90% (or better) level of certainty.
11. Refer to Table 1 to determine number of times the detection threshold testing needs to be repeated. If testing is required more than once, then go back to step 1, choose a different center frequency for the AWGN signal and repeat the process.

J. In-Band Emissions (Mask Figure 5)

1. Connect output of the antenna port to a spectrum analyzer or EMI receiver, with appropriate attenuation, as to not damage the instrumentation.
2. Set the reference level of the measuring equipment in accordance with procedure 4.1.5.2 of ANSI C63.10-2013.
3. Measure the 26 dB EBW using the test procedure 12.4.1 of ANSI C63.10-2013. (This will be used to determine the channel edge.)
4. Measure the power spectral density (which will be used for emissions mask reference) using the following procedure:
   a) Set the span to encompass the entire 26 dB EBW of the signal.
   b) Set RBW = same RBW used for 26 dB EBW measurement.
   c) Set VBW ≥ 3 X RBW
   d) Number of points in sweep ≥ [2 X span / RBW].
   e) Sweep time = auto.
   f) Detector = RMS (i.e., power averaging)
   g) Trace average at least 100 traces in power averaging (rms) mode.
   h) Use the peak search function on the instrument to find the peak of the spectrum.
5. For the purposes of developing the emission mask, the channel bandwidth is defined as the 26 dB EBW.
6. Using the measuring equipment limit line function, develop the emissions mask based on the following requirements. The emissions power spectral density must be reduced below the peak power spectral density (in dB) as follows:
   a. Suppressed by 20 dB at 1 MHz outside of the channel edge. (The channel edge is defined as the 26-dB point on either side of the carrier center frequency.)
   b. Suppressed by 28 dB at one channel bandwidth from the channel center.
   c. Suppressed by 40 dB at one- and one-half times the channel bandwidth from the channel center.
7. Adjust the span to encompass the entire mask as necessary.
8. Clear trace.
9. Trace average at least 100 traces in power averaging (rms) mode.
10. Adjust the reference level as necessary so that the crest of the channel touches the top of the emission mask.

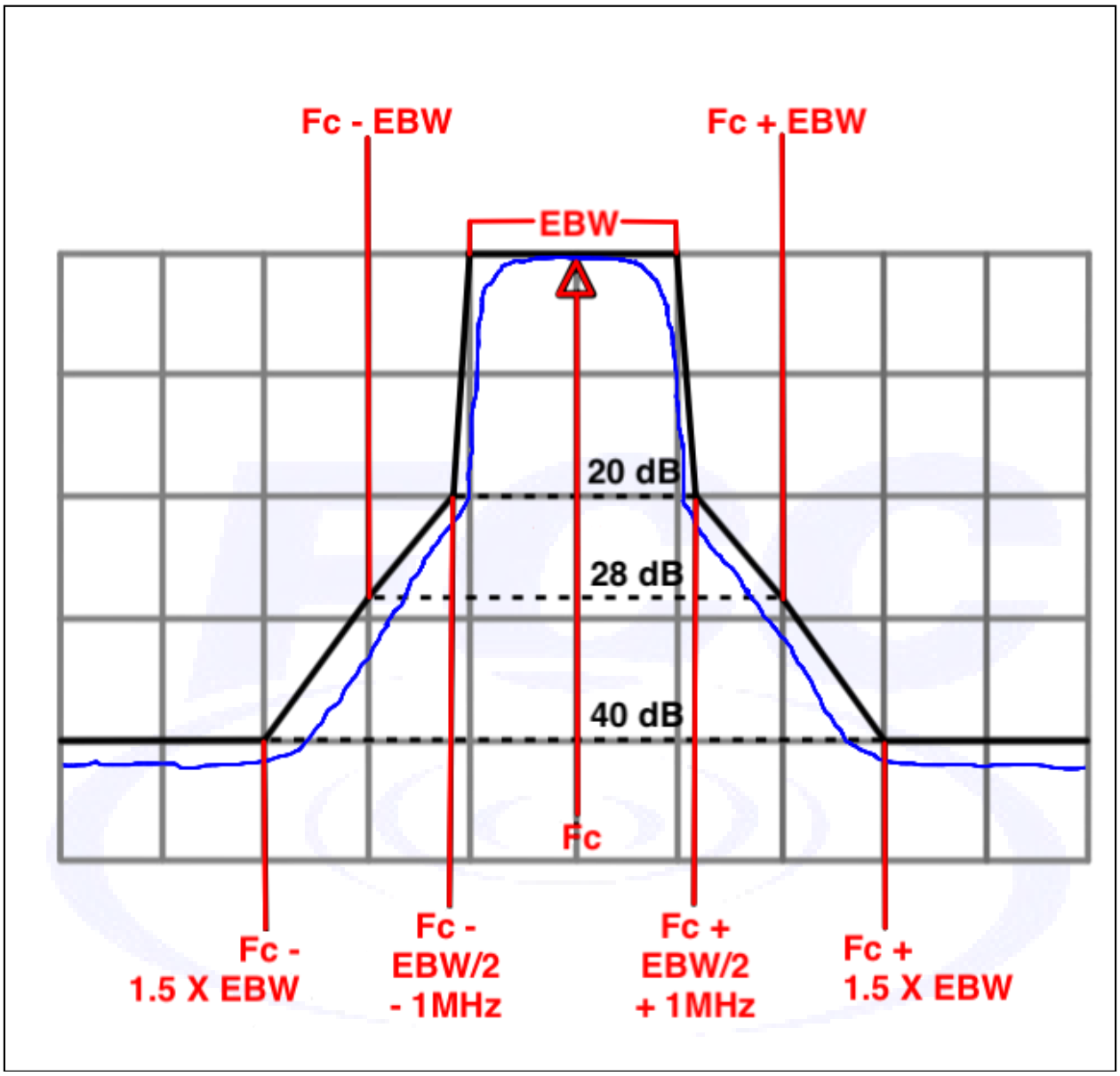

Figure 5. Generic Emission Mask

K. Dual Client Test, Demonstration of Proper Power Adjustment based on Associated AP

A client device may connect to a Standard Power AP with a maximum power level of 30 dBm EIRP. A client may also connect to a Low Power indoor AP, but the power level is limited to a maximum of 24 dBm EIRP. If a client has the flexibility to connect to both APs, verification is needed to show that it can distinguish between the two configurations, and then control the power levels accordingly.

TEST PROCEDURE:

1. Connect equipment as shown in Figure 6 below.
2. Adjust Atten 2 to Std Power AP so as to facilitate error free communication with the Client (Atten 1 should be set to High on the RF path to the Low Power AP).
3. Configure the Client and APs so that they associate and start sending data (stream data). It is important that the client is configured to transmit at its highest power level. Initially, because the attenuation on Atten 1 is set high, the Client will only associate with the Std Power AP.
4. Verify transmission between Client and Std Power AP. Additional attenuators may be required to protect measurement equipment. Measure the Client RF power using any of the methods in C63.10 for NII devices. Note – if the client RF power has been certified to never operate above 24 dBm EIRP then this test is not necessary.
5. Gradually increase Atten 2 while at the same time decreasing Atten 1. This simulates the Client moving from outdoors to indoors. At some level of attenuation the Client should associate with the Low Power indor AP. Verify transmission between Client and Low Power AP.
6. Measure the RF power of the Client device using the same method as in step 4. Verify the power is no more than 24 dBm EIRP.
   Note – measuring Client RF power reliably from a directional coupler measurement port may be tricky. Due to coupling, some energy from the AP will show up on the measurement port. Signal isolation techniques on the measurement analyzer will need to be used.

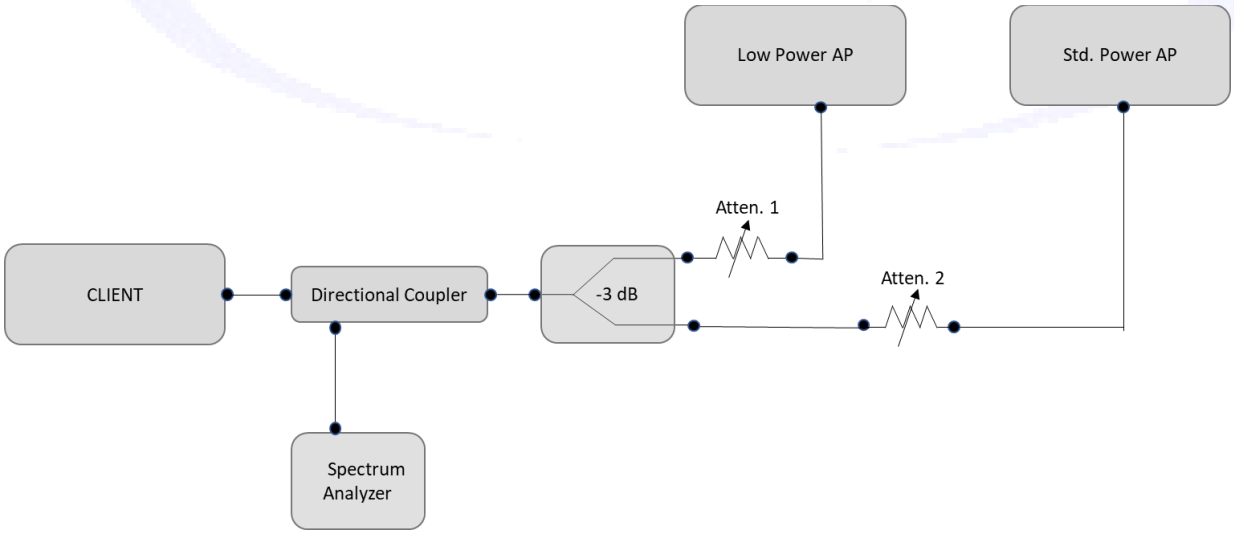

Figure 6. Test setup for conducted testing

.987594 D03 Q&A

Federal Communications Commission
Office of Engineering and Technology
Laboratory Division

Part 15 Subpart E U-NII 6 GHz
Questions and Answers

Q1. What are the different types of devices that can be certified for 6 GHz U-NII use?
A1

i. **Standard Power Access Point** – Devices that can be installed indoors or outdoors and utilize an AFC database to determine available channels and power levels. If installed outside, the access point must limit its EIRP to 21 dBm above 30 degree antenna elevation angles.
ii. **Client connected to Standard Power Access Point** – these devices can be used indoors or outdoors. They must maintain an EIRP level at least 6 dB below that of the associated AP.
iii. **Fixed Client Device** – Indoor/Outdoor client device that connects to a Standard Power Access point and is installed in a fixed location. These devices shall have the same certification requirements as a Standard Power Access Points (AFC required, power levels, etc.).
iv. **Low Power indoor Access Point** – Limited to indoor use. Must not be weatherproof, is supplied power from a wired connection, must not run on batteries and must have an integrated antenna. A Contention-based protocol is required to protect incumbent users.
v. **Client connected to low power indoor Access Point** – clients that connect to low power indoor Access Points and use a contention-based protocol.
vi. **Subordinate Device** – a device such as an indoor extender that is under the control of a low power indoor Access Point, is supplied power from a wired connection, has integral antenna, does not have a weatherized enclosure and is not used to connect devices between separate buildings and structures. Must use a contention-based protocol. Power limits are set the same as a Low Power indoor Access Point.
vii. **Dual Client** – these client devices can connect to Standard Power APs as well as Low Power indoor APs.

Q2. Can these devices be certified for vehicular use?

A2. No. At this time these devices cannot be used on cars, trains, boats and aircraft, with the exception that low power indoor devices and associated client devices can operate on large aircraft above 10,000 feet.

Q3. Can Low Power indoor APs have battery backup for power outages?

A3. Yes. User manual must clearly state that the battery backup is for power outages and is not meant to operate the device outside.

Q4. Is modular approval allowed for these devices?

A4. Yes, except for Subordinate devices.

Q5. How is linear interpolation interpreted when constructing the mask?
A5. The rules specify PSD suppression values in dB (logarithmic scale). When linearly interpolating, the dB values must first be converted to a linear scale. After interpolating in linear terms, the PSD values should be converted back into dB.

Q6. Is Transmit Power Control (TPC) required for client devices?

A6. TPC is required for all client devices connected to Standard Power Access Points excluding Fixed Client devices. The TPC mechanism shall limit client power to no more than 6 dB below its associated Standard Power APs authorized transmit power level. TPC is not required for client devices connected to Low Power indoor Access Points and Subordinate devices.

Q7. Can a Client device be certified for outdoor and indoor use?

A7. Yes. A Dual Client device may work with a Standard Power AP and a low power indoor AP. In this case the Client shall meet all the requirements for an Outdoor Client as well as an Indoor Client. Additionally, testing must show that the client properly adjusts its power when transitioning from Outdoor to Indoor.

Q8. Can a Client device directly connect to another Client device?

A8. No. Direct Client to Client communications is prohibited.

Q9. Can new 6 GHz bands be added to an existing NII grant under the same FCC ID?

A9. Yes. If hardware or enclosure changes have not been made, a new original equipment application can be filed under the same FCC ID. If granted application is not already a composite, the TCB shall send an inquiry to the FCC to request that the FCC place the application in audit mode thereby allowing TCB to modify the existing grant to identify the device as a composite.

Q10. If a device operates in U-NII bands 5, 6, 7 and 8, does the test lab need to test at least three channels (L, M & H) in each sub-band of operation?

A10. Yes. LMH in band 5, LMH in band 6, and so forth.

Q11. If a device only operates in one sub-band (example, U-NII-6), does OOBE need to be shown in other sub-bands (example, U-NII-5&7)?

A11. No. Compliance with OOBE limits only apply outside of the 5.925 – 7.125 GHz band. All in-band emissions need to meet the channel mask.

Q12. How are straddle channels listed on an equipment authorization grant?

A12. The frequency range for the Form 731 and listed on the grant shall be the contiguous frequency span of operation as authorized for that equipment class from the channel center frequency of the lowest frequency channel to the channel center frequency of the highest frequency channel. 99% of the occupied bandwidth must be contained within all the U-NII sub bands authorized for that equipment class.

For example:
A device such as aa low power indoor access point operating in all 6 GHz U-NII bands (5-8) would list the frequency range for all channels of operation as one line entry across all 6 GHz U-NII bands (5-8). Channels spanning within U-NII sub bands (i.e. 5 & 6, 6 & 7, 7 & 8) are not required to be separately listed on the Form 731. 99% of the occupied bandwidth of any channel must be contained within U-NII bands (5-8).

A device such as a standard power access point operating in U-NII bands (5 & 7) would list separately the frequency range for each contiguous frequency span of operation in U-NII sub band 5 and U-NII sub band 7. In no case are channels permitted spanning across U-NII bands that they are not authorized in (i.e. across 5 & 6, 6 & 7 and 7 & 8). 99% of the occupied bandwidth of any channel must be contained within each of its respective U-NII sub bands (e.g., 5) separately.

Q13. How does one determine if an enclosure is not weatherized?

A13. There are many factors in determining if an indoor device meets the requirement of not having a weatherized enclosure. Clearly if the enclosure has openings to vent heat it is not weatherized. The IP rating of a device could potentially be used. For example, if a device has been certified for IP 65 there is a good chance that the device can be used outdoors. However, test labs and TCBs shall review the user manual and other documentation to verify that the device cannot be used outdoors and that the intent of the requirement is met.