

KDB 987594 D05 – AFC DUT Harness Testing

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Note: The views expressed in this presentation are those of the author and may not necessarily represent the views of the Federal Communications Commission.



Standard Power APs (6SD) and Fixed Client Devices (6FC):

- 47 CFR 15.407(k)
 - Currently there are no real-world AFC (Automated Frequency Coordination) systems to test the requirements of 15.407(k)
 - Wi-Fi Alliance (WFA) created an AFC test harness that mimics the functionality of an AFC to assist in the certification of 6SD and 6FC devices
- 6SD/6FC certification using AFC test harness:
 - Test report demonstrating requirements of 47 CFR 15.407(k) are met along with required attestations.
 - Testing must be done by an accredited and FCC recognized test laboratory to either the FCC scope for U-NII with DFS or the FCC scope for U-NII without DFS per KDB 974614.
 - Approved PIA (Persistent Inquiry Approval) is required prior to certification



AFC Test Harness

- Wi-Fi Alliance
 - AFC DUT test harness
 - Includes .deb software package and user manual for install and GUI
 - AFC Specifications and Test Plans
 - Compliance test plan includes detailed test cases and P/F criteria.
- Devices that do not use the WiFi Alliance test harness must identify a specific AFC and demonstrate compliance using that AFC.



WFA AFC DUT Test Harness

AFC DUT Test Harness
Version (2.0.65.148)

Repeat: 0

UT Type : Access Point
Certification and Capability Selection

AFC capability - Inquired Channel - [v1: rev1] x
AFC capability - Server Validation - [v1: rev1] x

Test case selection - 1/29

- AFC capability - Inquired Channel
 - Test Group: Inquired Channel - Always**
 - CT_AFC_SP_AP_AFCDRSA31_Channel_20MHz_10618_1
 - CT_AFC_SP_AP_AFCDRSA31_Channel_40MHz_10619_1
 - CT_AFC_SP_AP_AFCDRSA31_Channel_80MHz_10620_1
 - CT_AFC_SP_AP_AFCDRSA31_Channel_160MHz_10621_1
 - CT_AFC_SP_AP_AFCDUSA32_Channel_10622_1
 - CT_AFC_SP_AP_AFCDUSA33_Channel_10623_1
 - CT_AFC_SP_AP_AFCDUAU34_Channel_10624_1
 - AFC capability - Inquired Frequency & Channel
 - AFC capability - Server Validation - Mandatory

Pass (1/1)
 Failed (0/1)
 Incomplete (0/1)
 Not tested (0/1)
 Validator Error (0/1)

Testcase Name	Objective
CT_AFC_SP_AP_AFCDRSA31_Channel_20MHz_10618_1	CT_AFC_SP_AP_AFCDRSA31_Channel_20MHz_10618_1

Measurement	Description	Value	Result
AFC_DUT_SEND_SPECTRUM_INQUIRYREQUEST_1	AFC DUT sends an Available Spectrum Inquiry Request	True	True
AFC_DUT_SPECTRUM_INQUIRYREQUEST_VALID_1	Valid mandatory registration information	True	Valid
AFC_DUT_CONFORM_SPECTRUM_INQUIRYRESPONSE_1	AFC DUT transmit power in the band is less than CEILING[LPI limits (5 dBm/MHz PSD) , SP limits (26.83782478933715 dBm EIRP) in Spectrum Reponse] on channel 25 bandwidth 20.	True	True
AFC_DUT_SEND_SPECTRUM_INQUIRYREQUEST_2	AFC DUT sends an Available Spectrum Inquiry Request	True	True
AFC_DUT_SPECTRUM_INQUIRYREQUEST_VALID_2	Valid mandatory registration information	True	Valid
AFC_DUT_CONFORM_SPECTRUM_INQUIRYRESPONSE_2	AFC DUT transmit power in the band is less than CEILING[LPI limits (5 dBm/MHz PSD) , SP limits (27.84475637129632 dBm EIRP) in Spectrum Reponse] on channel 33 bandwidth 20.	True	True



WFA AFC DUT Test Harness

AFC DUT connection to AFC Test Harness

Network Element/Proxy managing AFC DUT(s) connection to AFC Test Harness

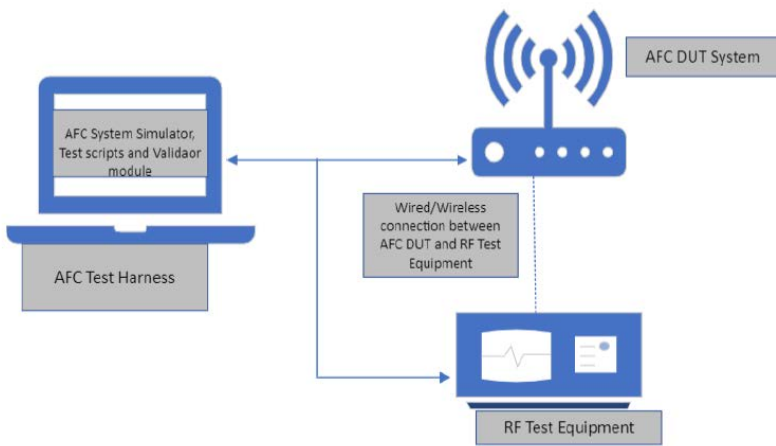


Figure 1. Standard Power Access Point Test Setup

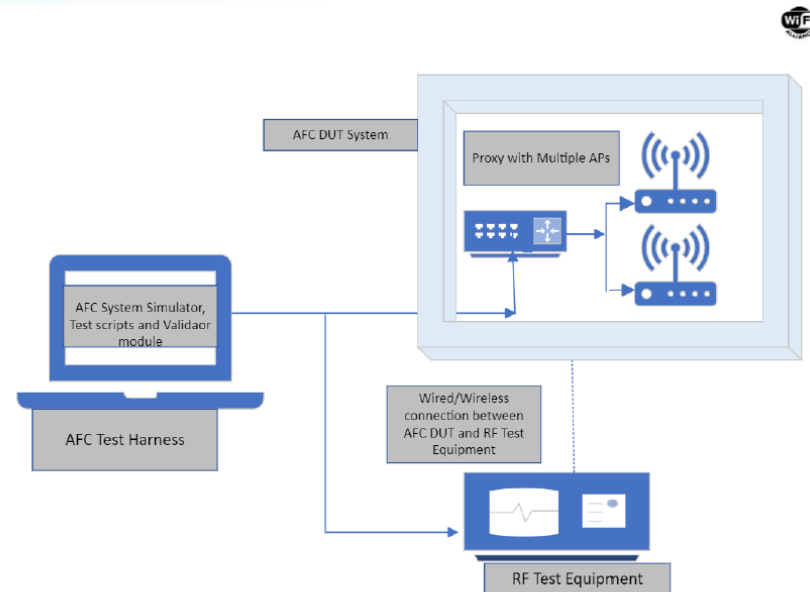


Figure 2. Proxy representing one or more Standard Power Access Points Test Setup



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- When testing using a proxy, a detailed description of the proxy must be submitted with the filing (D05).
 - Describe the communication network and protocol between the AFC DUT and proxy
 - Can be submitted as an Operational Description exhibit and held confidential.
 - Include security statement that no third party can control, authorize or allow a standard access point to radiate emissions in the 6 GHz band any other way than permitted by an AFC-registered session.



WFA AFC DUT Test Harness

- 2 ways for test harness to validate AFC DUT's RF emissions
 - Manual
 - RF measurements are done by test engineer and validated through UI popup messages in the test harness
 - Auto (LitePoint IQxel-MW)
 - If test lab has LitePoint IQxel-MW tester, it can be connected on the same network as the test harness and RF measurements are done automatically using LitePoint RF test equipment
- Both methods require plots to be included test report



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WFA AFC DUT Test Harness

- 5 tests involved in Wi-Fi Alliance AFC DUT Compliance Test Plan:
 - AFCD.RSA: Successful registration and spectrum access request
 - RF plot required in test report
 - AFCD.USA: Unsuccessful registration and spectrum access request
 - AFCD.SAU: Successful spectrum access update
 - RF plot required in test report
 - AFCD.UAU: Unsuccessful spectrum access update
 - AFCD.USV: Unsuccessful server validation



WFA AFC DUT Test Harness

- For AFCD.RSA and AFCD.SAU:
 - Available Spectrum Inquiry Request can be accomplished with channels, or frequency range, or both
 - Channels: AFC test harness returns list of available channels and associated MaxEIRP
 - Frequency Range: AFC test harness available frequency range and MaxPSD
 - If AFC DUT supports both frequency range and channel requests, then test harness will repeat AFCD.RSA and AFCD.SAU to test both cases



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● For AFCD.RSA and AFCD.SAU Cont:

- Test reports **must** include plots showing frequency and power the AFC DUT is transmitting on after test harness sends Available Spectrum Inquiry Response
- Test report must clearly explain EIRP value including any losses or antenna gains included

● AFCD.RSA

- Repeated for all supported channel widths of AFC DUT
- Validates 2 separate spectrum access requests and responses to mimic the AFC DUT 24-hour refresh requirement



WFA AFC DUT Test Harness

- Output files from test harness required for certification
 - Log File (For successful test cases)
 - DUT_Available_Spectrum_Inquiry_Request-Response.txt
 - Will list spectrum requests and responses from the AFC DUT and test harness
 - Tool report
 - Tool-report_(date_timestamp).html
 - Will list test harness test cases and P/F validation results
- Both files located at: /usr/local/bin/WFA-QuickTrack-Tool/Cloud-Reports/



WFA AFC DUT Test Harness

```
DUT_Available_Spectrum_Inquiry_Request-Response.txt...
/usr/local/bin/WFA-Quick...31_Channel_20MHz_10618_1

214 {
215   "availableSpectrumInquiryResponses": [
216     {
217       "response": {
218         "responseCode": 0,
219         "shortDescription": "SUCCESS"
220       },
221       "availableChannelInfo": [
222         {
223           "channelCfi": [
224             1,
225             5,
226             9,
227             13,
228             17,
229             21,
230             25,
231             29,
232             65,
233             69,
234             73,
235             77,
236             81,
237             85,
238             89,
239             93
240           ],
241           "globalOperatingClass": 131,
242           "maxEirp": [
243             34.75851012833461,
244             34.25826512155569,
245             32.751281498071755,
246             21.1936740150865,
247             29.27774765990749,
248             33.25685875873524,
249             26.83782478933715,
250             34.40770243231099,
251             25.458026060596463,
252             26.159410394546263,
253             30.943977449297563,
254             21.709787092052302
```



WFA AFC DUT Test Harness

AFC DUT Compliance Test Report

DUT Information

AFC DUT System	Standard Power AP with Proxy
DUT Vendor Name	FCC
DUT Product Model	FCC

Test Result

FCC Requirements	TestCaseName	Test Result
15.407(k)(1), 15.407(k)(8)(i), 15.407(k)(8)(ii), 15.407(k)(8)(iii), 15.407(l)(ii), 15.407(k)(8)(iv)	CT_AFC_SP_AP_AFCDRSA31_Channel_20MHz_10618_1 (Successful registration and spectrum access request)	PASS

Test Measurements

TestCaseName: CT_AFC_SP_AP_AFCDRSA31_Channel_20MHz_10618_1 (Successful registration and spectrum access request)

TestResult:PASS

Band:6GHz

Measurements Name	Description	Value	Validation Result
AFC_DUT_SP_OPERATION	AFC DUT transmit with standard power in the band before the Spectrum Inquiry Response	false	PASS
AFC_DUT_SEND_SPECTRUM_INQUIRYREQUEST_1	AFC DUT sends an Available Spectrum Inquiry Request	true	PASS
AFC_DUT_SPECTRUM_INQUIRYREQUEST_VALID_1	Valid mandatory registration information	true	PASS
AFC_DUT_CONFORM_SPECTRUM_INQUIRYRESPONSE_1	AFC DUT transmit power in the band is less than CEILING[LPI limits (5 dBm/MHz PSD) , SP limits (26.83782478933715 dBm EIRP) in Spectrum Reponse] on channel 25 bandwidth 20.	true	PASS
AFC_DUT_SEND_SPECTRUM_INQUIRYREQUEST_2	AFC DUT sends an Available Spectrum Inquiry Request	true	PASS
AFC_DUT_SPECTRUM_INQUIRYREQUEST_VALID_2	Valid mandatory registration information	true	PASS
AFC_DUT_CONFORM_SPECTRUM_INQUIRYRESPONSE_2	AFC DUT transmit power in the band is less than CEILING[LPI limits (5 dBm/MHz PSD) , SP limits (27.84475637129632 dBm EIRP) in Spectrum Reponse] on channel 33 bandwidth 20.	true	PASS