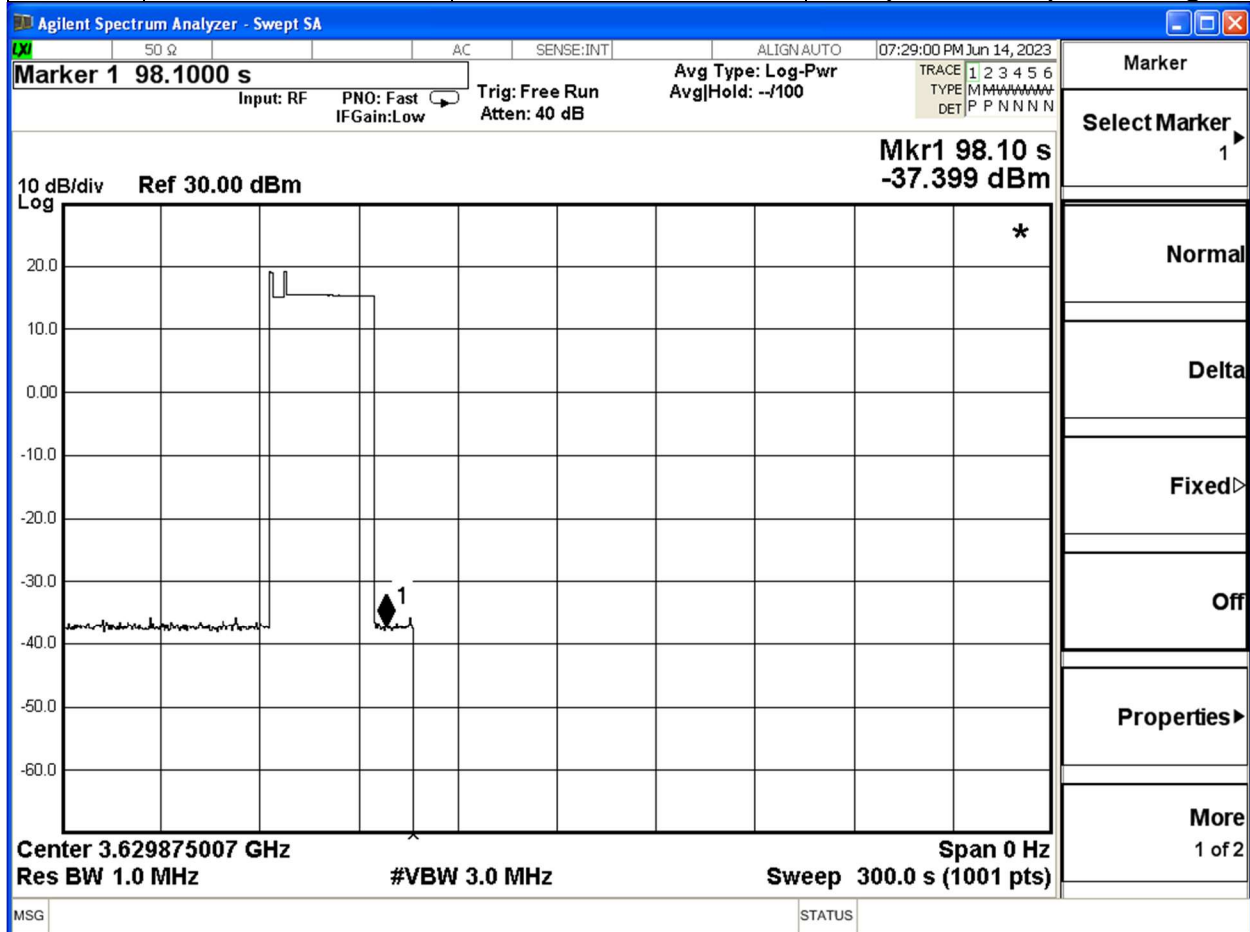


Client	CradlePoint, Inc.	
Product	Cradlepoint Cellular access points, Models A2400 Indoor Unit FCC ID: UXX-S1A227A A2405 Outdoor Unit FCC ID: UXX-S1A228A	
Standard(s)	FCC Part 96 SAS requirements (CBRS Test Plan)	

6.6.4.1.2	WINNF.FT.D.RLQ.2	Domain Proxy Successful Relinquishment	Monitor RF transmission. Ensure: • CBSD stops transmission at any time prior to sending the relinquishmentRequest message.	P
-----------	------------------	--	--	---

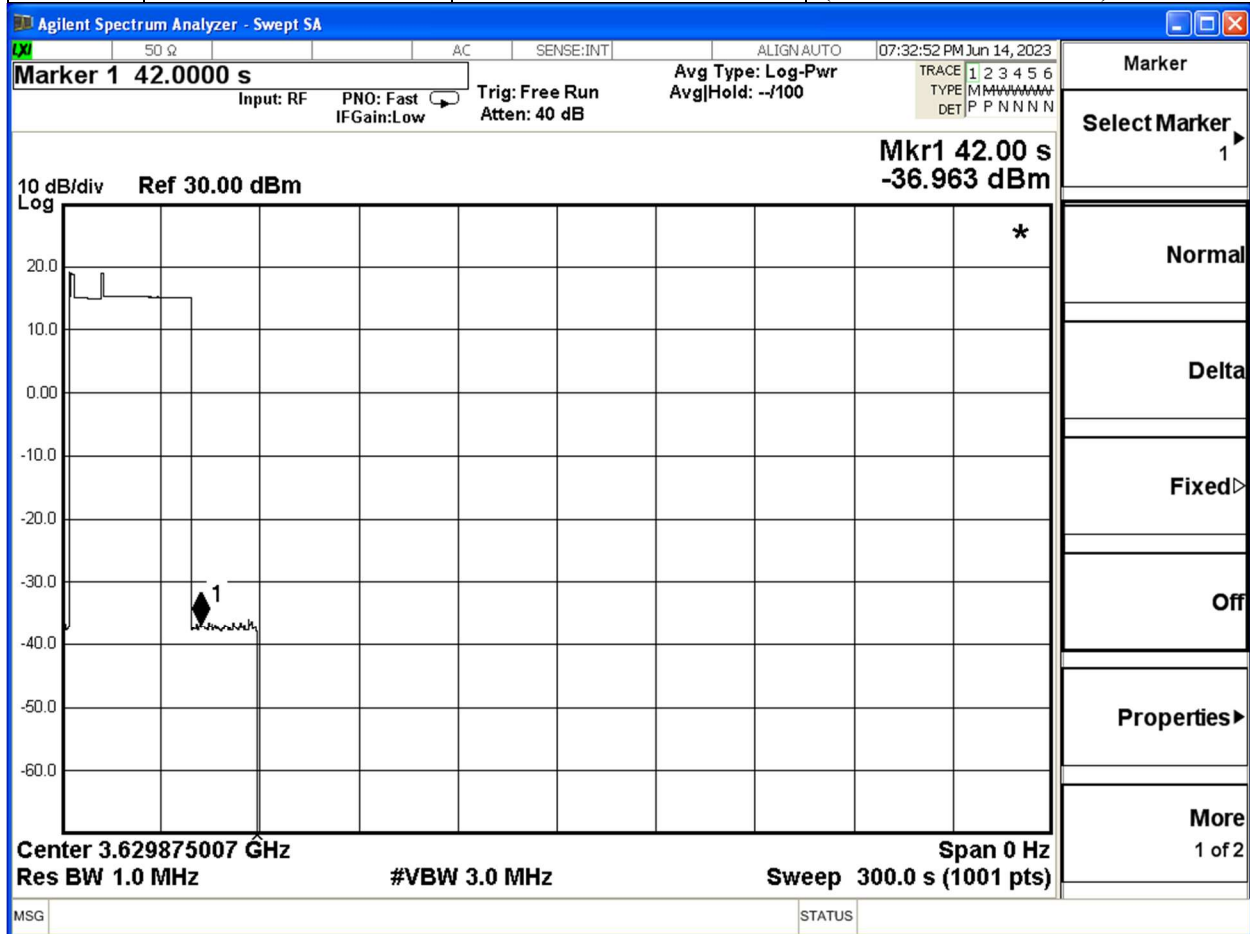


Test Harness logs and timing on graph was verified, the EUT passed the requirement.

Shutdown time taken from Domain Proxy logs, and shutdown confirmed by RF monitoring.

Client	CradlePoint, Inc.	
Product	Cradlepoint Cellular access points, Models A2400 Indoor Unit FCC ID: UXX-S1A227A A2405 Outdoor Unit FCC ID: UXX-S1A228A	
Standard(s)	FCC Part 96 SAS requirements (CBRS Test Plan)	

6.7.4.1.2	WINNF.FT.D.DRG.2	Domain Proxy Successful Deregistration	Monitor RF transmission. Ensure: • CBSD stops transmission at any time prior to sending the relinquishmentRequest message or deregistrationRequest message (whichever is sent first)	P
-----------	------------------	--	--	---



Test Harness logs and timing on graph was verified, the EUT passed the requirement.

Shutdown time taken from Domain Proxy logs, and shutdown confirmed by RF monitoring.

Client	CradlePoint, Inc.	
Product	Cradlepoint Cellular access points, Models A2400 Indoor Unit FCC ID: UXX-S1A227A A2405 Outdoor Unit FCC ID: UXX-S1A228A	
Standard(s)	FCC Part 96 SAS requirements (CBRS Test Plan)	

Confirm that the device transmits at a power level less than or equal to the maximum power level approved by the SAS.

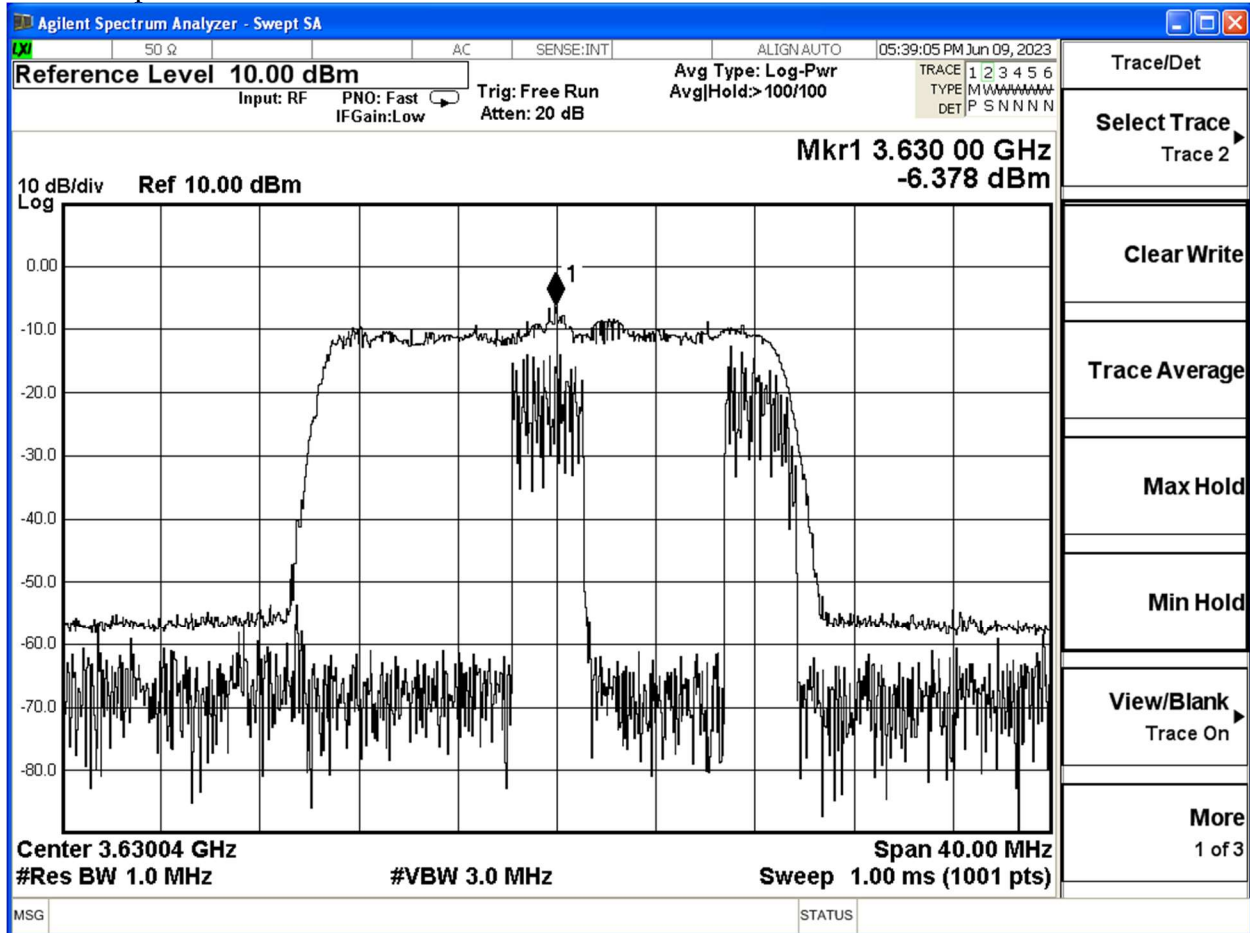
7.1.4.1.1	X	X	WINNF.PT.C.H BT	UUT RF Transmit Power Measurement	Power Spectral Density test case. Assume we use 1 carrier bandwidth (say, 5 or 10 MHz), one frequency (say middle channel in band) for test. Measure at max transmit power, and reduce in steps of 3 dB to minimum declared transmit power.	P
-----------	---	---	-----------------	-----------------------------------	--	---

Test Table

Channel	Freq (MHz)	Conducted Power Density dBm/MHz	Directional gain dBi	Power Density	Max EIRP(dBm)	Pass/Fail
Middle	3630	-6.37	15.82	-0.03	17	Pass
Middle	3630	11.09	15.82	17.12	36	Pass

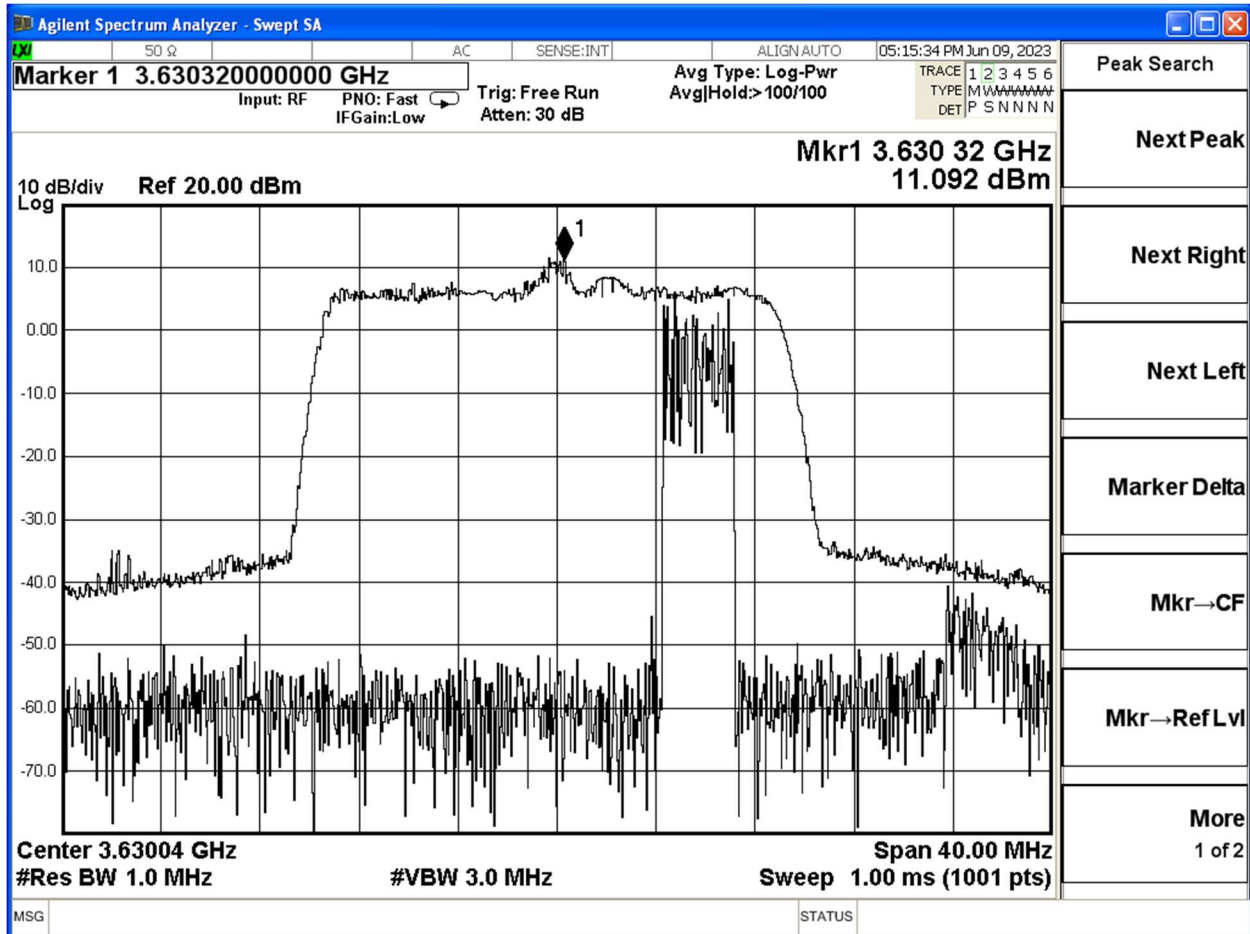
Client	CradlePoint, Inc.	
Product	Cradlepoint Cellular access points, Models A2400 Indoor Unit FCC ID: UXX-S1A227A A2405 Outdoor Unit FCC ID: UXX-S1A228A	
Standard(s)	FCC Part 96 SAS requirements (CBRS Test Plan)	

3630 low power



Client	CradlePoint, Inc.	
Product	Cradlepoint Cellular access points, Models A2400 Indoor Unit FCC ID: UXX-S1A227A A2405 Outdoor Unit FCC ID: UXX-S1A228A	
Standard(s)	FCC Part 96 SAS requirements (CBRS Test Plan)	

3630-high power



Client	CradlePoint, Inc.	
Product	Cradlepoint Cellular access points, Models A2400 Indoor Unit FCC ID: UXX-S1A227A A2405 Outdoor Unit FCC ID: UXX-S1A228A	
Standard(s)	FCC Part 96 SAS requirements (CBRS Test Plan)	

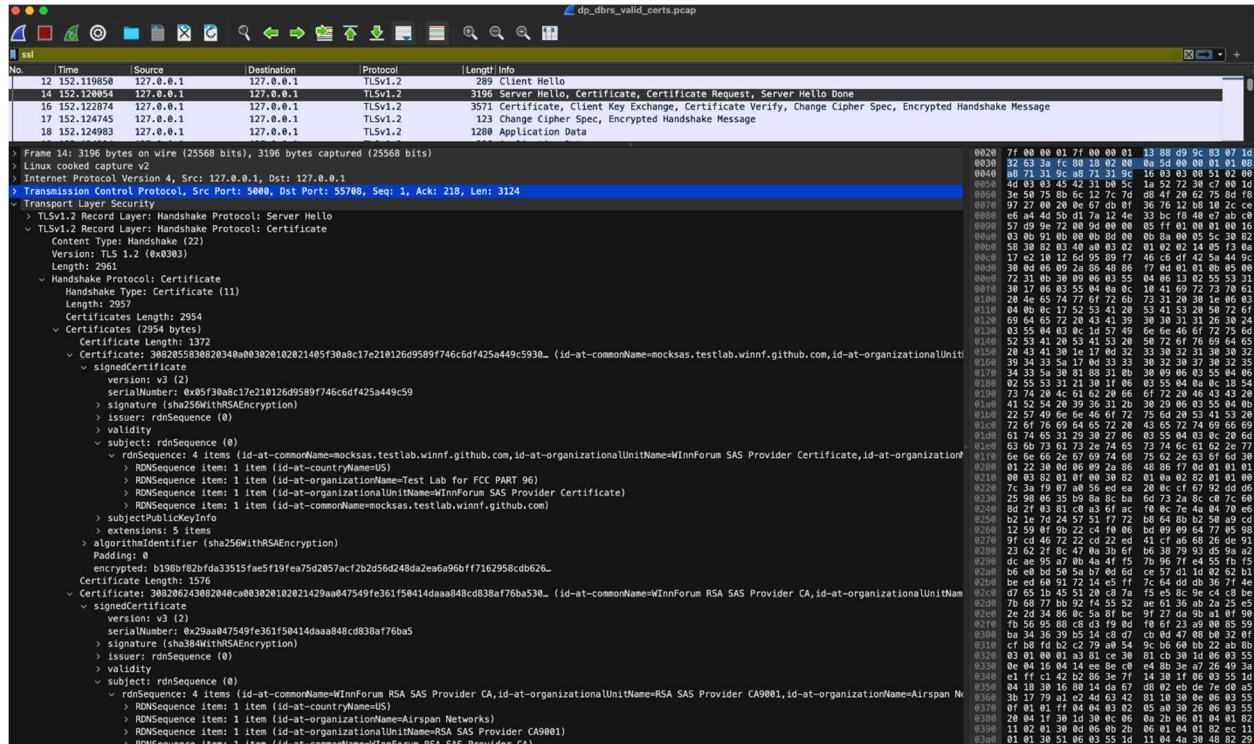
DOT CBRS Radio: WINNF / Security Test Case Analysis

WINNF.FT.C.SCS.1

Successful TLS connection between UUT and SAS Test Harness

PCAP Capture

Server Cert



The image shows a Wireshark packet capture of a TLS handshake. The selected packet is a TLSv1.2 Record Layer: Handshake Protocol: Certificate. The details pane shows the certificate structure, including the serial number, signature, and subject information.

```

No. | Time | Source | Destination | Protocol | Length | Info
---|---|---|---|---|---|---
12 | 152.119850 | 127.0.0.1 | 127.0.0.1 | TLSv1.2 | 289 | Client Hello
14 | 152.120354 | 127.0.0.1 | 127.0.0.1 | TLSv1.2 | 3190 | Server Hello, Certificate, Certificate Request, Server Hello Done
16 | 152.122874 | 127.0.0.1 | 127.0.0.1 | TLSv1.2 | 3571 | Certificate, Client Key Exchange, Certificate Verify, Change Cipher Spec, Encrypted Handshake Message
17 | 152.124745 | 127.0.0.1 | 127.0.0.1 | TLSv1.2 | 123 | Change Cipher Spec, Encrypted Handshake Message
18 | 152.124983 | 127.0.0.1 | 127.0.0.1 | TLSv1.2 | 1289 | Application Data

> Frame 14: 3196 bytes on wire (25568 bits), 3196 bytes captured (25568 bits) on 0
> Linux cooked capture v2
> Internet Protocol Version 4, Src: 127.0.0.1, Dst: 127.0.0.1
> Transmission Control Protocol, Src Port: 5000, Dst Port: 55708, Seq: 1, Ack: 218, Len: 3124
> Transport Layer Security
  > TLSv1.2 Record Layer: Handshake Protocol: Server Hello
  > TLSv1.2 Record Layer: Handshake Protocol: Certificate
    Content Type: Handshake (22)
    Version: TLS 1.2 (0x0303)
    Length: 2957
    > Handshake Protocol: Certificate
      Handshake Type: Certificate (11)
      Length: 2954
      > Certificates (2954 bytes)
        Certificate Length: 1372
        > Certificate: 308205830820340a003020102021405f30a8c17e210126d9589f746c6df425a449c5930_ (id-at-commonName=mocksas.testlab.winnf.github.com,id-at-organizationalUnitName=WinNF, id-at-countryName=US)
          version: v3 (2)
          serialNumber: 0x05f30a8c17e210126d9589f746c6df425a449c59
          signature (sha256WithRSAEncryption)
          issuer: rdnSequence (0)
          validity
          > subject: rdnSequence (0)
            > rdnSequence: 4 items (id-at-commonName=mocksas.testlab.winnf.github.com,id-at-organizationalUnitName=WinNF, id-at-organizationalUnitName=WinNF, id-at-organizationalUnitName=WinNF, id-at-organizationalUnitName=WinNF)
              > RDNSequence item: 1 item (id-at-countryName=US)
              > RDNSequence item: 1 item (id-at-organizationName=Test Lab for FCC PART 96)
              > RDNSequence item: 1 item (id-at-organizationalUnitName=WinNF, id-at-organizationalUnitName=WinNF)
              > RDNSequence item: 1 item (id-at-organizationalUnitName=WinNF, id-at-organizationalUnitName=WinNF)
            > subjectPublicKeyInfo
              extensions: 5 items
              > algorithmIdentifier (sha256WithRSAEncryption)
              padding: 0
              encrypted: b198b782bda3351fae5f19fea7542857acf2b2d56d248da2eafa96bf7162958cdeb62_
              Certificate Length: 1576
          > Certificate: 308206243082040ca003020102021429aa047549fe361f50414daaa848cd838af76ba530_ (id-at-commonName=WinNF, id-at-organizationalUnitName=WinNF, id-at-organizationalUnitName=WinNF, id-at-organizationalUnitName=WinNF, id-at-organizationalUnitName=WinNF)
            version: v3 (2)
            serialNumber: 0x29aa047549fe361f50414daaa848cd838af76ba5
            signature (sha384WithRSAEncryption)
            issuer: rdnSequence (0)
            validity
            > subject: rdnSequence (0)
              > rdnSequence: 4 items (id-at-commonName=WinNF, id-at-organizationalUnitName=WinNF, id-at-organizationalUnitName=WinNF, id-at-organizationalUnitName=WinNF, id-at-organizationalUnitName=WinNF)
                > RDNSequence item: 1 item (id-at-countryName=US)
                > RDNSequence item: 1 item (id-at-organizationName=WinNF, id-at-organizationalUnitName=WinNF)
                > RDNSequence item: 1 item (id-at-organizationalUnitName=WinNF, id-at-organizationalUnitName=WinNF)
                > RDNSequence item: 1 item (id-at-organizationalUnitName=WinNF, id-at-organizationalUnitName=WinNF)
            > subjectPublicKeyInfo
              extensions: 5 items
              > algorithmIdentifier (sha384WithRSAEncryption)
              padding: 0
              encrypted: b198b782bda3351fae5f19fea7542857acf2b2d56d248da2eafa96bf7162958cdeb62_
              Certificate Length: 1576

```



Client	CradlePoint, Inc.	
Product	Cradlepoint Cellular access points, Models A2400 Indoor Unit FCC ID: UXX-S1A227A A2405 Outdoor Unit FCC ID: UXX-S1A228A	
Standard(s)	FCC Part 96 SAS requirements (CBRS Test Plan)	

```
{ "lvl": "DEBUG", "ts": "2023-06-14T17:39:34.531Z", "at": "dp/aggregator/aggregator_generics.go:131", "msg": "Aggregated 1 registration requests" }
{ "lvl": "DEBUG", "ts": "2023-06-14T17:39:34.533Z", "at": "helpers/tls-helper/peer_verifier.go:45", "msg": "No OCSP servers provided", "certSubject": "mocksas.testlab.winnf.github.com" }
{ "lvl": "INFO", "ts": "2023-06-14T17:39:34.62Z", "at": "dp/aggregator/aggregator_generics.go:240", "msg": "SAS http request succeeded", "httpStatus": 200, "httpMethod": "POST", "duration": "87.872327ms", "url": "https://mocksas.testharness.cbsd.winnf.github.com:5000/v1.2/registration" }
{ "lvl": "DEBUG", "ts": "2023-06-14T17:39:34.62Z", "at": "dp/cbsd-mgr/interface.go:185", "msg": "response received", "response": { "cbsdId": "UXX-S1A228AMock-SAS2209DPT000261", "response": { "responseCode": 0 } } }
{ "lvl": "INFO", "ts": "2023-06-14T17:39:34.62Z", "at": "dp/kpi-mgr/kpi_mgr.go:109", "msg": "KPI metric received", "serialNumber": "2209DPT000261", "metricKey": "ap_sas_registration_success" }
```

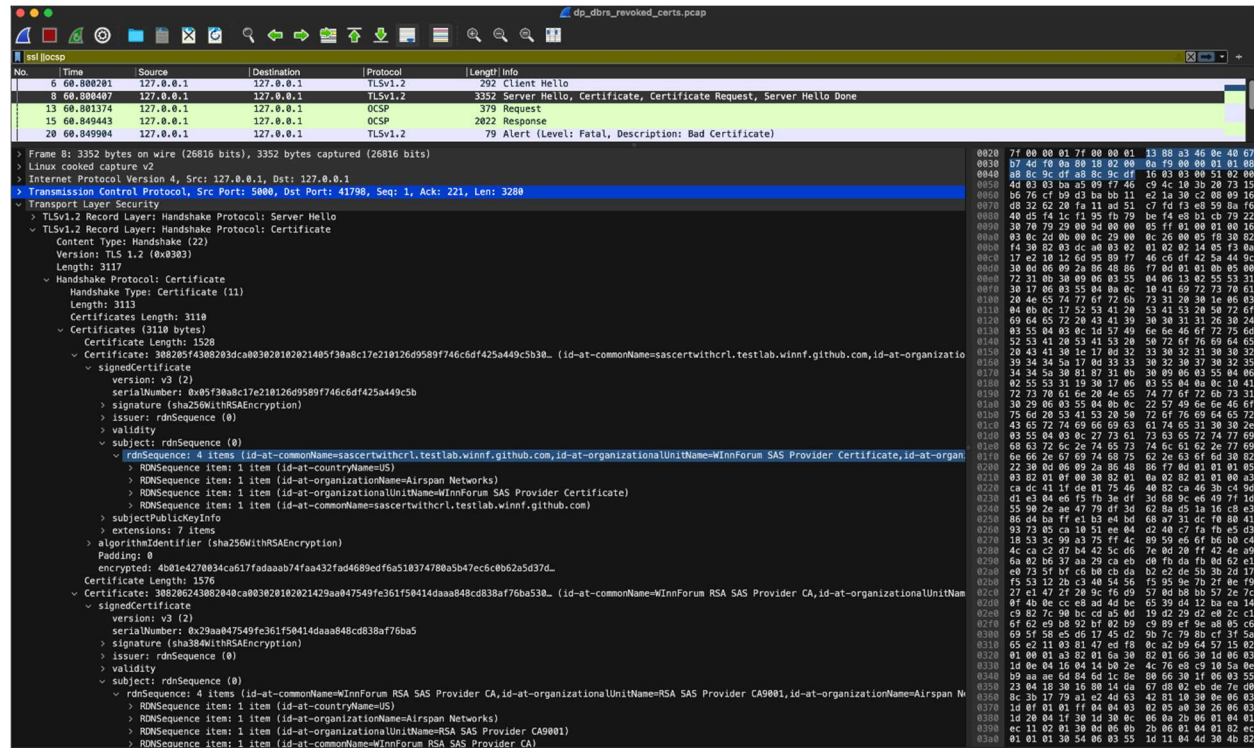
Client	CradlePoint, Inc.	
Product	Cradlepoint Cellular access points, Models A2400 Indoor Unit FCC ID: UXX-S1A227A A2405 Outdoor Unit FCC ID: UXX-S1A228A	
Standard(s)	FCC Part 96 SAS requirements (CBRS Test Plan)	

WINNF.FT.C.SCS.2

TLS failure due to revoked certificate

PCAP Capture

Server Cert

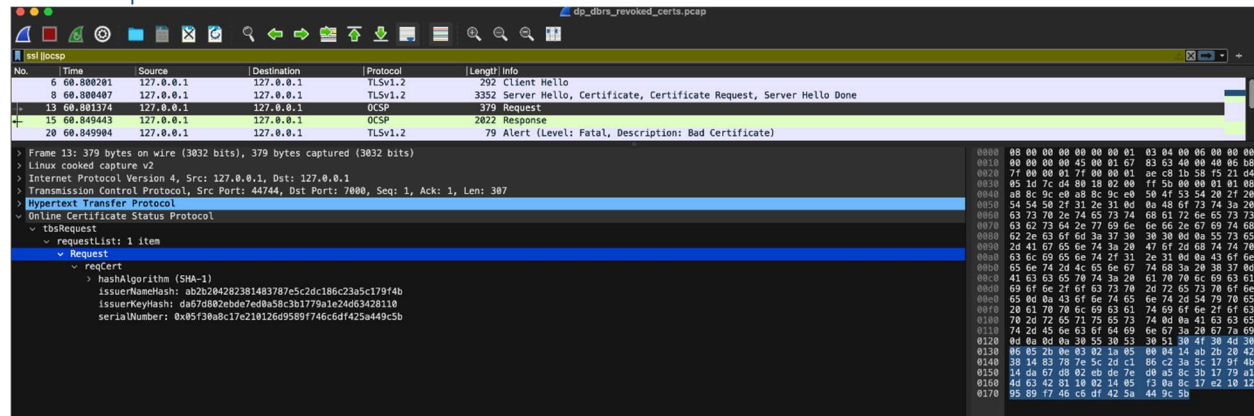


The image shows a Wireshark packet capture of a TLS handshake failure. The packet list on the left shows a '79 Alert (Level: Fatal, Description: Bad Certificate)' from 127.0.0.1 to 127.0.0.1. The packet details pane on the right shows the 'Alert' structure with the following fields:

- Alert Type: 2 (Bad Certificate)
- Alert Description: Bad Certificate

The packet bytes pane on the right shows the raw data of the alert message.

OCSF Request



The image shows a Wireshark packet capture of an OCSF request. The packet list on the left shows a '79 Alert (Level: Fatal, Description: Bad Certificate)' from 127.0.0.1 to 127.0.0.1. The packet details pane on the right shows the 'Alert' structure with the following fields:

- Alert Type: 2 (Bad Certificate)
- Alert Description: Bad Certificate

The packet bytes pane on the right shows the raw data of the alert message.



Client	CradlePoint, Inc.	
Product	Cradlepoint Cellular access points, Models A2400 Indoor Unit FCC ID: UXX-S1A227A A2405 Outdoor Unit FCC ID: UXX-S1A228A	
Standard(s)	FCC Part 96 SAS requirements (CBRS Test Plan)	

```
{ "lvl": "INFO", "ts": "2023-06-14T20:15:32.001Z", "at": "helpers/tls-
helper/peer_verifier.go:79", "msg": "Checking certificate status with OCSP
server", "ocspServer": "http://ocsp.testharness.cbsd.winnf.github.com:7000/" }
{ "lvl": "WARN", "ts": "2023-06-14T20:15:32.05Z", "at": "helpers/tls-
helper/peer_verifier.go:21", "msg": "Certificate status is
Revoked", "certSubject": "sascertwithcrl.testlab.winnf.github.com", "issuerCertSubject":
"WInnForum RSA SAS Provider
CA", "serialNumber": "33964953731498854550067417388306975434247281755" }
```



Client	CradlePoint, Inc.	
Product	Cradlepoint Cellular access points, Models A2400 Indoor Unit FCC ID: UXX-S1A227A A2405 Outdoor Unit FCC ID: UXX-S1A228A	
Standard(s)	FCC Part 96 SAS requirements (CBRS Test Plan)	

```

eu5wj_ZLuEneKCUNZcoXCctCexvtRburbUlWmFB6S_z5k-3bQKDQy2DHj0-0wZXepececIM4P-
6XZ4UPp9UpjgBePzVMqz2g-
CFv6U_niSuB1hFCCQfQ48_Ly7wTEImeohniJ02lMYNss5VNvUPkN5p_LwbAE7Vwfw"}}}
{"lvl":"DEBUG","ts":"2023-06-
14T19:54:12.973Z","at":"dp/aggregator/aggregator_generics.go:131","msg":"Aggregated 1
registration requests"}
{"lvl":"INFO","ts":"2023-06-14T19:54:12.974Z","at":"dp/kpi-
mgr/kpi_mgr.go:109","msg":"KPI metric
received","serialNumber":"2209DPT000350","metricKey":"ap_sas_derregistration_success"
}
{"lvl":"ERROR","ts":"2023-06-
14T19:54:12.974Z","at":"dp/aggregator/aggregator_generics.go:210","msg":"Unable to
perform http request","error":"Post
\"https://mocksas.testharness.cbsd.winnf.github.com:5000/v1.2/registration\": x509:
certificate has expired or is not yet valid: current time 2023-06-14T19:54:12Z is
after 2023-02-11T02:59:44Z"}
{"lvl":"ERROR","ts":"2023-06-14T19:54:12.974Z","at":"dp/cbsd-
mgr/interface.go:181","msg":"Error received from the channel","error":"Post
\"https://mocksas.testharness.cbsd.winnf.github.com:5000/v1.2/registration\": x509:
certificate has expired or is not yet valid: current time 2023-06-14T19:54:12Z is
after 2023-02-11T02:59:44Z"}

```



Client	CradlePoint, Inc.	
Product	Cradlepoint Cellular access points, Models A2400 Indoor Unit FCC ID: UXX-S1A227A A2405 Outdoor Unit FCC ID: UXX-S1A228A	
Standard(s)	FCC Part 96 SAS requirements (CBRS Test Plan)	

```

eu5wj_ZLuEneKCUNZcoXCctCexvtRburbUlwmfB6S_z5k-3bQKDQy2DHj0-0wZXepececIM4P-
6XZ4UPp9UpjgBePzVMqz2g-
CFv6U_niSuB1hFCCQfQ48_Ly7wTEImeohniJ02lMYNss5VNvUPkN5p_LwbAE7Vwfw"}}}
{"lvl":"DEBUG","ts":"2023-06-
14T20:02:20.395Z","at":"dp/aggregator/aggregator_generics.go:131","msg":"Aggregated 1
registration requests"}
{"lvl":"INFO","ts":"2023-06-14T20:02:20.395Z","at":"dp/kpi-
mgr/kpi_mgr.go:109","msg":"KPI metric
received","serialNumber":"2209DPT000350","metricKey":"ap_sas_derregistration_success"
}
{"req":"OUT","ts":"2023-06-
14T20:02:20.395Z","dur":"1.370908ms","status":500,"trace_id":"","method":"POST","clie
nt":"192.168.50.82","path":"/v1.2/registration"}
{"lvl":"ERROR","ts":"2023-06-
14T20:02:20.395Z","at":"dp/aggregator/aggregator_generics.go:210","msg":"Unable to
perform http request","error":"Post
\"https://mocksas.testharness.cbsd.winnf.github.com:5000/v1.2/registration\": x509:
certificate signed by unknown authority"}
{"lvl":"ERROR","ts":"2023-06-14T20:02:20.395Z","at":"dp/cbsd-
mgr/interface.go:181","msg":"Error received from the channel","error":"Post
\"https://mocksas.testharness.cbsd.winnf.github.com:5000/v1.2/registration\": x509:
certificate signed by unknown authority"}

```



Client	CradlePoint, Inc.	
Product	Cradlepoint Cellular access points, Models A2400 Indoor Unit FCC ID: UXX-S1A227A A2405 Outdoor Unit FCC ID: UXX-S1A228A	
Standard(s)	FCC Part 96 SAS requirements (CBRS Test Plan)	

```

6XZ4UPp9UpjgBePzVMqz2g-
CFv6U_niSuB1hFCCQfQ48_Ly7wTEImeohniJ02lMYNss5VNvUPkN5p_LwbAE7Vwfw"}}}
{"lvl":"DEBUG","ts":"2023-06-
14T19:57:45.986Z","at":"dp/aggregator/aggregator_generics.go:131","msg":"Aggregated 1
registration requests"}
{"lvl":"INFO","ts":"2023-06-14T19:57:45.987Z","at":"dp/kpi-
mgr/kpi_mgr.go:109","msg":"KPI metric
received","serialNumber":"2209DPT000350","metricKey":"ap_sas_derregistration_success"
}
{"lvl":"ERROR","ts":"2023-06-
14T19:57:45.987Z","at":"dp/aggregator/aggregator_generics.go:210","msg":"Unable to
perform http request","error":"Post
\"https://mocksas.testharness.cbsd.winnf.github.com:5000/v1.2/registration\": x509:
certificate signed by unknown authority (possibly because of \"crypto/rsa:
verification error\" while trying to verify candidate authority certificate
\"WInnForum RSA SAS Provider CA\")"}
{"lvl":"ERROR","ts":"2023-06-14T19:57:45.987Z","at":"dp/cbsd-
mgr/interface.go:181","msg":"Error received from the channel","error":"Post
\"https://mocksas.testharness.cbsd.winnf.github.com:5000/v1.2/registration\": x509:
certificate signed by unknown authority (possibly because of \"crypto/rsa:
verification error\" while trying to verify candidate authority certificate
\"WInnForum RSA SAS Provider CA\")"}
{"req":"OUT","ts":"2023-06-
14T19:57:45.987Z","dur":"1.83542ms","status":500,"trace_id":"","method":"POST","clien
t":"192.168.50.82","path":"/v1.2/registration"}

```

Test Equipment

Instrument	Manufacturer	Type No.	Serial No	Calibration Period (months)	Calibration Due
Signal Analyzer	Agilent	MXA	SSG013930	24 months	2024-04-26

Client	CradlePoint, Inc.	
Product	Cradlepoint Cellular access points, Models A2400 Indoor Unit FCC ID: UXX-S1A227A A2405 Outdoor Unit FCC ID: UXX-S1A228A	
Standard(s)	FCC Part 96 SAS requirements (CBRS Test Plan)	

Appendix A – EUT & Client Provided Details

Client	CradlePoint, Inc.	
Product	Cradlepoint Cellular access points, Models A2400 Indoor Unit FCC ID: UXX-S1A227A A2405 Outdoor Unit FCC ID: UXX-S1A228A	
Standard(s)	FCC Part 96 SAS requirements (CBRS Test Plan)	

General EUT Description

Manufacturer	Cradlepoint, Inc
Address	1100W. Idaho Street Boise, Idaho 83702-5389 USA
Product Name	A2400/A2405
Product Number(s)	S1A227A/S1A228A
Serial Number(s)	2210CW5000134/2209DPT000261
Software Version	DG3933v7@2305312023
Hardware Version	2.0/2.0
Test Specification/Issue/Date	FCC CFR 47 Part 96: 2022

Client	CradlePoint, Inc.	
Product	Cradlepoint Cellular access points, Models A2400 Indoor Unit FCC ID: UXX-S1A227A A2405 Outdoor Unit FCC ID: UXX-S1A228A	
Standard(s)	FCC Part 96 SAS requirements (CBRS Test Plan)	

Technical Description

The Equipment Under Test (EUT) is shown in the photograph below. A full technical description can be found in the Manufacturer's documentation.



Indoor Unit (IDU) model A2400

Client	CradlePoint, Inc.	
Product	Cradlepoint Cellular access points, Models A2400 Indoor Unit FCC ID: UXX-S1A227A A2405 Outdoor Unit FCC ID: UXX-S1A228A	
Standard(s)	FCC Part 96 SAS requirements (CBRS Test Plan)	



Outdoor Unit Model A2405

EUT Configuration

Please see Appendix B for close up pictures of the unit as configured during testing
Cables and earthing when applicable were connected as per manufacturer's specification.

Client	CradlePoint, Inc.	
Product	Cradlepoint Cellular access points, Models A2400 Indoor Unit FCC ID: UXX-S1A227A A2405 Outdoor Unit FCC ID: UXX-S1A228A	
Standard(s)	FCC Part 96 SAS requirements (CBRS Test Plan)	

Appendix B – EUT, Peripherals, and Test Setup Photos

PERIPHERALS

“Shuttle” computer



Client	CradlePoint, Inc.	
Product	Cradlepoint Cellular access points, Models A2400 Indoor Unit FCC ID: UXX-S1A227A A2405 Outdoor Unit FCC ID: UXX-S1A228A	
Standard(s)	FCC Part 96 SAS requirements (CBRS Test Plan)	

Cradlepoint ES3000 Router



Client	CradlePoint, Inc.	
Product	Cradlepoint Cellular access points, Models A2400 Indoor Unit FCC ID: UXX-S1A227A A2405 Outdoor Unit FCC ID: UXX-S1A228A	
Standard(s)	FCC Part 96 SAS requirements (CBRS Test Plan)	

Test setup

