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RTP payload format for Enhanced Variable Rate Narrowband-Wideband Codec  
(EVRC-NW)  
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## Abstract

This document specifies real-time transport protocol (RTP) payload formats to be used for the Enhanced Variable Rate Narrowband-Wideband Codec (EVRC-NW). Three media type registrations are included for EVRC-NW RTP payload formats. In addition, a file format is specified for transport of EVRC-NW speech data in storage mode applications such as e-mail.

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## Table of Contents

|                        |                                                          |                    |
|------------------------|----------------------------------------------------------|--------------------|
| <a href="#">1.</a>     | Introduction . . . . .                                   | <a href="#">3</a>  |
| <a href="#">2.</a>     | Conventions . . . . .                                    | <a href="#">4</a>  |
| <a href="#">3.</a>     | Background . . . . .                                     | <a href="#">5</a>  |
| <a href="#">4.</a>     | EVRN-NW codec . . . . .                                  | <a href="#">6</a>  |
| <a href="#">5.</a>     | RTP header usage . . . . .                               | <a href="#">7</a>  |
| <a href="#">6.</a>     | Payload format . . . . .                                 | <a href="#">8</a>  |
| <a href="#">7.</a>     | Congestion Control Considerations . . . . .              | <a href="#">9</a>  |
| <a href="#">8.</a>     | Storage format for the EVRN-NW Codec . . . . .           | <a href="#">10</a> |
| <a href="#">9.</a>     | IANA considerations . . . . .                            | <a href="#">11</a> |
| <a href="#">9.1.</a>   | Media Type Registrations . . . . .                       | <a href="#">11</a> |
| <a href="#">9.1.1.</a> | Registration of Media Type audio/EVRNWN . . . . .        | <a href="#">11</a> |
| <a href="#">9.1.2.</a> | Registration of Media Type audio/EVRNWN0 . . . . .       | <a href="#">13</a> |
| <a href="#">9.1.3.</a> | Registration of Media Type audio/EVRNWN1 . . . . .       | <a href="#">14</a> |
| <a href="#">10.</a>    | SDP mode attributes for EVRN-NW . . . . .                | <a href="#">17</a> |
| <a href="#">11.</a>    | Mapping EVRN-NW media type parameters into SDP . . . . . | <a href="#">18</a> |
| <a href="#">12.</a>    | Offer-Answer Model Considerations for EVRN-NW . . . . .  | <a href="#">19</a> |
| <a href="#">13.</a>    | Declarative SDP Considerations . . . . .                 | <a href="#">21</a> |
| <a href="#">14.</a>    | Examples . . . . .                                       | <a href="#">22</a> |
| <a href="#">15.</a>    | Security Considerations . . . . .                        | <a href="#">25</a> |
| <a href="#">16.</a>    | References . . . . .                                     | <a href="#">26</a> |
| <a href="#">16.1.</a>  | Normative References . . . . .                           | <a href="#">26</a> |
| <a href="#">16.2.</a>  | Informative References . . . . .                         | <a href="#">26</a> |
|                        | Author's Address . . . . .                               | <a href="#">28</a> |



## **1. Introduction**

This document specifies the payload formats for packetization of EVRC-NW encoded speech signals into the real-time transport protocol (RTP). It defines support for the header-free, interleaved/bundled and compact bundle packet formats for the EVRC-NW codec as well as discontinuous transmission (DTX) support for EVRC-NW encoded speech transported via RTP. The EVRC-NW codec offers better speech quality than the EVRC and EVRC-B codecs and better capacity than EVRC-WB codec. EVRC-NW belongs to the EVRC family of codecs.

## **2. Conventions**

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in [RFC 2119](#) [[1](#)].

### **3. Background**

EVRC-NW is an extension of both the EVRC-B [2] and EVRC-WB [3] speech codecs developed in 3GPP2 with support for discontinuous transmission (DTX). It provides enhanced voice quality and high spectral efficiency.

The EVRC-NW codec operates on 20 ms frames, and the default sampling rate is 16 kHz. Input and output at 8 kHz sampling rate is also supported. The EVRC-NW codec can operate in eight modes (0 to 7) defined in [4]. EVRC-NW modes 0, 1 and 7 are interoperable with EVRC-WB. EVRC-NW modes 1 to 7 are interoperable with EVRC-B. EVRC-NW modes 0 to 6 use full rate, 1/2 rate, 1/4 rate and 1/8 rate frames. EVRC-NW mode 7 uses only 1/2 rate and 1/8 rate frames. Mode change results in codec output bit-rate change but does not cause any decoding problems at the receiver. For successful decoding, the decoder does not need to know the encoder's current mode of operation. EVRC-NW provides a standardized solution for packetized voice applications that allow transitions between enhanced quality and increased capacity. The most important service addressed is IP telephony. Target devices can be IP phones or VoIP handsets, media gateways, voice messaging servers, etc.



#### 4. EVRC-NW codec

The EVRC-NW codec operates on 20 ms frames. It produces output frames of one of the four different sizes: 171 bits (Rate 1), 80 bits (Rate 1/2), 40 bits (Rate 1/4) or 16 bits (Rate 1/8 or Rate 1/8 Non-Critical). In addition, there are two zero bit codec frame types: blank (null) frames and erasure frames. For IP based traffic, the Rate 1/8 Non-Critical type frame shall be suppressed and denoted as blank (null) frame of 0 bit. The default sampling rate is 16 kHz. Input and output at 8 kHz sampling rate is also supported.

The frame type values and sizes of the associated codec data frames are listed in the table below:

| Value | Rate        | Total codec data frame size in bytes (and in bits) |                                       |
|-------|-------------|----------------------------------------------------|---------------------------------------|
| ----- |             |                                                    |                                       |
| 0     | Blank(Null) | 0                                                  | (0 bit)                               |
| 1     | 1/8         | 2                                                  | (16 bits)                             |
| 2     | 1/4         | 5                                                  | (40 bits)                             |
| 3     | 1/2         | 10                                                 | (80 bits)                             |
| 4     | 1           | 22                                                 | (171 bits; 5 bits padded at the end)  |
| 5     | Erasure     | 0                                                  | (SHOULD NOT be transmitted by sender) |



## 5. RTP header usage

The format of the RTP header is specified in [RFC 3550](#) [5]. The EVRC-NW payload formats ([Section 6](#)) use the fields of the RTP header in a manner consistent with [RFC 3550](#) [5].

EVRN-NW has also the capability to operate with 8 kHz sampled input/output signals. The decoder does not require a priori knowledge about the sampling rate of the original signal at the input of the encoder. The decoder output can be at 8kHz or 16kHz regardless of the sampling rate used at the encoder. Therefore, depending on the implementation and the electroacoustic audio capabilities of the devices, the input of the encoder and/or the output of the decoder can be configured at 8 kHz; however, a 16 kHz RTP clock rate MUST always be used. The RTP timestamp is increased by 320 for each 20 milliseconds.

The RTP header marker bit (M) SHALL be set to 1 if the first frame carried in the packet contains a speech frame which is the first in a talkspurt. For all other packets the marker bit SHALL be set to zero (M=0).



## **6. Payload format**

Three RTP packet formats are supported for the EVRC-NW codec - the interleaved/bundled packet format, the header-free packet format and the compact bundled packet format. For all these formats, the operational details and capabilities, such as ToC, interleaving, DTX, and bundling, of EVRC-NW are exactly the same as those of EVRC-B and EVRC-WB, as defined in [2] and [3], except that the mode change request field in the ToC MUST be interpreted according to the definition of the RATE\_REDUC parameter as defined in EVRC-NW [4]. The media type audio/EVRCNW maps to the interleaved/bundled packet format, audio/EVRCNW0 maps to the header-free packet format and audio/EVRCNW1 maps to the compact bundled packet format.



## **7. Congestion Control Considerations**

Congestion control for RTP SHALL be used in accordance with [RFC 3550](#) [5], and with any applicable RTP profile; e.g., [RFC 3551](#) [6].

Due to the header overhead, the number of frames encapsulated in each RTP packet influences the overall bandwidth of the RTP stream. Packing more frames in each RTP packet can reduce the number of packets sent and hence the header overhead, at the expense of increased delay and reduced error robustness.

## **8. Storage format for the EVRC-NW Codec**

The storage format is used for storing EVRC-NW encoded speech frames, e.g., as a file or e-mail attachment.

The file begins with a magic number to identify the vocoder that is used. The magic number for EVRC-NW corresponds to the ASCII character string "#!EVRCNW\n", i.e., "0x23 0x21 0x45 0x56 0x52 0x43 0x4E 0x57 0x0A".

The codec data frames are stored in consecutive order, with a single ToC entry field, extended to one octet, prefixing each codec data frame. The ToC field is extended to one octet by setting the four most significant bits of the octet to zero. For example, a ToC value of 4 (a full-rate frame) is stored as 0x04. See [Section 4](#) for the mapping from frame type to ToC value.

Speech frames lost in transmission and non-received frames MUST be stored as erasure frames (ToC value of 5) to maintain synchronization with the original media.



## **9. IANA considerations**

This document introduces a new EVRC-NW 'audio' media subtype.

### **9.1. Media Type Registrations**

Following the guidelines in [RFC 4855](#) [7] and [RFC 4288](#) [8], this section registers new 'audio' media subtypes for EVRC-NW.

#### **9.1.1. Registration of Media Type audio/EVRN**

Type name: audio

Subtype names: EVRNCN

Required parameters: None

Optional parameters:

These parameters apply to RTP transfer only.

mode-set-recv: A subset of EVRC-NW modes. Possible values are a comma separated list of modes from the set {0,1,2,3,4,5,6,7} (see Table 2.6.1.2-4 in 3GPP2 C.S0014-D). A decoder can use this attribute to inform an encoder of its preference to operate in a specified subset of modes. Absence of this parameter signals the mode set {0,1,2,3,4,5,6,7}.

sendmode: A mode of the EVRC-NW codec. An encoder can use this to signal its current mode of operation. Possible values are 0,1,2,3,4,5,6,7 (see Table 2.6.1.2-4 in 3GPP2 C.S0014-D). Absence of this parameter signals mode 0.

ptime: see [RFC 4566](#) [9].

maxptime: see [RFC 4566](#).

maxinterleave: Maximum number for interleaving length (field LLL in the Interleaving Octet)[0..7]. The interleaving lengths used in the entire session MUST NOT exceed this maximum value. If not signaled, the maxinterleave length MUST be 5.

silencesupp: see [Section 6.1 in RFC 4788](#).

dtxmax: see [Section 6.1 in RFC 4788](#).

dtxmin: see [Section 6.1 in RFC 4788](#).



hangover: see [Section 6.1 in RFC 4788](#).

Encoding considerations:

This media type is framed binary data (see [RFC 4288, Section 4.8](#)) and is defined for transfer of EVRC-NW encoded data via RTP using the Interleaved/Bundled packet format specified in [RFC 3558](#).

Security considerations: See [Section 15](#).

Interoperability considerations: None

Published specification:

The EVRC-NW vocoder is specified in 3GPP2 C.S0014-D. The transfer method with the Interleaved/Bundled packet format via RTP is specified in [RFC 3558](#).

Applications that use this media type:

It is expected that many VoIP applications (as well as mobile applications) will use this type.

Additional information:

The following applies to stored-file transfer methods:

Magic number: `#!EVRNWN` (see [Section 8](#))

File extensions: `enw`, `ENW`

Macintosh file type code: None

Object identifier or OID: None

EVRN-NW speech frames may also be stored in the file format "3g2" defined in 3GPP2 C.S0050-B, which is identified using the media types "audio/3gpp2" or "video/3gpp2" registered by [RFC 4393](#) [[10](#)].

Person & email address to contact for further information:

Zheng Fang <[zfang@qualcomm.com](mailto:zfang@qualcomm.com)>

Intended usage: COMMON

Restrictions on usage:

When this media type is used in the context of transfer over RTP, the



RTP payload format specified in [Section 4.1 of RFC 3558](#) SHALL be used. In all other contexts, the file format defined in [Section 8](#) SHALL be used.

Author:

Zheng Fang

Change controller:

IETF Audio/Video Transport working group delegated from the IESG.

#### **[9.1.2](#). Registration of Media Type audio/EVRNWN0**

Type name: audio

Subtype names: EVRWN0

Required parameters: None

Optional parameters:

These parameters apply to RTP transfer only.

mode-set-recv: A subset of EVRWN modes. Possible values are a comma separated list of modes from the set {0,1,2,3,4,5,6,7} (see Table 2.6.1.2-4 in 3GPP2 C.S0014-D). A decoder can use this attribute to inform an encoder of its preference to operate in a specified subset of modes. Absence of this parameter signals the mode set {0,1,2,3,4,5,6,7}.

sendmode: A mode of the EVRWN codec. An encoder can use this to signal its current mode of operation. Possible values are 0,1,2,3,4,5,6,7 (see Table 2.6.1.2-4 in 3GPP2 C.S0014-D). Absence of this parameter signals mode 0.

ptime: see [RFC 4566](#).

silencesupp: see [Section 6.1 in RFC 4788](#).

dtxmax: see [Section 6.1 in RFC 4788](#).

dtxmin: see [Section 6.1 in RFC 4788](#).

hangover: see [Section 6.1 in RFC 4788](#).

Encoding considerations:



This media type is framed binary data (see [RFC 4288, Section 4.8](#)) and is defined for transfer of EVRN-NW encoded data via RTP using the Header-Free packet format specified in [RFC 3558](#).

Security considerations: See [Section 15](#).

Interoperability considerations: None

Published specification:

The EVRN-NW vocoder is specified in 3GPP2 C.S0014-D. The transfer method with the Header-Free packet format via RTP is specified in [RFC 3558](#).

Applications that use this media type:

It is expected that many VoIP applications (as well as mobile applications) will use this type.

Additional information: None

Person & email address to contact for further information:

Zheng Fang <zfang@qualcomm.com>

Intended usage: COMMON

Restrictions on usage:

This media type depends on RTP framing, and hence is only defined for transfer via RTP [5], the RTP payload format specified in [Section 4.2 of RFC 3558](#) SHALL be used. This media type SHALL NOT be used for storage or file transfer, instead audio/EVRNWN SHALL be used.

Author:

Zheng Fang

Change controller:

IETF Audio/Video Transport working group delegated from the IESG.

#### **[9.1.3](#). Registration of Media Type audio/EVRNWN1**

Type name: audio

Subtype names: EVRNWN1



Required parameters: None

Optional parameters:

These parameters apply to RTP transfer only.

mode-set-recv: A subset of EVRC-NW modes. Possible values are a comma separated list of modes from the set {0,1} (see Table 2.6.1.2-4 in 3GPP2 C.S0014-D). A decoder can use this attribute to inform an encoder of its preference to operate in a specified subset of modes. A value of 0 signals the support for wideband fixed rate (full or half rate, depending on the value of 'fixedrate' parameter). A value of 1 signals narrowband fixed rate (full or half rate, depending on the value of 'fixedrate' parameter). Absence of this parameter signals the mode set {0,1}.

sendmode: A mode of the EVRC-NW codec. An encoder can use this to signal its current mode of operation. Possible values are 0,1 (see Table 2.6.1.2-4 in 3GPP2 C.S0014-D). 'sendmode' with value 0 signals wideband fixed rate operation (full or half rate, depending on the value of the 'fixedrate' parameter). 'sendmode' with value 1 signals narrowband fixed rate operation (full or half rate, depending on the value of the 'fixedrate' parameter). Absence of this parameter signals mode 0.

ptime: see [RFC 4566](#).

maxptime: see [RFC 4566](#).

fixedrate: Indicates the EVRC-NW rate of the session while in single rate operation. Valid values include: 0.5 and 1, where a value of 0.5 indicates the 1/2 rate while a value of 1 indicates the full rate. If this parameter is not present, 1/2 rate is assumed.

silencesupp: see [Section 6.1 in RFC 4788](#).

dtxmax: see [Section 6.1 in RFC 4788](#).

dtxmin: see [Section 6.1 in RFC 4788](#).

hangover: see [Section 6.1 in RFC 4788](#).

Encoding considerations:

This media type is framed binary data (see [RFC 4288, Section 4.8](#)) and is defined for transfer of EVRC-NW encoded data via RTP using the Compact Bundled packet format specified in [RFC 4788](#).



Security considerations: See [Section 15](#)

Interoperability considerations: None

Published specification:

The EVRC-NW vocoder is specified in 3GPP2 C.S0014-D. The transfer method with the Compact Bundled packet format via RTP is specified in [RFC 4788](#).

Applications that use this media type:

It is expected that many VoIP applications (as well as mobile applications) will use this type.

Additional information: None

Person & email address to contact for further information:

Zheng Fang <zfang@qualcomm.com>

Intended usage: COMMON

Restrictions on usage:

This media type depends on RTP framing, and hence is only defined for transfer via RTP [5], the RTP payload format specified in [Section 4 of RFC 4788](#) SHALL be used. This media type SHALL NOT be used for storage or file transfer, instead audio/EVRCNW SHALL be used.

Author:

Zheng Fang

Change controller:

IETF Audio/Video Transport working group delegated from the IESG.



## **10. SDP mode attributes for EVRC-NW**

'sendmode' can be used by a sender to announce its encoder's current mode of operation. A sender can change its mode anytime and this does not cause any decoding problems at the receiver.

'mode-set-recv' can be used by a decoder to inform an encoder of its preference to operate in a specified subset of modes. The receiver will continue to decode properly even if the sender does not operate in one of the preferred modes. A set has been defined so that several modes can be expressed as a preference in one attempt. For instance, the set {4,5,6,7} signals that the receiver prefers the sender to operate in bandwidth-efficient narrowband modes of EVRC-NW.



## **11. Mapping EVRC-NW media type parameters into SDP**

Information carried in the media type specification has a specific mapping to fields in the Session Description Protocol (SDP) [9], which is commonly used to describe RTP sessions. When SDP is used to specify sessions employing EVRC-NW encoded speech, the mapping is as follows.

- o The media type ("audio") goes in SDP "m=" as the media name.
- o The media subtype ("EVRCNW", "EVRCNW0" or "EVRCNW1") goes in SDP "a=rtpmap" as the encoding name.
- o The optional parameters 'ptime' and 'maxptime' (for subtypes EVRCNW, EVRCNW1) go in the SDP "a=ptime" and "a=maxptime" attributes, respectively.
- o Any remaining parameters (for subtypes EVRCNW, EVRCNW0 and EVRCNW1) go in the SDP "a=fmtp" attribute by copying them from the media type string as a semicolon separated list of parameter=value pairs.



## **12. Offer-Answer Model Considerations for EVRC-NW**

The following considerations apply when using the SDP offer-answer procedures of [RFC 3264](#) [[11](#)] to negotiate the use of EVRC-NW payload in RTP:

- o Since EVRC-NW is an extension of both EVRC-B and EVRC-WB, the offerer SHOULD also announce EVRC-B and EVRC-WB support in its "m=audio" lines, with EVRC-NW as the preferred codec. This will allow interoperability with an answerer which supports only EVRC-B and/or EVRC-WB.

Below is an example of such an offer:

```
m=audio 55954 RTP/AVP 98 99 100
a=rtpmap:98 EVRCNW0/16000
a=rtpmap:99 EVRCWB0/16000
a=rtpmap:100 EVRCB0/8000
a=fmtp:98 mode-set-recv=0,1,2,3,4,5,6;sendmode=0
a=fmtp:99 mode-set-recv=0,4;sendmode=0
a=fmtp:100 recvmode=0 sendmode=4
```

If the answerer supports EVRC-NW then the answerer can keep the payload type 98 in its answer and the conversation can be done using EVRC-NW. Else, if the answerer supports only EVRC-WB and/or EVRC-B then the answerer will leave only the payload type 99 and/or 100 respectively in its answer and the conversation will be done using EVRC-WB and/or EVRC-B respectively.

An example answer for the above offer:

```
m=audio 55954 RTP/AVP 98
a=rtpmap:98 EVRCNW0/16000
a=fmtp:98 mode-set-recv=4;sendmode=4
```

- o 'mode-set-recv' is a uni-directional receive only parameter.
- o 'sendmode' is a uni-directional send only parameter.
- o Using 'sendmode', a sender can signal its current mode of operation. Note that a receiver may receive RTP media well before the arrival of SDP with a (first time, or updated) 'sendmode' parameter.
- o An offerer can use 'mode-set-recv' to request that the remote sender's encoder be limited to the list of modes signaled in



'mode-set-recv'. A remote sender MAY ignore 'mode-set-recv' requests.

- o The parameters 'maxptime' and 'ptime' will in most cases not affect interoperability, however the setting of the parameters can affect the performance of the application. The SDP offer-answer handling of the 'ptime' parameter is described in [RFC 3264](#) [11]. The 'maxptime' parameter MUST be handled in the same way.
- o For a sendonly stream, the 'mode-set-recv' parameter is not useful and SHOULD NOT be used.
- o For a recvonly stream, the 'sendmode' parameter is not useful and SHOULD NOT be used.
- o When using EVRCNW1, the entire session MUST use the same fixed rate and mode (0-Wideband or 1-Narrowband).
- o For additional rules which MUST be followed while negotiating DTX parameters, see [Section 6.8 in RFC 4788](#) [2].
- o Any unknown parameter in an SDP offer MUST be ignored by the receiver and MUST NOT be included in the SDP answer.



### **13. Declarative SDP Considerations**

For declarative use of SDP in SAP [[13](#)] and RTSP [[14](#)], the following considerations apply:

- o Any 'maxptime' and 'ptime' values should be selected with care to ensure that the session's participants can achieve reasonable performance.
- o The payload format configuration parameters are all declarative and a participant MUST use the configuration(s) that is provided for the session. More than one configuration may be provided if necessary by declaring multiple RTP payload types, however the number of types should be kept small. For declarative examples, see [Section 14](#).



## 14. Examples

Some example SDP session descriptions utilizing EVRC-NW encodings follow. In these examples, long a=fmtp lines are folded to meet the column width constraints of this document. The backslash ("\") at the end of a line and the carriage return that follows it should be ignored. Note that media subtype names are case-insensitive. Parameter names are case-insensitive both in media types and in the mapping to the SDP a=fmtp attribute.

Example usage of EVRCNW:

```
m=audio 49120 RTP/AVP 97 98 99
a=rtpmap:97 EVRCNW/16000
a=rtpmap:98 EVRCWB/16000
a=rtpmap:99 EVRCB/8000
a=fmtp:97 mode-set-recv=0,1,2,3,4,5,6;sendmode=0
a=fmtp:98 mode-set-recv=0,4;sendmode=0
a=fmtp:99 recvmode=0;sendmode=0
a=maxptime:120
```

Example usage of EVRCNW0:

```
m=audio 49120 RTP/AVP 97 98 99
a=rtpmap:97 EVRCNW0/16000
a=rtpmap:98 EVRCWB0/16000
a=rtpmap:99 EVRCB0/8000
a=fmtp:97 mode-set-recv=0,1,2,3,4,5,6;sendmode=0
a=fmtp:98 mode-set-recv=0,4;sendmode=0
a=fmtp:99 recvmode=0;sendmode=0
```

Example SDP answer from a media gateway requesting a terminal to limit its encoder operation to EVRC-NW mode 4.

```
m=audio 49120 RTP/AVP 97
a=rtpmap:97 EVRCNW0/16000
a=fmtp:97 mode-set-recv=4;sendmode=4
```

Example usage of EVRCNW1:

```
m=audio 49120 RTP/AVP 97 98 99
a=rtpmap:97 EVRCNW1/16000
a=rtpmap:98 EVRCWB1/16000
a=rtpmap:99 EVRCB1/8000
a=fmtp:97 fixedrate=0.5
a=fmtp:98 fixedrate=0.5
a=fmtp:99 fixedrate=0.5
a=maxptime:100
```



Example usage of EVRCNW with DTX with silencesupp=1:

```
m=audio 49120 RTP/AVP 97 98 99
a=rtpmap:97 EVRCNW/16000
a=rtpmap:98 EVRCWB/16000
a=rtpmap:99 EVRCB/8000
a=fmtp:97 silencesupp=1;dtxmax=32;dtxmin=12;hangover=1 \
mode-set-recv=0,1,2,3,4,5,6;sendmode=0
a=fmtp:98 silencesupp=1;dtxmax=32;dtxmin=12;hangover=1 \
mode-set-recv=0,4;sendmode=0
a=fmtp:99 recvmode=0;sendmode=0
a=maxptime:120
```

Examples usage of EVRCNW with DTX with silencesupp=0:

```
m=audio 49120 RTP/AVP 97 98 99
a=rtpmap:97 EVRCNW/16000
a=rtpmap:98 EVRCWB/16000
a=rtpmap:99 EVRCB/8000
a=fmtp:97 silencesupp=0;dtxmax=32;dtxmin=12;hangover=1 \
mode-set-recv=0,1,2,3,4,5,6;sendmode=0
a=fmtp:98 silencesupp=0;dtxmax=32;dtxmin=12;hangover=1 \
mode-set-recv=0,4;sendmode=0
a=fmtp:99 recvmode=0;sendmode=0
a=maxptime:120
```

Example offer answer exchange between EVRC-NW and legacy EVRC-B ([RFC 4788](#)):

Offer:

```
m=audio 55954 RTP/AVP 97 98 99
a=rtpmap:97 EVRCNW0/16000
a=rtpmap:98 EVRCWB0/16000
a=rtpmap:99 EVRCB0/8000
a=rtpmap:97 mode-set-recv=0,1,2,3,4,5,6;sendmode=0
a=fmtp:98 mode-set-recv=0,4;sendmode=0
a=fmtp:99 recvmode=0;sendmode=0
```

Answer:

```
m=audio 55954 RTP/AVP 99
a=rtpmap:99 EVRCB0/8000
```

Example offer answer exchange between EVRC-NW and legacy EVRC-WB ([RFC 5188](#)):



Offer:

```
m=audio 55954 RTP/AVP 97 98 99
a=rtpmap:97 EVRCNW0/16000
a=rtpmap:98 EVRCWB0/16000
a=rtpmap:99 EVRCB0/8000
a=rtpmap:97 mode-set-recv=0,1,2,3,4,5,6;sendmode=0
a=fmtp:98 mode-set-recv=0,4;sendmode=0
a=fmtp:99 recvmode=0;sendmode=0
```

Answer:

```
m=audio 55954 RTP/AVP 98 99
a=rtpmap:98 EVRCWB0/16000
```



## **15. Security Considerations**

Since compression is applied to the payload formats end-to-end, and the encodings do not exhibit significant non-uniformity, implementations of this specification are subject to all the security considerations specified in [RFC 3558](#) [12]. Implementations using the payload defined in this specification are subject to the security considerations discussed in [RFC 3558](#) [12], [RFC 3550](#) [5] and any appropriate profile (for example [RFC 3551](#) [6]).

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