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Implementers Guide for Facsimile Using Internet Mail

Status of this Memo

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Abstract

This document is intended for the implementers of software that use email to send to facsimiles using RFC 2305 and 2532. This is an informational document and its guidelines do not supersede the referenced documents.

Table of Contents

1. Introduction

This document clarifies published RFCs which standardize facsimile communications using Internet Email. The intent is to prevent implementations that deviate in such a way as to cause interoperability problems.

1.1 Organization of this document

This document contains four sections that clarify, in order, the handling of simple mode fax messages, extended mode fax messages, the file format, and the internet addressing of fax recipients.

See Section 2 for terminology.

1.2 Discussion of this document

Discussion of this document should take place on the Internet fax mailing list hosted by the Internet Mail Consortium (IMC). Please send comments regarding this document to:

ietf-fax@imc.org

To subscribe to this list, send a message with the body 'subscribe' to "ietf-fax-request@imc.org".

To see what has gone on before you subscribed, please see the mailing list archive at:

http://www.imc.org/ietf-fax/

2. Terminology

The following terms are used throughout this document:

DSN	- RFC 1894, "An Extensible Message Format for Delivery Status Notifications" [7]
Extended Mode	- RFC 2532, "Extended Facsimile Using Internet Mail" [3]
MDN	- RFC 2298, "An Extensible Message Format for Message Disposition Notifications" [9]
Simple Mode	- RFC 2305, "A Simple Mode of Facsimile Using Internet Mail" [2]
TIFF	- profile S or F of "File Format for Internet Fax" [4] delivered as "image/tiff"
TIFF-FX	- other profiles sent as "image/tiff-fx"

In examples, "C:" is used to indicate lines sent by the client, and "S:" to indicate those sent by the server.

3. Implementation Issues Specific to Simple Mode

Issues specific to Simple Mode [2] are described below:

3.1 Simple Mode Fax Senders

3.1.1 Multipart/alternative

Although a requirement of MIME compliance (16, Section 5.1.4), some email client implementations are not capable of correctly processing messages with a MIME Content-Type of "multipart/alternative". If a sender is unsure if the recipient is able to correctly process a message with a Content-Type of "multipart/alternative", the sender should assume the worst and not use this MIME Content-Type.

3.2 Simple Mode Fax Receivers

3.2.1 Multipart/alternative and Storage Capacity

Devices with little storage capacity are unable to cache previous parts of a multipart/alternative message. In order for such devices to correctly process only one part of a multipart/alternative message, such devices may simply use the first part of a multipart/alternative message it is capable of processing.

This behavior means that even if subsequent, higher-fidelity parts could have been processed, they will not be used.

This behavior can cause user dissatisfaction because when two high-fidelity but low-memory devices are used with each other, the lowest-fidelity part of the multipart/alternative will be processed.

The solution to this problem is for the sender to determine the capability of the recipient and send only high fidelity parts. However, a mechanism to determine the recipient capabilities prior to an initial message sent to the recipient doesn’t yet exist on the Internet.

After an initial message is sent, the Extended Mode mechanism, described in RFC 2532 [3], Section 3.3, enables a recipient to include its capabilities in a delivery and/or a disposition notification: in a DSN, if the recipient device is an RFC 2532/ESMTP [3] compliant server or in an MDN if the recipient is a User Agent.

4. Implementation Issues Specific to Extended Mode

Issues specific to Extended Mode [3] fax are described below. Note that any Extended Mode device also needs to consider issues specific to Simple Mode (Section 3 of this document).

4.1 Multipart/Alternative

Sections 3.1.1 and 3.2.1 are also applicable to this mode.

4.2. Correlation of MDN with Original Message

To re-iterate a paragraph from section 2.1, RFC 2298 [9]:

> A message that contains a Disposition-Notification-To header SHOULD also contain a Message-ID header, as specified in RFC 822 [10]. This will permit automatic correlation of MDNs with original messages by user agents.

4.3 Correlation of DSN with Original Message

Similar to the requirement to correlate an MDN, above, DSNs also need to be correlated. This is best done using the ENVID parameter in the "MAIL" command. See Sections 3 and 5.4 of RFC 1891 [5] for details.

4.4 Extended Mode Receivers

Confirmation that the facsimile image (attachment) was delivered and successfully processed is an important aspect of the extended mode of the facsimile using Internet mail. This section describes implementation issues with several types of confirmations.

4.4.1 Confirmation of receipt and processing from User Agents

When a message is received with the "Disposition-Notification-To" header and the receiver has determined whether the message can be processed, it may generate a:

a) Negative MDN in case of error, or

b) Positive MDN in case of success

The purpose of receiving a requested MDN acknowledgement from an Extended Mode recipient is the indication of success or failure to process the file attachment that was sent. The attachment, not the body, constitutes the facsimile message. Therefore an Extended Mode sender would expect, and it is recommended that the Extended Mode receiver send (with an MDN), an acknowledgement of the success or failure to decode and process the file attachment.

Implementers of the Extended Mode [3] should be consistent in the feedback provided to senders in the form of error codes and/or failure/success messages.

4.4.1.1 Discrepancies in MDN [9] Interpretation

An Extended Mode sender must be aware that RFC 2298 [9] does not distinguish between the success or failure to decode the body-content part of the message and the success or failure to decode a file attachment. Consequently MDNs may be received which do not reflect the success or failure to decode the attached file, but rather to decode the body-content part of the message.

4.4.1.2 Disposition-Type and body of message in MDN

If the receiver of an MDN request is an RFC 2532 compliant device that automatically prints the received Internet mail messages and attachments, or forwards the attachment via GSTN fax, it should, in the case of success:

a) Use a "disposition-type" of "dispatched" (with no "disposition-modifier") in the MDN, and

b) Use text similar to the following in the body of the message:

"This is a Return Receipt for the mail that you sent to [above, or below, or this address, etc]. The message and attached files[s] may have been printed, faxed or saved. This is no guarantee that the message has been read or understood".

and in the case of failure:

a) Use a "disposition-type" of "processed" and disposition-modifier of "error", and

b) Use text similar to the following in the body of the message:

"This is a Return Receipt for the mail that you sent to [above, or below, or this address, etc]. An error occurred while attempting to decode the attached file[s]".

This recommendation adheres to the definition in RFC 2298 [9] and helps to distinguish the returned MDNs for proper handling.

Implementers may wish to consider sending messages in the language of the sender (by utilizing a header field from the original message) or including multiple languages, by using multipart/alternative for the text portion of the MDN.

4.4.2 "Subject" of MDN and DSN in Success and Failure Cases

Because legacy e-mail applications do not parse the machine-readable headers, e-mail users depend on the human-readable parts of the MDN to recognize the type of acknowledgement that is received.

Examples:

MDN:
Subject: Your message was processed successfully. (MDN)
Subject: Your message has been rejected. (MDN)

DSN:
Subject: Your message was delivered successfully. (DSN)
Subject: Your message could not be delivered. (DSN)
Subject: Your message is delayed. (DSN)

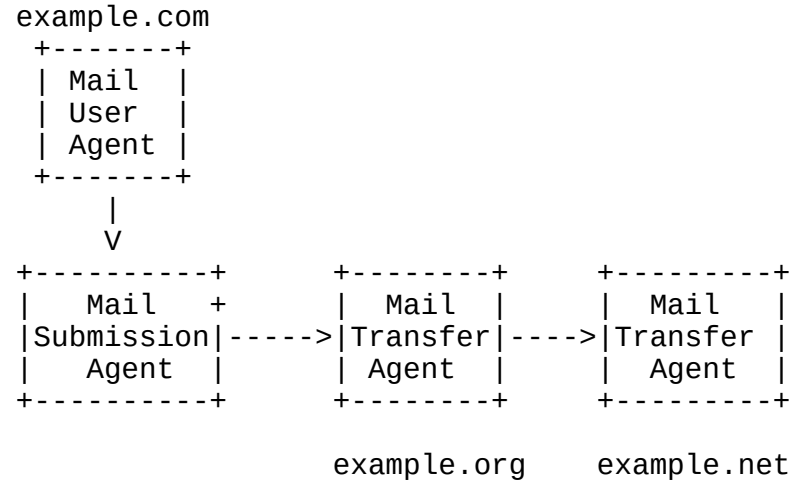
4.4.3 Extended Mode Receivers that are MTAs (or ESMTP servers)

SMTP server-based implementations are strongly encouraged to implement the "SMTP Service Extension for Returning Enhanced Error Codes" [8]. This standard is easy to implement and it allows detailed standardized success and error indications to be returned to the sender by the submitting MTA.

The following examples, are provided as illustration only. They should not be interpreted as limiting the protocol or the DSN form. If the examples conflict with the definitions in the standards (RFC 1891[5]/1893[6]/1894[7]/2034[8]), the standards take precedence.

4.4.3.1 Success Case Example

In the following example the sender <jean@example.com> sends a message to the receiver <ifax@example.net> which is an ESMTP server and the receiver successfully decodes the message.



SMTP Sequence:

```
S: 220 example.net SMTP service ready
C: EHLO example.org
S: 250-example.net
S: 250-DSN
S: 250 ENHANCEDSTATUSCODES
C: MAIL FROM:<jean@example.com> RET=HDRS ENVID=MM123456
S: 250 2.1.0 Originator <jean@example.com> ok
C: RCPT TO:<ifax@example.net> NOTIFY=SUCCESS,FAILURE \
   ORCPT=rfc822;ifax@example.net
S: 250 2.1.5 Recipient <ifax@example.net> ok
C: DATA
S: 354 Send message, ending in <CRLF>.<CRLF>
C:
C:  [Message goes here.]
C:
C: .
S: 250 2.0.0 Message accepted
C: QUIT
S: 221 2.0.0 Goodbye
```

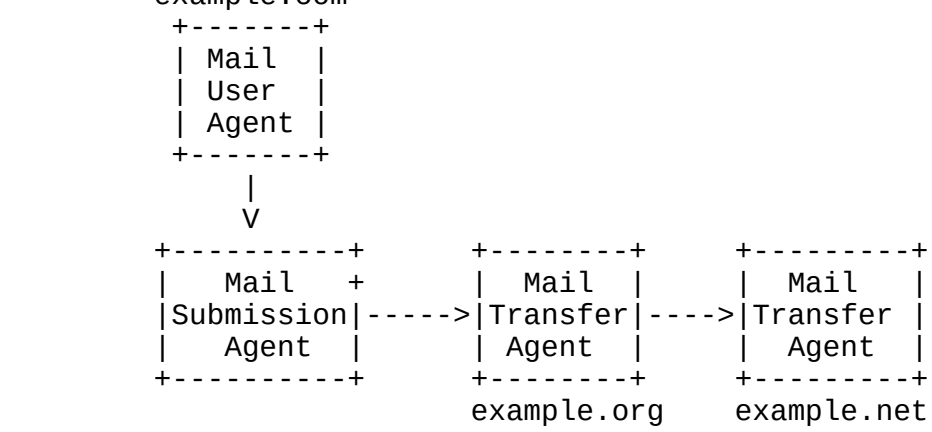
DSN (to jean@example.com):

```
Date: Mon, 12 Dec 1999 19:01:57 +0900
From: postmaster@example.net
Message-ID: <19991212190157.01234@example.net>
To: jean@example.com
Subject: Your message was delivered successfully. (DSN)
MIME-Version: 1.0
Content-Type: multipart/report; report-type=delivery-status;
  boundary=JUK199912121854870001

--JUK199912121854870001
Content-type: text/plain

Your message (id MM123456) was successfully delivered
to ifax@example.net.

--JUK199912121854870001
Content-type: message/delivery-status
```

```
Reporting-MTA: dns; example.net
Original-Envelope-ID: MM123456
Final-Recipient: rfc822;ifax@example.net
Action: delivered
Status: 2.1.5 (Destination address valid)
Diagnostic-Code: smtp; 250 2.1.5
  Recipient <ifax@example.net> ok

--JUK199912121854870001
Content-type: message/rfc822

[headers of returned message go here.]

--JUK199912121854870001--
```

4.4.3.2 Failure Case Example 1

In this example, the receiver determines it is unable to decode the attached file AFTER it has received the SMTP message. The receiver then sends a 'failure' DSN.



SMTP Sequence:

This is the same as the case a). After the sequence, a decode error occurs at the receiver, so instead of a 'success' DSN, a 'failure' DSN is sent.

DSN (to jean@example.com):

```
Date: Mon, 12 Dec 1999 19:31:20 +0900
From: postmaster@example.net
Message-ID: <19991212193120.87652@example.net>
To: jean@example.com
Subject:  Your message could not be delivered. (DSN)
MIME-Version: 1.0
Content-Type: multipart/report; report-type=delivery-status;
  boundary=JUK199912121934240002

--JUK199912121934240002
Content-type: text/plain

Your message (id MM123456) to ifax@example.net resulted in an
error while attempting to decode the attached file.

--JUK199912121934240002
Content-type: message/delivery-status

Reporting-MTA: dns; example.net
Original-Envelope-ID: MM123456
Final-Recipient: rfc822;ifax@example.net
Action: Failed
Status: 5.6.1 (Media not supported)
Diagnostic-Code: smtp; 554 5.6.1 Decode error

--JUK199912121934240002
Content-type: message/rfc822

[headers of returned message go here.]

--JUK199912121934240002--
```

4.4.3.3 Failure Case Example 2

In this example, the receiver determines it is unable to decode the attached file BEFORE it accepts the SMTP transmission.

SMTP sequence:

```
S: 220 example.net SMTP service ready
C: EHLO example.org
S: 250-example.net
S: 250-DSN
S: 250 ENHANCEDSTATUSCODES
C: MAIL FROM:<jean@example.com> RET=HDRS ENVID=MM123456
S: 250 2.1.0 Originator <jean@example.com> ok
C: RCPT TO:<ifax@example.net> NOTIFY=SUCCESS,FAILURE \
   ORCPT=rfc822;ifax@example.net
S: 250 2.1.5 Recipient <ifax@example.net> ok
C: DATA
S: 354 Send message, ending in <CRLF>.<CRLF>
C:
C:  [Message goes here.]
C:
C: .
S: 554 5.6.1 Media not supported
C: QUIT
S: 221 2.0.0 Goodbye
```

DSN:

Note: In this case, the previous MTA generates the DSN that is forwarded to the original sender. The receiving MTA has not accepted delivery and therefore can not generate a DSN.

4.4.4 Extended Mode Receivers that are POP3/IMAP4

NOTE: This document does not define new disposition-types or disposition-modifiers. Those used below are defined in RFC 2298[9]. This section provides examples on how POP3/IMAP4 devices may use the already defined values.

These examples are provided as illustration only. They should not be interpreted as limiting the protocol or the MDN form. If the examples conflict with the MDN [9] standard, the standard takes precedence.

4.4.4.1 Success Case Example

If the original sender receives an MDN which has "displayed", "dispatched" or "processed" disposition-type without disposition-modifier, the receiver may have received or decoded the attached file that it sent. The MDN does not guarantee that the receiver displays, prints or saves the attached file. See Section 4.4.1.1, Discrepancies in MDN Interpretation.

NOTE: This example does not include the third component of the MDN.

```
Date: 14 Dec 1999 17:48:44 +0900
From: ken_recipient@example.com
Message-ID: <19991214174844.98765@example.com>
Subject:  Your message was processed successfully. (MDN)
To: mary@example.net
Mime-Version: 1.0
Content-Type: multipart/report;
  report-type=disposition-notification; boundary="61FD1001_IFAX"

--61FD1001_IFAX
Content-Type: text/plain

This is a Return Receipt for the mail that you sent to
"ken_recipient@example.com".  The message and attached files may
have been printed, faxed or saved.  This is no guarantee that the
message has been read or understood.

--61FD1001_IFAX
Content-Type: message/disposition-notification

Reporting-UA: ken-ifax.example.com; barmail 1999.10
Original-Recipient: rfc822;ken_recipient@example.com
Final-Recipient: rfc822;ken_recipient@example.com
Original-Message-ID: <199912141740100.mary@example.net>
Disposition: automatic-action/MDN-sent-automatically; dispatched

--61FD1001_IFAX--
```

4.4.4.2 Failure Case Example

If the original sender receives an MDN with an "error" or "warning" disposition-modifier, it is possible that the receiver could not receive or decode the attached file. Currently there is no mechanism to associate the disposition-type with the handling of the main content body of the message or the attached file.

```
Date: 14 Dec 1999 19:48:44 +0900
From: ken_recipient@example.com
Message-ID: <19991214194844.67325@example.com>
Subject:  Your message has been rejected. (MDN)
To: mary@example.net
Mime-Version: 1.0
Content-Type: multipart/report;
  report-type=disposition-notification; boundary="84FD1011_IFAX"
```

```
--84FD1011_IFAX
Content-Type: text/plain

This is a Return Receipt for the mail that you sent to
"ken_recipient@example.com".  An error occurred while attempting
to decode the attached file[s]".

--84FD1011_IFAX
Content-Type: message/disposition-notification

Reporting-UA: ken-ifax.example.com; barmail 1999.10
Original-Recipient: rfc822;ken_recipient@example.com
Final-Recipient: rfc822;ken_recipient@example.com
Original-Message-ID: <199912141823123.mary@example.net>
Disposition: automatic-action/MDN-sent-automatically;
  processed/error

--84FD1011_IFAX
Content-Type: message/rfc822

[original message goes here]

--84FD1011_IFAX--
```

4.4.5 Receiving Multiple Attachments

A received email message could contain multiple attachments and each distinct attachment could use TIFF or TIFF-FX with different encodings or resolutions, and these could be mixed with other file types.

There is currently no mechanism to identify, in a returned MDN, the attachments that were successfully decoded from those that could not be decoded.

If the Extended Mode recipient is unable to decode any of the attached files, it is recommended that the Extended Mode recipient return a decoding error for the entire message.

5. Implementation Issues Specific to the File Format

5.1 IFD Placement & Profile-S Constraints

a) An IFD is required, by TIFF 6.0, to begin on a word boundary, however, there is ambiguity with regard to the defined size of a word. A word should be interpreted as a 2-byte quantity. This

recommendation is based on examination of Figure 1 and the definition of IFD Entry, Bytes 8-11, found in Section 2 of TIFF 6.0.

b) Low memory devices, which support resolutions greater than the required Profile-S, may be memory-constrained, such that those devices cannot properly handle arbitrary placement of TIFF IFDs within a TIFF file.

   To interoperate with a receiver that is constrained, it is strongly recommended that senders always place the IFD at the beginning of the image file when using any of the Profiles defined in [4].

5.2 Precautions for implementers of RFC 2301 [4]

5.2.1 Errors encountered during interoperability testing

The TIFF/RFC 2301 [4] errors listed below were encountered during interoperability testing and are provided so that implementers of TIFF readers and writers can take precautionary measures.

a) Although Profile S of TIFF [4] specifies that files should be in little-endian order, during testing it was found that some common TIFF writers create big-endian files. If possible, the TIFF reader should be coded to handle big-endian files. TIFF writers should always create little-endian files to be compliant with the standard and to allow interoperation with memory-constrained devices.

b) Bytes 0-1 of the Image File Header are supposed to be set to "II" (4949h) or "MM" (4d4dh) to indicate the byte order. During testing, other values were encountered. Readers should handle cases where the byte order field contains values other than "II" or "MM", and writers should ensure the correct value is used.

5.2.2 Color Gamut Considerations

The ITULAB encoding (PhotometricInterpretation = 10) allows choosing a gamut range for L*a*b* (see the TIFF field Decode), which in turn provides a way to place finer granularity on the integer values represented in this colorspace. But consequently, an inadequate gamut choice may cause a loss in the preservation of colors that don’t fall within the space of colors bounded by the gamut. As such, it is worth commenting on this.

The ITULAB default gamut, L [0,100] a [-85,85] b [-75,125], was chosen to accommodate most scan devices, which are typically acquired from a hardcopy source. It wasn't chosen to deal with the range of color from camera input or sRGB monitor data. In fact, when dealing with images from the web and other display oriented sources, the color range for a scanned hardcopy may likely be inadequate. It is important to use a gamut that matches the source of the image data.

The following guidelines are recommended:

1. When acquiring input from a printed hardcopy source, without modification, the ITU-T Recommendation T.42 default ITULAB gamut should be appropriate.

2. For an sRGB source, the ITU-T Recommendation T.42 default ITULAB gamut is not appropriate. A more appropriate gamut to consider is: L [0,100], a [-88,99] and b [-108.8,95.2]. These may be realized by using the following Decode values for 8-bit data: (0/1, 100/1, -22440/255, 25245/255, -27744/255, 24276/255).

3. If the range of L*a*b* value can be precomputed efficiently before converting to ITULAB, then you may get the best result by picking a gamut that is custom to this range.

5.2.3 File format Considerations

Implementers should make sure of the contents in the following two sections.

5.2.3.1 Considerations for greater reader flexibility

a) Readers are able to handle cases where IFD offsets point beyond the end of the file, while writers ensure that the IFD offset does not point beyond the end of the file.

b) Readers are able to handle the first IFD offset being on a non-word boundary, while writers ensure that the first IFD offset is on a word boundary.

c) Readers are flexible and able to accommodate: IFDs that are not presented in ascending page order; IFDs that are not placed at a location that precedes the image which the IFD describes; next IFD offsets that precede the current IFD, the current IFDs' field data, or the current IFDs' image data. Writers on the other hand should generate files with IFDs presented in ascending page order; IFDs placed at a location that precedes the image which the IFD describes; the next IFD should always follow the current IFD and all of its data.

d) Writers generate tags with the appropriate type of data (for example RATIONAL instead of SRATIONAL). Readers are flexible with those types of misrepresentations that may be readily accommodated (for example SHORT instead of LONG) and lead to enhanced robustness.

e) The appropriate count is associated with the tags (it is not 0 and matches the tag requirement), while readers are flexible with these types of misrepresentations, which may be readily accommodated and lead to enhanced robustness.

f) Tags appear in the correct order in the IFD and readers are flexible with these types of misrepresentations.

5.2.3.2 Error considerations

a) Readers only accept files with bytes 2-3 of the Image File Header equal to 42 (2Ah), the "magic number", as being valid TIFF or TIFF-FX files, while writers only generate files with the appropriate magic number.

b) Files are not generated with missing field entries, and readers reject any such files.

c) The PageNumber value is based on the order within the Primary IFD chain. The ImageLayer values are based on the layer order and the image order within the layer respectively. Readers may reject the pages where the PageNumber or ImageLayer values are not consistent with the number of Primary IFDs, number of layers or number of images within the layers.

d) Tags are unique within an IFD and readers may reject pages where this is not the case.

e) Strip data does not overlap other file data and the reader may error appropriately.

f) The strip offset does not point outside the file, under these conditions readers may reject the page where this is the case.

g) The strip offset + StripByteCounts does not point outside the file, under these conditions the reader may error appropriately.

h) Only one endian order is used within the file otherwise the rendered file will be corrupted.

i) Tag values are consistent with the data contained within the image strip. For example, a bi-level black mark on a white background image strip with a PhotometricInterpretation tag value of "1" (bit value of "0" means black) will result in the rendering of the image as white marks on a black background (reverse video).

j) For the special color spaces (ITULAB, YCBCR, CMYK), the parameters used for transformations are correct and compliant with the specification.

k) The XPosition and YPosition values are consistent with the horizontal and vertical offsets of the top-left of the IFD from the top-left of the Primary IFD, in units of the resolution. To do otherwise results in misplacement of the rendered image.

l) All combinations of tag values are correct, with special attention being given to the sets: XResolution, YResolution and ImageWidth; PhotometricInterpretation, SamplesPerPixel, and BitsPerSample. Any appropriate combinations will likely result in image distortion or an inability to render the image.

m) The appropriate Compression types are used for the image layers within a Profile M file, such as a bi-level coder for the mask layers (i.e. odd numbered layers) and multi-level (color) coders for the background and foreground layers. Readers should reject files where this is not true.

5.3 Content-Type for the file format

The content-type "image/tiff" should only be used for Profiles S and F. Some existing implementations based on [4] may use "image/tiff" for other Profiles. However, this usage is now deprecated. Instead, the content-type "image/tiff-fx", whose registration is being defined in [17] should be used.

To maximize interworking with devices that are only capable of rendering Profile S or F, "image/tiff" SHOULD be used when transporting Profile S or F.

6. Implementation Issues for Internet Fax Addressing

The "+" and "=" characters are valid within message headers, but must be encoded within some ESMTP commands, most notably ORCPT [5]. Implementations must take special care that ORCPT (and other ESMTP values) are properly encoded.

For example, the following header is valid as-is:

```
To: Home Fax <FAX=+390408565@example.com>
```

but when used with ORCPT, the "=" and "+" must be encoded like this:

```
RCPT TO:<FAX=+390408565@example.com> \
  ORCPT=FAX+3D+2B390408565@example.com
```

Note the "=" and "+" are valid inside the forward-path, but must be encoded when used within the esmtp value.

See [5] for details on this encoding.

7. Security Considerations

With regards to this document, Sections 5 in RFC 2305 [2] and Section 4 in RFC 2532 [3] apply.

8. Acknowledgements

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11. Full Copyright Statement

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