



1 **LoRaWAN® European Roaming Guidelines**
2 Copyright © 2021 LoRa Alliance, Inc. All rights reserved.

3

4 **NOTICE OF USE AND DISCLOSURE**

5 Copyright © LoRa Alliance, Inc. (2021). All Rights Reserved.

6

7 The information within this document is the property of the LoRa Alliance (“The Alliance”) and its use and disclosure
8 are subject to LoRa Alliance Corporate Bylaws, Intellectual Property Rights (IPR) Policy and Membership
9 Agreements.

10

11 Elements of LoRa Alliance specifications and other LoRa Alliance adopted documents may be subject to third party
12 intellectual property rights, including without limitation, patent, copyright or trademark rights (such a third party may
13 or may not be a member of LoRa Alliance). The Alliance is not responsible and shall not be held responsible in any
14 manner for identifying or failing to identify any or all such third-party intellectual property rights.

15

16 This document and the information contained herein are provided on an “AS IS” basis and THE ALLIANCE
17 DISCLAIMS ALL WARRANTIES EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO (A) ANY
18 WARRANTY THAT THE USE OF THE INFORMATION HEREIN WILL NOT INFRINGE ANY RIGHTS OF THIRD
19 PARTIES (INCLUDING WITHOUT LIMITATION ANY INTELLECTUAL PROPERTY RIGHTS INCLUDING
20 PATENT, COPYRIGHT OR TRADEMARK RIGHTS) OR (B) ANY IMPLIED WARRANTIES OF
21 MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, TITLE OR NONINFRINGEMENT.

22

23 IN NO EVENT WILL THE ALLIANCE BE LIABLE FOR ANY LOSS OF PROFITS, LOSS OF BUSINESS, LOSS
24 OF USE OF DATA, INTERRUPTION OF BUSINESS, OR FOR ANY OTHER DIRECT, INDIRECT, SPECIAL OR
25 EXEMPLARY, INCIDENTAL, PUNITIVE OR CONSEQUENTIAL DAMAGES OF ANY KIND, IN CONTRACT OR
26 IN TORT, IN CONNECTION WITH THIS DOCUMENT OR THE INFORMATION CONTAINED HEREIN, EVEN IF
27 ADVISED OF THE POSSIBILITY OF SUCH LOSS OR DAMAGE.

28

29 The above notice and this paragraph must be included on all copies of this document that are made.

30

31 LoRa Alliance, Inc.
32 5177 Brandin Court
33 Fremont, CA 94538
34 United States

35

36 *LoRa Alliance® and LoRaWAN® are trademarks of the LoRa Alliance, used by permission. All Company, brand
37 and product names may be trademarks that are the sole property of their respective owners.*

38



39

40

41

LoRaWAN® European Roaming Guidelines Technical Recommendation (TR8-1.0.0)

42

43

44

45

Authored by the Roaming Working Group of the LoRa Alliance Technical Committee

46

47

Technical Committee Chair and Vice Chair:

48

A.YEGIN (Actility), O.SELLER (Semtech)

49

50

Working Group Chair:

51

A.YEGIN (Actility)

52

53

Editor:

54

P.COLA (Bouygues Telecom)

55

56

Contributors:

57

E.BRUINZEEL (KPN), J.CATALANO (Kerlink), P.COLA (Bouygues Telecom), J.ERNST

58

(Swisscom), N.RUDA (CRA), T.SCHABERL (SENS)

59

60

61

Version: 1.0.0

62

Date: June 4, 2021

63

Status: Final

64 Contents

65	1	Introduction	4
66	2	Conventions	5
67	3	List of Radio Parameters to Share	6
68	3.1	Channel Plan	6
69	3.2	RX Parameters	6
70	3.3	Channel Modifications when Roaming	7
71	3.3.1	From Home Network to Visited Network.....	7
72	3.3.2	From Visited Network to Home Network.....	7
73	3.3.3	From Visited Network to Another Visited Network	7
74	4	Glossary.....	8
75	5	Bibliography	9
76	5.1	References	9
77			

78 Figures

79	Figure 1: Global Architecture for Roaming Between Public Operators	4
80	Figure 2: Roaming Situations	7

81 Tables

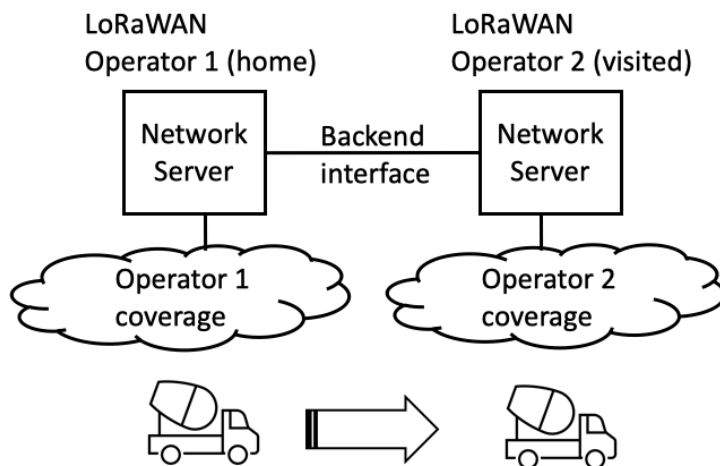
82	Table 1: Recommended Minimal European Channel Plan for Roaming	6
----	--	---

83 **1 Introduction**

84
85
86
87
88
89
90
91

Today, all operators offering roaming have implemented Passive Roaming with Activation Away feature (see Backend Interfaces Specification [TS2]).

To optimize the QoS of Passive Roaming on the LoRaWAN Network, it is necessary to define and share a few technical requirements between operators.



92
93

Figure 1: Global Architecture for Roaming Between Operators

94
95
96
97
98
99

Figure 1 illustrates the architecture between two public LoRaWAN operators.

The regional parameters depend on the country and regulations ([RP]). In each country, each public operator has its own radio frequency plan.

100 The challenge is that when the device moves to a different operator’s coverage, it changes
101 the operator; however, the device does not recognize this change and continues to use the
102 previous radio parameters (frequency plan, etc.).

103
104
105

It is necessary to share the information described in this document with network operators to optimize the QoS and improve network resources of the device.

106 2 Conventions

107

108 The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD",
109 "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be
110 interpreted as described in RFC 2119.

111 3 List of Radio Parameters to Share

112 3.1 Channel Plan

113 It is necessary for an operator to share as many channels as possible with other operators to
 114 optimize the probability of successfully receiving an uplink when a device moves out of an
 115 operator's coverage area and into another.

116
 117 Table 1 lists the minimum set of channels an operator in Europe SHOULD support on its
 118 network.

119
 120 Information in Table 1 was deduced from surveying the European operators and the channels
 121 they use. It represents a minimum set of channels that were supported by operators reporting
 122 to the survey.

Logical Channel	Channel Index	Default	DR Min	DR Max	Uplink Freq
1	0	Yes	0	5	868.1
2	1	Yes	0	5	868.3
3	2	Yes	0	5	868.5
4	3	Region set	0	5	867.1
5	4	Region set	0	5	867.3
6	5	Region set	0	5	(Not common)
7	6	Region set	0	5	(Not common)
8	7	Region set	0	5	867.9

123 **Table 1: Recommended Minimal European Channel Plan for Roaming**

124 3.2 RX Parameters

125 In the LoRaWAN Link Layer Specification [TS1], there are 2 receive windows defined to send
 126 a message to a Class A device: RX1 and RX2.

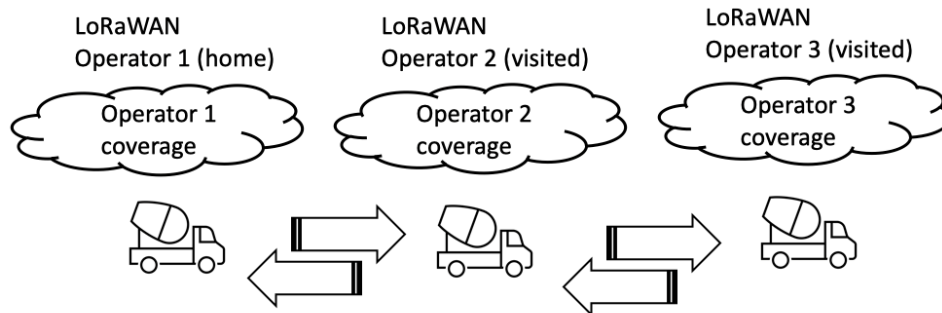
127
 128 To have enough time to send a downlink in a roaming situation, we recommend setting the
 129 RECEIVE_DELAY1 parameter to 5 seconds.

130 3.3 Channel Modifications when Roaming

131 There are 3 possible roaming device movement scenarios, as depicted in Figure 2.

132

133



134

135

Figure 2: Roaming Situations

136 3.3.1 From Home Network to Visited Network

137 When the home NS detects that the device is roaming (the device moves from home
138 coverage to visited coverage), the home NS receives a **PRStartReq** for this device via the
139 backend interface. There are then 2 possible outcomes:

140

141 • If the visited network channel plan is included in the home network channel plan, the
142 home network sends a **LinkADDRReq** command to modify the Channel Mask (to
143 change the mask and not the channels).

144

145 • If the visited network channel plan is different from the home network channel plan,
146 the home network sends a **NewChannelReq** to the device to add or modify the
147 necessary channels.

148 3.3.2 From Visited Network to Home Network

149 Same procedure as in Section 3.3.1 using the channel plan of the home network.

150 3.3.3 From Visited Network to Another Visited Network

151 Same procedure as in Section 3.3.1 using the channel plan of the new visited network.

152 4 Glossary

153

154 AS Application Server

155 NS Network Server

156 RX1 First receive window

157 RX2 Second receive window

158 QoS Quality of Services

159 RX Delay Delay between TX (transmission) and RX (reception)

160 **5 Bibliography**

161 **5.1 References**

162 [TS1] LoRaWAN[®] Link Layer 1.0.4 Specification, LoRa Alliance, October 2020

163 [RP] LoRaWAN[®] Regional Parameters, LoRa Alliance, May 2021

164 [TS2] LoRaWAN[®] Backend Interfaces 1.1 Specification, LoRa Alliance, October 2020