

Regional radio profiles for mioty® devices Ver. 1.1.4

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Regional radio profiles for mioty® devices

This document is authored by the technical committee of the mioty alliance, by the task force “New Frequency Bands”.

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Version History

Version	Date	Changes
1.0.0.	2022-09-20	First version
1.1.0.	2022-12-27	China Included. Fixed some minor editorial issues
1.1.1	2023-02-20	Removed chapter 3.3, added text to explain. In table 2, 868 and 433 spitted into separate entries.
1.1.2	2023-04-14	Disclaimer included
1.1.3	2023-05-10	Included countries outside Europe for EU433
1.1.4	2024-09-10	Dutch Caribbean Antilles added

Table of Content

1	Scope of the document	6
2	Conventions	7
2.1	Acronyms	7
2.2	Symbols in mathematical expressions	7
2.3	Verbal forms for the expression of provisions	7
3	Reference tables	8
3.1	Regional radio profile reference table	8
3.2	Country reference table	9
4	MAC & PHY level parameters	11
4.1	Standard TSMA characteristics	11
4.2	Wide TSMA characteristics	12
5	Bibliography references	14
6	Informative annex: Frequency plans	15
7	Informative annex: quick reference guide for radio terms	18
8	Informative annex: RRP naming	19

1 Scope of the document

The present document describes the regional radio profiles (RRP), that the mioty® alliance recommends for end-points and base stations. Regional radio profiles are sets of radio parameter values, that should be used by manufacturers to get:

- Compliance with local regulations in the stated countries, where unlicensed spectrum is available for the deployment of mioty® connectivity,
- Conformance to interoperability requirements set by the mioty® alliance.

For each country where the mioty® alliance defines a framework for interoperability, this document details one or several regional radio profiles.

This document is a companion document (see Figure 1) to the ETSI TS-UNB specifications (ref [1]) and various mioty® specifications (e.g. ref [2], [4], and [5]).

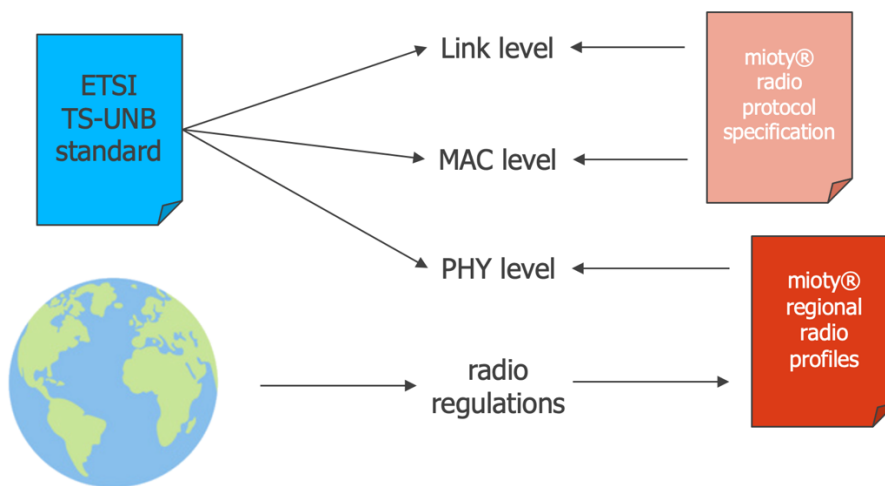


Figure 1 : Regional radio profiles and other relevant documents

NOTE1: Although mioty® regional radio profiles target compliancy with local regulations, manufacturers have to get their devices certified, as per local regulations, in each country where they want to distribute them.

NOTE2: manufacturers are free to put other radio parameters in their TS-UNB devices (i.e. "private radio profile"), but interoperability with mioty® devices will be lost.

2 Conventions

2.1 Acronyms

BS	Base Station
DC	Duty Cycle
DPG	Downlink (TSMA) Pattern Group
DL	Down-Link
EP	End-Point
FH	Frequency Hopping
MAC	Medium Access Control (level)
N/A	Not Applicable
PHY	PHYsical (level)
RRP	Regional Radio Profile
TSMa	Telegram Splitting Multiple Access
TS-UNB	Telegram Splitting Ultra Narrow Band
UL	Up-Link
ULP	Ultra Low Power
UPGx	Uplink (TSMA) Pattern Group x
WLAN	Wireless Local Area Network

2.2 Symbols in mathematical expressions

N_{RE}	Number of carrier spacings for offsetting a repetition
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2.3 Verbal forms for the expression of provisions

In the present specifications, the verbal forms "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "MAY", "NEED NOT", "WILL", "WILL NOT", "CAN" and "CAN NOT" are to be interpreted as in ref [3].

3 Reference tables

3.1 Regional radio profile reference table

Table 1 gives the main radio parameters to be used for each regional radio profile, defined by the mioty® alliance. Other parameters, related to MAC & PHY levels of the TS-UNB protocol, are stated in section 4.

Table 1 : Main parameters for the regional radio profiles

mioty® regional radio profile	Equivalent profile in ETSI specs.	Uplink channels (in MHz)	Downlink channels (in MHz)	Maximum power in regulations	Power limit for mioty® Cat1 EP	Spectrum sharing technique	TSMA parameters	N _{RE}
EU868A ^{1,2}	EU0	A:868.180 B: /	A:869.575 B: /	EP: 14dBm erp	10dBm	EP: 1% DC	Standard (see Table 3 and Table 4)	/
EU868	EU1	A:868.180 B: 868.080	A:869.575 B: 869.475	EP: 14dBm erp BS: 27dBm erp	10dBm	EP: 1% DC BS: 10% DC	Standard (see Table 3 and Table 4)	42
EU433	/	A:434.300 B:434.200	A:434.725 B:434.625	EP: 10dBm erp BS: 10dBm erp	7dBm	EP: 10% DC BS: 10% DC	Standard (see Table 3 and Table 4)	/
US915W	/	A:916.400 B: 915.600	A:916.400 B:915.600	EP: 36dBm eirp BS: 36dBm eirp	14dBm	FH	Wide (see Table 5 and Table 6)	28
IN866	/	A:866.875 B:866.775	A:865.180 B:865.080	EP: 30dBm erp BS: 30dBm erp	12dBm	EP: 1% DC BS: 10% DC	Standard (see Table 3 and Table 4)	42
CN510	/	A:494.100 B:494.000	A:486.100 B:486.000	EP: 17dBm erp BS: 17dBm erp	14dBm	EP/BS: Max 1 sec. single TX duration	Standard (see Table 3 and Table 4)	42
DC927W	/	A: 927.340 B: 925.600	A: 927.340 B: 925.600	EP: 20dBm BS: 20dBm	14dBm	FH	Wide (see Table 5 and Table 6)	28

In Table 1, N_{RE} of standard (resp. wide) TSMA parameters, is evaluated with standard (resp. wide) carrier spacing, as follows:

¹ EU868A is a single channel profile (i.e. only channel A) that is reserved for EPs only. Gateways shall be capable of receiving EU868A

² ETSI specification (ref [1]) defines EU2 and US0 profiles, that are not used by interoperable mioty® devices, at time of printing.

$$\frac{26 \cdot 10^6 \times 3}{2^{15}} \approx 2\,380.371\text{Hz} \quad (\text{Formula 1: standard carrier spacing})$$

$$\frac{26 \cdot 10^6 \times 9}{2^{13}} \approx 28\,564.453\text{Hz} \quad (\text{Formula 2: wide carrier spacing})$$

3.2 Country reference table

Table 2 gives the list of countries where mioty® regional radio profiles are relevant.

Table 2: Countries of relevance for regional radio profiles

Regional radio profile	Countries of relevance
US915W	Antigua and Barbuda, Bahamas, Barbados, Belize, Canada, Costa Rica, Cuba, Dominica, Dominican Republic, El Salvador, Grenada, Guatemala, Haiti, Honduras, Jamaica, Mexico, Nicaragua, Panama, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Trinidad and Tobago, United States of America (USA)
EU868A EU868	Albania, Andorra, Austria Azerbaijan Belarus, Belgium, Bosnia and Herzegovina, Bulgaria Croatia, Cyprus, Czech Republic, Denmark Estonia Finland, France Georgia, Germany, Greece Hungary Iceland, Ireland, Italy Latvia, Liechtenstein, Lithuania, Luxembourg Malta, Moldova, Monaco, Montenegro Netherlands, Norway Poland, Portugal Romania San Marino, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland Turkey Ukraine, United Kingdom Vatican
EU433	Albania, Andorra, Austria Azerbaijan Bahrain, Belarus, Belgium, Bosnia and Herzegovina, Bulgaria Croatia, Cyprus, Czech Republic, China, Costa Rica, Cuba Denmark Estonia Finland, France Georgia, Germany, Greece Hungary Iceland, Ireland, Israel, Italy

	Jordan Kuwait Latvia, Lebanon, Liechtenstein, Lithuania, Luxembourg Maldives, Malta, Morocco, Moldova, Monaco, Montenegro Netherlands, Nigeria, Norway Philippines, Poland, Portugal Romania Saudi Arabia, San Marino, Serbia, Slovakia, Slovenia, South Africa, Spain, Sweden, Switzerland Turkey Ukraine, United Kingdom Vatican
IN866	India
CN510	China
DC927W	Dutch Caribbean/Antilles (licensed spectrum)

4 MAC & PHY level parameters

4.1 Standard TSMA characteristics

This section details "standard TSMA" parameters for the TS-UNB protocol at MAC and PHY levels. Table 3 is for mioty® end-points. Table 4 is for mioty® base stations.

Table 3: Standard TSMA characteristics in end-points (i.e. UL)

Parameter	Value	Comment
TSMA pattern	standard	carrier spacing is given by formula 1
Channel width	100kHz	to be used for regulation conformity check
Occupied bandwidth (*)	60kHz (**)	value without drift
Modulation type	GMSK	BT=1
Symbol rate	ULP (i.e. 2 380.371 baud)	exact value is given by formula 1
Sync burst	always off	sync burst must not be used
Repetition functionality	off, by default	use is optional
Carrier offset value	3, by default	i.e. carrier offset value of a class A end-point (i.e. UL only)
Low latency functionality	off, by default	use is optional
Duration of a radio burst (*)	15.124ms	given for Duty Cycle evaluation
Time interval between consecutive radio burst (*)	UPG1 min: 138.63ms UPG1 max: 266.35ms UPG1 average: 159.21ms	
	UPG2 min: 134.01ms UPG2 max: 276.01ms UPG2 average: 158.73ms	
	UPG3 min: 25.21ms UPG3 max: 107.13ms UPG3 average: 34.52ms	

(*): Values, resulting from other parameter settings, are given for information only.

(**): This value derives from the nature of TSMA patterns, that exhibit a complex type of modulation.

Table 4: Standard TSMA characteristics in base stations (i.e. DL)

Parameter	Value	Comment
TSMA pattern	standard	carrier spacing is given by formula 1
Channel width	100kHz	to be used for regulation conformity check
Occupied bandwidth (*)	60kHz (**)	value excluding any drift
Modulation type	MSK	/
Symbol rate	ULP (i.e. 2 380.371 baud)	exact value is given by formula 1
Sync burst	always off	sync burst must not be used
Repetition functionality	N/A	/
Low latency functionality	N/A	/
Duration of a radio burst (*)	min: 11.763ms max: 21,425ms depending on payload size	given for Duty Cycle evaluation
Time interval between consecutive radio burst (*)	DPG min: 169.721ms DPG max: 272.647ms DPG average: 213.199ms	

(*): Values, resulting from other parameter settings, are given for information only.

(**): This value derives from the nature of TSMA patterns, that exhibit a complex type of modulation.

4.2 Wide TSMA characteristics

This section details "wide TSMA" parameters for the TS-UNB protocol at MAC and PHY levels.

Table 5 is for mioty® end-points. Table 6 is for mioty® base stations.

Table 5: Wide TSMA characteristics in end-points (i.e. UL)

Parameter	Value	Comment
TSMA pattern	wide	to comply with FH spectrum sharing regulations
Channel width (*)	28.6kHz	distance between two consecutive hopping channels. Exact value is given by formula (2)
Occupied bandwidth (*)	3.1kHz	occupied bandwidth of one radio burst in one hopping channel
Modulation type	GMSK	BT=1
Symbol rate	ULP (i.e. 2 380.371 baud)	exact value is given by formula (1)
Sync burst	always on	sync burst is mandatory
Repetition functionality	off, by default	optional use
Low latency functionality	off, by default	optional use
Duration of a radio burst	15.124ms	i.e. less than the maximum dwell time allowed by FH regulations
Number of hopping channels	50	/

(*): Values, resulting from other parameter settings, are given for information only.

Table 6: Wide TSMA characteristics in base stations (i.e DL)

Parameter	Value	Comment
TSMA pattern	wide	to comply with FH spectrum sharing
Channel width (*)	28.6kHz	distance between two consecutive hopping channels. Exact value is given by formula (2)
Occupied bandwidth (*)	3.1kHz	occupied bandwidth of one radio burst in one hopping channel
Modulation type	MSK	/
Symbol rate	ULP (i.e. 2 380.371 baud)	exact value is given by formula 1
Sync burst	always on	sync burst is mandatory
Repetition functionality	off, by default	optional use
Low latency functionality	off, by default	optional use
Duration of a radio burst	min: 11.763ms max: 21,425ms depending on payload size	i.e. less than the maximum dwell time allowed by regulations requiring FH

(*): Values, resulting from other parameter settings, are given for information only.

5 Bibliography references

- [1] ETSI TS 103 357 V1.1.1 (2018-06): "Short Range Devices; Low Throughput Networks (LTN); Protocols for radio interface A"
- [2] mioty® alliance, "Mioty Radio Protocol Specifications", revision 1.1.1, 2021 February 25th
- [3] ETSI Drafting Rules, section 3.2, pages 209-211, published 29 March 2021, <https://portal.etsi.org/Services/editHelp/How-to-start/ETSI-Drafting-Rules>
- [4] mioty® alliance, "Specifications of Conformance Validation Tests for mioty® end-points", revision 2.0.1, published 12 July 2021
- [5] mioty® alliance, "Specifications of Conformance Validation Tests for mioty® base stations", revision 1.0.0, to be published

6 Informative annex: Frequency plans

This informative annex illustrates the frequency plans for each mioty® regional radio profile.

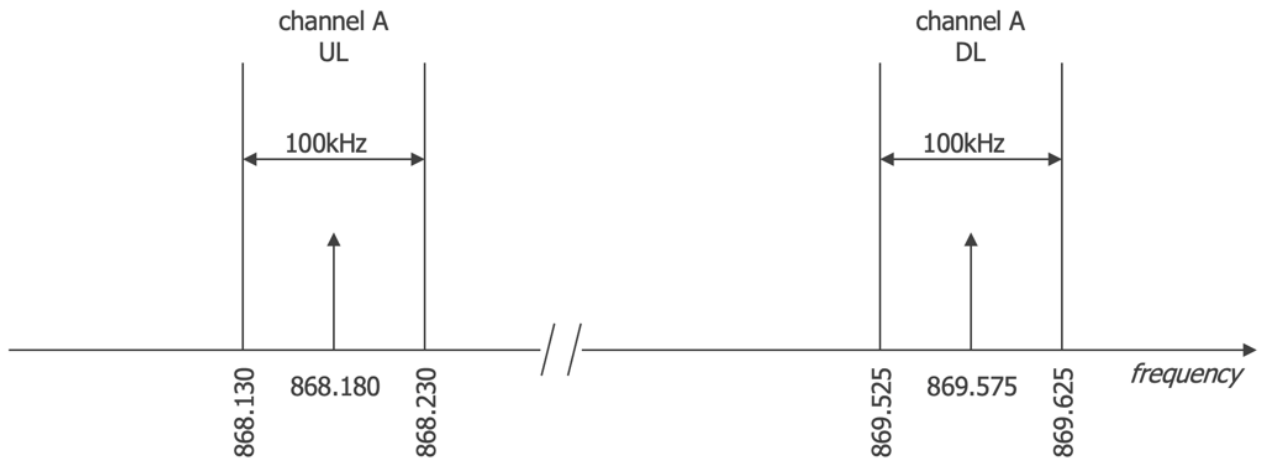


Figure 2 : EU868A frequency plan

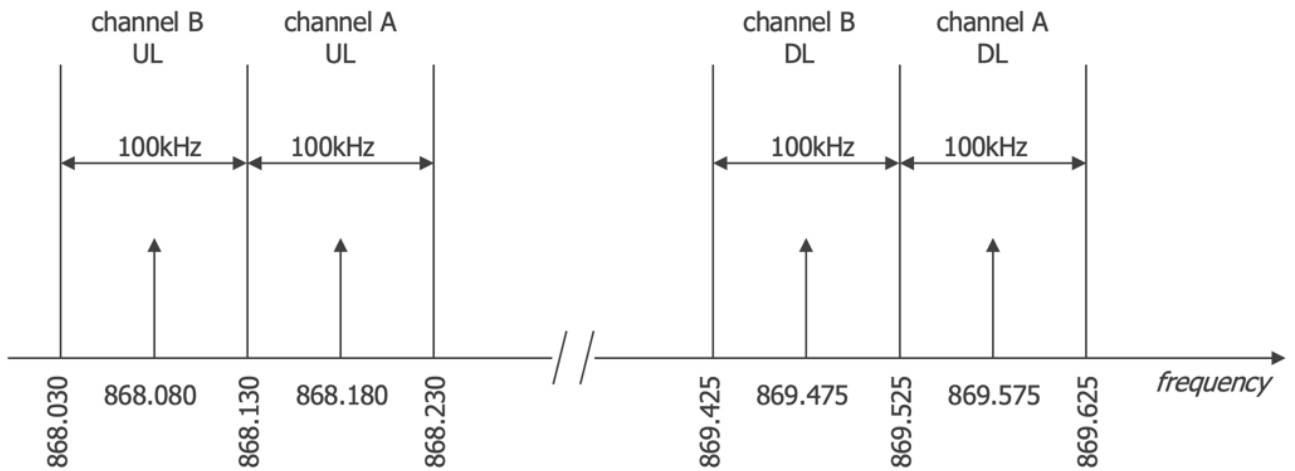


Figure 3 : EU868 frequency plan

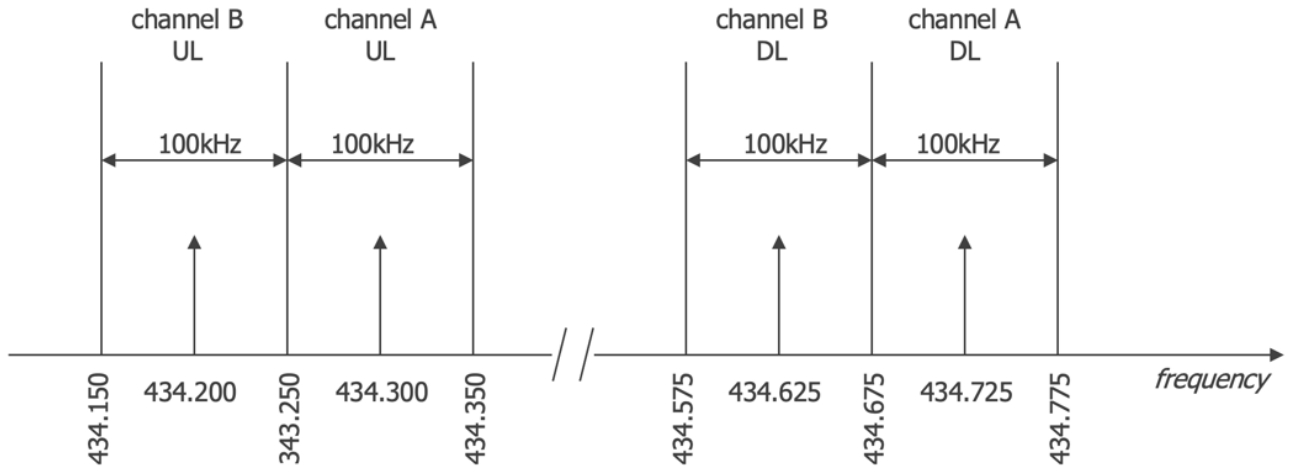


Figure 4 :EU433 frequency plan

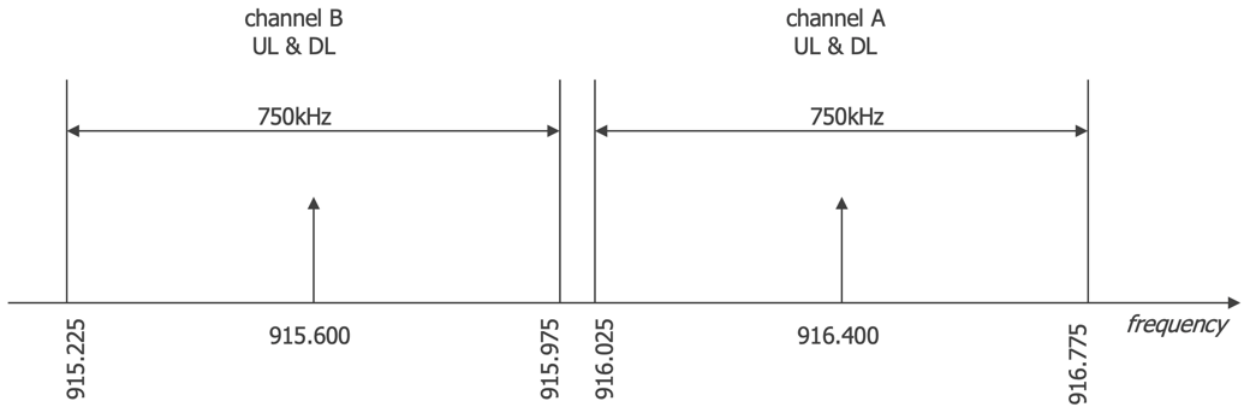


Figure 5 : US915W frequency plan

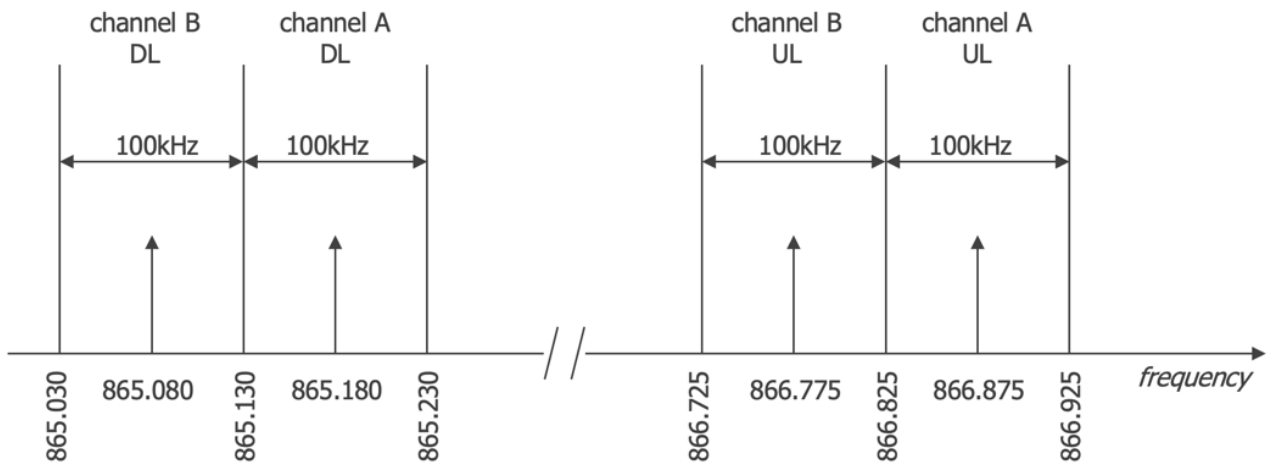


Figure 6 : IN866 frequency plan

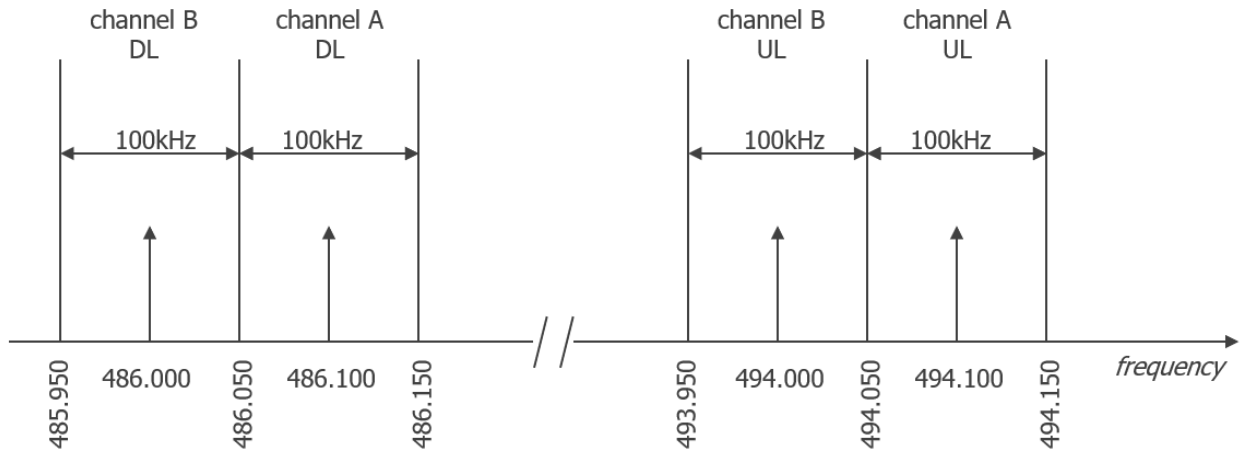


Figure 7 : CN510 frequency plan

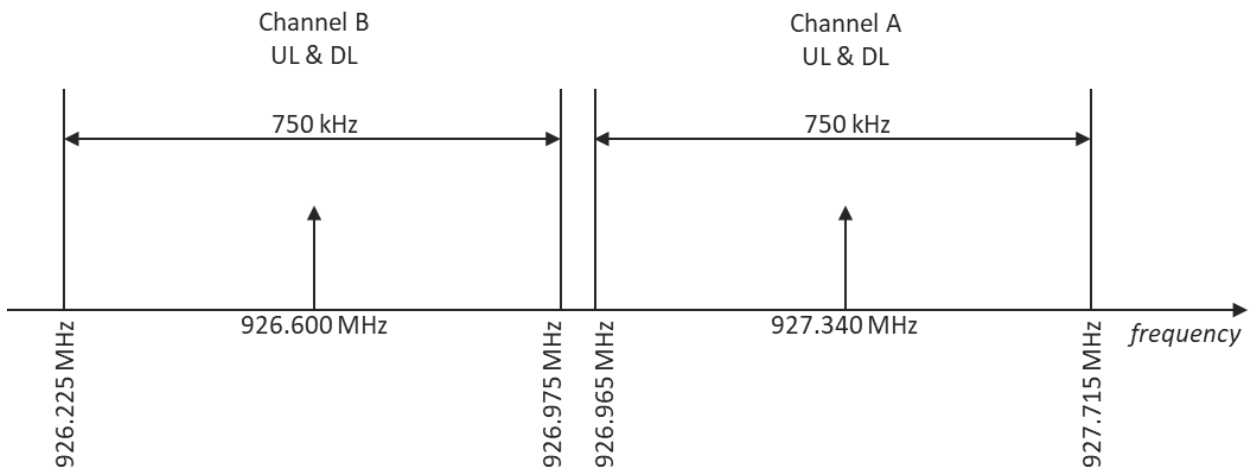


Figure 8 : DC927W frequency plan

7 Informative annex: quick reference guide for radio terms

NOTE: this informative annex gives simplified definitions of terms, used in the present document on regional radio profiles. These definitions shall not be considered as formal statements; they are provided here for information only. The reader is invited to consider ref [1], if formal definitions are needed.

Carrier offset: range of the frequency offset used to add a random shift to the TSMA frequency pattern used by an end-point when transmitting a message

Carrier spacing: frequency interval between two consecutive carriers in a TSMA pattern over the air

Channel width: spectrum extend encompassing TSMA transmissions and all their frequency drifts

N_{RE} : number of carrier spacing value used by and end-point to separate a message transmission from the repetition transmission over the air

Low latency functionality: functionality used by an end-point to transmit an application message within a short TSMA timeframe

Occupied bandwidth: spectrum extend of a transmission

Radio burst: an elementary emission over the air

Repetition functionality: functionality used by dual-channel end-point to repeat the transmission of a message

Symbol rate: number of symbols per second over the air. Mioty® profiles implement only the ultra-low power (ULP) rate

Sync burst: specific radio burst added before actual message bursts to help decoding in receiver

TSMA (telegram splitting multiple access): radio communication technology that splits a message in several radio bursts that are spreads over pre-defined pseudo-random time & frequency patterns

8 Informative annex: RRP naming

This informative annex explains the naming convention used by the mioty® regional radio profiles.

Regional radio profile (RRP) names contain three fields (see Figure 9), where:

- XX is a two-character field, that gives hint on the region where the profile is applicable
- YYY is a three-character field, that gives hint of the frequency band used by the profile
- Z..Z is a variable length field that gives details on how the spectrum is used by mioty® TS-UNB devices

X X Y Y Y Z..Z

Figure 9 : fields of regional radio profile names

Table 7 illustrates values that may be used for RRP names.

Table 7: values of field names

RRP field	Example of content
XX	EU: Europe and other countries that implement same regulations US: USA, Canada IN: India JP: Japan NZ: New Zealand AU: Australia ...
YYY	868: the legacy sub-gigahertz band for non-specific SRD devices in Europe 915: the sub-gigahertz ISM band in North America 2.4: the international 2.4GHz WLAN band 433: the international UHF unlicensed band 917: the new sub-gigahertz band for SRD in data network in Europe ...
Z..Z	A: channel A only (i.e. single channel device) C: cross-band profile (i.e. UL in one band and DL in another band) N: narrow TSMA pattern W: wide TSMA pattern none: standard TSMA pattern ...

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