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# RAK2247 LoRa GW 868MHz ISM band

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MBa



## Contents

1	Introduction .....	3
2	Compliance test matrix .....	4
3	Rx Sensitivity .....	5
3.1	Bench setup .....	5
3.2	Pass/Fail criteria.....	5
3.3	Results (LoRa&FSK).....	6
3.4	Conclusion.....	7
4	Rx PER, RSSI, SNR .....	8
4.1	Bench setup .....	8
4.2	Pass/Fail criteria.....	8
4.3	Results .....	8
4.3.1	Rx PER max, RSSI error mean and RSSI error max BW125,BW250 .....	8
4.3.2	PER over power SF7BW125.....	9
4.3.3	PER over power SF10BW125.....	13
4.3.4	PER over power SF12BW125.....	16
4.3.5	PER over power SF7BW250.....	17
4.3.6	RSSI over power SF7BW125.....	18
4.3.7	RSSI over power SF10BW125.....	21
4.3.8	RSSI over power SF12BW125.....	23
4.3.9	RSSI over power SF7BW250.....	27
4.3.10	RSSI dev over power SF7BW125.....	30
4.3.11	RSSI dev over power SF10BW125.....	32
4.3.12	RSSI dev over power SF12BW125.....	35
4.3.13	RSSI dev over power SF7BW250.....	38
4.3.14	SNR over power SF7BW125 .....	42
4.3.15	SNR over power SF10BW125 .....	44
4.3.16	SNR over power SF12BW125 .....	47
4.3.17	SNR over power SF7BW250 .....	50
4.4	Conclusion.....	53
5	Rx Frequency Error tolerance.....	54
5.1	Bench setup .....	54
5.2	Pass/Fail criteria.....	54
5.3	Results .....	54
5.4	Conclusion.....	59
6	Tx Gain sweep .....	60
6.1	Bench Setup.....	60
6.2	Pass/Fail criteria.....	60
6.3	Results .....	60
6.4	Conclusion.....	64

## 1 Introduction

This document presents the RAK2247 LoRa GW RF performance results on 868MHz ISM band measured in Semtech Shanghai LoRaLab.



Figure 1: RAK2247 LoRa GW

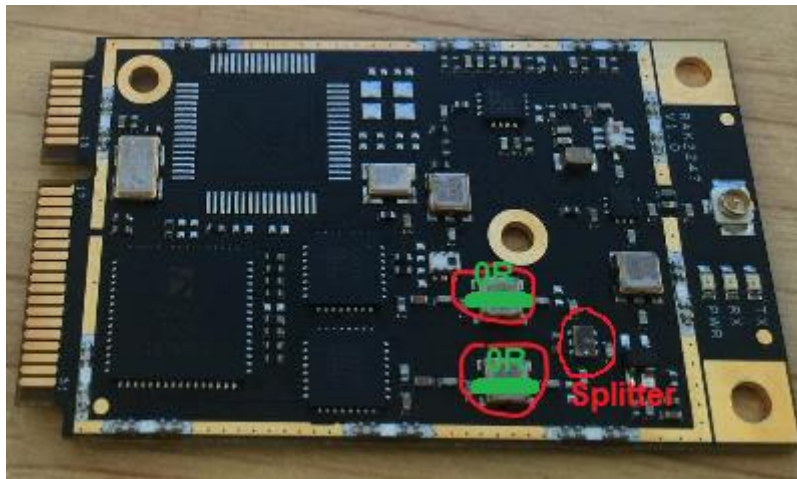
## 2 Compliance test matrix

Here is the summary table on the compliance of the completed tests:

**Table 1: Compliance test matrix**

#	Test	Compliance
1	Rx Sensitivity	* <b>JUSTIFY</b>
2	Rx PER, RSSI, SNR	<b>PASS</b>
3	Rx Frequency Error tolerance	<b>PASS</b>
4	Tx Gain sweep	<b>PASS</b>

\* RAK GW does not follow Semtech reference design and consequently GW module shows a leak of sensitivity due to additional 3 dB introduced by a signal splitter located after the LNA. Semtech engineer has temporarily replaced the 2<sup>nd</sup> SAW filter of the RX chain by a 0R to compensate insertion loss induced by this splitter (not in Semtech reference design). This 2<sup>nd</sup> SAW filter place after LNA is recommended for achieving targeted RX performances. Semtech strongly recommend RAK to follow the GW reference design for new designs and modify their current HW to match it.



### 3 Sensitivity

This test intends to measure the board sensitivity level. The targeted PER corresponding to the sensitivity level is 10%.

#### 3.1 Bench setup

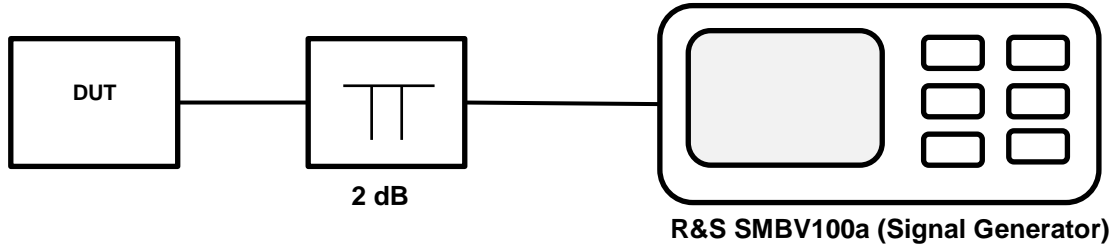


Figure 2: Rx Sensitivity test bench

#### 3.2 Pass/Fail criteria

Table 2: LoRa min. Rx sensitivity for 10% PER

BW \ SF	7	8	9	10	11	12
125 kHz	-125.5 dBm	-	-	-134 dBm	-137.3dBm	-139.7dBm
250 kHz	-121.2 dBm	-	--	--	--	--
500 kHz	--	-	--	--	--	--

Table 3: FSK min. Rx sensitivity for 10% PER

Data Rate(kb/s)	Sensitivity
50 kHz	-109.1 dBm

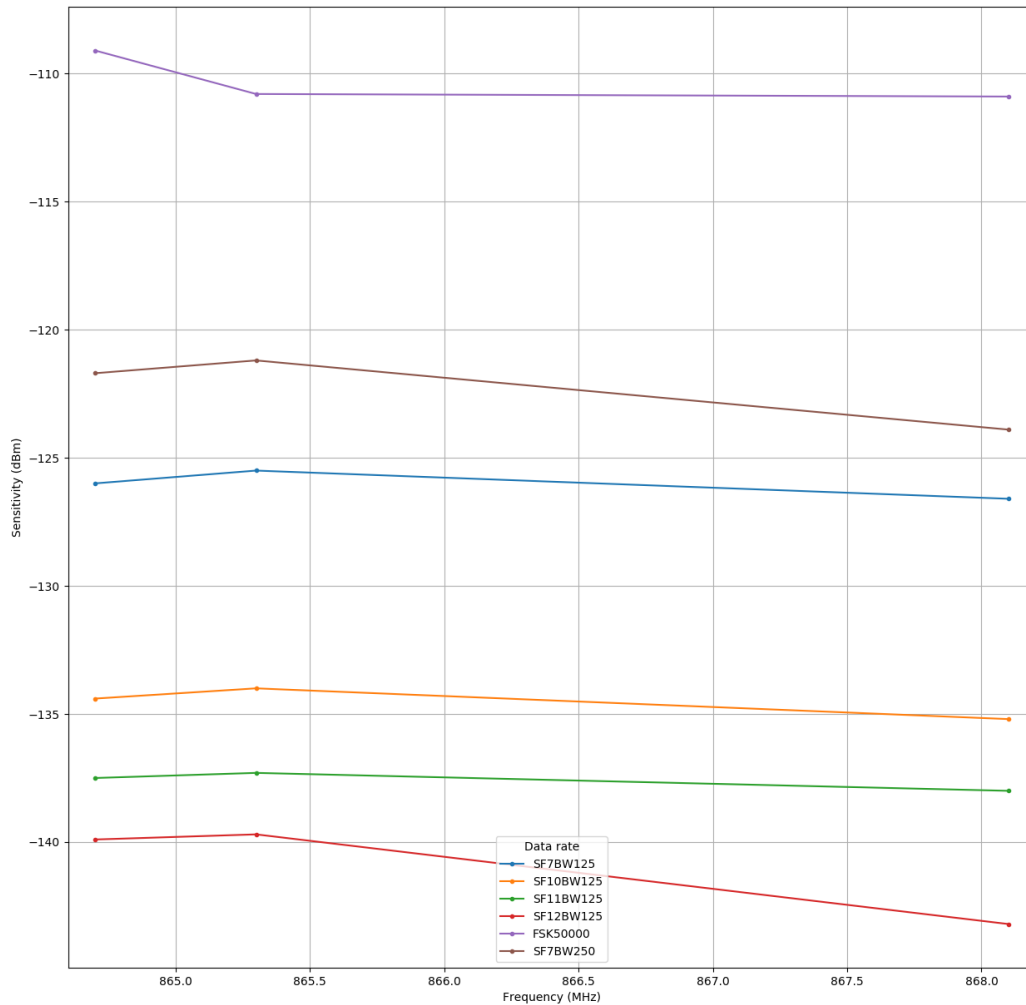
### 3.3 Results (LoRa&FSK)

Table 4: Rx Sensibility for SF7BW125, SF10BW125, SF11BW125, SF12BW125,FSK50000, SF7BW250

Mod	Data rate	Frequency (MHz)	Sensitivity (dBm)	Status
LORA	SF7BW125	864.7	-126	PASSED
LORA	SF7BW125	865.3	-125.5	PASSED
LORA	SF7BW125	868.1	-126.6	PASSED
LORA	SF10BW125	864.7	-134.4	PASSED
LORA	SF10BW125	865.3	-134	PASSED
LORA	SF10BW125	868.1	-135.2	PASSED
LORA	SF11BW125	864.7	-137.5	PASSED
LORA	SF11BW125	865.3	-137.3	PASSED
LORA	SF11BW125	868.1	-138	PASSED
LORA	SF12BW125	864.7	-139.9	PASSED
LORA	SF12BW125	865.3	-139.7	PASSED
LORA	SF12BW125	868.1	-143.2	PASSED
FSK	FSK50000	864.7	-109.1	PASSED
FSK	FSK50000	865.3	-110.8	PASSED
FSK	FSK50000	868.1	-110.9	PASSED
LORA	SF7BW250	864.7	-121.7	PASSED
LORA	SF7BW250	865.3	-121.2	PASSED
LORA	SF7BW250	868.1	-123.9	PASSED

**Figure 3: Rx Sensibility for SF7BW125, SF10BW125, SF11BW125, SF12BW125,FSK50000, SF7BW250**

RX Sensibility  
 Bench: RAK2247 Gateway V1.0 868MHz , Util SG - Pathloss = 2.0 dB  
 PER target: 10.0%, for 200 packets



### 3.4 Conclusion

**STATUS: JUSTIFY (see #1 of compliance matrix at page 4)**

## 4 Rx PER, RSSI, SNR

This test intends to evaluate 3 different parameters: PER, RSSI, and SNR. It verifies if, over sensitivity level, every packets are received, and if the RSSI does not diverge too much from the actual power. Furthermore, this test calculates the RSSI correction value ('rssi\_offset' field in the gateway configuration file) to input to the concentrator.

### 4.1 Bench setup

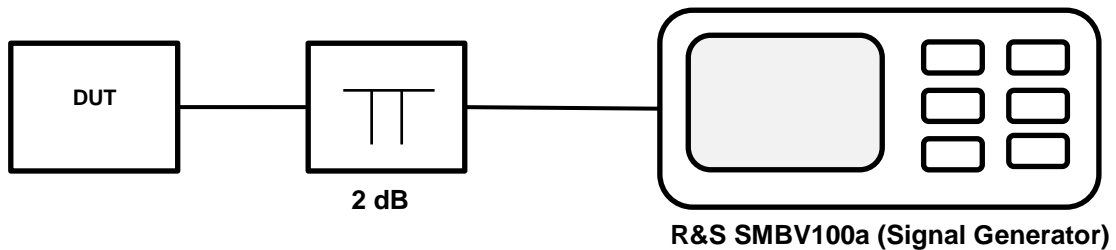


Figure 4 : Rx PER, RSSI, SNR test bench

### 4.2 Pass/Fail criteria

Power sweep from -125 dBm to -40 dBm by 5 dB step  
 PER max  $\leq$  10% when power level higher than sensitivity level  
 RSSI dev max  $\leq$  12dB

### 4.3 Results

#### 4.3.1 Rx PER max, RSSI error mean and RSSI error max BW125,BW250

Table 5 : Rx PER max, RSSI error mean and RSSI error max

Mod	Data rate	Frequency (MHz)	PER max (%)	RSSI error mean (dB)	RSSI error max (dB)	Status
LORA	SF7BW125	864.7	2	0.8	5	PASSED
LORA	SF7BW125	865.3	1	1.2	9	PASSED
LORA	SF7BW125	868.1	0	0.8	6	PASSED
LORA	SF10BW125	864.7	2	2.7	6	PASSED
LORA	SF10BW125	865.3	2	3.1	5	PASSED
LORA	SF10BW125	868.1	0	2.7	3	PASSED
LORA	SF12BW125	864.7	0	1.2	7	PASSED
LORA	SF12BW125	865.3	0	1.1	7	PASSED
LORA	SF12BW125	868.1	0	1	7	PASSED
LORA	SF7BW250	864.7	55	1.7	7	PASSED



LORA	SF7BW250	865.3	5	1.8	6	PASSED
LORA	SF7BW250	868.1	5	0.9	5	PASSED

### 4.3.2 PER over power SF7BW125

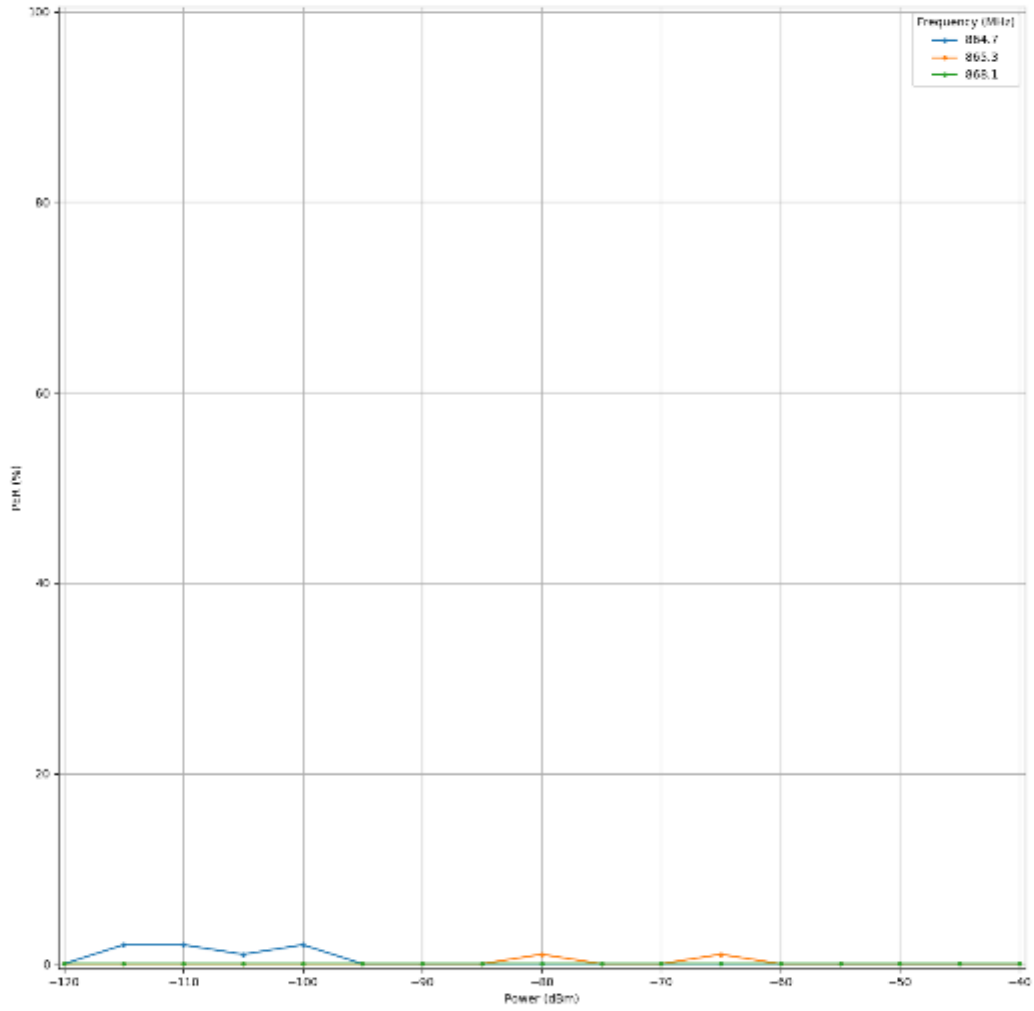
**Table 6: PER over power SF7BW125**

Mod	Data rate	Frequency (MHz)	Power (dBm)	PER (%)
LORA	SF7BW125	864.7	-120	0
LORA	SF7BW125	864.7	-115	2
LORA	SF7BW125	864.7	-110	2
LORA	SF7BW125	864.7	-105	1
LORA	SF7BW125	864.7	-100	2
LORA	SF7BW125	864.7	-95	0
LORA	SF7BW125	864.7	-90	0
LORA	SF7BW125	864.7	-85	0
LORA	SF7BW125	864.7	-80	0
LORA	SF7BW125	864.7	-75	0
LORA	SF7BW125	864.7	-70	0
LORA	SF7BW125	864.7	-65	0
LORA	SF7BW125	864.7	-60	0
LORA	SF7BW125	864.7	-55	0
LORA	SF7BW125	864.7	-50	0
LORA	SF7BW125	864.7	-45	0
LORA	SF7BW125	864.7	-40	0
LORA	SF7BW125	865.3	-120	0
LORA	SF7BW125	865.3	-115	0
LORA	SF7BW125	865.3	-110	0
LORA	SF7BW125	865.3	-105	0
LORA	SF7BW125	865.3	-100	0
LORA	SF7BW125	865.3	-95	0
LORA	SF7BW125	865.3	-90	0
LORA	SF7BW125	865.3	-85	0
LORA	SF7BW125	865.3	-80	1
LORA	SF7BW125	865.3	-75	0
LORA	SF7BW125	865.3	-70	0
LORA	SF7BW125	865.3	-65	1
LORA	SF7BW125	865.3	-60	0
LORA	SF7BW125	865.3	-55	0

LORA	SF7BW125	865.3	-50	0
LORA	SF7BW125	865.3	-45	0
LORA	SF7BW125	865.3	-40	0
LORA	SF7BW125	868.1	-120	0
LORA	SF7BW125	868.1	-115	0
LORA	SF7BW125	868.1	-110	0
LORA	SF7BW125	868.1	-105	0
LORA	SF7BW125	868.1	-100	0
LORA	SF7BW125	868.1	-95	0
LORA	SF7BW125	868.1	-90	0
LORA	SF7BW125	868.1	-85	0
LORA	SF7BW125	868.1	-80	0
LORA	SF7BW125	868.1	-75	0
LORA	SF7BW125	868.1	-70	0
LORA	SF7BW125	868.1	-65	0
LORA	SF7BW125	868.1	-60	0
LORA	SF7BW125	868.1	-55	0
LORA	SF7BW125	868.1	-50	0
LORA	SF7BW125	868.1	-45	0
LORA	SF7BW125	868.1	-40	0

Figure 5: PER over power SF7BW125

RX Per Rssi Snr  
 Bench: RAK2247 Gateway V1.0 868MHz , Util SG - Pathloss = 2.0 dB  
 PER over power - Waveform: SF7BW125, for 100 packets



### 4.3.3 PER over power SF10BW125

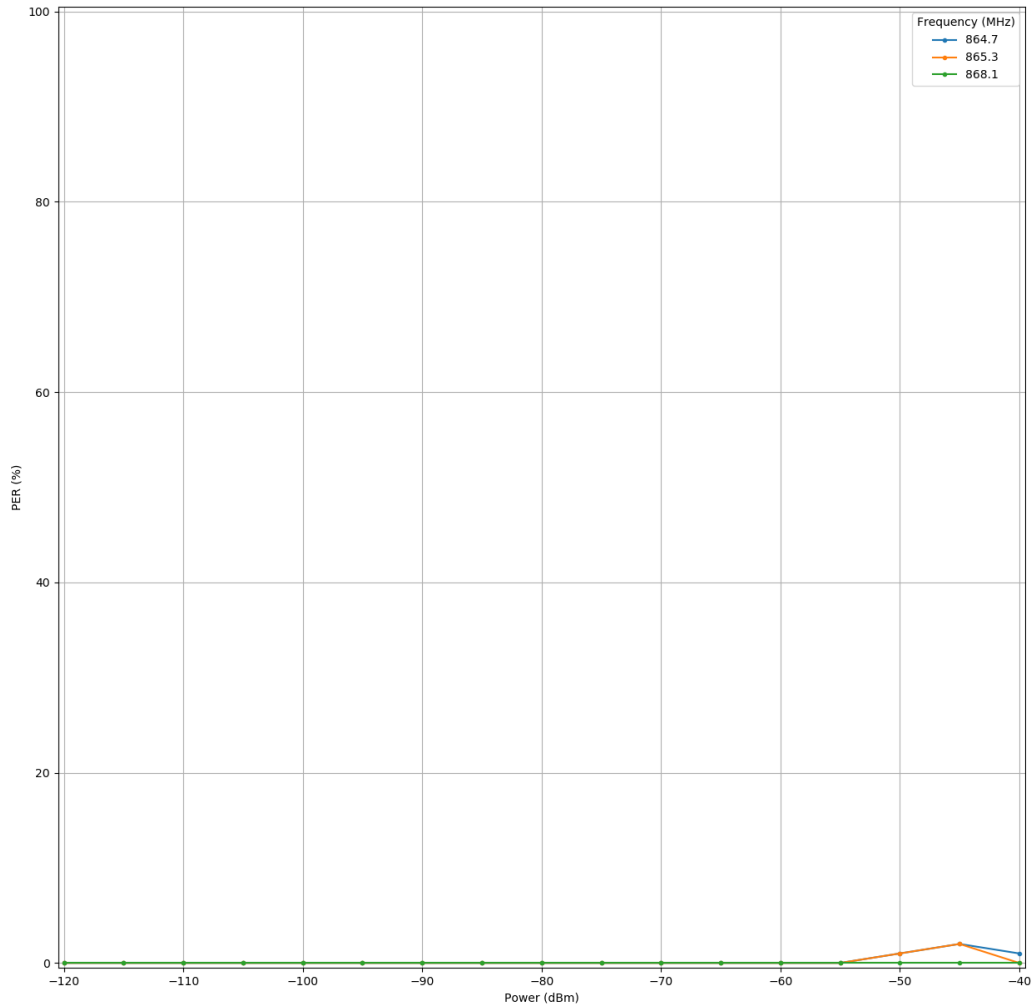
Table 7: PER over power SF10BW125

Mod	Data rate	Frequency (MHz)	Power (dBm)	PER (%)
LORA	SF10BW125	864.7	-120	0
LORA	SF10BW125	864.7	-115	0
LORA	SF10BW125	864.7	-110	0
LORA	SF10BW125	864.7	-105	0
LORA	SF10BW125	864.7	-100	0
LORA	SF10BW125	864.7	-95	0
LORA	SF10BW125	864.7	-90	0
LORA	SF10BW125	864.7	-85	0
LORA	SF10BW125	864.7	-80	0
LORA	SF10BW125	864.7	-75	0
LORA	SF10BW125	864.7	-70	0
LORA	SF10BW125	864.7	-65	0
LORA	SF10BW125	864.7	-60	0
LORA	SF10BW125	864.7	-55	0
LORA	SF10BW125	864.7	-50	1
LORA	SF10BW125	864.7	-45	2
LORA	SF10BW125	864.7	-40	1
LORA	SF10BW125	865.3	-120	0
LORA	SF10BW125	865.3	-115	0
LORA	SF10BW125	865.3	-110	0
LORA	SF10BW125	865.3	-105	0
LORA	SF10BW125	865.3	-100	0
LORA	SF10BW125	865.3	-95	0
LORA	SF10BW125	865.3	-90	0
LORA	SF10BW125	865.3	-85	0
LORA	SF10BW125	865.3	-80	0
LORA	SF10BW125	865.3	-75	0
LORA	SF10BW125	865.3	-70	0
LORA	SF10BW125	865.3	-65	0
LORA	SF10BW125	865.3	-60	0
LORA	SF10BW125	865.3	-55	0
LORA	SF10BW125	865.3	-50	1
LORA	SF10BW125	865.3	-45	2
LORA	SF10BW125	865.3	-40	0
LORA	SF10BW125	868.1	-120	0
LORA	SF10BW125	868.1	-115	0

LORA	SF10BW125	868.1	-110	0
LORA	SF10BW125	868.1	-105	0
LORA	SF10BW125	868.1	-100	0
LORA	SF10BW125	868.1	-95	0
LORA	SF10BW125	868.1	-90	0
LORA	SF10BW125	868.1	-85	0
LORA	SF10BW125	868.1	-80	0
LORA	SF10BW125	868.1	-75	0
LORA	SF10BW125	868.1	-70	0
LORA	SF10BW125	868.1	-65	0
LORA	SF10BW125	868.1	-60	0
LORA	SF10BW125	868.1	-55	0
LORA	SF10BW125	868.1	-50	0
LORA	SF10BW125	868.1	-45	0
LORA	SF10BW125	868.1	-40	0

**Figure 6: PER over power SF10BW125**

RX Per Rssi Snr  
Bench: RAK2247 Gateway V1.0 868MHz , Util SG - Pathloss = 2.0 dB  
PER over power - Waveform: SF10BW125, for 100 packets



#### 4.3.4 PER over power SF12BW125

Table 8: PER over power SF12BW125

Figure 7: PER over power SF12BW125



### 4.3.5 PER over power SF7BW250

Table 9: PER over power SF7BW250

Figure 8: PER over power SF7BW250

### 4.3.6 RSSI over power SF7BW125

- RSSI\_OFFSET : -164

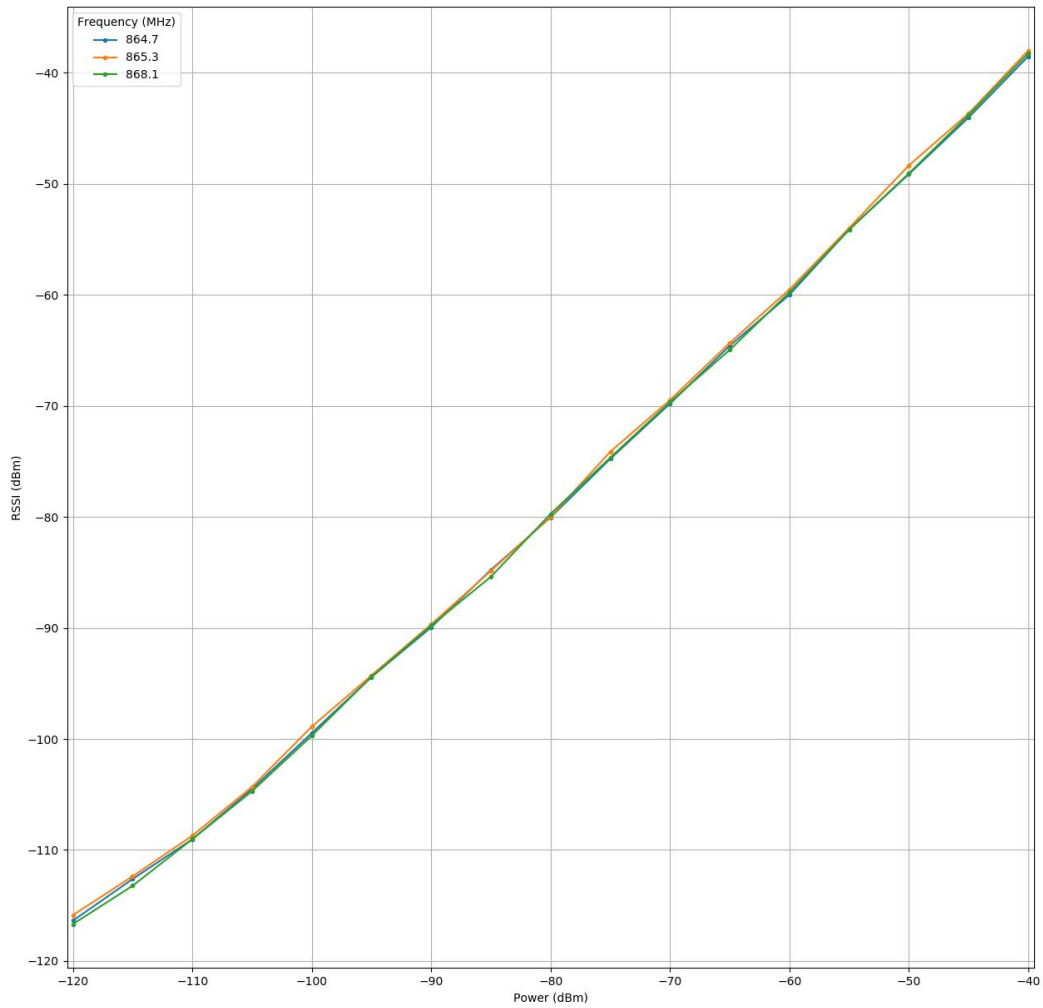
**Table 10: RSSI over power SF7BW125**

Mod	Data rate	Frequency (MHz)	Power (dBm)	RSSI (dBm)
LORA	SF7BW125	864.7	-120	-116.36
LORA	SF7BW125	864.7	-115	-112.61
LORA	SF7BW125	864.7	-110	-109.03
LORA	SF7BW125	864.7	-105	-104.49
LORA	SF7BW125	864.7	-100	-99.47
LORA	SF7BW125	864.7	-95	-94.42
LORA	SF7BW125	864.7	-90	-89.95
LORA	SF7BW125	864.7	-85	-84.77
LORA	SF7BW125	864.7	-80	-80.04
LORA	SF7BW125	864.7	-75	-74.77
LORA	SF7BW125	864.7	-70	-69.80
LORA	SF7BW125	864.7	-65	-64.59
LORA	SF7BW125	864.7	-60	-60.00
LORA	SF7BW125	864.7	-55	-54.12
LORA	SF7BW125	864.7	-50	-49.14
LORA	SF7BW125	864.7	-45	-44.04
LORA	SF7BW125	864.7	-40	-38.52
LORA	SF7BW125	865.3	-120	-115.86
LORA	SF7BW125	865.3	-115	-112.37
LORA	SF7BW125	865.3	-110	-108.71
LORA	SF7BW125	865.3	-105	-104.31
LORA	SF7BW125	865.3	-100	-98.89
LORA	SF7BW125	865.3	-95	-94.27
LORA	SF7BW125	865.3	-90	-89.68
LORA	SF7BW125	865.3	-85	-84.86
LORA	SF7BW125	865.3	-80	-79.99
LORA	SF7BW125	865.3	-75	-74.13
LORA	SF7BW125	865.3	-70	-69.48
LORA	SF7BW125	865.3	-65	-64.33
LORA	SF7BW125	865.3	-60	-59.52
LORA	SF7BW125	865.3	-55	-53.98
LORA	SF7BW125	865.3	-50	-48.35
LORA	SF7BW125	865.3	-45	-43.68
LORA	SF7BW125	865.3	-40	-37.99
LORA	SF7BW125	868.1	-120	-116.67

LORA	SF7BW125	868.1	-115	-113.22
LORA	SF7BW125	868.1	-110	-109.02
LORA	SF7BW125	868.1	-105	-104.70
LORA	SF7BW125	868.1	-100	-99.71
LORA	SF7BW125	868.1	-95	-94.40
LORA	SF7BW125	868.1	-90	-89.78
LORA	SF7BW125	868.1	-85	-85.39
LORA	SF7BW125	868.1	-80	-79.73
LORA	SF7BW125	868.1	-75	-74.66
LORA	SF7BW125	868.1	-70	-69.66
LORA	SF7BW125	868.1	-65	-64.96
LORA	SF7BW125	868.1	-60	-59.77
LORA	SF7BW125	868.1	-55	-54.13
LORA	SF7BW125	868.1	-50	-49.07
LORA	SF7BW125	868.1	-45	-43.81
LORA	SF7BW125	868.1	-40	-38.25

**Figure 9: RSSI over power SF7BW125**

RX Per Rssi Snr  
Bench: RAK2247 Gateway V1.0 868MHz , Util SG - Pathloss = 2.0 dB  
RSSI over power - Waveform: SF7BW125, for 100 packets



### 4.3.7 RSSI over power SF10BW125

- RSSI\_OFFSET : -164

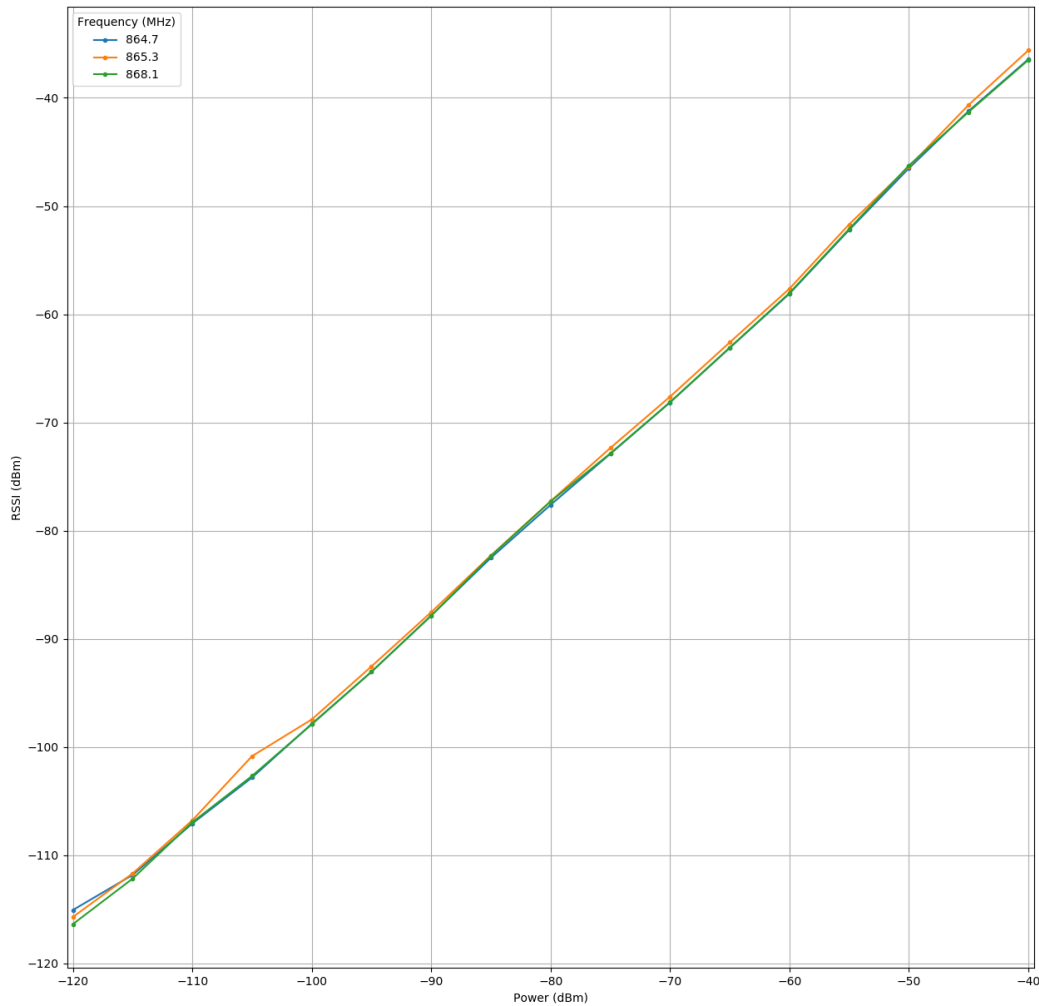
- **Table 11: RSSI over power SF10BW125**

Mod	Data rate	Frequency (MHz)	Power (dBm)	RSSI (dBm)
LORA	SF10BW125	864.7	-120	-115.05
LORA	SF10BW125	864.7	-115	-111.81
LORA	SF10BW125	864.7	-110	-107.06
LORA	SF10BW125	864.7	-105	-102.81
LORA	SF10BW125	864.7	-100	-97.85
LORA	SF10BW125	864.7	-95	-93.04
LORA	SF10BW125	864.7	-90	-87.84
LORA	SF10BW125	864.7	-85	-82.51
LORA	SF10BW125	864.7	-80	-77.61
LORA	SF10BW125	864.7	-75	-72.90
LORA	SF10BW125	864.7	-70	-68.15
LORA	SF10BW125	864.7	-65	-63.11
LORA	SF10BW125	864.7	-60	-58.10
LORA	SF10BW125	864.7	-55	-52.21
LORA	SF10BW125	864.7	-50	-46.52
LORA	SF10BW125	864.7	-45	-41.22
LORA	SF10BW125	864.7	-40	-36.44
LORA	SF10BW125	865.3	-120	-115.69
LORA	SF10BW125	865.3	-115	-111.67
LORA	SF10BW125	865.3	-110	-106.76
LORA	SF10BW125	865.3	-105	-100.83
LORA	SF10BW125	865.3	-100	-97.44
LORA	SF10BW125	865.3	-95	-92.54
LORA	SF10BW125	865.3	-90	-87.53
LORA	SF10BW125	865.3	-85	-82.29
LORA	SF10BW125	865.3	-80	-77.27
LORA	SF10BW125	865.3	-75	-72.36
LORA	SF10BW125	865.3	-70	-67.62
LORA	SF10BW125	865.3	-65	-62.60
LORA	SF10BW125	865.3	-60	-57.64
LORA	SF10BW125	865.3	-55	-51.69
LORA	SF10BW125	865.3	-50	-46.36
LORA	SF10BW125	865.3	-45	-40.66
LORA	SF10BW125	865.3	-40	-35.62

LORA	SF10BW125	868.1	-120	-116.35
LORA	SF10BW125	868.1	-115	-112.15
LORA	SF10BW125	868.1	-110	-106.94
LORA	SF10BW125	868.1	-105	-102.66
LORA	SF10BW125	868.1	-100	-97.89
LORA	SF10BW125	868.1	-95	-93.04
LORA	SF10BW125	868.1	-90	-87.86
LORA	SF10BW125	868.1	-85	-82.33
LORA	SF10BW125	868.1	-80	-77.30
LORA	SF10BW125	868.1	-75	-72.86
LORA	SF10BW125	868.1	-70	-68.12
LORA	SF10BW125	868.1	-65	-63.08
LORA	SF10BW125	868.1	-60	-58.04
LORA	SF10BW125	868.1	-55	-52.12
LORA	SF10BW125	868.1	-50	-46.26
LORA	SF10BW125	868.1	-45	-41.31
LORA	SF10BW125	868.1	-40	-36.51

**Figure 10: RSSI over power SF10BW125**

RX Per Rssi Snr  
 Bench: RAK2247 Gateway V1.0 868MHz , Util SG - Pathloss = 2.0 dB  
 RSSI over power - Waveform: SF10BW125, for 100 packets



### 4.3.8 RSSI over power SF12BW125

- RSSI\_OFFSET : -164

• Table 12: RSSI over power SF12BW125

Mod	Data rate	Frequency (MHz)	Power (dBm)	RSSI (dBm)
LORA	SF12BW125	864.7	-120	-115.46
LORA	SF12BW125	864.7	-115	-112.98
LORA	SF12BW125	864.7	-110	-108.66

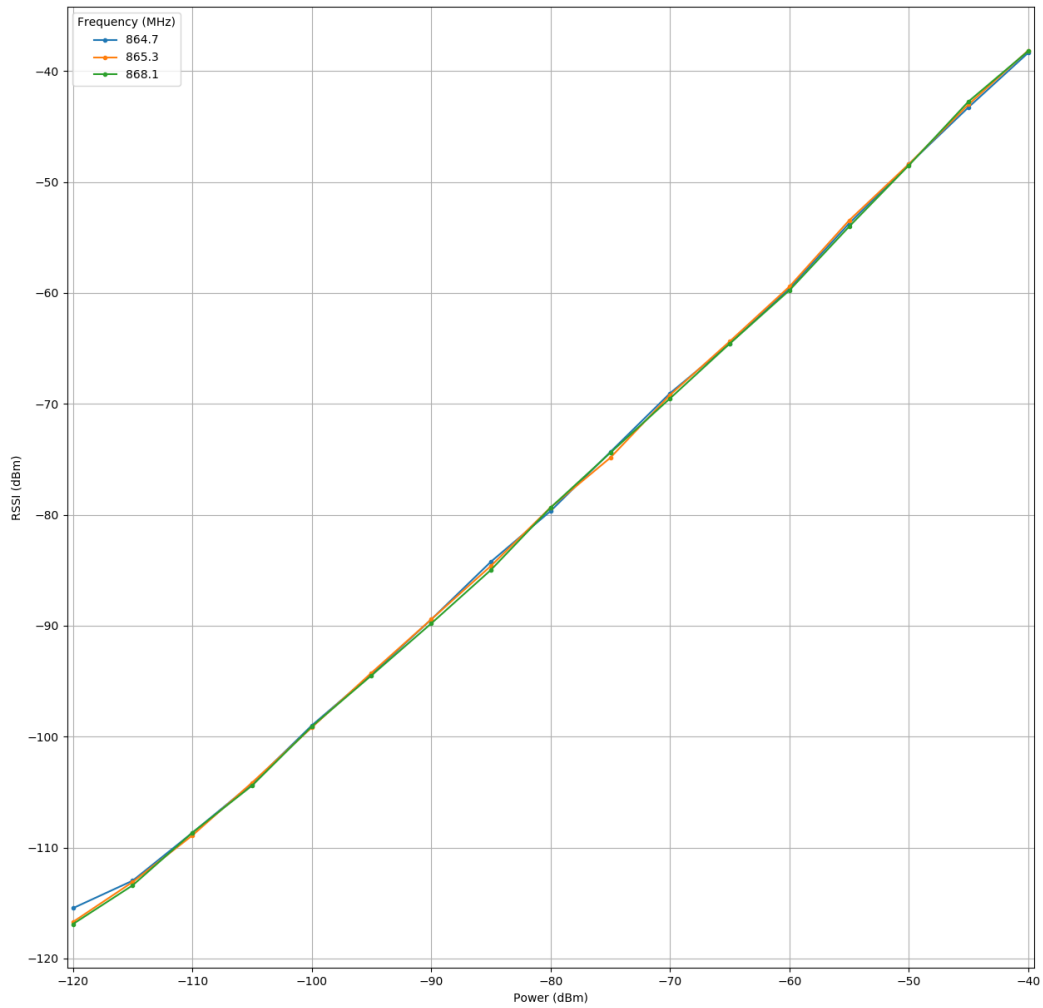
LORA	SF12BW125	864.7	-105	-104.23
LORA	SF12BW125	864.7	-100	-98.99
LORA	SF12BW125	864.7	-95	-94.37
LORA	SF12BW125	864.7	-90	-89.44
LORA	SF12BW125	864.7	-85	-84.23
LORA	SF12BW125	864.7	-80	-79.66
LORA	SF12BW125	864.7	-75	-74.34
LORA	SF12BW125	864.7	-70	-69.04
LORA	SF12BW125	864.7	-65	-64.56
LORA	SF12BW125	864.7	-60	-59.58
LORA	SF12BW125	864.7	-55	-53.74
LORA	SF12BW125	864.7	-50	-48.41
LORA	SF12BW125	864.7	-45	-43.26
LORA	SF12BW125	864.7	-40	-38.35
LORA	SF12BW125	865.3	-120	-116.70
LORA	SF12BW125	865.3	-115	-113.10
LORA	SF12BW125	865.3	-110	-108.90
LORA	SF12BW125	865.3	-105	-104.14
LORA	SF12BW125	865.3	-100	-99.17
LORA	SF12BW125	865.3	-95	-94.24
LORA	SF12BW125	865.3	-90	-89.43
LORA	SF12BW125	865.3	-85	-84.61
LORA	SF12BW125	865.3	-80	-79.33
LORA	SF12BW125	865.3	-75	-74.86
LORA	SF12BW125	865.3	-70	-69.20
LORA	SF12BW125	865.3	-65	-64.37
LORA	SF12BW125	865.3	-60	-59.43
LORA	SF12BW125	865.3	-55	-53.46
LORA	SF12BW125	865.3	-50	-48.39
LORA	SF12BW125	865.3	-45	-43.01
LORA	SF12BW125	865.3	-40	-38.14
LORA	SF12BW125	868.1	-120	-116.89
LORA	SF12BW125	868.1	-115	-113.40
LORA	SF12BW125	868.1	-110	-108.65
LORA	SF12BW125	868.1	-105	-104.41
LORA	SF12BW125	868.1	-100	-99.08
LORA	SF12BW125	868.1	-95	-94.48
LORA	SF12BW125	868.1	-90	-89.80
LORA	SF12BW125	868.1	-85	-84.97
LORA	SF12BW125	868.1	-80	-79.35



LORA	SF12BW125	868.1	-75	-74.41
LORA	SF12BW125	868.1	-70	-69.51
LORA	SF12BW125	868.1	-65	-64.57
LORA	SF12BW125	868.1	-60	-59.76
LORA	SF12BW125	868.1	-55	-54.02
LORA	SF12BW125	868.1	-50	-48.50
LORA	SF12BW125	868.1	-45	-42.74
LORA	SF12BW125	868.1	-40	-38.19

**Figure 11: RSSI over power SF12BW125**

RX Per Rssi Snr  
Bench: RAK2247 Gateway V1.0 868MHz , Util SG - Pathloss = 2.0 dB  
RSSI over power - Waveform: SF12BW125, for 100 packets



### 4.3.9 RSSI over power SF7BW250

- RSSI\_OFFSET : -164

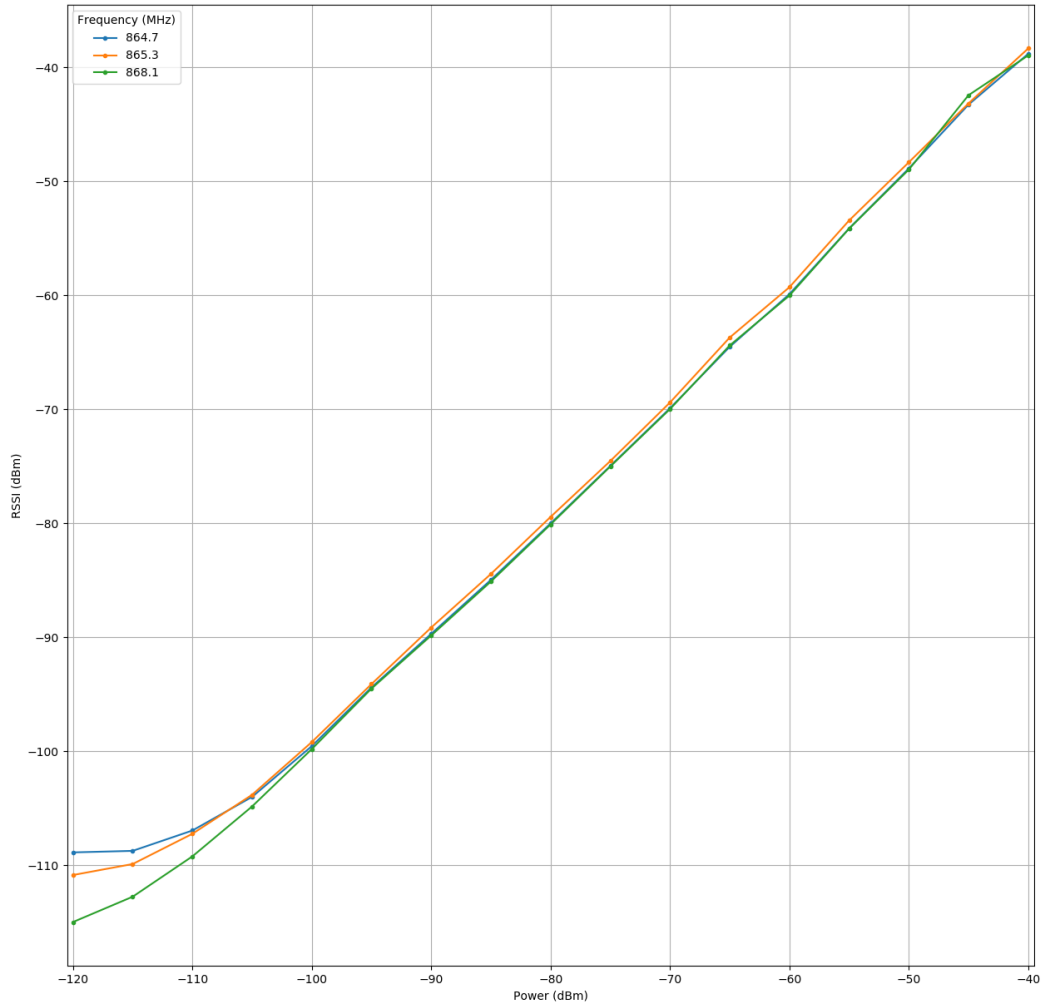
- **Table 13: RSSI over power SF7BW250**

Mod	Data rate	Frequency (MHz)	Power (dBm)	RSSI (dBm)
LORA	SF7BW250	864.7	-120	-108.89
LORA	SF7BW250	864.7	-115	-108.76
LORA	SF7BW250	864.7	-110	-106.97
LORA	SF7BW250	864.7	-105	-104.02
LORA	SF7BW250	864.7	-100	-99.57
LORA	SF7BW250	864.7	-95	-94.41
LORA	SF7BW250	864.7	-90	-89.71
LORA	SF7BW250	864.7	-85	-84.98
LORA	SF7BW250	864.7	-80	-80.02
LORA	SF7BW250	864.7	-75	-74.98
LORA	SF7BW250	864.7	-70	-69.92
LORA	SF7BW250	864.7	-65	-64.53
LORA	SF7BW250	864.7	-60	-59.91
LORA	SF7BW250	864.7	-55	-54.14
LORA	SF7BW250	864.7	-50	-48.88
LORA	SF7BW250	864.7	-45	-43.28
LORA	SF7BW250	864.7	-40	-38.82
LORA	SF7BW250	865.3	-120	-110.88
LORA	SF7BW250	865.3	-115	-109.91
LORA	SF7BW250	865.3	-110	-107.26
LORA	SF7BW250	865.3	-105	-103.83
LORA	SF7BW250	865.3	-100	-99.21
LORA	SF7BW250	865.3	-95	-94.12
LORA	SF7BW250	865.3	-90	-89.16
LORA	SF7BW250	865.3	-85	-84.46
LORA	SF7BW250	865.3	-80	-79.45
LORA	SF7BW250	865.3	-75	-74.55
LORA	SF7BW250	865.3	-70	-69.41
LORA	SF7BW250	865.3	-65	-63.71
LORA	SF7BW250	865.3	-60	-59.30
LORA	SF7BW250	865.3	-55	-53.44
LORA	SF7BW250	865.3	-50	-48.34
LORA	SF7BW250	865.3	-45	-43.17
LORA	SF7BW250	865.3	-40	-38.35
LORA	SF7BW250	868.1	-120	-115.00

LORA	SF7BW250	868.1	-115	-112.78
LORA	SF7BW250	868.1	-110	-109.24
LORA	SF7BW250	868.1	-105	-104.86
LORA	SF7BW250	868.1	-100	-99.82
LORA	SF7BW250	868.1	-95	-94.52
LORA	SF7BW250	868.1	-90	-89.86
LORA	SF7BW250	868.1	-85	-85.12
LORA	SF7BW250	868.1	-80	-80.11
LORA	SF7BW250	868.1	-75	-75.03
LORA	SF7BW250	868.1	-70	-69.99
LORA	SF7BW250	868.1	-65	-64.41
LORA	SF7BW250	868.1	-60	-60.03
LORA	SF7BW250	868.1	-55	-54.16
LORA	SF7BW250	868.1	-50	-48.98
LORA	SF7BW250	868.1	-45	-42.45
LORA	SF7BW250	868.1	-40	-38.96

**Figure 12: RSSI over power SF7BW250**

RX Per Rssi Snr  
Bench: RAK2247 Gateway V1.0 868MHz , Util SG - Pathloss = 2.0 dB  
RSSI over power - Waveform: SF7BW250, for 100 packets



### 4.3.10 RSSI dev over power SF7BW125

RSSI\_OFFSET : -164

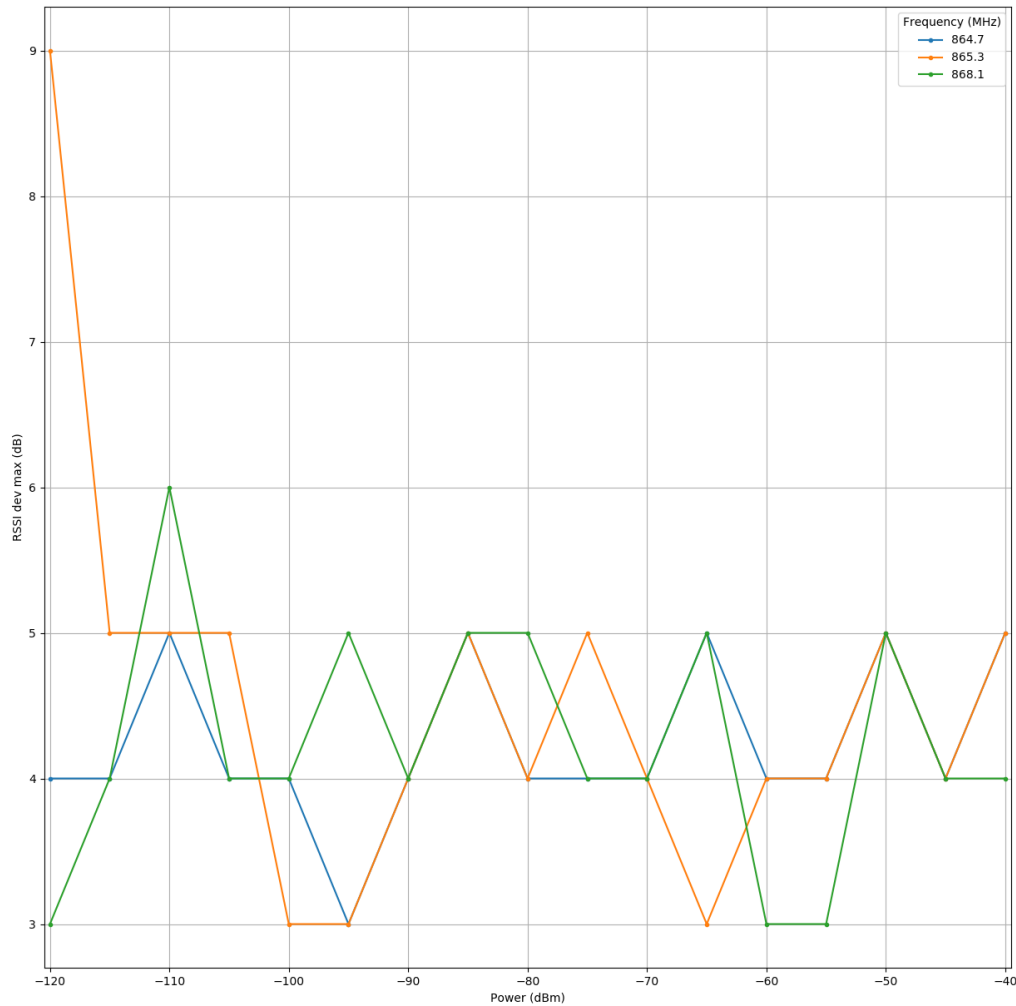
**Table 14: RSSI dev over power SF7BW125**

Mod	Data rate	Frequency (MHz)	Power (dBm)	RSSI dev max (dB)
LORA	SF7BW125	864.7	-120	4
LORA	SF7BW125	864.7	-115	4
LORA	SF7BW125	864.7	-110	5
LORA	SF7BW125	864.7	-105	4
LORA	SF7BW125	864.7	-100	4
LORA	SF7BW125	864.7	-95	3
LORA	SF7BW125	864.7	-90	4
LORA	SF7BW125	864.7	-85	5
LORA	SF7BW125	864.7	-80	4
LORA	SF7BW125	864.7	-75	4
LORA	SF7BW125	864.7	-70	4
LORA	SF7BW125	864.7	-65	5
LORA	SF7BW125	864.7	-60	4
LORA	SF7BW125	864.7	-55	4
LORA	SF7BW125	864.7	-50	5
LORA	SF7BW125	864.7	-45	4
LORA	SF7BW125	864.7	-40	5
LORA	SF7BW125	865.3	-120	9
LORA	SF7BW125	865.3	-115	5
LORA	SF7BW125	865.3	-110	5
LORA	SF7BW125	865.3	-105	5
LORA	SF7BW125	865.3	-100	3
LORA	SF7BW125	865.3	-95	3
LORA	SF7BW125	865.3	-90	4
LORA	SF7BW125	865.3	-85	5
LORA	SF7BW125	865.3	-80	4
LORA	SF7BW125	865.3	-75	5
LORA	SF7BW125	865.3	-70	4
LORA	SF7BW125	865.3	-65	3
LORA	SF7BW125	865.3	-60	4
LORA	SF7BW125	865.3	-55	4
LORA	SF7BW125	865.3	-50	5
LORA	SF7BW125	865.3	-45	4
LORA	SF7BW125	865.3	-40	5
LORA	SF7BW125	868.1	-120	3

LORA	SF7BW125	868.1	-115	4
LORA	SF7BW125	868.1	-110	6
LORA	SF7BW125	868.1	-105	4
LORA	SF7BW125	868.1	-100	4
LORA	SF7BW125	868.1	-95	5
LORA	SF7BW125	868.1	-90	4
LORA	SF7BW125	868.1	-85	5
LORA	SF7BW125	868.1	-80	5
LORA	SF7BW125	868.1	-75	4
LORA	SF7BW125	868.1	-70	4
LORA	SF7BW125	868.1	-65	5
LORA	SF7BW125	868.1	-60	3
LORA	SF7BW125	868.1	-55	3
LORA	SF7BW125	868.1	-50	5
LORA	SF7BW125	868.1	-45	4
LORA	SF7BW125	868.1	-40	4

**Figure 13: RSSI dev over power SF7BW125**

RX Per Rssi Snr  
 Bench: RAK2247 Gateway V1.0 868MHz , Util SG - Pathloss = 2.0 dB  
 RSSI error over power - Waveform: SF7BW125, for 100 packets



### 4.3.11 RSSI dev over power SF10BW125

RSSI\_OFFSET : -164

**Table 15: RSSI dev over power SF10BW125**

Mod	Data rate	Frequency (MHz)	Power (dBm)	RSSI dev max (dB)
LORA	SF10BW125	864.7	-120	6
LORA	SF10BW125	864.7	-115	3
LORA	SF10BW125	864.7	-110	4

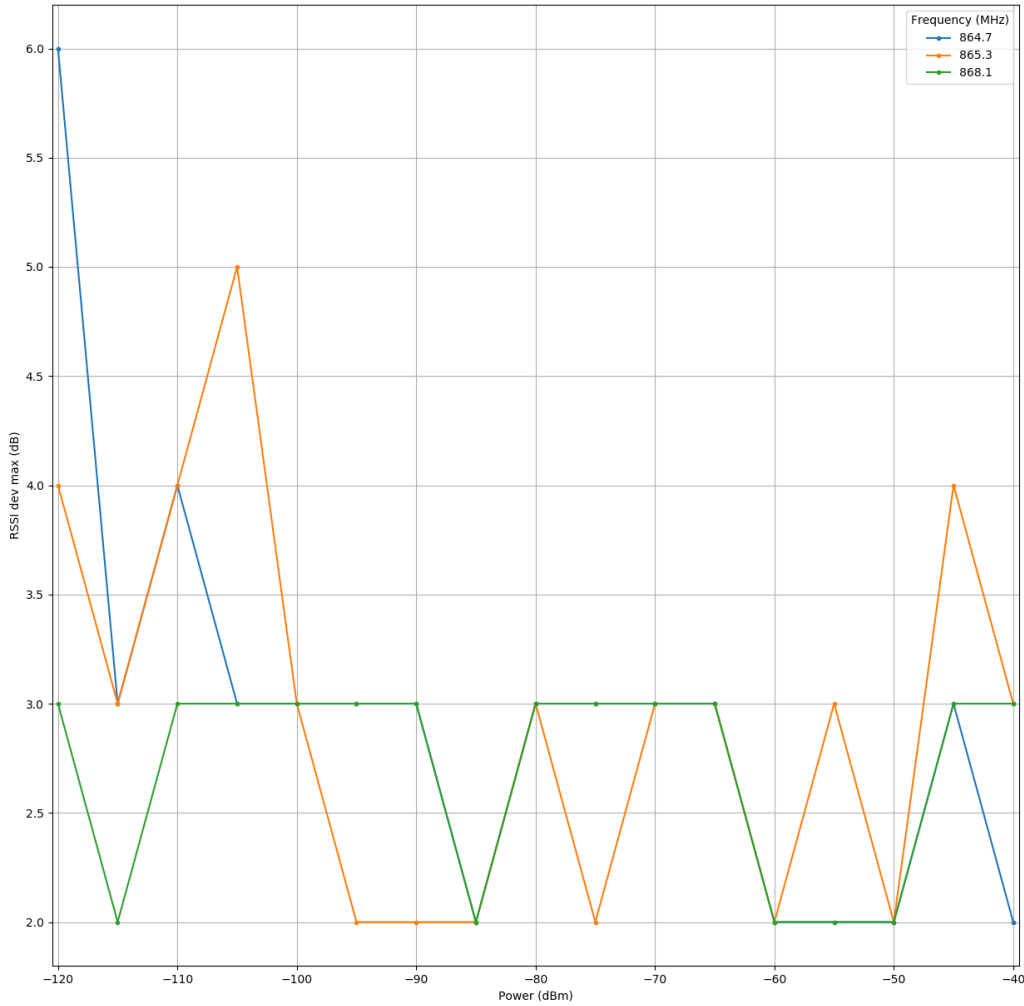


LORA	SF10BW125	864.7	-105	3
LORA	SF10BW125	864.7	-100	3
LORA	SF10BW125	864.7	-95	3
LORA	SF10BW125	864.7	-90	3
LORA	SF10BW125	864.7	-85	2
LORA	SF10BW125	864.7	-80	3
LORA	SF10BW125	864.7	-75	3
LORA	SF10BW125	864.7	-70	3
LORA	SF10BW125	864.7	-65	3
LORA	SF10BW125	864.7	-60	2
LORA	SF10BW125	864.7	-55	2
LORA	SF10BW125	864.7	-50	2
LORA	SF10BW125	864.7	-45	3
LORA	SF10BW125	864.7	-40	2
LORA	SF10BW125	865.3	-120	4
LORA	SF10BW125	865.3	-115	3
LORA	SF10BW125	865.3	-110	4
LORA	SF10BW125	865.3	-105	5
LORA	SF10BW125	865.3	-100	3
LORA	SF10BW125	865.3	-95	2
LORA	SF10BW125	865.3	-90	2
LORA	SF10BW125	865.3	-85	2
LORA	SF10BW125	865.3	-80	3
LORA	SF10BW125	865.3	-75	2
LORA	SF10BW125	865.3	-70	3
LORA	SF10BW125	865.3	-65	3
LORA	SF10BW125	865.3	-60	2
LORA	SF10BW125	865.3	-55	3
LORA	SF10BW125	865.3	-50	2
LORA	SF10BW125	865.3	-45	4
LORA	SF10BW125	865.3	-40	3
LORA	SF10BW125	868.1	-120	3
LORA	SF10BW125	868.1	-115	2
LORA	SF10BW125	868.1	-110	3
LORA	SF10BW125	868.1	-105	3
LORA	SF10BW125	868.1	-100	3
LORA	SF10BW125	868.1	-95	3
LORA	SF10BW125	868.1	-90	3
LORA	SF10BW125	868.1	-85	2
LORA	SF10BW125	868.1	-80	3

LORA	SF10BW125	868.1	-75	3
LORA	SF10BW125	868.1	-70	3
LORA	SF10BW125	868.1	-65	3
LORA	SF10BW125	868.1	-60	2
LORA	SF10BW125	868.1	-55	2
LORA	SF10BW125	868.1	-50	2
LORA	SF10BW125	868.1	-45	3
LORA	SF10BW125	868.1	-40	3

**Figure 14: RSSI dev over power SF10BW125**

RX Per Rssi Snr  
 Bench: RAK2247 Gateway V1.0 868MHz , Util SG - Pathloss = 2.0 dB  
 RSSI error over power - Waveform: SF10BW125, for 100 packets



### 4.3.12 RSSI dev over power SF12BW125

RSSI\_OFFSET : -164

**Table 16: RSSI dev over power SF12BW125**

Mod	Data rate	Frequency (MHz)	Power (dBm)	RSSI dev max (dB)
LORA	SF12BW125	864.7	-120	7
LORA	SF12BW125	864.7	-115	5
LORA	SF12BW125	864.7	-110	5

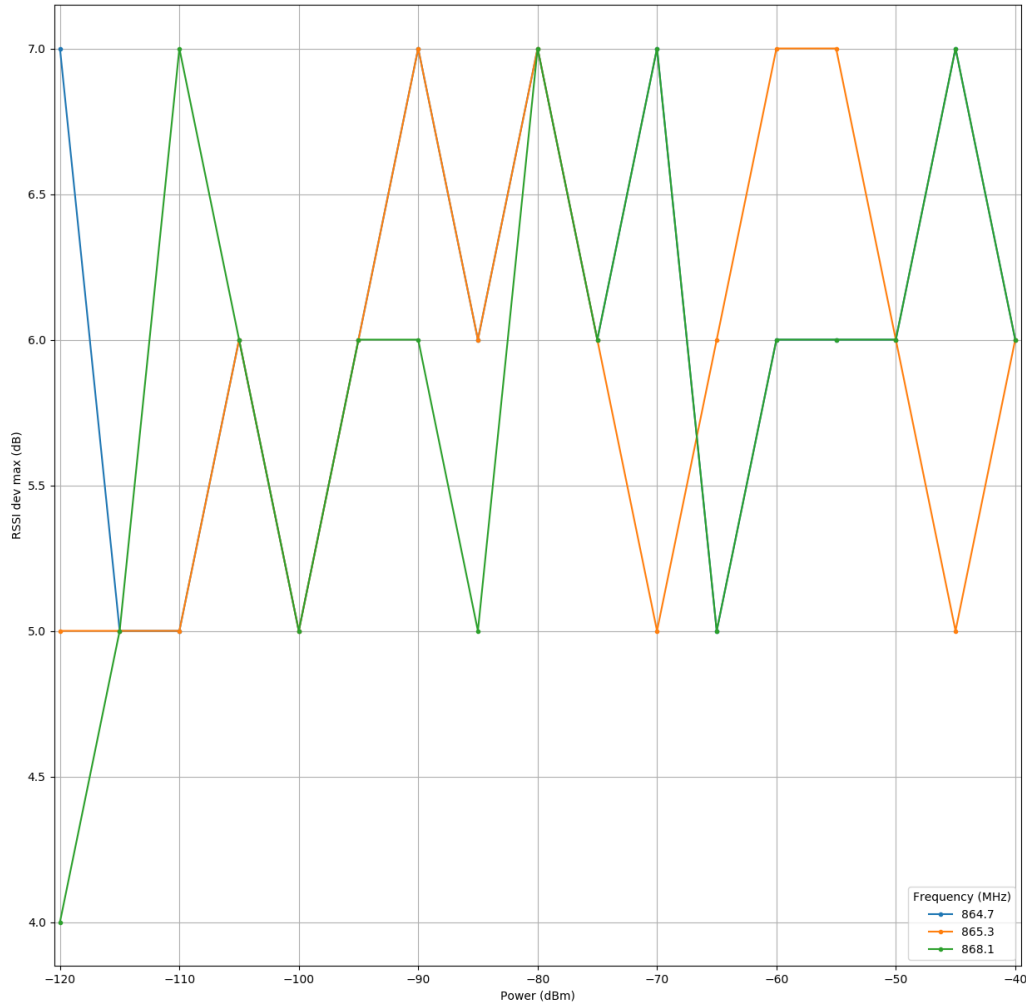
LORA	SF12BW125	864.7	-105	6
LORA	SF12BW125	864.7	-100	5
LORA	SF12BW125	864.7	-95	6
LORA	SF12BW125	864.7	-90	7
LORA	SF12BW125	864.7	-85	6
LORA	SF12BW125	864.7	-80	7
LORA	SF12BW125	864.7	-75	6
LORA	SF12BW125	864.7	-70	7
LORA	SF12BW125	864.7	-65	5
LORA	SF12BW125	864.7	-60	6
LORA	SF12BW125	864.7	-55	6
LORA	SF12BW125	864.7	-50	6
LORA	SF12BW125	864.7	-45	7
LORA	SF12BW125	864.7	-40	6
LORA	SF12BW125	865.3	-120	5
LORA	SF12BW125	865.3	-115	5
LORA	SF12BW125	865.3	-110	5
LORA	SF12BW125	865.3	-105	6
LORA	SF12BW125	865.3	-100	5
LORA	SF12BW125	865.3	-95	6
LORA	SF12BW125	865.3	-90	7
LORA	SF12BW125	865.3	-85	6
LORA	SF12BW125	865.3	-80	7
LORA	SF12BW125	865.3	-75	6
LORA	SF12BW125	865.3	-70	5
LORA	SF12BW125	865.3	-65	6
LORA	SF12BW125	865.3	-60	7
LORA	SF12BW125	865.3	-55	7
LORA	SF12BW125	865.3	-50	6
LORA	SF12BW125	865.3	-45	5
LORA	SF12BW125	865.3	-40	6
LORA	SF12BW125	868.1	-120	4
LORA	SF12BW125	868.1	-115	5
LORA	SF12BW125	868.1	-110	7
LORA	SF12BW125	868.1	-105	6
LORA	SF12BW125	868.1	-100	5
LORA	SF12BW125	868.1	-95	6
LORA	SF12BW125	868.1	-90	6
LORA	SF12BW125	868.1	-85	5
LORA	SF12BW125	868.1	-80	7

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LORA	SF12BW125	868.1	-75	6
LORA	SF12BW125	868.1	-70	7
LORA	SF12BW125	868.1	-65	5
LORA	SF12BW125	868.1	-60	6
LORA	SF12BW125	868.1	-55	6
LORA	SF12BW125	868.1	-50	6
LORA	SF12BW125	868.1	-45	7
LORA	SF12BW125	868.1	-40	6

**Figure 15: RSSI dev over power SF12BW125**

RX Per Rssi Snr  
 Bench: RAK2247 Gateway V1.0 868MHz , Util SG - Pathloss = 2.0 dB  
 RSSI error over power - Waveform: SF12BW125, for 100 packets



### 4.3.13 RSSI dev over power SF7BW250

RSSI\_OFFSET : -164

**Table 17: RSSI dev over power SF7BW250**

Mod	Data rate	Frequency (MHz)	Power (dBm)	RSSI dev max (dB)
LORA	SF7BW250	864.7	-120	4

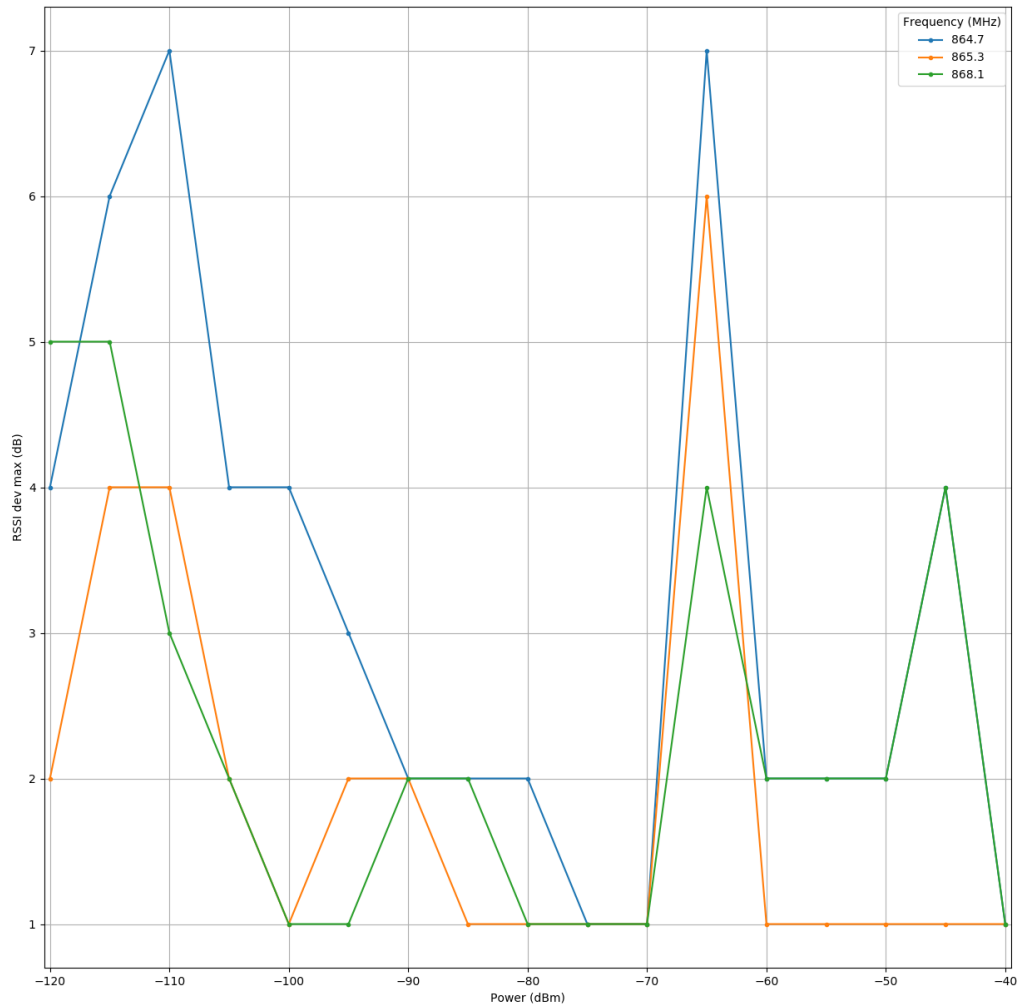
LORA	SF7BW250	864.7	-115	6
LORA	SF7BW250	864.7	-110	7
LORA	SF7BW250	864.7	-105	4
LORA	SF7BW250	864.7	-100	4
LORA	SF7BW250	864.7	-95	3
LORA	SF7BW250	864.7	-90	2
LORA	SF7BW250	864.7	-85	2
LORA	SF7BW250	864.7	-80	2
LORA	SF7BW250	864.7	-75	1
LORA	SF7BW250	864.7	-70	1
LORA	SF7BW250	864.7	-65	7
LORA	SF7BW250	864.7	-60	2
LORA	SF7BW250	864.7	-55	2
LORA	SF7BW250	864.7	-50	2
LORA	SF7BW250	864.7	-45	4
LORA	SF7BW250	864.7	-40	1
LORA	SF7BW250	865.3	-120	2
LORA	SF7BW250	865.3	-115	4
LORA	SF7BW250	865.3	-110	4
LORA	SF7BW250	865.3	-105	2
LORA	SF7BW250	865.3	-100	1
LORA	SF7BW250	865.3	-95	2
LORA	SF7BW250	865.3	-90	2
LORA	SF7BW250	865.3	-85	1
LORA	SF7BW250	865.3	-80	1
LORA	SF7BW250	865.3	-75	1
LORA	SF7BW250	865.3	-70	1
LORA	SF7BW250	865.3	-65	6
LORA	SF7BW250	865.3	-60	1
LORA	SF7BW250	865.3	-55	1
LORA	SF7BW250	865.3	-50	1
LORA	SF7BW250	865.3	-45	1
LORA	SF7BW250	865.3	-40	1
LORA	SF7BW250	868.1	-120	5
LORA	SF7BW250	868.1	-115	5
LORA	SF7BW250	868.1	-110	3
LORA	SF7BW250	868.1	-105	2
LORA	SF7BW250	868.1	-100	1
LORA	SF7BW250	868.1	-95	1
LORA	SF7BW250	868.1	-90	2

LORA	SF7BW250	868.1	-85	2
LORA	SF7BW250	868.1	-80	1
LORA	SF7BW250	868.1	-75	1
LORA	SF7BW250	868.1	-70	1
LORA	SF7BW250	868.1	-65	4
LORA	SF7BW250	868.1	-60	2
LORA	SF7BW250	868.1	-55	2
LORA	SF7BW250	868.1	-50	2
LORA	SF7BW250	868.1	-45	4
LORA	SF7BW250	868.1	-40	1

**Figure 16: RSSI dev over power SF7BW250**



RX Per Rssi Snr  
 Bench: RAK2247 Gateway V1.0 868MHz , Util SG - Pathloss = 2.0 dB  
 RSSI error over power - Waveform: SF7BW250, for 100 packets



### 4.3.14 SNR over power SF7BW125

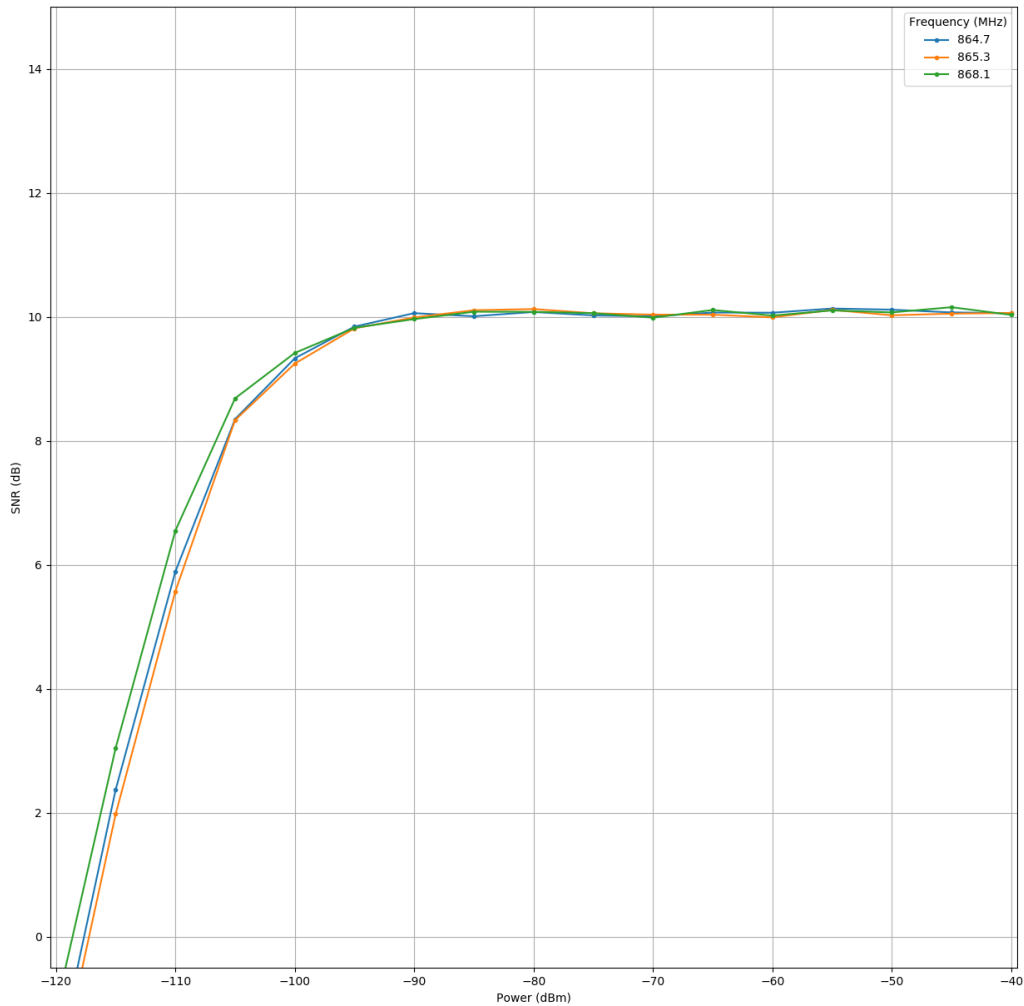
**Table 18: SNR over power SF7BW125**

Mod	Data rate	Frequency (MHz)	Power (dBm)	SNR (dB)
LORA	SF7BW125	864.7	-120	-2.11
LORA	SF7BW125	864.7	-115	2.37
LORA	SF7BW125	864.7	-110	5.89
LORA	SF7BW125	864.7	-105	8.35
LORA	SF7BW125	864.7	-100	9.33
LORA	SF7BW125	864.7	-95	9.84
LORA	SF7BW125	864.7	-90	10.06
LORA	SF7BW125	864.7	-85	10.01
LORA	SF7BW125	864.7	-80	10.08
LORA	SF7BW125	864.7	-75	10.02
LORA	SF7BW125	864.7	-70	10.01
LORA	SF7BW125	864.7	-65	10.07
LORA	SF7BW125	864.7	-60	10.07
LORA	SF7BW125	864.7	-55	10.13
LORA	SF7BW125	864.7	-50	10.11
LORA	SF7BW125	864.7	-45	10.07
LORA	SF7BW125	864.7	-40	10.06
LORA	SF7BW125	865.3	-120	-2.45
LORA	SF7BW125	865.3	-115	1.98
LORA	SF7BW125	865.3	-110	5.57
LORA	SF7BW125	865.3	-105	8.33
LORA	SF7BW125	865.3	-100	9.24
LORA	SF7BW125	865.3	-95	9.81
LORA	SF7BW125	865.3	-90	9.99
LORA	SF7BW125	865.3	-85	10.11
LORA	SF7BW125	865.3	-80	10.12
LORA	SF7BW125	865.3	-75	10.06
LORA	SF7BW125	865.3	-70	10.03
LORA	SF7BW125	865.3	-65	10.03
LORA	SF7BW125	865.3	-60	9.99
LORA	SF7BW125	865.3	-55	10.11
LORA	SF7BW125	865.3	-50	10.02
LORA	SF7BW125	865.3	-45	10.05
LORA	SF7BW125	865.3	-40	10.06
LORA	SF7BW125	868.1	-120	-1.17

LORA	SF7BW125	868.1	-115	3.05
LORA	SF7BW125	868.1	-110	6.55
LORA	SF7BW125	868.1	-105	8.68
LORA	SF7BW125	868.1	-100	9.42
LORA	SF7BW125	868.1	-95	9.82
LORA	SF7BW125	868.1	-90	9.96
LORA	SF7BW125	868.1	-85	10.08
LORA	SF7BW125	868.1	-80	10.08
LORA	SF7BW125	868.1	-75	10.06
LORA	SF7BW125	868.1	-70	9.98
LORA	SF7BW125	868.1	-65	10.11
LORA	SF7BW125	868.1	-60	10.02
LORA	SF7BW125	868.1	-55	10.10
LORA	SF7BW125	868.1	-50	10.07
LORA	SF7BW125	868.1	-45	10.15
LORA	SF7BW125	868.1	-40	10.03

**Figure 17 : SNR over power SF7BW125**

RX Per Rssi Snr  
 Bench: RAK2247 Gateway V1.0 868MHz , Util SG - Pathloss = 2.0 dB  
 SNR over power - Waveform: SF7BW125, for 100 packets



### 4.3.15 SNR over power SF10BW125

Table 19: SNR over power SF10BW125

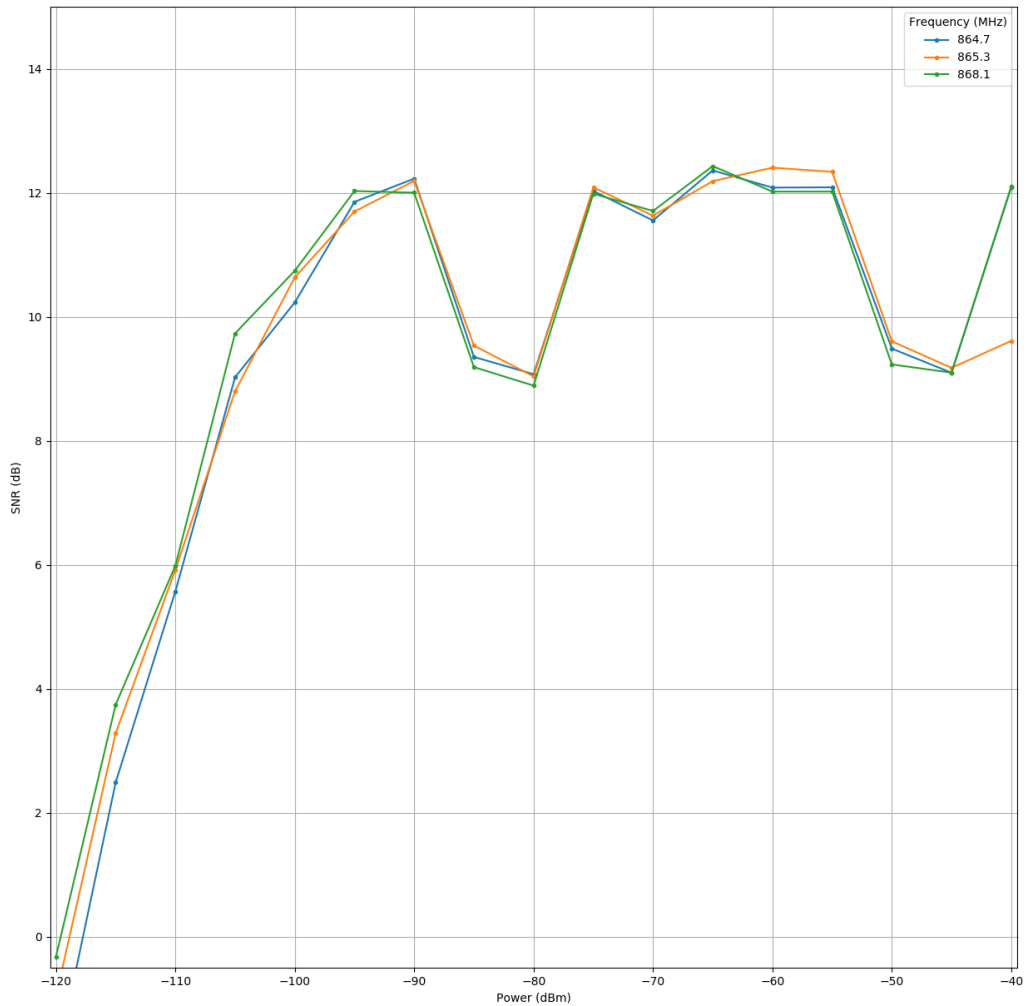
Mod	Data rate	Frequency (MHz)	Power (dBm)	SNR (dB)
LORA	SF10BW125	864.7	-120	-2.06
LORA	SF10BW125	864.7	-115	2.49
LORA	SF10BW125	864.7	-110	5.57

LORA	SF10BW125	864.7	-105	9.02
LORA	SF10BW125	864.7	-100	10.23
LORA	SF10BW125	864.7	-95	11.85
LORA	SF10BW125	864.7	-90	12.23
LORA	SF10BW125	864.7	-85	9.35
LORA	SF10BW125	864.7	-80	9.07
LORA	SF10BW125	864.7	-75	12.03
LORA	SF10BW125	864.7	-70	11.55
LORA	SF10BW125	864.7	-65	12.36
LORA	SF10BW125	864.7	-60	12.08
LORA	SF10BW125	864.7	-55	12.09
LORA	SF10BW125	864.7	-50	9.49
LORA	SF10BW125	864.7	-45	9.10
LORA	SF10BW125	864.7	-40	12.09
LORA	SF10BW125	865.3	-120	-0.96
LORA	SF10BW125	865.3	-115	3.28
LORA	SF10BW125	865.3	-110	5.92
LORA	SF10BW125	865.3	-105	8.80
LORA	SF10BW125	865.3	-100	10.64
LORA	SF10BW125	865.3	-95	11.70
LORA	SF10BW125	865.3	-90	12.19
LORA	SF10BW125	865.3	-85	9.53
LORA	SF10BW125	865.3	-80	9.04
LORA	SF10BW125	865.3	-75	12.09
LORA	SF10BW125	865.3	-70	11.63
LORA	SF10BW125	865.3	-65	12.19
LORA	SF10BW125	865.3	-60	12.41
LORA	SF10BW125	865.3	-55	12.34
LORA	SF10BW125	865.3	-50	9.60
LORA	SF10BW125	865.3	-45	9.18
LORA	SF10BW125	865.3	-40	9.61
LORA	SF10BW125	868.1	-120	-0.32
LORA	SF10BW125	868.1	-115	3.74
LORA	SF10BW125	868.1	-110	5.99
LORA	SF10BW125	868.1	-105	9.73
LORA	SF10BW125	868.1	-100	10.74
LORA	SF10BW125	868.1	-95	12.03
LORA	SF10BW125	868.1	-90	12.00
LORA	SF10BW125	868.1	-85	9.19
LORA	SF10BW125	868.1	-80	8.89

LORA	SF10BW125	868.1	-75	11.98
LORA	SF10BW125	868.1	-70	11.71
LORA	SF10BW125	868.1	-65	12.43
LORA	SF10BW125	868.1	-60	12.02
LORA	SF10BW125	868.1	-55	12.02
LORA	SF10BW125	868.1	-50	9.23
LORA	SF10BW125	868.1	-45	9.10
LORA	SF10BW125	868.1	-40	12.10

**Figure 18: SNR over power SF10BW125**

RX Per Rssi Snr  
 Bench: RAK2247 Gateway V1.0 868MHz , Util SG - Pathloss = 2.0 dB  
 SNR over power - Waveform: SF10BW125, for 100 packets



### 4.3.16 SNR over power SF12BW125

**Table 20: SNR over power SF12BW125**

Mod	Data rate	Frequency (MHz)	Power (dBm)	SNR (dB)
LORA	SF12BW125	864.7	-120	-0.91
LORA	SF12BW125	864.7	-115	3.11
LORA	SF12BW125	864.7	-110	5.27

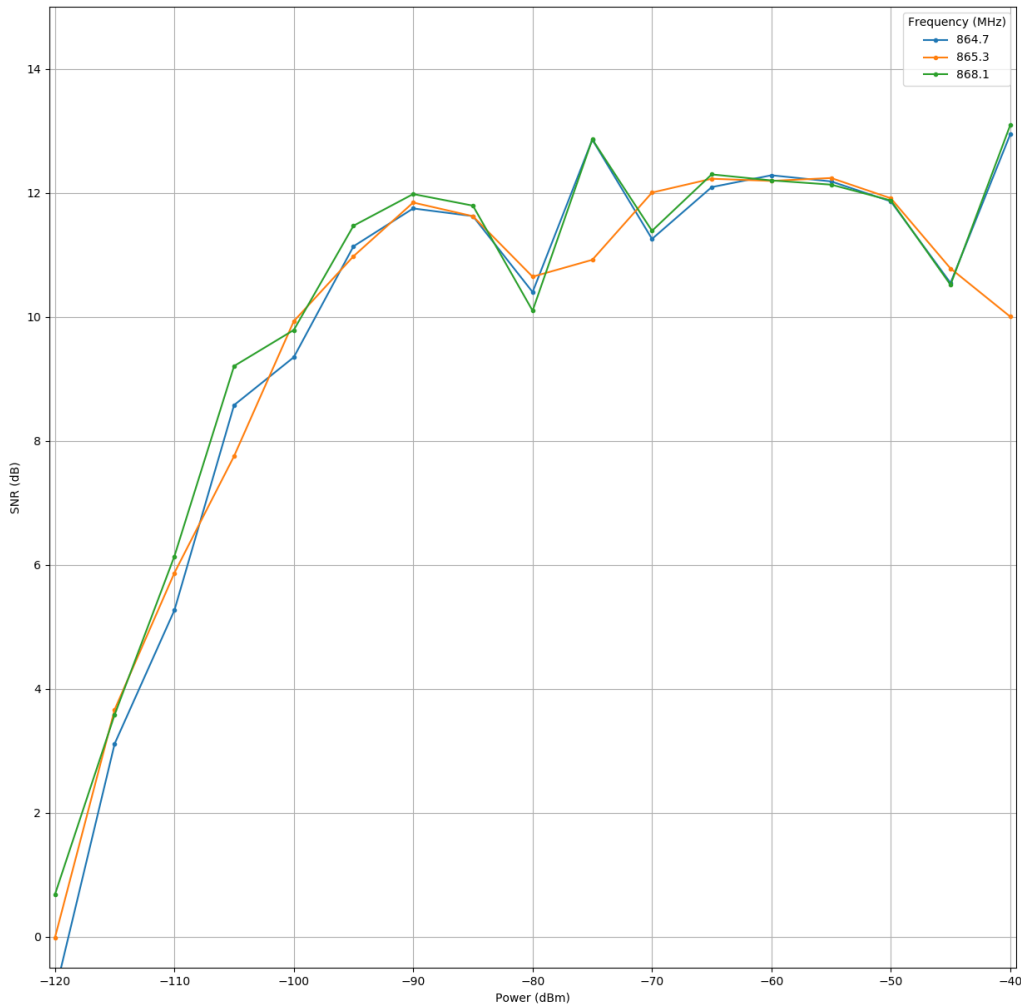
LORA	SF12BW125	864.7	-105	8.57
LORA	SF12BW125	864.7	-100	9.35
LORA	SF12BW125	864.7	-95	11.14
LORA	SF12BW125	864.7	-90	11.75
LORA	SF12BW125	864.7	-85	11.62
LORA	SF12BW125	864.7	-80	10.40
LORA	SF12BW125	864.7	-75	12.86
LORA	SF12BW125	864.7	-70	11.25
LORA	SF12BW125	864.7	-65	12.09
LORA	SF12BW125	864.7	-60	12.28
LORA	SF12BW125	864.7	-55	12.18
LORA	SF12BW125	864.7	-50	11.86
LORA	SF12BW125	864.7	-45	10.55
LORA	SF12BW125	864.7	-40	12.94
LORA	SF12BW125	865.3	-120	-0.01
LORA	SF12BW125	865.3	-115	3.67
LORA	SF12BW125	865.3	-110	5.87
LORA	SF12BW125	865.3	-105	7.75
LORA	SF12BW125	865.3	-100	9.93
LORA	SF12BW125	865.3	-95	10.98
LORA	SF12BW125	865.3	-90	11.84
LORA	SF12BW125	865.3	-85	11.62
LORA	SF12BW125	865.3	-80	10.65
LORA	SF12BW125	865.3	-75	10.92
LORA	SF12BW125	865.3	-70	12.00
LORA	SF12BW125	865.3	-65	12.23
LORA	SF12BW125	865.3	-60	12.19
LORA	SF12BW125	865.3	-55	12.24
LORA	SF12BW125	865.3	-50	11.91
LORA	SF12BW125	865.3	-45	10.78
LORA	SF12BW125	865.3	-40	10.00
LORA	SF12BW125	868.1	-120	0.68
LORA	SF12BW125	868.1	-115	3.58
LORA	SF12BW125	868.1	-110	6.14
LORA	SF12BW125	868.1	-105	9.21
LORA	SF12BW125	868.1	-100	9.79
LORA	SF12BW125	868.1	-95	11.47
LORA	SF12BW125	868.1	-90	11.98
LORA	SF12BW125	868.1	-85	11.79
LORA	SF12BW125	868.1	-80	10.10



LORA	SF12BW125	868.1	-75	12.86
LORA	SF12BW125	868.1	-70	11.39
LORA	SF12BW125	868.1	-65	12.30
LORA	SF12BW125	868.1	-60	12.20
LORA	SF12BW125	868.1	-55	12.13
LORA	SF12BW125	868.1	-50	11.88
LORA	SF12BW125	868.1	-45	10.52
LORA	SF12BW125	868.1	-40	13.09

**Figure 19: SNR over power SF12BW125**

RX Per Rssi Snr  
 Bench: RAK2247 Gateway V1.0 868MHz , Util SG - Pathloss = 2.0 dB  
 SNR over power - Waveform: SF12BW125, for 100 packets



### 4.3.17 SNR over power SF7BW250

Table 21: SNR over power SF7BW250

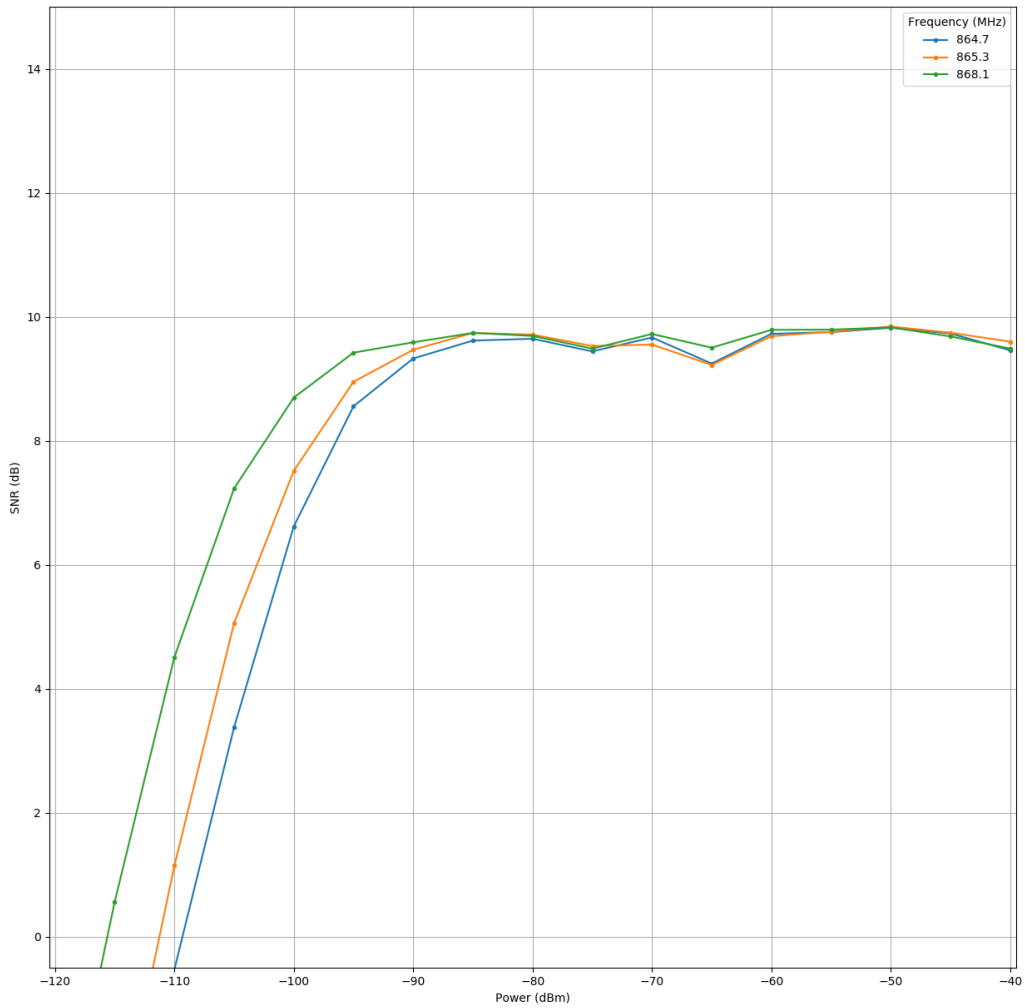
Mod	Data rate	Frequency (MHz)	Power (dBm)	SNR (dB)
LORA	SF7BW250	864.7	-120	-9.64
LORA	SF7BW250	864.7	-115	-5.22
LORA	SF7BW250	864.7	-110	-0.53

LORA	SF7BW250	864.7	-105	3.38
LORA	SF7BW250	864.7	-100	6.62
LORA	SF7BW250	864.7	-95	8.56
LORA	SF7BW250	864.7	-90	9.33
LORA	SF7BW250	864.7	-85	9.62
LORA	SF7BW250	864.7	-80	9.65
LORA	SF7BW250	864.7	-75	9.44
LORA	SF7BW250	864.7	-70	9.66
LORA	SF7BW250	864.7	-65	9.24
LORA	SF7BW250	864.7	-60	9.72
LORA	SF7BW250	864.7	-55	9.75
LORA	SF7BW250	864.7	-50	9.82
LORA	SF7BW250	864.7	-45	9.73
LORA	SF7BW250	864.7	-40	9.46
LORA	SF7BW250	865.3	-120	-7.76
LORA	SF7BW250	865.3	-115	-3.43
LORA	SF7BW250	865.3	-110	1.14
LORA	SF7BW250	865.3	-105	5.06
LORA	SF7BW250	865.3	-100	7.52
LORA	SF7BW250	865.3	-95	8.95
LORA	SF7BW250	865.3	-90	9.47
LORA	SF7BW250	865.3	-85	9.74
LORA	SF7BW250	865.3	-80	9.71
LORA	SF7BW250	865.3	-75	9.53
LORA	SF7BW250	865.3	-70	9.55
LORA	SF7BW250	865.3	-65	9.22
LORA	SF7BW250	865.3	-60	9.69
LORA	SF7BW250	865.3	-55	9.76
LORA	SF7BW250	865.3	-50	9.84
LORA	SF7BW250	865.3	-45	9.74
LORA	SF7BW250	865.3	-40	9.60
LORA	SF7BW250	868.1	-120	-4.00
LORA	SF7BW250	868.1	-115	0.56
LORA	SF7BW250	868.1	-110	4.51
LORA	SF7BW250	868.1	-105	7.23
LORA	SF7BW250	868.1	-100	8.70
LORA	SF7BW250	868.1	-95	9.42
LORA	SF7BW250	868.1	-90	9.59
LORA	SF7BW250	868.1	-85	9.74
LORA	SF7BW250	868.1	-80	9.69

LORA	SF7BW250	868.1	-75	9.49
LORA	SF7BW250	868.1	-70	9.72
LORA	SF7BW250	868.1	-65	9.50
LORA	SF7BW250	868.1	-60	9.79
LORA	SF7BW250	868.1	-55	9.79
LORA	SF7BW250	868.1	-50	9.83
LORA	SF7BW250	868.1	-45	9.68
LORA	SF7BW250	868.1	-40	9.49

**Figure 20: SNR over power SF7BW250**

RX Per Rssi Snr  
 Bench: RAK2247 Gateway V1.0 868MHz , Util SG - Pathloss = 2.0 dB  
 SNR over power - Waveform: SF7BW250, for 100 packets



#### 4.4 Conclusion

**STATUS: PASS**

## 5 Rx Frequency Error tolerance

This test intends to evaluate the tolerance to a frequency error on a received signal. It calculates the PER for a signal whose frequency is shifted of some offset. The tests is performed for several values of offset. The test is considered passed if the frequency offset at which the PER threshold (10%) is reached is over (below) 40 ppm (-40 ppm).

### 5.1 Bench setup

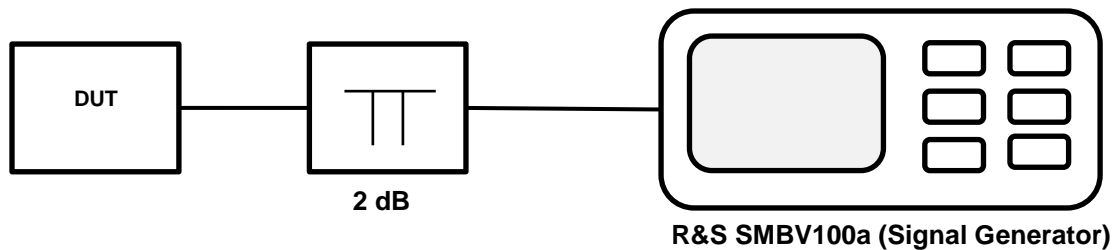


Figure 21: Rx Frequency Error tolerance test bench

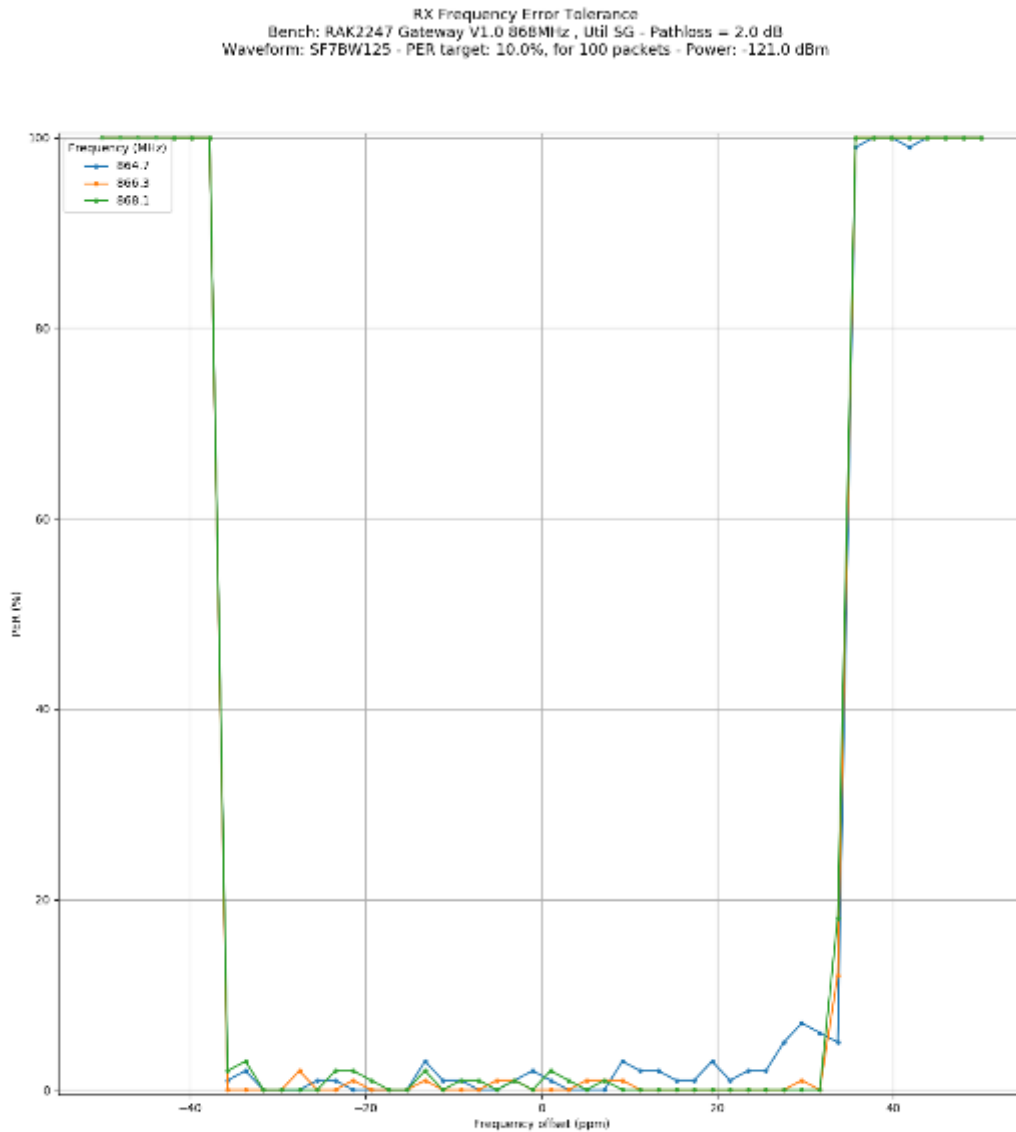
### 5.2 Pass/Fail criteria

PER must be below 10% for a shift of +/- 25 ppm of frequency.

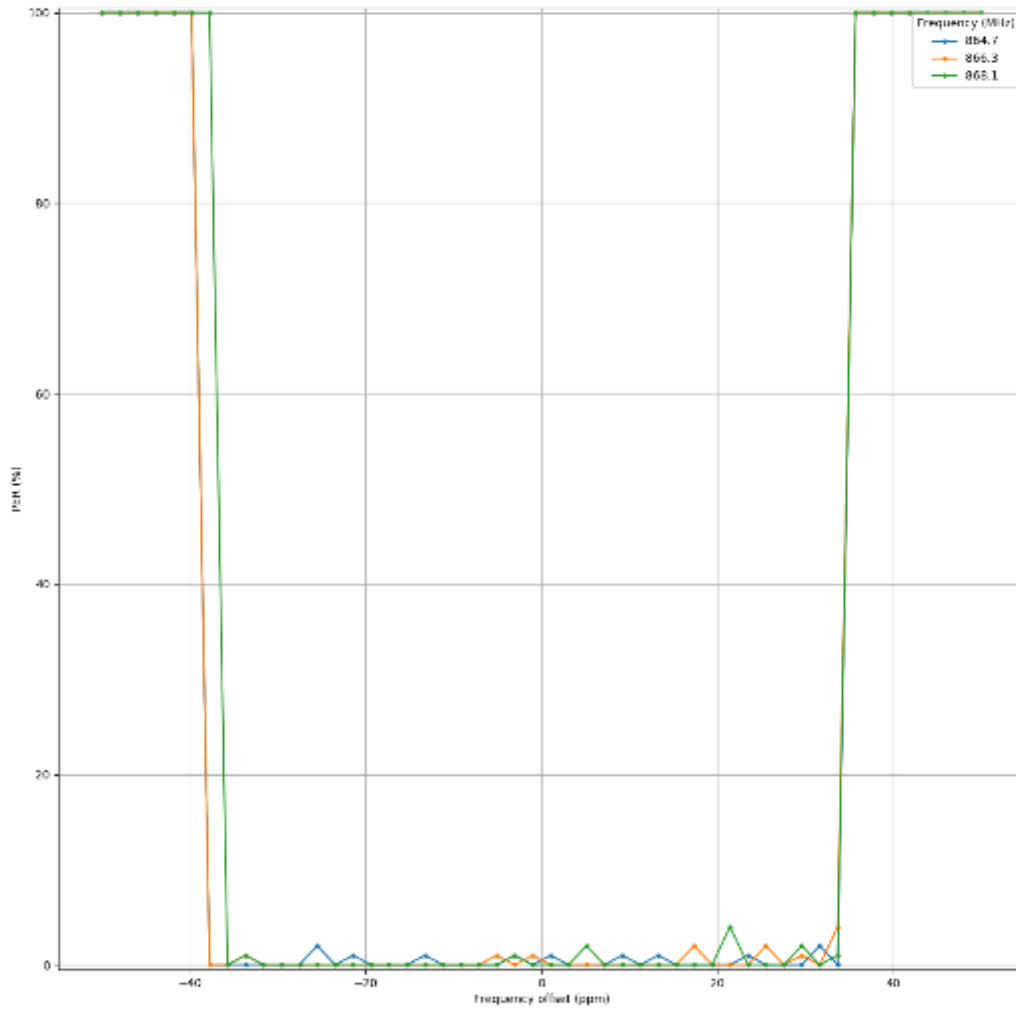
### 5.3 Results

Table 22: Rx Frequency Error tolerance

Mod	Data rate	Frequency (MHz)	Error max (ppm)	Status
LORA	SF7BW125	864.7	(-35.89, 33.78)	PASSED
LORA	SF7BW125	866.3	(-35.91, 33.33)	PASSED
LORA	SF7BW125	868.1	(-35.88, 32.76)	PASSED
LORA	SF10BW125	864.7	(-37.95, 33.87)	PASSED
LORA	SF10BW125	866.3	(-37.95, 33.80)	PASSED
LORA	SF10BW125	868.1	(-35.91, 33.85)	PASSED
LORA	SF12BW125	864.7	(-28.62, 33.85)	PASSED
LORA	SF12BW125	866.3	(-28.32, 33.87)	PASSED
LORA	SF12BW125	868.1	(-33.88, 33.87)	PASSED

**Figure 22: Rx Frequency Error tolerance SF7 BW125**

**Figure 23: Rx Frequency Error tolerance SF10BW125**

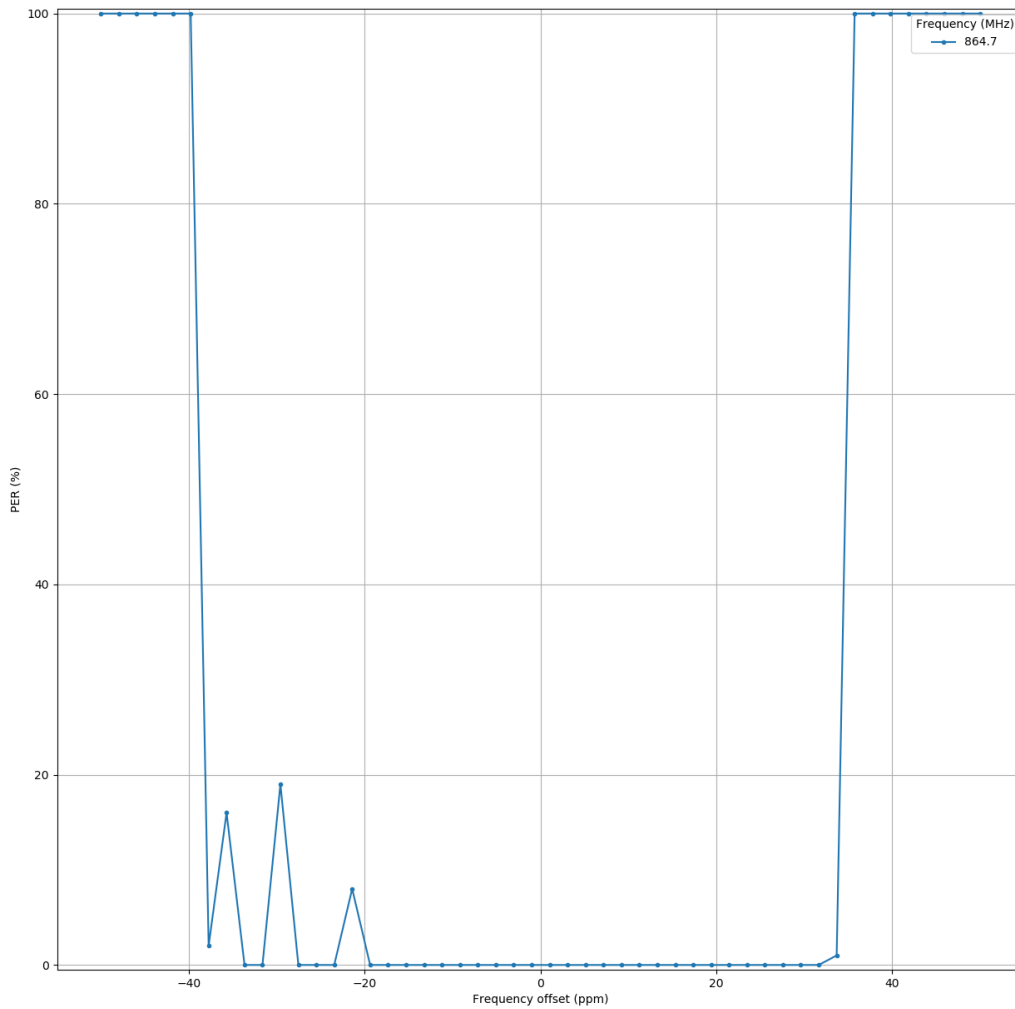
RX Frequency Error Tolerance  
 Bench: RAK2247 Gateway V1.0 868MHz , Util 5G - Pathloss = 2.0 dB  
 Waveform: 5F10BW125 - PER target: 10.0%, for 100 packets - Power: -121.0 dBm





**Figure 24-1: Rx Frequency Error tolerance SF12BW125 @864.7MHz**

RX Frequency Error Tolerance  
 Bench: RAK2247 Gateway V1.0 868MHz , Util SG - Pathloss = 2.0 dB  
 Waveform: SF12BW125 - PER target: 10.0%, for 100 packets - Power: -121.0 dBm


**Figure 25-2: Rx Frequency Error tolerance SF12BW125 @866.3MHz**

RX Frequency Error Tolerance  
Bench: RAK2247 Gateway V1.0 868MHz , Util SG - Pathloss = 2.0 dB  
Waveform: SF12BW125 - PER target: 10.0%, for 100 packets - Power: -121.0 dBm

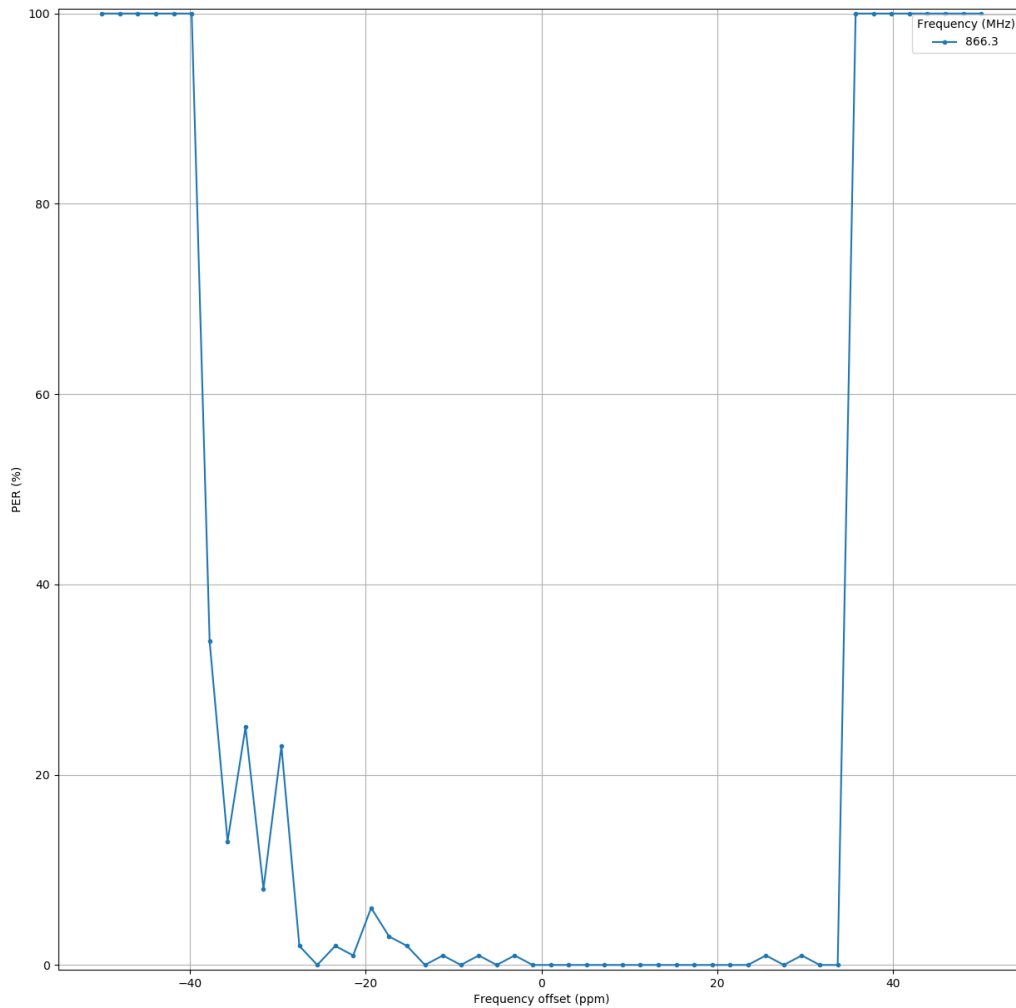
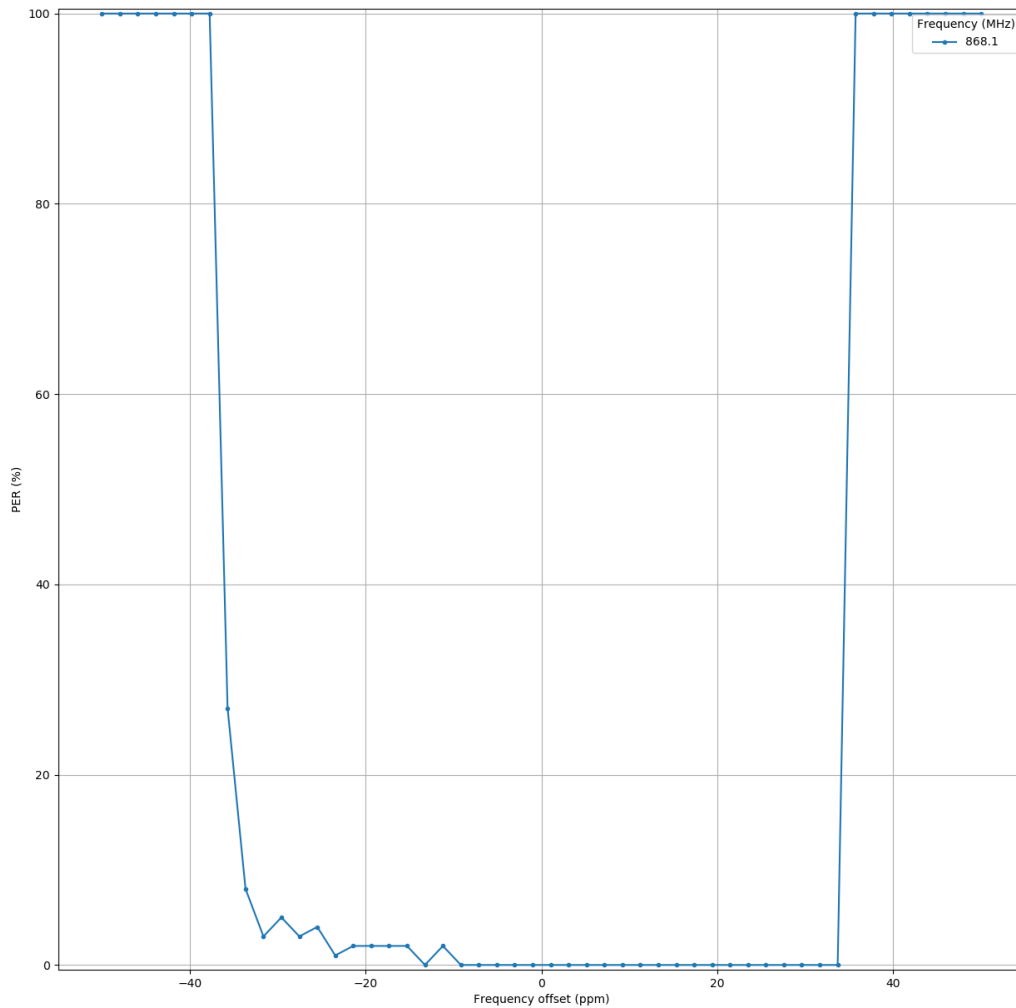


Figure 26-3: Rx Frequency Error tolerance SF12BW125 @868.1MHz

RX Frequency Error Tolerance  
Bench: RAK2247 Gateway V1.0 868MHz , Util SG - Pathloss = 2.0 dB  
Waveform: SF12BW125 - PER target: 10.0%, for 100 packets - Power: -121.0 dBm



## 5.4 Conclusion

**STATUS: PASS**

## 6 Tx Gain sweep

The objective of this test is to measure the output power for each gain step, to see if the maximum power (27 dBm) is reached and be able to calibrate the look-up table (gateway configuration file).

### 6.1 Bench Setup

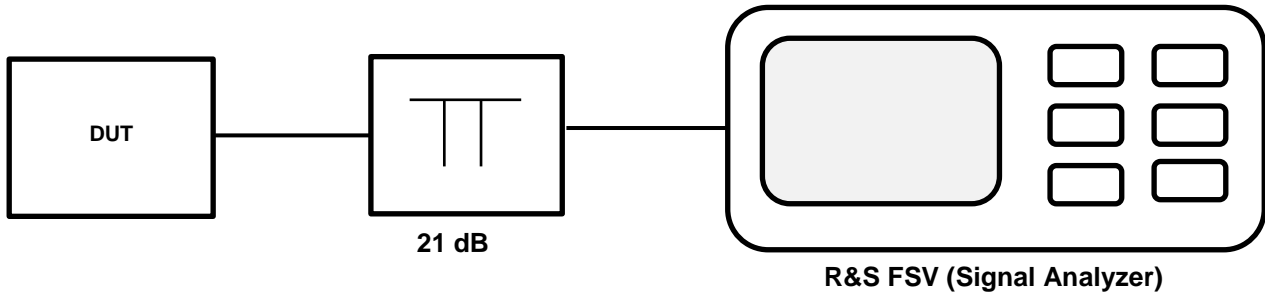


Figure 27: Tx Gain sweep test bench

### 6.2 Pass/Fail criteria

Tx output power > 25 dBm @ max gain setting

### 6.3 Results

Table 23: Tx Gain sweep

mod	sf	bw	Freq center (MHz)	Gain	pa	mix	dig	Max power (dBm)	Frequency error (MHz)
LORA	7	125	867.1	0	3	15	0	23.97	0.001499
LORA	7	125	867.1	1	3	15	1	28.55	0.001205
LORA	7	125	867.1	2	3	15	2	28.37	0.000834
LORA	7	125	867.1	3	3	15	3	27.13	0.000841
LORA	7	125	867.1	4	3	14	0	28.43	0.001323
LORA	7	125	867.1	5	3	14	1	28.27	0.000992
LORA	7	125	867.1	6	3	14	2	27.91	0.001471
LORA	7	125	867.1	7	3	14	3	25.87	0.001579
LORA	7	125	867.1	8	3	13	0	28.11	0.000893
LORA	7	125	867.1	9	3	13	1	27.76	0.000975
LORA	7	125	867.1	10	3	13	2	27.04	0.000874

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LORA	7	125	867.1	11	3	13	3	24.58	0.001016
LORA	7	125	867.1	12	3	12	0	27.34	0.000855
LORA	7	125	867.1	13	3	12	1	26.64	0.001283
LORA	7	125	867.1	14	3	12	2	25.72	0.000864
LORA	7	125	867.1	15	3	12	3	22.96	0.001482
LORA	7	125	867.1	16	3	11	0	26.06	0.001417
LORA	7	125	867.1	17	3	11	1	25.21	0.001295
LORA	7	125	867.1	18	3	11	2	24.15	0.001078
LORA	7	125	867.1	19	3	11	3	21.12	0.001547
LORA	7	125	867.1	20	3	10	0	24.57	0.000900
LORA	7	125	867.1	21	3	10	1	23.66	0.001519
LORA	7	125	867.1	22	3	10	2	22.47	0.001566
LORA	7	125	867.1	23	3	10	3	19.06	0.001529
LORA	7	125	867.1	24	3	9	0	23.04	0.000919
LORA	7	125	867.1	25	3	9	1	22.00	0.001551
LORA	7	125	867.1	26	3	9	2	20.74	0.000883
LORA	7	125	867.1	27	3	9	3	17.07	0.000812
LORA	7	125	867.1	28	3	8	0	20.94	0.000879
LORA	7	125	867.1	29	3	8	1	19.82	0.001119
LORA	7	125	867.1	30	3	8	2	18.39	0.001400
LORA	7	125	867.1	31	3	8	3	14.61	0.001526
LORA	7	125	867.1	32	2	15	0	22.85	0.000847
LORA	7	125	867.1	33	2	15	1	22.25	0.000971
LORA	7	125	867.1	34	2	15	2	21.45	0.000826
LORA	7	125	867.1	35	2	15	3	18.63	0.001523
LORA	7	125	867.1	36	2	14	0	21.94	0.001340
LORA	7	125	867.1	37	2	14	1	21.13	0.000836
LORA	7	125	867.1	38	2	14	2	20.07	0.001367
LORA	7	125	867.1	39	2	14	3	17.10	0.001020
LORA	7	125	867.1	40	2	13	0	20.76	0.001517
LORA	7	125	867.1	41	2	13	1	19.82	0.001011
LORA	7	125	867.1	42	2	13	2	18.65	0.001540
LORA	7	125	867.1	43	2	13	3	15.60	0.001106
LORA	7	125	867.1	44	2	12	0	19.14	0.001096
LORA	7	125	867.1	45	2	12	1	18.16	0.001566
LORA	7	125	867.1	46	2	12	2	16.99	0.001151
LORA	7	125	867.1	47	2	12	3	13.97	0.001111
LORA	7	125	867.1	48	2	11	0	17.45	0.001166
LORA	7	125	867.1	49	2	11	1	16.41	0.000848
LORA	7	125	867.1	50	2	11	2	15.29	0.001481

**WIRELESS & SENSING**
**Customer report**

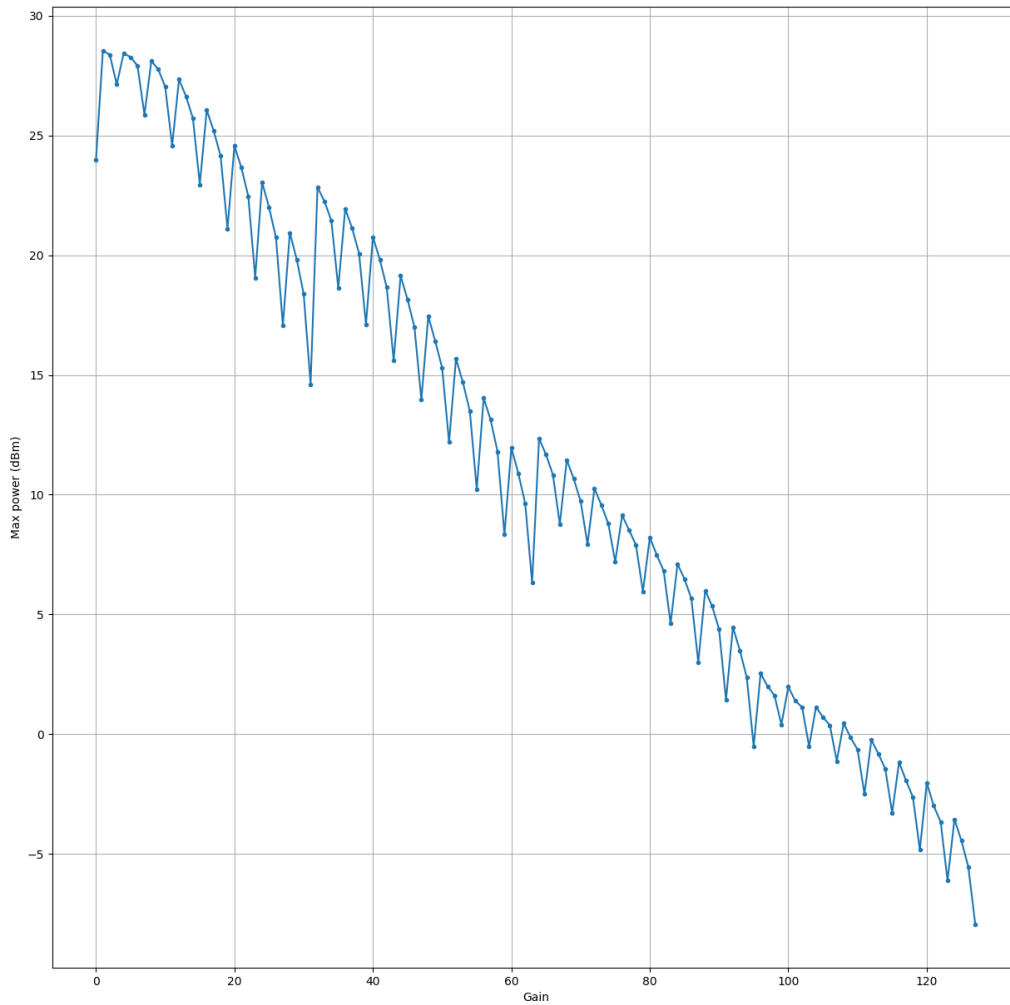
LORA	7	125	867.1	51	2	11	3	12.19	0.001542
LORA	7	125	867.1	52	2	10	0	15.68	0.000865
LORA	7	125	867.1	53	2	10	1	14.69	0.000801
LORA	7	125	867.1	54	2	10	2	13.49	0.001384
LORA	7	125	867.1	55	2	10	3	10.22	0.001530
LORA	7	125	867.1	56	2	9	0	14.03	0.001258
LORA	7	125	867.1	57	2	9	1	13.13	0.000976
LORA	7	125	867.1	58	2	9	2	11.80	0.001321
LORA	7	125	867.1	59	2	9	3	8.33	0.001407
LORA	7	125	867.1	60	2	8	0	11.96	0.001260
LORA	7	125	867.1	61	2	8	1	10.89	0.000850
LORA	7	125	867.1	62	2	8	2	9.63	0.000792
LORA	7	125	867.1	63	2	8	3	6.31	0.001089
LORA	7	125	867.1	64	1	15	0	12.34	0.001413
LORA	7	125	867.1	65	1	15	1	11.68	0.000961
LORA	7	125	867.1	66	1	15	2	10.83	0.000796
LORA	7	125	867.1	67	1	15	3	8.77	0.001462
LORA	7	125	867.1	68	1	14	0	11.45	0.001537
LORA	7	125	867.1	69	1	14	1	10.67	0.001517
LORA	7	125	867.1	70	1	14	2	9.73	0.001313
LORA	7	125	867.1	71	1	14	3	7.93	0.000974
LORA	7	125	867.1	72	1	13	0	10.26	0.001112
LORA	7	125	867.1	73	1	13	1	9.57	0.000880
LORA	7	125	867.1	74	1	13	2	8.79	0.001326
LORA	7	125	867.1	75	1	13	3	7.20	0.000864
LORA	7	125	867.1	76	1	12	0	9.14	0.000915
LORA	7	125	867.1	77	1	12	1	8.52	0.001136
LORA	7	125	867.1	78	1	12	2	7.89	0.000845
LORA	7	125	867.1	79	1	12	3	5.96	0.001226
LORA	7	125	867.1	80	1	11	0	8.21	0.001356
LORA	7	125	867.1	81	1	11	1	7.48	0.001063
LORA	7	125	867.1	82	1	11	2	6.81	0.000806
LORA	7	125	867.1	83	1	11	3	4.62	0.001047
LORA	7	125	867.1	84	1	10	0	7.11	0.000974
LORA	7	125	867.1	85	1	10	1	6.48	0.001527
LORA	7	125	867.1	86	1	10	2	5.66	0.000963
LORA	7	125	867.1	87	1	10	3	2.99	0.001384
LORA	7	125	867.1	88	1	9	0	6.00	0.001041
LORA	7	125	867.1	89	1	9	1	5.34	0.001039
LORA	7	125	867.1	90	1	9	2	4.38	0.000826

**WIRELESS & SENSING**
**Customer report**

LORA	7	125	867.1	91	1	9	3	1.43	0.001527
LORA	7	125	867.1	92	1	8	0	4.46	0.001227
LORA	7	125	867.1	93	1	8	1	3.50	0.000885
LORA	7	125	867.1	94	1	8	2	2.37	0.001091
LORA	7	125	867.1	95	1	8	3	-0.51	0.001518
LORA	7	125	867.1	96	0	15	0	2.53	0.001089
LORA	7	125	867.1	97	0	15	1	2.00	0.001457
LORA	7	125	867.1	98	0	15	2	1.62	0.001504
LORA	7	125	867.1	99	0	15	3	0.40	0.000802
LORA	7	125	867.1	100	0	14	0	1.98	0.001313
LORA	7	125	867.1	101	0	14	1	1.39	0.001212
LORA	7	125	867.1	102	0	14	2	1.12	0.000787
LORA	7	125	867.1	103	0	14	3	-0.52	0.001407
LORA	7	125	867.1	104	0	13	0	1.13	0.001442
LORA	7	125	867.1	105	0	13	1	0.71	0.000838
LORA	7	125	867.1	106	0	13	2	0.37	0.000820
LORA	7	125	867.1	107	0	13	3	-1.12	0.000834
LORA	7	125	867.1	108	0	12	0	0.44	0.001118
LORA	7	125	867.1	109	0	12	1	-0.14	0.001350
LORA	7	125	867.1	110	0	12	2	-0.65	0.000867
LORA	7	125	867.1	111	0	12	3	-2.51	0.000908
LORA	7	125	867.1	112	0	11	0	-0.24	0.001291
LORA	7	125	867.1	113	0	11	1	-0.82	0.001528
LORA	7	125	867.1	114	0	11	2	-1.44	0.001253
LORA	7	125	867.1	115	0	11	3	-3.29	0.001481
LORA	7	125	867.1	116	0	10	0	-1.17	0.001348
LORA	7	125	867.1	117	0	10	1	-1.94	0.001371
LORA	7	125	867.1	118	0	10	2	-2.63	0.001187
LORA	7	125	867.1	119	0	10	3	-4.84	0.001515
LORA	7	125	867.1	120	0	9	0	-2.03	0.001397
LORA	7	125	867.1	121	0	9	1	-3.00	0.001294
LORA	7	125	867.1	122	0	9	2	-3.66	0.001066
LORA	7	125	867.1	123	0	9	3	-6.11	0.001459
LORA	7	125	867.1	124	0	8	0	-3.56	0.001033
LORA	7	125	867.1	125	0	8	1	-4.45	0.000856
LORA	7	125	867.1	126	0	8	2	-5.54	0.001389
LORA	7	125	867.1	127	0	8	3	-7.93	0.000813

**Figure 28 : Tx Gain sweep**

TX Eu Output Power Sweep  
Bench: RAK2247 Gateway V1.0 868MHz , Spectrum analyzer - Pathloss = 21.0 dB  
Power over gain



## 6.4 Conclusion

**STATUS: PASS**