



Test Report No.: <i>Prüfbericht-Nr.:</i>	US21UPY0.002 Rev.:02	Order No.: <i>Auftrags-Nr.:</i>	P00230106 234174290	Page 1 of 83 Seite 1 von 83
Client Reference No.: <i>Kunden-Referenz-Nr.:</i>	2229228	Order date: <i>Auftragsdatum:</i>	6/14/2021	
Client: <i>Auftraggeber:</i>	Satellite Tracking of People, LLC 5353 W Sam Houston Parkway N, Suite 190 Houston, Texas, 77041			
Test item: <i>Prüfgegenstand:</i>	BLUbase			
Identification/ Type No.: <i>Bezeichnung / Typ-Nr.</i>	BLUbase V1			
Order content: <i>Auftrags-Inhalt:</i>	Radio Compliance Test Report			
Test specification: <i>Prüfgrundlage:</i>	FCC 47 CFR Part 15.247:2021, RSS-247:2020			
Date of sample receipt: <i>Wareneingangsdatum:</i>	7/11/2021	See Test Setup Exhibit for Photos		
Test sample No.: <i>Prüfmuster-Nr.:</i>	24-010668, 24-010669			
Testing period: <i>Prüfzeitraum:</i>	7/14/2021- 8/5/2021			
Testing laboratory: <i>Prüflaboratorium:</i>	TUV Rheinland of North America 710 Resende Road, Building 199 Webster, NY 14580			
Test result*: <i>Prüfergebnis*:</i>	Pass			
tested by: Alexander Sowinski <i>geprüft von:</i>		authorized by: Richard Decker <i>genehmigt von:</i>		
Date: 12/9/2021 <i>Datum:</i>		Issue Date: 12/9/2021 <i>Ausstellungsdatum:</i>		
Position / Stellung:	Expert	Position / Stellung:	Expert	
Others / <i>Sonstiges:</i>				
Condition of the test item at delivery: <i>Zustand des Prüfgegenstandes bei Anlieferung:</i>	Test sample complete and undamaged			
* Legend: P(ass) = passed a.m. test specification(s) F(ail) = failed a.m. test specification(s) N/A = not applicable N/T = not tested				
* Legende: P(ass) = entspricht o.g. Prüfgrundlage(n) F(ail) = entspricht nicht o.g. Prüfgrundlage(n) N/A = nicht anwendbar N/T = nicht getestet				
This test report only relates to the a. m. test sample. Without permission of the test center this test report is not permitted to be duplicated in extracts. This test report does not entitle to carry any test mark.				
<i>Dieser Prüfbericht bezieht sich nur auf das o.g. Prüfmuster und darf ohne Genehmigung der Prüfstelle nicht auszugsweise vervielfältigt werden. Dieser Bericht berechtigt nicht zur Verwendung eines Prüfzeichens.</i>				

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Remarks
Anmerkungen

1	<p>The equipment used during the specified testing period was calibrated according to our test laboratory calibration program. The equipment fulfils the requirements included in the relevant standards. The traceability of the test equipment used is ensured by compliance with the regulations of our management system. Detailed information regarding test conditions, equipment and measurement uncertainty is available in the test laboratory and could be provided on request.</p> <p><i>Alle eingesetzten Prüfmittel waren zum angegebenen Prüfzeitraum gemäß eines festgelegten Kalibrierungsprogramms unseres Prüfhauses kalibriert. Sie entsprechen den in den Prüfprogrammen hinterlegten Anforderungen. Die Rückverfolgbarkeit der eingesetzten Prüfmittel ist durch die Einhaltung der Regelungen unseres Managementsystems gegeben. Detaillierte Informationen bezüglich Prüfkonditionen, Prüfequipment und Messunsicherheiten sind im Prüflabor vorhanden und können auf Wunsch bereitgestellt werden.</i></p>
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3	<p>Test clauses with remark of * are subcontracted to qualified subcontractors and described under the respective test clause in the report. Deviations of testing specification(s) or customer requirements are listed in specific test clause in the report.</p> <p><i>Prüfklausel mit der Note * wurden an qualifizierte Unterauftragnehmer vergeben und sind unter der jeweiligen Prüfklausel des Berichts beschrieben. Abweichungen von Prüfspezifikation(en) oder Kundenanforderungen sind in der jeweiligen Prüfklausel im Bericht aufgeführt.</i></p>
4	<p>The test results contained in this report refer exclusively to the product(s) presented for testing. No liability may be assumed for models or products not referred to herein. This test report may not be published or duplicated in part without permission of the testing body. This test report by itself does not constitute authorization for the use of any TÜV Rheinland test mark. The report must not be used by the client to claim product certification, approval, or endorsement by A2LA.</p>
5	<p>Radio Compliance Test Report. The above product was found to be Compliant to the above test standard(s).</p>

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Product description
Produktbeschreibung

1	Product details: <i>Produktdetails:</i>	BLUbase is our small, lightweight (RF) transceiver. Working in tandem with BLUband, BLUbase receives, enters, and leaves records from BLUband.
2	Dimensions / Weight: <i>Maße / Gewicht:</i>	11 cm x 11 cm x 3 cm / 0.16 kg
3	Operating elements: <i>Bedienelemente:</i>	AC Mains 100-240 VAC, 50/60Hz. Transmit bands 903-927 MHz and 2.412-2.4620 GHz.
4	Equipment / Accessories: <i>Ausstattung / Zubehör:</i>	None.
5	Used materials: <i>Verwendete Materialien:</i>	None.
6	Other: <i>Sonstiges:</i>	Test sample(s), as well sample information, description, product details and intended usage was provided by customer.
7	Test sample obtaining: <i>Prüfmusterbereitstellung:</i>	<input checked="" type="checkbox"/> Sending by customer <input type="checkbox"/> Sampling by TÜV Rheinland Group <input type="checkbox"/> others:

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Revisions

Date mm/dd/yy	Name	Page Number of Change	Describe Change
08/12/2021	Rev.:01	N/A	Original Document
12/09/2021	Rev.:02	All	Updated FCC ID, Operating Bands

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1 General Information

1.1 Scope

This report is intended to document the status of conformance based on the results of testing performed on the BLUbase, Model Number: BLUbase V1, manufactured by Satellite Tracking of People, LLC. This report only applies to the specific samples tested under the stated test conditions. It is the responsibility of the manufacturer to assure that additional production units of this model are manufactured with identical or EMI equivalent electrical and mechanical components.

1.2 Purpose

Testing was performed to evaluate the Radio performance of the EUT (Equipment Under Test) in accordance with the applicable requirements, procedures, and criteria defined in the application of regulations and application of standards listed in this report.

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1.3 Summary of Test Results

Applicant:	Satellite Tracking of People, LLC 5353 W Sam Houston Parkway N, Suite 190 Houston, Texas, 77041	Tel:	713-354-9393	Contact:	Mark Kirincic
		Fax:	--	e-mail:	mkirincic@securustechnologies.com
Description:	BLUbase	Test Voltage/Freq.:		120VAC 60Hz	
Model Number:	BLUbase V1				
Serial Number:	24-010668, 24-010669	Test Engineer:		Alexander Sowinski	
Standards	Description	Severity Level or Limit		Criteria	Test Result
FCC 47 CFR Part 15.247:2021, RSS-247:2020 Radio Standard	Operation within the bands 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz.	See Basic Sections Below		See Below	Complies
FCC 47 CFR Part 15.203, RSS-Gen (6.8)	Antenna Requirements	Per Standards		Report	Complies
FCC 47 CFR Part 15.247 (b.3), RSS-247 (5.4)	Transmitter Output Power	EIRP < 1 Watt (30 dBm)		Limit	Complies
FCC 47 CFR Part 15.247 (a.2), RSS-247 (5.2)	Occupied Bandwidth	6dB OBW > 500 kHz		Limit	Complies
FCC 47 CFR Part 15.247 (e), RSS-247 (5.2)	Power Spectral Density	PSD < 8dBm / 3kHz band		Limit	Complies
FCC 47 CFR Part 15.247 (d), RSS-247 (5.5)	Out of Band Emissions	< 20 dBr / 100kHz band		Limit	Complies
FCC CFR 15.209, RSS-Gen (8.9)	Transmitter Spurious Emissions	Class B, 30 - 1000 MHz Class B, 1000 - 18000 MHz		Limit	Complies
FCC CFR 15.207, RSS-Gen (8.8)	AC Line Conducted Emissions	Class B, 150 kHz – 30 MHz		Limit	Complies

2 Laboratory Information

2.1 Accreditations & Endorsements

TUV Rheinland of North America located at, 710 Resende Road Webster, NY 14580 is accredited by the commission for performing testing services for the general public on a fee basis. This laboratory test facilities have been fully described in reports submitted to and accepted by the FCC (Registration No 5253). The laboratory scope of accreditation includes: Title 47 CFR Part 15, and 18. The accreditation is updated every 3 years.

2.1.1 ILAC/A2LA

This is a program which is administered under the auspices of A2LA accredited. The laboratory has been assessed and accredited in accordance with ISO Standard 17025:2017 (Certificate Number: 3331.08). The scope of laboratory accreditation includes emission and immunity testing. The accreditation is updated annually.

2.1.2 VCCI

VCCI Accredited test lab. Registration numbers A-0329.

2.1.3 Industry Canada

(Registration No.: 482B-1) The 10 meter Semi-Anechoic chamber has been accepted by Industry Canada to perform testing to 3 and to 10m, based on the test procedures described in ANSI C63.4-2014.

2.1.4 BSMI

Registration No.: SL2-IN-E-1159R. The BSMI accreditation was obtained by NIST MRA with the BSMI.

2.1.5 Korea

(Designation No.: US0192). Recognized by National Radio Research Agency (RRA) as an accredited Conformity Assessment Body (CAB) under the terms for Korea Phase I of the APEC TEL.

2.2 Test Software

- 1) CIGUI 32 Version 1.4 for California Instruments AC power source
- 2) TILE version 4.1.B
- 3) TILE 7 version 7.1.3.24
- 4) Voltech PM 6000 Firmware 1.22.07RC6, Software IEC61000-3 for PM6000 Release 1.24.12
- 5) California Instruments AC power source MXHCL
- 6) Rohde & Schwarz EMI Measurement software EMC32 version 8.54.0
- 7) TEMA 3000 version 4.1.2
- 8) TILE version 3.4.k.28

2.3 Measurement Uncertainty

Two types of measurement uncertainty are expressed in this report, per *ISO Guide To The Expression Of Uncertainty In Measurement*, 1st Edition, 1995.

The Combined Standard Uncertainty is the standard uncertainty of the result of a measurement when that result is obtained from the values of a number of other quantities, equal to the positive square root of a sum of terms, the terms being the variances or co-variances of these other quantities weighted according to how the measurement result varies with changes in these quantities. The term standard uncertainty is the result of a measurement expressed as a standard deviation.

The Expanded Uncertainty defines an interval about the result of a measurement that may be expected to encompass a large fraction of the distribution of values that could reasonably be attributed to the measurand. The fraction may be viewed as the coverage probability or level of confidence of the interval.

2.3.1 Sample Calculation – radiated & conducted emissions

The field strength is calculated by subtracting the Amplifier Gain and adding the Cable Loss and Antenna Correction Factor to the measured reading. The basic equation is as follows:

$$\text{Field Strength (dB}\mu\text{V/m)} = \text{RAW} - \text{AMP} + \text{CBL} + \text{ACF}$$

Where: RAW = Measured level before correction (dBμV)

AMP = Amplifier Gain (dB)

CBL = Cable Loss (dB)

ACF = Antenna Correction Factor (dB/m)

$$\mu\text{V/m} = 10^{\frac{\text{dB}\mu\text{V/m}}{20}}$$

Sample radiated emissions calculation @ 30 MHz

Measurement +Antenna Factor–Amplifier Gain+Cable loss=Radiated Emissions (dBuV/m)

$$25 \text{ dBuV/m} + 17.5 \text{ dB} - 20 \text{ dB} + 1.0 \text{ dB} = 23.5 \text{ dBuV/m}$$

2.3.2 Measurement Uncertainty Emissions

Per CISPR 16-4-2	Ulab	Ucisprr
Radiated Disturbance @ 10m		
30 MHz – 1,000 MHz	4.57 dB	5.2 dB
Radiated Disturbance @ 3m		
1.0 GHz – 6.0 GHz	5.18 dB	5.2 dB
6.0 GHz – 18.0 GHz	5.48 dB	5.5 dB
18.0 GHz – 26.5 GHz	5.21 dB	
26.5 GHz – 40.0 GHz	4.99 dB	
Conducted Disturbance @ Mains Terminals		
150 kHz – 30 MHz	2.62 dB	3.6 dB
Disturbance Power		
30 MHz – 300 MHz	3.88 dB	4.5 dB

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Measurement Uncertainty Emissions

The estimated combined standard uncertainty for radiated emissions measurements is ± 4.57 dB	Per CISPR16-4-2 Method
The estimated combined standard uncertainty for radiated emissions measurements from 1 GHz to 6 GHz is ± 5.18 dB	Per CISPR16-4-2 Method
The estimated combined standard uncertainty for radiated emissions measurements from 6 GHz to 18 GHz is ± 5.48 dB	Per CISPR16-4-2 Method
The estimated combined standard uncertainty for conducted emissions measurements is ± 2.62 dB.	Per CISPR16-4-2 Method

Expanded measurement uncertainty numbers are shown in the tables above. Compliance criteria are not based on measurement uncertainty.

2.4 Calibration Traceability

All measurement instrumentation is traceable to the National Institute of Standards and Technology (NIST). Measurement method complies with ANSI/NCSL Z540-1-1994 and ISO Standard ISO IEC 17025:2017. Equipment calibration records are kept on file at the test facility.

2.5 Measurement Equipment Identification

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Equip.	Description	Model	Manufacturer	Page 1 of 1	
				Last Date MM/DD/YYYY	Due Date MM/DD/YYYY
G1701077	SunAR JB6 Antenna	JB6	SunAR	04/30/2020	04/30/2022
G1701081	Fluke Multimeter 87 V 39760226	87 V	Fluke	04/09/2021	04/09/2022
G1701082	Temperature/Humidity/Barometer	68000-49	Control Company	02/12/2021	06/12/2023
G1701089	R&S EMI Receiver ESW44 101880	ESW44	Rohde & Schwarz	04/02/2021	04/02/2022
G1701233	EMCO Horn Antenna 3115 9812-5635	3115	EMCO	02/28/2020	03/28/2022
G1701365	EMCO Horn 3160-10 1180	3160-10	EMCO	08/11/2020	08/11/2022
G1701367	EMCO Horn 3160-09 6707	3160-09	EMCO	08/11/2020	08/11/2022
G1701385	R&S EMI Receiver ESU40 100274	ESU40	Rohde & Schwarz	02/09/2021	02/09/2022
G1701452	RF Path 30-1000MHz	RF Cable Path		05/12/2021	02/12/2023
G1701526	Tunable Notch Filter	240NFM	EAGLE	No Cal	No Cal

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3 Product Information

3.1 Test Plan

The EUT product information, test configuration, mode of operation, test types, test procedures, test levels, pass/failure criteria, in this report were carried out per the product test plan located in appendix A of this report.

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4 Transmitter Requirements

4.1 Antenna Requirements

Per the requirements of FCC 47 CFR 15.203: 2021, the antenna of an intentional transmitter shall:
... be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section.

The BLUbase contains a stamp metal embedded SMT antenna with a maximum gain of +1.0 dBi (LoRa/FSK) or +3.4 dBi (WiFi). The antenna is contained fully within the BLUbase and is not accessible to the end user.

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4.2 Transmitter Output Power

This test measures conducted output power of the transmitter

4.2.1 Over View of Test

Results	Complies (as tested per this report)				Date	07/29/2021	
Standard	FCC 47 CFR Part 15.247 (b.3), RSS-247 (5.4)						
Product Model	BLUbase V1			Serial#	24-010668		
Configuration	See test plan for details.						
Test Set-up	Tested in shielded room, EUT placed on table. See test plans for details.						
EUT Powered By	120V60Hz	Temp	22°C	Humidity	56%	Pressure	986 mbar
Channel Frequencies	Low Channel: 903 MHz Mid Channel: 915 MHz High Channel: 927 MHz		Power Setting @ Channel		14 dBm		
Perf. Criteria	ERP < 1 Watt (30 dBm)		Perf. Verification		Readings Under Limit		
Mod. to EUT	None		Test Performed By		Alexander Sowinski		

4.2.2 Test Procedure

Antenna port conducted emission tests were performed using the procedures of FCC 47 CFR Part 15.247 (b.3), RSS-247 (5.4) and/or ANSI C63.10 including methods for signal maximizations and EUT configuration. The EUT was placed in the test chamber and connected directly to the spectrum analyzer via temporary SMA connection. Peak measurements were taken with RBW = 1 MHz on each of the low, mid, and high channels utilizing both the LoRa and FSK transmission schemes of the EUT.

4.2.3 Deviations

There were no deviations from the test methodology listed in the test plan for the conducted emission test.

4.2.4 Final Test

All final conducted emissions measurements were below (in compliance) the limits.

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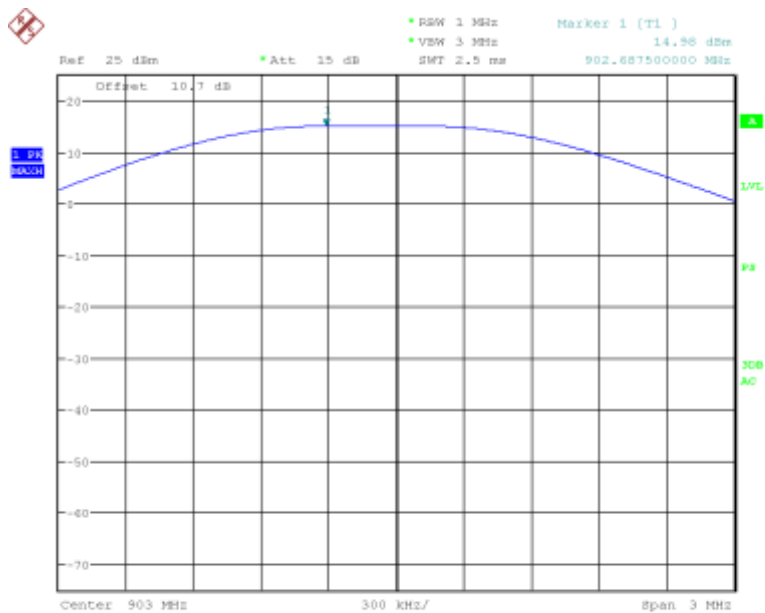
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4.2.5 Final Data

Table 1: Output Power, EUT power setting @ 14 dBm

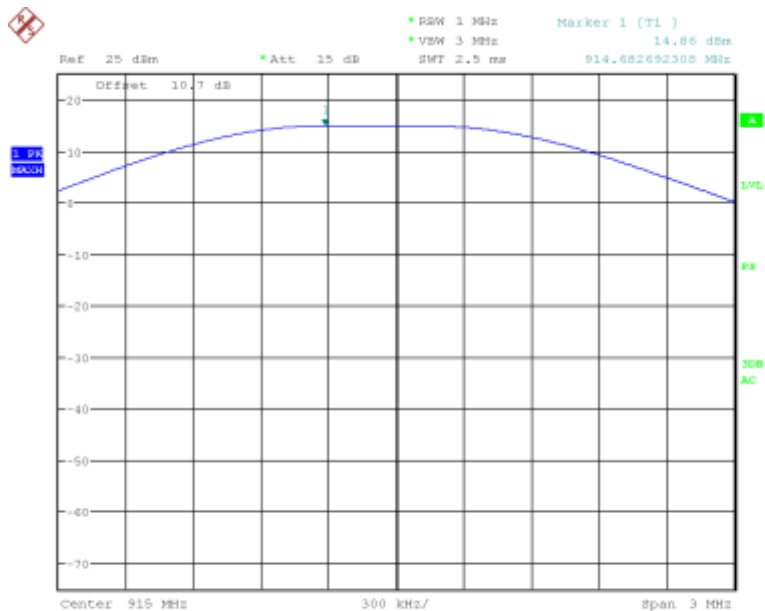
Type	Frequency	Conducted Power	Limit	Margin
	MHz	dBm	dBm	dB
LoRa	903.00	14.98	30.0	-15.02
LoRa	915.00	14.86	30.0	-15.14
LoRa	927.00	14.70	30.0	-15.30
FSK	903.00	14.83	30.0	-15.17
FSK	915.00	14.74	30.0	-15.26
FSK	927.00	14.65	30.0	-15.35

4.2.6 Final Plots



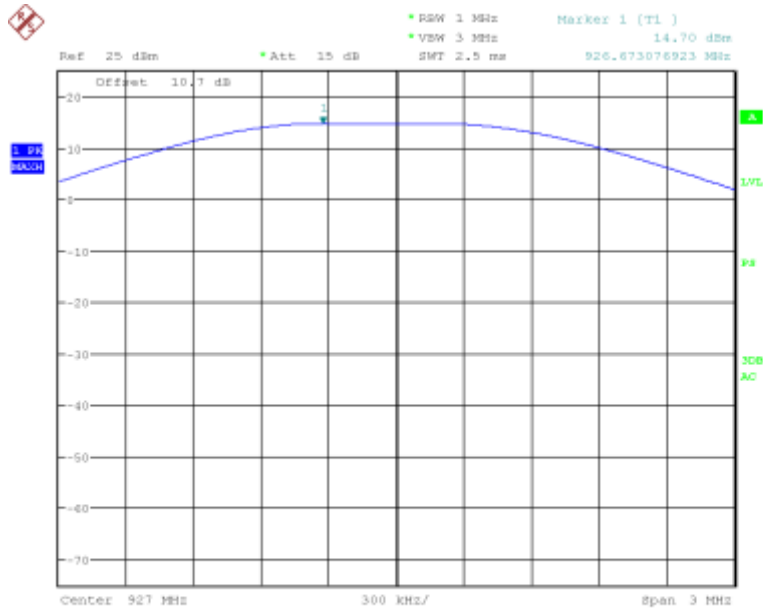
Date: 29.JUL.2021 00:43:02

Figure 1 – Low Channel Output Power (LoRa)



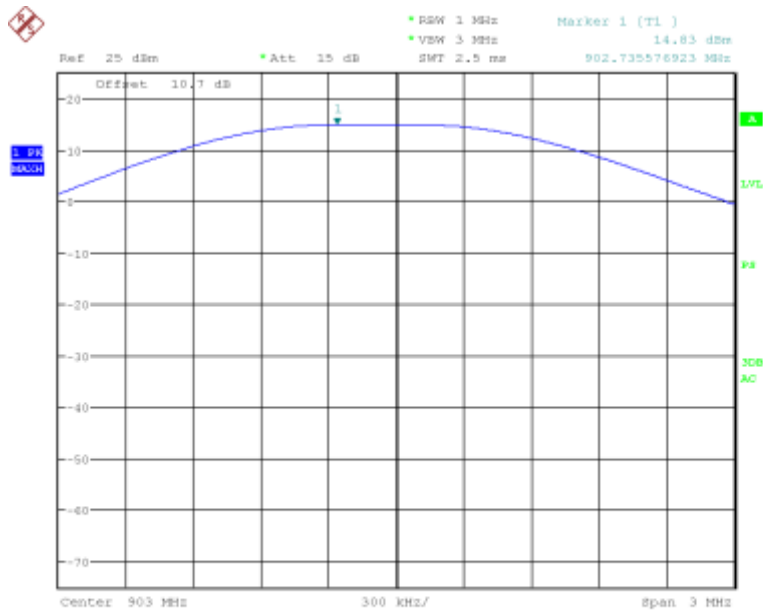
Date: 29.JUL.2021 00:53:20

Figure 2 – Mid Channel Output Power (LoRa)



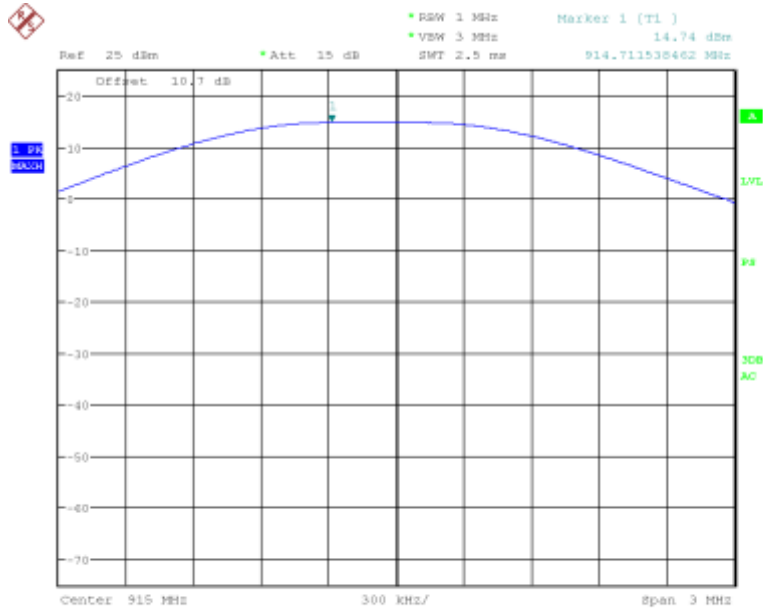
Date: 29.JUL.2021 01:03:03

Figure 3 – High Channel Output Power (LoRa)



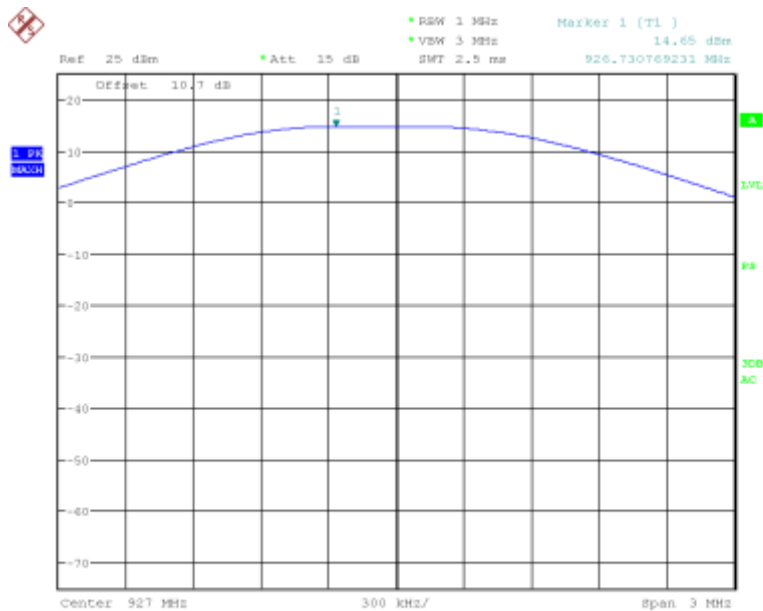
Date: 29.JUL.2021 01:23:45

Figure 4 – Low Channel Output Power (FSK)



Date: 29.JUL.2021 01:37:39

Figure 5 – Mid Channel Output Power (FSK)



Date: 29.JUL.2021 01:50:20

Figure 6 – High Channel Output Power (FSK)

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4.3 Occupied Bandwidth

This test measures the 6 dB and 99% bandwidth of the EUT.

4.3.1 Test Over View

Results	Complies (as tested per this report)			Date	07/29/2021		
Standard	FCC 47 CFR Part 15.247 (a.2), RSS-247 (5.2)						
Product Model	BLUbase V1			Serial#	24-010668		
Configuration	See test plan for details.						
Test Set-up	Tested in shielded room, EUT placed on table. See test plan for details.						
EUT Powered By	120V60Hz	Temp	22°C	Humidity	56%	Pressure	986 mbar
Channel Frequencies	Low Channel: 903 MHz Mid Channel: 915 MHz High Channel: 927 MHz		Power Setting @ Channel		14 dBm		
Perf. Criteria	6 dB OBW > 500 kHz		Perf. Verification		Readings above Minimum		
Mod to EUT	None		Test Performed By		Alexander Sowinski		

4.3.2 Test Procedure

Antenna port conducted emission tests were performed using the procedures of FCC 47 CFR Part 15.247 (a.2), RSS-247 (5.2) and/or ANSI C63.10 including methods for signal maximizations and EUT configuration. The EUT was placed in the test chamber and connected directly to the spectrum analyzer via temporary SMA connection. Peak measurements were taken with RBW = 100 kHz on each of the low, mid, and high channels utilizing both the LoRa and FSK transmission schemes of the EUT.

4.3.3 Deviations

There were no deviations from the test methodology listed in the test plan for the occupied bandwidth test.

4.3.4 Final Test

The occupied bandwidth of the EUT were above the minimum levels specified by the standard

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4.3.5 Final Data

Table 2: Occupied Bandwidth, EUT power setting @ 14 dBm

Type	Frequency MHz	Flow MHz	Fhigh MHz	6dB OBW kHz	99% OBW kHz	6dB OBW Minimum kHz	Result
LoRa	903.00	902.60577	903.24039	634.61600	687.50000	500.00000	PASS
LoRa	915.00	914.61058	915.23558	625.00000	677.88462	500.00000	PASS
LoRa	927.00	926.61539	927.23558	620.19200	1014.42310	500.00000	PASS
FSK	903.00	902.64904	903.19231	543.27000	610.57692	500.00000	PASS
FSK	915.00	914.64904	915.18750	538.46200	610.57692	500.00000	PASS
FSK	927.00	926.65385	927.18269	528.84600	649.03846	500.00000	PASS

4.3.6 Final Plots

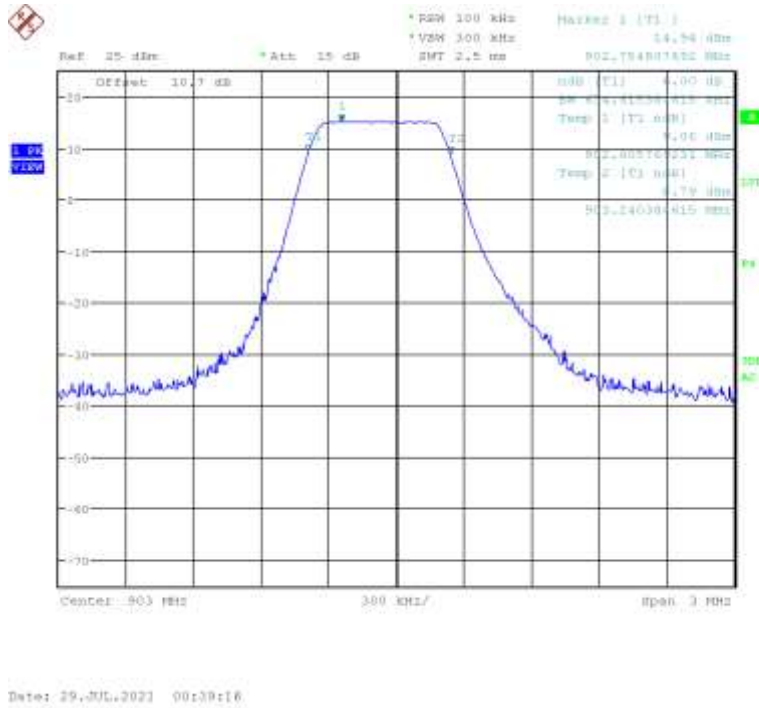


Figure 7 – Low Channel 6 dB Occupied Bandwidth (LoRa)

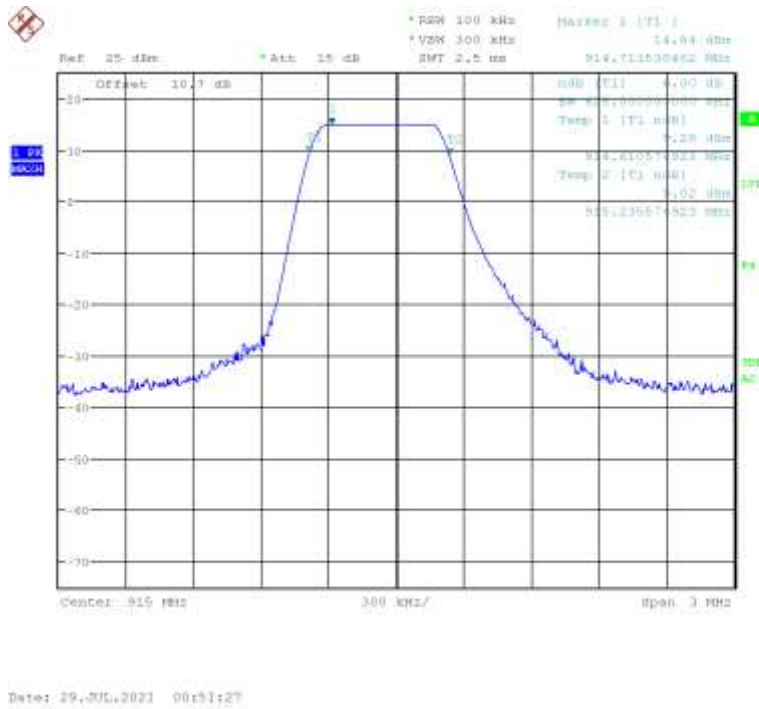
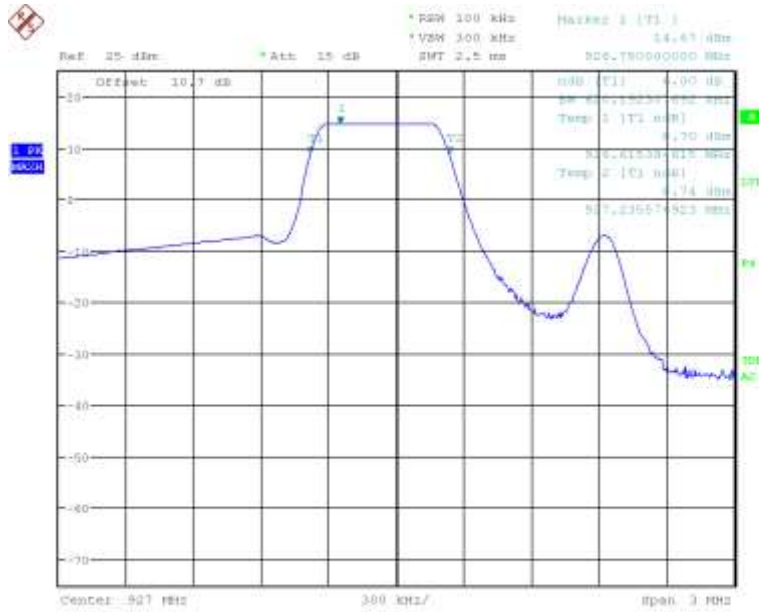
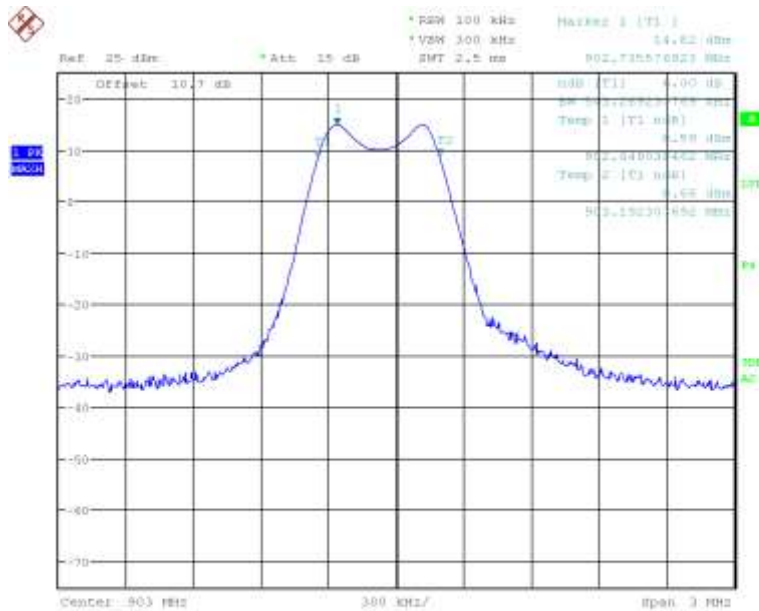


Figure 8 – Mid Channel 6 dB Occupied Bandwidth (LoRa)



Date: 29.JUL.2021 01:00:13

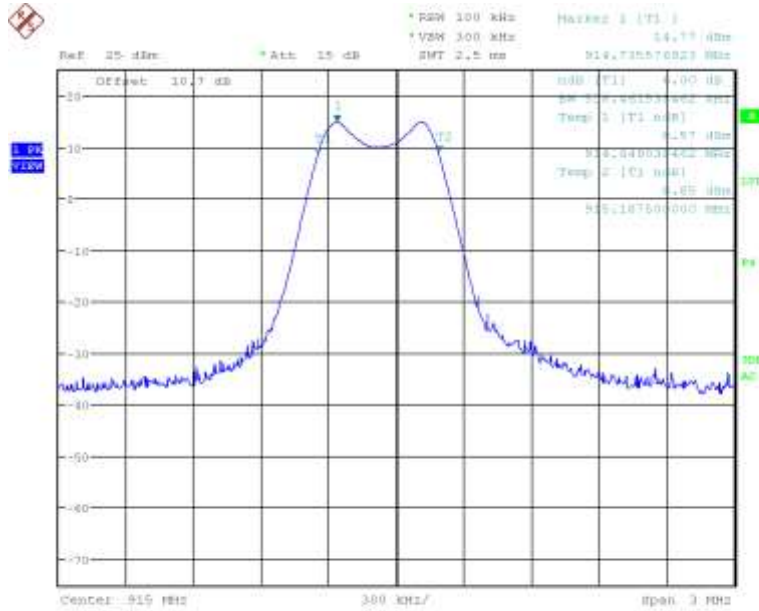
Figure 9 – High Channel 6 dB Occupied Bandwidth (LoRa)



Date: 29.JUL.2021 01:21:58

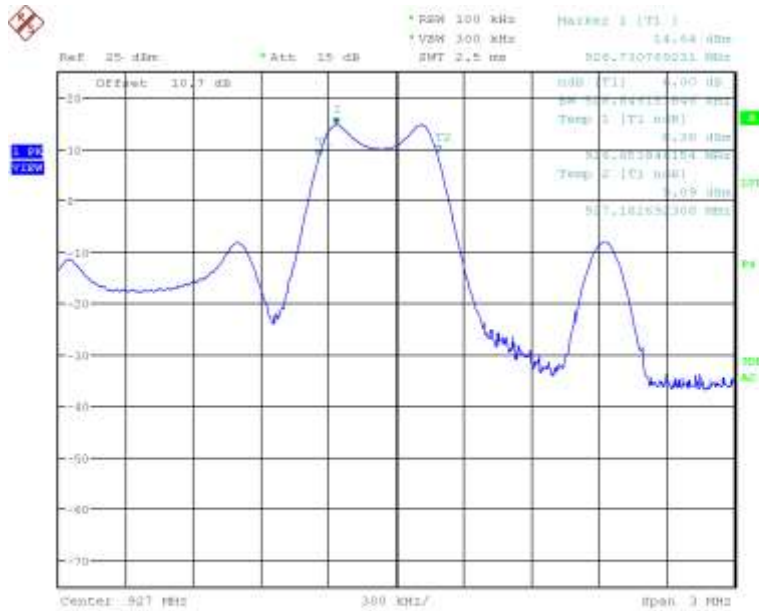
Figure 10 – Low Channel 6 dB Occupied Bandwidth (FSK)

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Date: 29.JUL.2021 01:31:18

Figure 11 – Mid Channel 6 dB Occupied Bandwidth (FSK)



Date: 29.JUL.2021 01:45:21

Figure 12 – High Channel 6 dB Occupied Bandwidth (FSK)

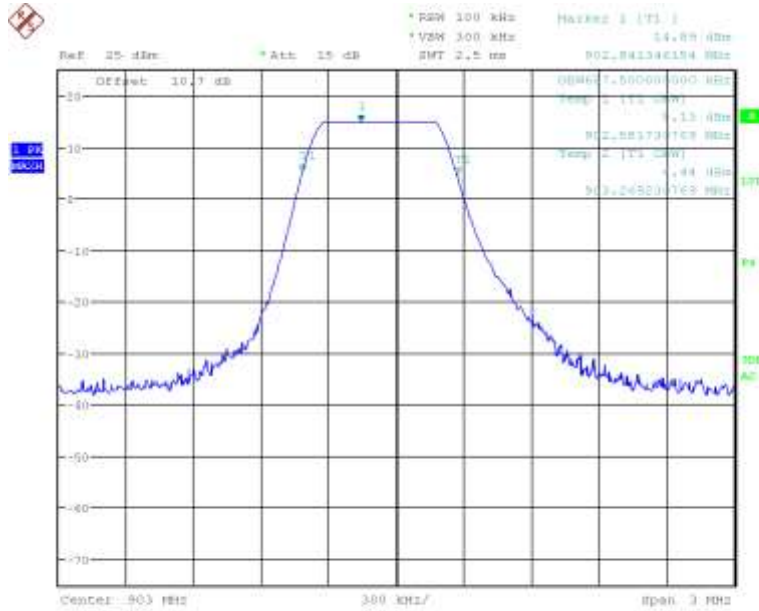


Figure 13 – Low Channel 99% Occupied Bandwidth (LoRa)

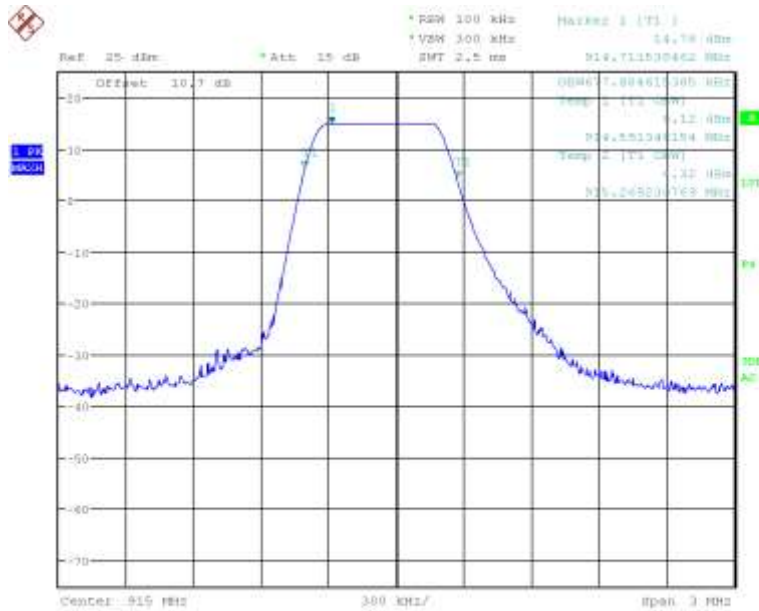
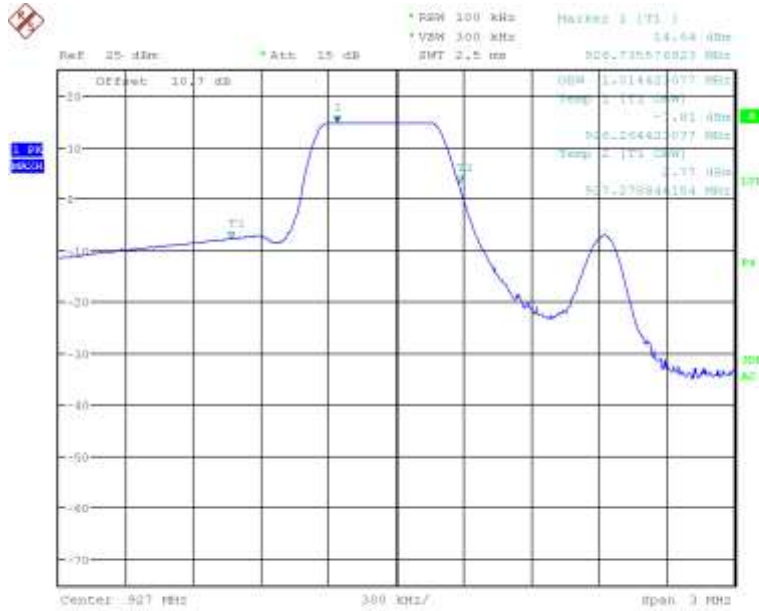
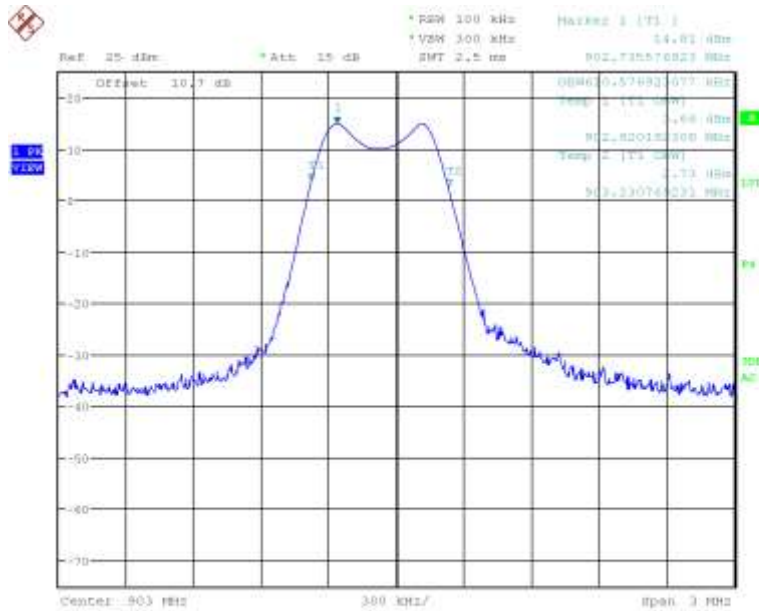


Figure 14 – Mid Channel 99% Occupied Bandwidth (LoRa)



Date: 29.JUL.2021 01:02:18

Figure 15 – High Channel 99% Occupied Bandwidth (LoRa)



Date: 29.JUL.2021 01:33:08

Figure 16 – Low Channel 99% Occupied Bandwidth (FSK)

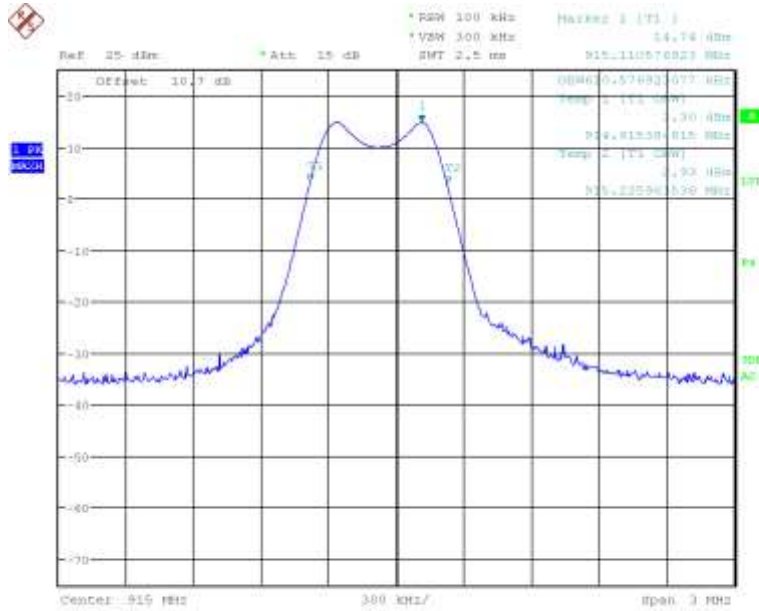


Figure 17 – Mid Channel 99% Occupied Bandwidth (FSK)

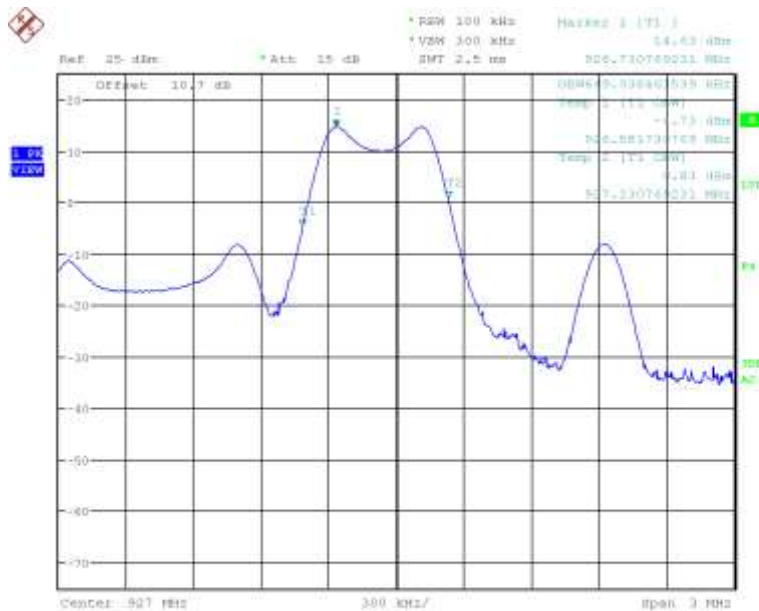


Figure 18 – High Channel 99% Occupied Bandwidth (FSK)

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4.4 Power Spectral Density

This test measures the power spectral density of the EUT.

4.4.1 Test Over View

Results	Complies (as tested per this report)				Date	07/29/2021	
Standard	FCC 47 CFR Part 15.247 (e), RSS-247 (5.2)						
Product Model	BLUbase V1			Serial#	24-010668		
Configuration	See test plan for details.						
Test Set-up	Tested in shielded room, EUT placed on table. See test plan for details						
EUT Powered By	120V60Hz	Temp	22°C	Humidity	56%	Pressure	986 mbar
Channel Frequencies	Low Channel: 903 MHz Mid Channel: 915 MHz High Channel: 927 MHz		Power Setting @ Channel		14 dBm		
Perf. Criteria	PSD < 8dBm / 3kHz		Perf. Verification		Readings under Limit		
Mod to EUT	None		Test Performed By		Alexander Sowinski		

4.4.2 Test Procedure

Antenna port conducted emission tests were performed using the procedures of FCC 47 CFR Part 15.247 (e), RSS-247 (5.2) and/or ANSI C63.10 including methods for signal maximizations and EUT configuration. The EUT was placed in the test chamber and connected directly to the spectrum analyzer via temporary SMA connection. Peak measurements were taken with RBW = 3 kHz on each of the low, mid, and high channels utilizing both the LoRa and FSK transmission schemes of the EUT.

4.4.3 Deviations

There were no deviations from the test methodology listed in the test plan for the power spectral density test.

4.4.4 Final Test

The power spectral density measurements were below the limits specified by the standard

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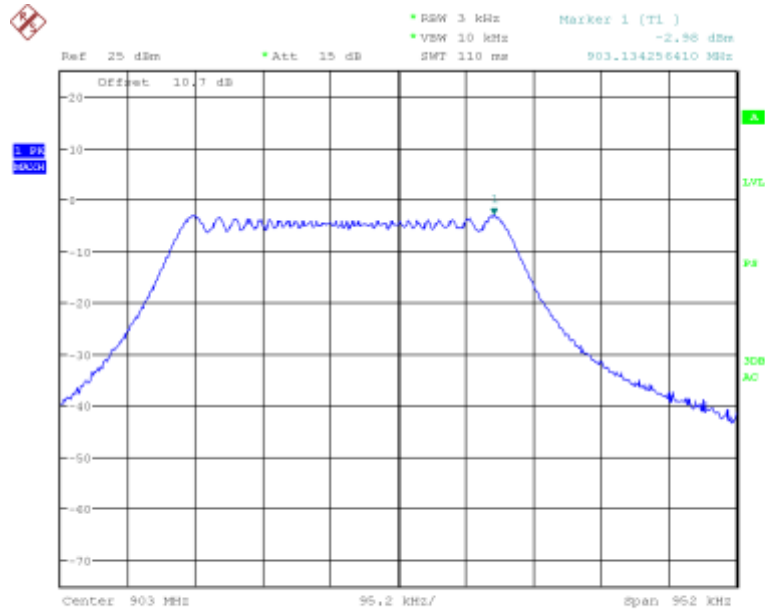
Prüfbericht-Nr.:

4.4.5 Final Data

Table 3: Power Spectral Density, EUT power setting @ 14 dBm.

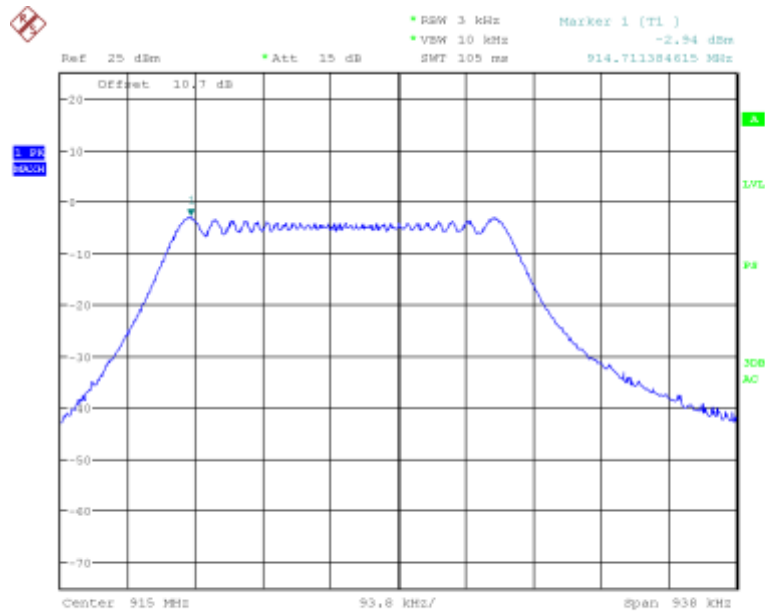
Type	Frequency	PSD	Limit	Margin
	MHz	dBm/3kHz	dBm	dB
LoRa	903.00	-3.04	8.0	-11.04
LoRa	915.00	-2.97	8.0	-10.97
LoRa	927.00	-2.66	8.0	-10.66
FSK	903.00	7.76	8.0	-0.24
FSK	915.00	7.69	8.0	-0.31
FSK	927.00	7.44	8.0	-0.56

4.4.6 Final Plots



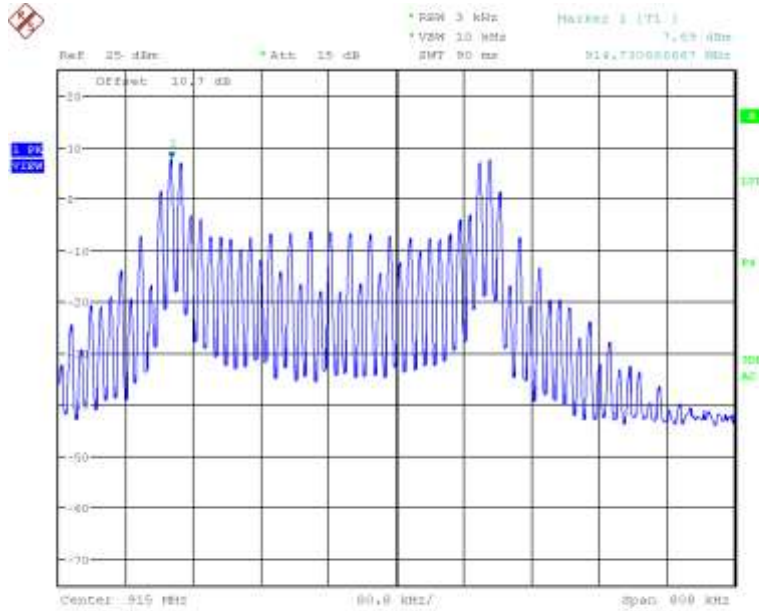
Date: 29.JUL.2021 00:44:29

Figure 19 – Low Channel Power Spectral Density (LoRa)



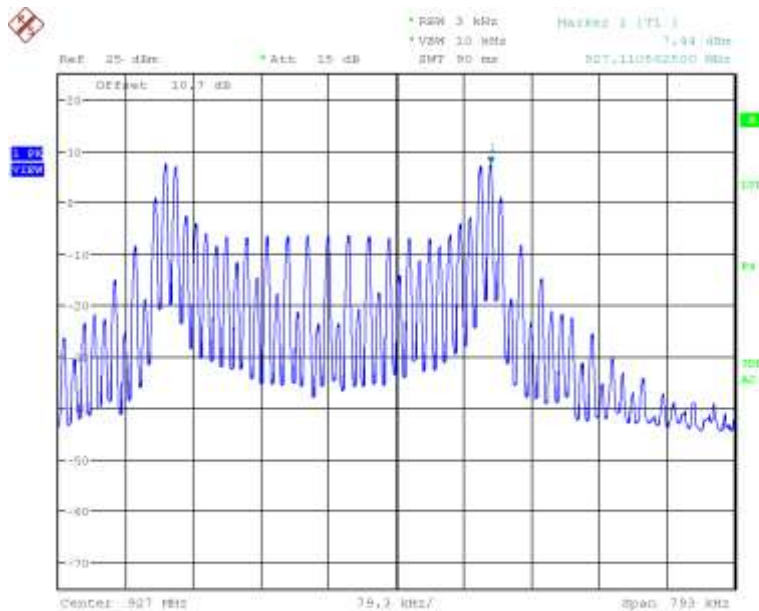
Date: 29.JUL.2021 00:54:21

Figure 20 – Mid Channel Power Spectral Density (LoRa)



Date: 29.JUL.2021 01:39:15

Figure 23 – Mid Channel Power Spectral Density (FSK)



Date: 29.JUL.2021 01:51:21

Figure 24 – High Channel Power Spectral Density (FSK)

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4.5 Out of Band Emissions

This test checks for any spurious emissions outside of the transmit band.

4.5.1 Test Over View

Results	Complies (as tested per this report)			Date	07/29/2021		
Standard	FCC 47 CFR Part 15.247 (d), RSS-247 (5.5)						
Product Model	BLUbase V1			Serial#	24-010668		
Configuration	See test plan for details.						
Test Set-up	Tested in shielded room, EUT placed on table. See test plan for details						
EUT Powered By	120V60Hz	Temp	22°C	Humidity	56%	Pressure	986 mbar
Channel Frequencies	Low Channel: 903 MHz Mid Channel: 915 MHz High Channel: 927 MHz		Power Setting @ Channel		14 dBm		
Perf. Criteria	< 20 dBr / 100 kHz band		Perf. Verification		Readings Below Limit		
Mod to EUT	None		Test Performed By		Alexander Sowinski		

4.5.2 Test Procedure

Antenna port conducted emission tests were performed using the procedures of FCC 47 CFR Part 15.247 (d), RSS-247 (5.5) and/or ANSI C63.10 including methods for signal maximizations and EUT configuration. The EUT was placed in the test chamber and connected directly to the spectrum analyzer via temporary SMA connection. Peak measurements were taken with RBW = 100 kHz on each of the low, mid, and high channels utilizing both the LoRa and FSK transmission schemes of the EUT.

4.5.3 Deviations

There were no deviations from the test methodology listed in the test plan for the out of band emissions test.

4.5.4 Final Test

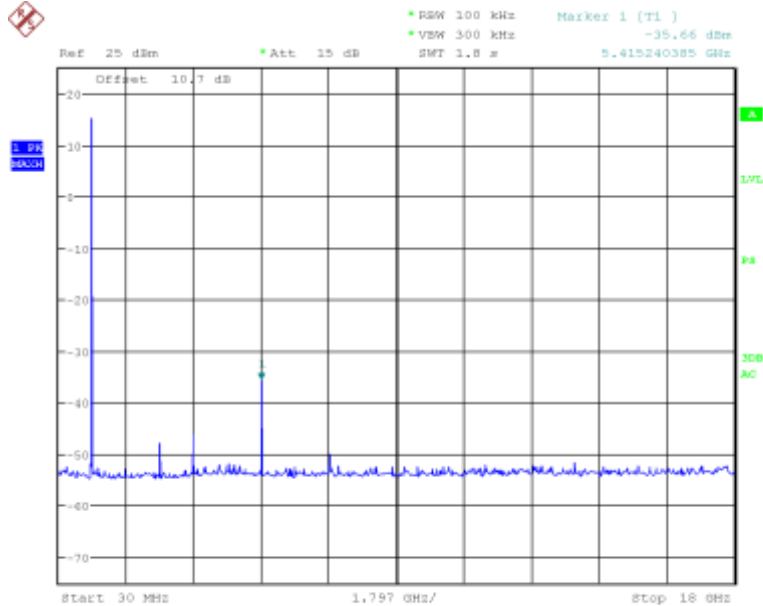
The reading from the EUT were below the limits specified by the relevant standard.

4.5.5 Final Data

Table 4: Conducted Out of Band Emissions – EUT power setting @ 14 dBm

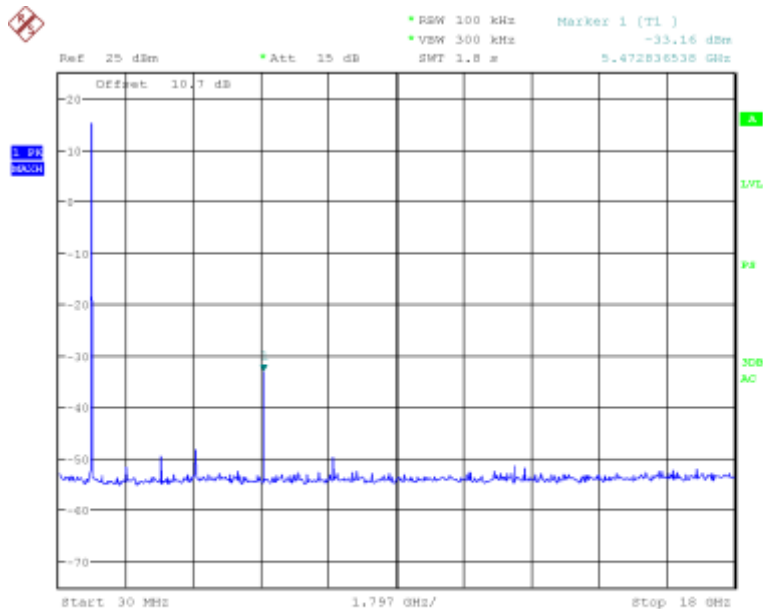
Type	Freq MHz	Level dBm	Limit dBm	Margin dB			Type	Freq MHz	Level dBm	Limit dBm	Margin dB
LoRa	903.00	15.28	N/A	N/A			FSK	903.00	15.12	N/A	N/A
	2708.221	-47.81	-4.72	-43.09				2708.221	-48.81	-4.88	-43.93
	3600.962	-46.02	-4.72	-41.30				3600.962	-46.40	-4.88	-41.52
	5415.24	-35.66	-4.72	-30.94				5415.24	-36.25	-4.88	-31.37
LoRa	915.00	15.20	N/A	N/A			FSK	915.00	15.04	N/A	N/A
	2737.019	-49.52	-4.80	-44.72				5472.837	-33.59	-4.96	-28.63
	5472.837	-33.16	-4.80	-28.36							
LoRa	927.00	14.98	N/A	N/A			FSK	927.00	14.92	N/A	N/A
	5559.231	-33.10	-5.02	-28.08				5559.231	-33.65	-5.08	-28.57

4.5.6 Final Plots



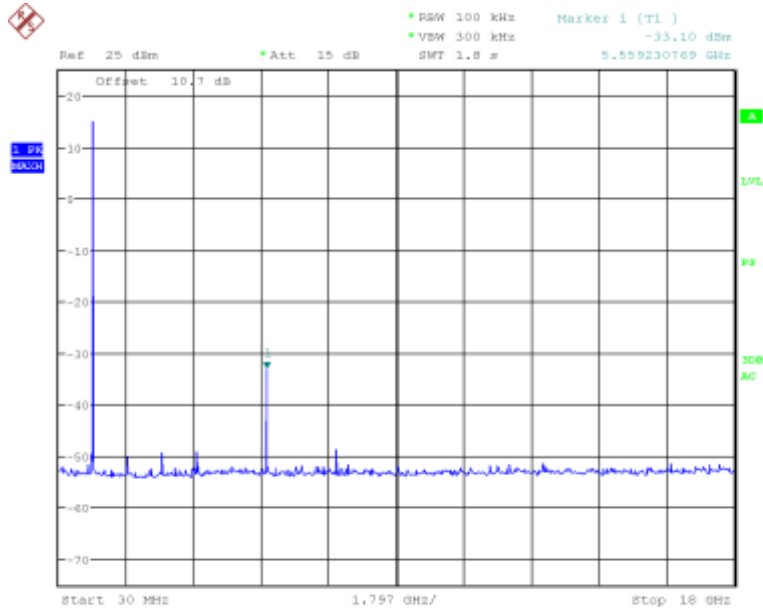
Date: 29.JUL.2021 00:48:44

Figure 25 – Low Channel Conducted Spurious Emissions (LoRa)



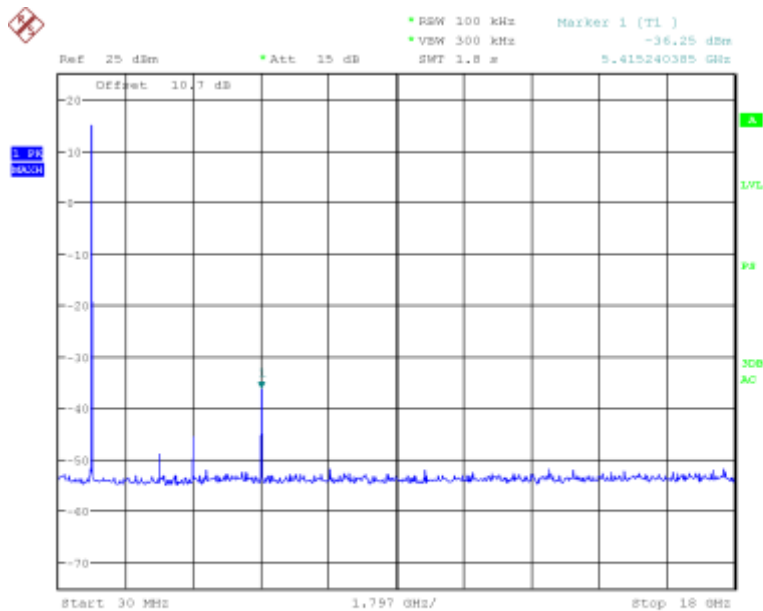
Date: 29.JUL.2021 00:56:24

Figure 26 – Mid Channel Conducted Spurious Emissions (LoRa)



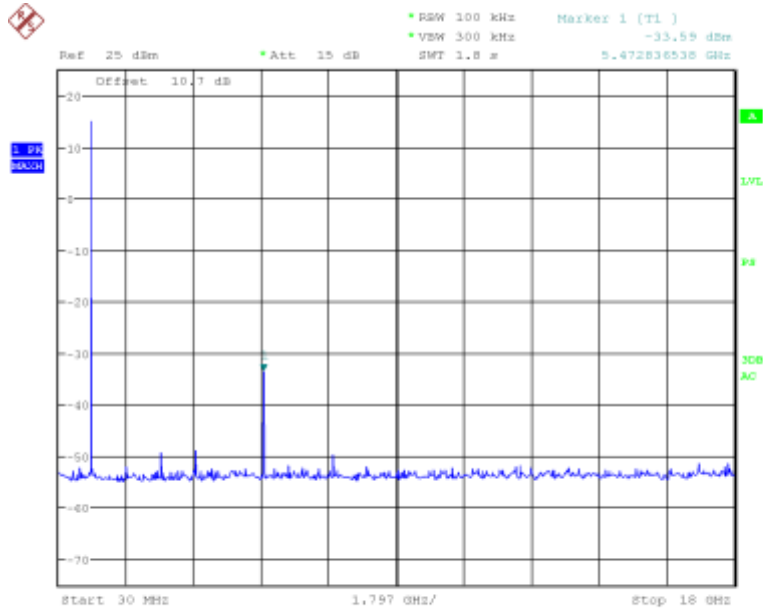
Date: 29.JUL.2021 01:17:10

Figure 27 – High Channel Conducted Spurious Emissions (LoRa)



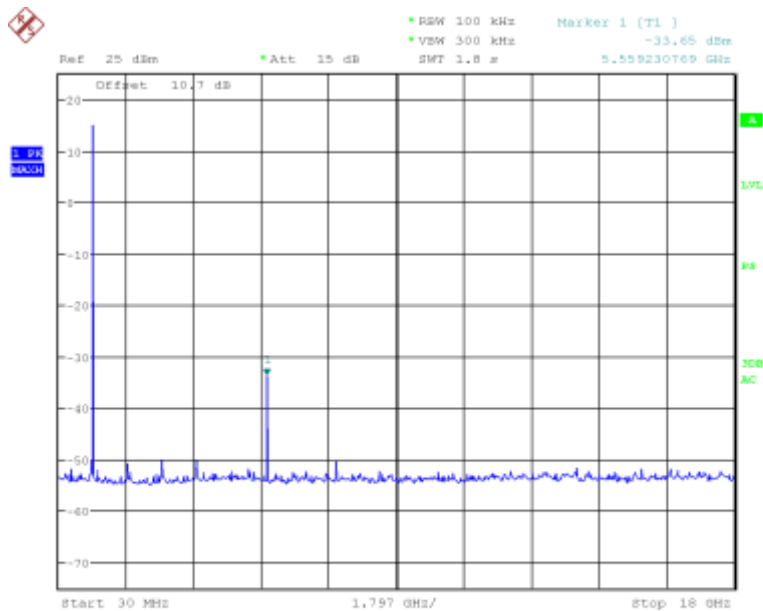
Date: 29.JUL.2021 01:27:01

Figure 28 – Low Channel Conducted Spurious Emissions (FSK)



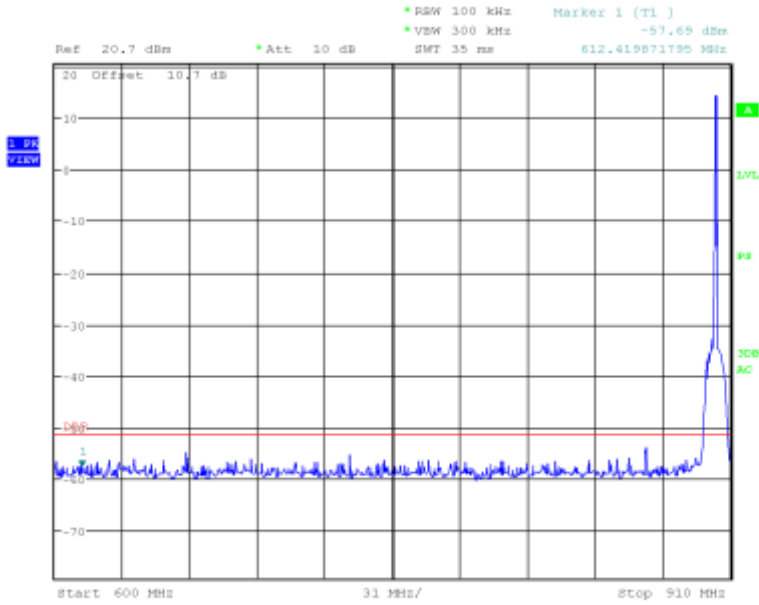
Date: 29.JUL.2021 01:41:44

Figure 29 – Mid Channel Conducted Spurious Emissions (FSK)



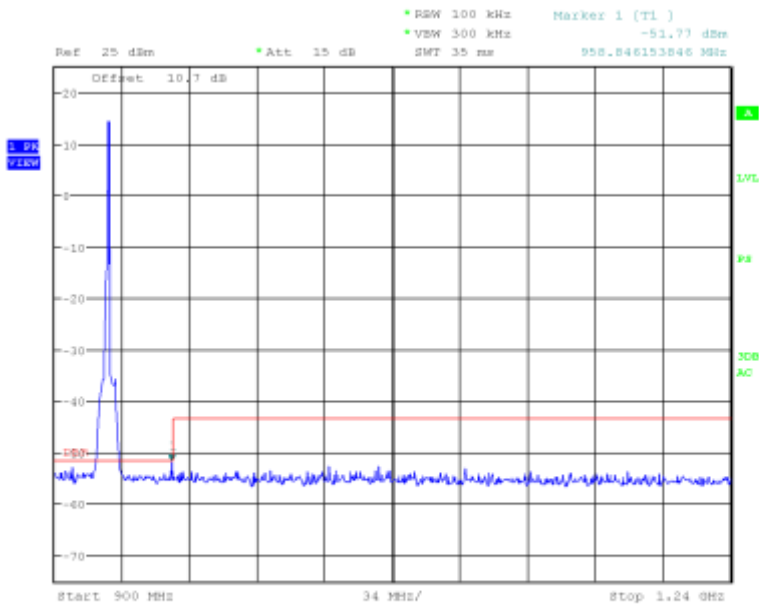
Date: 29.JUL.2021 01:54:43

Figure 30 – High Channel Conducted Spurious Emissions (FSK)



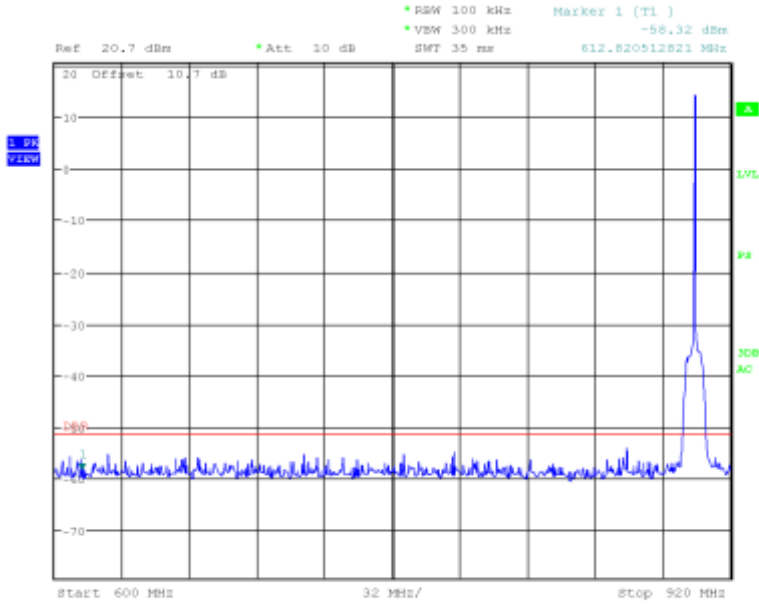
Date: 7.JUL.2021 01:18:46

Figure 31 – Low Channel Conducted Band Edge (LoRa)



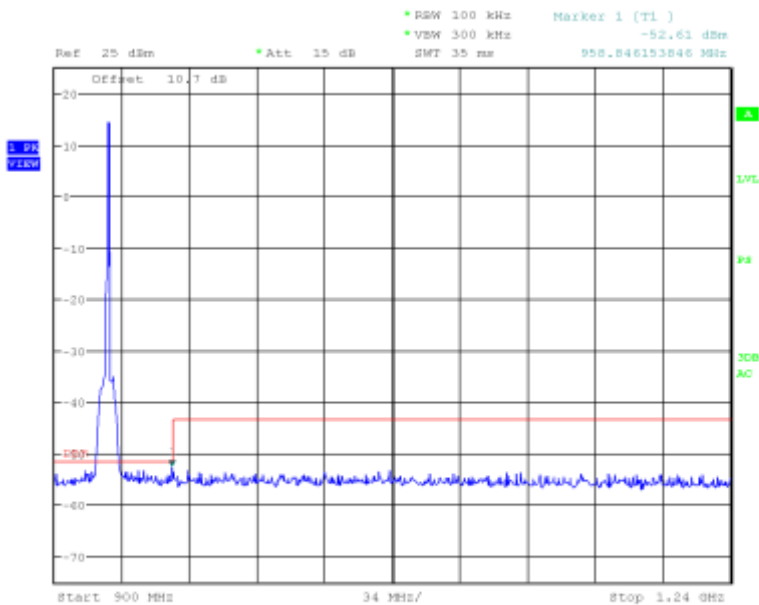
Date: 7.JUL.2021 01:40:42

Figure 32 – High Channel Conducted Band Edge (LoRa)



Date: 7.JUL.2021 01:50:49

Figure 33 – Low Channel Conducted Band Edge (FSK)



Date: 7.JUL.2021 02:08:36

Figure 34 – High Channel Conducted Band Edge (FSK)

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4.6 Transmitter Spurious Emissions

This test measures the electromagnetic levels of spurious signals generated by the EUT that radiated from the EUT and may affect the performance of other nearby electronic equipment.

4.6.1 Over View of Test

Results	Complies (as tested per this report)				Date	08/03/2021	
Standard	FCC CFR 15.209, RSS-Gen (8.9)						
Product Model	BLUbase V1			Serial#	24-010669		
Configuration	See test plan for details.						
Test Set-up	Tested 3 meters semi- anechoic chamber placed on turn-table, see test plans for details.						
EUT Powered By	120V60Hz	Temp	22°C	Humidity	54%	Pressure	1002 mbar
Frequency Range	30 - 1000 MHz @ 3 meters 1000 - 18000 MHz @ 3 meters						
Channel Frequencies	Low Channel: 903 MHz Mid Channel: 915 MHz High Channel: 927 MHz			Power Setting @ Channel	14 dBm		
Perf. Criteria	Class B (Below Limit)			Perf. Verification	Readings Under Limit		
Mod. to EUT	None			Test Performed By	Alexander Sowinski		

4.6.2 Test Procedure

Radiated emissions tests were performed using the procedures of FCC 47 CFR Part 15.209 and/or ANSI C63.10 including methods for signal maximizations and EUT configuration. The photos included with the report show the EUT in its maximized configuration. Further radiated emission tests were performed per the procedures stated in the other emissions standards listed in this report. A notch filter was installed along the signal path to protect the measurement equipment.

The frequency range 30 – 18000 MHz investigated for radiated emissions. No spurious emissions were discovered below 30MHz or above 18 GHz.

4.6.3 Deviations

There were no deviations from the test methodology listed in the test plan for the radiated emission test.

4.6.4 Final Test

All final radiated emissions measurements were below (in compliance) the limits.

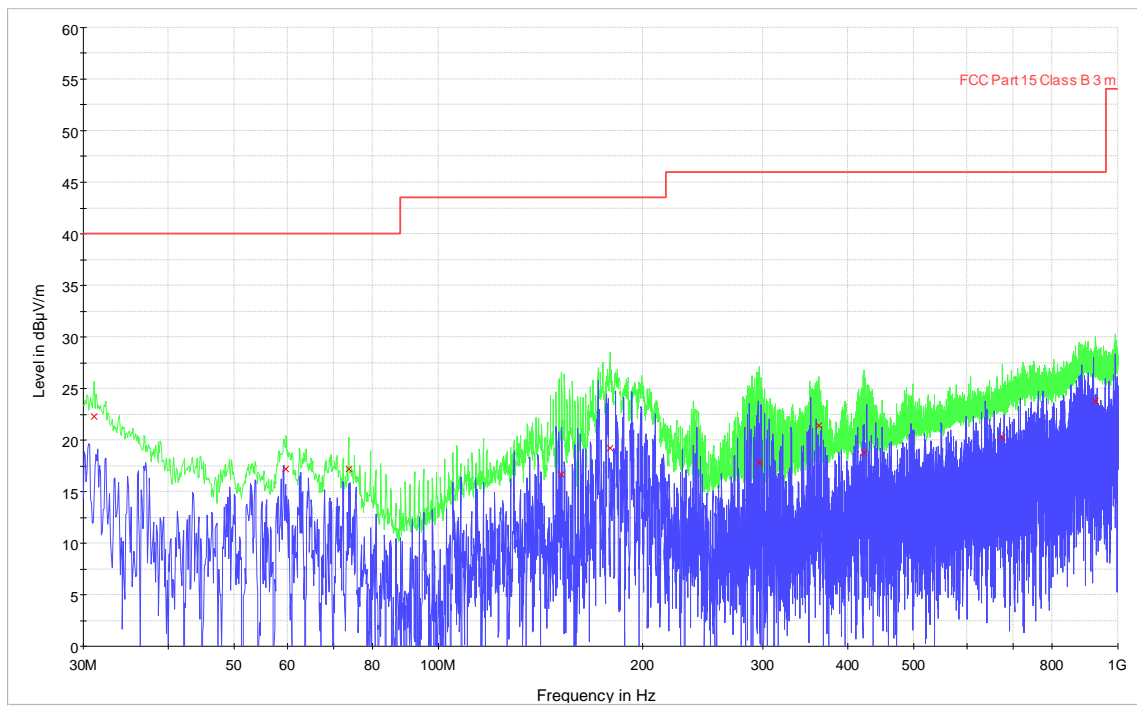
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4.6.5 Final Graphs

NOTES: LoRa Low Channel (903 MHz)
Radiated Emissions 30 – 1000 MHz
Vertical

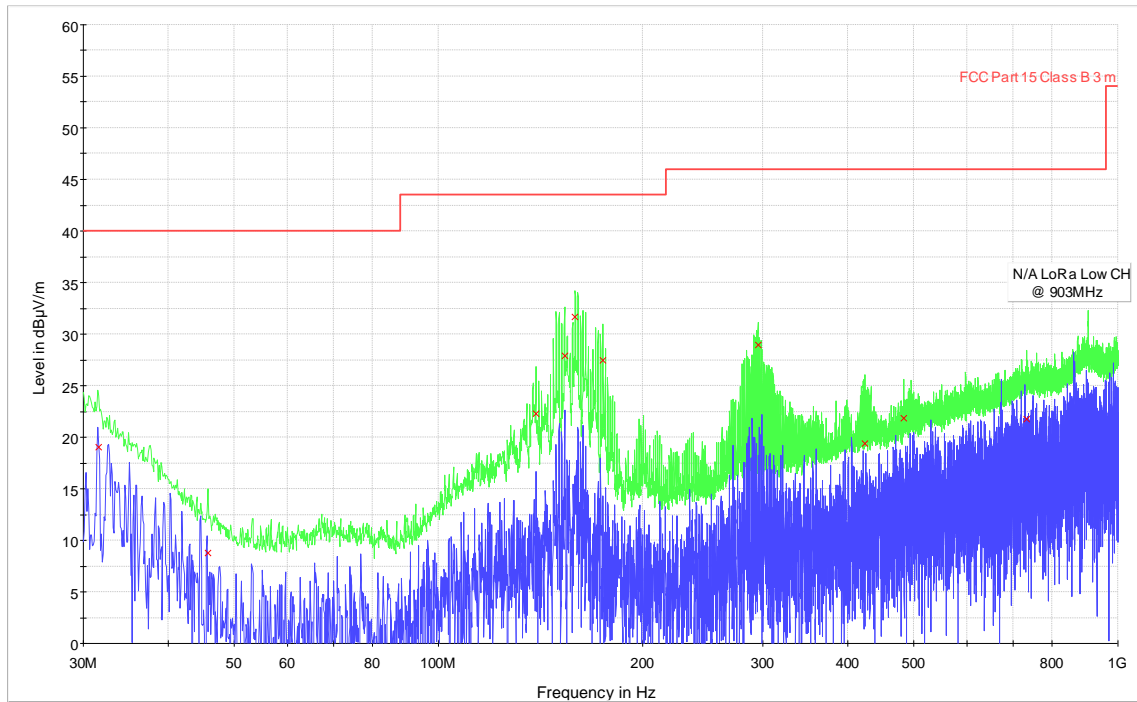


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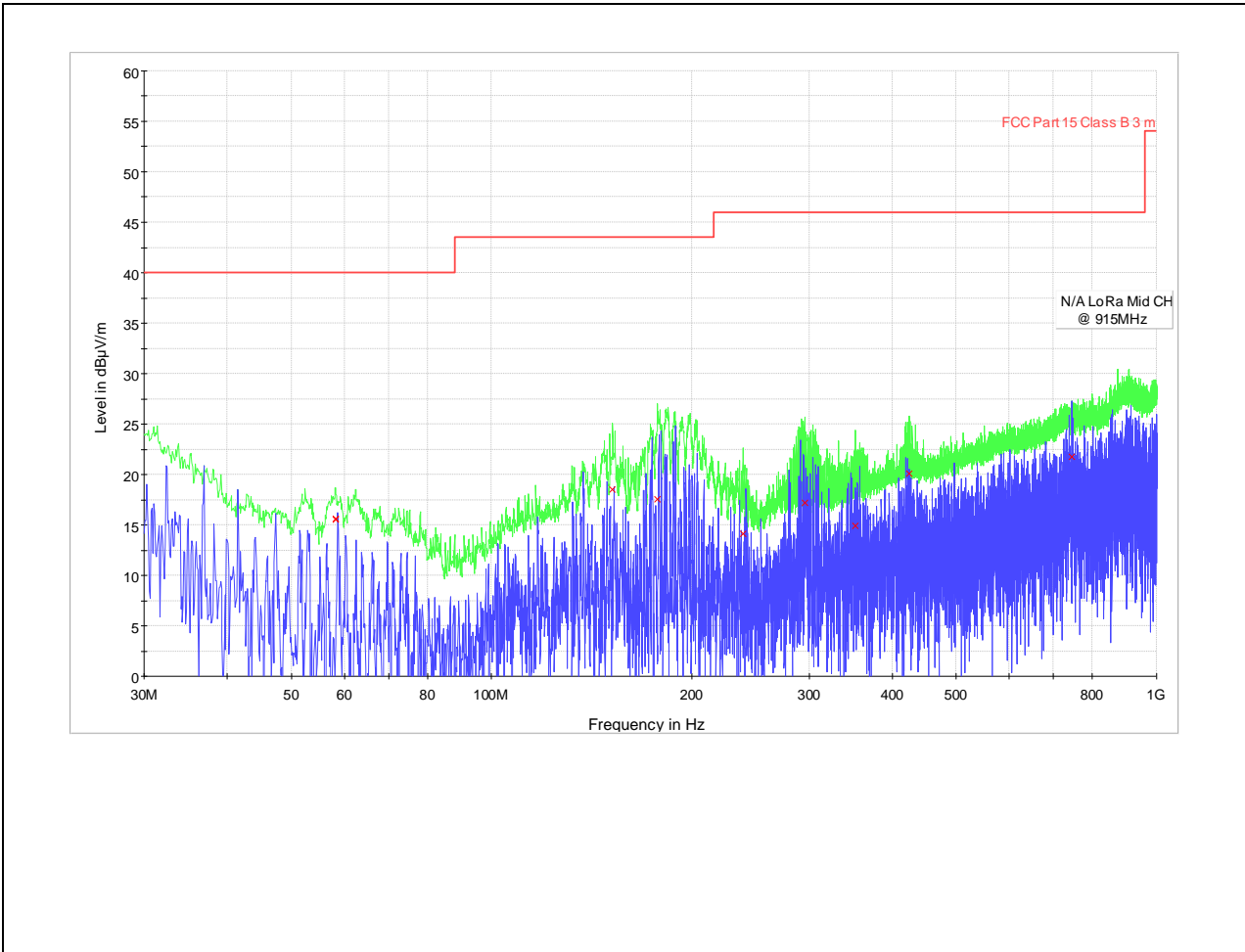
Prüfbericht-Nr.:

NOTES: LoRa Low Channel (903 MHz)
Radiated Emissions 30 – 1000 MHz
Horizontal



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Prüfbericht-Nr.:

NOTES: LoRa Mid Channel (915 MHz)
Radiated Emissions 30 – 1000 MHz
Vertical

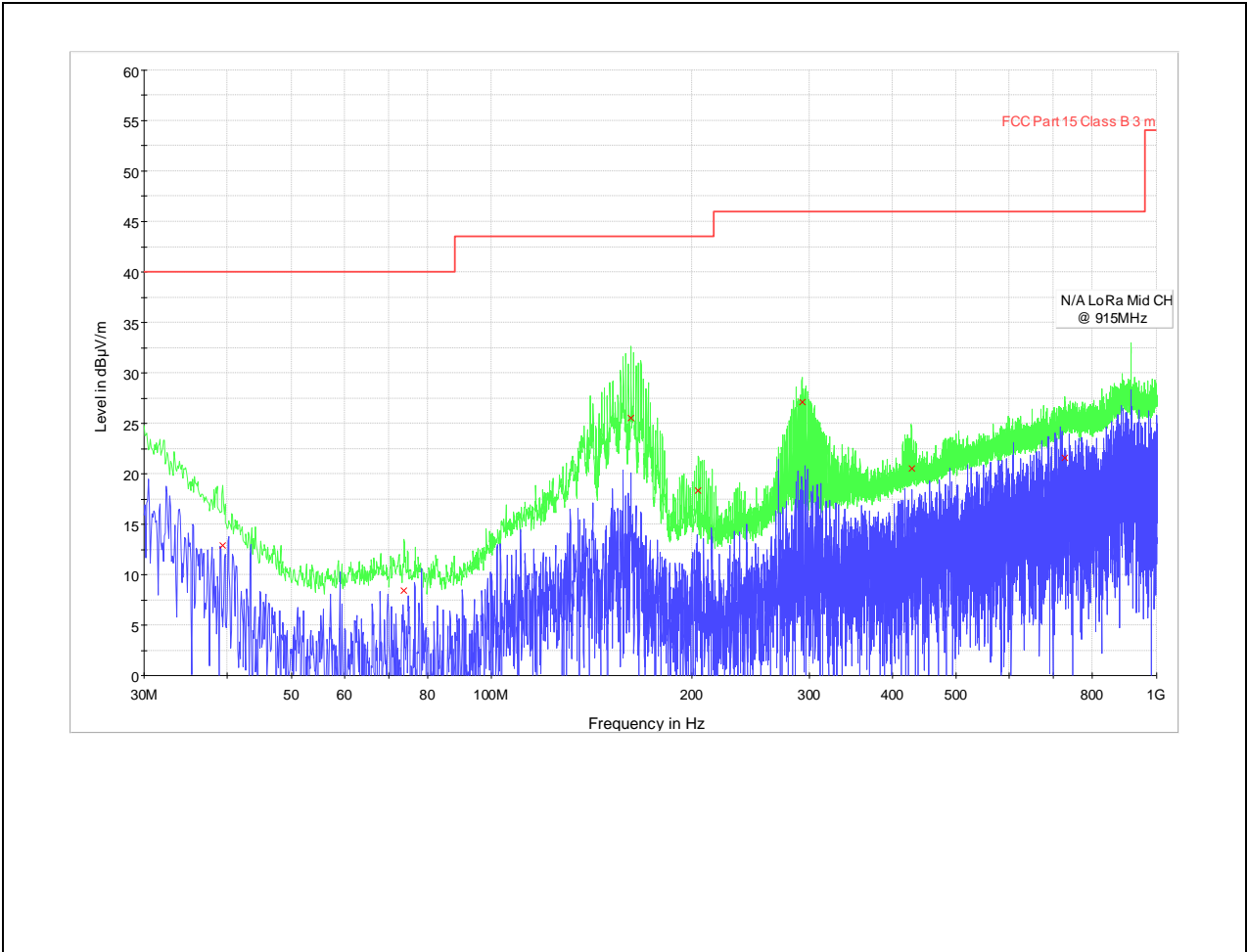


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Prüfbericht-Nr.:

NOTES: LoRa Mid Channel (915 MHz)
Radiated Emissions 30 – 1000 MHz
Horizontal

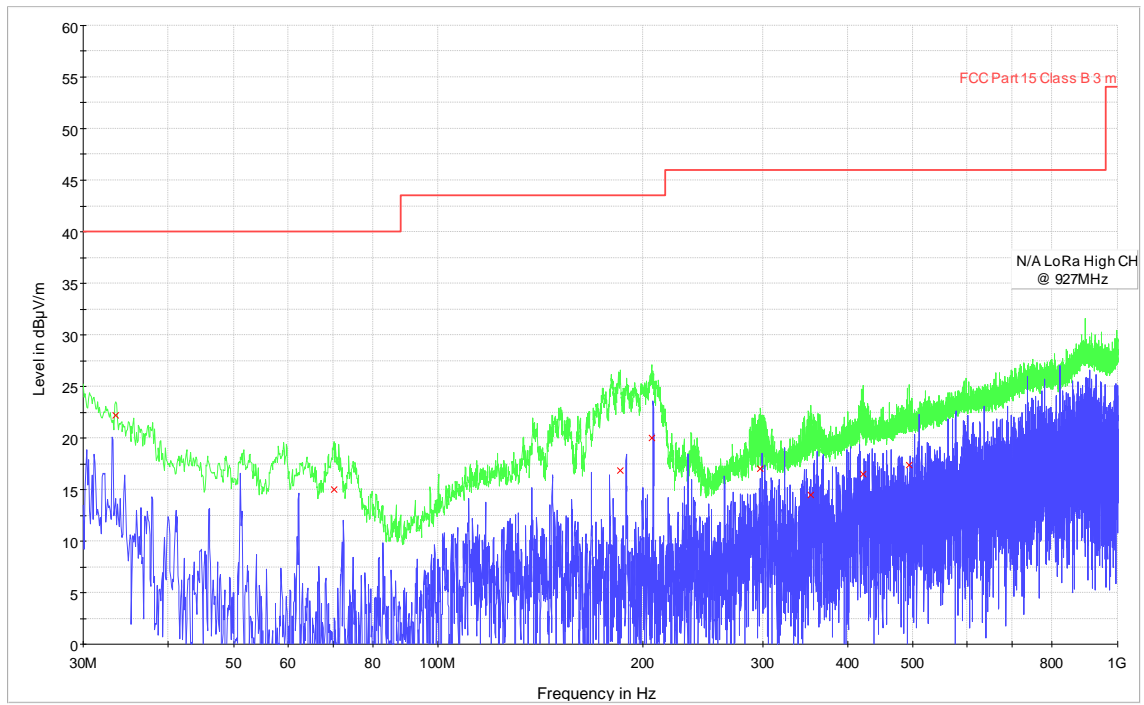


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NOTES: LoRa High Channel (927 MHz)
Radiated Emissions 30 – 1000 MHz
Vertical

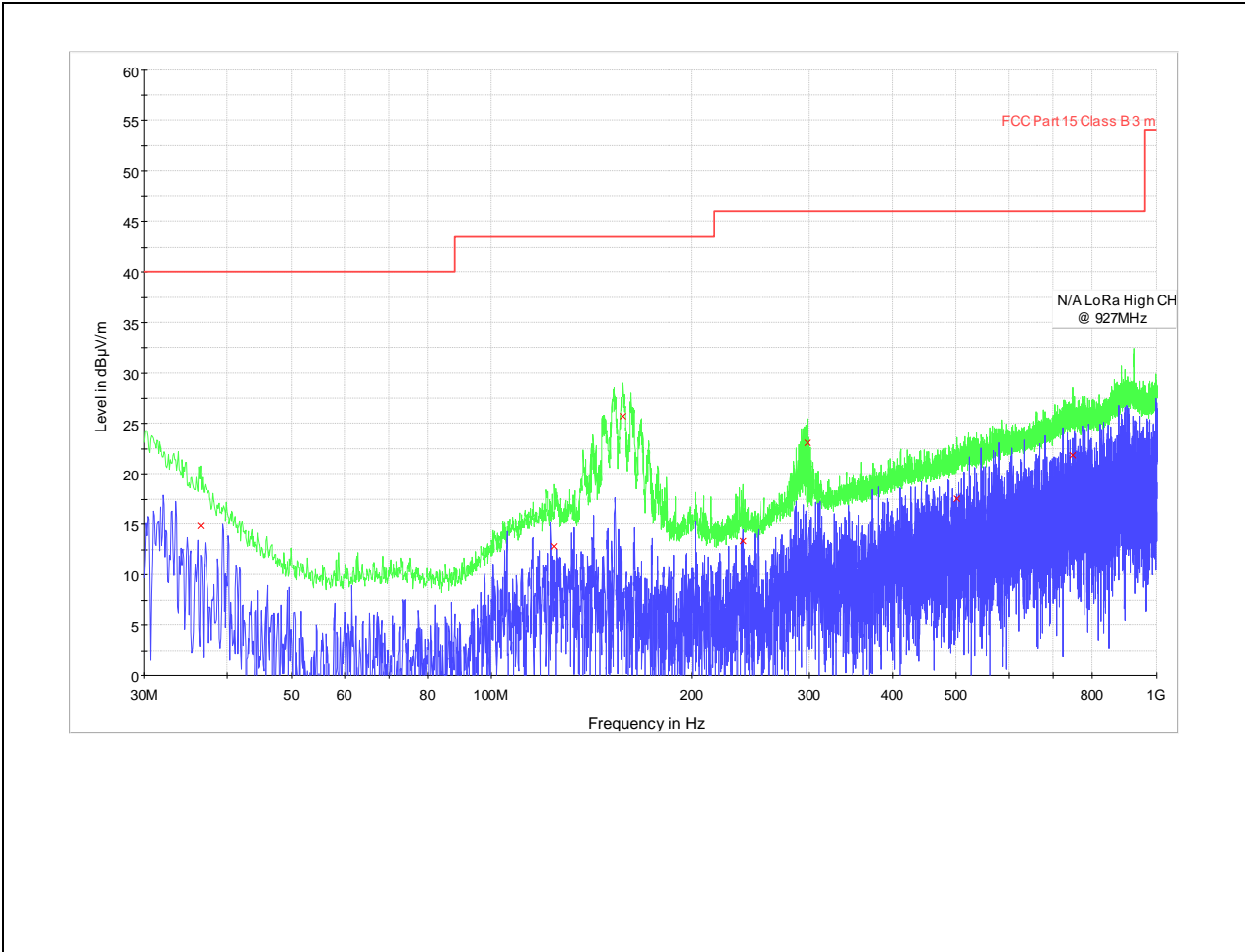


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NOTES: LoRa High Channel (927 MHz)
Radiated Emissions 30 – 1000 MHz
Horizontal



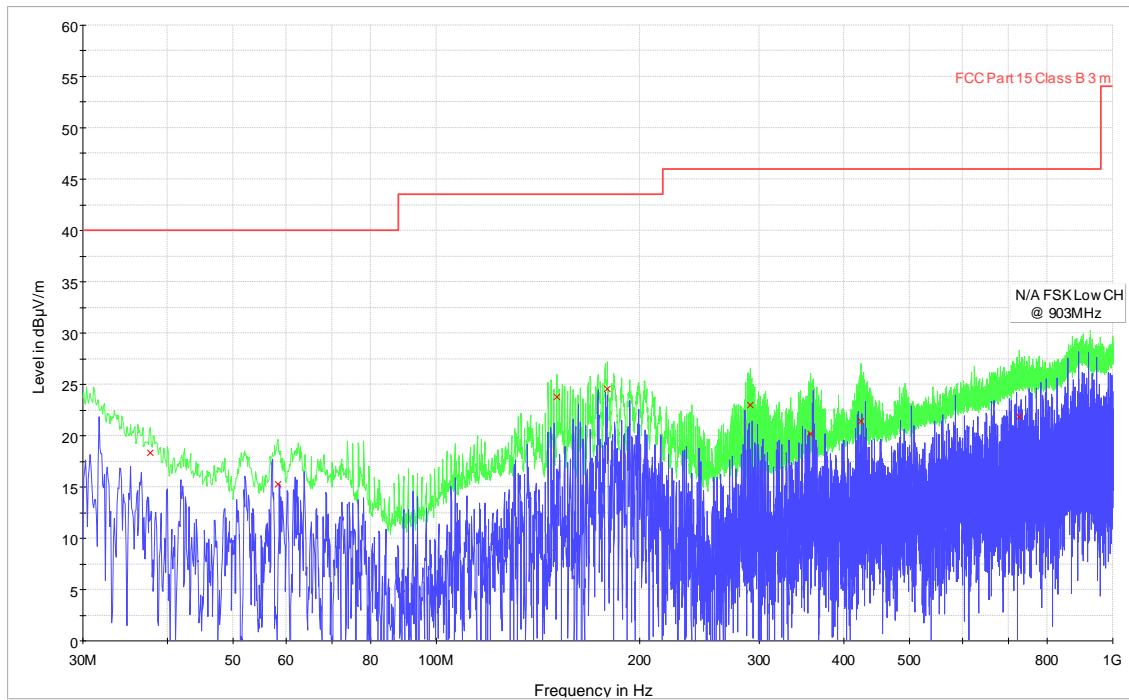
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NOTES: FSK Low Channel (903 MHz)

**Radiated Emissions 30 – 1000 MHz
Vertical**

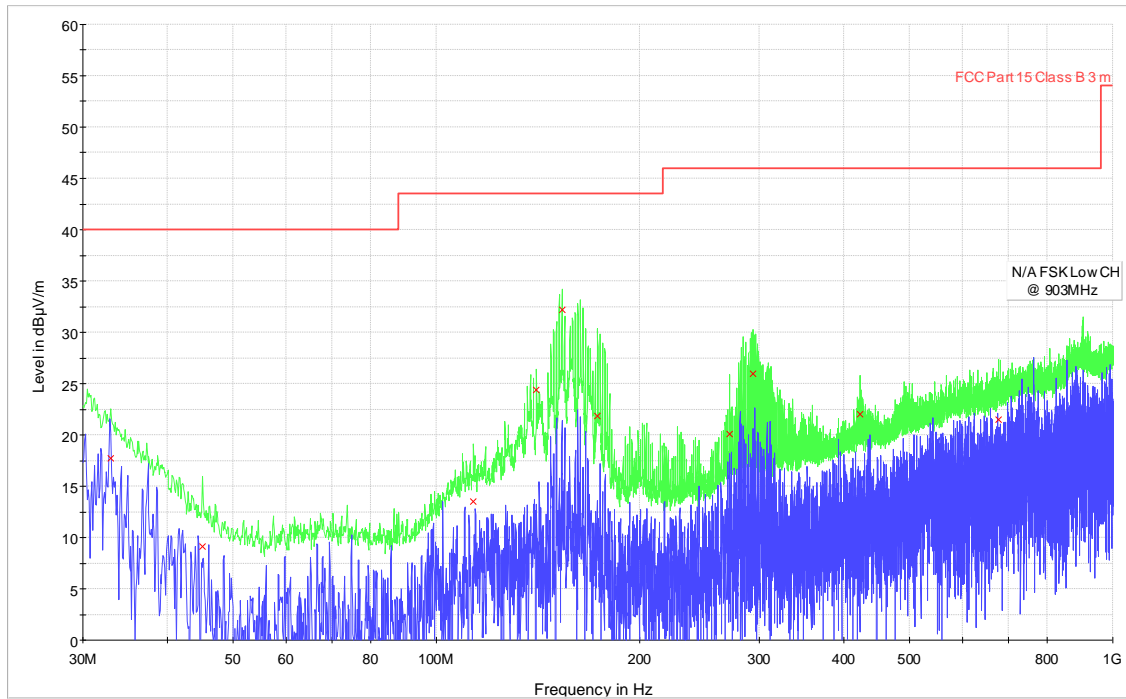


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Prüfbericht-Nr.:

NOTES: FSK Low Channel (903 MHz)
Radiated Emissions 30 – 1000 MHz
Horizontal



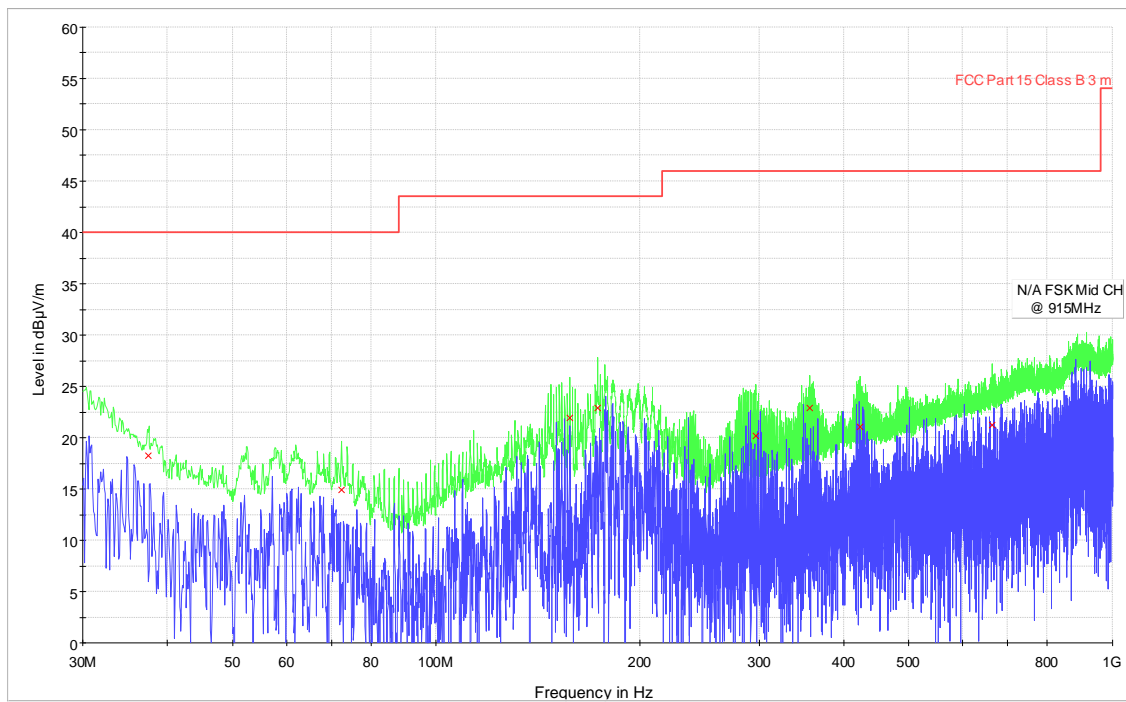
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NOTES: FSK Mid Channel (915 MHz)

**Radiated Emissions 30 – 1000 MHz
Vertical**

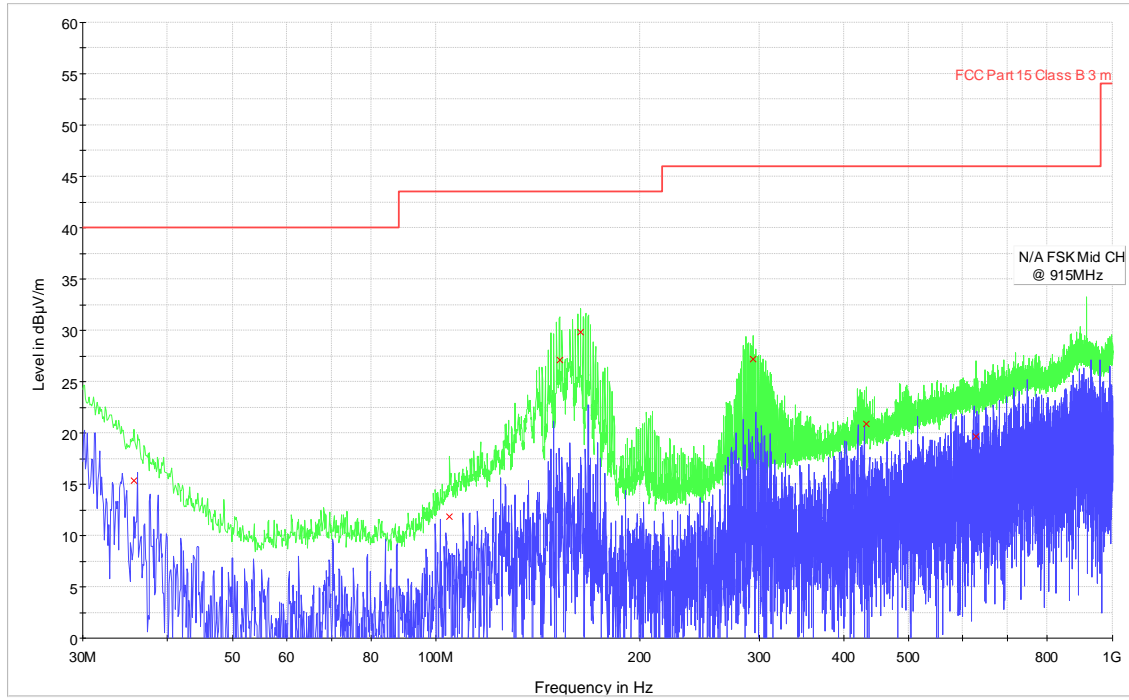


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Prüfbericht-Nr.:

NOTES: FSK Mid Channel (915 MHz)
Radiated Emissions 30 – 1000 MHz
Horizontal

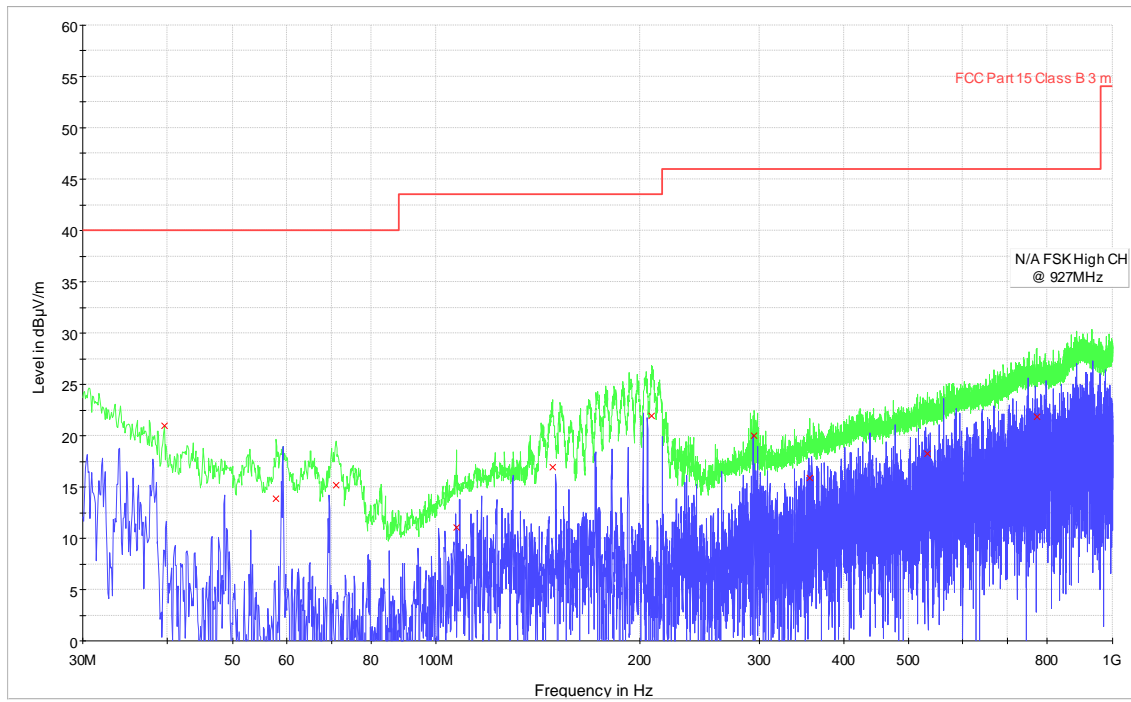


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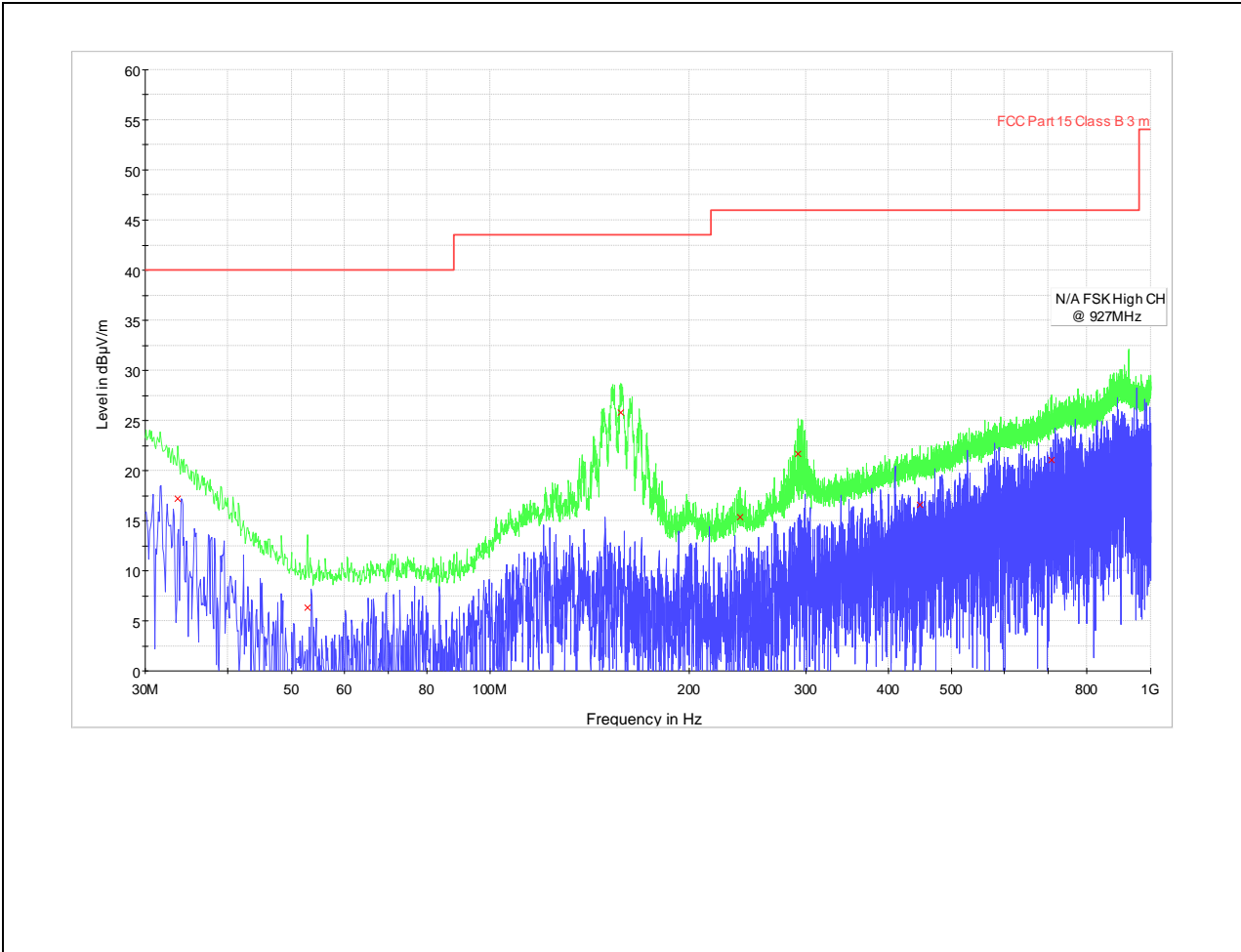
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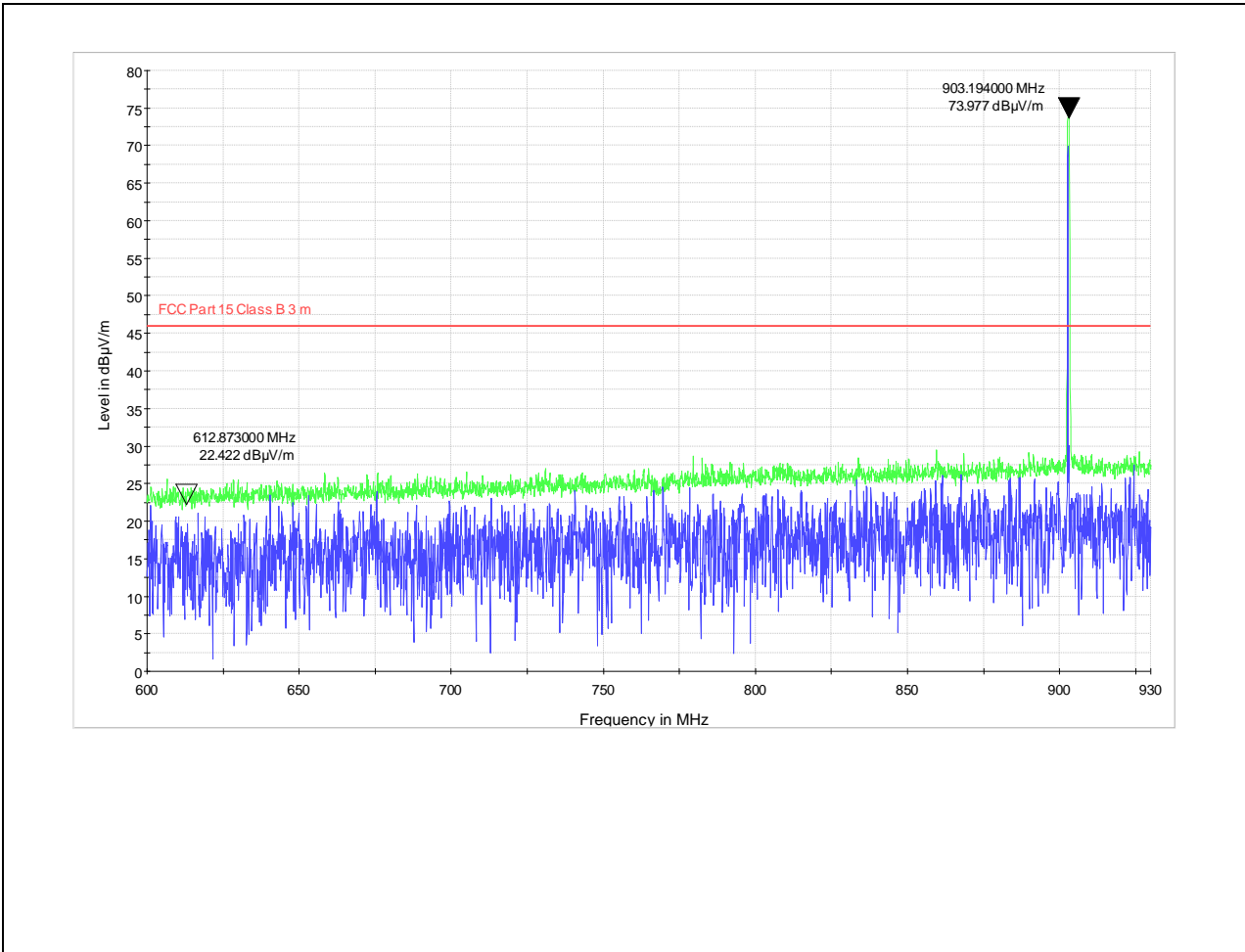
NOTES: FSK High Channel (927 MHz)
Radiated Emissions 30 – 1000 MHz
Vertical



NOTES: FSK High Channel (927 MHz)
Radiated Emissions 30 – 1000 MHz
Horizontal



NOTES: LoRa Low Channel (903 MHz)
**Radiated Emissions Band Edge
Worst Case - Horizontal**



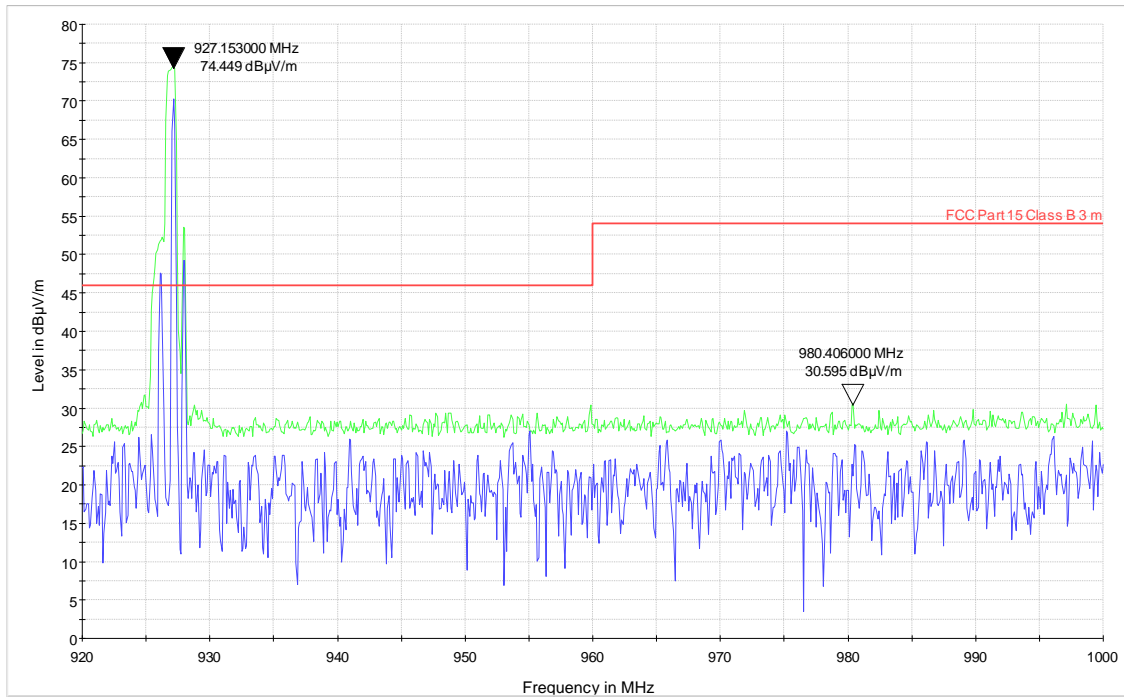
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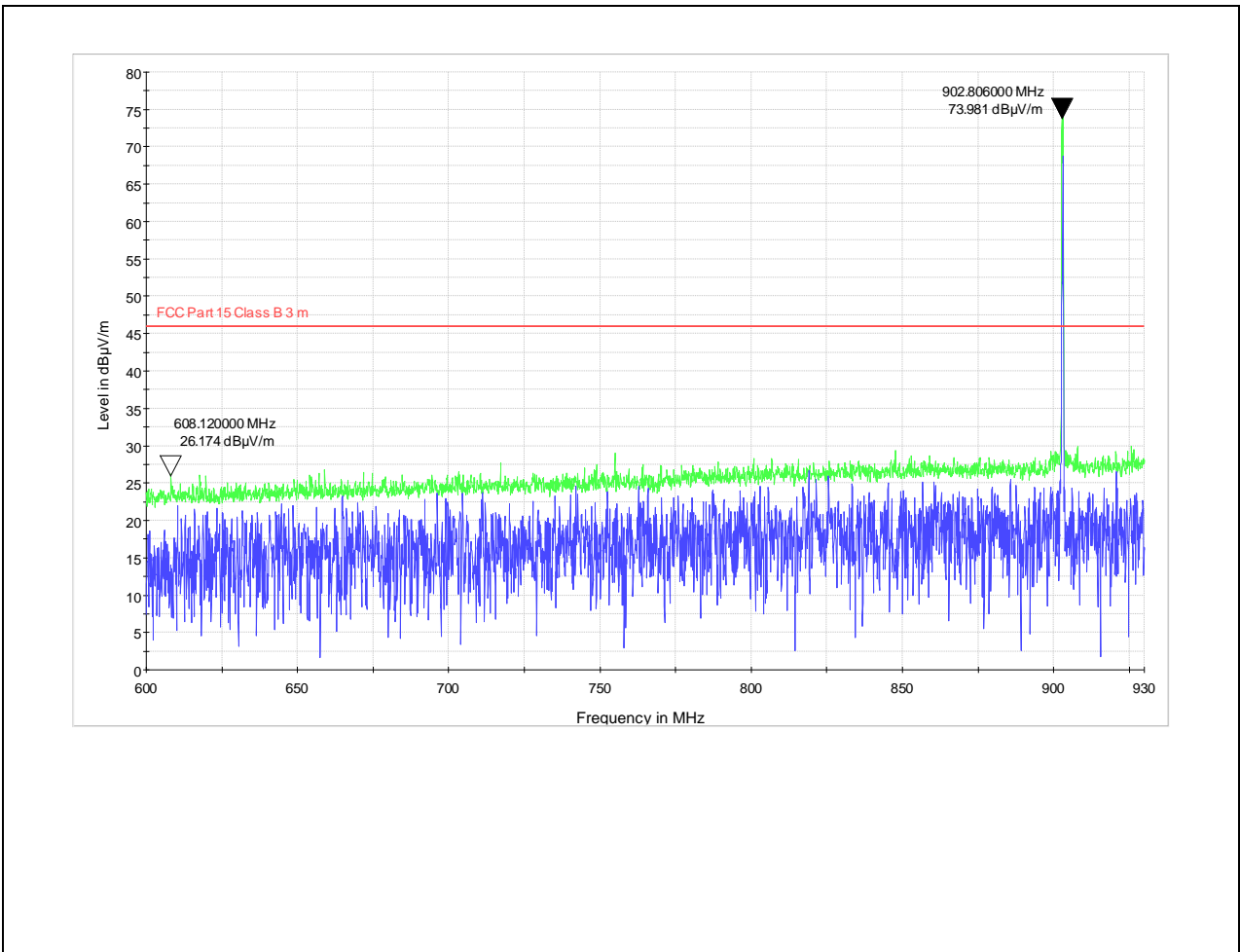
Prüfbericht-Nr.:

NOTES: LoRa High Channel (927 MHz)

**Radiated Emissions Band Edge
Worst Case - Horizontal**



NOTES: FSK Low Channel (903 MHz)
**Radiated Emissions Band Edge
Worst Case - Horizontal**



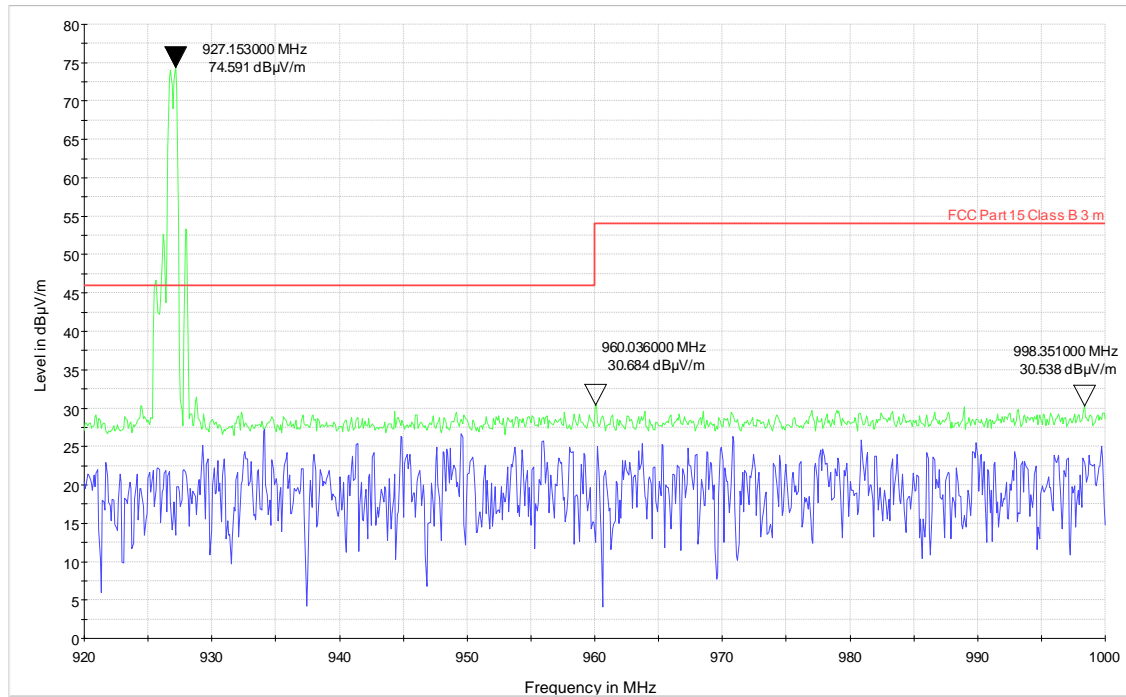
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NOTES: FSK High Channel (927 MHz)

**Radiated Emissions Band Edge
Worst Case - Horizontal**



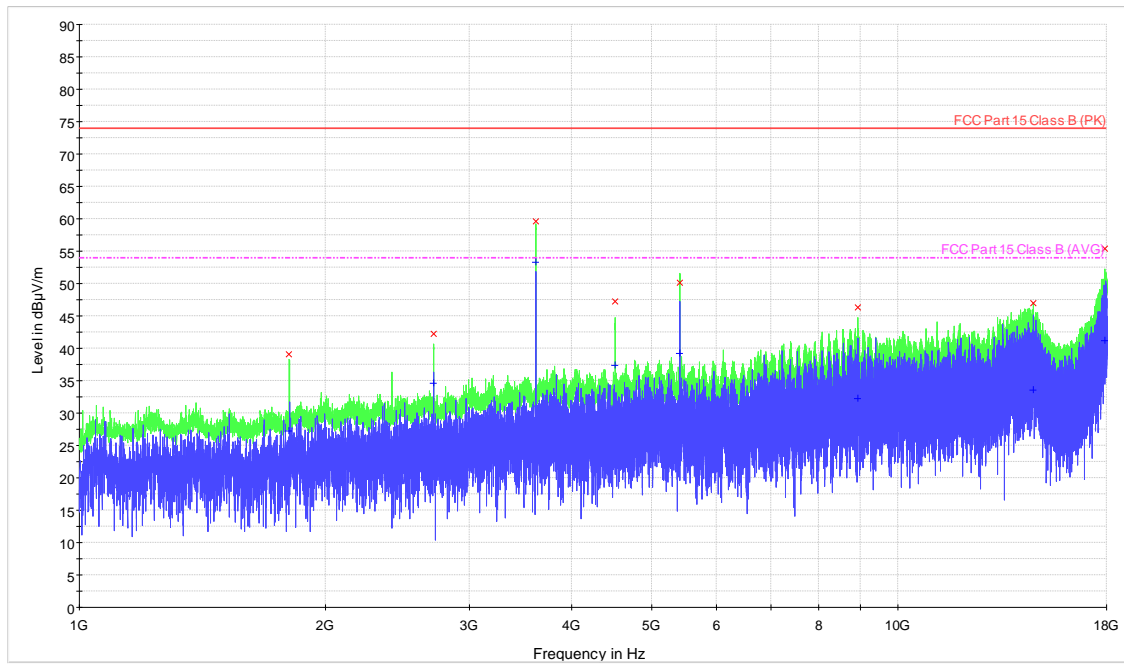
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NOTES: LoRa Low Channel (903 MHz)

**Radiated Emissions 1 – 18 GHz
Vertical**



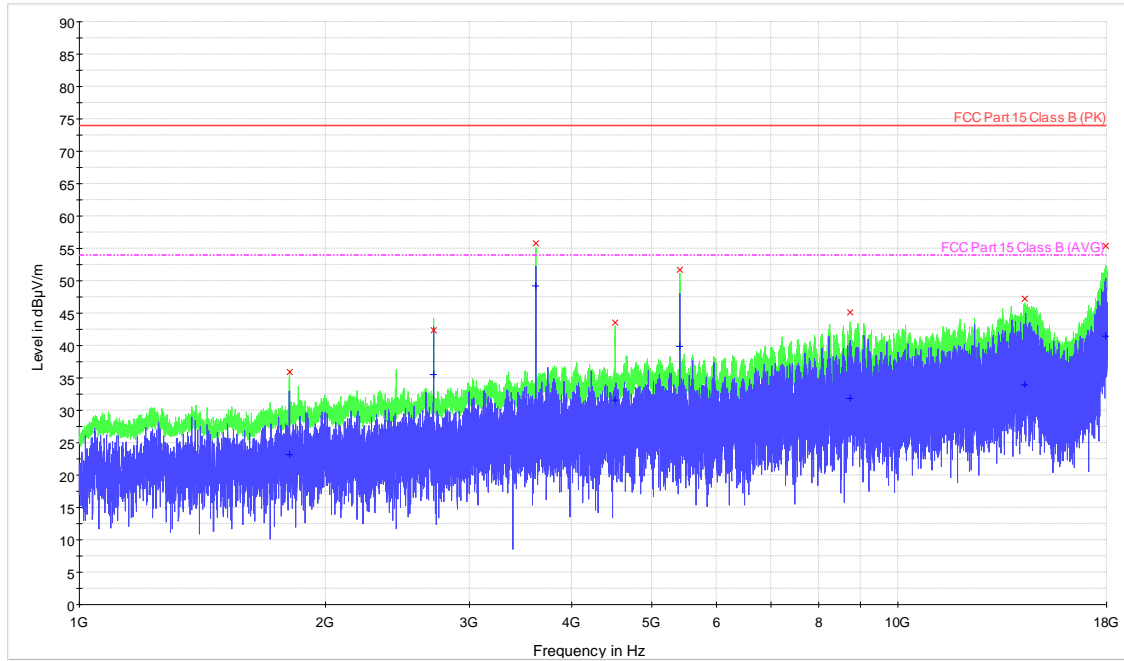
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NOTES: LoRa Low Channel (903 MHz)

**Radiated Emissions 1 – 18 GHz
Horizontal**



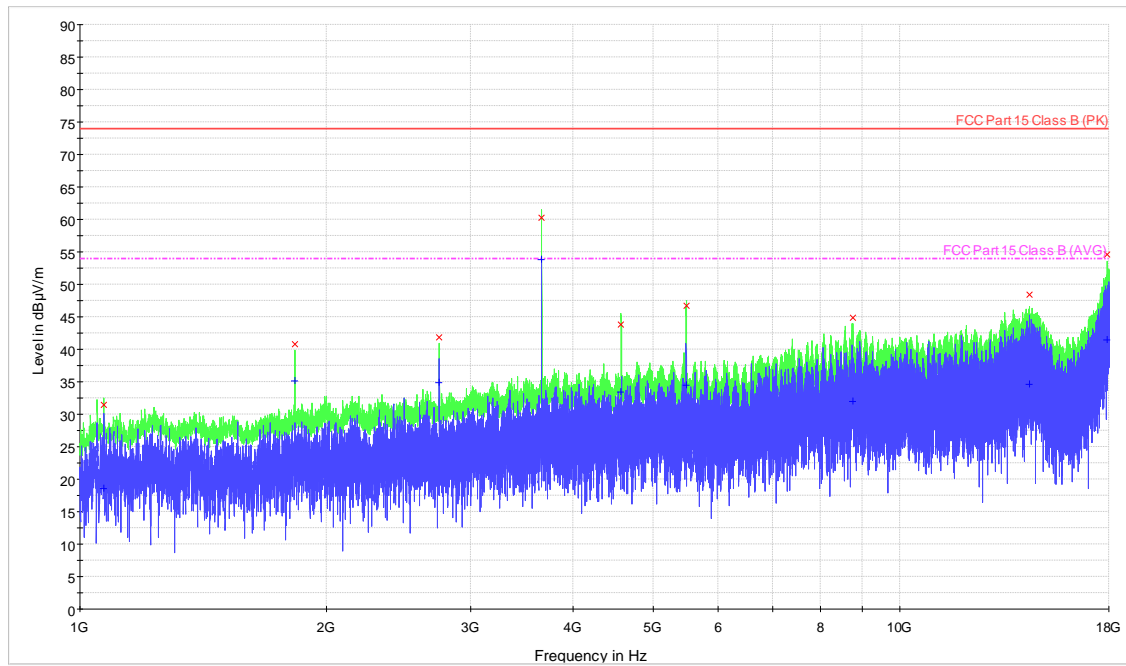
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Prüfbericht-Nr.:

NOTES: LoRa Mid Channel (915 MHz)

**Radiated Emissions 1 – 18 GHz
Vertical**



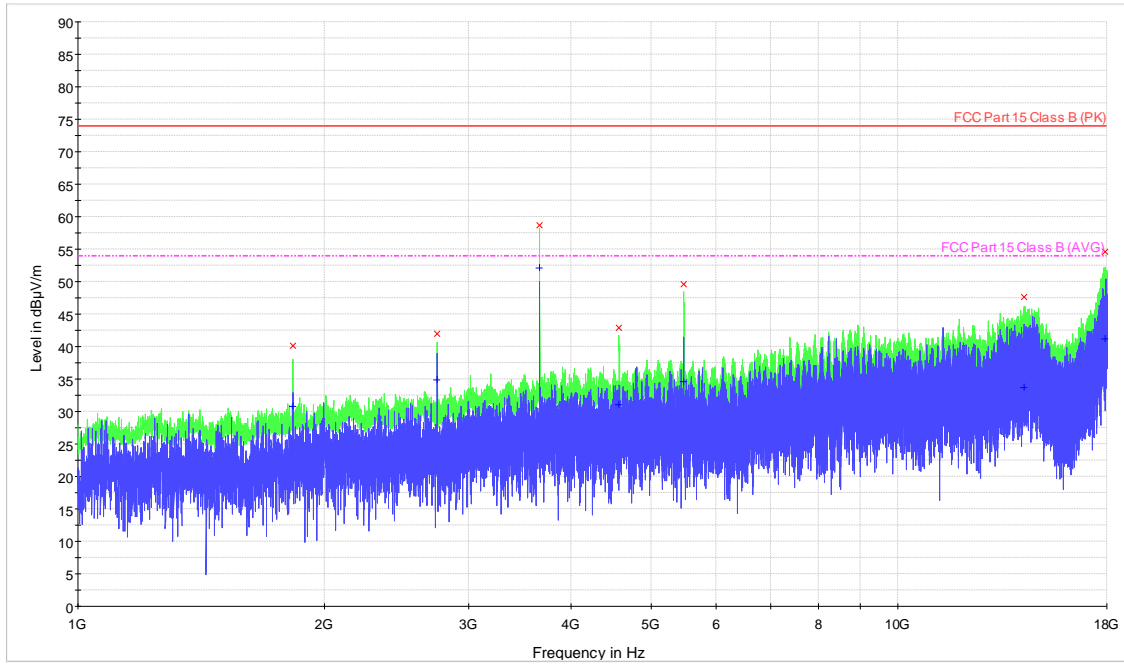
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NOTES: LoRa Mid Channel (915 MHz)

**Radiated Emissions 1 – 18 GHz
Horizontal**

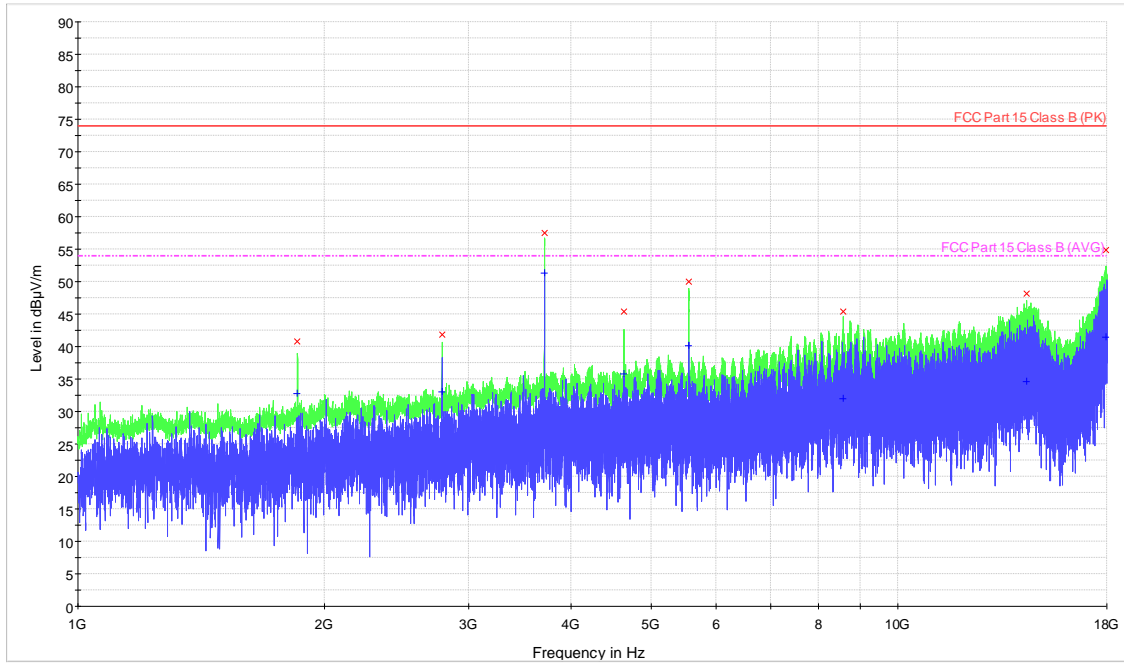


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Prüfbericht-Nr.:

NOTES: LoRa High Channel (927 MHz)
Radiated Emissions 1 – 18 GHz
Vertical



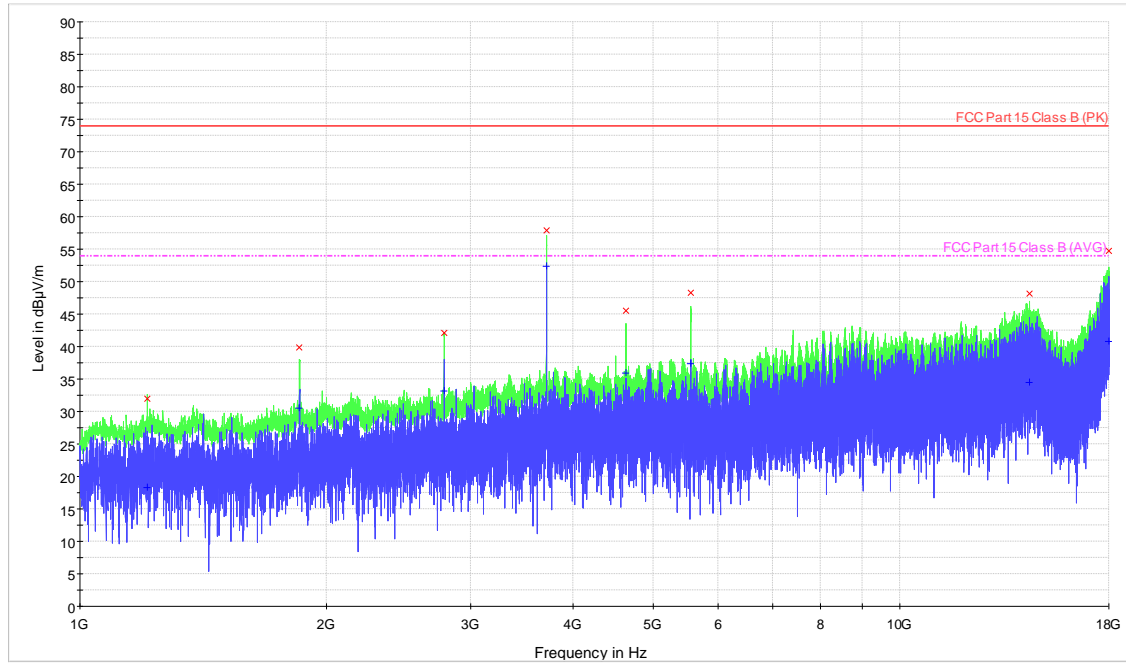
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NOTES: LoRa High Channel (927 MHz)

**Radiated Emissions 1 – 18 GHz
Horizontal**



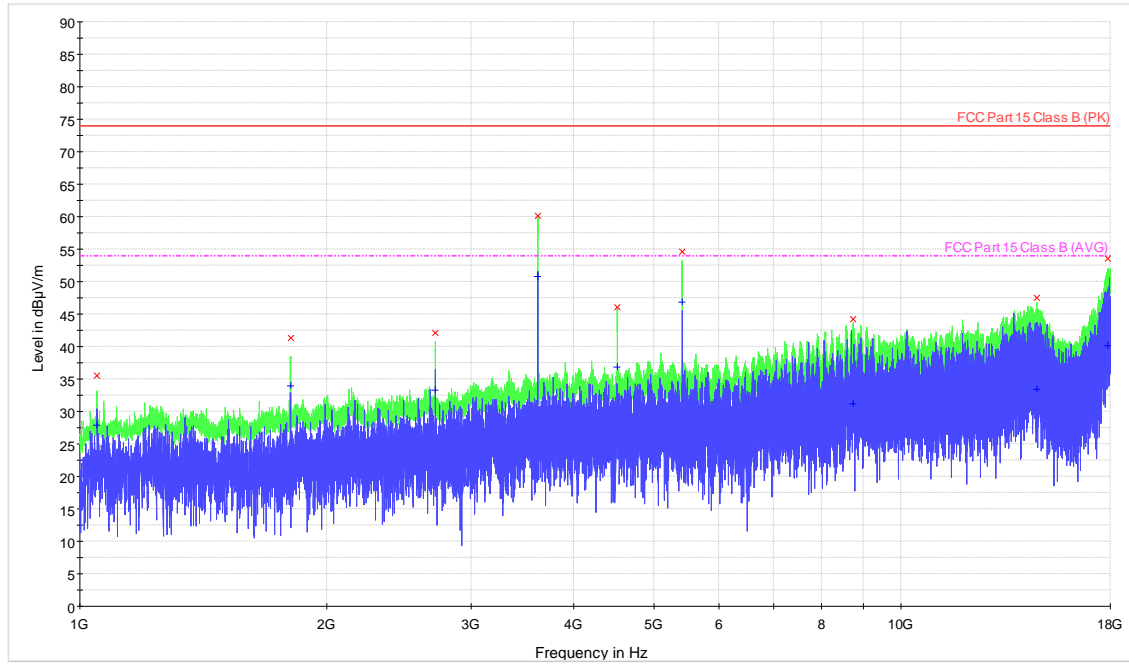
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Prüfbericht-Nr.:

NOTES: FSK Low Channel (903 MHz)

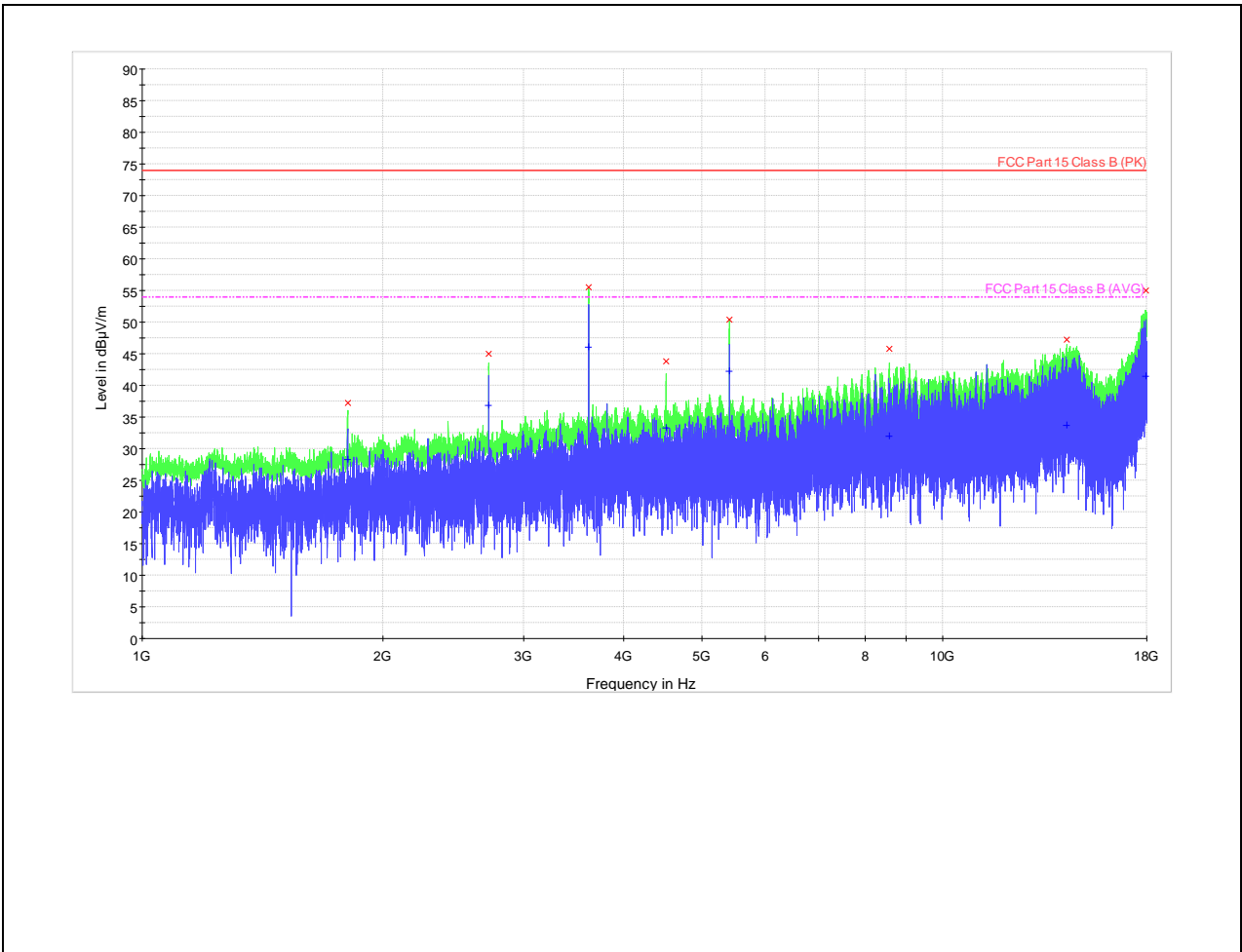
**Radiated Emissions 1 – 18 GHz
Vertical**



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NOTES: FSK Low Channel (903 MHz)
Radiated Emissions 1 – 18 GHz
Horizontal



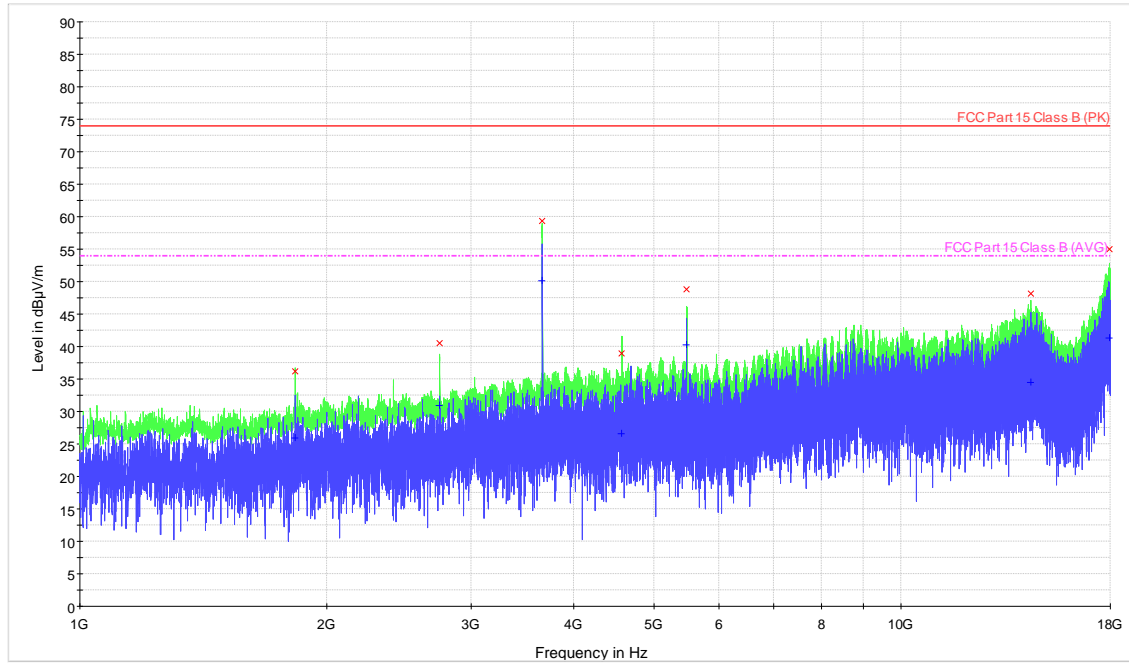
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Prüfbericht-Nr.:

NOTES: FSK Mid Channel (915 MHz)

**Radiated Emissions 1 – 18 GHz
Vertical**



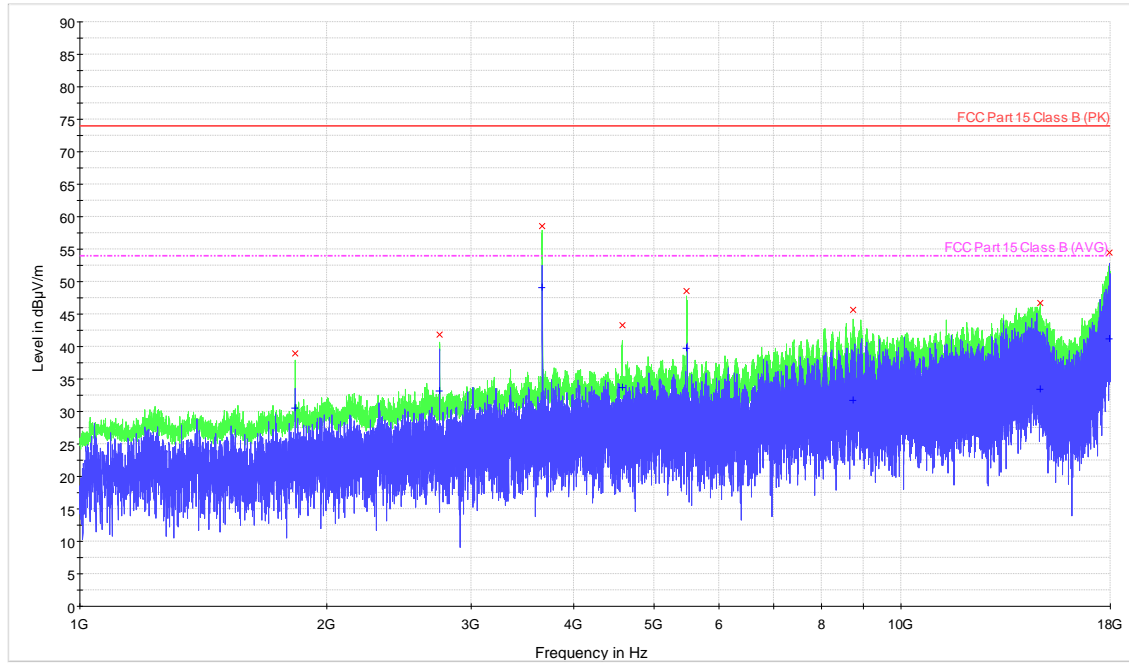
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Prüfbericht-Nr.:

NOTES: FSK Mid Channel (915 MHz)

**Radiated Emissions 1 – 18 GHz
Horizontal**



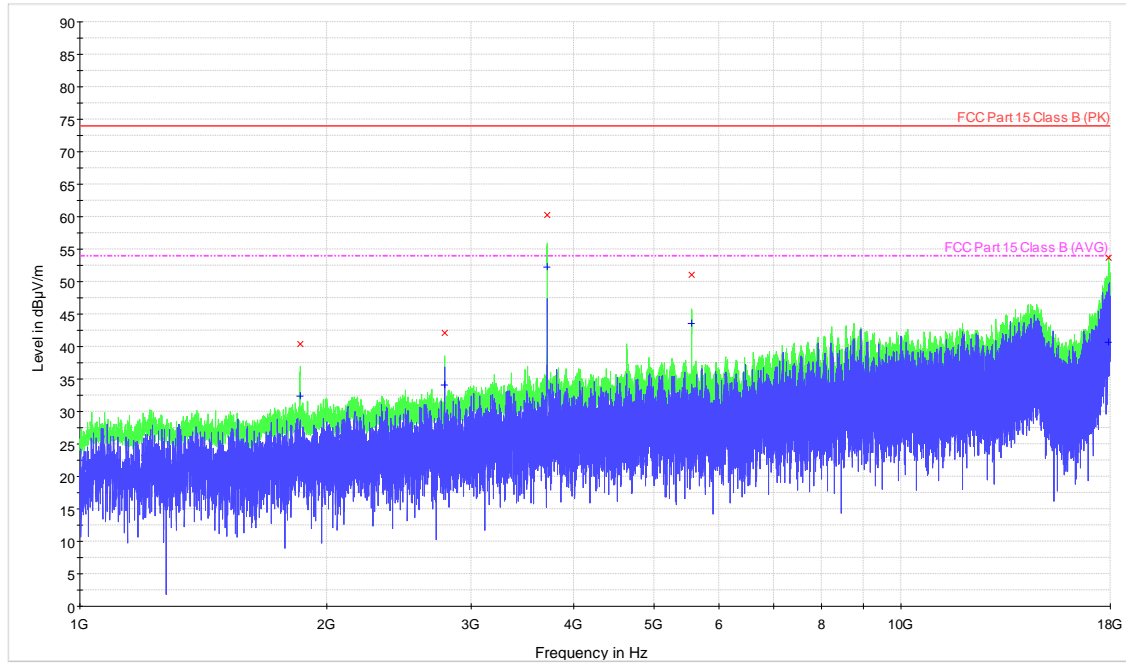
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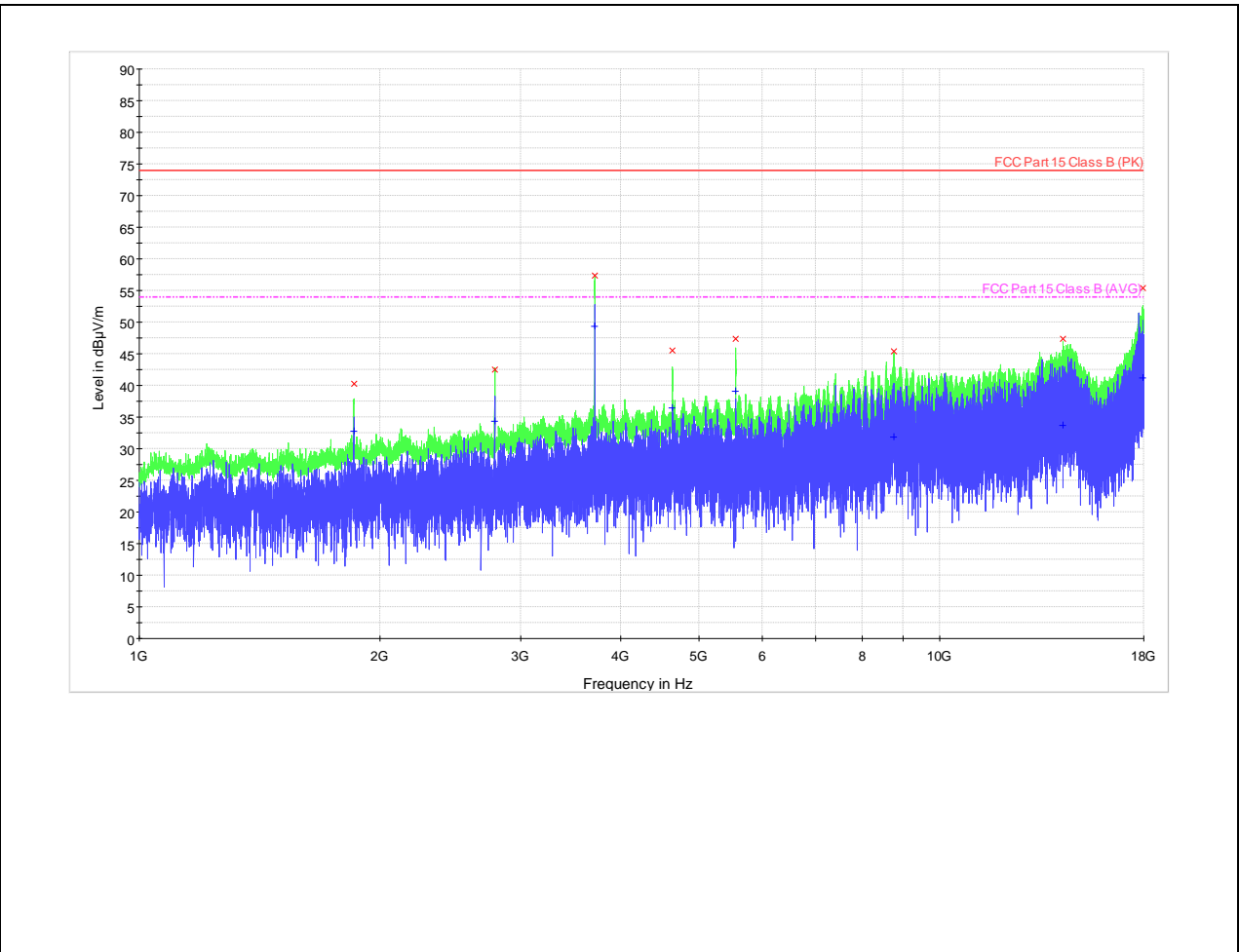
Prüfbericht-Nr.:

NOTES: FSK High Channel (927 MHz)

**Radiated Emissions 1 – 18 GHz
Vertical**



NOTES: FSK High Channel (927 MHz)
Radiated Emissions 1 – 18 GHz
Horizontal



4.6.6 Final Tabulated Data

30-1000 MHz (LoRa Low Channel 903 MHz) –

Frequency MHz	QuasiPeak dBµV/m	Height cm	Pol	Azimuth deg	Limit - QPK dBµV/m	Margin - QPK dB
31.16	22.3	100.0	V	191.0	40.0	-17.7
31.56	19.0	150.0	H	242.0	40.0	-21.0
45.72	8.8	150.0	H	335.0	40.0	-31.2
59.60	17.2	100.0	V	42.0	40.0	-22.8
73.76	17.2	100.0	V	154.0	40.0	-22.8
139.12	22.3	150.0	H	98.0	43.5	-21.2
151.72	16.7	100.0	V	244.0	43.5	-26.8
153.28	27.9	150.0	H	141.0	43.5	-15.6
158.92	31.7	150.0	H	72.0	43.5	-11.8
174.64	27.4	150.0	H	347.0	43.5	-16.1
178.72	19.2	100.0	V	2.0	43.5	-24.3
295.20	29.0	150.0	H	264.0	46.0	-17.0
296.64	17.9	100.0	V	238.0	46.0	-28.1
363.20	21.4	100.0	V	57.0	46.0	-24.6
422.84	18.8	100.0	V	116.0	46.0	-27.2
424.48	19.4	150.0	H	260.0	46.0	-26.6
484.04	21.8	150.0	H	85.0	46.0	-24.2
675.04	20.3	100.0	V	141.0	46.0	-25.7
734.04	21.7	150.0	H	80.0	46.0	-24.3
927.64	23.8	100.0	V	293.0	46.0	-22.2

30-1000 MHz (LoRa Mid Channel 915 MHz) –

Frequency MHz	QuasiPeak dBµV/m	Height cm	Pol	Azimuth deg	Limit - QPK dBµV/m	Margin - QPK dB
39.40	12.9	150.0	H	316.0	40.0	-27.1
58.24	15.6	100.0	V	77.0	40.0	-24.4
58.24	15.6	100.0	V	2.0	40.0	-24.4
73.84	8.4	150.0	H	14.0	40.0	-31.6
152.04	18.5	100.0	V	355.0	43.5	-25.0
161.92	25.6	150.0	H	330.0	43.5	-17.9
177.52	17.5	100.0	V	143.0	43.5	-26.0
204.60	18.3	150.0	H	31.0	43.5	-25.2
238.64	14.1	100.0	V	29.0	46.0	-31.9
292.76	27.1	150.0	H	226.0	46.0	-18.9
295.48	17.2	100.0	V	220.0	46.0	-28.8
352.32	14.9	100.0	V	125.0	46.0	-31.1
424.68	20.1	100.0	V	221.0	46.0	-25.9
427.80	20.5	150.0	H	164.0	46.0	-25.5
728.40	21.6	150.0	H	184.0	46.0	-24.4
746.04	21.7	100.0	V	41.0	46.0	-24.3

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30-1000 MHz (LoRa High Channel 927 MHz) –

Frequency MHz	QuasiPeak dBµV/m	Height cm	Pol	Azimuth deg	Limit - QPK dBµV/m	Margin - QPK dB
33.48	22.2	100.0	V	9.0	40.0	-17.8
36.48	14.8	150.0	H	178.0	40.0	-25.2
70.16	15.0	100.0	V	200.0	40.0	-25.0
124.20	12.8	150.0	H	301.0	43.5	-30.7
157.44	25.7	150.0	H	82.0	43.5	-17.8
185.20	16.8	100.0	V	11.0	43.5	-26.7
205.96	20.0	100.0	V	116.0	43.5	-23.5
238.56	13.3	150.0	H	355.0	46.0	-32.7
298.12	17.0	100.0	V	107.0	46.0	-29.0
298.32	23.0	150.0	H	266.0	46.0	-23.0
353.40	14.5	100.0	V	153.0	46.0	-31.5
421.48	16.5	100.0	V	307.0	46.0	-29.5
493.96	17.4	100.0	V	181.0	46.0	-28.6
501.12	17.5	150.0	H	217.0	46.0	-28.5
747.32	21.8	150.0	H	85.0	46.0	-24.2

30-1000 MHz (FSK Low Channel 903 MHz) –

Frequency MHz	QuasiPeak dBµV/m	Height cm	Pol	Azimuth deg	Limit - QPK dBµV/m	Margin - QPK dB
33.00	17.7	150.0	H	272.0	40.0	-22.3
37.76	18.4	100.0	V	37.0	40.0	-21.6
45.04	9.1	150.0	H	55.0	40.0	-30.9
58.24	15.2	100.0	V	201.0	40.0	-24.8
113.40	13.5	150.0	H	2.0	43.5	-30.0
140.56	24.4	150.0	H	149.0	43.5	-19.1
150.56	23.8	100.0	V	91.0	43.5	-19.7
153.28	32.2	150.0	H	211.0	43.5	-11.3
173.08	21.8	150.0	H	313.0	43.5	-21.7
179.00	24.6	100.0	V	327.0	43.5	-18.9
271.16	20.1	150.0	H	244.0	46.0	-25.9
291.24	23.0	100.0	V	-2.0	46.0	-23.0
293.84	26.0	150.0	H	57.0	46.0	-20.0
357.76	20.2	100.0	V	198.0	46.0	-25.8
423.04	22.0	150.0	H	68.0	46.0	-24.0
424.48	21.4	100.0	V	260.0	46.0	-24.6
678.64	21.5	150.0	H	143.0	46.0	-24.5
727.52	21.9	100.0	V	136.0	46.0	-24.1

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30-1000 MHz (FSK Mid Channel 915 MHz) –

Frequency MHz	QuasiPeak dBµV/m	Height cm	Pol	Azimuth deg	Limit - QPK dBµV/m	Margin - QPK dB
35.72	15.4	150.0	H	237.0	40.0	-24.6
37.56	18.3	100.0	V	54.0	40.0	-21.7
72.40	14.9	100.0	V	354.0	40.0	-25.1
104.68	11.8	150.0	H	-2.0	43.5	-31.7
152.12	27.1	150.0	H	315.0	43.5	-16.4
157.64	22.0	100.0	V	164.0	43.5	-21.5
163.36	29.9	150.0	H	9.0	43.5	-13.6
173.28	22.9	100.0	V	174.0	43.5	-20.6
294.24	27.2	150.0	H	166.0	46.0	-18.8
296.76	20.2	100.0	V	-2.0	46.0	-25.8
356.52	22.9	100.0	V	351.0	46.0	-23.1
423.44	21.0	100.0	V	161.0	46.0	-25.0
431.96	20.9	150.0	H	167.0	46.0	-25.1
627.32	19.6	150.0	H	108.0	46.0	-26.4
663.20	21.2	100.0	V	266.0	46.0	-24.8

30-1000 MHz (FSK High Channel 927 MHz) –

Frequency MHz	QuasiPeak dBµV/m	Height cm	Pol	Azimuth deg	Limit - QPK dBµV/m	Margin - QPK dB
33.60	17.2	150.0	H	257.0	40.0	-22.8
39.60	20.9	100.0	V	139.0	40.0	-19.1
52.88	6.3	150.0	H	160.0	40.0	-33.7
57.92	13.9	100.0	V	182.0	40.0	-26.1
71.04	15.2	100.0	V	2.0	40.0	-24.8
107.12	11.0	100.0	V	113.0	43.5	-32.5
148.52	16.9	100.0	V	187.0	43.5	-26.6
157.44	25.8	150.0	H	309.0	43.5	-17.7
208.28	21.9	100.0	V	22.0	43.5	-21.6
238.64	15.4	150.0	H	109.0	46.0	-30.6
292.68	21.7	150.0	H	351.0	46.0	-24.3
295.40	20.0	100.0	V	110.0	46.0	-26.0
356.40	15.9	100.0	V	239.0	46.0	-30.1
447.60	16.6	150.0	H	40.0	46.0	-29.4
531.80	18.3	100.0	V	38.0	46.0	-27.7
707.64	21.1	150.0	H	241.0	46.0	-24.9
772.24	21.8	100.0	V	241.0	46.0	-24.2

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1-18GHz (LoRa Low Channel 903 MHz) –

Frequency MHz	MaxPeak dBµV/m	CAverage dBµV/m	Height cm	Pol	Azimuth deg	Limit - PK dBµV/m	Margin - PK dB	Limit - AVG dBµV/m	Margin - AVG dB
1805.10	39.0	27.2	250.0	V	298.0	74.0	-35.0	54.0	-26.8
1806.50	35.9	23.2	350.0	H	75.0	74.0	-38.1	54.0	-30.8
2708.50	42.3	34.7	250.0	V	228.0	74.0	-31.7	54.0	-19.3
2708.80	42.4	35.5	350.0	H	294.0	74.0	-31.6	54.0	-18.5
3612.00	59.6	53.2	250.0	V	57.0	74.0	-14.4	54.0	-0.8
3612.00	55.7	49.2	350.0	H	40.0	74.0	-18.3	54.0	-4.8
4514.60	47.2	37.4	250.0	V	16.0	74.0	-26.8	54.0	-16.6
4515.60	43.5	31.6	350.0	H	150.0	74.0	-30.5	54.0	-22.4
5416.30	51.8	39.8	350.0	H	158.0	74.0	-22.2	54.0	-14.2
5416.60	50.1	39.2	250.0	V	167.0	74.0	-23.9	54.0	-14.8
8754.40	45.1	31.8	350.0	H	18.0	74.0	-28.9	54.0	-22.2
8939.00	46.3	32.3	250.0	V	87.0	74.0	-27.7	54.0	-21.7
14293.70	47.3	34.0	350.0	H	356.0	74.0	-26.7	54.0	-20.0
14656.10	47.0	33.5	250.0	V	168.0	74.0	-27.0	54.0	-20.5
17928.90	55.4	41.2	250.0	V	353.0	74.0	-18.6	54.0	-12.8
17937.80	55.4	41.5	350.0	H	278.0	74.0	-18.6	54.0	-12.5

1-18GHz (LoRa Mid Channel 915 MHz) –

Frequency MHz	MaxPeak dBµV/m	CAverage dBµV/m	Height cm	Pol	Azimuth deg	Limit - PK dBµV/m	Margin - PK dB	Limit - AVG dBµV/m	Margin - AVG dB
1069.70	31.5	18.6	210.0	V	263.0	74.0	-42.5	54.0	-35.4
1829.30	40.2	30.8	350.0	H	131.0	74.0	-33.8	54.0	-23.2
1829.90	40.8	35.2	210.0	V	132.0	74.0	-33.2	54.0	-18.8
2744.50	41.8	34.9	210.0	V	31.0	74.0	-32.2	54.0	-19.1
2744.90	42.0	34.8	350.0	H	334.0	74.0	-32.0	54.0	-19.2
3660.00	60.3	53.8	210.0	V	281.0	74.0	-13.7	54.0	-0.2
3660.00	58.7	52.1	350.0	H	183.0	74.0	-15.3	54.0	-1.9
4573.70	42.9	31.1	350.0	H	17.0	74.0	-31.1	54.0	-22.9
4574.40	43.8	33.4	210.0	V	191.0	74.0	-30.2	54.0	-20.6
5488.00	49.6	34.6	350.0	H	89.0	74.0	-24.4	54.0	-19.4
5490.70	46.7	34.5	210.0	V	136.0	74.0	-27.3	54.0	-19.5
8763.60	44.9	32.0	210.0	V	315.0	74.0	-29.1	54.0	-22.0
14278.40	47.7	33.7	350.0	H	314.0	74.0	-26.3	54.0	-20.3
14394.30	48.4	34.7	210.0	V	335.0	74.0	-25.6	54.0	-19.3
17926.90	54.6	41.1	350.0	H	204.0	74.0	-19.4	54.0	-12.9
17935.10	54.6	41.5	210.0	V	202.0	74.0	-19.4	54.0	-12.5

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1-18GHz (LoRa High Channel 927 MHz) –

Frequency MHz	MaxPeak dBµV/m	CAverage dBµV/m	Height cm	Pol	Azimuth deg	Limit - PK dBµV/m	Margin - PK dB	Limit - AVG dBµV/m	Margin - AVG dB
1209.10	32.0	18.3	350.0	H	300.0	74.0	-42.0	54.0	-35.7
1853.40	40.8	32.8	230.0	V	229.0	74.0	-33.2	54.0	-21.2
1853.40	39.8	30.6	350.0	H	41.0	74.0	-34.2	54.0	-23.4
2781.30	41.9	33.0	230.0	V	246.0	74.0	-32.1	54.0	-21.0
2781.30	42.1	33.1	350.0	H	93.0	74.0	-31.9	54.0	-20.9
3707.40	58.0	52.4	350.0	H	175.0	74.0	-16.0	54.0	-1.6
3708.00	57.6	51.3	230.0	V	261.0	74.0	-16.4	54.0	-2.7
4634.30	45.6	36.0	350.0	H	229.0	74.0	-28.4	54.0	-18.0
4634.60	45.4	35.8	230.0	V	349.0	74.0	-28.6	54.0	-18.2
5560.40	48.3	37.4	350.0	H	44.0	74.0	-25.7	54.0	-16.6
5562.50	50.1	40.2	230.0	V	76.0	74.0	-23.9	54.0	-13.8
8582.00	45.4	31.9	230.0	V	211.0	74.0	-28.6	54.0	-22.1
14382.10	48.2	34.6	230.0	V	79.0	74.0	-25.8	54.0	-19.4
14396.00	48.2	34.4	350.0	H	135.0	74.0	-25.8	54.0	-19.6
17940.50	54.9	41.4	230.0	V	103.0	74.0	-19.1	54.0	-12.6
17984.40	54.7	40.8	350.0	H	267.0	74.0	-19.3	54.0	-13.2

1-18GHz (FSK Low Channel 903 MHz) –

Frequency MHz	MaxPeak dBµV/m	CAverage dBµV/m	Height cm	Pol	Azimuth deg	Limit - PK dBµV/m	Margin - PK dB	Limit - AVG dBµV/m	Margin - AVG dB
1050.00	35.5	27.9	330.0	V	292.0	74.0	-38.5	54.0	-26.1
1805.50	41.3	33.9	330.0	V	205.0	74.0	-32.7	54.0	-20.1
1805.80	37.3	28.3	350.0	H	10.0	74.0	-36.7	54.0	-25.7
2708.20	42.1	33.3	330.0	V	70.0	74.0	-31.9	54.0	-20.7
2708.20	45.0	36.8	350.0	H	351.0	74.0	-29.0	54.0	-17.2
3612.00	60.1	50.8	330.0	V	58.0	74.0	-13.9	54.0	-3.2
3612.00	55.6	46.0	350.0	H	86.0	74.0	-18.4	54.0	-8.0
4513.90	46.1	36.9	330.0	V	159.0	74.0	-27.9	54.0	-17.1
4515.30	43.8	33.3	350.0	H	106.0	74.0	-30.2	54.0	-20.7
5416.30	54.6	46.8	330.0	V	286.0	74.0	-19.4	54.0	-7.2
5416.30	50.4	42.3	350.0	H	143.0	74.0	-23.6	54.0	-11.7
8583.70	45.8	32.0	350.0	H	174.0	74.0	-28.2	54.0	-22.0
8749.30	44.2	31.2	330.0	V	306.0	74.0	-29.8	54.0	-22.8
14294.70	47.3	33.7	350.0	H	212.0	74.0	-26.7	54.0	-20.3
14642.20	47.4	33.5	330.0	V	186.0	74.0	-26.6	54.0	-20.5
17865.00	53.5	40.1	330.0	V	343.0	74.0	-20.5	54.0	-13.9
17961.20	55.0	41.4	350.0	H	95.0	74.0	-19.0	54.0	-12.6

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1-18GHz (FSK Mid Channel 915 MHz) –

Frequency MHz	MaxPeak dBµV/m	CAverage dBµV/m	Height cm	Pol	Azimuth deg	Limit - PK dBµV/m	Margin - PK dB	Limit - AVG dBµV/m	Margin - AVG dB
1829.30	36.3	25.9	220.0	V	170.0	74.0	-37.7	54.0	-28.1
1829.60	38.9	30.5	350.0	H	15.0	74.0	-35.1	54.0	-23.5
2744.20	41.9	33.1	350.0	H	225.0	74.0	-32.1	54.0	-20.9
2745.60	40.5	30.9	220.0	V	257.0	74.0	-33.5	54.0	-23.1
3660.00	59.4	50.1	220.0	V	73.0	74.0	-14.6	54.0	-3.9
3660.00	58.5	49.1	350.0	H	349.0	74.0	-15.5	54.0	-4.9
4573.70	39.0	26.5	220.0	V	314.0	74.0	-35.0	54.0	-27.5
4575.40	43.3	33.7	350.0	H	327.0	74.0	-30.7	54.0	-20.3
5488.30	48.9	40.2	220.0	V	97.0	74.0	-25.1	54.0	-13.8
5488.30	48.5	39.8	350.0	H	194.0	74.0	-25.5	54.0	-14.2
8756.40	45.6	31.7	350.0	H	134.0	74.0	-28.4	54.0	-22.3
14414.70	48.2	34.5	220.0	V	112.0	74.0	-25.8	54.0	-19.5
14792.10	46.7	33.4	350.0	H	241.0	74.0	-27.3	54.0	-20.6
17955.50	54.9	41.4	220.0	V	245.0	74.0	-19.1	54.0	-12.6
17961.90	54.5	41.3	350.0	H	89.0	74.0	-19.5	54.0	-12.7

1-18GHz (FSK High Channel 927 MHz) –

Frequency MHz	MaxPeak dBµV/m	CAverage dBµV/m	Height cm	Pol	Azimuth deg	Limit - PK dBµV/m	Margin - PK dB	Limit - AVG dBµV/m	Margin - AVG dB
1854.10	40.5	32.3	325.0	V	26.0	74.0	-33.5	54.0	-21.7
1854.10	40.2	32.7	350.0	H	347.0	74.0	-33.8	54.0	-21.3
2780.20	42.1	34.0	270.0	V	158.0	74.0	-31.9	54.0	-20.0
2780.20	42.4	34.3	350.0	H	308.0	74.0	-31.6	54.0	-19.7
3708.00	60.3	52.3	350.0	V	66.0	74.0	-13.7	54.0	-1.7
3708.00	57.4	49.3	350.0	H	105.0	74.0	-16.6	54.0	-4.7
4635.60	45.5	36.5	350.0	H	224.0	74.0	-28.5	54.0	-17.5
5560.40	51.1	43.5	300.0	V	72.0	74.0	-22.9	54.0	-10.5
5560.40	47.4	39.0	350.0	H	286.0	74.0	-26.6	54.0	-15.0
8764.60	45.4	31.9	350.0	H	98.0	74.0	-28.6	54.0	-22.1
14278.00	47.3	33.6	350.0	H	137.0	74.0	-26.7	54.0	-20.4
17907.50	53.7	40.6	325.0	V	308.0	74.0	-20.3	54.0	-13.4
17954.10	55.4	41.2	350.0	H	236.0	74.0	-18.6	54.0	-12.8

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4.7 AC Line Conducted Emissions

This test measures the electromagnetic levels of spurious signals generated by the EUT on the AC power line that may affect the performance of other nearby electronic equipment.

4.7.1 Over View of Test

Results	Complies (as tested per this report)				Date	07/30/2021		
Standard	FCC CFR 15.207, RSS-Gen (8.8)							
Product Model	BLUbase V1				Serial#	24-010668		
Configuration	See test plan for details.							
Test Set-up	Tested in shielded room, EUT placed on table. See test plans for details.							
EUT Powered By	120VAC 60Hz	Temp	23°C	Humidity	59%	Pressure	994 mbar	
Frequency Range	150 kHz – 30 MHz							
Perf. Criteria	Class B (Below Limit)			Perf. Verification	Readings Under Limit for L1 & Neutral			
Mod. to EUT	None			Test Performed By	Alexander Sowinski			

4.7.2 Test Procedure

Conducted and emissions tests were performed using the procedures of FCC CFR 15.207, RSS-Gen (8.8) and/or ANSI C63.4 including methods for signal maximizations and EUT configuration. The photos included with the report show the EUT in its maximized configuration. Further conducted emission tests were performed per the procedures stated in the other emissions standards listed in this report.

The frequency range from 150 kHz – 30 MHz was investigated for conducted emissions.

Conducted Emissions measurements were performed in the shielded room using procedures specified in the test plan and standard.

4.7.3 Deviations

There were no deviations from the test methodology listed in the test plan for the conducted emission test.

4.7.4 Final Test

All final conducted emissions measurements were below (in compliance) the limits.

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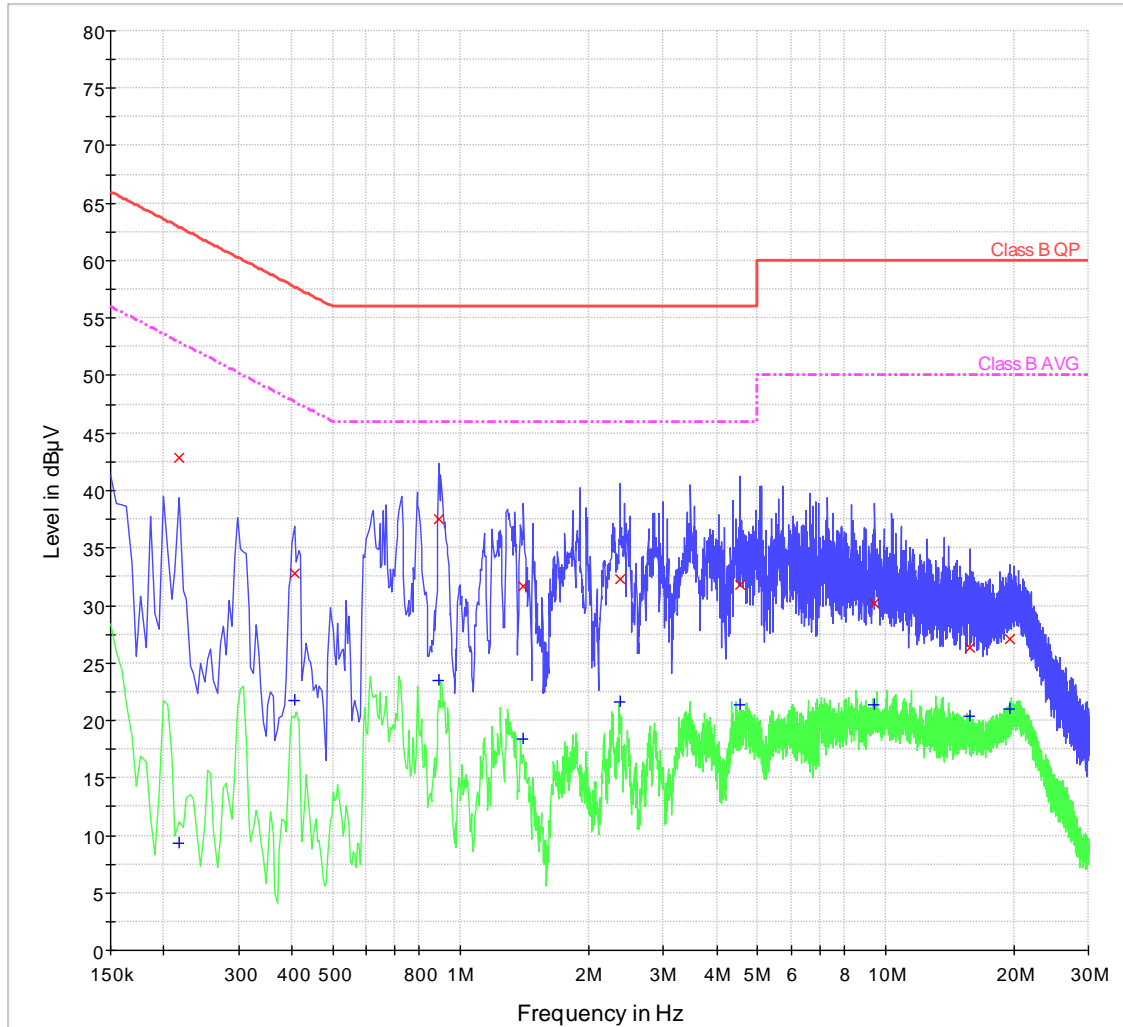
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4.7.5 Final Graphs

NOTES:

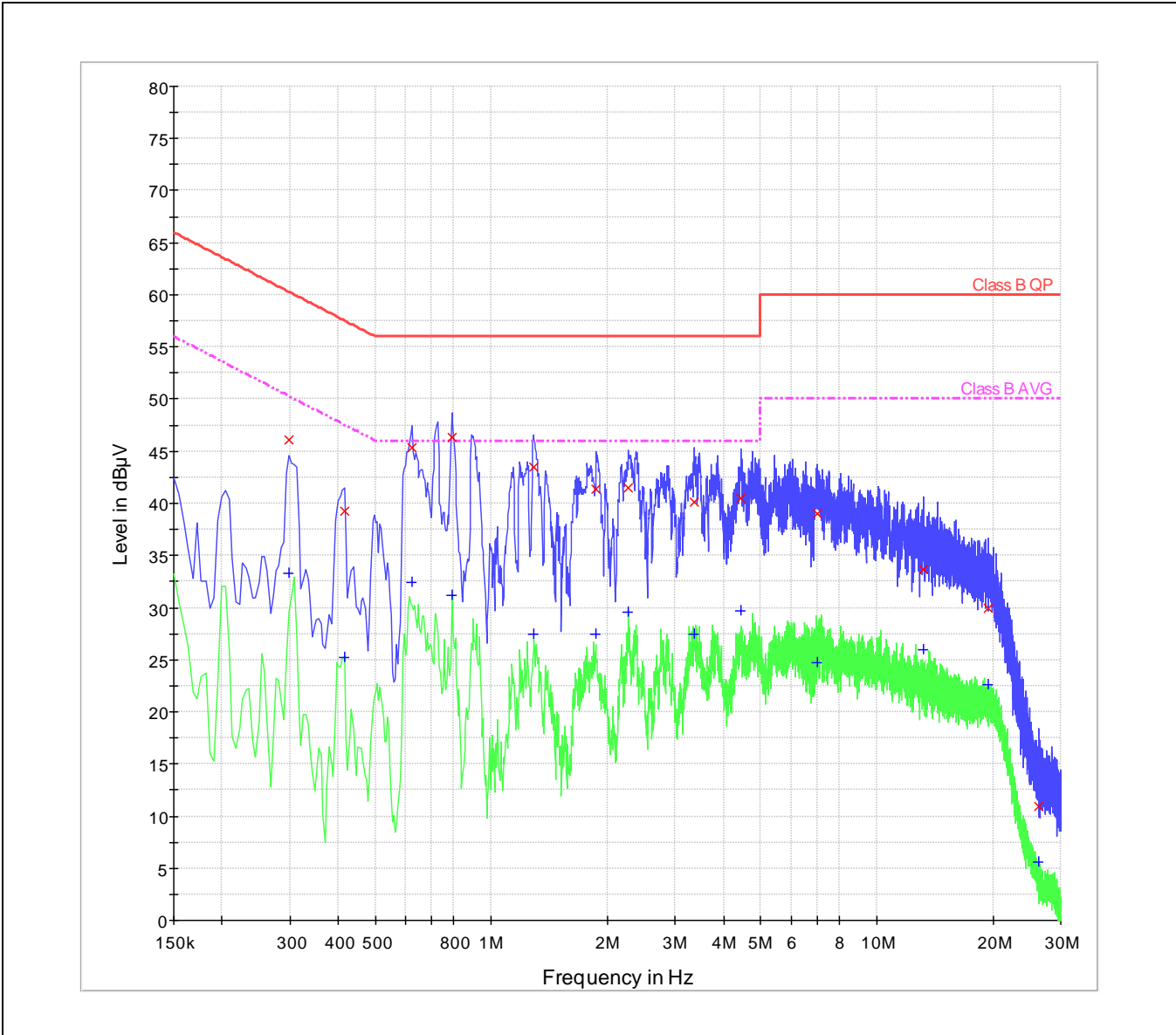
Conducted Emissions @ 120V/60Hz
Line



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NOTES:

**Conducted Emissions @ 120V/60Hz
Neutral**



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4.7.6 Final Tabulated Data at 120V/60Hz

Frequency MHz	QuasiPeak dBµV	Average dBµV	Line	Limit - QPK dBµV	Margin - QPK dB	Limit - AVG dBµV	Margin - AVG dB
0.2175	42.9	9.3	L1	62.9	-20.0	52.9	-43.6
0.2985	46.1	33.2	N	60.3	-14.2	50.3	-17.1
0.4065	32.8	21.7	L1	57.7	-24.9	47.7	-26.0
0.4155	39.3	25.2	N	57.5	-18.2	47.5	-22.3
0.6225	45.4	32.4	N	56.0	-10.6	46.0	-13.6
0.7890	46.4	31.2	N	56.0	-9.6	46.0	-14.8
0.8880	37.5	23.5	L1	56.0	-18.5	46.0	-22.5
1.2840	43.5	27.4	N	56.0	-12.5	46.0	-18.6
1.4055	31.6	18.4	L1	56.0	-24.4	46.0	-27.6
1.8735	41.4	27.5	N	56.0	-14.6	46.0	-18.5
2.2695	41.5	29.6	N	56.0	-14.5	46.0	-16.4
2.3775	32.3	21.6	L1	56.0	-23.7	46.0	-24.4
3.3540	40.1	27.5	N	56.0	-15.9	46.0	-18.5
4.4385	40.5	29.7	N	56.0	-15.5	46.0	-16.3
4.5375	31.8	21.4	L1	56.0	-24.2	46.0	-24.6
6.9990	39.0	24.7	N	60.0	-21.0	50.0	-25.3
9.4380	30.2	21.4	L1	60.0	-29.8	50.0	-28.6
13.1685	33.6	26.0	N	60.0	-26.4	50.0	-24.0
15.7515	26.4	20.4	L1	60.0	-33.6	50.0	-29.6
19.4010	30.0	22.6	N	60.0	-30.0	50.0	-27.4
19.6035	27.1	21.0	L1	60.0	-32.9	50.0	-29.0
26.3715	11.0	5.5	N	60.0	-49.0	50.0	-44.5

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Appendix A

5 Test Plan

This test report is intended to follow the test plan outlined herein unless otherwise stated. The test plan provides product information, reference standards, and testing details. The product information below came via client, product manual, product itself and or the internet. Test procedure information will reference standards or internal TUV Rheinland NA procedures.

5.1 General Information

Client	Satellite Tracking of People, LLC
Address 1	5353 W Sam Houston Parkway N, Suite 190
Address 2	Houston, Texas, 77041
Contact Person	Mark Kirincic
Telephone	713-354-9393
Fax	--
e-mail	mkirincic@securustechnologies.com

5.2 Model(s) Name

BLUbase V1

5.3 Type of Product

BLUbase

5.4 Equipment Under Test (EUT) Description

BLUbase is our small, lightweight (RF) transceiver. Working in tandem with BLUband, BLUbase receives, enters, and leaves records from BLUband.

5.5 Wireless Information

EUT Specifications	
Environment:	Indoor
Operating Temperature Range °C:	-20°C - 50°C
Multiple Feeds:	No
LoRa/FSK FCC ID:	S5EBBE010321
LoRa/FSK IC ID:	9086A-BBE010321
Contains WiFi FCC ID:	VPY-LB1LD
Contains WiFi IC ID:	772C-LB1LD
Product Marketing Name (PMN):	BLUbase
Hardware Version Identification Number (HVIN):	BLUbase V1
Firmware Version Identification Number (FVIN):	1.0
RF Software Version:	1.0
Operating Modes:	LoRa, FSK, WiFi (2.4GHz only)
Transmitter Frequency Band:	903 - 927 MHz (LoRa/FSK) 2.412-2.4620 GHz (WiFi)
Power @ Operating Channel (dBm):	+14 dBm (LoRa/FSK) +19 dBm (WiFi)
Antenna Type	Stamp metal embedded SMT
Antenna Gain (dBi)	+1.0 dBi (LoRa/FSK) +3.4 dBi (WiFi)
Modulation:	CSS, FSK, 64-QAM
Data Rate	LoRa CSS : 23.810 kbps FSK : 21.875 kbps WiFi : 288 Mbps
TX/RX Chain (s):	Single
Type of Equipment:	LoRa/FSK/WiFi base station
*All EUT specifications are provided by the manufacturer or the TUV direct customer	
Note: Information supplied by the customer and can affect the validity of results	
Note: WiFi test results can be found in TUV Rheinland Report #US2179HM.002. The EUT does not contain the capability of simultaneous transmission, each transmitter was tested separately.	

5.6 Testing Preparation

Four units were provided by the client. One (24-010669) was used for radiated measurements, while the other (24-010668) was used for antenna port conducted measurements. The remaining units were spares.

5.7 General Product Information

Size	H 11 cm	W 11 cm	L 3 cm
Weight	0.16 kg	Fork-Lift Needed	No
Notes			

5.8 Modifications

Custom software was used to place the device in assorted transmit modes for the purpose of testing. These settings would not be available to the end user.

5.9 EUT Electrical Power Information

5.9.1 Electrical Power Type

<input checked="" type="checkbox"/>	AC	<input type="checkbox"/>	DC	<input type="checkbox"/>	Batteries	<input type="checkbox"/>	Host -
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5.9.2 Electrical Power Information

Name	Type	Voltage		Frequency	Current	Notes
		min	max			
AC Mains	AC	100	240	50-60 Hz	< 1 mA	
Notes						

5.10 EUT Modes of Operation during Testing

The EUT can be operated in two active modes. The EUT can be operated using a standard LoRa scheme or a basic FSK scheme for the purpose of transmitting data. The transmitters cannot be operated independently of each other.

5.11 EUT Clock/Oscillator Frequencies

Please specify the maximum clock frequency used in the product – 32.768 MHz

In the table below, please specify other clock frequencies and sensitive operating frequencies in the product.

Clock Frequencies & Sensitive Frequencies
32 MHz
32.768 MHz

5.12 Electrical Support Equipment

Type	Manufacturer	Model	Connected To
Laptop	Lenovo	T470	USB Serial Connection

5.13 Non - Electrical Support Equipment

Item	Notes
Gas	None.
Water	None.
Air	None.

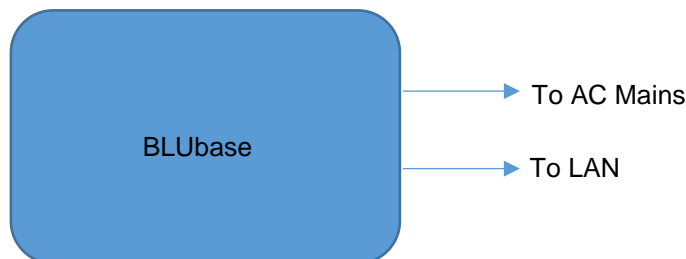
5.14 EUT Equipment/Cabling Information

EUT Port	Connected To	Location	Length	Shielded / Unshielded
None.				

5.15 EUT Configuration

Configuration	Description
Radiated	EUT is configured to transmit radiated at a desired channel
Conducted	EUT is configured to transmit along temporary SMA connection at a desired channel
Notes	All configurations are the same except as noted above

5.16 Block Diagram



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