



Timco Engineering, Inc., an IIA Company
849 NW State Road 45, Newberry, Florida 32669
(352) 472-5500 / testing@timcoengr.com

Timco Test Report # TR_2993-20_FCC_DTS_2

Revision: 2

Issue Date: September 3, 2020

Final Test Date: August 25, 2020



Test Report- FCC PART 15.247 / DTS

Prepared For: ALOXY nv

Approved for Release By:

Signature: Bruno Clavier

Name & Title: Bruno Clavier, General Manager

Date of Signature

(YYYY-MM-DD): 2020-09-03

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1 Customer Information

Applicant: ALOXY nv
Address: Sint Pietersvliet 7
Antwerp 2000 Belgium

Contact: Carl Stevens
Telephone: +32 474 73 64 03
Email address: carl.stevens@aloxio

1.1 Test Result Summary

The following test procedure and guidance were used for measuring Digital Transmission System (DTS); FCC KDB 558074 D01 DTS Measurement Guidance and ANSI C63.10-2013. Full test results are available in this report.

No additions to the test methods were needed. There were no deviations, or exclusions from the test methods. No test results are from external providers or from the customer. The test results relate only to the items tested. Timco does not offer opinions and interpretations, only a pass/fail statement.

The Following is for Test item FCC ID: 2AXF4-APS-001

FCC Clauses	Description of the requirements	Result (Pass, Fail or N/A)
Applicable Clauses from Part 2 or KDB		
KDB 558074 D01	Duty Cycle	
KDB 558074 D01	99 % Bandwidth	for reporting only
KDB 558074 D01	Band-edge measurements	Pass
Applicable Clauses from Part 15.247		
15.247 (a) (1)	FHSS (i,ii,iii)	N/A
15.247 (a) (2)	6dB Bandwidth	Pass
15.247 (b) (1)	FHSS conducted output power for 2.400-2483.5 MHz	N/A
15.247 (b) (2)	FHSS conducted output power for 902-928 MHz	N/A
15.247 (b) (3)	DTS conducted output power	Pass
15.247 (b) (4)	Conducted output power >6dBi	Pass
15.247 (c) (1)	Ant Gain >6dBi Fixed PtP	
15.247 (c) (2)	Ant Gain >6dBi MIMO	
15.247 (d) / 15.215 (b)	Spurious Emissions (Out of Band) Emissions in nonrestricted frequency bands	Pass
15.247 (e)	Power Spectral Density (PSD)	Pass
15.247 (f)	Hybrid System requirements	
15.247 (g)	FHSS System requirements	N/A
15.247 (h)	FHSS spectrum sensing	N/A
Applicable Clauses from Part 2 and Part 15 Subpart C		
15.203	Antenna requirements	
15.205	Restricted bands of operation	
15.207	AC Power Conducted Emissions	N/A
15.209	Radiated Emissions	
15.211	Tunnel Radio Systems	N/A
15.212 (a)	Single Modular Transmitter	
15.212 (b)	Limited Modular Transmitter	
15.213	Cable Locating Equipment	N/A



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2 Location of Testing

Test Laboratory

Timco Engineering Inc. is a subsidiary of Industrial Inspection & Analysis, Inc. ("IIA").
Testing was performed at Timco's permanent laboratory located at 849 NW State Road 45,
Newberry, Florida 32669

FCC test firm # 578780

FCC Designation # US1070

FCC site registration is under A2LA certificate # 0955.01

ISED Canada test site registration # 2056A

EU Notified Body # 1177

For all designations see A2LA scope # 0955.01

2.1 Testing was performed, reviewed by:

Dates of Testing: August 25, 2020

Signature: _____

A handwritten signature in black ink, appearing to read "Tim Royer", is written over a horizontal line.

Sr. EMC Engineer
EMC-003838-NE



Name & Title: Tim Royer, EMC Engineer

Date of Signature

(YYYY-MM-DD): 2020-09-3

3 Test Sample(s) (EUT/DUT)

The test sample was received: August 25, 2020

3.1 Description of the EUT

A description as well as unambiguous identification of the EUT(s) tested. Where more than one sample is required for technical reasons (such as the use of connected units for the purpose of conducted output power testing where the product units will have integral antennas), each specific test shall identify which unit was tested.

Identification

FCC ID:	2AXF4-APS-001
Brief Description	Low power 900 MHz MODULE
Type of Modular	NA
Model(s) #	ALOXY Pulse V01
Trade name	DTS/DSS MODULE
Firmware version	NA
Software version	NA
Serial Number	NA

Technical Characteristics

Technology	Hybrid System requirements
Frequency Range	902-928
RF O/P Power (Max.)	16.94 dBm
Modulation	GFSK
Bandwidth & Emission Class	615.38 kHz
Number of Channels	64
Duty Cycle	10%
Antenna Type	Integrated
Antenna Gain (for each ant.)	1 dBi
Antenna Connector	N/A
Voltage Rating (AC or Batt.)	DC

Antenna Characteristics

Frequency Range	Mode / BW	Ant Gain 1	Ant Gain 2
902-928		1 dBi	

3.2 Configuration of EUT

Test Modes

Band	Mode	BW (nominal)	Modulation	Number of Ant.
902-928	1		GFSK	1

DTS	Test Frequencies	Number of Ant.
LoRa (Long Range)	903 MHz, 907.8 MHz, 914.2 MHz	1
DASH7	902.25 MHz, 914.9 MHz, 927.74 MHz	1

Operating conditions during Testing:

No modifications of the device under test (including firmware, specific software settings, and input/output signal levels to the EUT).

Peripherals used during Testing:

No peripherals used.

3.3 Test Setup of EUT

Equipment, antenna, and cable arrangement. The setup of the equipment and cable or wire placement on the test site that produces the highest radiated and the highest ac power-line conducted emissions shall be shown clearly and described. Information on the orientation of portable equipment during testing shall be included. Drawings or photographs may be used for this purpose.

Test Setups are included in the test report.

4 Test methods & Applicable Regulatory Limits

Test methods/Standards/Guidance:

Test procedures and guidance for measuring Digital Transmission System (DTS) are provided in the FCC KDB 558074 D01 DTS Measurement Guidance and in Clause 11 of ANSI C63.10-2013.

- 1) ANSI C63.10-2013;
- 2) FCC KDB 558074 D01

Limits and Regulatory Limits:

- 1) FCC CFR 47 Part 15.247

5 Measurement Uncertainty

Parameter	Uncertainty (dB)
Conducted Emissions	1.42
Radiated Emissions (30 – 200 MHz)	5.49
Radiated Emissions (200 – 1000 MHz)	5.79
Radiated Emissions (1 GHz – 18 GHz)	4.37
The uncertainties provided in this table represent an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of K=2.	

6 Environmental Conditions

Temperature & Humidity

Measurements performed at the test site did not exceed the following:

TEMPERATURE	23 C +/- 5%
HUMIDITY	55% +/- 5%
BARAMETRIC PRESSURE	30.05 inHg

Note: Specific environmental conditions that are applicable to a specific test are available in the test result section.

7 List of Test Equipment and Test Facility

The test equipment used identified by type, manufacturer, serial number, or other identification and the date on which the next calibration or service check is due.



Description of the firmware or software used to operate EUT for testing purposes.

A complete list of all test equipment used shall be included with the test report. The manufacturer's model and serial numbers, and date of last calibration, and calibration interval shall be included. Measurement cable loss, measuring instrument bandwidth and detector function, video bandwidth, if appropriate, and antenna factors shall also be included where applicable.

List of Test Equipment

Device	Manufacturer	Model	Serial Number	Cal/Char Date	Due Date
Antenna: Active Loop	ETS-Lindgren	6502	62529	12/11/2017	12/11/2020
Antenna: Biconical 1057	Eaton	94455-1	1057	12/13/2017	12/13/2020
Antenna: Log-Periodic 1122	Electro-Metrics	LPA-25	1122	8/26/2017	8/26/2020
CHAMBER	Panashield	3M	N/A	3/15/2019	3/15/2021
EMI Test Receiver R & S ESU 40 Chamber	Rohde & Schwarz	ESU 40	100320	08/28/18	08/28/2021
Software: Field Strength Program	Timco	N/A	Version 4.10.7.0	N/A	N/A
Antenna: Double-Ridged Horn/ETS Horn 2	ETS-Lindgren	3117	41534	9/1/2017	9/1/2020
Bore-sight Antenna Positioning Tower	Sunol Sciences	TLT2	N/A	N/A	N/A
Coaxial Cable #103 - KMKM-0180-01 Aqua	Micro-Coax	UFB142A-0-0720-200200	225363-002 (#103)	4/12/2019	4/12/2021
Coaxial Cable - Chamber 3 cable set (Primary)	Micro-Coax	Chamber 3 cable set (Primary)	KMKM-0244-01 KMKM-0670-00 KFKF-0198-01	4/12/2019	4/12/2021
Band Reject Filter 2.4 GHz	Micro-Tronics	BRM50702-02	0	4/12/2019	4/12/2021
Pre-amp	RF-LAMBDA	RLNA00M45GA	N/A	2/27/2019	2/27/2021
Antenna: Double-Ridged Horn 18-40 GHz	EMCO	3116	9011-2145	12/8/2017	12/8/2020
Attenuator SMA 30dB 5W DC-18G	Pasternack	PE7013-30	#23	11/19/2017	11/19/2020
Test Software	Rohde & Schwarz	RSCCommander	18e	17-Jun-2019	N/A

8 Test Results

The results of the test are usually indicated in the form of tables, spectrum analyzer plots, charts, sample calculations, as appropriate for each test procedure.

A description and/or a block diagram of the test setup is usually provided.

The measurement results, along with the appropriate limits for comparison, may be presented in tabular or graphical form. In addition, any variation in the measurement environment may be reported if applicable (e.g., a significant change of temperature that could affect the cable loss and amplifier response).

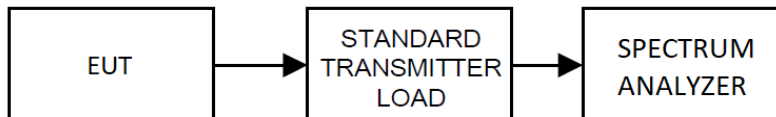
Units of measurement

Unless noted otherwise in the referenced standard, the measurements of **ac power-line conducted emissions and conducted power output** will be reported in units of dB μ V. Unless noted otherwise in the referenced standard, the measurements of **radiated emissions** will be reported in units of decibels, referenced to one microvolt per meter (dB μ V/m) for electric fields, or to one ampere per meter (dBA/m) for magnetic fields, at the distance specified in the appropriate standards or requirements. The measurements of antenna-conducted power for receivers may be reported in units of dB μ V if the impedance of the measuring instrument is also reported. Otherwise, antenna-conducted power will be reported in units of decibels referenced to one milliwatt (dBm). All formulas for data conversions and conversion factors, if used, will be included in this measurement report.

8.1 99% Occupied Bandwidth

Requirement from FCC KDB 558074 D01 and test procedure from ANSI C63.10-2013 section 6.9.3

Setup



99% BW Test Results

LoRa (Long Range)	
Tuned Frequency (MHz)	99% BW (kHz)
903	538.46
907.8	578.99
914.2	561.52

DASH7	
Tuned Frequency (MHz)	99% BW (kHz)
902.25	167.7
914.9	167.7
927.74	167.7

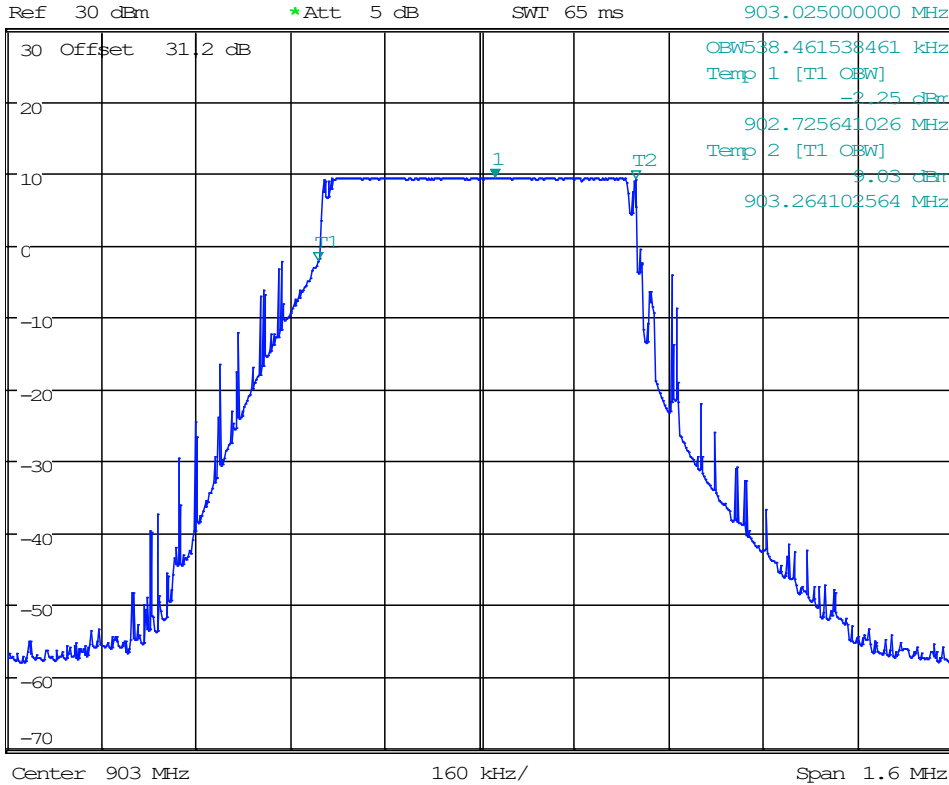
99% Occupied Bandwidth Test Data / Spectrum Plots

99% BW

LoRa at 903 MHz



*RBW 10 kHz
VBW 30 kHz
SWT 65 ms
Marker 1 [T1]
9.23 dBm
903.025000000 MHz

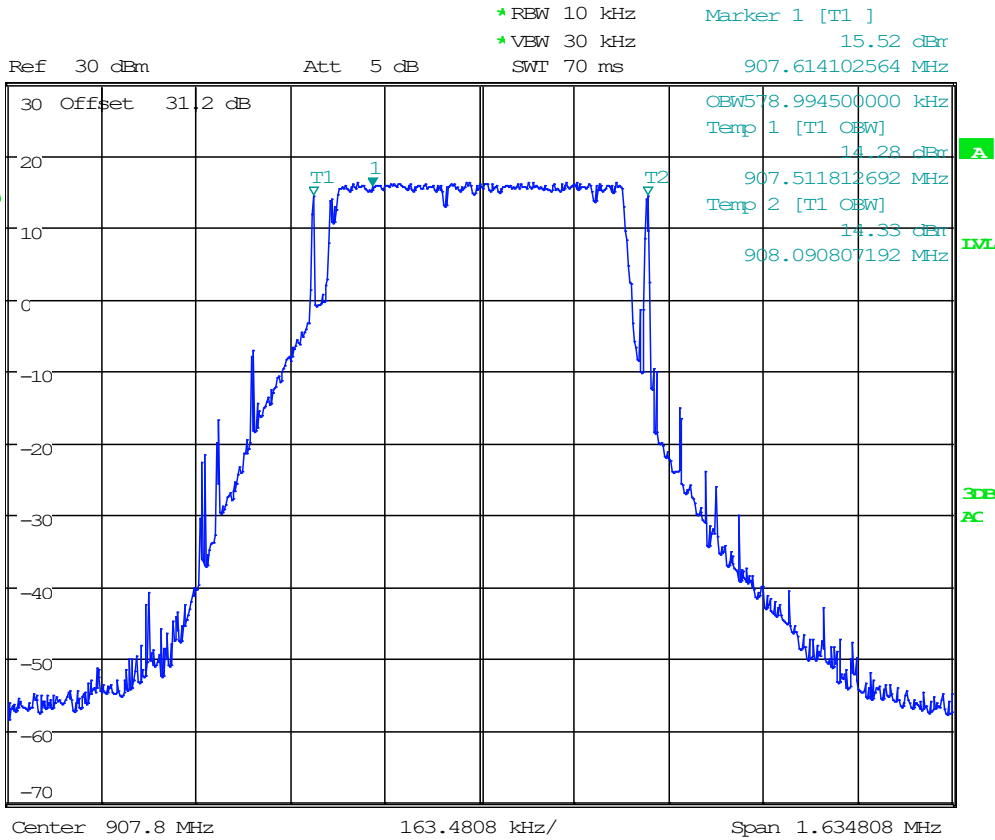


Date: 20.AUG.2020 11:33:39

99% BW
LoRa at 907 MHz



1.5V
VPP

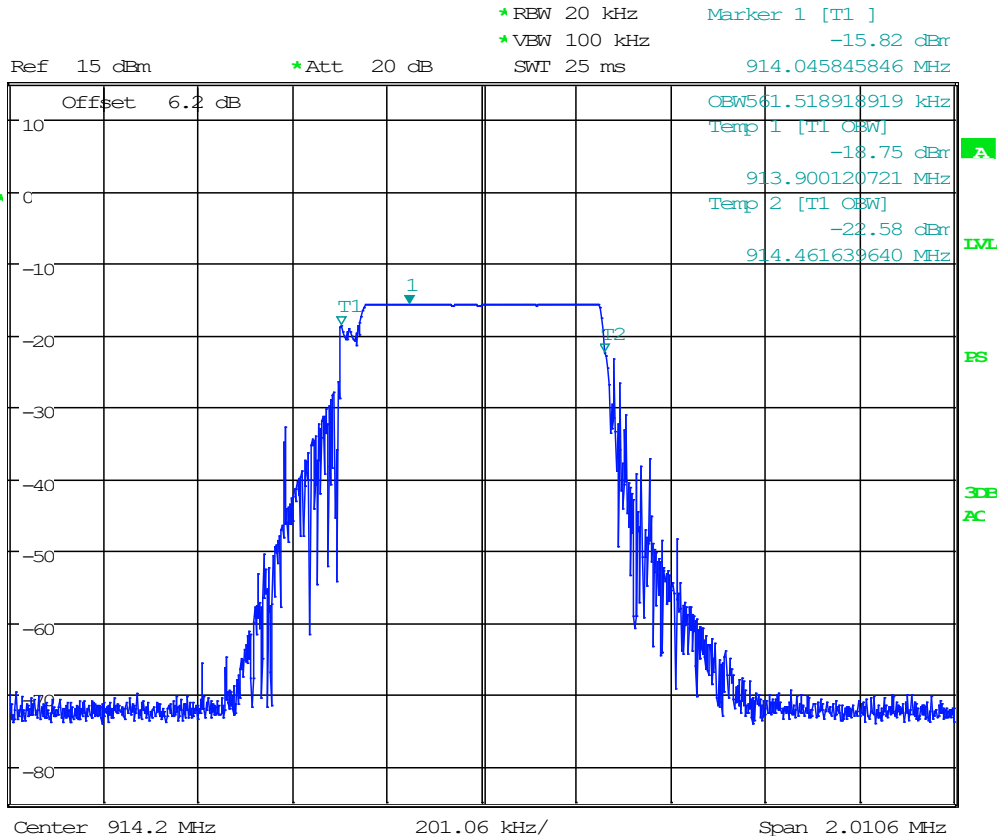


Date: 19.AUG.2020 18:08:20

99% BW LoRa at 914.2 MHz

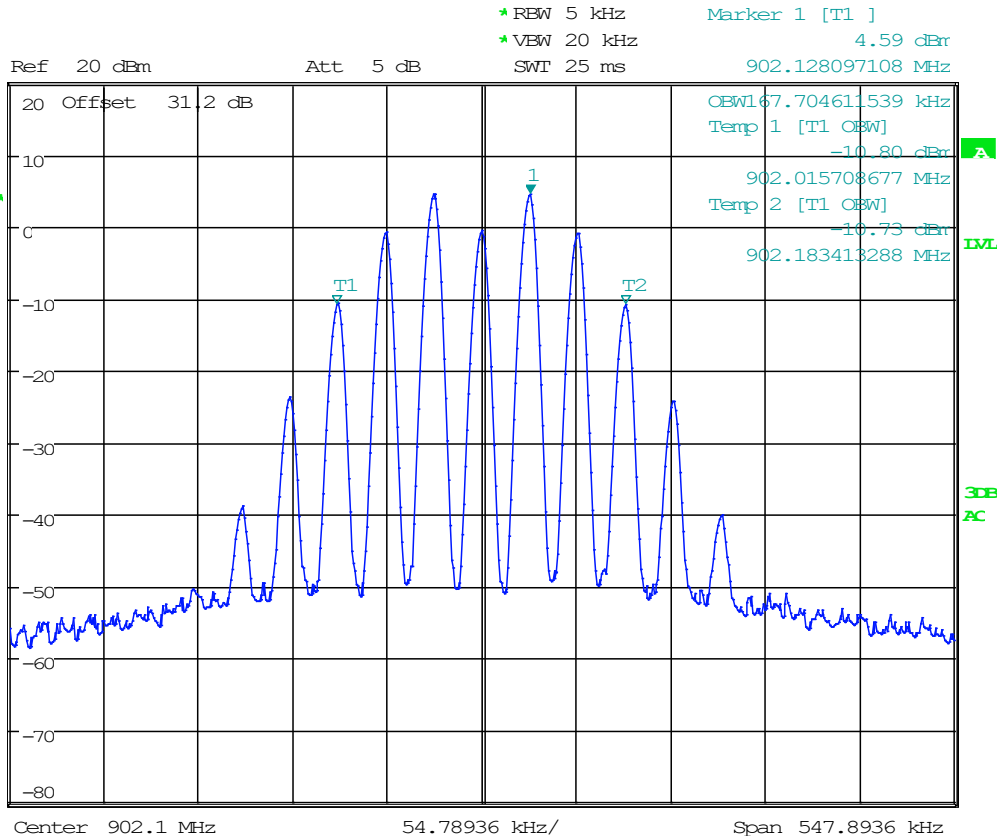


100%
VMW



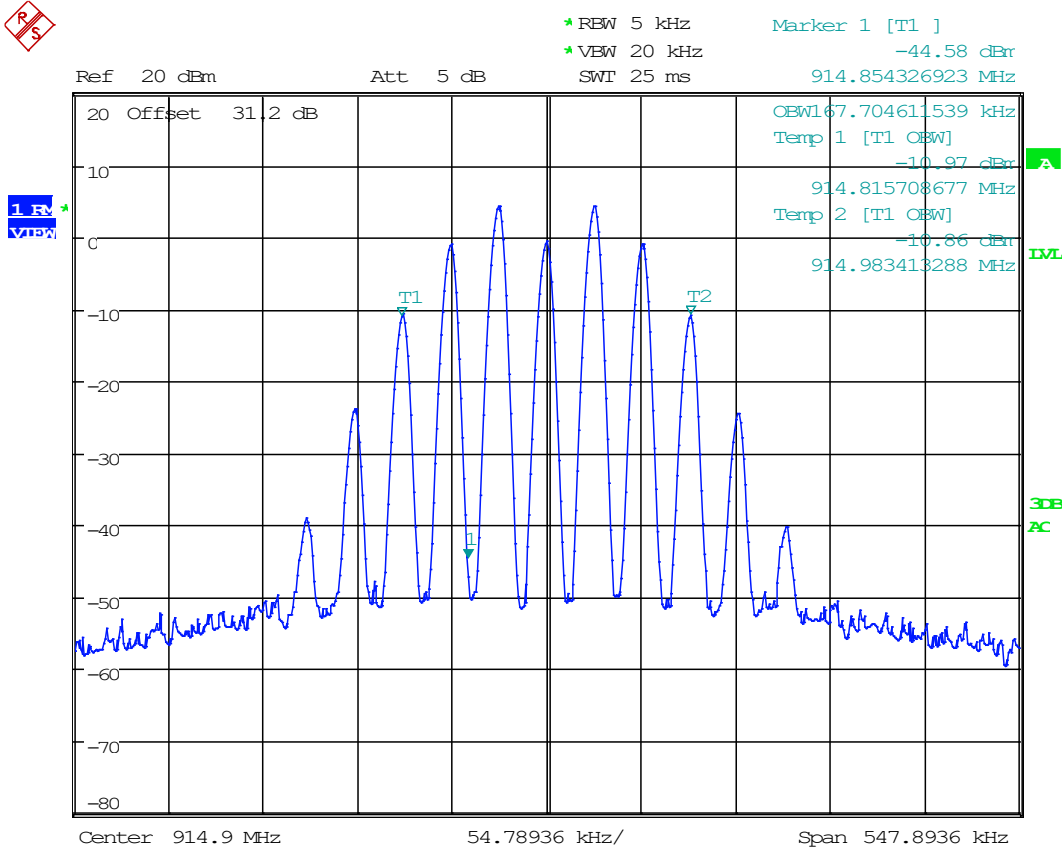
Date: 20.AUG.2020 12:36:59

99% BW
DASH7 at 902.25 MHz



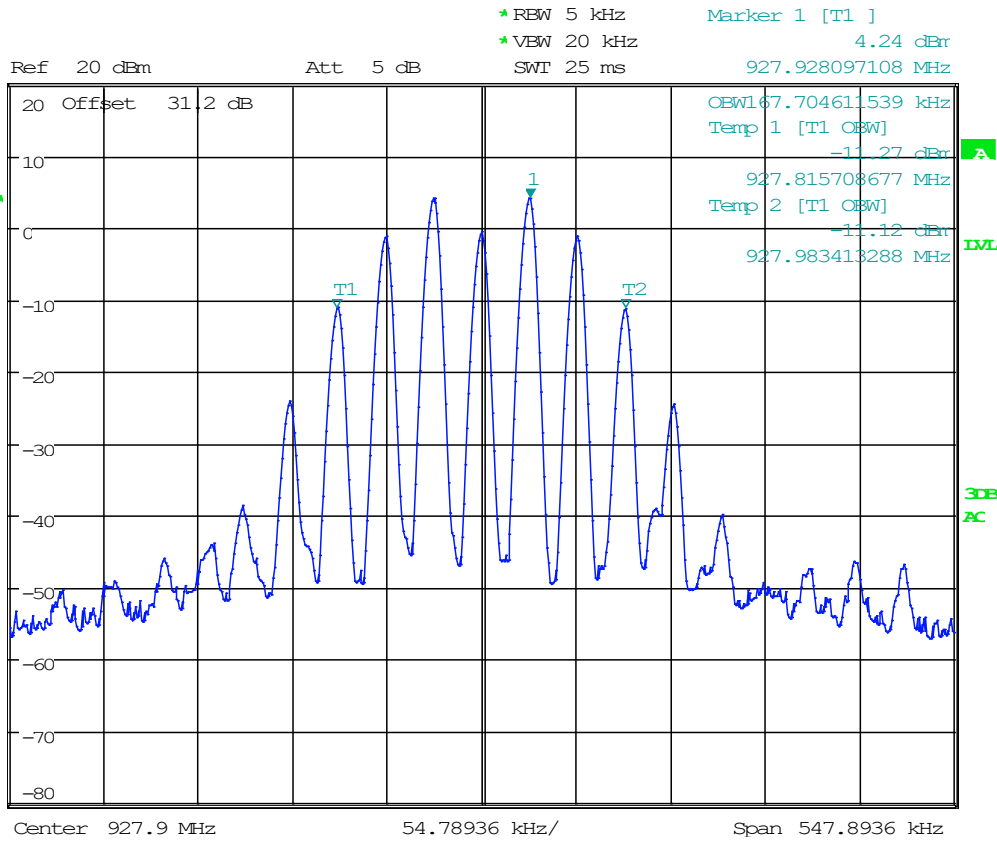
Date: 20.AUG.2020 18:08:05

99% BW DASH7 at 914.9 MHz



Date: 20.AUG.2020 18:12:48

99% BW
DASH7 at 927.74 MHz

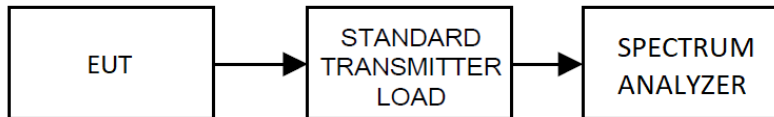


Date: 20.AUG.2020 18:16:51

8.2 6dB Bandwidth (DTS BW)

Limits from FCC Part 15.247 (a) (2) and test procedure from ANSI C63.10-2013 section 11.8

Setup



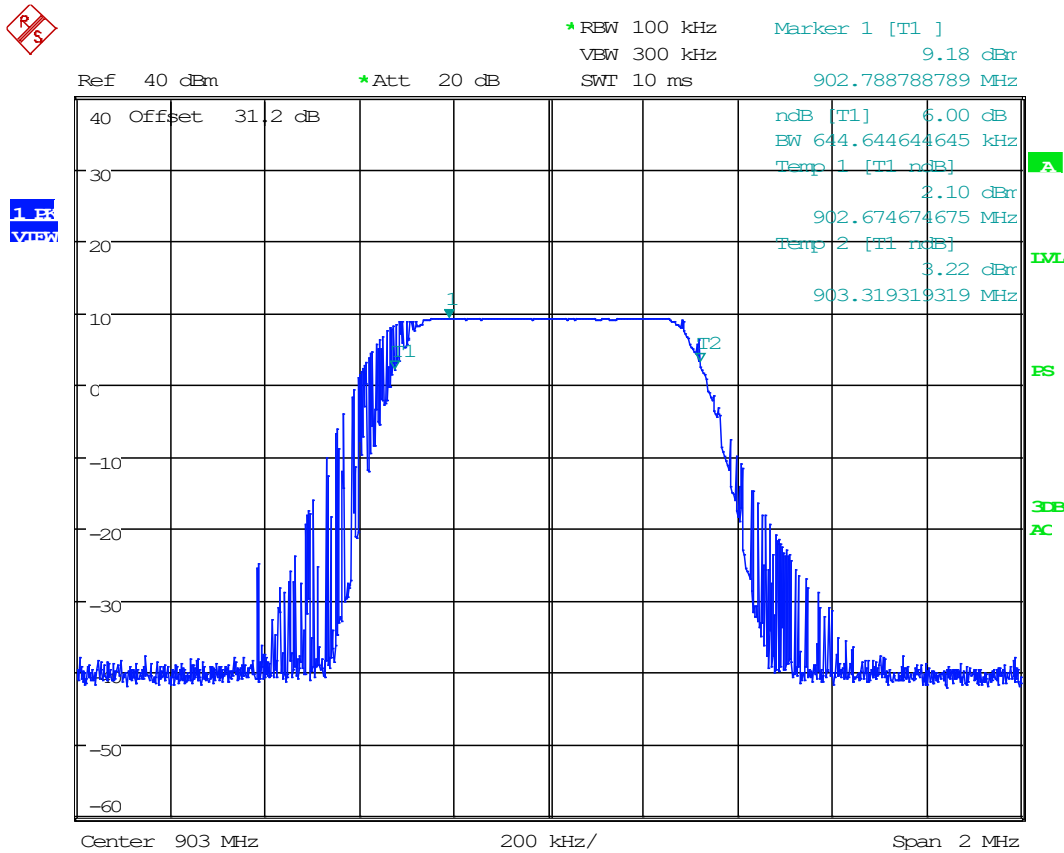
6dB BW Results

LoRa (Long Range)	
Tuned Frequency (MHz)	6dB Bandwidth (DTS BW) (kHz)
903	644.64
907.8	746.8
914.2	626.6

DASH7	
Tuned Frequency (MHz)	6dB Bandwidth (DTS BW) (kHz)
902.25	182.3
914.9	189.9
927.74	189.9

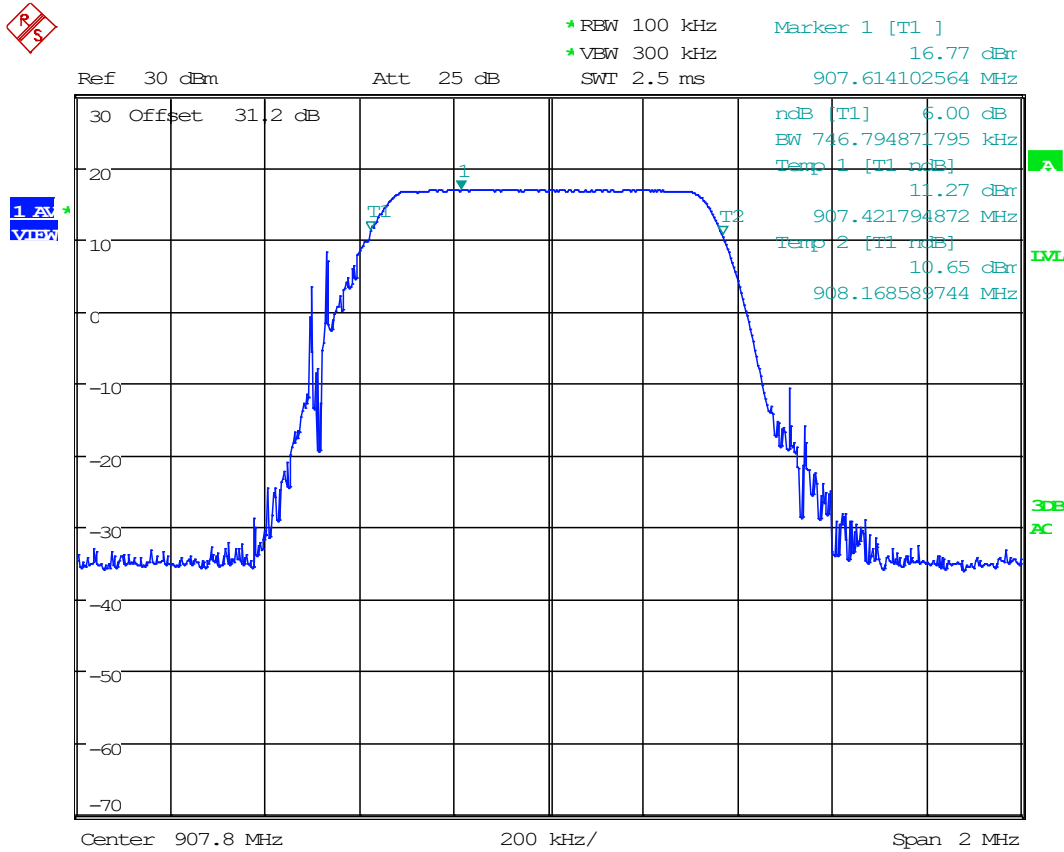
6dB BW Test Data / Spectrum Plots

6dB Bandwidth (DTS BW) LoRa at 903 MHz



Date: 20.AUG.2020 11:36:33

6dB Bandwidth (DTS BW) LoRa at 907.8 MHz

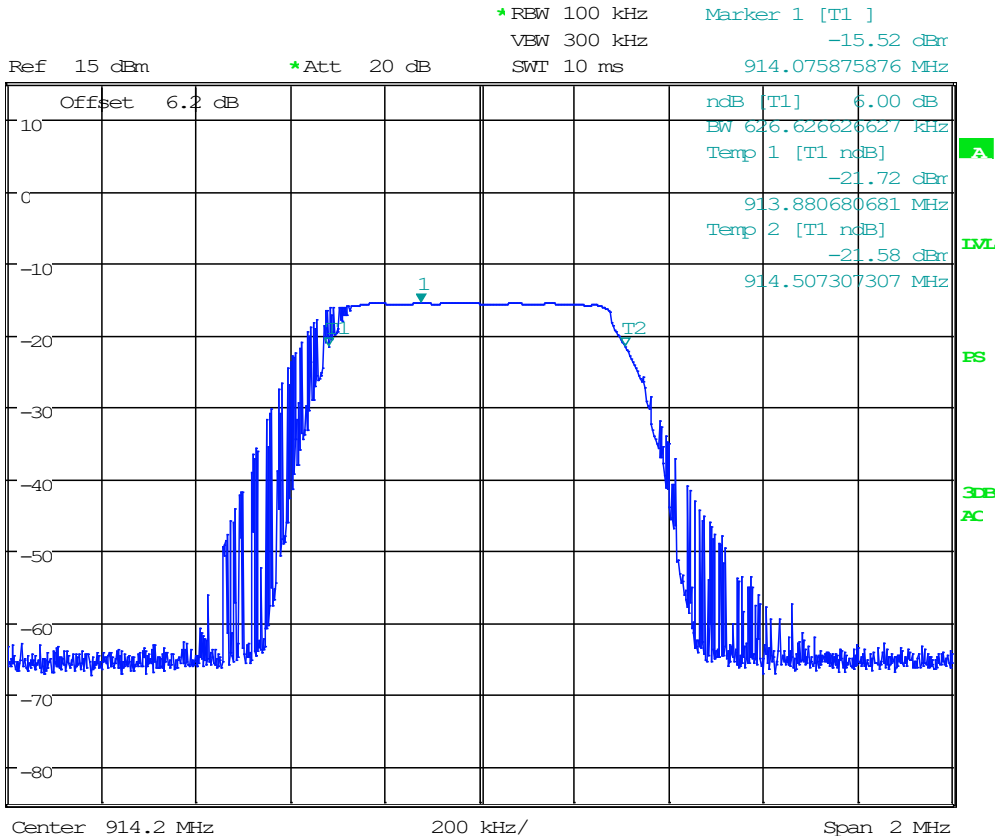


Date: 19.AUG.2020 18:06:58

6dB Bandwidth (DTS BW) LoRa at 914.2 MHz

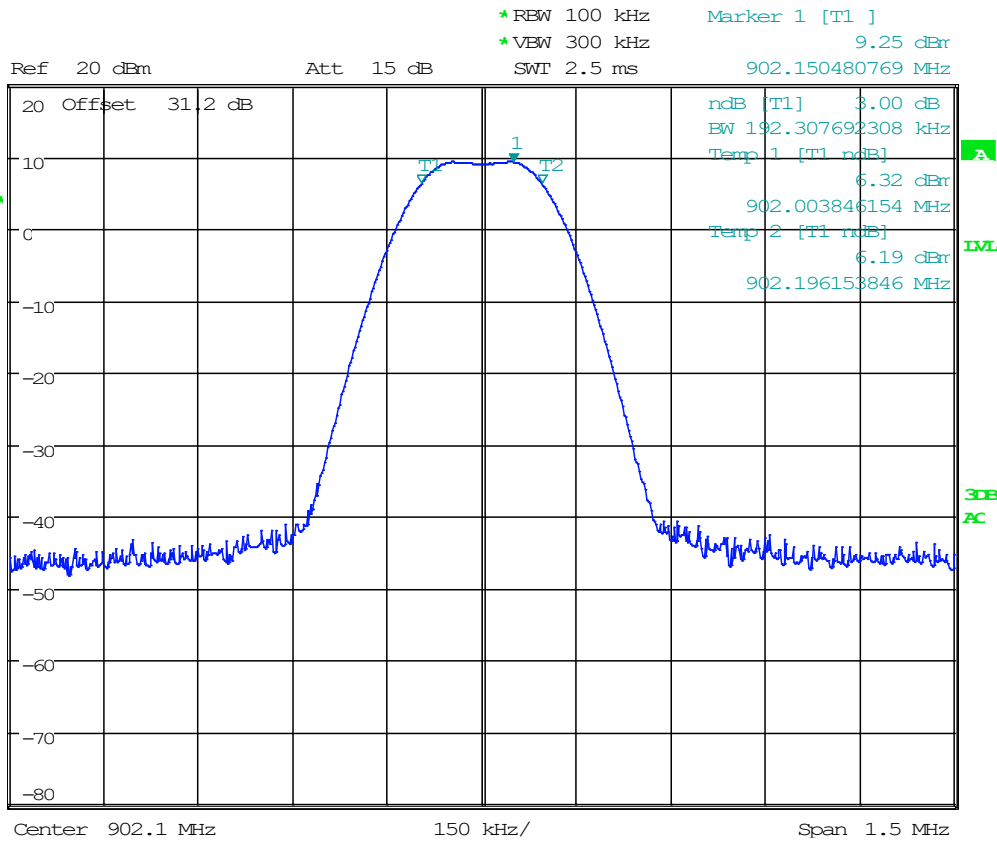


1.00
 VPP



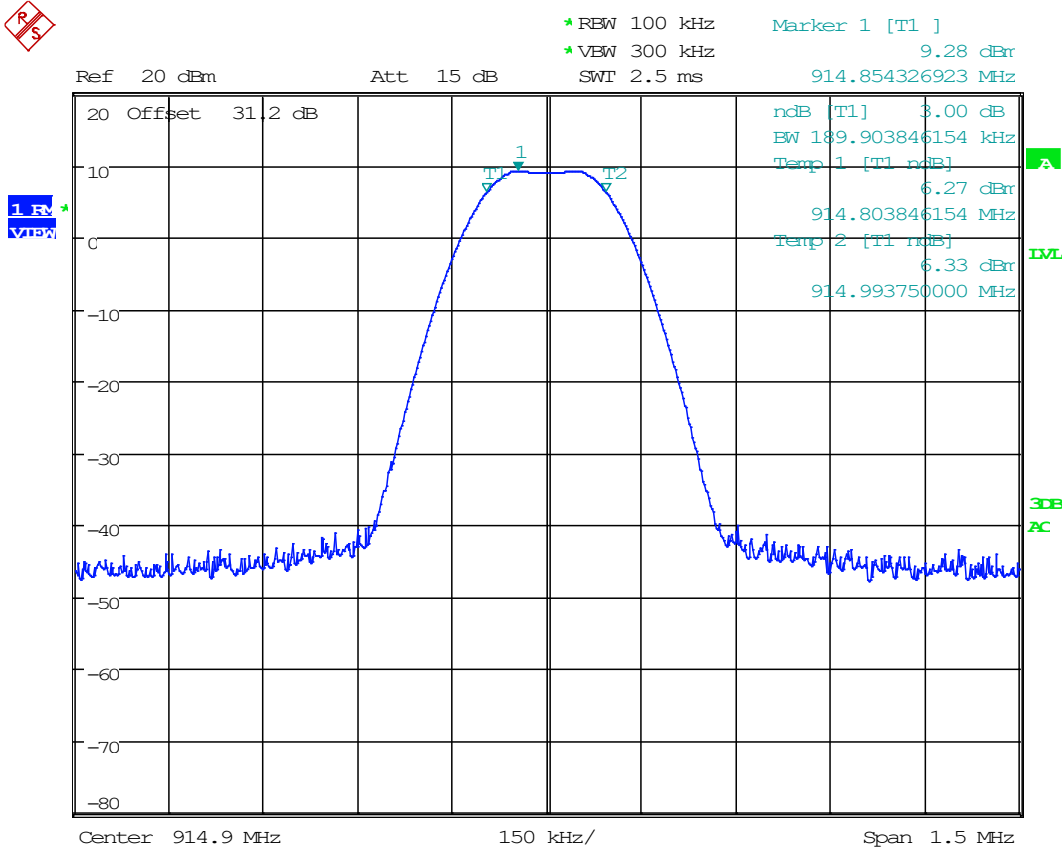
Date: 20.AUG.2020 12:34:44

6dB Bandwidth (DTS BW) DASH7 at 902.25 MHz



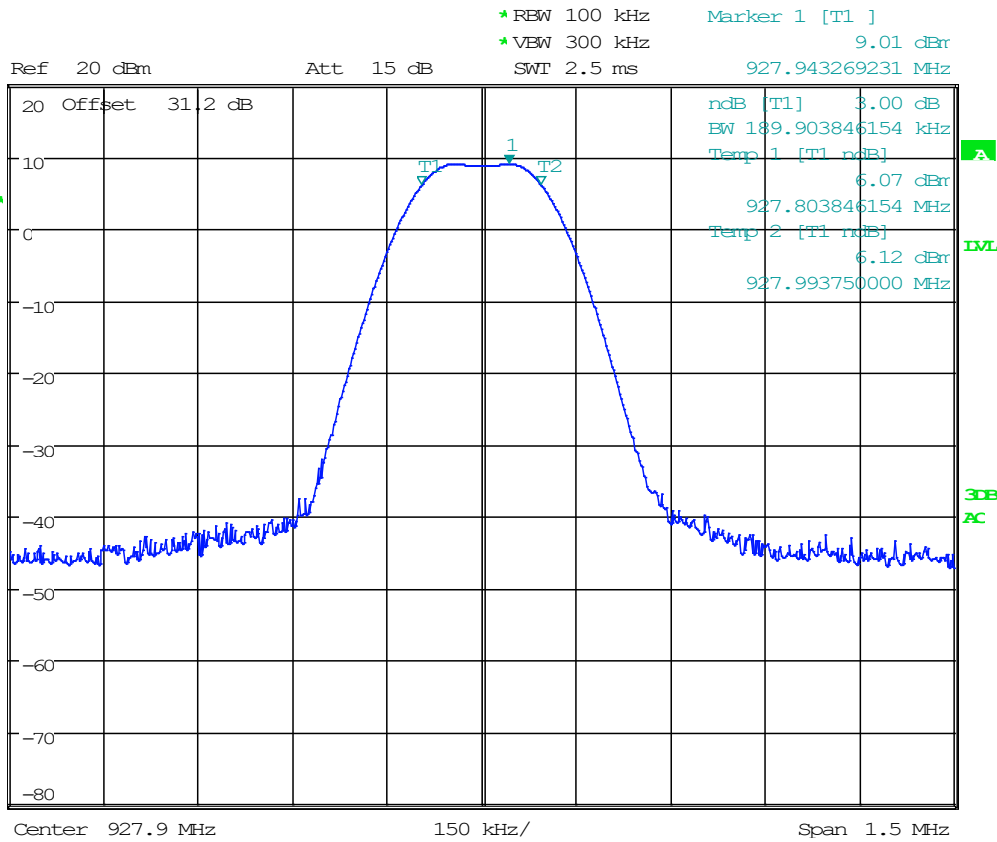
Date: 20.AUG.2020 18:09:26

6dB Bandwidth (DTS BW) DASH7 at 914.9 MHz



Date: 20.AUG.2020 18:12:14

6dB Bandwidth (DTS BW) DASH7 at 927.74 MHz

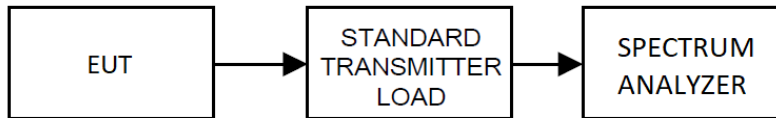


Date: 20.AUG.2020 18:17:50

8.3 DTS conducted output power

Limits from FCC Part 15.247 (b) (3) and test procedure from ANSI C63.10-2013 section 11.9

Setup



Conducted Output Power Test Results

LoRa (Long Range)	
Tuned Frequency (MHz)	Power Output (dBm)
903	16.94
907.8	16.93
914.2	16.87

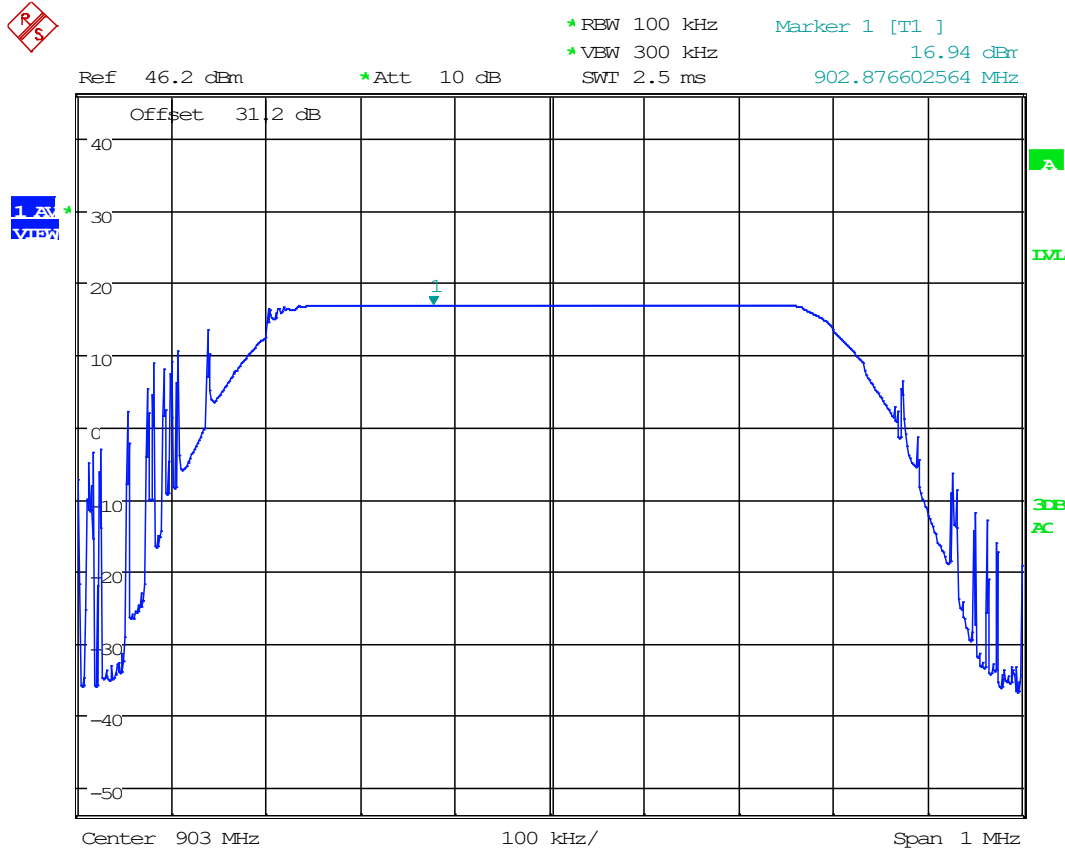
- LoRa MAXIMUM Conducted Output Power = 16.94 dBm

DASH7	
Tuned Frequency (MHz)	Power Output (dBm)
902.25	16.92
914.9	16.85
927.74	16.74

- DASH7 MAXIMUM Conducted Output Power = 16.92 dBm

Conducted Output Power Test Data / Spectrum Plots

Conducted Output Power LoRa at 903 MHz

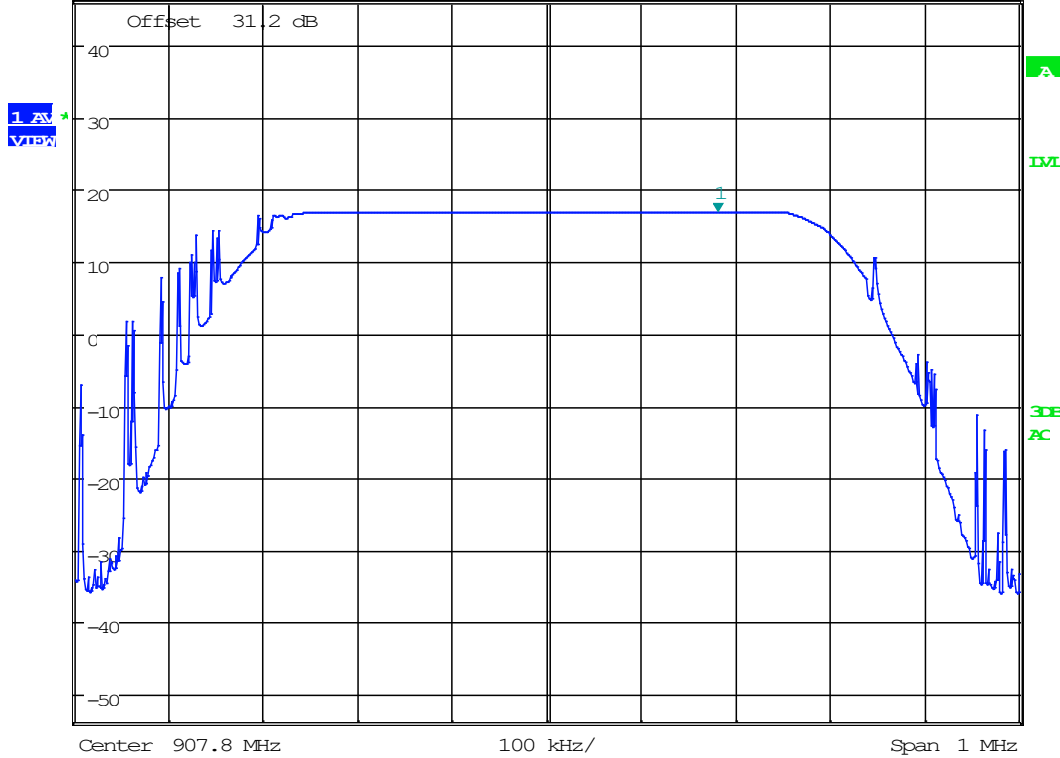


Date: 25.AUG.2020 18:13:39

Conducted Output Power LoRa at 907.8 MHz

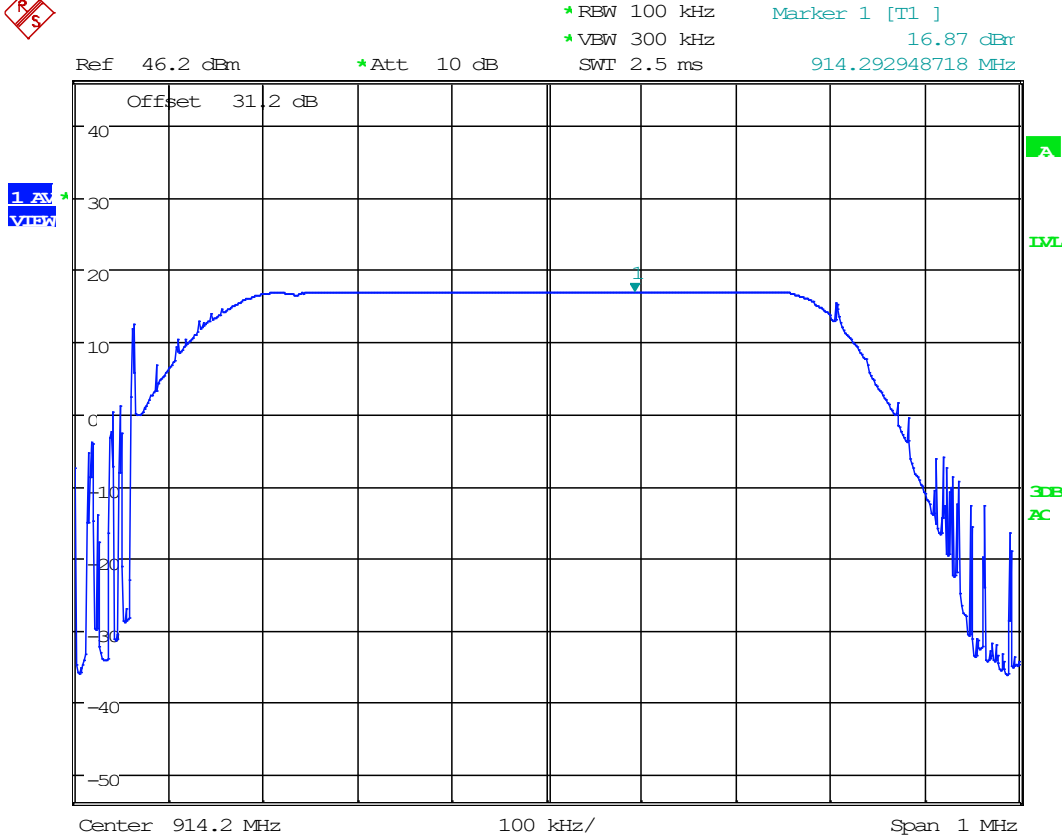


*RBW 100 kHz Marker 1 [T1]
 *VBW 300 kHz 16.93 dBm
 SWI 2.5 ms 907.981089744 MHz



Date: 25.AUG.2020 18:12:54

Conducted Output Power LoRa at 914.2 MHz

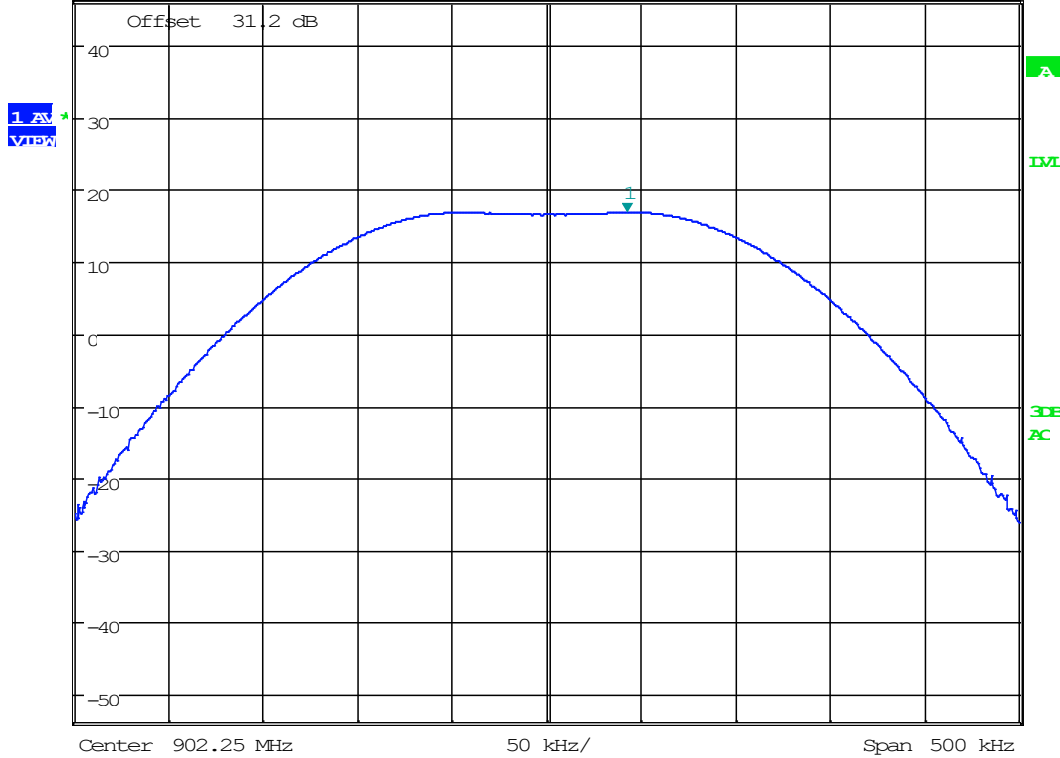


Date: 25.AUG.2020 18:11:27

Conducted Output Power DASH7 at 902.25 MHz

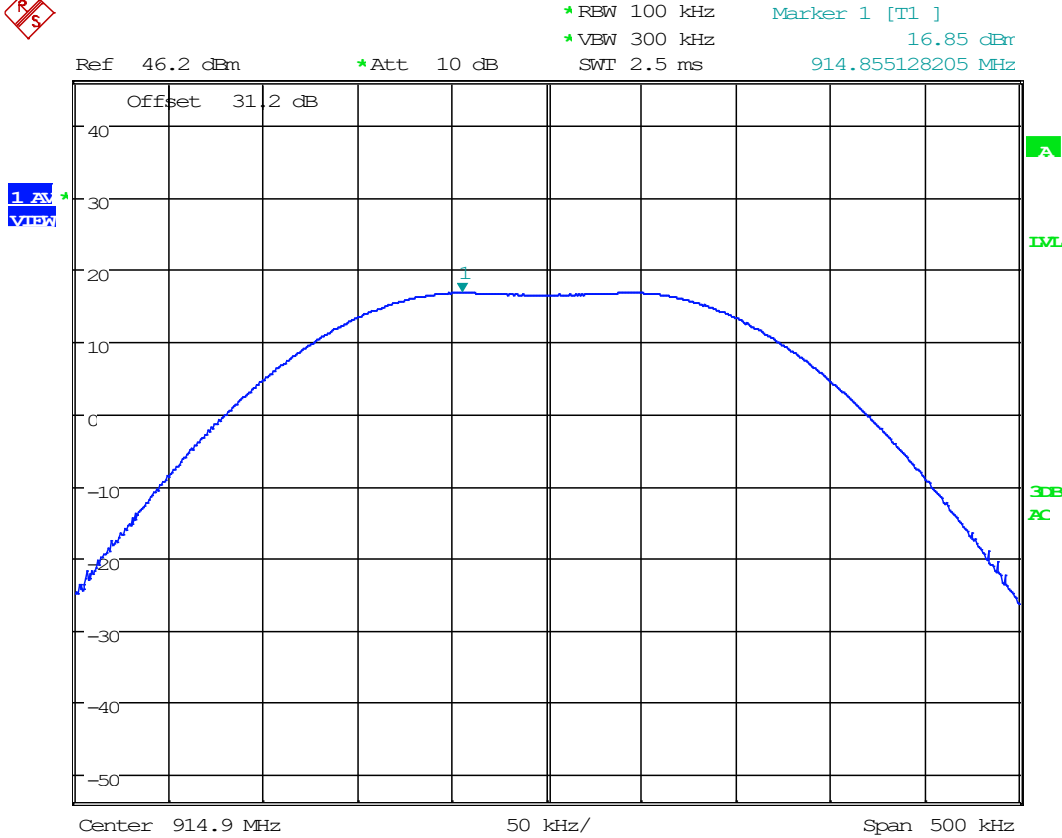


* RBW 100 kHz Marker 1 [T1]
* VBW 300 kHz 16.92 dBm
SWT 2.5 ms 902.292467949 MHz



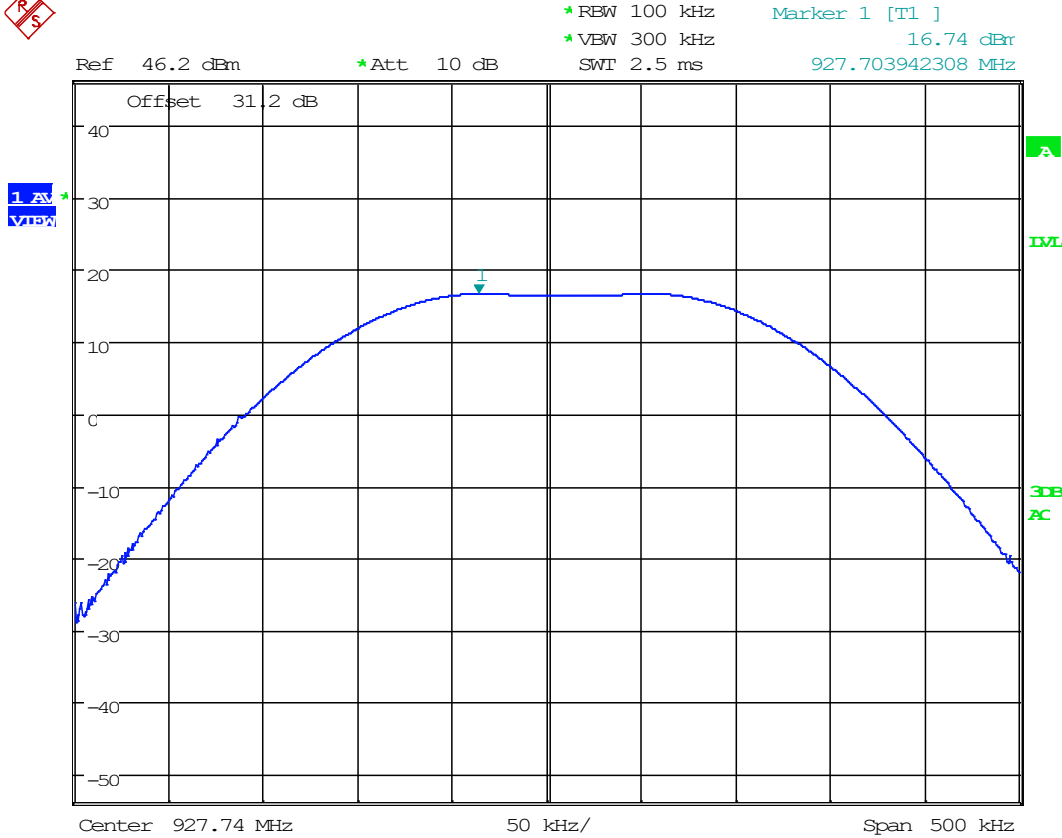
Date: 25.AUG.2020 18:14:29

Conducted Output Power DASH7 at 914.9 MHz



Date: 25.AUG.2020 18:15:22

Conducted Output Power DASH7 at 927.74 MHz

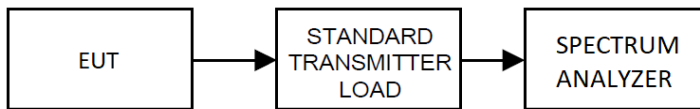


Date: 25.AUG.2020 18:15:57

8.4 Power Spectral Density (PSD)

Limits from FCC Part 15.247 (e) and test procedure from ANSI C63.10-2013 section 11.10

Setup



PSD Test Results

LoRa (Long Range)	
Tuned Frequency (MHz)	PSD Level (dBm)
903	-7.61
907.8	-1.62
914.2	0.67

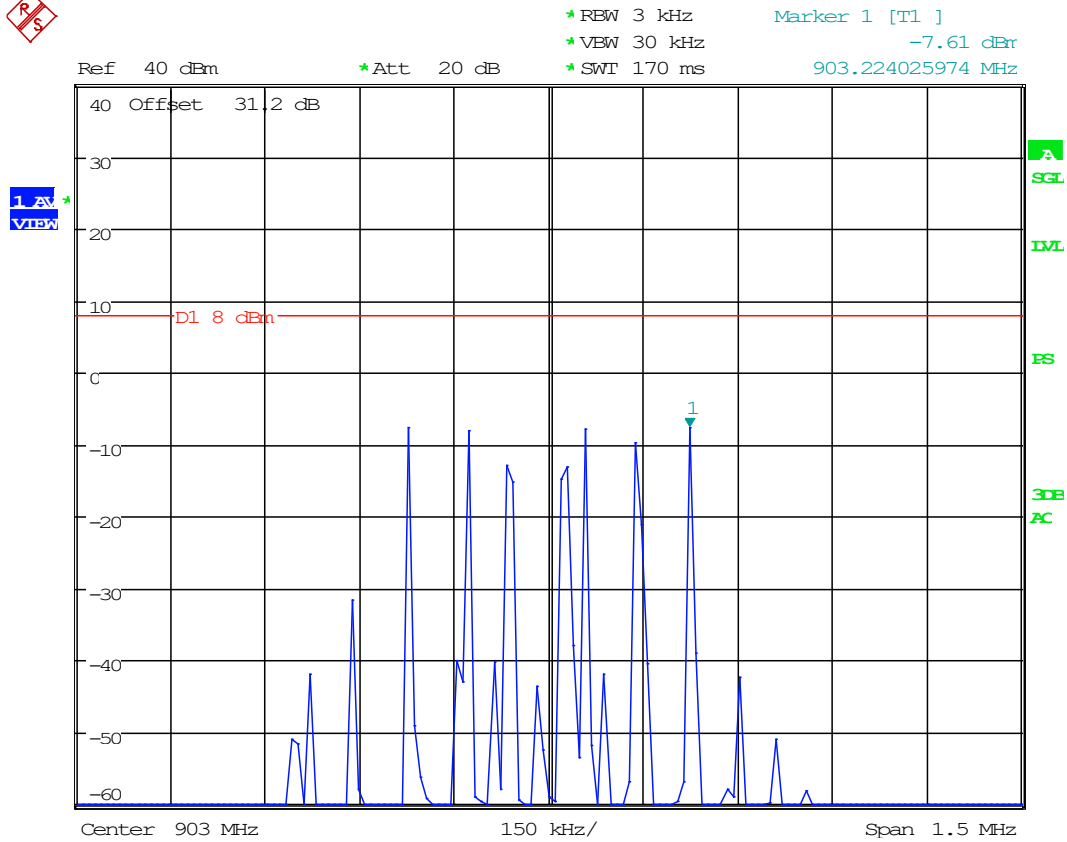


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Power Spectral Density (PSD) Test Data / Spectrum Plots

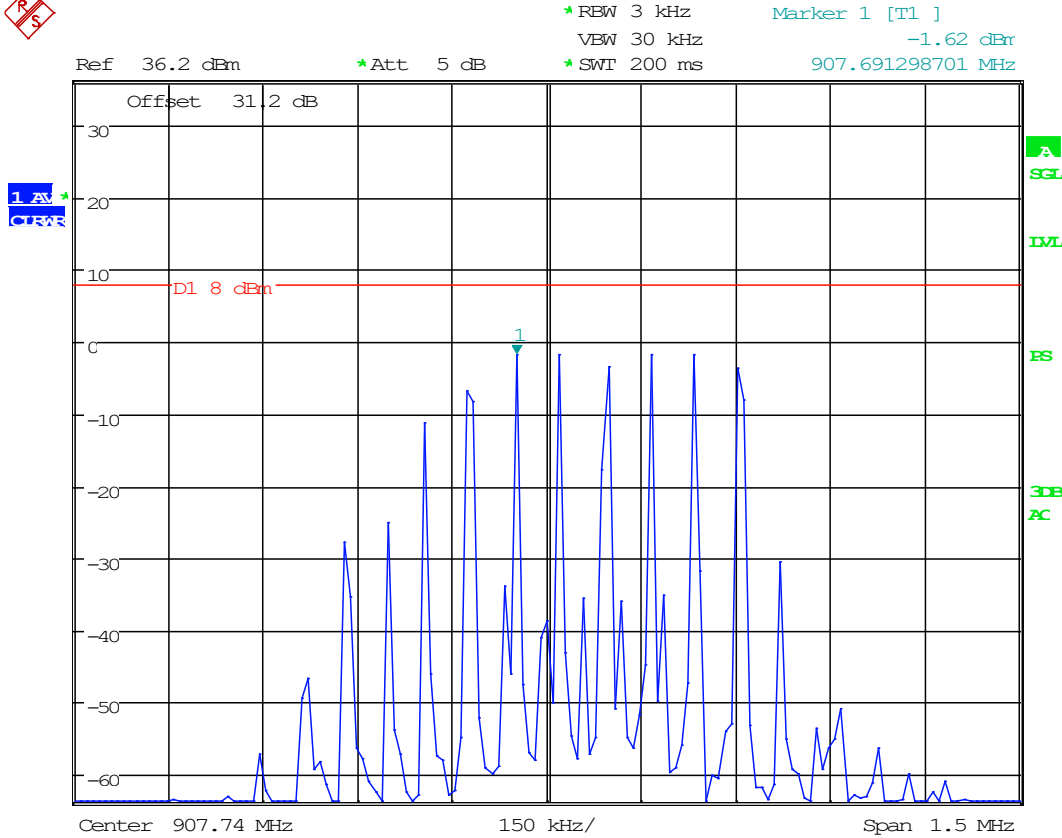
PSD

LoRa at 903 MHz



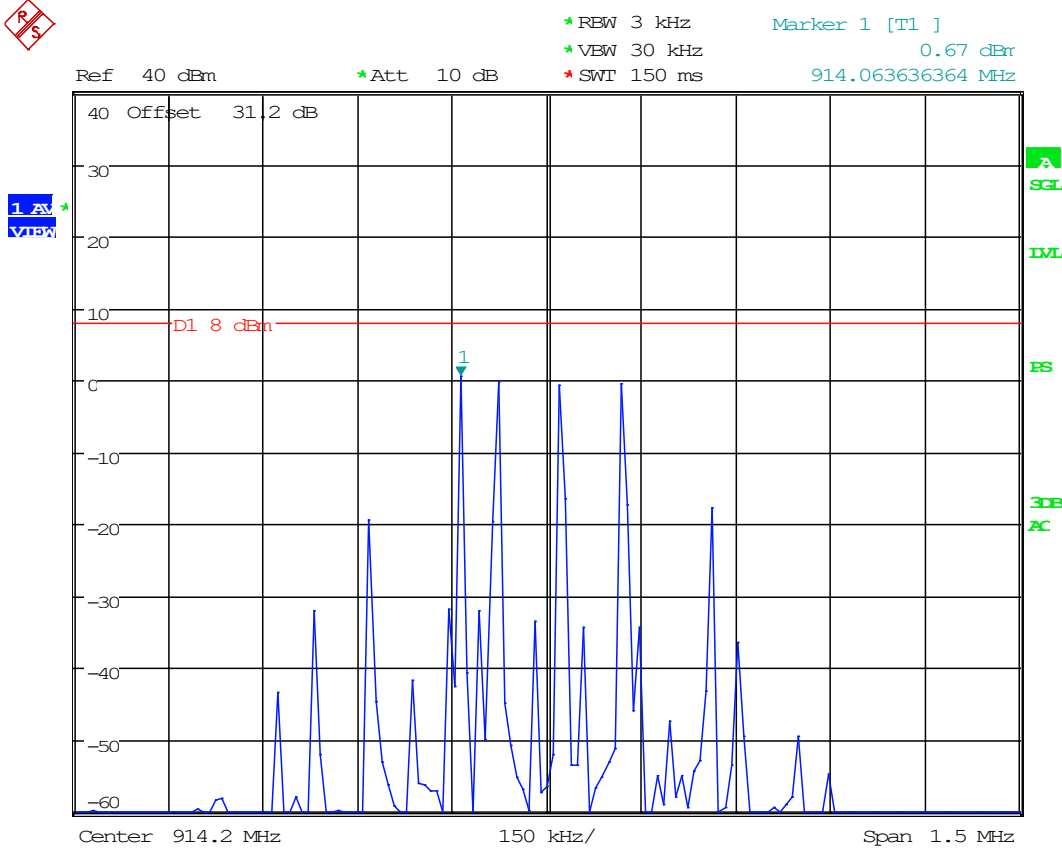
Date: 20.AUG.2020 12:07:21

PSD LoRa at 907.8 MHz



Date: 19.AUG.2020 17:32:19

PSD LoRa at 914.2 MHz



Date: 25.AUG.2020 18:06:50

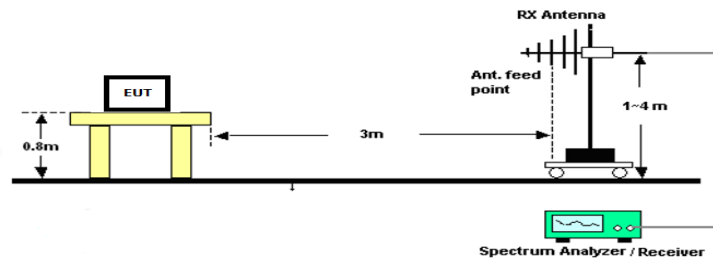
8.5 Spurious Emissions (Out of Band)

Emissions in nonrestricted frequency bands

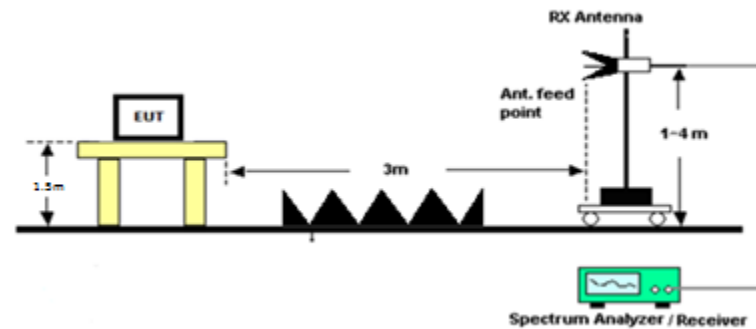
Limits from FCC Part 15.247 (d) and 15.215 (b) and test procedure from ANSI C63.10-2013 section 11.11

Setup

Emissions 30 – 1000 MHz



Emissions above 1 GHz





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Lora DTS

Tuned Frequency (MHz)	Emission Frequency (MHz)	15.205 Restricted Band	15.205, 15.35, 15.247(d) Detector	Meter Reading (dBμV)	Antenna Polarity	Coax Loss (dB)	Duty Cycle Correction (dB)	Antenna Correction Factor (dB/m)	Distance (m)	Field Strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
903.00	1806.00		PK	7.49	H	4.90	0.00	30.36	3.00	42.75	54.00	11.25
903.00	1806.00		PK	3.25	V	4.90	0.00	30.36	3.00	38.51	54.00	15.49
903.00	1806.00				H	4.90	0.00	30.36	3.00		54.00	
903.00	1806.00				V	4.90	0.00	30.36	3.00		54.00	
903.00	6321.00		PK	-0.30	H	8.64	0.00	35.39	3.00	43.73	54.00	10.27
903.00	6321.00		PK	-0.66	V	8.64	0.00	35.39	3.00	43.37	54.00	10.63
903.00	6321.00				H	8.64	0.00	35.39	3.00		54.00	
903.00	6321.00				V	8.64	0.00	35.39	3.00		54.00	
903.00	7224.00		PK	3.26	H	9.52	0.00	36.36	3.00	49.15	54.00	4.85
903.00	7224.00		PK	7.01	V	9.52	0.00	36.36	3.00	52.90	54.00	1.10
903.00	7224.00				H	9.52	0.00	36.36	3.00		54.00	
903.00	7224.00				V	9.52	0.00	36.36	3.00		54.00	

Tuned Frequency (MHz)	Emission Frequency (MHz)	15.205 Restricted Band	15.205, 15.35, 15.247(d) Detector	Meter Reading (dBμV)	Antenna Polarity	Coax Loss (dB)	Duty Cycle Correction (dB)	Antenna Correction Factor (dB/m)	Distance (m)	Field Strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
907.80	1815.60		PK	5.34	H	4.91	0.00	30.48	3.00	40.73	54.00	13.27
907.80	1815.60		PK	5.14	V	4.91	0.00	30.48	3.00	40.53	54.00	13.47
907.80	1815.60				H	4.91	0.00	30.48	3.00		54.00	
907.80	1815.60				V	4.91	0.00	30.48	3.00		54.00	
907.80	6354.60		PK	-3.93	H	8.84	0.00	35.40	3.00	40.31	54.00	13.69
907.80	6354.60		PK	-2.46	V	8.84	0.00	35.40	3.00	41.78	54.00	12.22
907.80	6354.60				H	8.84	0.00	35.40	3.00		54.00	
907.80	6354.60				V	8.84	0.00	35.40	3.00		54.00	

Tuned Frequency (MHz)	Emission Frequency (MHz)	15.205 Restricted Band	15.205, 15.35, 15.247(d) Detector	Meter Reading (dBμV)	Antenna Polarity	Coax Loss (dB)	Duty Cycle Correction (dB)	Antenna Correction Factor (dB/m)	Distance (m)	Field Strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
914.20	1828.40		PK	6.25	H	4.94	0.00	30.63	3.00	41.81	54.00	12.19
914.20	1828.40		PK	1.20	V	4.94	0.00	30.63	3.00	36.76	54.00	17.24
914.20	1828.40				H	4.94	0.00	30.63	3.00		54.00	
914.20	1828.40				V	4.94	0.00	30.63	3.00		54.00	
914.20	5485.20		PK	-0.10	H	8.08	0.00	34.47	3.00	42.45	54.00	11.55
914.20	5485.20		PK	-3.37	V	8.08	0.00	34.47	3.00	39.18	54.00	14.82
914.20	5485.20				H	8.08	0.00	34.47	3.00		54.00	
914.20	5485.20				V	8.08	0.00	34.47	3.00		54.00	
914.20	6399.40		PK	0.57	H	8.95	0.00	35.45	3.00	44.97	54.00	9.03
914.20	6399.40		PK	-0.17	V	8.95	0.00	35.45	3.00	44.23	54.00	9.77
914.20	6399.40				H	8.95	0.00	35.45	3.00		54.00	
914.20	6399.40				V	8.95	0.00	35.45	3.00		54.00	

Dash 7

Tuned Frequency (MHz)	Emission Frequency (MHz)	15.205 Restricted Band	15.205, 15.35, 15.247(d) Detector	Meter Reading (dBμV)	Antenna Polarity	Coax Loss (dB)	Duty Cycle Correction (dB)	Antenna Correction Factor (dB/m)	Distance (m)	Field Strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
902.25	1804.50		PK	4.89	H	4.90	0.00	30.34	3.00	40.13	54.00	13.87
902.25	1804.50		PK	6.84	V	4.90	0.00	30.34	3.00	42.08	54.00	11.92
902.25	1804.50				H	4.90	0.00	30.34	3.00		54.00	
902.25	1804.50				V	4.90	0.00	30.34	3.00		54.00	
902.25	6315.75		PK	0.12	H	8.61	0.00	35.39	3.00	44.12	54.00	9.88
902.25	6315.75		PK	-0.53	V	8.61	0.00	35.39	3.00	43.47	54.00	10.53
902.25	6315.75				H	8.61	0.00	35.39	3.00		54.00	
902.25	6315.75				V	8.61	0.00	35.39	3.00		54.00	
902.25	7218.00		PK	4.33	H	9.53	0.00	36.37	3.00	50.23	54.00	3.77
902.25	7218.00		PK	5.54	V	9.53	0.00	36.37	3.00	51.44	54.00	2.56
902.25	7218.00				H	9.53	0.00	36.37	3.00		54.00	
902.25	7218.00				V	9.53	0.00	36.37	3.00		54.00	

Tuned Frequency (MHz)	Emission Frequency (MHz)	15.205 Restricted Band	15.205, 15.35, 15.247(d) Detector	Meter Reading (dBμV)	Antenna Polarity	Coax Loss (dB)	Duty Cycle Correction (dB)	Antenna Correction Factor (dB/m)	Distance (m)	Field Strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
914.90	1829.80		PK	10.51	H	4.94	0.00	30.64	3.00	46.09	54.00	7.91
914.90	1829.80		PK	5.58	V	4.94	0.00	30.64	3.00	41.16	54.00	12.84
914.90	1829.80				H	4.94	0.00	30.64	3.00		54.00	
914.90	1829.80				V	4.94	0.00	30.64	3.00		54.00	
914.90	5489.40		PK	-0.46	H	8.07	0.00	34.47	3.00	42.09	54.00	11.91
914.90	5489.40		PK	-0.12	V	8.07	0.00	34.47	3.00	42.43	54.00	11.57
914.90	5489.40				H	8.07	0.00	34.47	3.00		54.00	
914.90	5489.40				V	8.07	0.00	34.47	3.00		54.00	
914.90	6404.30		PK	-0.18	H	8.95	0.00	35.46	3.00	44.23	54.00	9.77
914.90	6404.30		PK	-0.79	V	8.95	0.00	35.46	3.00	43.62	54.00	10.38
914.90	6404.30				H	8.95	0.00	35.46	3.00		54.00	
914.90	6404.30				V	8.95	0.00	35.46	3.00		54.00	

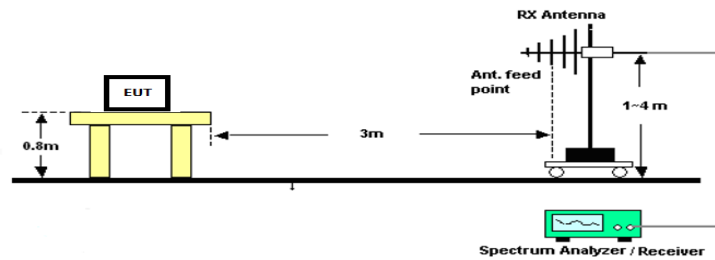
Tuned Frequency (MHz)	Emission Frequency (MHz)	15.205 Restricted Band	15.205, 15.35, 15.247(d) Detector	Meter Reading (dBμV)	Antenna Polarity	Coax Loss (dB)	Duty Cycle Correction (dB)	Antenna Correction Factor (dB/m)	Distance (m)	Field Strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
927.74	1855.48		PK	6.73	H	4.99	0.00	30.89	3.00	42.61	54.00	11.39
927.74	1855.48		PK	6.43	V	4.99	0.00	30.89	3.00	42.31	54.00	11.69
927.74	1855.48				H	4.99	0.00	30.89	3.00		54.00	
927.74	1855.48				V	4.99	0.00	30.89	3.00		54.00	
927.74	5566.44		PK	-3.62	H	8.07	0.00	34.42	3.00	38.87	54.00	15.13
927.74	5566.44		PK	-2.70	V	8.07	0.00	34.42	3.00	39.79	54.00	14.21
927.74	5566.44				H	8.07	0.00	34.42	3.00		54.00	
927.74	5566.44				V	8.07	0.00	34.42	3.00		54.00	
927.74	6494.18		PK	-1.18	H	9.07	0.00	35.53	3.00	43.43	54.00	10.57
927.74	6494.18		PK	-0.05	V	9.07	0.00	35.53	3.00	44.56	54.00	9.44
927.74	6494.18				H	9.07	0.00	35.53	3.00		54.00	
927.74	6494.18				V	9.07	0.00	35.53	3.00		54.00	
927.74	9277.40		PK	-2.68	H	10.86	0.00	36.31	3.00	44.48	54.00	9.52
927.74	9277.40		PK	-3.22	V	10.86	0.00	36.31	3.00	43.94	54.00	10.06
927.74	9277.40				H	10.86	0.00	36.31	3.00		54.00	
927.74	9277.40				V	10.86	0.00	36.31	3.00		54.00	

8.6 Restricted Bands of Operation

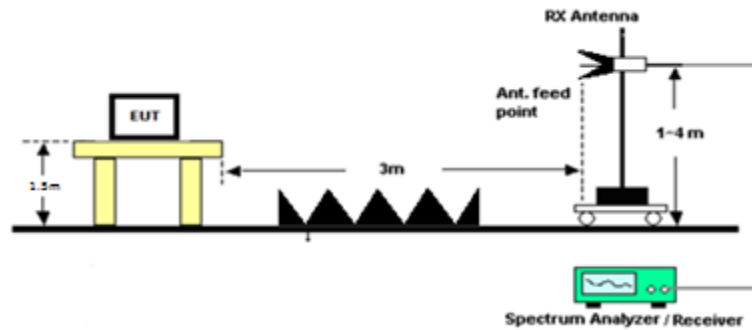
Limits from FCC Part 15.209

Setup

Emissions 30 – 1000 MHz



Emissions above 1 GHz





Timco Engineering, Inc., an IIA Company
 849 NW State Road 45, Newberry, Florida 32669
 (352) 472-5500 / testing@timcoengr.com

Plots

Lora DTS

Tuned Frequency (MHz)	Emission Frequency (MHz)	15.205 Restricted Band	15.205, 15.35, 15.247(d) Detector	Meter Reading (dBμV)	Antenna Polarity	Coax Loss (dB)	Duty Cycle Correction (dB)	Antenna Correction Factor (dB/m)	Distance (m)	Field Strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
903.00	2709.00	X	PK	-0.32	H	6.00	0.00	32.48	3.00	38.16	73.98	35.82
903.00	2709.00	X	PK	0.58	V	6.00	0.00	32.48	3.00	39.06	73.98	34.92
903.00	2709.00	X	AVG	-0.32	H	6.00	0.00	32.48	3.00	38.16	53.98	15.82
903.00	2709.00	X	AVG	0.58	V	6.00	0.00	32.48	3.00	39.06	53.98	14.92
903.00	3612.00	X	PK	-1.96	H	6.64	0.00	33.13	3.00	37.81	73.98	36.17
903.00	3612.00	X	PK	-0.92	V	6.64	0.00	33.13	3.00	38.85	73.98	35.13
903.00	3612.00	X	AVG	-1.96	H	6.64	0.00	33.13	3.00	37.81	53.98	16.17
903.00	3612.00	X	AVG	-0.92	V	6.64	0.00	33.13	3.00	38.85	53.98	15.13
903.00	4515.00	X	PK	0.83	H	7.37	0.00	33.92	3.00	42.12	73.98	31.86
903.00	4515.00	X	PK	1.40	V	7.37	0.00	33.92	3.00	42.69	73.98	31.29
903.00	4515.00	X	AVG	0.83	H	7.37	0.00	33.92	3.00	42.12	53.98	11.86
903.00	4515.00	X	AVG	1.40	V	7.37	0.00	33.92	3.00	42.69	53.98	11.29
903.00	5418.00	X	PK	0.13	H	8.15	0.00	34.40	3.00	42.68	73.98	31.30
903.00	5418.00	X	PK	0.92	V	8.15	0.00	34.40	3.00	43.47	73.98	30.51
903.00	5418.00	X	AVG	0.13	H	8.15	0.00	34.40	3.00	42.68	53.98	11.30
903.00	5418.00	X	AVG	0.92	V	8.15	0.00	34.40	3.00	43.47	53.98	10.51
903.00	8127.00	X	PK	0.09	H	9.96	0.00	35.80	3.00	45.85	73.98	28.13
903.00	8127.00	X	PK	-3.75	V	9.96	0.00	35.80	3.00	42.01	73.98	31.97
903.00	8127.00	X	AVG	0.09	H	9.96	0.00	35.80	3.00	45.85	53.98	8.13
903.00	8127.00	X	AVG	-3.75	V	9.96	0.00	35.80	3.00	42.01	53.98	11.97
903.00	9030.00	X	PK	-5.21	H	10.70	0.00	36.13	3.00	41.62	73.98	32.36
903.00	9030.00	X	PK	-6.17	V	10.70	0.00	36.13	3.00	40.66	73.98	33.32
903.00	9030.00	X	AVG	-5.21	H	10.70	0.00	36.13	3.00	41.62	53.98	12.36
903.00	9030.00	X	AVG	-6.17	V	10.70	0.00	36.13	3.00	40.66	53.98	13.32

Tuned Frequency (MHz)	Emission Frequency (MHz)	15.205 Restricted Band	15.205, 15.35, 15.247(d) Detector	Meter Reading (dBμV)	Antenna Polarity	Coax Loss (dB)	Duty Cycle Correction (dB)	Antenna Correction Factor (dB/m)	Distance (m)	Field Strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
907.80	2723.40	X	PK	0.82	H	6.03	0.00	32.45	3.00	39.30	73.98	34.68
907.80	2723.40	X	PK	-0.91	V	6.03	0.00	32.45	3.00	37.57	73.98	36.41
907.80	2723.40	X	AVG	0.82	H	6.03	0.00	32.45	3.00	39.30	53.98	14.68
907.80	2723.40	X	AVG	-0.91	V	6.03	0.00	32.45	3.00	37.57	53.98	16.41
907.80	3631.20	X	PK	0.00	H	6.61	0.00	33.16	3.00	39.78	73.98	34.20
907.80	3631.20	X	PK	1.11	V	6.61	0.00	33.16	3.00	40.89	73.98	33.09
907.80	3631.20	X	AVG	0.00	H	6.61	0.00	33.16	3.00	39.78	53.98	14.20
907.80	3631.20	X	AVG	1.11	V	6.61	0.00	33.16	3.00	40.89	53.98	13.09
907.80	4539.00	X	PK	-2.62	H	7.45	0.00	33.97	3.00	38.80	73.98	35.18
907.80	4539.00	X	PK	-1.13	V	7.45	0.00	33.97	3.00	40.29	73.98	33.69
907.80	4539.00	X	AVG	-2.62	H	7.45	0.00	33.97	3.00	38.80	53.98	15.18
907.80	4539.00	X	AVG	-1.13	V	7.45	0.00	33.97	3.00	40.29	53.98	13.69
907.80	5446.80	X	PK	-1.93	H	8.13	0.00	34.47	3.00	40.67	73.98	33.31
907.80	5446.80	X	PK	-2.79	V	8.13	0.00	34.47	3.00	39.81	73.98	34.17
907.80	5446.80	X	AVG	-1.93	H	8.13	0.00	34.47	3.00	40.67	53.98	13.31
907.80	5446.80	X	AVG	-2.79	V	8.13	0.00	34.47	3.00	39.81	53.98	14.17
907.80	7262.40	X	PK	3.57	H	9.53	0.00	36.31	3.00	49.41	73.98	24.57
907.80	7262.40	X	PK	7.61	V	9.53	0.00	36.31	3.00	53.45	73.98	20.53
907.80	7262.40	X	AVG	3.57	H	9.53	0.00	36.31	3.00	49.41	53.98	4.57
907.80	7262.40	X	AVG	7.61	V	9.53	0.00	36.31	3.00	53.45	53.98	0.53
907.80	8170.20	X	PK	-2.13	H	9.87	0.00	35.80	3.00	43.54	73.98	30.44
907.80	8170.20	X	PK	-1.96	V	9.87	0.00	35.80	3.00	43.71	73.98	30.27
907.80	8170.20	X	AVG	-2.13	H	9.87	0.00	35.80	3.00	43.54	53.98	10.44
907.80	8170.20	X	AVG	-1.96	V	9.87	0.00	35.80	3.00	43.71	53.98	10.27
907.80	9078.00	X	PK	-1.45	H	10.77	0.00	36.13	3.00	45.45	73.98	28.53
907.80	9078.00	X	PK	-2.53	V	10.77	0.00	36.13	3.00	44.37	73.98	29.61
907.80	9078.00	X	AVG	-1.45	H	10.77	0.00	36.13	3.00	45.45	53.98	8.53
907.80	9078.00	X	AVG	-2.53	V	10.77	0.00	36.13	3.00	44.37	53.98	9.61

Tuned Frequency (MHz)	Emission Frequency (MHz)	15.205 Restricted Band	15.205, 15.35, 15.247(d) Detector	Meter Reading (dBμV)	Antenna Polarity	Coax Loss (dB)	Duty Cycle Correction (dB)	Antenna Correction Factor (dB/m)	Distance (m)	Field Strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
914.20	2742.60	X	PK	1.13	H	6.08	0.00	32.40	3.00	39.61	73.98	34.37
914.20	2742.60	X	PK	0.71	V	6.08	0.00	32.40	3.00	39.19	73.98	34.79
914.20	2742.60	X	AVG	1.13	H	6.08	0.00	32.40	3.00	39.61	53.98	14.37
914.20	2742.60	X	AVG	0.71	V	6.08	0.00	32.40	3.00	39.19	53.98	14.79
914.20	3656.80	X	PK	0.65	H	6.62	0.00	33.20	3.00	40.47	73.98	33.51
914.20	3656.80	X	PK	1.48	V	6.62	0.00	33.20	3.00	41.30	73.98	32.68
914.20	3656.80	X	AVG	0.65	H	6.62	0.00	33.20	3.00	40.47	53.98	13.51
914.20	3656.80	X	AVG	1.48	V	6.62	0.00	33.20	3.00	41.30	53.98	12.68
914.20	4571.00	X	PK	-0.77	H	7.52	0.00	34.02	3.00	40.78	73.98	33.20
914.20	4571.00	X	PK	-1.67	V	7.52	0.00	34.02	3.00	39.88	73.98	34.10
914.20	4571.00	X	AVG	-0.77	H	7.52	0.00	34.02	3.00	40.78	53.98	13.20
914.20	4571.00	X	AVG	-1.67	V	7.52	0.00	34.02	3.00	39.88	53.98	14.10
914.20	7313.60	X	PK	-4.33	H	9.63	0.00	36.26	3.00	41.55	73.98	32.43
914.20	7313.60	X	PK	-1.12	V	9.63	0.00	36.26	3.00	44.76	73.98	29.22
914.20	7313.60	X	AVG	-4.33	H	9.63	0.00	36.26	3.00	41.55	53.98	12.43
914.20	7313.60	X	AVG	-1.12	V	9.63	0.00	36.26	3.00	44.76	53.98	9.22
914.20	8227.80	X	PK	-2.83	H	9.97	0.00	35.80	3.00	42.94	73.98	31.04
914.20	8227.80	X	PK	-1.99	V	9.97	0.00	35.80	3.00	43.78	73.98	30.20
914.20	8227.80	X	AVG	-2.83	H	9.97	0.00	35.80	3.00	42.94	53.98	11.04
914.20	8227.80	X	AVG	-1.99	V	9.97	0.00	35.80	3.00	43.78	53.98	10.20
914.20	9142.00	X	PK	-4.44	H	10.78	0.00	36.17	3.00	42.51	73.98	31.47
914.20	9142.00	X	PK	-4.16	V	10.78	0.00	36.17	3.00	42.79	73.98	31.19
914.20	9142.00	X	AVG	-4.44	H	10.78	0.00	36.17	3.00	42.51	53.98	11.47
914.20	9142.00	X	AVG	-4.16	V	10.78	0.00	36.17	3.00	42.79	53.98	11.19

Dash 7

Tuned Frequency (MHz)	Emission Frequency (MHz)	15.205 Restricted Band	15.205, 15.35, 15.247(d) Detector	Meter Reading (dBμV)	Antenna Polarity	Coax Loss (dB)	Duty Cycle Correction (dB)	Antenna Correction Factor (dB/m)	Distance (m)	Field Strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
902.25	2706.75	X	PK	-0.04	H	5.99	0.00	32.49	3.00	38.44	73.98	35.54
902.25	2706.75	X	PK	-1.07	V	5.99	0.00	32.49	3.00	37.41	73.98	36.57
902.25	2706.75	X	AVG	-0.04	H	5.99	0.00	32.49	3.00	38.44	53.98	15.54
902.25	2706.75	X	AVG	-1.07	V	5.99	0.00	32.49	3.00	37.41	53.98	16.57
902.25	3609.00	X	PK	-0.13	H	6.65	0.00	33.12	3.00	39.64	73.98	34.34
902.25	3609.00	X	PK	-0.80	V	6.65	0.00	33.12	3.00	38.97	73.98	35.01
902.25	3609.00	X	AVG	-0.13	H	6.65	0.00	33.12	3.00	39.64	53.98	14.34
902.25	3609.00	X	AVG	-0.80	V	6.65	0.00	33.12	3.00	38.97	53.98	15.01
902.25	4511.25	X	PK	0.34	H	7.36	0.00	33.91	3.00	41.61	73.98	32.37
902.25	4511.25	X	PK	2.75	V	7.36	0.00	33.91	3.00	44.02	73.98	29.96
902.25	4511.25	X	AVG	0.34	H	7.36	0.00	33.91	3.00	41.61	53.98	12.37
902.25	4511.25	X	AVG	2.75	V	7.36	0.00	33.91	3.00	44.02	53.98	9.96
902.25	5413.50	X	PK	-0.55	H	8.15	0.00	34.38	3.00	41.99	73.98	31.99
902.25	5413.50	X	PK	1.72	V	8.15	0.00	34.38	3.00	44.26	73.98	29.72
902.25	5413.50	X	AVG	-0.55	H	8.15	0.00	34.38	3.00	41.99	53.98	11.99
902.25	5413.50	X	AVG	1.72	V	8.15	0.00	34.38	3.00	44.26	53.98	9.72
902.25	8120.25	X	PK	-0.37	H	9.96	0.00	35.80	3.00	45.39	73.98	28.59
902.25	8120.25	X	PK	-1.18	V	9.96	0.00	35.80	3.00	44.58	73.98	29.40
902.25	8120.25	X	AVG	-0.37	H	9.96	0.00	35.80	3.00	45.39	53.98	8.59
902.25	8120.25	X	AVG	-1.18	V	9.96	0.00	35.80	3.00	44.58	53.98	9.40
902.25	9022.50	X	PK	-4.49	H	10.68	0.00	36.12	3.00	42.32	73.98	31.66
902.25	9022.50	X	PK	-3.33	V	10.68	0.00	36.12	3.00	43.48	73.98	30.50
902.25	9022.50	X	AVG	-4.49	H	10.68	0.00	36.12	3.00	42.32	53.98	11.66
902.25	9022.50	X	AVG	-3.33	V	10.68	0.00	36.12	3.00	43.48	53.98	10.50



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Tuned Frequency (MHz)	Emission Frequency (MHz)	15.205 Restricted Band	15.205, 15.35, 15.247(d) Detector	Meter Reading (dBμV)	Antenna Polarity	Coax Loss (dB)	Duty Cycle Correction (dB)	Antenna Correction Factor (dB/m)	Distance (m)	Field Strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
914.90	2744.70	X	PK	1.25	H	6.08	0.00	32.40	3.00	39.73	73.98	34.25
914.90	2744.70	X	PK	2.03	V	6.08	0.00	32.40	3.00	40.51	73.98	33.47
914.90	2744.70	X	AVG	1.25	H	6.08	0.00	32.40	3.00	39.73	53.98	14.25
914.90	2744.70	X	AVG	2.03	V	6.08	0.00	32.40	3.00	40.51	53.98	13.47
914.90	3659.60	X	PK	0.96	H	6.62	0.00	33.20	3.00	40.78	73.98	33.20
914.90	3659.60	X	PK	-0.45	V	6.62	0.00	33.20	3.00	39.37	73.98	34.61
914.90	3659.60	X	AVG	0.96	H	6.62	0.00	33.20	3.00	40.78	53.98	13.20
914.90	3659.60	X	AVG	-0.45	V	6.62	0.00	33.20	3.00	39.37	53.98	14.61
914.90	4574.50	X	PK	-0.53	H	7.53	0.00	34.03	3.00	41.02	73.98	32.96
914.90	4574.50	X	PK	1.96	V	7.53	0.00	34.03	3.00	43.51	73.98	30.47
914.90	4574.50	X	AVG	-0.53	H	7.53	0.00	34.03	3.00	41.02	53.98	12.96
914.90	4574.50	X	AVG	1.96	V	7.53	0.00	34.03	3.00	43.51	53.98	10.47
914.90	7319.20	X	PK	3.49	H	9.61	0.00	36.24	3.00	49.34	73.98	24.64
914.90	7319.20	X	PK	0.11	V	9.61	0.00	36.24	3.00	45.96	73.98	28.02
914.90	7319.20	X	AVG	3.49	H	9.61	0.00	36.24	3.00	49.34	53.98	4.64
914.90	7319.20	X	AVG	0.11	V	9.61	0.00	36.24	3.00	45.96	53.98	8.02
914.90	8234.10	X	PK	1.37	H	10.00	0.00	35.80	3.00	47.16	73.98	26.82
914.90	8234.10	X	PK	-0.15	V	10.00	0.00	35.80	3.00	45.64	73.98	28.34
914.90	8234.10	X	AVG	1.37	H	10.00	0.00	35.80	3.00	47.16	53.98	6.82
914.90	8234.10	X	AVG	-0.15	V	10.00	0.00	35.80	3.00	45.64	53.98	8.34
914.90	9149.00	X	PK	-4.02	H	10.81	0.00	36.18	3.00	42.97	73.98	31.01
914.90	9149.00	X	PK	-6.06	V	10.81	0.00	36.18	3.00	40.93	73.98	33.05
914.90	9149.00	X	AVG	-4.02	H	10.81	0.00	36.18	3.00	42.97	53.98	11.01
914.90	9149.00	X	AVG	-6.06	V	10.81	0.00	36.18	3.00	40.93	53.98	13.05

Tuned Frequency (MHz)	Emission Frequency (MHz)	15.205 Restricted Band	15.205, 15.35, 15.247(d) Detector	Meter Reading (dBμV)	Antenna Polarity	Coax Loss (dB)	Duty Cycle Correction (dB)	Antenna Correction Factor (dB/m)	Distance (m)	Field Strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
927.74	2783.22	X	PK	-1.23	H	6.16	0.00	32.47	3.00	37.39	73.98	36.59
927.74	2783.22	X	PK	-0.34	V	6.16	0.00	32.47	3.00	38.28	73.98	35.70
927.74	2783.22	X	AVG	-1.23	H	6.16	0.00	32.47	3.00	37.39	53.98	16.59
927.74	2783.22	X	AVG	-0.34	V	6.16	0.00	32.47	3.00	38.28	53.98	15.70
927.74	3710.96	X	PK	-1.27	H	6.56	0.00	33.18	3.00	38.47	73.98	35.51
927.74	3710.96	X	PK	-2.13	V	6.56	0.00	33.18	3.00	37.61	73.98	36.37
927.74	3710.96	X	AVG	-1.27	H	6.56	0.00	33.18	3.00	38.47	53.98	15.51
927.74	3710.96	X	AVG	-2.13	V	6.56	0.00	33.18	3.00	37.61	53.98	16.37
927.74	4638.70	X	PK	-3.72	H	7.50	0.00	33.94	3.00	37.72	73.98	36.26
927.74	4638.70	X	PK	-0.91	V	7.50	0.00	33.94	3.00	40.53	73.98	33.45
927.74	4638.70	X	AVG	-3.72	H	7.50	0.00	33.94	3.00	37.72	53.98	16.26
927.74	4638.70	X	AVG	-0.91	V	7.50	0.00	33.94	3.00	40.53	53.98	13.45
927.74	7421.92	X	PK	1.74	H	9.53	0.00	36.03	3.00	47.30	73.98	26.68
927.74	7421.92	X	PK	-0.52	V	9.53	0.00	36.03	3.00	45.04	73.98	28.94
927.74	7421.92	X	AVG	1.74	H	9.53	0.00	36.03	3.00	47.30	53.98	6.68
927.74	7421.92	X	AVG	-0.52	V	9.53	0.00	36.03	3.00	45.04	53.98	8.94
927.74	8349.66	X	PK	-4.07	H	10.16	0.00	35.91	3.00	42.00	73.98	31.98
927.74	8349.66	X	PK	-3.90	V	10.16	0.00	35.91	3.00	42.17	73.98	31.81
927.74	8349.66	X	AVG	-4.07	H	10.16	0.00	35.91	3.00	42.00	53.98	11.98
927.74	8349.66	X	AVG	-3.90	V	10.16	0.00	35.91	3.00	42.17	53.98	11.81



8.7 Band-edge measurements

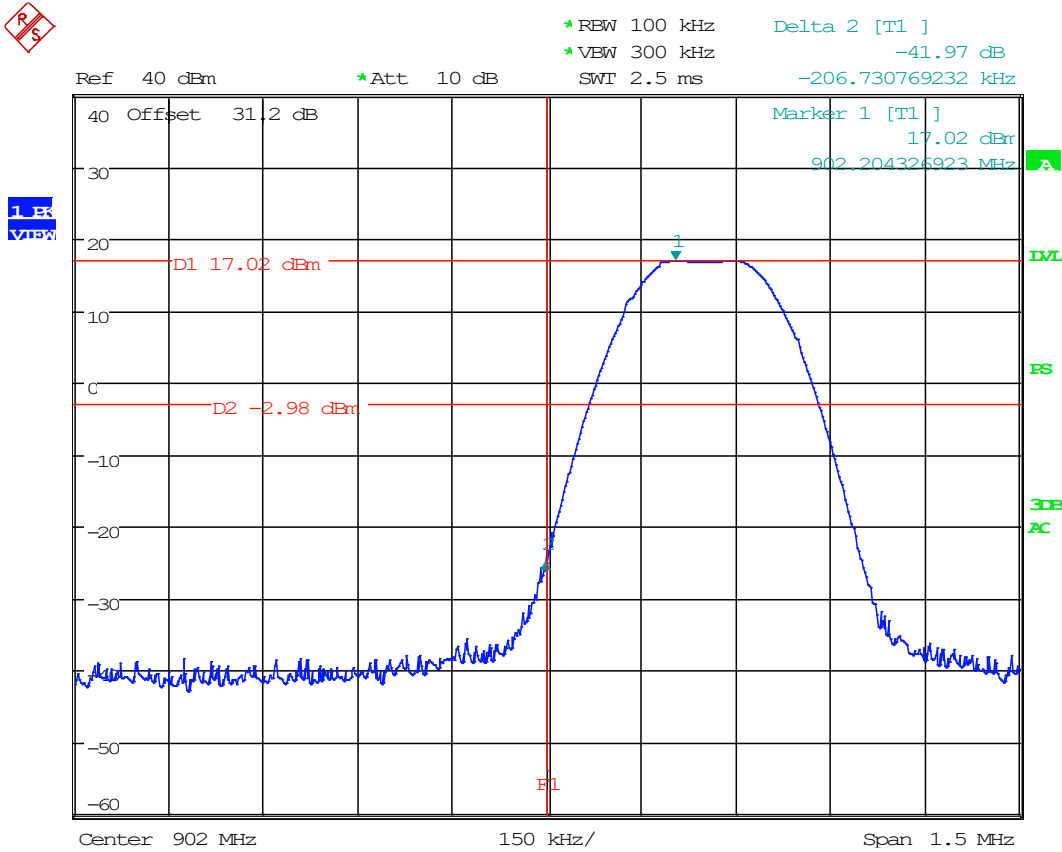
Requirement from FCC KDB 558074 D01 and test procedure from ANSI C63.10-2013 section 11.13

General

Emissions within a restricted band and within 2 MHz of an authorized band edge may be measured using either the marker-delta method or the integration method, which is described in 11.13.3, provided that the DTS bandwidth (or EBW) edge falls within 2 MHz of the band edge. Otherwise, all unwanted emissions measurements shall be performed using the standard methods.

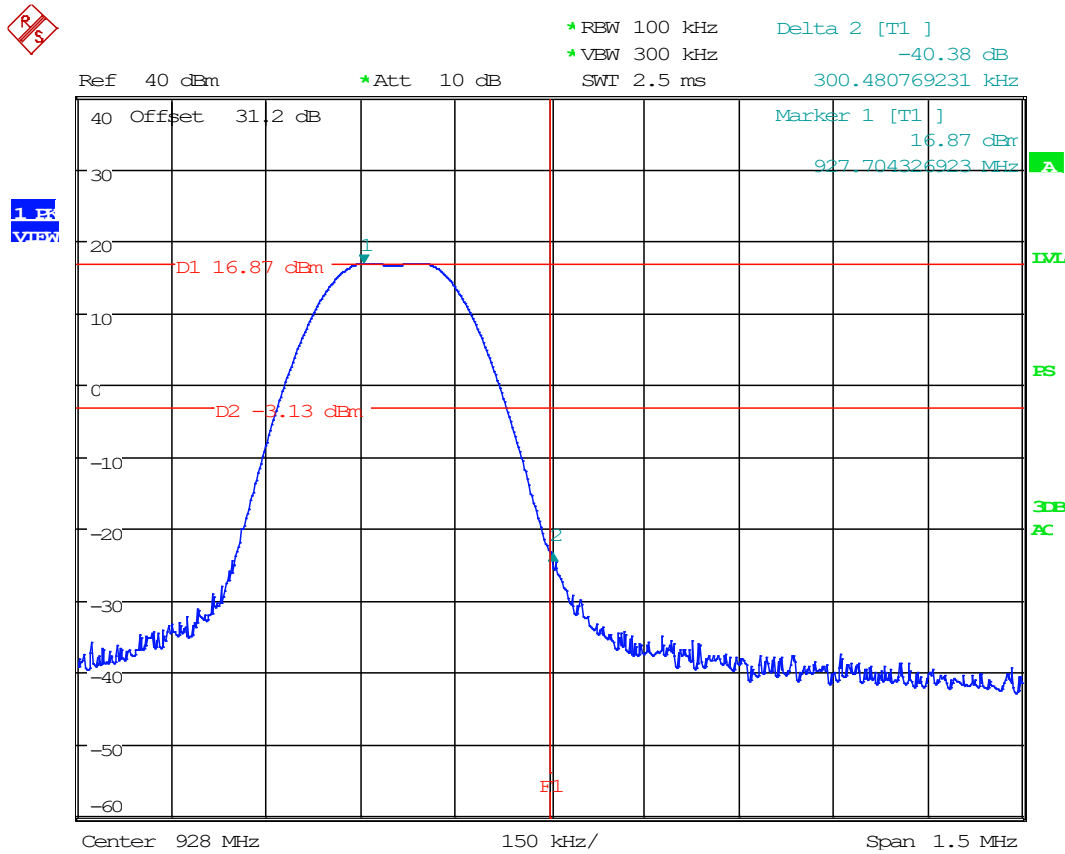
Band-edge Test Data / Spectrum Plots

Lower Band-edge spectrum plot



Date: 25.AUG.2020 17:40:43

Upper Band-edge spectrum plot



Date: 25.AUG.2020 17:38:48



9 ANNEX-A - Photographs of the EUT

Photographs of the EUT and any manufacturer supplied accessories to be used with the EUT
Are in a separate supplementary ANNEX-A document.

10 ANNEX-B – Test Setup Photographs

Test setup photographs are located in a separate supplementary ANNEX-B document.

11 History of Test Report Changes

Test Report #	Revision #	Description	Date of Issue
TR_2993-20_FCC_DTS_1	1	Initial release	September 3, 2020
	2	Revised pages 37,38 & 40-42	October 30, 2020



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END of Test Report
