RF Test Report

As per

RSS-210 Issue 10:2019
&
FCC Part 15 Subpart 15.249

Unlicensed Intentional Radiators

on the

Precision 3 Powermeter
PML300 and PMR300
(ANT Transmitter)

Issued by: **TÜV SÜD Canada Inc.**
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Testing produced for

See Appendix A for full client & EUT details.

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Certificate #2955.02

R-14023, G-20072
C-14498, T-20060

Registration # CA6844

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Report Scope

This report addresses the EMC verification testing and test results of the **Precision 3 Powermeter** Models: **PML300 and PMR300**, and is herein referred to as EUT (Equipment Under Test). The EUT was tested for compliance against the following standards:

RSS-210 Issue 10:2019

FCC Part 15 Subpart C 15.249

Test procedures, results, justifications, and engineering considerations, if any, follow later in this report.

This report does not imply product endorsement by any government, accreditation agency, or TÜV SÜD Canada Inc.

Opinions or interpretations expressed in this report, if any, are outside the scope of TÜV SÜD Canada Inc. accreditations. Any opinions expressed do not necessarily reflect the opinions of TÜV SÜD Canada Inc., unless otherwise stated.

Summary

The results contained in this report relate only to the item(s) tested.

EUT:	Precision 3 Powermeter PML300 & PMR300
FCC Certification #, FCC ID:	ZZNPM301
ISED Certification #, IC:	9896A-PM300
EUT passed all tests performed	Yes
Tests conducted by	Jadon Bull
Report reviewed by	Min Xie

For testing dates, see "Testing Environmental Conditions and Dates".

Test Results Summary

Standard/Method	Description	Class/Limit	Result
FCC 15.203	Antenna Requirement	Unique	Pass See Justification
FCC 15.205 RSS-GEN (Table 7)	Restricted Bands for Intentional Operation	QuasiPeak Average	Pass
FCC 15.207 RSS-GEN (Table 4)	Power Line Conducted Emissions	QuasiPeak Average	N/A See Justification
FCC 15.249(a) RSS-210 F.1(a)	Maximum Output Power	< 50 mV/m	Pass
FCC 15.249(d) RSS-210 F.1(e)	Transmitter Spurious Radiated Emissions	QuasiPeak Average	Pass
FCC 15.249 RSS-GEN 6.7	Emission Bandwidth	99% BW 20dB BW	Pass
Overall Result			**Pass**

If the product as tested or otherwise complies with the specification, the EUT is deemed to comply with the requirement and is deemed a ‘PASS’ grade. If not ‘FAIL’ grade will be issued. Note that ‘PASS’ / ‘FAIL’ grade is independent of any measurement uncertainties. A ‘PASS’ / ‘FAIL’ grade within measurement uncertainty is marked with a ‘*’.

Notes, Justifications, or Deviations

The following notes, justifications for tests not performed or deviations from the above listed specifications apply:

Maximum Radiated Output Power and Transmitter Spurious Radiated Emissions tests were performed on both the PML300 and PMR300 models. Emissions Bandwidth measurements were performed on the PML300 as representative of both EUT models.

For the Antenna requirement specified in FCC 15.203 (RSS-247 section 5.4(d)), the unit uses a custom antenna (-7.0 dBi max peak gain) with less than 6 dBi gain.

For the Restricted Bands of operation, the EUT is designed to only operate between 2400 – 2483.5 MHz.

The EUT was mounted in three orthogonal axes. Worst case results were obtained with the EUT in the X-axis. Worst case results are presented. See Appendix B for axis details.

Power line conducted emissions was not applicable since the EUT is a coin cell battery operated device. All tests were performed with a new battery.

Sample Calculation(s)

Radiated Emission Test

E-Field Level = Received Signal + Antenna Factor + Cable Loss – Pre-Amp Gain
E-Field Level = 50dBµV + 10dB/m + 2dB – 20dB
E-Field Level = 42dBµV/m

Margin = Limit – E-Field Level
Margin = 50dBµV/m – 42dBµV/m
Margin = 8.0 dB (pass)

Applicable Standards, Specifications and Methods

ANSI C63.4:2014	Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
ANSI C63.10:2013	American National Standard For Testing Unlicensed Wireless Devices
CFR 47 FCC 15 Subpart C	Code of Federal Regulations – Radio Frequency Devices, Intentional Radiators
FCC KDB 447498: 2015	RF exposure procedures and equipment authorization policies for mobile and portable devices
ICES-003 Issue 7 2020	Digital Apparatus - Spectrum Management and Telecommunications Policy Interference-Causing Equipment Standard
RSS-GEN Issue 5 2019	General Requirements and Information for the Certification of Radio Apparatus
RSS-210 Issue 10 2019	Licence-Exempt Radio Apparatus: Category I Equipment
ISO 17025:2017	General Requirements for the Competence of Testing and Calibration Laboratories

Document Revision Status

Revision	Date	Description	Initials
000	May 24th, 2023	Initial Release	JB

Definitions and Acronyms

The following definitions and acronyms are applicable in this report.
See also ANSI C63.14.

DTS – Digital Transmission System
LISN – Line Impedance Stabilization Network
NCR – No Calibration Required
NSA – Normalized Site Attenuation
N/A – Not Applicable
RF – Radio Frequency

AE – Auxiliary Equipment. A digital accessory that feeds data into or receives data from another device (host) that in turn, controls its operation.

Antenna Port – Port, other than a broadcast receiver tuner port, for connection of an antenna used for intentional transmission and/or reception of radiated RF energy.

BW – Bandwidth. Unless otherwise stated, this refers to the 6 dB bandwidth.

EMC – Electro-Magnetic Compatibility. The ability of an equipment or system to function satisfactorily in its electromagnetic environment without introducing intolerable electromagnetic disturbances to anything in that environment.

EMI – Electro-Magnetic Immunity. The ability to maintain a specified performance when the equipment is subjected to disturbance (unwanted) signals of specified levels.

EUT – Equipment Under Test. A device or system being evaluated for compliance that is representative of a product to be marketed.

ITE – Information Technology Equipment. Has a primary function of entry, storage, display, retrieval, transmission, processing, switching, or control of data and/or telecommunication messages and which may be equipped with one or more ports typically for information transfer.

Testing Facility

Testing for EMC on the EUT was carried out at TÜV SÜD Canada testing lab near Toronto, Ontario. The testing lab has calibrated 3m semi-anechoic chambers which allow measurements on a EUT that has a maximum width or length of up to 2m and a height of up to 3m. The testing lab also has a calibrated 10m Open Area Test Site (OATS). The chambers are equipped with a turntable that is capable of testing devices up to 5000lb in weight and are equipped with a mast that controls the polarization and height of the antenna. Control of the mast occurs in the control room adjoining the shielded chamber. This facility is capable of testing products that are rated for single phase or 3-phase AC input and DC capability is also available. Radiated emission measurements are performed using a BiLog antenna and a Horn antenna where applicable. Conducted emissions, unless otherwise stated, are performed using a LISN and using the vertical ground plane if applicable.

Calibrations and Accreditations

The 3m semi-anechoic chamber is registered with Federal Communications Commission (FCC, CA6844), Innovation, Science and Economic Development Canada (ISED, 6844A-3) and Voluntary Control Council for Interference (VCCI, R-14023, G-20072, C-14498, and T-20060). This chamber was calibrated for Normalized Site Attenuation (NSA) using test procedures outlined in ANSI C63.4 "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz". The chamber is lined with ferrite tiles and absorption cones to minimize any undesired reflections. The NSA data is kept on file at TÜV SÜD Canada. For radiated susceptibility testing, a 16 point field calibration has been performed on the chamber. The field uniformity data is kept on file at TÜV SÜD Canada. TÜV SÜD Canada Inc. is accredited to ISO 17025 by A2LA with Testing Certificate #2955.02. The laboratory's current scope of accreditation listing can be found as listed on the A2LA website. All measuring equipment is calibrated on an annual or biennial basis as listed for each respective test.

Testing Environmental Conditions and Dates

Following environmental conditions were recorded in the facility during time of testing

Date	Test	Initials	Temperature (°C)	Humidity (%)	Pressure (kPa)
4/10/2023 4/11/2023 4/14/2023	Radiated Emissions	JB	22.1 22.7 22.5	16.9 20.9 35.3	103 20.9 35.3
4/20/2023 4/21/2023	Emission Bandwidth	JB	21.8 23.0	24.6 22.6	102.4 101.3

Detailed Test Results Section

Maximum Output Power

Purpose

The purpose of this test is to ensure that the maximum equivalent isotropically radiated power does not exceed the limits specified.

Limits and Method

The limits are defined in FCC Part 15.249(a) and RSS-210 F.1(a). The method is given in ANSI C63.10 Section 11.9.

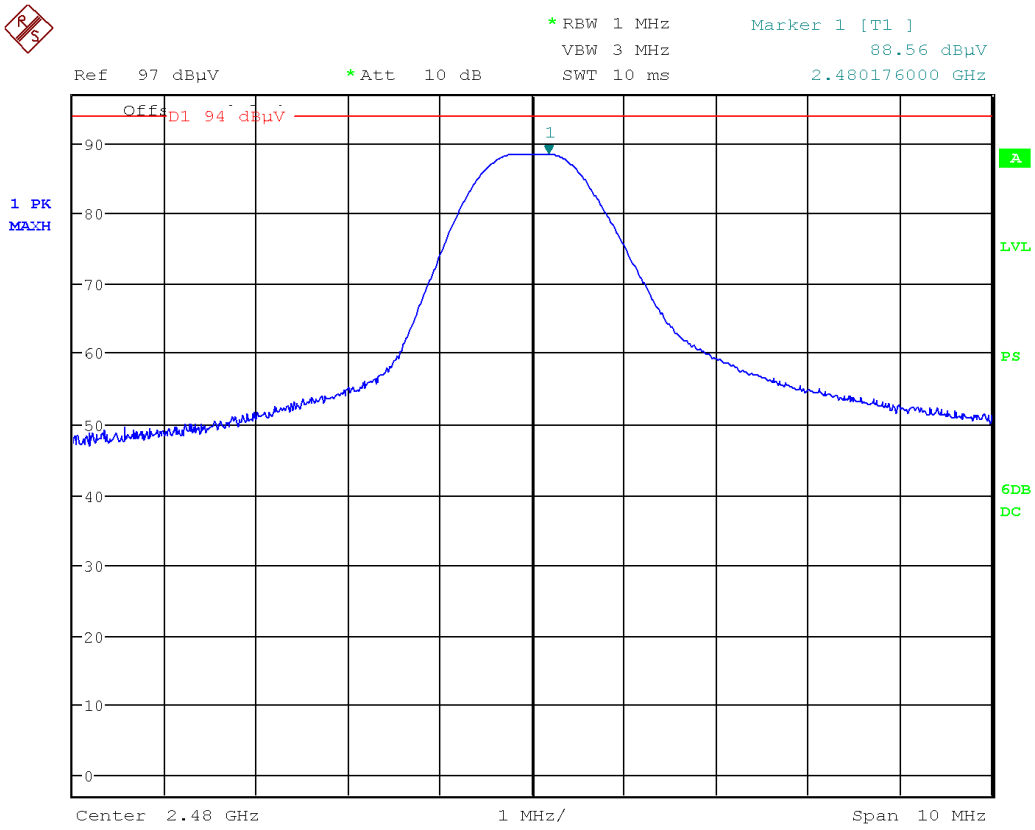
Fundamental Frequency	Field Strength of Fundamental	Field Strength of Harmonics
2400 – 2483.5 MHz	50 mV/m (94 dBuV/m) at 3m	500 uV/m (54 dBuV/m) at 3m

Harmonic emissions falling into restricted frequency bands listed in RSS-Gen 8.10 Table 7 shall meet the general field strength limits specified in RSS-Gen 8.9 Tables 5 & 6, regardless of the limits given above. See also the Transmitter Spurious Radiated Emissions section of this test report.

Results

The EUT passed. Maximum field strength of fundamental was measured in the high channel, with an amplitude of 88.56 dBµV/m. The correction factors were applied as a Reference Level Offset in the spectrum analyzer.

Frequency (MHz)	Antenna Polarization	EUT Axis	Detector	Received Signal (dBµV)	Total Loss Factors (dB)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Test Result
2402	Horizontal	X	Peak	86.30	-0.5	86.80	94	7.20	Pass
2402	Vertical	X	Peak	71.07	-0.5	71.57	94	22.43	Pass
2440	Horizontal	X	Peak	87.51	-0.5	88.01	94	5.99	Pass
2440	Vertical	X	Peak	80.17	-0.5	80.67	94	13.33	Pass
2480	Horizontal	X	Peak	88.06	-0.5	88.56	94	5.44	Pass
2480	Vertical	X	Peak	79.97	-0.5	80.47	94	13.53	Pass



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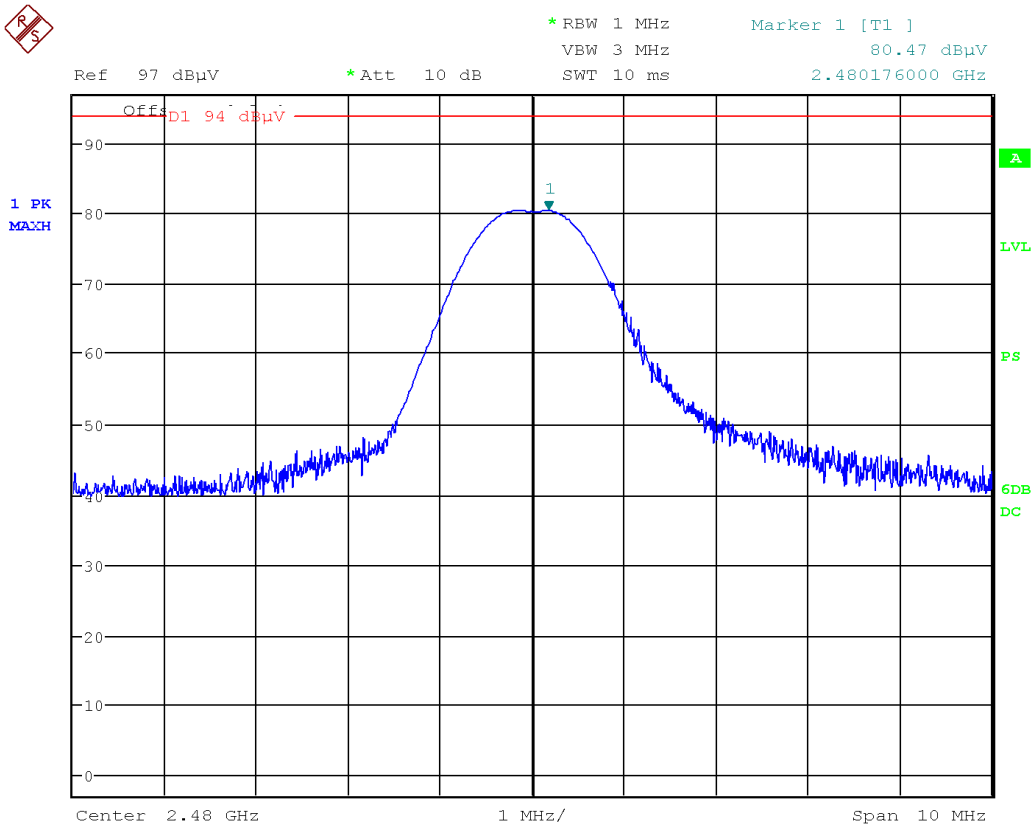
Peak Power – High Channel X-Axis - Horizontal Antenna



Peak Power – High Channel X-Axis - Vertical Antenna

See 'Appendix B – EUT and Test Setup Photos' for photos showing the test set-up.

Test Equipment List

Equipment	Model No.	Manufacturer	Last Calibration Date	Next Calibration Date	Asset #
Spectrum Analyzer	ESU 40	Rohde & Schwarz	Feb. 11, 2022	Feb. 11, 2024	GEMC 233
Horn Antenna 1 – 18 GHz	3117	ETS-Lindgren	Mar. 11, 2022	Mar. 11, 2024	GEMC 340
Pre-Amp 1 – 26.5 GHz	HP 8449B	HP	Mar. 11, 2022	Mar. 11, 2024	GEMC 189
RF Cable >1GHz	EMC2	MegaPhase	NCR	NCR	GEMC 369

Transmitter Spurious Radiated Emissions

Purpose

The purpose of this test is to ensure that the RF energy unintentionally emitted from the EUT does not exceed the limits listed below as defined in the applicable test standard, as measured from a receiving antenna. This helps protect broadcast radio services such as television, FM radio, pagers, cellular telephones, emergency services, and so on, from unwanted interference.

Limits and Method

The method is as defined in ANSI C63.10 Section 6.3.

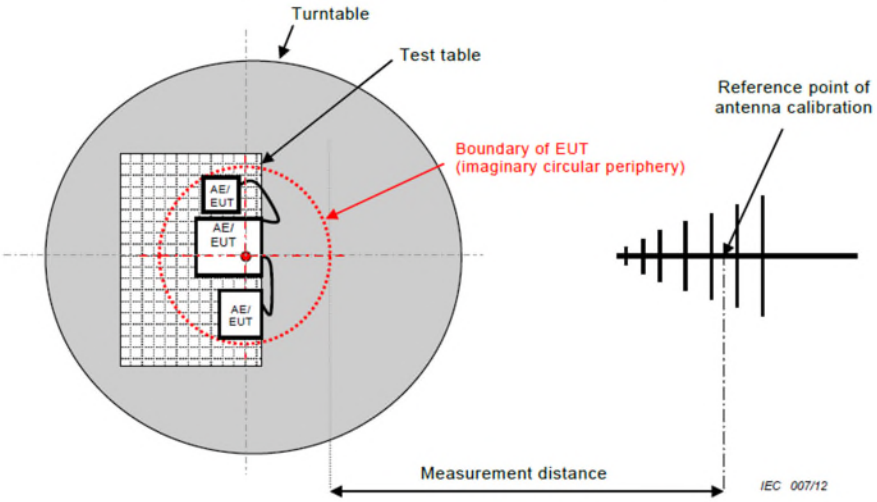
The limits, as defined in FCC Part 15.249(d) and RSS-210 F.1(e) for unintentional radiated emissions, apply for those emissions that fall in the restricted bands defined in FCC Part 15.205(a) and RSS-GEN 8.10 Table 7. These emissions must comply with the radiated emission limits specified in FCC Part 15.209(a) and RSS-GEN 8.9 Tables 5 & 6.

Frequency	Field Strength Limit (µV/m)	Field Strength at 3m (dBµV/m)
0.009 MHz – 0.490 MHz	2400/F(kHz) [a] (at 300m)	128.5 to 93.8[a]
0.490 MHz – 1.705 MHz	24000/F(kHz)[a] (at 30m)	73.8 to 63.0[a]
1.705 MHz – 30 MHz	30[a] (at 30m)	69.5[a]
30 MHz – 88 MHz	100[a] (at 3m)	40.0[a]
88 MHz – 216 MHz	150[a] (at 3m)	43.5[a]
216 MHz – 960 MHz	200[a] (at 3m)	46.0[a]
Above 960 MHz	500[a] (at 3m)	54.0[a]
Above 1000 MHz	500[b] (at 3m)	54.0[b]
Above 1000 MHz	5 mV/m[c] (at 3m)	74.0[c]

[a]Limit is with Quasi Peak detector with bandwidths as defined in CISPR-16-1-1
[b]Limit is with 1 MHz measurement bandwidth and using an Average detector
[c]Limit is with 1 MHz measurement bandwidth and using a Peak detector

Based on ANSI C63.4 Section 4.2, if the Peak detector measurements do not exceed the Quasi-Peak limits, where defined, then the EUT is deemed to have passed the requirements.

Typical Radiated Emissions Setup



Measurement Uncertainty

The expanded measurement uncertainty is calculated in accordance with CISPR 16-4-2 and is ±5.67dB for 30MHz – 1GHz and ±4.58dB for 1GHz – 18GHz with a 'k=2' coverage factor and a 95% confidence level.

Preliminary Graphs

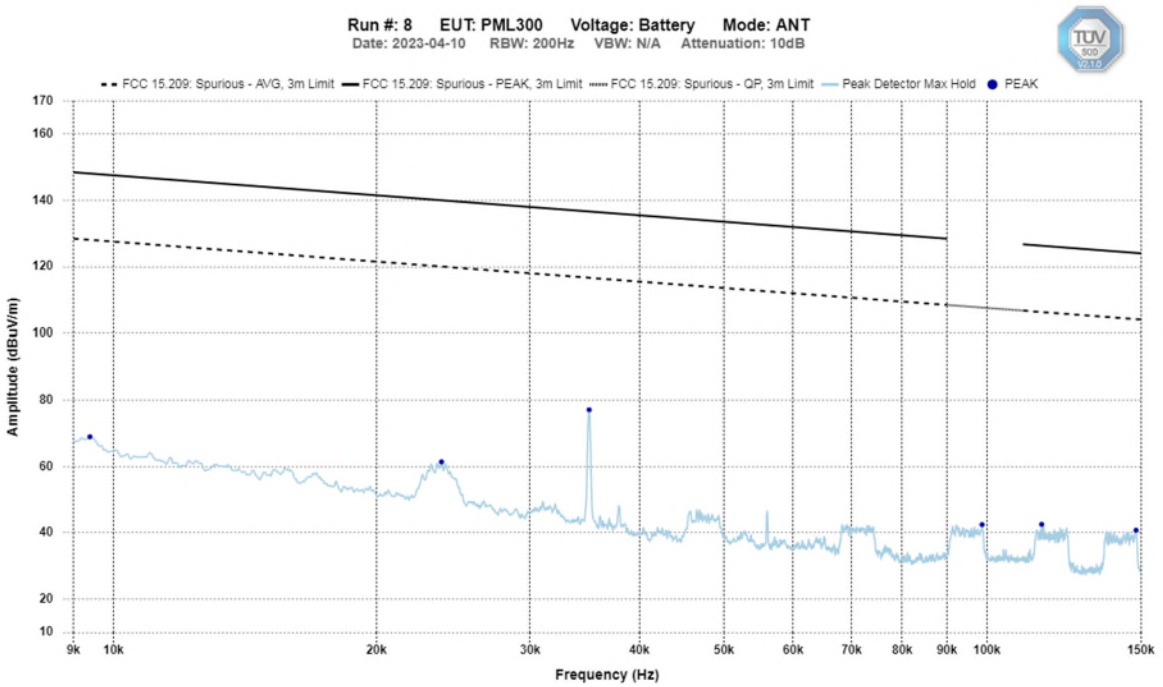
The graphs shown below are maximized peak measurement graphs measured with a resolution bandwidth greater than or equal to the final required detector over a full 0-360°. This peaking process is done as a worst case measurement and enables the detection of frequencies of concern for final measurement. For final measurements with the appropriate detector, where applicable, please refer to the tables under Final Measurements.

In accordance with FCC Part 15, Subpart A, Section 15.33, the device was scanned to the 10^{th} harmonic (a minimum of 24.835 GHz).

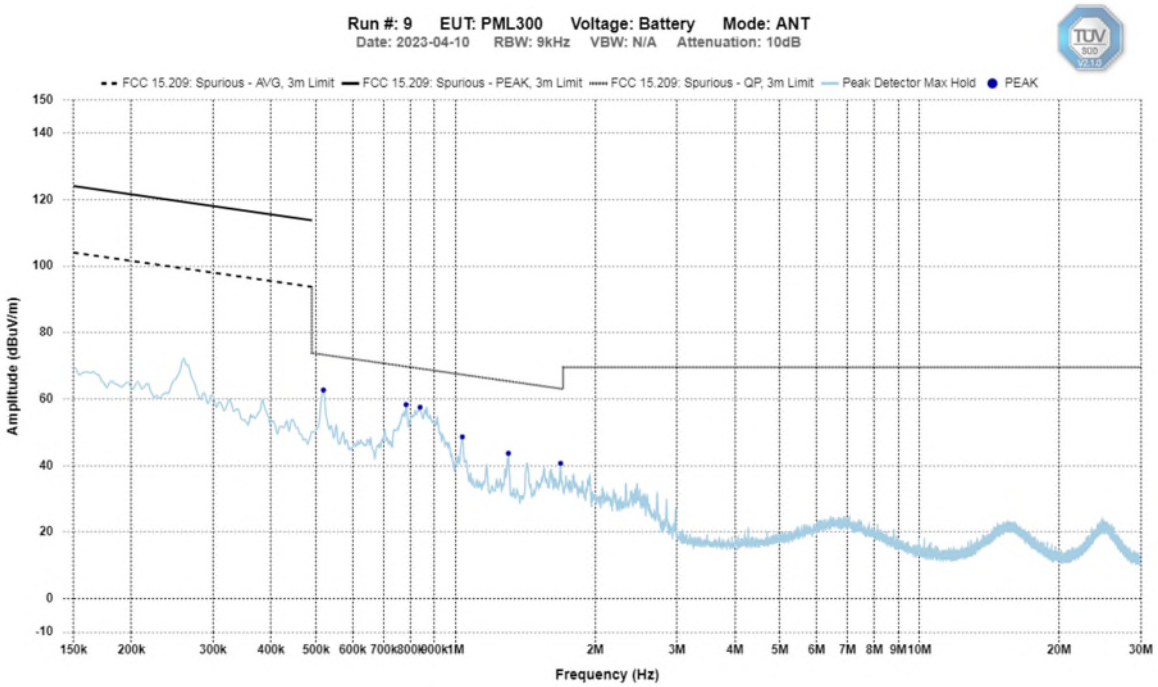
Devices scanned may be scanned at alternate test distances and in accordance with FCC Part 15, Subpart A, Section 15.31, an extrapolation factor of 20 dB/decade was used above 30 MHz and 40 dB/decade below 30 MHz. For example for 1 meter measurements, an extrapolation factor 9.5 dB from 20 Log (1m / 3m) is applied.

Peak output power was checked in three orthogonal axes and the worst case was used to measure low, middle and high channels. The worst case was used for the spurious emissions which was on the high channel and in the X-axis.

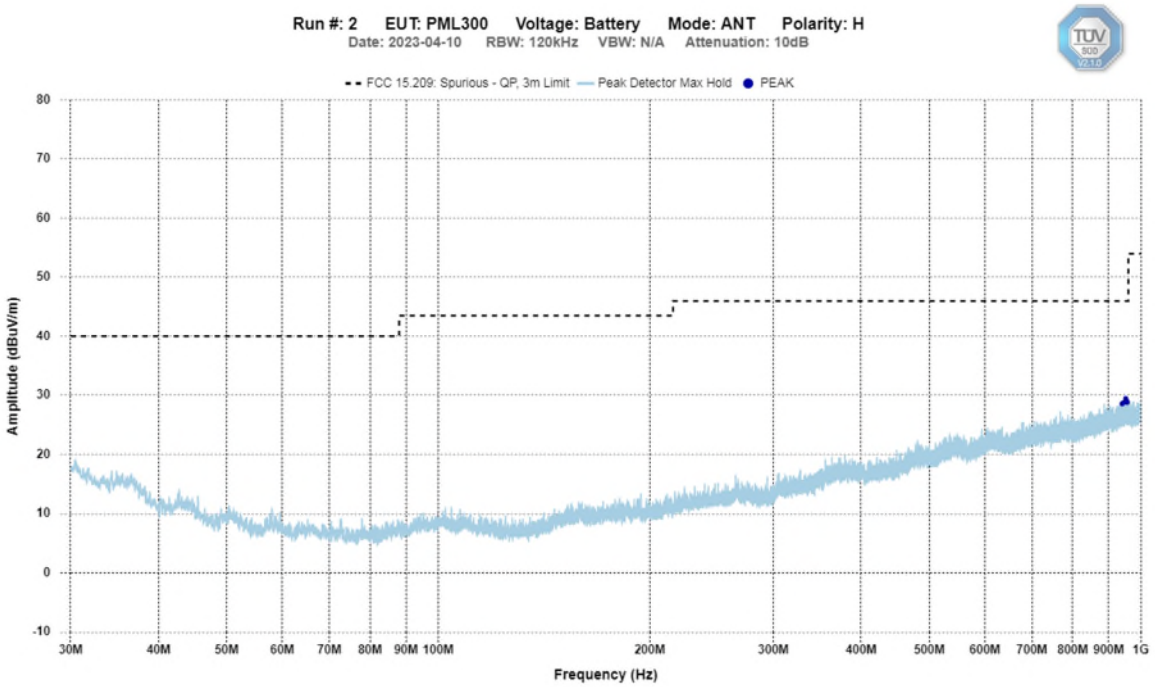
Spurious Emissions – PML300



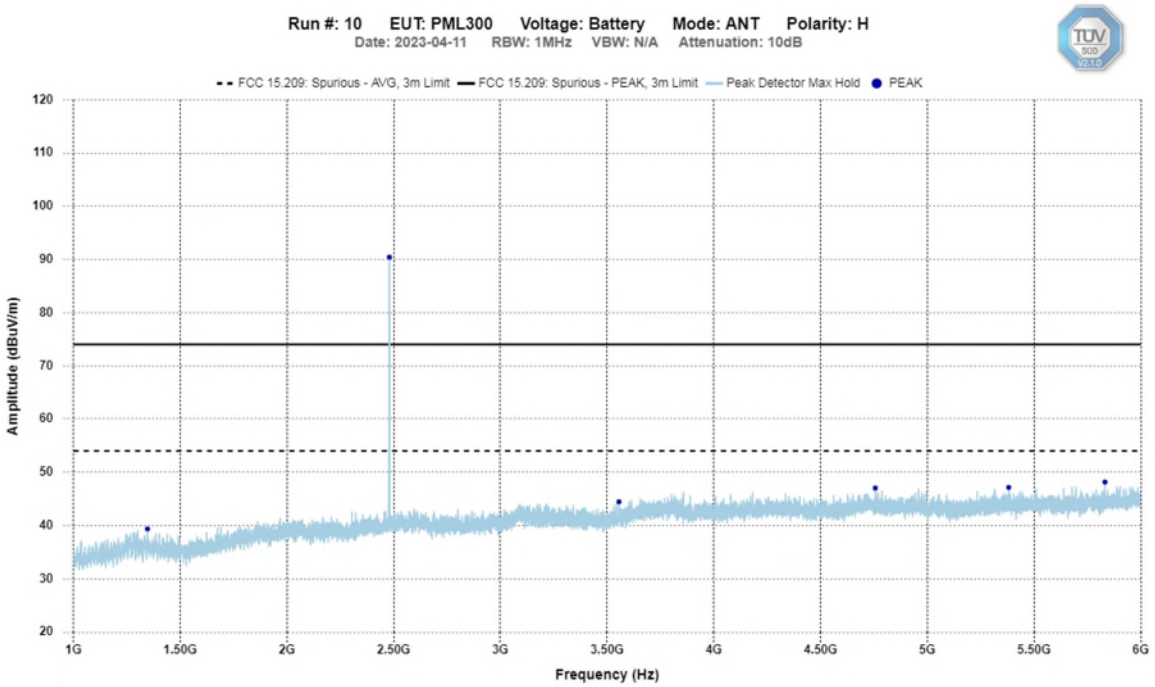
High Channel
9 kHz – 150 kHz
Peak Emission Graph



High Channel
150 kHz – 30 MHz
Peak Emission Graph

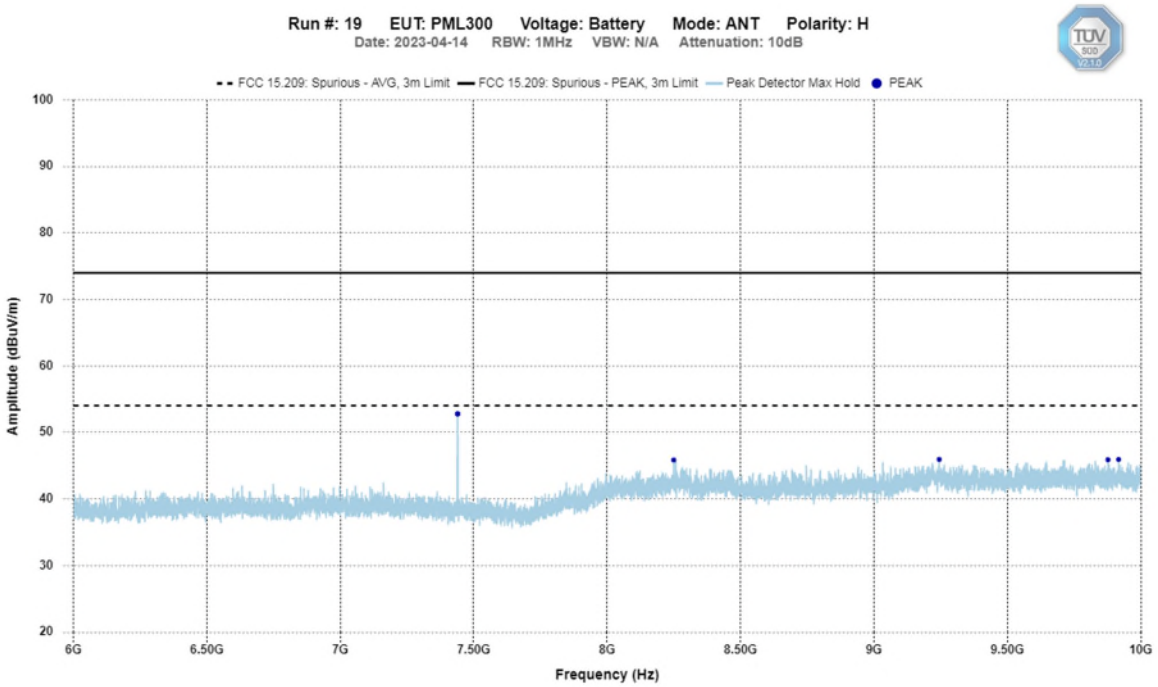


High Channel – 30 MHz – 1 GHz
Horizontal - Peak Emission Graph

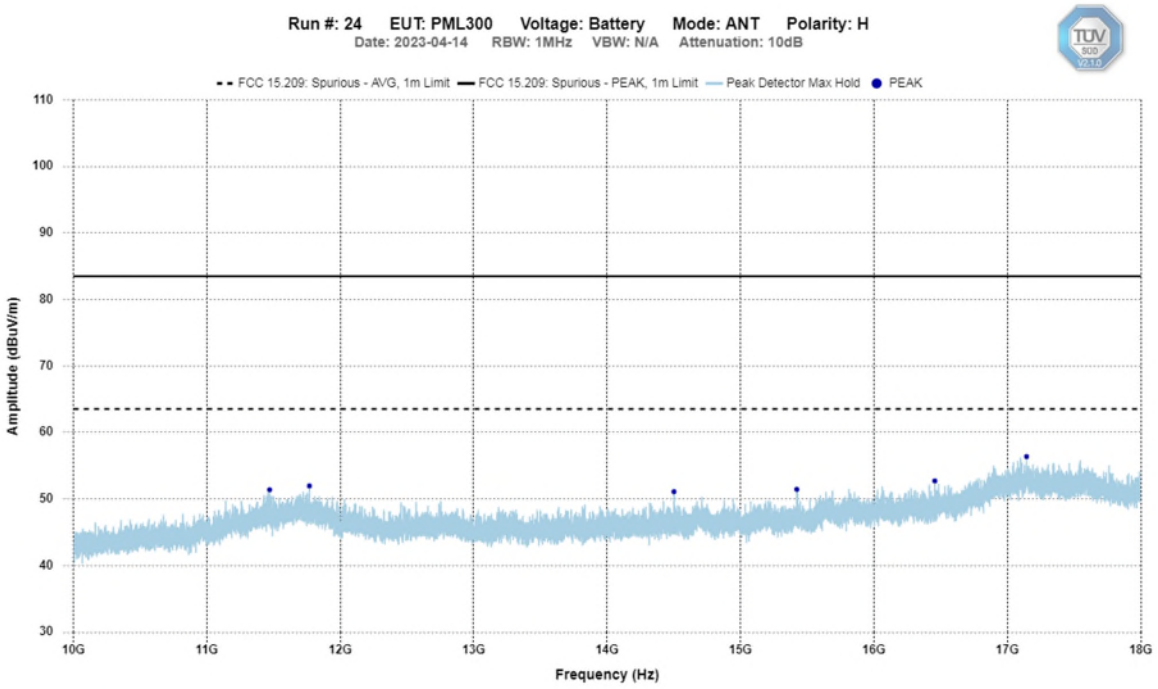


High Channel – 1 GHz – 6 GHz
Horizontal - Peak Emission Graph

NOTE: The emissions at 2.4GHz are the fundamental of the intentional transmitter and therefore are not considered for final measurements of spurious emissions.

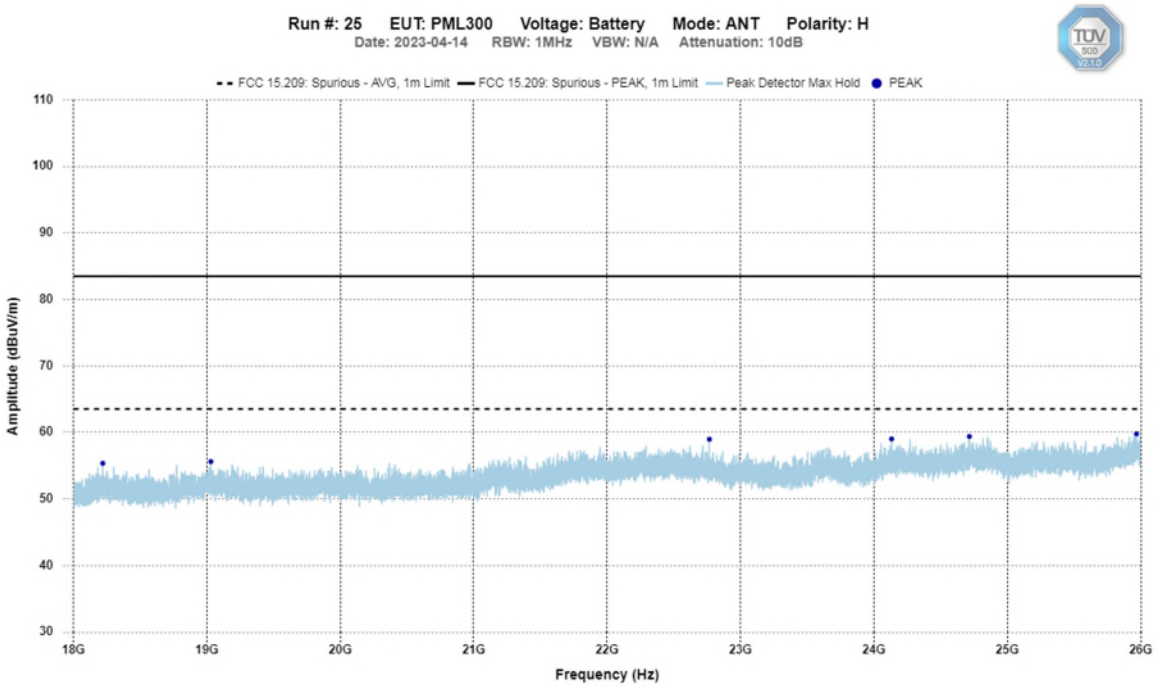


High Channel – 6 GHz – 10 GHz
Horizontal - Peak Emission Graph



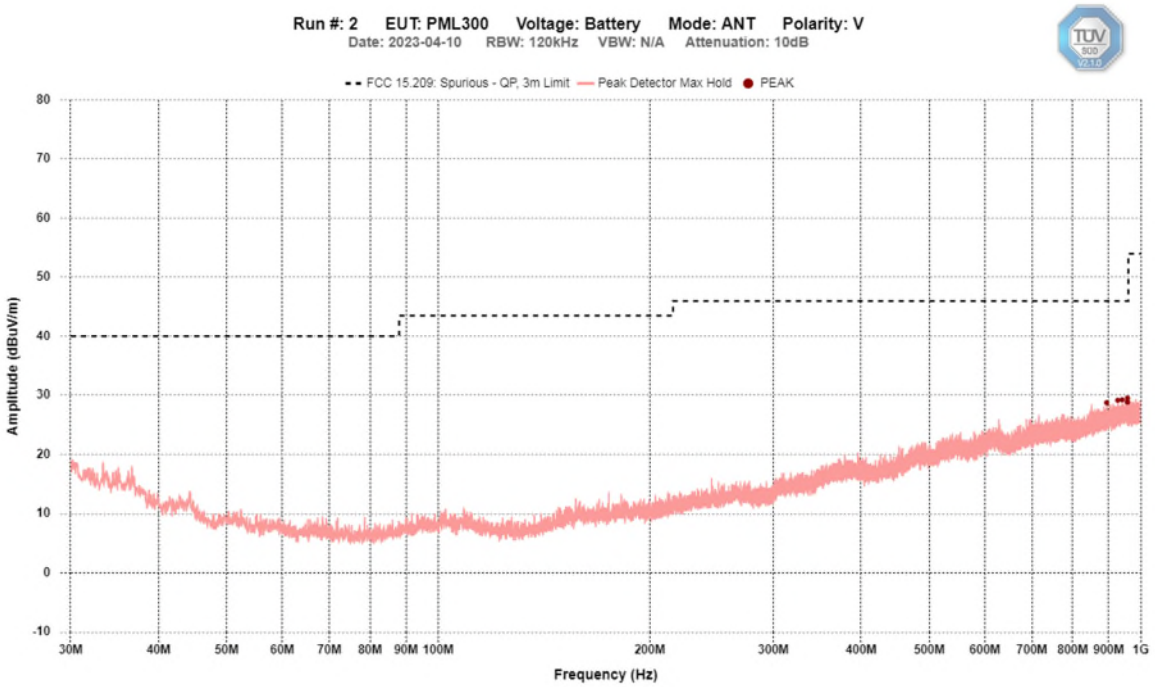
High Channel – 10 GHz – 18 GHz
Horizontal - Peak Emission Graph

Plot was taken at a 1 meter distance. All emissions were noise floor of measurement instrument. No emissions were found in this frequency range.

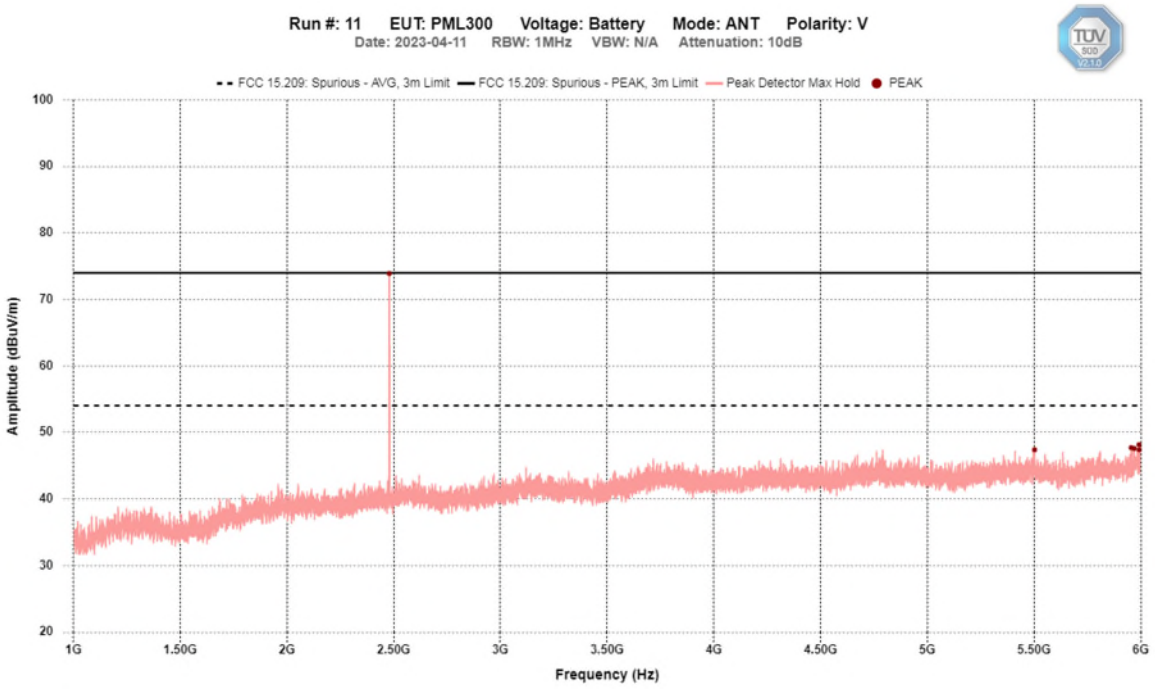


High Channel – 18 GHz – 26 GHz
Horizontal - Peak Emission Graph

Plot was taken at a 1 meter distance. All emissions were noise floor of measurement instrument. No emissions were found in this frequency range.

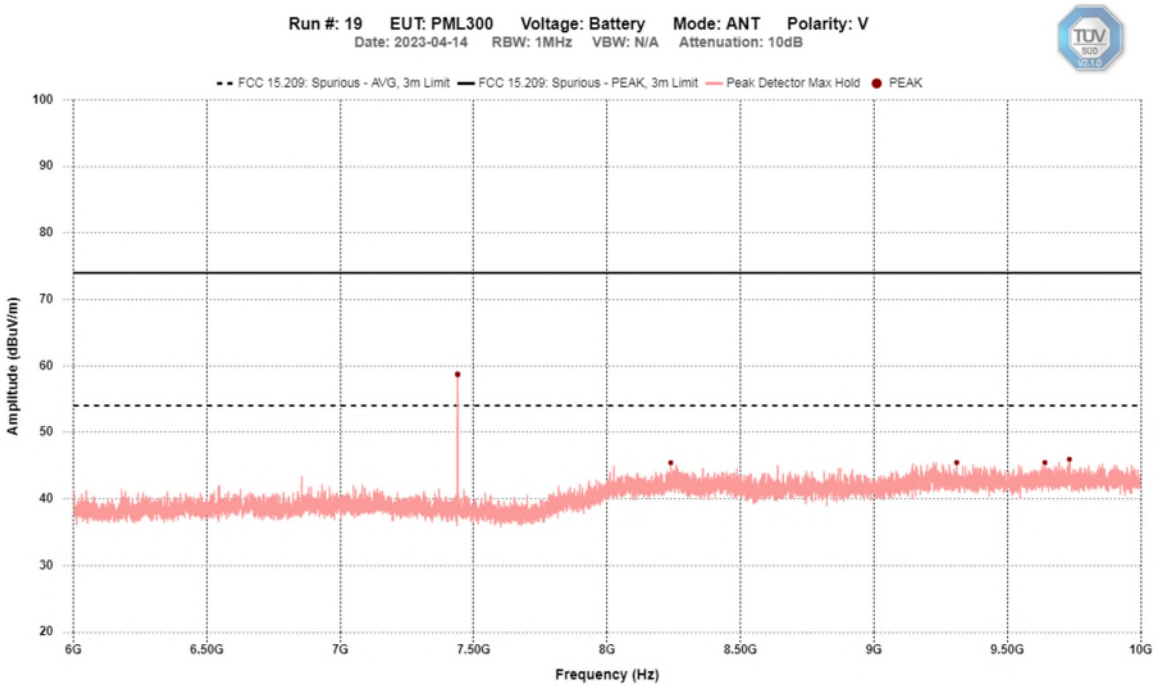


High Channel – 30 MHz – 1 GHz
Vertical - Peak Emission Graph

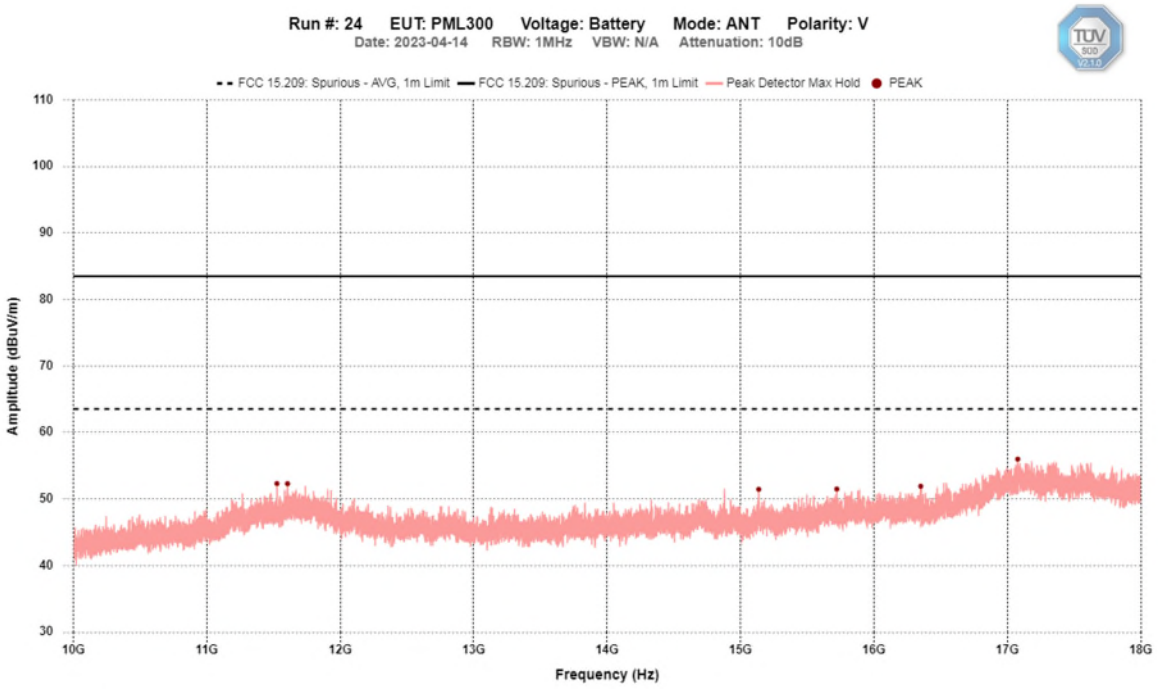


High Channel – 1 GHz – 6 GHz
Vertical - Peak Emission Graph

NOTE: The emissions at 2.4GHz are the fundamental of the intentional transmitter and therefore are not considered for final measurements of spurious emissions.

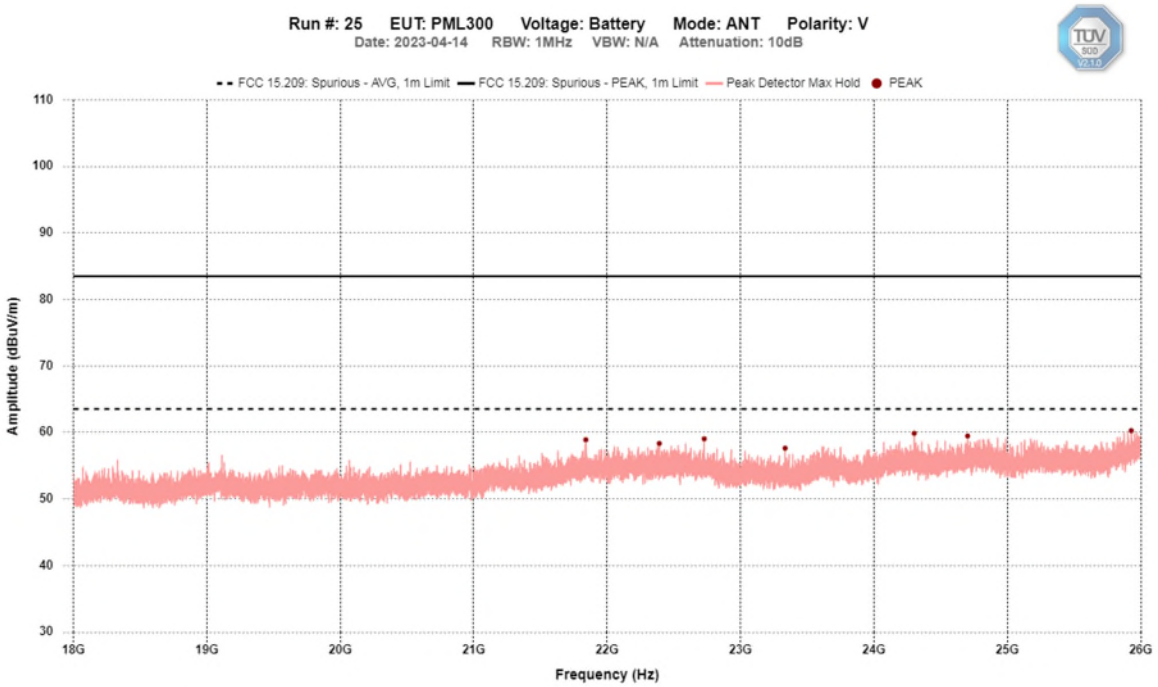


High Channel – 6 GHz – 10 GHz
Vertical - Peak Emission Graph



High Channel – 10 GHz – 18 GHz
Vertical - Peak Emission Graph

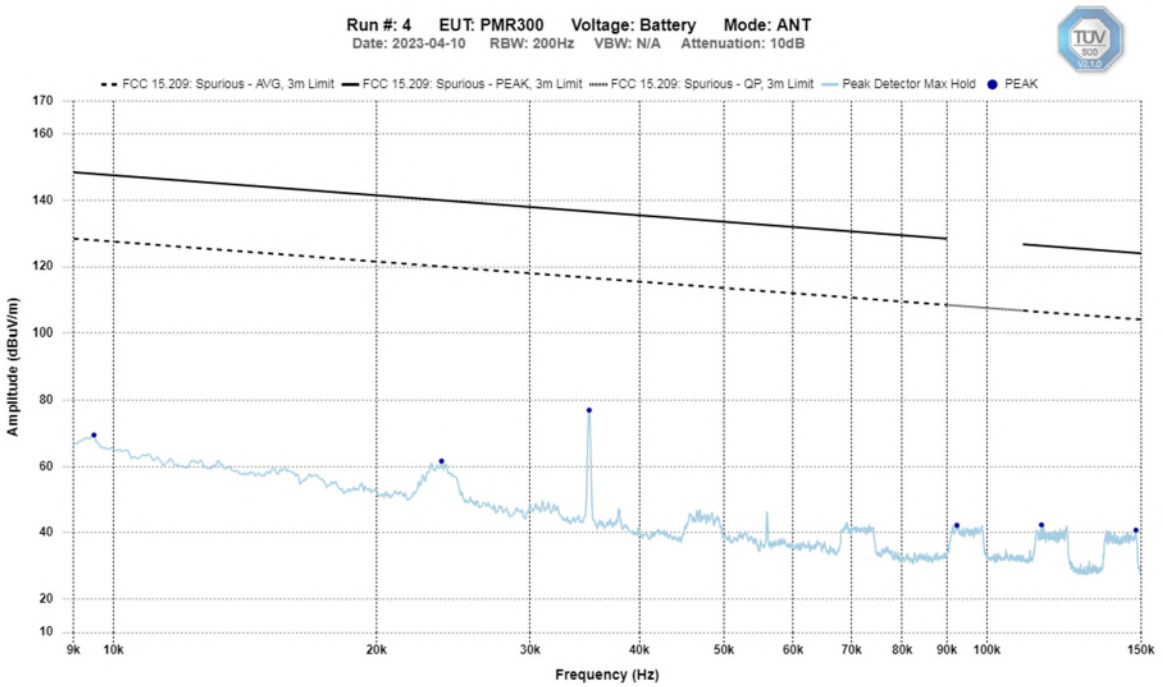
Plot was taken at a 1 meter distance. All emissions were noise floor of measurement instrument. No emissions were found in this frequency range.



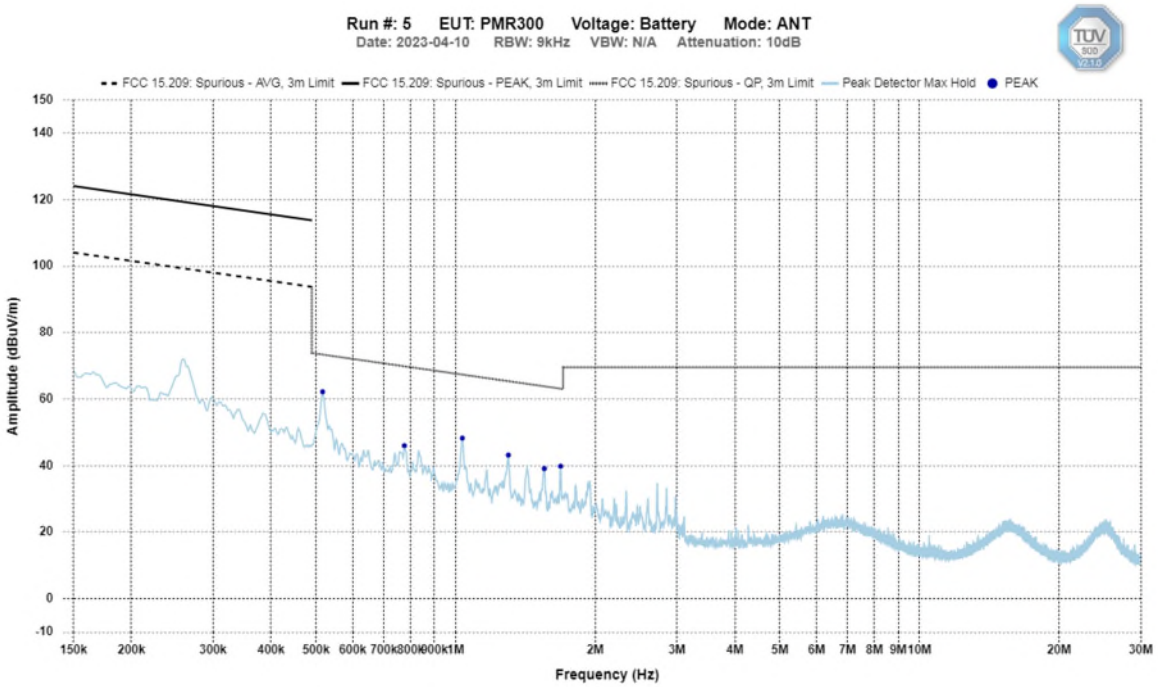
High Channel – 18 GHz – 26 GHz
Vertical - Peak Emission Graph

Plot was taken at a 1 meter distance. All emissions were noise floor of measurement instrument. No emissions were found in this frequency range.

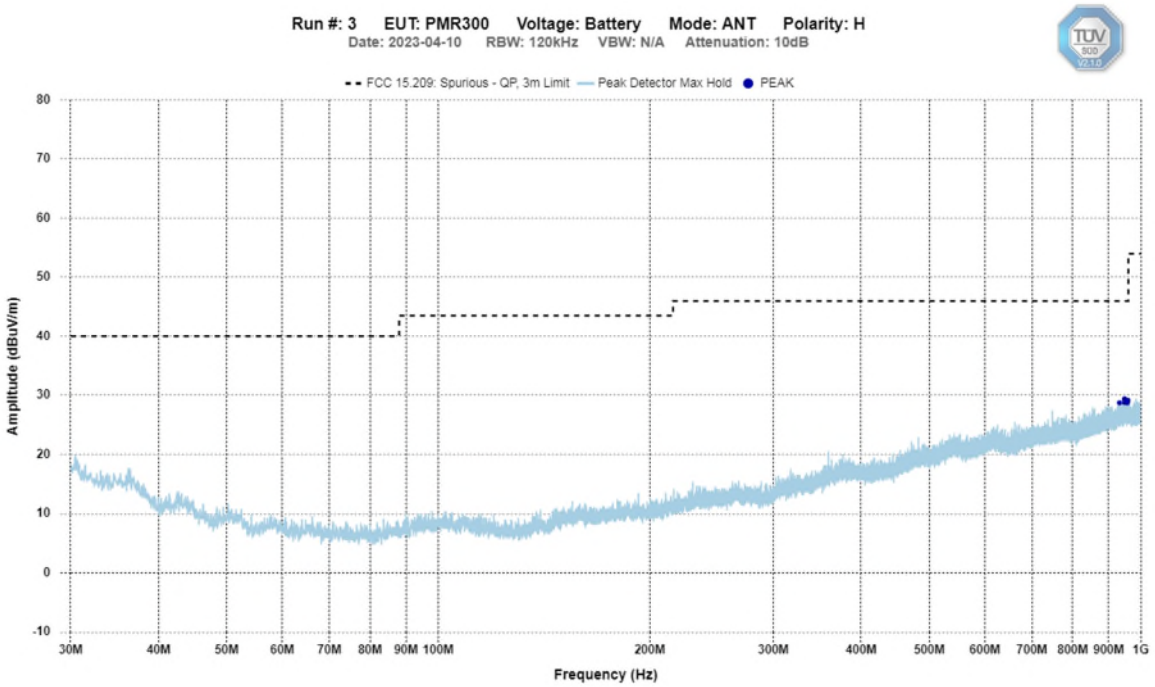
Spurious Emissions – PMR300



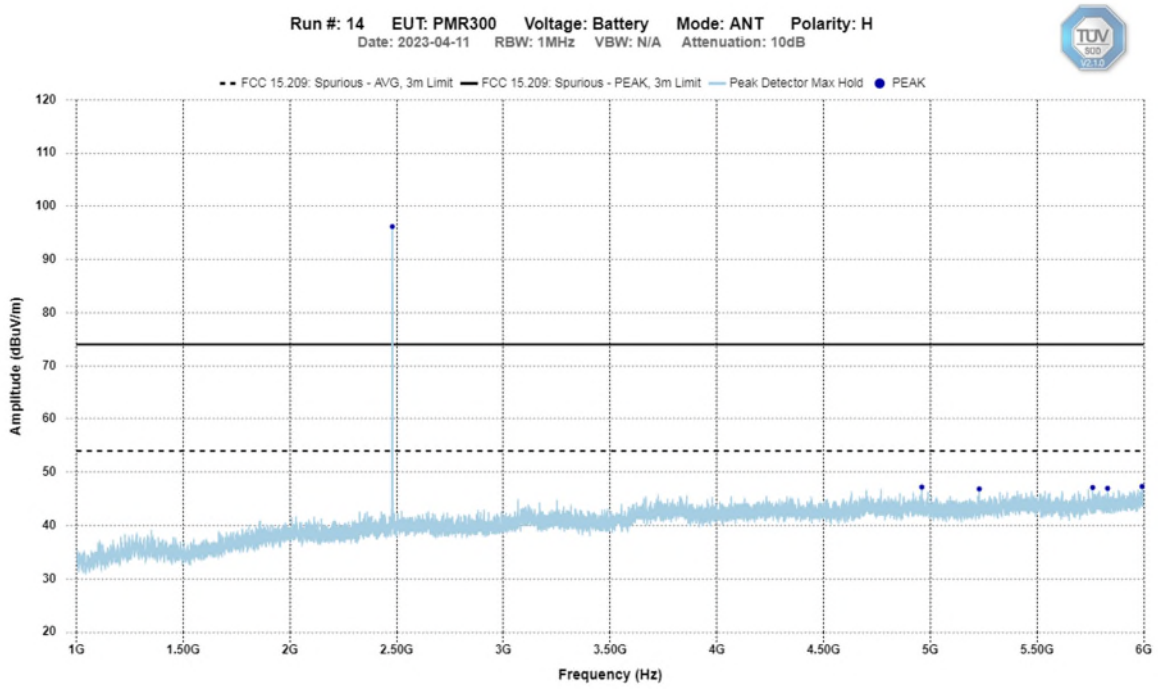
High Channel
9 kHz – 150 kHz
Peak Emission Graph



High Channel
150 kHz – 30 MHz
Peak Emission Graph

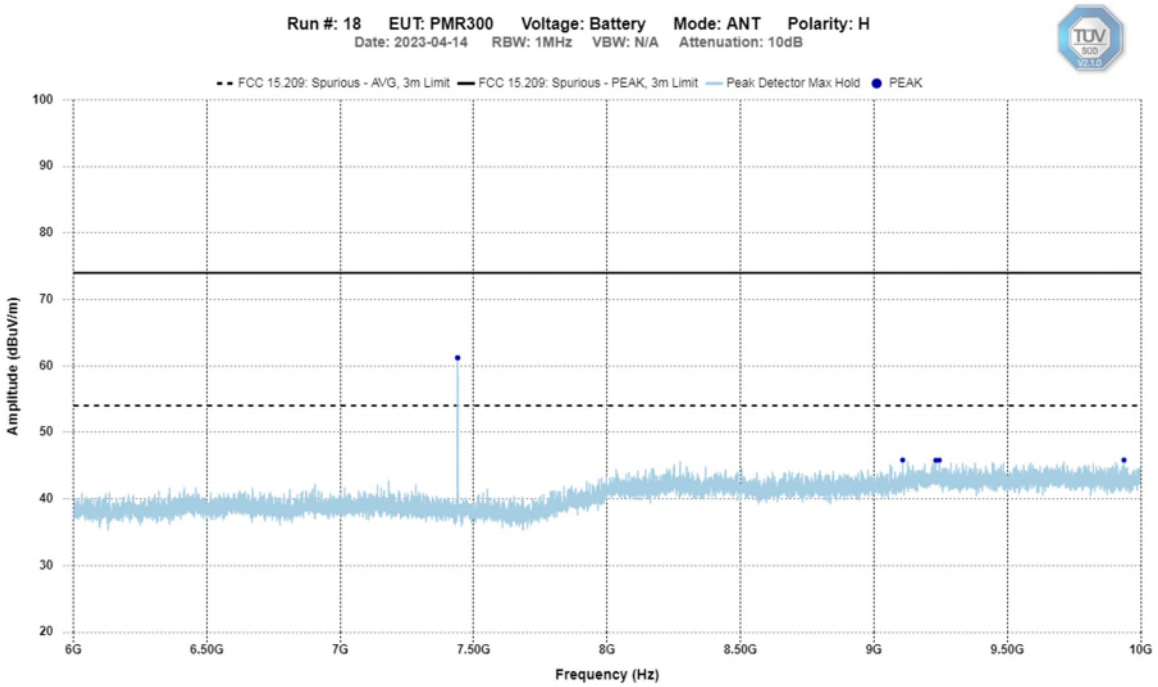


High Channel – 30 MHz – 1 GHz
Horizontal - Peak Emission Graph

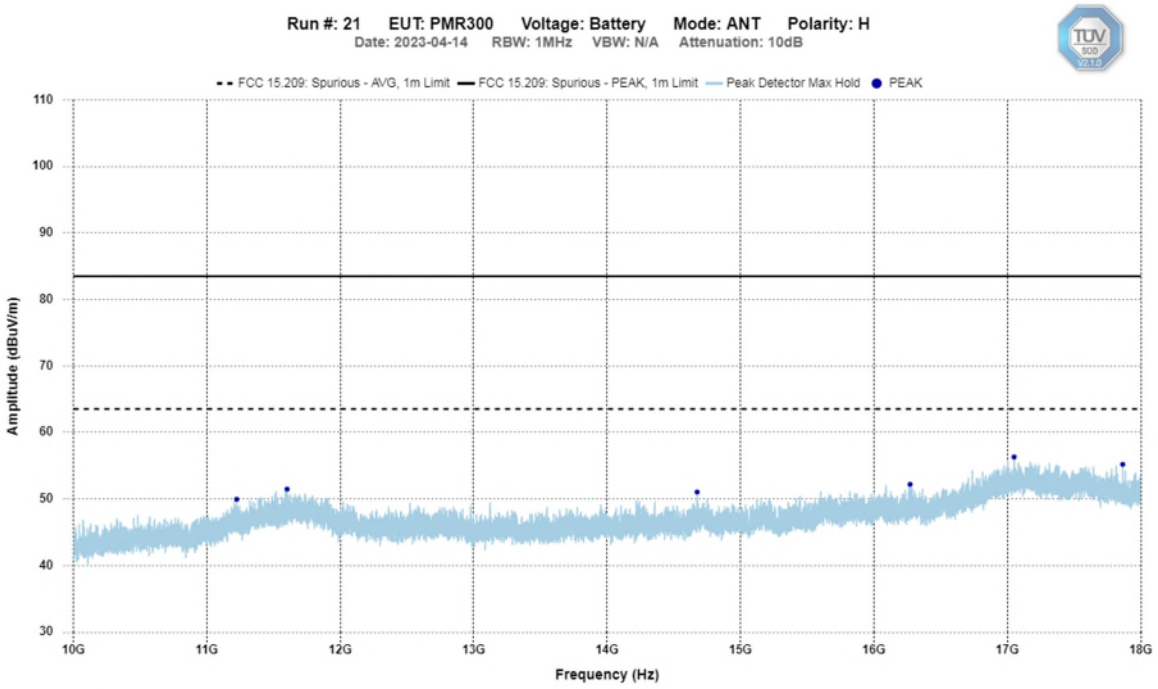


High Channel – 1 GHz – 6 GHz
Horizontal - Peak Emission Graph

NOTE: The emissions at 2.4GHz are the fundamental of the intentional transmitter and therefore are not considered for final measurements of spurious emissions.

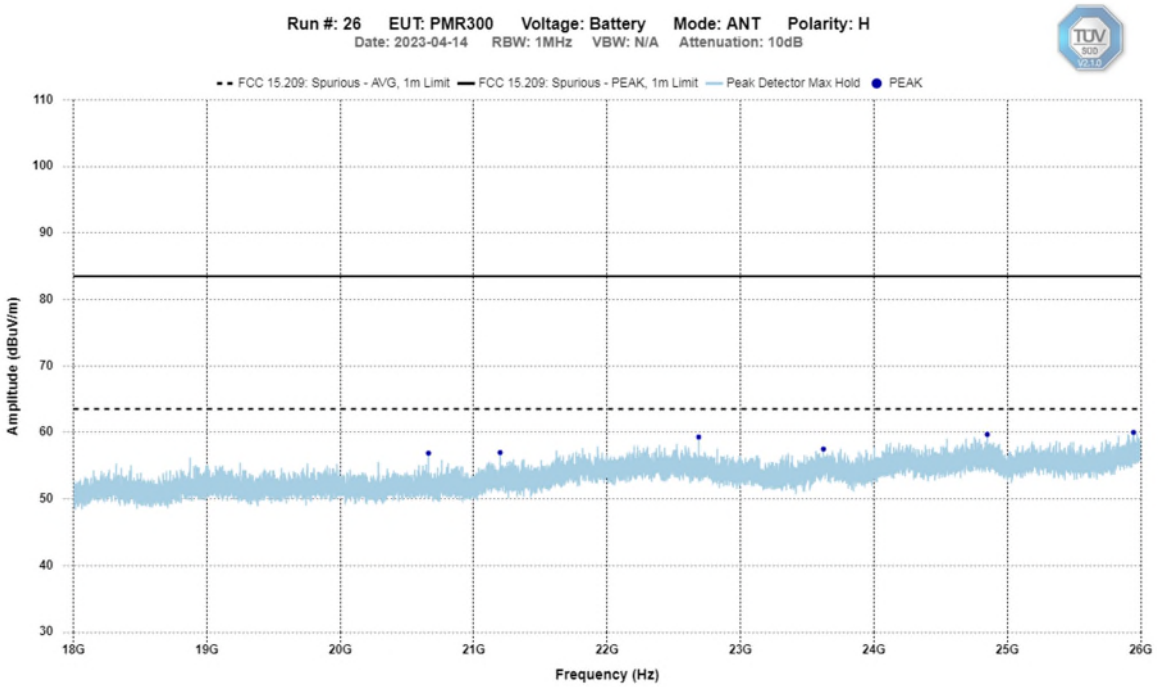


High Channel – 6 GHz – 10 GHz
Horizontal - Peak Emission Graph



High Channel – 10 GHz – 18 GHz
Horizontal - Peak Emission Graph

Plot was taken at a 1 meter distance. All emissions were noise floor of measurement instrument. No emissions were found in this frequency range.



High Channel – 18 GHz – 26 GHz
Horizontal - Peak Emission Graph

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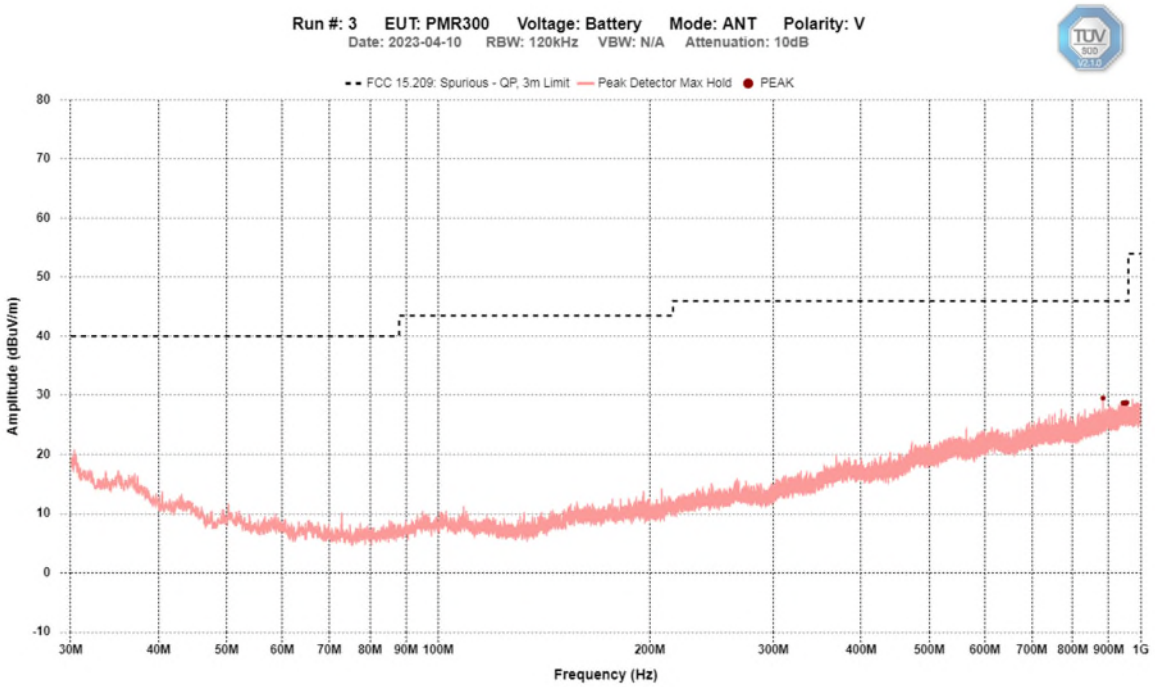
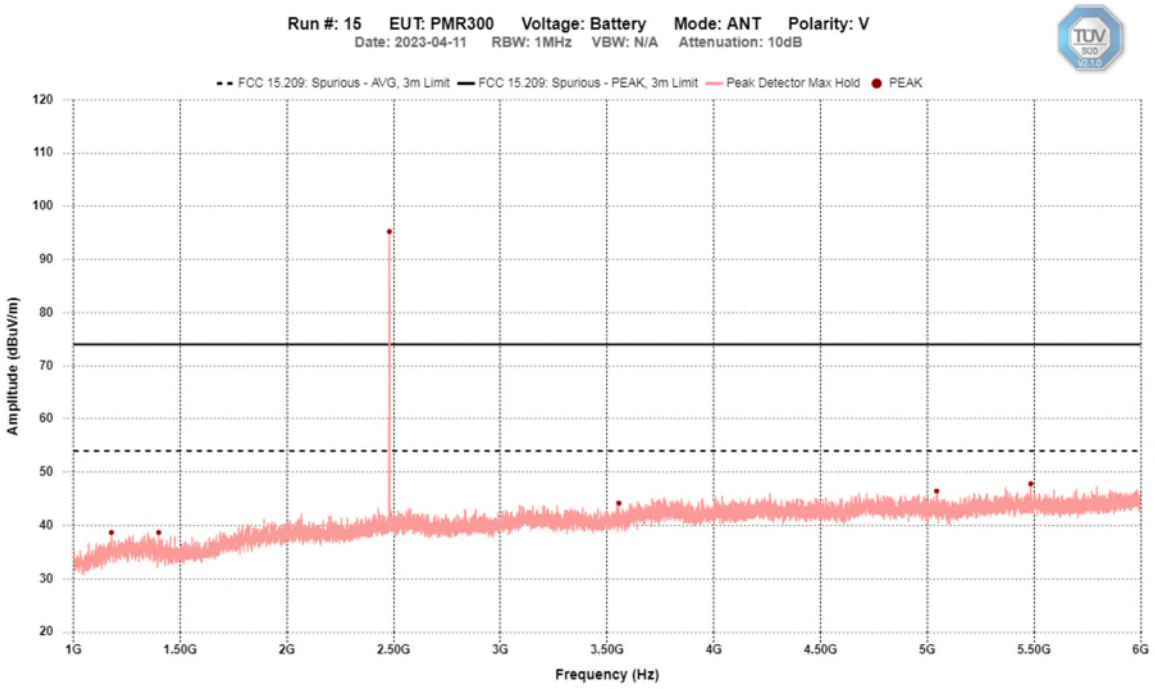
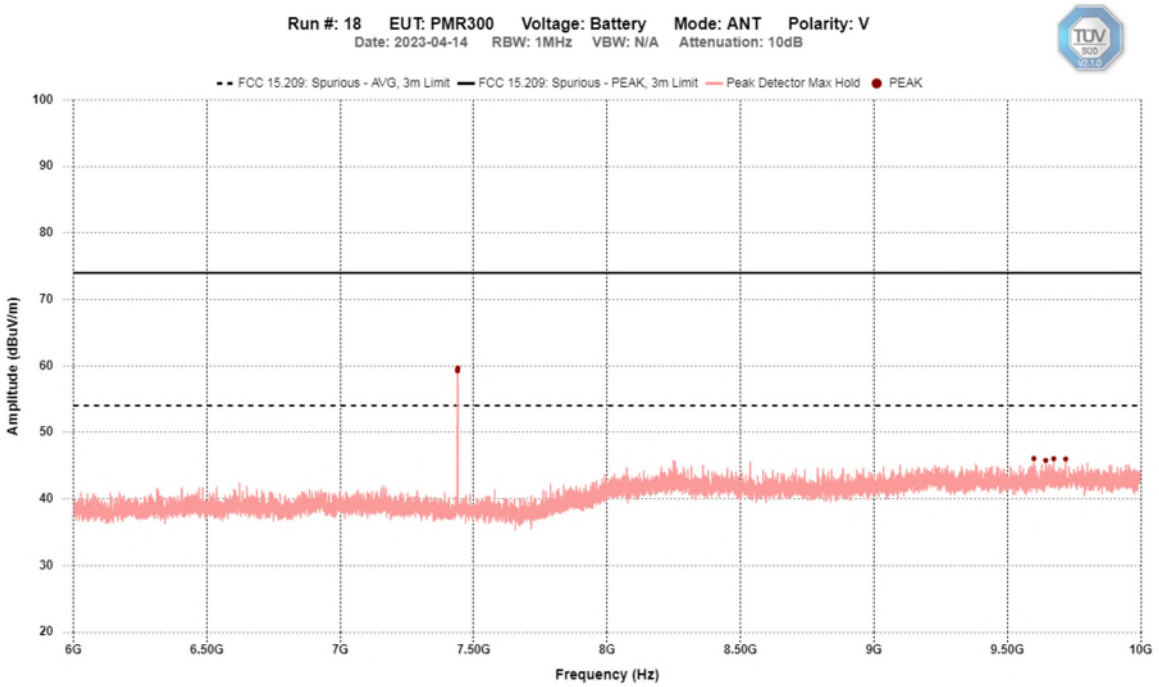


High Channel – 30 MHz – 1 GHz
Vertical - Peak Emission Graph

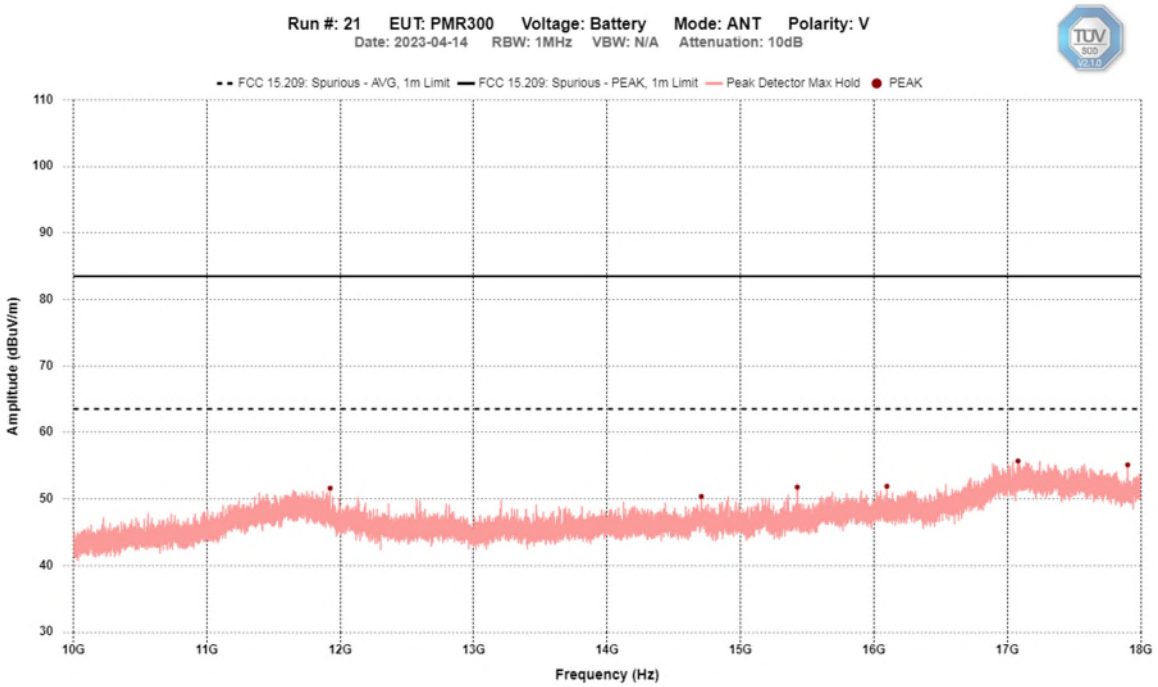


High Channel – 1 GHz – 6 GHz
Vertical - Peak Emission Graph

NOTE: The emissions at 2.4GHz are the fundamental of the intentional transmitter and therefore are not considered for final measurements of spurious emissions.

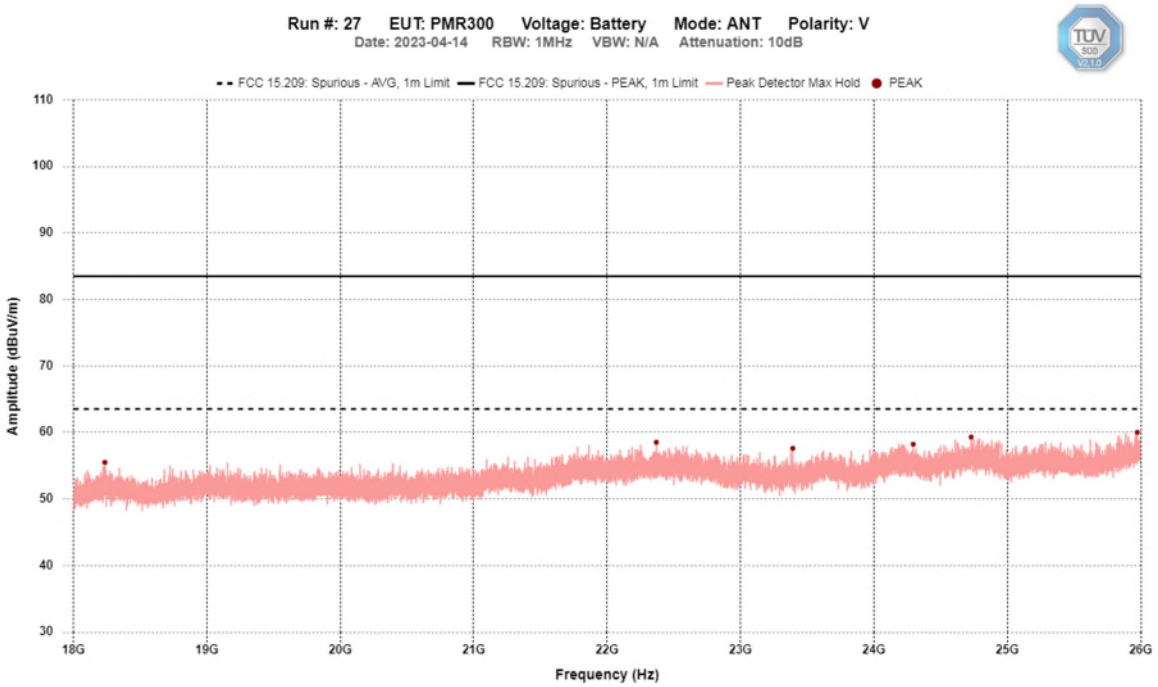


High Channel – 6 GHz – 10 GHz
Vertical - Peak Emission Graph



High Channel – 10 GHz – 18 GHz
Vertical - Peak Emission Graph

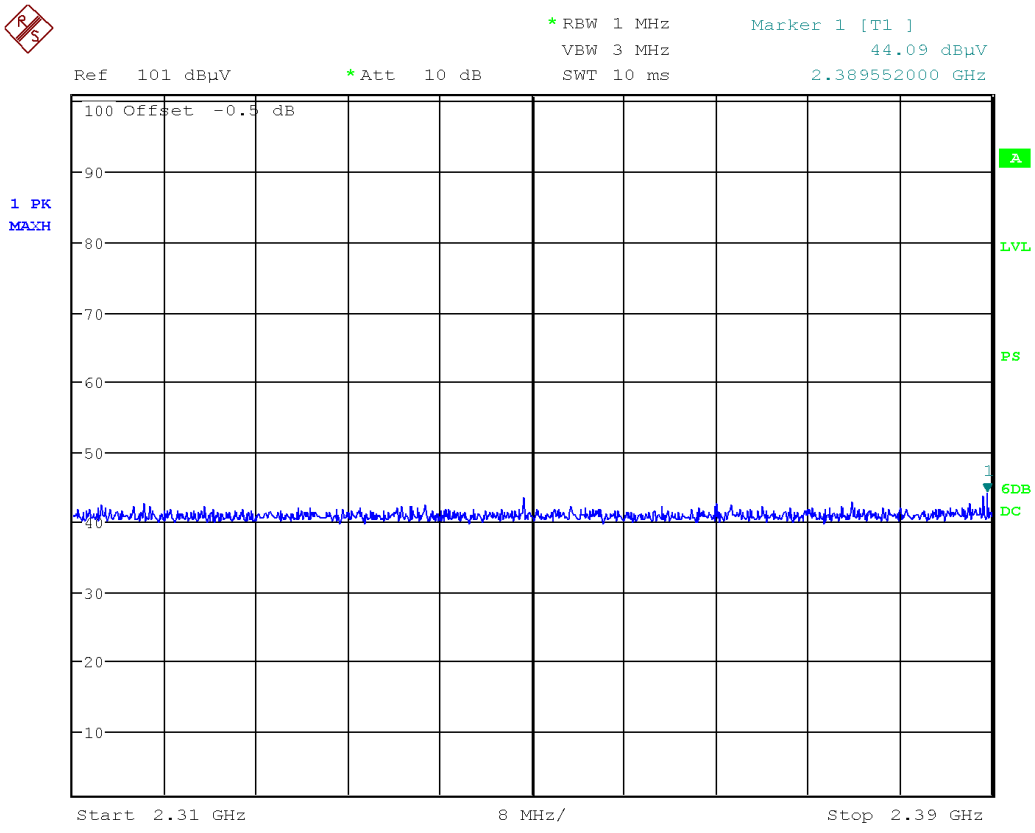
Plot was taken at a 1 meter distance. All emissions were noise floor of measurement instrument. No emissions were found in this frequency range.



High Channel – 18 GHz – 26 GHz
Vertical - Peak Emission Graph

Plot was taken at a 1 meter distance. All emissions were noise floor of measurement instrument. No emissions were found in this frequency range.

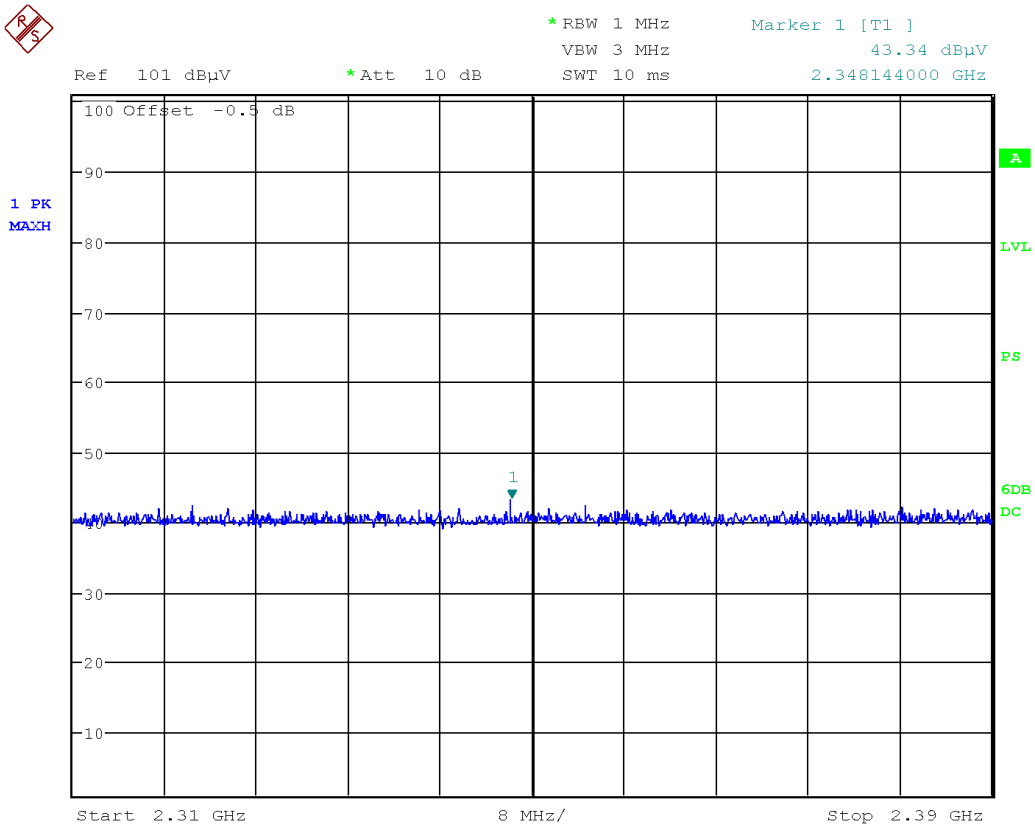
Band Edges – PML300



Date: 11.APR.2023 12:10:03

Band Edge – Low Channel
Horizontal - Peak Emission

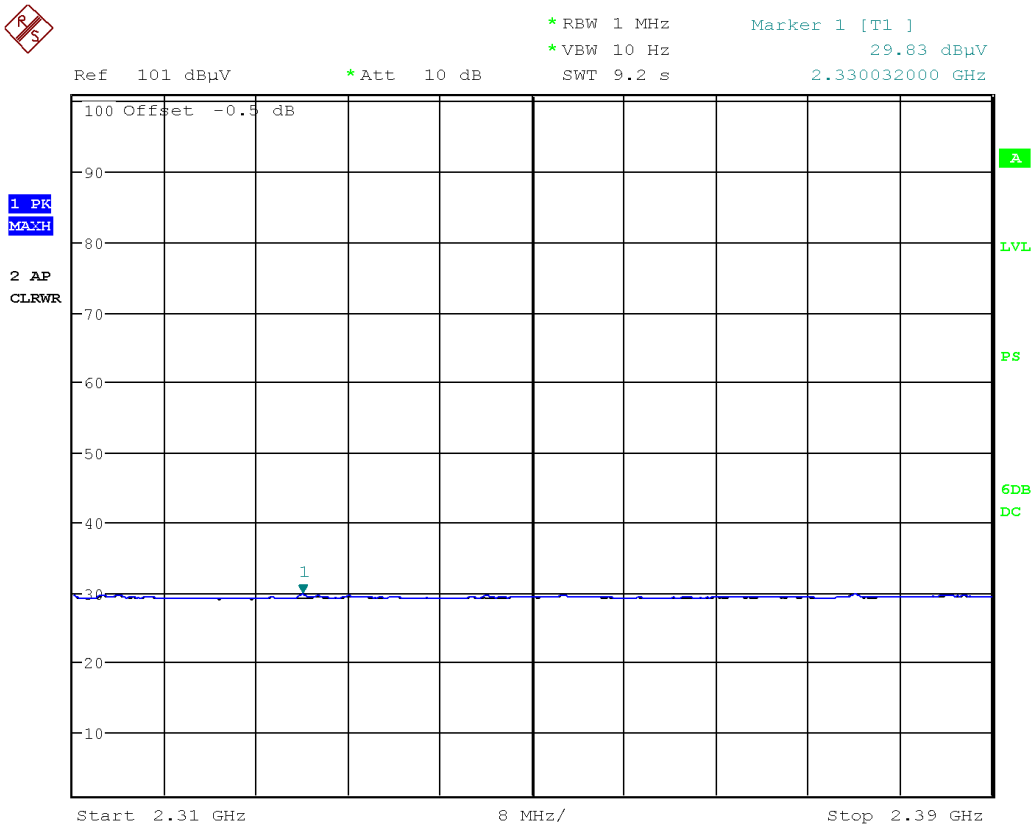
Note: Restricted band Band Edge plot was taken at a 3m measurement distance. The marker shows the raw value. See the Final Measurements and Results section below for correct values.



Date: 11.APR.2023 12:12:01

Band Edge – Low Channel
Vertical - Peak Emission

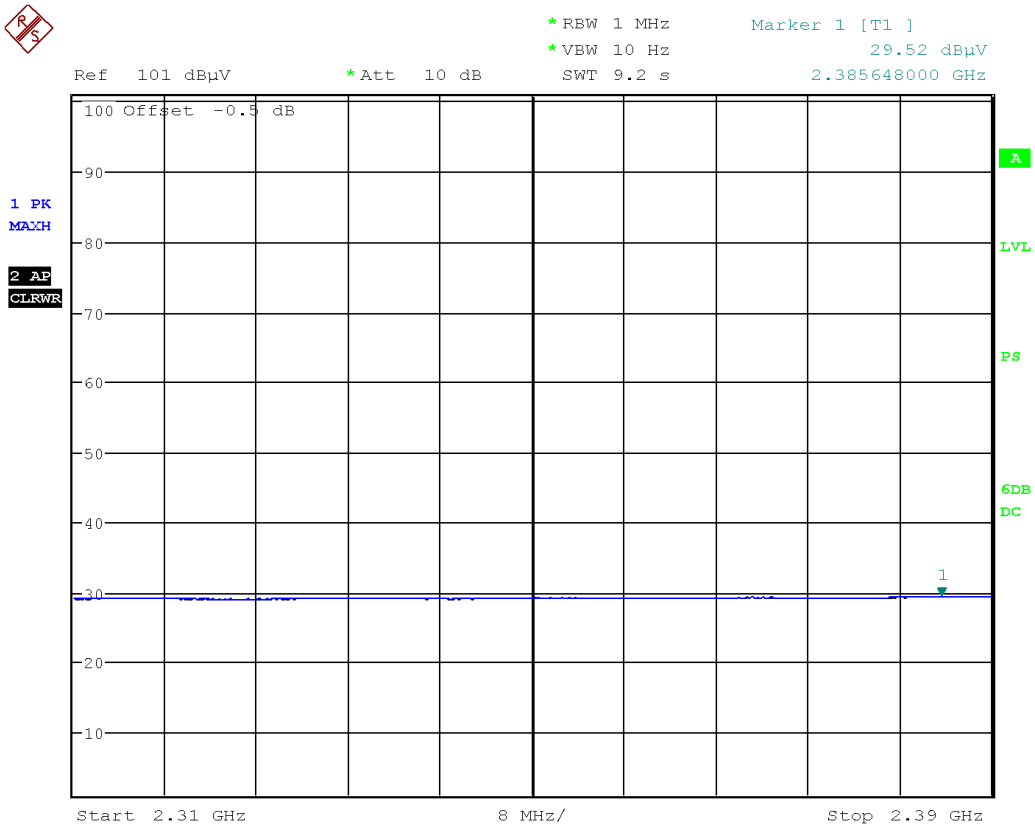
Note: Restricted band Band Edge plot was taken at a 3m measurement distance. The marker shows the raw value. See the Final Measurements and Results section below for correct values.



Date: 11.APR.2023 12:10:54

Band Edge – Low Channel
Horizontal - Average Emission

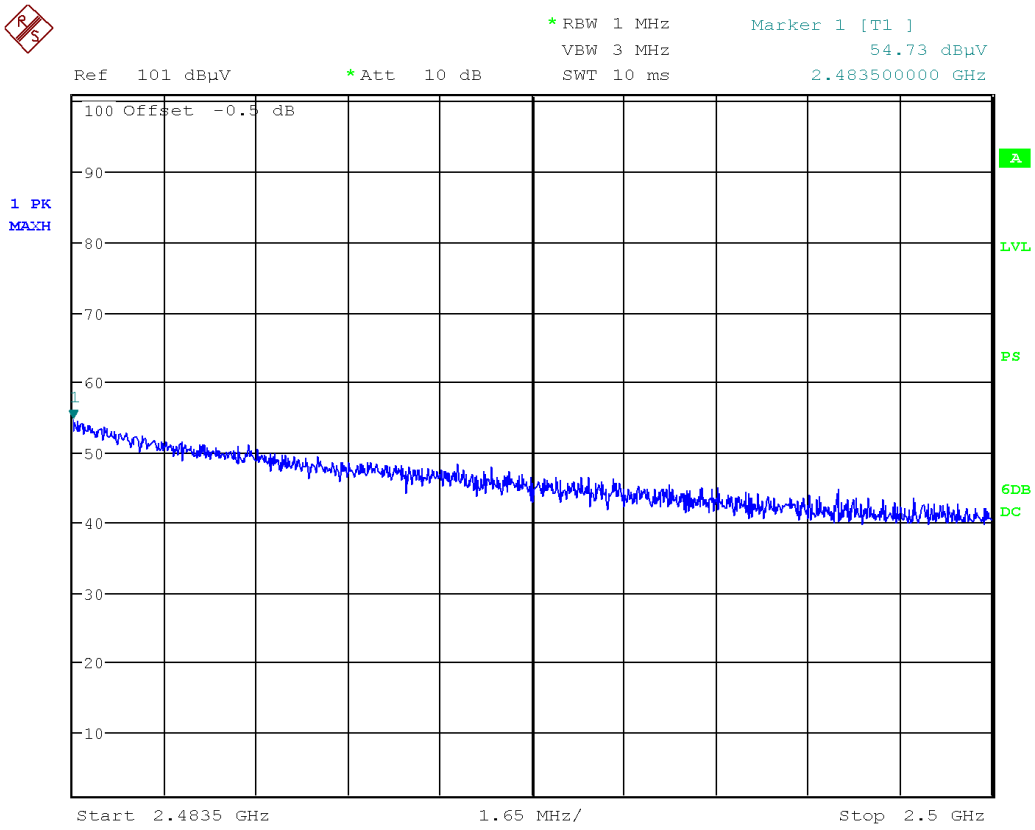
Note: Restricted band Band Edge plot was taken at a 3m measurement distance. The marker shows the raw value. See the Final Measurements and Results section below for correct values.



Date: 11.APR.2023 12:12:42

Band Edge – Low Channel
Vertical – Average Emission

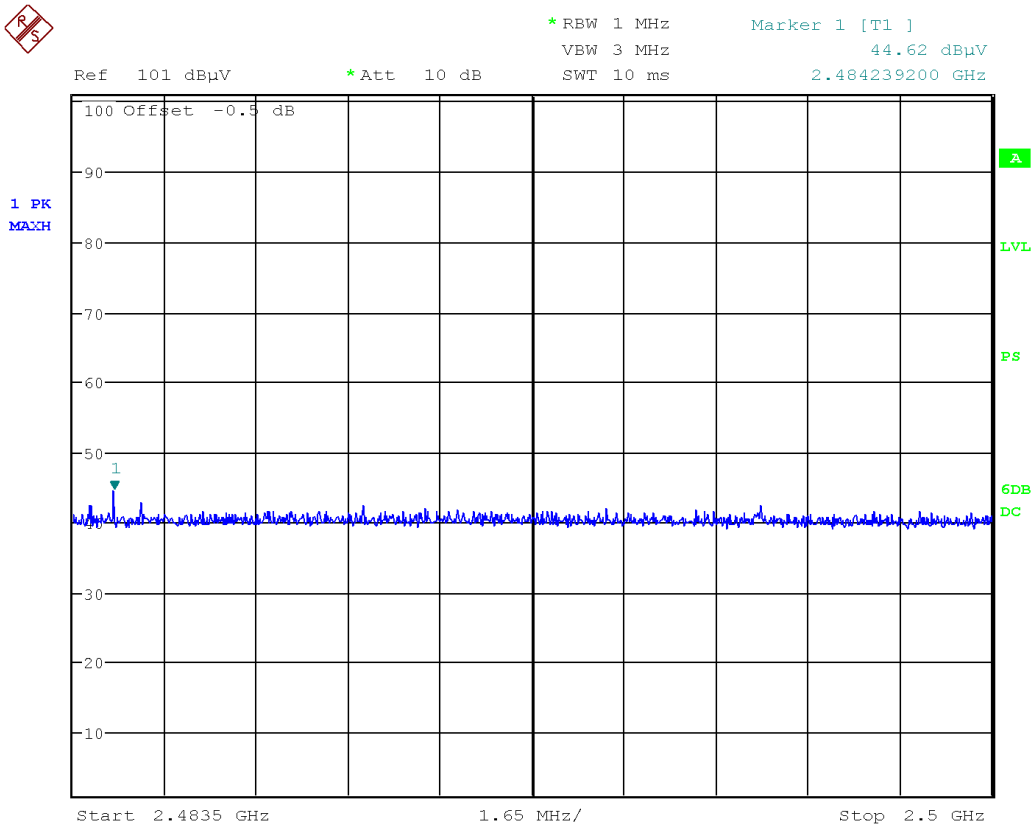
Note: Restricted band Band Edge plot was taken at a 3m measurement distance. The marker shows the raw value. See the Final Measurements and Results section below for correct values.



Date: 11.APR.2023 12:18:24

Band Edge – High Channel
Horizontal - Peak Emission

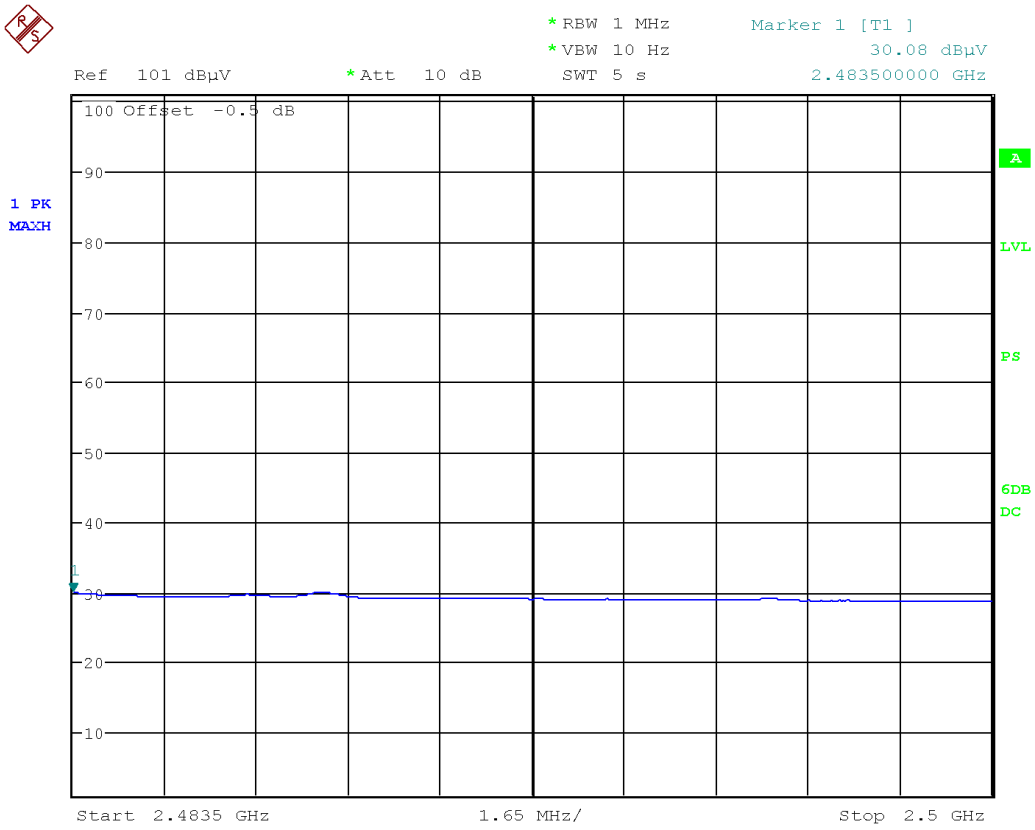
Note: Restricted band Band Edge plot was taken at a 3m measurement distance. The marker shows the raw value. See the Final Measurements and Results section below for correct values.



Date: 11.APR.2023 12:15:53

Band Edge – High Channel
Vertical - Peak Emission

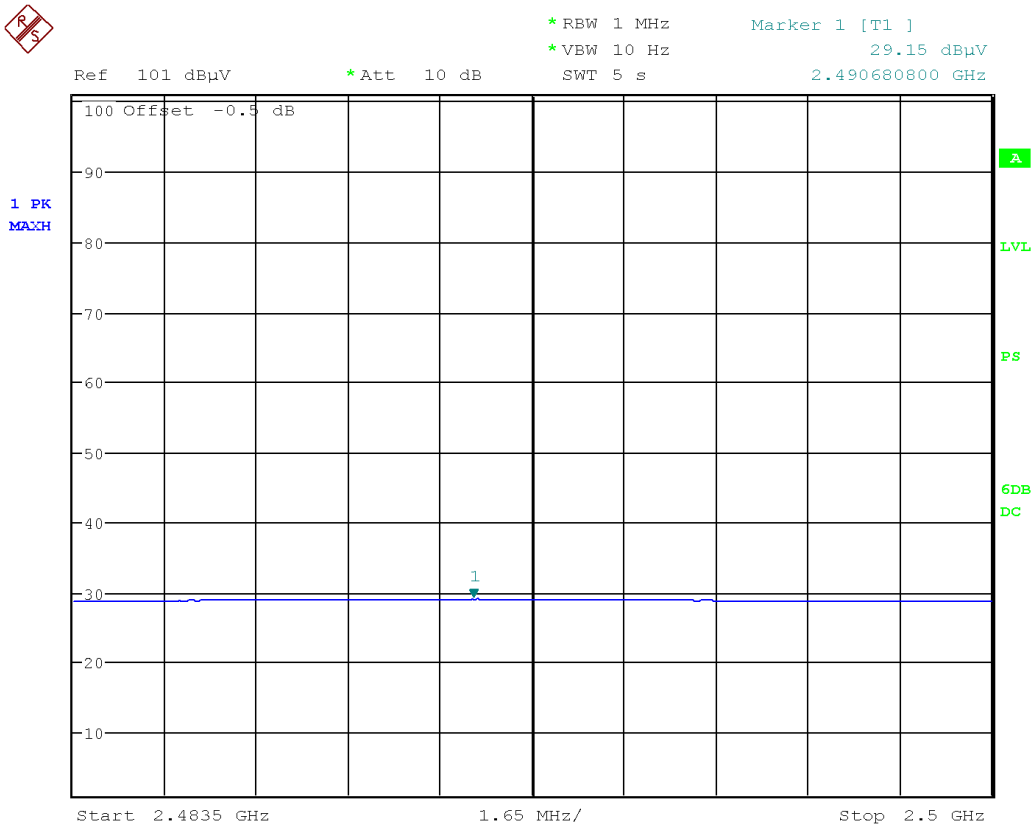
Note: Restricted band Band Edge plot was taken at a 3m measurement distance. The marker shows the raw value. See the Final Measurements and Results section below for correct values.



Date: 11.APR.2023 12:19:41

Band Edge – High Channel
Horizontal - Average Emission

Note: Restricted band Band Edge plot was taken at a 3m measurement distance. The marker shows the raw value. See the Final Measurements and Results section below for correct values.

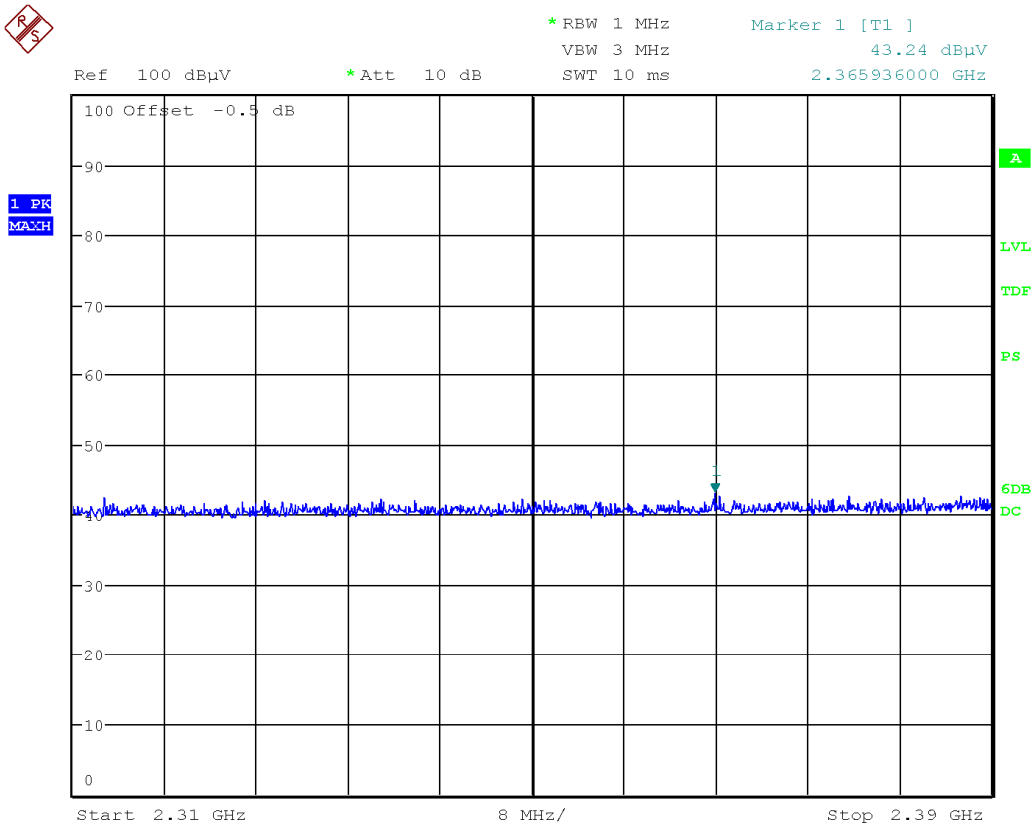


Date: 11.APR.2023 12:16:23

Band Edge – High Channel
Vertical – Average Emission

Note: Restricted band Band Edge plot was taken at a 3m measurement distance. The marker shows the raw value. See the Final Measurements and Results section below for correct values.

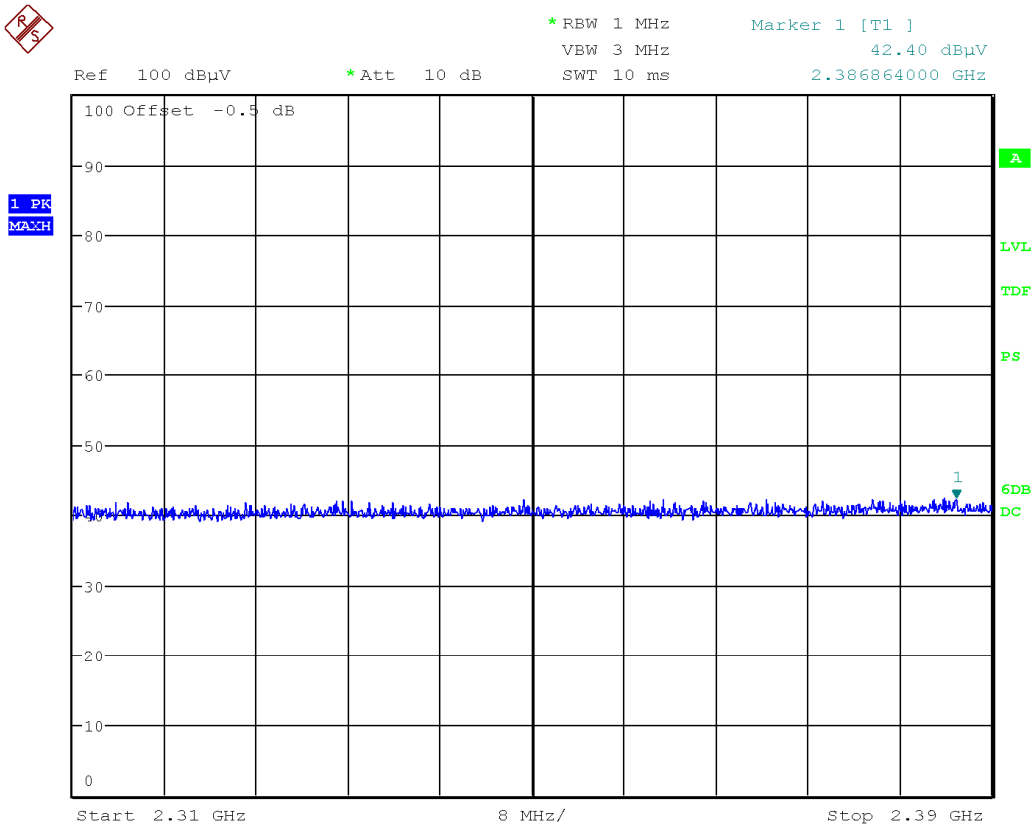
Band Edges – PMR300



Date: 11.APR.2023 16:26:19

Band Edge – Low Channel
Horizontal - Peak Emission

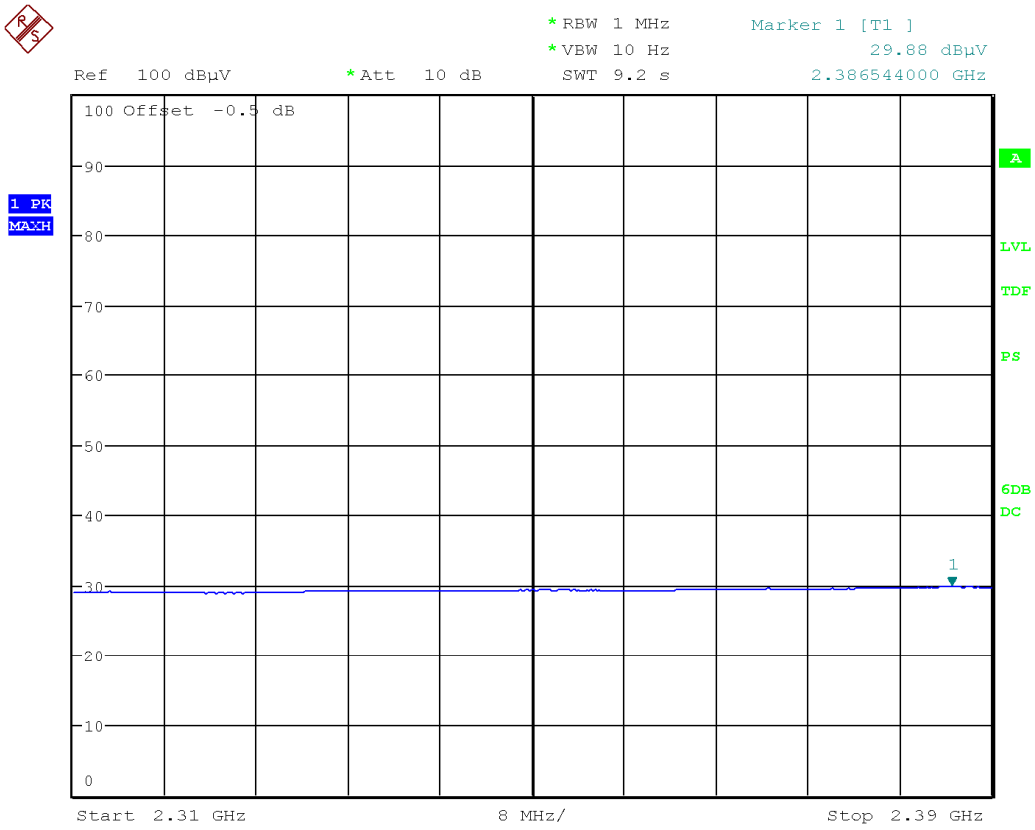
Note: Restricted band Band Edge plot was taken at a 3m measurement distance. The marker shows the raw value. See the Final Measurements and Results section below for correct values.



Date: 11.APR.2023 16:23:29

Band Edge – Low Channel
Vertical – Peak Emission

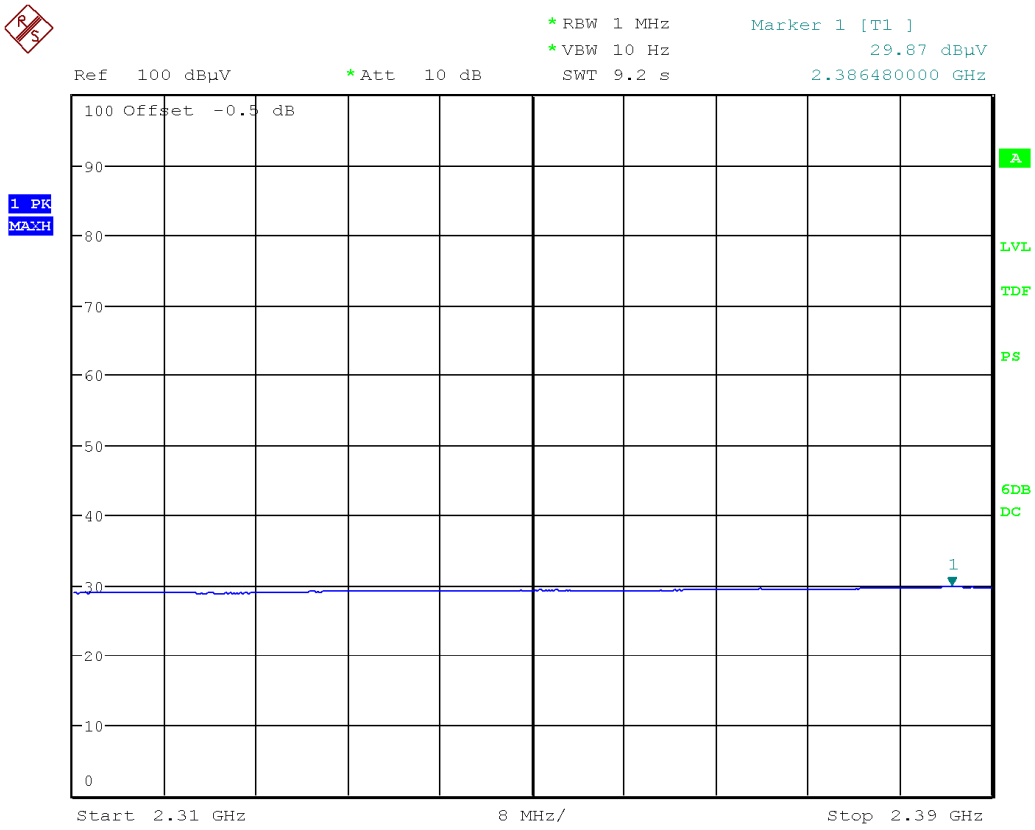
Note: Restricted band Band Edge plot was taken at a 3m measurement distance. The marker shows the raw value. See the Final Measurements and Results section below for correct values.



Date: 11.APR.2023 16:27:05

Band Edge – Low Channel
Horizontal - Average Emission

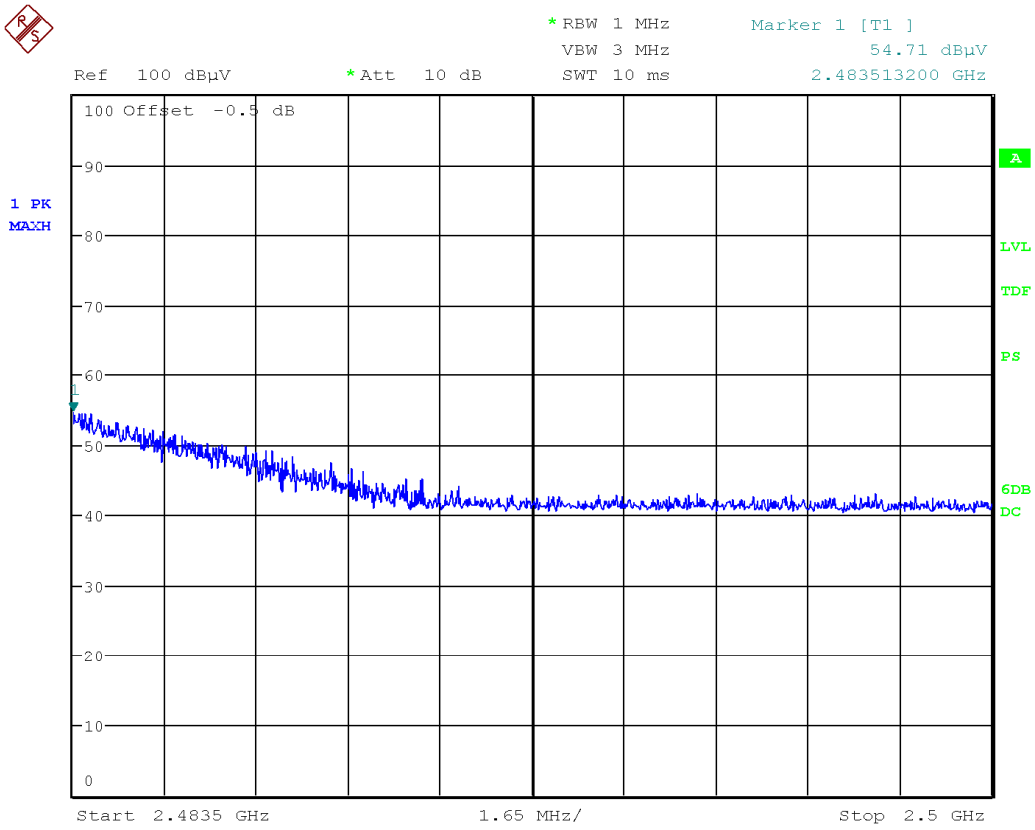
Note: Restricted band Band Edge plot was taken at a 3m measurement distance. The marker shows the raw value. See the Final Measurements and Results section below for correct values.



Date: 11.APR.2023 16:24:49

Band Edge – Low Channel
Vertical – Average Emission

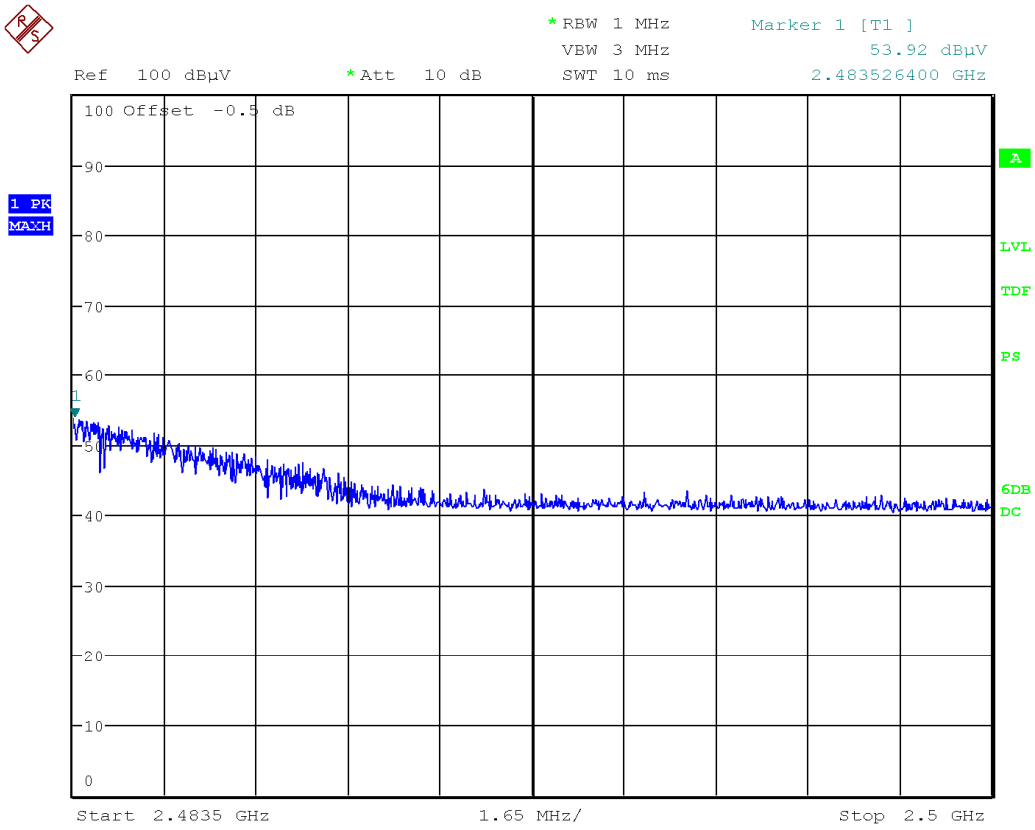
Note: Restricted band Band Edge plot was taken at a 3m measurement distance. The marker shows the raw value. See the Final Measurements and Results section below for correct values.



Date: 11.APR.2023 16:16:52

Band Edge – High Channel
Horizontal - Peak Emission

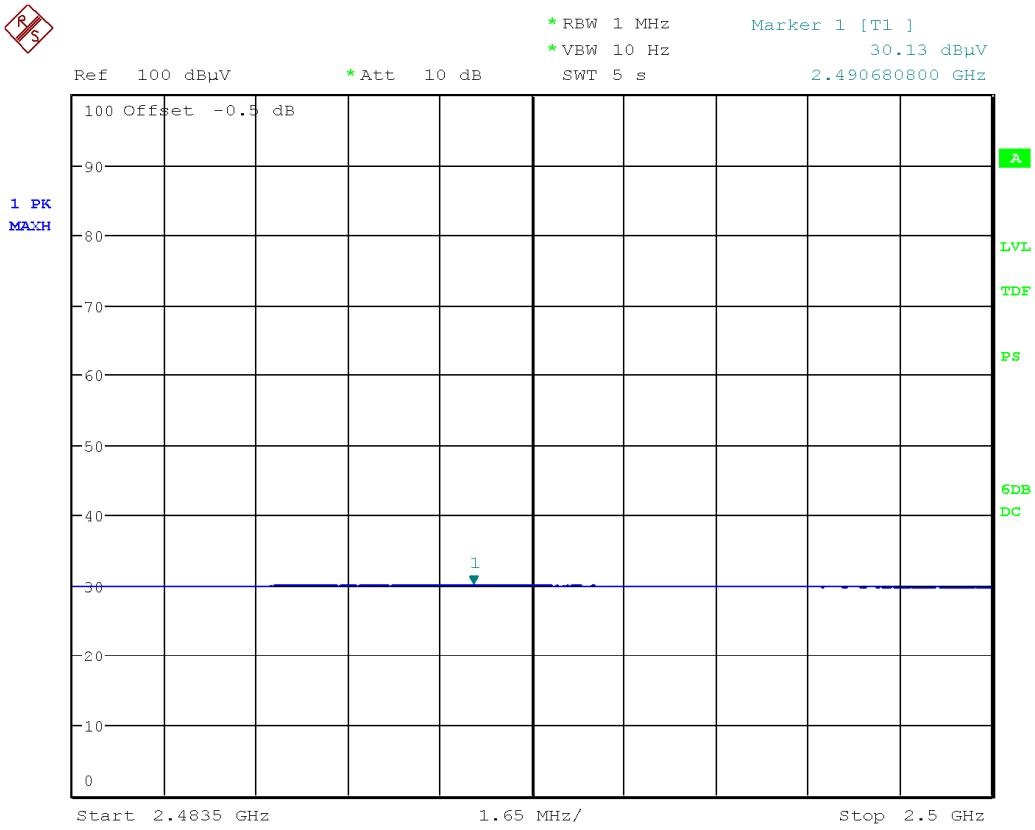
Note: Restricted band Band Edge plot was taken at a 3m measurement distance. The marker shows the raw value. See the Final Measurements and Results section below for correct values.



Date: 11.APR.2023 16:19:23

Band Edge – High Channel
Vertical - Peak Emission

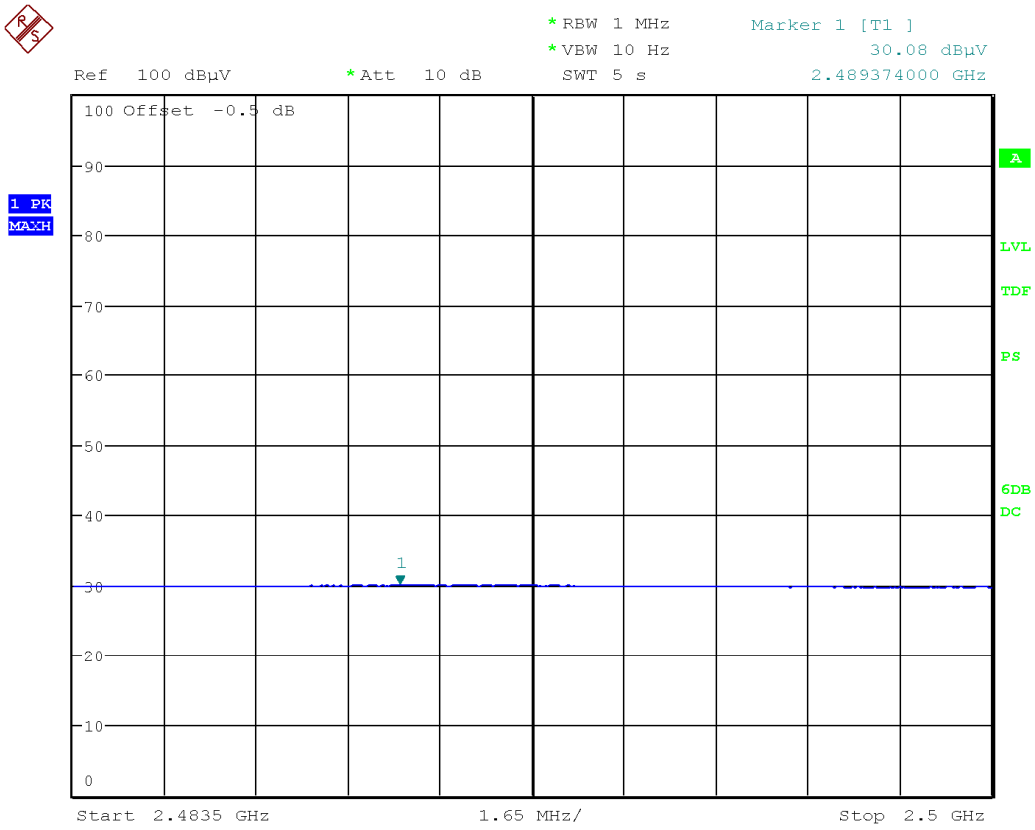
Note: Restricted band Band Edge plot was taken at a 3m measurement distance. The marker shows the raw value. See the Final Measurements and Results section below for correct values.



Date: 11.APR.2023 16:17:57

Band Edge – High Channel
Horizontal - Average Emission

Note: Restricted band Band Edge plot was taken at a 3m measurement distance. The marker shows the raw value. See the Final Measurements and Results section below for correct values.



Date: 11.APR.2023 16:20:05

Band Edge – High Channel
Vertical – Average Emission

Note: Restricted band Band Edge plot was taken at a 3m measurement distance. The marker shows the raw value. See the Final Measurements and Results section below for correct values.

Final Measurements and Results

In accordance with FCC Part 15.249(d), only frequencies exceeding the 15.209 limit that occur within the bands listed in 15.205 need to be verified with a final detector.

The measurements were maximized by rotating the turn table over a full 0-360 rotation and the antenna height was varied from 1 m to 4 m.

The EUT passed. As per clause 7.5 of ANSI 63.10, a duty cycle correction factor was applied to the peak emissions of the third harmonic to determine the average value and compared to the spurious emissions limits of FCC Part 15.209. The spectrum analyzer plots below support the calculation of the duty cycle correction factor. This duty cycle correction factor is determined by summing the “on” time of pulses within a 100ms window and calculating the duty cycle in dB with the following equation:

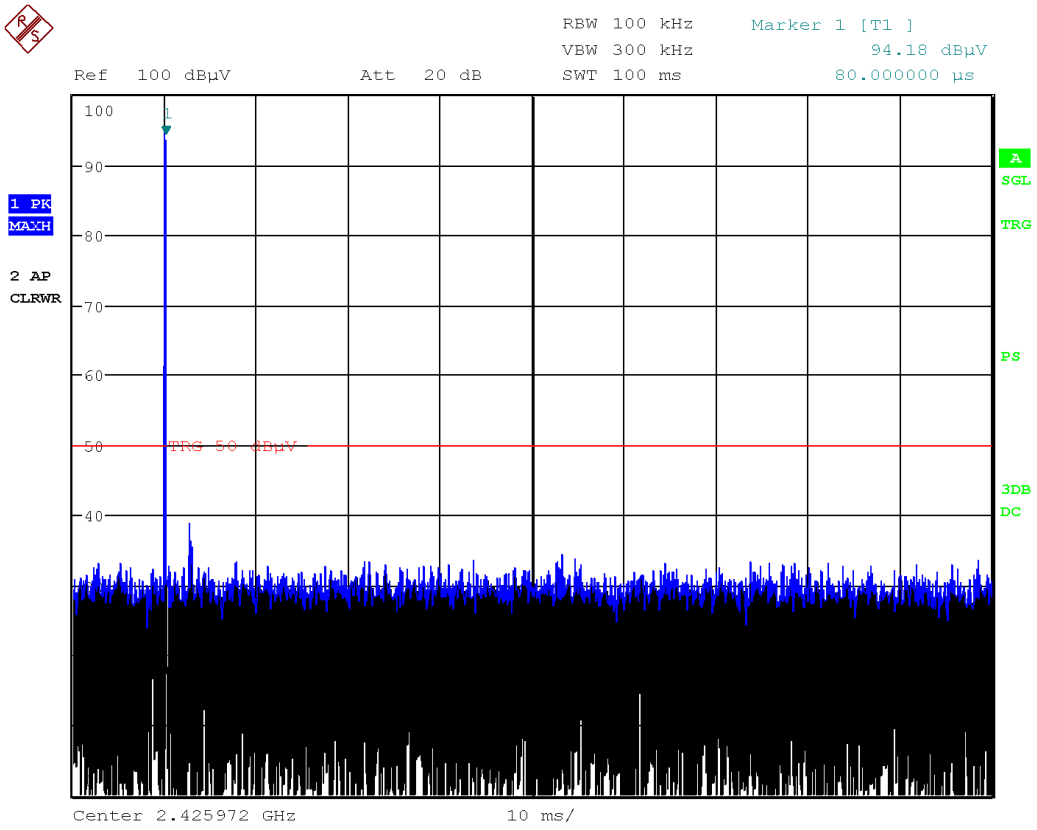
$$\delta(\mathrm{dB}) = 20\log(\Delta)$$

where

δ is the duty cycle correction factor (dB)
Δ is the duty cycle (dimensionless)

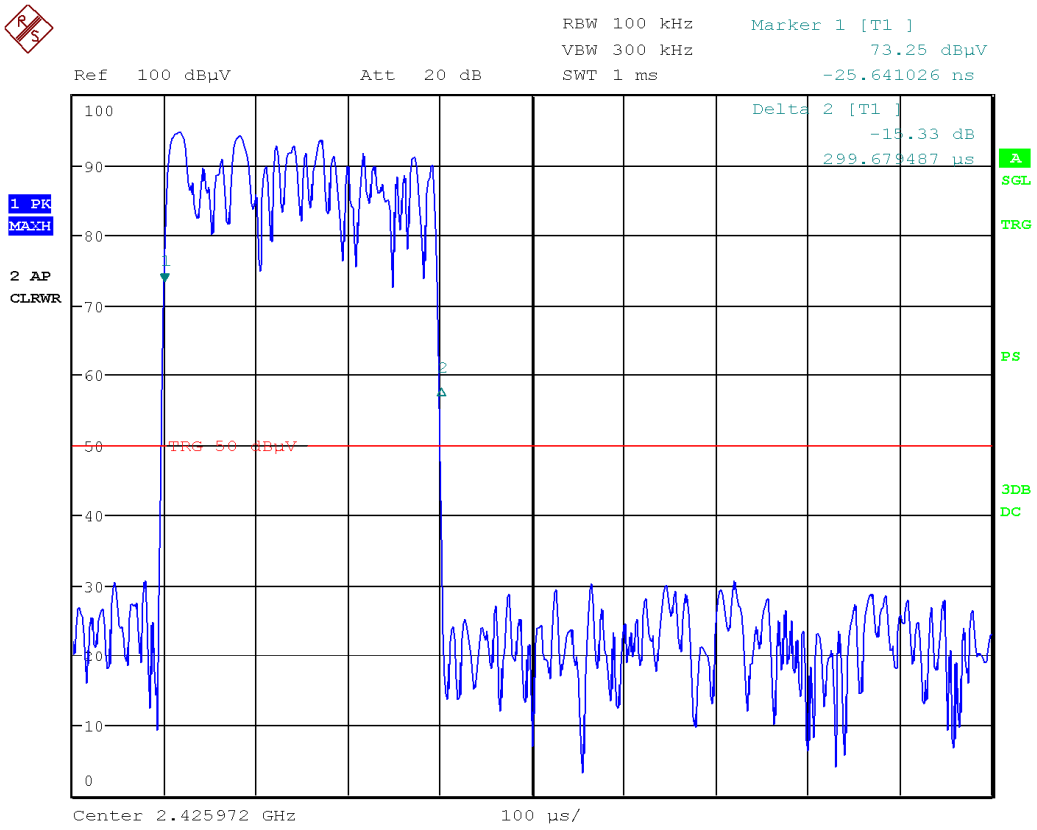
Therefore, based on the measurements shown in the plots below, the duty cycle correction factor has been calculated as follows. The AVG measurements in the Final Measurements tables below are calculated by adding the duty cycle correction factor to the PEAK measurements.

$$\delta(dB) = 20\log\left(\frac{300E^{-3}ms}{100ms}\right) = -50.46dB$$



Date: 20.APR.2023 10:42:56

Duty Cycle Measurement – Number of Transmissions within 100ms Sweep Time



Date: 20.APR.2023 10:46:04

Duty Cycle Measurement – Pulse Width Time

EUT Name		PML300						
Limit		FCC 15.209, Spurious						
Power Supply		**Battery**						
Frequency (Hz)	**Detector**	**Correction Factor (dB)**	**Level (dBuV/m)**	**PEAK Limit (dBuV/m)**	**AVG Limit (dBuV/m)**	**PEAK Margin (dB)**	**AVG Margin (dB)**	**Test Result**
Horizontal								
7.441G	PEAK	1.5	50.0	74.0	--	24.0	--	Pass
7.441G	AVG	1.5	-0.5	--	54.0	--	54.5	Pass
7.439G	PEAK	1.5	53.8	74.0	--	20.2	--	Pass
7.439G	AVG	1.5	3.3	--	54.0	--	50.7	Pass
Vertical								
7.439G	PEAK	1.5	60.1	74.0	--	13.9	--	Pass
7.439G	AVG	1.5	9.6	--	54.0	--	44.4	Pass
7.441G	PEAK	1.5	55.4	74.0	--	18.6	--	Pass
7.441G	AVG	1.5	4.9	--	54.0	--	49.1	Pass

Final Spurious Emissions Measurement Table – PML300

EUT Name		PMR300						
Limit		FCC 15.209, Spurious						
Power Supply		**Battery**						
Frequency (Hz)	**Detector**	**Correction Factor (dB)**	**Level (dBuV/m)**	**PEAK Limit (dBuV/m)**	**AVG Limit (dBuV/m)**	**PEAK Margin (dB)**	**AVG Margin (dB)**	**Test Result**
Horizontal								
7.441G	PEAK	1.5	62.4	74.0	--	11.6	--	Pass
7.441G	AVG	1.5	11.9	--	54.0	--	42.1	Pass
7.439G	PEAK	1.5	58.2	74.0	--	15.8	--	Pass
7.439G	AVG	1.5	7.7	--	54.0	--	46.3	Pass
Vertical								
7.441G	PEAK	1.5	60.3	74.0	--	13.7	--	Pass
7.441G	AVG	1.5	9.8	--	54.0	--	44.2	Pass
7.439G	PEAK	1.5	59.2	74.0	--	14.8	--	Pass
7.439G	AVG	1.5	8.8	--	54.0	--	45.2	Pass

Final Spurious Emissions Measurement Table – PMR300

Test Equipment List

Equipment	Model No.	Manufacturer	Last Calibration Date	Next Calibration Date	Asset #
Spectrum Analyzer	ESU 40	Rohde & Schwarz	Feb. 11, 2022	Feb. 11, 2024	GEMC 233
Loop Antenna	EM 6871	Electro-Metrics	Mar 13, 2023	Mar 13, 2025	GEMC 70
Loop Antenna	EM 6872	Electro-Metrics	Mar 13, 2023	Mar 13, 2025	GEMC 71
BiLog Antenna	3142-C	ETS-Lindgren	Dec. 7, 2022	Dec. 7, 2023	GEMC 8
Horn Antenna 1 – 18 GHz	3117	ETS-Lindgren	Mar. 11, 2022	Mar. 11, 2024	GEMC 340
Attenuator 6 dB	6N5W-06	Inmet	NCR	NCR	GEMC 345
Pre-Amp 9 kHz – 1 GHz	CPA9230	Chase	Sep. 16, 2022	Sep. 16, 2024	GEMC 301
Pre-Amp 1 – 26.5 GHz	HP 8449B	HP	Mar. 11, 2022	Mar. 11, 2024	GEMC 189
RF Cable <1GHz	LMR-400	LexTec	NCR	NCR	GEMC 274
RF Cable <1GHz	Sucoflex 104A	Huber+Suhner	NCR	NCR	GEMC 271
RF Cable >1GHz	EMC2	MegaPhase	NCR	NCR	GEMC 369
Emissions Software	V2.1.0	TUV SUD Canada, Inc.	NCR	NCR	GEMC 361

Emission Bandwidth

Purpose

The purpose of this test is to ensure that the upper and lower frequency limits of the transmitter 99% emission power bandwidth remain within the operating frequency limits at all times.

Limits and Method

The method is given in ANSI C63.10 Section 6.9.3 and RSS-GEN 6.7.

The 99% bandwidth of systems using digital modulation techniques operating in the 902 – 928 MHz band shall remain within the operating frequency band at all times. This should be measured with a RBW in the range of 1% to 5% of the occupied bandwidth and a VBW of approximately three times RBW.

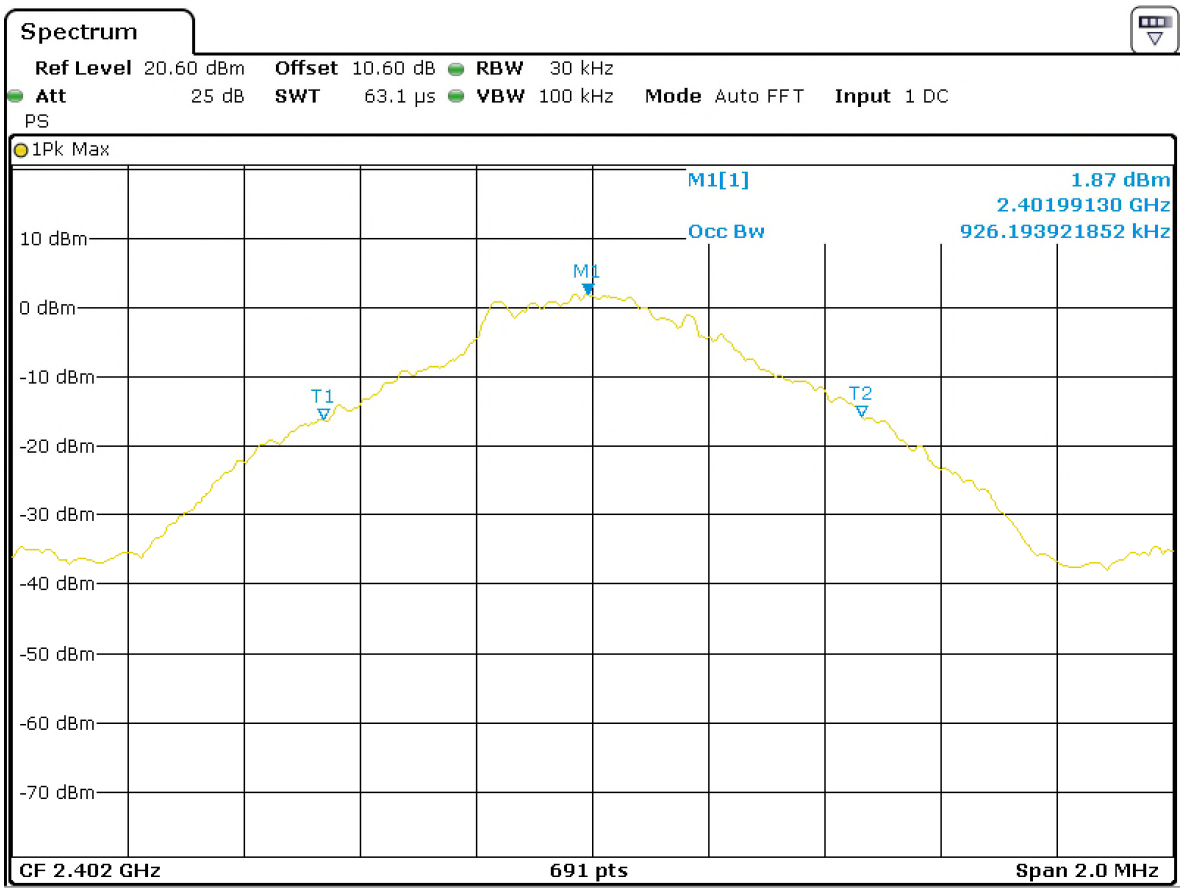
Results

The EUT passed. The 99% bandwidth was measured using the 99% bandwidth function of the spectrum analyzer and using the modified EUT with direct connection to the antenna port for conducted measurement.

Frequency (MHz)	99% Bandwidth			Result
	F_{LOW} (MHz)	F_{HIGH} (MHz)	Occupied Bandwidth (kHz)	
2402	2401.5	-	926.2	Pass
2440	-	-	937.8	Pass
2480	-	2480.5	937.8	Pass

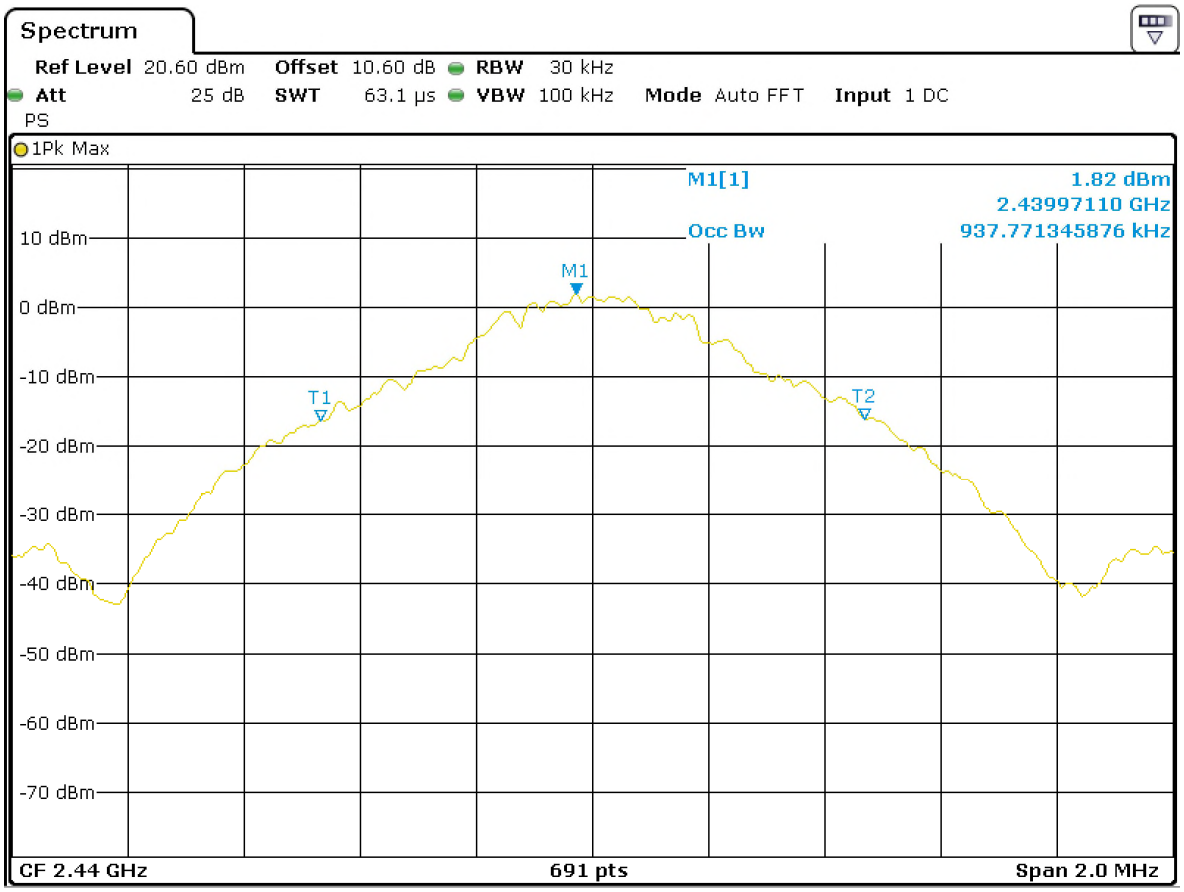
Frequency (MHz)	20dB Bandwidth			Result
	F_{LOW} (MHz)	F_{HIGH} (MHz)	20dB Bandwidth (MHz)	
2402	2401.5	-	1.1328	Pass
2440	-	-	1.1312	Pass
2480	-	2480.6	1.1392	Pass

Graphs



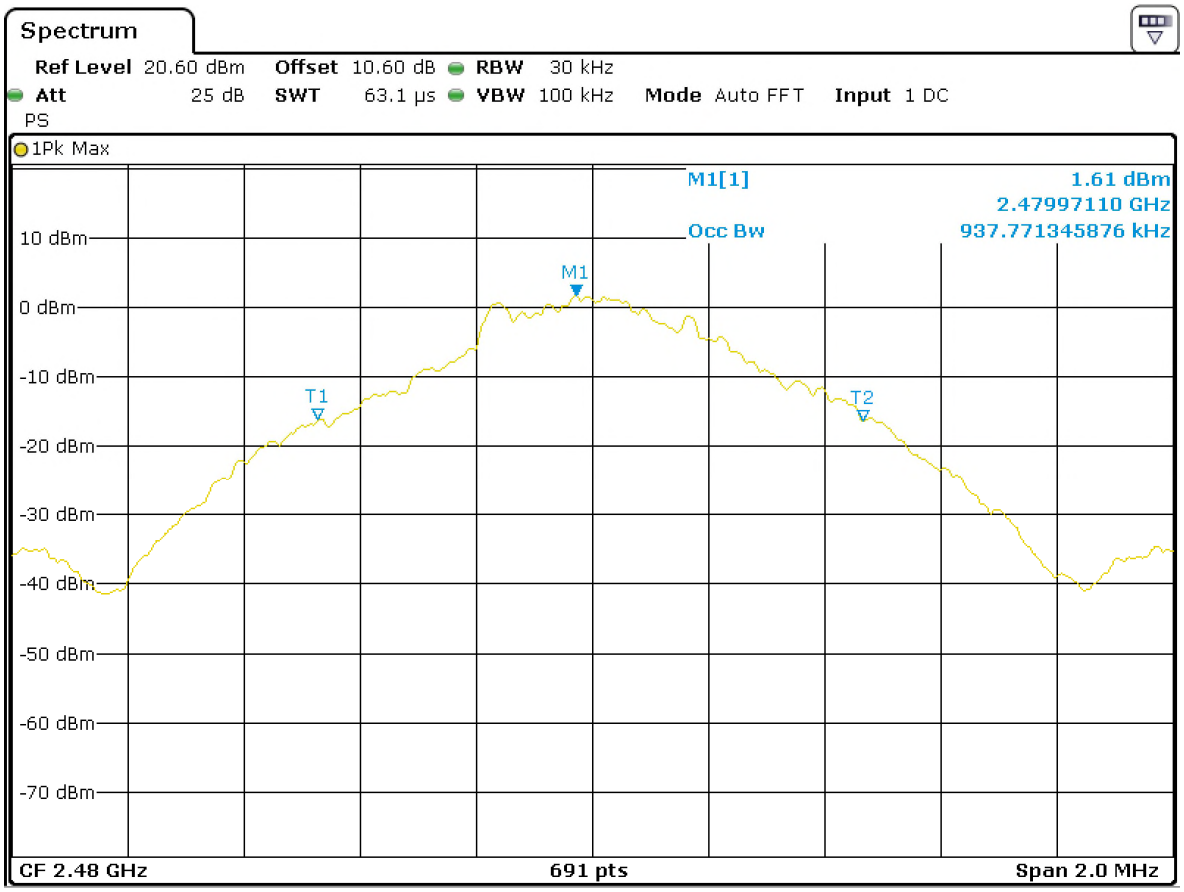
Date: 20.APR.2023 14:33:09

Low Channel - 99% Bandwidth



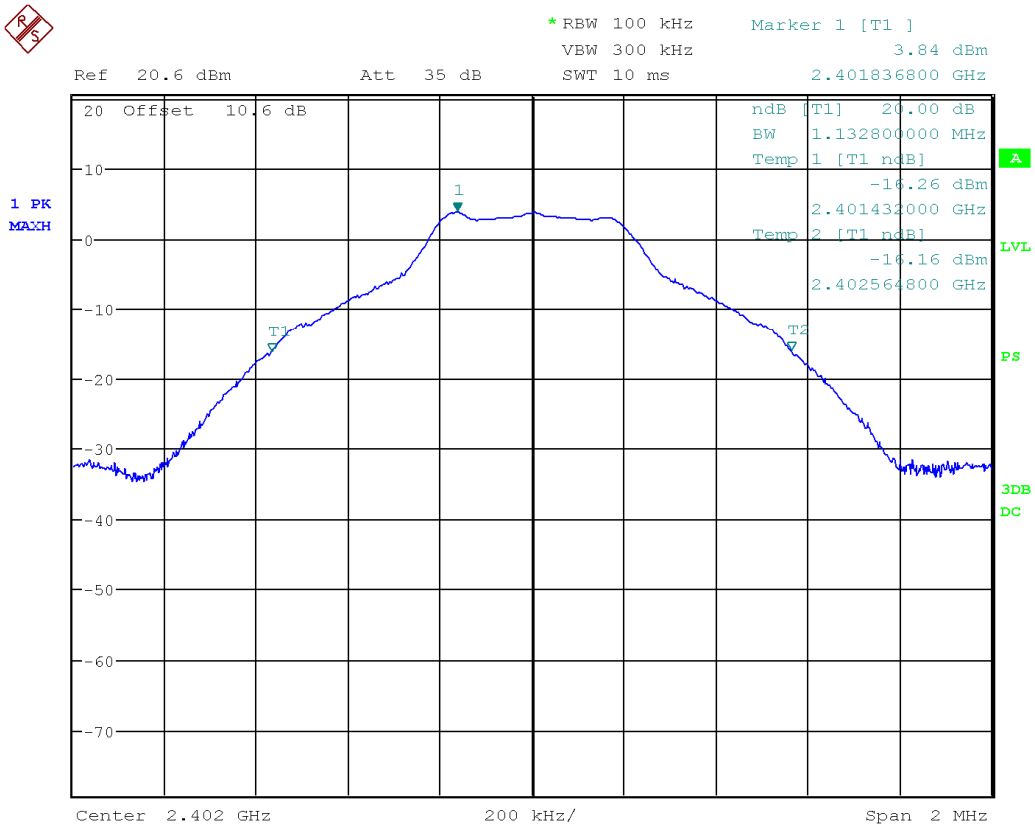
Date: 20.APR.2023 14:50:28

Mid Channel - 99% Bandwidth

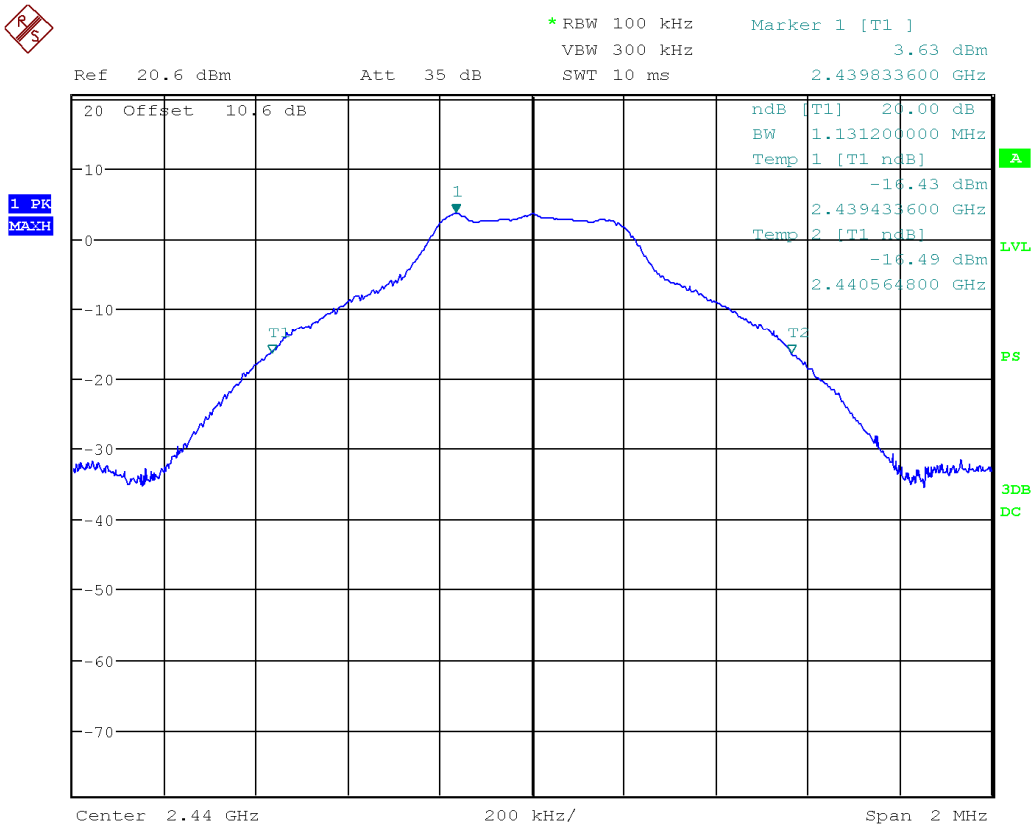


Date: 20.APR.2023 14:54:00

High Channel - 99% Bandwidth

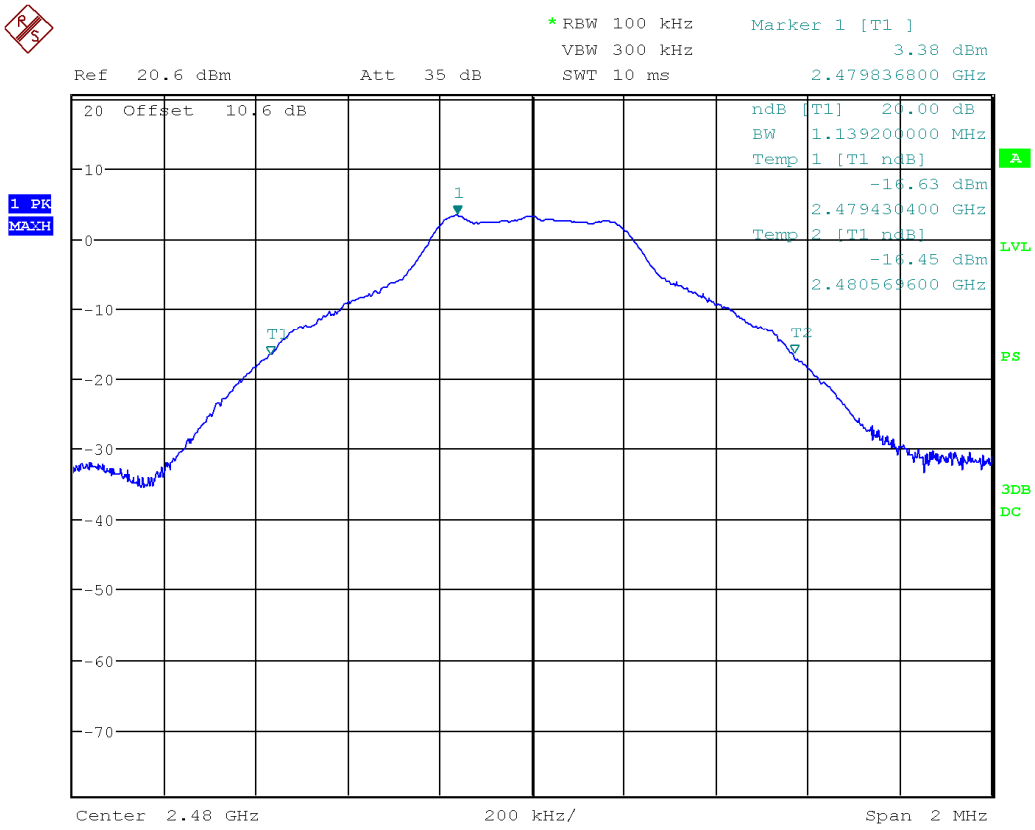


Low Channel – 20dB Bandwidth



Date: 21.APR.2023 13:36:42

Mid Channel – 20dB Bandwidth



High Channel – 20dB Bandwidth

Note: See ‘Appendix B – EUT & Test Setup Photos’ for photos showing the test set-up.

Test Equipment List

Equipment	Model No.	Manufacturer	Last Calibration Date	Next Calibration Date	Asset #
Spectrum Analyzer	ESR 26	Rohde & Schwarz	Mar. 31, 2022	Mar. 31, 2024	GEMC 341
Spectrum Analyzer	ESU 40	Rohde & Schwarz	Feb. 11, 2022	Feb. 11, 2024	GEMC 233
Attenuator 10 dB	8493B	Agilent	NCR	NCR	GEMC 133

Appendix A – EUT Summary

For further details for filing purposes, refer to filing package.

General EUT Description

Client	
Organization / Address	4iiii Innovations Inc. 141 2nd Ave East, Cochrane, AB, Canada, T4C 2B9
Contact	Michael Mercer
Phone	403-800-3095
Email	mike@4iiii.com
EUT Details	
EUT Name	PRECISION3 POWERMETER
EUT Model	PML300 and PMR300
FCC ID	ZZNPM301
IC	9896A-PM300
Equipment Category	ITE
Basic EUT Functionality	The PML300/PMR300 power meter is an electronic device that is permanently attached to a bicycle crank and measures the amount of energy a rider imparts to the drive train. The device connects wirelessly to any BLE equipped smart phone as well as most ANT+® bicycle computer head units.
Input Voltage and Frequency	2.6 – 3.3 VDC
Rated Input Current	10mA
Connectors available on EUT	None
Peripherals Required for Test	Android phone with 4iiii configuration App
Release type	Final
Intentional Radiator Frequency	2400 – 2483.5 MHz for ANT applications as described above.
EUT Configuration	Wireless configured to transmit continuously at 100% duty cycle Power Setting: +4dBm

Note the EUT is considered to have been received the date of the commencement of the first test, unless otherwise stated. For a close-up picture of the EUT, see ‘Appendix B – EUT and Test Setup Photos’.

Appendix B – EUT and Test Setup Photos

Refer to the files separate from this test report