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www.ComplianceTesting.com
info@ComplianceTesting.com

Test Report

Prepared for: Wave Central

EUT Name: Axis Transmitter
Model: AXISTX

FCC ID: 2AD9D-AXTXD16

To

FCC Part 15.407

Date of Issue: November 29, 2022

On the behalf of the applicant:	**Wave Central** **99 Garden Parkway – Suite C** **Carlisle, PA, 17013**
Attention of:	**Tom Doyle, General Manager** **Ph: (717) 503-7157** **Email:** tom@wavecentralrf.com

Prepared By
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Project No: p2230006

John Michalowicz
Sr Compliance Engineer

Test Summary

Specification	Test Name	Pass, Fail, N/A	Comments
§15.203	Antenna Requirements	Pass	
§15.207 §15.407(b)(6)	Line Conducted Emissions	Pass	
§15.407(a)(3)	Conducted Output Power	Pass	
§15.407(a)(3),(5)	Power Spectral Density	Pass	
§15.403(i) §15.407(e)	6dB Occupied Bandwidth	Pass	
	99% Occupied Bandwidth		
§15.407(b)(4)	Undesirable Emissions	Pass	
§15.205 §15.407(b)(4),(5),(6)	General Field Strength Limits (Restricted Bands and Radiated Emission limits)	Pass	

Statements of conformity are reported as:

- Pass - the measured value is below the acceptance limit, *acceptance limit = test limit*.
- Fail - the measured value is above the acceptance limit, *acceptance limit = test limit*.

References	Description
CFR47, Part 15, Subpart B	Unintentional Radiators
CFR47, Part 15, Subpart C	Intentional Radiators
CFR47, Part 15, Subpart E	Unlicensed Nation Information Infrastructure Devices (U-NII)
ANSI C63.10-2013	American National standard for testing Unlicensed Wireless Devices
ANSI C63.4-2014	Method and Measurements of Radio-Noise Emissions from low-Voltage Electrical and Electronic Equipment in the range 9kHz to 40GHz.
ISO/IEC 17025:2005	General requirements for the Competence of Testing and Calibrations Laboratories
KDB 644545 D03	Guidance for IEEE 802 11ac New Rules
KDB 789033 D02	General U-NII Test Procedures New Rules V01
KDB 926956 D01	U-NII Transition Plan

Test Report Revision History

Revision	Date	Revised By	Reason for Revision
1.0	November 29, 2022	John Michalowicz	Original Document
2.0	May 9, 2023	John Michalowicz	Updated the Test Summary Table

Table of Contents

ANAB

Compliance Testing, LLC, has been accredited in accordance with the recognized International Standard ISO/IEC 17025:2017. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to the joint ISO-ILAC-IAF Communiqué dated January 2009).

The tests results contained within this test report all fall within our scope of accreditation.

Please refer to http://www.compliancetesting.com/labscope.html for current scope of accreditation.

FCC Site Reg. #349717

IC Site Reg. #2044A-2

The applicant has been cautioned as to the following

15.21 - Information to User

The user's manual or instruction manual for an intentional radiator shall caution the user that changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

15.27(a) - Special Accessories

Equipment marked to a consumer must be capable of complying with the necessary regulations in the configuration in which the equipment is marketed. Where special accessories, such as shielded cables and/or special connectors are required to enable an unintentional or intentional radiator to comply with the emission limits in this part, the equipment must be marketed with, i.e. shipped and sold with, those special accessories. However, in lieu of shipping or packaging the special accessories with the unintentional or intentional radiator, the responsible party may employ other methods of ensuring that the special accessories are provided to the consumer without an additional charge.

Information detailing any alternative method used to supply the special accessories for a grant of equipment authorization or retained in the verification records, as appropriate. The party responsible for the equipment, as detailed in § 2.909 of this chapter, shall ensure that these special accessories are provided with the equipment. The instruction manual for such devices shall include appropriate instructions on the first page of text concerned with the installation of the device that these special accessories must be used with the device. It is the responsibility of the user to use the needed special accessories supplied with the equipment.

Standard Test Conditions Engineering Practices

Except as noted herein, the following conditions and procedures were observed during the testing:

In accordance with ANSI C63.10-2013 and unless otherwise indicated in the specific measurement results, the ambient temperature of the actual EUT was maintained within the range of 10° to 40°C (50° to 104°F) unless the particular equipment requirements specified testing over a different temperature range. Also, unless otherwise indicated, the humidity levels were in the range of 10% to 90% relative humidity.

Measurement results, unless otherwise noted, are worst-case measurements.

Environmental Conditions		
Temperature (ºC)	**Humidity (%)**	**Pressure (mbar)**
21 – 22.4	27.4 - 35.4	970.4 - 973.4

EUT Description

Serial Number (SN)	12554
DUT Power Input	6-17 V_{DC}
Frequency Range	5725-5850 MHz
Modulation(s)	16QAM
Nominal Bandwidth(s):	6 / 7 / 8 MHz
Antenna	Type: Dipole Part Number: AXIS OFLX6 Pk Gain: 6 dBi Frequency Range: 5725-5850 MHz

General Description of EUT and its intended use:
The EUT is a Radio module intended to attach to a commercial video camera and transmit audio and video over the UNII-3 band. The EUT can be powered from the host camera or via AC/DC adapter in fixed locations.

EUT operation during test:

The EUT was controlled with a Device Controller software provided by the manufacturer. Using the provided software, the EUT was able to be placed in a test mode with 100 % duty cycle for all nominal bandwidths and channels.

Support Equipment:

Qty	Description	Manufacturer	Model	S/N
1	AC / DC Switching Adapter	Mean Well	GS90A12	EB4B372237

Cables:

Qty	Description	Length (M)	Shielding Y/N	Shielded Hood Y/N	Termination
1	Charging cable	0.91	Y	Y	Power Adapter
1	USB Cable	1	N	N	NA

Modifications:

none

15.203: Antenna Requirement:

	The antenna is permanently attached to the EUT
	The antenna uses a unique coupling
X	The EUT must be professionally installed
	The antenna requirement does not apply

Occupied Bandwidth

Engineer: Aaron S. Froehlich
Test Date: 8/2/2022

Test Procedure

KDB 789033 D02 Clause II.C.2 was used to measure the minimum 6 dB emission bandwidth.
KDB 789033 D02 Clause II.C.1 was used to measure the 26 dB emission bandwidth.
The method of clause 6.9.3 was utilized to measure the 99% Occupied Bandwidth.

The “n dB down” function of the spectrum analyzer, was used as long as the marker did not settle in a null region. When that was the case the markers were manually configured from the edge of the emission until a value equal to or less than n dB below the peak was used.

During the measurement of the 26 dB emission bandwidth the RBW available in the spectrum analyzer that yielded a ratio closest to 1% was reported.

Limit Minimum Emissions Bandwidth

47 CFR 15.407(a)(e)

The minimum 6 dB Bandwidth shall be at least 500 kHz

Limit 26 dB Emissions Bandwidth

None – The Conducted Output Power Limit is based on the 26 dB Emissions Bandwidth data, but there is no limit associated with the Bandwidth data.

Limit 99%

None

The Spectrum Analyzer was set to the following:

6 dB Minimum Emission Bandwidth

Span	Between 1.5 times and 5.0 times the OBW
RBW	≤ 100 kHz
VBW	3 time RBW
Detector	Peak
Trace	Max Hold
Sweep	Auto

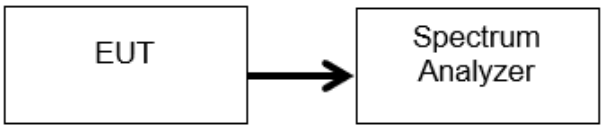
99% Occupied Bandwidth

Span	Between 1.5 times and 5.0 times the OBW
RBW	1% to 5% of the OBW
VBW	~3 time RBW

26 dB Emission Bandwidth

Span	Between 1.5 times and 5.0 times the OBW
RBW	~1% of the OBW
VBW	~3 time RBW

Test Setup



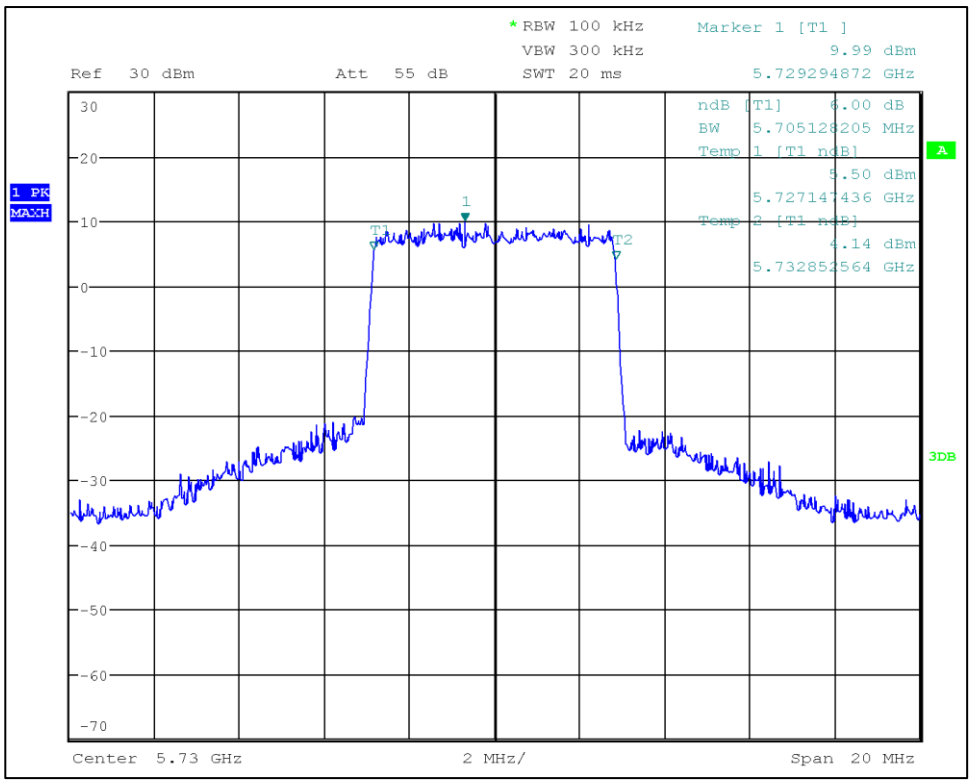
Test Data

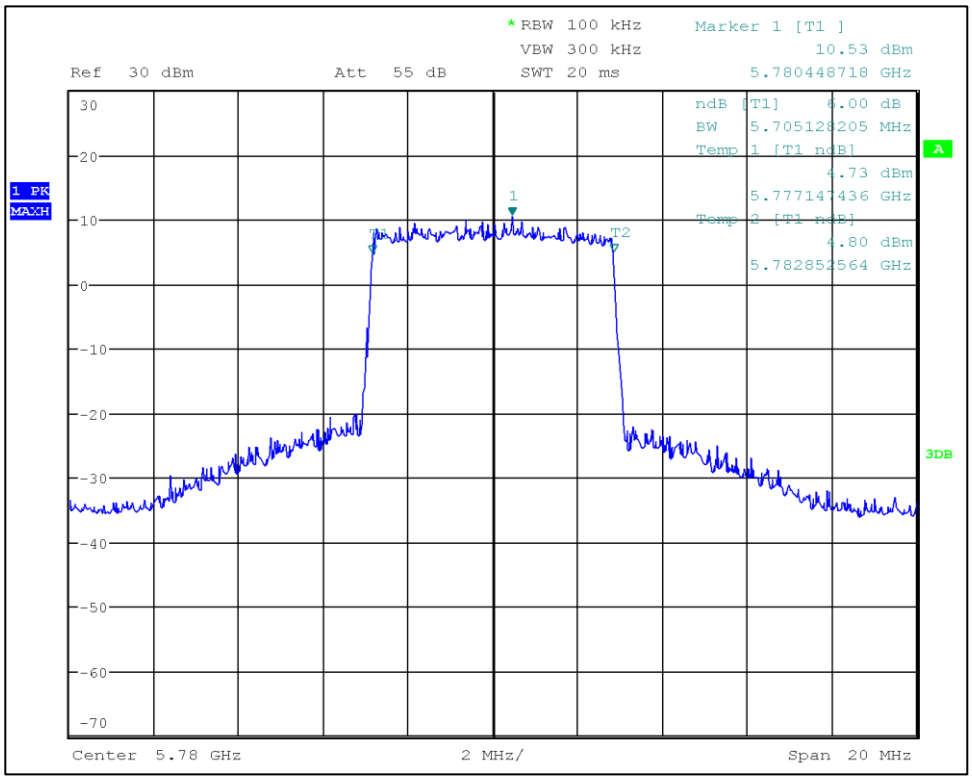
Tabular Data

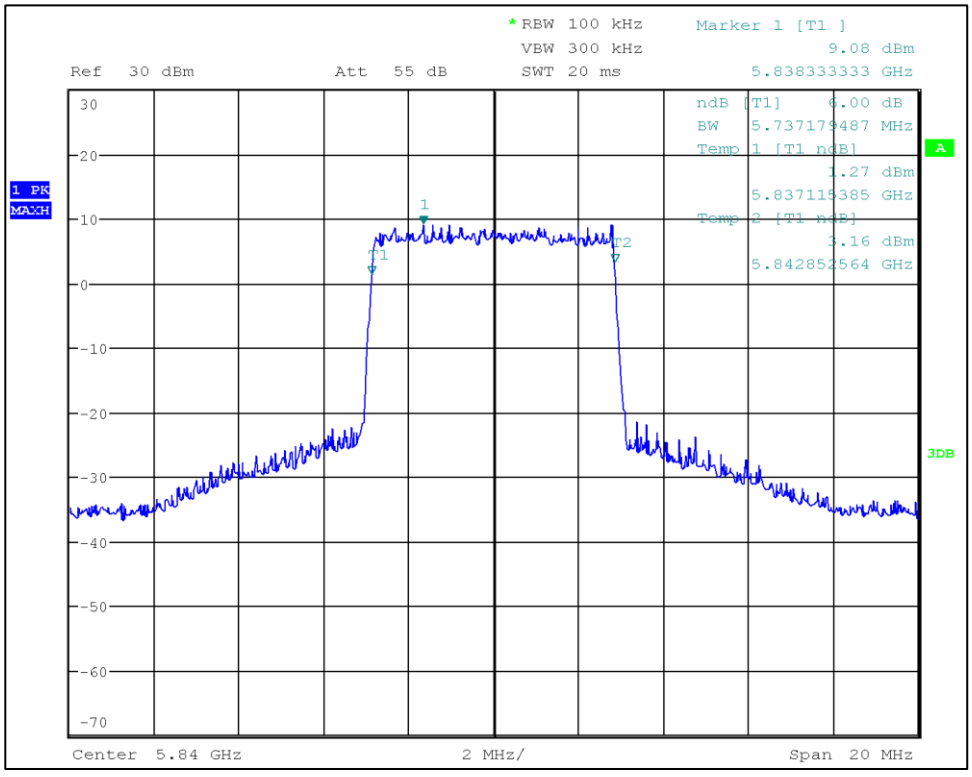
Frequency MHz	Channel #	Nominal BW MHz	BW (MHz)			Limit MHz	Margin MHz	Result
			99%	26 dB	6 dB			
5730	1	6	5.71	6.08	5.71	0.5	-5.21	Compliant
5780	6	6	5.71	6.05	5.71	0.5	-5.21	Compliant
5840	12	6	5.71	6.05	5.71	0.5	-5.21	Compliant
5730	1	7	7.57	7.08	6.67	0.5	-6.17	Compliant
5780	6	7	7.57	7.03	6.67	0.5	-6.17	Compliant
5840	12	7	7.57	7.05	6.67	0.5	-6.17	Compliant
5730	1	8	6.64	8.10	7.66	0.5	-7.16	Compliant
5780	6	8	6.64	8.10	7.63	0.5	-7.13	Compliant
5840	12	8	6.67	8.05	7.63	0.5	-7.13	Compliant

Margin = Limit – $BW_{6\ dB}$

6 dB Minimum Emission Bandwidth Plots




*RBW 100 kHz
VBW 300 kHz
SWT 20 ms
Marker 1 [T1]
10.53 dBm
5.780448718 GHz
Ref 30 dBm
Att 55 dB
ndB [T1] 6.00 dB
BW 5.705128205 MHz
Temp 1 [T1 ndB]
4.73 dBm
5.777147436 GHz
Temp 2 [T1 ndB]
4.80 dBm
5.782852564 GHz
1 PK
MAXH
A
3DB
Center 5.78 GHz
2 MHz/
Span 20 MHz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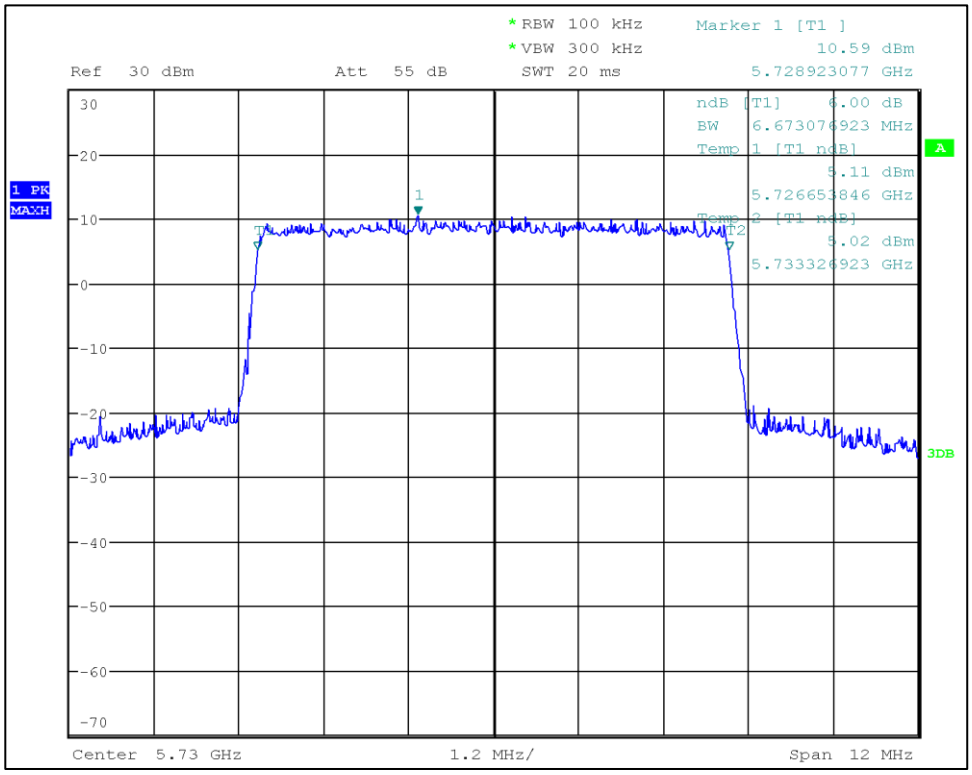
SWT 20 ms
Marker 1 [T1]
9.08 dBm
5.838333333 GHz
Ref 30 dBm
Att 55 dB
ndB [T1] 6.00 dB
BW 5.737179487 MHz
Temp 1 [T1 ndB]
1.27 dBm
5.837115385 GHz
Temp 2 [T1 ndB]
3.16 dBm
5.842852564 GHz
1 PK
MAXH
A
3DB
Center 5.84 GHz
2 MHz/
Span 20 MHz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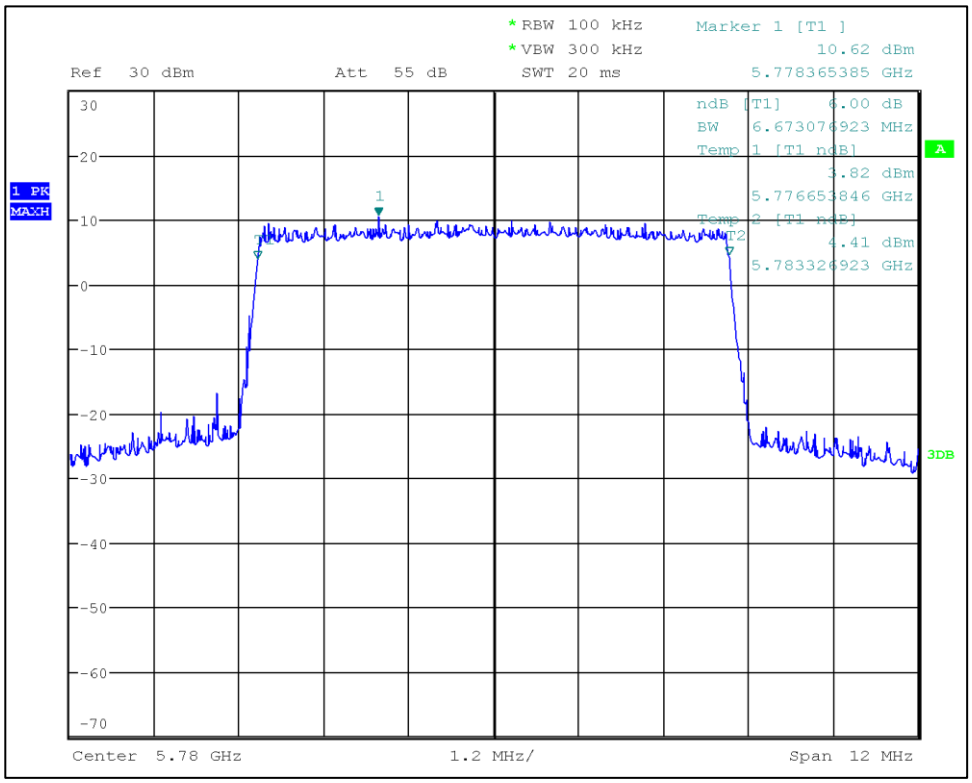
Ref 30 dBm
Att 55 dB
SWT 20 ms
Marker 1 [T1]
10.59 dBm
5.728923077 GHz
ndB [T1] 6.00 dB
BW 6.673076923 MHz
Temp 1 [T1 ndB]
5.11 dBm
5.726653846 GHz
Temp 2 [T1 ndB]
5.02 dBm
5.733326923 GHz
1 PK
MAXH
A
3DB
Center 5.73 GHz
1.2 MHz/
Span 12 MHz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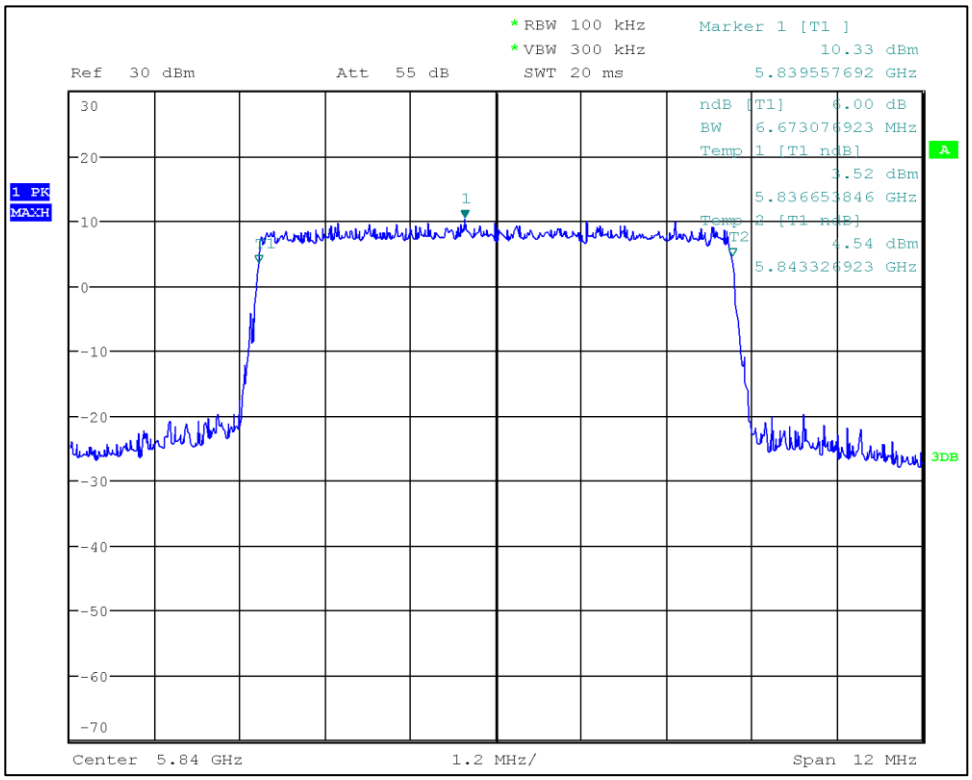
Ref 30 dBm
Att 55 dB
SWT 20 ms
Marker 1 [T1]
10.62 dBm
5.778365385 GHz
ndB [T1] 6.00 dB
BW 6.673076923 MHz
Temp 1 [T1 ndB]
3.82 dBm
5.776653846 GHz
Temp 2 [T1 ndB]
4.41 dBm
5.783326923 GHz
1 PK
MAXH
A
3DB
Center 5.78 GHz
1.2 MHz/
Span 12 MHz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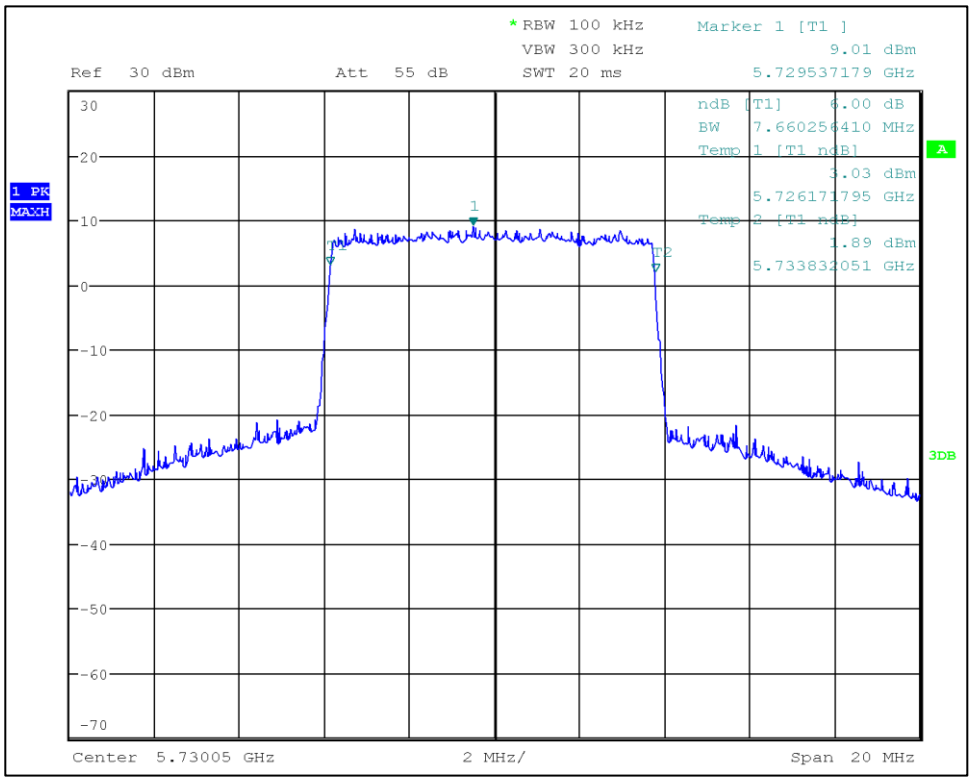
Ref 30 dBm
Att 55 dB
SWT 20 ms
Marker 1 [T1]
10.33 dBm
5.839557692 GHz
ndB [T1] 6.00 dB
BW 6.673076923 MHz
Temp 1 [T1 ndB]
3.52 dBm
5.836653846 GHz
Temp 2 [T1 ndB]
4.54 dBm
5.843326923 GHz
1 PK
MAXH
A
3DB
30
20
10
0
-10
-20
-30
-40
-50
-60
-70
Center 5.84 GHz
1.2 MHz/
Span 12 MHz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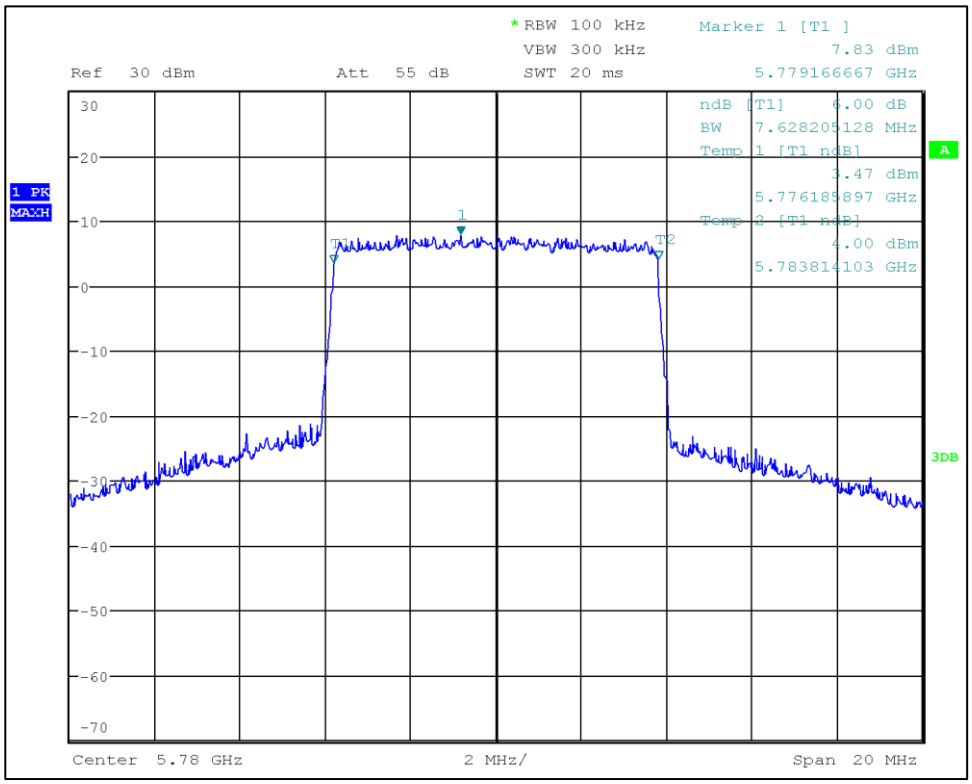
VBW 300 kHz
Ref 30 dBm
Att 55 dB
SWT 20 ms
Marker 1 [T1]
9.01 dBm
5.729537179 GHz
ndB [T1] 6.00 dB
BW 7.660256410 MHz
Temp 1 [T1 ndB]
3.03 dBm
5.726171795 GHz
Temp 2 [T1 ndB]
1.89 dBm
5.733832051 GHz
1 PK
MAXH
A
3DB
30
20
10
0
-10
-20
-30
-40
-50
-60
-70
Center 5.73005 GHz
2 MHz/
Span 20 MHz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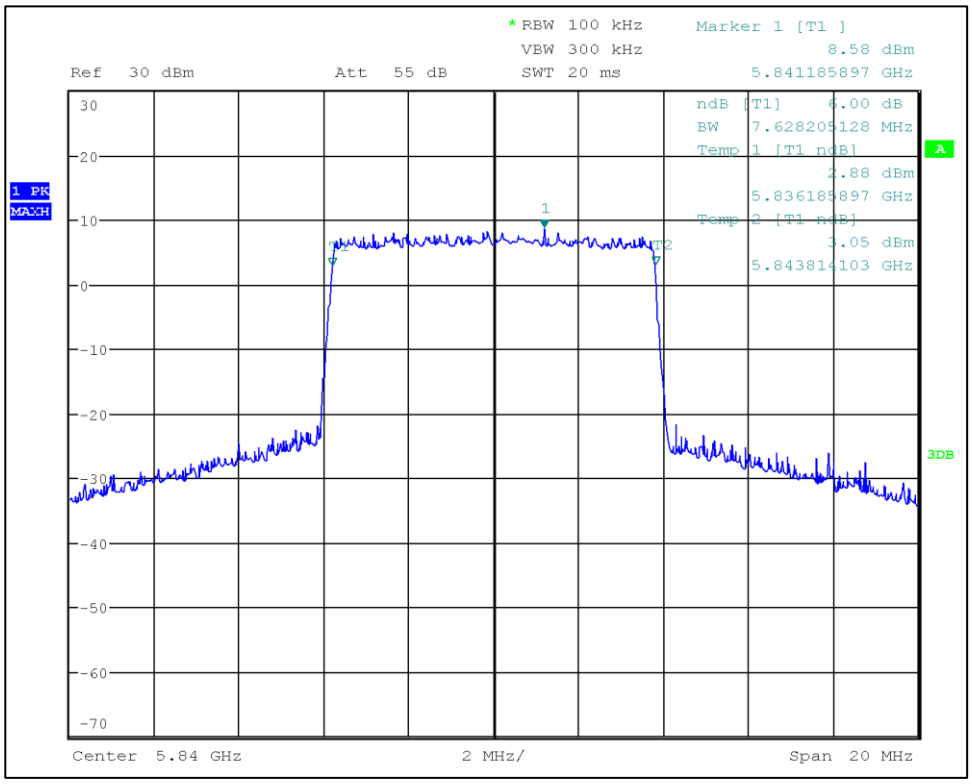
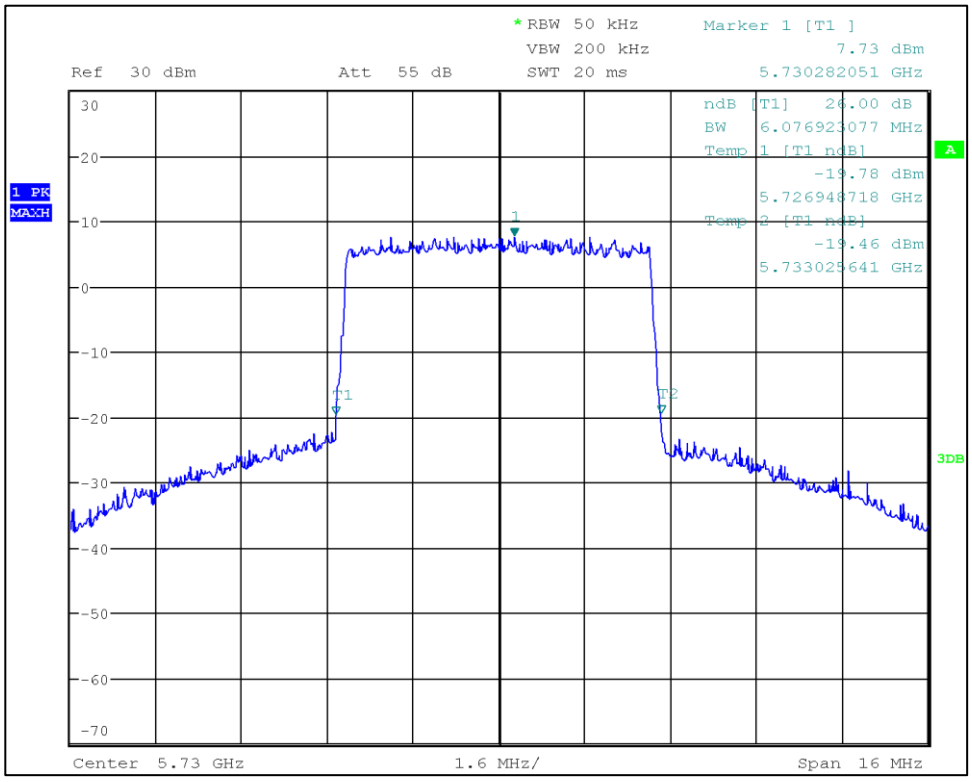
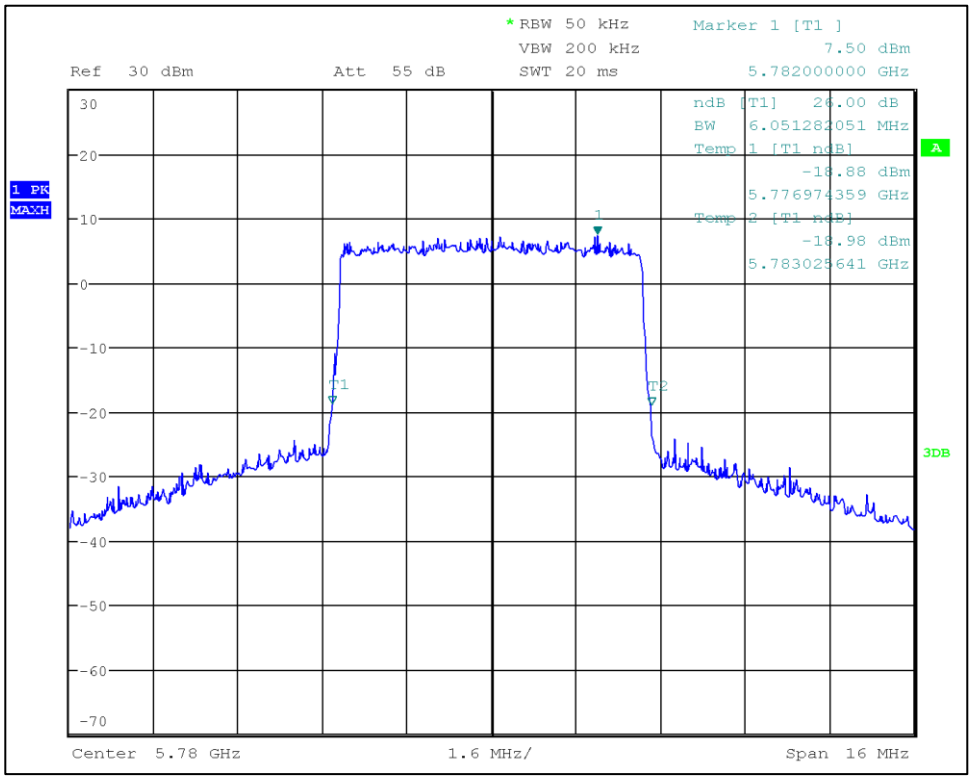
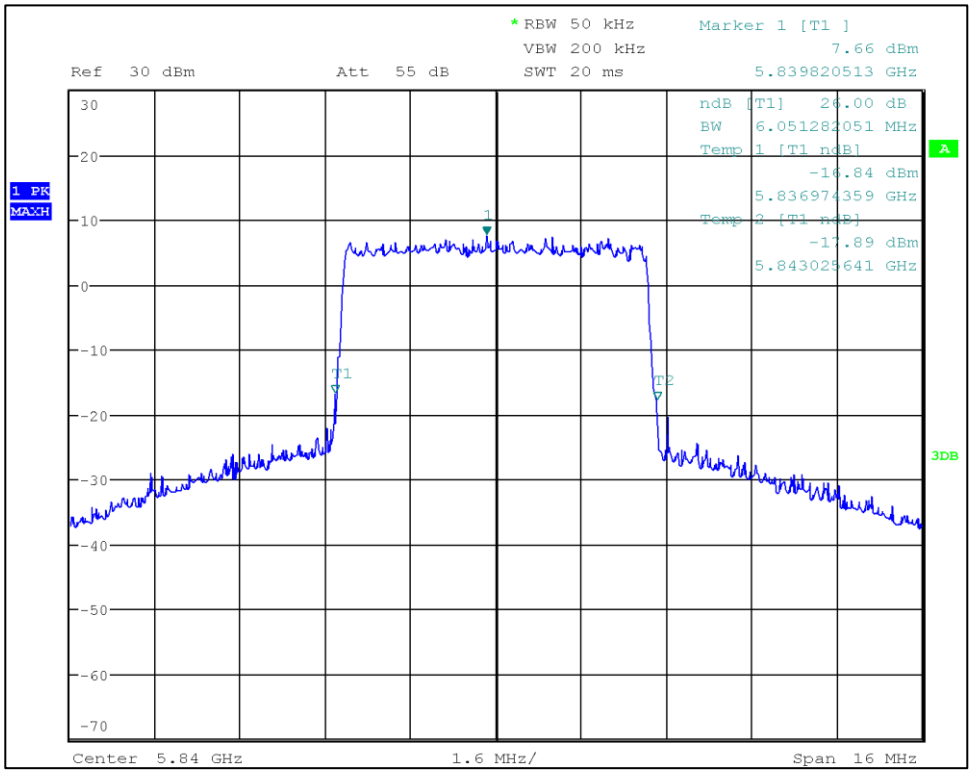
VBW 300 kHz
SWT 20 ms
Marker 1 [T1]
7.83 dBm
5.779166667 GHz
Ref 30 dBm
Att 55 dB
ndB [T1] 6.00 dB
BW 7.628205128 MHz
Temp 1 [T1 ndB]
3.47 dBm
5.776185897 GHz
Temp 2 [T1 ndB]
4.00 dBm
5.783814103 GHz
1 PK
MAXH
A
3DB
30
20
10
0
-10
-20
-30
-40
-50
-60
-70
Center 5.78 GHz
2 MHz/
Span 20 MHz

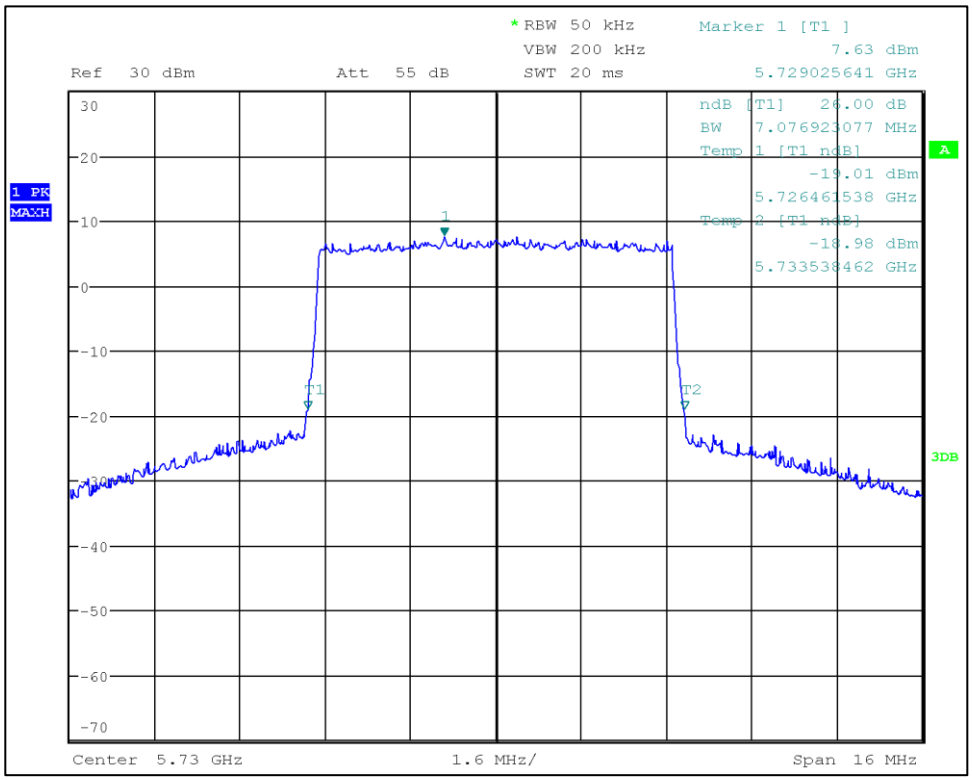

* RBW 100 kHz
VBW 300 kHz
SWT 20 ms
Marker 1 [T1]
8.58 dBm
5.841185897 GHz
Ref 30 dBm
Att 55 dB
ndB [T1] 6.00 dB
BW 7.628205128 MHz
Temp 1 [T1 ndB]
2.88 dBm
5.836185897 GHz
Temp 2 [T1 ndB]
3.05 dBm
5.843814103 GHz
1 PK
MAXH
A
3DB
30
20
10
0
-10
-20
-30
-40
-50
-60
-70
Center 5.84 GHz
2 MHz/
Span 20 MHz

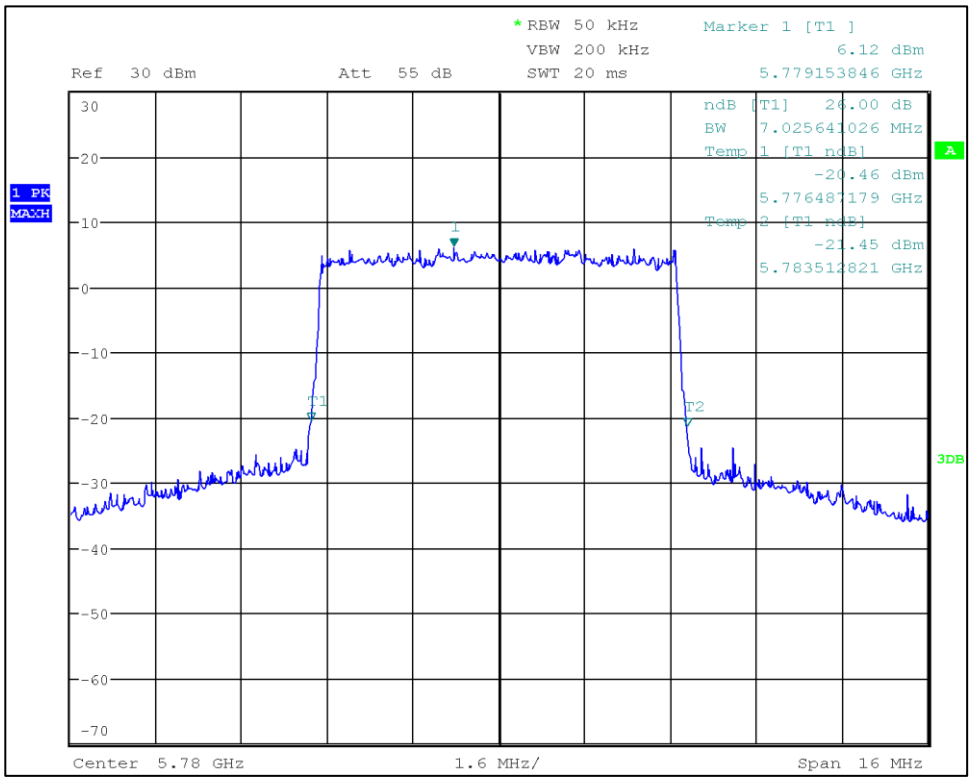
26 dB Emission Bandwidth Plots






RBW 50 kHz
VBW 200 kHz
SWT 20 ms
Marker 1 [T1]
7.66 dBm
5.839820513 GHz
Ref 30 dBm
Att 55 dB
ndB [T1] 26.00 dB
BW 6.051282051 MHz
Temp 1 [T1 ndB]
-16.84 dBm
5.836974359 GHz
Temp 2 [T1 ndB]
-17.89 dBm
5.843025641 GHz
1 PK
MAXH
A
3DB
T1
T2
Center 5.84 GHz
1.6 MHz/
Span 16 MHz


RBW 50 kHz
VBW 200 kHz
SWT 20 ms
Marker 1 [T1]
7.63 dBm
5.729025641 GHz
Ref 30 dBm
Att 55 dB
ndB [T1] 26.00 dB
BW 7.076923077 MHz
Temp 1 [T1 ndB]
-19.01 dBm
5.726461538 GHz
Temp 2 [T1 ndB]
-18.98 dBm
5.733538462 GHz
1 PK
MAXH
A
3DB
T1
T2
Center 5.73 GHz
1.6 MHz/
Span 16 MHz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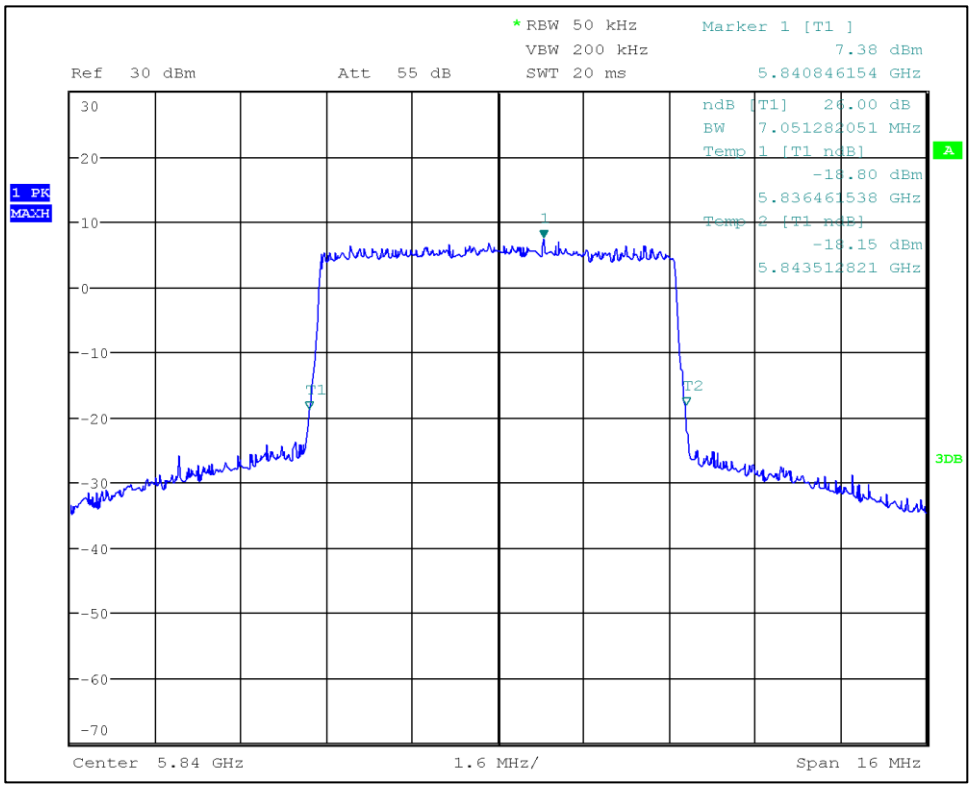
VBW 200 kHz
SWT 20 ms
Marker 1 [T1]
6.12 dBm
5.779153846 GHz
Ref 30 dBm
Att 55 dB
ndB [T1] 26.00 dB
BW 7.025641026 MHz
Temp 1 [T1 ndB]
-20.46 dBm
5.776487179 GHz
Temp 2 [T1 ndB]
-21.45 dBm
5.783512821 GHz
1 PK
MAXH
A
3DB
T1
T2
30
20
10
0
-10
-20
-30
-40
-50
-60
-70
Center 5.78 GHz
1.6 MHz/
Span 16 MHz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VBW 200 kHz
SWT 20 ms
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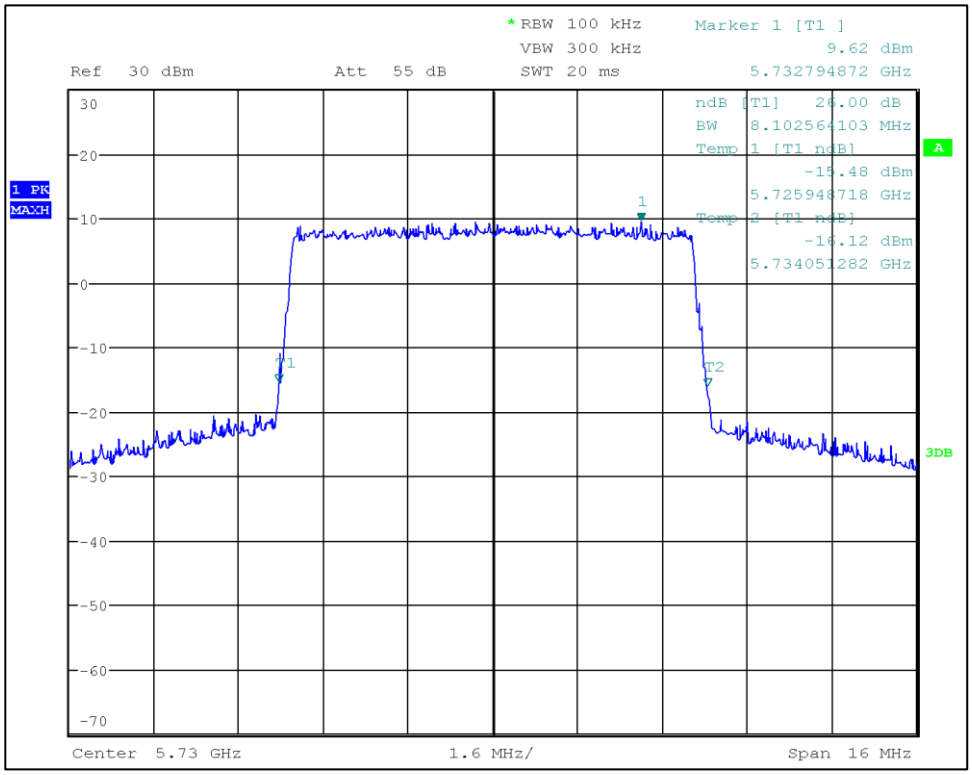
7.38 dBm
5.840846154 GHz
Ref 30 dBm
Att 55 dB
ndB [T1] 26.00 dB
BW 7.051282051 MHz
Temp 1 [T1 ndB]
-18.80 dBm
5.836461538 GHz
Temp 2 [T1 ndB]
-18.15 dBm
5.843512821 GHz
1 PK
MAXH
A
3DB
T1
T2
30
20
10
0
-10
-20
-30
-40
-50
-60
-70
Center 5.84 GHz
1.6 MHz/
Span 16 MHz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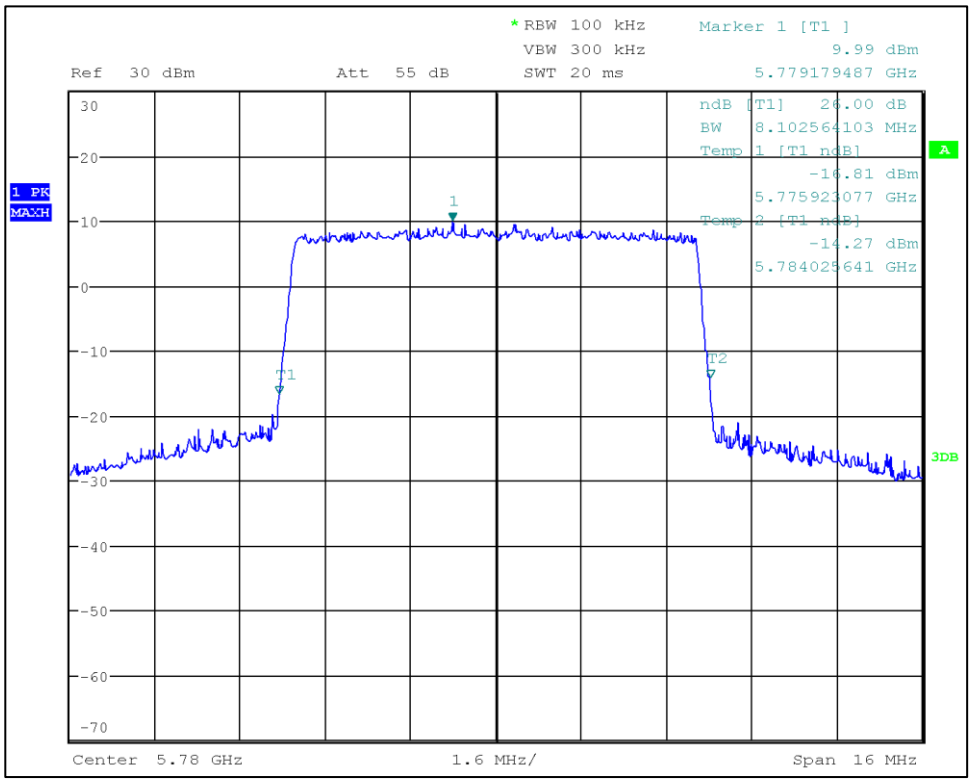
VBW 300 kHz
SWT 20 ms
Marker 1 [T1]
9.62 dBm
5.732794872 GHz
Ref 30 dBm
Att 55 dB
ndB [T1] 26.00 dB
BW 8.102564103 MHz
Temp 1 [T1 ndB]
-15.48 dBm
5.725948718 GHz
Temp 2 [T1 ndB]
-16.12 dBm
5.734051282 GHz
1 PK
MAXH
A
3DB
T1
T2
Center 5.73 GHz
1.6 MHz/
Span 16 MHz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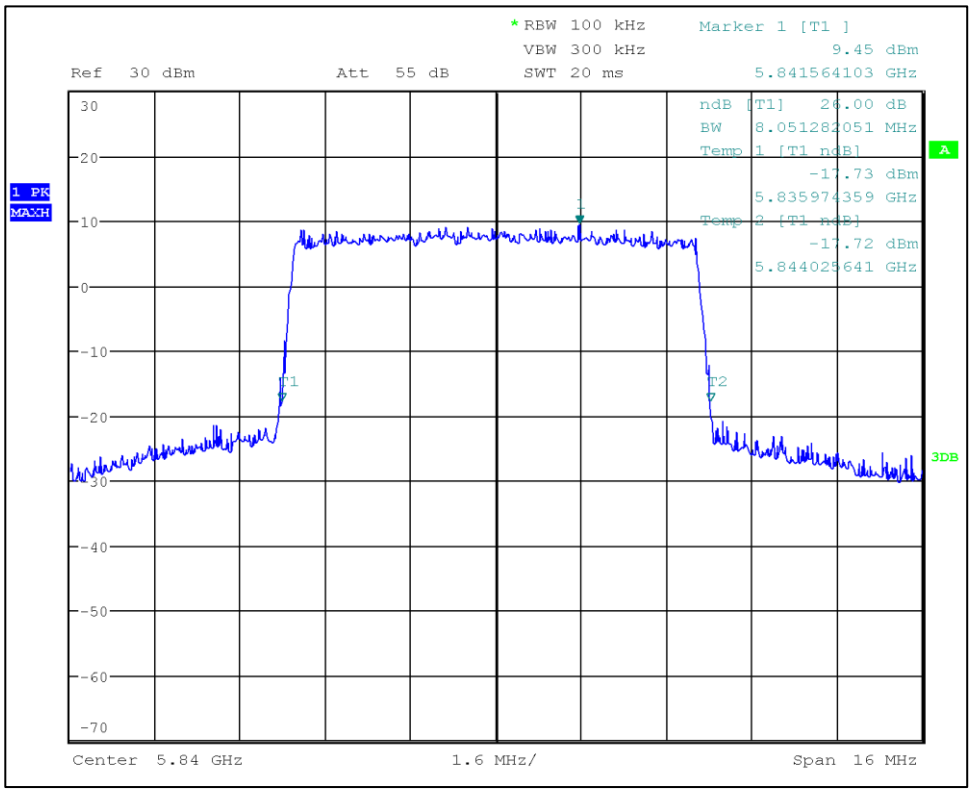
VBW 300 kHz
SWT 20 ms
Marker 1 [T1]
9.99 dBm
5.779179487 GHz
Ref 30 dBm
Att 55 dB
ndB [T1] 26.00 dB
BW 8.102564103 MHz
Temp 1 [T1 ndB]
-16.81 dBm
5.775923077 GHz
Temp 2 [T1 ndB]
-14.27 dBm
5.784025641 GHz
1 PK
MAXH
A
3DB
T1
T2
Center 5.78 GHz
1.6 MHz/
Span 16 MHz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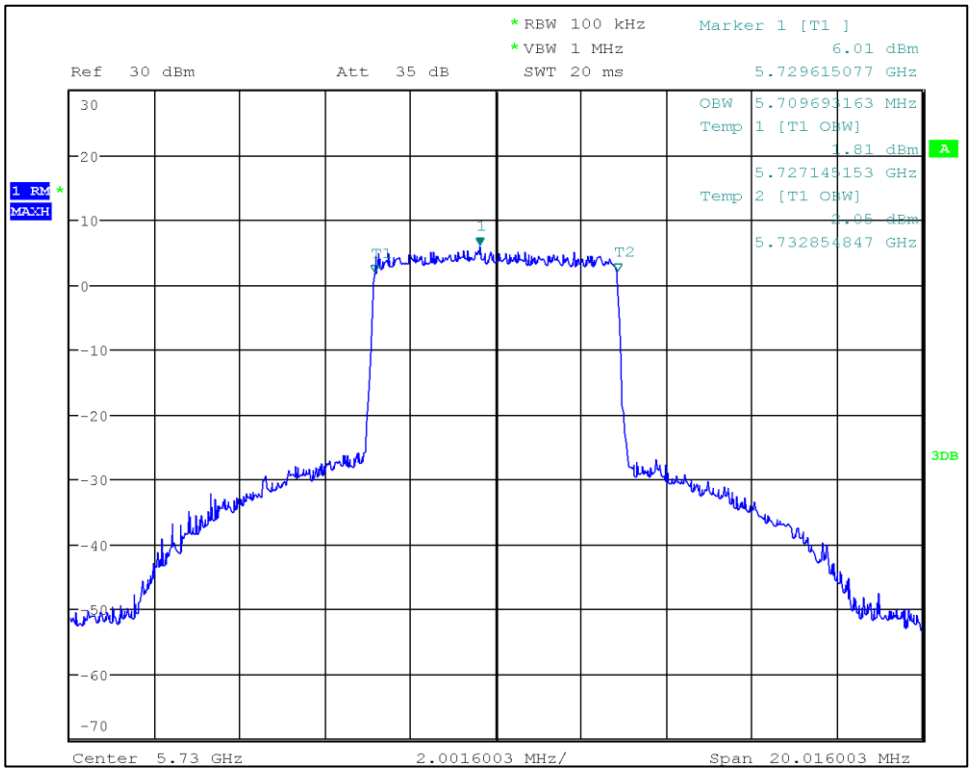
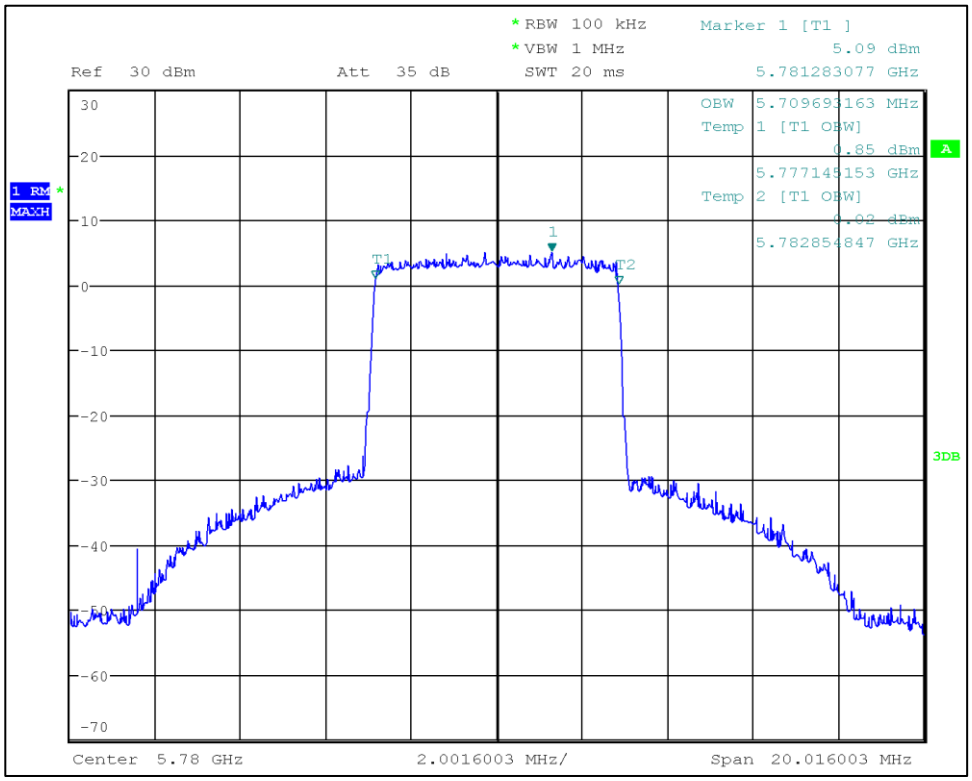
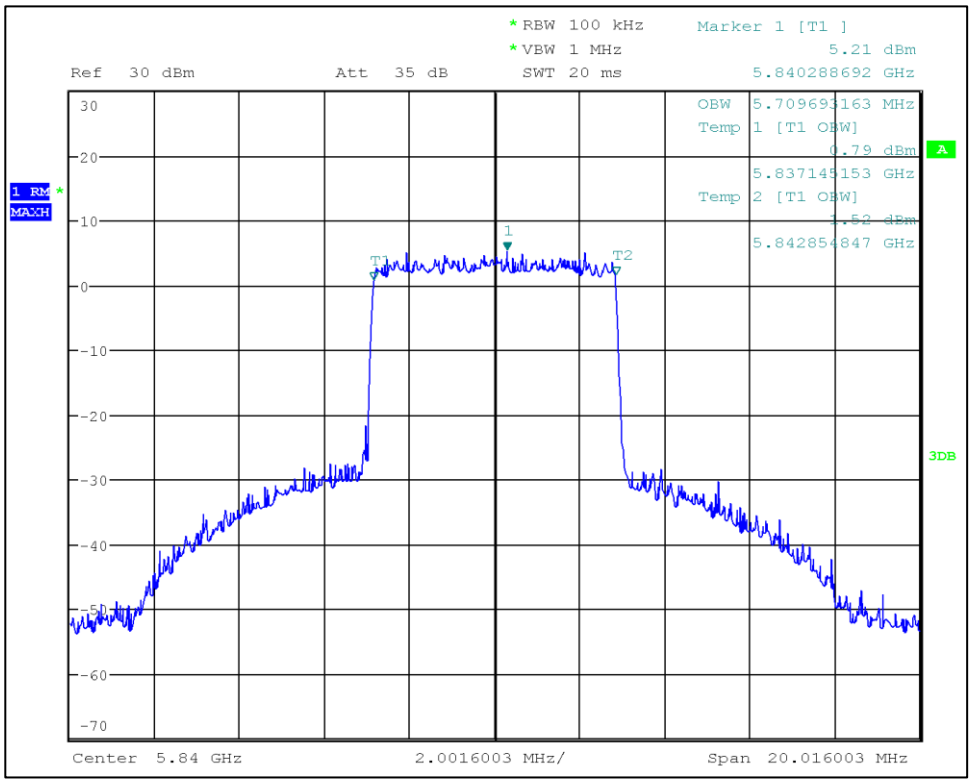
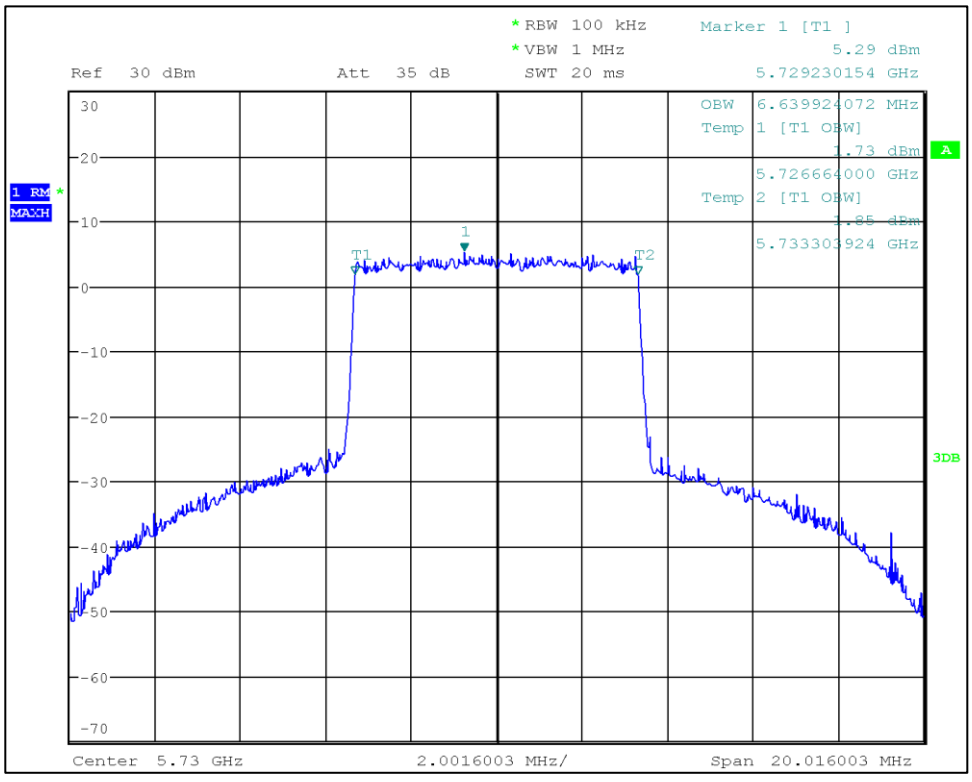
VBW 300 kHz
SWT 20 ms
Marker 1 [T1]
9.45 dBm
5.841564103 GHz
Ref 30 dBm
Att 55 dB
ndB [T1] 26.00 dB
BW 8.051282051 MHz
Temp 1 [T1 ndB]
-17.73 dBm
5.835974359 GHz
Temp 2 [T1 ndB]
-17.72 dBm
5.844025641 GHz
1 PK
MAXH
A
3DB
T1
T2
30
20
10
0
-10
-20
-30
-40
-50
-60
-70
Center 5.84 GHz
1.6 MHz/
Span 16 MHz

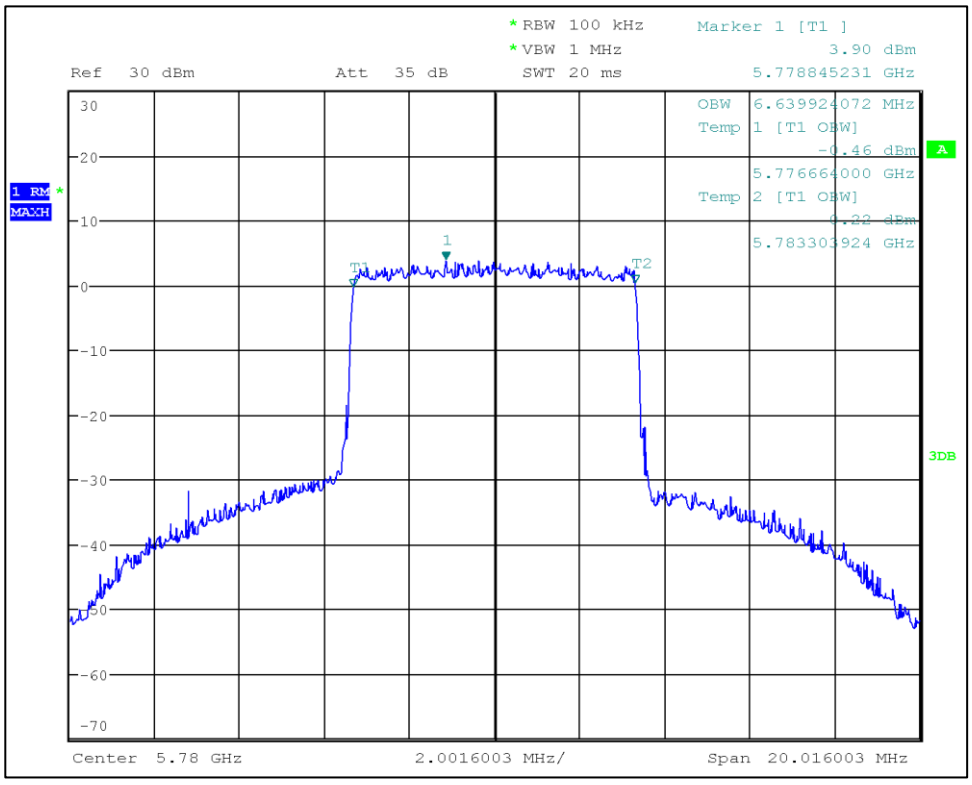
99% Occupied Bandwidth Plots

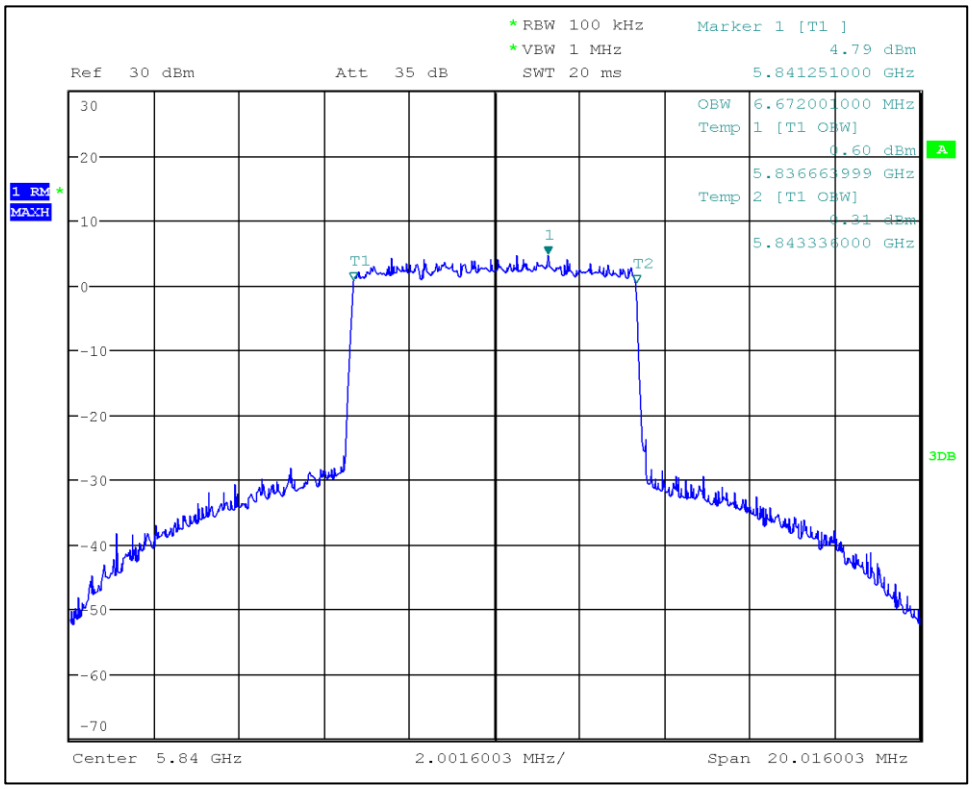


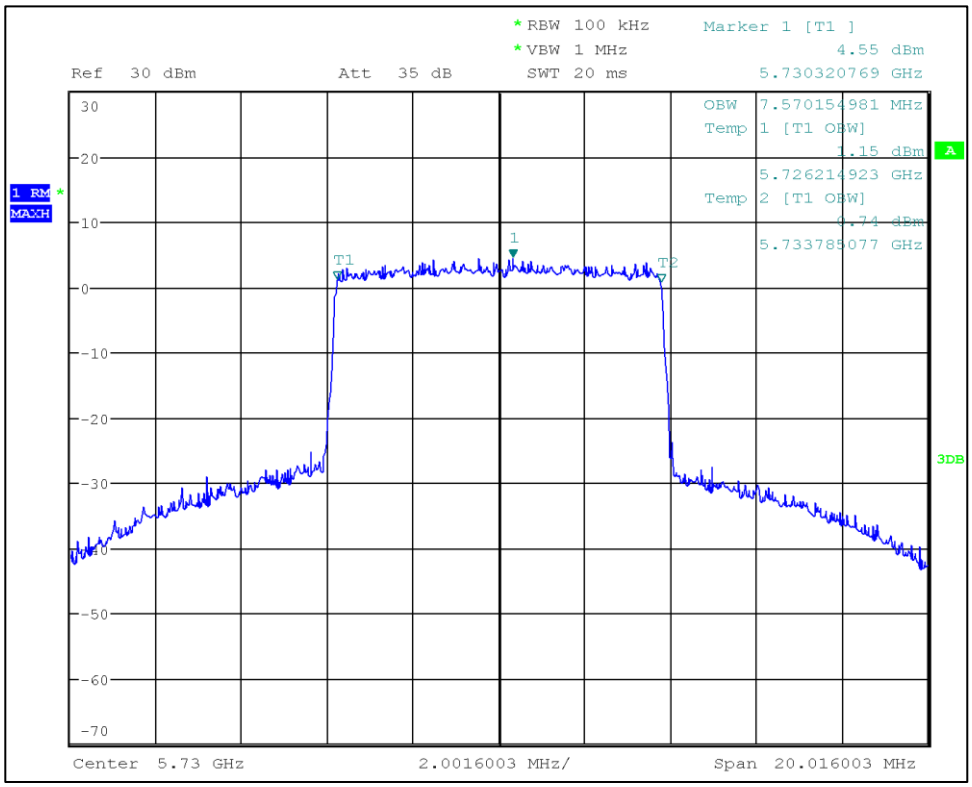


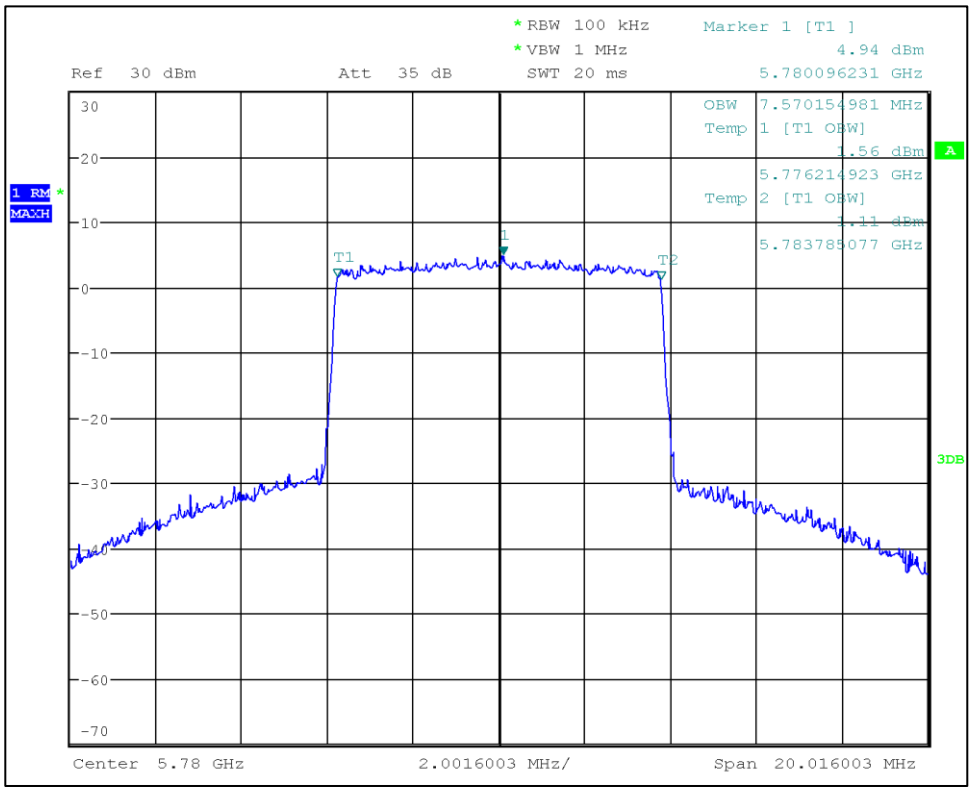

*RBW 100 kHz
*VBW 1 MHz
Ref 30 dBm
Att 35 dB
SWT 20 ms
Marker 1 [T1]
5.21 dBm
5.840288692 GHz
OBW 5.709693163 MHz
Temp 1 [T1 OBW]
0.79 dBm
5.837145153 GHz
Temp 2 [T1 OBW]
1.52 dBm
5.842854847 GHz
1 RM
MAXH
A
3DB
T1
T2
1
30
20
10
0
-10
-20
-30
-40
-50
-60
-70
Center 5.84 GHz
2.0016003 MHz/
Span 20.016003 MHz

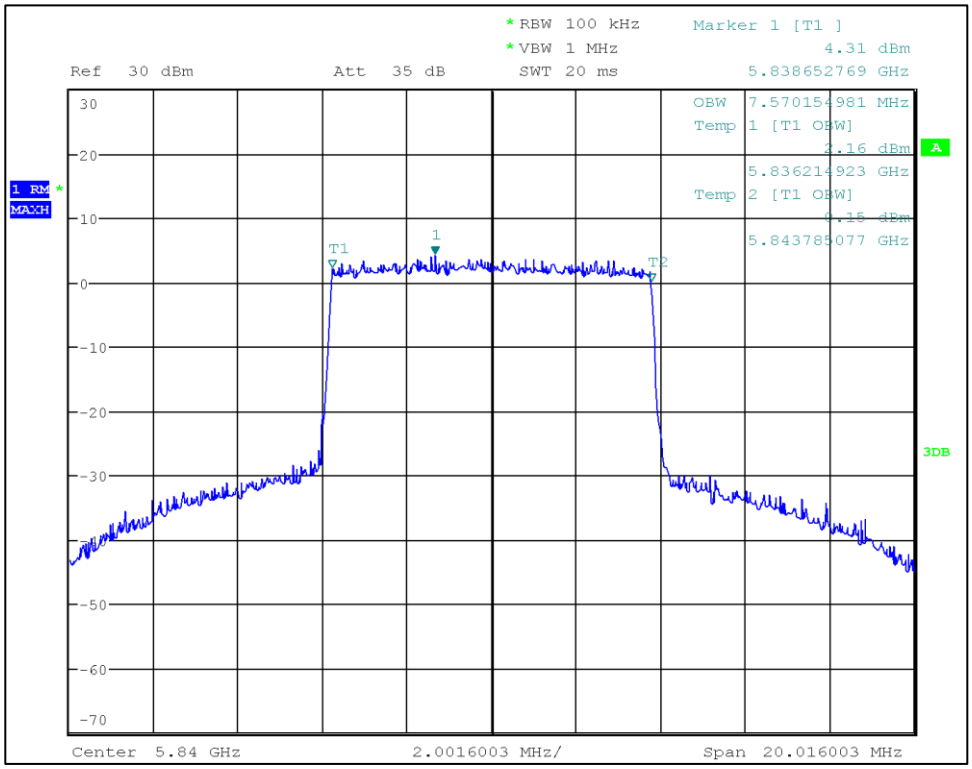

*RBW 100 kHz
*VBW 1 MHz
Ref 30 dBm
Att 35 dB
SWT 20 ms
Marker 1 [T1]
5.29 dBm
5.729230154 GHz
OBW 6.639924072 MHz
Temp 1 [T1 OBW]
1.73 dBm
5.726664000 GHz
Temp 2 [T1 OBW]
1.85 dBm
5.733303924 GHz
1 RM
MAXH
A
3DB
T1
T2
1
30
20
10
0
-10
-20
-30
-40
-50
-60
-70
Center 5.73 GHz
2.0016003 MHz/
Span 20.016003 MHz


RBW 100 kHz
VBW 1 MHz
SWT 20 ms
Marker 1 [T1]
3.90 dBm
5.778845231 GHz
Ref 30 dBm
Att 35 dB
OBW 6.639924072 MHz
Temp 1 [T1 OBW]
-0.46 dBm
5.776664000 GHz
Temp 2 [T1 OBW]
0.22 dBm
5.783303924 GHz
1 RM
MAXH
A
3DB
Center 5.78 GHz
2.0016003 MHz/
Span 20.016003 MHz


RBW 100 kHz
VBW 1 MHz
SWT 20 ms
Marker 1 [T1]
4.79 dBm
5.841251000 GHz
Ref 30 dBm
Att 35 dB
OBW 6.672001000 MHz
Temp 1 [T1 OBW]
0.60 dBm
5.836663999 GHz
Temp 2 [T1 OBW]
0.31 dBm
5.843336000 GHz
1 RM
MAXH
A
3DB
Center 5.84 GHz
2.0016003 MHz/
Span 20.016003 MHz


*RBW 100 kHz
*VBW 1 MHz
Ref 30 dBm
Att 35 dB
SWT 20 ms
Marker 1 [T1]
4.55 dBm
5.730320769 GHz
OBW 7.570154981 MHz
Temp 1 [T1 OBW]
1.15 dBm
5.726214923 GHz
Temp 2 [T1 OBW]
0.74 dBm
5.733785077 GHz
1 RM
MAXH
A
3DB
T1
T2
1
30
20
10
0
-10
-20
-30
-40
-50
-60
-70
Center 5.73 GHz
2.0016003 MHz/
Span 20.016003 MHz


*RBW 100 kHz
*VBW 1 MHz
Ref 30 dBm
Att 35 dB
SWT 20 ms
Marker 1 [T1]
4.94 dBm
5.780096231 GHz
OBW 7.570154981 MHz
Temp 1 [T1 OBW]
1.56 dBm
5.776214923 GHz
Temp 2 [T1 OBW]
1.11 dBm
5.783785077 GHz
1 RM
MAXH
A
3DB
T1
T2
1
30
20
10
0
-10
-20
-30
-40
-50
-60
-70
Center 5.78 GHz
2.0016003 MHz/
Span 20.016003 MHz


*RBW 100 kHz
*VBW 1 MHz
Ref 30 dBm
Att 35 dB
SWT 20 ms
Marker 1 [T1]
4.31 dBm
5.838652769 GHz
OBW 7.570154981 MHz
Temp 1 [T1 OBW]
2.16 dBm
5.836214923 GHz
Temp 2 [T1 OBW]
2.15 dBm
5.843785077 GHz
1 RM
MAXH
A
3DB
T1
T2
1
30
20
10
0
-10
-20
-30
-50
-60
-70
Center 5.84 GHz
2.0016003 MHz/
Span 20.016003 MHz

Output Power

Engineer: Aaron S. Froehlich
Test Date: 8/2/22

Test Procedure

Method SA-1 of KDB 789033 D02 Clause II.E.2.b) was utilized to measure the average Maximum Conducted Output Power. The DUT was operating at 100% duty cycle.

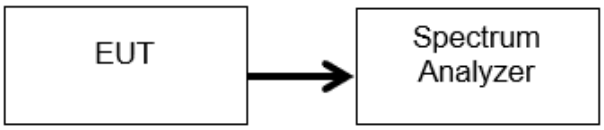
Limit

47 CFR 15.407(a)(3)(i)
For the band 5.725-5.850 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W.

Spectrum Analyzer Settings:

Span	Wide enough to encompass the entire EBW
RBW	1 MHz
VBW	≥ [3 x RBW]
Sweep	Auto
Detector	RMS (power averaging)
Trace Mode	Average
Trace Count	≥ 100
Integration	Via channel power measurement function

Test Setup



Test Data

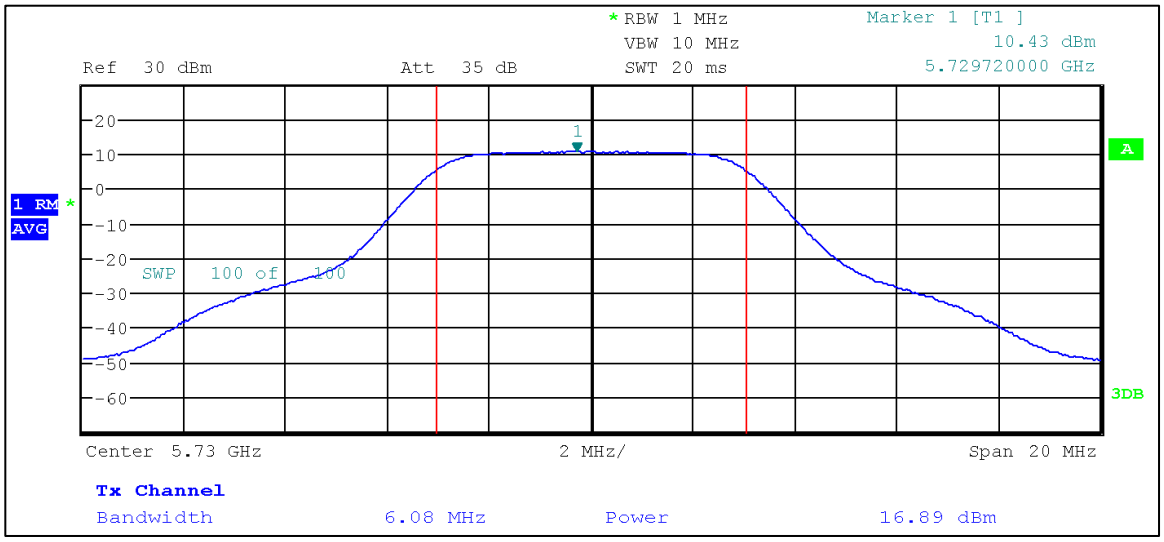
Tabular Data

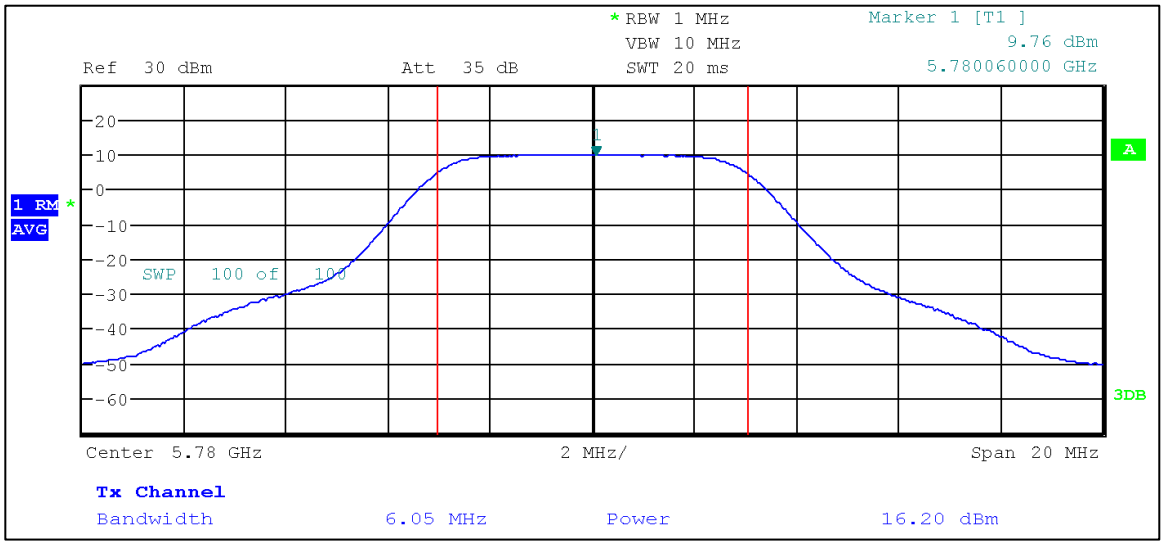
Frequency MHz	Channel #	Nominal BW MHz	Raw Pwr dBm	Path Loss dB	Avg Pwr dBm	Limit dBm	Margin dB	Avg Pwr mW
5730	1	6	16.89	1.15	18.04	30	-11.96	63.7
5780	6	6	16.20	1.14	17.34	30	-12.66	54.3
5840	12	6	16.41	1.19	17.60	30	-12.40	57.6
5730	1	7	17.01	1.15	18.16	30	-11.84	65.5
5780	6	7	16.32	1.14	17.46	30	-12.54	55.8
5840	12	7	16.60	1.19	17.79	30	-12.21	60.1
5730	1	8	16.92	1.15	18.07	30	-11.93	64.2
5780	6	8	16.25	1.14	17.39	30	-12.61	54.9
5840	12	8	16.53	1.19	17.72	30	-12.28	59.2

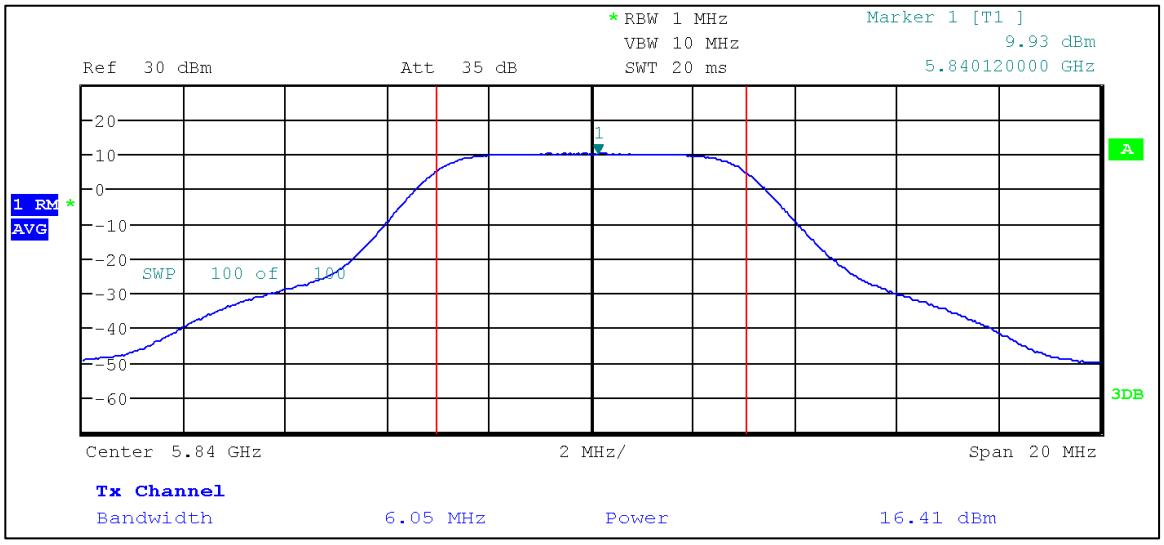
Margin = Avg Pwr – Limit

Maximum Conducted Output Power: 18.16 dBm, 65.5 mW

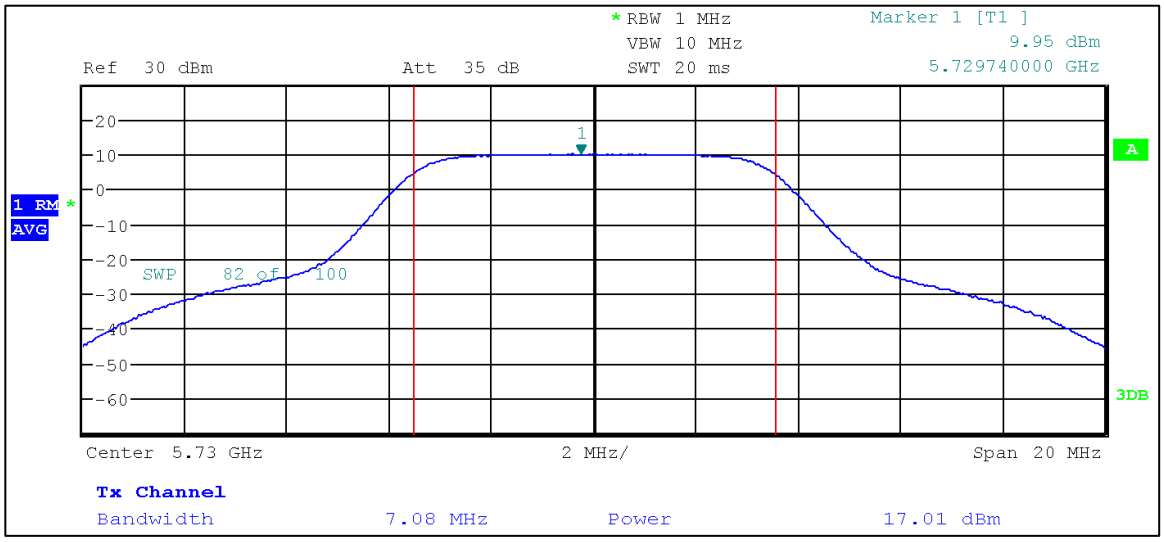
6 MHz Nominal Bandwidth

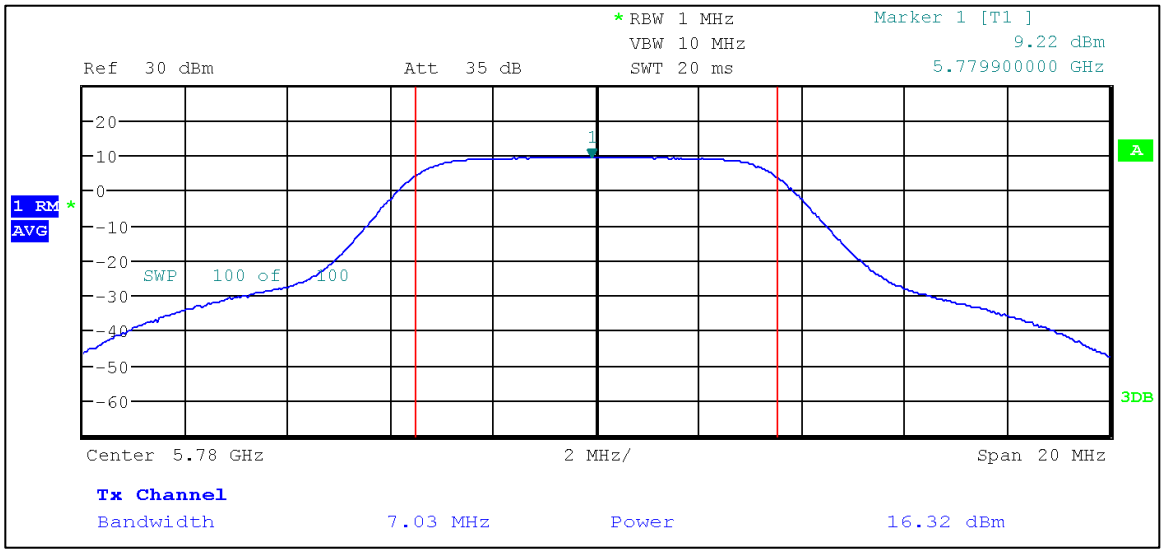


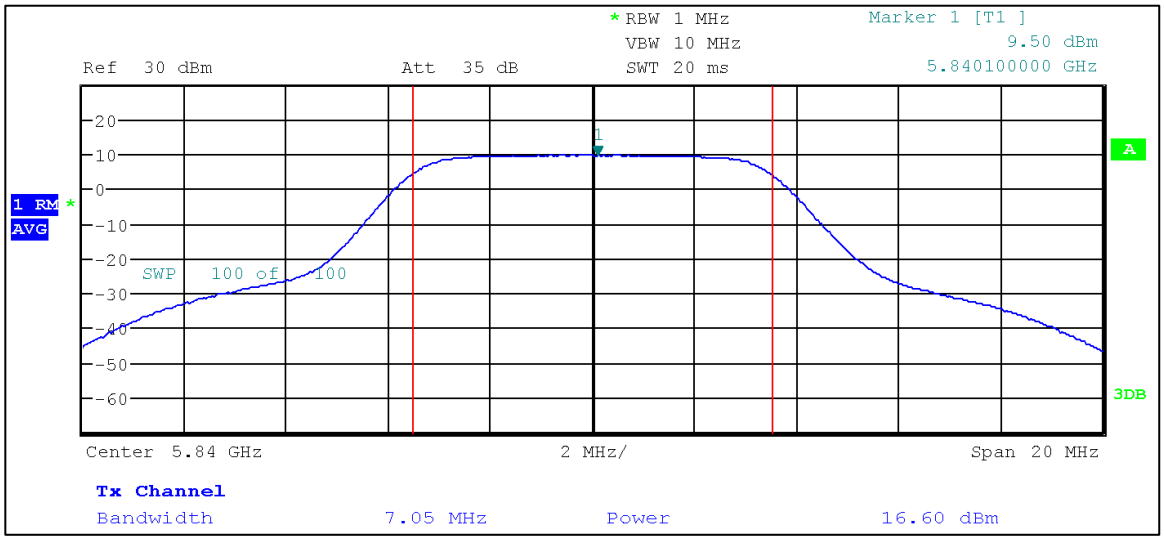




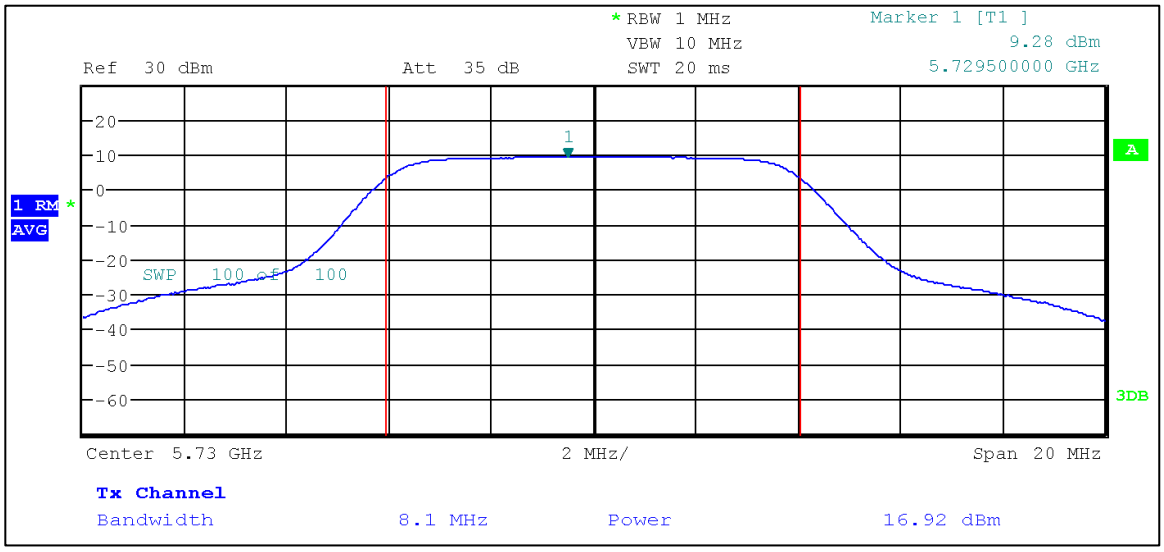
7 MHz Nominal Bandwidth

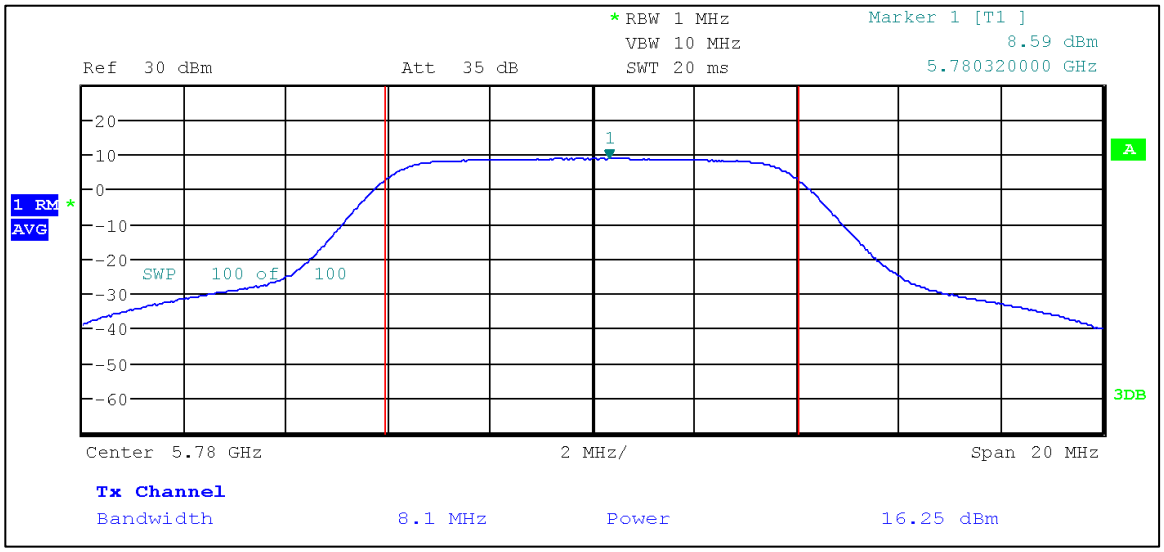


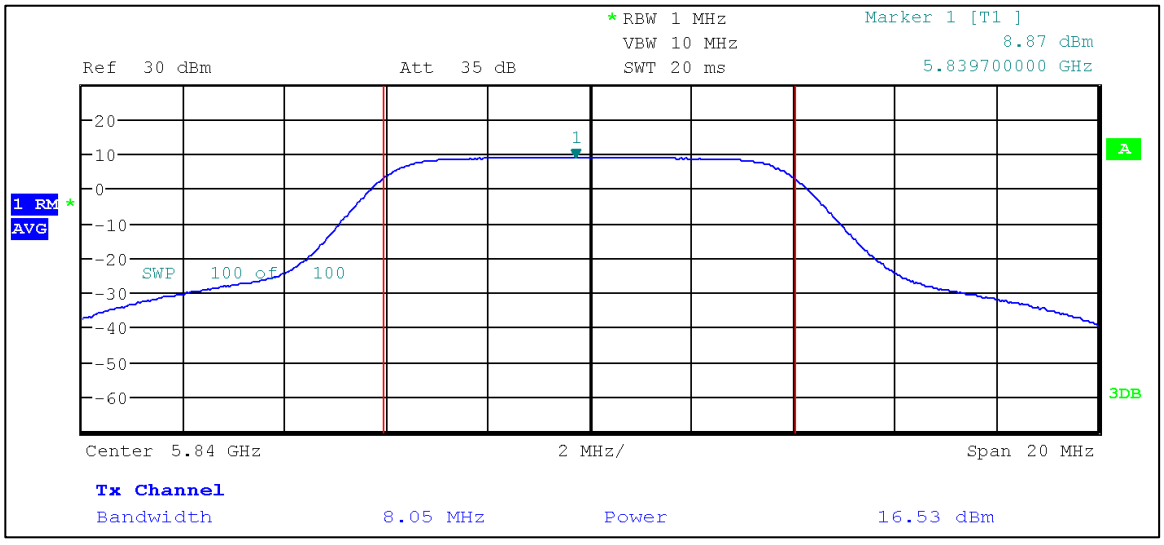




8 MHz Nominal Bandwidth







Power Spectral Density

Engineer: Aaron S. Froehlich
Test Date: 8/2/22

Test Procedure

The test methods and settings of KDB 789033 D02 Clause II.F. were used to demonstrate compliance matching the Averaging method used to demonstrate Maximum Conducted Output Power.

Limit

47 CFR 15.407(a)(3)(i)

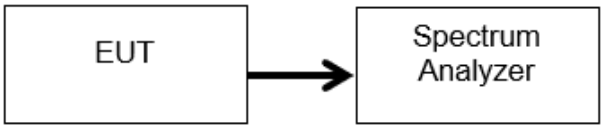
the maximum power spectral density shall not exceed 30 dBm in any 500-kHz band.

47 CFR 15.407(a)(12)
Power spectral density measurement: … Measurements in the 5.725-5.895 GHz band are made over a reference bandwidth of 500 kHz or the 26 dB emission bandwidth of the device, whichever is less.

Spectrum Analyzer Settings:

Span	Wide enough to encompass the entire EBW
RBW	500 kHz
VBW	≥ [3 x RBW]
Sweep	Auto
Detector	RMS (power averaging)
Trace Mode	Average
Trace Count	≥ 100
Measurement	Marker to Peak

Test Setup



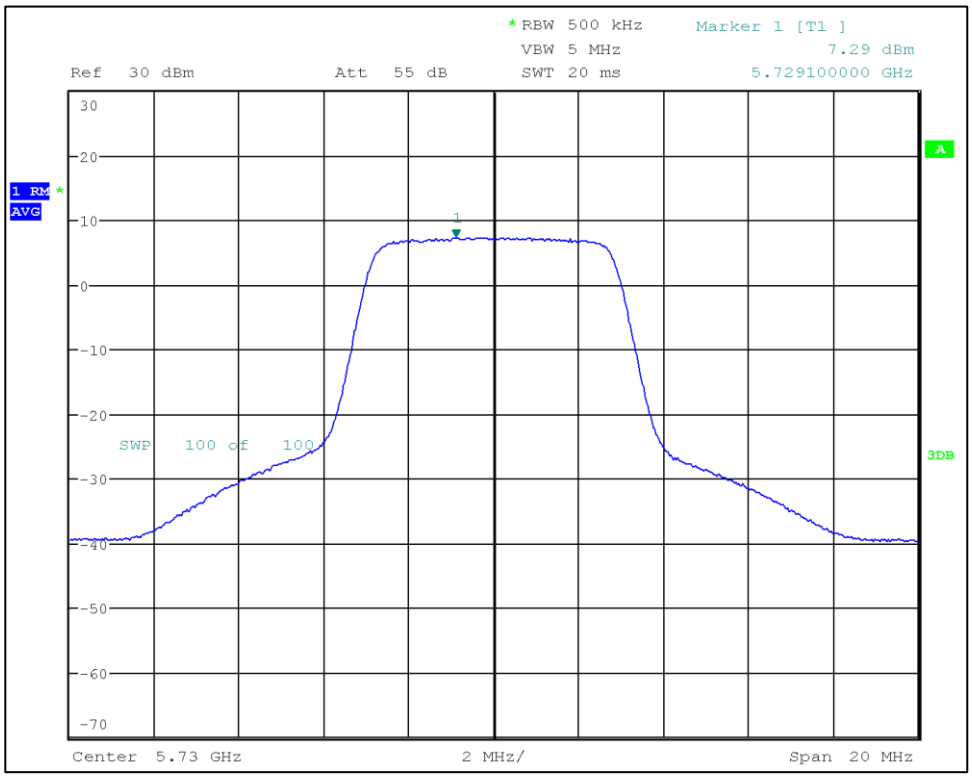
Test Data

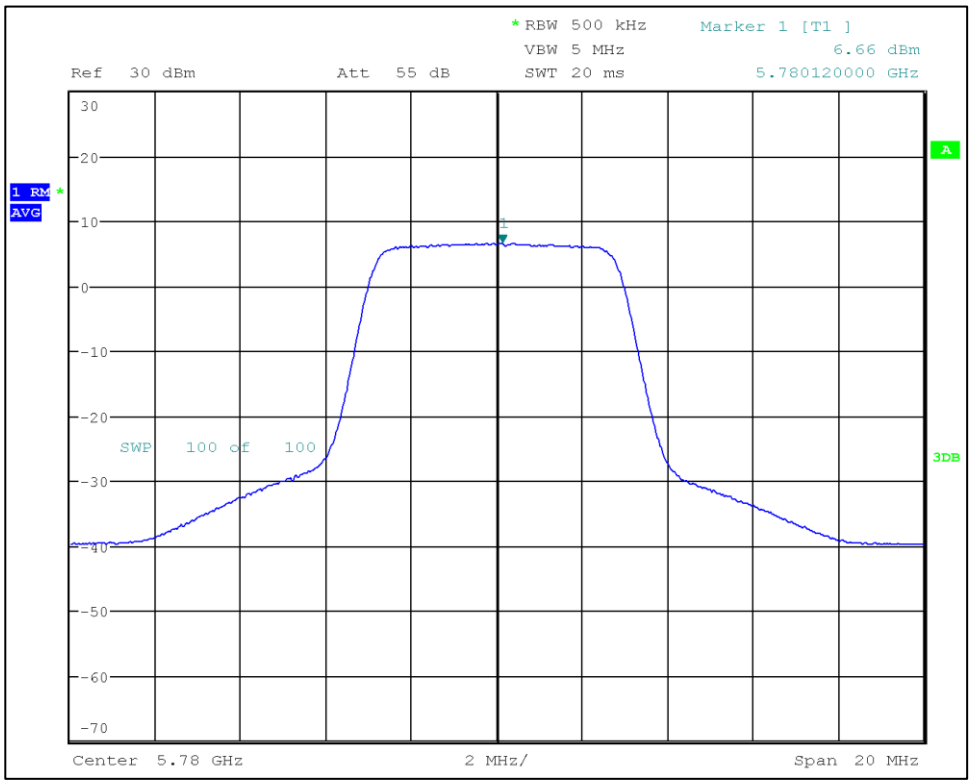
Tabular Data

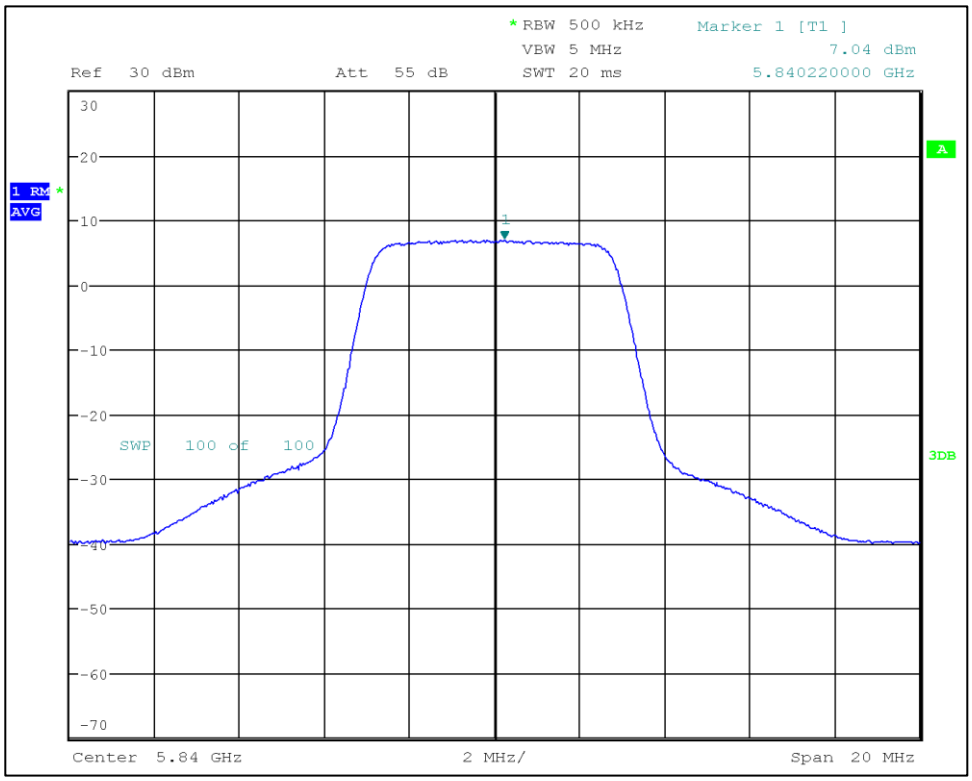
Frequency MHz	Channel #	Nominal BW MHz	Raw PSD dBm	Path Loss dB	Avg PSD dBm	Limit dBm	Margin dB	Result
5730	1	6	7.29	1.15	8.44	30	-21.56	Pass
5780	6	6	6.66	1.14	7.80	30	-22.20	Pass
5840	12	6	7.04	1.19	8.23	30	-21.77	Pass
5730	1	7	6.7	1.15	7.85	30	-22.15	Pass
5780	6	7	5.99	1.14	7.13	30	-22.87	Pass
5840	12	7	6.39	1.19	7.58	30	-22.42	Pass
5730	1	8	6.02	1.15	7.17	30	-22.83	Pass
5780	6	8	5.42	1.14	6.56	30	-23.44	Pass
5840	12	8	5.68	1.19	6.87	30	-23.13	Pass

Margin = Limit – Avg PSD

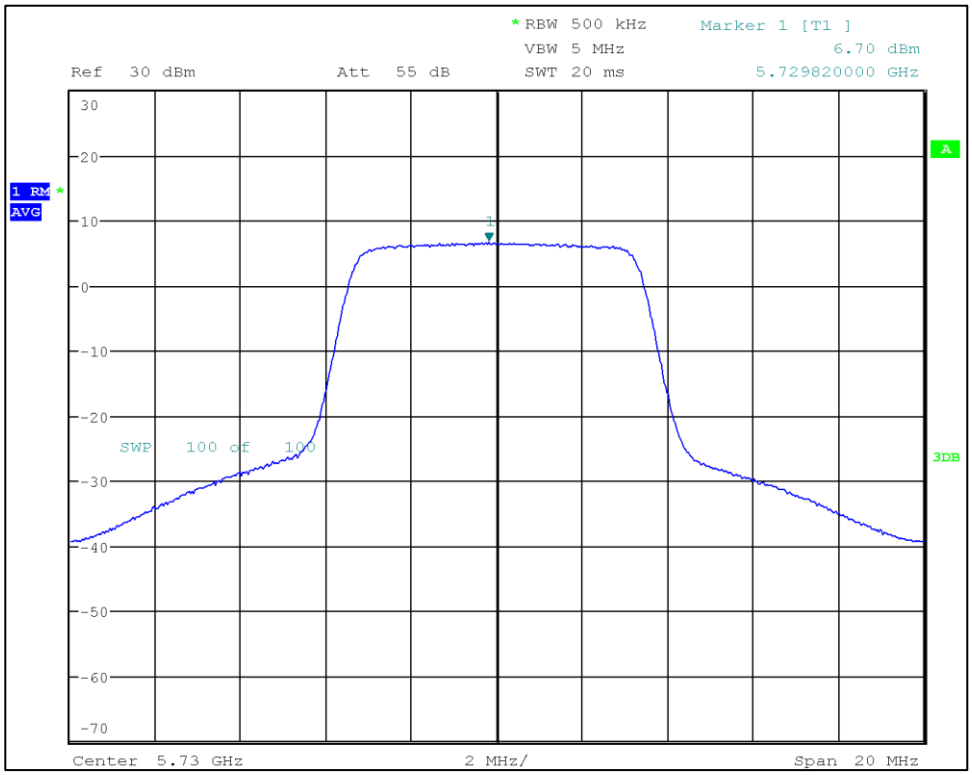
6 MHz Nominal Bandwidth Plots

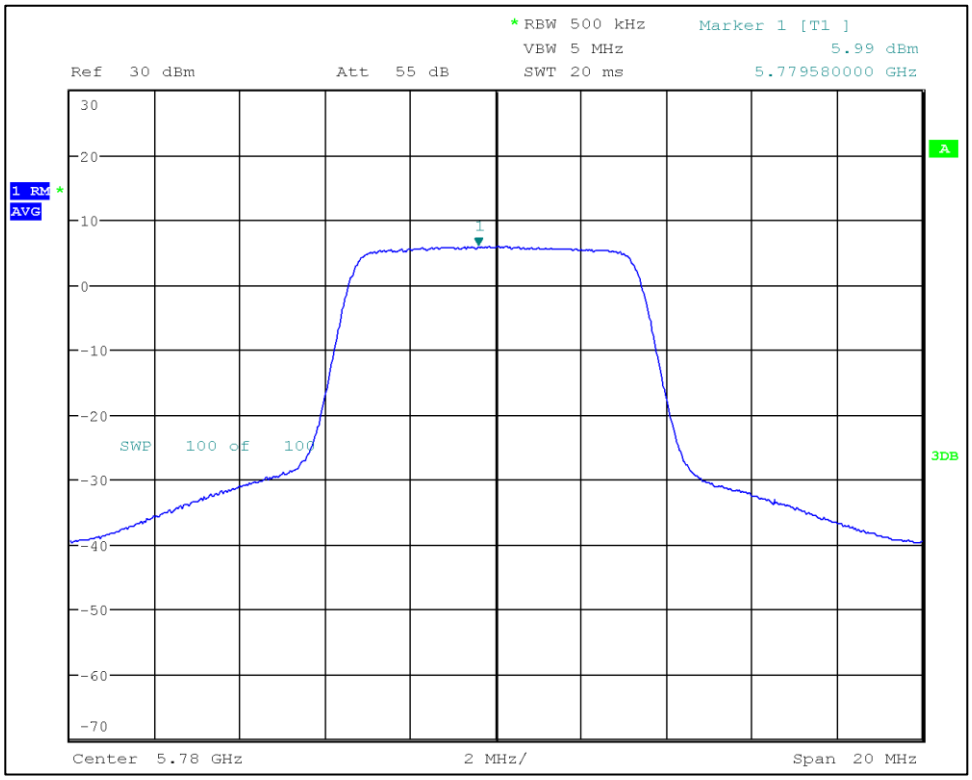


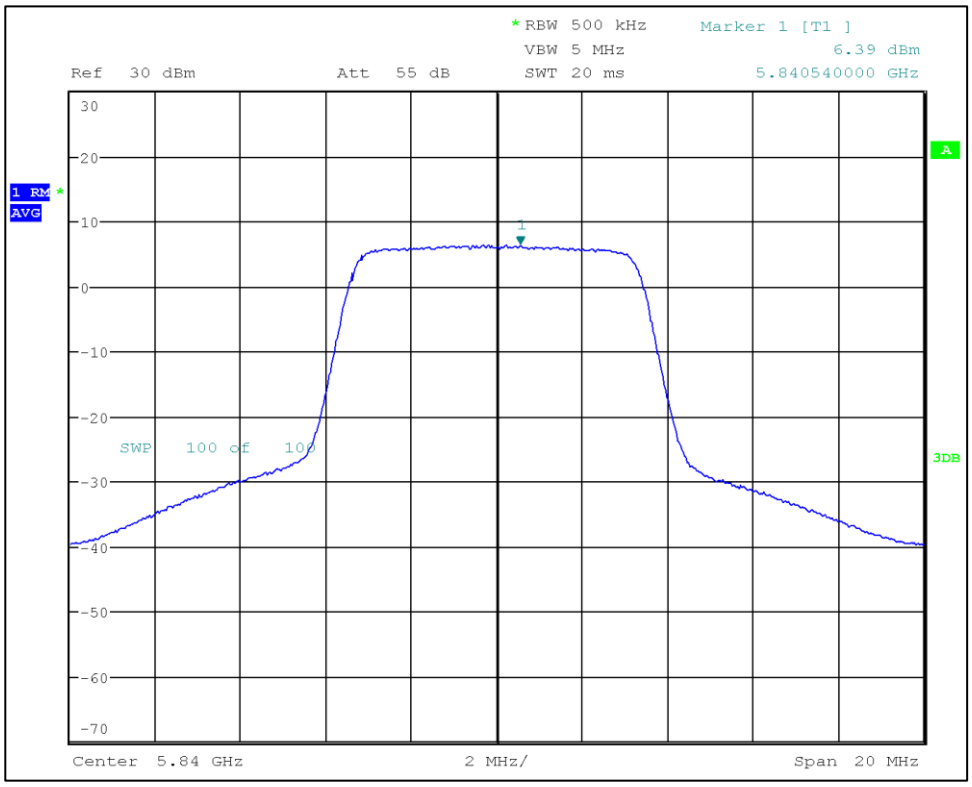



RBW 500 kHz
VBW 5 MHz
SWT 20 ms
Marker 1 [T1]
7.04 dBm
5.840220000 GHz
Ref 30 dBm
Att 55 dB
1 RM
AVG
A
3DB
SWP 100 of 100
30
20
10
0
-10
-20
-30
-40
-50
-60
-70
Center 5.84 GHz
2 MHz/
Span 20 MHz

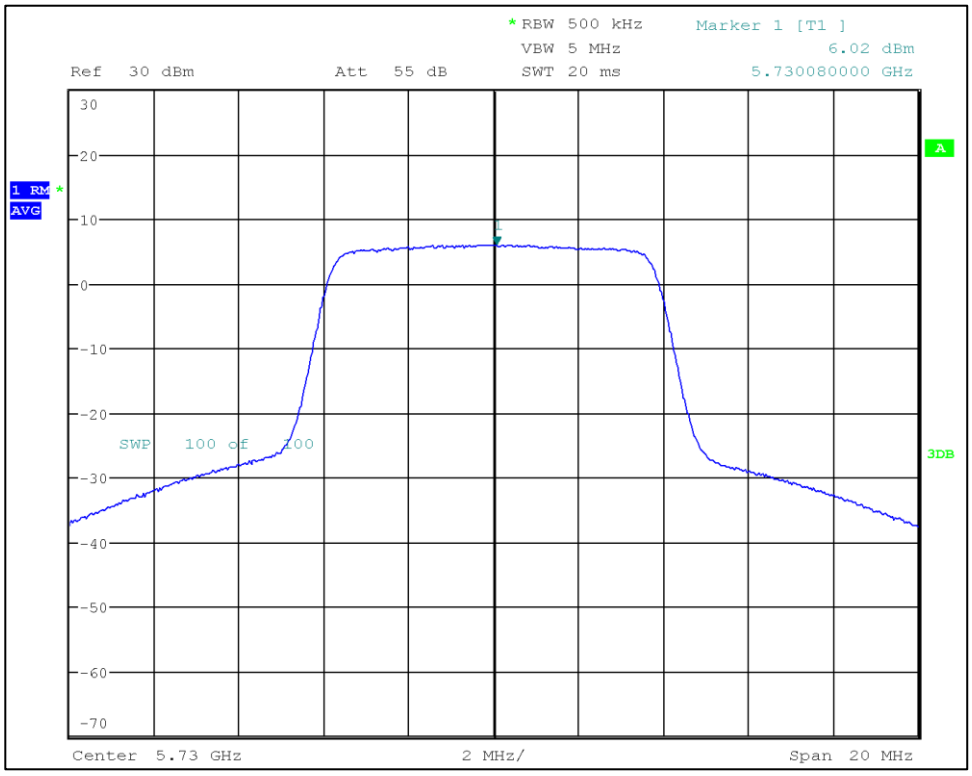
7 MHz Nominal Bandwidth Plots

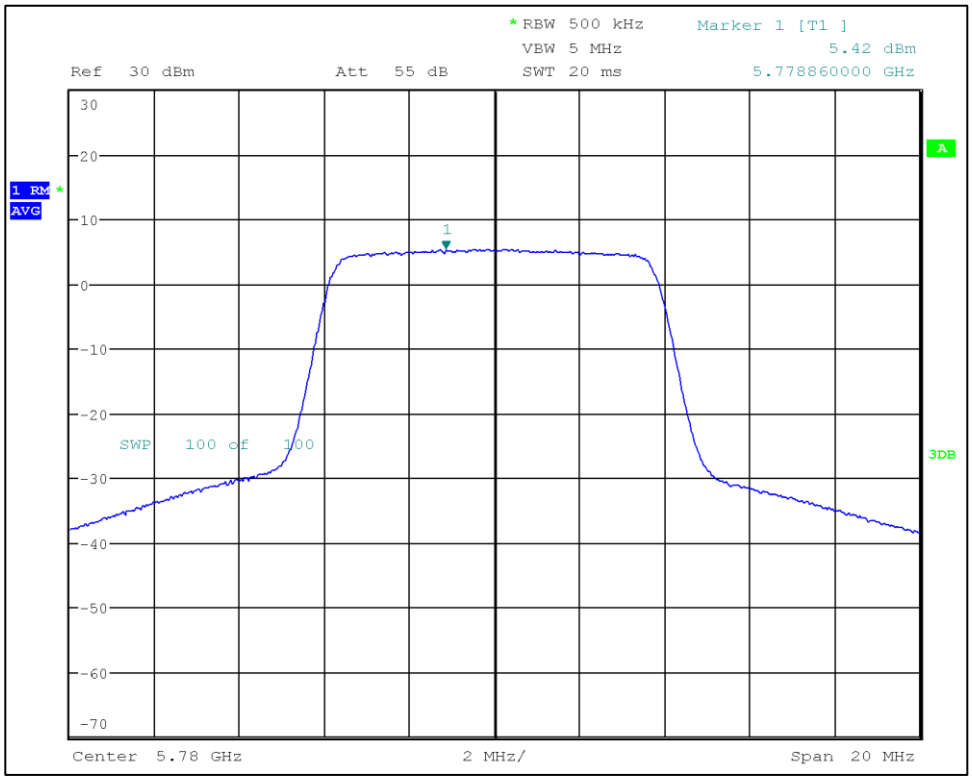


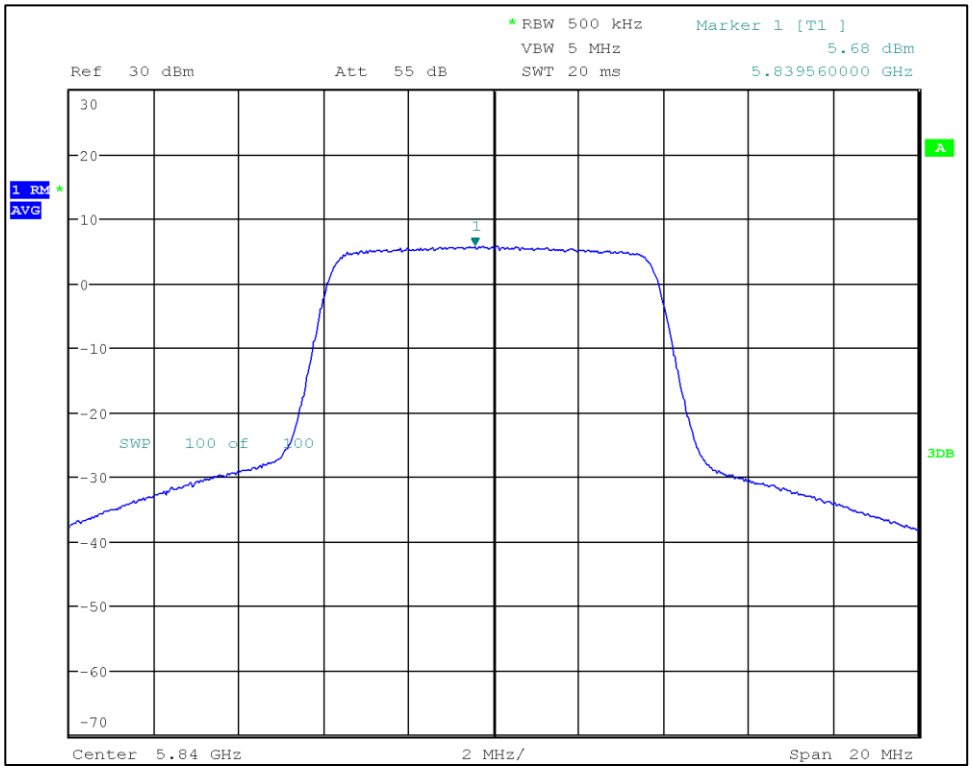



*RBW 500 kHz
VBW 5 MHz
SWT 20 ms
Marker 1 [T1]
6.39 dBm
5.840540000 GHz
Ref 30 dBm
Att 55 dB
1 RM *
AVG
A
3DB
SWP 100 of 100
Center 5.84 GHz
2 MHz/
Span 20 MHz

8 MHz Nominal Bandwidth Plots






*RBW 500 kHz
VBW 5 MHz
SWT 20 ms
Marker 1 [T1]
5.68 dBm
5.839560000 GHz
Ref 30 dBm
Att 55 dB
1 RM *
AVG
A
3DB
SWP 100 of 100
Center 5.84 GHz
2 MHz/
Span 20 MHz

Unwanted Emissions that fall Outside of the Restricted Bands

Engineer: Aaron S. Froehlich

Test Date: 8/3/22

Test Procedure

The General Requirements for Unwanted Emissions Measurements of KDB 789033 D02 Clause II.G.2, Unwanted Emissions that fall Outside of the Restricted Bands, specifies the use of Clause II.G.4 below 1000 MHz and Clauses II.G.5 (Peak Measurements).

General Requirements Clause II.G.3
•EUT duty cycle 100%
•A value representative of an upper bound on out-of-band antenna gain (in dBi) shall be added to the measured antenna-port conducted emission power to compute EIRP within the specified measurement bandwidth. Minimum 2 dBi.
•Unwanted Band-edge emissions may be measured using the marker delta or integration methods.
•For band edge emission measurements, follow the procedures described in II.G.5 or II.G.6. except
RBW = 100 kHz,
VBW ≥ 3 x RBW,
perform a band-power integration across the 1 MHz bandwidth in which the band edge emission level is to be measured.
Peak Measurements: Peak detector max hold
Average Measurements: RMS detector, power averaging, sweep count ≥ 100

Above 1000 MHz Peak Clause II.G.5
Follow the requirements in II.G.3
Maximum Emission levels are measure by setting the analyzer as follows

RBW = 1 MHz.

VBW ≥ 3 MHz.

Detector = Peak.

Sweep time = auto.

Trace mode = max hold.

Allow sweeps to continue until the trace stabilizes. Note that if the transmission is not continuous, the time required for the trace to stabilize will increase by a factor of approximately 1/x, where x is the duty cycle. For example, at 50% duty cycle, the measurement time will increase by a factor of two relative to measurement time for continuous transmission.

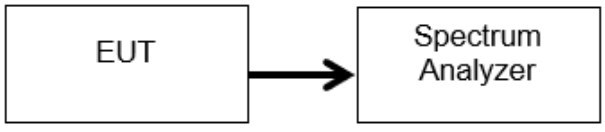
Limits

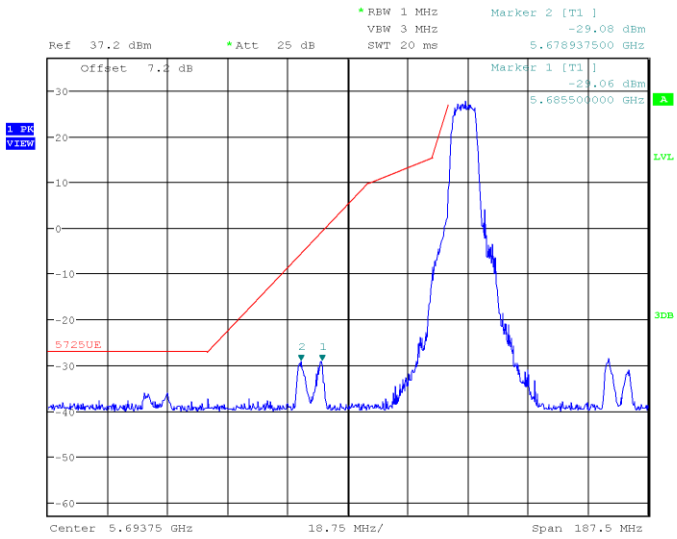
47 CFR 15.407(b)(4)(i)

For transmitters operating solely in the 5.725-5.850 GHz band:

All emissions shall be limited to a level of −27 dBm/MHz at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge. The EUT complies to the restricted band limits outside of 75 MHz which is the tighter limit. This can be seen in the radiated spurious section.

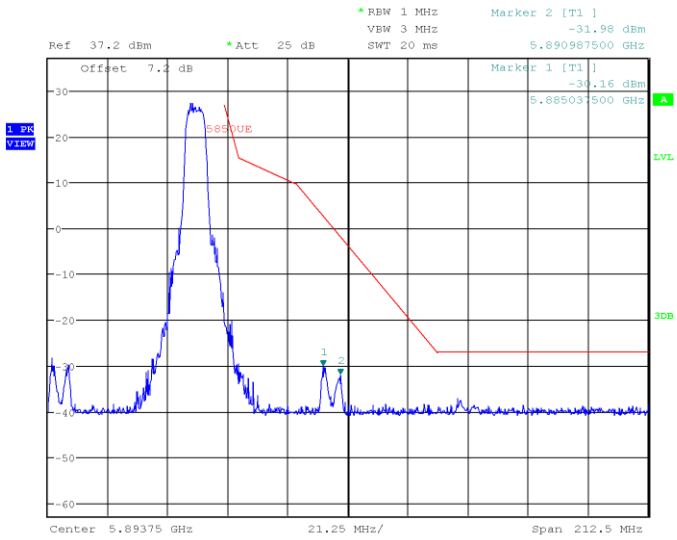
Test Setup





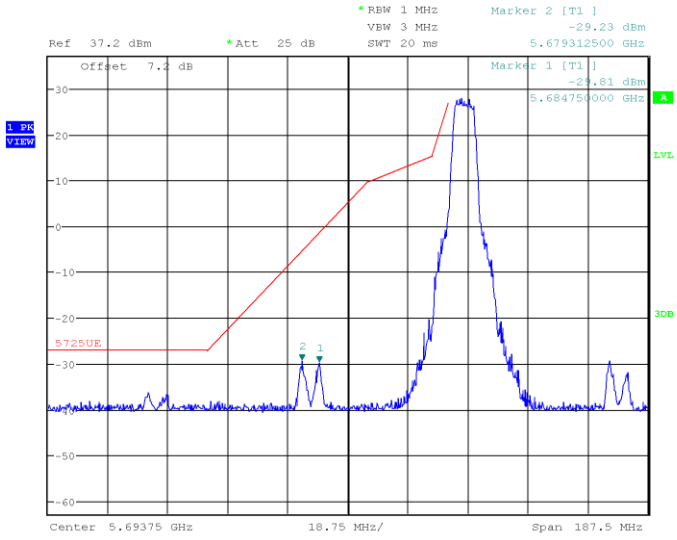
condspur_b3_1g2g
Date: 3.AUG.2022 00:42:33

6MHz bandwidth Low Channel



condspur_b3_1g2g
Date: 3.AUG.2022 00:51:48

6MHz bandwidth High Channel



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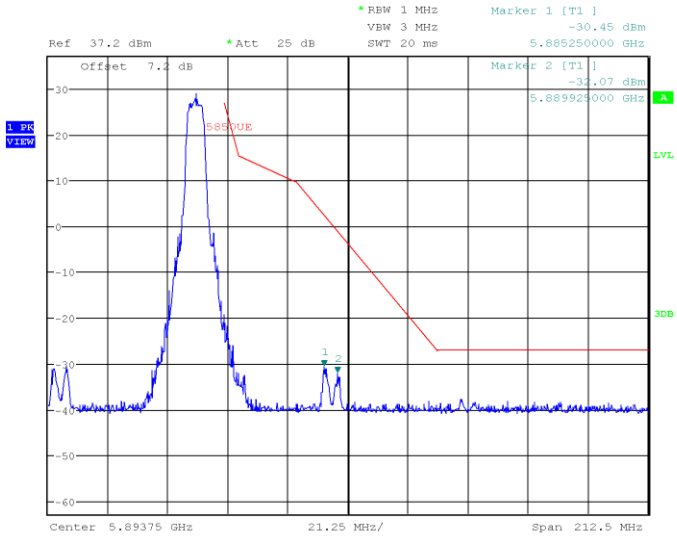
7MHz bandwidth Low Channel



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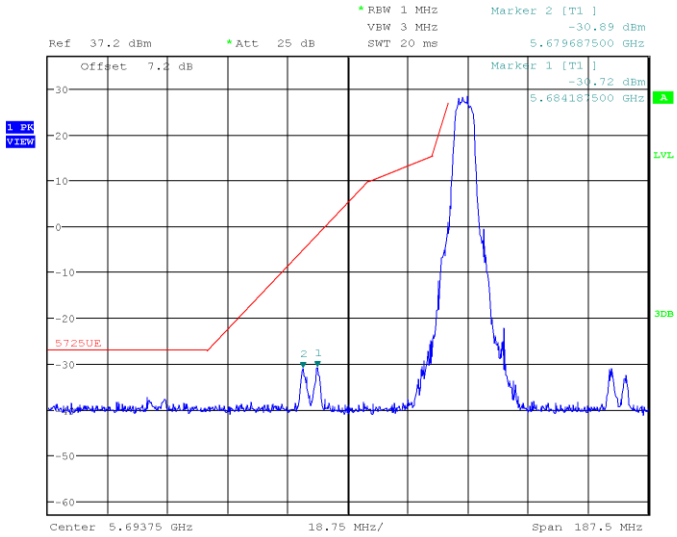
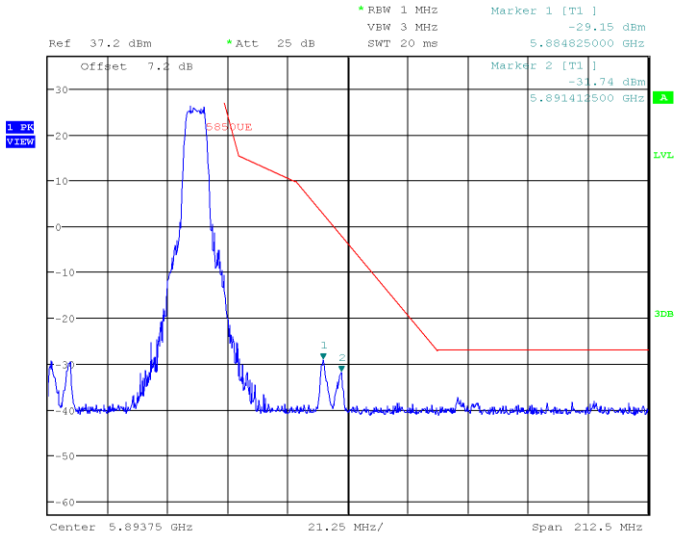
7MHz bandwidth High Channel



condspur_b3_1g2g
Date: 3.AUG.2022 00:45:51

8MHz bandwidth Low Channel



condspur_b3_1g2g
Date: 3.AUG.2022 00:52:54

8MHz bandwidth High Channel

Radiated Spurious Emissions

Engineer: John Michalowicz
Test Date: 11/29/22

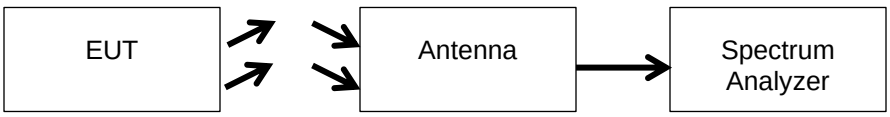
Test Procedure: 30-1000 MHz

The EUT was setup in a semi-anechoic test chamber set 3m from the receiving antenna. The EUT was set to transmit on the lowest, middle and highest frequency of operation, as well as frequency hopping, at the maximum power level. The EUT was tested, in 3 orthogonal axis, by rotating it 360° with the receive antenna in both the vertical and horizontal orientation while raised from 1 to 4 meters to ensure the TX signal levels were maximized. A spectrum analyzer was used to verify that the EUT met the requirements for Radiated Spurious Emissions.

All emissions from 30 MHz to 1 GHz were examined.
Measured Level includes antenna and receiver cable correction factors.
Correction factors were input into the spectrum analyzer before recording "Measured Level".

RBW = 100 KHz
VBW = 300 KHz
Detector – Quasi Peak

Test Setup

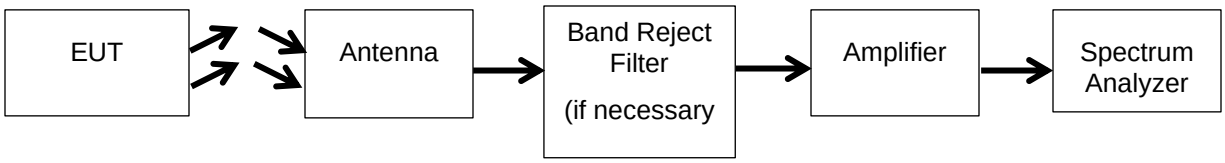


Test Procedure: ≥ 1 GHz

The EUT was setup in a semi-anechoic test chamber set 3m from the receiving antenna. The EUT was set to transmit on the lowest, middle and highest frequency of operation at the maximum power level. The EUT was tested, in 3 orthogonal axis, by rotating it 360° with the receive antenna in both the vertical and horizontal orientation while raised from 1 to 4 meters to ensure the TX signal levels were maximized. A spectrum analyzer was used to verify that the EUT met the requirements for Radiated Spurious Emissions up to 40 GHz. No emissions are seen above 11.45 GHz

RBW = 1 MHz
VBW = 3 MHz
Detector – Peak

Test Setup

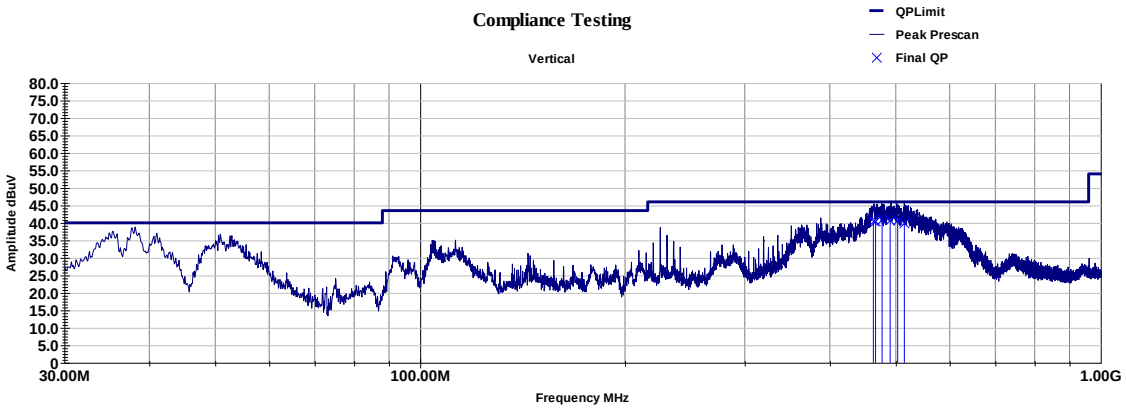


Worst Case Emission:

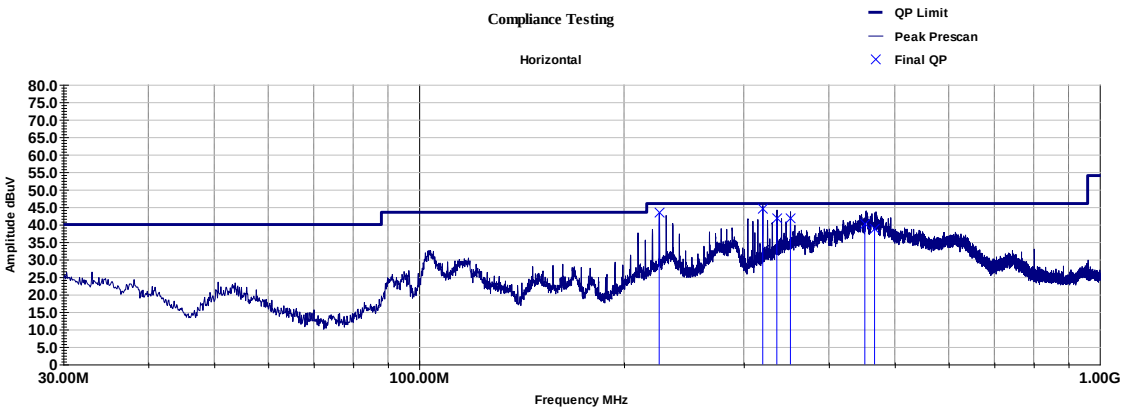
Frequency	Azimuth	Height	Raw Pk	Raw Avg	Correction	Final Pk	Pk Limit	Pk Margin	Final Avg	Avg Limit	Avg Margin
MHz	deg	cm	dBuV	dBuV	dB	dBuV/m	dBuV/m	dB	dBuV/m	dBuV/m	dB
11462495500	0.00	117.00	59.41	45.00	7.95	67.36	74.00	-6.64	52.95	54	-1.05
Final = Raw + Path Loss											
Margin = Final - Limit											

Final = Raw + Correction
Margin = Final - Limit

Low ch_30 - 1000 MHz

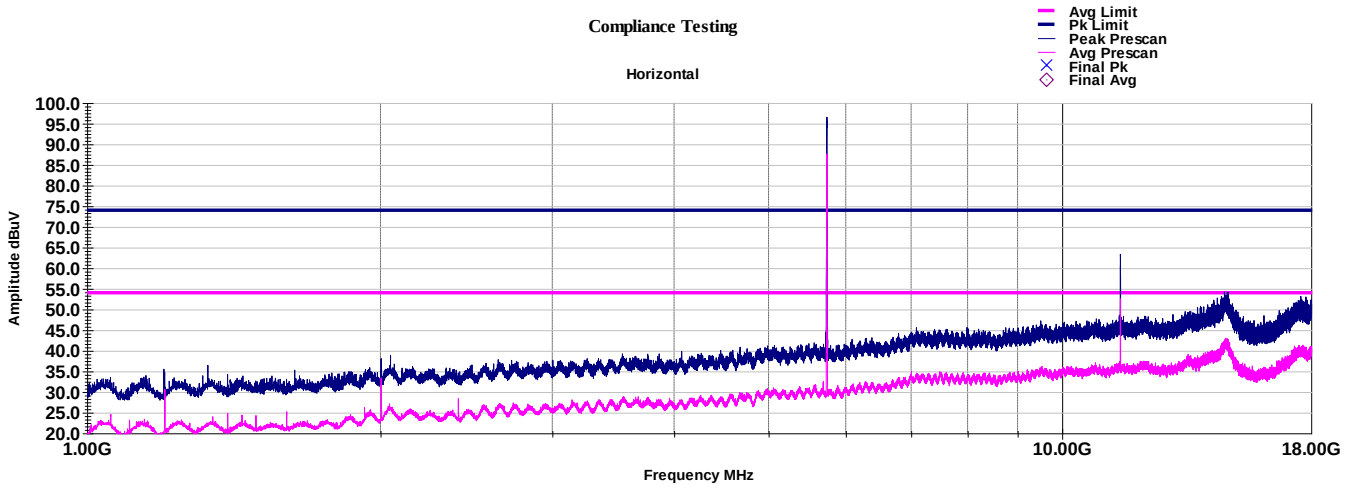


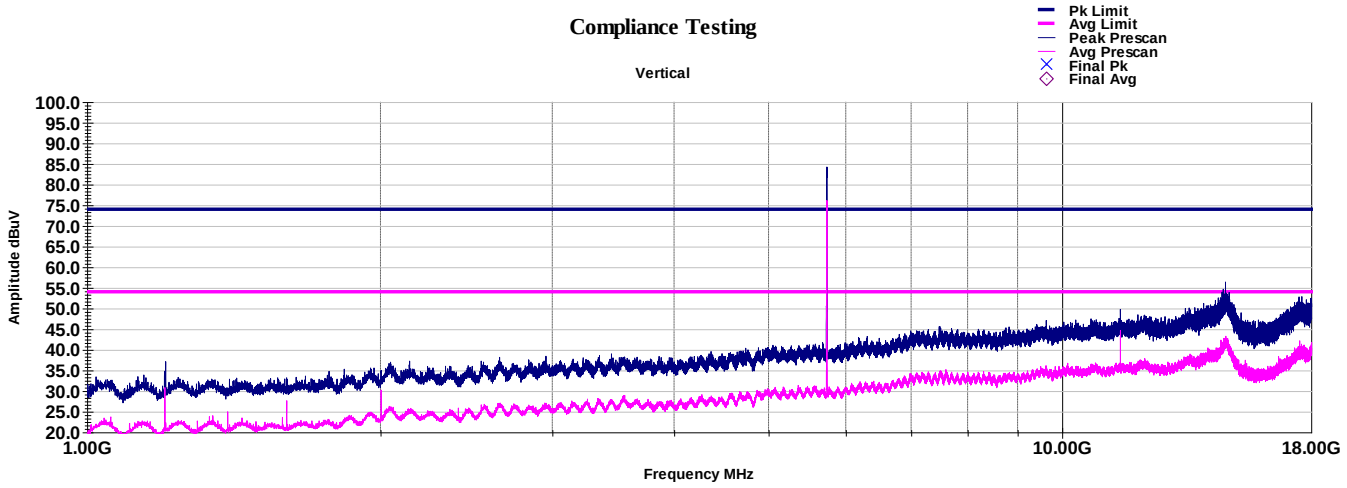
Frequency	Azimuth	Height	Raw QP	Correction	Final QP	Limit	QP Margin
MHz	deg	cm	dBuV	dB	dBuV/m	dBuV/m	dB
463.467	316.00	100.00	59.72	-19.28	40.40	46.00	-5.60
466.816	318.00	100.00	59.53	-19.22	40.30	46.00	-5.70
477.308	352.00	105.00	60.07	-19.03	41.00	46.00	-5.00
490.588	341.00	105.00	59.23	-18.65	40.60	46.00	-5.40
503.121	336.00	105.00	59.04	-18.33	40.70	46.00	-5.30
514.682	344.00	105.00	57.86	-18.01	39.90	46.00	-6.10
Final = Raw + Path Loss							
Margin = Final - Limit							



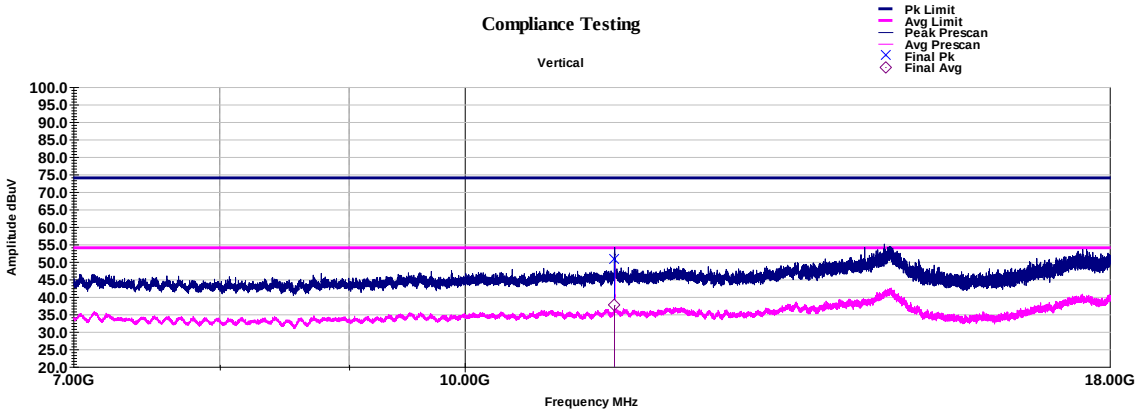
Frequency	Azimuth	Height	Raw QP	Correction	Final QP	Limit	QP Margin
MHz	deg	cm	dBuV	dB	dBuV/m	dBuV/m	dB
225.303	119.00	128.00	70.61	-27.15	43.50	46.00	-2.50
319.769	230.00	100.00	67.51	-22.94	44.60	46.00	-1.40
335.41	149.00	105.00	64.04	-22.28	41.80	46.00	-4.20
351.201	149.00	100.00	63.40	-21.75	41.60	46.00	-4.40
451.641	253.00	179.00	59.39	-19.21	40.20	46.00	-5.80
466.787	98.00	100.00	57.77	-18.92	38.90	46.00	-7.10
Final = Raw + Path Loss							
Margin = Final - Limit							

Low ch_1 – 18 GHz

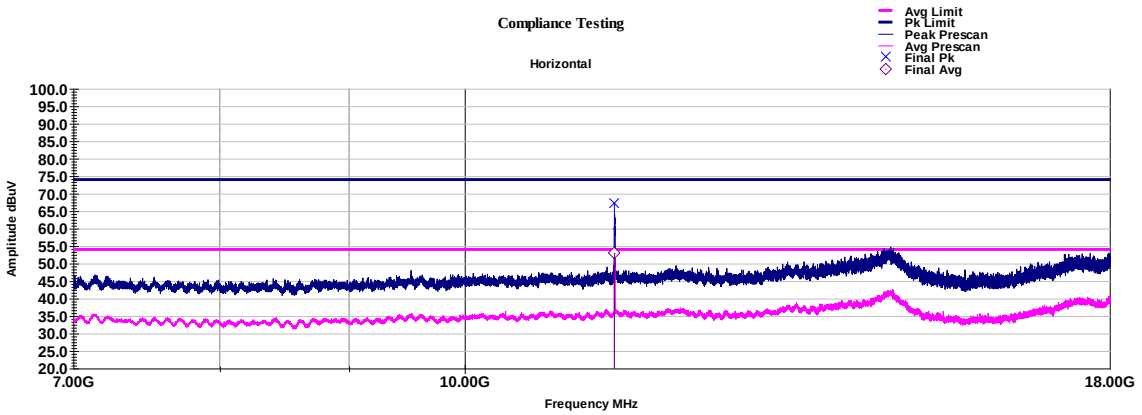




Low Channel 7 - 18 GHz final measurements

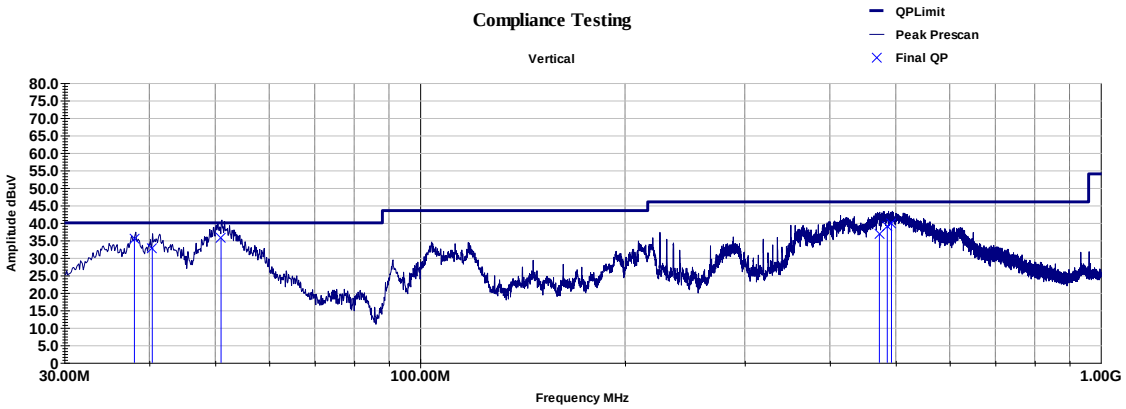


Frequency	Azimuth	Height	Raw Pk	Raw Avg	Correction	Final Pk	Pk Limit	Pk Margin	Final Avg	Avg Limit	Avg Margin
MHz	deg	cm	dBuV	dBuV	dB	dBuV/m	dBuV/m	dB	dBuV/m	dBuV/m	dB
11463313500	243.00	325.00	42.84	29.62	7.95	50.79	74.00	-23.21	37.57	54	-16.43
Final = Raw + Path Loss											
Margin = Final - Limit											

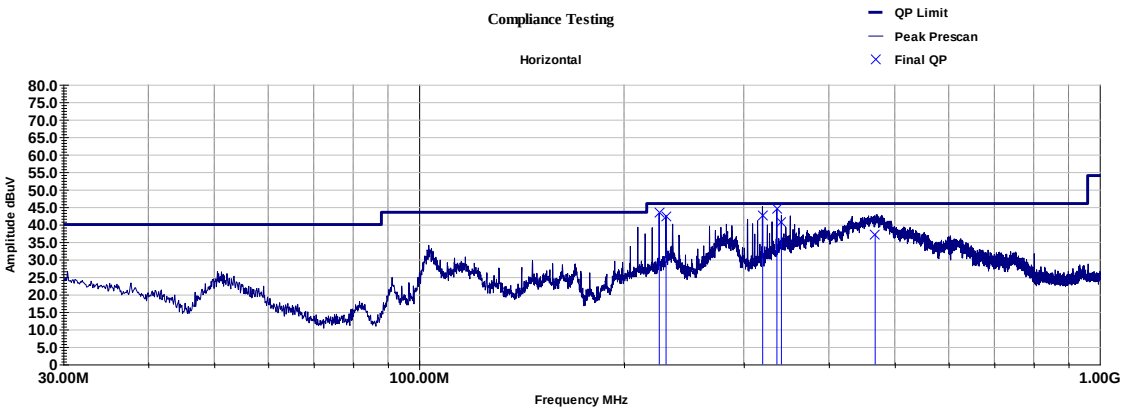


Frequency	Azimuth	Height	Raw Pk	Raw Avg	Correction	Final Pk	Pk Limit	Pk Margin	Final Avg	Avg Limit	Avg Margin
MHz	deg	cm	dBuV	dBuV	dB	dBuV/m	dBuV/m	dB	dBuV/m	dBuV/m	dB
11462495500	0.00	117.00	59.41	45.00	7.95	67.36	74.00	-6.64	52.95	54	-1.05
Final = Raw + Path Loss											
Margin = Final - Limit											

Mid ch_30 - 1000 MHz

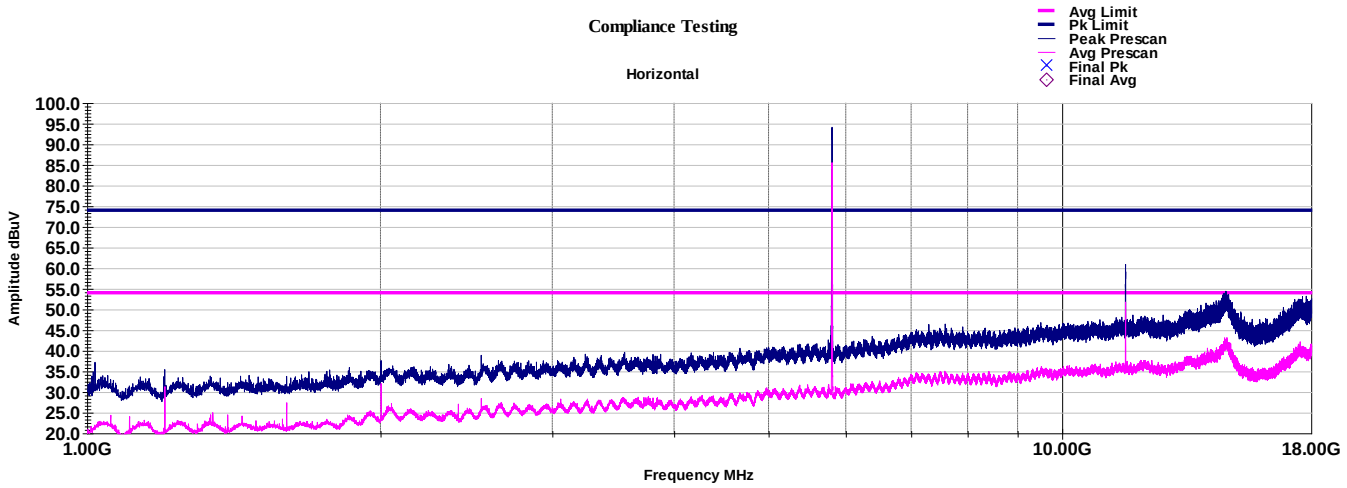


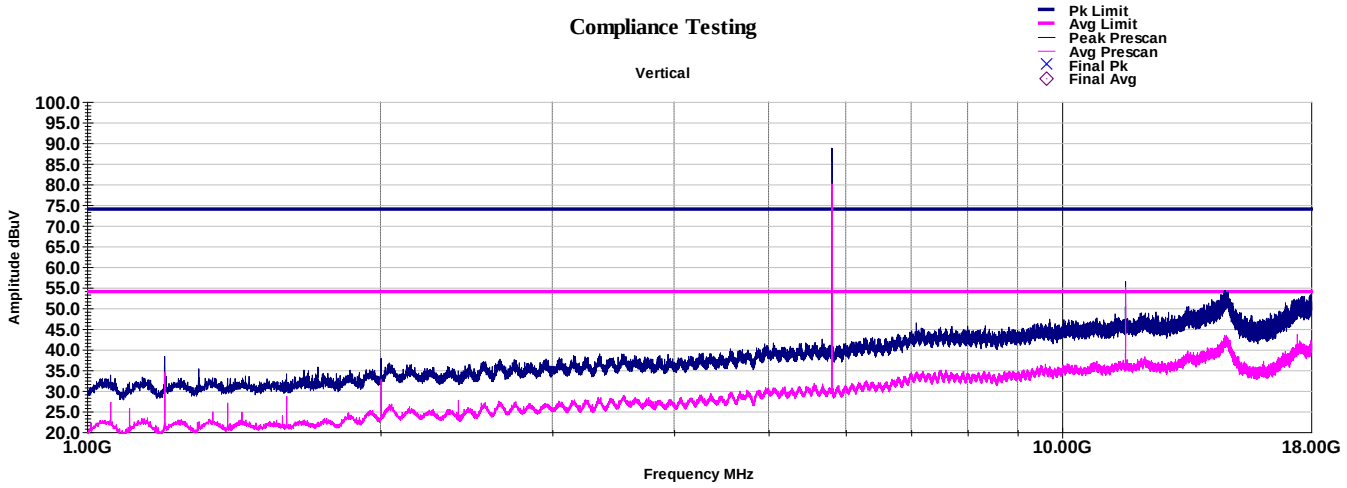
Frequency	Azimuth	Height	Raw QP	Correction	Final QP	Limit	QP Margin
MHz	deg	cm	dBuV	dB	dBuV/m	dBuV/m	dB
38.032	184.00	100.00	60.63	-25.13	35.50	40.00	-4.50
40.411	148.00	105.00	59.20	-26.43	32.80	40.00	-7.20
50.985	101.00	100.00	67.28	-31.66	35.60	40.00	-4.40
473.013	352.00	105.00	55.92	-19.13	36.80	46.00	-9.20
485.733	341.00	117.00	57.73	-18.81	38.90	46.00	-7.10
492.721	346.00	109.00	58.42	-18.64	39.80	46.00	-6.20
Final = Raw + Path Loss							
Margin = Final - Limit							



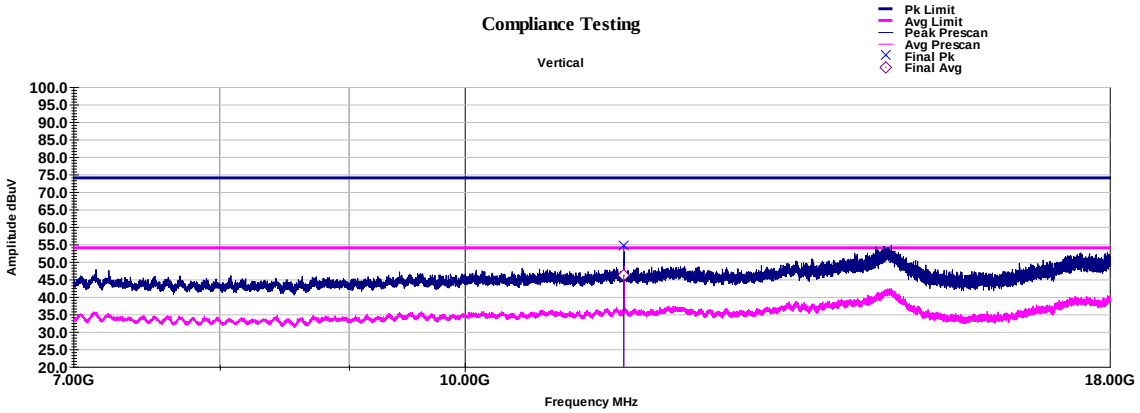
Frequency	Azimuth	Height	Raw QP	Correction	Final QP	Limit	QP Margin
MHz	deg	cm	dBuV	dB	dBuV/m	dBuV/m	dB
225.354	134.00	139.00	70.49	-27.15	43.30	46.00	-2.70
230.569	110.00	128.00	69.10	-26.81	42.30	46.00	-3.70
319.753	245.00	105.00	65.45	-22.94	42.50	46.00	-3.50
335.496	130.00	100.00	66.64	-22.27	44.40	46.00	-1.60
340.677	123.00	100.00	62.72	-22.10	40.60	46.00	-5.40
467.884	166.00	105.00	56.12	-18.90	37.20	46.00	-8.80
Final = Raw + Path Loss							
Margin = Final - Limit							

Mid ch_1 – 18 GHz

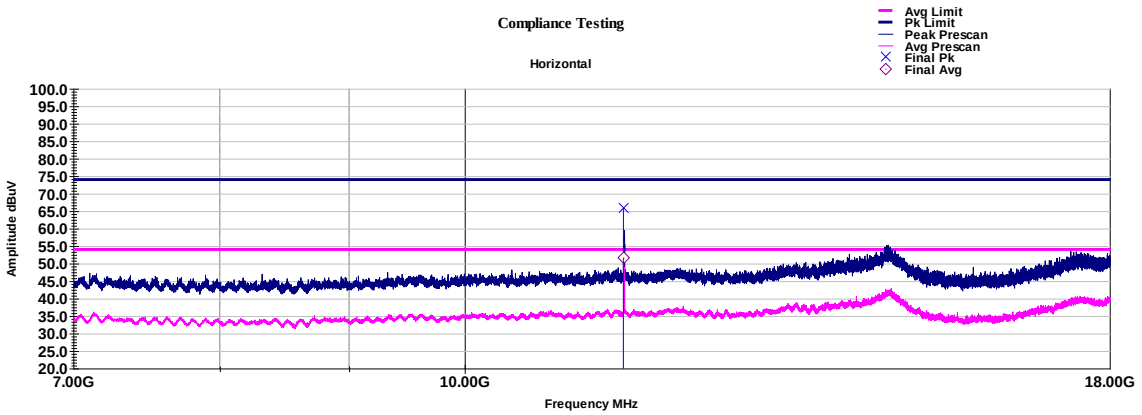




Mid channel 7 - 18 GHz final measurements

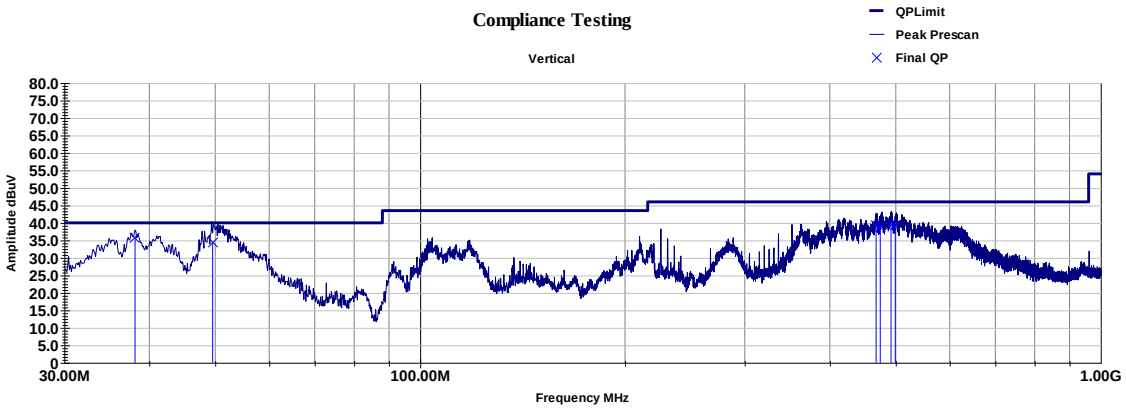


Frequency	Azimuth	Height	Raw Pk	Raw Avg	Correction	Final Pk	Pk Limit	Pk Margin	Final Avg	Avg Limit	Avg Margin
MHz	deg	cm	dBuV	dBuV	dB	dBuV/m	dBuV/m	dB	dBuV/m	dBuV/m	dB
11559923000	229.00	208.00	46.67	38.35	7.89	54.56	74.00	-19.45	46.24	54	-7.76
Final = Raw + Path Loss											
Margin = Final - Limit											

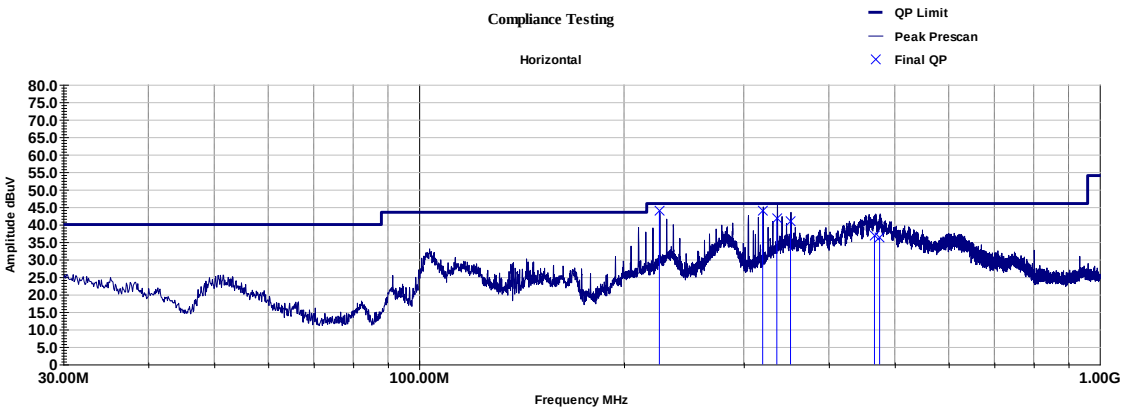


Frequency	Azimuth	Height	Raw Pk	Raw Avg	Correction	Final Pk	Pk Limit	Pk Margin	Final Avg	Avg Limit	Avg Margin
MHz	deg	cm	dBuV	dBuV	dB	dBuV/m	dBuV/m	dB	dBuV/m	dBuV/m	dB
11556717500	359.00	100.00	57.99	43.77	7.88	65.87	74.00	-8.13	51.65	54	-2.35
Final = Raw + Path Loss											
Margin = Final - Limit											

High ch_30 - 1000 MHz

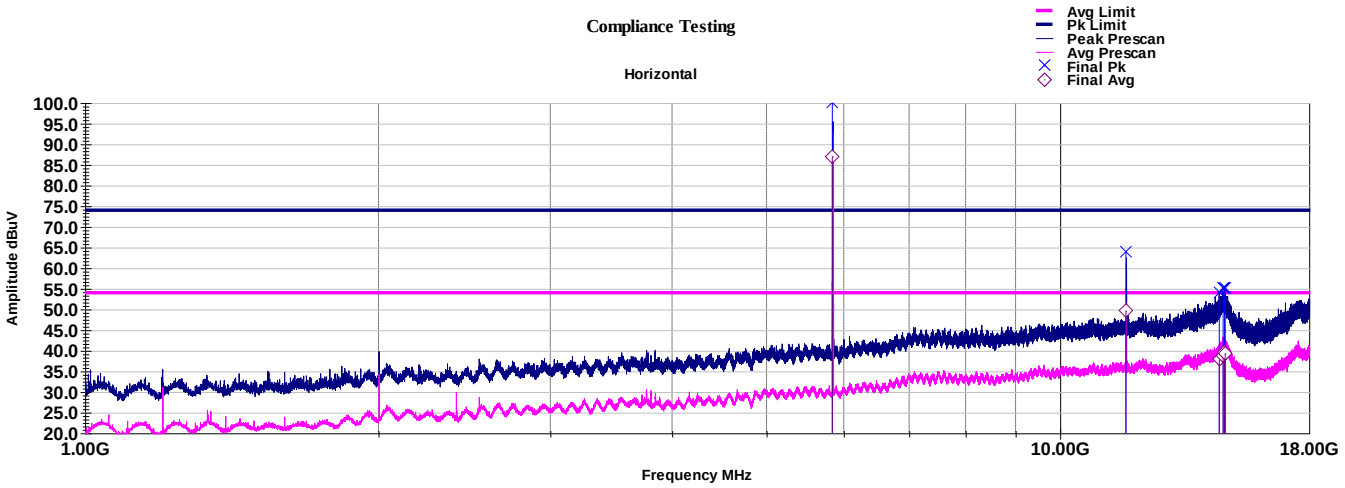


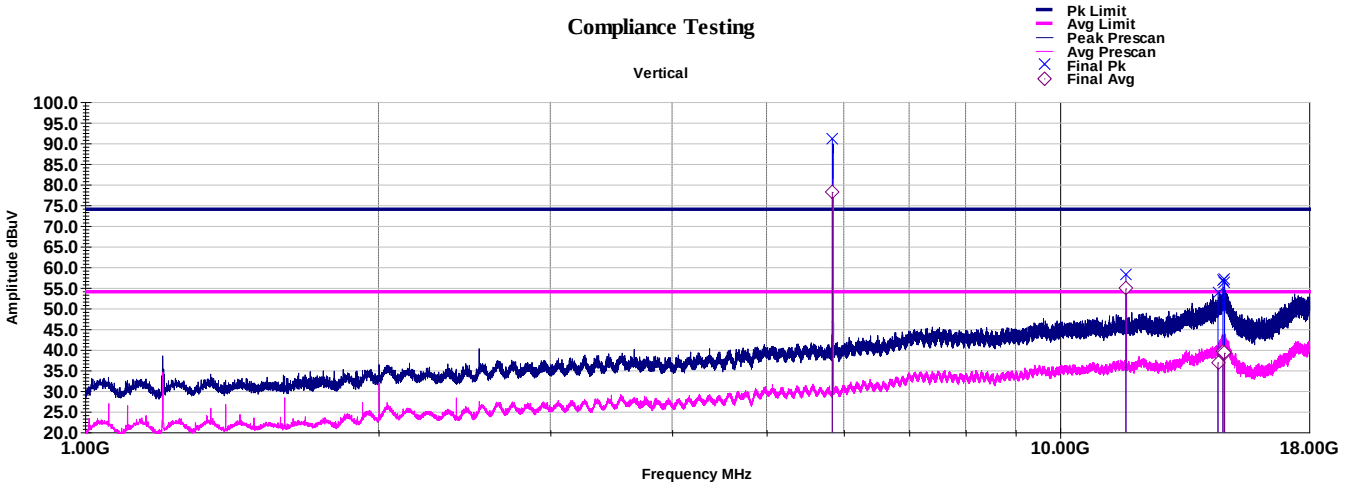
Frequency	Azimuth	Height	Raw QP	Correction	Final QP	Limit	QP Margin
MHz	deg	cm	dBuV	dB	dBuV/m	dBuV/m	dB
38.117	148.00	100.00	60.90	-25.18	35.70	40.00	-4.30
49.547	101.00	105.00	65.47	-31.09	34.40	40.00	-5.60
467.736	337.00	105.00	58.54	-19.20	39.30	46.00	-6.70
474.304	352.00	100.00	57.97	-19.11	38.90	46.00	-7.10
491.985	348.00	100.00	58.23	-18.64	39.60	46.00	-6.40
498.995	346.00	100.00	57.86	-18.50	39.40	46.00	-6.60
Final = Raw + Path Loss							
Margin = Final - Limit							



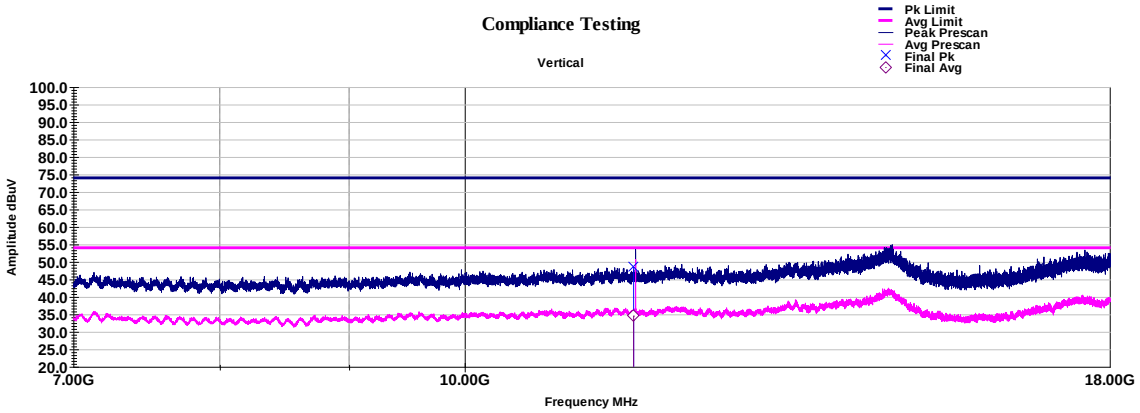
Frequency	Azimuth	Height	Raw QP	Correction	Final QP	Limit	QP Margin
MHz	deg	cm	dBuV	dB	dBuV/m	dBuV/m	dB
225.4	126.00	120.00	71.05	-27.15	43.90	46.00	-2.10
319.716	230.00	105.00	67.00	-22.94	44.10	46.00	-1.90
335.379	150.00	105.00	64.07	-22.28	41.80	46.00	-4.20
351.323	150.00	100.00	62.79	-21.74	41.00	46.00	-5.00
466.627	136.00	173.00	55.75	-18.93	36.80	46.00	-9.20
474.96	55.00	100.00	55.13	-18.85	36.30	46.00	-9.70
Final = Raw + Path Loss							
Margin = Final - Limit							

High ch_1 – 18 GHz

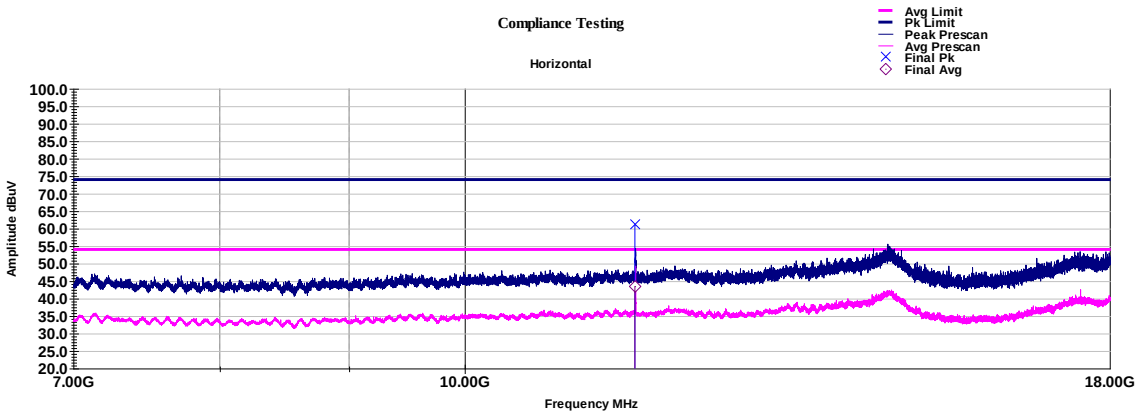




Highest channel 7 - 18 GHz final measurements

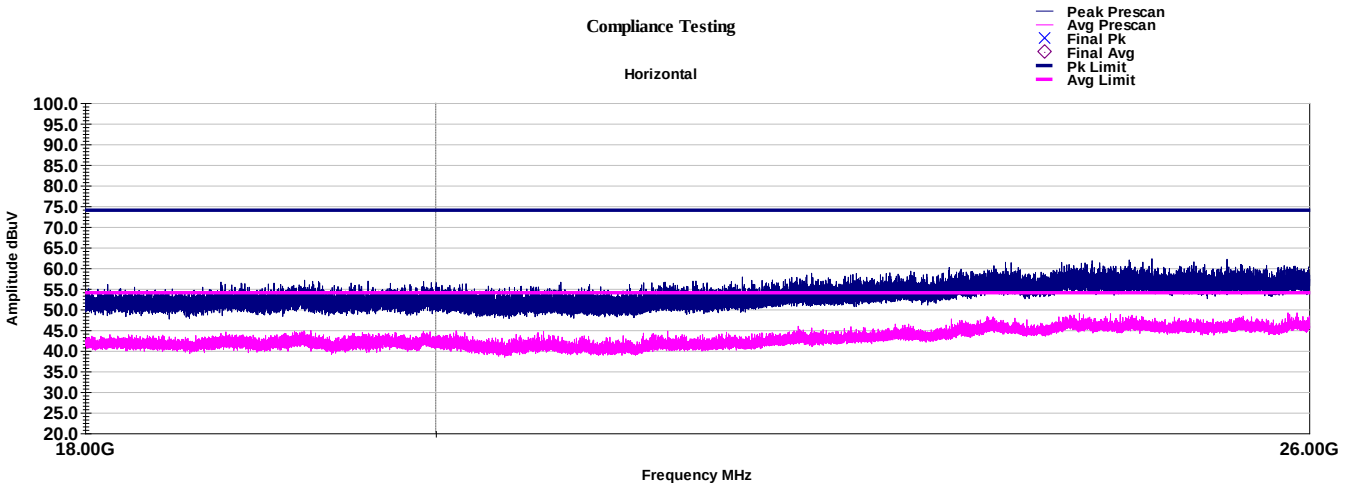


Frequency	Azimuth	Height	Raw Pk	Raw Avg	Correction	Final Pk	Pk Limit	Pk Margin	Final Avg	Avg Limit	Avg Margin
MHz	deg	cm	dBuV	dBuV	dB	dBuV/m	dBuV/m	dB	dBuV/m	dBuV/m	dB
11664747500	158.00	325.00	40.30	26.38	8.23	48.53	74.00	-25.47	34.61	54	-19.39
Final = Raw + Path Loss											
Margin = Final - Limit											



Frequency	Azimuth	Height	Raw Pk	Raw Avg	Correction	Final Pk	Pk Limit	Pk Margin	Final Avg	Avg Limit	Avg Margin
MHz	deg	cm	dBuV	dBuV	dB	dBuV/m	dBuV/m	dB	dBuV/m	dBuV/m	dB
11677467000	309.00	100.00	52.88	35.30	8.23	61.12	74.00	-12.88	43.53	54	-10.47
Final = Raw + Path Loss											
Margin = Final - Limit											

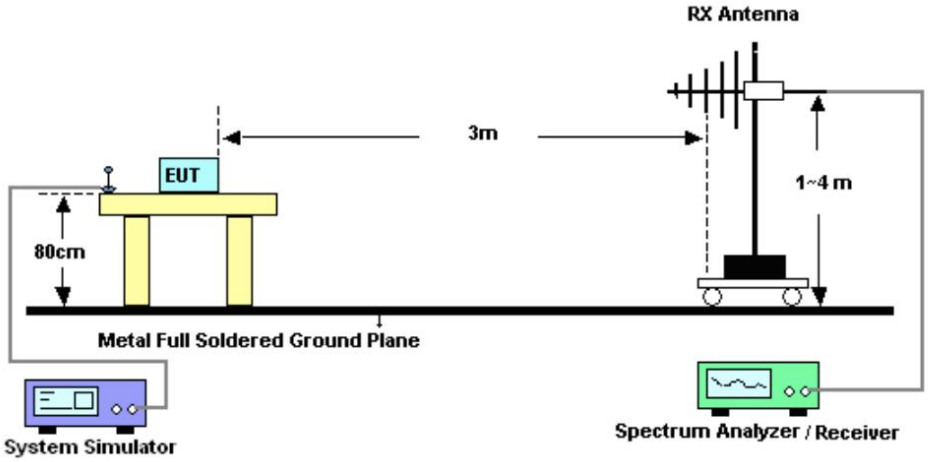
18 – 26 GHz



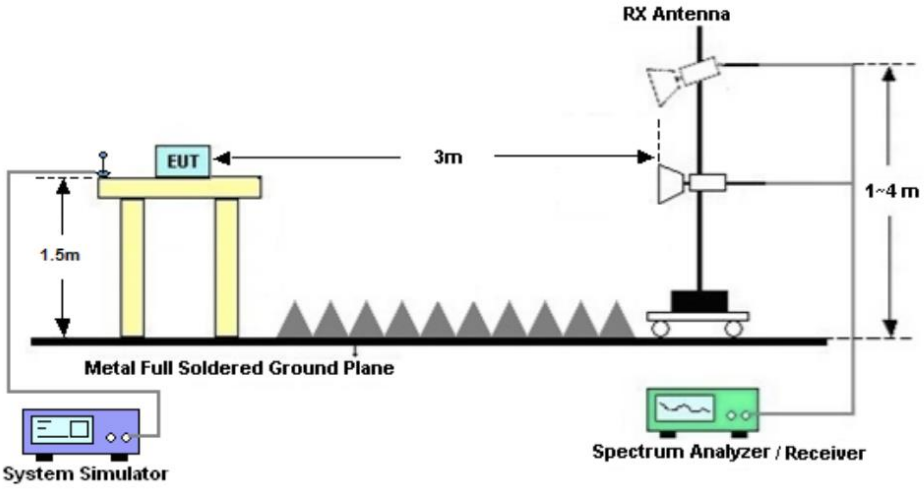
There were no emissions observed above 11.45 GHz

Chamber Setup Diagrams

For radiated emissions from 30MHz to 1GHz



For radiated emissions above 1GHz



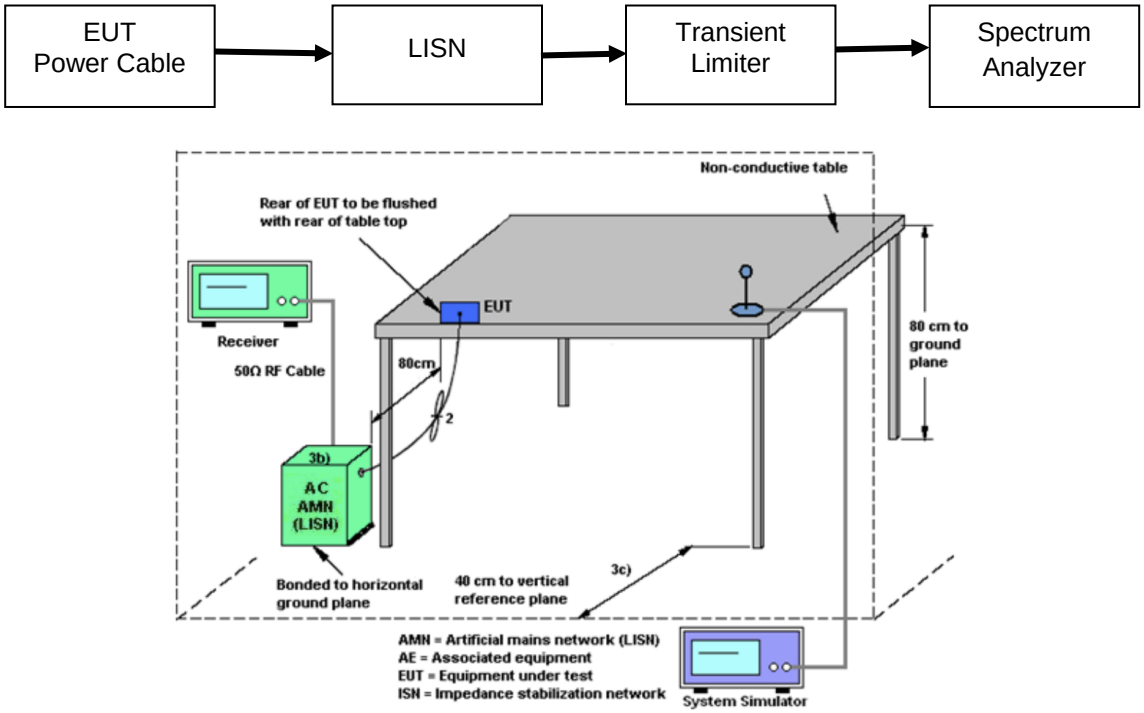
A/C Powerline Conducted Emission

Engineer: Sujatha Rayipudi
Test Date: 11/29/2022

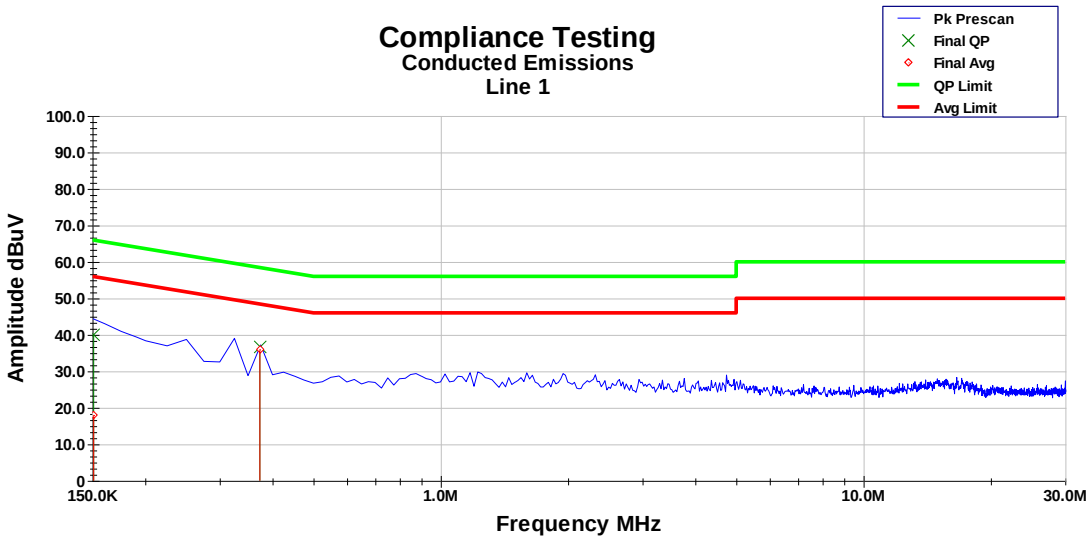
Test Procedure

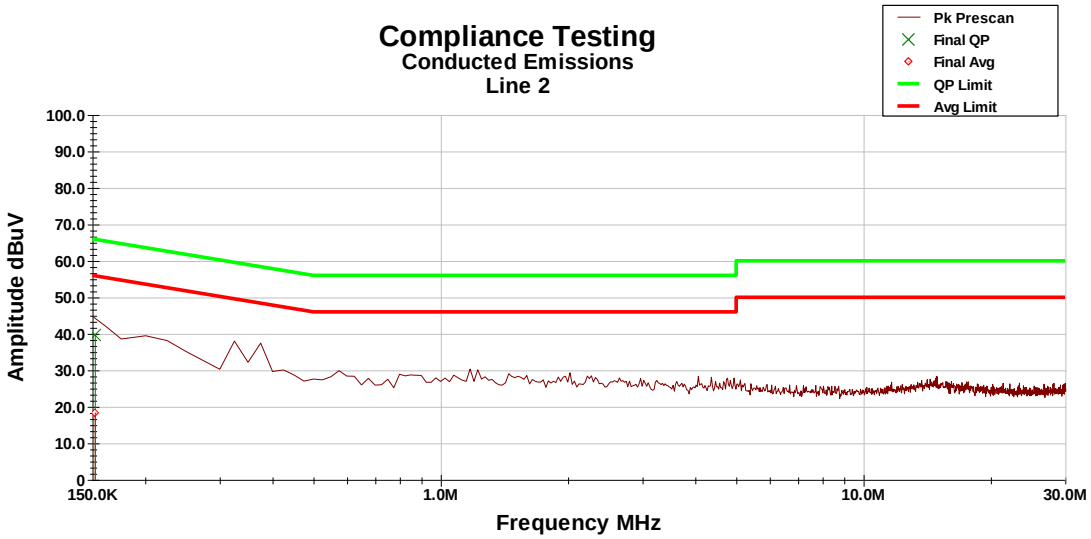
The EUT power cable was connected to a LISN and the monitored output of the LISN was connected to a transient limiter, which then connected directly to a spectrum analyzer. The conducted emissions from 150 kHz to 30 MHz were measured and compared to the specification limits.

Test Setup



Test Data





Peak emissions are below the average and quasi-peak limits

Test Equipment Utilized

Description	Manufacturer	Model #	CT Asset #	Last Cal Date	Cal Due Date
Preamplifier	Eravant	S BB-0115034018-2F2F-E3	i00650	Verified on: 11/29/22	
Transient Limiter	Com-Power	LIT-153	i00123	Verified on: 11/29/22	
Horn Antenna	EMCO	3116	i00085	2/22/21	2/22/23
Bi-Log antenna	Chase	CBL6111C	i00349	2/27/22	2/27/24
Humidity / Temp Meter*	Omega	IBTHX-W-5	i00631	11/3/21	11/3/22*
3 Meter Semi-Anechoic Chamber	Panashield	3 Meter Semi-Anechoic Chamber	i00428	7/17/20	7/17/23
LISN	Com-Power	LI-125A	i00447	4/19/22	4/19/24
LISN	Com-Power	LI-125A	i00449	4/19/22	4/19/24
Horn Antenna	ARA	DRG-118/A	i00271	8/11/22	8/11/24
EMI Analyzer	Rohde & Schwarz	FSU 26	i00501	5/10/22	5/10/23
EMI Receiver	Keysight	N9038A	i00552	2/24/22	2/24/23

*Calibration extended with the approval of Quality Manager.

In addition to the above listed equipment standard RF connectors and cables were utilized in the testing of the described equipment. Prior to testing these components were tested to verify proper operation.

Measurement Uncertainty

Measurement Uncertainty (U_{lab}) for Compliance Testing is listed in the table below.

Measurement	U_{lab}
Radio Frequency	± 3.3 x 10^{-8}
RF Power, conducted	± 1.5 dB
RF Power Density, conducted	± 1.0 dB
Conducted Emissions	± 1.8 dB
Radiated Emissions	± 4.5 dB
Temperature	± 1.5 deg C
Humidity	± 4.3 %
DC voltage	± 0.20 VDC
AC Voltage	± 1.2 VAC

The reported expanded uncertainty +/- U_{lab}(dB) has been estimated at a 95% confidence level (k=2)

U_{lab} is less than or equal to U_{ETSI} therefore

- Compliance is deemed to occur if no measured disturbance exceeds the disturbance limit
- Non-Compliance is deemed to occur if any measured disturbance exceeds the disturbance limit

END OF TEST REPORT