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CommScope Technologies, LLC

TEST REPORT

SCOPE OF WORK
EMISSIONS TESTING – RPM-A5A11-B05 with W/ 5G NR waveform With OneCell® RP5100

REPORT NUMBER
104751739BOX-021

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10/04/2021

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DOCUMENT CONTROL NUMBER
Non-Specific Radio Report Shell Rev. December 2017

EMISSIONS TEST REPORT

(**Class II Permissive Change**)

Report Number: 104751739BOX-021
Project Number: G104751739

Report Issue Date: 10/04/2021
Report Revision Date: 02/02/2022

Model(s) Tested:	RPM-A5A11-B05 with W/ 5G NR waveform With OneCell® RP5100
Model(s) Partially Tested:	None
Model(s) Not Tested but declared equivalent by the client:	None

Standards: CFR47 FCC Part 22 (09/2021)

Tested by:
Intertek Testing Services NA, Inc.
70 Codman Hill Road
Boxborough, MA 01719
USA

Client:
CommScope Technologies LLC
900 Chelmsford St.
Lowell, MA 01851
USA

Report prepared by

Vathana Ven / EMC Engineering Supervisor

Report reviewed by

Kouma Sinn / EMC Engineering Supervisor

Table of Contents

1 Introduction and Conclusion

The tests indicated in section 2.0 were performed on the product constructed as described in section 4.0. The remaining test sections are the verbatim text from the actual data sheets used during the investigation. These test sections include the test name, the specified test Method, a list of the actual Test Equipment Used, documentation Photos, Results and raw Data. No additions, deviations, or exclusions have been made from the standard(s) unless specifically noted.

Based on the results of our investigation, we have concluded the product tested **complies** with the requirements of the standard(s) indicated. The results obtained in this test report pertain only to the item(s) tested. Intertek does not make any claims of compliance for samples or variants which were not tested.

2 Test Summary

Section	Test full name	Result
3	Client Information	--
4	Description of Equipment Under Test and Variant Models	--
5	System Setup and Method	--
6	Maximum Peak Output Power and Human RF exposure CFR47 FCC Parts 2.1046, 22.913(a) and 22.379	Pass
7	Occupied Bandwidth CFR47 FCC Parts 2.1049, and 22.917(b)	Pass
8	Band Edge Compliance CFR47 FCC Parts 2.1051, 2.1053, and 24.917	Pass
9	Frequency Stability Due to Voltage Variation CFR47 FCC Parts 2.1055 and 22.355	Pass
10	Transmitter Spurious Emissions CFR47 FCC Parts 2.1051, 2.1053, 2.1057 and 22.917	Pass
11	Revision History	--

Notes: Class II permissive change for Band 5 with 5G NR waveform with RP5100 host. Band 5 with 5G NR waveform with RP5200 host is being filed with the FCC.

3 Client Information

This EUT was tested at the request of:

Client: CommScope Technologies LLC
900 Chelmsford St.
Lowell, MA 01851
USA

Contact: Mr. Kevin Craig
Telephone: (978) 250-2678
Fax: None
Email: kevin.craig@commscope.com

4 Description of Equipment Under Test and Variant Models

Manufacturer: CommScope Telecommunications (China) Ltd.
68 Su Hong Xi Lu, Suzhou Industrial Park.
Suzhou, Jiangsu, 215021, China

Equipment Under Test			
Description	Manufacturer	Model Number	Serial Number
Band 5 Radio Module With OneCell® RP5100 host	CommScope Technologies LLC	RPM-A5A11-B05	21268410114
OneCell® RP5100	CommScope Technologies LLC	RP-A51xxi	19198000019

Receive Date:	07/30/2021
Received Condition:	Good
Type:	Production

Description of Equipment Under Test (provided by client)
The Radio Module is band specific using the Analog devices RF Agile Transceiver IC, AD936x. The device combines an RF front end with a flexible mixed-signal baseband section and integrated frequency synthesizers providing a configurable digital interface to the processor. The Radio Module also contains a band specific front end, band specific antenna and required power rails. All power rails required are derived from the 12 VDC bus supplied by the Baseband card. The reference frequency for the radio IC is 38.4 MHz is derived from the from an OCXO which is disciplined from a 1588 reference clock. The original LTE radio has included the 5G NR capabilities for Class II Permissive Change. It supports bandwidths of 5, 10, 15, and 20 MHz with four modulations; TM1.1-QPSK, TM3.2-16QAM, TM3.1-64QAM, and TM3.1a-256QAM. The radio is fixed.

Description of Radio Host (provided by client)
The OneCell® RP5100 family is factory configurable with 2 – 4 Radios Modules mounted to a Baseband card. The same PCB's will be used in both indoor and outdoor version of the radio point. The device is fixed. The baseband card is the host for the modular radios. It contains a two ethernet PHY's with one supporting 100M/1G/2.5G/5G/10G ethernet and the other supporting 100M/1G. The main processor is Zylinx Ultrascale+ MPSoC with 2 GB DDR3 and 4 GB Flash memory. The baseband PCBA converts POE power to +12 VDC bus voltage require as input to the radio modules.

Equipment Under Test Power Configuration

Rated Voltage	Rated Current	Rated Frequency	Number of Phases
48 VDC	0.960 mA per pair max	DC	N/A

Operating modes of the EUT:

No.	Descriptions of EUT Exercising
1	Pre-programmed to transmit at Low, Mid, and High channels at four different modulations, TM1.1-QPSK, TM3.2-16QAM, TM3.1-64QAM, and TM3.1a-256QAM.

Software used by the EUT:

No.	Descriptions of EUT Exercising
1	RP5100 Diagnostics Ver 1009

Radio/Receiver Characteristics	
Frequency Band(s)	869 - 894 MHz
Modulation Type(s)	TM1.1-QPSK, TM3.2-16QAM, TM3.1-64 QAM, TM3.1a-256QAM
Maximum Output Power (conducted):	20.40 dBm (Conducted)
Test Channels	Low, Middle, High Channels of 5 MHz, 10 MHz, 15 MHz, and 20 MHz Bandwidths, Single Channel operation only
Occupied Bandwidth	18.98 MHz (Worst-case)
MIMO Information (# of Transmit and Receive antenna ports)	2x2 MIMO using cross polarized antennas and uncorrelated data streams
Equipment Type	Module in a host
Antenna Type and Gain	Detachable Antenna: +4 dBi (as provided by the client. Intertek takes no responsibility for the accuracy of this information. Actual antenna gain will be determined at the time of licensing)

Variant Models:

The following variant models were not tested as part of this evaluation, but have been identified by the manufacturer as being electrically identical models, depopulated models, or with reasonable similarity to the model(s) tested. Intertek does not make any claims of compliance for samples or variants which were not tested.

None

5 System Setup and Method

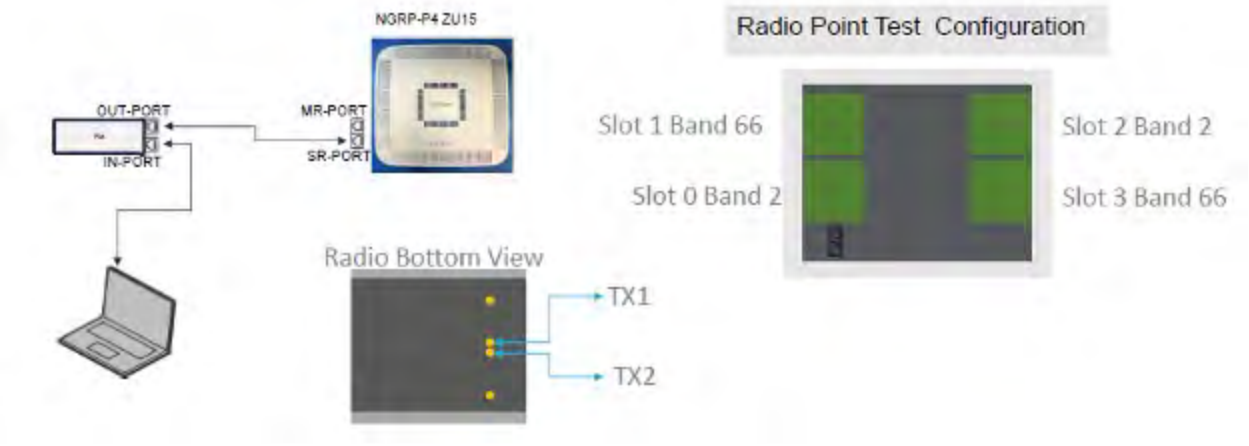
Cables					
ID	Description	Length (m)	Shielding	Ferrites	Termination
--	LAN (POE Power Cable)	2.58	Shielded	None	POE P/S
--	LAN (Communication)	9.00	Shielded	None	Laptop

Support Equipment			
Description	Manufacturer	Model Number	Serial Number
Laptop	Dell	LATITUDE	None
Power Device Analzyer	Sifos Technologies	PDA-604A	604A0033

5.1 Method:

Configuration as required by ANSI C63.26-2015, KDB 662911, and CFR47 FCC Part 22 (09/2021).

5.2 EUT Block Diagram:



6 Maximum Peak Output Power and Human RF exposure

6.1 Method

Tests are performed in accordance with CFR47 FCC Parts 2.1046 and 22.913(a)(1), KDB662911, and ANSI C63.26 Section 5.2.4.4.

TEST SITE: EMC Lab

The EMC Lab has one Semi-anechoic Chamber and one Shielded Chamber. AC Mains Power is available at 120, 230, and 277 Single Phase; 208, 400, and 480 3-Phase. Large reference ground-planes are installed in the general lab area to facilitate EMC work not requiring a shielded environment.

6.2 Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
CEN001'	DC-40GHz attenuator 20dB	Centric RF	C411-20	CEN001	01/22/2021	01/22/2022
CBLSHF204'	Cable, SMA - SMA, 9kHz -40GHz, (Cable Kit 5)	Huber + Suhner	Sucoflex 102EA	234714001	02/03/2021	02/03/2022
ROS005-1'	Signal and Spectrum Analyzer	Rohde and Shwartz	FSW43	100646	11/02/2021	11/02/2022
DAV005'	Weather Station	Davis	6250	MS191218083	02/07/2021	02/07/2022

Software Utilized:

Name	Manufacturer	Version
None	--	--

6.3 Results:

The maximum conducted output power was measured to be 20.40 dBm, which is much less than the EIRP limit of 22.913(a)(1). The sample tested was found to Comply. Output power from the two antenna ports was not summed since the data streams are uncorrelated and the antennas are cross polarized.

Licensees in the Cellular Radiotelephone Service are subject to the effective radiated power (ERP) limits and other requirements in this Section. *See also* § 22.169.

(a) ***Maximum ERP.*** The ERP of transmitters in the Cellular Radiotelephone Service must not exceed the limits in this section.

(1) Except as described in paragraphs (a)(2), (3), and (4) of this section, the ERP of base stations and repeaters must not exceed -

(i) 500 watts per emission; or

(ii) 400 watts/MHz (PSD) per sector.

(2) Except as described in paragraphs (a)(3) and (4) of this section, for systems operating in areas more than 72 kilometers (45 miles) from international borders that:

(i) Are located in counties with population densities of 100 persons or fewer per square mile, based upon the most recently available population statistics from the Bureau of the Census; or

(ii) Extend coverage into Unserved Area on a secondary basis (*see* § 22.949), the ERP of base transmitters and repeaters must not exceed -

(A) 1000 watts per emission; or

(B) 800 watts/MHz (PSD) per sector.

Slot 0 (Band 5), Bandwidth: 5 MHz, Modulation: TM1.1-QPSK

Channel	Frequency (MHz)	Antenna Port	Output Power (dBm)
Low	871.5	ANT0	19.14
		ANT1	18.89
Mid	881	ANT0	19.57
		ANT1	19.54
High	891.5	ANT0	20.18
		ANT1	20.12

Slot 0 (Band 5), Bandwidth: 10 MHz, Modulation: TM1.1-QPSK

Channel	Frequency (MHz)	Antenna Port	Output Power (dBm)
Low	874	ANT0	19.94
		ANT1	19.60
Mid	881	ANT0	19.78
		ANT1	19.79
High	889	ANT0	19.98
		ANT1	19.86

Slot 0 (Band 5), Bandwidth: 15 MHz, Modulation: TM1.1-QPSK

Channel	Frequency (MHz)	Antenna Port	Output Power (dBm)
Low	876.5	ANT0	19.55
		ANT1	19.37
Mid	881	ANT0	19.89
		ANT1	19.83
High	886.5	ANT0	20.10
		ANT1	19.96

Slot 0 (Band 5), Bandwidth: 20 MHz, Modulation: TM1.1-QPSK

Channel	Frequency (MHz)	Antenna Port	Output Power (dBm)
Low	879	ANT0	19.76
		ANT1	19.45
Mid	881	ANT0	19.97
		ANT1	19.70
High	884	ANT0	20.14
		ANT1	19.99

Slot 0 (Band 5), Bandwidth: 5 MHz, Modulation: TM3.2-16QAM

Channel	Frequency (MHz)	Antenna Port	Output Power (dBm)
Low	871.5	ANT0	19.70
		ANT1	19.29
Mid	881	ANT0	19.66
		ANT1	19.71
High	891.5	ANT0	20.30
		ANT1	20.19

Slot 0 (Band 5), Bandwidth: 10 MHz, Modulation: TM3.2-16QAM

Channel	Frequency (MHz)	Antenna Port	Output Power (dBm)
Low	874	ANT0	20.01
		ANT1	19.65
Mid	881	ANT0	19.80
		ANT1	19.84
High	889	ANT0	20.12
		ANT1	19.67

Slot 0 (Band 5), Bandwidth: 15 MHz, Modulation: TM3.2-16QAM

Channel	Frequency (MHz)	Antenna Port	Output Power (dBm)
Low	876.5	ANT0	19.77
		ANT1	19.44
Mid	881	ANT0	19.79
		ANT1	19.81
High	886.5	ANT0	20.03
		ANT1	19.83

Slot 0 (Band 5), Bandwidth: 20 MHz, Modulation: TM3.2-16QAM

Channel	Frequency (MHz)	Antenna Port	Output Power (dBm)
Low	879	ANT0	19.86
		ANT1	19.51
Mid	881	ANT0	19.78
		ANT1	19.80
High	884	ANT0	20.16
		ANT1	19.97

Slot 0 (Band 5), Bandwidth: 5 MHz, Modulation: TM3.1-64QAM

Channel	Frequency (MHz)	Antenna Port	Output Power (dBm)
Low	871.5	ANT0	19.77
		ANT1	19.23
Mid	881	ANT0	19.73
		ANT1	19.78
High	891.5	ANT0	20.40
		ANT1	20.03

Slot 0 (Band 5), Bandwidth: 10 MHz, Modulation: TM3.1-64QAM

Channel	Frequency (MHz)	Antenna Port	Output Power (dBm)
Low	874	ANT0	20.00
		ANT1	19.50
Mid	881	ANT0	19.81
		ANT1	19.84
High	889	ANT0	20.17
		ANT1	19.72

Slot 0 (Band 5), Bandwidth: 15 MHz, Modulation: TM3.1-64QAM

Channel	Frequency (MHz)	Antenna Port	Output Power (dBm)
Low	876.5	ANT0	19.82
		ANT1	19.46
Mid	881	ANT0	19.82
		ANT1	19.83
High	886.5	ANT0	20.07
		ANT1	19.88

Slot 0 (Band 5), Bandwidth: 20 MHz, Modulation: TM3.1-64QAM

Channel	Frequency (MHz)	Antenna Port	Output Power (dBm)
Low	879	ANT0	19.75
		ANT1	19.44
Mid	881	ANT0	19.94
		ANT1	19.74
High	884	ANT0	20.12
		ANT1	19.94

Slot 0 (Band 5), Bandwidth: 5 MHz, Modulation: TM3.1a-256QAM_

Channel	Frequency (MHz)	Antenna Port	Output Power (dBm)
Low	871.5	ANT0	19.75
		ANT1	19.23
Mid	881	ANT0	19.76
		ANT1	19.70
High	891.5	ANT0	20.37
		ANT1	20.32

Slot 0 (Band 5), Bandwidth: 10 MHz, Modulation: TM3.1a-256QAM_

Channel	Frequency (MHz)	Antenna Port	Output Power (dBm)
Low	874	ANT0	19.95
		ANT1	19.48
Mid	881	ANT0	19.82
		ANT1	19.80
High	889	ANT0	20.01
		ANT1	20.14

Slot 0 (Band 5), Bandwidth: 15 MHz, Modulation: TM3.1a-256QAM

Channel	Frequency (MHz)	Antenna Port	Output Power (dBm)
Low	876.5	ANT0	19.79
		ANT1	19.47
Mid	881	ANT0	19.80
		ANT1	19.78
High	886.5	ANT0	20.03
		ANT1	19.92

Slot 0 (Band 5), Bandwidth: 20 MHz, Modulation: TM3.1a-256QAM

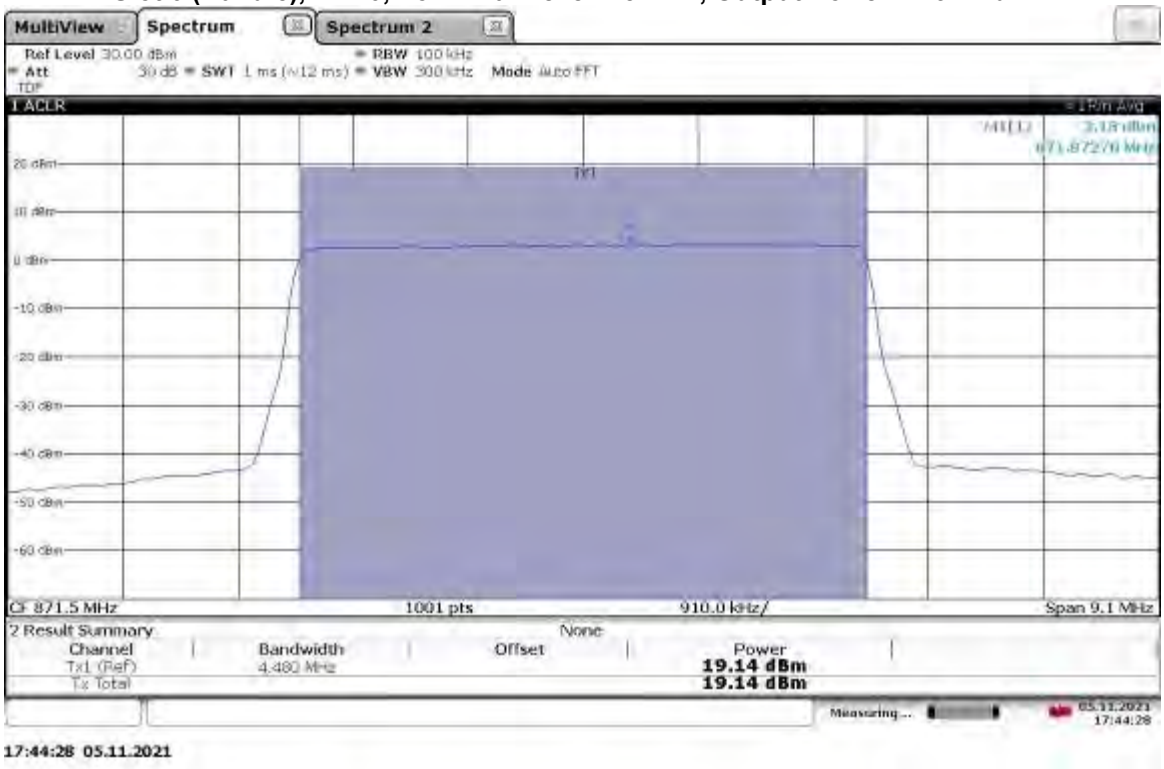
Channel	Frequency (MHz)	Antenna Port	Output Power (dBm)
Low	879	ANT0	19.75
		ANT1	19.49
Mid	881	ANT0	19.79
		ANT1	19.75
High	884	ANT0	20.19
		ANT1	20.04

6.4 Setup Photograph:

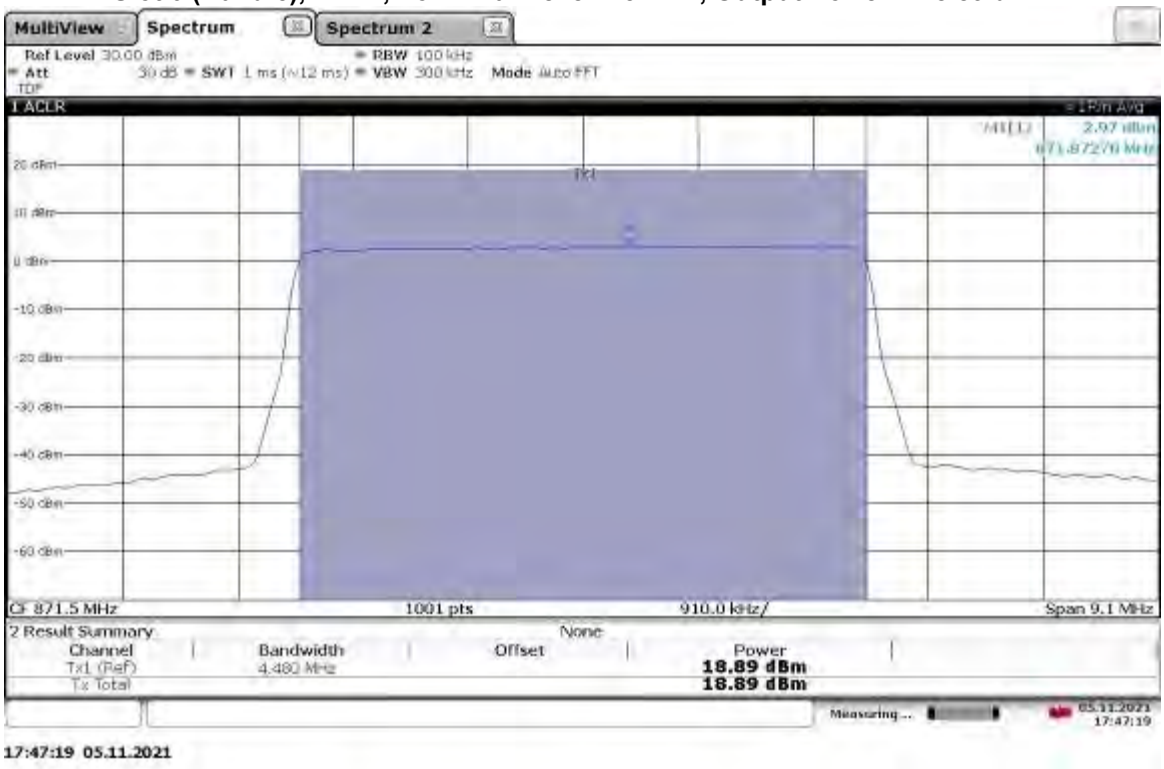
Confidential – Test setup photo not included in this report

6.5 Plots/Data:

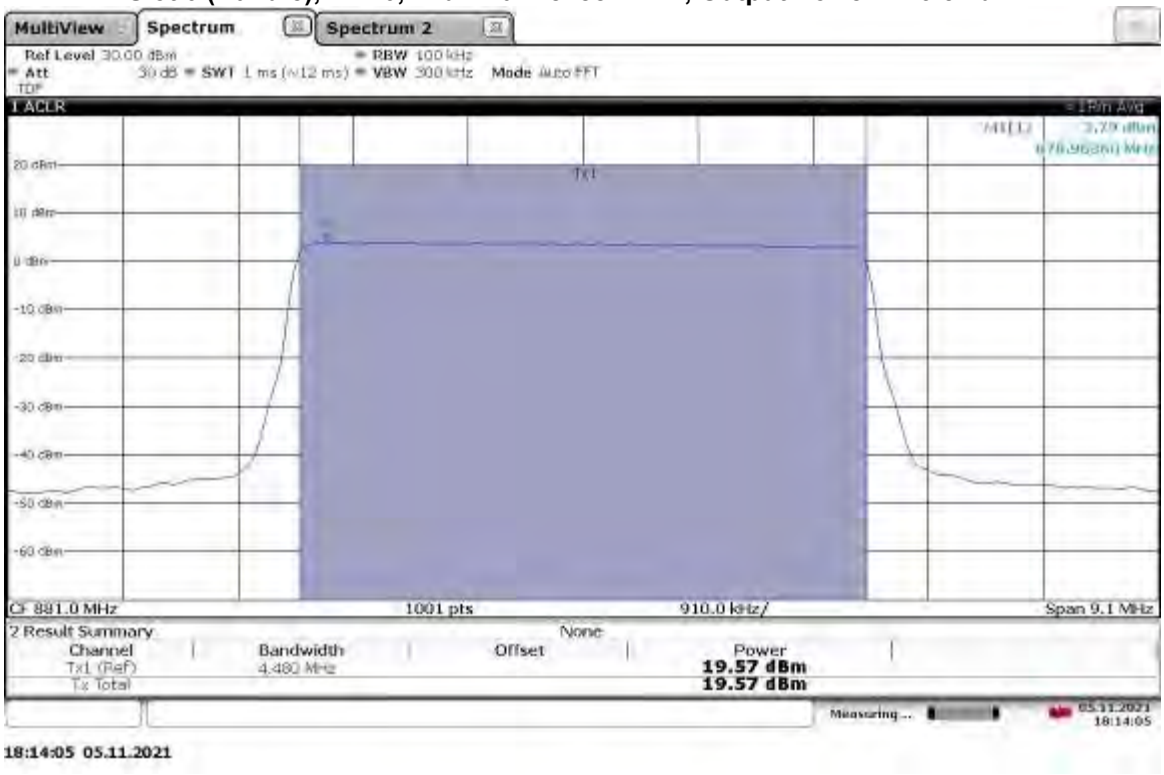
TM1.1-QPSK_5 MHz Bandwidth
Slot 0 (Band 5), ANT0, Low Channel 871.5 MHz, Output Power = 19.14 dBm



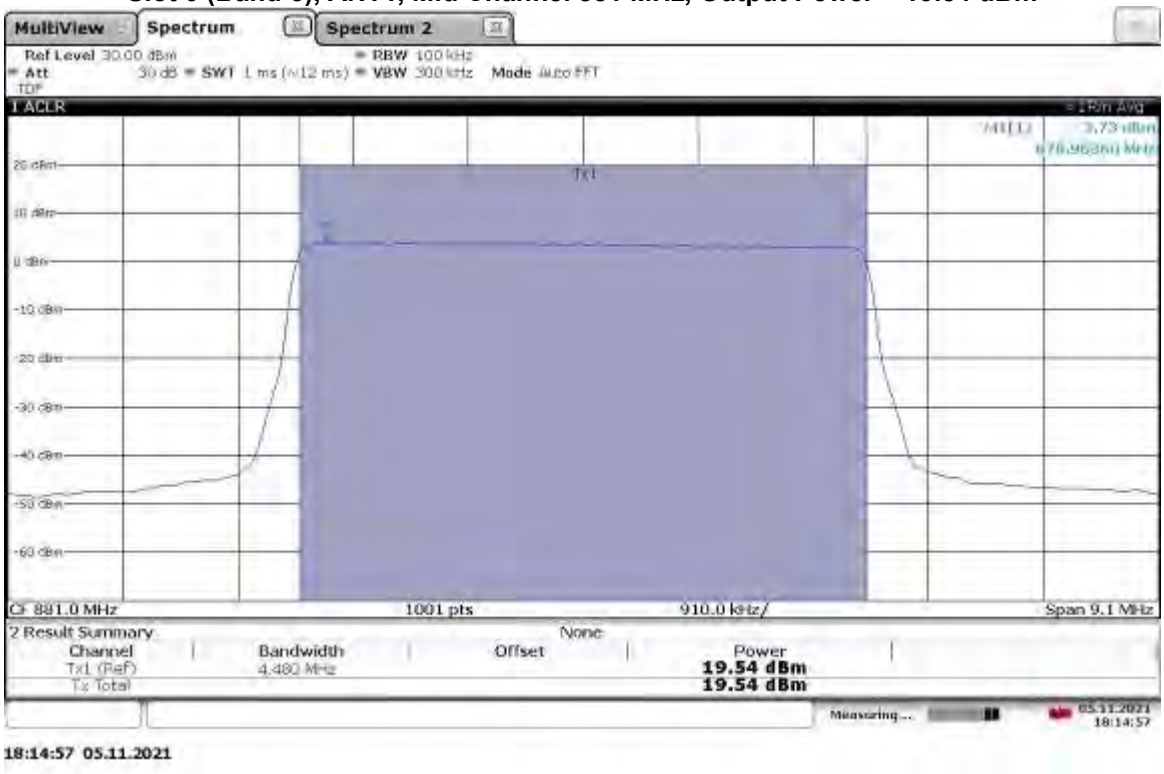
TM1.1-QPSK_5 MHz Bandwidth
Slot 0 (Band 5), ANT1, Low Channel 871.5 MHz, Output Power = 18.89 dBm



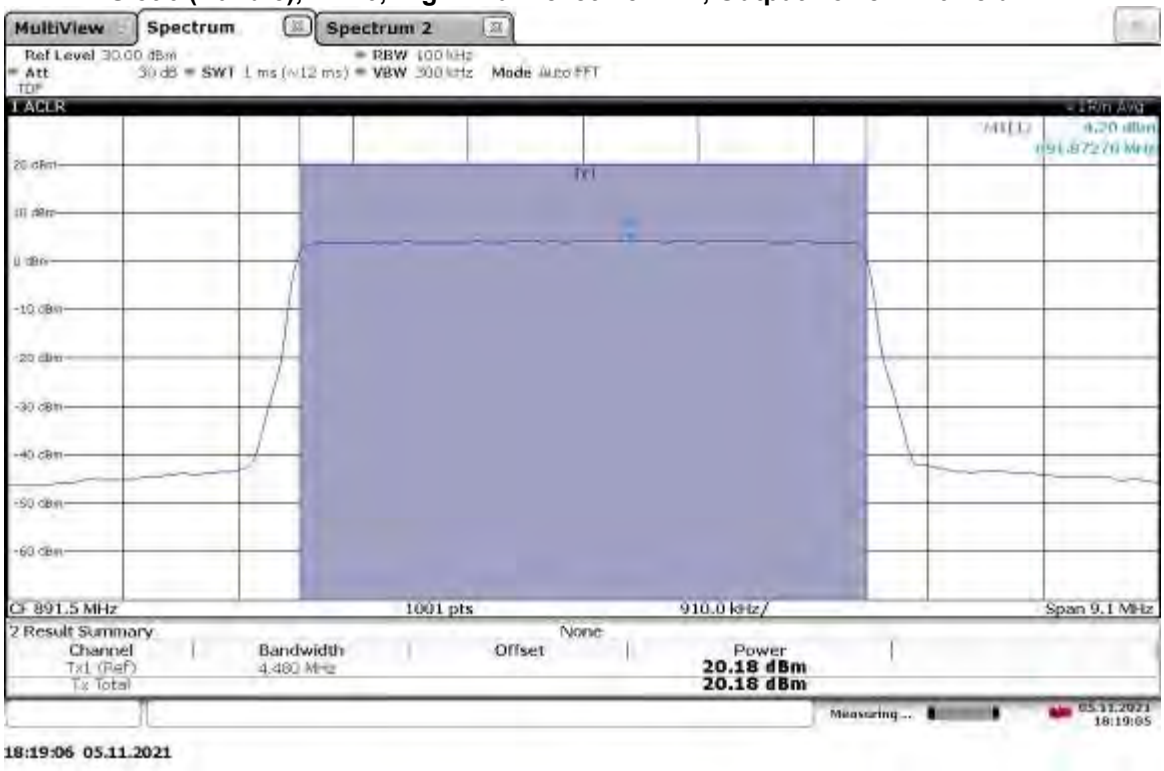
TM1.1-QPSK_5 MHz Bandwidth
Slot 0 (Band 5), ANT0, Mid Channel 881 MHz, Output Power = 19.57 dBm



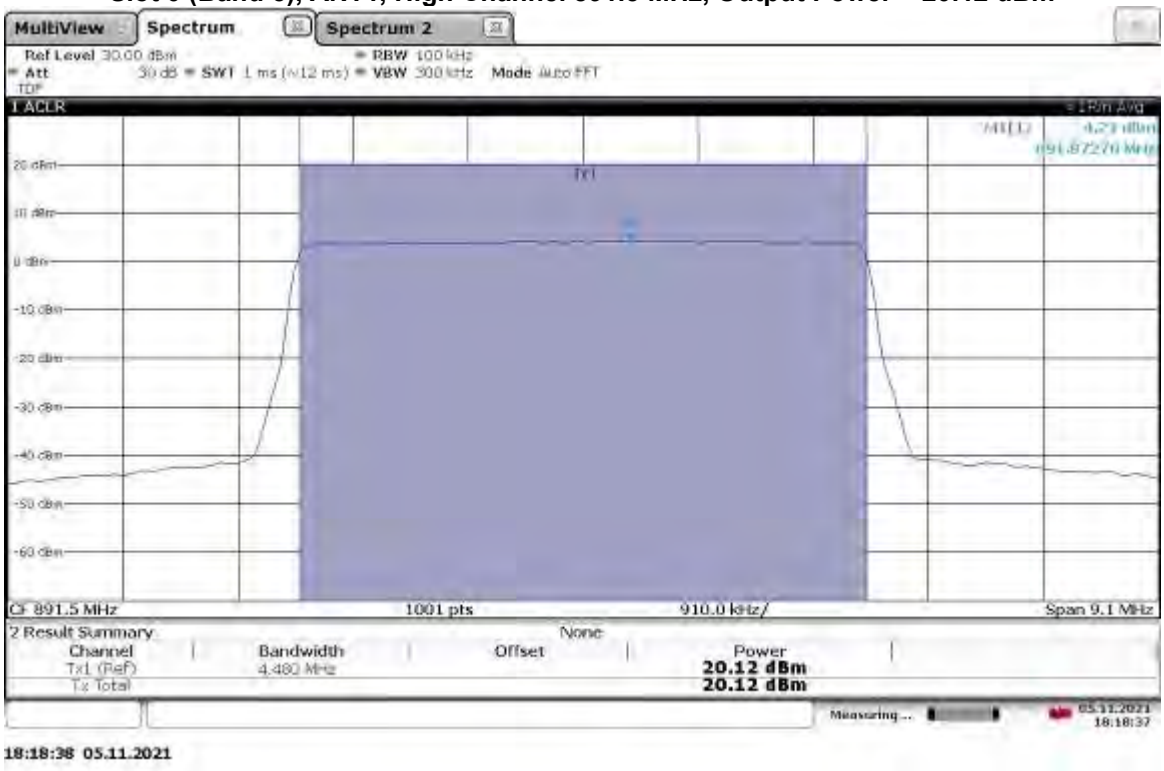
TM1.1-QPSK_5 MHz Bandwidth
Slot 0 (Band 5), ANT1, Mid Channel 881 MHz, Output Power = 19.54 dBm



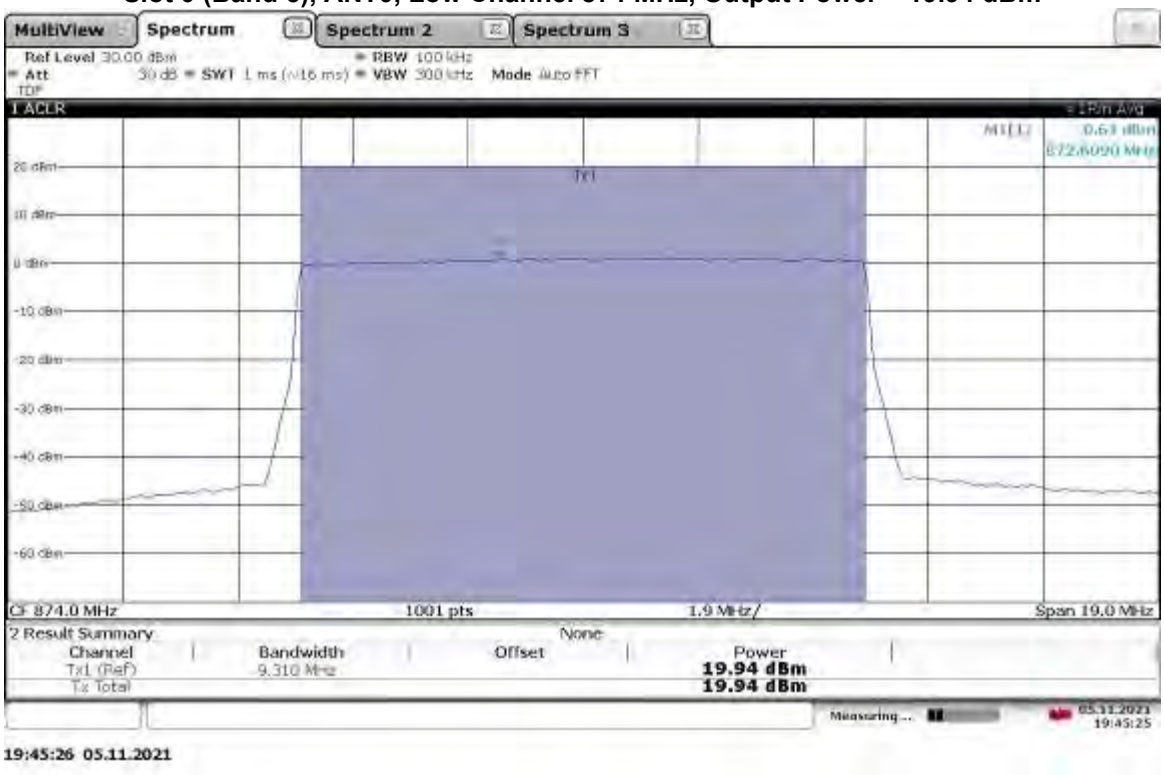
TM1.1-QPSK_5 MHz Bandwidth
Slot 0 (Band 5), ANT0, High Channel 891.5 MHz, Output Power = 20.18 dBm



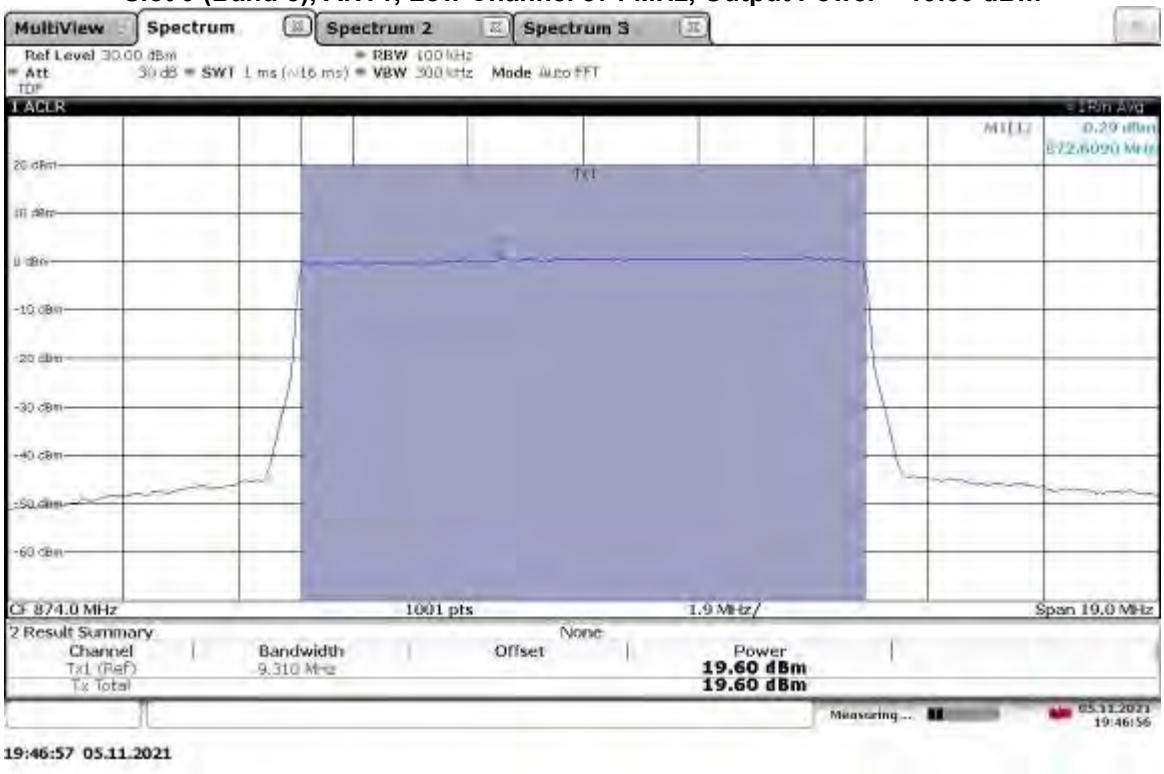
TM1.1-QPSK_5 MHz Bandwidth
Slot 0 (Band 5), ANT1, High Channel 891.5 MHz, Output Power = 20.12 dBm



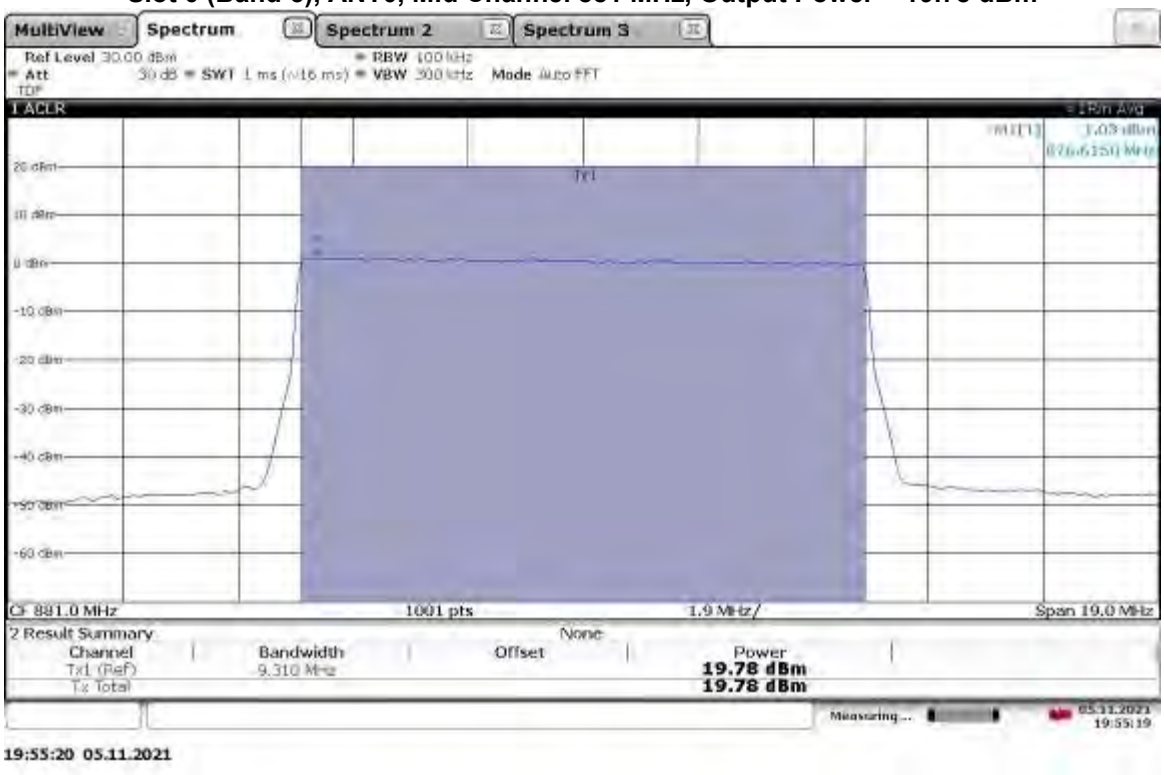
TM1.1-QPSK_10 MHz Bandwidth
Slot 0 (Band 5), ANT0, Low Channel 874 MHz, Output Power = 19.94 dBm



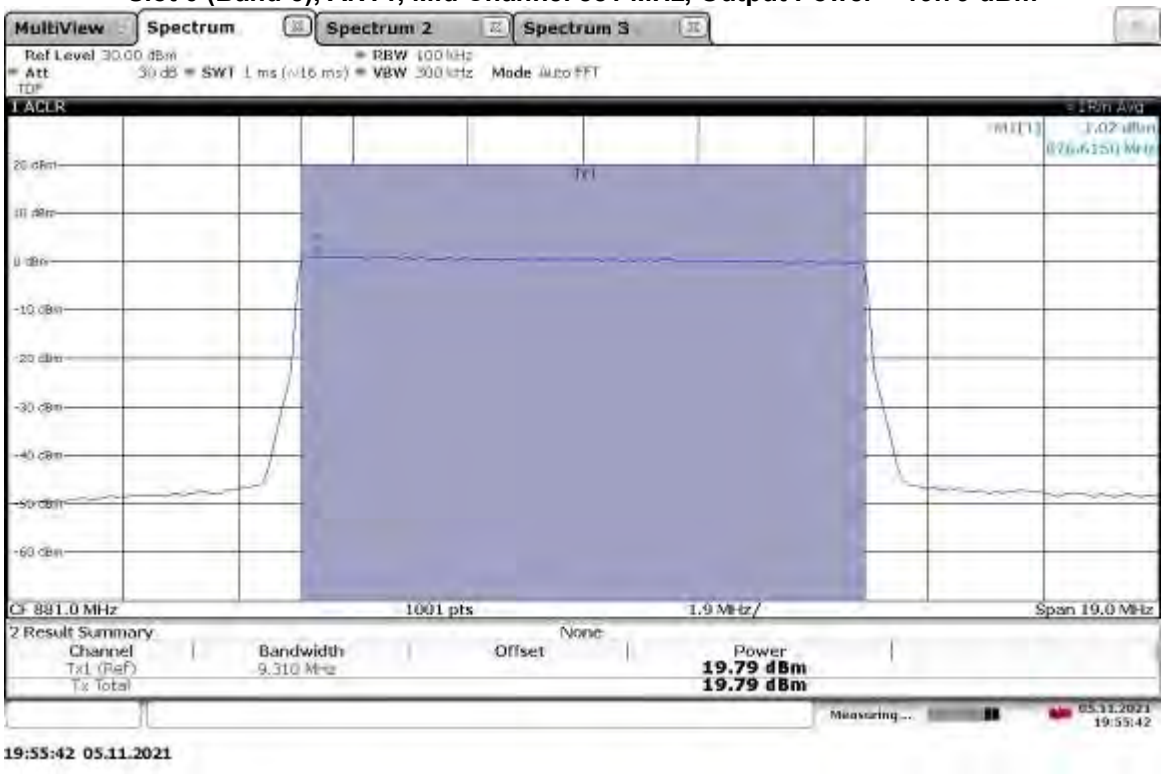
TM1.1-QPSK_10 MHz Bandwidth
Slot 0 (Band 5), ANT1, Low Channel 874 MHz, Output Power = 19.60 dBm



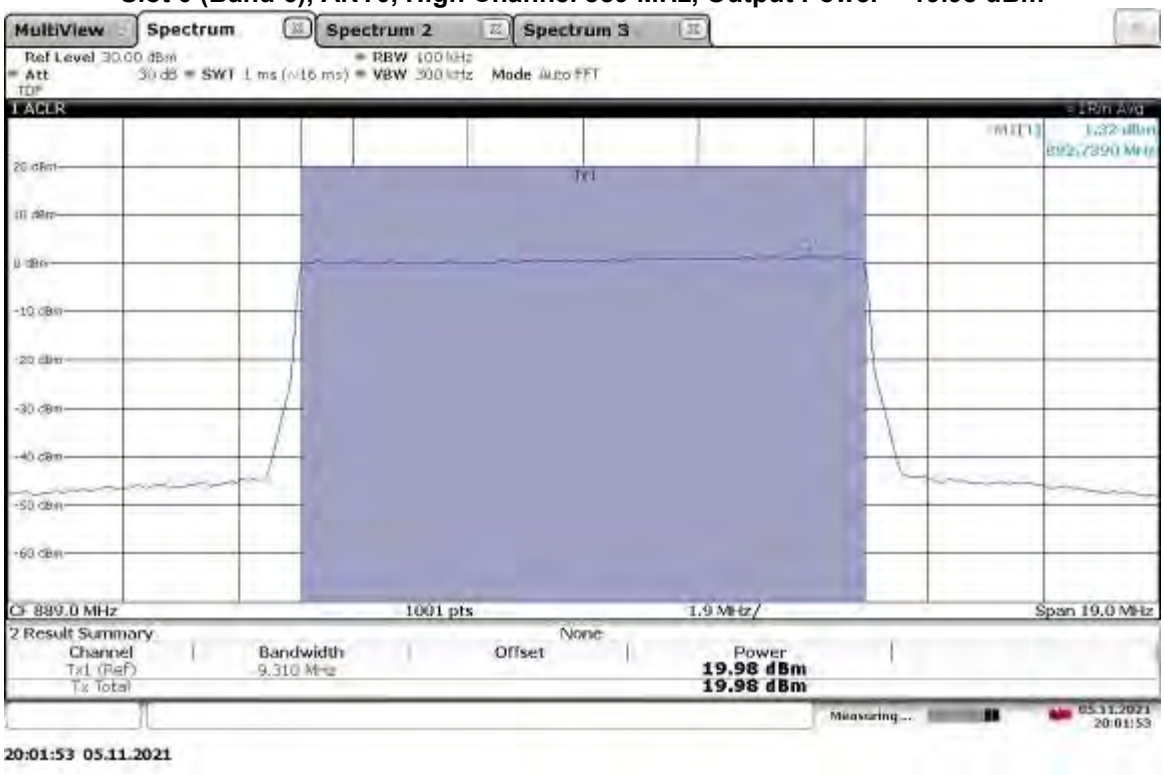
TM1.1-QPSK_10 MHz Bandwidth
Slot 0 (Band 5), ANT0, Mid Channel 881 MHz, Output Power = 19.78 dBm



TM1.1-QPSK_10 MHz Bandwidth
Slot 0 (Band 5), ANT1, Mid Channel 881 MHz, Output Power = 19.79 dBm

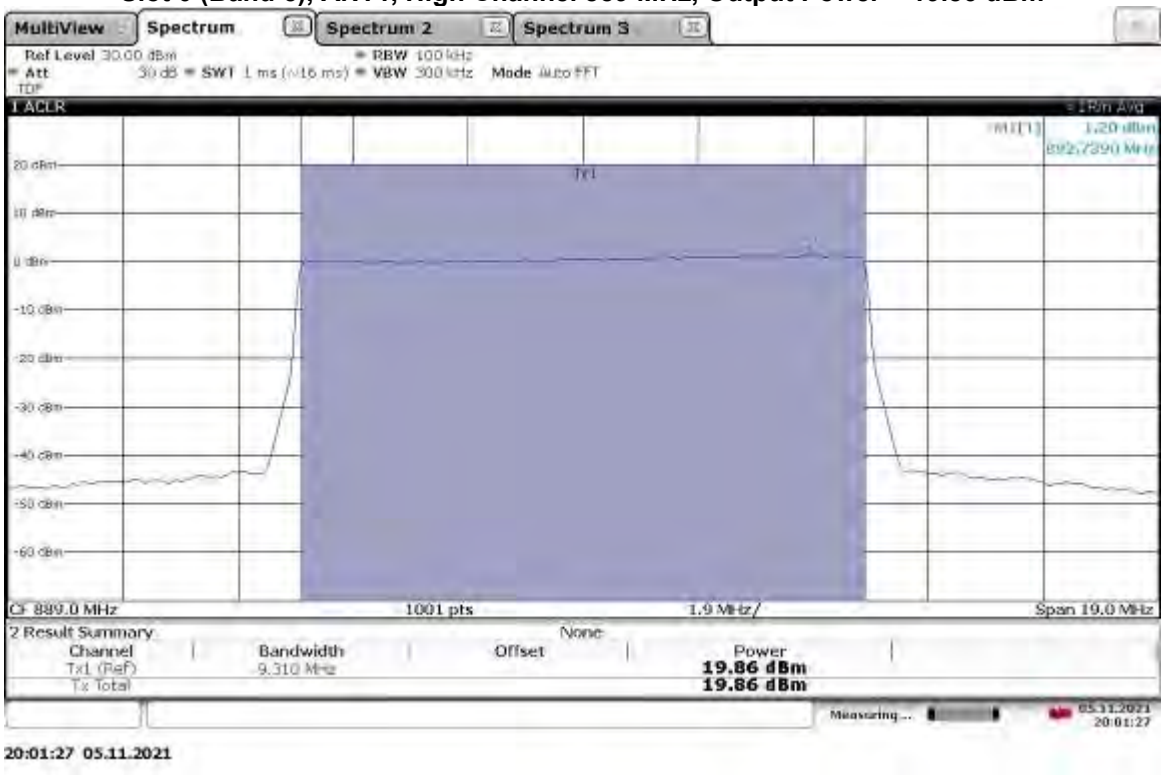


TM1.1-QPSK_10 MHz Bandwidth
Slot 0 (Band 5), ANT0, High Channel 889 MHz, Output Power = 19.98 dBm



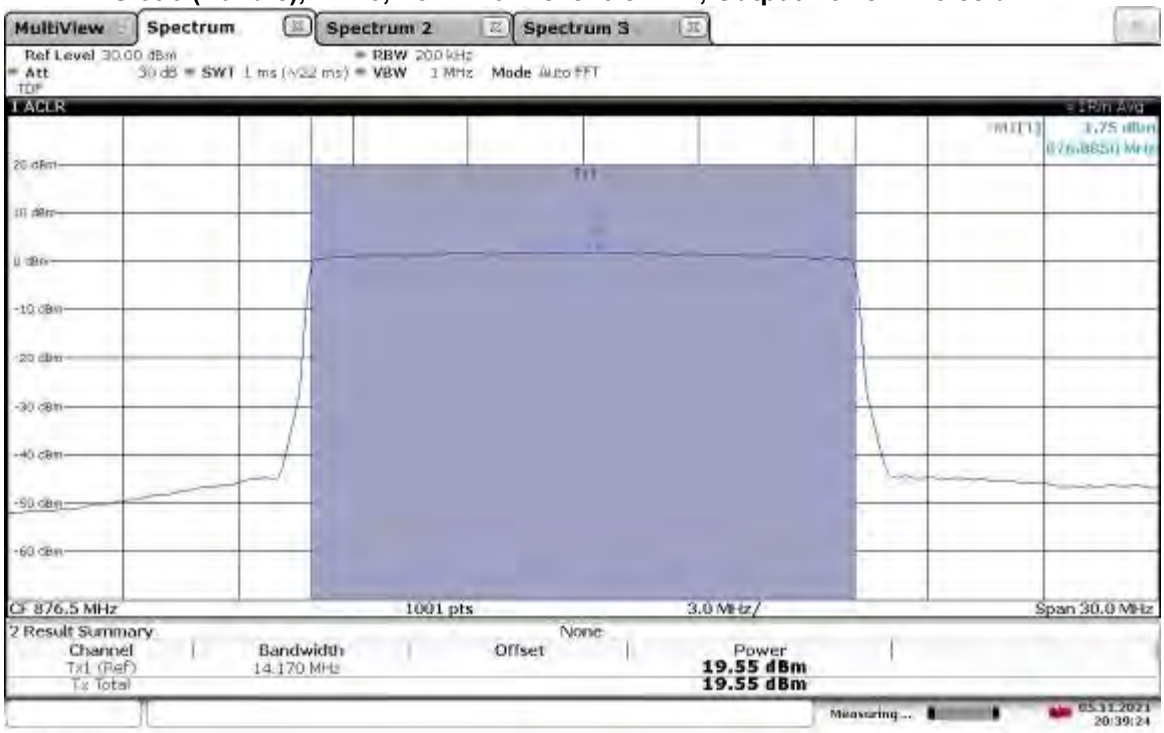
20:01:53 05.11.2021

TM1.1-QPSK_10 MHz Bandwidth
Slot 0 (Band 5), ANT1, High Channel 889 MHz, Output Power = 19.86 dBm

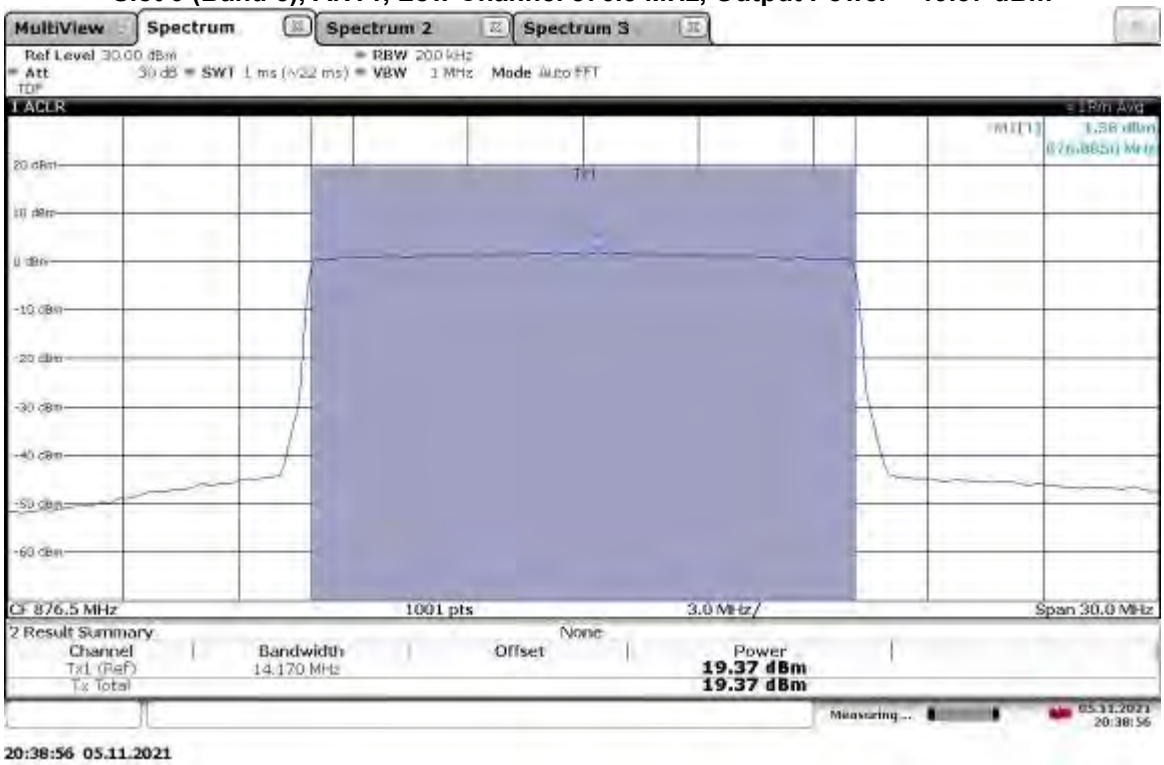


20:01:27 05.11.2021

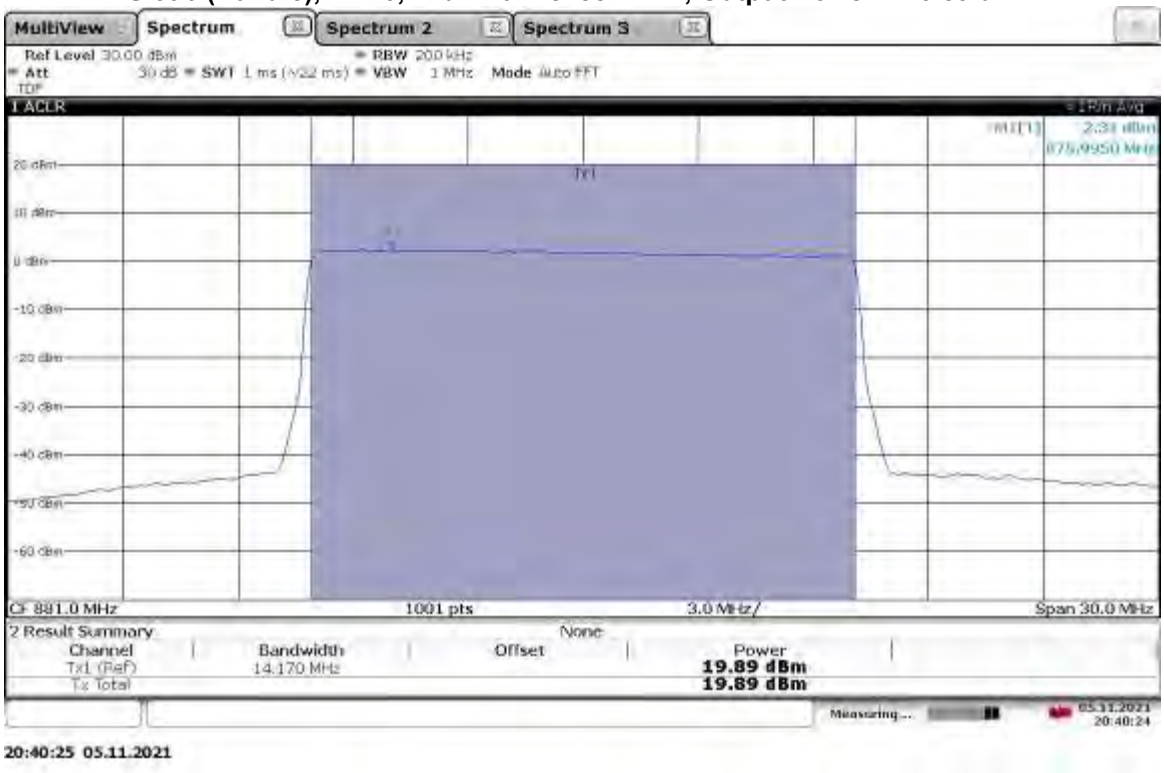
TM1.1-QPSK_15 MHz Bandwidth
Slot 0 (Band 5), ANT0, Low Channel 876.5 MHz, Output Power = 19.55 dBm



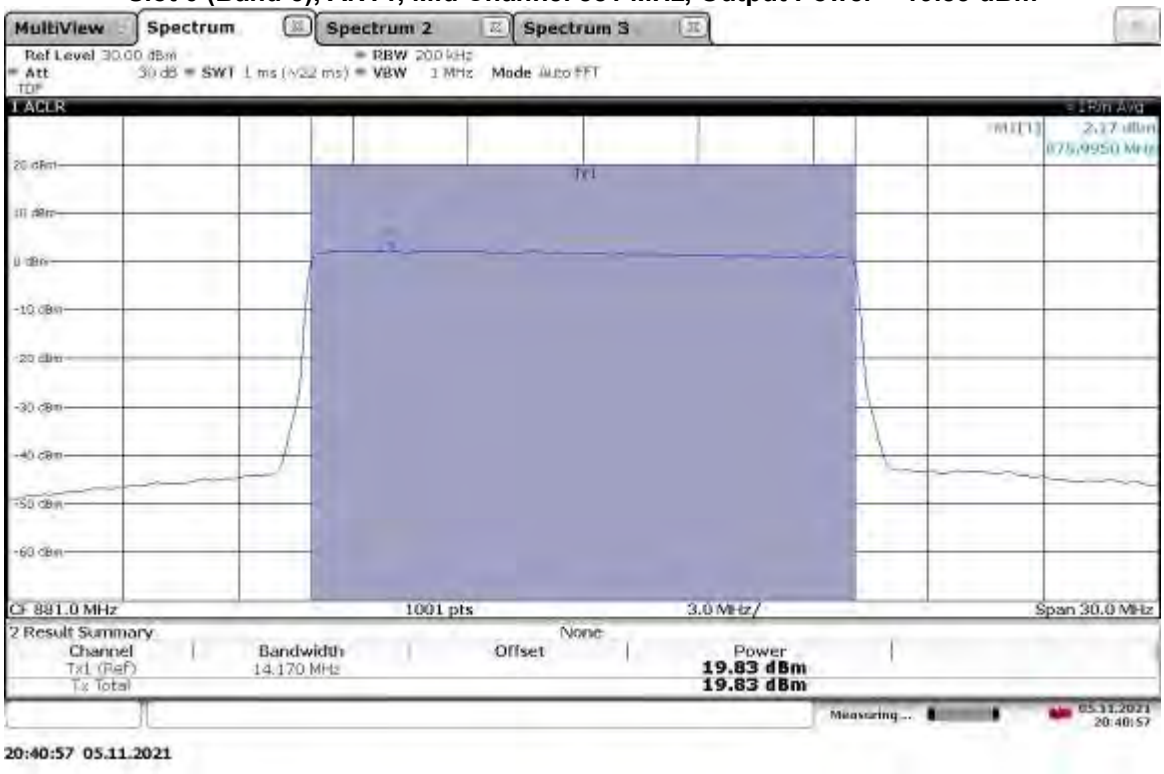
TM1.1-QPSK_15 MHz Bandwidth
Slot 0 (Band 5), ANT1, Low Channel 876.5 MHz, Output Power = 19.37 dBm



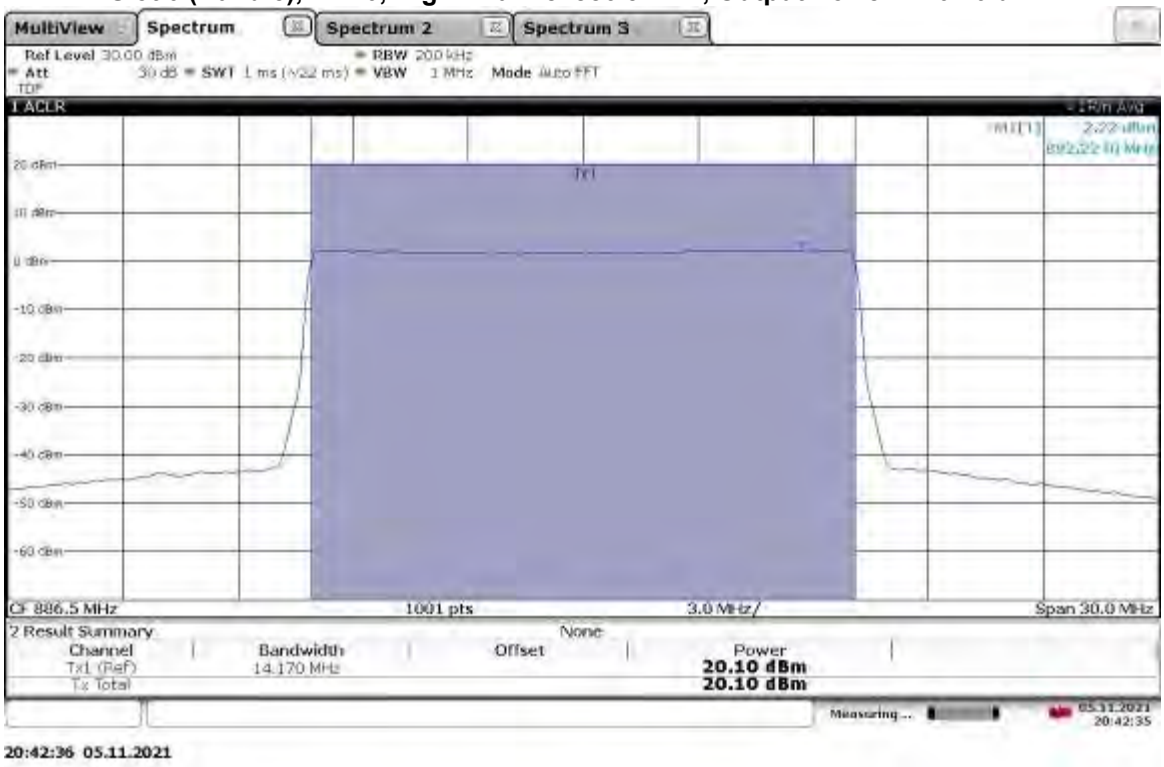
TM1.1-QPSK_15 MHz Bandwidth
Slot 0 (Band 5), ANT0, Mid Channel 881 MHz, Output Power = 19.89 dBm



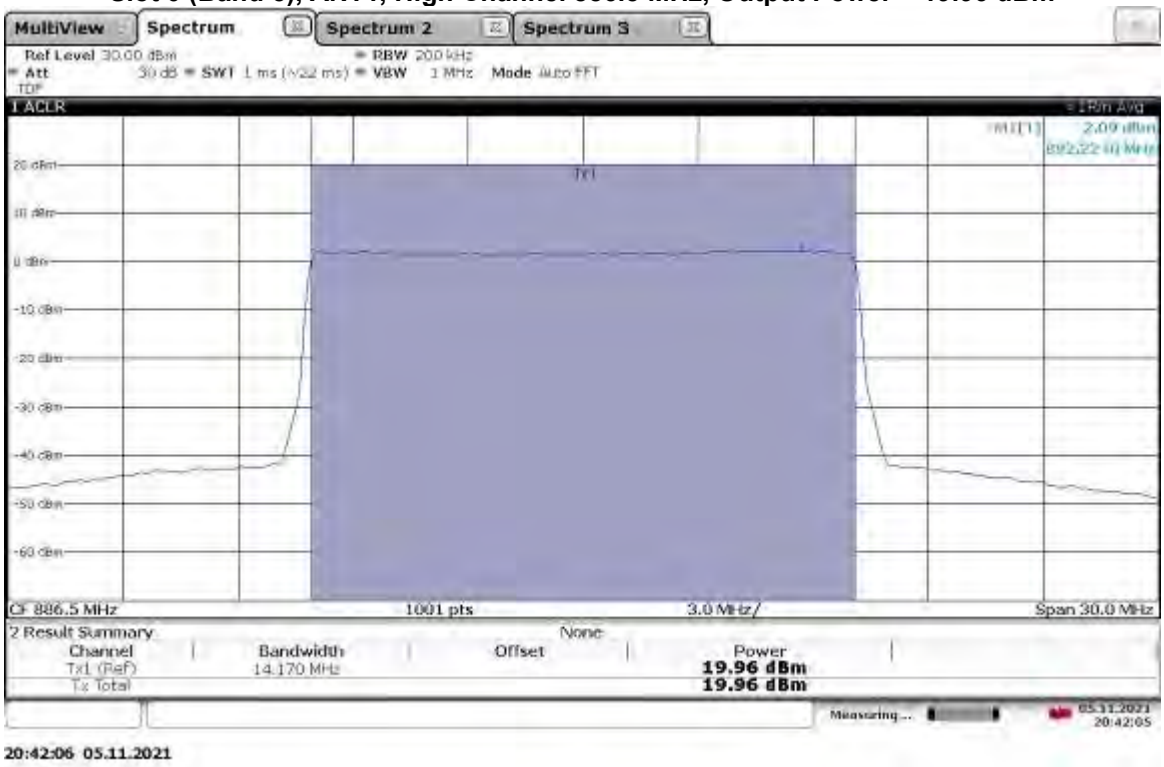
TM1.1-QPSK_15 MHz Bandwidth
Slot 0 (Band 5), ANT1, Mid Channel 881 MHz, Output Power = 19.83 dBm



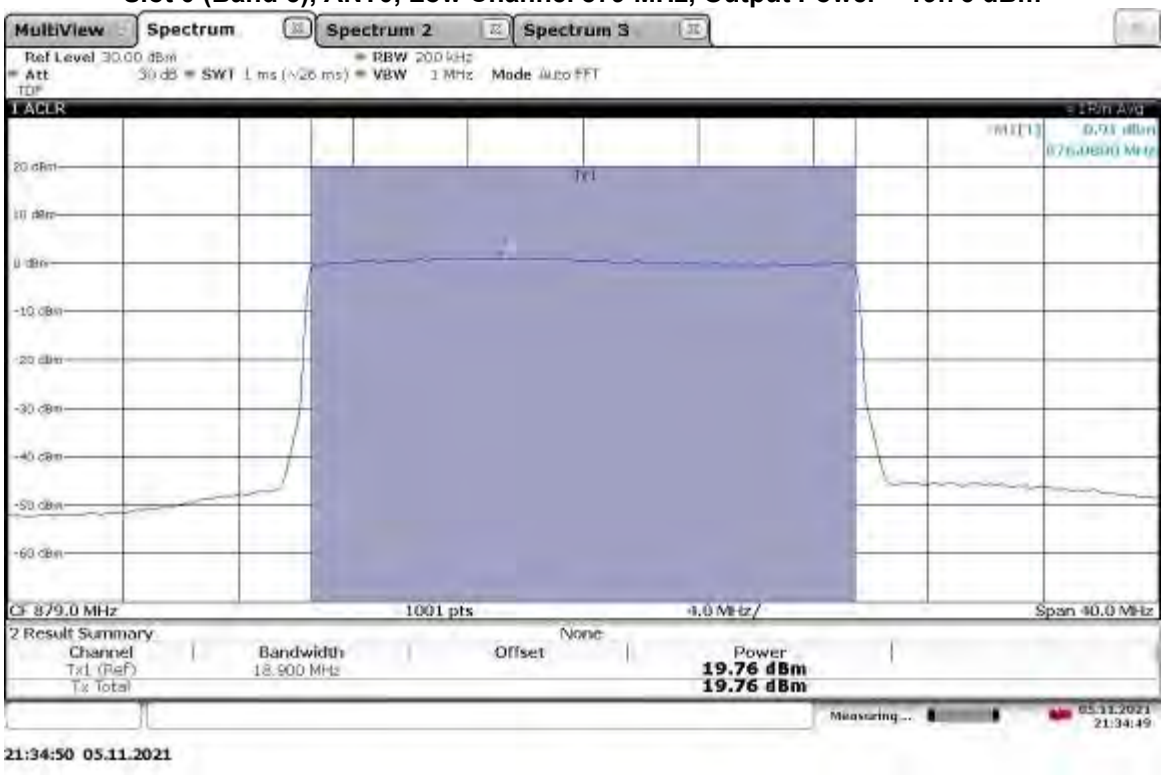
TM1.1-QPSK_15 MHz Bandwidth
Slot 0 (Band 5), ANT0, High Channel 886.5 MHz, Output Power = 20.10 dBm



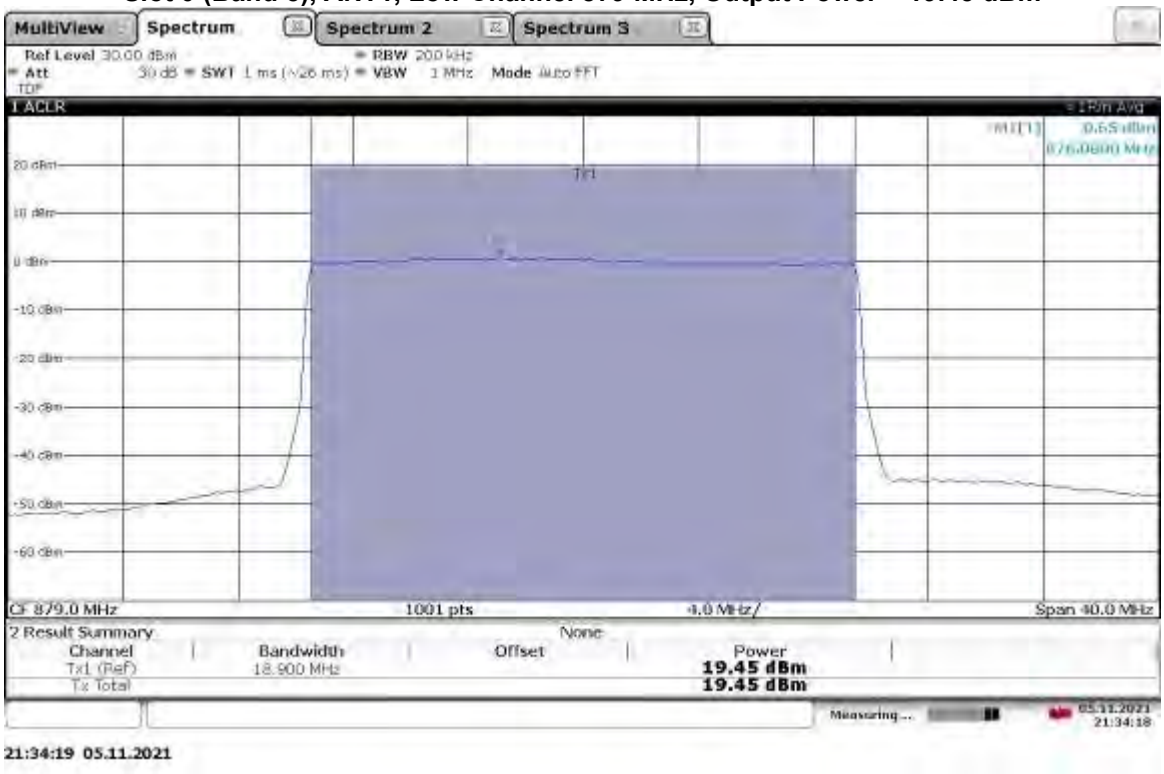
TM1.1-QPSK_15 MHz Bandwidth
Slot 0 (Band 5), ANT1, High Channel 886.5 MHz, Output Power = 19.96 dBm



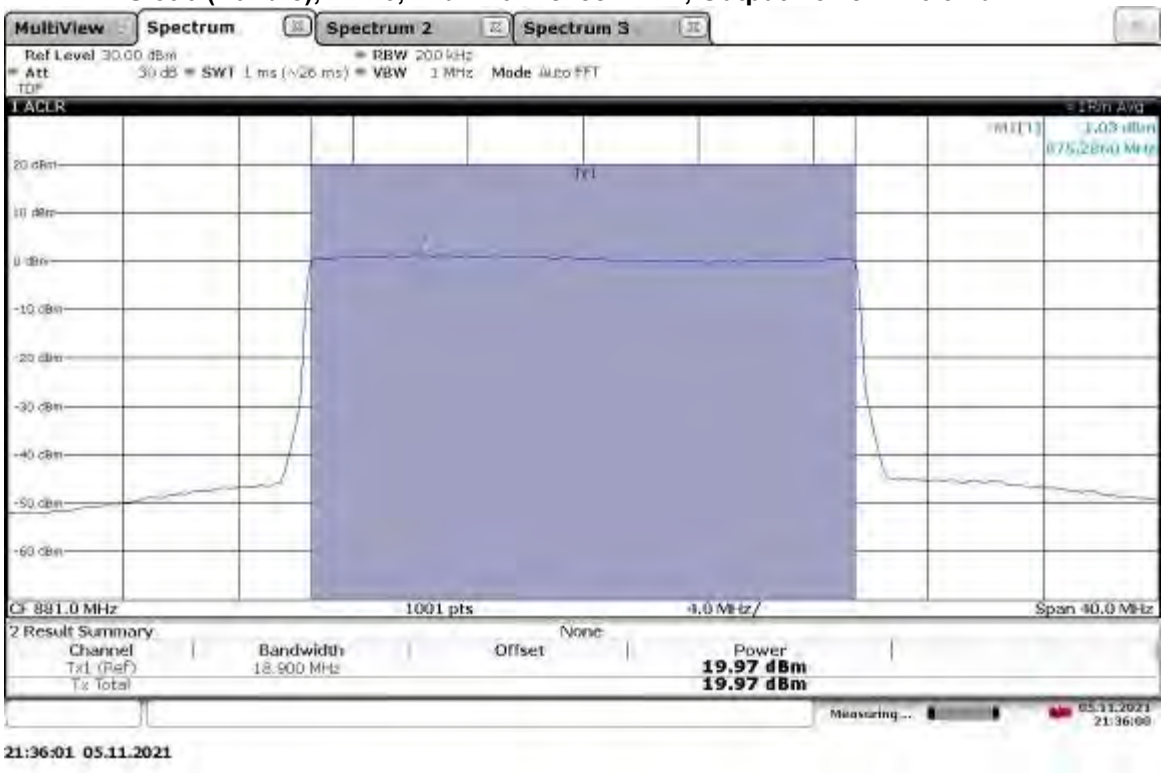
TM1.1-QPSK_20 MHz Bandwidth
Slot 0 (Band 5), ANT0, Low Channel 879 MHz, Output Power = 19.76 dBm



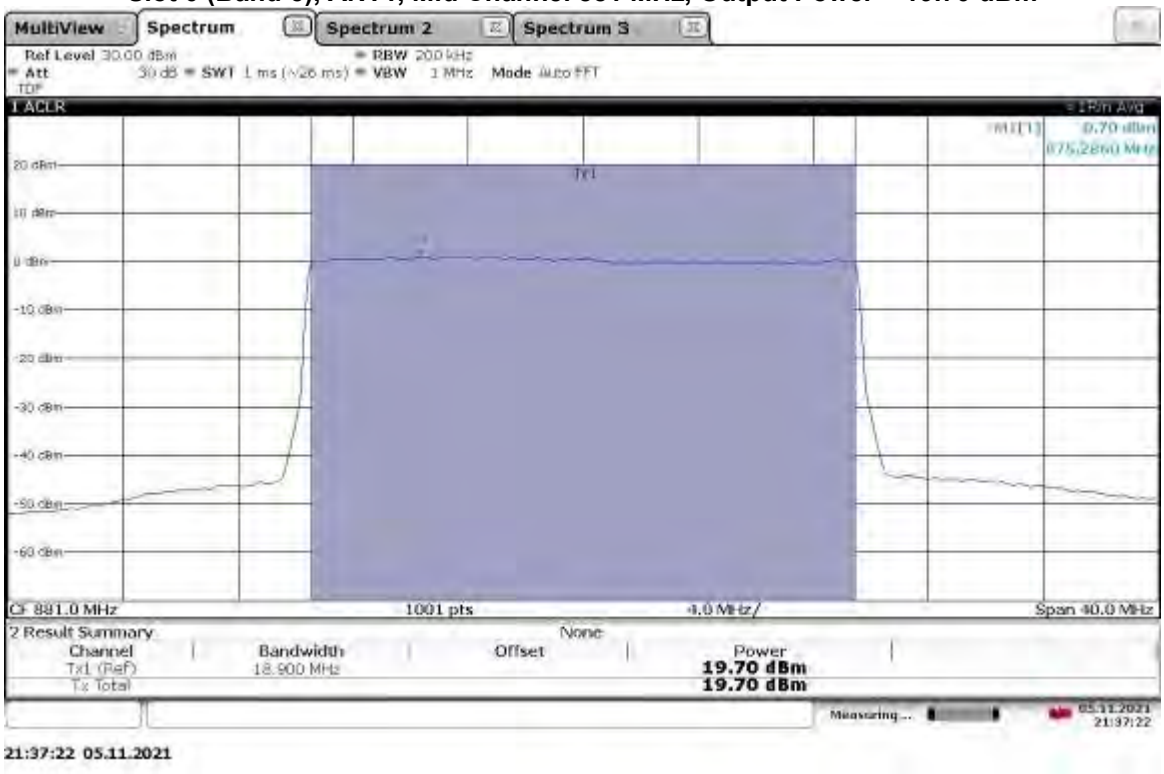
TM1.1-QPSK_20 MHz Bandwidth
Slot 0 (Band 5), ANT1, Low Channel 879 MHz, Output Power = 19.45 dBm



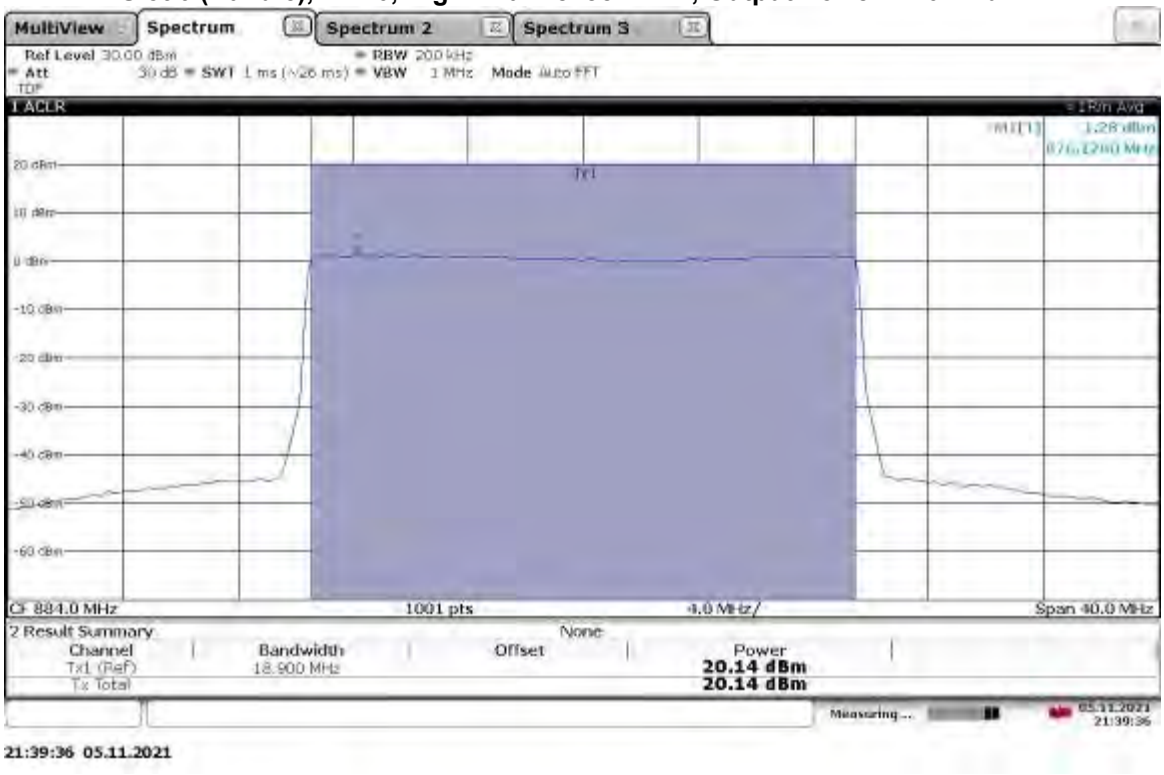
TM1.1-QPSK_20 MHz Bandwidth
Slot 0 (Band 5), ANT0, Mid Channel 881 MHz, Output Power = 19.97 dBm



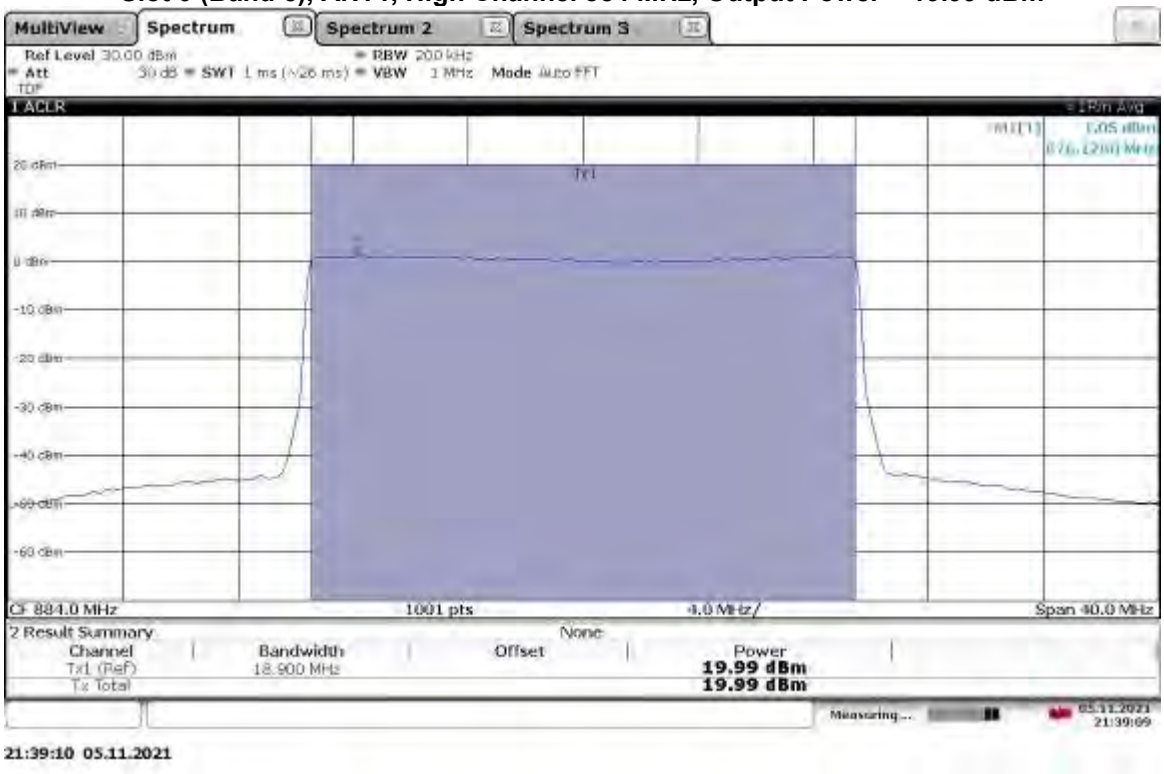
TM1.1-QPSK_20 MHz Bandwidth
Slot 0 (Band 5), ANT1, Mid Channel 881 MHz, Output Power = 19.70 dBm



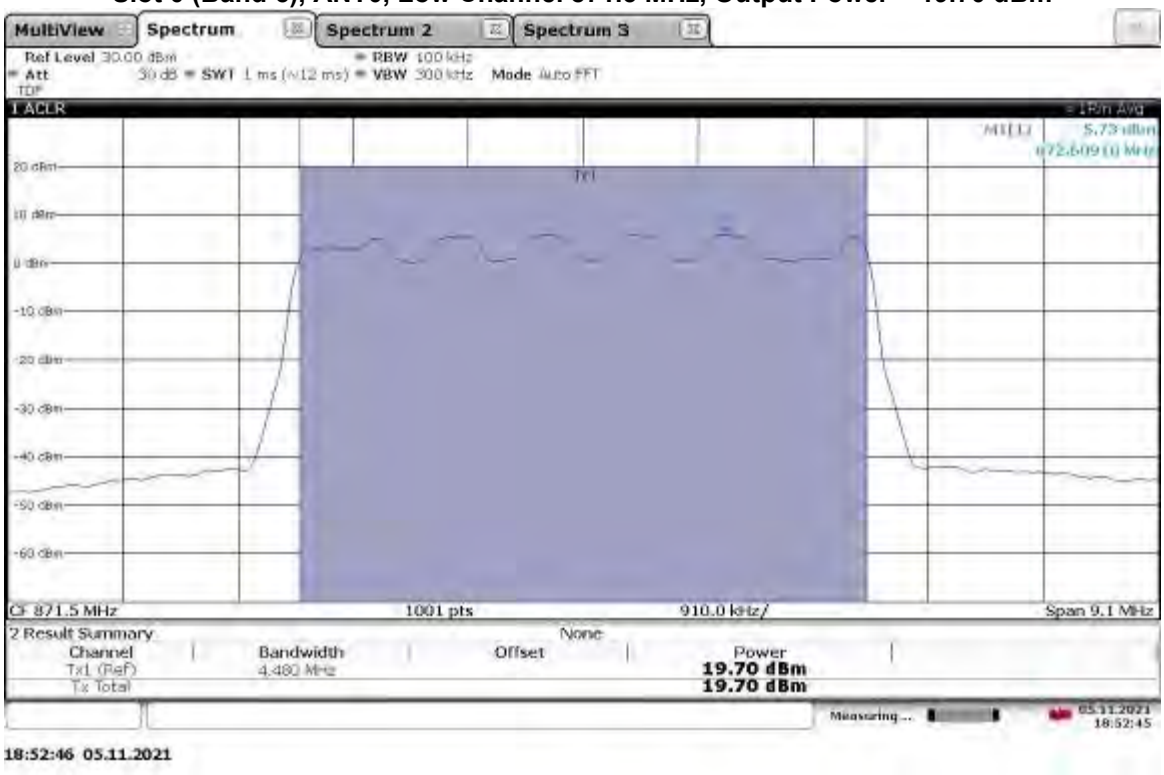
TM1.1-QPSK_20 MHz Bandwidth
Slot 0 (Band 5), ANT0, High Channel 884 MHz, Output Power = 20.14 dBm



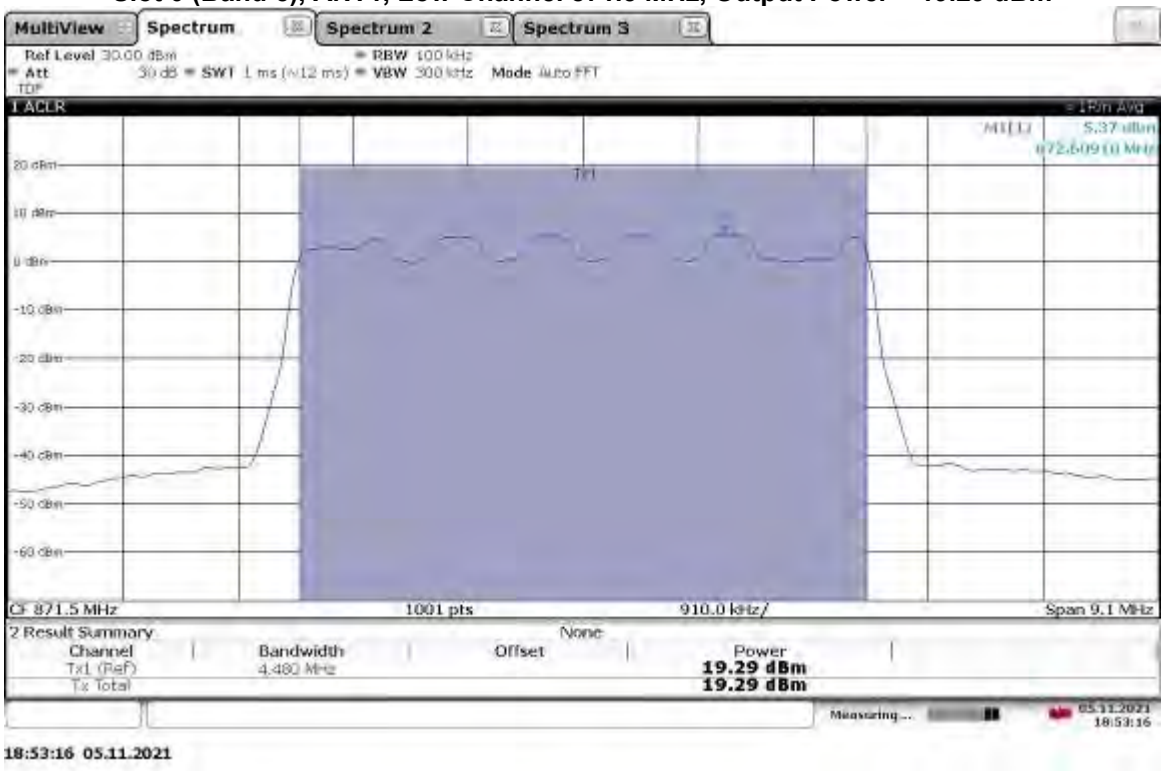
TM1.1-QPSK_20 MHz Bandwidth
Slot 0 (Band 5), ANT1, High Channel 884 MHz, Output Power = 19.99 dBm



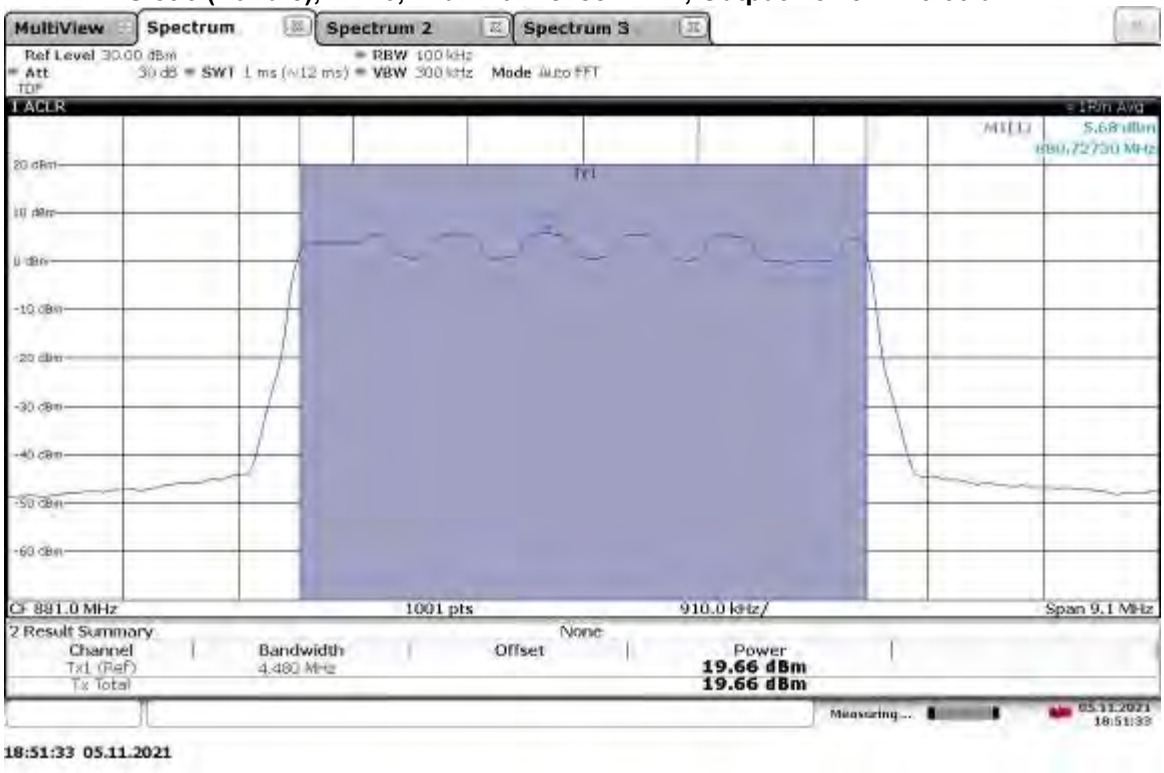
TM3.2-16QAM_5 MHz Bandwidth
Slot 0 (Band 5), ANT0, Low Channel 871.5 MHz, Output Power = 19.70 dBm



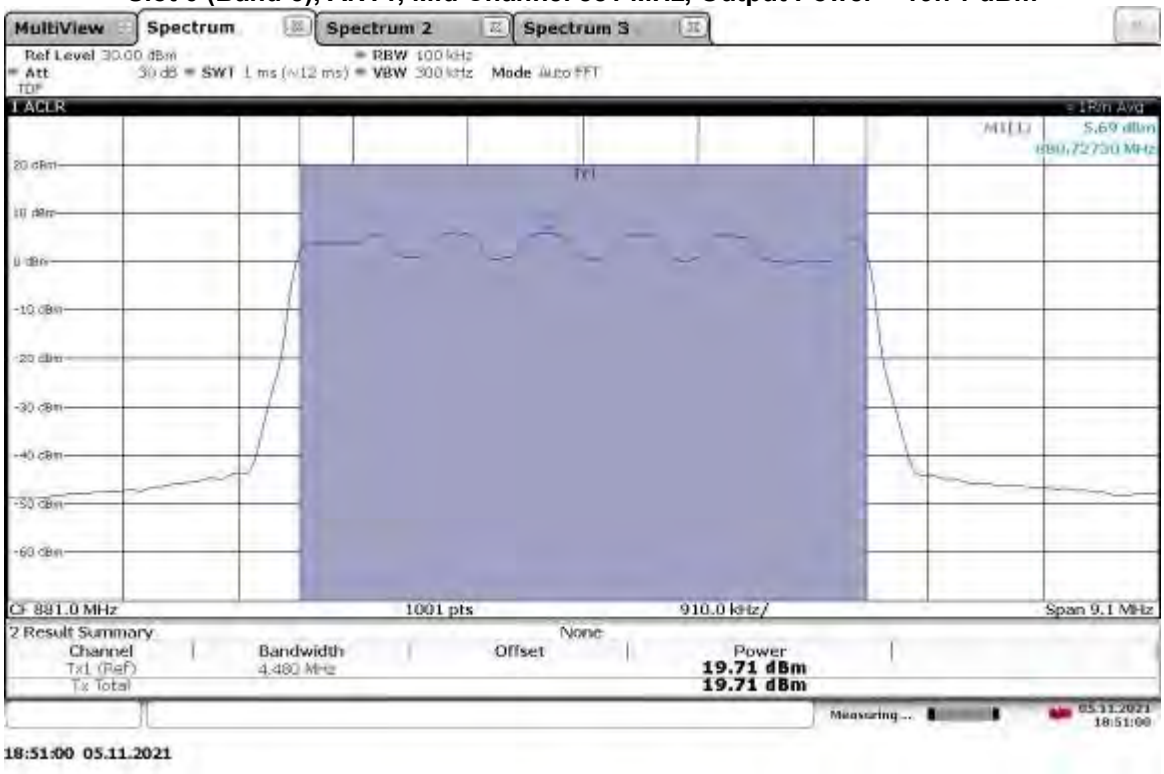
TM3.2-16QAM_5 MHz Bandwidth
Slot 0 (Band 5), ANT1, Low Channel 871.5 MHz, Output Power = 19.29 dBm



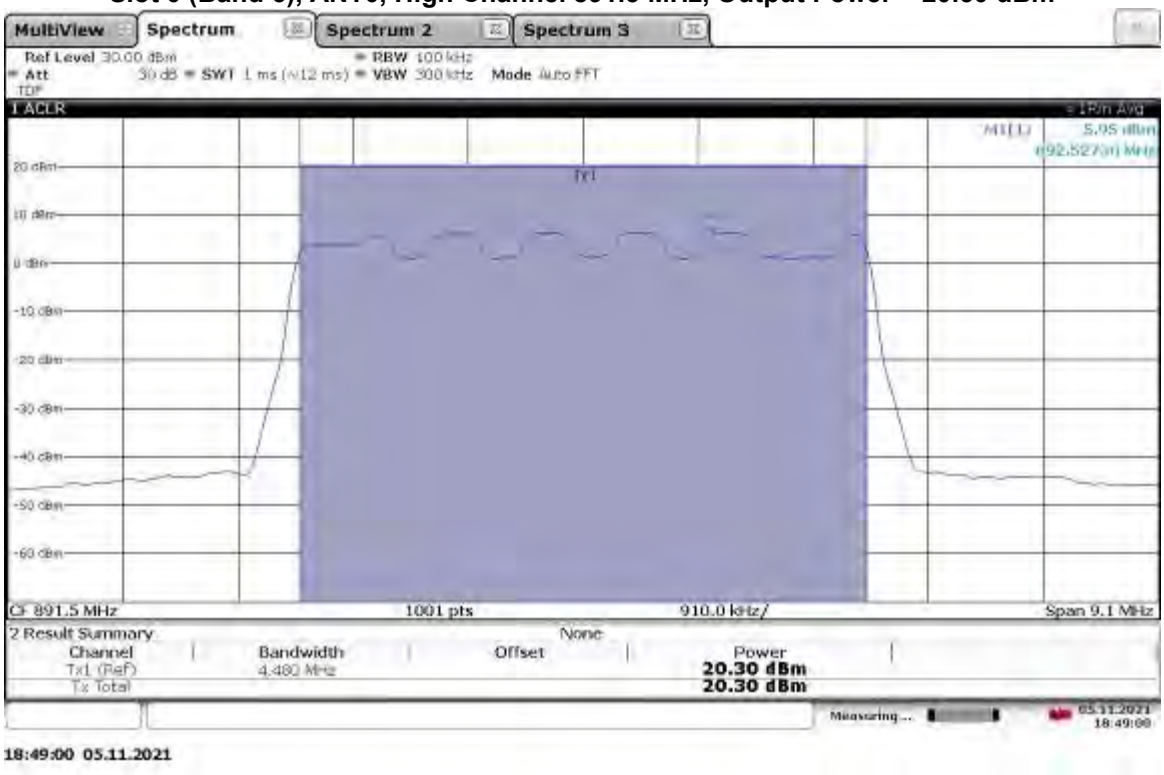
TM3.2-16QAM_5 MHz Bandwidth
Slot 0 (Band 5), ANT0, Mid Channel 881 MHz, Output Power = 19.66 dBm



TM3.2-16QAM_5 MHz Bandwidth
Slot 0 (Band 5), ANT1, Mid Channel 881 MHz, Output Power = 19.71 dBm



TM3.2-16QAM_5 MHz Bandwidth
Slot 0 (Band 5), ANT0, High Channel 891.5 MHz, Output Power = 20.30 dBm



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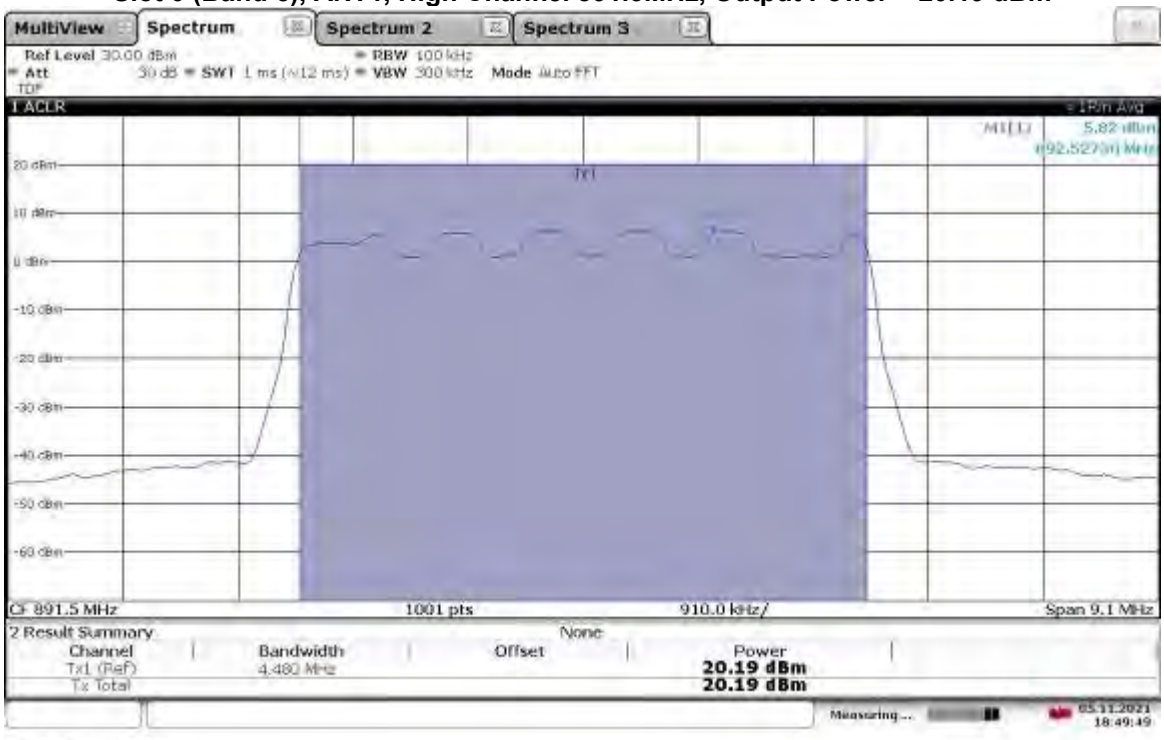
TM3.2-16QAM_5 MHz Bandwidth
Slot 0 (Band 5), ANT1, High Channel 891.5MHz, Output Power = 20.19 dBm



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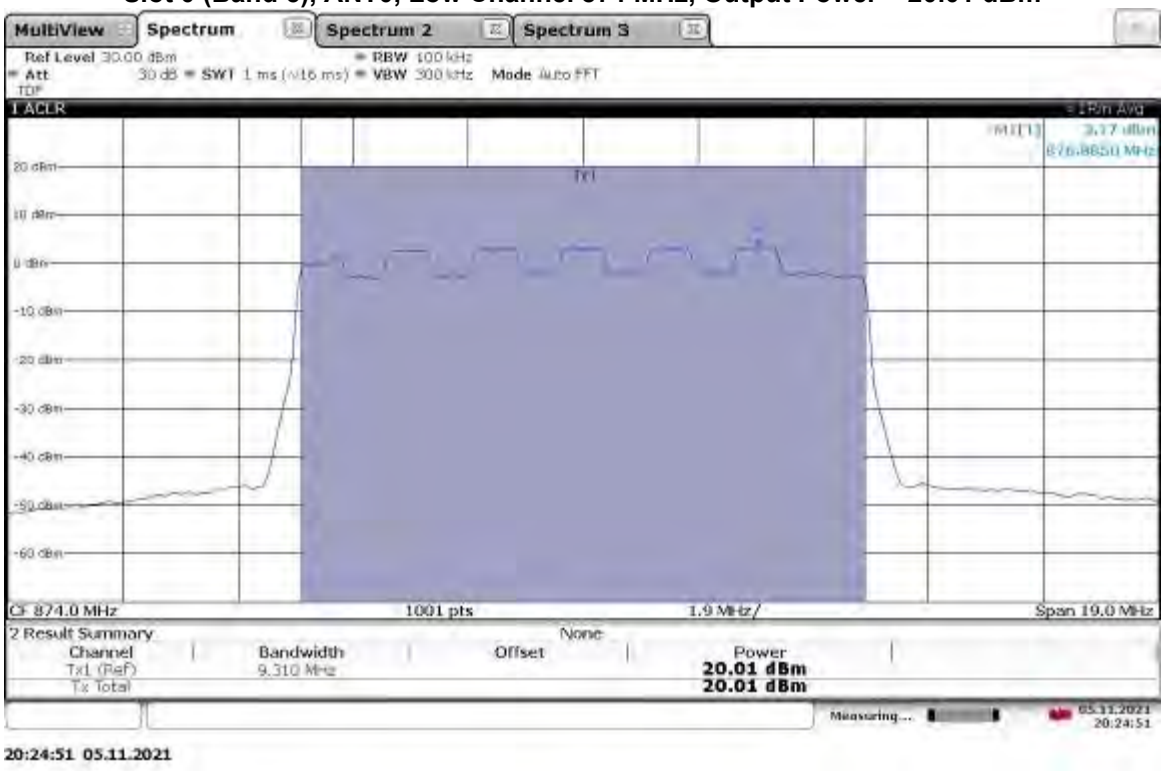
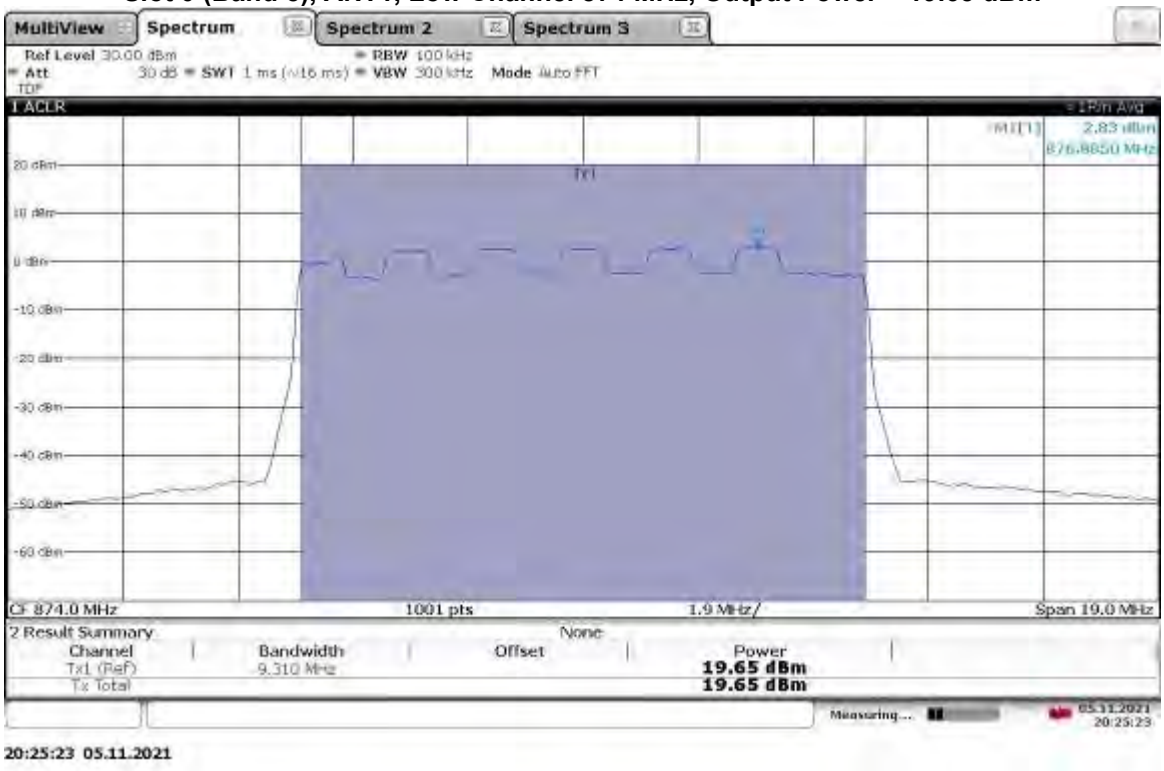
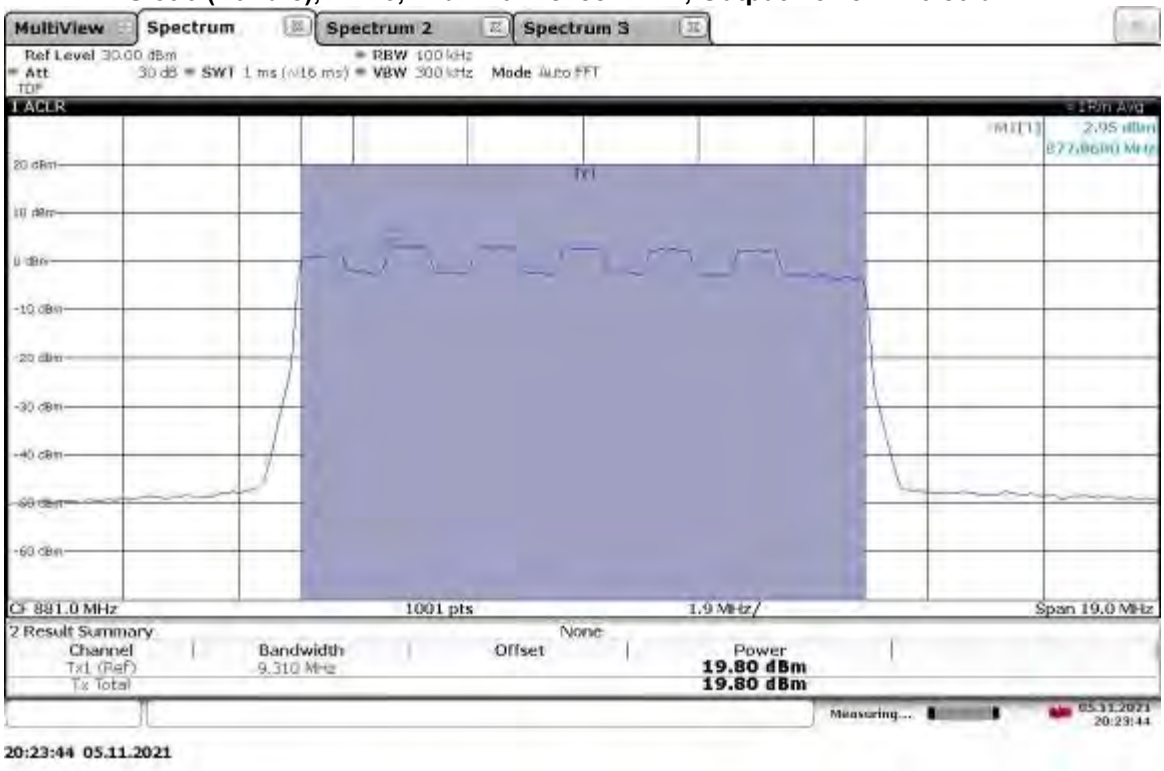
TM3.2-16QAM_10 MHz Bandwidth
Slot 0 (Band 5), ANT0, Low Channel 874 MHz, Output Power = 20.01 dBm



TM3.2-16QAM_10 MHz Bandwidth
Slot 0 (Band 5), ANT1, Low Channel 874 MHz, Output Power = 19.65 dBm



TM3.2-16QAM_10 MHz Bandwidth
Slot 0 (Band 5), ANT0, Mid Channel 881 MHz, Output Power = 19.80 dBm



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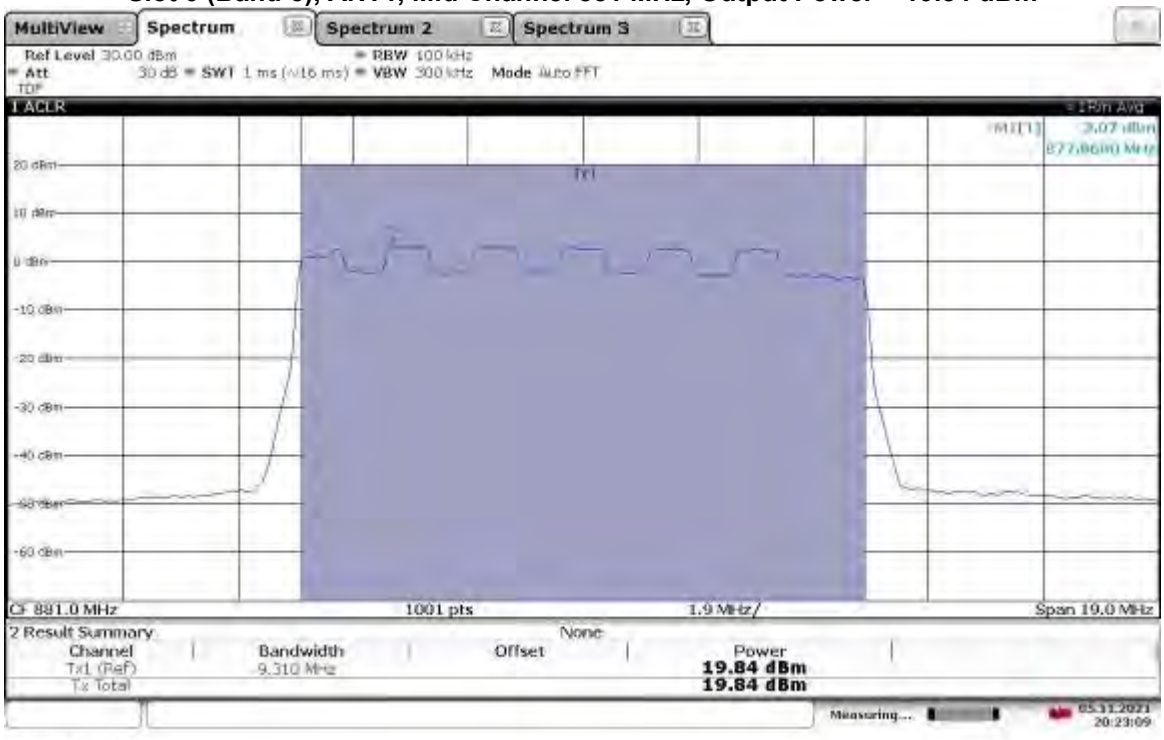
TM3.2-16QAM_10 MHz Bandwidth
Slot 0 (Band 5), ANT1, Mid Channel 881 MHz, Output Power = 19.84 dBm



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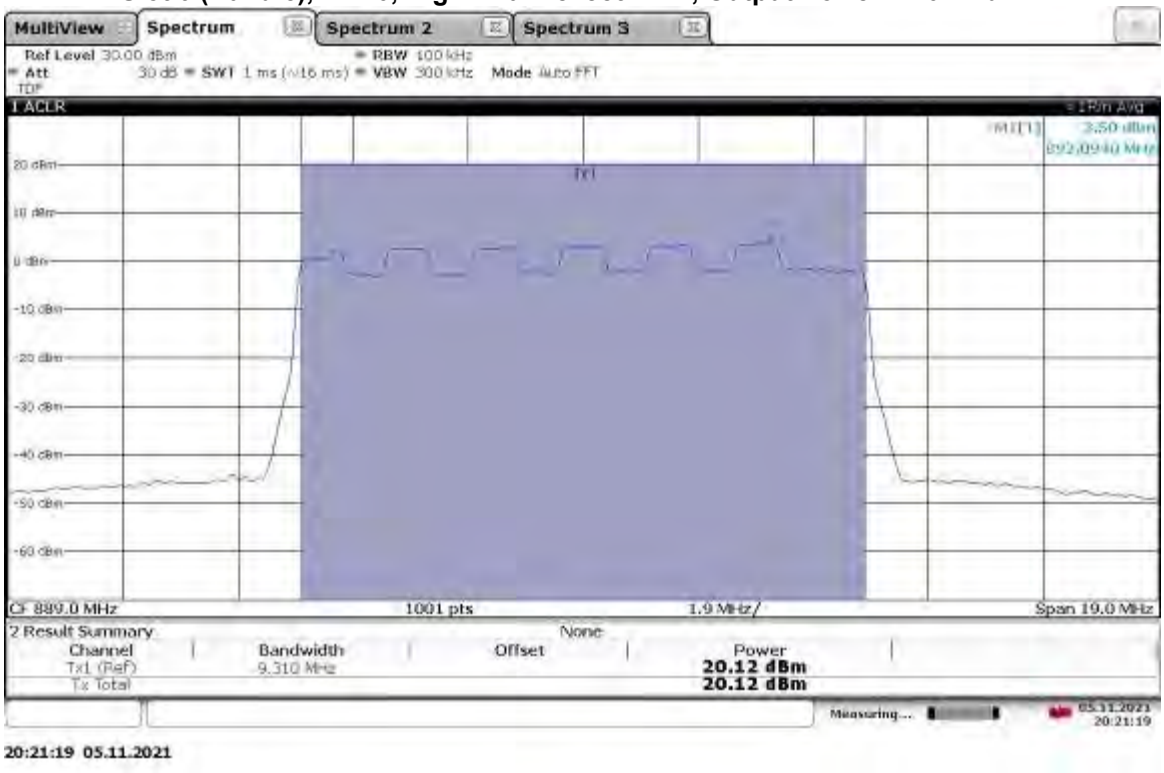
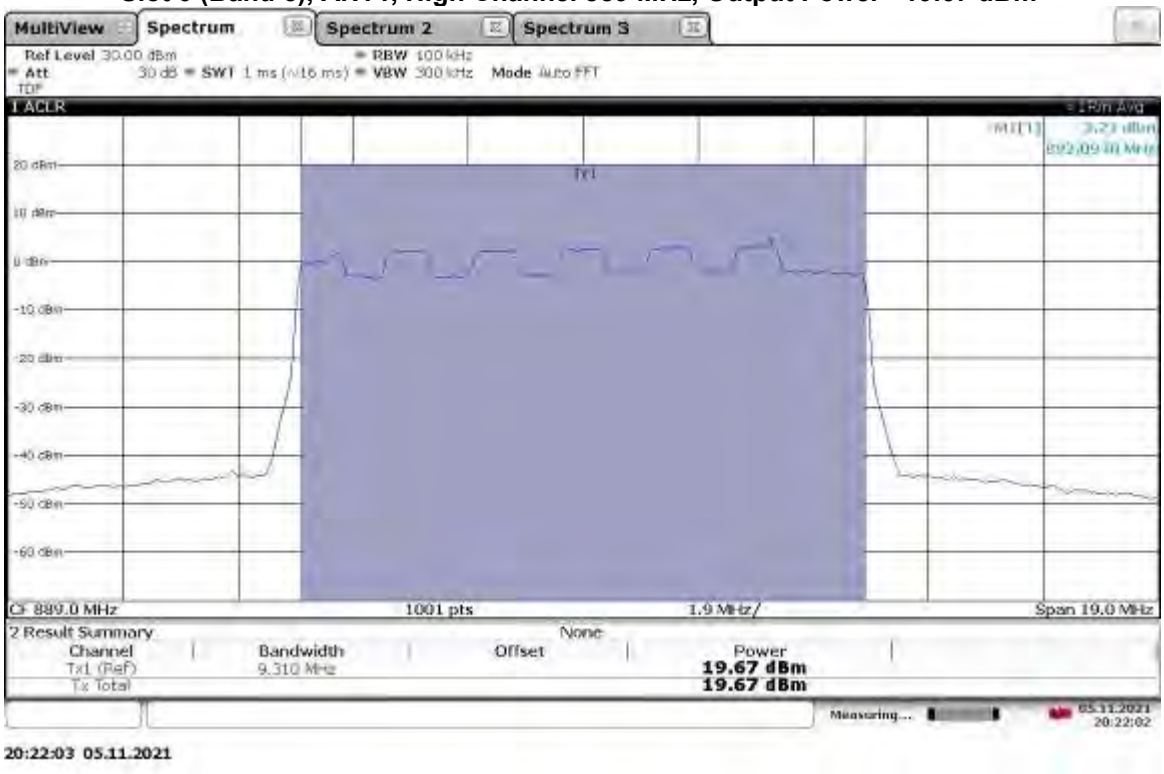
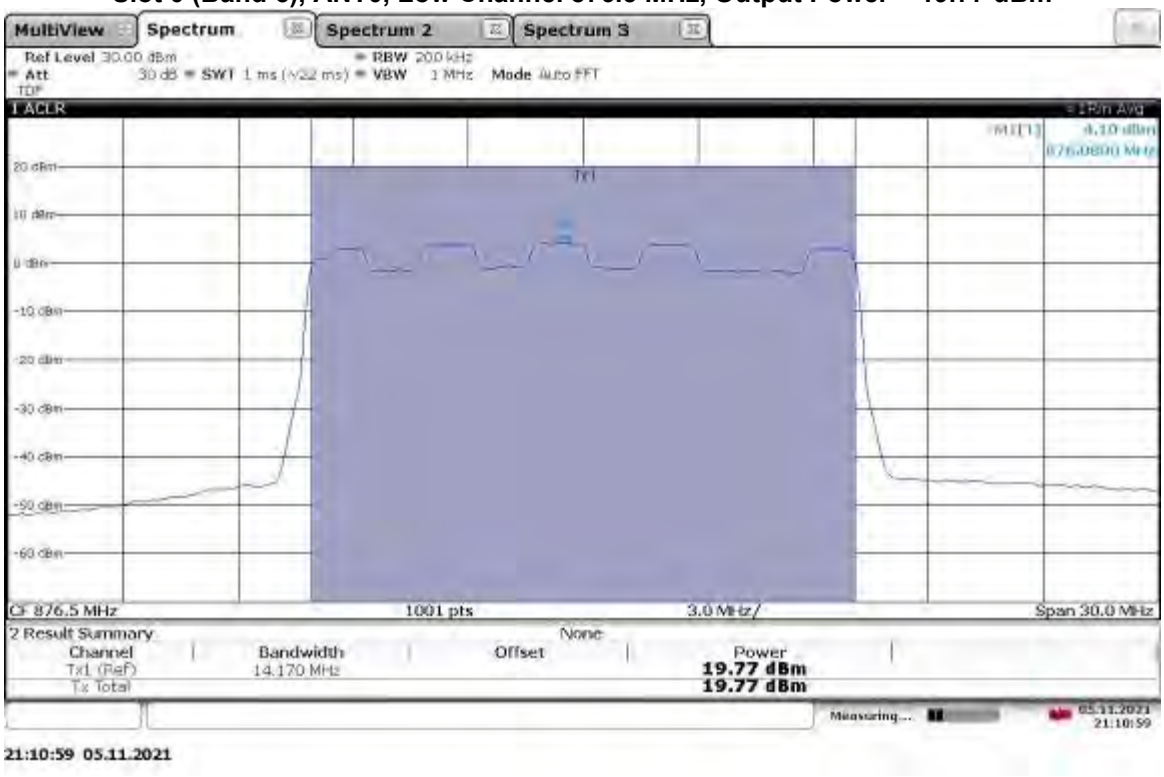
TM3.2-16QAM_10 MHz Bandwidth
Slot 0 (Band 5), ANT0, High Channel 889 MHz, Output Power = 20.12 dBm



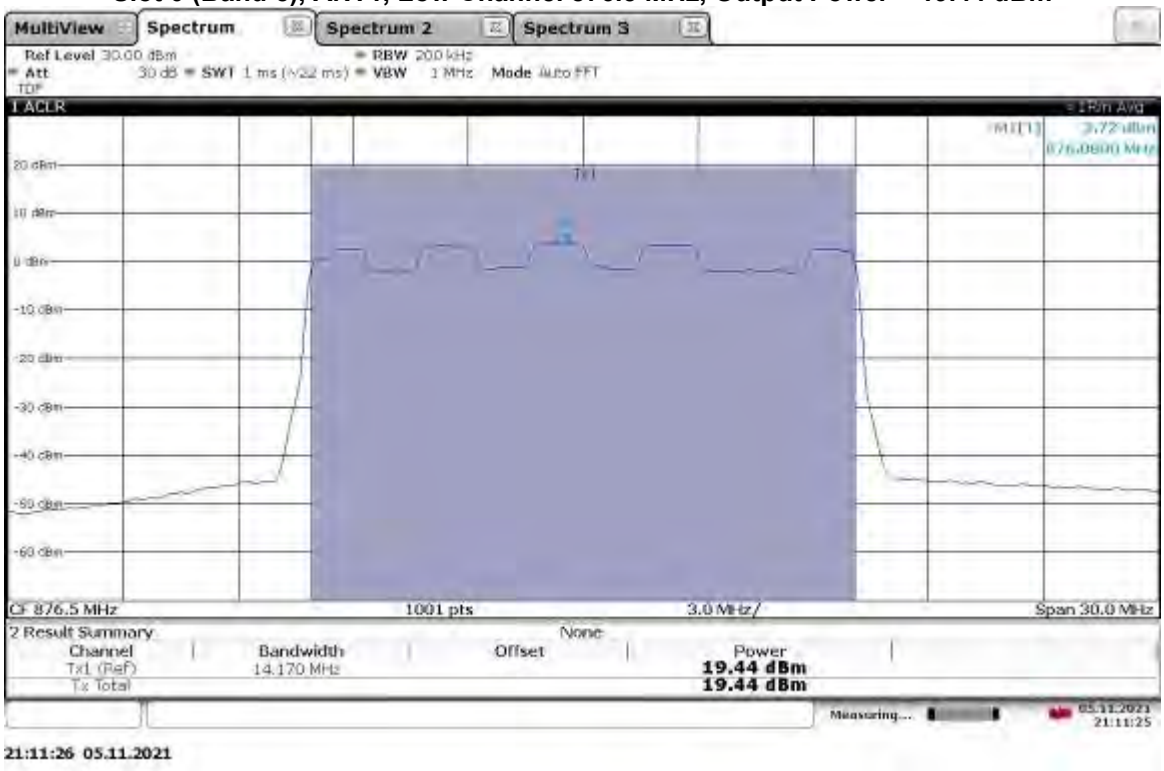
TM3.2-16QAM_10 MHz Bandwidth
Slot 0 (Band 5), ANT1, High Channel 889 MHz, Output Power =19.67 dBm



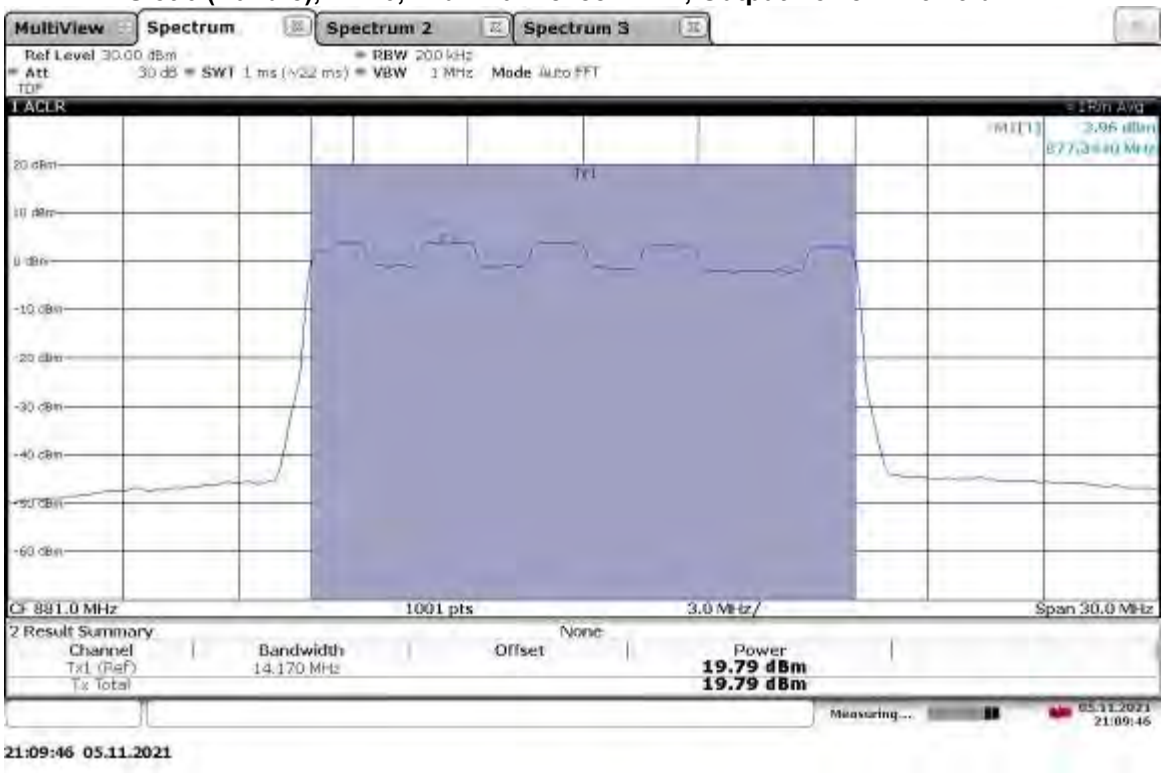
TM3.2-16QAM_15 MHz Bandwidth
Slot 0 (Band 5), ANT0, Low Channel 876.5 MHz, Output Power = 19.77 dBm



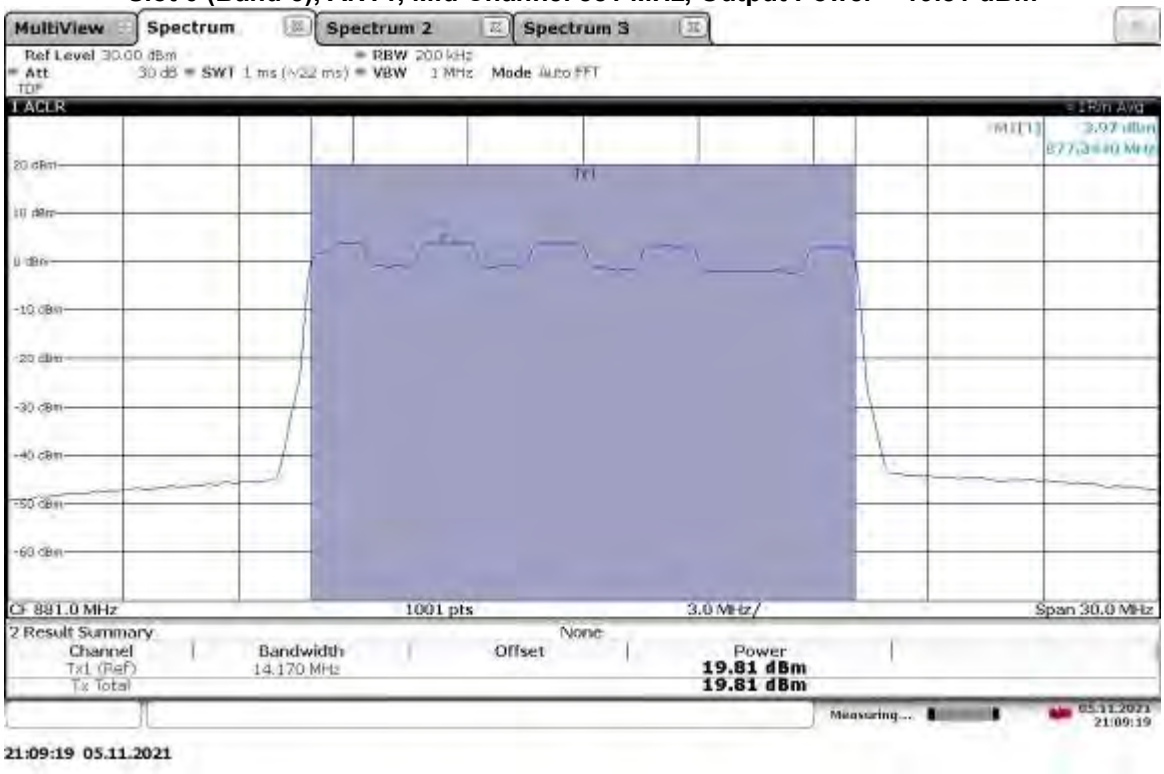
TM3.2-16QAM_15 MHz Bandwidth
Slot 0 (Band 5), ANT1, Low Channel 876.5 MHz, Output Power = 19.44 dBm



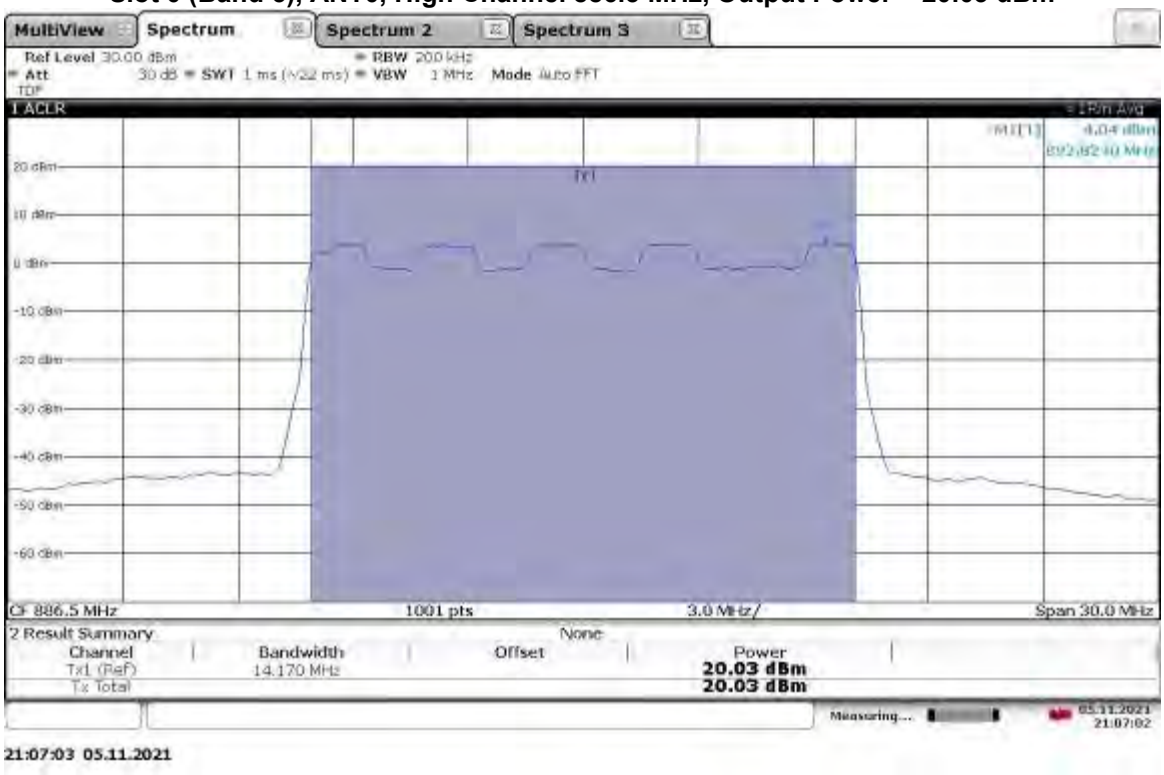
TM3.2-16QAM_15 MHz Bandwidth
Slot 0 (Band 5), ANT0, Mid Channel 881 MHz, Output Power = 19.79 dBm



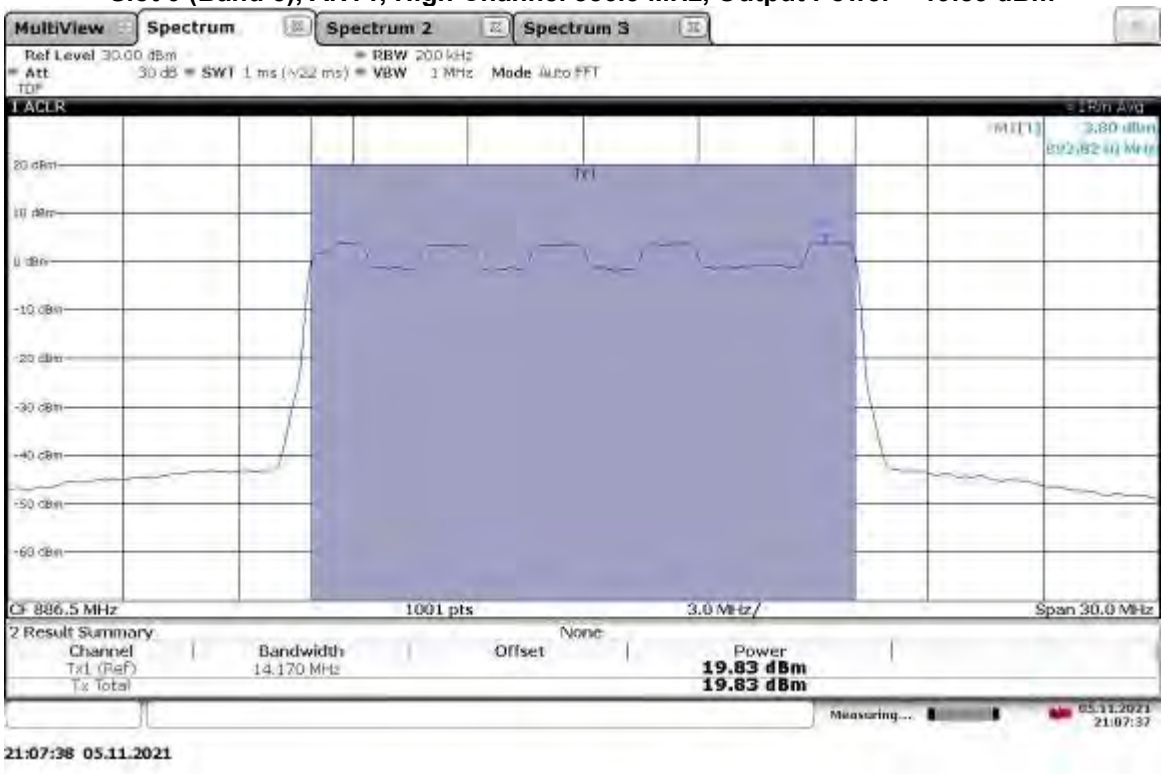
TM3.2-16QAM_15 MHz Bandwidth
Slot 0 (Band 5), ANT1, Mid Channel 881 MHz, Output Power = 19.81 dBm



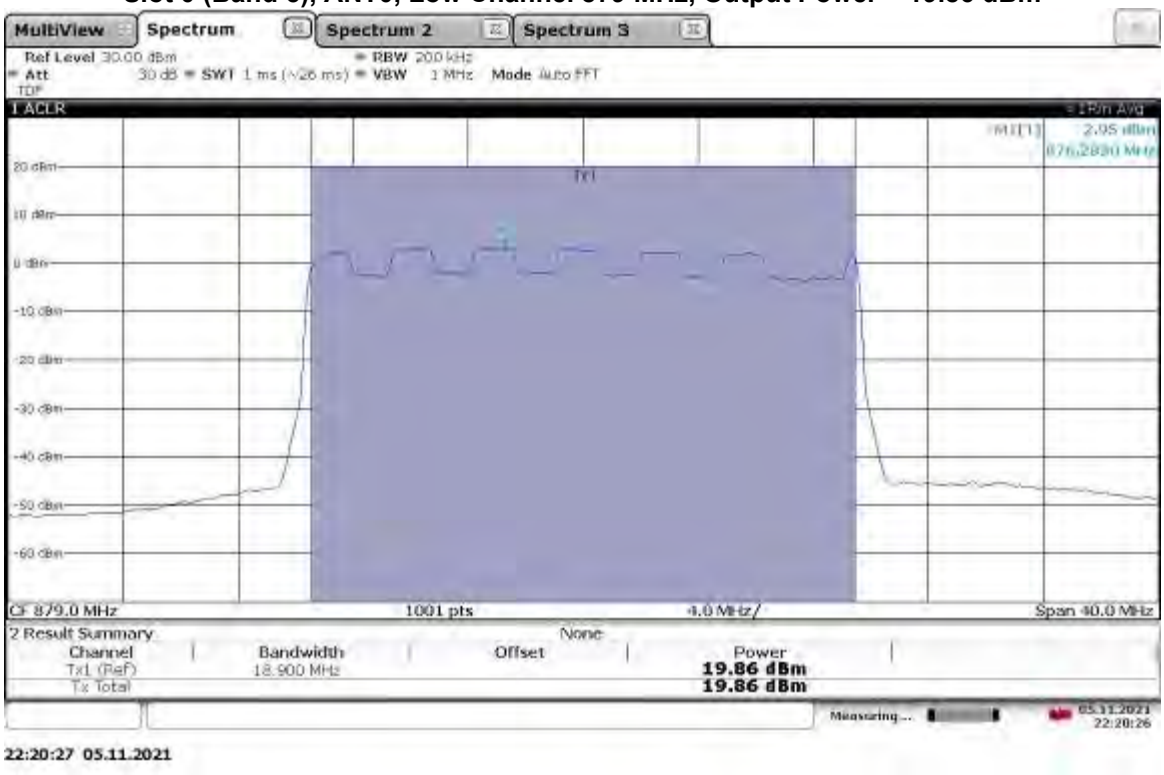
TM3.2-16QAM_15 MHz Bandwidth
Slot 0 (Band 5), ANT0, High Channel 886.5 MHz, Output Power = 20.03 dBm



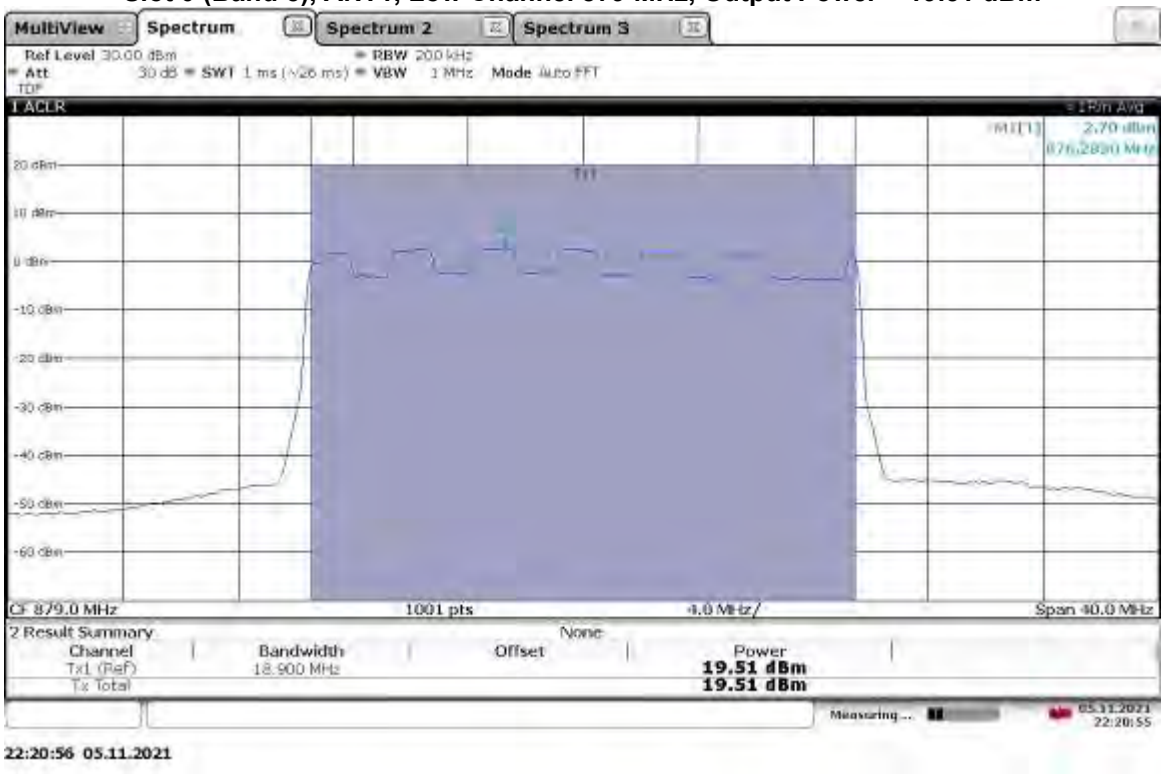
TM3.2-16QAM_15 MHz Bandwidth
Slot 0 (Band 5), ANT1, High Channel 886.5 MHz, Output Power = 19.83 dBm



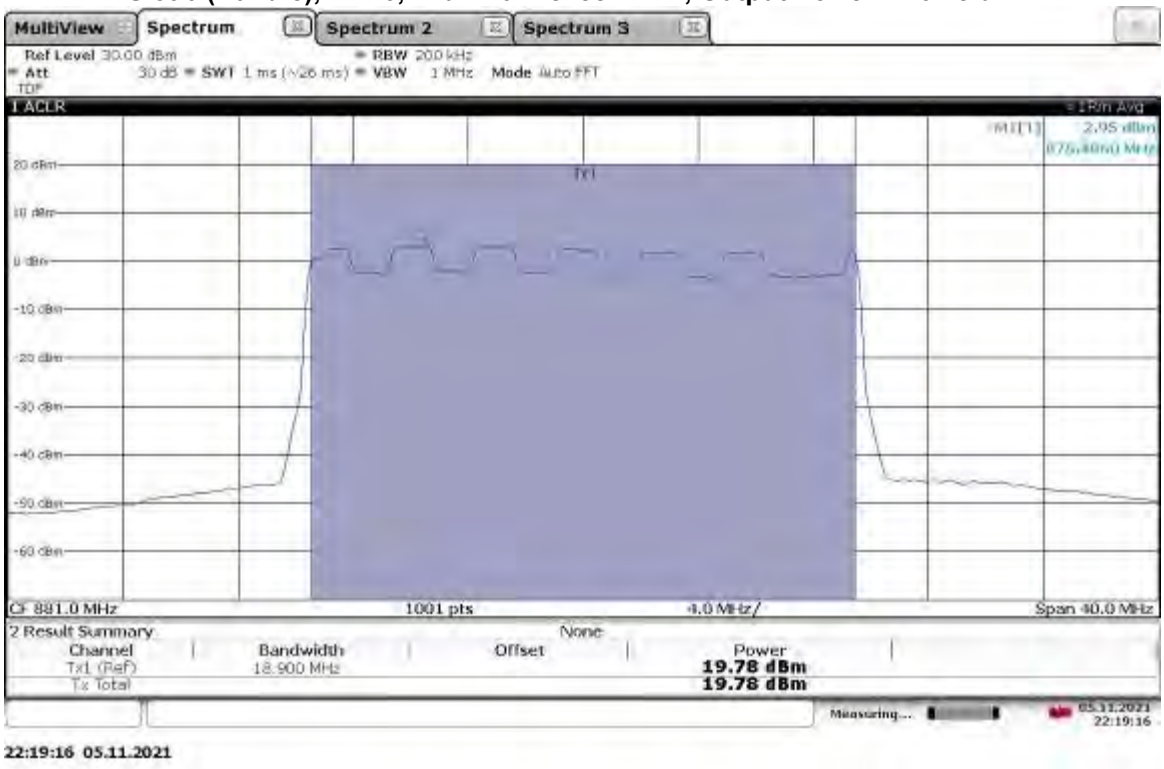
TM3.2-16QAM_20 MHz Bandwidth
Slot 0 (Band 5), ANT0, Low Channel 879 MHz, Output Power = 19.86 dBm



TM3.2-16QAM_20 MHz Bandwidth
Slot 0 (Band 5), ANT1, Low Channel 879 MHz, Output Power = 19.51 dBm



TM3.2-16QAM_20 MHz Bandwidth
Slot 0 (Band 5), ANT0, Mid Channel 881 MHz, Output Power = 19.78 dBm



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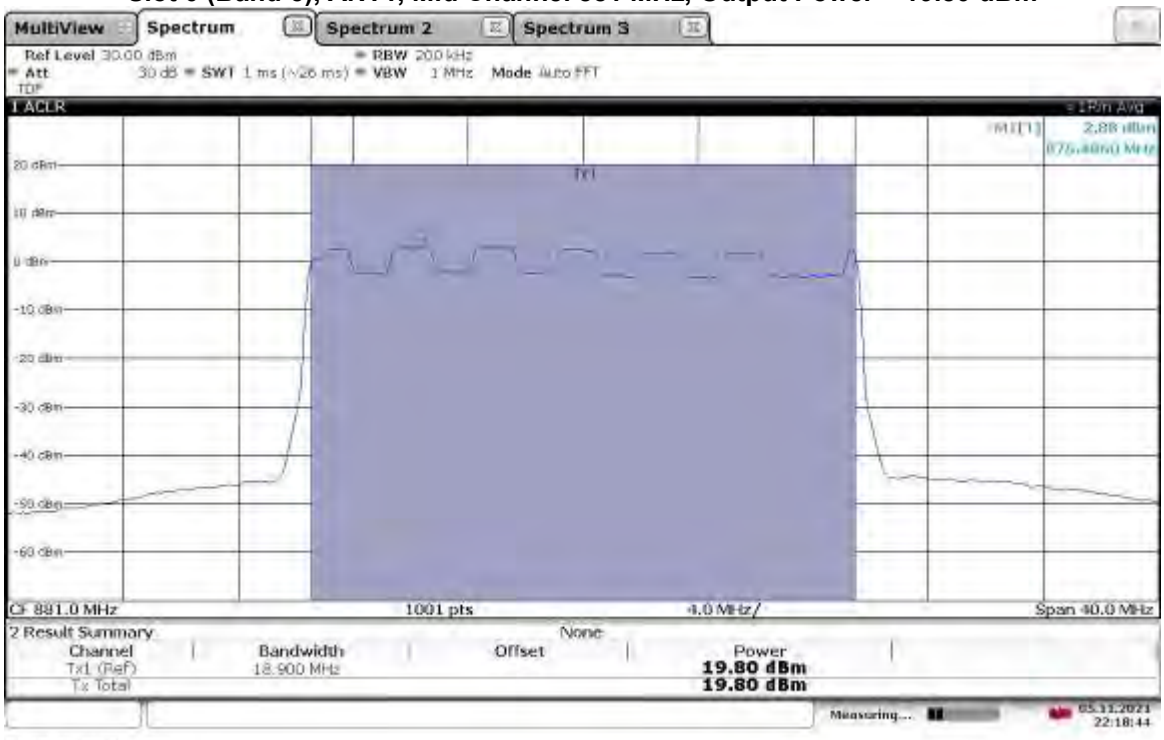
TM3.2-16QAM_20 MHz Bandwidth
Slot 0 (Band 5), ANT1, Mid Channel 881 MHz, Output Power = 19.80 dBm



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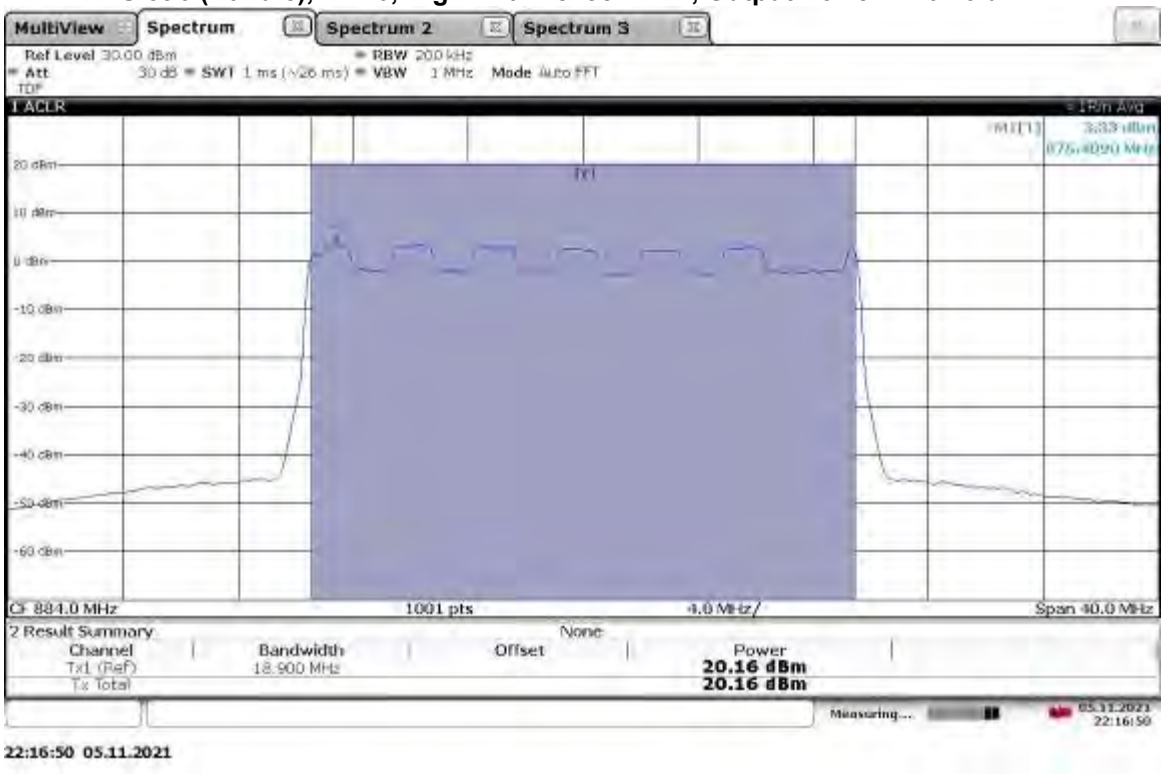
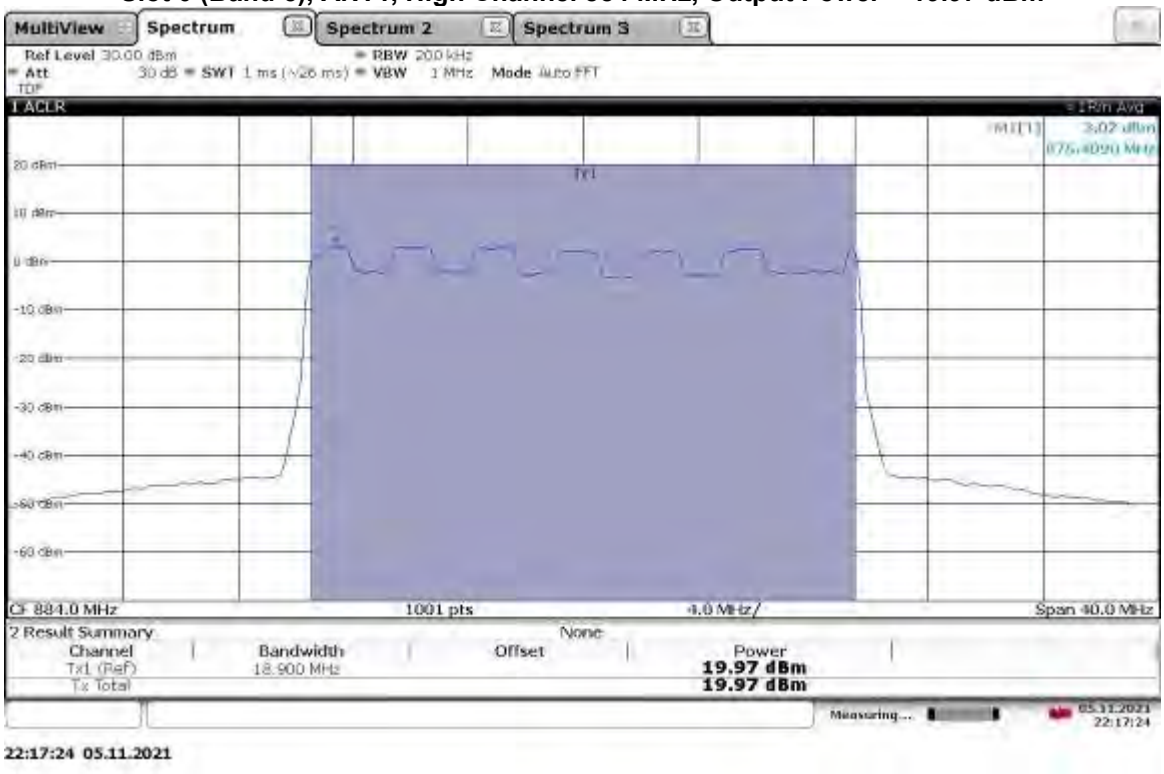
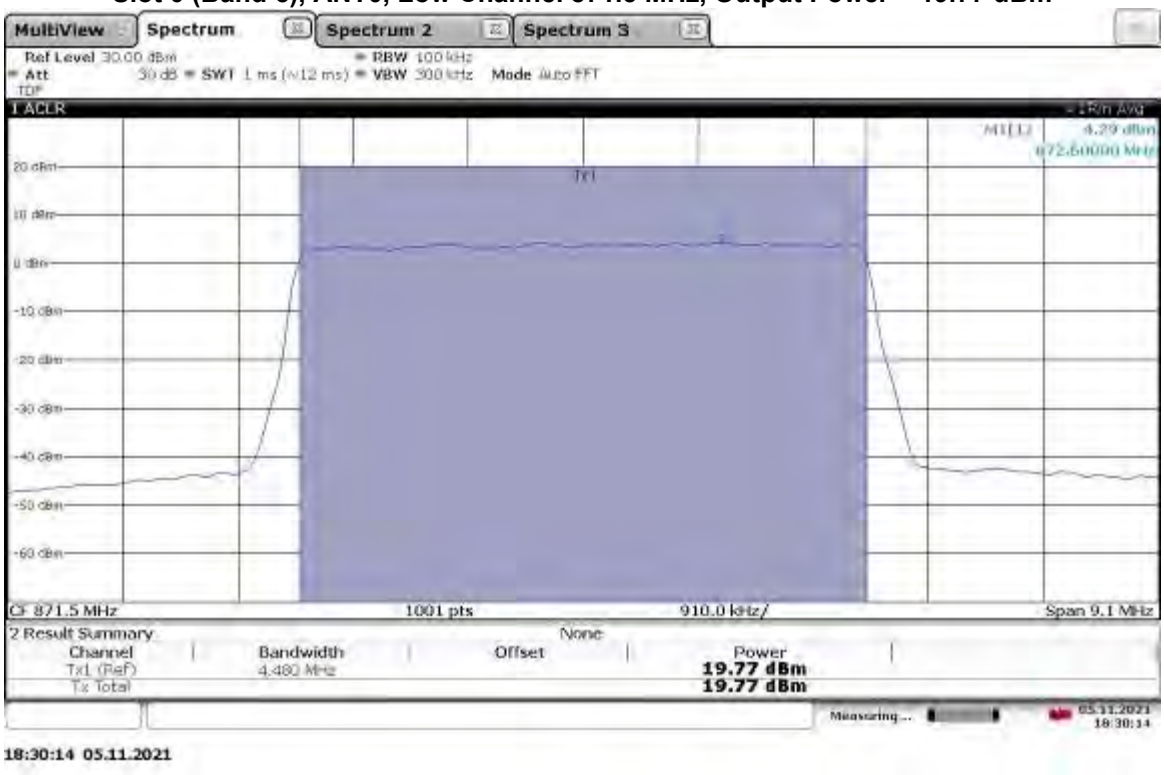
TM3.2-16QAM_20 MHz Bandwidth
Slot 0 (Band 5), ANT0, High Channel 884 MHz, Output Power = 20.16 dBm



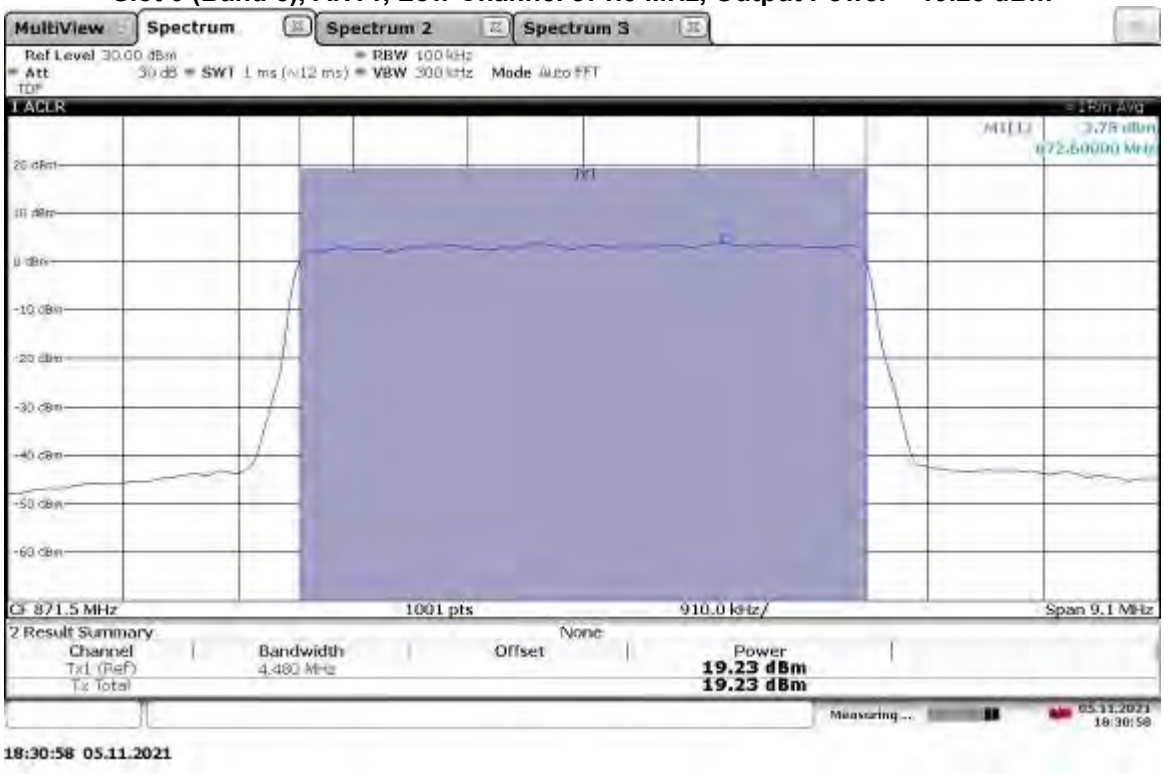
TM3.2-16QAM_20 MHz Bandwidth
Slot 0 (Band 5), ANT1, High Channel 884 MHz, Output Power = 19.97 dBm



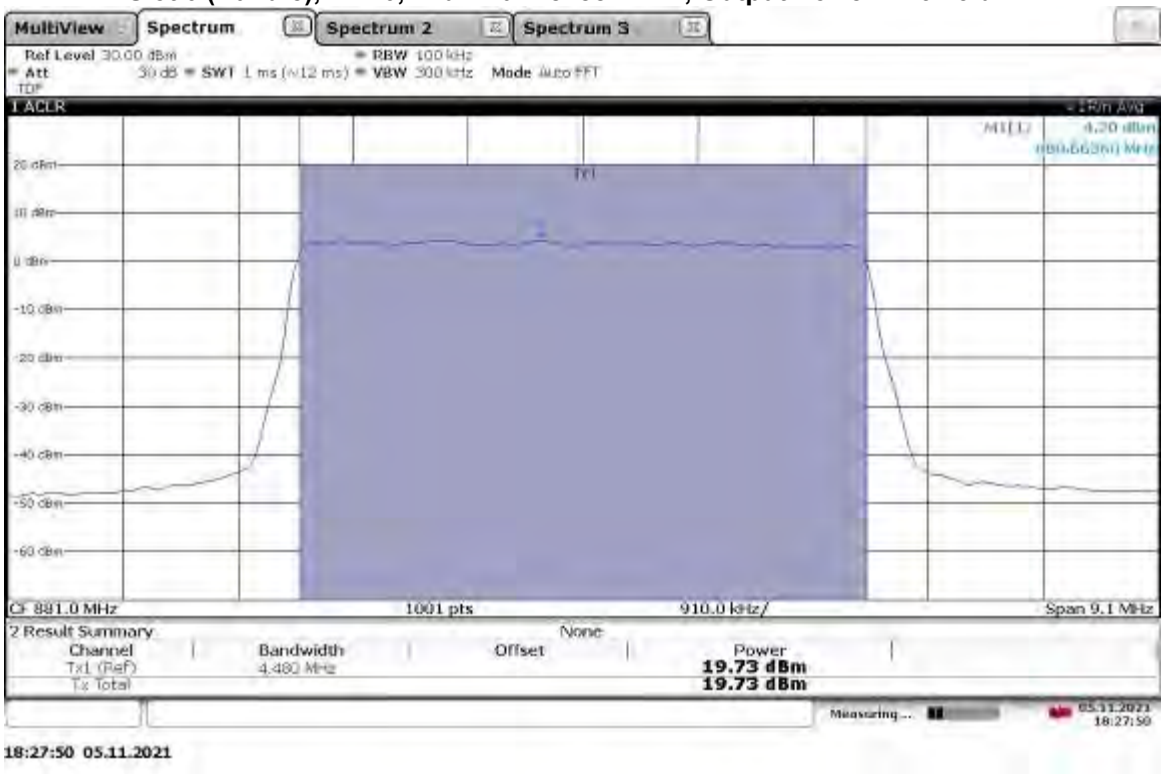
TM3.1-64QAM_5 MHz Bandwidth
Slot 0 (Band 5), ANT0, Low Channel 871.5 MHz, Output Power = 19.77 dBm



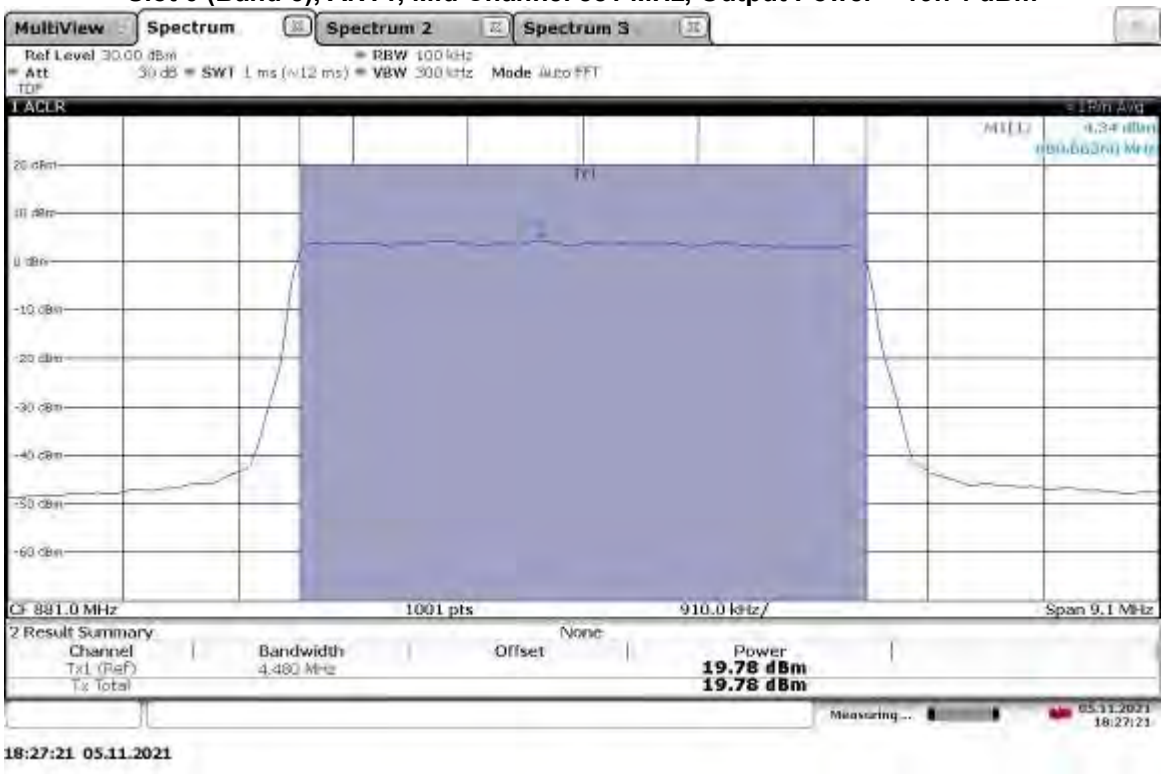
TM3.1-64QAM_5 MHz Bandwidth
Slot 0 (Band 5), ANT1, Low Channel 871.5 MHz, Output Power = 19.23 dBm



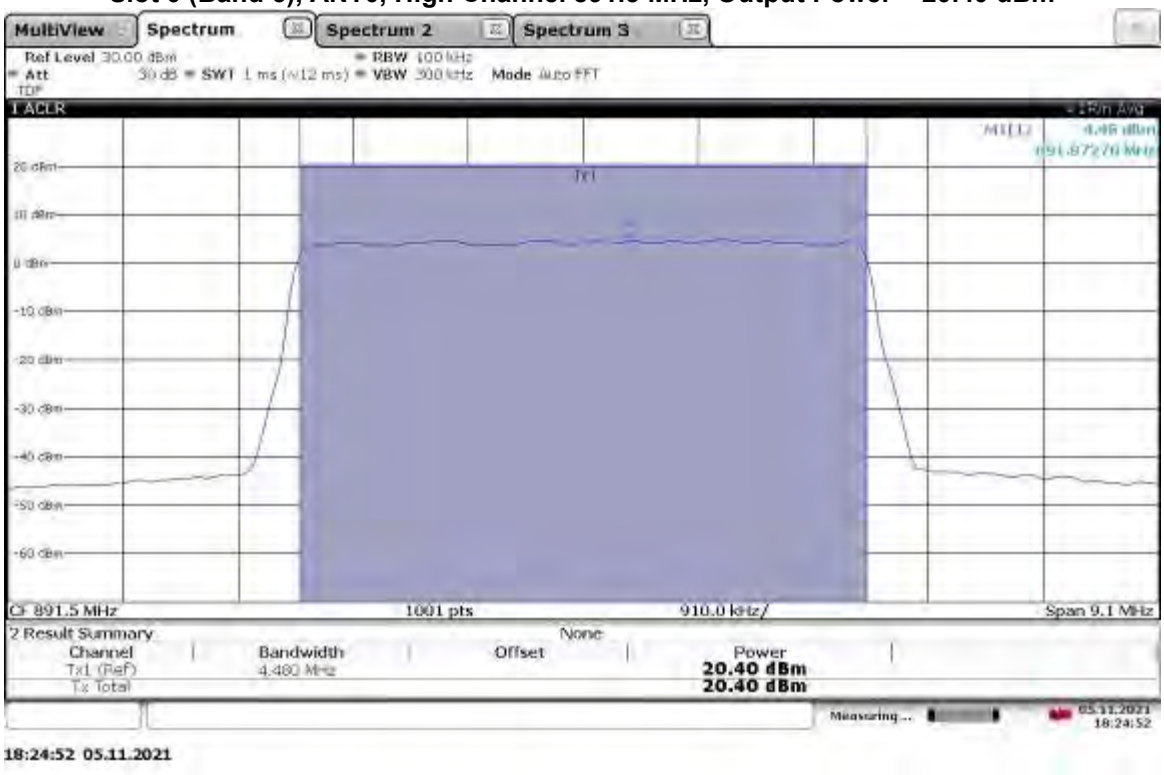
TM3.1-64QAM_5 MHz Bandwidth
Slot 0 (Band 5), ANT0, Mid Channel 881 MHz, Output Power = 19.73 dBm



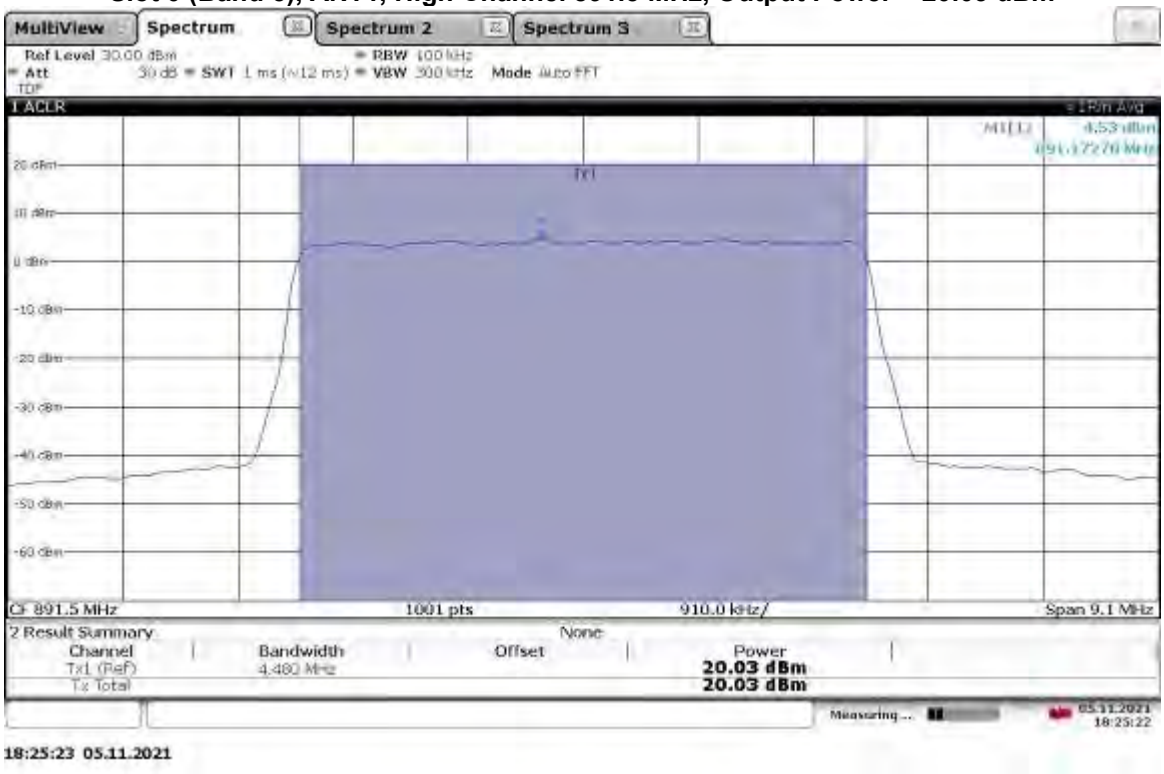
TM3.1-64QAM_5 MHz Bandwidth
Slot 0 (Band 5), ANT1, Mid Channel 881 MHz, Output Power = 19.74 dBm



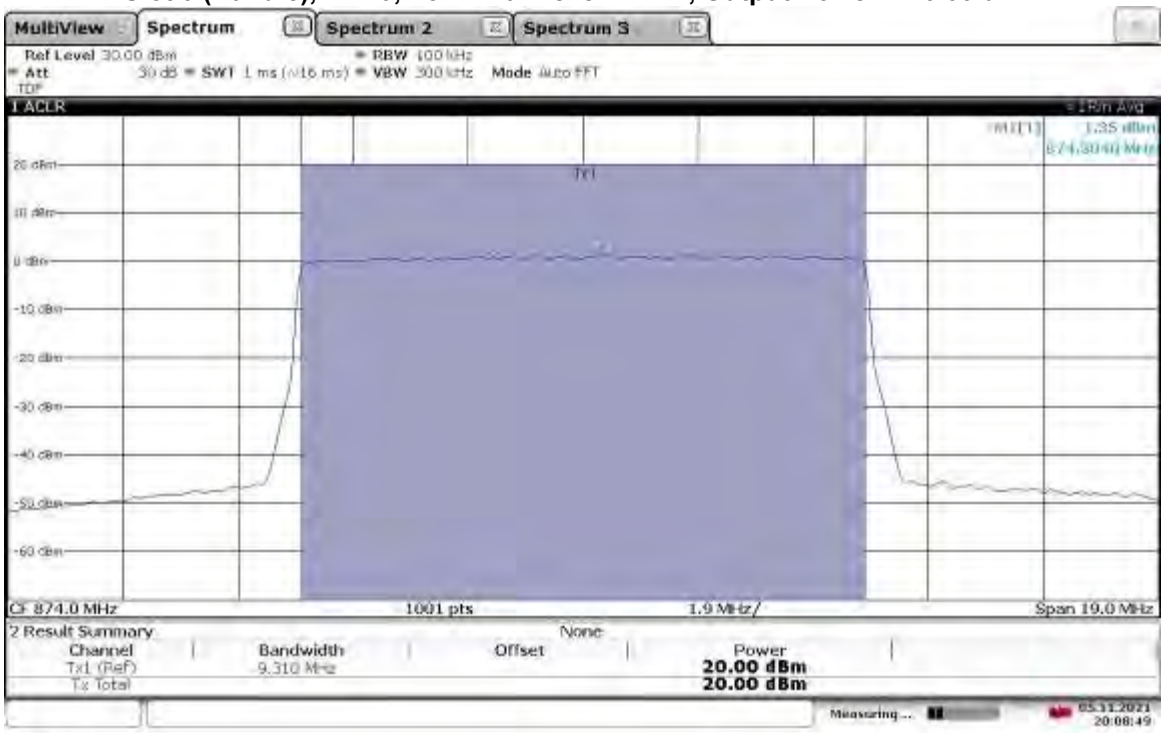
TM3.1-64QAM_5 MHz Bandwidth
Slot 0 (Band 5), ANT0, High Channel 891.5 MHz, Output Power = 20.40 dBm



TM3.1-64QAM_5 MHz Bandwidth
Slot 0 (Band 5), ANT1, High Channel 891.5 MHz, Output Power = 20.03 dBm



TM3.1-64QAM_10 MHz Bandwidth
Slot 0 (Band 5), ANT0, Low Channel 874 MHz, Output Power = 20.00 dBm



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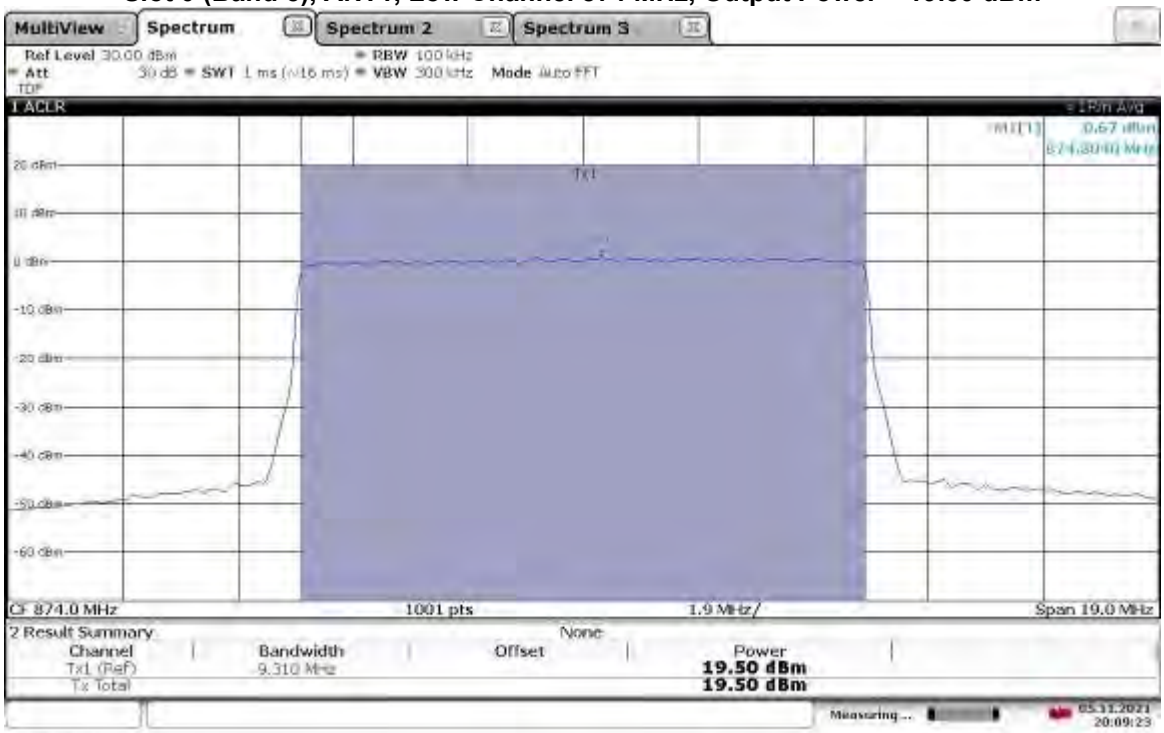
TM3.1-64QAM_10 MHz Bandwidth
Slot 0 (Band 5), ANT1, Low Channel 874 MHz, Output Power = 19.50 dBm



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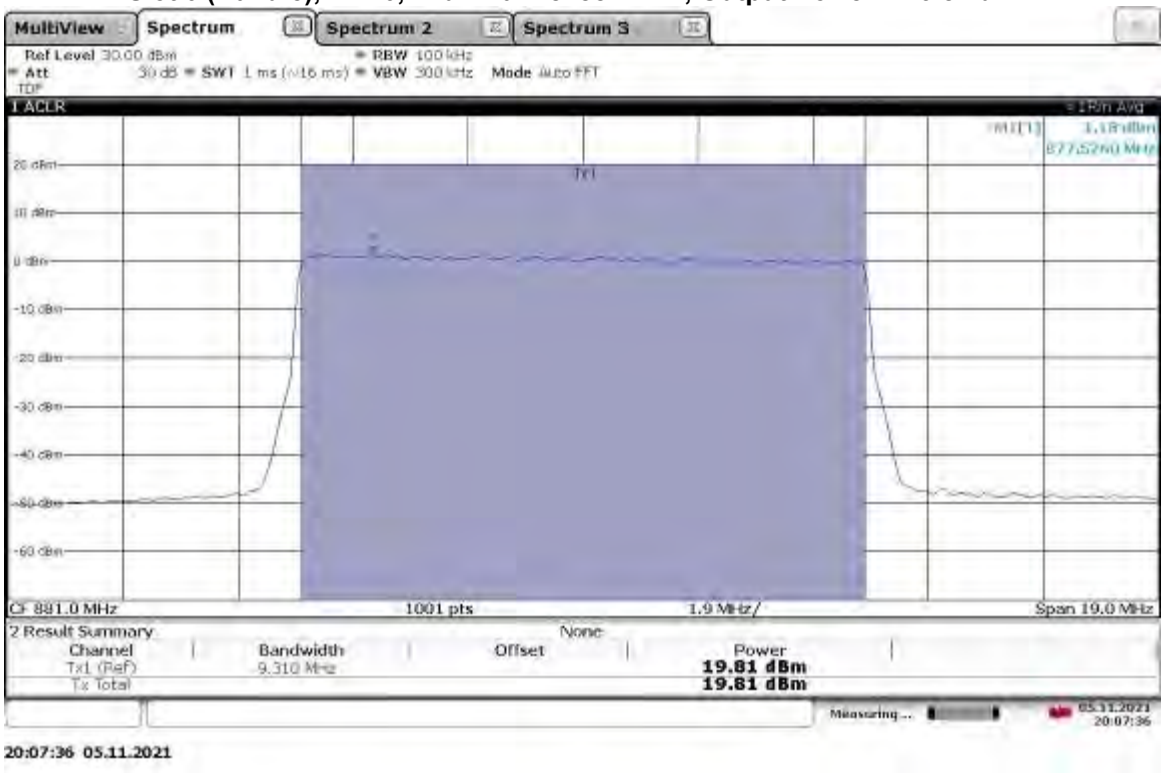
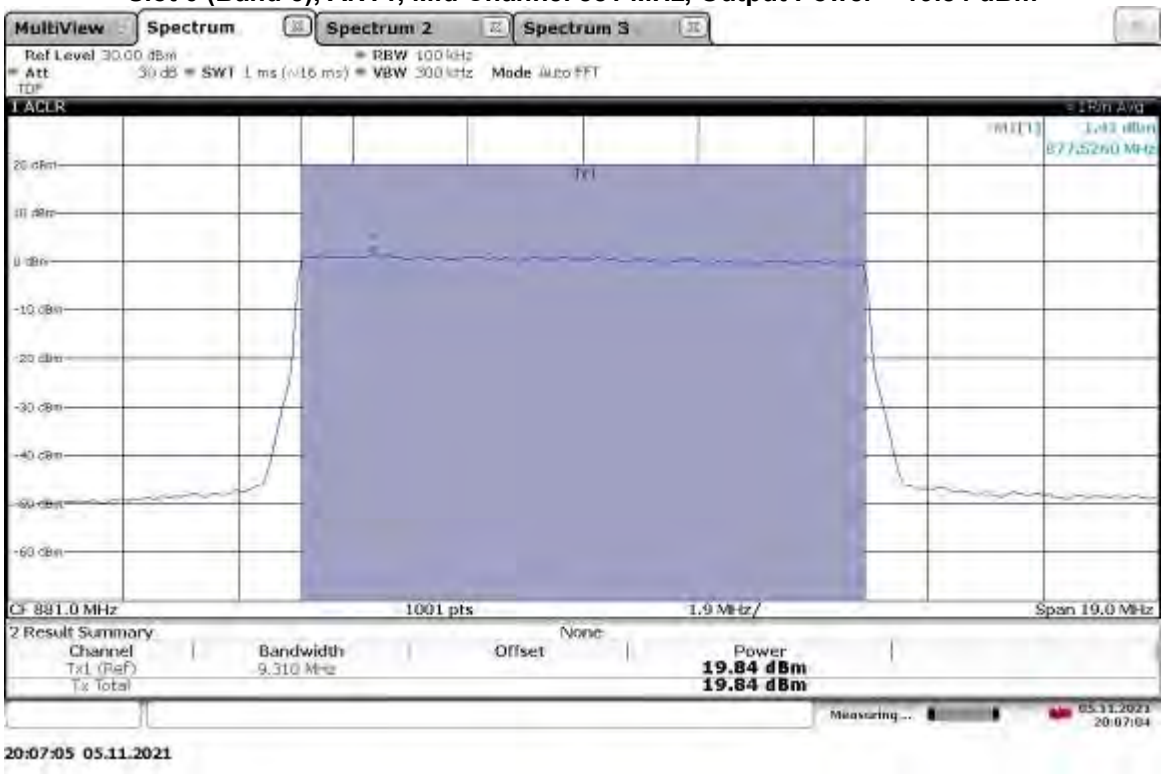
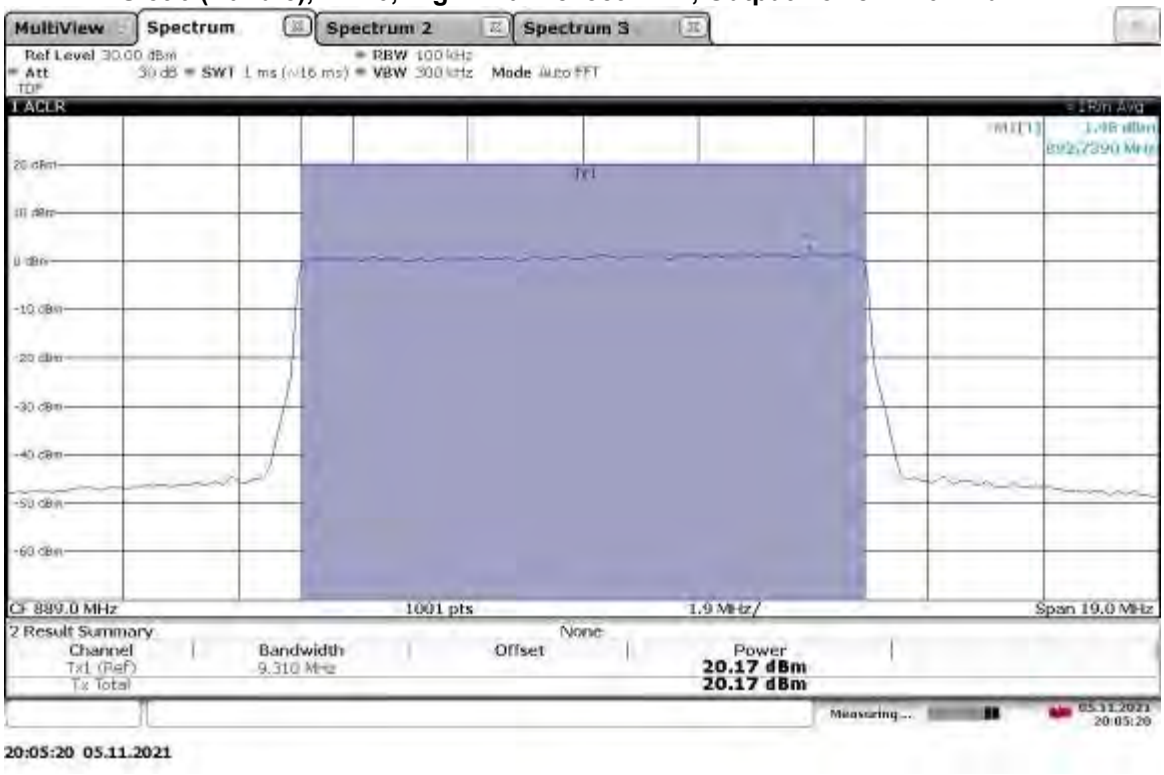
TM3.1-64QAM_10 MHz Bandwidth
Slot 0 (Band 5), ANT0, Mid Channel 881 MHz, Output Power = 19.81 dBm



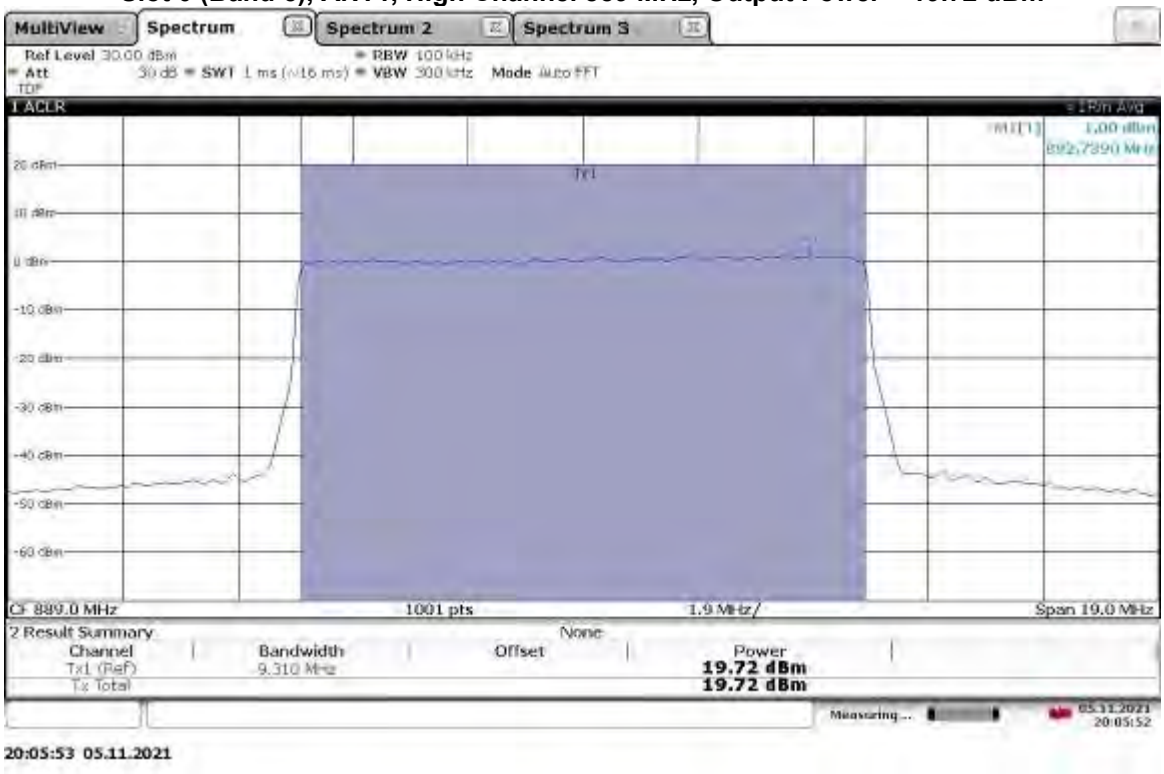
TM3.1-64QAM_10 MHz Bandwidth
Slot 0 (Band 5), ANT1, Mid Channel 881 MHz, Output Power = 19.84 dBm



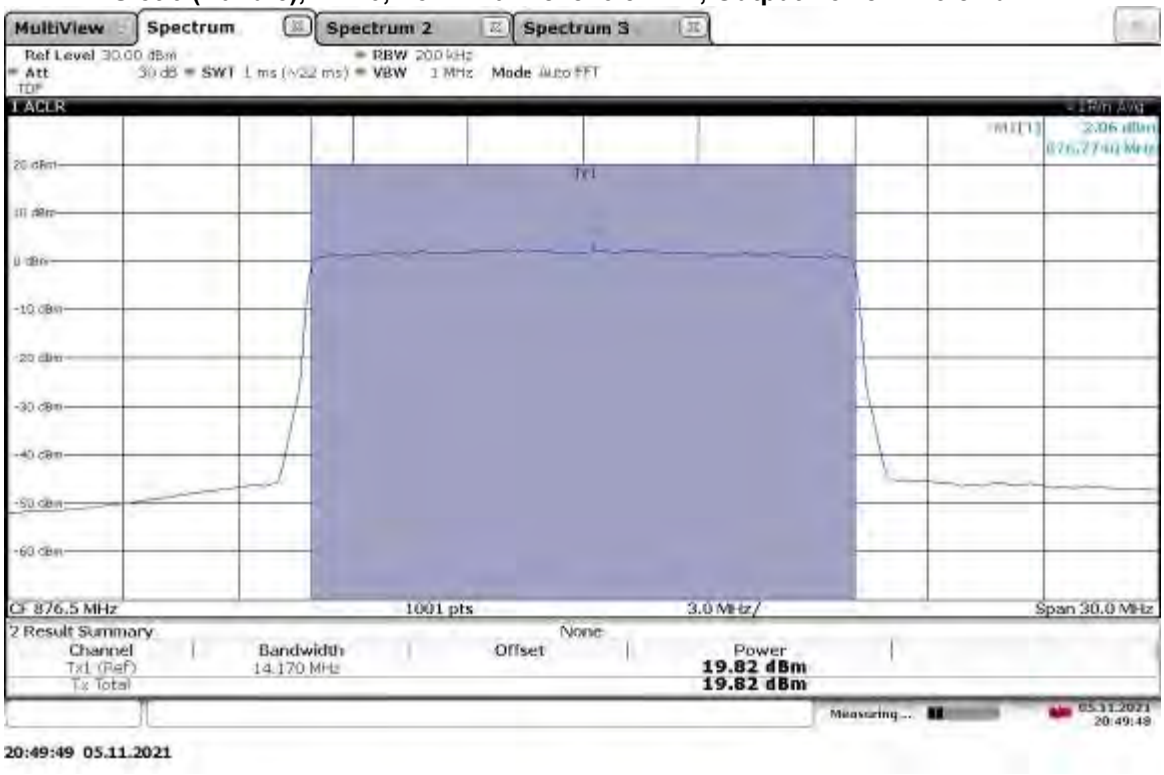
TM3.1-64QAM_10 MHz Bandwidth
Slot 0 (Band 5), ANT0, High Channel 889 MHz, Output Power = 20.17 dBm



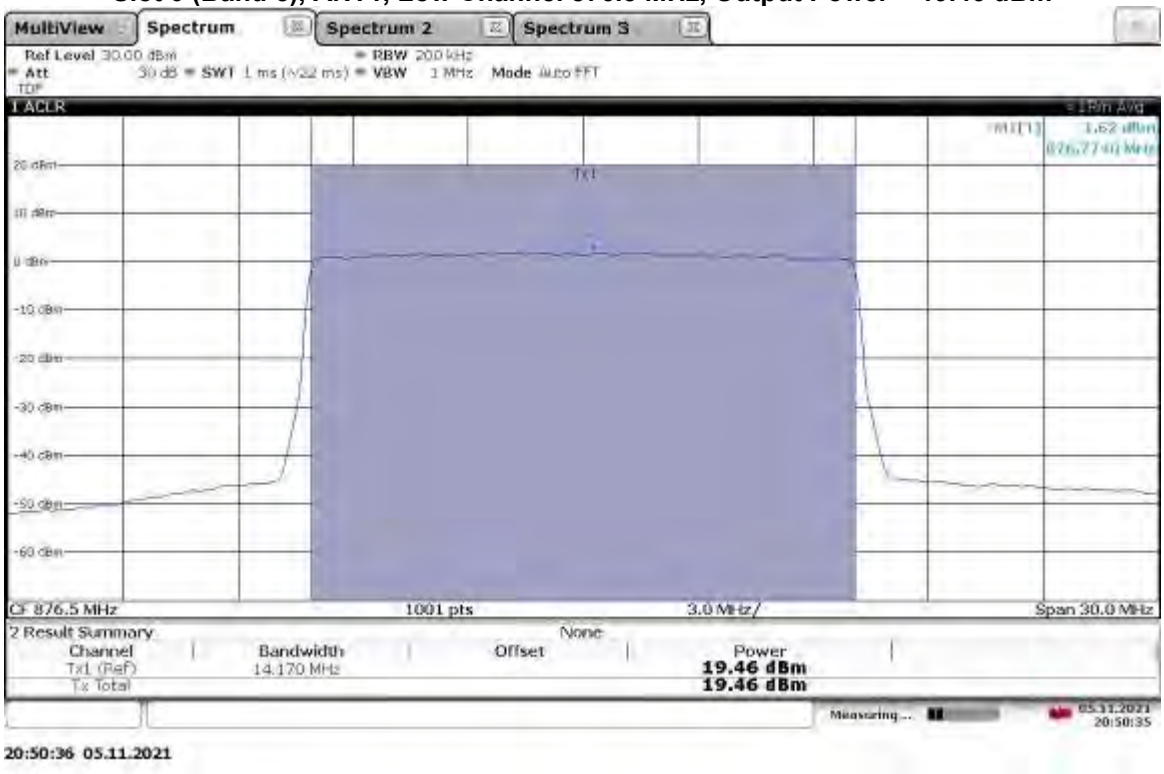
TM3.1-64QAM_10 MHz Bandwidth
Slot 0 (Band 5), ANT1, High Channel 889 MHz, Output Power = 19.72 dBm



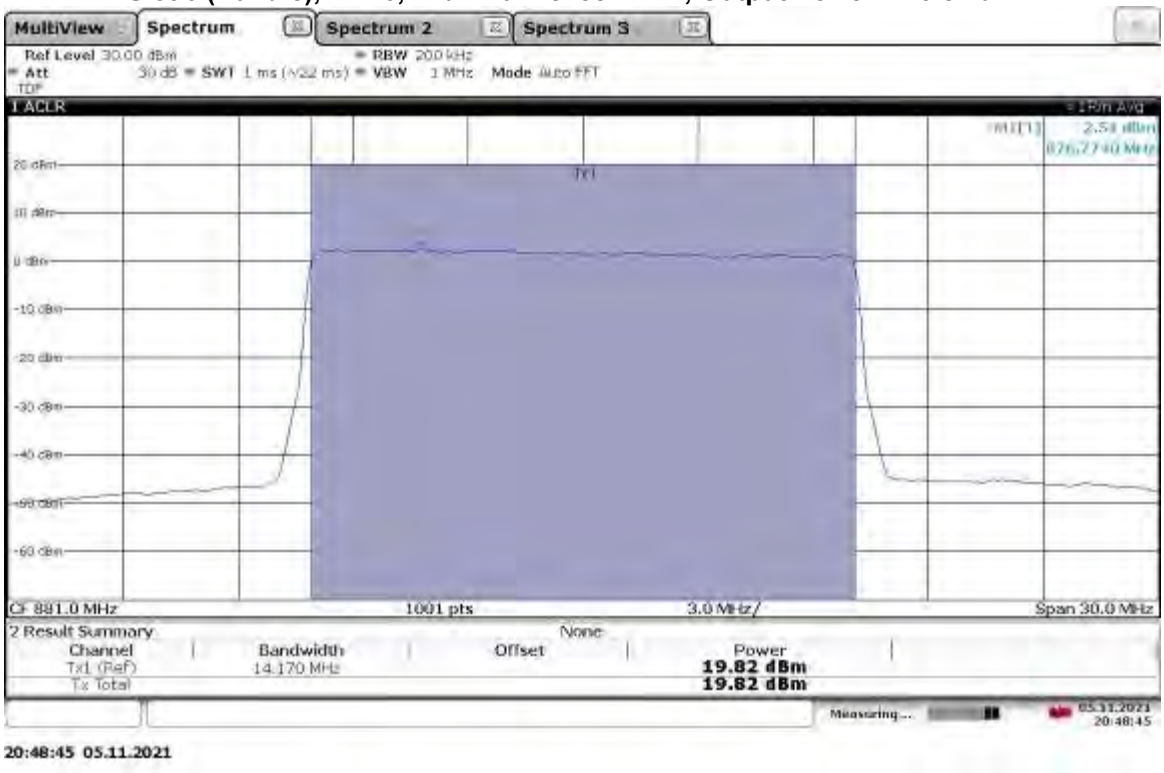
TM3.1-64QAM_15 MHz Bandwidth
Slot 0 (Band 5), ANT0, Low Channel 876.5 MHz, Output Power = 19.82 dBm



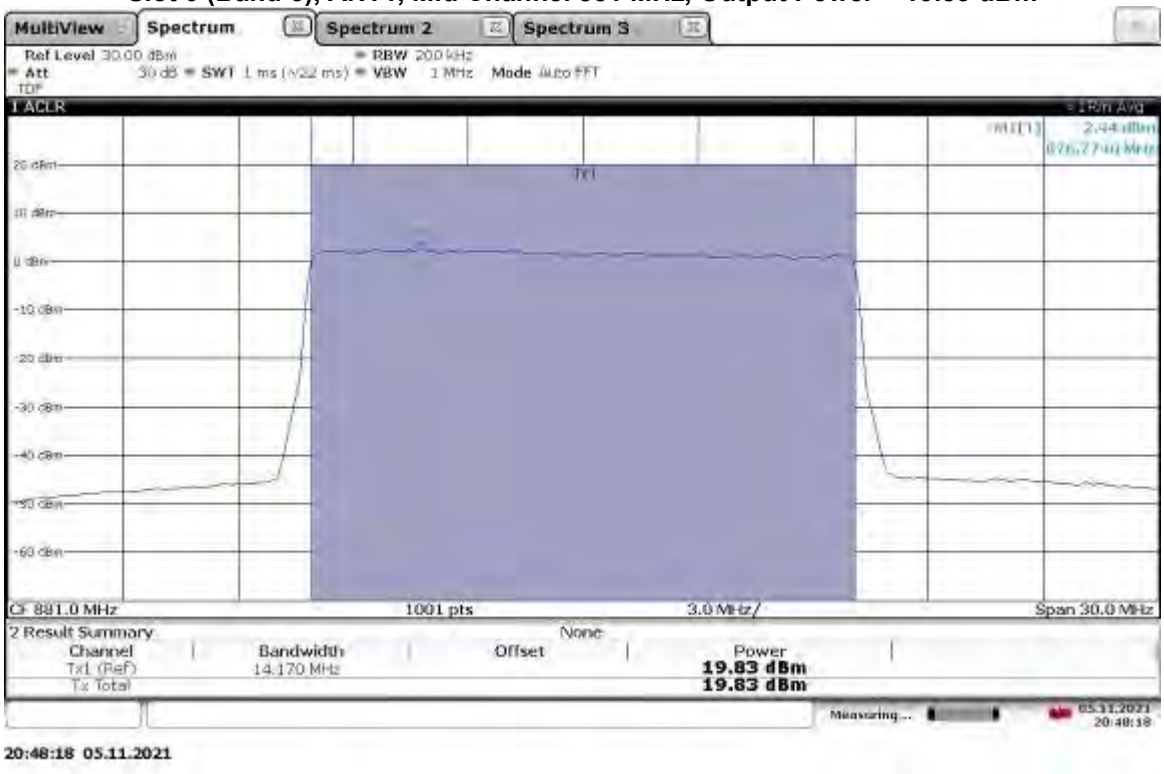
TM3.1-64QAM_15 MHz Bandwidth
Slot 0 (Band 5), ANT1, Low Channel 876.5 MHz, Output Power = 19.46 dBm



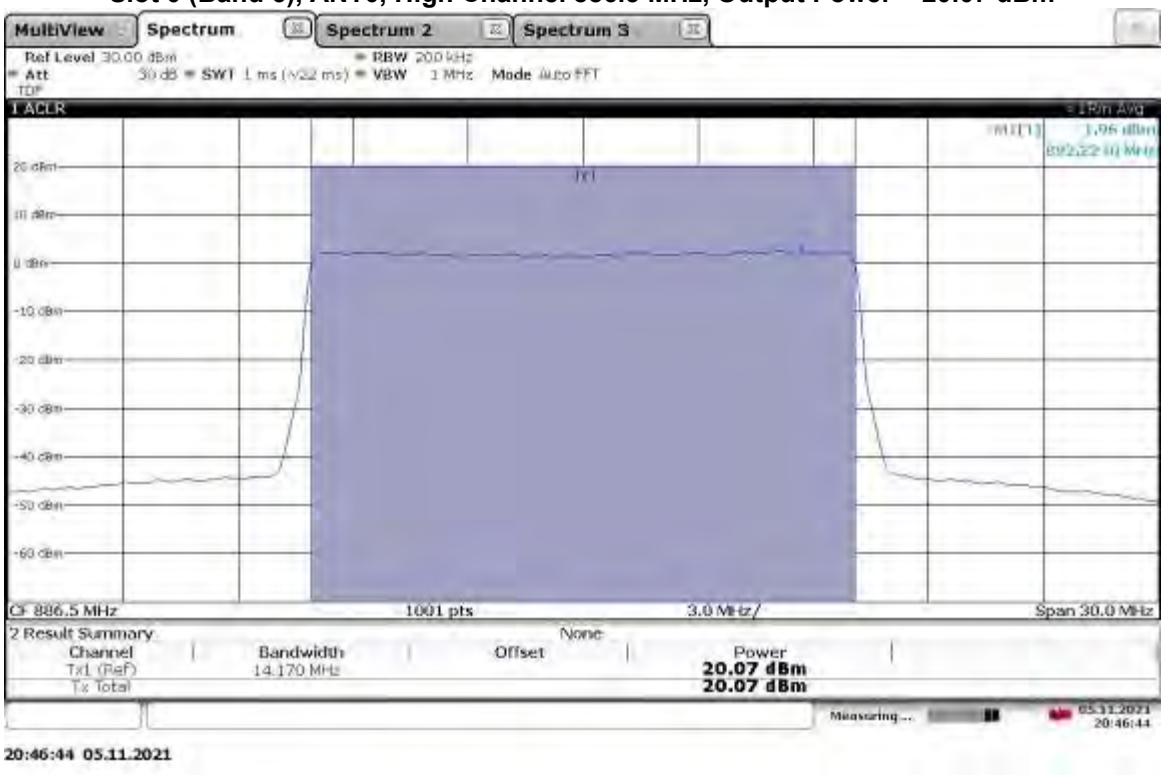
TM3.1-64QAM_15 MHz Bandwidth
Slot 0 (Band 5), ANT0, Mid Channel 881 MHz, Output Power = 19.82 dBm



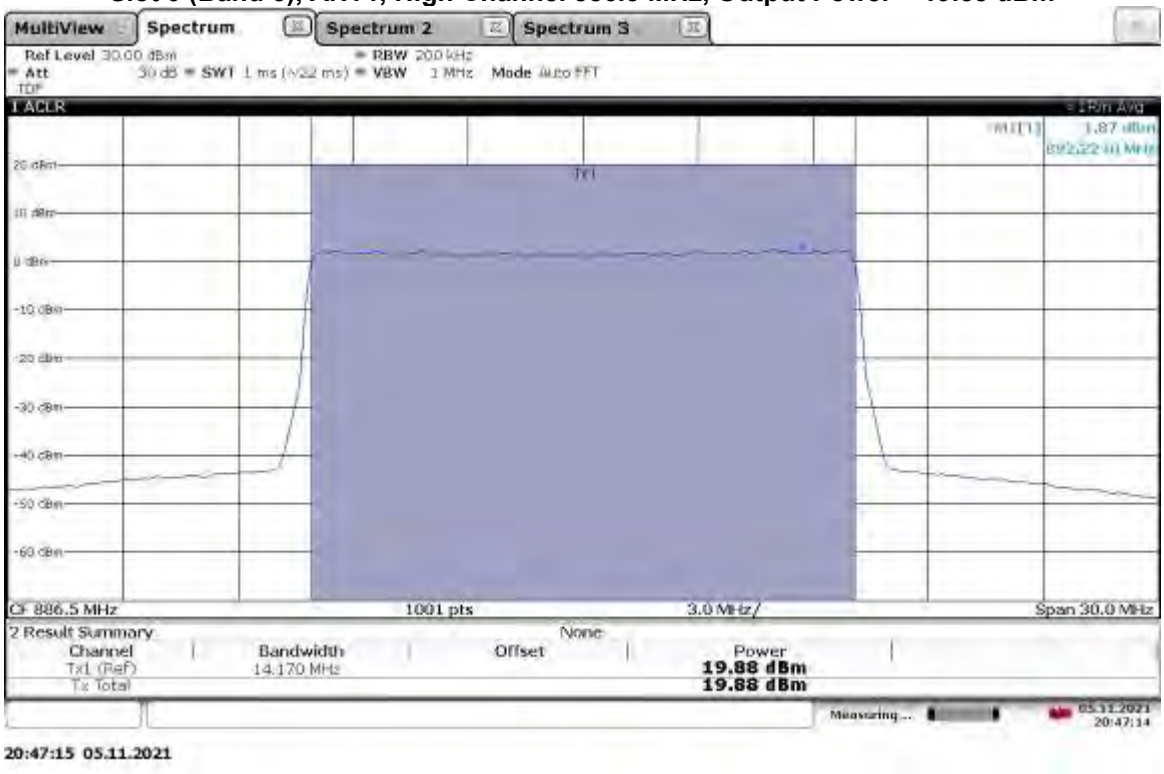
TM3.1-64QAM_15 MHz Bandwidth
Slot 0 (Band 5), ANT1, Mid Channel 881 MHz, Output Power = 19.83 dBm



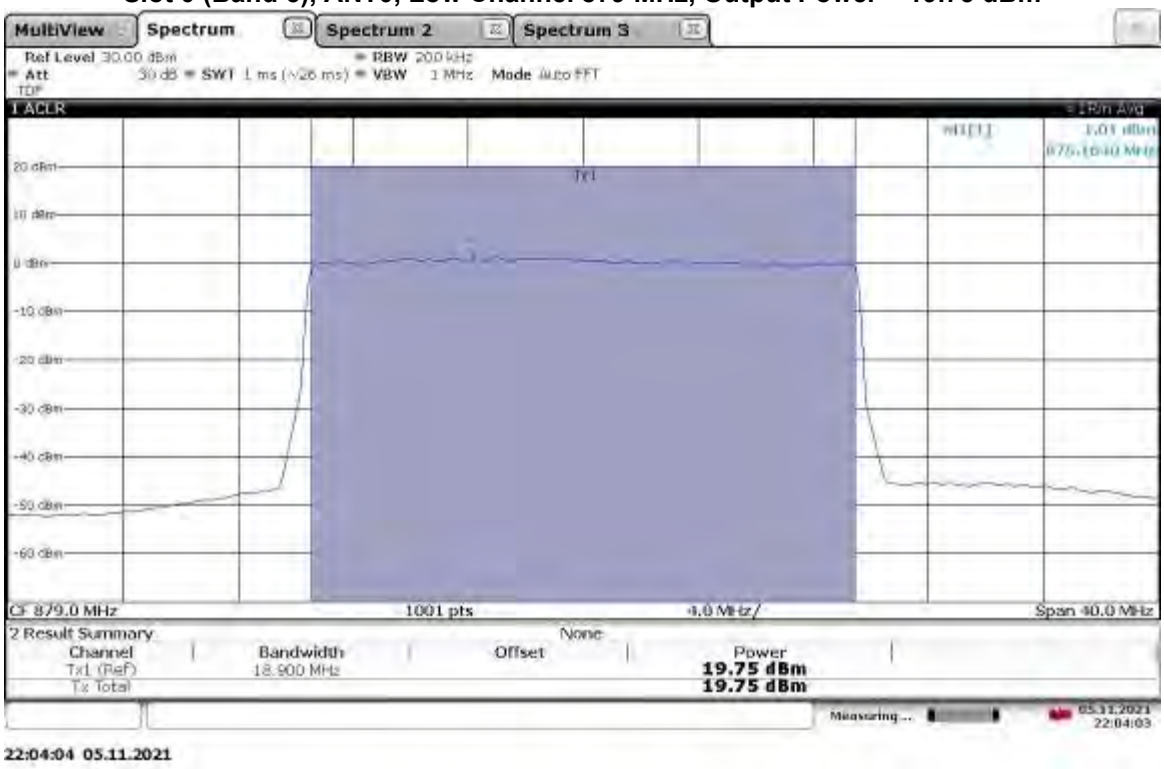
TM3.1-64QAM_15 MHz Bandwidth
Slot 0 (Band 5), ANT0, High Channel 886.5 MHz, Output Power = 20.07 dBm



TM3.1-64QAM_15 MHz Bandwidth
Slot 0 (Band 5), ANT1, High Channel 886.5 MHz, Output Power = 19.88 dBm

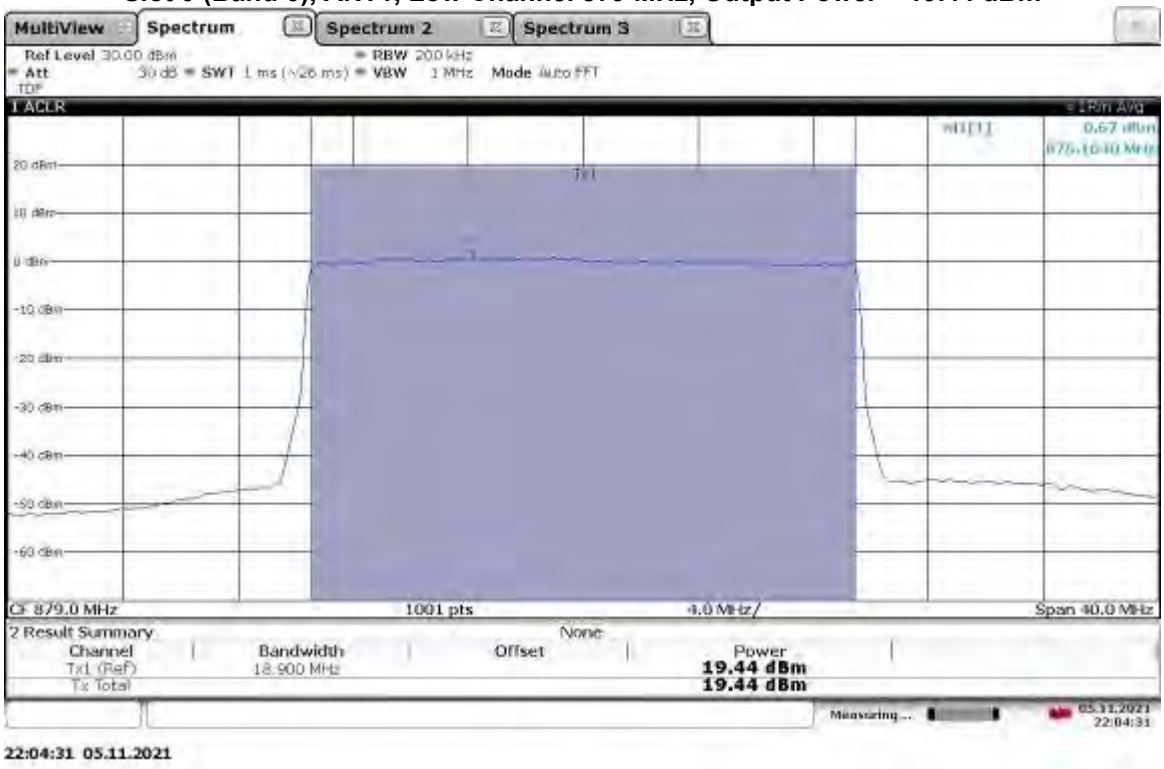


TM3.1-64QAM_20 MHz Bandwidth
Slot 0 (Band 5), ANT0, Low Channel 879 MHz, Output Power = 19.75 dBm



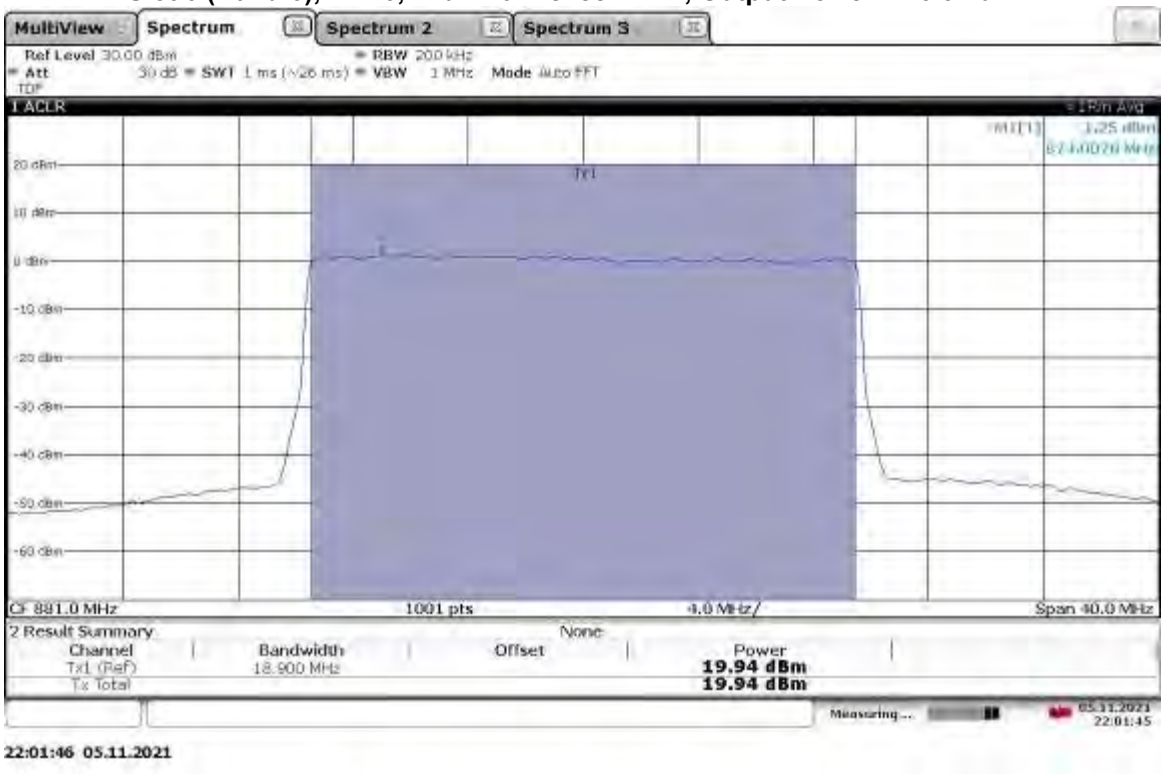
22:04:04 05.11.2021

TM3.1-64QAM_20 MHz Bandwidth
Slot 0 (Band 0), ANT1, Low Channel 879 MHz, Output Power = 19.44 dBm

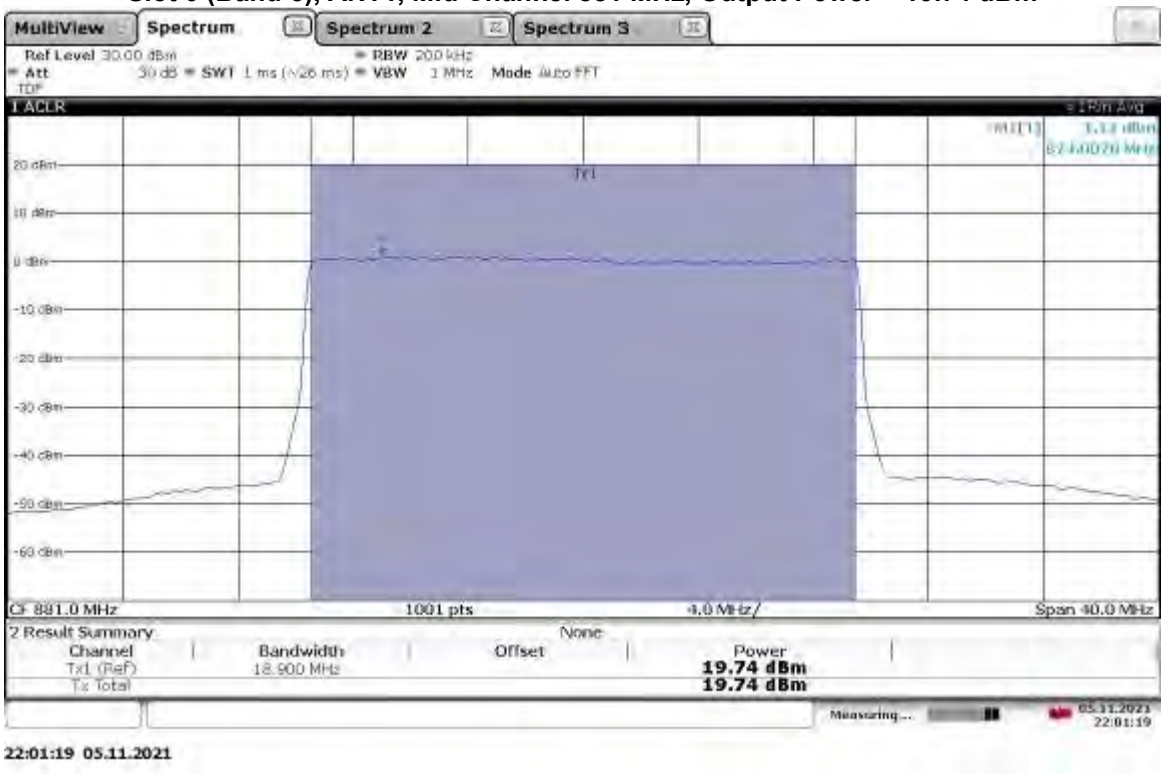


22:04:31 05.11.2021

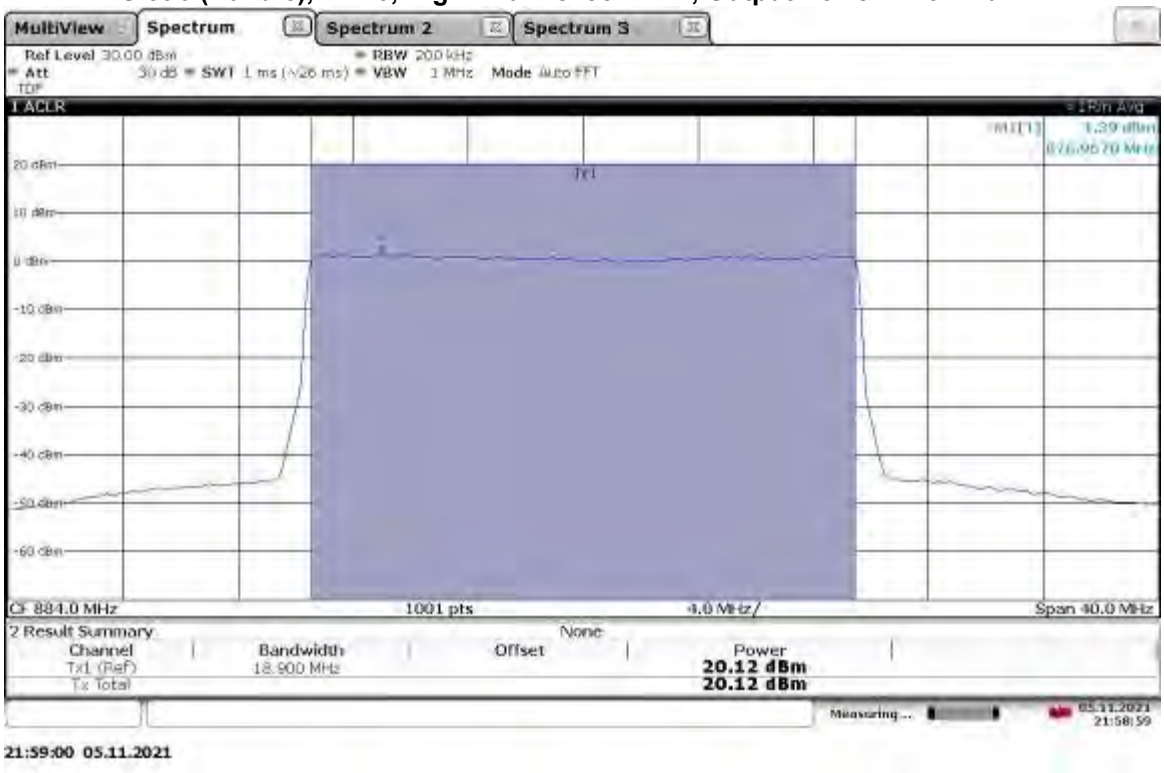
TM3.1-64QAM_20 MHz Bandwidth
Slot 0 (Band 0), ANT0, Mid Channel 881 MHz, Output Power = 19.94 dBm



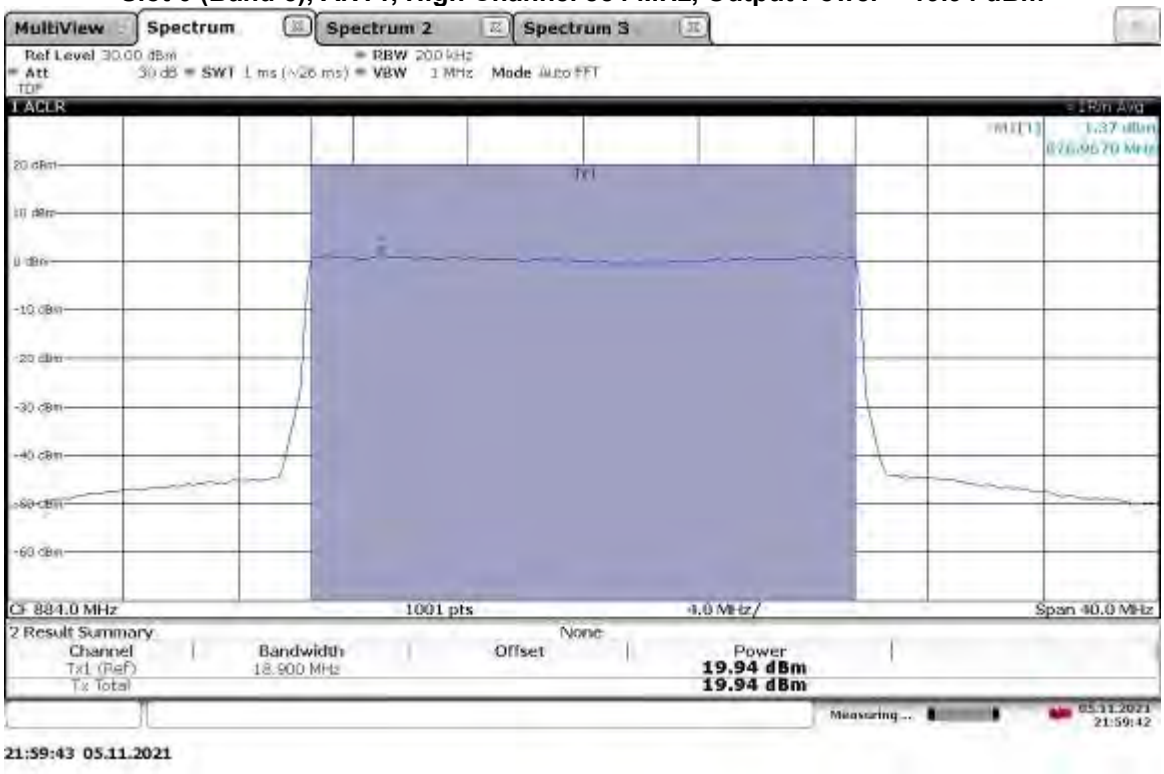
TM3.1-64QAM_20 MHz Bandwidth
Slot 0 (Band 5), ANT1, Mid Channel 881 MHz, Output Power = 19.74 dBm



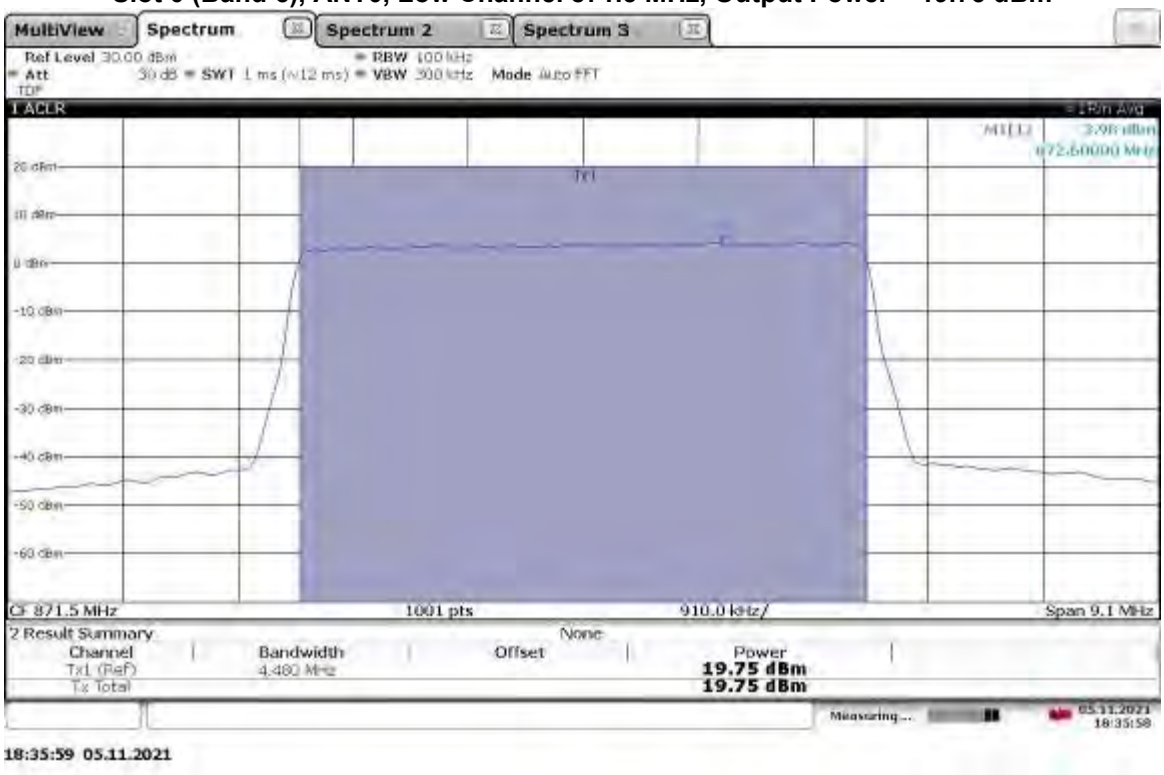
TM3.1-64QAM_20 MHz Bandwidth
Slot 0 (Band 5), ANT0, High Channel 884 MHz, Output Power = 20.12 dBm



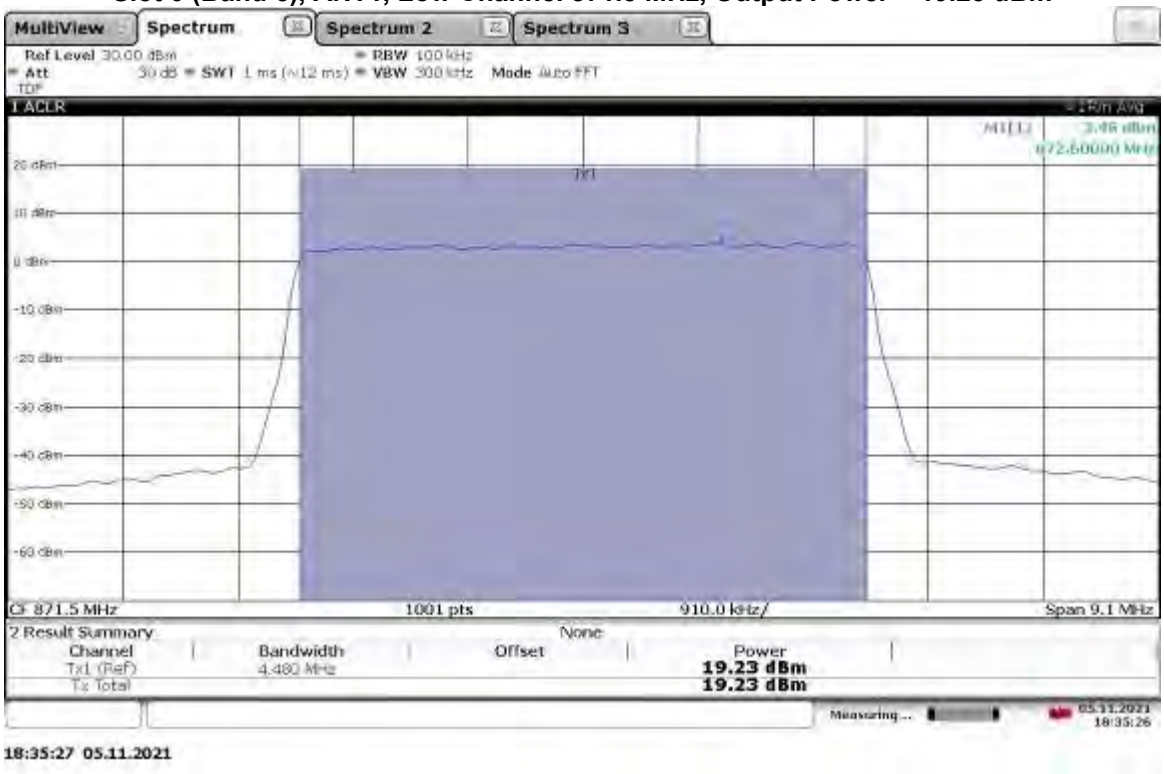
TM3.1-64QAM_20 MHz Bandwidth
Slot 0 (Band 5), ANT1, High Channel 884 MHz, Output Power = 19.94 dBm



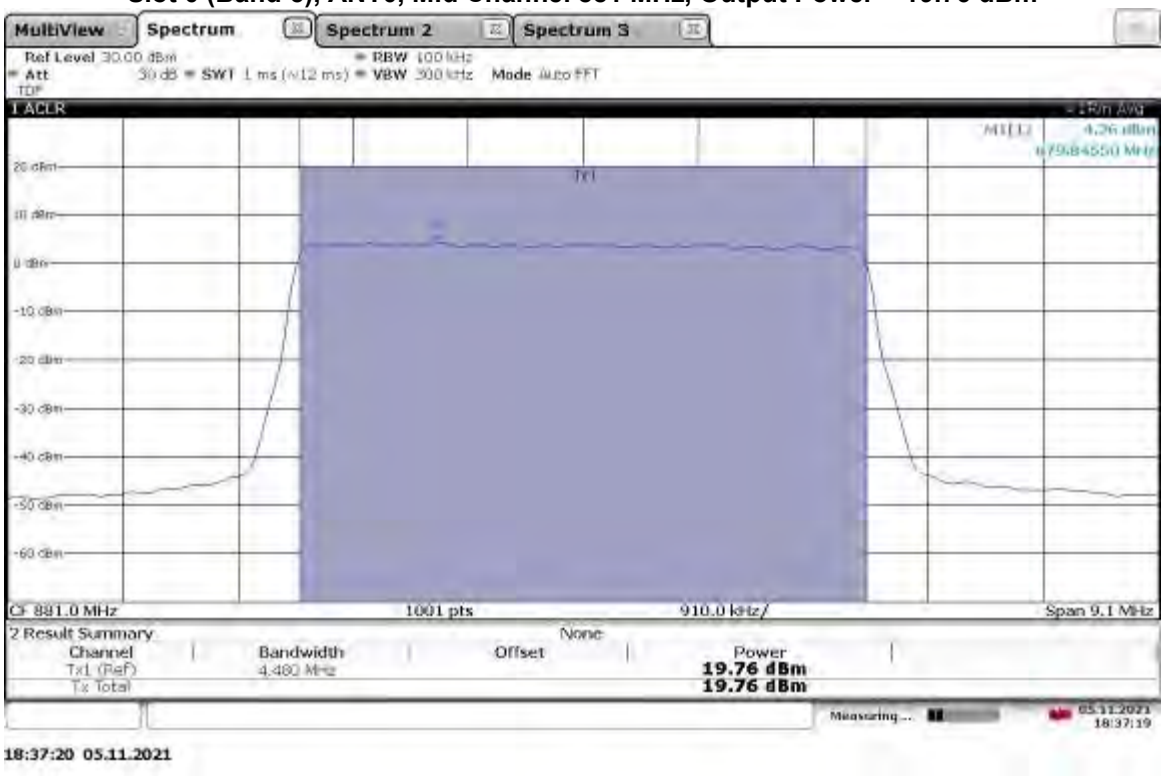
TM3.1a-256QAM _5 MHz Bandwidth
Slot 0 (Band 5), ANT0, Low Channel 871.5 MHz, Output Power = 19.75 dBm



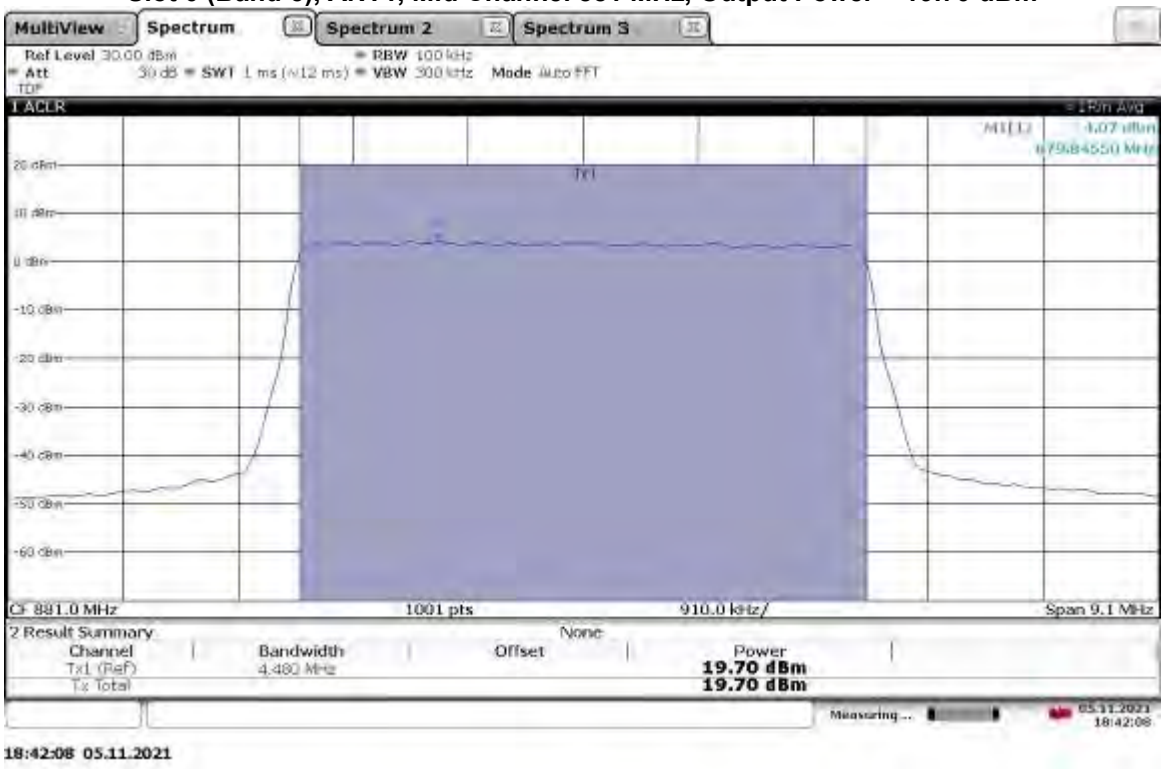
TM3.1a-256QAM _5 MHz Bandwidth
Slot 0 (Band 5), ANT1, Low Channel 871.5 MHz, Output Power = 19.23 dBm



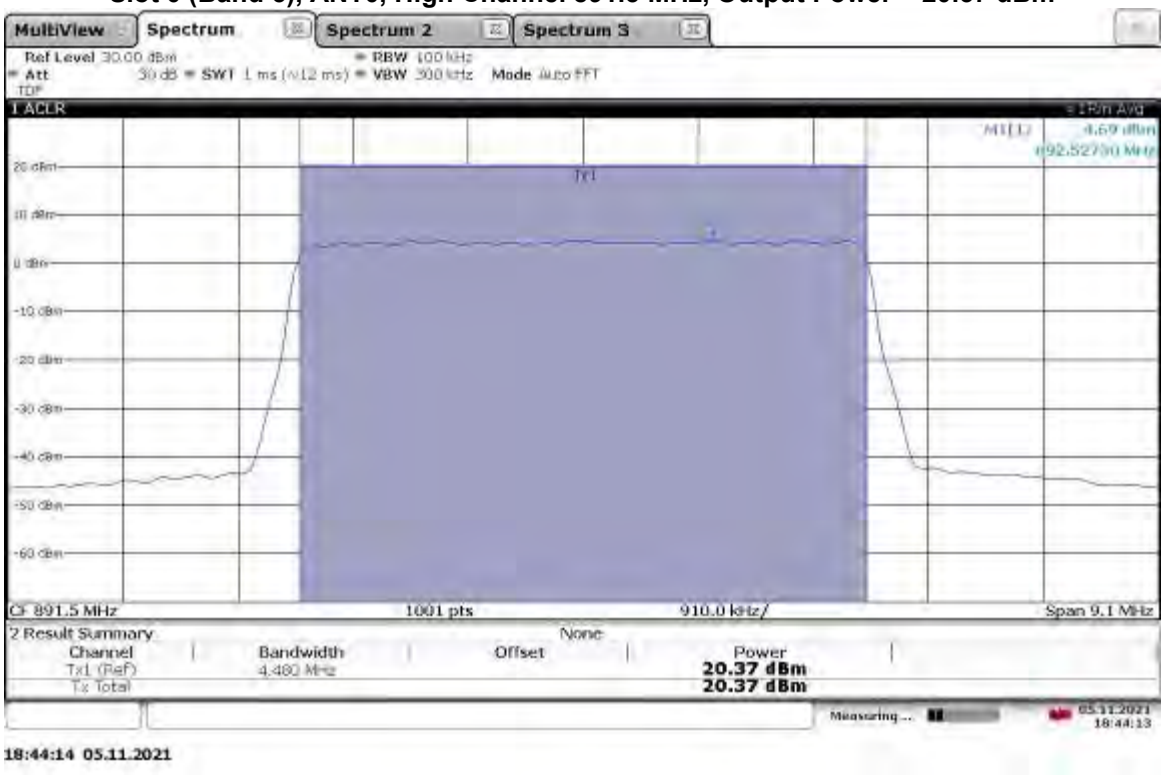
TM3.1a-256QAM _5 MHz Bandwidth
Slot 0 (Band 5), ANT0, Mid Channel 881 MHz, Output Power = 19.76 dBm



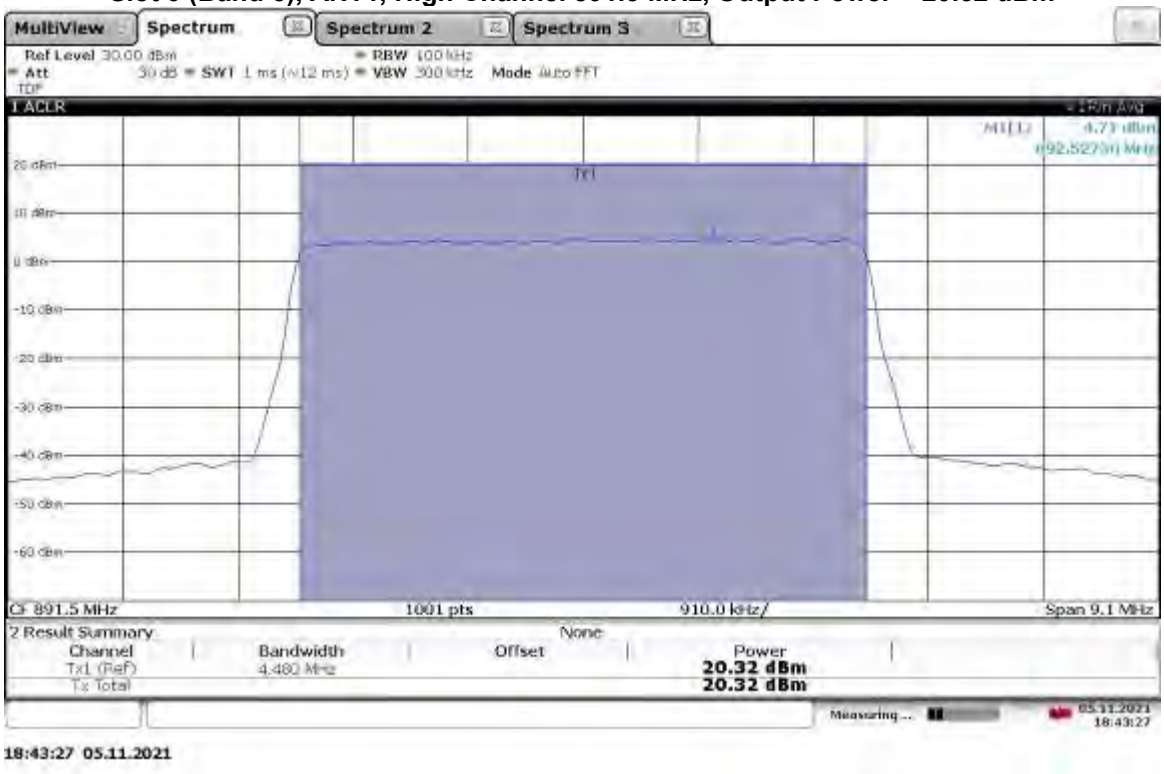
TM3.1a-256QAM _5 MHz Bandwidth
Slot 0 (Band 5), ANT1, Mid Channel 881 MHz, Output Power = 19.70 dBm



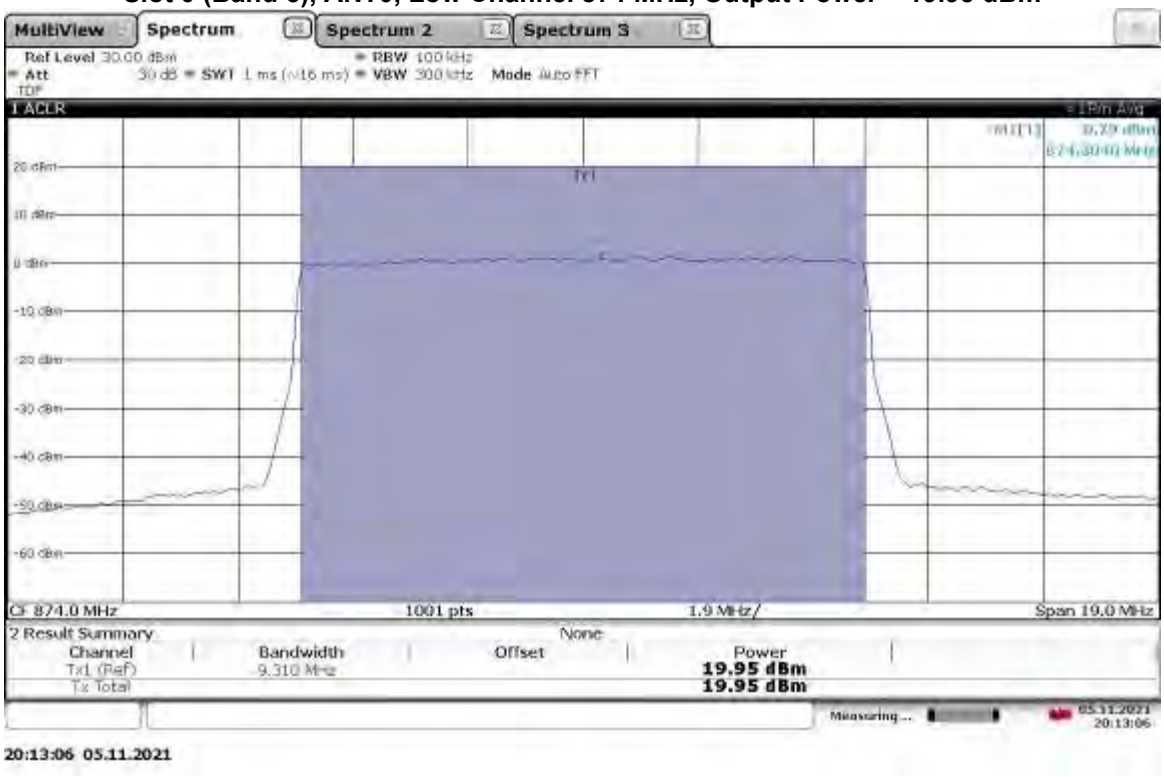
TM3.1a-256QAM _5 MHz Bandwidth
Slot 0 (Band 5), ANT0, High Channel 891.5 MHz, Output Power = 20.37 dBm



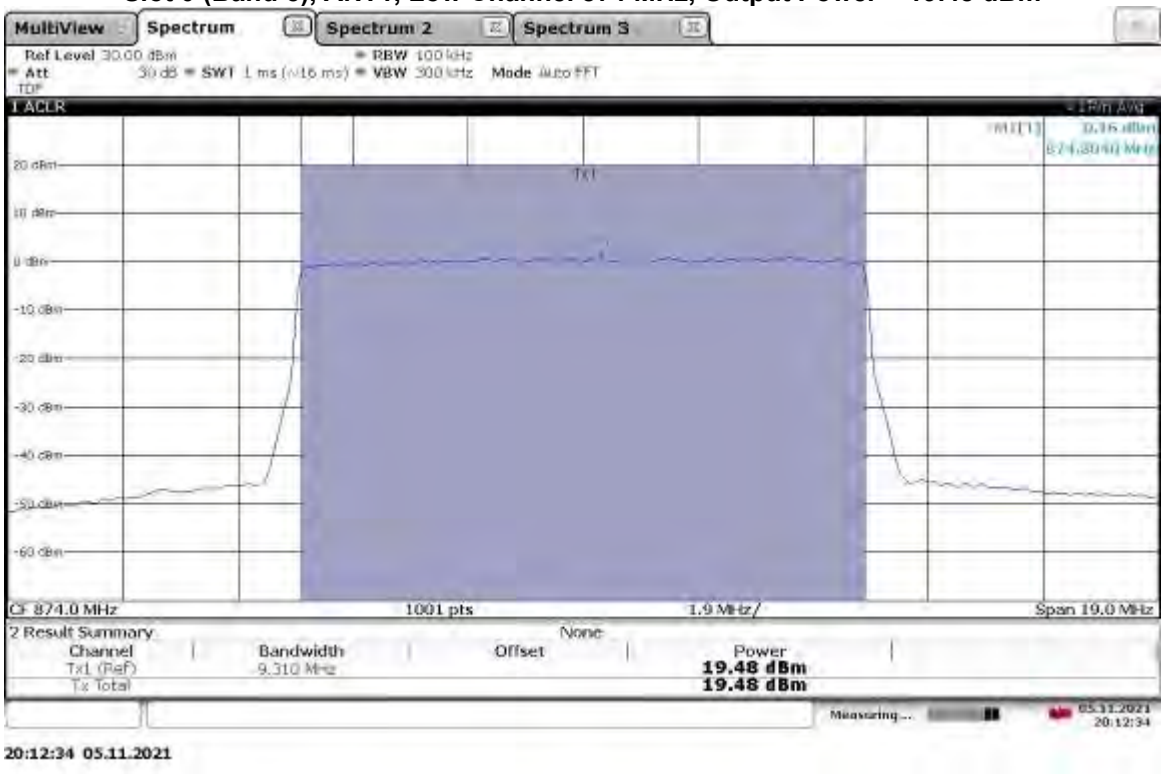
TM3.1a-256QAM _5 MHz Bandwidth
Slot 0 (Band 5), ANT1, High Channel 891.5 MHz, Output Power = 20.32 dBm



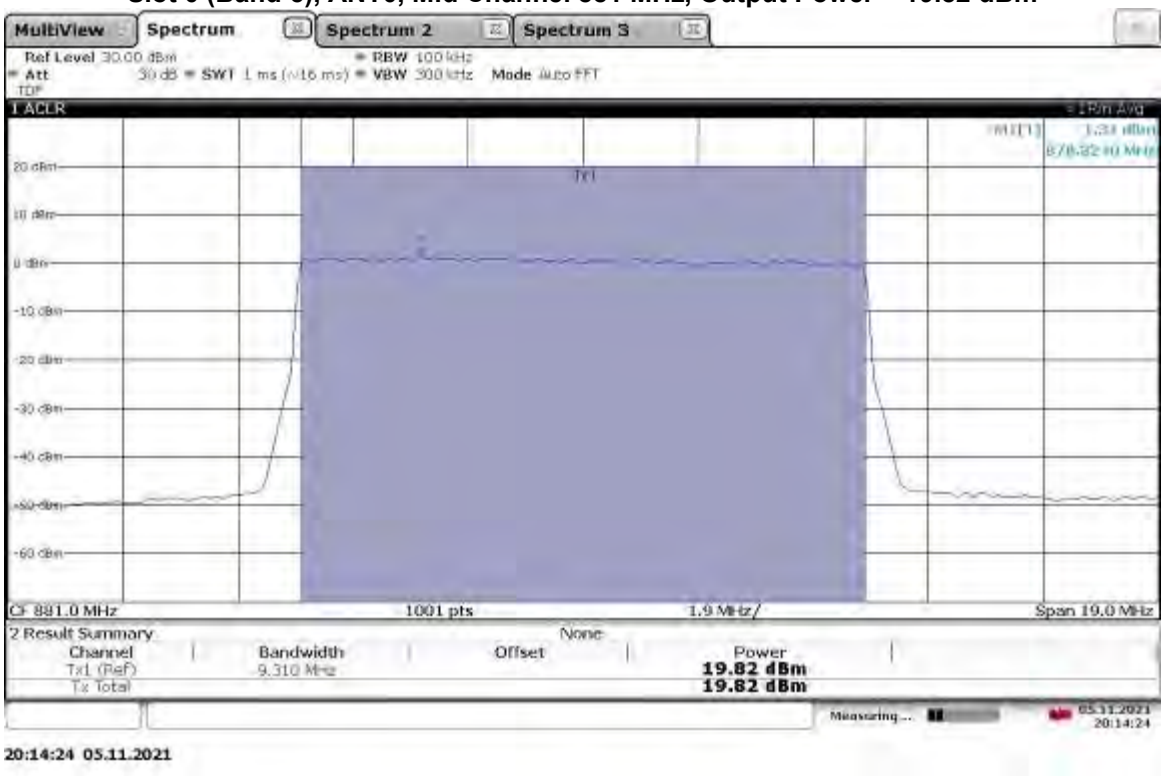
TM3.1a-256QAM _10 MHz Bandwidth
Slot 0 (Band 5), ANT0, Low Channel 874 MHz, Output Power = 19.95 dBm



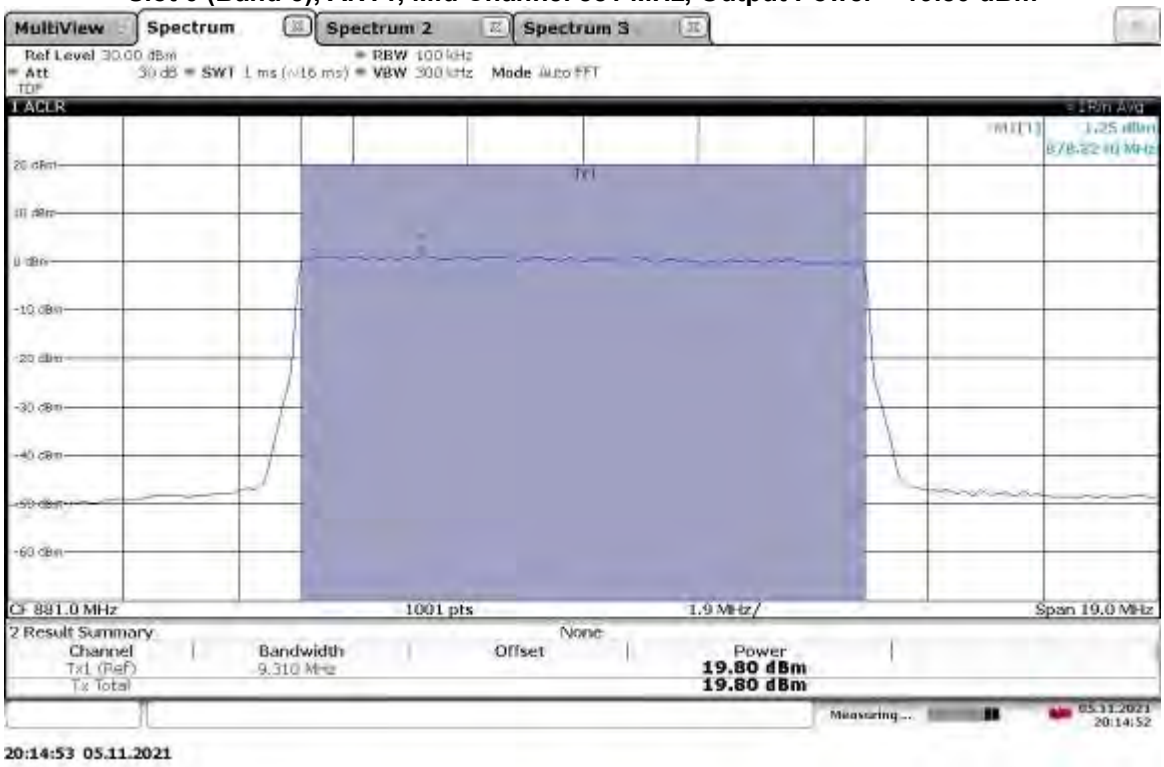
TM3.1a-256QAM _10 MHz Bandwidth
Slot 0 (Band 5), ANT1, Low Channel 874 MHz, Output Power = 19.48 dBm



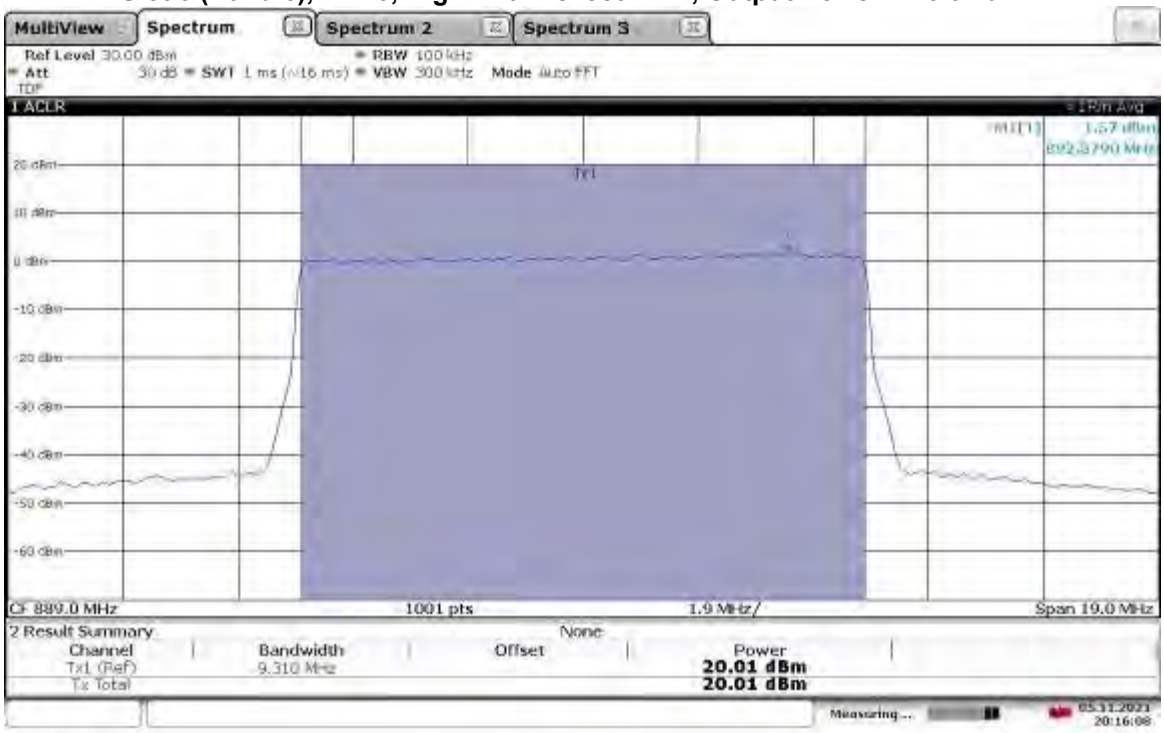
TM3.1a-256QAM _10 MHz Bandwidth
Slot 0 (Band 5), ANT0, Mid Channel 881 MHz, Output Power = 19.82 dBm



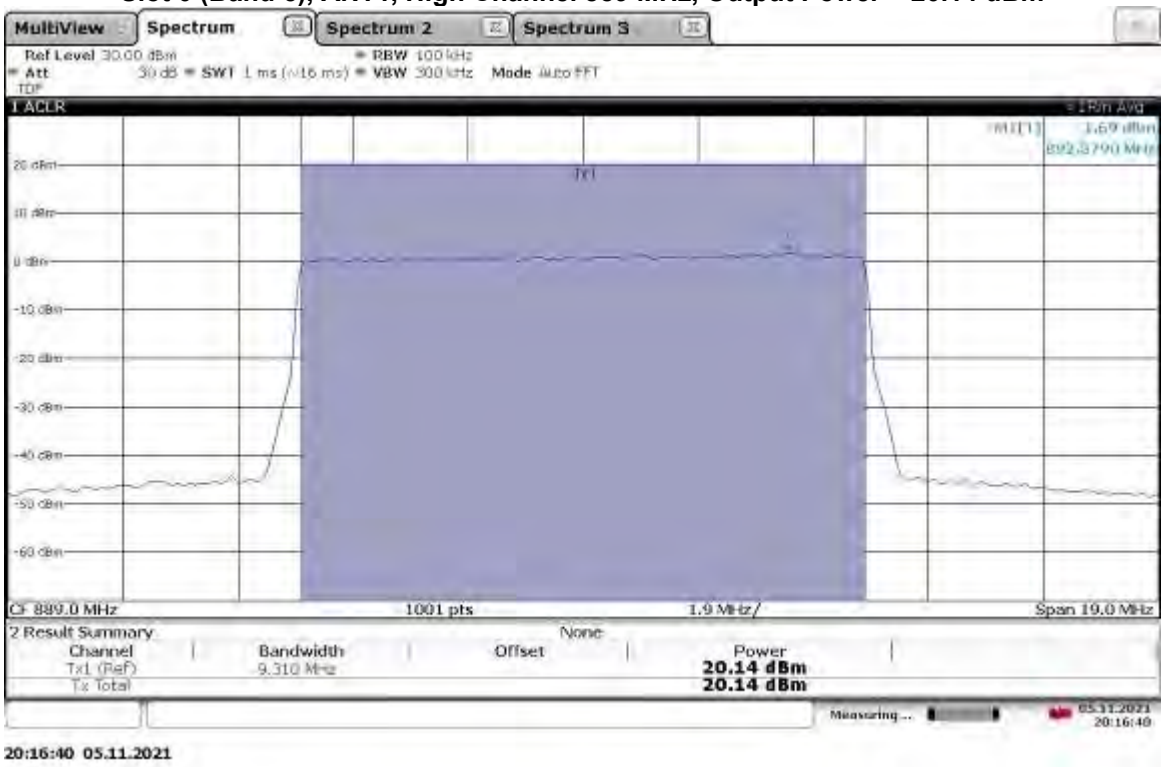
TM3.1a-256QAM _10 MHz Bandwidth
Slot 0 (Band 5), ANT1, Mid Channel 881 MHz, Output Power = 19.80 dBm



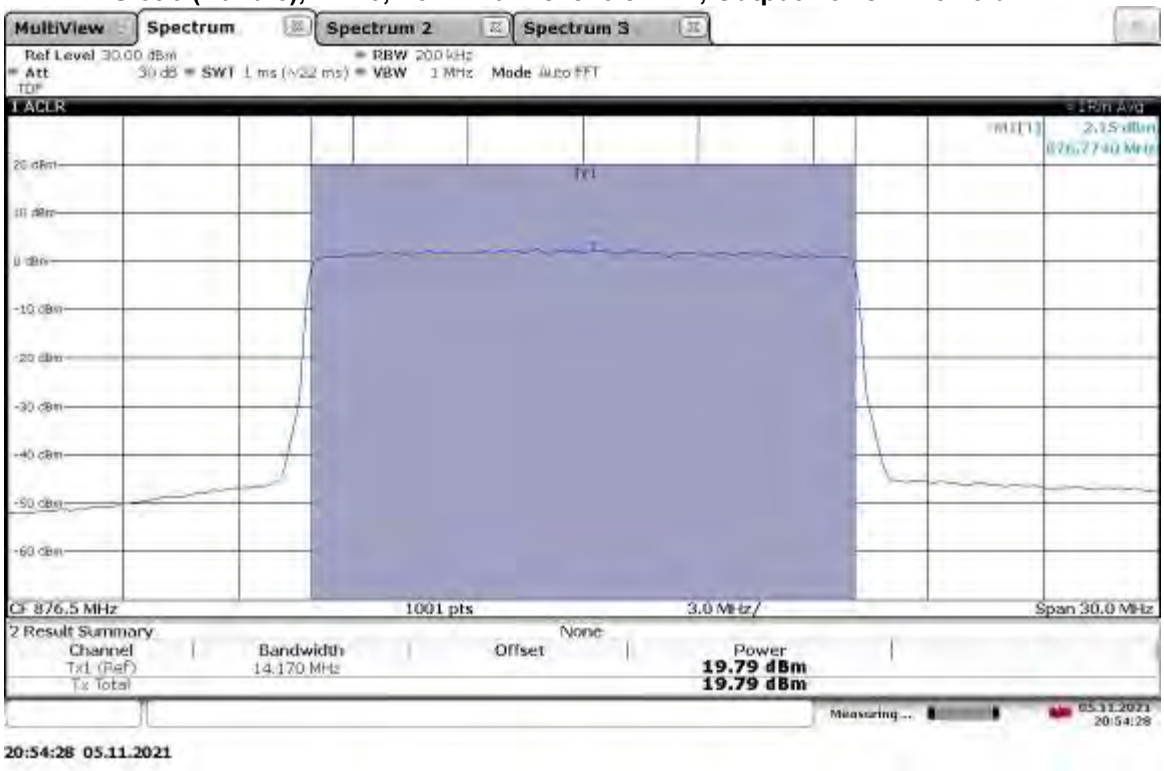
TM3.1a-256QAM _10 MHz Bandwidth
Slot 0 (Band 5), ANT0, High Channel 889 MHz, Output Power = 20.01 dBm



TM3.1a-256QAM _10 MHz Bandwidth
Slot 0 (Band 5), ANT1, High Channel 889 MHz, Output Power = 20.14 dBm



TM3.1a-256QAM _15 MHz Bandwidth
Slot 0 (Band 5), ANT0, Low Channel 876.5 MHz, Output Power = 19.79 dBm



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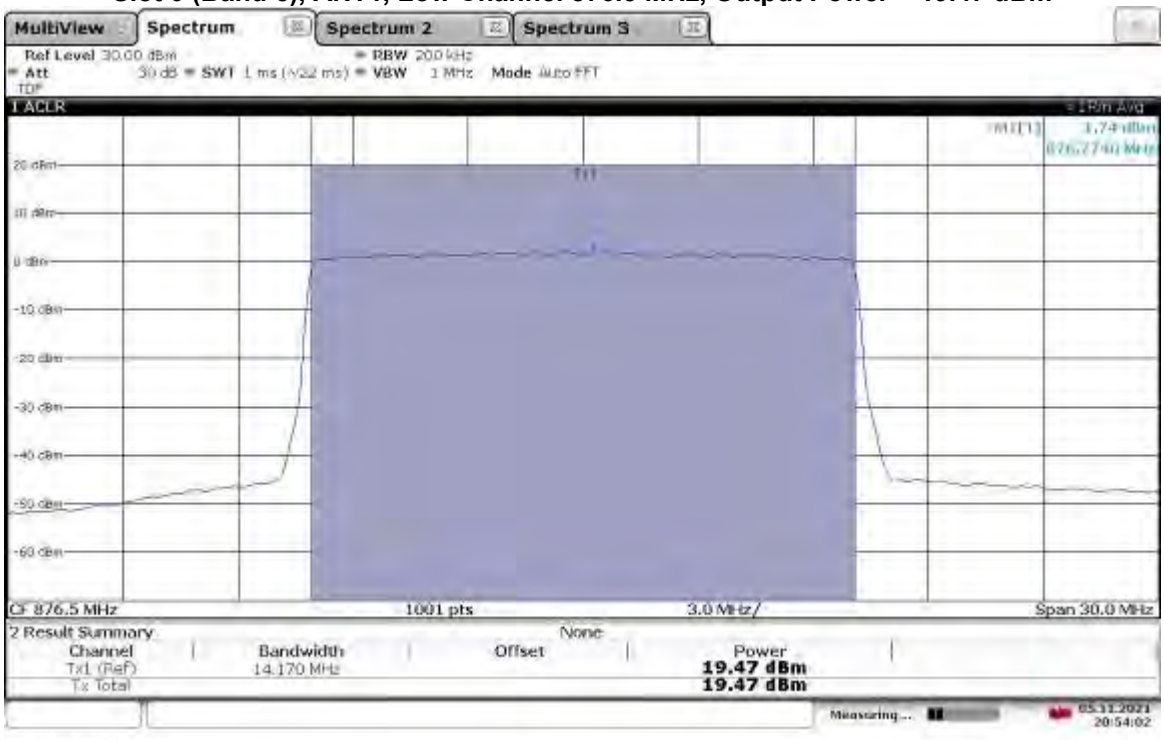
TM3.1a-256QAM _15 MHz Bandwidth
Slot 0 (Band 5), ANT1, Low Channel 876.5 MHz, Output Power = 19.47 dBm



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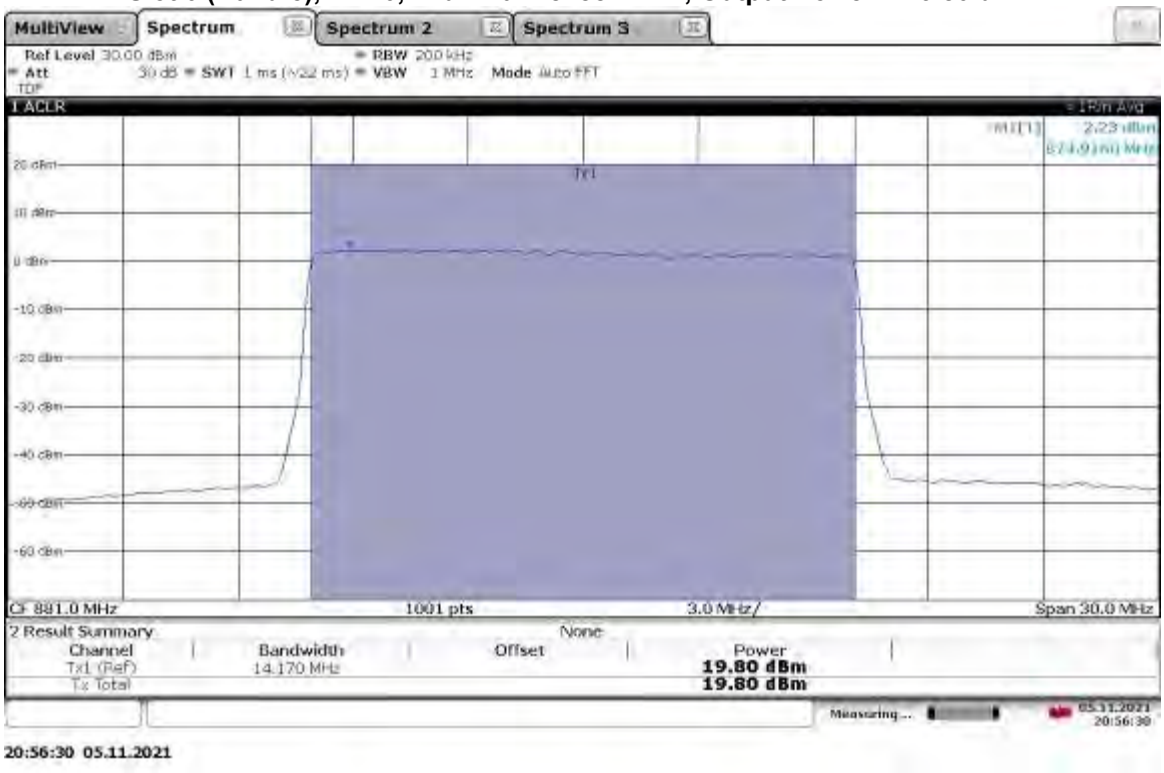
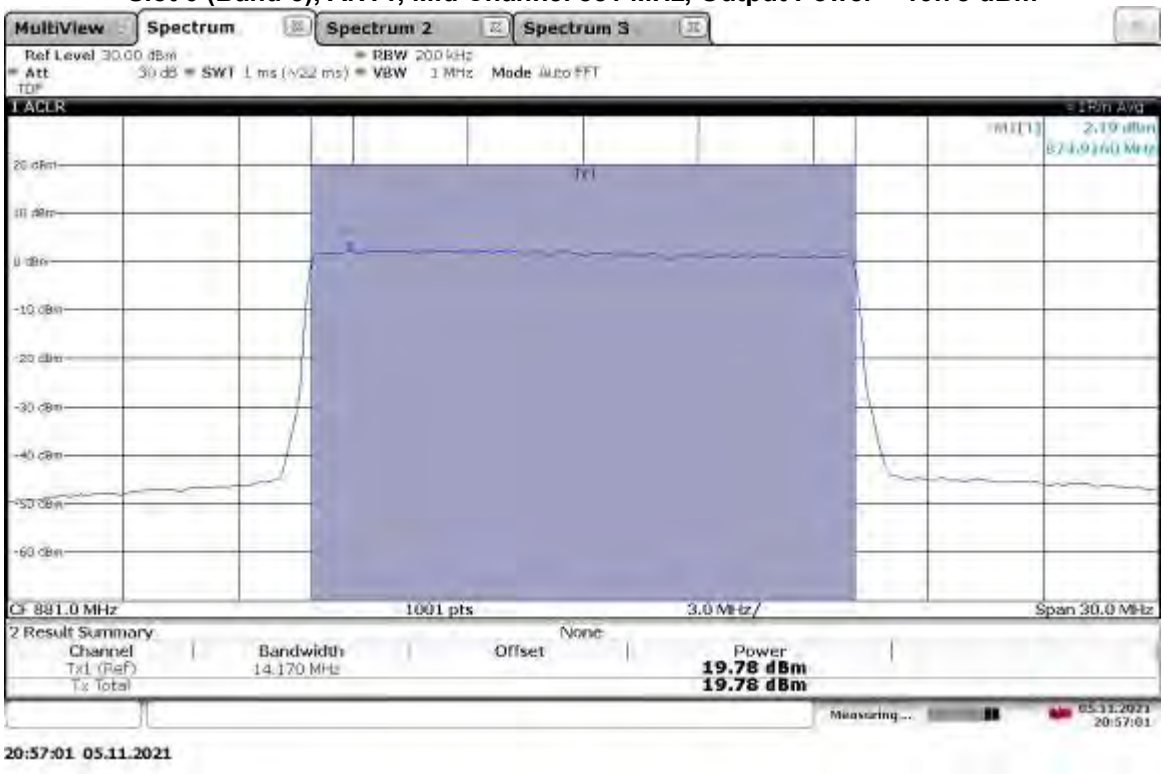
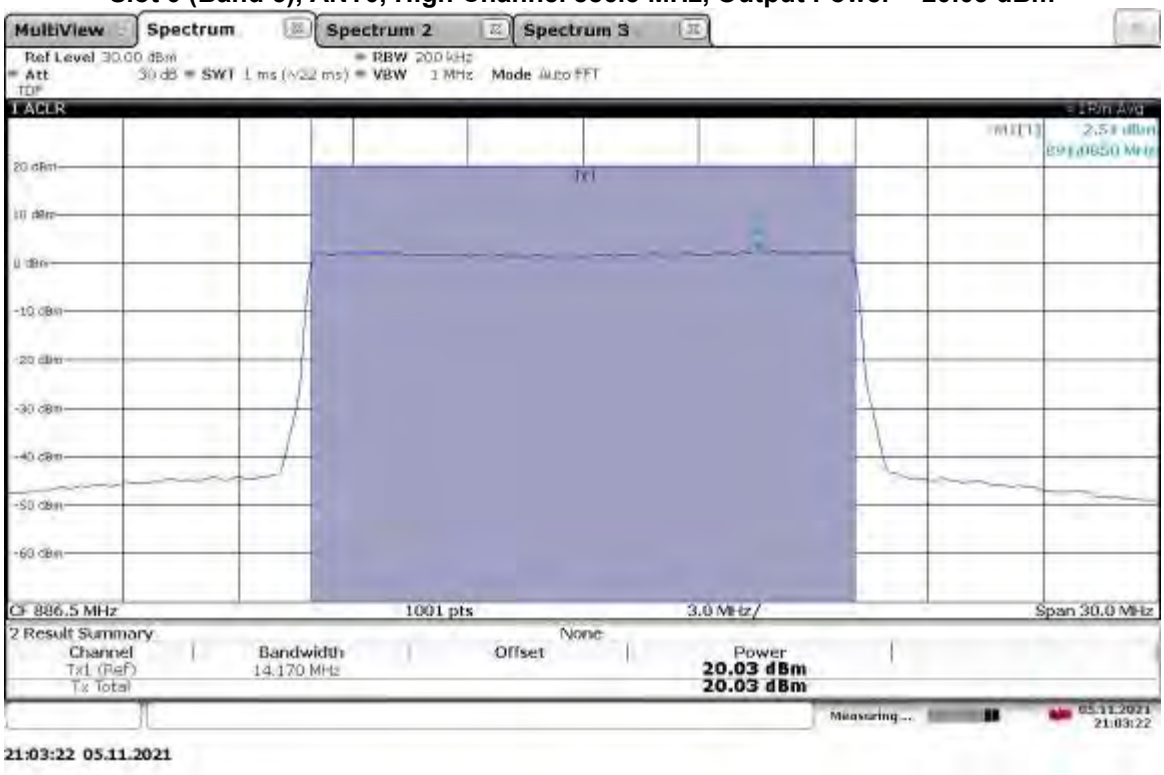
TM3.1a-256QAM _15 MHz Bandwidth
Slot 0 (Band 5), ANT0, Mid Channel 881 MHz, Output Power = 19.80 dBm



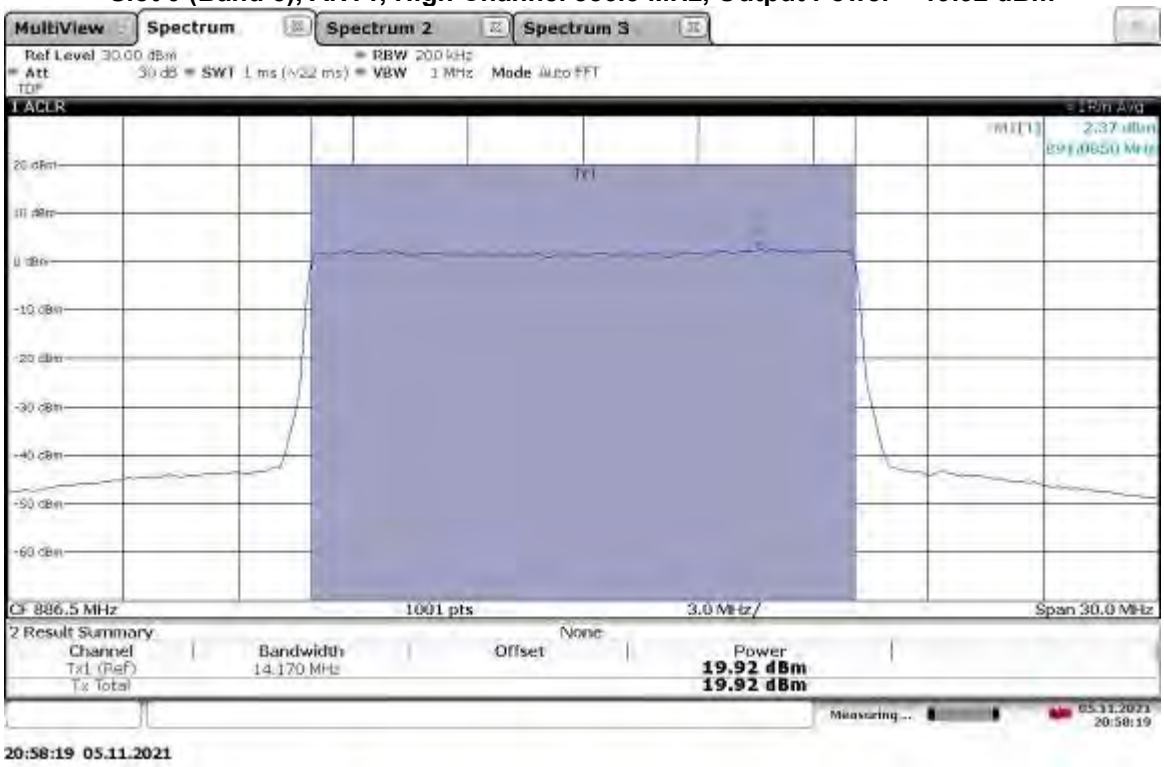
TM3.1a-256QAM _15 MHz Bandwidth
Slot 0 (Band 5), ANT1, Mid Channel 881 MHz, Output Power = 19.78 dBm



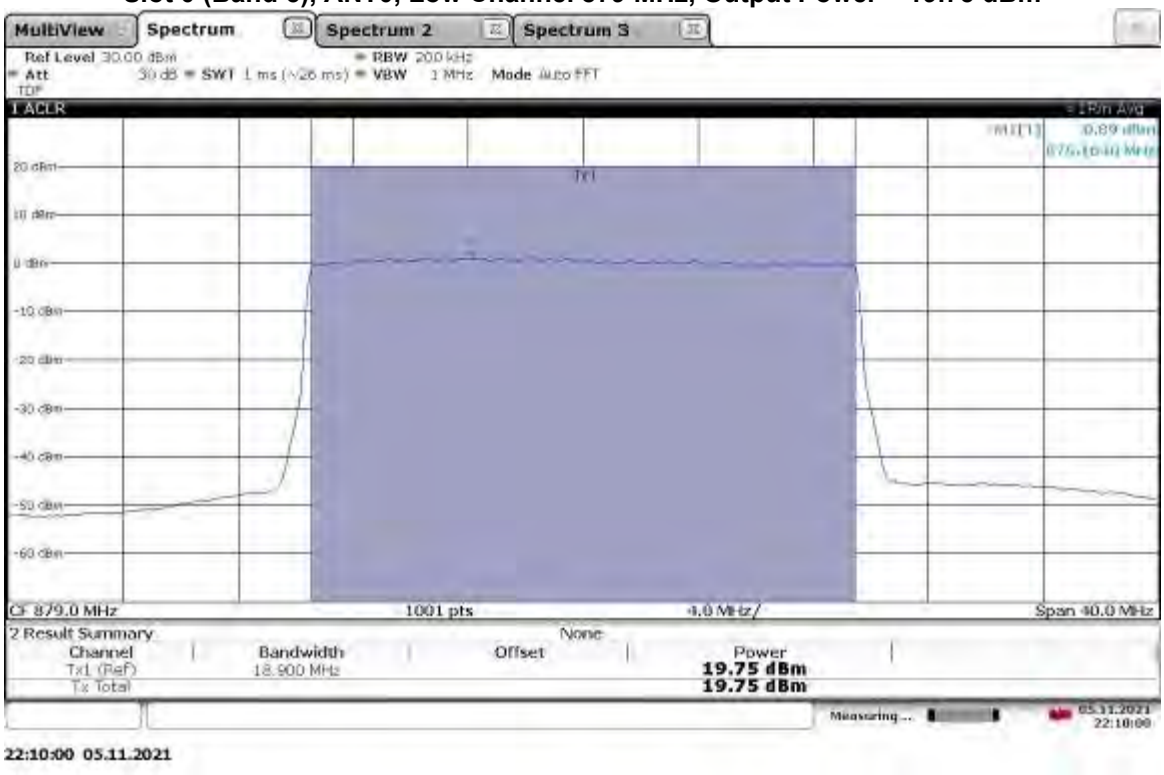
TM3.1a-256QAM _15 MHz Bandwidth
Slot 0 (Band 5), ANT0, High Channel 886.5 MHz, Output Power = 20.03 dBm



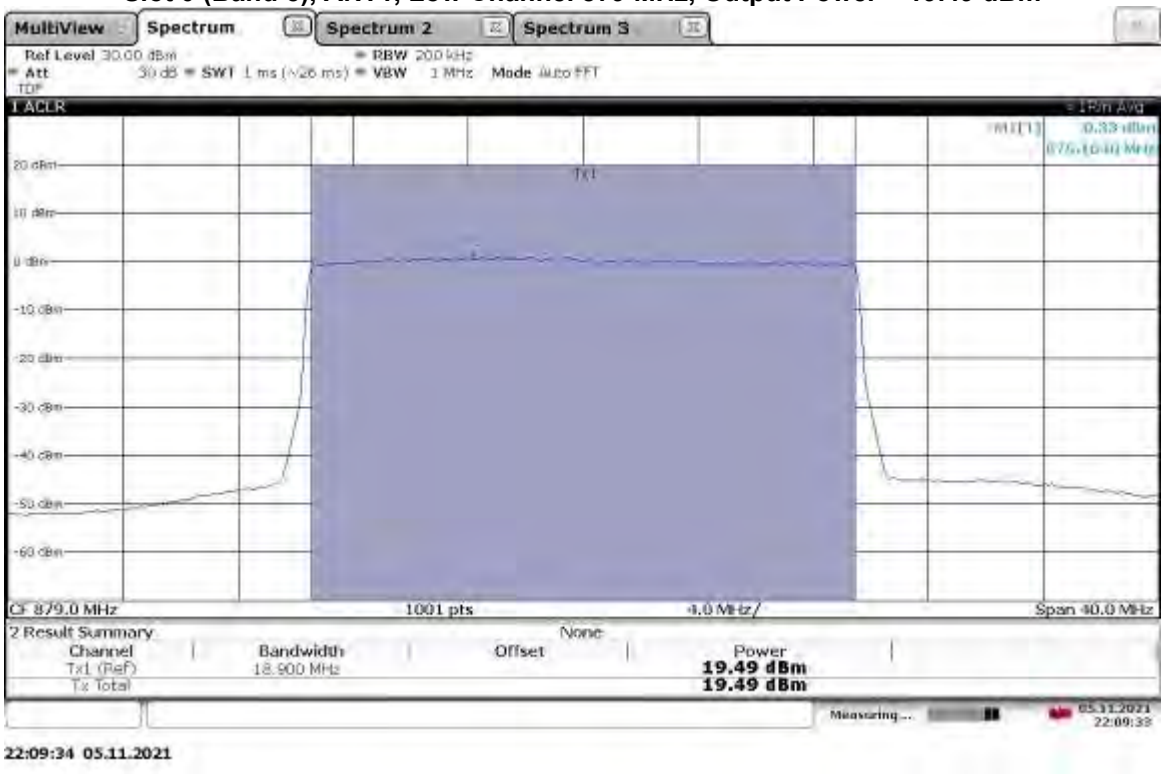
TM3.1a-256QAM _15 MHz Bandwidth
Slot 0 (Band 5), ANT1, High Channel 886.5 MHz, Output Power = 19.92 dBm



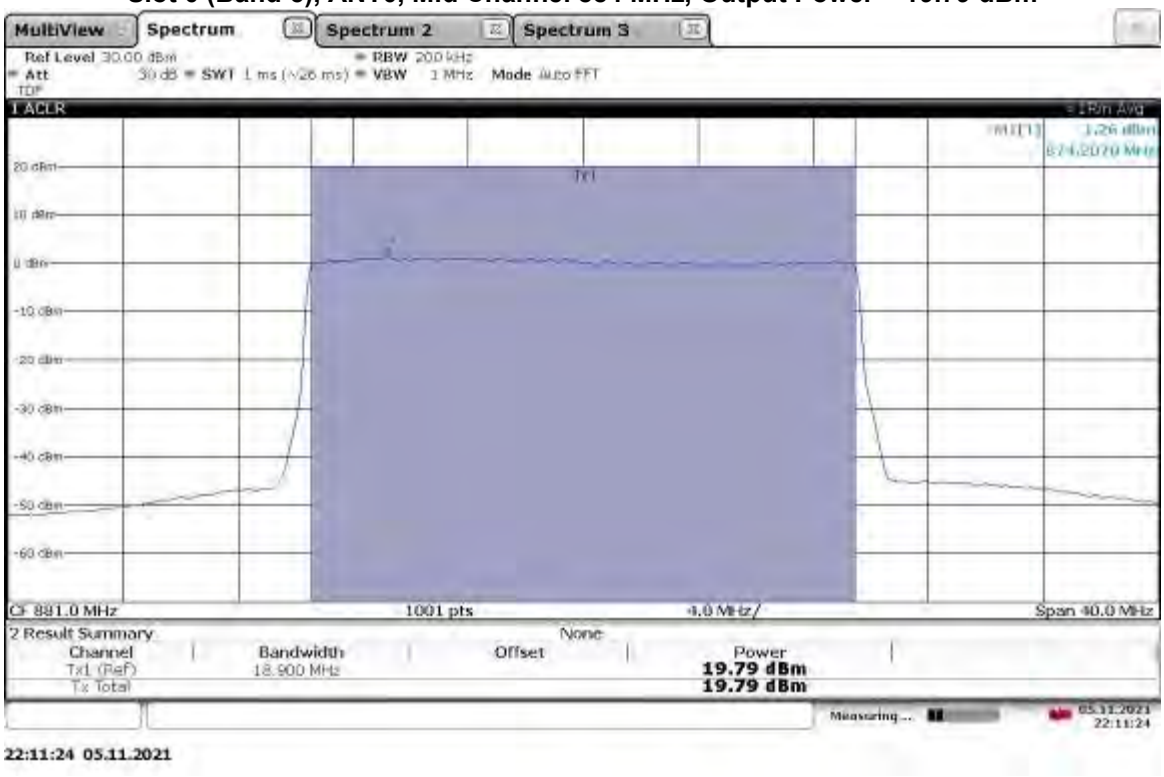
TM3.1a-256QAM _20 MHz Bandwidth
Slot 0 (Band 5), ANT0, Low Channel 879 MHz, Output Power = 19.75 dBm



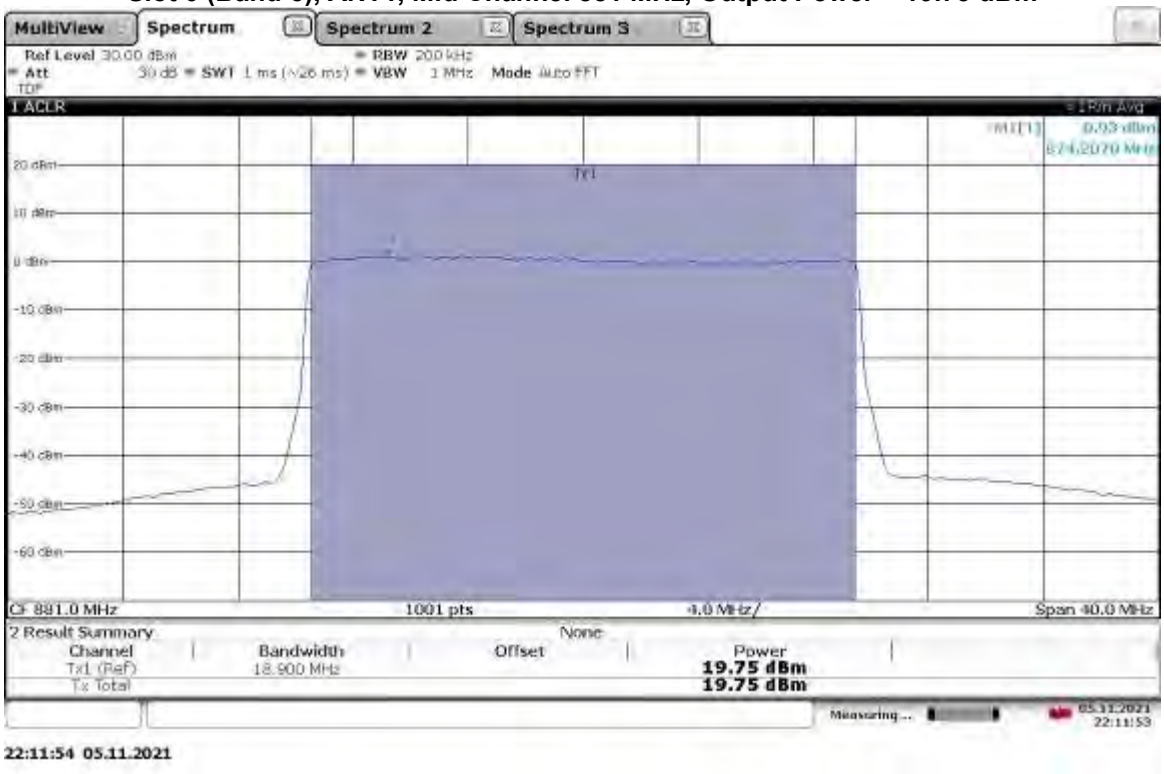
TM3.1a-256QAM _20 MHz Bandwidth
Slot 0 (Band 5), ANT1, Low Channel 879 MHz, Output Power = 19.49 dBm



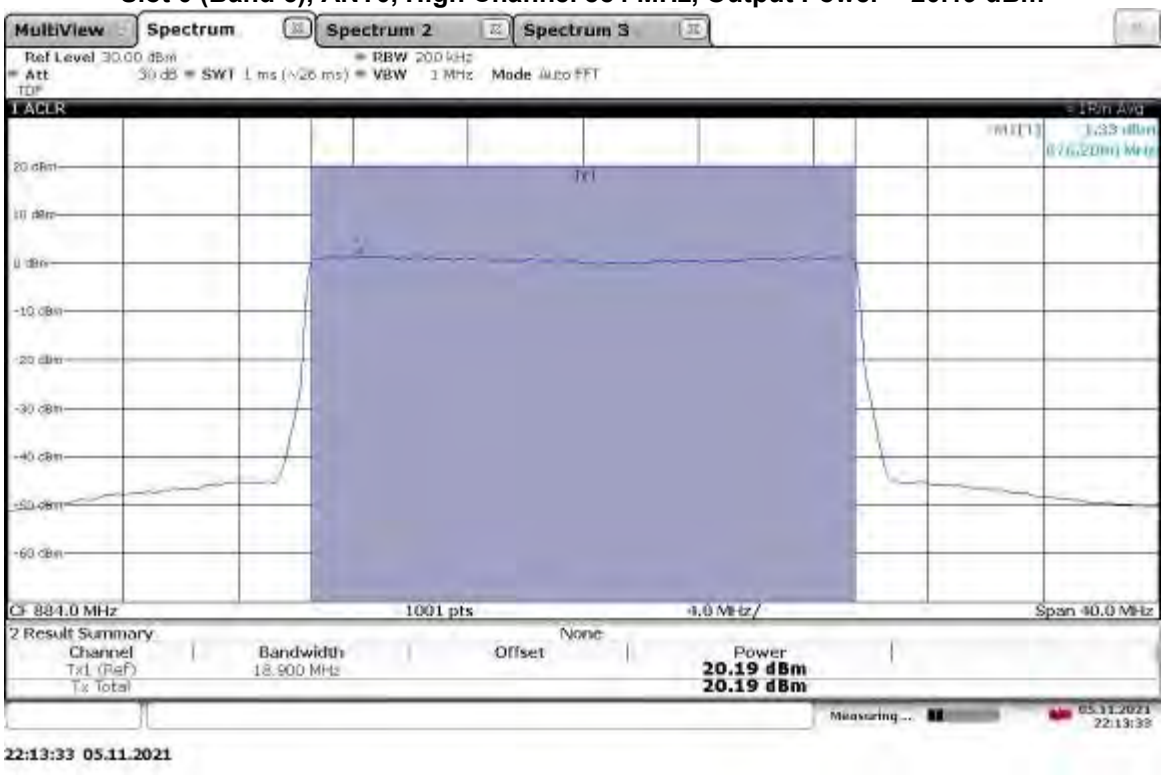
TM3.1a-256QAM _20 MHz Bandwidth
Slot 0 (Band 5), ANT0, Mid Channel 884 MHz, Output Power = 19.79 dBm



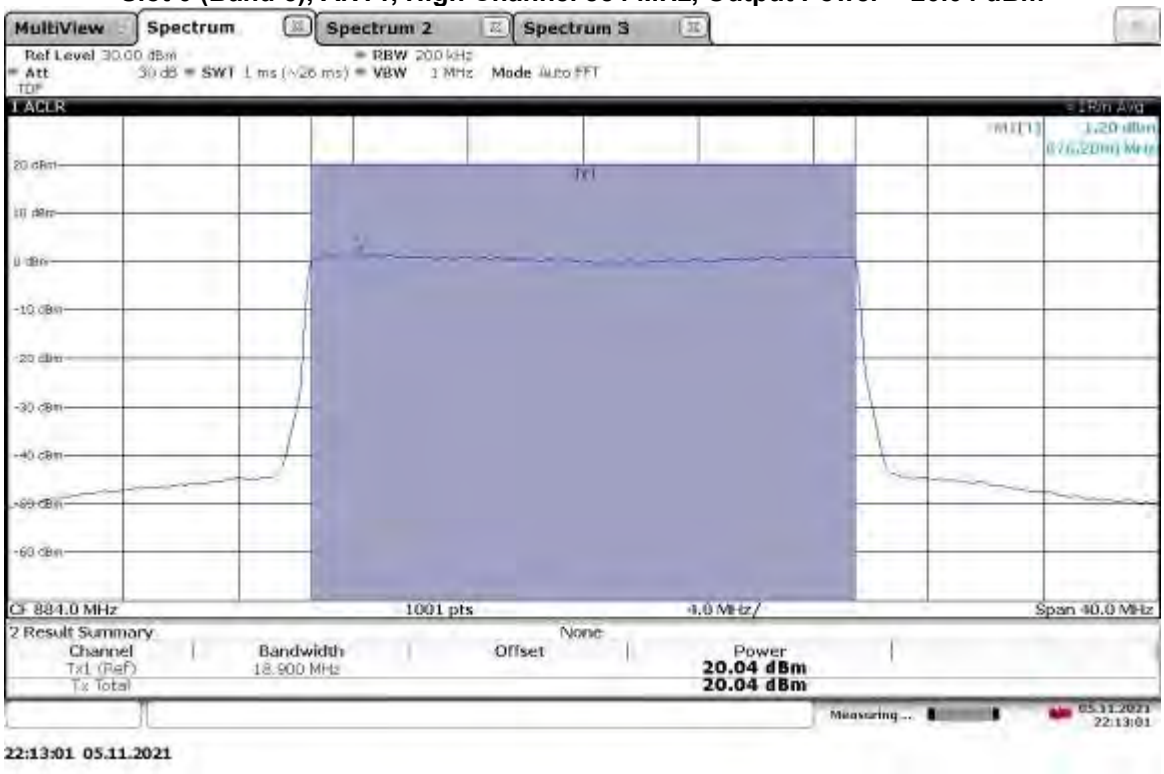
TM3.1a-256QAM _20 MHz Bandwidth
Slot 0 (Band 5), ANT1, Mid Channel 881 MHz, Output Power = 19.75 dBm



TM3.1a-256QAM _20 MHz Bandwidth
Slot 0 (Band 5), ANT0, High Channel 884 MHz, Output Power = 20.19 dBm



TM3.1a-256QAM _20 MHz Bandwidth
Slot 0 (Band 5), ANT1, High Channel 884 MHz, Output Power = 20.04 dBm



Limit for Maximum Permissible Exposure (MPE)

FCC Human RF Exposure Limits:

The FCC §1.1310 The criteria listed in table 1 was used to evaluate the environmental impact of human exposure to radiofrequency (RF) radiation as specified in §1.1307(b), except in the case of portable devices shall be evaluated according to the provisions of §2.1093 of this chapter.

Part §1.1310 Limits for Maximum Permissible Exposure (MPE)

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm^2)	Averaging time (minutes)
(A) Limits for Occupational/Controlled Exposure				
0.3-3.0	614	1.63	*100	6
3.0-30	1842/f	4.89/f	$*900/f^2$	6
30-300	61.4	0.163	1.0	6
300-1,500			f/300	6
1,500-100,000			5	6
(B) Limits for General Population/Uncontrolled Exposure				
0.3-1.34	614	1.63	*100	30
1.34-30	824/f	2.19/f	$*180/f^2$	30
30-300	27.5	0.073	0.2	30
300-1,500			f/1500	30
1,500-100,000			1.0	30

f = frequency in MHz * = Plane-wave equivalent power density

(1) Occupational/controlled exposure limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when a person is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure. The phrase *fully aware* in the context of applying these exposure limits means that an exposed person has received written and/or verbal information fully explaining the potential for RF exposure resulting from his or her employment. With the exception of *transient* persons, this phrase also means that an exposed person has received appropriate training regarding work practices relating to controlling or mitigating his or her exposure. Such training is not required for *transient* persons, but they must receive written and/or verbal information and notification (for example, using signs) concerning their exposure potential and appropriate means available to mitigate their exposure. The phrase *exercise control* means that an exposed person is allowed to and knows how to reduce or avoid exposure by administrative or engineering controls and work practices, such as use of personal protective equipment or time averaging of exposure.

(2) General population/uncontrolled exposure limits apply in situations in which the general public may be exposed, or in which persons who are exposed as a consequence of their employment may not be fully aware of the potential for exposure or cannot exercise control over their exposure.

Test Procedure

RF exposure for licensed transmitter is handled at the time of licensing, however, an MPE calculation was performed in order to show the distance at which the device is compliant with the limits of §1.1310, assuming antenna gains of 0 dBi and 4 dBi. The highest measured conducted output power was used, adjusted by +3dB to account for two antenna MIMO operation.

FCC Limit For General Population/Uncontrolled Exposure at 1.985 GHz = 1 mW/cm^2

Power Density = [EIRP] / [4π x $(D_{cm})^2$]

Where EIRP is in milliwatts and D is in centimeters. Setting the power density equal to the limit of 1 mW/cm^2 and solving for D_{cm} yields the following results.

Results:
EUT EIRP = Conducted power + Array Gain + Antenna gain in dBi

Power Density Limit = [EIRP] / [4π x $(D_{cm})^2$]
1 mW/cm^2 = [EIRP] / [4π x $(D_{cm})^2$]
D_{cm} = ([EIRP] / [4π])$^{1/2}$

For Gain = 0 dBi,
EIRP = 20.40 dBm + 10*LOG(2) + 0 dBi = 20.40 dBm + 3 dB + 0dBi
EIRP = 23.40 dBm or 218.77616239 mW
Therefore, the minimum safe distance D_{cm} is D_{cm} = ([218.77616239] / [4π])$^{1/2}$
D_{cm} = 4.17 cm at 0 dBi gain two antenna MIMO

For Gain = 4 dBi,
EIRP = 20.40 dBm + 10*LOG(2) + 4 dBi = 20.40 dBm + 3 dB + 4dBi
EIRP = 27.40 dBm or 549.54087386 mW
Therefore, the minimum safe distance D_{cm} is D_{cm} = ([549.54087386] / [4π])$^{1/2}$
D_{cm} = 6.61 cm at 4 dBi gain two antenna MIMO

For Gain = X dBi,
EIRP = 20.40 dBm + 10*LOG(2) + X dBi = 20.40 dBm + 3 dB + XdBi
EIRP = 23.40+X dBm or 218.77616239 + 10^(X/10) mW
Therefore, the minimum safe distance D_{cm} is D_{cm} = ([218.77616239 + 10^(X/10)] / [4π])$^{1/2}$
D_{cm} = 0.282 * (218.77616239 + 10^(X/10))$^{1/2}$ cm at X dBi gain two antenna MIMO

Test Personnel:	Vathana Ven	Test Date:	11/05/2021
Supervising/Reviewing Engineer: (Where Applicable)	N/A		
Product Standard:	FCC Part 22	Limit Applied:	See report section 6.3
Input Voltage:	48 VDC (POE)		
Pretest Verification w/ Ambient Signals or BB Source:	N/A	Ambient Temperature:	23 ºC
		Relative Humidity:	19 %
		Atmospheric Pressure:	1017 mbars

Deviations, Additions, or Exclusions: None

7 Occupied Bandwidth

7.1 Method

Tests are performed in accordance with ANSI C63.26 and CFR47 FCC Parts 2.1049 and 24.

TEST SITE: EMC Lab

The EMC Lab has one Semi-anechoic Chamber and one Shielded Chamber. AC Mains Power is available at 120, 230, and 277 Single Phase; 208, 400, and 480 3-Phase. Large reference ground-planes are installed in the general lab area to facilitate EMC work not requiring a shielded environment.

7.2 Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
CEN001'	DC-40GHz attenuator 20dB	Centric RF	C411-20	CEN001	01/22/2021	01/22/2022
CBLSHF204'	Cable, SMA - SMA, 9kHz -40GHz, (Cable Kit 5)	Huber + Suhner	Sucoflex 102EA	234714001	02/03/2021	02/03/2022
ROS005-1'	Signal and Spectrum Analyzer	Rohde and Shwartz	FSW43	100646	10/27/2020	10/27/2021
DAV005'	Weather Station	Davis	6250	MS191218083	02/07/2021	02/07/2022

Software Utilized:

Name	Manufacturer	Version
None	--	--

7.3 Results:

The sample tested was found to Comply.

§22.917(b): The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

§2.1049: The occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission.

Slot 0 (Band 5), Bandwidth: 5 MHz, Modulation: TM1.1-QPSK

Channel	Frequency (MHz)	Antenna Port	OBW (MHz)
Low	871.5	ANT0	4.48
		ANT1	4.48
Mid	881	ANT0	4.48
		ANT1	4.48
High	891.5	ANT0	4.48
		ANT1	4.48

Slot 0 (Band 5), Bandwidth: 10 MHz, Modulation: TM1.1-QPSK

Channel	Frequency (MHz)	Antenna Port	OBW (MHz)
Low	874	ANT0	9.30
		ANT1	9.30
Mid	881	ANT0	9.31
		ANT1	9.31
High	889	ANT0	9.30
		ANT1	9.31

Slot 0 (Band 5), Bandwidth: 15 MHz, Modulation: TM1.1-QPSK

Channel	Frequency (MHz)	Antenna Port	OBW (MHz)
Low	876.5	ANT0	14.17
		ANT1	14.17
Mid	881	ANT0	14.19
		ANT1	14.20
High	886.5	ANT0	14.21
		ANT1	14.20

Slot 0 (Band 2), Bandwidth: 20 MHz, Modulation: TM1.1-QPSK

Channel	Frequency (MHz)	Antenna Port	OBW (MHz)
Low	879	ANT0	18.90
		ANT1	18.90
Mid	881	ANT0	18.93
		ANT1	18.93
High	884	ANT0	18.95
		ANT1	18.95

Slot 0 (Band 5), Bandwidth: 5 MHz, Modulation: TM3.2-16QAM

Channel	Frequency (MHz)	Antenna Port	OBW (MHz)
Low	871.5	ANT0	4.52
		ANT1	4.51
Mid	881	ANT0	4.51
		ANT1	4.51
High	891.5	ANT0	4.52
		ANT1	4.52

Slot 0 (Band 5), Bandwidth: 10 MHz, Modulation: TM3.2-16QAM

Channel	Frequency (MHz)	Antenna Port	OBW (MHz)
Low	874	ANT0	9.23
		ANT1	9.23
Mid	881	ANT0	9.24
		ANT1	9.23
High	889	ANT0	9.28
		ANT1	9.24

Slot 0 (Band 5), Bandwidth: 15 MHz, Modulation: TM3.2-16QAM

Channel	Frequency (MHz)	Antenna Port	OBW (MHz)
Low	876.5	ANT0	14.15
		ANT1	14.14
Mid	881	ANT0	14.19
		ANT1	14.18
High	886.5	ANT0	14.20
		ANT1	14.20

Slot 0 (Band 5), Bandwidth: 20 MHz, Modulation: TM3.2-16QAM

Channel	Frequency (MHz)	Antenna Port	OBW (MHz)
Low	879	ANT0	18.97
		ANT1	18.95
Mid	881	ANT0	19.00
		ANT1	19.00
High	884	ANT0	19.00
		ANT1	19.00

Slot 0 (Band 5), Bandwidth: 5 MHz, Modulation: TM3.1-64QAM

Channel	Frequency (MHz)	Antenna Port	OBW (MHz)
Low	871.5	ANT0	4.49
		ANT1	4.48
Mid	881	ANT0	4.48
		ANT1	4.48
High	891.5	ANT0	4.48
		ANT1	4.48

Slot 0 (Band 5), Bandwidth: 10 MHz, Modulation: TM3.1-64QAM

Channel	Frequency (MHz)	Antenna Port	OBW (MHz)
Low	874	ANT0	9.30
		ANT1	9.30
Mid	881	ANT0	9.31
		ANT1	9.30
High	889	ANT0	9.30
		ANT1	9.31

Slot 0 (Band 5), Bandwidth: 15 MHz, Modulation: TM3.1-64QAM

Channel	Frequency (MHz)	Antenna Port	OBW (MHz)
Low	876.5	ANT0	14.11
		ANT1	14.11
Mid	881	ANT0	14.15
		ANT1	14.15
High	886.5	ANT0	14.16
		ANT1	14.17

Slot 0 (Band 5), Bandwidth: 20 MHz, Modulation: TM3.1-64QAM

Channel	Frequency (MHz)	Antenna Port	OBW (MHz)
Low	879	ANT0	18.92
		ANT1	18.90
Mid	881	ANT0	18.92
		ANT1	18.93
High	884	ANT0	18.94
		ANT1	18.95

Slot 0 (Band 5), Bandwidth: 5 MHz, Modulation: TM3.1a-256QAM_

Channel	Frequency (MHz)	Antenna Port	OBW (MHz)
Low	871.5	ANT0	4.48
		ANT1	4.48
Mid	881	ANT0	4.48
		ANT1	4.48
High	891.5	ANT0	4.48
		ANT1	4.48

Slot 0 (Band 5), Bandwidth: 10 MHz, Modulation: TM3.1a-256QAM_

Channel	Frequency (MHz)	Antenna Port	OBW (MHz)
Low	874	ANT0	9.29
		ANT1	9.28
Mid	881	ANT0	9.30
		ANT1	9.29
High	889	ANT0	9.30
		ANT1	9.30

Slot 0 (Band 5), Bandwidth: 15 MHz, Modulation: TM3.1a-256QAM

Channel	Frequency (MHz)	Antenna Port	OBW (MHz)
Low	876.5	ANT0	14.11
		ANT1	14.10
Mid	881	ANT0	14.16
		ANT1	14.15
High	886.5	ANT0	14.15
		ANT1	14.16

Slot 0 (Band 5), Bandwidth: 20 MHz, Modulation: TM3.1a-256QAM

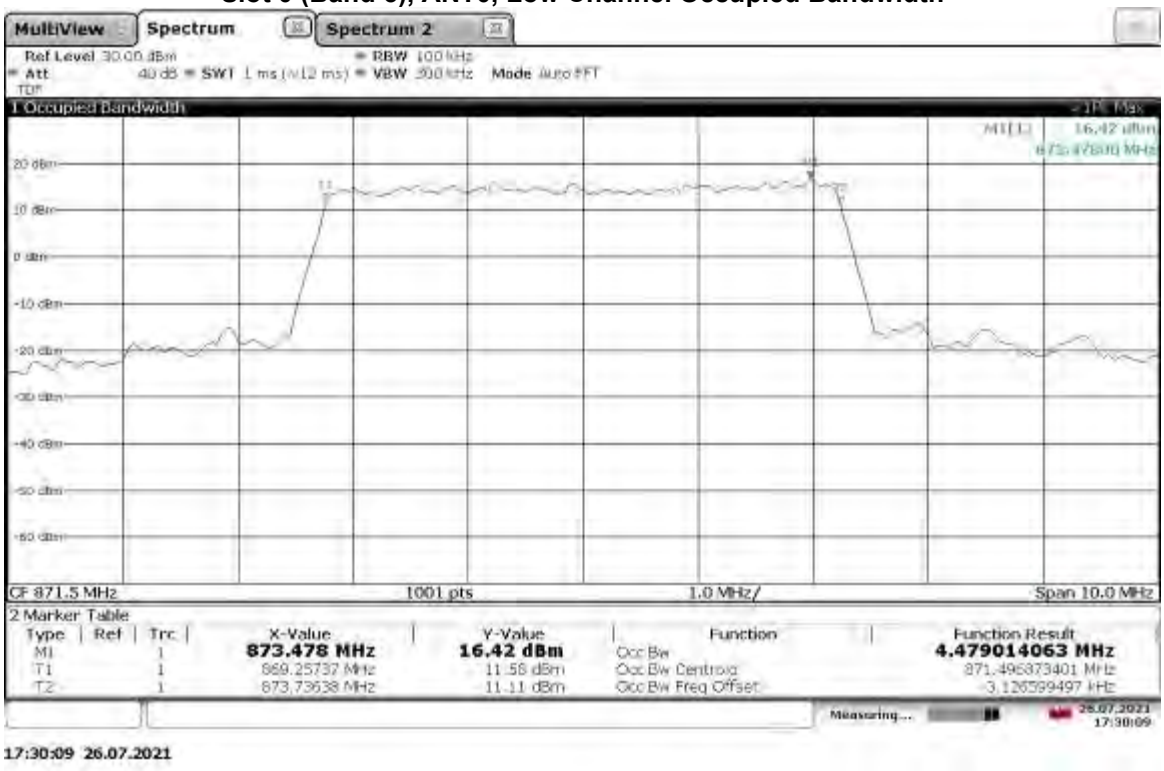
Channel	Frequency (MHz)	Antenna Port	OBW (MHz)
Low	879	ANT0	18.93
		ANT1	18.93
Mid	881	ANT0	18.95
		ANT1	18.94
High	884	ANT0	18.98
		ANT1	18.95

7.4 Setup Photograph:

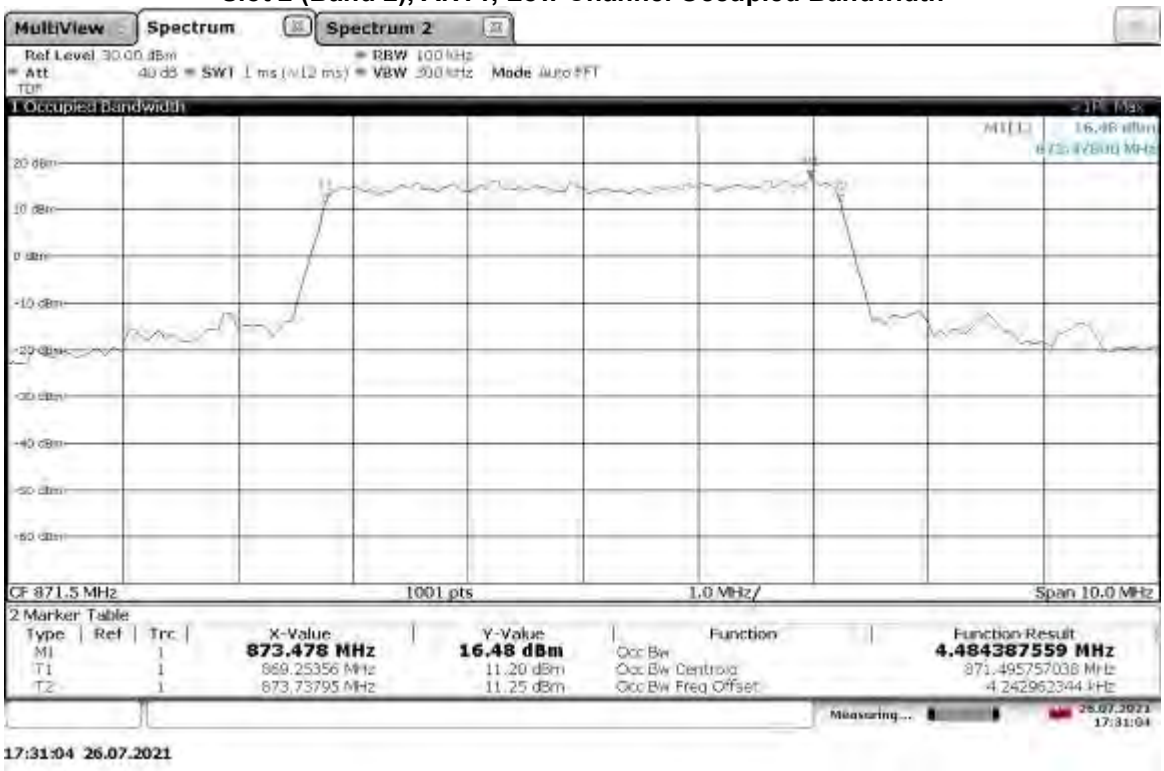
Confidential – Test setup photo not included in this report

7.5 Plots/Data:

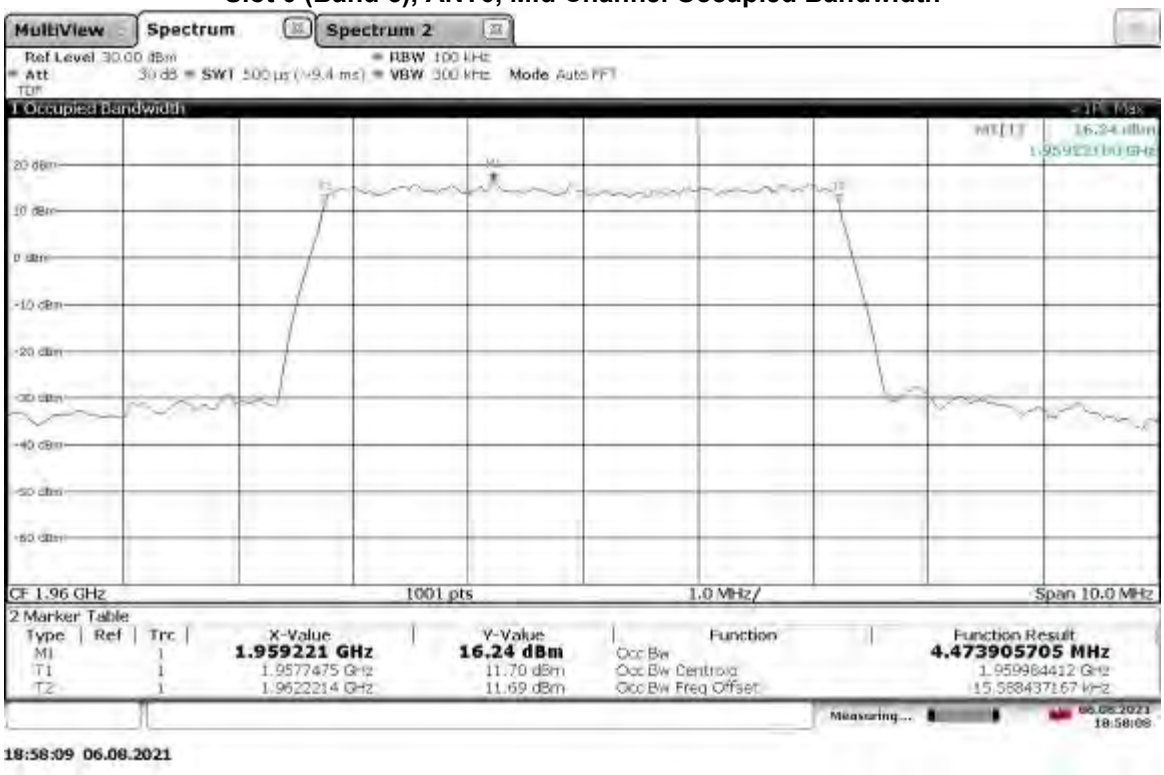
TM1.1-QPSK_5 MHz Bandwidth
Slot 0 (Band 5), ANT0, Low Channel Occupied Bandwidth



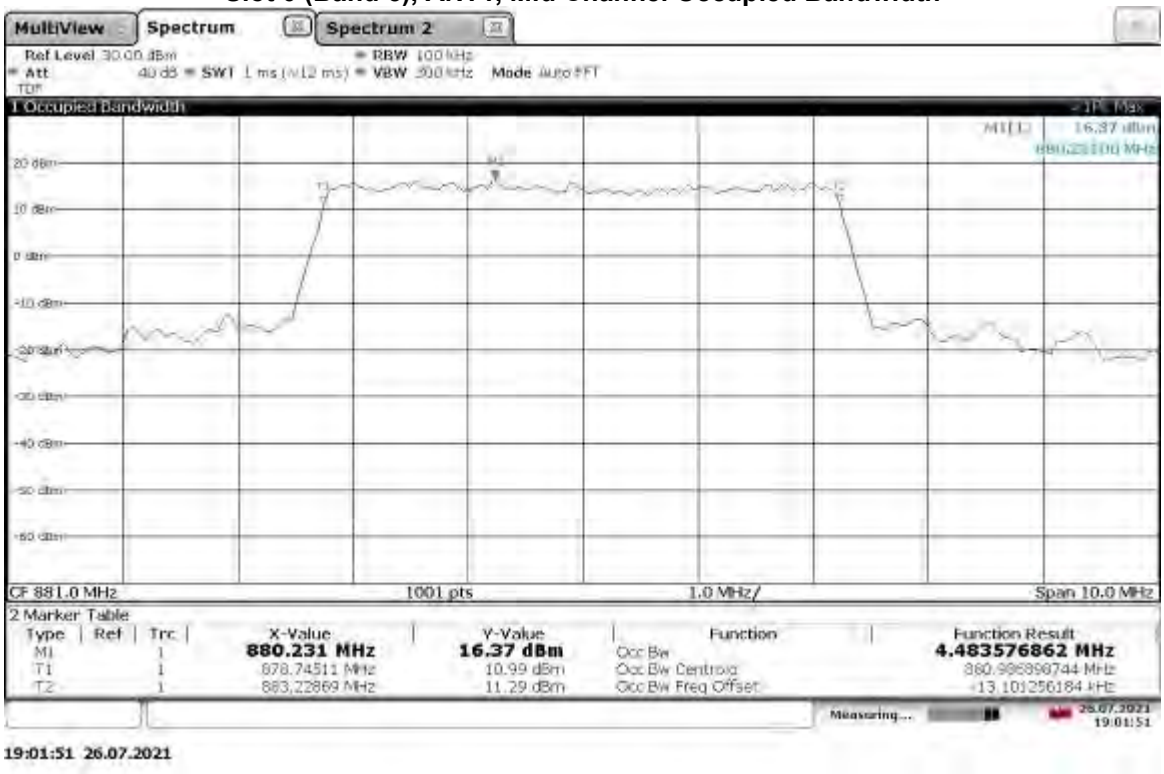
TM1.1-QPSK_5 MHz Bandwidth
Slot 2 (Band 2), ANT1, Low Channel Occupied Bandwidth



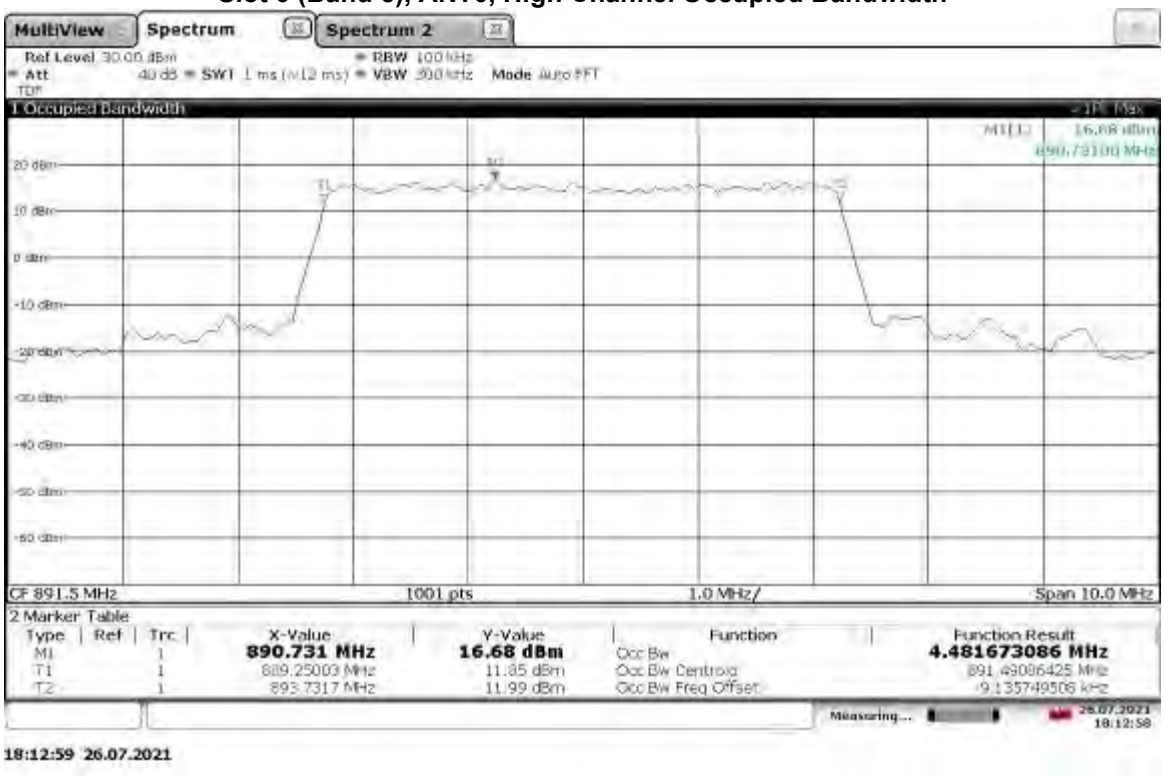
TM1.1-QPSK_5 MHz Bandwidth
Slot 0 (Band 5), ANT0, Mid Channel Occupied Bandwidth



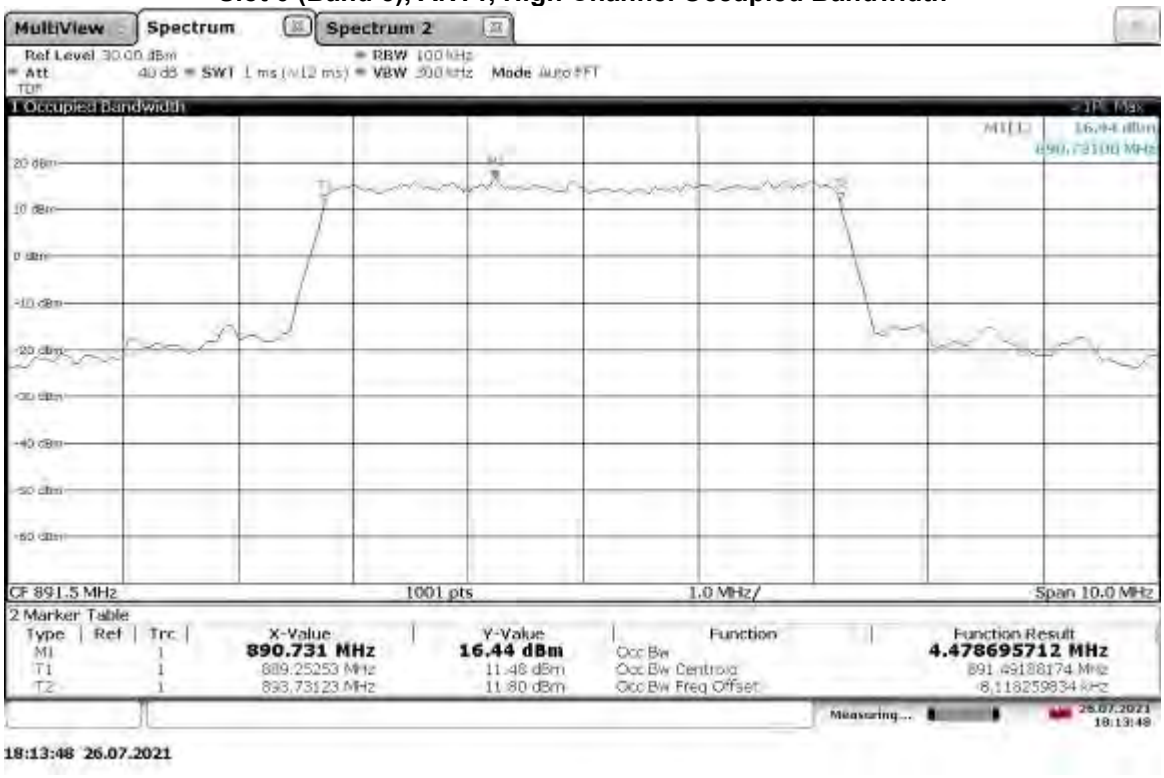
TM1.1-QPSK_5 MHz Bandwidth
Slot 0 (Band 5), ANT1, Mid Channel Occupied Bandwidth



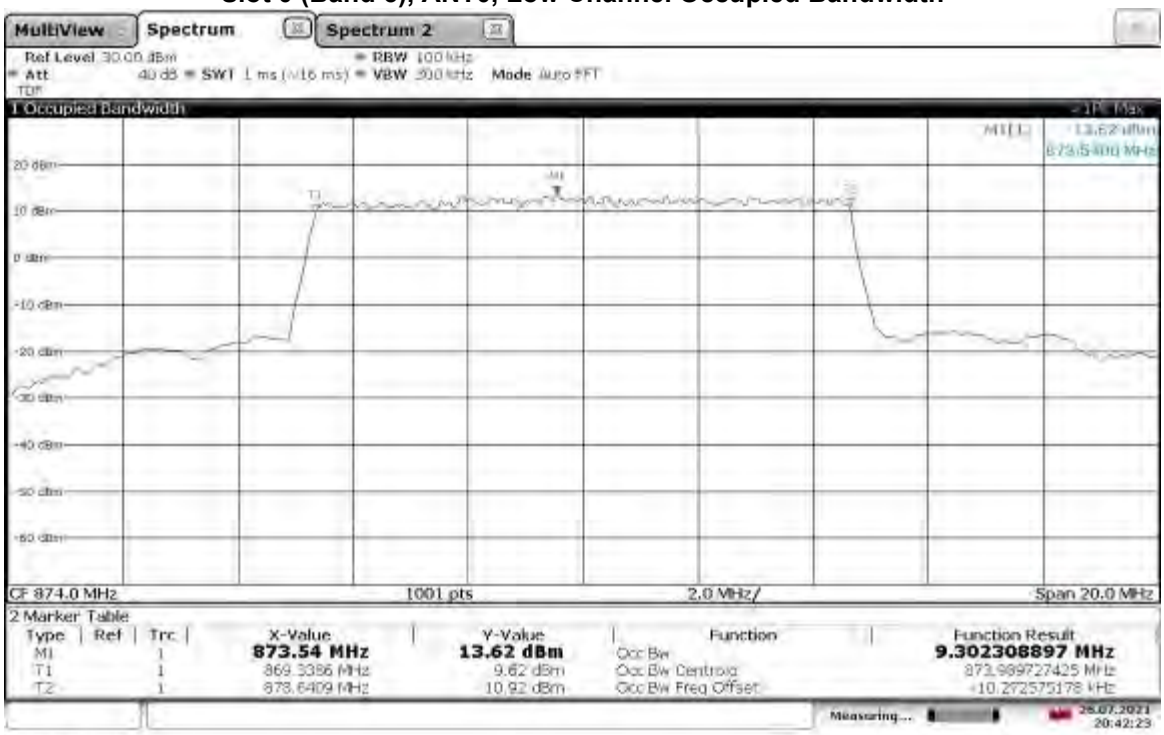
TM1.1-QPSK_5 MHz Bandwidth
Slot 0 (Band 5), ANT0, High Channel Occupied Bandwidth



TM1.1-QPSK_5 MHz Bandwidth
Slot 0 (Band 5), ANT1, High Channel Occupied Bandwidth

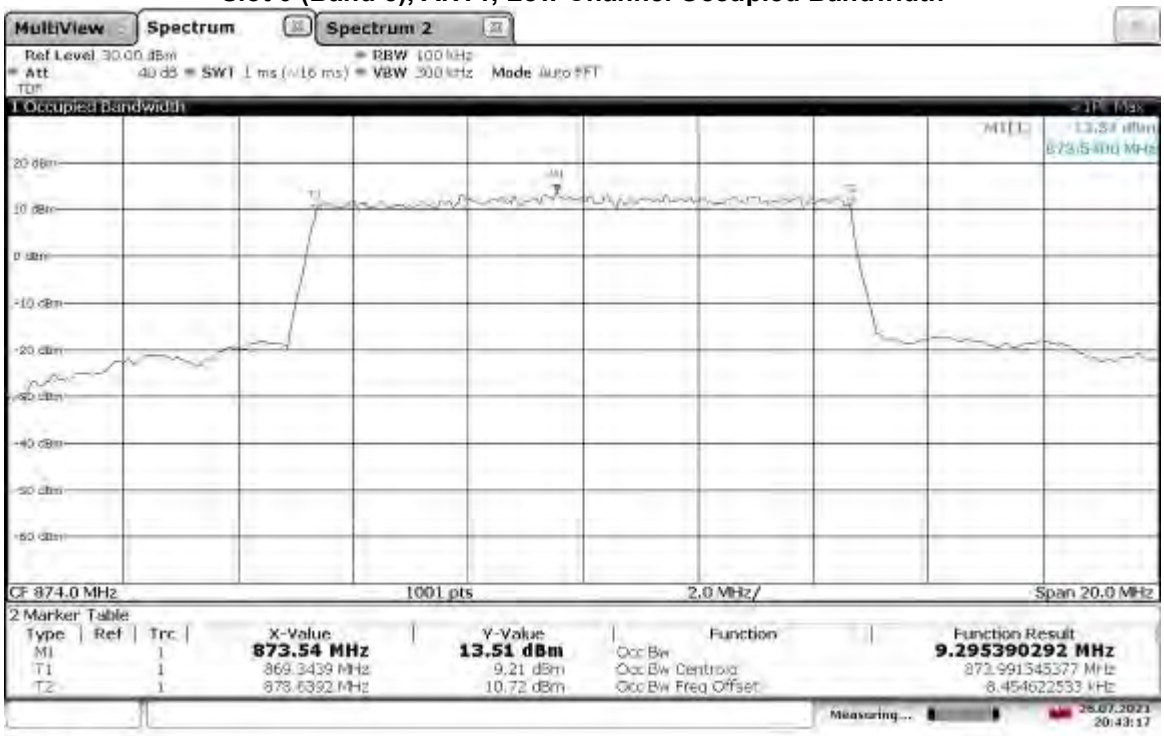


TM1.1-QPSK_10 MHz Bandwidth
Slot 0 (Band 5), ANT0, Low Channel Occupied Bandwidth



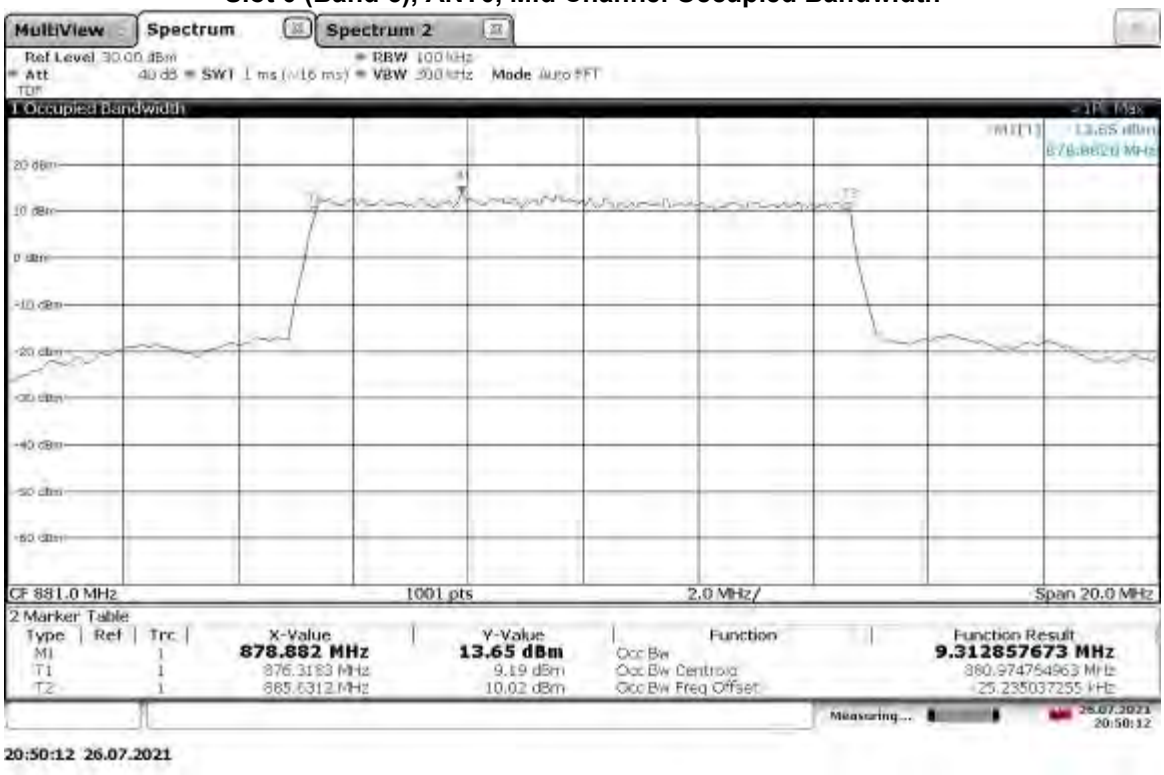
20:42:24 26.07.2021

TM1.1-QPSK_10 MHz Bandwidth
Slot 0 (Band 5), ANT1, Low Channel Occupied Bandwidth

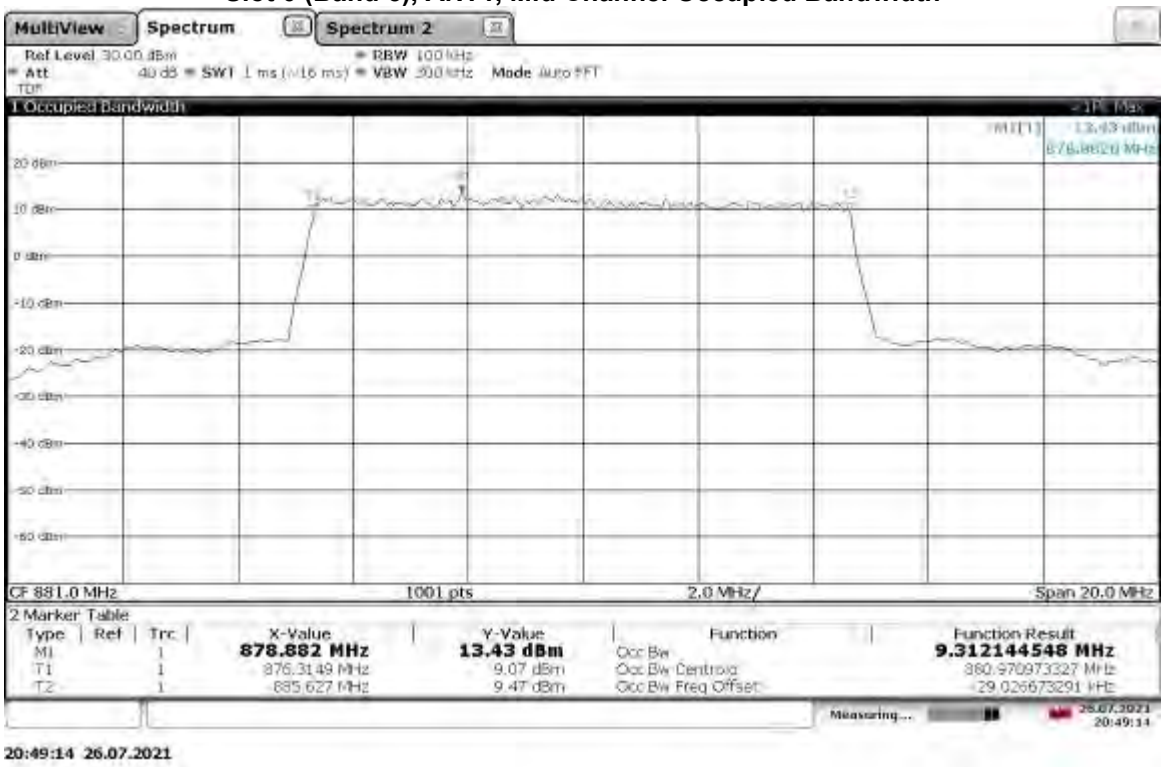


20:43:18 26.07.2021

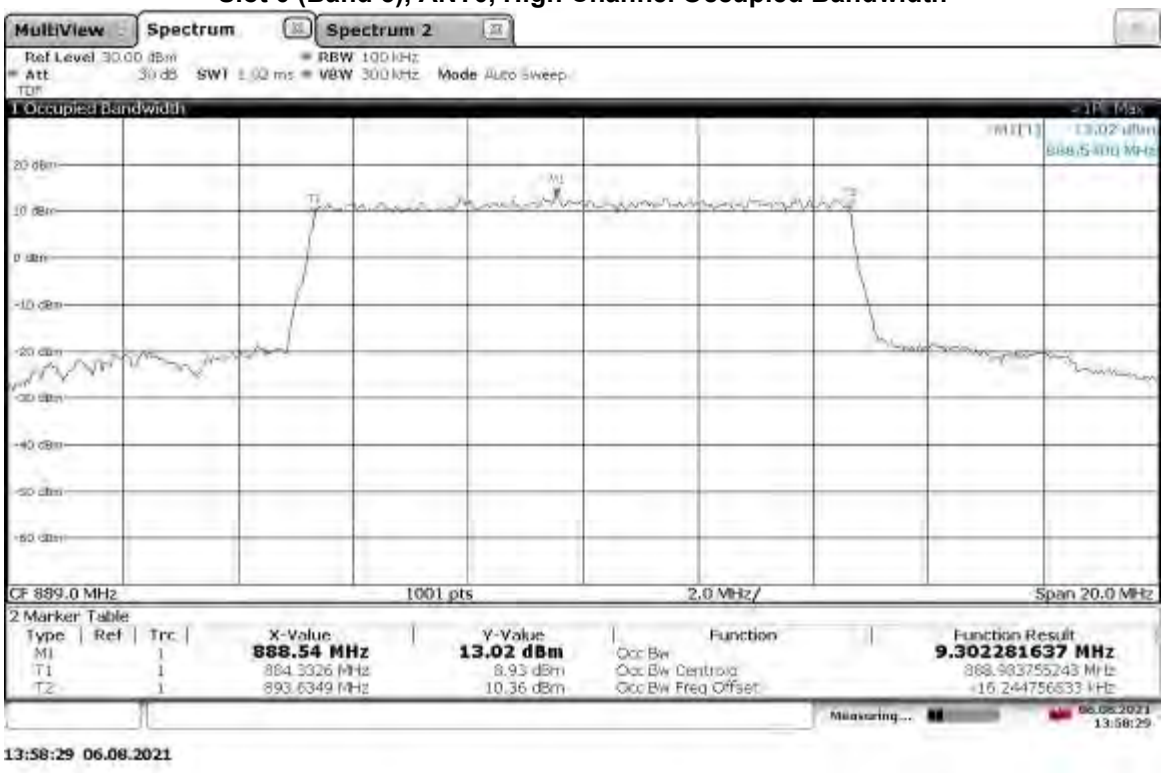
TM1.1-QPSK_10 MHz Bandwidth
Slot 0 (Band 5), ANT0, Mid Channel Occupied Bandwidth



TM1.1-QPSK_10 MHz Bandwidth
Slot 0 (Band 5), ANT1, Mid Channel Occupied Bandwidth

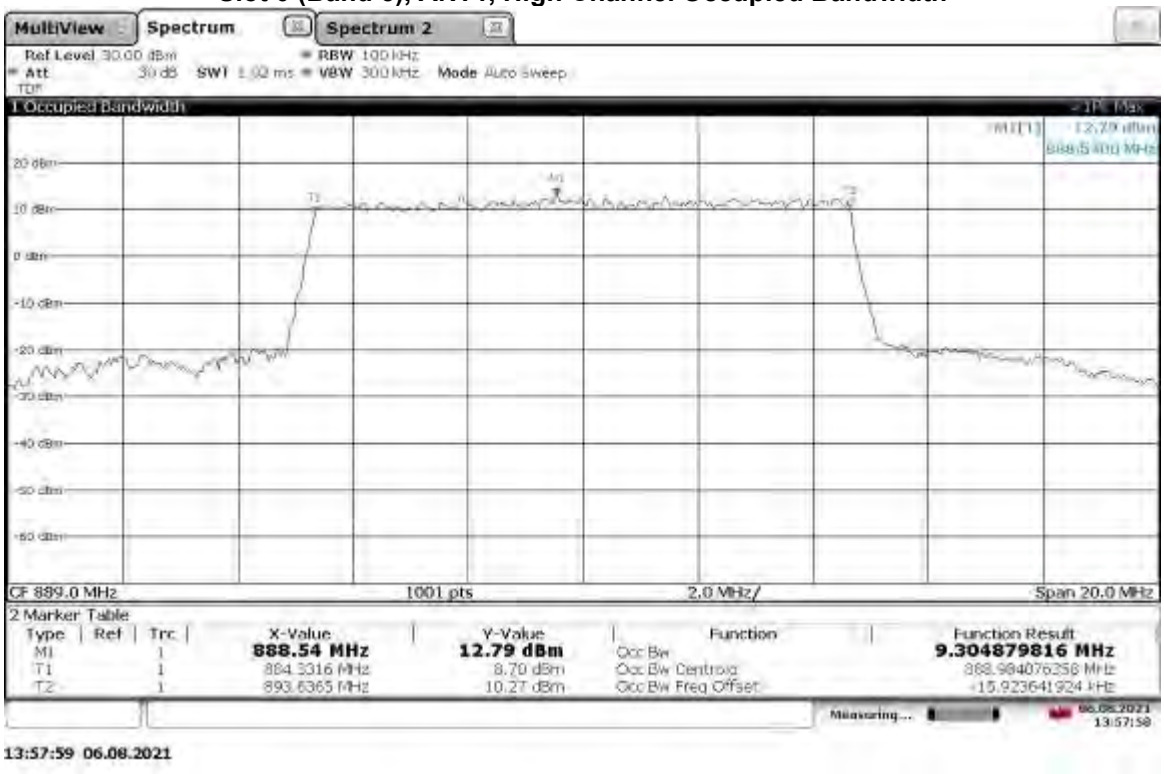


TM1.1-QPSK_10 MHz Bandwidth
Slot 0 (Band 5), ANT0, High Channel Occupied Bandwidth



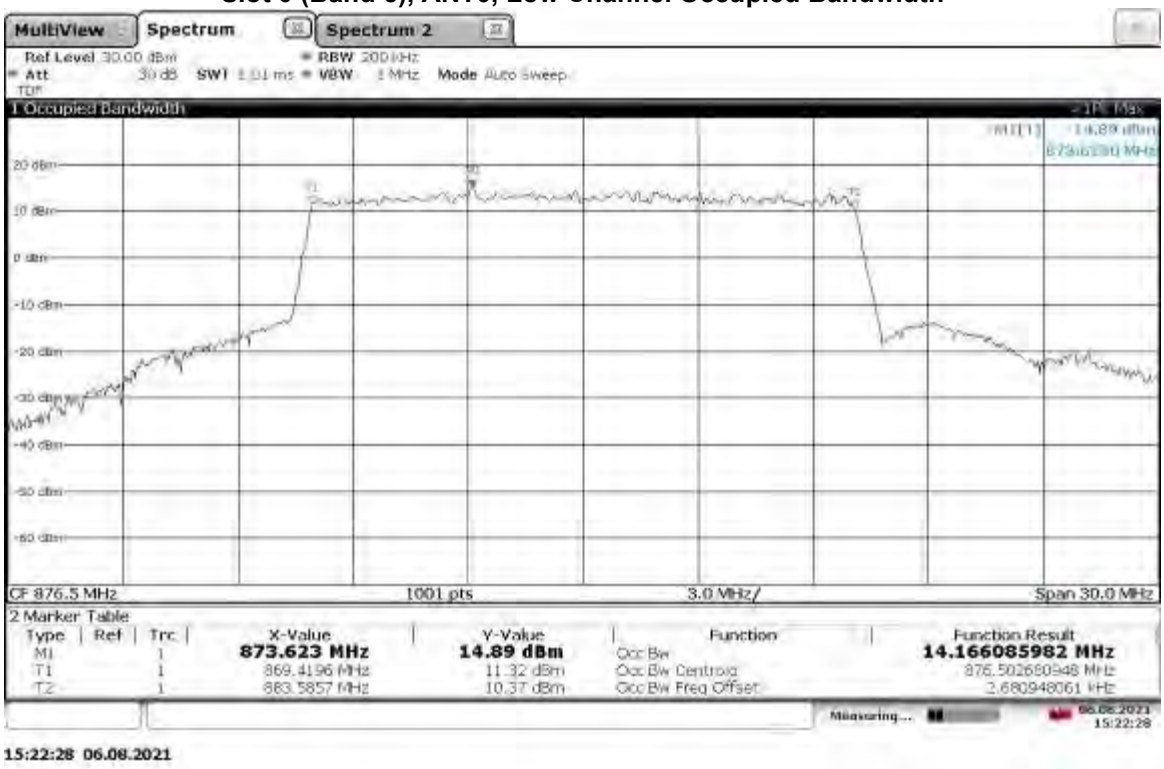
13:58:29 06.08.2021

TM1.1-QPSK_10 MHz Bandwidth
Slot 0 (Band 5), ANT1, High Channel Occupied Bandwidth



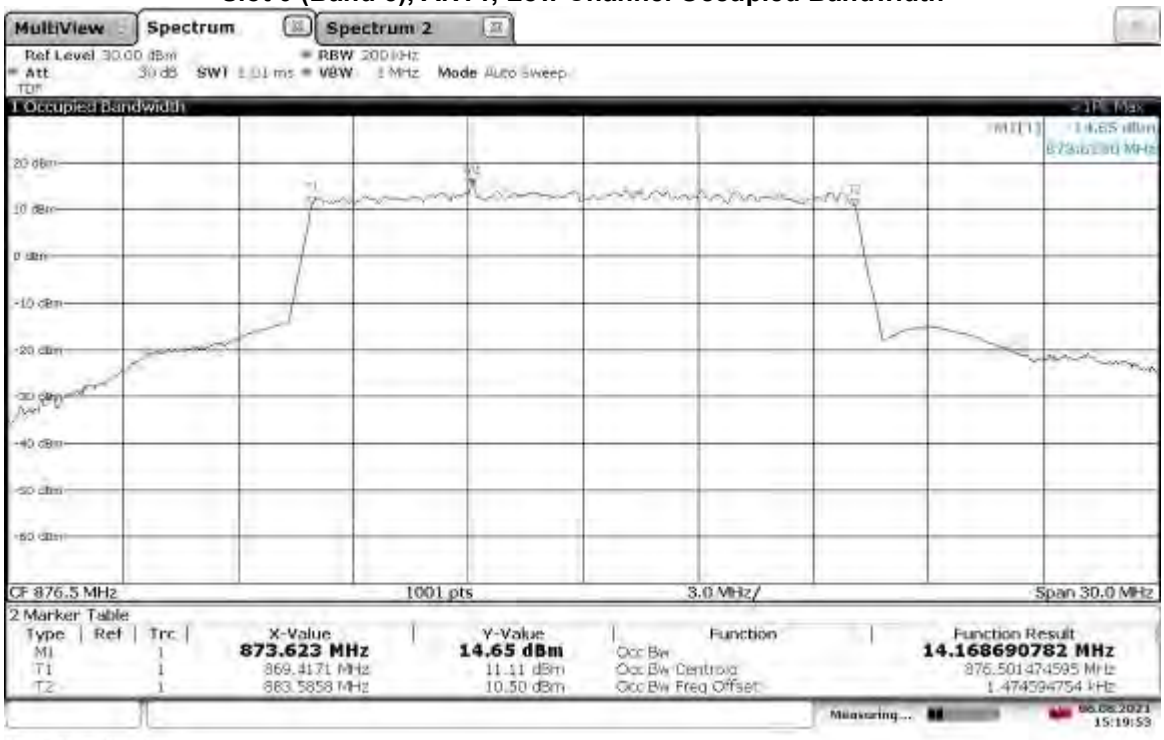
13:57:59 06.08.2021

TM1.1-QPSK_15 MHz Bandwidth
Slot 0 (Band 5), ANT0, Low Channel Occupied Bandwidth



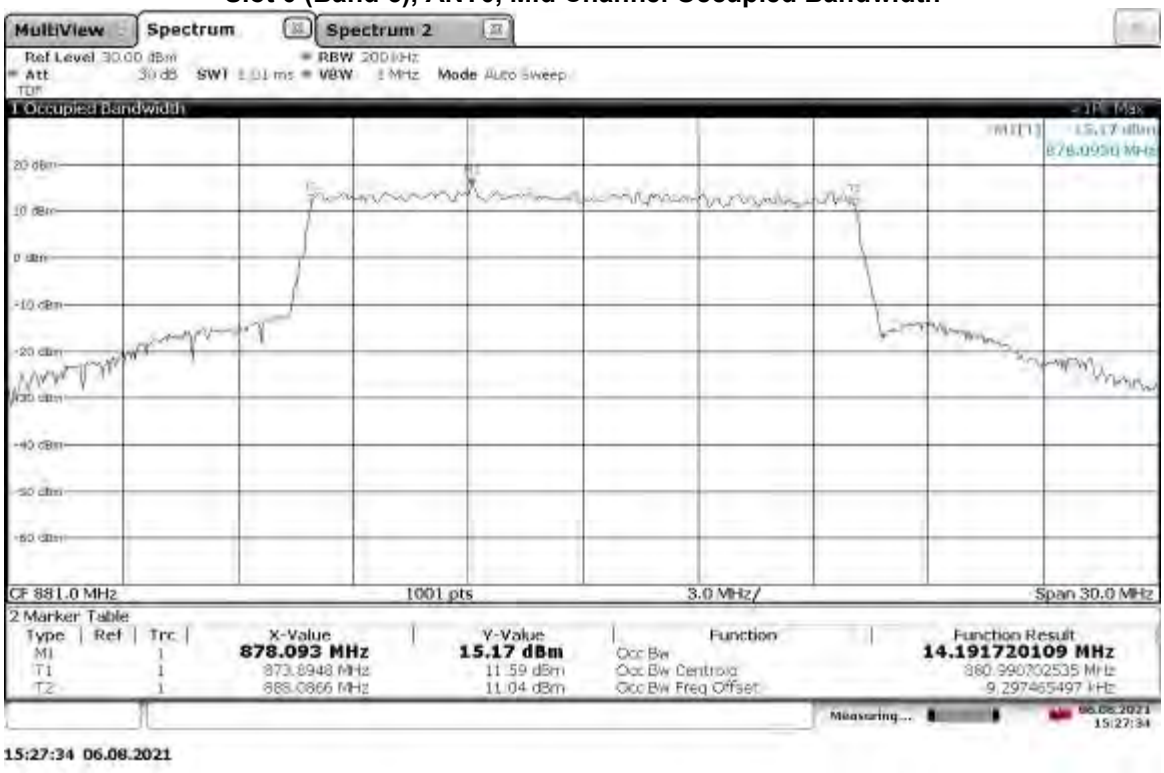
15:22:28 06.08.2021

TM1.1-QPSK_15 MHz Bandwidth
Slot 0 (Band 5), ANT1, Low Channel Occupied Bandwidth



15:19:53 06.08.2021

TM1.1-QPSK_15 MHz Bandwidth
Slot 0 (Band 5), ANT0, Mid Channel Occupied Bandwidth



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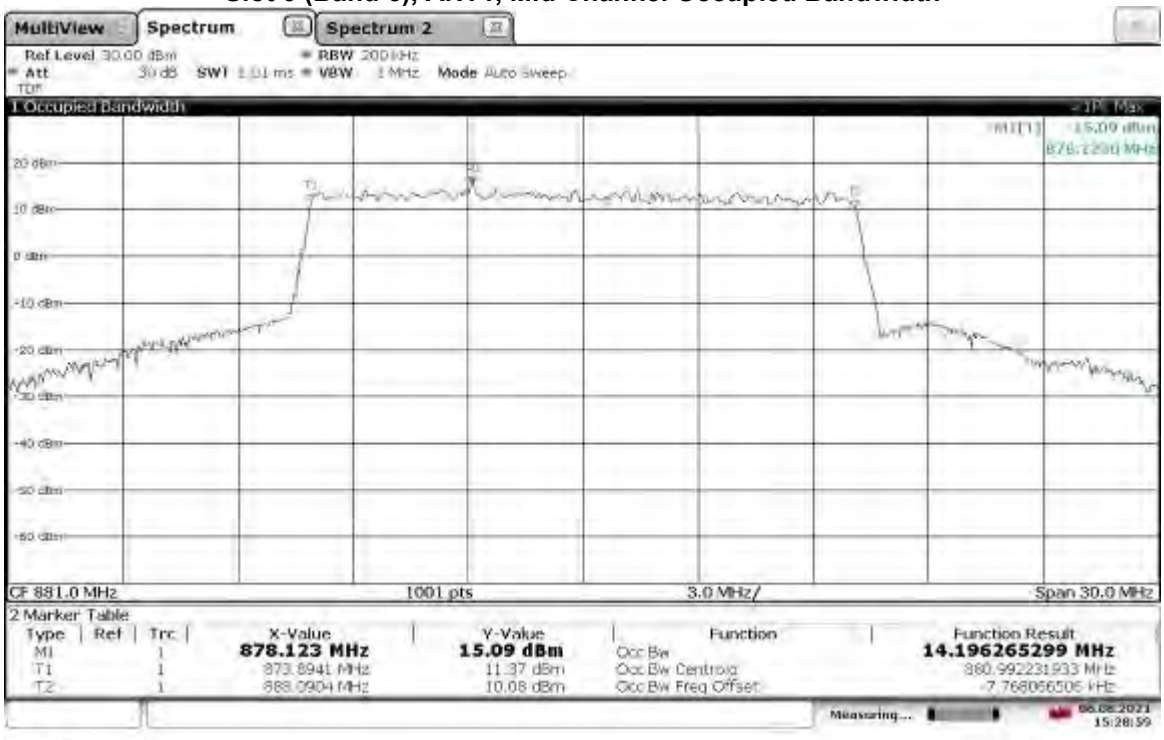
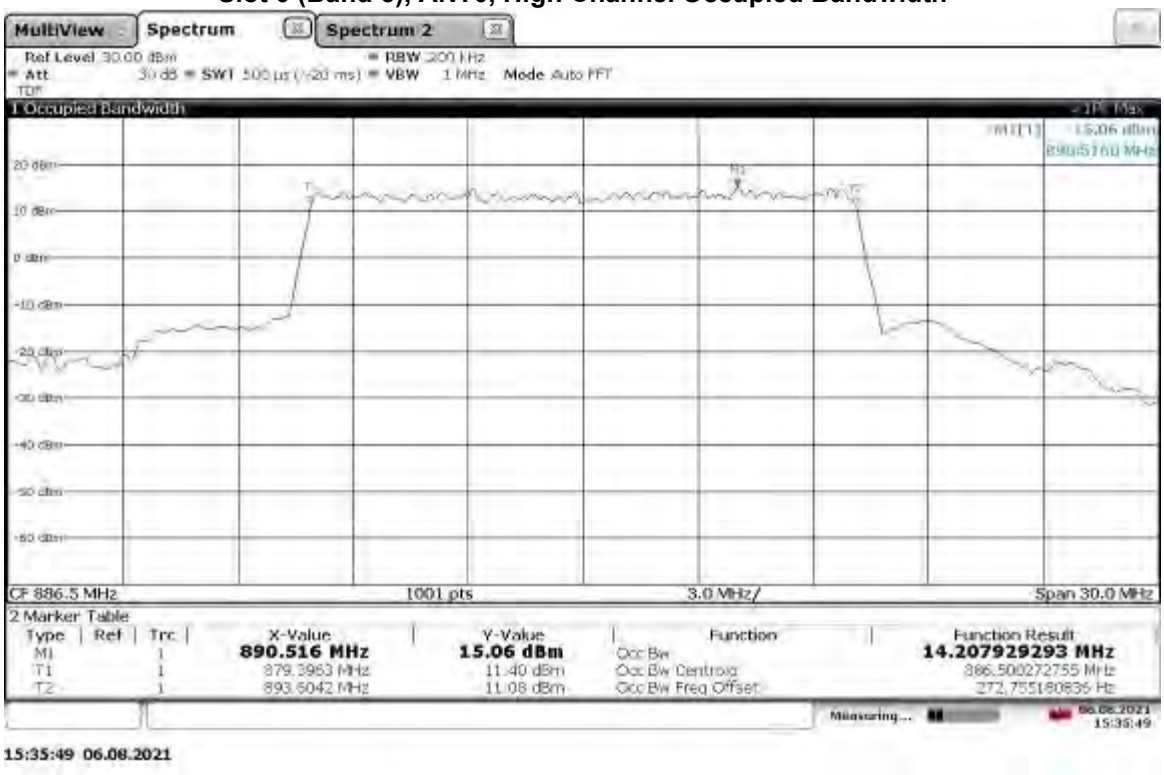
TM1.1-QPSK_15 MHz Bandwidth
Slot 0 (Band 5), ANT1, Mid Channel Occupied Bandwidth



15:28:59 06.08.2021

TM1.1-QPSK_15 MHz Bandwidth
Slot 0 (Band 5), ANT0, High Channel Occupied Bandwidth



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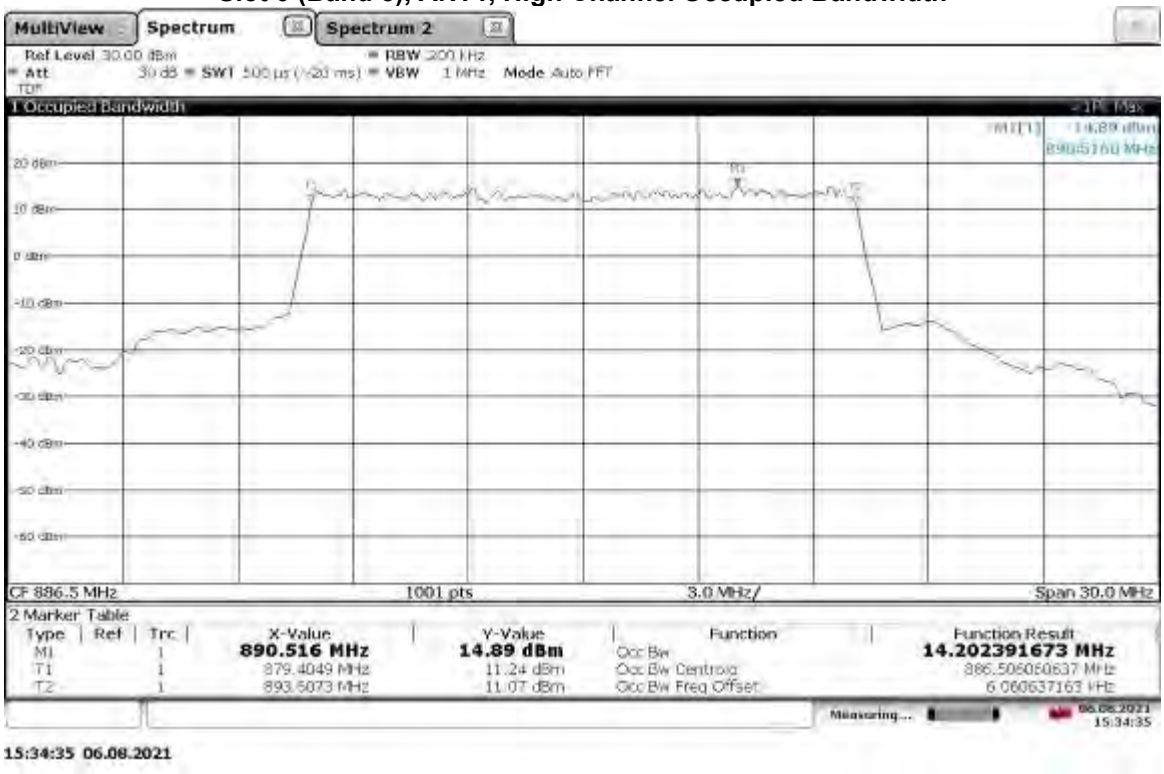
TM1.1-QPSK_15 MHz Bandwidth
Slot 0 (Band 5), ANT1, High Channel Occupied Bandwidth



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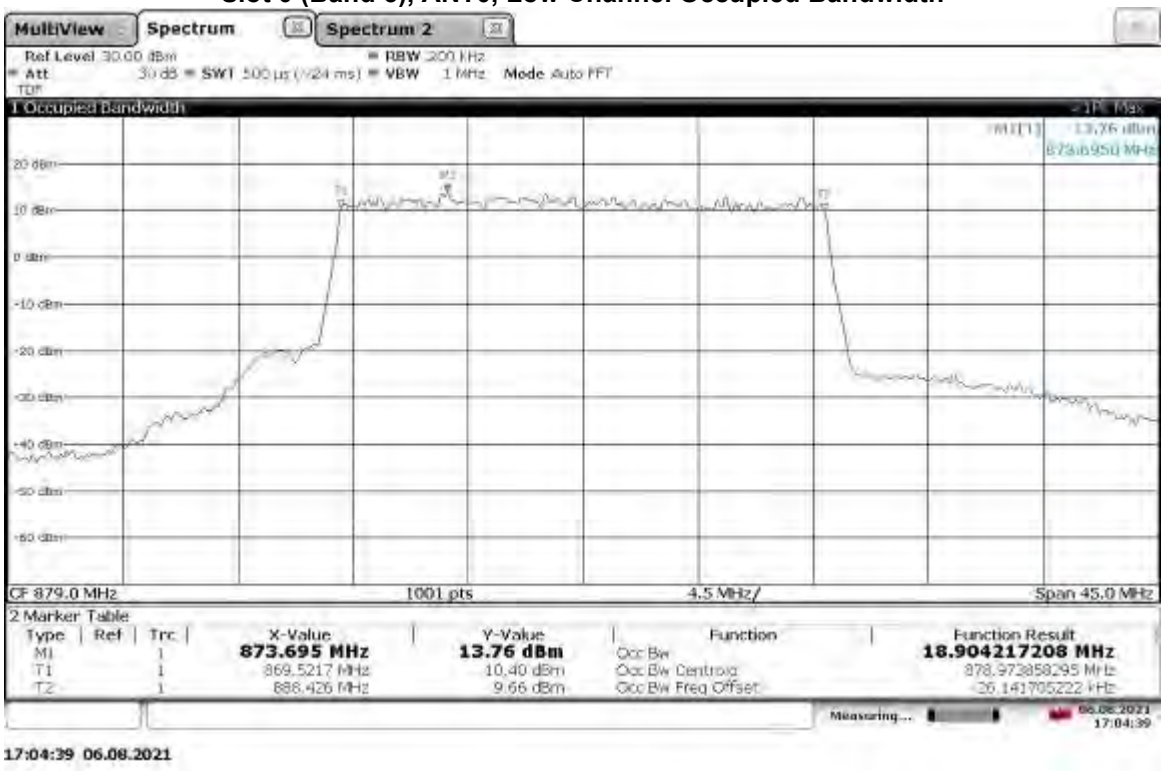
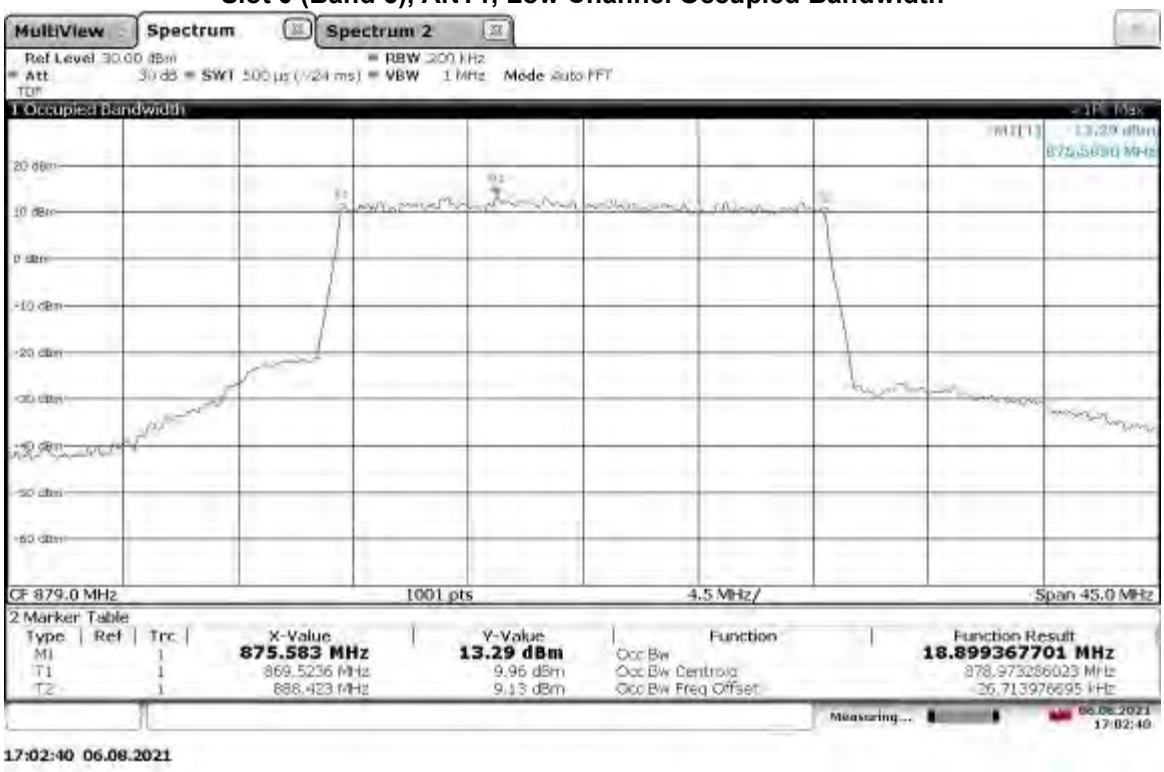
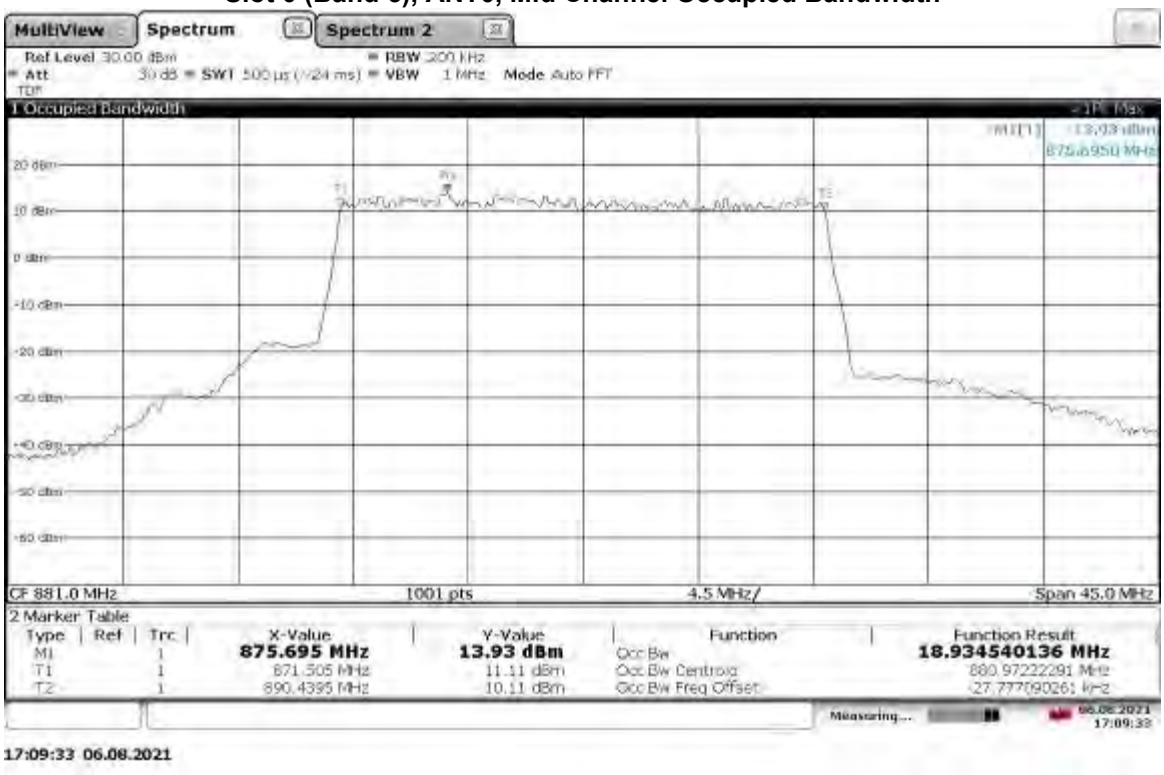
TM1.1-QPSK_20 MHz Bandwidth
Slot 0 (Band 5), ANT0, Low Channel Occupied Bandwidth



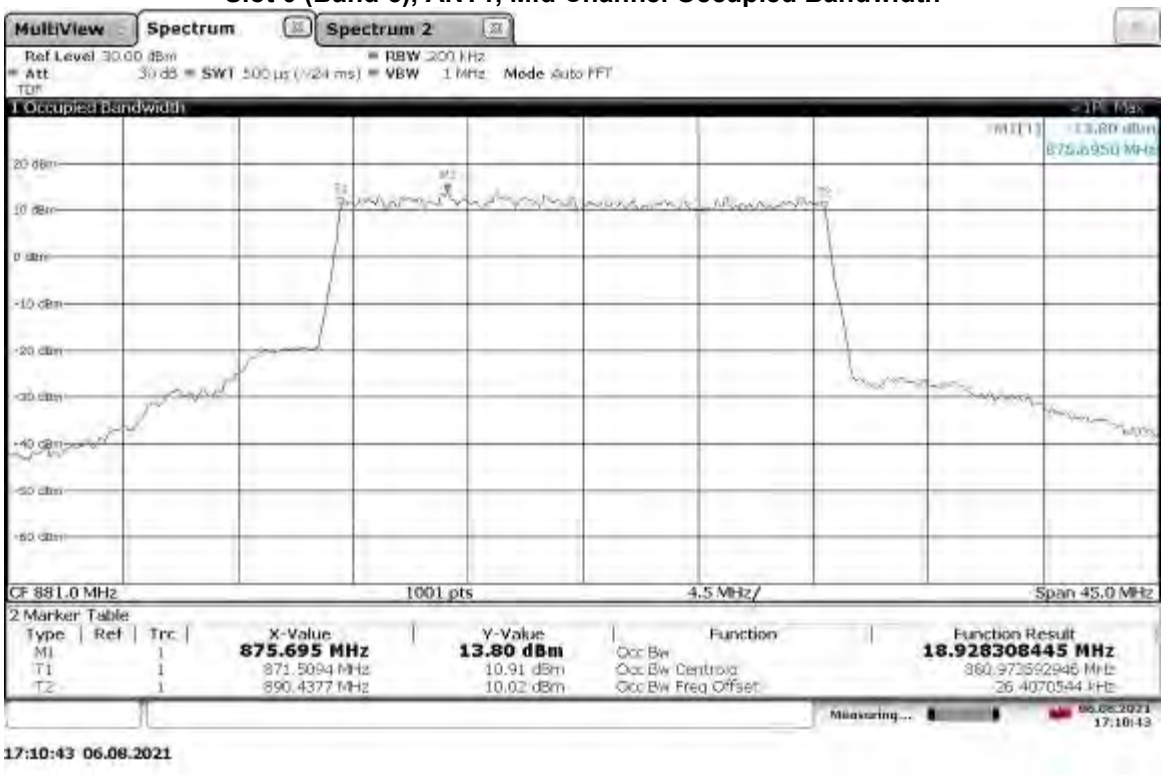
TM1.1-QPSK_20 MHz Bandwidth
Slot 0 (Band 5), ANT1, Low Channel Occupied Bandwidth



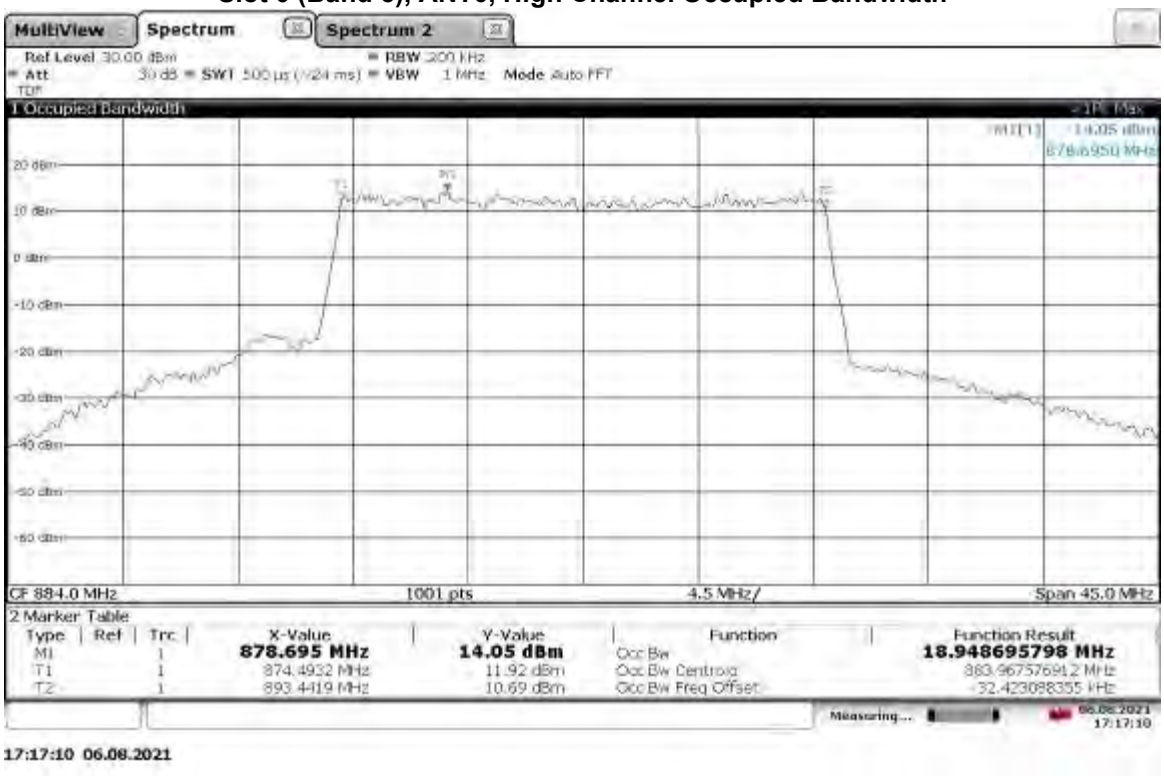
TM1.1-QPSK_20 MHz Bandwidth
Slot 0 (Band 5), ANT0, Mid Channel Occupied Bandwidth



TM1.1-QPSK_20 MHz Bandwidth
Slot 0 (Band 5), ANT1, Mid Channel Occupied Bandwidth

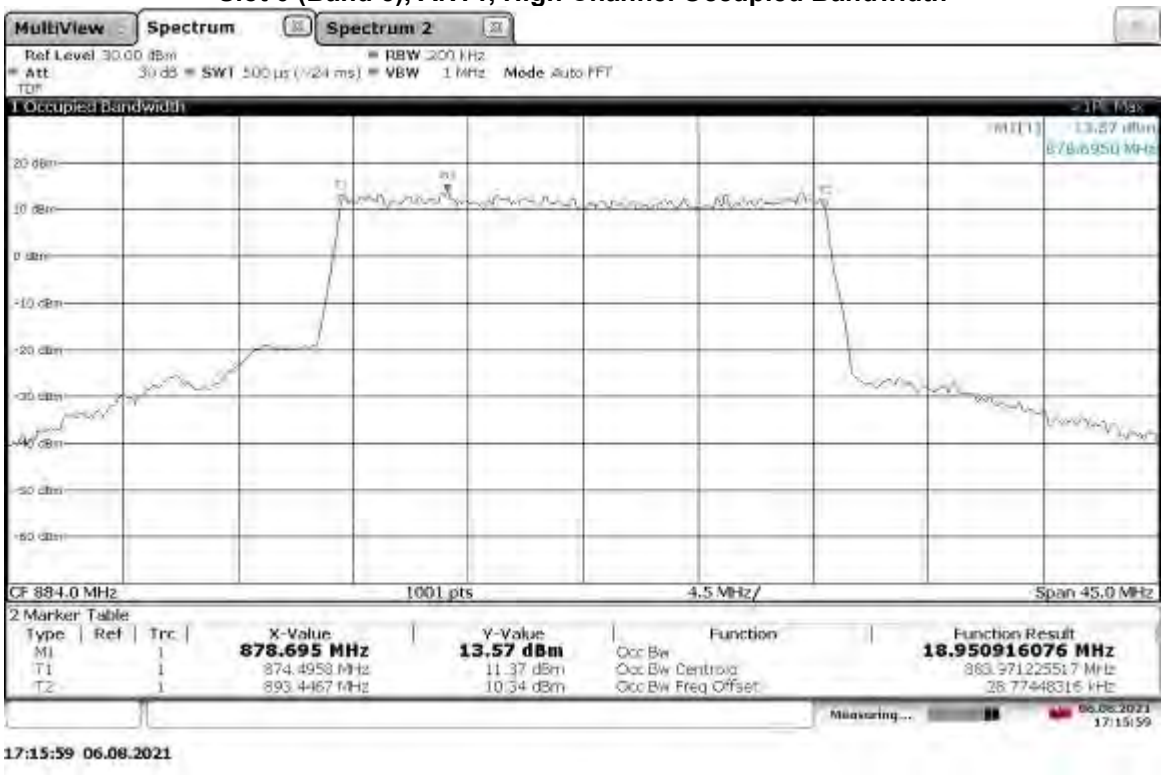


TM1.1-QPSK_20 MHz Bandwidth
Slot 0 (Band 5), ANT0, High Channel Occupied Bandwidth



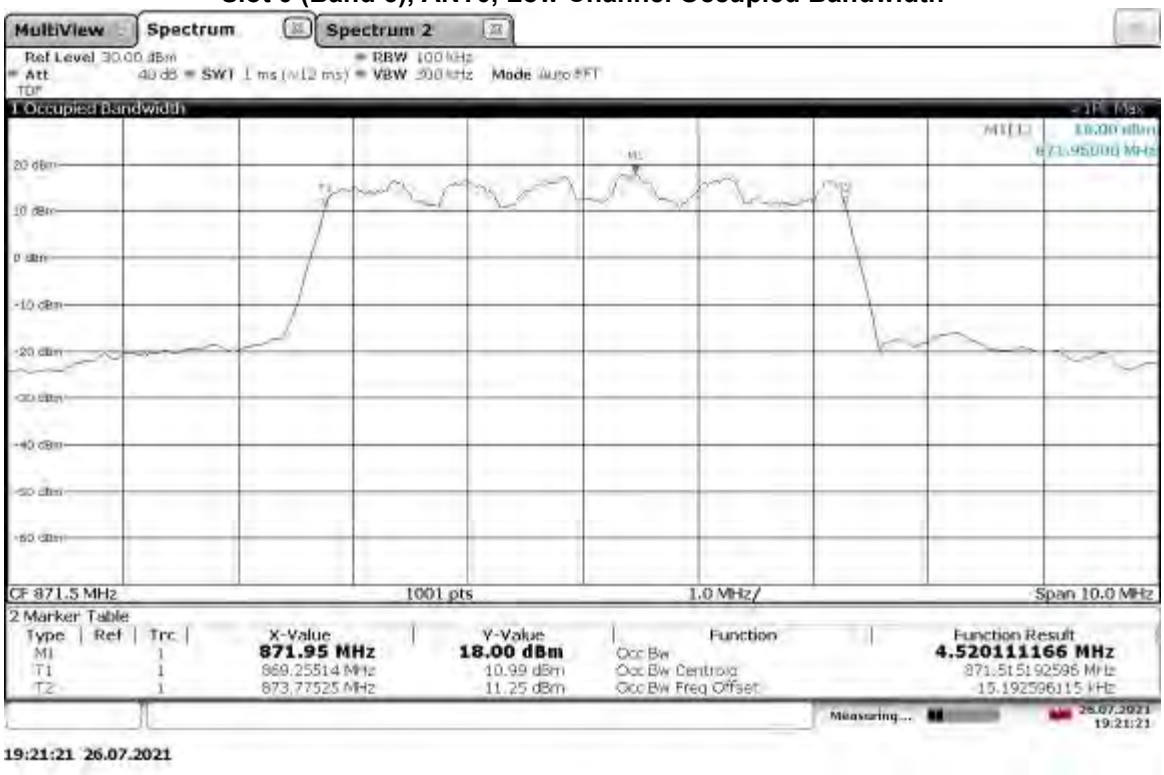
17:17:10 06.08.2021

TM1.1-QPSK_20 MHz Bandwidth
Slot 0 (Band 5), ANT1, High Channel Occupied Bandwidth



17:15:59 06.08.2021

TM3.2-16QAM_5 MHz Bandwidth
Slot 0 (Band 5), ANT0, Low Channel Occupied Bandwidth

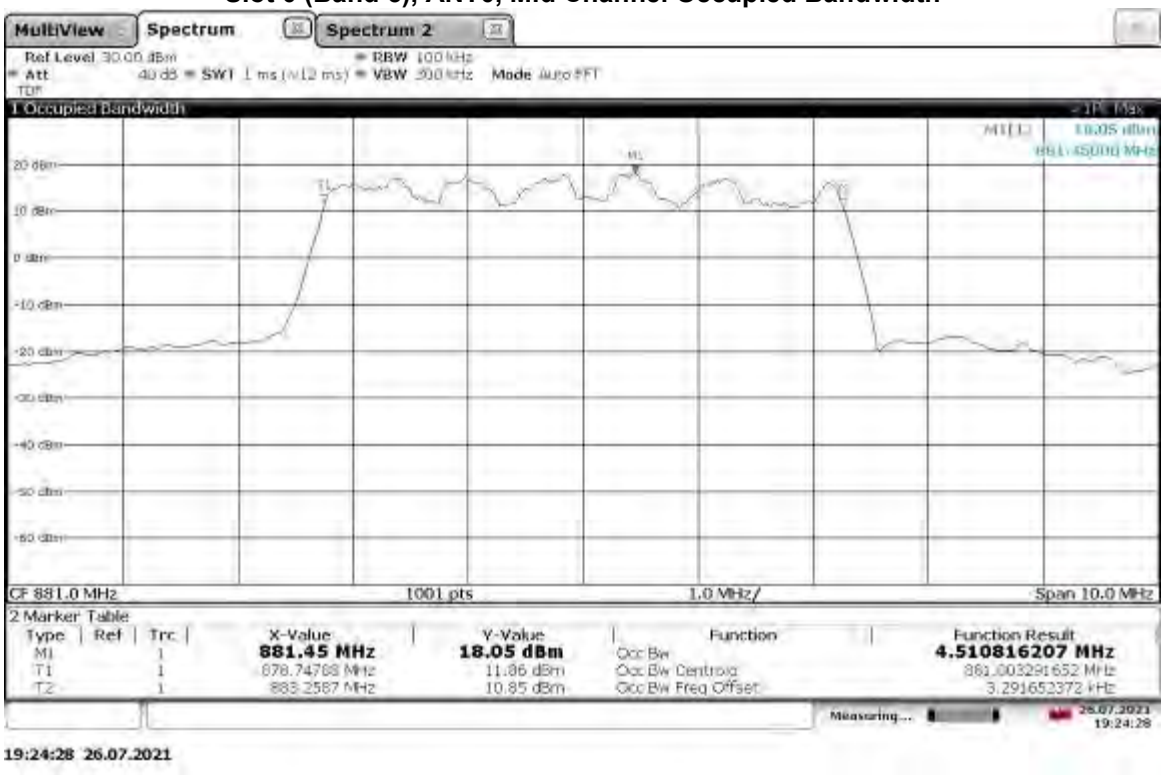


19:21:21 26.07.2021

TM3.2-16QAM_5 MHz Bandwidth
Slot 0 (Band 5), ANT1, Low Channel Occupied Bandwidth

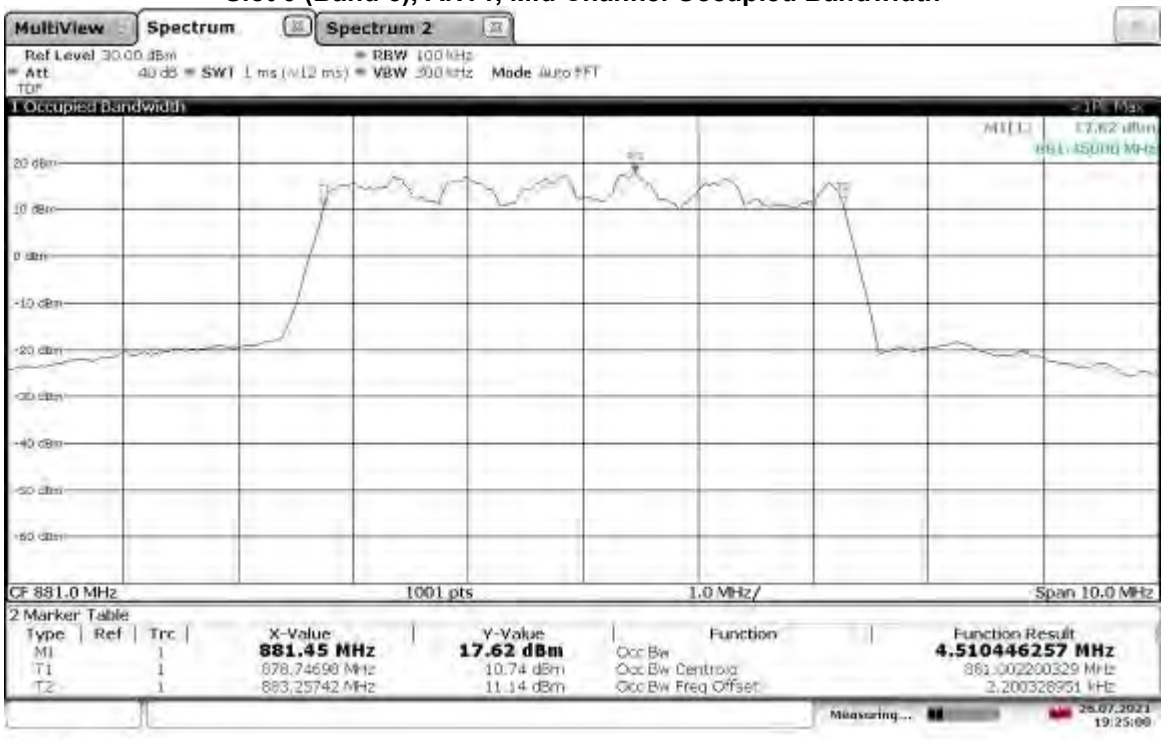
19:20:42 26.07.2021

TM3.2-16QAM_5 MHz Bandwidth
Slot 0 (Band 5), ANT0, Mid Channel Occupied Bandwidth



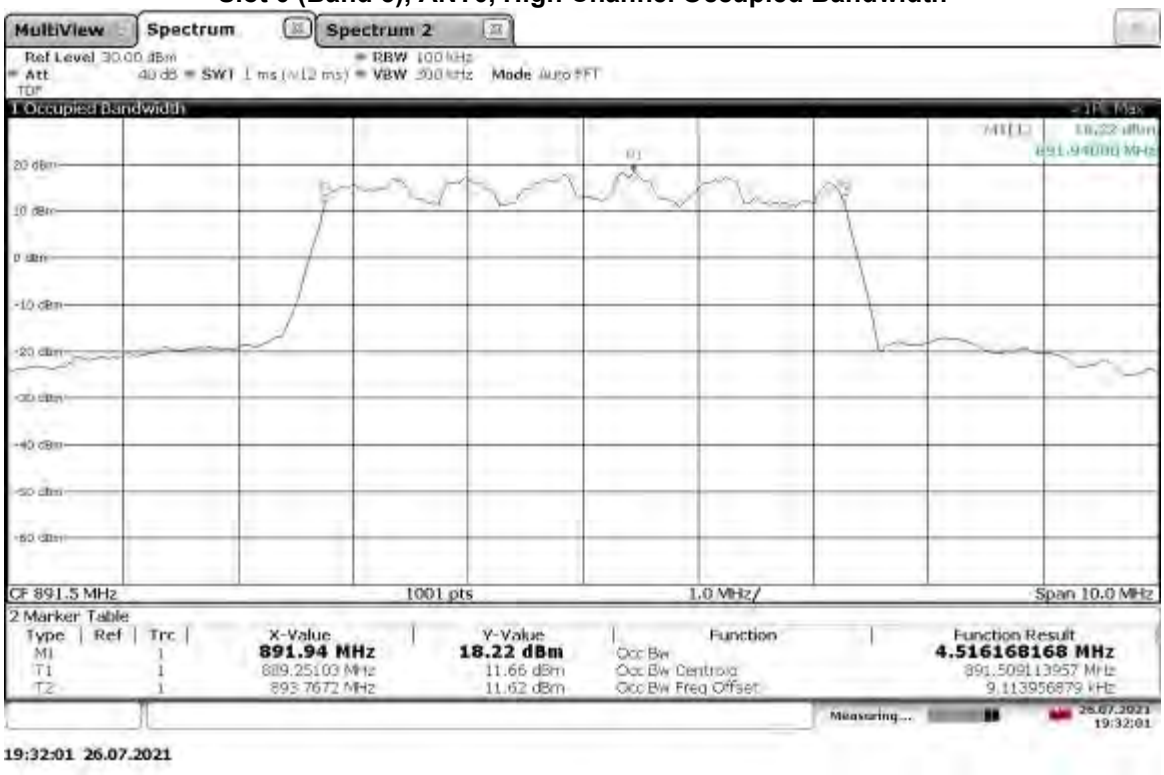
19:24:28 26.07.2021

TM3.2-16QAM_5 MHz Bandwidth
Slot 0 (Band 5), ANT1, Mid Channel Occupied Bandwidth



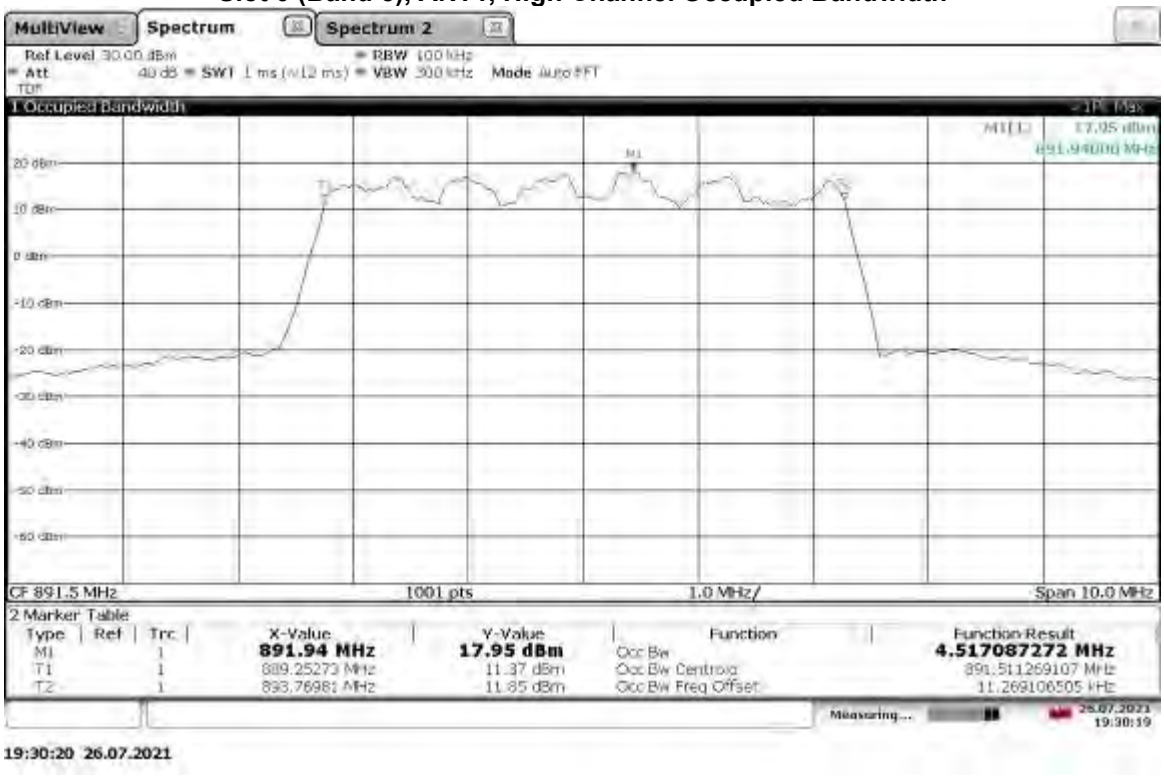
19:25:00 26.07.2021

TM3.2-16QAM_5 MHz Bandwidth
Slot 0 (Band 5), ANT0, High Channel Occupied Bandwidth



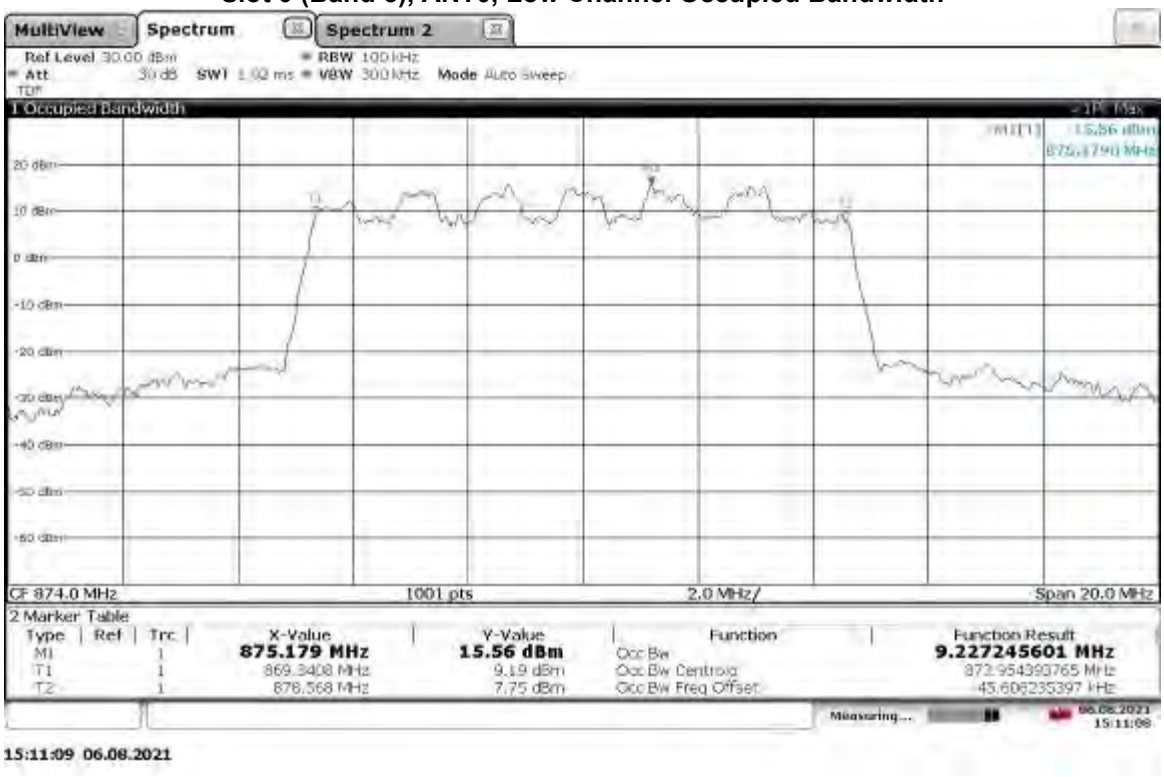
19:32:01 26.07.2021

TM3.2-16QAM_5 MHz Bandwidth
Slot 0 (Band 5), ANT1, High Channel Occupied Bandwidth

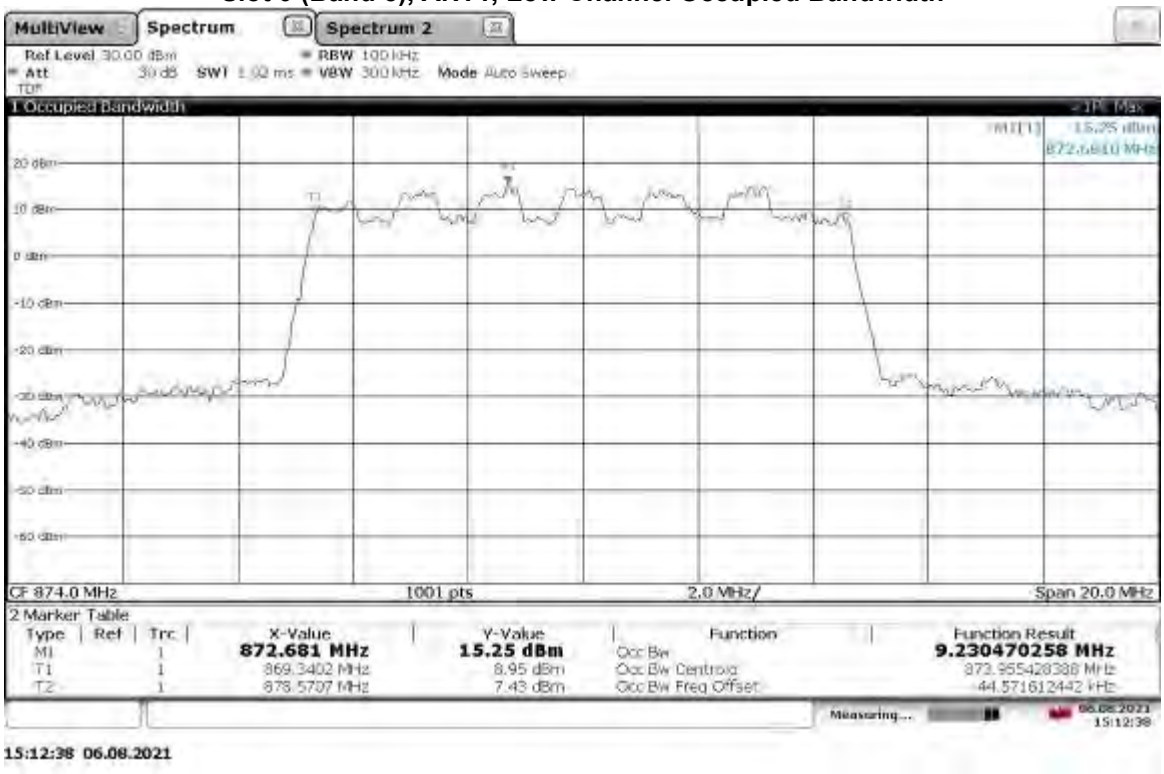


19:30:20 26.07.2021

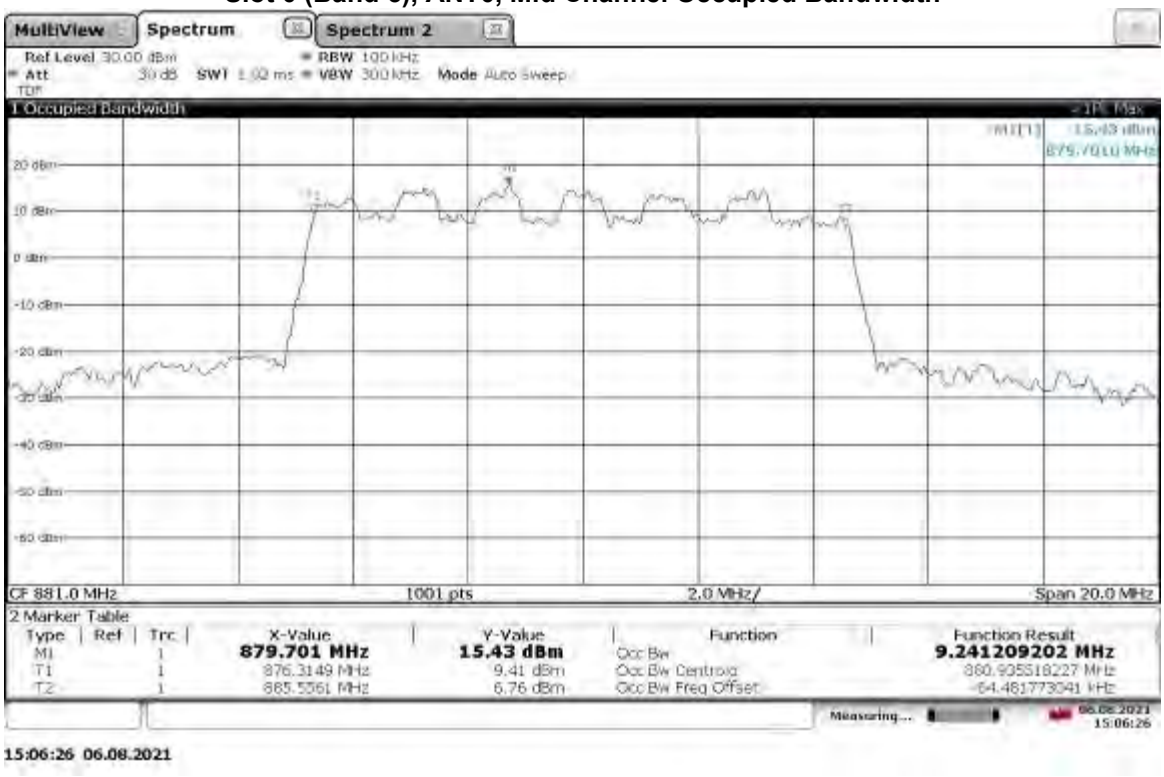
TM3.2-16QAM_10 MHz Bandwidth
Slot 0 (Band 5), ANT0, Low Channel Occupied Bandwidth



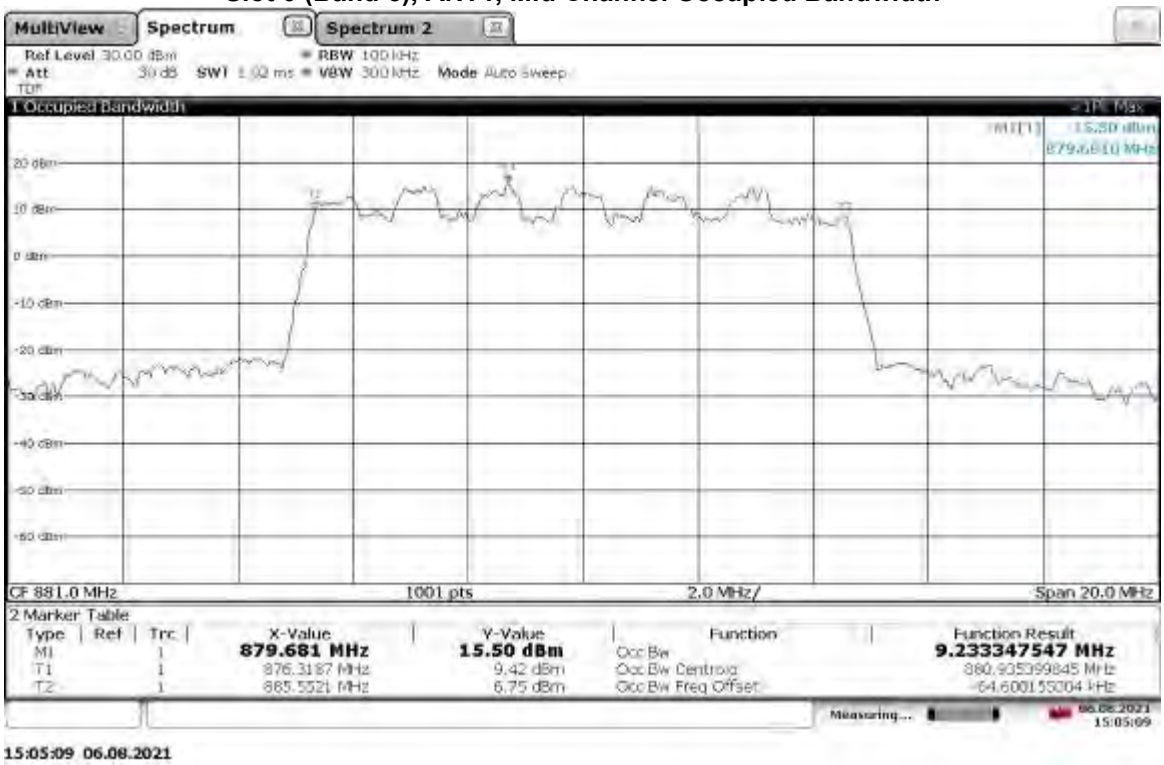
TM3.2-16QAM_10 MHz Bandwidth
Slot 0 (Band 5), ANT1, Low Channel Occupied Bandwidth



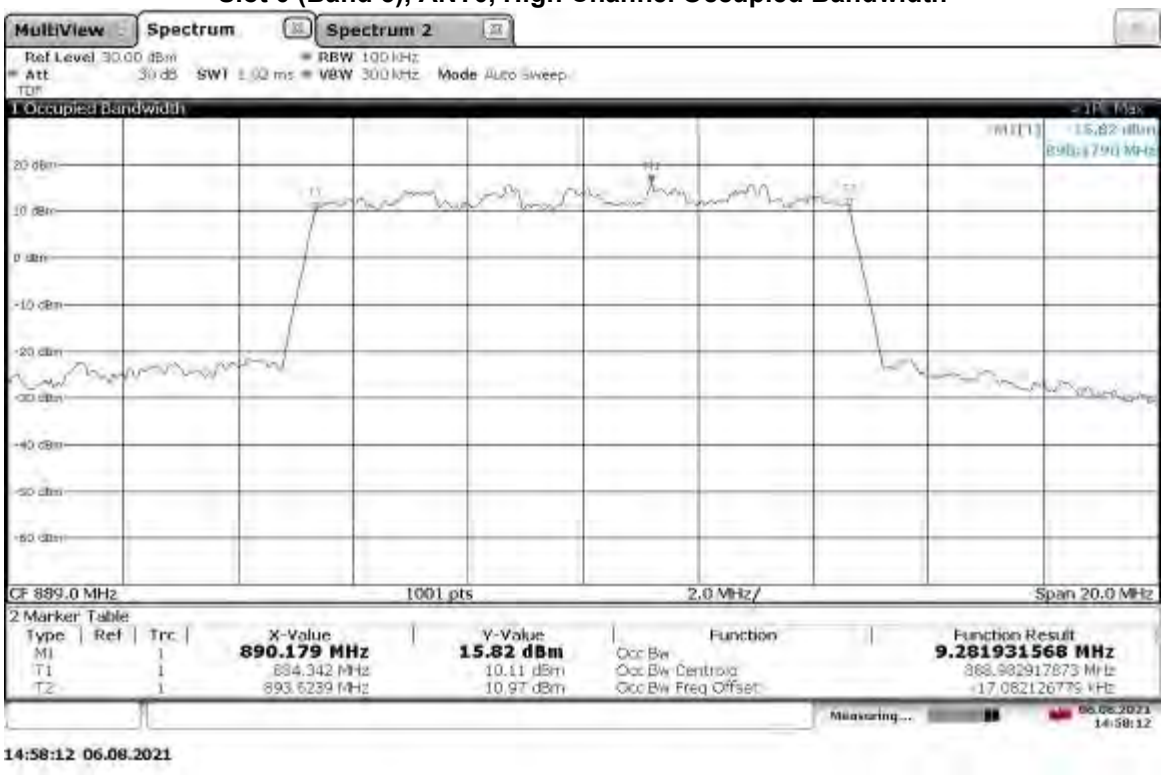
TM3.2-16QAM_10 MHz Bandwidth
Slot 0 (Band 5), ANT0, Mid Channel Occupied Bandwidth



TM3.2-16QAM_10 MHz Bandwidth
Slot 0 (Band 5), ANT1, Mid Channel Occupied Bandwidth

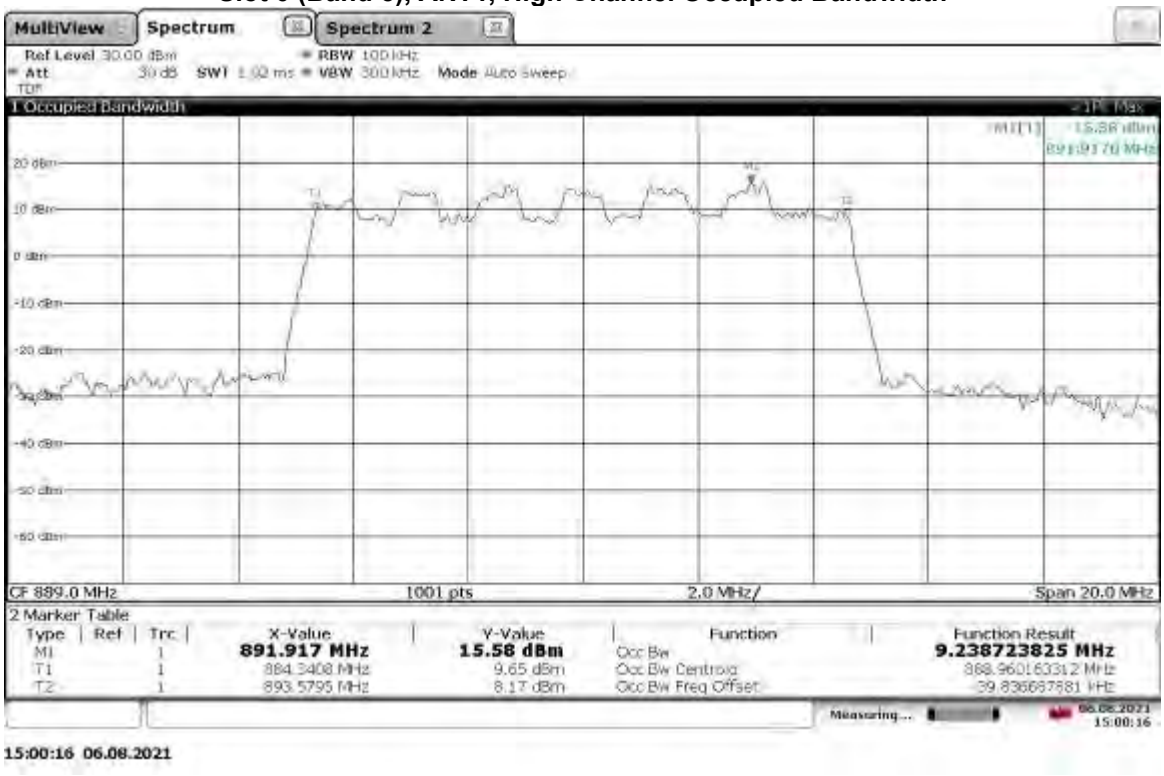


TM3.2-16QAM_10 MHz Bandwidth
Slot 0 (Band 5), ANT0, High Channel Occupied Bandwidth



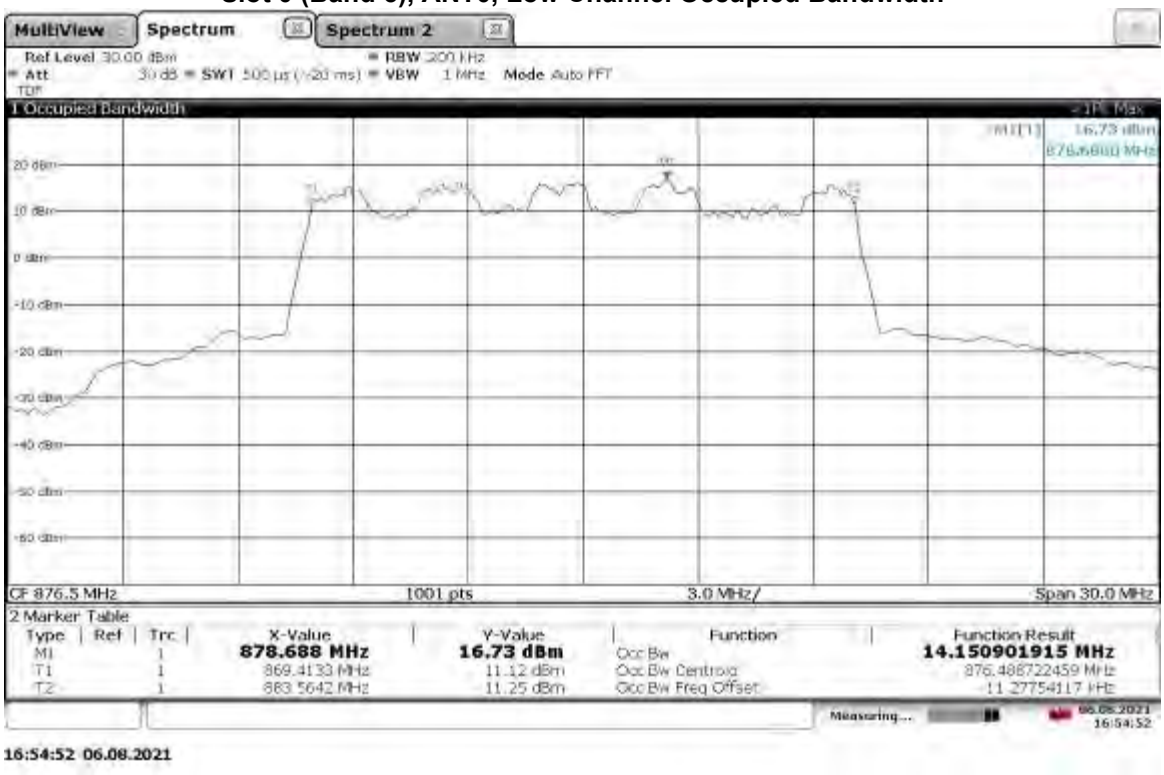
14:58:12 06.08.2021

TM3.2-16QAM_10 MHz Bandwidth
Slot 0 (Band 5), ANT1, High Channel Occupied Bandwidth



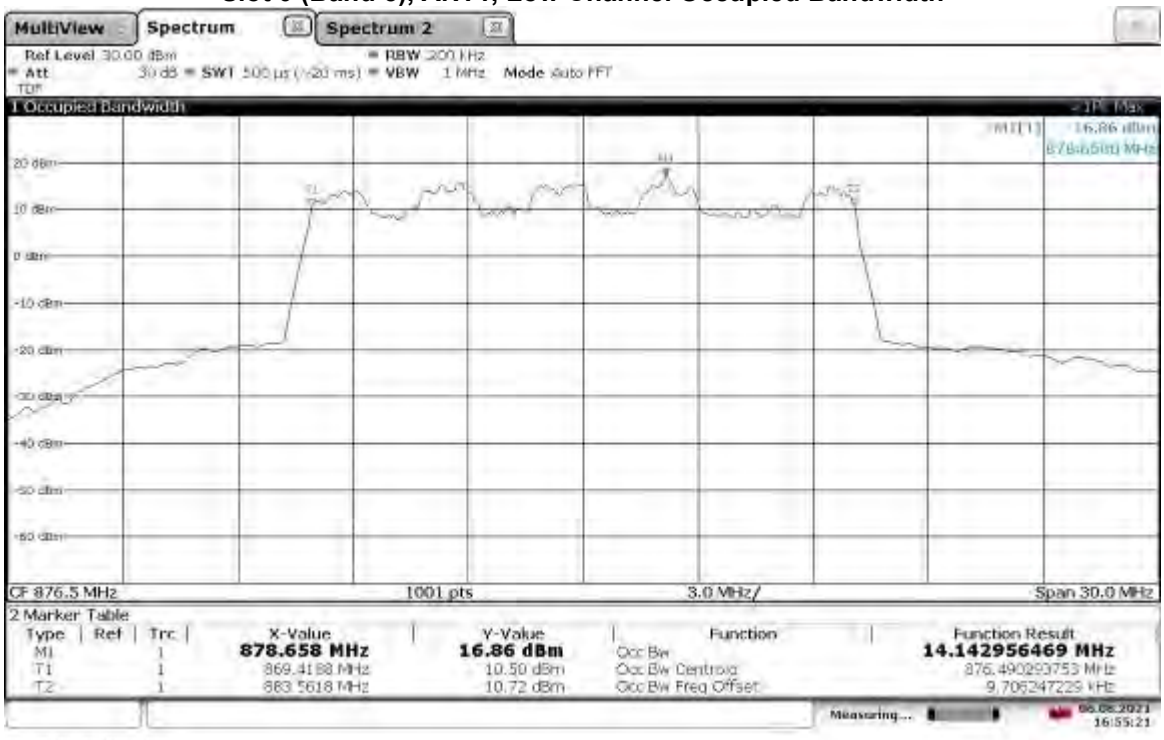
15:00:16 06.08.2021

TM3.2-16QAM_15 MHz Bandwidth
Slot 0 (Band 5), ANT0, Low Channel Occupied Bandwidth



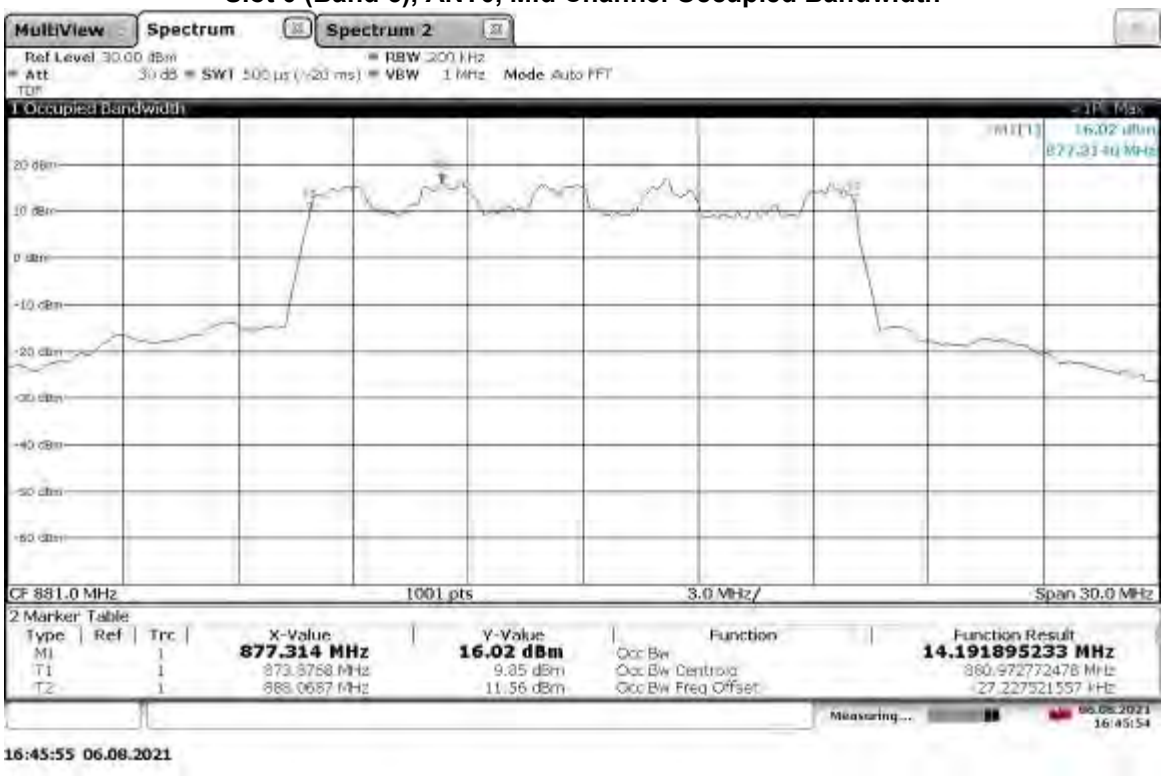
16:54:52 06.08.2021

TM3.2-16QAM_15 MHz Bandwidth
Slot 0 (Band 5), ANT1, Low Channel Occupied Bandwidth

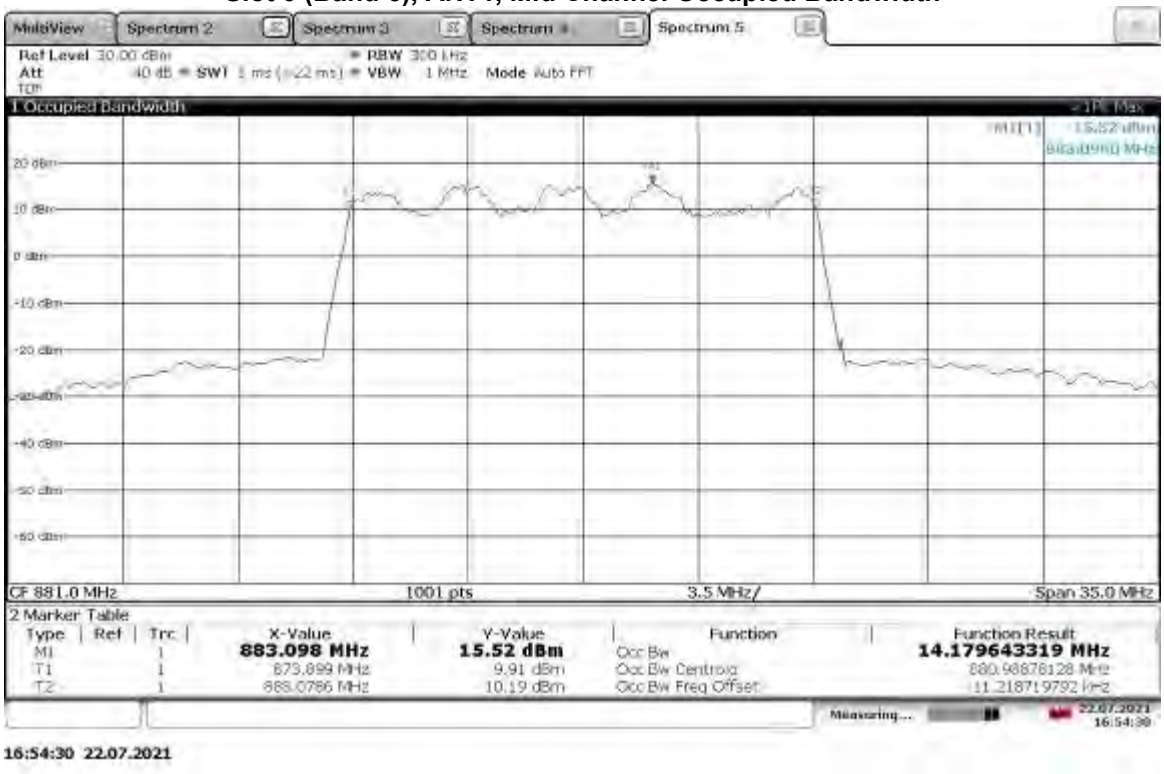


16:55:22 06.08.2021

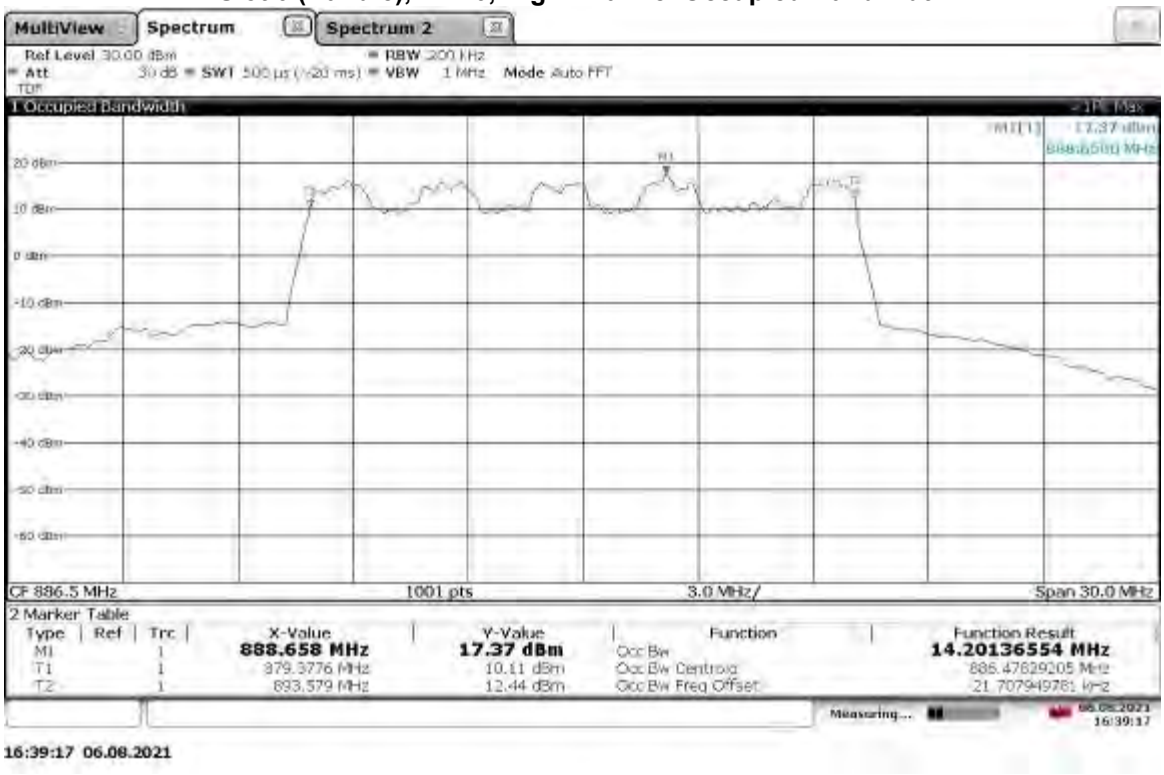
TM3.2-16QAM_15 MHz Bandwidth
Slot 0 (Band 5), ANT0, Mid Channel Occupied Bandwidth



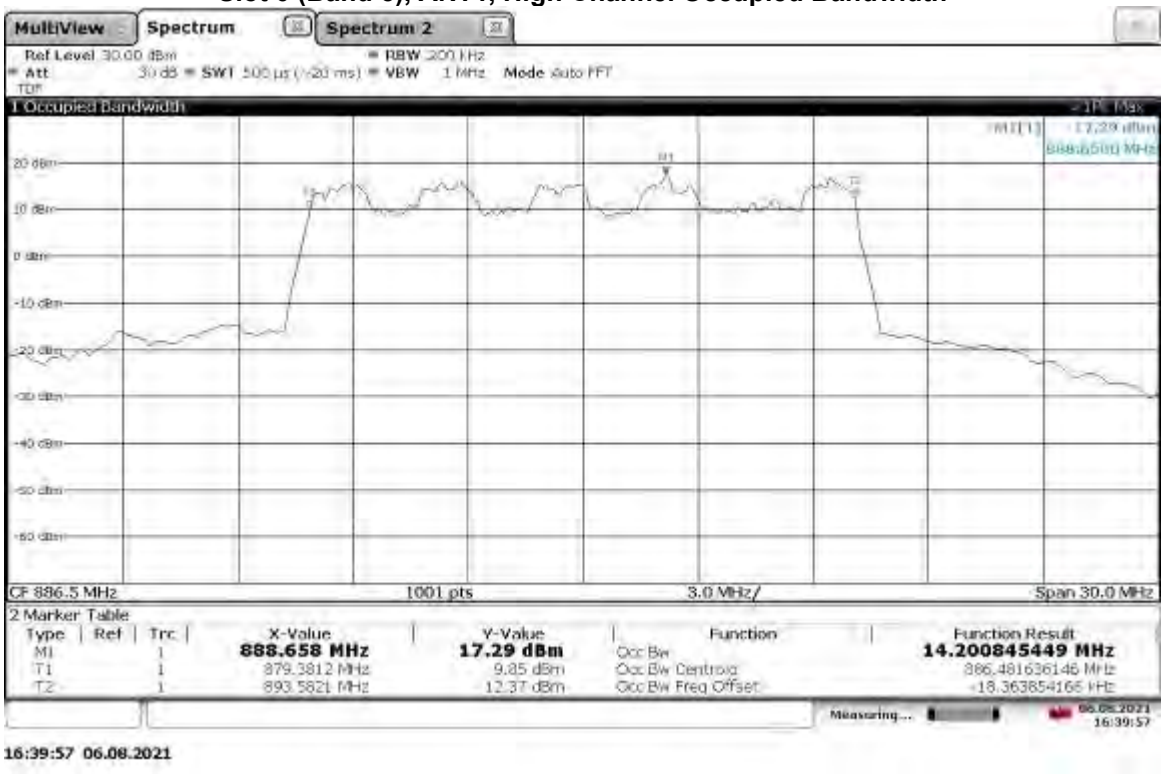
TM3.2-16QAM_15 MHz Bandwidth
Slot 0 (Band 5), ANT1, Mid Channel Occupied Bandwidth



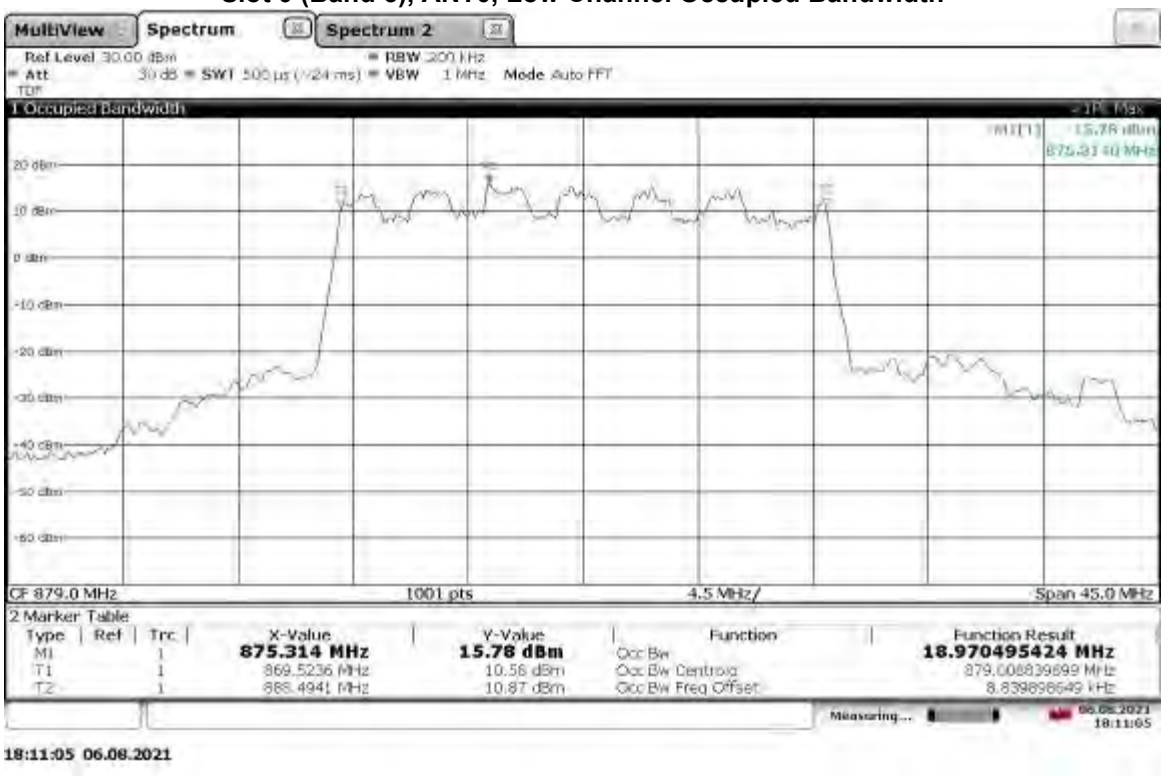
TM3.2-16QAM_15 MHz Bandwidth
Slot 0 (Band 5), ANT0, High Channel Occupied Bandwidth



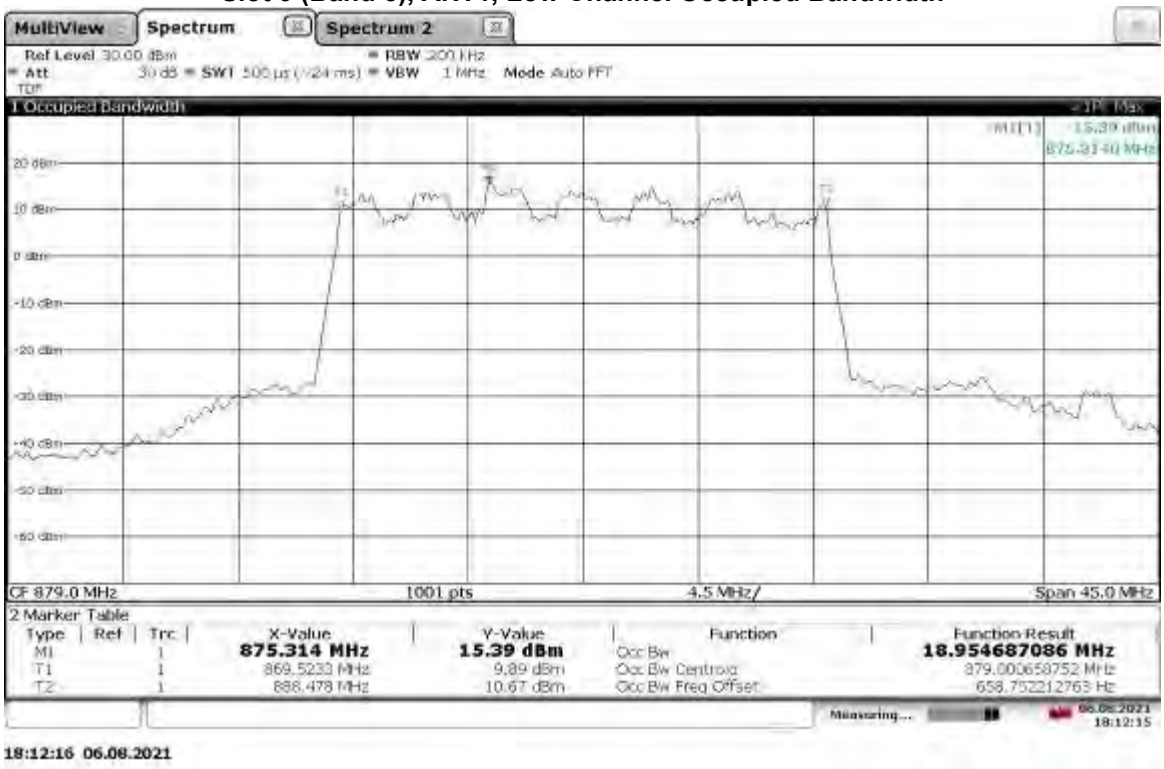
TM3.2-16QAM_15 MHz Bandwidth
Slot 0 (Band 5), ANT1, High Channel Occupied Bandwidth



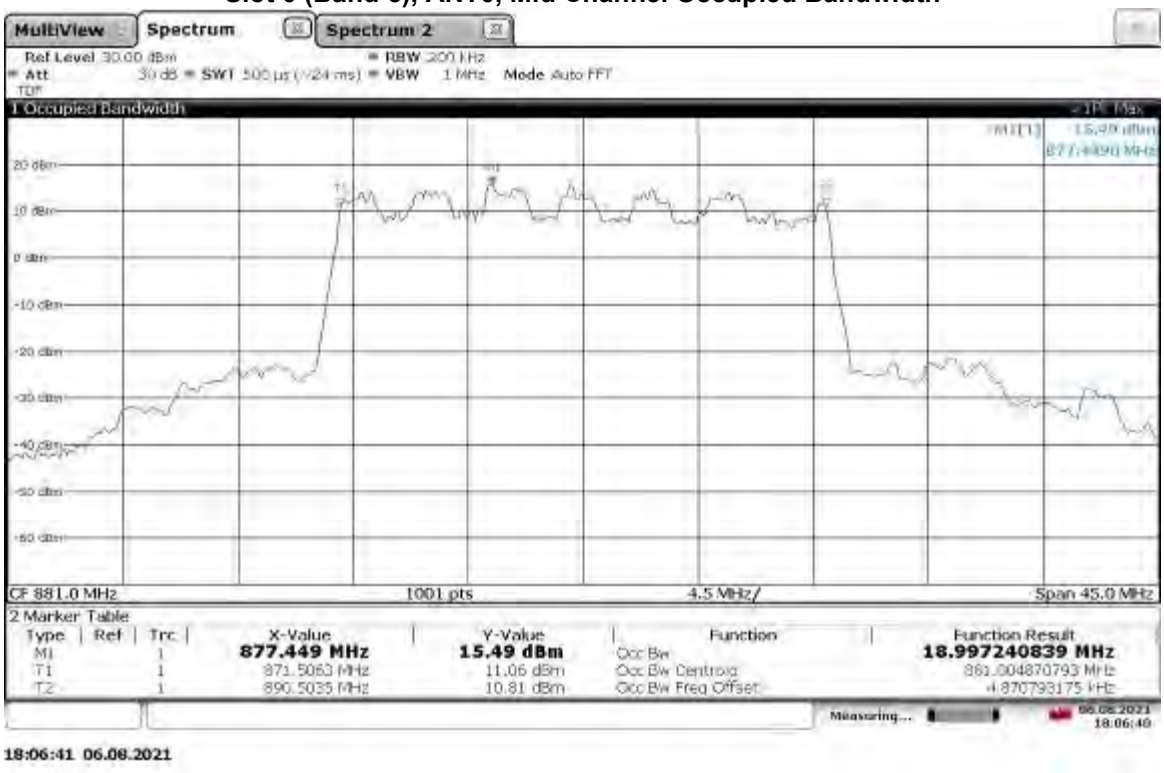
TM3.2-16QAM_20 MHz Bandwidth
Slot 0 (Band 5), ANT0, Low Channel Occupied Bandwidth



TM3.2-16QAM_20 MHz Bandwidth
Slot 0 (Band 5), ANT1, Low Channel Occupied Bandwidth

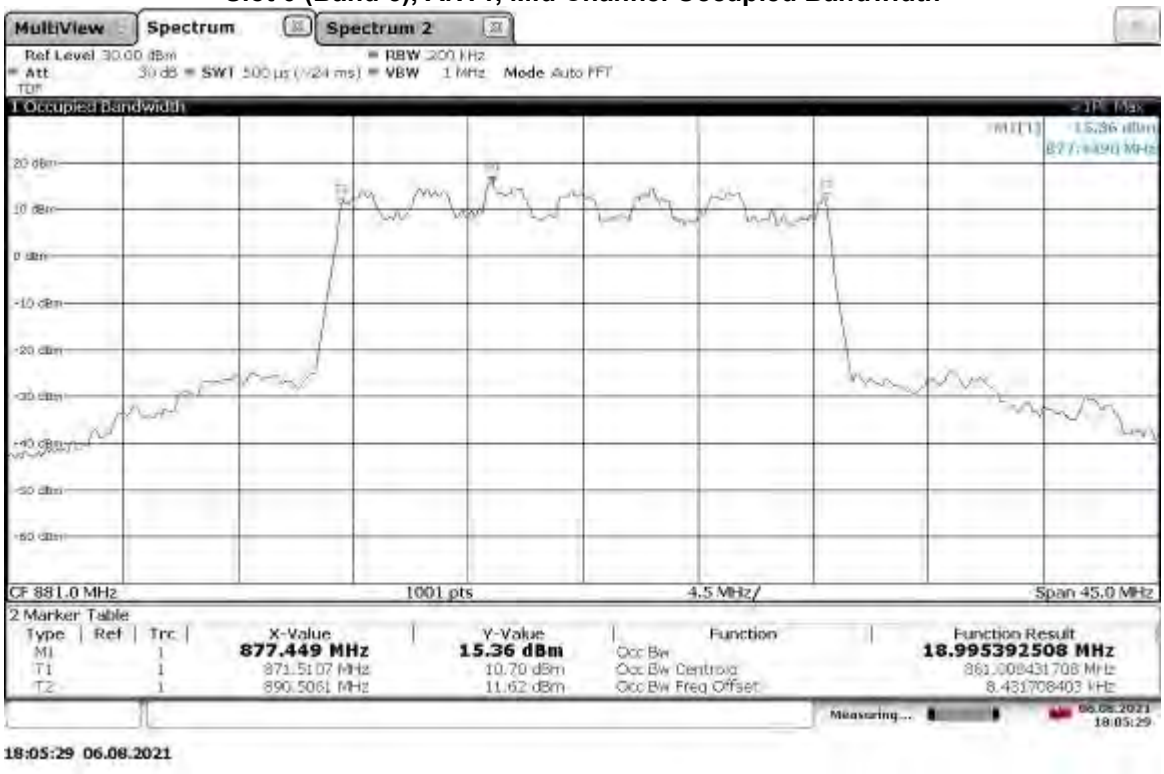


TM3.2-16QAM_20 MHz Bandwidth
Slot 0 (Band 5), ANT0, Mid Channel Occupied Bandwidth



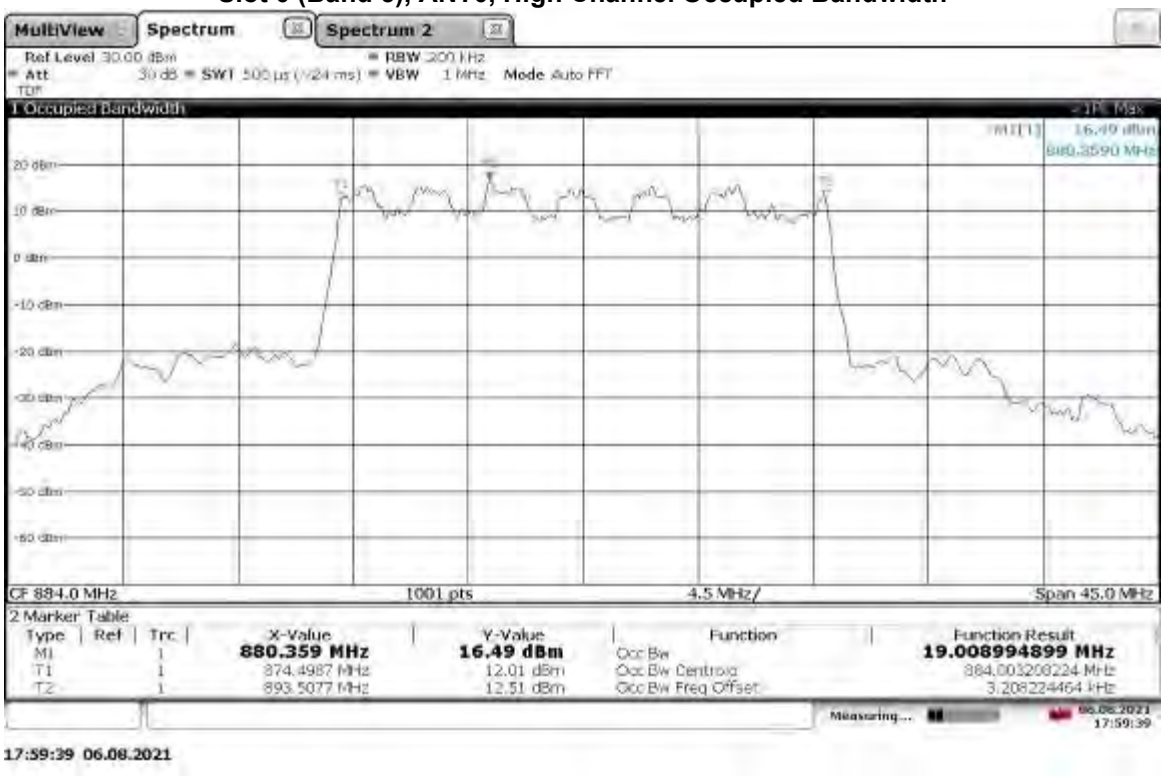
18:06:41 06.08.2021

TM3.2-16QAM_20 MHz Bandwidth
Slot 0 (Band 5), ANT1, Mid Channel Occupied Bandwidth



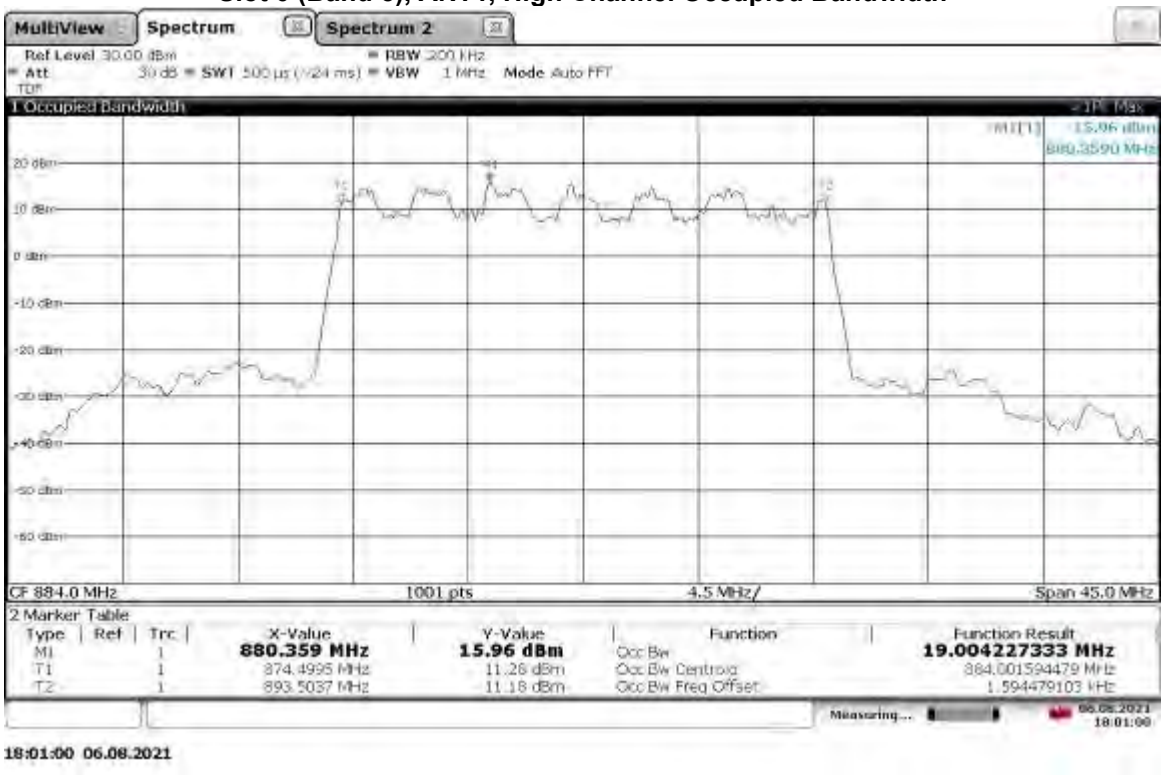
18:05:29 06.08.2021

TM3.2-16QAM_20 MHz Bandwidth
Slot 0 (Band 5), ANT0, High Channel Occupied Bandwidth



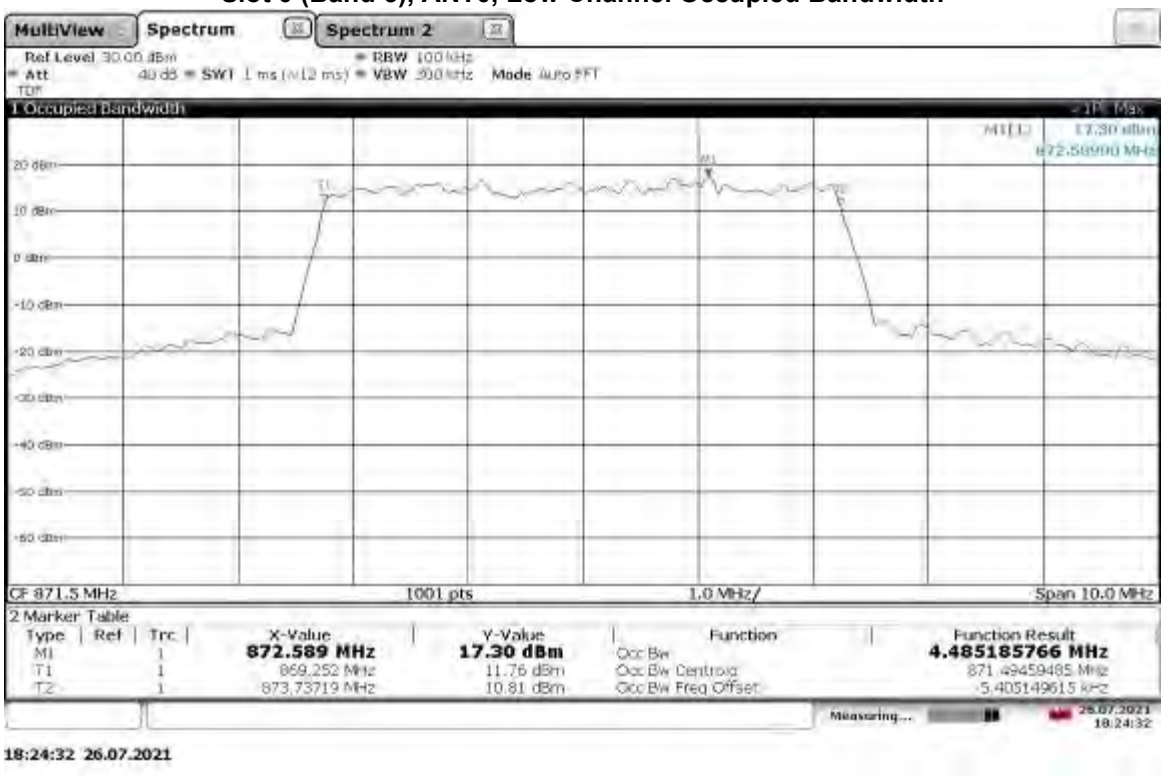
17:59:39 06.08.2021

TM3.2-16QAM_20 MHz Bandwidth
Slot 0 (Band 5), ANT1, High Channel Occupied Bandwidth



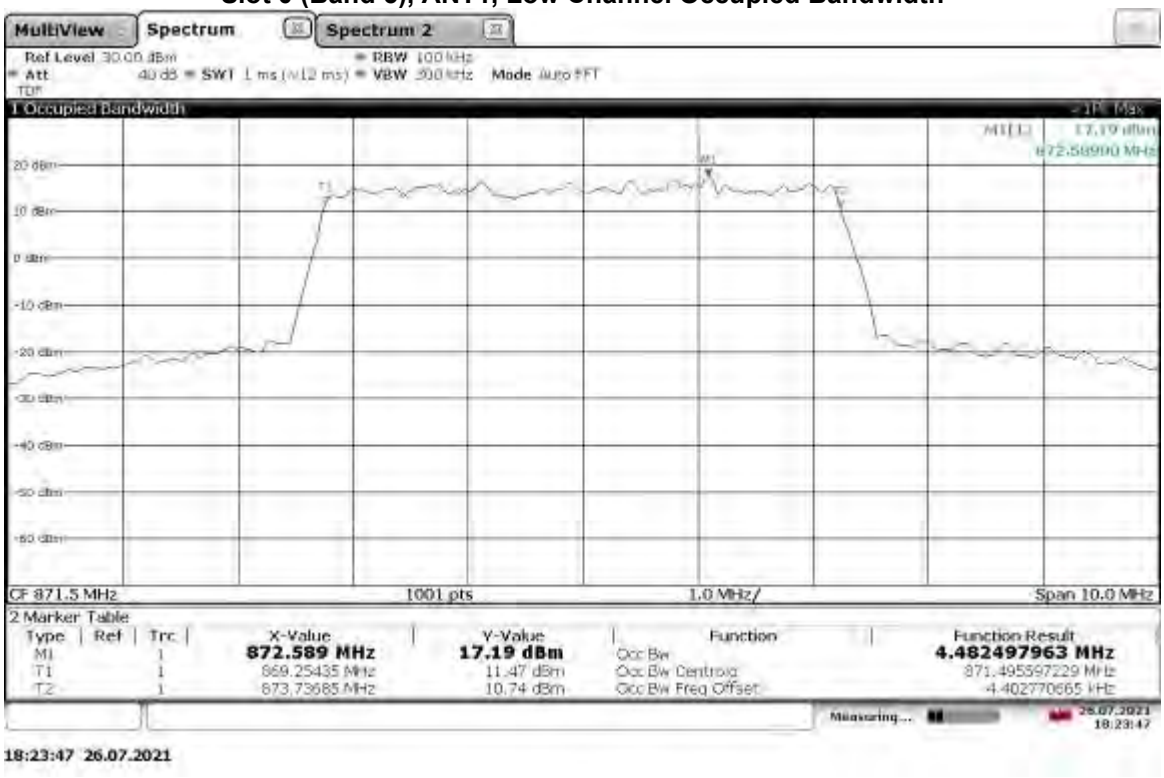
18:01:00 06.08.2021

TM3.1-64QAM_5 MHz Bandwidth
Slot 0 (Band 5), ANT0, Low Channel Occupied Bandwidth



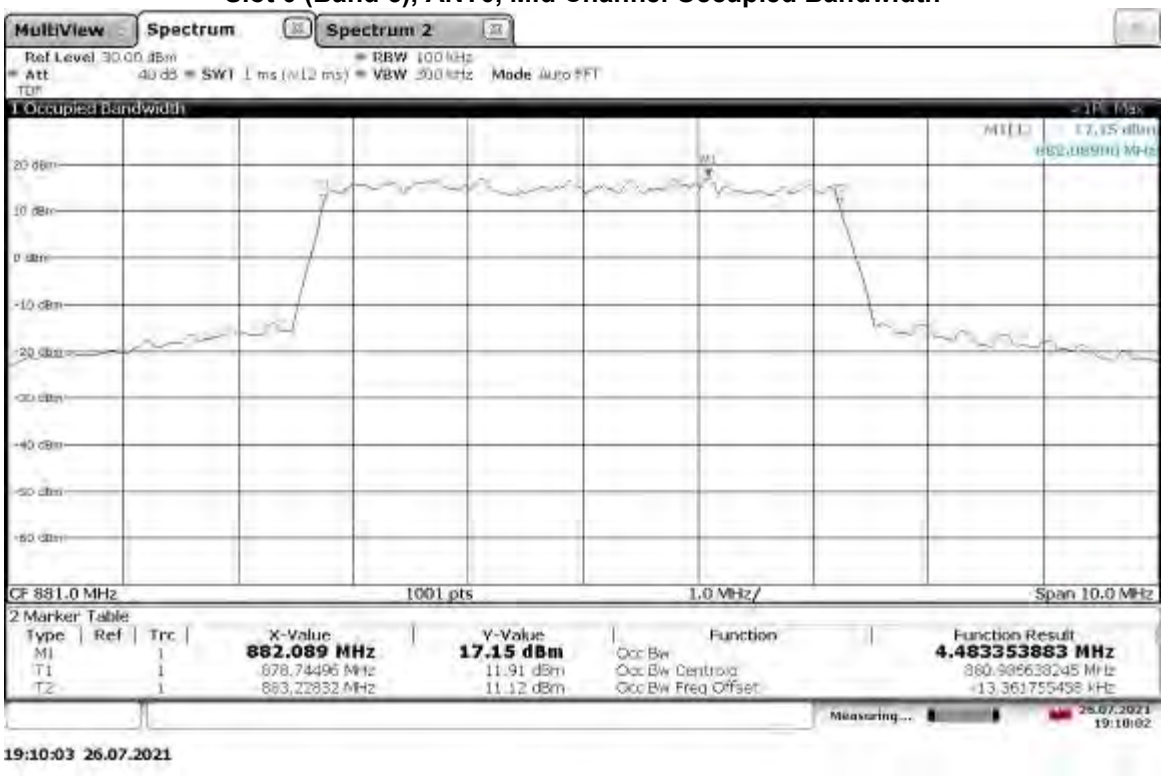
18:24:32 26.07.2021

TM3.1-64QAM_5 MHz Bandwidth
Slot 0 (Band 5), ANT1, Low Channel Occupied Bandwidth

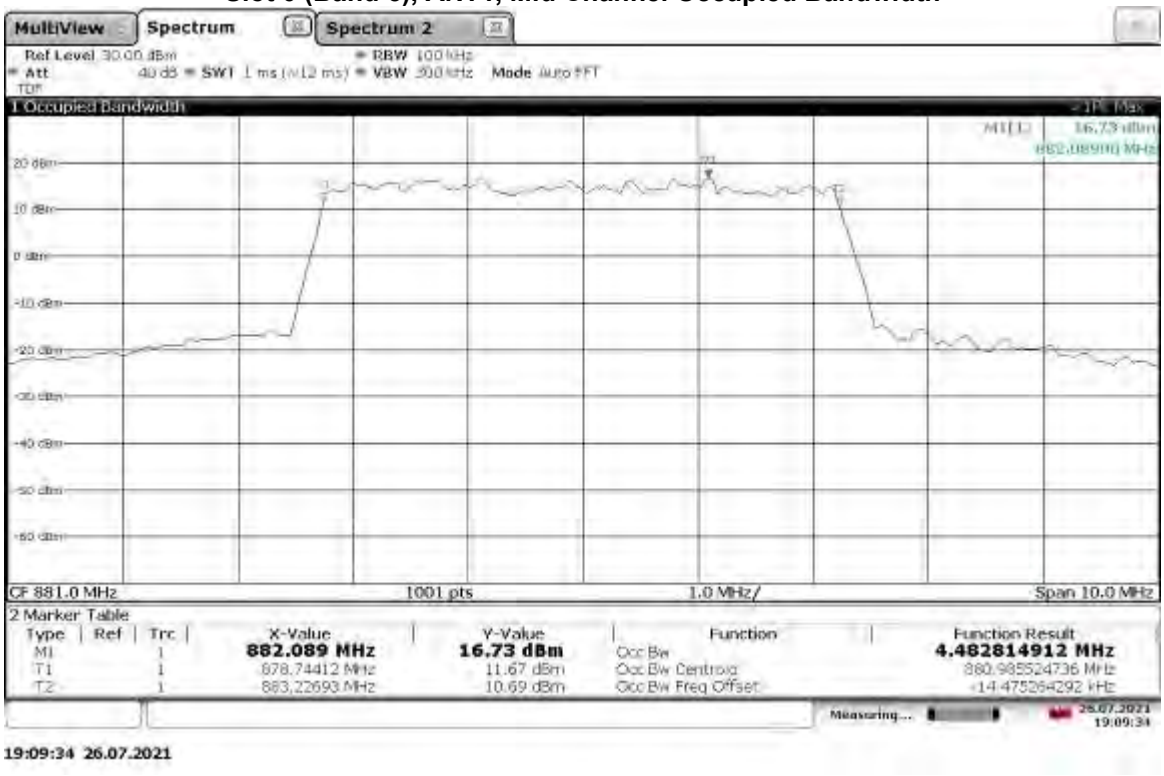


18:23:47 26.07.2021

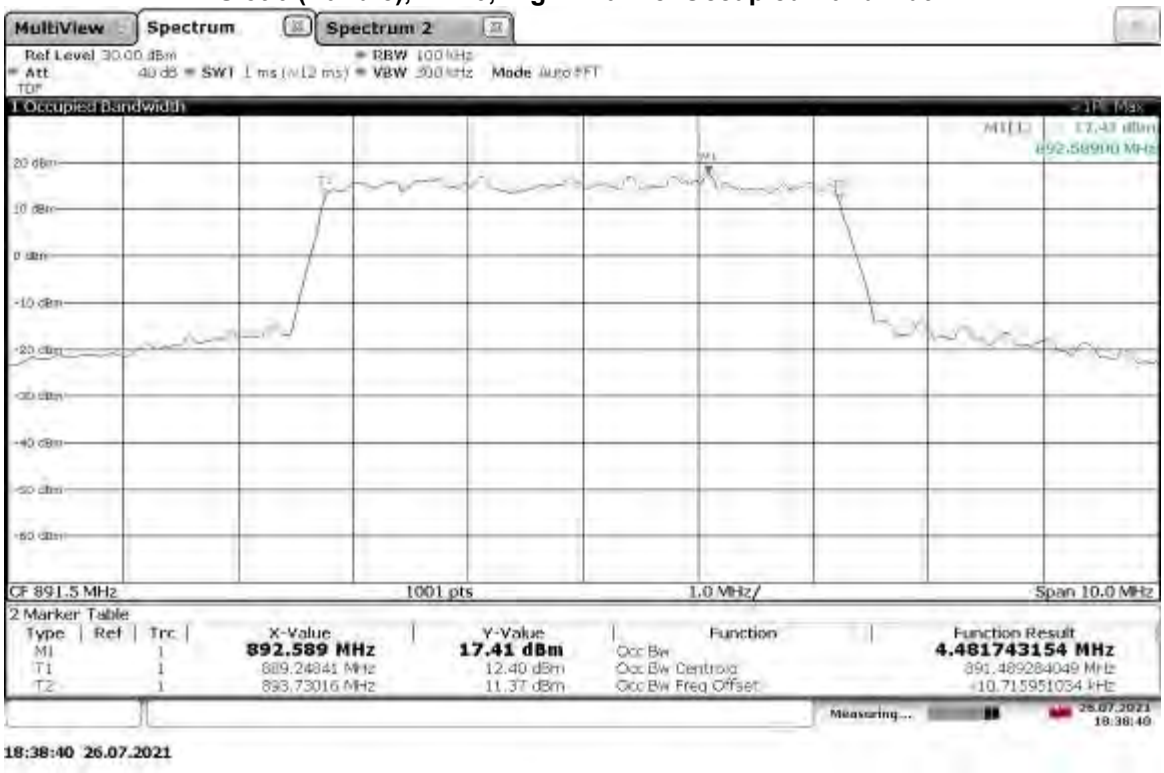
TM3.1-64QAM_5 MHz Bandwidth
Slot 0 (Band 5), ANT0, Mid Channel Occupied Bandwidth



TM3.1-64QAM_5 MHz Bandwidth
Slot 0 (Band 5), ANT1, Mid Channel Occupied Bandwidth

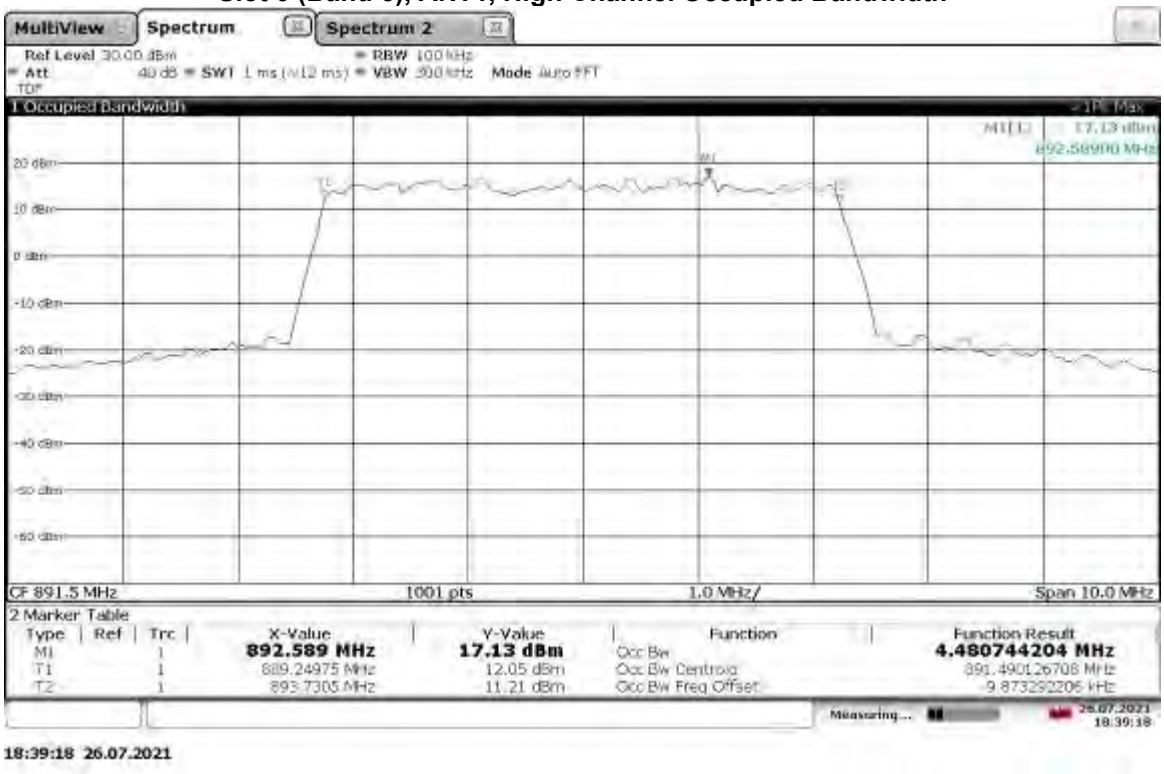


TM3.1-64QAM_5 MHz Bandwidth
Slot 0 (Band 5), ANT0, High Channel Occupied Bandwidth



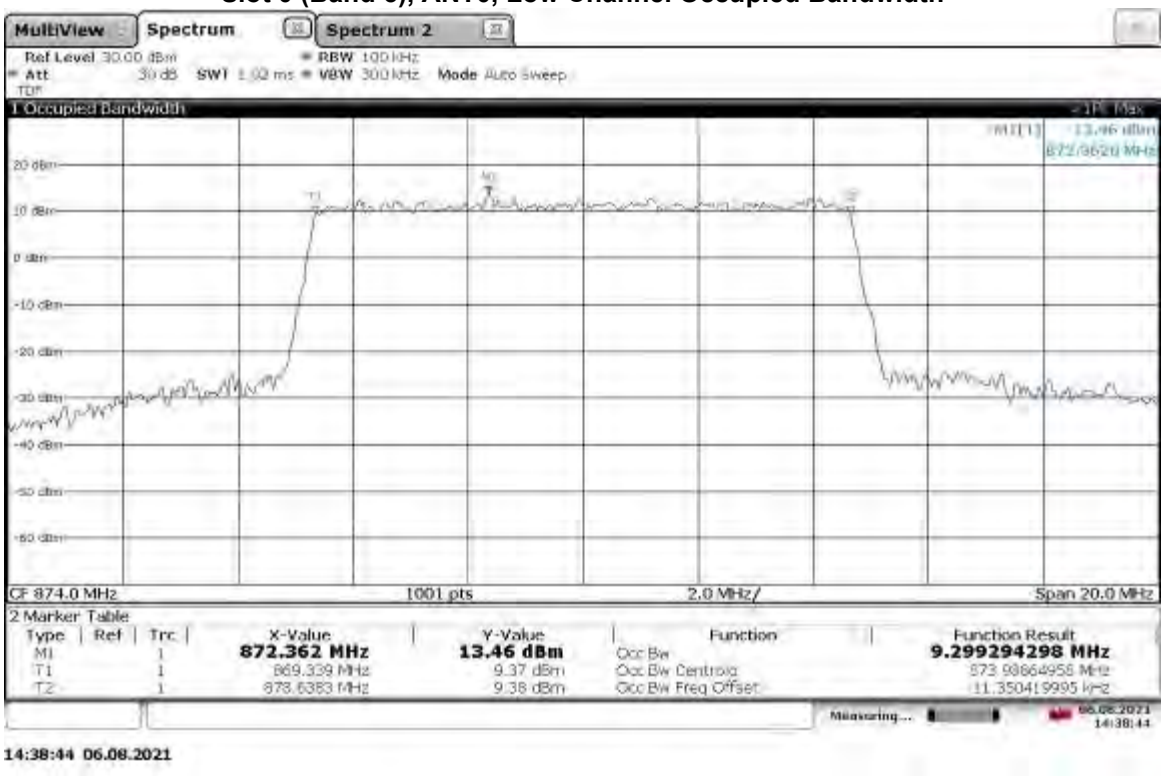
18:38:40 26.07.2021

TM3.1-64QAM_5 MHz Bandwidth
Slot 0 (Band 5), ANT1, High Channel Occupied Bandwidth

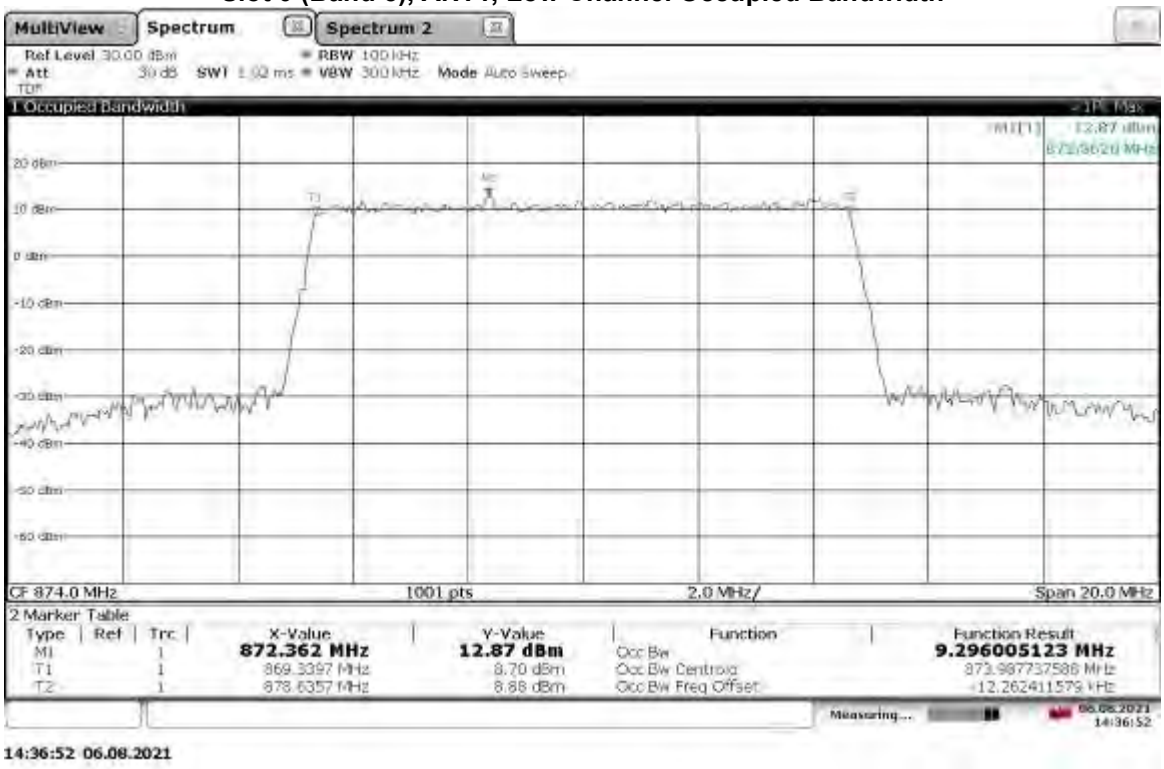


18:39:18 26.07.2021

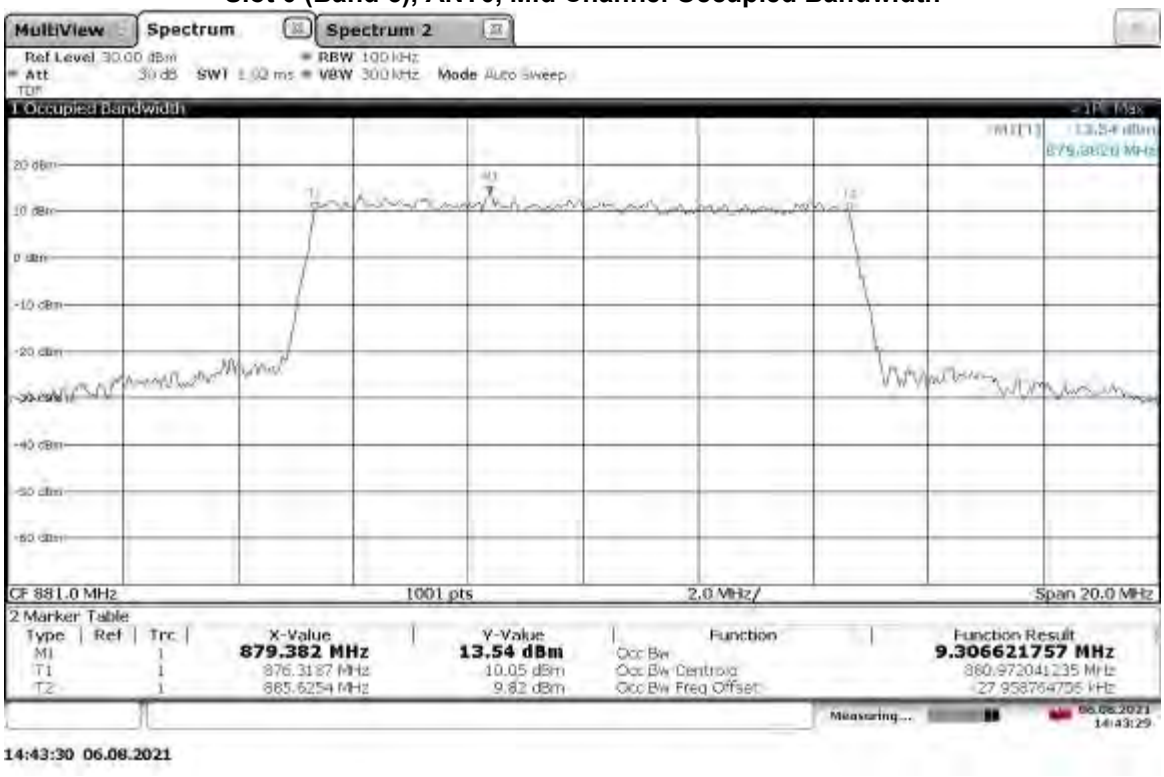
TM3.1-64QAM_10 MHz Bandwidth
Slot 0 (Band 5), ANT0, Low Channel Occupied Bandwidth



TM3.1-64QAM_10 MHz Bandwidth
Slot 0 (Band 5), ANT1, Low Channel Occupied Bandwidth

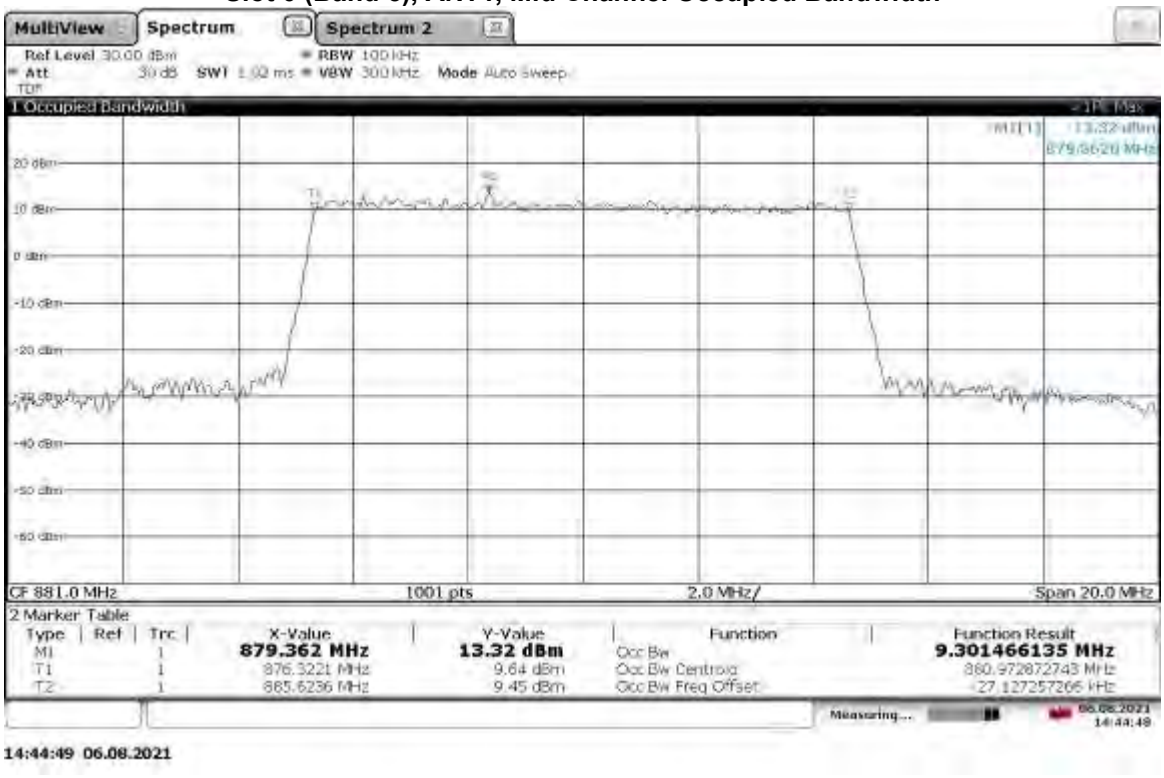


TM3.1-64QAM_10 MHz Bandwidth
Slot 0 (Band 5), ANT0, Mid Channel Occupied Bandwidth



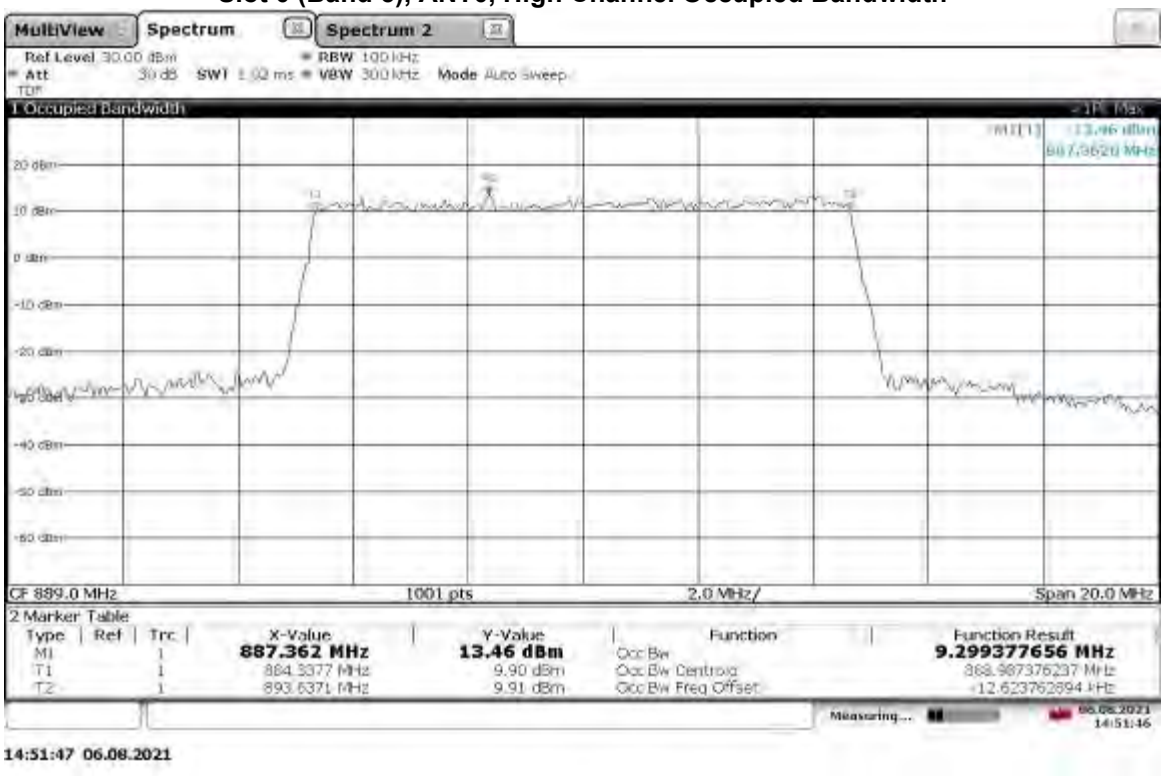
14:43:30 06.08.2021

TM3.1-64QAM_10 MHz Bandwidth
Slot 0 (Band 5), ANT1, Mid Channel Occupied Bandwidth



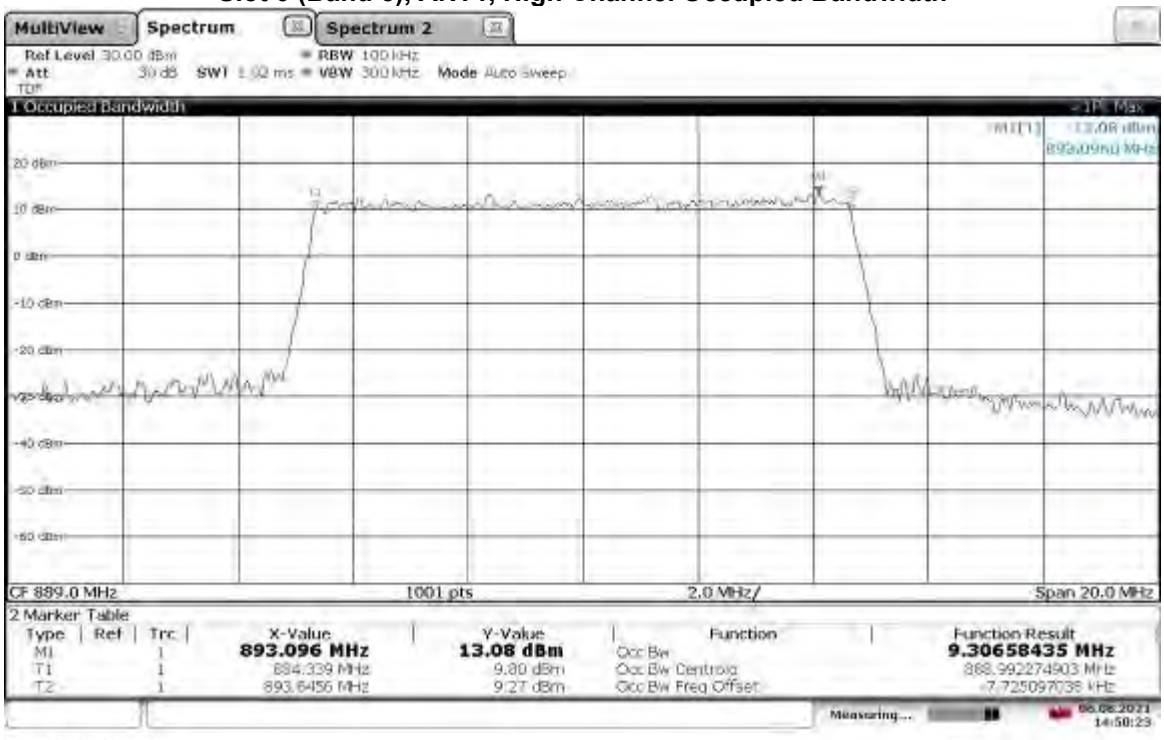
14:44:49 06.08.2021

TM3.1-64QAM_10 MHz Bandwidth
Slot 0 (Band 5), ANT0, High Channel Occupied Bandwidth



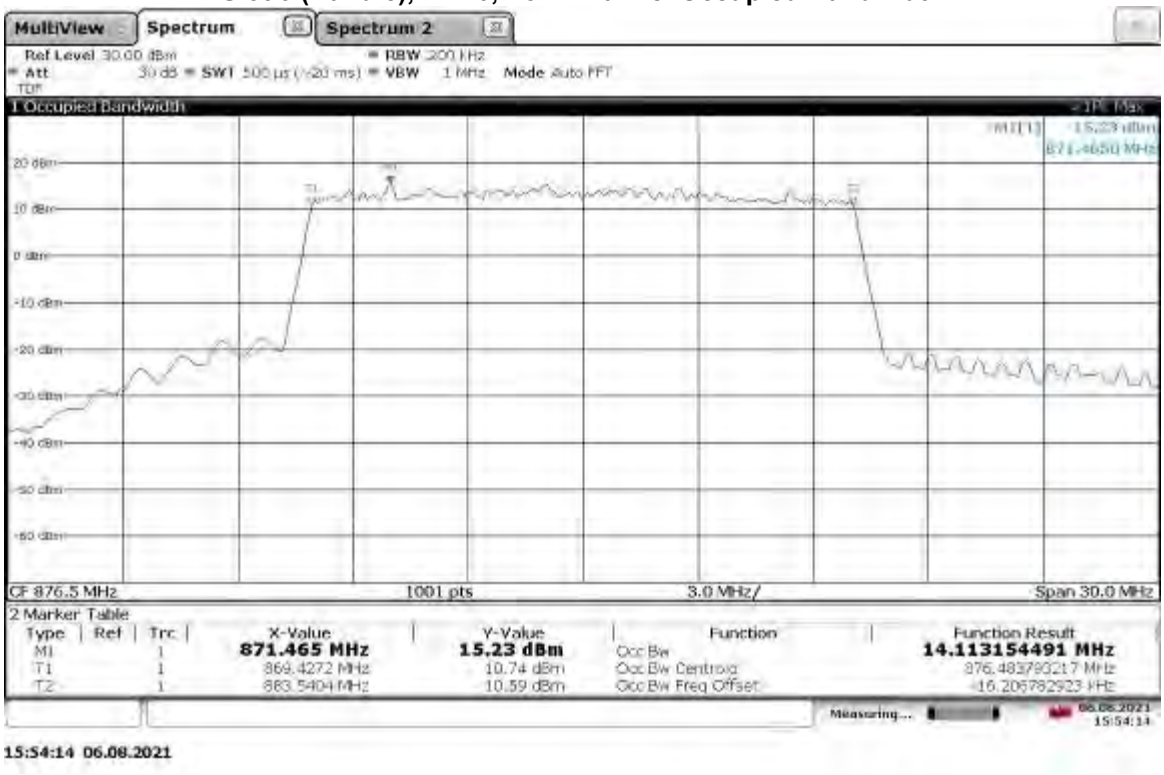
14:51:47 06.08.2021

TM3.1-64QAM_10 MHz Bandwidth
Slot 0 (Band 5), ANT1, High Channel Occupied Bandwidth



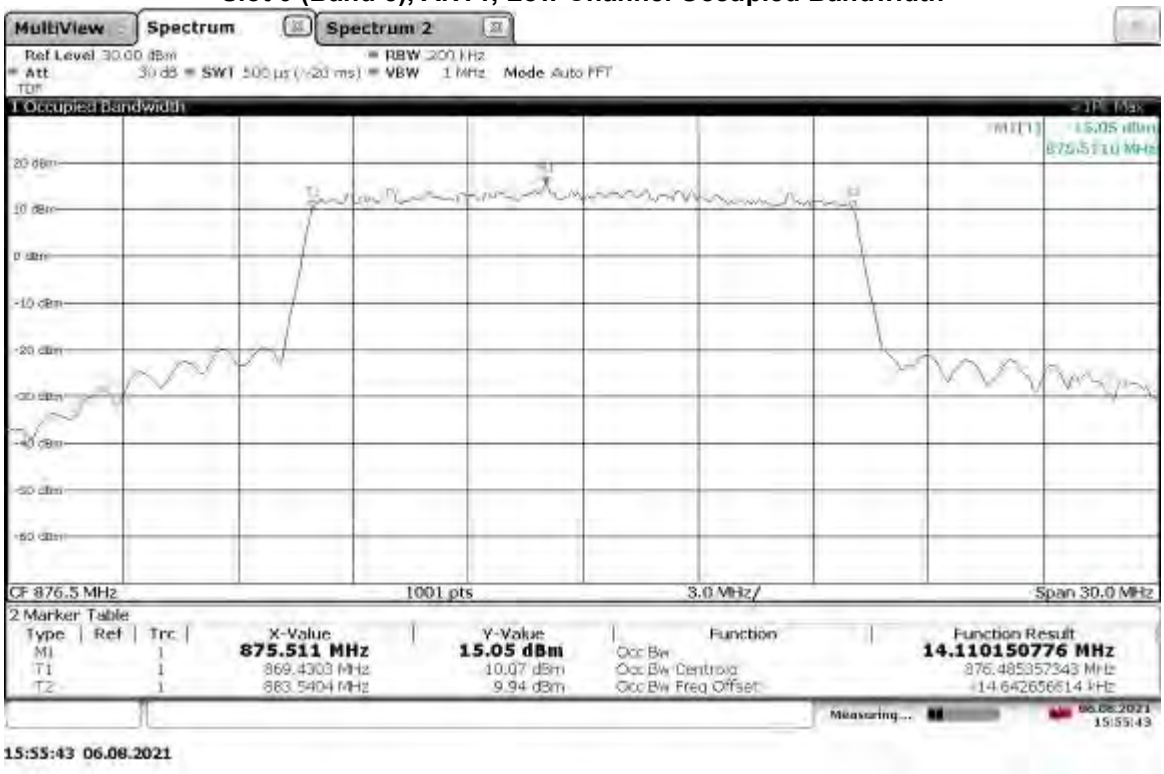
14:50:24 06.08.2021

TM3.1-64QAM_15 MHz Bandwidth
Slot 0 (Band 5), ANT0, Low Channel Occupied Bandwidth



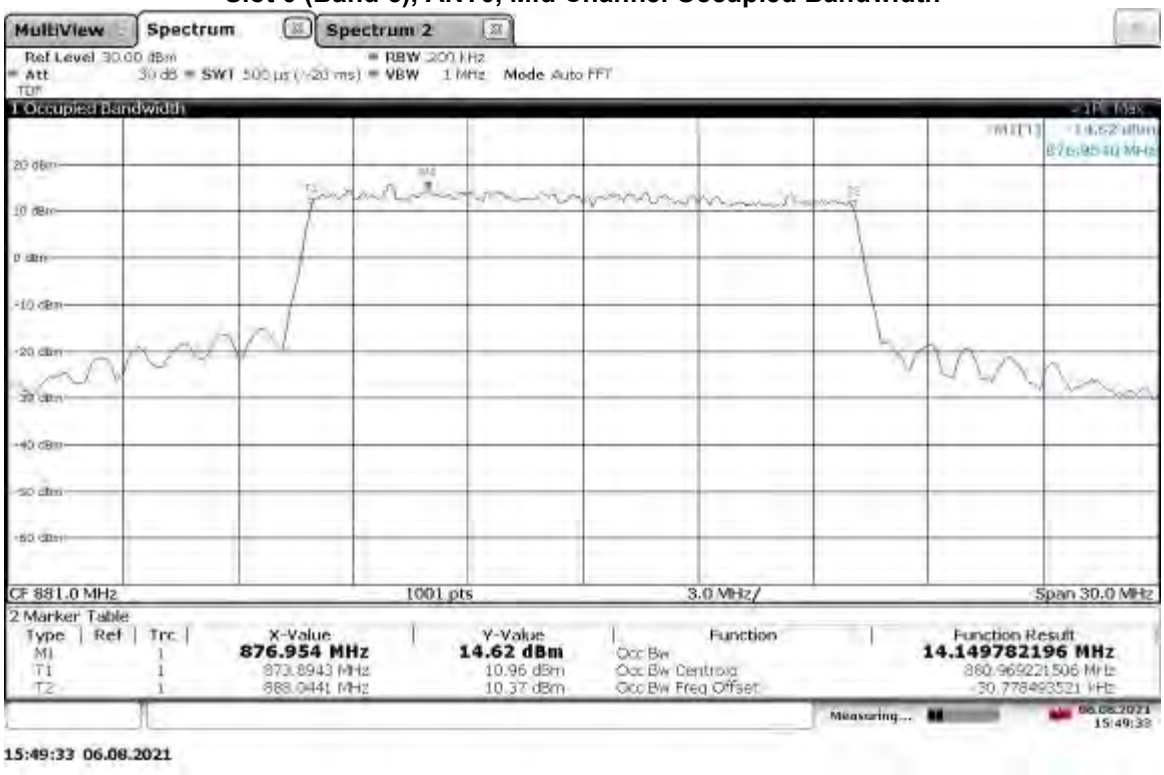
15:54:14 06.08.2021

TM3.1-64QAM_15 MHz Bandwidth
Slot 0 (Band 5), ANT1, Low Channel Occupied Bandwidth

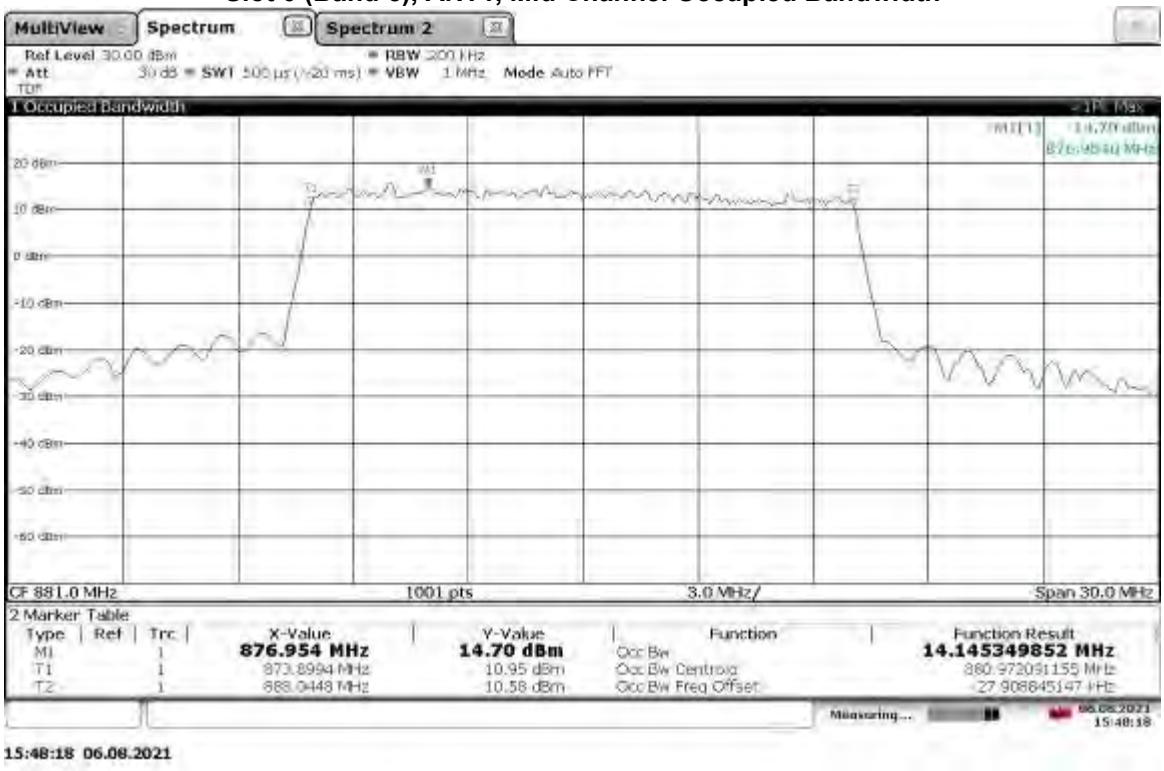


15:55:43 06.08.2021

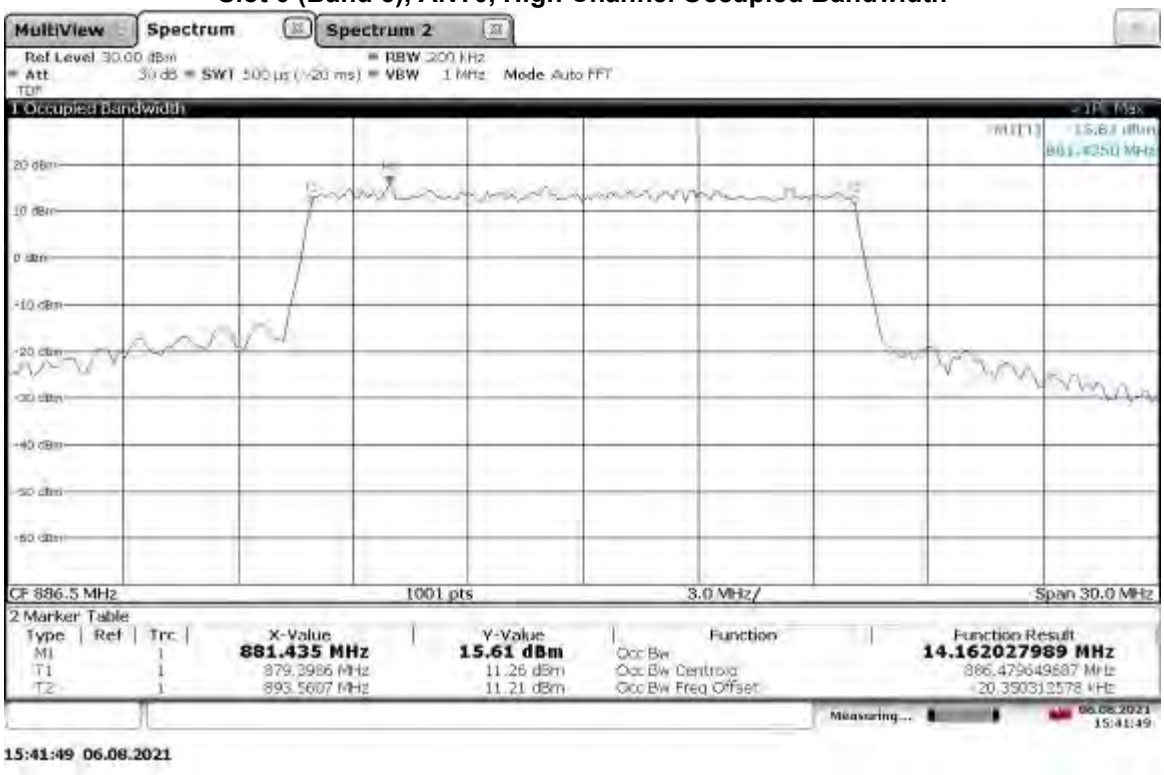
TM3.1-64QAM_15 MHz Bandwidth
Slot 0 (Band 5), ANT0, Mid Channel Occupied Bandwidth



TM3.1-64QAM_15 MHz Bandwidth
Slot 0 (Band 5), ANT1, Mid Channel Occupied Bandwidth

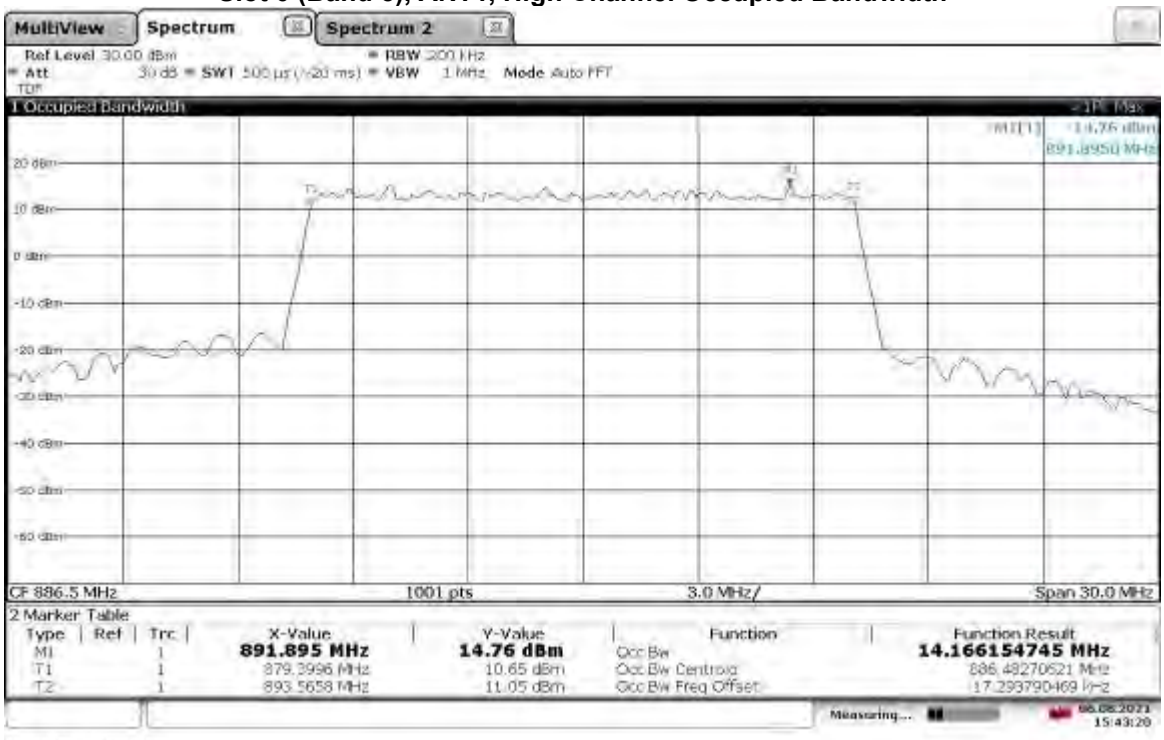


TM3.1-64QAM_15 MHz Bandwidth
Slot 0 (Band 5), ANT0, High Channel Occupied Bandwidth



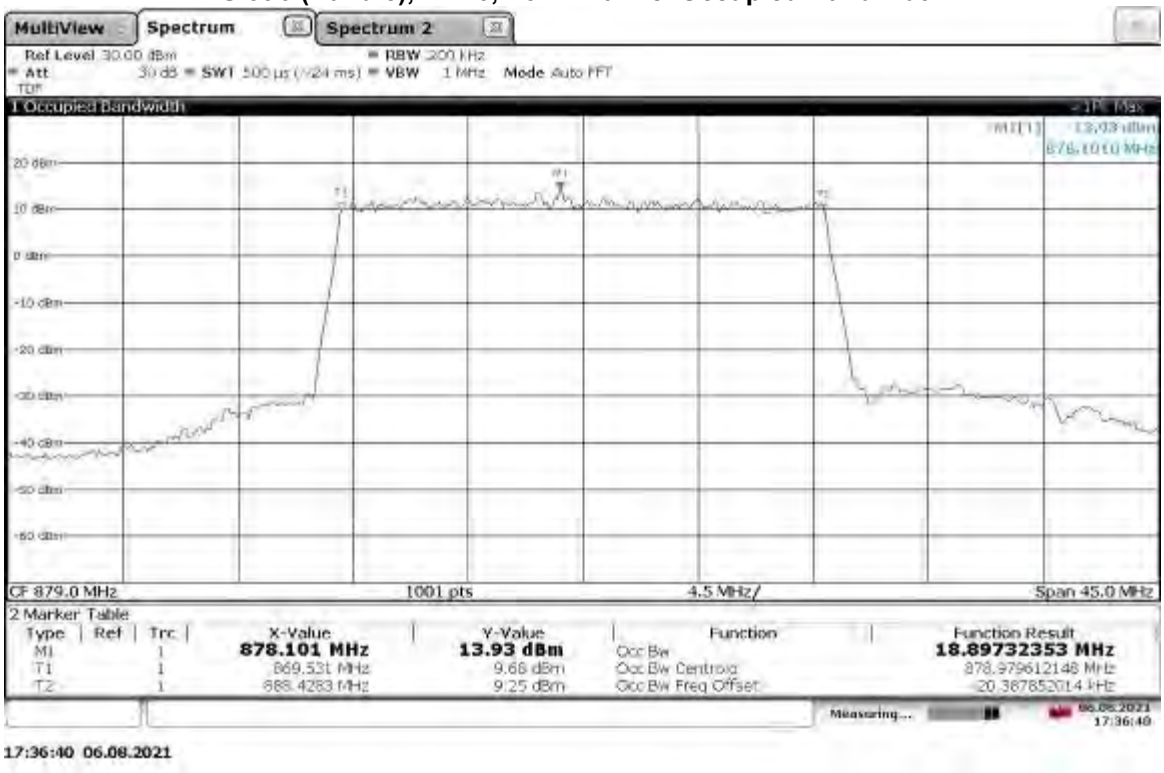
15:41:49 06.08.2021

TM3.1-64QAM_15 MHz Bandwidth
Slot 0 (Band 5), ANT1, High Channel Occupied Bandwidth



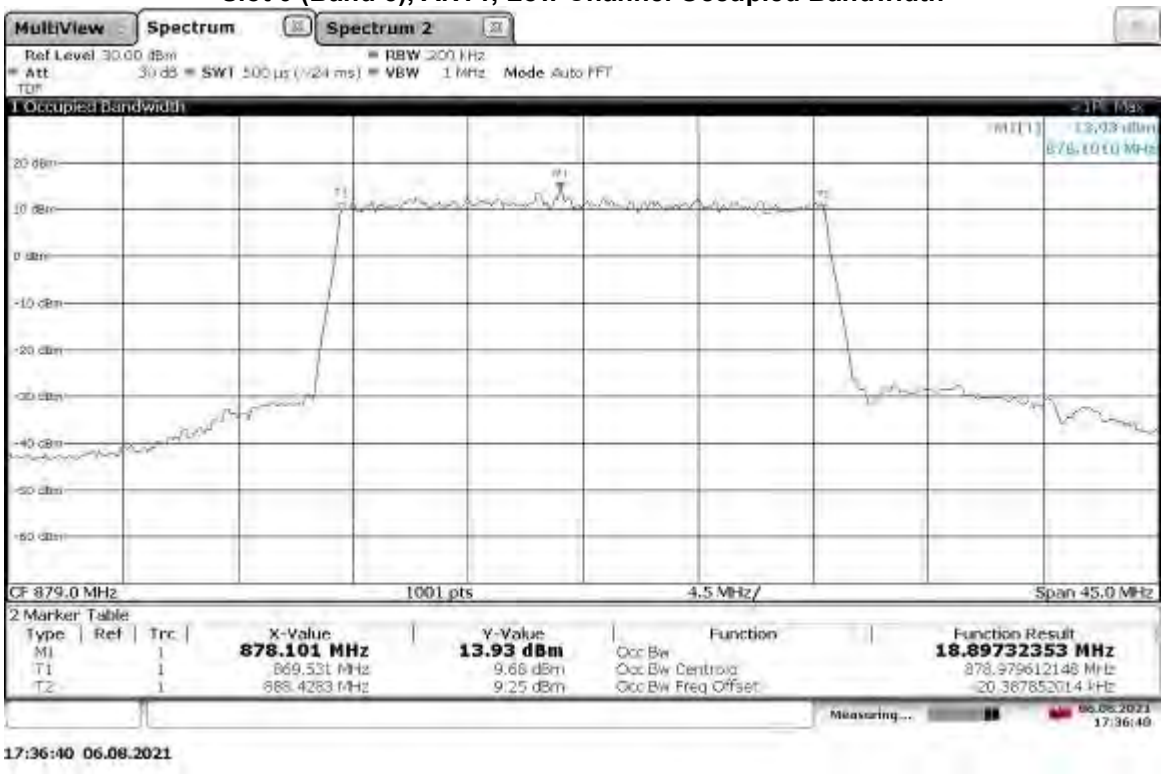
15:43:20 06.08.2021

TM3.1-64QAM_20 MHz Bandwidth
Slot 0 (Band 5), ANT0, Low Channel Occupied Bandwidth



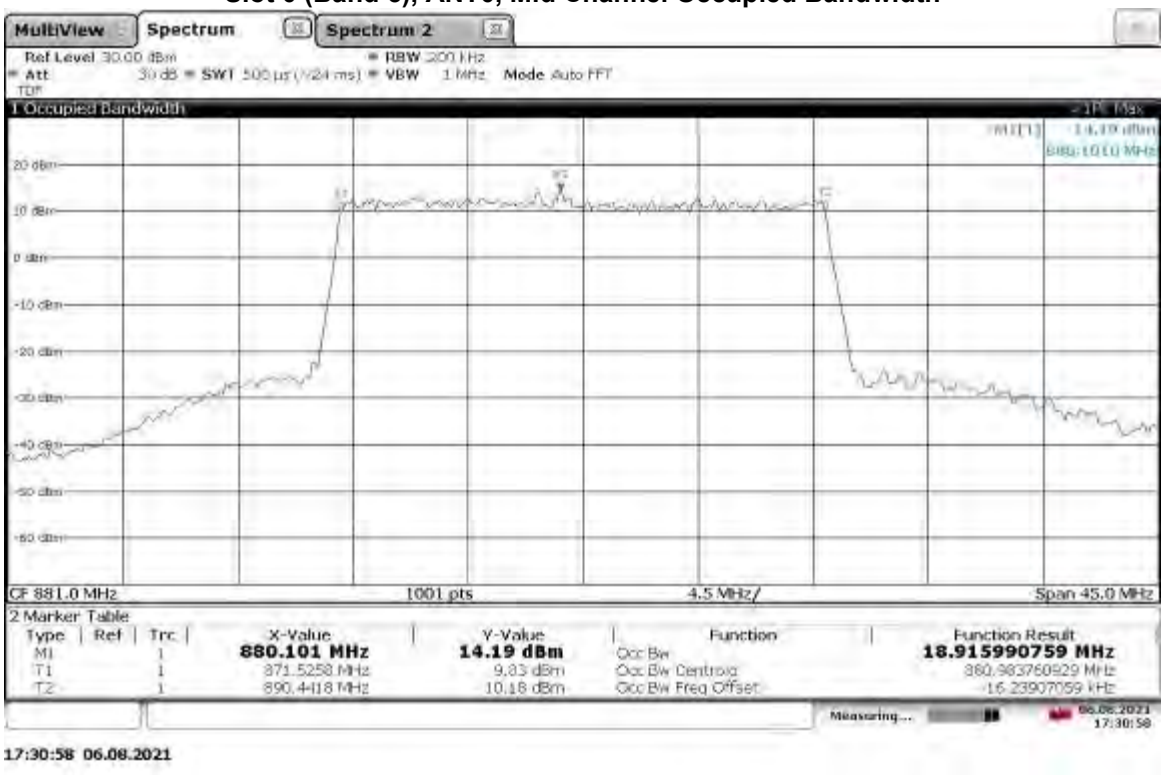
17:36:40 06.08.2021

TM3.1-64QAM_20 MHz Bandwidth
Slot 0 (Band 5), ANT1, Low Channel Occupied Bandwidth

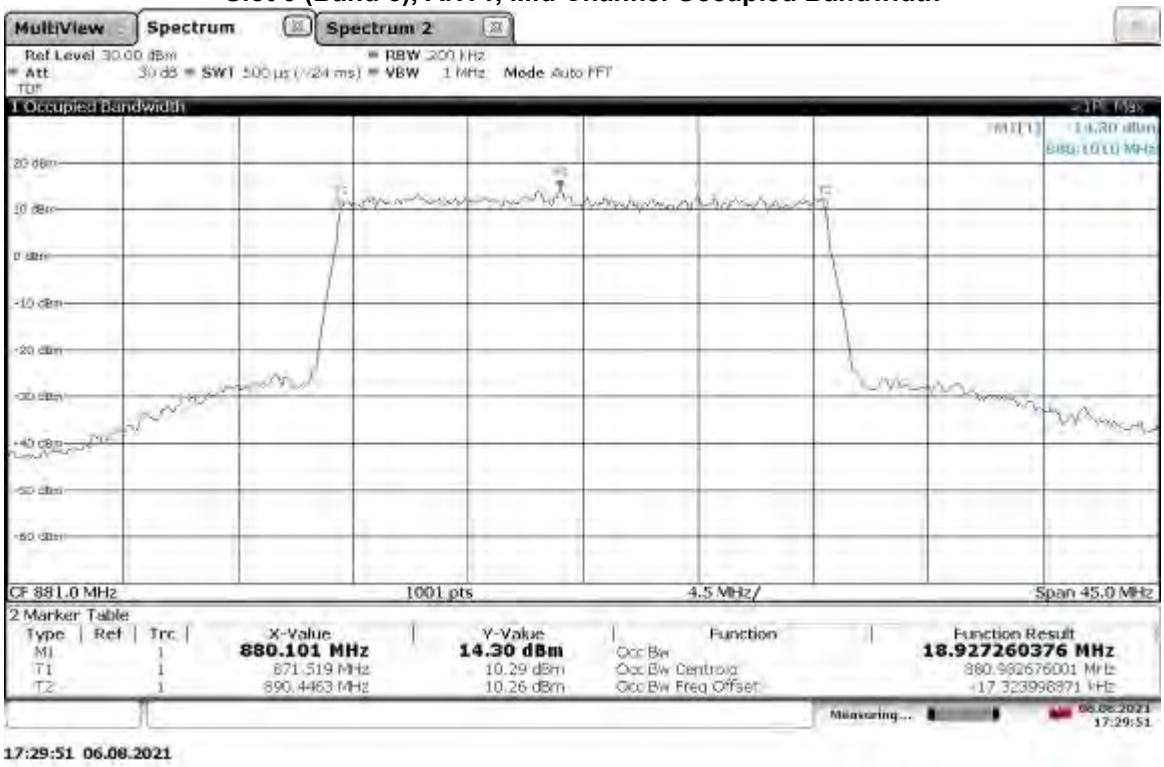


17:36:40 06.08.2021

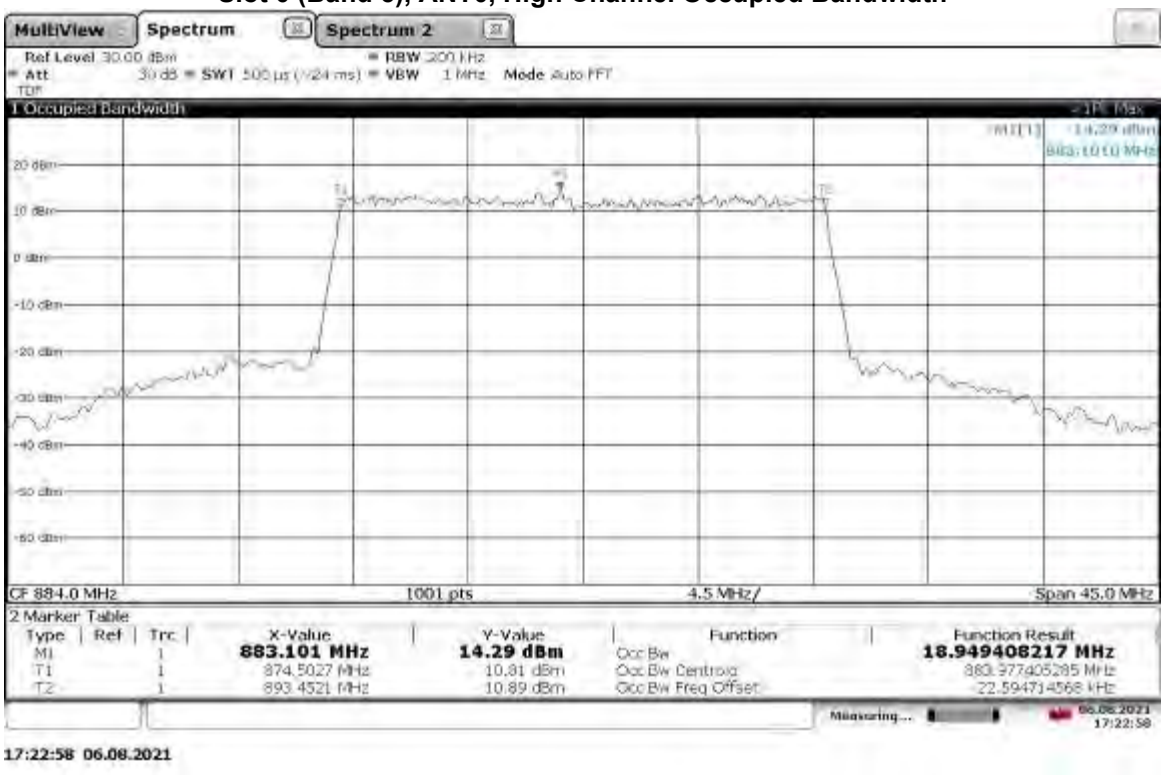
TM3.1-64QAM_20 MHz Bandwidth
Slot 0 (Band 5), ANT0, Mid Channel Occupied Bandwidth



TM3.1-64QAM_20 MHz Bandwidth
Slot 0 (Band 5), ANT1, Mid Channel Occupied Bandwidth



TM3.1-64QAM_20 MHz Bandwidth
Slot 0 (Band 5), ANT0, High Channel Occupied Bandwidth



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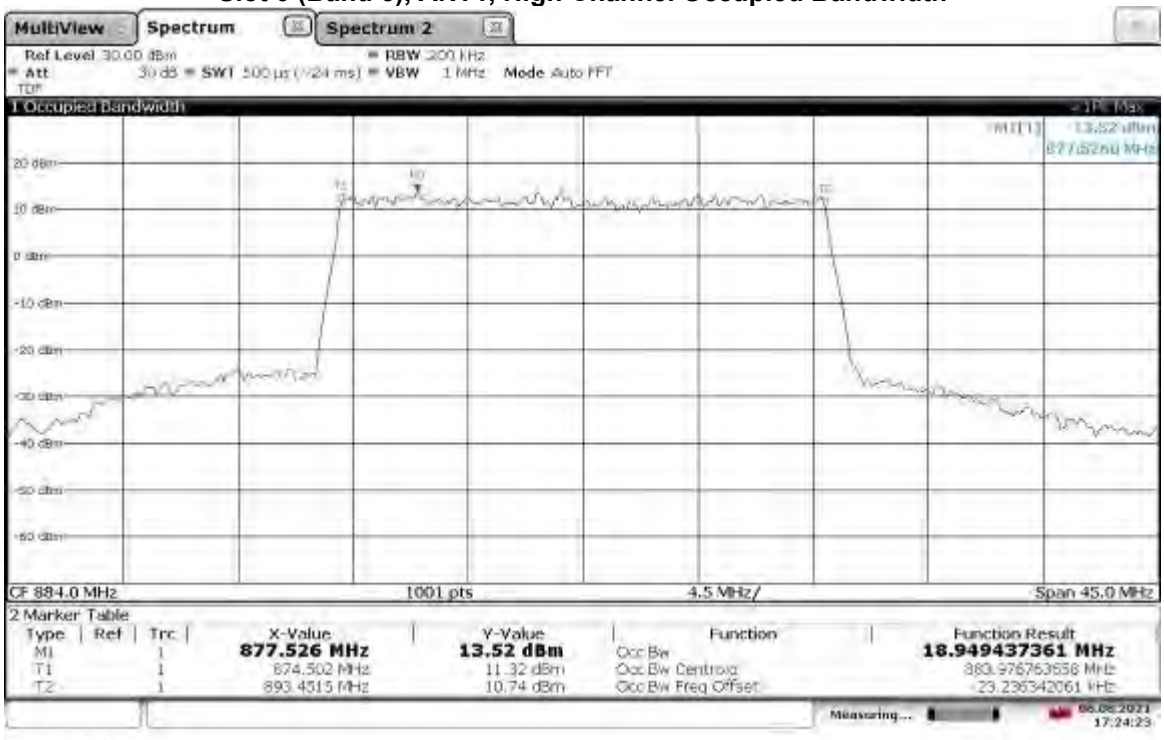
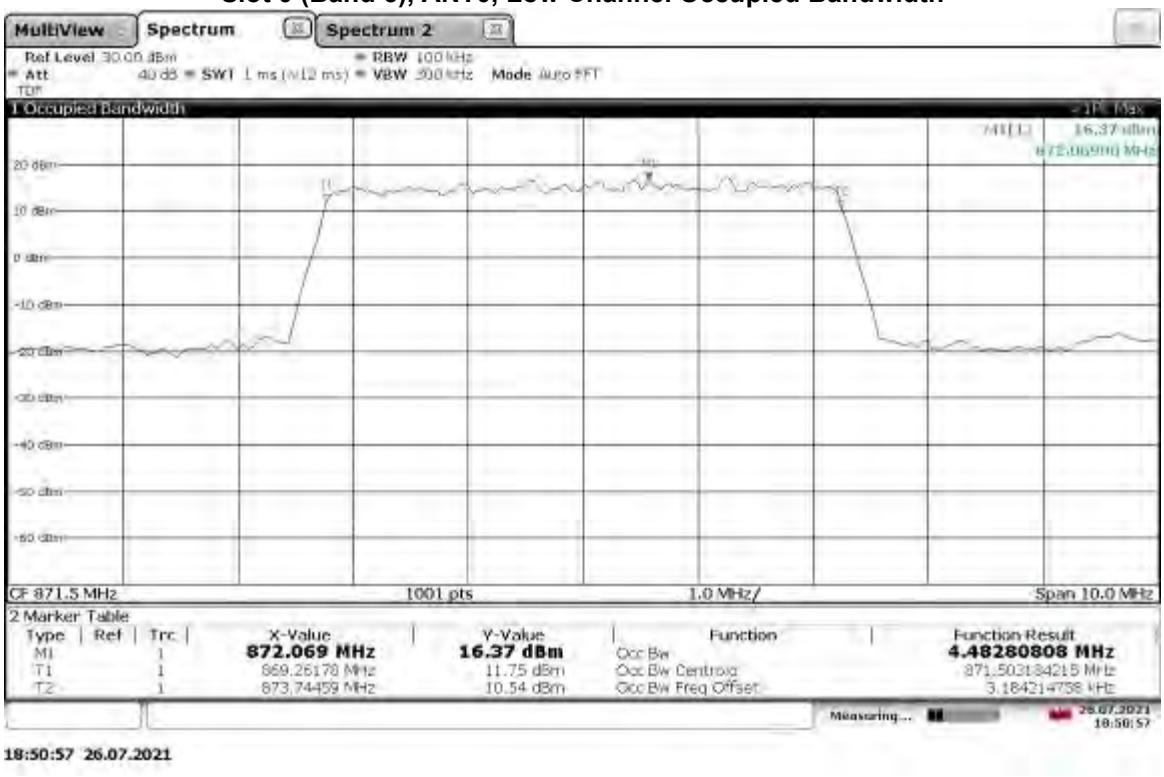
TM3.1-64QAM_20 MHz Bandwidth
Slot 0 (Band 5), ANT1, High Channel Occupied Bandwidth



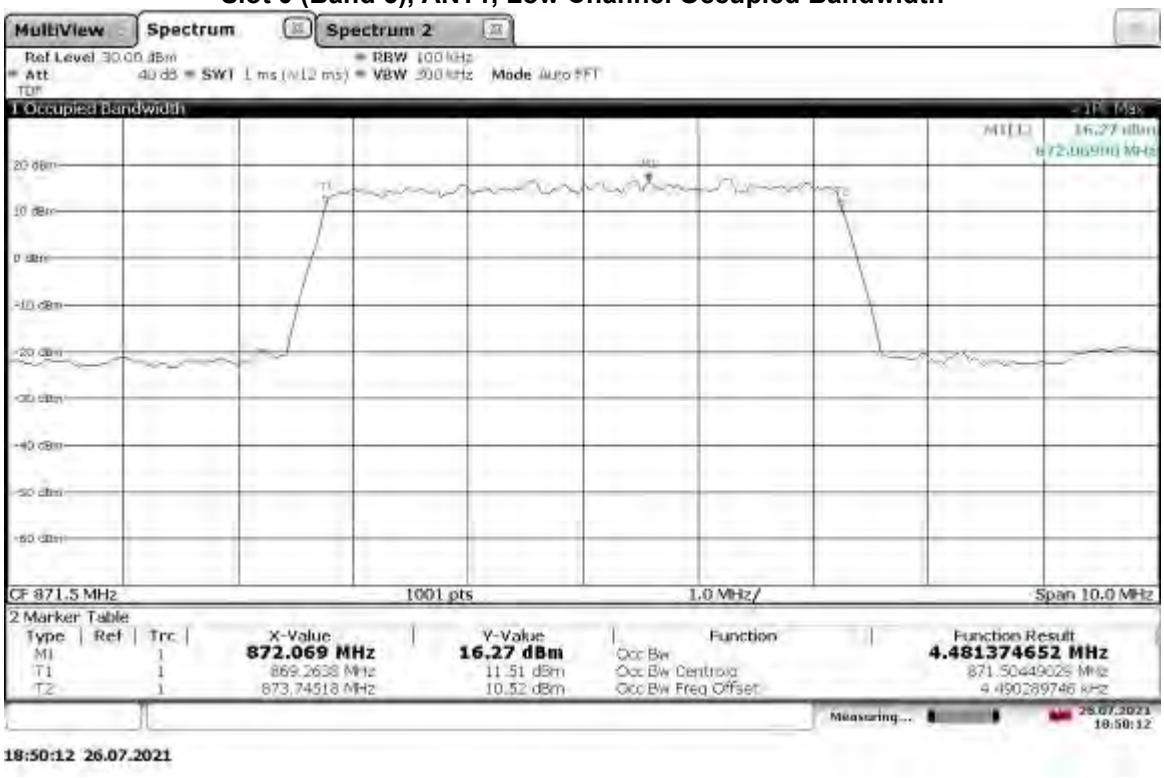
17:24:23 06.08.2021

TM3.1a-256QAM_5 MHz Bandwidth
Slot 0 (Band 5), ANT0, Low Channel Occupied Bandwidth



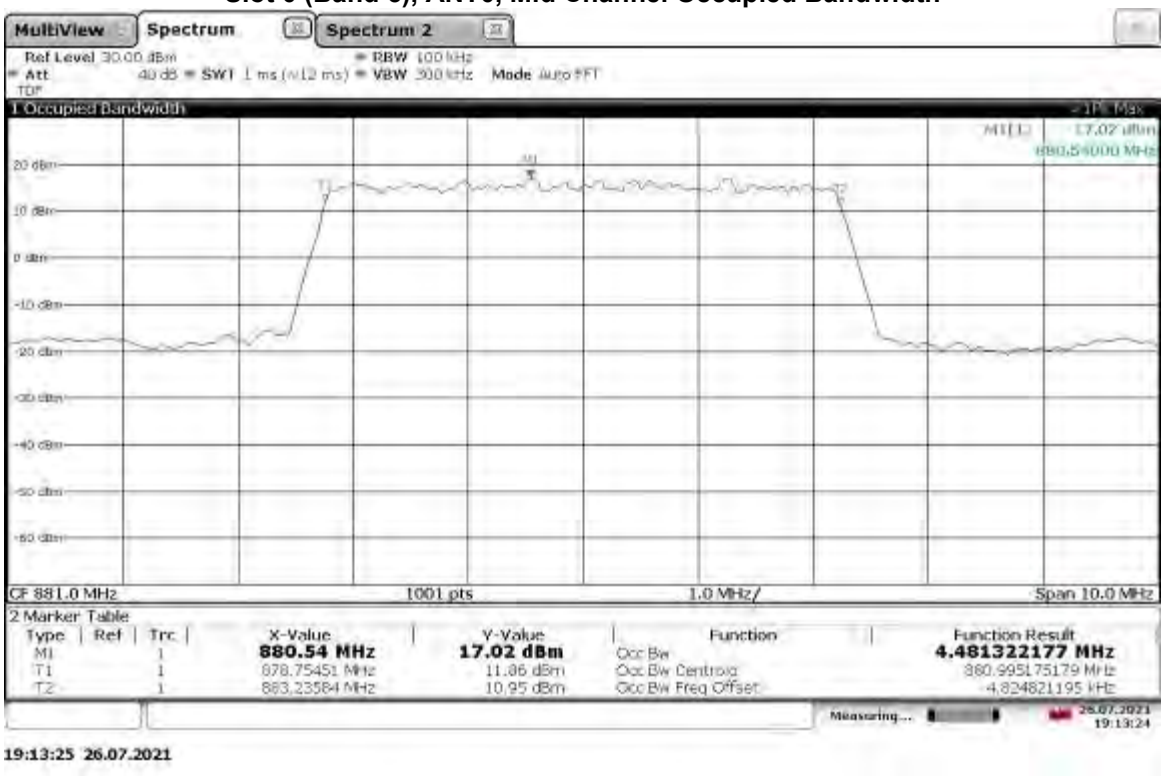
18:50:57 26.07.2021

TM3.1a-256QAM_5 MHz Bandwidth
Slot 0 (Band 5), ANT1, Low Channel Occupied Bandwidth



18:50:12 26.07.2021

TM3.1a-256QAM_5 MHz Bandwidth
Slot 0 (Band 5), ANT0, Mid Channel Occupied Bandwidth



19:13:25 26.07.2021

TM3.1a-256QAM_5 MHz Bandwidth
Slot 0 (Band 5), ANT1, Mid Channel Occupied Bandwidth

18:50:12 26.07.2021

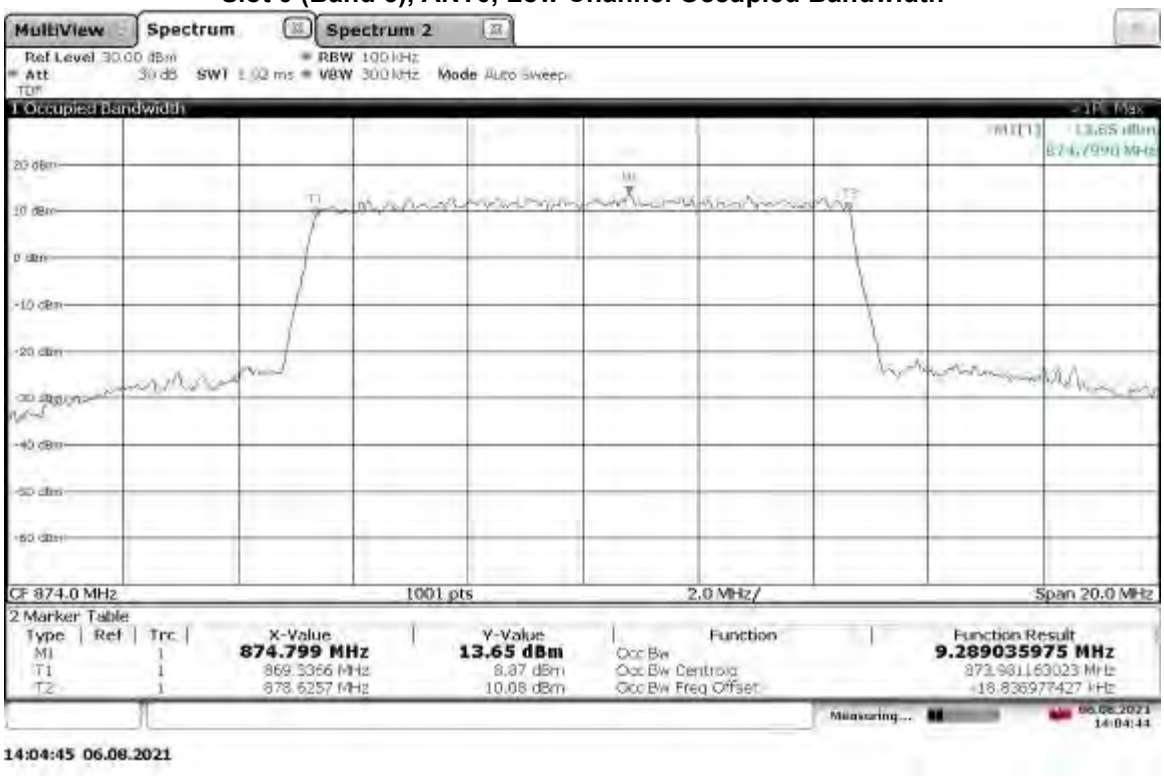
TM3.1a-256QAM_5 MHz Bandwidth
Slot 0 (Band 5), ANT0, High Channel Occupied Bandwidth

13:39:15 06.08.2021

TM3.1a-256QAM_5 MHz Bandwidth
Slot 0 (Band 5), ANT1, High Channel Occupied Bandwidth

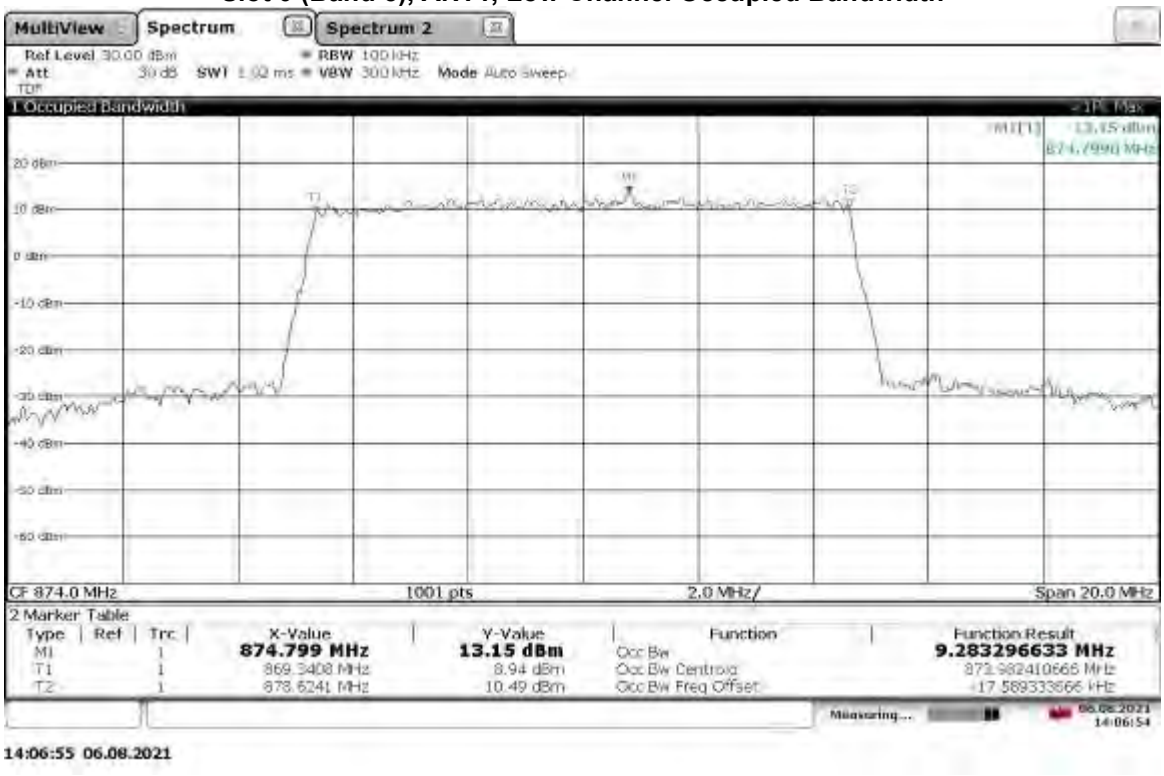
13:40:44 06.08.2021

TM3.1a-256QAM_10 MHz Bandwidth
Slot 0 (Band 5), ANT0, Low Channel Occupied Bandwidth



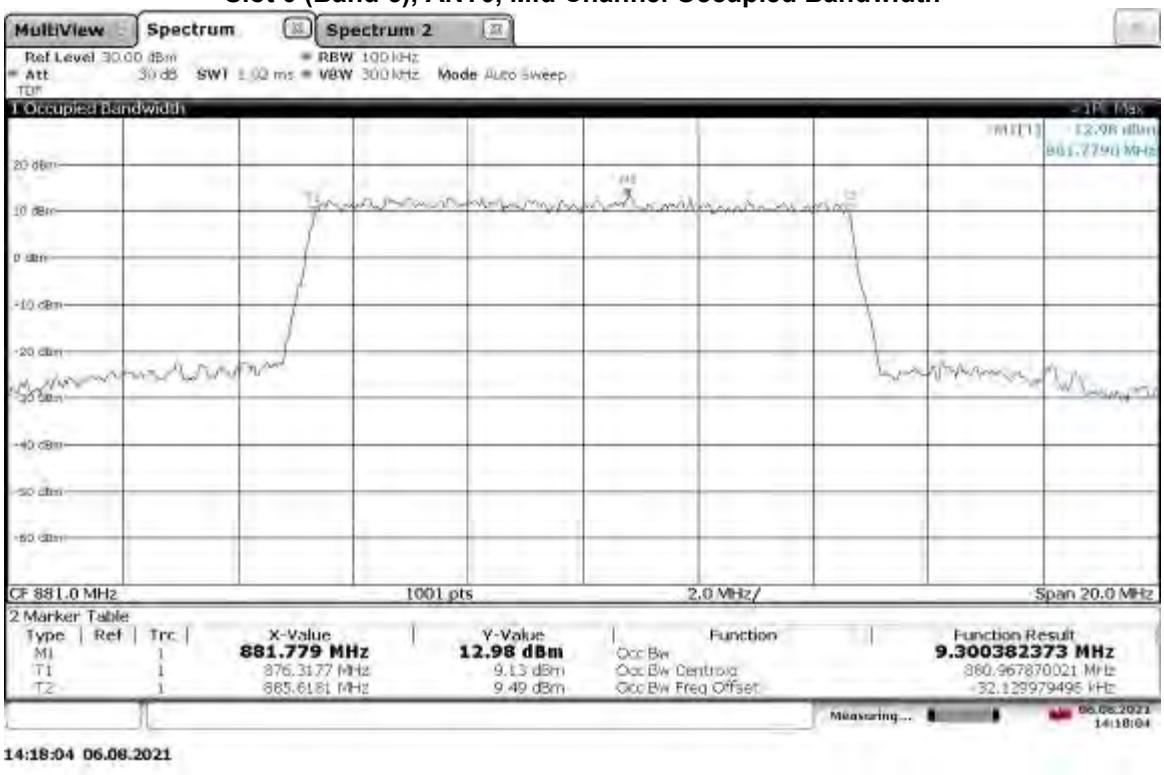
14:04:45 06.08.2021

TM3.1a-256QAM_10 MHz Bandwidth
Slot 0 (Band 5), ANT1, Low Channel Occupied Bandwidth



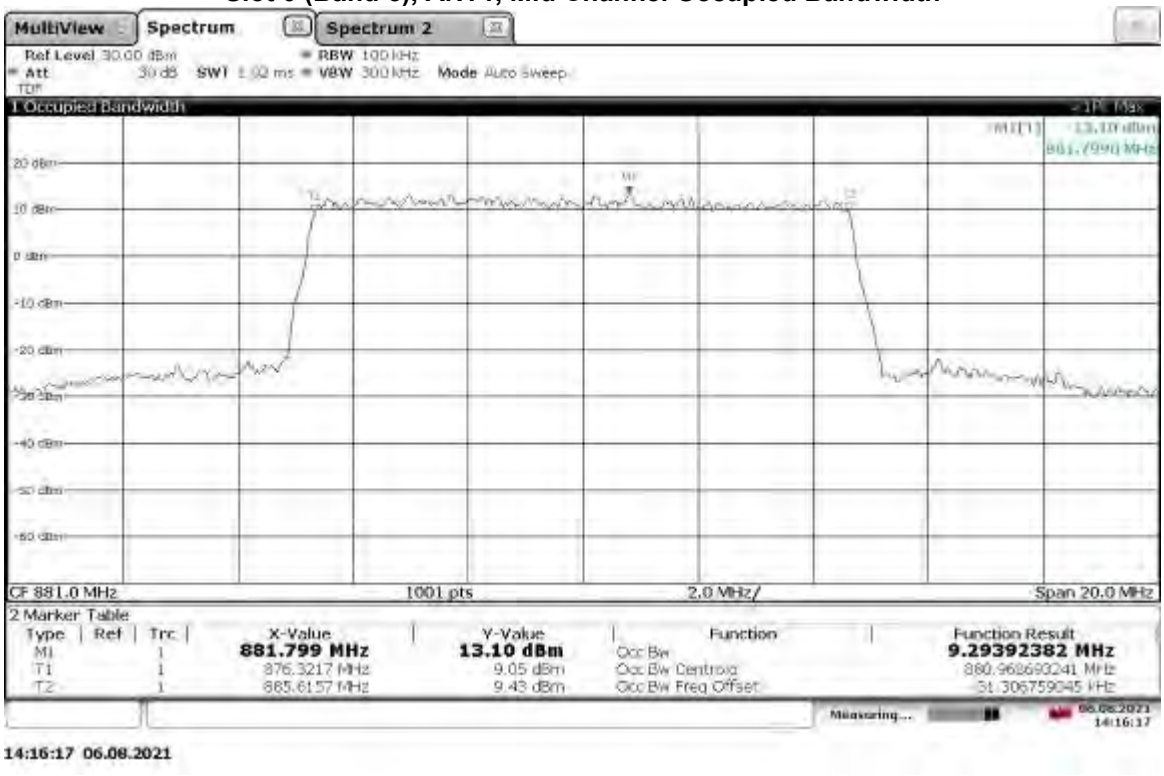
14:06:55 06.08.2021

TM3.1a-256QAM_10 MHz Bandwidth
Slot 0 (Band 5), ANT0, Mid Channel Occupied Bandwidth



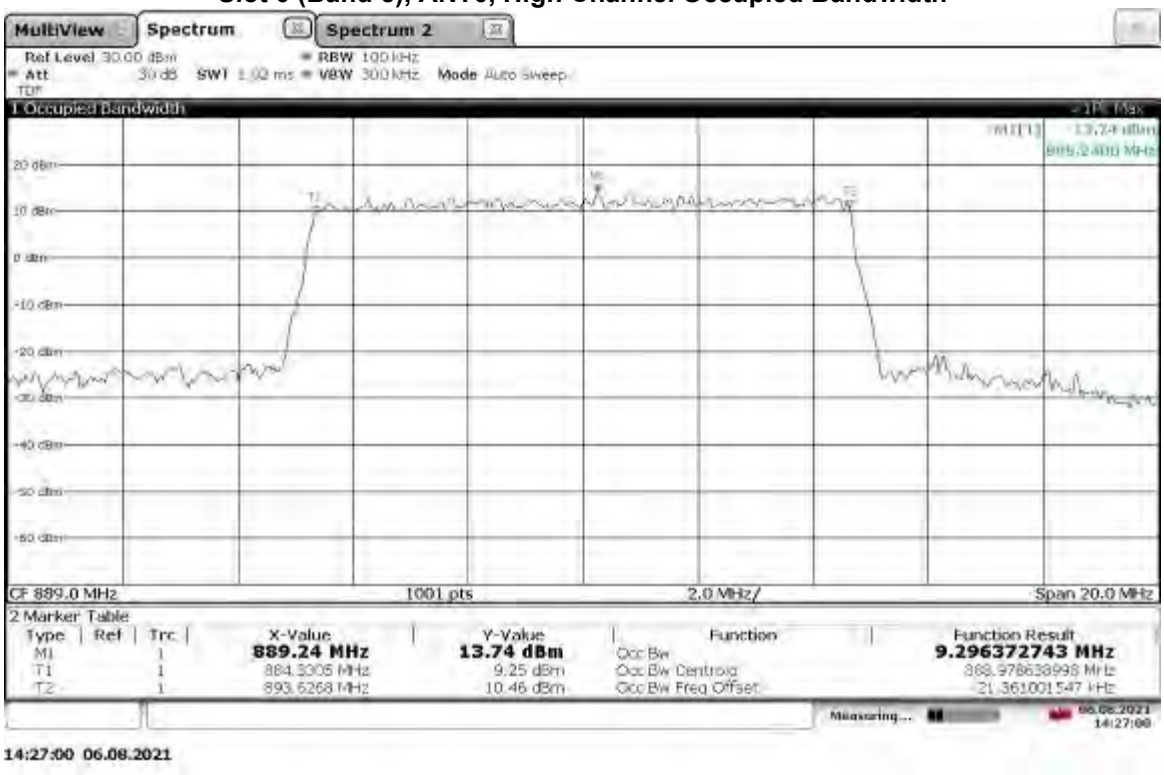
14:18:04 06.08.2021

TM3.1a-256QAM_10 MHz Bandwidth
Slot 0 (Band 5), ANT1, Mid Channel Occupied Bandwidth



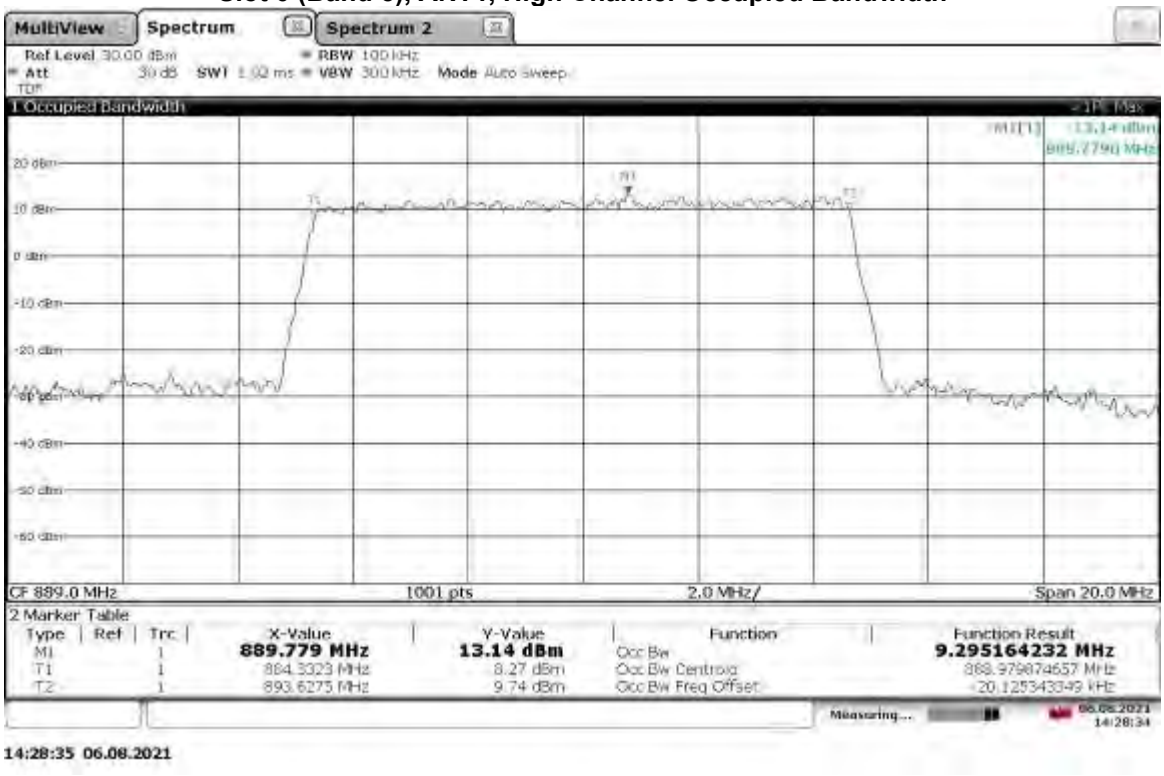
14:16:17 06.08.2021

TM3.1a-256QAM_10 MHz Bandwidth
Slot 0 (Band 5), ANT0, High Channel Occupied Bandwidth



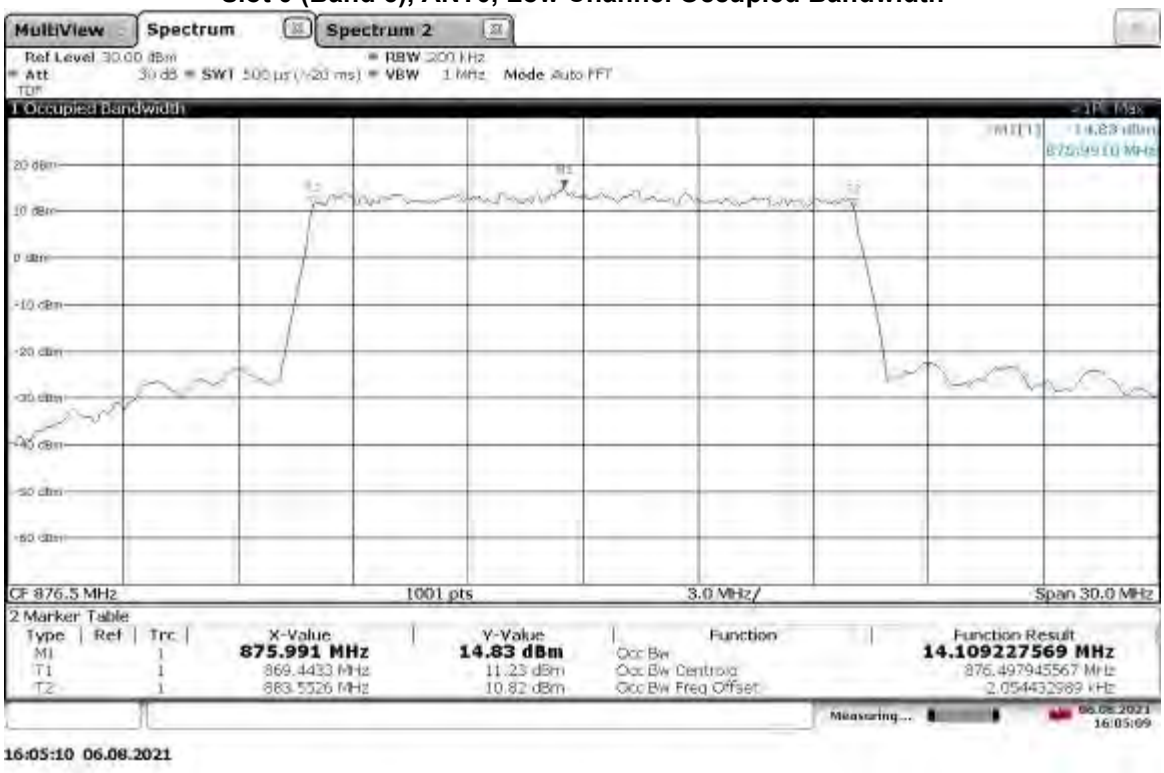
14:27:00 06.08.2021

TM3.1a-256QAM_10 MHz Bandwidth
Slot 0 (Band 5), ANT1, High Channel Occupied Bandwidth

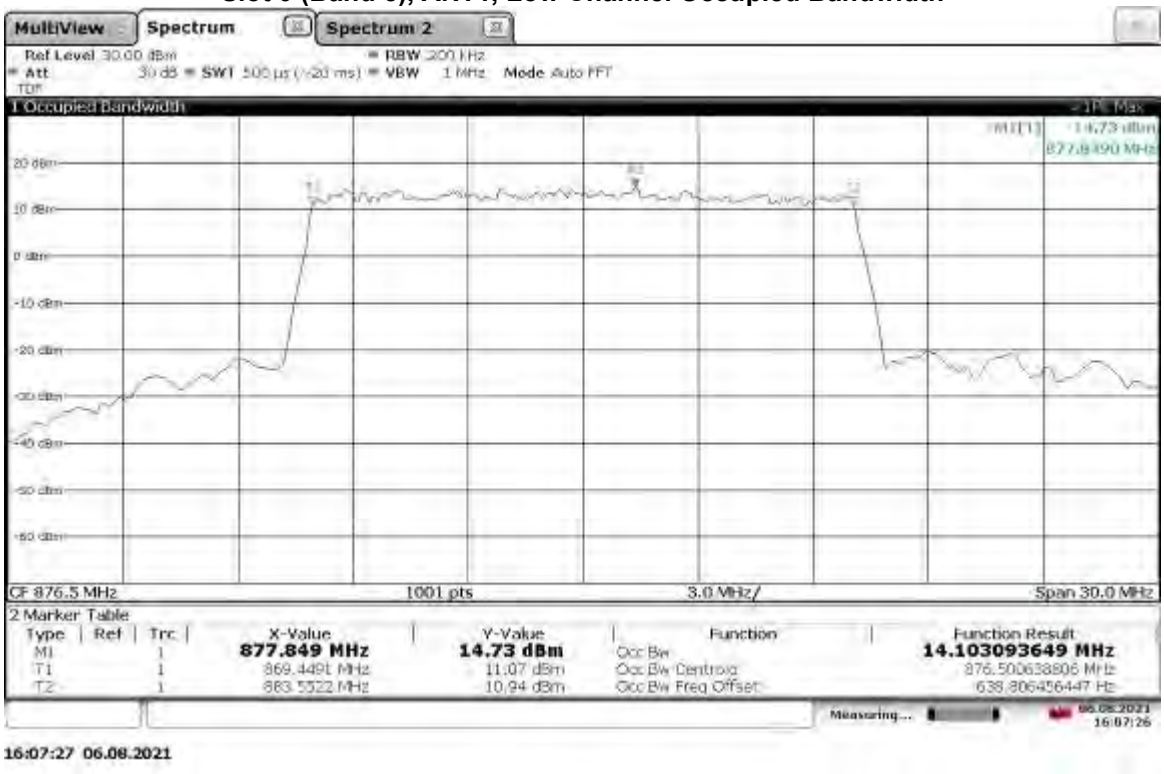


14:28:35 06.08.2021

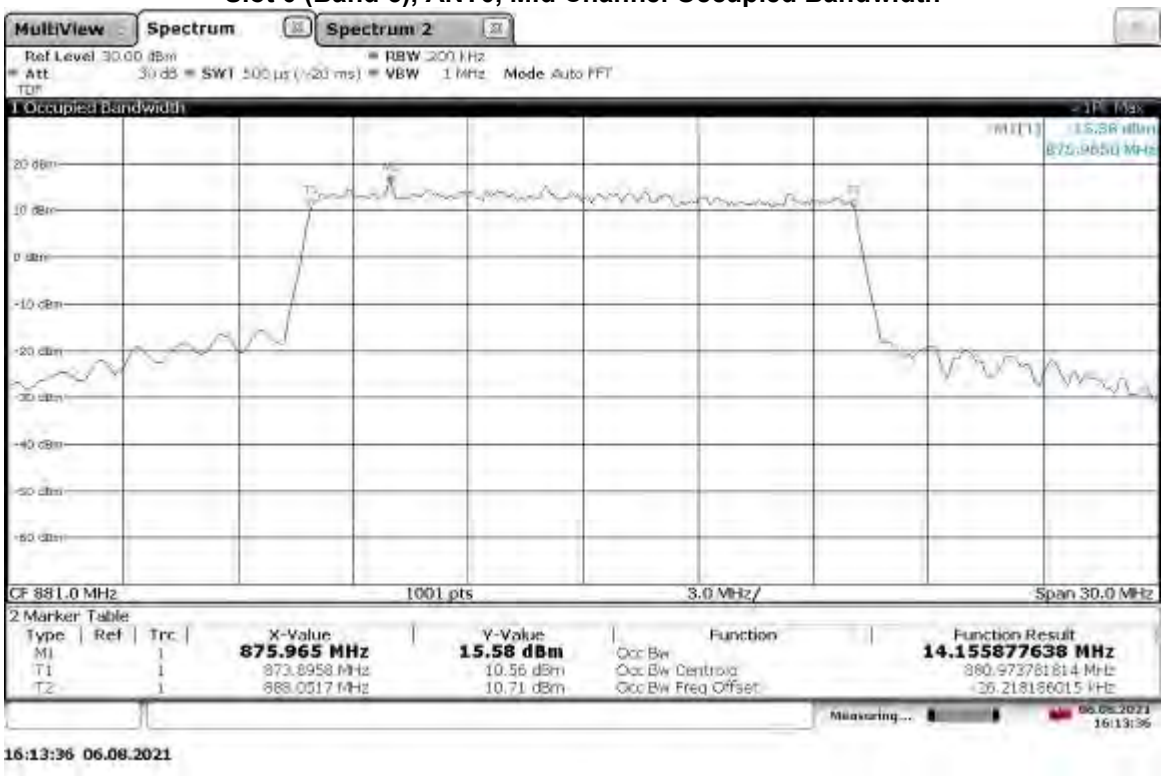
TM3.1a-256QAM_15 MHz Bandwidth
Slot 0 (Band 5), ANT0, Low Channel Occupied Bandwidth



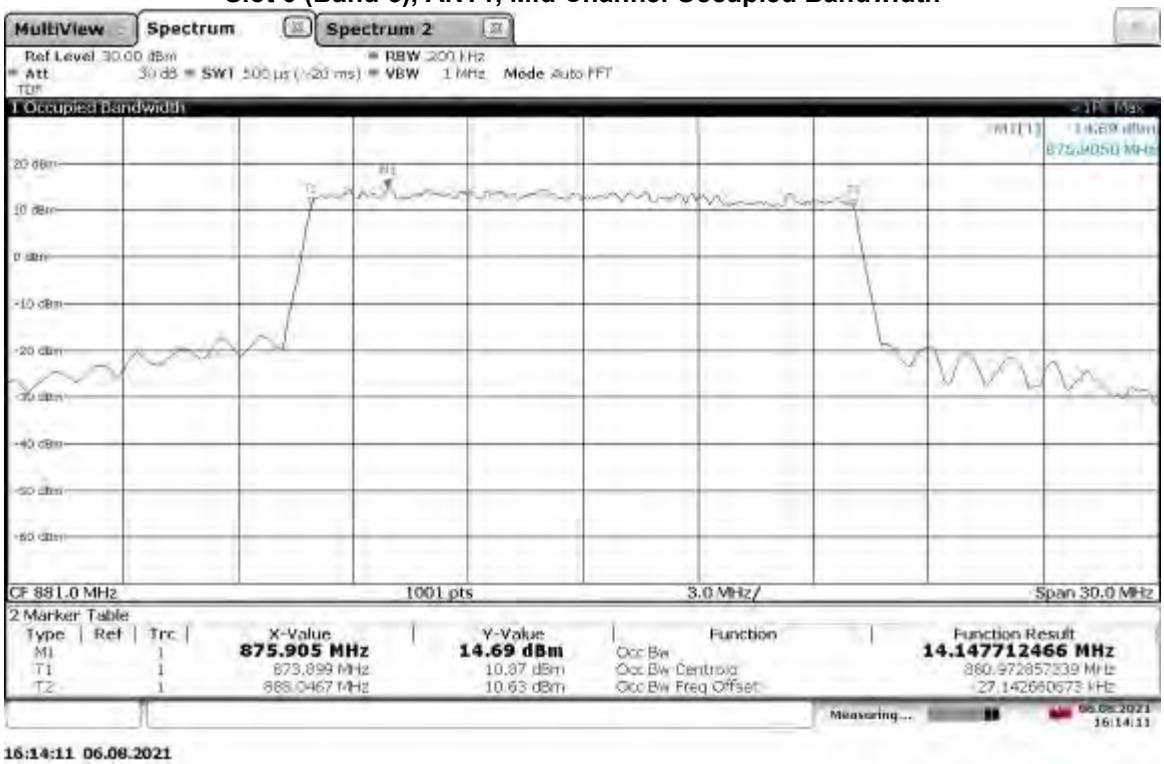
TM3.1a-256QAM_15 MHz Bandwidth
Slot 0 (Band 5), ANT1, Low Channel Occupied Bandwidth



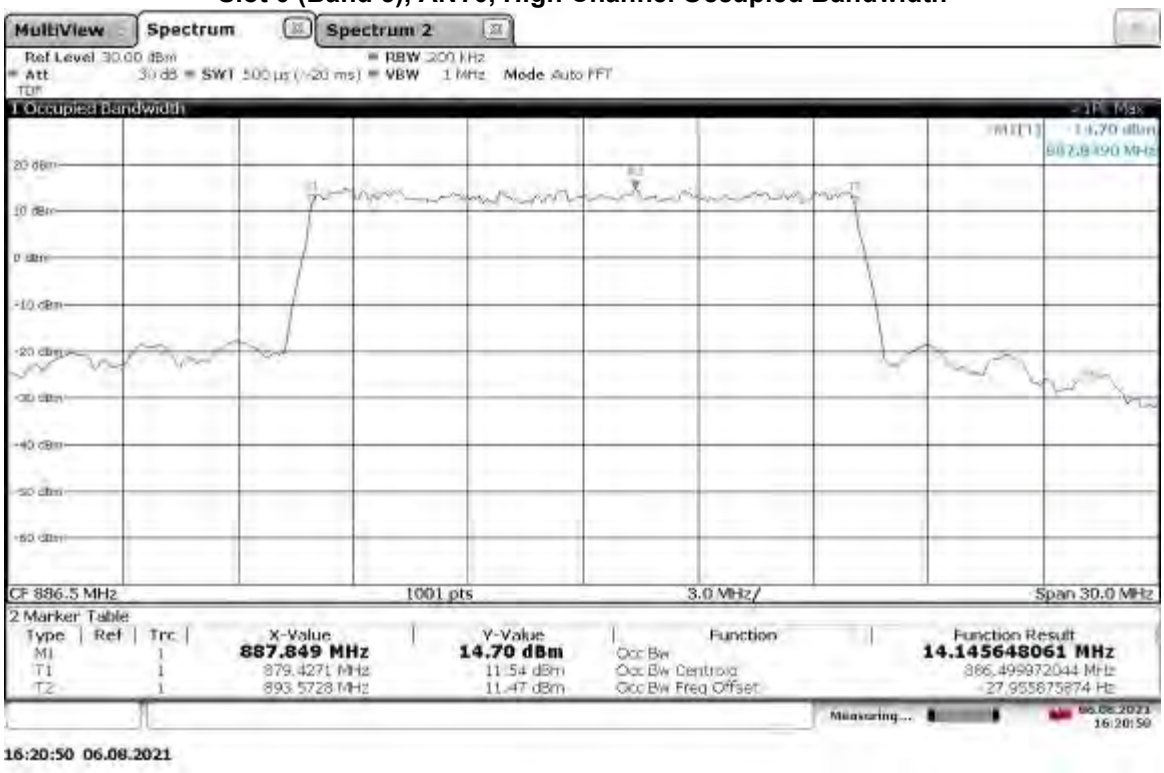
TM3.1a-256QAM_15 MHz Bandwidth
Slot 0 (Band 5), ANT0, Mid Channel Occupied Bandwidth



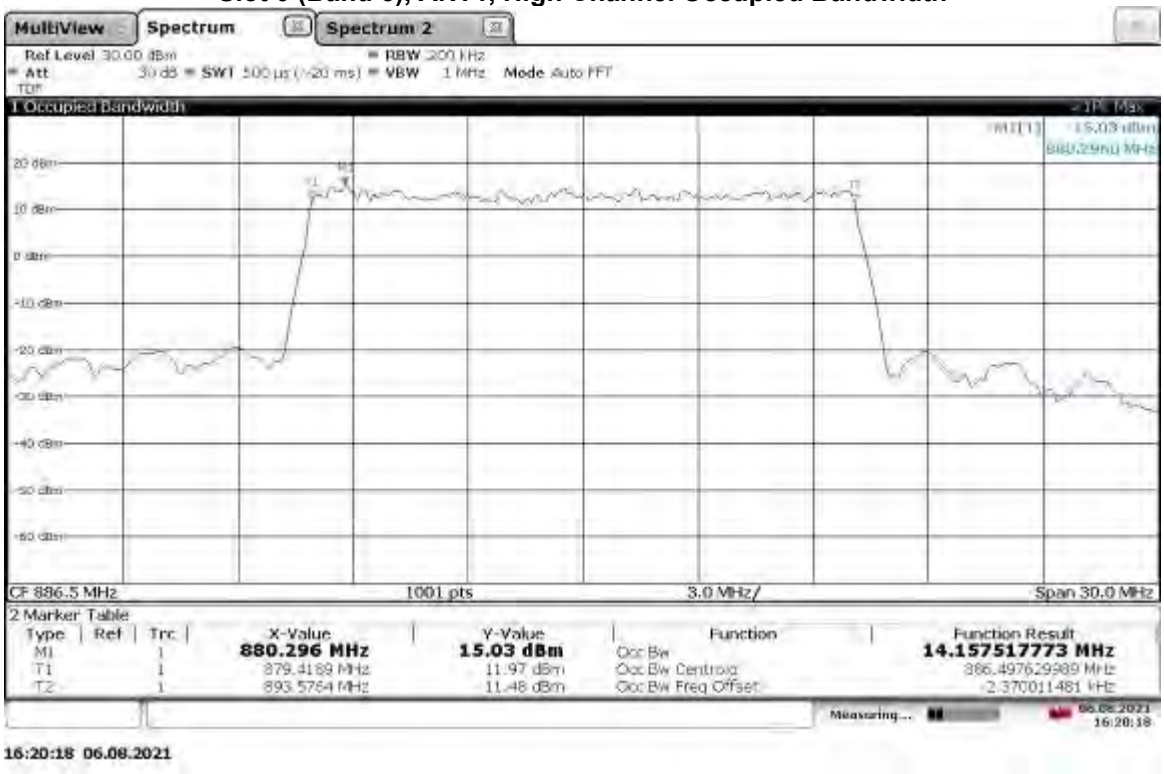
TM3.1a-256QAM_15 MHz Bandwidth
Slot 0 (Band 5), ANT1, Mid Channel Occupied Bandwidth



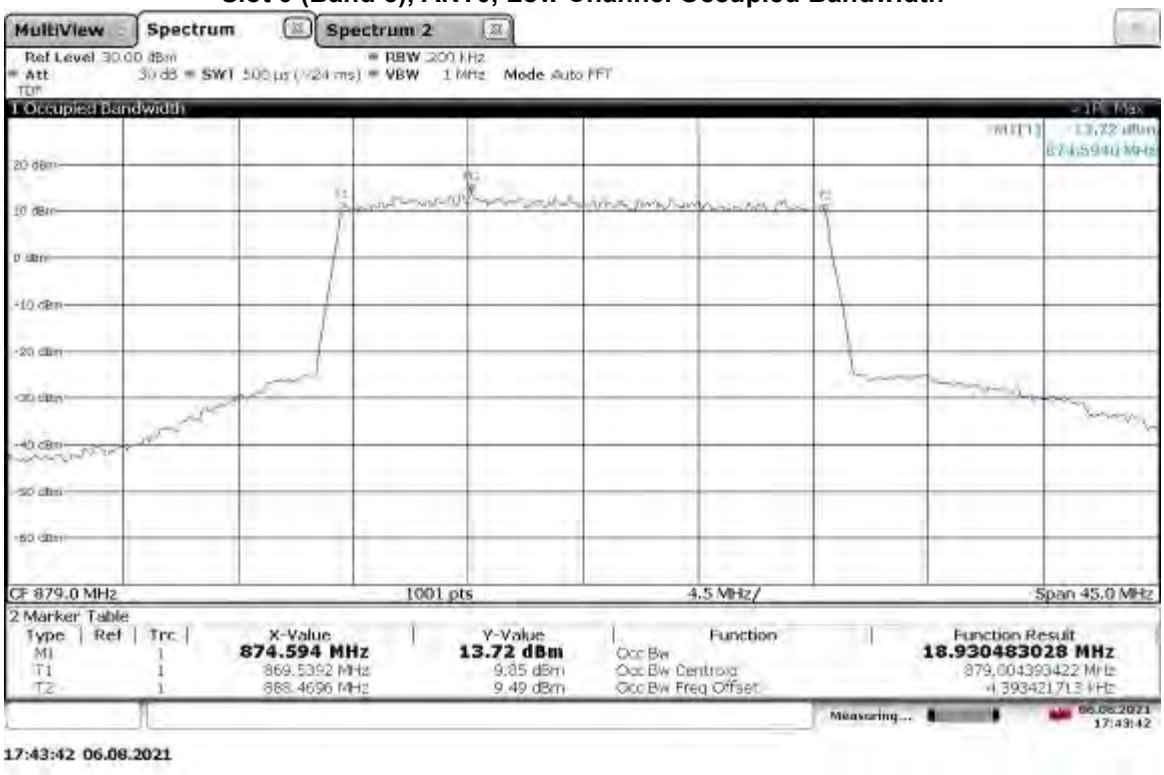
TM3.1a-256QAM_15 MHz Bandwidth
Slot 0 (Band 5), ANT0, High Channel Occupied Bandwidth



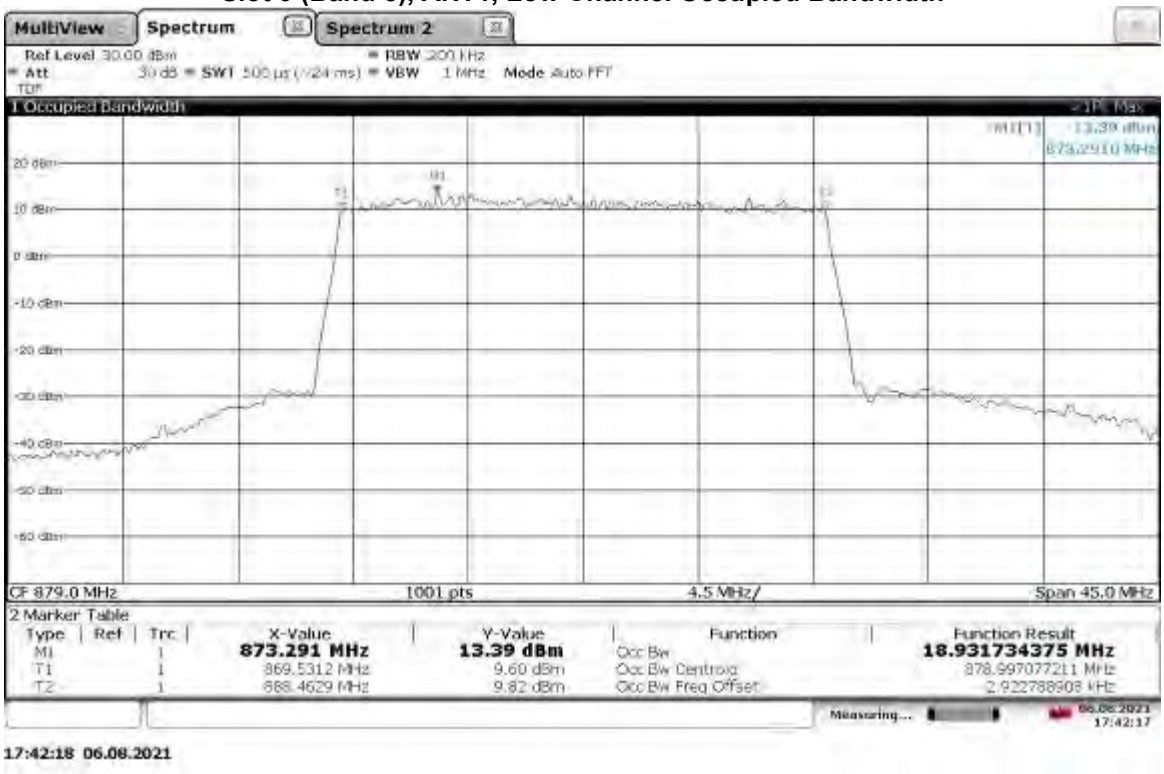
TM3.1a-256QAM_15 MHz Bandwidth
Slot 0 (Band 5), ANT1, High Channel Occupied Bandwidth



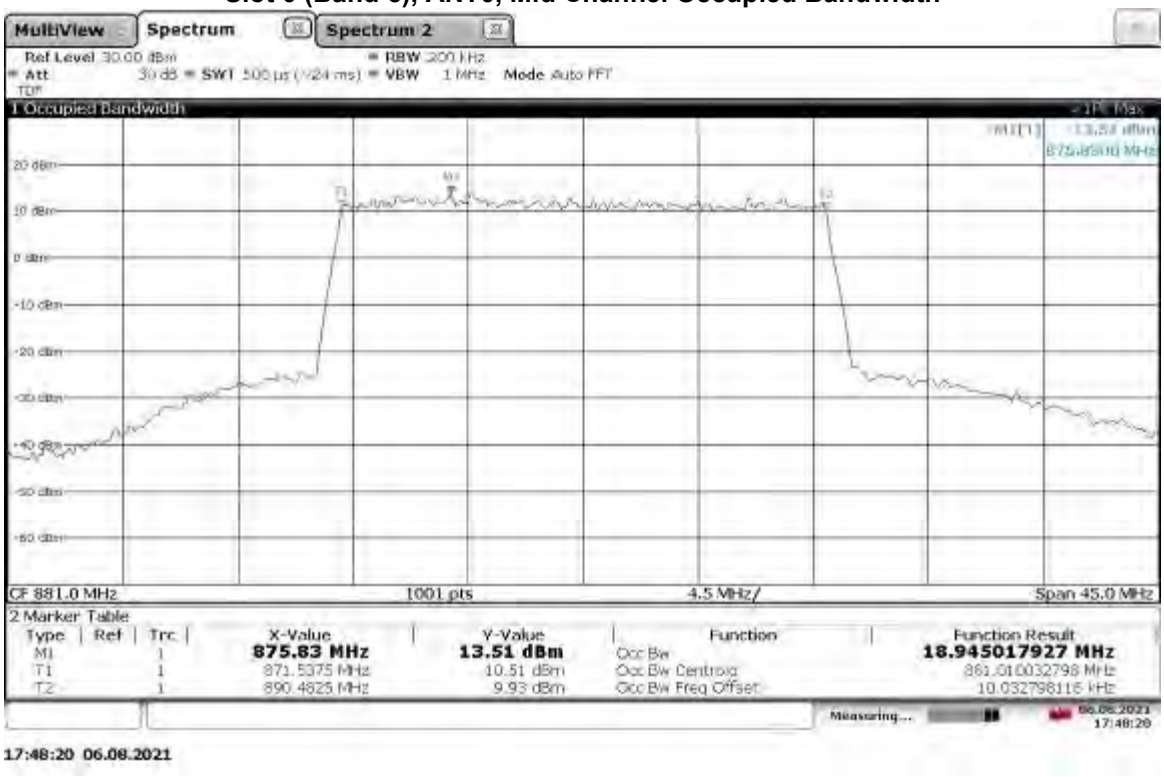
TM3.1a-256QAM_20 MHz Bandwidth
Slot 0 (Band 5), ANT0, Low Channel Occupied Bandwidth



TM3.1a-256QAM_20 MHz Bandwidth
Slot 0 (Band 5), ANT1, Low Channel Occupied Bandwidth

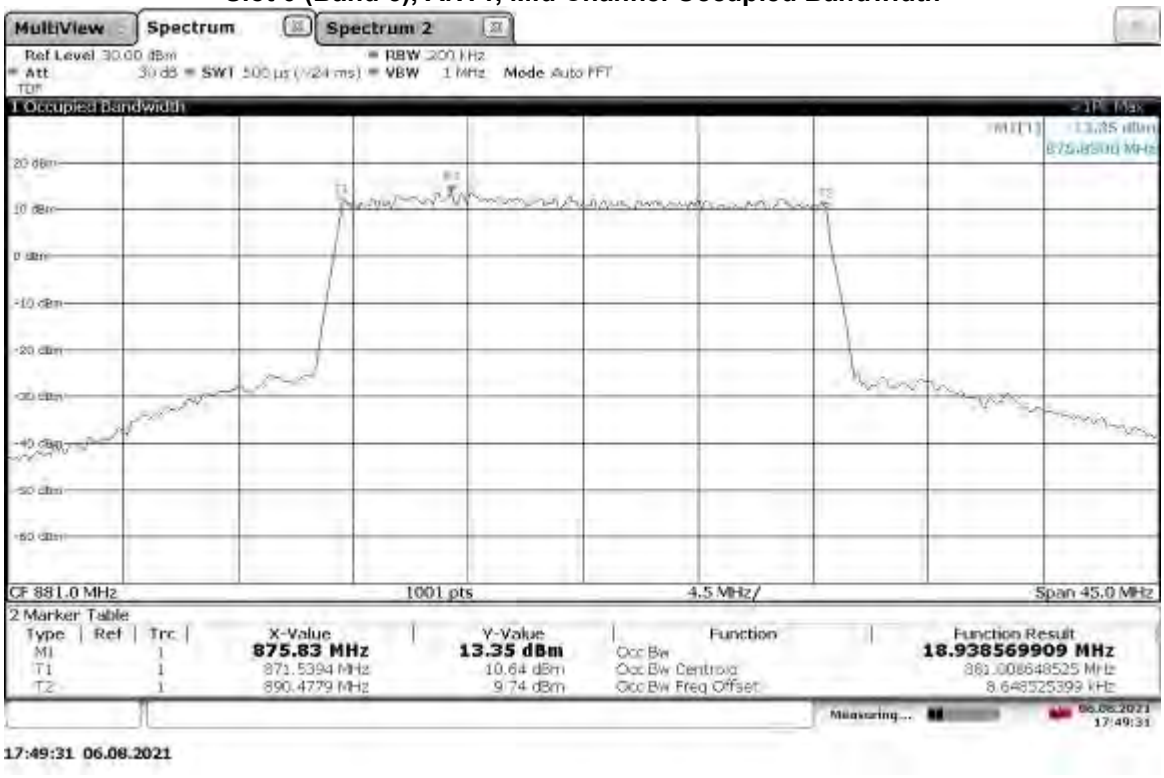


TM3.1a-256QAM_20 MHz Bandwidth
Slot 0 (Band 5), ANT0, Mid Channel Occupied Bandwidth



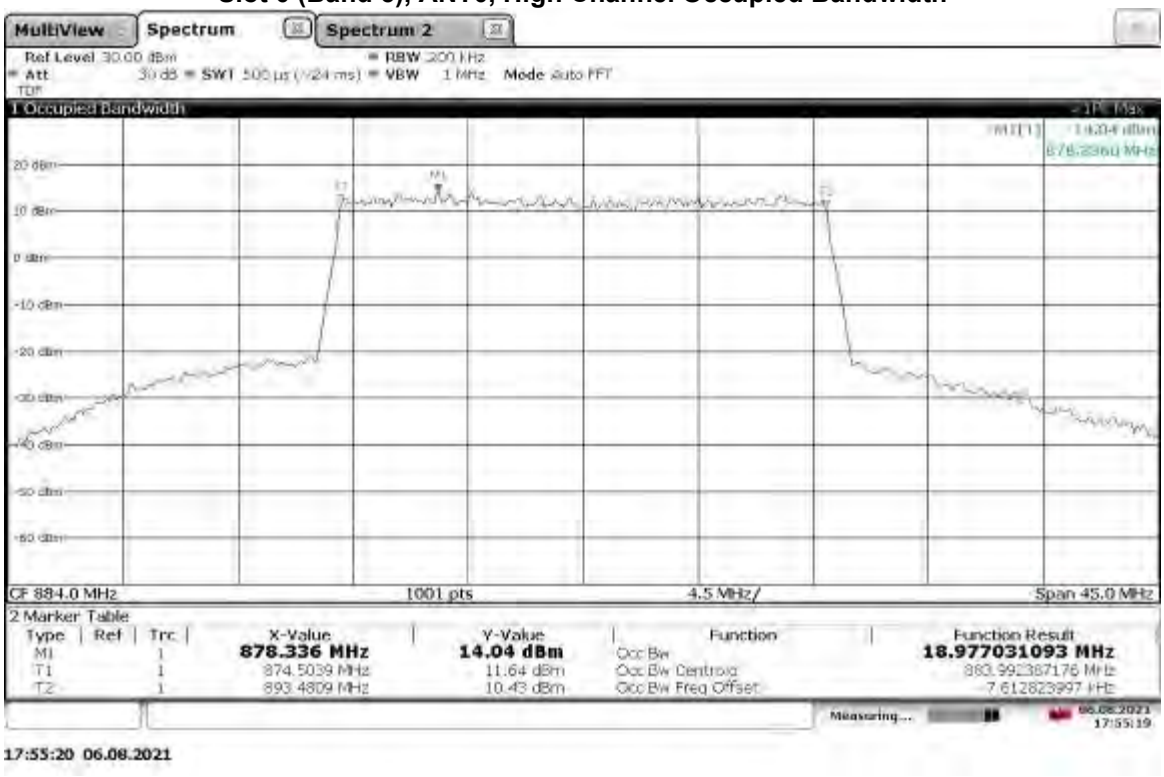
17:48:20 06.08.2021

TM3.1a-256QAM_20 MHz Bandwidth
Slot 0 (Band 5), ANT1, Mid Channel Occupied Bandwidth

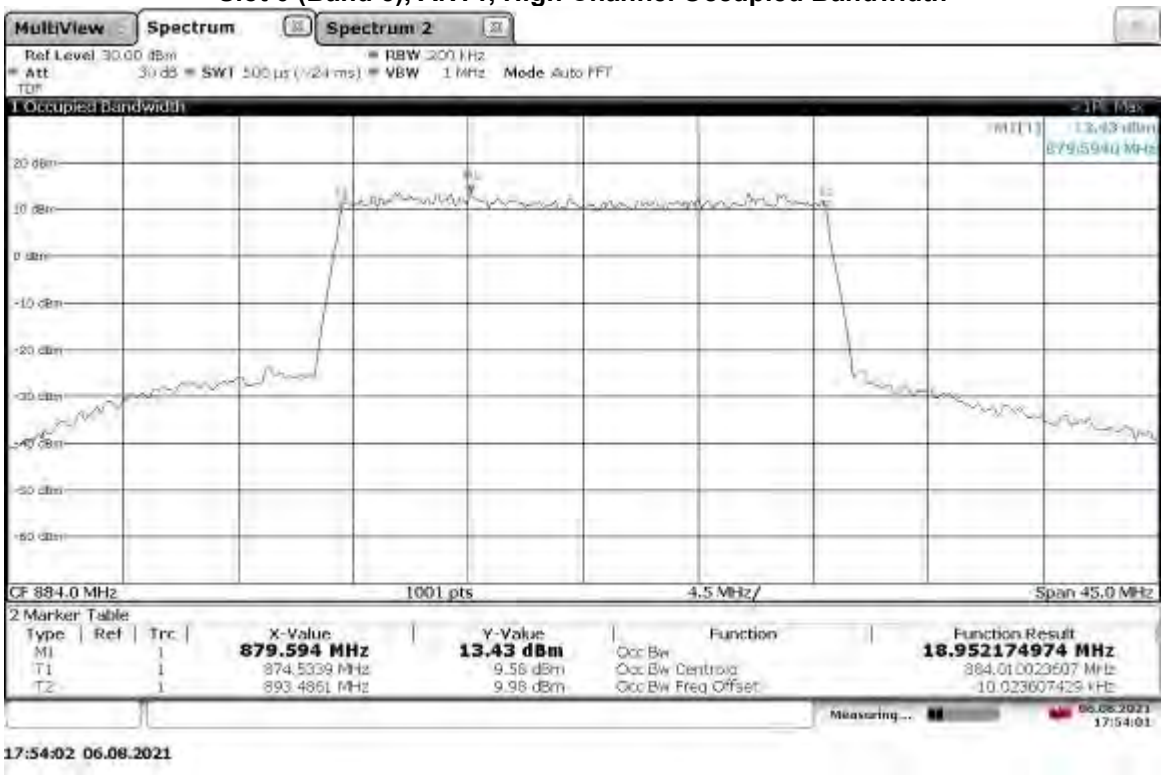


17:49:31 06.08.2021

TM3.1a-256QAM_20 MHz Bandwidth
Slot 0 (Band 5), ANT0, High Channel Occupied Bandwidth



TM3.1a-256QAM_20 MHz Bandwidth
Slot 0 (Band 5), ANT1, High Channel Occupied Bandwidth



Test Personnel:	Vathana Ven	Test Date:	07/26/2021, 08/06/2021
Supervising/Reviewing Engineer: (Where Applicable)	N/A		
Product Standard:	FCC Part 22	Limit Applied:	See report section 7.3
Input Voltage:	48 VDC (POE)		
Pretest Verification w/ Ambient Signals or BB Source:	N/A	Ambient Temperature:	22, 23 ºC
		Relative Humidity:	26, 47 %
		Atmospheric Pressure:	1004, 980 mbars

Deviations, Additions, or Exclusions: None

8 Band Edge Compliance

8.1 Method

Tests are performed in accordance with ANSI C63.26 and CFR47 FCC Parts 2.1051, 2.1053, and 22.917(a)(b).

TEST SITE: EMC Lab & 10m ALSE

The EMC Lab has one Semi-anechoic Chamber and one Shielded Chamber. AC Mains Power is available at 120, 230, and 277 Single Phase; 208, 400, and 480 3-Phase. Large reference ground-planes are installed in the general lab area to facilitate EMC work not requiring a shielded environment.

8.2 Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
CEN001'	DC-40GHz attenuator 20dB	Centric RF	C411-20	CEN001	01/22/2021	01/22/2022
CBLSHF204'	Cable, SMA - SMA, 9kHz -40GHz, (Cable Kit 5)	Huber + Suhner	Sucoflex 102EA	234714001	02/03/2021	02/03/2022
ROS005-1'	Signal and Spectrum Analyzer	Rohde and Shwartz	FSW43	100646	11/02/2021	11/02/2022
DAV005'	Weather Station	Davis	6250	MS191218083	02/07/2021	02/07/2022

Software Utilized:

Name	Manufacturer	Version
None	--	--

8.3 Results:

The sample tested was found to Comply.

§22.861(a)(b) The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB.

Slot 0 (Band 5), Bandwidth: 5 MHz, Modulation: TM1.1-QPSK

Band Edge	Frequency (MHz)	Antenna Port	Reading (dBm)
Low	871.5	ANT0	-33.95
		ANT1	-33.67
High	891.5	ANT0	-33.04
		ANT1	-31.66

Slot 0 (Band 5), Bandwidth: 10 MHz, Modulation: TM1.1-QPSK

Band Edge	Frequency (MHz)	Antenna Port	Reading (dBm)
Low	874	ANT0	-34.10
		ANT1	-34.1
High	889	ANT0	-32.55
		ANT1	-32.03

Slot 0 (Band 5), Bandwidth: 15 MHz, Modulation: TM1.1-QPSK

Band Edge	Frequency (MHz)	Antenna Port	Reading (dBm)
Low	876.5	ANT0	-34.98
		ANT1	-35.23
High	886.5	ANT0	-32.90
		ANT1	-32.80

Slot 0 (Band 2), Bandwidth: 20 MHz, Modulation: TM1.1-QPSK

Band Edge	Frequency (MHz)	Antenna Port	Reading (dBm)
Low	879	ANT0	-37.12
		ANT1	-36.67
High	884	ANT0	-34.47
		ANT1	-34.21

Slot 0 (Band 5), Bandwidth: 5 MHz, Modulation: TM3.2-16QAM

Band Edge	Frequency (MHz)	Antenna Port	Reading (dBm)
Low	871.5	ANT0	-33.23
		ANT1	-32.98
High	891.5	ANT0	-33.55
		ANT1	-31.68

Slot 0 (Band 5), Bandwidth: 10 MHz, Modulation: TM3.2-16QAM

Band Edge	Frequency (MHz)	Antenna Port	Reading (dBm)
Low	874	ANT0	-34.28
		ANT1	-33.90
High	889	ANT0	-34.53
		ANT1	-33.62

Slot 0 (Band 5), Bandwidth: 15 MHz, Modulation: TM3.2-16QAM

Band Edge	Frequency (MHz)	Antenna Port	Reading (dBm)
Low	876.5	ANT0	-34.21
		ANT1	-34.16
High	886.5	ANT0	-33.76
		ANT1	-33.25

Slot 0 (Band 5), Bandwidth: 20 MHz, Modulation: TM3.2-16QAM

Band Edge	Frequency (MHz)	Antenna Port	Reading (dBm)
Low	879	ANT0	-35.63
		ANT1	-35.32
High	884	ANT0	-33.95
		ANT1	-33.43

Slot 0 (Band 5), Bandwidth: 5 MHz, Modulation: TM3.1-64QAM

Band Edge	Frequency (MHz)	Antenna Port	Reading (dBm)
Low	871.5	ANT0	-33.76
		ANT1	-33.77
High	891.5	ANT0	-33.06
		ANT1	-31.84

Slot 0 (Band 5), Bandwidth: 10 MHz, Modulation: TM3.1-64QAM

Band Edge	Frequency (MHz)	Antenna Port	Reading (dBm)
Low	874	ANT0	-34.89
		ANT1	-34.82
High	889	ANT0	-32.92
		ANT1	-32-32

Slot 0 (Band 5), Bandwidth: 15 MHz, Modulation: TM3.1-64QAM

Band Edge	Frequency (MHz)	Antenna Port	Reading (dBm)
Low	876.5	ANT0	-35.44
		ANT1	-35.22
High	886.5	ANT0	-33.50
		ANT1	-33.09

Slot 0 (Band 5), Bandwidth: 20 MHz, Modulation: TM3.1-64QAM

Band Edge	Frequency (MHz)	Antenna Port	Reading (dBm)
Low	879	ANT0	-35.25
		ANT1	-35.32
High	884	ANT0	-35.08
		ANT1	-34.43

Slot 0 (Band 5), Bandwidth: 5 MHz, Modulation: TM3.1a-256QAM_

Band Edge	Frequency (MHz)	Antenna Port	Reading (dBm)
Low	871.5	ANT0	-33.26
		ANT1	-33.37
High	891.5	ANT0	-32.98
		ANT1	-31.27

Slot 0 (Band 5), Bandwidth: 10 MHz, Modulation: TM3.1a-256QAM_

Band Edge	Frequency (MHz)	Antenna Port	Reading (dBm)
Low	874	ANT0	-34.20
		ANT1	-34.21
High	889	ANT0	-33.27
		ANT1	-32.51

Slot 0 (Band 5), Bandwidth: 15 MHz, Modulation: TM3.1a-256QAM

Band Edge	Frequency (MHz)	Antenna Port	Reading (dBm)
Low	876.5	ANT0	-36.72
		ANT1	-36.46
High	886.5	ANT0	-33.57
		ANT1	-33.30

Slot 0 (Band 5), Bandwidth: 20 MHz, Modulation: TM3.1a-256QAM

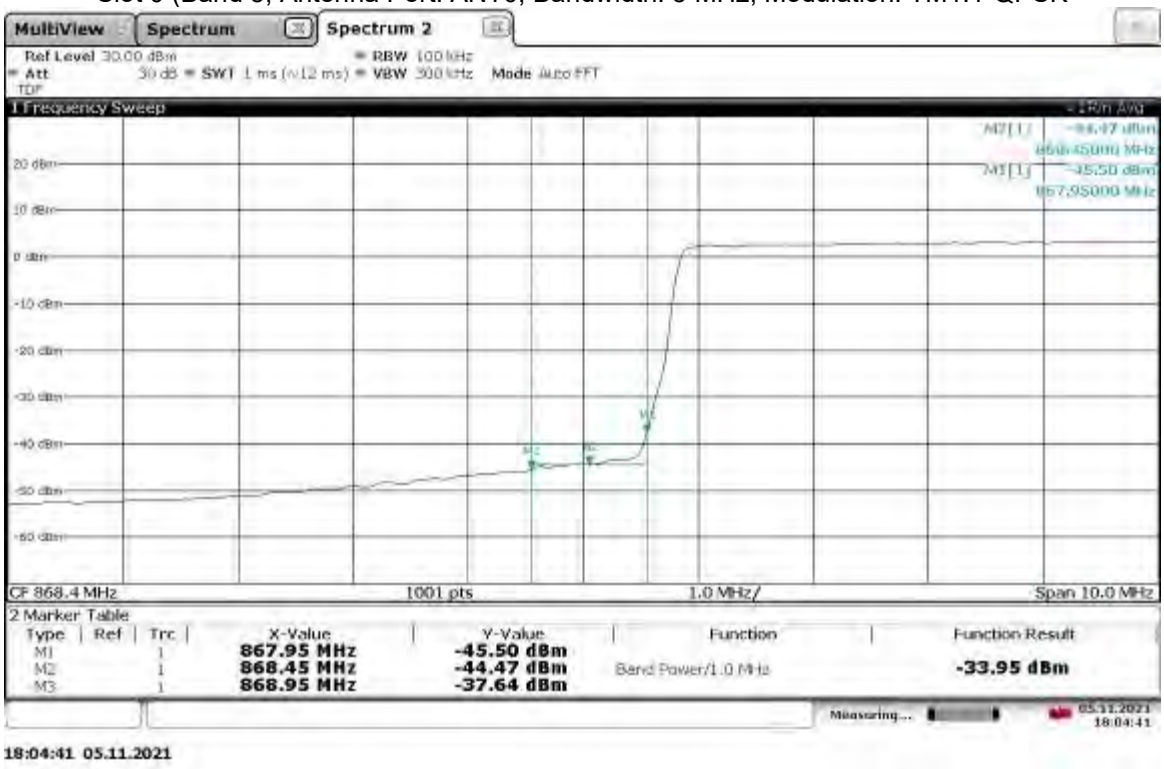
Band Edge	Frequency (MHz)	Antenna Port	Reading (dBm)
Low	879	ANT0	-35.68
		ANT1	-35.35
High	884	ANT0	-32.40
		ANT1	-32.32

8.4 Setup Photograph:

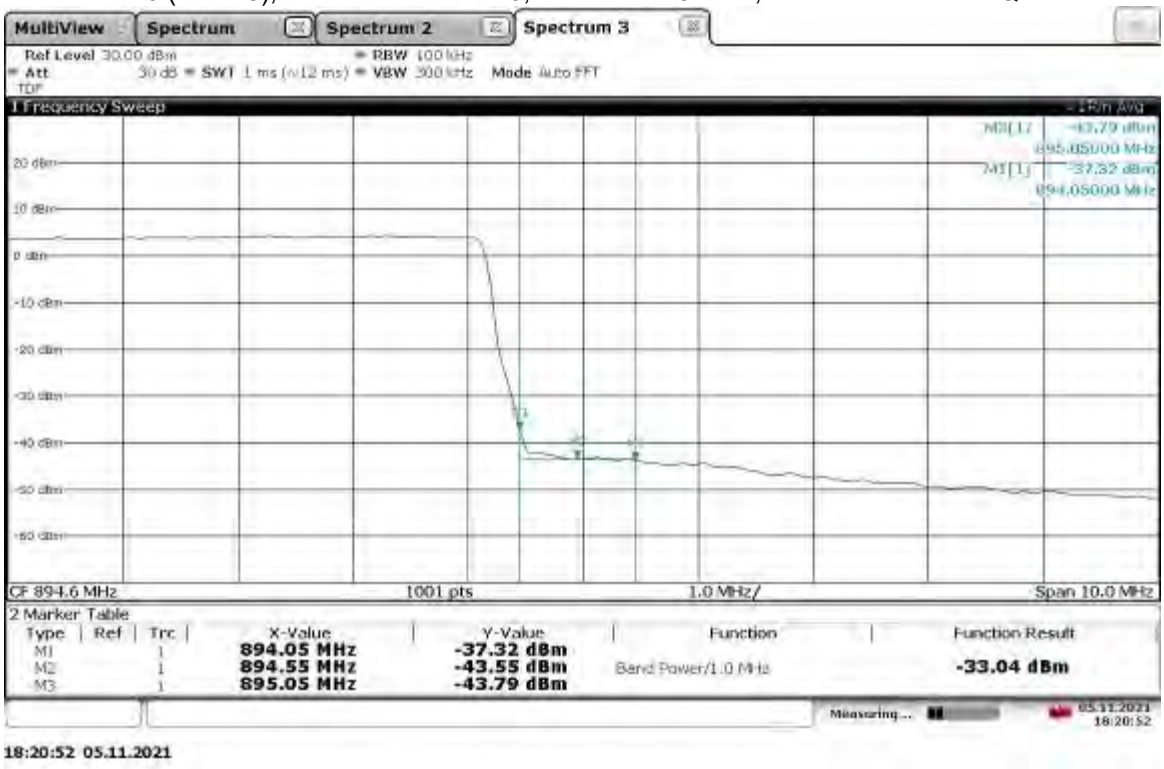
Confidential – Test setup photo not included in this report

8.5 Plots/Data:

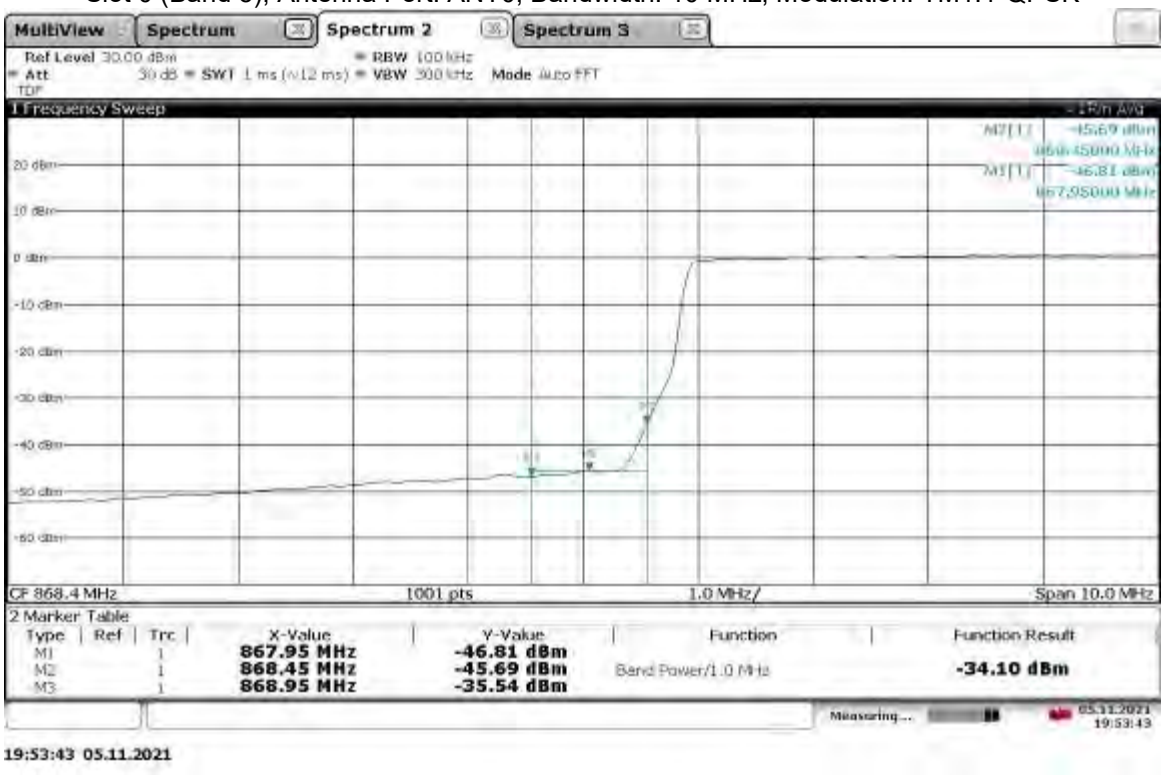
Band Edge Compliant, Lower Band Edge, 871.5 MHz
Slot 0 (Band 5, Antenna Port: ANT0, Bandwidth: 5 MHz, Modulation: TM1.1-QPSK



Band Edge Compliant, Upper Band Edge, 891.5 MHz
Slot 0 (Band 5), Antenna Port: ANT0, Bandwidth: 5 MHz, Modulation: TM1.1-QPSK



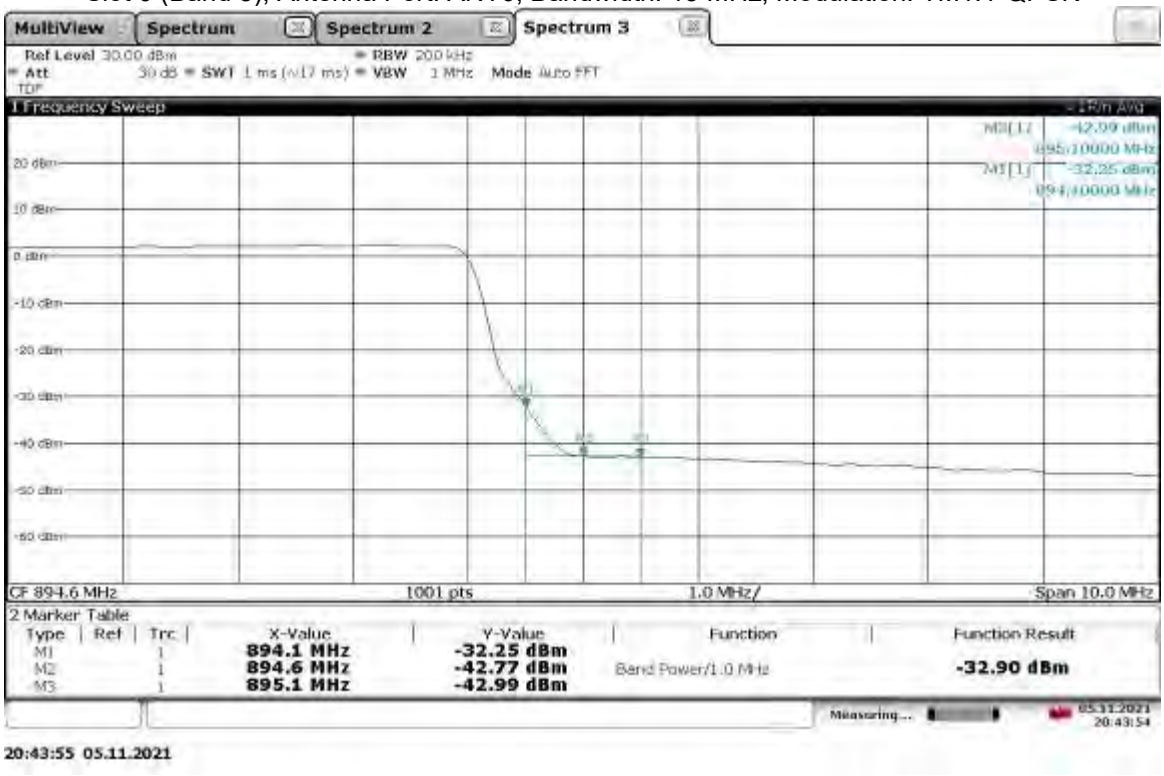
Band Edge Compliant, Lower Band Edge, 874 MHz
Slot 0 (Band 5), Antenna Port: ANT0, Bandwidth: 10 MHz, Modulation: TM1.1-QPSK



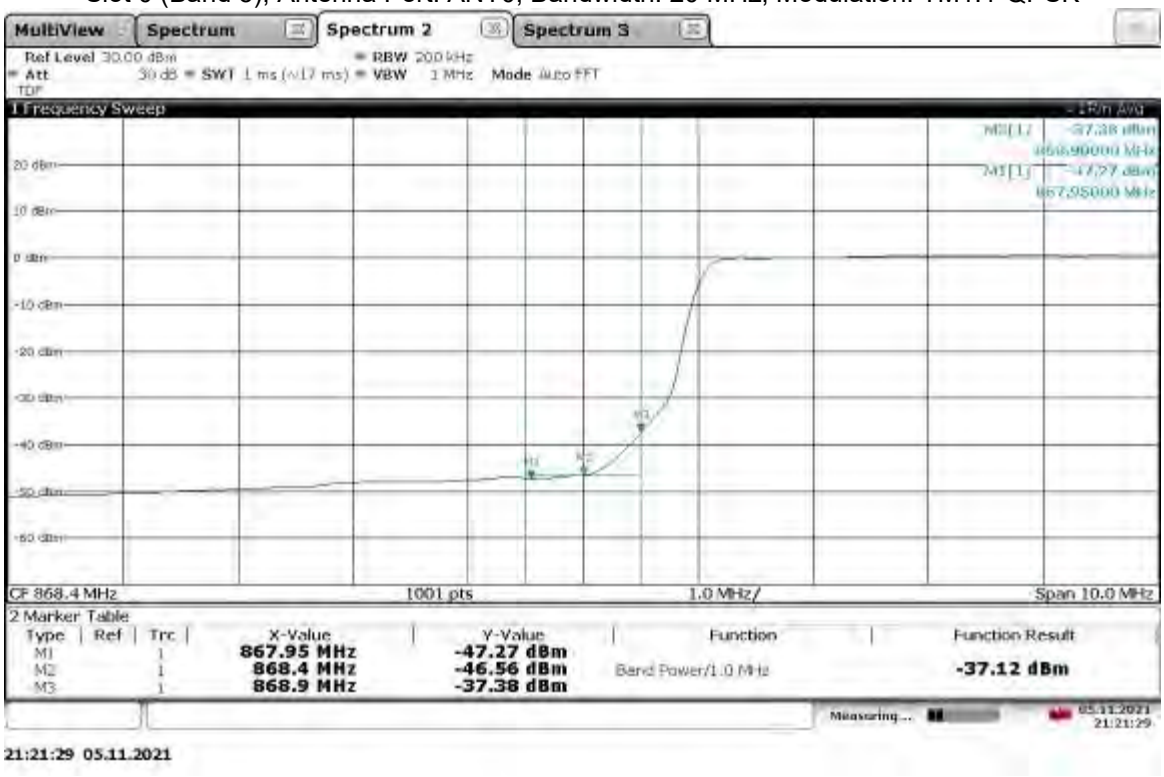
Band Edge Compliant, Upper Edge, 889 MHz
Slot 0 (Band 5), Antenna Port: ANT0, Bandwidth: 10 MHz, Modulation: TM1.1-QPSK

Band Edge Compliant, Lower Band Edge, 876.5 MHz
Slot 0 (Band 5), Antenna Port: ANT0, Bandwidth: 15 MHz, Modulation: TM1.1-QPSK

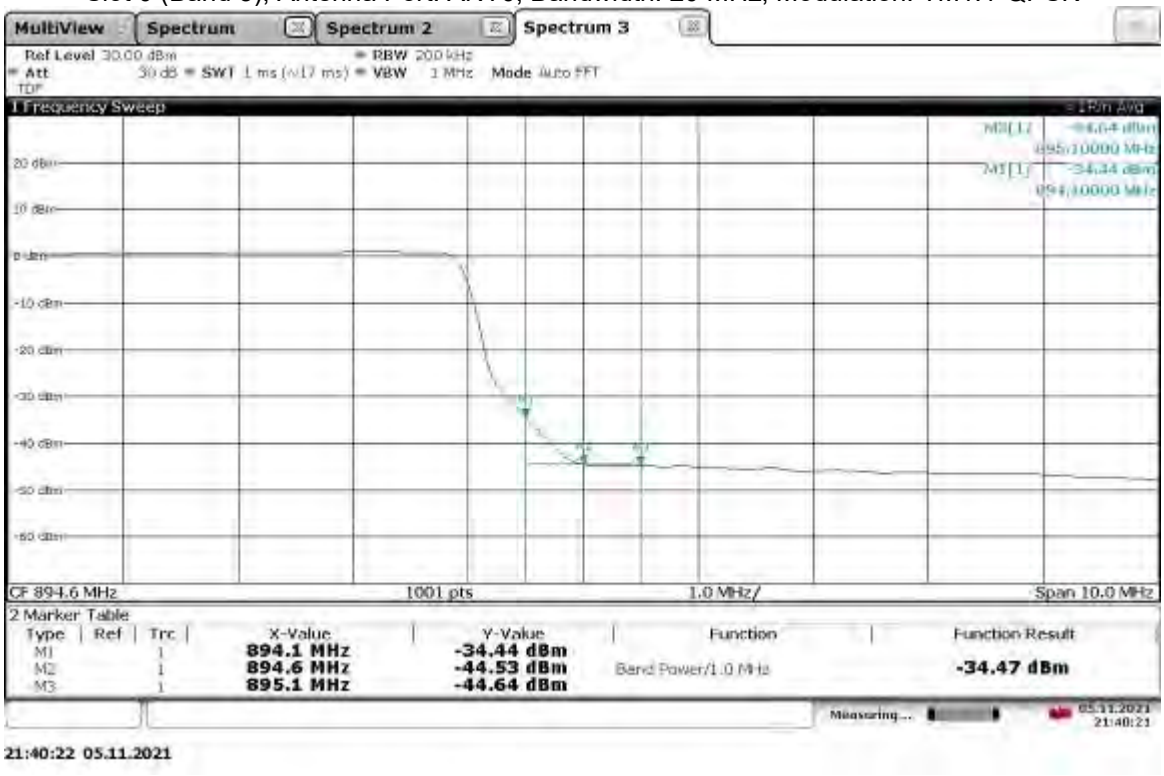
Band Edge Compliant, Upper Band Edge, 886.5 MHz
Slot 0 (Band 5), Antenna Port: ANT0, Bandwidth: 15 MHz, Modulation: TM1.1-QPSK



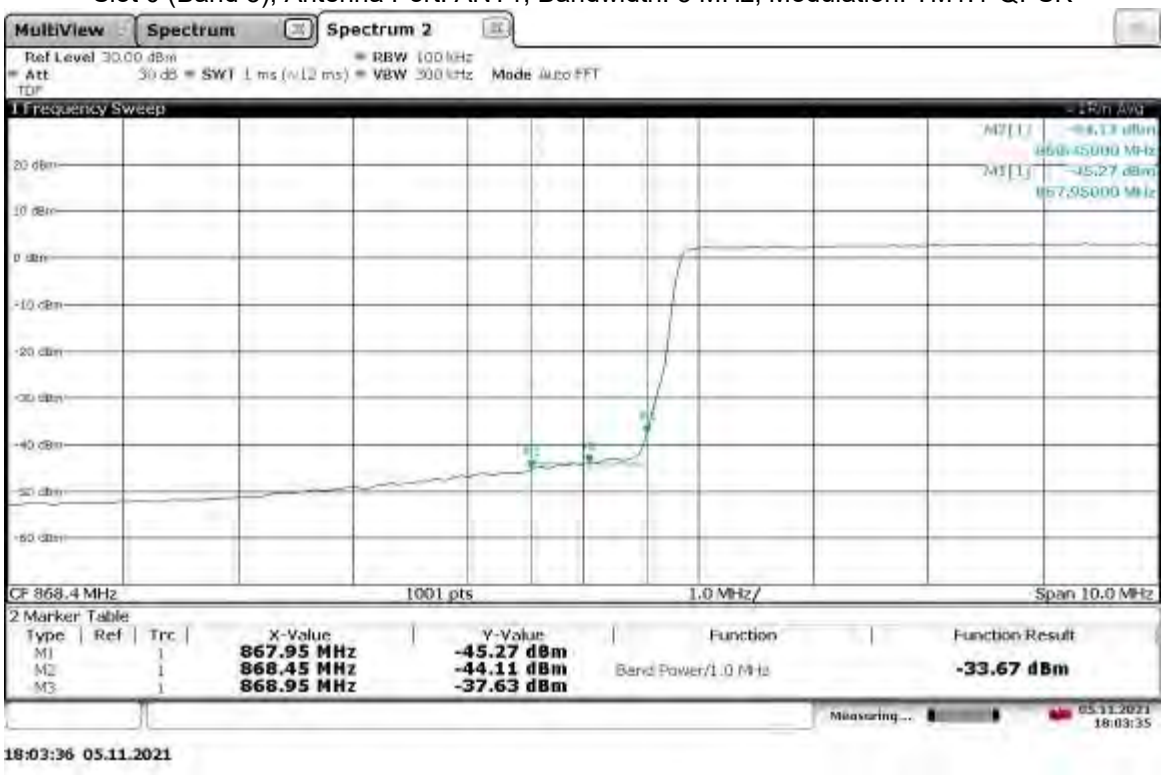
Band Edge Compliant, Lower Band Edge, 879 MHz
Slot 0 (Band 5), Antenna Port: ANT0, Bandwidth: 20 MHz, Modulation: TM1.1-QPSK



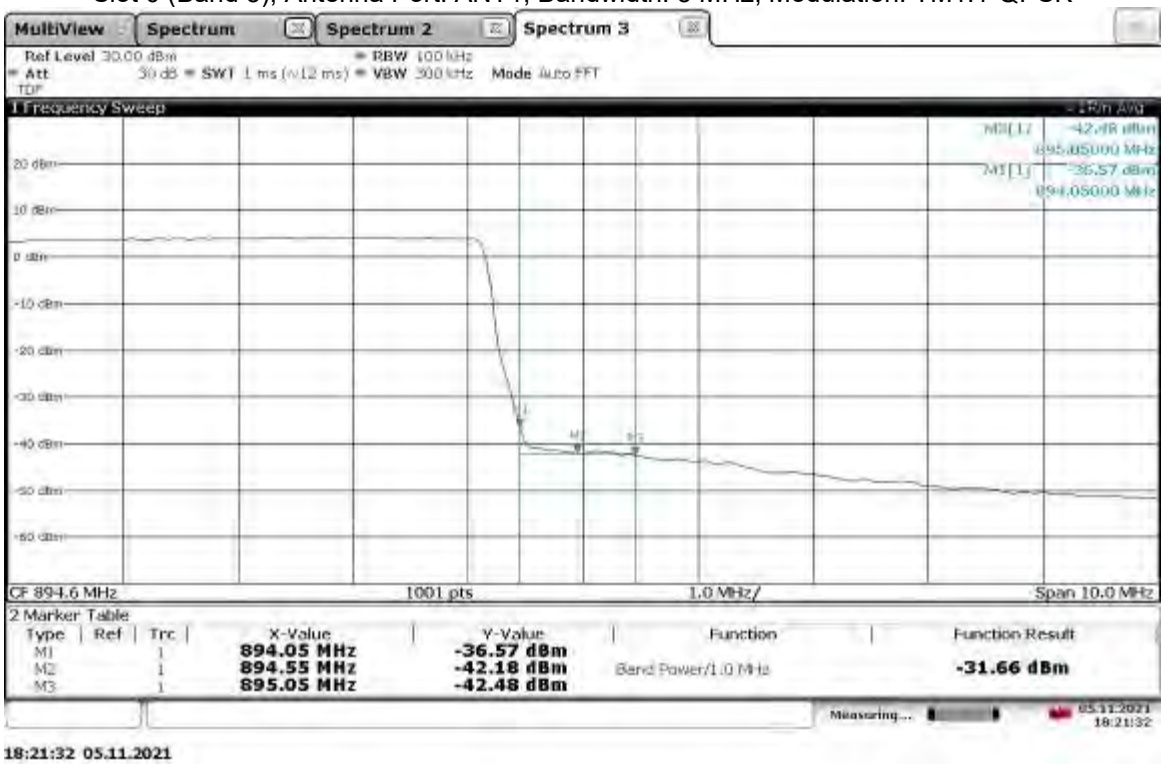
Band Edge Compliant, Upper Band Edge, 884 MHz
Slot 0 (Band 5), Antenna Port: ANT0, Bandwidth: 20 MHz, Modulation: TM1.1-QPSK



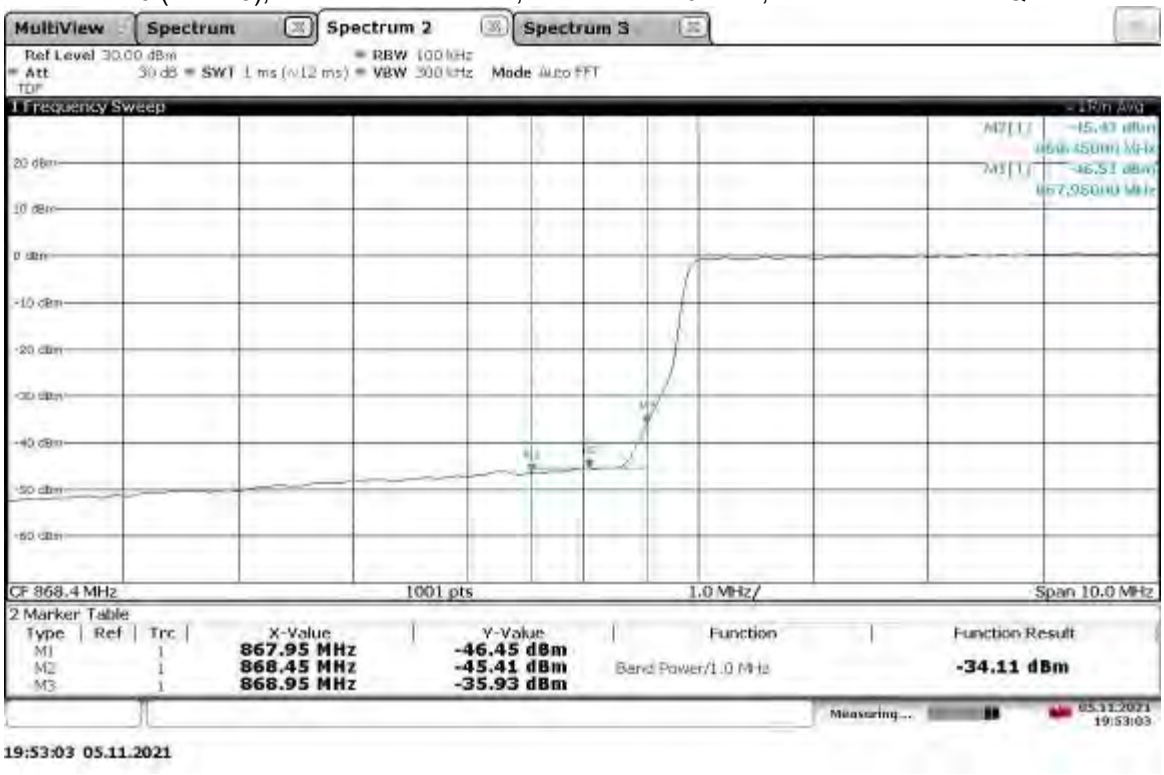
Band Edge Compliant, Lower Band Edge, 871.5 MHz
Slot 0 (Band 5), Antenna Port: ANT1, Bandwidth: 5 MHz, Modulation: TM1.1-QPSK



Band Edge Compliant, Lower Band Edge, 891.5 MHz
Slot 0 (Band 5), Antenna Port: ANT1, Bandwidth: 5 MHz, Modulation: TM1.1-QPSK



Band Edge Compliant, Lower Band Edge, 874 MHz
Slot 0 (Band 5), Antenna Port: ANT1, Bandwidth: 10 MHz, Modulation: TM1.1-QPSK



Band Edge Compliant, Lower Band Edge, 889 MHz
Slot 0 (Band 5), Antenna Port: ANT1, Bandwidth: 10 MHz, Modulation: TM1.1-QPSK

Band Edge Compliant, Lower Band Edge, 876.5 MHz
Slot 0 (Band 5), Antenna Port: ANT1, Bandwidth: 15 MHz, Modulation: TM1.1-QPSK

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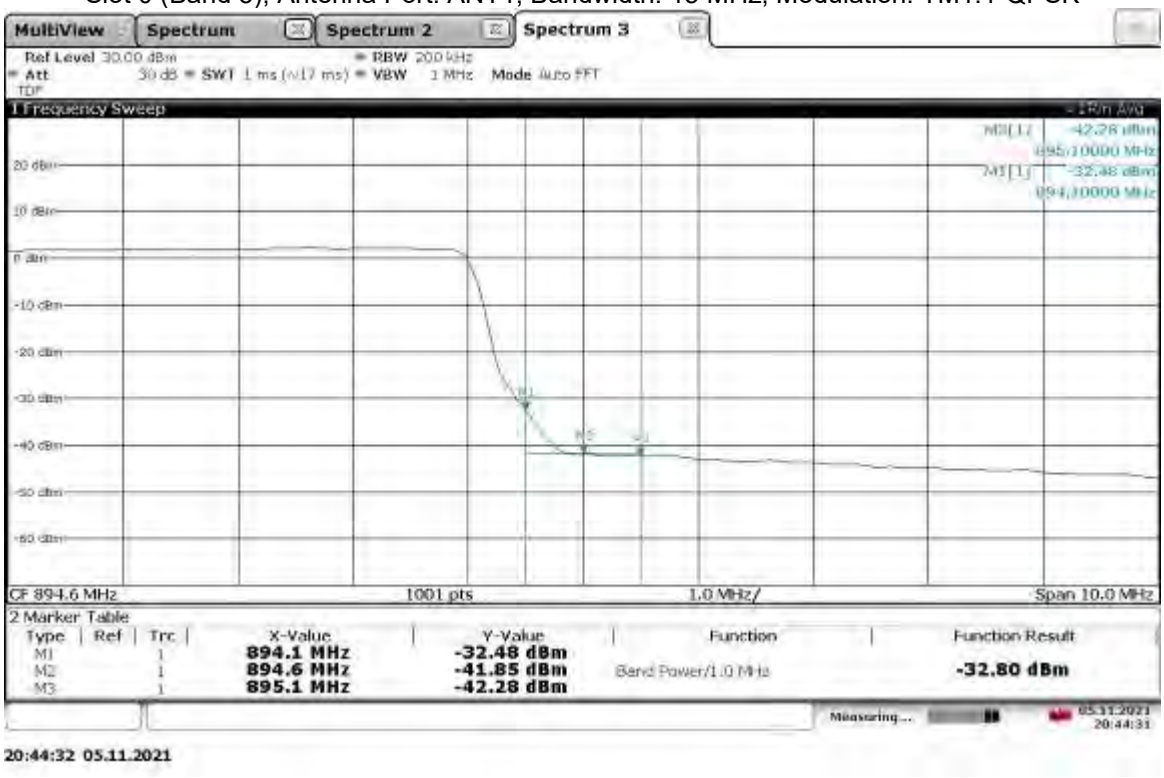
Band Edge Compliant, Upper Band Edge, 886.5 MHz
Slot 0 (Band 5), Antenna Port: ANT1, Bandwidth: 15 MHz, Modulation: TM1.1-QPSK



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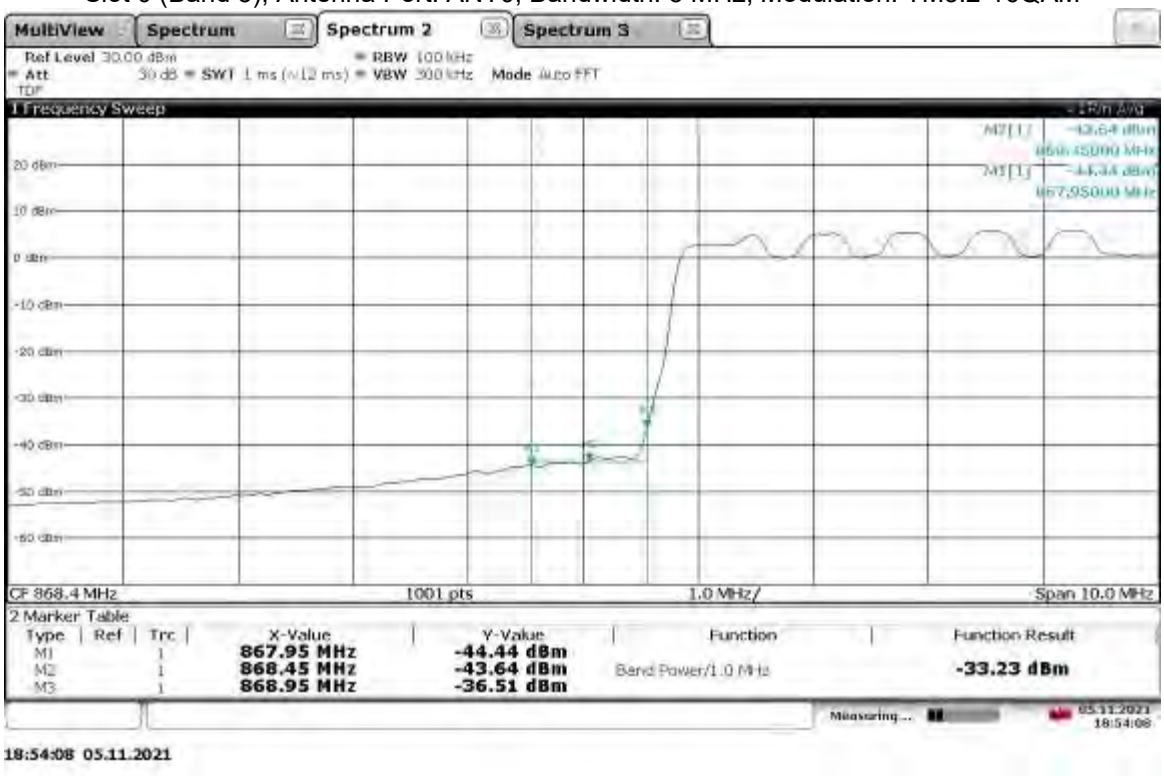
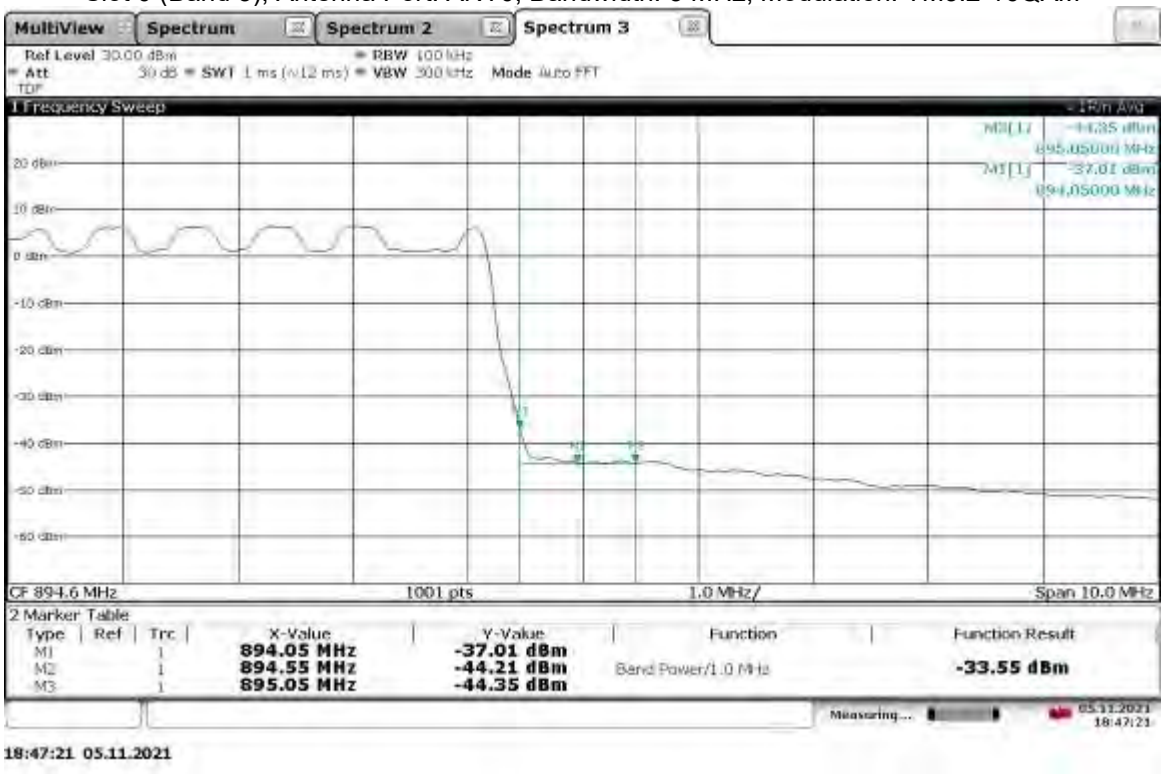
Band Edge Compliant, Lower Band Edge, 879 MHz
Slot 0 (Band 5), Antenna Port: ANT1, Bandwidth: 20 MHz, Modulation: TM1.1-QPSK

Band Edge Compliant, Upper Band Edge, 884 MHz
Slot 0 (Band 0), Antenna Port: ANT1, Bandwidth: 20 MHz, Modulation: TM1.1-QPSK

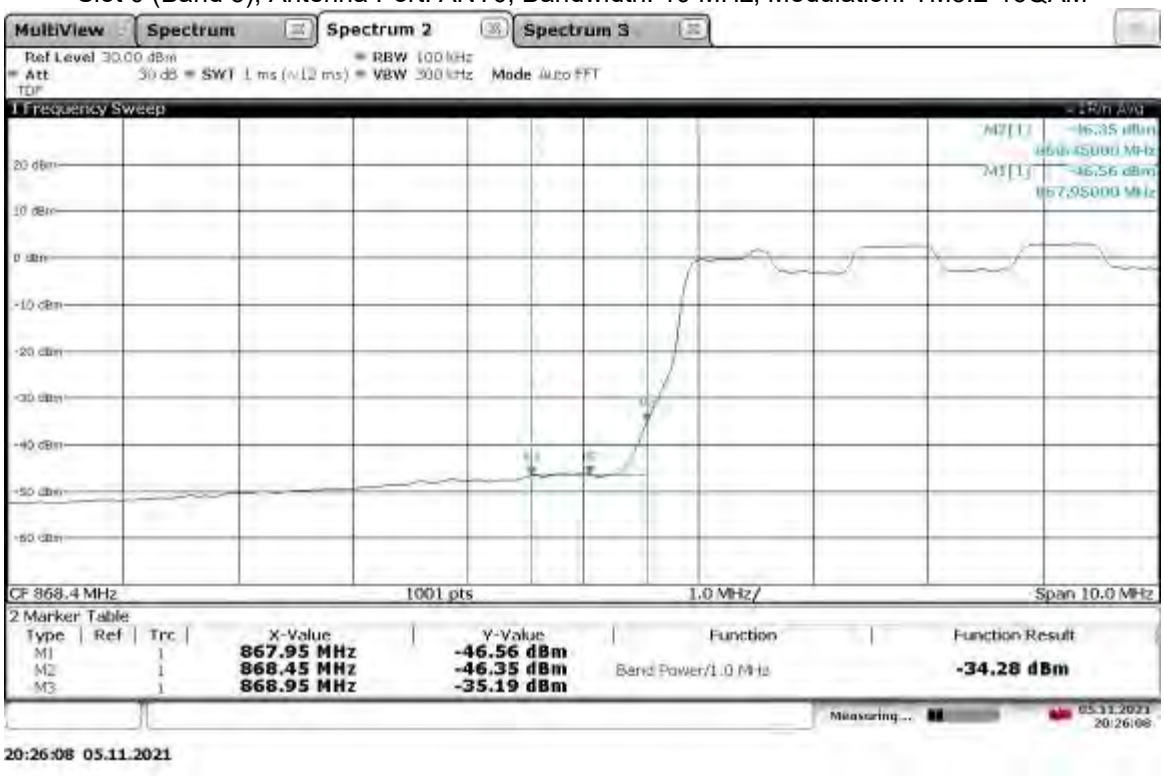
Band Edge Compliant, Lower Band Edge, 871.5MHz
Slot 0 (Band 5), Antenna Port: ANT0, Bandwidth: 5 MHz, Modulation: TM3.2-16QAM



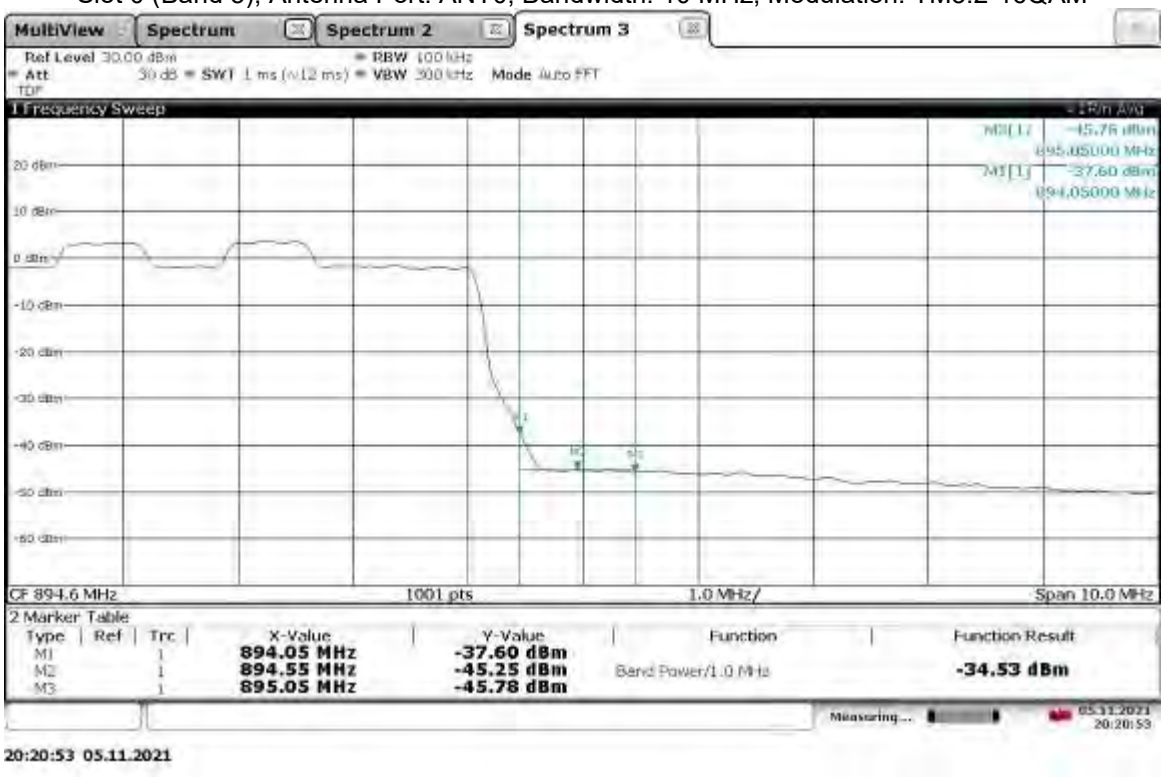
Band Edge Compliant, Upper Band Edge, 884 MHz
Slot 0 (Band 5), Antenna Port: ANT0, Bandwidth: 5 MHz, Modulation: TM3.2-16QAM



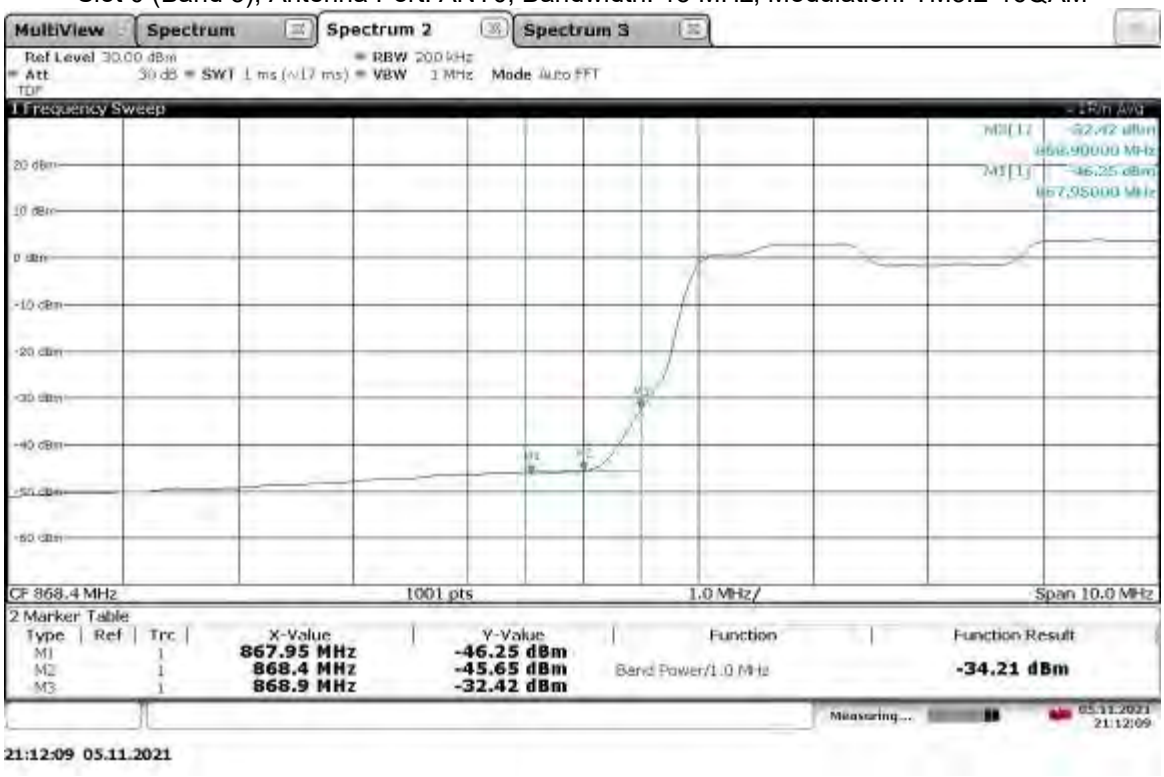
Band Edge Compliant, Lower Band Edge, 874 MHz
Slot 0 (Band 5), Antenna Port: ANT0, Bandwidth: 10 MHz, Modulation: TM3.2-16QAM



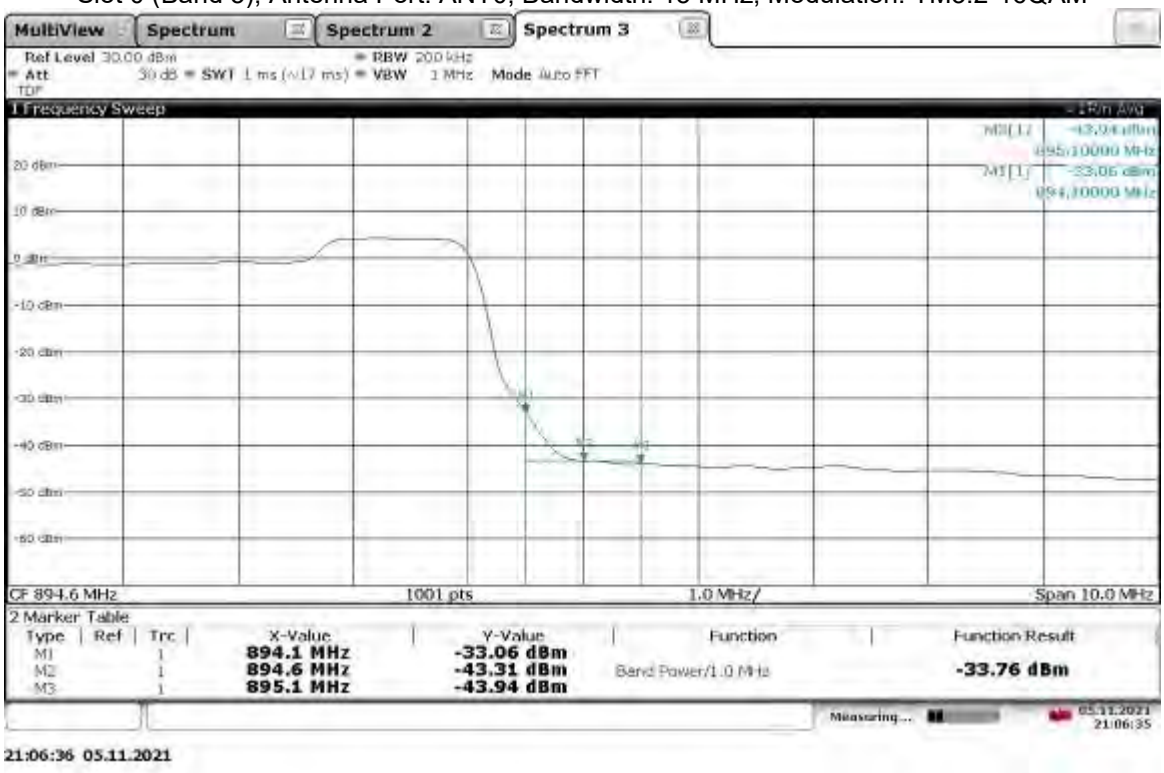
Band Edge Compliant, Upper Band Edge, 889 MHz
Slot 0 (Band 5), Antenna Port: ANT0, Bandwidth: 10 MHz, Modulation: TM3.2-16QAM



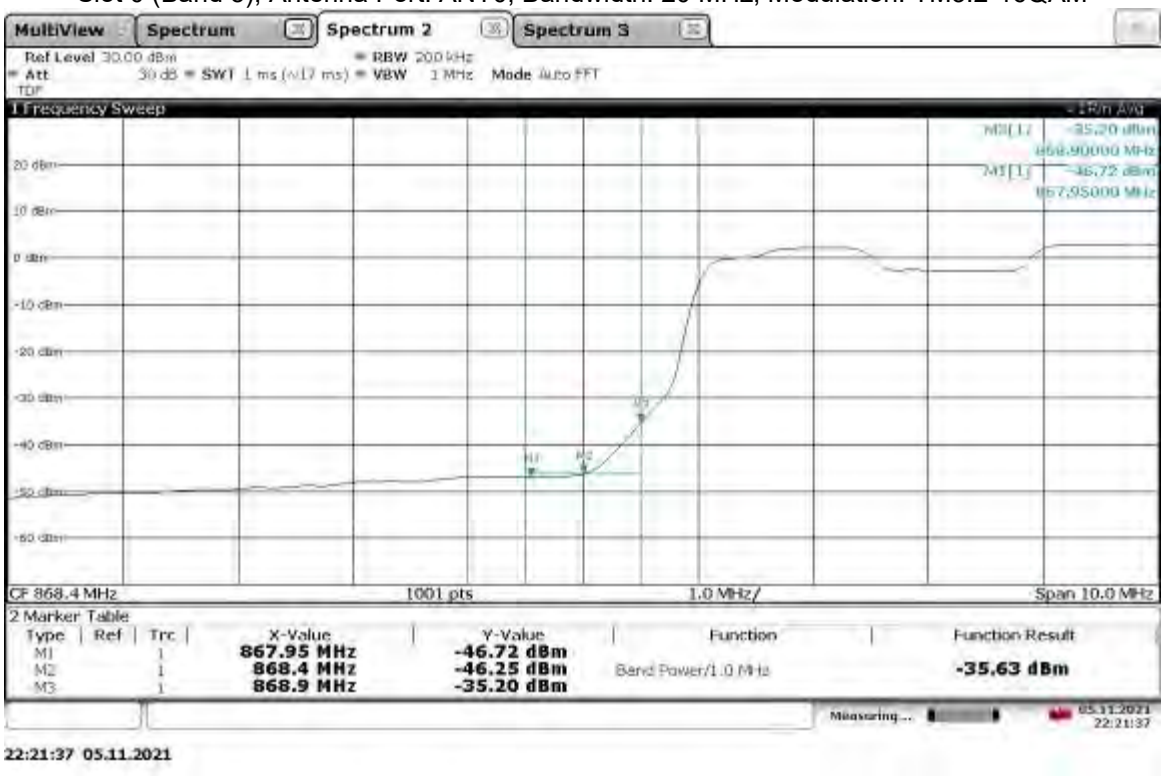
Band Edge Compliant, Lower Band Edge, 876.5 MHz
Slot 0 (Band 5), Antenna Port: ANT0, Bandwidth: 15 MHz, Modulation: TM3.2-16QAM



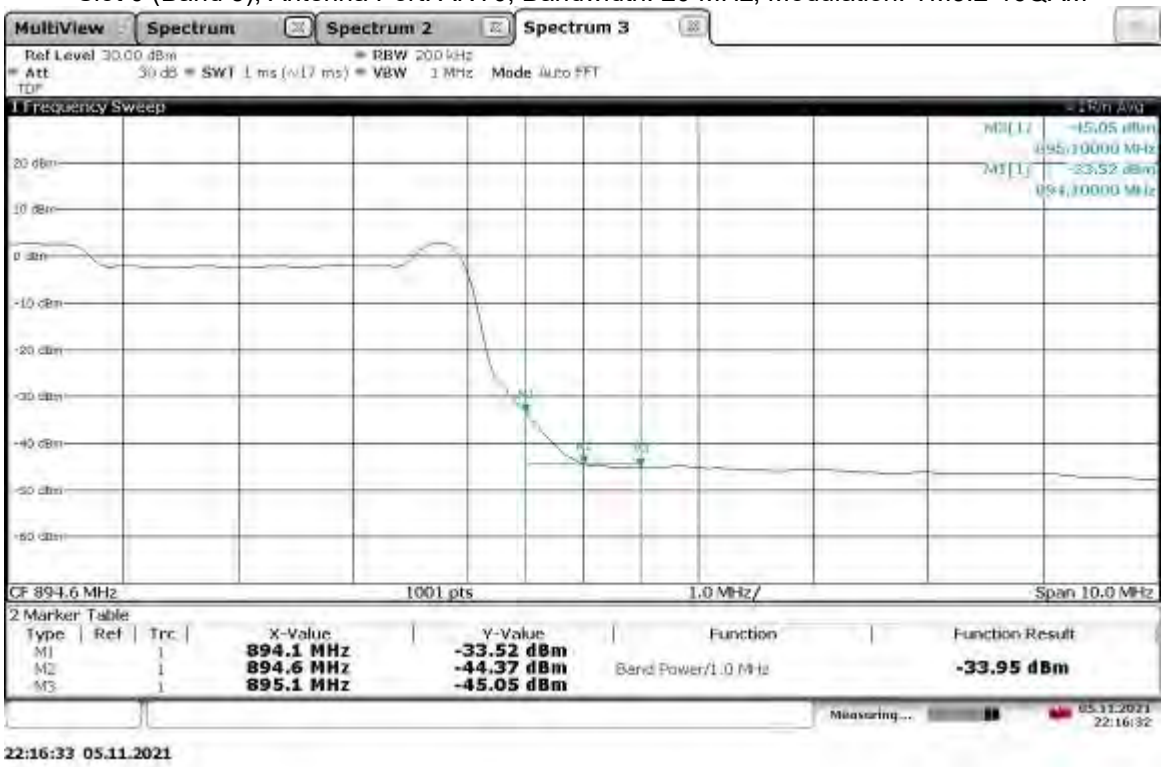
Band Edge Compliant, Upper Band Edge, 886.5 MHz
Slot 0 (Band 5), Antenna Port: ANT0, Bandwidth: 15 MHz, Modulation: TM3.2-16QAM



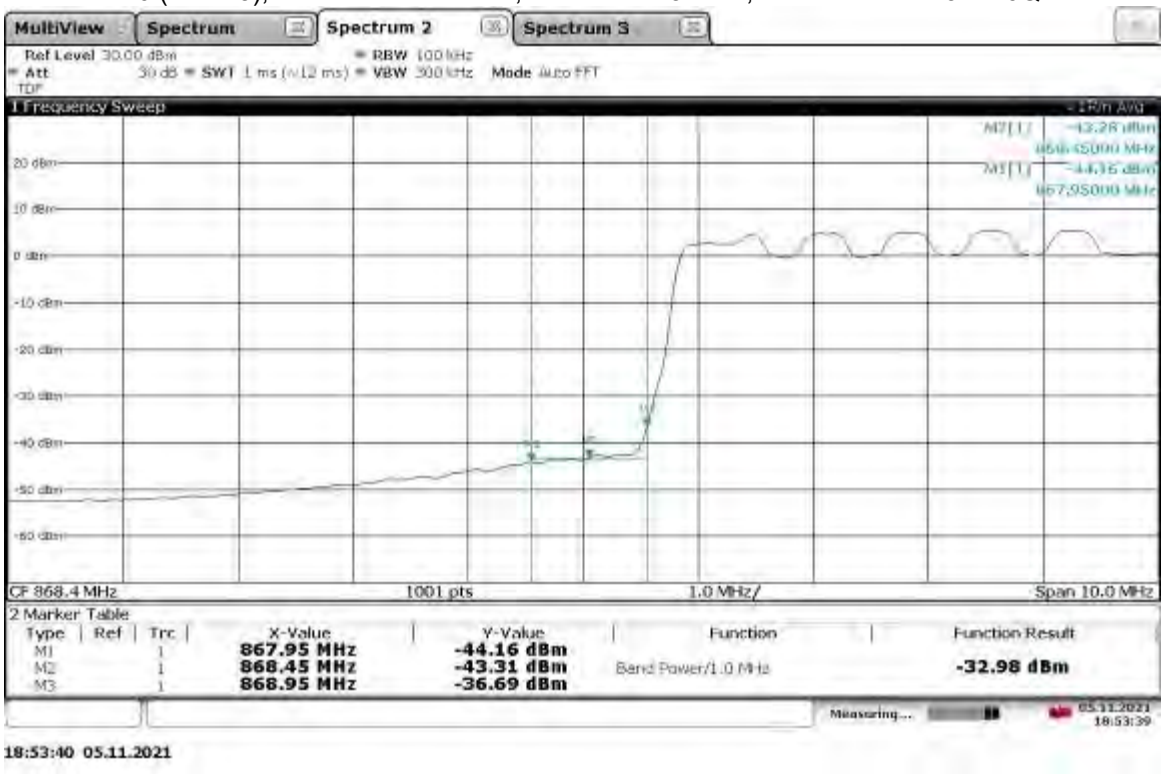
Band Edge Compliant, Lower Band Edge, 879 MHz
Slot 0 (Band 5), Antenna Port: ANT0, Bandwidth: 20 MHz, Modulation: TM3.2-16QAM



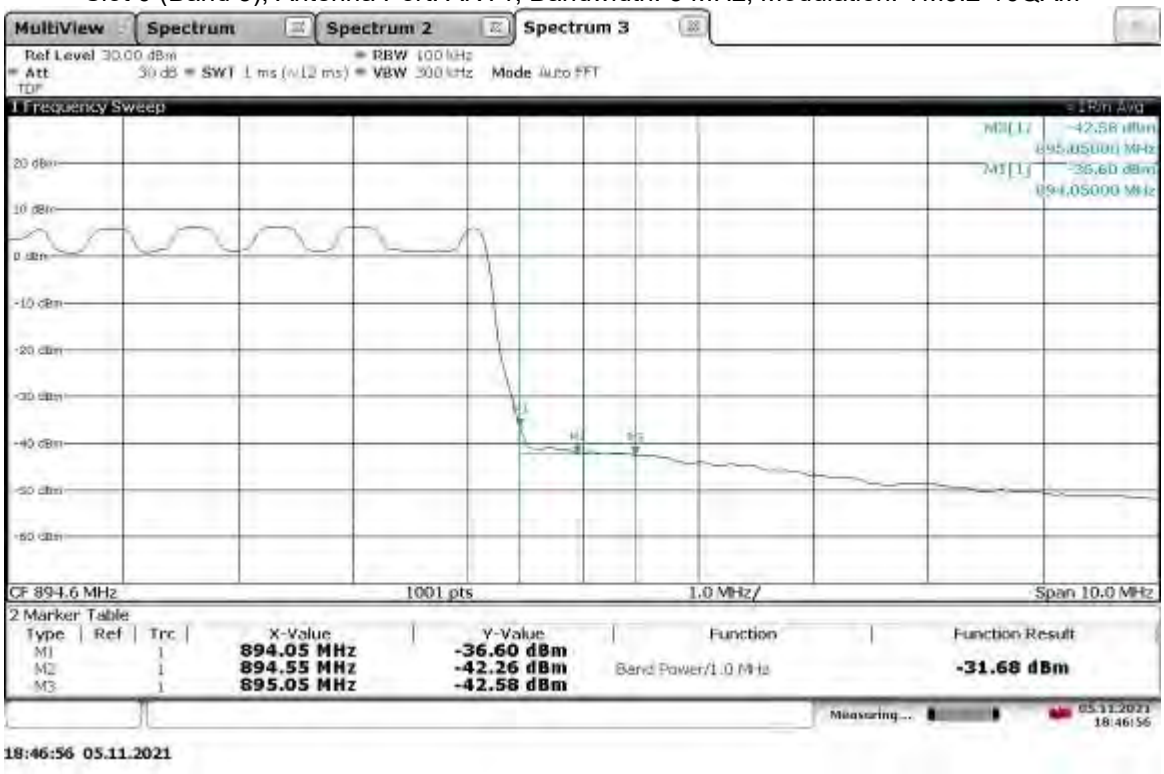
Band Edge Compliant, Upper Band Edge, 884 MHz
Slot 0 (Band 5), Antenna Port: ANT0, Bandwidth: 20 MHz, Modulation: TM3.2-16QAM



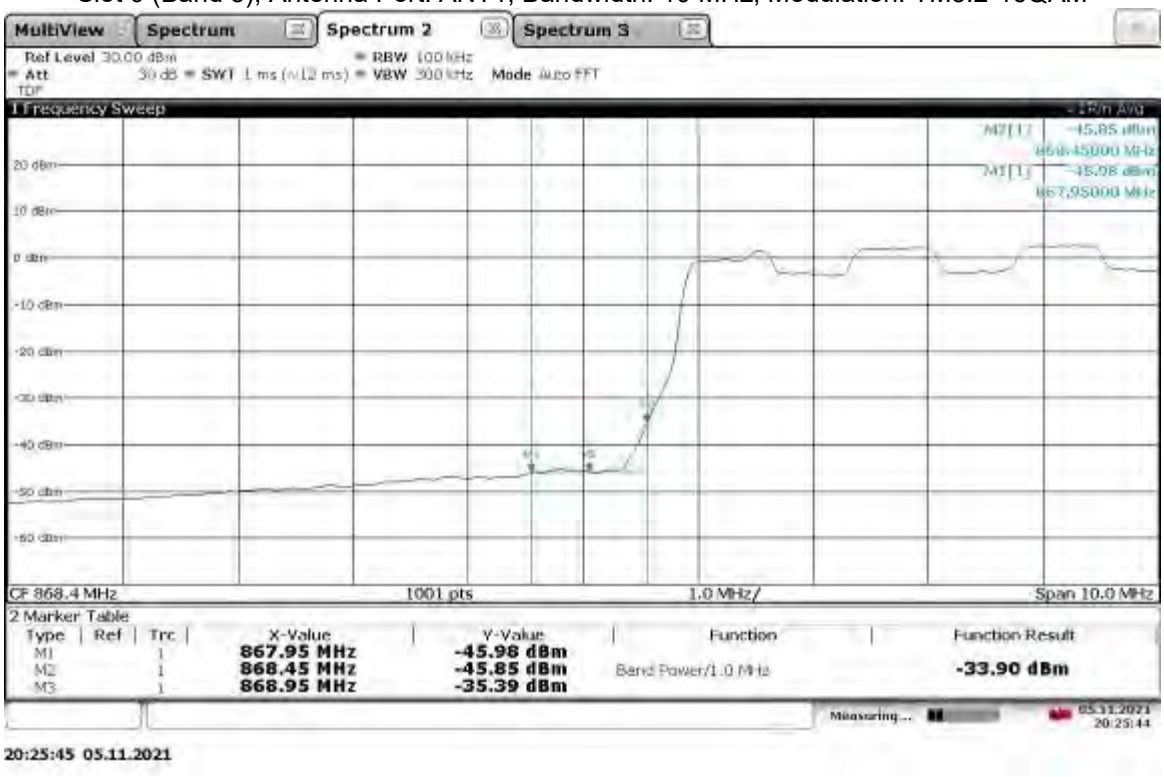
Band Edge Compliant, Lower Band Edge, 871.5 MHz
Slot 0 (Band 5), Antenna Port: ANT1, Bandwidth: 5 MHz, Modulation: TM3.2-16QAM



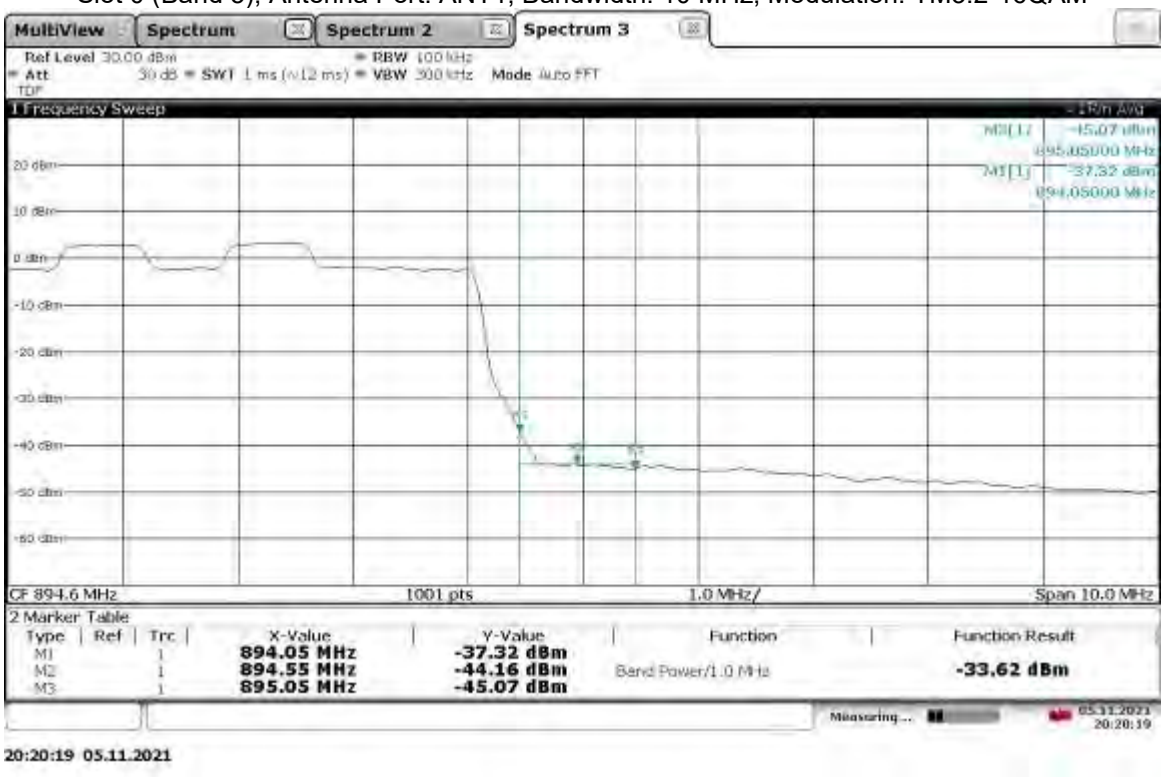
Band Edge Compliant, Upper Band Edge, 891.5 MHz
Slot 0 (Band 5), Antenna Port: ANT1, Bandwidth: 5 MHz, Modulation: TM3.2-16QAM



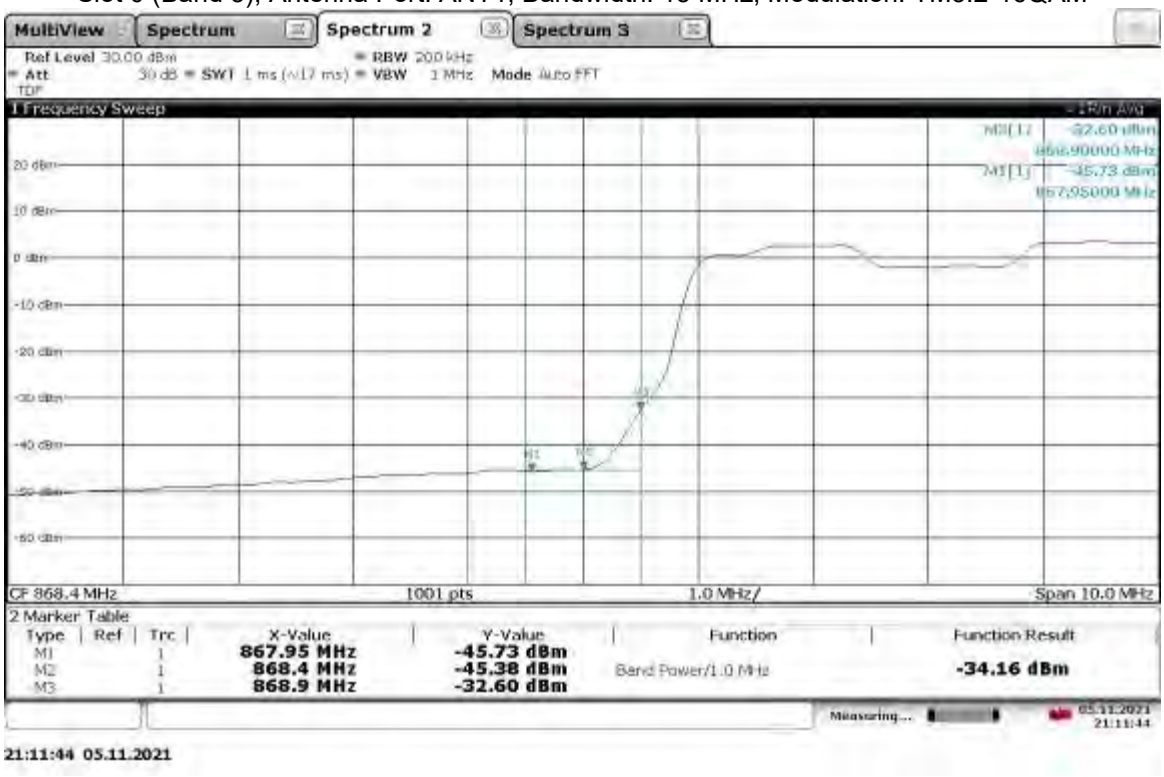
Band Edge Compliant, Lower Band Edge, 874 MHz
Slot 0 (Band 5), Antenna Port: ANT1, Bandwidth: 10 MHz, Modulation: TM3.2-16QAM



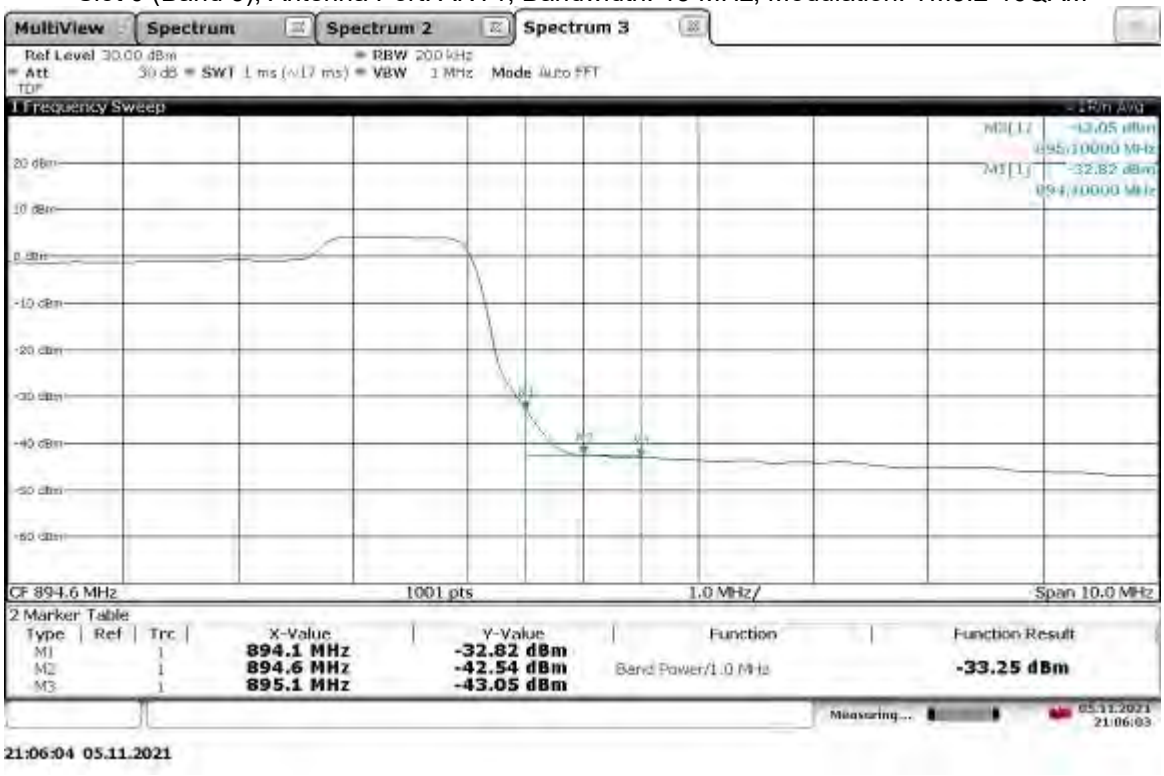
Band Edge Compliant, Upper Band Edge, 889 MHz
Slot 0 (Band 5), Antenna Port: ANT1, Bandwidth: 10 MHz, Modulation: TM3.2-16QAM



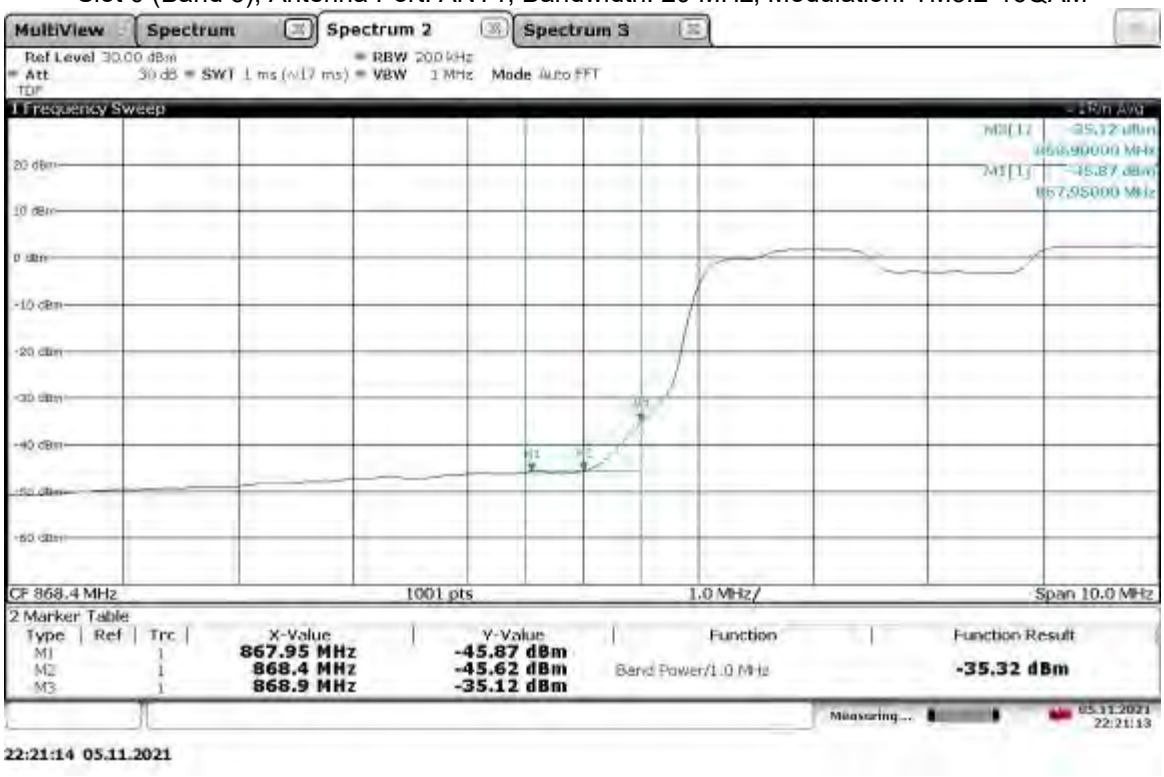
Band Edge Compliant, Lower Band Edge, 876.5 MHz
Slot 0 (Band 5), Antenna Port: ANT1, Bandwidth: 15 MHz, Modulation: TM3.2-16QAM



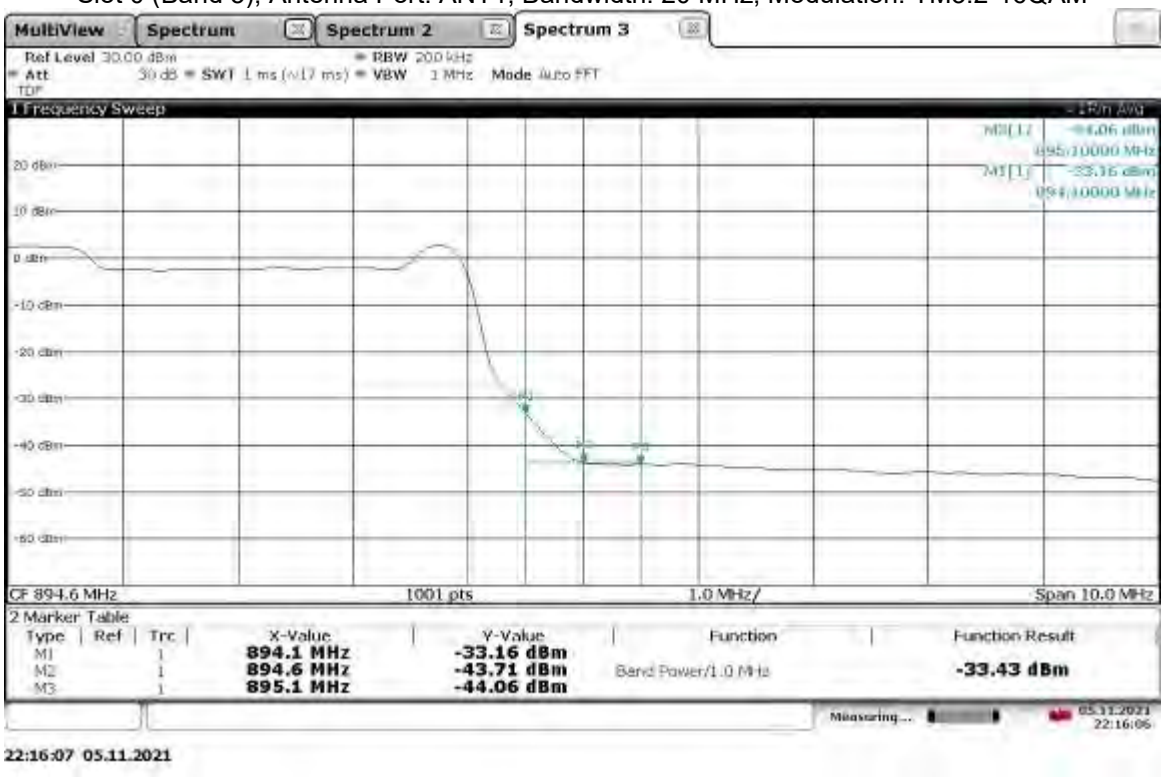
Band Edge Compliant, Upper Band Edge, 886.5 MHz
Slot 0 (Band 5), Antenna Port: ANT1, Bandwidth: 15 MHz, Modulation: TM3.2-16QAM



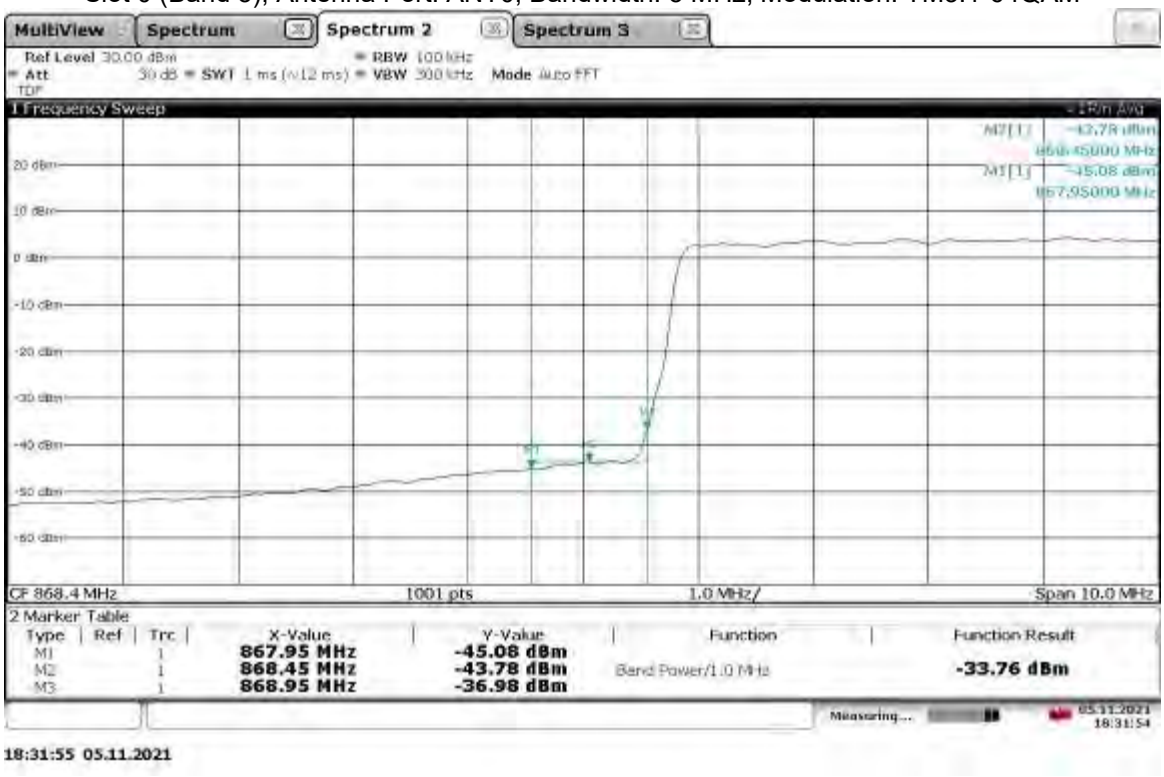
Band Edge Compliant, Lower Band Edge, 879 MHz
Slot 0 (Band 5), Antenna Port: ANT1, Bandwidth: 20 MHz, Modulation: TM3.2-16QAM



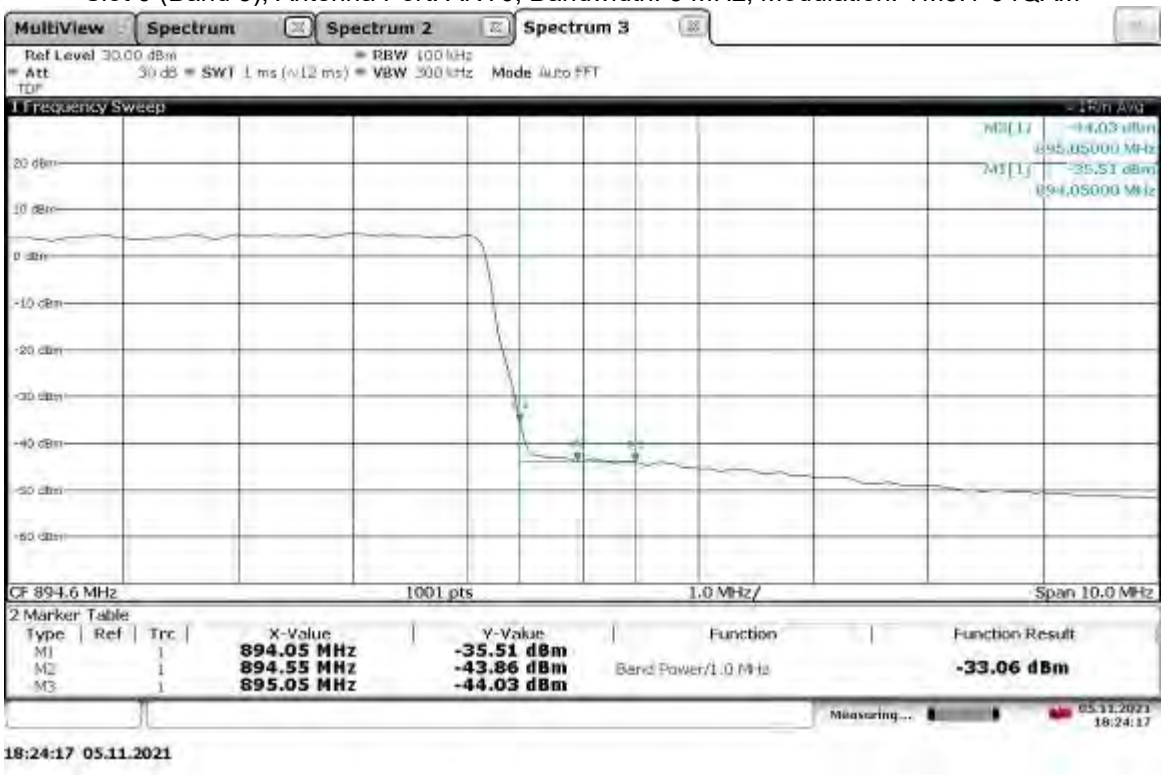
Band Edge Compliant, Upper Band Edge, 884 MHz
Slot 0 (Band 5), Antenna Port: ANT1, Bandwidth: 20 MHz, Modulation: TM3.2-16QAM



Band Edge Compliant, Lower Band Edge, 871.5 MHz
Slot 0 (Band 5), Antenna Port: ANT0, Bandwidth: 5 MHz, Modulation: TM3.1-64QAM

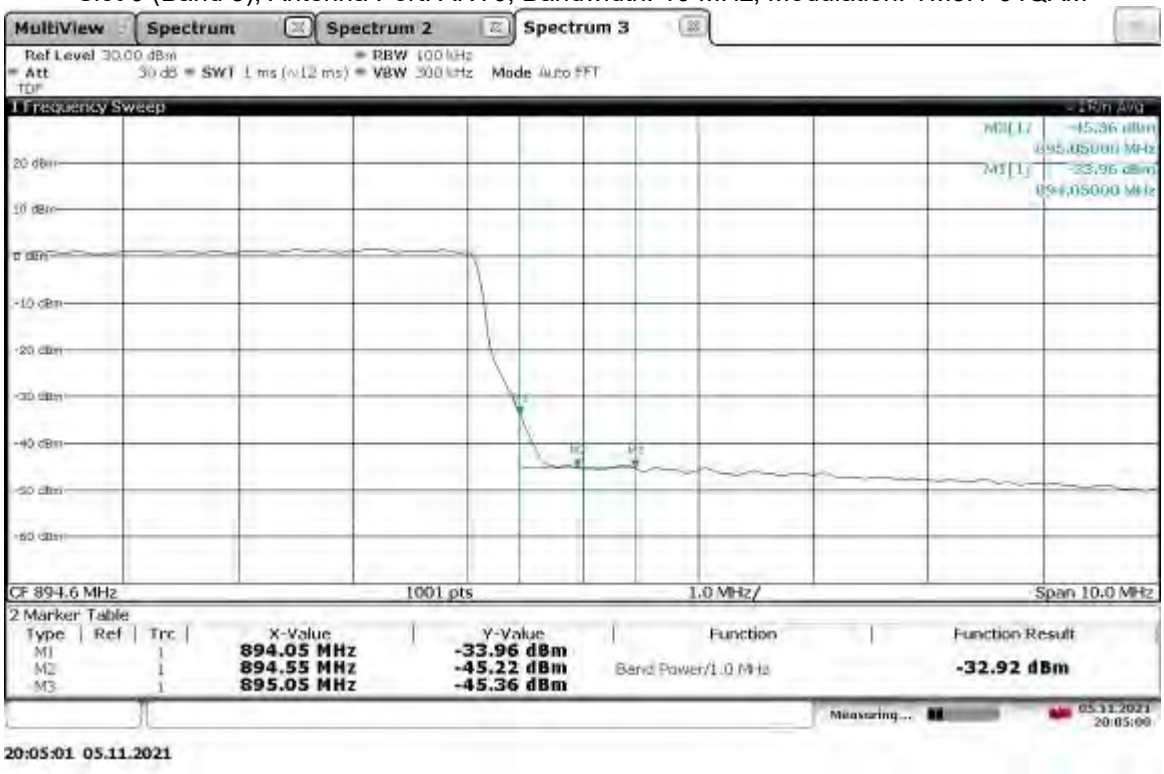


Band Edge Compliant, Upper Band Edge, 891.5 MHz
Slot 0 (Band 5), Antenna Port: ANT0, Bandwidth: 5 MHz, Modulation: TM3.1-64QAM

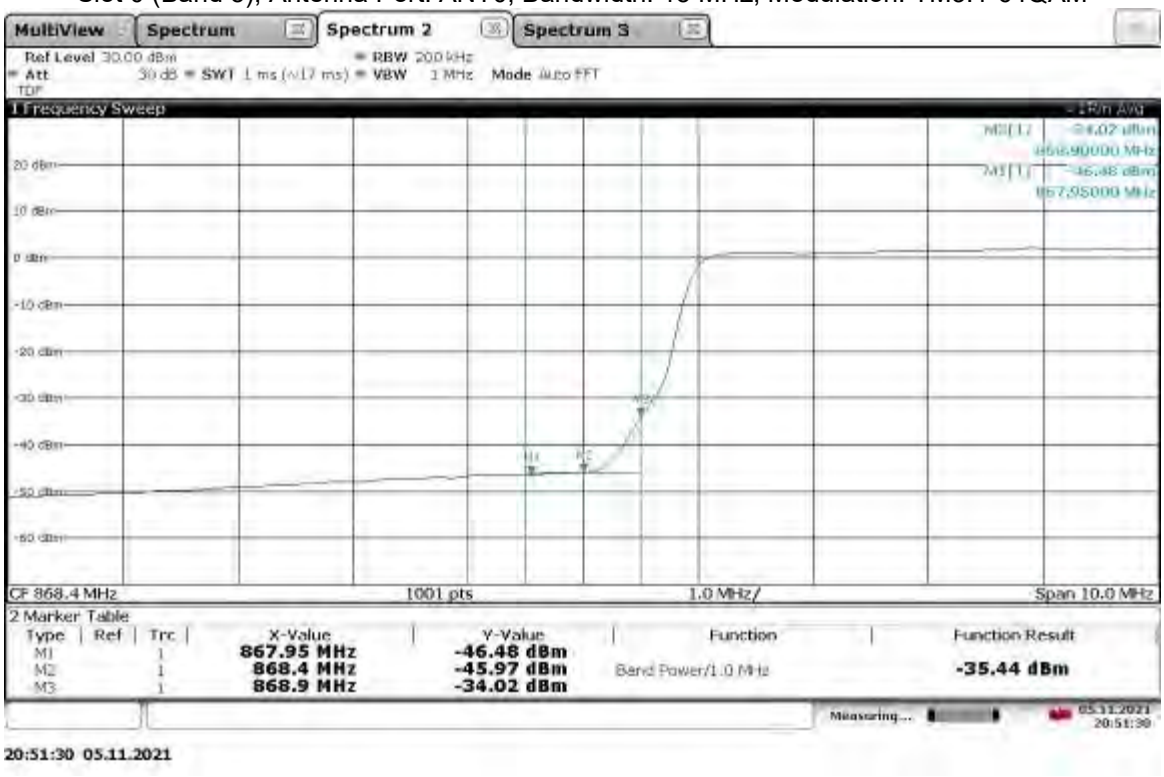


Band Edge Compliant, Lower Band Edge, 874 MHz
Slot 0 (Band 5), Antenna Port: ANT0, Bandwidth: 10 MHz, Modulation: TM3.1-64QAM

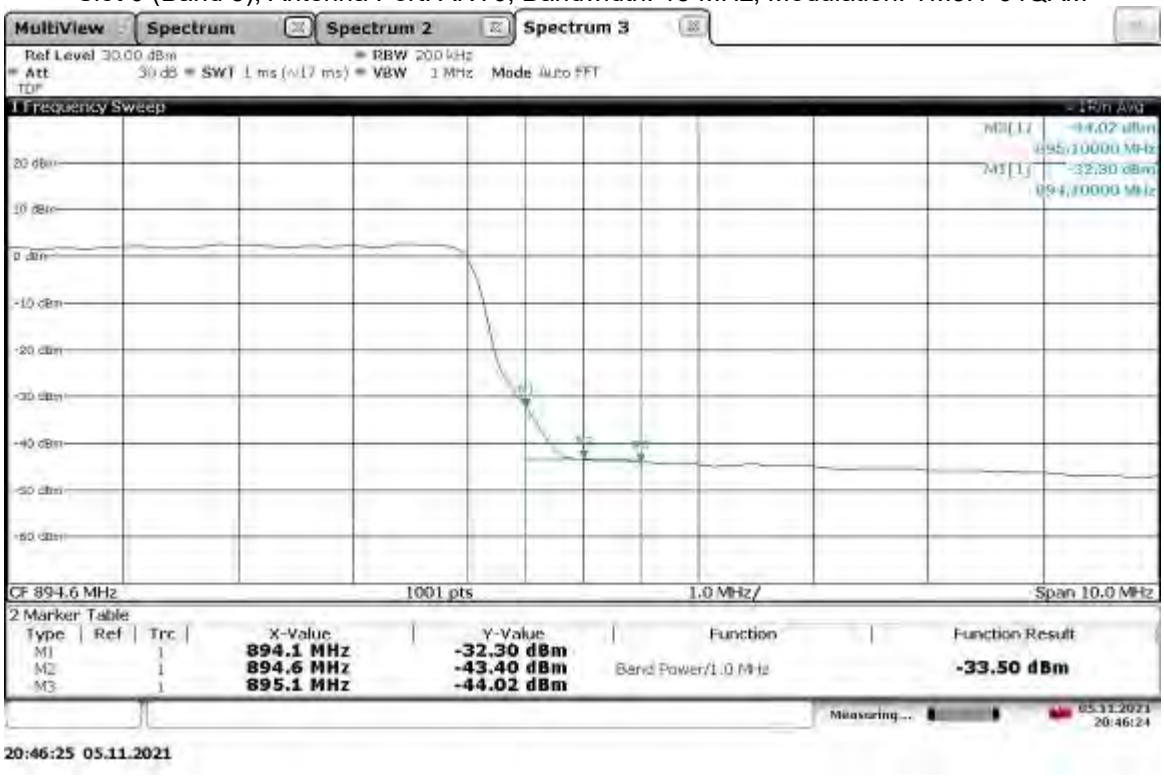
Band Edge Compliant, Upper Band Edge, 889 MHz
Slot 0 (Band 5), Antenna Port: ANT0, Bandwidth: 10 MHz, Modulation: TM3.1-64QAM



Band Edge Compliant, Lower Band Edge, 876.5 MHz
Slot 0 (Band 5), Antenna Port: ANT0, Bandwidth: 15 MHz, Modulation: TM3.1-64QAM

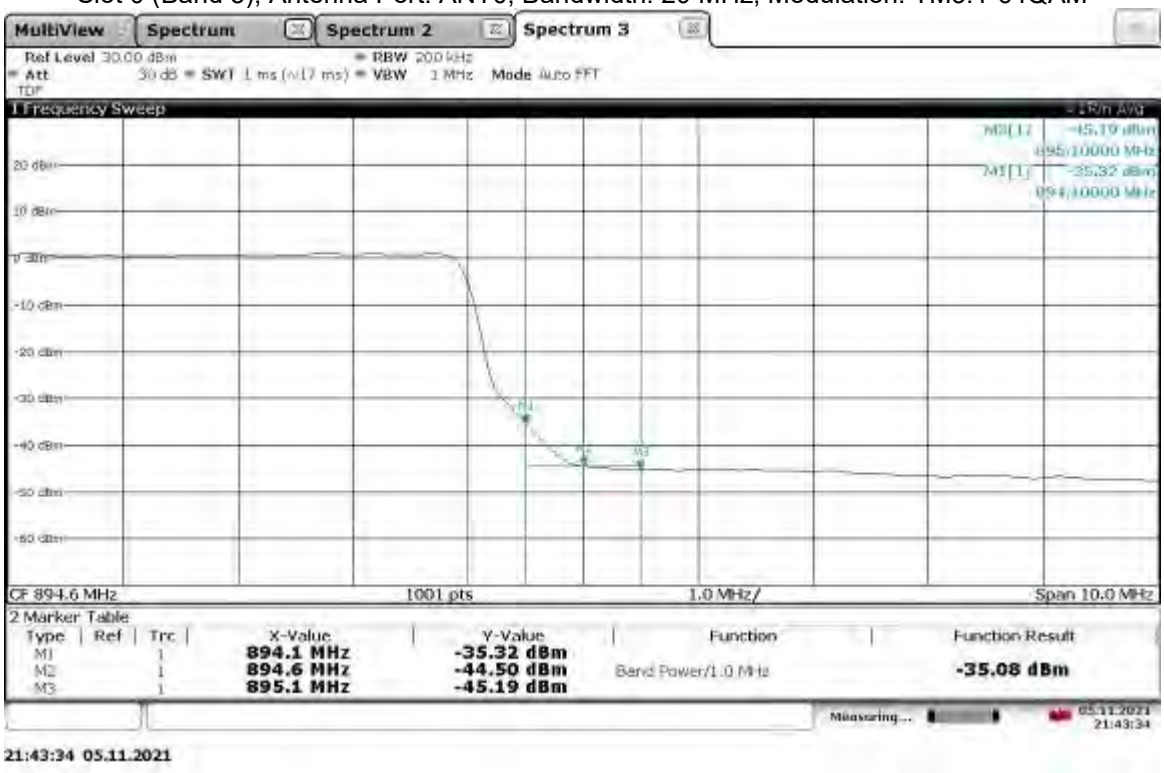


Band Edge Compliant, Upper Band Edge, 886.5 MHz
Slot 0 (Band 5), Antenna Port: ANT0, Bandwidth: 15 MHz, Modulation: TM3.1-64QAM

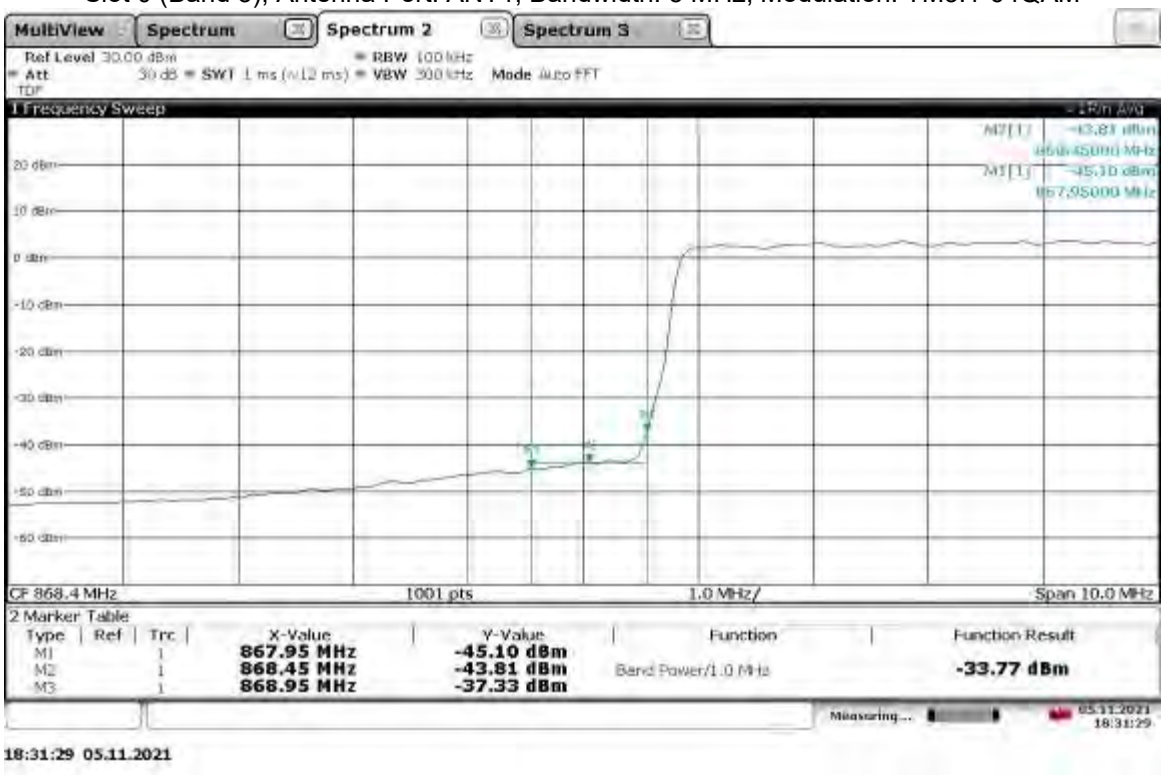


Band Edge Compliant, Lower Band Edge, 879 MHz
Slot 0 (Band 5), Antenna Port: ANT0, Bandwidth: 20 MHz, Modulation: TM3.1-64QAM

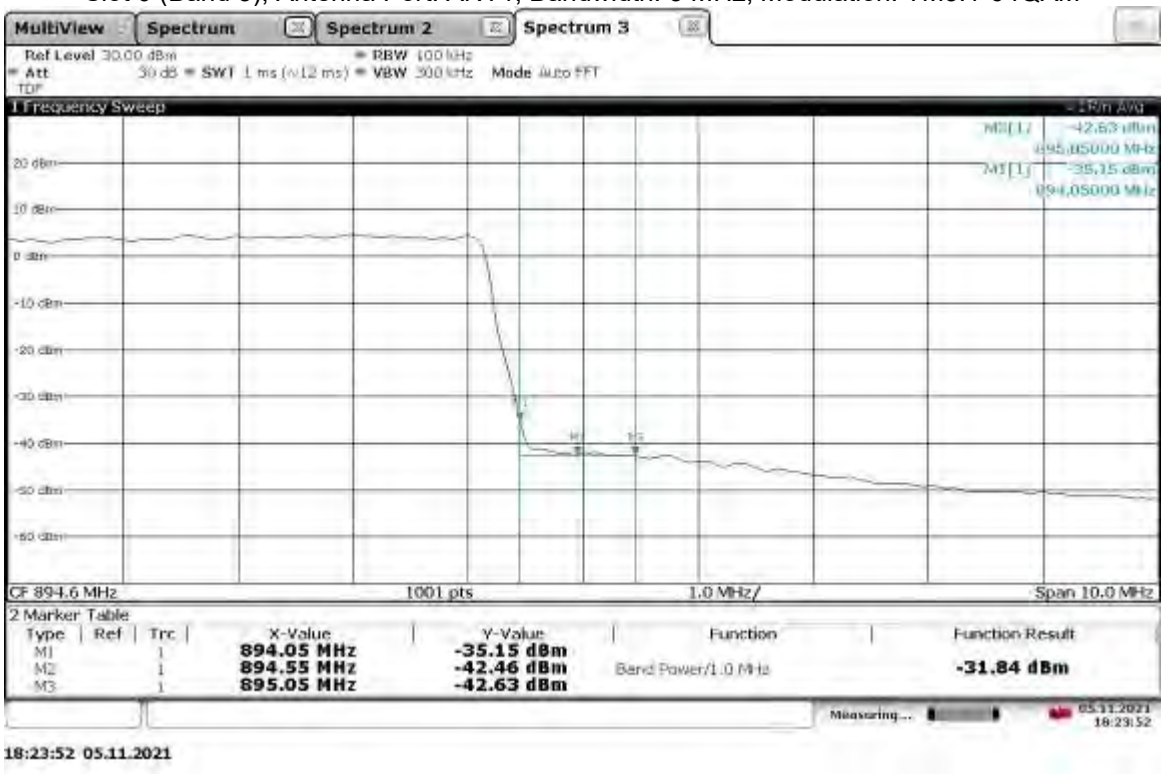
Band Edge Compliant, Upper Band Edge, 884 MHz
Slot 0 (Band 5), Antenna Port: ANT0, Bandwidth: 20 MHz, Modulation: TM3.1-64QAM



Band Edge Compliant, Lower Band Edge, 871.5 MHz
Slot 0 (Band 5), Antenna Port: ANT1, Bandwidth: 5 MHz, Modulation: TM3.1-64QAM

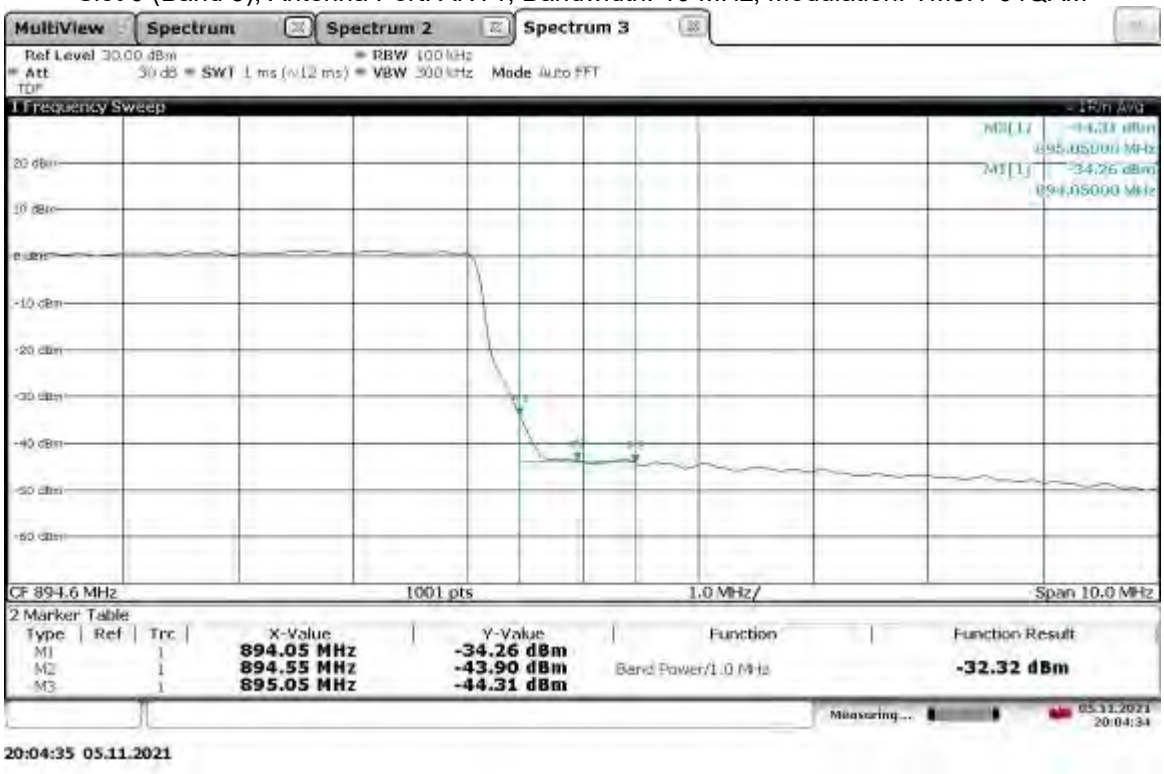


Band Edge Compliant, Upper Band Edge, 891.5 MHz
Slot 0 (Band 5), Antenna Port: ANT1, Bandwidth: 5 MHz, Modulation: TM3.1-64QAM

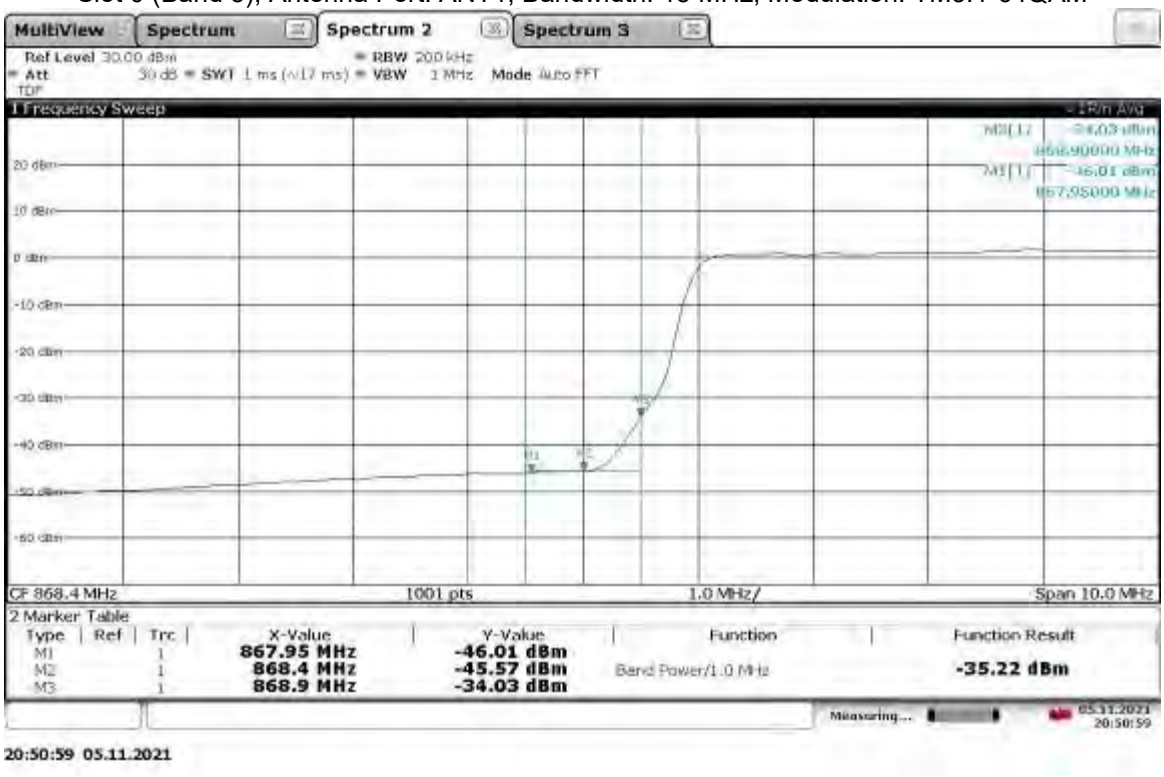


Band Edge Compliant, Lower Band Edge, 874 MHz
Slot 0 (Band 5), Antenna Port: ANT1, Bandwidth: 10 MHz, Modulation: TM3.1-64QAM

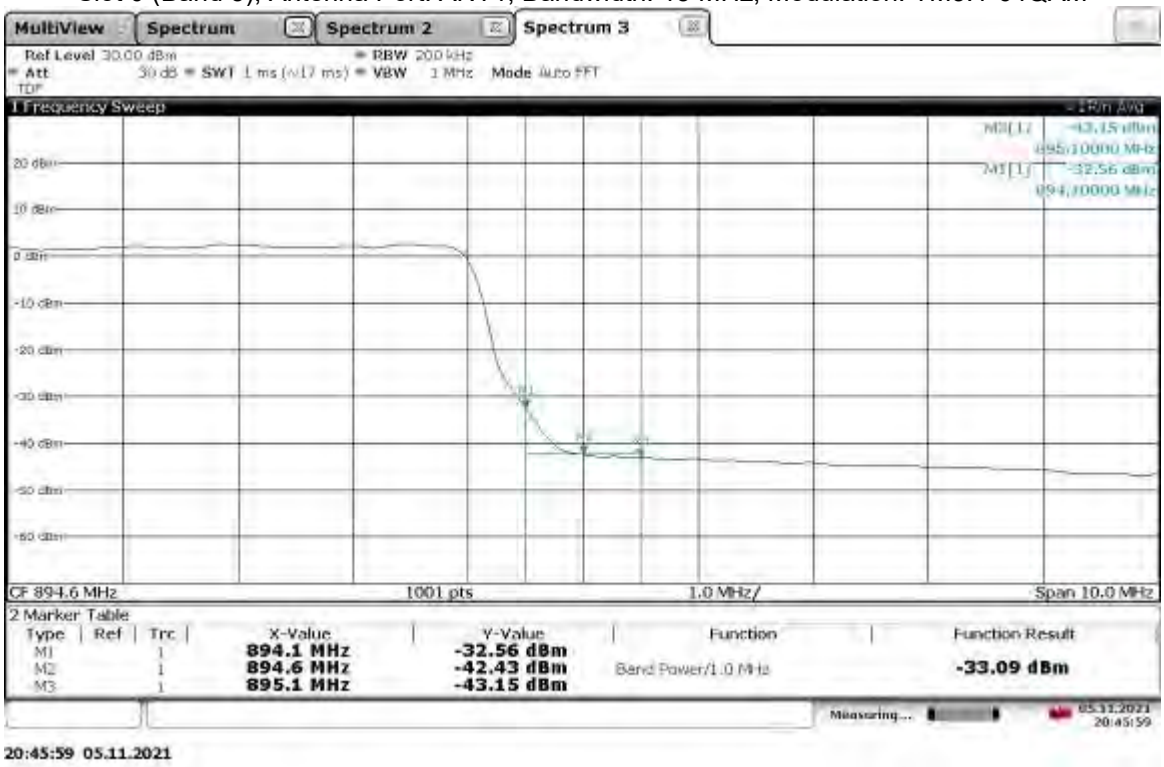
Band Edge Compliant, Upper Band Edge, 889 MHz
Slot 0 (Band 5), Antenna Port: ANT1, Bandwidth: 10 MHz, Modulation: TM3.1-64QAM



Band Edge Compliant, Lower Band Edge, 876.5 MHz
Slot 0 (Band 5), Antenna Port: ANT1, Bandwidth: 15 MHz, Modulation: TM3.1-64QAM

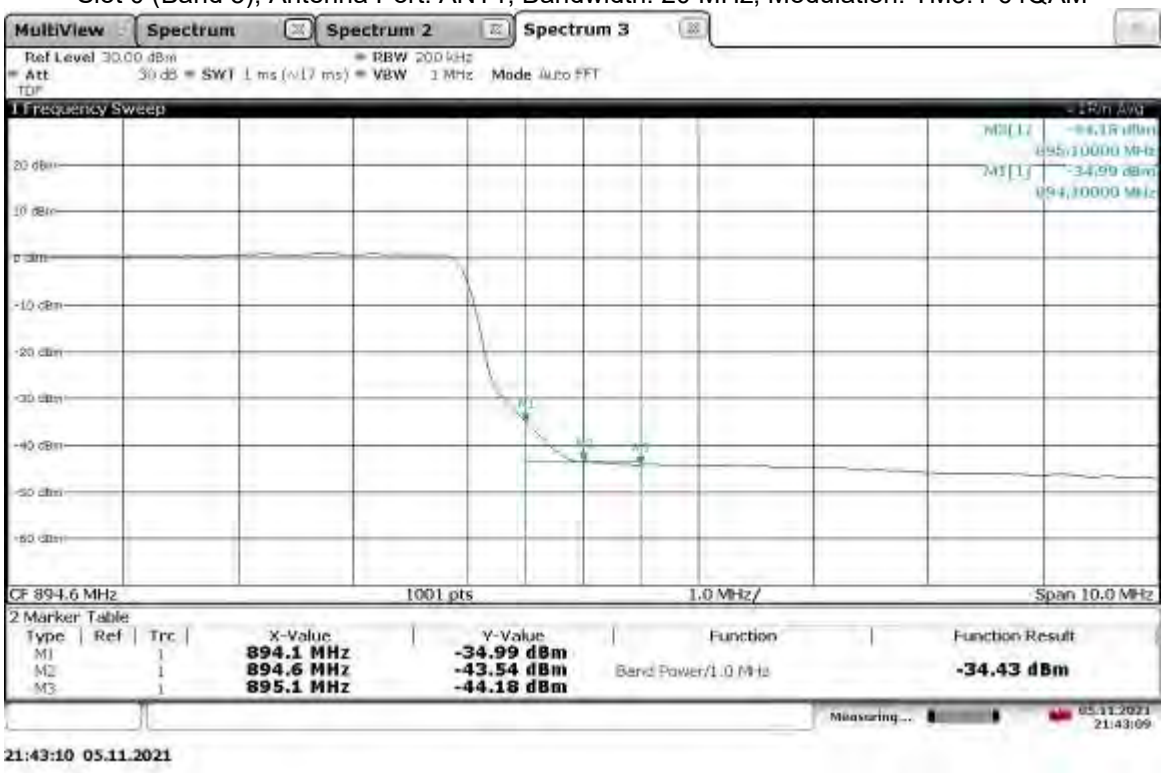


Band Edge Compliant, Upper Band Edge, 886.5 MHz
Slot 0 (Band 5), Antenna Port: ANT1, Bandwidth: 15 MHz, Modulation: TM3.1-64QAM

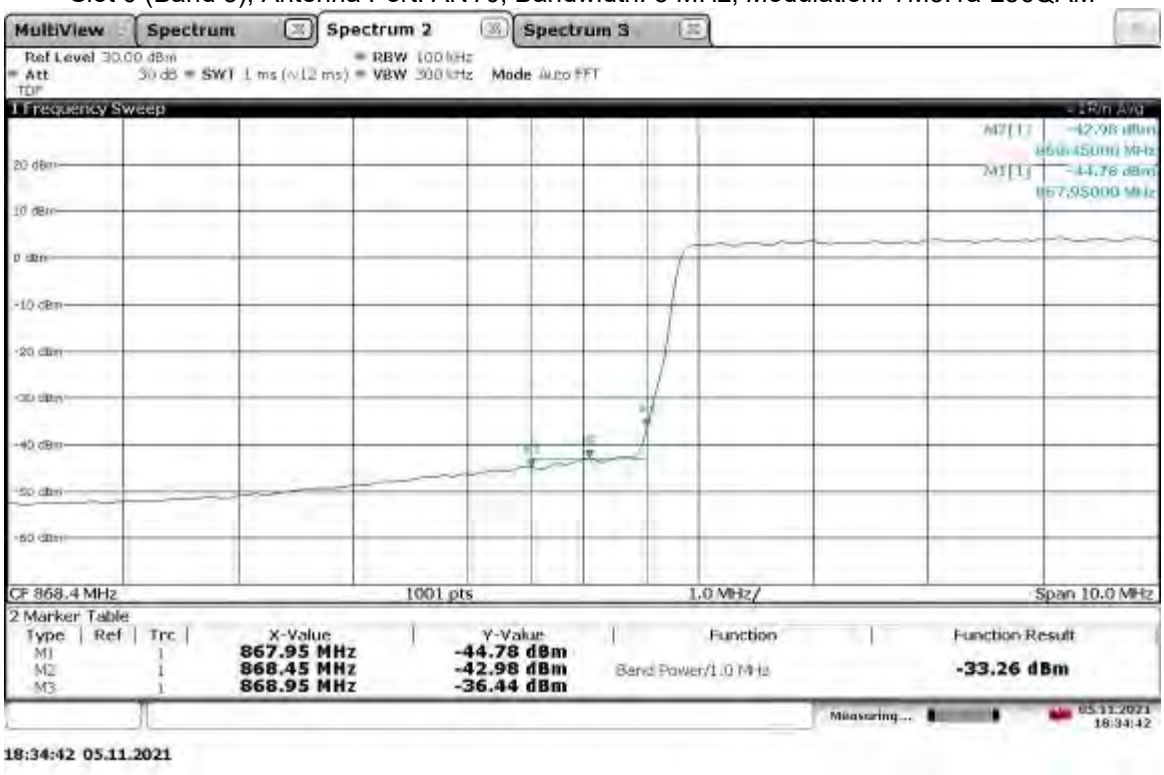


Band Edge Compliant, Lower Band Edge, 879 MHz
Slot 0 (Band 5), Antenna Port: ANT1, Bandwidth: 20 MHz, Modulation: TM3.1-64QAM

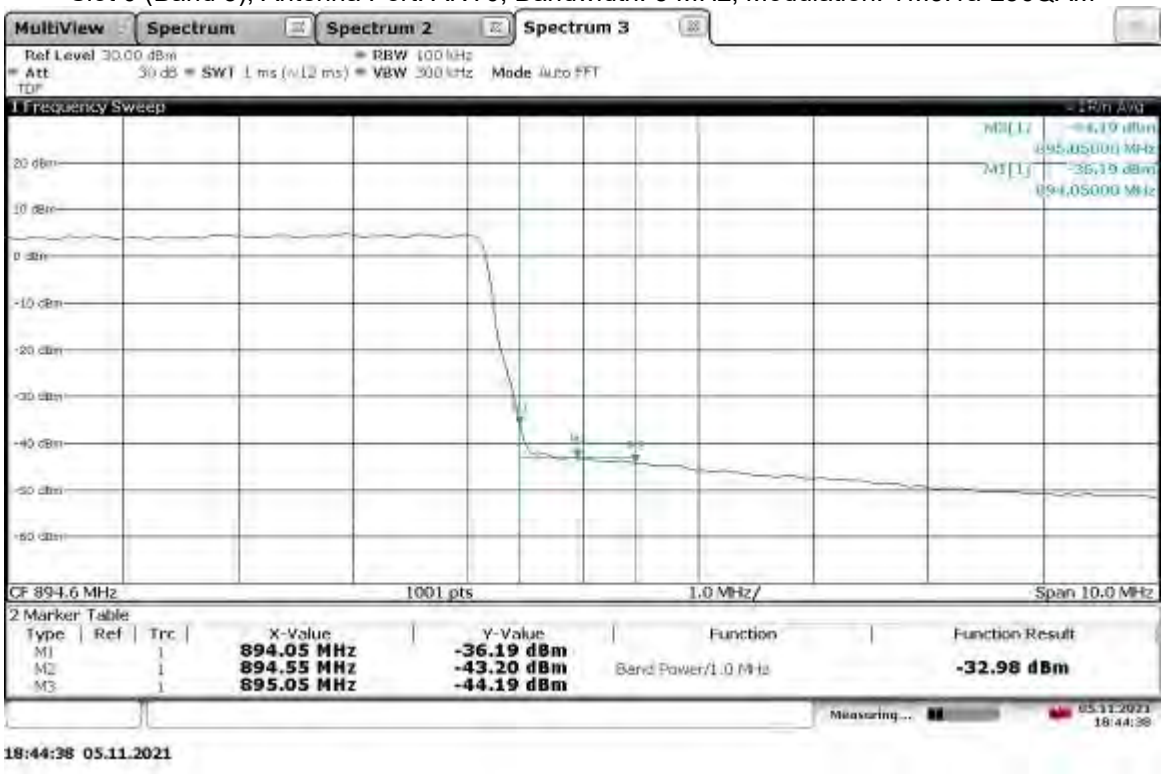
Band Edge Compliant, Upper Band Edge, 884 MHz
Slot 0 (Band 5), Antenna Port: ANT1, Bandwidth: 20 MHz, Modulation: TM3.1-64QAM



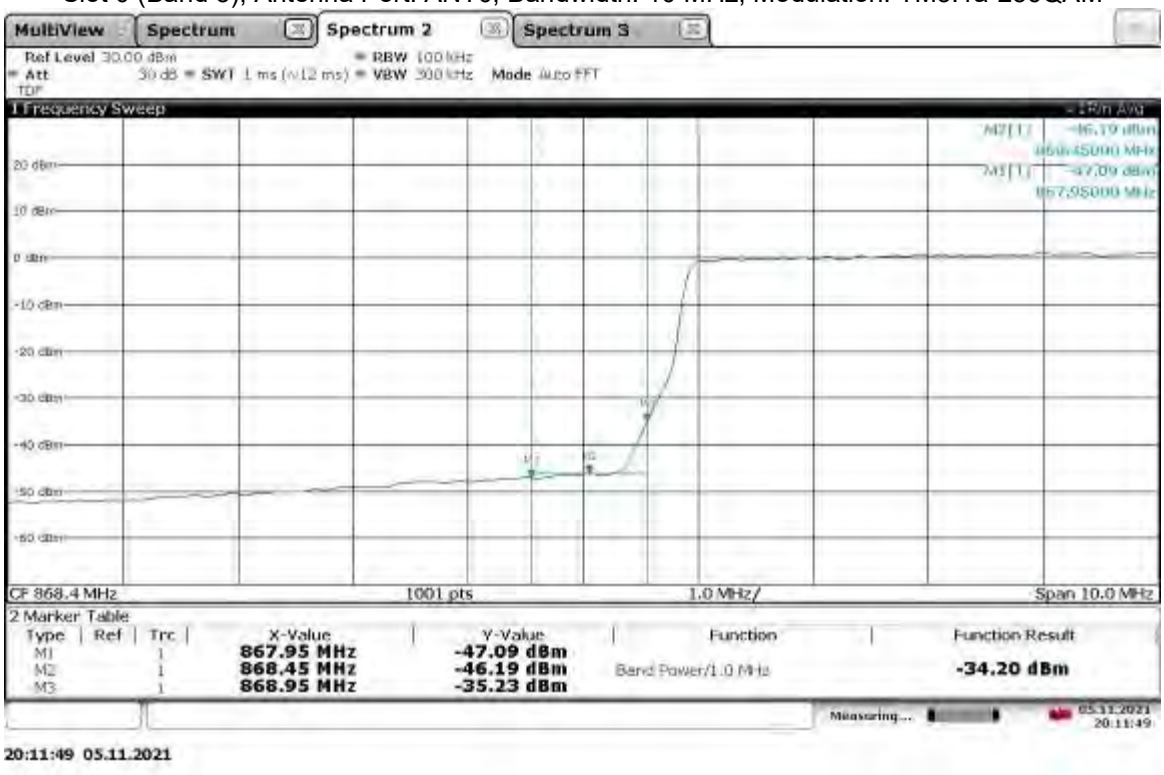
Band Edge Compliant, Lower Band Edge, 871.5 MHz
Slot 0 (Band 5), Antenna Port: ANT0, Bandwidth: 5 MHz, Modulation: TM3.1a-256QAM



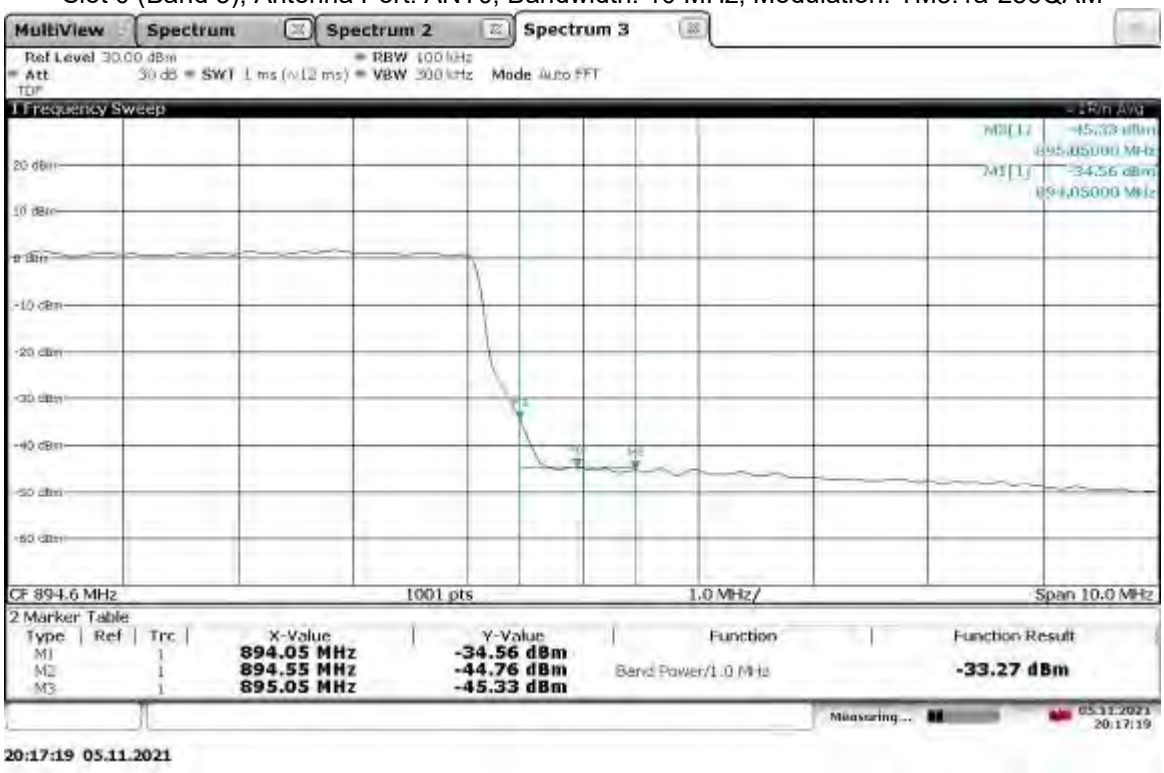
Band Edge Compliant, Upper Band Edge, 891.5 MHz
Slot 0 (Band 5), Antenna Port: ANT0, Bandwidth: 5 MHz, Modulation: TM3.1a-256QAM



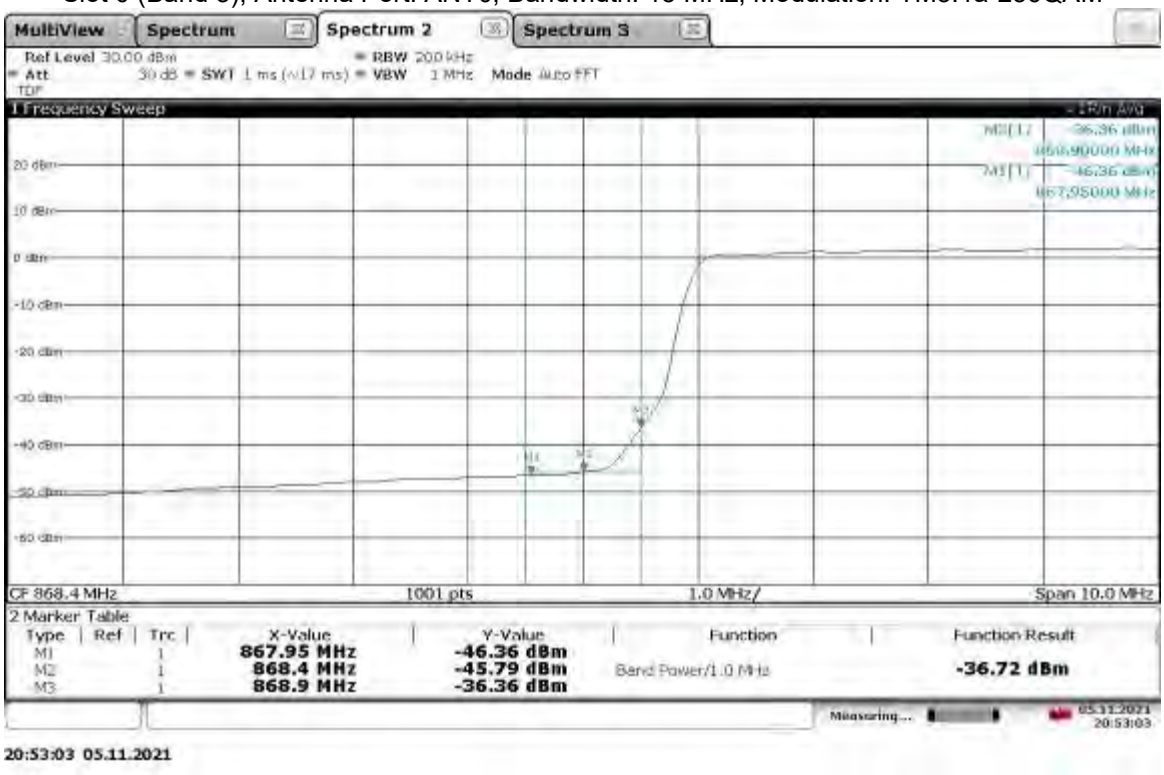
Band Edge Compliant, Lower Band Edge, 874 MHz
Slot 0 (Band 5), Antenna Port: ANT0, Bandwidth: 10 MHz, Modulation: TM3.1a-256QAM



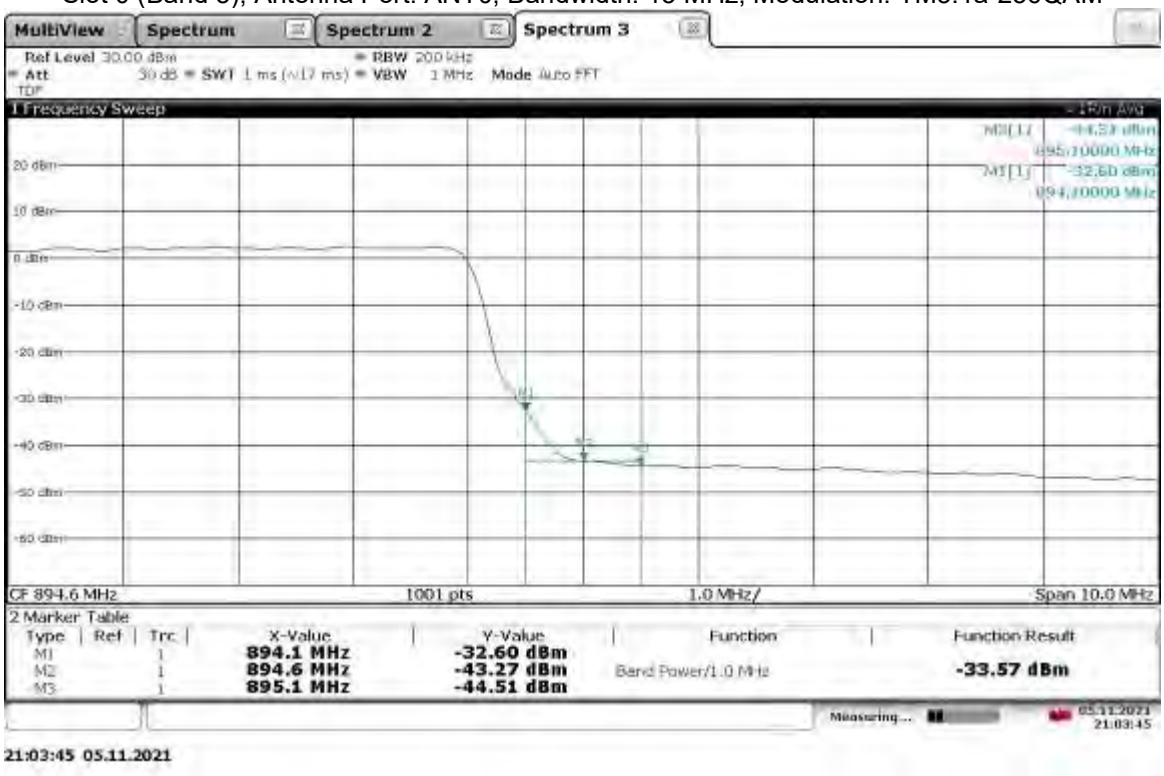
Band Edge Compliant, Upper Band Edge, 889 MHz
Slot 0 (Band 5), Antenna Port: ANT0, Bandwidth: 10 MHz, Modulation: TM3.1a-256QAM



Band Edge Compliant, Lower Band Edge,876.5MHz
Slot 0 (Band 5), Antenna Port: ANT0, Bandwidth: 15 MHz, Modulation: TM3.1a-256QAM

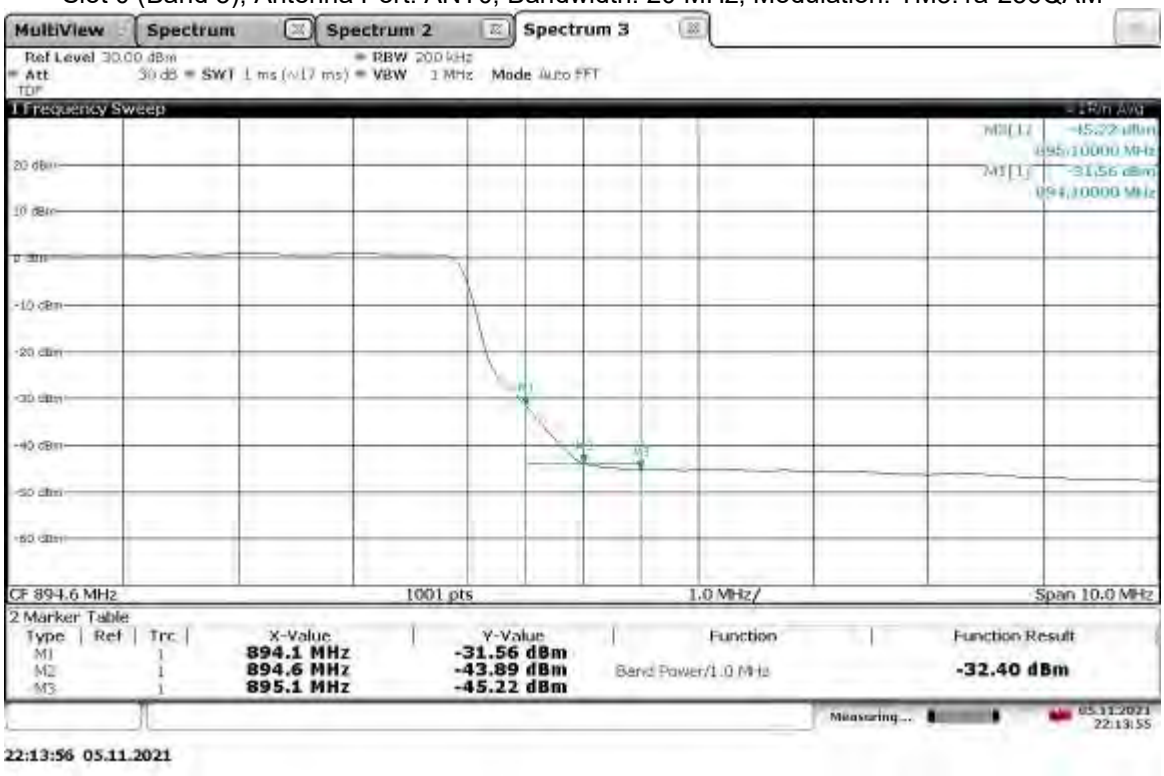


Band Edge Compliant, Upper Band Edge, 886.5 MHz
Slot 0 (Band 5), Antenna Port: ANT0, Bandwidth: 15 MHz, Modulation: TM3.1a-256QAM

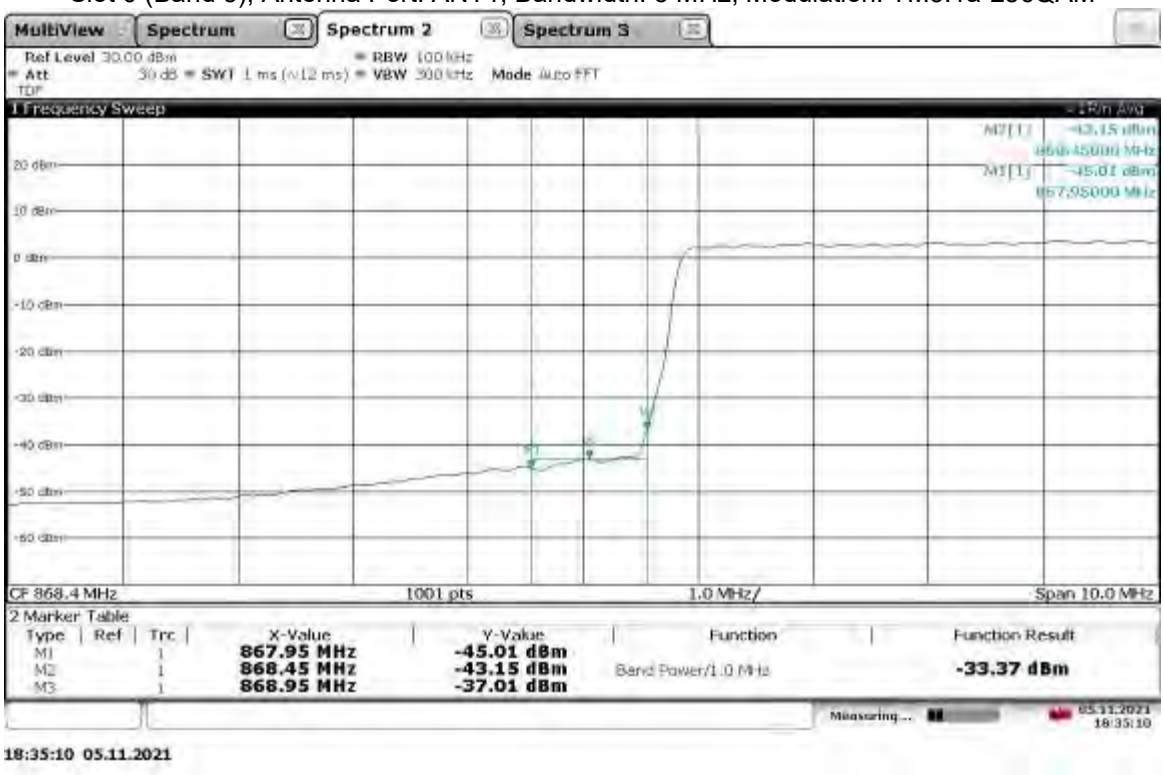


Band Edge Compliant, Lower Band Edge, 879 MHz
Slot 0 (Band 5), Antenna Port: ANT0, Bandwidth: 20 MHz, Modulation: TM3.1a-256QAM

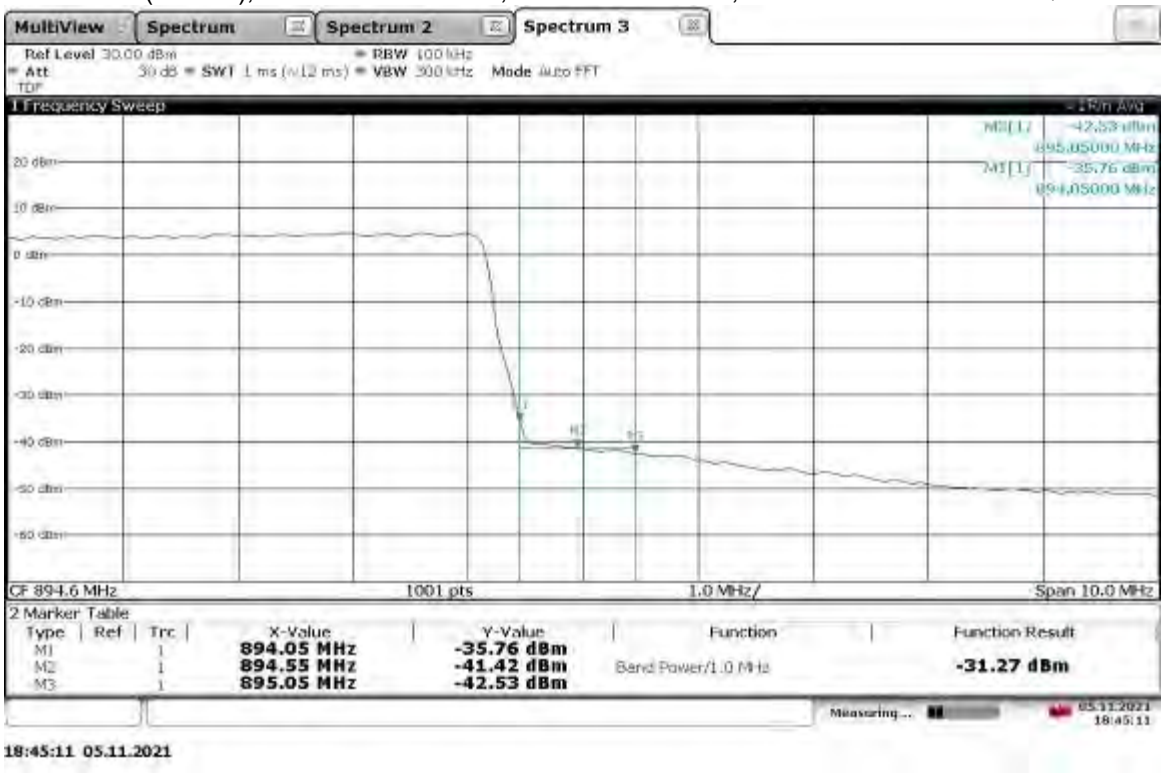
Band Edge Compliant, Upper Band Edge, 884 MHz
Slot 0 (Band 5), Antenna Port: ANT0, Bandwidth: 20 MHz, Modulation: TM3.1a-256QAM



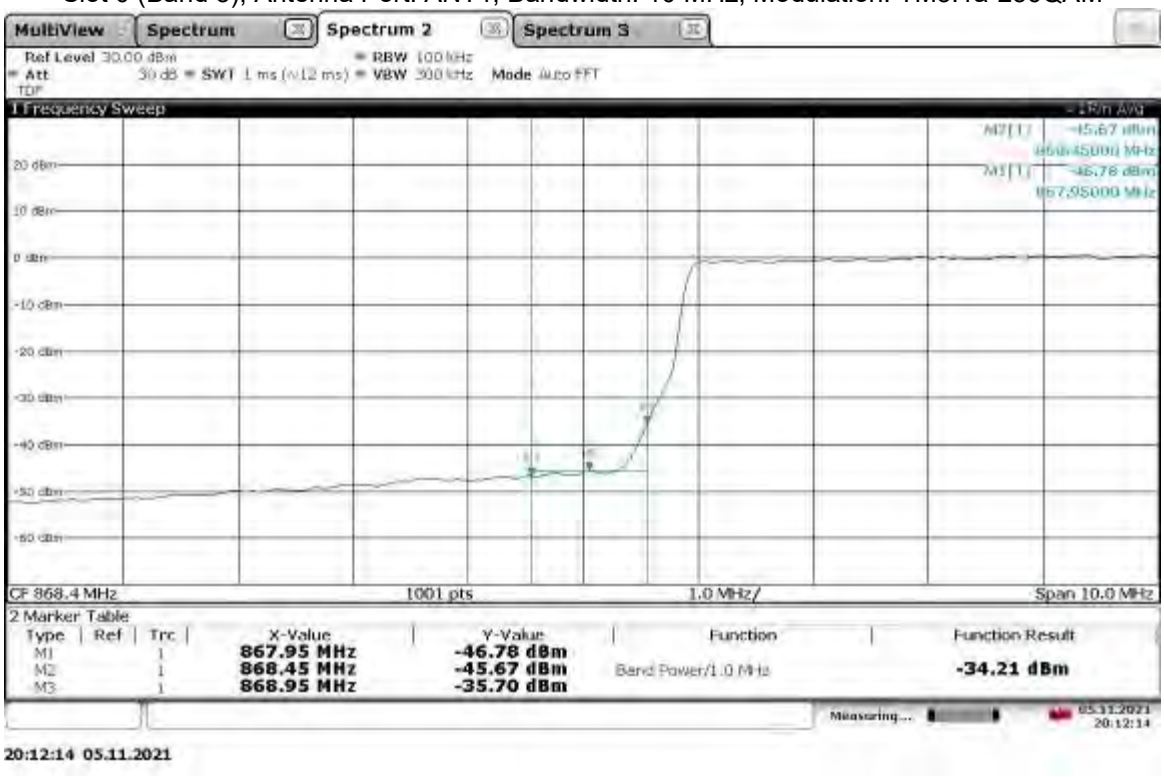
Band Edge Compliant, Lower Band Edge, 871.5 MHz
Slot 0 (Band 5), Antenna Port: ANT1, Bandwidth: 5 MHz, Modulation: TM3.1a-256QAM



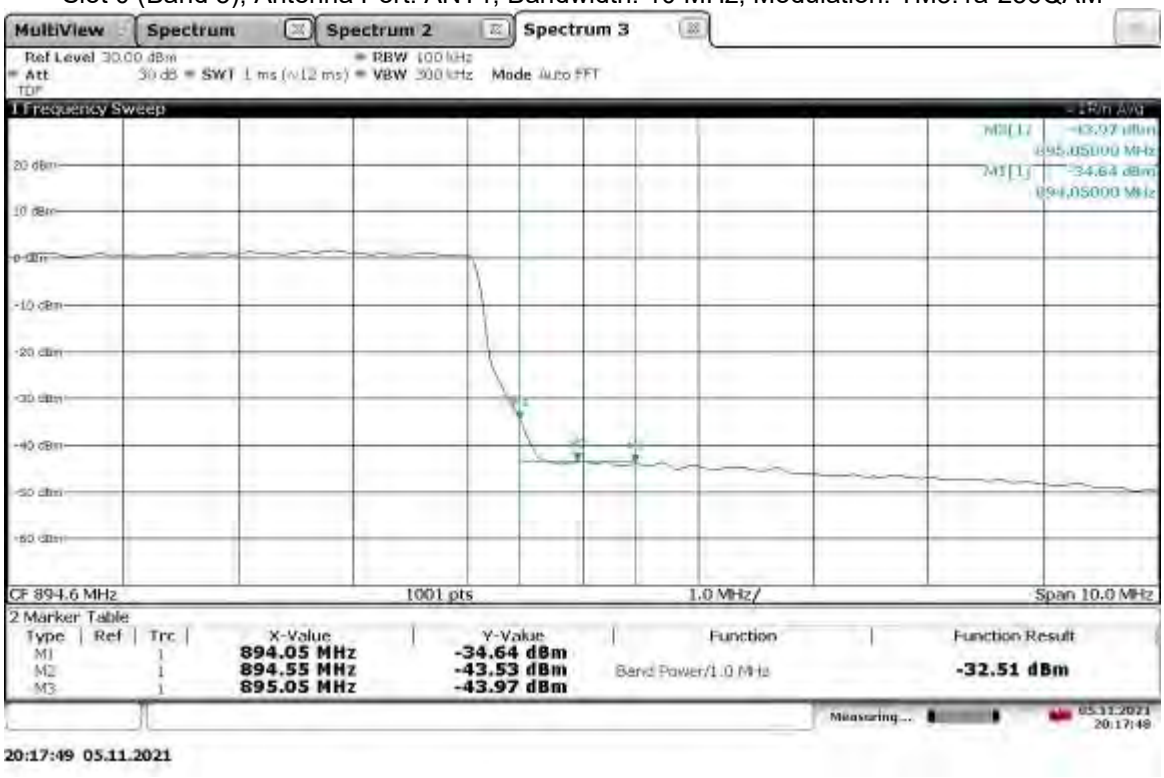
Band Edge Compliant, Upper Band Edge, 891.5 MHz
Slot 0 (Band 5), Antenna Port: ANT1, Bandwidth: 5 MHz, Modulation: TM3.1a-256QAM



Band Edge Compliant, Lower Band Edge, 874 MHz
Slot 0 (Band 5), Antenna Port: ANT1, Bandwidth: 10 MHz, Modulation: TM3.1a-256QAM

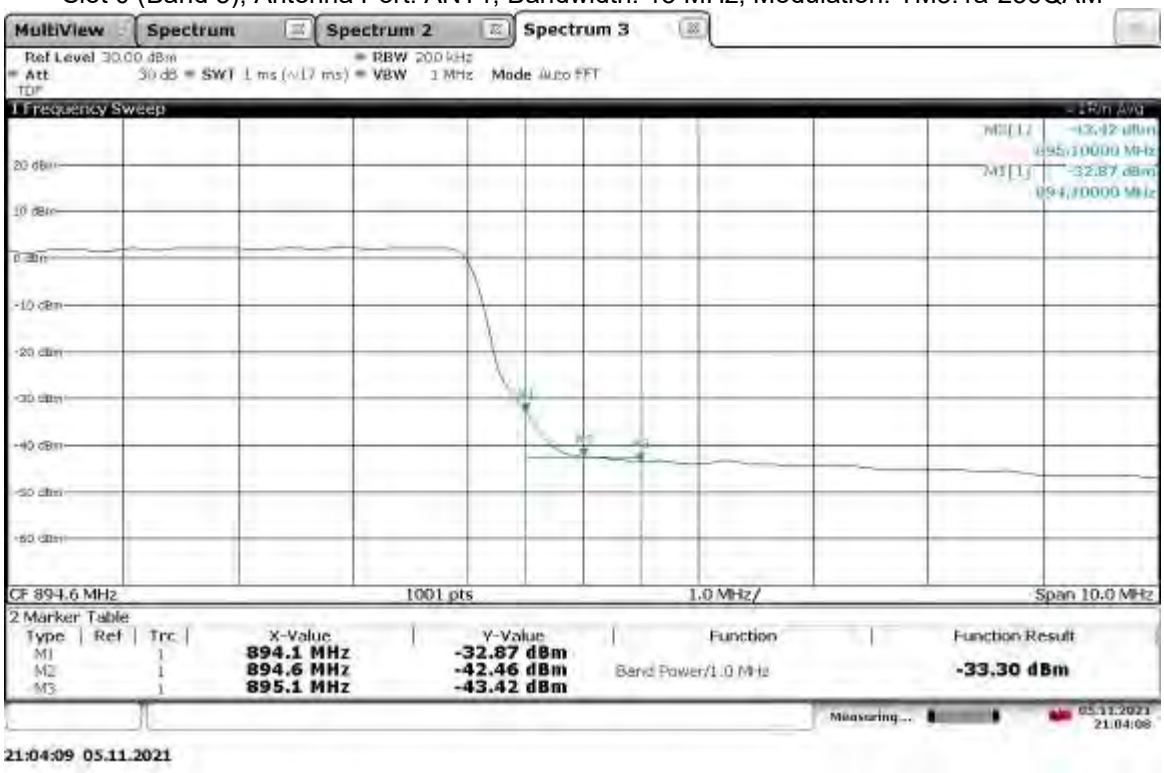


Band Edge Compliant, Upper Band Edge, 889 MHz
Slot 0 (Band 5), Antenna Port: ANT1, Bandwidth: 10 MHz, Modulation: TM3.1a-256QAM

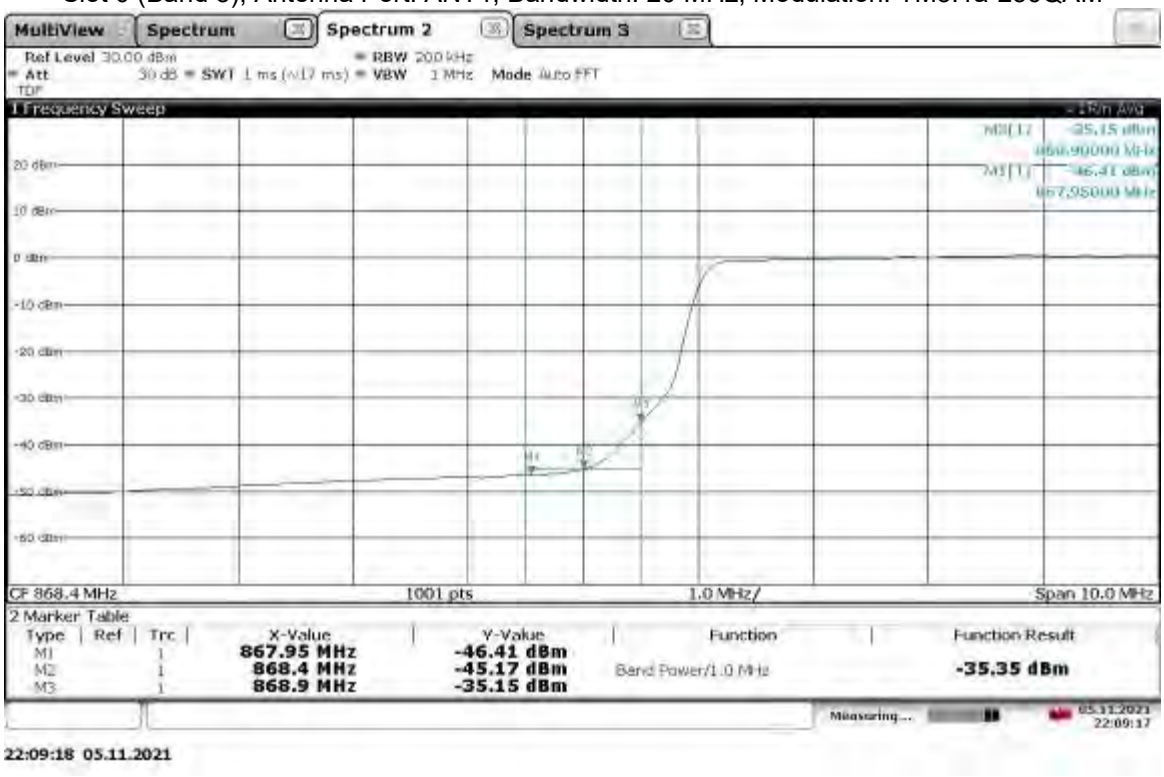


Band Edge Compliant, Lower Band Edge, 876.5 MHz
Slot 0 (Band 5), Antenna Port: ANT1, Bandwidth: 15 MHz, Modulation: TM3.1a-256QAM

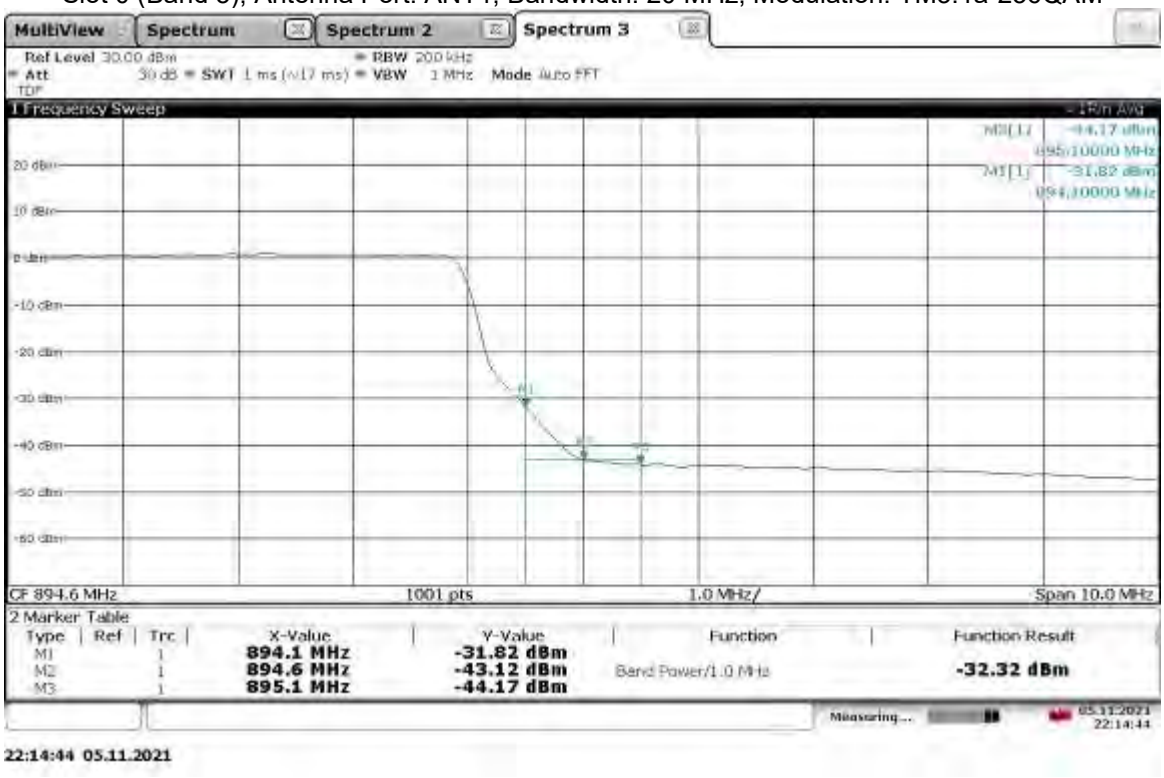
Band Edge Compliant, Upper Band Edge, 886.5 MHz
Slot 0 (Band 5), Antenna Port: ANT1, Bandwidth: 15 MHz, Modulation: TM3.1a-256QAM



Band Edge Compliant, Lower Band Edge, 879 MHz
Slot 0 (Band 5), Antenna Port: ANT1, Bandwidth: 20 MHz, Modulation: TM3.1a-256QAM



Band Edge Compliant, Upper Band Edge, 884 MHz
Slot 0 (Band 5), Antenna Port: ANT1, Bandwidth: 20 MHz, Modulation: TM3.1a-256QAM



Test Personnel:	Vathana Ven VSV	Test Date:	11/05/2021
Supervising/Reviewing Engineer: (Where Applicable)	N/A		
Product Standard:	FCC Part 22	Limit Applied:	See report section 8.3
Input Voltage:	48 VDC (POE)		
Pretest Verification w/ Ambient Signals or BB Source:	N/A	Ambient Temperature:	23 ºC
		Relative Humidity:	19 %
		Atmospheric Pressure:	1017 mbars

Deviations, Additions, or Exclusions: None

9 Frequency Stability Due Voltage Variation

9.1 Method

Tests are performed in accordance with ANSI C63.26 and CFR47 FCC Parts 2.1055 and 22.355.

TEST SITE: Safety Lab

9.2 Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
CEN001'	DC-40GHz attenuator 20dB	Centric RF	C411-20	CEN001	01/22/2021	01/22/2022
CBLHF2012-5M-2'	5m 9kHz-40GHz Coaxial Cable - SET2	Huber & Suhner	SF102	252676002	02/19/2021	02/19/2022
ROS005-1'	Signal and Spectrum Analyzer	Rohde and Shwartz	FSW43	100646	10/27/2020	10/27/2021
DAV005'	Weather Station	Davis	6250	MS191218083	02/07/2021	02/07/2022
SAF1153'	Freezing Rain\Icing\Temp\Humidity\ - 73deg C to +190deg C, 95% humidity, Ice Freezing Rain	Cincinnati Sub-Zero	CTH-(FR)64-6-6-SC/AC	12-CT15628	11/18/2020	11/18/2021

Software Utilized:

Name	Manufacturer	Version
None	--	--

9.3 Results:

The sample tested was found to Comply.

§22.355 Frequency stability – The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block. The occupied bandwidth measurement was used to make sure the lower and upper frequencies of the occupied bandwidth remains within the assigned band of 821-896 MHz.

Frequency stability over voltages

Band 5, 5G, RP5100, Modulation: QPSK, Bandwidth: 5MHz, Antenna Port: ANT1 , Low Channel

Low Edge of Occupied Bandwidth

Voltage	Low Edge	Low Edge Deviation	Low Edge (%)	PPM	Limit
(VDC)	(GHz)	(GHz)	--	--	PPM
41.1	869.25644	0.00288	3.31319E-06	0.03	2.5
48	869.25356	0	0	0.00	--
57	869.25566	0.0021	2.41587E-06	0.02	2.5

Upper Edge of Occupied Bandwidth

Volt	Upper Edge	Upper Edge Deviation	Upper Edge (%)	PPM	Limit
(VDC)	(GHz)	(GHz)	--	--	PPM
41.1	873.73123	-0.00672	-7.69109E-06	-0.08	2.5
48	873.73795	0	0	0.00	--
57	873.73575	-0.0022	-2.51792E-06	-0.03	2.5

Band 5, 5G, RP5100, Modulation: QPSK, Bandwidth: 5MHz, Antenna Port: ANT1 , High Channel

Low Edge of Occupied Bandwidth

Voltage	Low Edge	Low Edge Deviation	Low Edge (%)	PPM	Limit
(VDC)	(GHz)	(GHz)	--	--	PPM
41.1	889.25382	0.00129	1.45066E-06	0.01	2.5
48	889.25253	0	0	0.00	--
57	889.24633	-0.0062	-6.97215E-06	-0.07	2.5

Upper Edge of Occupied Bandwidth

Volt	Upper Edge	Upper Edge Deviation	Upper Edge (%)	PPM	Limit
(VDC)	(GHz)	(GHz)	--	--	PPM
41.1	893.72981	-0.00142	-1.58884E-06	-0.02	2.5
48	893.73123	0	0	0.00	--
57	893.72905	-0.00218	-2.43921E-06	-0.02	2.5

Frequency stability over voltages

Band 5, 5G, RP5100, Modulation: QPSK, Bandwidth: 20MHz, Antenna Port: ANT0 , Low Channel

Low Edge of Occupied Bandwidth

Voltage	Low Edge	Low Edge Deviation	Low Edge (%)	PPM	Limit
(VDC)	(GHz)	(GHz)	--	--	PPM
41.1	869.5152	-0.0065	-7.47537E-06	-0.07	2.5
48	869.5217	0	0	0.00	--
57	869.513	-0.0087	-1.00055E-05	-0.10	2.5

Upper Edge of Occupied Bandwidth

Volt	Upper Edge	Upper Edge Deviation	Upper Edge (%)	PPM	Limit
(VDC)	(GHz)	(GHz)	--	--	PPM
41.1	888.4191	-0.0069	-7.76654E-06	-0.08	2.5
48	888.426	0	0	0.00	--
57	888.4291	0.0031	3.48932E-06	0.03	2.5

Band 5, 5G, RP5100, Modulation: QPSK, Bandwidth: 20MHz, Antenna Port: ANT0 , High Channel

Low Edge of Occupied Bandwidth

Voltage	Low Edge	Low Edge Deviation	Low Edge (%)	PPM	Limit
(VDC)	(GHz)	(GHz)	--	--	PPM
41.1	874.4853	-0.0079	-9.0338E-06	-0.09	2.5
48	874.4932	0	0	0.00	--
57	874.4854	-0.0078	-8.91945E-06	-0.09	2.5

Upper Edge of Occupied Bandwidth

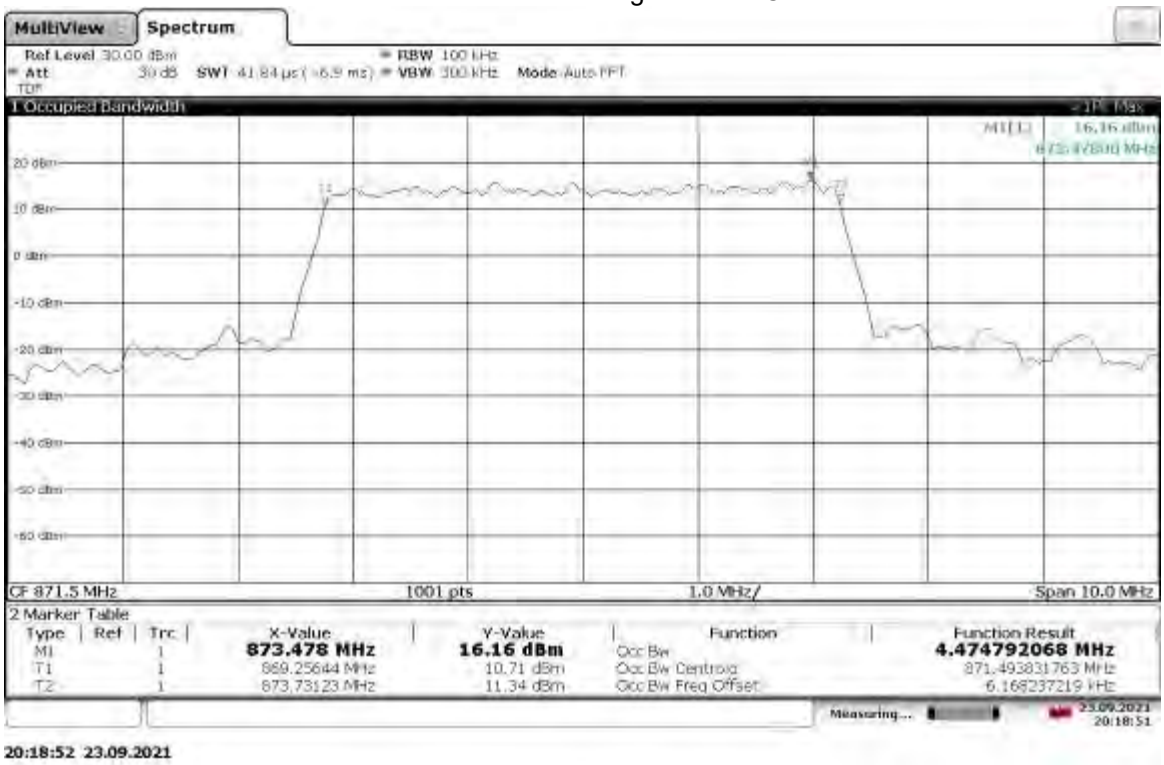
Volt	Upper Edge	Upper Edge Deviation	Upper Edge (%)	PPM	Limit
(VDC)	(GHz)	(GHz)	--	--	PPM
41.1	893.4445	0.0026	2.91009E-06	0.03	2.5
48	893.4419	0	0	0.00	--
57	893.4434	0.0015	1.6789E-06	0.02	2.5

9.4 Setup Photograph:

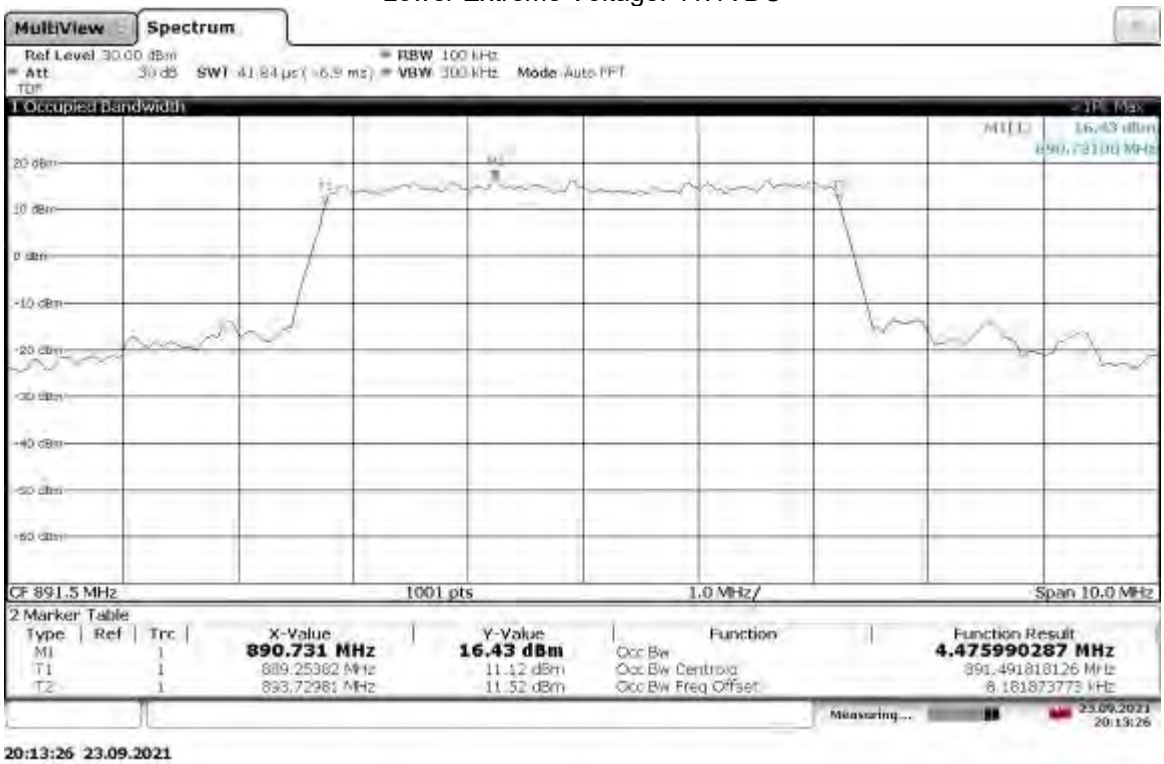
Confidential – Test setup photo not included in this report

9.5 Plots/Data:

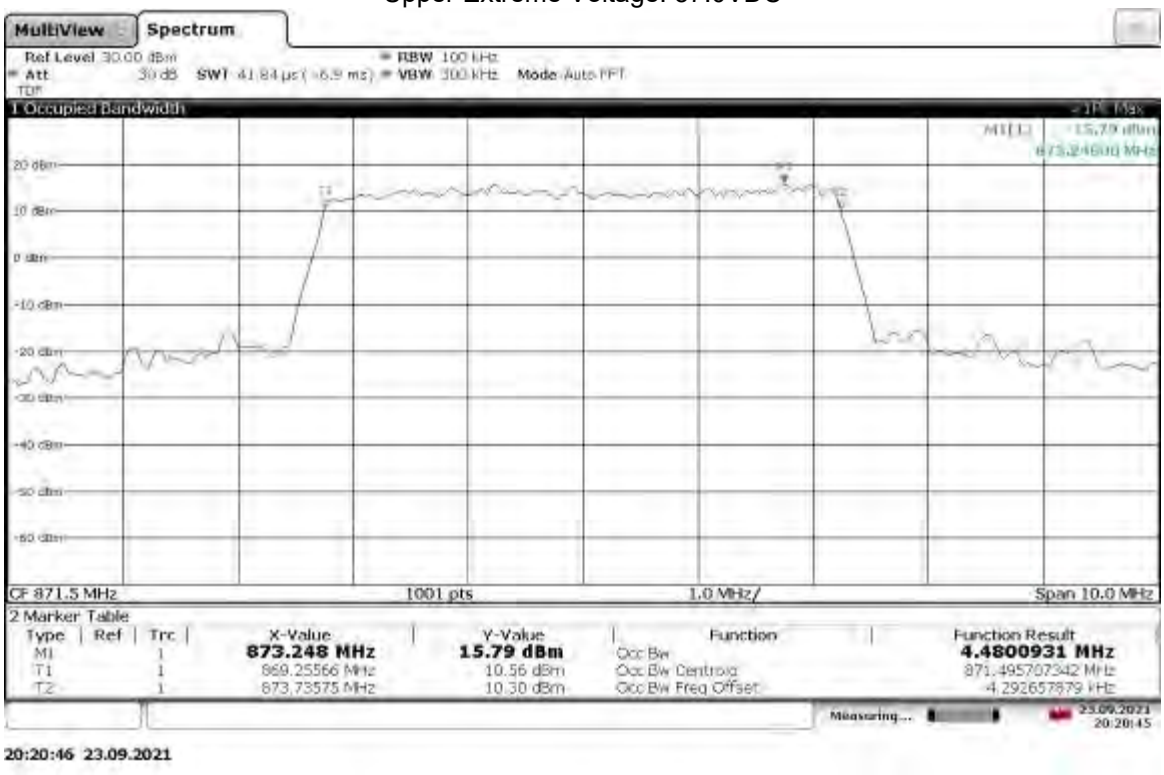
Slot 0 (Band 5), ANT1, Modulation: QPSK, Bandwidth: 5 MHz, Low Channel,
Lower Extreme Voltage: 41.1VDC



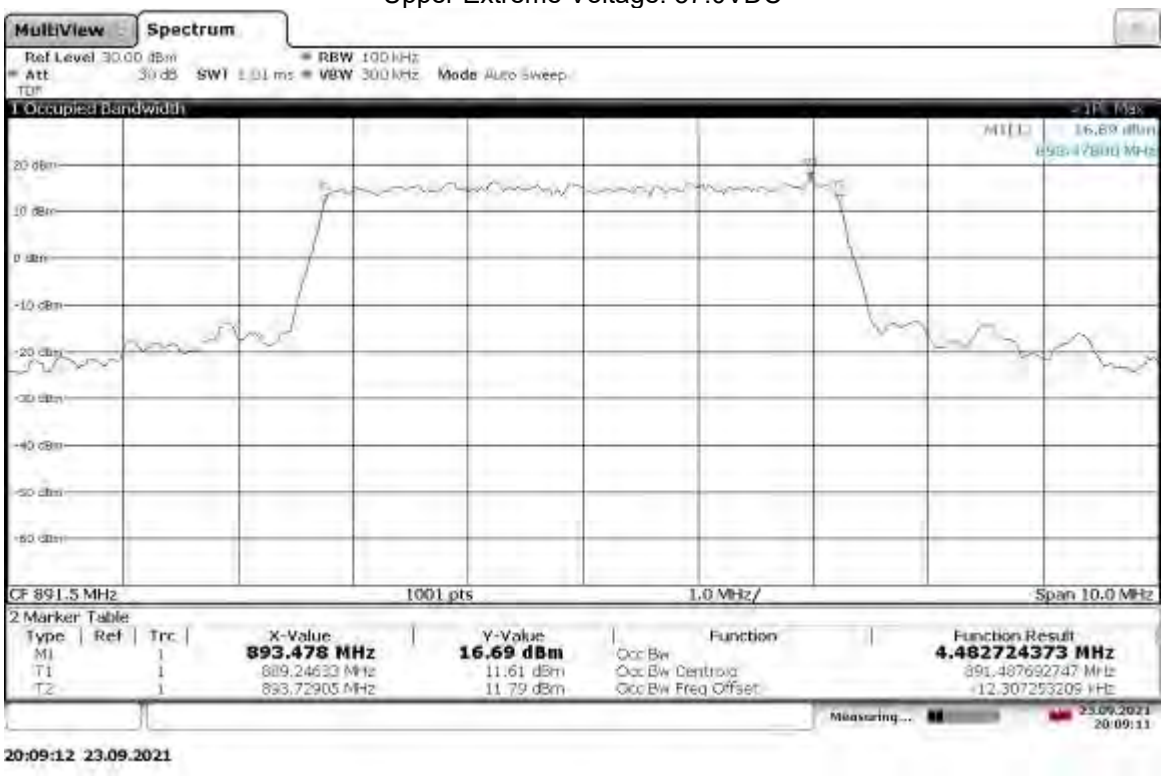
Slot 0 (Band 5), ANT1, Modulation: QPSK, Bandwidth: 5 MHz, High Channel,
Lower Extreme Voltage: 41.1VDC



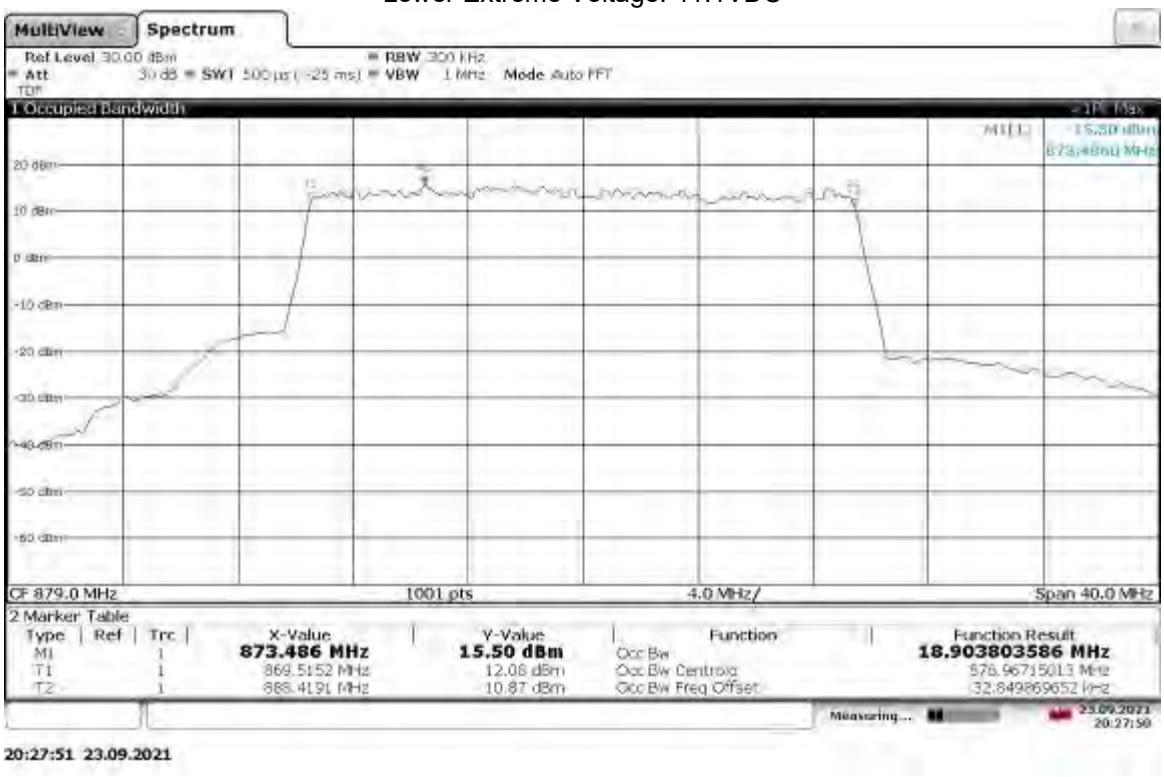
Slot 0 (Band 5), ANT1, Modulation: QPSK, Bandwidth: 5 MHz, Low Channel,
Upper Extreme Voltage: 57.0VDC



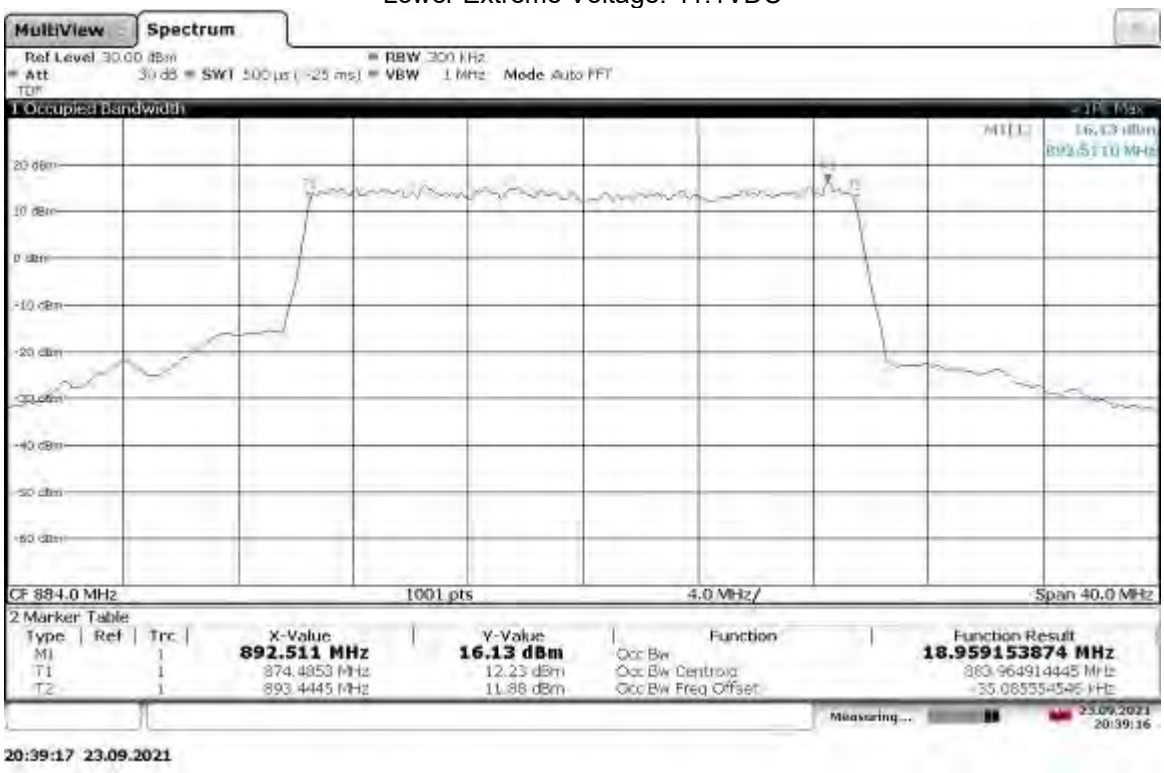
Slot 0 (Band 5), ANT1, Modulation: QPSK, Bandwidth: 5 MHz, High Channel,
Upper Extreme Voltage: 57.0VDC



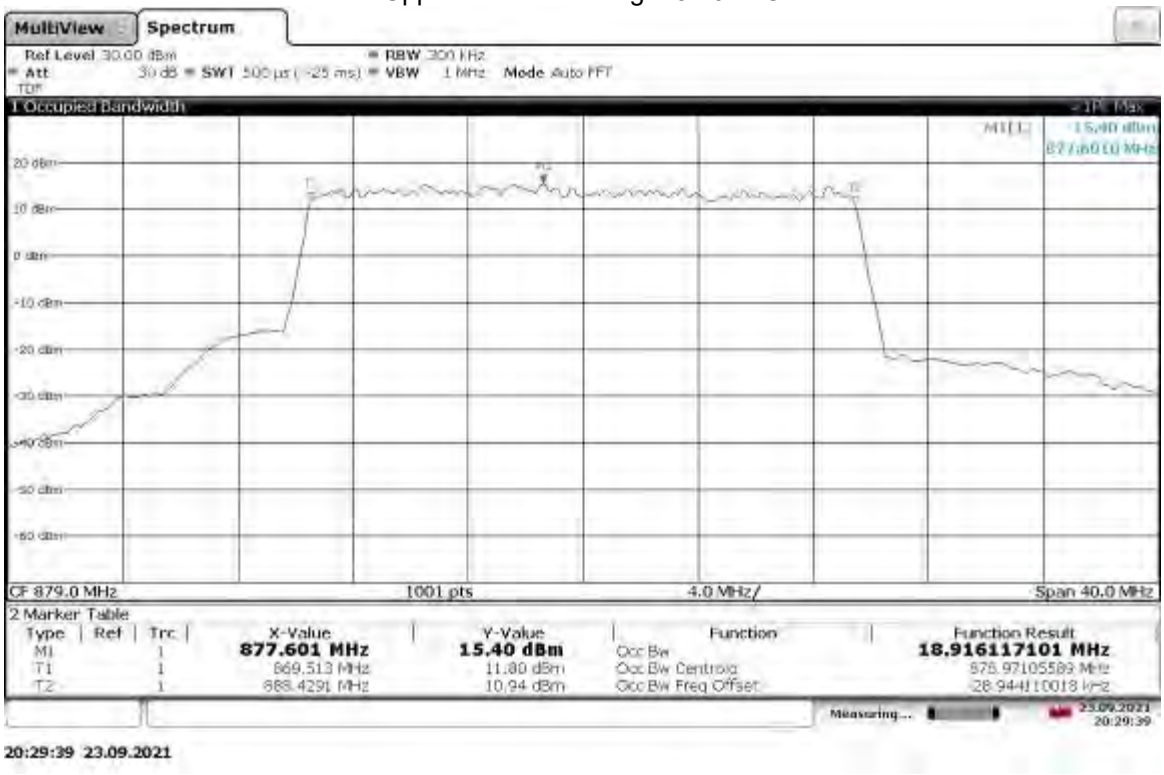
Slot 0 (Band 5), ANT0, Modulation: QPSK, Bandwidth: 20 MHz, Low Channel,
Lower Extreme Voltage: 41.1VDC



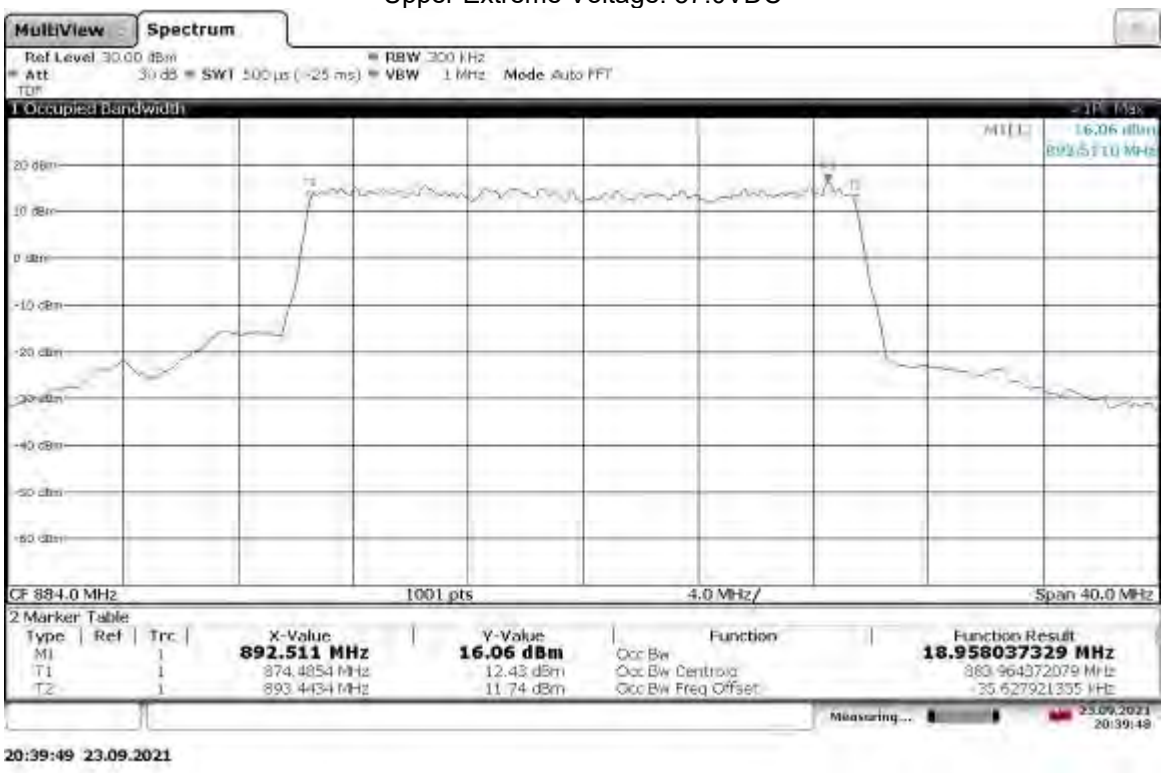
Slot 0 (Band 5), ANT0, Modulation: QPSK, Bandwidth: 20 MHz, High Channel,
Lower Extreme Voltage: 41.1VDC



Slot 0 (Band 5), ANT1, Modulation: QPSK, Bandwidth: 20 MHz, Low Channel,
Upper Extreme Voltage: 57.0VDC



Slot 0 (Band 5), ANT1, Modulation: QPSK, Bandwidth: 20 MHz, High Channel,
Upper Extreme Voltage: 57.0VDC



Test Personnel:	Vathana Ven VSV	Test Date:	09/23/2021
Supervising/Reviewing Engineer: (Where Applicable)	N/A		
Product Standard:	FCC Part 22	Limit Applied:	See report section 9.3
Input Voltage:	48VDC (POE)		
Pretest Verification w/ Ambient Signals or BB Source:	N/A	Ambient Temperature:	24 ºC
		Relative Humidity:	68 %
		Atmospheric Pressure:	1008 mbars

Deviations, Additions, or Exclusions: None

10 Transmitter spurious emissions

10.1 Method

Tests are performed in accordance with ANSI C63.26 and CFR47 FCC Parts 2.1051, 2.1053, 2.1057, and 22.359.

TEST SITE: EMC Lab & 10m ALSE

The EMC Lab has one Semi-anechoic Chamber and one Shielded Chamber. AC Mains Power is available at 120, 230, and 277 Single Phase; 208, 400, and 480 3-Phase. Large reference ground-planes are installed in the general lab area to facilitate EMC work not requiring a shielded environment.

The 10m ALSE is 13m (Length) x 21m (Depth) x 10m (Height) with the effective size in terms of space from the tips of the absorber is 12m (Length) x 20m (Depth) x 8.5m (Height). This chamber achieves broadband performance using a unique arrangement of hybrid and ferrite tile absorber. This chamber has a built in 3m diameter turntable (Embedded type). The metal structure of the table makes electrical connection around the entire circumference of the turntable to the ground plane with a metal brush type connection. The turntable is located on one end of the chamber and the antennas are mounted 3 and 10 meters away at the other end of the chamber on the adjustable an Antenna Mast. The antenna mast is a non-conductive bore sighted type with remote control of antenna height and polarization. The Antenna Mast and the turntable can be remotely controlled through the controller located in the adjacent Control room. A Styrofoam table 80 cm high is used for table-top equipment.

Measurement Uncertainty

Measurement	Frequency Range	Expanded Uncertainty (k=2)	Ucispr
Radiated Emissions, 10m	30-1000 MHz	4.6dB	6.3 dB
Radiated Emissions, 3m	30-1000 MHz	5.3 dB	6.3 dB
Radiated Emissions, 3m	1-6 GHz	4.5 dB	5.2 dB
Radiated Emissions, 3m	6-15 GHz	5.2 dB	5.5 dB
Radiated Emissions, 3m	15-18 GHz	5.0 dB	5.5 dB
Radiated Emissions, 3m	18-40 GHz	5.0 dB	5.5 dB

As shown in the table above our radiated emissions U_{lab} is less than the corresponding U_{CISPR} reference value in CISPR 16-4-2 Table 1, hence the compliance of the product is only based on the measured value, and no measurement uncertainty correction is required, based on CISPR 22 and CISPR 11 (for 2006 and later revisions) Clause 11.

Sample Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation with a sample calculation is as follows:

FS = RA + AF + CF - AG
Where FS = Field Strength in dBμV/m
RA = Receiver Amplitude (including preamplifier) in dBμV
CF = Cable Attenuation Factor in dB
AF = Antenna Factor in dB
AG = Amplifier Gain in dB

In the following table(s), the reading shown on the data table reflects the preamplifier gain. An example for the calculations in the following table is as follows.

Assume a receiver reading of 52.0 dBμV is obtained. The antenna factor of 7.4 dB and cable factor of 1.6 dB is added. The amplifier gain of 29 dB is subtracted, giving a field strength of 32 dBμV/m. This value in dBμV/m was converted to its corresponding level in μV/m.

RA = 52.0 dBμV
AF = 7.4 dB/m
CF = 1.6 dB
AG = 29.0 dB
FS = 32 dBμV/m

To convert from dBμV to μV or mV the following was used:

$UF = 10^{(NF / 20)}$ where UF = Net Reading in μV
NF = Net Reading in dBμV

Example:

FS = RA + AF + CF – AG = 52.0 + 7.4 + 1.6 – 29.0 = 32.0
$UF = 10^{(32\ dB\mu V / 20)}$ = 39.8 μV/m

Alternately, when BAT-EMC Emission Software is used, the “Level” includes all losses and gains and is compared directly in the “Margin” column to the “Limit”. The “Correction” includes Antenna Factor, Preamp, and Cable Loss. These are already accounted for in the “Level” column.

10.2 Test Equipment Used:

Test equipment used for antenna port conducted test

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
CEN001'	DC-40GHz attenuator 20dB	Centric RF	C411-20	CEN001	01/22/2021	01/22/2022
CBLSHF204'	Cable, SMA - SMA, 9kHz -40GHz, (Cable Kit 5)	Huber + Suhner	Sucoflex 102EA	234714001	02/03/2021	02/03/2022
ROS005-1'	Signal and Spectrum Analyzer	Rohde and Shwartz	FSW43	100646	10/27/2020	10/27/2021
DAV005'	Weather Station	Davis	6250	MS191218083	02/07/2021	02/07/2022

Software Utilized:

Name	Manufacturer	Version
None	--	--

Test equipment used for radiated emissions

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
IW001`	2 meter cable	Insulated Wire	2801-NPS	001	10/07/2020	10/07/2021
HS003'	10m under floor cable	Huber-Schuner	10m-1	HS003	02/17/2021	02/17/2022
HS002`	DC-18GHz cable 1.4m long	Huber & Suhner	SucoFlex 106A	HS002	11/25/2020	11/25/2021
PRE10'	30-1000MHz pre-amp	ITS	PRE10	PRE10	02/17/2021	02/17/2022
IW006`	DC-18GHz cable 8.4m long	Insulated Wire	2800-NPS	IW006	11/25/2020	11/25/2021
PRE12'	Pre-amplifier	Com Power	PAM-118A	18040117	12/07/2020	12/07/2021
145106	Bilog Antenna (30MHz - 5GHz)	Sunol Sciences	JB5	A111003	06/16/2020	06/16/2021
EMC04'	ANTENNA, RIDGED GUIDE, 18-40 GHZ	EMCO	3116	2090	01/28/2021	01/28/2022
CBLSHF204'	Cable, SMA - SMA, 9kHz -40GHz, (Cable Kit 5)	Huber + Suhner	Sucoflex 102EA	234714001	02/03/2021	02/03/2022
145108`	EMI Test Receiver (20Hz – 40GHz)	Rohde & Schwarz	ESIB40	100209	06/22/2021	06/22/2022
PRE8'	PREAMPLFIER 1- 40 GHz	MITEQ	NSP4000-NF	507145	11/25/2020	11/25/2021
DAV007`	Weather Station Vantage Vue	Davis	6250	MS191212003	03/22/2021	03/22/2022
ETS005'	1-18GHz horn antenna	ETS-Lindgren	3117	00218279	09/28/2020	09/28/2021

Software Utilized:

Name	Manufacturer	Version
BAT-EMC	Nexio	3.18.0.16

10.3 Results:

The sample tested was found to Comply. Where a resolution bandwidth of less than 1 MHz was used (in some cases, 120 kHz or 100 kHz), more than 10 dB margin to the limit is shown. Since the two antenna ports transmit uncorrelated data streams and use cross polarized antennas, no adjustments to the test results were applied due to MIMO operation, per KDB 662911.

§22.359(a): The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB.
(b) Measurement procedure. Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 1 MHz or greater. However, in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is integrated over the full required measurement bandwidth (i.e. 1 MHz or 1 percent of emission bandwidth, as specified). The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

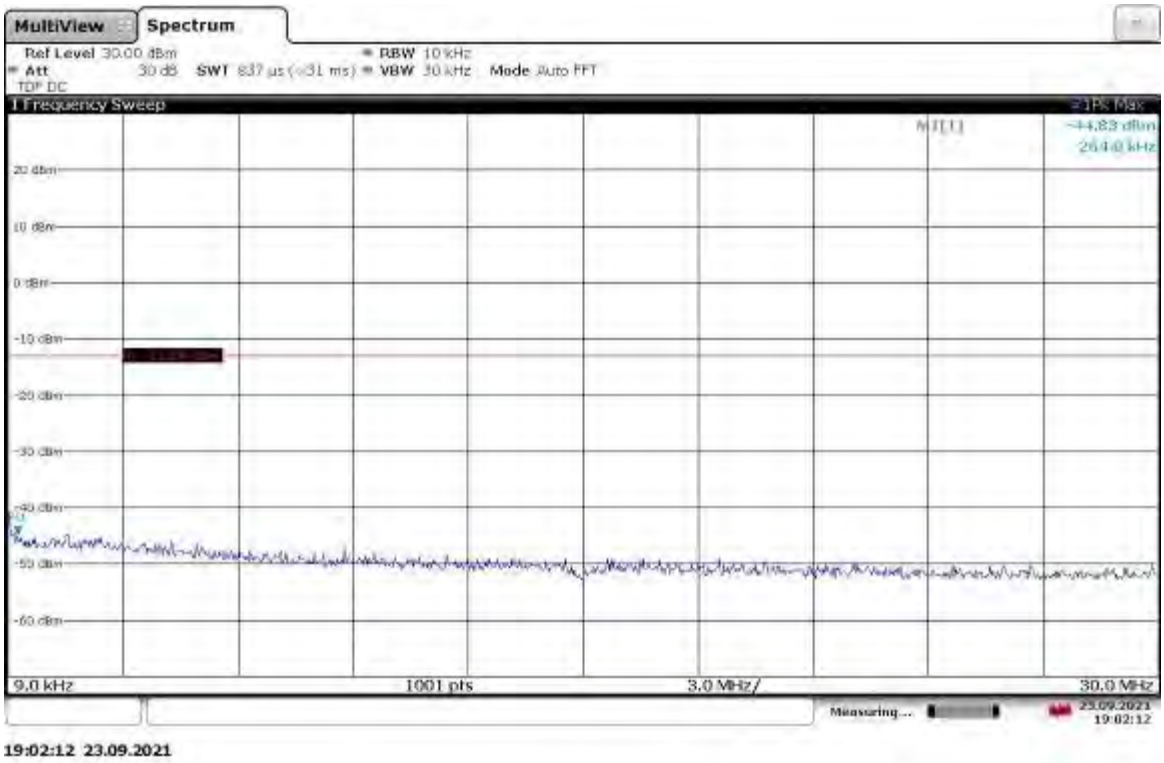
Note: All spurious emissions were tested with narrowest bandwidth and QPSK modulation settings. Since there were no emissions within 30dB of limit, and settings had ~1dB effect on peak readings, other settings were not tested and EUT was considered compliant.

10.4 Setup Photographs:

Confidential – Test setup photo not included in this report

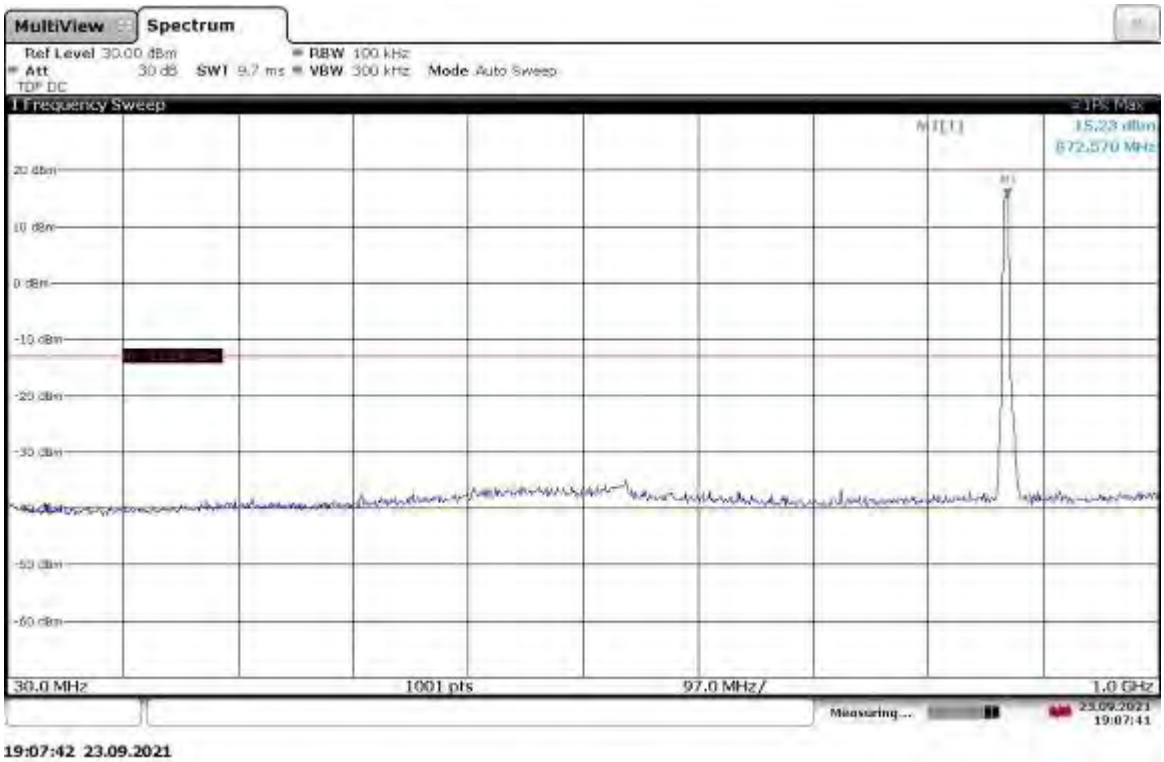
10.5 Plots/Data:

Slot 0 (Band 5), ANT0, Modulation: TM1.1-QPSK, Bandwidth: 5 MHz, Low Channel 871.5 MHz
9 kHz-30 MHz



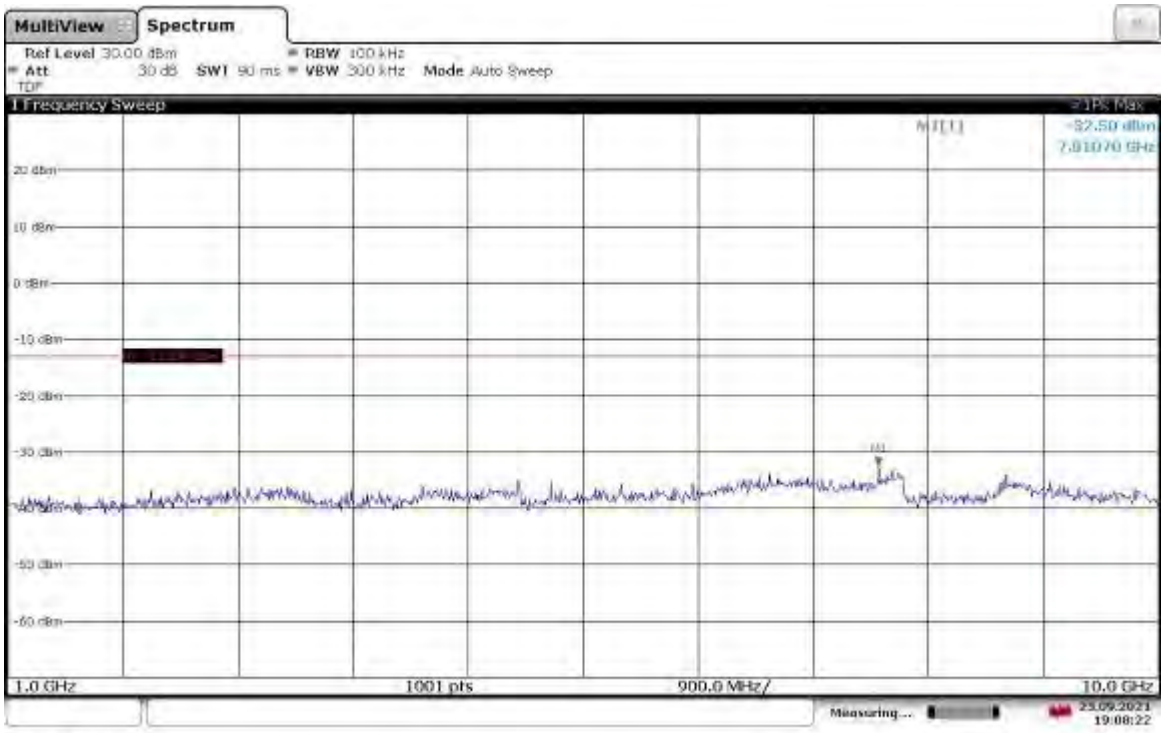
19:02:12 23.09.2021

Slot 0 (Band 5), ANT0, Modulation: TM1.1-QPSK, Bandwidth: 5 MHz, Low Channel 871.5 MHz
30MHz-1GHz



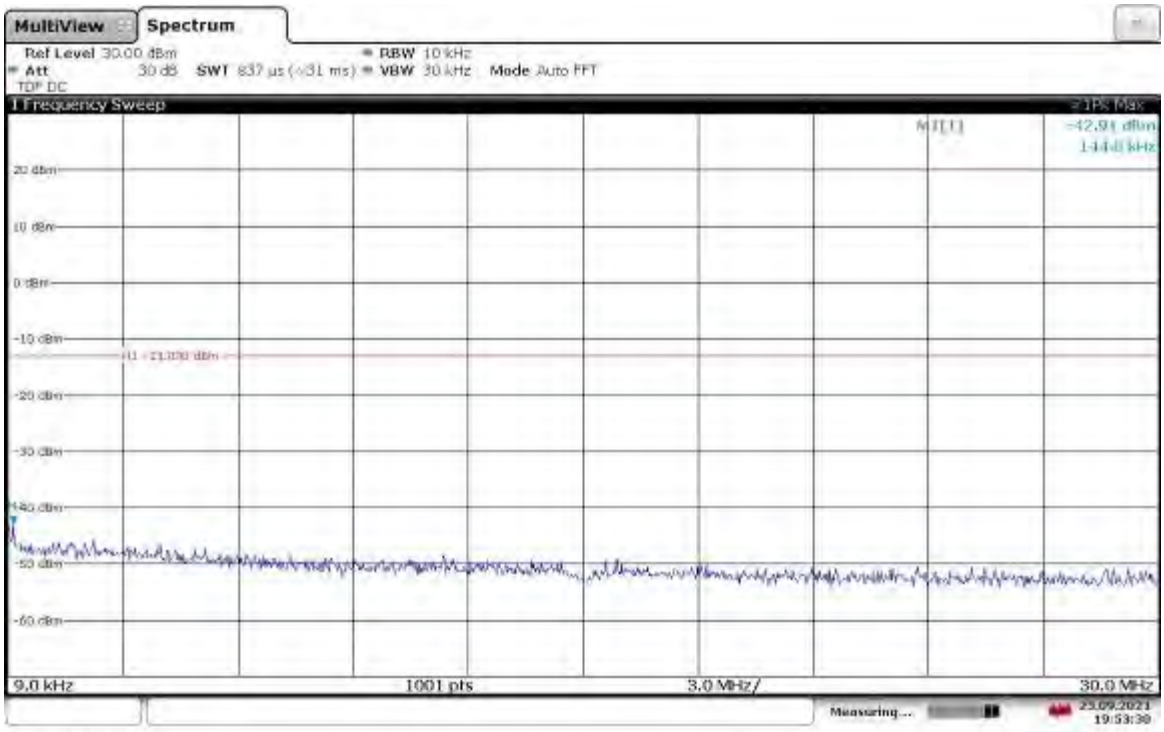
19:07:42 23.09.2021

Slot 0 (Band 5), ANT0, Modulation: TM1.1-QPSK, Bandwidth: 5 MHz, Low Channel 871.5 MHz 1-10 GHz



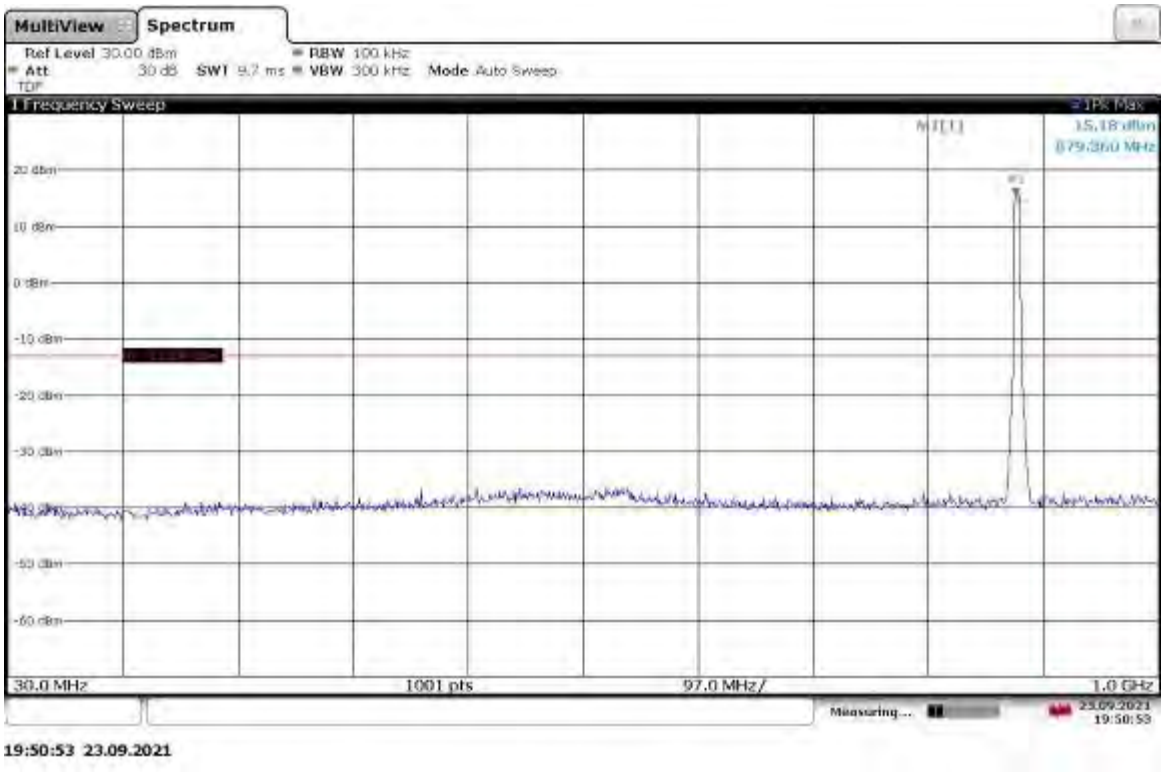
19:08:23 23.09.2021

Slot 0 (Band 5), ANT0, Modulation: TM1.1-QPSK, Bandwidth: 5 MHz, Mid Channel 881 MHz 9kHz-30MHz



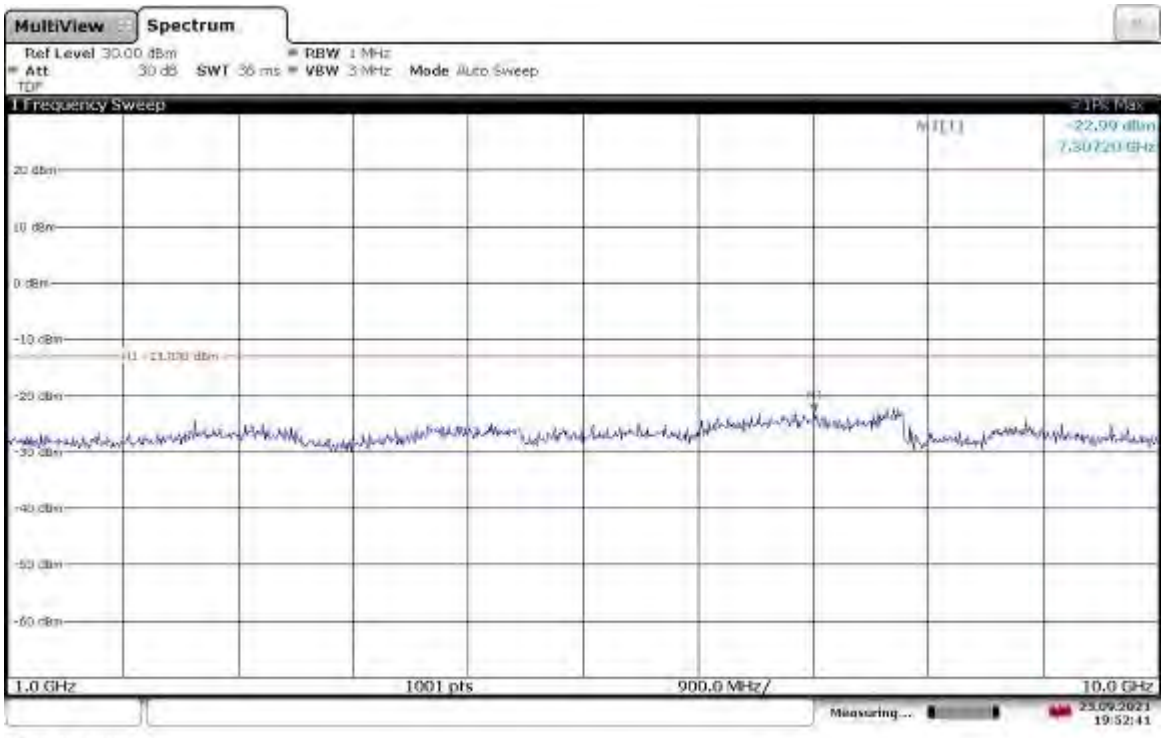
19:53:30 23.09.2021

Slot 0 (Band 5), ANT0, Modulation: TM1.1-QPSK, Bandwidth: 5 MHz, Mid Channel 881 MHz 30MHz-1GHz



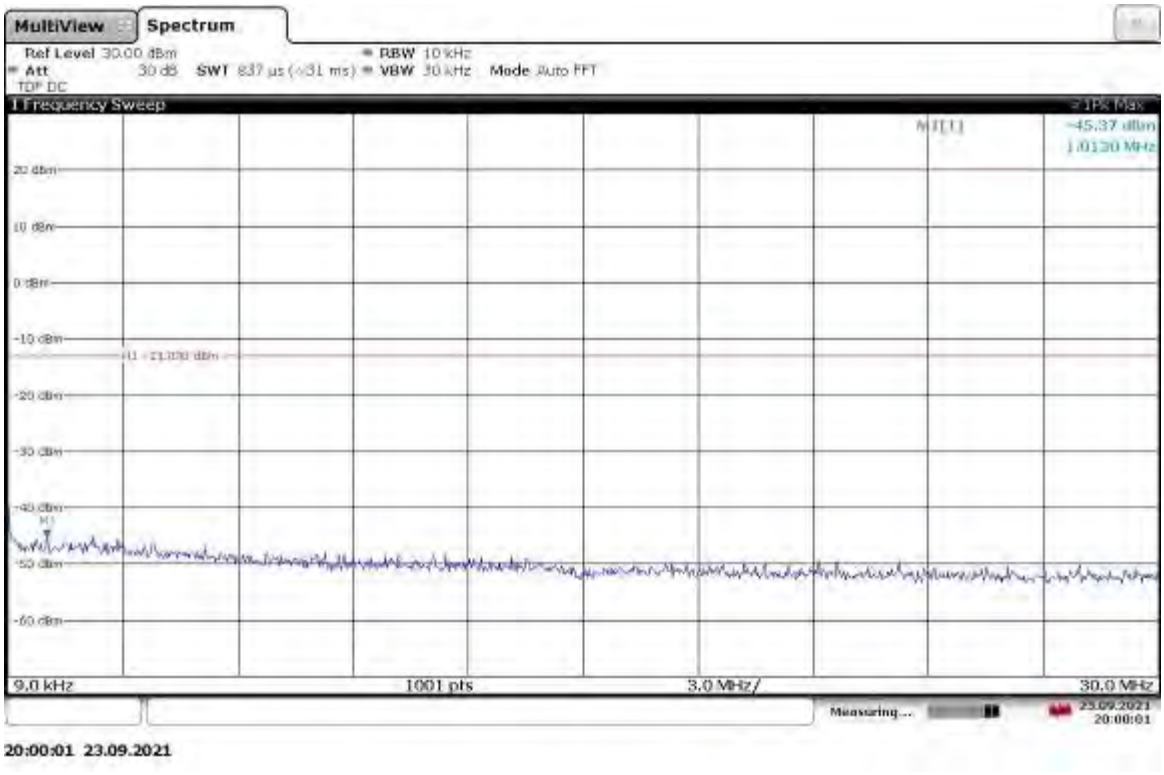
19:50:53 23.09.2021

Slot 0 (Band 5), ANT0, Modulation: TM1.1-QPSK, Bandwidth: 5 MHz, Mid Channel 881 MHz 1-10GHz

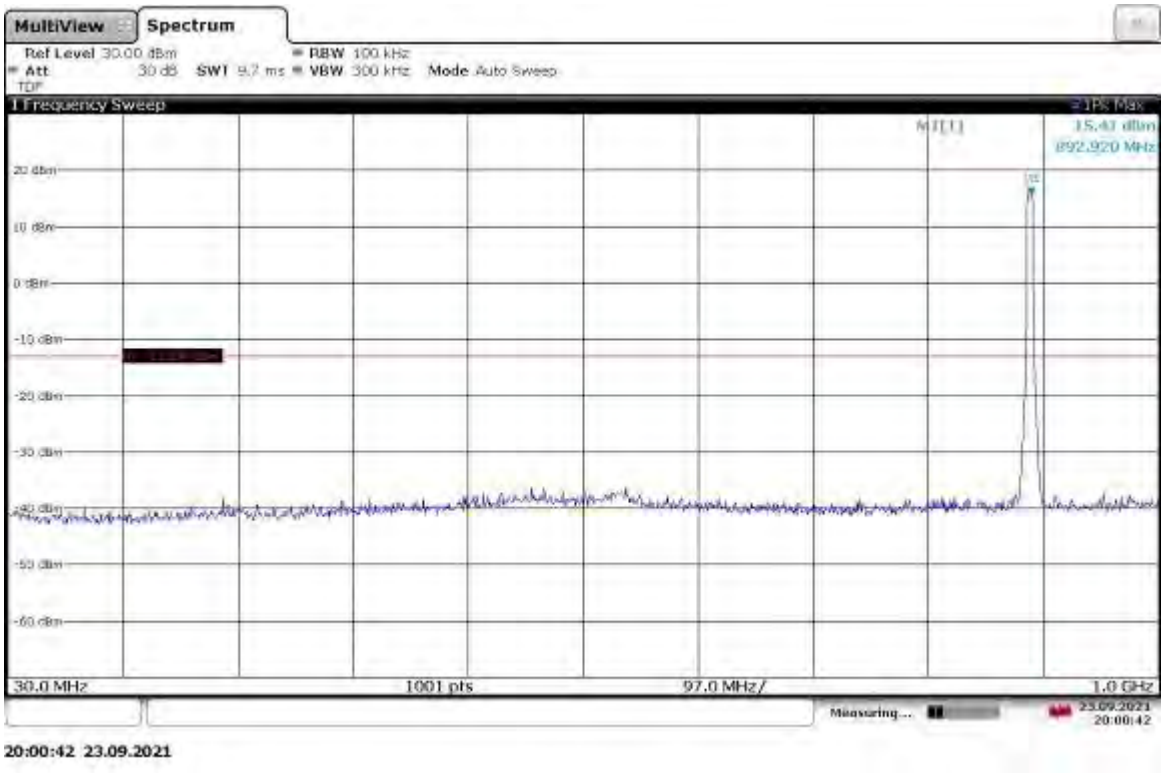


19:52:41 23.09.2021

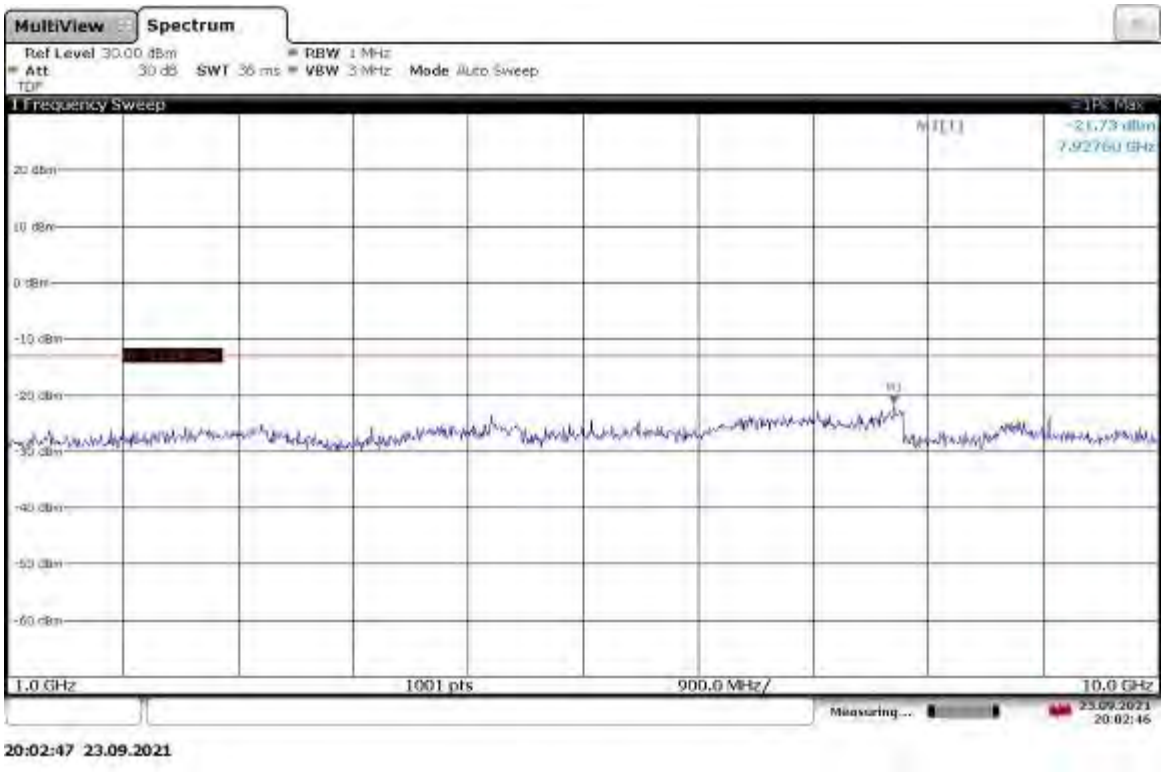
Slot 0 (Band 5), ANT0, Modulation: TM1.1-QPSK, Bandwidth: 5 MHz, High Channel 891.5 MHz 9kHz-30Hz



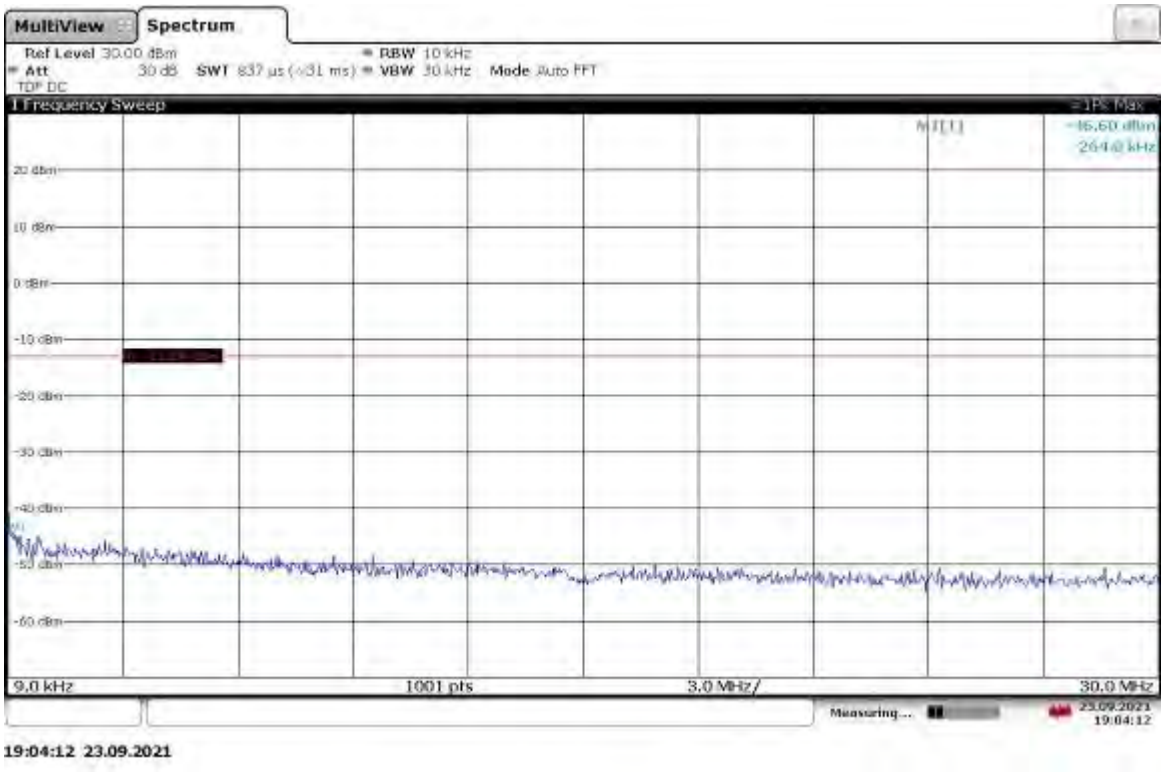
Slot 0 (Band 5), ANT0, Modulation: TM1.1-QPSK, Bandwidth: 5 MHz, High Channel 891.5 MHz 30MHz-1GHz



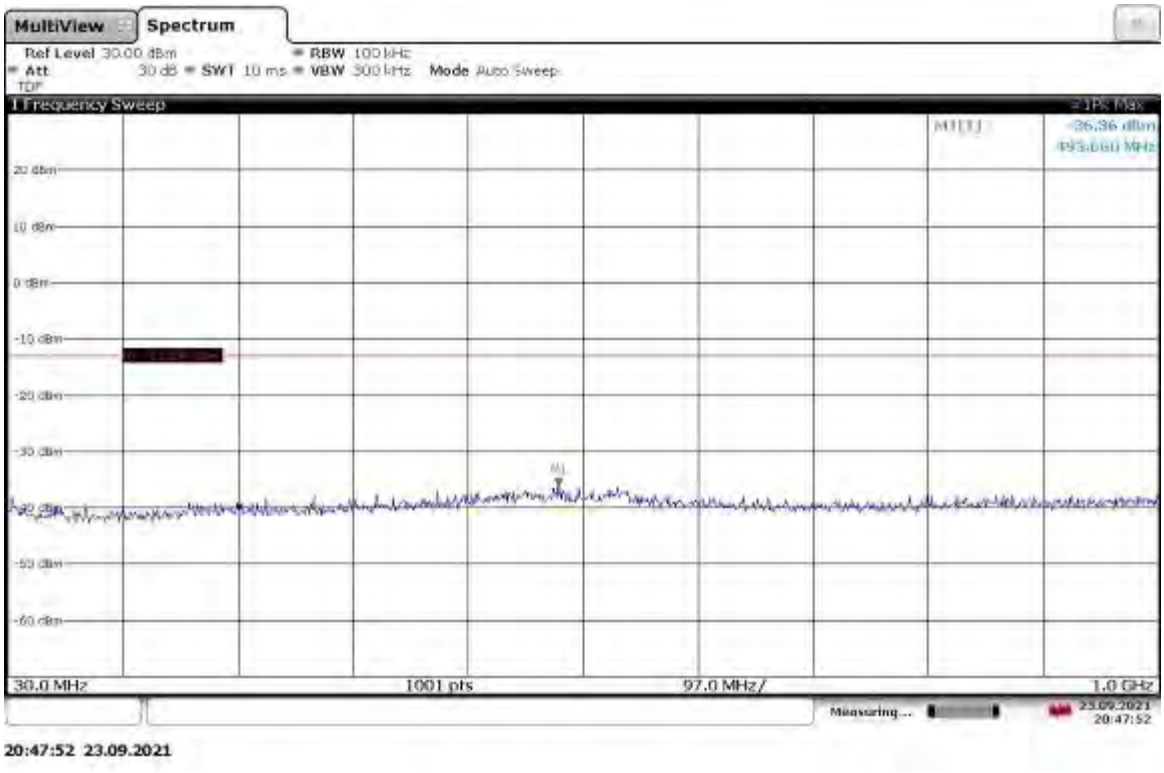
Slot 0 (Band 5), ANT0, Modulation: TM1.1-QPSK, Bandwidth: 5 MHz, High Channel 891.5 MHz 1-10GHz



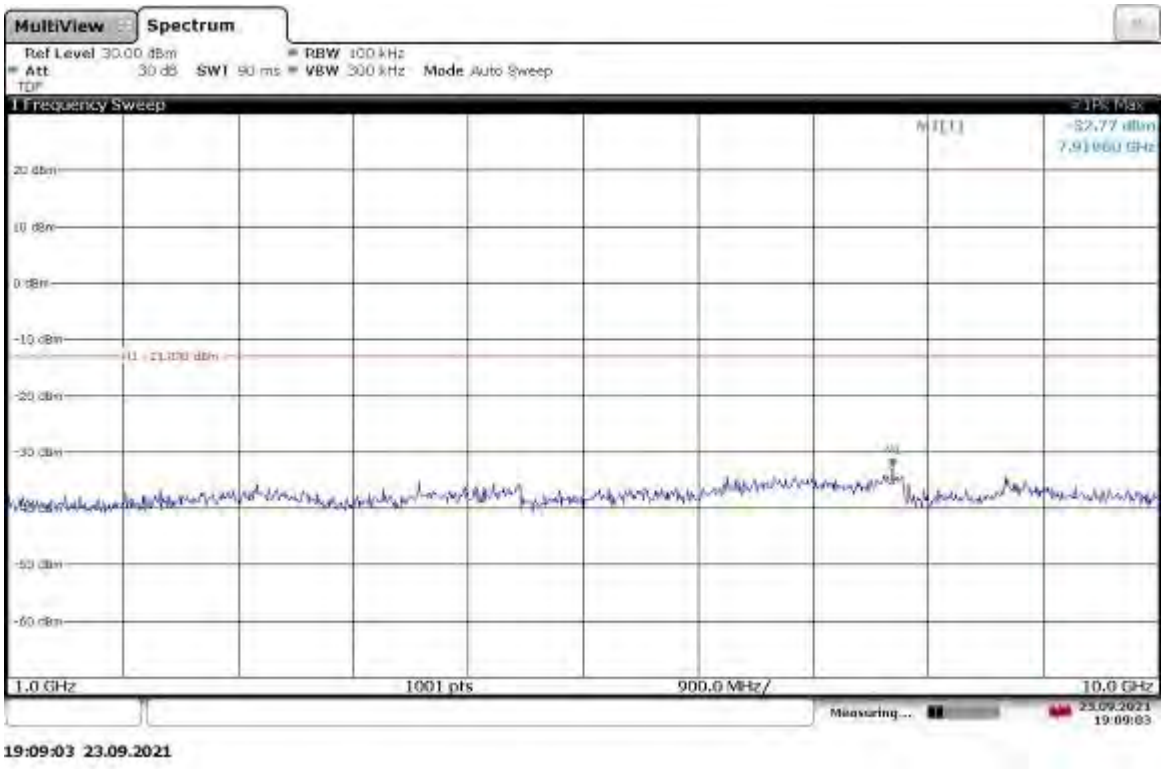
Slot 0 (Band 5), ANT1, Modulation: TM1.1-QPSK, Bandwidth: 5 MHz, Low Channel 871.5 MHz 9kHz-30MHz



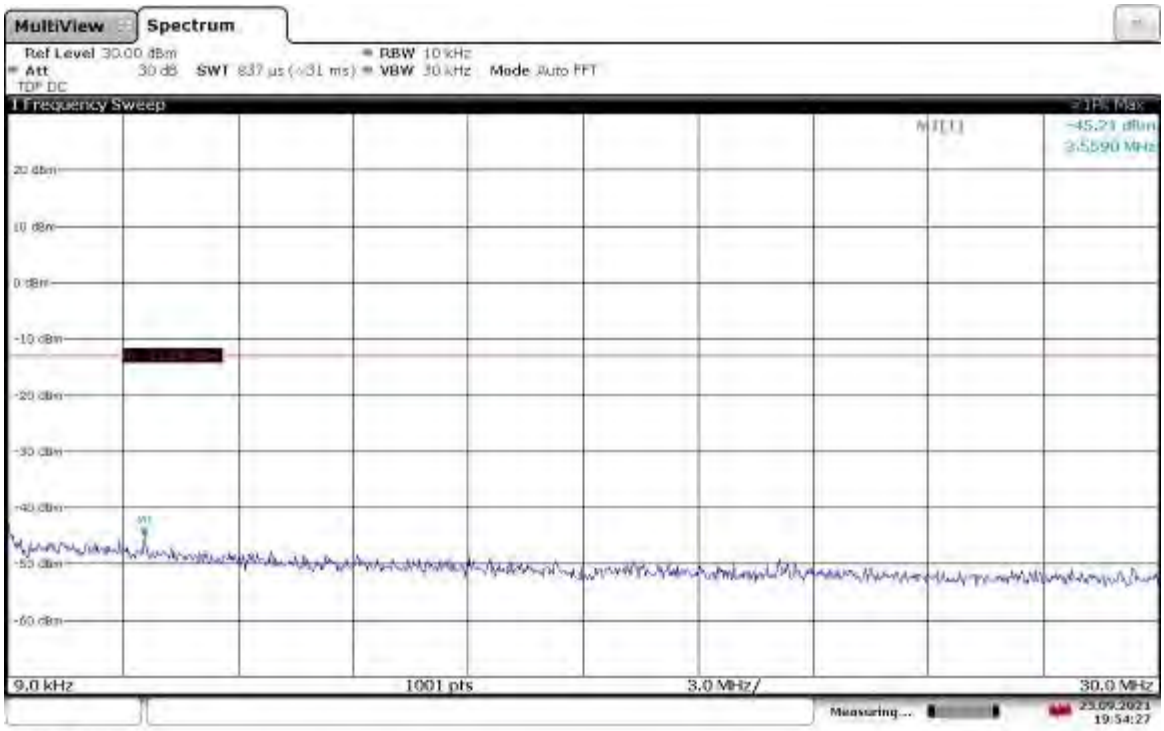
Slot 0 (Band 5), ANT1, Modulation: TM1.1-QPSK, Bandwidth: 5 MHz, Low Channel 871.5 MHz 30MHz-1GHz



Slot 0 (Band 5), ANT1, Modulation: TM1.1-QPSK, Bandwidth: 5 MHz, Low Channel 871.5 MHz 1-10GHz

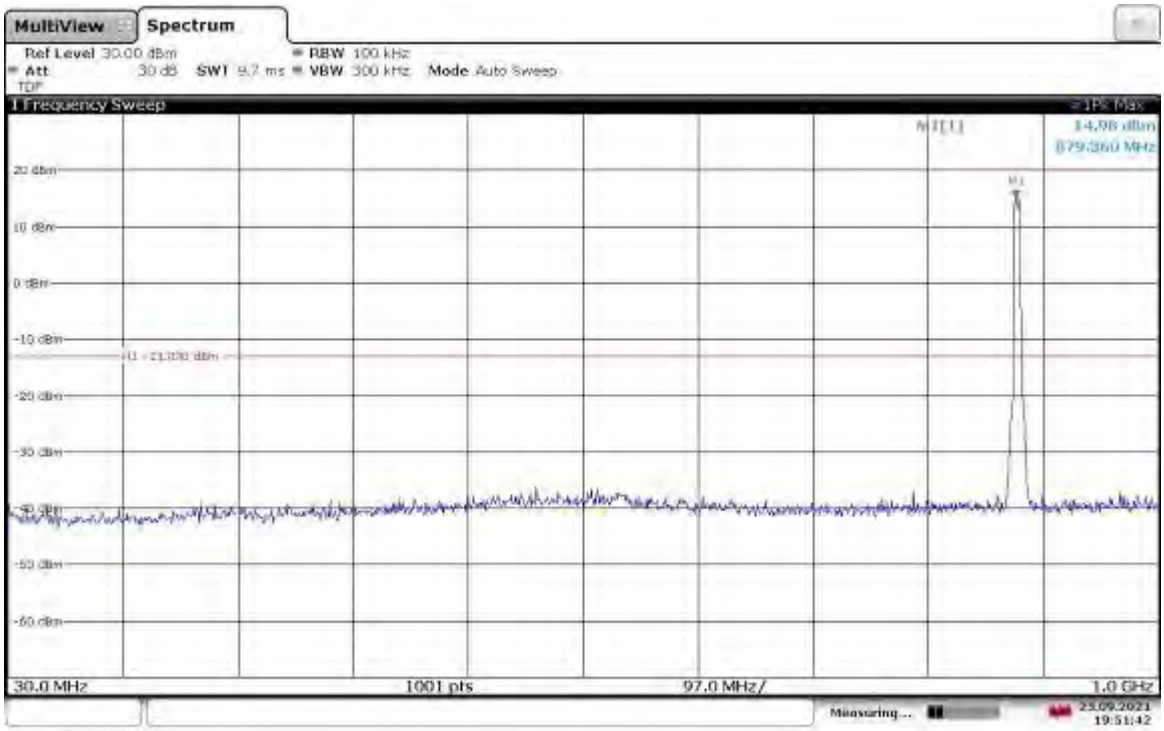


Slot 0 (Band 5), ANT1, Modulation: TM1.1-QPSK, Bandwidth: 5 MHz, Mid Channel 881 MHz
9kHz-30MHz



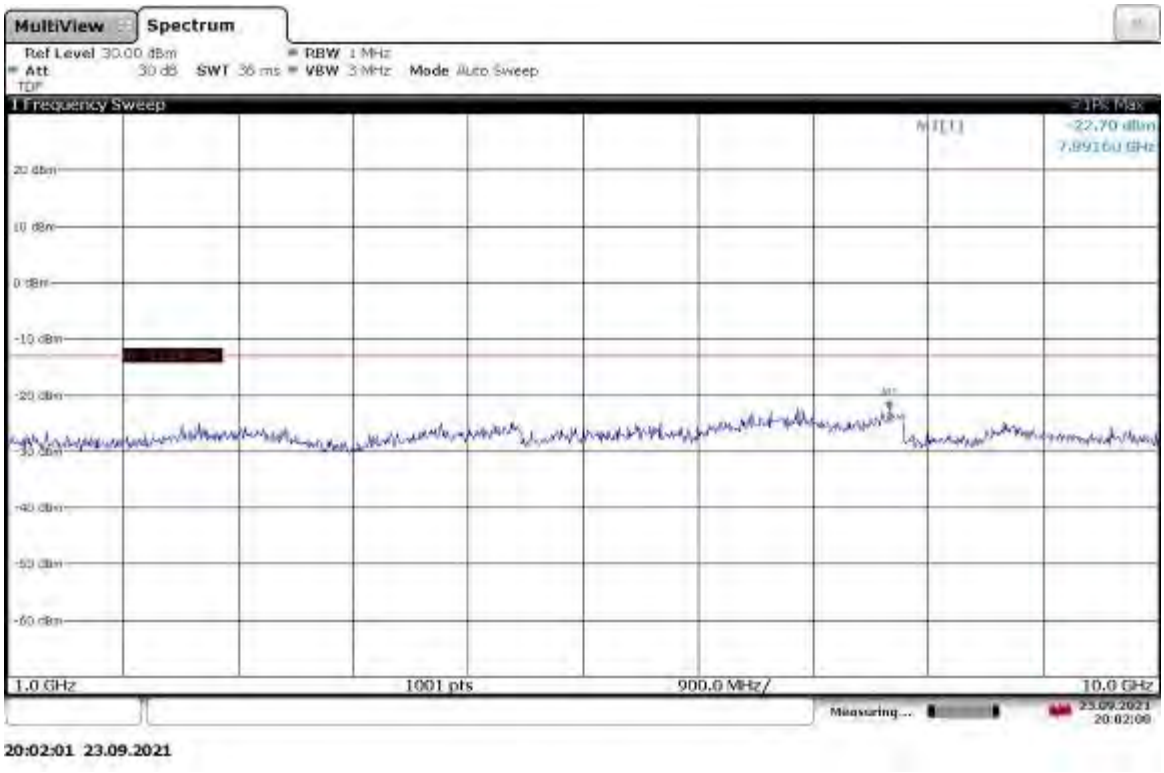
19:54:27 23.09.2021

Slot 0 (Band 5), ANT1, Modulation: TM1.1-QPSK, Bandwidth: 5 MHz, Mid Channel 881 MHz
30MHz-1GHz



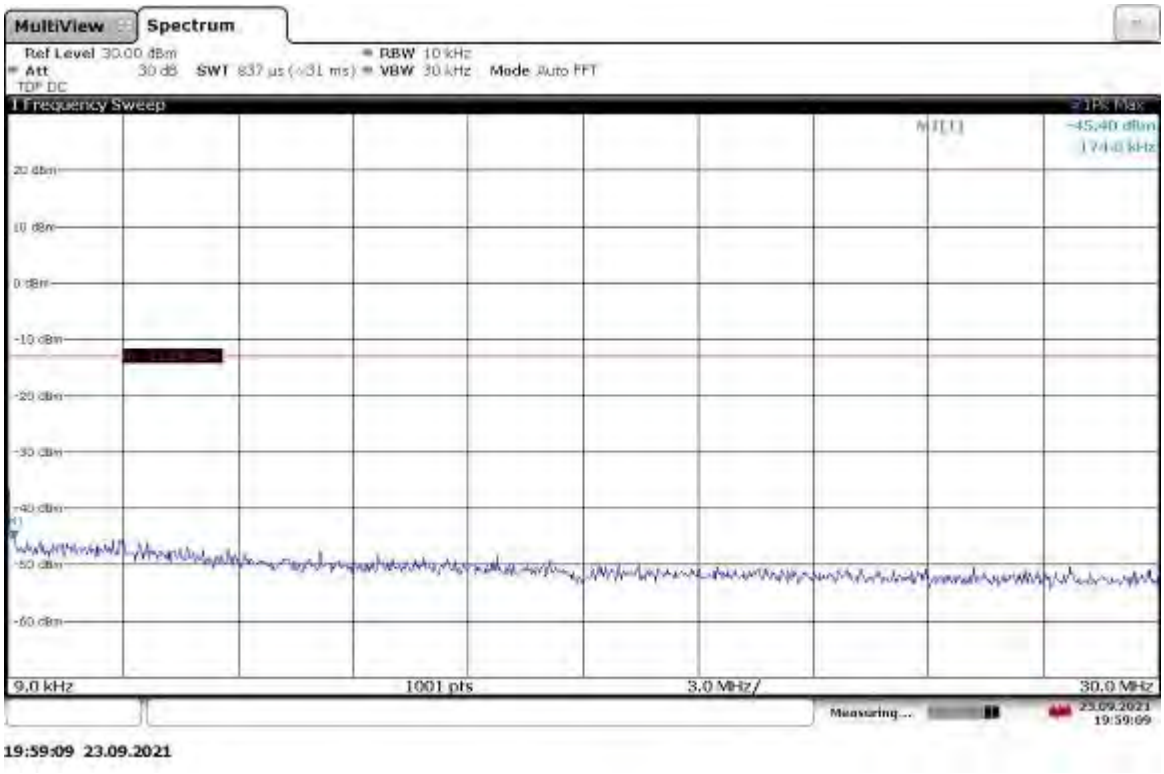
19:51:42 23.09.2021

Slot 0 (Band 5), ANT1, Modulation: TM1.1-QPSK, Bandwidth: 5 MHz, Mid Channel 881 MHz
1-10GHz



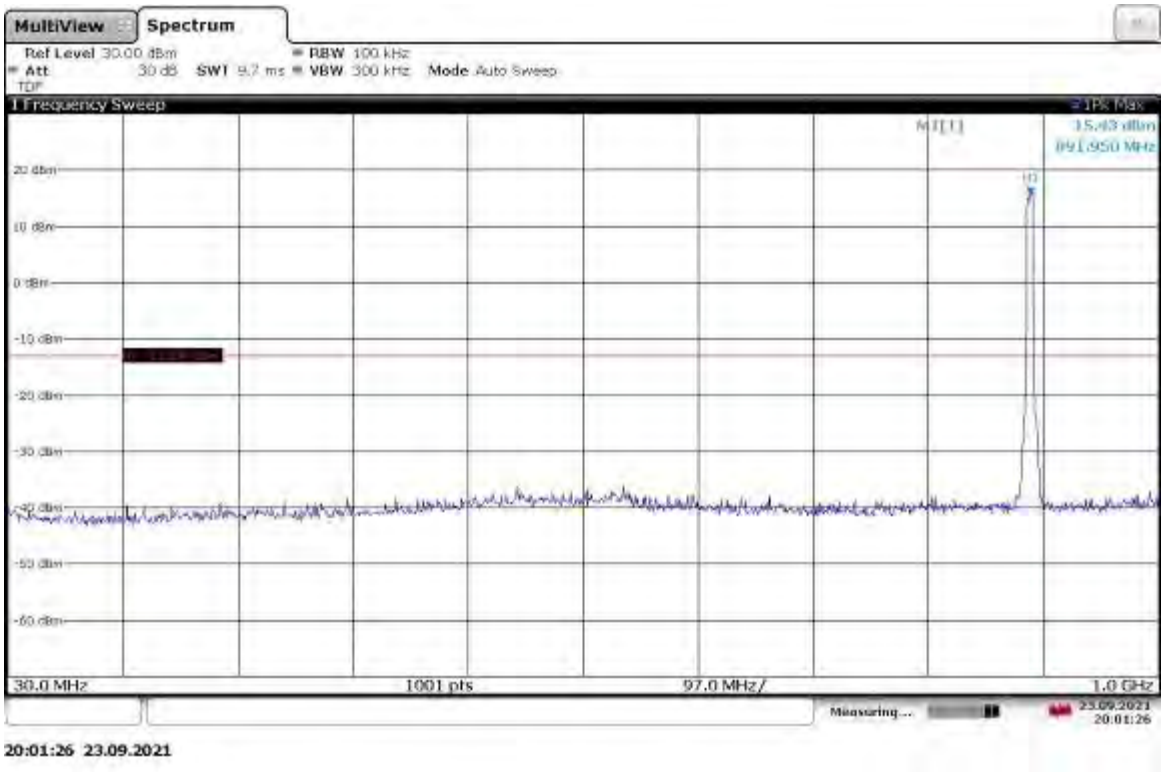
20:02:01 23.09.2021

Slot 0 (Band 5), ANT1, Modulation: TM1.1-QPSK, Bandwidth: 5 MHz, High Channel 891.5 MHz
9kHz-30MHz

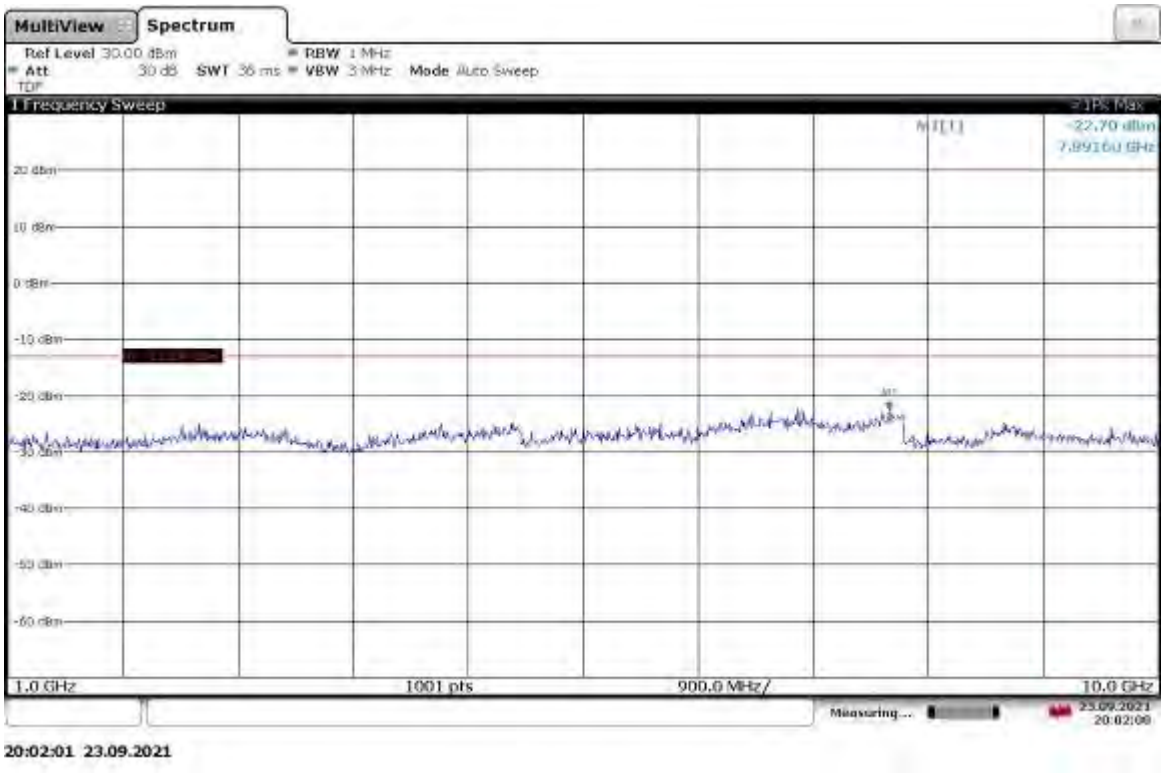


19:59:09 23.09.2021

Slot 0 (Band 5), ANT1, Modulation: TM1.1-QPSK, Bandwidth: 5 MHz, High Channel 891.5 MHz 30MHz-1GHz



Slot 0 (Band 5), ANT1, Modulation: TM1.1-QPSK, Bandwidth: 5 MHz, High Channel 891.5 MHz 1-10GHz

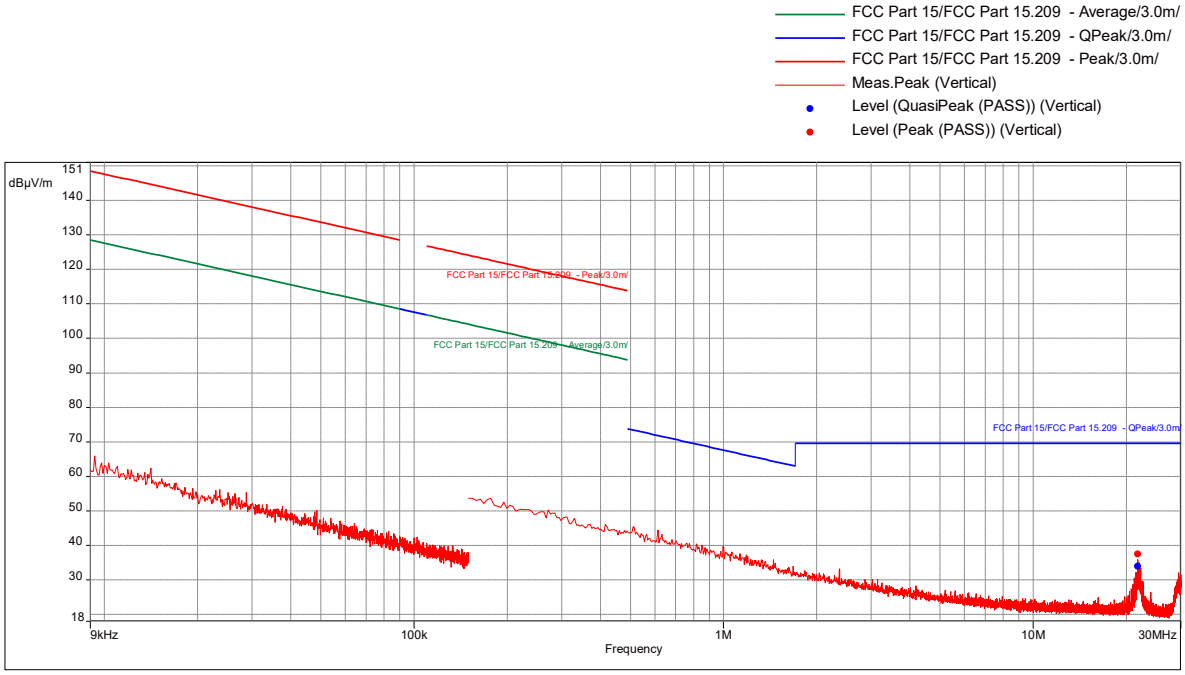


Radiated Emissions, 9kHz-30 MHz
Slot 0 (Band 5), Modulation: TM1.1-QPSK, Bandwidth 5 MHz, Transmit @ Low Channel

Test Information:

Date and Time	8/27/2021 7:59:04 PM
Client and Project Number	CommScope_G104751739
Engineer	Vathana Ven
Temperature	31 deg C
Humidity	39%
Atmospheric Pressure	1007 mB
Comments	RE 9kHz-30MHz_POE_Band 5 5MHz BW_TM1.1 (worst-case)_Tx Low CH 871.5MHz_RP5100 host

Graph:



Results:

Peak (PASS) (1)

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW (Hz)	Correction (dB)
21.73413158	37.49	69.54	-32.05	354.00	1.00	Vertical	9000.00	11.04

QuasiPeak (PASS) (1)

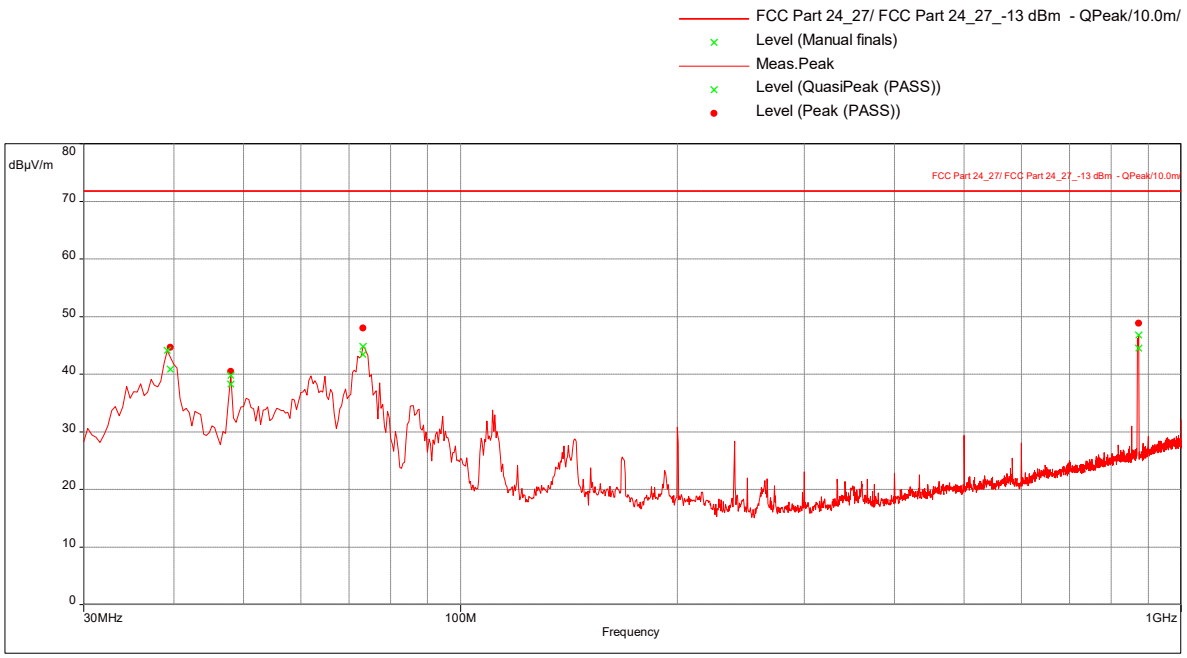
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW (Hz)	Correction (dB)
21.73413158	33.91	69.54	-35.63	354.00	1.00	Vertical	9000.00	11.04

Radiated Emissions, 30-1000 MHz
Slot 0 (Band 5), Modulation: TM1.1-QPSK, Bandwidth 5 MHz, Transmit @ Low Channel

Test Information:

Date and Time	9/19/2021 8:02:20 AM
Client and Project Number	CommScope_G104751739
Engineer	Vathana Ven
Temperature	31 deg C
Humidity	39%
Atmospheric Pressure	1007 mB
Comments	RE 30-1000MHz_POE_Band 5 5MHz BW_TM1.1 (worst-case)_Tx Low CH 871.5MHz_RP5100 host

Graph:



Results:

Peak (PASS) (4)

Frequency (MHz)	Level (dBµV/m)	Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW (Hz)	Correction (dB)
39.45263158	44.67	-40.13	-13.00	-27.13	53.00	1.00	Vertical	120000.00	-19.16
48	40.47	-44.33	-13.00	-31.33	107.00	2.13	Vertical	120000.00	-24.48
73.16842105	47.98	-36.82	-13.00	-23.82	118.00	1.62	Vertical	120000.00	-24.77
873.4842105	48.80	-36.00	-13.00	-23.00	37.00	1.00	Horizontal	120000.00	-6.72

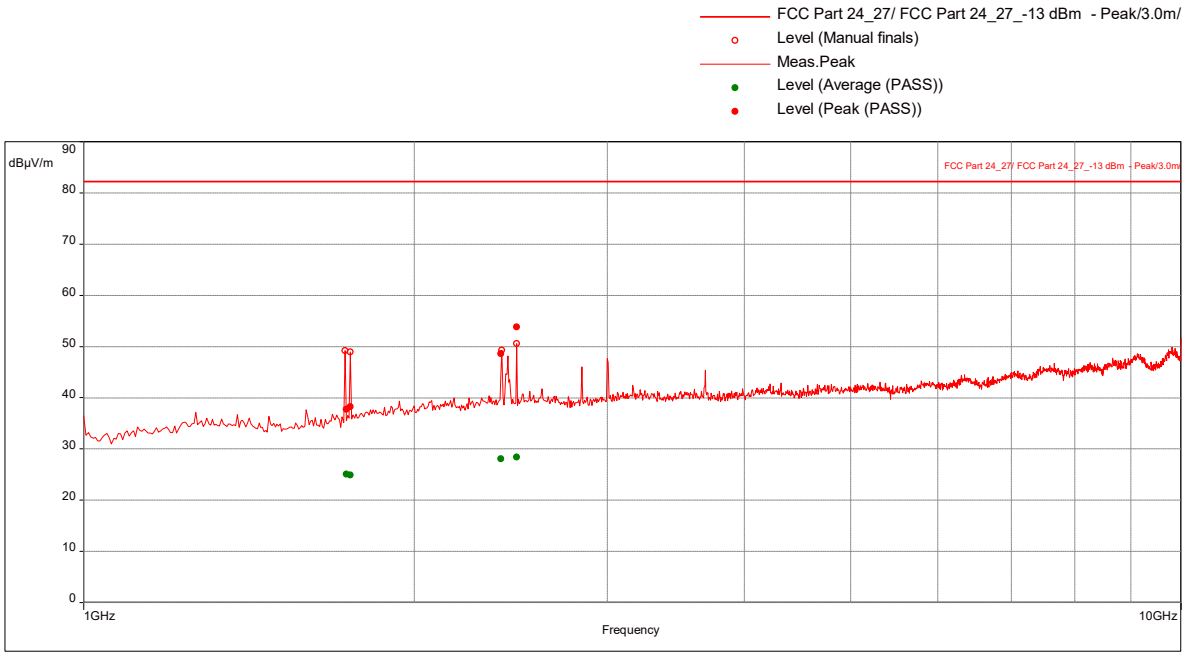
Level EIRP (dBm) = Level Peak (dBuV/m) -84.8

Radiated Emissions, 1-10 GHz
Slot 0 (Band 5), Modulation: TM1.1-QPSK, Bandwidth 5 MHz, Transmit @ Low Channel

Test Information:

Date and Time	9/19/2021 10:15:43 AM
Client and Project Number	CommScope_G104751739
Engineer	Vathana Ven
Temperature	31 deg C
Humidity	39%
Atmospheric Pressure	1007 mB
Comments	RE 1 to 10 GHz_POE_Band 5 5MHz BW_TM1.1 (worst-case)_Tx Low CH 871.5MHz_RP5100 host

Graph:



Results:

Peak (PASS) (4)

Frequency (MHz)	Level (dBµV/m)	Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW (Hz)	Correction (dB)
1732.894737	37.70	-57.56	-13.00	-44.56	82.00	1.30	Horizontal	1000000.00	-6.49
1751.315789	38.27	-56.99	-13.00	-43.99	46.00	3.34	Horizontal	1000000.00	-6.18
2402.105263	48.57	-46.69	-13.00	-33.69	48.00	1.35	Horizontal	1000000.00	-3.15
2480.263158	53.84	-41.42	-13.00	-28.42	211.00	1.00	Horizontal	1000000.00	-3.26

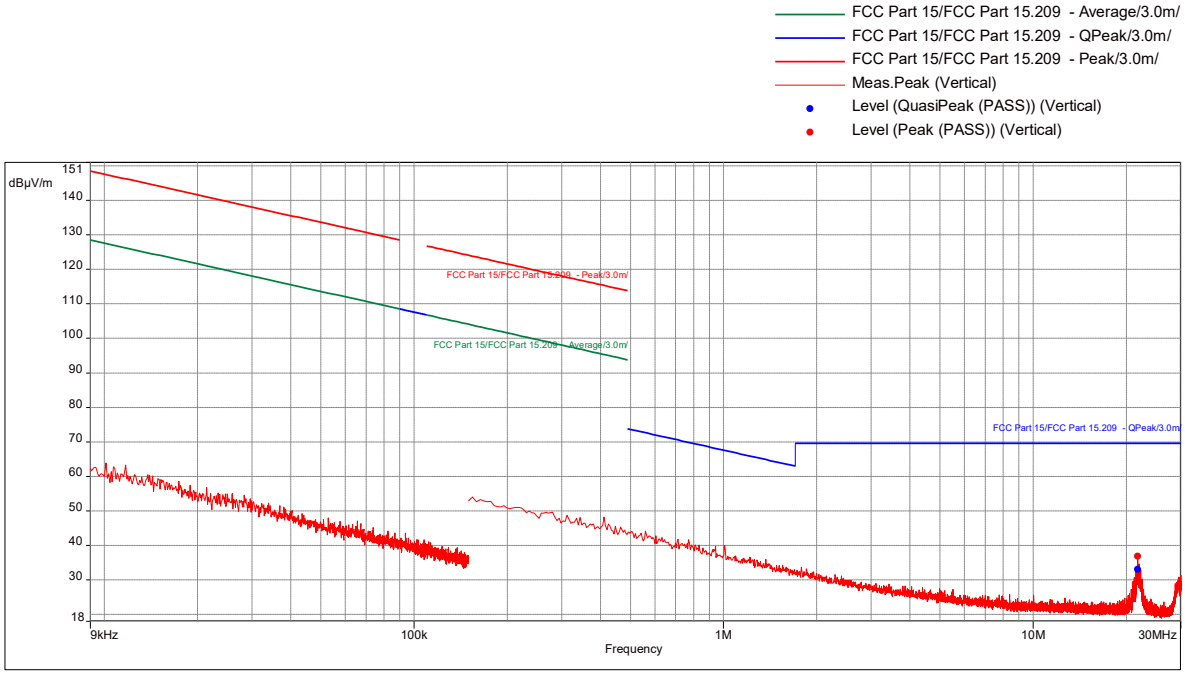
Level EIRP (dBm) = Level Peak (dBuV/m) – 95.30

Radiated Emissions, 9kHz-30 MHz
Slot 0 (Band 5), Modulation: TM1.1-QPSK, Bandwidth 5 MHz, Transmit @ Mid Channel

Test Information:

Date and Time	8/27/2021 8:43:41 PM
Client and Project Number	CommScope_G104751739
Engineer	Vathana Ven
Temperature	31 deg C
Humidity	39%
Atmospheric Pressure	1007 mB
Comments	RE 9kHz-30MHz_POE_Band 5 5MHz BW_TM1.1 (worst-case)_Tx Mid CH 881MHz_RP5100 host

Graph:



Results:

Peak (PASS) (1)

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW (Hz)	Correction (dB)
21.73152632	36.81	69.54	-32.73	259.00	1.00	Vertical	9000.00	11.04

QuasiPeak (PASS) (1)

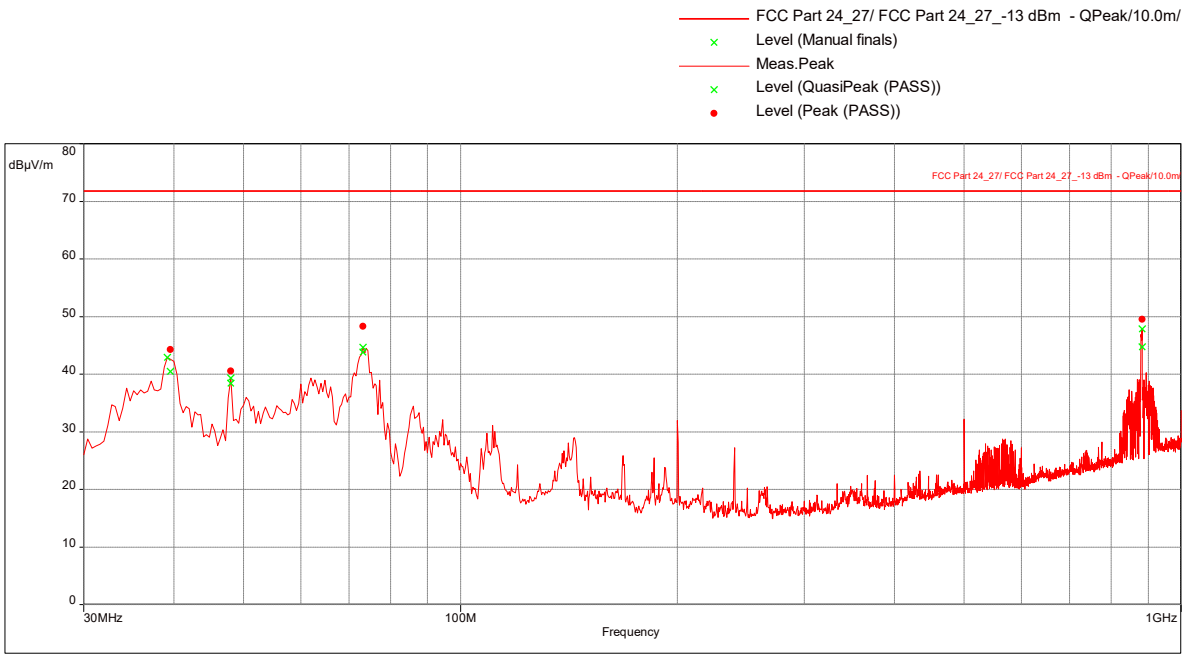
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW (Hz)	Correction (dB)
21.73152632	33.04	69.54	-36.50	259.00	1.00	Vertical	9000.00	11.04

Radiated Emissions, 30-1000 MHz
Slot 0 (Band 5), Modulation: TM1.1-QPSK, Bandwidth 5 MHz, Transmit @ Mid Channel

Test Information:

Date and Time	9/19/2021 8:31:32 AM
Client and Project Number	CommScope_G104751739
Engineer	Vathana Ven
Temperature	31 deg C
Humidity	39%
Atmospheric Pressure	1007 mB
Comments	RE 30-1000MHz_POE_Band 5 5MHz BW_TM1.1 (worst-case)_Tx Mid CH 8881MHz_RP5100 host

Graph:



Results:

Peak (PASS) (4)

Frequency (MHz)	Level (dBµV/m)	Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW (Hz)	Correction (dB)
39.45263158	44.30	-40.50	-13.00	-27.50	46.00	1.00	Vertical	120000.00	-19.16
48	40.55	-44.25	-13.00	-31.25	132.00	2.40	Vertical	120000.00	-24.48
73.16842105	48.26	-36.54	-13.00	-23.54	132.00	1.57	Vertical	120000.00	-24.77
882.9578947	49.49	-35.31	-13.00	-22.31	39.00	1.00	Horizontal	120000.00	-6.62

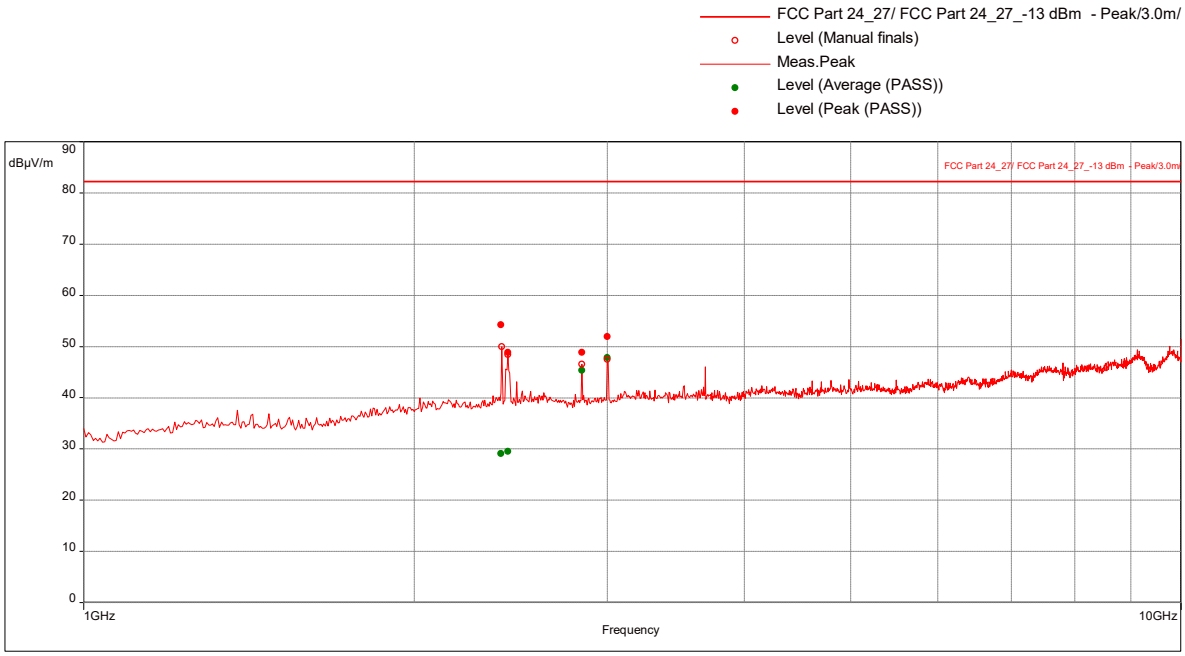
Level EIRP (dBm) = Level Peak (dBuV/m) -84.8

Radiated Emissions, 1-10 GHz
Slot 0 (Band 5), Modulation: TM1.1-QPSK, Bandwidth 5 MHz, Transmit @ Mid Channel

Test Information:

Date and Time	9/19/2021 9:51:37 AM
Client and Project Number	CommScope_G104751739
Engineer	Vathana Ven
Temperature	31 deg C
Humidity	39%
Atmospheric Pressure	1007 mB
Comments	RE 1 to 10 GHz_POE_Band 5 5MHz BW_TM1.1 (worst-case)_Tx Mid CH 881MHz_RP5100 host

Graph:



Results:

Peak (PASS) (4)

Frequency (MHz)	Level (dBµV/m)	Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW (Hz)	Correction (dB)
2402.105263	54.23	-41.03	82.26	-28.03	218.00	3.59	Horizontal	1000000.00	-3.15
2434.473684	48.84	-46.42	82.26	-33.42	227.00	1.00	Horizontal	1000000.00	-3.32
2844.473684	48.83	-46.43	82.26	-33.43	211.00	1.85	Horizontal	1000000.00	-2.75
3000	51.97	-43.29	82.26	-30.29	132.00	3.00	Horizontal	1000000.00	-2.35

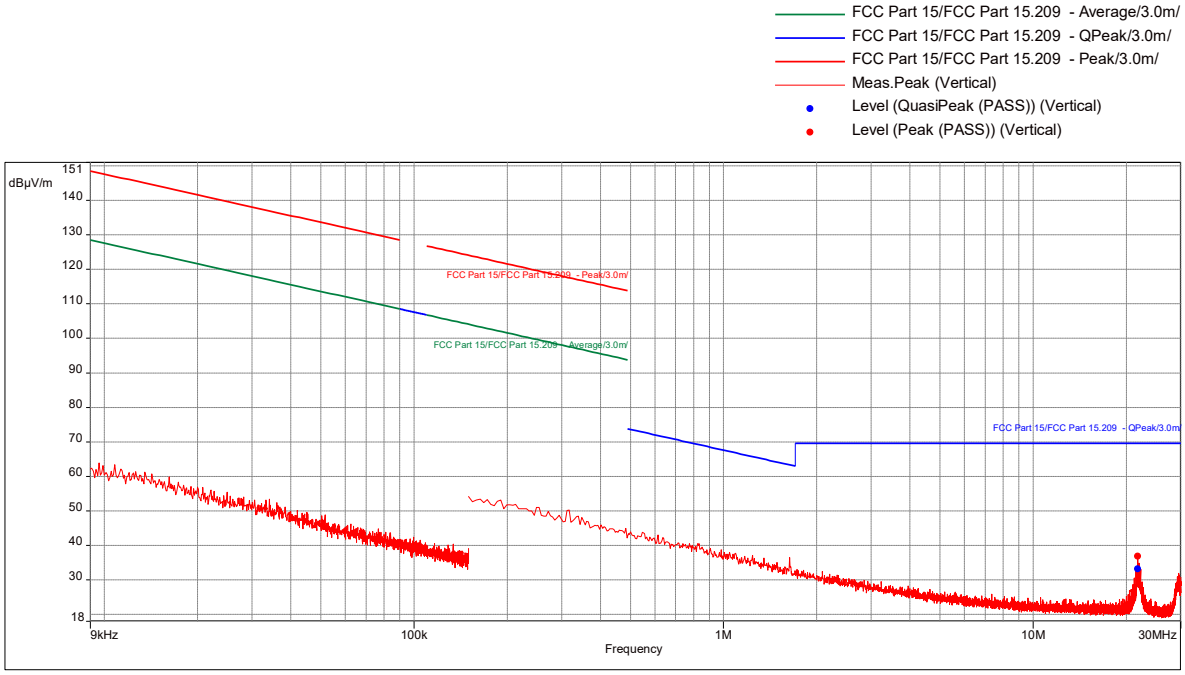
Level EIRP (dBm) = Level Peak (dBuV/m) – 95.30

Radiated Emissions, 9kHz-30 MHz
Slot 0 (Band 5), Modulation: TM1.1-QPSK, Bandwidth 5 MHz, Transmit @ High Channel

Test Information:

Date and Time	8/27/2021 9:19:58 PM
Client and Project Number	CommScope_G104751739
Engineer	Vathana Ven
Temperature	31 deg C
Humidity	39%
Atmospheric Pressure	1007 mB
Comments	RE 9kHz-30MHz_POE_Band 5 5MHz BW_TM1.1 (worst-case)_Tx High CH 891.5MHz_RP5100 host

Graph:



Results:

Peak (PASS) (1)

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW (Hz)	Correction (dB)
21.73389474	36.84	69.54	-32.70	240.00	1.00	Vertical	9000.00	11.04

QuasiPeak (PASS) (1)

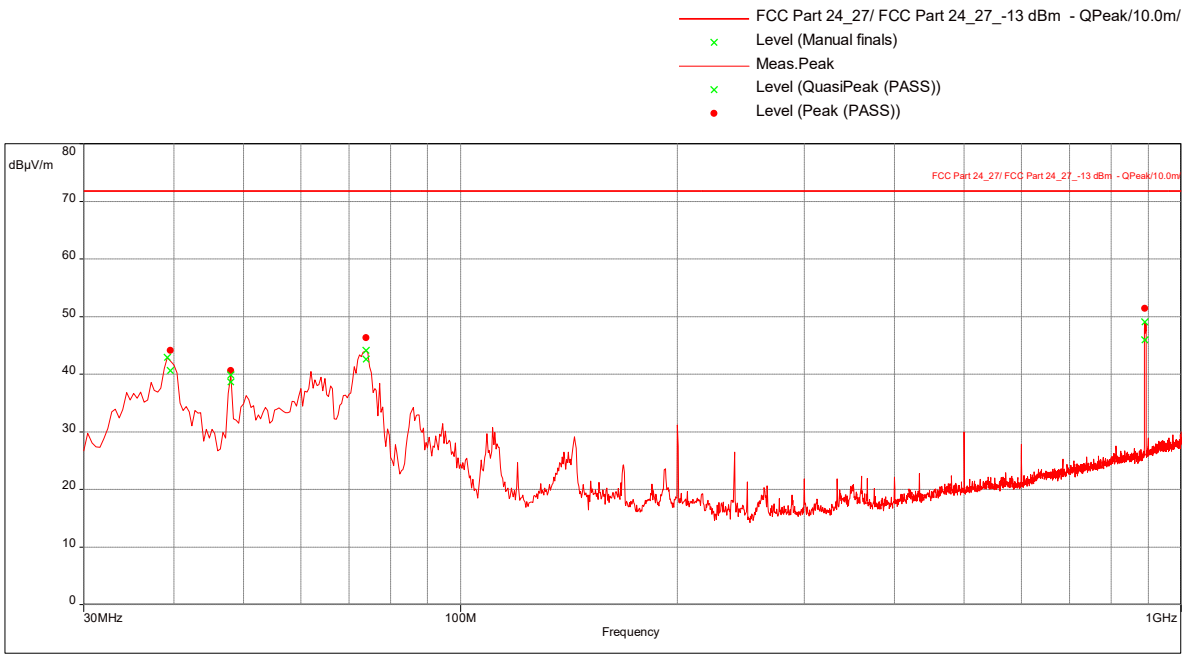
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW (Hz)	Correction (dB)
21.73389474	33.19	69.54	-36.35	240.00	1.00	Vertical	9000.00	11.04

Radiated Emissions, 30-1000 MHz
Slot 0 (Band 5), Modulation: TM1.1-QPSK, Bandwidth 5 MHz, Transmit @ High Channel

Test Information:

Date and Time	9/19/2021 8:54:58 AM
Client and Project Number	CommScope_G104751739
Engineer	Vathana Ven
Temperature	31 deg C
Humidity	39%
Atmospheric Pressure	1007 mB
Comments	RE 30-1000MHz_POE_Band 5 5MHz BW_TM1.1 (worst-case)_Tx High CH 891.5MHz_RP5100 host

Graph:



Results:

Peak (PASS) (4)

Frequency (MHz)	Level (dBµV/m)	Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW (Hz)	Correction (dB)
39.48421053	44.15	-40.65	-13.00	-27.65	46.00	1.00	Vertical	120000.00	-19.19
48	40.60	-44.20	-13.00	-31.20	31.00	1.73	Vertical	120000.00	-24.48
73.93684211	46.30	-38.50	-13.00	-25.50	218.00	1.81	Vertical	120000.00	-24.86
890.7368421	51.44	-33.36	-13.00	-20.36	45.00	1.00	Horizontal	120000.00	-6.45

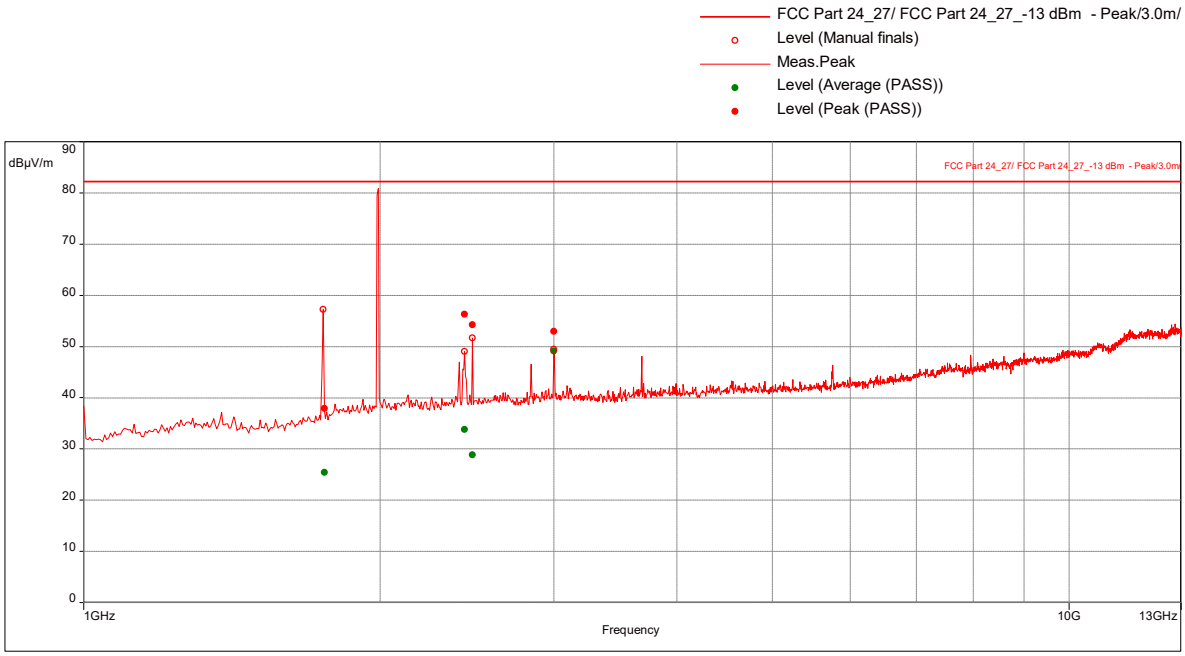
Level EIRP (dBm) = Level Peak (dBuV/m) -84.8

Radiated Emissions, 1-10 GHz
Slot 2 (Band 2), Modulation: TM1.1-QPSK, Bandwidth 5 MHz, Transmit @ High Channel

Test Information:

Date and Time	9/19/2021 11:42:08 AM
Client and Project Number	CommScope_G104751739
Engineer	Vathana Ven
Temperature	31 deg C
Humidity	39%
Atmospheric Pressure	1007 mB
Comments	RE 1 to 13 GHz_POE_Band 2 5MHz BW_TM1.1_Tx High CH 891.5MHz_RP5100 host

Graph:



Results:

Peak (PASS) (4)

Frequency (MHz)	Level (dBµV/m)	Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW (Hz)	Correction (dB)
1752.894737	37.90	-57.36	-13.0	-44.36	17.00	1.85	Horizontal	1000000.00	-6.15
2435.789474	56.28	-38.98	-13.0	-25.98	125.00	1.20	Horizontal	1000000.00	-3.33
2480.263158	54.25	-41.01	-13.0	-28.01	177.00	1.00	Horizontal	1000000.00	-3.26
3000	52.97	-42.29	-13.0	-29.29	132.00	2.10	Horizontal	1000000.00	-2.35

Level EIRP (dBm) = Level Peak (dBuV/m) – 95.30

Test Personnel:	Vathana Ven	Test Date:	08/27/2021, 09/19/2021, 09/23/2021
Supervising/Reviewing Engineer: (Where Applicable)	N/A		
Product Standard:	FCC Part 22	Limit Applied:	See report section 10.3
Input Voltage:	48 VDC (POE)		
Pretest Verification w/ Ambient Signals or BB Source:	N/A	Ambient Temperature:	31, 31, 23 ºC
		Relative Humidity:	39, 39, 59 %
		Atmospheric Pressure:	1007, 1007, 1008 mbars

Deviations, Additions, or Exclusions: None

11 Revision History

Revision Level	Date	Report Number	Prepared By	Reviewed By	Notes
0	10/04/2021	104751739BOX-021	VFV	KPS	Original Issue
1	11/10/2021	104751739BOX-021	VFV	KPS	Updated output power and Band edge measurements
2	01/06/2022	104751739BOX-021	VFV	KPS	Removed test setup photos, added frequency stability vs. voltage test results tables, referenced the original LTE and new 5G NR capabilities of this device in product description
3	02/02/2022	104751739BOX-021	VFV	KPS	Added justification for worst case for spurious emissions on page 166