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CommScope Technologies, LLC

TEST REPORT

SCOPE OF WORK
EMISSIONS TESTING – RPM-A5A11-B02 W/ 5G NR waveform With OneCell® RP5200

REPORT NUMBER
104751739BOX-005

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10/11/2021

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Non-Specific Radio Report Shell Rev. December 201

EMISSIONS TEST REPORT

(FULL COMPLIANCE)

Report Number: 104751739BOX-005
Project Number: G104751739

Report Issue Date: 10/11/2021
Report Issue Date: 02/02/2022

Model(s) Tested: RPM-A5A11-B02 W/ 5G NR waveform With OneCell® RP5200
Model(s) Partially Tested: None
Model(s) Not Tested but declared equivalent by the client: None

Standards: CFR47 FCC Part 24 (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 and 24.232(a-b)	Pass
7	Peak-to-Average Power Ratio (PAPR) CFR47 FCC Part 24.232(d)	Pass
8	26 dB Bandwidth and Occupied Bandwidth CFR47 FCC Parts 2.1049 and 24.238(b)	Pass
9	Band Edge Compliance CFR47 FCC Parts 2.1051, 2.1053, and 24.238(a-b)	Pass
10	Frequency Stability CFR47 FCC Parts 2.1055 and 24.235	Pass
11	Transmitter Spurious Emissions CFR47 FCC Parts 2.1051, 2.1053, 2.1057 and 24.238(a-b)	Pass
12	Revision History	--

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 2 Radio Module With OneCell® RP5200 host	CommScope Technologies LLC	RPM-A5A11-B02	19513000008
OneCell® RP5200	CommScope Technologies LLC	RP-A52xxi	BOX2107211402-013 (Intertek Assigned)

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. 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® RP5200 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	RP5200 Diagnostics Version 4.19.0

Radio/Receiver Characteristics	
Frequency Band(s)	1930-1990 MHz
Modulation Type(s)	TM1.1-QPSK, TM3.2-16QAM, TM3.1-64 QAM, TM3.1a-256QAM
Maximum Output Power (conducted):	23.33 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	18.92 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
OneCell® RP5200*	CommScope Technologies LLC	RP-A52xxi	None

*Radio host used for testing

5.1 Method:

Configuration as required by ANSI C63.26-2015, KDB 662911, and CFR47 FCC Part 24 (09/2021).

5.2 EUT Block Diagram:

Photographs are available in a separate exhibit

6 Maximum Peak Output Power and Human RF exposure

6.1 Method

Tests are performed in accordance with CFR47 FCC Parts 2.1046 and 24, 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	10/27/2020	10/27/2021
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 23.33 dBm, which is much less than the EIRP limit of 24.232(a-b). The sample tested was found to Comply. Antenna gain limitations will depend on geographical locations and Height Above Average Terrain (HAAT). Output power from the two antenna ports was not summed since the data streams are uncorrelated and the antennas are cross polarized.

§24.232(a-b):

(a)(1) Base stations with an emission bandwidth of 1 MHz or less are limited to 1640 watts equivalent isotropically radiated power (EIRP) with an antenna height up to 300 meters HAAT, except as described in paragraph (b) below.

(2) Base stations with an emission bandwidth greater than 1 MHz are limited to 1640 watts/MHz equivalent isotropically radiated power (EIRP) with an antenna height up to 300 meters HAAT, except as described in paragraph (b) below.

(3) Base station antenna heights may exceed 300 meters HAAT with a corresponding reduction in power; *see*Tables 1 and 2 of this section.

(4) The service area boundary limit and microwave protection criteria specified in §§24.236 and 24.237 apply.

TABLE 1—REDUCED POWER FOR BASE STATION ANTENNA HEIGHTS OVER 300 METERS, WITH EMISSION BANDWIDTH OF 1 MHZ OR LESS

HAAT in meters	Maximum EIRP watts
≤300	1640
≤500	1070
≤1000	490
≤1500	270
≤2000	160

TABLE 2—REDUCED POWER FOR BASE STATION ANTENNA HEIGHTS OVER 300 METERS, WITH EMISSION BANDWIDTH GREATER THAN 1 MHZ

HAAT in meters	Maximum EIRP watts/MHz
≤300	1640
≤500	1070
≤1000	490
≤1500	270
≤2000	160

(b)(1) Base stations that 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, with an emission bandwidth of 1 MHz or less are limited to 3280 watts equivalent isotropically radiated power (EIRP) with an antenna height up to 300 meters HAAT.

(2) Base stations that 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, with an emission bandwidth greater than 1 MHz are limited to 3280 watts/MHz equivalent isotropically radiated power (EIRP) with an antenna height up to 300 meters HAAT.

(3) Base station antenna heights may exceed 300 meters HAAT with a corresponding reduction in power; *see*Tables 3 and 4 of this section.

(4) The service area boundary limit and microwave protection criteria specified in §§24.236 and 24.237 apply.

(5) Operation under this paragraph (b) at power limits greater than permitted under paragraph (a) of this section must be coordinated in advance with all broadband PCS licensees authorized to operate on adjacent frequency blocks within 120 kilometers (75 miles) of the base station and is limited to base stations located more than 120 kilometers (75 miles) from the Canadian border and more than 75 kilometers (45 miles) from the Mexican border.

TABLE 3—REDUCED POWER FOR BASE STATION ANTENNA HEIGHTS OVER 300 METERS, WITH EMISSION BANDWIDTH OF 1 MHZ OR LESS

HAAT in meters	Maximum EIRP watts
≤300	3280
≤500	2140
≤1000	980
≤1500	540
≤2000	320

TABLE 4—REDUCED POWER FOR BASE STATION ANTENNA HEIGHTS OVER 300 METERS, WITH EMISSION BANDWIDTH GREATER THAN 1 MHZ

HAAT in meters	Maximum EIRP watts/MHz
≤300	3280
≤500	2140
≤1000	980
≤1500	540
≤2000	320

Slot 2 (Band 2), Bandwidth: 5 MHz, Modulation: TM1.1-QPSK

Channel	Frequency (MHz)	Antenna Port	Output Power (dBm)
Low	1932.50	ANT0	21.62
		ANT1	21.70
Mid	1960.00	ANT0	22.78
		ANT1	22.68
High	1987.50	ANT0	22.98
		ANT1	22.91

Slot 2 (Band 2), Bandwidth: 10 MHz, Modulation: TM1.1-QPSK

Channel	Frequency (MHz)	Antenna Port	Output Power (dBm)
Low	1935.00	ANT0	22.37
		ANT1	22.41
Mid	1960.00	ANT0	22.68
		ANT1	22.65
High	1985.00	ANT0	22.60
		ANT1	22.41

Slot 2 (Band 2), Bandwidth: 15 MHz, Modulation: TM1.1-QPSK

Channel	Frequency (MHz)	Antenna Port	Output Power (dBm)
Low	1937.50	ANT0	22.89
		ANT1	23.18
Mid	1960.00	ANT0	23.06
		ANT1	23.01
High	1982.50	ANT0	23.32
		ANT1	23.06

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

Channel	Frequency (MHz)	Antenna Port	Output Power (dBm)
Low	1940.00	ANT0	22.71
		ANT1	22.99
Mid	1960.00	ANT0	22.77
		ANT1	22.76
High	1980.00	ANT0	23.16
		ANT1	22.92

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

Channel	Frequency (MHz)	Antenna Port	Output Power (dBm)
Low	1932.50	ANT0	21.92
		ANT1	21.87
Mid	1960.00	ANT0	22.62
		ANT1	22.67
High	1987.50	ANT0	22.92
		ANT1	22.69

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

Channel	Frequency (MHz)	Antenna Port	Output Power (dBm)
Low	1935.00	ANT0	22.81
		ANT1	22.87
Mid	1960.00	ANT0	23.18
		ANT1	23.13
High	1985.00	ANT0	23.33
		ANT1	23.15

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

Channel	Frequency (MHz)	Antenna Port	Output Power (dBm)
Low	1937.50	ANT0	22.62
		ANT1	22.95
Mid	1960.00	ANT0	22.79
		ANT1	22.81
High	1982.50	ANT0	23.10
		ANT1	22.79

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

Channel	Frequency (MHz)	Antenna Port	Output Power (dBm)
Low	1940.00	ANT0	22.95
		ANT1	22.93
Mid	1960.00	ANT0	22.85
		ANT1	22.85
High	1980.00	ANT0	22.95
		ANT1	22.67

Slot 2 (Band 2), Bandwidth: 5 MHz, Modulation: TM3.1-64QAM

Channel	Frequency (MHz)	Antenna Port	Output Power (dBm)
Low	1932.50	ANT0	22.06
		ANT1	21.58
Mid	1960.00	ANT0	22.66
		ANT1	22.65
High	1987.50	ANT0	22.93
		ANT1	22.76

Slot 2 (Band 2), Bandwidth: 10 MHz, Modulation: TM3.1-64QAM

Channel	Frequency (MHz)	Antenna Port	Output Power (dBm)
Low	1935.00	ANT0	22.49
		ANT1	22.45
Mid	1960.00	ANT0	22.46
		ANT1	22.46
High	1985.00	ANT0	22.93
		ANT1	22.69

Slot 2 (Band 2), Bandwidth: 15 MHz, Modulation: TM3.1-64QAM

Channel	Frequency (MHz)	Antenna Port	Output Power (dBm)
Low	1937.50	ANT0	22.88
		ANT1	23.22
Mid	1960.00	ANT0	23.12
		ANT1	23.02
High	1982.50	ANT0	23.31
		ANT1	23.09

Slot 2 (Band 2), Bandwidth: 20 MHz, Modulation: TM3.1-64QAM

Channel	Frequency (MHz)	Antenna Port	Output Power (dBm)
Low	1940.00	ANT0	22.79
		ANT1	22.75
Mid	1960.00	ANT0	22.79
		ANT1	22.79
High	1980.00	ANT0	23.21
		ANT1	22.90

Slot 2 (Band 2), Bandwidth: 5 MHz, Modulation: TM3.1a-256QAM_

Channel	Frequency (MHz)	Antenna Port	Output Power (dBm)
Low	1932.50	ANT0	22.06
		ANT1	22.19
Mid	1960.00	ANT0	22.84
		ANT1	22.75
High	1987.50	ANT0	23.01
		ANT1	22.87

Slot 2 (Band 2), Bandwidth: 10 MHz, Modulation: TM3.1a-256QAM_

Channel	Frequency (MHz)	Antenna Port	Output Power (dBm)
Low	1935.00	ANT0	22.26
		ANT1	22.28
Mid	1960.00	ANT0	23.11
		ANT1	23.05
High	1985.00	ANT0	23.33
		ANT1	23.09

Slot 2 (Band 2), Bandwidth: 15 MHz, Modulation: TM3.1a-256QAM

Channel	Frequency (MHz)	Antenna Port	Output Power (dBm)
Low	1937.500	ANT0	22.27
		ANT1	22.46
Mid	1960.00	ANT0	22.87
		ANT1	22.85
High	1982.50	ANT0	23.15
		ANT1	22.73

Slot 2 (Band 2), Bandwidth: 20 MHz, Modulation: TM3.1a-256QAM

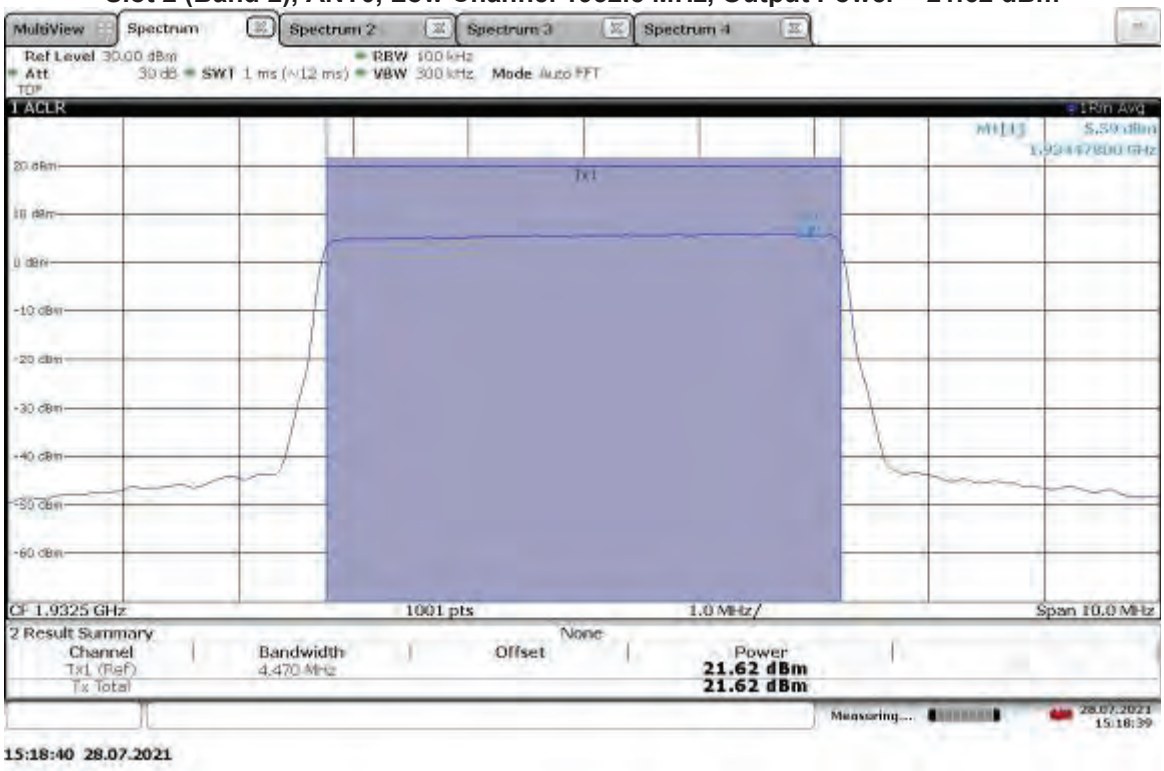
Channel	Frequency (MHz)	Antenna Port	Output Power (dBm)
Low	1940	ANT0	22.74
		ANT1	22.79
Mid	1960	ANT0	22.85
		ANT1	22.80
High	1980	ANT0	23.19
		ANT1	22.95

6.4 Setup Photograph:

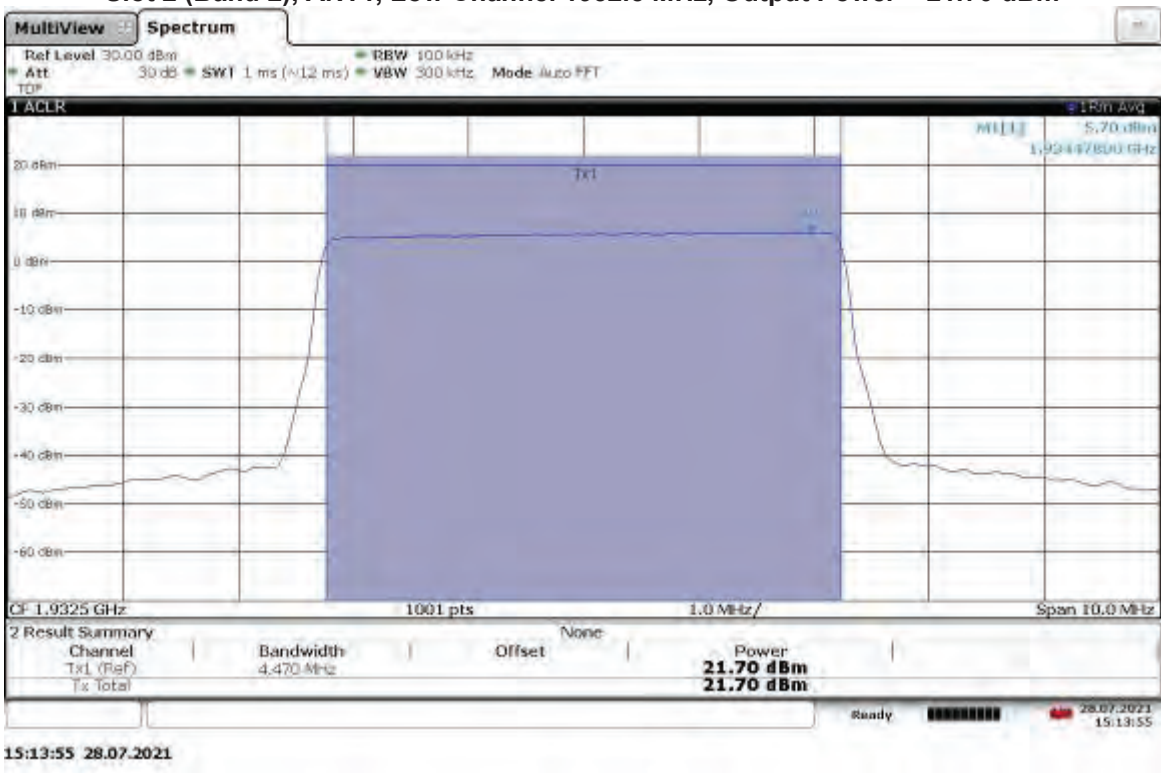
Photographs are available in a separate exhibit

6.5 Plots/Data:

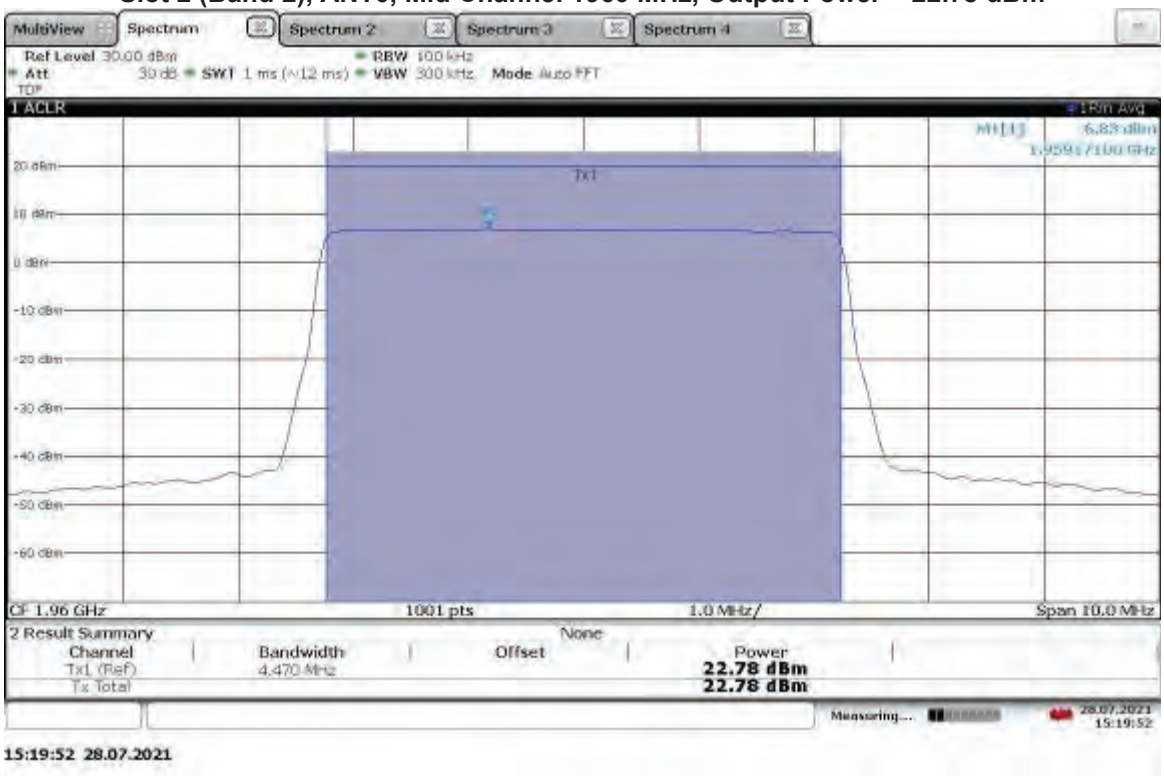
TM1.1-QPSK_5 MHz Bandwidth
Slot 2 (Band 2), ANT0, Low Channel 1932.5 MHz, Output Power = 21.62 dBm



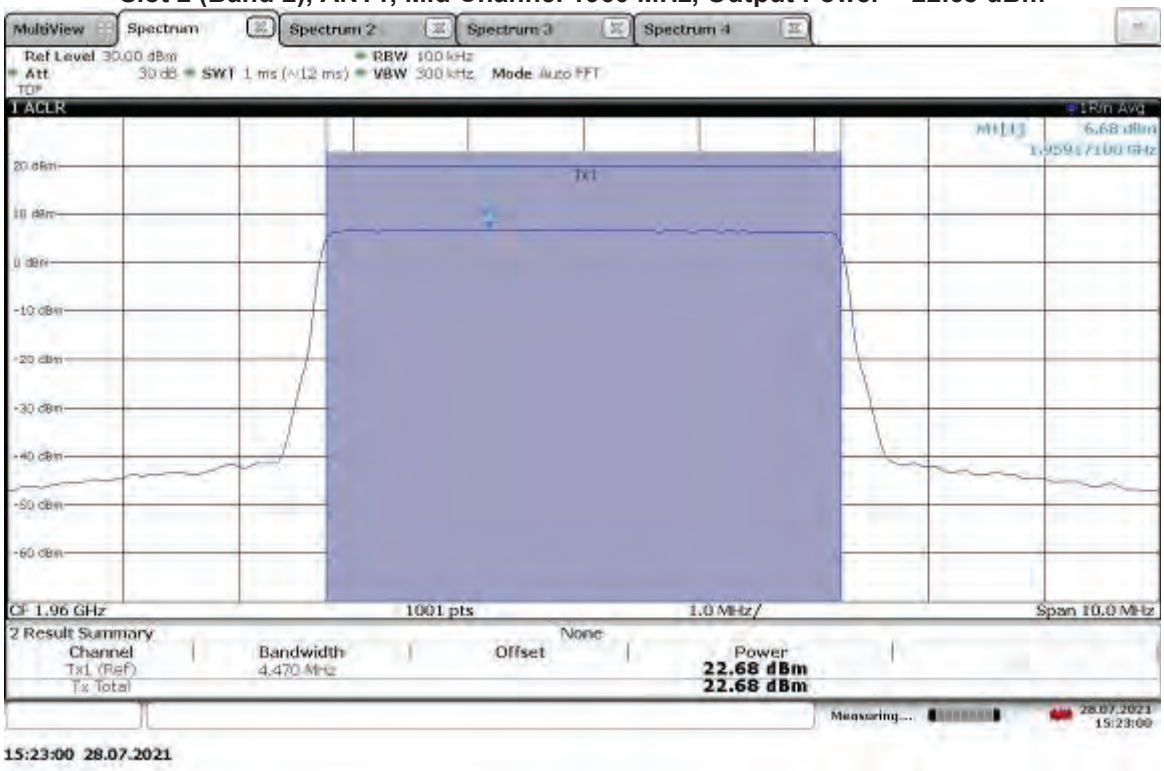
TM1.1-QPSK_5 MHz Bandwidth
Slot 2 (Band 2), ANT1, Low Channel 1932.5 MHz, Output Power = 21.70 dBm



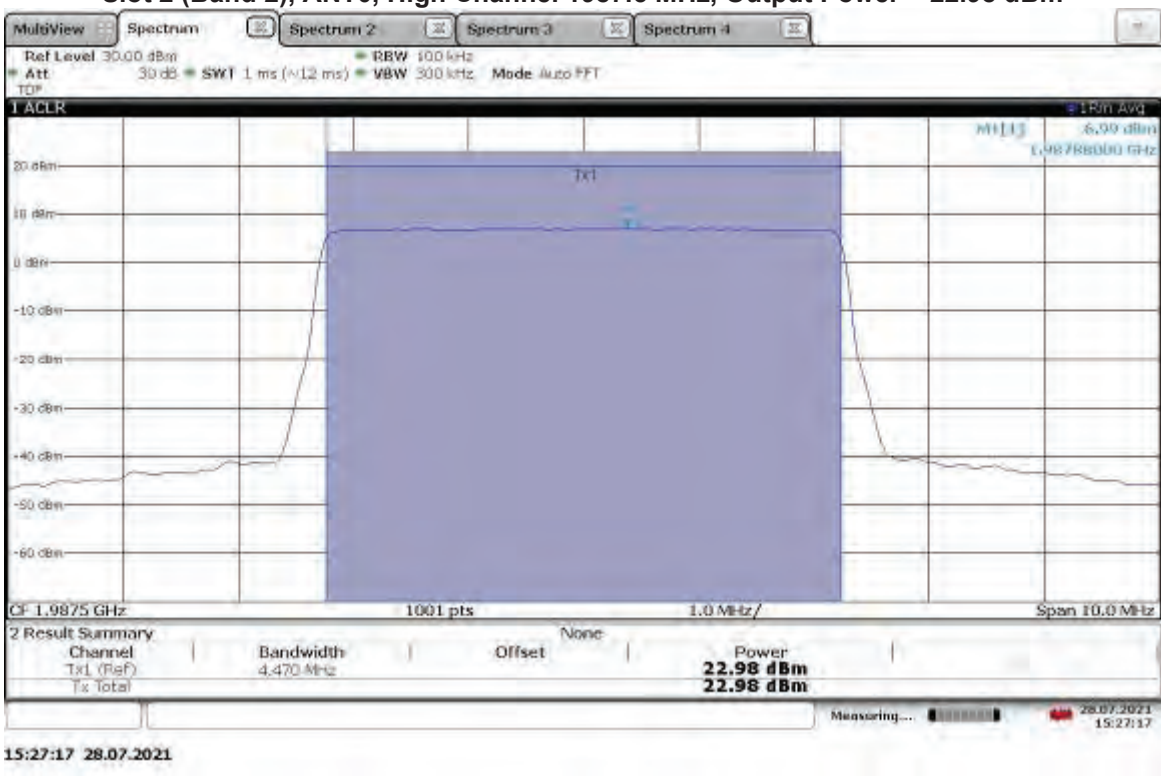
TM1.1-QPSK_5 MHz Bandwidth
Slot 2 (Band 2), ANT0, Mid Channel 1960 MHz, Output Power = 22.78 dBm



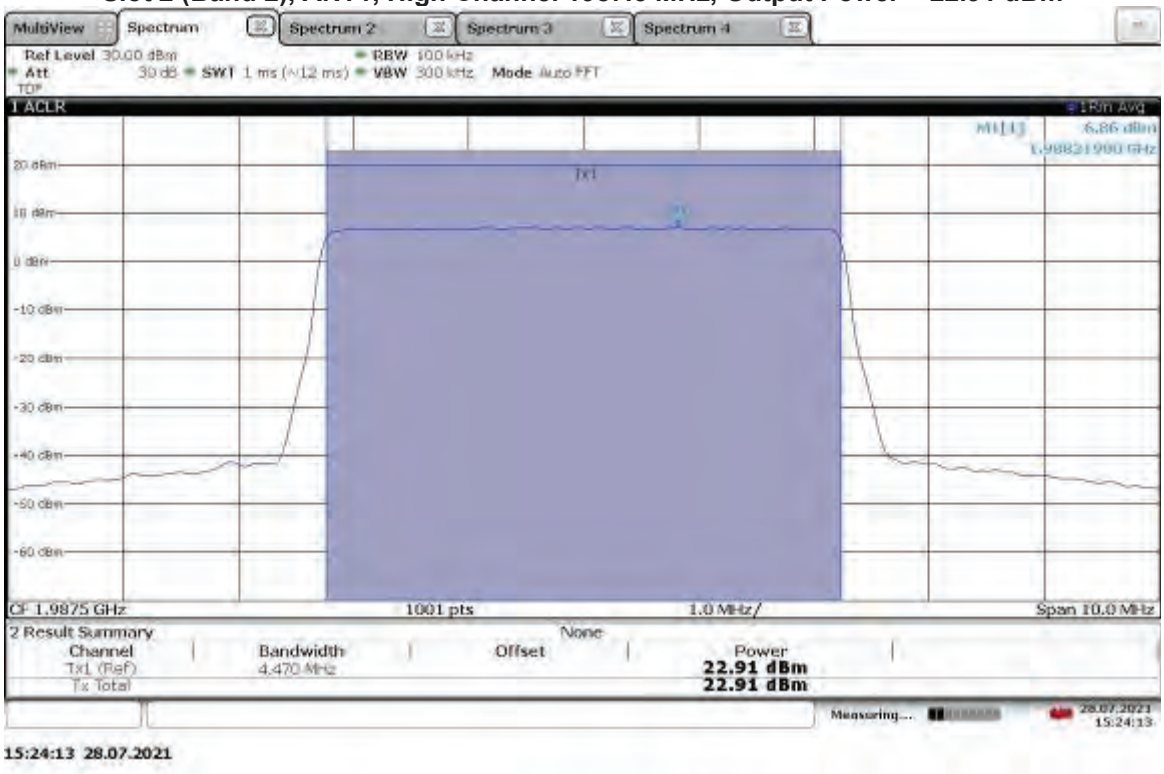
TM1.1-QPSK_5 MHz Bandwidth
Slot 2 (Band 2), ANT1, Mid Channel 1960 MHz, Output Power = 22.68 dBm



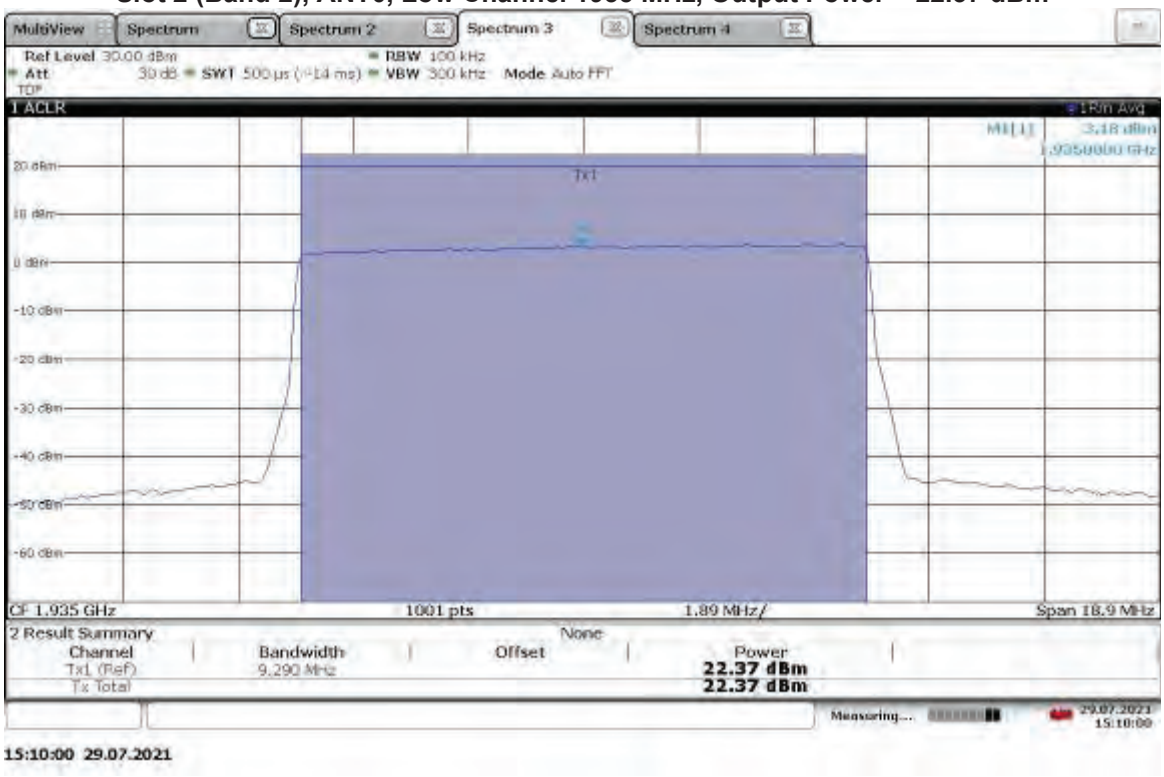
TM1.1-QPSK_5 MHz Bandwidth
Slot 2 (Band 2), ANT0, High Channel 1987.5 MHz, Output Power = 22.98 dBm



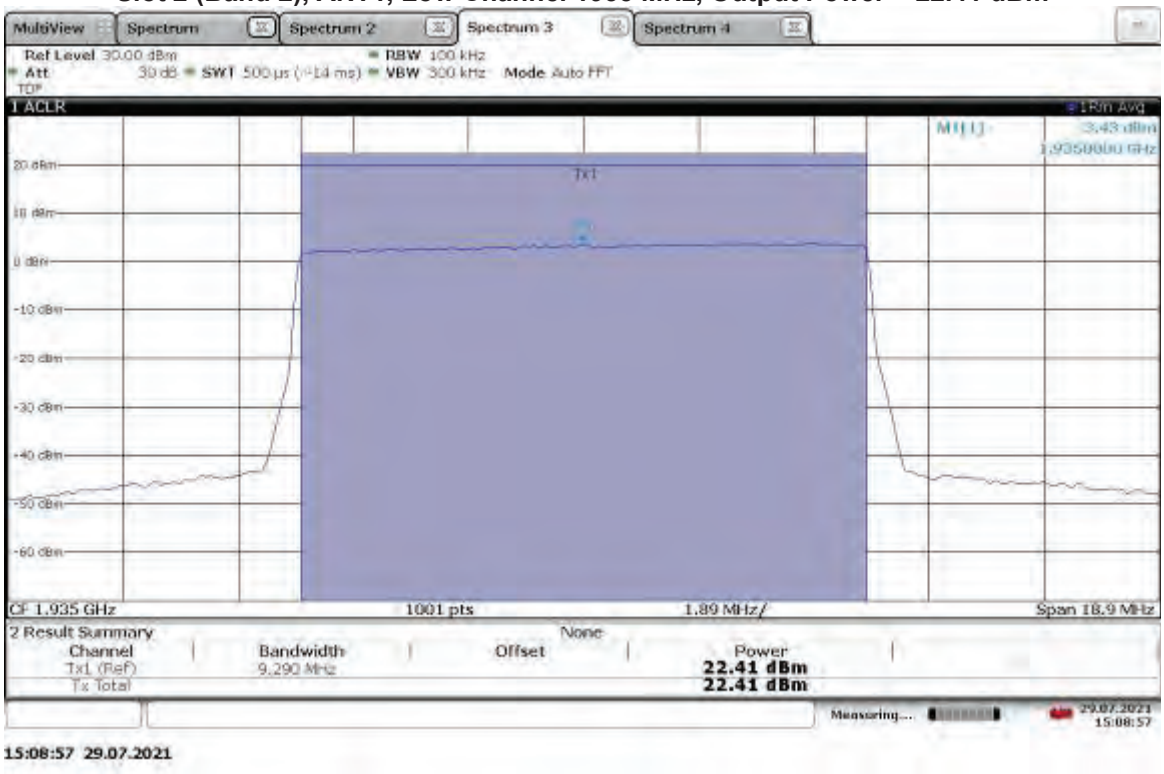
TM1.1-QPSK_5 MHz Bandwidth
Slot 2 (Band 2), ANT1, High Channel 1987.5 MHz, Output Power = 22.91 dBm



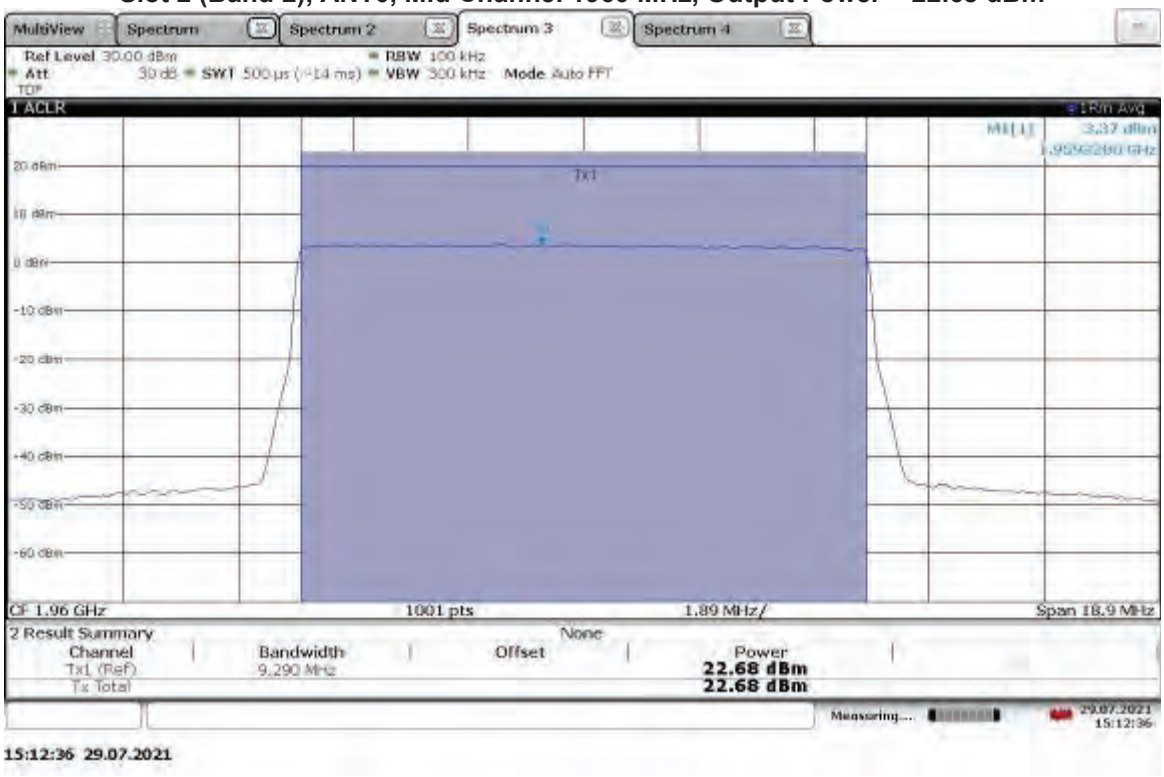
TM1.1-QPSK_10 MHz Bandwidth
Slot 2 (Band 2), ANT0, Low Channel 1935 MHz, Output Power = 22.37 dBm



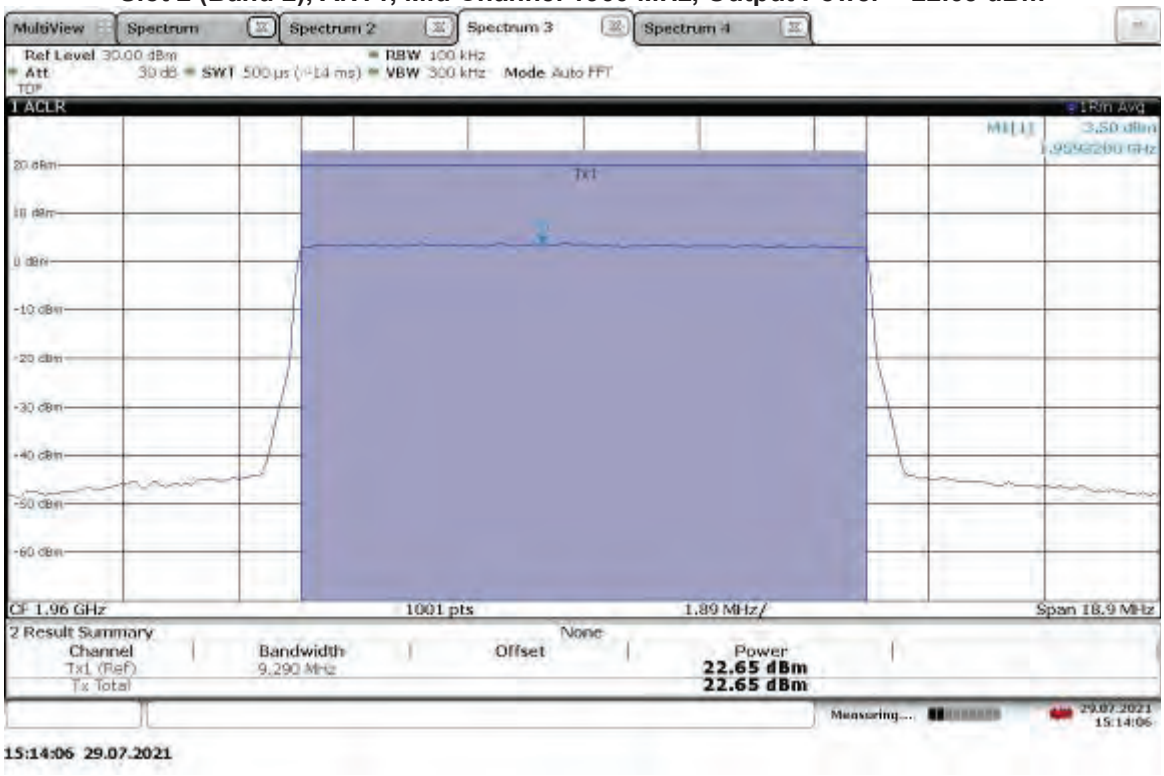
TM1.1-QPSK_10 MHz Bandwidth
Slot 2 (Band 2), ANT1, Low Channel 1935 MHz, Output Power = 22.41 dBm



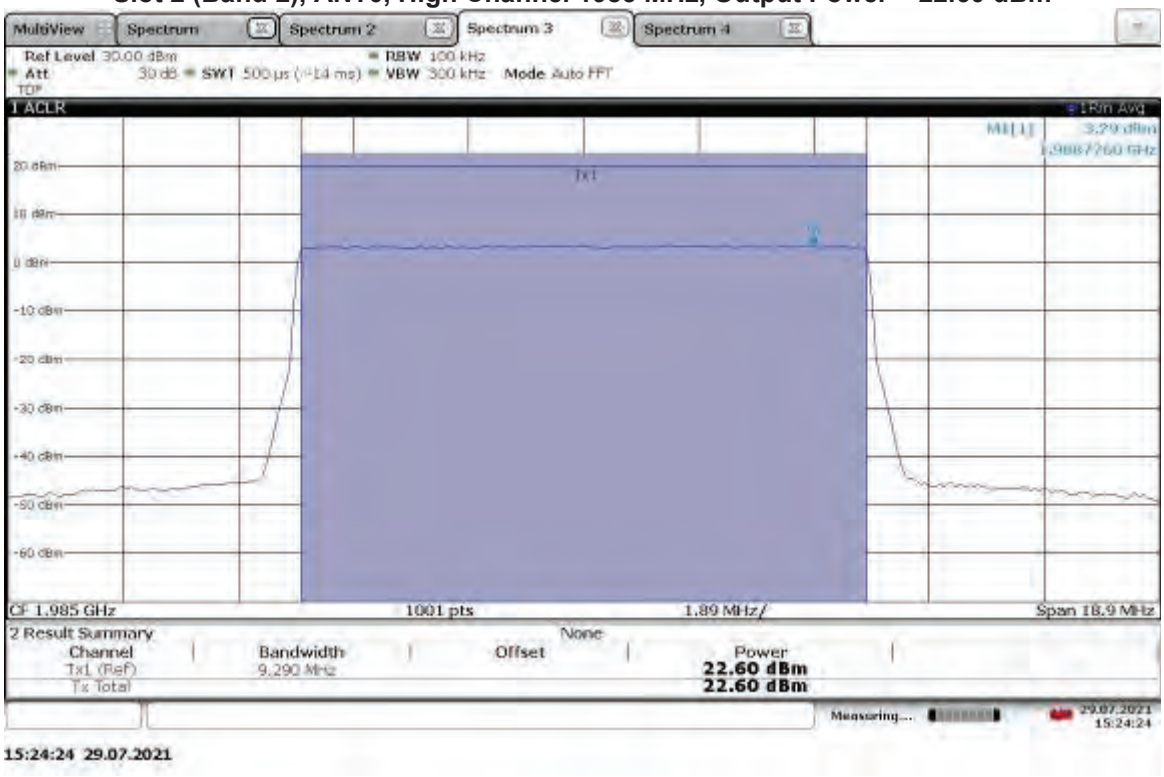
TM1.1-QPSK_10 MHz Bandwidth
Slot 2 (Band 2), ANT0, Mid Channel 1960 MHz, Output Power = 22.68 dBm



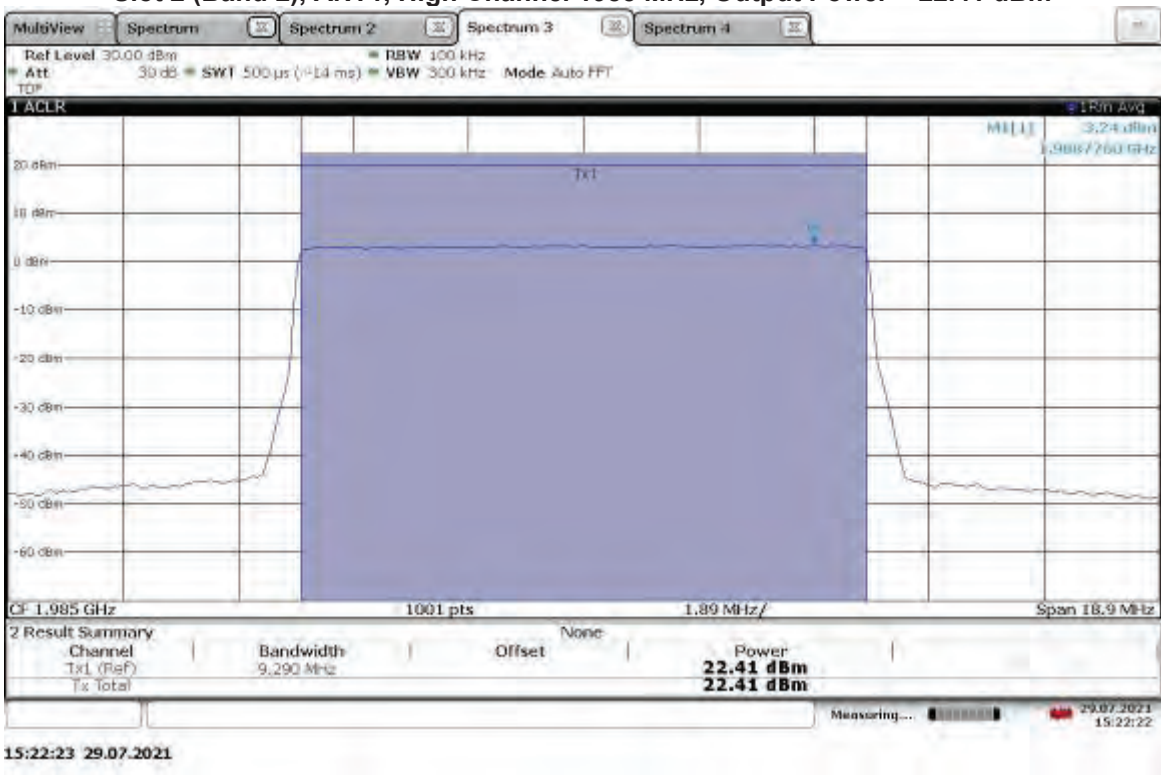
TM1.1-QPSK_10 MHz Bandwidth
Slot 2 (Band 2), ANT1, Mid Channel 1960 MHz, Output Power = 22.65 dBm



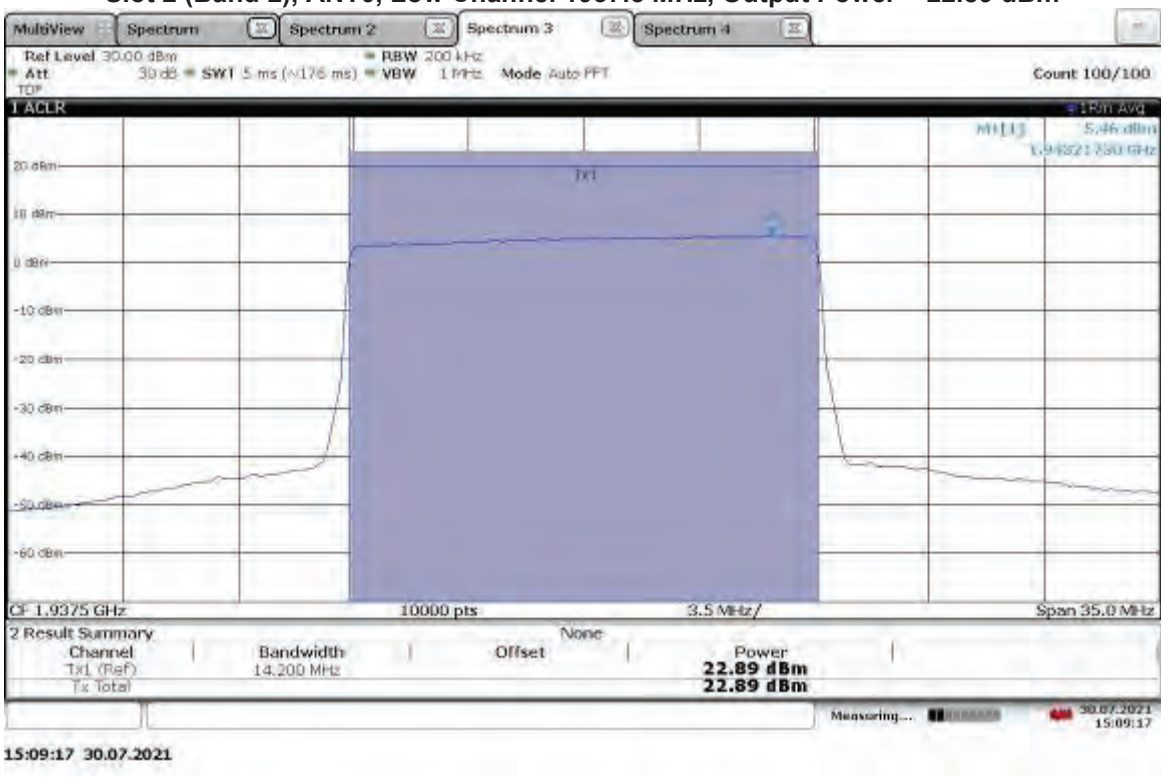
TM1.1-QPSK_10 MHz Bandwidth
Slot 2 (Band 2), ANT0, High Channel 1985 MHz, Output Power = 22.60 dBm



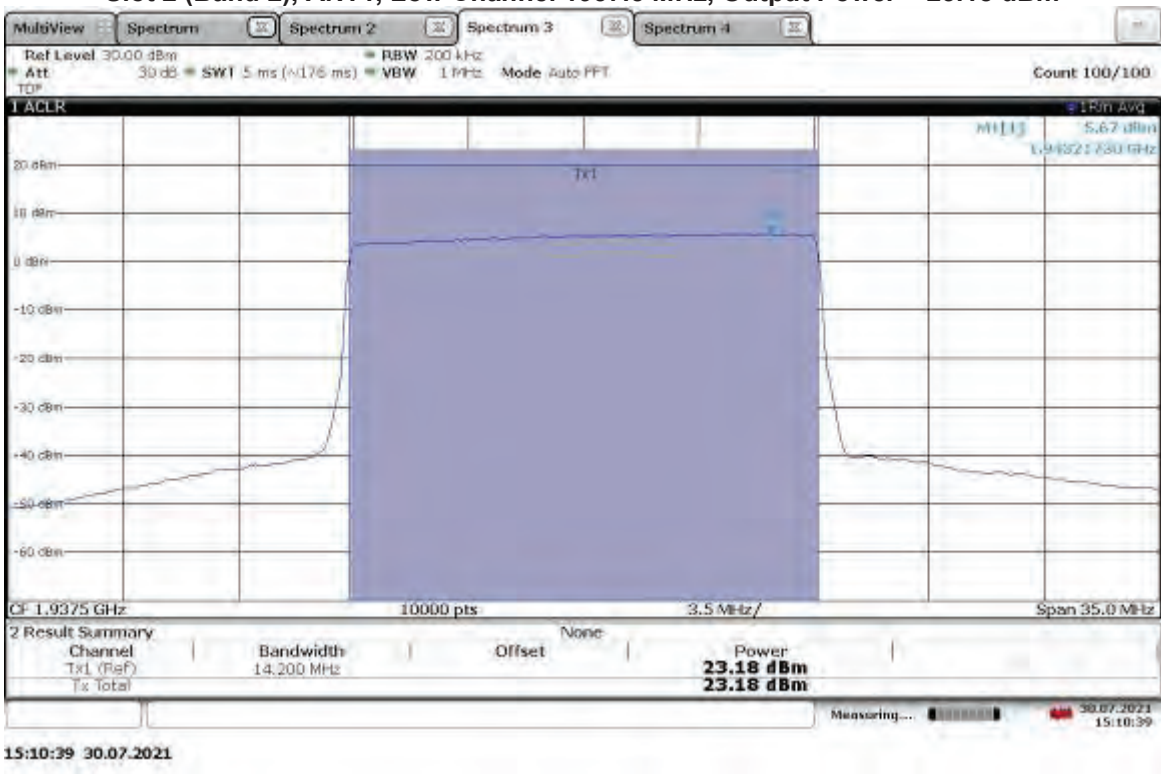
TM1.1-QPSK_10 MHz Bandwidth
Slot 2 (Band 2), ANT1, High Channel 1985 MHz, Output Power = 22.41 dBm



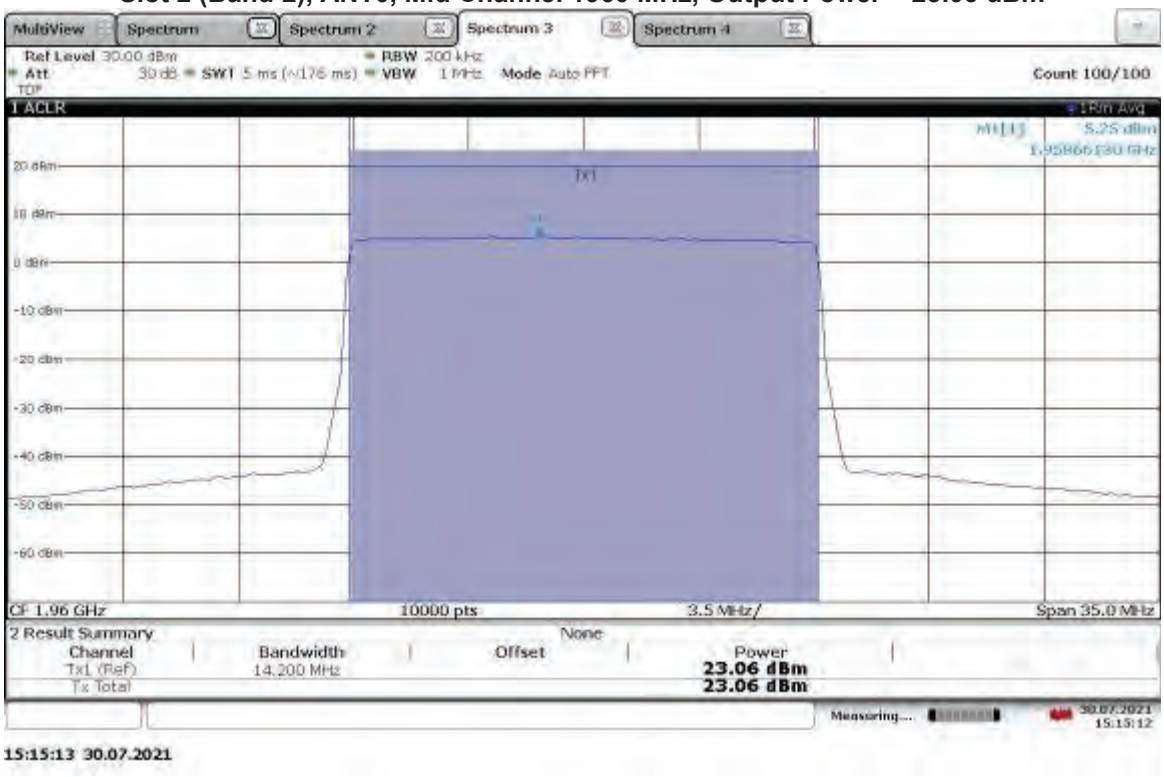
TM1.1-QPSK_15 MHz Bandwidth
Slot 2 (Band 2), ANT0, Low Channel 1937.5 MHz, Output Power = 22.89 dBm



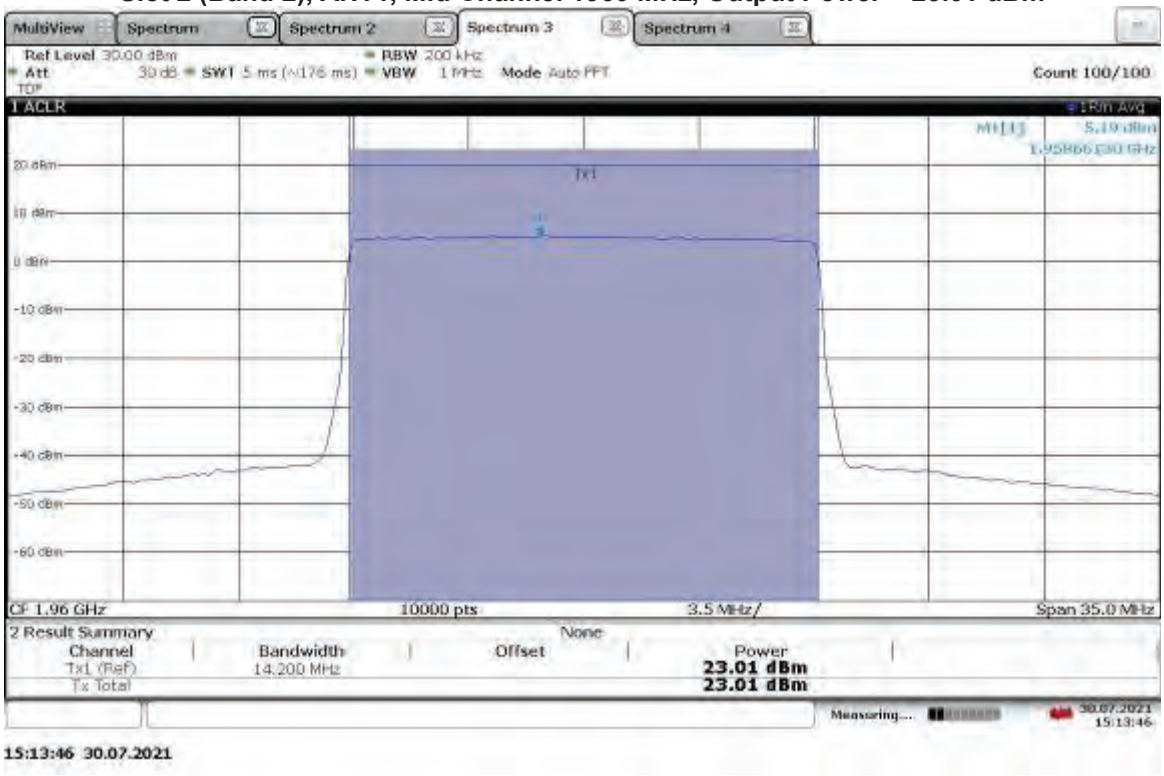
TM1.1-QPSK_15 MHz Bandwidth
Slot 2 (Band 2), ANT1, Low Channel 1937.5 MHz, Output Power = 23.18 dBm



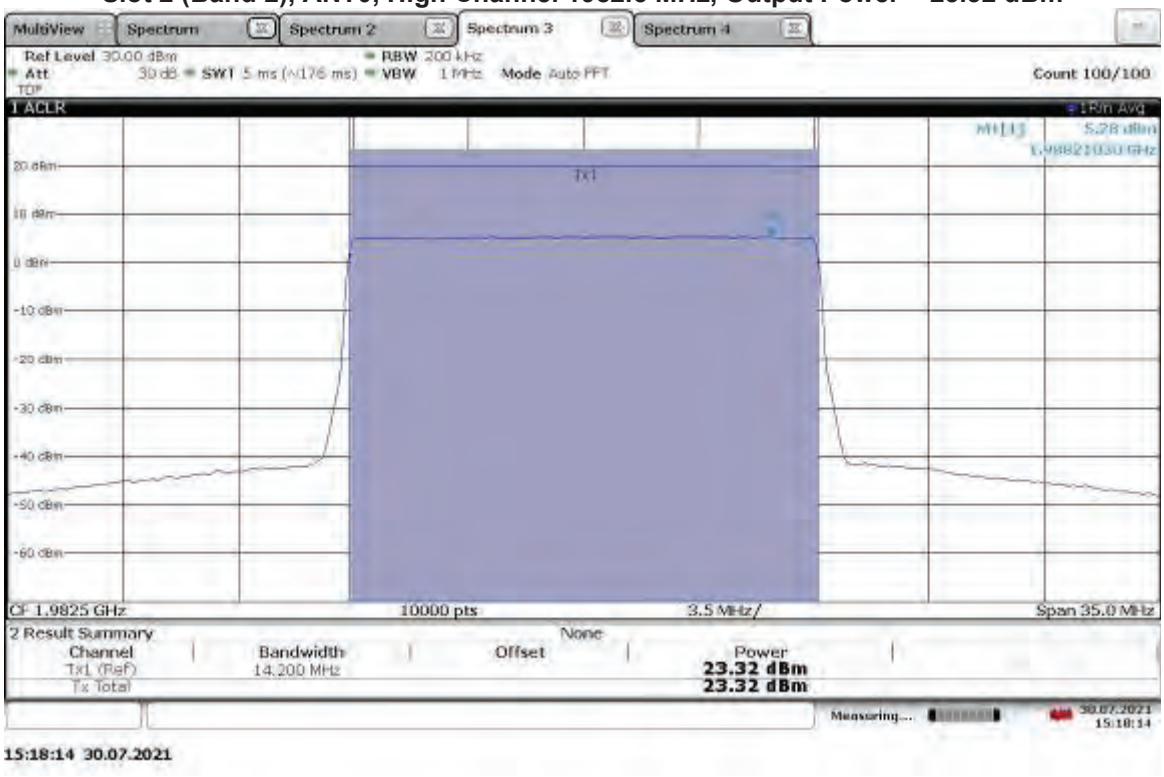
TM1.1-QPSK_15 MHz Bandwidth
Slot 2 (Band 2), ANT0, Mid Channel 1960 MHz, Output Power = 23.06 dBm



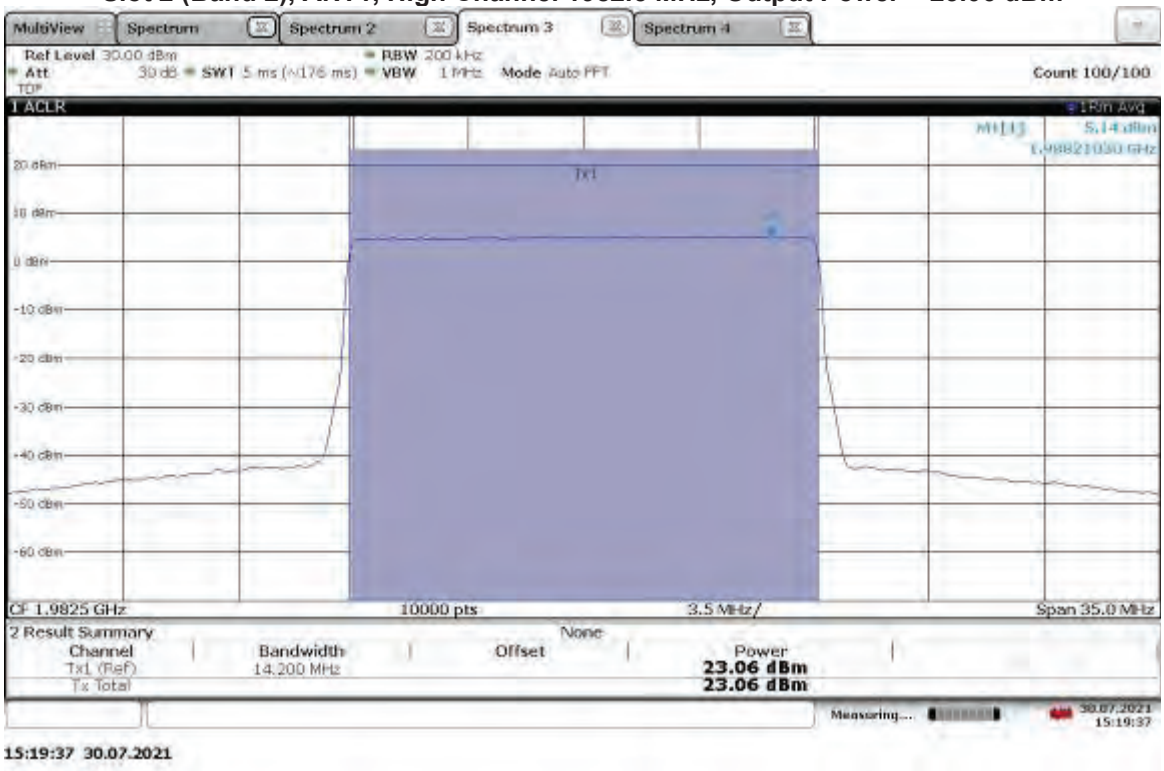
TM1.1-QPSK_15 MHz Bandwidth
Slot 2 (Band 2), ANT1, Mid Channel 1960 MHz, Output Power = 23.01 dBm



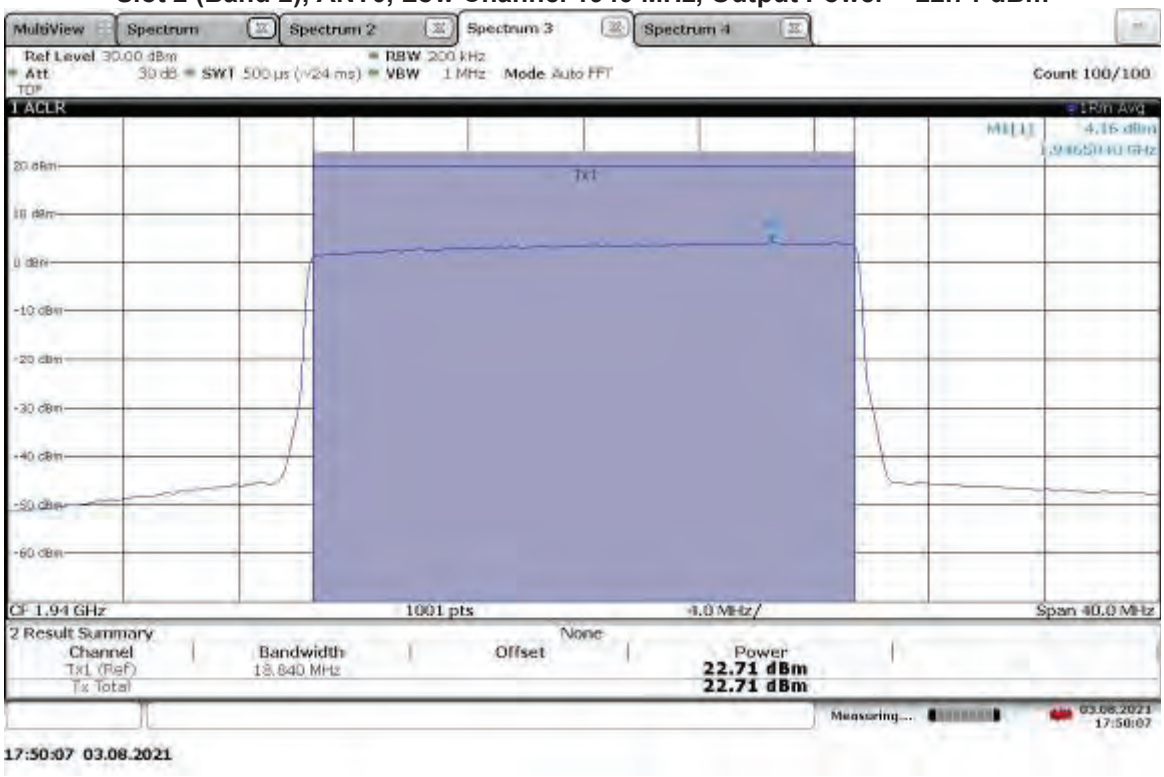
TM1.1-QPSK_15 MHz Bandwidth
Slot 2 (Band 2), ANT0, High Channel 1982.5 MHz, Output Power = 23.32 dBm



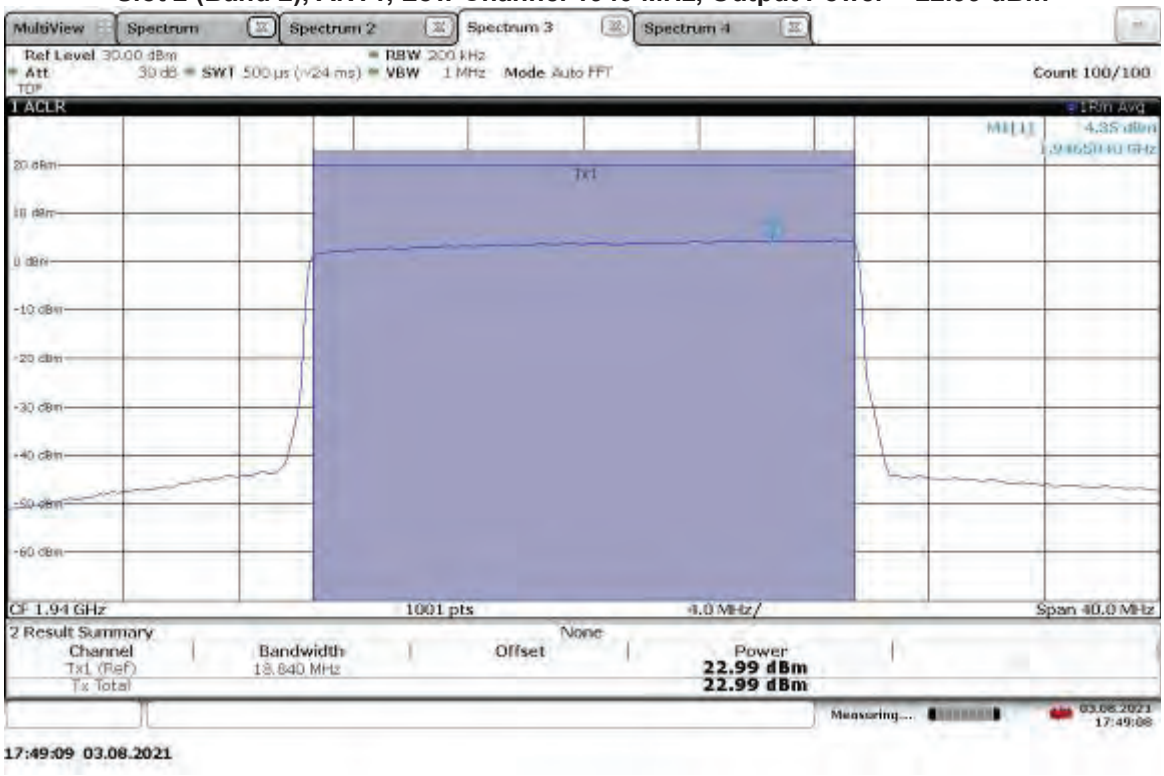
TM1.1-QPSK_15 MHz Bandwidth
Slot 2 (Band 2), ANT1, High Channel 1982.5 MHz, Output Power = 23.06 dBm



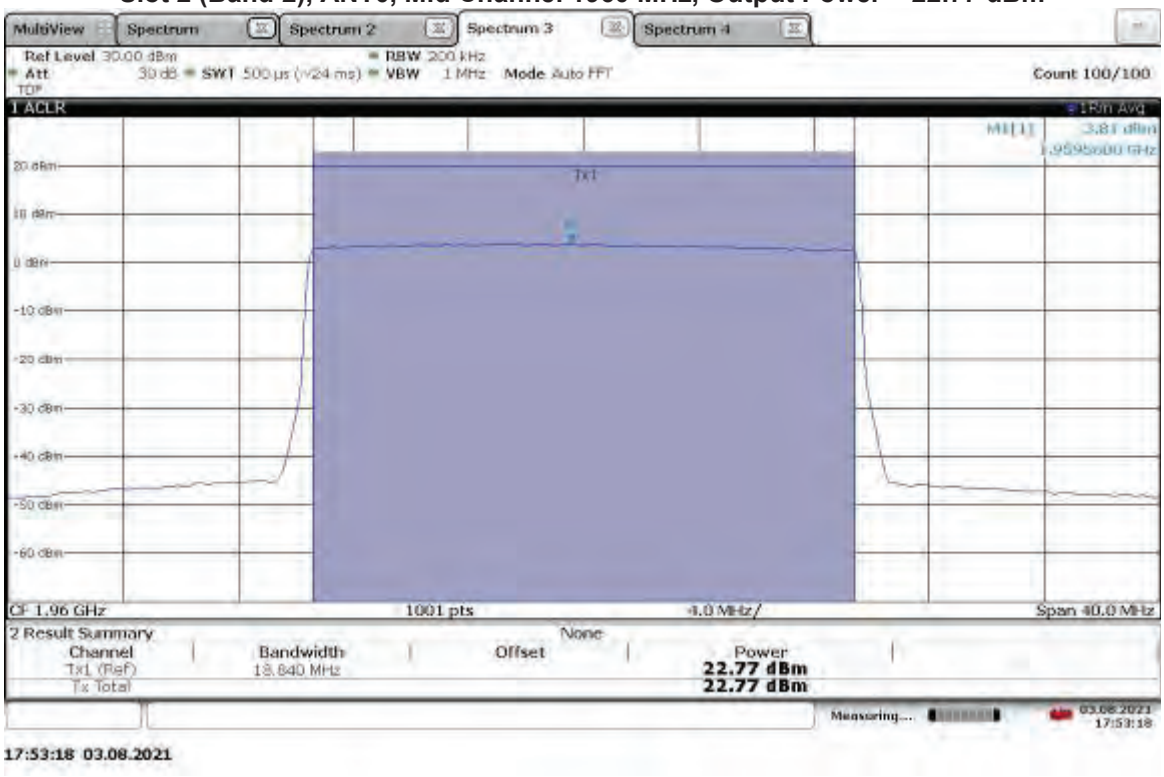
TM1.1-QPSK_20 MHz Bandwidth
Slot 2 (Band 2), ANT0, Low Channel 1940 MHz, Output Power = 22.71 dBm



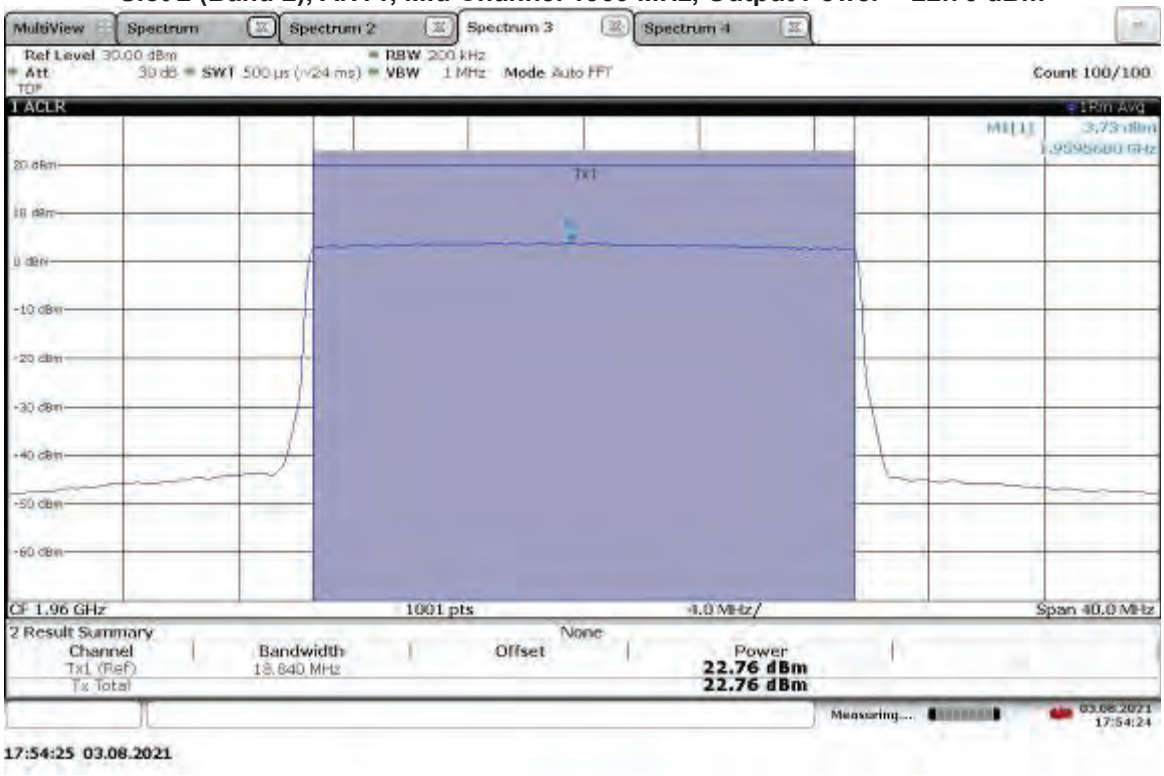
TM1.1-QPSK_20 MHz Bandwidth
Slot 2 (Band 2), ANT1, Low Channel 1940 MHz, Output Power = 22.99 dBm



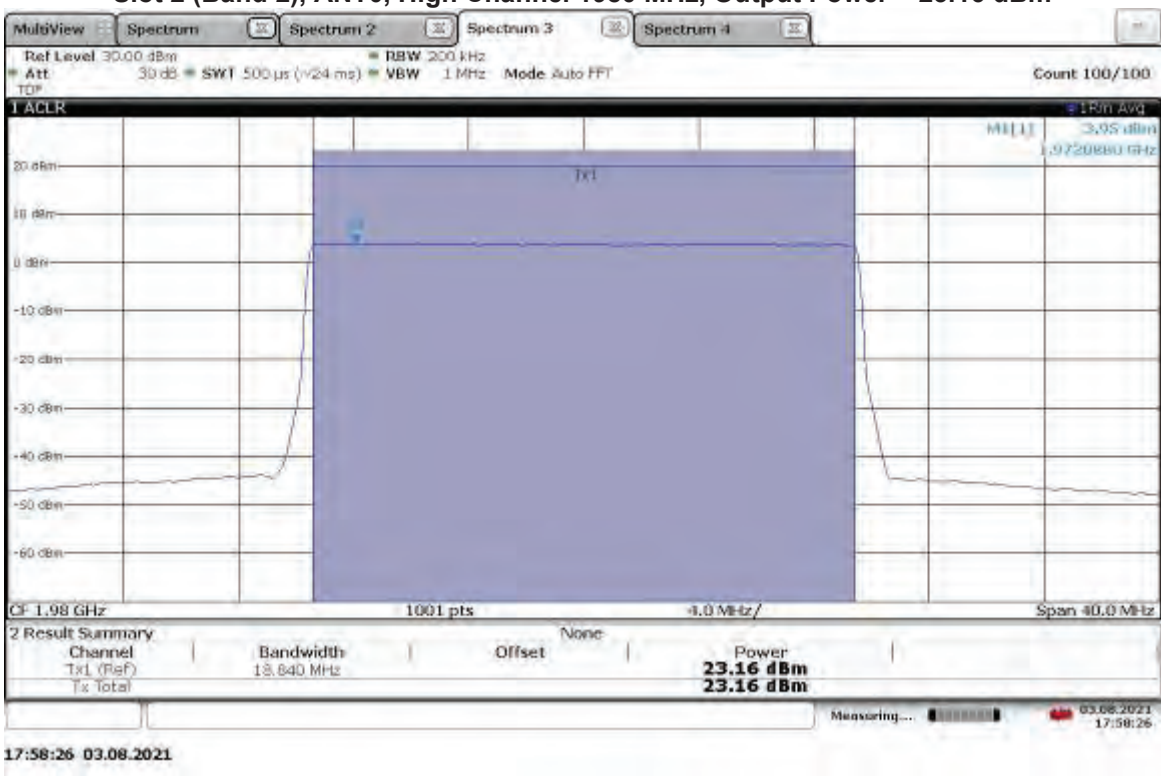
TM1.1-QPSK_20 MHz Bandwidth
Slot 2 (Band 2), ANT0, Mid Channel 1960 MHz, Output Power = 22.77 dBm



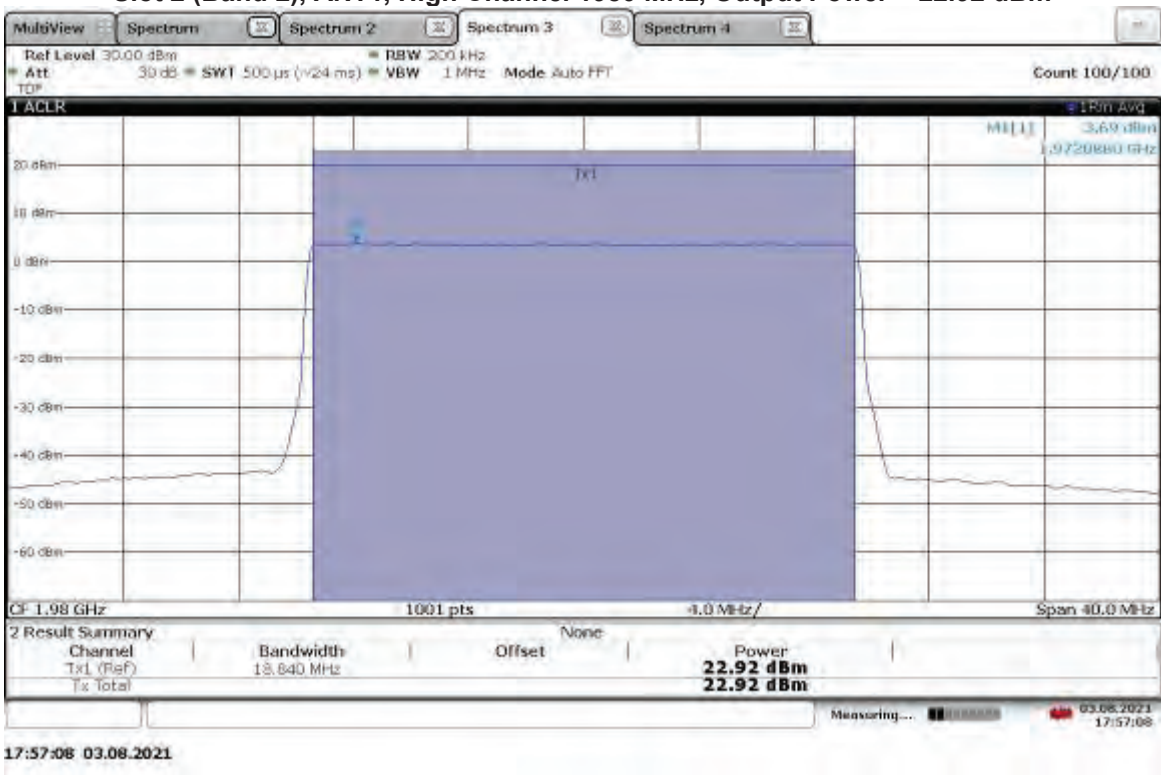
TM1.1-QPSK_20 MHz Bandwidth
Slot 2 (Band 2), ANT1, Mid Channel 1960 MHz, Output Power = 22.76 dBm



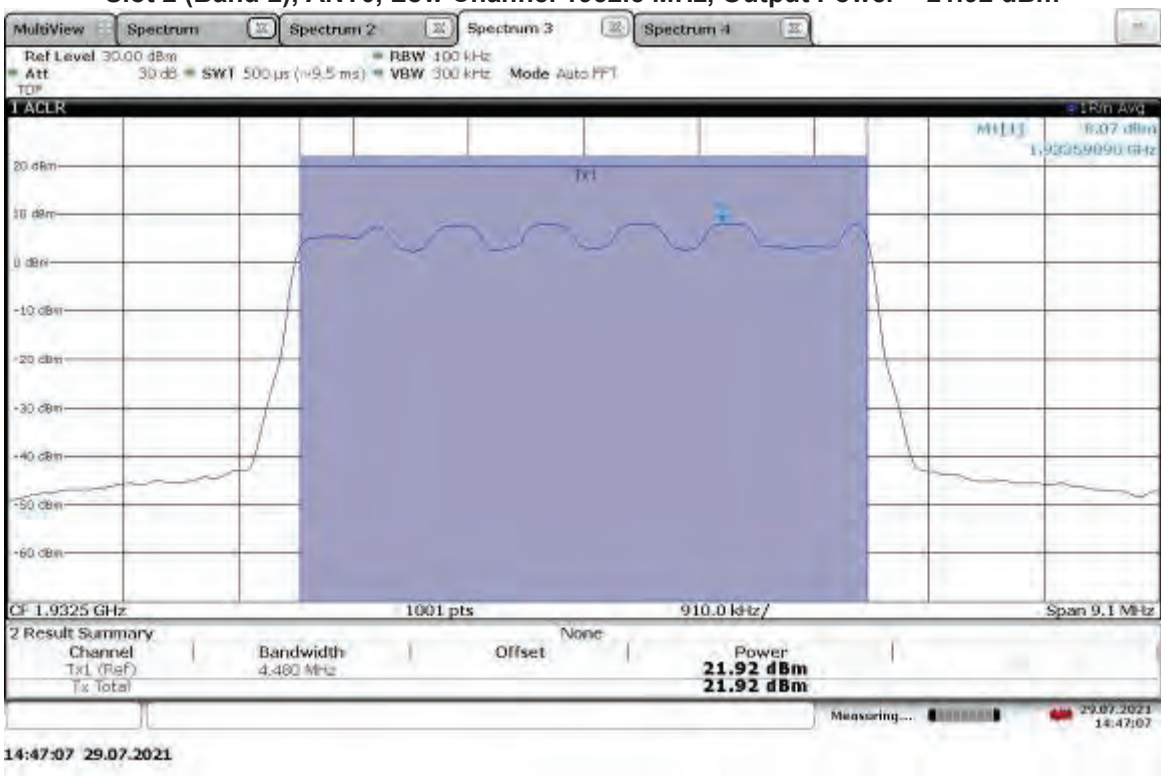
TM1.1-QPSK_20 MHz Bandwidth
Slot 2 (Band 2), ANT0, High Channel 1980 MHz, Output Power = 23.16 dBm



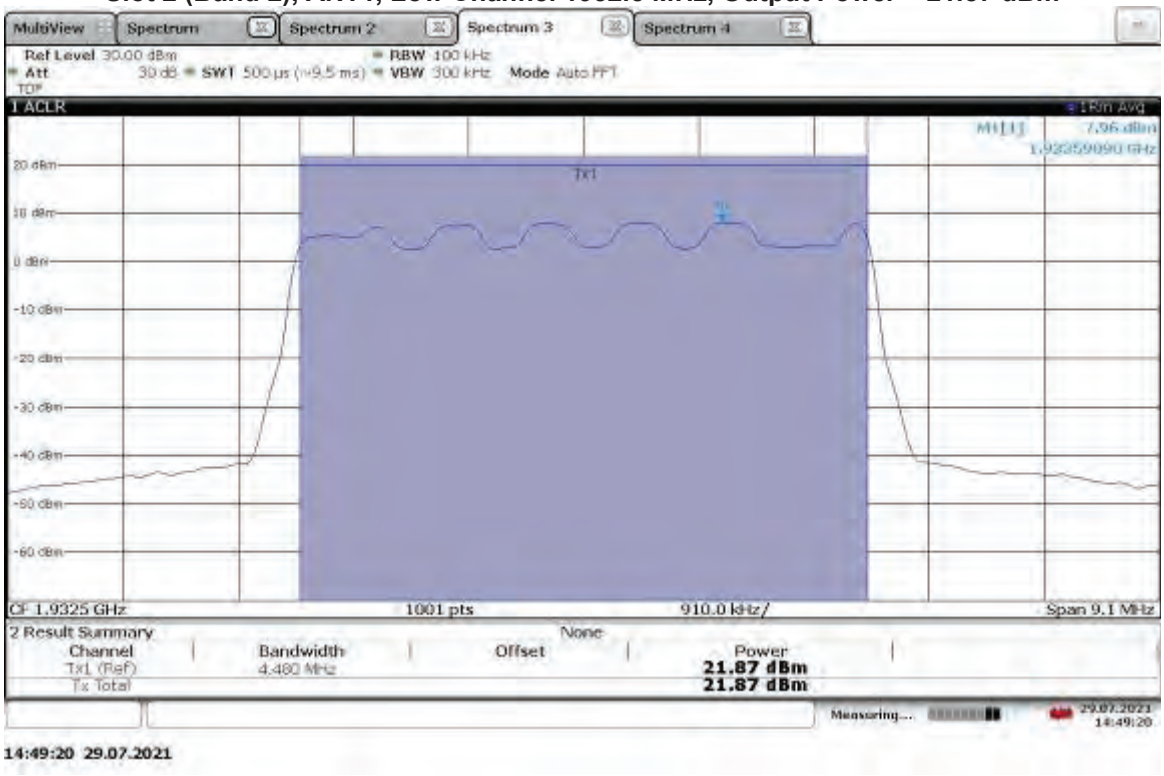
TM1.1-QPSK_20 MHz Bandwidth
Slot 2 (Band 2), ANT1, High Channel 1980 MHz, Output Power = 22.92 dBm



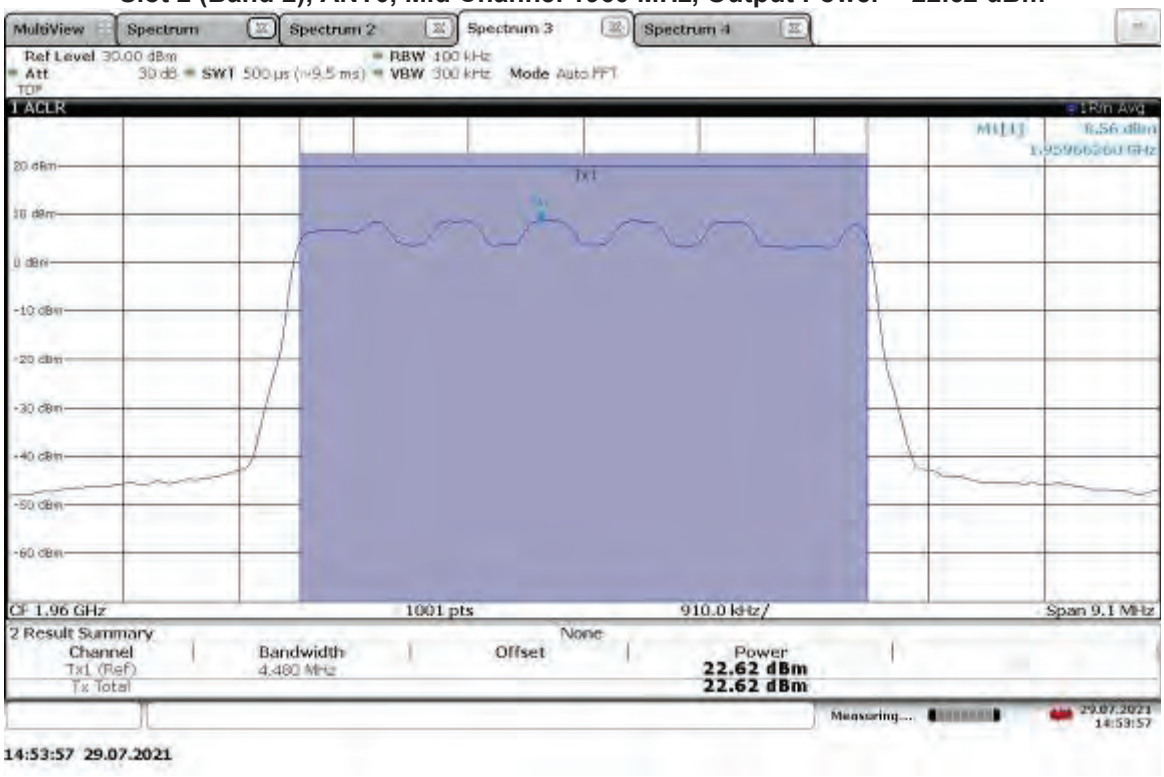
TM3.2-16QAM_5 MHz Bandwidth
Slot 2 (Band 2), ANT0, Low Channel 1932.5 MHz, Output Power = 21.92 dBm



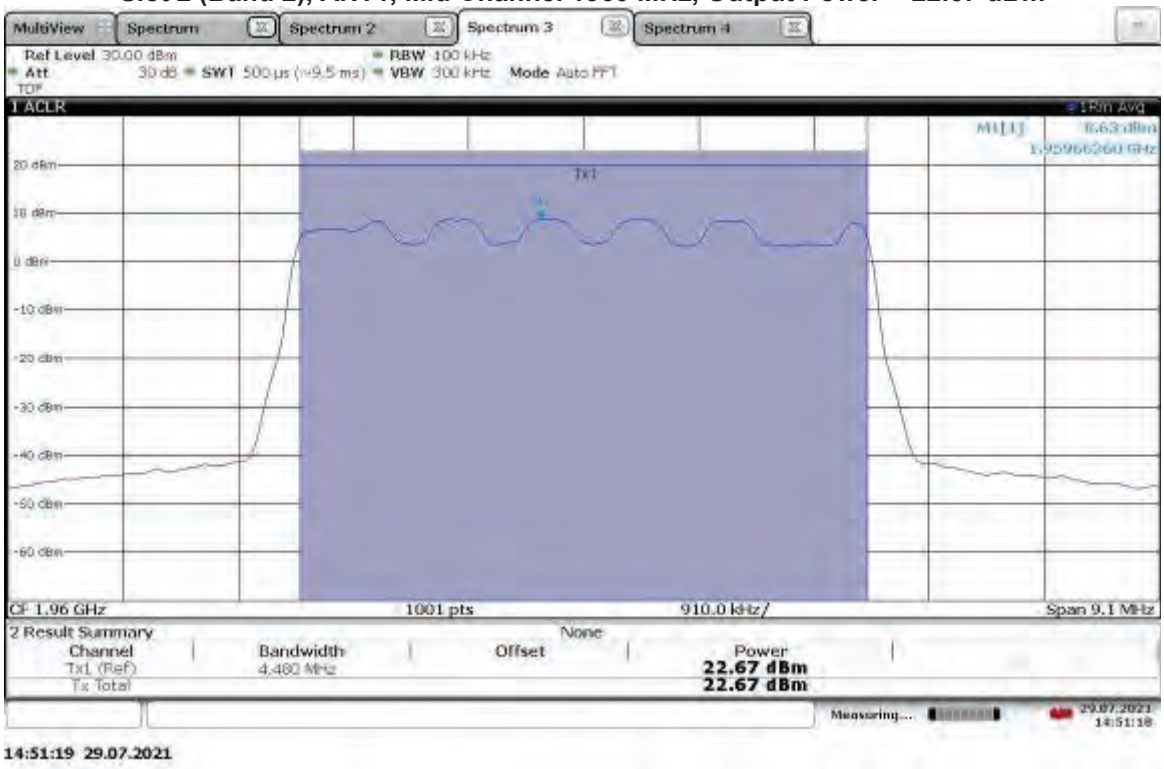
TM3.2-16QAM_5 MHz Bandwidth
Slot 2 (Band 2), ANT1, Low Channel 1932.5 MHz, Output Power = 21.87 dBm



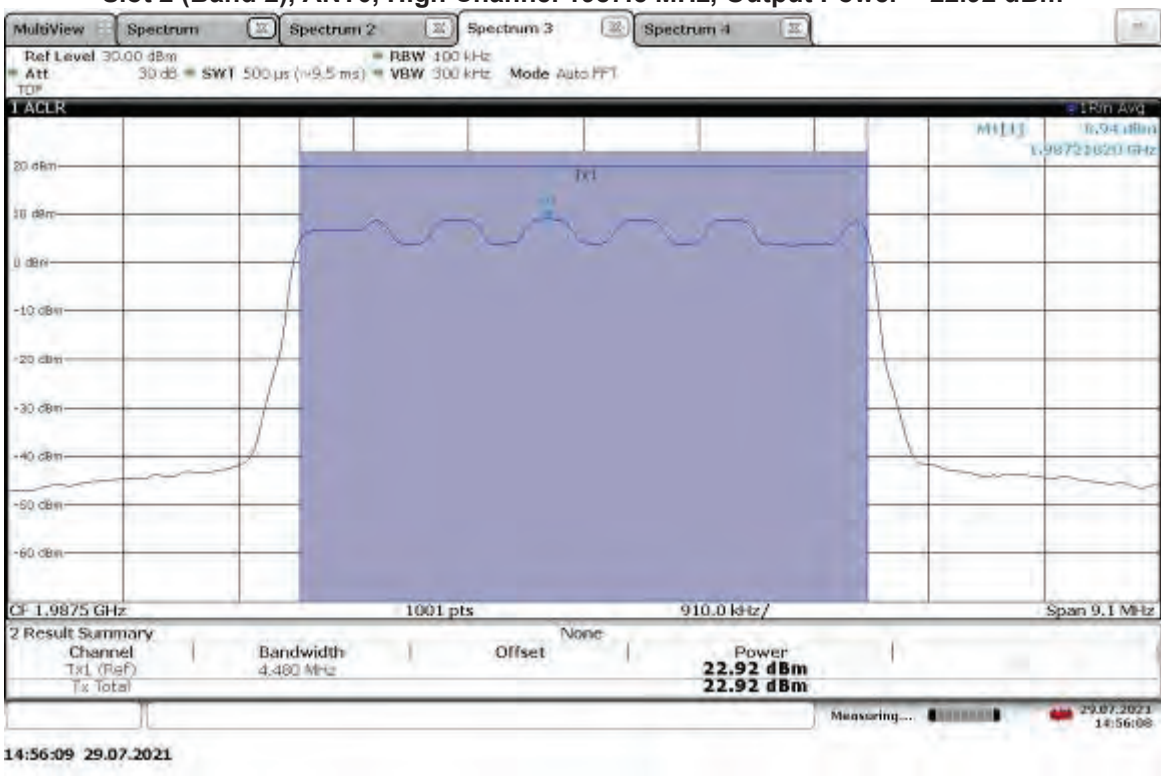
TM3.2-16QAM_5 MHz Bandwidth
Slot 2 (Band 2), ANT0, Mid Channel 1960 MHz, Output Power = 22.62 dBm



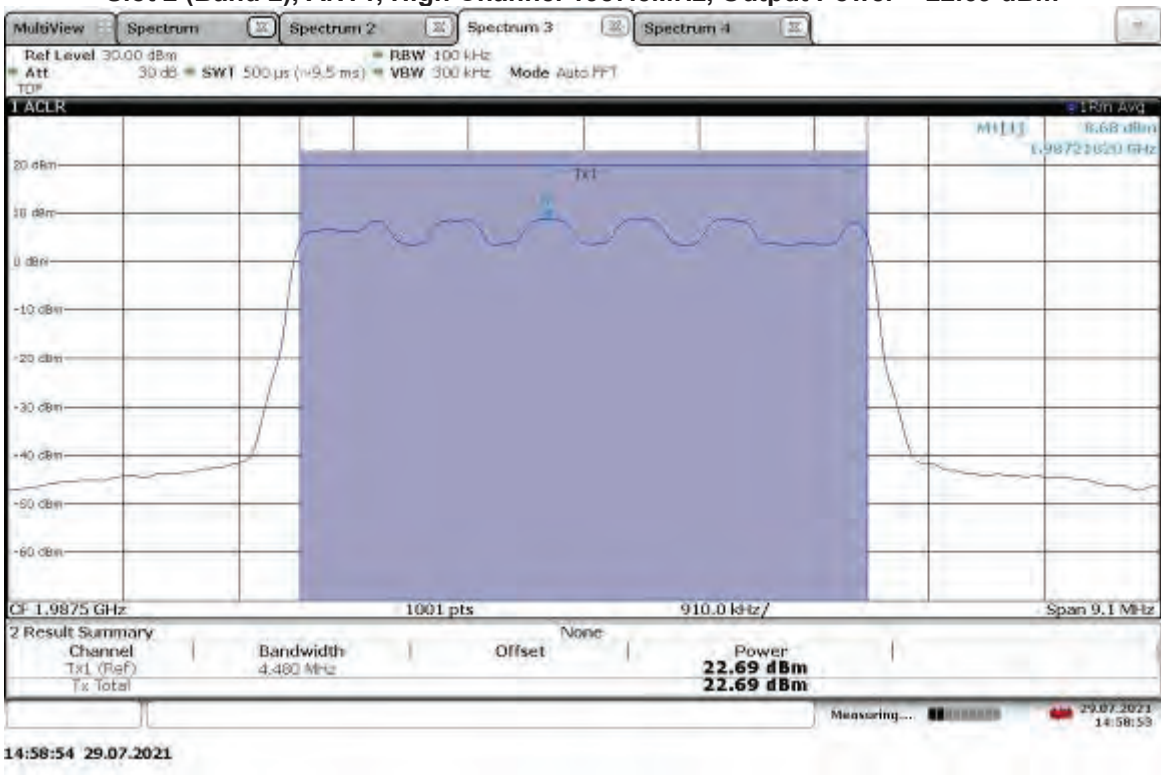
TM3.2-16QAM_5 MHz Bandwidth
Slot 2 (Band 2), ANT1, Mid Channel 1960 MHz, Output Power = 22.67 dBm



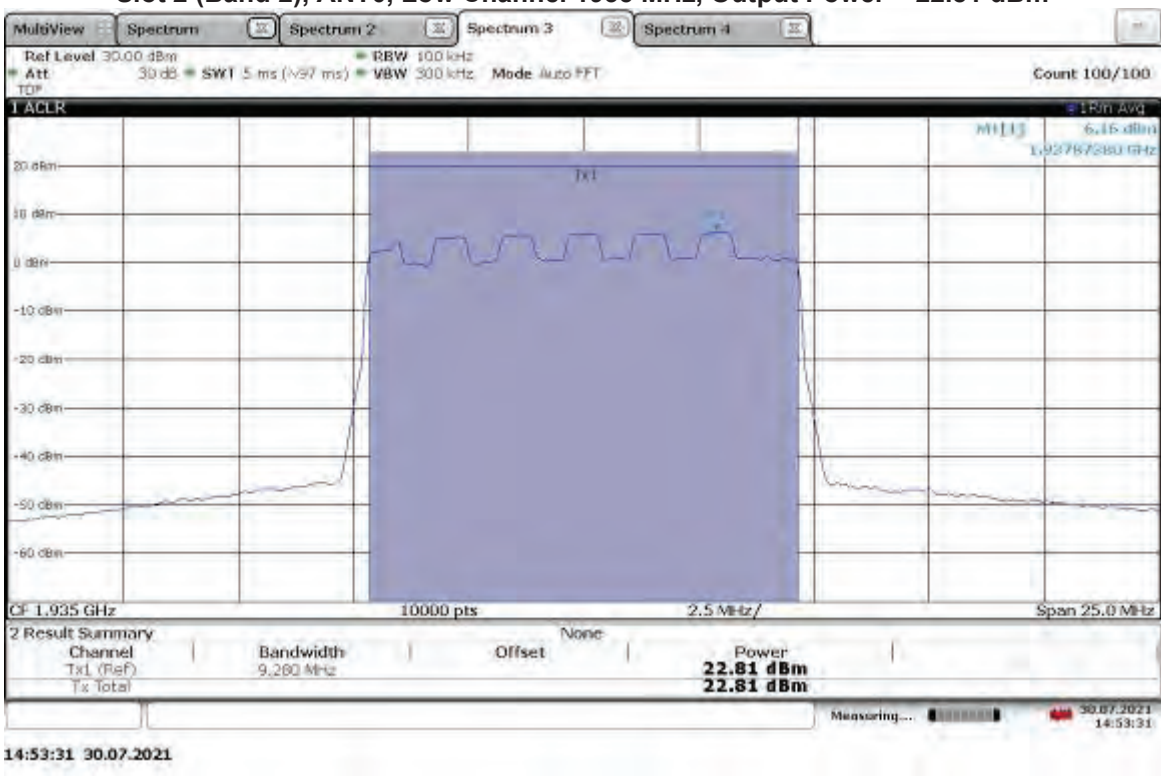
TM3.2-16QAM_5 MHz Bandwidth
Slot 2 (Band 2), ANT0, High Channel 1987.5 MHz, Output Power = 22.92 dBm



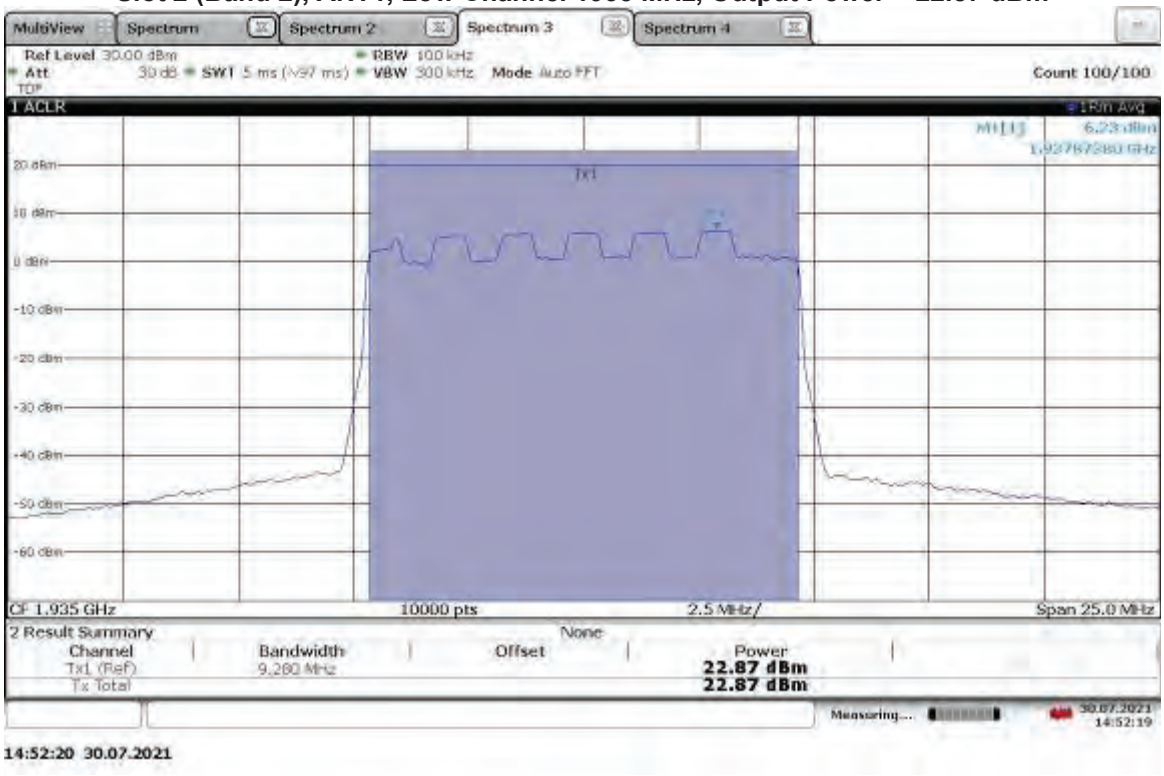
TM3.2-16QAM_5 MHz Bandwidth
Slot 2 (Band 2), ANT1, High Channel 1987.5MHz, Output Power = 22.69 dBm



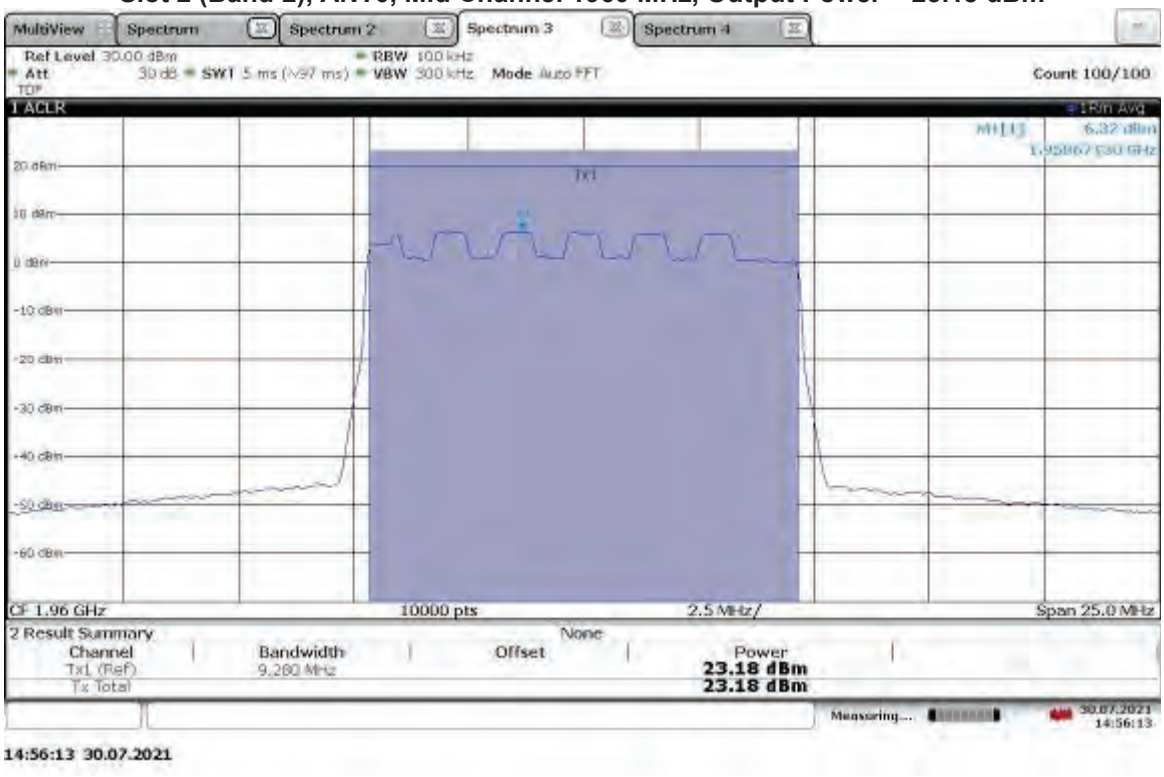
TM3.2-16QAM_10 MHz Bandwidth
Slot 2 (Band 2), ANT0, Low Channel 1935 MHz, Output Power = 22.81 dBm



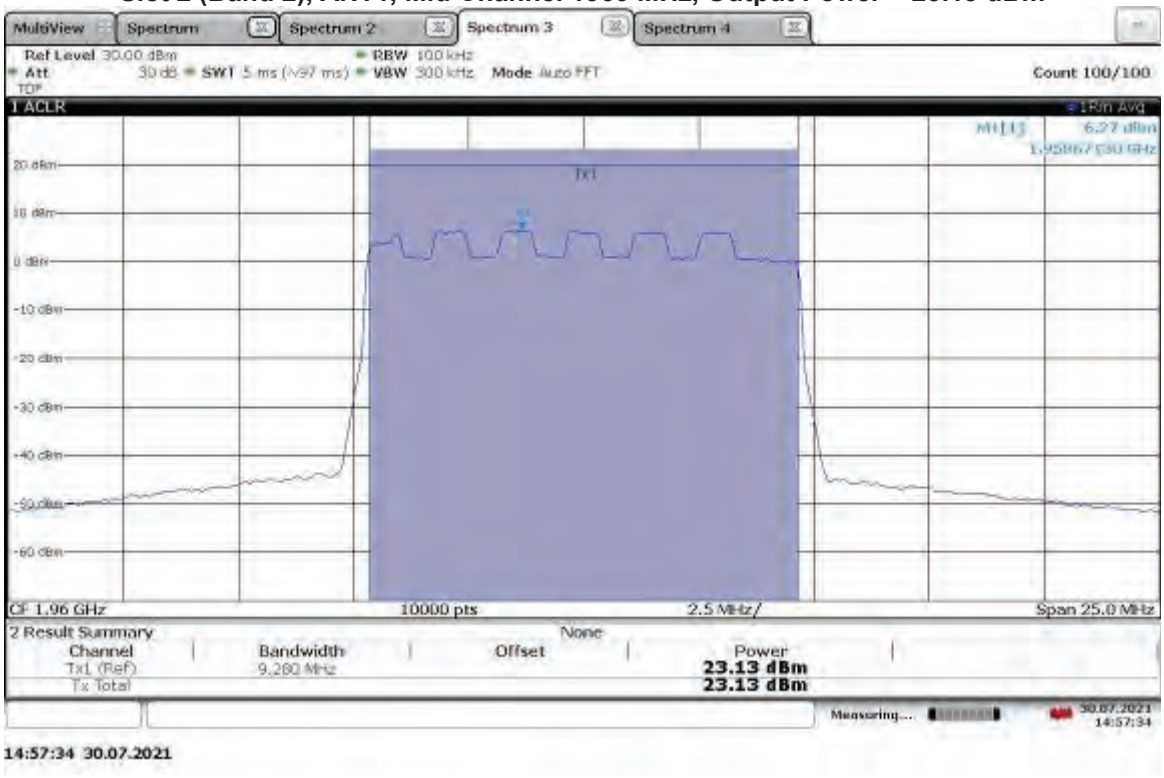
TM3.2-16QAM_10 MHz Bandwidth
Slot 2 (Band 2), ANT1, Low Channel 1935 MHz, Output Power = 22.87 dBm



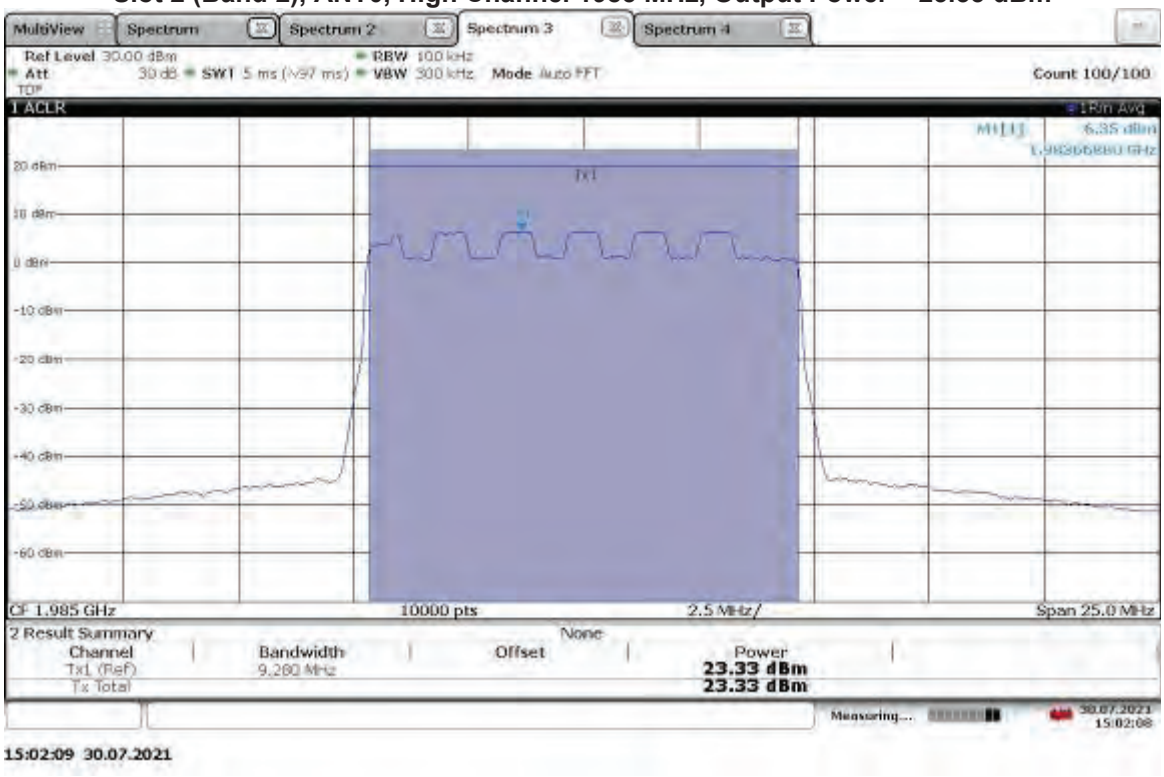
TM3.2-16QAM_10 MHz Bandwidth
Slot 2 (Band 2), ANT0, Mid Channel 1960 MHz, Output Power = 23.18 dBm



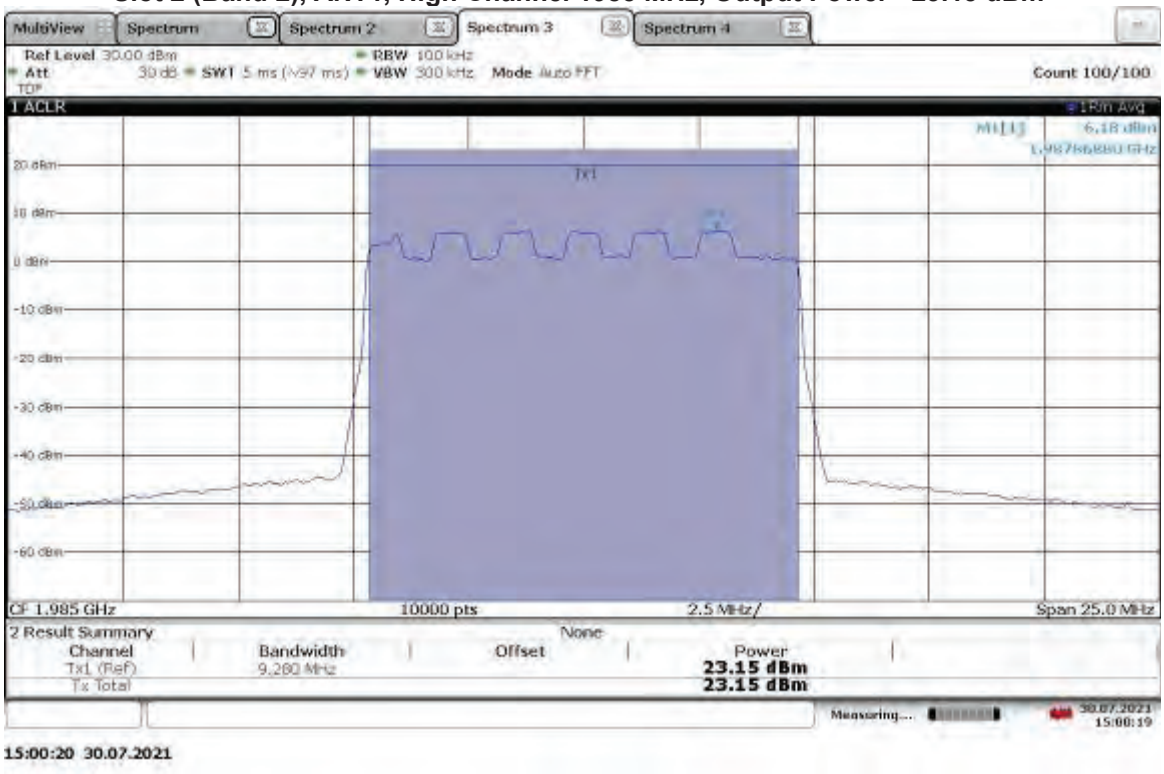
TM3.2-16QAM_10 MHz Bandwidth
Slot 2 (Band 2), ANT1, Mid Channel 1960 MHz, Output Power = 23.13 dBm



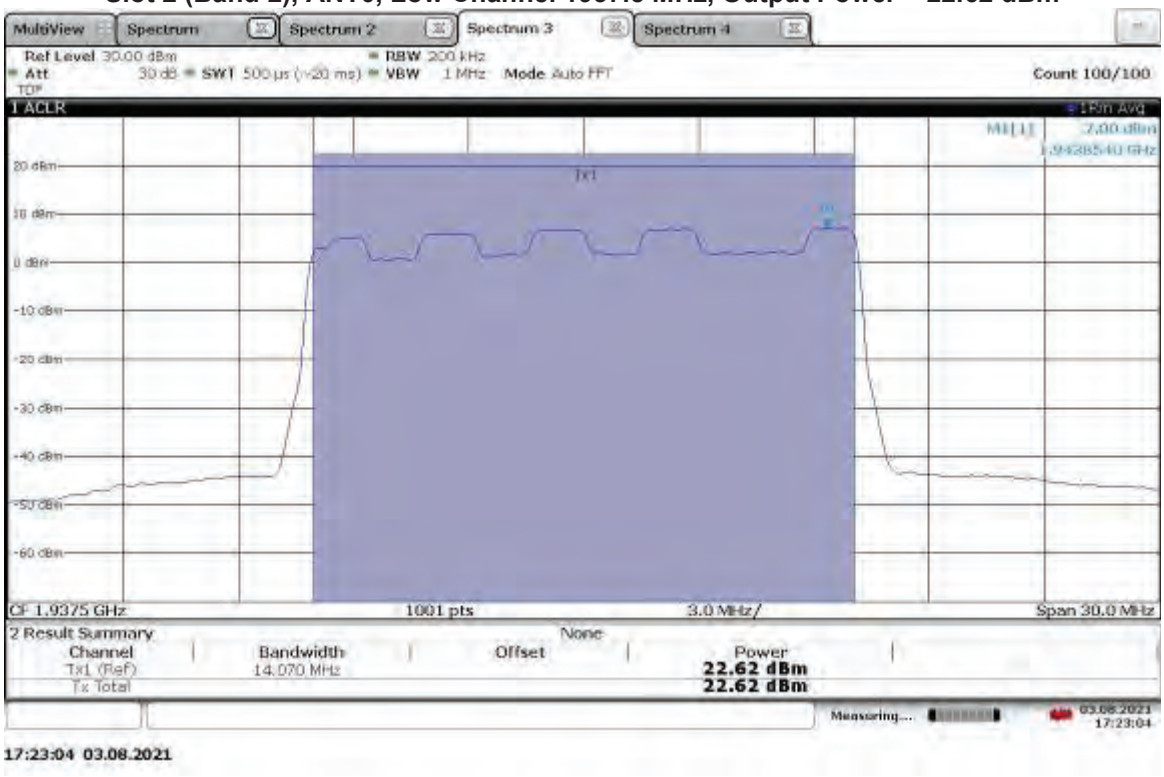
TM3.2-16QAM_10 MHz Bandwidth
Slot 2 (Band 2), ANT0, High Channel 1985 MHz, Output Power = 23.33 dBm



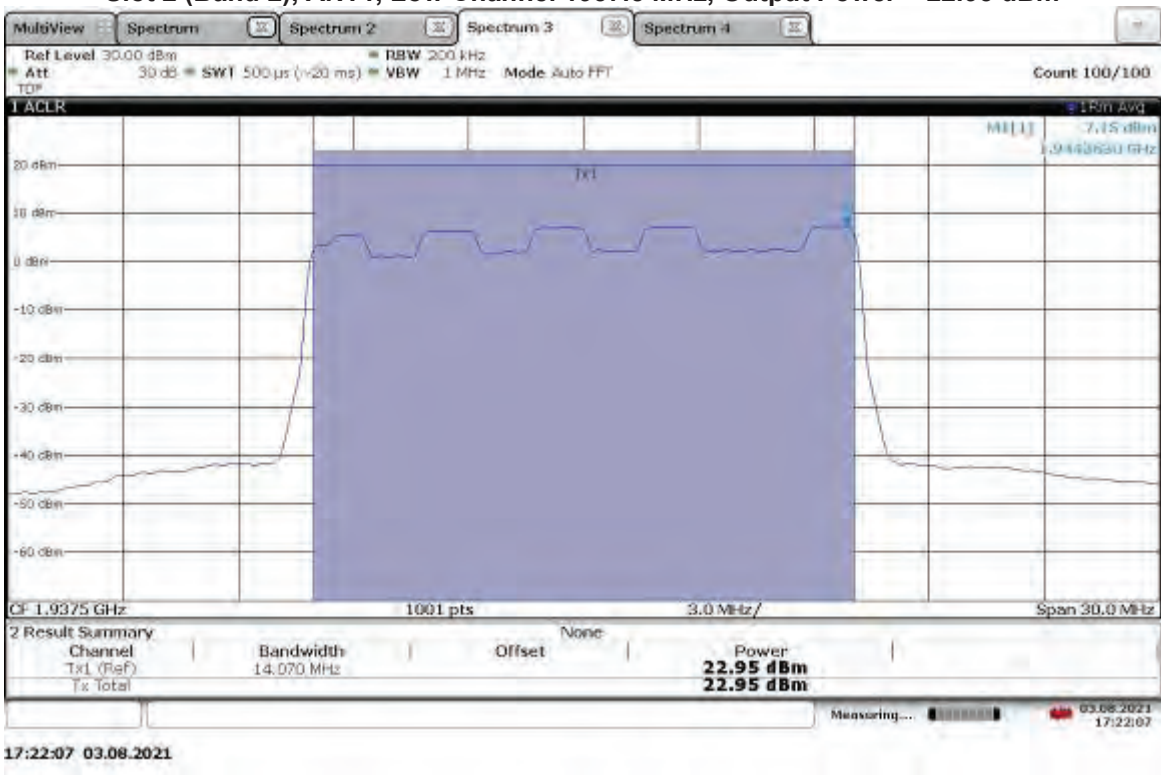
TM3.2-16QAM_10 MHz Bandwidth
Slot 2 (Band 2), ANT1, High Channel 1985 MHz, Output Power =23.15 dBm



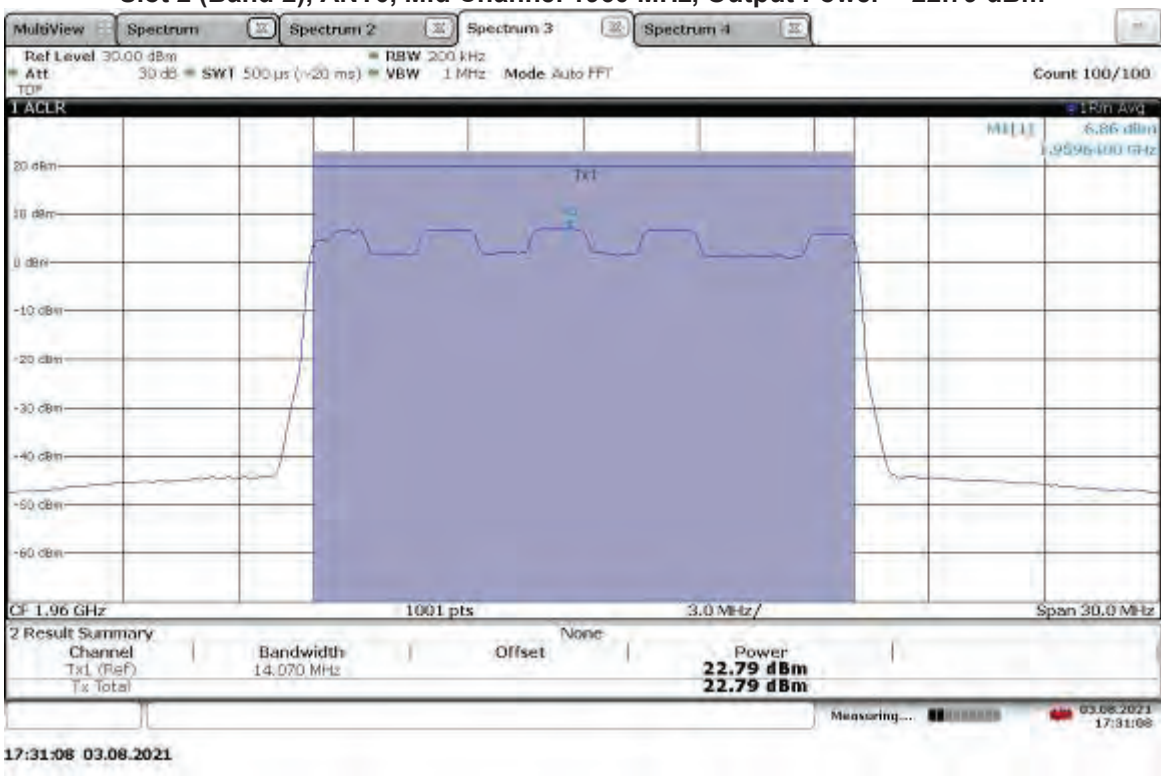
TM3.2-16QAM_15 MHz Bandwidth
Slot 2 (Band 2), ANT0, Low Channel 1937.5 MHz, Output Power = 22.62 dBm



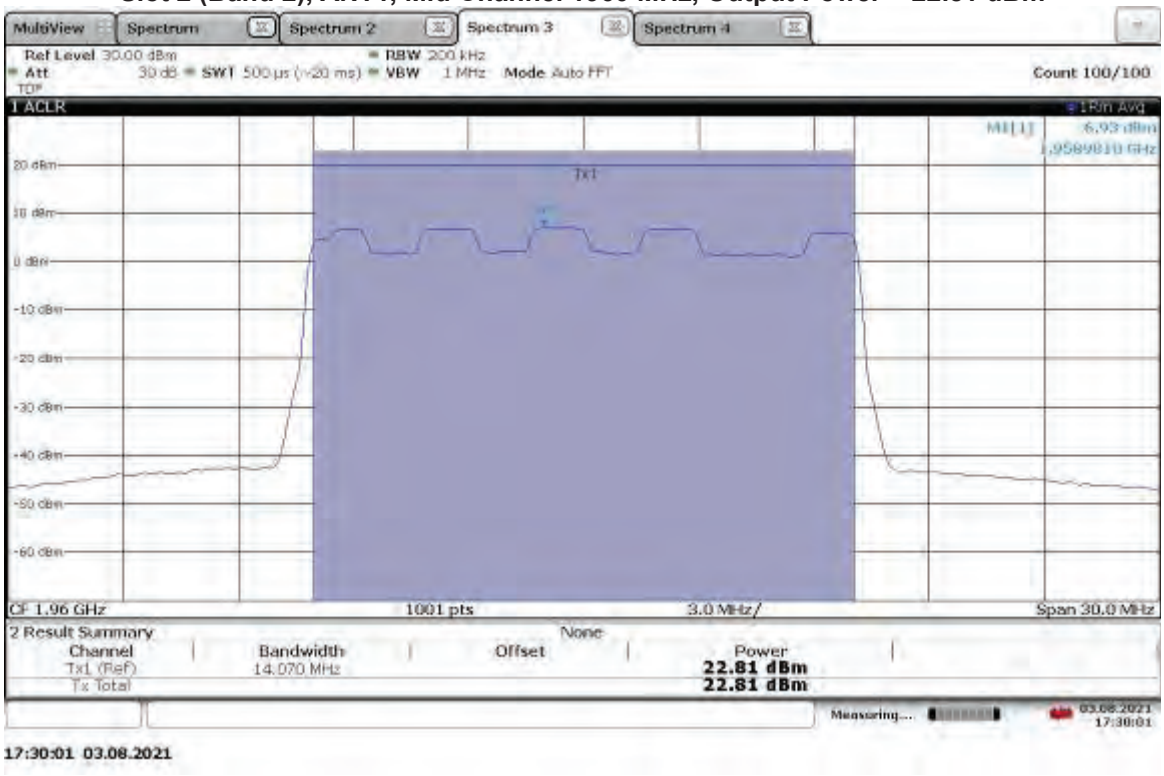
TM3.2-16QAM_15 MHz Bandwidth
Slot 2 (Band 2), ANT1, Low Channel 1937.5 MHz, Output Power = 22.95 dBm



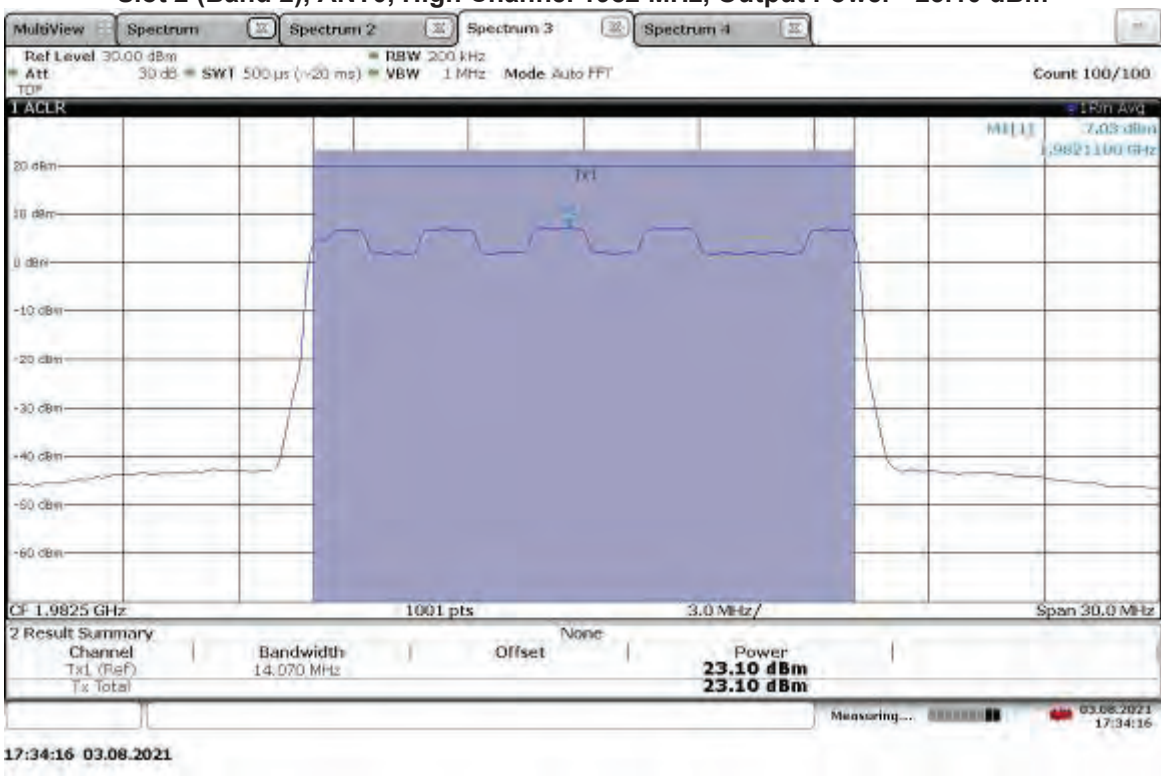
TM3.2-16QAM_15 MHz Bandwidth
Slot 2 (Band 2), ANT0, Mid Channel 1960 MHz, Output Power = 22.79 dBm



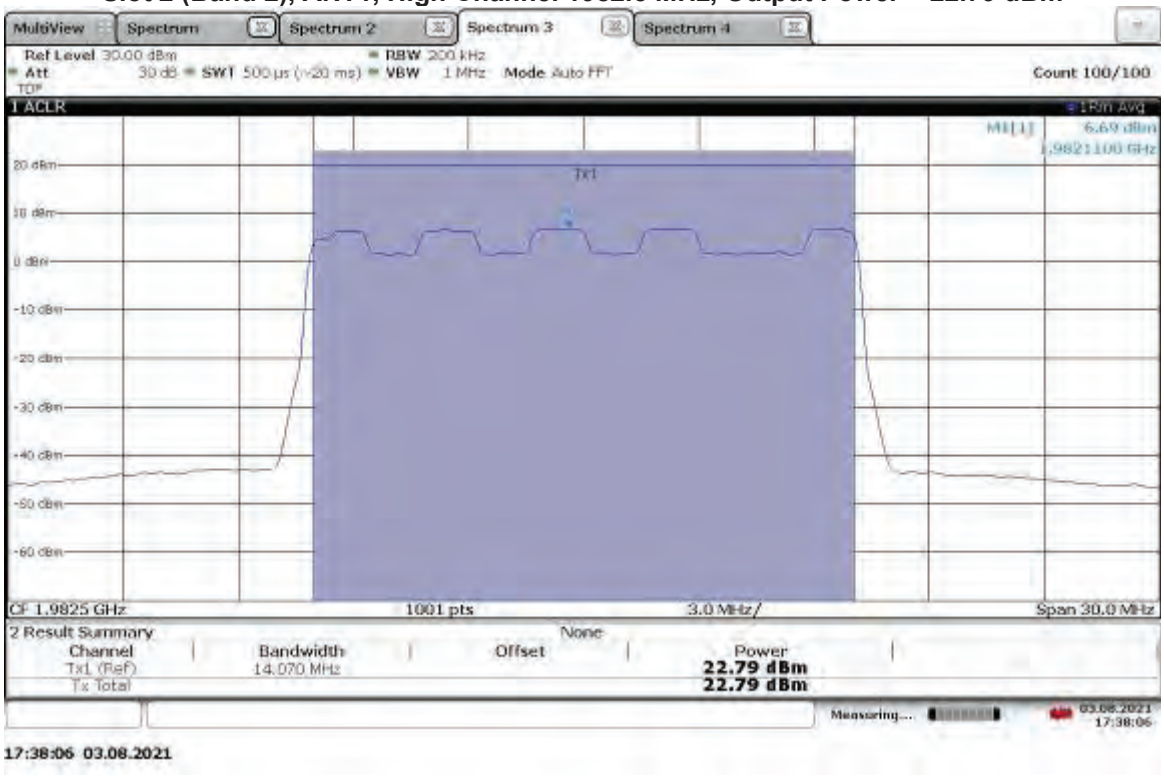
TM3.2-16QAM_15 MHz Bandwidth
Slot 2 (Band 2), ANT1, Mid Channel 1960 MHz, Output Power = 22.81 dBm



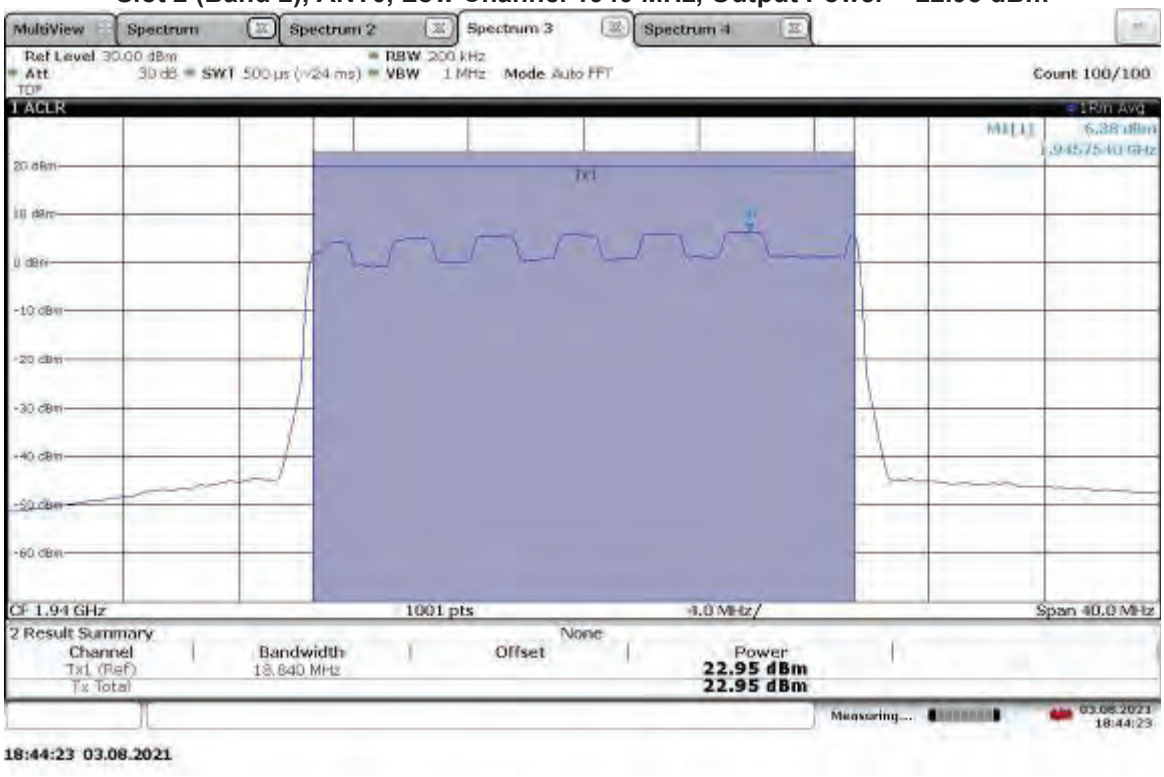
TM3.2-16QAM_15 MHz Bandwidth
Slot 2 (Band 2), ANT0, High Channel 1982 MHz, Output Power =23.10 dBm



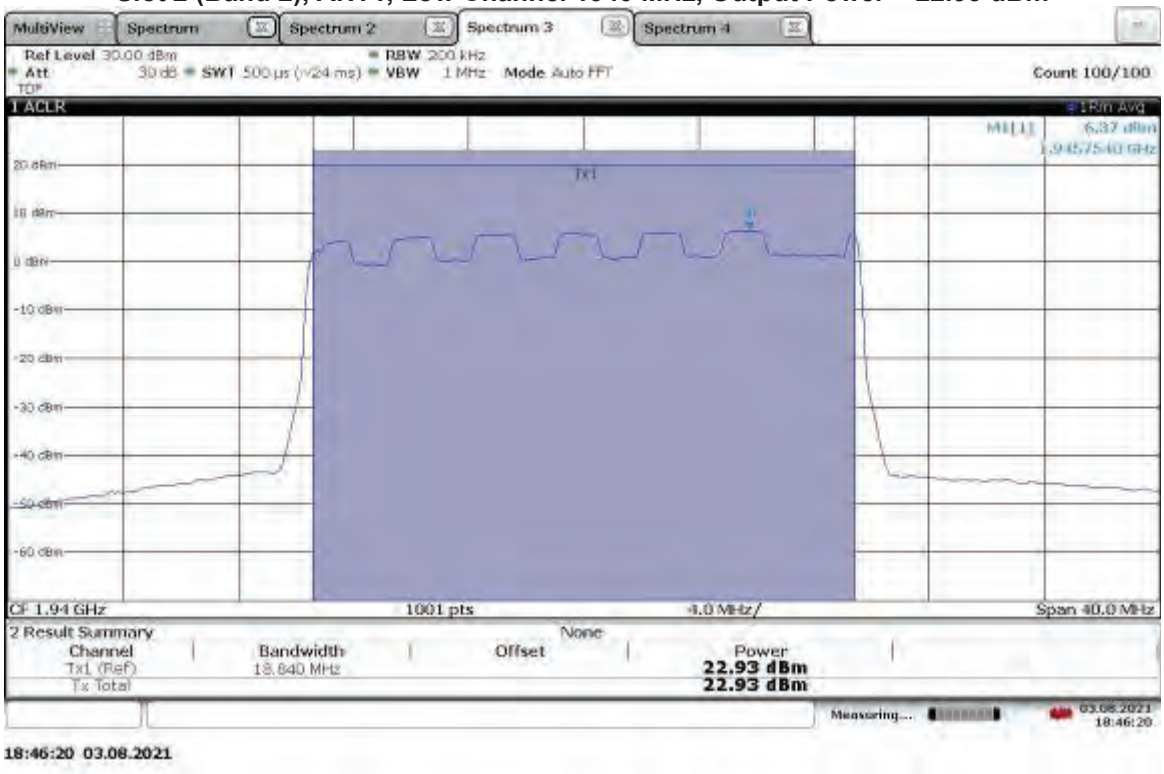
TM3.2-16QAM_15 MHz Bandwidth
Slot 2 (Band 2), ANT1, High Channel 1982.5 MHz, Output Power = 22.79 dBm



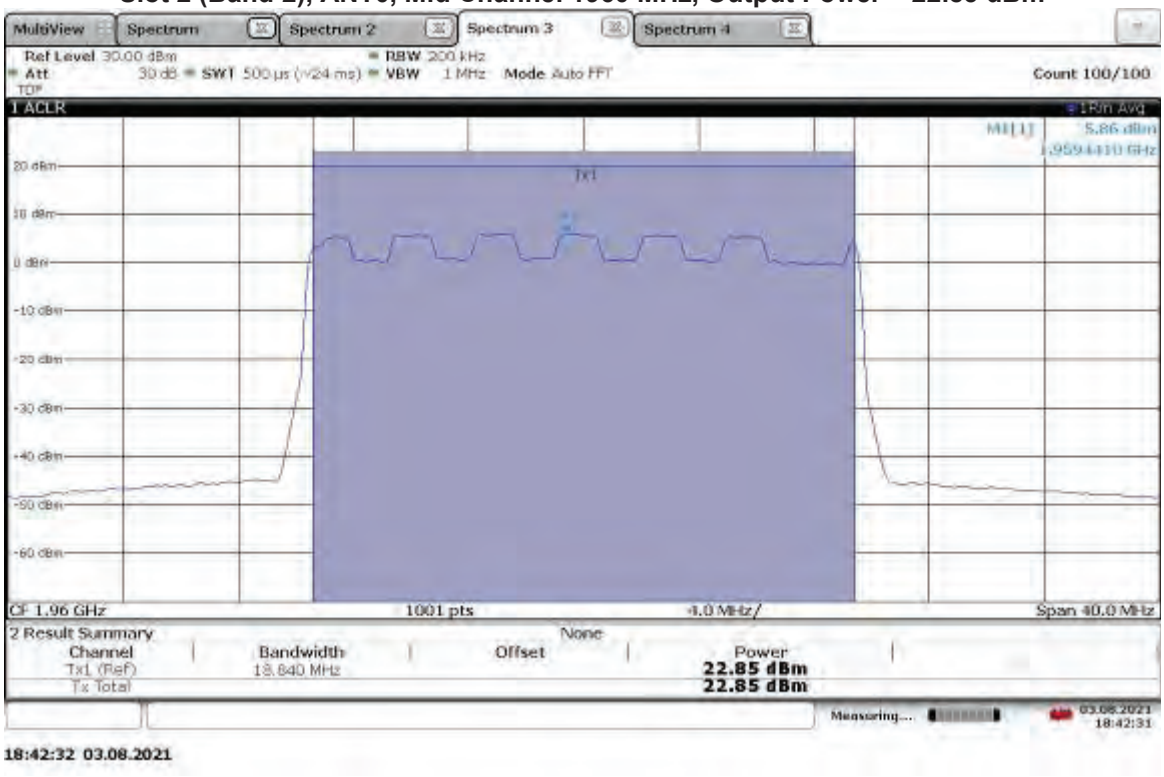
TM3.2-16QAM_20 MHz Bandwidth
Slot 2 (Band 2), ANT0, Low Channel 1940 MHz, Output Power = 22.95 dBm



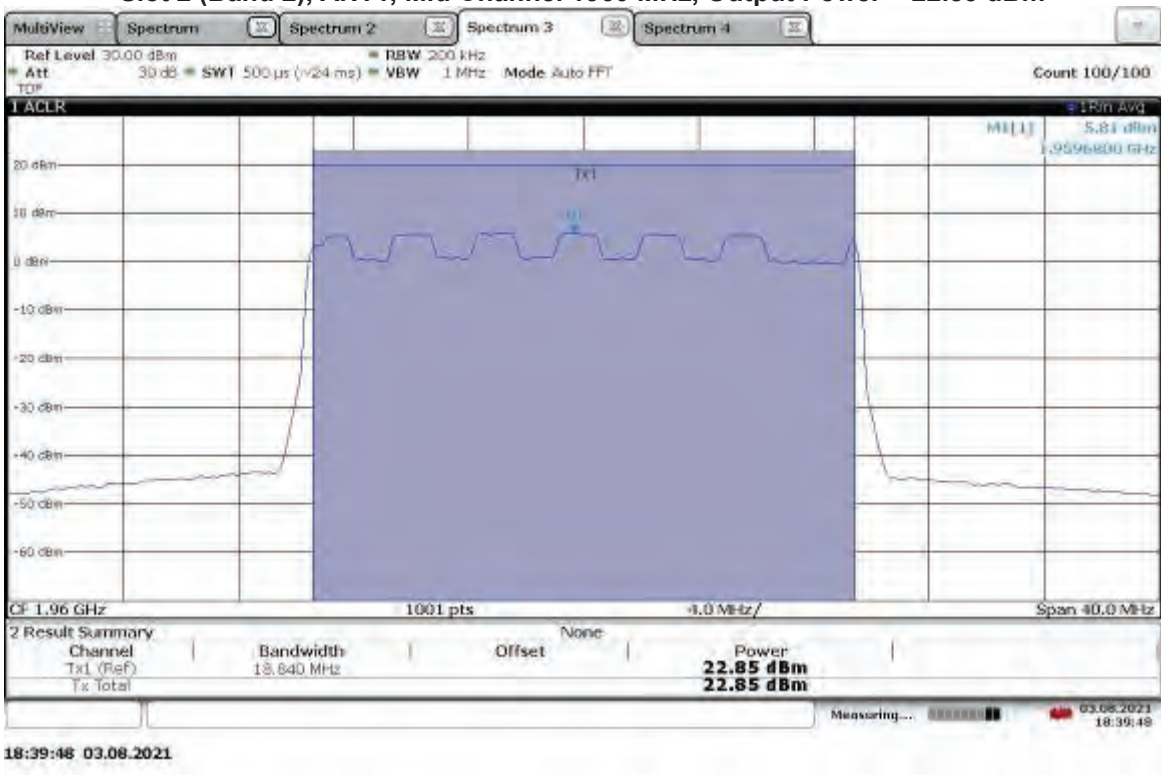
TM3.2-16QAM_20 MHz Bandwidth
Slot 2 (Band 2), ANT1, Low Channel 1940 MHz, Output Power = 22.93 dBm



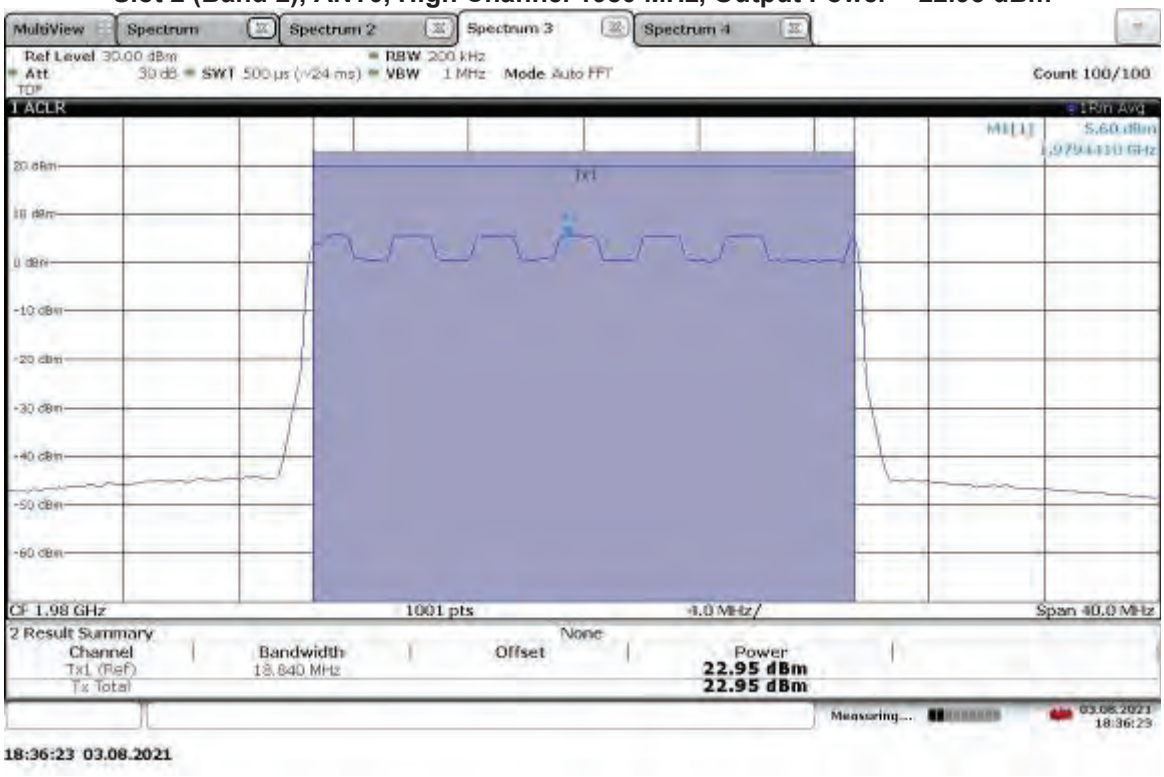
TM3.2-16QAM_20 MHz Bandwidth
Slot 2 (Band 2), ANT0, Mid Channel 1960 MHz, Output Power = 22.85 dBm



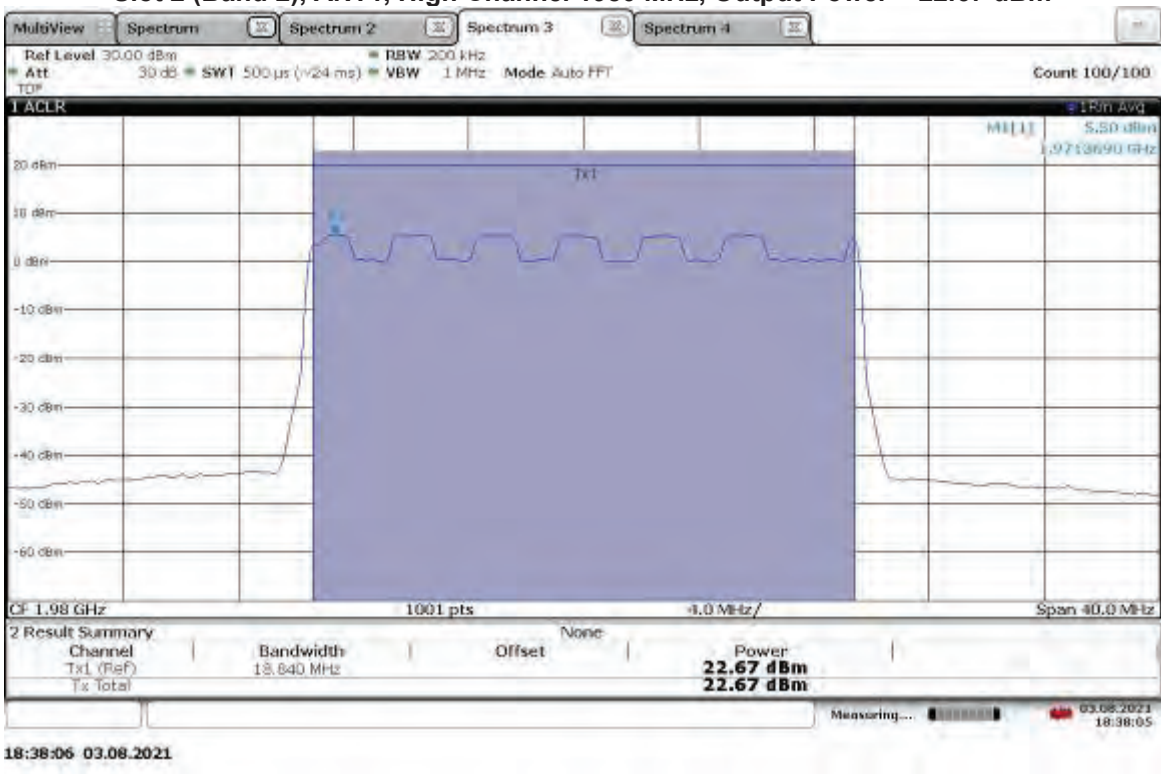
TM3.2-16QAM_20 MHz Bandwidth
Slot 2 (Band 2), ANT1, Mid Channel 1960 MHz, Output Power = 22.85 dBm



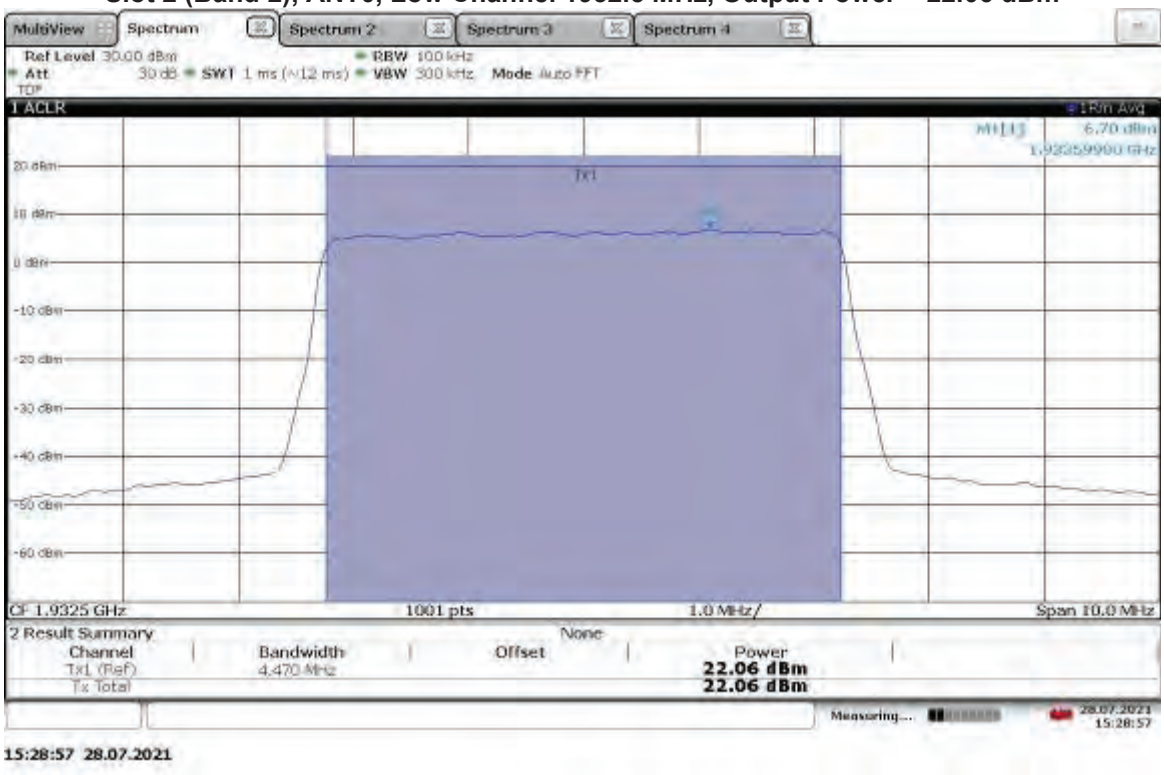
TM3.2-16QAM_20 MHz Bandwidth
Slot 2 (Band 2), ANT0, High Channel 1980 MHz, Output Power = 22.95 dBm



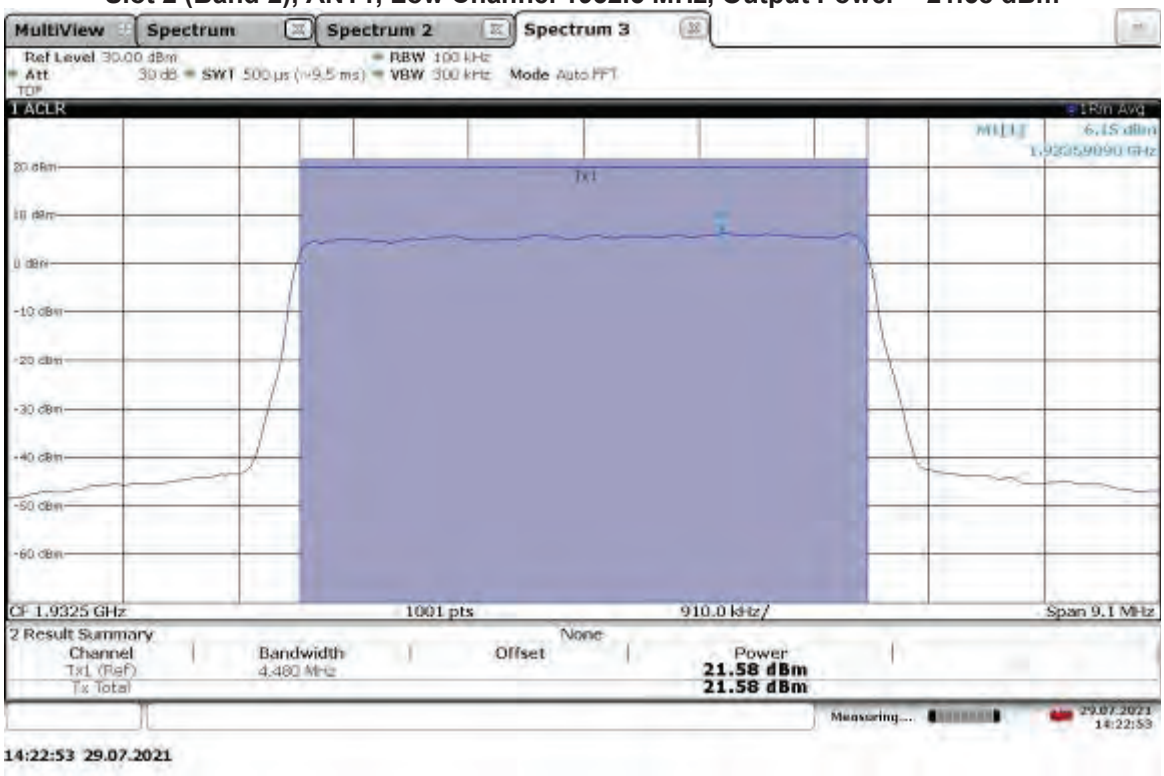
TM3.2-16QAM_20 MHz Bandwidth
Slot 2 (Band 2), ANT1, High Channel 1980 MHz, Output Power = 22.67 dBm



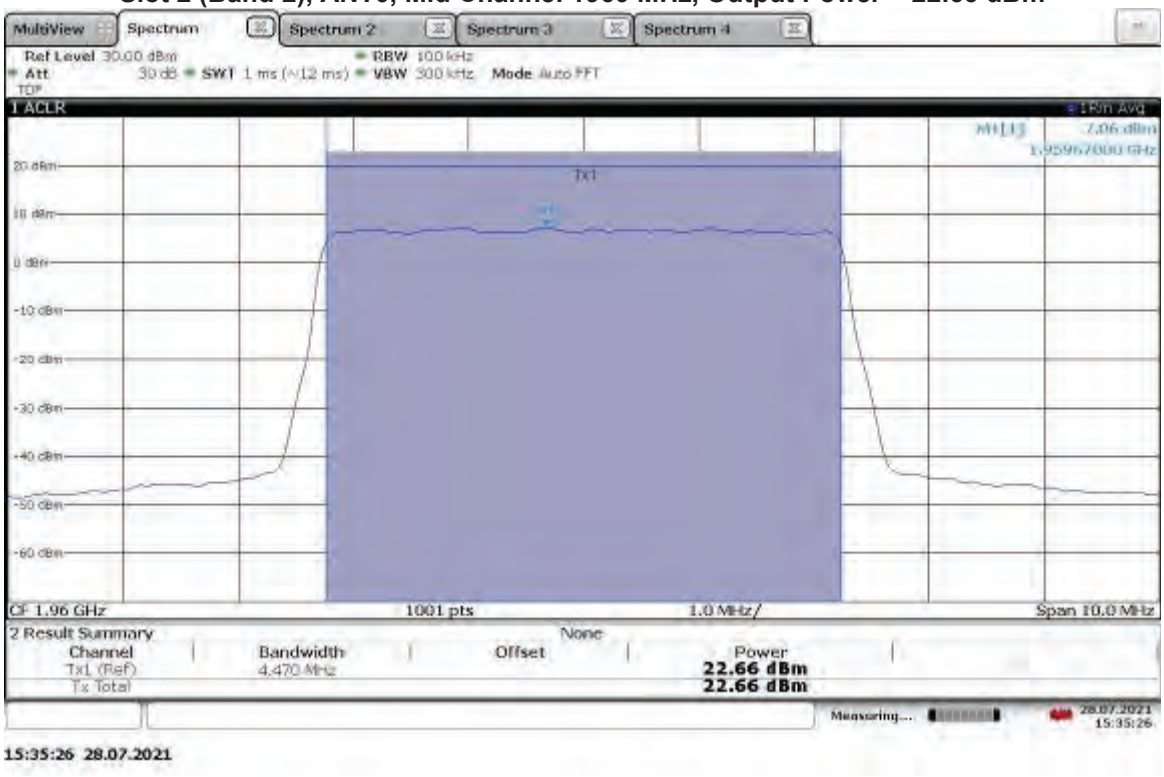
TM3.1-64QAM_5 MHz Bandwidth
Slot 2 (Band 2), ANT0, Low Channel 1932.5 MHz, Output Power = 22.06 dBm



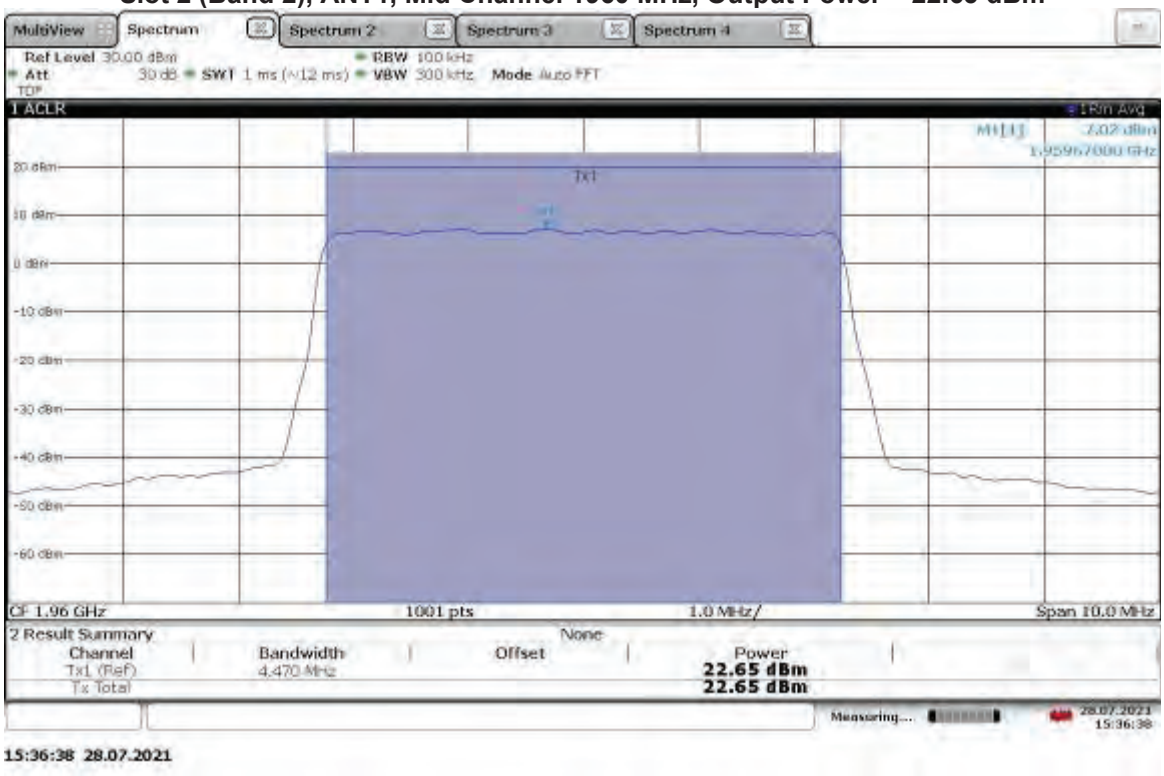
TM3.1-64QAM_5 MHz Bandwidth
Slot 2 (Band 2), ANT1, Low Channel 1932.5 MHz, Output Power = 21.58 dBm



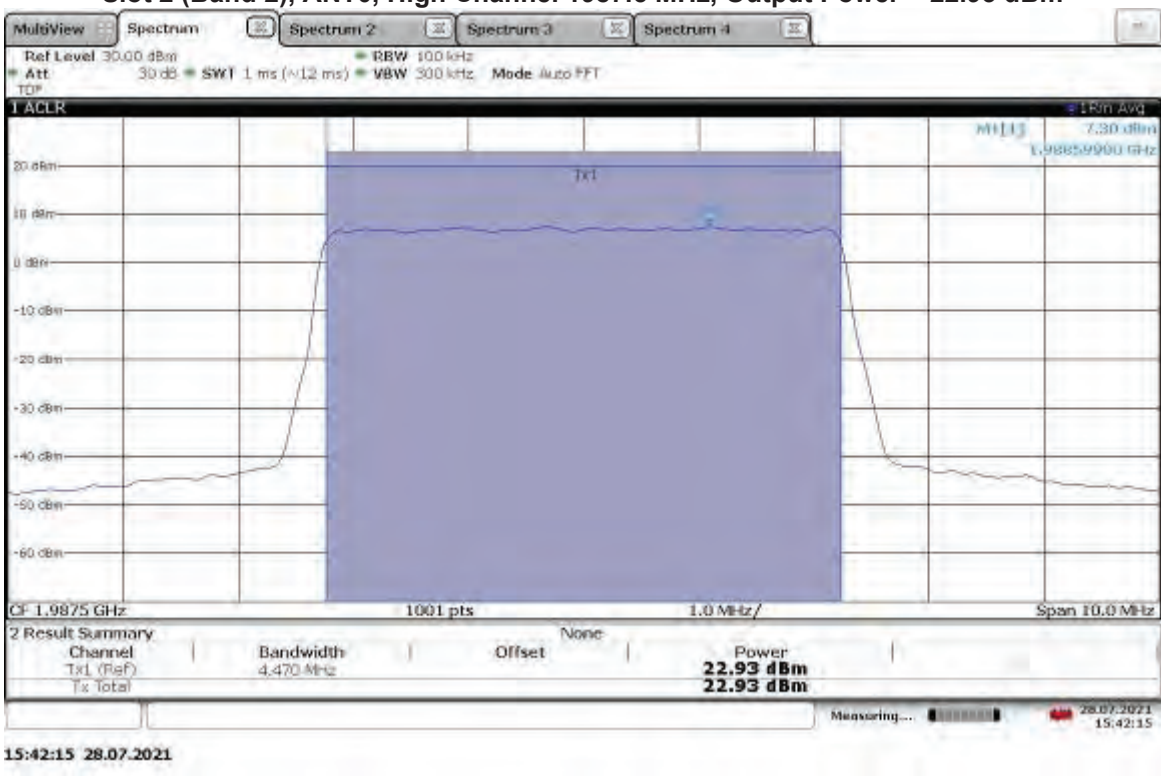
TM3.1-64QAM_5 MHz Bandwidth
Slot 2 (Band 2), ANT0, Mid Channel 1960 MHz, Output Power = 22.66 dBm



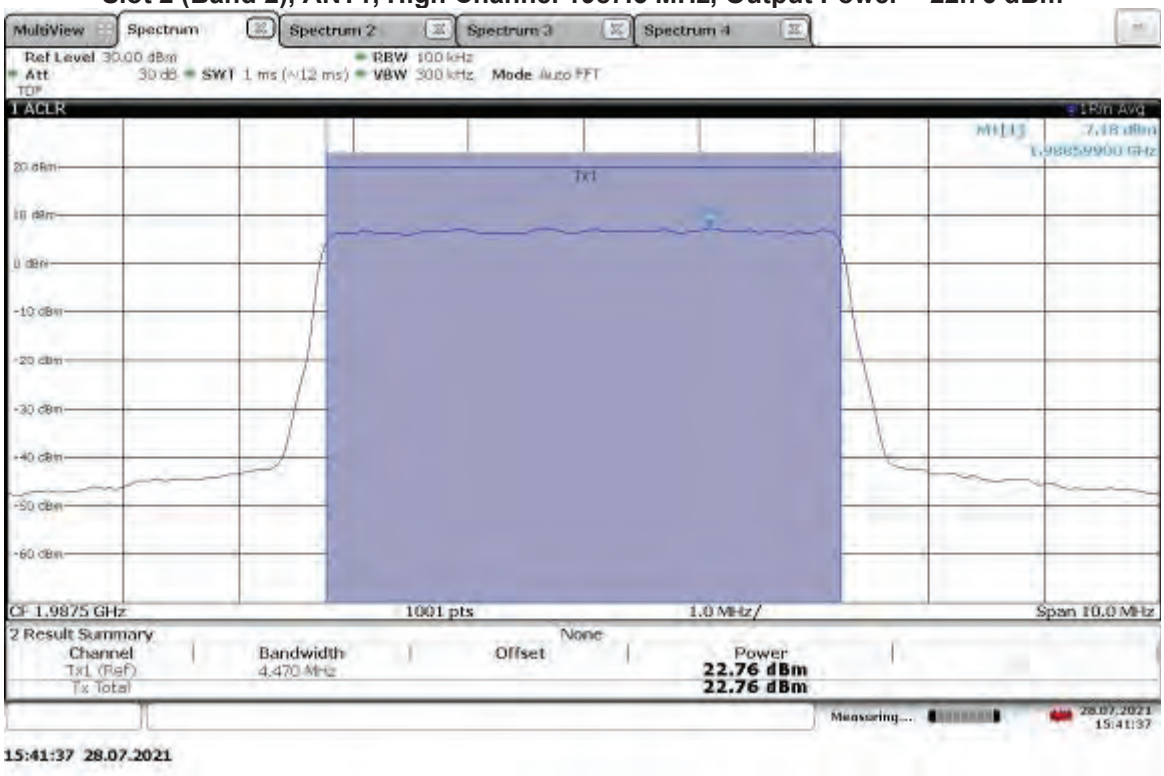
TM3.1-64QAM_5 MHz Bandwidth
Slot 2 (Band 2), ANT1, Mid Channel 1960 MHz, Output Power = 22.65 dBm



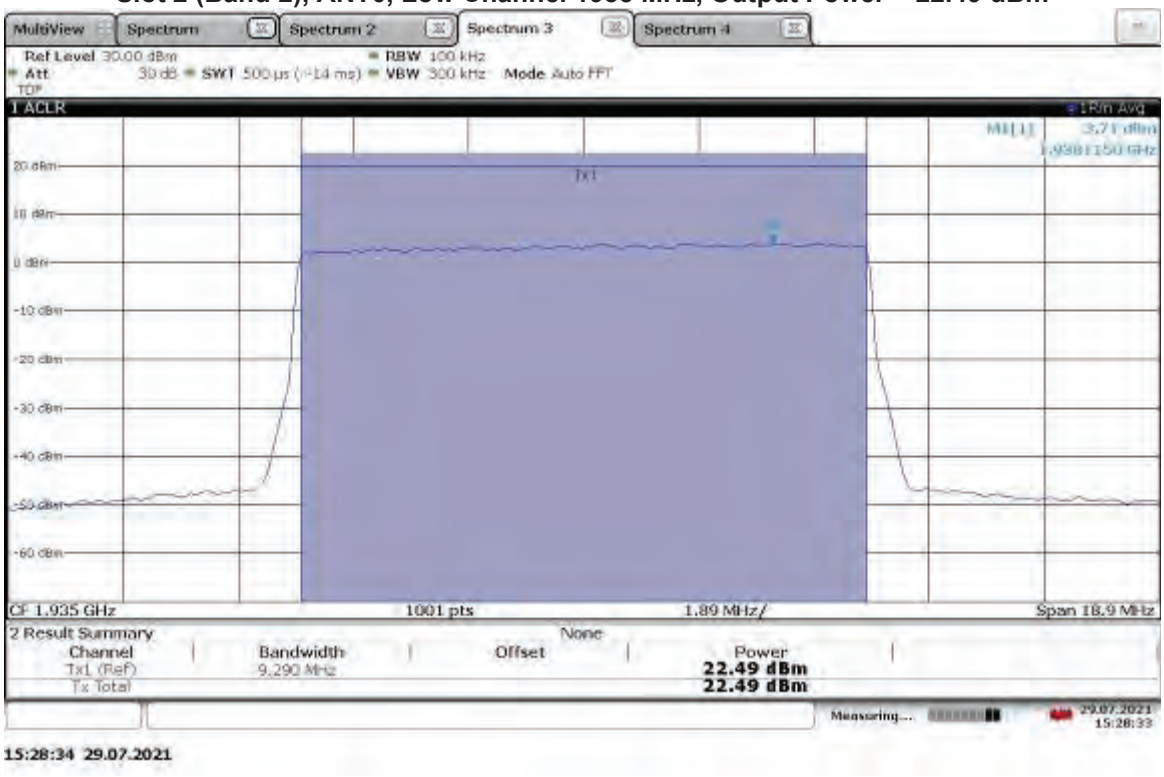
TM3.1-64QAM_5 MHz Bandwidth
Slot 2 (Band 2), ANT0, High Channel 1987.5 MHz, Output Power = 22.93 dBm



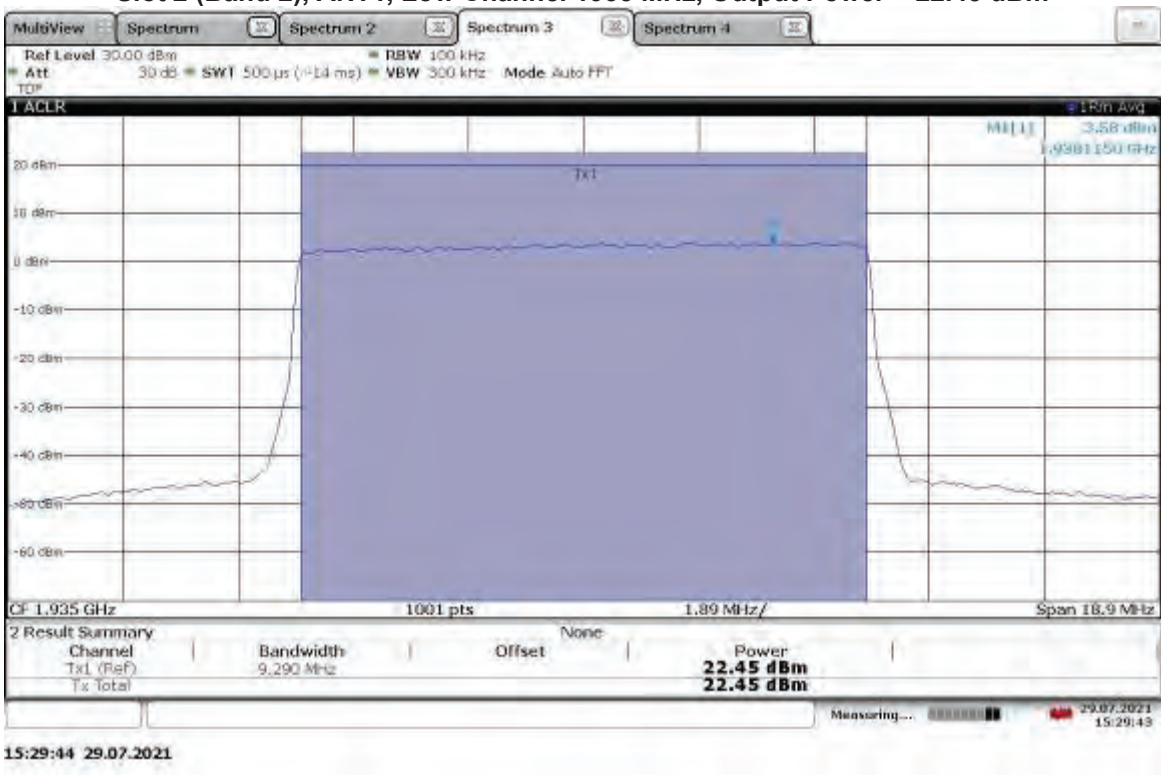
TM3.1-64QAM_5 MHz Bandwidth
Slot 2 (Band 2), ANT1, High Channel 1987.5 MHz, Output Power = 22.76 dBm



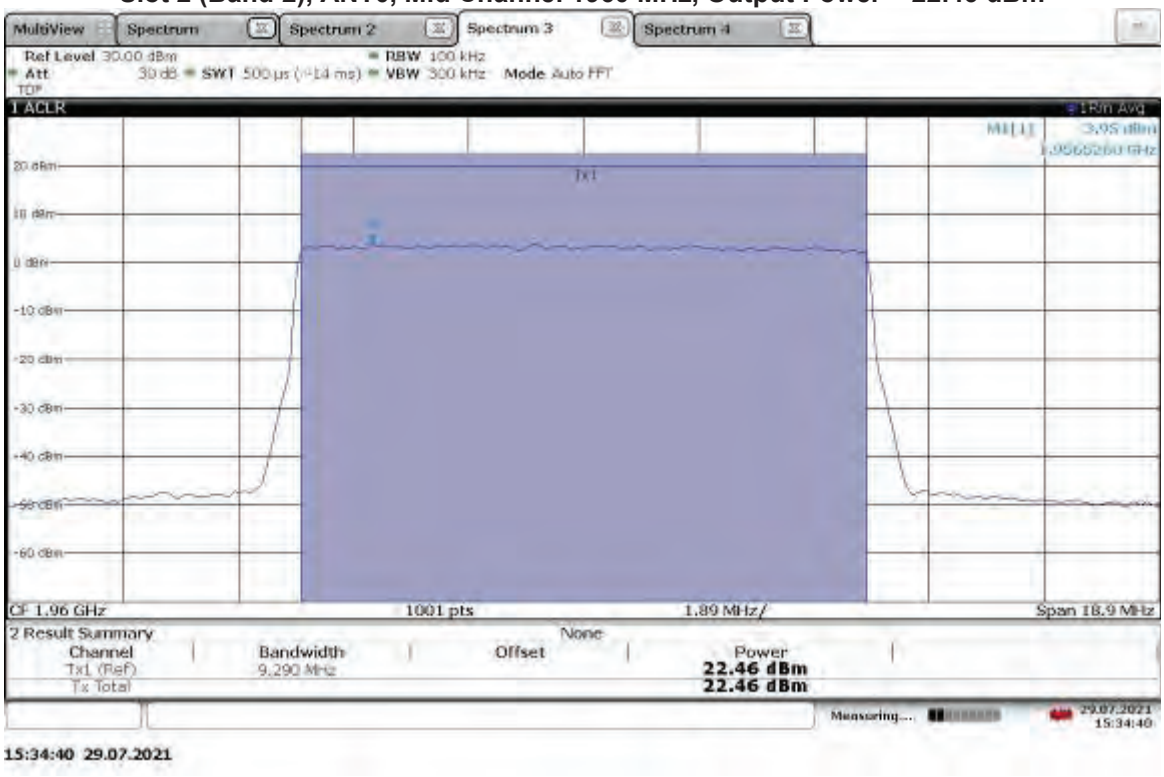
TM3.1-64QAM_10 MHz Bandwidth
Slot 2 (Band 2), ANT0, Low Channel 1935 MHz, Output Power = 22.49 dBm



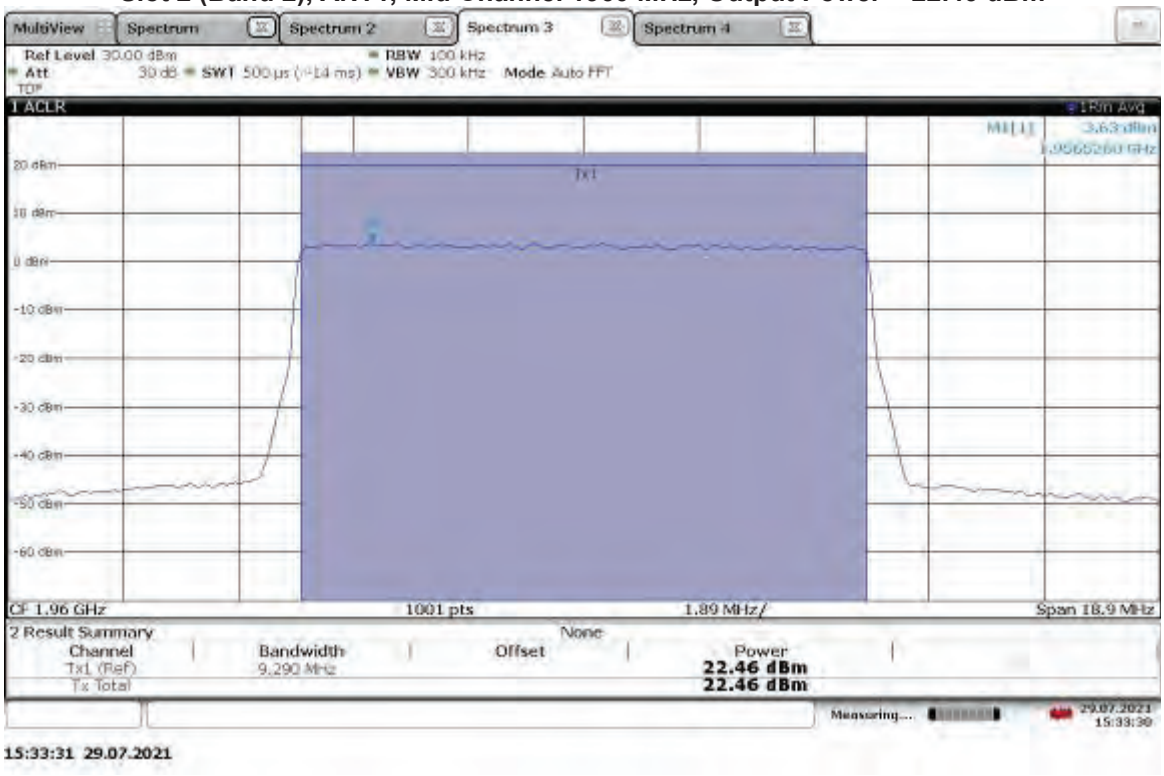
TM3.1-64QAM_10 MHz Bandwidth
Slot 2 (Band 2), ANT1, Low Channel 1935 MHz, Output Power = 22.45 dBm



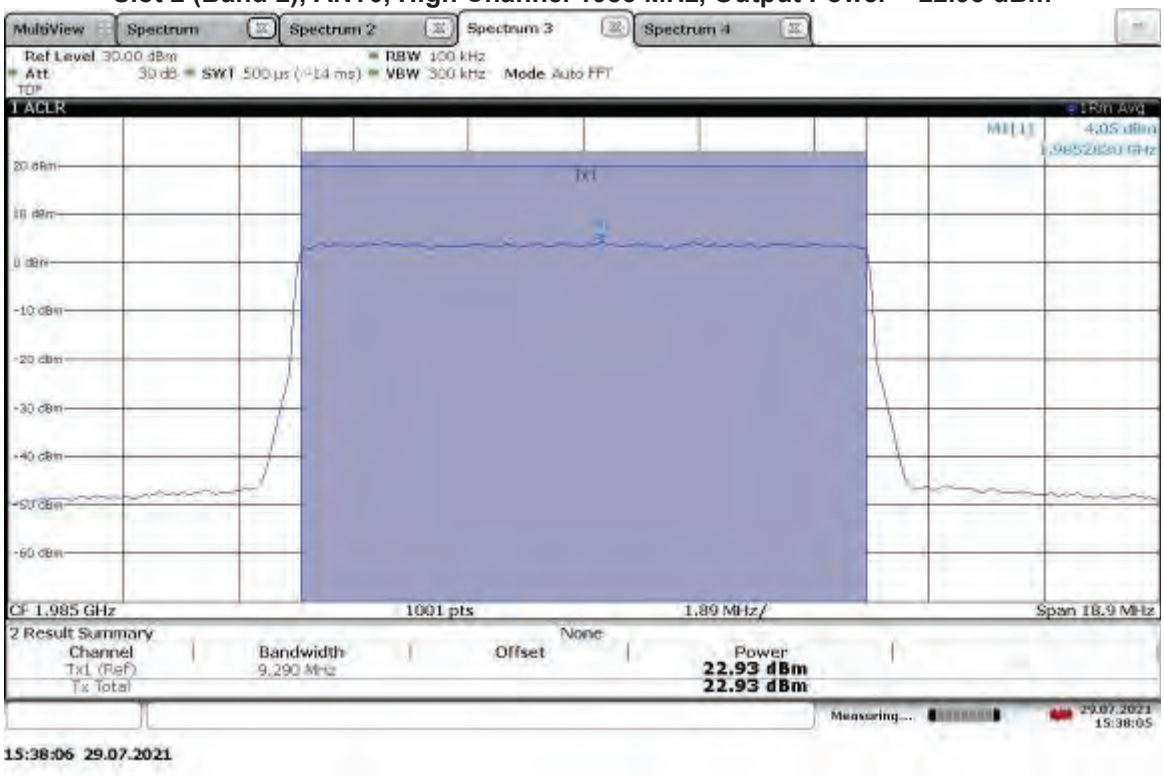
TM3.1-64QAM_10 MHz Bandwidth
Slot 2 (Band 2), ANT0, Mid Channel 1960 MHz, Output Power = 22.46 dBm



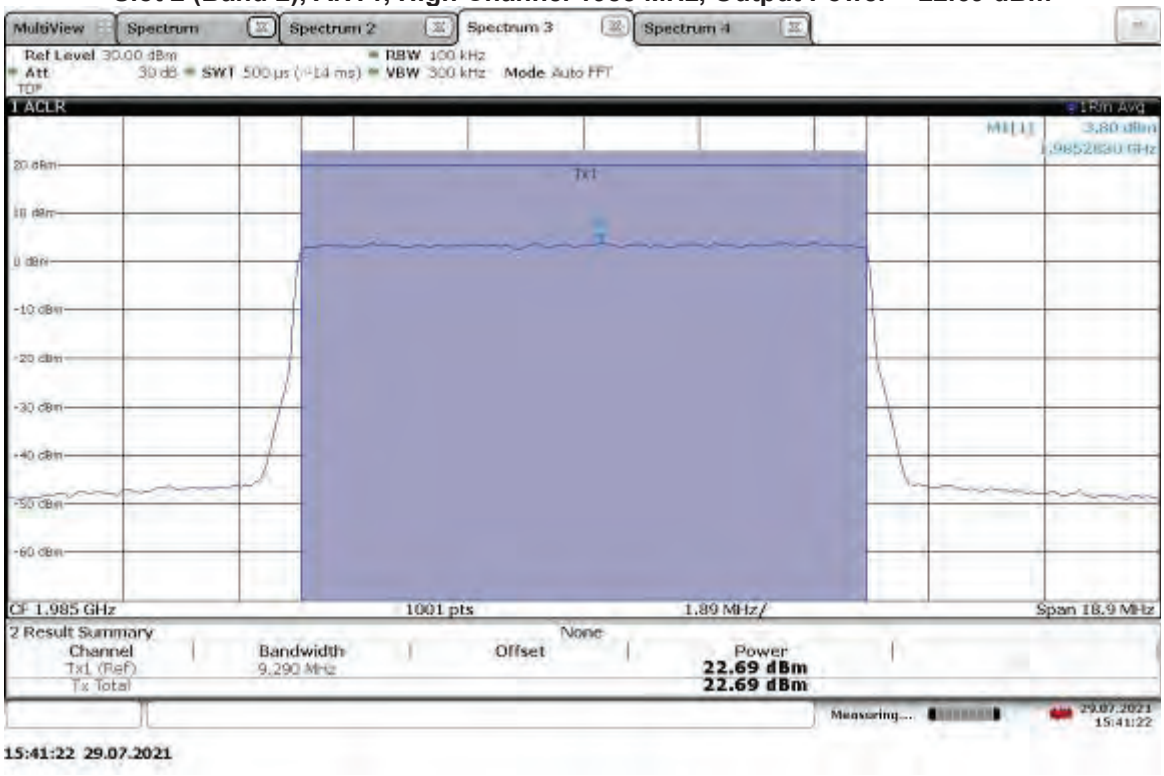
TM3.1-64QAM_10 MHz Bandwidth
Slot 2 (Band 2), ANT1, Mid Channel 1960 MHz, Output Power = 22.46 dBm



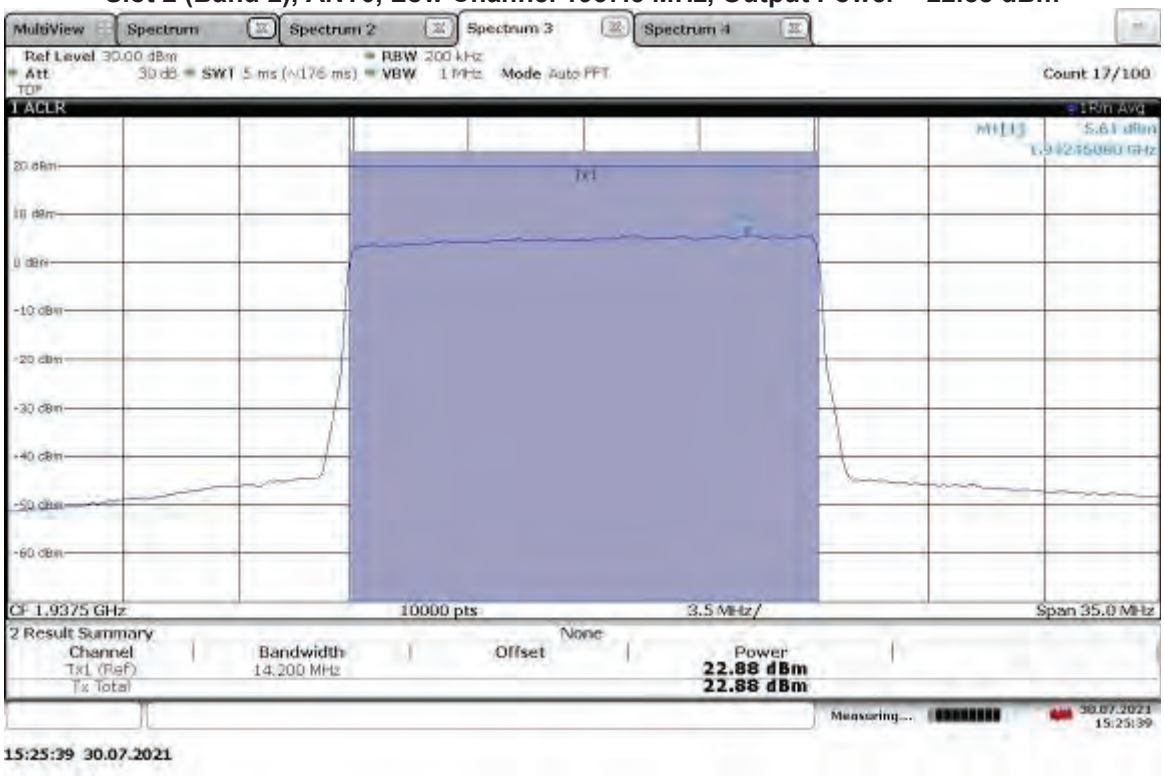
TM3.1-64QAM_10 MHz Bandwidth
Slot 2 (Band 2), ANT0, High Channel 1985 MHz, Output Power = 22.93 dBm



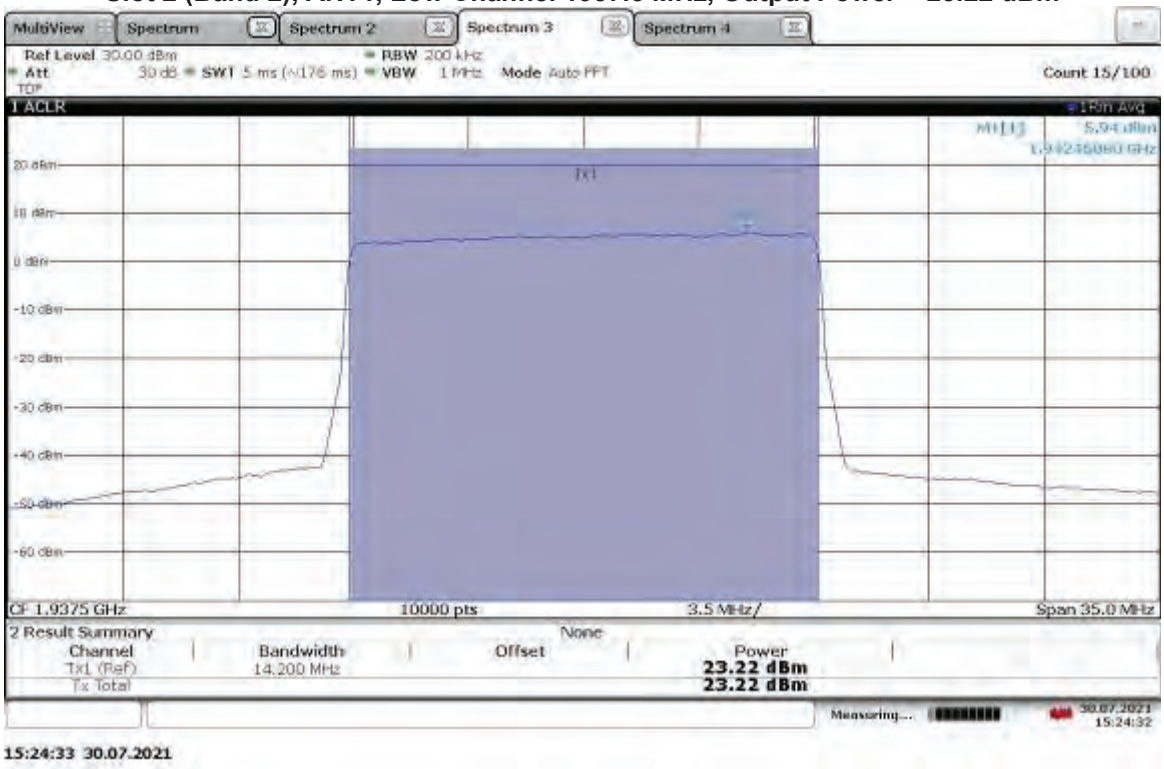
TM3.1-64QAM_10 MHz Bandwidth
Slot 2 (Band 2), ANT1, High Channel 1985 MHz, Output Power = 22.69 dBm



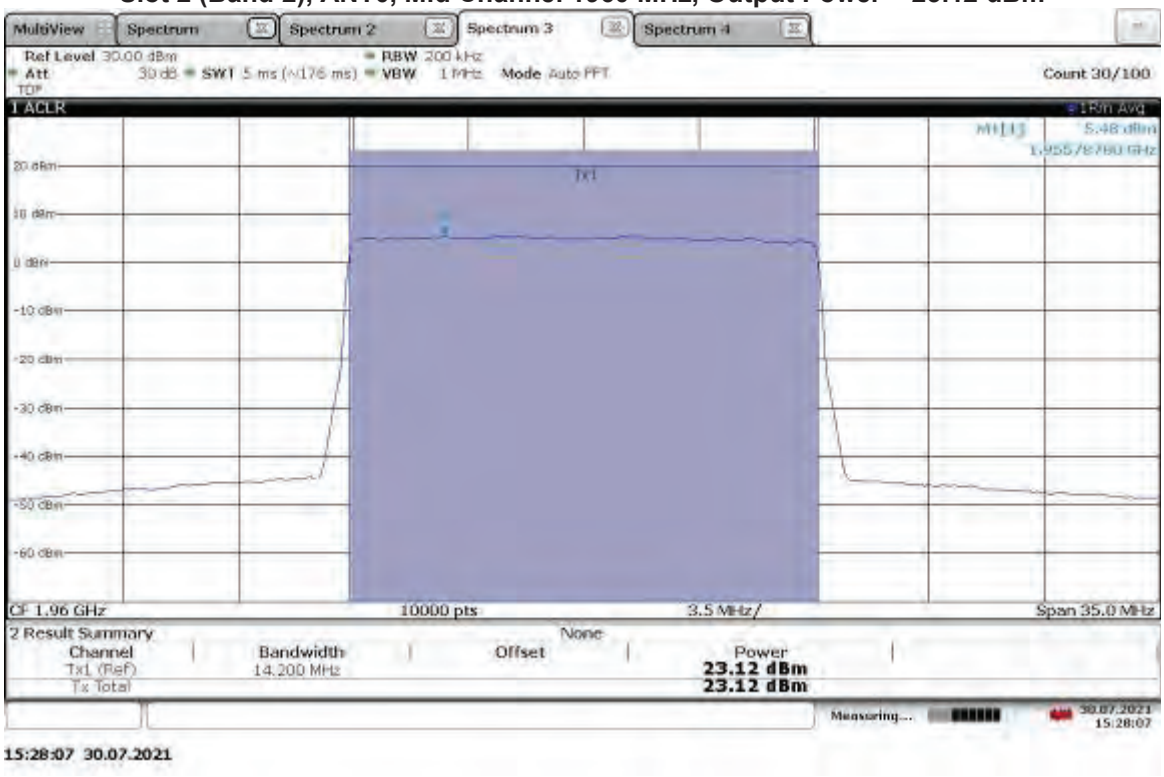
TM3.1-64QAM_15 MHz Bandwidth
Slot 2 (Band 2), ANT0, Low Channel 1937.5 MHz, Output Power = 22.88 dBm



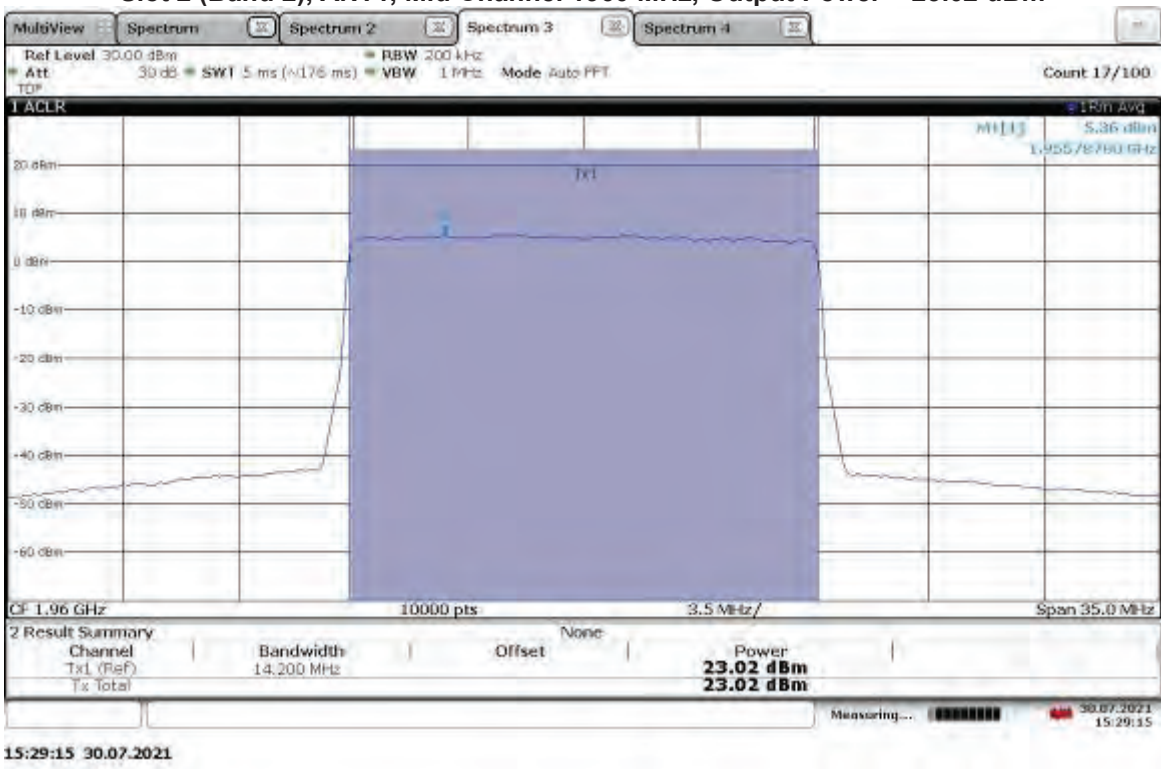
TM3.1-64QAM_15 MHz Bandwidth
Slot 2 (Band 2), ANT1, Low Channel 1937.5 MHz, Output Power = 23.22 dBm



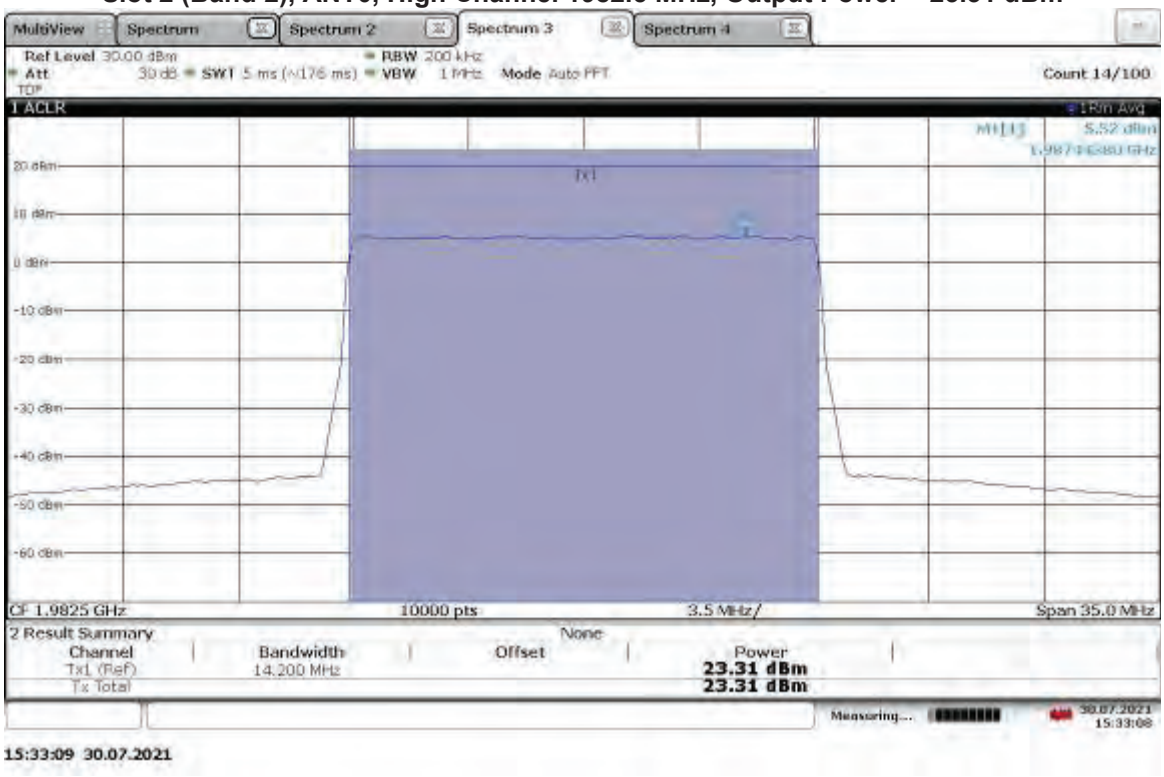
TM3.1-64QAM_15 MHz Bandwidth
Slot 2 (Band 2), ANT0, Mid Channel 1960 MHz, Output Power = 23.12 dBm



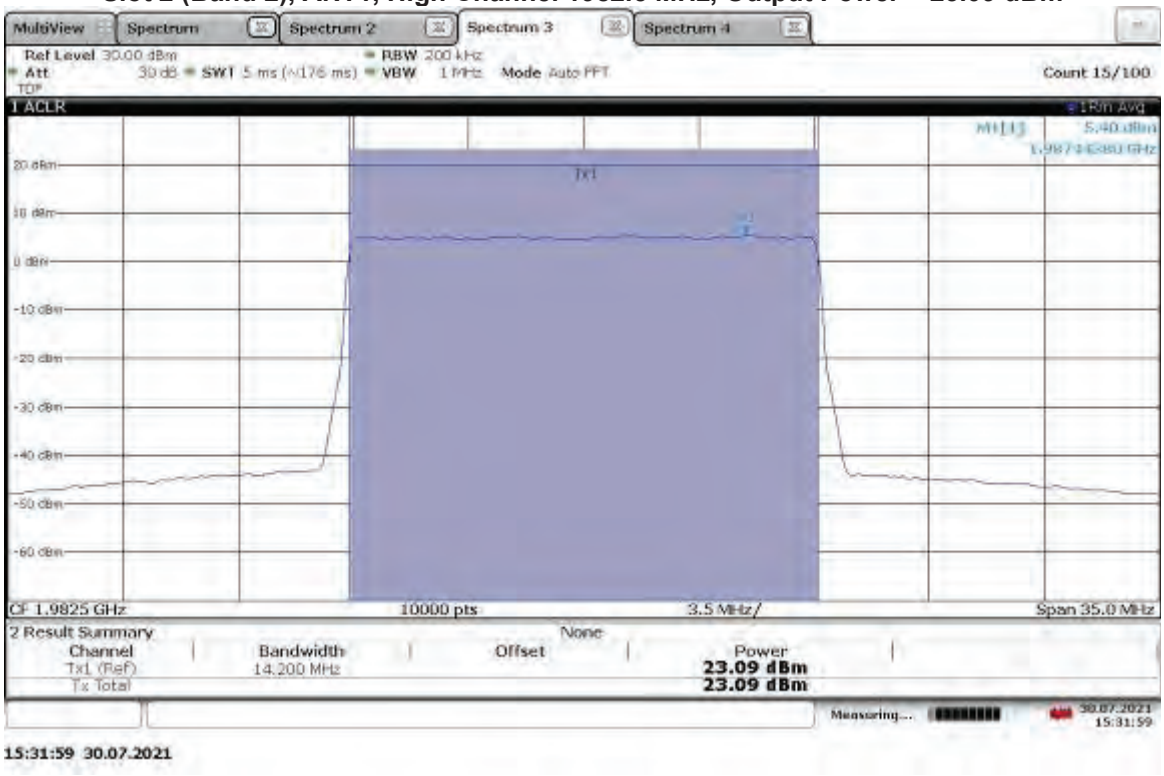
TM3.1-64QAM_15 MHz Bandwidth
Slot 2 (Band 2), ANT1, Mid Channel 1960 MHz, Output Power = 23.02 dBm



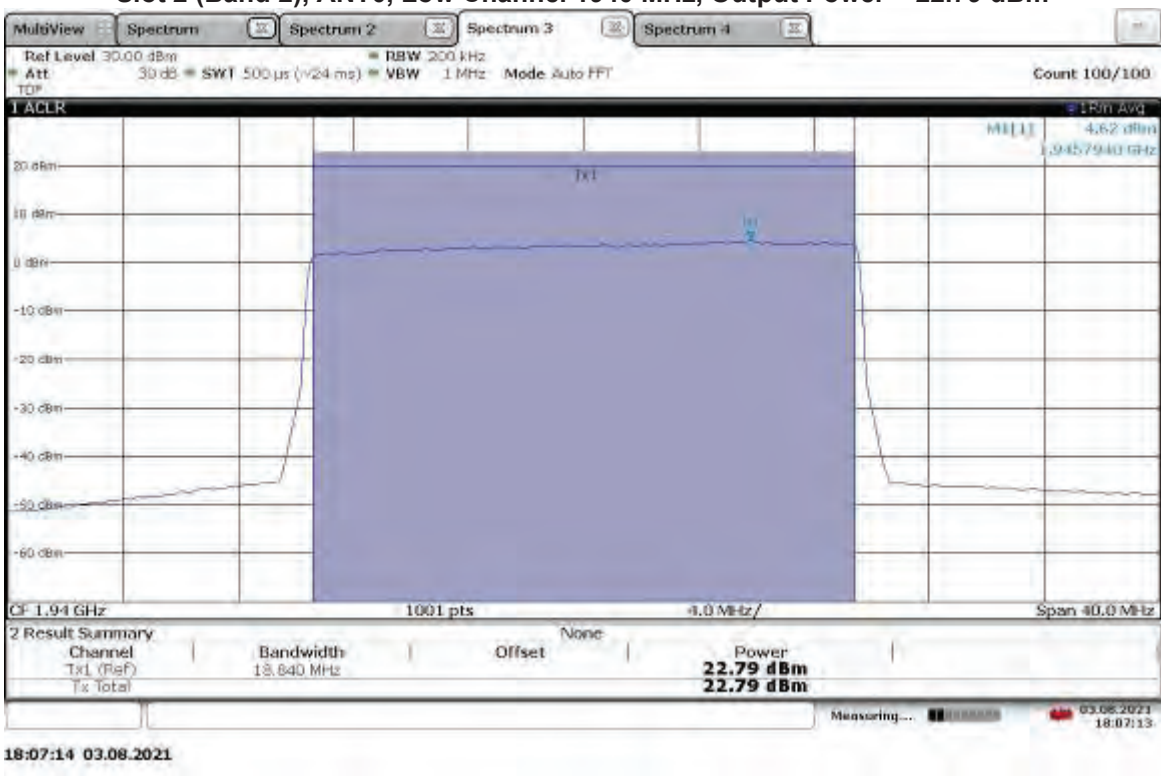
TM3.1-64QAM_15 MHz Bandwidth
Slot 2 (Band 2), ANT0, High Channel 1982.5 MHz, Output Power = 23.31 dBm



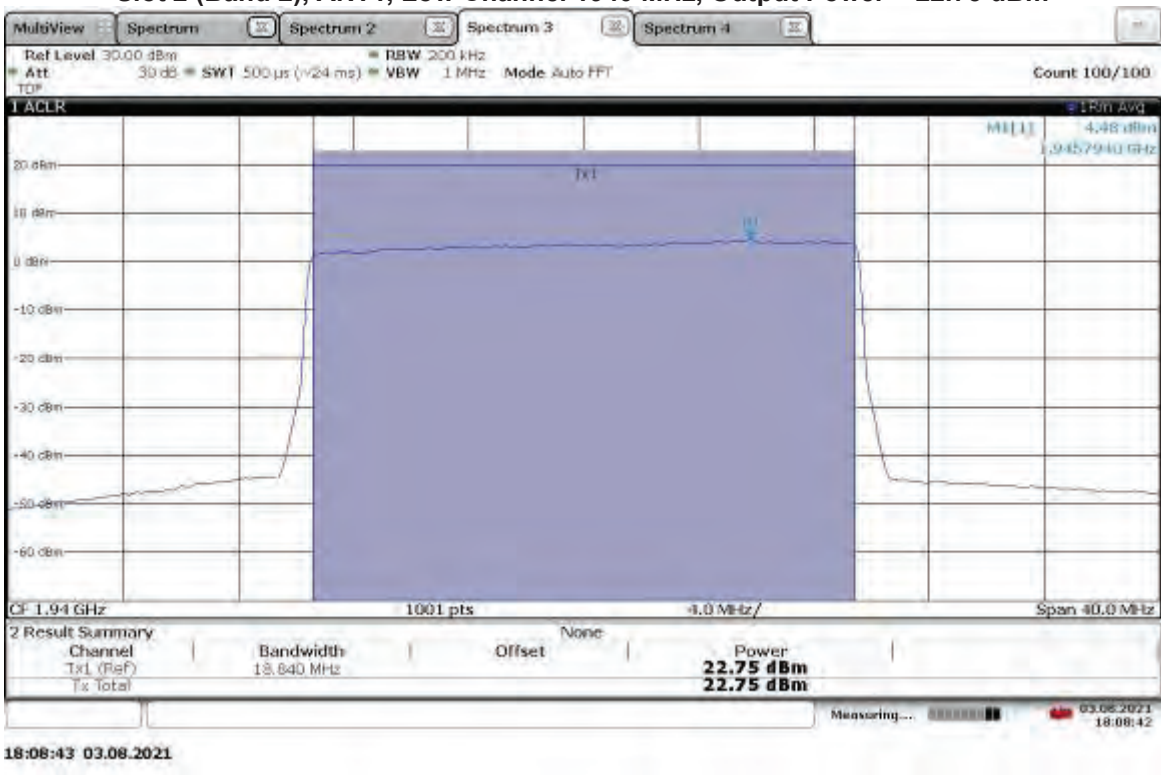
TM3.1-64QAM_15 MHz Bandwidth
Slot 2 (Band 2), ANT1, High Channel 1982.5 MHz, Output Power = 23.09 dBm



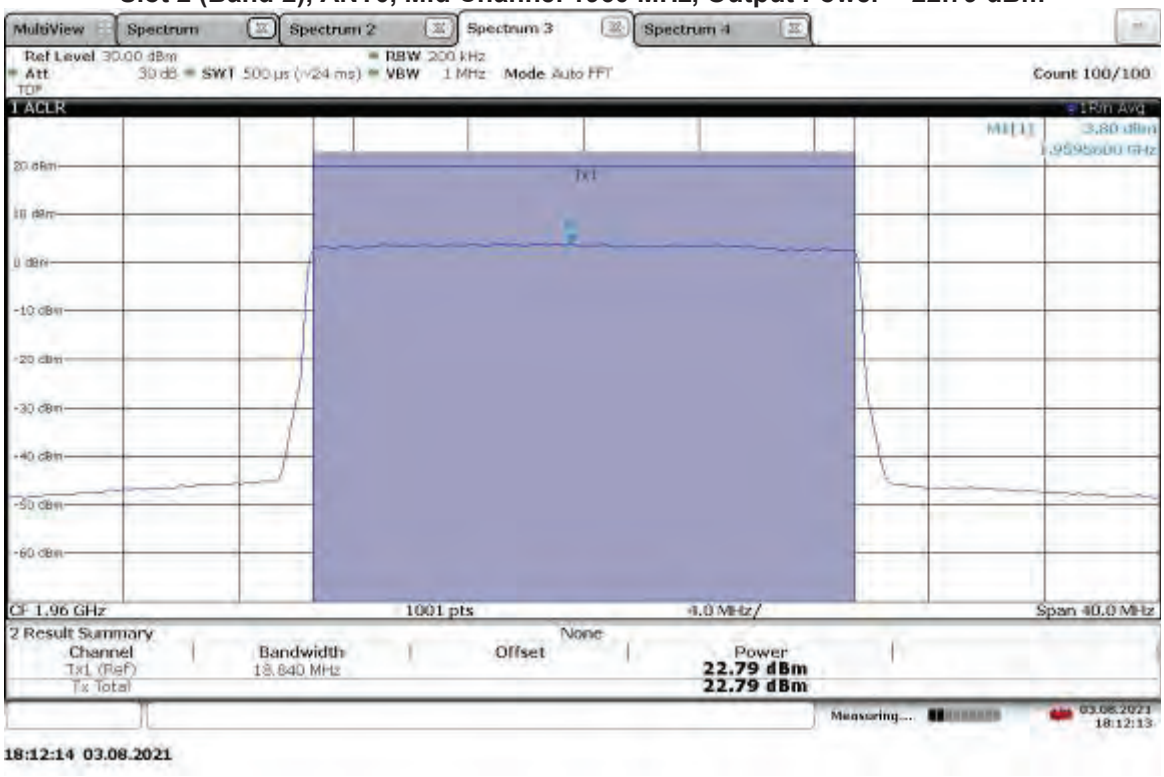
TM3.1-64QAM_20 MHz Bandwidth
Slot 2 (Band 2), ANT0, Low Channel 1940 MHz, Output Power = 22.79 dBm



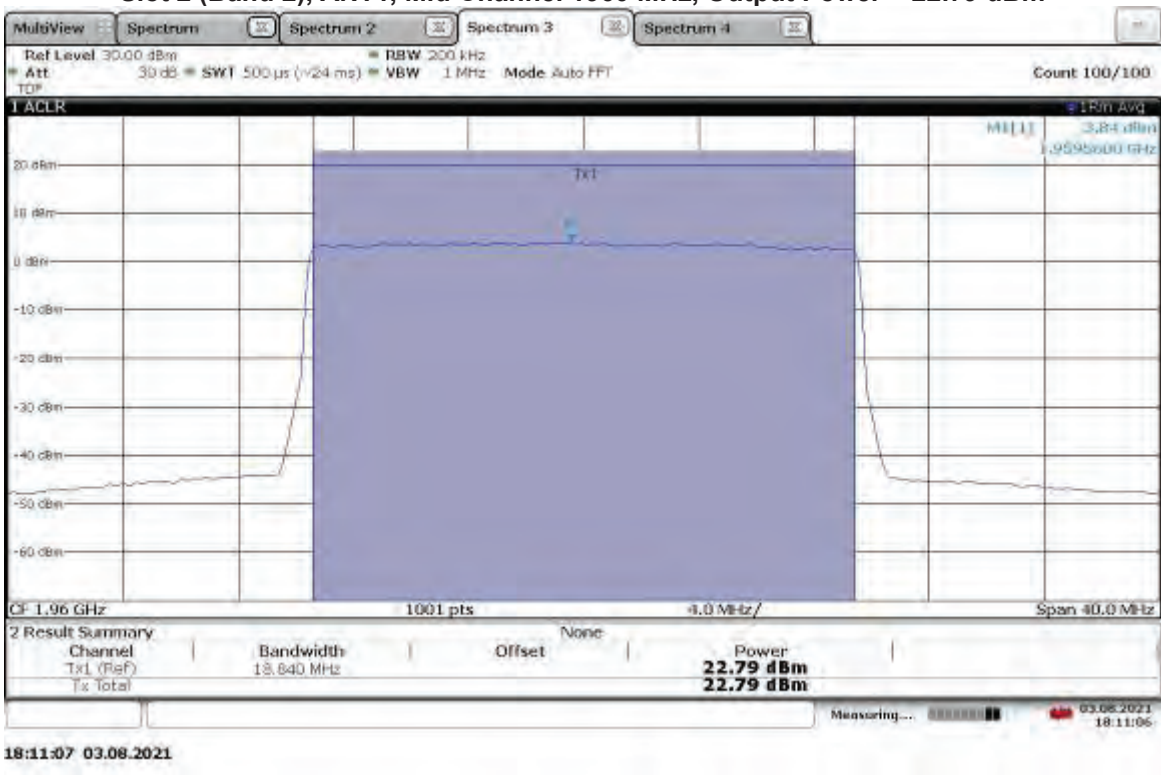
TM3.1-64QAM_20 MHz Bandwidth
Slot 2 (Band 2), ANT1, Low Channel 1940 MHz, Output Power = 22.75 dBm



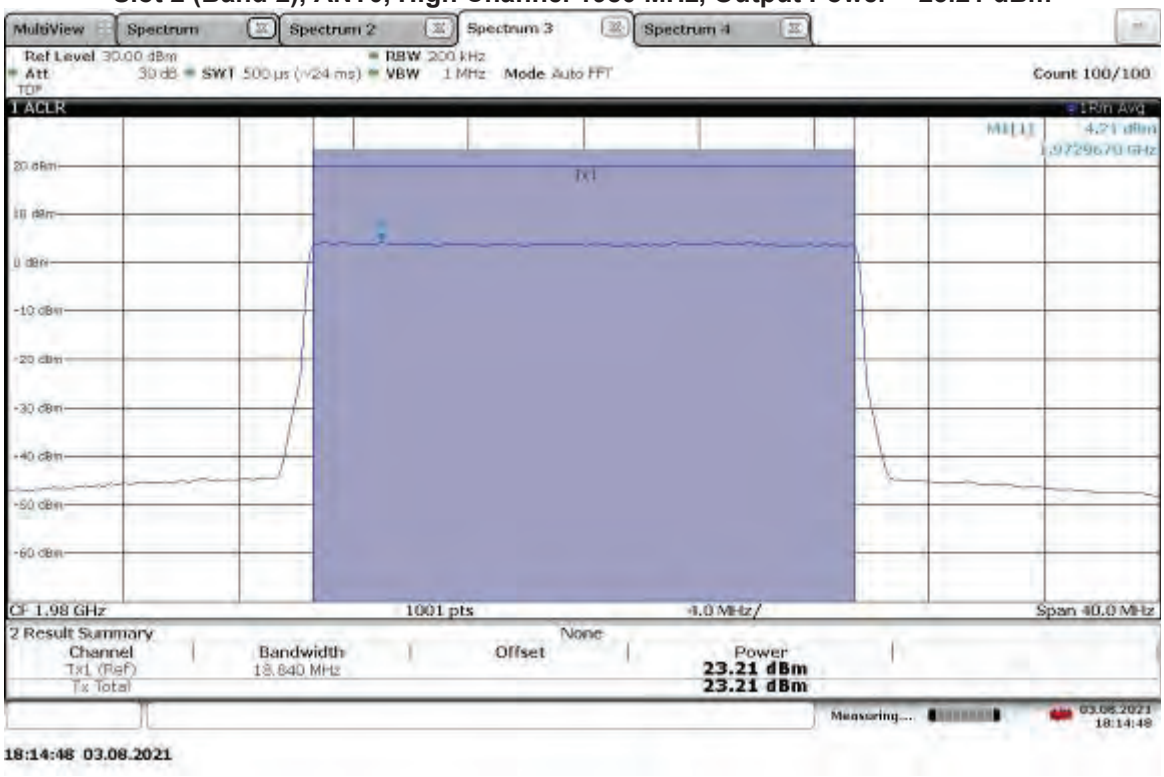
TM3.1-64QAM_20 MHz Bandwidth
Slot 2 (Band 2), ANT0, Mid Channel 1960 MHz, Output Power = 22.79 dBm



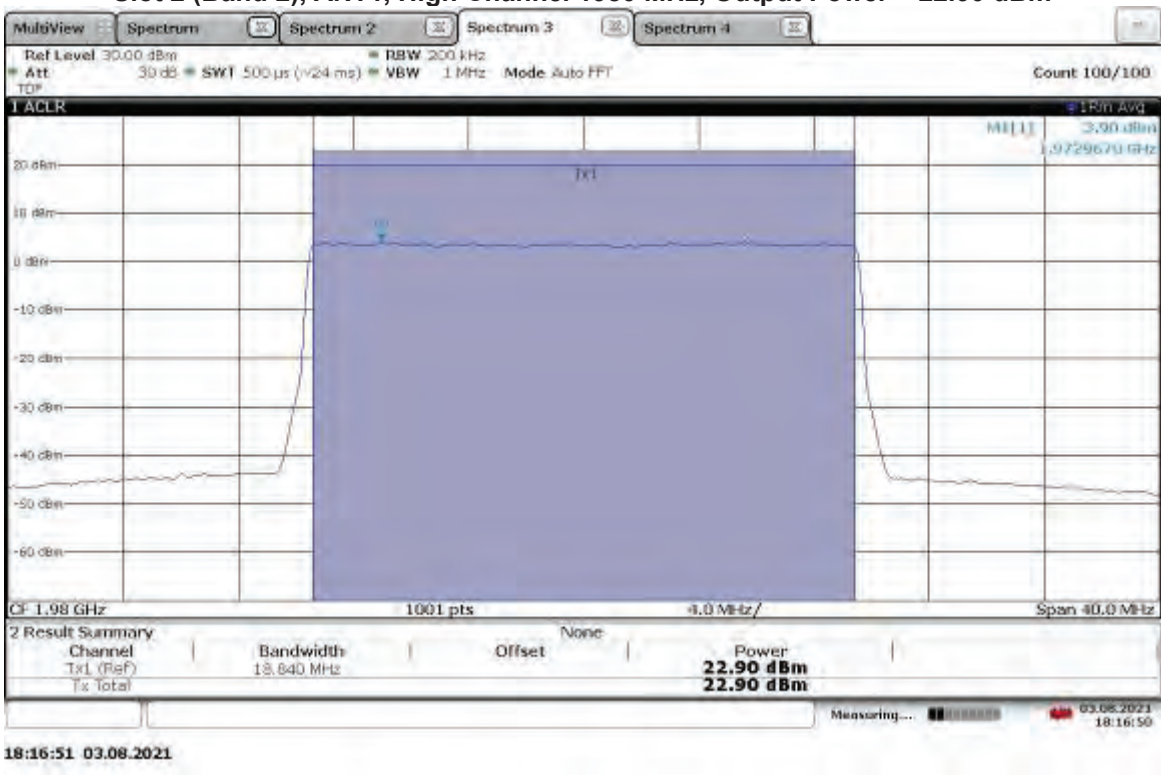
TM3.1-64QAM_20 MHz Bandwidth
Slot 2 (Band 2), ANT1, Mid Channel 1960 MHz, Output Power = 22.79 dBm



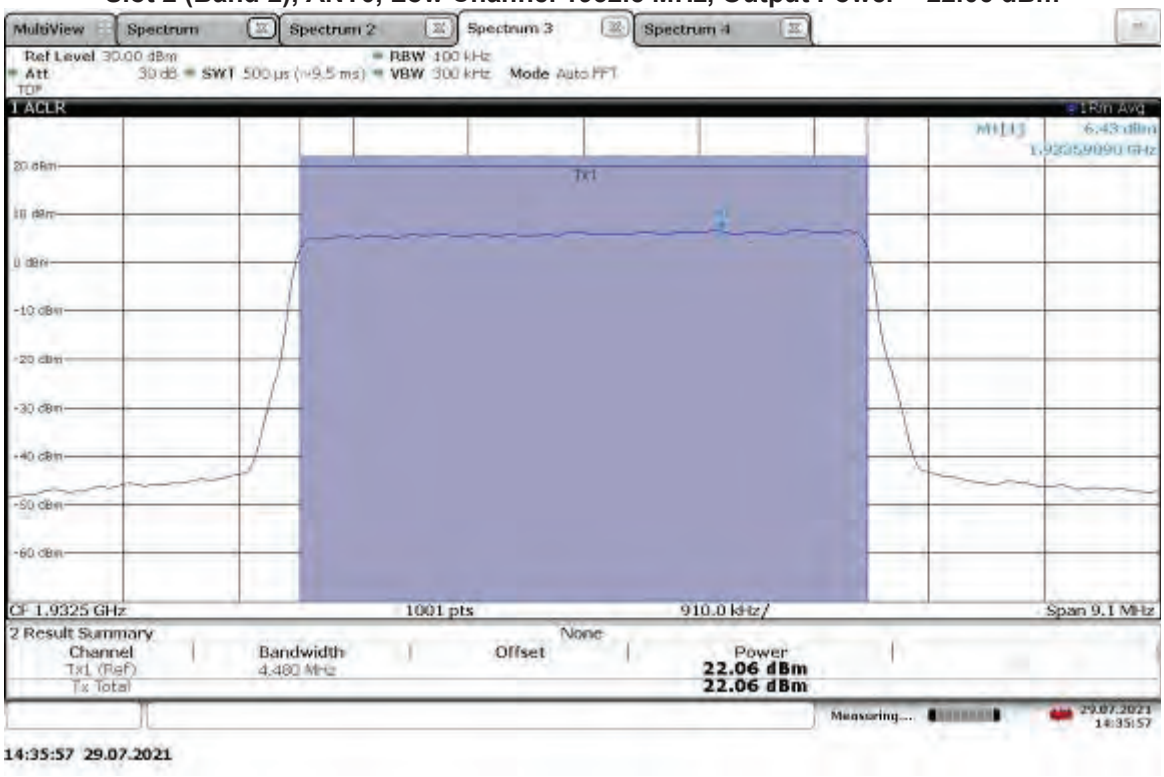
TM3.1-64QAM_20 MHz Bandwidth
Slot 2 (Band 2), ANT0, High Channel 1980 MHz, Output Power = 23.21 dBm



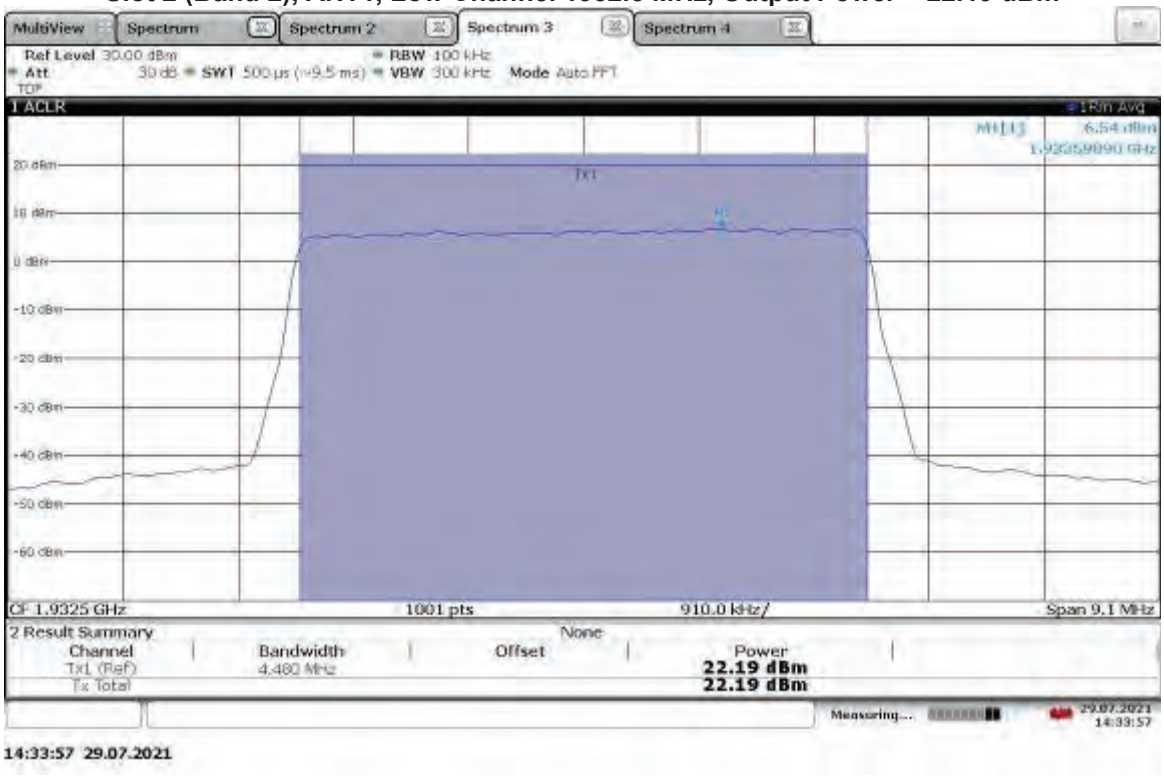
TM3.1-64QAM_20 MHz Bandwidth
Slot 2 (Band 2), ANT1, High Channel 1980 MHz, Output Power = 22.90 dBm



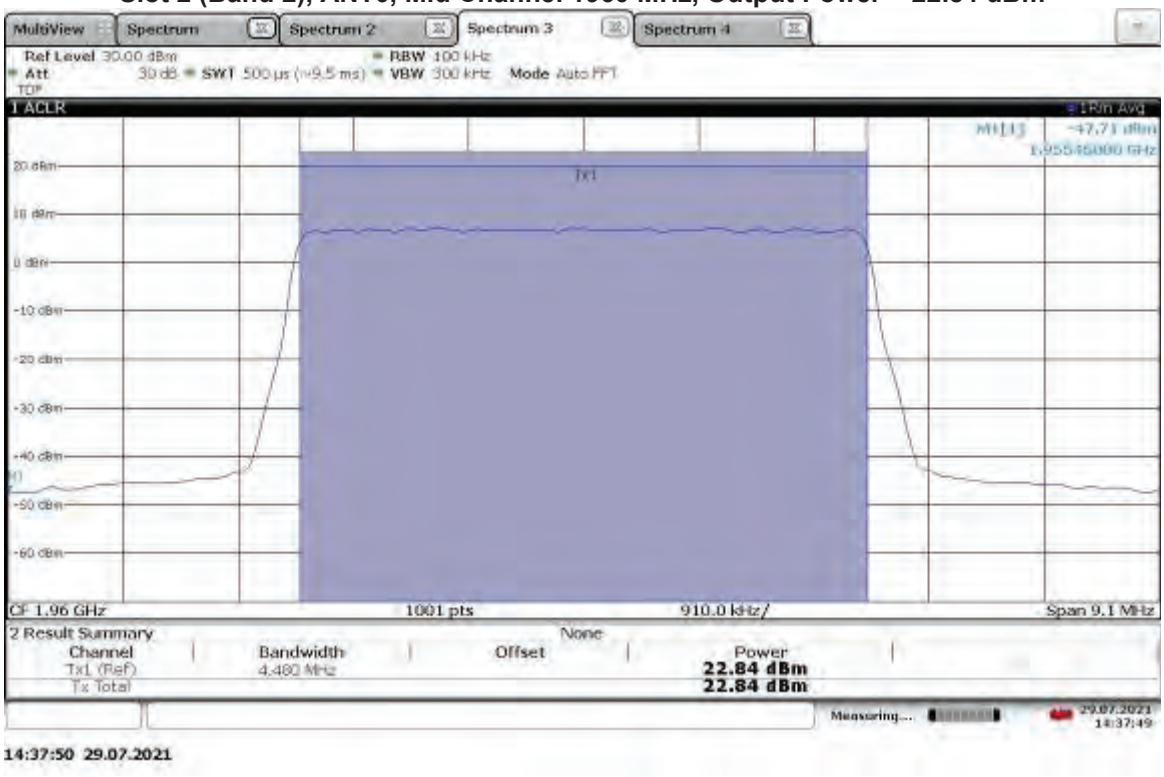
TM3.1a-256QAM _5 MHz Bandwidth
Slot 2 (Band 2), ANT0, Low Channel 1932.5 MHz, Output Power = 22.06 dBm



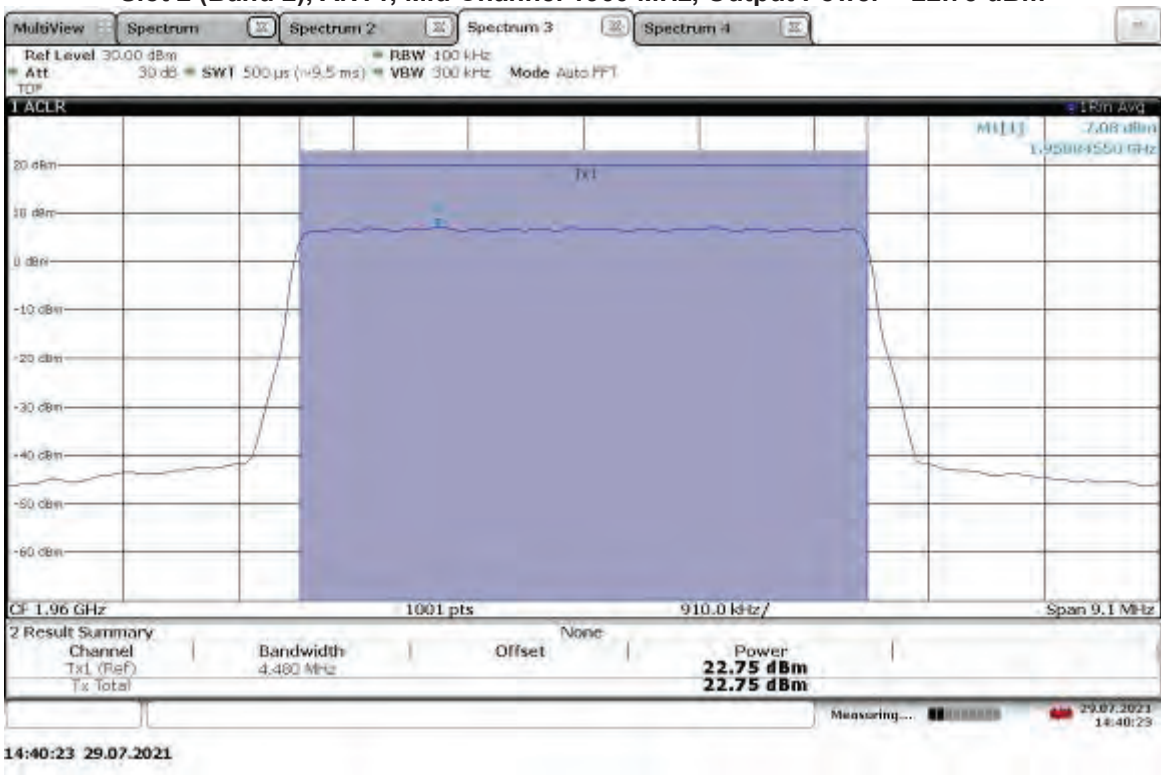
TM3.1a-256QAM _5 MHz Bandwidth
Slot 2 (Band 2), ANT1, Low Channel 1932.5 MHz, Output Power = 22.19 dBm



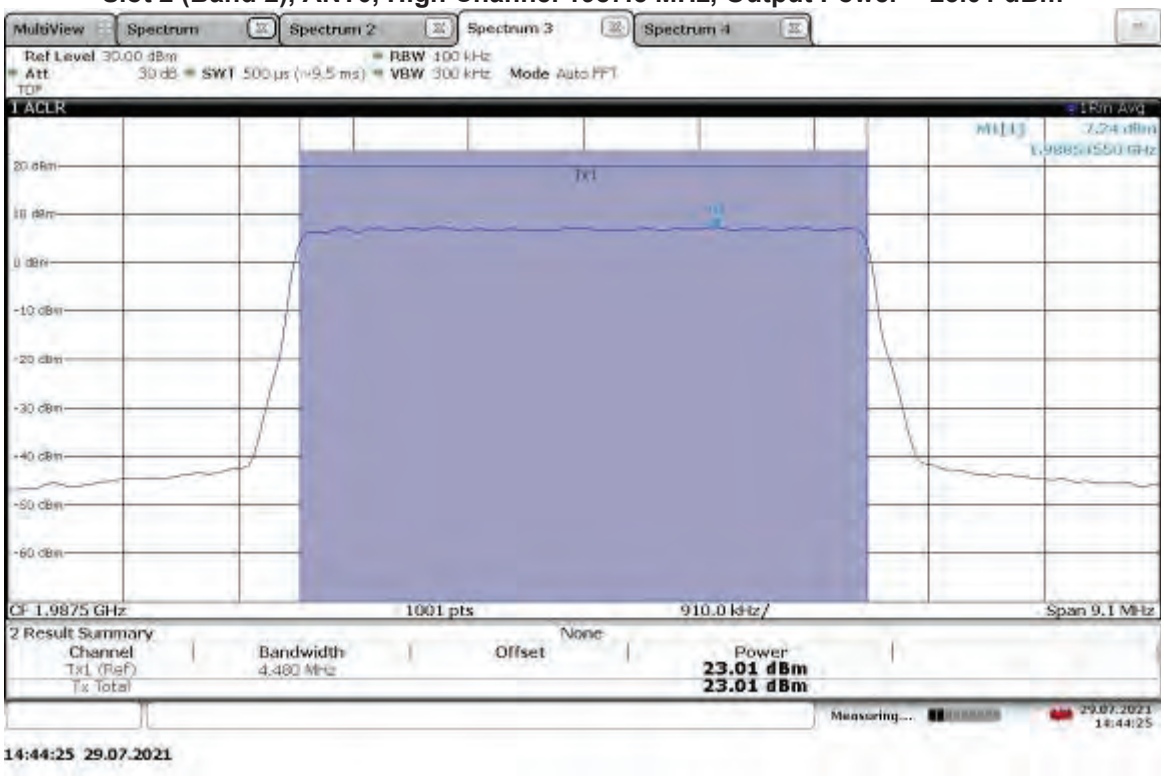
TM3.1a-256QAM _5 MHz Bandwidth
Slot 2 (Band 2), ANT0, Mid Channel 1960 MHz, Output Power = 22.84 dBm



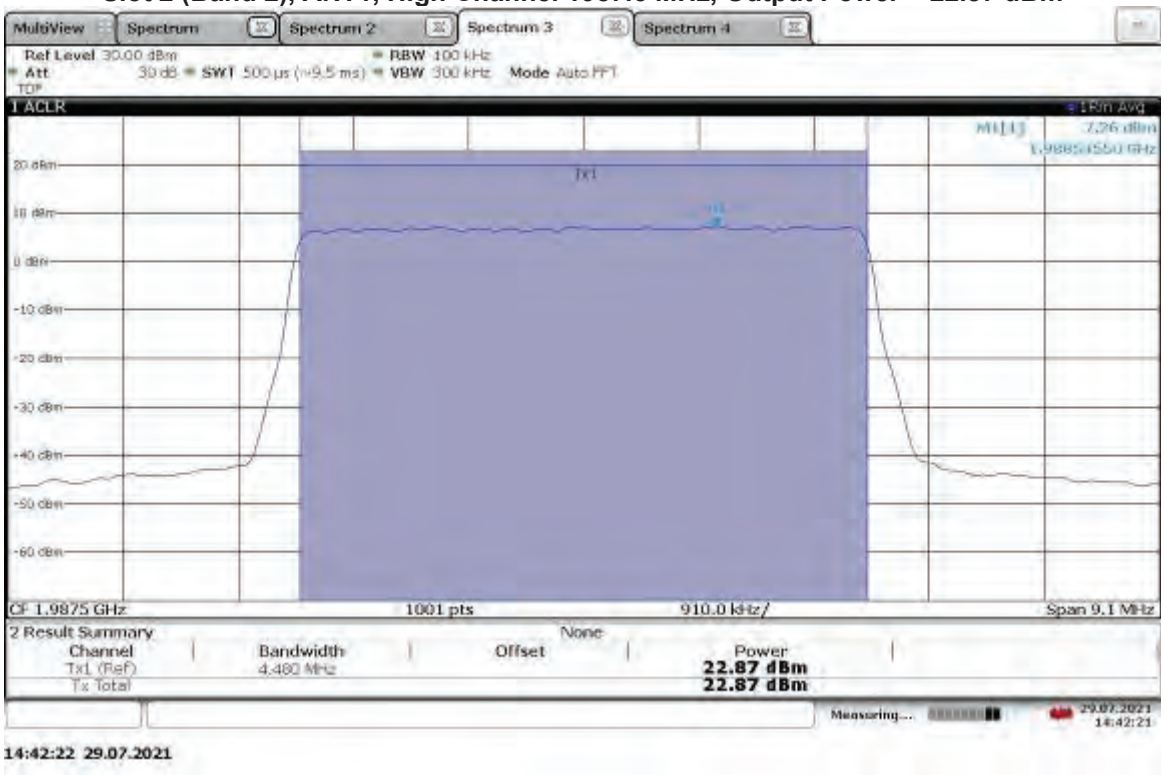
TM3.1a-256QAM _5 MHz Bandwidth
Slot 2 (Band 2), ANT1, Mid Channel 1960 MHz, Output Power = 22.75 dBm



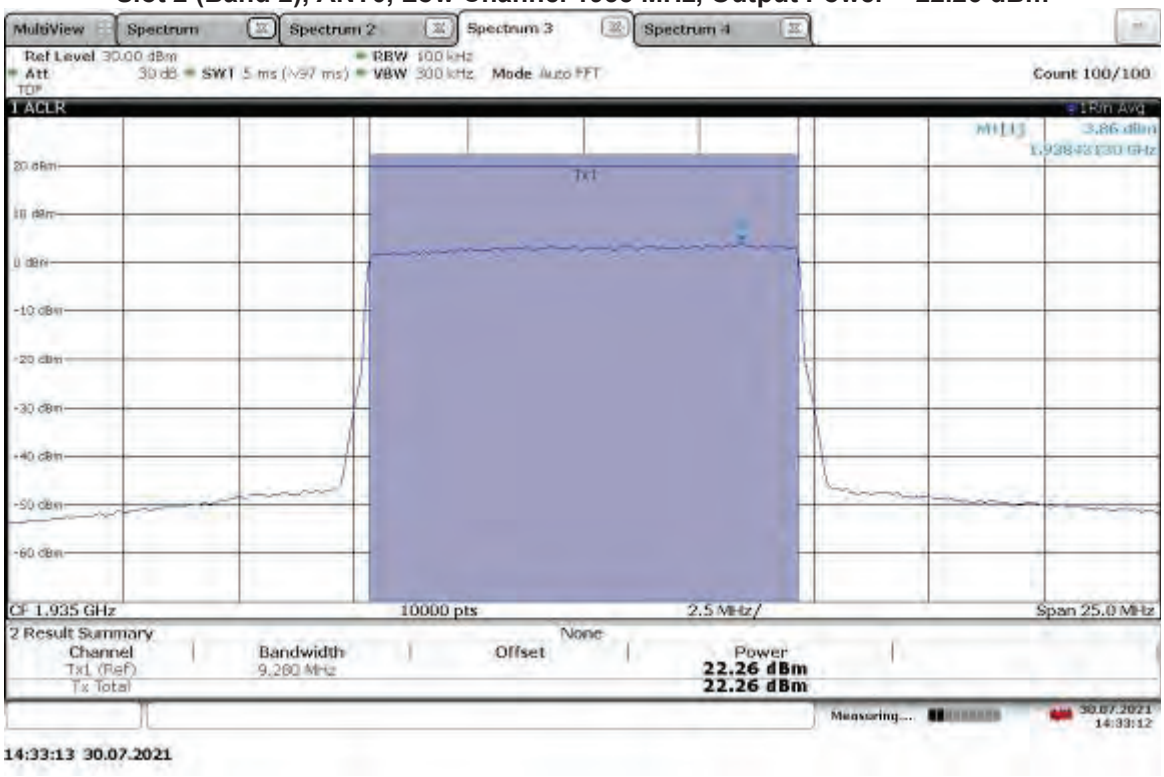
TM3.1a-256QAM _5 MHz Bandwidth
Slot 2 (Band 2), ANT0, High Channel 1987.5 MHz, Output Power = 23.01 dBm



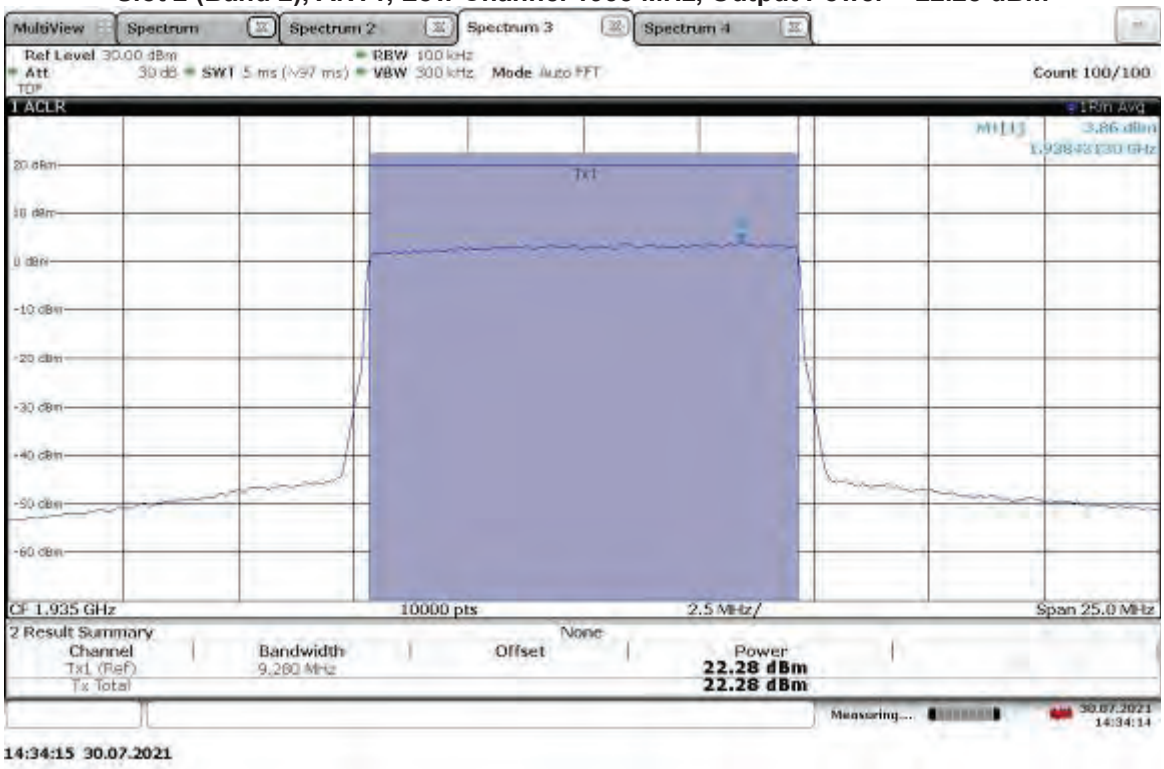
TM3.1a-256QAM _5 MHz Bandwidth
Slot 2 (Band 2), ANT1, High Channel 1987.5 MHz, Output Power = 22.87 dBm



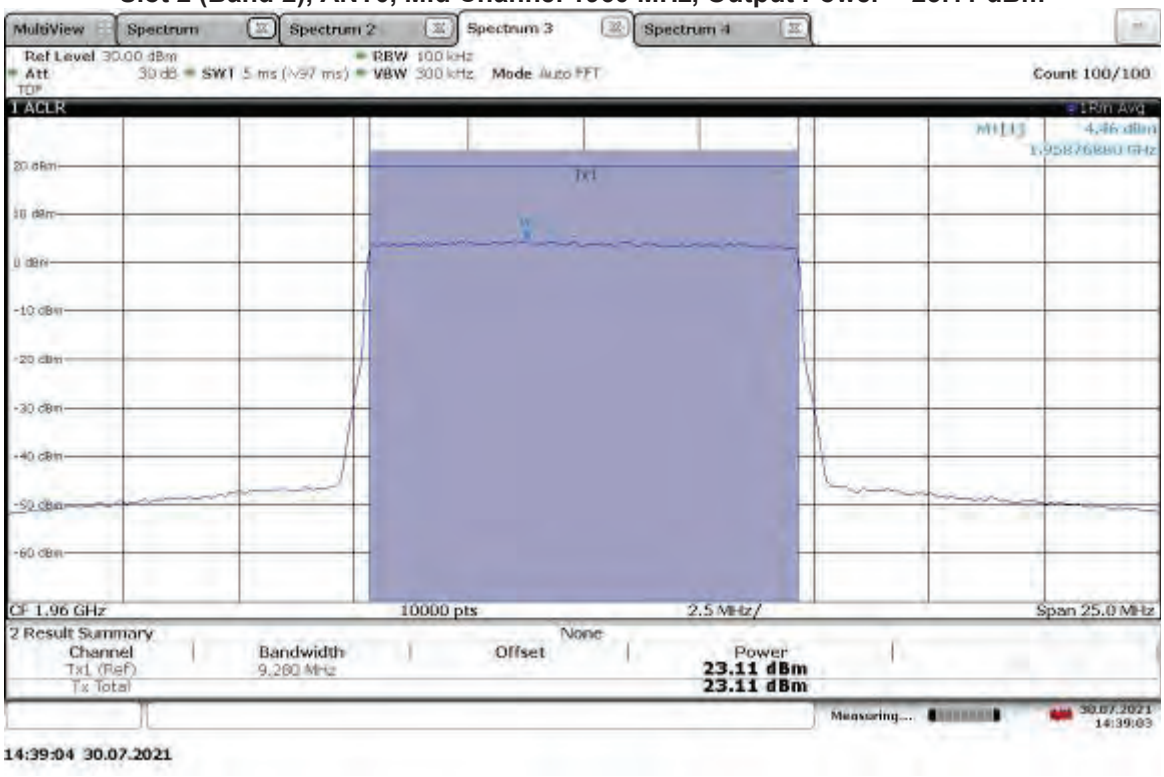
TM3.1a-256QAM _10 MHz Bandwidth
Slot 2 (Band 2), ANT0, Low Channel 1935 MHz, Output Power = 22.26 dBm



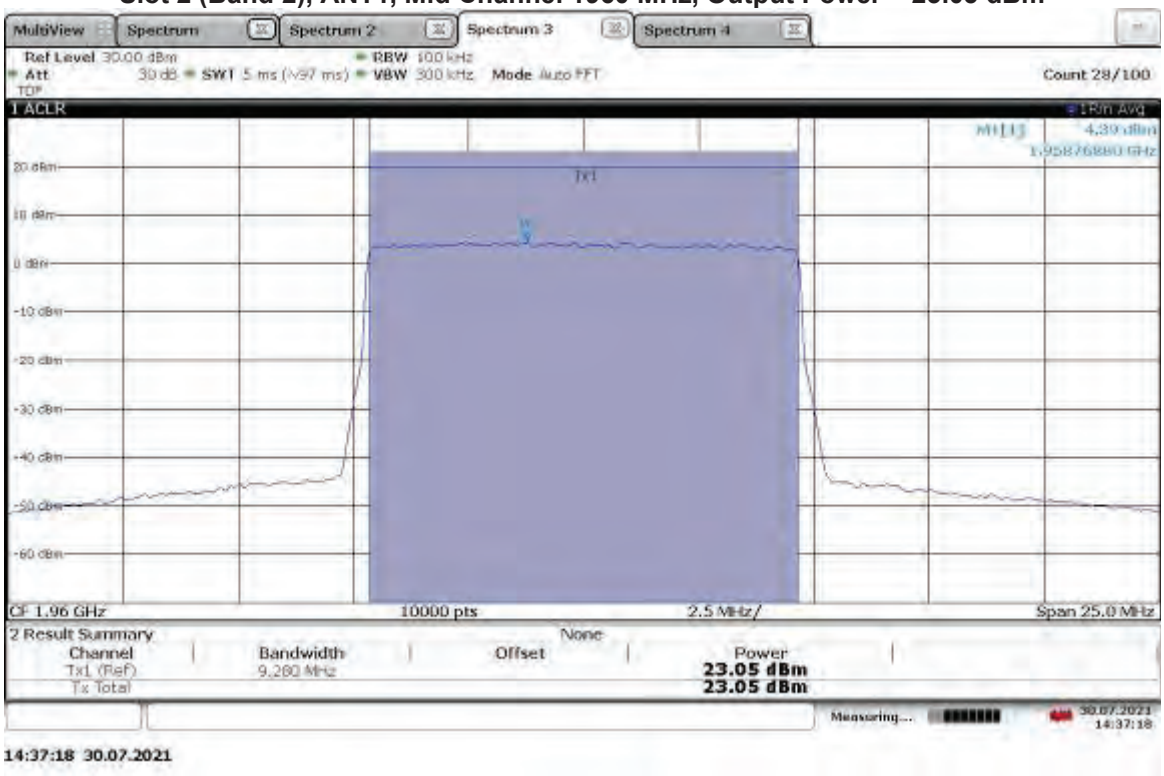
TM3.1a-256QAM _10 MHz Bandwidth
Slot 2 (Band 2), ANT1, Low Channel 1935 MHz, Output Power = 22.28 dBm



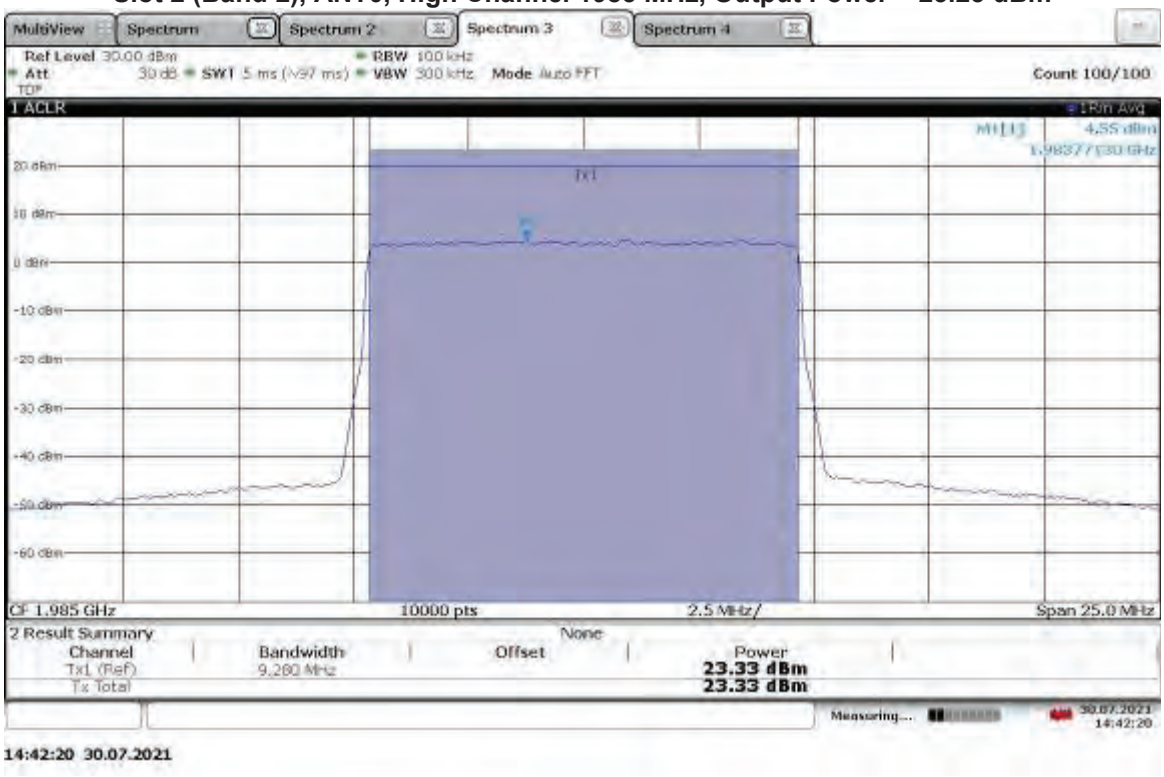
TM3.1a-256QAM _10 MHz Bandwidth
Slot 2 (Band 2), ANT0, Mid Channel 1960 MHz, Output Power = 23.11 dBm



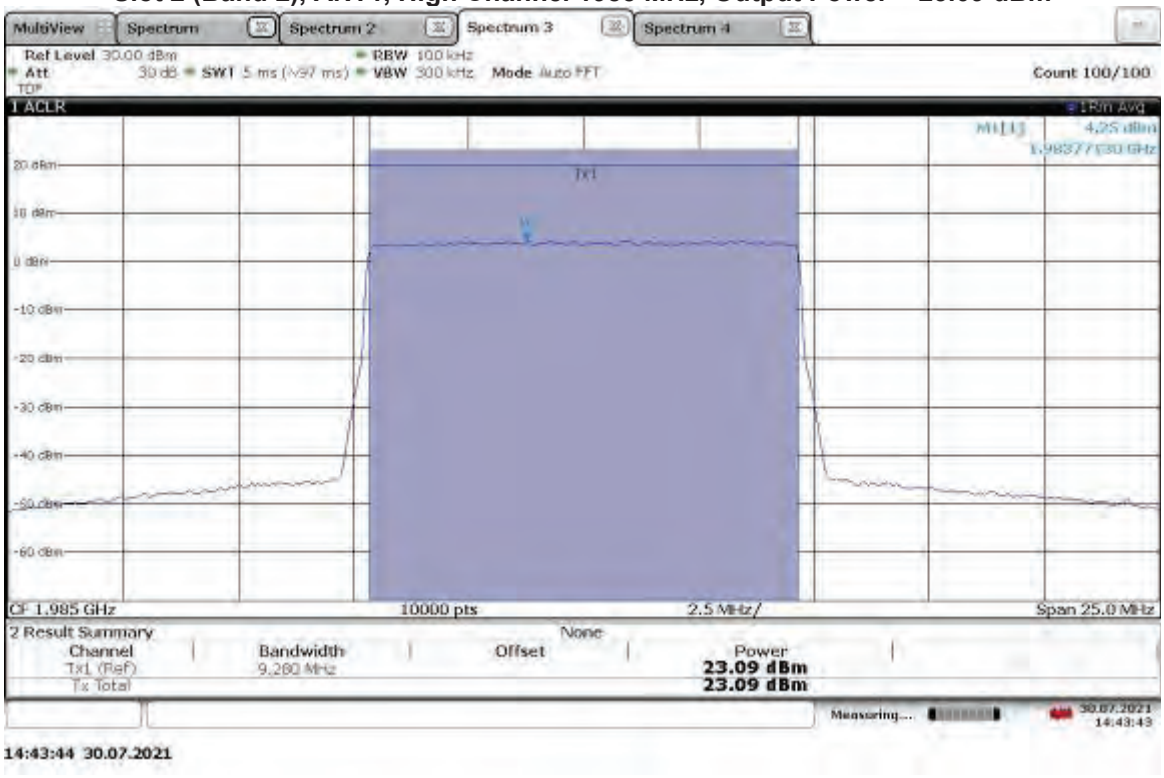
TM3.1a-256QAM _10 MHz Bandwidth
Slot 2 (Band 2), ANT1, Mid Channel 1960 MHz, Output Power = 23.05 dBm



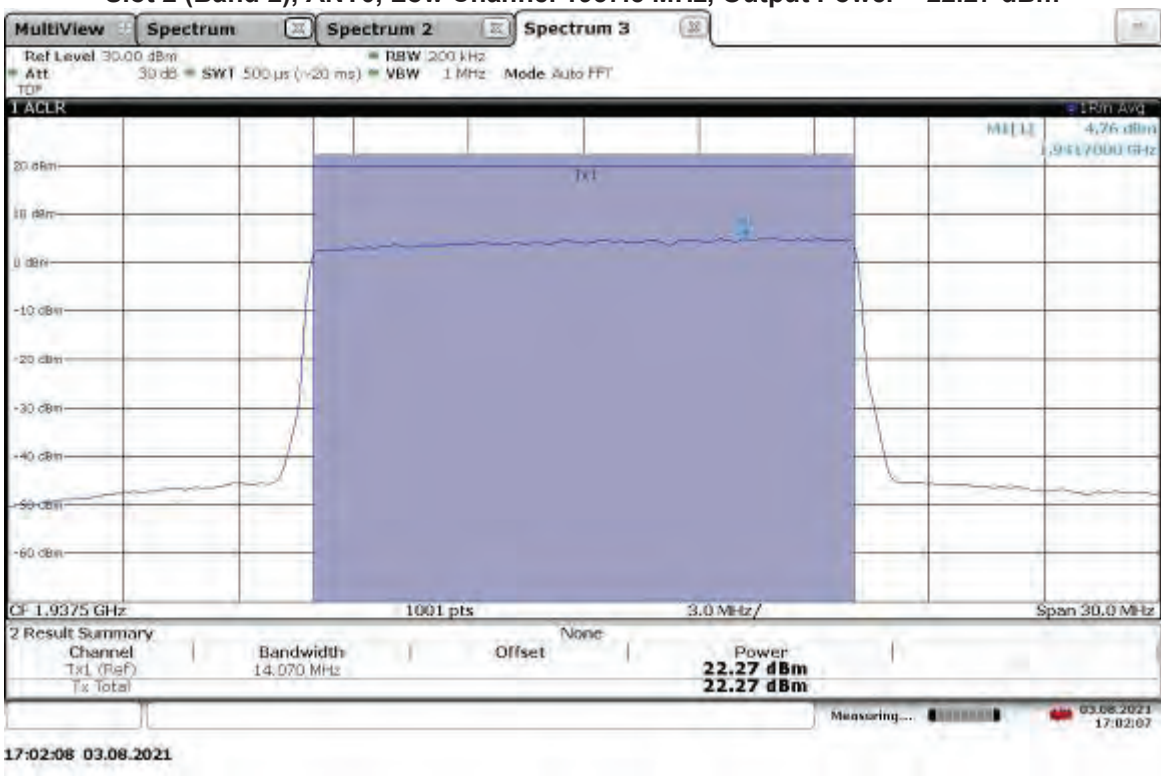
TM3.1a-256QAM _10 MHz Bandwidth
Slot 2 (Band 2), ANT0, High Channel 1985 MHz, Output Power = 23.23 dBm



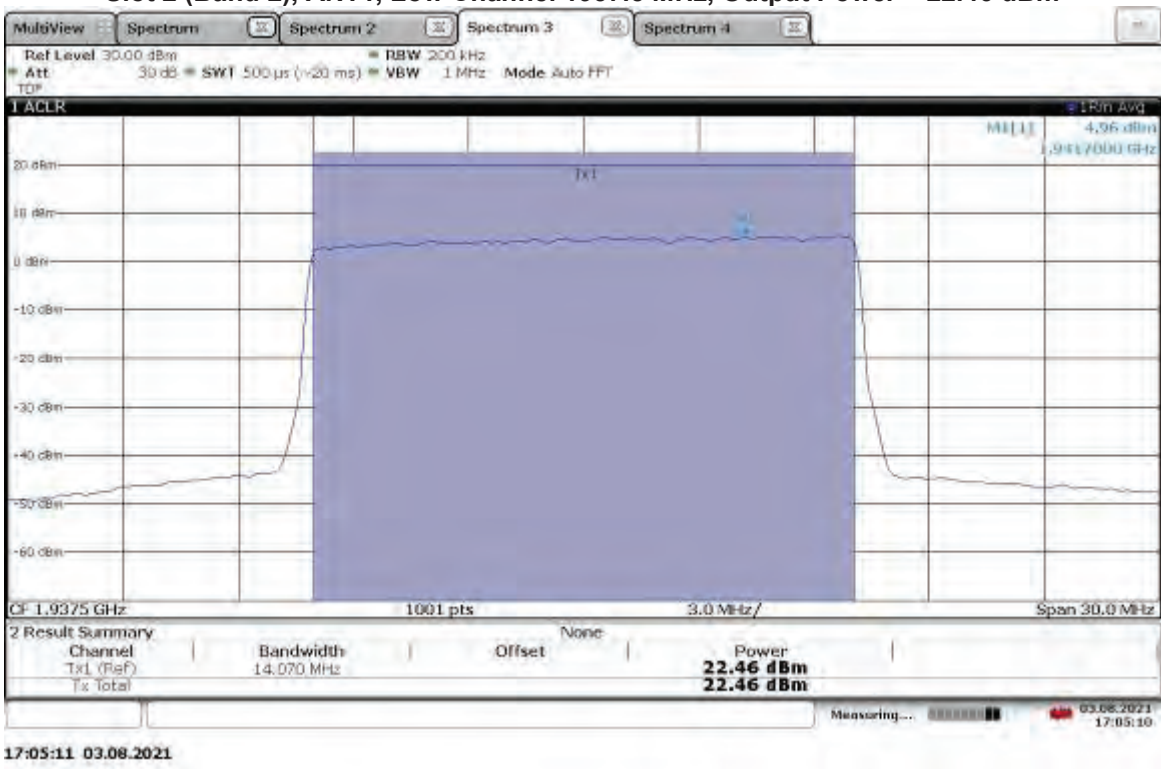
TM3.1a-256QAM _10 MHz Bandwidth
Slot 2 (Band 2), ANT1, High Channel 1985 MHz, Output Power = 23.09 dBm



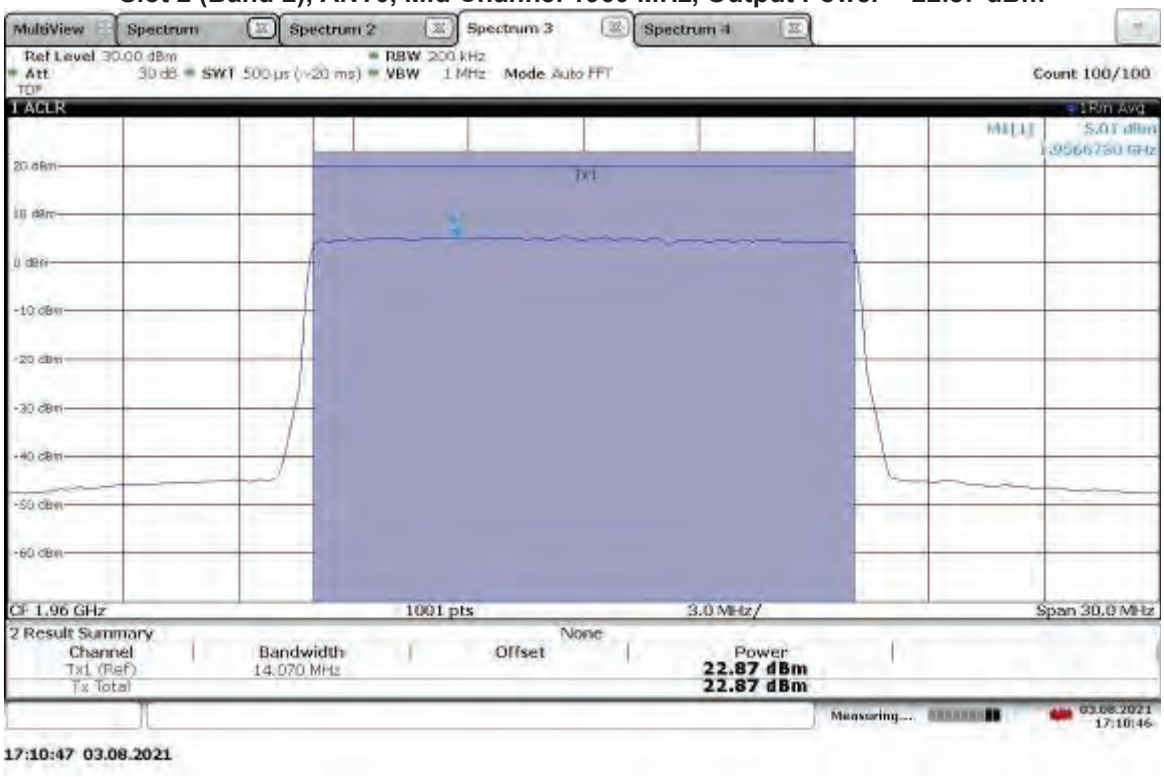
TM3.1a-256QAM _15 MHz Bandwidth
Slot 2 (Band 2), ANT0, Low Channel 1937.5 MHz, Output Power = 22.27 dBm



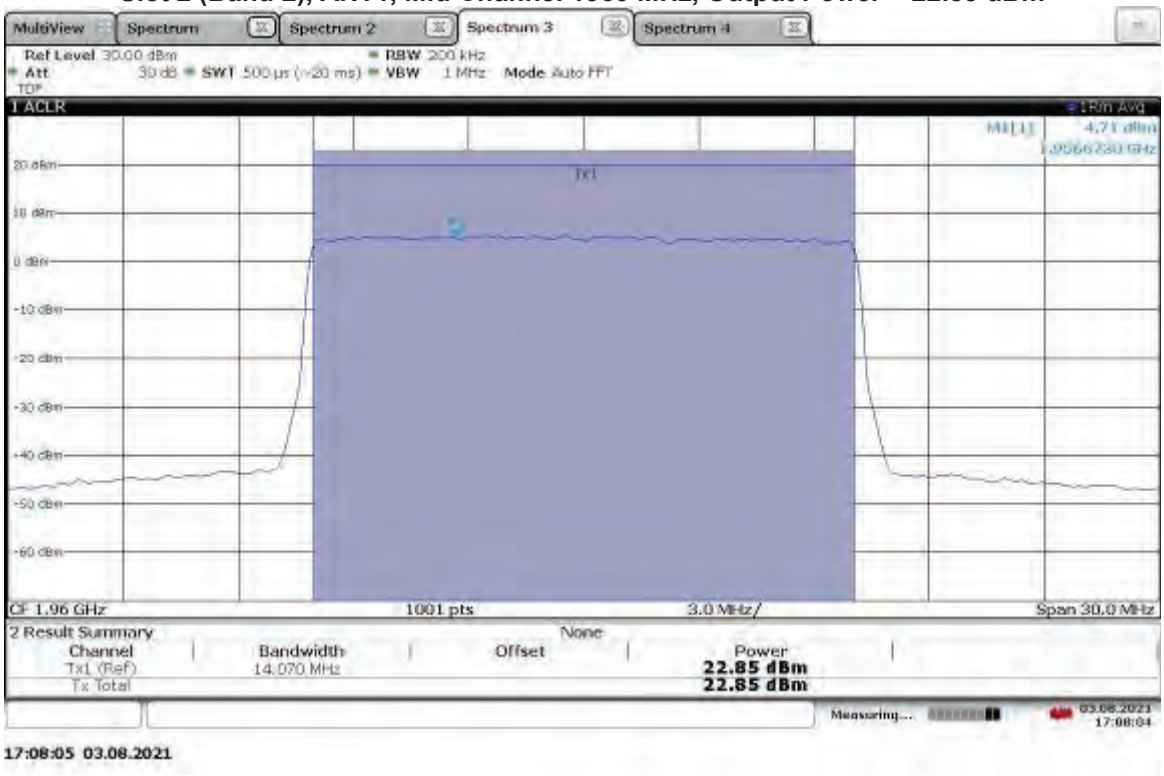
TM3.1a-256QAM _15 MHz Bandwidth
Slot 2 (Band 2), ANT1, Low Channel 1937.5 MHz, Output Power = 22.46 dBm



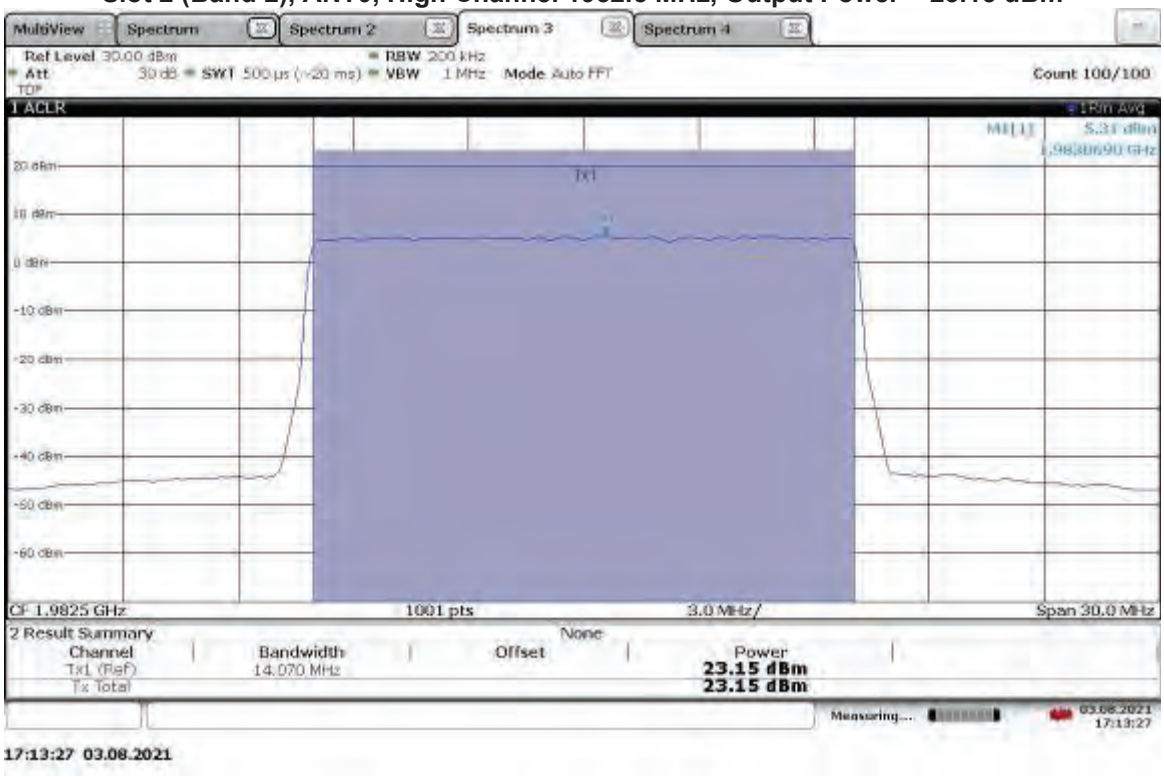
TM3.1a-256QAM _15 MHz Bandwidth
Slot 2 (Band 2), ANT0, Mid Channel 1960 MHz, Output Power = 22.87 dBm



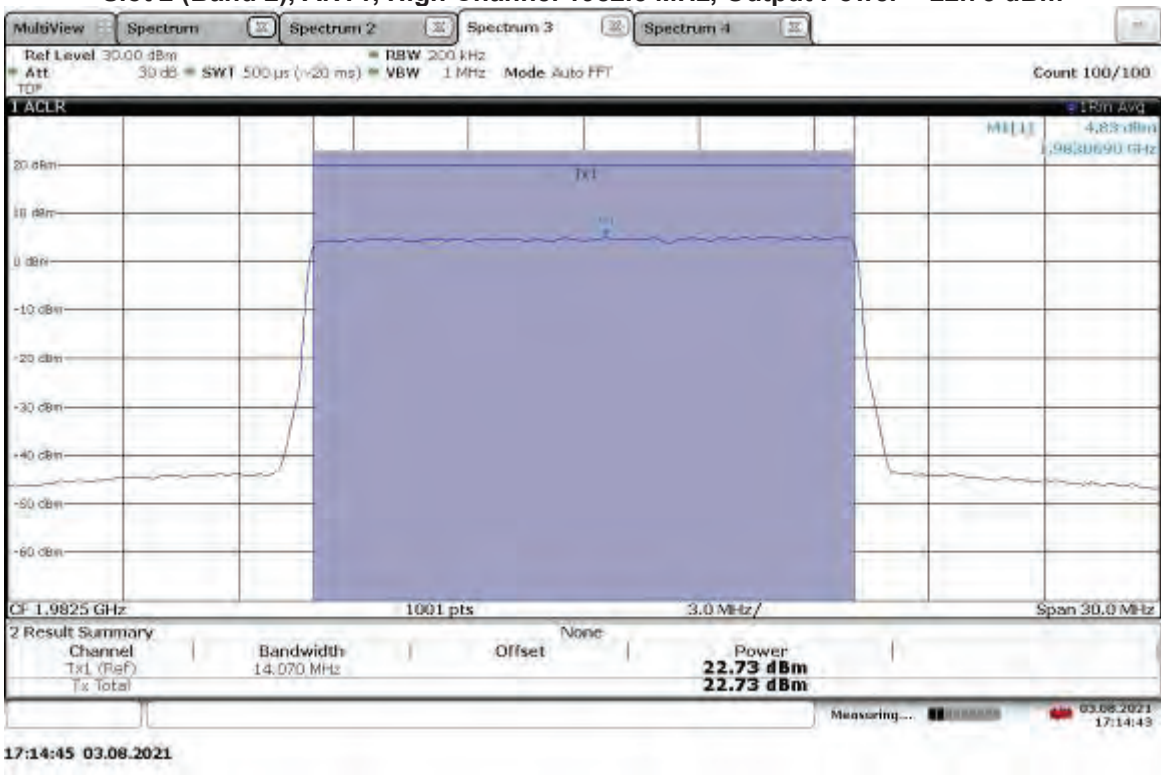
TM3.1a-256QAM _15 MHz Bandwidth
Slot 2 (Band 2), ANT1, Mid Channel 1960 MHz, Output Power = 22.85 dBm



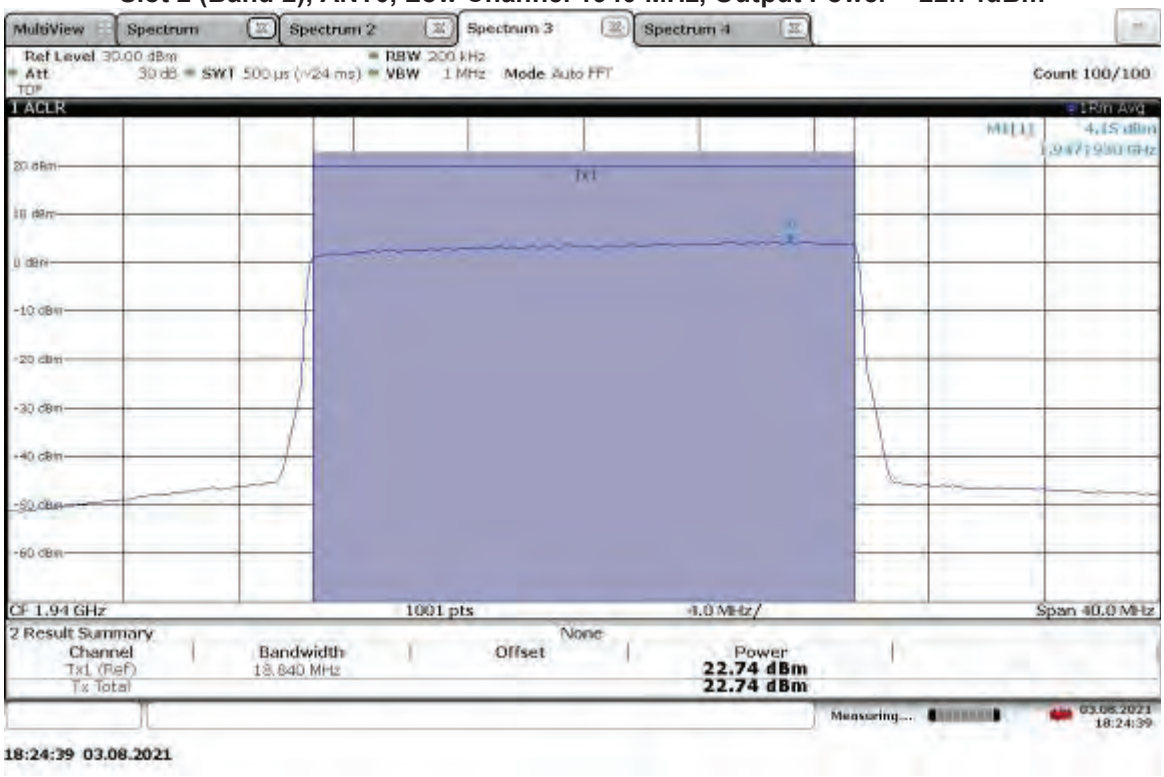
TM3.1a-256QAM _15 MHz Bandwidth
Slot 2 (Band 2), ANT0, High Channel 1932.5 MHz, Output Power = 23.15 dBm



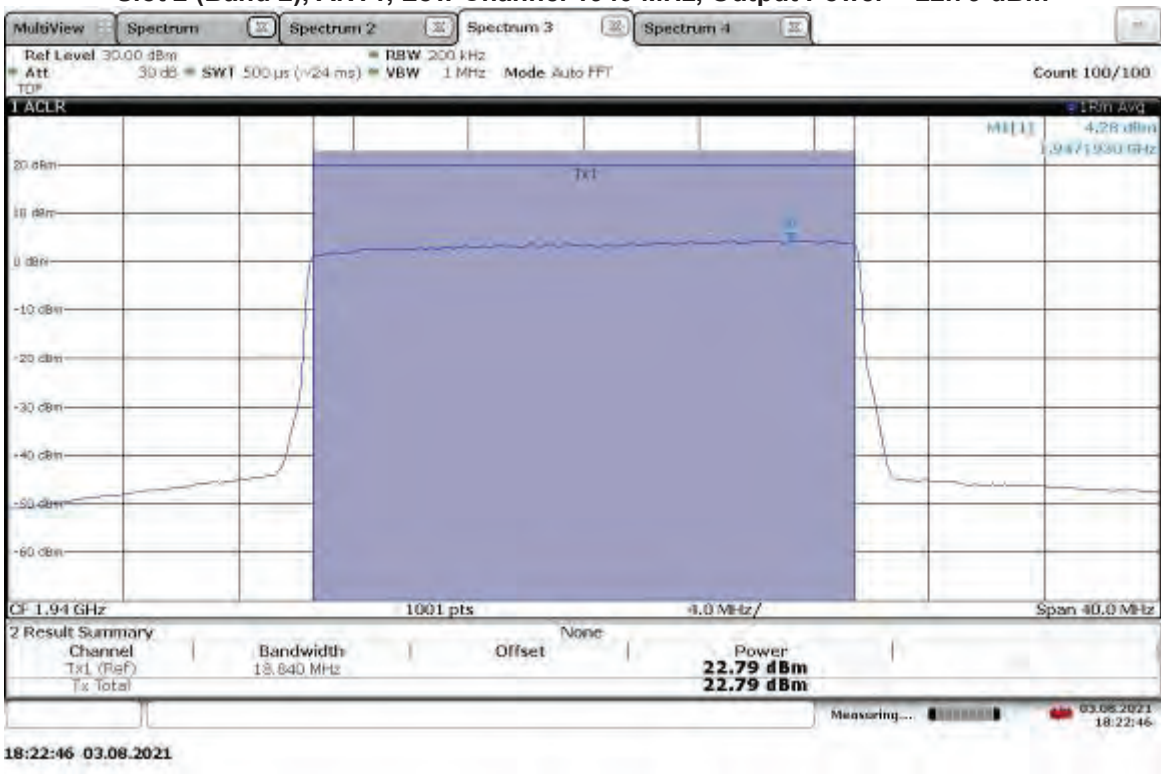
TM3.1a-256QAM _15 MHz Bandwidth
Slot 2 (Band 2), ANT1, High Channel 1982.5 MHz, Output Power = 22.73 dBm



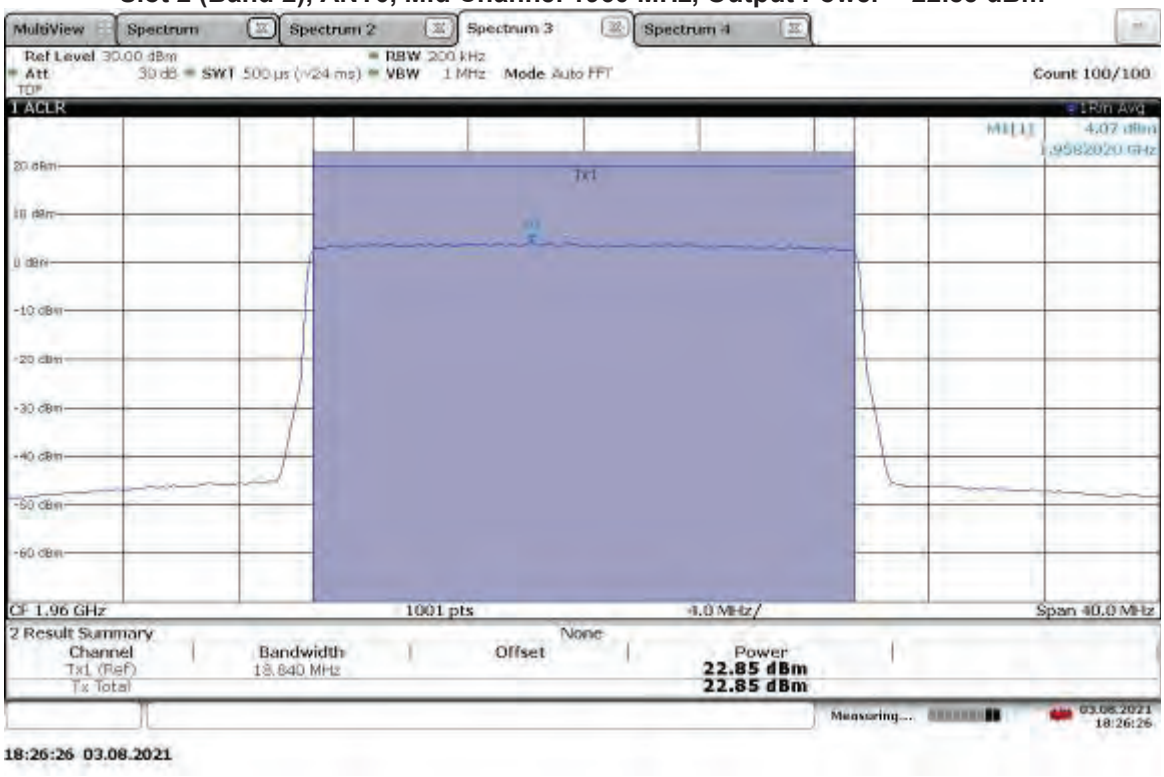
TM3.1a-256QAM _20 MHz Bandwidth
Slot 2 (Band 2), ANT0, Low Channel 1940 MHz, Output Power = 22.74dBm



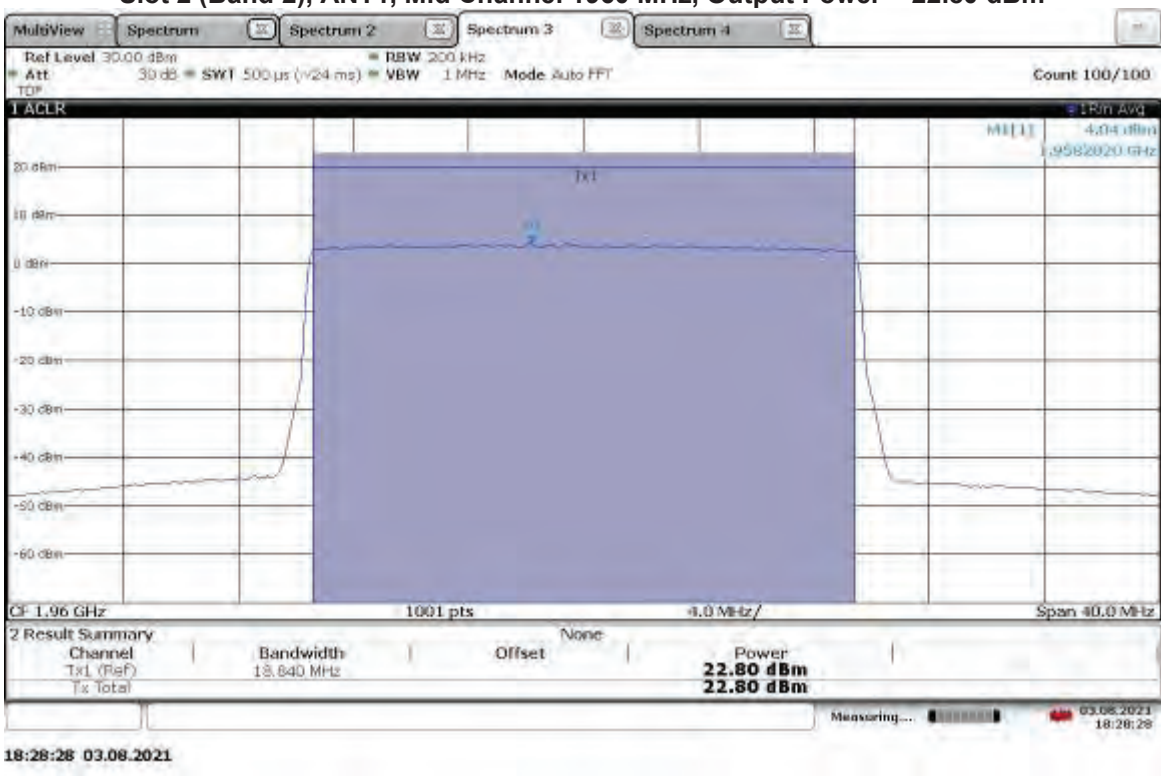
TM3.1a-256QAM _20 MHz Bandwidth
Slot 2 (Band 2), ANT1, Low Channel 1940 MHz, Output Power = 22.79 dBm



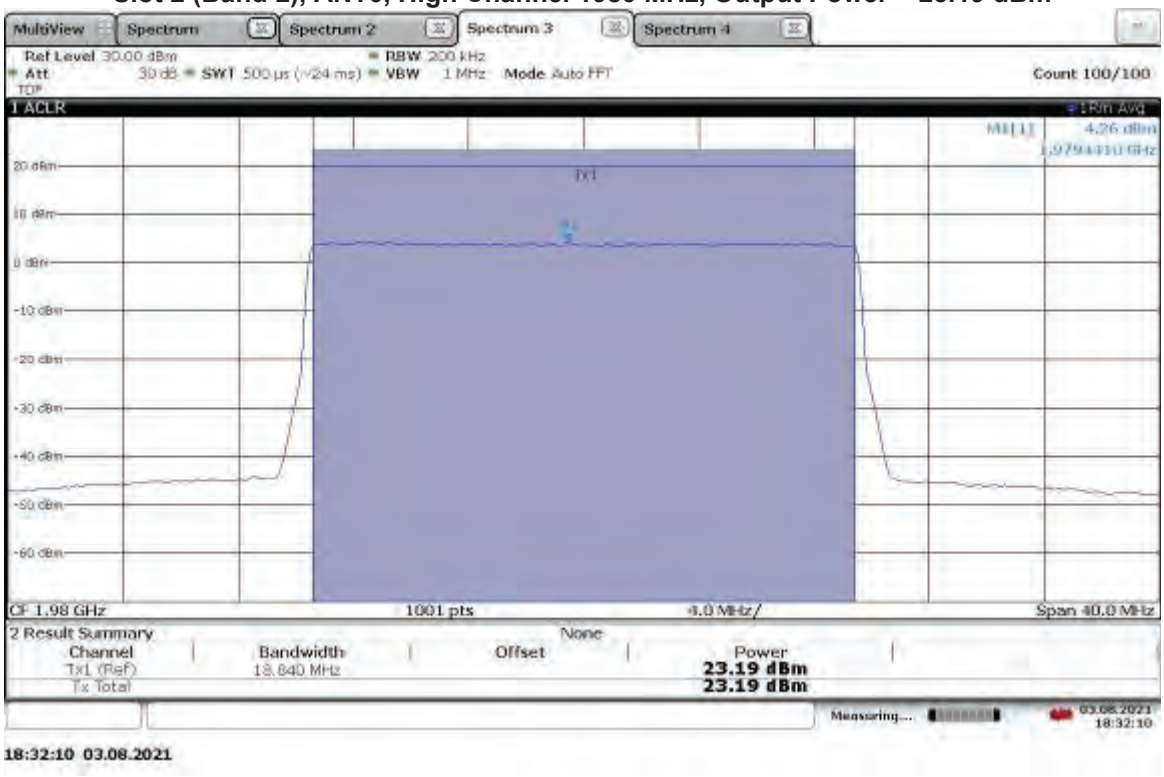
TM3.1a-256QAM _20 MHz Bandwidth
Slot 2 (Band 2), ANT0, Mid Channel 1960 MHz, Output Power = 22.85 dBm



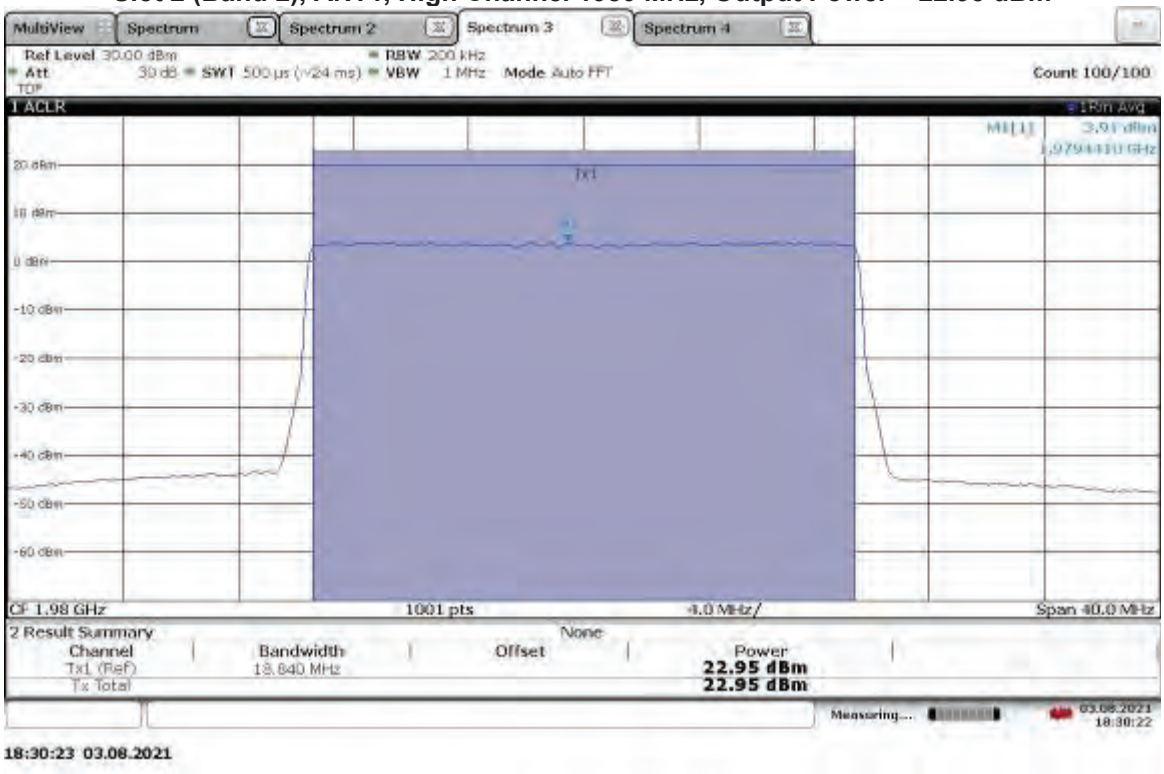
TM3.1a-256QAM _20 MHz Bandwidth
Slot 2 (Band 2), ANT1, Mid Channel 1960 MHz, Output Power = 22.80 dBm



TM3.1a-256QAM _20 MHz Bandwidth
Slot 2 (Band 2), ANT0, High Channel 1980 MHz, Output Power = 23.19 dBm



TM3.1a-256QAM _20 MHz Bandwidth
Slot 2 (Band 2), ANT1, High Channel 1980 MHz, Output Power = 22.95 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 = 23.33 dBm + 10*LOG(2) + 0 dBi = 23.33 dBm + 3 dB + 0dBi
EIRP = 26.33 dBm or 429.536423 mW
Therefore, the minimum safe distance D_{cm} is D_{cm} = ([429.536423] / [4π])$^{1/2}$
D_{cm} = 5.85 cm at 0 dBi gain two antenna MIMO

For Gain = 4 dBi,
EIRP = 23.33 dBm + 10*LOG(2) + 4 dBi = 23.33 dBm + 3 dB + 4dBi
EIRP = 30.33 dBm or 1078.94672 mW
Therefore, the minimum safe distance D_{cm} is D_{cm} = ([1078.94672] / [4π])$^{1/2}$
D_{cm} = 9.27 cm at 4 dBi gain two antenna MIMO

For Gain = X dBi,
EIRP = 23.33 dBm + 10*LOG(2) + X dBi = 23.33 dBm + 3 dB + XdBi
EIRP = 26.33+X dBm or 429.536423 + 10^(X/10) mW
Therefore, the minimum safe distance D_{cm} is D_{cm} = ([429.536423 + 10^(X/10)] / [4π])$^{1/2}$
D_{cm} = 0.282 * (429.536423 + 10^(X/10))$^{1/2}$ cm at X dBi gain two antenna MIMO

Test Personnel:	Vathana Ven	Test Date:	07/28/2021, 07/29/2021, 07/30/2021, 08/03/2021
Supervising/Reviewing Engineer: (Where Applicable)	N/A		
Product Standard:	FCC Part 24	Limit Applied:	See report section 6.3
Input Voltage:	48 VDC (POE)		
Pretest Verification w/ Ambient Signals or BB Source:	N/A	Ambient Temperature:	22, 23, 23, 23 ºC
		Relative Humidity:	21, 15, 26, 47, 20, 22 %
		Atmospheric Pressure:	1004, 1013, 1004, 980 mbars

Deviations, Additions, or Exclusions: None

7 Peak-to-Average Power Ratio (PAPR)

7.1 Method

Tests are performed in accordance with CFR47 FCC Part 24 and ANSI C63.26:2015.

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.

§24.232(d) The peak-to-average ratio (PAR) of the transmission may not exceed 13 dB.

Slot 0 (Band 2), Bandwidth: 5 MHz, Modulation: TM1.1-QPSK

Channel	Frequency (MHz)	Antenna Port	PAPR (dB)
Low	1932.50	ANT0	10.22
		ANT1	10.13
Mid	1960.00	ANT0	10.29
		ANT1	10.30
High	1987.50	ANT0	10.03
		ANT1	10.25

Slot 0 (Band 2), Bandwidth: 10 MHz, Modulation: TM1.1-QPSK

Channel	Frequency (MHz)	Antenna Port	PAPR (dB)
Low	1935.00	ANT0	10.67
		ANT1	11.32
Mid	1960.00	ANT0	11.87
		ANT1	11.87
High	1985.00	ANT0	11.85
		ANT1	10.60

Slot 0 (Band 2), Bandwidth: 15 MHz, Modulation: TM1.1-QPSK

Channel	Frequency (MHz)	Antenna Port	PAPR (dB)
Low	1937.50	ANT0	11.34
		ANT1	11.07
Mid	1960.00	ANT0	11.40
		ANT1	11.35
High	1982.50	ANT0	11.05
		ANT1	11.33

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

Channel	Frequency (MHz)	Antenna Port	PAPR (dB)
Low	1940.00	ANT0	10.32
		ANT1	10.17
Mid	1960.00	ANT0	10.50
		ANT1	10.43
High	1980.00	ANT0	10.19
		ANT1	10.24

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

Channel	Frequency (MHz)	Antenna Port	PAPR (dB)
Low	1932.50	ANT0	9.65
		ANT1	9.58
Mid	1960.00	ANT0	9.66
		ANT1	9.64
High	1987.50	ANT0	9.54
		ANT1	9.67

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

Channel	Frequency (MHz)	Antenna Port	PAPR (dB)
Low	1935.00	ANT0	9.87
		ANT1	9.82
Mid	1960.00	ANT0	10.05
		ANT1	10.00
High	1985.00	ANT0	9.91
		ANT1	10.08

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

Channel	Frequency (MHz)	Antenna Port	PAPR (dB)
Low	1937.50	ANT0	11.25
		ANT1	10.82
Mid	1960.00	ANT0	10.67
		ANT1	10.57
High	1982.50	ANT0	10.34
		ANT1	10.58

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

Channel	Frequency (MHz)	Antenna Port	PAPR (dB)
Low	1940.00	ANT0	10.11
		ANT1	9.99
Mid	1960.00	ANT0	10.23
		ANT1	10.14
High	1980.00	ANT0	10.14
		ANT1	10.30

Slot 0 (Band 2), Bandwidth: 5 MHz, Modulation: TM3.1-64QAM

Channel	Frequency (MHz)	Antenna Port	PAPR (dB)
Low	1932.50	ANT0	9.94
		ANT1	10.14
Mid	1960.00	ANT0	10.02
		ANT1	10.00
High	1987.50	ANT0	9.88
		ANT1	10.00

Slot 0 (Band 2), Bandwidth: 10 MHz, Modulation: TM3.1-64QAM

Channel	Frequency (MHz)	Antenna Port	PAPR (dB)
Low	1935.00	ANT0	10.13
		ANT1	9.76
Mid	1960.00	ANT0	9.89
		ANT1	10.31
High	1985.00	ANT0	9.68
		ANT1	9.79

Slot 0 (Band 2), Bandwidth: 15 MHz, Modulation: TM3.1-64QAM

Channel	Frequency (MHz)	Antenna Port	PAPR (dB)
Low	1937.50	ANT0	9.92
		ANT1	9.65
Mid	1960.00	ANT0	9.87
		ANT1	10.52
High	1982.50	ANT0	9.77
		ANT1	9.89

Slot 0 (Band 2), Bandwidth: 20 MHz, Modulation: TM3.1-64QAM

Channel	Frequency (MHz)	Antenna Port	PAPR (dB)
Low	1940.00	ANT0	9.74
		ANT1	10.36
Mid	1960.00	ANT0	9.68
		ANT1	10.39
High	1980.00	ANT0	9.94
		ANT1	9.72

Slot 0 (Band 2), Bandwidth: 5 MHz, Modulation: TM3.1a-256QAM_

Channel	Frequency (MHz)	Antenna Port	PAPR (dB)
Low	1932.50	ANT0	9.73
		ANT1	9.52
Mid	1960.00	ANT0	9.73
		ANT1	9.73
High	1987.50	ANT0	9.62
		ANT1	9.63

Slot 0 (Band 2), Bandwidth: 10 MHz, Modulation: TM3.1a-256QAM_

Channel	Frequency (MHz)	Antenna Port	PAPR (dB)
Low	1935.00	ANT0	10.16
		ANT1	10.19
Mid	1960.00	ANT0	10.09
		ANT1	10.20
High	1985.00	ANT0	10.05
		ANT1	10.18

Slot 0 (Band 2), Bandwidth: 15 MHz, Modulation: TM3.1a-256QAM

Channel	Frequency (MHz)	Antenna Port	PAPR (dB)
Low	1937.500	ANT0	9.97
		ANT1	10.05
Mid	1960.00	ANT0	9.96
		ANT1	10.01
High	1982.50	ANT0	10.02
		ANT1	10.12

Slot 0 (Band 2), Bandwidth: 20 MHz, Modulation: TM3.1a-256QAM

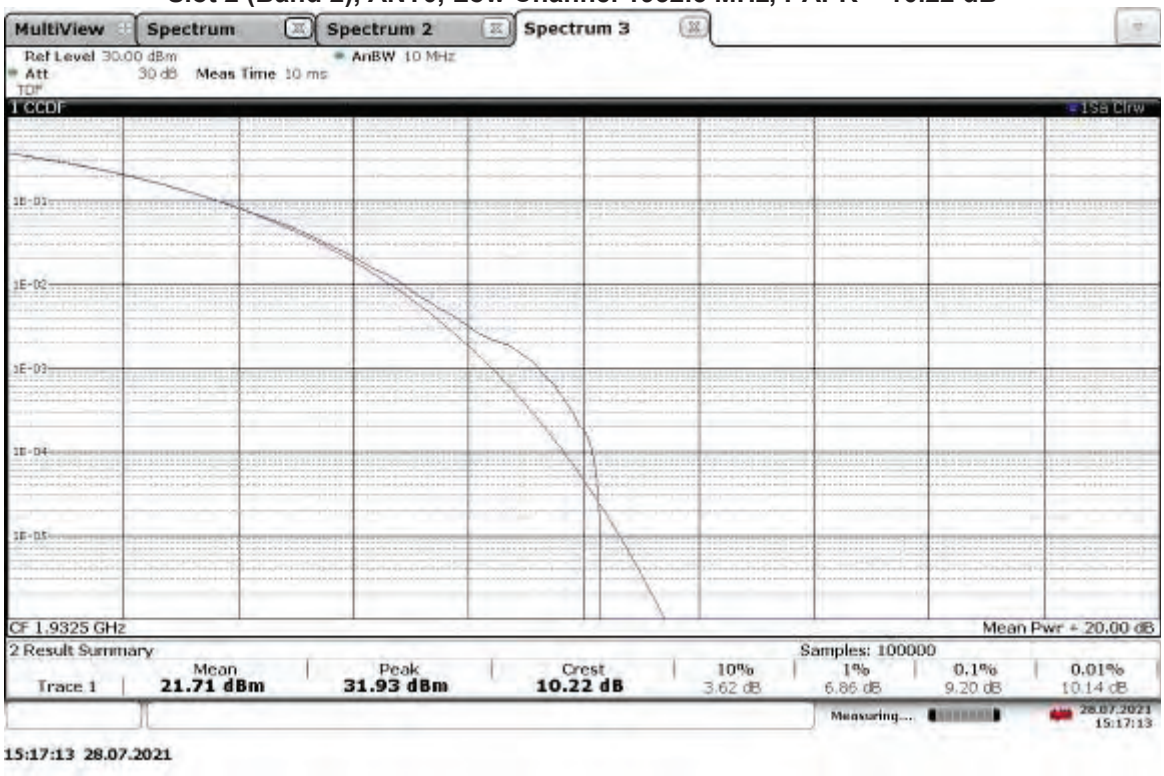
Channel	Frequency (MHz)	Antenna Port	PAPR (dB)
Low	1940	ANT0	9.80
		ANT1	10.09
Mid	1960	ANT0	10.14
		ANT1	10.26
High	1980	ANT0	10.06
		ANT1	10.01

7.4 Setup Photograph:

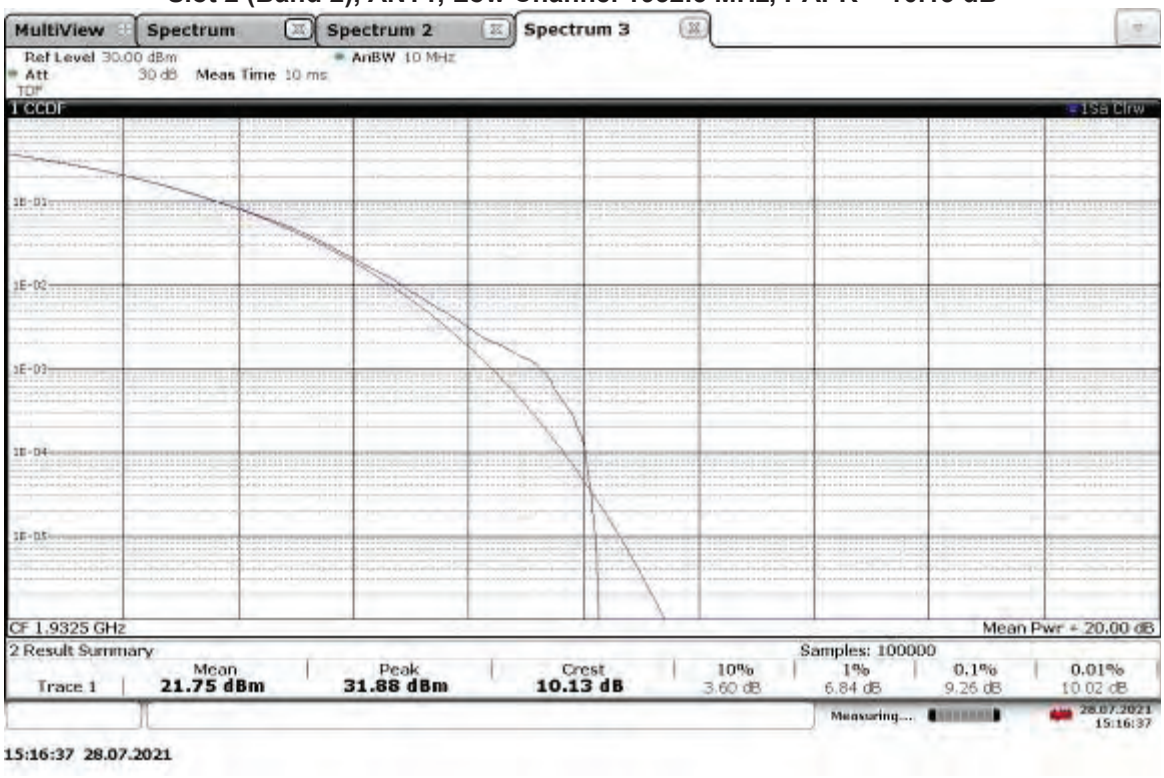
Photographs are available in a separate exhibit

7.5 Plots/Data:

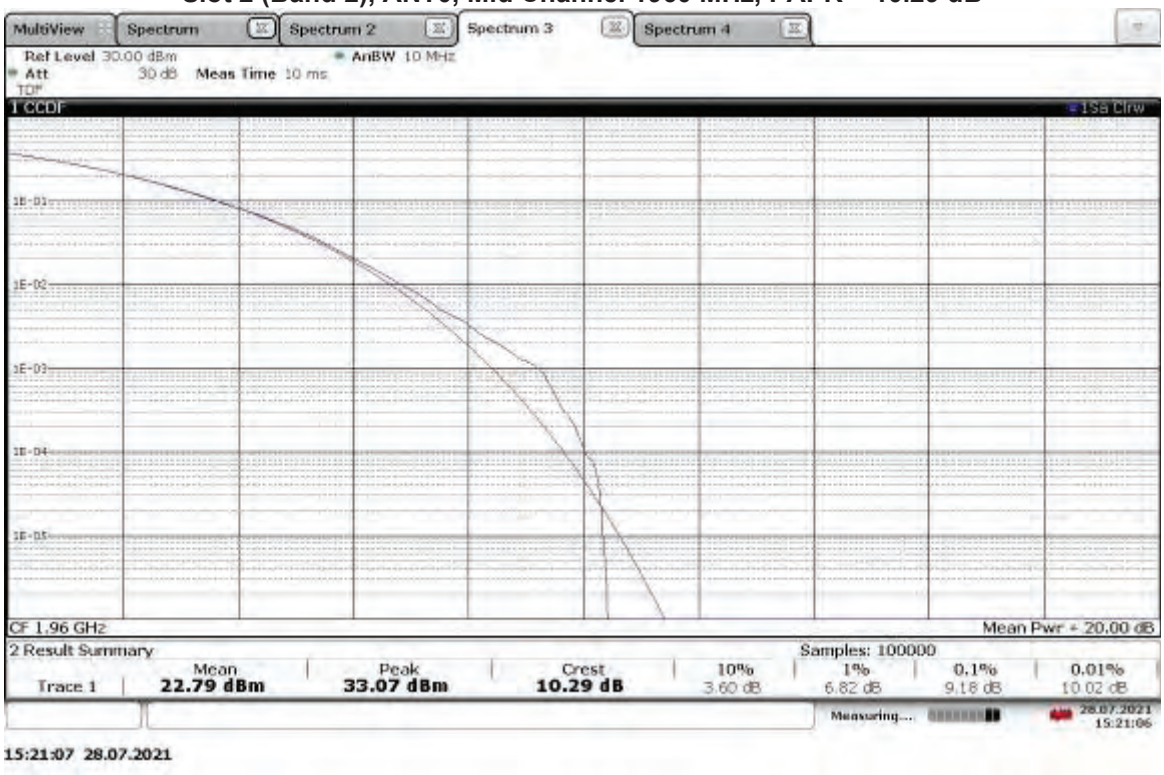
TM1.1-QPSK_5 MHz Bandwidth
Slot 2 (Band 2), ANT0, Low Channel 1932.5 MHz, PAPR = 10.22 dB



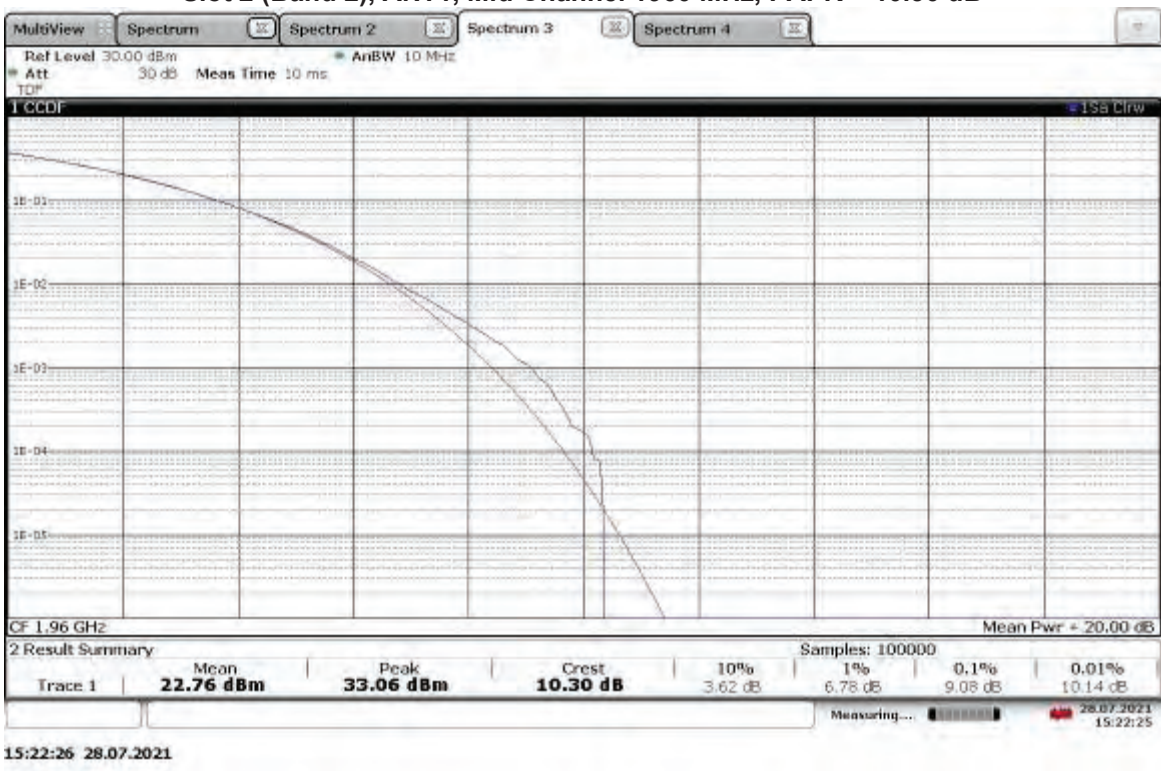
TM1.1-QPSK_5 MHz Bandwidth
Slot 2 (Band 2), ANT1, Low Channel 1932.5 MHz, PAPR = 10.13 dB



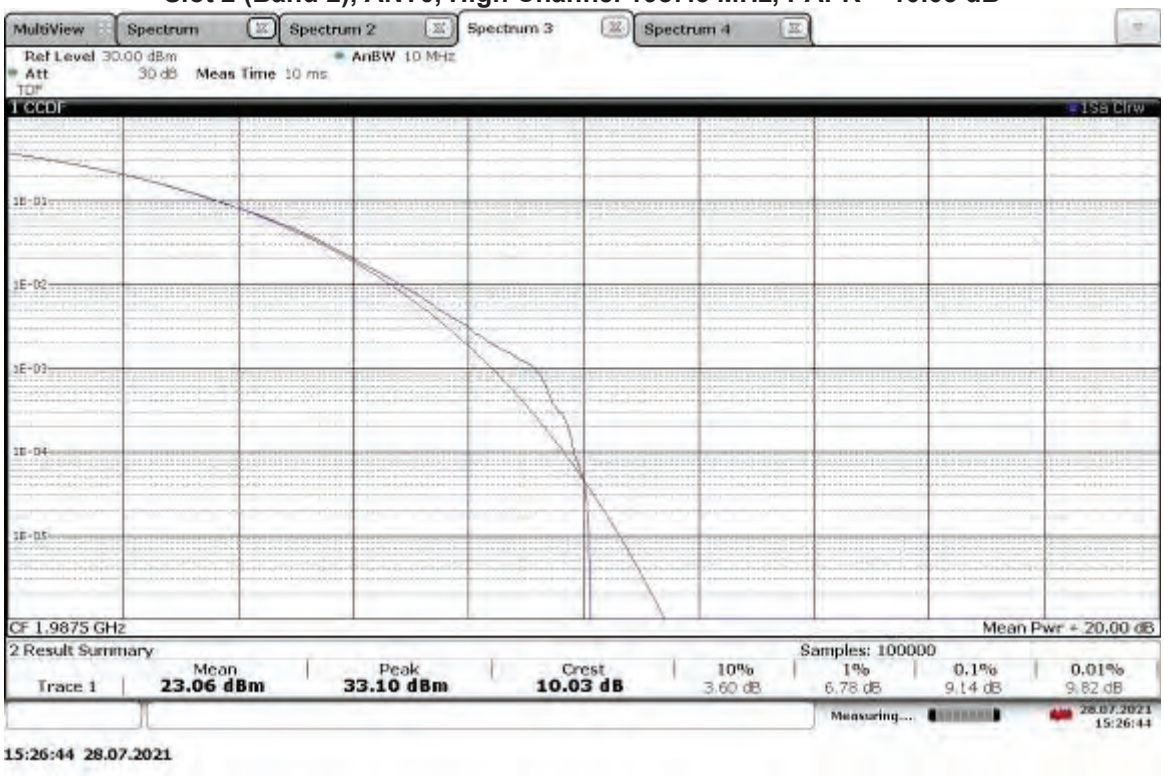
TM1.1-QPSK_5 MHz Bandwidth
Slot 2 (Band 2), ANT0, Mid Channel 1960 MHz, PAPR = 10.29 dB



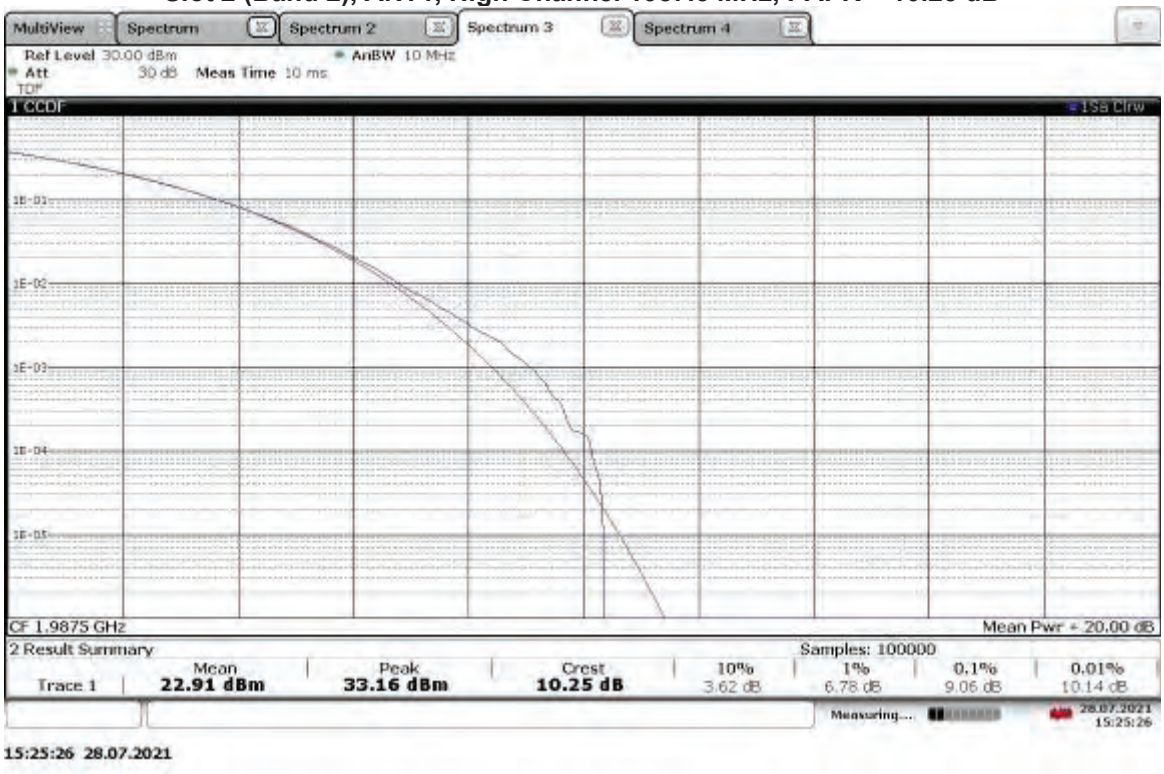
TM1.1-QPSK_5 MHz Bandwidth
Slot 2 (Band 2), ANT1, Mid Channel 1960 MHz, PAPR = 10.30 dB



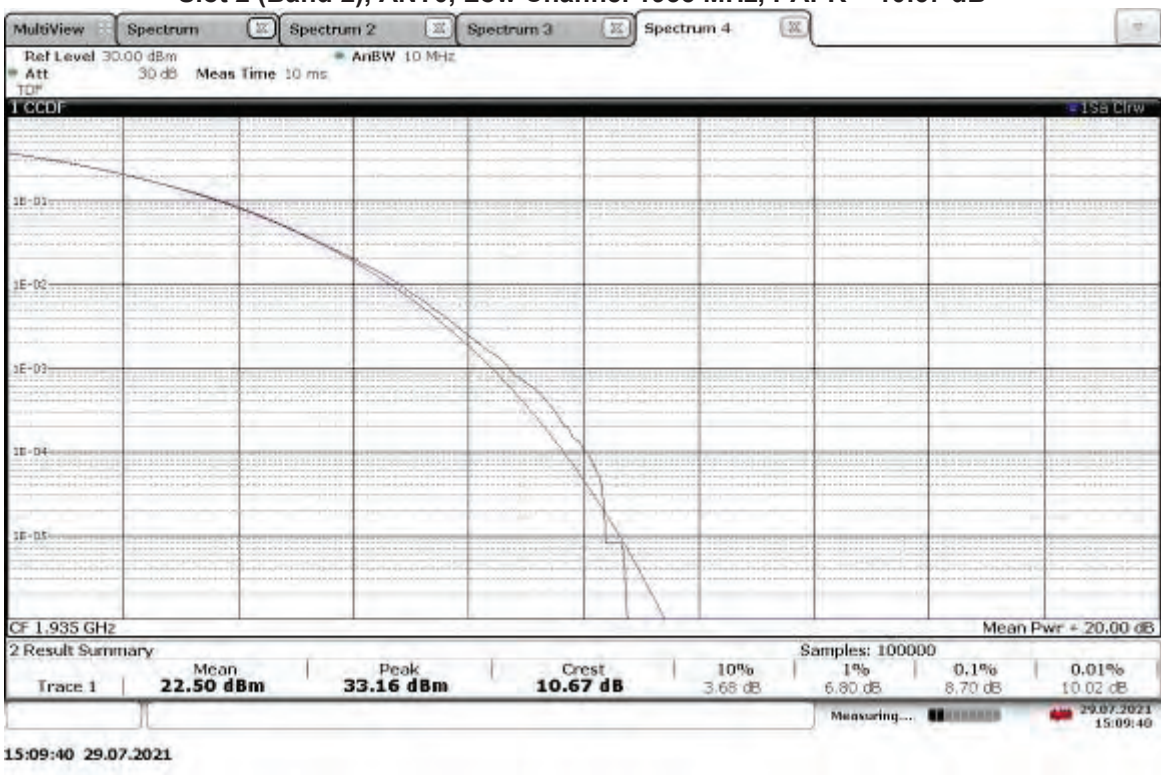
TM1.1-QPSK_5 MHz Bandwidth
Slot 2 (Band 2), ANT0, High Channel 1987.5 MHz, PAPR = 10.03 dB



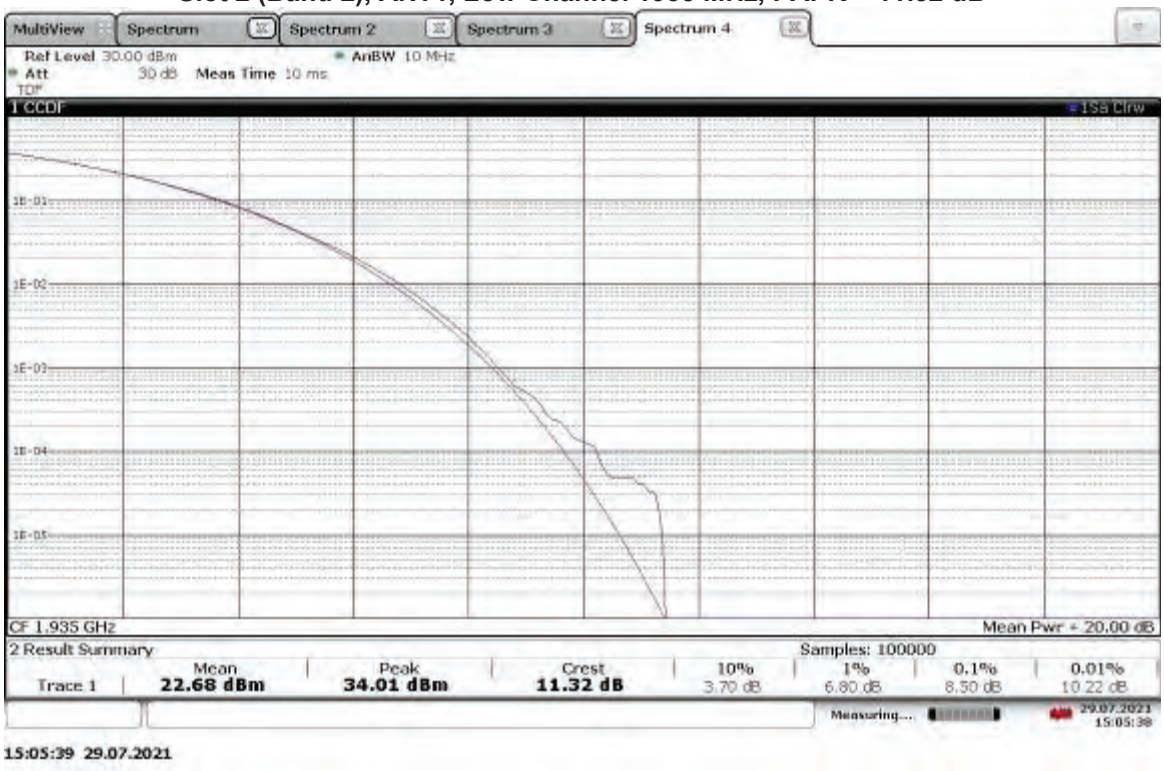
TM1.1-QPSK_5 MHz Bandwidth
Slot 2 (Band 2), ANT1, High Channel 1987.5 MHz, PAPR = 10.25 dB



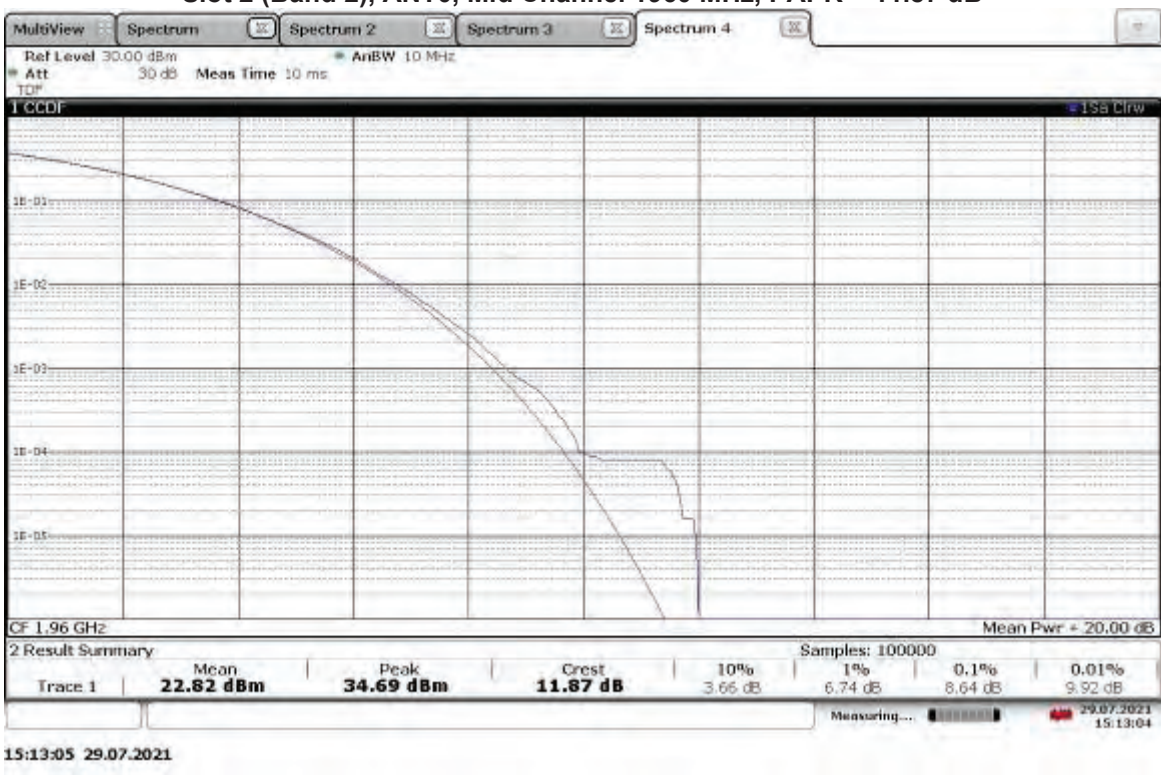
TM1.1-QPSK_10 MHz Bandwidth
Slot 2 (Band 2), ANT0, Low Channel 1935 MHz, PAPR = 10.67 dB



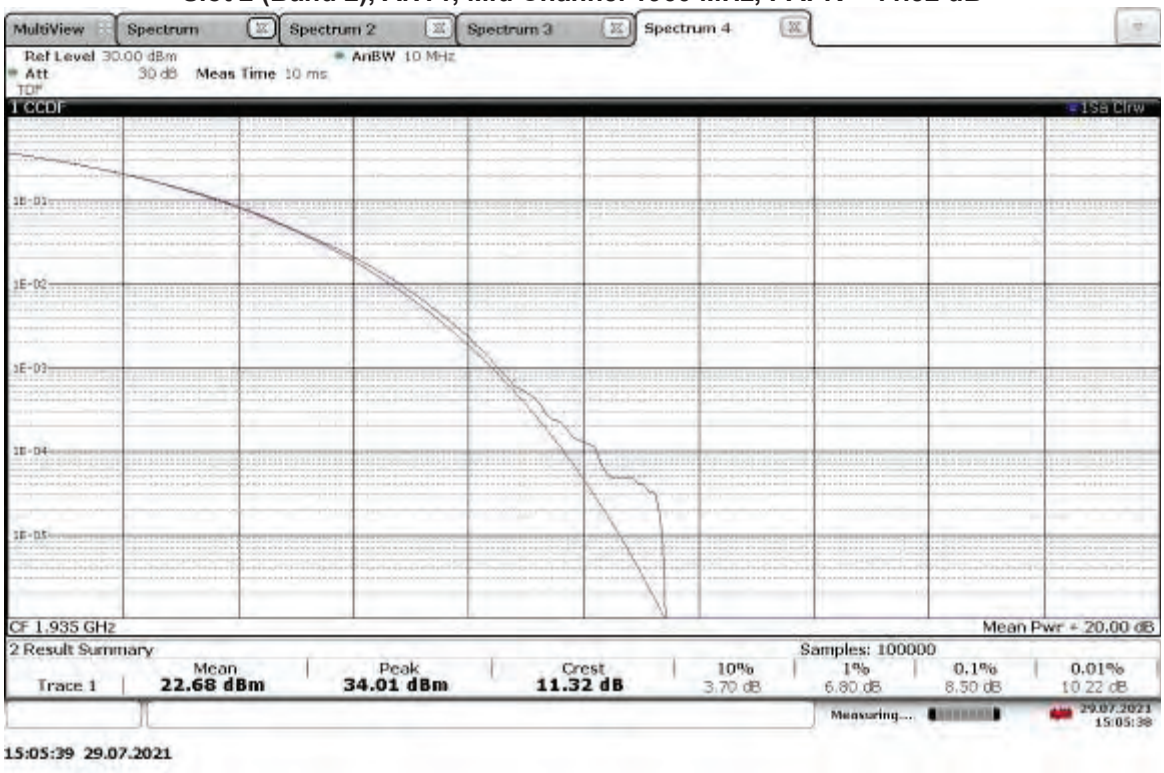
TM1.1-QPSK_10 MHz Bandwidth
Slot 2 (Band 2), ANT1, Low Channel 1935 MHz, PAPR = 11.32 dB



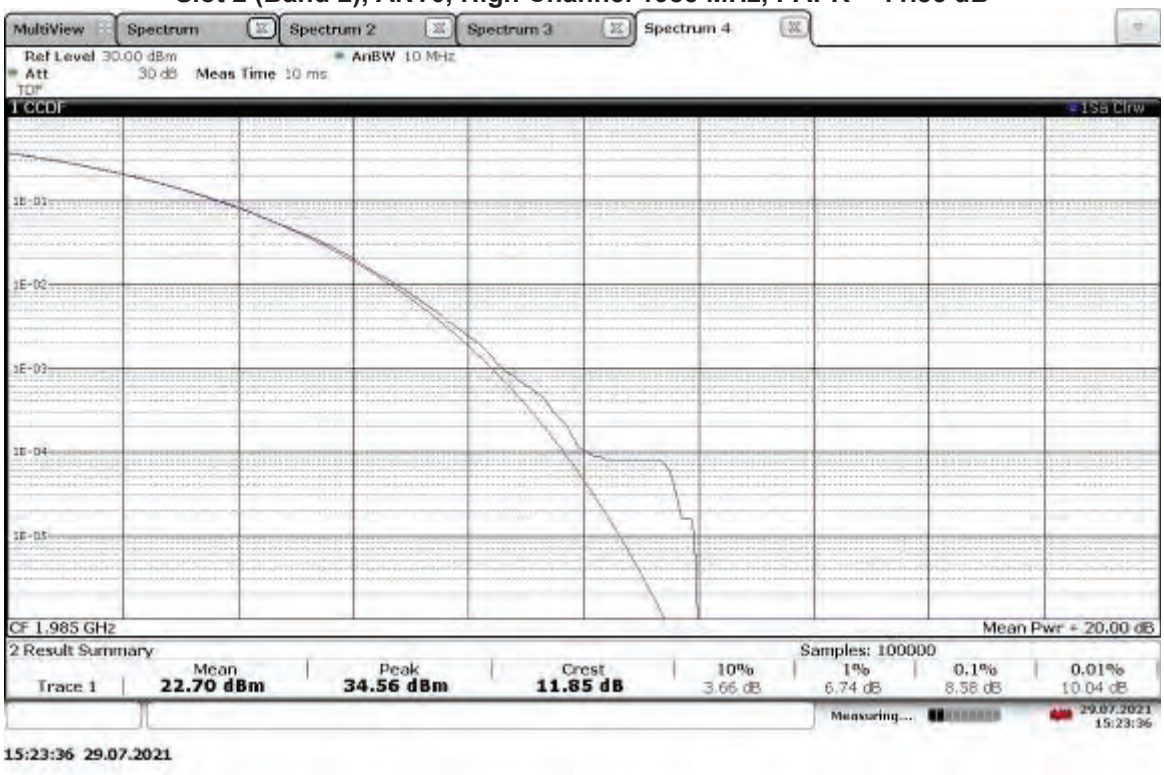
TM1.1-QPSK_10 MHz Bandwidth
Slot 2 (Band 2), ANT0, Mid Channel 1960 MHz, PAPR = 11.87 dB



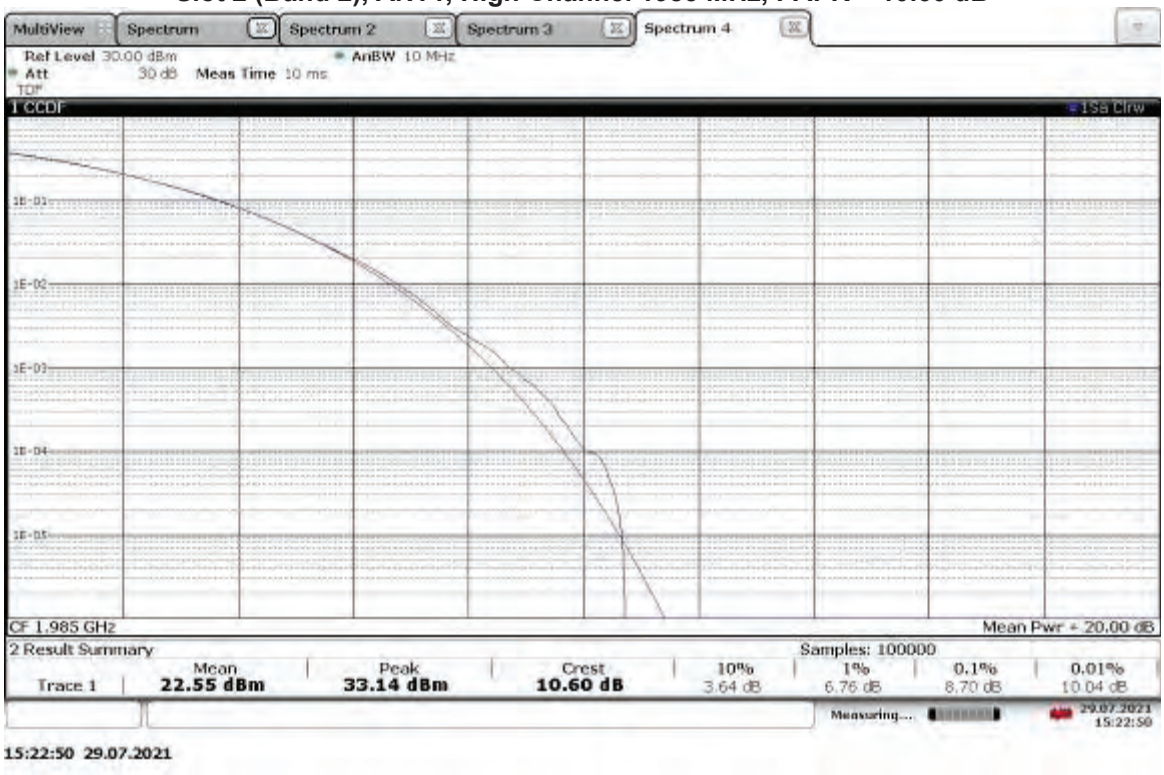
TM1.1-QPSK_10 MHz Bandwidth
Slot 2 (Band 2), ANT1, Mid Channel 1960 MHz, PAPR = 11.32 dB



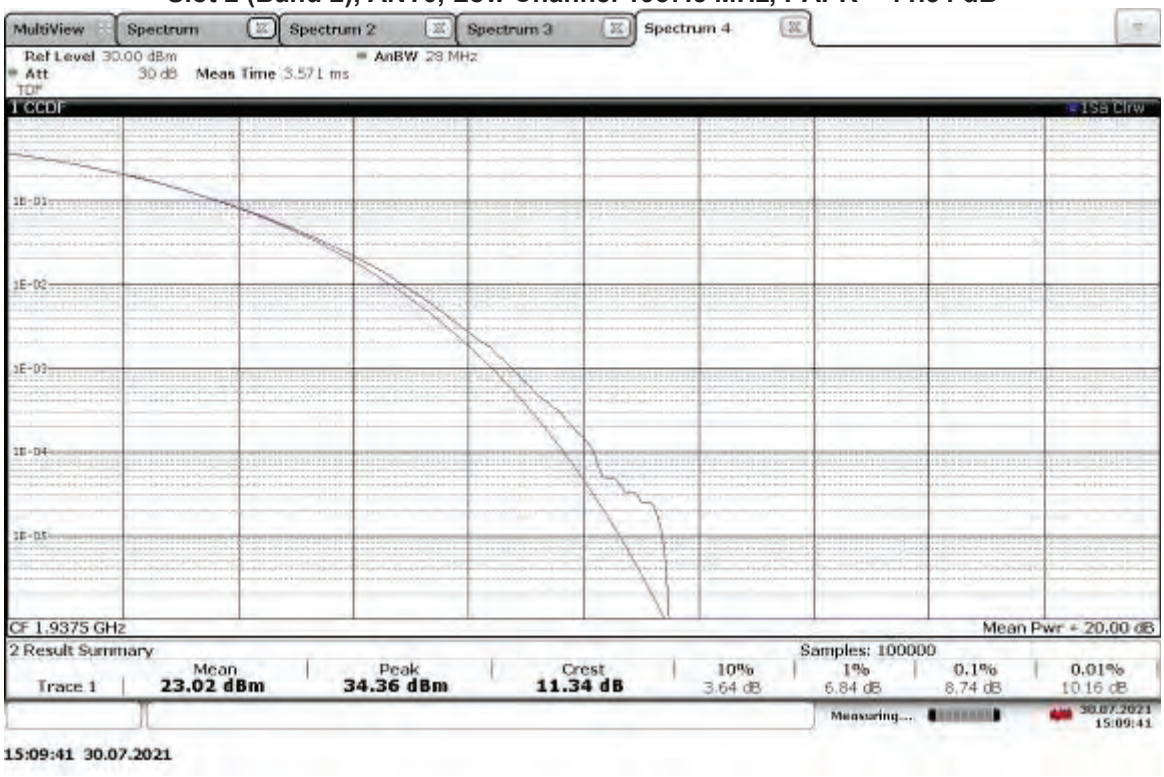
TM1.1-QPSK_10 MHz Bandwidth
Slot 2 (Band 2), ANT0, High Channel 1985 MHz, PAPR = 11.85 dB



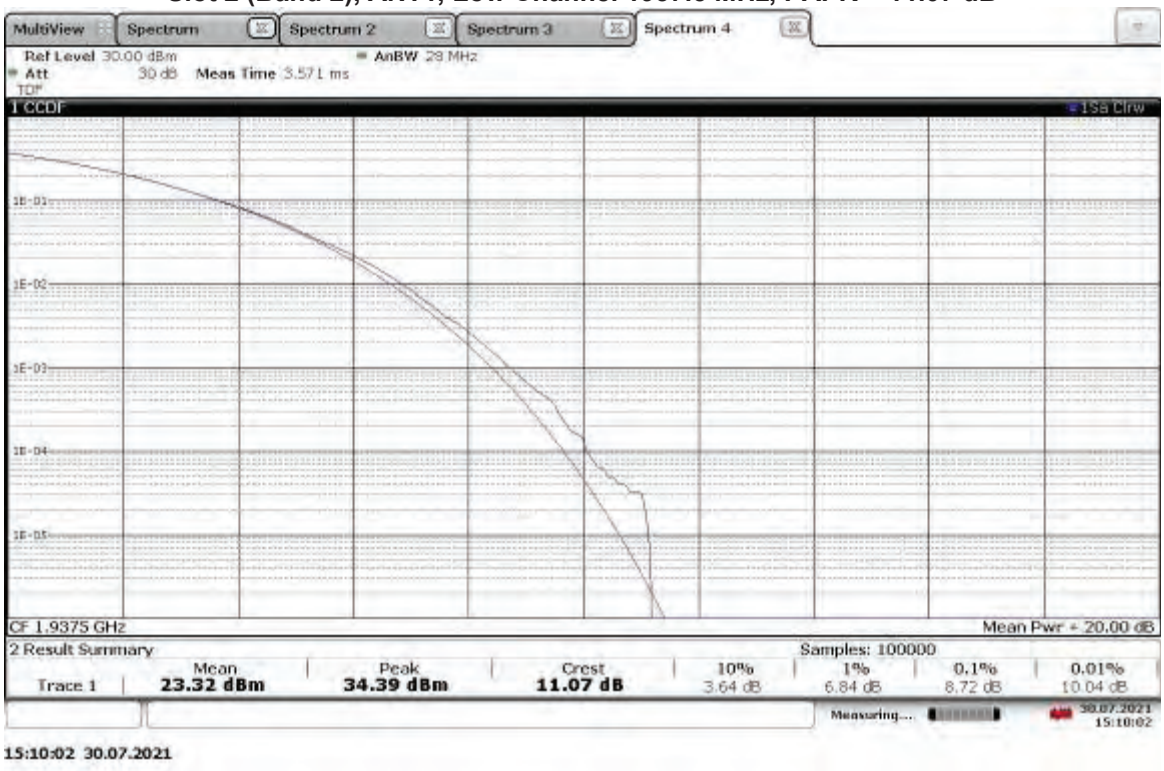
TM1.1-QPSK_10 MHz Bandwidth
Slot 2 (Band 2), ANT1, High Channel 1985 MHz, PAPR = 10.60 dB



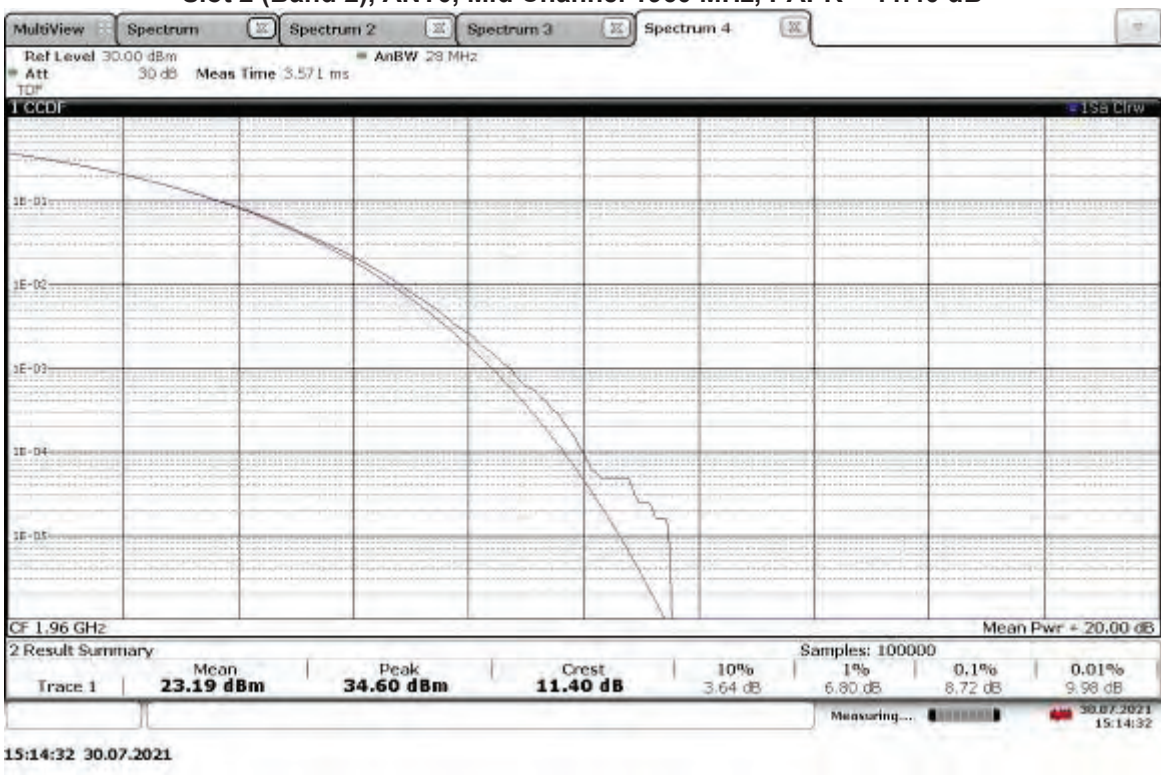
TM1.1-QPSK_15 MHz Bandwidth
Slot 2 (Band 2), ANT0, Low Channel 1937.5 MHz, PAPR = 11.34 dB



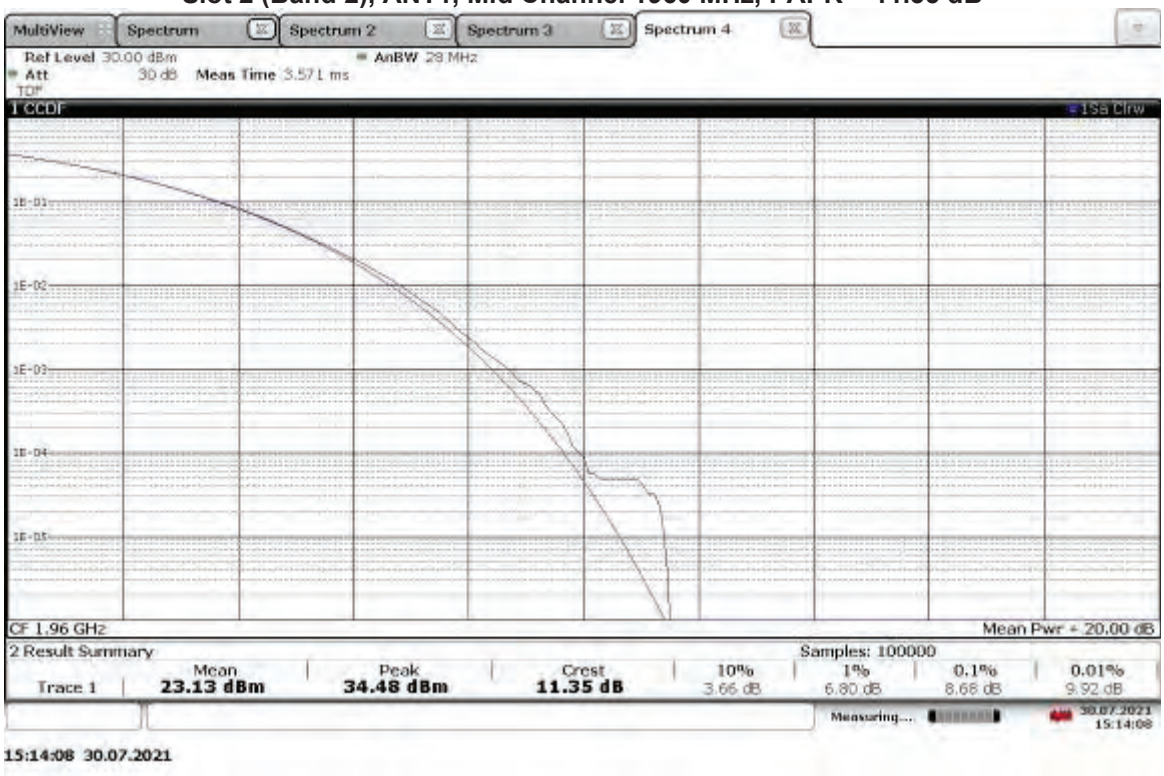
TM1.1-QPSK_15 MHz Bandwidth
Slot 2 (Band 2), ANT1, Low Channel 1937.5 MHz, PAPR = 11.07 dB



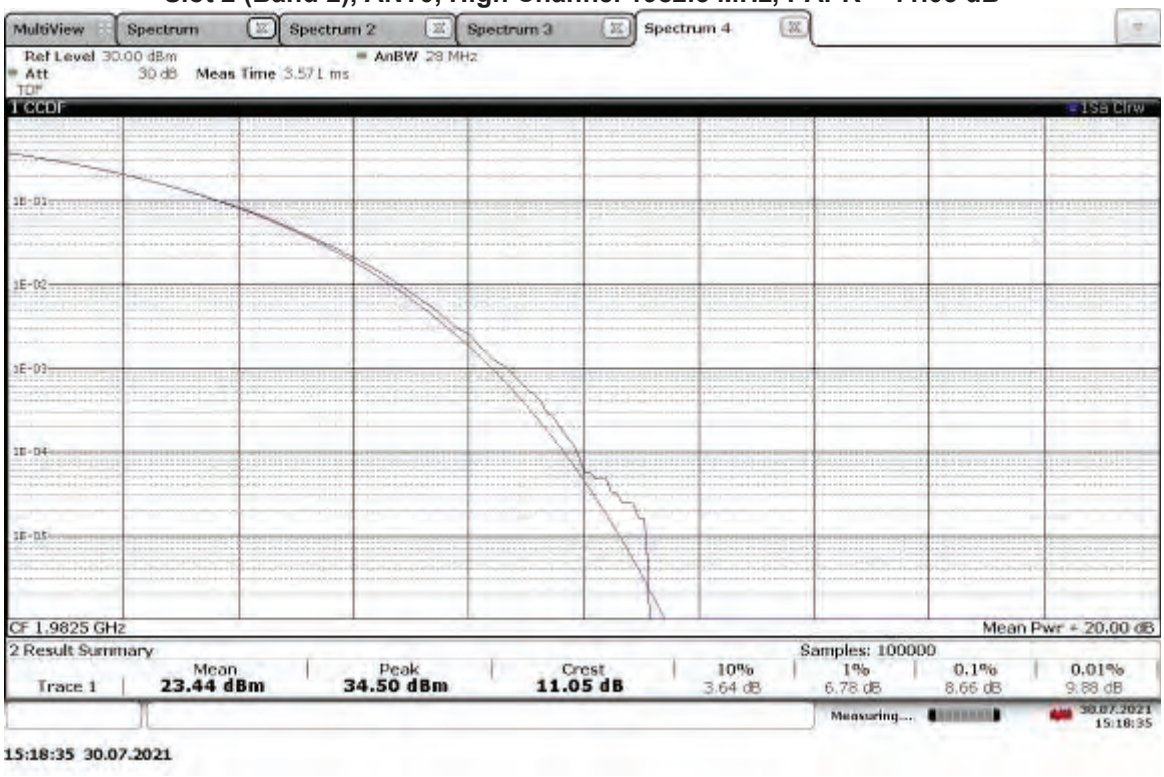
TM1.1-QPSK_15 MHz Bandwidth
Slot 2 (Band 2), ANT0, Mid Channel 1960 MHz, PAPR = 11.40 dB



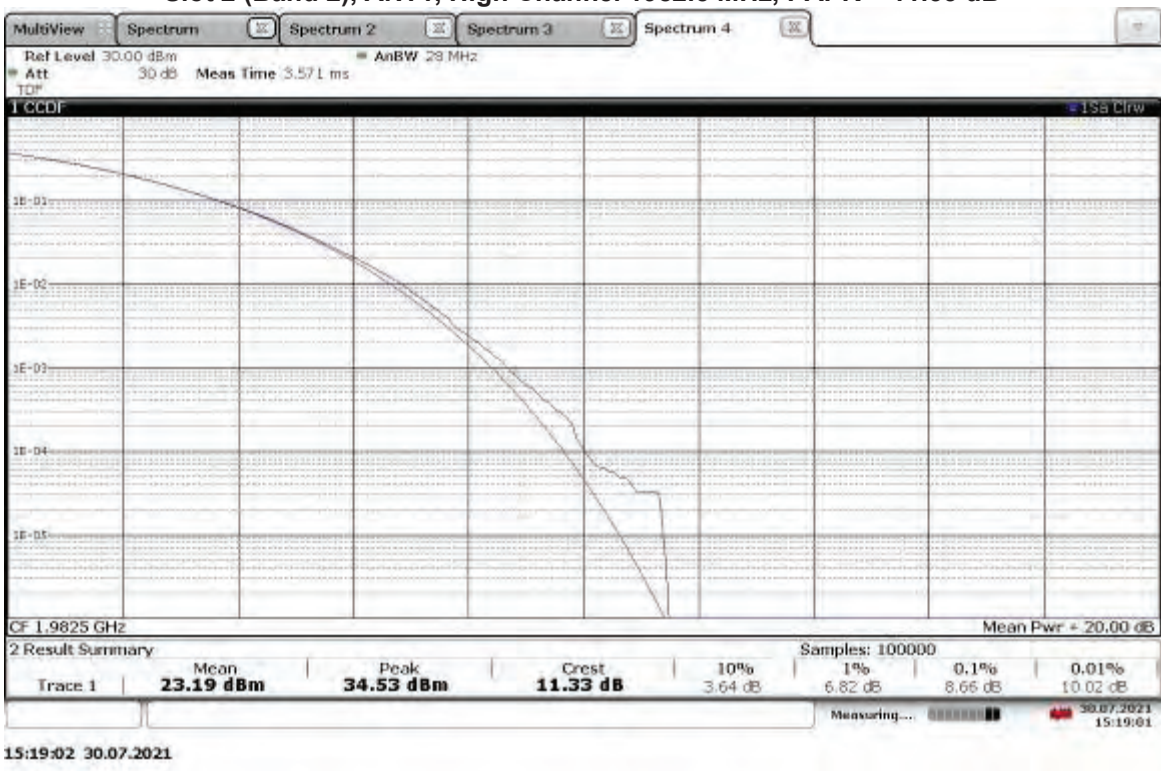
TM1.1-QPSK_15 MHz Bandwidth
Slot 2 (Band 2), ANT1, Mid Channel 1960 MHz, PAPR = 11.35 dB



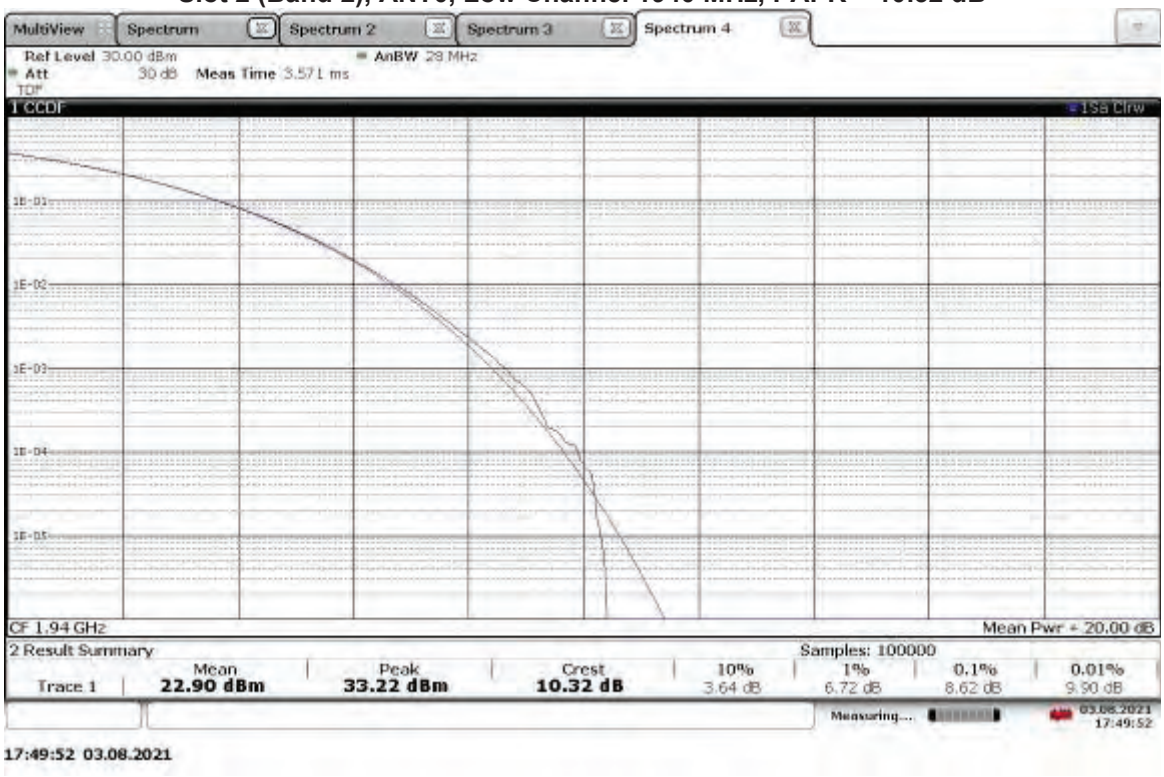
TM1.1-QPSK_15 MHz Bandwidth
Slot 2 (Band 2), ANT0, High Channel 1982.5 MHz, PAPR = 11.05 dB



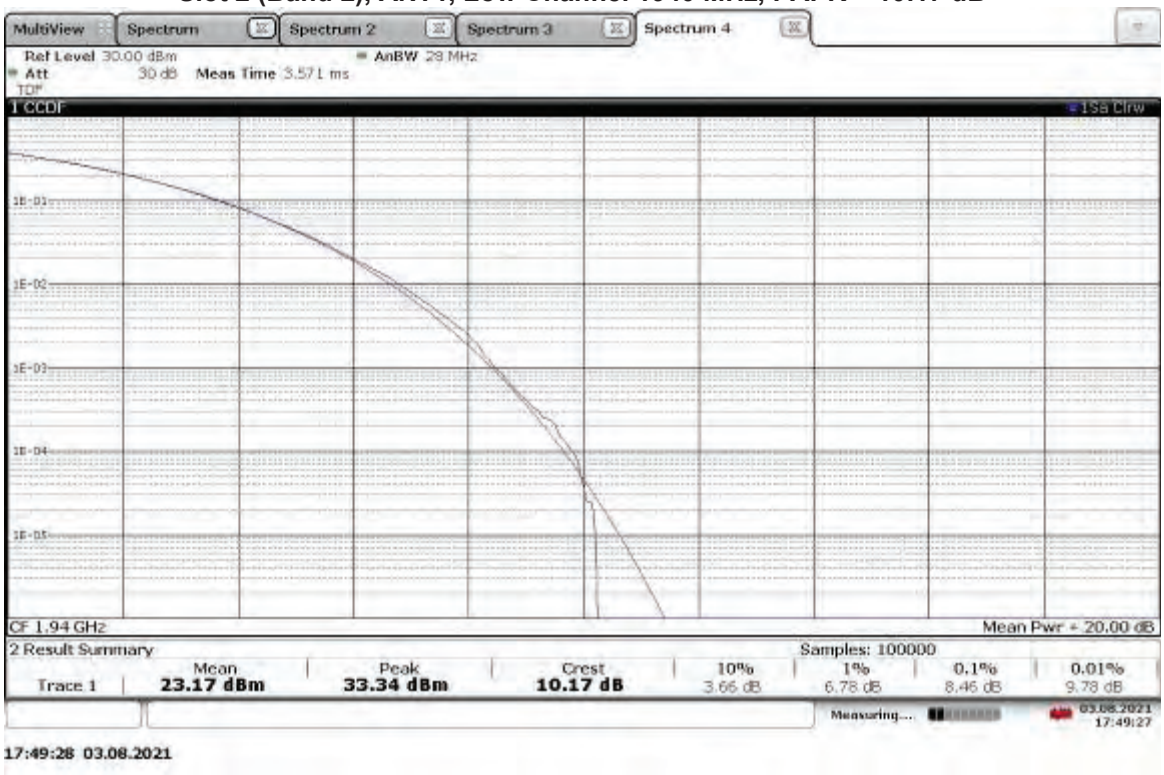
TM1.1-QPSK_15 MHz Bandwidth
Slot 2 (Band 2), ANT1, High Channel 1982.5 MHz, PAPR = 11.33 dB



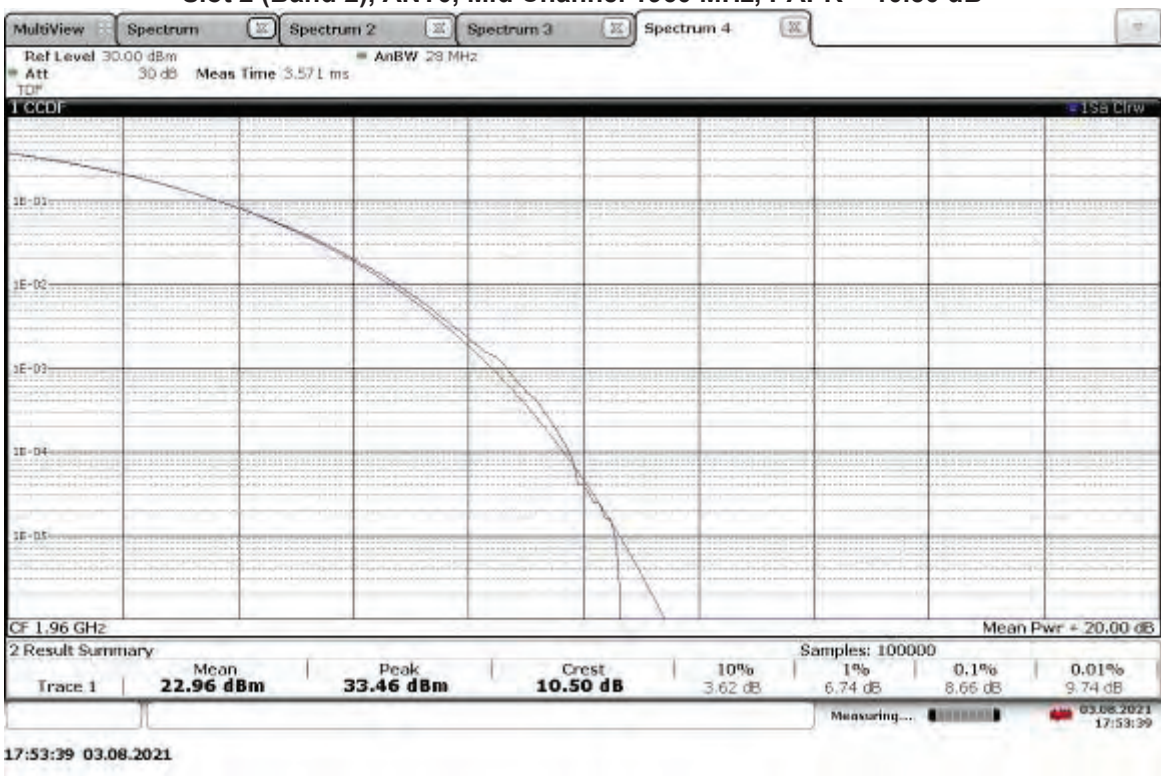
TM1.1-QPSK_20 MHz Bandwidth
Slot 2 (Band 2), ANT0, Low Channel 1940 MHz, PAPR = 10.32 dB



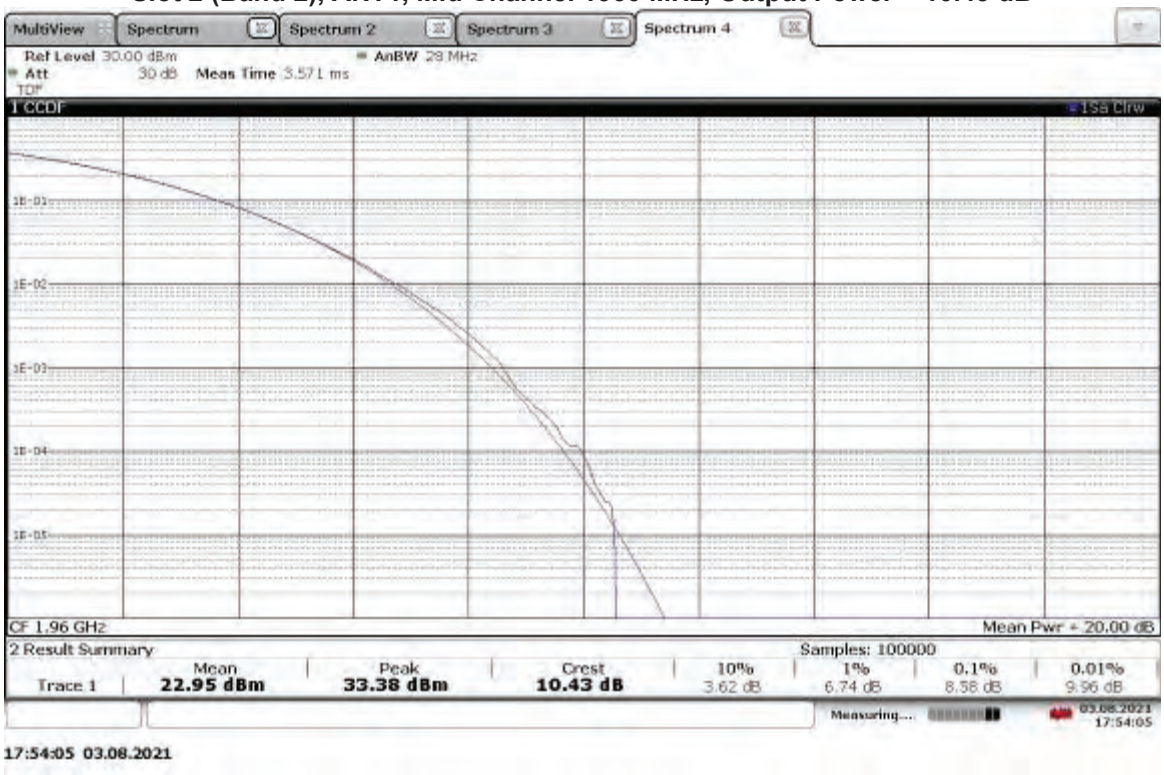
TM1.1-QPSK_20 MHz Bandwidth
Slot 2 (Band 2), ANT1, Low Channel 1940 MHz, PAPR = 10.17 dB



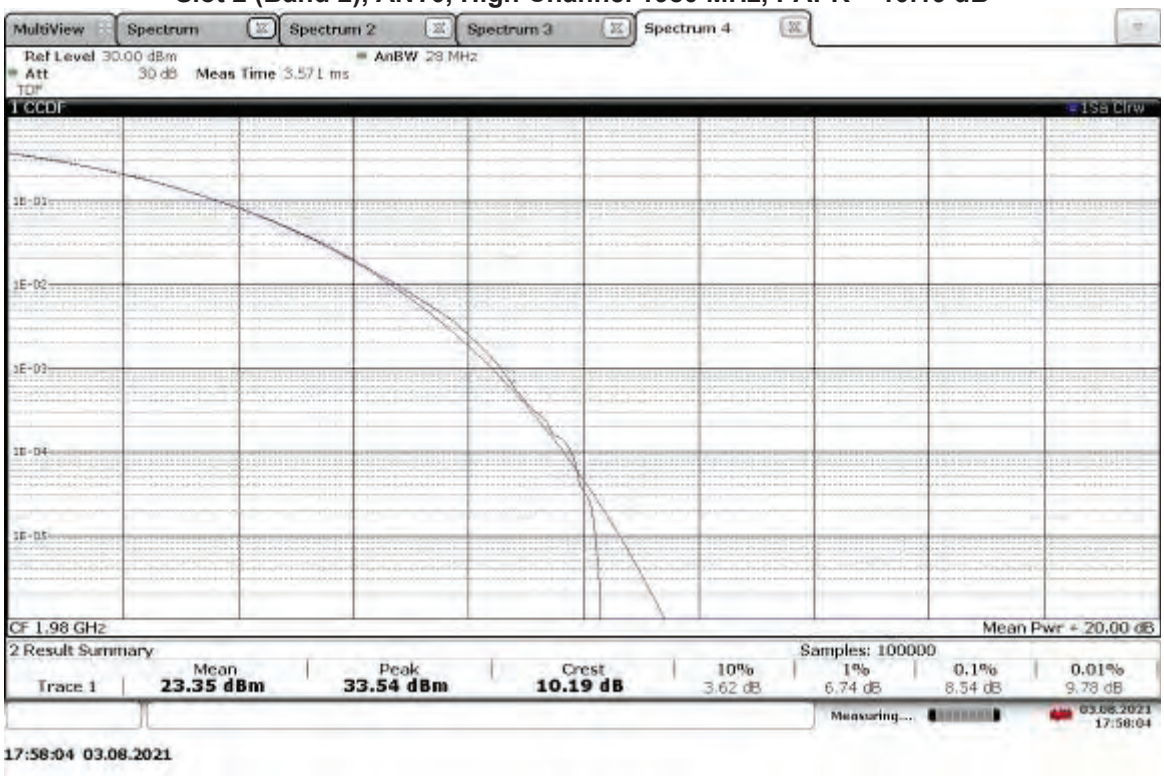
TM1.1-QPSK_20 MHz Bandwidth
Slot 2 (Band 2), ANT0, Mid Channel 1960 MHz, PAPR = 10.50 dB



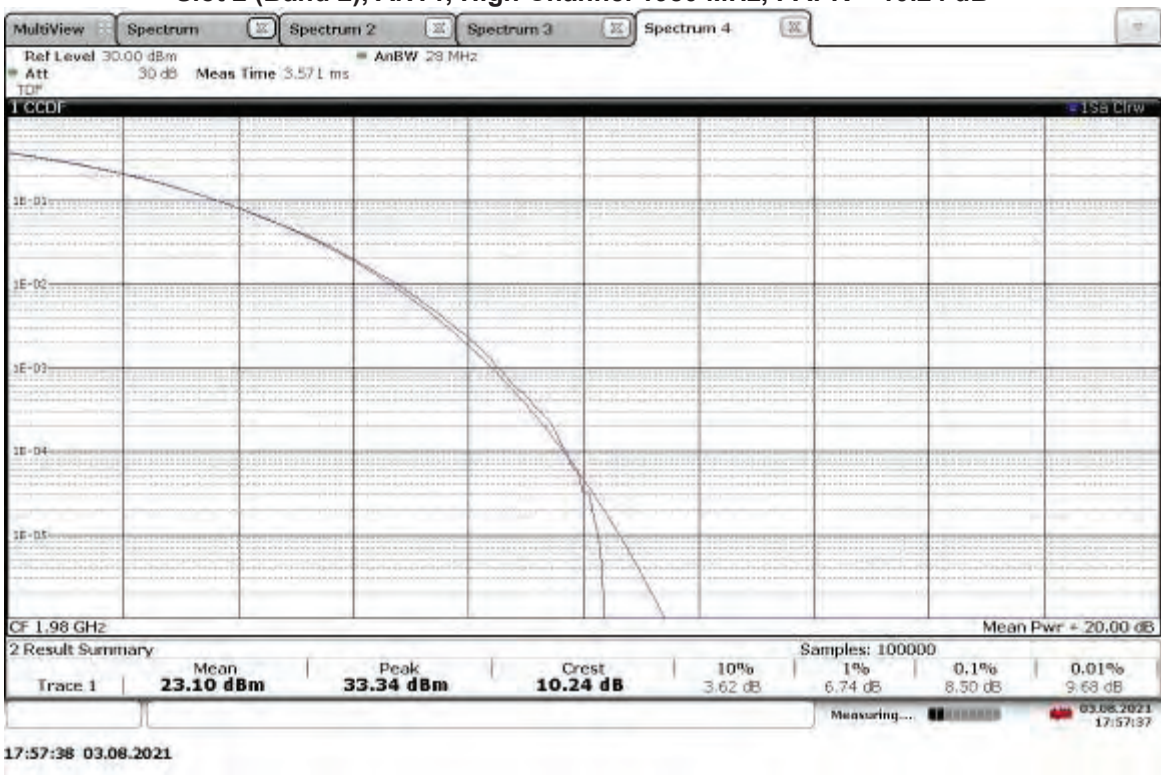
TM1.1-QPSK_20 MHz Bandwidth
Slot 2 (Band 2), ANT1, Mid Channel 1960 MHz, Output Power = 10.43 dB



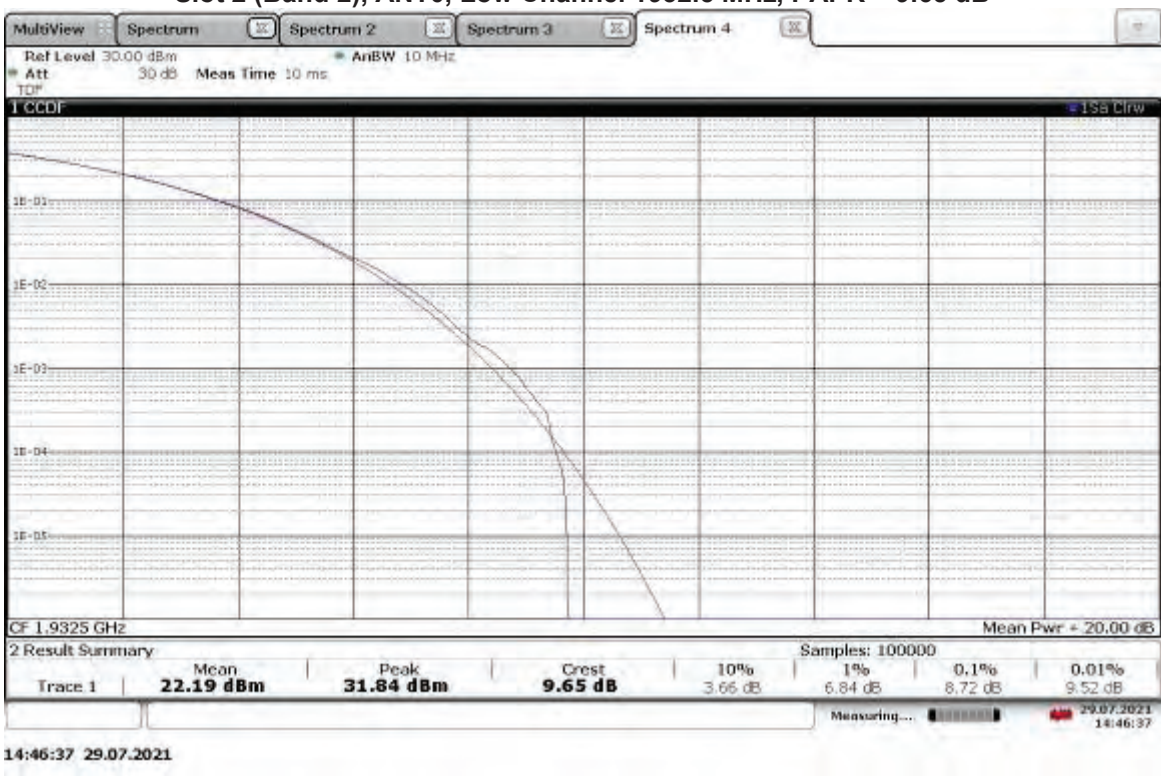
TM1.1-QPSK_20 MHz Bandwidth
Slot 2 (Band 2), ANT0, High Channel 1980 MHz, PAPR = 10.19 dB



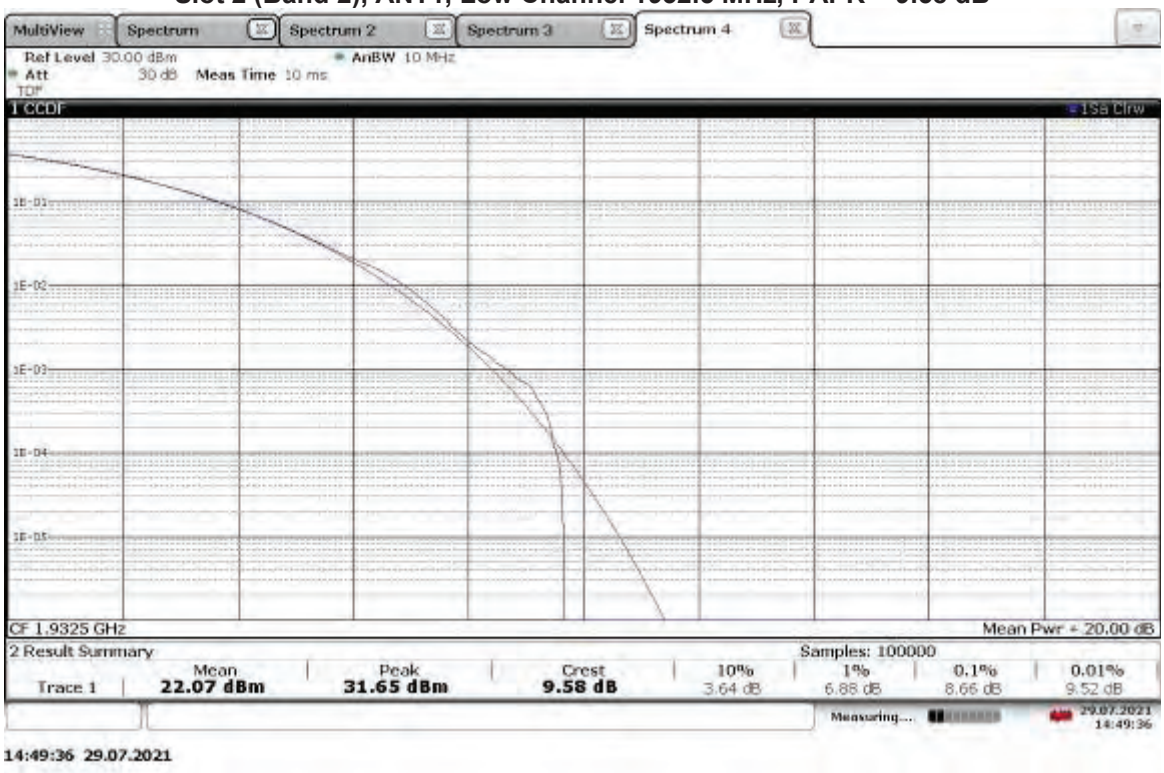
TM1.1-QPSK_20 MHz Bandwidth
Slot 2 (Band 2), ANT1, High Channel 1980 MHz, PAPR = 10.24 dB



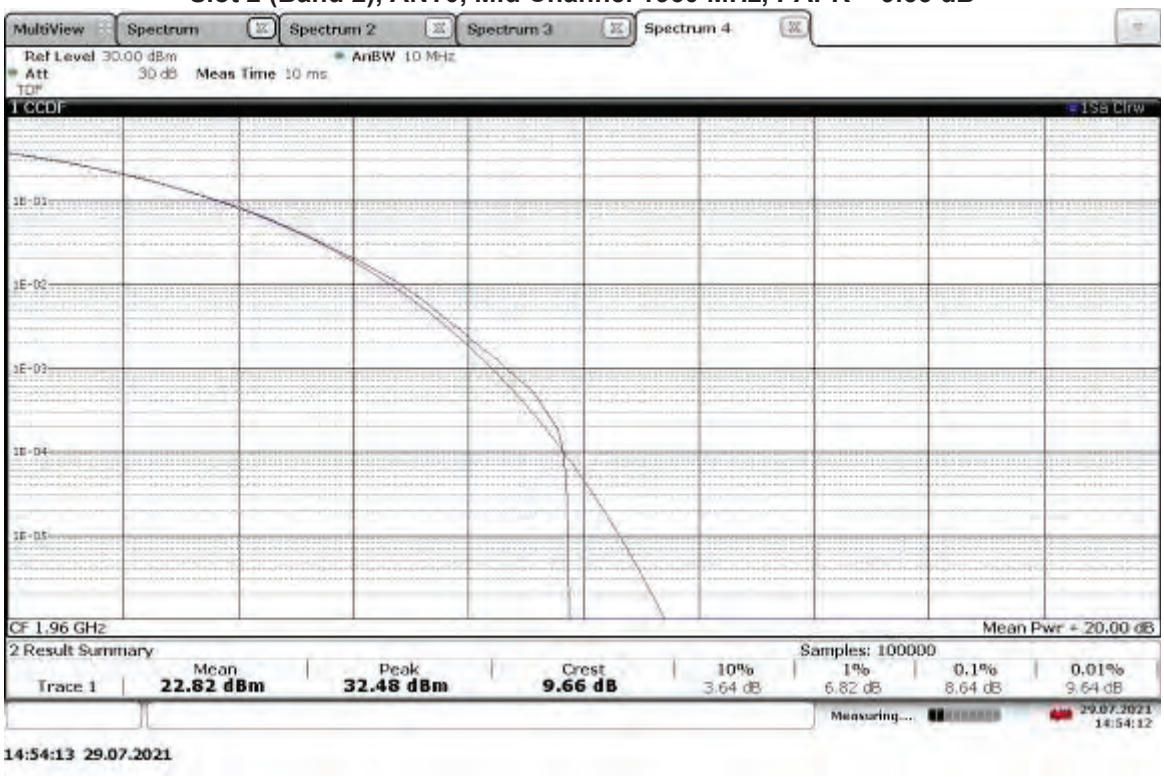
TM3.2 - 16QAM_5MHz Bandwidth
Slot 2 (Band 2), ANT0, Low Channel 1932.5 MHz, PAPR = 9.65 dB



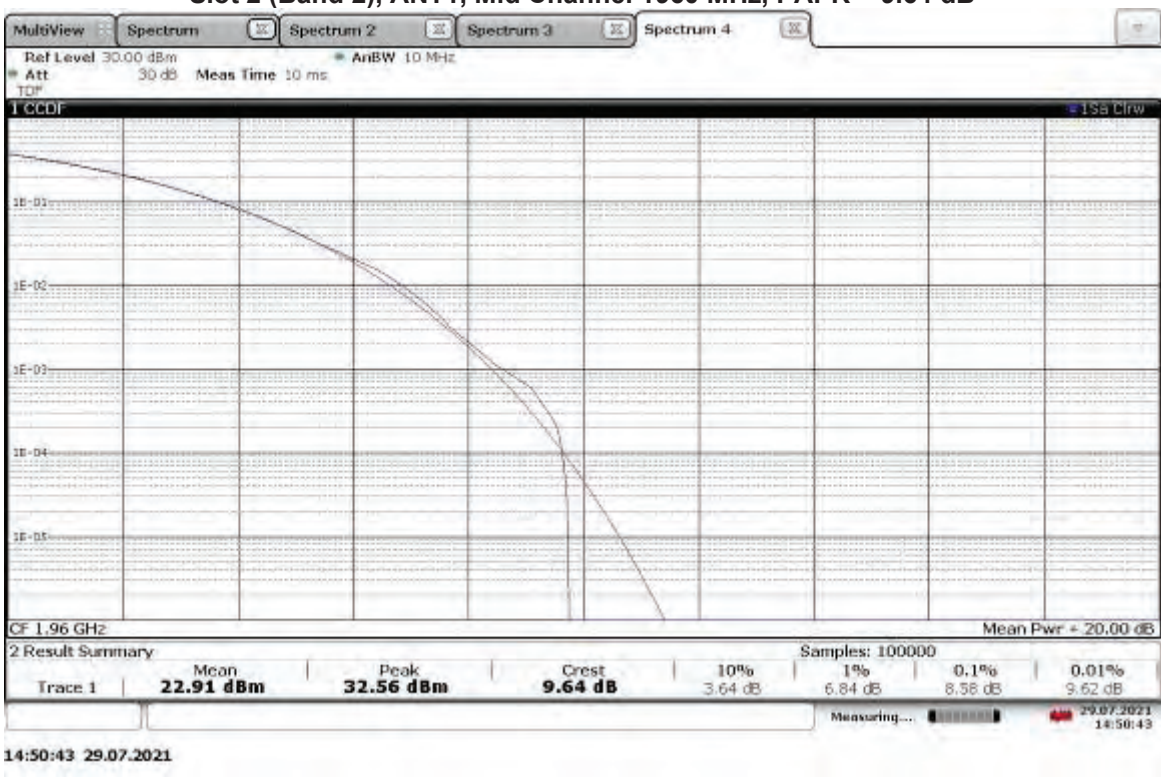
TM3.2 - 16QAM_5MHz Bandwidth
Slot 2 (Band 2), ANT1, Low Channel 1932.5 MHz, PAPR = 9.58 dB



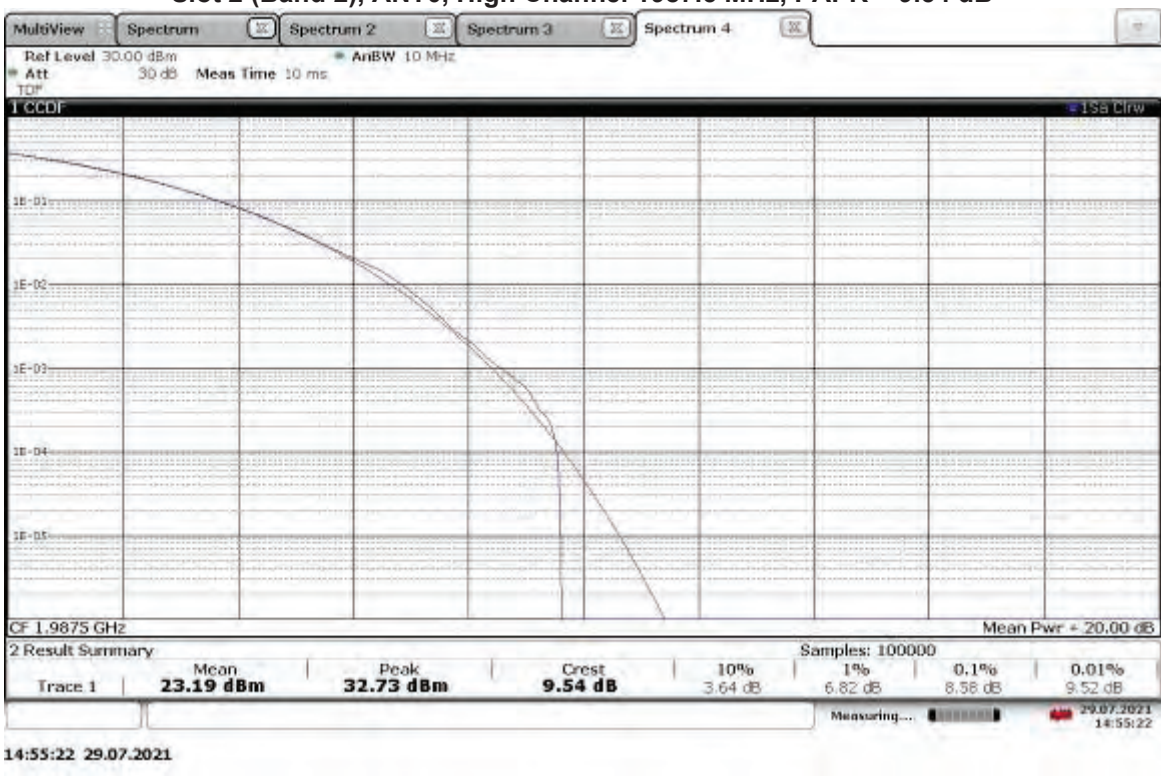
TM3.2 - 16QAM_5MHz Bandwidth
Slot 2 (Band 2), ANT0, Mid Channel 1960 MHz, PAPR = 9.66 dB



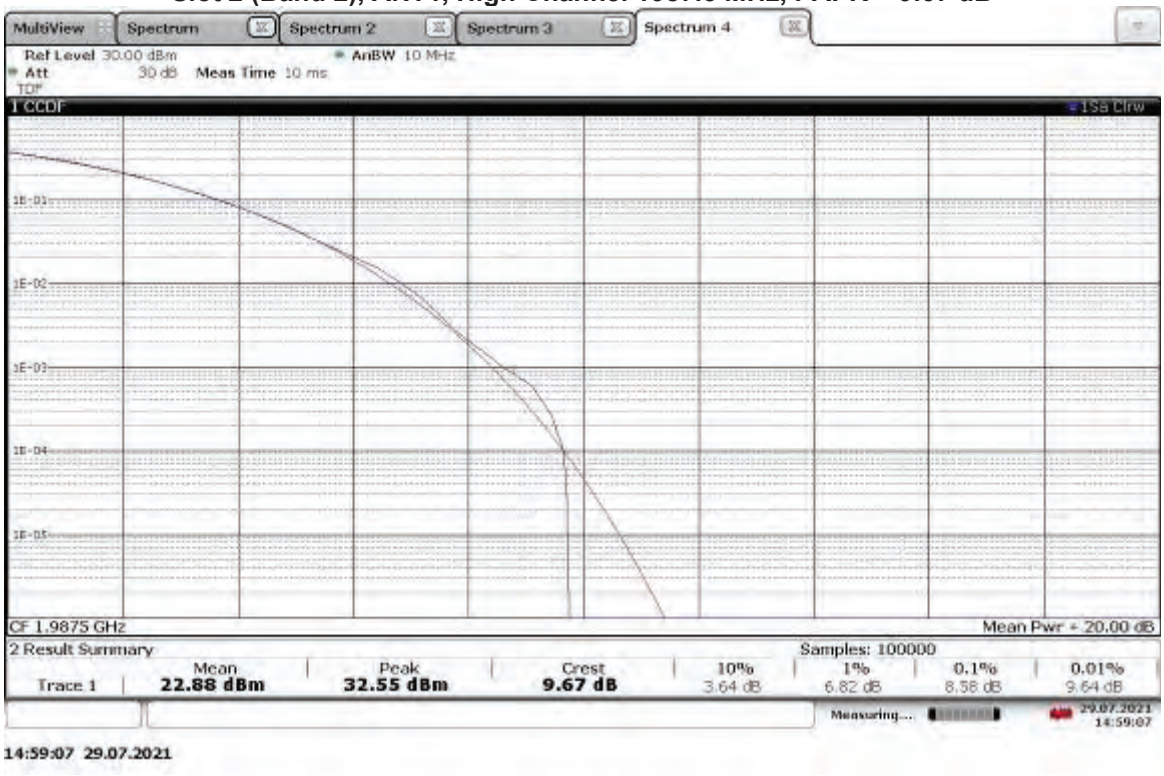
TM3.2 - 16QAM_5MHz Bandwidth
Slot 2 (Band 2), ANT1, Mid Channel 1960 MHz, PAPR = 9.64 dB



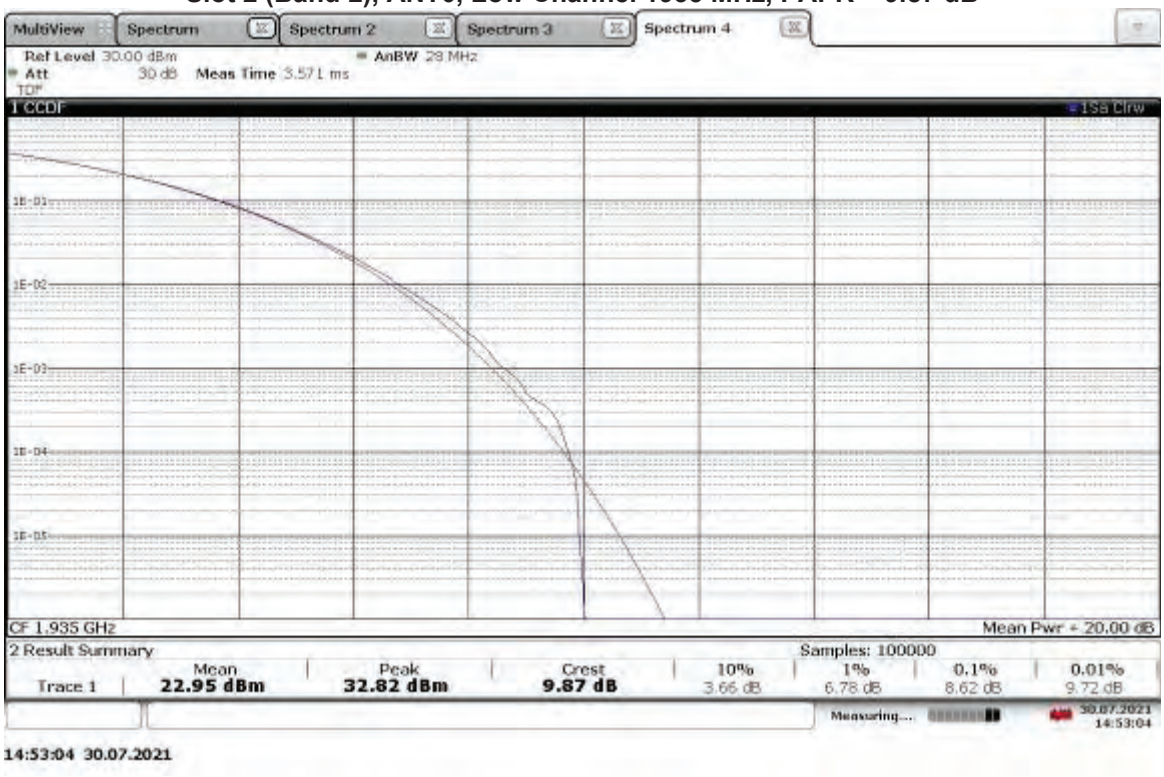
TM3.2 - 16QAM_5MHz Bandwidth
Slot 2 (Band 2), ANT0, High Channel 1987.5 MHz, PAPR = 9.54 dB



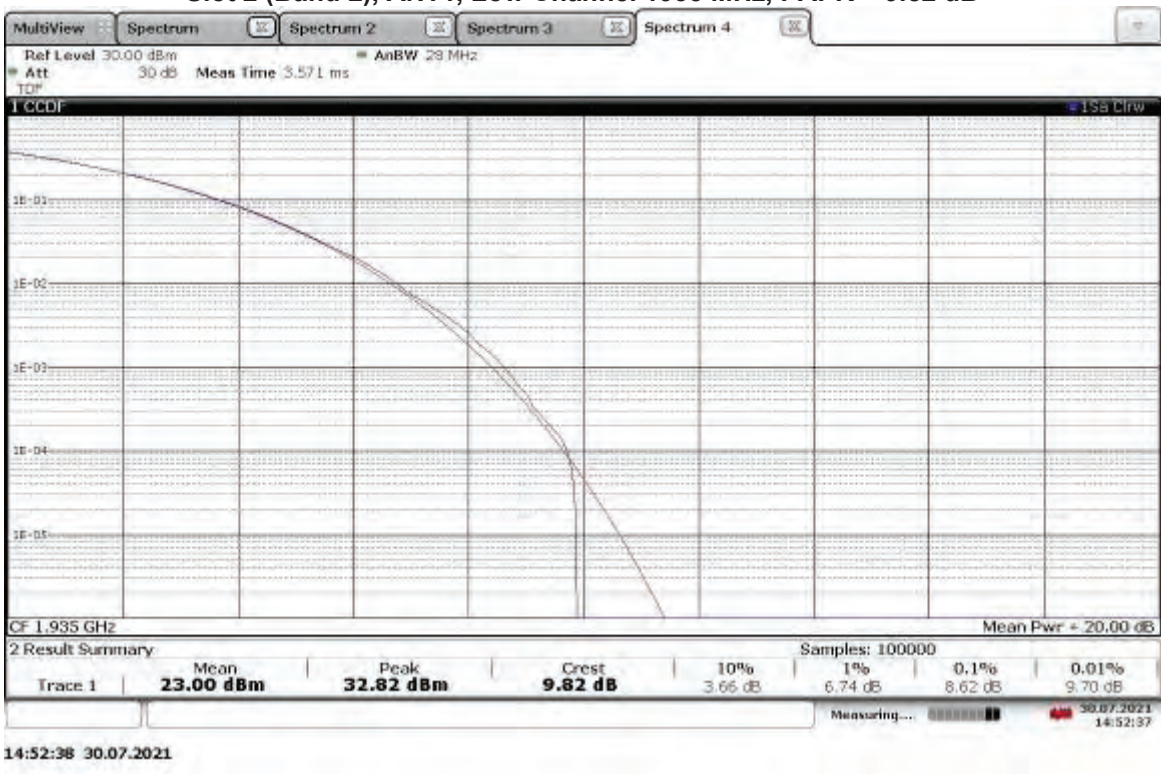
TM3.2 - 16QAM_5MHz Bandwidth
Slot 2 (Band 2), ANT1, High Channel 1987.5 MHz, PAPR = 9.67 dB



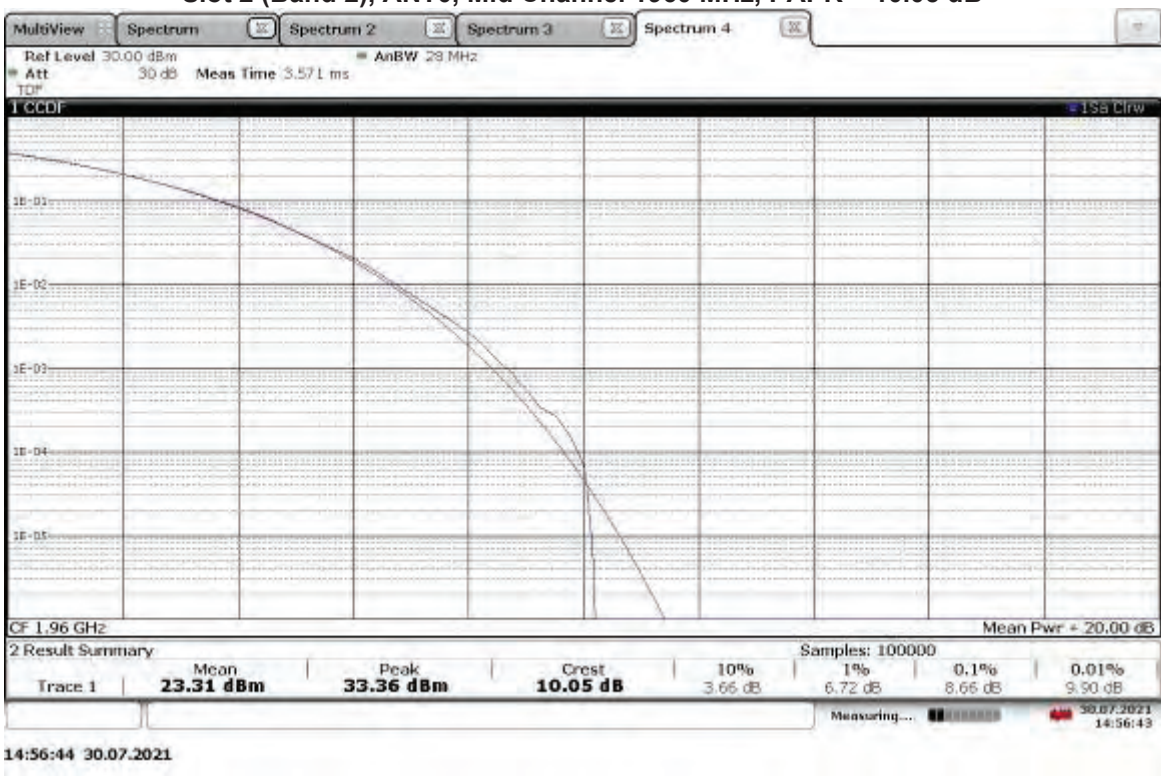
TM3.2 - 16QAM_10 MHz Bandwidth
Slot 2 (Band 2), ANT0, Low Channel 1935 MHz, PAPR = 9.87 dB



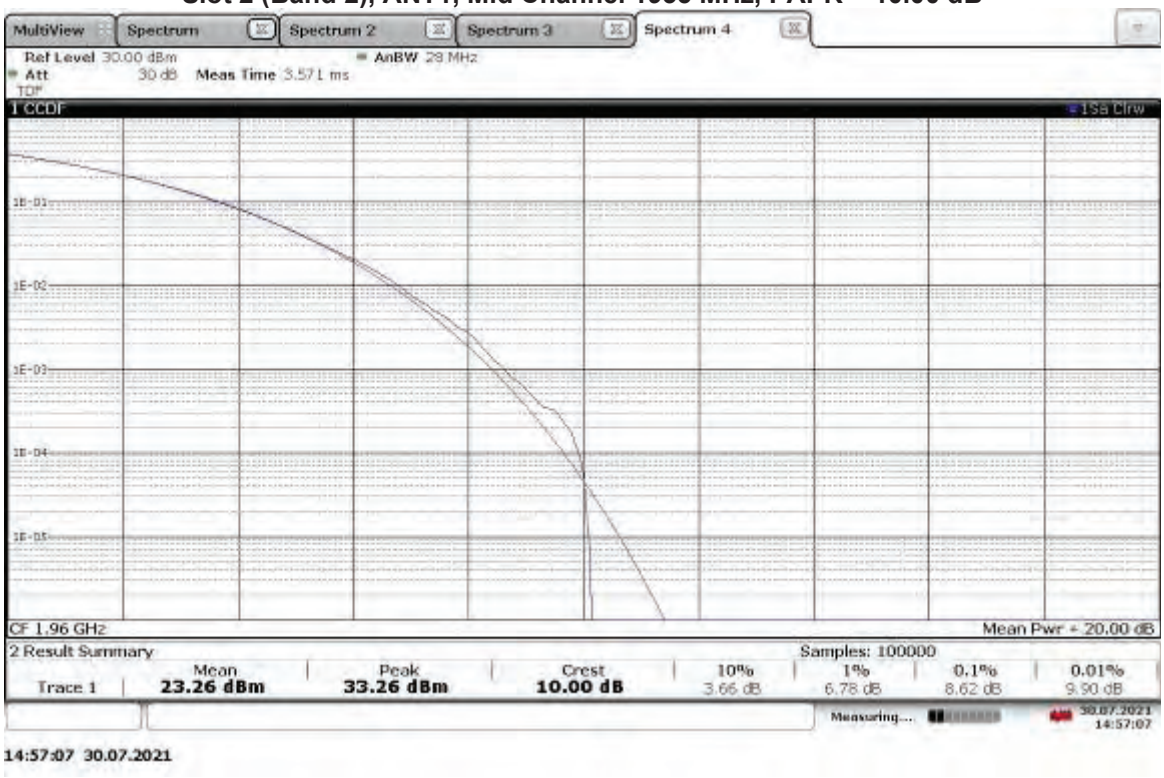
TM3.2 - 16QAM_10 MHz Bandwidth
Slot 2 (Band 2), ANT1, Low Channel 1935 MHz, PAPR = 9.82 dB



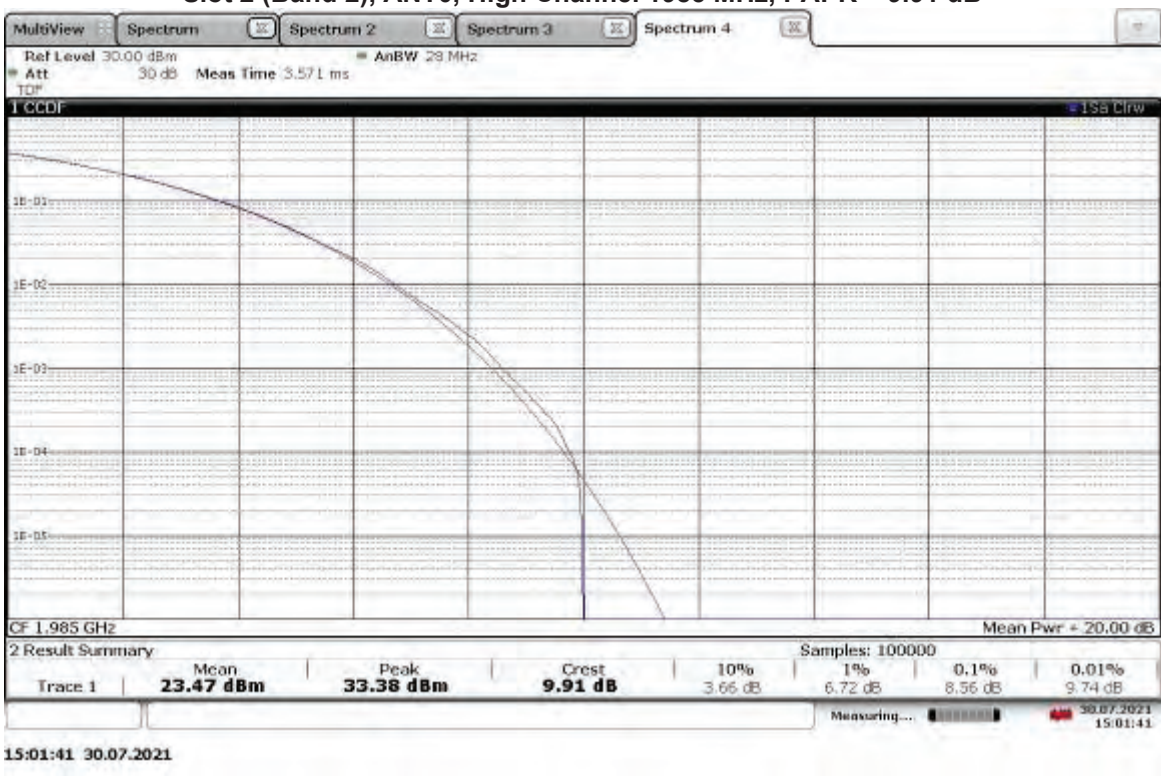
TM3.2 - 16QAM_10 MHz Bandwidth
Slot 2 (Band 2), ANT0, Mid Channel 1960 MHz, PAPR = 10.05 dB



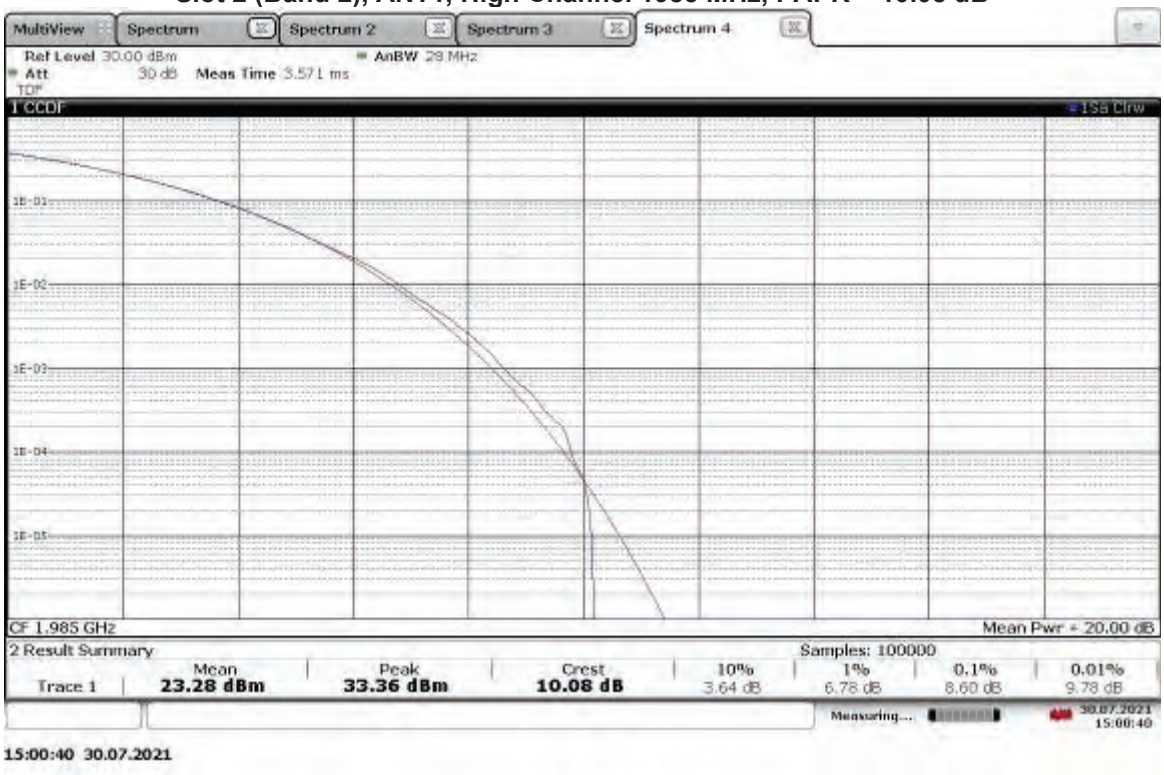
TM3.2 - 16QAM_10 MHz Bandwidth
Slot 2 (Band 2), ANT1, Mid Channel 1935 MHz, PAPR = 10.00 dB



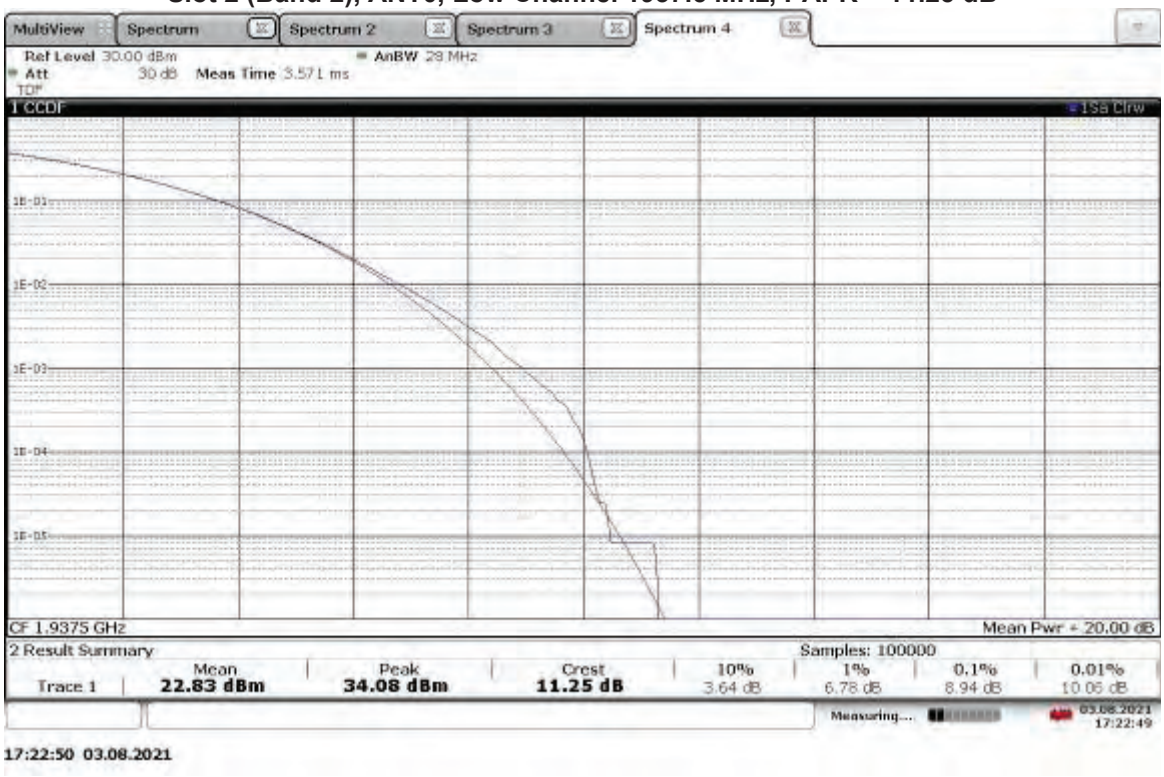
TM3.2 - 16QAM_10 MHz Bandwidth
Slot 2 (Band 2), ANT0, High Channel 1985 MHz, PAPR = 9.91 dB



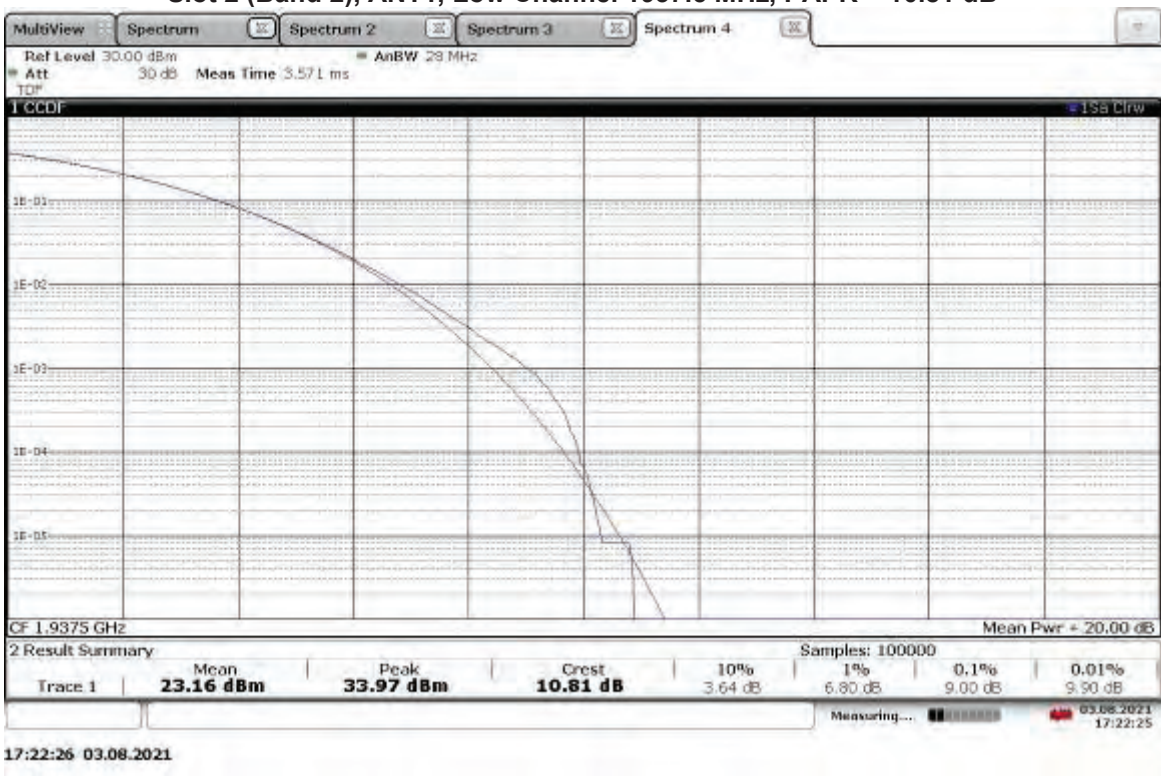
TM3.2 - 16QAM_10 MHz Bandwidth
Slot 2 (Band 2), ANT1, High Channel 1985 MHz, PAPR = 10.08 dB



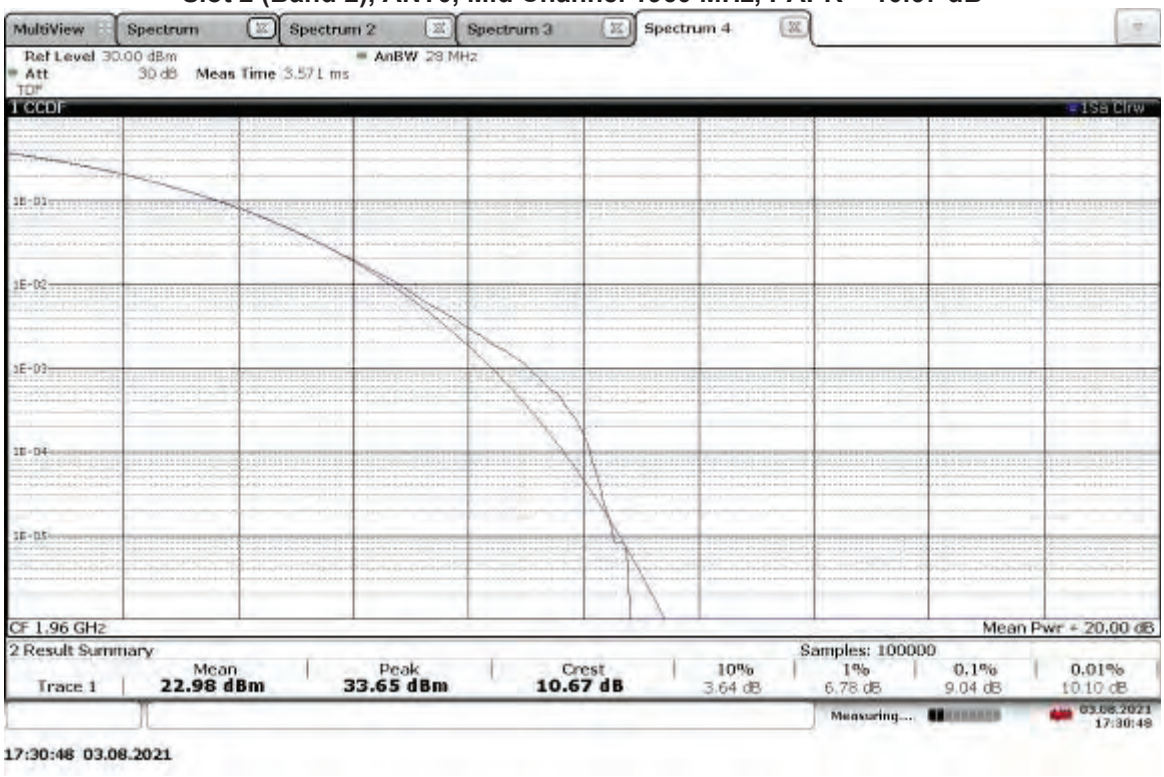
TM3.2 - 16QAM_15 MHz Bandwidth
Slot 2 (Band 2), ANT0, Low Channel 1937.5 MHz, PAPR = 11.25 dB



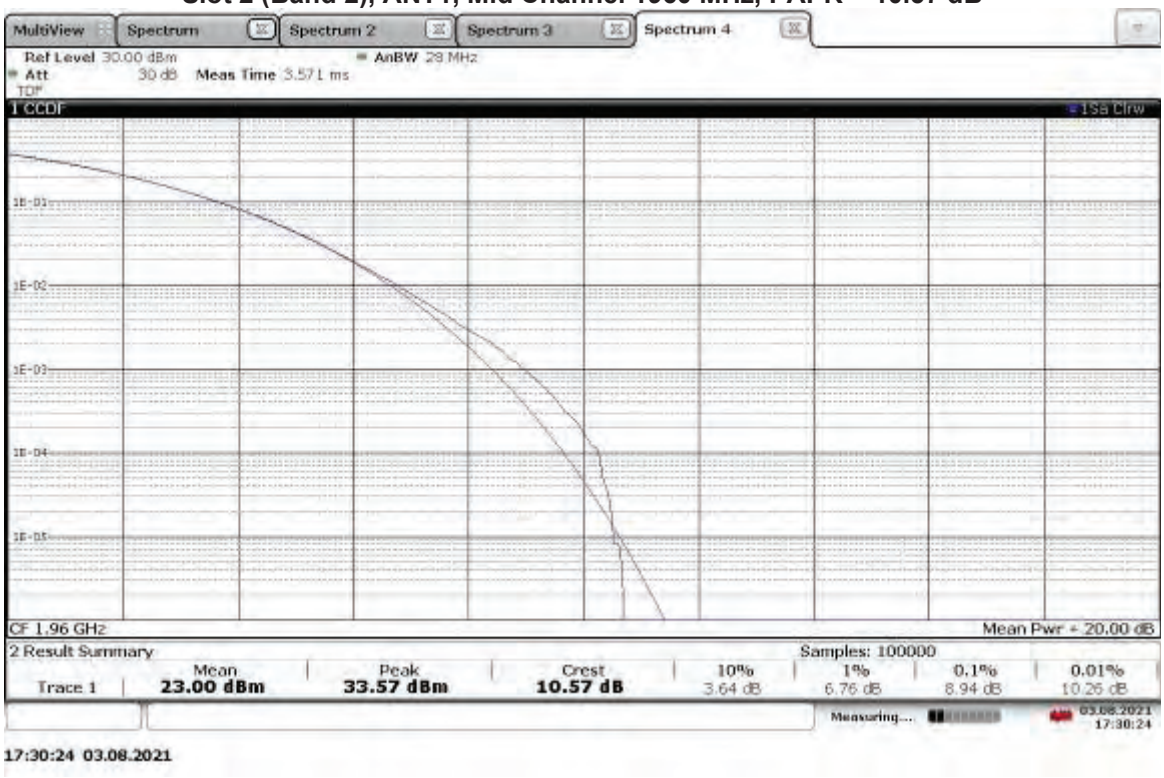
TM3.2 - 16QAM_15 MHz Bandwidth
Slot 2 (Band 2), ANT1, Low Channel 1937.5 MHz, PAPR = 10.81 dB



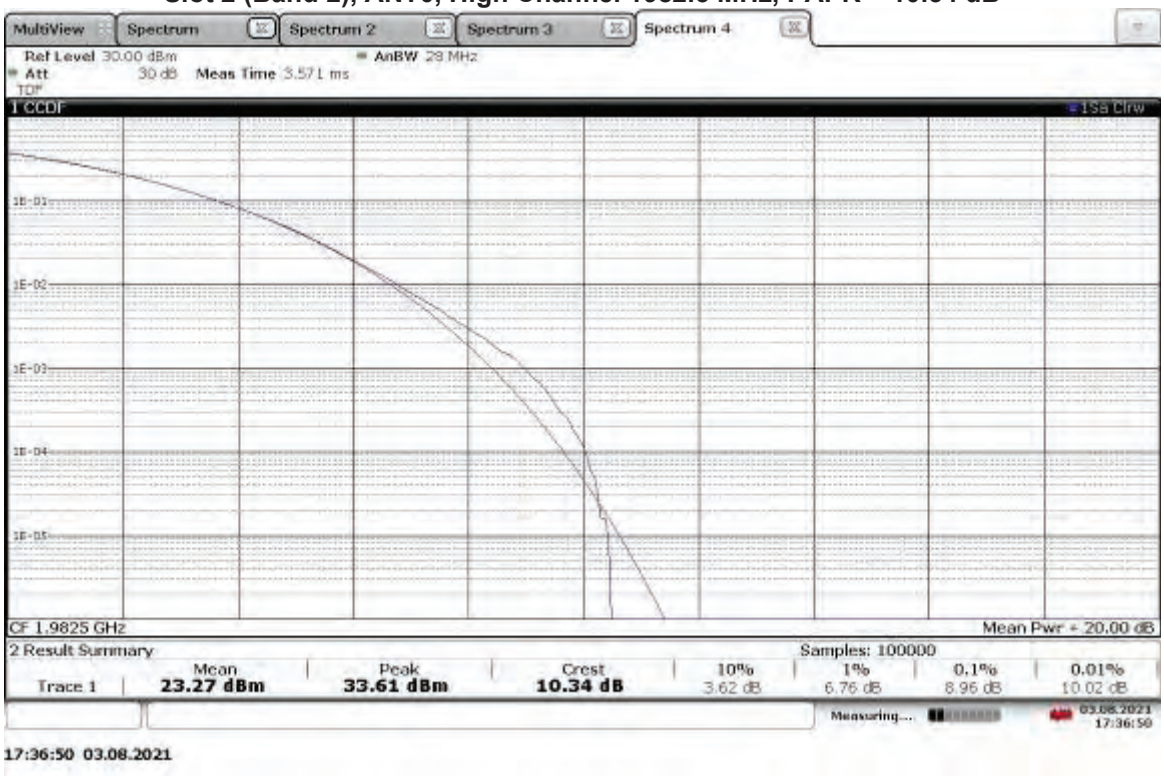
TM3.2 - 16QAM_15 MHz Bandwidth
Slot 2 (Band 2), ANT0, Mid Channel 1960 MHz, PAPR = 10.67 dB



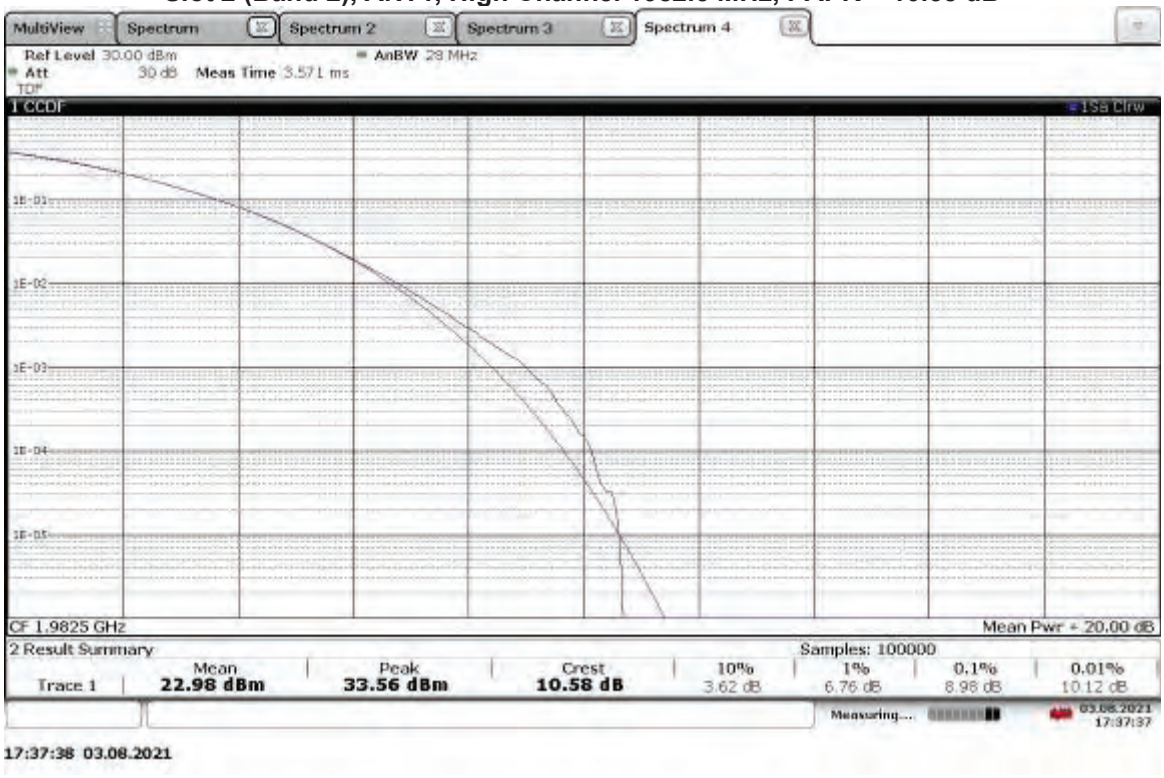
TM3.2 - 16QAM_15 MHz Bandwidth
Slot 2 (Band 2), ANT1, Mid Channel 1960 MHz, PAPR = 10.57 dB



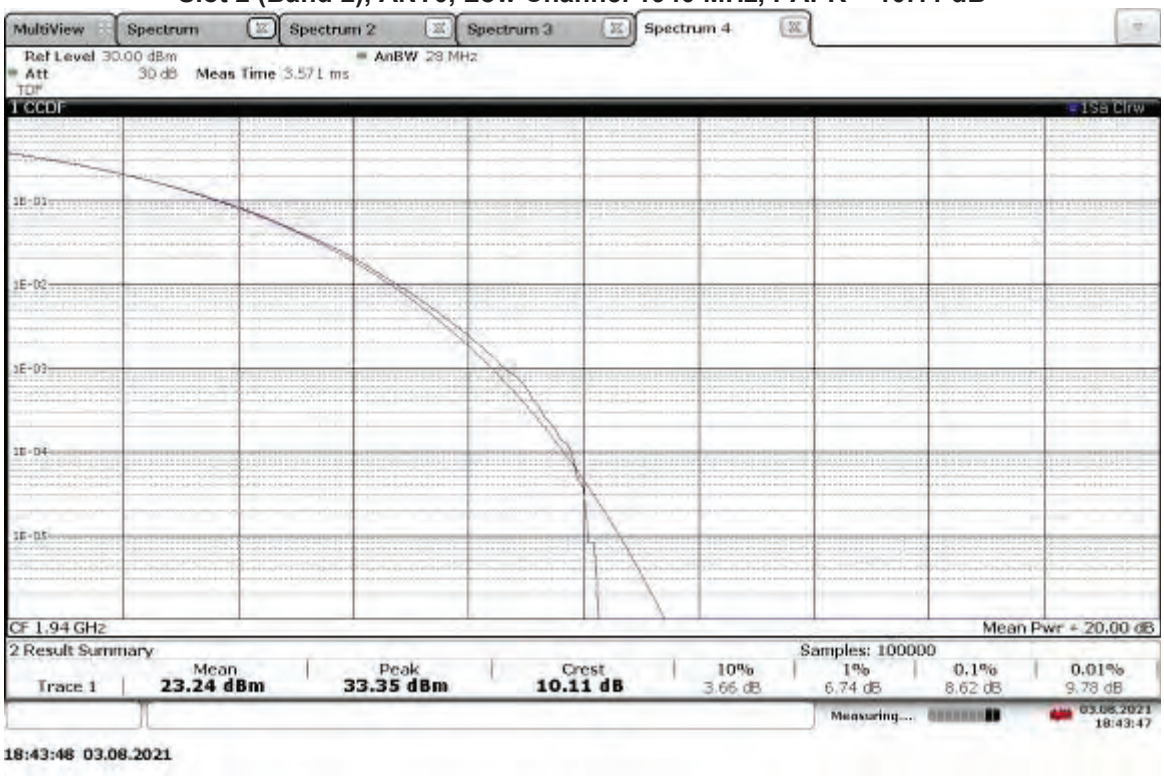
TM3.2 - 16QAM_15 MHz Bandwidth
Slot 2 (Band 2), ANT0, High Channel 1982.5 MHz, PAPR = 10.34 dB



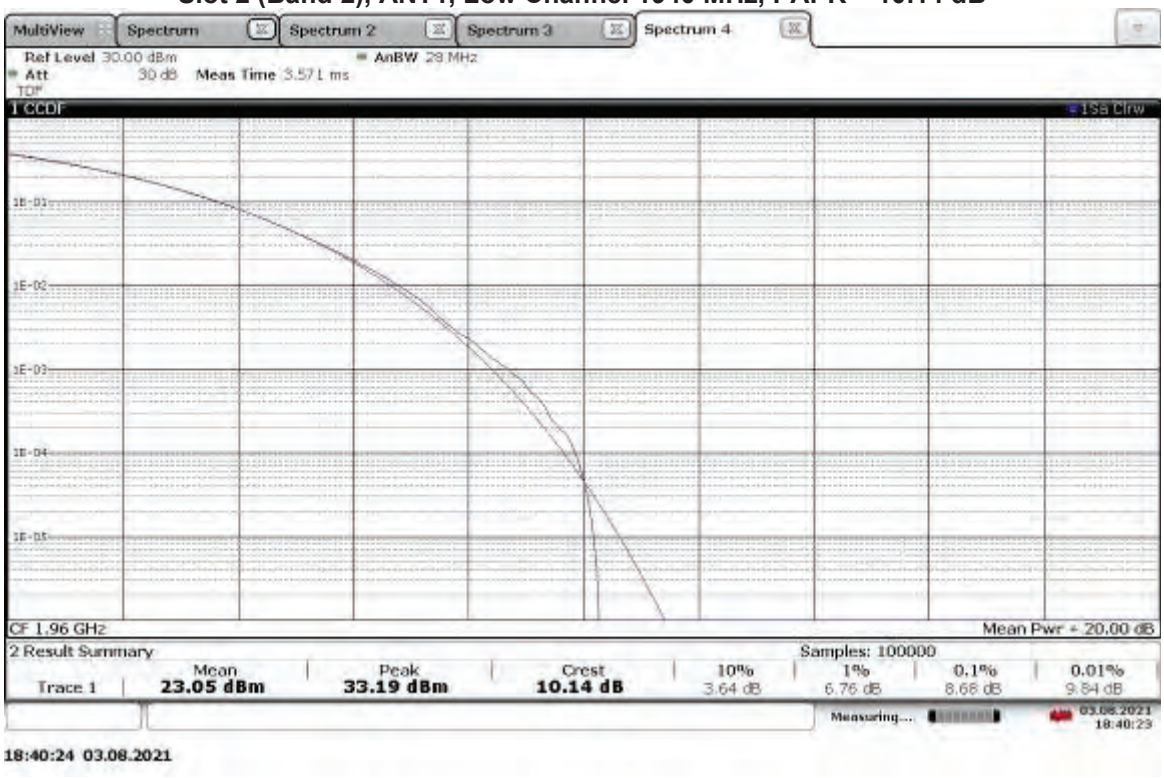
TM3.2 - 16QAM_15 MHz Bandwidth
Slot 2 (Band 2), ANT1, High Channel 1982.5 MHz, PAPR = 10.58 dB



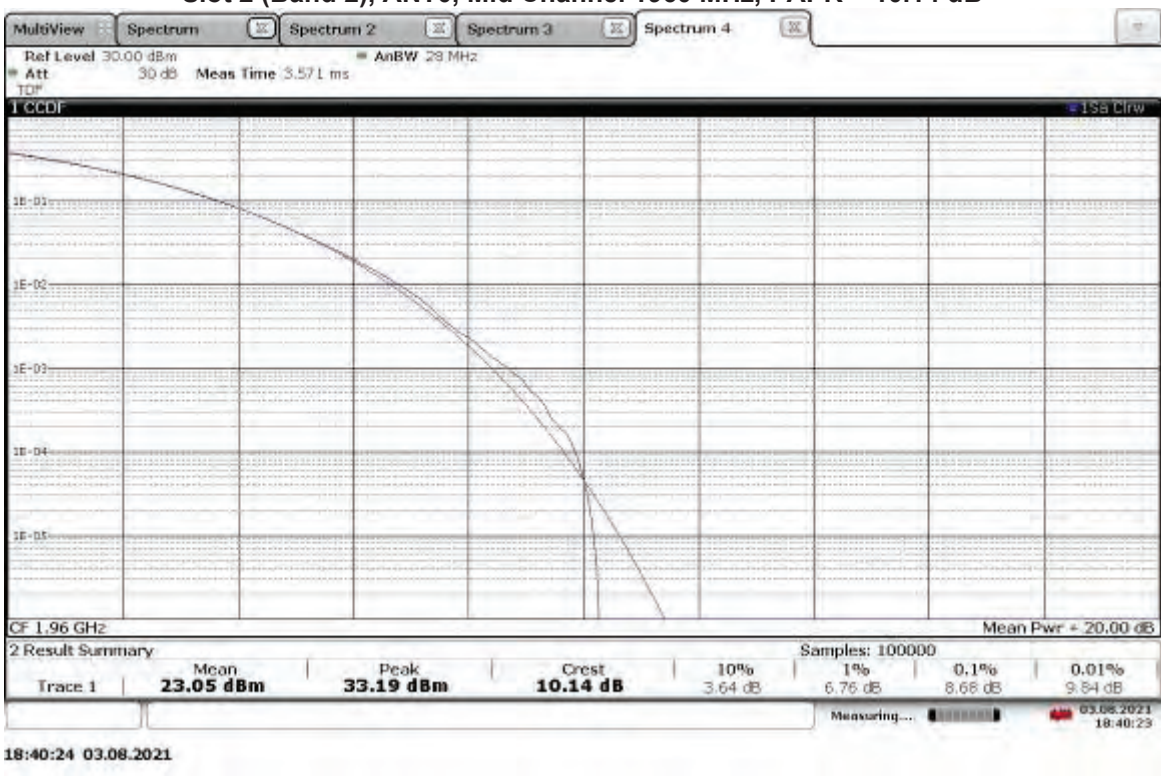
TM3.2 - 16QAM_20 MHz Bandwidth
Slot 2 (Band 2), ANT0, Low Channel 1940 MHz, PAPR = 10.11 dB



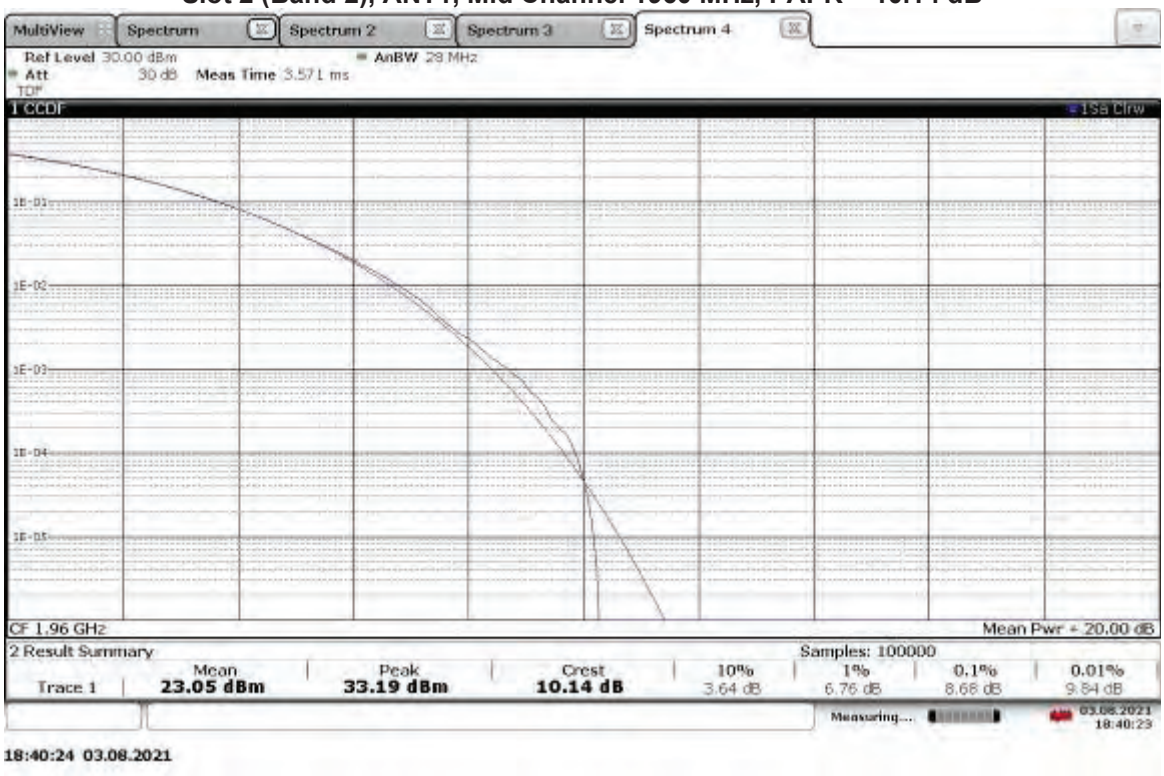
TM3.2 - 16QAM_20 MHz Bandwidth
Slot 2 (Band 2), ANT1, Low Channel 1940 MHz, PAPR = 10.14 dB



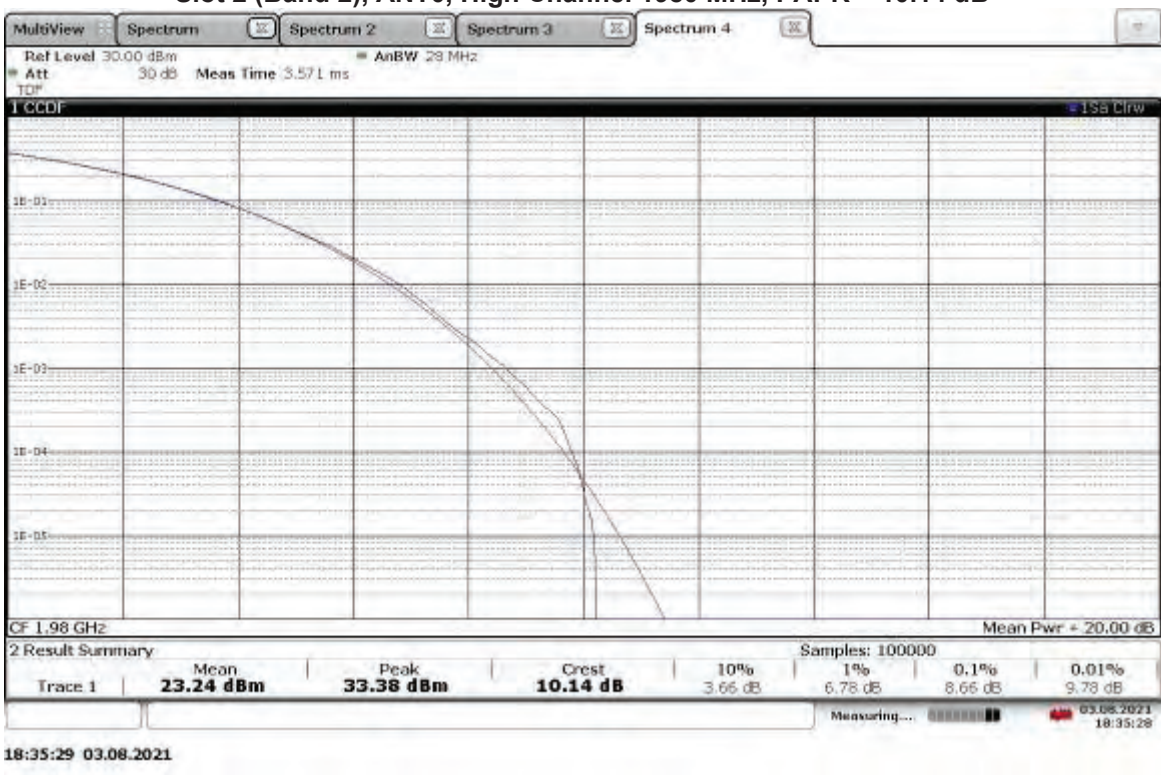
TM3.2 - 16QAM_20 MHz Bandwidth
Slot 2 (Band 2), ANT0, Mid Channel 1960 MHz, PAPR = 10.14 dB



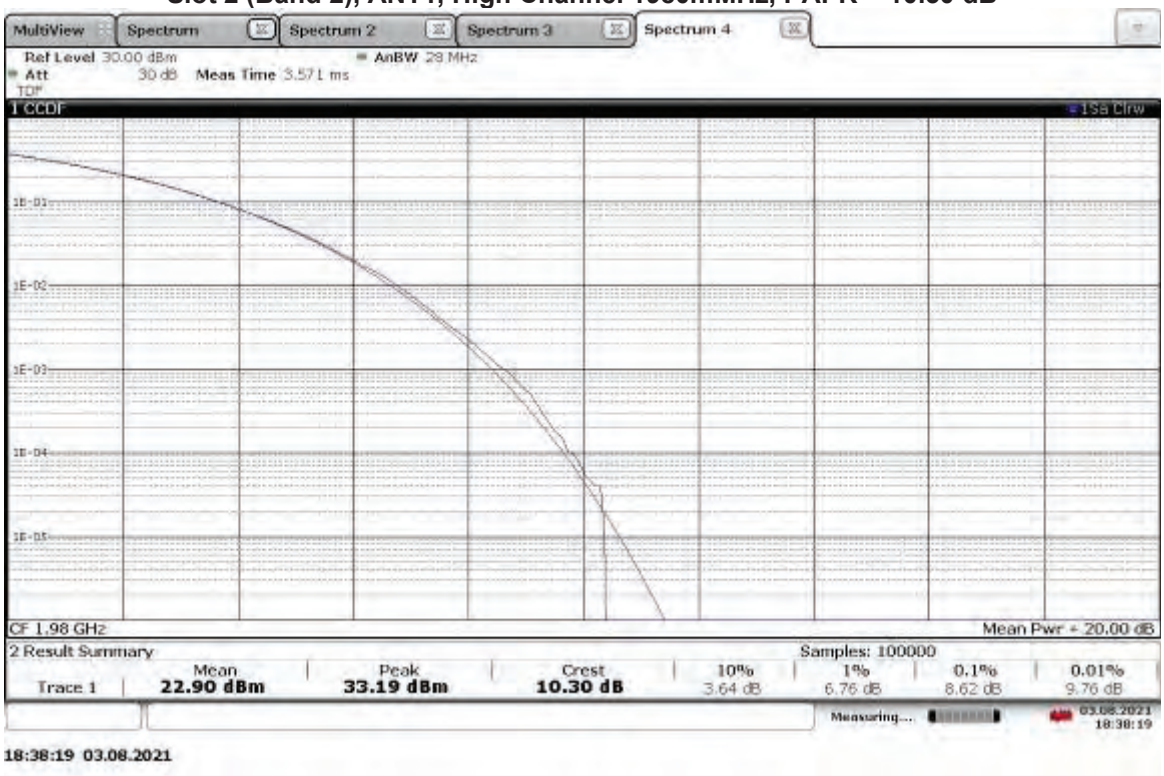
TM3.2 - 16QAM_20 MHz Bandwidth
Slot 2 (Band 2), ANT1, Mid Channel 1960 MHz, PAPR = 10.14 dB



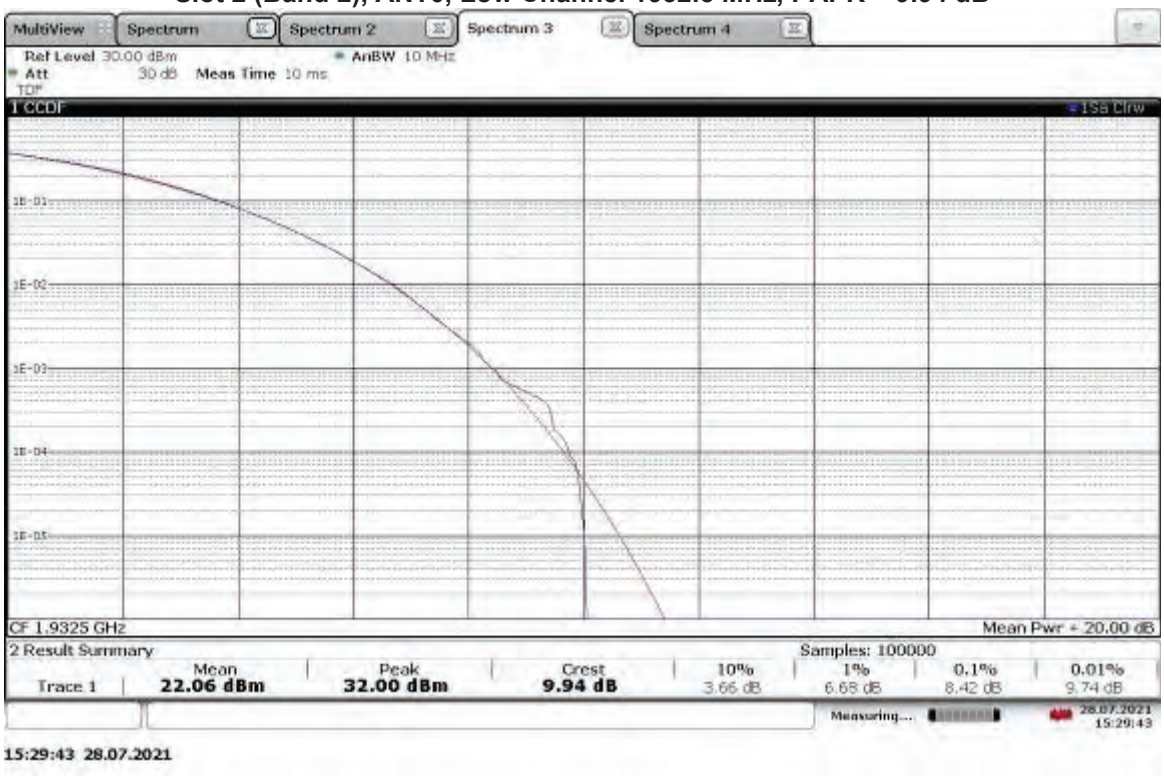
TM3.2 - 16QAM_20 MHz Bandwidth
Slot 2 (Band 2), ANT0, High Channel 1980 MHz, PAPR = 10.14 dB



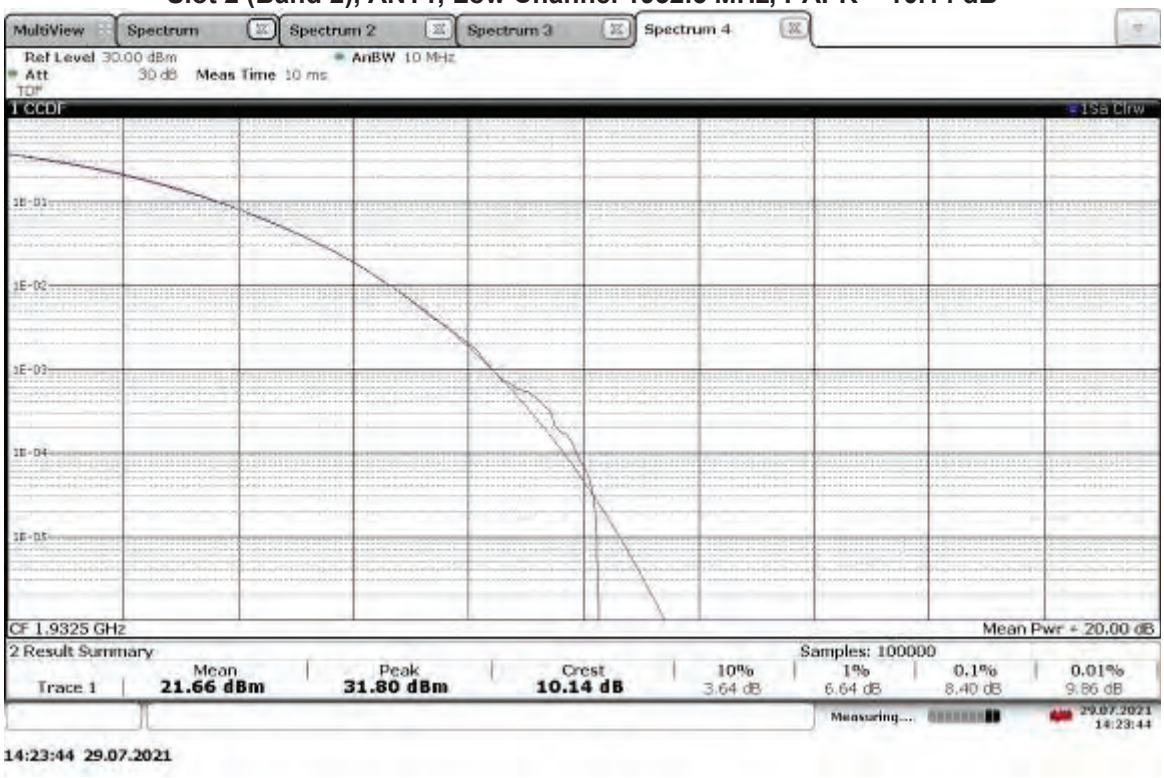
TM3.2 - 16QAM_20 MHz Bandwidth
Slot 2 (Band 2), ANT1, High Channel 1980mMHz, PAPR = 10.30 dB



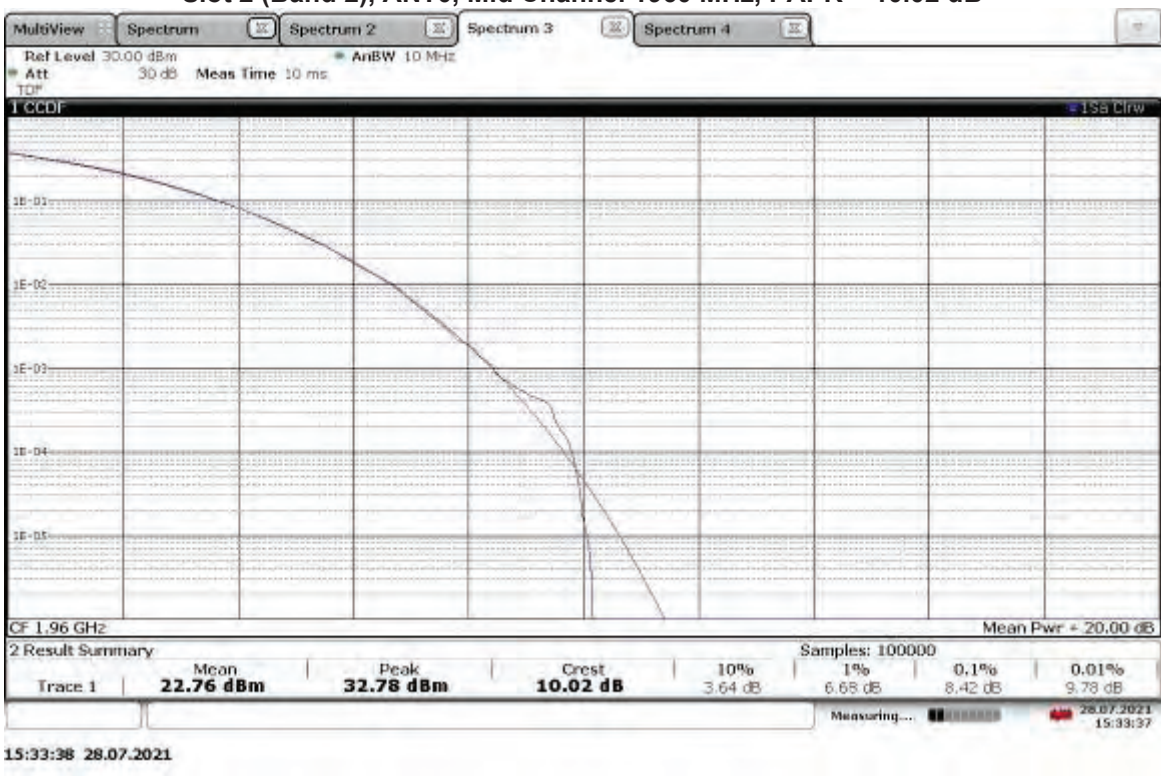
TM3.1-64QAM_5MHz Bandwidth
Slot 2 (Band 2), ANT0, Low Channel 1932.5 MHz, PAPR = 9.94 dB



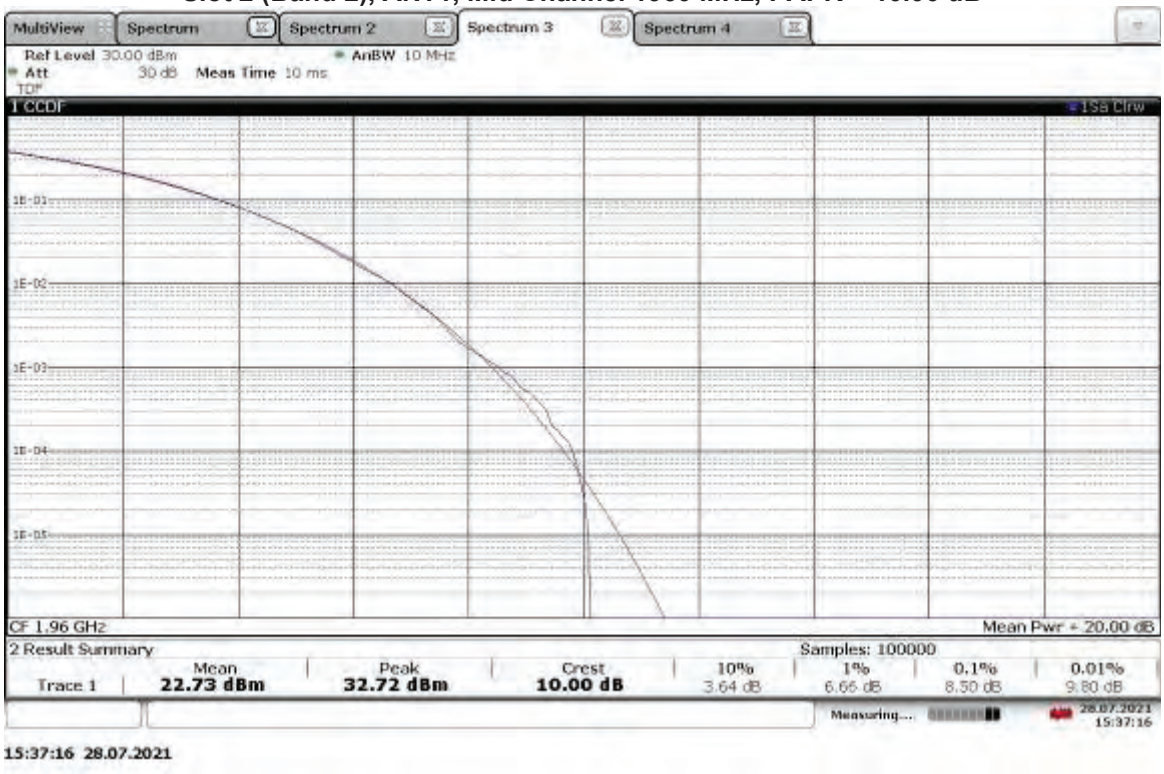
TM3.1-64QAM_5MHz Bandwidth
Slot 2 (Band 2), ANT1, Low Channel 1932.5 MHz, PAPR = 10.14 dB



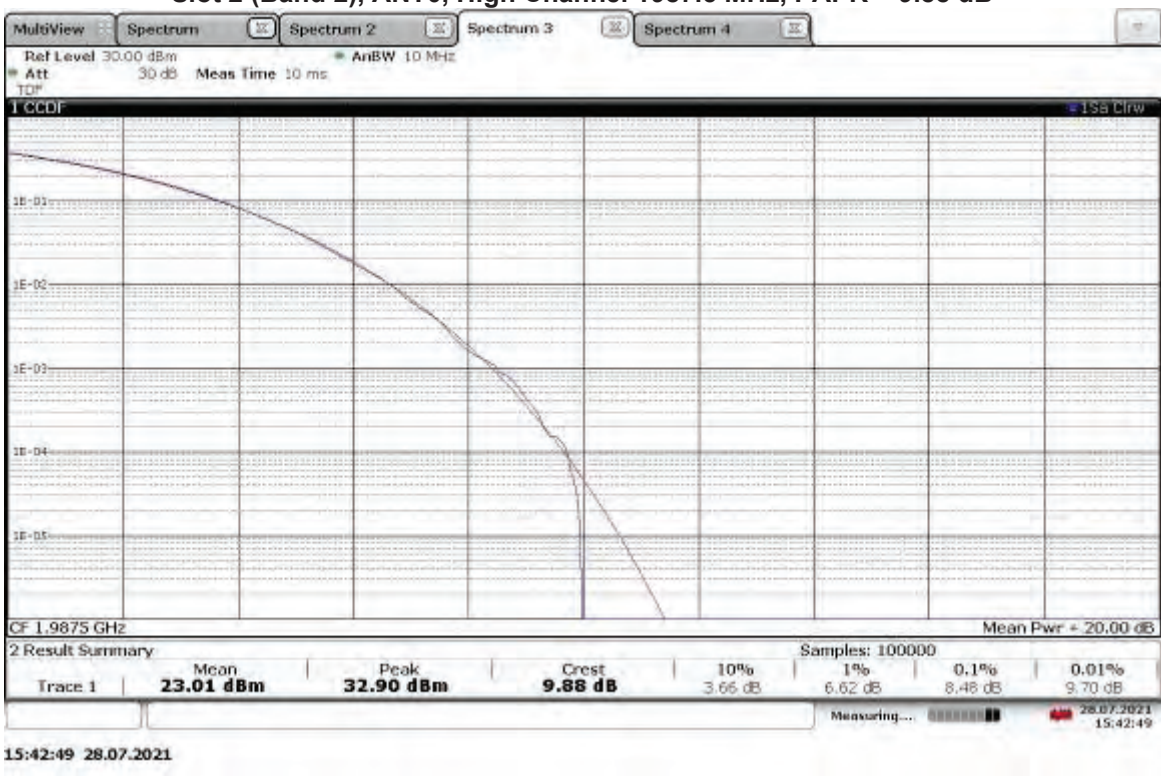
TM3.1-64QAM_5MHz Bandwidth
Slot 2 (Band 2), ANT0, Mid Channel 1960 MHz, PAPR = 10.02 dB



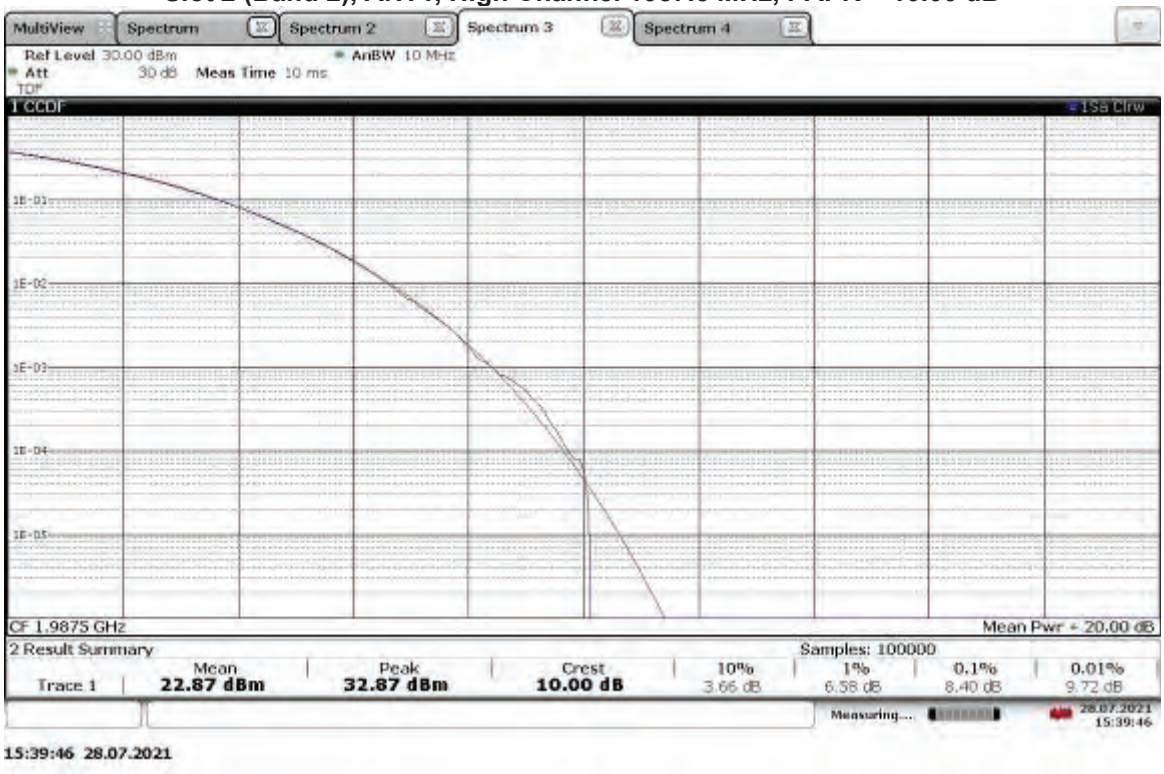
TM3.1-64QAM_5MHz Bandwidth
Slot 2 (Band 2), ANT1, Mid Channel 1960 MHz, PAPR = 10.00 dB



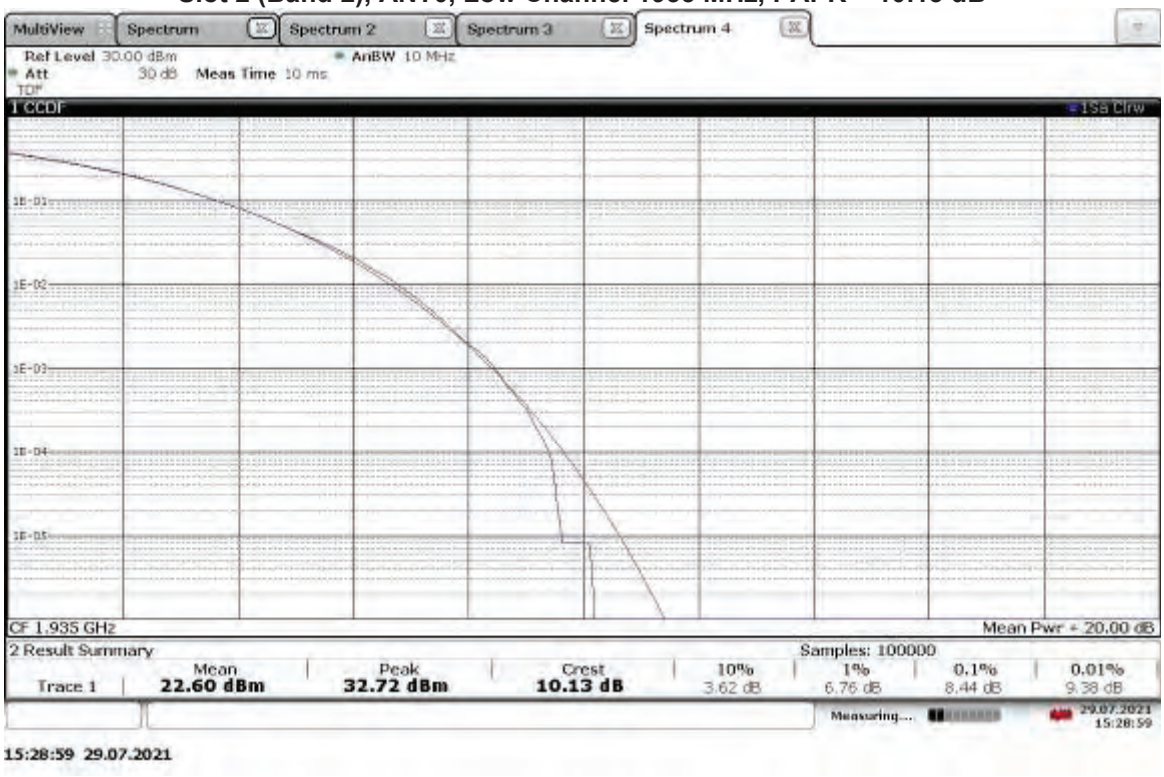
TM3.1-64QAM_5MHz Bandwidth
Slot 2 (Band 2), ANT0, High Channel 1987.5 MHz, PAPR = 9.88 dB



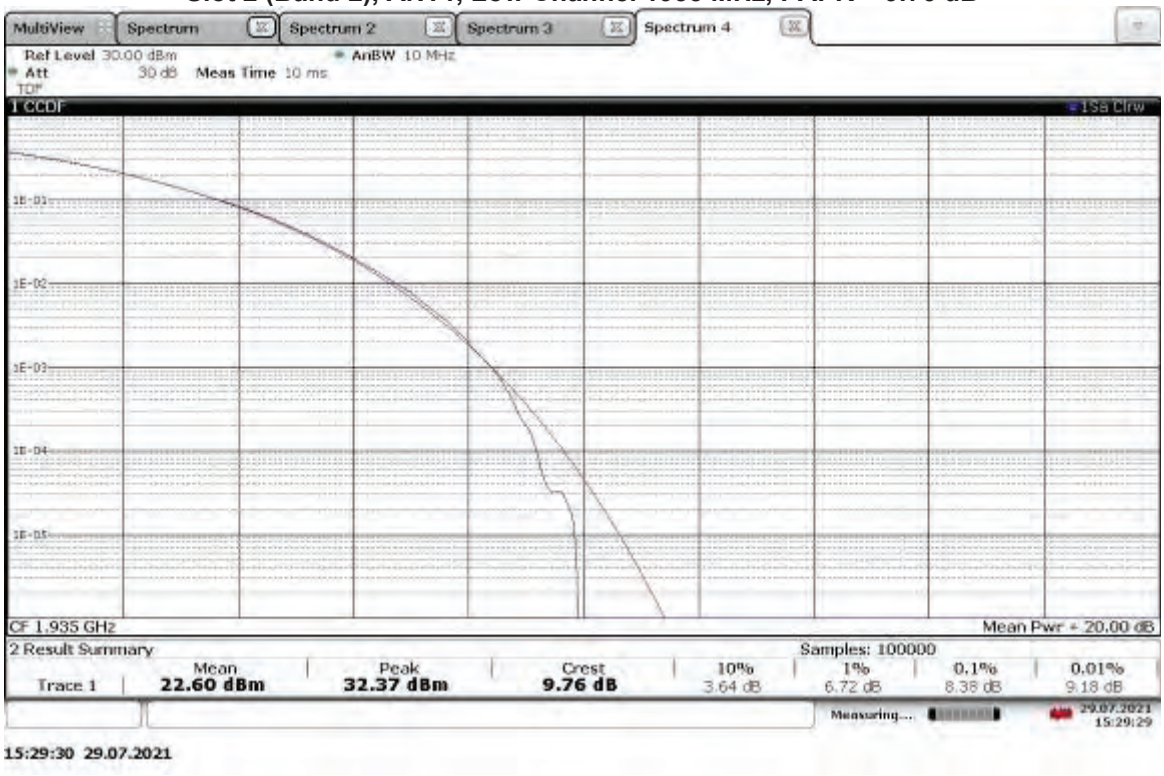
TM3.1-64QAM_5MHz Bandwidth
Slot 2 (Band 2), ANT1, High Channel 1987.5 MHz, PAPR = 10.00 dB



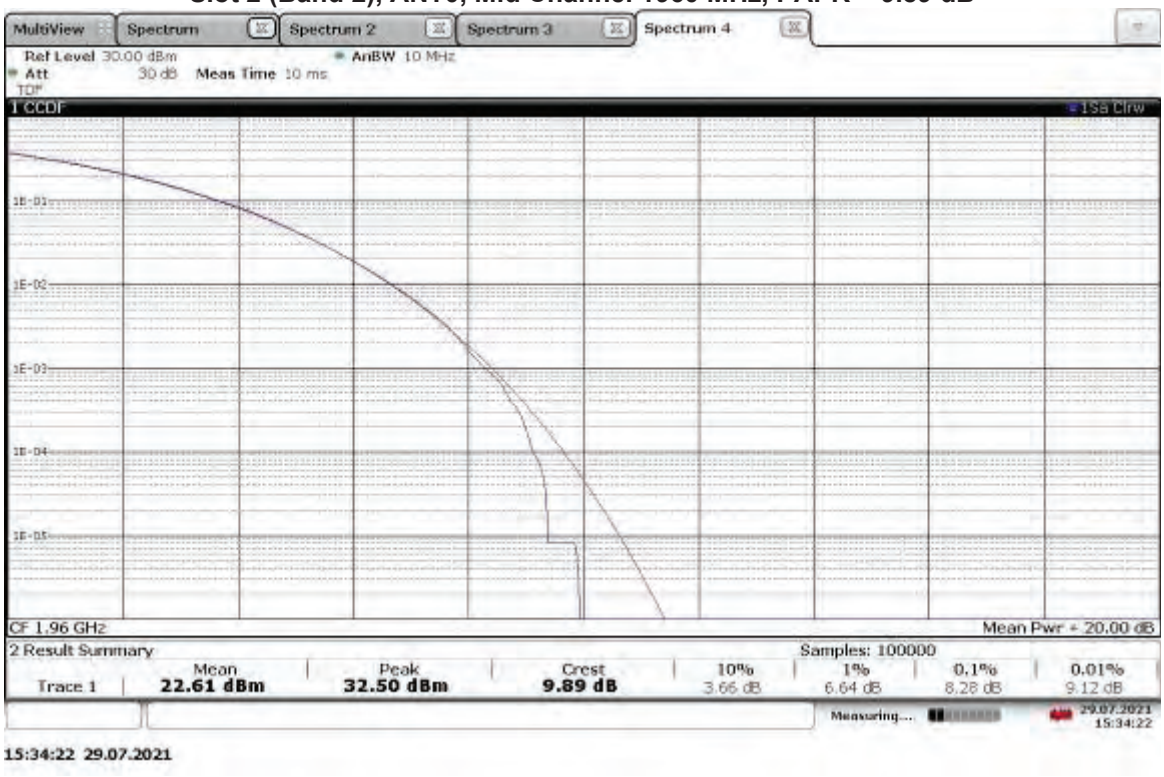
TM3.1-64QAM_10 MHz Bandwidth
Slot 2 (Band 2), ANT0, Low Channel 1935 MHz, PAPR = 10.13 dB



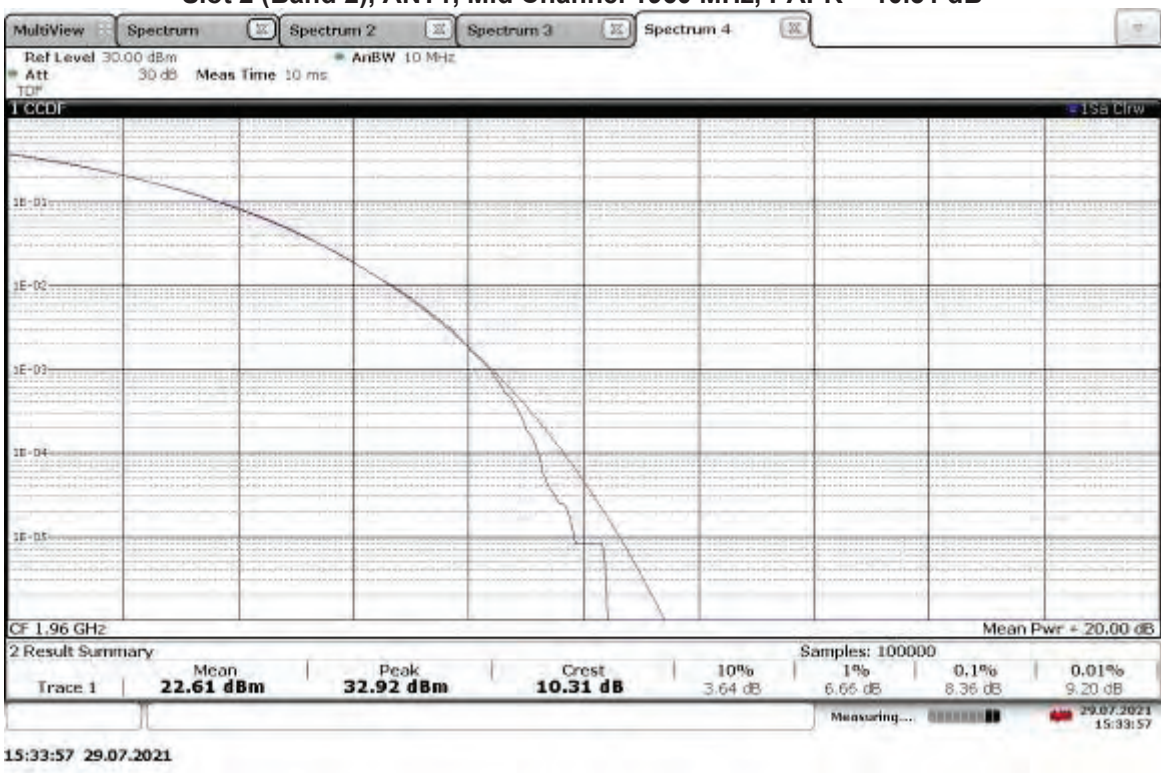
TM3.1-64QAM_10 MHz Bandwidth
Slot 2 (Band 2), ANT1, Low Channel 1935 MHz, PAPR = 9.76 dB



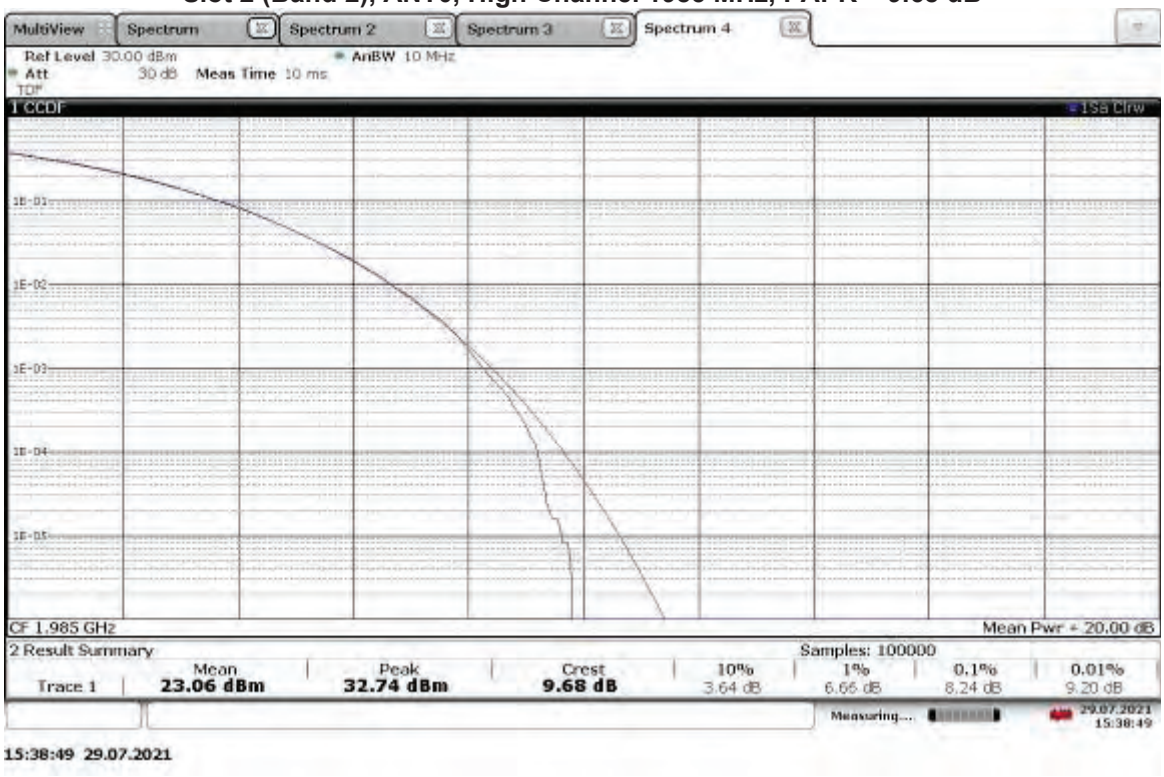
TM3.1-64QAM_10 MHz Bandwidth
Slot 2 (Band 2), ANT0, Mid Channel 1960 MHz, PAPR = 9.89 dB



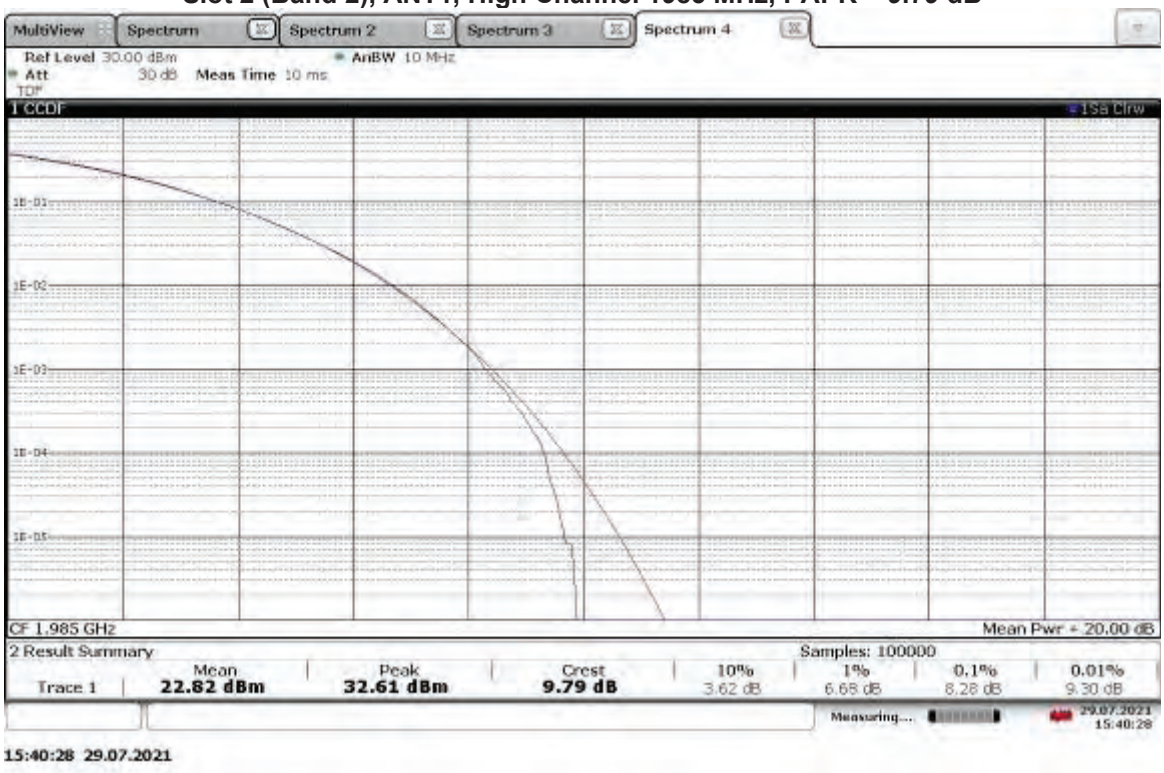
TM3.1-64QAM_10 MHz Bandwidth
Slot 2 (Band 2), ANT1, Mid Channel 1960 MHz, PAPR = 10.31 dB



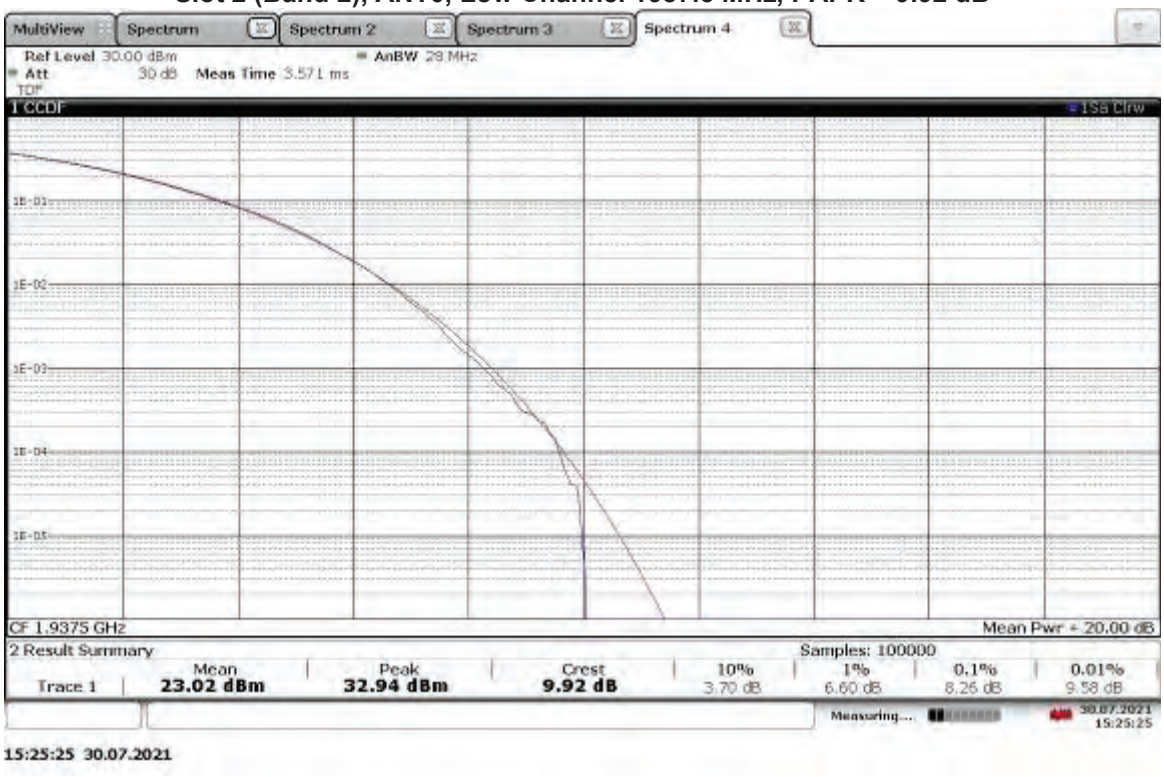
TM3.1-64QAM_10 MHz Bandwidth
Slot 2 (Band 2), ANT0, High Channel 1985 MHz, PAPR = 9.68 dB



TM3.1-64QAM_10 MHz Bandwidth
Slot 2 (Band 2), ANT1, High Channel 1985 MHz, PAPR = 9.79 dB



TM3.1-64QAM_15 MHz Bandwidth
Slot 2 (Band 2), ANT0, Low Channel 1987.5 MHz, PAPR = 9.92 dB



TM3.1-64QAM_15 MHz Bandwidth
Slot 2 (Band 2), ANT1, Low Channel 1937.5 MHz, PAPR = 9.65 dB