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CommScope Technologies, LLC

TEST REPORT

SCOPE OF WORK
FCC CLASS II PERMISSIVE EMISSIONS TESTING – RPM-A5A11-B66

REPORT NUMBER
104194737BOX-001

ISSUE DATE **[REVISED DATE]**
January 11, 2021 Original Issue

DOCUMENT CONTROL NUMBER
Non-Specific Radio Report Shell Rev. August 2020

FCC CLASS II PERMISSIVE TEST REPORT

(FULL COMPLIANCE)

Report Number: 104194737BOX-001
Project Number: G104194737

Report Issue Date: January 11, 2021

Model(s) Tested: RPM-A5A11-B66
Model(s) Partially Tested: None
Model(s) Not Tested but declared equivalent by the client: None

Standards: CFR47 FCC Part 27 (11/2020)

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

Kouma Sinn / EMC Staff Engineer

Report reviewed by

Nicholas Abbondante / Chief Engineer

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 27.50(d)(1-2)	Pass
7	Peak-to-Average Power Ratio (PAR) CFR47 FCC Part 27.50(d)(5)	Pass
8	Band Edge Compliance CFR47 FCC 2.1051, 2.1053, and 27.53(h)	Pass
9	Transmitter Spurious Emissions CFR47 Parts 2.1051, 2.1053, 2.1057, and 27.53(h)	Pass
10	FCC Class II Permissive Change Description of Change	--
11	Revision History	--

Notes: Testing for FCC Class II permissive change due to change of amplifier chip with a pin-for-pin compatible chip, with no artwork changes required. This information has been provided by the client and has not been verified.

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: **+1-**978-614-3182
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 66 Radio Module	CommScope Technologies LLC	RPM-A5A11-B66	19473000001

Receive Date:	10/14/2020
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. 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)	2110-2200 MHz
Modulation Type(s)	TM1.1-QPSK, TM3.2-16QAM, TM3.1-64 QAM, TM3.1a-256QAM
Maximum Output Power (conducted)	23.88 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	17.900 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

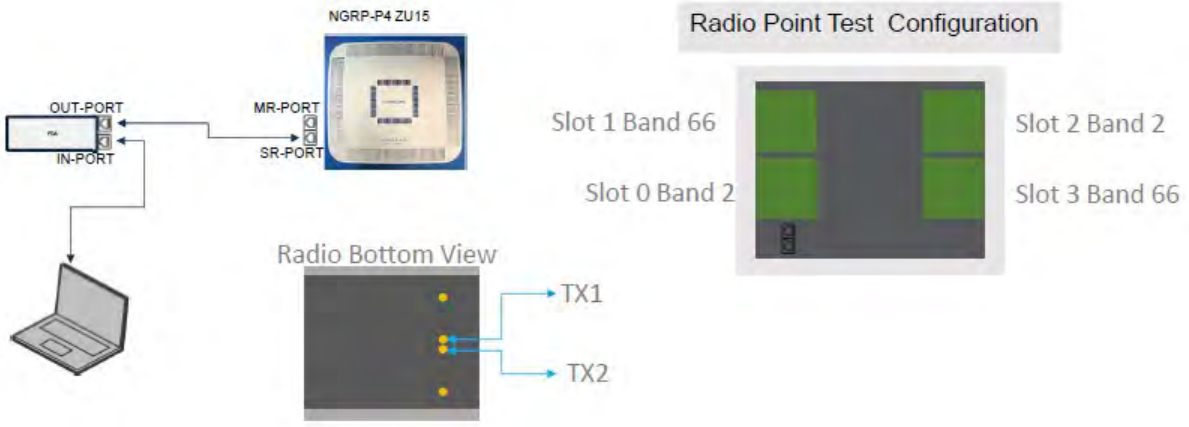
Support Equipment			
Description	Manufacturer	Model Number	Serial Number
Laptop	Dell	LATITUDE	None
Power Device Analzyer	Sifos Technologies	PDA-604A	604A0033
OneCell® RP5100*	CommScope Technologies LLC	BV SUPPORT BBC	None

*Radio host used for testing

5.1 Method:

Configuration as required by ANSI C63.26-2015, KDB662911, and CFR47 FCC Part 27 (10/2020).

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 27, KDB 662911, 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	01/22/2020	01/22/2021
CBLHF2012-2M-1'	2m 9kHz-40GHz Coaxial Cable - SET1	Huber & Suhner	SF102	252675001	02/17/2020	02/17/2021
ROS005-1'	Signal and Spectrum Analyzer	Rohde & Schwarz	FSW43	100646	10/27/2020	10/27/2021
DAV005'	Weather Station	Davis	6250	MS191218083	02/05/2020	02/05/2021

Software Utilized:

Name	Manufacturer	Version
None	--	--

6.3 Results:

The maximum conducted output power was measured to be 23.88 dBm, which is much less than the EIRP limit of 27.50(d)(1-2). The sample tested was found to Comply. Antenna gain limitations will depend on the location of deployment. Output power from the two antenna ports was not summed since the data streams are uncorrelated and the antennas are cross polarized.

§27.50(d) The following power and antenna height requirements apply to stations transmitting in the 1695-1710 MHz, 1710-1755 MHz, 1755-1780 MHz, 1915-1920 MHz, 1995-2000 MHz, 2000-2020 MHz, 2110-2155 MHz, 2155-2180 MHz and 2180-2200 MHz bands:
(1) The power of each fixed or base station transmitting in the 1995-2000 MHz, 2110-2155 MHz, 2155-2180 MHz or 2180-2200 MHz band and located in any county with population density of 100 or fewer persons per square mile, based upon the most recently available population statistics from the Bureau of the Census, is limited to:
(i) An equivalent isotropically radiated power (EIRP) of 3280 watts when transmitting with an emission bandwidth of 1 MHz or less;
(ii) An EIRP of 3280 watts/MHz when transmitting with an emission bandwidth greater than 1 MHz.
(2) The power of each fixed or base station transmitting in the 1995-2000 MHz, the 2110-2155 MHz 2155-2180 MHz band, or 2180-2200 MHz band and situated in any geographic location other than that described in paragraph (d)(1) of this section is limited to:
(i) An equivalent isotropically radiated power (EIRP) of 1640 watts when transmitting with an emission bandwidth of 1 MHz or less;
(ii) An EIRP of 1640 watts/MHz when transmitting with an emission bandwidth greater than 1 MHz.

Band 66, Bandwidth: 5 MHz, Modulation: TM1.1-QPSK

Channel	Frequency (MHz)	Antenna Port	Output Power (dBm)
Low	2112.50	ANT0	22.75
		ANT1	22.78
Mid	2155.00	ANT0	23.02
		ANT1	23.62
High	2197.50	ANT0	22.97
		ANT1	23.25

Band 66, Bandwidth: 10 MHz, Modulation: TM1.1-QPSK

Channel	Frequency (MHz)	Antenna Port	Output Power (dBm)
Low	2115.00	ANT0	22.45
		ANT1	22.22
Mid	2155.00	ANT0	23.43
		ANT1	22.92
High	2195.00	ANT0	23.25
		ANT1	23.42

Band 66, Bandwidth: 15 MHz, Modulation: TM1.1-QPSK

Channel	Frequency (MHz)	Antenna Port	Output Power (dBm)
Low	2117.50	ANT0	21.97
		ANT1	21.45
Mid	2155.00	ANT0	23.03
		ANT1	23.88
High	2192.50	ANT0	23.65
		ANT1	23.64

Band 66, Bandwidth: 20 MHz, Modulation: TM1.1-QPSK

Channel	Frequency (MHz)	Antenna Port	Output Power (dBm)
Low	2120.00	ANT0	21.97
		ANT1	21.45
Mid	2155.00	ANT0	23.01
		ANT1	23.88
High	2190.00	ANT0	23.65
		ANT1	23.64

Band 66, Bandwidth: 5 MHz, Modulation: TM3.2-16QAM

Channel	Frequency (MHz)	Antenna Port	Output Power (dBm)
Low	2112.50	ANT0	22.68
		ANT1	22.76
Mid	2155.00	ANT0	23.08
		ANT1	23.60
High	2197.50	ANT0	22.95
		ANT1	23.60

Band 66, Bandwidth: 10 MHz, Modulation: TM3.2-16QAM

Channel	Frequency (MHz)	Antenna Port	Output Power (dBm)
Low	2115.00	ANT0	22.97
		ANT1	22.82
Mid	2155.00	ANT0	23.07
		ANT1	23.73
High	2195.00	ANT0	23.65
		ANT1	23.80

Band 66, Bandwidth: 15 MHz, Modulation: TM3.2-16QAM

Channel	Frequency (MHz)	Antenna Port	Output Power (dBm)
Low	2117.50	ANT0	23.02
		ANT1	22.77
Mid	2155.00	ANT0	23.01
		ANT1	23.57
High	2192.50	ANT0	23.35
		ANT1	23.47

Band 66, Bandwidth: 20 MHz, Modulation: TM3.2-16QAM

Channel	Frequency (MHz)	Antenna Port	Output Power (dBm)
Low	2120.00	ANT0	23.49
		ANT1	23.22
Mid	2155.00	ANT0	23.49
		ANT1	23.81
High	2190.00	ANT0	23.84
		ANT1	23.84

Band 66, Bandwidth: 5 MHz, Modulation: TM3.1-64QAM

Channel	Frequency (MHz)	Antenna Port	Output Power (dBm)
Low	2112.50	ANT0	22.77
		ANT1	22.78
Mid	2155.00	ANT0	23.01
		ANT1	23.66
High	2197.50	ANT0	22.97
		ANT1	23.24

Band 66, Bandwidth: 10 MHz, Modulation: TM3.1-64QAM

Channel	Frequency (MHz)	Antenna Port	Output Power (dBm)
Low	2115.00	ANT0	22.93
		ANT1	22.81
Mid	2155.00	ANT0	23.05
		ANT1	23.67
High	2195.00	ANT0	23.25
		ANT1	23.41

Band 66, Bandwidth: 15 MHz, Modulation: TM3.1-64QAM

Channel	Frequency (MHz)	Antenna Port	Output Power (dBm)
Low	2117.50	ANT0	23.00
		ANT1	22.80
Mid	2155.00	ANT0	23.02
		ANT1	23.57
High	2192.50	ANT0	23.39
		ANT1	23.47

Band 66, Bandwidth: 20 MHz, Modulation: TM3.1-64QAM

Channel	Frequency (MHz)	Antenna Port	Output Power (dBm)
Low	2120.00	ANT0	23.44
		ANT1	23.21
Mid	2155.00	ANT0	23.46
		ANT1	23.82
High	2190.00	ANT0	23.39
		ANT1	23.47

Band 66, Bandwidth: 5 MHz, Modulation: TM3.1a-256QAM

Channel	Frequency (MHz)	Antenna Port	Output Power (dBm)
Low	2112.50	ANT0	22.04
		ANT1	21.97
Mid	2155.00	ANT0	22.82
		ANT1	23.69
High	2197.50	ANT0	23.00
		ANT1	23.30

Band 66, Bandwidth: 10 MHz, Modulation: TM3.1a-256QAM

Channel	Frequency (MHz)	Antenna Port	Output Power (dBm)
Low	2115.00	ANT0	22.95
		ANT1	22.80
Mid	2155.00	ANT0	23.05
		ANT1	23.65
High	2195.00	ANT0	23.24
		ANT1	23.41

Band 66, Bandwidth: 15 MHz, Modulation: TM3.1a-256QAM

Channel	Frequency (MHz)	Antenna Port	Output Power (dBm)
Low	2117.50	ANT0	23.00
		ANT1	22.79
Mid	2155.00	ANT0	23.03
		ANT1	23.63
High	2192.50	ANT0	23.83
		ANT1	23.47

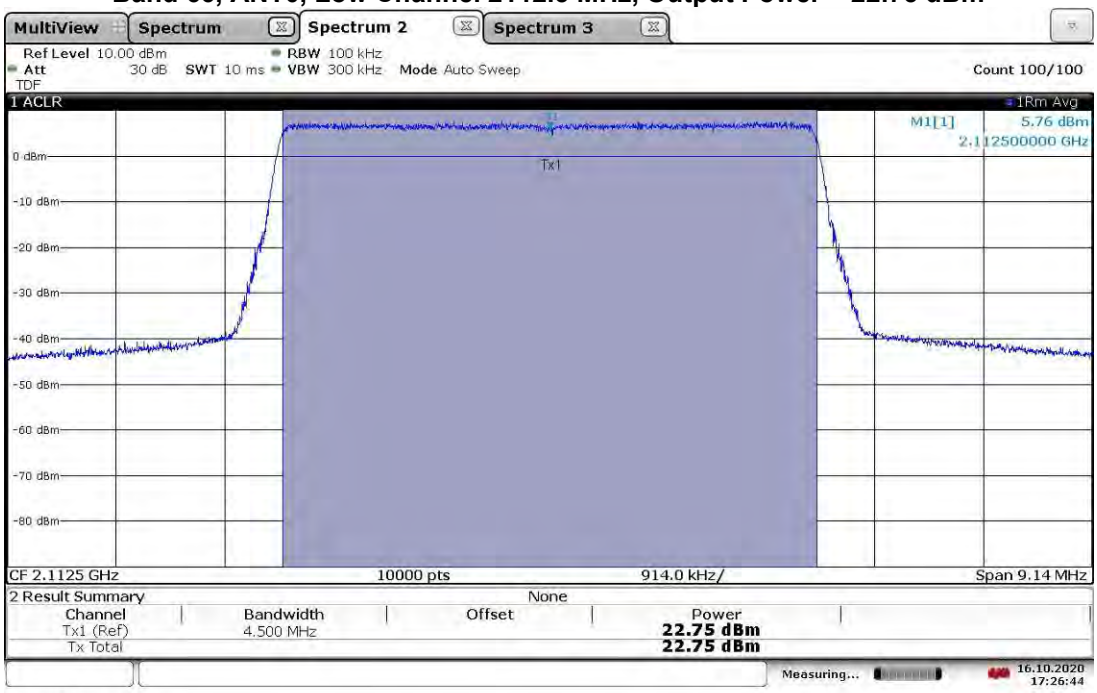
Band 66, Bandwidth: 20 MHz, Modulation: TM3.1a-256QAM

Channel	Frequency (MHz)	Antenna Port	Output Power (dBm)
Low	2120.00	ANT0	23.46
		ANT1	23.22
Mid	2150.00	ANT0	23.45
		ANT1	23.83
High	2190.00	ANT0	23.80
		ANT1	23.81

6.4 Setup Photograph:

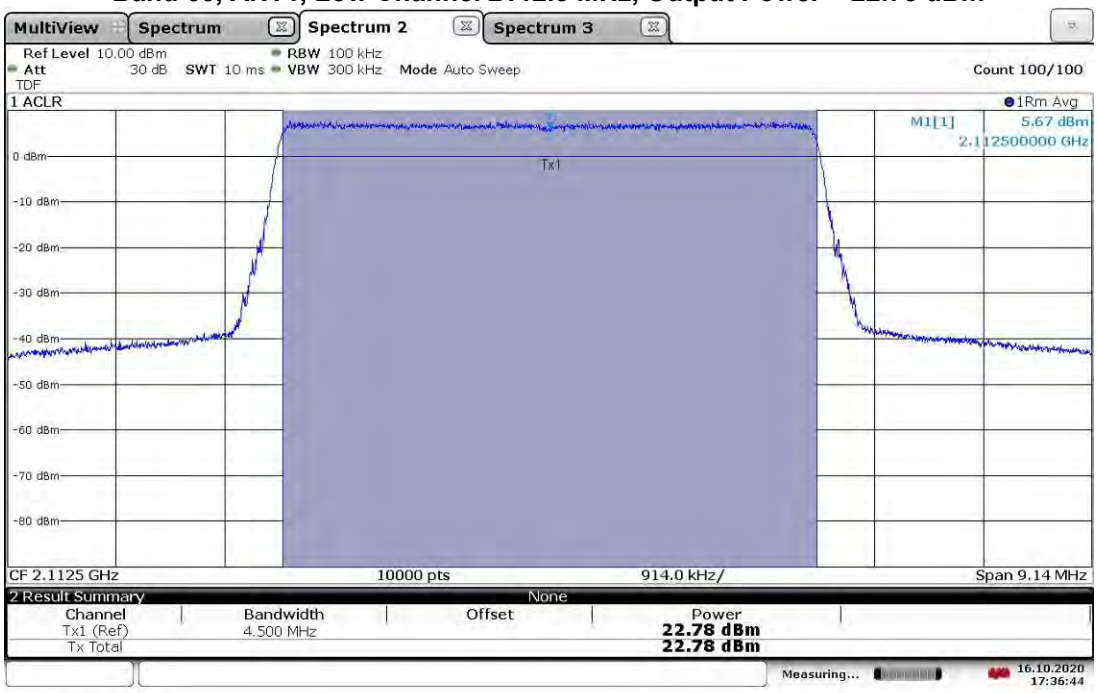
6.5 Plots/Data:

TM1.1-QPSK_5 MHz Bandwidth
Band 66, ANT0, Low Channel 2112.5 MHz, Output Power = 22.75 dBm



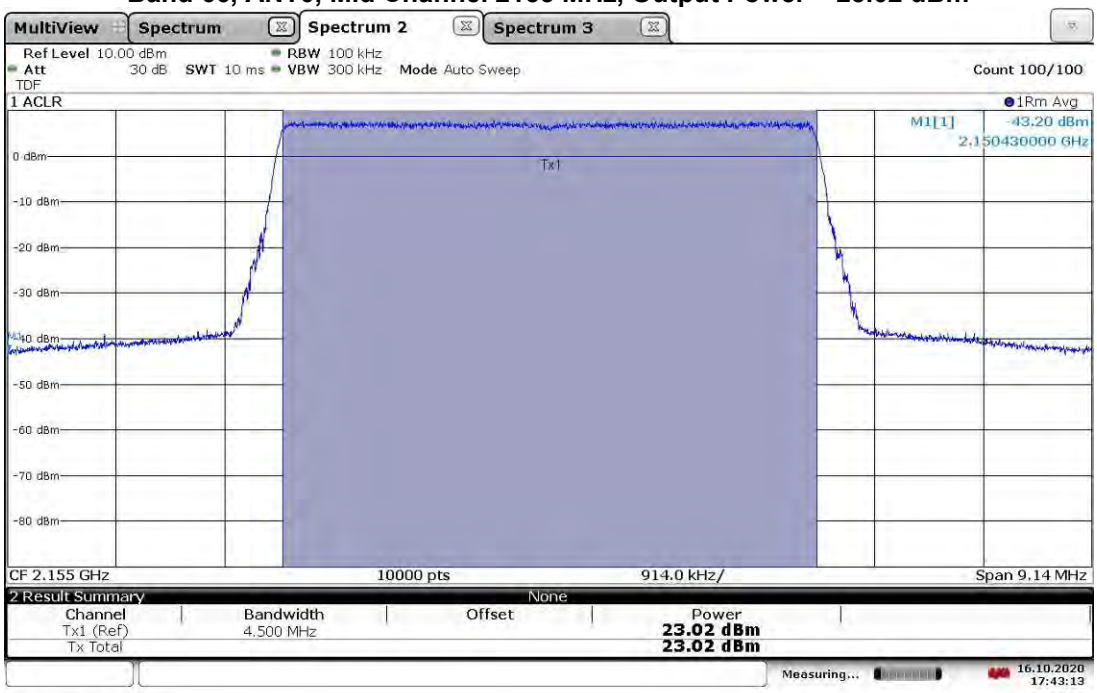
17:26:44 16.10.2020

TM1.1-QPSK_5 MHz Bandwidth
Band 66, ANT1, Low Channel 2112.5 MHz, Output Power = 22.78 dBm



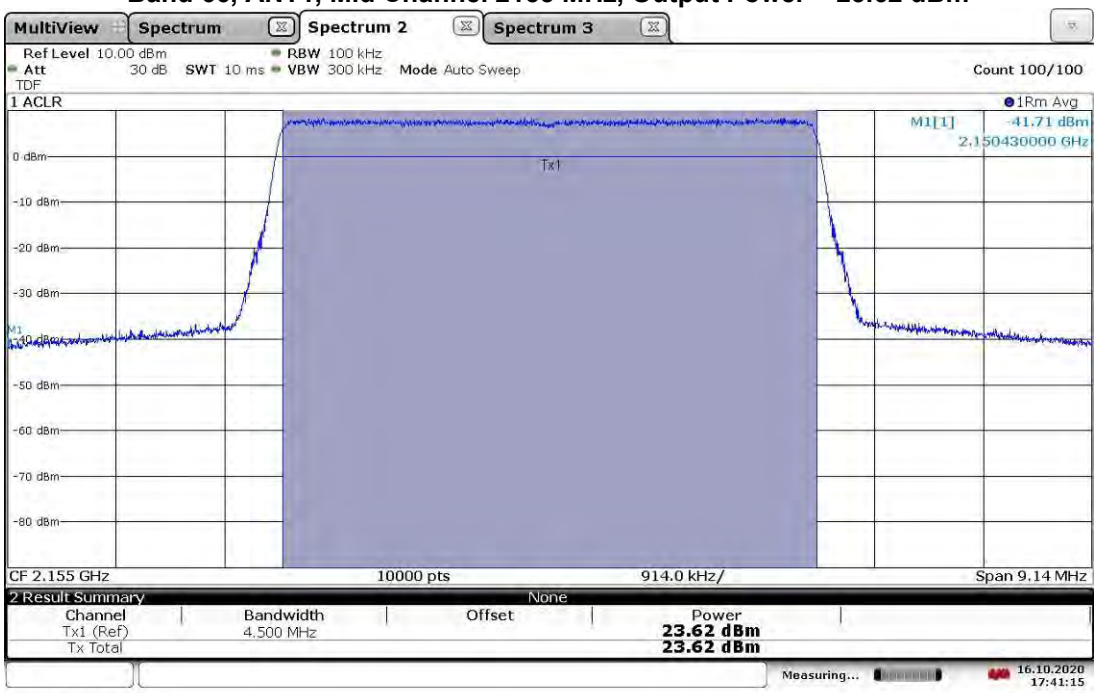
17:36:45 16.10.2020

TM1.1-QPSK_5 MHz Bandwidth
Band 66, ANT0, Mid Channel 2155 MHz, Output Power = 23.02 dBm



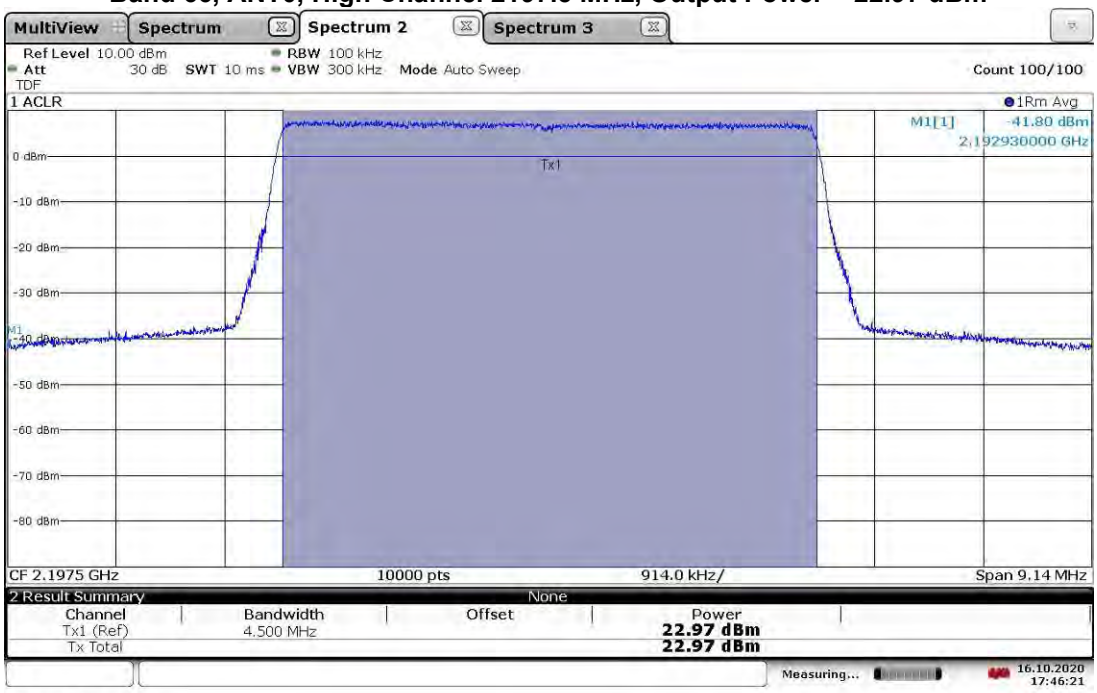
17:43:13 16.10.2020

TM1.1-QPSK_5 MHz Bandwidth
Band 66, ANT1, Mid Channel 2155 MHz, Output Power = 23.62 dBm



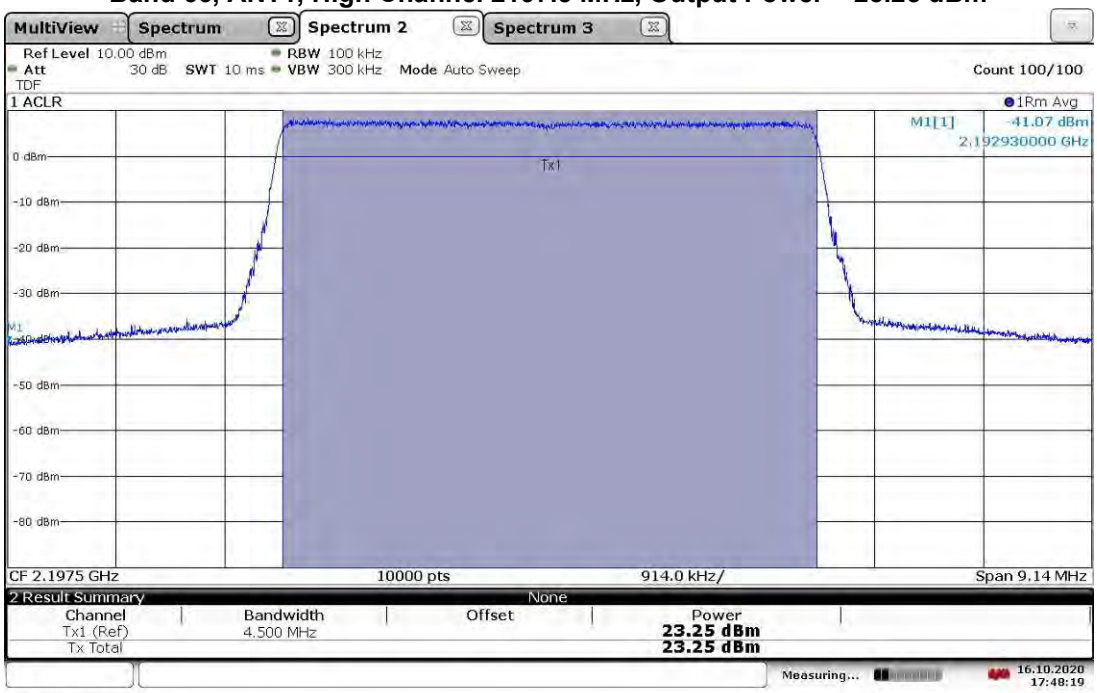
17:41:16 16.10.2020

TM1.1-QPSK_5 MHz Bandwidth
Band 66, ANT0, High Channel 2197.5 MHz, Output Power = 22.97 dBm



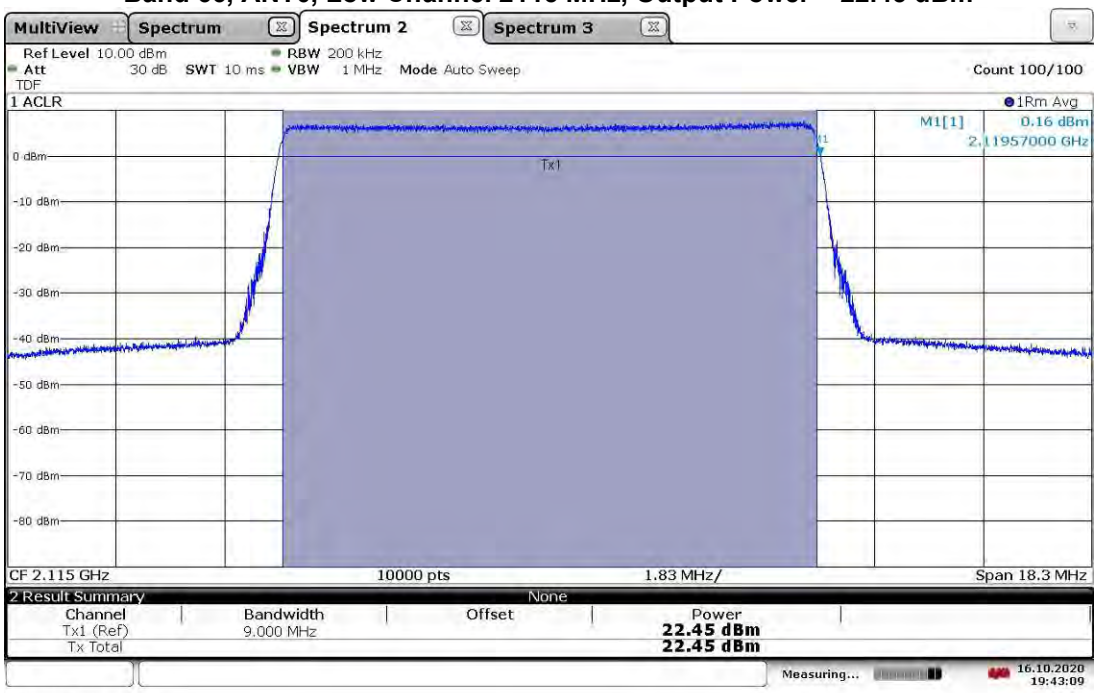
17:46:21 16.10.2020

TM1.1-QPSK_5 MHz Bandwidth
Band 66, ANT1, High Channel 2197.5 MHz, Output Power = 23.25 dBm



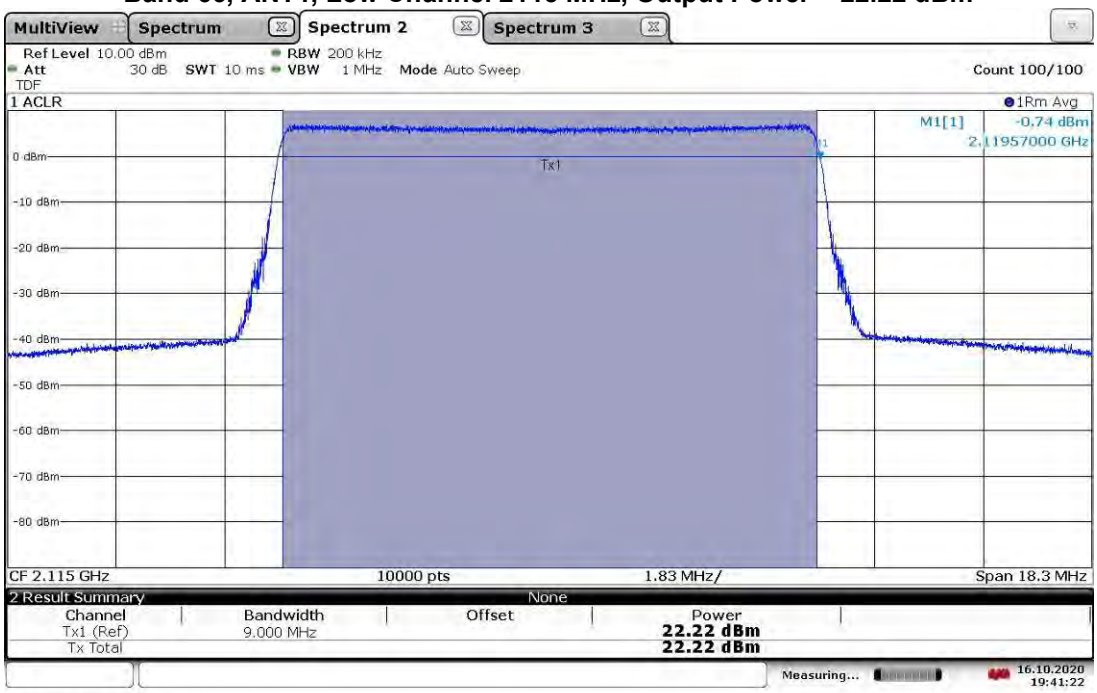
17:48:20 16.10.2020

TM1.1-QPSK_10 MHz Bandwidth
Band 66, ANT0, Low Channel 2115 MHz, Output Power = 22.45 dBm



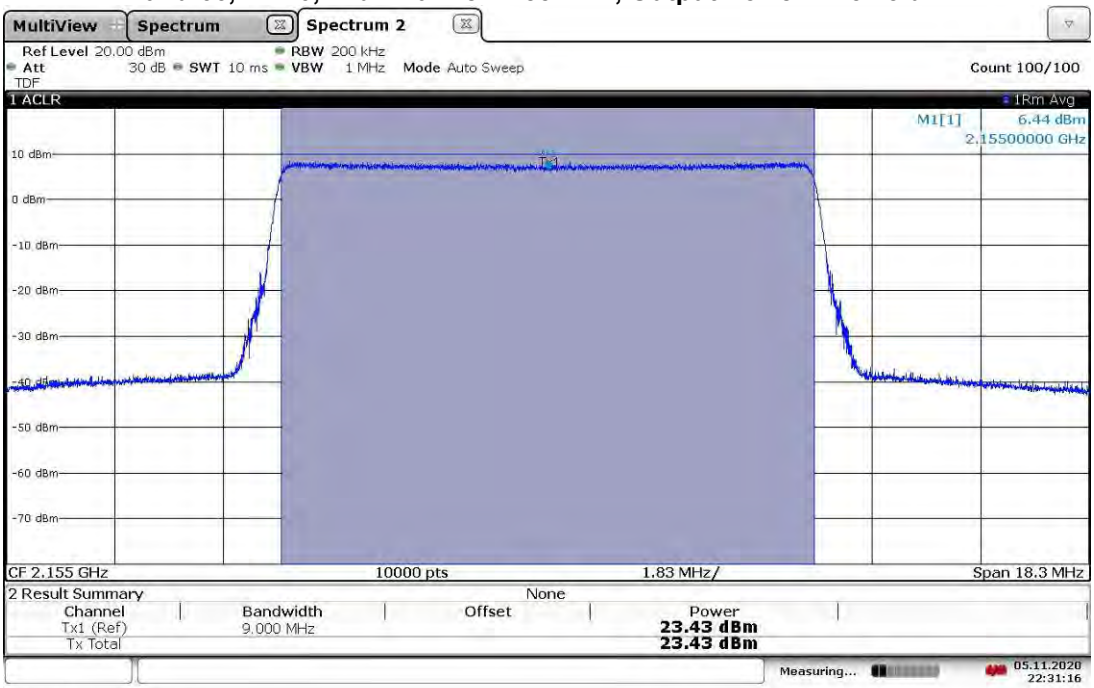
19:43:10 16.10.2020

TM1.1-QPSK_10 MHz Bandwidth
Band 66, ANT1, Low Channel 2115 MHz, Output Power = 22.22 dBm



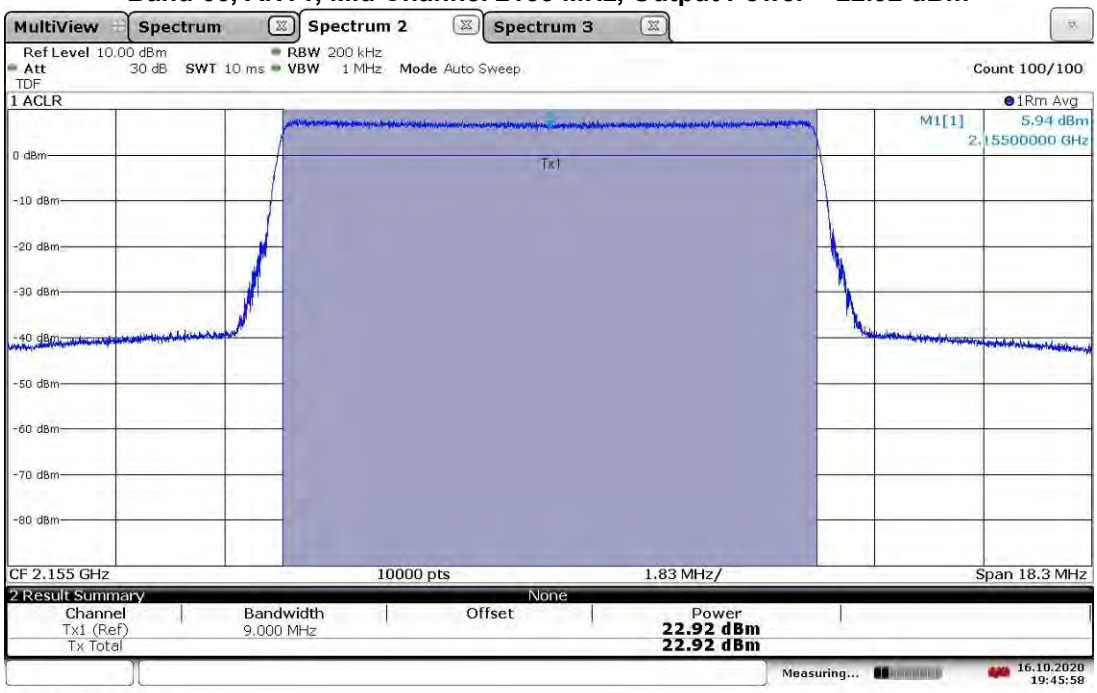
19:41:22 16.10.2020

TM1.1-QPSK_10 MHz Bandwidth
Band 66, ANT0, Mid Channel 2155 MHz, Output Power = 23.43 dBm



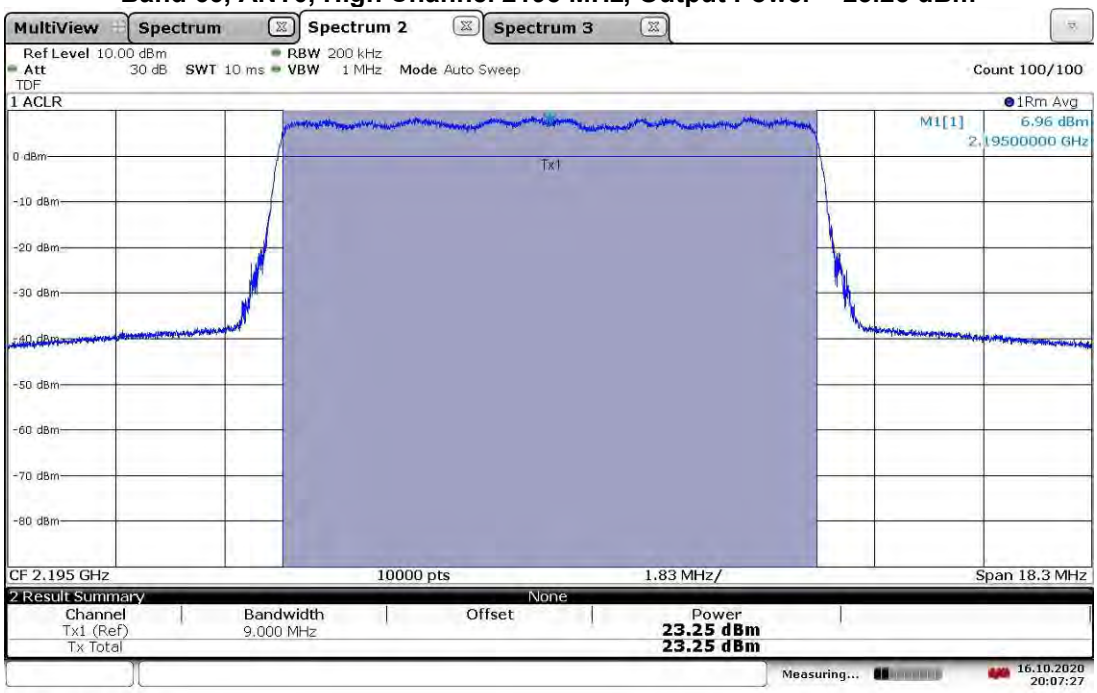
22:31:17 05.11.2020

TM1.1-QPSK_10 MHz Bandwidth
Band 66, ANT1, Mid Channel 2155 MHz, Output Power = 22.92 dBm



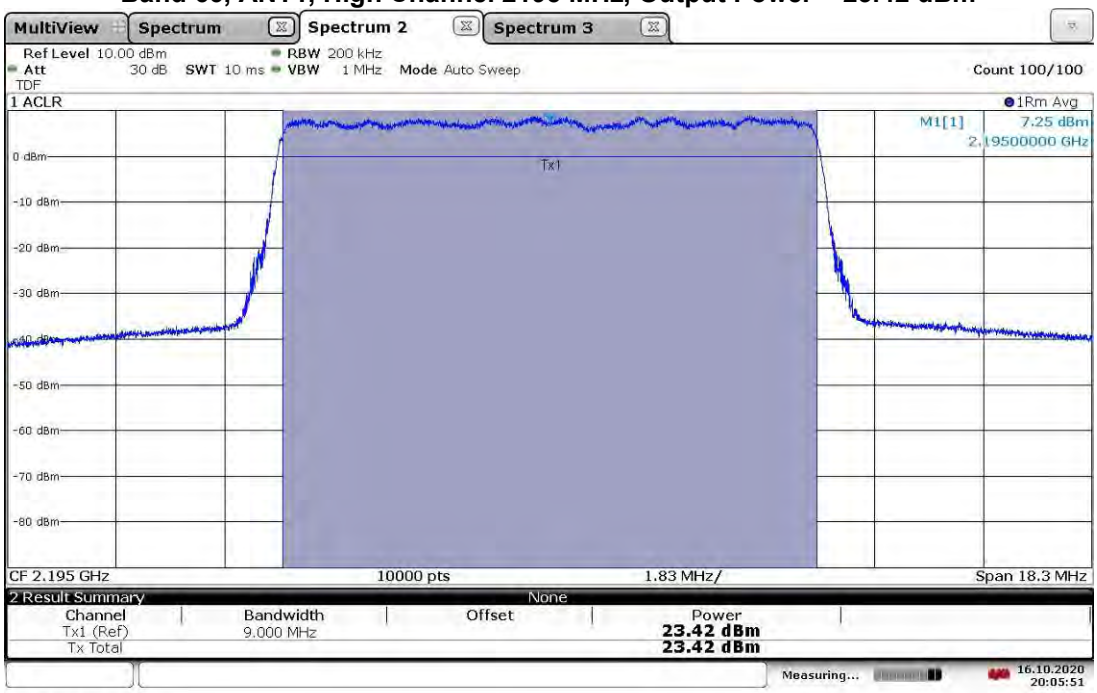
19:45:59 16.10.2020

TM1.1-QPSK_10 MHz Bandwidth
Band 66, ANT0, High Channel 2195 MHz, Output Power = 23.25 dBm



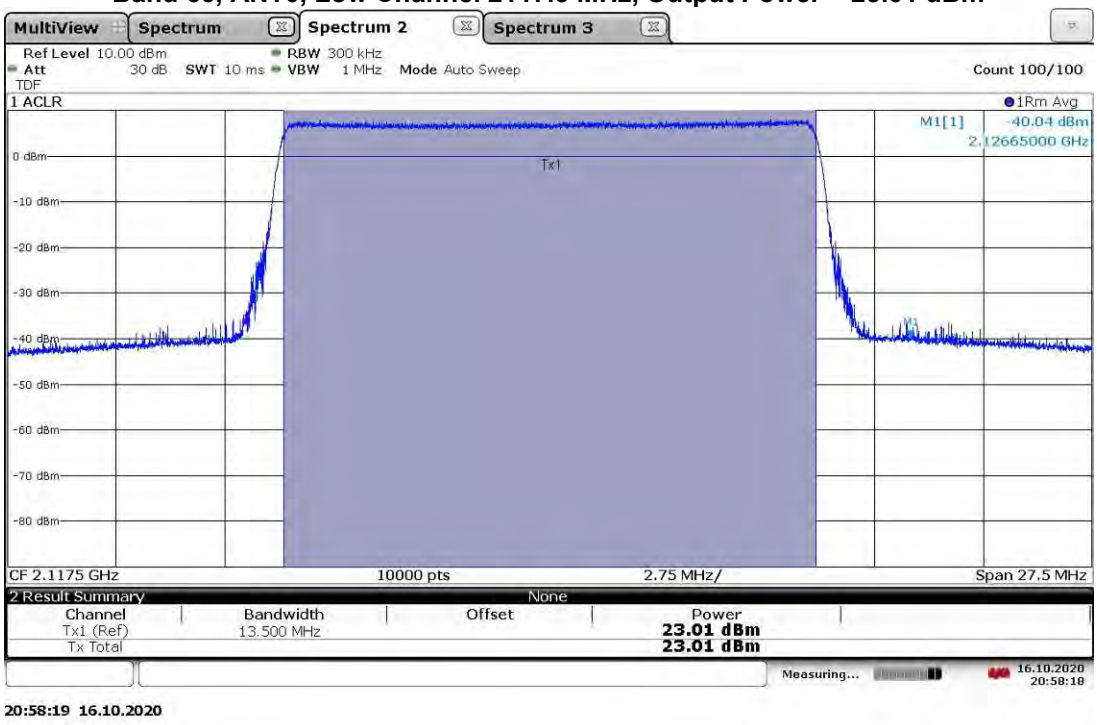
20:07:27 16.10.2020

TM1.1-QPSK_10 MHz Bandwidth
Band 66, ANT1, High Channel 2195 MHz, Output Power = 23.42 dBm



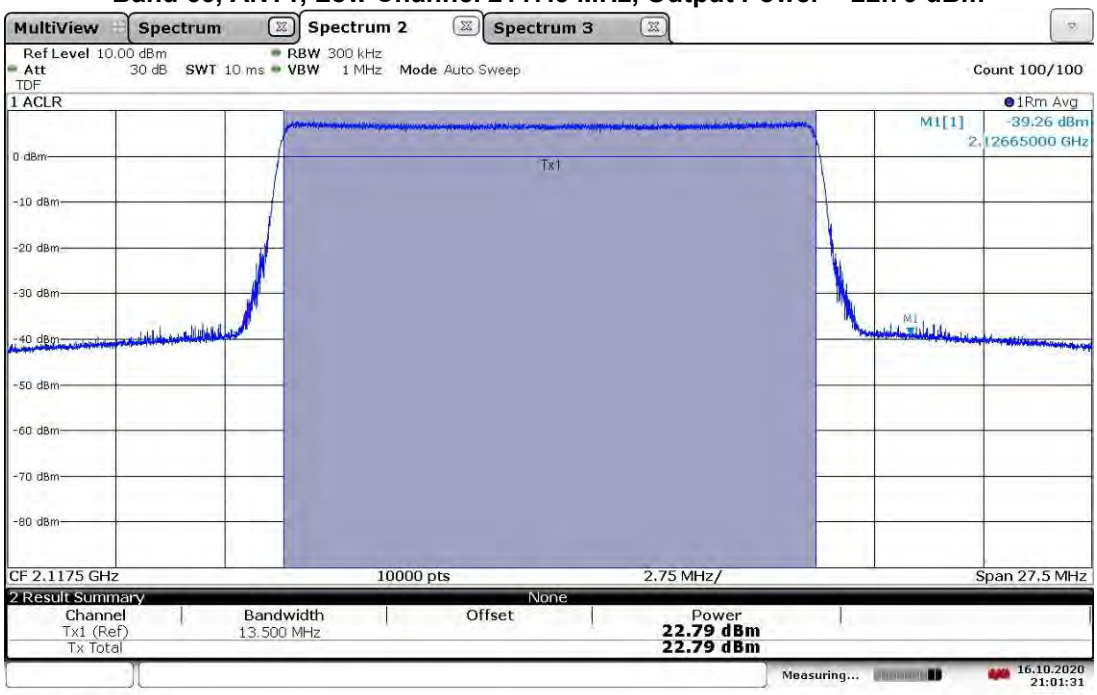
20:05:52 16.10.2020

TM1.1-QPSK_15 MHz Bandwidth
Band 66, ANT0, Low Channel 2117.5 MHz, Output Power = 23.01 dBm



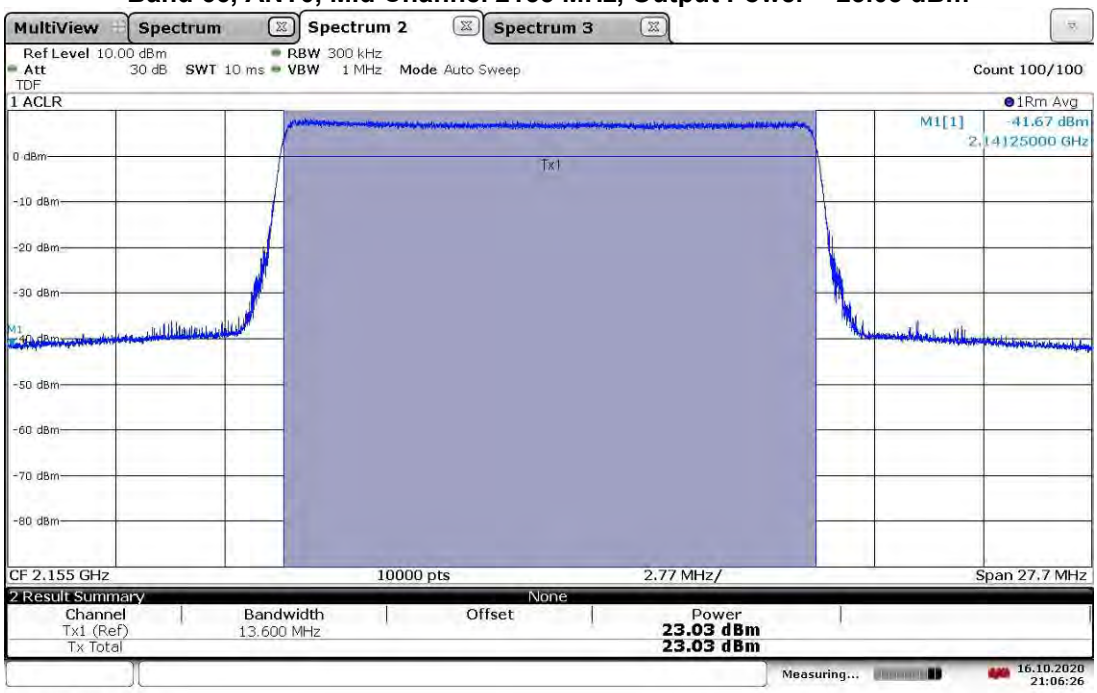
20:58:19 16.10.2020

TM1.1-QPSK_15 MHz Bandwidth
Band 66, ANT1, Low Channel 2117.5 MHz, Output Power = 22.79 dBm

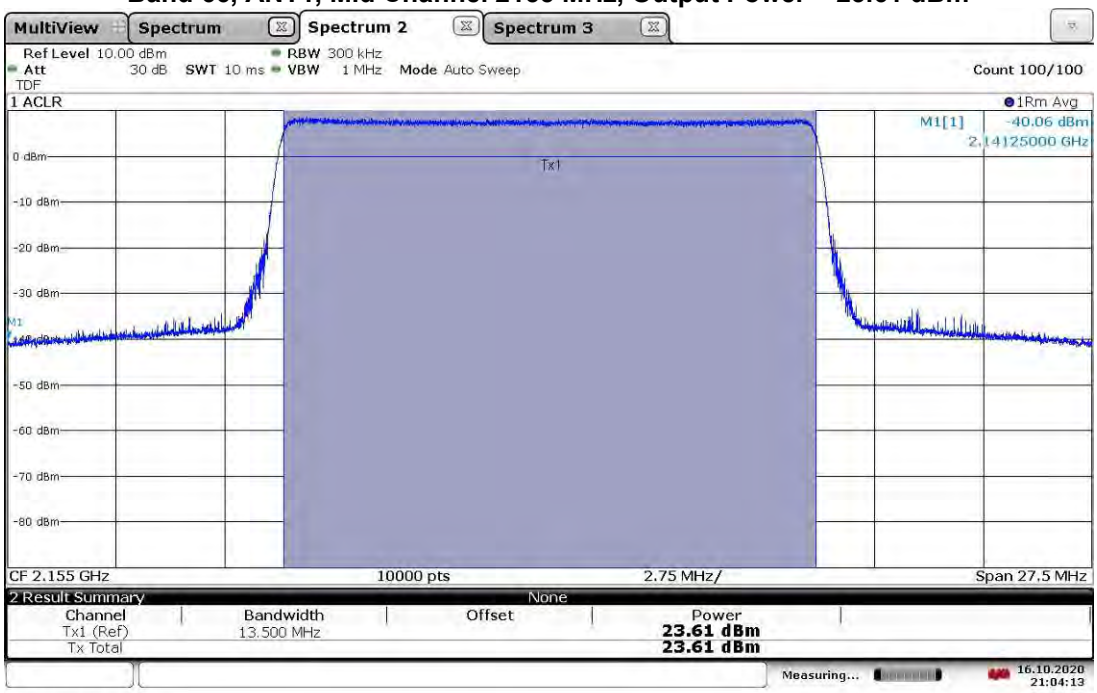


21:01:31 16.10.2020

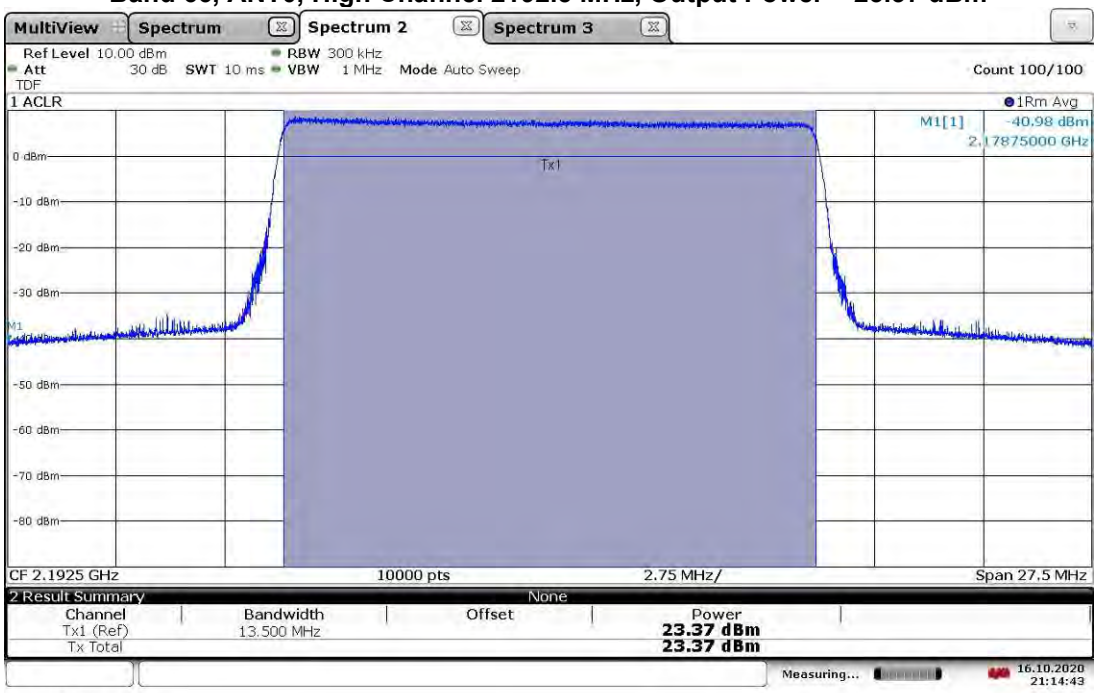
TM1.1-QPSK_15 MHz Bandwidth
Band 66, ANT0, Mid Channel 2155 MHz, Output Power = 23.03 dBm



TM1.1-QPSK_15 MHz Bandwidth
Band 66, ANT1, Mid Channel 2155 MHz, Output Power = 23.61 dBm

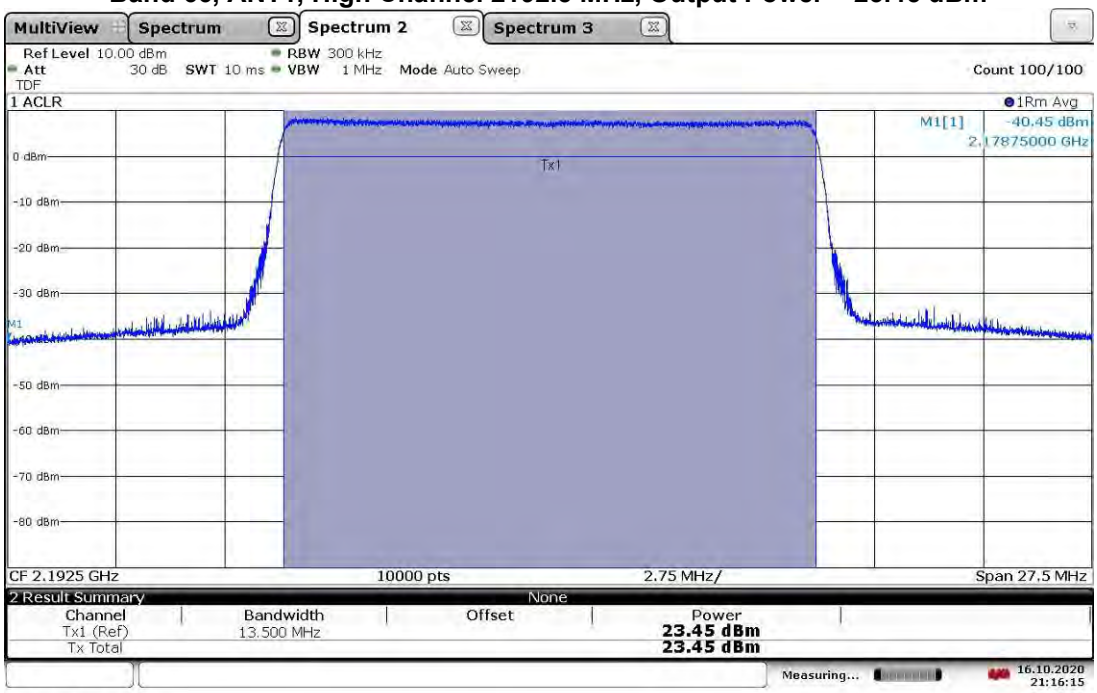


TM1.1-QPSK_15 MHz Bandwidth
Band 66, ANT0, High Channel 2192.5 MHz, Output Power = 23.37 dBm



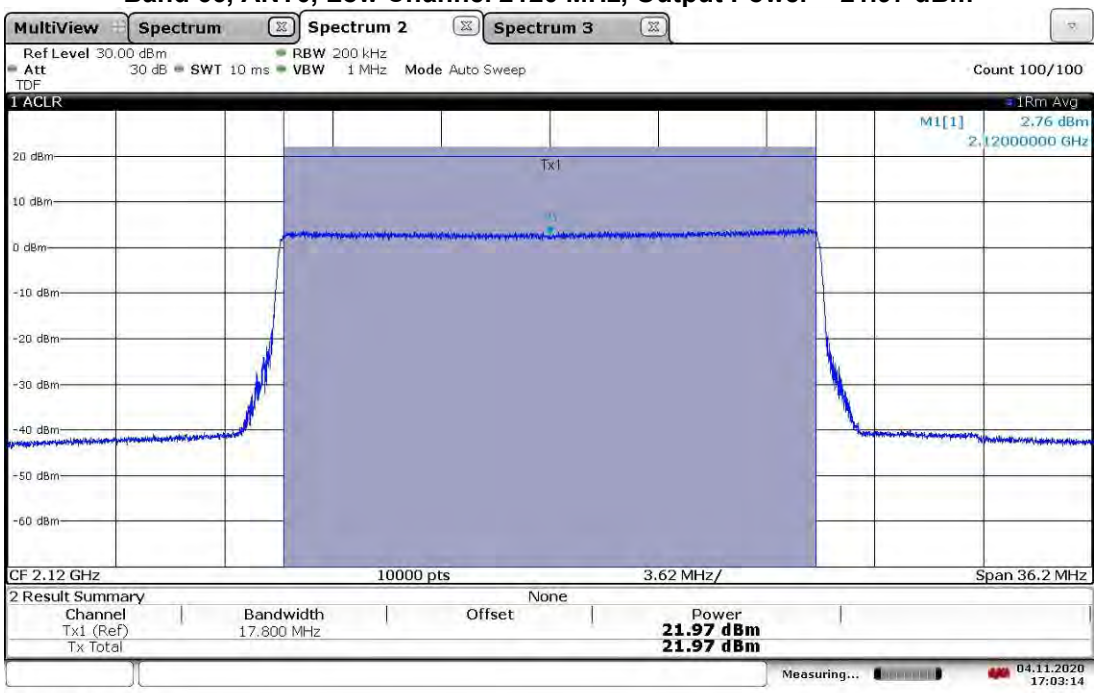
21:14:44 16.10.2020

TM1.1-QPSK_15 MHz Bandwidth
Band 66, ANT1, High Channel 2192.5 MHz, Output Power = 23.45 dBm



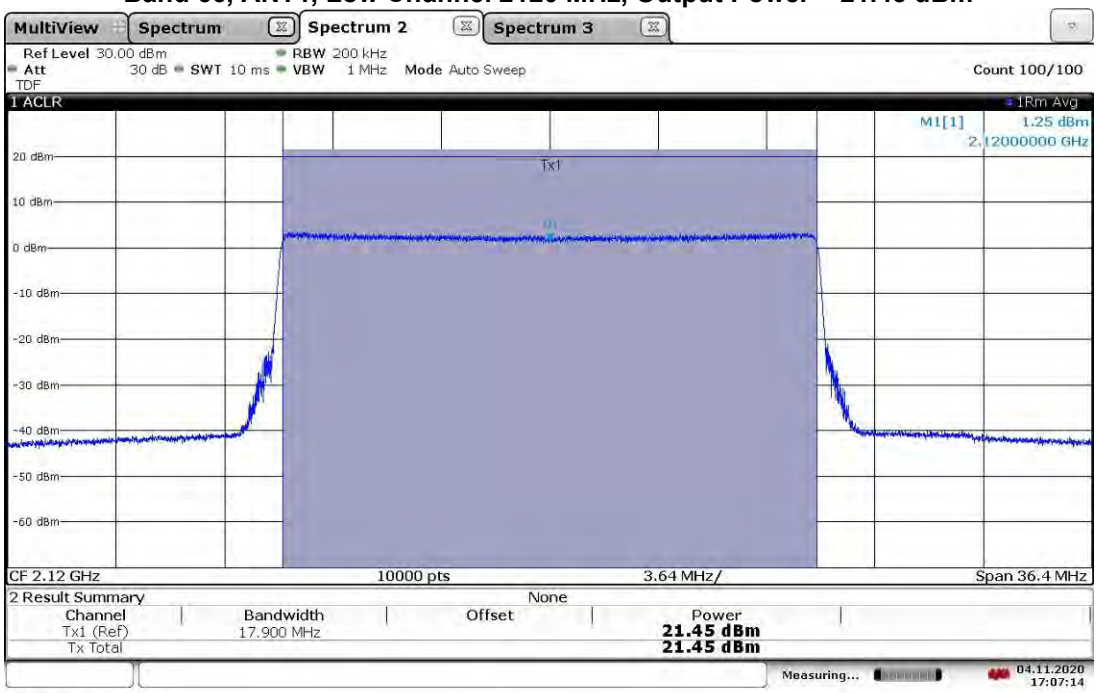
21:16:16 16.10.2020

TM1.1-QPSK_20 MHz Bandwidth
Band 66, ANT0, Low Channel 2120 MHz, Output Power = 21.97 dBm



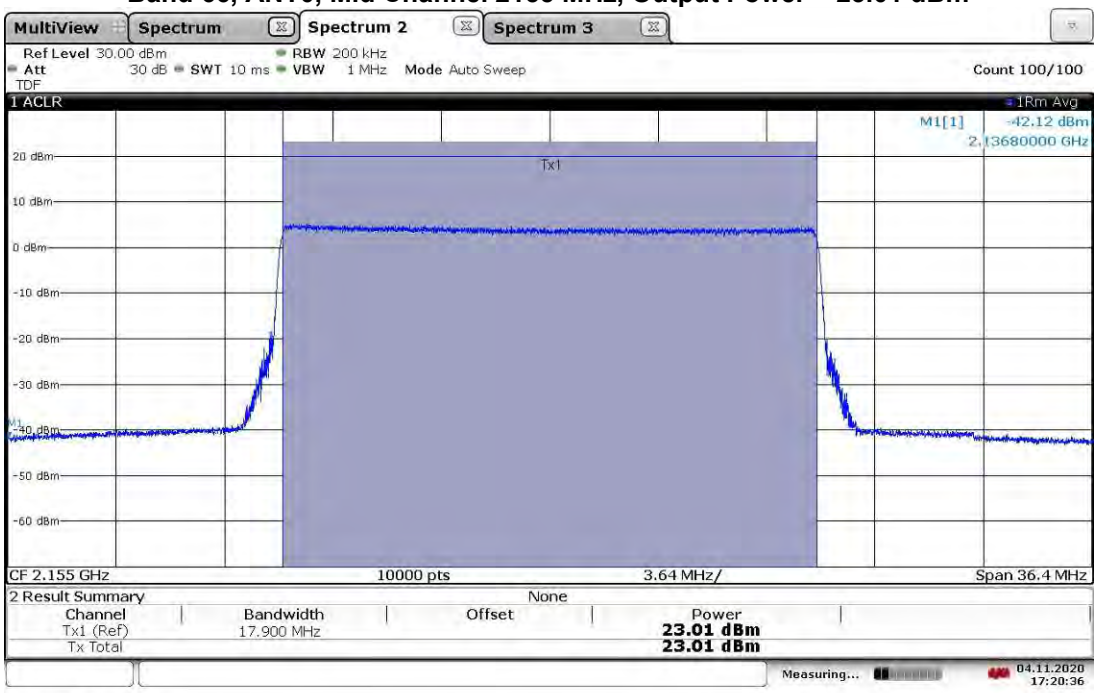
17:03:15 04.11.2020

TM1.1-QPSK_20 MHz Bandwidth
Band 66, ANT1, Low Channel 2120 MHz, Output Power = 21.45 dBm



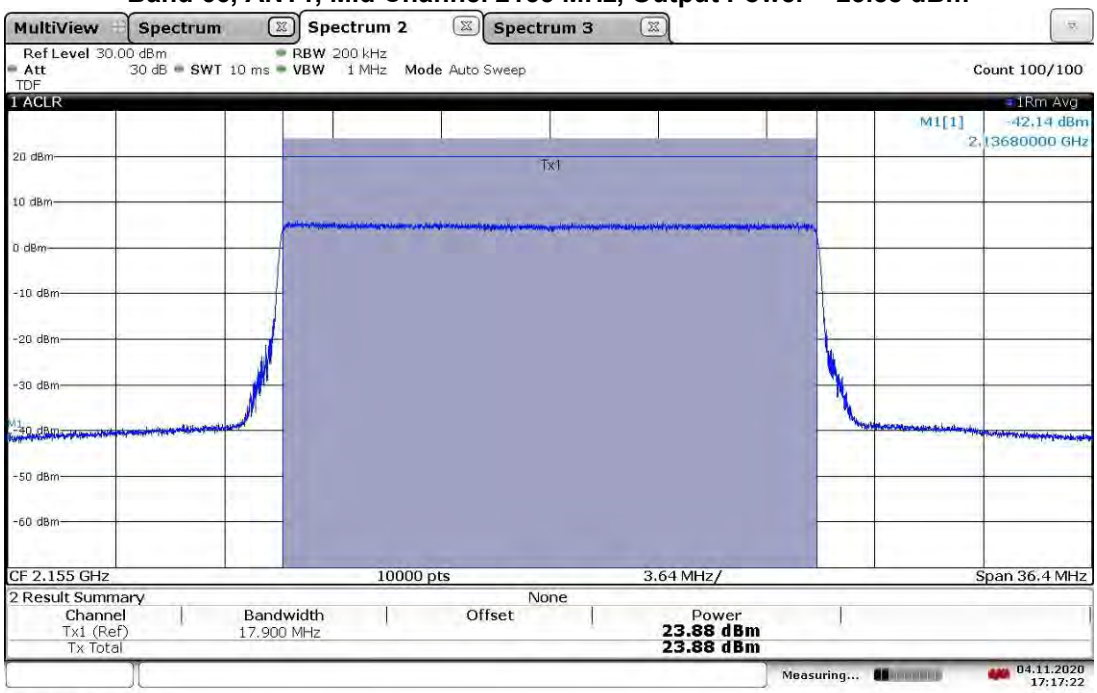
17:07:14 04.11.2020

TM1.1-QPSK_20 MHz Bandwidth
Band 66, ANT0, Mid Channel 2155 MHz, Output Power = 23.01 dBm



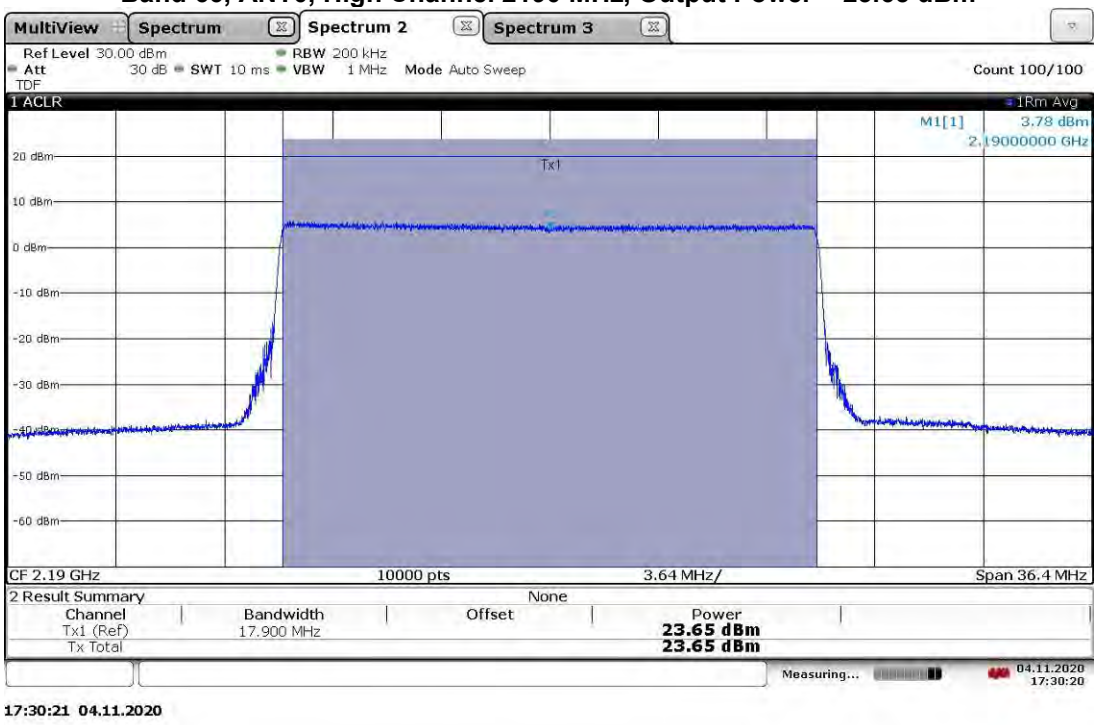
17:20:36 04.11.2020

TM1.1-QPSK_20 MHz Bandwidth
Band 66, ANT1, Mid Channel 2155 MHz, Output Power = 23.88 dBm



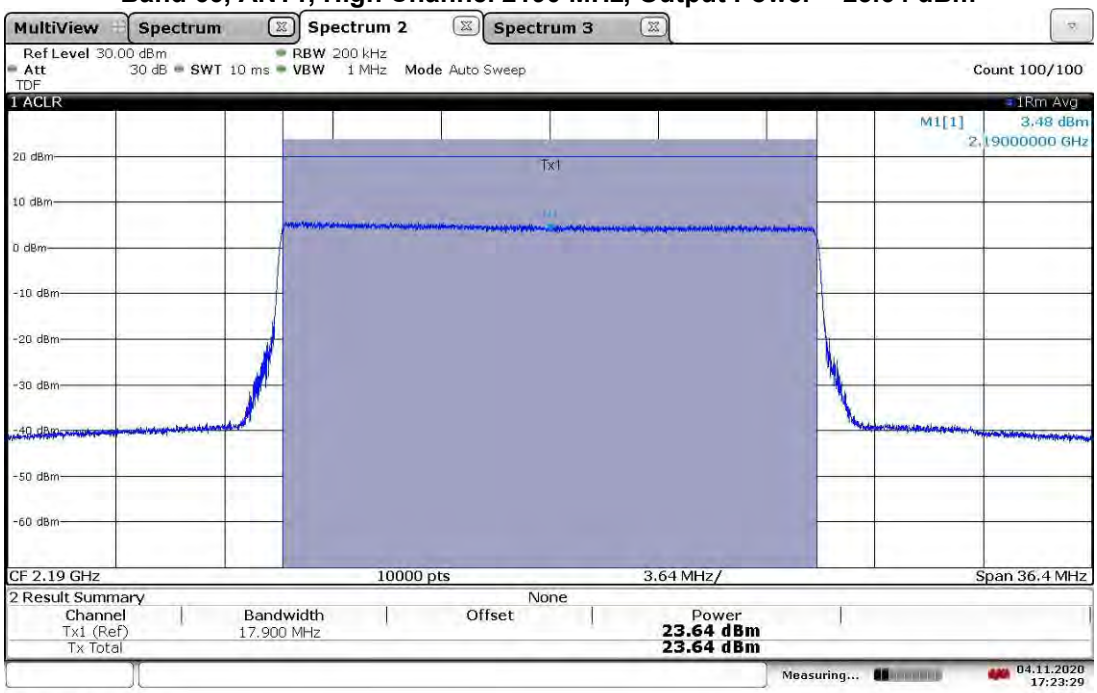
17:17:23 04.11.2020

TM1.1-QPSK_20 MHz Bandwidth
Band 66, ANT0, High Channel 2190 MHz, Output Power = 23.65 dBm



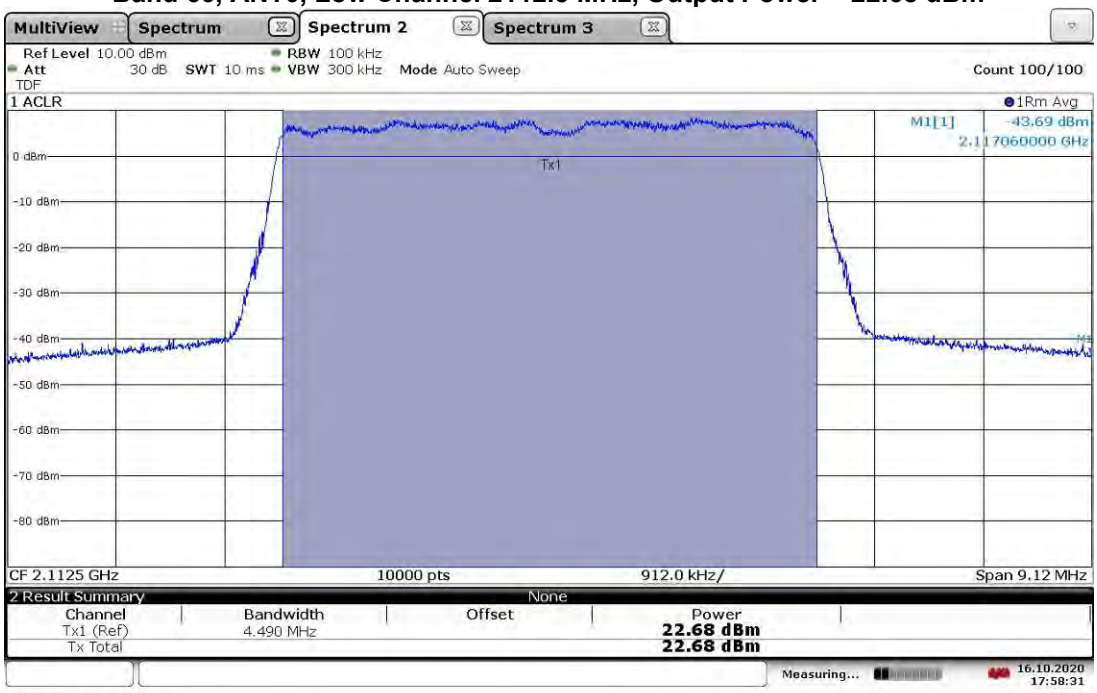
17:30:21 04.11.2020

TM1.1-QPSK_20 MHz Bandwidth
Band 66, ANT1, High Channel 2190 MHz, Output Power = 23.64 dBm



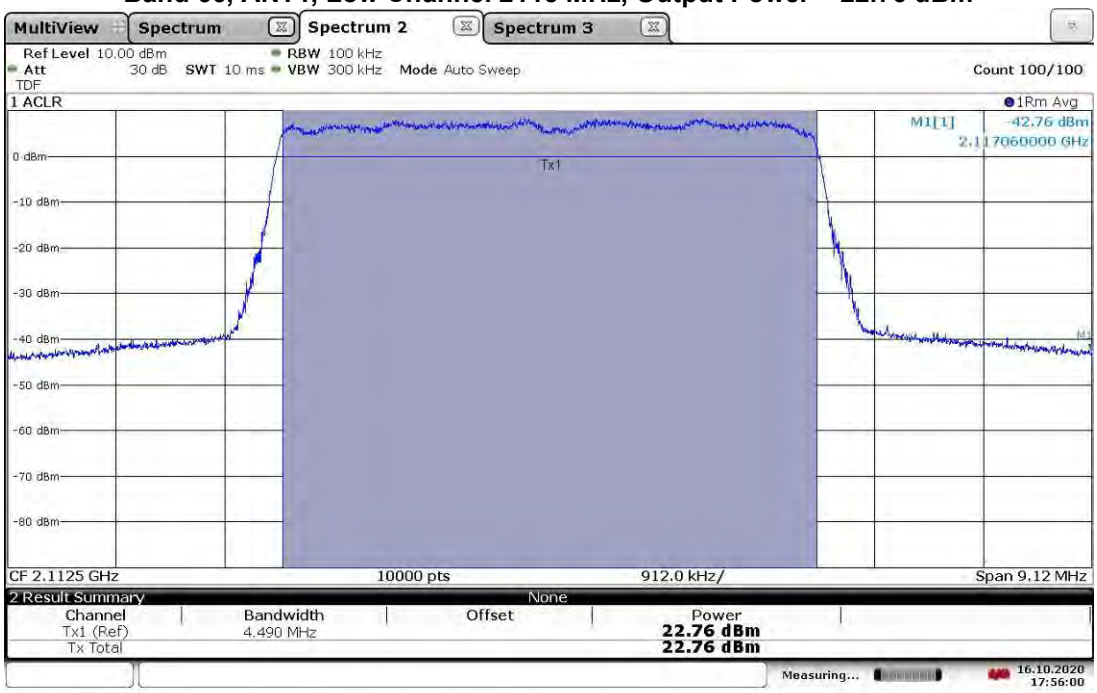
17:23:29 04.11.2020

TM3.2-16QAM_5 MHz Bandwidth
Band 66, ANT0, Low Channel 2112.5 MHz, Output Power = 22.68 dBm



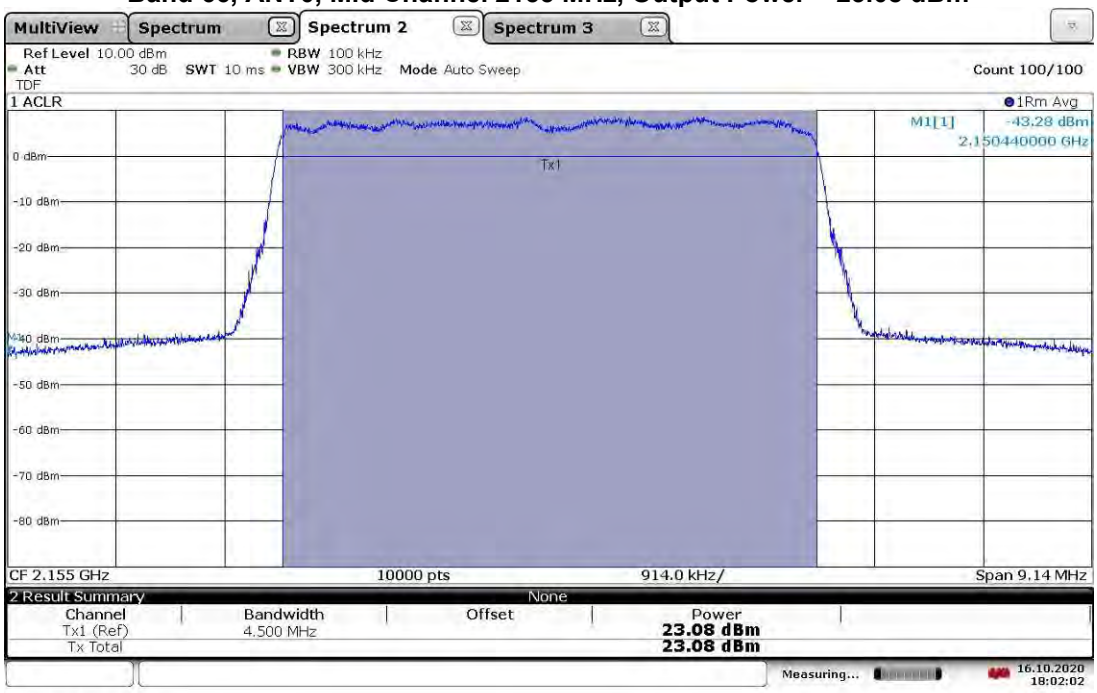
17:58:31 16.10.2020

TM3.2-16QAM_5 MHz Bandwidth
Band 66, ANT1, Low Channel 2115 MHz, Output Power = 22.76 dBm



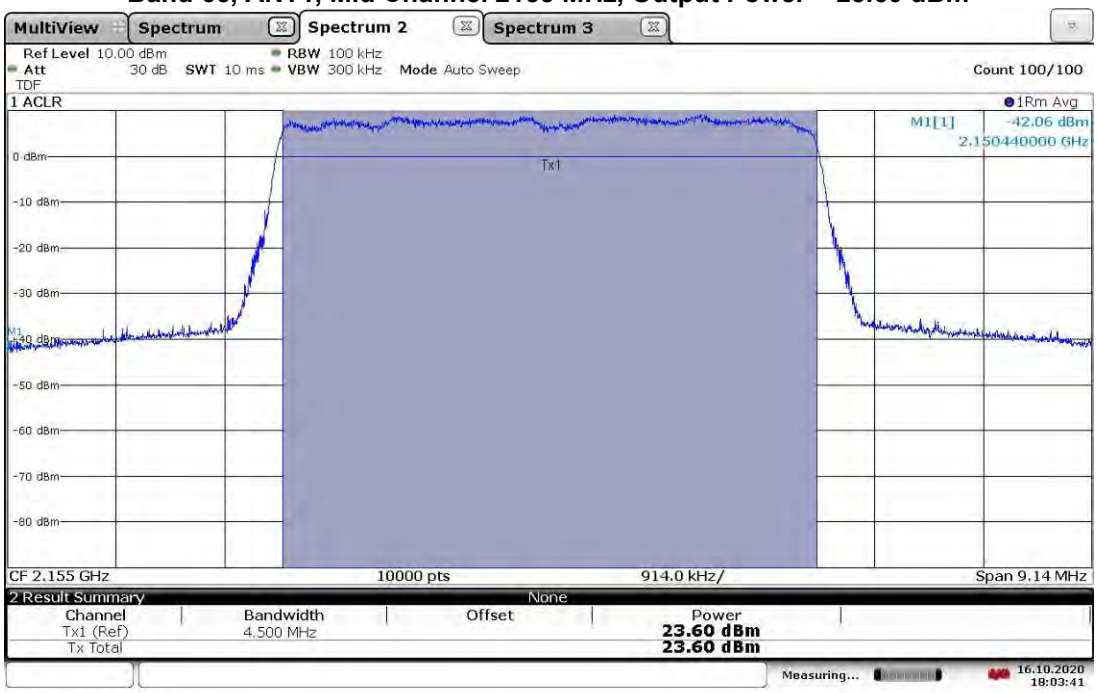
17:56:00 16.10.2020

TM3.2-16QAM_5 MHz Bandwidth
Band 66, ANT0, Mid Channel 2155 MHz, Output Power = 23.08 dBm



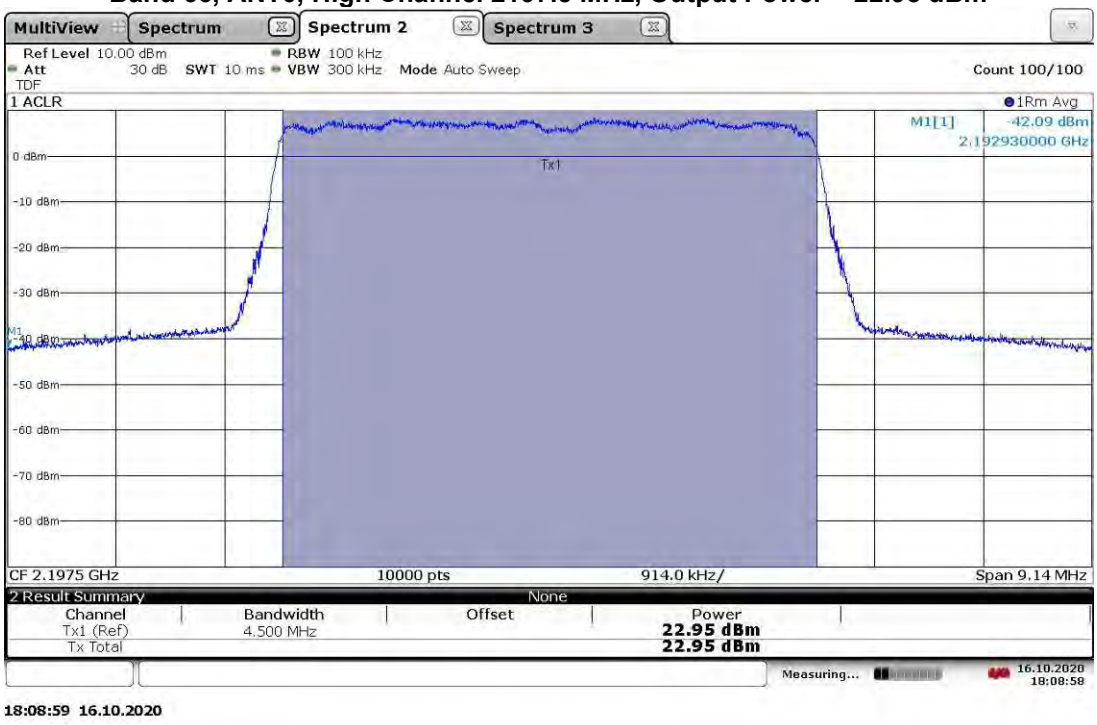
18:02:02 16.10.2020

TM3.2-16QAM_5 MHz Bandwidth
Band 66, ANT1, Mid Channel 2155 MHz, Output Power = 23.60 dBm



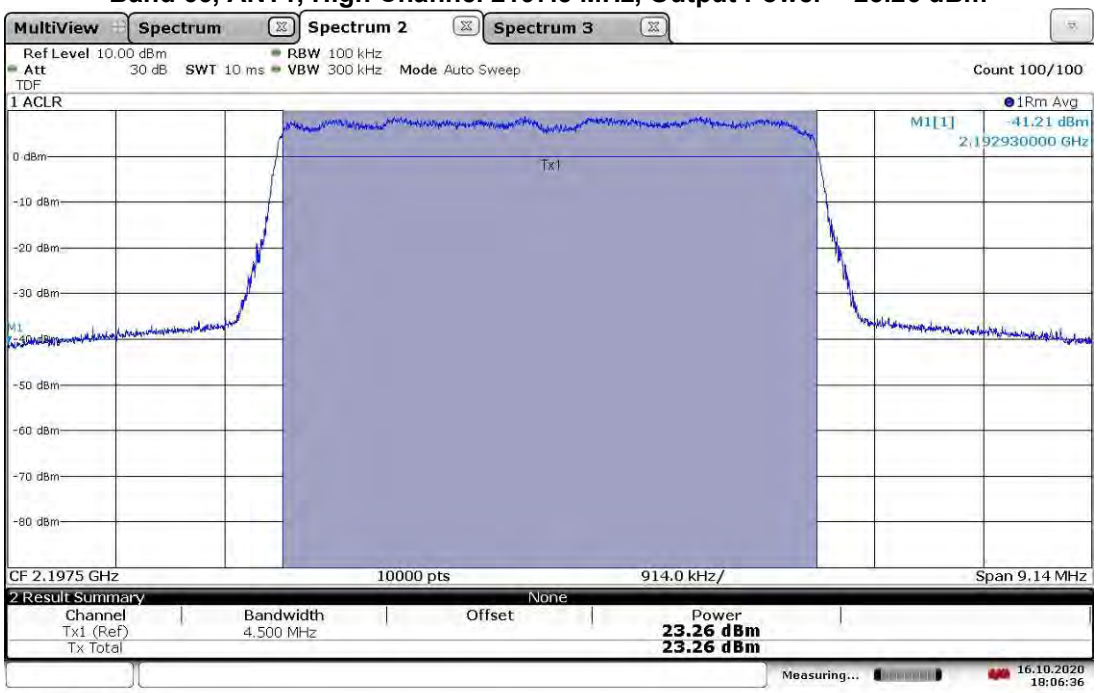
18:03:42 16.10.2020

TM3.2-16QAM_5 MHz Bandwidth
Band 66, ANT0, High Channel 2197.5 MHz, Output Power = 22.95 dBm



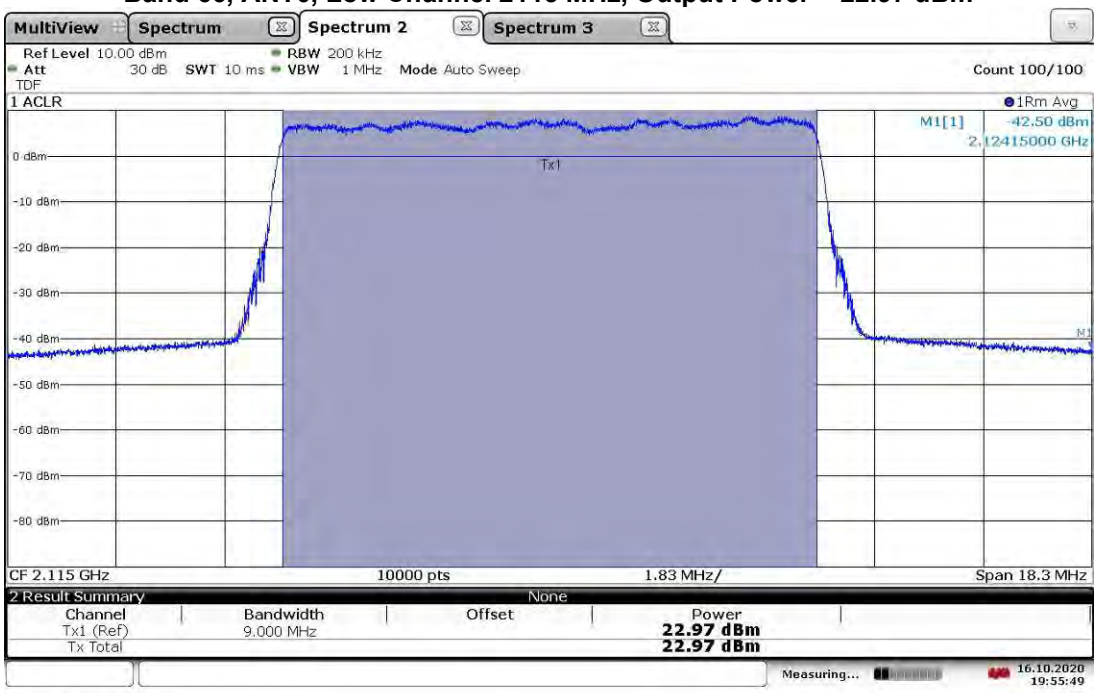
18:08:59 16.10.2020

TM3.2-16QAM_5 MHz Bandwidth
Band 66, ANT1, High Channel 2197.5 MHz, Output Power = 23.26 dBm

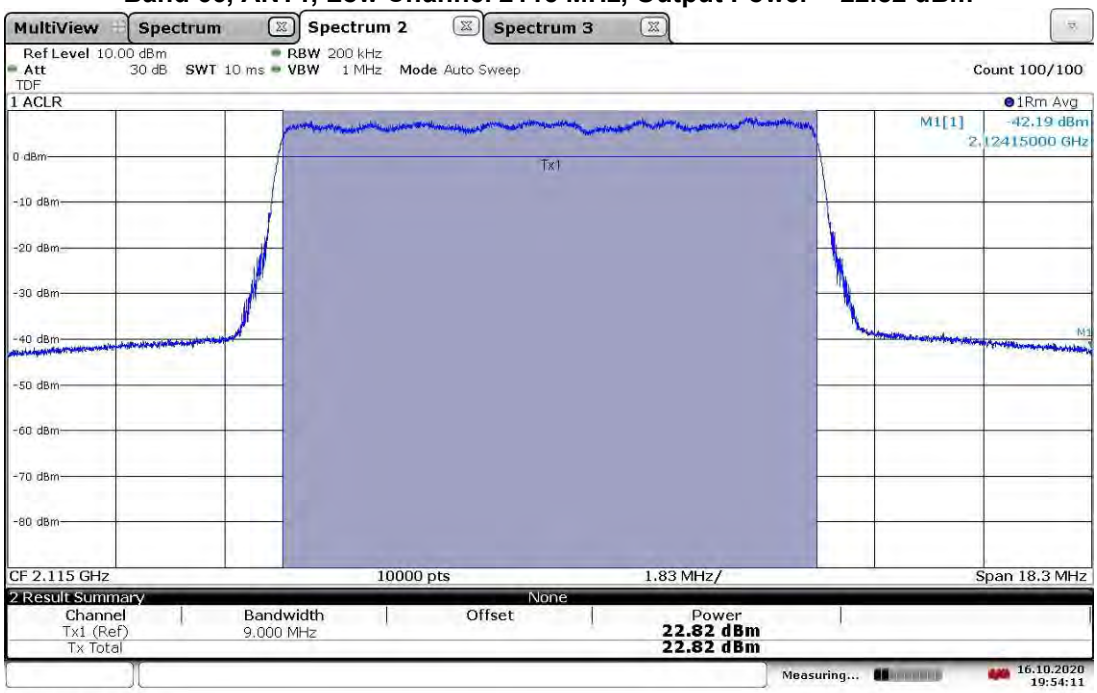


18:06:36 16.10.2020

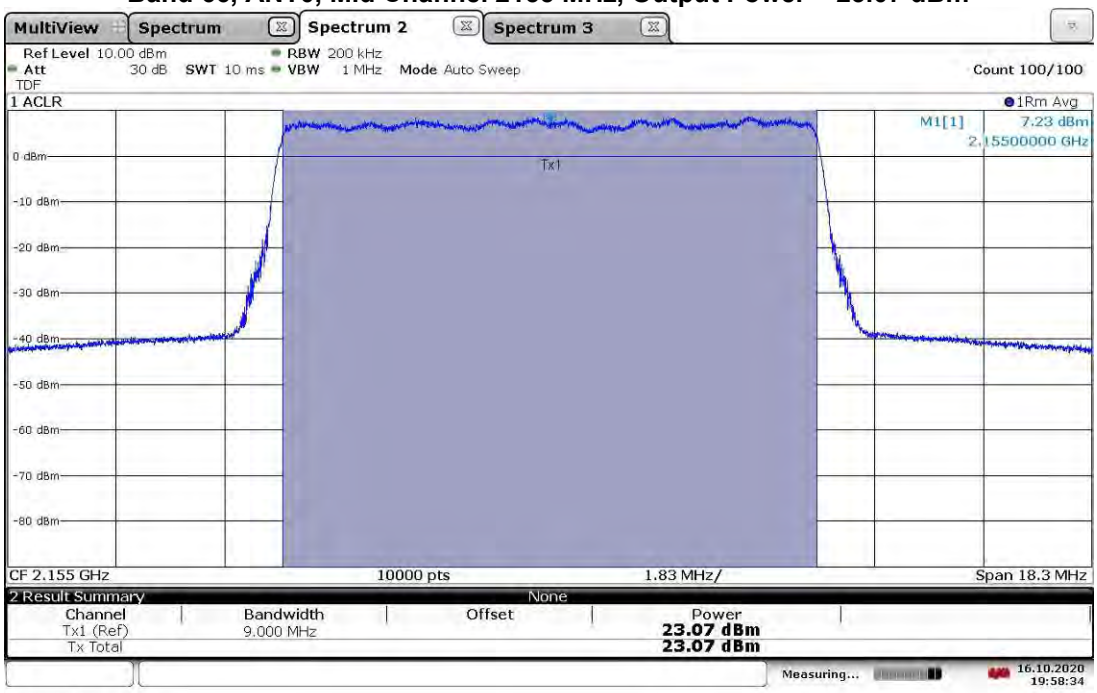
TM3.2-16QAM_10 MHz Bandwidth
Band 66, ANT0, Low Channel 2115 MHz, Output Power = 22.97 dBm



TM3.2-16QAM_10 MHz Bandwidth
Band 66, ANT1, Low Channel 2115 MHz, Output Power = 22.82 dBm

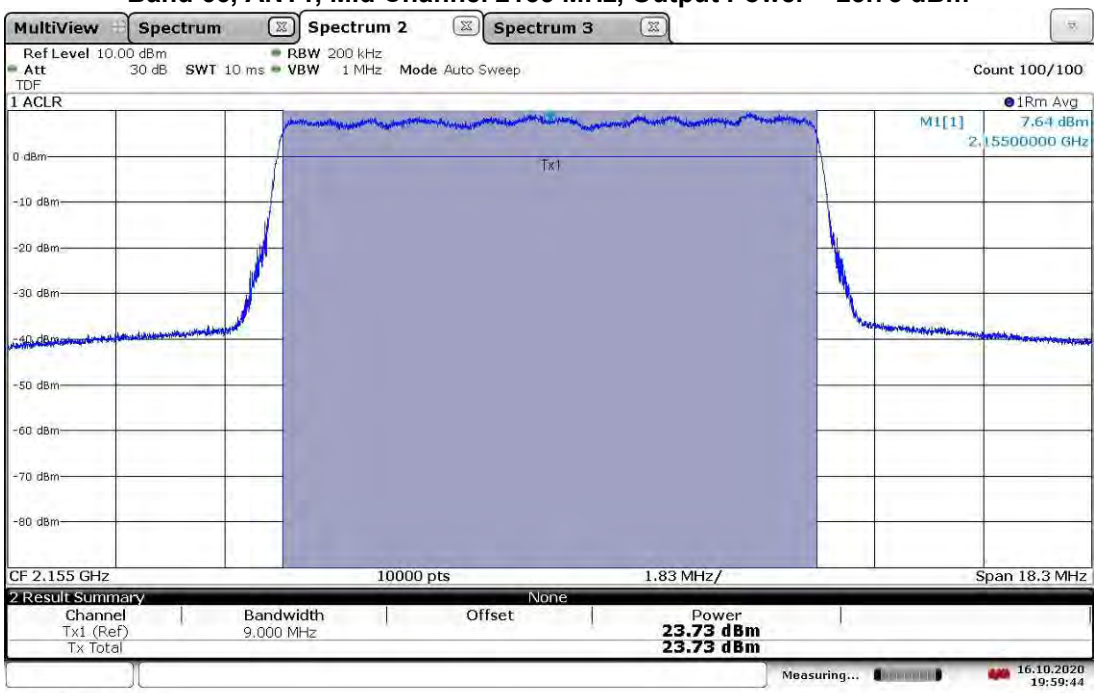


TM3.2-16QAM_10 MHz Bandwidth
Band 66, ANT0, Mid Channel 2155 MHz, Output Power = 23.07 dBm



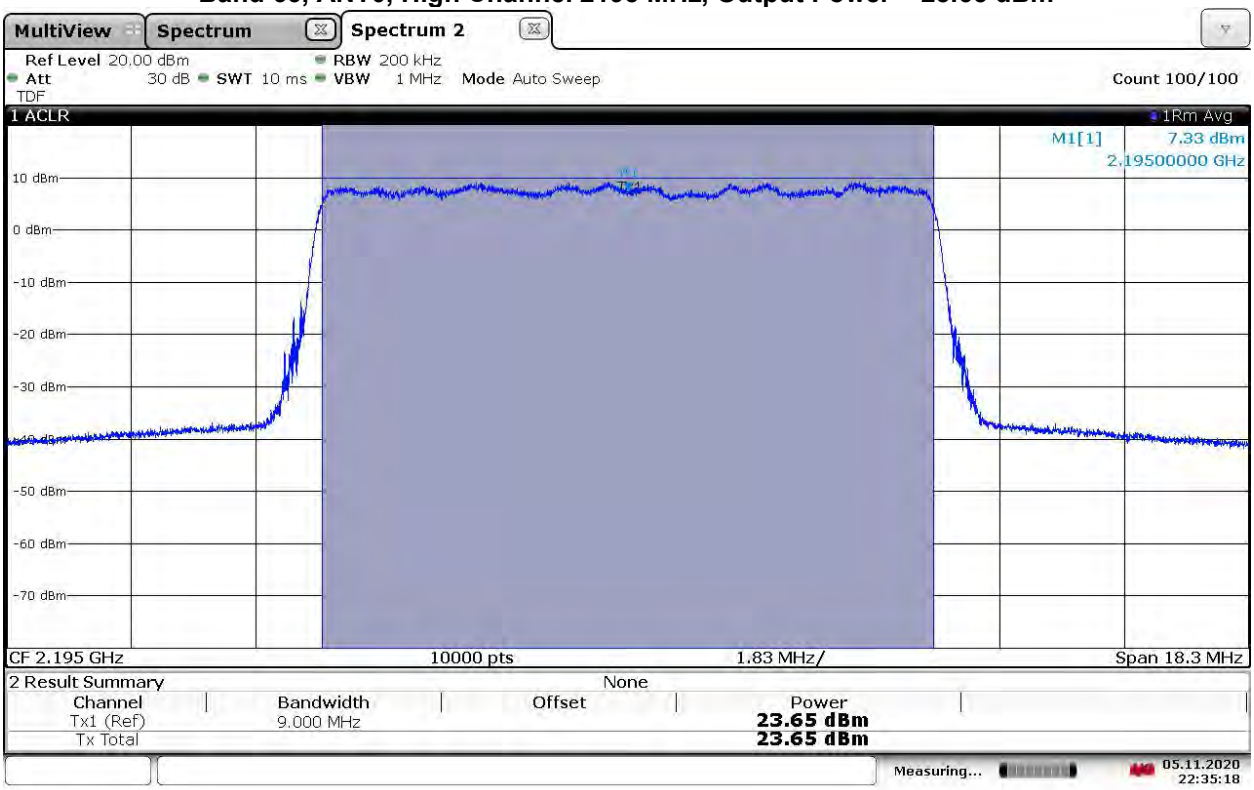
19:58:34 16.10.2020

TM3.2-16QAM_10 MHz Bandwidth
Band 66, ANT1, Mid Channel 2155 MHz, Output Power = 23.73 dBm



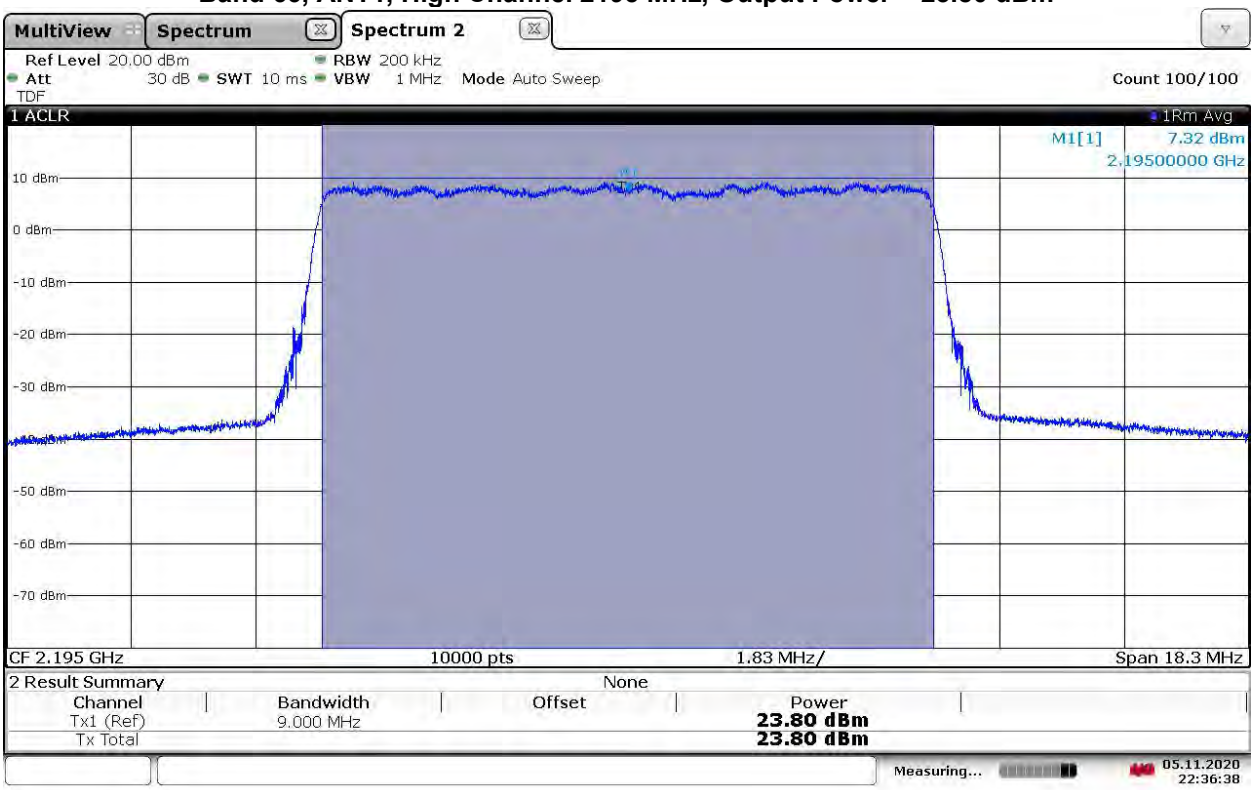
19:59:44 16.10.2020

TM3.2-16QAM_10 MHz Bandwidth
Band 66, ANT0, High Channel 2195 MHz, Output Power = 23.65 dBm



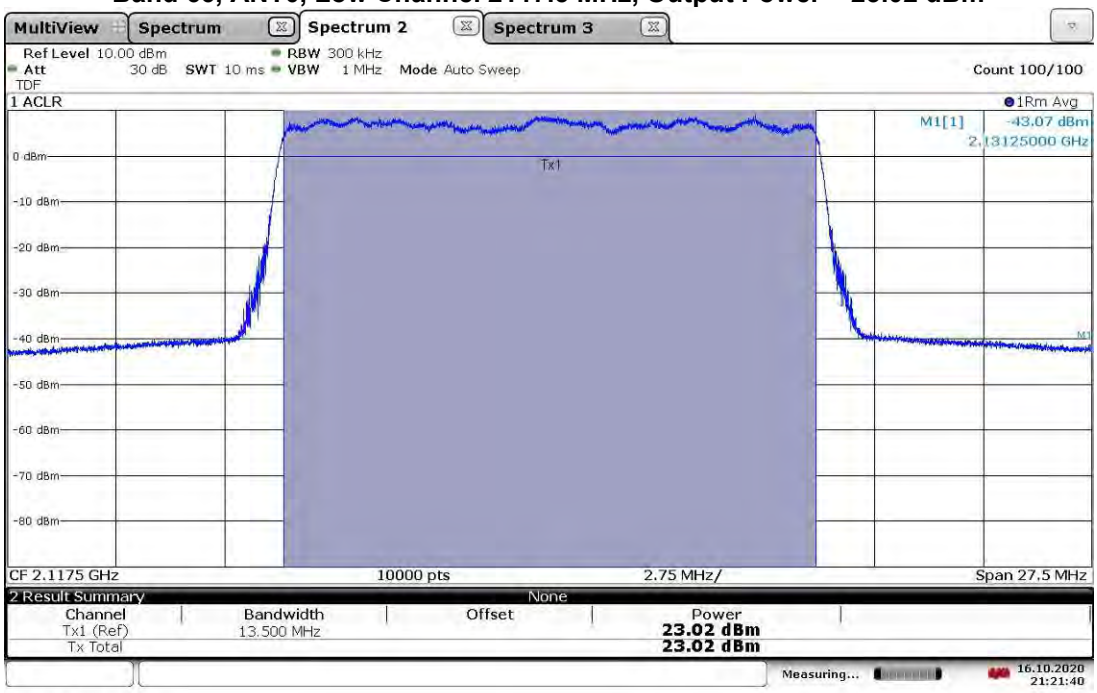
22:35:18 05.11.2020

TM3.2-16QAM_10 MHz Bandwidth
Band 66, ANT1, High Channel 2195 MHz, Output Power = 23.80 dBm

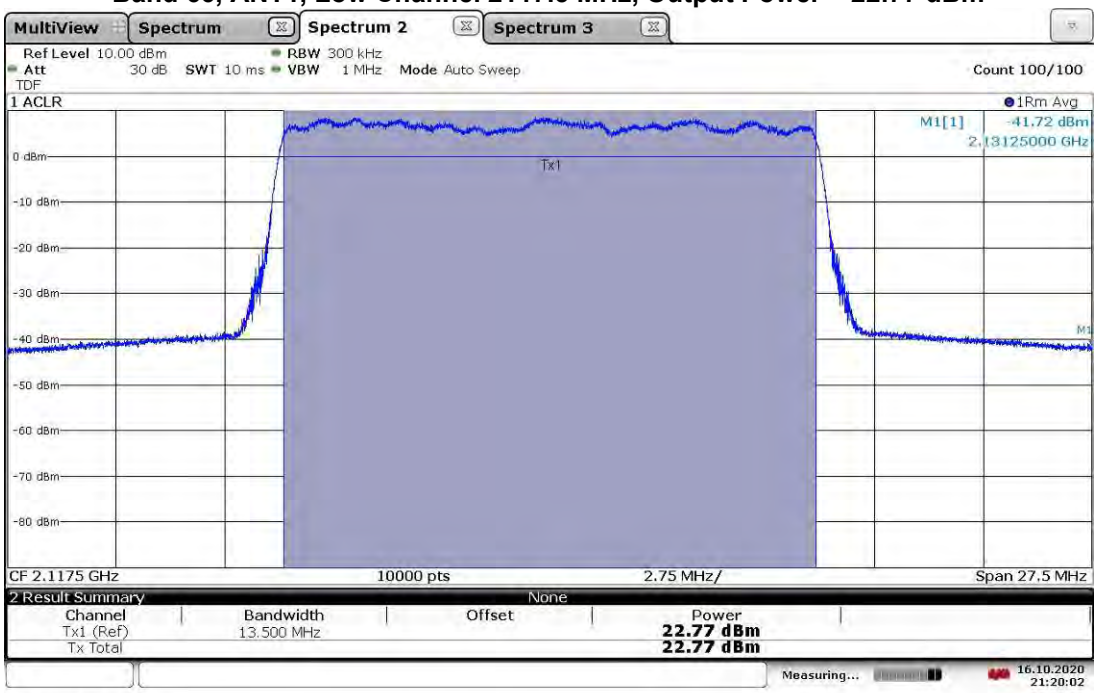


22:36:38 05.11.2020

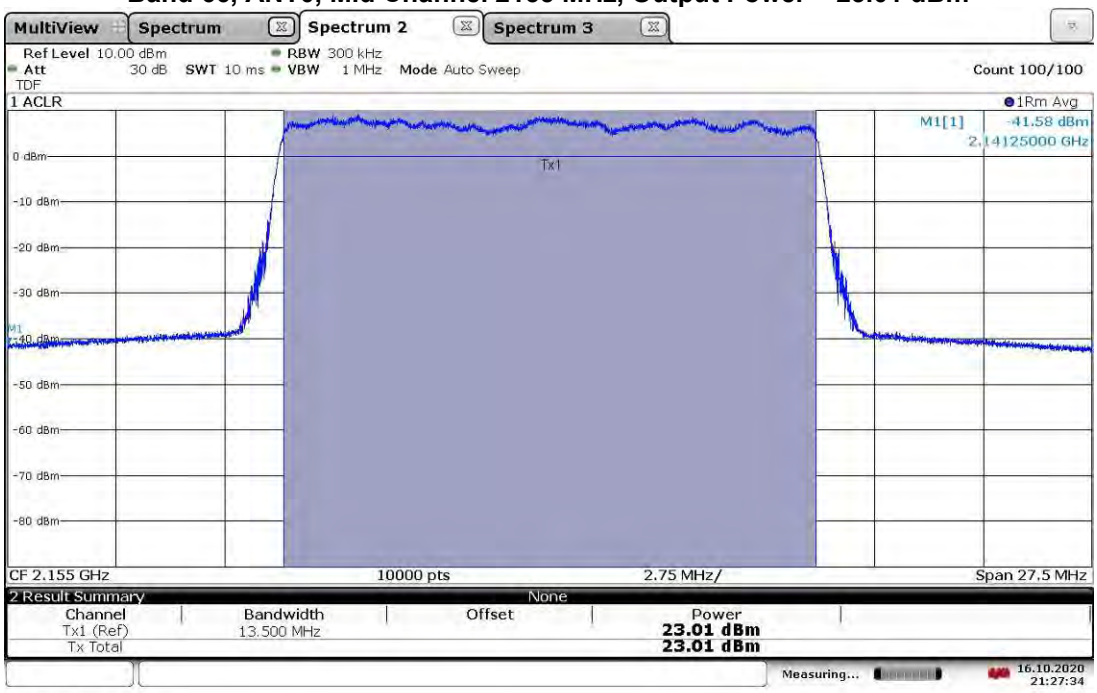
TM3.2-16QAM_15 MHz Bandwidth
Band 66, ANT0, Low Channel 2117.5 MHz, Output Power = 23.02 dBm



TM3.2-16QAM_15 MHz Bandwidth
Band 66, ANT1, Low Channel 2117.5 MHz, Output Power = 22.77 dBm

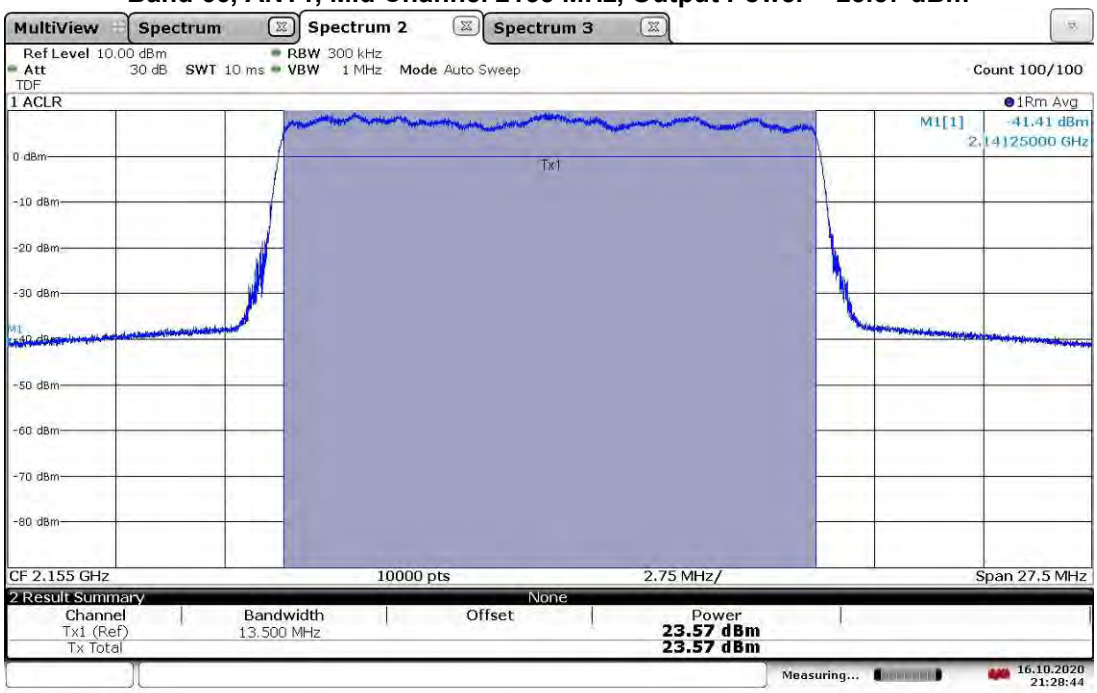


TM3.2-16QAM_15 MHz Bandwidth
Band 66, ANT0, Mid Channel 2155 MHz, Output Power = 23.01 dBm



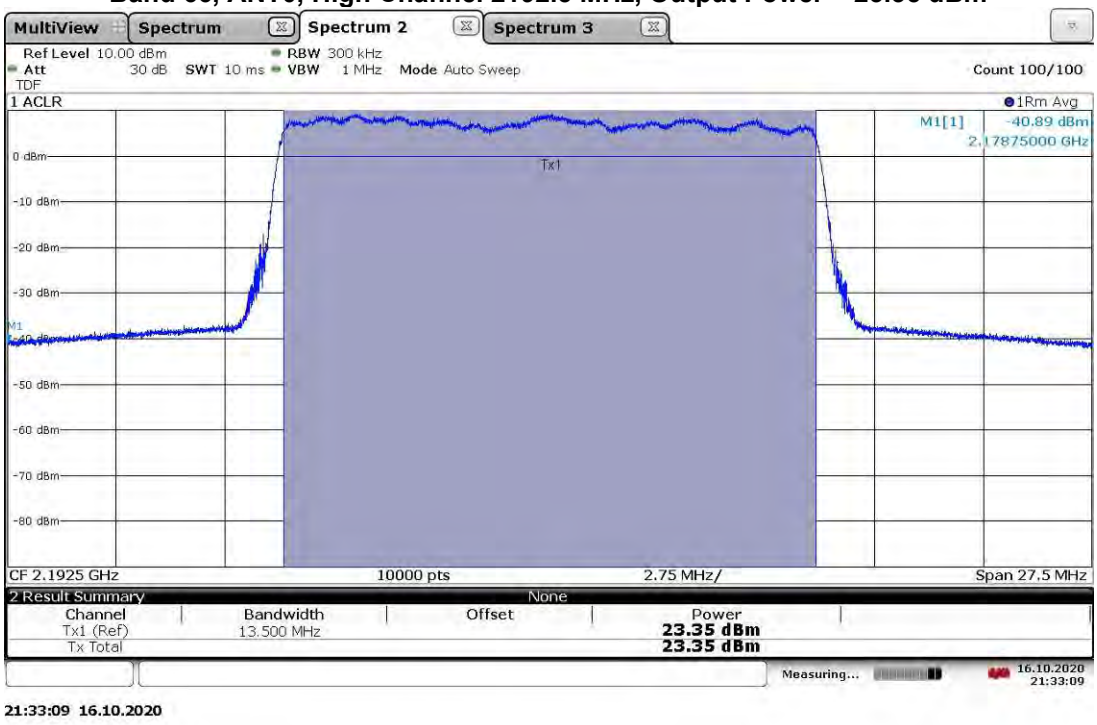
21:27:34 16.10.2020

TM3.2-16QAM_15 MHz Bandwidth
Band 66, ANT1, Mid Channel 2155 MHz, Output Power = 23.57 dBm



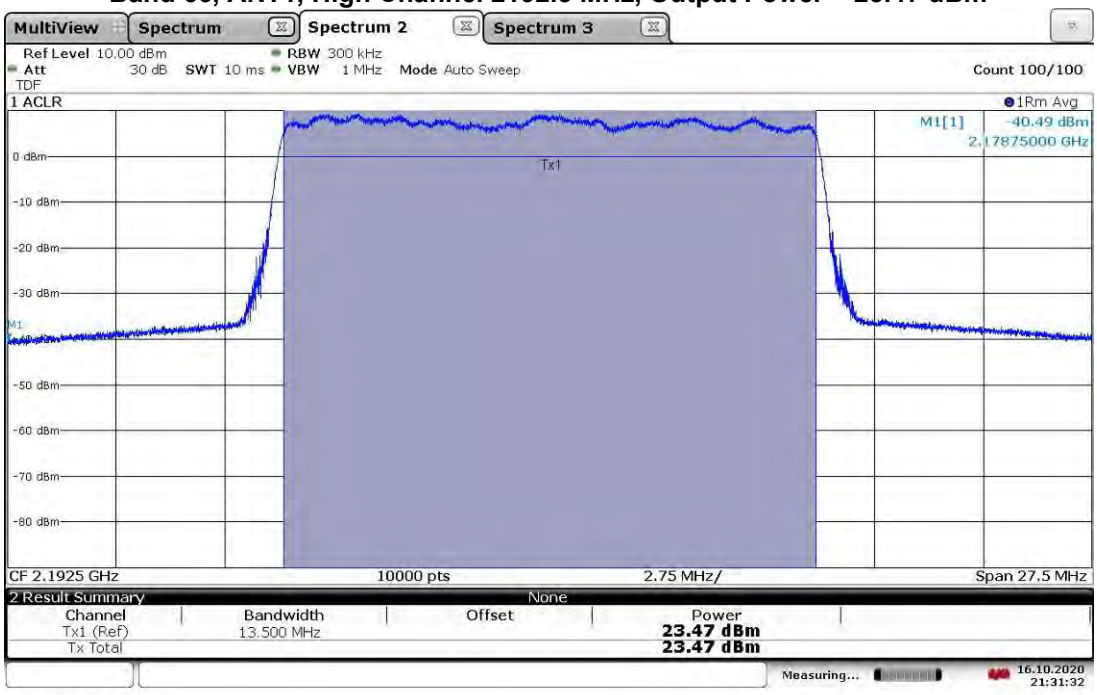
21:28:45 16.10.2020

TM3.2-16QAM_15 MHz Bandwidth
Band 66, ANT0, High Channel 2192.5 MHz, Output Power = 23.35 dBm



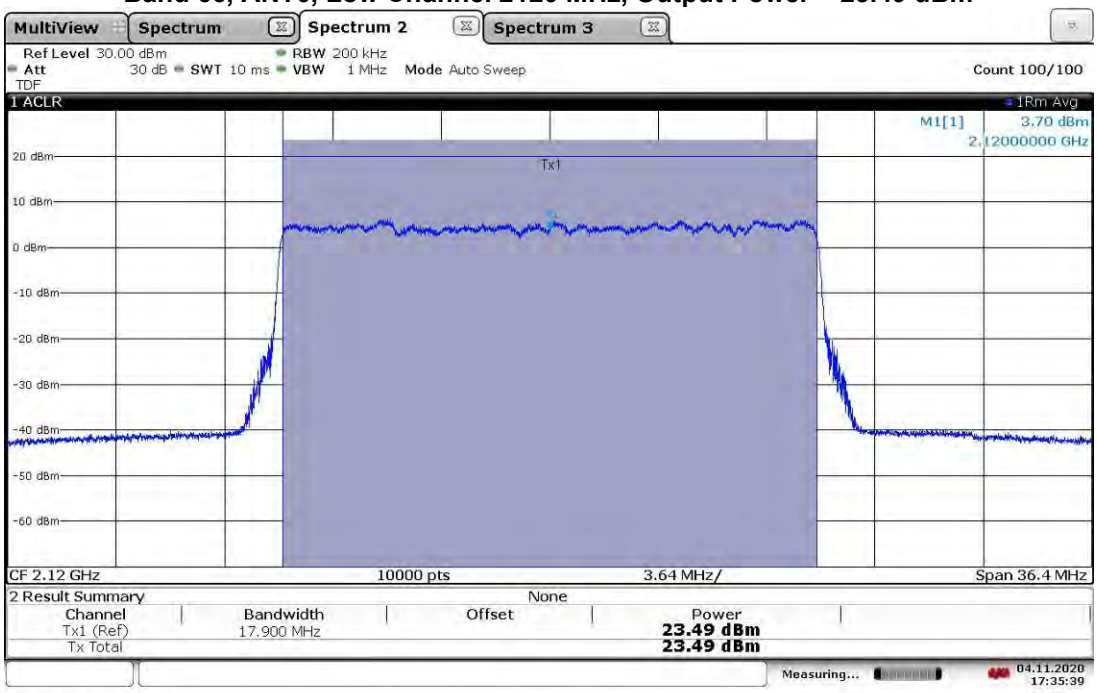
21:33:09 16.10.2020

TM3.2-16QAM_15 MHz Bandwidth
Band 66, ANT1, High Channel 2192.5 MHz, Output Power = 23.47 dBm



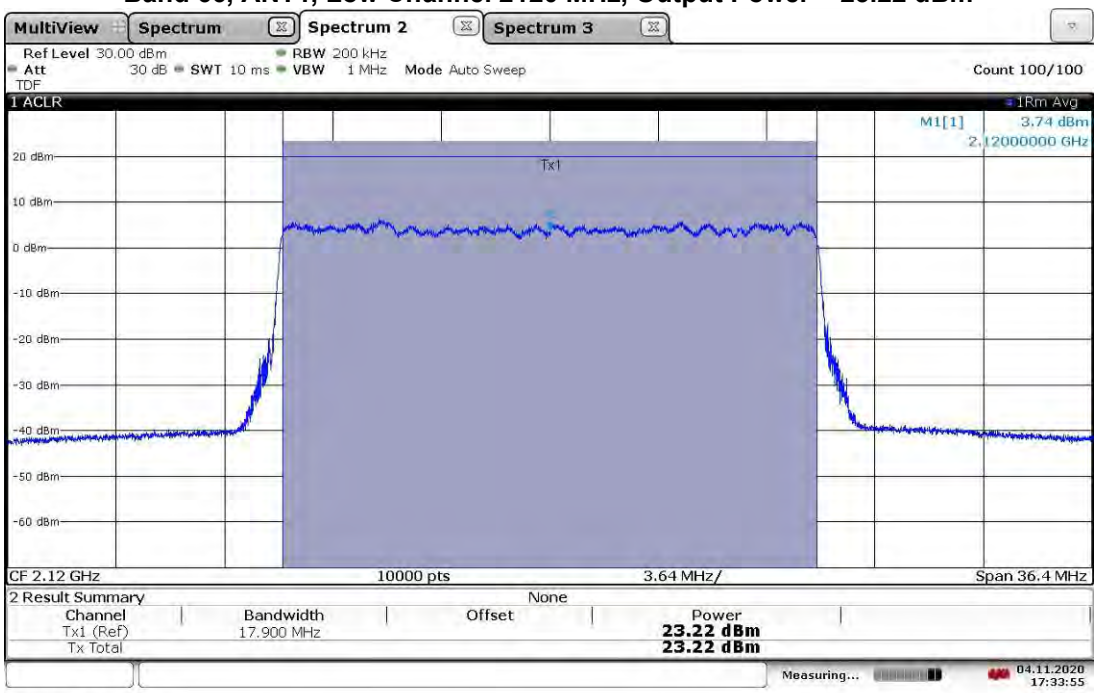
21:31:32 16.10.2020

TM3.2-16QAM_20 MHz Bandwidth
Band 66, ANT0, Low Channel 2120 MHz, Output Power = 23.49 dBm



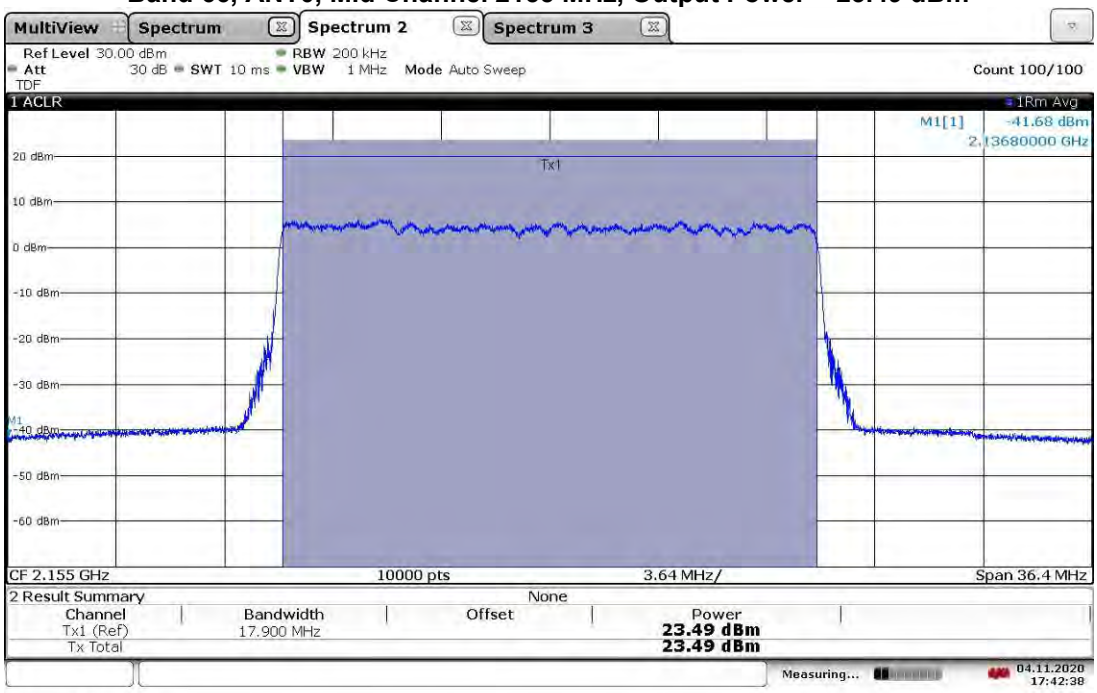
17:35:40 04.11.2020

TM3.2-16QAM_20 MHz Bandwidth
Band 66, ANT1, Low Channel 2120 MHz, Output Power = 23.22 dBm



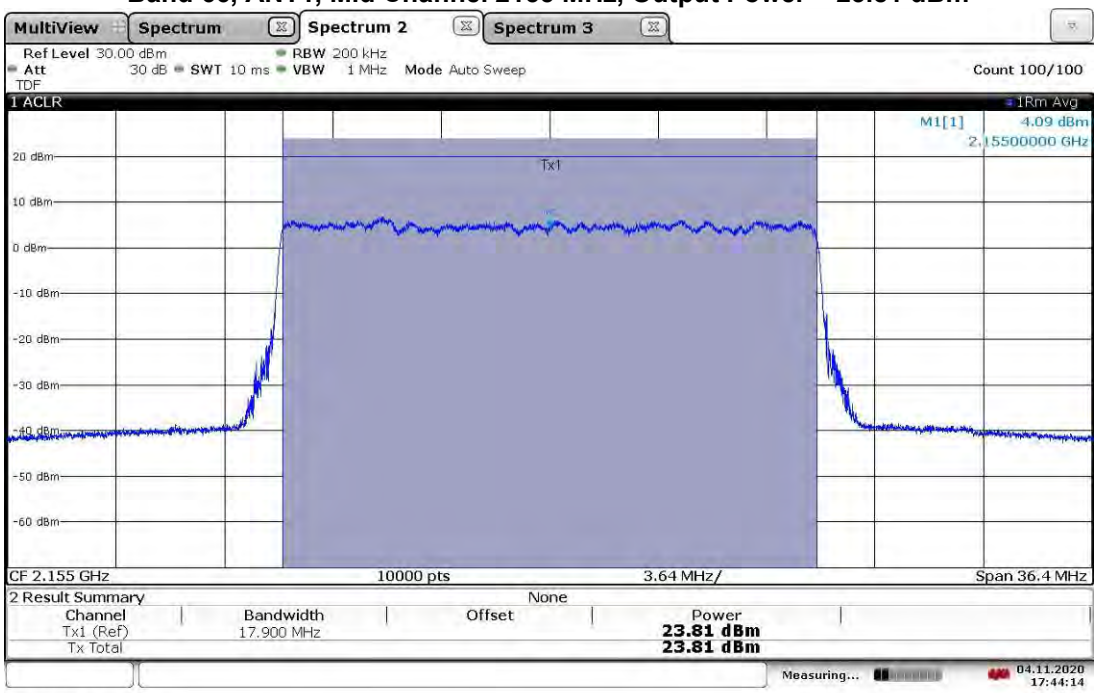
17:33:55 04.11.2020

TM3.2-16QAM_20 MHz Bandwidth
Band 66, ANT0, Mid Channel 2155 MHz, Output Power = 23.49 dBm



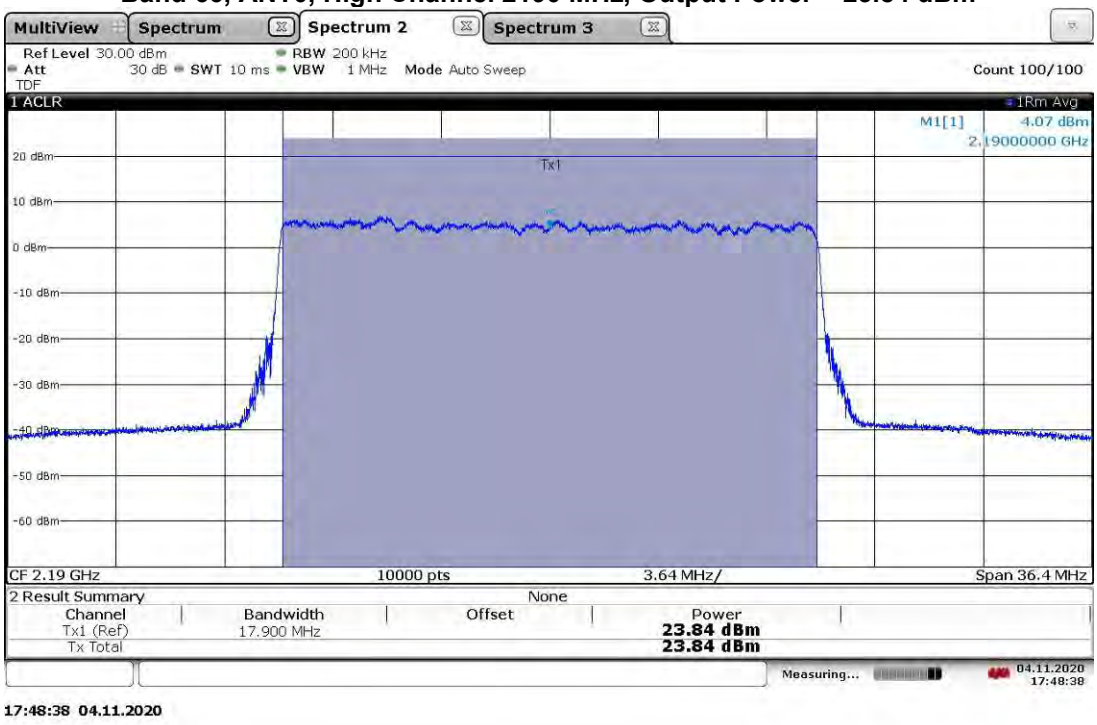
17:42:39 04.11.2020

TM3.2-16QAM_20 MHz Bandwidth
Band 66, ANT1, Mid Channel 2155 MHz, Output Power = 23.81 dBm



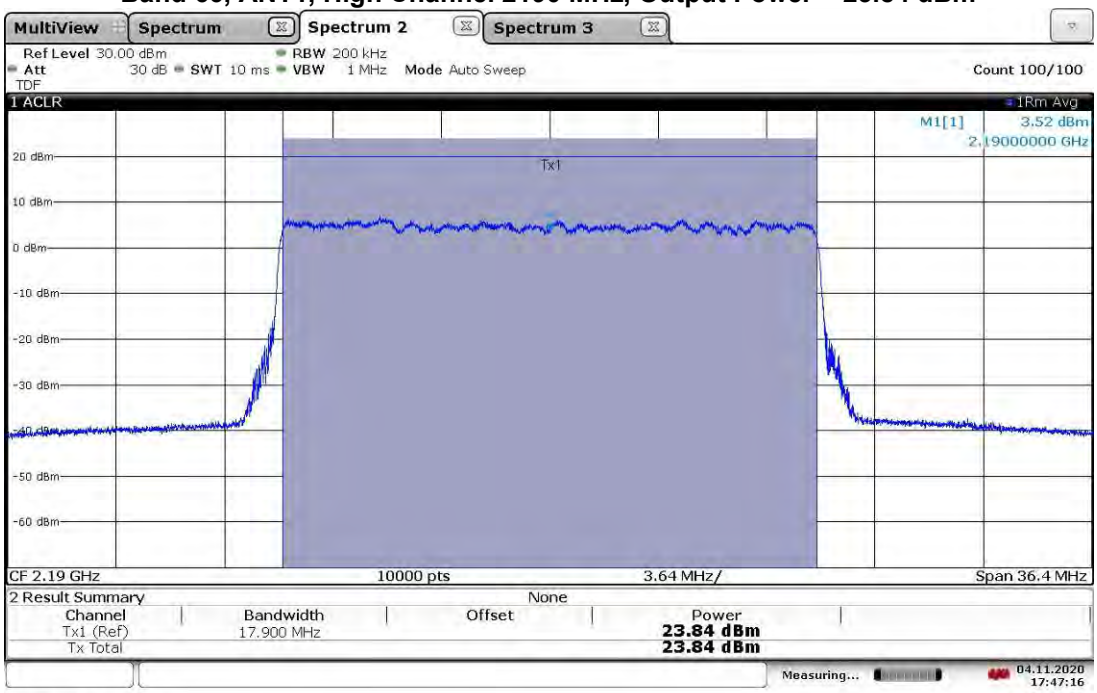
17:44:15 04.11.2020

TM3.2-16QAM_20 MHz Bandwidth
Band 66, ANT0, High Channel 2190 MHz, Output Power = 23.84 dBm



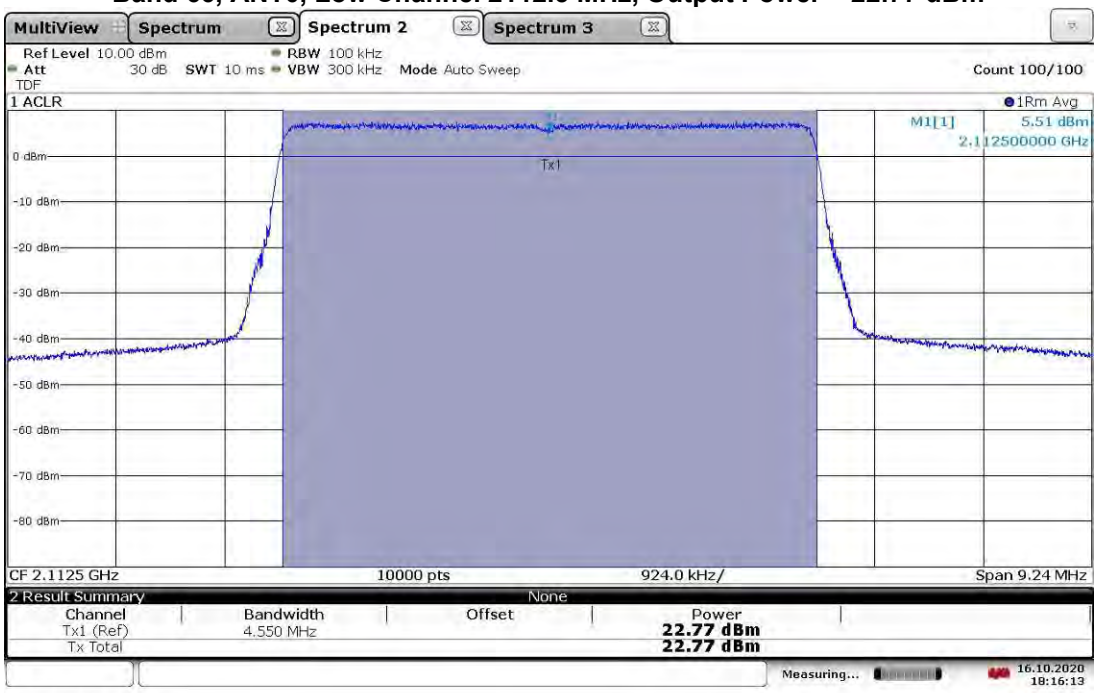
17:48:38 04.11.2020

TM3.2-16QAM_20 MHz Bandwidth
Band 66, ANT1, High Channel 2190 MHz, Output Power = 23.84 dBm



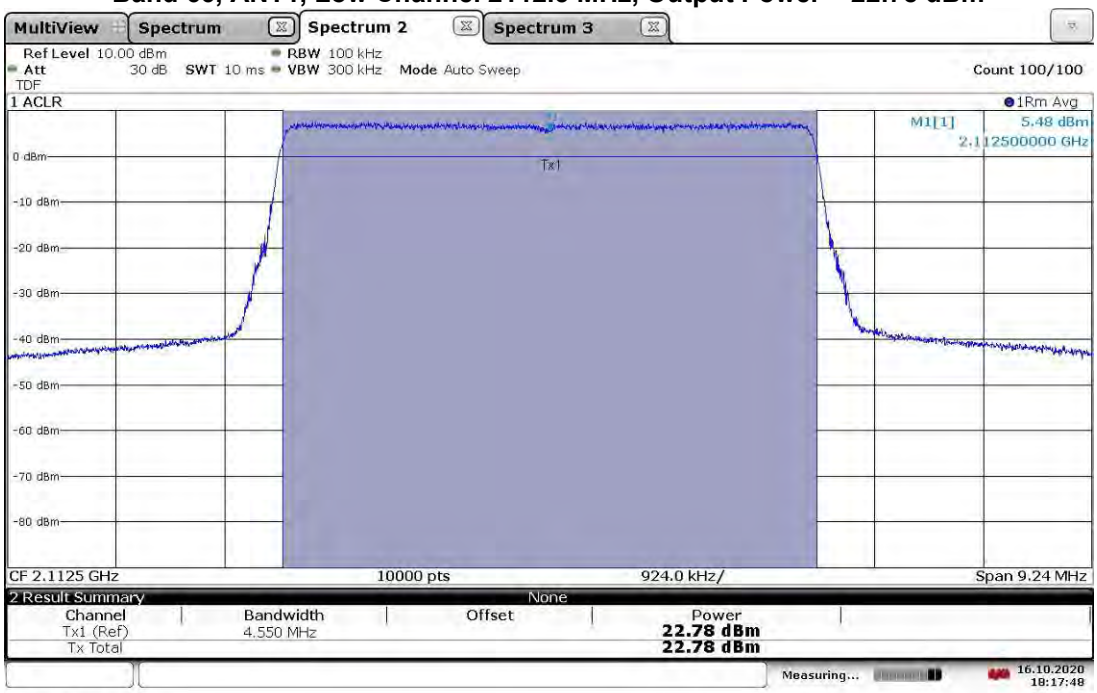
17:47:16 04.11.2020

TM3.1-64QAM_5 MHz Bandwidth
Band 66, ANT0, Low Channel 2112.5 MHz, Output Power = 22.77 dBm



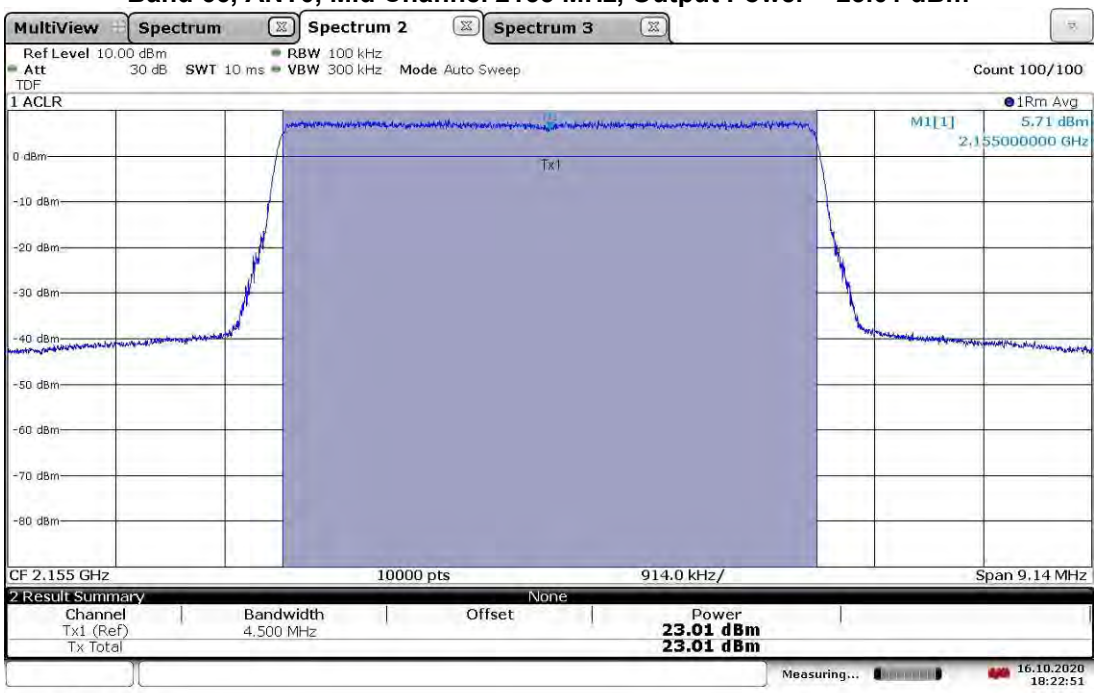
18:16:13 16.10.2020

TM3.1-64QAM_5 MHz Bandwidth
Band 66, ANT1, Low Channel 2112.5 MHz, Output Power = 22.78 dBm



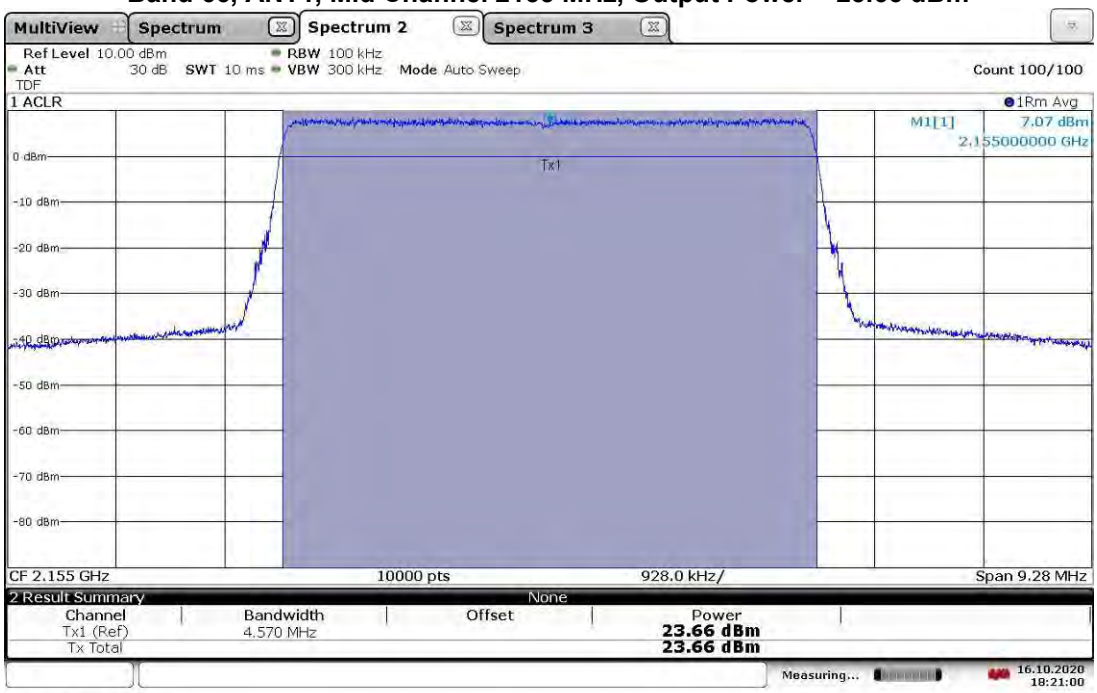
18:17:48 16.10.2020

TM3.1-64QAM_5 MHz Bandwidth
Band 66, ANT0, Mid Channel 2155 MHz, Output Power = 23.01 dBm



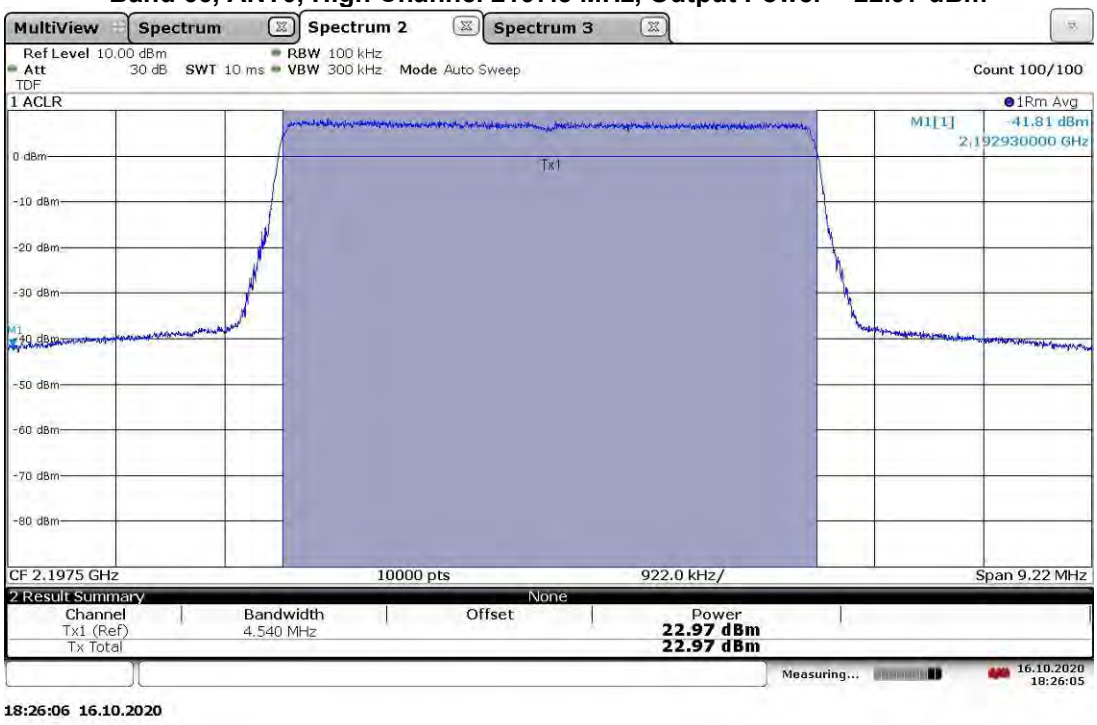
18:22:51 16.10.2020

TM3.1-64QAM_5 MHz Bandwidth
Band 66, ANT1, Mid Channel 2155 MHz, Output Power = 23.66 dBm



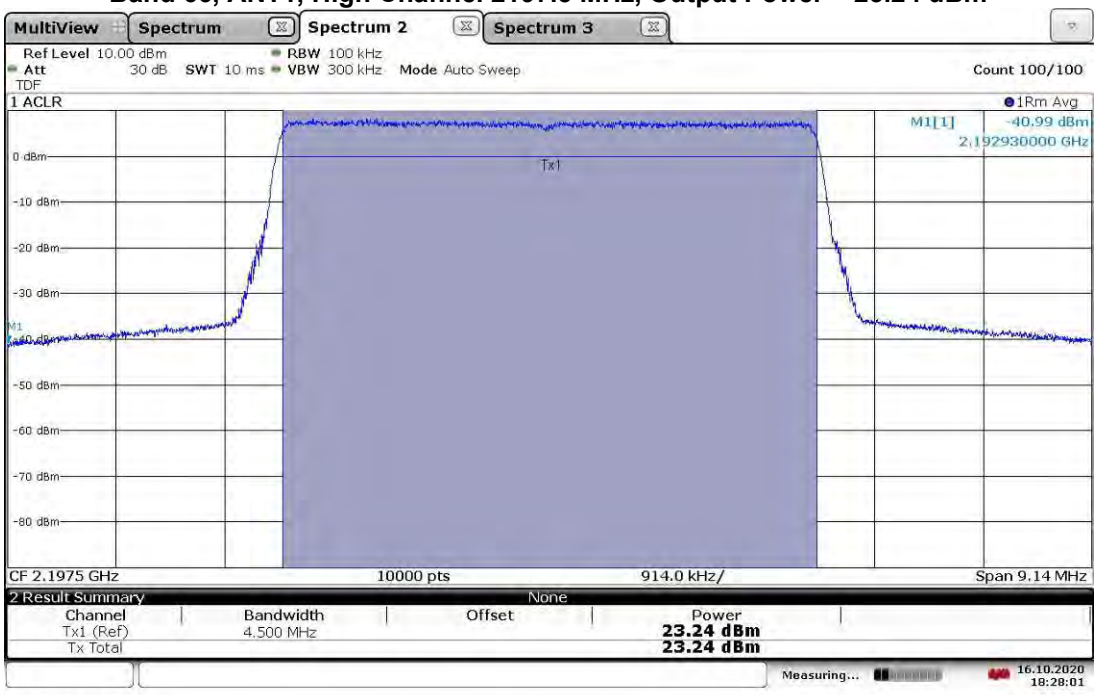
18:21:00 16.10.2020

TM3.1-64QAM_5 MHz Bandwidth
Band 66, ANT0, High Channel 2197.5 MHz, Output Power = 22.97 dBm



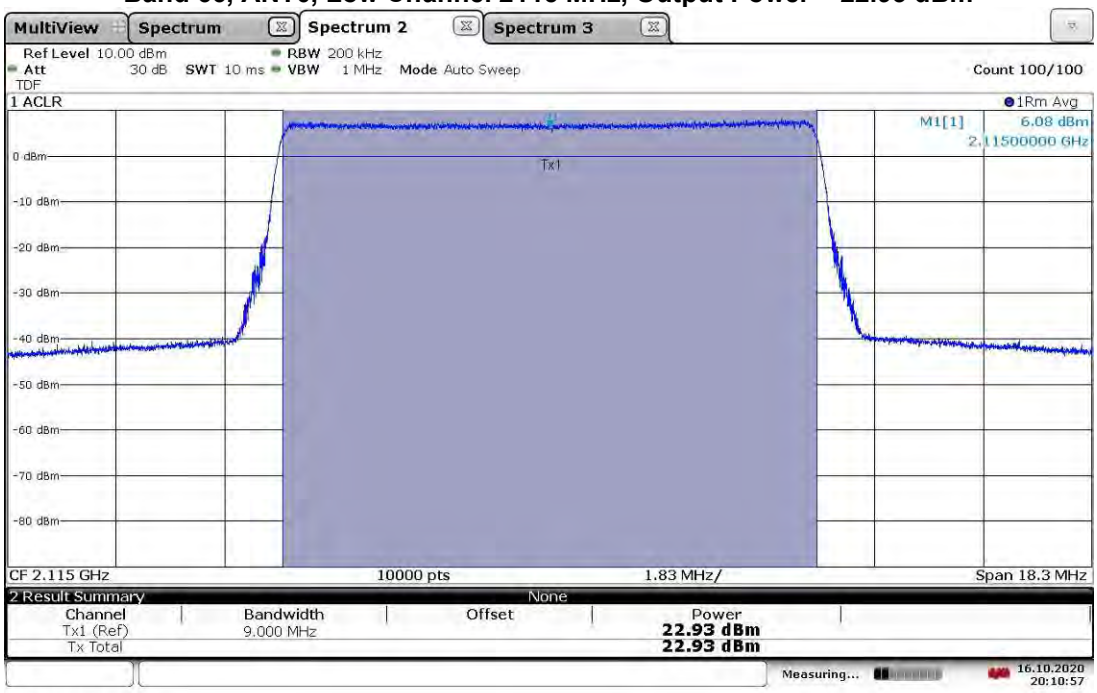
18:26:06 16.10.2020

TM3.1-64QAM_5 MHz Bandwidth
Band 66, ANT1, High Channel 2197.5 MHz, Output Power = 23.24 dBm



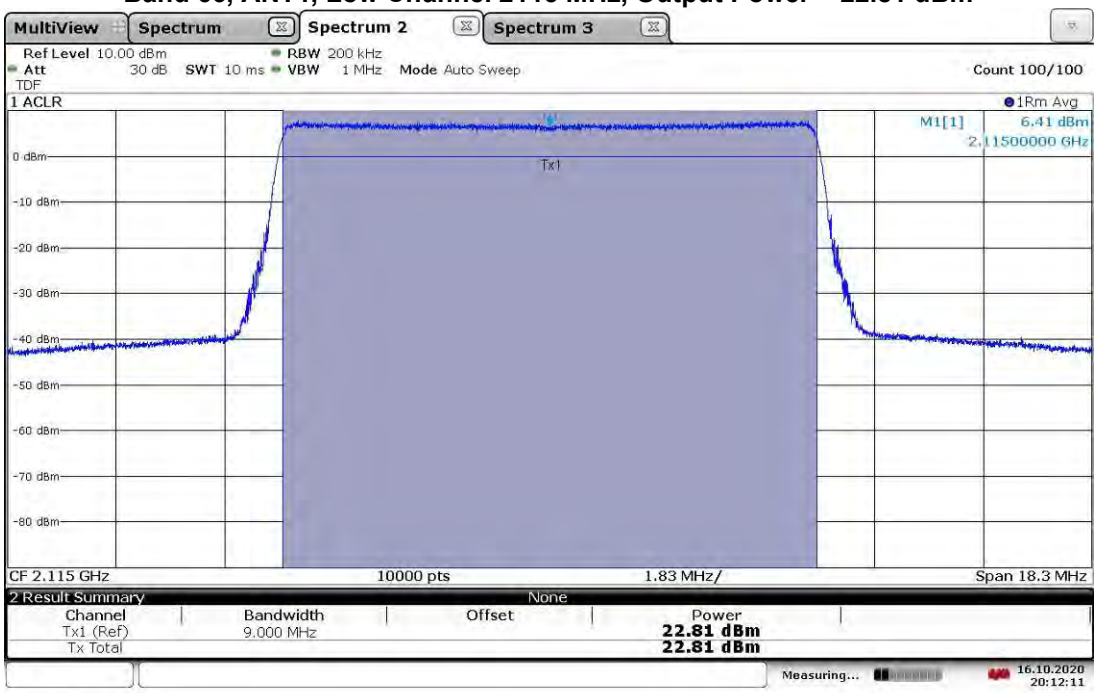
18:28:02 16.10.2020

TM3.1-64QAM_10 MHz Bandwidth
Band 66, ANT0, Low Channel 2115 MHz, Output Power = 22.93 dBm



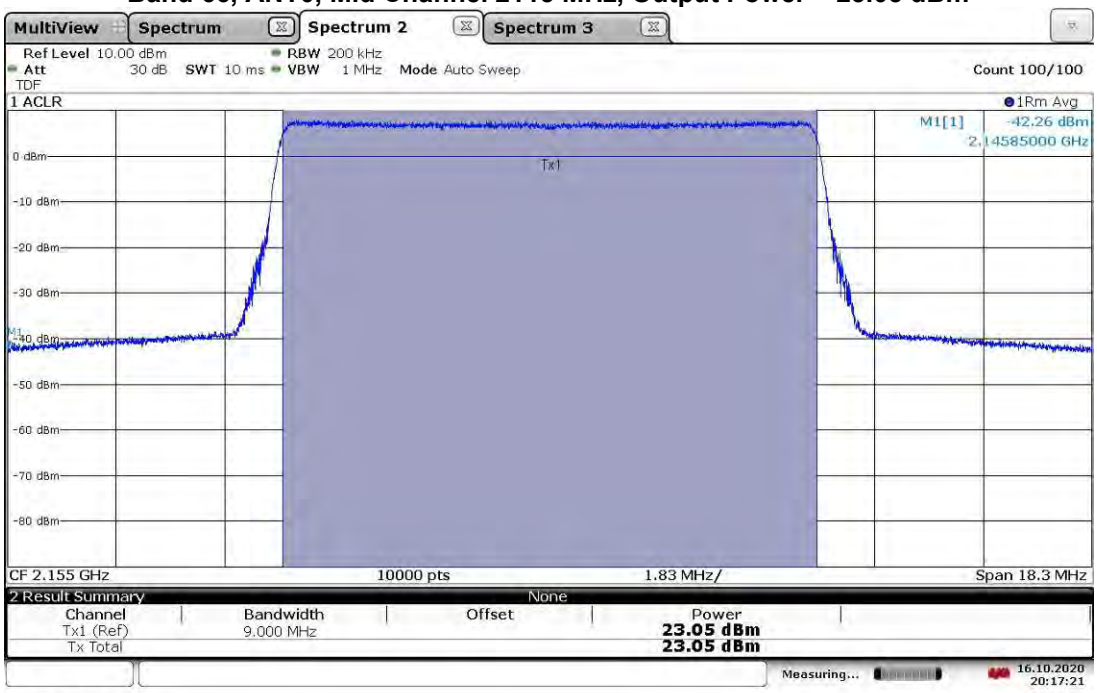
20:10:57 16.10.2020

TM3.1-64QAM_10 MHz Bandwidth
Band 66, ANT1, Low Channel 2115 MHz, Output Power = 22.81 dBm



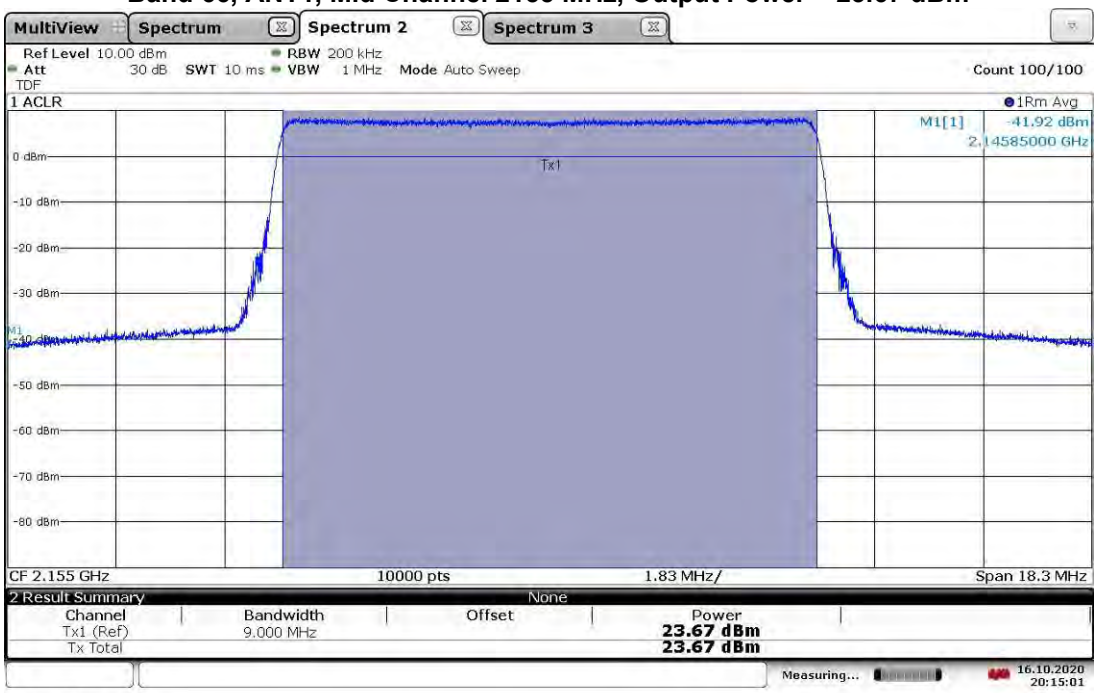
20:12:11 16.10.2020

TM3.1-64QAM_10 MHz Bandwidth
Band 66, ANT0, Mid Channel 2115 MHz, Output Power = 23.05 dBm



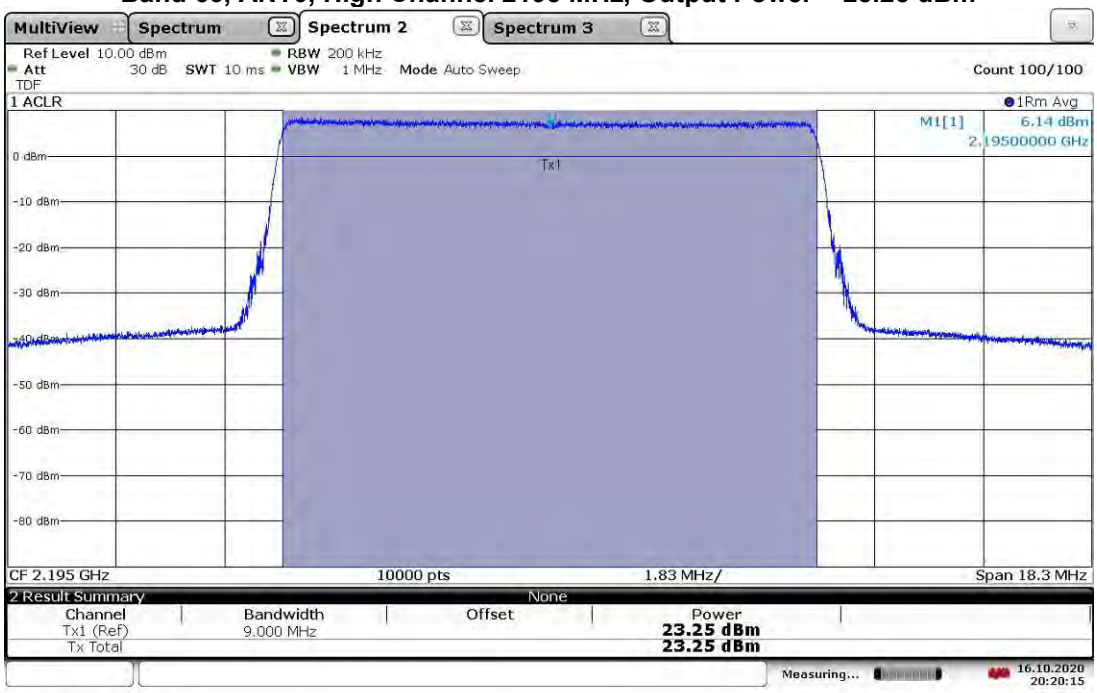
20:17:21 16.10.2020

TM3.1-64QAM_10 MHz Bandwidth
Band 66, ANT1, Mid Channel 2155 MHz, Output Power = 23.67 dBm



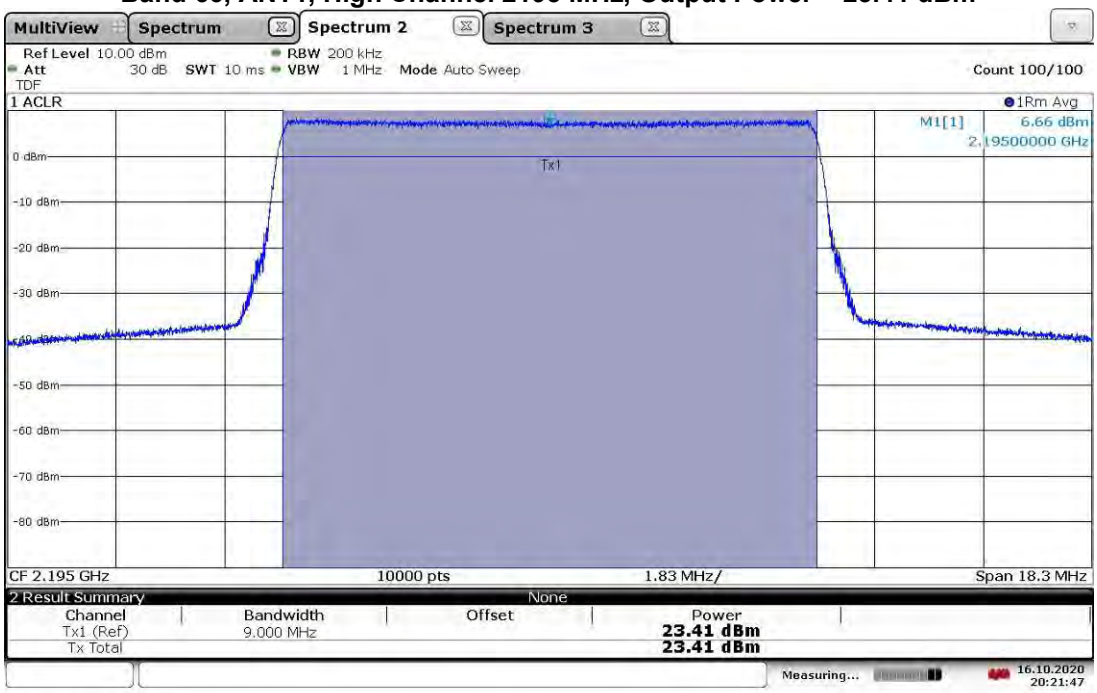
20:15:01 16.10.2020

TM3.1-64QAM_10 MHz Bandwidth
Band 66, ANT0, High Channel 2195 MHz, Output Power = 23.25 dBm



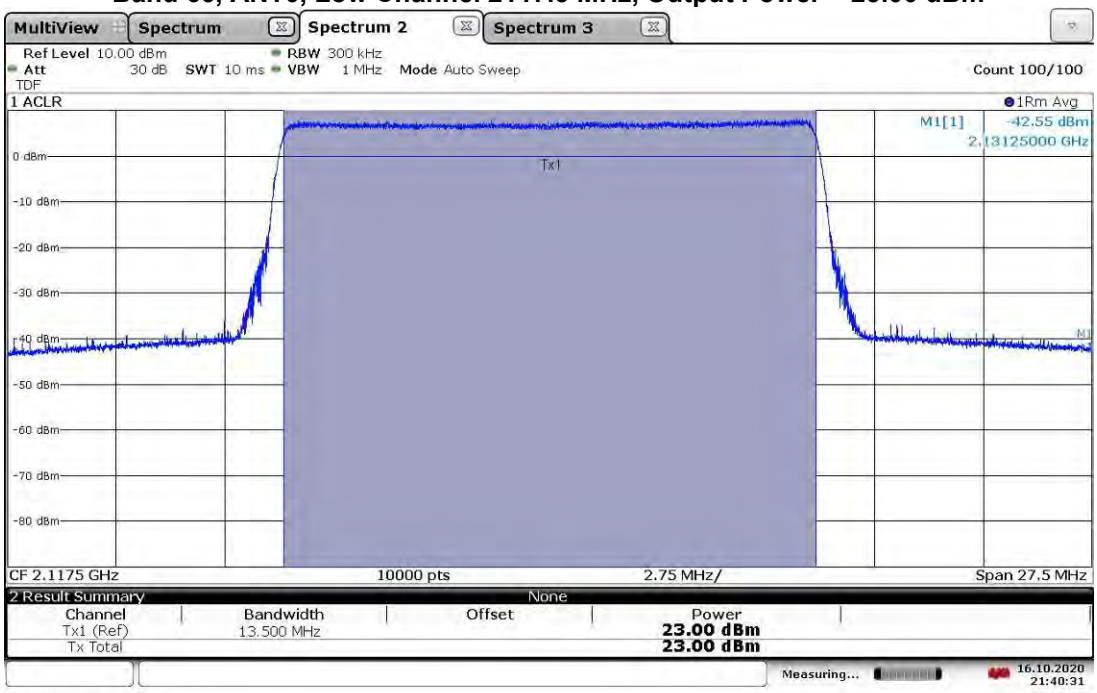
20:20:16 16.10.2020

TM3.1-64QAM_10 MHz Bandwidth
Band 66, ANT1, High Channel 2195 MHz, Output Power = 23.41 dBm



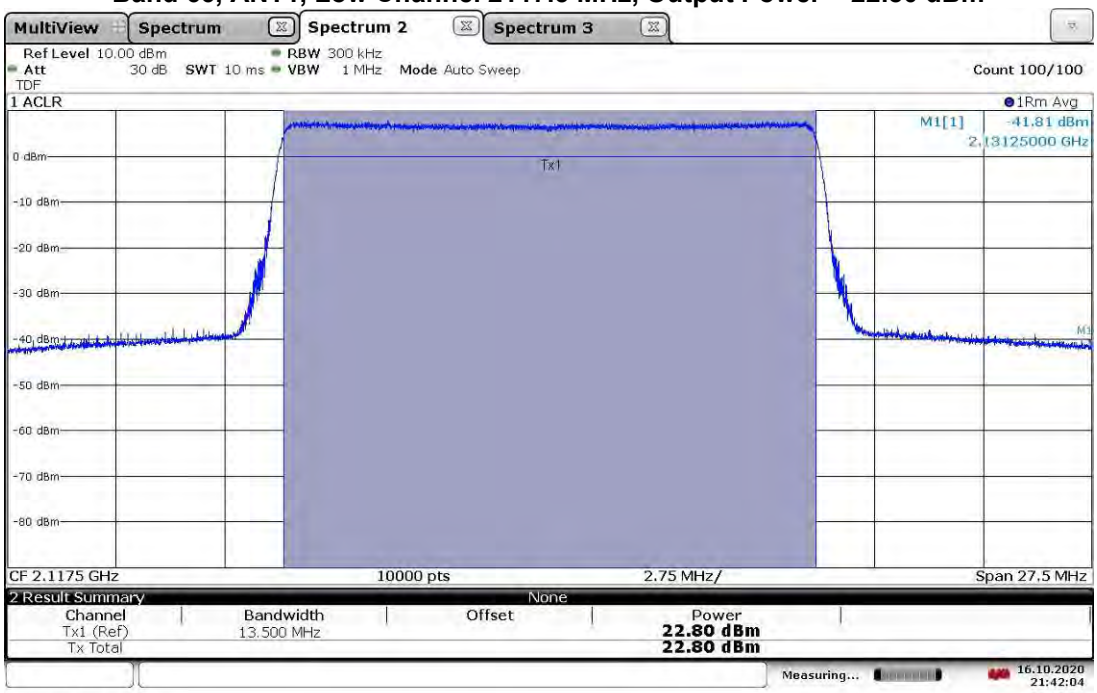
20:21:47 16.10.2020

TM3.1-64QAM_15 MHz Bandwidth
Band 66, ANT0, Low Channel 2117.5 MHz, Output Power = 23.00 dBm



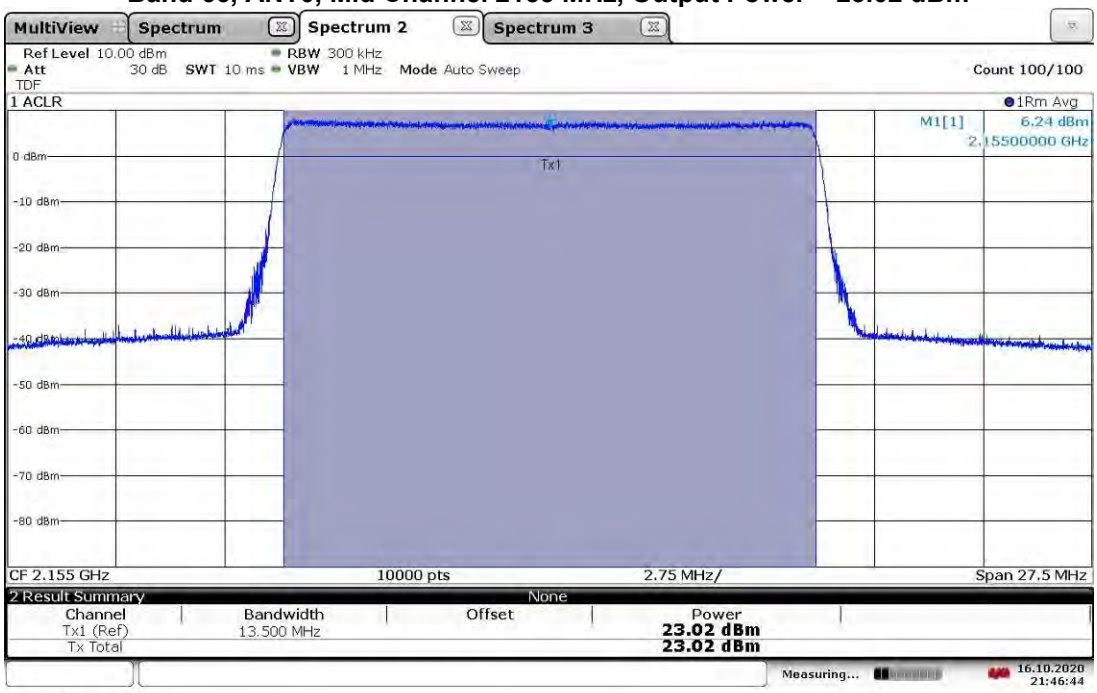
21:40:31 16.10.2020

TM3.1-64QAM_15 MHz Bandwidth
Band 66, ANT1, Low Channel 2117.5 MHz, Output Power = 22.80 dBm



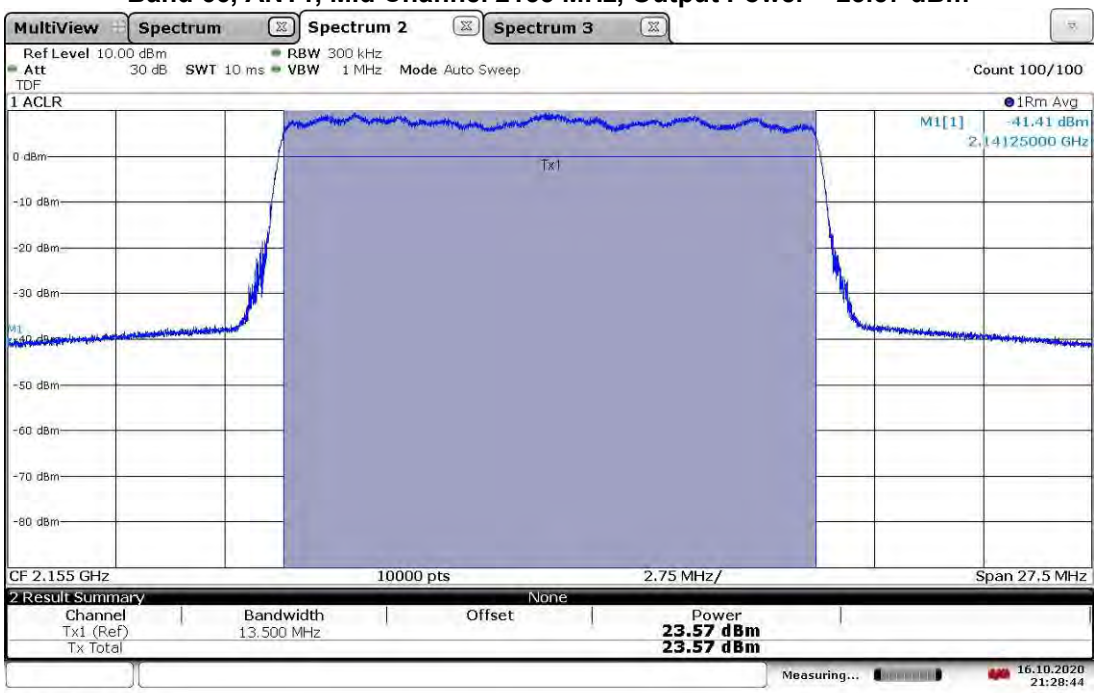
21:42:04 16.10.2020

TM3.1-64QAM_15 MHz Bandwidth
Band 66, ANT0, Mid Channel 2155 MHz, Output Power = 23.02 dBm



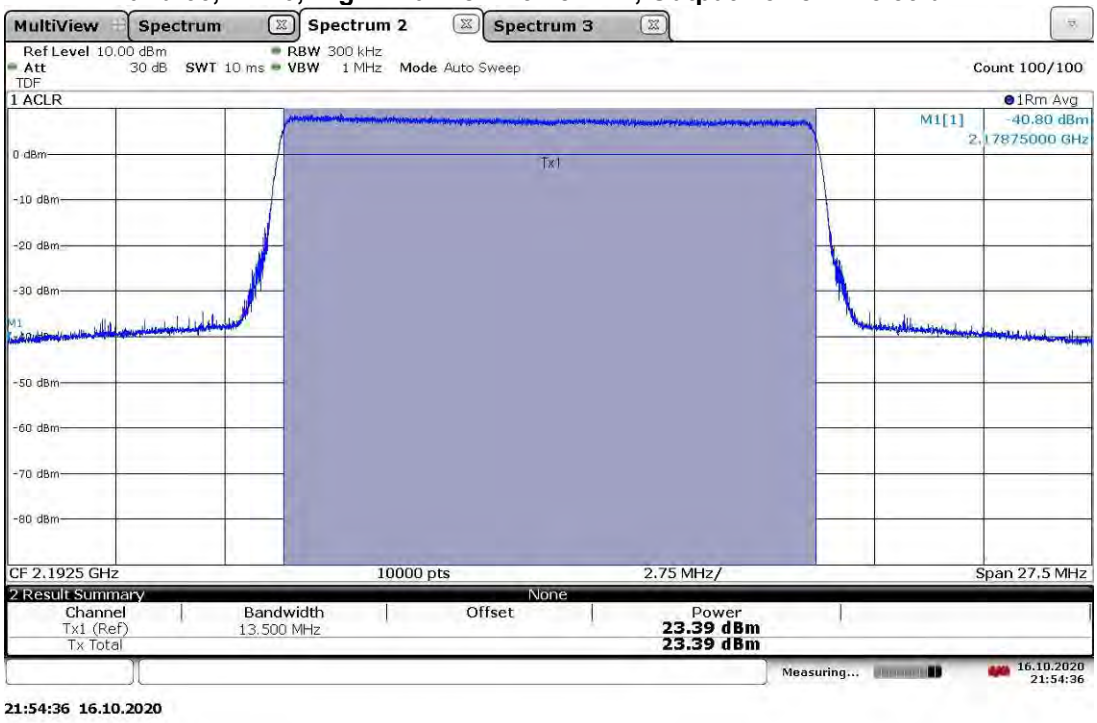
21:46:44 16.10.2020

TM3.1-64QAM_15 MHz Bandwidth
Band 66, ANT1, Mid Channel 2155 MHz, Output Power = 23.57 dBm



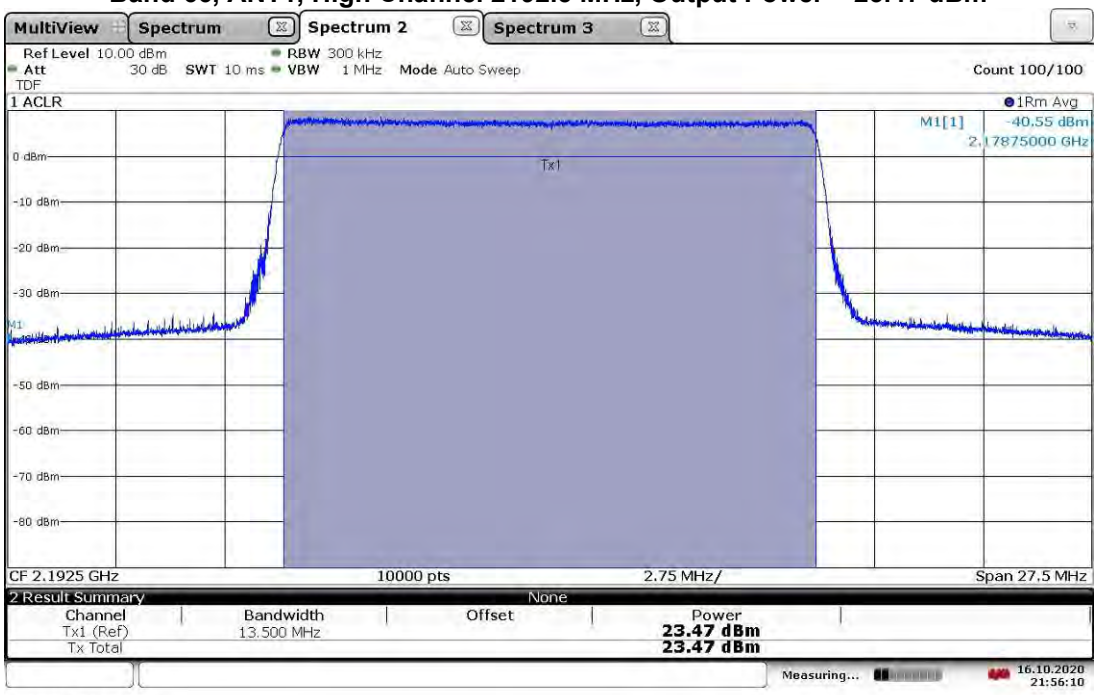
21:28:45 16.10.2020

TM3.1-64QAM_15 MHz Bandwidth
Band 66, ANT0, High Channel 2192.5 MHz, Output Power = 23.39 dBm



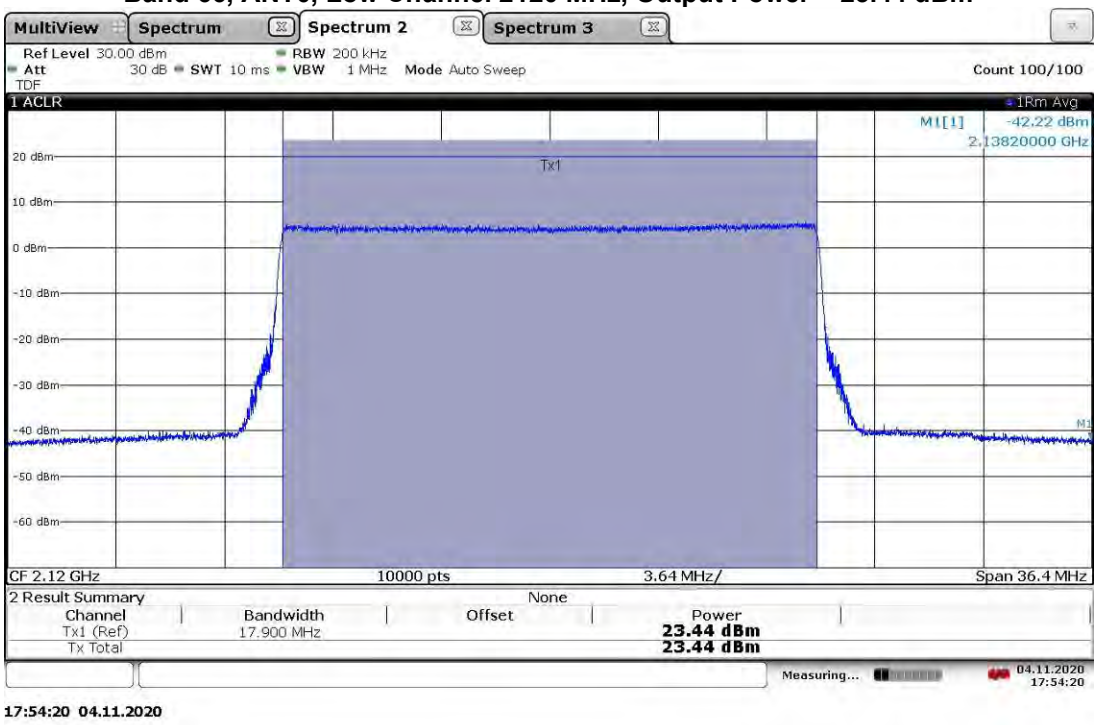
21:54:36 16.10.2020

TM3.1-64QAM_15 MHz Bandwidth
Band 66, ANT1, High Channel 2192.5 MHz, Output Power = 23.47 dBm



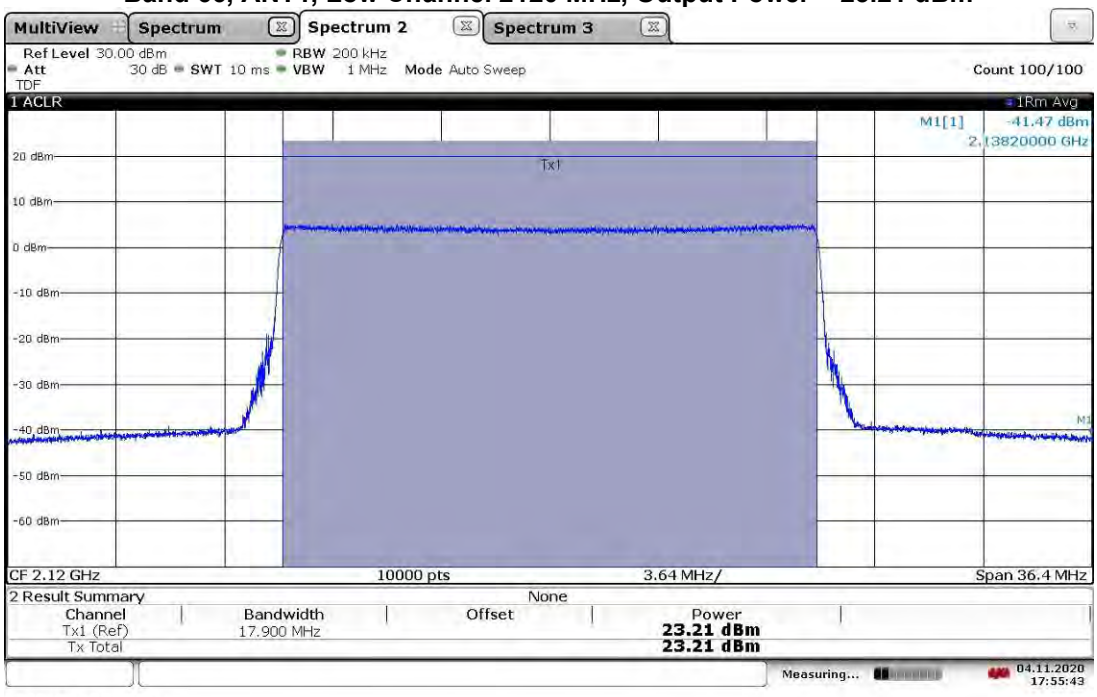
21:56:10 16.10.2020

TM3.1-64QAM_20 MHz Bandwidth
Band 66, ANT0, Low Channel 2120 MHz, Output Power = 23.44 dBm



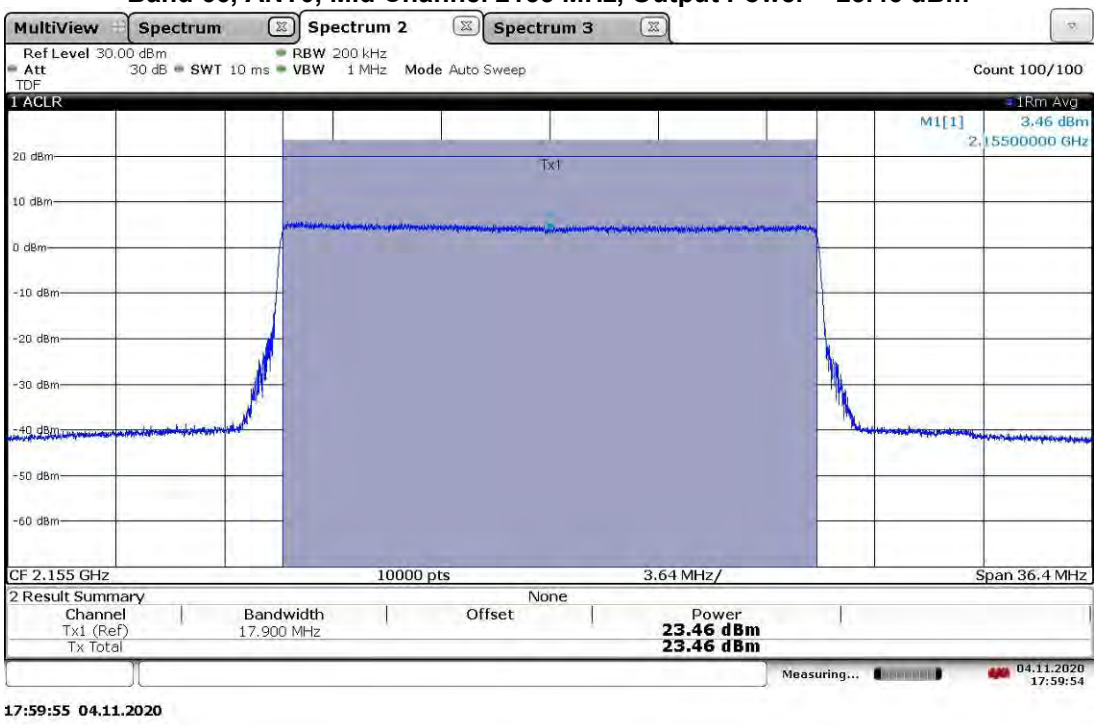
17:54:20 04.11.2020

TM3.1-64QAM_20 MHz Bandwidth
Band 66, ANT1, Low Channel 2120 MHz, Output Power = 23.21 dBm



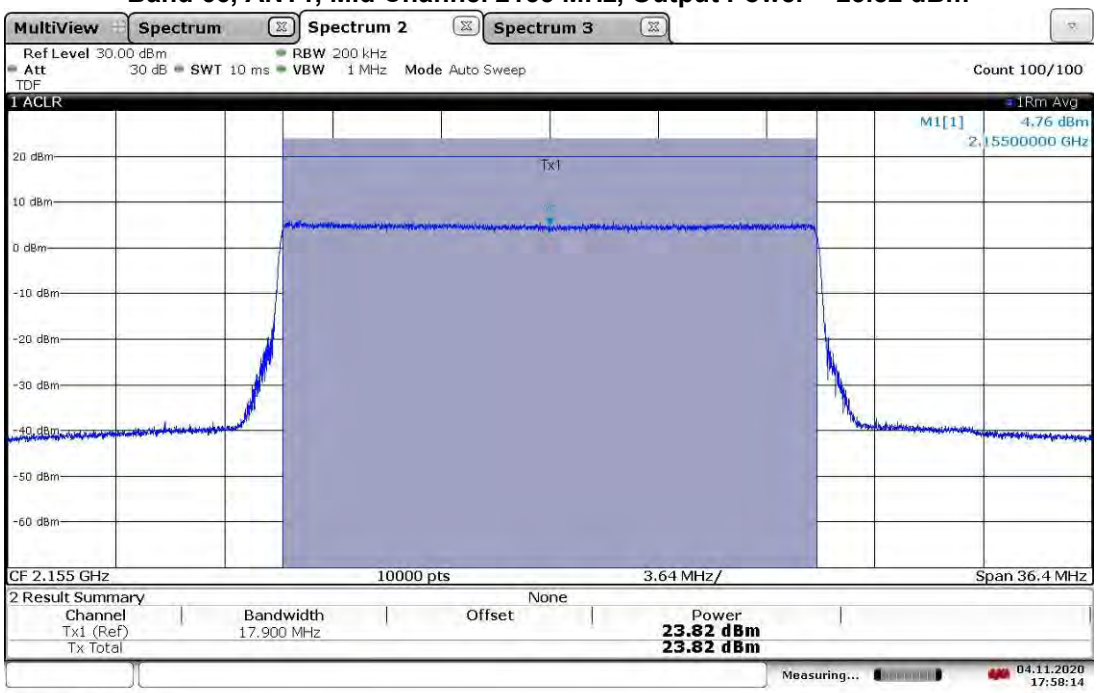
17:55:44 04.11.2020

TM3.1-64QAM_20 MHz Bandwidth
Band 66, ANT0, Mid Channel 2155 MHz, Output Power = 23.46 dBm



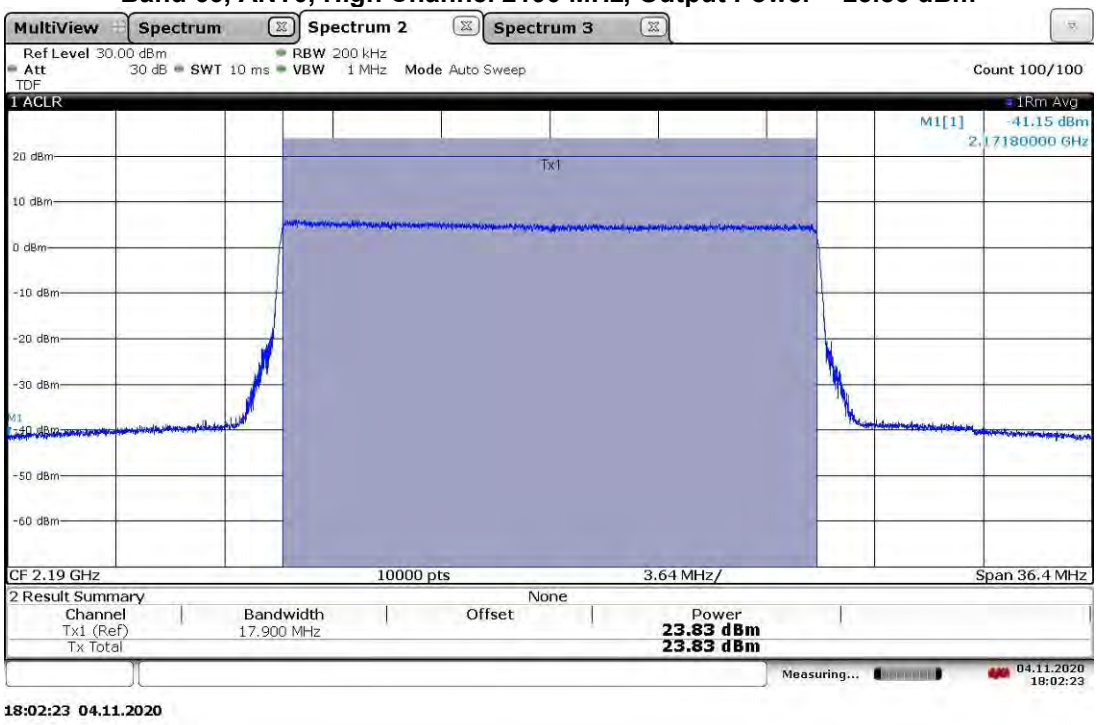
17:59:55 04.11.2020

TM3.1-64QAM_20 MHz Bandwidth
Band 66, ANT1, Mid Channel 2155 MHz, Output Power = 23.82 dBm

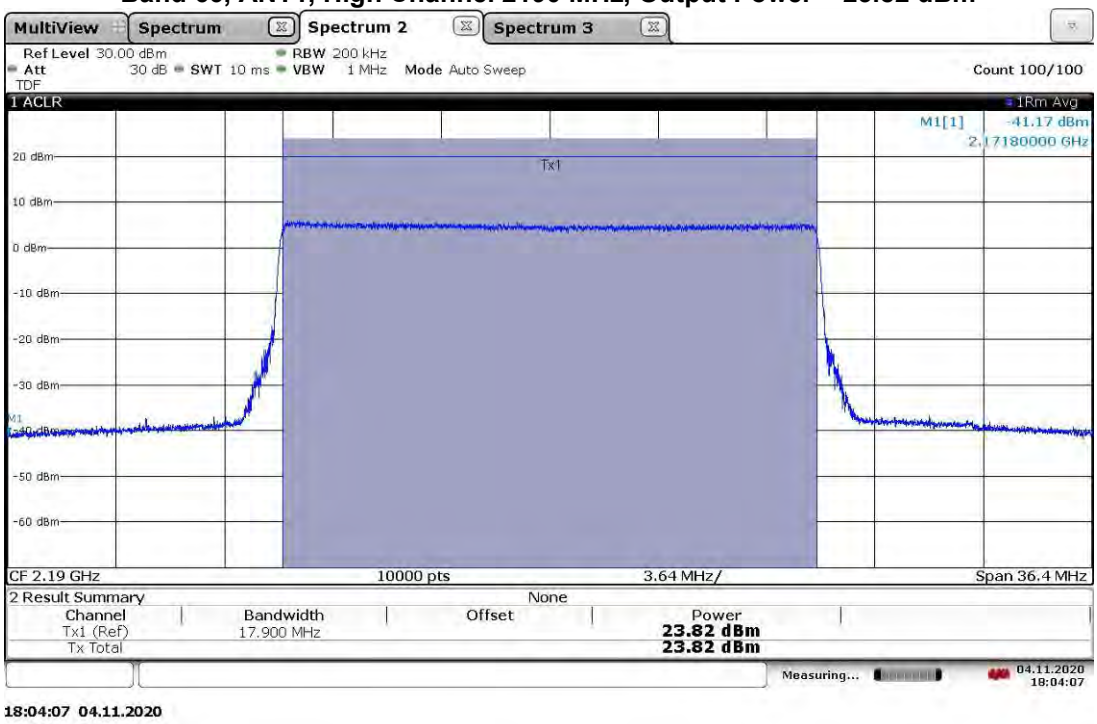


17:58:14 04.11.2020

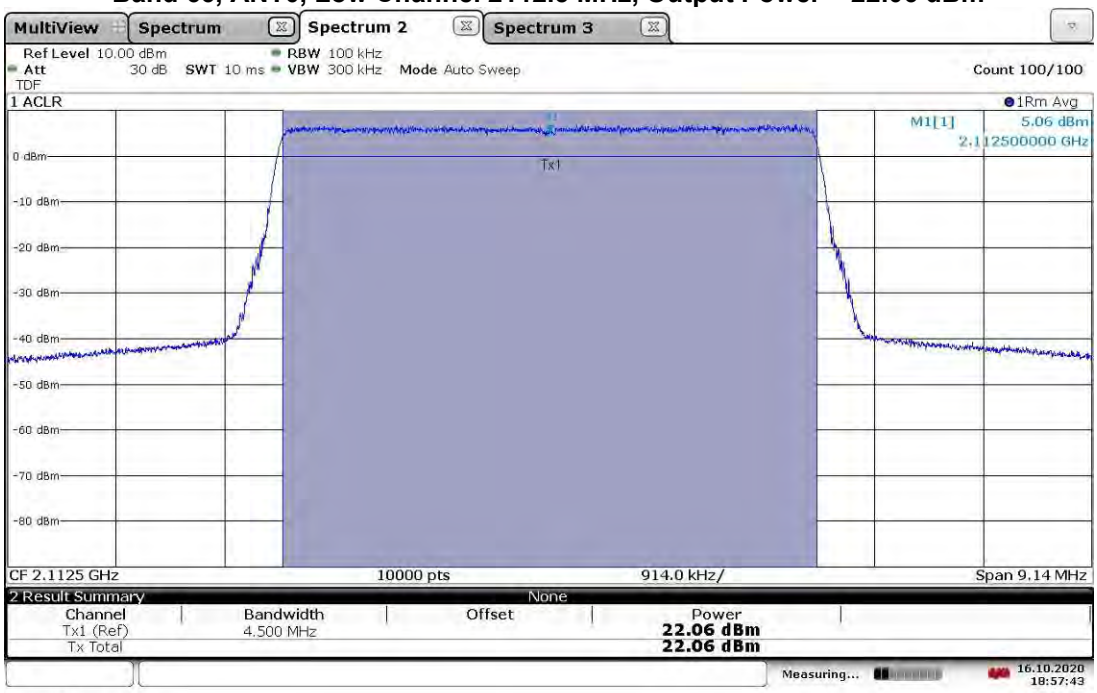
TM3.1-64QAM_20 MHz Bandwidth
Band 66, ANT0, High Channel 2190 MHz, Output Power = 23.83 dBm



TM3.1-64QAM_20 MHz Bandwidth
Band 66, ANT1, High Channel 2190 MHz, Output Power = 23.82 dBm

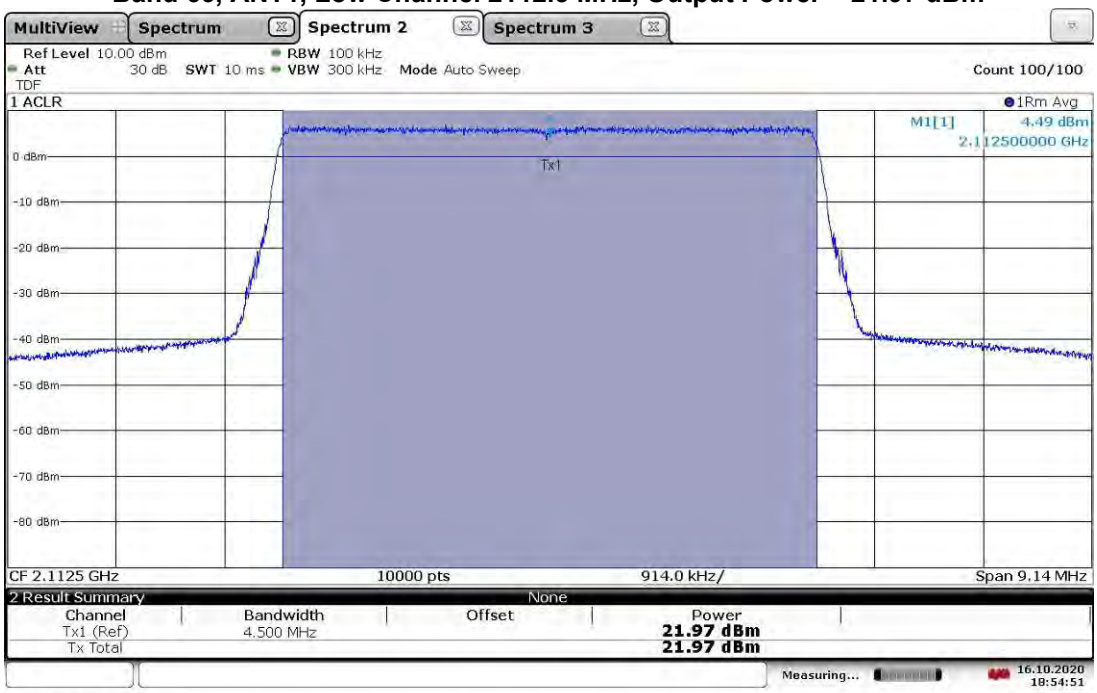


TM3.1a-256QAM_5 MHz Bandwidth
Band 66, ANT0, Low Channel 2112.5 MHz, Output Power = 22.06 dBm



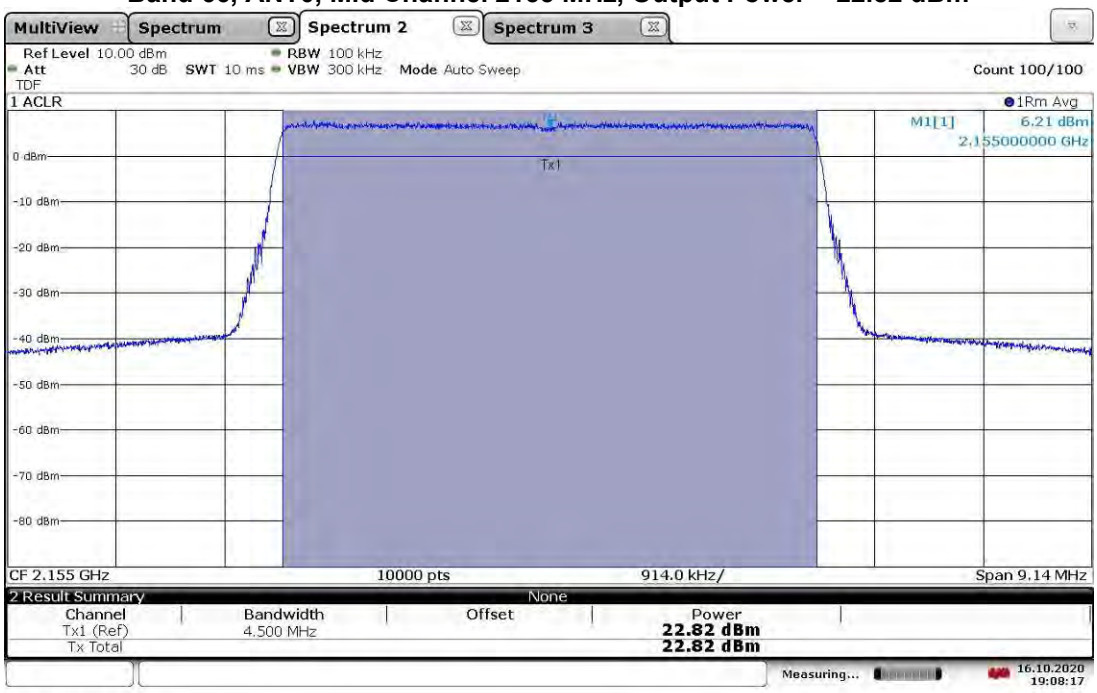
18:57:44 16.10.2020

TM3.1a-256QAM_5 MHz Bandwidth
Band 66, ANT1, Low Channel 2112.5 MHz, Output Power = 21.97 dBm



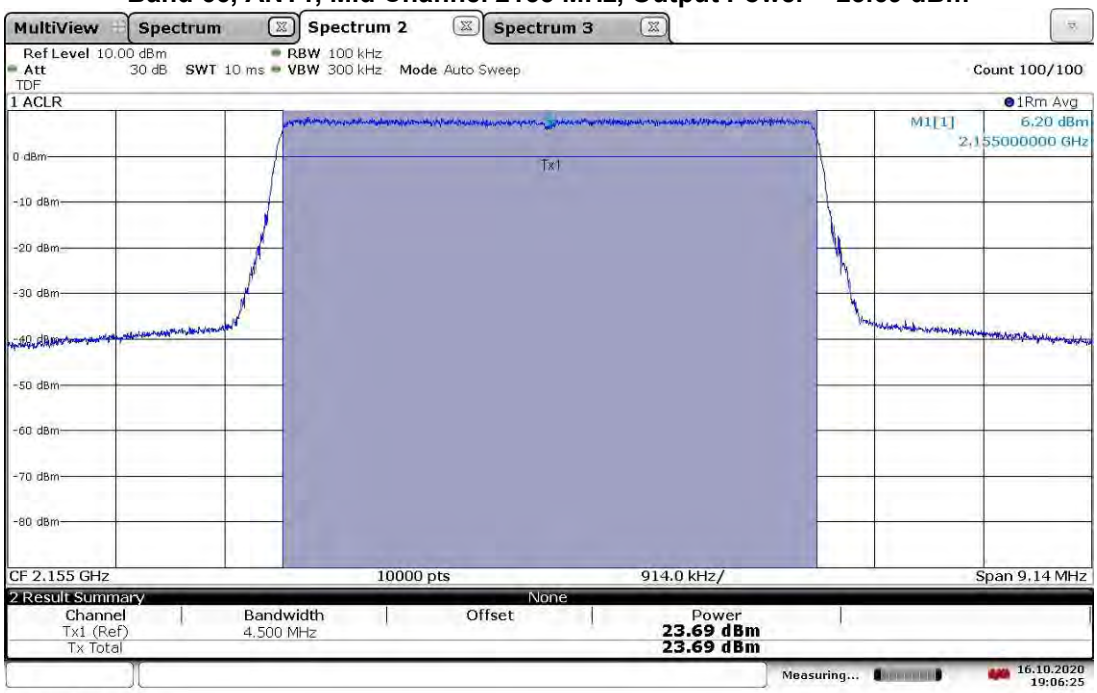
18:54:52 16.10.2020

TM3.1a-256QAM_5 MHz Bandwidth
Band 66, ANT0, Mid Channel 2155 MHz, Output Power = 22.82 dBm



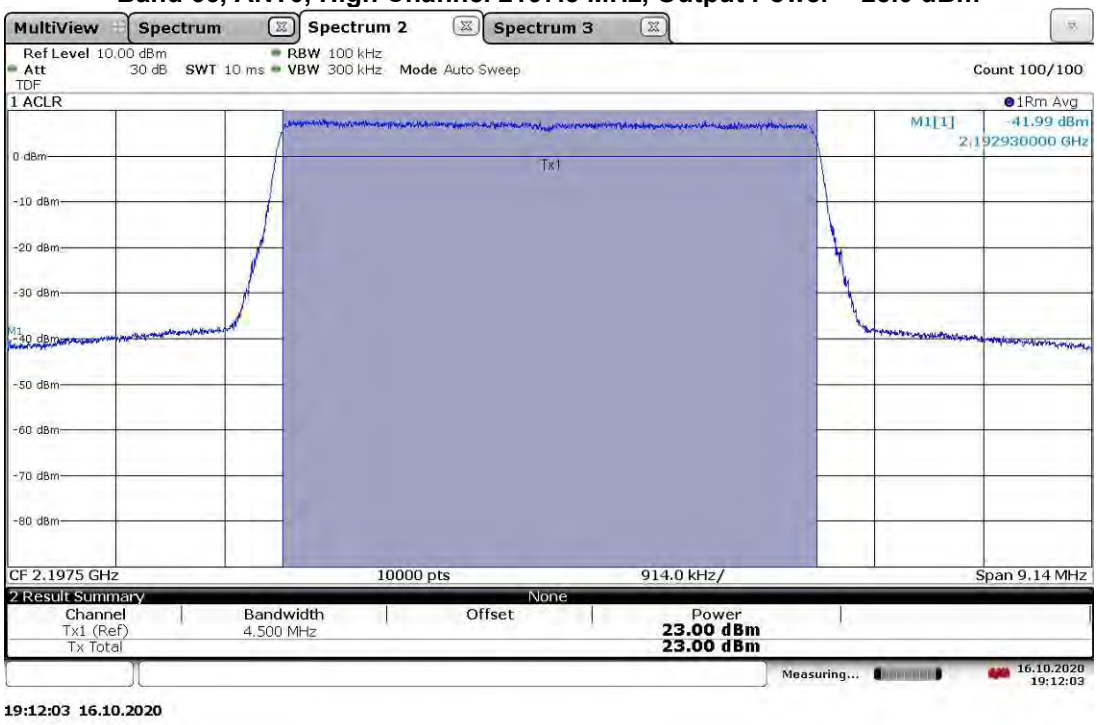
19:08:17 16.10.2020

TM3.1a-256QAM_5 MHz Bandwidth
Band 66, ANT1, Mid Channel 2155 MHz, Output Power = 23.69 dBm



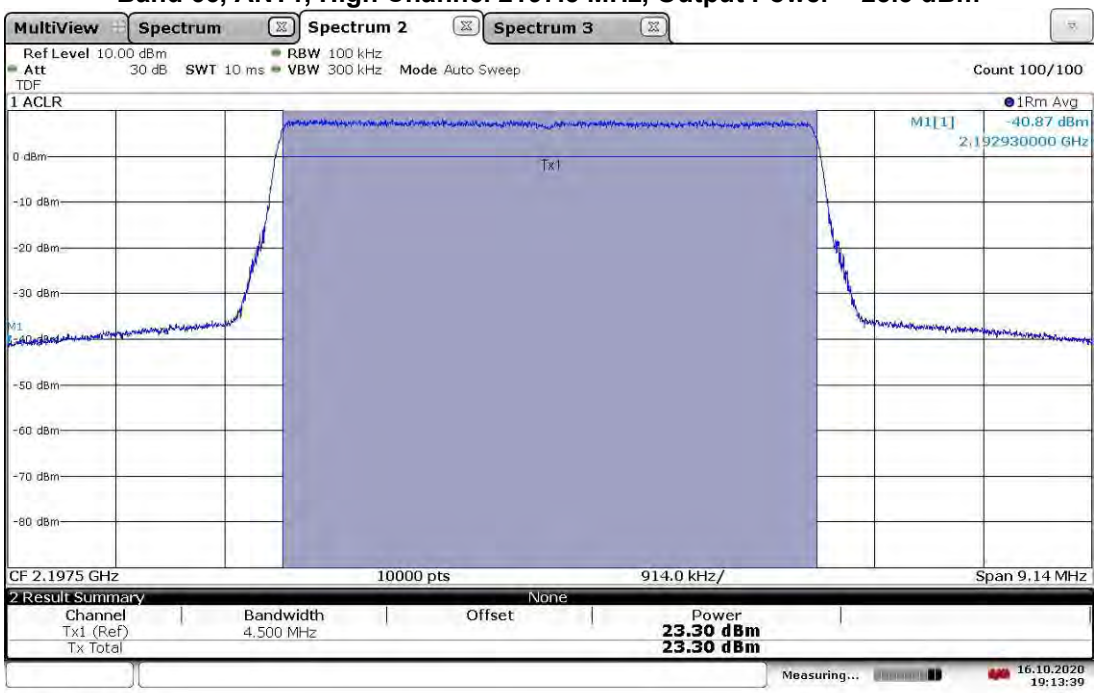
19:06:26 16.10.2020

TM3.1a-256QAM_5 MHz Bandwidth
Band 66, ANT0, High Channel 2197.5 MHz, Output Power = 23.0 dBm



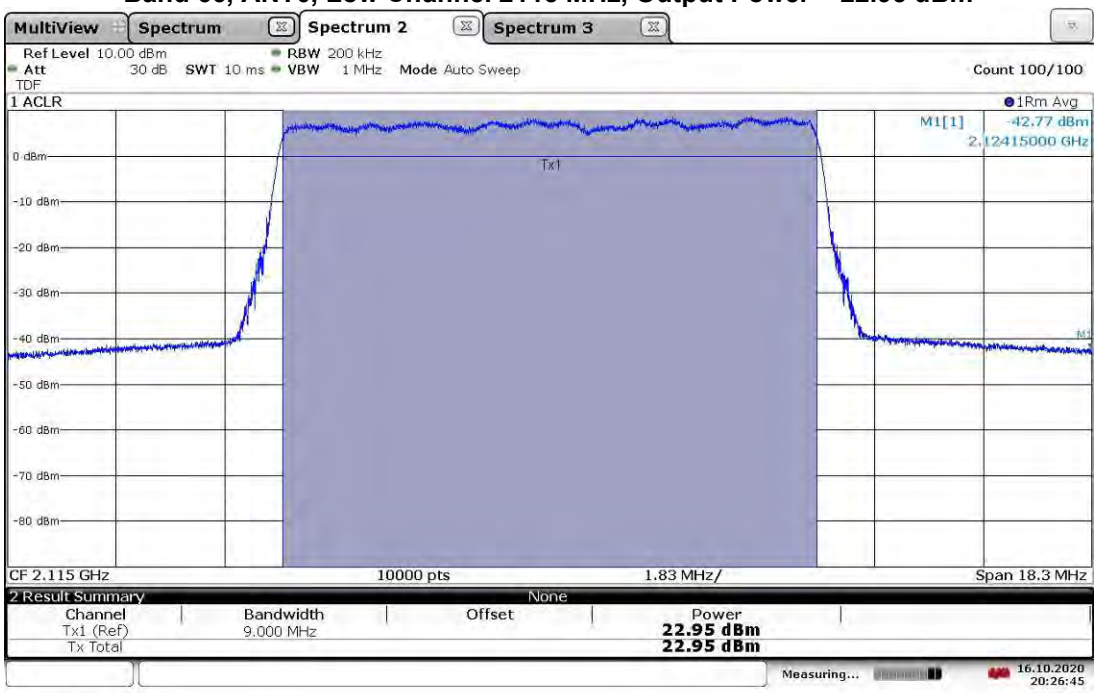
19:12:03 16.10.2020

TM3.1a-256QAM_5 MHz Bandwidth
Band 66, ANT1, High Channel 2197.5 MHz, Output Power = 23.3 dBm



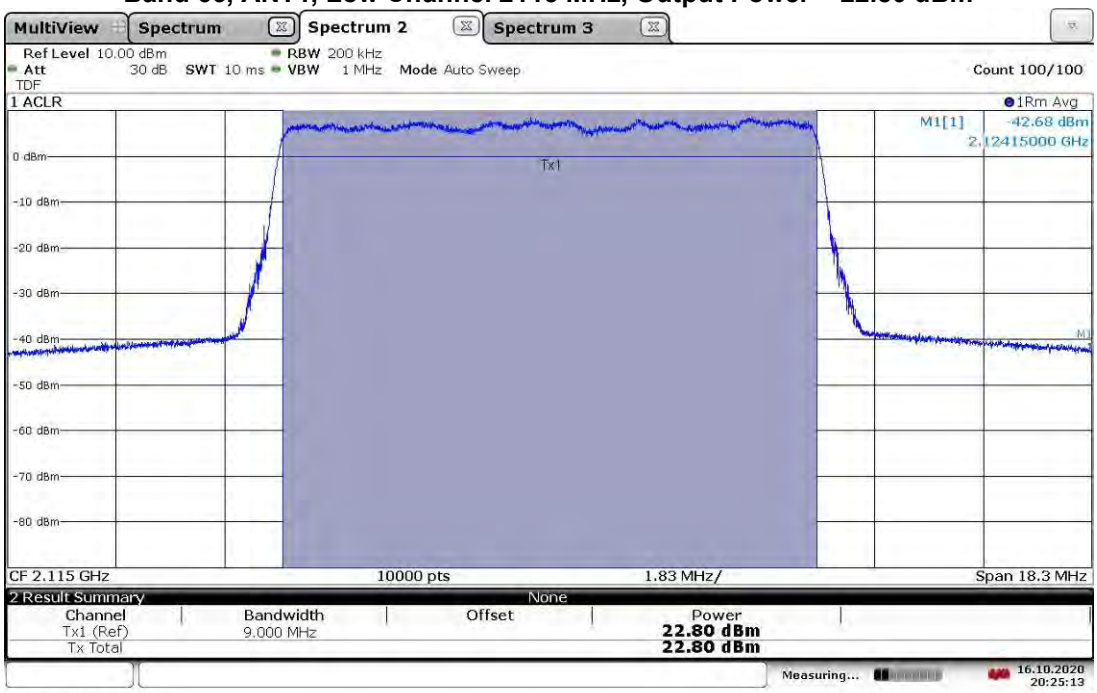
19:13:39 16.10.2020

TM3.1a-256QAM_10 MHz Bandwidth
Band 66, ANT0, Low Channel 2115 MHz, Output Power = 22.95 dBm



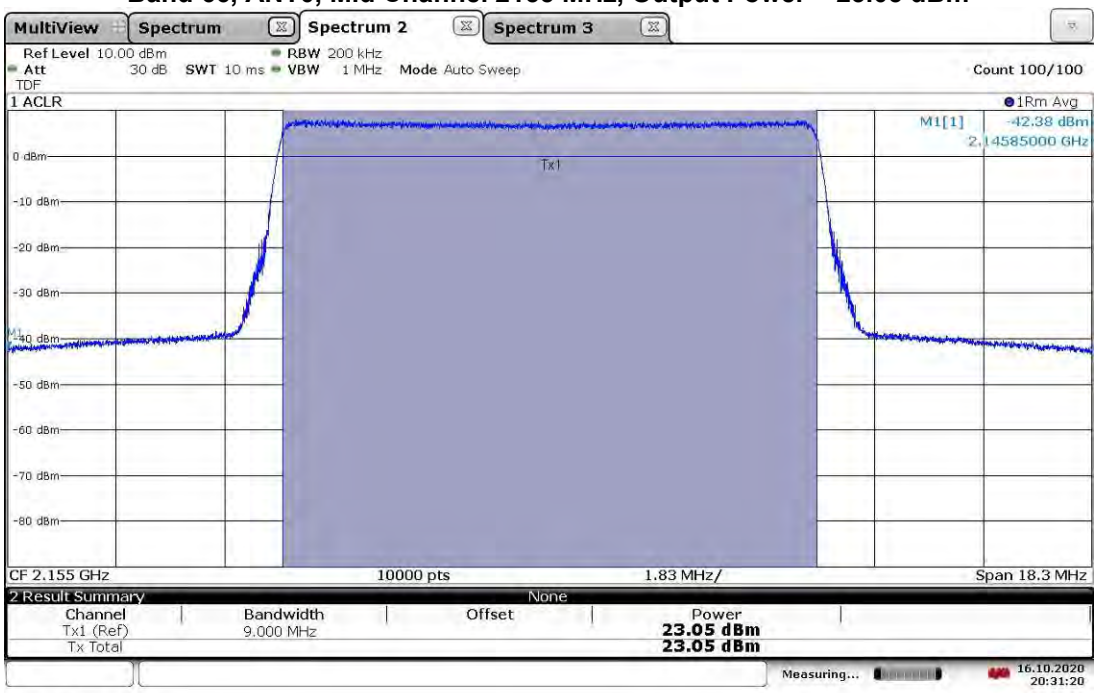
20:26:45 16.10.2020

TM3.1a-256QAM_10 MHz Bandwidth
Band 66, ANT1, Low Channel 2115 MHz, Output Power = 22.80 dBm



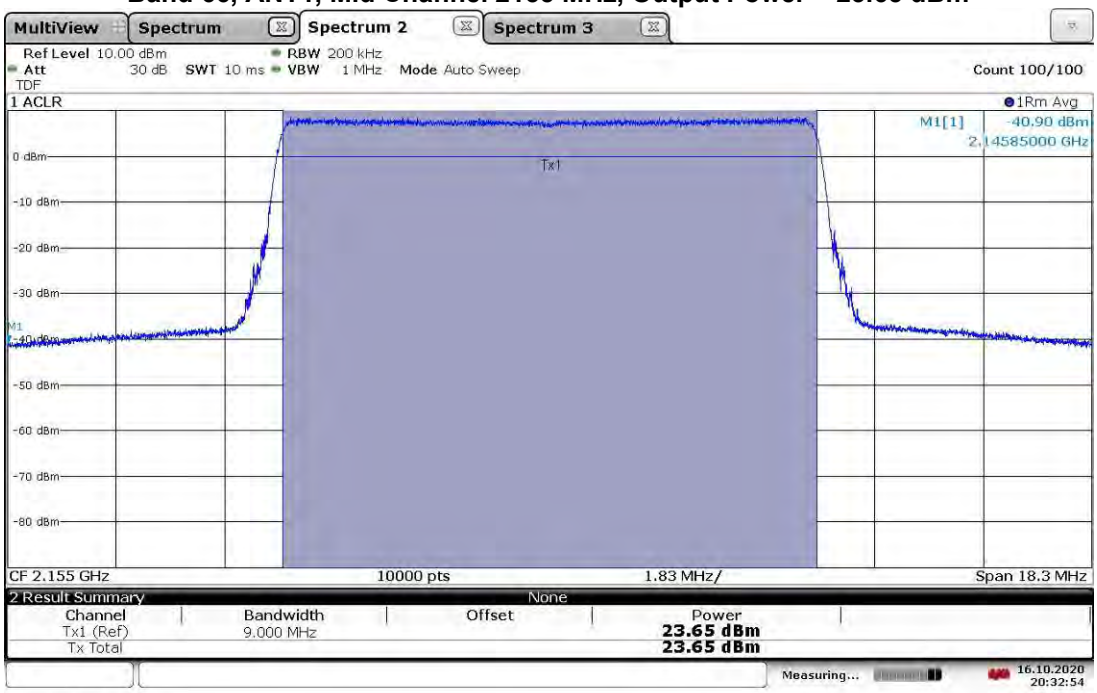
20:25:14 16.10.2020

TM3.1a-256QAM_10 MHz Bandwidth
Band 66, ANT0, Mid Channel 2155 MHz, Output Power = 23.05 dBm



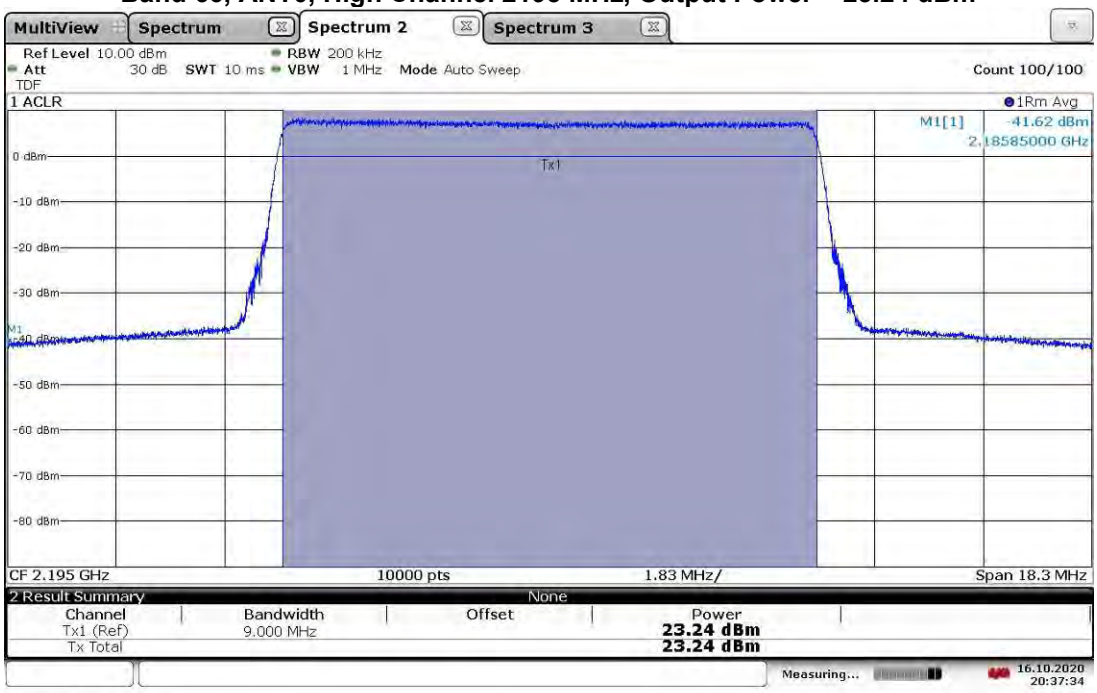
20:31:20 16.10.2020

TM3.1a-256QAM_10 MHz Bandwidth
Band 66, ANT1, Mid Channel 2155 MHz, Output Power = 23.65 dBm



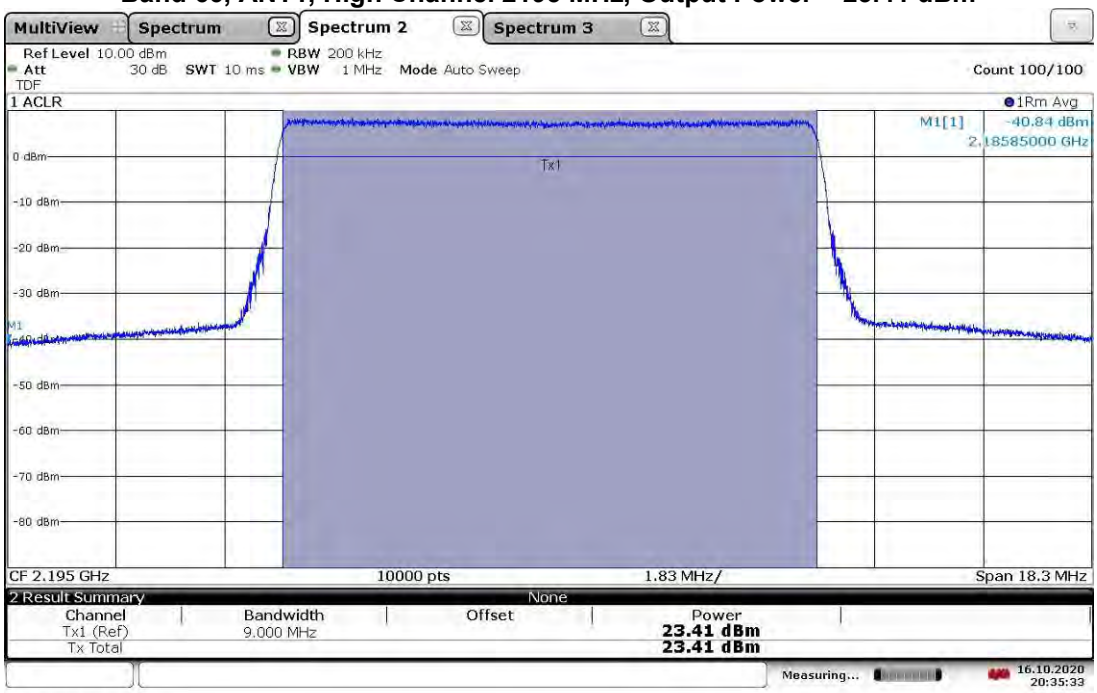
20:32:54 16.10.2020

TM3.1a-256QAM_10 MHz Bandwidth
Band 66, ANT0, High Channel 2195 MHz, Output Power = 23.24 dBm



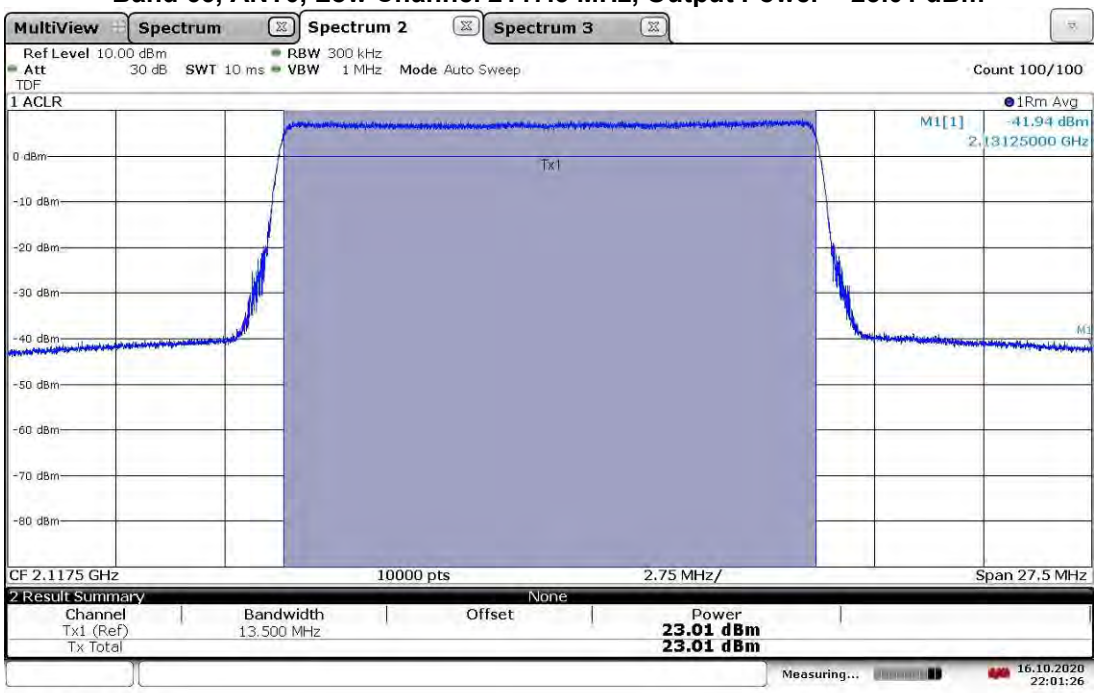
20:37:34 16.10.2020

TM3.1a-256QAM_10 MHz Bandwidth
Band 66, ANT1, High Channel 2195 MHz, Output Power = 23.41 dBm

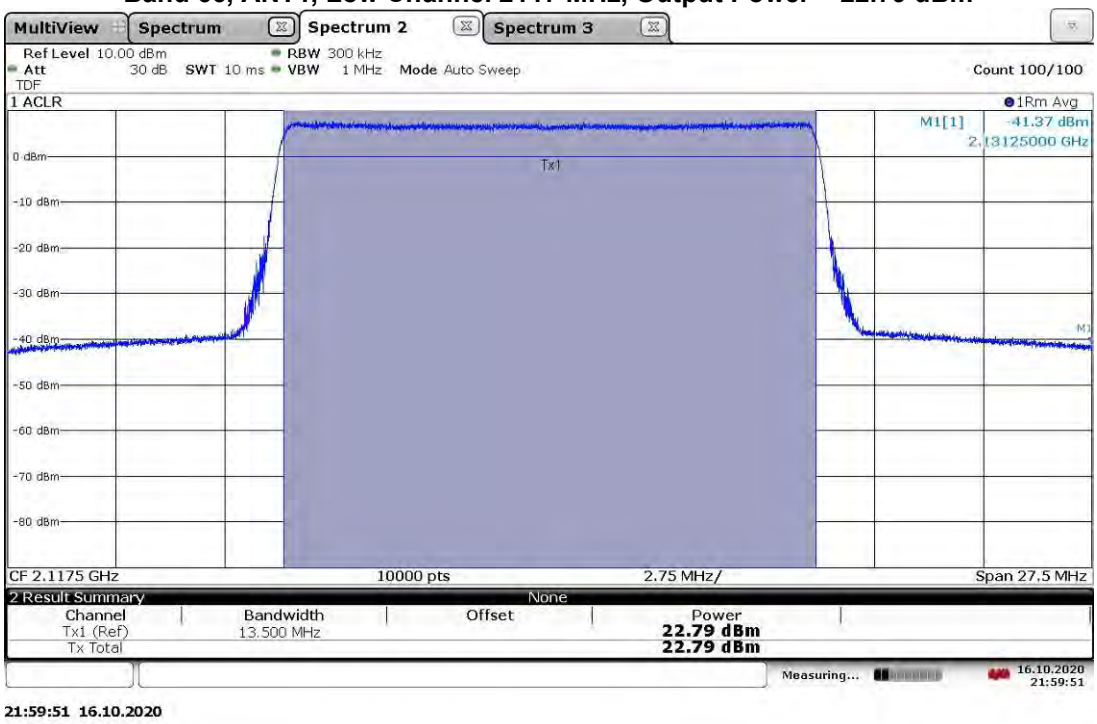


20:35:33 16.10.2020

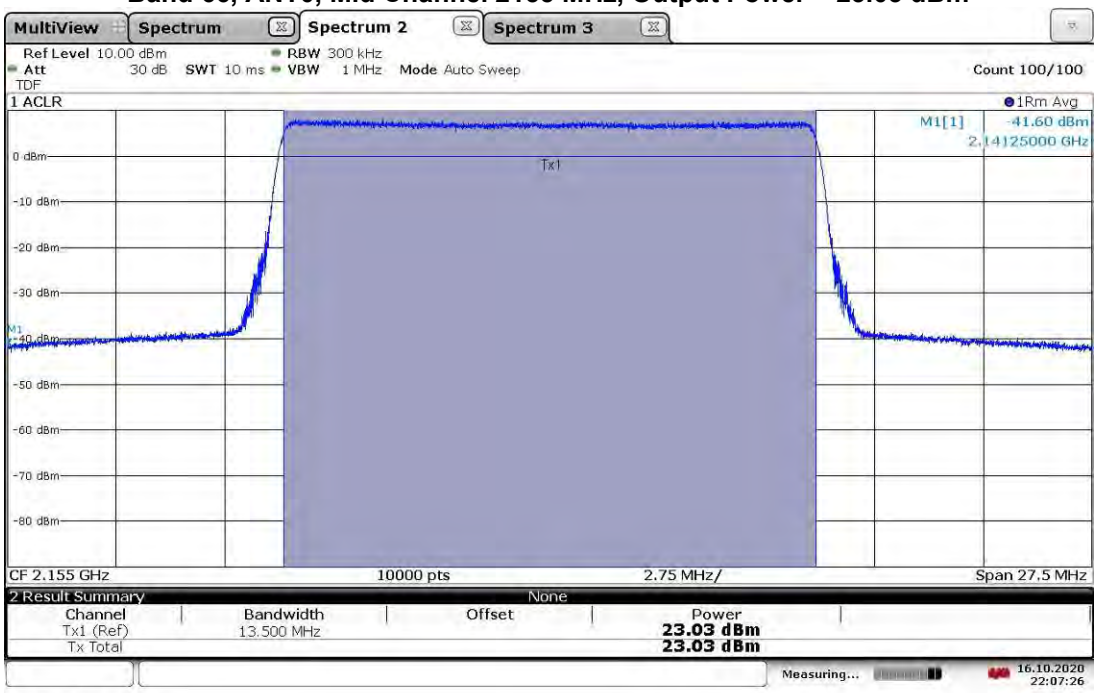
TM3.1a-256QAM_15 MHz Bandwidth
Band 66, ANT0, Low Channel 2117.5 MHz, Output Power = 23.01 dBm



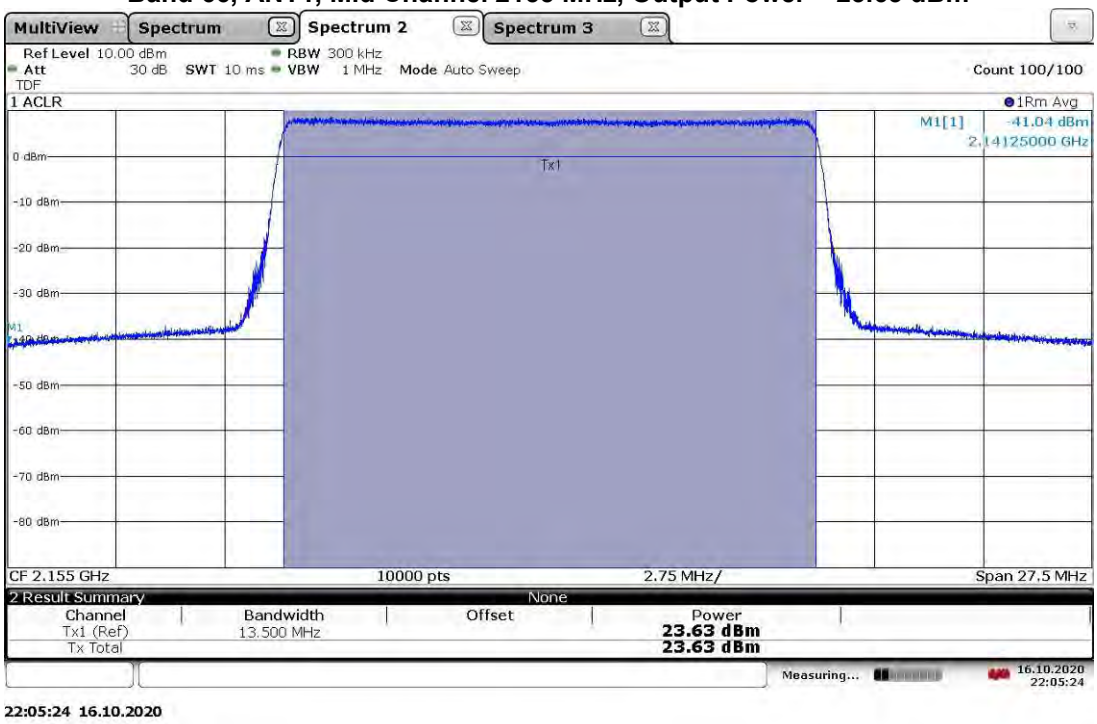
TM3.1a-256QAM_15 MHz Bandwidth
Band 66, ANT1, Low Channel 2117 MHz, Output Power = 22.79 dBm



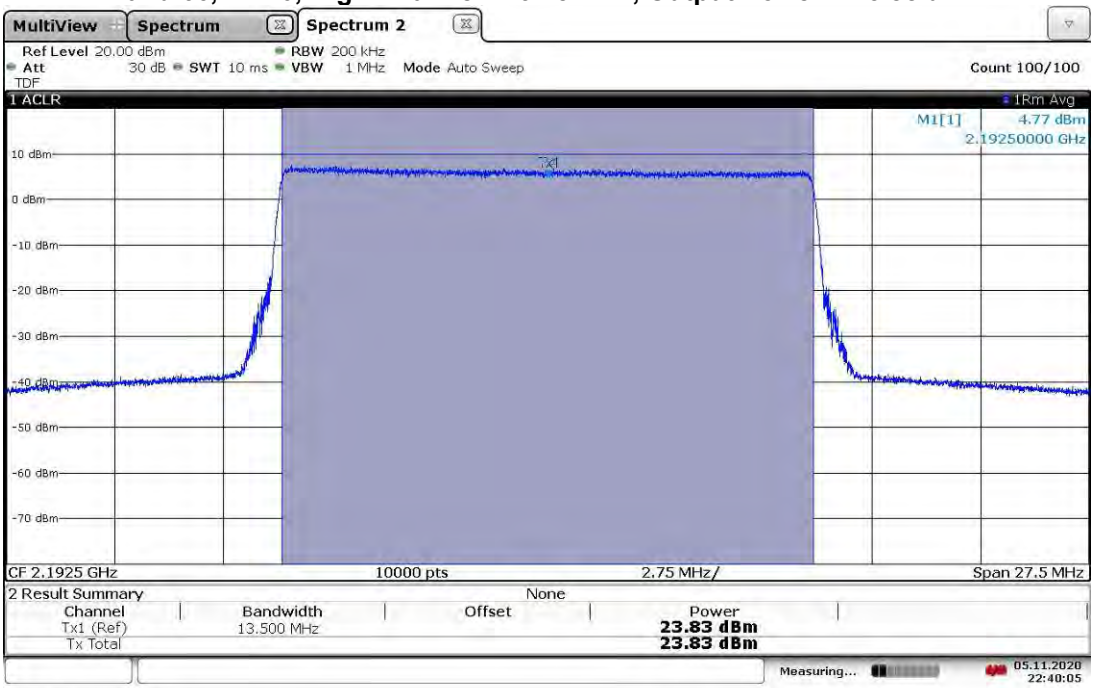
TM3.1a-256QAM_15 MHz Bandwidth
Band 66, ANT0, Mid Channel 2155 MHz, Output Power = 23.03 dBm



TM3.1a-256QAM_15 MHz Bandwidth
Band 66, ANT1, Mid Channel 2155 MHz, Output Power = 23.63 dBm

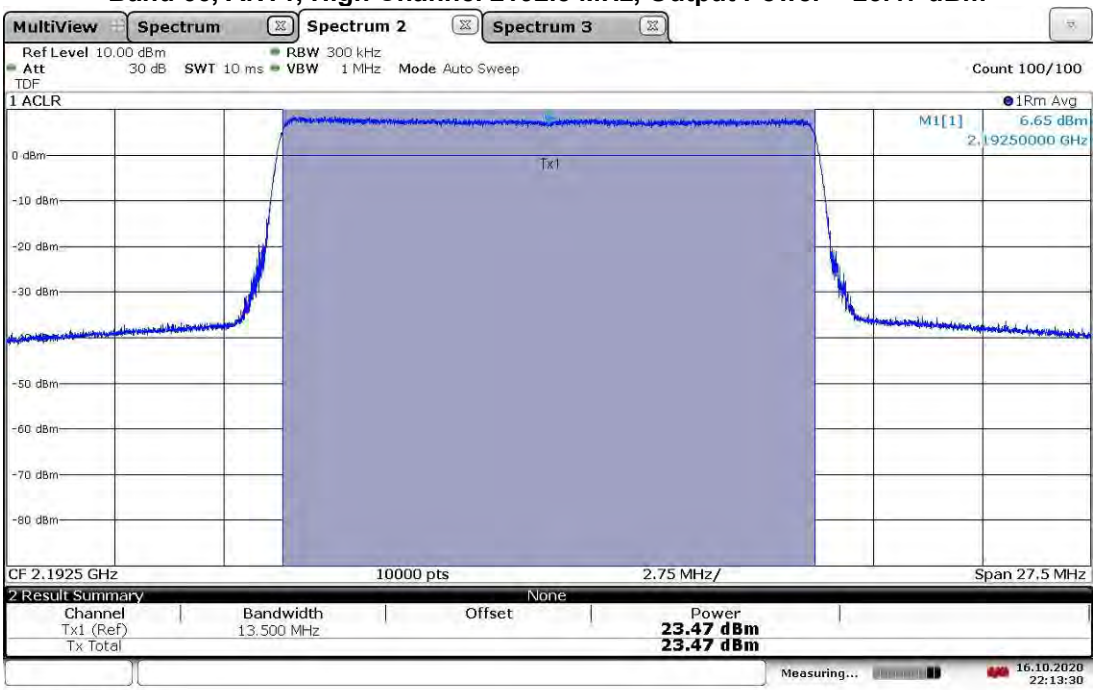


TM3.1a-256QAM_15 MHz Bandwidth
Band 66, ANT0, High Channel 2192.5 MHz, Output Power = 23.88 dBm



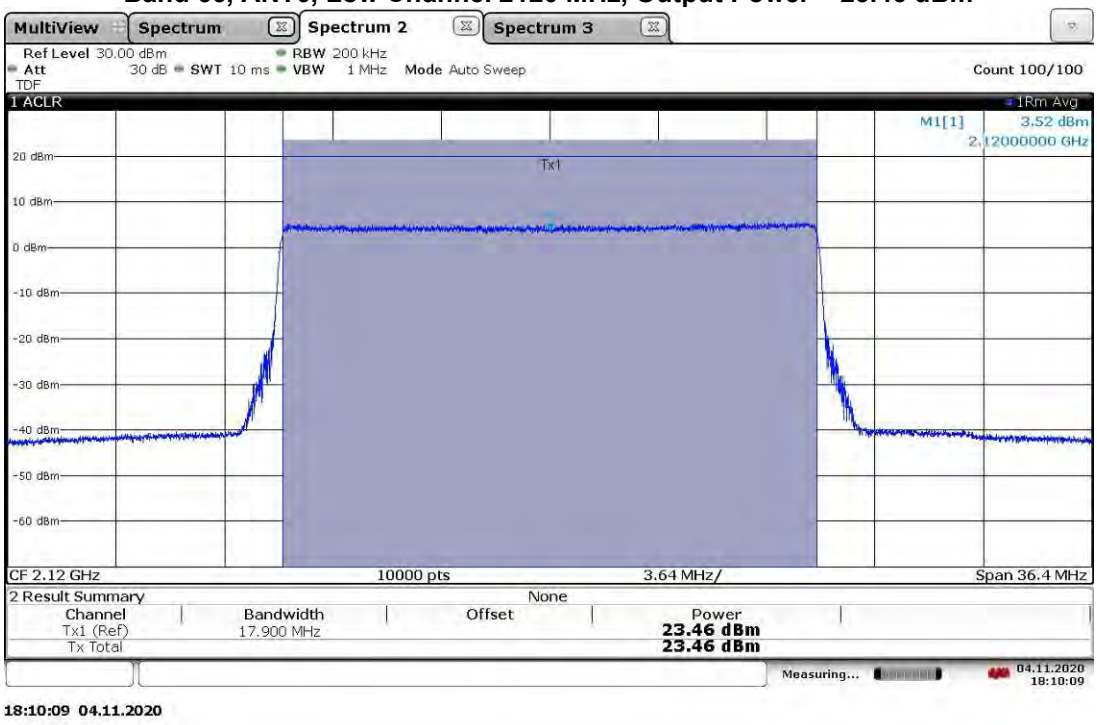
22:40:05 05.11.2020

TM3.1a-256QAM_15 MHz Bandwidth
Band 66, ANT1, High Channel 2192.5 MHz, Output Power = 23.47 dBm

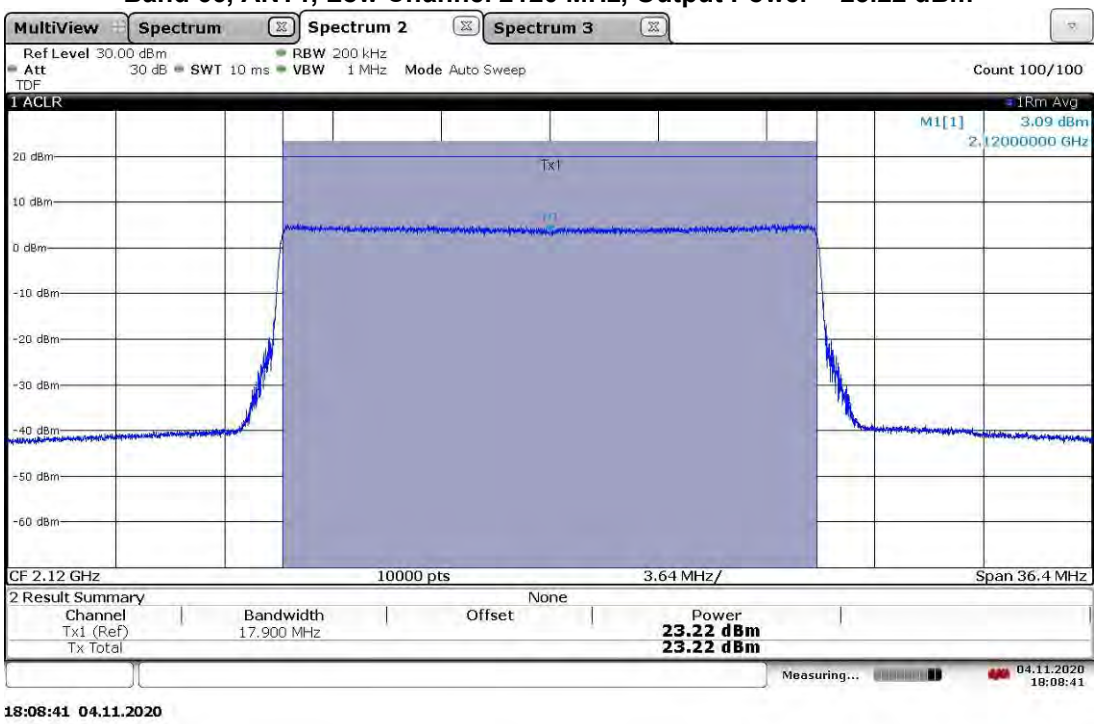


22:13:30 16.10.2020

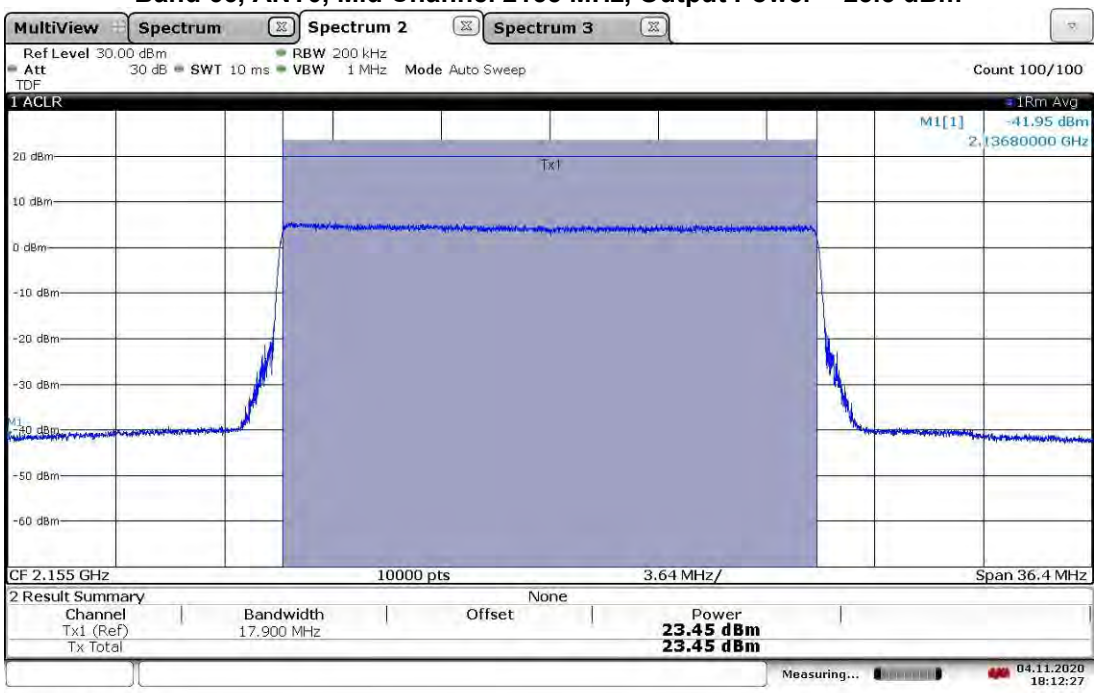
TM3.1a-256QAM_20 MHz Bandwidth
Band 66, ANT0, Low Channel 2120 MHz, Output Power = 23.46 dBm



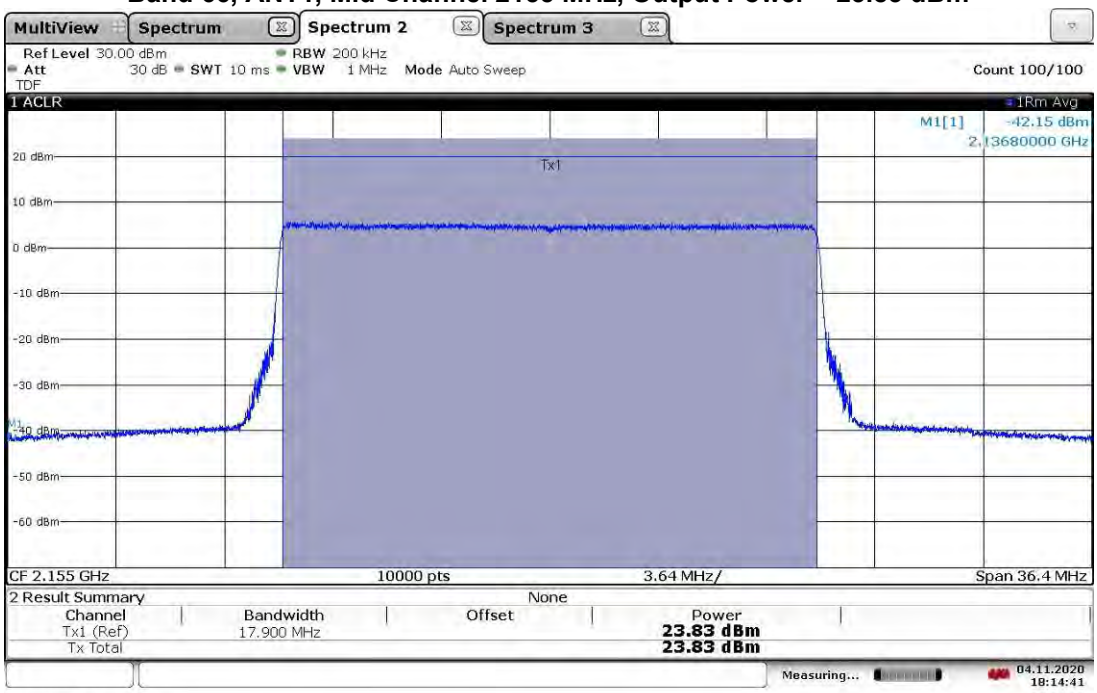
TM3.1a-256QAM_20 MHz Bandwidth
Band 66, ANT1, Low Channel 2120 MHz, Output Power = 23.22 dBm



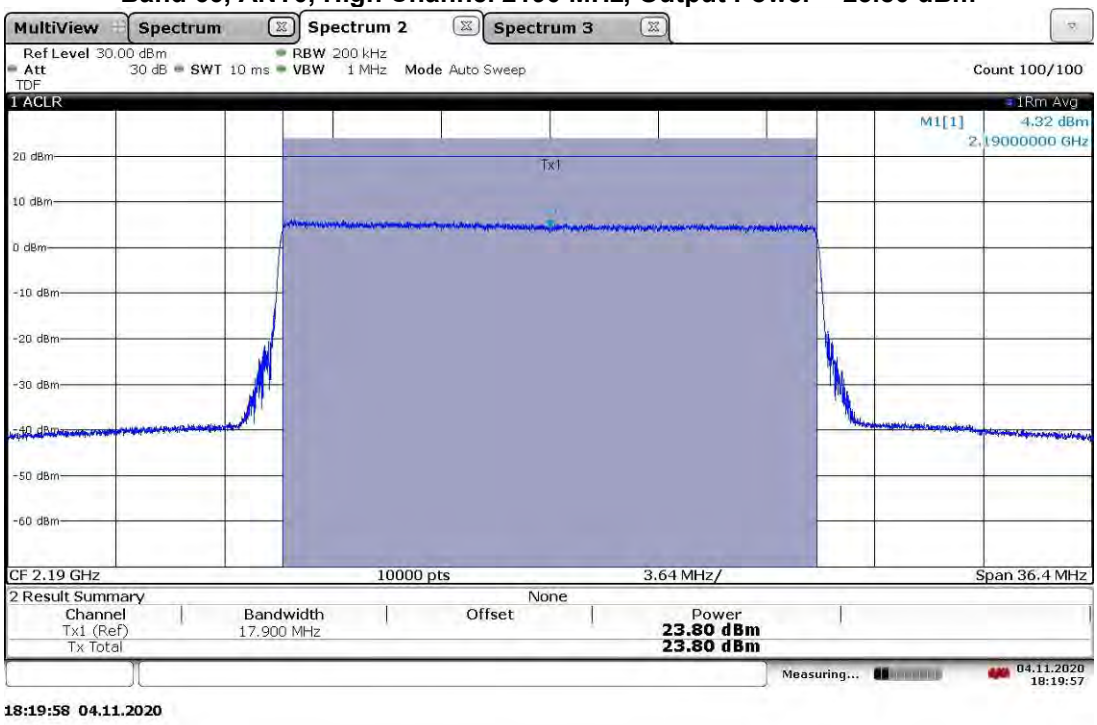
TM3.1a-256QAM_20 MHz Bandwidth
Band 66, ANT0, Mid Channel 2155 MHz, Output Power = 23.5 dBm



TM3.1a-256QAM_20 MHz Bandwidth
Band 66, ANT1, Mid Channel 2155 MHz, Output Power = 23.83 dBm

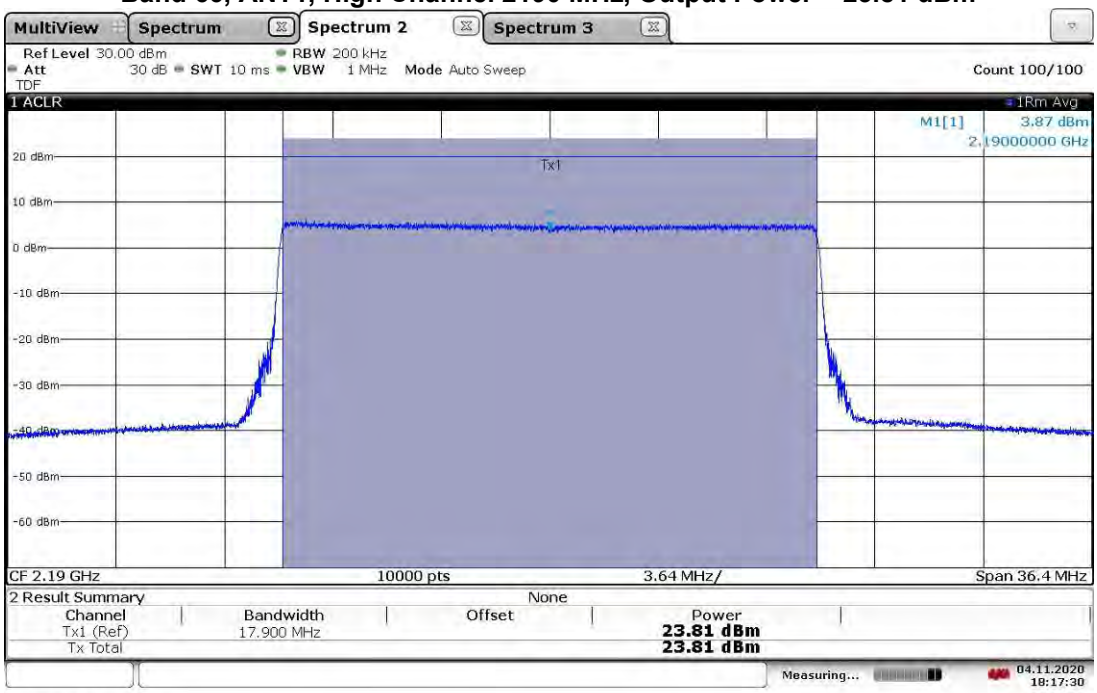


TM3.1a-256QAM_20 MHz Bandwidth
Band 66, ANT0, High Channel 2190 MHz, Output Power = 23.80 dBm



18:19:58 04.11.2020

TM3.1a-256QAM_20 MHz Bandwidth
Band 66, ANT1, High Channel 2190 MHz, Output Power = 23.81 dBm



18:17:30 04.11.2020

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 2.155 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 = 23.88 dBm + 10*LOG(2) + 0 dBi = 23.88 dBm + 3 dB + 0dBi
EIRP = 26.88 dBm or 487.529 mW
Therefore, the minimum safe distance D_{cm} = ([516.4] / [4π])$^{1/2}$
D_{cm} = 4.41 cm at 0 dBi gain two antenna MIMO

For Gain = 4 dBi,
EIRP = 23.88 dBm + 10*LOG(2) + 4 dBi = 23.88 dBm + 3 dB + 4dBi
EIRP = 30.88 dBm or 1224.616 mW

Therefore, the minimum safe distance D_{cm} = ([1297] / [4π])$^{1/2}$
D_{cm} = 9.871 cm at 4 dBi gain two antenna MIMO

For Gain = X dBi,
EIRP = 23.88 dBm + 10*LOG(2) + X dBi = 23.88 dBm + 3 dB + XdBi
EIRP = 26.88 + X dBm or 487.529 + 10^(X/10) mW
Therefore, the minimum safe distance D_{cm} = ([487.529 + 10^(X/10)] / [4π])$^{1/2}$
D_{cm} = 0.282 * (487.529 + 10^(X/10))$^{1/2}$ cm at X dBi gain two antenna MIMO

Test Personnel:	Kouma Sinn KPS	Test Date:	10/16/2020,10/27/2020, 11/04/2020, 11/05/2020,
Supervising/Reviewing Engineer: (Where Applicable)	N/A		
Product Standard:	FCC Part 27	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, 22, 21, 22, 23 ºC
		Relative Humidity:	59, 41,21, 24, 59 %
		Atmospheric Pressure:	1008, 1011,1022, 1017, 1008 mbars

Deviations, Additions, or Exclusions: None

7 Peak-to-Average Power Ratio (PAR)

7.1 Method

Tests are performed in accordance with ANSI C63.26 and CFR47 FCC Part 27.

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	01/22/2020	01/22/2021
CBLHF2012-2M-1'	2m 9kHz-40GHz Coaxial Cable - SET1	Huber & Suhner	SF102	252675001	02/17/2020	02/17/2021
ROS005-1'	Signal and Spectrum Analyzer	Rohde & Schwarz	FSW43	100646	10/27/2020	10/27/2021
DAV005'	Weather Station	Davis	6250	MS191218083	02/05/2020	02/05/2021

Software Utilized:

Name	Manufacturer	Version
None	--	--

7.3 Results:

The sample tested was found to Comply.

§27.50(d)(5) The peak-to-average ratio (PAR) of the transmission may not exceed 13 dB.

Band 66, Bandwidth: 5 MHz, Modulation: TM1.1-QPSK

Channel	Frequency (MHz)	Antenna Port	PAR (dB)
Low	2112.50	ANT0	10.91
		ANT1	10.80
Mid	2155.00	ANT0	10.86
		ANT1	10.56
High	2197.50	ANT0	10.83
		ANT1	10.45

Band 66, Bandwidth: 10 MHz, Modulation: TM1.1-QPSK

Channel	Frequency (MHz)	Antenna Port	PAR (dB)
Low	2115.00	ANT0	11.45
		ANT1	11.63
Mid	2155.00	ANT0	11.23
		ANT1	11.21
High	2195.00	ANT0	10.08
		ANT1	10.13

Band 66, Bandwidth: 15 MHz, Modulation: TM1.1-QPSK

Channel	Frequency (MHz)	Antenna Port	PAR (dB)
Low	2117.50	ANT0	10.25
		ANT1	10.13
Mid	2155.00	ANT0	11.11
		ANT1	10.03
High	2192.50	ANT0	10.98
		ANT1	10.71

Band 66, Bandwidth: 20 MHz, Modulation: TM1.1-QPSK

Channel	Frequency (MHz)	Antenna Port	PAR (dB)
Low	2120.00	ANT0	11.4
		ANT1	10.98
Mid	2155.00	ANT0	10.50
		ANT1	10.37
High	2190.00	ANT0	10.50
		ANT1	10.37

Band 66, Bandwidth: 5 MHz, Modulation: TM3.2-16QAM

Channel	Frequency (MHz)	Antenna Port	PAR (dB)
Low	2112.50	ANT0	11.03
		ANT1	11.17
Mid	2155.00	ANT0	11.06
		ANT1	10.76
High	2197.50	ANT0	10.05
		ANT1	10.81

Band 66, Bandwidth: 10 MHz, Modulation: TM3.2-16QAM

Channel	Frequency (MHz)	Antenna Port	PAR (dB)
Low	2115.00	ANT0	10.12
		ANT1	10.09
Mid	2155.00	ANT0	10.20
		ANT1	10.03
High	2195.00	ANT0	10.29
		ANT1	10.68

Band 66, Bandwidth: 15 MHz, Modulation: TM3.2-16QAM

Channel	Frequency (MHz)	Antenna Port	PAR (dB)
Low	2117.50	ANT0	10.39
		ANT1	10.47
Mid	2155.00	ANT0	10.6
		ANT1	10.41
High	2192.50	ANT0	10.44
		ANT1	10.12

Band 66, Bandwidth: 20 MHz, Modulation: TM3.2-16QAM

Channel	Frequency (MHz)	Antenna Port	PAR (dB)
Low	2120.00	ANT0	10.97
		ANT1	10.80
Mid	2155.00	ANT0	10.41
		ANT1	11.17
High	2190.00	ANT0	10.64
		ANT1	10.70

Band 66, Bandwidth: 5 MHz, Modulation: TM3.1-64QAM

Channel	Frequency (MHz)	Antenna Port	PAR (dB)
Low	2112.50	ANT0	10.05
		ANT1	10.01
Mid	2155.00	ANT0	10.12
		ANT1	9.86
High	2197.50	ANT0	9.98
		ANT1	9.80

Band 66, Bandwidth: 10 MHz, Modulation: TM3.1-64QAM

Channel	Frequency (MHz)	Antenna Port	PAR (dB)
Low	2115.00	ANT0	10.82
		ANT1	10.81
Mid	2155.00	ANT0	10.44
		ANT1	9.91
High	2195.00	ANT0	10.58
		ANT1	9.99

Band 66, Bandwidth: 15 MHz, Modulation: TM3.1-64QAM

Channel	Frequency (MHz)	Antenna Port	PAR (dB)
Low	2117.50	ANT0	10.44
		ANT1	10.32
Mid	2155.00	ANT0	11.05
		ANT1	11.26
High	2192.50	ANT0	10.09
		ANT1	10.75

Band 66, Bandwidth: 20 MHz, Modulation: TM3.1-64QAM

Channel	Frequency (MHz)	Antenna Port	PAR (dB)
Low	2120.00	ANT0	10.92
		ANT1	11.15
Mid	2150.00	ANT0	11.36
		ANT1	11.11
High	2190.00	ANT0	11.06
		ANT1	10.78

Band 66, Bandwidth: 5 MHz, Modulation: TM3.1a-256QAM

Channel	Frequency (MHz)	Antenna Port	PAR (dB)
Low	2112.50	ANT0	10.55
		ANT1	10.62
Mid	2155.00	ANT0	10.52
		ANT1	10.10
High	2197.50	ANT0	10.48
		ANT1	10.06

Band 66, Bandwidth: 10 MHz, Modulation: TM3.1a-256QAM

Channel	Frequency (MHz)	Antenna Port	PAR (dB)
Low	2115.00	ANT0	10.45
		ANT1	10.06
Mid	2155.00	ANT0	10.23
		ANT1	9.99
High	2195.00	ANT0	9.88
		ANT1	10.26

Band 66, Bandwidth: 15 MHz, Modulation: TM3.1a-256QAM

Channel	Frequency (MHz)	Antenna Port	PAR (dB)
Low	2117.50	ANT0	9.81
		ANT1	10.24
Mid	2155.00	ANT0	11.10
		ANT1	9.93
High	2192.50	ANT0	10.40
		ANT1	10.11

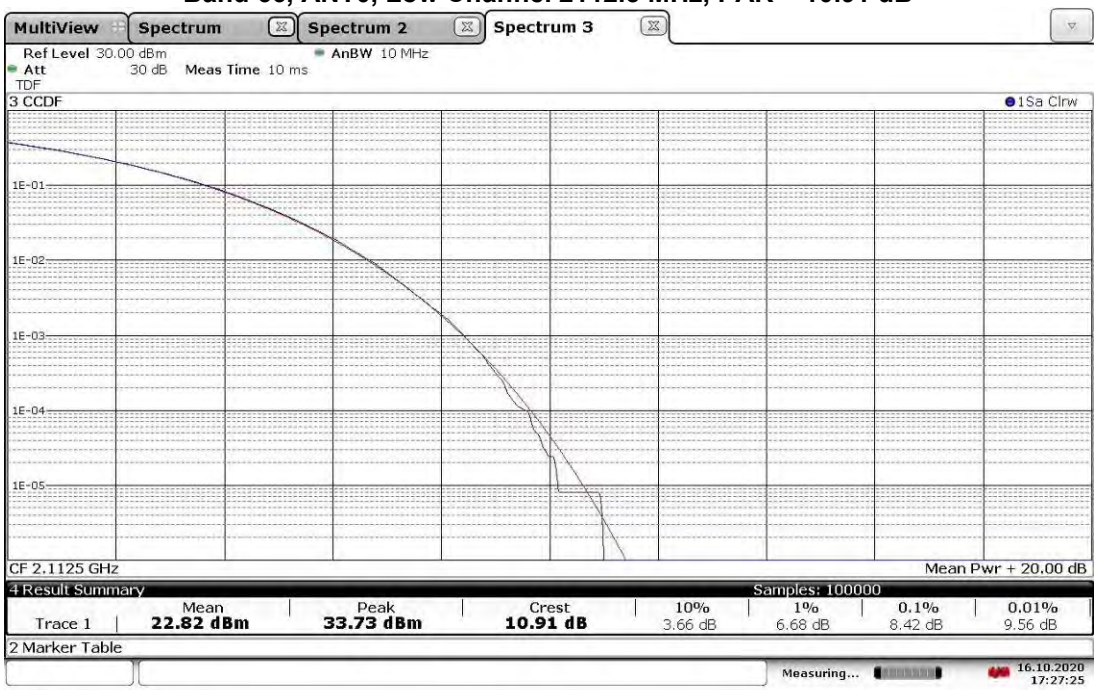
Band 66, Bandwidth: 20 MHz, Modulation: TM3.1a-256QAM

Channel	Frequency (MHz)	Antenna Port	PAR (dB)
Low	2120.00	ANT0	10.24
		ANT1	10.51
Mid	2150.00	ANT0	10.60
		ANT1	10.20
High	2190.00	ANT0	10.15
		ANT1	10.28

7.4 Setup Photograph:

7.5 Plots/Data:

TM1.1-QPSK_5 MHz Bandwidth
Band 66, ANT0, Low Channel 2112.5 MHz, PAR = 10.91 dB



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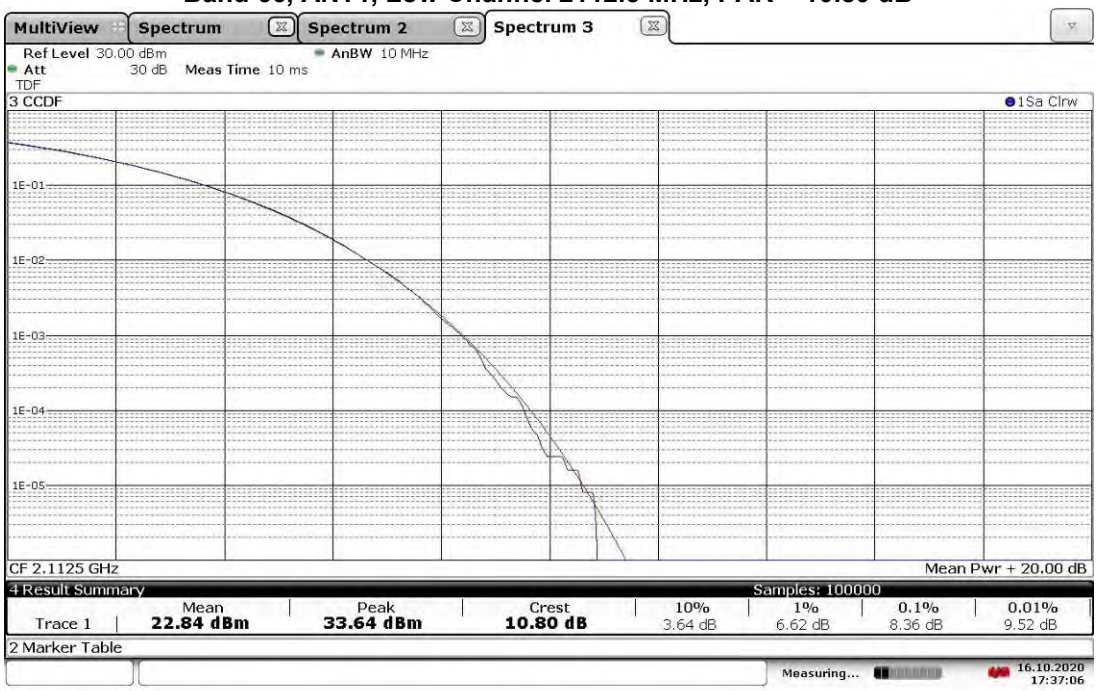
TM1.1-QPSK_5 MHz Bandwidth
Band 66, ANT1, Low Channel 2112.5 MHz, PAR = 10.80 dB



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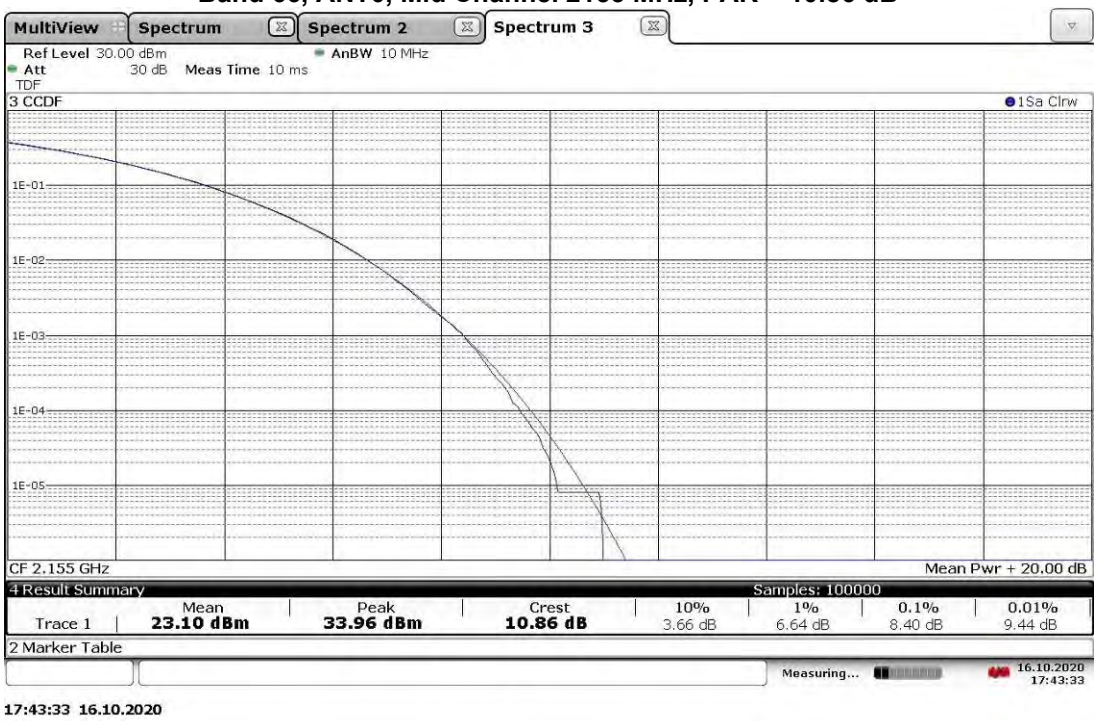
TM1.1-QPSK_5 MHz Bandwidth
Band 66, ANT0, Mid Channel 2155 MHz, PAR = 10.86 dB



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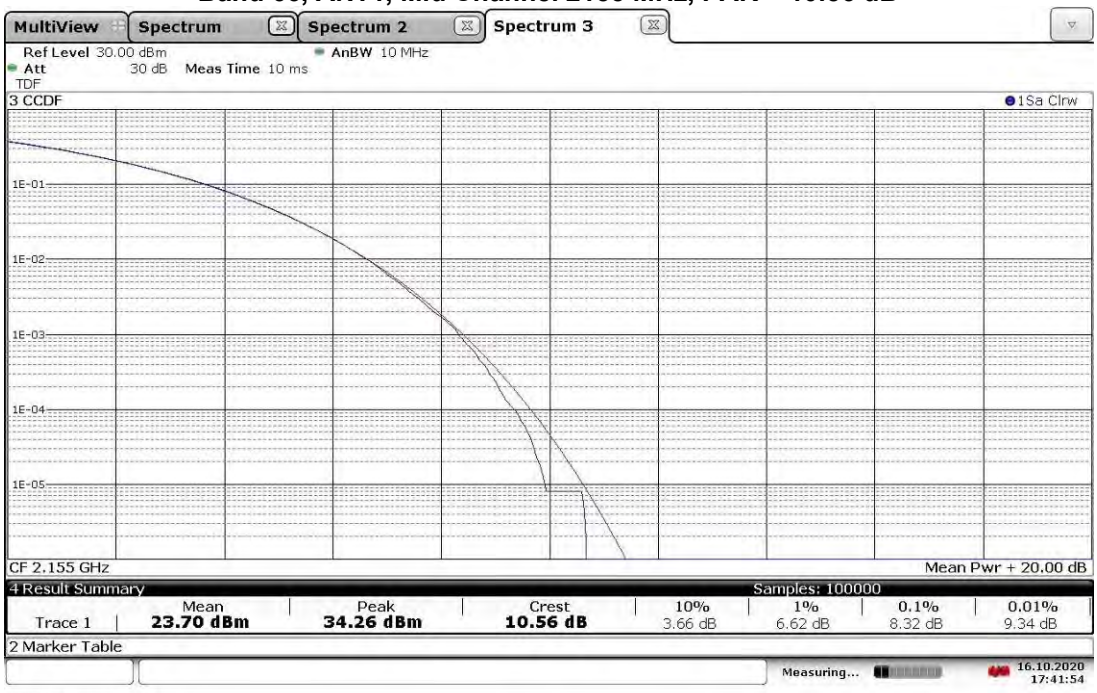
TM1.1-QPSK_5 MHz Bandwidth
Band 66, ANT1, Mid Channel 2155 MHz, PAR = 10.56 dB



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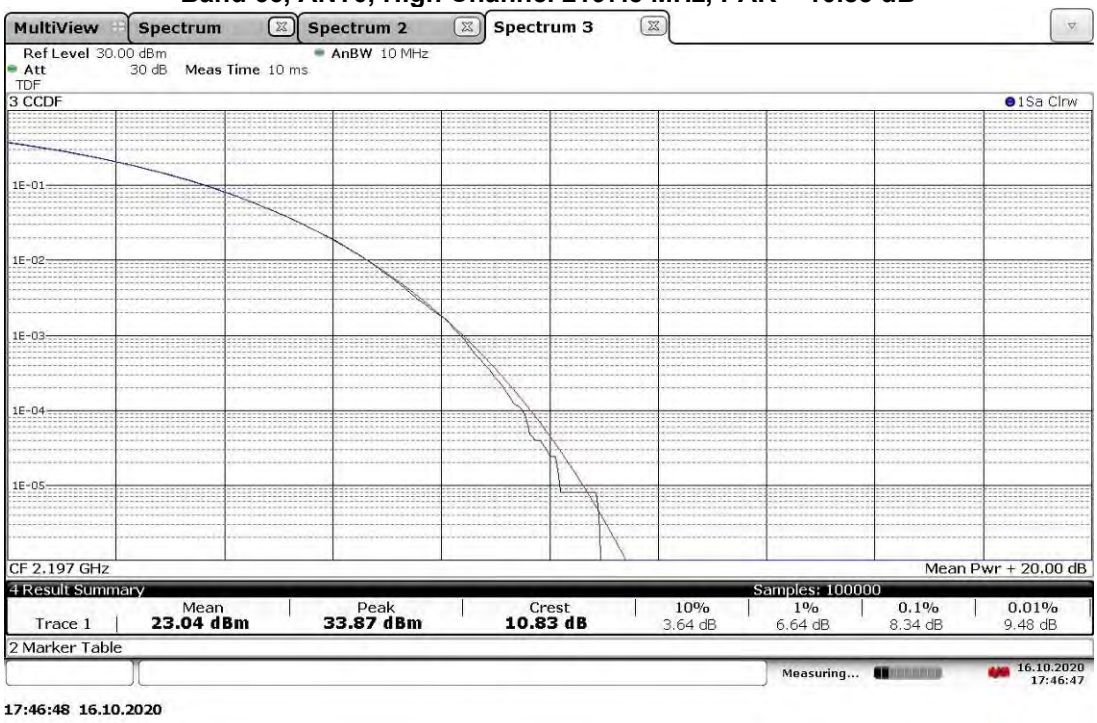
TM1.1-QPSK_5 MHz Bandwidth
Band 66, ANT0, High Channel 2197.5 MHz, PAR = 10.83 dB



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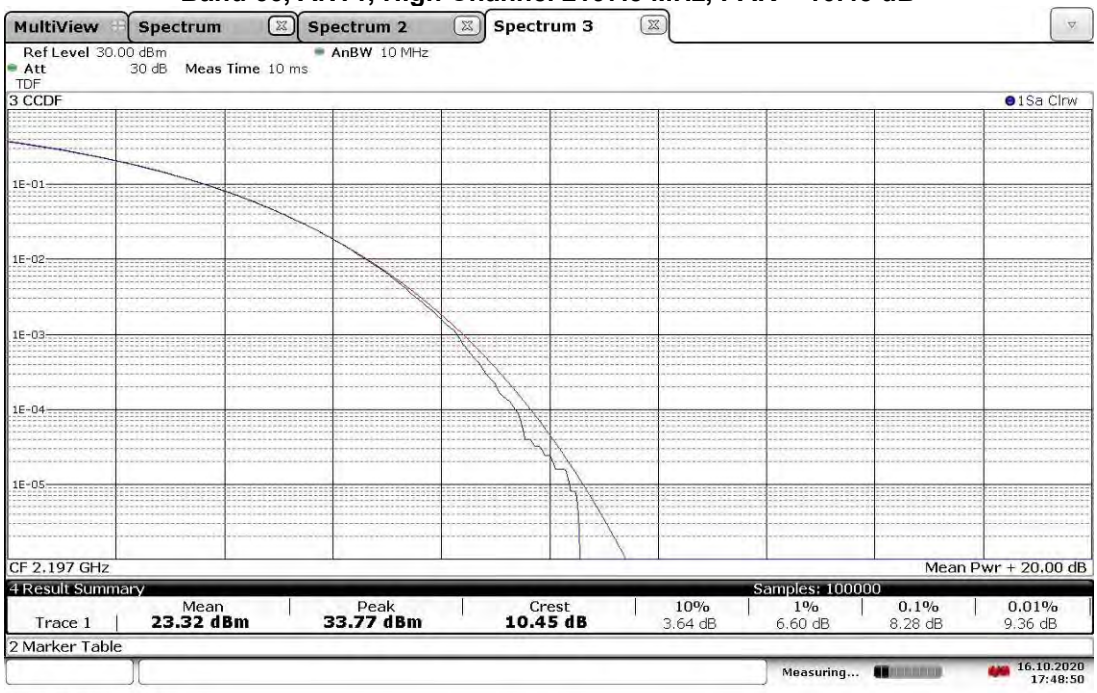
TM1.1-QPSK_5 MHz Bandwidth
Band 66, ANT1, High Channel 2197.5 MHz, PAR = 10.45 dB



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