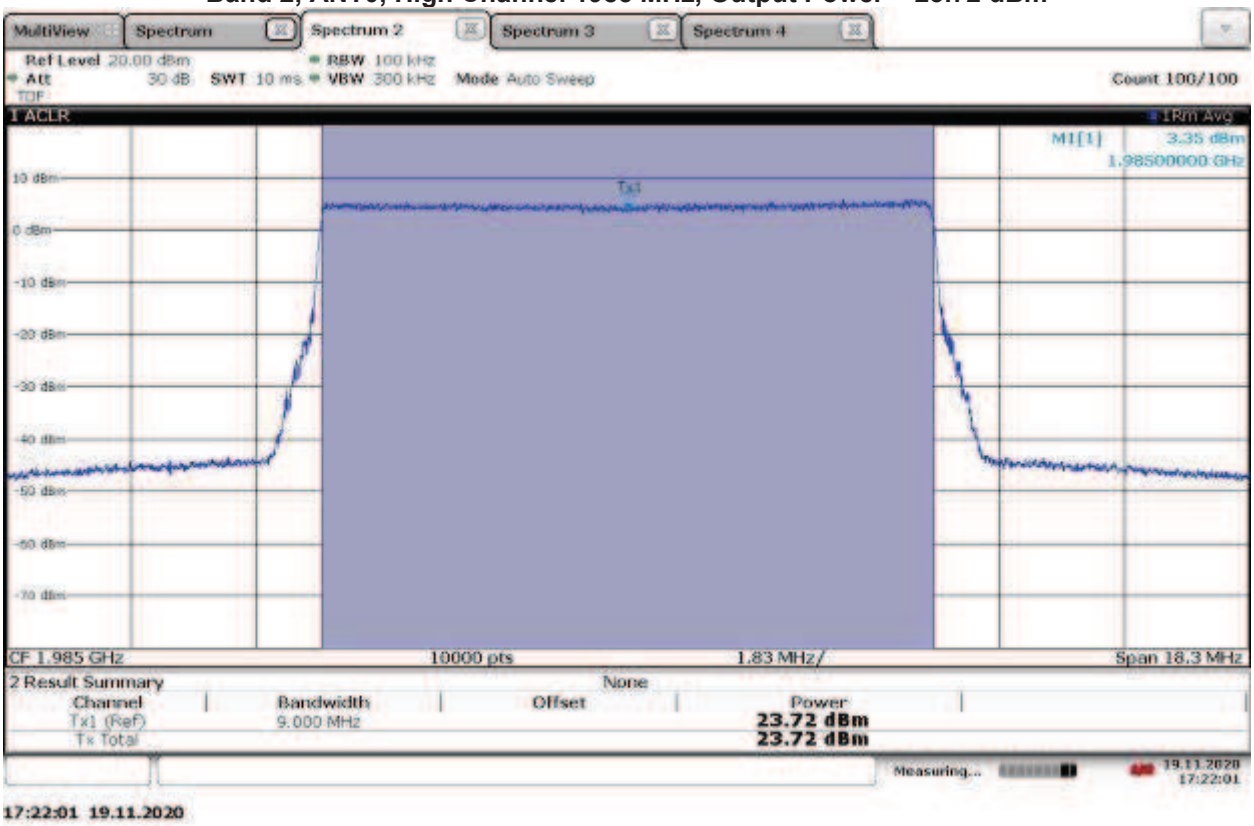
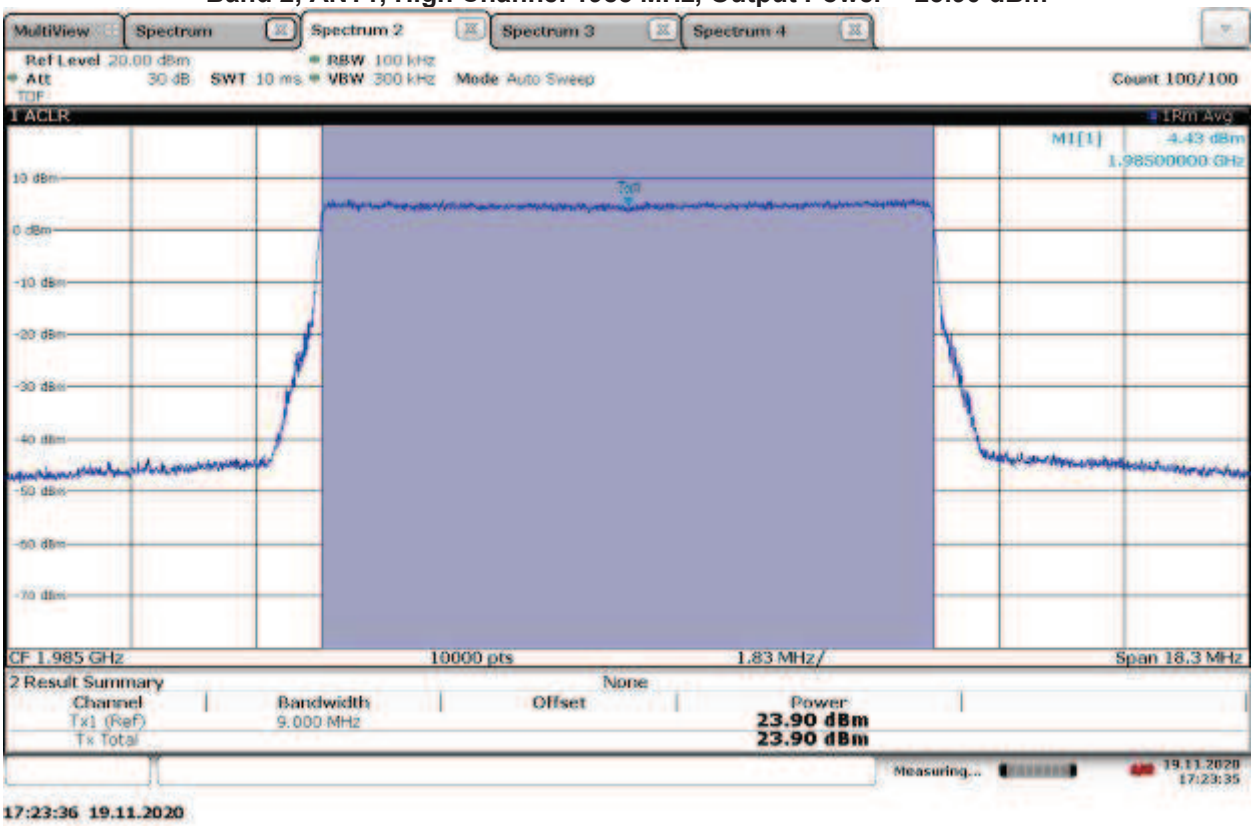
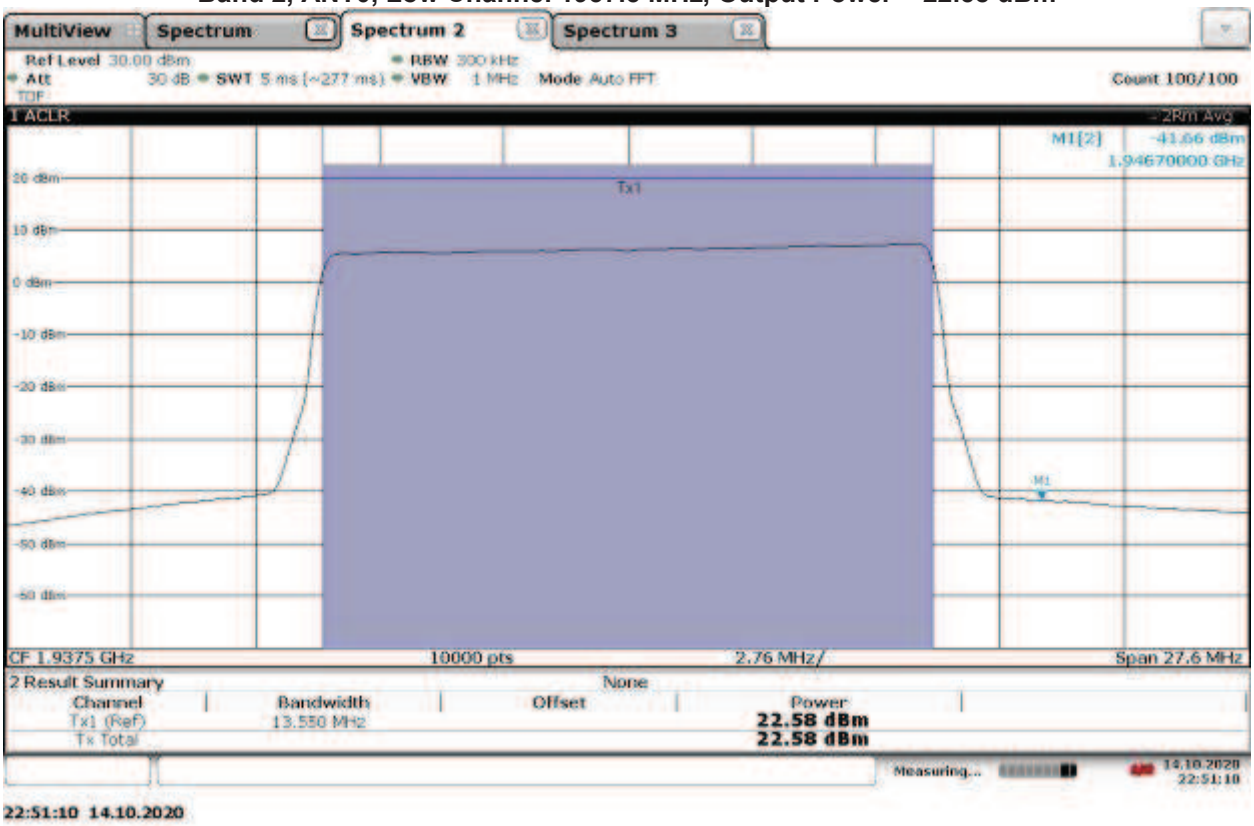
TM3.1a-256QAM _10 MHz Bandwidth
Band 2, ANT0, High Channel 1985 MHz, Output Power = 23.72 dBm



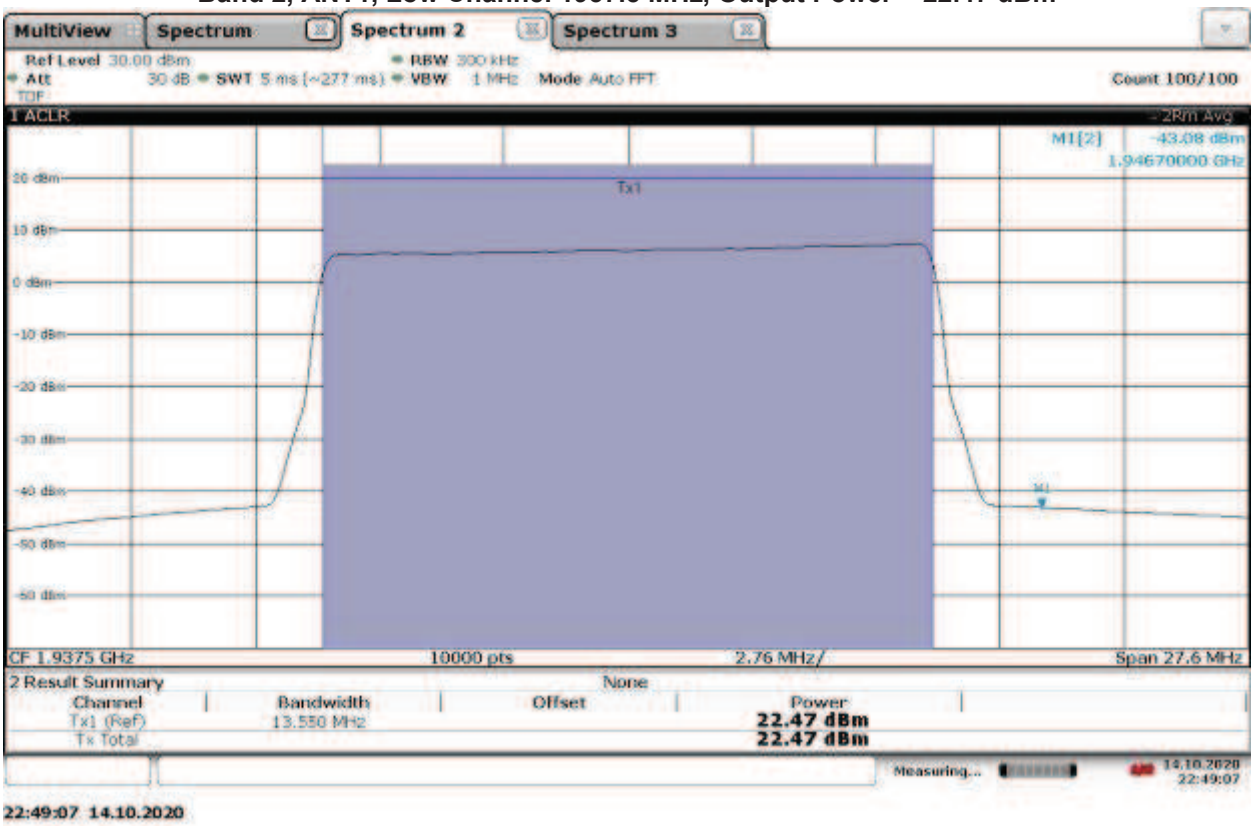
TM3.1a-256QAM _10 MHz Bandwidth
Band 2, ANT1, High Channel 1985 MHz, Output Power = 23.90 dBm



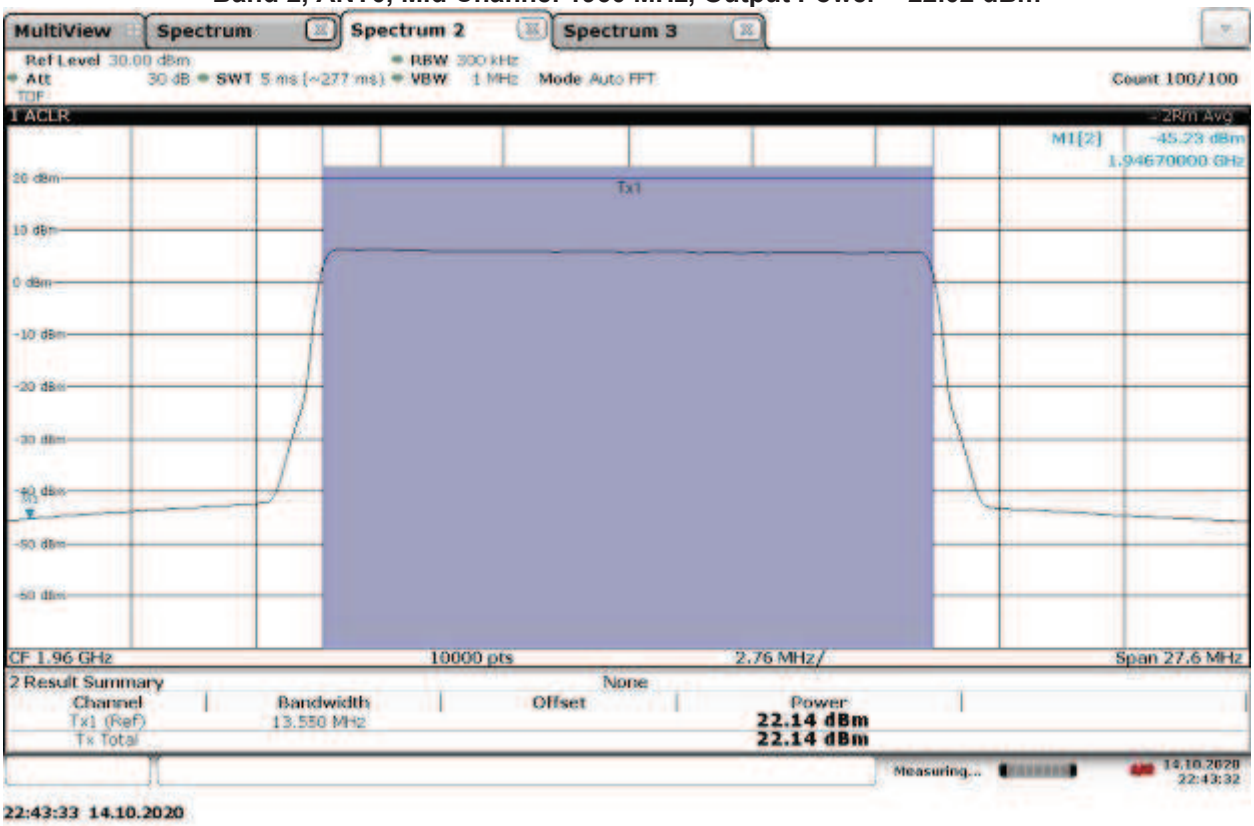
TM3.1a-256QAM _15 MHz Bandwidth
Band 2, ANT0, Low Channel 1937.5 MHz, Output Power = 22.58 dBm



TM3.1a-256QAM _15 MHz Bandwidth
Band 2, ANT1, Low Channel 1937.5 MHz, Output Power = 22.47 dBm

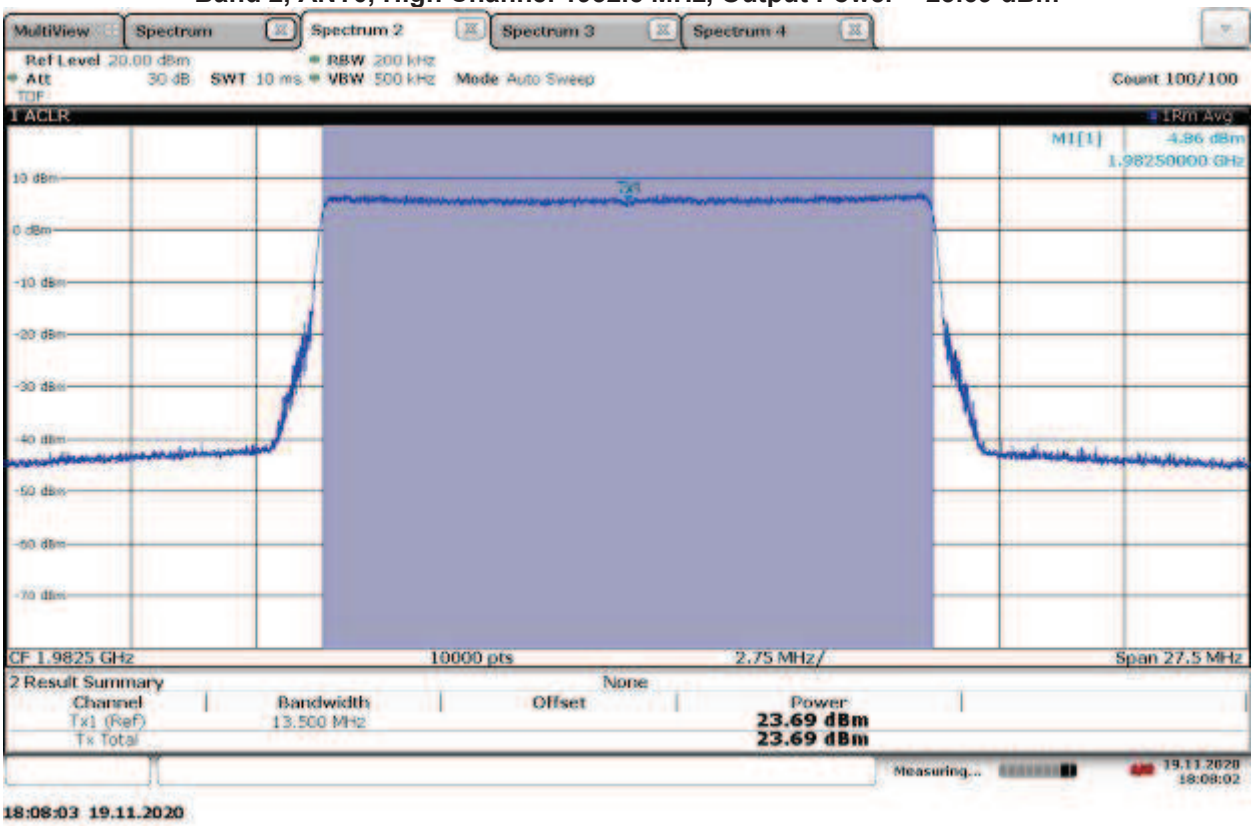


TM3.1a-256QAM _15 MHz Bandwidth
Band 2, ANT0, Mid Channel 1960 MHz, Output Power = 22.02 dBm

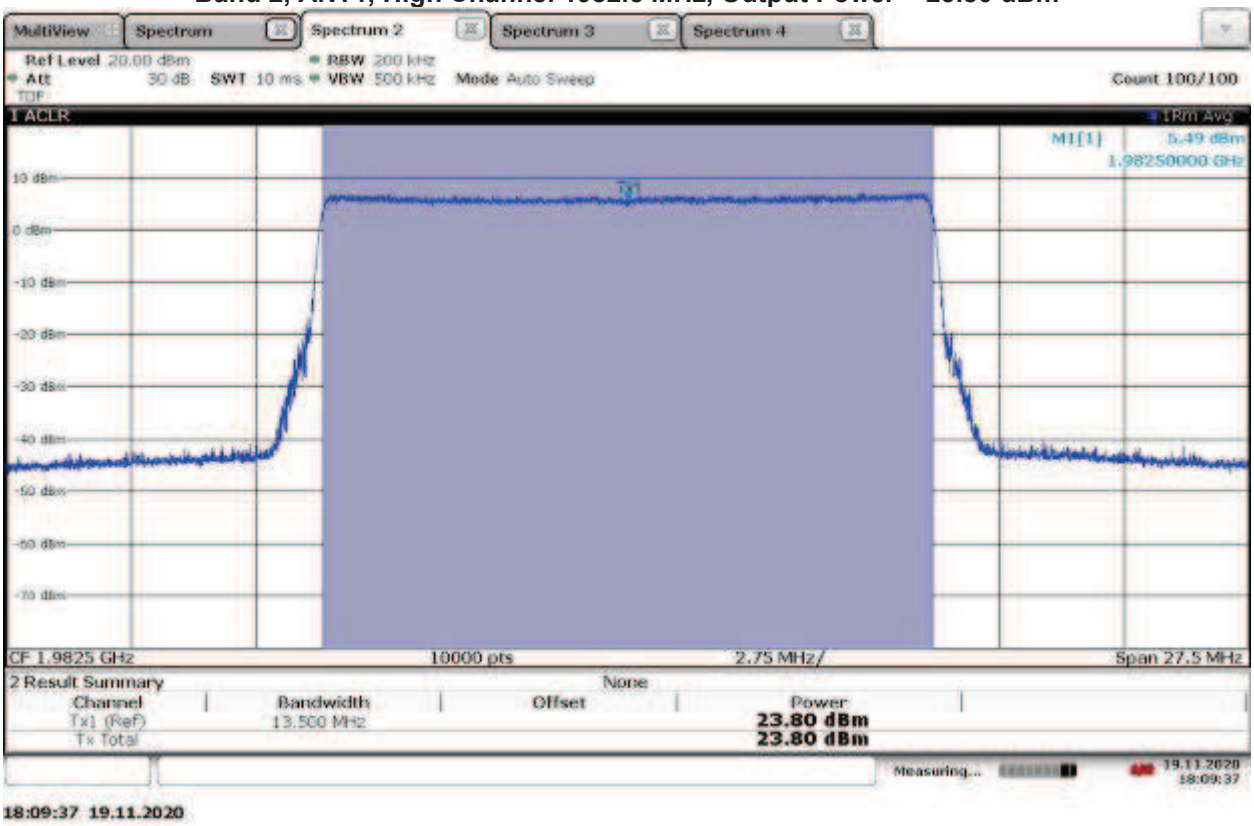


TM3.1a-256QAM _15 MHz Bandwidth
Band 2, ANT1, Mid Channel 1960 MHz, Output Power = 22.70 dBm

TM3.1a-256QAM _15 MHz Bandwidth
Band 2, ANT0, High Channel 1932.5 MHz, Output Power = 23.69 dBm



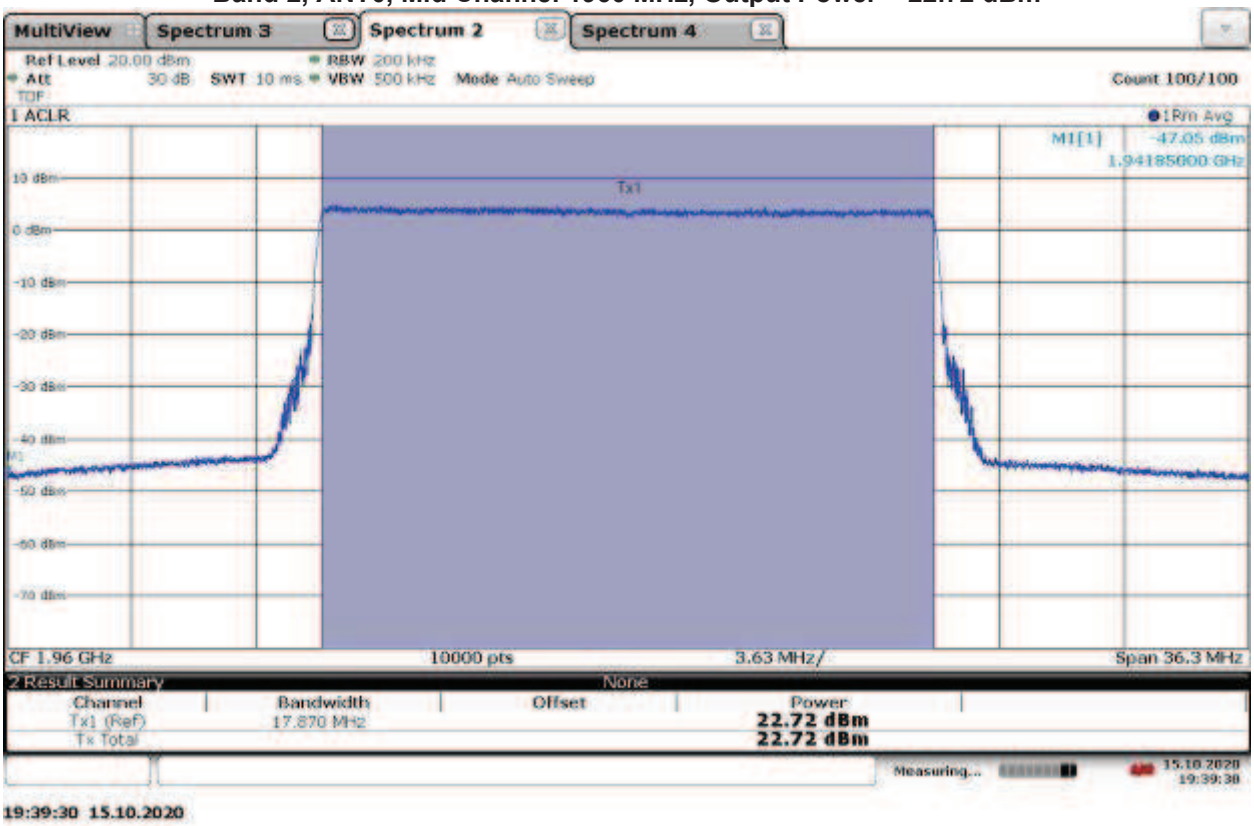
TM3.1a-256QAM _15 MHz Bandwidth
Band 2, ANT1, High Channel 1982.5 MHz, Output Power = 23.80 dBm



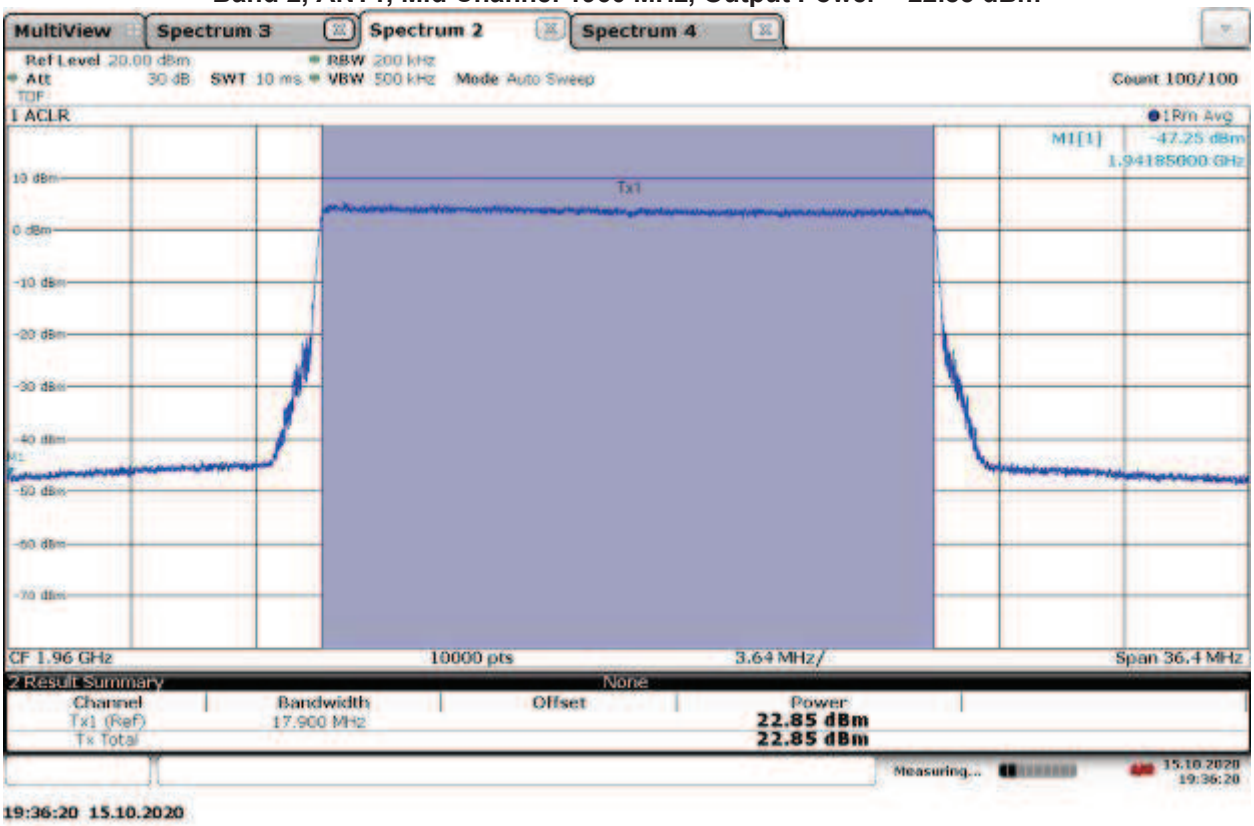
TM3.1a-256QAM _20 MHz Bandwidth
Band 2, ANT0, Low Channel 1940 MHz, Output Power = 23.11 dBm

TM3.1a-256QAM _20 MHz Bandwidth
Band 2, ANT1, Low Channel 1940 MHz, Output Power = 23.21 dBm

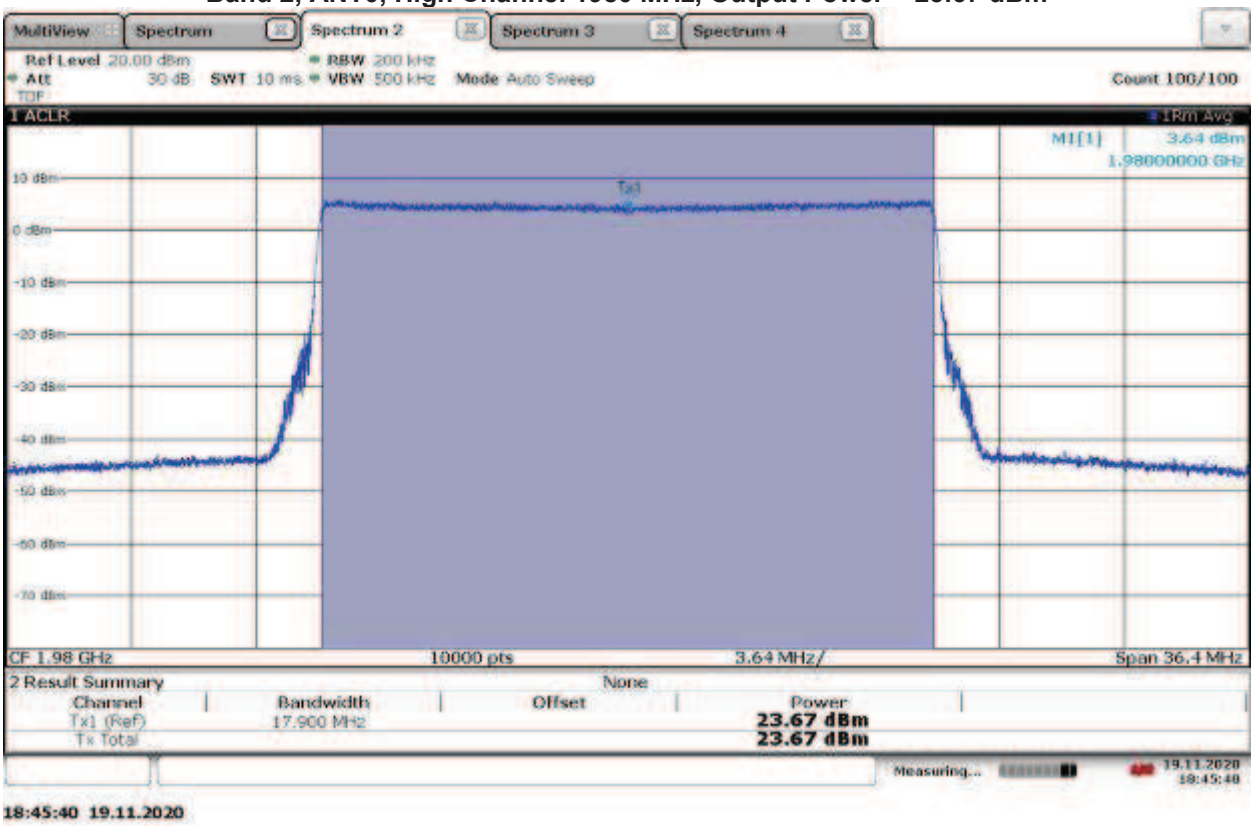
TM3.1a-256QAM _20 MHz Bandwidth
Band 2, ANT0, Mid Channel 1960 MHz, Output Power = 22.72 dBm



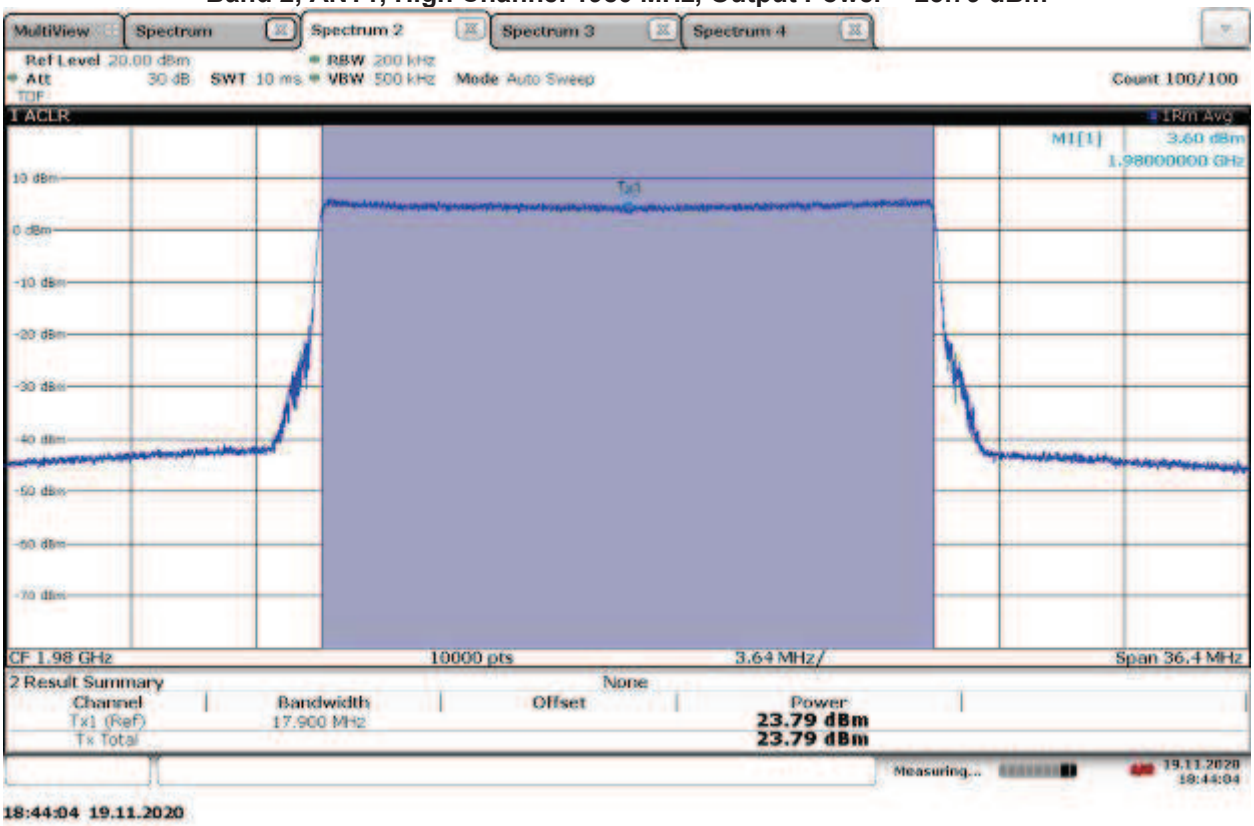
TM3.1a-256QAM _20 MHz Bandwidth
Band 2, ANT1, Mid Channel 1960 MHz, Output Power = 22.85 dBm



TM3.1a-256QAM _20 MHz Bandwidth
Band 2, ANT0, High Channel 1980 MHz, Output Power = 23.67 dBm



TM3.1a-256QAM _20 MHz Bandwidth
Band 2, ANT1, High Channel 1980 MHz, Output Power = 23.79 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 = 23.97 dBm + 10*LOG(2) + 0 dBi = 23.97 dBm + 3 dB + 0dBi
EIRP = 26.97 dBm or 497.77 mW
Therefore, the minimum safe distance D_{cm} is D_{cm} = ([528.4] / [4π])$^{1/2}$
D_{cm} = 6.29 cm at 0 dBi gain two antenna MIMO

For Gain = 4 dBi,
EIRP = 23.97 dBm + 10*LOG(2) + 4 dBi = 23.97 dBm + 3 dB + 4dBi
EIRP = 30.97 dBm or 1250.26 mW
Therefore, the minimum safe distance D_{cm} is D_{cm} = ([1327] / [4π])$^{1/2}$
D_{cm} = 9.97 cm at 4 dBi gain two antenna MIMO

For Gain = X dBi,
EIRP = 23.97 dBm + 10*LOG(2) + X dBi = 23.97 dBm + 3 dB + XdBi
EIRP = 26.97 + X dBm or 497.77 + 10^(X/10) mW
Therefore, the minimum safe distance D_{cm} is D_{cm} = ([497.77 + 10^(X/10)] / [4π])$^{1/2}$
D_{cm} = 0.282 * (497.77 + 10^(X/10))$^{1/2}$ cm at X dBi gain two antenna MIMO

Test Personnel:	Kouma Sinn KPS	Test Date:	10/14/2020, 10/15/2020, 11/19/2020
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, 22, 24 ºC
		Relative Humidity:	41, 45, 21 %
		Atmospheric Pressure:	1007, 1006, 1015 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	01/22/2020	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.

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

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

Channel	Frequency (MHz)	Antenna Port	PAPR (dB)
Low	1932.50	ANT0	10.30
		ANT1	10.43
Mid	1960.00	ANT0	10.89
		ANT1	10.81
High	1987.50	ANT0	10.48
		ANT1	10.25

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

Channel	Frequency (MHz)	Antenna Port	PAPR (dB)
Low	1935.00	ANT0	10.88
		ANT1	10.31
Mid	1960.00	ANT0	10.79
		ANT1	11.40
High	1985.00	ANT0	10.80
		ANT1	9.57

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

Channel	Frequency (MHz)	Antenna Port	PAPR (dB)
Low	1937.50	ANT0	11.36
		ANT1	11.71
Mid	1960.00	ANT0	11.82
		ANT1	11.66
High	1982.50	ANT0	10.89
		ANT1	9.84

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

Channel	Frequency (MHz)	Antenna Port	PAPR (dB)
Low	1940.00	ANT0	10.61
		ANT1	10.38
Mid	1960.00	ANT0	10.65
		ANT1	10.38
High	1980.00	ANT0	10.42
		ANT1	10.25

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

Channel	Frequency (MHz)	Antenna Port	PAPR (dB)
Low	1932.50	ANT0	10.33
		ANT1	10.45
Mid	1960.00	ANT0	10.83
		ANT1	10.96
High	1987.50	ANT0	10.65
		ANT1	10.52

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

Channel	Frequency (MHz)	Antenna Port	PAPR (dB)
Low	1935.00	ANT0	10.16
		ANT1	10.19
Mid	1960.00	ANT0	10.53
		ANT1	10.65
High	1985.00	ANT0	9.90
		ANT1	10.16

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

Channel	Frequency (MHz)	Antenna Port	PAPR (dB)
Low	1937.50	ANT0	10.12
		ANT1	10.31
Mid	1960.00	ANT0	10.42
		ANT1	10.50
High	1982.50	ANT0	10.23
		ANT1	10.3

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

Channel	Frequency (MHz)	Antenna Port	PAPR (dB)
Low	1940.00	ANT0	10.40
		ANT1	10.11
Mid	1960.00	ANT0	11.17
		ANT1	10.72
High	1980.00	ANT0	10.78
		ANT1	10.40

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

Channel	Frequency (MHz)	Antenna Port	PAPR (dB)
Low	1932.50	ANT0	9.82
		ANT1	9.92
Mid	1960.00	ANT0	7.36
		ANT1	7.29
High	1987.50	ANT0	9.86
		ANT1	9.70

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

Channel	Frequency (MHz)	Antenna Port	PAPR (dB)
Low	1935.00	ANT0	10.20
		ANT1	10.03
Mid	1960.00	ANT0	10.96
		ANT1	10.52
High	1985.00	ANT0	10.62
		ANT1	10.39

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

Channel	Frequency (MHz)	Antenna Port	PAPR (dB)
Low	1937.50	ANT0	10.19
		ANT1	10.84
Mid	1960.00	ANT0	10.83
		ANT1	10.74
High	1982.50	ANT0	11.30
		ANT1	10.70

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

Channel	Frequency (MHz)	Antenna Port	PAPR (dB)
Low	1940.00	ANT0	10.29
		ANT1	9.96
Mid	1960.00	ANT0	10.24
		ANT1	11.23
High	1980.00	ANT0	10.66
		ANT1	10.06

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

Channel	Frequency (MHz)	Antenna Port	PAPR (dB)
Low	1932.50	ANT0	10.19
		ANT1	10.20
Mid	1960.00	ANT0	10.27
		ANT1	10.17
High	1987.50	ANT0	10.18
		ANT1	10.08

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

Channel	Frequency (MHz)	Antenna Port	PAPR (dB)
Low	1935.00	ANT0	10.22
		ANT1	10.10
Mid	1960.00	ANT0	10.22
		ANT1	10.32
High	1985.00	ANT0	9.87
		ANT1	10.30

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

Channel	Frequency (MHz)	Antenna Port	PAPR (dB)
Low	1937.500	ANT0	10.47
		ANT1	10.53
Mid	1960.00	ANT0	10.50
		ANT1	10.99
High	1982.50	ANT0	10.53
		ANT1	10.39

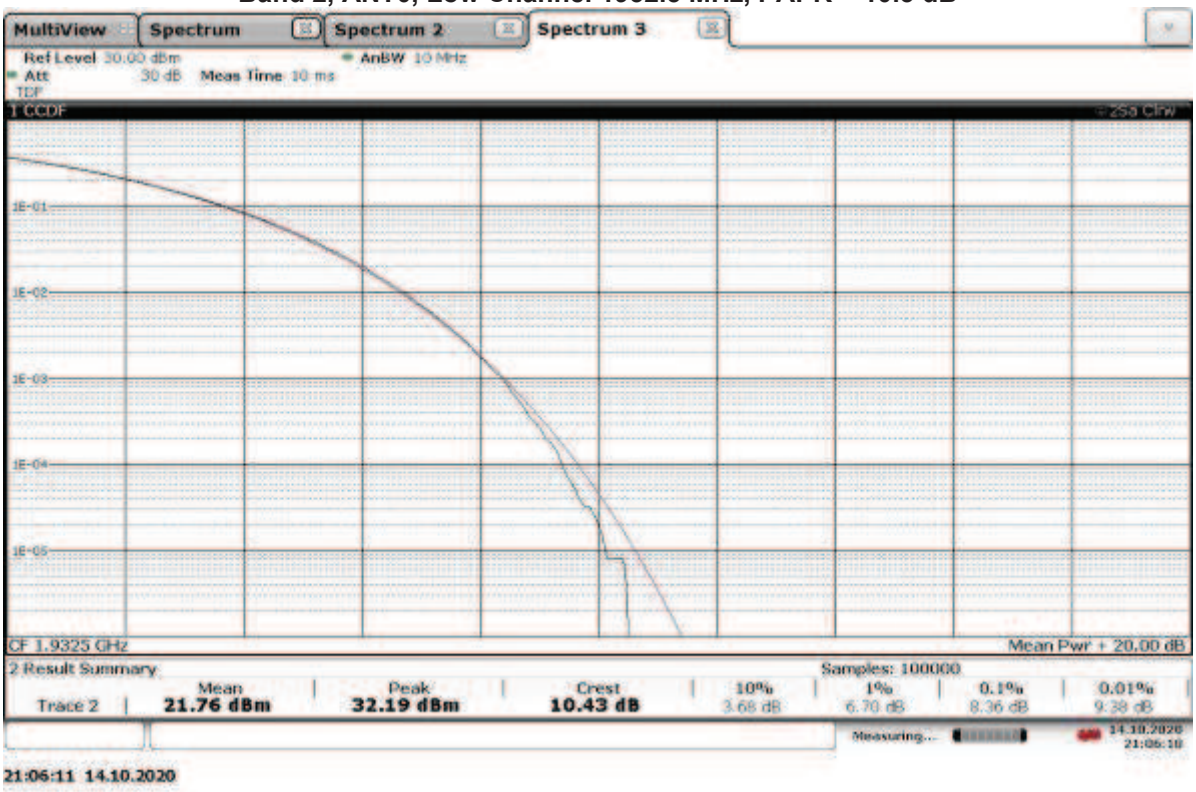
Band 2, Bandwidth: 20 MHz, Modulation: TM3.1a-256QAM

Channel	Frequency (MHz)	Antenna Port	PAPR (dB)
Low	1940	ANT0	10.21
		ANT1	10.24
Mid	1960	ANT0	10.22
		ANT1	10.31
High	1980	ANT0	10.18
		ANT1	7.91

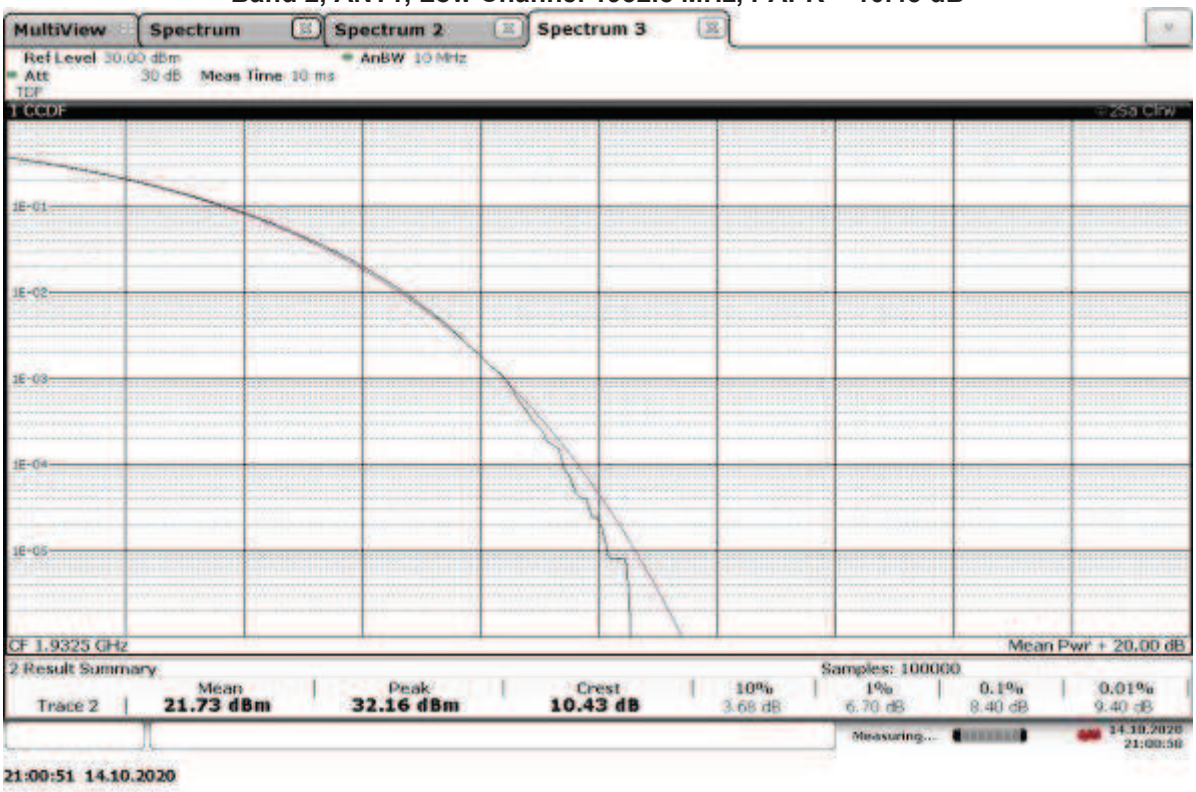
7.4 Setup Photograph:

7.5 Plots/Data:

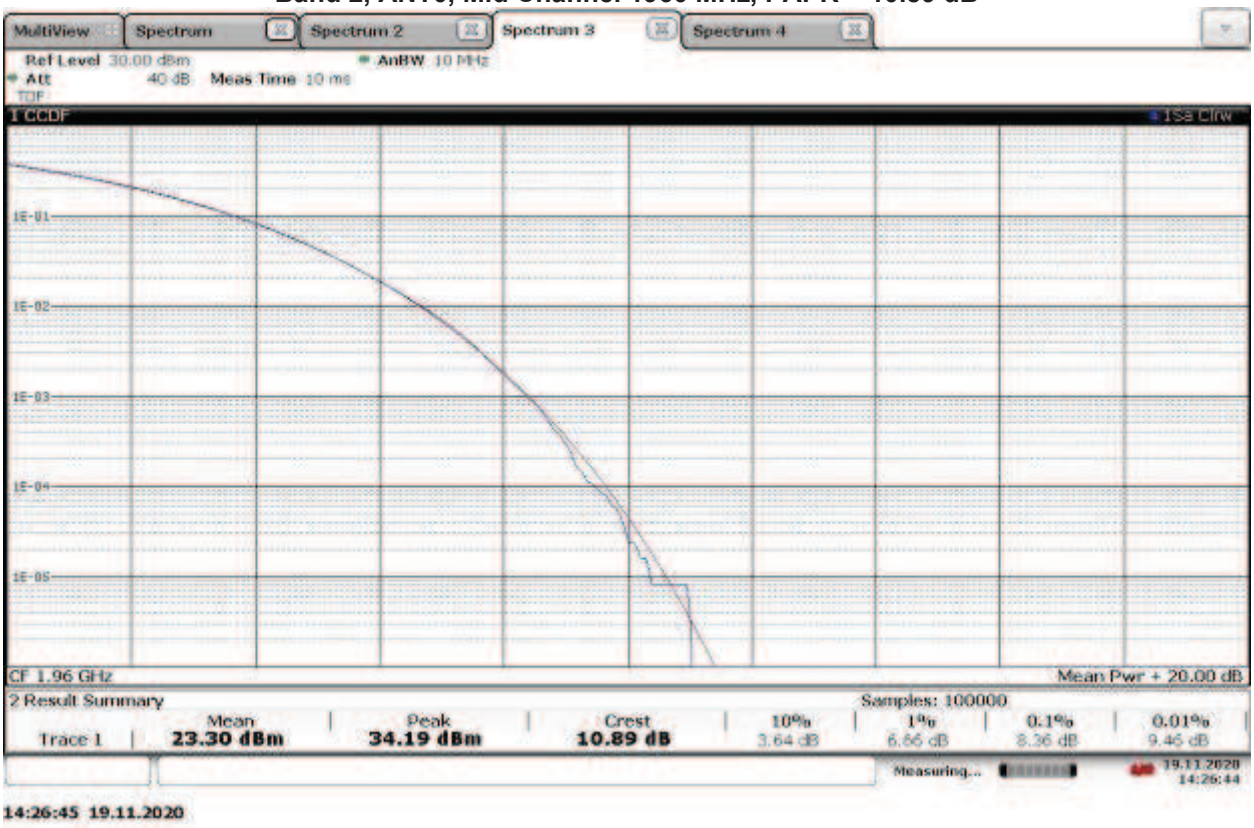
TM1.1-QPSK_5 MHz Bandwidth
Band 2, ANT0, Low Channel 1932.5 MHz, PAPR = 10.3 dB



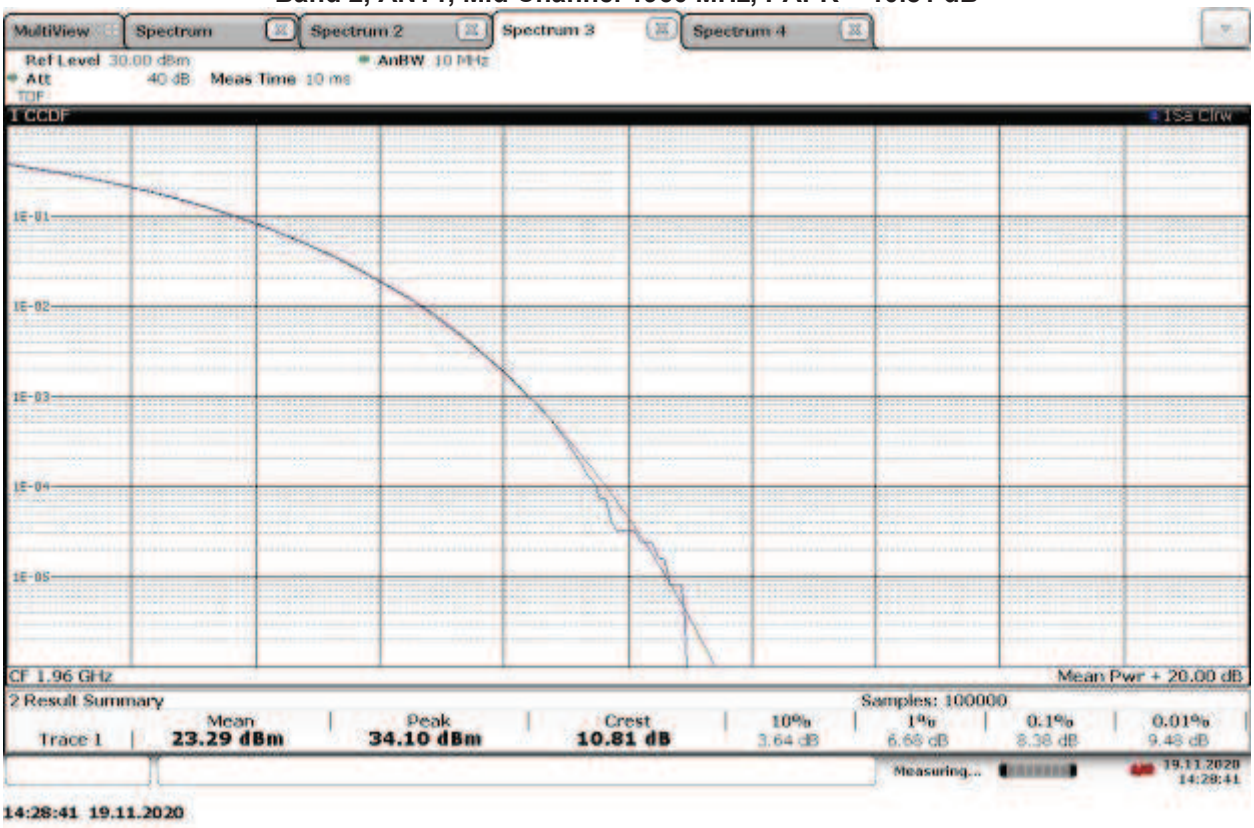
TM1.1-QPSK_5 MHz Bandwidth
Band 2, ANT1, Low Channel 1932.5 MHz, PAPR = 10.43 dB



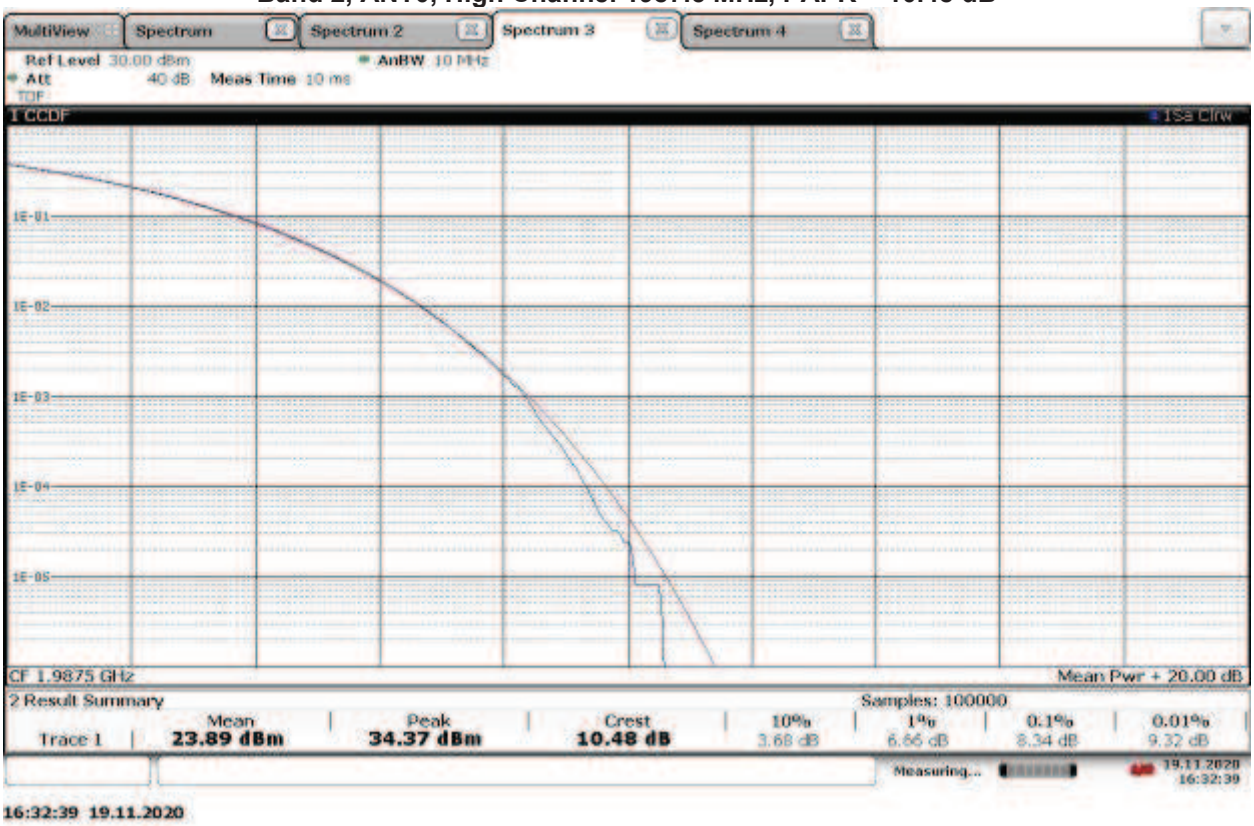
TM1.1-QPSK_5 MHz Bandwidth
Band 2, ANT0, Mid Channel 1960 MHz, PAPR = 10.89 dB



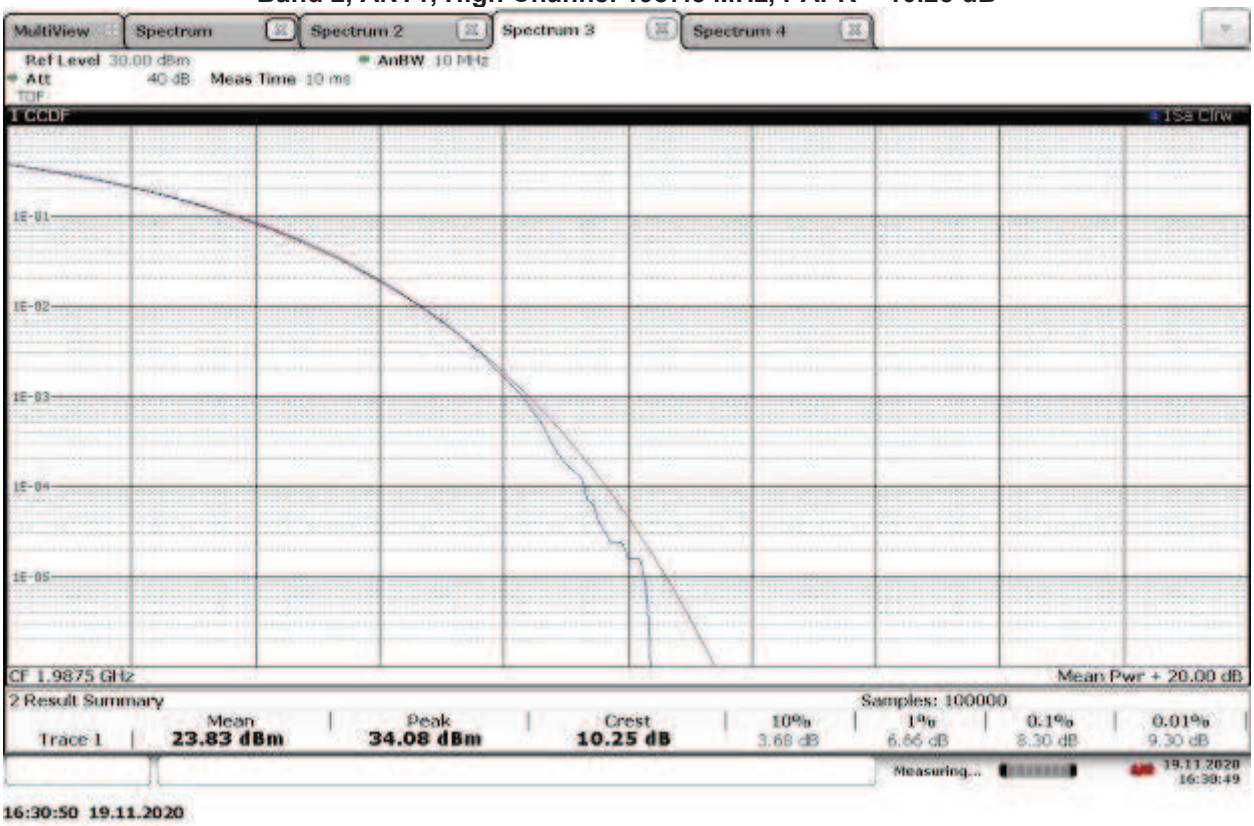
TM1.1-QPSK_5 MHz Bandwidth
Band 2, ANT1, Mid Channel 1960 MHz, PAPR = 10.81 dB



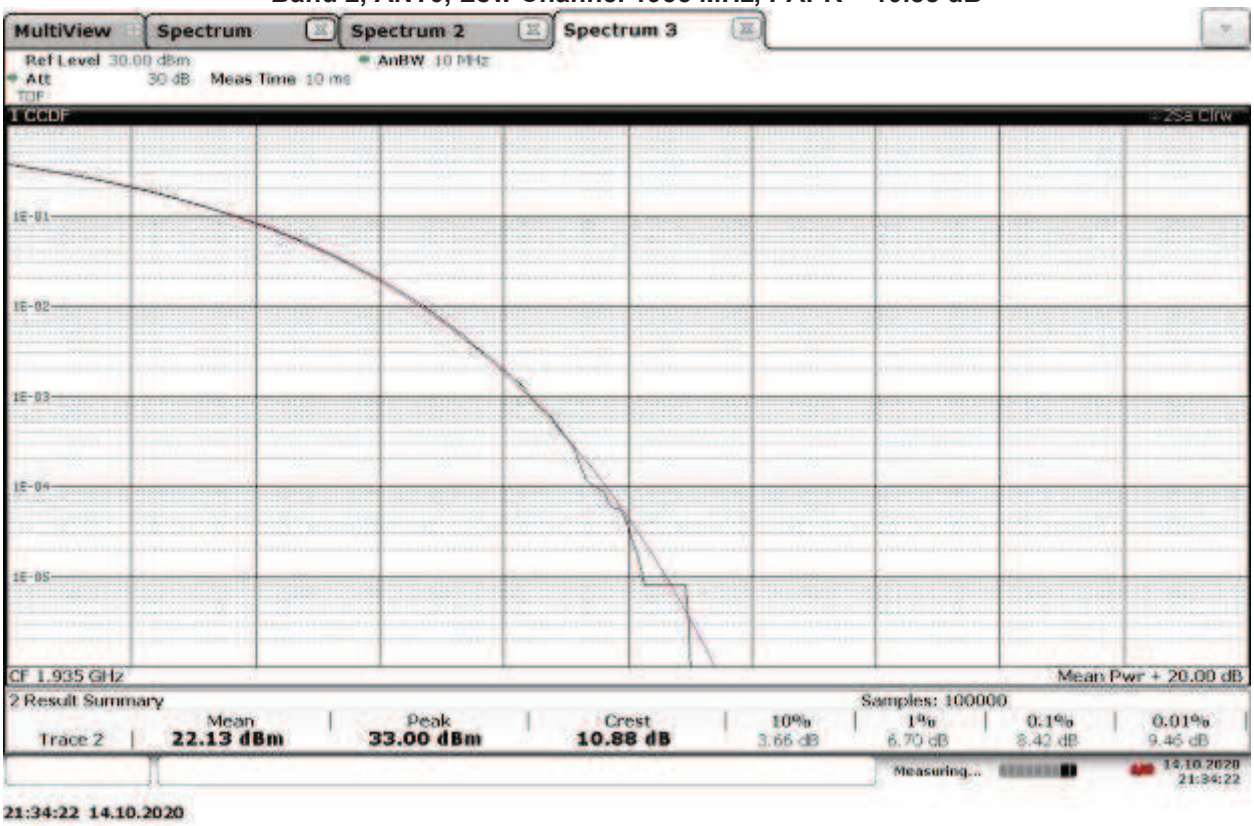
TM1.1-QPSK_5 MHz Bandwidth
Band 2, ANT0, High Channel 1987.5 MHz, PAPR = 10.48 dB



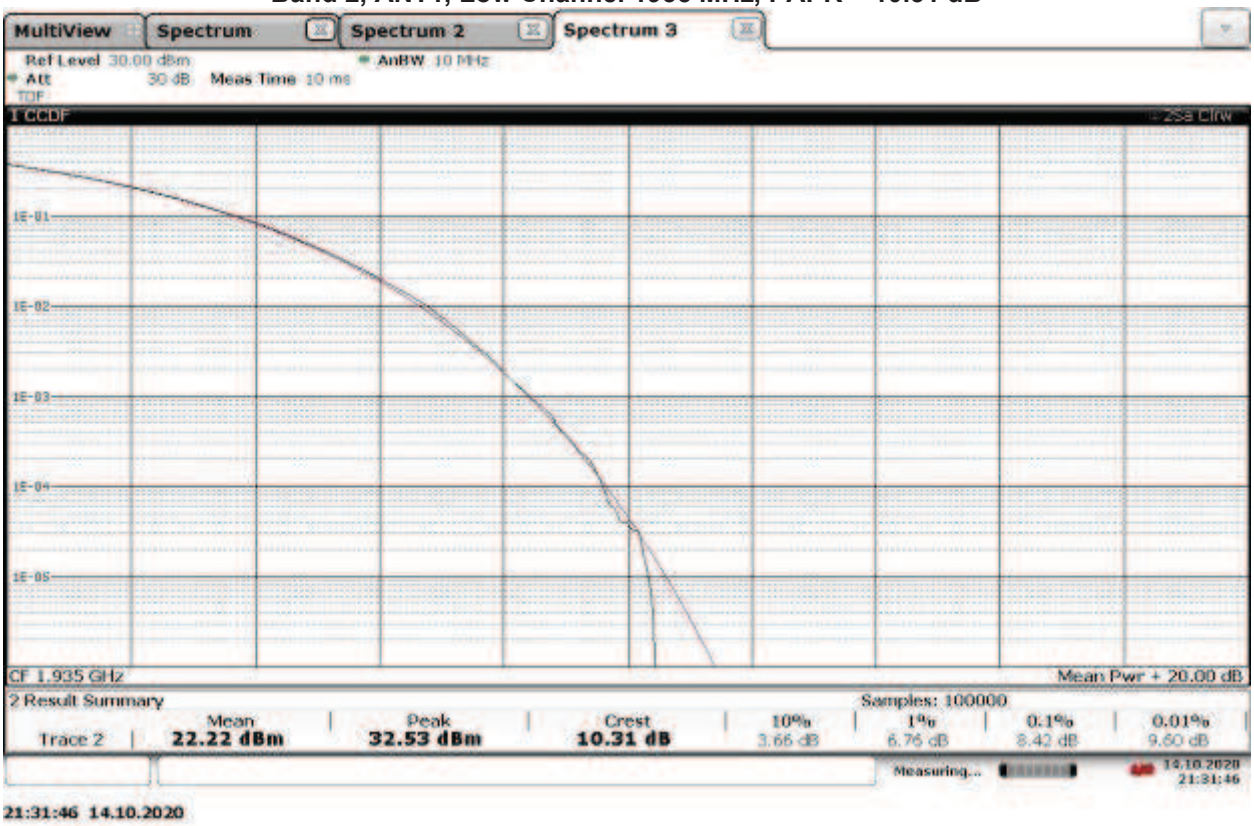
TM1.1-QPSK_5 MHz Bandwidth
Band 2, ANT1, High Channel 1987.5 MHz, PAPR = 10.25 dB



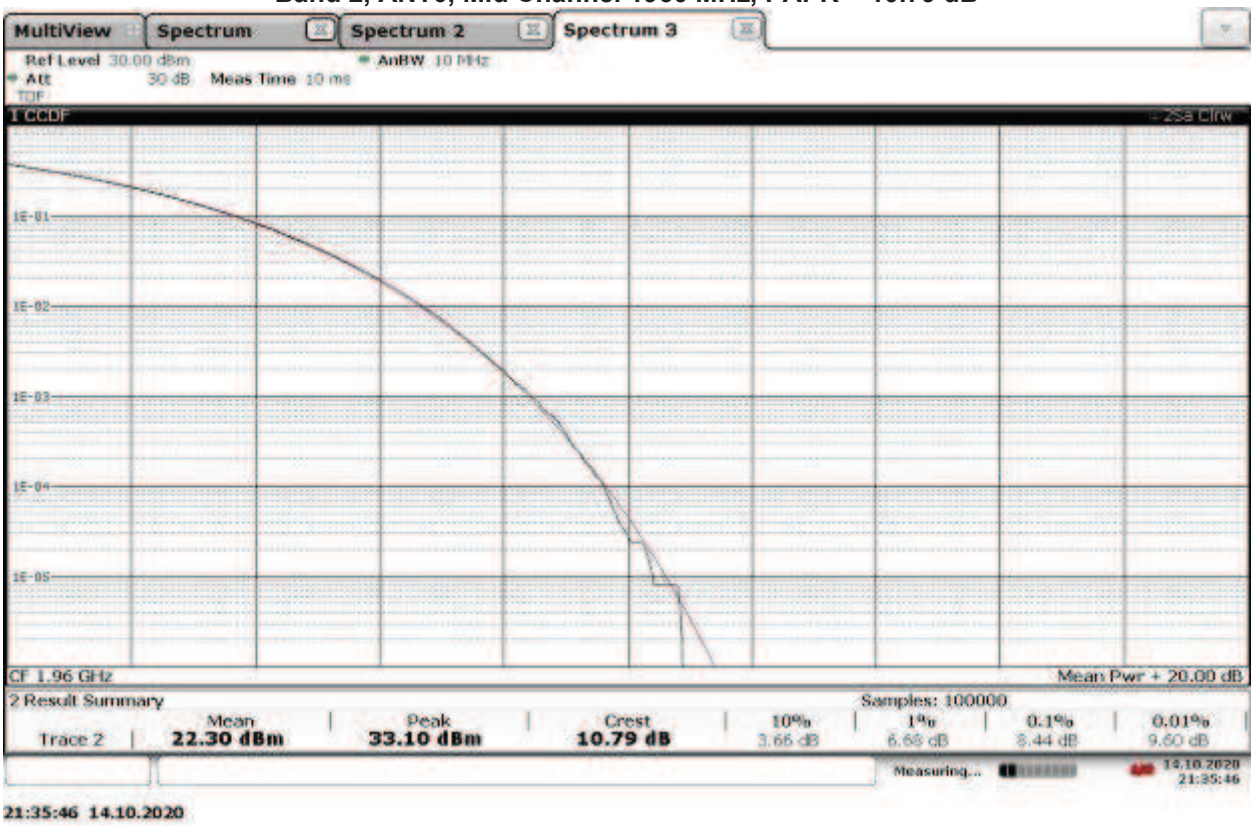
TM1.1-QPSK_10 MHz Bandwidth
Band 2, ANT0, Low Channel 1935 MHz, PAPR = 10.88 dB



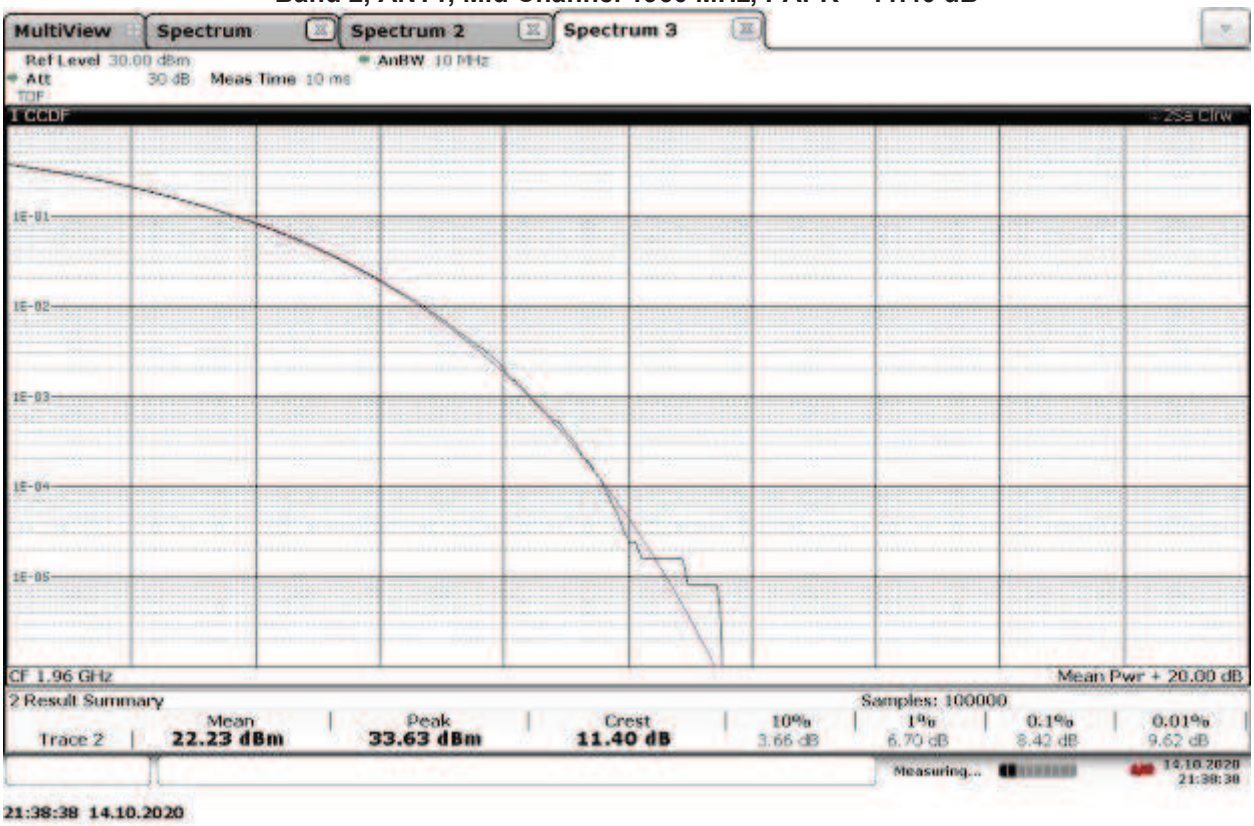
TM1.1-QPSK_10 MHz Bandwidth
Band 2, ANT1, Low Channel 1935 MHz, PAPR = 10.31 dB



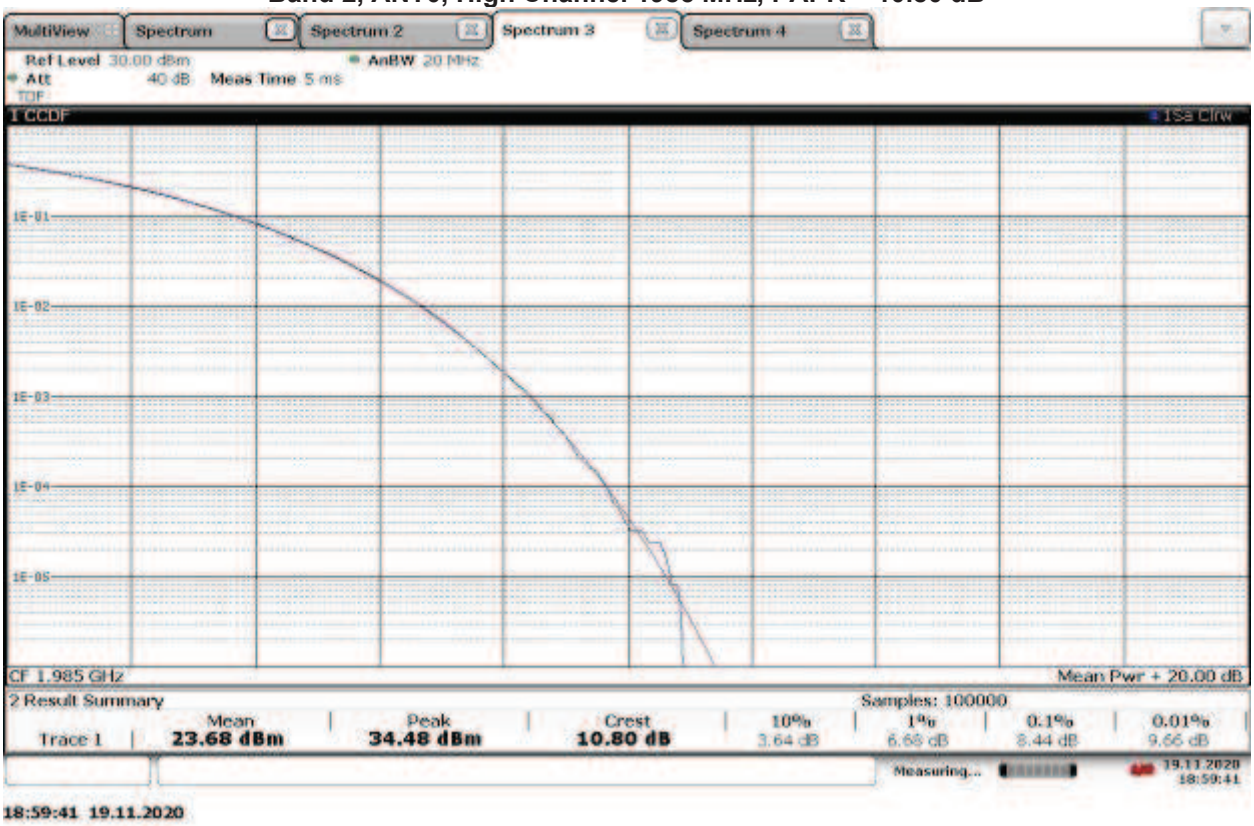
TM1.1-QPSK_10 MHz Bandwidth
Band 2, ANT0, Mid Channel 1960 MHz, PAPR = 10.79 dB



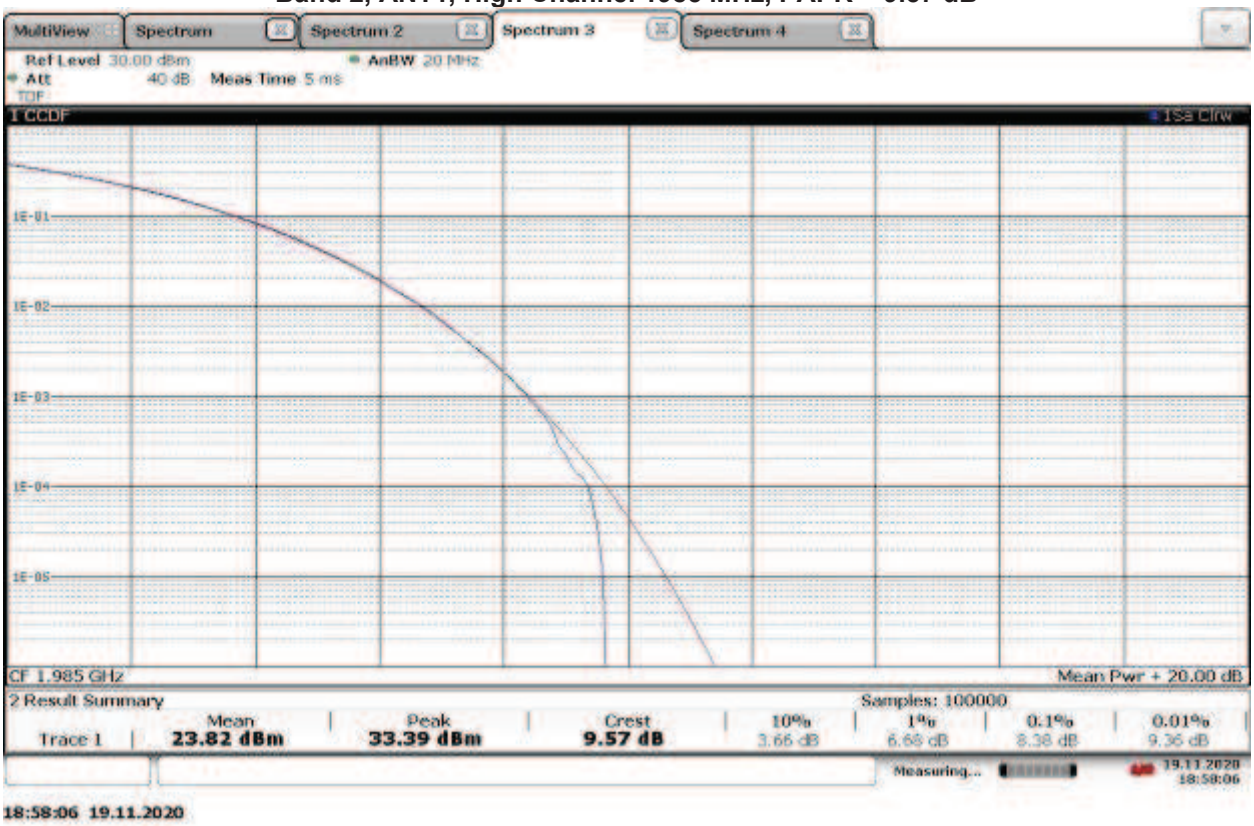
TM1.1-QPSK_10 MHz Bandwidth
Band 2, ANT1, Mid Channel 1960 MHz, PAPR = 11.40 dB



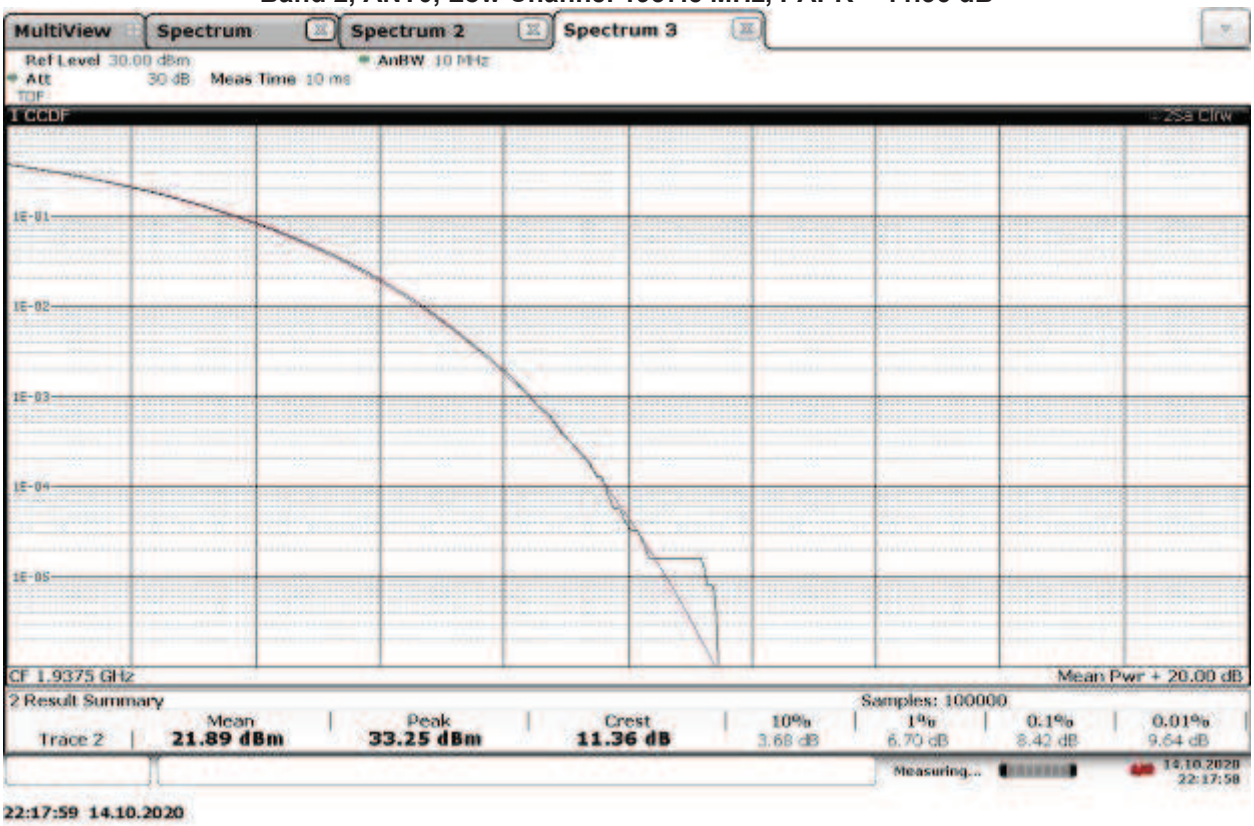
TM1.1-QPSK_10 MHz Bandwidth
Band 2, ANT0, High Channel 1985 MHz, PAPR = 10.80 dB



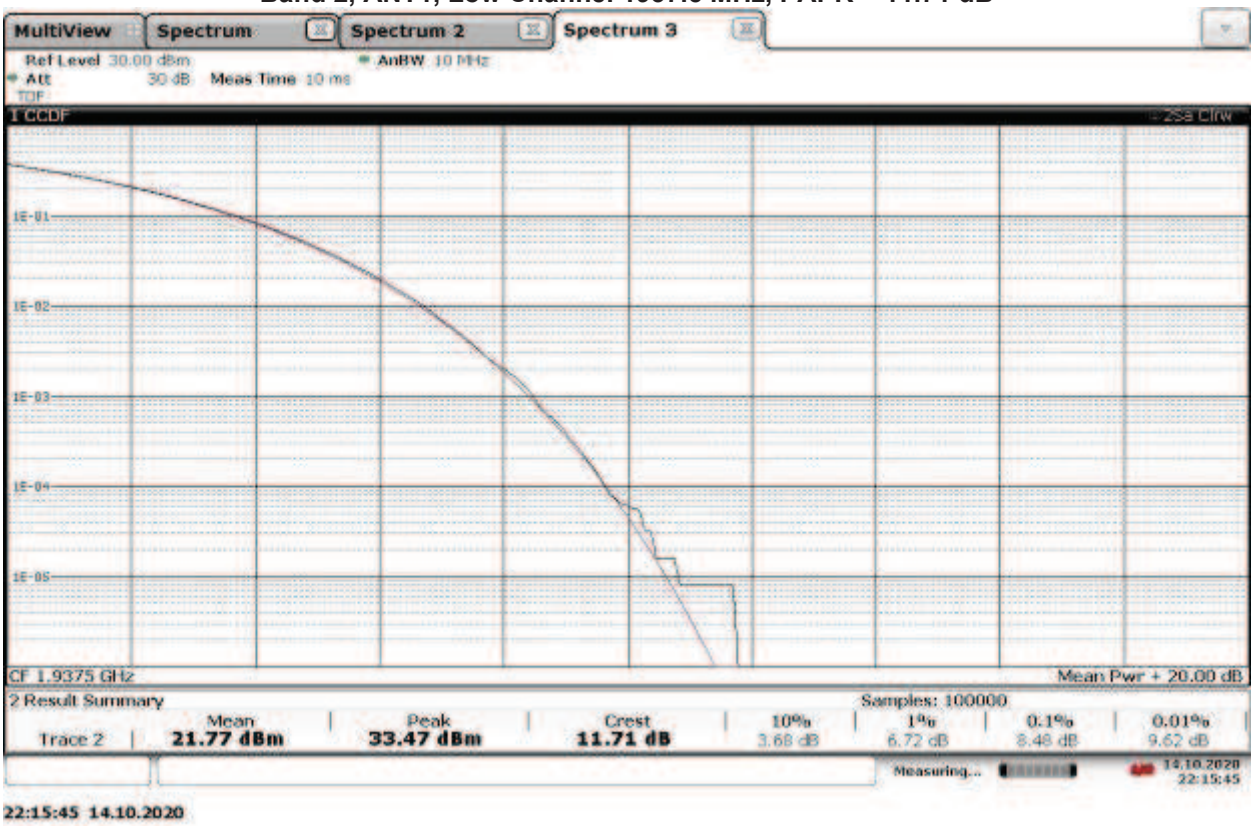
TM1.1-QPSK_10 MHz Bandwidth
Band 2, ANT1, High Channel 1985 MHz, PAPR = 9.57 dB



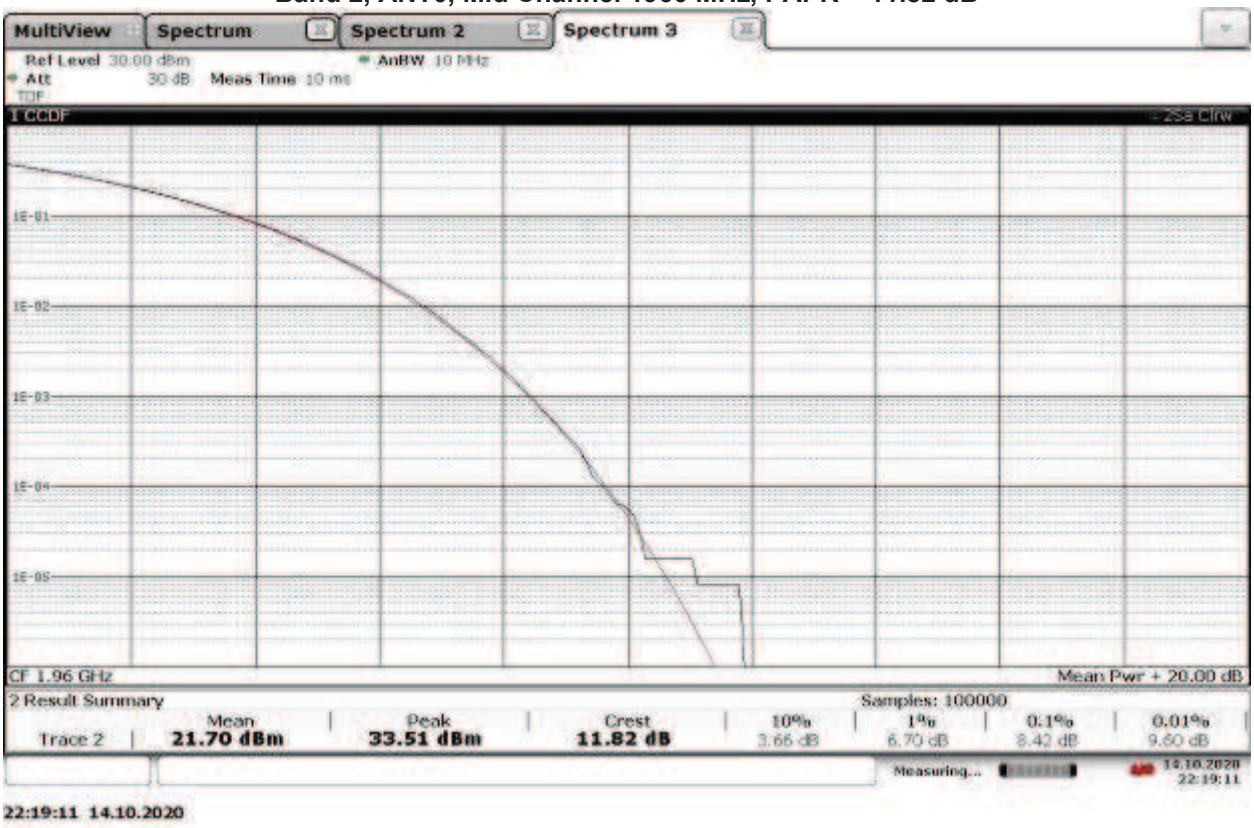
TM1.1-QPSK_15 MHz Bandwidth
Band 2, ANT0, Low Channel 1937.5 MHz, PAPR = 11.36 dB



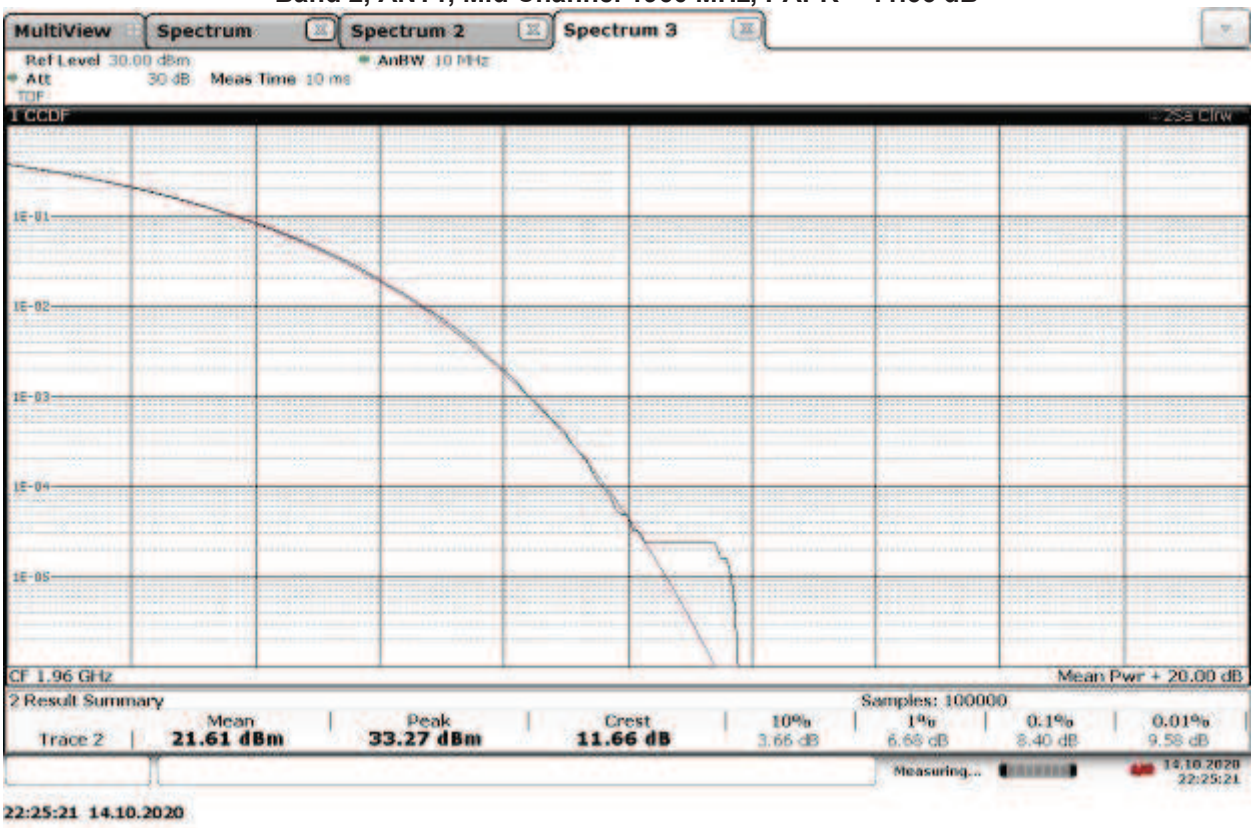
TM1.1-QPSK_15 MHz Bandwidth
Band 2, ANT1, Low Channel 1937.5 MHz, PAPR = 11.71 dB



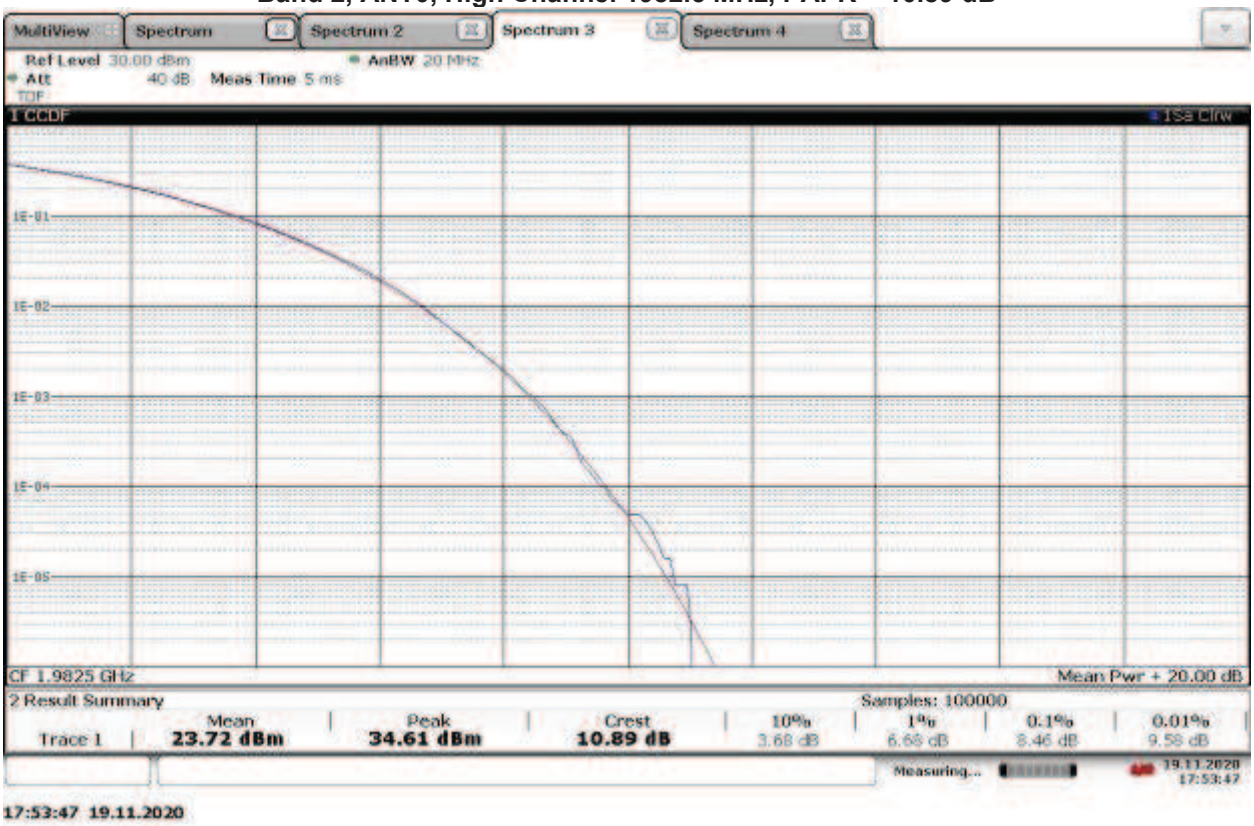
TM1.1-QPSK_15 MHz Bandwidth
Band 2, ANT0, Mid Channel 1960 MHz, PAPR = 11.82 dB



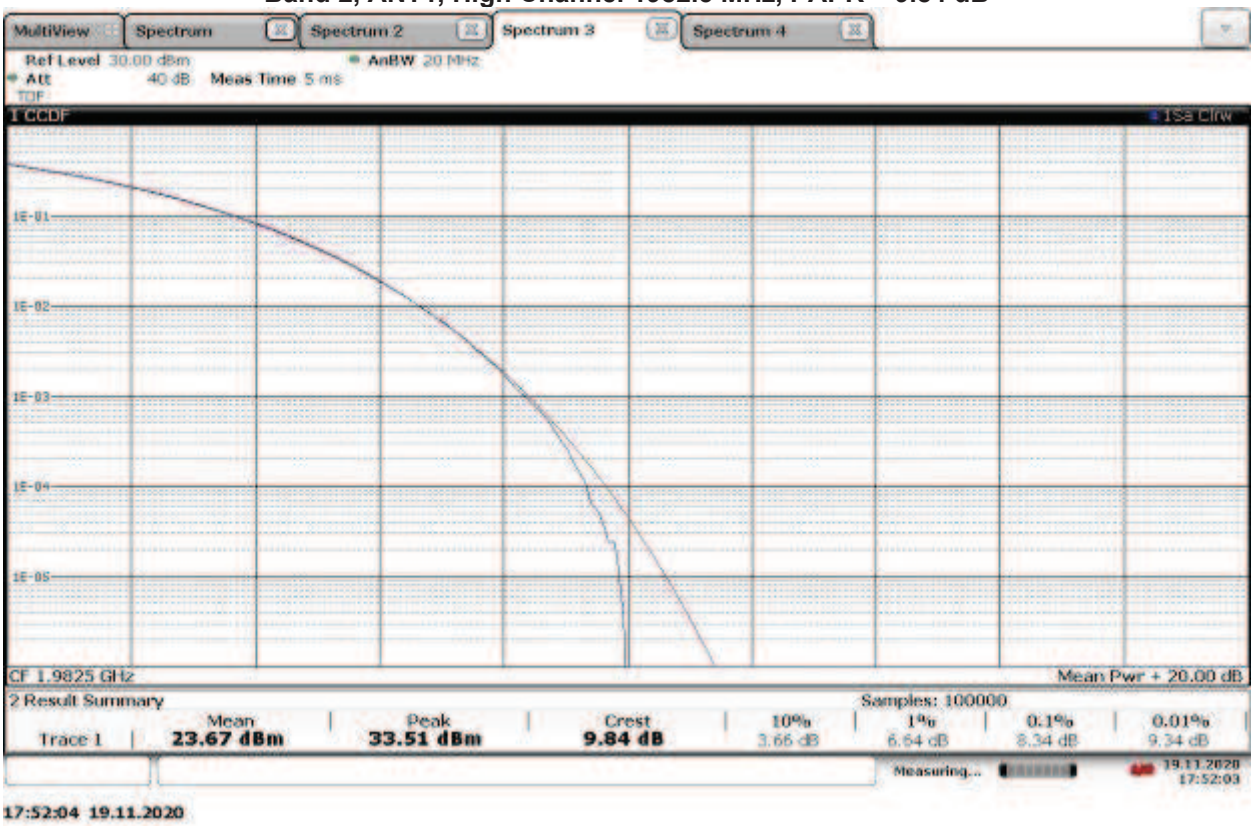
TM1.1-QPSK_15 MHz Bandwidth
Band 2, ANT1, Mid Channel 1960 MHz, PAPR = 11.66 dB



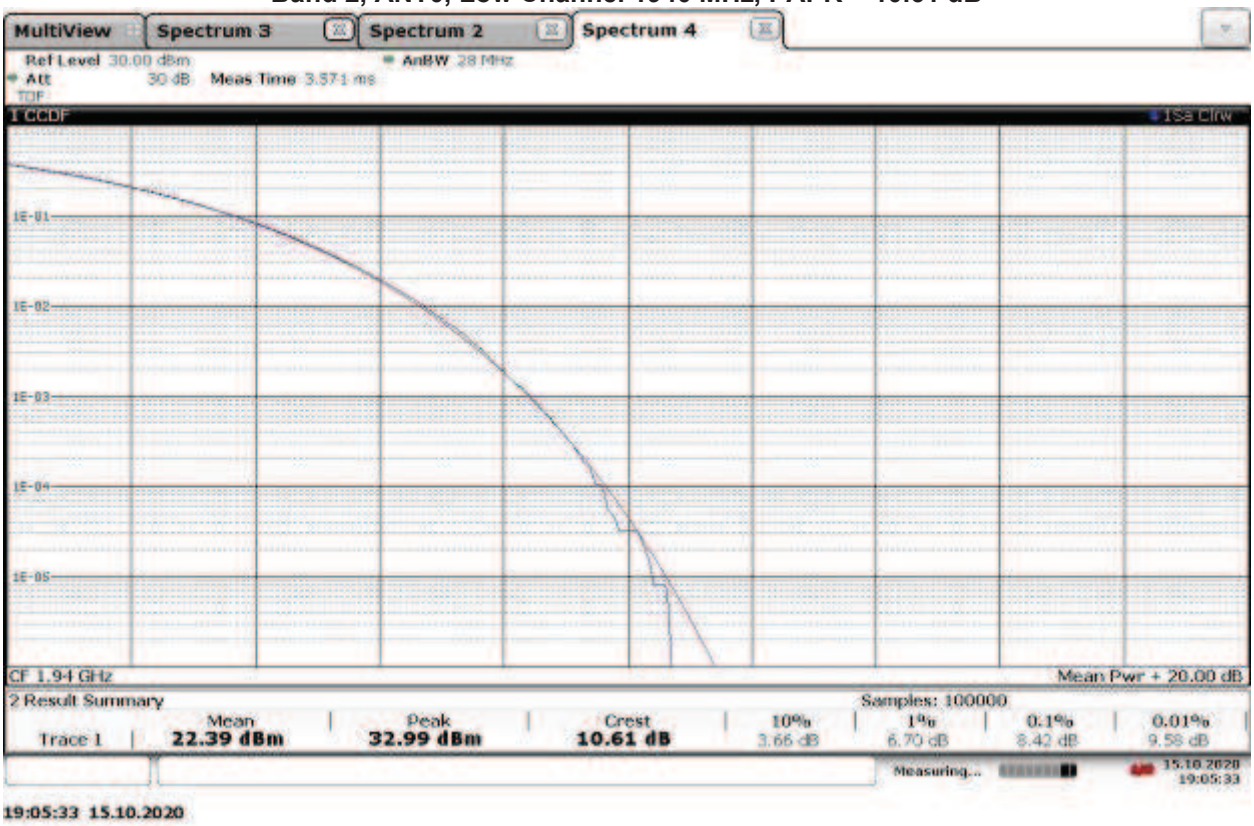
TM1.1-QPSK_15 MHz Bandwidth
Band 2, ANT0, High Channel 1982.5 MHz, PAPR = 10.89 dB



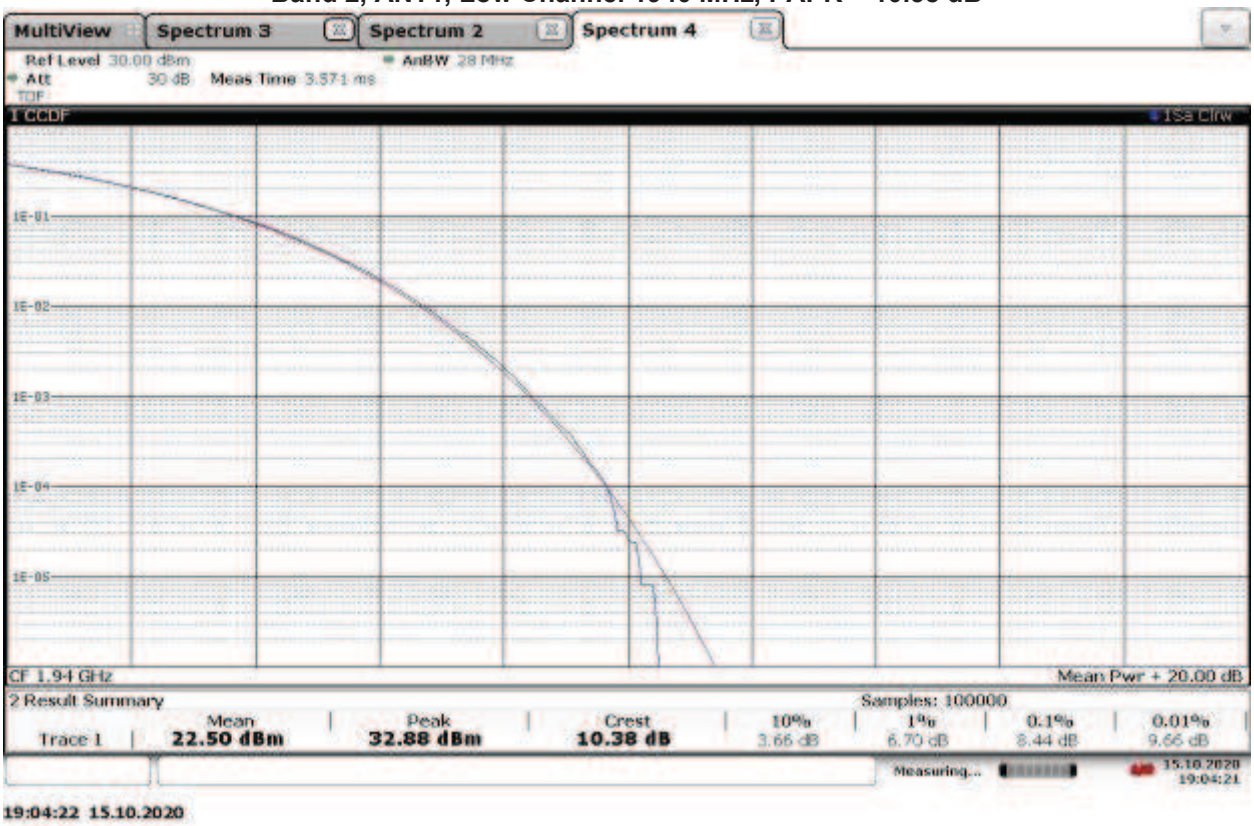
TM1.1-QPSK_15 MHz Bandwidth
Band 2, ANT1, High Channel 1982.5 MHz, PAPR = 9.84 dB



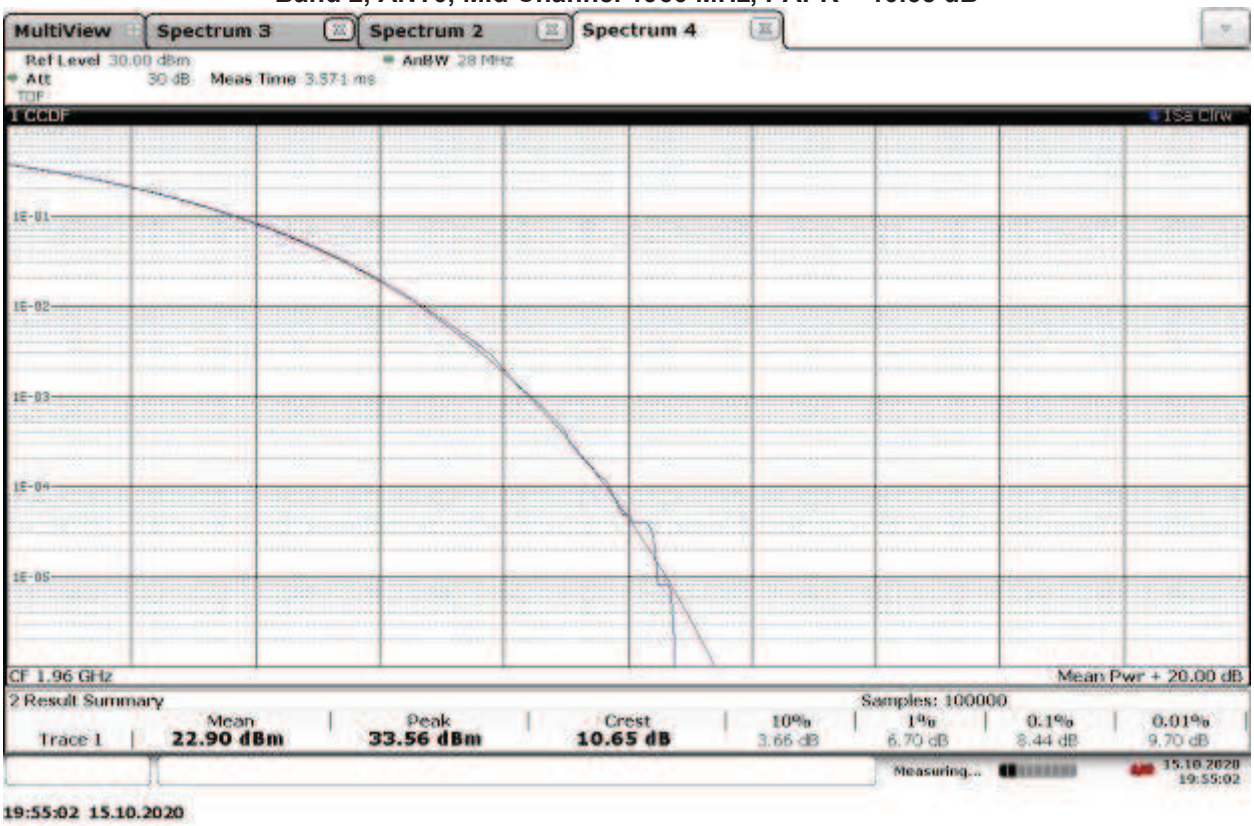
TM1.1-QPSK_20 MHz Bandwidth
Band 2, ANT0, Low Channel 1940 MHz, PAPR = 10.61 dB



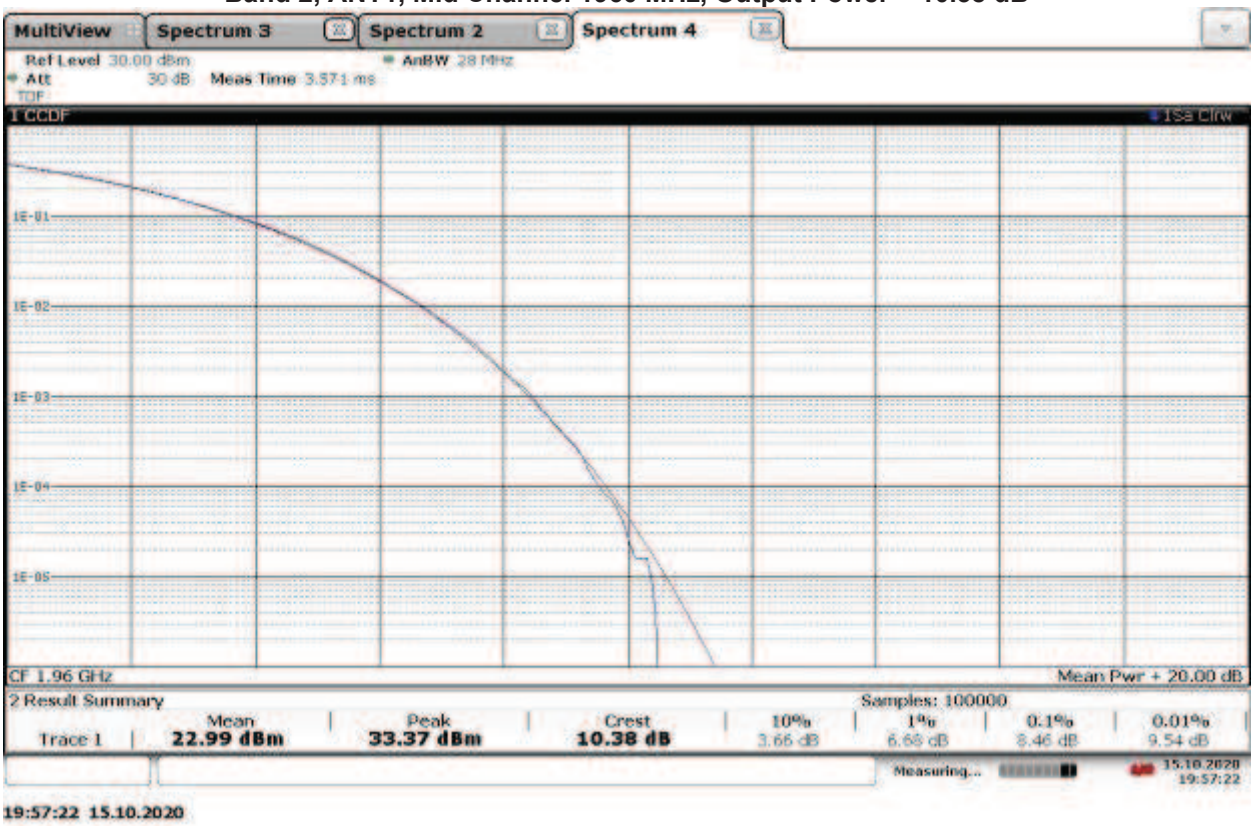
TM1.1-QPSK_20 MHz Bandwidth
Band 2, ANT1, Low Channel 1940 MHz, PAPR = 10.38 dB



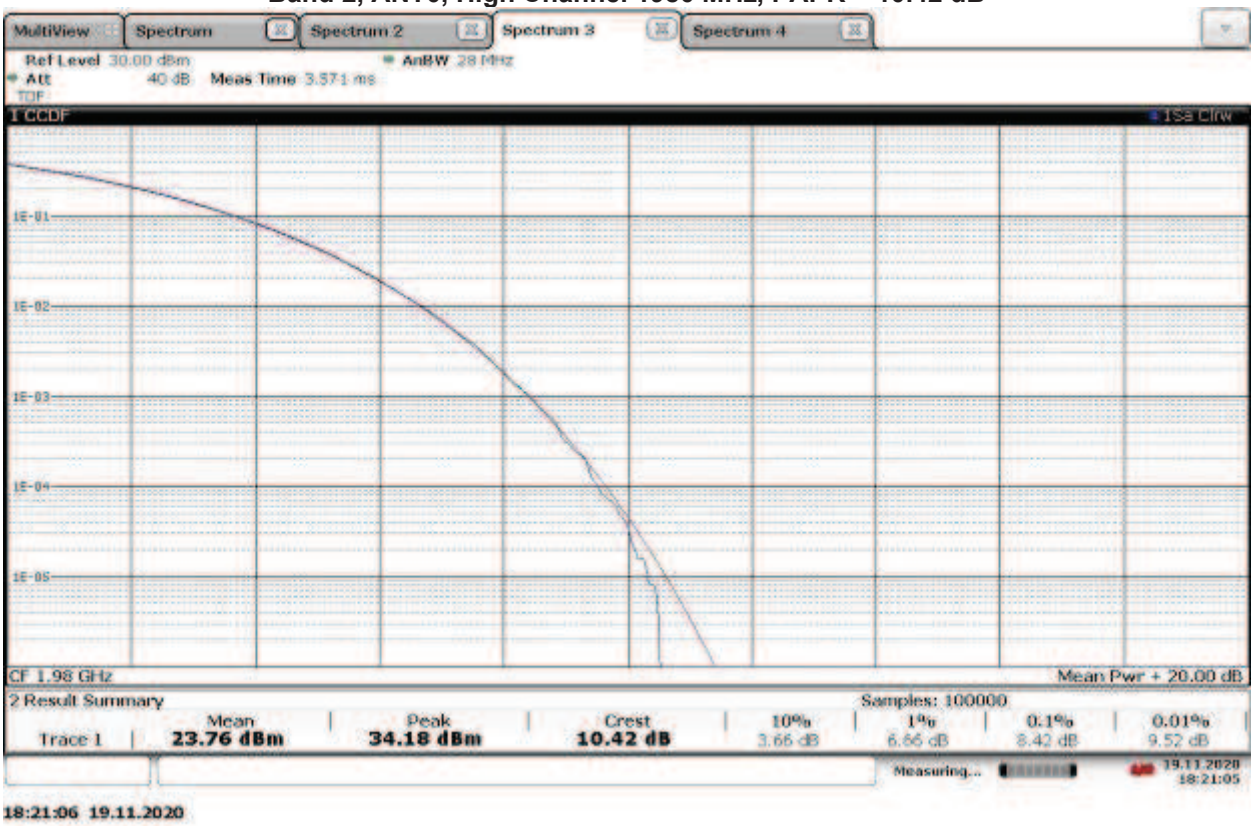
TM1.1-QPSK_20 MHz Bandwidth
Band 2, ANT0, Mid Channel 1960 MHz, PAPR = 10.65 dB



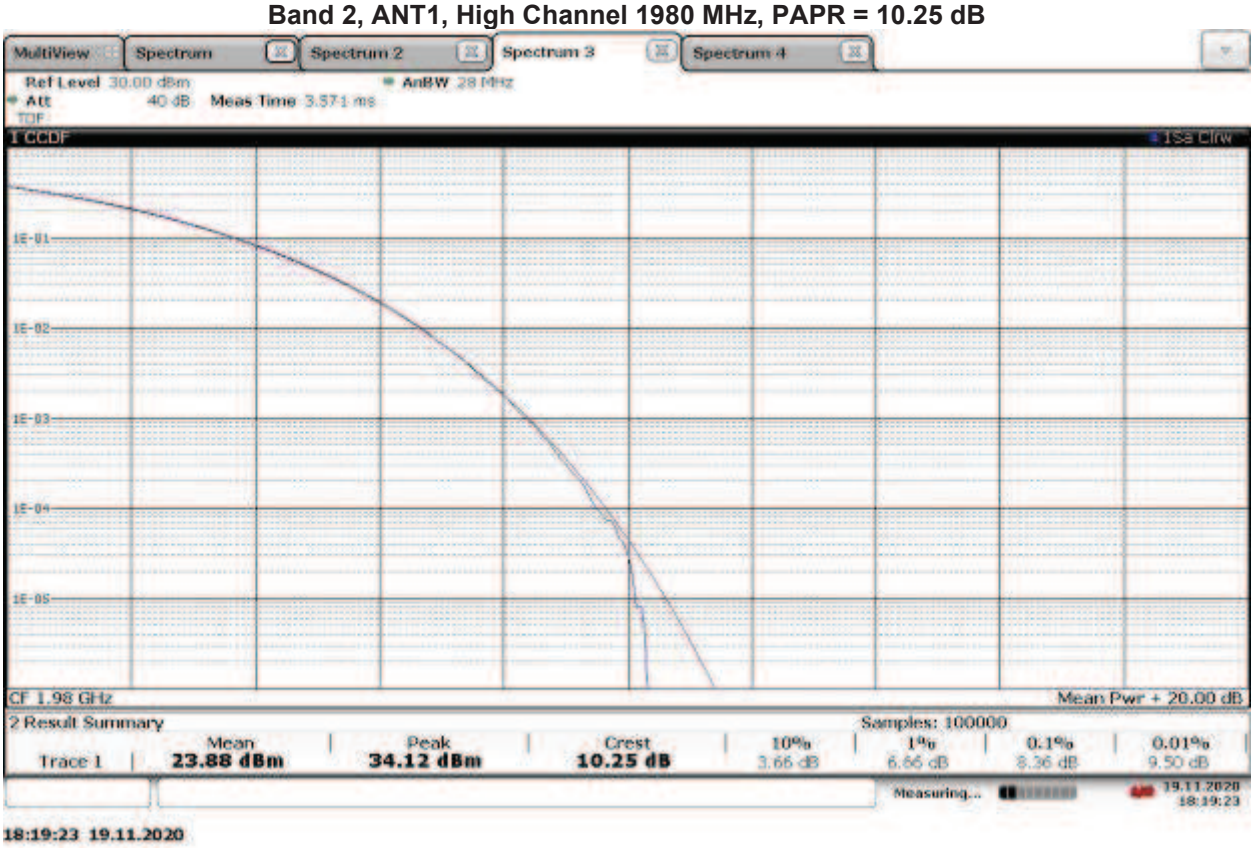
TM1.1-QPSK_20 MHz Bandwidth
Band 2, ANT1, Mid Channel 1960 MHz, Output Power = 10.38 dB



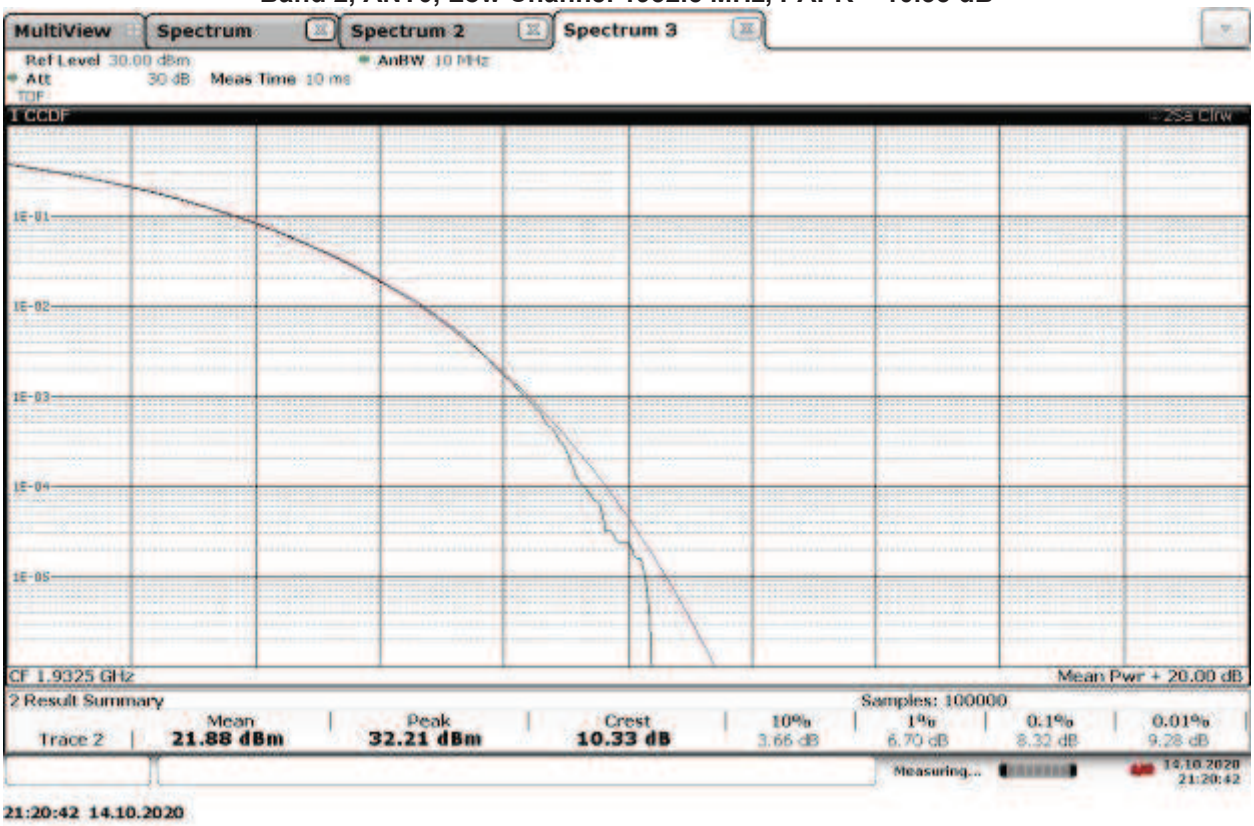
TM1.1-QPSK_20 MHz Bandwidth
Band 2, ANT0, High Channel 1980 MHz, PAPR = 10.42 dB



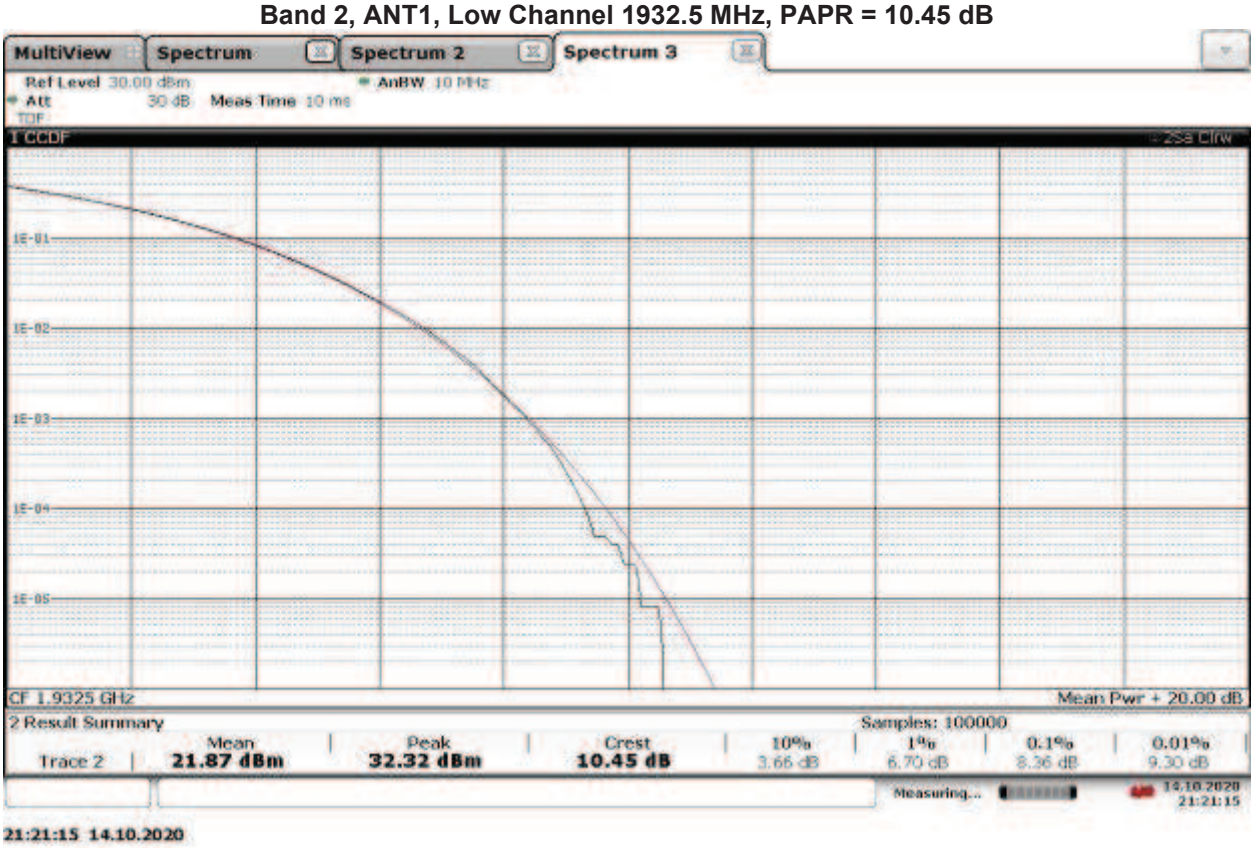
TM1.1-QPSK_20 MHz Bandwidth
Band 2, ANT1, High Channel 1980 MHz, PAPR = 10.25 dB



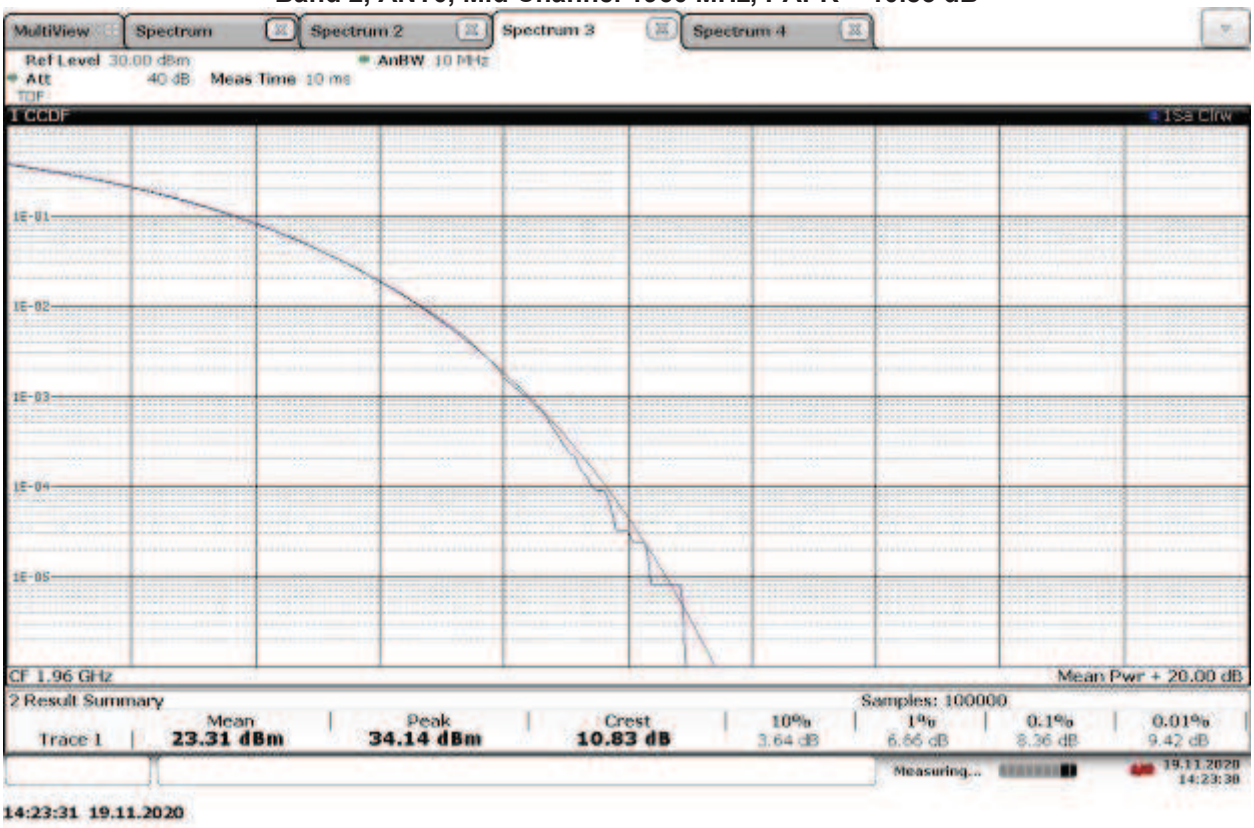
TM3.2 - 16QAM_5MHz Bandwidth
Band 2, ANT0, Low Channel 1932.5 MHz, PAPR = 10.33 dB



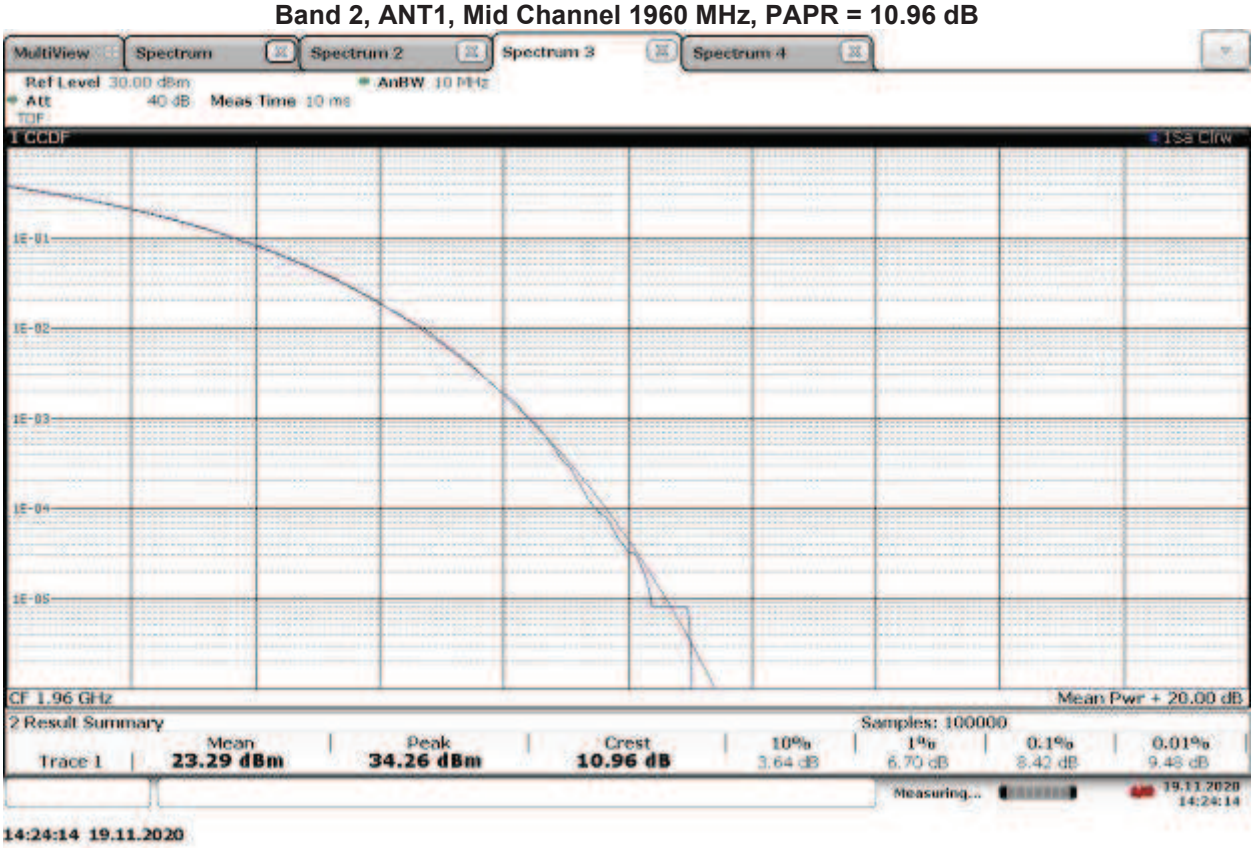
TM3.2 - 16QAM_5MHz Bandwidth
Band 2, ANT1, Low Channel 1932.5 MHz, PAPR = 10.45 dB



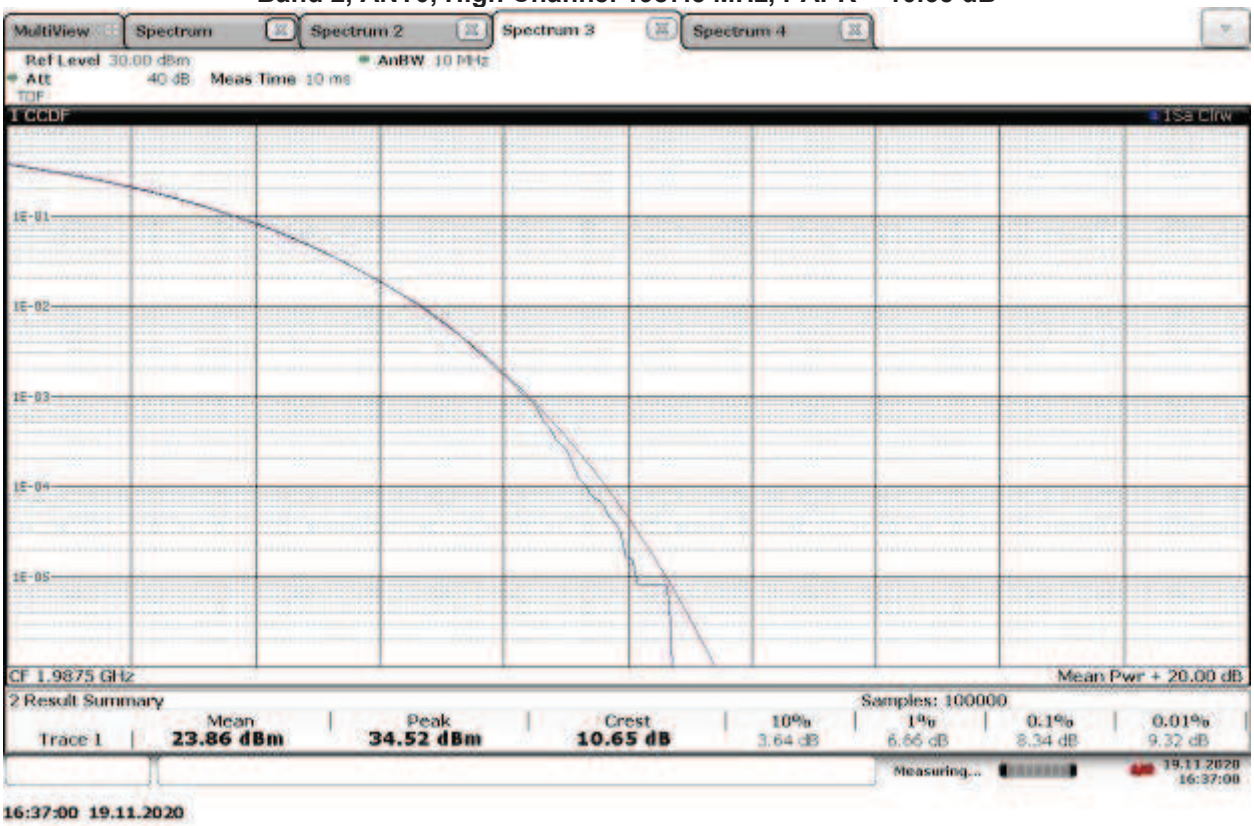
TM3.2 - 16QAM_5MHz Bandwidth
Band 2, ANT0, Mid Channel 1960 MHz, PAPR = 10.83 dB



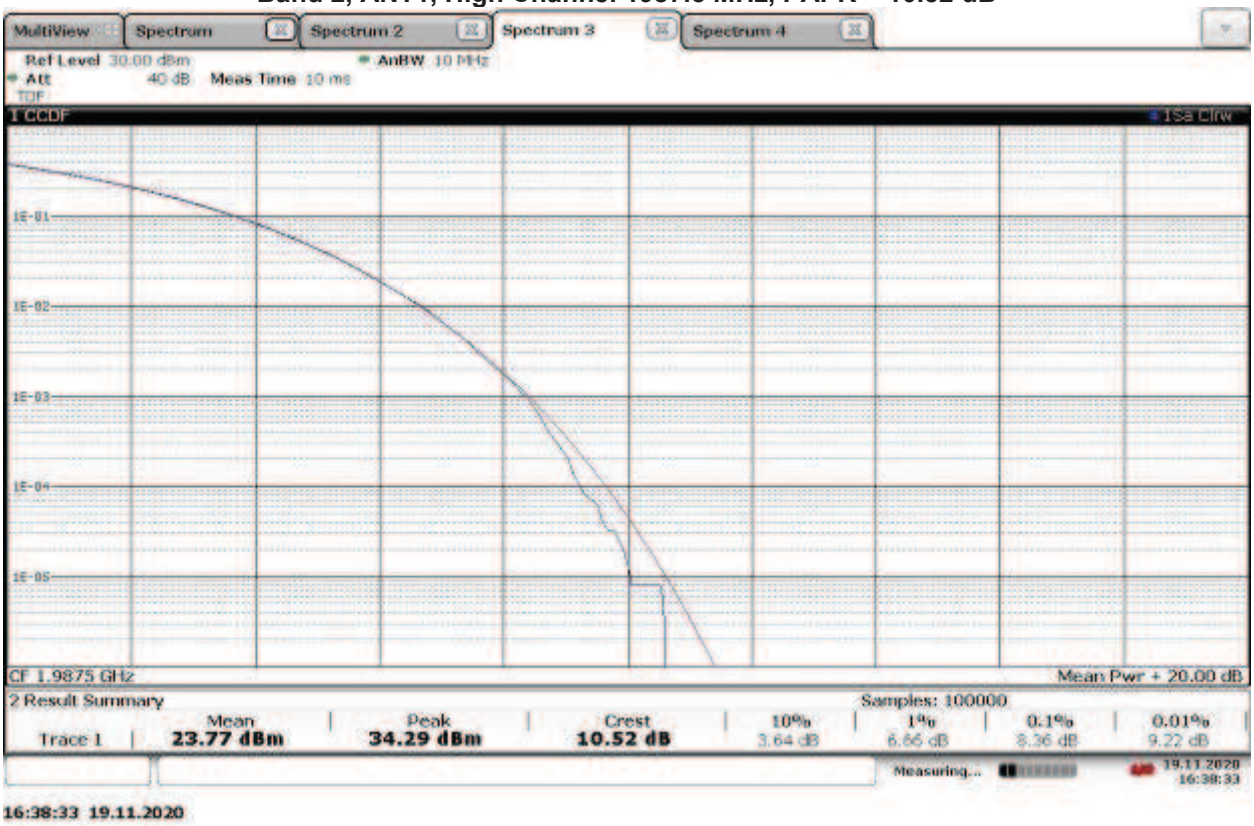
TM3.2 - 16QAM_5MHz Bandwidth
Band 2, ANT1, Mid Channel 1960 MHz, PAPR = 10.96 dB



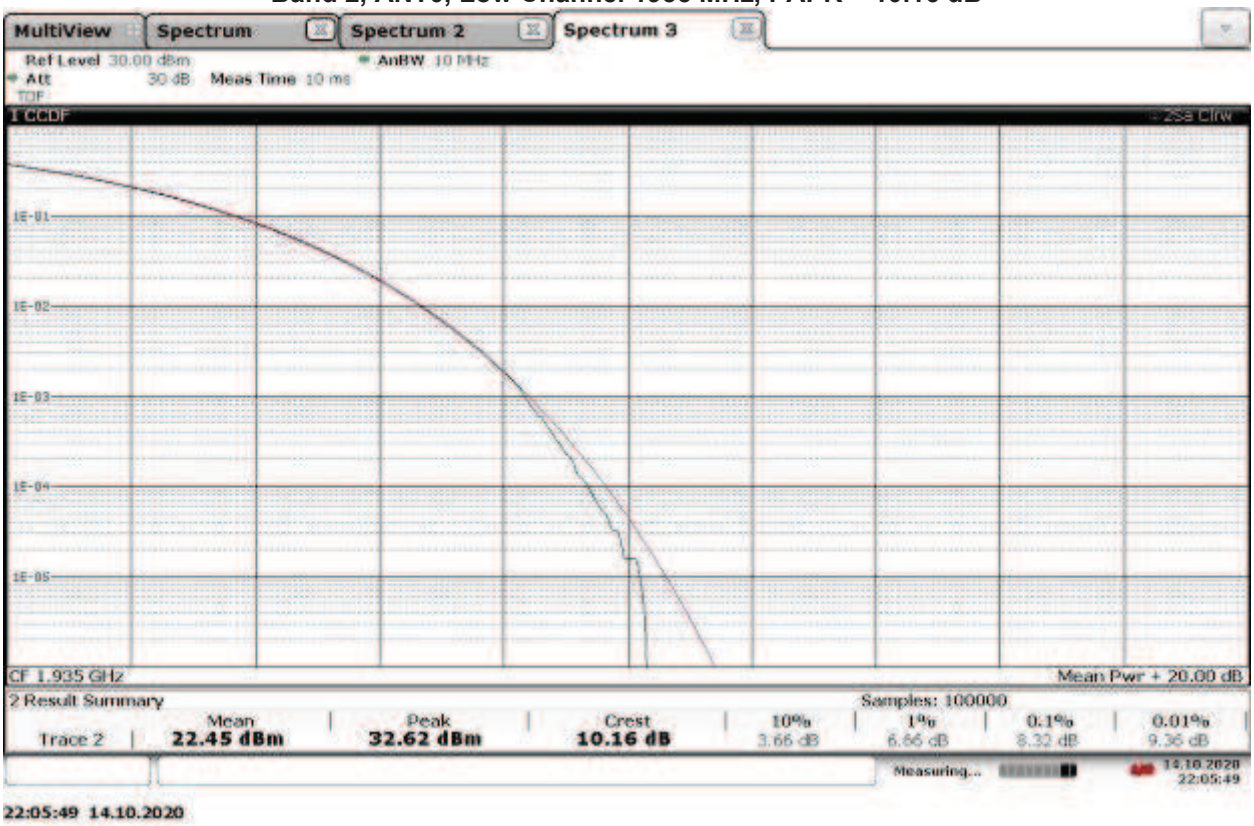
TM3.2 - 16QAM_5MHz Bandwidth
Band 2, ANT0, High Channel 1987.5 MHz, PAPR = 10.65 dB



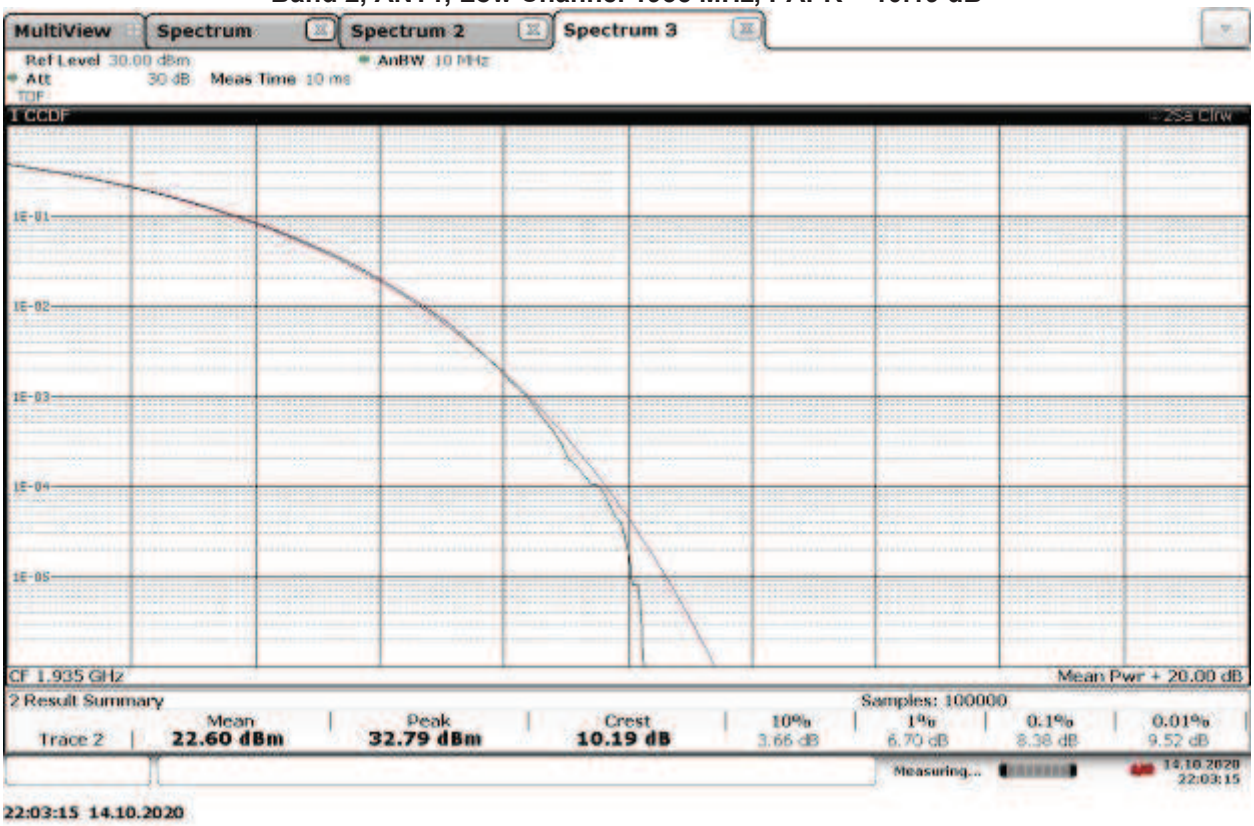
TM3.2 - 16QAM_5MHz Bandwidth
Band 2, ANT1, High Channel 1987.5 MHz, PAPR = 10.52 dB



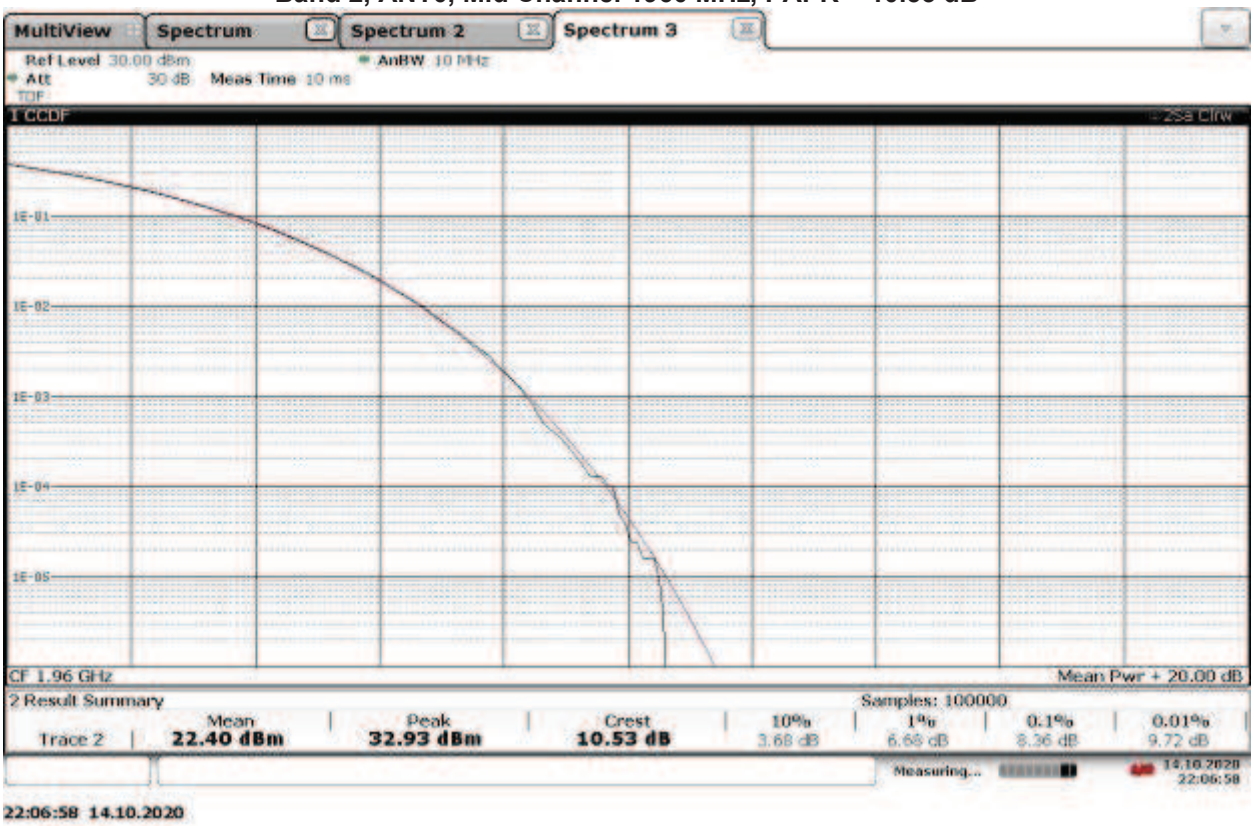
TM3.2 - 16QAM_10 MHz Bandwidth
Band 2, ANT0, Low Channel 1935 MHz, PAPR = 10.16 dB



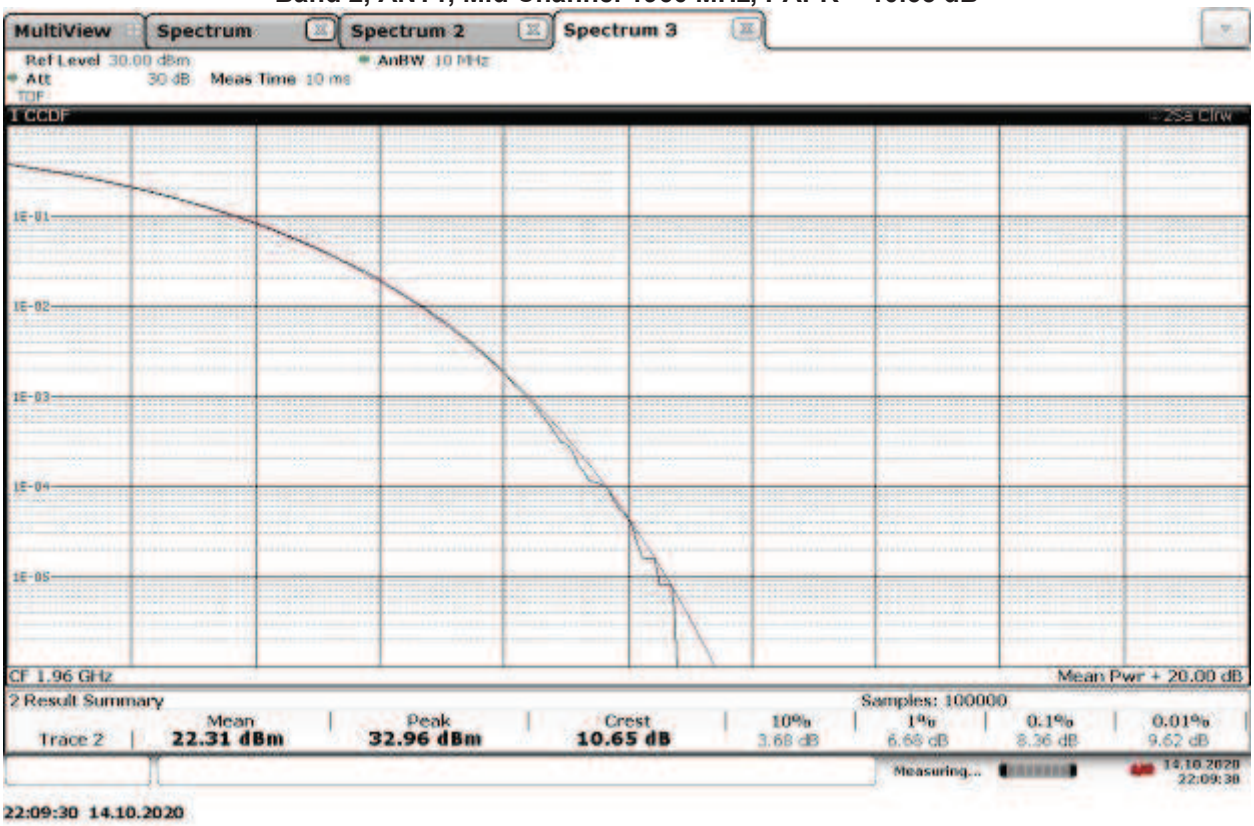
TM3.2 - 16QAM_10 MHz Bandwidth
Band 2, ANT1, Low Channel 1935 MHz, PAPR = 10.19 dB



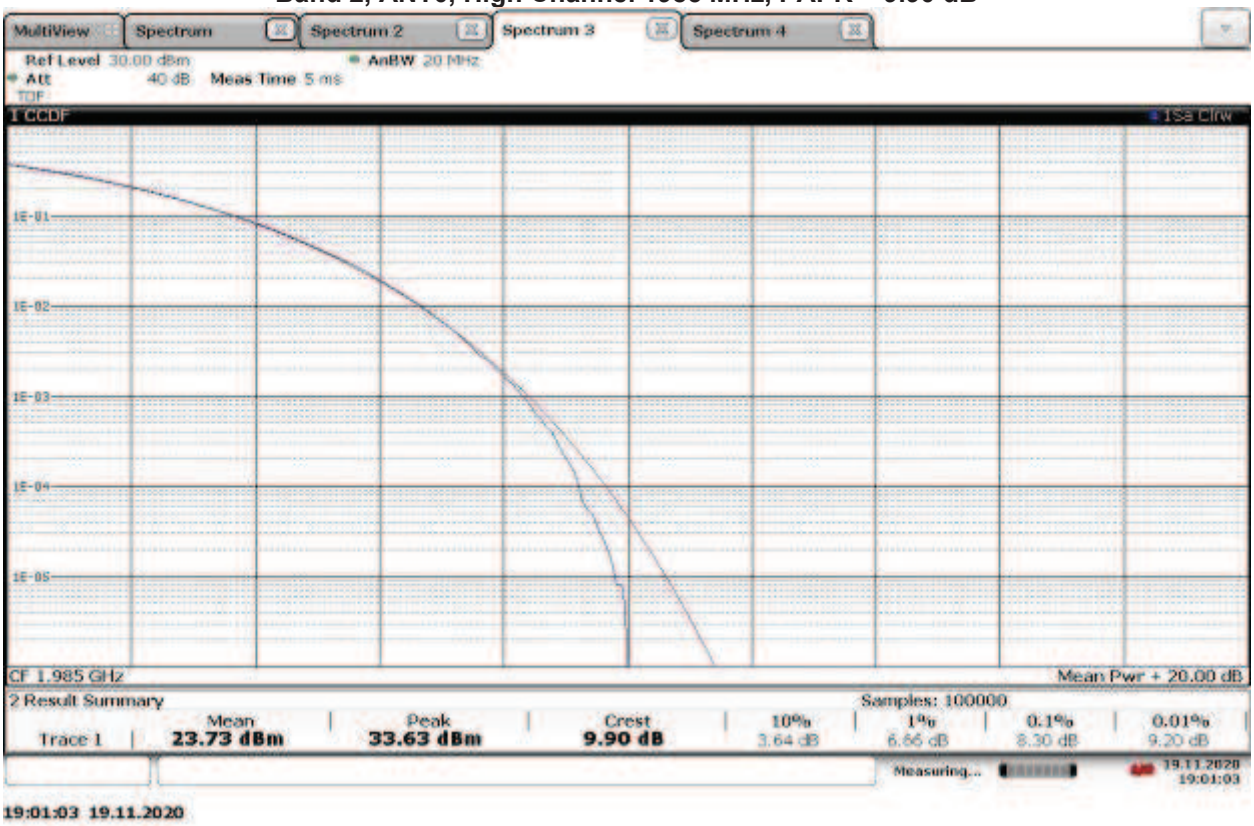
TM3.2 - 16QAM_10 MHz Bandwidth
Band 2, ANT0, Mid Channel 1960 MHz, PAPR = 10.53 dB



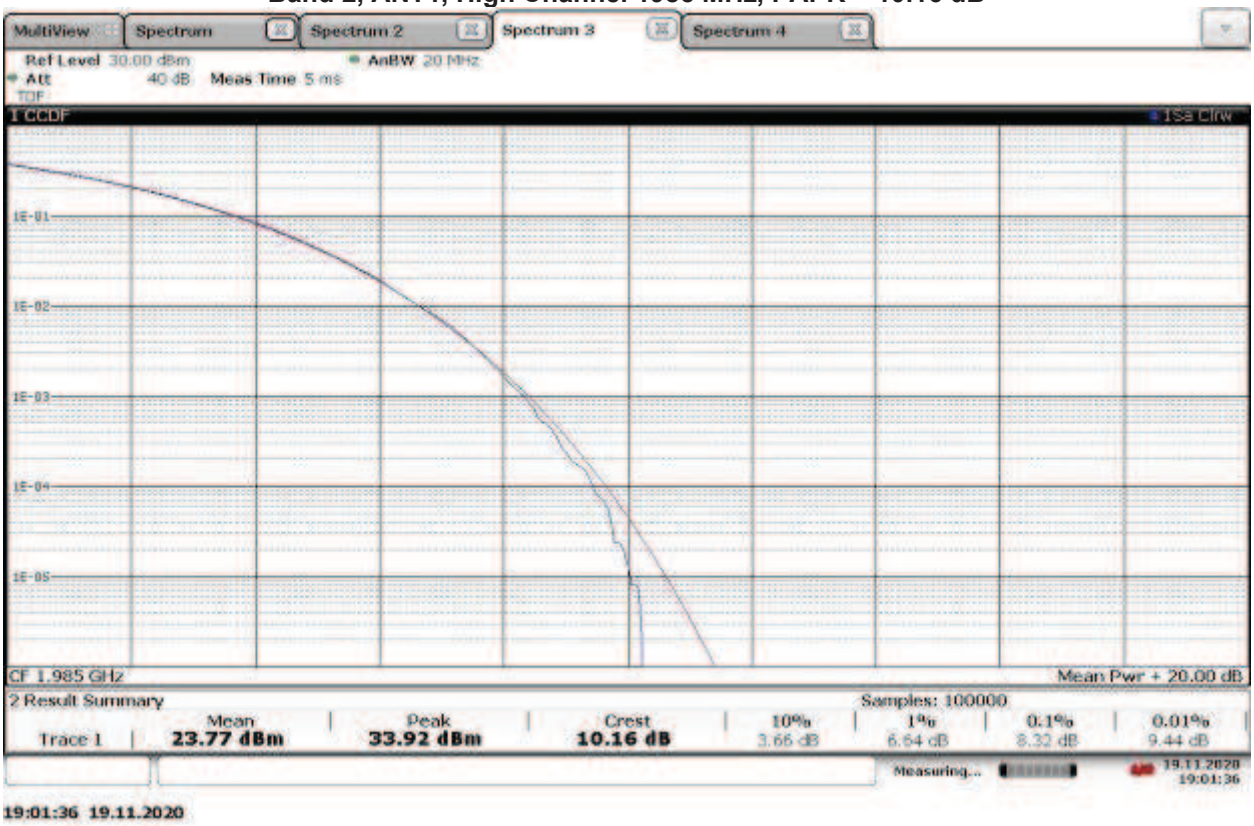
TM3.2 - 16QAM_10 MHz Bandwidth
Band 2, ANT1, Mid Channel 1960 MHz, PAPR = 10.65 dB



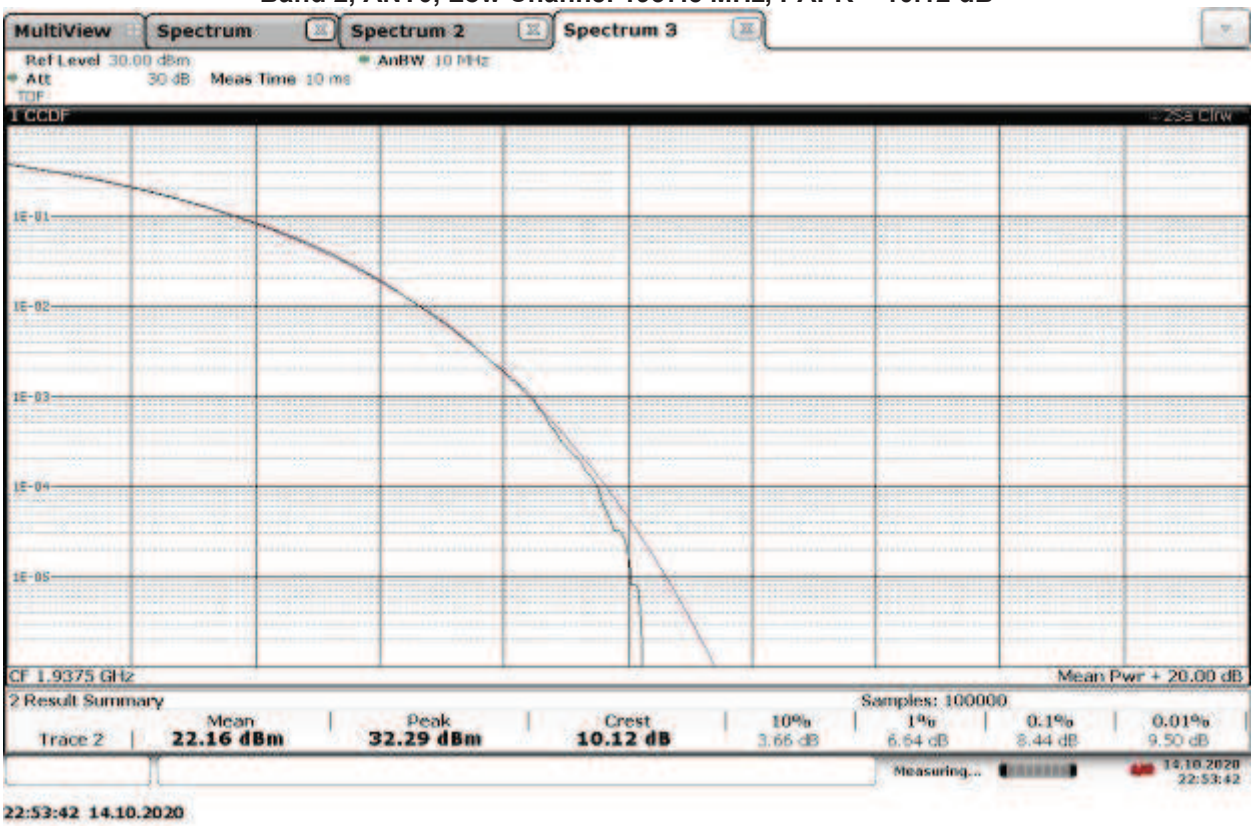
TM3.2 - 16QAM_10 MHz Bandwidth
Band 2, ANT0, High Channel 1985 MHz, PAPR = 9.90 dB



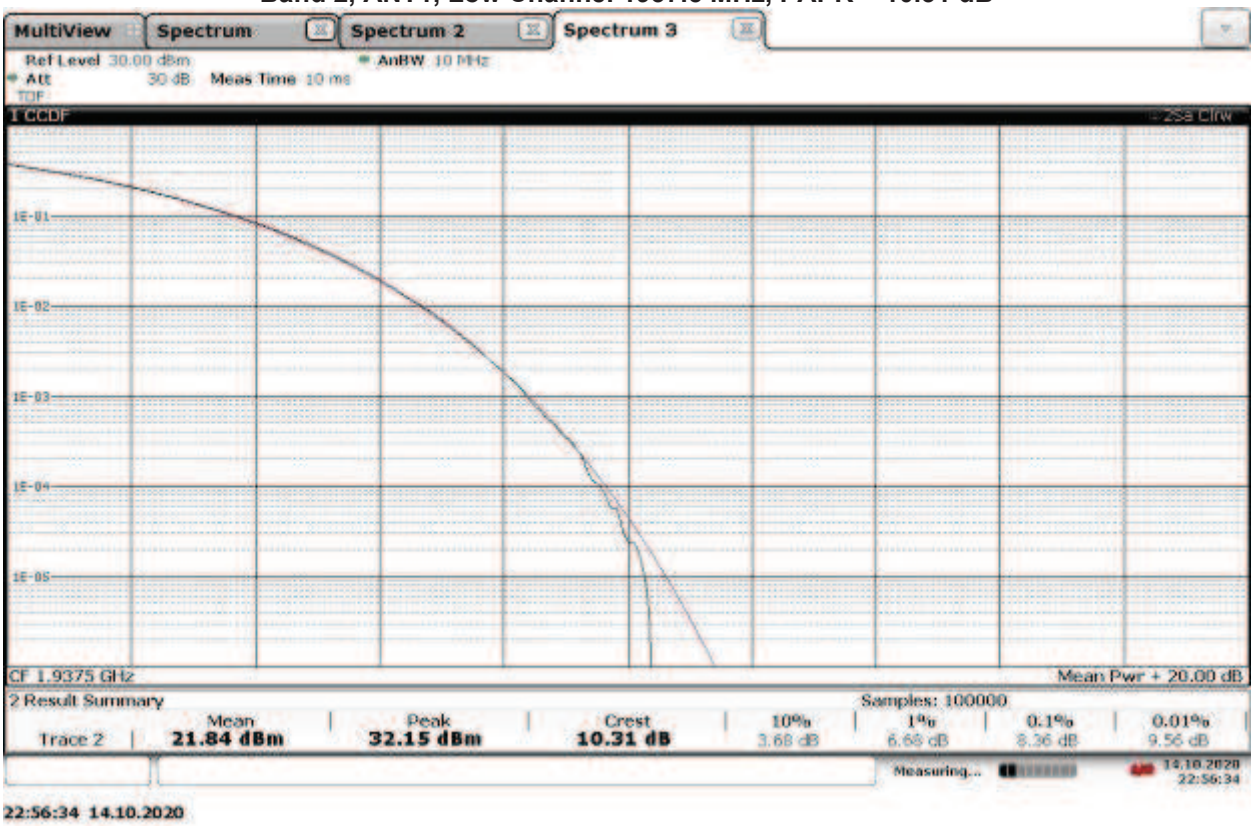
TM3.2 - 16QAM_10 MHz Bandwidth
Band 2, ANT1, High Channel 1985 MHz, PAPR = 10.16 dB



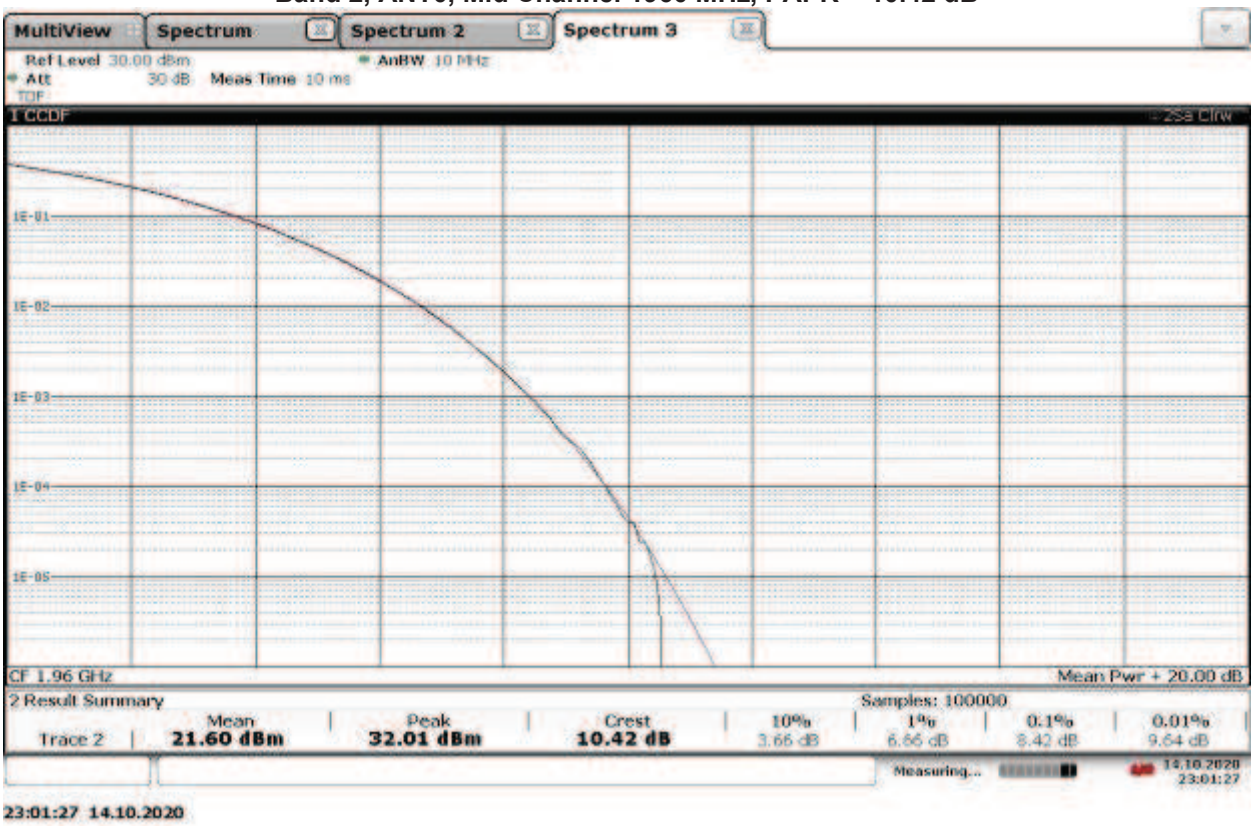
TM3.2 - 16QAM_15 MHz Bandwidth
Band 2, ANT0, Low Channel 1937.5 MHz, PAPR = 10.12 dB



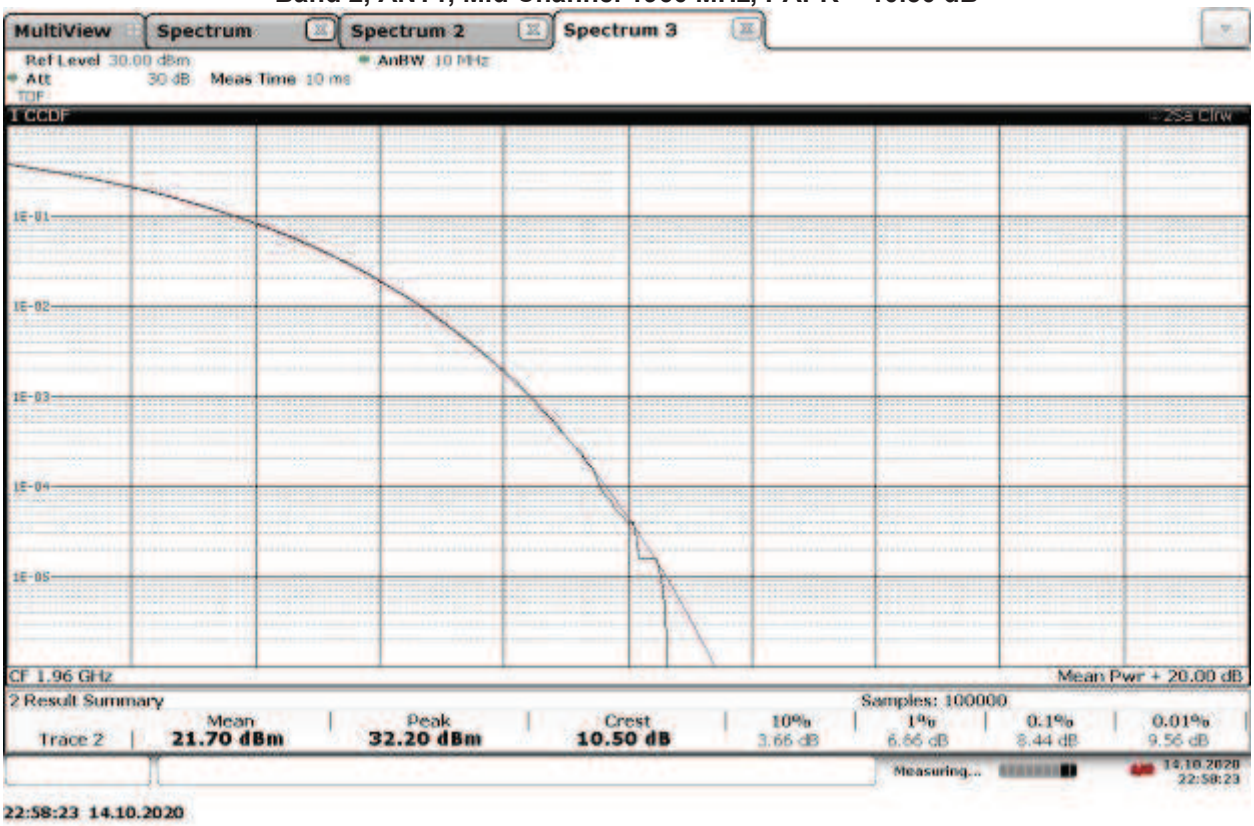
TM3.2 - 16QAM_15 MHz Bandwidth
Band 2, ANT1, Low Channel 1937.5 MHz, PAPR = 10.31 dB



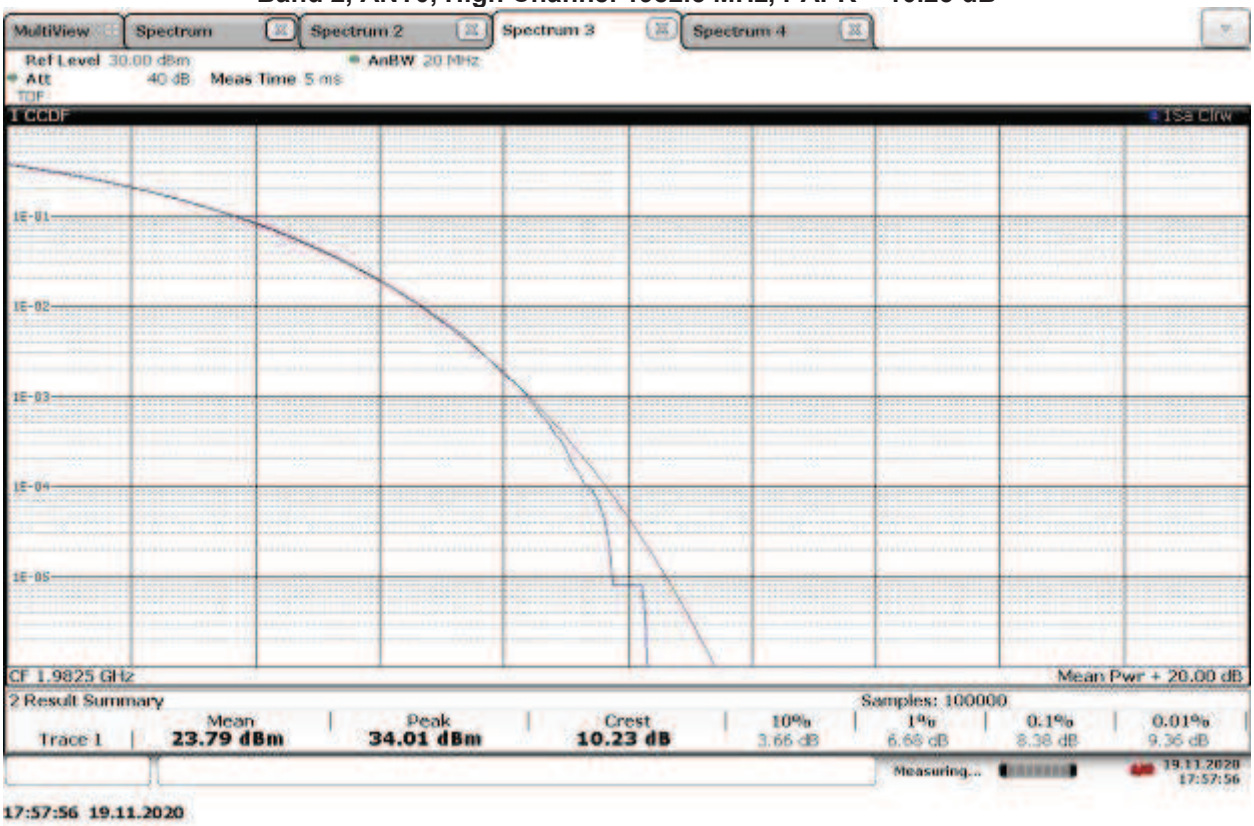
TM3.2 - 16QAM_15 MHz Bandwidth
Band 2, ANT0, Mid Channel 1960 MHz, PAPR = 10.42 dB



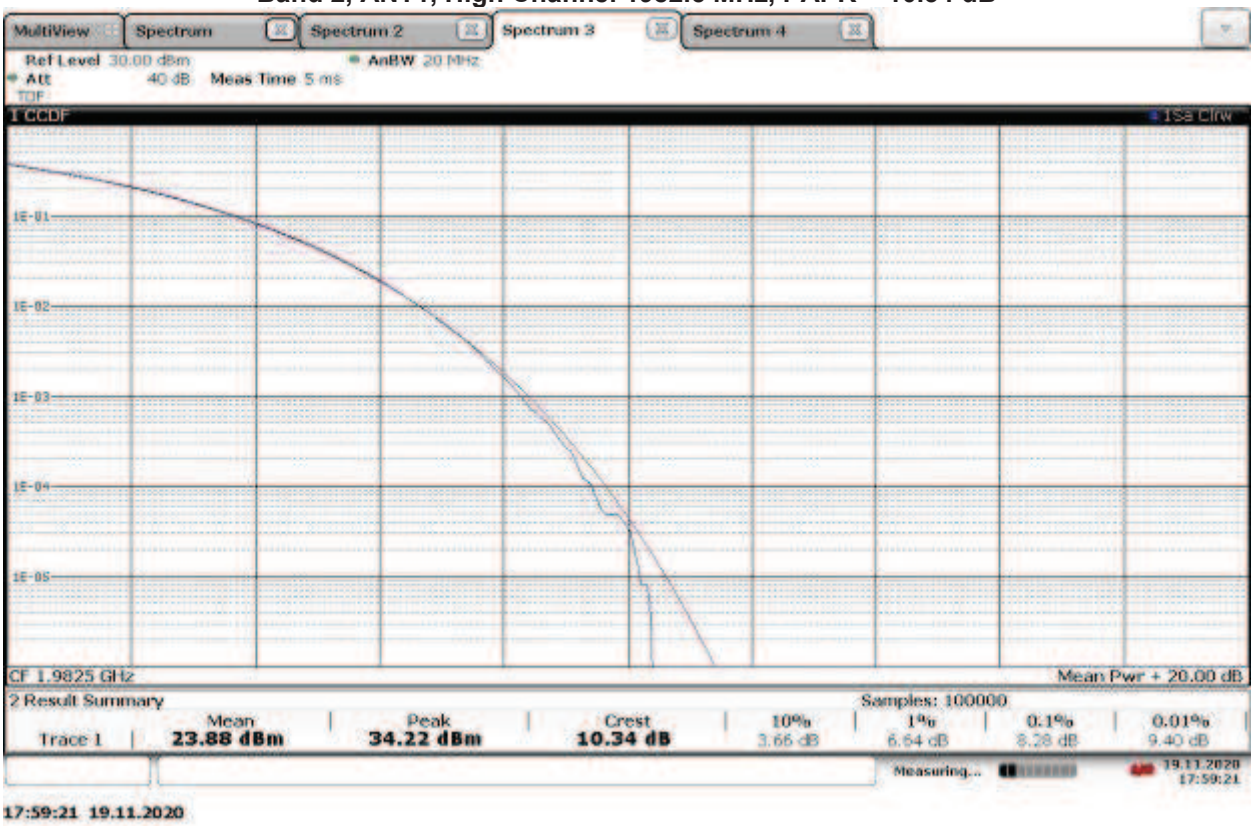
TM3.2 - 16QAM_15 MHz Bandwidth
Band 2, ANT1, Mid Channel 1960 MHz, PAPR = 10.50 dB



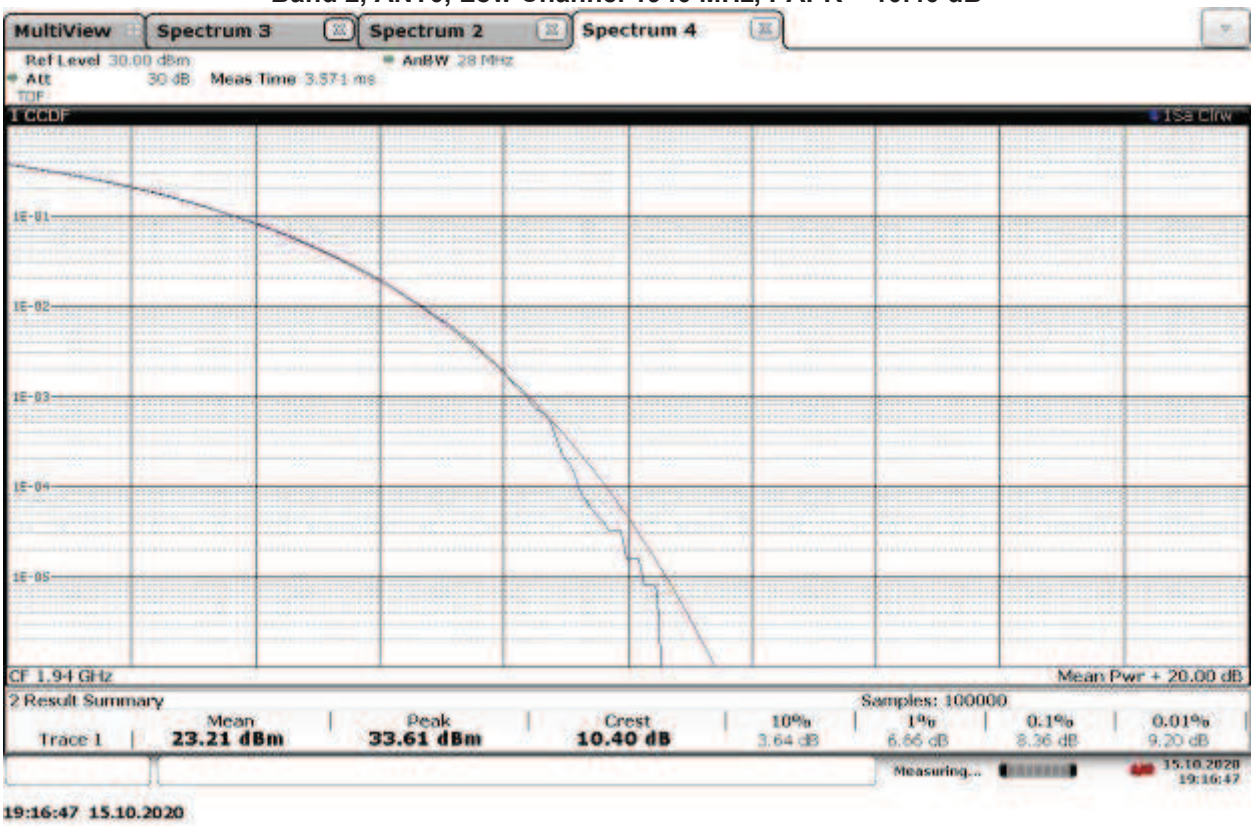
TM3.2 - 16QAM_15 MHz Bandwidth
Band 2, ANT0, High Channel 1982.5 MHz, PAPR = 10.23 dB



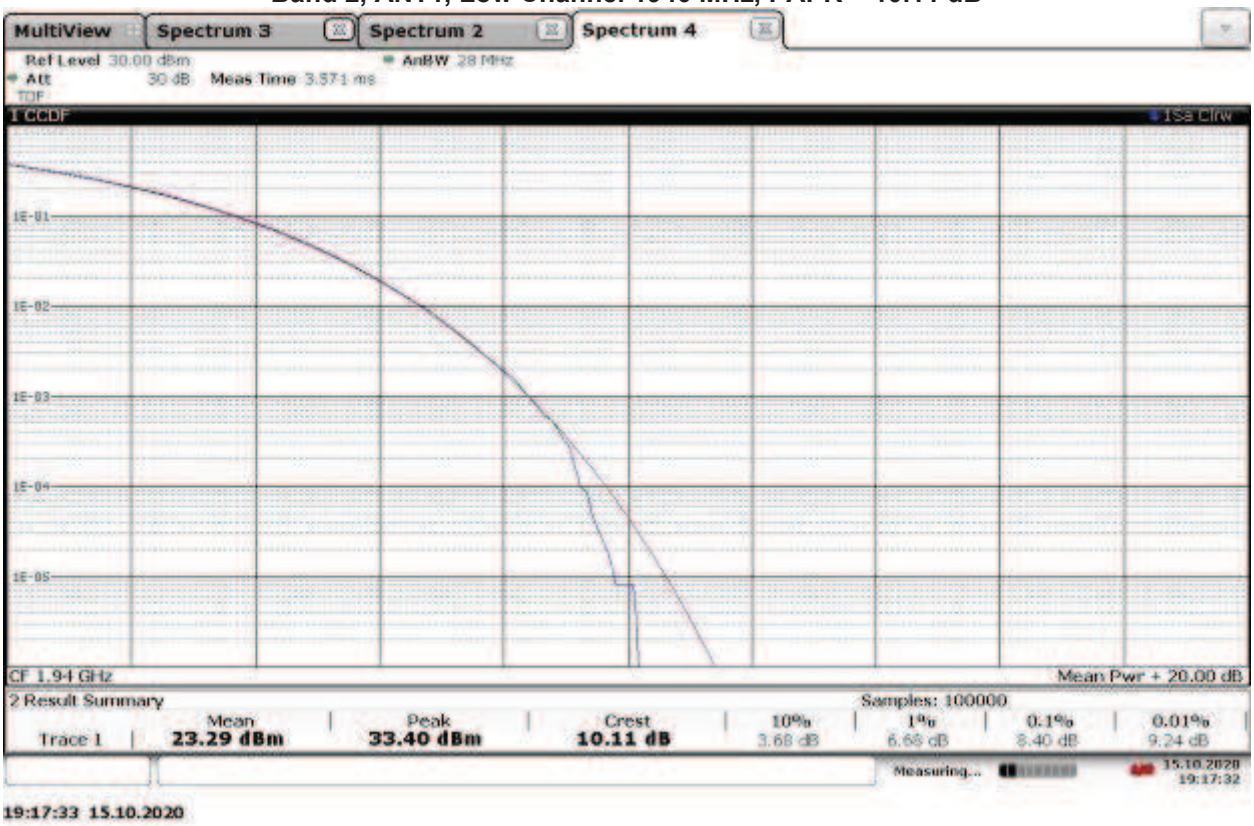
TM3.2 - 16QAM_15 MHz Bandwidth
Band 2, ANT1, High Channel 1982.5 MHz, PAPR = 10.34 dB



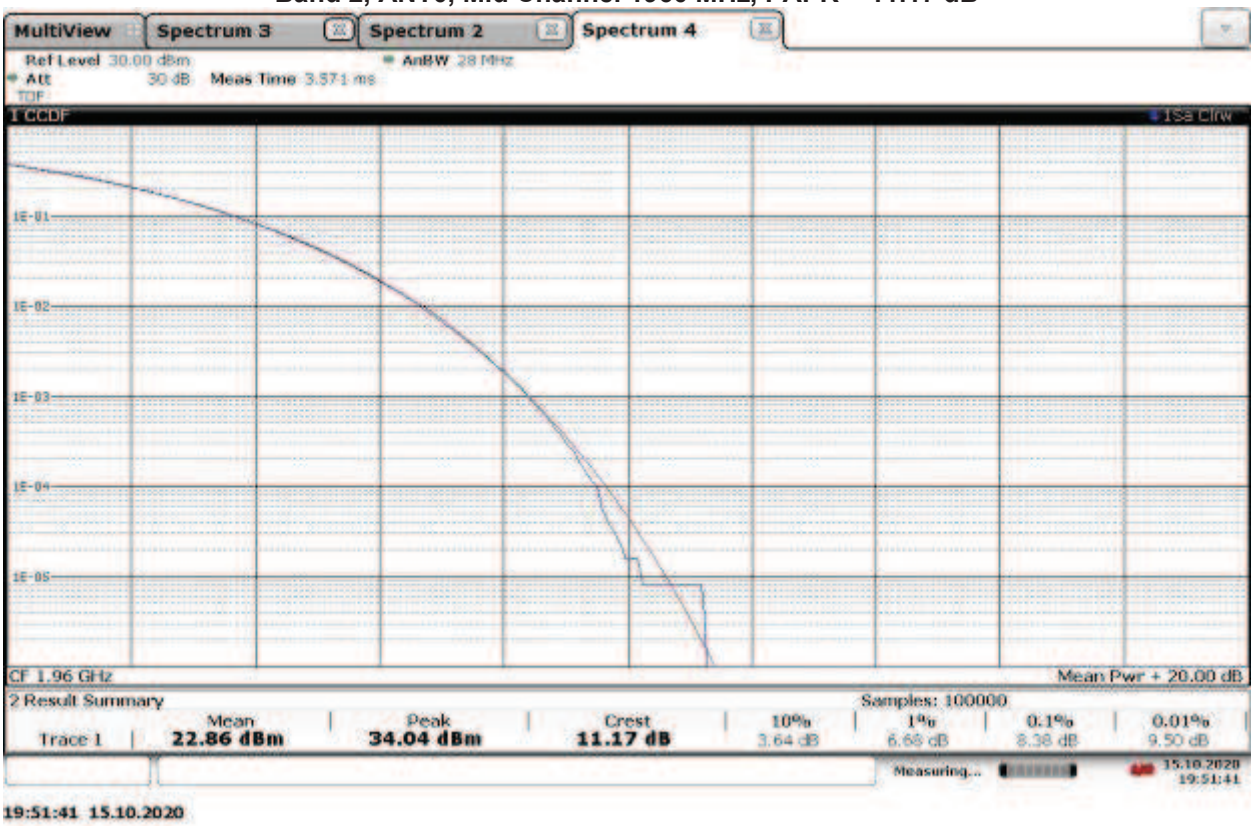
TM3.2 - 16QAM_20 MHz Bandwidth
Band 2, ANT0, Low Channel 1940 MHz, PAPR = 10.40 dB



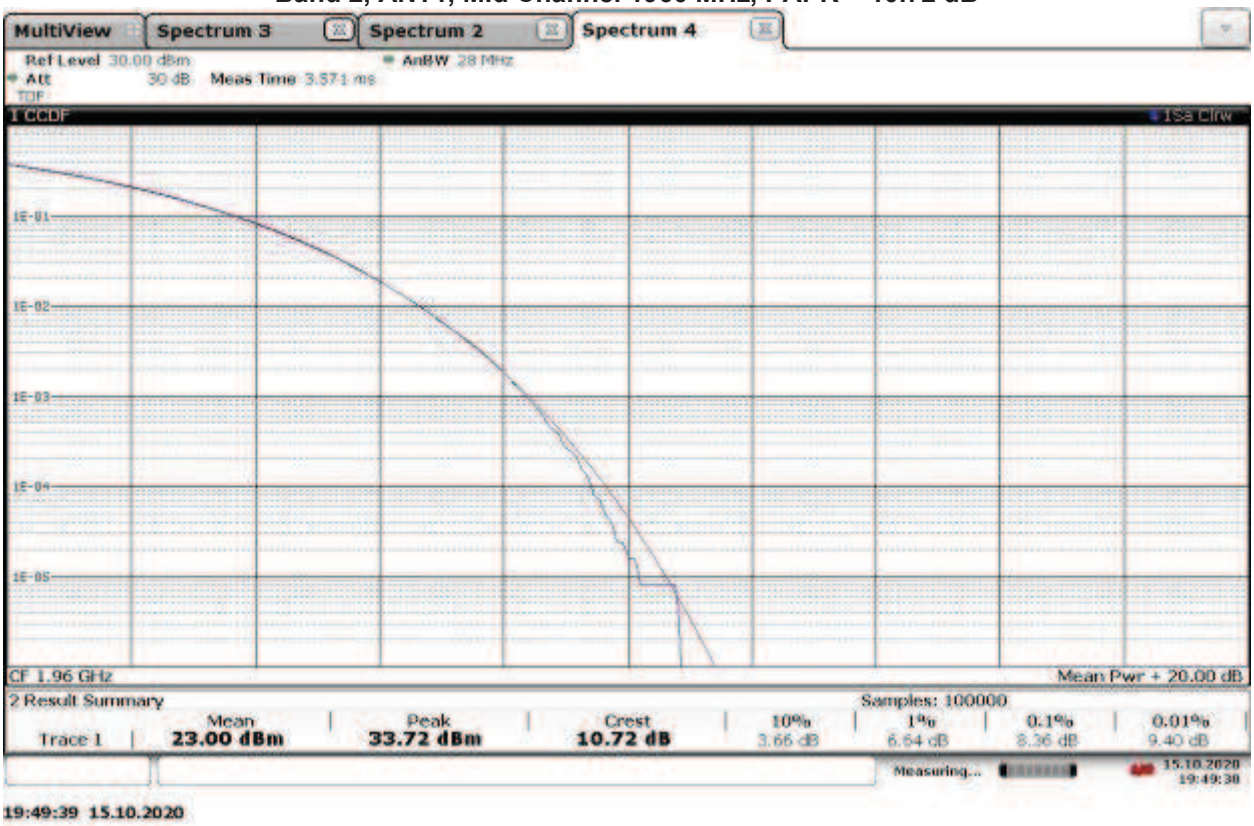
TM3.2 - 16QAM_20 MHz Bandwidth
Band 2, ANT1, Low Channel 1940 MHz, PAPR = 10.11 dB



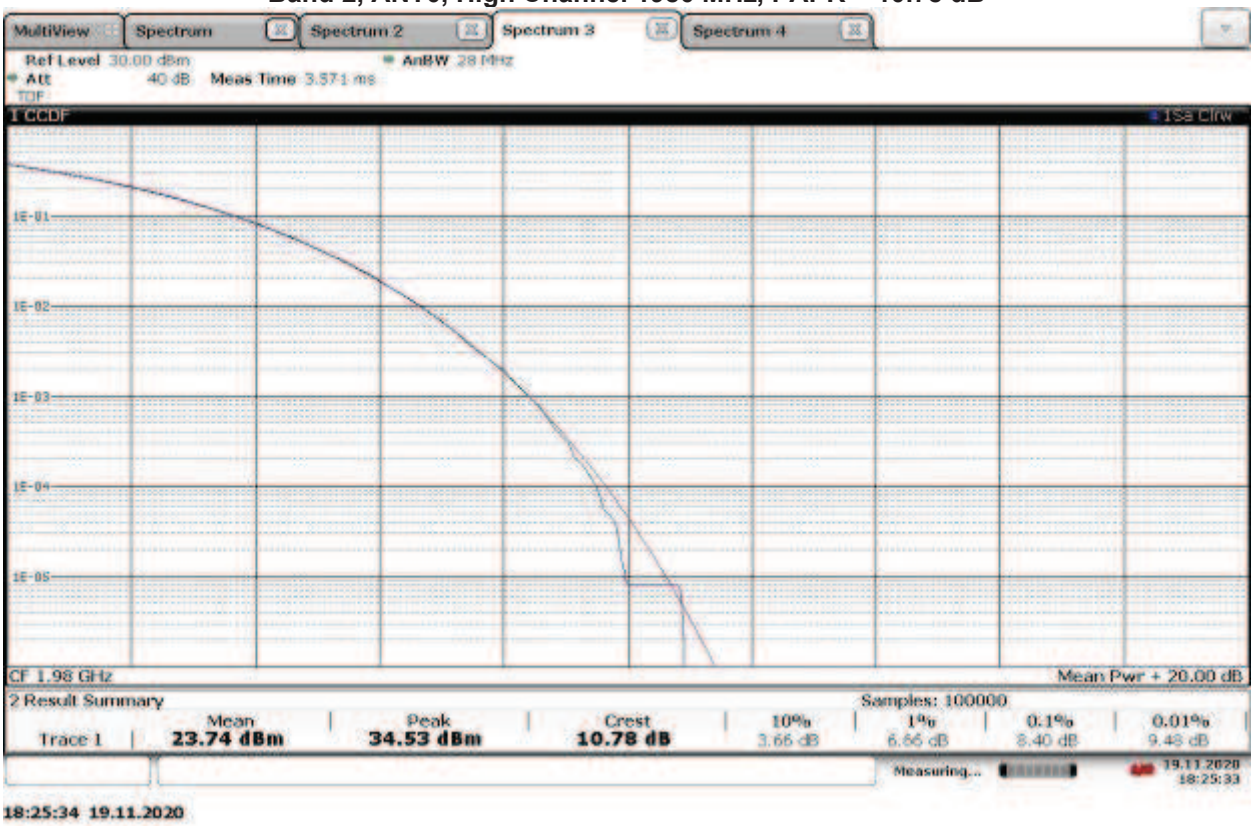
TM3.2 - 16QAM_20 MHz Bandwidth
Band 2, ANT0, Mid Channel 1960 MHz, PAPR = 11.17 dB



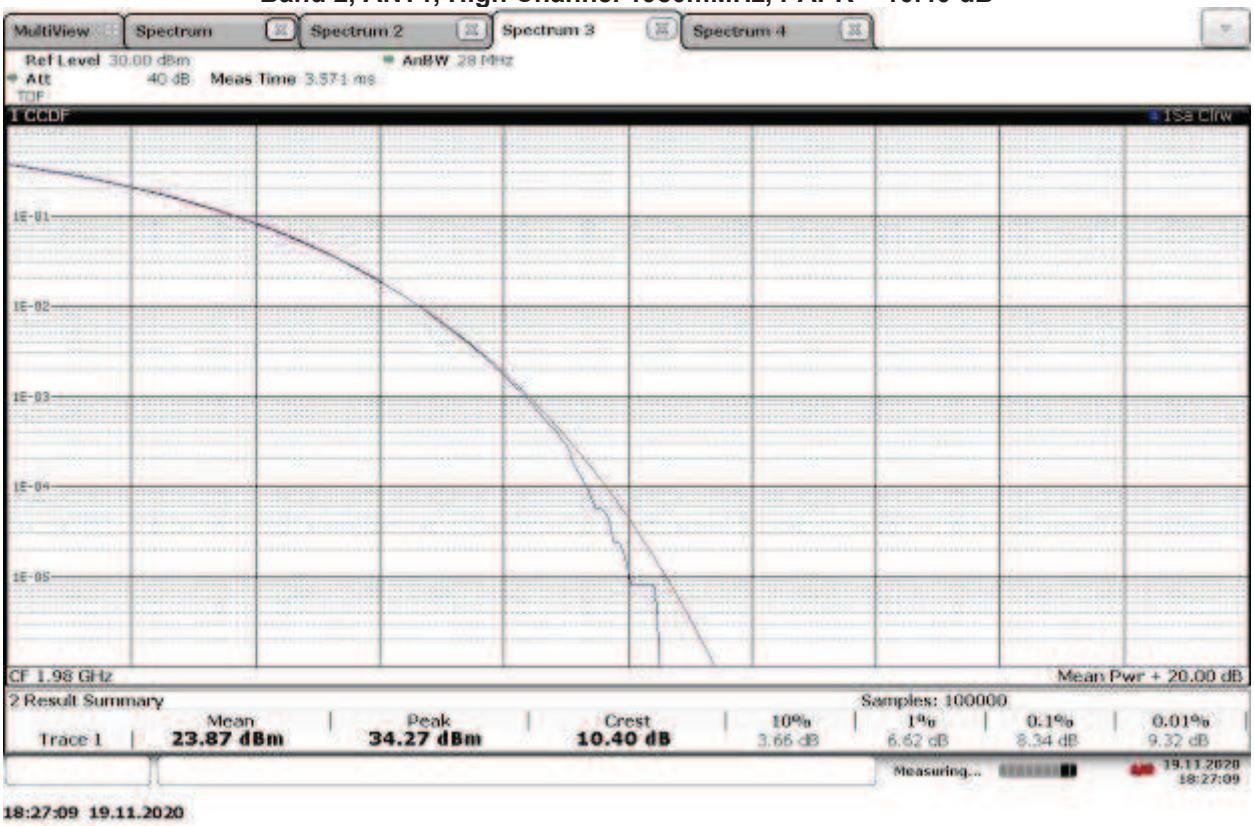
TM3.2 - 16QAM_20 MHz Bandwidth
Band 2, ANT1, Mid Channel 1960 MHz, PAPR = 10.72 dB



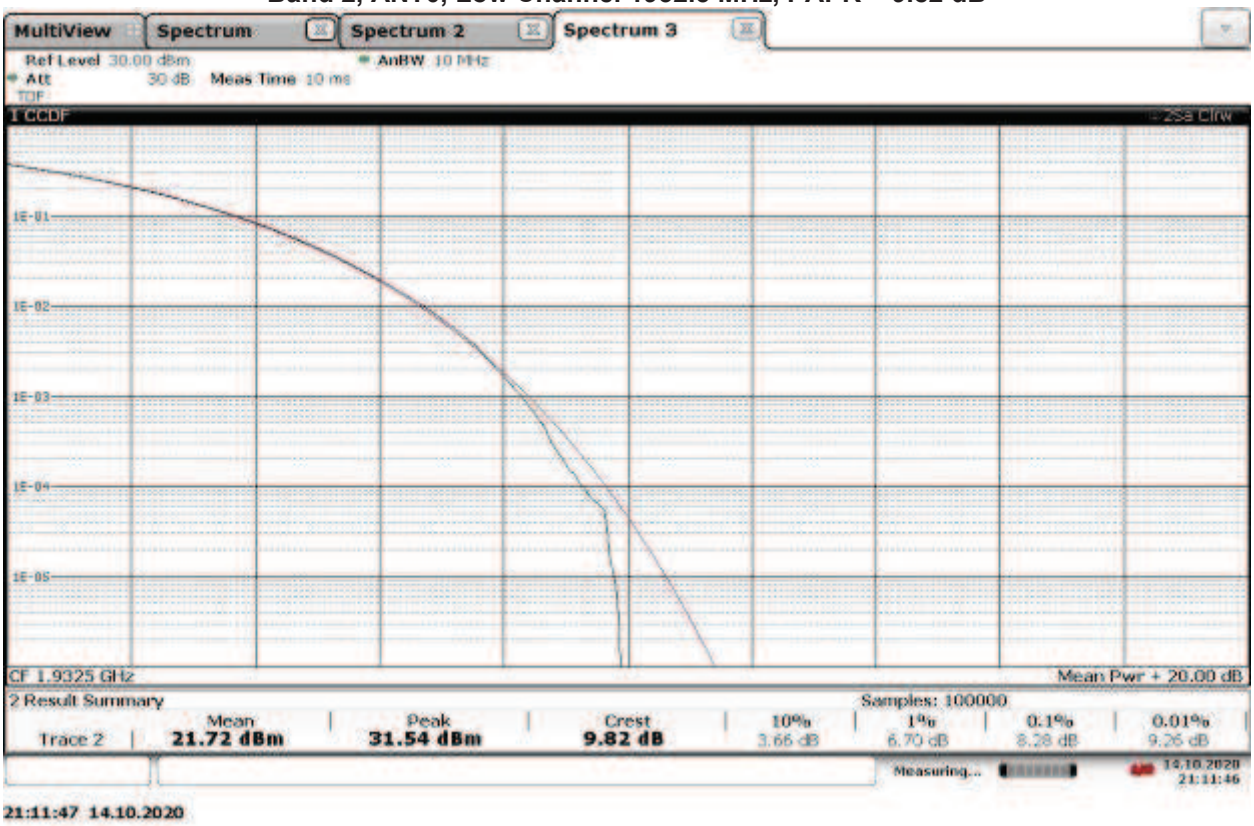
TM3.2 - 16QAM_20 MHz Bandwidth
Band 2, ANT0, High Channel 1980 MHz, PAPR = 10.78 dB



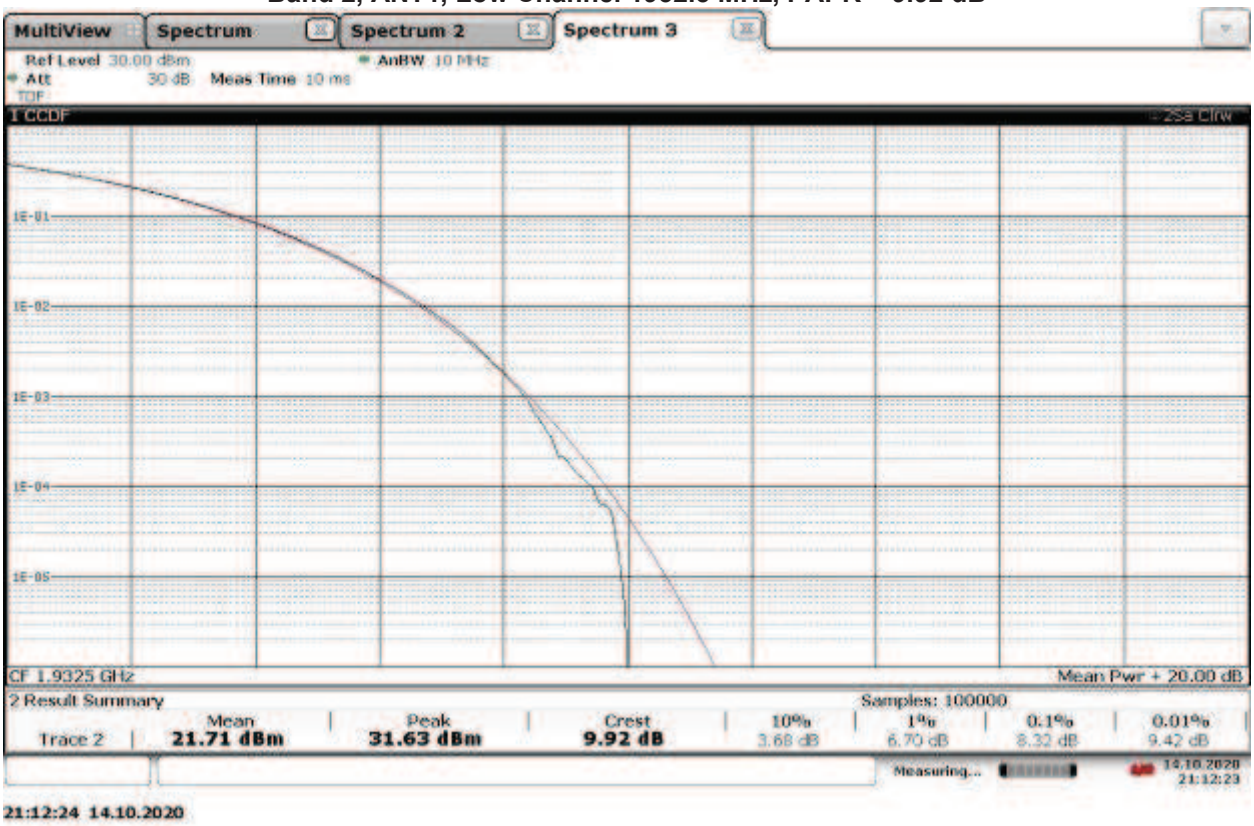
TM3.2 - 16QAM_20 MHz Bandwidth
Band 2, ANT1, High Channel 1980mMHz, PAPR = 10.40 dB



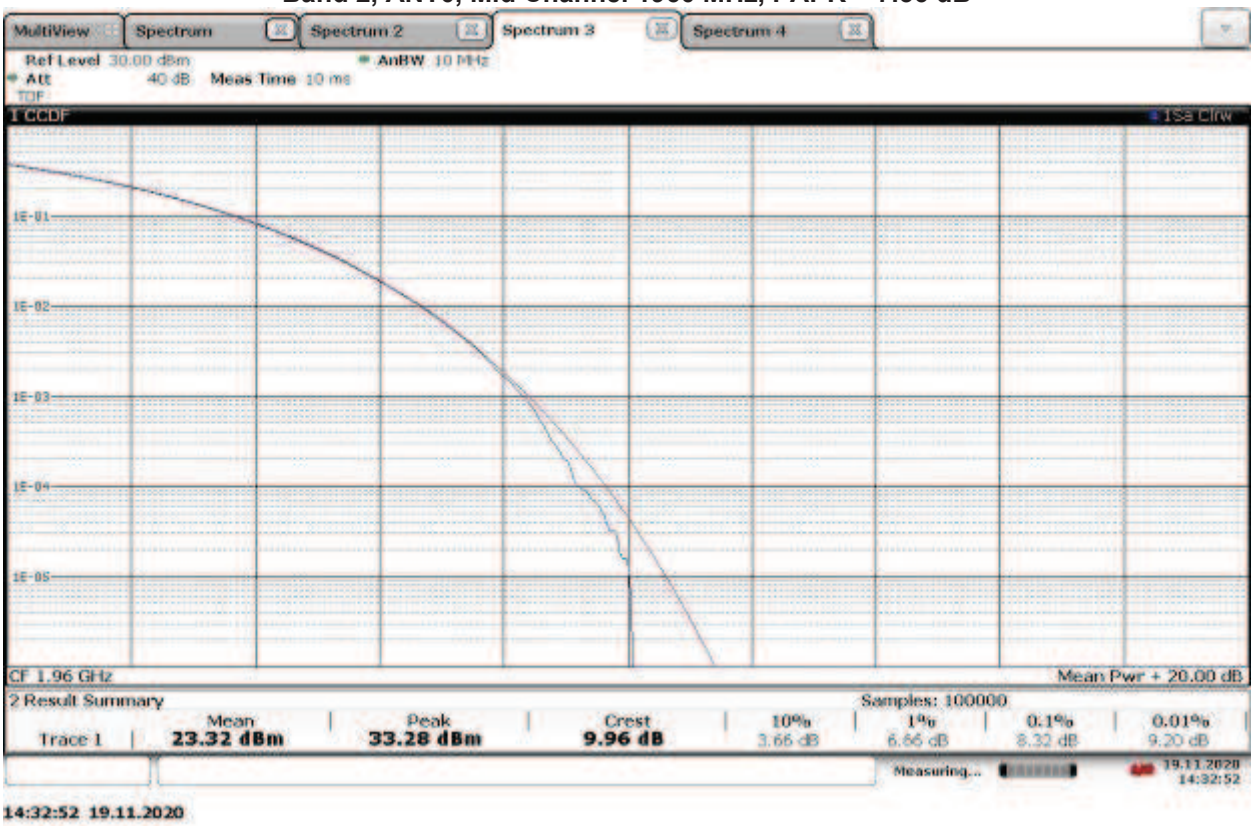
TM3.1-64QAM_5MHz Bandwidth
Band 2, ANT0, Low Channel 1932.5 MHz, PAPR = 9.82 dB



TM3.1-64QAM_5MHz Bandwidth
Band 2, ANT1, Low Channel 1932.5 MHz, PAPR = 9.92 dB



TM3.1-64QAM_5MHz Bandwidth
Band 2, ANT0, Mid Channel 1960 MHz, PAPR = 7.36 dB



TM3.1-64QAM_5MHz Bandwidth
Band 2, ANT1, Mid Channel 1960 MHz, PAPR = 7.29 Db