CERTIFICATION TEST REPORT

Report Number. : 4789893923-E5V2

Applicant	:	SAMSUNG ELECTRONICS CO., LTD. 129 SAMSUNG-RO, YEONGTONG-GU, SUWON-SI, GYEONGGI-DO, 16677, KOREA
Model	:	NP545XLA, NP545XLA-KA1TT, NP545XLA-KA1VZ
FCC ID	:	A3LNP545XLA
EUT Description	:	WCDMA/LTE/5G NR Laptop + BT/BLE, DTS/UNII a/b/g/n/ac/ax
Test Standard	:	FCC CFR47 PART 30 Mobile Transmitter (5GM)

Date Of Issue:
2021-06-25

Prepared by:
UL Korea, Ltd.
26th floor, 152, Teheran-ro, Gangnam-gu Seoul, 06236, Korea

Suwon Test Site: UL Korea, Ltd. Suwon Laboratory
218 Maeyeong-ro, Yeongtong-gu,
Suwon-si, Gyeonggi-do, 16675, Korea
TEL: (031) 337-9902
FAX: (031) 213-5433

IAS ACCREDITED
Testing Laboratory
TL-637

Revision History

Rev.	Issue Date	Revisions	Revised By
V1	2021-06-14	Initial issue	Seokhwan Hong
V2	2021-06-25	Updated to address TCB's question	Seokhwan Hong

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218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433

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UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_30(04)
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433

UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_30(04)
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1. ATTESTATION OF TEST RESULTS

COMPANY NAME:	SAMSUNG ELECTRONICS CO., LTD.
EUT DESCRIPTION:	WCDMA/LTE/5G NR Laptop + BT/BLE, DTS/UNII a/b/g/n/ac/ax
MODEL NUMBER:	NP545XLA, NP545XLA-KA1TT, NP545XLA-KA1VZ
SERIAL NUMBER:	FLKJ930R400152H, FLKJ930R400153F, FLKR01R2S00173;
DATE TESTED:	2021-04-27 – 2021-06-10;

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
FCC PART 30 Mobile Transmitter (5GM)	Pass

UL Korea, Ltd. tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by UL Korea, Ltd. based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL Korea, Ltd. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL Korea, Ltd. will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by IAS, any agency of the Federal Government, or any agency of any government.

Approved & Released For
UL Korea, Ltd. By:

Junwhan Lee
Suwon Lab Engineer
UL Korea, Ltd.

Tested By:

Seokhwan Hong
Suwon Lab Engineer
UL Korea, Ltd.

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with following methods.

1. FCC CFR 47 Part 2.
2. FCC CFR 47 Part 30.
3. ANSI C63.26-2015
4. KDB 842590 D01 Upper Microwave Flexible Use Service v01r02
5. KDB 971168 D01 Power Meas License Digital Systems v03r01

3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do,16675, Korea. Line conducted emissions are measured only at the 218 address. The following table identifies which facilities were utilized for radiated emission measurements documented in this report. Specific facilities are also identified in the test results sections.

218 Maeyeong-ro
☐ Chamber 1
☒ Chamber 2
☐ Chamber 3
☒ mmWave Chamber 1
☒ mmWave Chamber 2

UL Korea, Ltd. is accredited by IAS, Laboratory Code TL-637. The full scope of accreditation can be viewed at https://www.iasonline.org/wp-content/uploads/2017/05/TL-637-cert-New.pdf.

4. CALIBRATION AND UNCERTAINTY

4.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

4.2. SAMPLE CALCULATION

Where relevant, the following sample calculation is provided:

Field Strength[dBuV/m] = PXA reading with EUT worst orientation (dBm) + Antenna Factor(dBuV/m) + cable loss(dB) + 107

EIRP[dBm] = PXA reading with EUT worst orientation (dBm) + Path loss (dB) – cable loss(between the SG and substitution antenna) + Substitution Antenna Factor (dBi)

4.3. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

PARAMETER	UNCERTAINTY
Conducted Disturbance, 0.15 to 30 MHz	3.01 dB
Radiated Disturbance, 30 MHz to 1 GHz	4.26 dB
Radiated Disturbance, 1 GHz to 18 GHz	5.90 dB
Radiated Disturbance, Above 18 GHz	5.49 dB

Uncertainty figures are valid to a confidence level of 95%.

4.4. DECISION RULE

Decision rule for statement(s) of conformity is based on Procedure 2, Clause 4.4.3 in IEC Guide 115:2007.

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5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The EUT is a WCDMA/LTE/5G NR Laptop + BT/BLE, DTS/UNII a/b/g/n/ac/ax.
This test report addresses the 5G NR operational mode.

This report covers the Samsung models NP545XLA, NP545XLA-KA1TT and NP545XLA-KA1VZ. These models are identical in hardware except below.

NP545XLA-KA1TT: eSIM IC unmounted on PCB.
NP545XLA-KA1VZ: There is no difference in hardware(Supported RF band is different).

With some pre-scan, model NP545XLA was set for final test.

The EUT has an array antenna configuration. 2 patches, placed on the left and right side (denoted as K patch and L patch).
Each of the patch antennas is comprised of two separate antenna feeds - one for horizontal and one for vertical polarization. Only one array antenna can be active at a time.

Antenna	Name
Module 0	K Patch
Module 1	L Patch

The EUT supports up to 8CC for DL, and 2CC for UL. For each CC, the EUT supports both 50MHz bandwidth and 100MHz bandwidth.

For modulation, the EUT supports a subcarrier spacing (SCS) of 120kHz with two transmission schemes, CP-OFDM and DFT-s-OFDM, with QPSK, pi/2-BPSK, 16-QAM, and 64-QAM modulations.

Different Beam IDs are supported, each corresponding to a different position in space for each antenna. During testing, FTM (Factory Test Mode) was used to operate the transmitter.
MIMO operation was achieved by enabling two Beam IDs at the same time: one is from the list of H Beam IDs and other is from the list of V Beam IDs.

Manufacturer provided the Beam ID settings that yield the highest EIRP for each antenna by the EIRP Simulation tool. These Beam ID settings were used for all tests. All tests were performed in a non-signaling, stand-alone mode of operation.

5.2. MAXIMUM OUTPUT POWER

The transmitter has a maximum average radiated EIRP output powers as follows:

Module 0 / Band n261

FCC Part 30								
Band	Frequency Range [MHz]	Antenna	BandWidth [MHz]	CCs Active	Mode	Modulation	Radiated	
							Avg [dBm]	Avg [mW]
n261	27500 - 28350	Module 0	50	1CC	SISO	QPSK	27.45	555.90
					SISO-Dual	QPSK	**29.74**	**941.89**
					SISO-Dual	pi/2-BPSK	29.37	864.97
					SISO-Dual	16QAM	27.43	553.35
					SISO-Dual	64QAM	25.23	333.43
					MIMO	QPSK	24.60	288.40
				2CC	SISO	QPSK	21.95	156.68
					SISO-Dual	QPSK	**25.59**	**362.24**
					SISO-Dual	pi/2-BPSK	25.51	355.63
					SISO-Dual	16QAM	24.03	252.93
					SISO-Dual	64QAM	21.79	151.01
					MIMO	QPSK	22.61	182.39
			100	1CC	SISO	QPSK	27.86	610.94
					SISO-Dual	QPSK	**29.32**	**855.07**
					SISO-Dual	pi/2-BPSK	29.04	801.68
					SISO-Dual	16QAM	27.08	510.50
					SISO-Dual	64QAM	24.71	295.80
					MIMO	QPSK	24.47	279.90
				2CC	SISO	QPSK	24.44	277.97
					SISO-Dual	QPSK	**25.27**	**336.51**
					SISO-Dual	pi/2-BPSK	25.25	334.97
					SISO-Dual	16QAM	23.70	234.42
					SISO-Dual	64QAM	21.57	143.55
					MIMO	QPSK	22.16	164.44

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Module 0 / Band n260

FCC Part 30								
Band	Frequency Range [MHz]	Antenna	BandWidth [MHz]	CCs Active	Mode	Modulation	Radiated	
							Avg [dBm]	Avg [mW]
n260	37000 - 40000	Module 0	50	1CC	SISO	QPSK	**30.35**	**1083.93**
					SISO	pi/2-BPSK	30.17	1039.92
					SISO	16QAM	28.14	651.63
					SISO	64QAM	26.37	433.51
					SISO-Dual	QPSK	29.42	874.98
					MIMO	pi/2-BPSK	26.26	422.67
				2CC	SISO	QPSK	**27.01**	**502.34**
					SISO	pi/2-BPSK	26.95	495.45
					SISO	16QAM	25.39	345.94
					SISO	64QAM	22.54	179.47
					SISO-Dual	pi/2-BPSK	25.99	397.19
					MIMO	QPSK	24.65	291.74
			100	1CC	SISO	QPSK	**30.16**	**1037.53**
					SISO	pi/2-BPSK	29.87	970.51
					SISO	16QAM	27.81	603.95
					SISO	64QAM	25.93	391.74
					SISO-Dual	QPSK	29.52	895.36
					MIMO	QPSK	26.66	463.45
				2CC	SISO	QPSK	27.60	575.44
					SISO	pi/2-BPSK	**27.61**	**576.77**
					SISO	16QAM	26.06	403.65
					SISO	64QAM	23.10	204.17
					SISO-Dual	pi/2-BPSK	25.99	397.19
					MIMO	pi/2-BPSK	25.86	385.48

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Module 1 / Band n261

FCC Part 30								
Band	Frequency Range [MHz]	Antenna	BandWidth [MHz]	CCs Active	CCs Active	Modulation	Radiated	
							Avg [dBm]	Avg [mW]
n261	27500 - 28350	Module 1	50	1CC	SISO	QPSK	27.16	520.00
					SISO-Dual	QPSK	28.66	734.51
					SISO-Dual	pi/2-BPSK	**29.11**	**814.70**
					SISO-Dual	16QAM	26.60	457.09
					SISO-Dual	64QAM	24.62	289.73
					MIMO	QPSK	26.38	434.51
				2CC	SISO	QPSK	24.06	254.68
					SISO-Dual	QPSK	**25.78**	**378.44**
					SISO-Dual	pi/2-BPSK	25.77	377.57
					SISO-Dual	16QAM	24.14	259.42
					SISO-Dual	64QAM	21.97	157.40
					MIMO	QPSK	23.15	206.54
			100	1CC	SISO	pi/2-BPSK	27.41	550.81
					SISO-Dual	QPSK	**28.08**	**642.69**
					SISO-Dual	pi/2-BPSK	28.04	636.80
					SISO-Dual	16QAM	26.23	419.76
					SISO-Dual	64QAM	23.76	237.68
					MIMO	QPSK	24.59	287.74
				2CC	SISO	pi/2-BPSK	23.95	248.31
					SISO-Dual	QPSK	**24.68**	**293.76**
					SISO-Dual	pi/2-BPSK	24.67	293.09
					SISO-Dual	16QAM	23.14	206.06
					SISO-Dual	64QAM	20.93	123.88
					MIMO	QPSK	22.29	169.43

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Module 1 / Band n260

FCC Part 30								
Band	Frequency Range [MHz]	Antenna	BandWidth [MHz]	CCs Active	Mode	Modulation	Radiated	
							Avg [dBm]	Avg [mW]
n260	37000 - 40000	Module 1	50	1CC	SISO	QPSK	28.48	704.69
					SISO-Dual	QPSK	**29.40**	**870.96**
					SISO-Dual	pi/2-BPSK	29.14	820.35
					SISO-Dual	16QAM	27.16	520.00
					SISO-Dual	64QAM	25.75	375.84
					MIMO	QPSK	25.50	354.81
				2CC	SISO	pi/2-BPSK	25.44	349.95
					SISO-Dual	QPSK	**26.14**	**411.15**
					SISO-Dual	pi/2-BPSK	26.04	401.79
					SISO-Dual	16QAM	24.52	283.14
					SISO-Dual	64QAM	21.90	154.88
					MIMO	QPSK	23.85	242.66
			100	1CC	SISO	QPSK	28.64	731.14
					SISO-Dual	QPSK	29.40	870.96
					SISO-Dual	pi/2-BPSK	**29.72**	**937.56**
					SISO-Dual	16QAM	27.19	523.60
					SISO-Dual	64QAM	26.31	427.56
					MIMO	QPSK	25.51	355.63
				2CC	SISO	pi/2-BPSK	25.73	374.11
					SISO-Dual	QPSK	26.66	463.45
					SISO-Dual	pi/2-BPSK	**26.68**	**465.59**
					SISO-Dual	16QAM	25.13	325.84
					SISO-Dual	64QAM	22.35	171.79
					MIMO	QPSK	23.64	231.21

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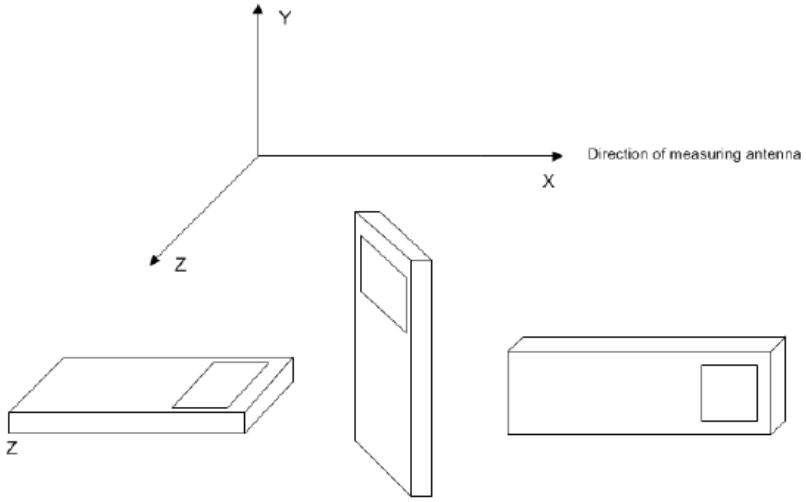
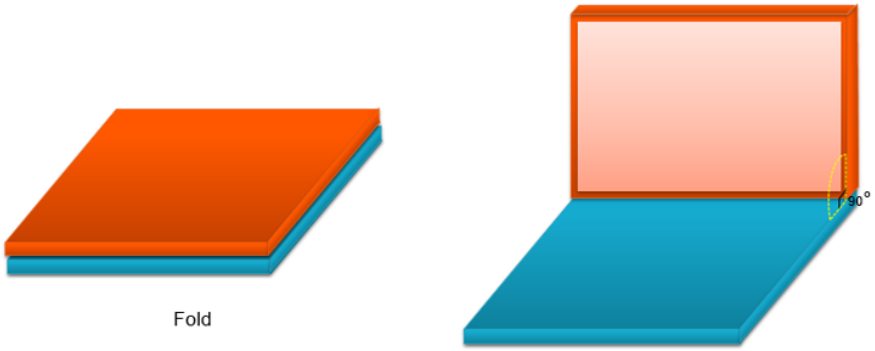
5.3. WORST-CASE ORIENTATION

For all 5G NR FR2 Bands, the worst-case scenario for all measurements is based on the EIRP measurement investigation results. EIRP were measured on QPSK, pi/2-BPSK, 16QAM and 64QAM modulations. It was found that QPSK results were worst case. 16QAM and 64QAM is EIRP testing was performed using based on QPSK worst channel modulations to represent the worst case. However, the out of band emissions and spurious radiation were only performed on bandwidth and RB offset(with RB size 1) with the highest EIRP in QPSK.

The fundamental and radiated spurious emission were investigated in three orthogonal orientations X, Y and Roll, where is applicable. The final optimum position resulting in the highest EIRP for the frequency or band under investigation is placed on an open air fixture allowing no blockage of the signal as measured by the receiving antenna.



The Fundamental of the EUT was investigated two foldable conditions[Fold, Laptop(90 degree)]. For 5G NR FR2 Bands, Since EIRP was highest in laptop condition, all results were tested under laptop condition.



Fold

Laptop(90 degree)

Note : EIRP Simulation data for all Beam IDs was used to determine the worst case Beam ID for SISO operation and Beam ID pair for MIMO operation. These Beam ID's were used for final measurements.

5.4. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	**Manufacturer**	**Model**	**Serial Number**	**FCC ID**
Charger	SAMSUNG	EP-TA800	R37R32A00XADK3	N/A
Data Cable	SAMSUNG	EP-DW767JWE	N/A	N/A

I/O CABLE

I/O Cable List						
Cable No.	**Port**	**# of identical ports**	**Connector Type**	**Cable Type**	**Cable Length (m)**	**Remarks**
1	DC Power	1	C Type	Shielded	1.8 m	N/A

TEST SETUP

All testing was performed using FTM (Factory Test Mode) software at continuous Tx operation. When implemented out in the field, the EUT will operate with a maximum uplink configuration (i.e., a maximum uplink duty cycle of 100%). The FTM software was also used for the EUT operation in the ENDC mode.

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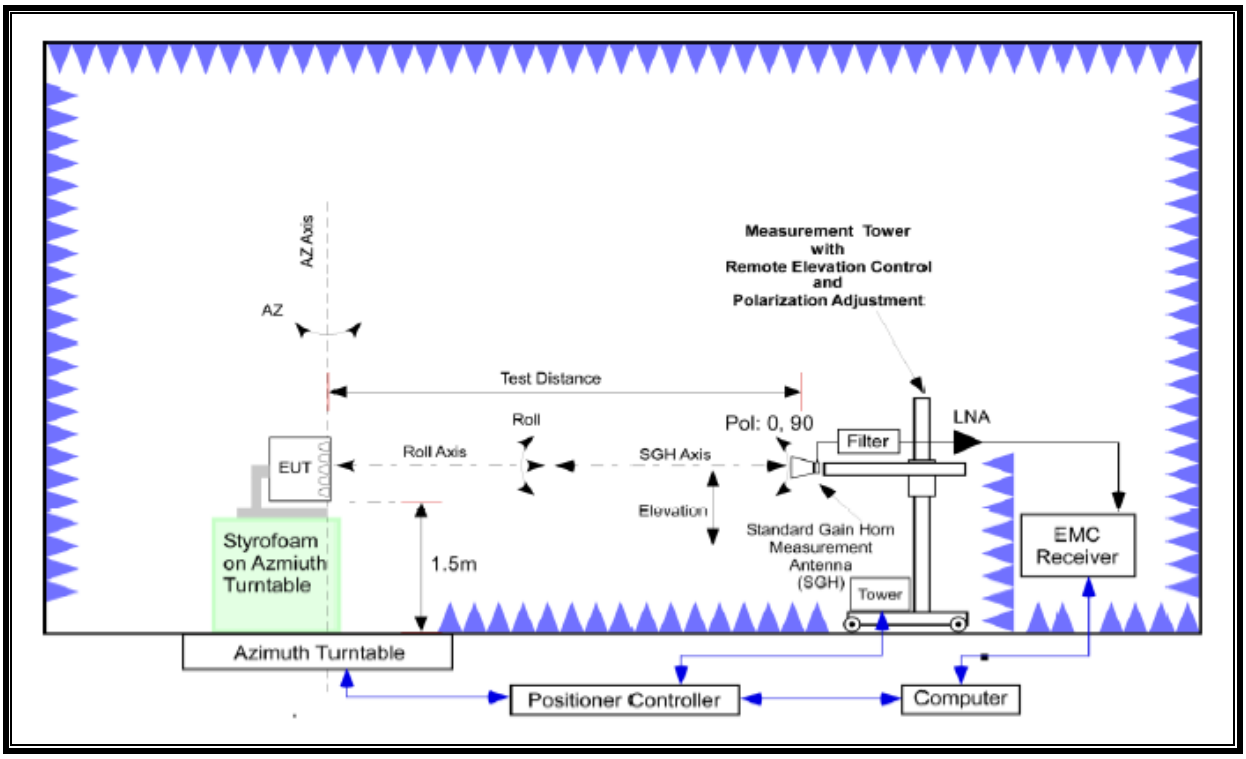
SETUP DIAGRAM FOR TESTS (RADIATED TEST SETUP)

Radiated power (EIRP) measurements were performed in a full anechoic chamber (FAC) conforming to the site validation requirements of CISPR 16-1-4. Radiated spurious emission measurements from 30MHz - 18GHz were performed in a semi anechoic chamber (SAC) conforming to the site validation requirements of CISPR 16-1-4. A positioner was used to manipulate the EUT through several positions in space by rotating about the roll axis as shown in the figure below. The positioner was mounted on top of a turntable bringing the total EUT height to 1.5m.



FAR-FIELD DISTANCE AND MEASUREMENT DISTANCE

The equipment under test was transmitting while connected to its integral antenna and is placed on a turntable.

The measurement antenna is in the far field of the EUT per formula $2D^2/\lambda$ where D is the larger between the dimension of the measurement antenna and the transmitting antenna of the EUT. In this case, "D" is the largest dimension of the measurement antenna. The EUT is manipulated through all orthogonal planes representative of its typical use to achieve the highest reading on the receive spectrum analyzer.

Frequency Range(GHz)	Wavelength(m)	Far Field Distance(m)	Measurement Distance(m)
18-40	0.008	0.54	1.00 (EIRP and Band Edge = 3.00)
40-50	0.006	1.05	1.50
50-75	0.004	0.69	1.00
75-110	0.003	0.46	1.00
110-175	0.002	0.34	1.00
175-200	0.002	0.16	1.00

Radiated power levels are investigated while the receive antenna was rotated through all angles to determine the worst case polarization/positioning. It was determined that H=0 degree and V=90 degree are the worst case positions when the EUT was transmitting horizontally and vertically polarized beams, respectively.

The maximized power level is recorded using the spectrum analyzer “Channel Power” function with the integration bandwidth set to the emissions’ occupied bandwidth. The EIRP is calculated from the raw power level measured with the spectrum analyzer using the formulas shown below.

6. TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment was utilized for the tests documented in this report:

Test Equipment List				
Description	**Manufacturer**	**Model**	**S/N**	**Cal Due**
Spectrum Analyzer	KEYSIGHT	N9040B	US57212313	2022-01-13
Spectrum Analyzer	KEYSIGHT	N9040B	MY60080268	2022-01-13
Spectrum Analyzer	KEYSIGHT	N9030A	MY54490312	2021-08-05
Loop Antenna	Rohde & Schwarz	HFH2-Z2	100418	2021-10-02
Antenna, Bilog, 30MHz-1GHz	SCHWARZBECK	VULB9163	749	2022-08-13
Antenna, Horn, 18 GHz	ETS	3117	00168724	2022-07-27
DC Power Supply	Agilent / HP	E3640A	MY54226395	2021-08-05
Preamplifier, 1000 MHz	Sonoma	310N	351741	2021-08-03
Preamplifier, 18 GHz	Miteq	AFS42-00101800-25-S-42	1896138	2021-08-03
Temperature & Humidity Chamber	ESPEC	PL-1J	15004769	2021-08-04
Antenna, Horn, 40 GHz	ETS LINDGREN	3116C	00166155	2022-08-04
Antenna, Horn, 40 GHz	ETS LINDGREN	3116C	00168645	2021-10-02
Antenna, Horn, 33 to 50 GHz	CMI, Inc.	HO22R	UL22001	2023-02-24
Antenna, Horn, 33 to 50 GHz	CMI, Inc.	HO22R	UL22002	2023-02-24
Antenna, Horn, 50 to 75 GHz	CMI, Inc.	HO15R	UL15001	2023-02-24
Antenna, Horn, 50 to 75 GHz	CMI, Inc.	HO15R	UL15002	2023-02-24
Antenna, Horn, 75 to 110 GHz	CMI, Inc.	HO10R	UL10001	2023-02-24
Antenna, Horn, 75 to 110 GHz	CMI, Inc.	HO10R	UL10002	2023-02-24
Antenna, Horn, 110 to 170 GHz	CMI, Inc.	HO06R	UL06001	2023-02-24
Antenna, Horn, 110 to 170 GHz	CMI, Inc.	HO06R	UL06002	2023-02-24
Antenna, Horn, 170 to 260 GHz	CMI, Inc.	HO04R	UL04001	2023-02-24
Antenna, Horn, 170 to 260 GHz	CMI, Inc.	HO04R	UL04002	2023-02-24
EMI Test Receive, 40 GHz	Rohde & Schwarz	ESU40	100457	2021-08-03
SA Extension Module	Virginia Diodes Inc	N9029AV15	SAX486	2022-03-29
SA Extension Module	Virginia Diodes Inc	N9029AV10	SAX388	2022-01-19
SA Extension Module	Virginia Diodes Inc	N9029AV06	SAX483	2022-01-20
SA Extension Module	Virginia Diodes Inc	N9029AV04	SAX487	2022-01-20
Digital Multimeter	FLUKE	17B	27770596WS	2021-08-05
Temp and Humidity recorder	LUTRON	MHB-382SD	AH.91469	2021-08-07
Temp and Humidity recorder	LUTRON	MHB-382SD	AJ.72586	2022-01-16
Description	**Manufacturer**	**Model**	**Version**	
Radiated software	UL	UL EMC	Ver 9.5	

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7. SUMMARY TABLE

FCC Part Section	Test Description	Test Limit	Test Condition	Test Result
2.1049	Occupied Bandwidth	N/A	Radiated	Pass
2.1046, 30.202	Equivalent Isotropic Radiated Power	43 dBm		Pass
2.1051, 30.203	Out-of-Band Emissions at the Band Edge	-13 dBm/MHz for all out-of-band emissions, -5 dBm/MHz from the band edge up to 10% of the channel BW		Pass
2.1051, 30.203	Spurious Emission	-13 dBm/MHz for all out-of-band emissions		Pass
2.1055	Frequency Stabillity	Fundamental emissions stay within authorized frequency block		Pass

8. LIMITS AND CONDUCTED RESULTS

8.1. OCCUPIED BANDWIDTH

RULE PART(S)

FCC: §2.1049

LIMITS

For reporting purposes only

TEST PROCEDURE

Automatic bandwidth measurement function of the signal analyzer was used to measure 99% occupied.

a) RBW = 1 – 5% of OBW
b) VBW ≥ 3 x RBW
c) Detector = Peak
d) Trace mode = max hold
e) Sweep = auto couple
f) The trace was allowed to stabilize

(KDB 842590 D01 Upper Microwave Flexible Use Service v01r02 Section 4.3)
(ANSI C63.26-2015 Section 5.4.3)

Note

5G NR: All Waveforms (CP-OFDM vs DFT-s OFDM) were investigated to determine the worst case configuration. All modes of operation were investigated and the worst case configuration results are reported in this section.

RESULTS

See the following pages.

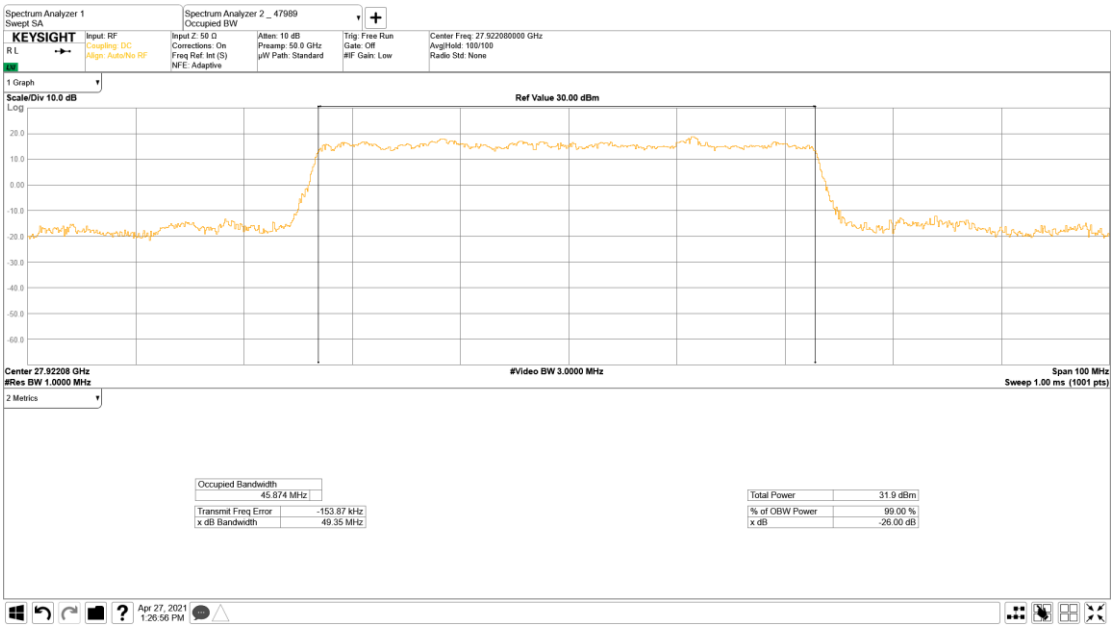
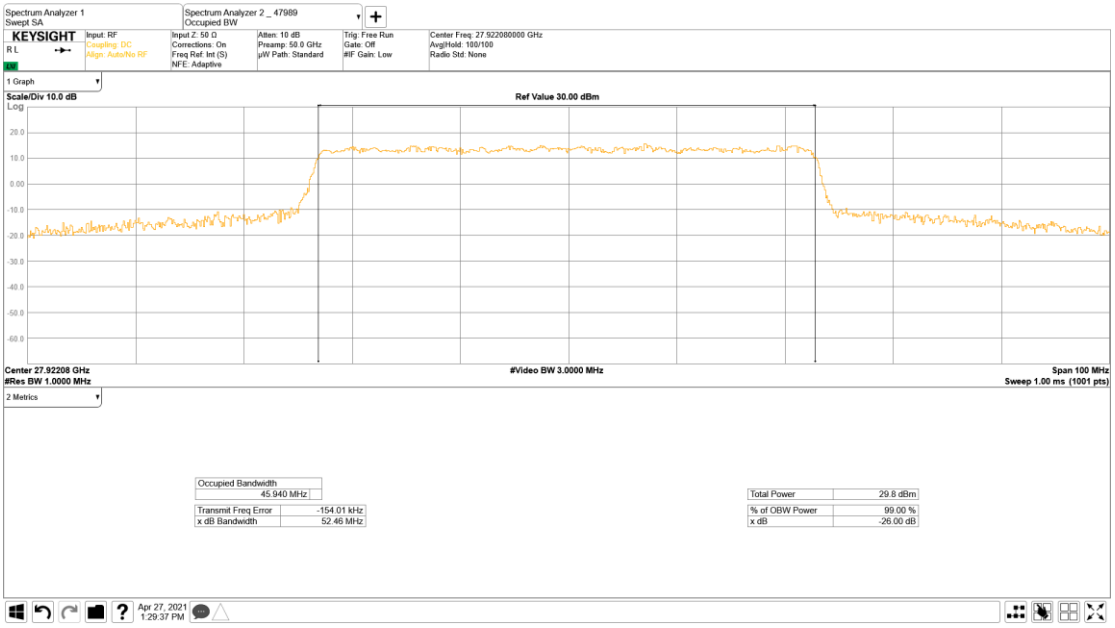
8.1.1. OCCUPIED BANDWIDTH RESULTS

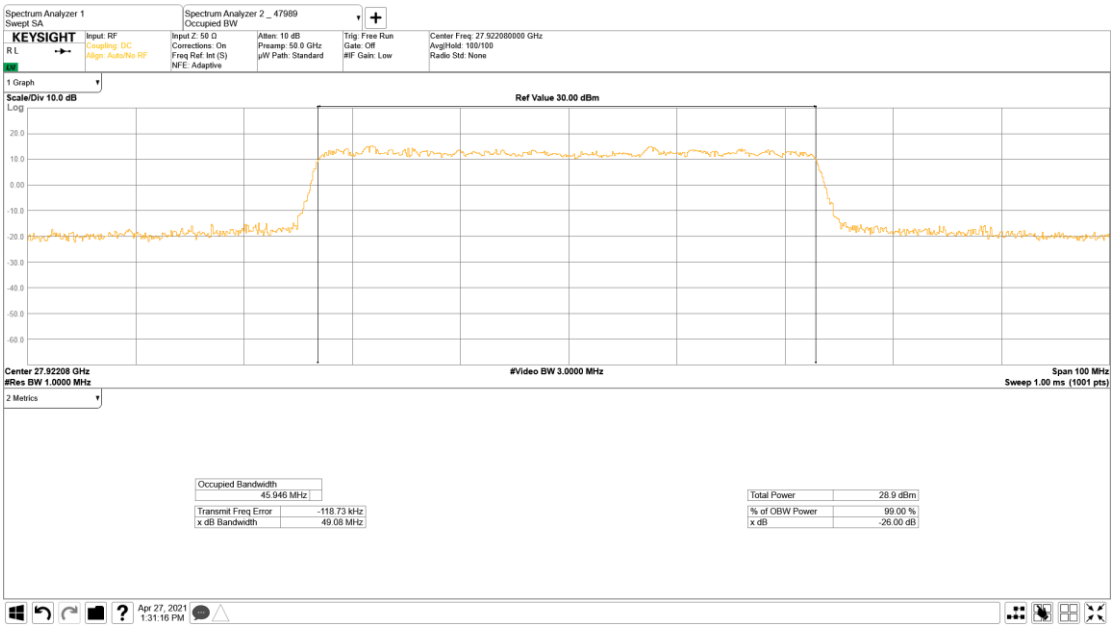
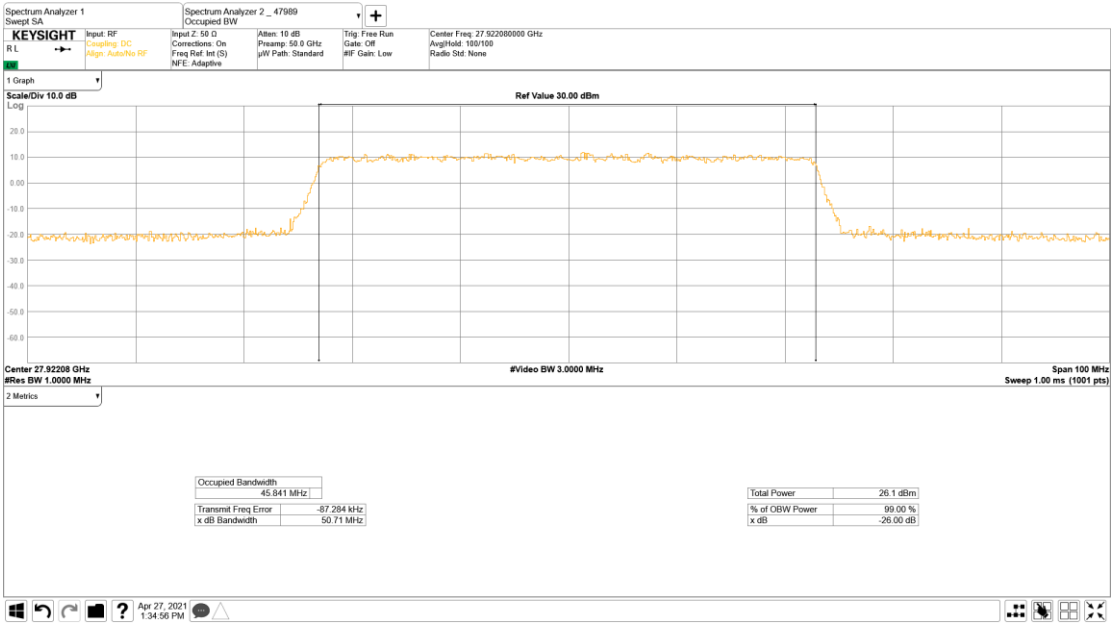
OBW Result - Module 0

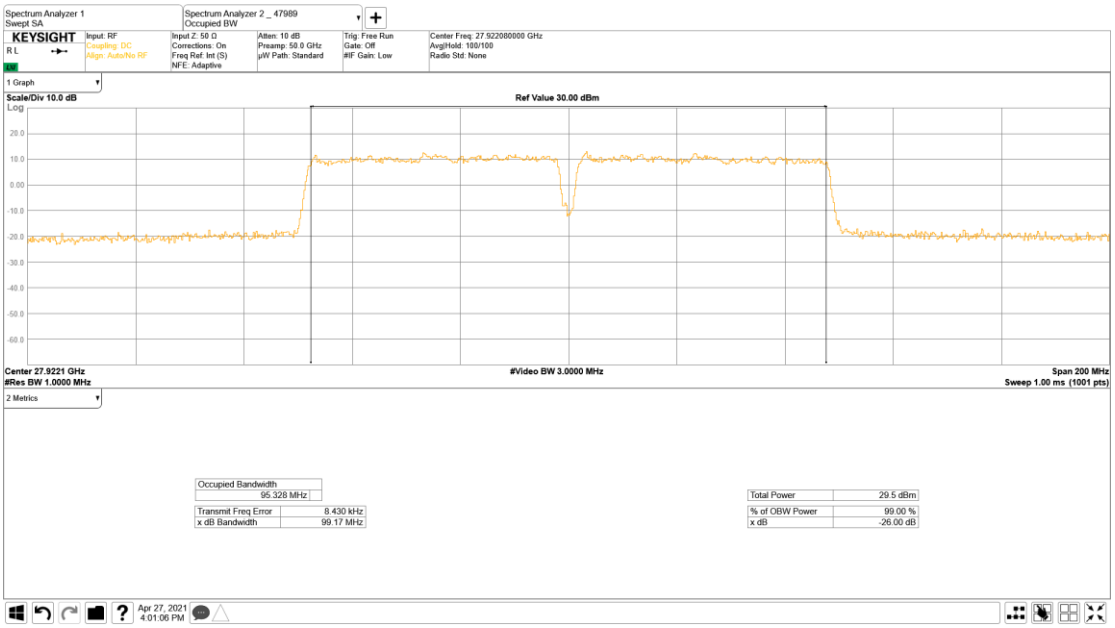
Antenna	Band	BandWidth [MHz]	CCs Active	Modulation	OBW [MHz]
Module 0	n261	50	1CC	pi/2-BPSK	45.87
				QPSK	45.94
				16QAM	**45.95**
				64QAM	45.84
			2CC	pi/2-BPSK	95.33
				QPSK	95.16
				16QAM	95.44
				64QAM	**95.75**
		100	1CC	pi/2-BPSK	91.23
				QPSK	94.48
				16QAM	94.51
				64QAM	**94.70**
			2CC	pi/2-BPSK	190.34
				QPSK	193.39
				16QAM	194.04
				64QAM	**194.07**
	n260	50	1CC	pi/2-BPSK	45.90
				QPSK	45.98
				16QAM	45.97
				64QAM	**46.00**
			2CC	pi/2-BPSK	95.83
				QPSK	95.48
				16QAM	95.73
				64QAM	**96.41**
		100	1CC	pi/2-BPSK	91.28
				QPSK	94.49
				16QAM	94.67
				64QAM	**95.17**
			2CC	pi/2-BPSK	191.50
				QPSK	194.51
				16QAM	195.61
				64QAM	**195.63**

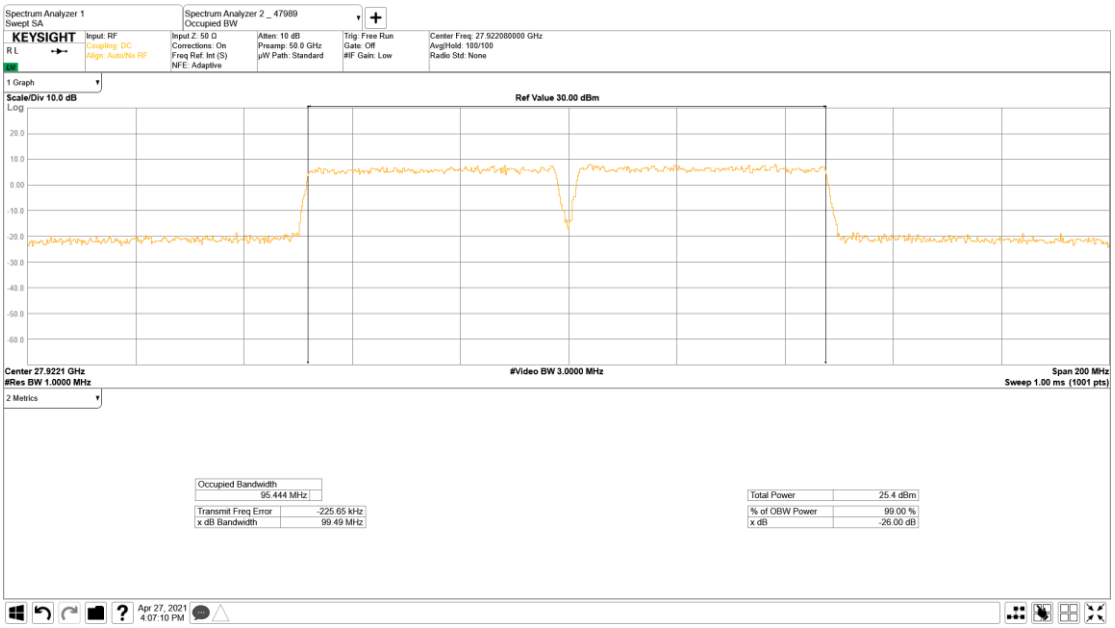
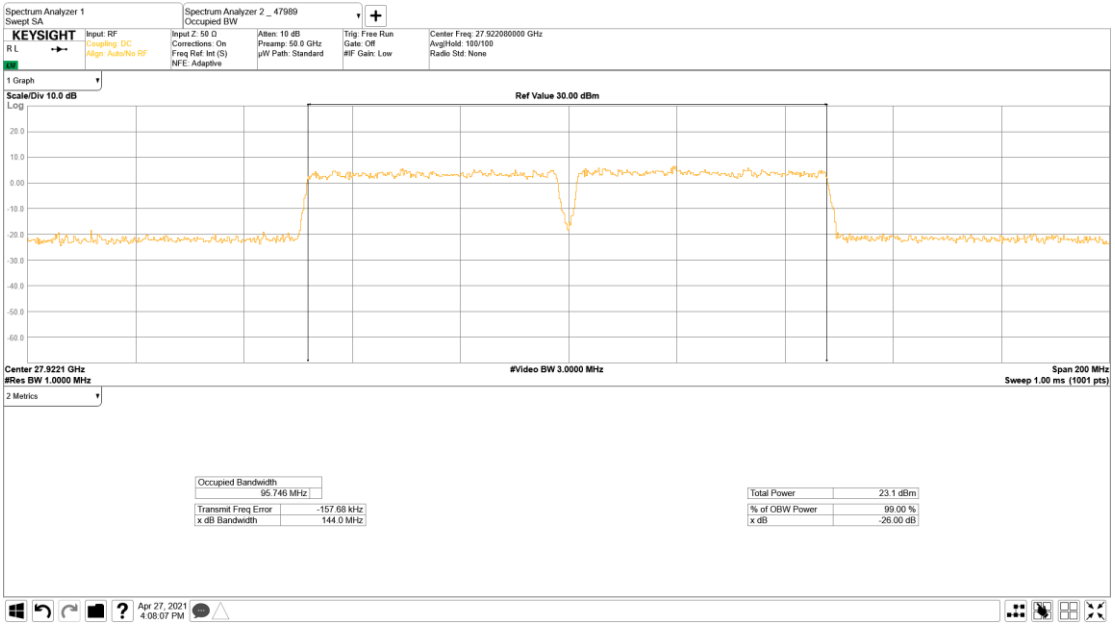
UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_30(04)
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433

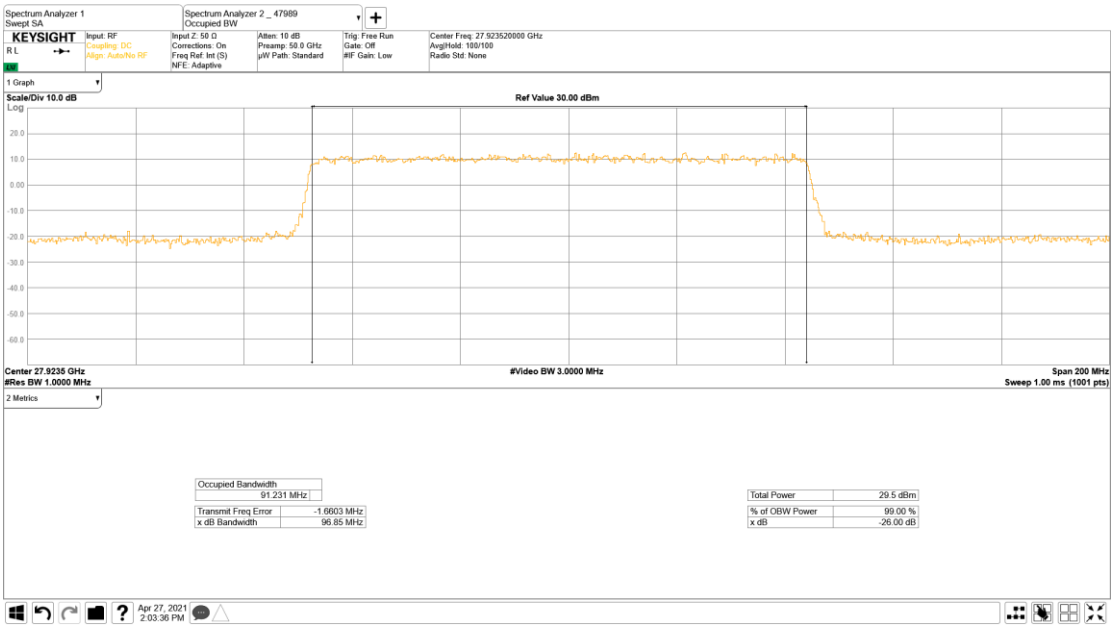
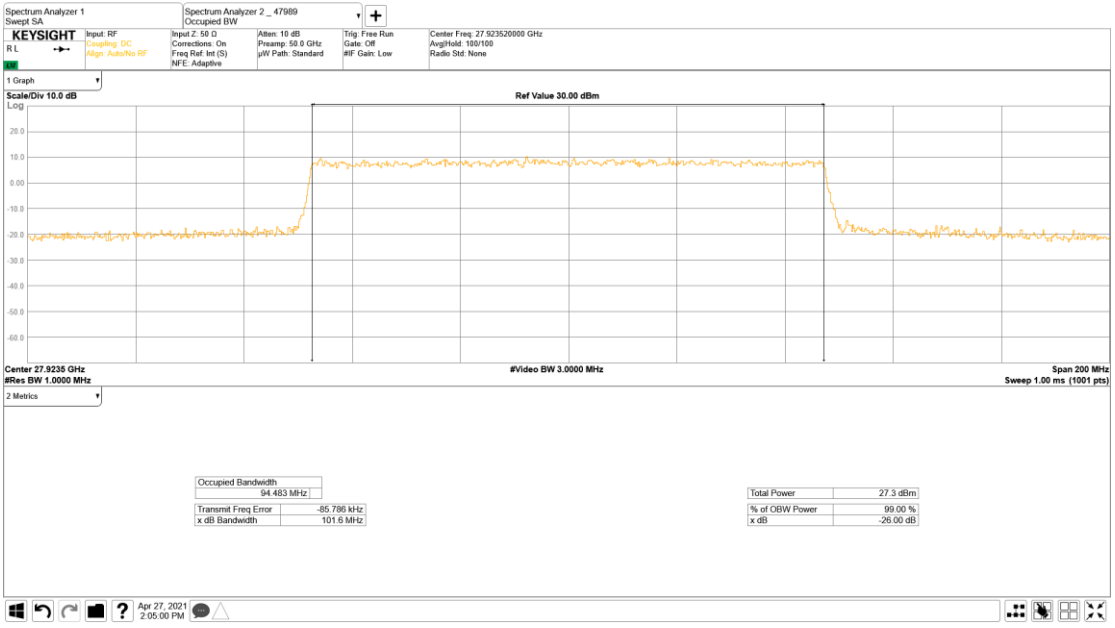
Module 0, Band n261

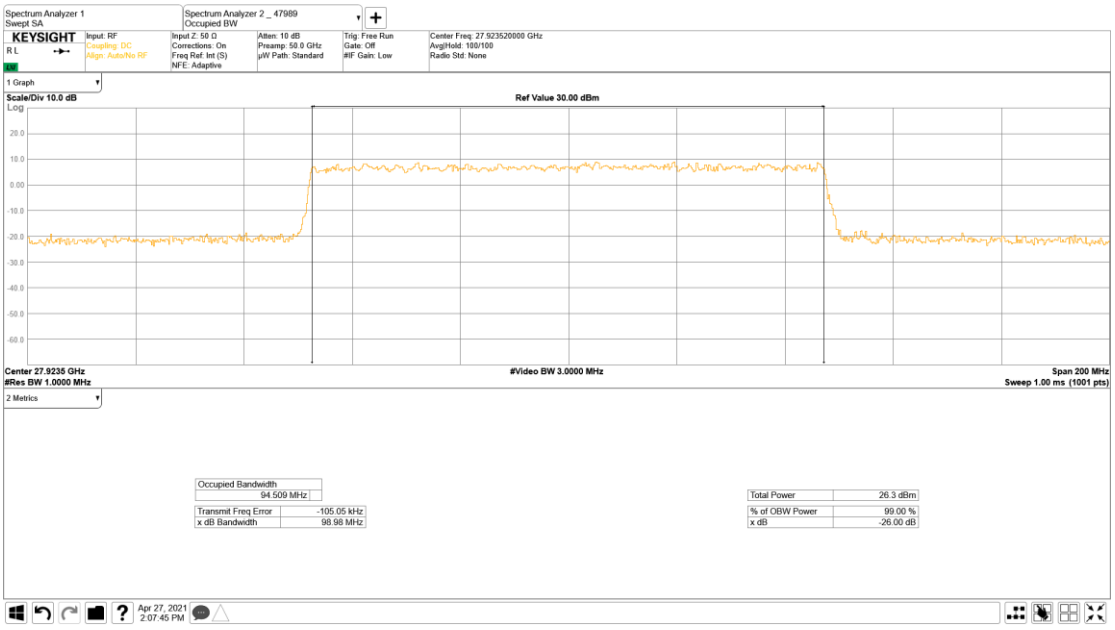
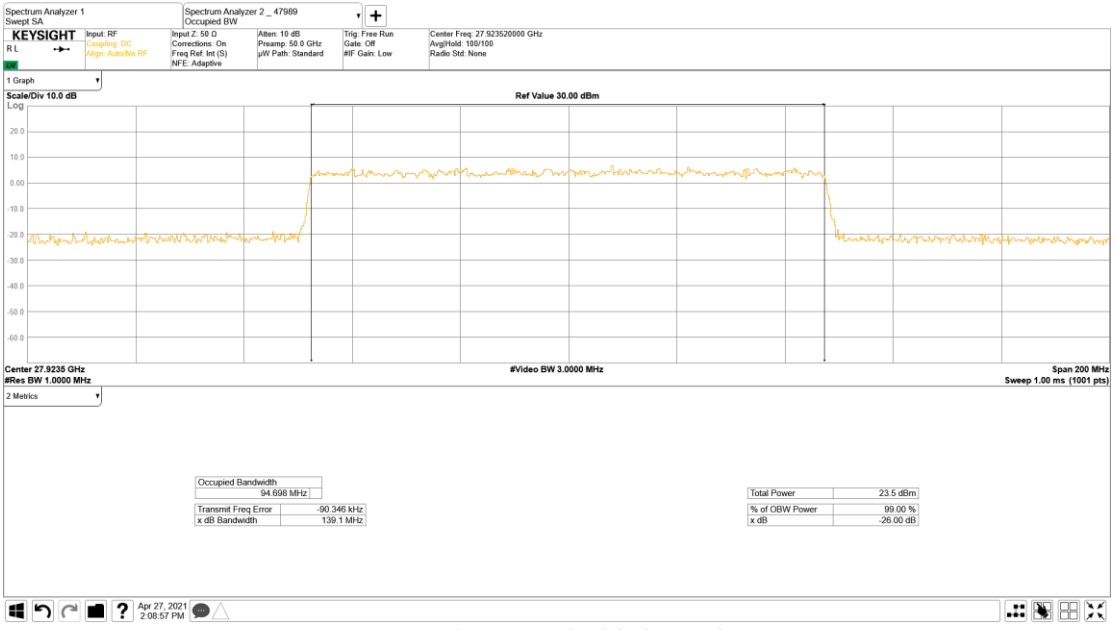
M 0 n261 BW 50MHz	 1CC / BPSK / Mid channel
M 0 n261 BW 50MHz	 1CC / QPSK / Mid channel

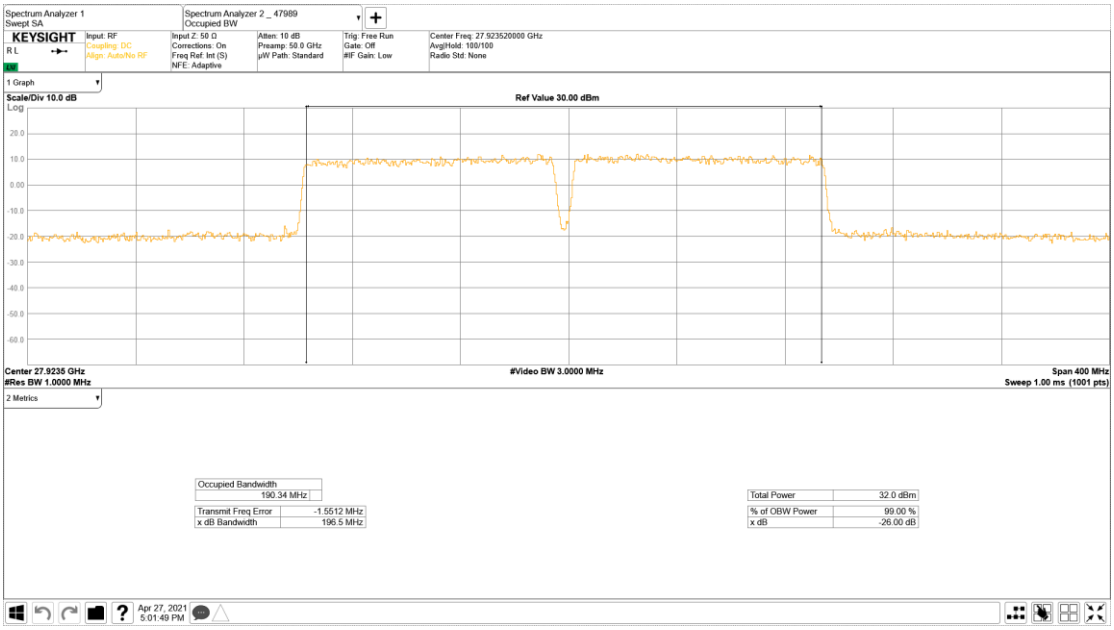
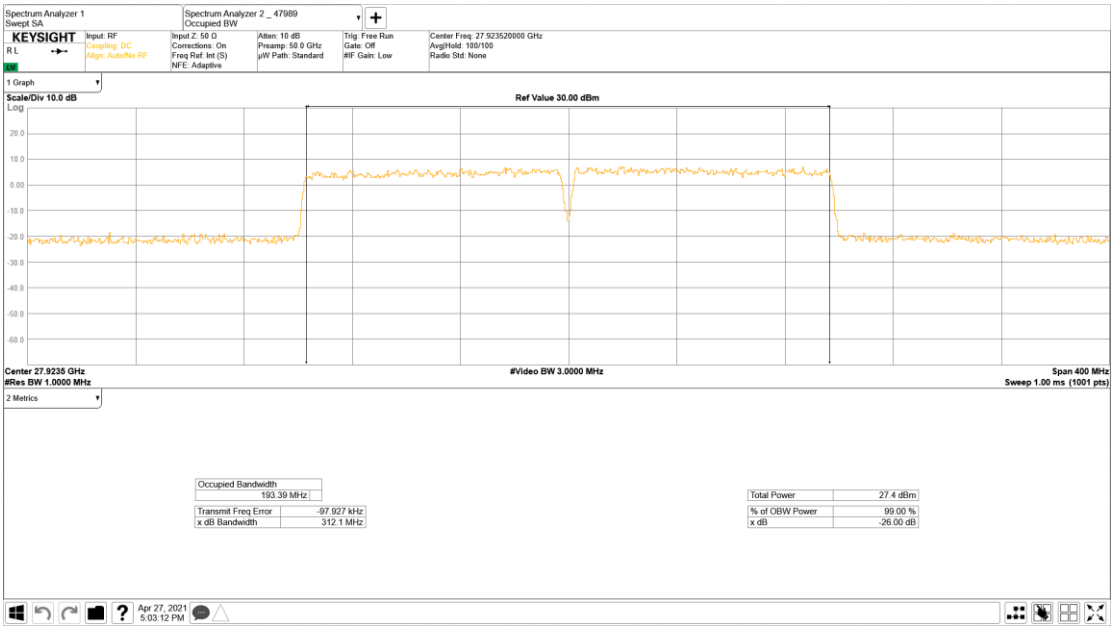
M 0 n261 BW 50MHz	 1CC / 16QAM / Mid channel
M 0 n261 BW 50MHz	 1CC / 64QAM / Mid channel

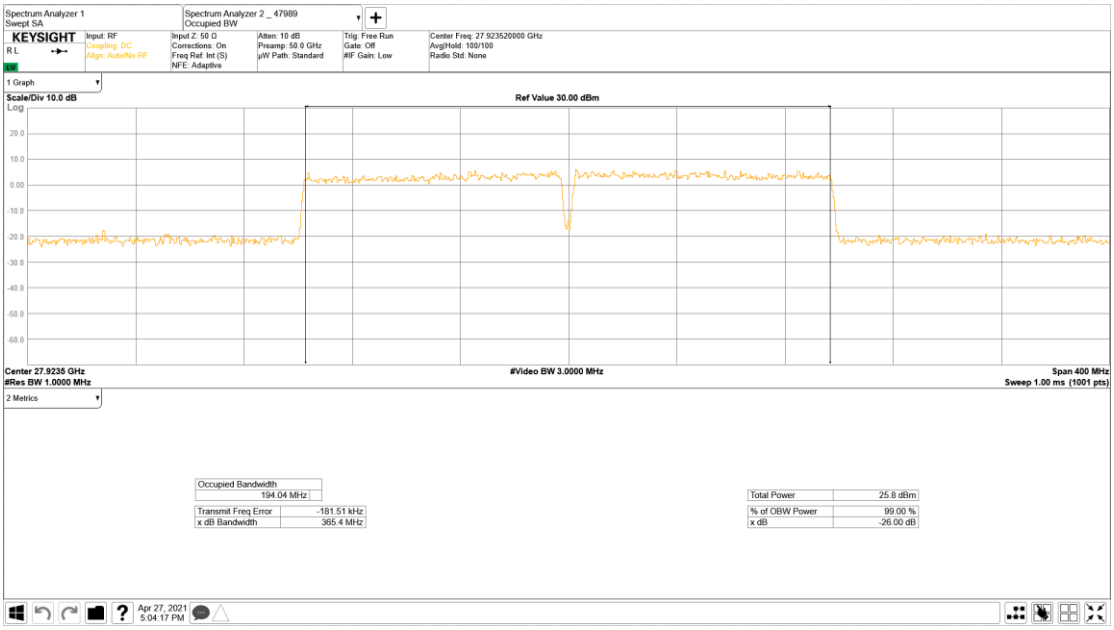
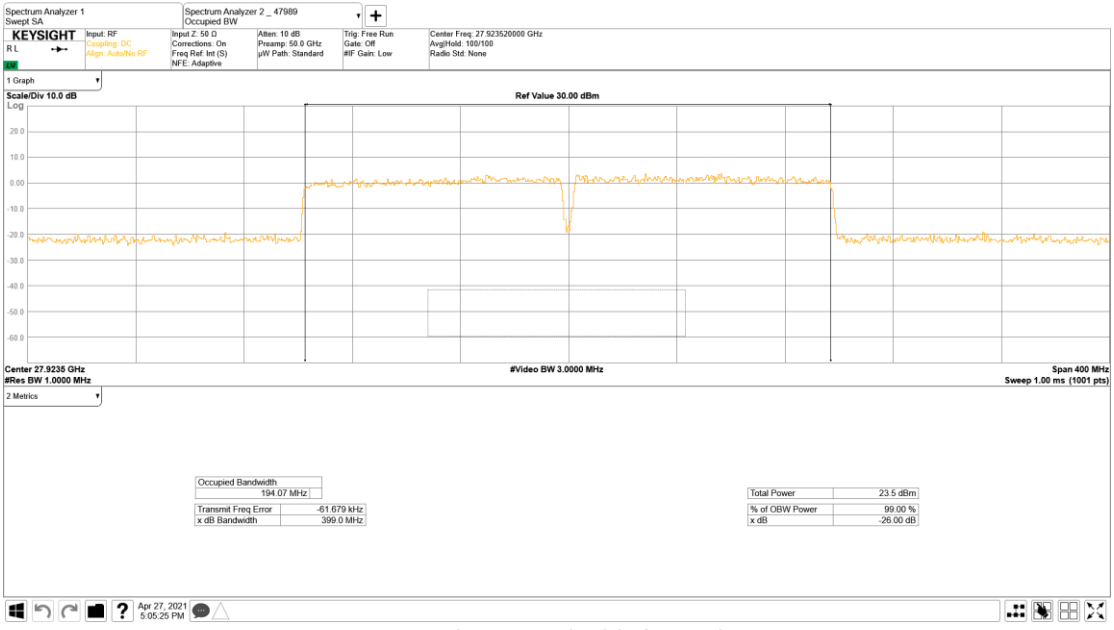
M 0 n261 BW 50MHz	 2CC / BPSK / Mid channel
M 0 n261 BW 50MHz	 2CC / QPSK / Mid channel

M 0 n261 BW 50MHz	 2CC / 16QAM / Mid channel
M 0 n261 BW 50MHz	 2CC / 64QAM / Mid channel

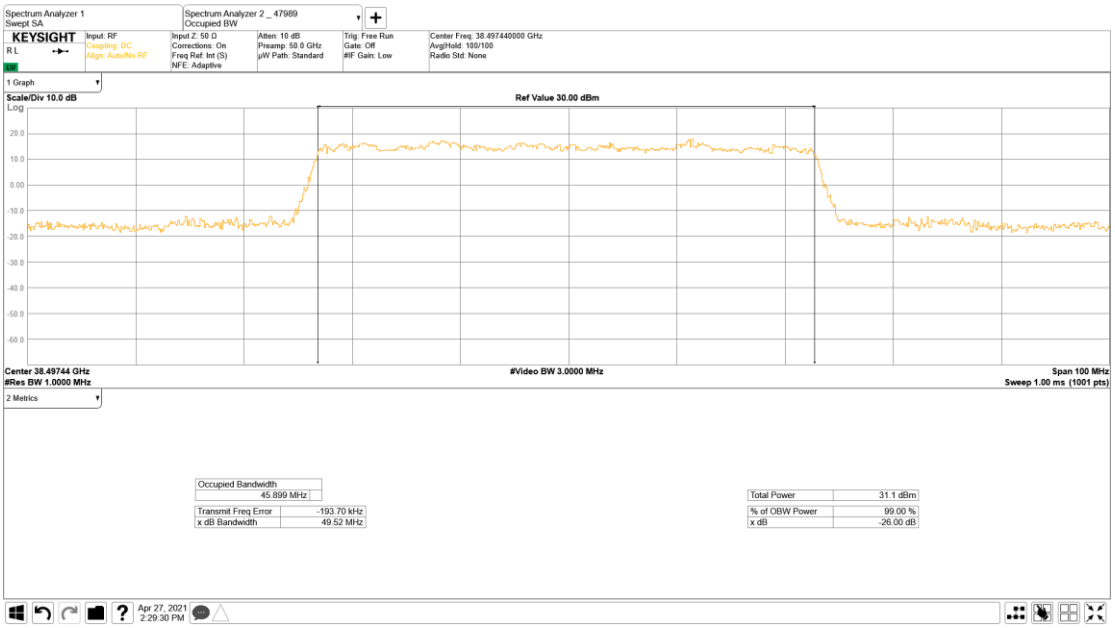
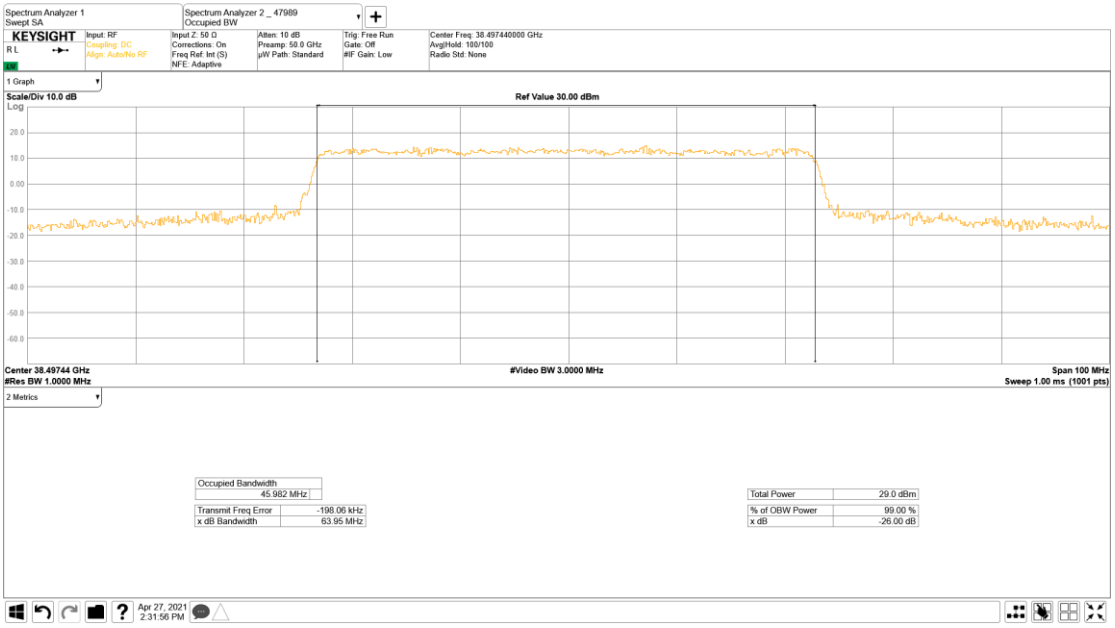
M 0 n261 BW 100MHz	 1CC / BPSK / Mid channel
M 0 n261 BW 100MHz	 1CC / QPSK / Mid channel

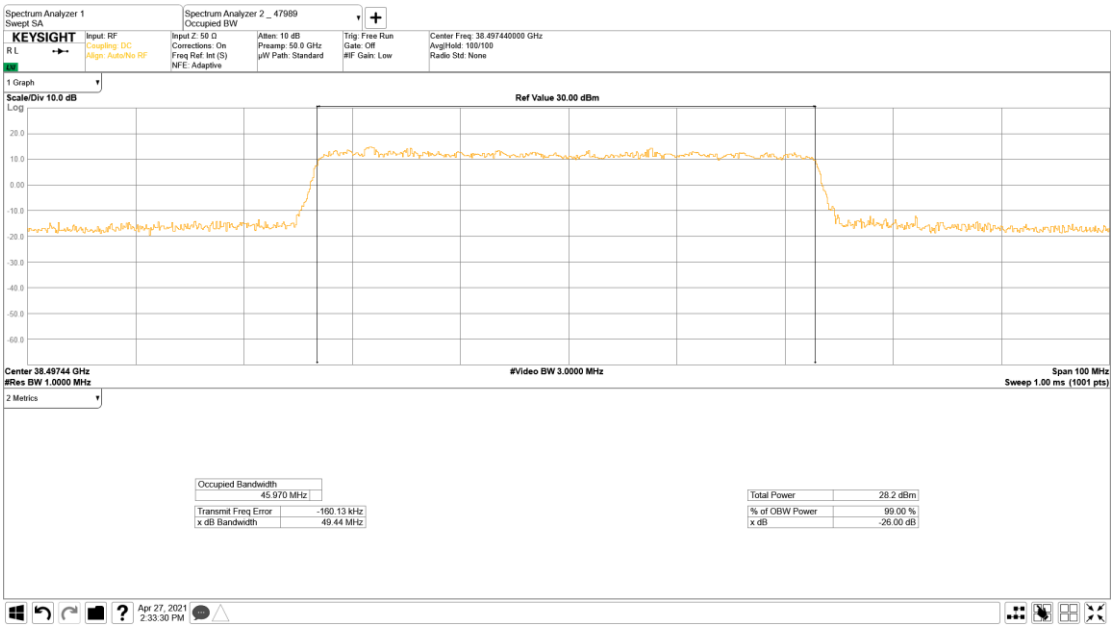
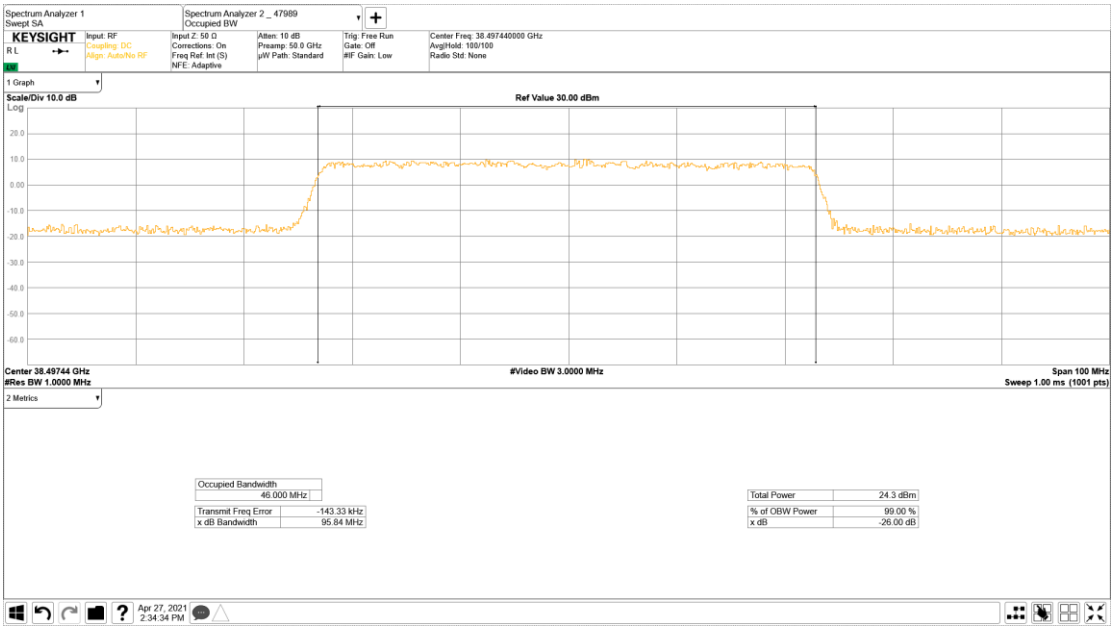
M 0 n261 BW 100MHz	 1CC / 16QAM / Mid channel
M 0 n261 BW 100MHz	 1CC / 64QAM / Mid channel

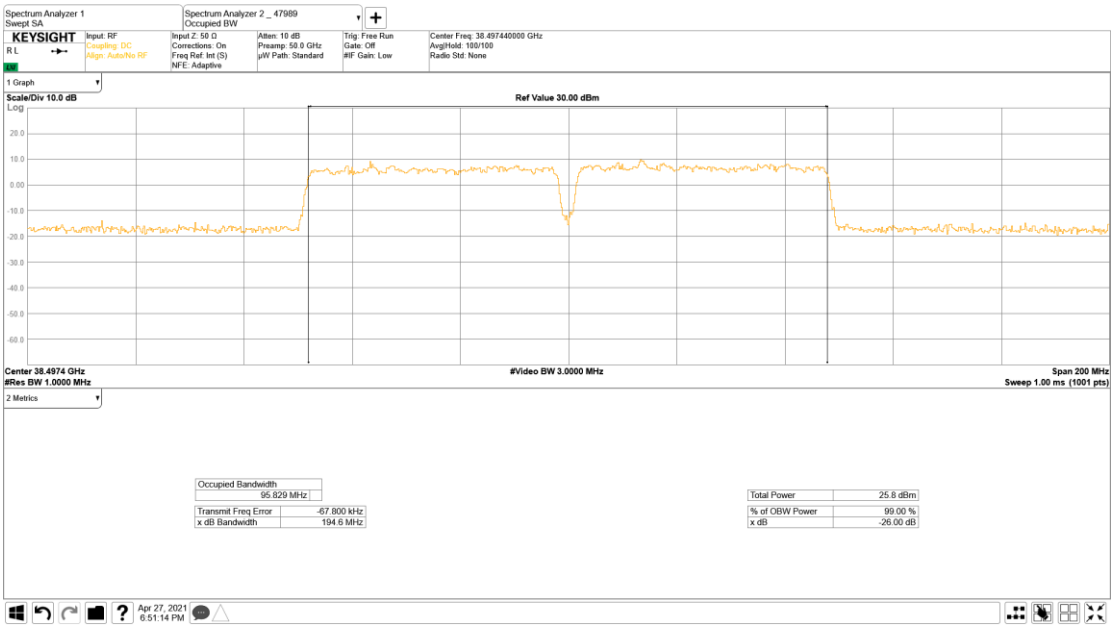
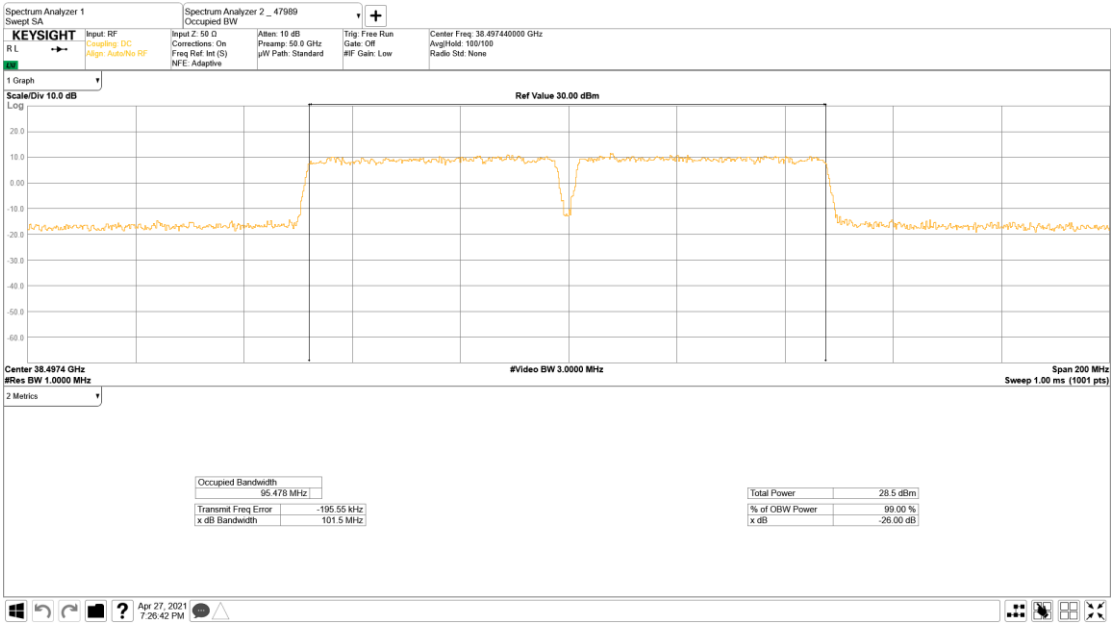
M 0 n261 BW 100MHz	 2CC / BPSK / Mid channel
M 0 n261 BW 100MHz	 2CC / QPSK / Mid channel

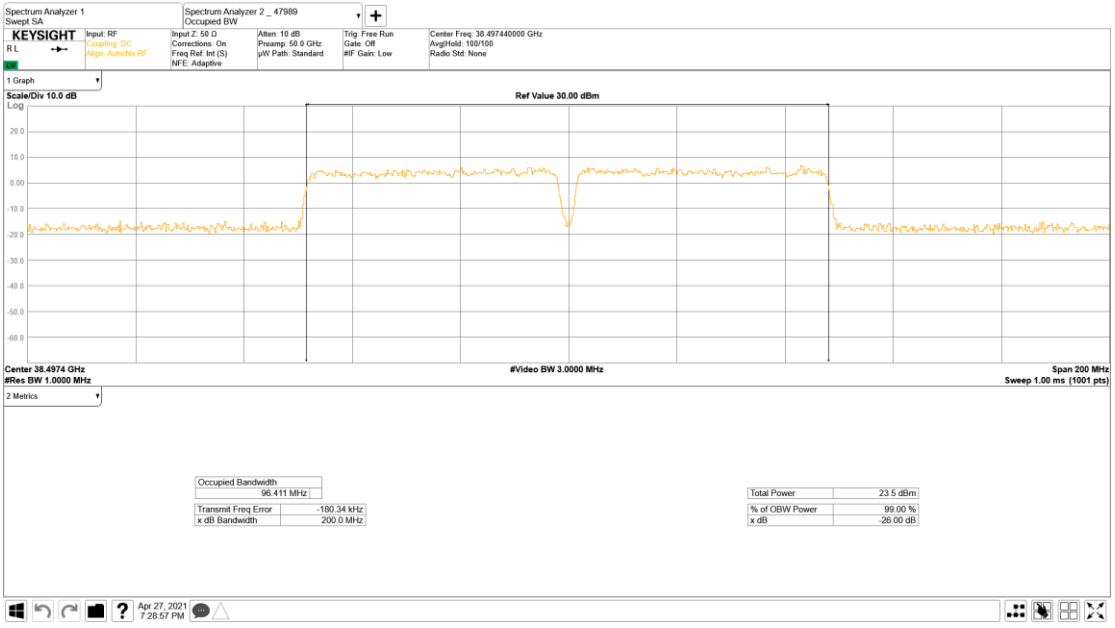
M 0 n261 BW 100MHz	 2CC / 16QAM / Mid channel
M 0 n261 BW 100MHz	 2CC / 64QAM / Mid channel

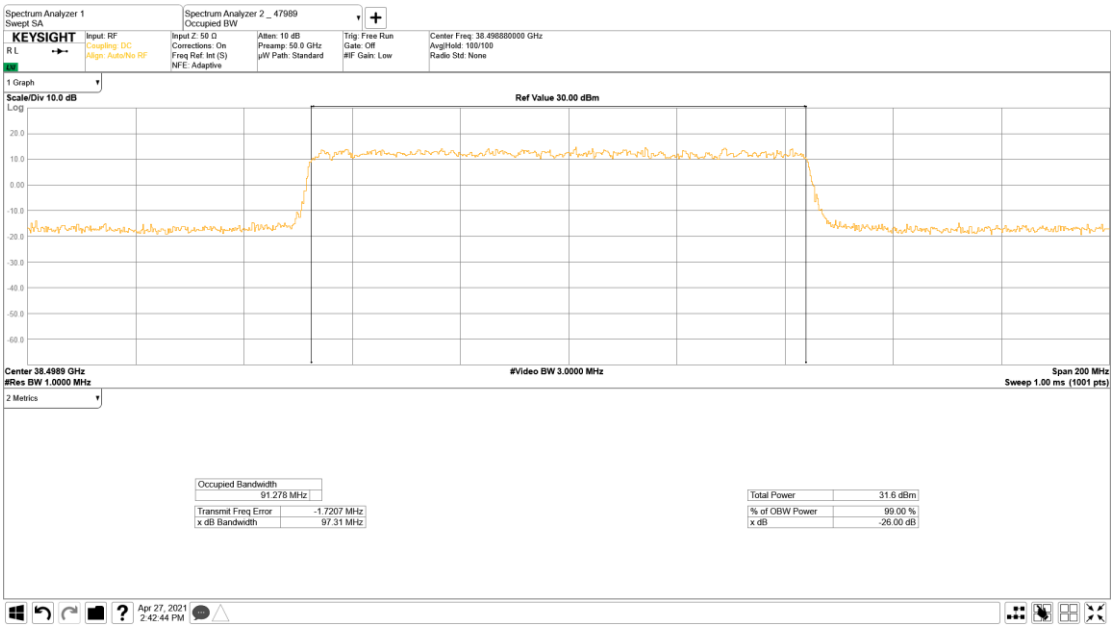
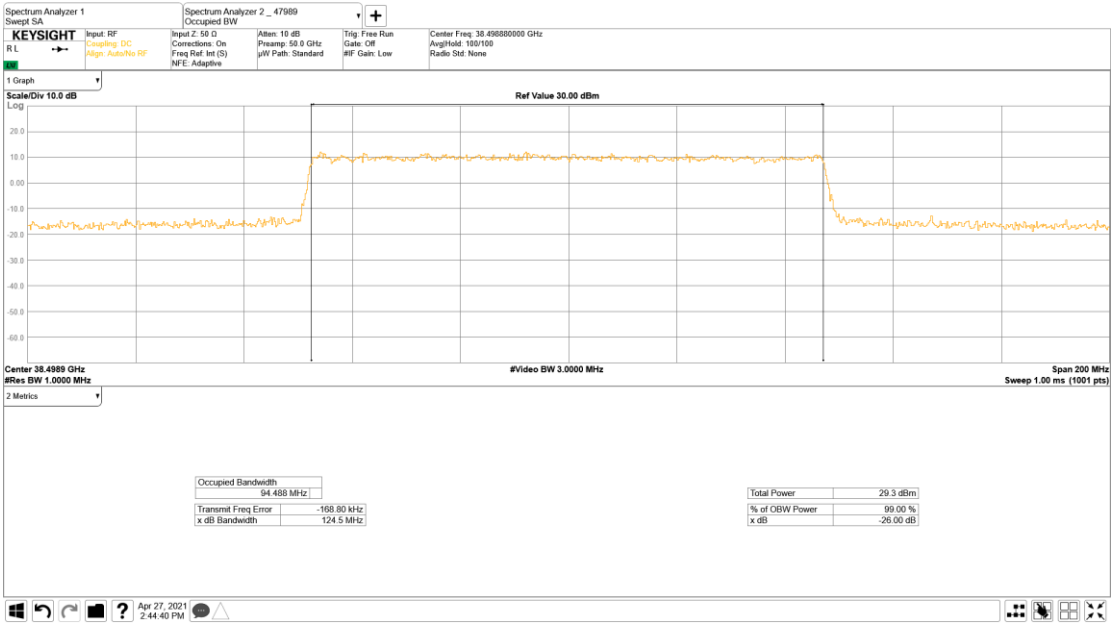
Module 0, Band n260

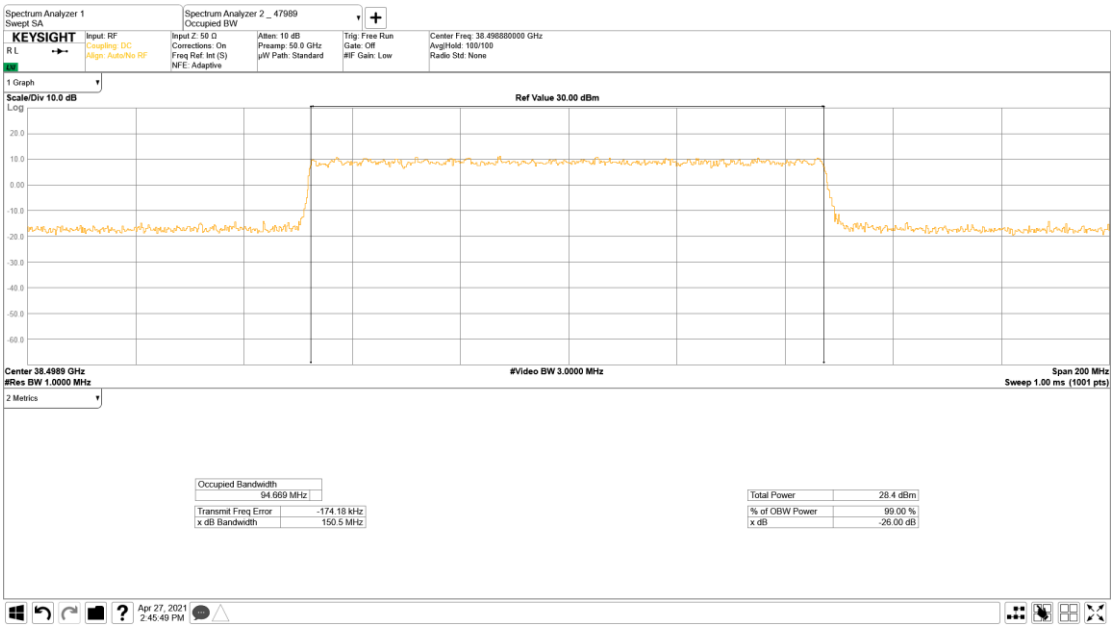
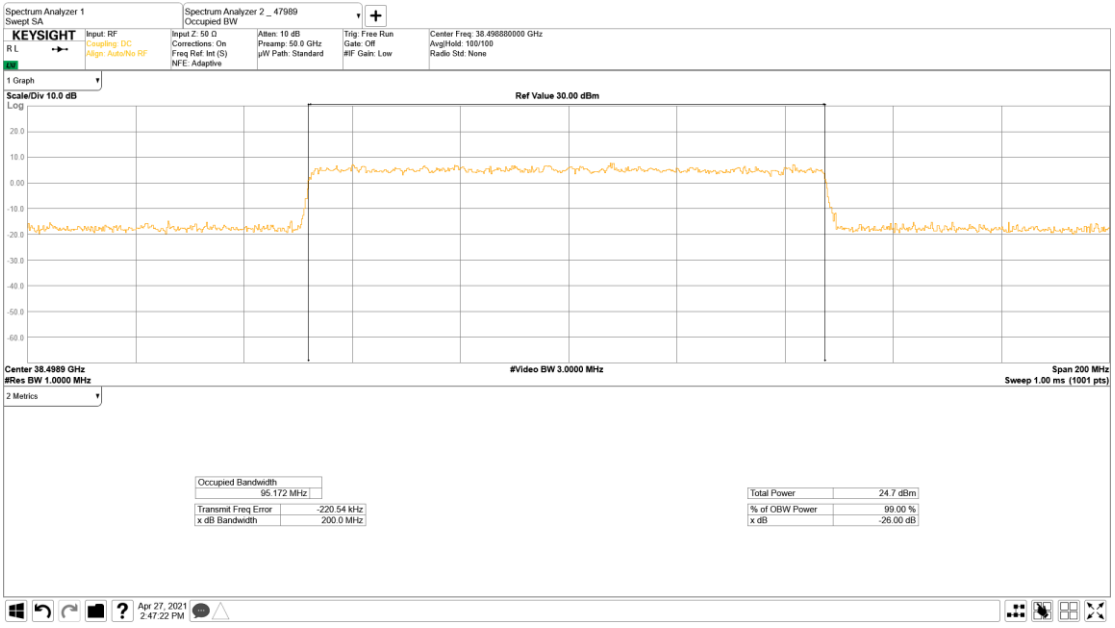
M 0 n260 BW 50MHz	 1CC / BPSK / Mid channel
M 0 n260 BW 50MHz	 1CC / QPSK / Mid channel

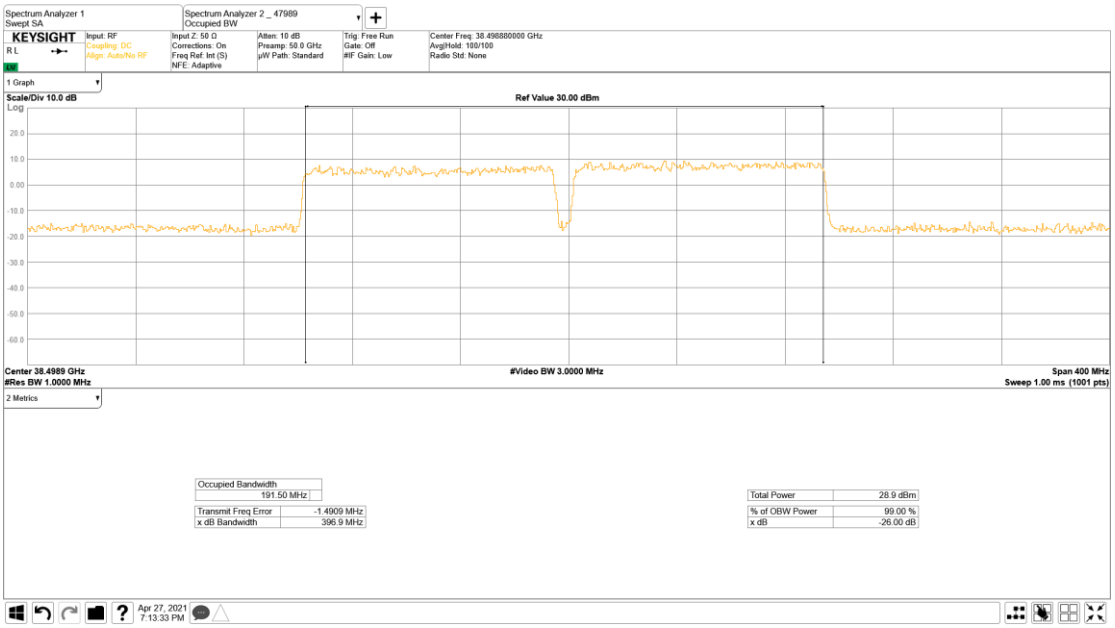
M 0 n260 BW 50MHz	 1CC / 16QAM / Mid channel
M 0 n260 BW 50MHz	 1CC / 64QAM / Mid channel

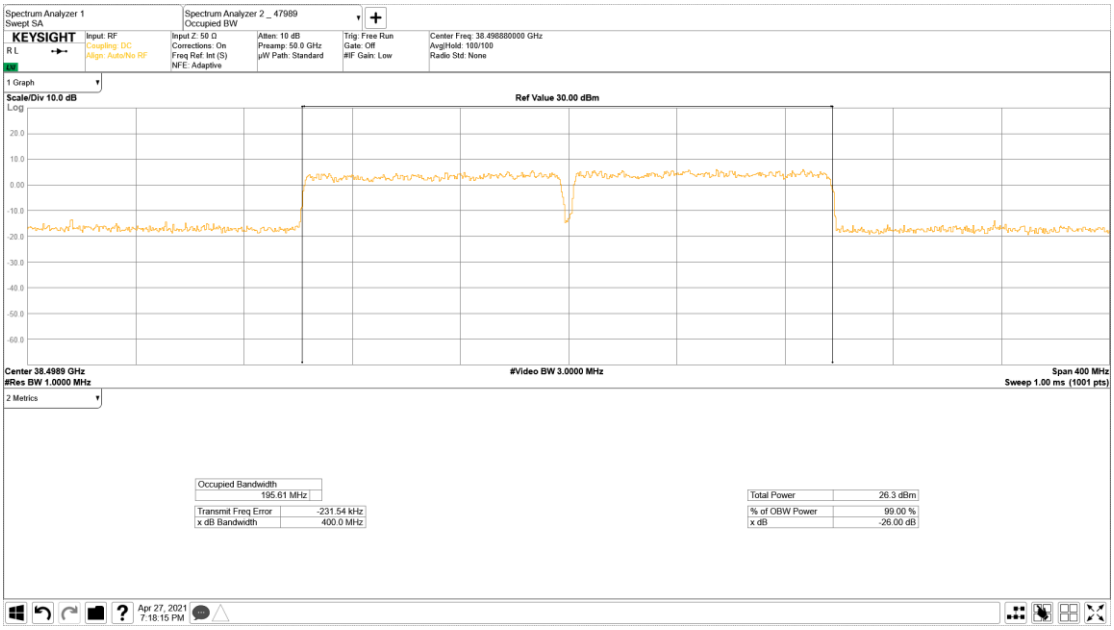
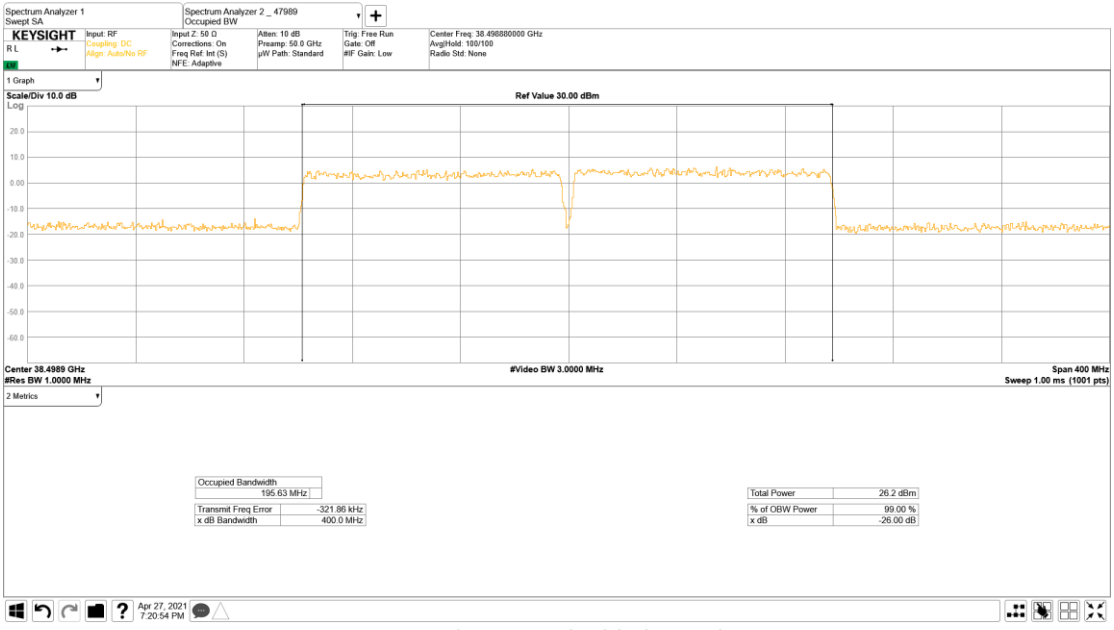
M 0 n260 BW 50MHz	 2CC / BPSK / Mid channel
M 0 n260 BW 50MHz	 2CC / QPSK / Mid channel

M 0 n260 BW 50MHz	 2CC / 16QAM / Mid channel
M 0 n260 BW 50MHz	 2CC / 64QAM / Mid channel

M 0 n260 BW 100MHz	 1CC / BPSK / Mid channel
M 0 n260 BW 100MHz	 1CC / QPSK / Mid channel

M 0 n260 BW 100MHz	 1CC / 16QAM / Mid channel
M 0 n260 BW 100MHz	 1CC / 64QAM / Mid channel

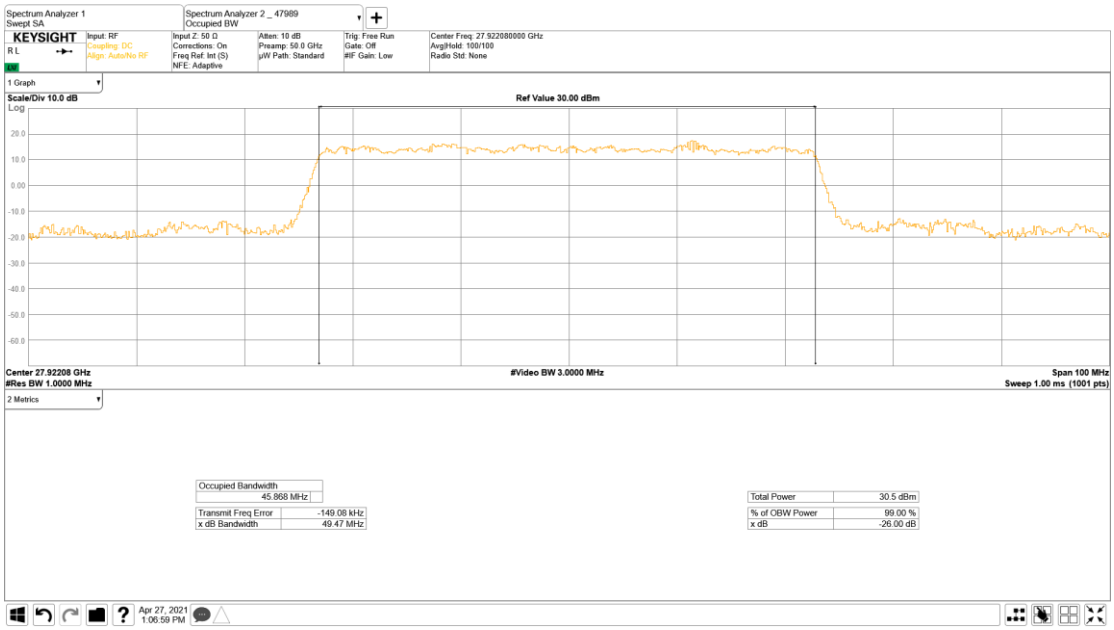
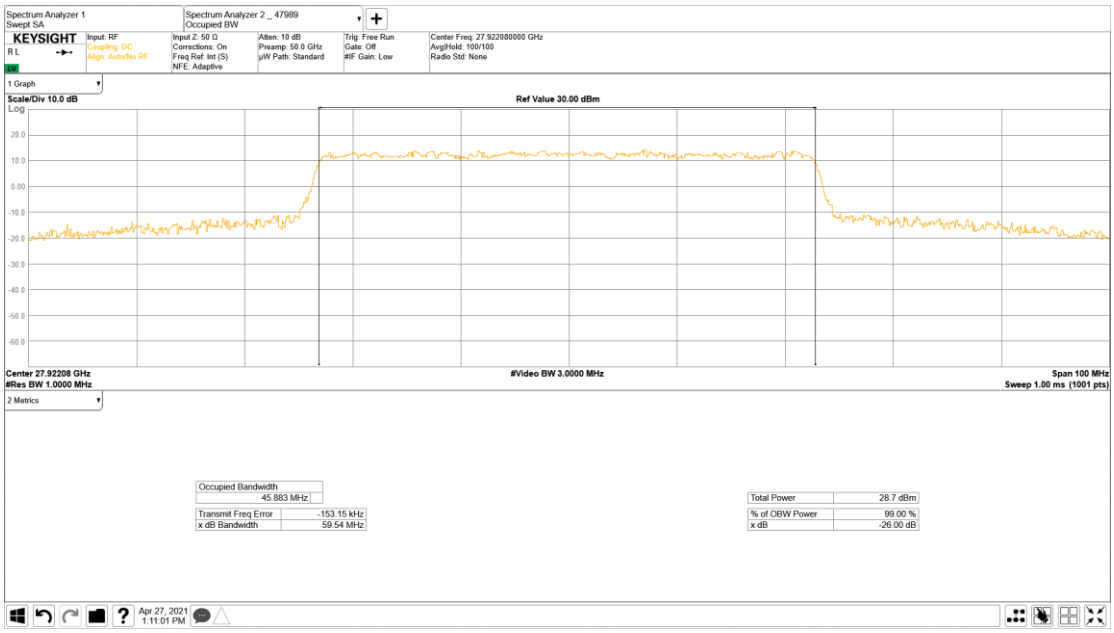
M 0 n260 BW 100MHz	 2CC / BPSK / Mid channel
M 0 n260 BW 100MHz	 2CC / QPSK / Mid channel

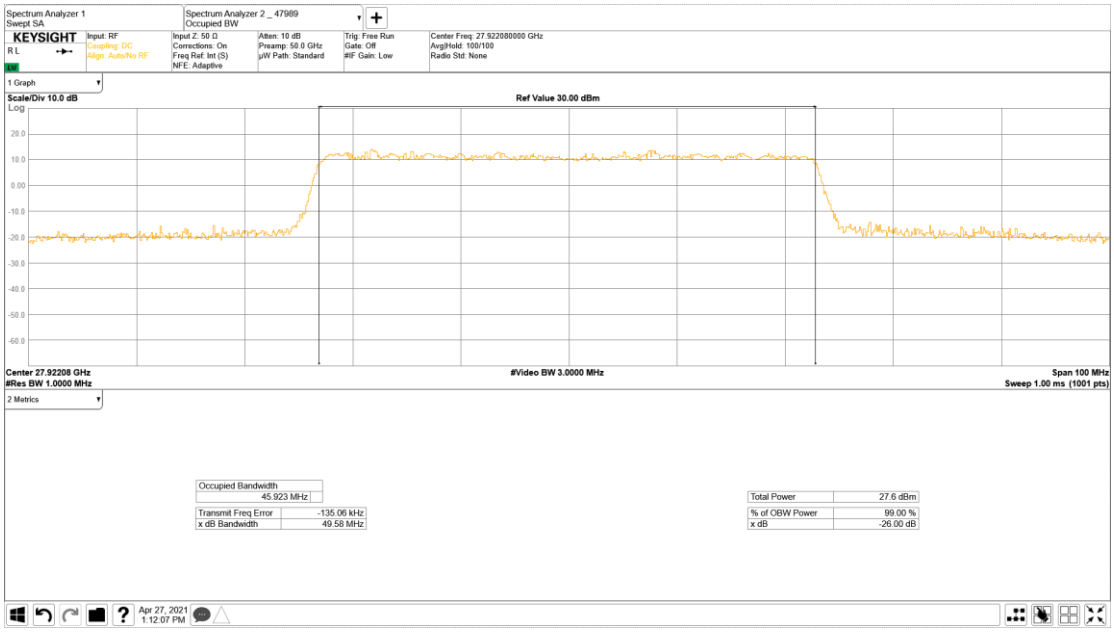
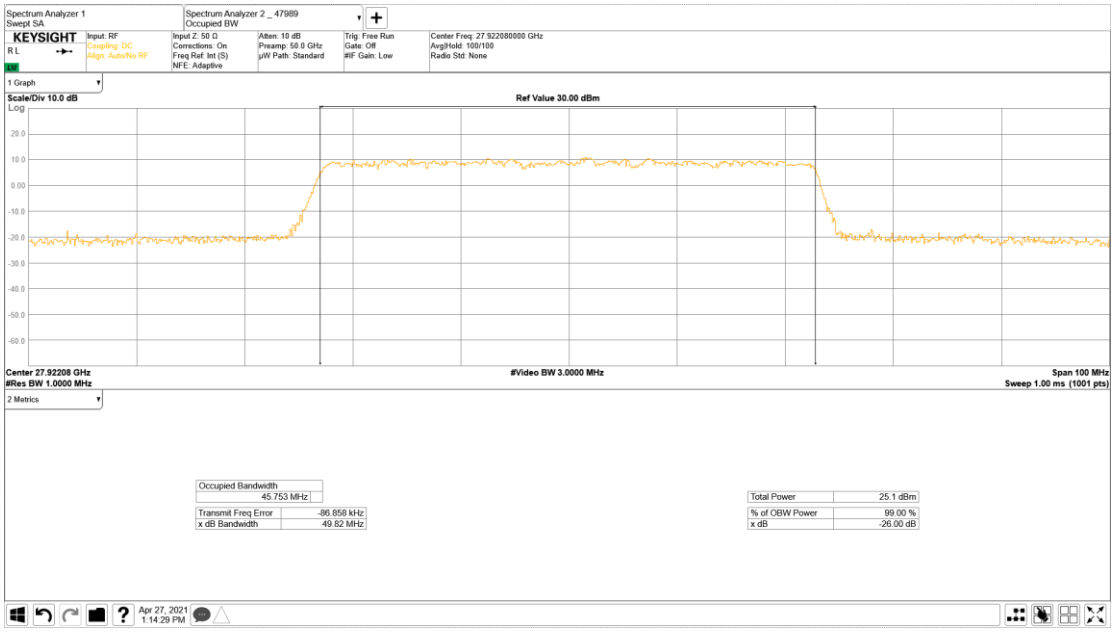
M 0 n260 BW 100MHz	 2CC / 16QAM / Mid channel
M 0 n260 BW 100MHz	 2CC / 64QAM / Mid channel

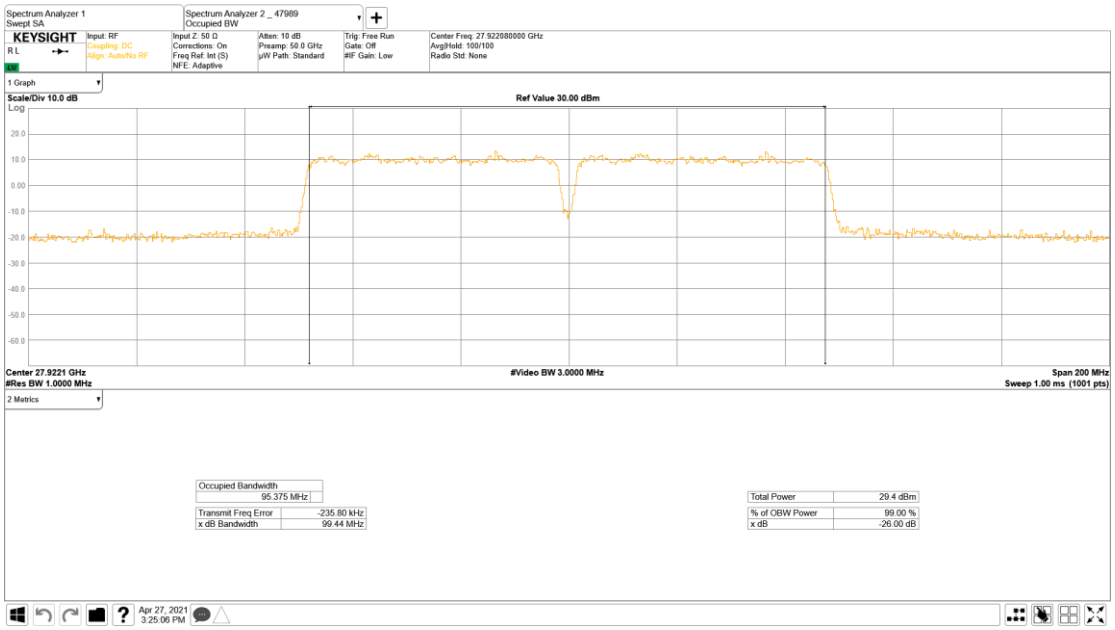
OBW Result - Module 1

Antenna	Band	BandWidth [MHz]	CCs Active	Modulation	OBW [MHz]
Module 1	n261	50	1CC	pi/2-BPSK	45.87
				QPSK	45.88
				16QAM	**45.92**
				64QAM	45.75
			2CC	pi/2-BPSK	95.38
				QPSK	95.18
				16QAM	**95.51**
				64QAM	95.50
		100	1CC	pi/2-BPSK	91.13
				QPSK	94.24
				16QAM	**94.43**
				64QAM	**94.43**
			2CC	pi/2-BPSK	190.56
				QPSK	193.47
				16QAM	193.86
				64QAM	**193.90**
	n260	50	1CC	pi/2-BPSK	45.87
				QPSK	45.98
				16QAM	46.01
				64QAM	**46.12**
			2CC	pi/2-BPSK	95.60
				QPSK	95.75
				16QAM	96.10
				64QAM	**97.57**
		100	1CC	pi/2-BPSK	91.26
				QPSK	94.54
				16QAM	94.80
				64QAM	**95.31**
			2CC	pi/2-BPSK	191.57
				QPSK	**203.91**
				16QAM	197.29
				64QAM	194.95

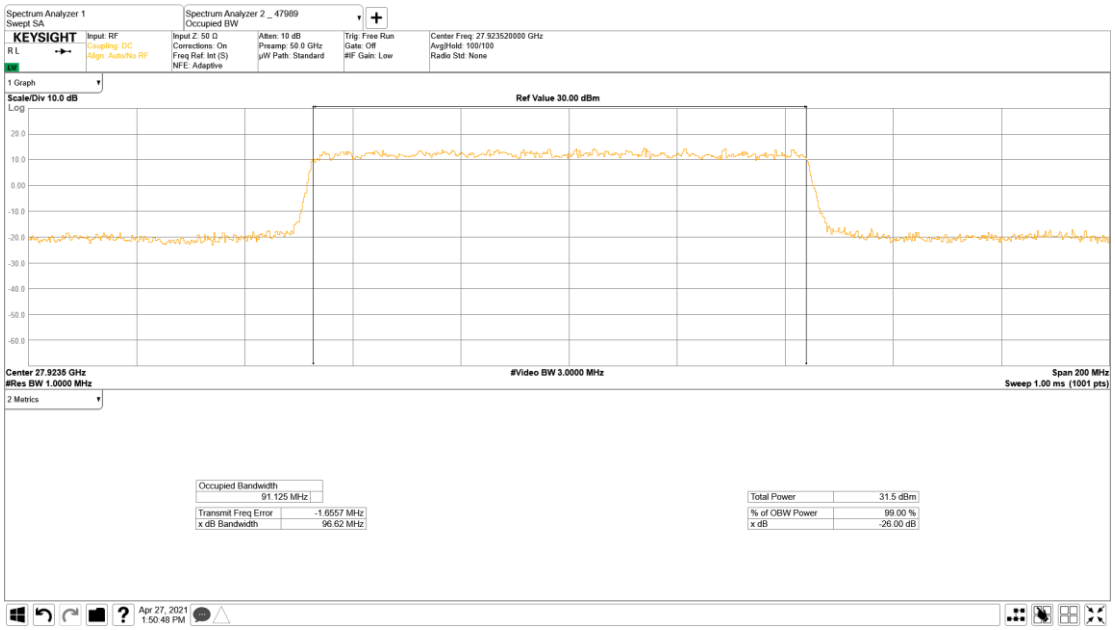
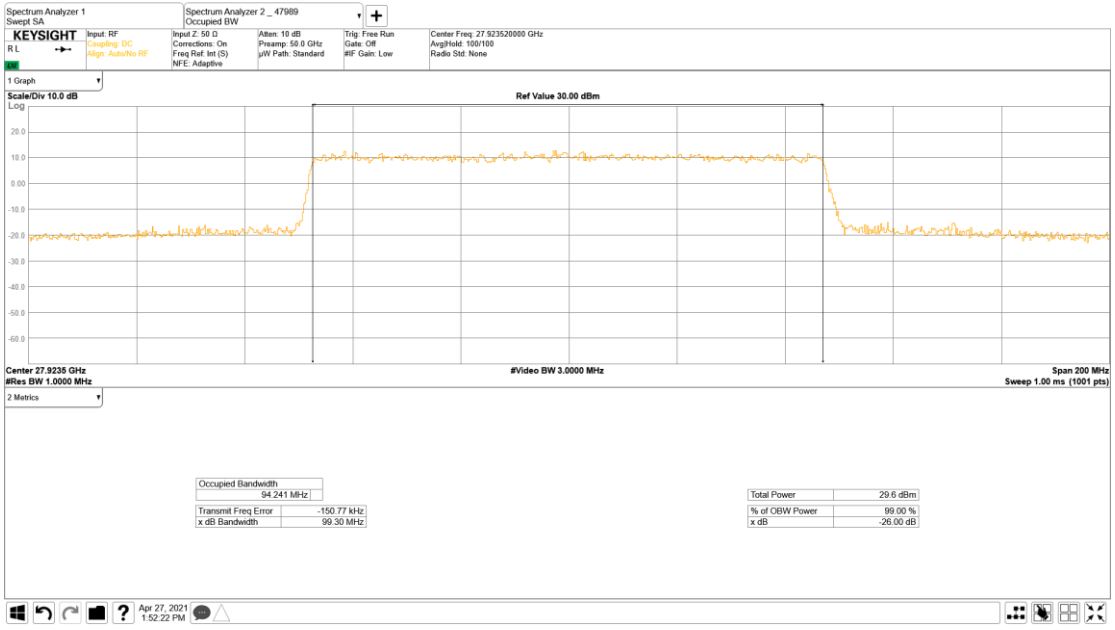
Module 1, Band n261

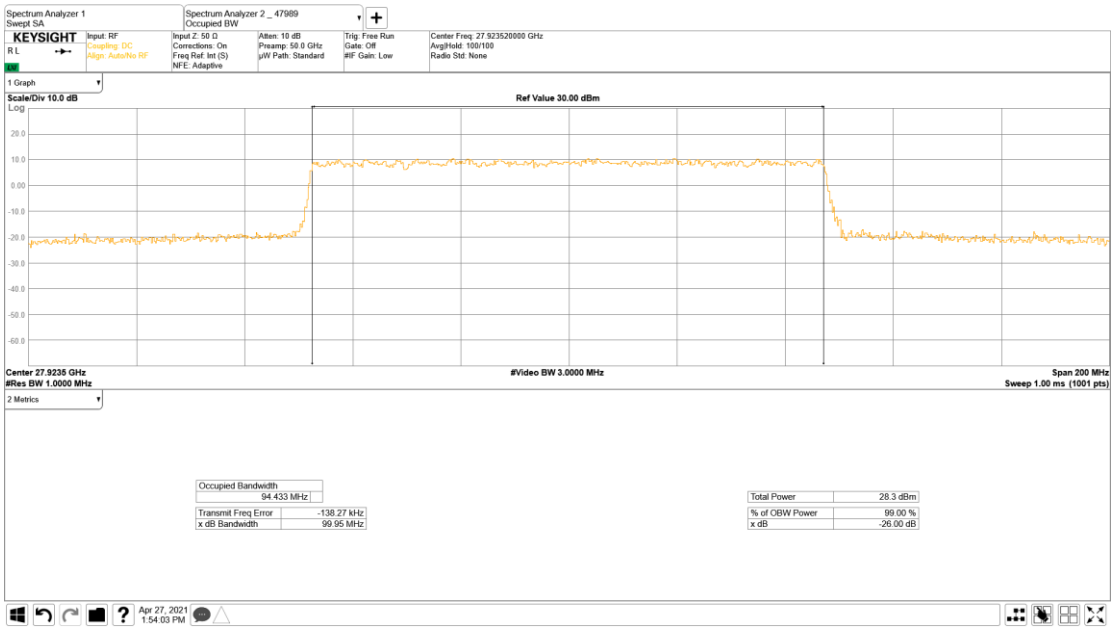
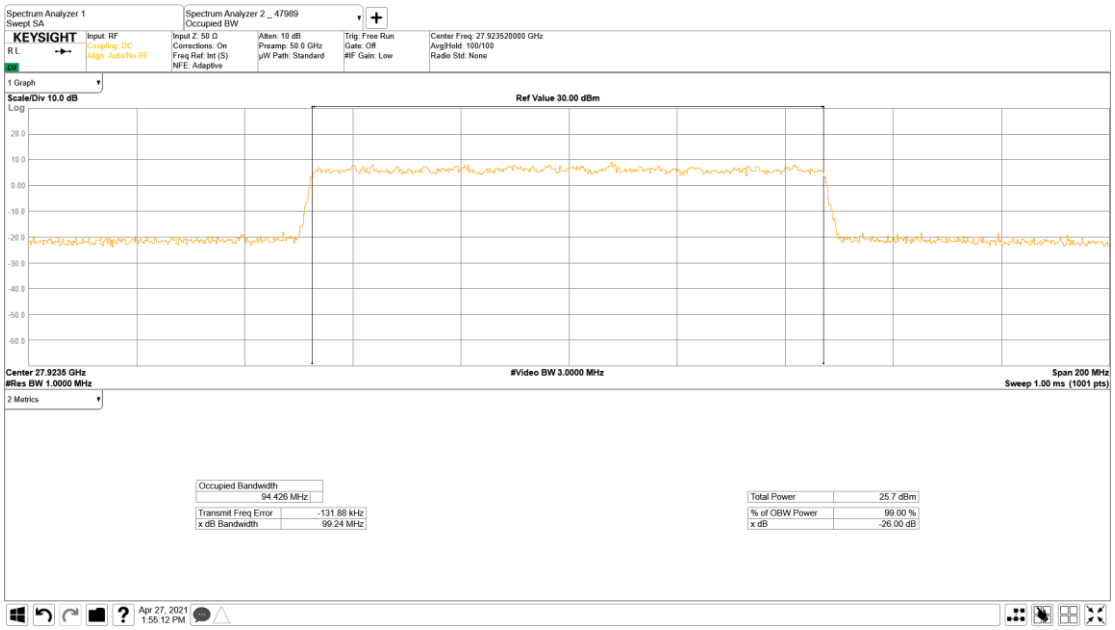
M 1 n261 BW 50MHz	 1CC / BPSK / Mid channel
M 1 n261 BW 50MHz	 1CC / QPSK / Mid channel

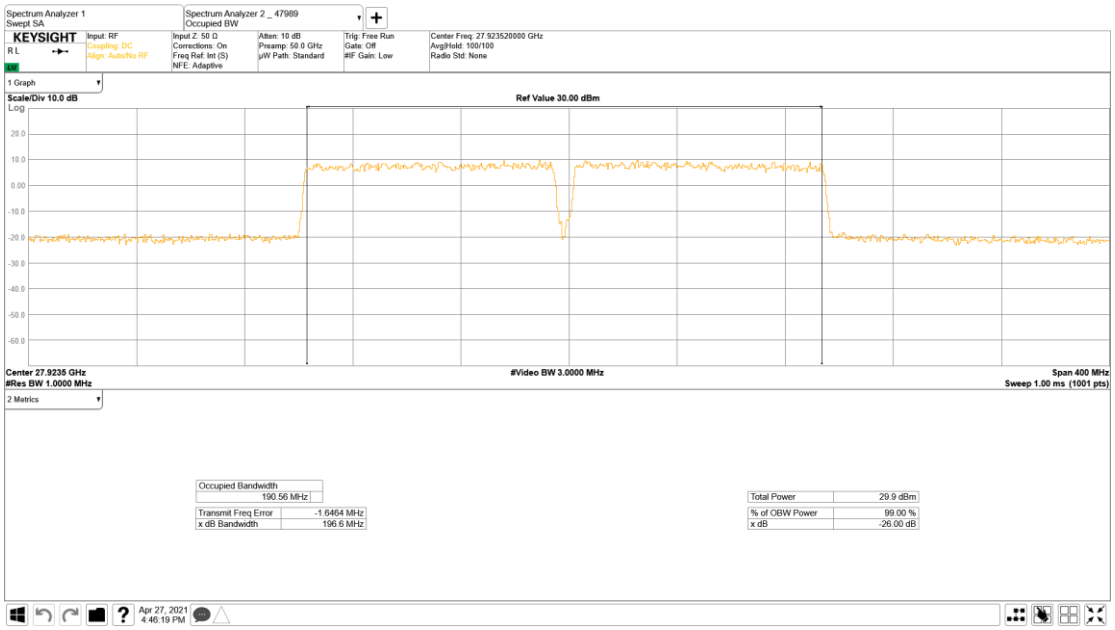
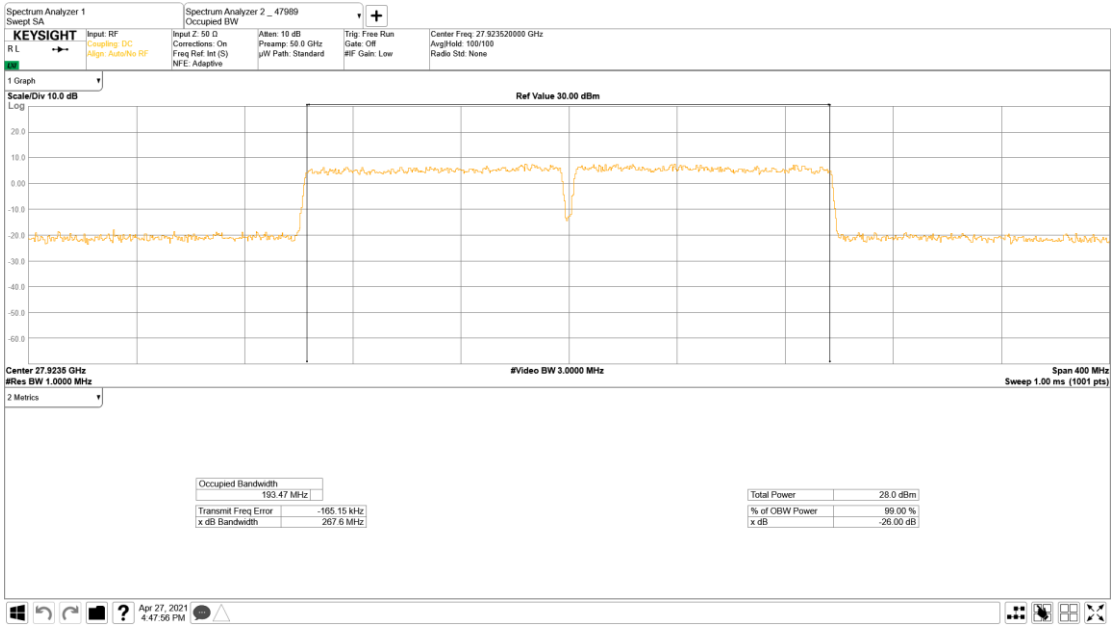
M 1 n261 BW 50MHz	 1CC / 16QAM / Mid channel
M 1 n261 BW 50MHz	 1CC / 64QAM / Mid channel

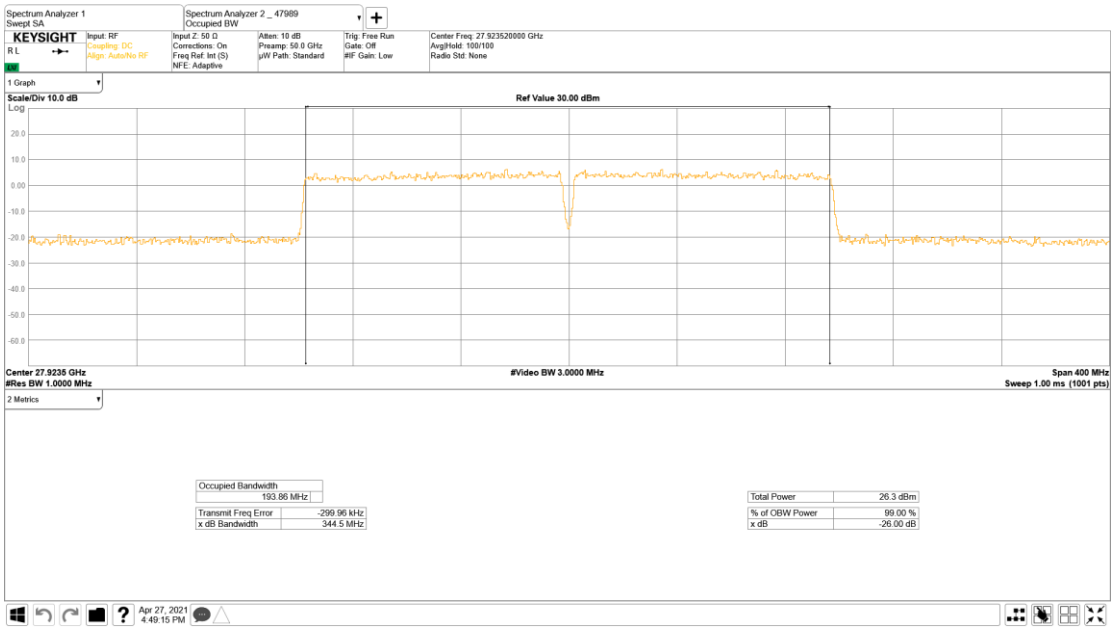
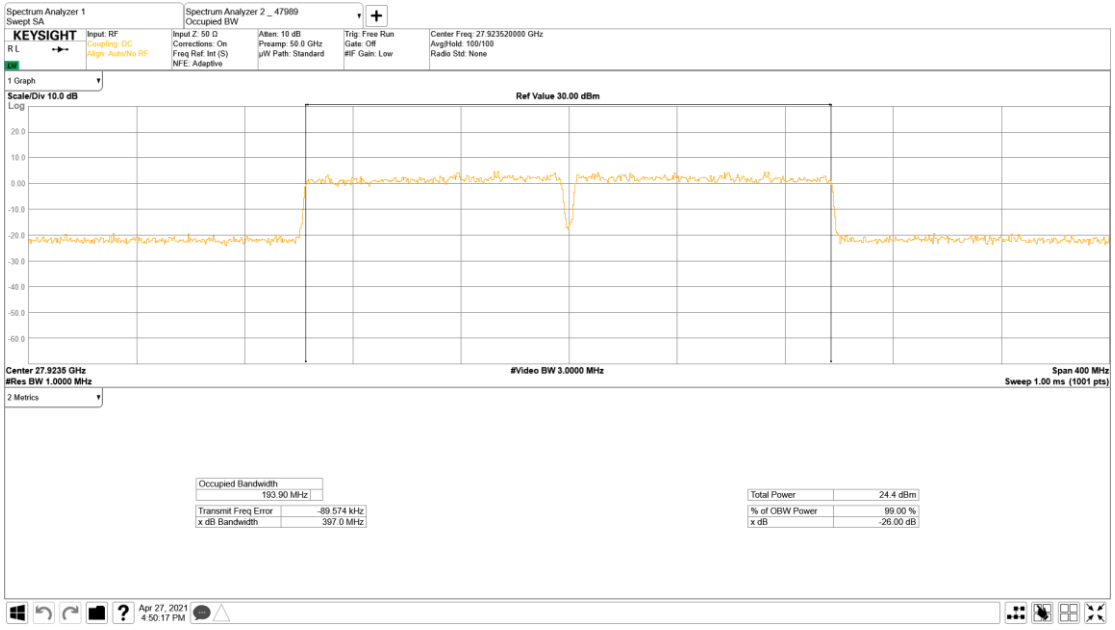
M 1 n261 BW 50MHz	 2CC / BPSK / Mid channel
M 1 n261 BW 50MHz	 2CC / QPSK / Mid channel

M 1 n261 BW 50MHz	 2CC / 16QAM / Mid channel
M 1 n261 BW 50MHz	 2CC / 64QAM / Mid channel

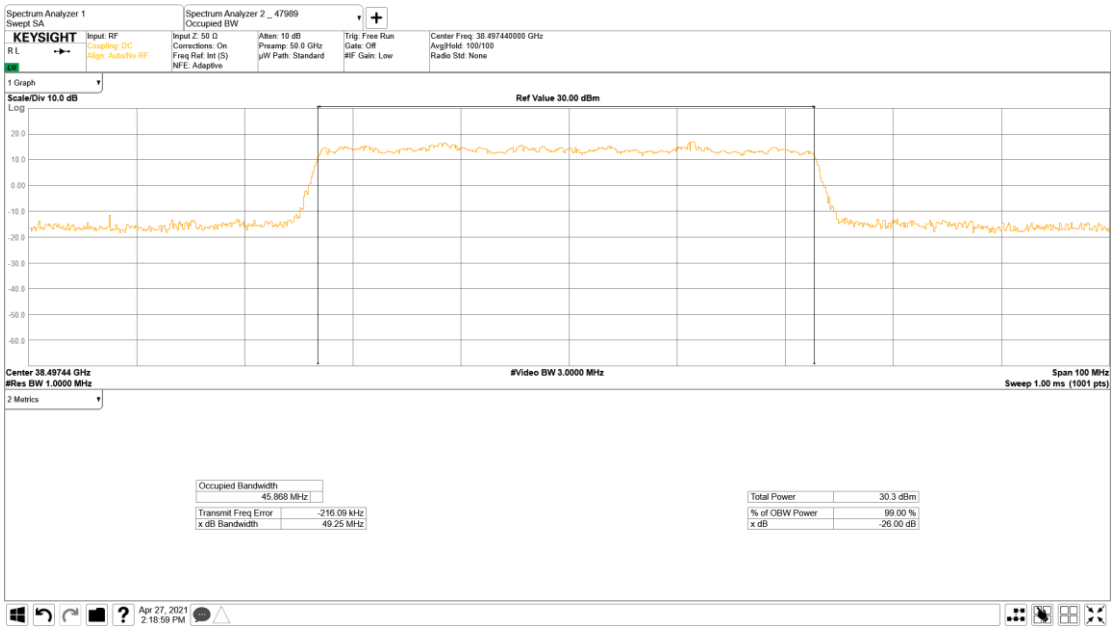
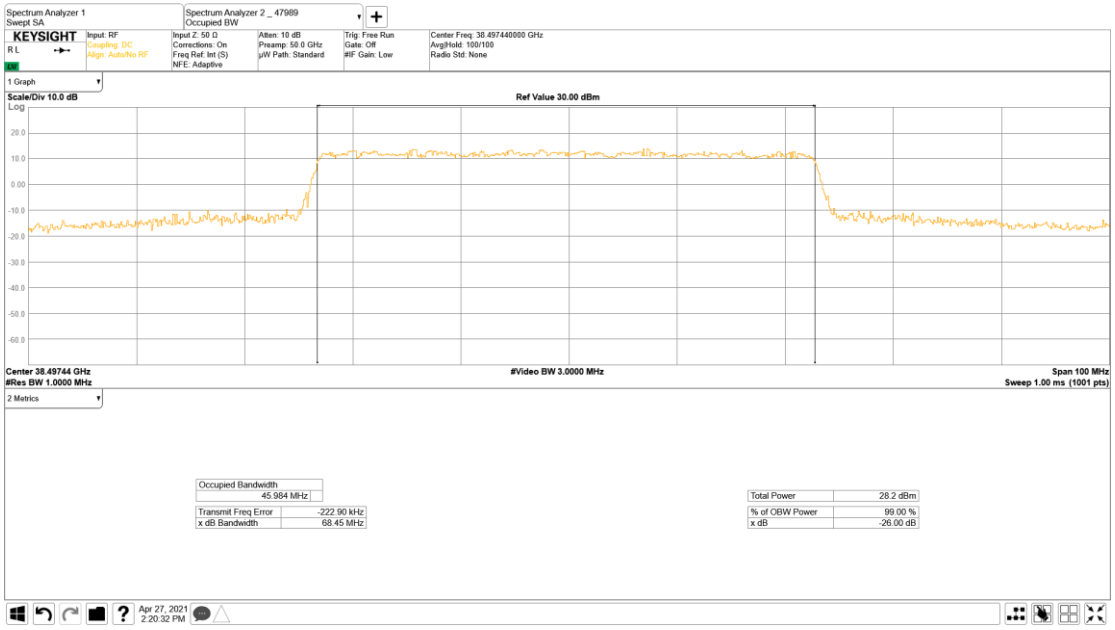
M 1 n261 BW 100MHz	 1CC / BPSK / Mid channel
M 1 n261 BW 100MHz	 1CC / QPSK / Mid channel

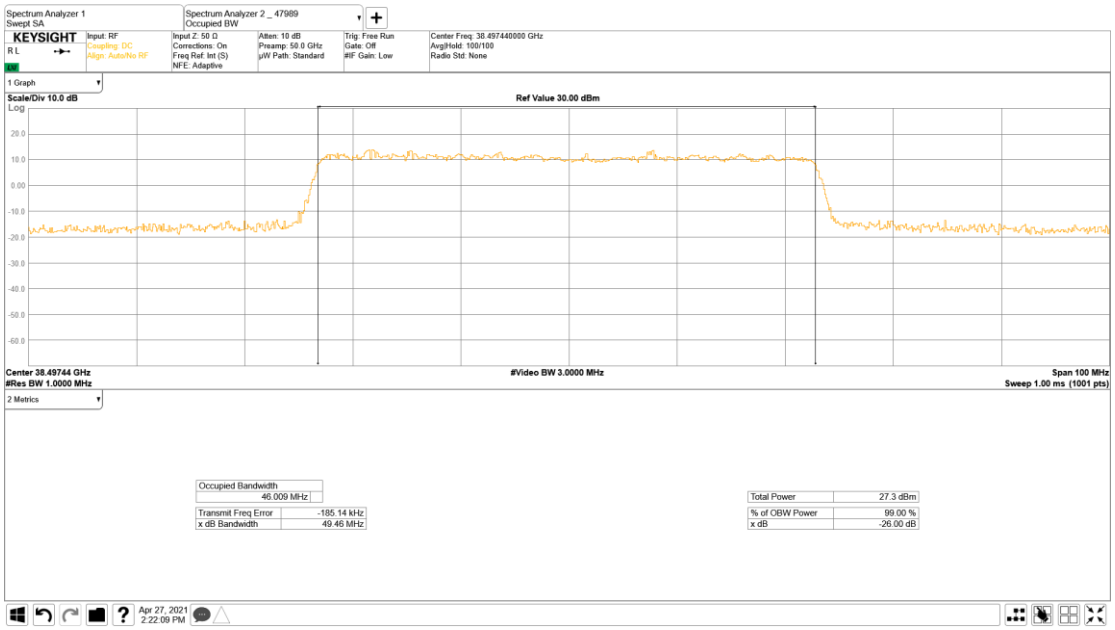
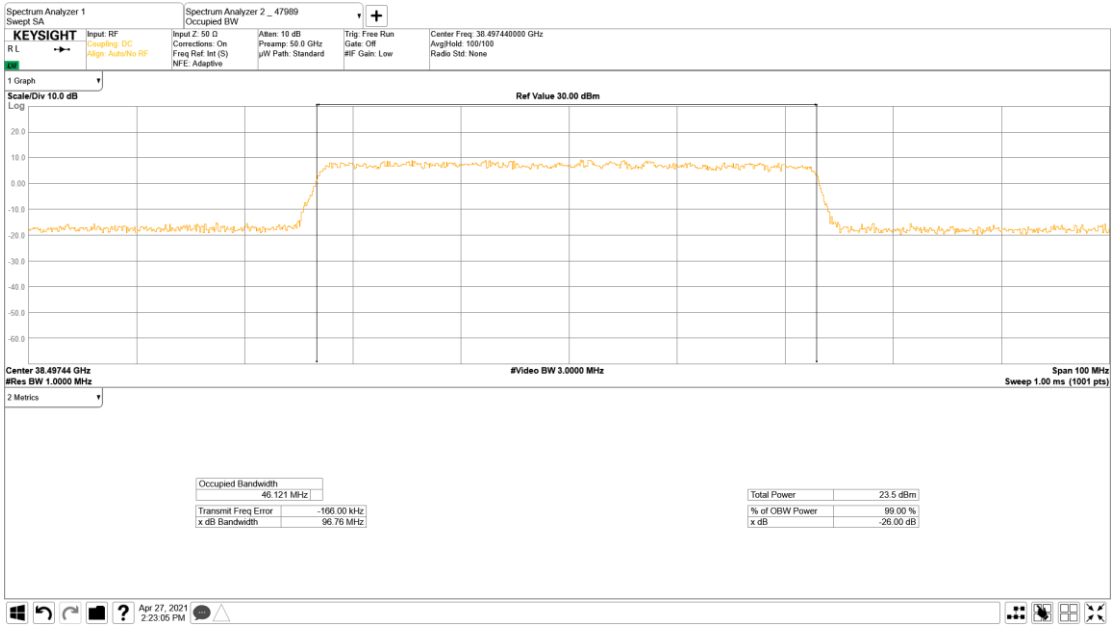
M 1 n261 BW 100MHz	 1CC / 16QAM / Mid channel
M 1 n261 BW 100MHz	 1CC / 64QAM / Mid channel

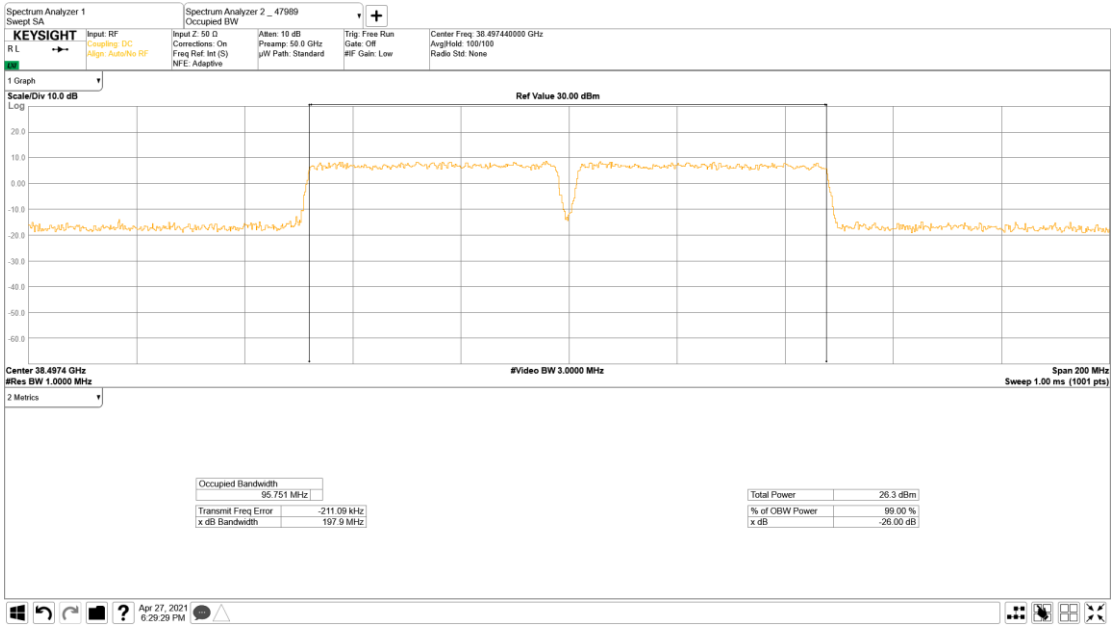
M 1 n261 BW 100MHz	 2CC / BPSK / Mid channel
M 1 n261 BW 100MHz	 2CC / QPSK / Mid channel

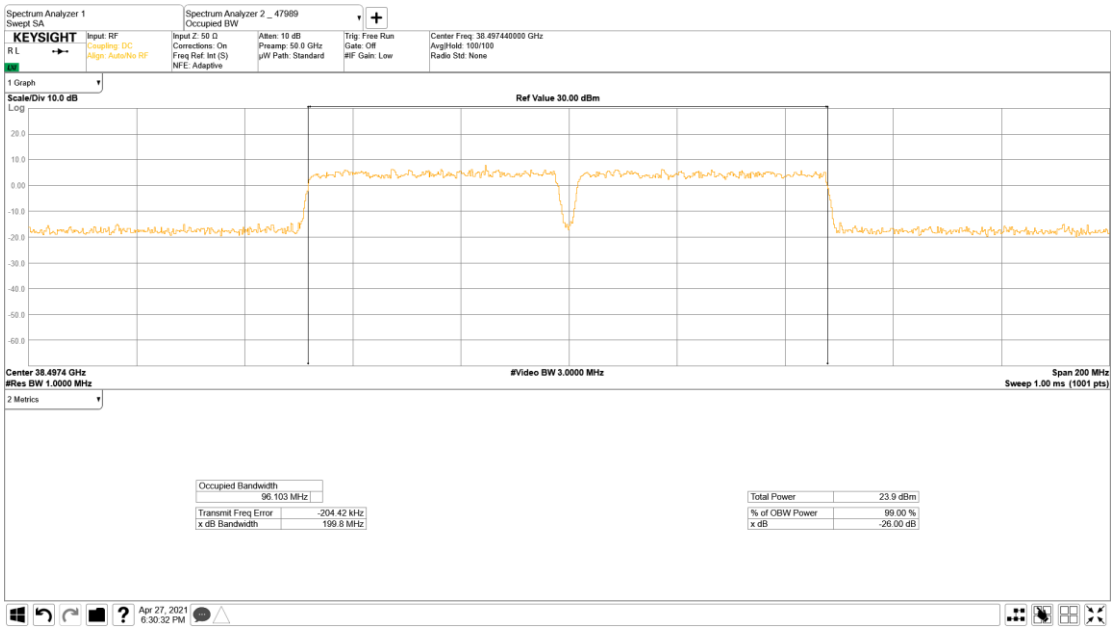
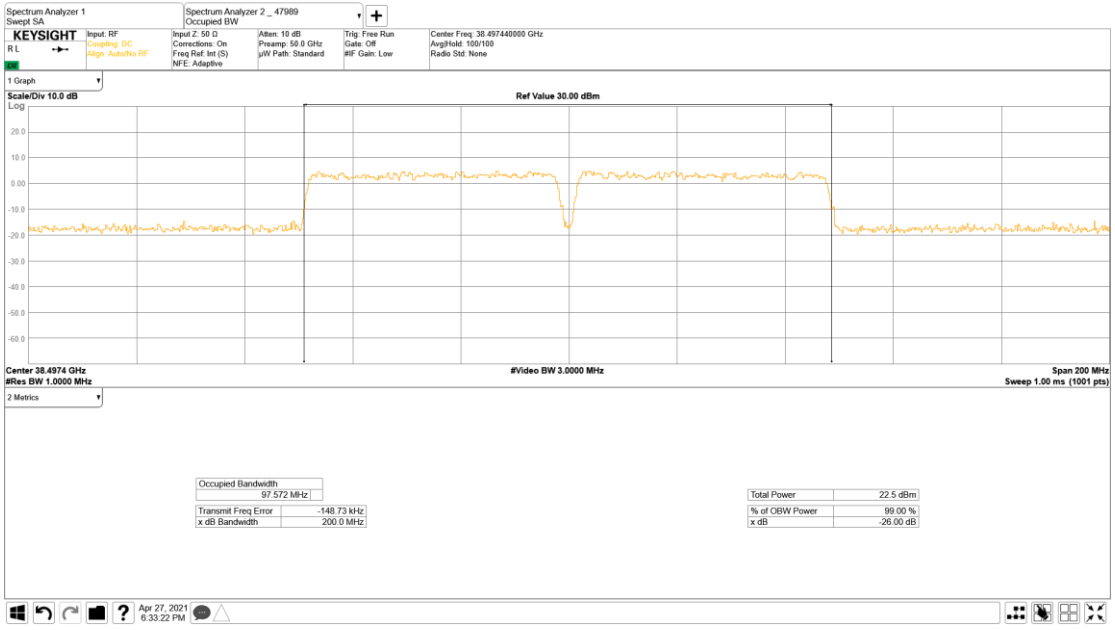
M 1 n261 BW 100MHz	 2CC / 16QAM / Mid channel
M 1 n261 BW 100MHz	 2CC / 64QAM / Mid channel

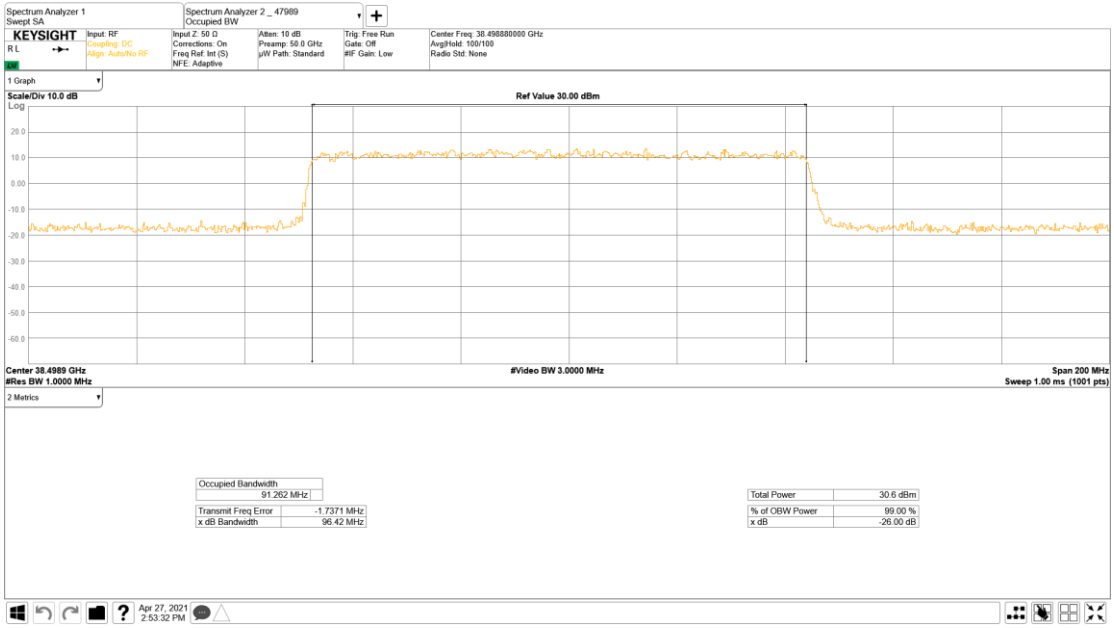
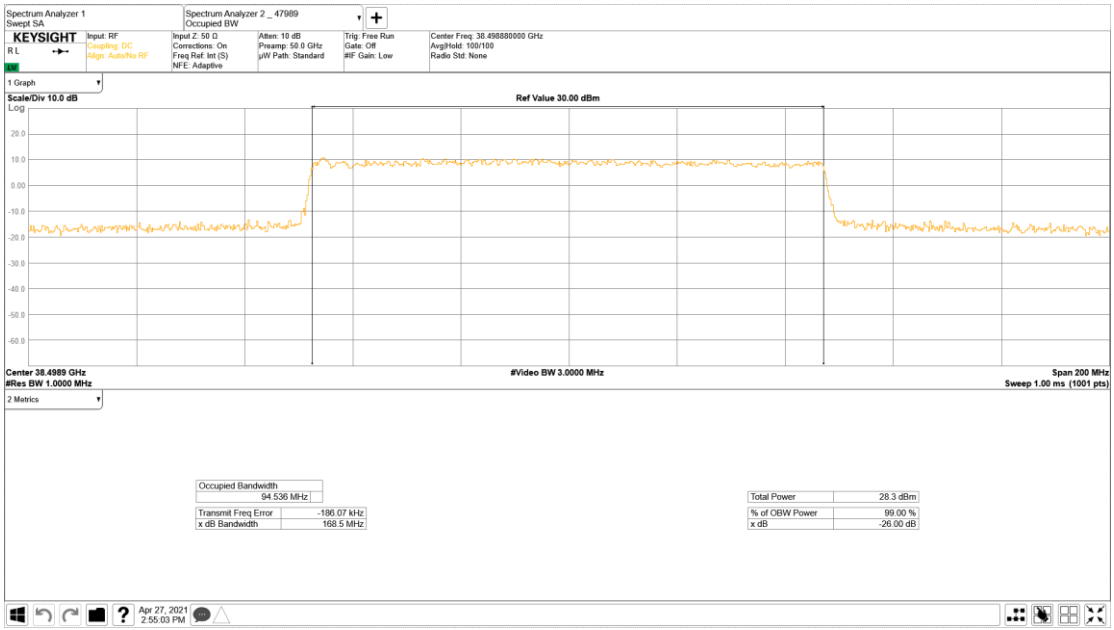
Module 1, Band n260

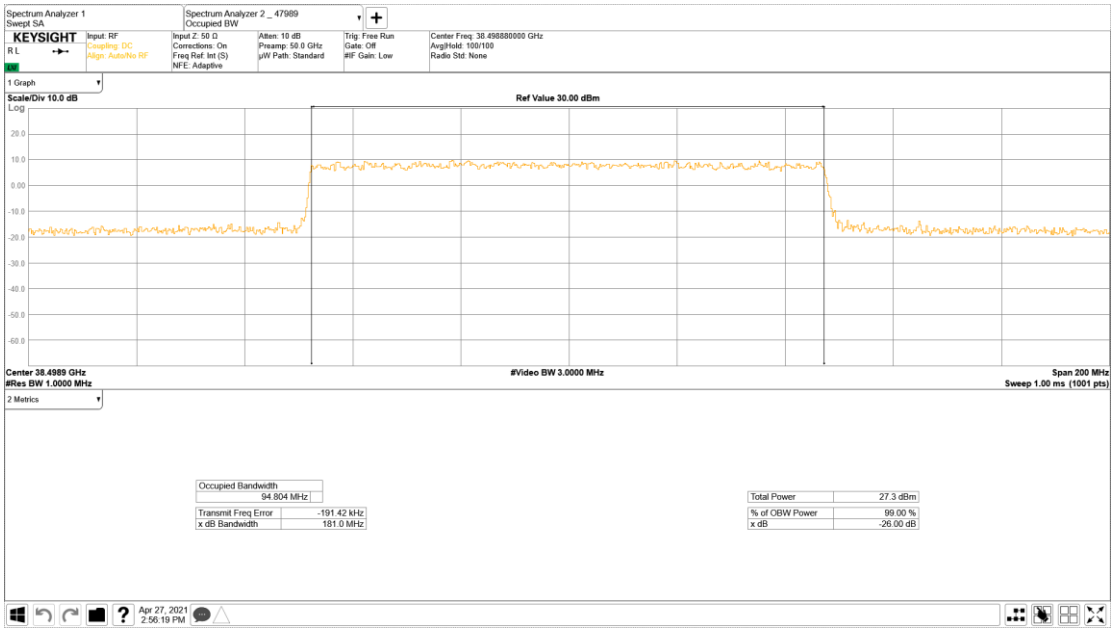
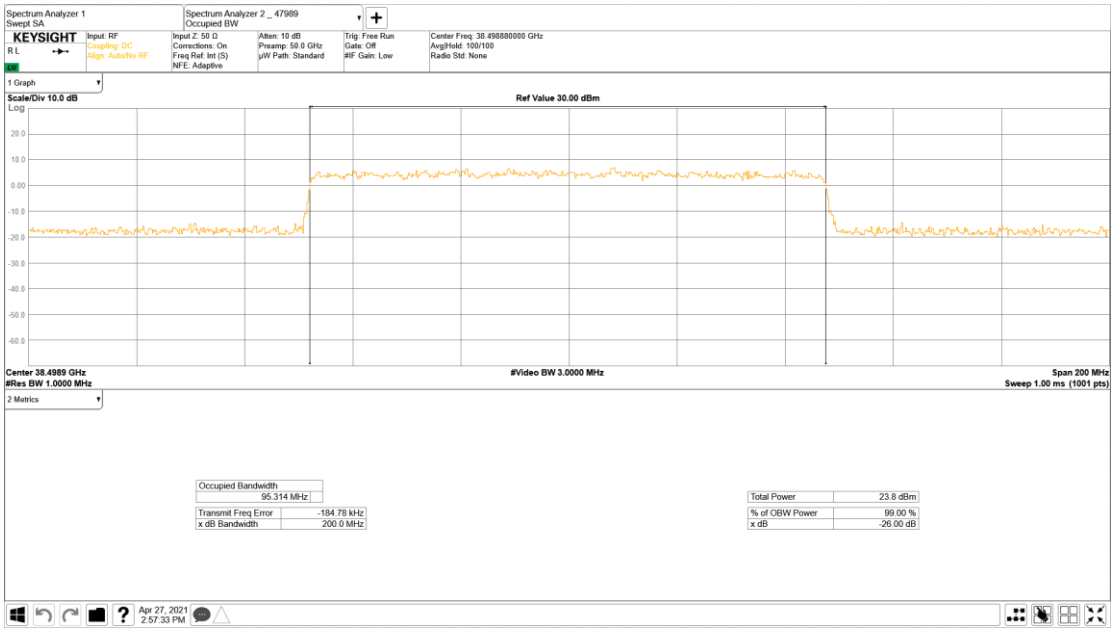
M 1 n260 BW 50MHz	 1CC / BPSK / Mid channel
M 1 n260 BW 50MHz	 1CC / QPSK / Mid channel

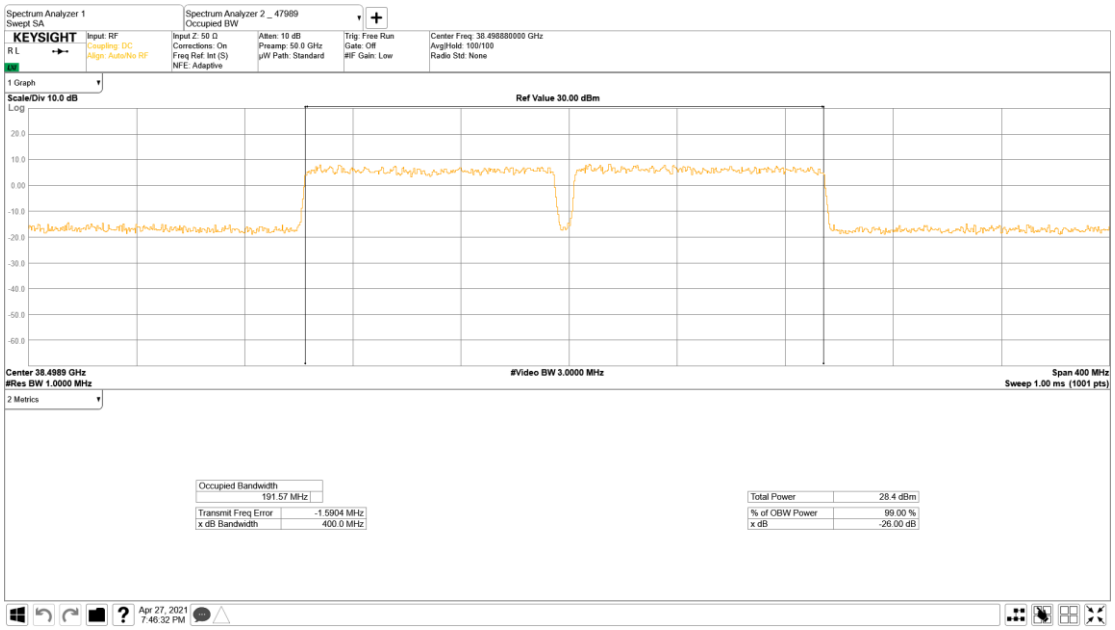
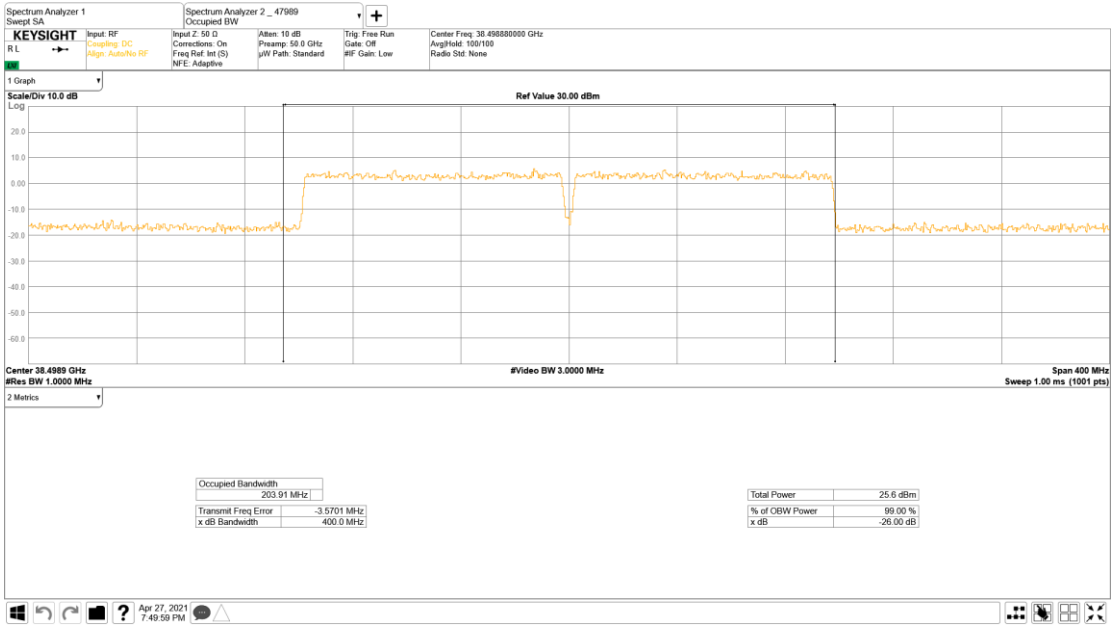
M 1 n260 BW 50MHz	 1CC / 16QAM / Mid channel
M 1 n260 BW 50MHz	 1CC / 64QAM / Mid channel

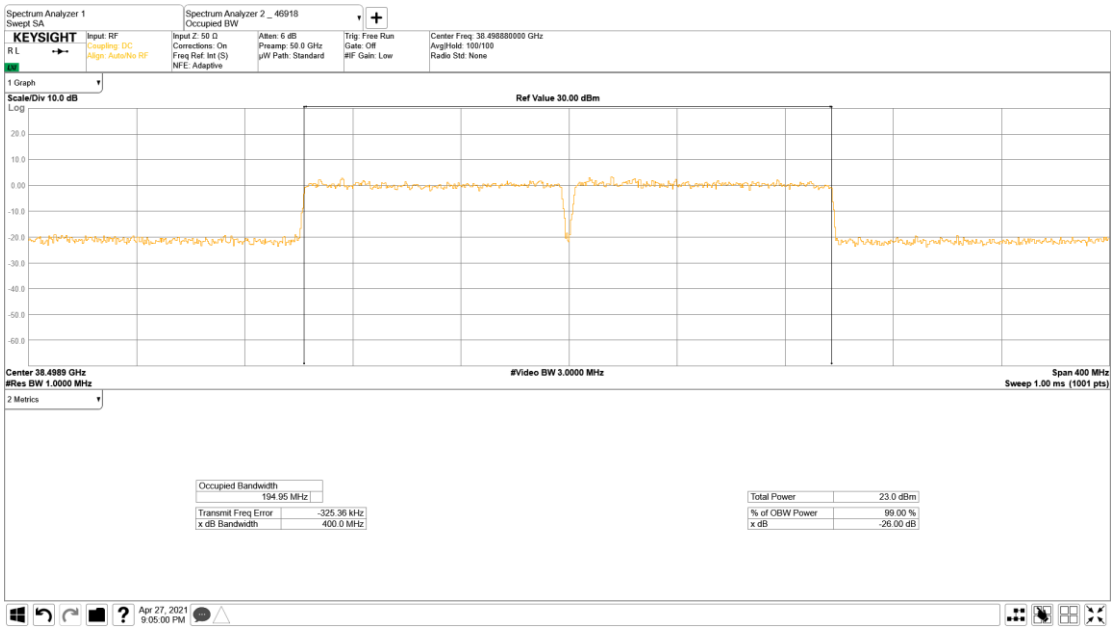
M 1 n260 BW 50MHz	 2CC / BPSK / Mid channel
M 1 n260 BW 50MHz	 2CC / QPSK / Mid channel

M 1 n260 BW 50MHz	 2CC / 16QAM / Mid channel
M 1 n260 BW 50MHz	 2CC / 64QAM / Mid channel

M 1 n260 BW 100MHz	 1CC / BPSK / Mid channel
M 1 n260 BW 100MHz	 1CC / QPSK / Mid channel

M 1 n260 BW 100MHz	 1CC / 16QAM / Mid channel
M 1 n260 BW 100MHz	 1CC / 64QAM / Mid channel

M 1 n260 BW 100MHz	 2CC / BPSK / Mid channel
M 1 n260 BW 100MHz	 2CC / QPSK / Mid channel

M 1 n260 BW 100MHz	 2CC / 16QAM / Mid channel
M 1 n260 BW 100MHz	 2CC / 64QAM / Mid channel

8.2. EQUIVALENT ISOTROPIC RADIATED POWER

RULE PART(S)

FCC: §2.1046, §30.202

LIMITS

30.202 (b) - For mobile stations, the average power of the sum of all antenna elements is limited to a maximum EIRP of +43 dBm.

TEST PROCEDURE

Radiated power measurements are performed using the signal analyzer's "channel power" measurement capability for signals with continuous operation.

a) RBW = 1 – 5% of the OBW, not to exceed 1MHz
b) VBW $\geq$ 3 x RBW
c) Span = 2x to 3x the OBW
d) number of measurement points in sweep > 2 x span / RBW
e) Sweep time = auto-couple
f) Detector = RMS
g) Trace mode = average over 100 sweeps

(KDB 842590 D01 Upper Microwave Flexible Use Service v01r02 Section 4.2)
(ANSI C63.26-2015 Section 5.2.4.4.1)

Note

EIRP measurements were taken at 3m test distance.

Elements within the same antenna array are correlated to produce beamforming array gain. Antenna arrays cannot be correlated with another antenna array. During testing, only one antenna array was active.

The average EIRP reported below is calculated per section 5.2.7 of ANSI C63.26-2015 which states: EIRP (dBm) = E (dBμV/m) + 20log(D) − 104.8; where D is the measurement distance (in the far field region) in meter.
The field strength E is calculated E (dBμV/m) = Spectrum Analyzer Channel Power Level (dBm) + Antenna Factor (dB/m) + Cable Loss (dB) + 107.

Radiated power levels are investigated while the receive antenna was rotated through all angles to determine the worst case polarization/positioning.

For antenna M0 and antenna M1, pi/2-BPSK, QPSK, 16QAM and 64QAM modulations were all investigated in SISO, SISO-Dual and MIMO configurations. Full data is provided for those combinations. Single RB (highest power) and full RB allocations were measured, but worst RB allocation was reported.

The Fundamental of the EUT was investigated two foldable conditions[Fold, Laptop(90 degree)]. For 5G NR FR2 Bands, Since EIRP was highest in laptop condition, all results were tested under laptop condition.

5G NR: All Waveforms (CP-OFDM vs DFT-s OFDM) were investigated to determine the worst case configuration. All modes of operation were investigated and the worst case configuration results are reported in this section.

RESULTS

8.2.1. EIRP Results

Module 0, Band n261, 50M BW

Tx Type	Freq	Channel	CCs	Mod	Beam ID	Beam Pol	Ant Pol	RB_offset	X-axis	Y-axis	EIRP(dBm)
SISO	27534.84	Low	1CC	QPSK	26	V	H	1_16	294.9	306.7	25.25
SISO	27534.84	Low	1CC	QPSK	26	V	V	1_16	292.4	329.3	25.68
SISO	27922.08	Mid	1CC	QPSK	25	V	H	1_16	252.7	81.1	**27.45**
SISO	27922.08	Mid	1CC	QPSK	25	V	V	1_16	263.9	0	23.98
SISO	28319.52	High	1CC	QPSK	25	V	H	1_16	284.7	268.7	27.26
SISO	28319.52	High	1CC	QPSK	25	V	V	1_16	268.2	185	23.83
SISO	27922.08	Mid	1CC	BPSK	25	V	H	1_16	252.7	81.1	27.22
SISO	27922.08	Mid	1CC	16QAM	25	V	H	1_16	252.7	81.1	24.69
SISO	27922.08	Mid	1CC	64QAM	25	V	H	1_16	252.7	81.1	22.66
SISO	27922.08	Mid	2CC	QPSK	25	V	H	32_0	293	265.8	21.95
SISO	27922.08	Mid	2CC	BPSK	25	V	H	32_0	293	265.8	21.94
SISO	27922.08	Mid	2CC	16QAM	25	V	H	32_0	293	265.8	20.37
SISO	27922.08	Mid	2CC	64QAM	25	V	H	32_0	293	265.8	18.02
SISO-Dual	27534.84	Low	1CC	QPSK	33/161	H+V	H	1_16	246.7	65.4	28.57
SISO-Dual	27534.84	Low	1CC	QPSK	33/161	H+V	V	1_16	251.3	41.2	28.10
SISO-Dual	27922.08	Mid	1CC	QPSK	25/153	H+V	H	1_16	253.6	102.2	**29.74**
SISO-Dual	27922.08	Mid	1CC	QPSK	25/153	H+V	V	1_16	254.1	56	27.11
SISO-Dual	28319.52	High	1CC	QPSK	25/153	H+V	H	1_16	252.9	92.8	29.05
SISO-Dual	28319.52	High	1CC	QPSK	25/153	H+V	V	1_16	279.1	230.4	26.83
SISO-Dual	27922.08	Mid	1CC	BPSK	25/153	H+V	H	1_16	253.6	102.2	29.37
SISO-Dual	27922.08	Mid	1CC	16QAM	25/153	H+V	H	1_16	253.6	102.2	27.43
SISO-Dual	27922.08	Mid	1CC	64QAM	25/153	H+V	H	1_16	253.6	102.2	25.23
SISO-Dual	27922.08	Mid	2CC	QPSK	25/153	H+V	H	32_0	252.5	103.9	25.59
SISO-Dual	27922.08	Mid	2CC	BPSK	25/153	H+V	H	32_0	252.5	103.9	25.51
SISO-Dual	27922.08	Mid	2CC	16QAM	25/153	H+V	H	32_0	252.5	103.9	24.03
SISO-Dual	27922.08	Mid	2CC	64QAM	25/153	H+V	H	32_0	252.5	103.9	21.79
MIMO	27922.08	Mid	1CC	QPSK	25/153	H+V	H	1_16	253.6	102.2	**24.60**
MIMO	27922.08	Mid	1CC	BPSK	25/153	H+V	H	1_16	253.6	102.2	21.27
MIMO	27922.08	Mid	1CC	16QAM	25/153	H+V	H	1_16	253.6	102.2	23.92
MIMO	27922.08	Mid	1CC	64QAM	25/153	H+V	H	1_16	253.6	102.2	21.59
MIMO	27922.08	Mid	2CC	QPSK	25/153	H+V	H	32_0	252.5	103.9	22.61
MIMO	27922.08	Mid	2CC	BPSK	25/153	H+V	H	32_0	252.5	103.9	22.04
MIMO	27922.08	Mid	2CC	16QAM	25/153	H+V	H	32_0	252.5	103.9	20.43
MIMO	27922.08	Mid	2CC	64QAM	25/153	H+V	H	32_0	252.5	103.9	18.43

UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_30(04)
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433

Module 0, Band n261, 100M BW

Tx Type	Freq	Channel	CCs	Mod	Beam ID	Beam Pol	Ant Pol	RB_offset	X-axis	Y-axis	EIRP(dBm)
SISO	27559.32	Low	1CC	QPSK	26	V	H	1_32	306.9	302.1	24.96
SISO	27559.32	Low	1CC	QPSK	26	V	V	1_32	297.9	333.8	27.11
SISO	27923.52	Mid	1CC	QPSK	25	V	H	1_32	285.3	263	**27.86**
SISO	27923.52	Mid	1CC	QPSK	25	V	V	1_32	271	353.3	25.09
SISO	28292.16	High	1CC	QPSK	25	V	H	1_32	287.7	258.1	27.45
SISO	28292.16	High	1CC	QPSK	25	V	V	1_32	264.8	146.7	23.20
SISO	27923.52	Mid	1CC	BPSK	25	V	H	1_32	285.3	263	27.81
SISO	27923.52	Mid	1CC	16QAM	25	V	H	1_32	285.3	263	25.63
SISO	27923.52	Mid	1CC	64QAM	25	V	H	1_32	285.3	263	23.42
SISO	27923.52	Mid	2CC	QPSK	25	V	H	64_0	284.8	270.5	24.44
SISO	27923.52	Mid	2CC	BPSK	25	V	H	64_0	284.8	270.5	24.31
SISO	27923.52	Mid	2CC	16QAM	25	V	H	64_0	284.8	270.5	22.76
SISO	27923.52	Mid	2CC	64QAM	25	V	H	64_0	284.8	270.5	20.48
SISO-Dual	27559.32	Low	1CC	QPSK	33/161	H+V	H	1_32	246.9	65	28.32
SISO-Dual	27559.32	Low	1CC	QPSK	33/161	H+V	V	1_32	253	36.8	27.37
SISO-Dual	27923.52	Mid	1CC	QPSK	25/153	H+V	H	1_32	252.1	103.3	**29.32**
SISO-Dual	27923.52	Mid	1CC	QPSK	25/153	H+V	V	1_32	254.1	59.5	28.05
SISO-Dual	28292.16	High	1CC	QPSK	25/153	H+V	H	1_32	252.6	97.8	28.87
SISO-Dual	28292.16	High	1CC	QPSK	25/153	H+V	V	1_32	254.4	52.3	27.67
SISO-Dual	27923.52	Mid	1CC	BPSK	25/153	H+V	H	1_32	252.1	103.3	29.04
SISO-Dual	27923.52	Mid	1CC	16QAM	25/153	H+V	H	1_32	252.1	103.3	27.08
SISO-Dual	27923.52	Mid	1CC	64QAM	25/153	H+V	H	1_32	252.1	103.3	24.71
SISO-Dual	27923.52	Mid	2CC	QPSK	25/153	H+V	H	64_0	253.7	110.1	25.27
SISO-Dual	27923.52	Mid	2CC	BPSK	25/153	H+V	H	64_0	253.7	110.1	25.25
SISO-Dual	27923.52	Mid	2CC	16QAM	25/153	H+V	H	64_0	253.7	110.1	23.70
SISO-Dual	27923.52	Mid	2CC	64QAM	25/153	H+V	H	64_0	253.7	110.1	21.57
MIMO	27923.52	Mid	1CC	QPSK	25/153	H+V	H	1_32	252.1	103.3	**24.47**
MIMO	27923.52	Mid	1CC	BPSK	25/153	H+V	H	1_32	252.1	103.3	21.22
MIMO	27923.52	Mid	1CC	16QAM	25/153	H+V	H	1_32	252.1	103.3	23.58
MIMO	27923.52	Mid	1CC	64QAM	25/153	H+V	H	1_32	252.1	103.3	21.35
MIMO	27923.52	Mid	2CC	QPSK	25/153	H+V	H	66_0	253.7	110.1	22.16
MIMO	27923.52	Mid	2CC	BPSK	25/153	H+V	H	66_0	253.7	110.1	21.49
MIMO	27923.52	Mid	2CC	16QAM	25/153	H+V	H	66_0	253.7	110.1	20.50
MIMO	27923.52	Mid	2CC	64QAM	25/153	H+V	H	66_0	253.7	110.1	18.21

Module 0, Band n260, 50M BW

Tx Type	Freq	Channel	CCs	Mod	Beam ID	Beam Pol	Ant Pol	RB_offset	X-axis	Y-axis	EIRP(dBm)
SISO	37027.32	Low	1CC	QPSK	25	V	H	1_16	259.3	72.7	28.27
SISO	37027.32	Low	1CC	QPSK	25	V	V	1_16	261.9	13.5	24.21
SISO	38497.44	Mid	1CC	QPSK	34	V	H	1_16	283.7	275.3	**30.35**
SISO	38497.44	Mid	1CC	QPSK	34	V	V	1_16	271.6	359.4	25.64
SISO	39966.24	High	1CC	QPSK	33	V	H	1_16	251	40	23.00
SISO	39966.24	High	1CC	QPSK	33	V	V	1_16	248.9	29.4	28.50
SISO	38497.44	Mid	1CC	BPSK	34	V	H	1_16	283.7	275.3	30.17
SISO	38497.44	Mid	1CC	16QAM	34	V	H	1_16	283.7	275.3	28.14
SISO	38497.44	Mid	1CC	64QAM	34	V	H	1_16	283.7	275.3	26.37
SISO	38497.44	Mid	2CC	QPSK	34	V	H	32_0	283.2	281	27.01
SISO	38497.44	Mid	2CC	BPSK	34	V	H	32_0	283.2	281	26.95
SISO	38497.44	Mid	2CC	16QAM	34	V	H	32_0	283.2	281	25.39
SISO	38497.44	Mid	2CC	64QAM	34	V	H	32_0	283.2	281	22.54
SISO-Dual	37027.32	Low	1CC	QPSK	34/162	H+V	H	1_16	254.6	70	28.28
SISO-Dual	37027.32	Low	1CC	QPSK	34/162	H+V	V	1_16	275.1	321.1	25.48
SISO-Dual	38497.44	Mid	1CC	QPSK	34/162	H+V	H	1_16	257.8	74.2	**29.42**
SISO-Dual	38497.44	Mid	1CC	QPSK	34/162	H+V	V	1_16	284.6	285.6	26.43
SISO-Dual	39966.24	High	1CC	QPSK	35/163	H+V	H	1_16	285.6	254.9	28.00
SISO-Dual	39966.24	High	1CC	QPSK	35/163	H+V	V	1_16	295	332.7	29.09
SISO-Dual	38497.44	Mid	1CC	BPSK	34/162	H+V	H	1_16	257.8	74.2	29.40
SISO-Dual	38497.44	Mid	1CC	16QAM	34/162	H+V	H	1_16	257.8	74.2	27.43
SISO-Dual	38497.44	Mid	1CC	64QAM	34/162	H+V	H	1_16	257.8	74.2	25.75
SISO-Dual	38497.44	Mid	2CC	QPSK	34/162	H+V	H	32_0	245.8	86.9	25.97
SISO-Dual	38497.44	Mid	2CC	BPSK	34/162	H+V	H	32_0	245.8	86.9	25.99
SISO-Dual	38497.44	Mid	2CC	16QAM	34/162	H+V	H	32_0	245.8	86.9	24.44
SISO-Dual	38497.44	Mid	2CC	64QAM	34/162	H+V	H	32_0	245.8	86.9	21.64
MIMO	38497.44	Mid	1CC	QPSK	34/162	H+V	H	1_16	257.8	74.2	26.23
MIMO	38497.44	Mid	1CC	BPSK	34/162	H+V	H	1_16	257.8	74.2	**26.26**
MIMO	38497.44	Mid	1CC	16QAM	34/162	H+V	H	1_16	257.8	74.2	24.91
MIMO	38497.44	Mid	1CC	64QAM	34/162	H+V	H	1_16	257.8	74.2	23.81
MIMO	38497.44	Mid	2CC	QPSK	34/162	H+V	H	32_0	245.8	86.9	24.65
MIMO	38497.44	Mid	2CC	BPSK	34/162	H+V	H	32_0	245.8	86.9	23.93
MIMO	38497.44	Mid	2CC	16QAM	34/162	H+V	H	32_0	245.8	86.9	22.09
MIMO	38497.44	Mid	2CC	64QAM	34/162	H+V	H	32_0	245.8	86.9	19.38

Module 0, Band n260, 100M BW

Tx Type	Freq	Channel	CCs	Mod	Beam ID	Beam Pol	Ant Pol	RB_offset	X-axis	Y-axis	EIRP(dBm)
SISO	37051.80	Low	1CC	QPSK	25	V	H	1_32	258.5	74.4	28.43
SISO	37051.80	Low	1CC	QPSK	25	V	V	1_32	267.4	11.7	23.94
SISO	38498.88	Mid	1CC	QPSK	34	V	H	1_32	284	275.4	**30.16**
SISO	38498.88	Mid	1CC	QPSK	34	V	V	1_32	271.4	351	25.72
SISO	39949.92	High	1CC	QPSK	33	V	H	1_32	237	52.3	24.35
SISO	39949.92	High	1CC	QPSK	33	V	V	1_32	248.9	29.6	28.20
SISO	38498.88	Mid	1CC	BPSK	34	V	H	1_32	284	275.4	29.87
SISO	38498.88	Mid	1CC	16QAM	34	V	H	1_32	284	275.4	27.81
SISO	38498.88	Mid	1CC	64QAM	34	V	H	1_32	284	275.4	25.93
SISO	38498.88	Mid	2CC	QPSK	34	V	H	64_0	281.3	275.9	27.60
SISO	38498.88	Mid	2CC	BPSK	34	V	H	64_0	281.3	275.9	27.61
SISO	38498.88	Mid	2CC	16QAM	34	V	H	64_0	281.3	275.9	26.06
SISO	38498.88	Mid	2CC	64QAM	34	V	H	64_0	281.3	275.9	23.10
SISO-Dual	37051.80	Low	1CC	QPSK	34/162	H+V	H	1_32	259.4	69.4	29.24
SISO-Dual	37051.80	Low	1CC	QPSK	34/162	H+V	V	1_32	271	154	25.49
SISO-Dual	38498.88	Mid	1CC	QPSK	34/162	H+V	H	1_32	258.5	71.9	29.28
SISO-Dual	38498.88	Mid	1CC	QPSK	34/162	H+V	V	1_32	272.4	327.4	24.69
SISO-Dual	39949.92	High	1CC	QPSK	35/163	H+V	H	1_32	301.5	65.7	29.28
SISO-Dual	39949.92	High	1CC	QPSK	35/163	H+V	V	1_32	295	332.6	**29.52**
SISO-Dual	39949.92	High	1CC	BPSK	35/163	H+V	V	1_32	295	332.6	29.39
SISO-Dual	39949.92	High	1CC	16QAM	35/163	H+V	V	1_32	295	332.6	27.09
SISO-Dual	39949.92	High	1CC	64QAM	35/163	H+V	V	1_32	295	332.6	25.37
SISO-Dual	39899.92	High	2CC	QPSK	35/163	H+V	V	64_0	293.8	335.1	25.92
SISO-Dual	39899.92	High	2CC	BPSK	35/163	H+V	V	64_0	293.8	335.1	25.99
SISO-Dual	39899.92	High	2CC	16QAM	35/163	H+V	V	64_0	293.8	335.1	24.55
SISO-Dual	39899.92	High	2CC	64QAM	35/163	H+V	V	64_0	293.8	335.1	21.89
MIMO	39949.92	High	1CC	QPSK	35/163	H+V	V	1_33	295	332.6	**26.66**
MIMO	39949.92	High	1CC	BPSK	35/163	H+V	V	1_33	295	332.6	24.27
MIMO	39949.92	High	1CC	16QAM	35/163	H+V	V	1_33	295	332.6	24.93
MIMO	39949.92	High	1CC	64QAM	35/163	H+V	V	1_33	295	332.6	22.80
MIMO	39899.92	High	2CC	QPSK	35/163	H+V	V	66_0	293.8	335.1	24.25
MIMO	39899.92	High	2CC	BPSK	35/163	H+V	V	66_0	293.8	335.1	25.86
MIMO	39899.92	High	2CC	16QAM	35/163	H+V	V	66_0	293.8	335.1	22.08
MIMO	39899.92	High	2CC	64QAM	35/163	H+V	V	66_0	293.8	335.1	19.70

Module 1, Band n261, 50M BW

Tx Type	Freq	Channel	CCs	Mod	Beam ID	Beam Pol	Ant Pol	RB_offset	X-axis	Y-axis	EIRP(dBm)
SISO	27534.84	Low	1CC	QPSK	30	V	H	1_16	104	78.3	26.99
SISO	27534.84	Low	1CC	QPSK	30	V	V	1_16	96.3	357.3	24.17
SISO	27922.08	Mid	1CC	QPSK	30	V	H	1_16	120.1	70.3	26.79
SISO	27922.08	Mid	1CC	QPSK	30	V	V	1_16	97.7	6.3	25.04
SISO	28319.52	High	1CC	QPSK	30	V	H	1_16	116.4	87.2	**27.16**
SISO	28319.52	High	1CC	QPSK	30	V	V	1_16	97.8	356.2	24.05
SISO	28319.52	High	1CC	BPSK	30	V	H	1_16	116.4	87.2	27.07
SISO	28319.52	High	1CC	16QAM	30	V	H	1_16	116.4	87.2	24.60
SISO	28319.52	High	1CC	64QAM	30	V	H	1_16	116.4	87.2	22.59
SISO	28294.52	High	2CC	QPSK	30	V	H	32_0	107	65.1	24.06
SISO	28294.52	High	2CC	BPSK	30	V	H	32_0	107	65.1	24.04
SISO	28294.52	High	2CC	16QAM	30	V	H	32_0	107	65.1	22.46
SISO	28294.52	High	2CC	64QAM	30	V	H	32_0	107	65.1	20.15
SISO-Dual	27534.84	Low	1CC	QPSK	30/158	H+V	H	1_16	105.2	75.2	28.66
SISO-Dual	27534.84	Low	1CC	QPSK	30/158	H+V	V	1_16	101.4	4.3	25.18
SISO-Dual	27922.08	Mid	1CC	QPSK	30/158	H+V	H	1_16	106.2	73.2	28.23
SISO-Dual	27922.08	Mid	1CC	QPSK	30/158	H+V	V	1_16	101	15.9	25.55
SISO-Dual	28319.52	High	1CC	QPSK	30/158	H+V	H	1_16	109.5	51.9	27.38
SISO-Dual	28319.52	High	1CC	QPSK	30/158	H+V	V	1_16	102.9	360	23.85
SISO-Dual	27534.84	Low	1CC	BPSK	30/158	H+V	H	1_16	105.2	75.2	**29.11**
SISO-Dual	27534.84	Low	1CC	16QAM	30/158	H+V	H	1_16	105.2	75.2	26.60
SISO-Dual	27534.84	Low	1CC	64QAM	30/158	H+V	H	1_16	105.2	75.2	24.62
SISO-Dual	27559.84	Low	2CC	QPSK	30/158	H+V	H	32_0	106.8	61.6	25.78
SISO-Dual	27559.84	Low	2CC	BPSK	30/158	H+V	H	32_0	106.8	61.6	25.77
SISO-Dual	27559.84	Low	2CC	16QAM	30/158	H+V	H	32_0	106.8	61.6	24.14
SISO-Dual	27559.84	Low	2CC	64QAM	30/158	H+V	H	32_0	106.8	61.6	21.97
MIMO	27534.84	Low	1CC	QPSK	30/158	H+V	H	1_16	105.2	75.2	**26.38**
MIMO	27534.84	Low	1CC	BPSK	30/158	H+V	H	1_16	105.2	75.2	23.24
MIMO	27534.84	Low	1CC	16QAM	30/158	H+V	H	1_16	105.2	75.2	24.53
MIMO	27534.84	Low	1CC	64QAM	30/158	H+V	H	1_16	105.2	75.2	22.58
MIMO	27559.84	Low	2CC	QPSK	30/158	H+V	H	32_0	106.8	61.6	23.15
MIMO	27559.84	Low	2CC	BPSK	30/158	H+V	H	32_0	106.8	61.6	21.83
MIMO	27559.84	Low	2CC	16QAM	30/158	H+V	H	32_0	106.8	61.6	21.37
MIMO	27559.84	Low	2CC	64QAM	30/158	H+V	H	32_0	106.8	61.6	19.44

Module 1, Band n261, 100M BW

Tx Type	Freq	Channel	CCs	Mod	Beam ID	Beam Pol	Ant Pol	RB_offset	X-axis	Y-axis	EIRP(dBm)
SISO	27559.32	Low	1CC	QPSK	30	V	H	1_32	104.3	76.7	26.93
SISO	27559.32	Low	1CC	QPSK	30	V	V	1_32	99.8	5	25.45
SISO	27923.52	Mid	1CC	QPSK	30	V	H	1_32	108.9	77.9	26.87
SISO	27923.52	Mid	1CC	QPSK	30	V	V	1_32	96	355.5	25.17
SISO	28292.16	High	1CC	QPSK	30	V	H	1_32	72.2	270.7	27.12
SISO	28292.16	High	1CC	QPSK	30	V	V	1_32	100.8	0	24.47
SISO	28292.16	High	1CC	BPSK	30	V	H	1_32	72.2	270.7	**27.41**
SISO	28292.16	High	1CC	16QAM	30	V	H	1_32	72.2	270.7	24.80
SISO	28292.16	High	1CC	64QAM	30	V	H	1_32	72.2	270.7	22.88
SISO	28242.16	High	2CC	QPSK	30	V	H	64_0	110.6	94	23.94
SISO	28242.16	High	2CC	BPSK	30	V	H	64_0	110.6	94	23.95
SISO	28242.16	High	2CC	16QAM	30	V	H	64_0	110.6	94	22.36
SISO	28242.16	High	2CC	64QAM	30	V	H	64_0	110.6	94	20.11
SISO-Dual	27559.32	Low	1CC	QPSK	30/158	H+V	H	1_32	110.9	46	28.07
SISO-Dual	27559.32	Low	1CC	QPSK	30/158	H+V	V	1_32	101.5	9	25.17
SISO-Dual	27923.52	Mid	1CC	QPSK	30/158	H+V	H	1_32	107.9	53.3	**28.08**
SISO-Dual	27923.52	Mid	1CC	QPSK	30/158	H+V	V	1_32	100.9	16.1	25.48
SISO-Dual	28292.16	High	1CC	QPSK	30/158	H+V	H	1_32	109.2	50.2	27.72
SISO-Dual	28292.16	High	1CC	QPSK	30/158	H+V	V	1_32	103.1	360	23.81
SISO-Dual	27923.52	Mid	1CC	BPSK	30/158	H+V	H	1_32	107.9	53.3	28.04
SISO-Dual	27923.52	Mid	1CC	16QAM	30/158	H+V	H	1_32	107.9	53.3	26.23
SISO-Dual	27923.52	Mid	1CC	64QAM	30/158	H+V	H	1_32	107.9	53.3	23.76
SISO-Dual	27923.52	Mid	2CC	QPSK	30/158	H+V	H	64_0	108.8	50.5	24.68
SISO-Dual	27923.52	Mid	2CC	BPSK	30/158	H+V	H	64_0	108.8	50.5	24.67
SISO-Dual	27923.52	Mid	2CC	16QAM	30/158	H+V	H	64_0	108.8	50.5	23.14
SISO-Dual	27923.52	Mid	2CC	64QAM	30/158	H+V	H	64_0	108.8	50.5	20.93
MIMO	27923.52	Mid	1CC	QPSK	30/158	H+V	H	1_32	107.9	53.3	**24.59**
MIMO	27923.52	Mid	1CC	BPSK	30/158	H+V	H	1_32	107.9	53.3	22.20
MIMO	27923.52	Mid	1CC	16QAM	30/158	H+V	H	1_32	107.9	53.3	24.27
MIMO	27923.52	Mid	1CC	64QAM	30/158	H+V	H	1_32	107.9	53.3	20.72
MIMO	27923.52	Mid	2CC	QPSK	30/158	H+V	H	66_0	108.8	50.5	22.29
MIMO	27923.52	Mid	2CC	BPSK	30/158	H+V	H	66_0	108.8	50.5	21.04
MIMO	27923.52	Mid	2CC	16QAM	30/158	H+V	H	66_0	108.8	50.5	20.76
MIMO	27923.52	Mid	2CC	64QAM	30/158	H+V	H	66_0	108.8	50.5	18.75

Module 1, Band n260, 50M BW

Tx Type	Freq	Channel	CCs	Mod	Beam ID	Beam Pol	Ant Pol	RB_offset	X-axis	Y-axis	EIRP(dBm)
SISO	37027.32	Low	1CC	QPSK	21	V	H	1_16	103	96.8	27.37
SISO	37027.32	Low	1CC	QPSK	21	V	V	1_16	89.1	2.9	23.22
SISO	38497.44	Mid	1CC	QPSK	21	V	H	1_16	78	290.8	**28.48**
SISO	38497.44	Mid	1CC	QPSK	21	V	V	1_16	85.7	355.1	25.01
SISO	39966.24	High	1CC	QPSK	32	V	H	1_16	130.7	17.9	24.79
SISO	39966.24	High	1CC	QPSK	32	V	V	1_16	125.3	17.4	26.14
SISO	38497.44	Mid	1CC	BPSK	21	V	H	1_16	78	290.8	**28.48**
SISO	38497.44	Mid	1CC	16QAM	21	V	H	1_16	78	290.8	26.49
SISO	38497.44	Mid	1CC	64QAM	21	V	H	1_16	78	290.8	24.63
SISO	38497.44	Mid	2CC	QPSK	21	V	H	32_0	104.2	107.9	25.42
SISO	38497.44	Mid	2CC	BPSK	21	V	H	32_0	104.2	107.9	25.44
SISO	38497.44	Mid	2CC	16QAM	21	V	H	32_0	104.2	107.9	23.87
SISO	38497.44	Mid	2CC	64QAM	21	V	H	32_0	104.2	107.9	21.29
SISO-Dual	37027.32	Low	1CC	QPSK	21/149	H+V	H	1_16	78.7	283.2	28.45
SISO-Dual	37027.32	Low	1CC	QPSK	21/149	H+V	V	1_16	91.6	217.8	24.92
SISO-Dual	38497.44	Mid	1CC	QPSK	21/149	H+V	H	1_16	76.9	301.4	**29.40**
SISO-Dual	38497.44	Mid	1CC	QPSK	21/149	H+V	V	1_16	103	59	27.23
SISO-Dual	39966.24	High	1CC	QPSK	31/159	H+V	H	1_16	78.1	270.7	24.36
SISO-Dual	39966.24	High	1CC	QPSK	31/159	H+V	V	1_16	102.4	58.3	28.40
SISO-Dual	38497.44	Mid	1CC	BPSK	21/149	H+V	H	1_16	76.9	301.4	29.14
SISO-Dual	38497.44	Mid	1CC	16QAM	21/149	H+V	H	1_16	76.9	301.4	27.16
SISO-Dual	38497.44	Mid	1CC	64QAM	21/149	H+V	H	1_16	76.9	301.4	25.75
SISO-Dual	38497.44	Mid	2CC	QPSK	21/149	H+V	H	32_0	103.6	106.7	26.14
SISO-Dual	38497.44	Mid	2CC	BPSK	21/149	H+V	H	32_0	103.6	106.7	26.04
SISO-Dual	38497.44	Mid	2CC	16QAM	21/149	H+V	H	32_0	103.6	106.7	24.52
SISO-Dual	38497.44	Mid	2CC	64QAM	21/149	H+V	H	32_0	103.6	106.7	21.90
MIMO	38497.44	Mid	1CC	QPSK	21/149	H+V	H	1_16	76.9	301.4	**25.50**
MIMO	38497.44	Mid	1CC	BPSK	21/149	H+V	H	1_16	76.9	301.4	24.57
MIMO	38497.44	Mid	1CC	16QAM	21/149	H+V	H	1_16	76.9	301.4	23.36
MIMO	38497.44	Mid	1CC	64QAM	21/149	H+V	H	1_16	76.9	301.4	22.51
MIMO	38497.44	Mid	2CC	QPSK	21/149	H+V	H	32_0	103.6	106.7	23.85
MIMO	38497.44	Mid	2CC	BPSK	21/149	H+V	H	32_0	103.6	106.7	22.55
MIMO	38497.44	Mid	2CC	16QAM	21/149	H+V	H	32_0	103.6	106.7	21.49
MIMO	38497.44	Mid	2CC	64QAM	21/149	H+V	H	32_0	103.6	106.7	18.76

Module 1, Band n260, 100M BW

Tx Type	Freq	Channel	CCs	Mod	Beam ID	Beam Pol	Ant Pol	RB_offset	X-axis	Y-axis	EIRP(dBm)
SISO	37051.80	Low	1CC	QPSK	21	V	H	1_32	103.5	96.6	27.36
SISO	37051.80	Low	1CC	QPSK	21	V	V	1_32	89	6.4	23.13
SISO	38498.88	Mid	1CC	QPSK	21	V	H	1_32	77.7	290.1	**28.64**
SISO	38498.88	Mid	1CC	QPSK	21	V	V	1_32	85.6	359.8	24.85
SISO	39949.92	High	1CC	QPSK	32	V	H	1_32	130.5	18.2	24.74
SISO	39949.92	High	1CC	QPSK	32	V	V	1_32	125.3	19.8	26.16
SISO	38498.88	Mid	1CC	BPSK	21	V	H	1_32	77.7	290.1	28.58
SISO	38498.88	Mid	1CC	16QAM	21	V	H	1_32	77.7	290.1	26.70
SISO	38498.88	Mid	1CC	64QAM	21	V	H	1_32	77.7	290.1	24.80
SISO	38498.88	Mid	2CC	QPSK	21	V	H	64_0	103.1	102.3	25.67
SISO	38498.88	Mid	2CC	BPSK	21	V	H	64_0	103.1	102.3	25.73
SISO	38498.88	Mid	2CC	16QAM	21	V	H	64_0	103.1	102.3	24.28
SISO	38498.88	Mid	2CC	64QAM	21	V	H	64_0	103.1	102.3	21.56
SISO-Dual	37051.80	Low	1CC	QPSK	21/149	H+V	H	1_32	101.6	105.7	28.16
SISO-Dual	37051.80	Low	1CC	QPSK	21/149	H+V	V	1_32	81.3	241.3	25.36
SISO-Dual	38498.88	Mid	1CC	QPSK	21/149	H+V	H	1_32	78.5	296.6	29.40
SISO-Dual	38498.88	Mid	1CC	QPSK	21/149	H+V	V	1_32	113.2	259.1	27.49
SISO-Dual	39949.92	High	1CC	QPSK	31/159	H+V	H	1_32	81.7	265.1	24.61
SISO-Dual	39949.92	High	1CC	QPSK	31/159	H+V	V	1_32	101.1	56.3	27.57
SISO-Dual	38498.88	Mid	1CC	BPSK	21/149	H+V	H	1_32	78.5	296.6	**29.72**
SISO-Dual	38498.88	Mid	1CC	16QAM	21/149	H+V	H	1_32	78.5	296.6	27.19
SISO-Dual	38498.88	Mid	1CC	64QAM	21/149	H+V	H	1_32	78.5	296.6	26.31
SISO-Dual	38498.88	Mid	2CC	QPSK	21/149	H+V	H	64_0	102.6	113	26.66
SISO-Dual	38498.88	Mid	2CC	BPSK	21/149	H+V	H	64_0	102.6	113	26.68
SISO-Dual	38498.88	Mid	2CC	16QAM	21/149	H+V	H	64_0	102.6	113	25.13
SISO-Dual	38498.88	Mid	2CC	64QAM	21/149	H+V	H	64_0	102.6	113	22.35
MIMO	38498.88	Mid	1CC	QPSK	21/149	H+V	H	1_33	78.5	296.6	**25.51**
MIMO	38498.88	Mid	1CC	BPSK	21/149	H+V	H	1_33	78.5	296.6	20.60
MIMO	38498.88	Mid	1CC	16QAM	21/149	H+V	H	1_33	78.5	296.6	24.13
MIMO	38498.88	Mid	1CC	64QAM	21/149	H+V	H	1_33	78.5	296.6	21.66
MIMO	38498.88	Mid	2CC	QPSK	21/149	H+V	H	66_0	102.6	113	23.64
MIMO	38498.88	Mid	2CC	BPSK	21/149	H+V	H	66_0	102.6	113	22.20
MIMO	38498.88	Mid	2CC	16QAM	21/149	H+V	H	66_0	102.6	113	21.35
MIMO	38498.88	Mid	2CC	64QAM	21/149	H+V	H	66_0	102.6	113	18.90

UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_30(04)
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433

8.3. BAND EDGE EMISSIONS

RULE PART(S)

FCC: §2.1051, §30.203

LIMITS

30.203 (a) - The conductive power or the total radiated power of any emission outside a licensee's frequency block shall be −13 dBm/MHz or lower. However, in the bands immediately outside and adjacent to the licensee's frequency block, having a bandwidth equal to 10 percent of the channel bandwidth, the conductive power or the total radiated power of any emission shall be −5 dBm/MHz or lower.

TEST PROCEDURE

a) RBW = 1MHz

b) VBW ≥ 3 x RBW

c) number of measurement points in sweep > 2 x span / RBW

d) Sweep time = auto-couple

e) Detector = RMS

f) Trace mode = average

(KDB 842590 D01 Upper Microwave Flexible Use Service v01r02 Section 4.4.2.5)
(ANSI C63.26-2015 Section 5 and 6.4)

NOTE

Band Edge emissions were measured at a 3 meter distance.

Band Edge measurements were measured as EIRP for direct comparison to the 30.203 TRP limit to demonstrate compliance.

pi/2-BPSK, QPSK, 16QAM and 64QAM modulations were all investigated in SISO, SISO-Dual and MIMO configurations. The highest band edge emissions were for the SISO-Dual antenna configuration consistent with this also being the configuration with the highest EIRP. The SISO-Dual configuration was, therefore, use for the final band-edge measurements. Additional measurements were made on the MIMO configuration as it has a wider bandwidth than the SISO-DUAL configuration. The worst results were reported for each modulation.

5G NR: All Waveforms (CP-OFDM vs DFT-s OFDM) were investigated to determine the worst case configuration. All modes of operation were investigated and the worst case configuration results are reported in this section.

The spectrum analyzer for each measurement shows an offset value that was determined using the measurement antenna factor, cable loss, far field measurement distance, and EUT antenna gain. A sample calculation is shown below.

Sample Analyzer Offset Calculation (at 30GHz)
Measurement Antenna Factor = 46.90dB/m
Cable Loss = 2.53dB, EUT Antenna Gain = 8.22dBi
Analyzer Offset (dB) = AF (dB/m) + CL (dB) + 107 + 20log10(D) – 104.8dB – Gain (dBi), where D = 3m
= 46.90dB/m + 2.53dB + 107 + 20log10(3m) – 104.8dB – 8.22dBi = 52.95dB

Antenna gain Information at the Band Edge
The following antenna gain information is provided to demonstrate the antenna performance of the 27.5 – 28.35GHz and 37 – 40GHz band. These antenna gains were subtracted from the measured EIRP levels at the lower and upper band edge frequencies to determine an equivalent conductive power that was compared directly with the §30.203 limits.

EUT Antenna gain (n261)			
Antenna	Channel	Beam Pol	Gain (dBi)
Module 0	Low	H	8.16
		V	10.6
	High	H	7.83
		V	10.51
Module 1	Low	H	7.4
		V	11.53
	High	H	7.74
		V	11.21

EUT Antenna gain (n260)			
Antenna	Channel	Beam Pol	Gain (dBi)
Module 0	Low	H	9.38
		V	11.71
	High	H	9.58
		V	10.01
Module 1	Low	H	9.61
		V	10.71
	High	H	8.29
		V	11.45

The antenna gain listed is worst value, including Out of band, and this gain value applied to the band edge test.

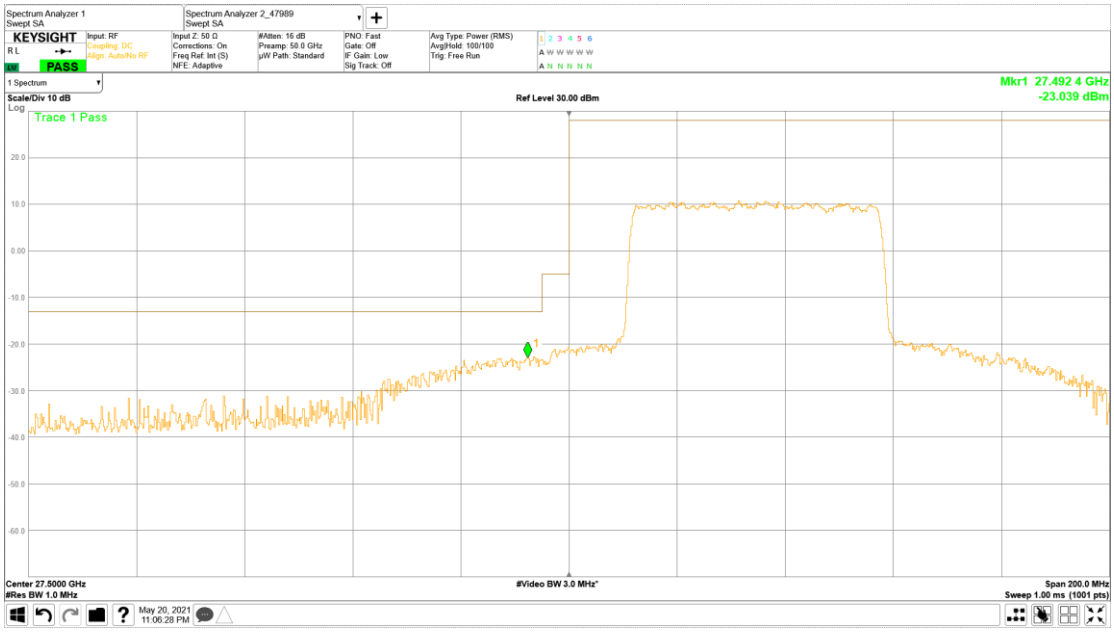
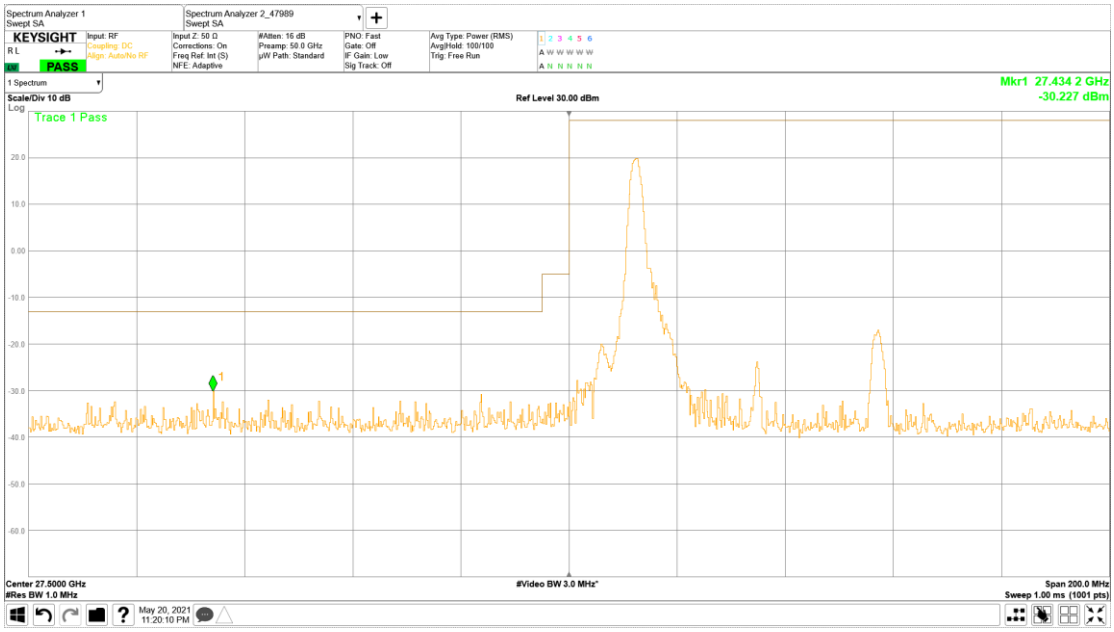
Band edge emission was initially tested without correction for antenna gain. If the result exceeds the limit or the margin is less than 1 dB, antenna gain provided by the manufacturer was calibrated to the offset of the Signal Analyzer.

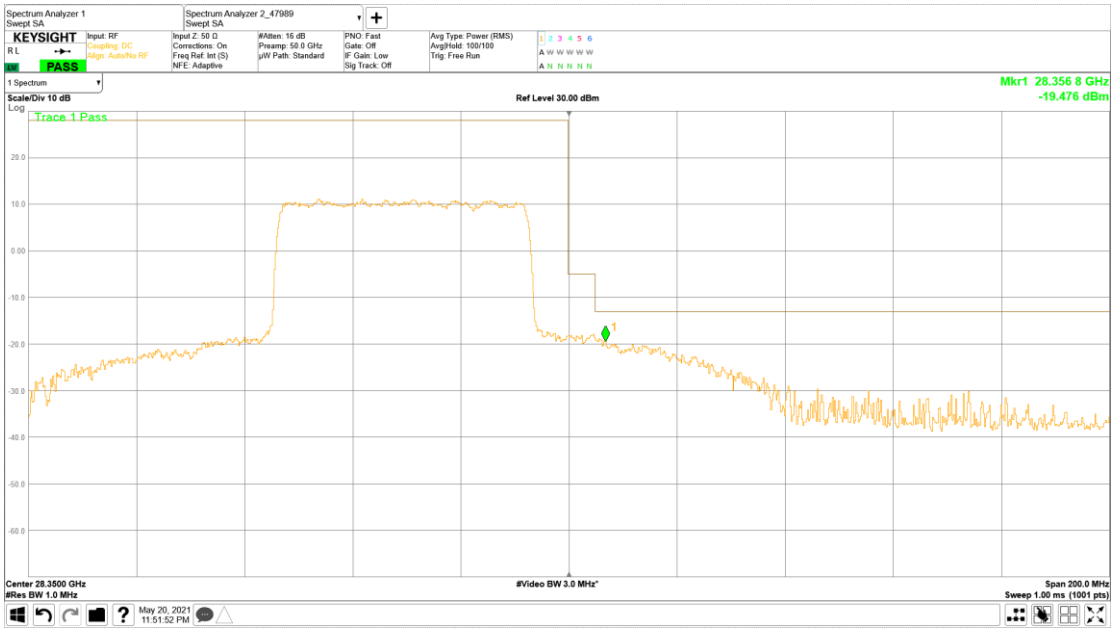
RESULTS

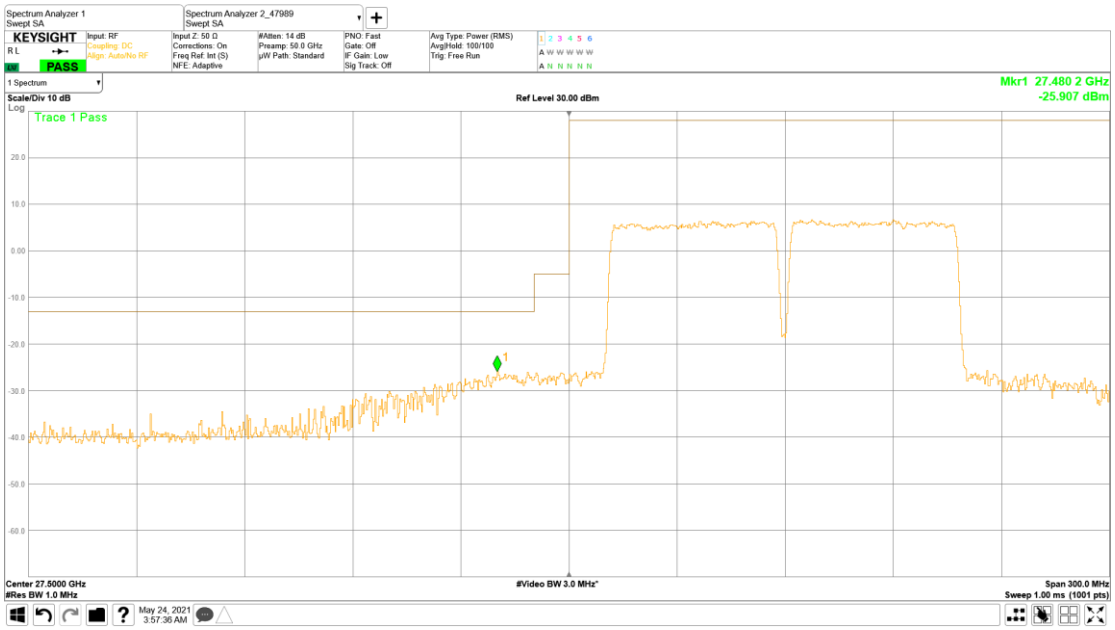
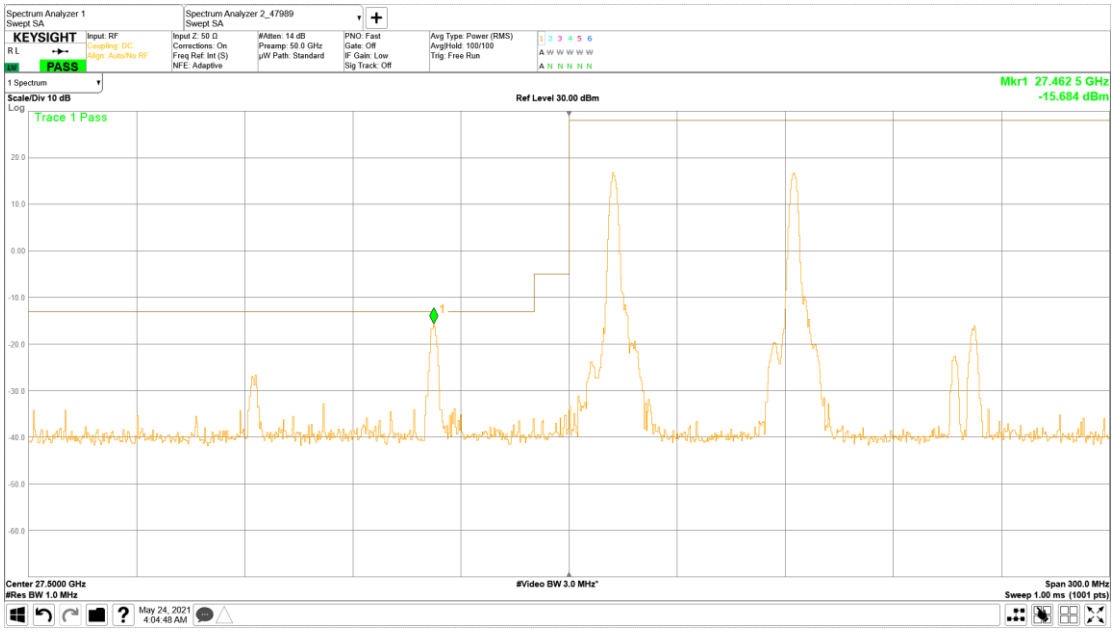
See the following pages.

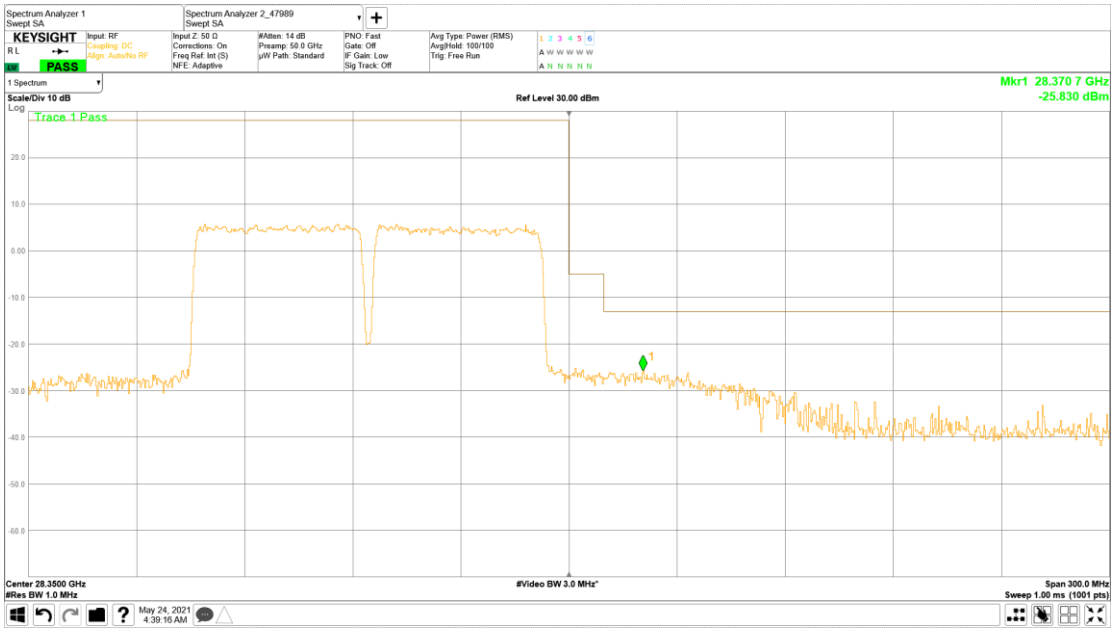
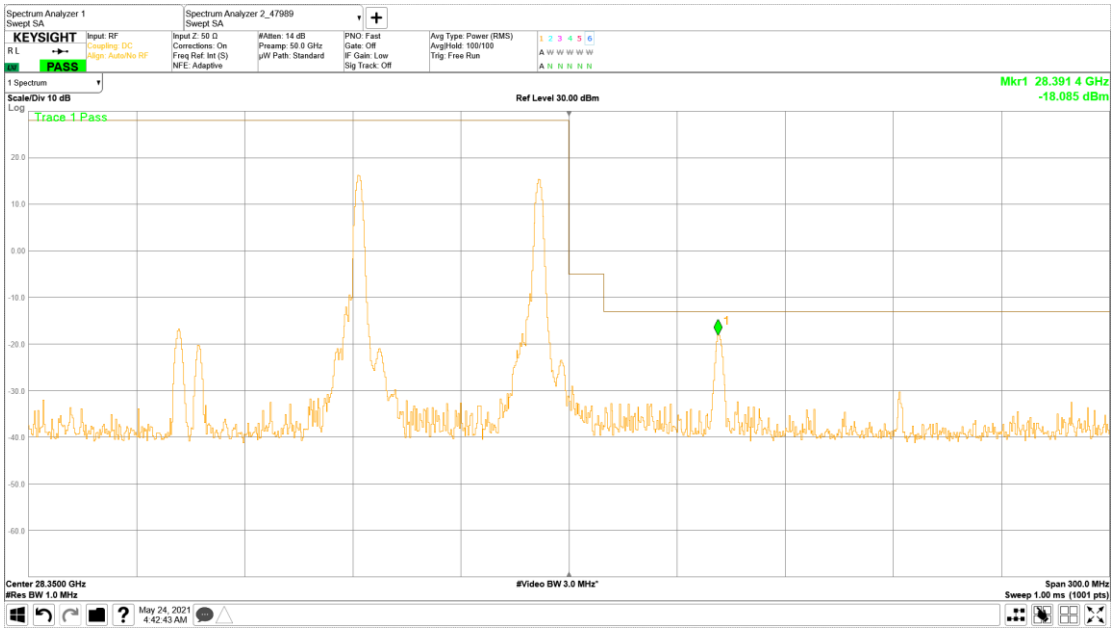
8.3.1. BAND EDGE RESULT

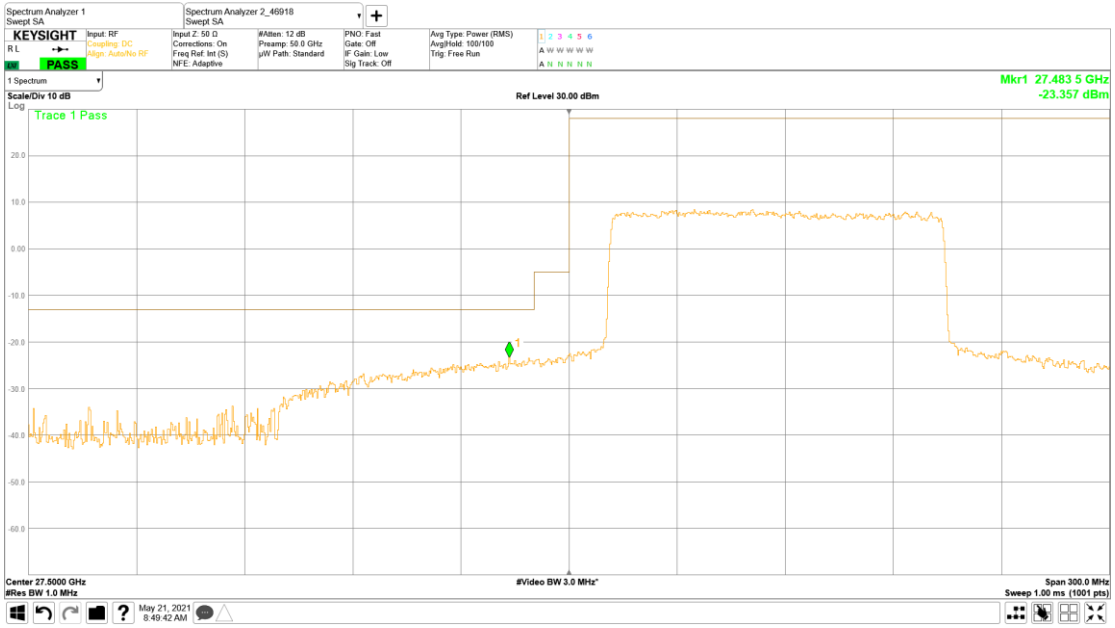
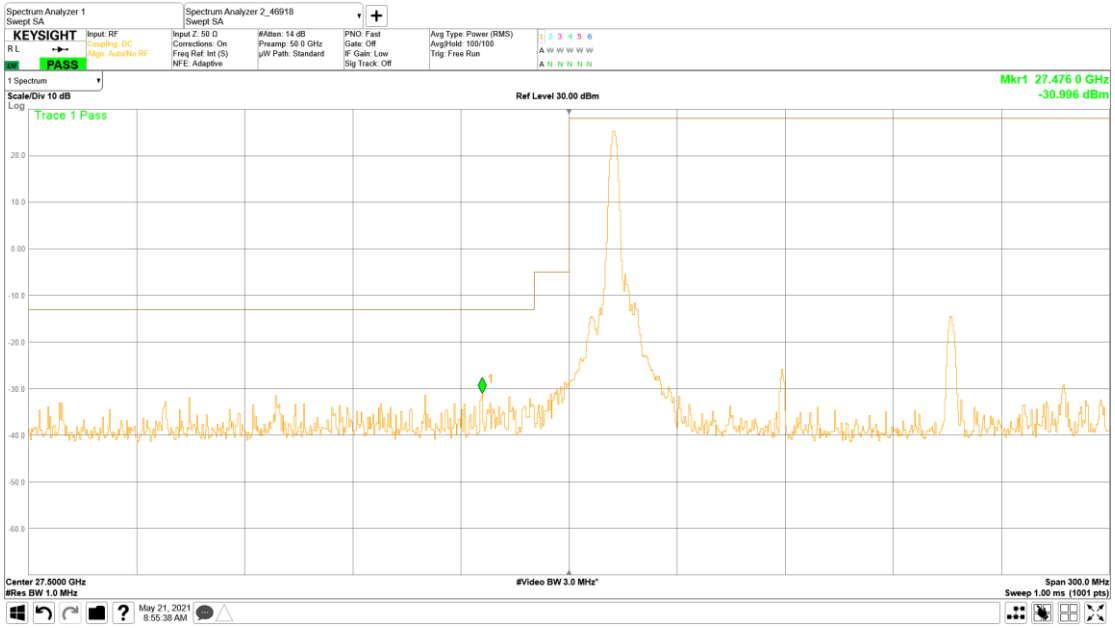
Module 0, Band n261, SISO-Dual

M 0 n261 SISO -Dual BW 50MHz	 1CC / QPSK / Low channel / Full RB
M 0 n261 SISO -Dual BW 50MHz	 1CC / 64QAM / Low channel / 1 RB

M 0 n261 SISO -Dual BW 50MHz	 1CC / QPSK / High channel / Full RB
M 0 n261 SISO -Dual BW 50MHz	 1CC / 64QAM / High channel / 1 RB

M 0 n261 SISO -Dual BW 50MHz	 2CC / QPSK / Low channel / Full RB
M 0 n261 SISO -Dual BW 50MHz	 2CC / 64QAM / Low channel / 1 RB

M 0 n261 SISO -Dual BW 50MHz	 2CC / QPSK / High channel / Full RB
M 0 n261 SISO -Dual BW 50MHz	 2CC / 16QAM / High channel / 1 RB

M 0 n261 SISO -Dual BW 100MHz	 1CC / BPSK / Low channel / Full RB
M 0 n261 SISO -Dual BW 100MHz	 1CC / QPSK / Low channel / 1 RB