

Ericsson AB

RF TEST REPORT

Report Type:

RF report

PRODUCT NAME:

Radio 4415 B2 B25

REPORT NUMBER:

230801154SHA-001

ISSUE DATE:

August 29, 2023

DOCUMENT CONTROL NUMBER:

TTRFFCC Part 24_V1 © 2018 Intertek



Applicant: Ericsson AB
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Manufacturer: Ericsson AB
Isafjordsgatan 10 SE-164 80 Stockholm 16480 Sweden

FCC ID: TA8AKRC161636

IC: 287AB-AS161636

SUMMARY:

The equipment is tested according to the following standard(s) or Specification:

FCC CFR 47 Part 24: PERSONAL COMMUNICATIONS SERVICES

ISED RSS-133 Issue 6: 2 GHz Personal Communications Services

PREPARED BY:

REVIEWED BY:



Project Engineer
Victor Yang



Reviewer
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TEST REPORT

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Revision History

Report No.	Version	Description	Issued Date
230801154SHA-001	Rev. 01	Initial issue of report	August 29, 2023

Measurement result summary

TEST ITEM	FCC REFERANCE	IC REFERANCE	RESULT
Max Output Power and Peak to Average Power Ratio and EIRP	24.232(a) 2.1046	RSS-133 6.4	Pass
Occupied Bandwidth	24.238(b) 2.1049	RSS-GEN 6.6	Pass
Unwanted Emissions at Band Edge	24.238(b) 2.1051	RSS-133 6.5	Pass
Conducted Unwanted Emission	24.238(b) 2.1051	RSS-133 6.5	Pass

TEST REPORT**1 GENERAL INFORMATION****1.1 Description of Equipment Under Test (EUT)**

Description:	Remote Radio Unit
Product name:	Radio 4415 B2 B25
Product number:	KRC 161 636/1, KRC 161 636/3
HVIN	AS161636
Serial Number(s)	B440941517
Rating:	-48V DC
Software Version:	PIS: CXP9013268/15_R96AH, UP: CXP9024418/15_R81A194
Hardware Version:	R2B
Sample received date:	August 23, 2023
Date of test:	August 23, 2023

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1.2 Technical Specification

Frequency Range:	B2: TX: 1930-1990 MHz, RX: 1850-1910 MHz B25: TX: 1930-1995 MHz, RX: 1850-1915 MHz
Number of Antenna ports:	4 TX/RX
Supported RAT:	SR/MR: GSM, LTE, WCDMA, NR for B2 SR/MR: LTE, WCDMA, NR for B25
Max RF bandwidth (IBW):	B2: 60 MHz; B25: 65 MHz
Supported Number of Carriers:	Single RAT: LTE/WCDMA/NR: 6, GSM: 4 Multi-RAT: 6
Supported modulation:	GSM: GMSK, 8PSK, AQPSK WCDMA: QPSK, 16QAM, 64QAM NR/LTE: QPSK, 16QAM, 64QAM, 256QAM
Supported Channel Bandwidth:	GSM: 200kHz WCDMA: 5MHz LTE: 1.4, 3, 5, 10, 15, 20 MHz NR: 5, 10, 15, 20, 25, 30, 35, 40 MHz
Declaration output power:	Maximum 40W per port

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1.3 Description of Test Facility

Name:	Intertek Testing Services Shanghai
Address 1:	Building 86, No. 1198 Qinzhou Road(North), Shanghai 200233, P.R. China
Address 2:	No. 5 Lize East Street, Ericsson Tower, Chaoyang District, Beijing 100102 P.R.C.
Telephone:	+86 21 61278200
Telefax:	+86 21 54262353
The test facility is recognized, certified, or accredited by these organizations:	FCC Accredited Lab Designation Number: CN0175
	IC Registration Lab CAB identifier.: CN0014
	A2LA Accreditation Lab Certificate Number: 3309.02

2 TEST SPECIFICATIONS

2.1 Related documents

FCC Part 24 (2021)
FCC Part 2 (2021)
ISED RSS-133 issue 6 January 2018
ANSI C63.26:2015
KDB 971168 D01 v03r01
KDB 662911 D01 v02r01
SRSP-510

2.2 Product Information

The Equipment Under Test (EUT) is an Ericsson Radio Unit working in the wireless communications services 1930-1995MHz which provides communication connections to network in GSM/WCDMA/LTE/NR modes and MSR modes. The Radio 4415 B2 B25 operates from a -48V DC.

EUT has 2 variants. KRC 161 636/1 without NEBS cover; KRC 161 636/3 with NEBS cover. We test KRC 161 636/1 as typical model and list the worst data.

The EUT includes 4 TX/RX ports and it can be configured to transmit in MIMO mode, and MIMO mode was used for measurements as the worst configuration. The complete testing was performed with the EUT transmitting at maximum RF power unless otherwise stated.

A full technical description can be found in the Manufacturer's documentation.

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2.3 Configuration Description

The following settings were used to represent all traffic scenarios. The output power was measured on the bottom, middle and top channel of all applicable antenna ports. By measuring the output power of QPSK, 16QAM, 64QAM, 256QAM on one of the antenna ports, it was determined that QPSK for NR was the worst-case modulation schemes and were used for all testing.

Complete testing was carried out on the worst-case antenna port which was established as being the highest output power from the 4 measured ports on worst case modulation scheme. This antenna port was Port B for all modes.

The settings below were used for all measurements unless otherwise noted:

NR

Configuration	No. of Carriers	NR Carrier Bandwidth (MHz)	Carrier Frequency Configuration (MHz)		
			Bottom	Middle	Top
NR-1C	1NR	35	1947.5	1962.5	1977.5

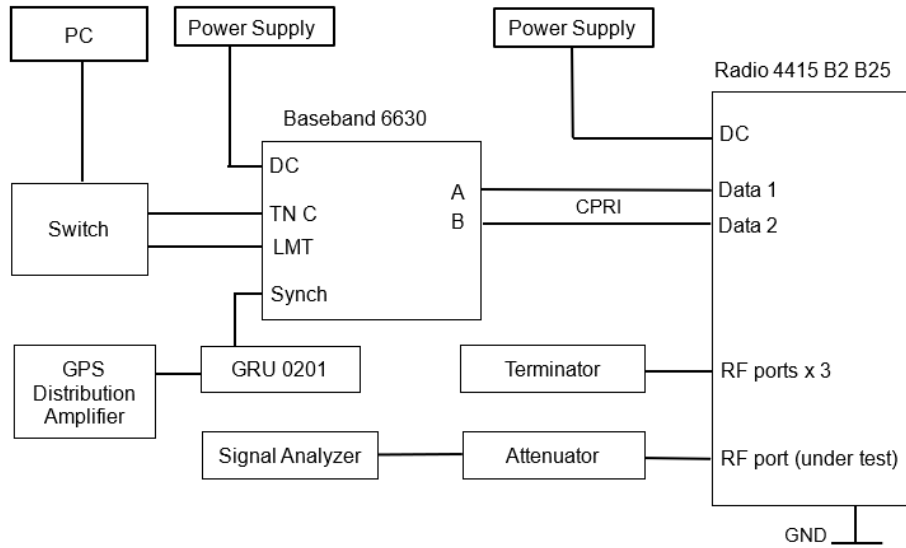
NR

Configuration	No. of Carriers	NR Carrier Bandwidth (MHz)	Carrier Frequency Configuration (MHz)		
			Bottom	Middle	Top
NR-1C-BE	1NR	35	1947.5	-	1977.5

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2.4 Test Setup

Conducted Measurement:



No.	Auxiliary Equipment	Product Number / Model Type	Version
1	PC	PowerEdge R230	-
2	Baseband 6630	KDU 137 848/1	R2F
3	GRU 02 01	NCD 901 41/1	R1D
4	GPS Distribution Amplifier	58536A	-
5	Switch	LS-S5024E-CN	-
6	Terminator	60Z150/01020605006	-
7	Terminator	TF150/11081908	-
8	Terminator	TF150/06081408	-

Proper Attenuator will be chosen to use in relative test case. And the cable loss of specified Attenuator with connect cable will be calibrated before test for relative frequency range and the worst reading will be used as offset in the relative test case.

TEST REPORT**2.5 Test environment condition:**

Test items	Temperature	Humidity
Max Output Power and Peak to Average Power Ratio and EIRP	23°C	54% RH
Occupied Bandwidth		
Unwanted Emissions at Band Edge		
Conducted Unwanted Emission		

2.6 Instrument list

RF test					
Used	Equipment	Manufacturer	Type	Internal no.	Due date
<input checked="" type="checkbox"/>	PXA Signal Analyzer	Keysight	N9030A	EC1046	2024.4.7
<input checked="" type="checkbox"/>	Humiture meter	托普	CEEC-WR16H-50W	EC1053	2024.2.21
<input checked="" type="checkbox"/>	DC Power Supply	Keysight	N8737A	US23B3304A	N/A
<input checked="" type="checkbox"/>	40dB Attenuator	Aeroflex	57-40-33	SK389	N/A
<input checked="" type="checkbox"/>	40dB Attenuator	SHX	2.92TS50	21041401	N/A
<input checked="" type="checkbox"/>	Network Analyzer	Keysight	E5071C	MY46631193	2023.10.17
<input checked="" type="checkbox"/>	Network Analyzer	R&S	ZNA43	100948	2024.3.15

2.7 Measurement uncertainty

The measurement uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of $k=2$.

Test item	Measurement uncertainty
Maximum output power	0.73dB
Occupied Bandwidth	0.88%
Unwanted Emissions at Band Edge	3.03dB
Conducted Unwanted Emission	3.03dB

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3 Maximum Output Power and Peak to Average Power Ratio and EIRP

Test result: Pass

3.1 Limit

Output Power: Base stations with an emission bandwidth greater than 1 MHz are limited to 1640 watts/MHz equivalent isotopically radiated power (EIRP) with an antenna height up to 300 meters HAAT
Peak to Average Ratio: ≤ 13 dB

3.2 Measurement Procedure

The EUT was configured to transmit on maximum power and proper modulation. The transmitter power shall be measured in terms of a root-mean-square (RMS) average value. In case of the EUT was configured to MIMO mode, since the EUT transmits on all antennas simultaneously in the same frequency range, using the Measure-and-Sum approach, the output power at all antennas were tested, and the total output power were then summed mathematically in linear power units according to FCC KDB 662911 D01.

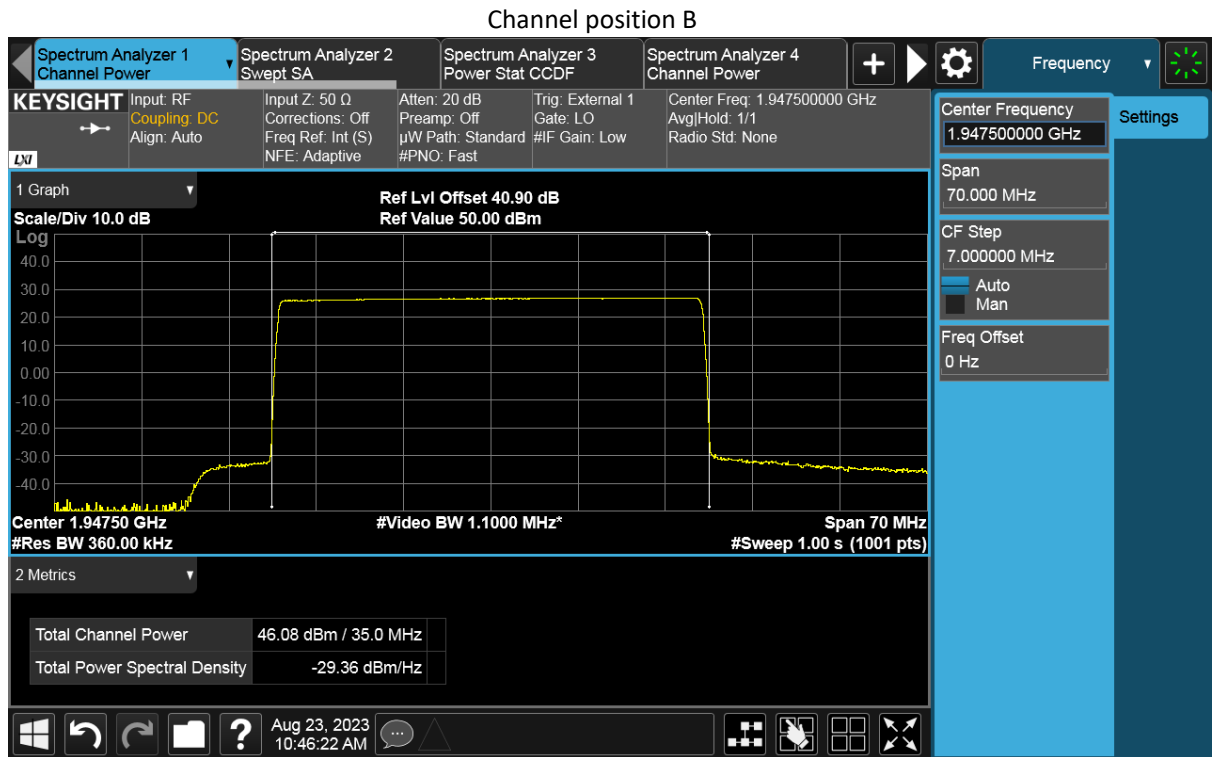
A peak to average ratio measurement is performed at the conducted ports of the EUT for single carrier for single RAT mode. The spectrum analyzers Complementary Cumulative Distribution Function (CCDF) was used and 0.1% probability value recorded.

3.3 Measurement result

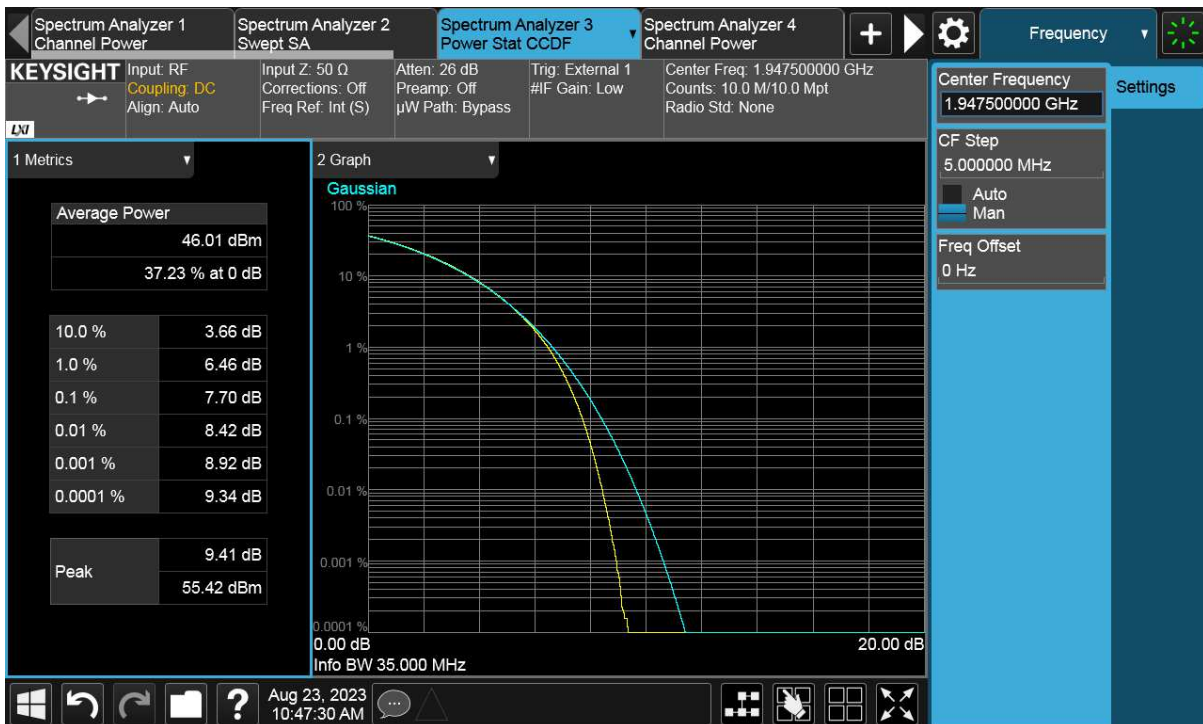
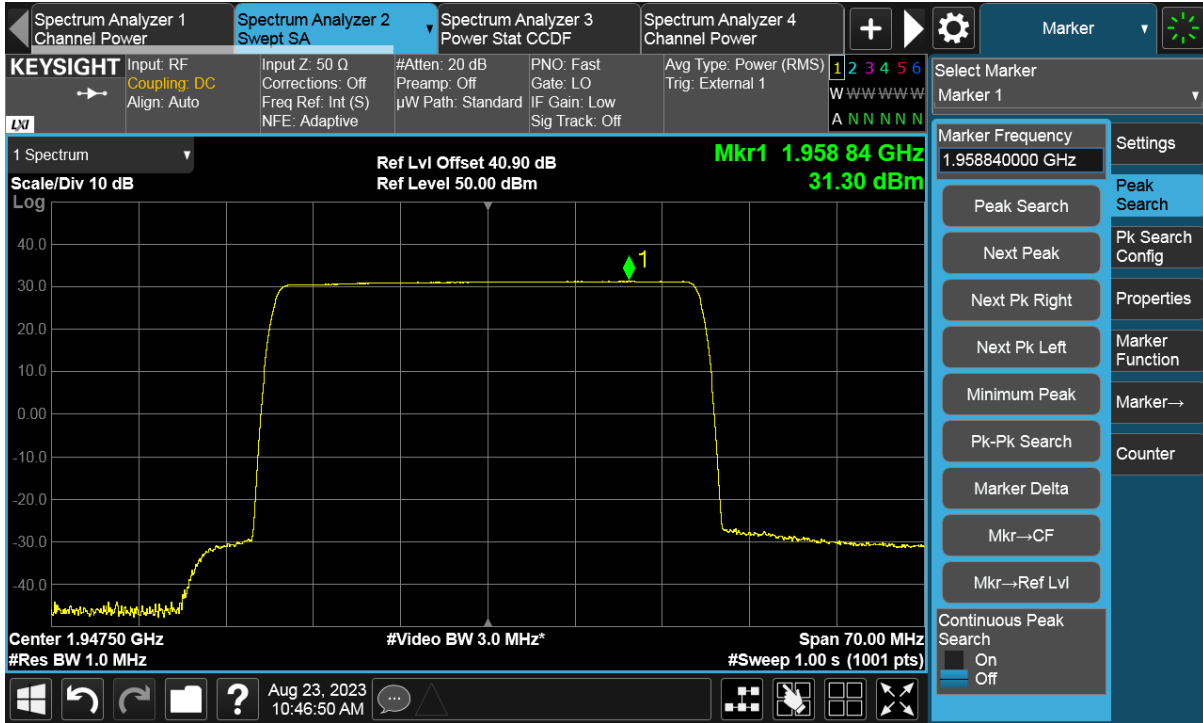
NR mode:

NR-1C

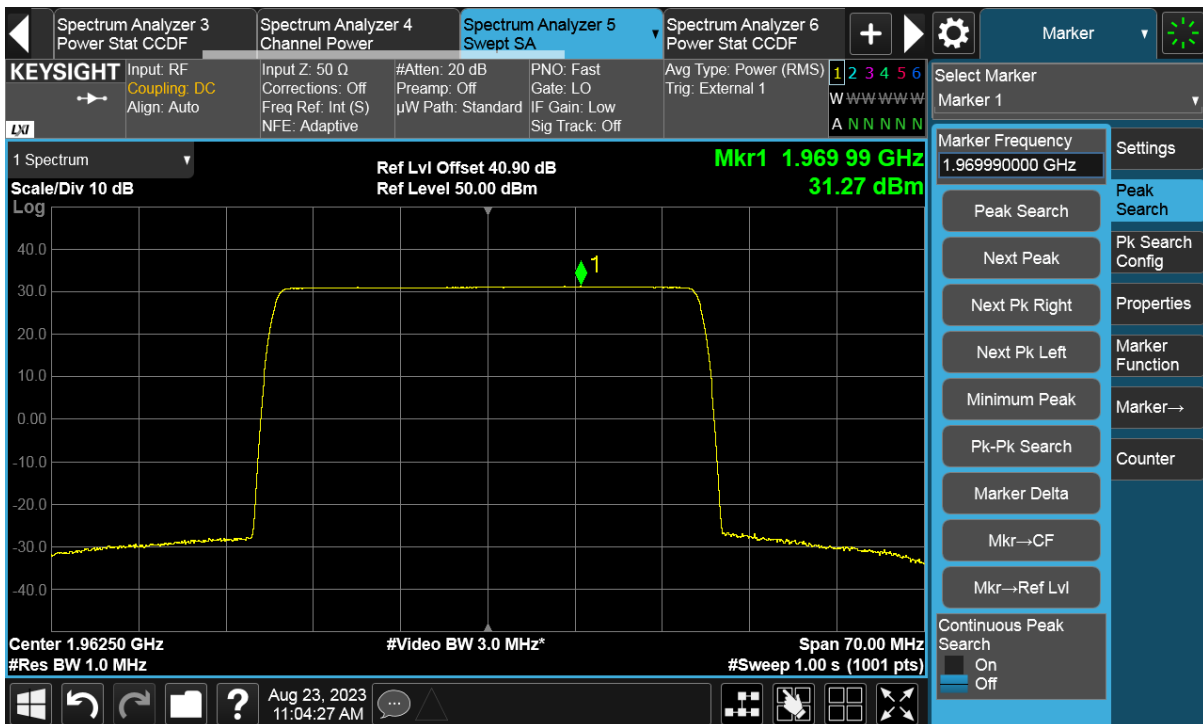
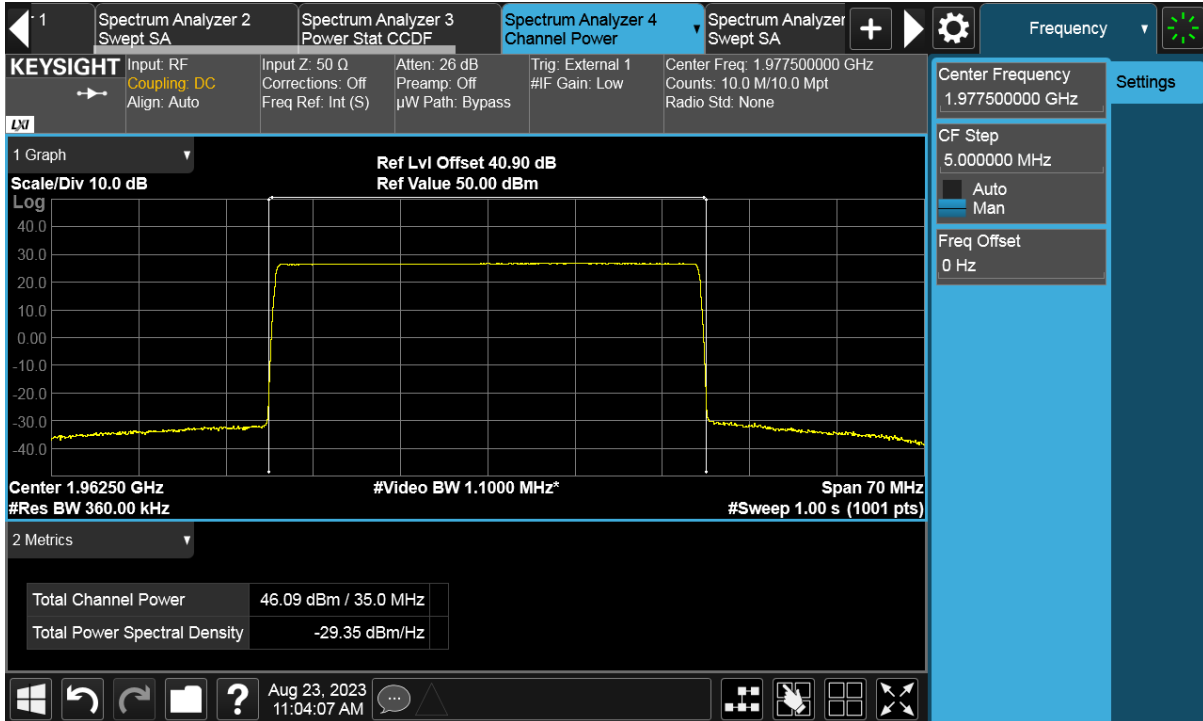
Antenna Port	NR Modulation	NR Carrier Bandwidth (MHz)	Output power / Peak-to-Average Ratio (PAR)								
			Channel position B			Channel position M			Channel position T		
			Power (dBm)	Power (dBm /MHz)	PAR (dB)	Power (dBm)	Power (dBm /MHz)	PAR (dB)	Power (dBm)	Power (dBm /MHz)	PAR (dB)
A	QPSK	35	46.08	31.30	7.70	46.08	21.33	7.27	45.99	31.16	7.42
B	QPSK	35	45.92	31.21	7.70	45.99	31.08	7.27	46.11	31.19	7.43
C	QPSK	35	45.93	31.26	7.71	46.09	31.27	7.27	46.03	31.21	7.39
D	QPSK	35	45.78	31.06	7.70	45.97	31.13	7.26	45.99	31.06	7.39
Total conducted power			51.95	37.23	-	52.05	36.08	-	52.05	37.18	-
EIRP limit			-	62.15	13.00	-	62.15	13.00	-	62.15	13.00
Max antenna gain			-	24.92	-	-	26.07	-	-	24.97	-



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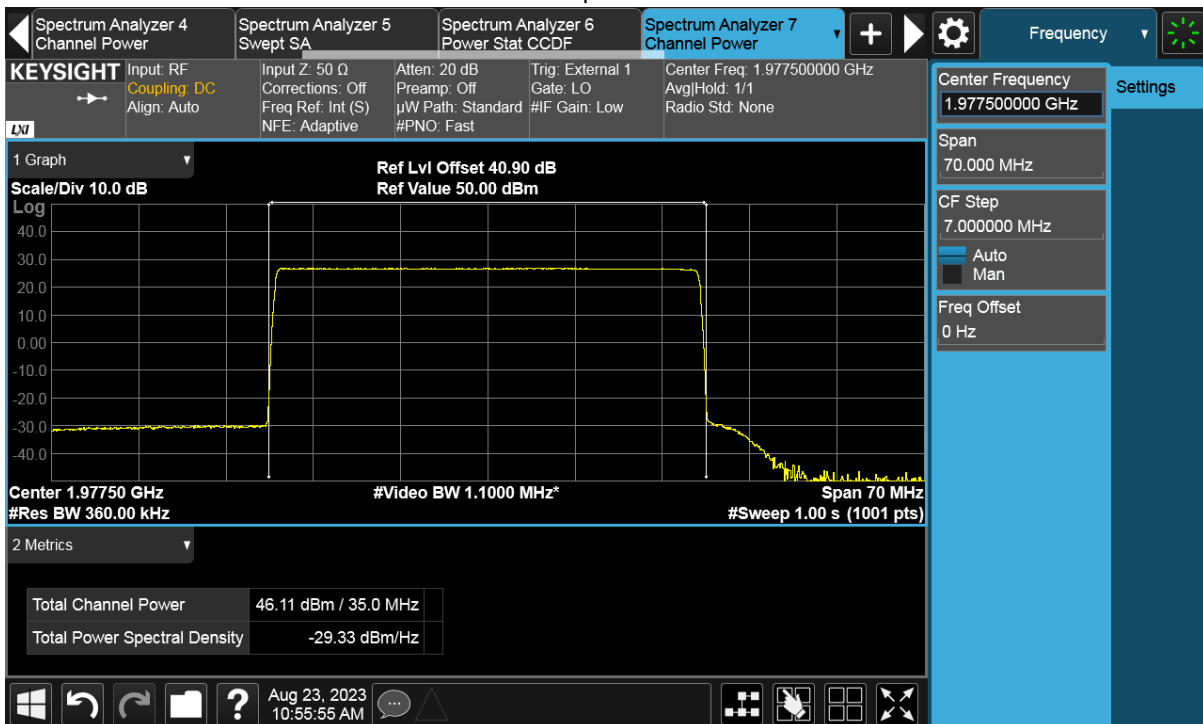
Channel position M



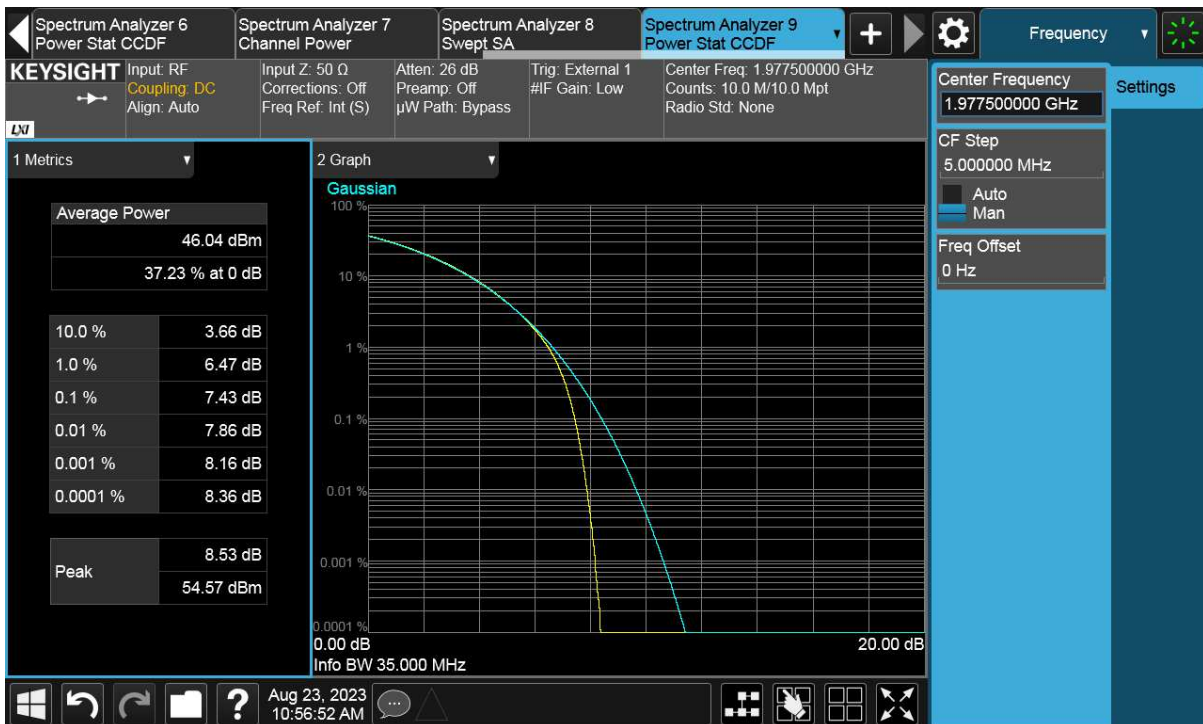
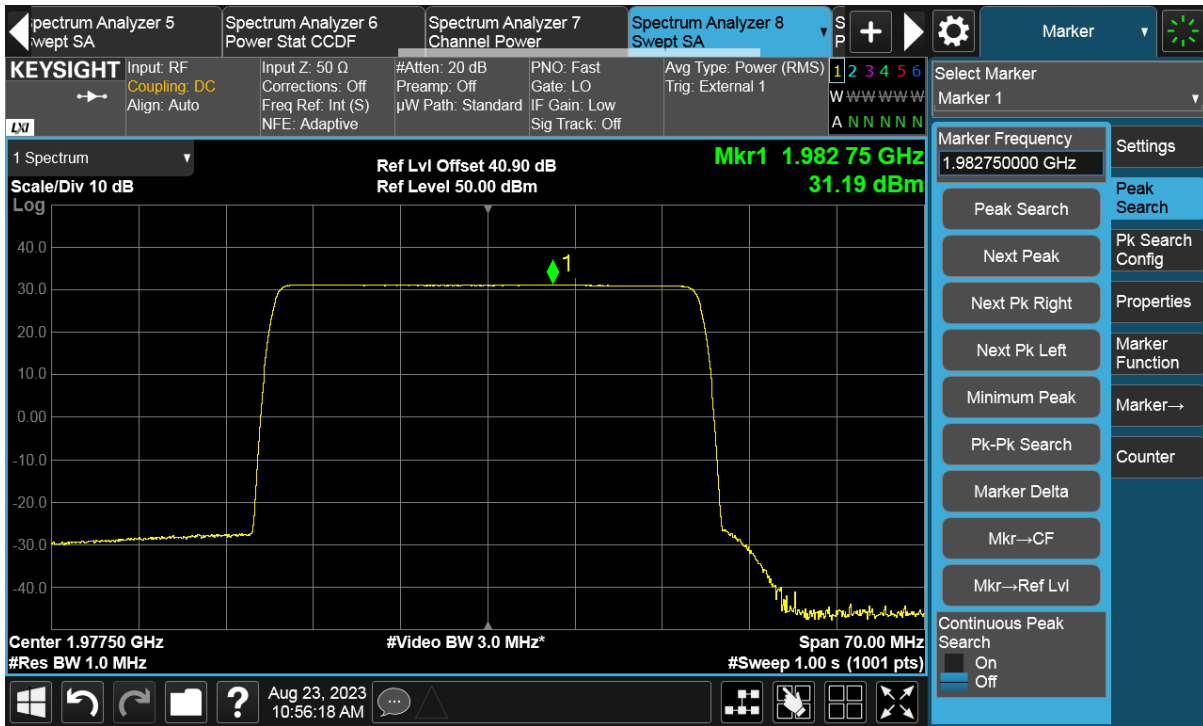
TEST REPORT



Channel position T



TEST REPORT



TEST REPORT**4 Occupied Bandwidth****Test result: Pass****4.1 Measurement Procedure**

The EUT was set to transmit at maximum power and testing was carried out on bottom, middle and top channels. Using the Occupied Bandwidth measurement function in the spectrum analyzer, the 26dB bandwidth was measured in accordance with FCC KDB 971168 D01 Clause 4.2.

The measurement method is from KDB 971168 4.2:

- a) The spectrum analyzer center frequency is set to the nominal EUT channel center frequency. The frequency span for the spectrum analyzer shall be set wide enough to capture all modulation products including the emission skirts (i.e., two to five times the OBW).
- b) The nominal IF filter bandwidth (3 dB RBW) shall be in the range of 1 to 5 % of the anticipated OBW, and the VBW shall be at least 3 times the RBW.
- c) Set the reference level of the instrument as required to keep the signal from exceeding the maximum input mixer level for linear operation. In general, the peak of the spectral envelope must be at least $10\log(\text{OBW} / \text{RBW})$ below the reference level.
- d) Set the detection mode to peak, and the trace mode to max hold.
- e) Use the 99 % power bandwidth function of the spectrum analyzer and report the measured bandwidth.

TEST REPORT

4.2 Measurement result

NR-1C

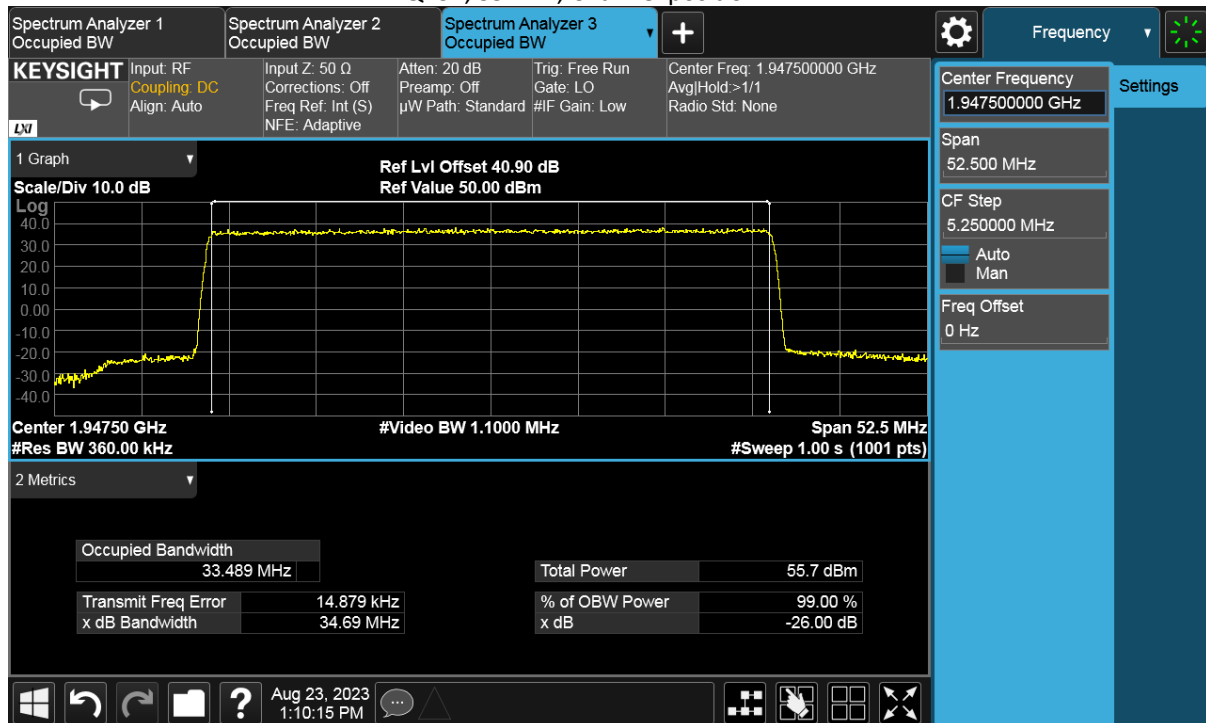
99% Occupied Bandwidth

Antenna Port	Modulation	Bandwidth	Occupied Bandwidth (MHz)		
			Channel Position B	Channel Position M	Channel Position T
B	QPSK	35MHz	33.489	33.492	33.485

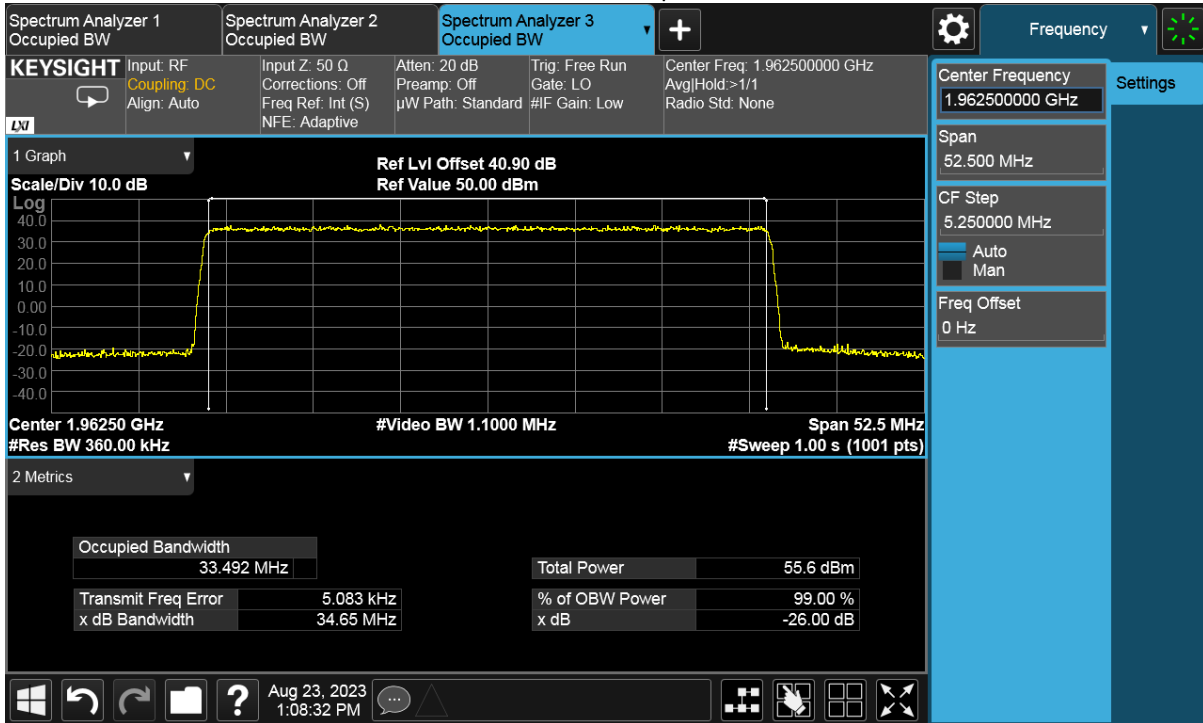
-26dBc Occupied Bandwidth

Antenna Port	Modulation	Bandwidth	Occupied Bandwidth (MHz)		
			Channel Position B	Channel Position M	Channel Position T
B	QPSK	35MHz	34.69	34.65	34.70

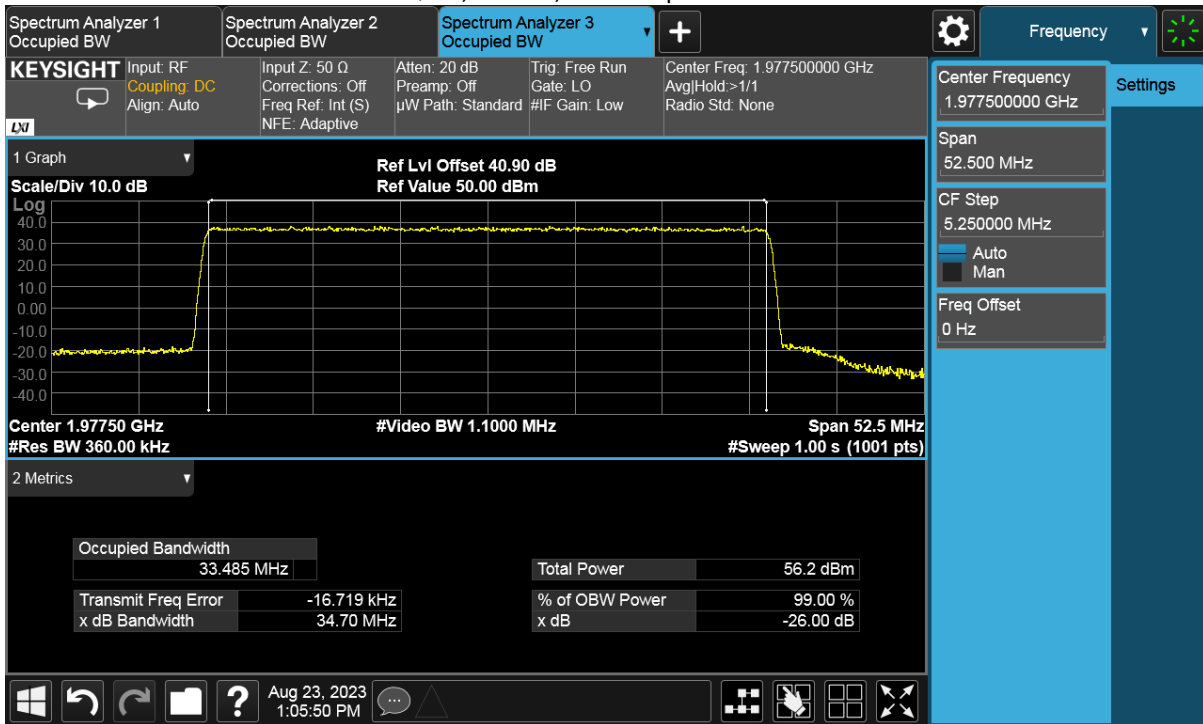
QPSK, 35MHz, Channel position B



QPSK, 35MHz, Channel position M



QPSK, 35MHz, Channel position T



TEST REPORT**5 Unwanted Emissions at Band Edge****Test result:** Pass**5.1 Limit**

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

5.2 Measurement Procedure

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

For MIMO mode configurations, the limit was adjusted with a correction of -6.02dB [$10\log(1/4)$] by using the Measure and Add $10\log(N)$ dB technique according to KDB 662911 D01 Multiple Transmitter Output accounting for simultaneous transmission from antenna ports . Then the limit was adjusted to -19.02dBm .

In the 1 MHz bands immediately outside and adjacent to the frequency block, a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed and a RBW of 1MHz for measurements of emissions $> 1\text{MHz}$ away from the band edges.

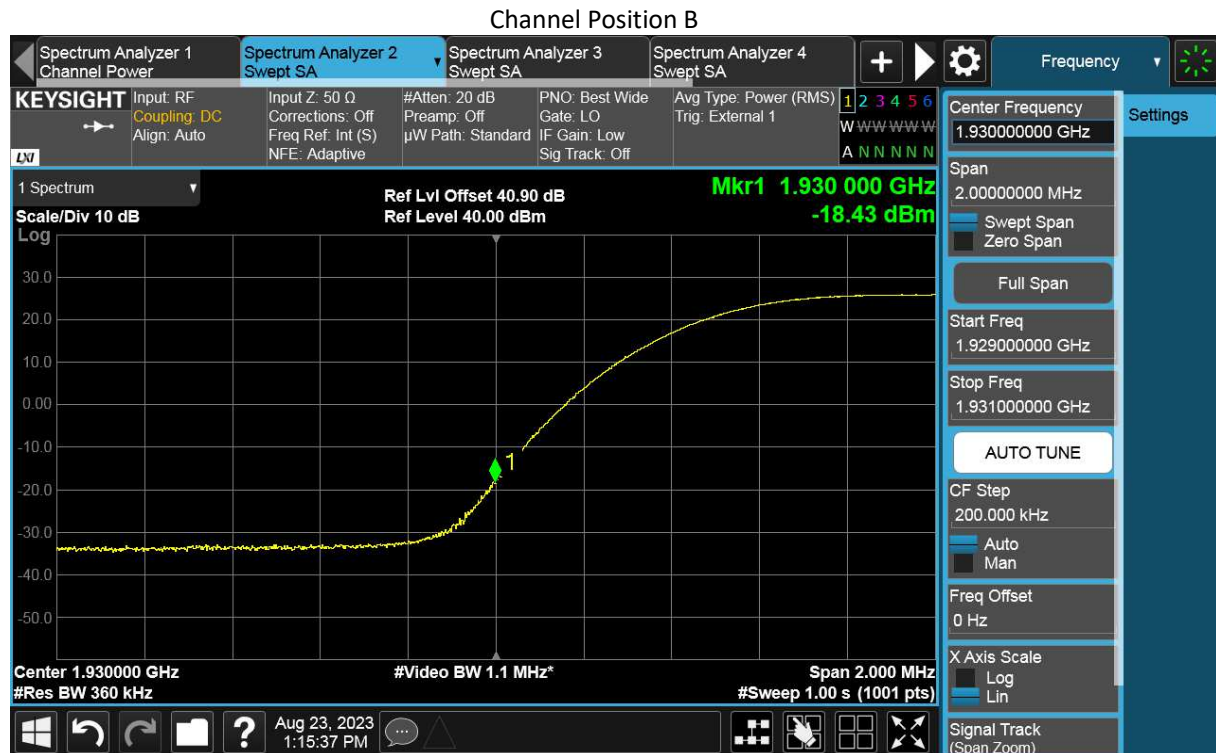
Spectrum analyzer detector was set as RMS.

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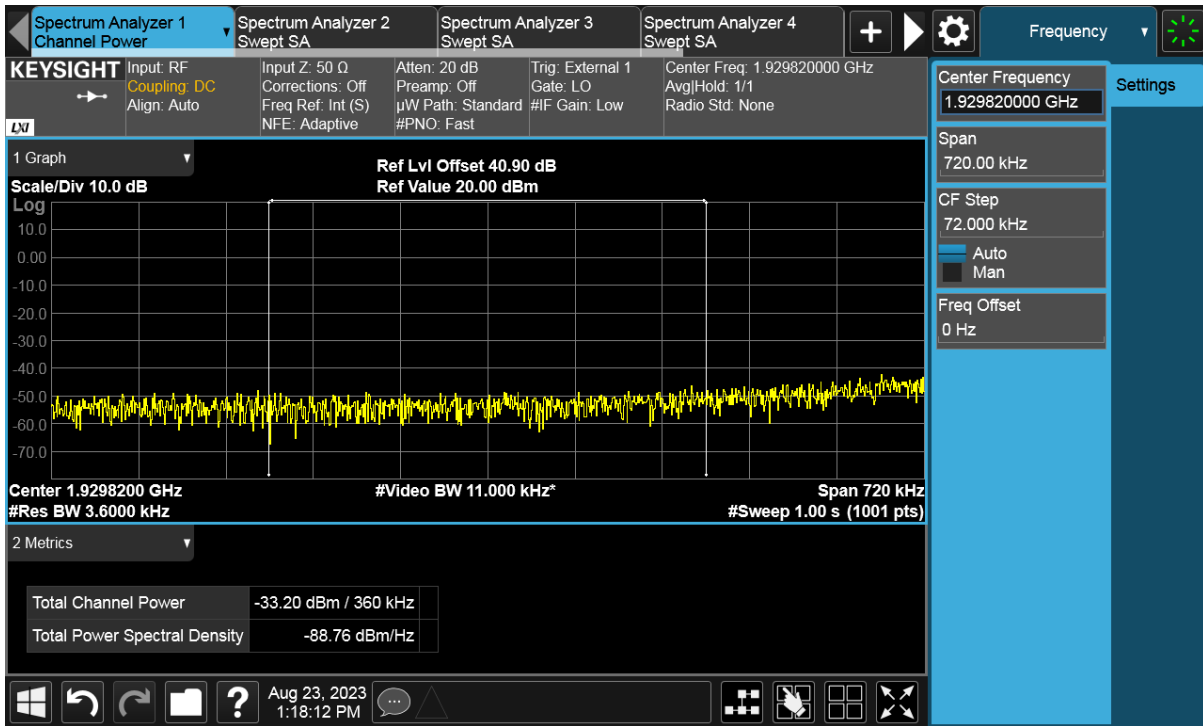
5.3 Measurement result

NR-1C-BE

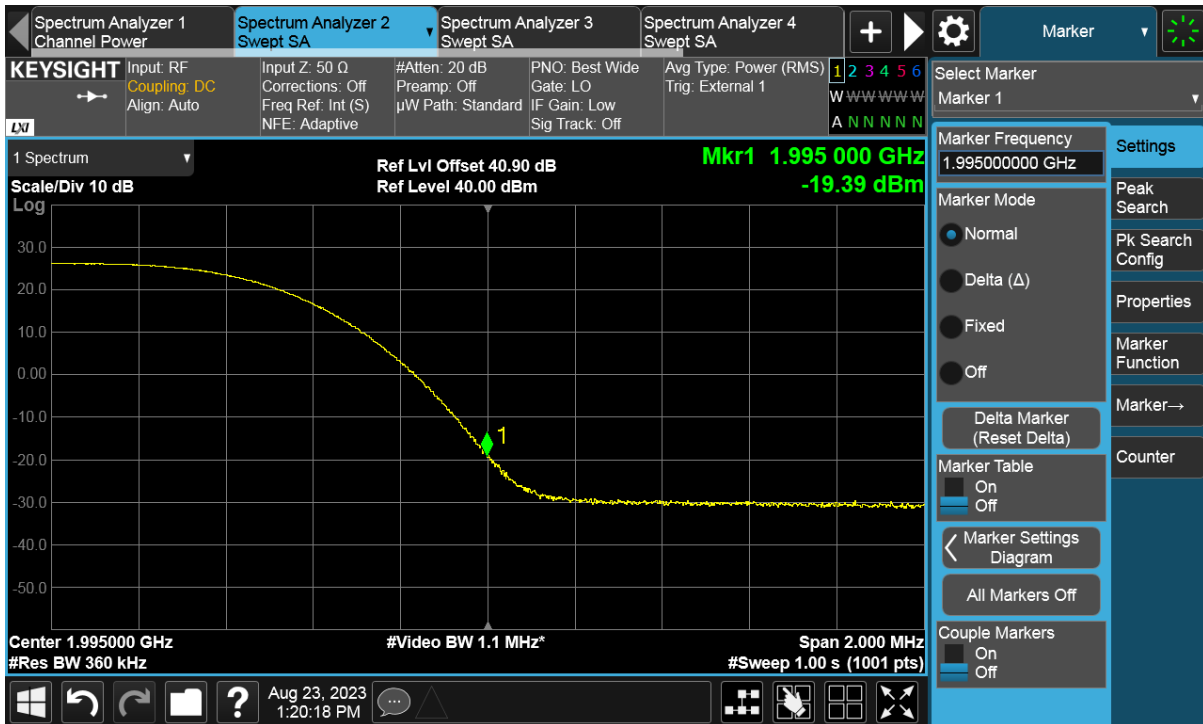
Antenna Port	Channel Position	Modulation	Carrier BW (MHz)	RBW (kHz)	Limit (dBm)
B	B	QPSK	35	360	-19.02
B	T	QPSK	35	360	-19.02



TEST REPORT



Channel Position T



TEST REPORT**6 Conducted Unwanted Emission**

Test result: Pass

6.1 Limit

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

6.2 Measurement Procedure

In accordance with FCC rules, the power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10\log(P)$ dB.

The spurious emissions from the antenna terminal were measured. The transmitter output power was attenuated using an attenuator and the frequency spectrum investigated from 9kHz to 20GHz. The resolution bandwidth of 1MHz was employed for frequency band 9kHz to 20GHz. The spectrum analyzer detector was set to RMS.

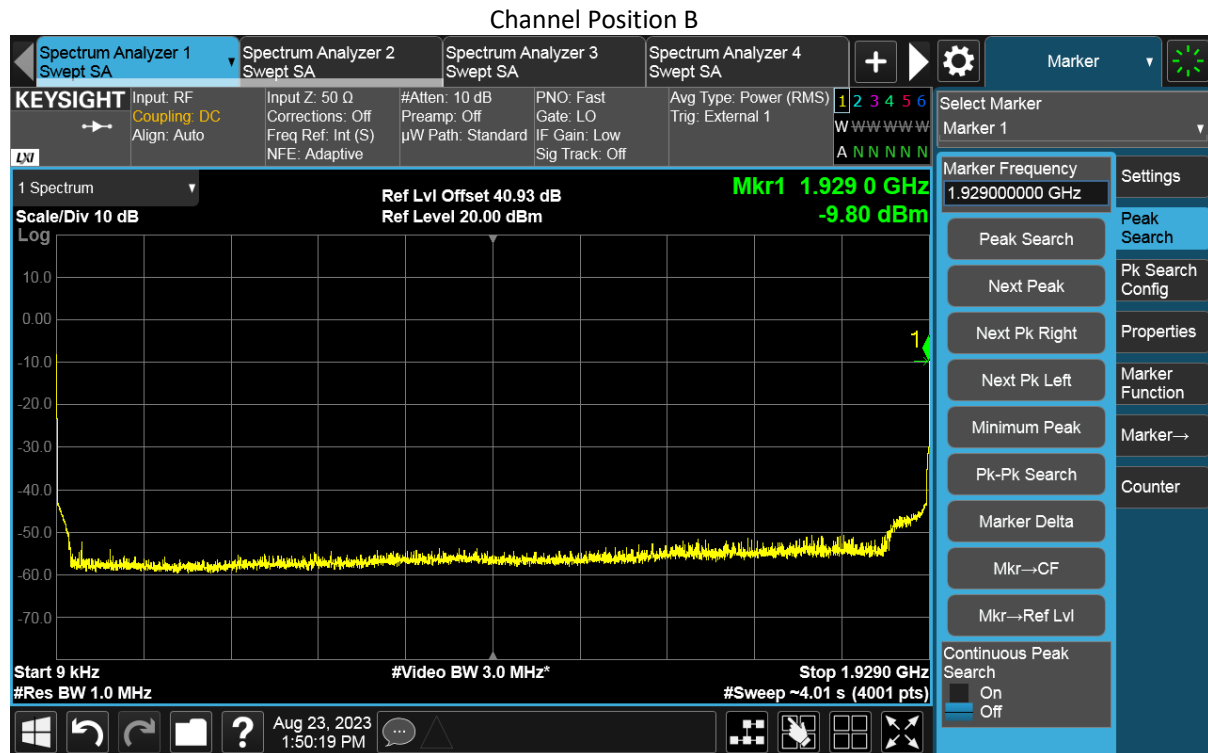
For MIMO mode configurations, the limit was adjusted with a correction of -6.02dB [$10\log(1/4)$] by using the Measure and Add $10\log(N)$ dB technique according to KDB 662911 D01 Multiple Transmitter Output accounting for simultaneous transmission from antenna ports. Then the limit was adjusted to -19.02dBm .

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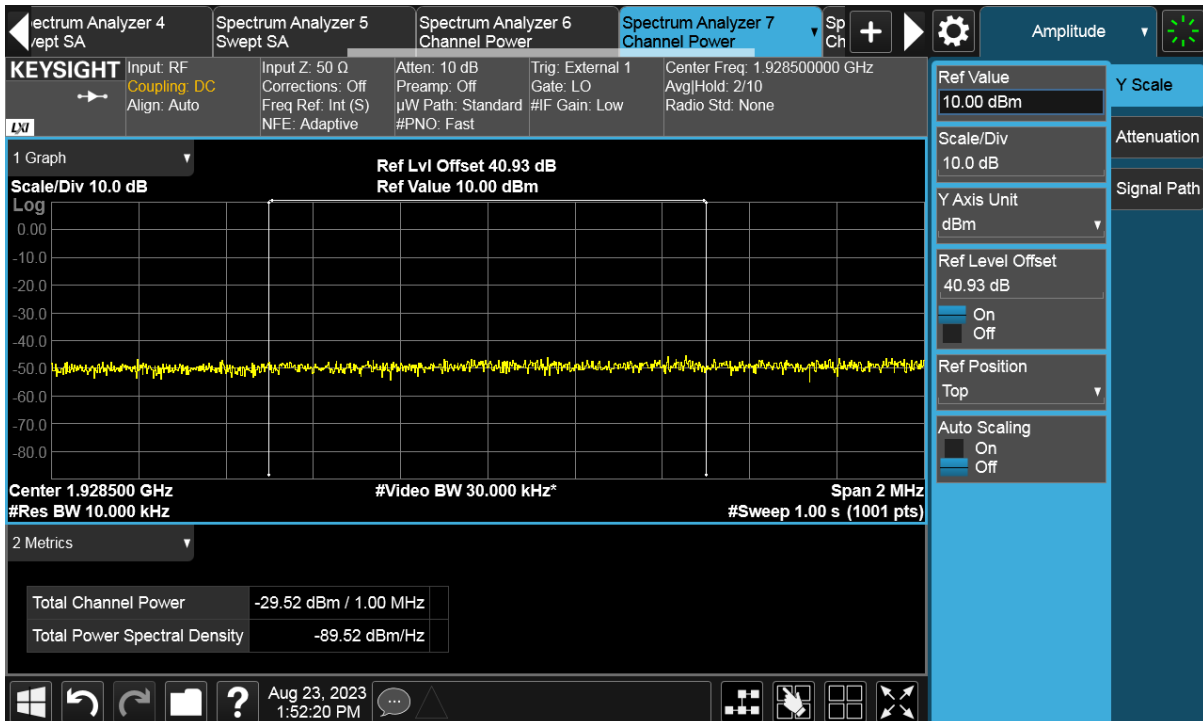
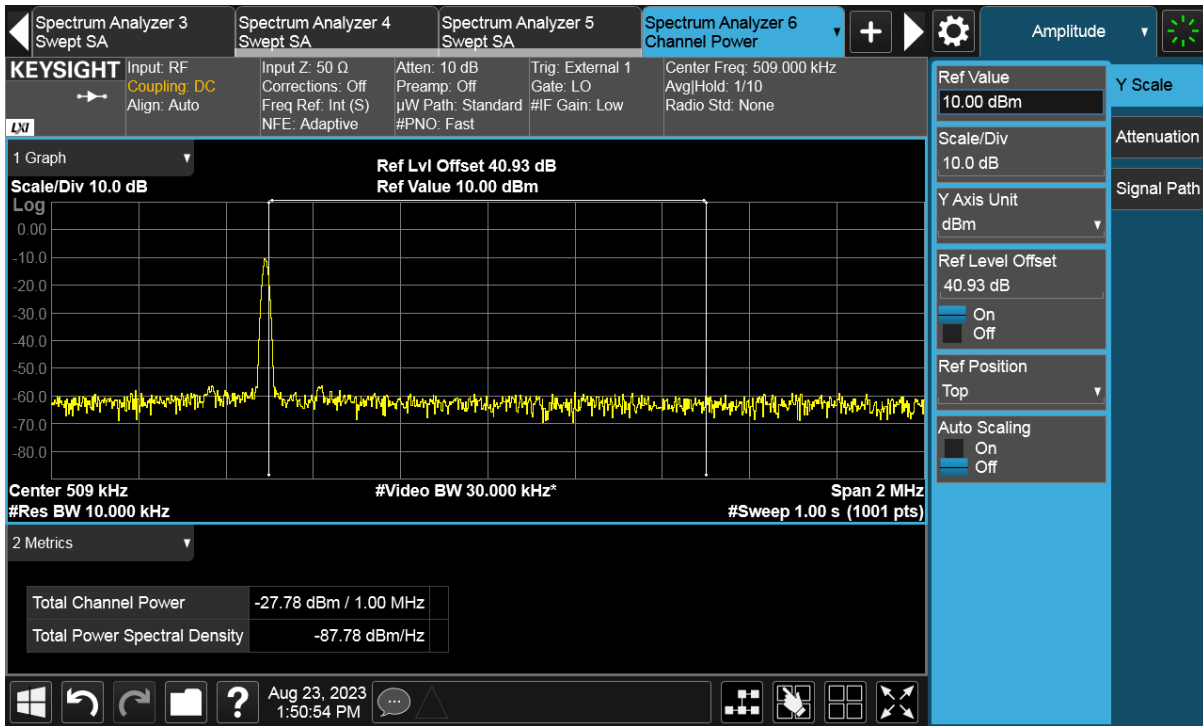
6.3 Measurement result

NR-1C

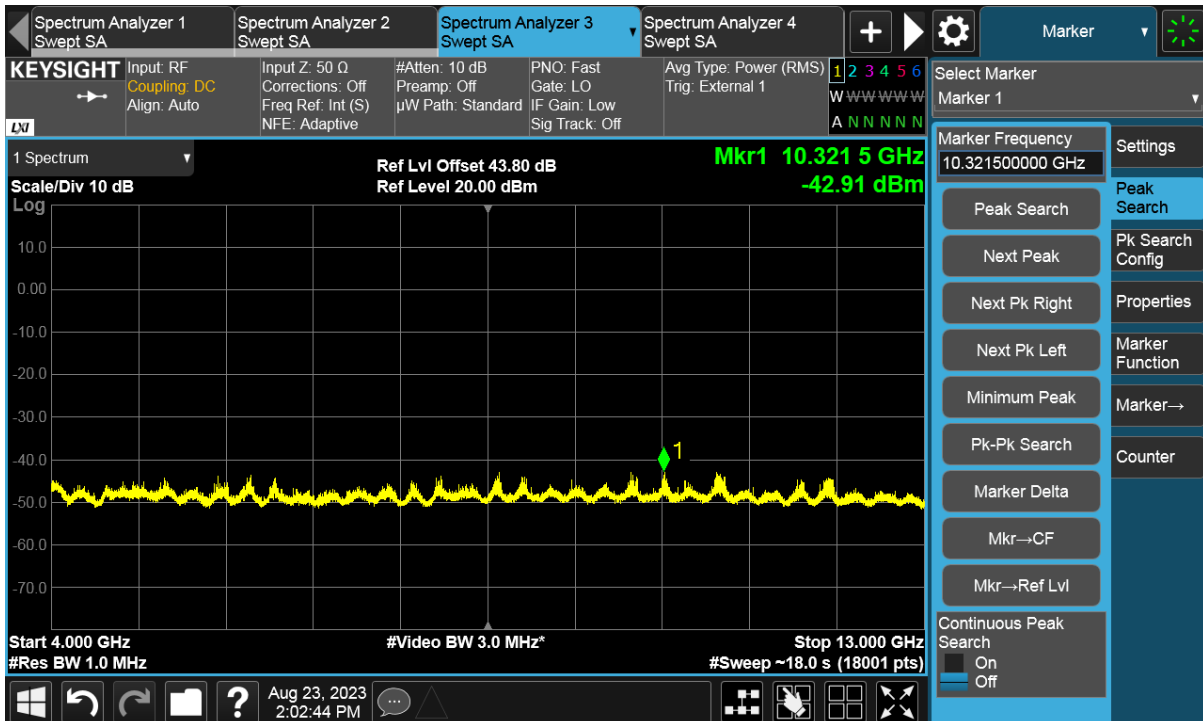
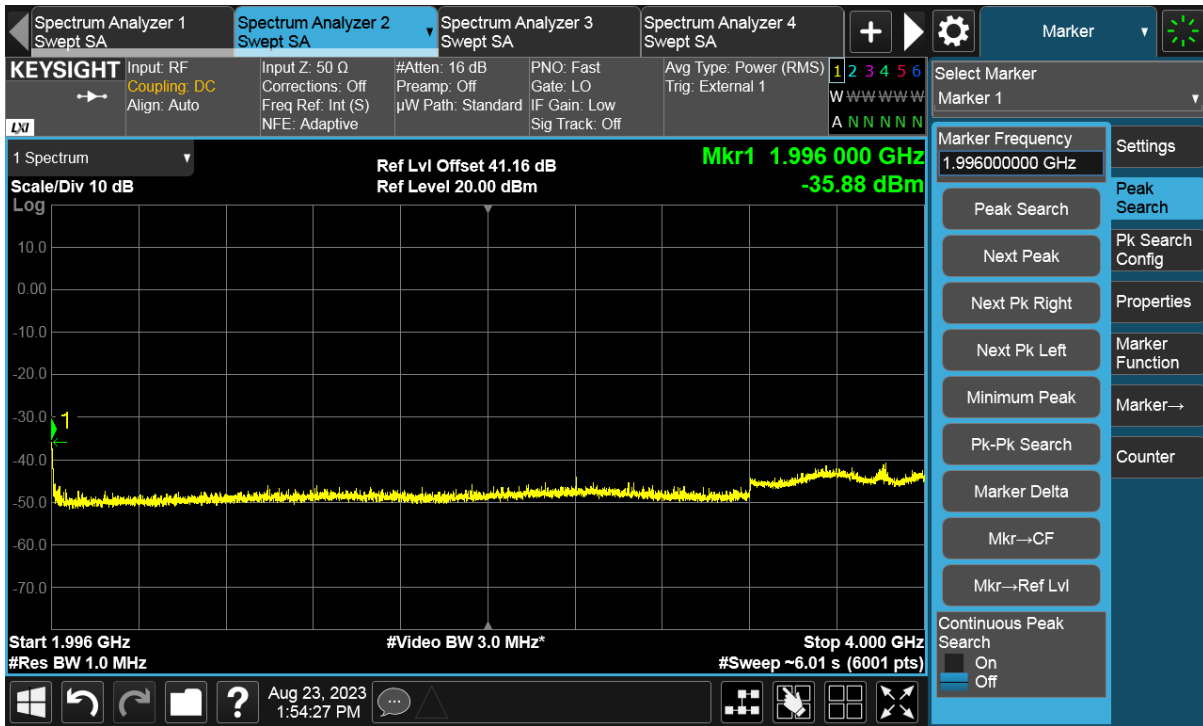
Antenna Port	Channel Position	Modulation	Carrier BW (MHz)	RBW (kHz)	Limit (dBm)
B	B	QPSK	35	1000	-19.02
B	M	QPSK	35	1000	-19.02
B	T	QPSK	35	1000	-19.02



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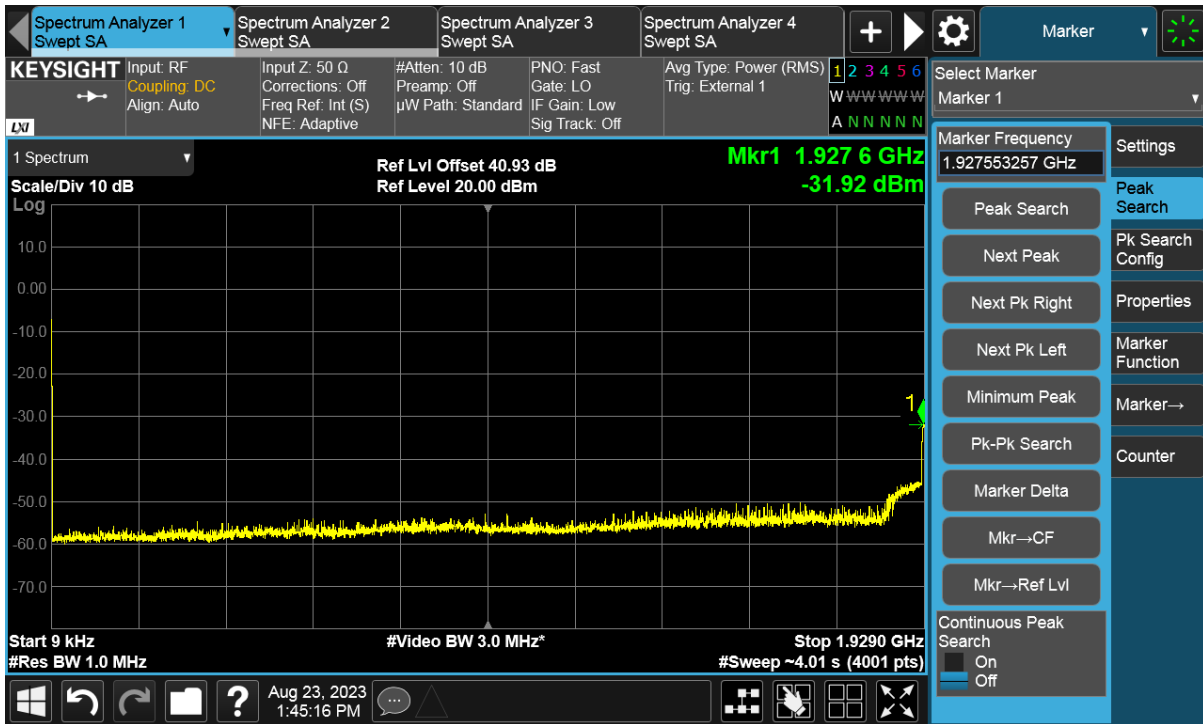
TEST REPORT



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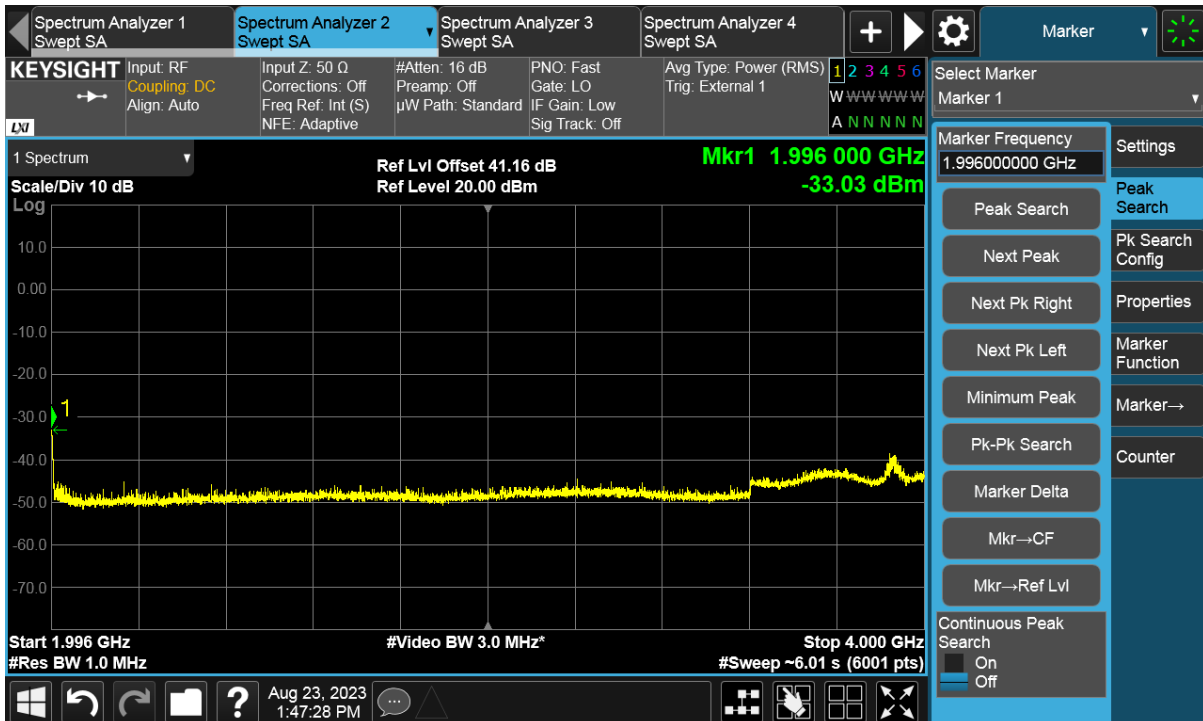
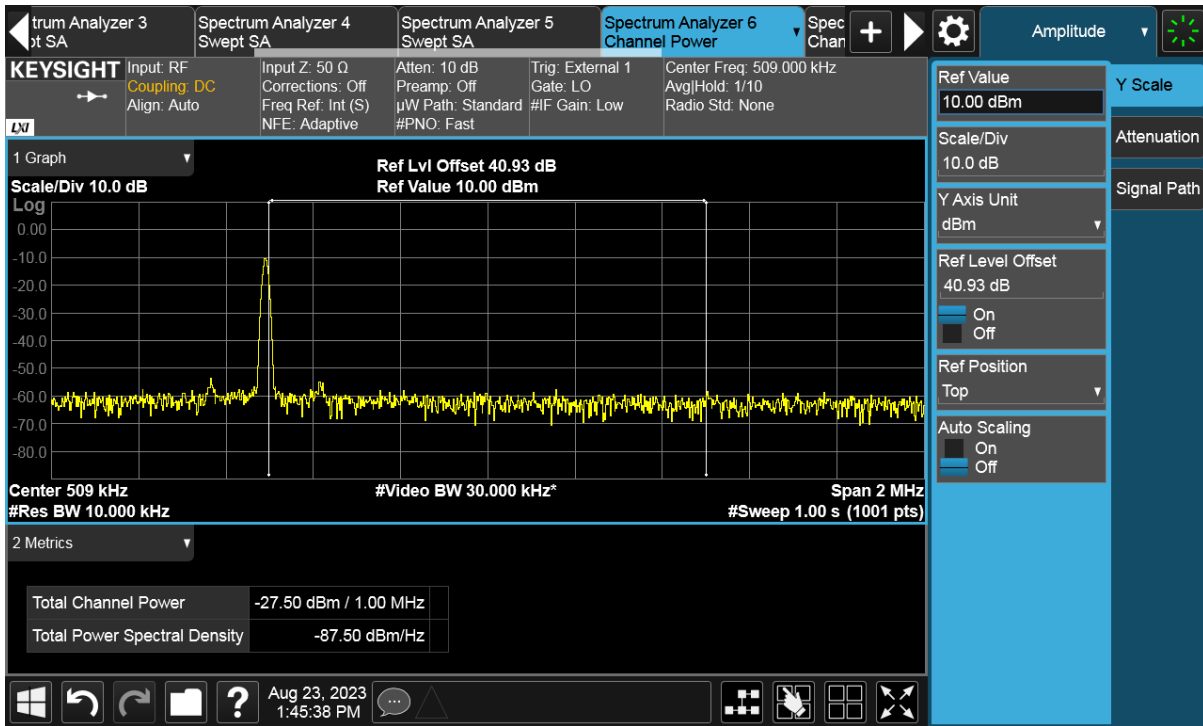


Channel Position M

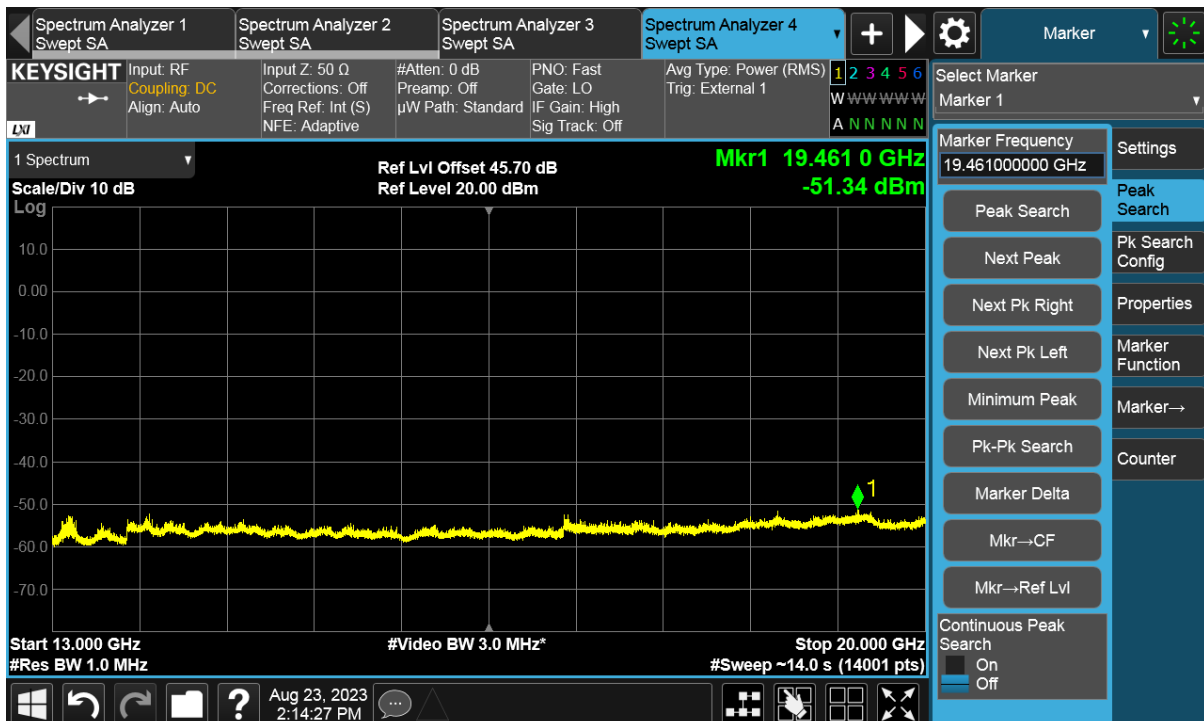
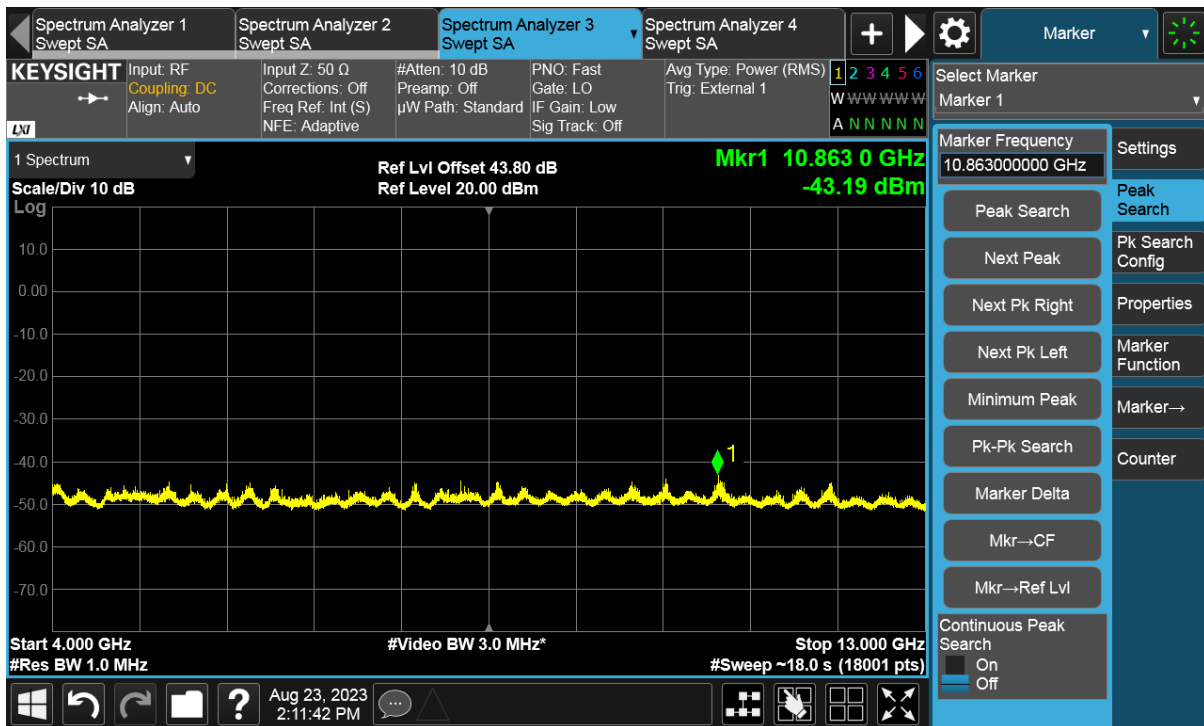


Total Quality. Assured.

TEST REPORT

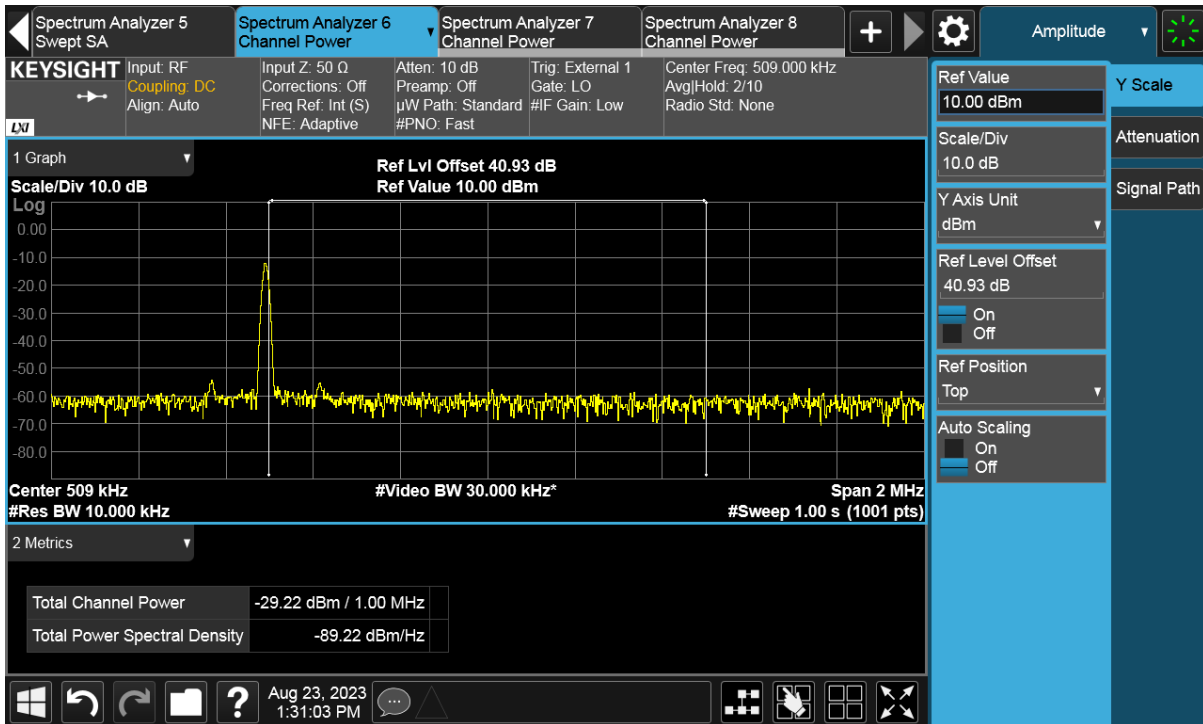
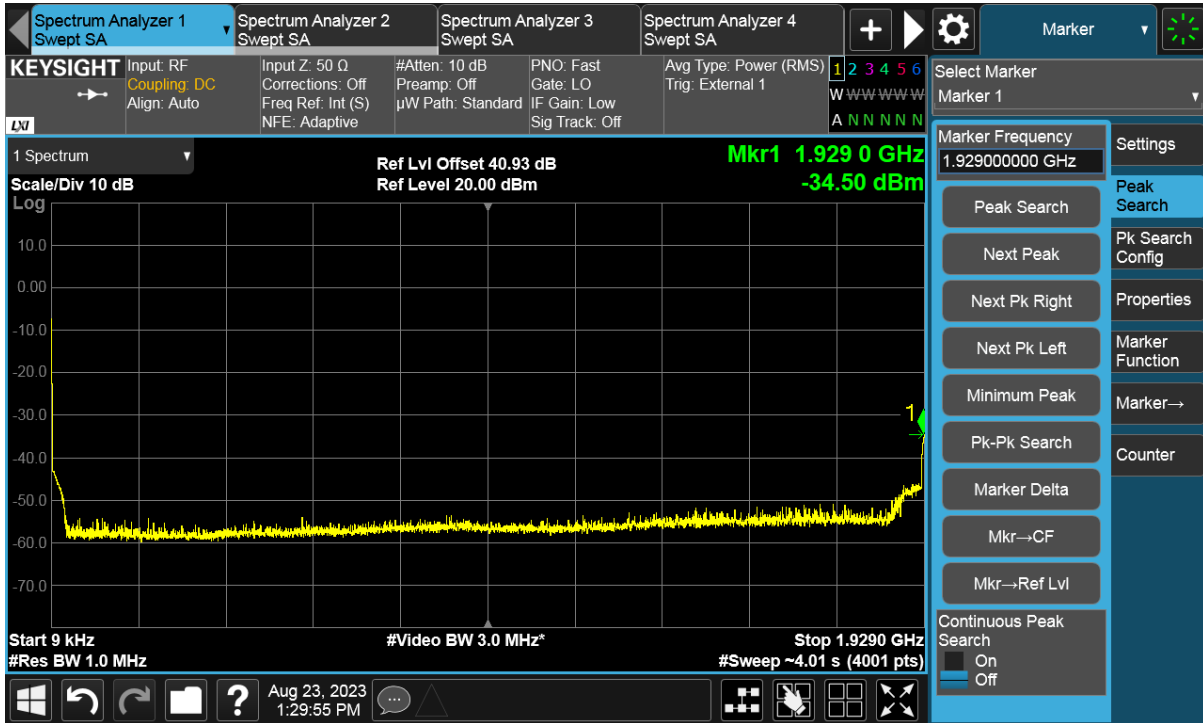


TEST REPORT

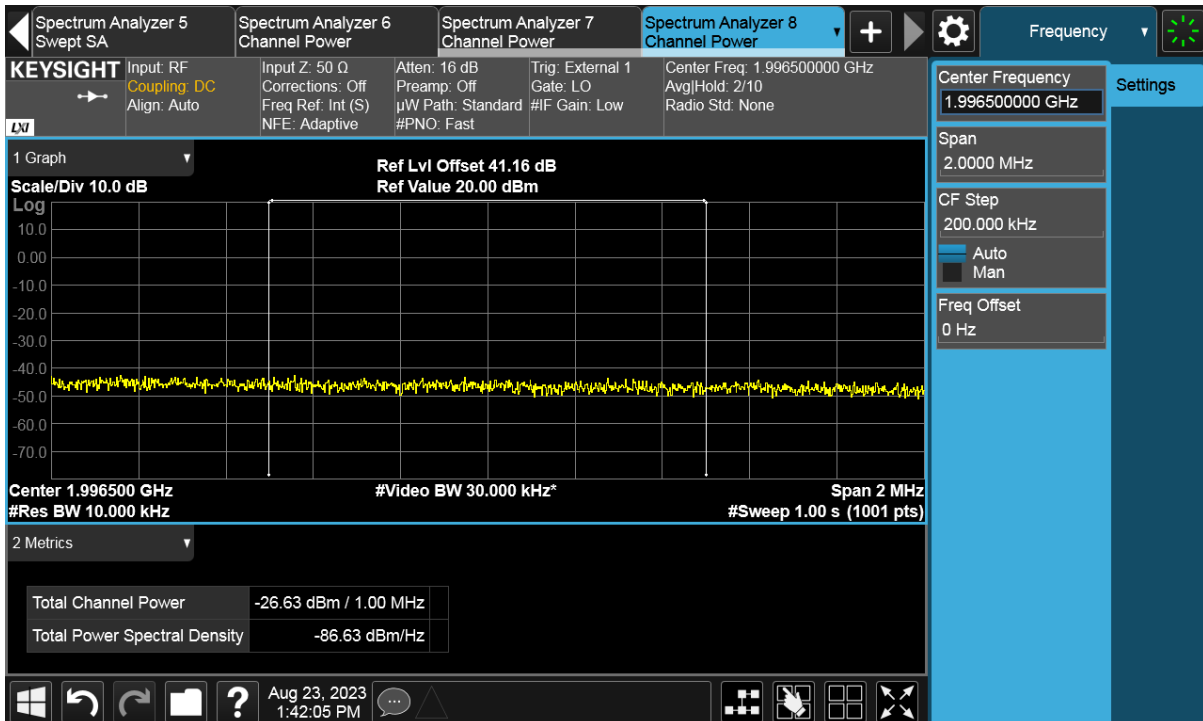
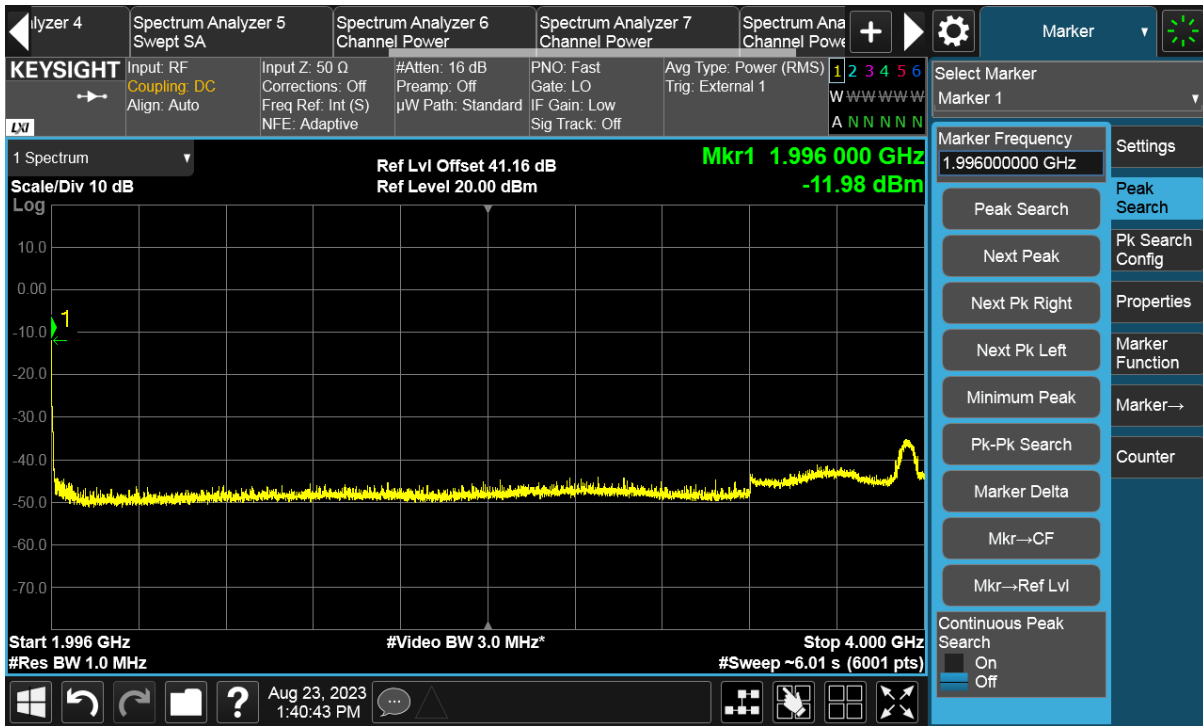


TEST REPORT

Channel Position T

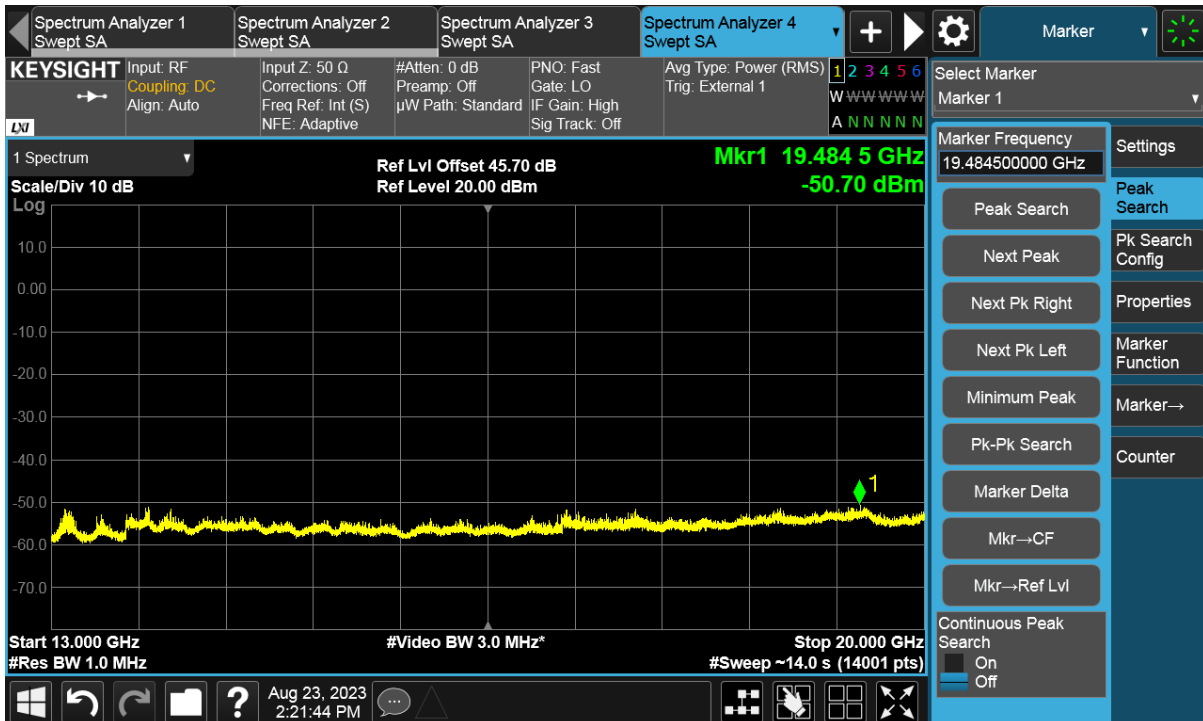
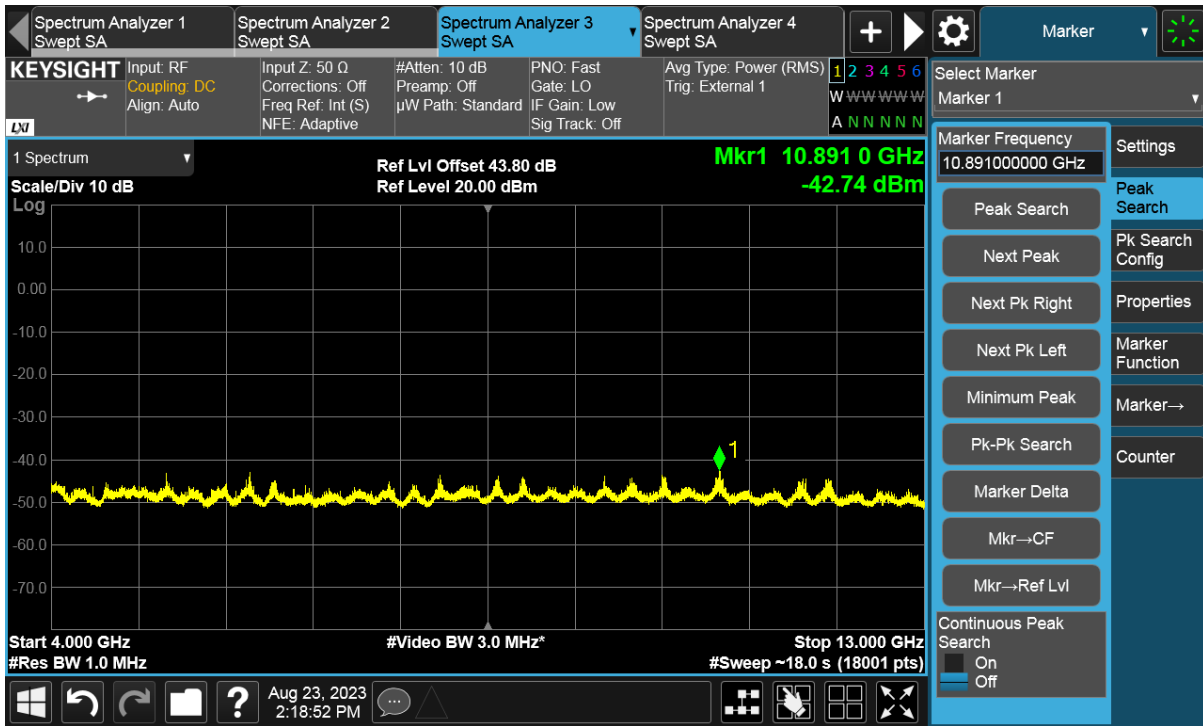


TEST REPORT



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