



TEST REPORT

KCTL Inc. 65, Sinwon-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Korea TEL: 82-31-285-0894 FAX: 82-505-299-8311 www.kctl.co.kr	Report No.: KR22-SRF0113-A Page (1) of (47)	KCTL
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1. Client

- Name : Plume Design, Inc.
- Address : 325 Lytton Ave., Palo Alto, CA 94301
- Date of Receipt : 2022-04-05

2. Name of Product / Model : SuperPod with WiFi 6 / F3A

3. FCC ID : 2AG7G-F3A

4. Date of Test : 2022-04-24 to 2022-05-08

5. Location of Test : ☒ Permanent Testing Lab ☐ On Site Testing
 : (Address: 65, Sinwon-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Korea)

6. Test method used : FCC Part 15 Subpart F, 15.517

7. Test Result : Refer to the test result in the test report

Affirmation	Tested by Name : Taekyong Nam (Signature)	Technical Manager Name : Heesu Ahn (Signature)
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2022-06-23

KCTL Inc.

As a test result of the sample which was submitted from the client, this report does not guarantee the whole product quality. This test report should not be used and copied without a written agreement by KCTL Inc.

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REPORT REVISION HISTORY

Date	Revision	Page No
2022-06-17	Originally issued	-
2022-06-23	Updated	All page

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Note. The report No. KR22-SRF0113 is superseded by the report No. KR22-SRF0113-A.

General remarks for test reports

Statement concerning the uncertainty of the measurement systems used for the tests

(may be required by the product standard or client)

☐ Internal procedure used for type testing through which traceability of the measuring uncertainty has been established:

Procedure number, issue date and title:

Calculations leading to the reported values are on file with the testing laboratory that conducted the testing.

☒ Statement not required by the standard or client used for type testing

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2.1. Frequency/channel operations

This device contains the following capabilities:
 Ultra-Wideband

Ch.	Frequency (MHz)
5	6 489.6
9	7 987.2

Table 2.1.1. Ultra-Wideband

2.2. EUT Description

Antenna	Channel	Configuration	Preamble Length	Packet Length	Preamble
A	5	SP0	256	32	3
					9
	9				3
					9
B	5	SP0	256	32	3
					9
	9				3
					9

Notes:

Worst case Preamble :

(Peak : Ant A_Ch 5_Preamble 3/ Average : Ant A_Ch 5_Preamble 9)

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3. Antenna requirement

Requirement of FCC part section 15.203:

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section.

- The transmitter has permanently attached FPCB antenna(internal antenna) on board.
- The E.U.T Complies with the requirement of §15.203.



4. Summary of tests

FCC Part section(s)	Parameter	Test Condition	Test results
15.503(a)	10 dB Bandwidth	Radiated	Pass
15.517(c)(e)	Peak Power & Maximum Average Emission		Pass
15.517(c)	Radiated Emissions Above 960 MHz		Pass
15.517(d)	Radiated Emission in the 1 164 – 1 240 MHz and 1 559 – 1 610 MHz GPS Bands		Pass
15.209	Radiated Emissions Below 960 MHz		Pass
15.207	AC Line Conducted Emission		Pass

Notes:

1. All modes of operation and data rates were investigated. The test results shown in the following sections represent the worst case emissions.
2. According to exploratory test no any obvious emission were detected from 9 kHz to 30 MHz. Although these tests were performed other than open field site, adequate comparison measurements were confirmed against 30 m open field site. Therefore sufficient tests were made to demonstrate that the alternative site produces results that correlate with the ones of tests made in an open field based on KDB 414788.
3. The fundamental of the EUT was investigated in three orthogonal orientations X, Y and Z. It was determined that Y orientation was worst-case orientation. Therefore, all final radiated testing was performed with the EUT in Y orientation
4. The test procedure(s) in this report were performed in accordance as following.
 - ♦ ANSI C63.10-2013
 - ♦ KDB 393764 D01 UWB FAQ v02

5. Measurement uncertainty

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI C63.10-2013.

All measurement uncertainty values are shown with a coverage factor of $k=2$ to indicated a 95 % level of confidence. The measurement data shown herein meets or exceeds the U_{CISPR} measurement uncertainty values specified in CISPR 16-4-2 and thus, can be compared directly to specified limits to determine compliance.

Parameter	Expanded uncertainty ($\pm$)	
Radiated spurious emissions	9 kHz ~ 30 MHz:	2.3 dB
	30 MHz ~ 300 MHz	5.4 dB
	300 MHz ~ 1 000 MHz	5.5 dB
	Above 1 GHz	6.7 dB
Conducted emissions	9 kHz ~ 150 kHz	3.7 dB
	150 kHz ~ 30 MHz	3.3 dB

6. Test results

6.1. 10 dB Bandwidth

Limit

FCC

According to §15.503(a), For the purpose of this subpart, the UWB bandwidth is the frequency band bounded by the points that are 10 dB below the highest radiated emission, as based on the complete transmission system including the antenna. The upper boundary is designated f_H and the lower boundary is designated f_L . The frequency at which the highest radiated emission occurs is designated f_M .

Center frequency. The center frequency, f_C , equals $(f_H + f_L) / 2$.

Fractional bandwidth. The fractional bandwidth equals $2(f_H - f_L) / (f_H + f_L)$.

Ultra-wideband (UWB) transmitter. An intentional radiator that, at any point in time, has a fractional bandwidth equal to or greater than 0.20 or has a UWB bandwidth equal to or greater than 500 MHz, regardless of the fractional bandwidth.

According to §15.519(b), The UWB bandwidth of a device operating under the provisions of this section must be contained between 3 100 MHz and 10 600 MHz.

A UWB device is an intentional radiator that has either a -10 dB bandwidth¹ of at least 500 MHz or a -10 dB fractional bandwidth² greater than 0.2. There are eight distinct subclasses of UWB device.

Test procedure

ANSI C63.10 - Section 10.1

Test settings

RBW	1 MHz
VBW	1 MHz or greater.
Detector	Peak
Trace mode	Max-hold
Sweep	Auto couple
The trace was allowed to stabilize	

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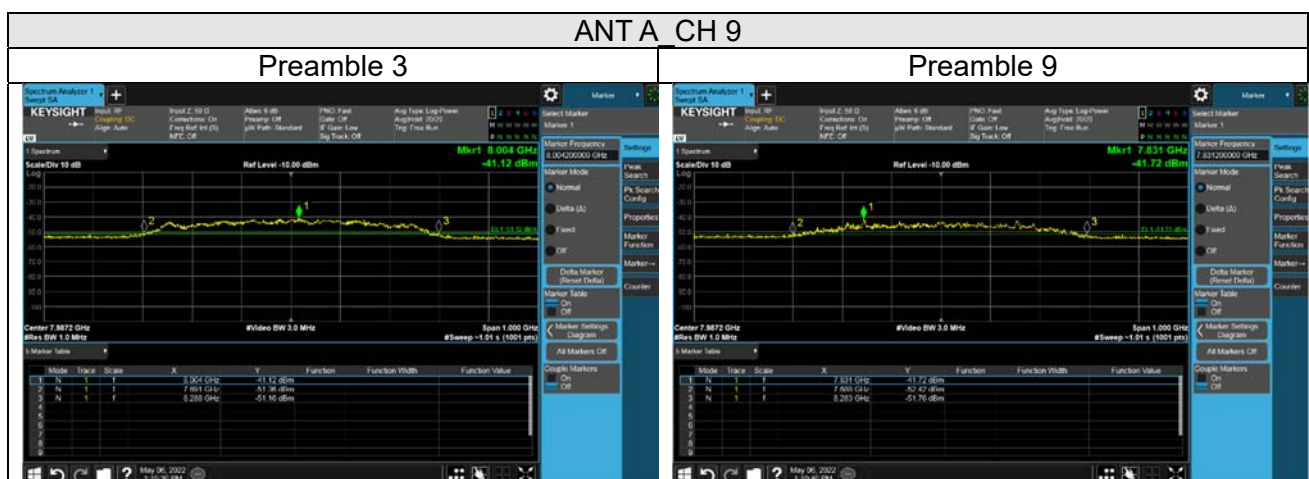
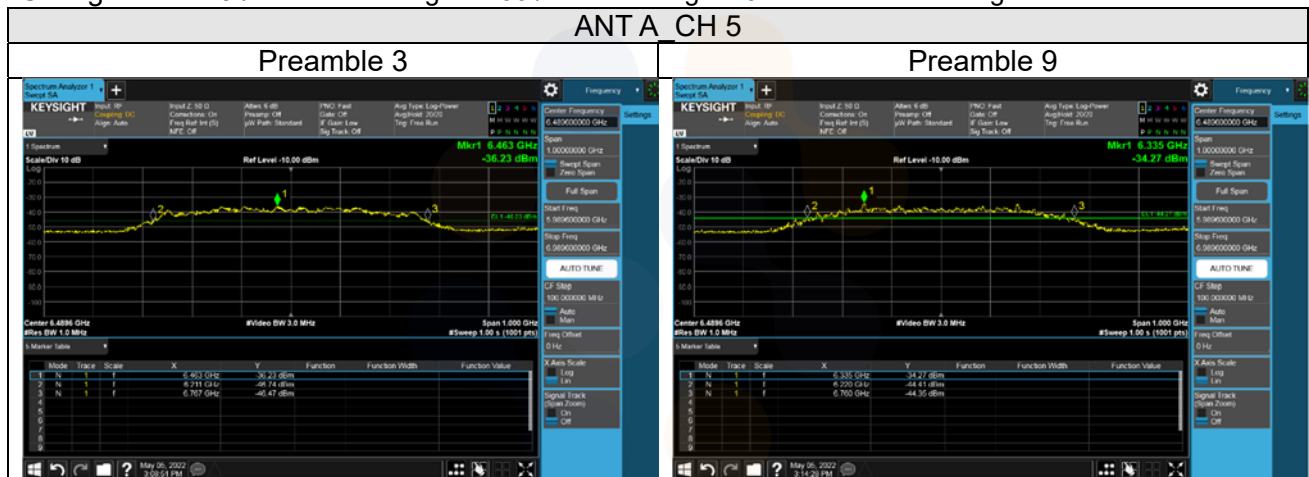


Test results

Antenna	Channel	Preamble	F _L [MHz]	F _H [MHz]	F _C [MHz]	BW [MHz]
A	5	3	6 211.00	6 767.00	6 489.00	556.00
		9	6 220.00	6 760.00	6 490.00	540.00
	9	3	7 691.00	8 288.00	7 989.50	597.00
		9	7 688.00	8 283.00	7 985.50	595.00

Antenna	Channel	Preamble	F _L [MHz]	F _H [MHz]	F _C [MHz]	BW [MHz]
B	5	3	6 213.00	6 788.00	6 500.50	575.00
		9	6 226.00	6 785.00	6 505.50	559.00
	9	3	7 670.00	8 279.00	7 974.50	609.00
		9	7 673.00	8 273.00	7 973.00	600.00

*Configuration : 0 / Preamble Length : 256 / Packet Length : 32 as a default setting.



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ANT B CH 5

Preamble 3



Preamble 9



ANT B CH 9

Preamble 3



Preamble 9



6.2. Peak Power & Maximum Average Emission

Limit

According to §15.517(c) The radiated emissions at or below 960 MHz from a device operating under the provisions of this section shall not exceed the emission levels in §15.209. The radiated emissions above 960 MHz from a device operating under the provisions of this section shall not exceed the following average limits when measured using a resolution bandwidth of 1 MHz:

Frequency in MHz	EIRP in dBm
3 100-10 600	-41.3

According to §15.517(e) peak level of the emissions contained within a 50 MHz bandwidth centered on the frequency at which the highest radiated emission occurs, f_M . That limit is 0 dBm EIRP

Test procedure

ANSI C63.10 – Section 10.3.5 and 10.3.7

Test settings

Peak EIRP Measurements

RBW 50 MHz
 VBW 50 MHz
 Detector Peak
 Trace mode Max-hold
 Sweep Auto couple
 The trace was allowed to stabilize

Average EIRP Measurements

RBW 1 MHz
 VBW 3 MHz
 Detector Average(RMS)
 Trace mode Max-hold
 Sweep time No more than a 1 ms integration period over each measurement bin
 The trace was allowed to stabilize

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Test results

ANT.	CH.	Preamble	Peak power [dBm/50MHz]	Peak limit [dBm/50MHz]	Margin [dB]	AV power [dBm/MHz]	AV limit [dBm/MHz]	Margin [dB]
A	5	3	-11.00	0.00	11.00	-47.40	-41.30	6.10
		9	-16.88		16.88	-45.79		4.49
	9	3	-15.50		15.50	-52.03		10.73
		9	-22.05		22.05	-53.85		12.55

ANT.	CH.	Preamble	Peak power [dBm/50MHz]	Peak limit [dBm/50MHz]	Margin [dB]	AV power [dBm/MHz]	AV limit [dBm/MHz]	Margin [dB]
B	5	3	-12.31	0.00	12.31	-49.66	-41.30	8.36
		9	-16.59		16.59	-49.24		7.94
	9	3	-15.54		15.54	-53.77		12.47
		9	-24.93		24.93	-56.29		14.99

*Configuration : 0 / Preamble Length : 256 / Packet Length : 32 as a default setting.

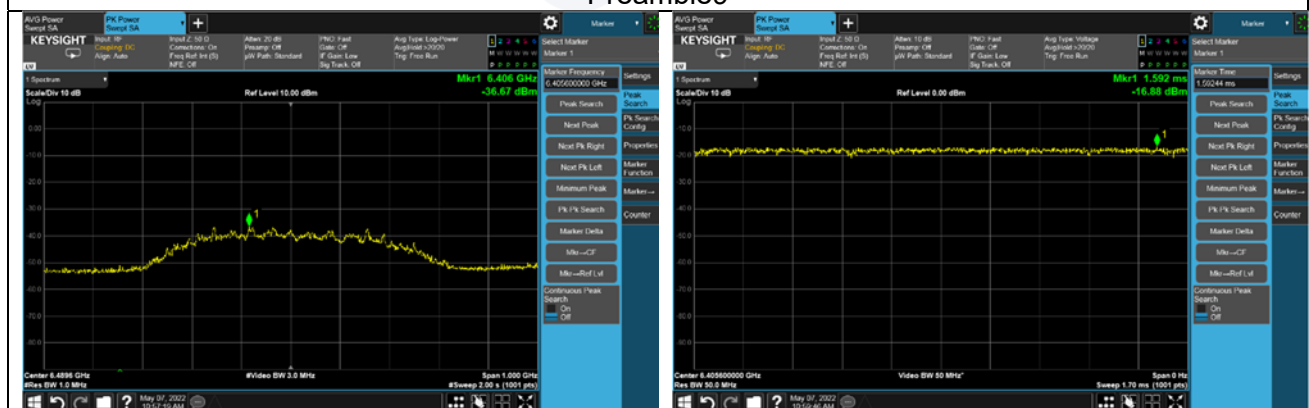
Peak power

ANT A CH 5

Preamble3



Preamble9



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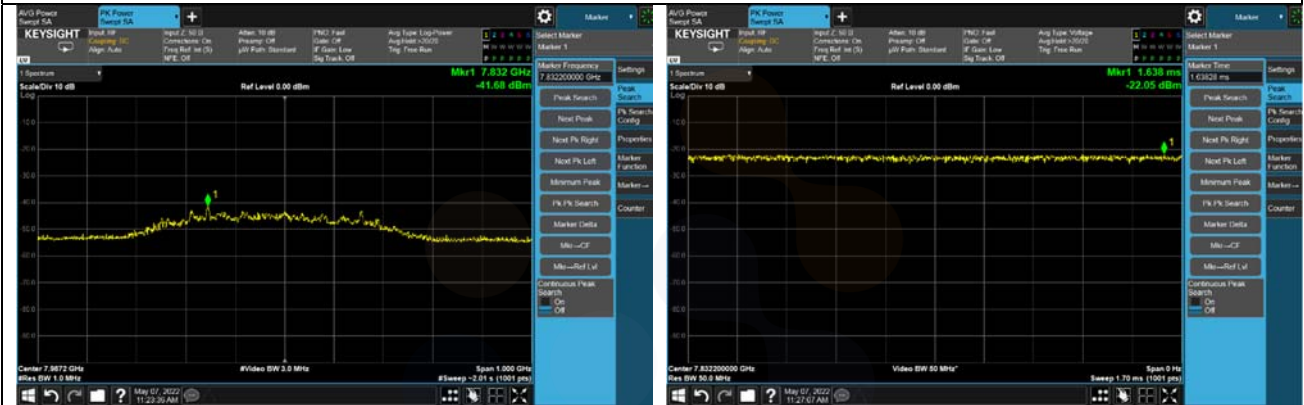


ANT A CH 9

Preamble3



Preamble9



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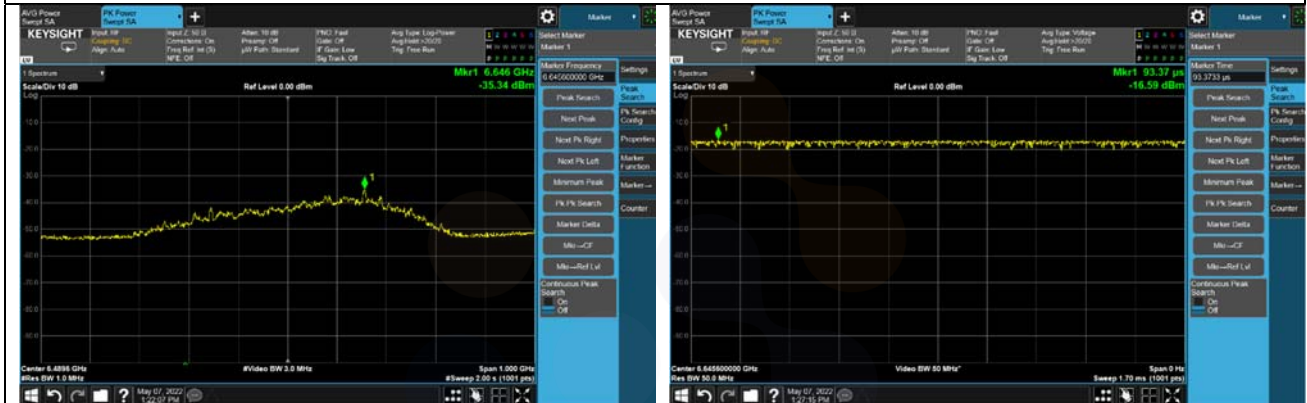


ANT B CH 5

Preamble3



Preamble9



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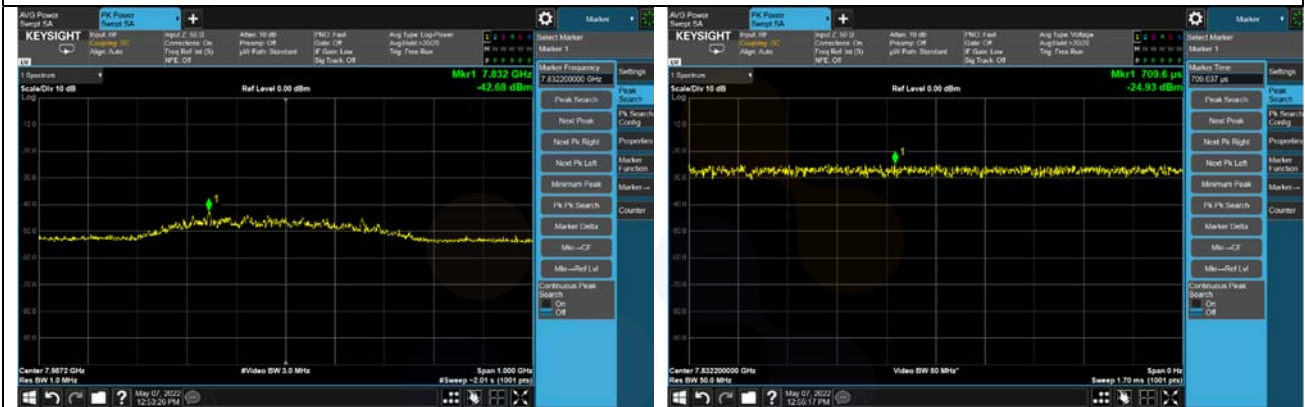


ANT B CH 9

Preamble3



Preamble9



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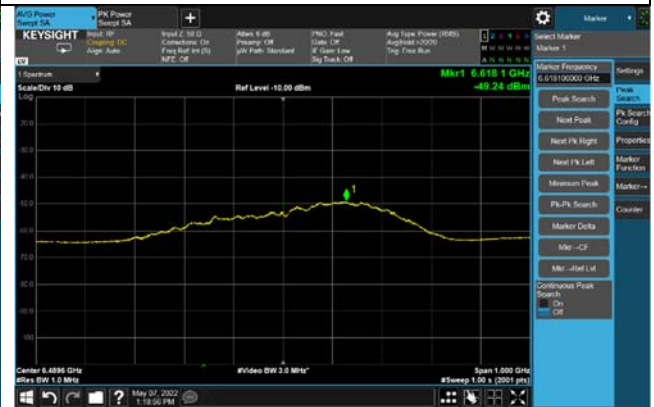


ANT B CH 5

Preamble 3

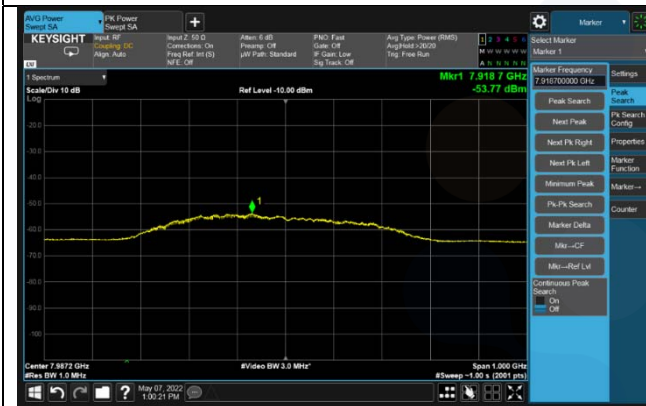


Preamble 9

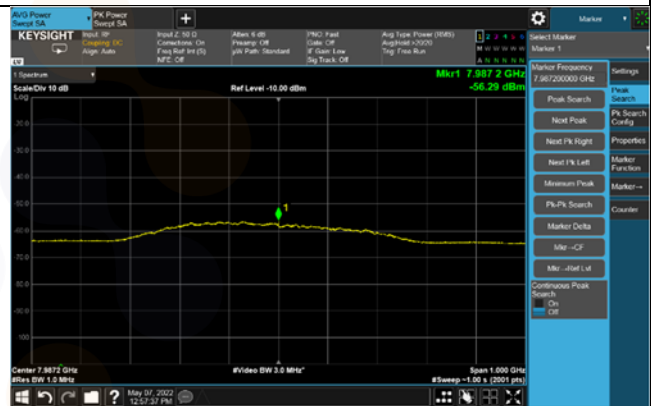


ANT B CH 9

Preamble 3



Preamble 9



6.3. Radiated Spurious Emission – Above 960 MHz Limit

According to §15.517(c), The radiated emissions at or below 960 MHz from a device operating under the provisions of this section shall not exceed the emission levels in §15.209. The radiated emissions above 960 MHz from a device operating under the provisions of this section shall not exceed the following average limits when measured using a resolution bandwidth of 1 MHz:

Frequency[MHz]	EIRP[dBm]
960-1 610	-75.3
1 610-1 990	-53.3
1 990-3 100	-51.3
3 100-10 600	-41.3
Above 10 600	-51.3

*FCC Radiated Spurious Emission Limit

Frequency[MHz]	EIRP[dBm]
1 164-1 240	-85.3
1 559-1 610	-85.3

*FCC/IC Radiated Spurious Emission Limit for GPS Frequency bands

Test procedure

ANSI C63.10-2013 - Section 10.3
 KDB 393764 D01 v02

*The EUT is placed on a non-conducting table 80 cm above the ground plane for below 1 GHz and 150 cm for above 1 GHz. The antenna to EUT distance is 0.5 or 3 meters. The EUT is configured in accordance with ANSI C63.10. The EUT is set to transmit in a continuous mode.

Test settings

RBW 1 MHz (30 kHz for emissions in the GPS band)
 VBW 3 MHz (100 kHz for emissions in the GPS band)
 Detector Average (RMS)
 Trace mode Max-hold
 Sweep time No more than a 1ms integration period over each measurement bin
 The trace was allowed to stabilize

*Emission was scanned up to 40 GHz; No emissions were detected above the noise floor which was at least 20 dB below the specification limit.

* It was recorded for the SP3_Preamble 9 mode.

Test results

[CH 5]

960 MHz ~ 6 000 MHz

Frequency [MHz]	Pol. [V/H]	Reading [dBm]	Ant. Factor [dB]	Amp. + Cable [dB]	Conv. Factor [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
1 500.15	H	-79.08	27.70	-57.26	-3.82	-82.90	-75.30	7.60
1 079.60	V	-79.19	27.78	-58.09	-3.82	-83.01	-75.30	7.71
1 698.16	H	-78.58	29.05	-56.96	-3.82	-82.40	-53.30	29.10
1 698.54	V	-78.45	29.05	-56.96	-3.82	-82.27	-53.30	28.97
2 425.40	H	-75.13	32.04	-55.69	-3.82	-78.95	-51.30	27.65
2 398.40	V	-75.55	31.98	-55.75	-3.82	-79.37	-51.30	28.07
5 575.90	H	-73.97	34.69	-52.00	-3.82	-77.79	-41.30	36.49
5 574.90	V	-73.96	34.69	-52.00	-3.82	-77.78	-41.30	36.48

9 000 MHz ~ 18 000 MHz

Frequency [MHz]	Pol. [V/H]	Reading [dBm]	Ant. Factor [dB]	Amp. + Cable [dB]	Conv. Factor [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
10 595.00	H	-72.89	37.38	-48.88	-3.82	-76.71	-41.30	35.41
10 593.00	V	-72.76	37.37	-48.88	-3.82	-76.58	-41.30	35.28
13 032.30	H	-68.76	38.45	-46.68	-3.82	-72.58	-51.30	21.28
13 027.30	V	-68.68	38.46	-46.68	-3.82	-72.50	-51.30	21.20

1 610 MHz ~ 6 000 MHz (*IC : 1 610 ~ 4 750 MHz and 4 750 ~ 6 000 MHz)

Frequency [MHz]	Pol. [V/H]	Reading [dBm]	Ant. Factor [dB]	Amp. + Cable [dB]	Conv. Factor [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
3 999.80	H	-76.36	33.40	-53.38	-3.82	-80.18	-70.00	10.18
2 428.30	V	-71.55	32.04	-55.68	-3.82	-75.37	-70.00	5.37
5 579.70	H	-74.08	34.70	-52.00	-3.82	-77.90	-41.30	36.60
5 591.70	V	-74.12	34.71	-52.00	-3.82	-77.94	-41.30	36.64

Notes:

Conversion Factor [dB] = $107 - 104.8 + 20 \cdot \log(D_{\text{Meas}}) = -3.82 \text{ dB}$

$D_{\text{meas}} = 0.5 \text{ m}$

Reading [dBm] = Analyzer Level + Ant. Factor + Amp. + Cable Loss

Result [dBm] = Reading + Conv. Factor

1 164 MHz ~ 1 240 MHz_(For GPS Band)

Frequency [MHz]	Pol. [V/H]	Reading [dBm]	Ant. Factor [dB]	Amp. + Cable [dB]	Conv. Factor [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
1 170.004	H	-89.36	27.77	-58.03	-3.82	-93.18	-85.30	7.88
1 177.452	V	-92.55	27.76	-58.02	-3.82	-96.37	-85.30	11.07

1 559 MHz ~ 1 610 MHz_(For GPS Band)

Frequency [MHz]	Pol. [V/H]	Reading [dBm]	Ant. Factor [dB]	Amp. + Cable [dB]	Conv. Factor [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
1 600.004	H	-88.42	28.38	-57.10	-3.82	-92.24	-85.30	6.94
1 600.004	V	-85.90	28.38	-57.10	-3.82	-89.72	-85.30	4.42

Notes:

Conversion Factor [dB] = $107 - 104.8 + 20 \cdot \log(D_{\text{Meas}}) = -3.82 \text{ dB}$

$D_{\text{meas}} = 0.5 \text{ m}$

Reading [dBm] = Analyzer Level + Ant. Factor + Amp. + Cable Loss

Result [dBm] = Reading + Conv. Factor

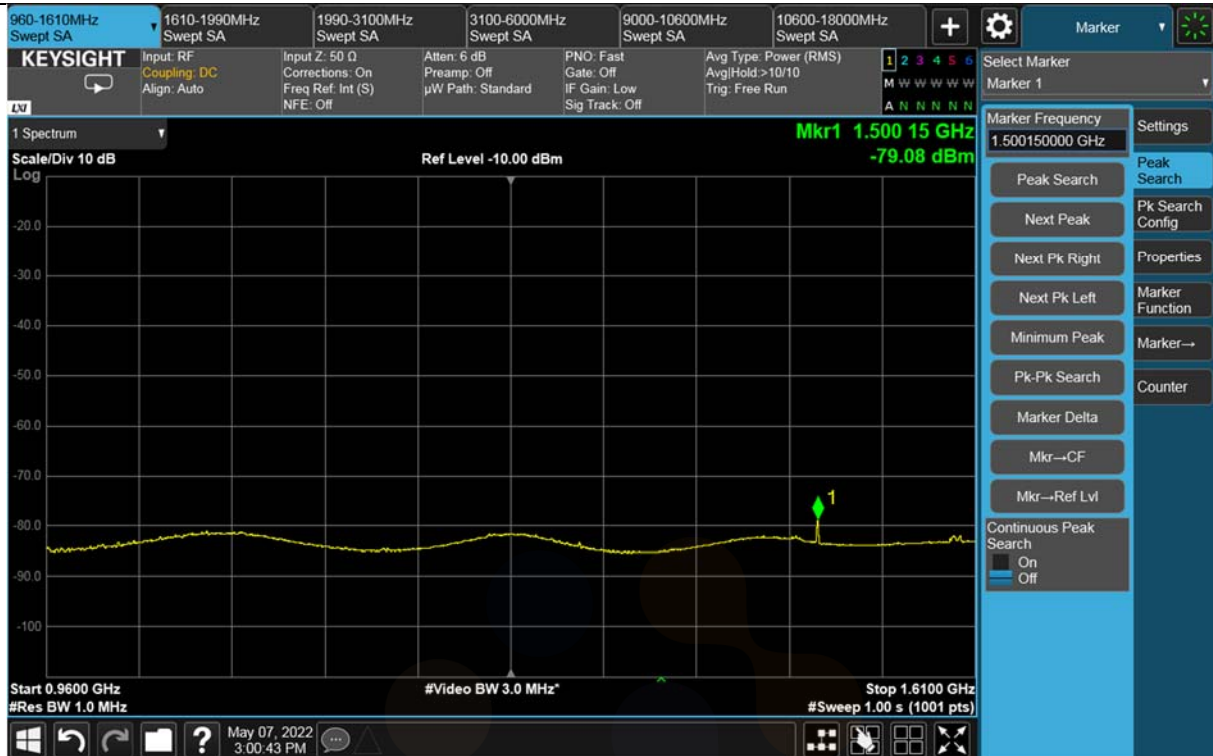
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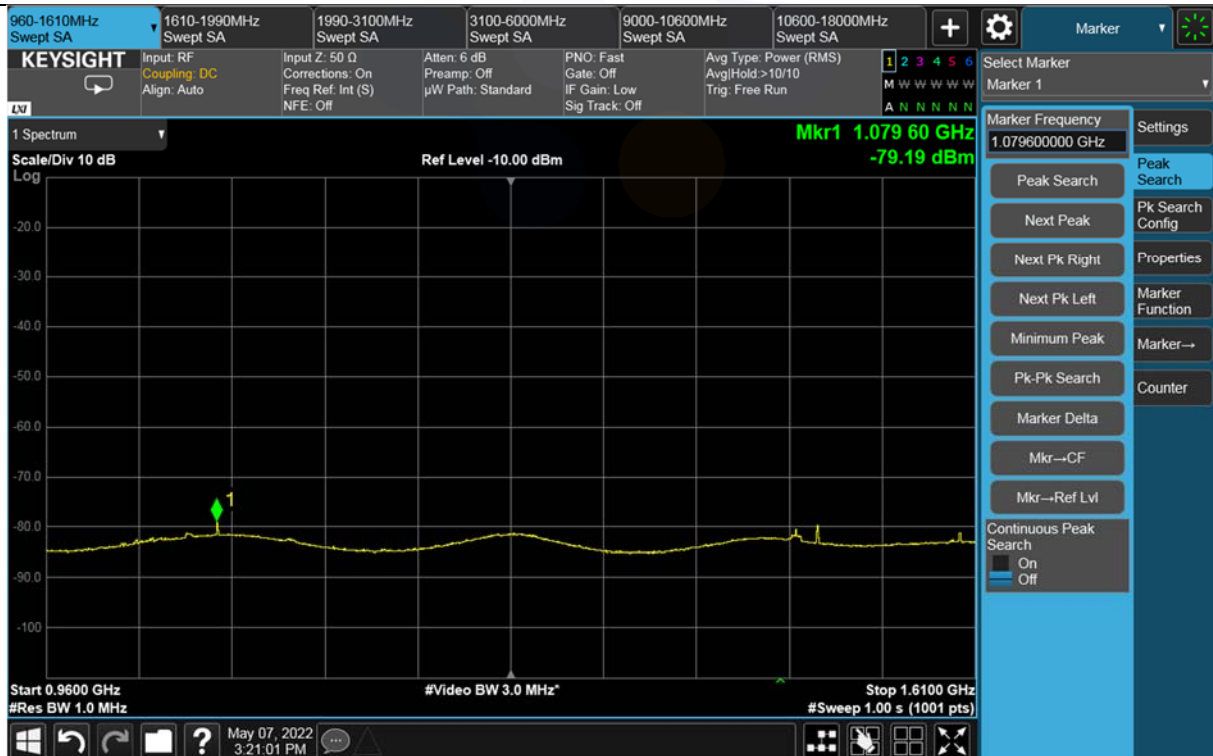
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960 MHz ~ 1 610 MHz Horizontal



960 MHz ~ 1 610 MHz Vertical



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1 610 MHz ~ 1 990 MHz Horizontal



1 610 MHz ~ 1 990 MHz Vertical



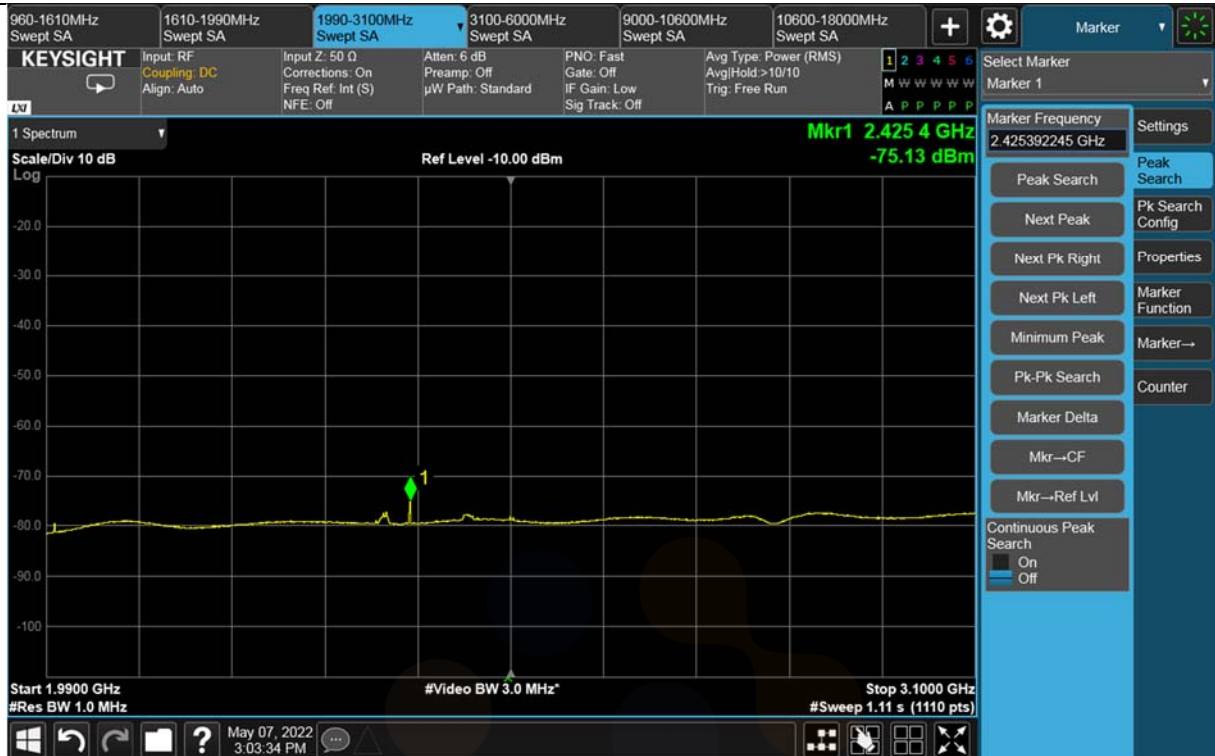
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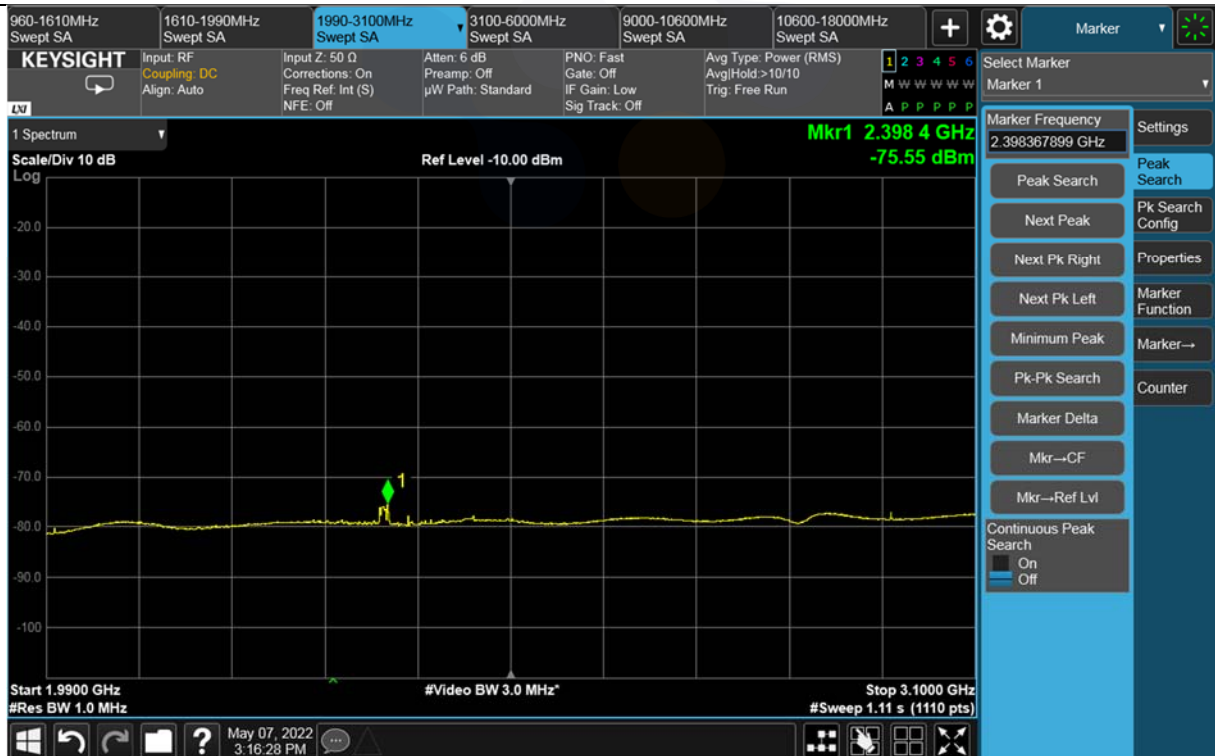
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1 990 MHz ~ 3 100 MHz Horizontal



1 990 MHz ~ 3 100 MHz Vertical



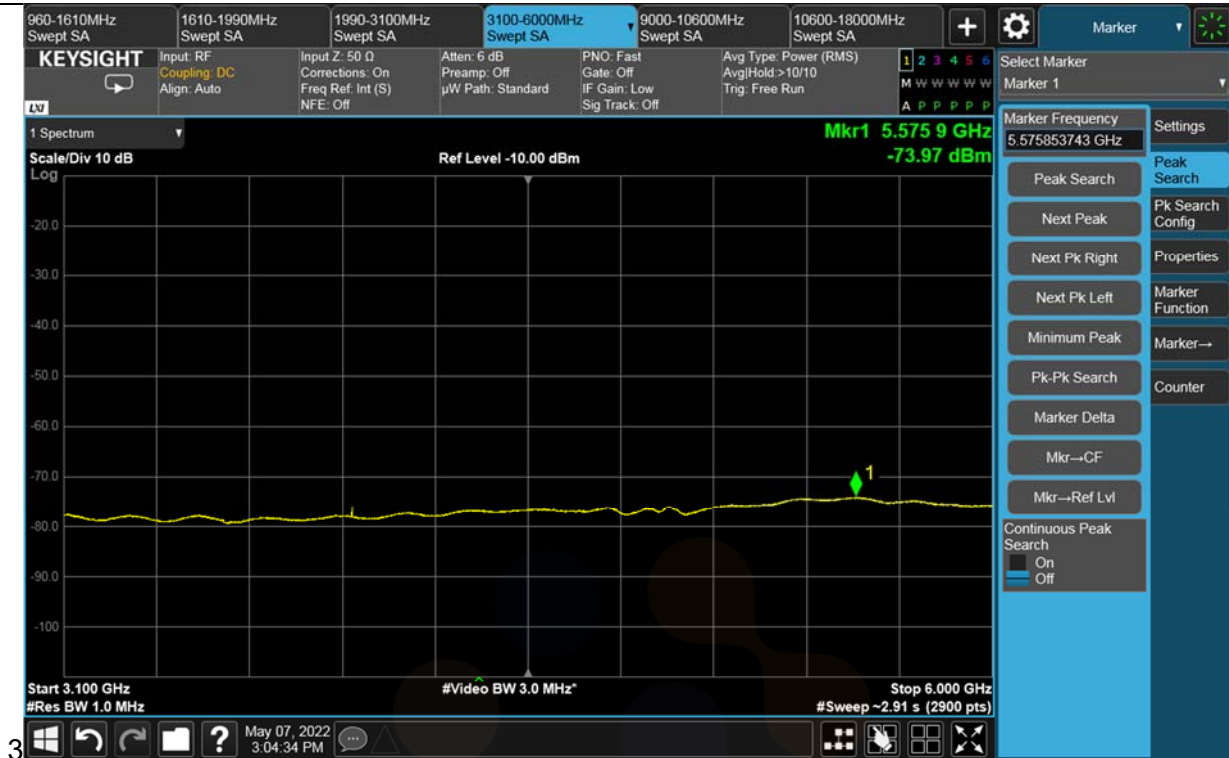
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3 100 MHz ~ 6 000 MHz Horizontal



3 100 MHz ~ 6 000 MHz Vertical



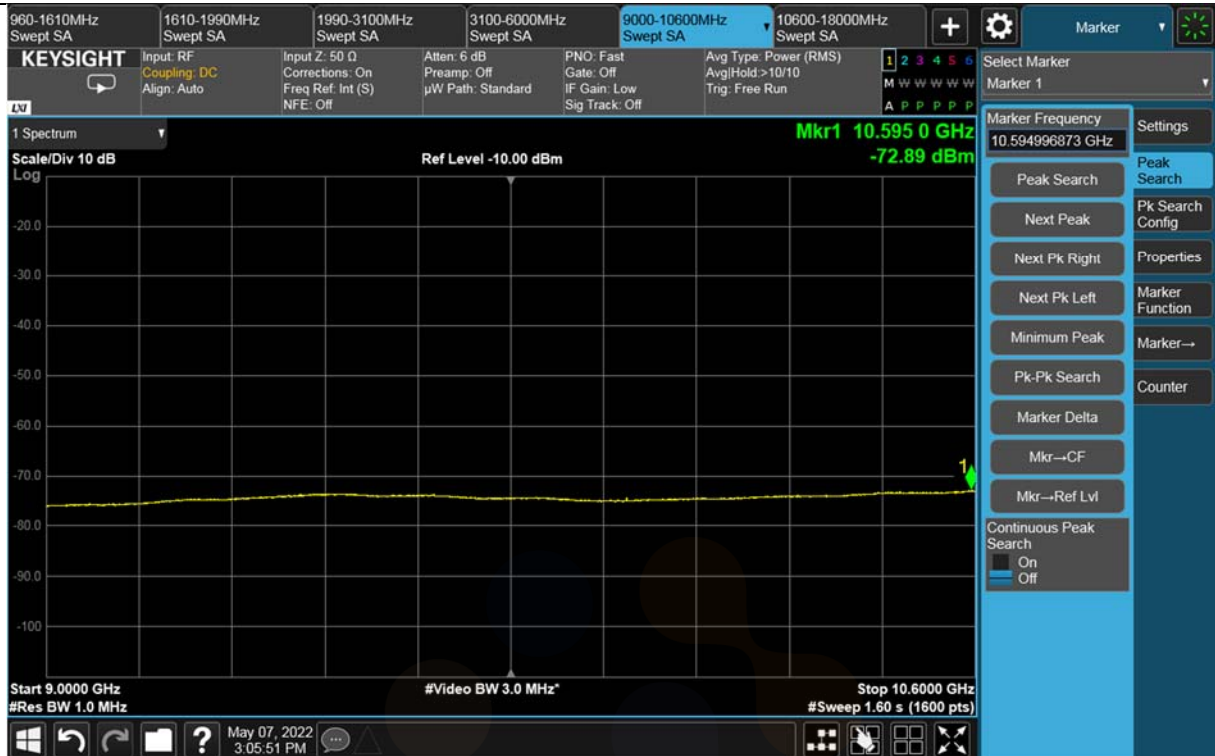
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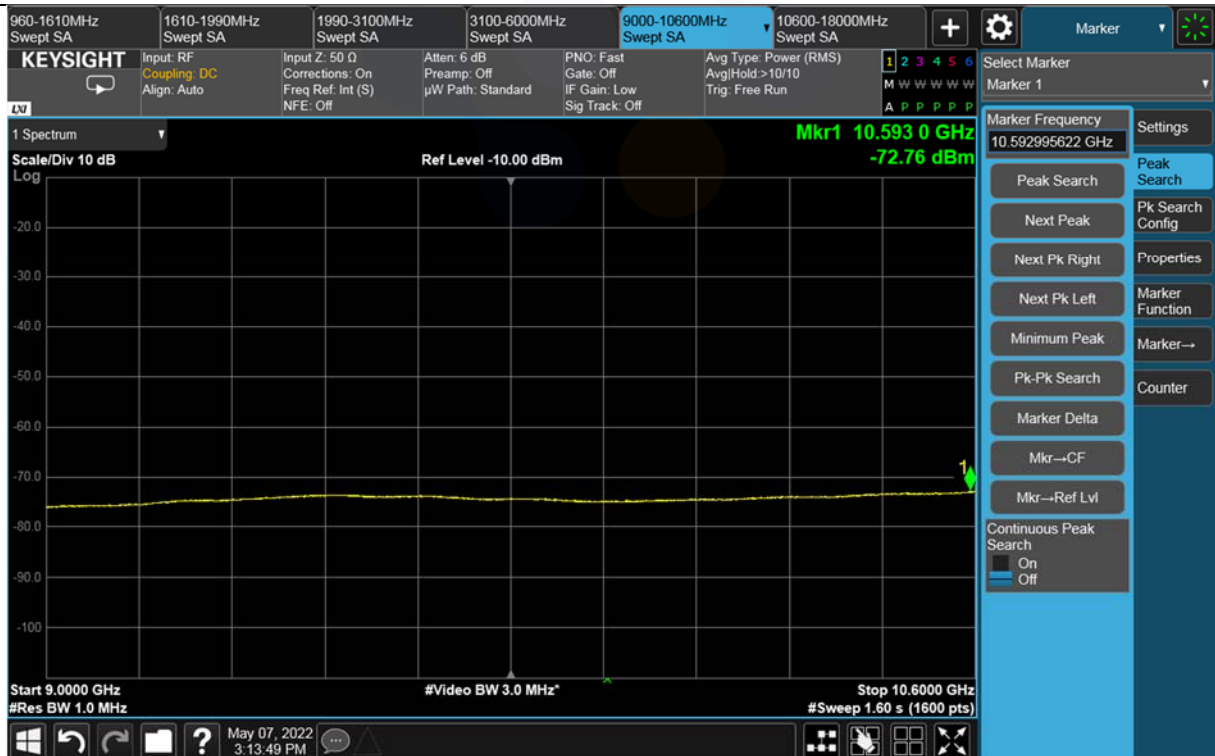
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9 000 MHz ~ 10 600 MHz Horizontal



9 000 MHz ~ 10 600 MHz Vertical



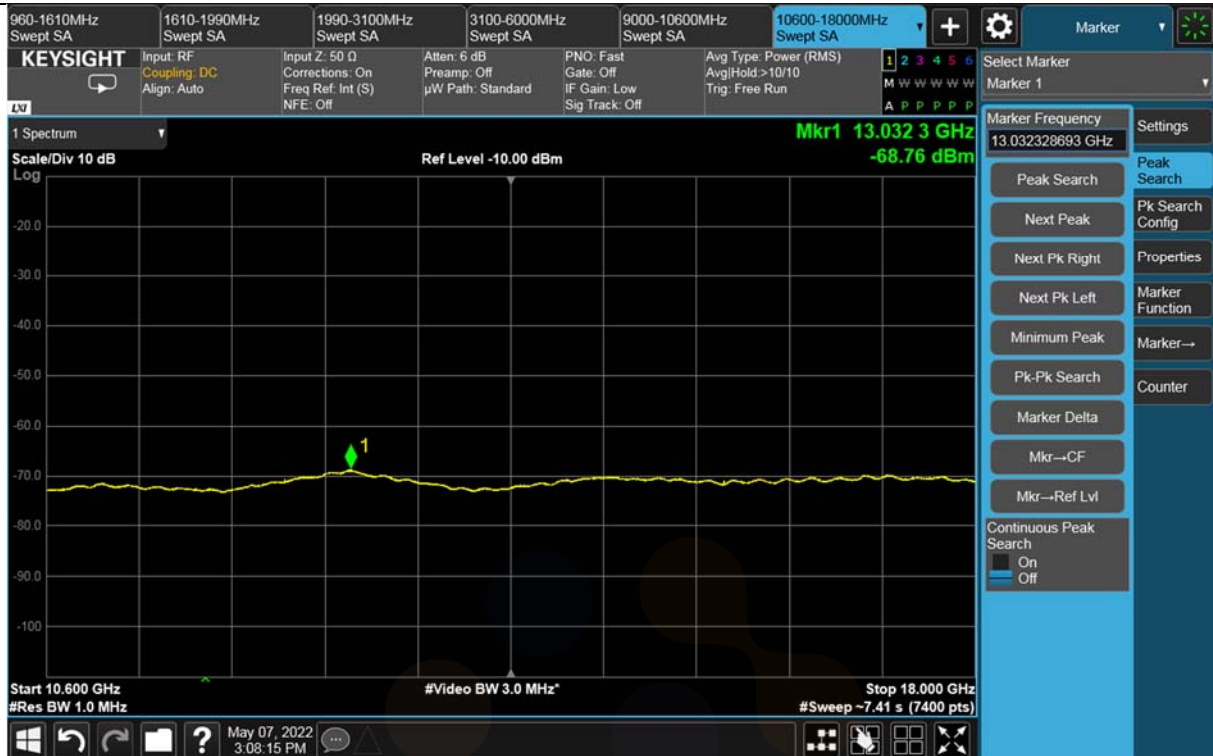
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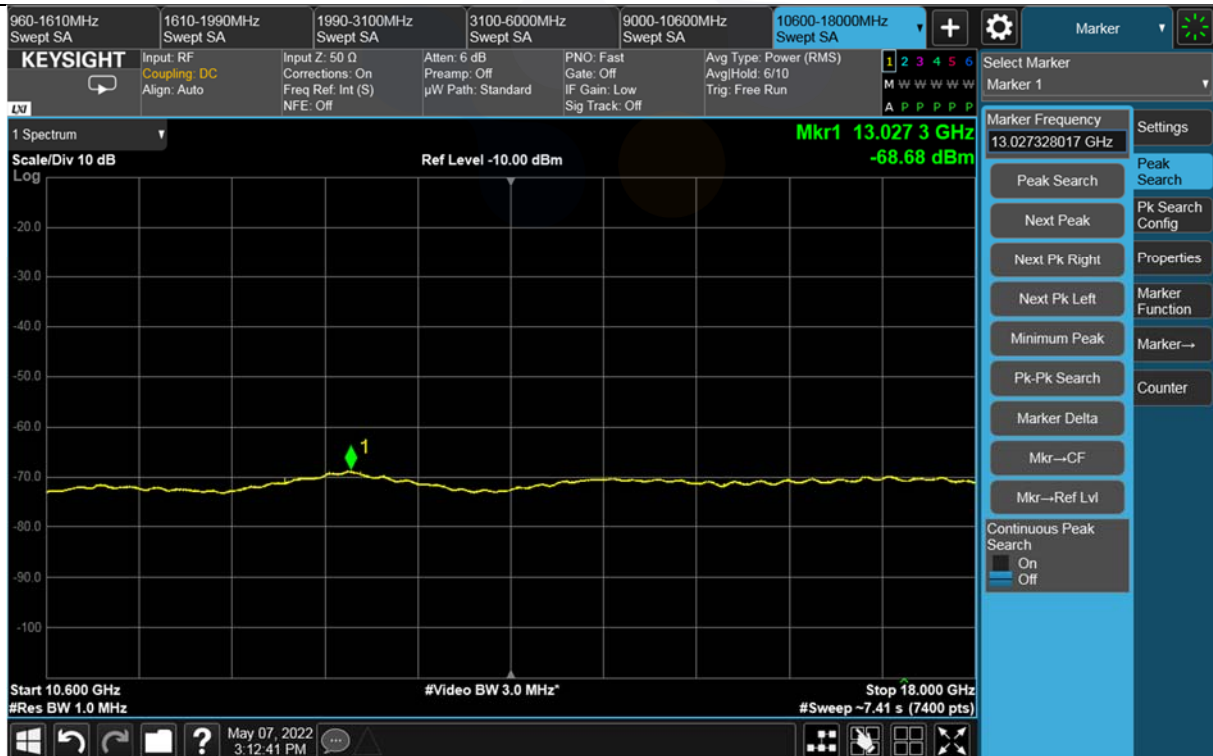
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10 600 MHz ~ 18 000 MHz Horizontal



10 600 MHz ~ 18 000 MHz Vertical



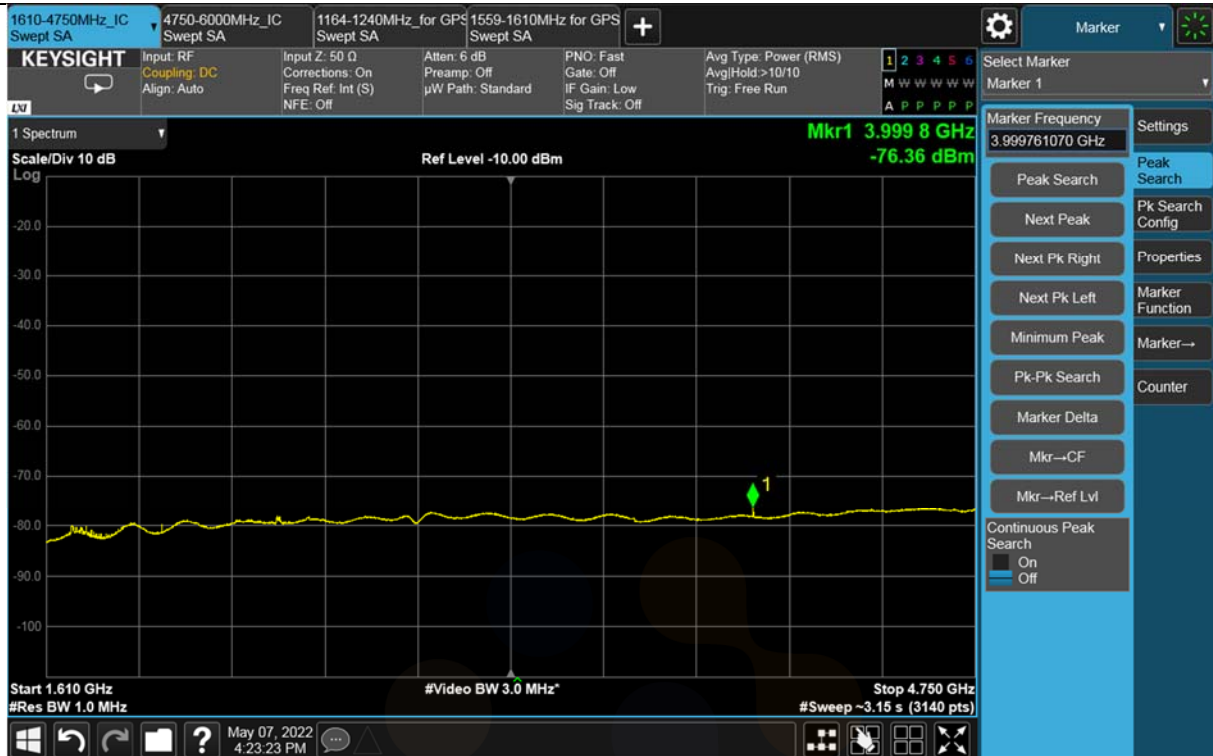
KCTL Inc.

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Suwon-si, Gyeonggi-do, 16677, Korea
TEL: 82-31-285-0894 FAX: 82-505-299-8311
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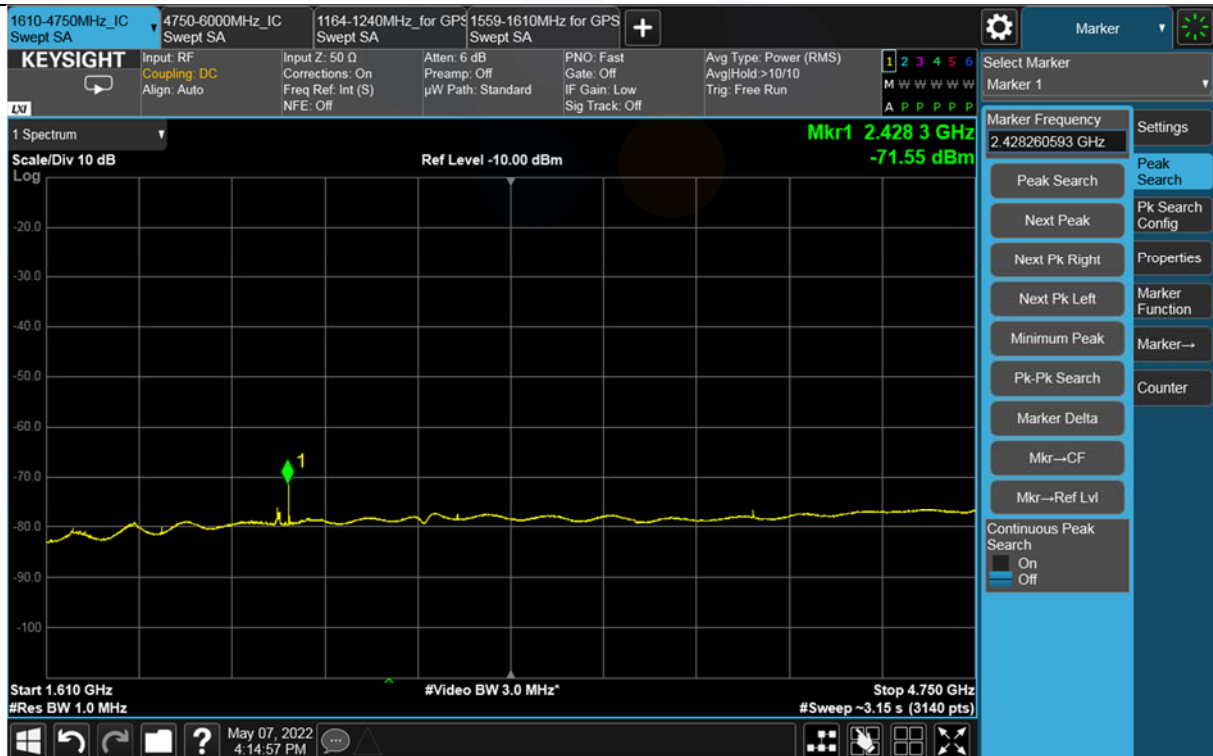
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1 610 MHz ~ 4 750 MHz Horizontal



1 610 MHz ~ 4 750 MHz Vertical



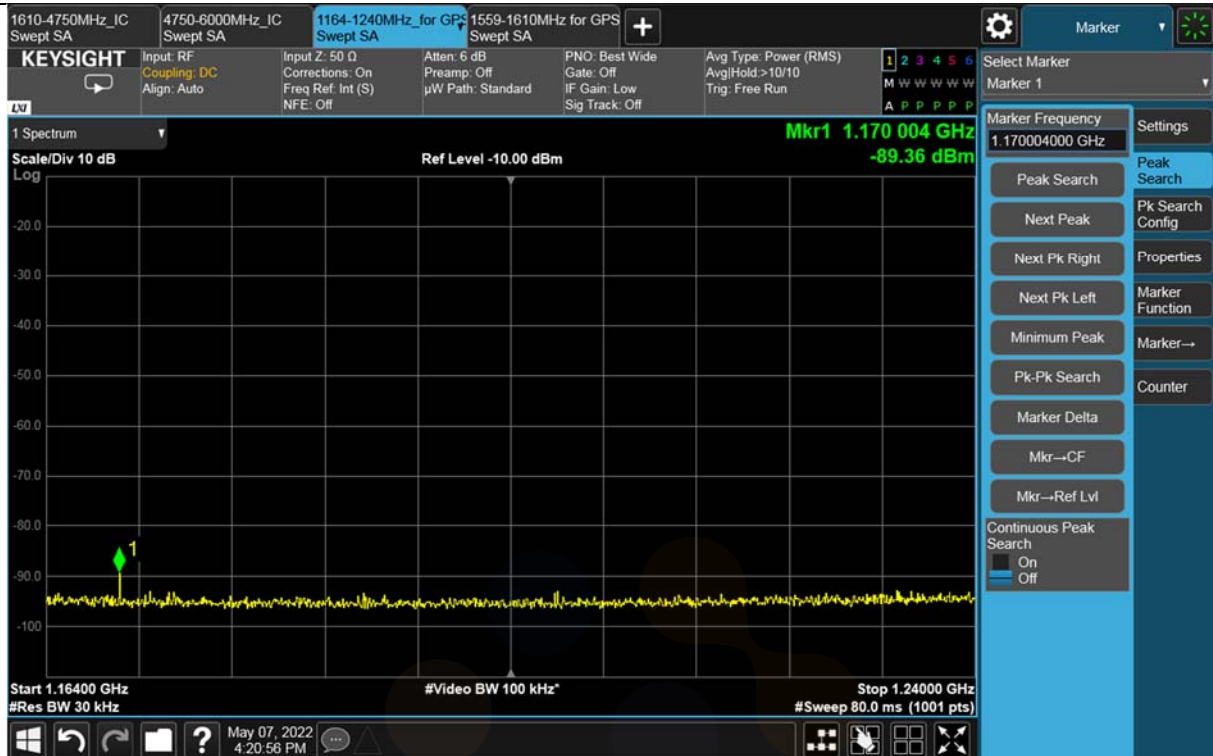
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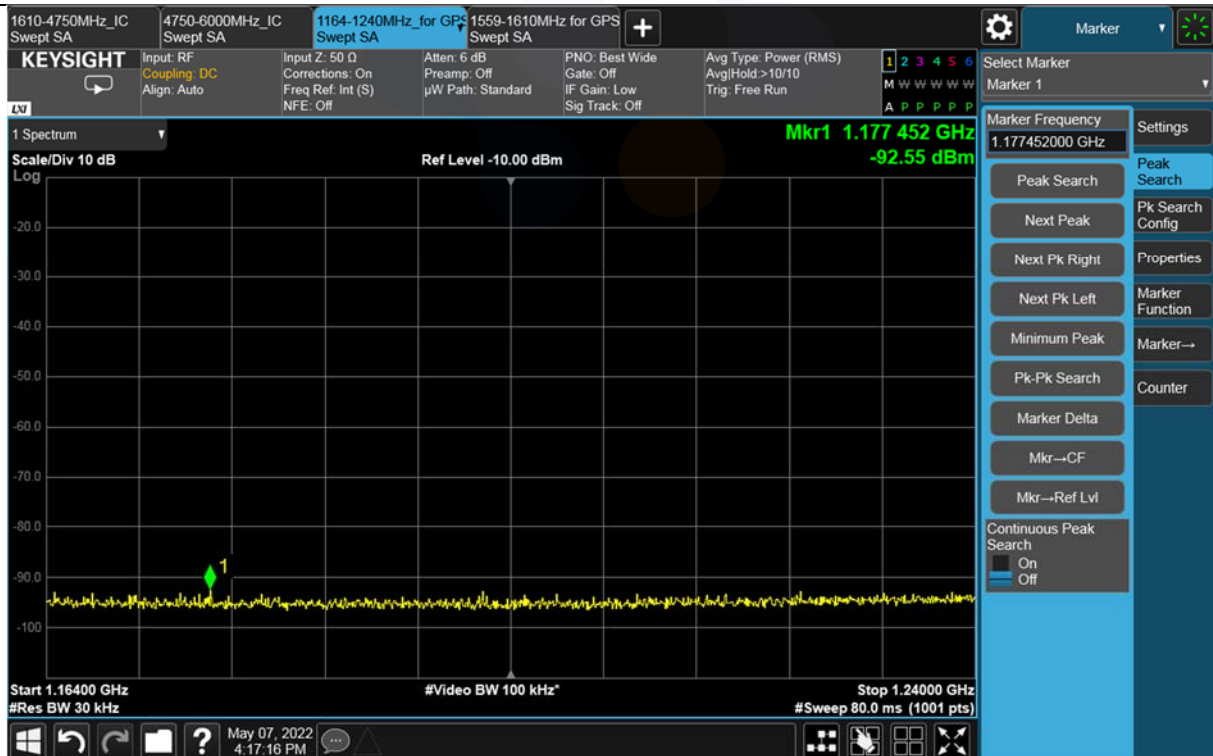
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1 164 MHz ~ 1 240 MHz Horizontal



1 164 MHz ~ 1 240 MHz Vertical



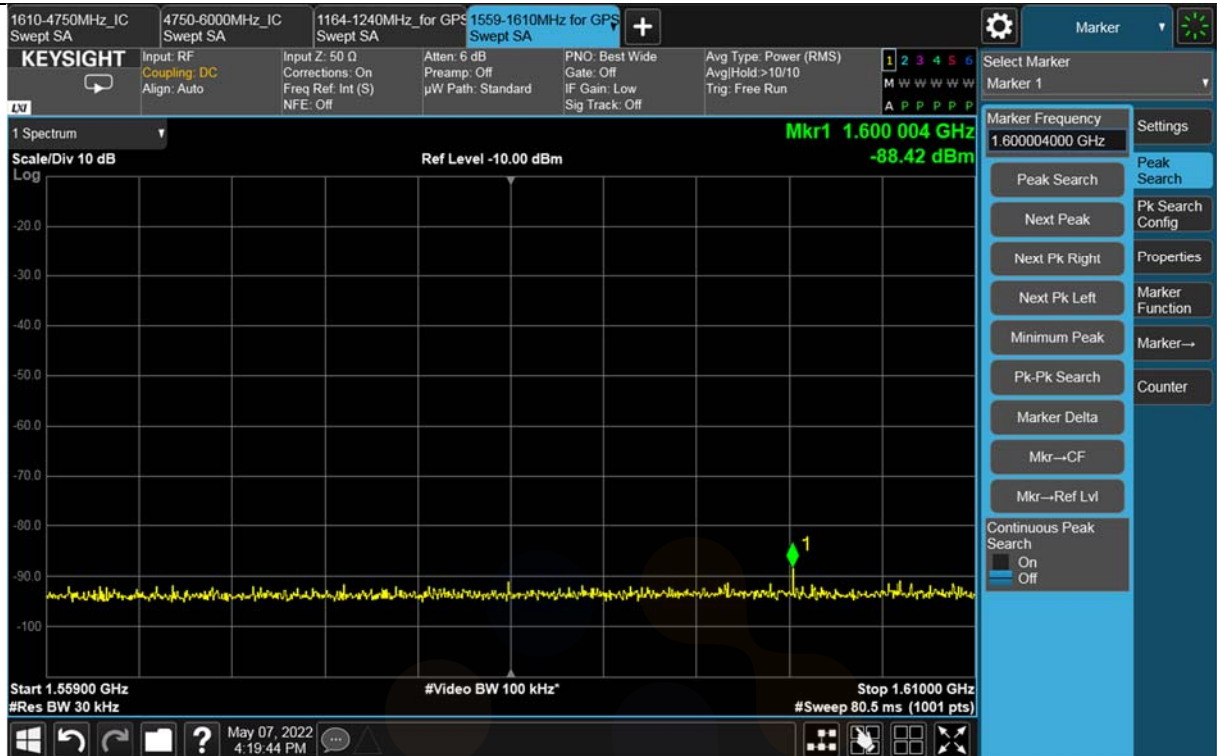
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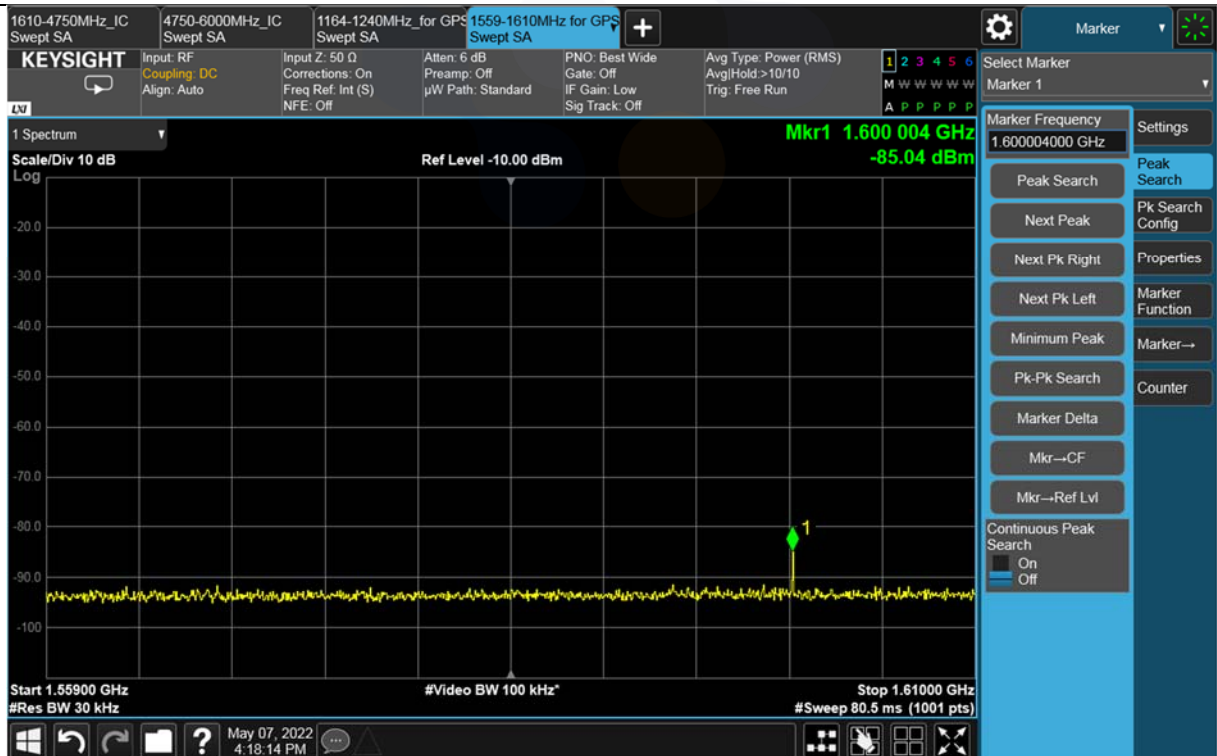
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1 559 MHz ~ 1 610 MHz Horizontal



1 559 MHz ~ 1 610 MHz Vertical



[CH 9]

960 MHz ~ 6 000 MHz

Frequency [MHz]	Pol. [V/H]	Reading [dBm]	Ant. Factor [dB]	Amp. + Cable [dB]	Conv. Factor [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
1 500.15	H	-79.29	27.70	-57.26	-3.82	-83.11	-75.30	7.81
1 500.15	V	-79.56	27.70	-57.26	-3.82	-83.38	-75.30	8.08
1 698.92	H	-78.20	29.05	-56.96	-3.82	-82.02	-53.30	28.72
1 909.44	V	-78.84	30.48	-56.53	-3.82	-82.66	-53.30	29.36
2 480.40	H	-76.95	32.16	-55.56	-3.82	-80.77	-51.30	29.47
2 993.90	V	-73.73	32.99	-54.83	-3.82	-77.55	-51.30	26.25
5 584.90	H	-73.94	34.70	-52.00	-3.82	-77.76	-41.30	36.46
3 425.10	V	-73.78	33.09	-54.25	-3.82	-77.60	-41.30	36.30

9 000 MHz ~ 18 000 MHz

Frequency [MHz]	Pol. [V/H]	Reading [dBm]	Ant. Factor [dB]	Amp. + Cable [dB]	Conv. Factor [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
10 600.00	H	-72.86	37.38	-48.88	-3.82	-76.68	-41.30	35.38
10 599.00	V	-72.72	37.38	-48.88	-3.82	-76.54	-41.30	35.24
13 023.30	H	-68.65	38.46	-46.69	-3.82	-72.47	-51.3	21.17
13 011.30	V	-68.64	38.48	-46.70	-3.82	-72.46	-51.3	21.16

1 610 MHz ~ 6 000 MHz (*IC : 1 610 ~ 4 750 MHz and 4 750 ~ 6 000 MHz)

Frequency [MHz]	Pol. [V/H]	Reading [dBm]	Ant. Factor [dB]	Amp. + Cable [dB]	Conv. Factor [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
3 449.60	H	-70.15	33.09	-54.20	-3.82	-73.97	-70.00	3.97
2 398.30	V	-75.95	31.98	-55.75	-3.82	-79.77	-70.00	9.77
5 588.70	H	-74.11	34.71	-52.00	-3.82	-77.93	-41.30	36.63
5 576.70	V	-74.10	34.69	-52.00	-3.82	-77.92	-41.30	36.62

Notes:

Conversion Factor [dB] = 107 - 104.8 + 20*log(D_{Meas}) = -3.82 dB

D_{meas} = 0.5 m

Reading [dBm] = Analyzer Level + Ant. Factor + Amp. + Cable Loss

Result [dBm] = Reading + Conv. Factor

1 164 MHz ~ 1 240 MHz_(For GPS Band)

Frequency [MHz]	Pol. [V/H]	Reading [dBm]	Ant. Factor [dB]	Amp. + Cable [dB]	Conv. Factor [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
1 233.616	H	-92.74	27.75	-57.93	-3.82	-96.56	-85.30	11.26
1 236.048	V	-91.86	27.75	-57.93	-3.82	-95.68	-85.30	10.38

1 559 MHz ~ 1 610 MHz_(For GPS Band)

Frequency [MHz]	Pol. [V/H]	Reading [dBm]	Ant. Factor [dB]	Amp. + Cable [dB]	Conv. Factor [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
1 600.004	H	-87.41	28.38	-57.10	-3.82	-91.23	-85.30	5.93
1 600.004	V	-84.74	28.38	-57.10	-3.82	-88.56	-85.30	3.26

Notes:

Conversion Factor [dB] = $107 - 104.8 + 20 \cdot \log(D_{\text{Meas}}) = -3.82 \text{ dB}$

$D_{\text{meas}} = 0.5 \text{ m}$

Reading [dBm] = Analyzer Level + Ant. Factor + Amp. + Cable Loss

Result [dBm] = Reading + Conv. Factor