



TEST REPORT

Eurofins KCTL Co.,Ltd. 65, Sinwon-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Korea TEL: 82-70-5008-1021 FAX: 82-505-299-8311 www.kctl.co.kr	Report No.: KR23-SRF0180-C Page (1) of (26)	KCTL
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1. Client

- Name : KONA I Co., Ltd.
- Address : 8F, 3, Eunhaeng-ro, Yeongdeungpo-gu, Seoul, Republic of Korea
- Date of Receipt : 2023-05-15

2. Use of Report : Certification

3. Name of Product / Model : SMART CARD KEY / KSC200

4. Manufacturer / Country of Origin : KONA I Co., Ltd. / Korea

5. FCC ID : 2ARI2-KSC200

6. Date of Test : 2023-06-07 to 2023-06-12

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

8. Test method used : FCC Part 15 Subpart F, 15.519

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

Affirmation	Tested by Name : Minki Kim (Signature) 	Technical Manager Name : Heesu Ahn (Signature)
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2023-07-24

Eurofins KCTL Co.,Ltd.

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 Eurofins KCTL Co.,Ltd.

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REPORT REVISION HISTORY

Date	Revision	Page No
2023-06-14	Originally issued	-
2023-06-20	Updated	1,5,9
2023-07-12	Updated	12
2023-07-24	Updated	3,9,21

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Note. The report No. KR23-SRF0180-B is superseded by the report No. KR23-SRF0180-C.

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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1. General information

Client : KONA I Co., Ltd.
 Address : 8F, 3, Eunhaeng-ro, Yeongdeungpo-gu, Seoul, Republic of Korea
 Manufacturer : KONA I Co., Ltd.
 Address : 8F, 3, Eunhaeng-ro, Yeongdeungpo-gu, Seoul, Republic of Korea
 Laboratory : Eurofins KCTL Co.,Ltd.
 Address : 65, Sinwon-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Korea
 Accreditations : FCC Site Designation No: KR0040, FCC Site Registration No: 687132
 VCCI Registration No. : R-20080, G-20078, C-20059, T-20056
 CAB Identifier: KR0040, ISED Number: 8035A
 KOLAS No.: KT231

2. Device information

Equipment under test : SMART CARD KEY
 Model : KSC200
 Frequency range : 6 489.6 MHz
 Modulation technique : OFDM
 Number of channels : 1 ch
 Power source : DC 4.2 V (Battery)
 Antenna type : Chip Antenna
 Antenna gain : 3.57 dBi
 Software version : 1.0
 Hardware version : 1.0
 Test device serial No. : N/A
 Operation temperature : -20 °C ~ 50 °C

2.1. Frequency/channel operations

This device contains the following capabilities:
 Ultra-Wideband

Ch.	Frequency (MHz)
5	6 489.6

Table 2.1.1. Ultra-Wideband

2.2. Accessory information

Equipment	Manufacturer	Model	Serial No.	Power Source
Rechargeable lithium ion battery	NGK INSULATORS, LTD.	EC382704P-C	-	4.2V ~ 3.0V 24mAh

2.3. EUT Description

Equipment Description	Channel	Configuration	Preamble
Handheld Device	5	SP3	9

2.4. RF power setting in TEST SW

Channel	Configuration	Preamble	Frequency (MHz)	Power Setting
5	SP3	9	6 489.6	-

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 attached Dielectric Chip Antenna(internal antenna) on the 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
15.519(c)(e)	Peak Power & Maximum Average Emission		Pass
15.519(c)	Radiated Emissions Above 960 MHz		Pass
15.519(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
15.519(a)(1)	Cease Transmission Time		Pass
15.207	AC Line Conducted Emission		N/A ⁴⁾

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 **X** orientation was worst-case orientation. Therefore, all final radiated testing was performed with the EUT in **X** orientation
4. This test is not applicable because the EUT uses battery and it's not to be connected to the public utility(AC) power line.
5. 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 Emissions	Below 30 MHz	2.3 dB
	30 MHz to 1 000 MHz	2.5 dB
	1 000 MHz to 18 000 MHz	4.7 dB
	Above 18 000 MHz	4.8 dB



6. Test results

6.1. 10 dB Bandwidth

Limit

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.

Test procedure

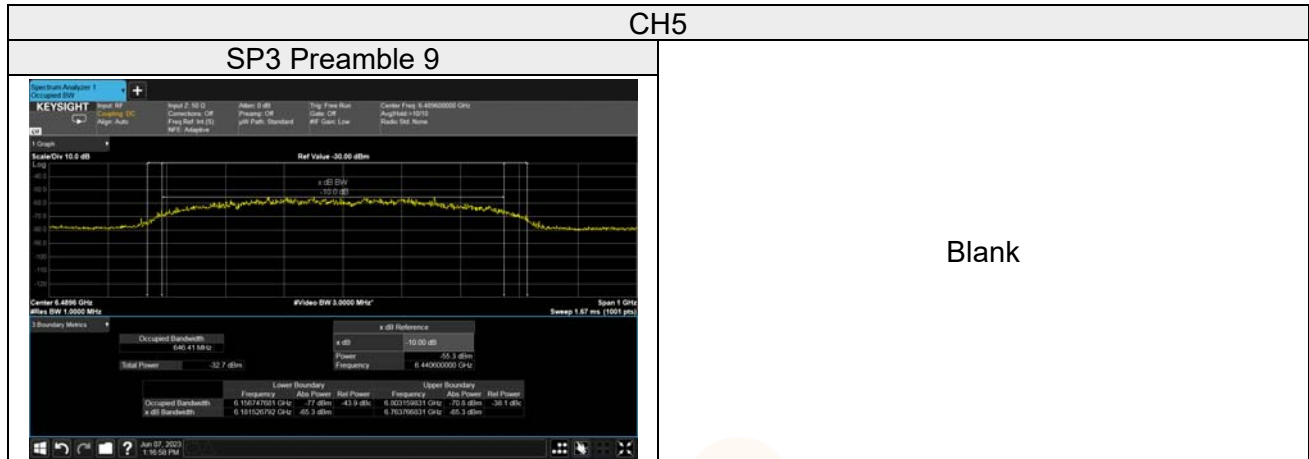
ANSI C63.10 - Section 10.1

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	

Test results

Channel	Configure	Preamble	F _M [MHz]	F _L [MHz]	F _H [MHz]	F _C [MHz]	BW [MHz]	Limit [MHz]
5	SP3	9	6 440.60	6 181.53	6 763.77	6 472.65	582.24	500.00



Notes:

- $F_c = (F_H + F_L) / 2$
 $BW = F_H - F_L$
- Limit : 10 dB BW $\geq$ 500 MHz

6.2. Peak Power & Maximum Average Emission

Limit

According to §15.519(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 §15.519(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

Test results

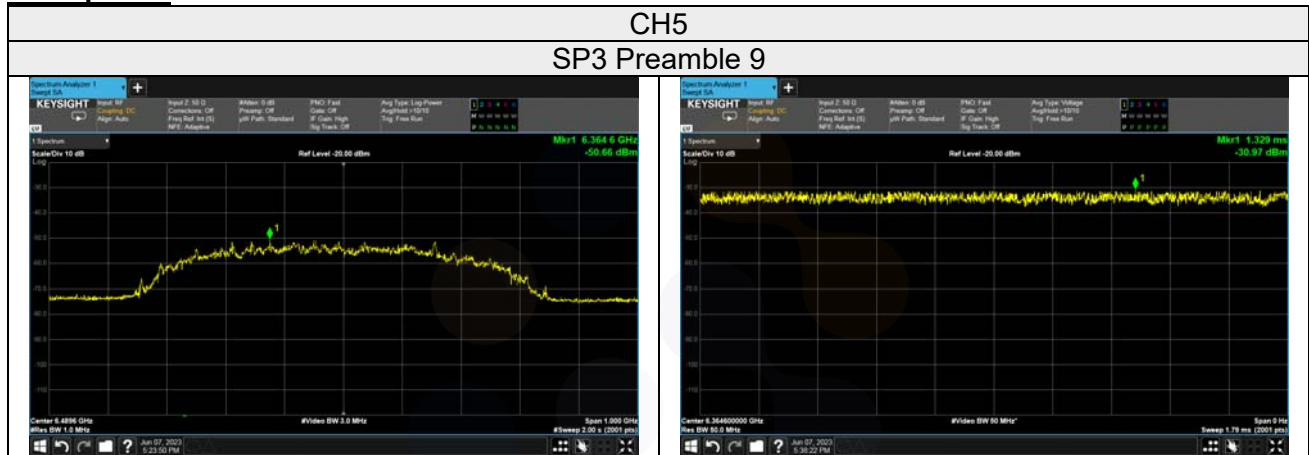
[CH 5_SP3_Preamble 9_Peak Power]

Frequency [MHz]	Pol. [V/H]	Reading [dBm/50MHz]	Ant. Factor [dB]	Amp. + Cable [dB]	Conv. Factor [dB]	Result [dBm/50MHz]	Limit [dBm/50MHz]	Margin [dB]
6 489.60	H	-30.97	35.06	-21.88	-	-17.79	0.00	17.79

[CH 5_SP3_Preamble 9_Average Power]

Frequency [MHz]	Pol. [V/H]	Reading [dBm/MHz]	Ant. Factor [dB]	Amp. + Cable [dB]	Conv. Factor [dB]	Result [dBm/MHz]	Limit [dBm/MHz]	Margin [dB]
6 489.60	H	-69.62	35.19	-21.88	-	-56.31	-41.30	15.01

Peak power



Average power



Notes:

1. Result [dBm/MHz] = Reading + Ant. Factor + Amp. + Cable Loss

6.3. Cease Transmission Time

Limit

According to section §15.519(a)(1), A UWB device operating under the provisions of this section shall transmit only when it is sending information to an associated receiver. The UWB intentional radiator shall cease transmission within 10 seconds unless it receives an acknowledgement from the associated receiver that its transmission is being received. An acknowledgment of reception must continue to be received by the UWB intentional radiator at least every 10 seconds or the UWB device must cease transmitting.

Test Procedure

KDB 393764 D01 v02

Test settings

RBW 1 MHz

VBW 3 MHz

Span Zero Span Mode

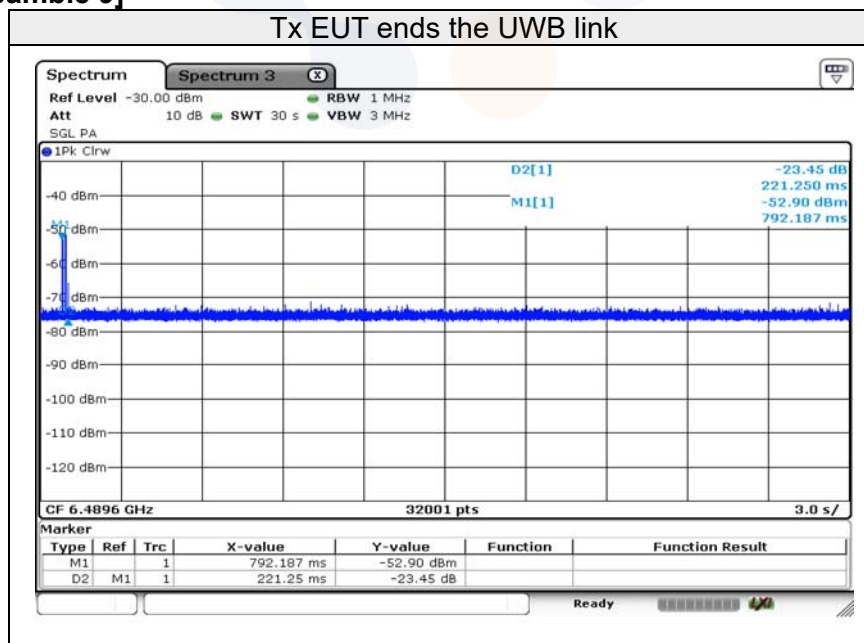
Sweep time shall be sufficient to demonstrate EUT's compliance with the rule part.

- Companion Device information

Equipment Name	Manufacturer	Model No.	Serial No.
Anchor	KONAI	UNIT ASSY-ULTRA WIDEBAND	N/A

Test results

[CH 5_SP3_Preamble 9]



Nooes:

1. The EUT transmit only 221.250 ms when sending information to an associated receiver

6.4. Radiated Spurious Emission – Above 960 MHz

Limit

According to §15.519(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	-63.3
1 990-3 100	-61.3
3 100-10 600	-41.3
Above 10 600	-61.3

*FCC Radiated Spurious Emission Limit

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

*FCC 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 1 ms 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.

Test results

[CH 5_SP3_Preamble 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]
1 039.30	H	-78.65	27.33	-30.05	-	-81.37	-75.30	6.07
1 038.65	V	-78.58	27.33	-30.05	-	-81.30	-75.30	6.00
1 673.08	H	-79.76	28.95	-29.10	-	-79.91	-63.30	16.61
1 843.32	V	-79.71	30.17	-29.11	-	-78.65	-63.30	15.35
2 449.50	H	-73.43	32.20	-28.24	-	-69.47	-61.30	8.17
2 479.50	V	-77.10	32.26	-28.12	-	-72.96	-61.30	11.66
3 184.10	H	-82.47	32.44	-27.17	-	-77.20	-41.30	35.90
3 236.30	V	-82.53	32.45	-27.04	-	-77.12	-41.30	35.82

9 000 MHz ~ 40 000 MHz

Frequency [MHz]	Pol. [V/H]	Reading [dBm]	Ant. Factor [dB]	Amp. + Cable [dB]	Conv. Factor [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
9 057.60	H	-88.83	35.77	-19.08	-	-72.14	-41.30	30.84
9 057.60	V	-88.59	35.77	-19.08	-	-71.90	-41.30	30.60
10 970.00	H	-90.23	37.58	-17.85	-	-70.50	-61.30	9.20
10 992.20	V	-90.27	37.59	-17.87	-	-70.55	-61.30	9.25
18 000.00	H	-62.20	43.80	-43.60	-	-62.00	-61.30	0.70
18 000.00	V	-62.12	43.80	-43.60	-	-61.92	-61.30	0.62

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]
1 231.18	H	-85.50	27.48	-30.20	-	-88.22	-85.30	2.92
1 187.33	V	-86.41	27.45	-30.21	-	-89.17	-85.30	3.87

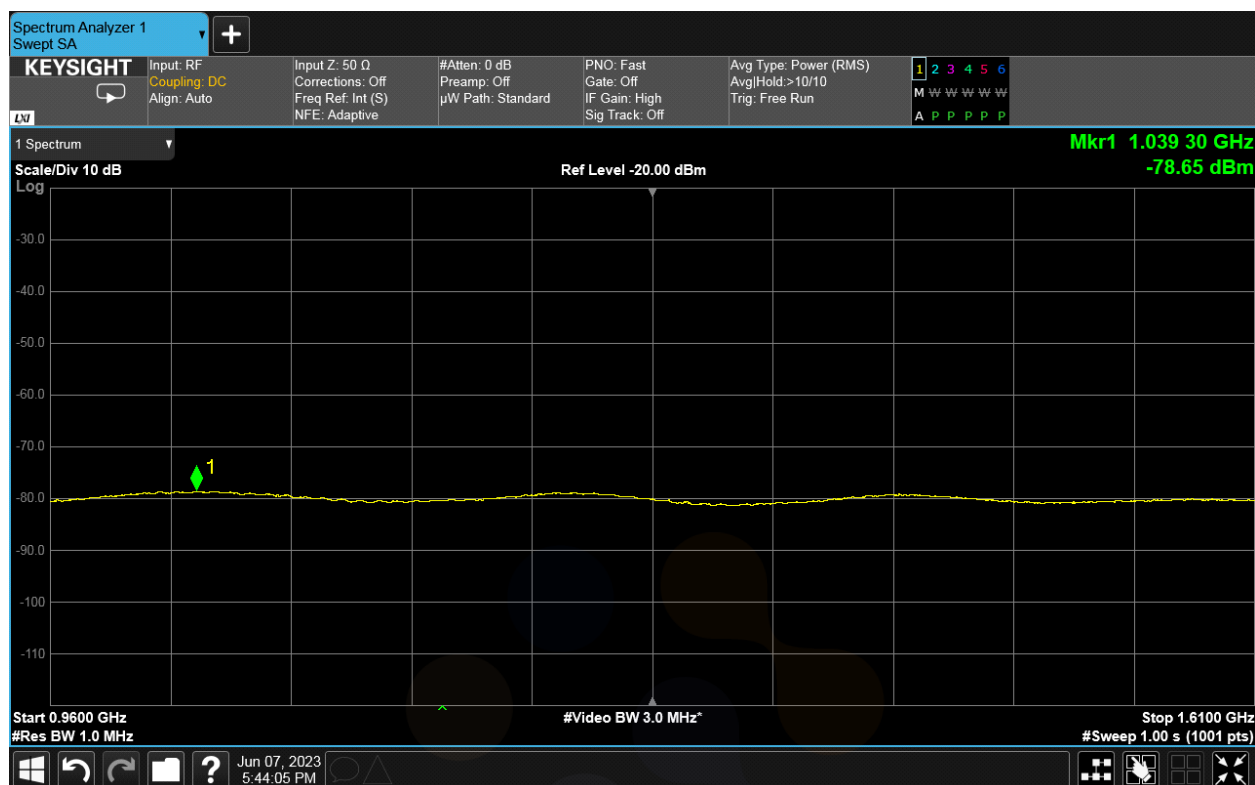
1 559 MHz ~ 1 610 MHz_(For GPS Band)

Frequency [MHz]	Pol. [V/H]	Reading [dBm]	Ant. Factor [dB]	Amp. + Cable [dB]	Conv. Factor [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
1 575.78	H	-85.27	28.25	-29.25	-	-86.27	-85.30	0.97
1 588.78	V	-86.59	28.34	-29.21	-	-87.46	-85.30	2.16

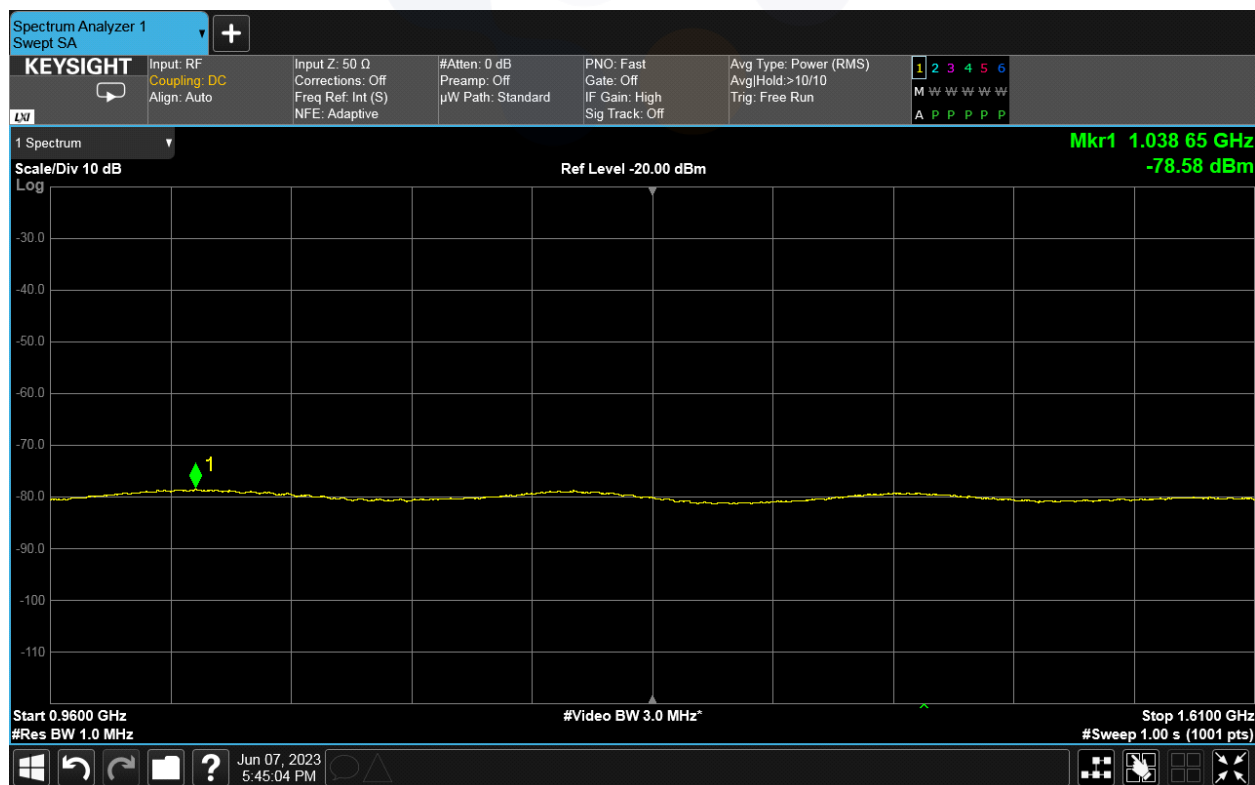
Notes:

1. Result [dBm] = Reading + Ant. Factor + Amp. + Cable Loss

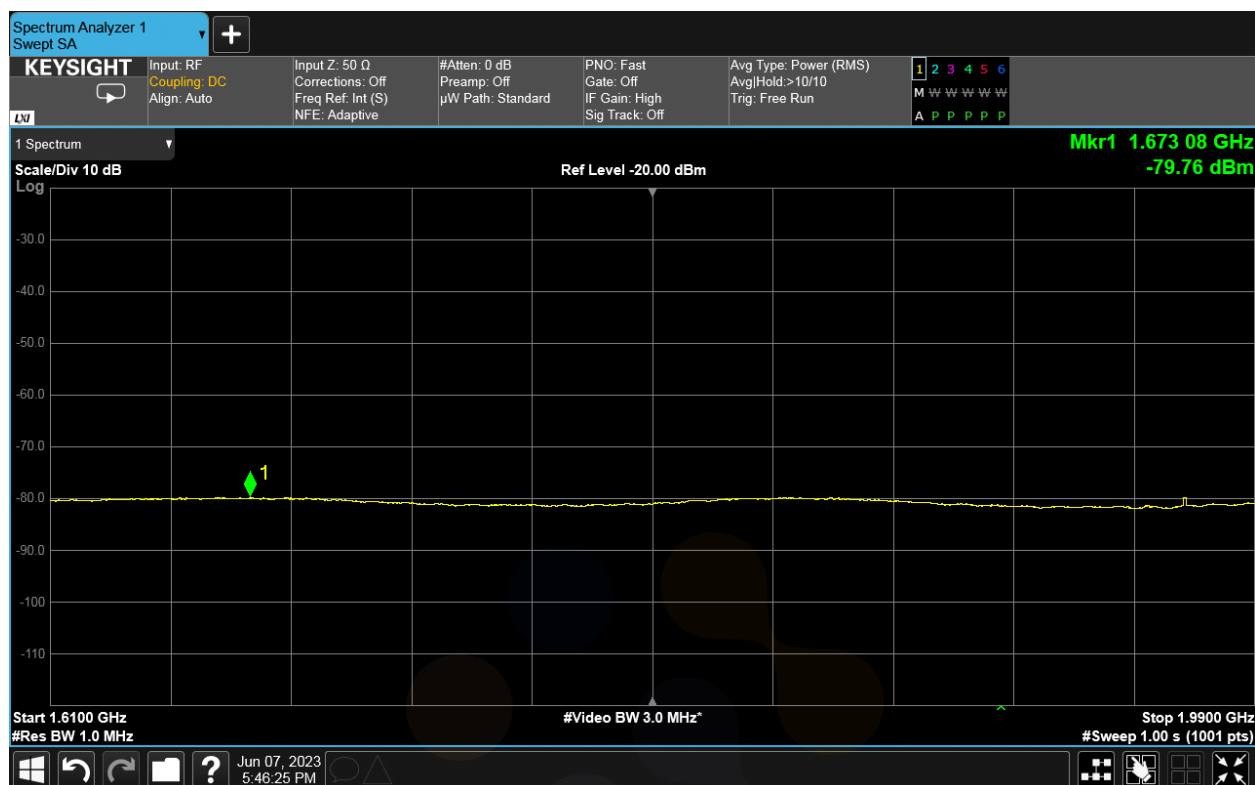
960 MHz ~ 1 610 MHz Horizontal



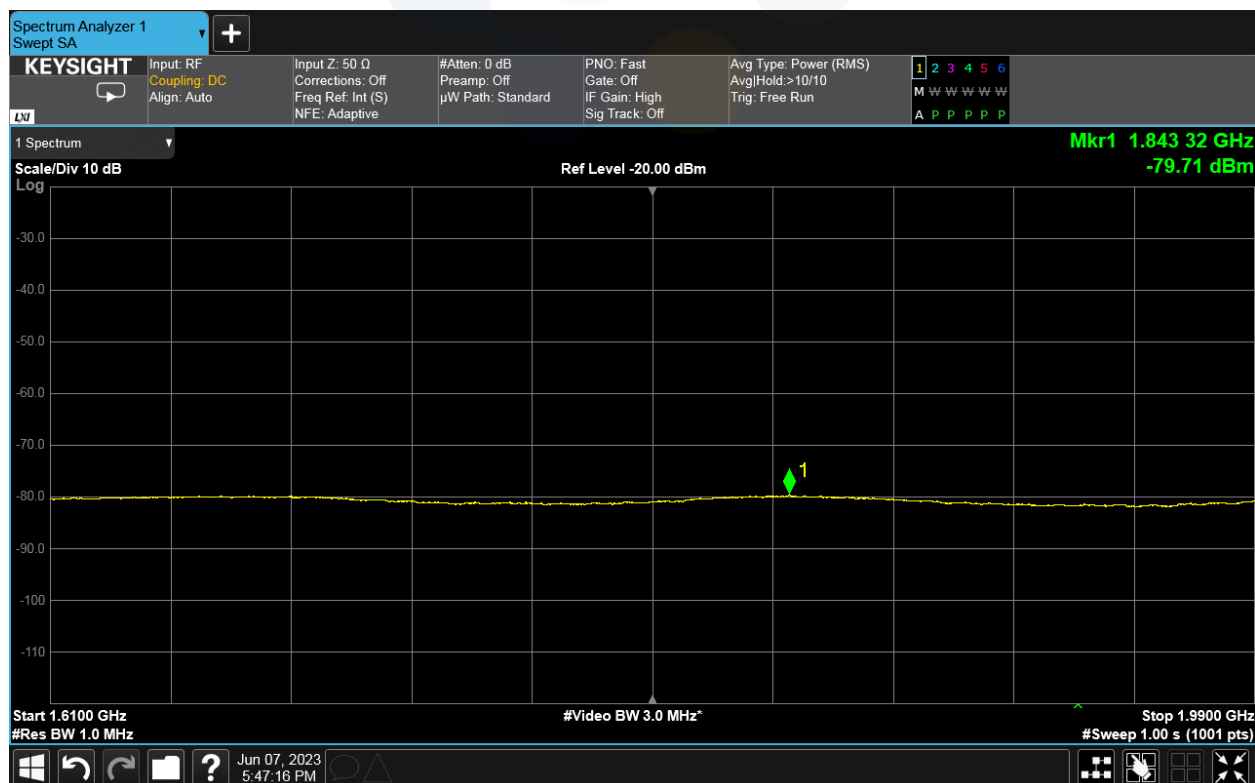
960 MHz ~ 1 610 MHz Vertical



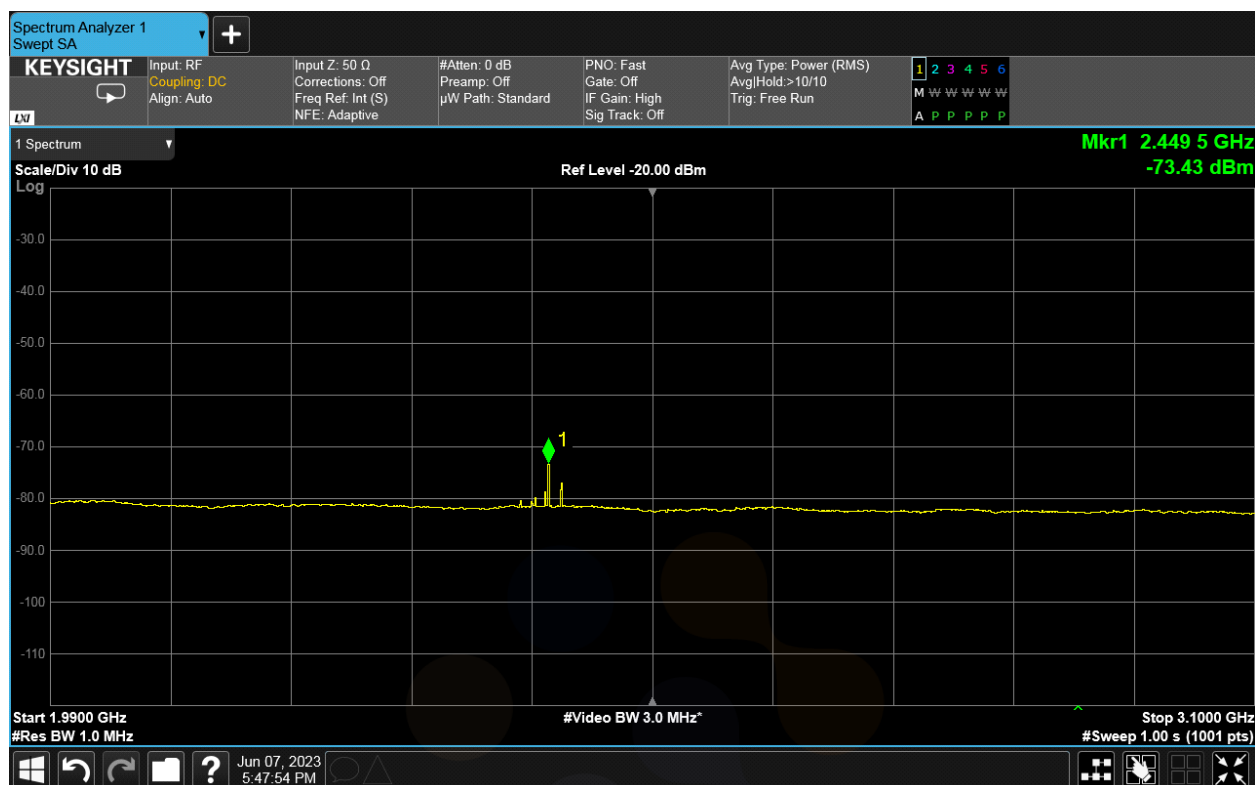
1 610 MHz ~ 1 990 MHz Horizontal



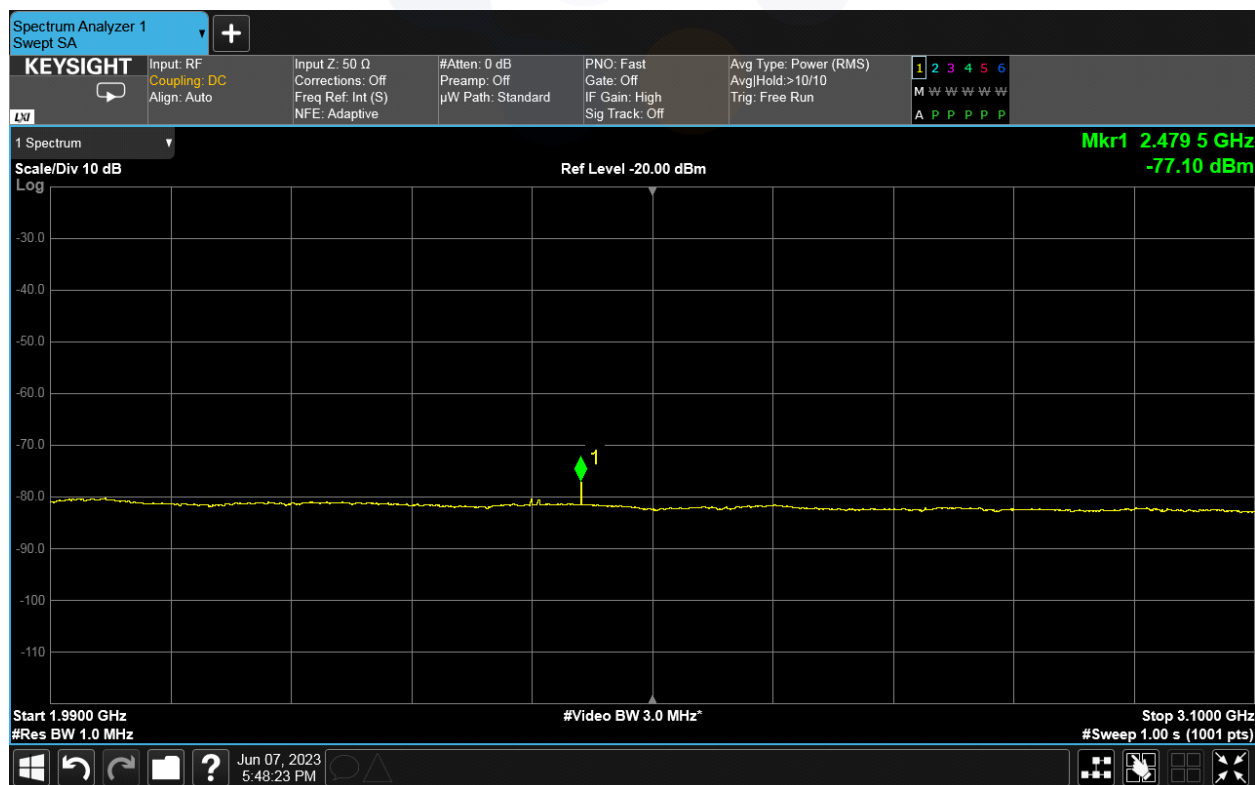
1 610 MHz ~ 1 990 MHz Vertical



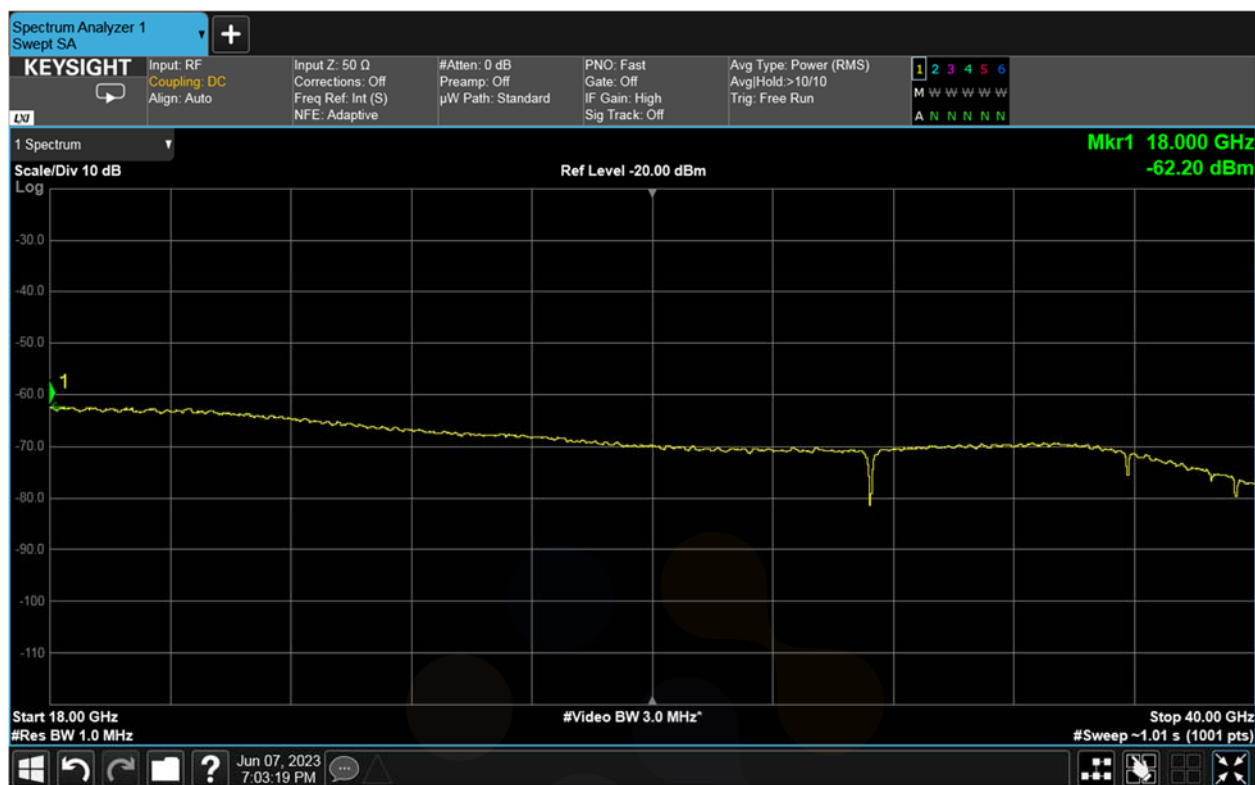
1 990 MHz ~ 3 100 MHz Horizontal



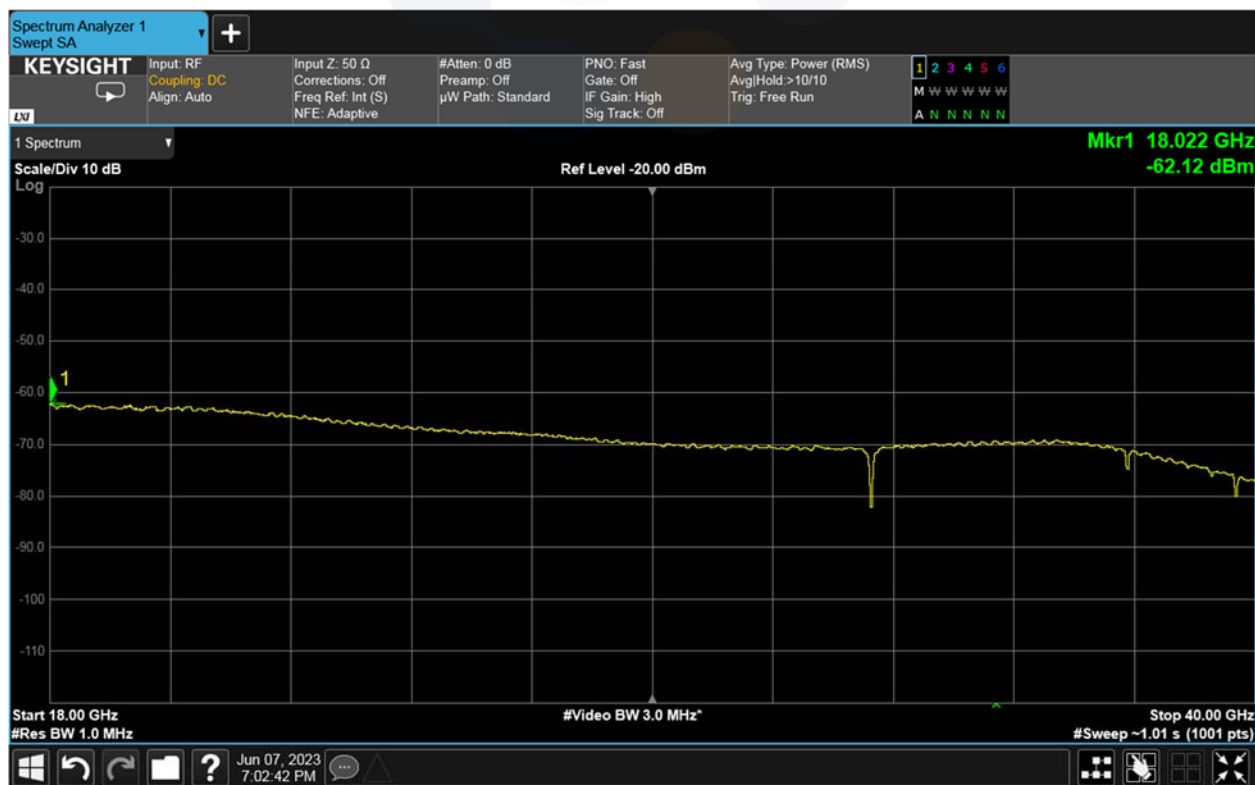
1 990 MHz ~ 3 100 MHz Vertical



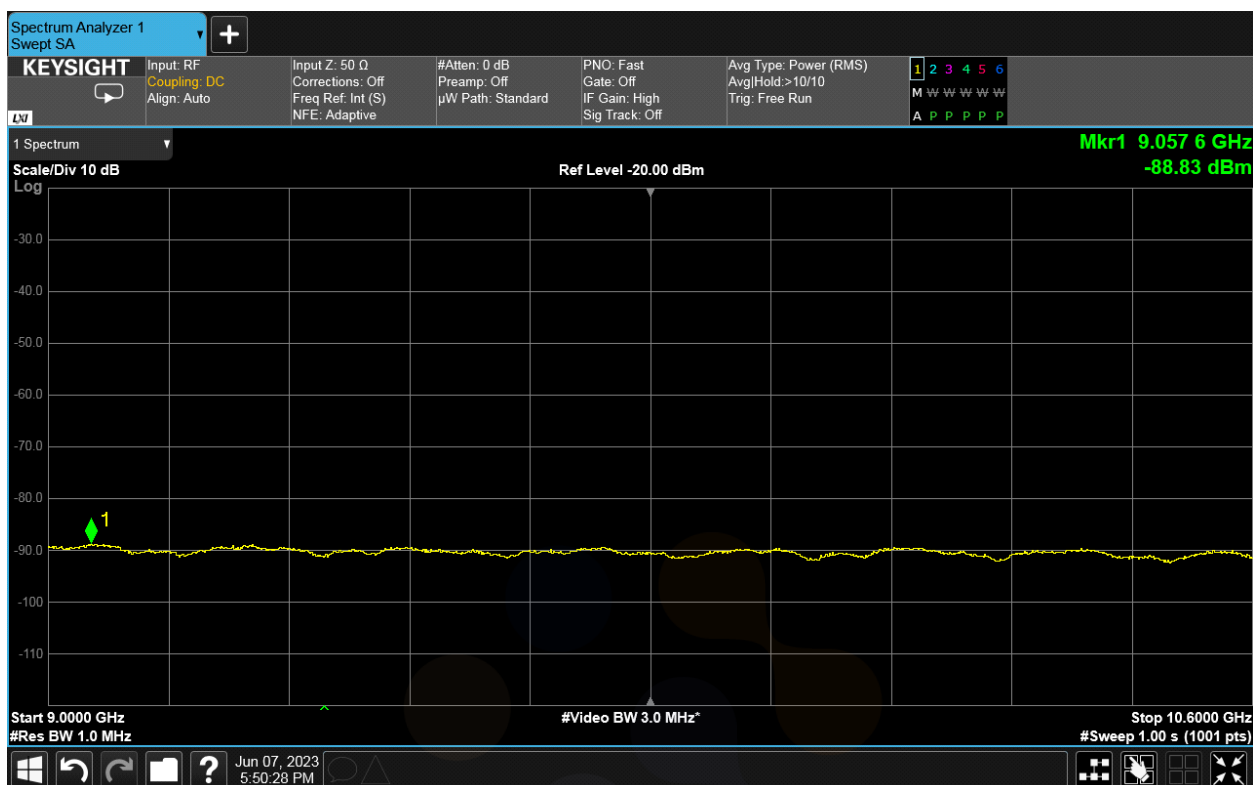
3 100 MHz ~ 6 000 MHz Horizontal



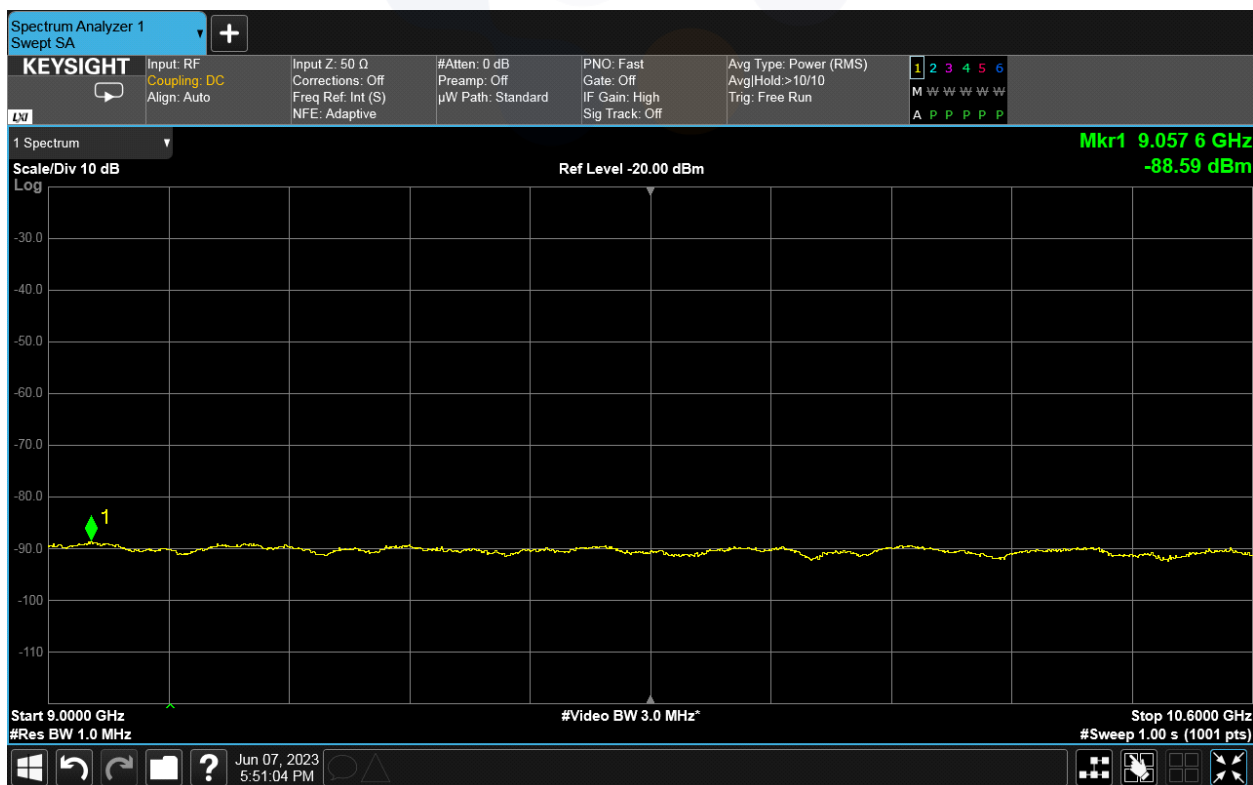
3 100 MHz ~ 6 000 MHz Vertical



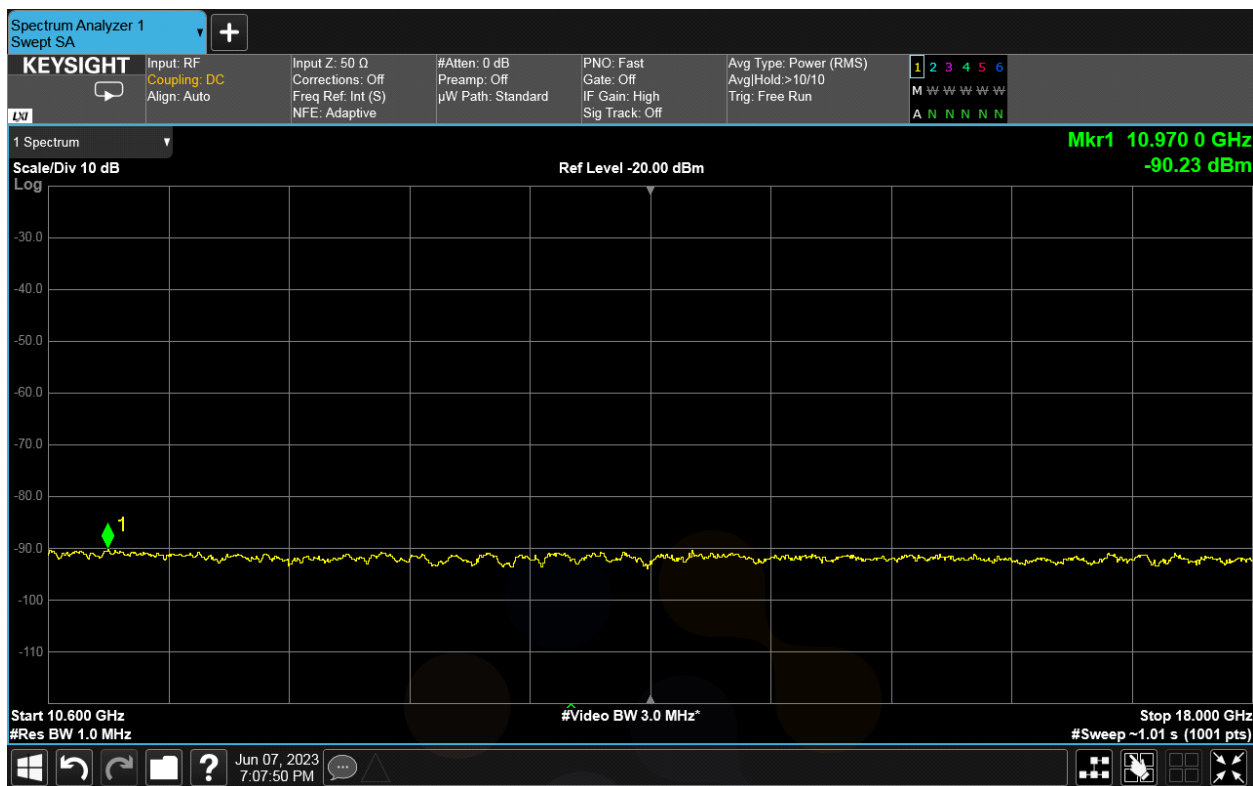
9 000 MHz ~ 10 600 MHz Horizontal



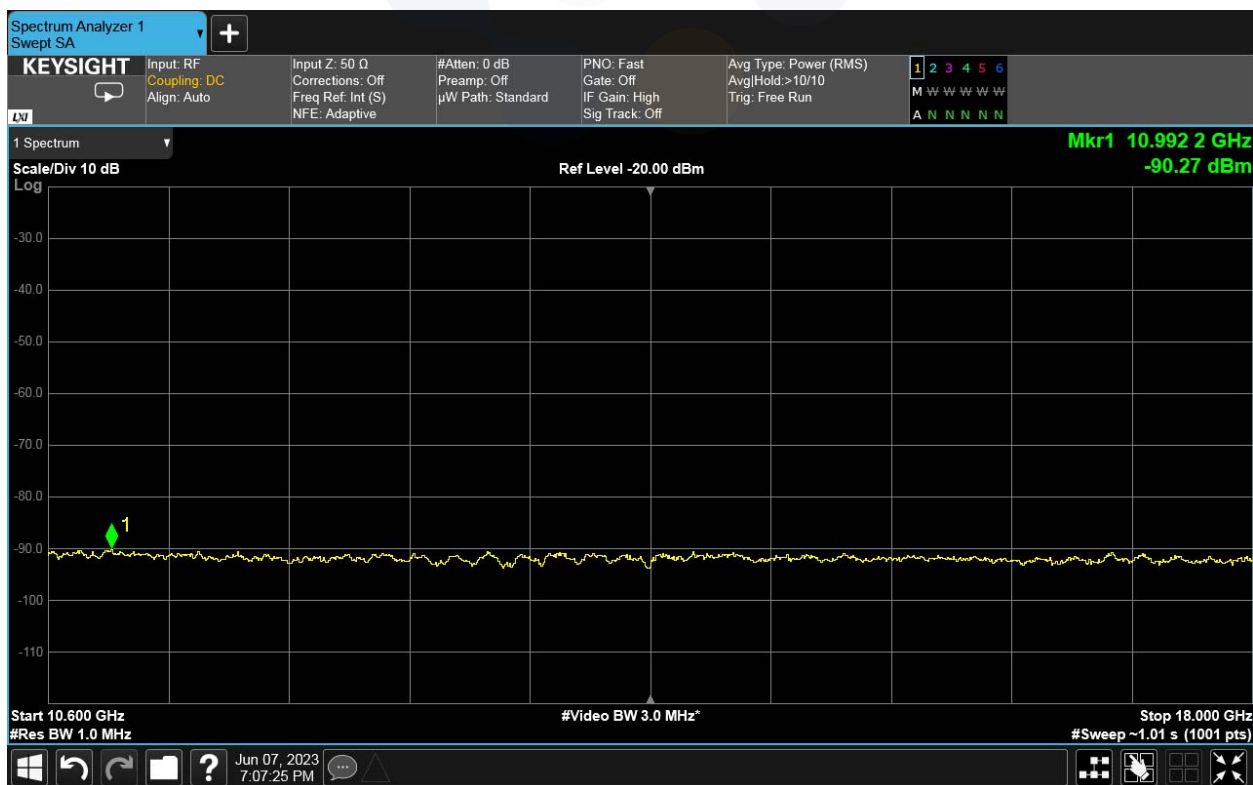
9 000 MHz ~ 10 600 MHz Vertical



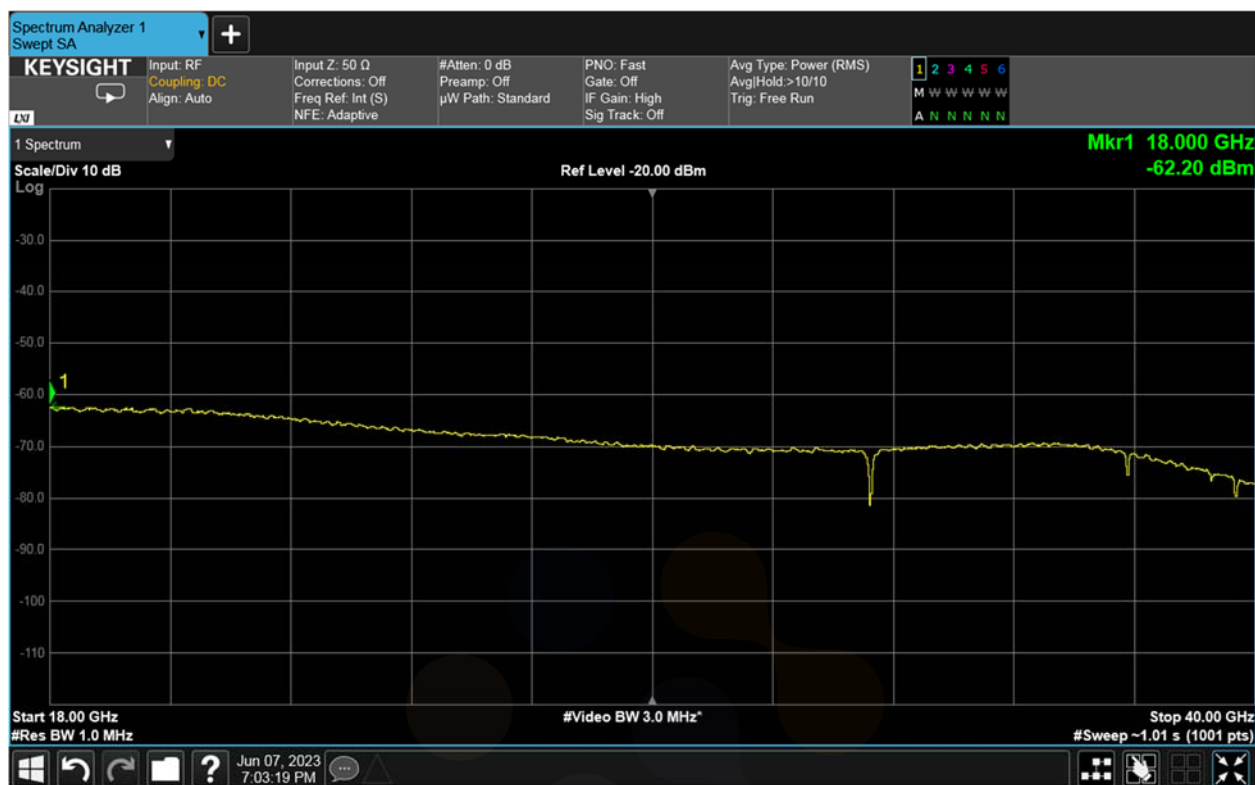
10 600 MHz ~ 18 000 MHz Horizontal



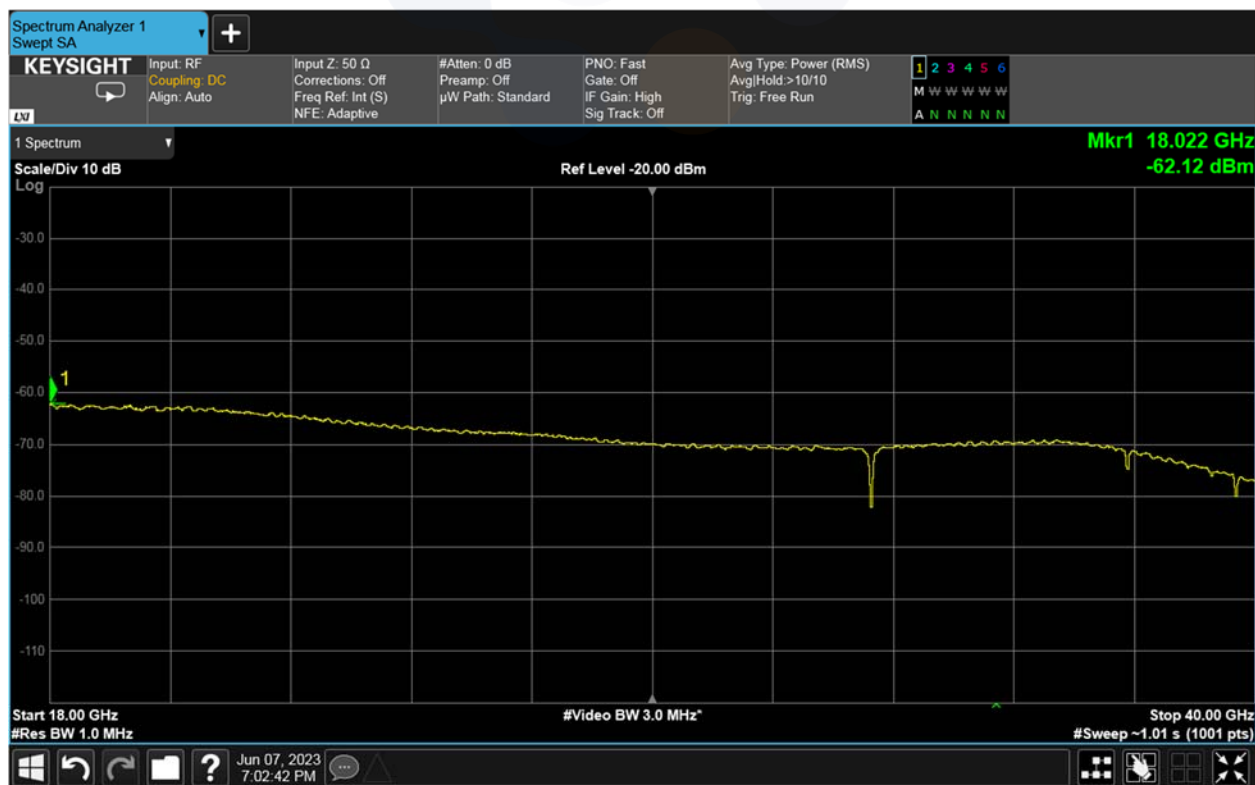
10 600 MHz ~ 18 000 MHz Vertical



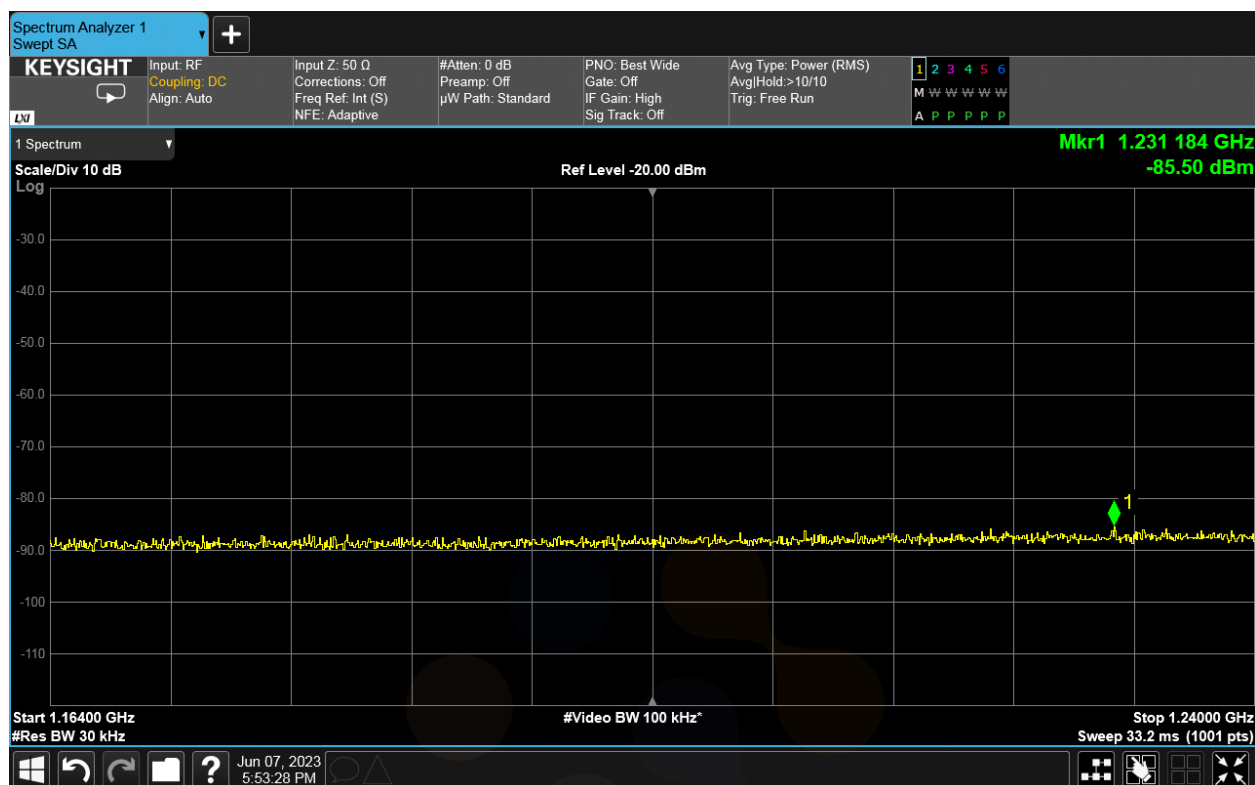
18 000 MHz ~ 40 000 MHz Horizontal



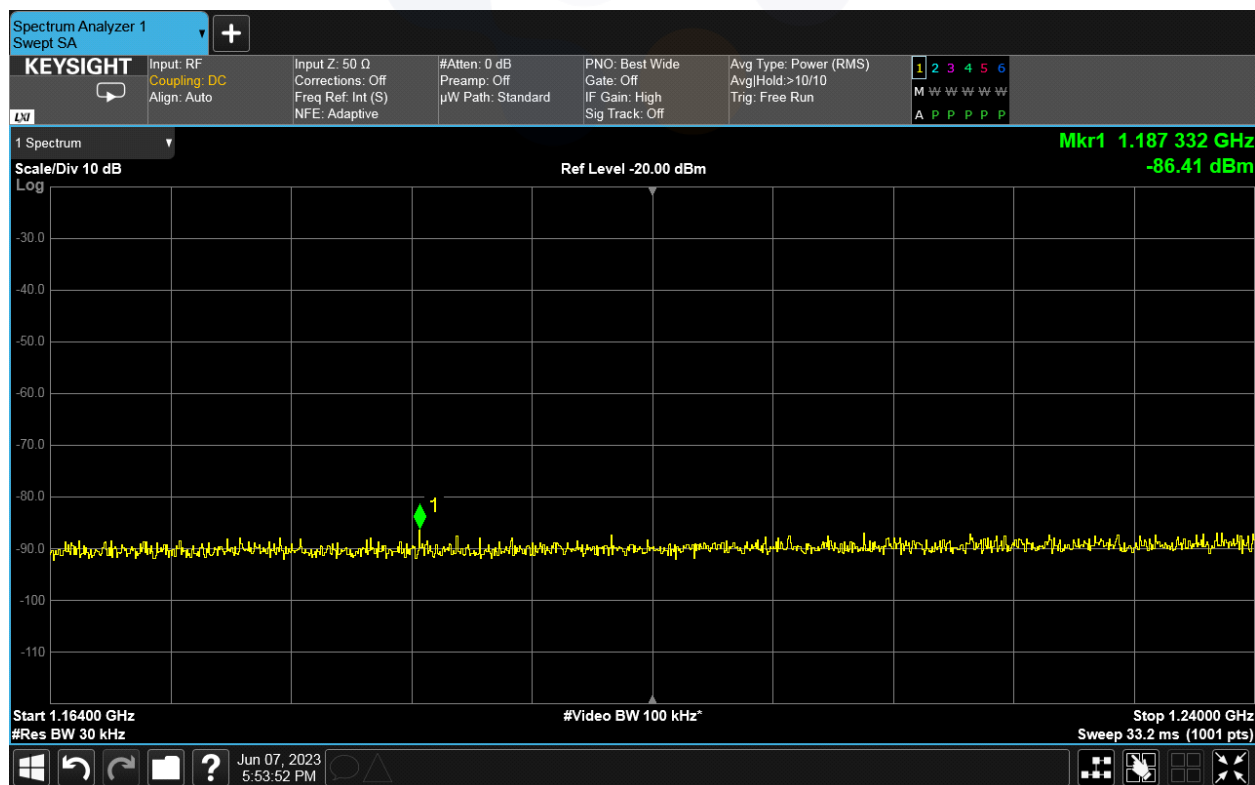
18 000 MHz ~ 40 000 MHz Vertical



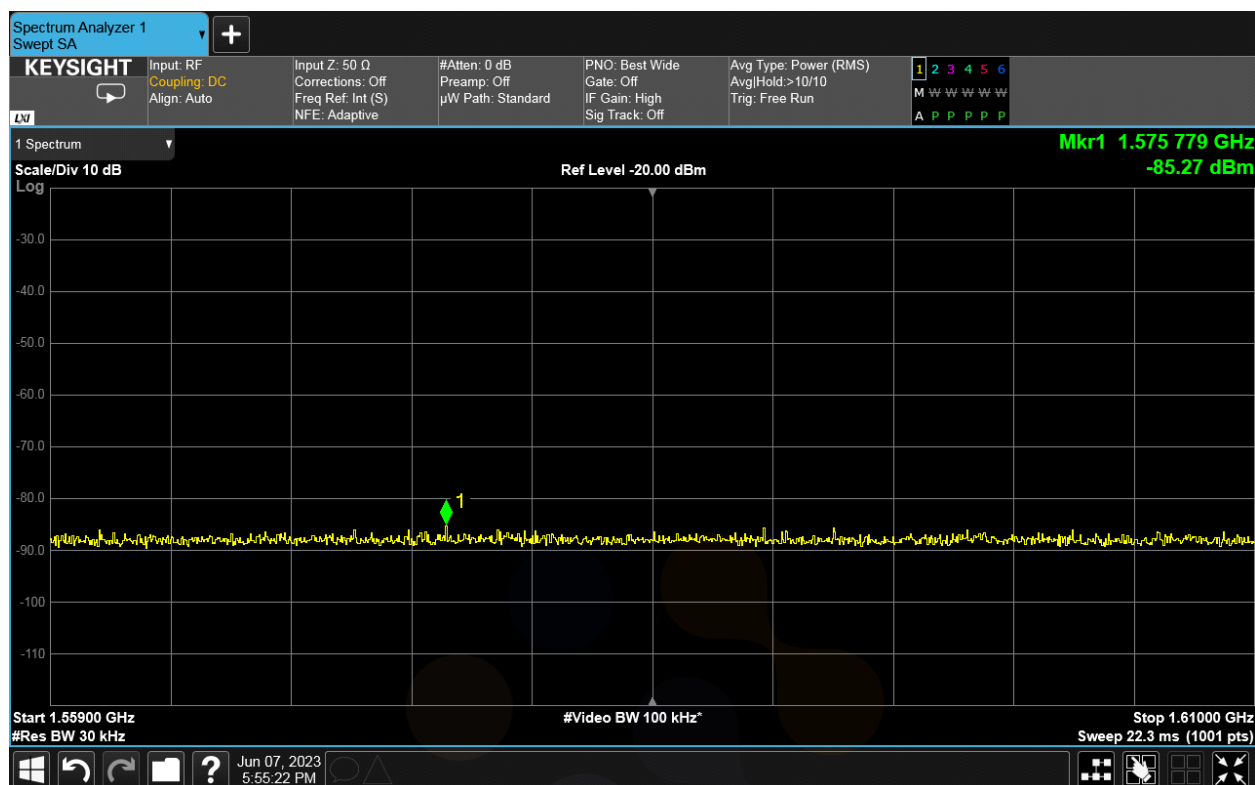
1 164 MHz ~ 1 240 MHz Horizontal



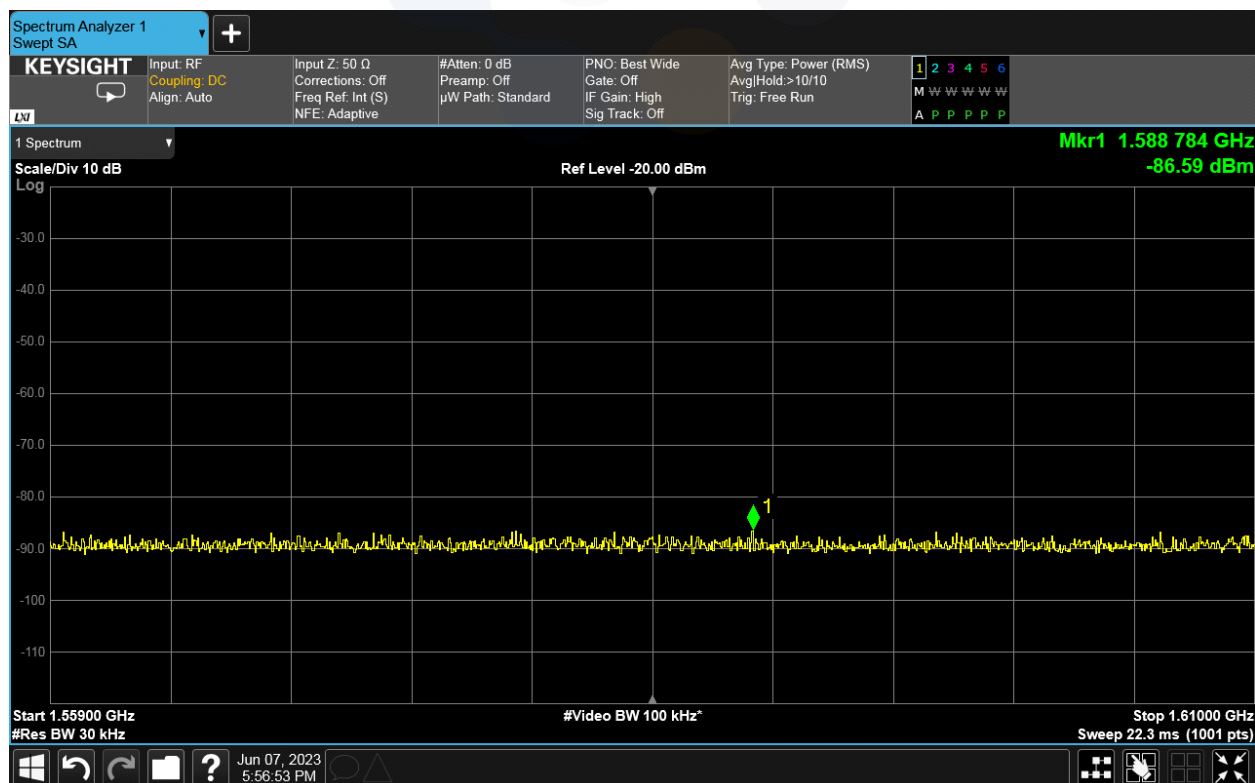
1 164 MHz ~ 1 240 MHz Vertical



1 559 MHz ~ 1 610 MHz Horizontal



1 559 MHz ~ 1 610 MHz Vertical



6.5. Radiated Spurious Emission – Below 960 MHz

Limit

Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency[MHz]	Field strength [$\mu V/m$]	Measurement distance[m]
0.009-0.490	2400/F	300
0.490-1.705	24000/F	30
1.705-30.0	30	30
30-88	100**	3
88-216	150**	3
216-960	200**	3
Above 960	500	3

*Radiated Limit

**Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this part, e.g., §§15.231 and 15.241.

Test procedure

ANSI C63.10-2013

Test settings

Below 30 MHz

RBW 120 kHz (for emissions from 30 MHz – 1 GHz)
Detector Quasi-peak
Trace mode Max-hold
Sweep time Auto couple
The trace was allowed to stabilize

Below 960 MHz

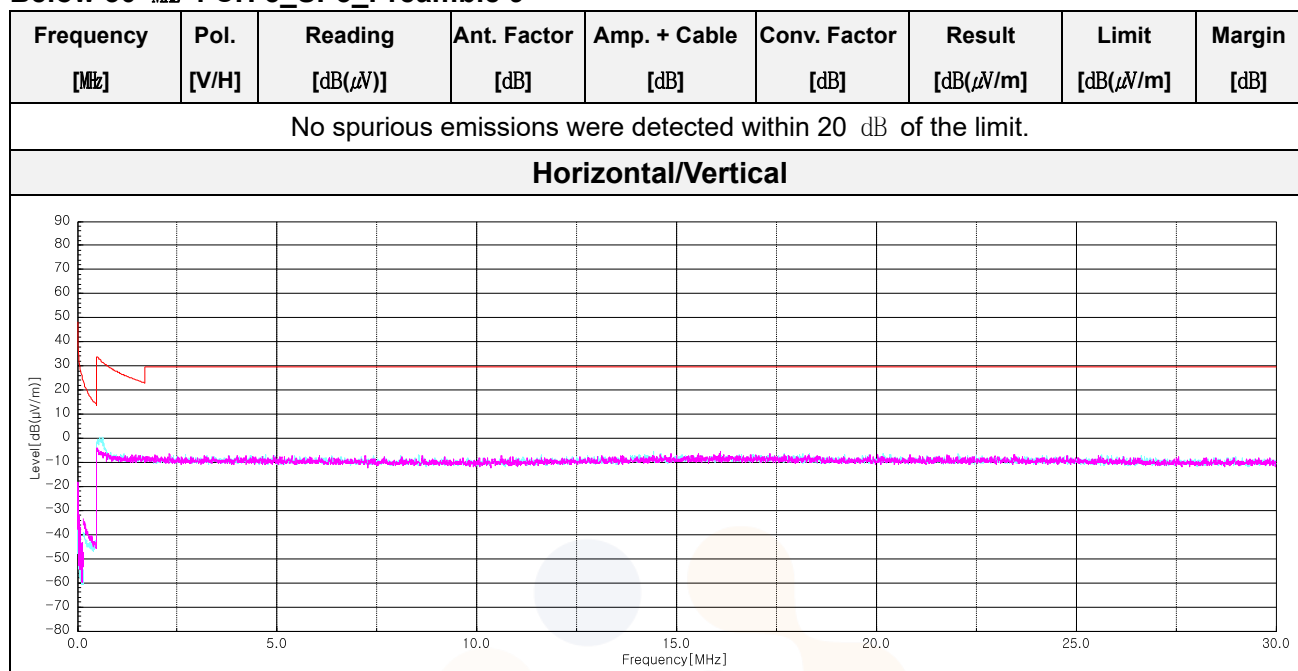
RBW 120 kHz (for emissions from 30 MHz – 1 GHz)
VBW 300 kHz
Detector Peak
Trace mode Max-hold
Sweep time Auto couple
The trace was allowed to stabilize

*The Limits in CFR 47, Part 15, Subpart C, paragraph 15.209(a), are identical to those in RSS-GEN Section 8.9, Table 6, since the measurements are performed in terms of magnetic field strength and converted to electric field Strength levels (as reported in the table) using the free space impedance of 377Ω . For example, the measurement frequency X kHz resulted in a level of Y dB($\mu V/m$), which is equivalent to $Y-51.5 = Z$ dB($\mu A/m$), which has the same margin, W dB, to the corresponding RSS-GEN Table 6 limit as it has to the 15.209(a) limit

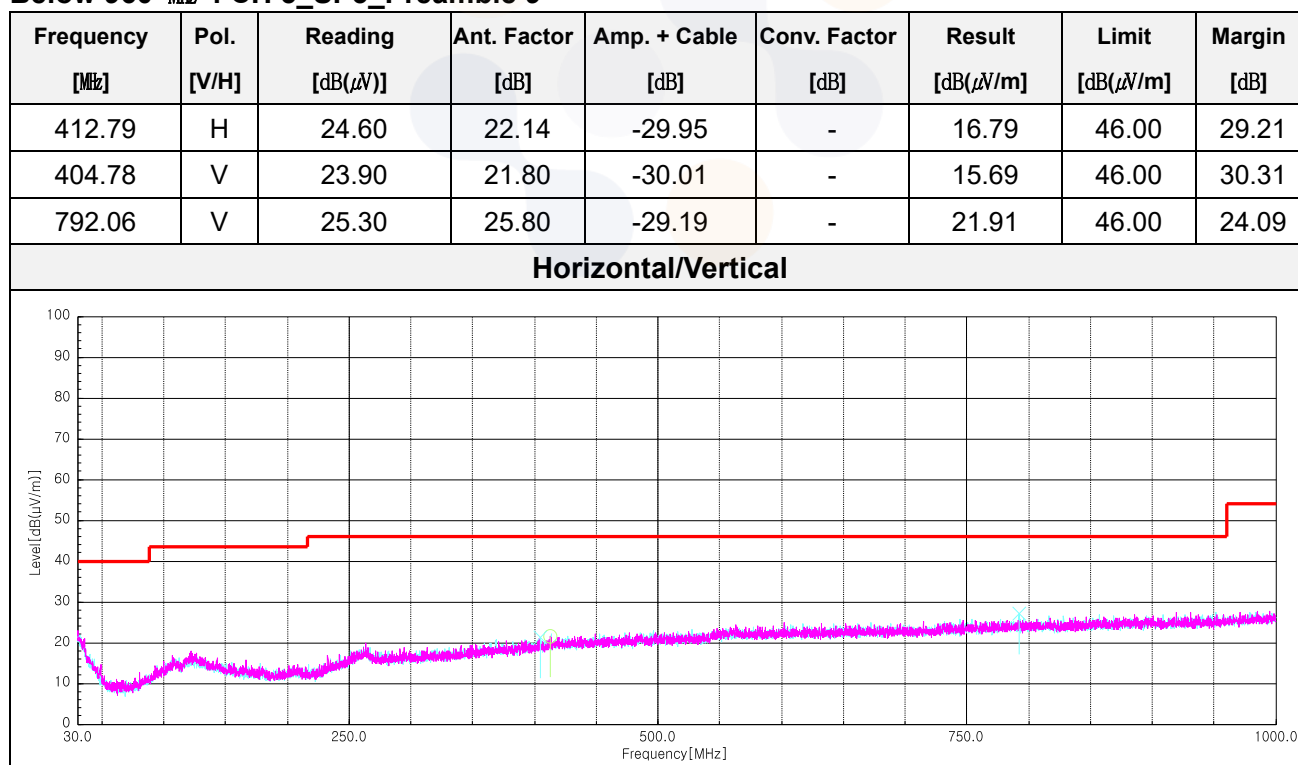
*Result [dB($\mu V/m$)] = Reading + Ant. Factor + Amp. + Cable Loss

Test results

Below 30 MHz : CH 5_SP3_Preamble 9



Below 960 MHz : CH 5_SP3_Preamble 9



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7. Measurement equipment

Equipment Name	Manufacturer	Model No.	Serial No.	Next Cal. Date
PXA Signal Analyzer	KEYSIGHT	N9040B	US56050101	23.07.11
Horn antenna	ETS.lindgren	3117	251528	24.02.02
Horn antenna	ETS.lindgren	3116	86632	24.01.25
AMPLIFIER	B&Z Technologies	BZRT-00504000-481055-382525	26299-27735	23.09.19
AMPLIFIER	B&Z Technologies	BZR-0050400-551028-252525	27736	23.09.19
High pass Filter	Qotana	DBHF058004000A	20070100016	23.07.04
Signal Generator	R&S	SMB100A	176206	24.01.19
Spectrum Analyzer	R&S	FSVA40	101575	23.07.22
PSA Spectrum Analyzer	Agilent	E4440A	MY46186407	24.03.22
Amplifier	SONOMA INSTRUMENT	310N	421821	23.12.14
Bilog Antenna	Teseq GmbH	CBL 6112D	63756	24.11.17
Loop Antenna	R&S	HFH2-Z2	100355	24.08.10
Antenna Mast	Innco Systems	MA4640-XP-ET	-	-
Controller	Innco Systems	CO3000	1175/45850319/P	-
Controller	INNCO SYSTEMS	CO3000	1441/54370322/P	-
Antenna Mast	INNCO SYSTEMS	MA4640-XP-ET	-	-
Turn Device	INNCO SYSTEMS	DS1200-S-1t	-	-

End of test report