

Japan radio Test Report

Report No.: AGC09881200501TE04

PRODUCT DESIGNATION : NINA-B4

BRAND NAME : u-blox

MODEL NAME : NINA-B400, NINA-B410, NINA-B406, NINA-B416

APPLICANT : u-blox AG

DATE OF ISSUE : Nov. 09, 2020

STANDARD(S) : Article 2 Paragraph 1 Item 19 of the Certification,
Article 49.20 of Ordinance Regulating Radio Equipment
MIC Notice No.88 Appendix No.43

REPORT VERSION : V1.0



Attestation of Global Compliance (Shenzhen) Co., Ltd



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Report Revise Record

Report Version	Revise Time	Issued Date	Valid Version	Notes
V1.0	/	Nov. 09, 2020	Valid	Initial release

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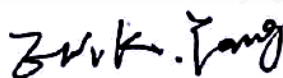


1. VERIFICATION OF CONFORMITY

Applicant	u-blox AG
Address	Zuercherstrasse 68, Ch-8800 Thalwil, Switzerland
Manufacturer	u-blox AG
Address	Zuercherstrasse 68, Ch-8800 Thalwil, Switzerland
Product Designation	NINA-B4
Brand Name	u-blox
Test Model	NINA-B400, NINA-B406
Series Model	NINA-B410, NINA-B406, NINA-B416
Difference Description	All the same except for the model name and the Antenna type. NINA-B400 - Open CPU, U.FL connector NINA-B410 - u-blox connectivity SW, U.FL connector NINA-B406 - Open CPU, PCB trace antenna NINA-B416 - u-blox connectivity SW, PCB trace antenna
Date of test	Jul. 24, 2020 to Nov. 09, 2020
Deviation	None
Condition of Test Sample	Normal
Report Template	AGCRT-JP-BLE/RF

We, Attestation of Global Compliance (Shenzhen) Co., Ltd., has tested the product above mentioned as per the Japan MIC Notice No.88 Annex 43. Those results of testing in this report apply to the product/system which was tested only. Other similar equipment will not necessarily produce the same results due to production tolerance and measurement uncertainties. The test results of this report relate only to the tested sample identified in this report.

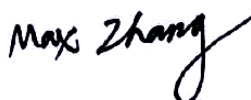
Prepared By



Erik Yang
(Project Engineer)

Nov. 09, 2020

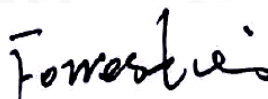
Reviewed By



Max Zhang
(Reviewer)

Nov. 09, 2020

Approved By



Forrest Lei
(Authorized Officer)

Nov. 09, 2020

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2. GENERAL INFORMATION

2.1. DESCRIPTION OF EUT

The following data is based on the information by the applicant.

Hardware Version	A
Software Version	V1.0
Operating Frequency	2405MHz ~2480MHz
Support Channels	16 Channels
Modulation	O-QPSK
Antenna Type	NINA-B406 :Integral Antenna; NINA-B400:External Antenna
Antenna Gain	3dBi
Rated RF Output Power	4mW
Conducted Power	CRYSTAL A:2.897mW CRYSTAL B:3.347mW
Test Channel	2.405GHz (CH00) 2.440GHz (CH07) 2.480GHz (CH15)
Test Power	(3.63V) High Voltage + 10% of Normal Voltage (2.97V) Low Voltage - 10% of Normal Voltage (3.3V) Normal Voltage

Note:

1. CH00~CH16 are Operating within 2405~2480MHz.
2. Please refer to Appendix B for the photographs of the EUT. For more details, please refer to the User's manual of the EUT.
3. All the models would be marketed with the CRYSTAL A (EPSON FA-118T) or the CRYSTAL B (Taisaw TZ3 124CIW-B4017). Both of them have the same size and radio parameters. The version of the CRYSTAL A had been tested with all the items and the version of the CRYSTAL B only had been tested with bandwidth test and RF output power test for the difference.

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2.2. CHANNEL LIST

Channel	Frequency (GHz)	Channel	Frequency (GHz)
00	2.405	08	2.445
01	2.410	09	2.450
02	2.415	10	2.455
03	2.420	11	2.460
04	2.425	12	2.465
05	2.430	13	2.470
06	2.435	14	2.475
07	2.440	15	2.480

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2.3. DESCRIPTION OF TEST MODES

The BT device was tested while in a continuous transmitter/receiver mode.

The EUT was tuned to a low, middle, and high channel for all tests. For all test case pre/scans were completed in all modes to determine worst case levels.

Power Supply Voltage Fluctuation Test

Voltage Fluctuation Test	Normal Voltage	High Voltage +10% of Normal Voltage	Low Voltage -10% of Normal Voltage
Input DC Power	3.3	2.97	3.63
Voltage Variation (%)	--	10%	-10%

Note:

Voltage Variation (%)

= (Output high or Low Voltage - Output Normal Voltage) / Output Normal Voltage * 100%

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2.4. TEST ITEMS AND THE RESULTS

Ordinance Regulating Radio Equipment	Description of Test	Result
Article 5	Frequency Error	Complies
Article 6	Occupied Bandwidth (99%) and Spread-spectrum Bandwidth (90%)	Complies
Article 7	Unwanted Emission Intensity	Complies
Article 49.20 & Article 14	Antenna Power Error	Complies
Article 24	Limitation of Collateral Emission of Receiver	Complies
Article 49.20	Transmission Antenna Gain (EIRP Antenna Power)	Complies
Article 49.20	Transmission Radiation Angle Width (3dB Bandwidth)	Not applicable
Article 9.4	Radio Interference Prevention Capability	Complies
Article 49.20	Construction Protection Confirmation	Complies

2.5. ENVIRONMENTAL CONDITIONS

During the measurement the environmental conditions were within the listed ranges:

- Temperature: 5-35°C
- Humidity: 45-85 %
- Atmospheric pressure: 86-106kPa

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3. IDENTIFICATION OF THE RESPONSIBLE TESTING LOCATION

Site	Attestation of Global Compliance (Shenzhen) Co., Ltd
Location	1-2/F, Building 19, Junfeng Industrial Park, Chongqing Road, Heping Community, Fuhai Street, Bao'an District, Shenzhen, Guangdong, China

4. TEST EQUIPMENTS LIST

Equipment	Manufacturer	Model	S/N	Cal. Date	Cal. Due
MXG X-Series Vector Signal Generator	Agilent	N5182B	MY50140530	Sep. 09, 2019	Sep. 08, 2020
MXG X-Series Vector Signal Generator	Agilent	N5182B	MY53050647	Aug. 21, 2020	Aug. 20, 2021
EXA Signal Analyzer	Agilent	N9020A	MY52090123	Sep. 09, 2019	Sep. 08, 2020
EXA Signal Analyzer	Agilent	N9020A	MY52090123	Aug. 21, 2020	Aug. 20, 2021
HORN ANTENNA	ETS-LINDGREN	3117	00034609	May. 17, 2019	May. 16, 2021
HORN ANTENNA	ETS-LINDGREN	3117	00154520	Oct. 26, 2019	Oct. 25, 2021
DC Power Supply	AGILENT	E3642A	N/A	Oct. 08, 2019	Oct. 07, 2020
DC Power Supply	AGILENT	E3642A	N/A	Aug. 21, 2020	Aug. 20, 2021

Note: The equipment was calibrated by Guangzhou Lisai Calibration and Testing co., Ltd.

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5. TEST RESULTS

5.1. FREQUENCY ERROR MEASUREMENT

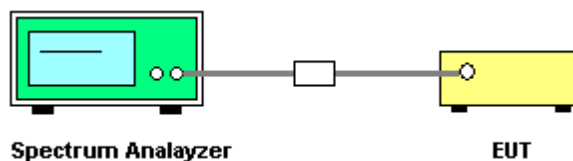
5.1.1. LIMIT

Item	Limits
Frequency Tolerance (2400~2483.5MHz)	$-50\text{ppm} \leq \text{Frequency Error} \leq 50\text{ppm}$

5.1.2. TEST PROCEDURES

1. Frequency accuracy of SA shall be less than 10% of limits tolerance (5ppm)
2. Setting of SA is following as: RB: 10kHz / VB: 10kHz / SPAN: 0.5MHz
3. Center Frequency: The center frequency of testing for EUT
4. Sweep time: Auto
5. Sweep mode: Continuous sweep
6. Detect mode: Positive peak
7. EUT have transmitted absence of modulation signal and fixed channelize. if is using the mark cursor to mark the peak frequency value , f_c is declaring of channel frequency. Then the frequency error formula is $(f_c - f)/f_c \times 10^6 \text{ ppm}$ and the limit is less than $\pm 50\text{ppm}$

5.1.3. TEST SETUP LAYOUT



5.1.4. TEST DEVIATION

There is no deviation with the original standard.

5.1.5. EUT OPERATION DURING TEST

The EUT was placed on the test table and programmed in un-modulation function.

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5.1.6. RESULTS OF FREQUENCY ERROR

EUT:	NINA-B400	Test Date:	Aug. 03, 2020
Temperature:	25°C	Tested by:	Erik
Humidity:	55 % RH	Operation Mode:	Un-modulation

CRYSTAL A

Test Voltage	Test Frequency (MHz)	Measured Frequency (MHz)	Frequency Error(ppm)	Limit (ppm)	P/F
Normal Voltage	2405	2404.9920	-3.33	±50	PASS
	2440	2439.9915	-3.48	±50	PASS
	2480	2479.9915	-3.43	±50	PASS
Low Voltage	2405	2404.9920	-3.33	±50	PASS
	2440	2439.9915	-3.48	±50	PASS
	2480	2479.9915	-3.43	±50	PASS
High Voltage	2405	2404.9920	-3.33	±50	PASS
	2440	2439.9915	-3.48	±50	PASS
	2480	2479.9915	-3.43	±50	PASS

CRYSTAL B

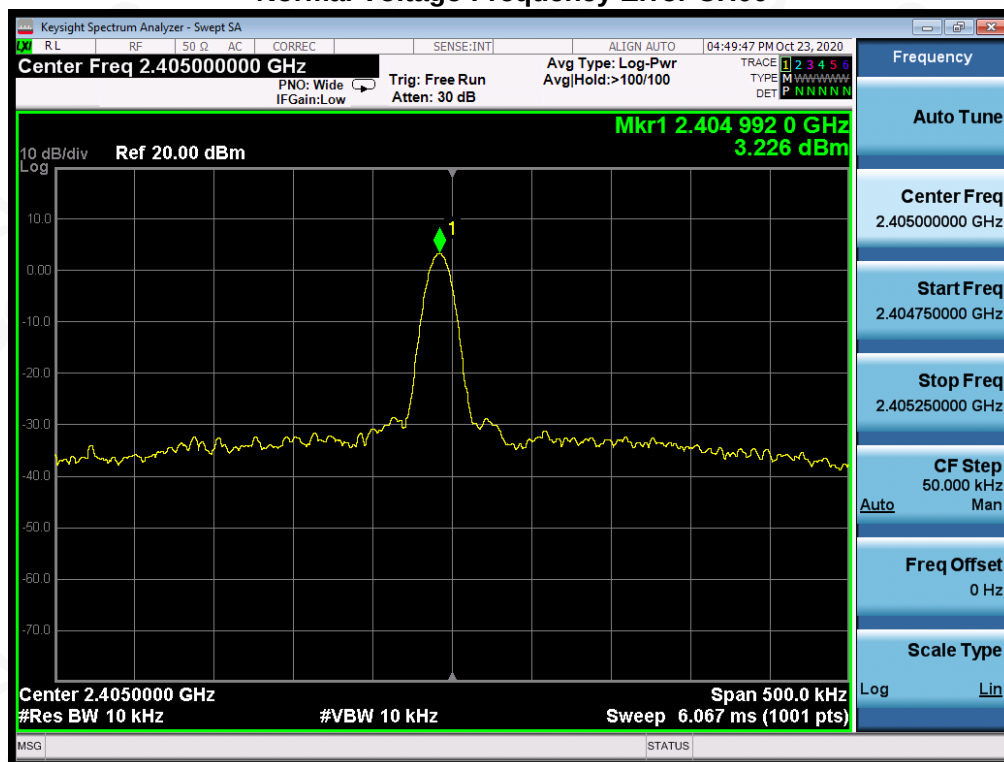
Test Voltage	Test Frequency (MHz)	Measured Frequency (MHz)	Frequency Error(ppm)	Limit (ppm)	P/F
Normal Voltage	2405	2404.9980	-0.83	±50	PASS
	2440	2439.9970	-1.23	±50	PASS
	2480	2479.9970	-1.21	±50	PASS
Low Voltage	2405	2404.9980	-0.83	±50	PASS
	2440	2439.9970	-1.23	±50	PASS
	2480	2479.9970	-1.21	±50	PASS
High Voltage	2405	2404.9980	-0.83	±50	PASS
	2440	2439.9970	-1.23	±50	PASS
	2480	2479.9970	-1.21	±50	PASS

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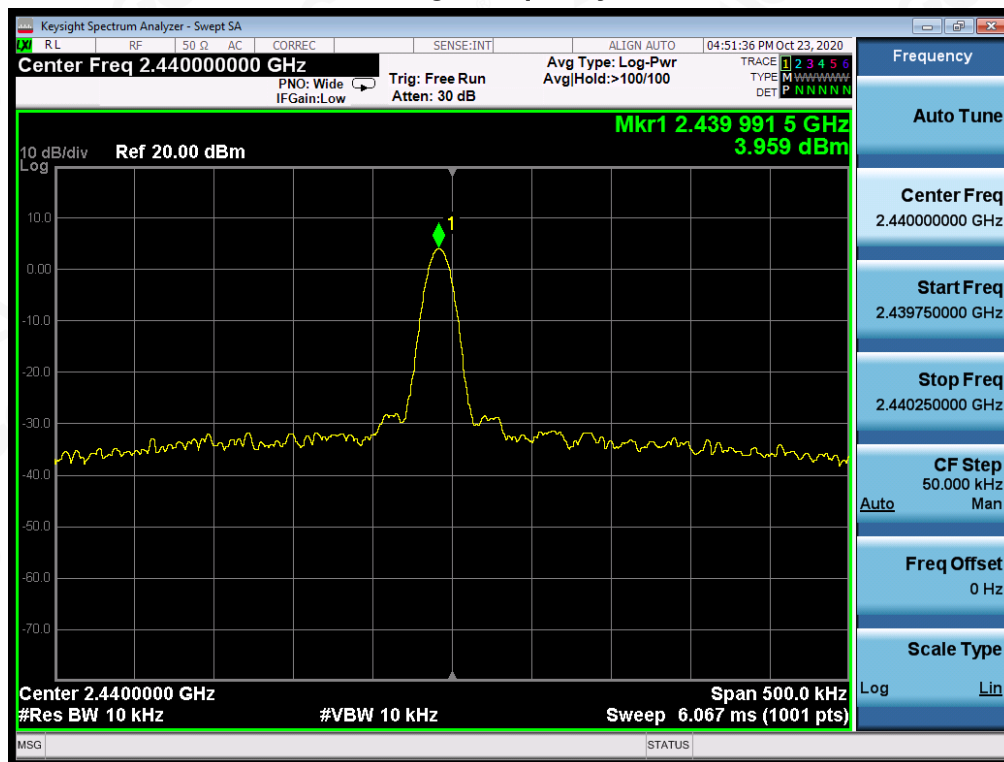


CRYSTAL A

Normal Voltage-Frequency Error CH00



Normal Voltage-Frequency Error CH19

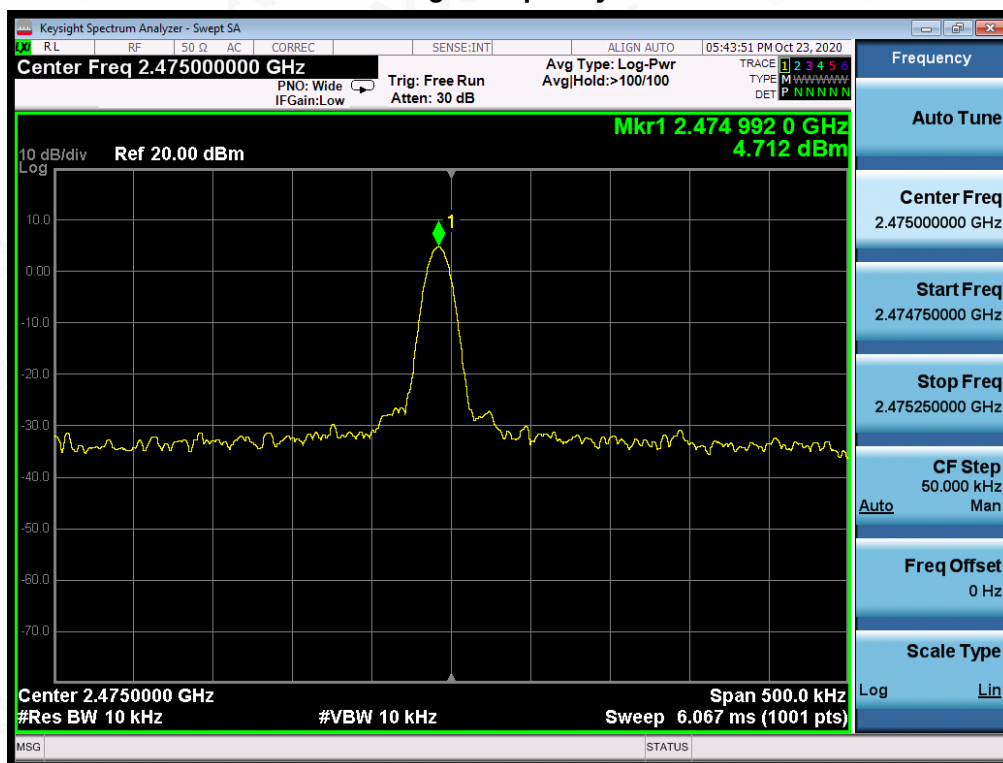


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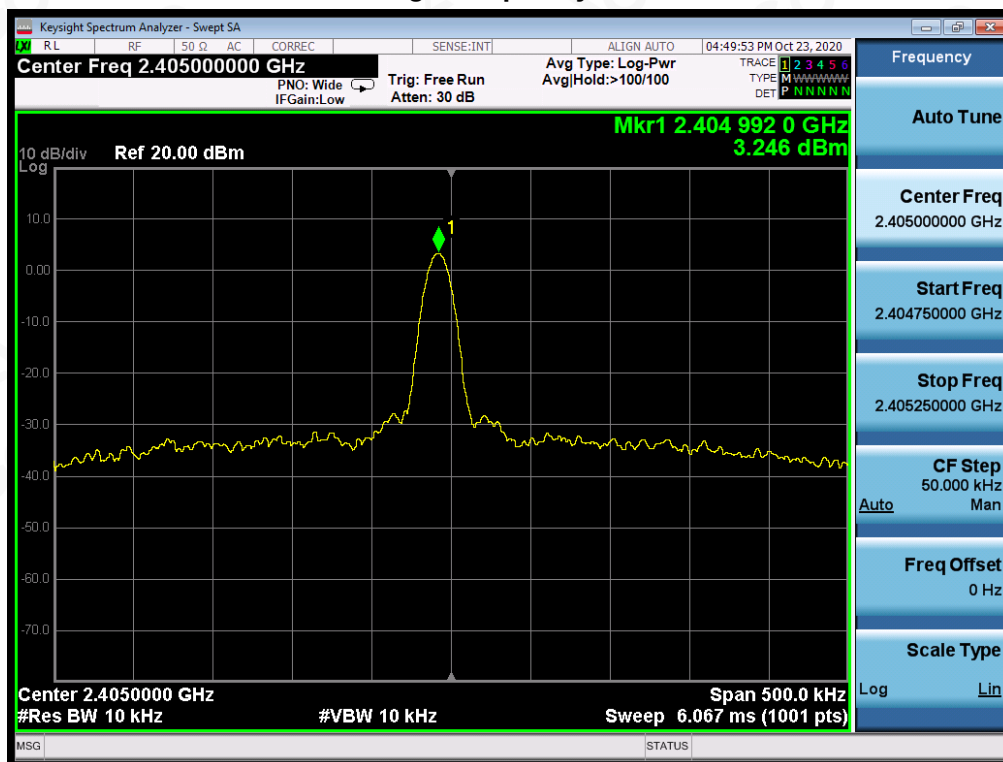
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Normal Voltage-Frequency Error CH39



Low Voltage-Frequency Error CH00

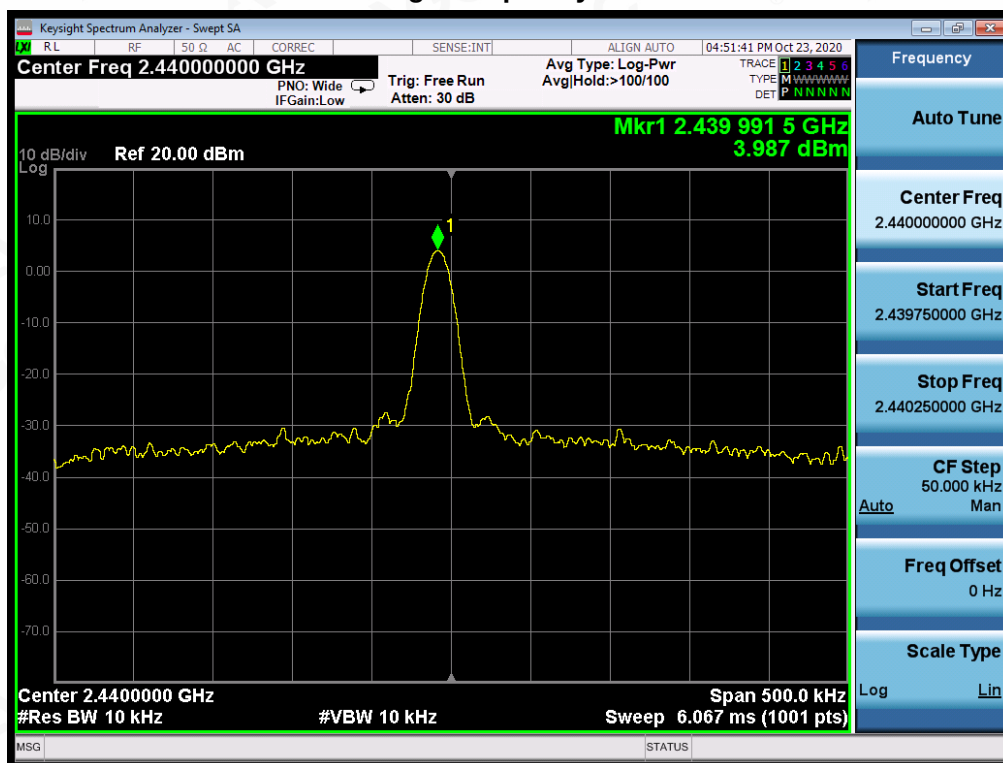


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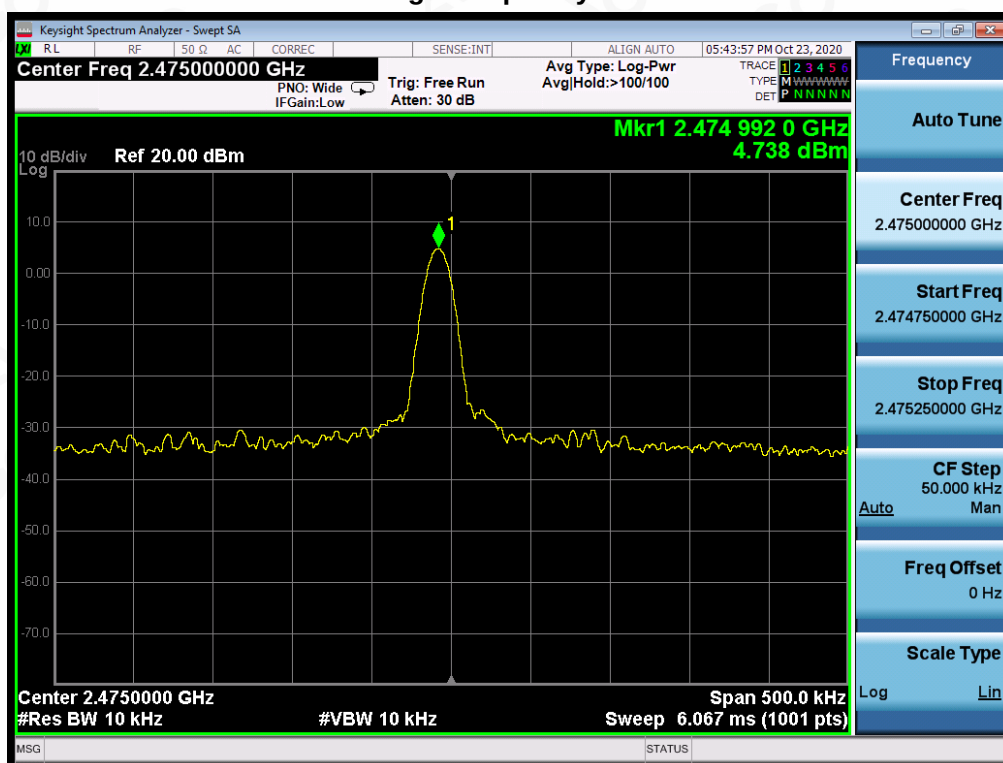
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Low Voltage-Frequency Error CH19



Low Voltage-Frequency Error CH39

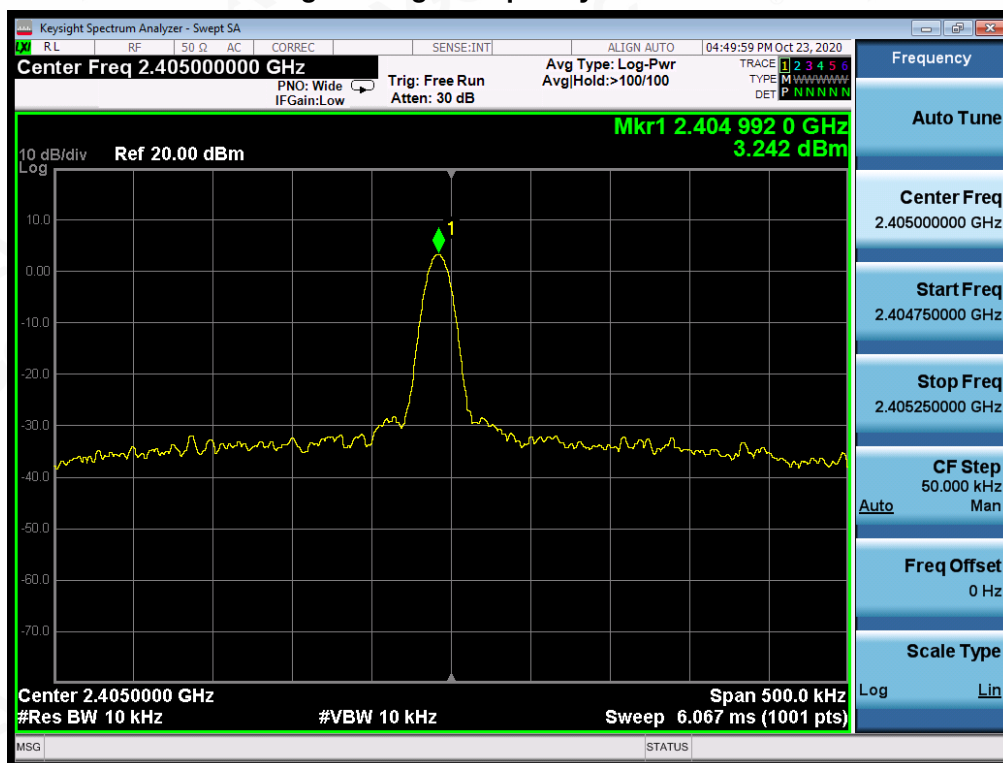


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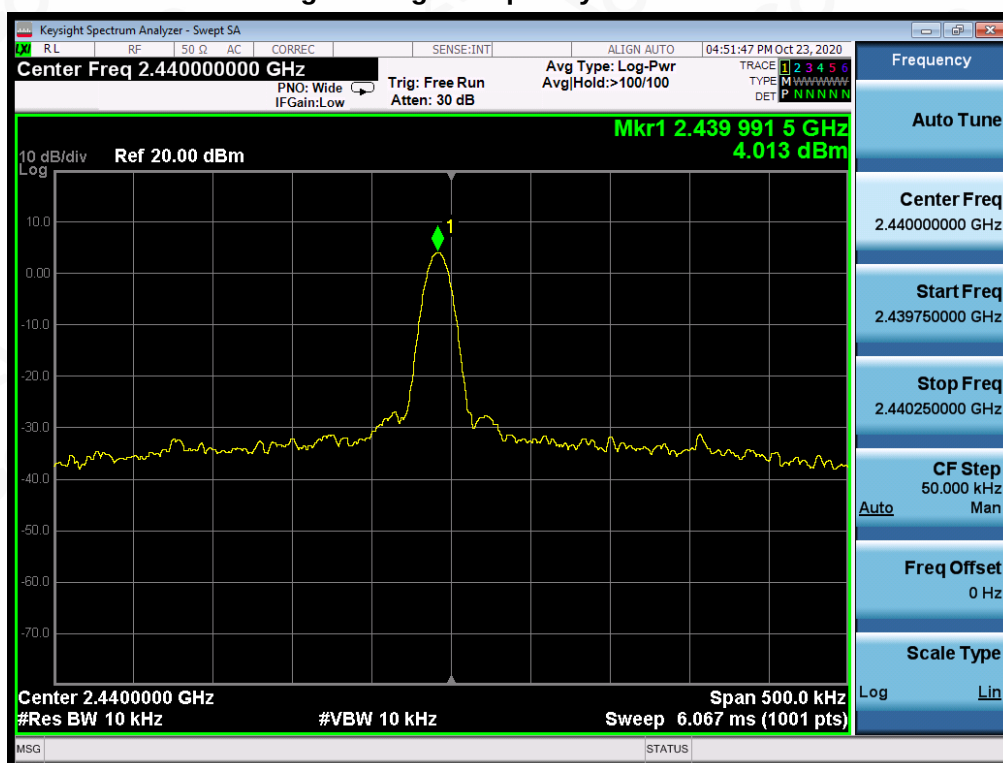
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High Voltage-Frequency Error CH00



High Voltage-Frequency Error CH19

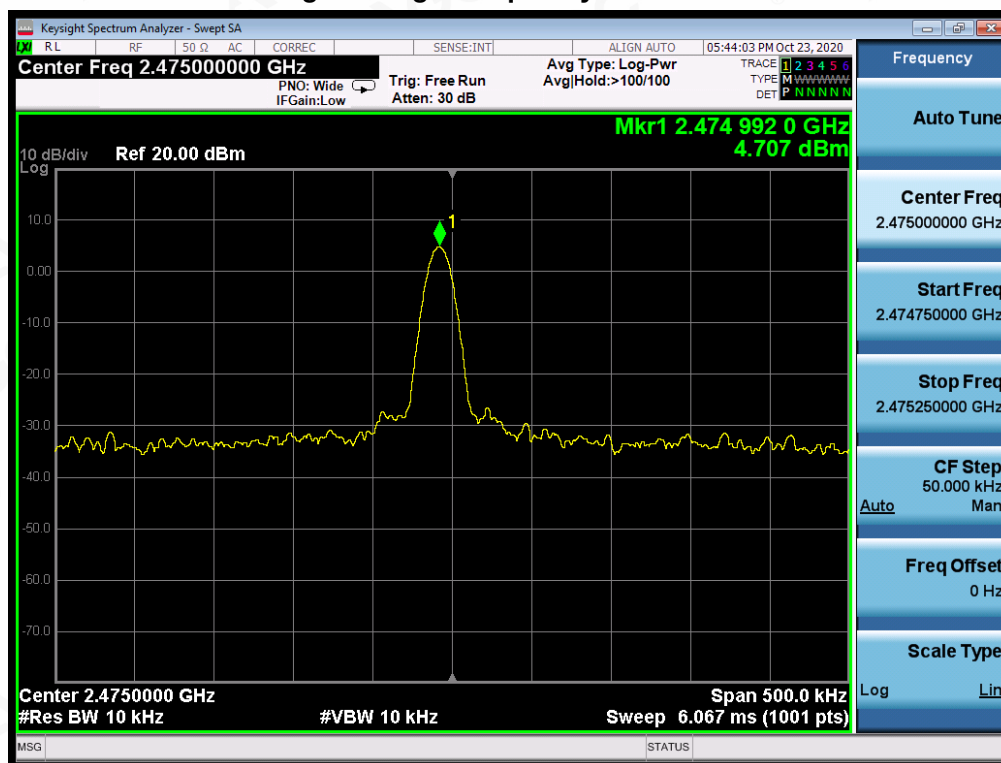


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High Voltage-Frequency Error CH39



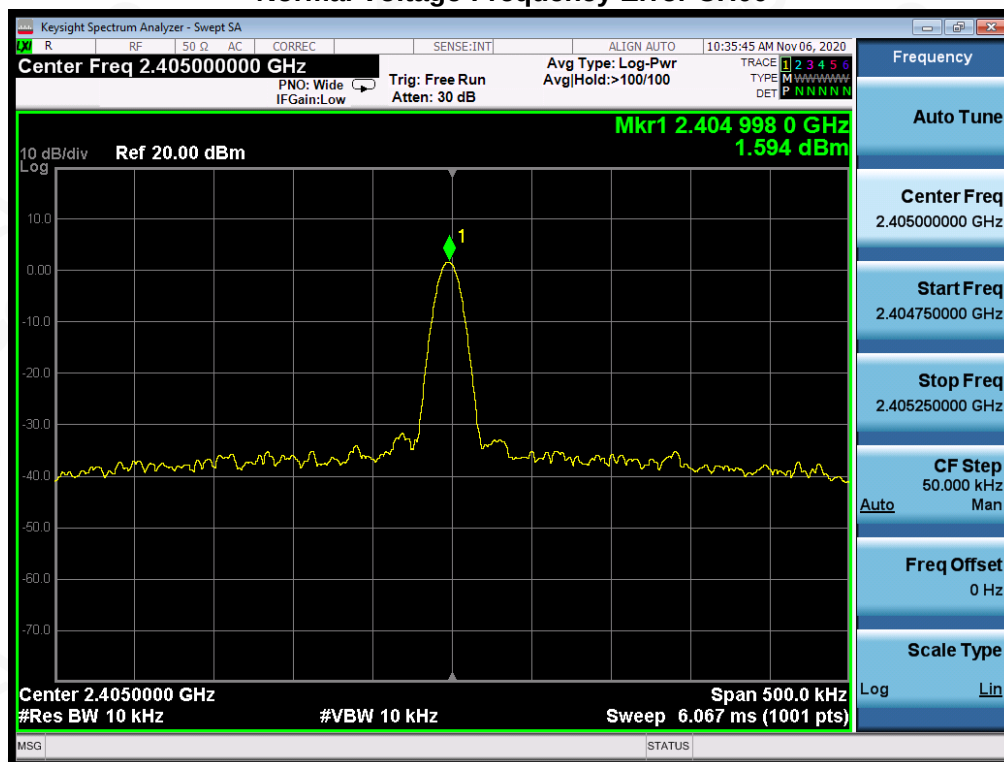
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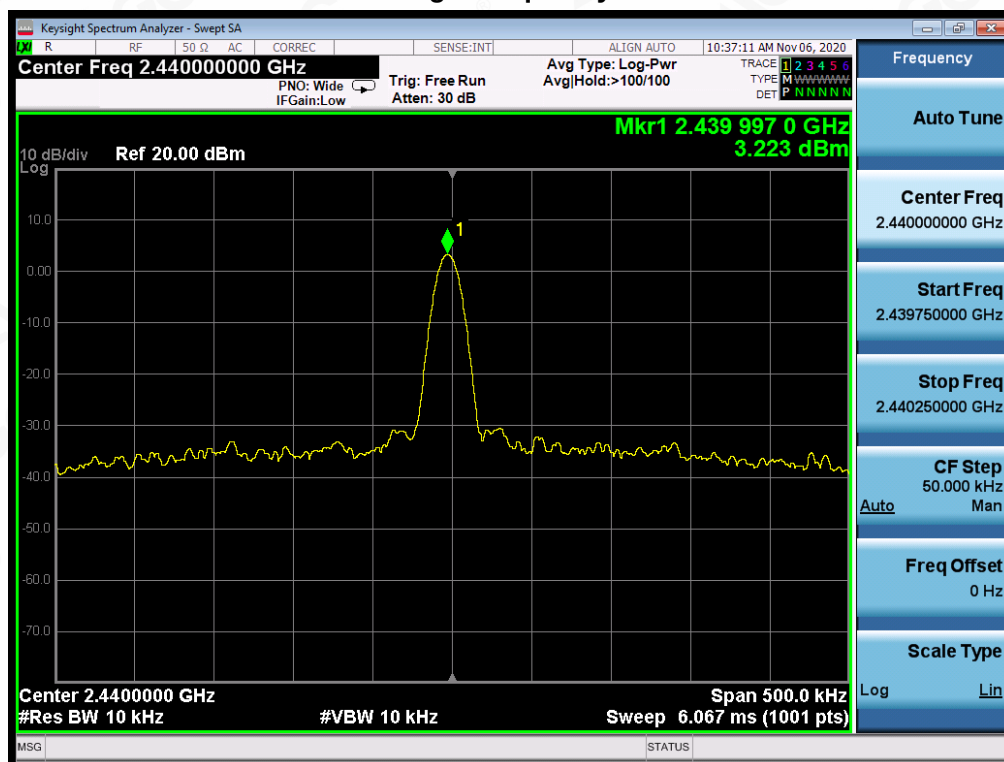


CRYSTAL B

Normal Voltage-Frequency Error CH00



Normal Voltage-Frequency Error CH19

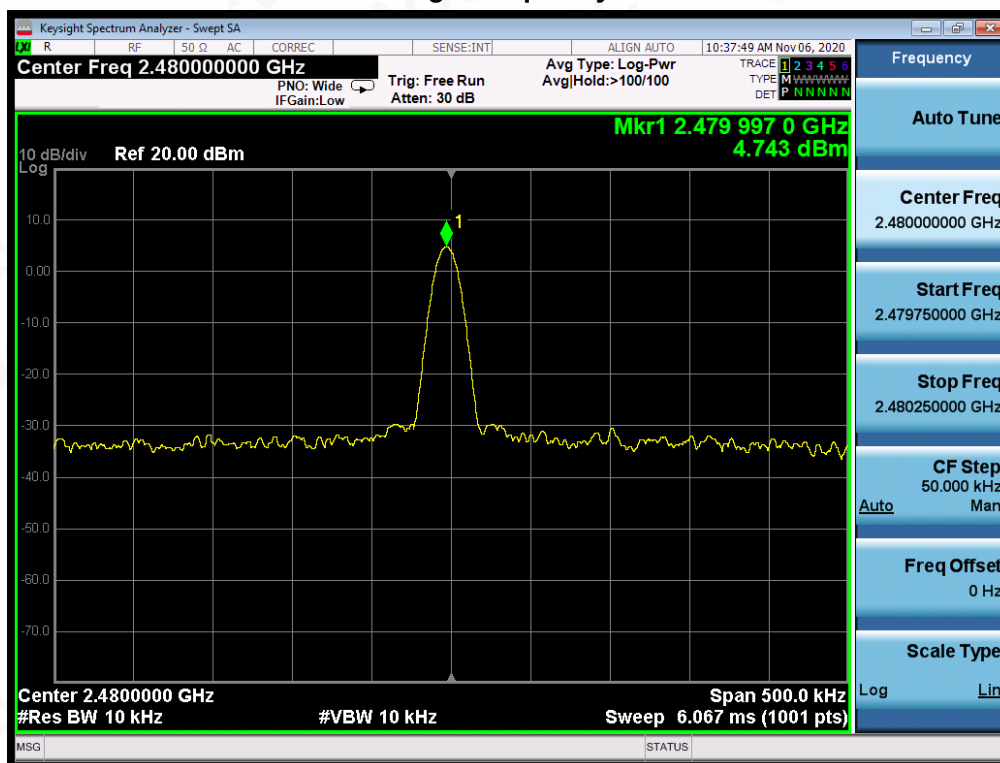


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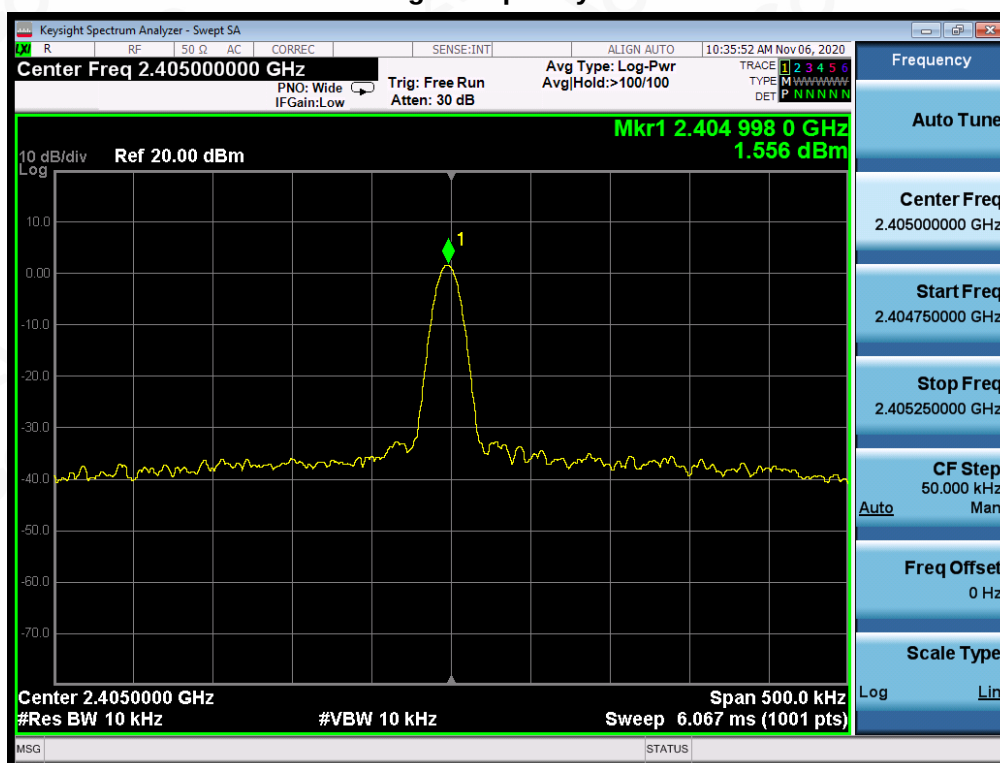
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Normal Voltage-Frequency Error CH39



Low Voltage-Frequency Error CH00

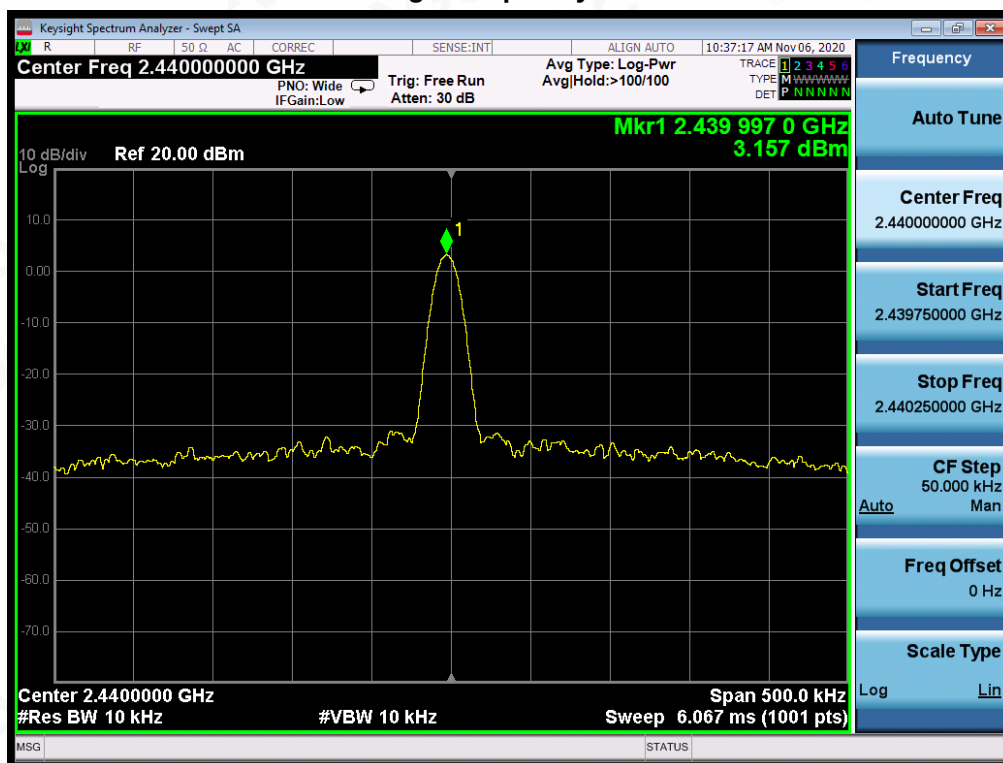


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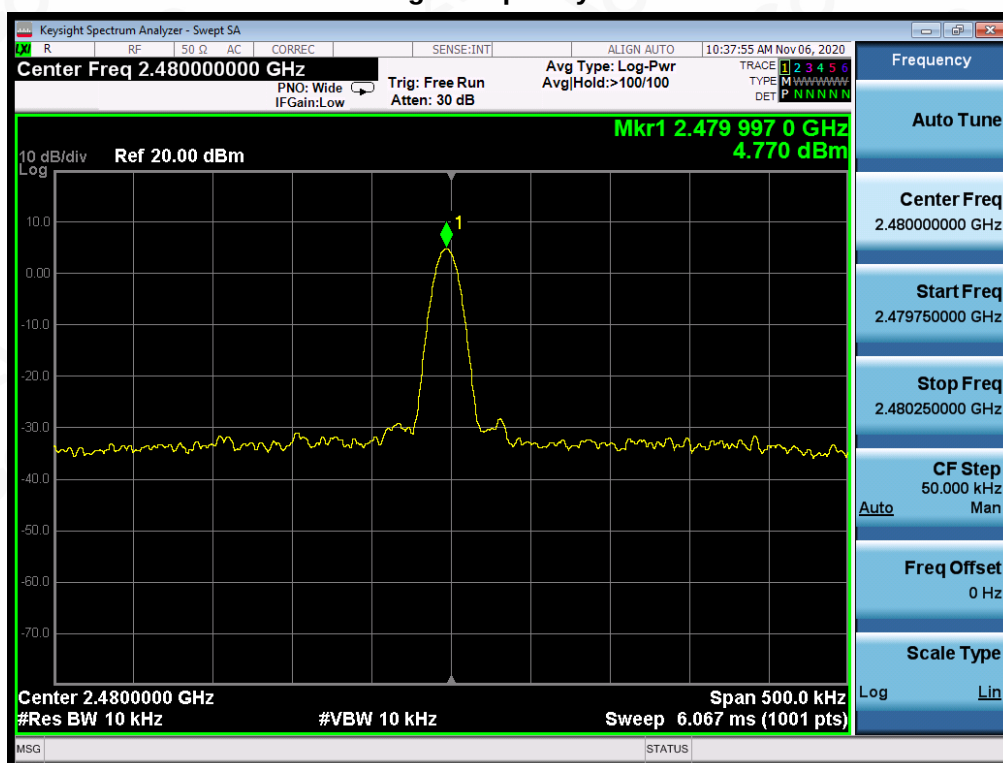
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Low Voltage-Frequency Error CH19



Low Voltage-Frequency Error CH39

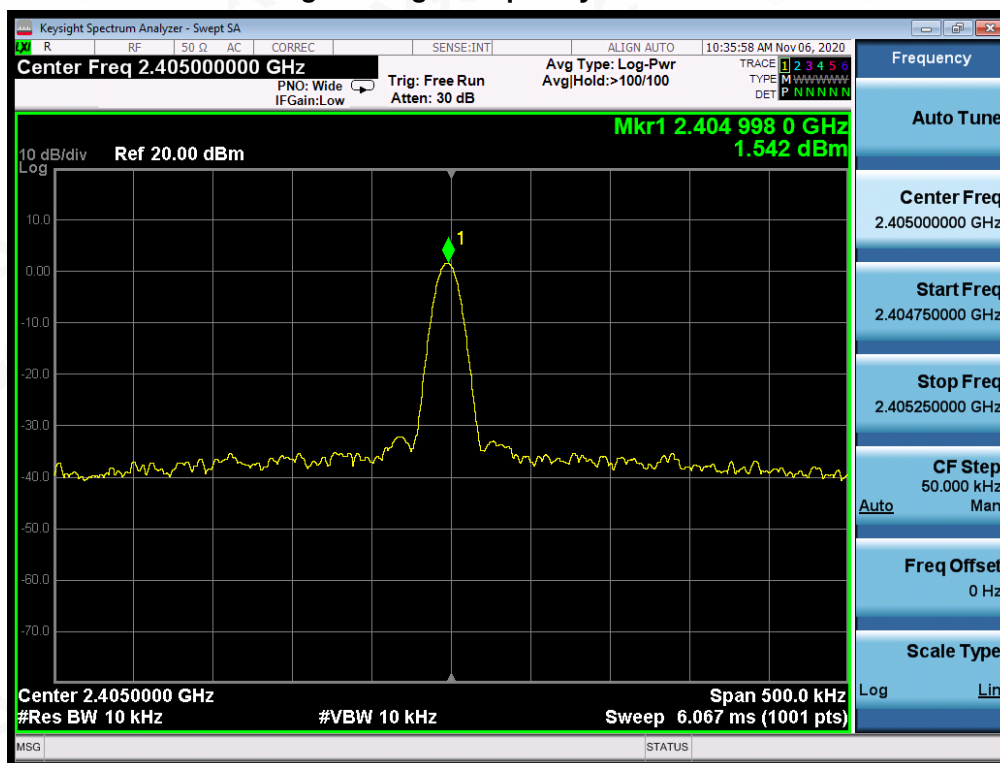


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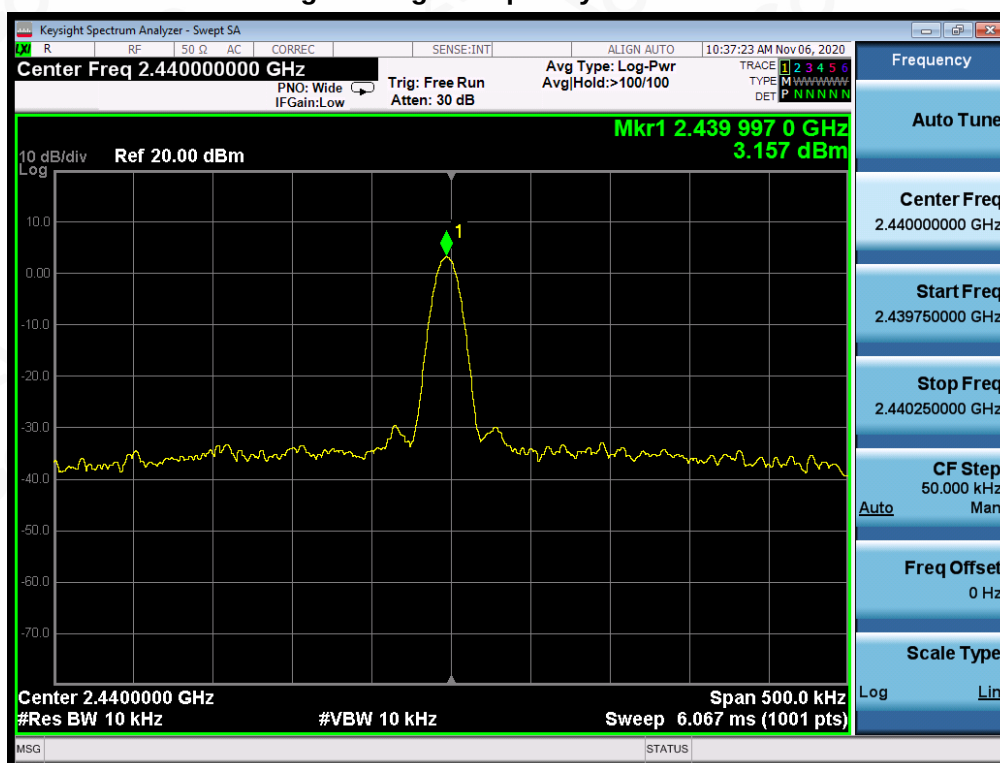
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High Voltage-Frequency Error CH00



High Voltage-Frequency Error CH19

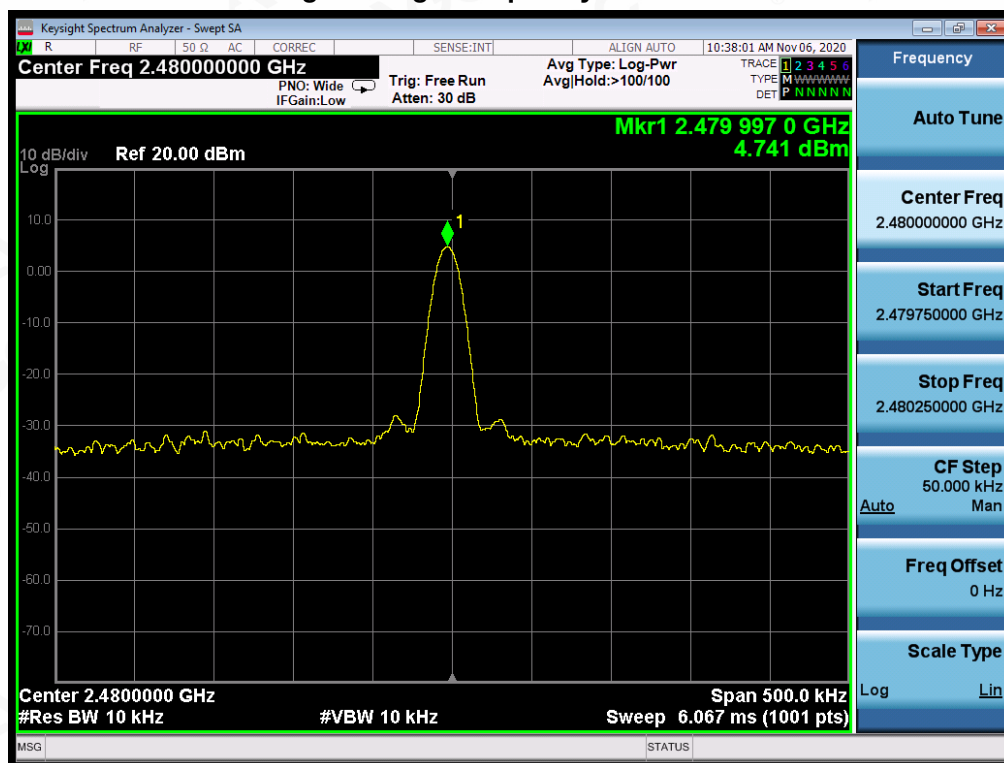


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5.2. OCCUPIED BANDWIDTH AND SPREAD-SPECTRUM BANDWIDTH MEASUREMENT

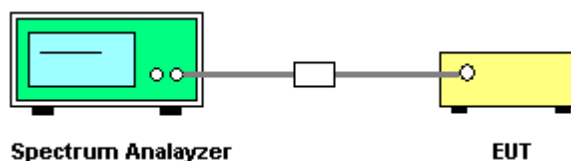
5.2.1. LIMIT

Item	Limits
Occupied Band Width	FH 83.5MHz; $26\text{MHz} \leq \text{OFDM 40M system} \leq 40\text{MHz}$; OFDM 20M system, DS, Others $\leq 26\text{MHz}$
Spreading Bandwidth	$\geq 500 \text{ kHz}$ (FH, DS)

5.2.2. TEST PROCEDURES

- Setting of SA is following as: RB: 30kHz / VB: 30kHz / SPAN: 3MHz / AT: 20dB Ref: 10dBm / Sweep time: Auto / Sweep Mode: Continuous sweep / Detect mode: Positive peak / Trace mode: Max hold
- EUT have transmitted the maximum modulation signal and fixed channelize.
SA set to 99% of occupied bandwidth to measure occupied bandwidth.
The limit is less than 26MHz.

5.2.3. TEST SETUP LAYOUT



5.2.4. TEST DEVIATION

There is no deviation with the original standard.

5.2.5. EUT OPERATION DURING TEST

The EUT was programmed to be in continuously transmitting mode.

5.2.6. RESULTS OF OCCUPIED BANDWIDTH AND SPREAD-SPECTRUM BANDWIDTH

EUT	NINA-B400	Test Date	Aug. 03, 2020
Temperature	25°C	Tested by	Erik
Humidity	55 % RH	Operation Mode	TX (CH00, CH07, CH15)

CRYSTAL A

Test Voltage	Test Frequency (MHz)	Occupied Bandwidth (MHz)
Normal Voltage	2405	2.255
	2440	2.255
	2480	2.275
Low Voltage	2405	2.248
	2440	2.257
	2480	2.280
High Voltage	2405	2.249
	2440	2.261
	2480	2.280

CRYSTAL B

Test Voltage	Test Frequency (MHz)	Occupied Bandwidth (MHz)
Normal Voltage	2402	2.249
	2440	2.269
	2480	2.275
Low Voltage	2402	2.250
	2440	2.265
	2480	2.283
High Voltage	2402	2.255
	2440	2.271
	2480	2.281

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CRYSTAL A

Normal Voltage-Occupied Bandwidth (99%)- CH00



Normal Voltage-Occupied Bandwidth (99%)- CH19



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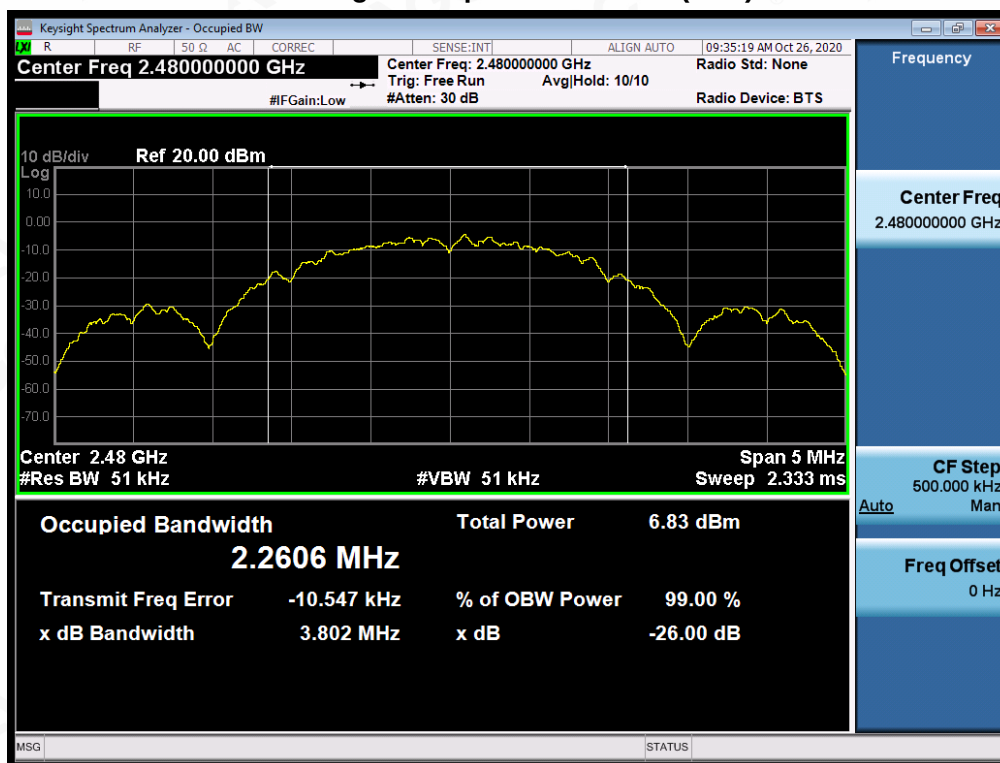
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Normal Voltage-Occupied Bandwidth (99%)- CH39



Low Voltage-Occupied Bandwidth (99%)- CH00

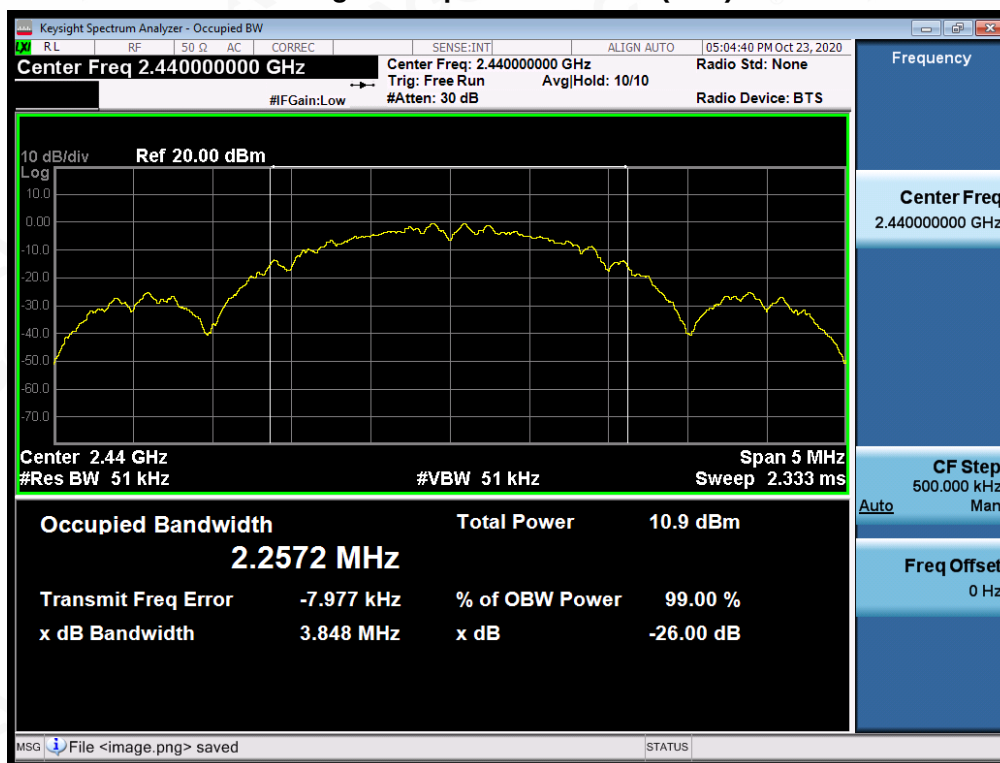


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Low Voltage-Occupied Bandwidth (99%)- CH19



Low Voltage-Occupied Bandwidth (99%)- CH39

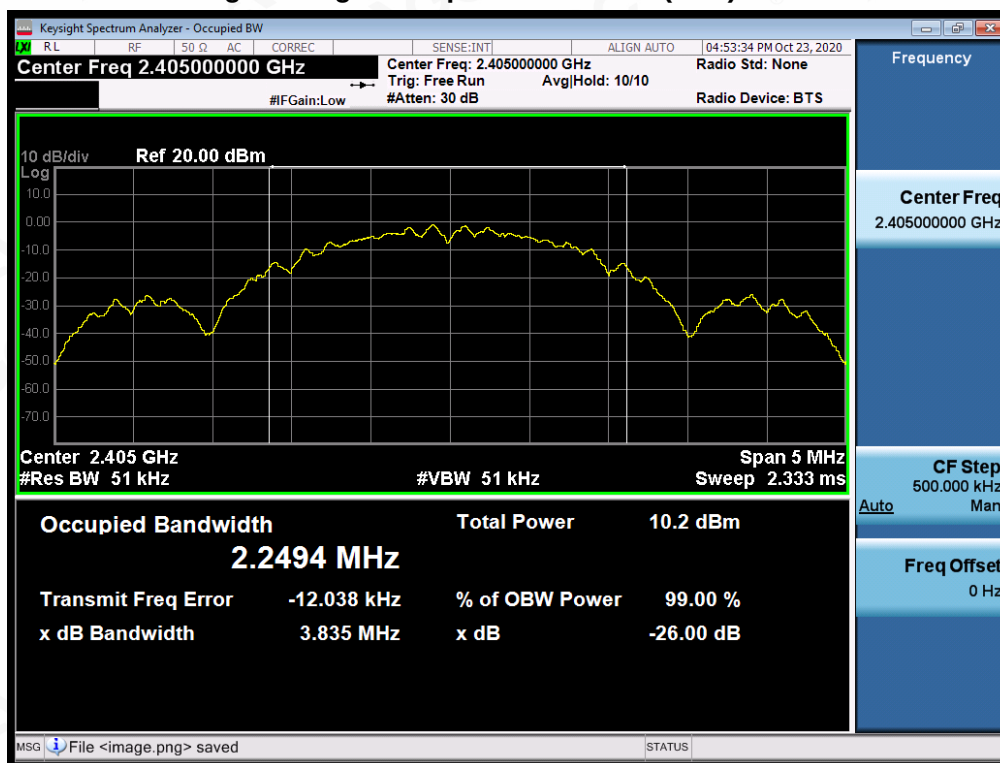


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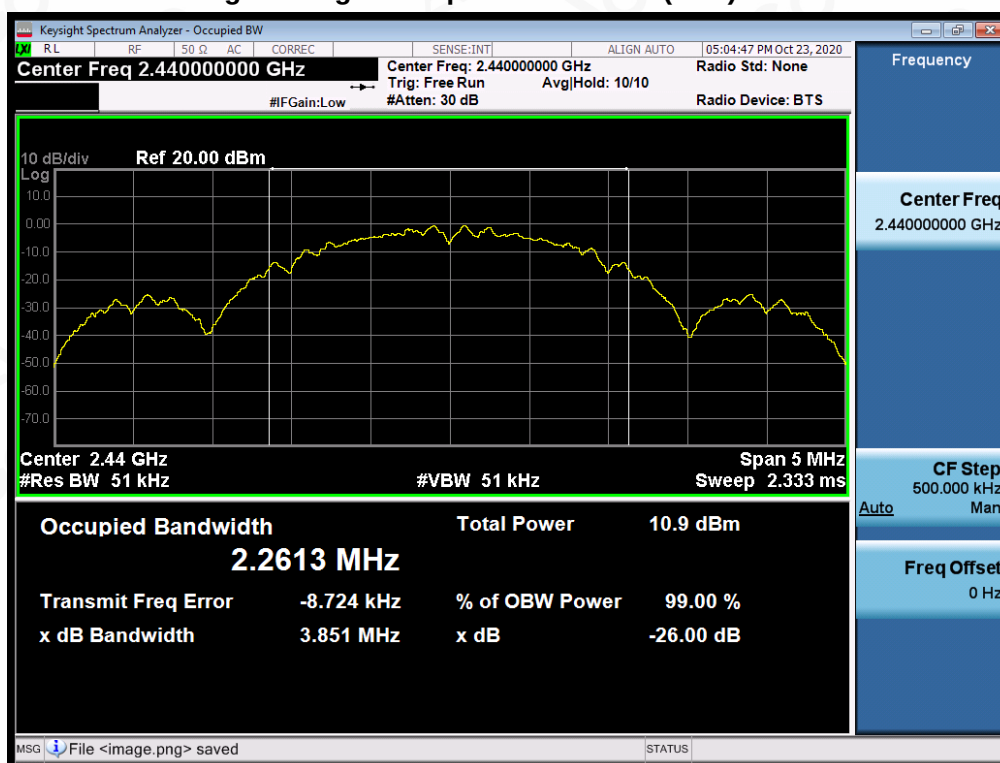
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High Voltage-Occupied Bandwidth (99%)- CH00



High Voltage-Occupied Bandwidth (99%)- CH19

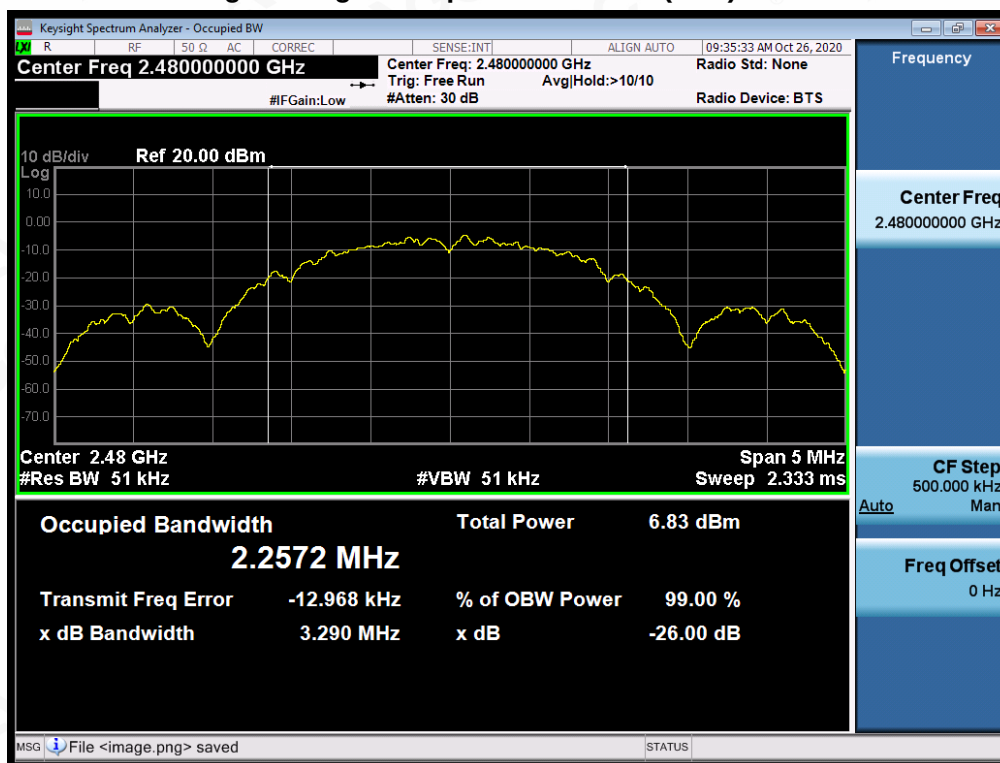


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High Voltage-Occupied Bandwidth (99%)- CH39



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CRYSTAL B

Normal Voltage-Occupied Bandwidth (99%)- CH00



Normal Voltage-Occupied Bandwidth (99%)- CH19

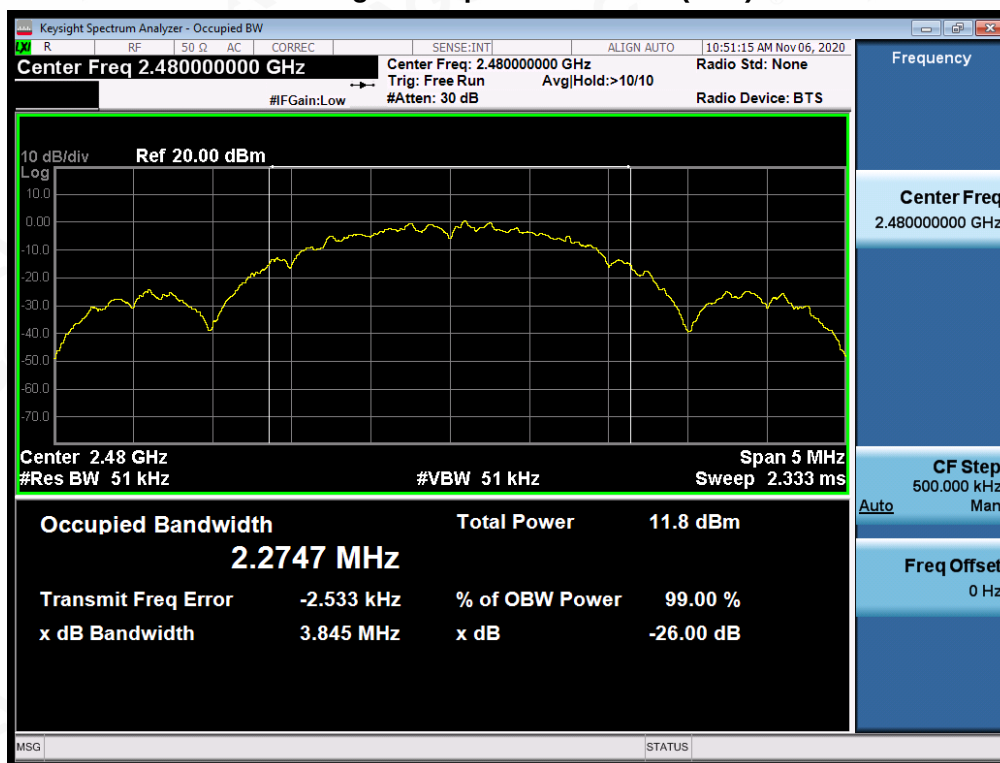


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Normal Voltage-Occupied Bandwidth (99%)- CH39



Low Voltage-Occupied Bandwidth (99%)- CH00



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Low Voltage-Occupied Bandwidth (99%)- CH19



Low Voltage-Occupied Bandwidth (99%)- CH39

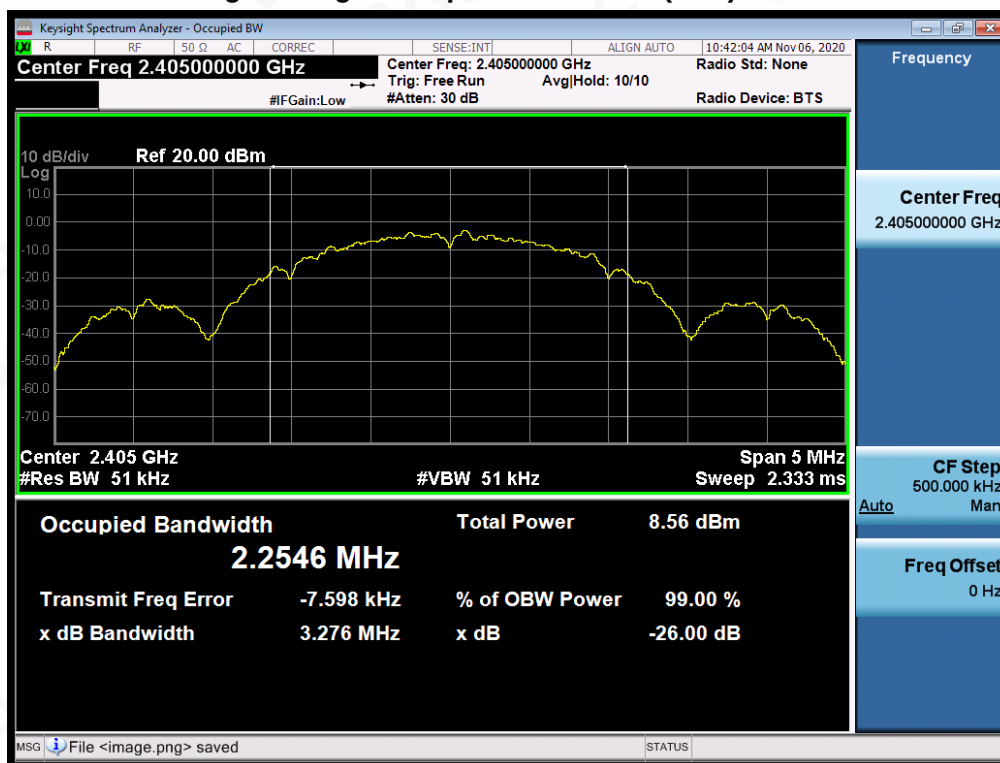


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High Voltage-Occupied Bandwidth (99%)- CH00



High Voltage-Occupied Bandwidth (99%)- CH19



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5.3. UNWANTED EMISSION INTENSITY MEASUREMENT

5.3.1 LIMIT

Item	Limits
TX Spurious Emission(2400~2483.5MHz)	$\leq 2.5\mu\text{W/MHz}$ ($30\text{MHz} \leq f \leq 1000\text{MHz}$)
	$\leq 2.5\mu\text{W/MHz}$ ($1000\text{MHz} < f \leq 2387\text{MHz}$)
	$\leq 25\mu\text{W/MHz}$ ($2387\text{MHz} < f \leq 2400\text{MHz}$)
	$\leq 25\mu\text{W/MHz}$ ($2483.5\text{MHz} \leq f < 2496.5\text{MHz}$)
	$\leq 2.5\mu\text{W/MHz}$ ($2496.5\text{MHz} \leq f < 12500\text{MHz}$)

5.3.2. MEASURING INSTRUMENTS AND SETTING

The following table is the setting of spectrum analyzer.

Spectrum Parameter	Setting
RB / VB	Below 1GHz RB:100KHz / VB:100KHz Above 1GHz RB:1MHz / VB:1MHz
Detector	Peak
Trace	Max Hold
Sweep Time	Auto

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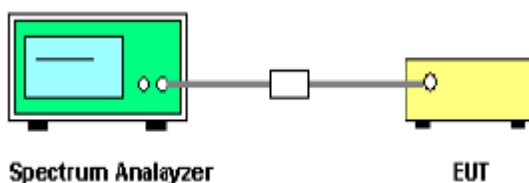
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5.3.3. TEST PROCEDURES

1. EUT have transmitted the maximum modulation signal and fixed channelize.
2. Setting of SA is following as: Below 1GHz RB: 100KHz / VB: 100KHz
Above 1GHz RB: 1MHz / VB:1MHz / AT: 20dB Ref:10dBm / Sweep time: Auto
Sweep Mode: Continuous sweep / Detect mode: Positive peak
Trace mode: Max hold
3. Setting of SA is following as 30MHz and stop frequency 1000MHz Then to mark peak reading value + cable loss shall be less than 0.25μW.
4. Setting of SA is following as 1000MHz and stop frequency 2387MHz Then to mark peak reading value + cable loss shall be less than 2.5μW.
5. SA adjusted to start frequency 2387MHz and stop frequency 2400MHz. Then to mark peak reading value + cable loss shall be less than 25μW.
6. SA adjusted to start frequency 2483.5MHz and stop frequency 2496.5MHz Then to mark peak reading value + cable loss shall be less than 25μW
7. SA adjusted to start frequency 2496.5MHz and stop frequency 12500MHz Then to mark peak reading value + cable loss shall be less than 2.5μW
8. Measure side band spurious as follows: For 2.4GHz band: 2374MHz~2400MHz and 2483.5MHz~2509.5MHz RBW = VBW = 30kHz, Result Value = Measured_ Value + 15.2 [dBm]
9. If the Result Value is over the requirement, take total sum of 1MHz band centered at the spur frequency like ACLP measurement as Result Value.

5.3.4. TEST SETUP LAYOUT



5.3.5. TEST DEVIATION

There is no deviation with the original standard.

5.3.6. EUT OPERATION DURING TEST

The EUT was programmed to be in continuously transmitting mode.

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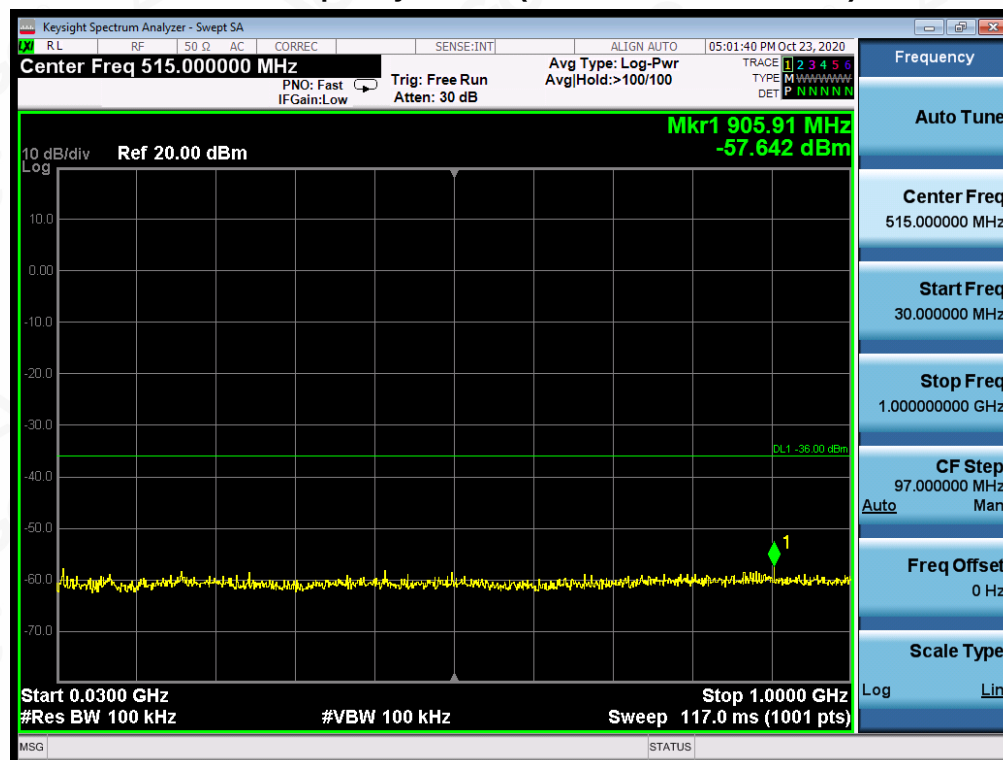
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5.3.7. TEST RESULT OF UNWANTED EMISSION INTENSITY

EUT	NINA-B400	Test Date	Aug. 03, 2020
Temperature	25°C	Tested by	Erik
Humidity	55 % RH	Test Voltage	Normal Voltage
Operation Mode	TX (CH00, CH07, CH15)		

CH 00- Frequency Band 1 (30 MHz ≤ f ≤ 1000 MHz)

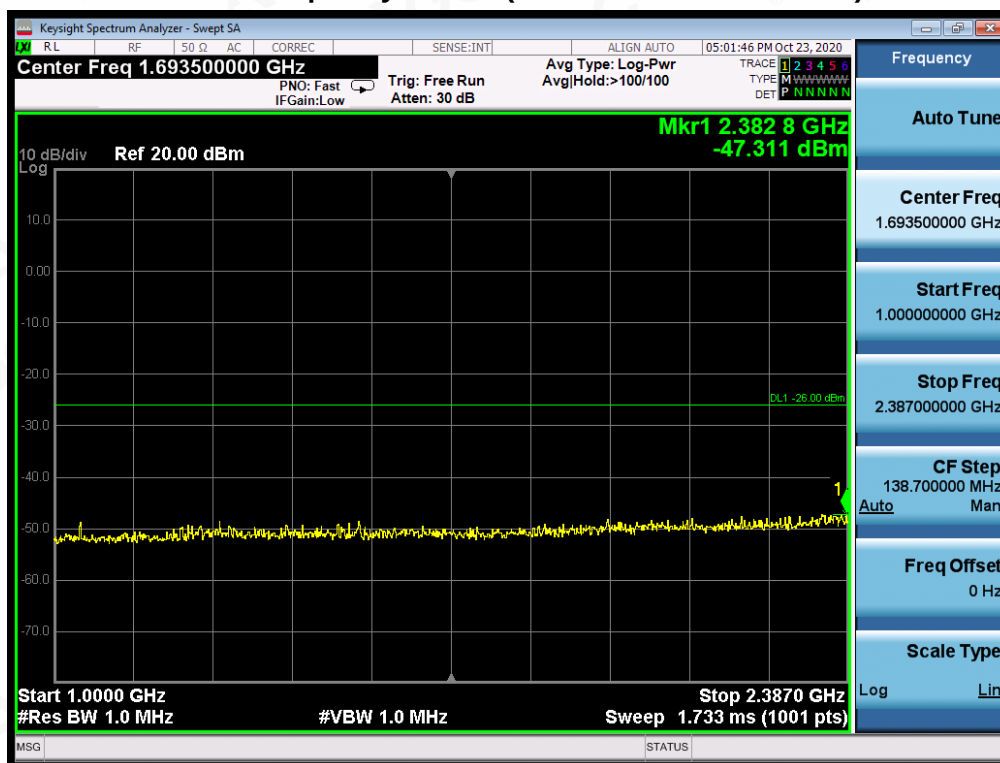


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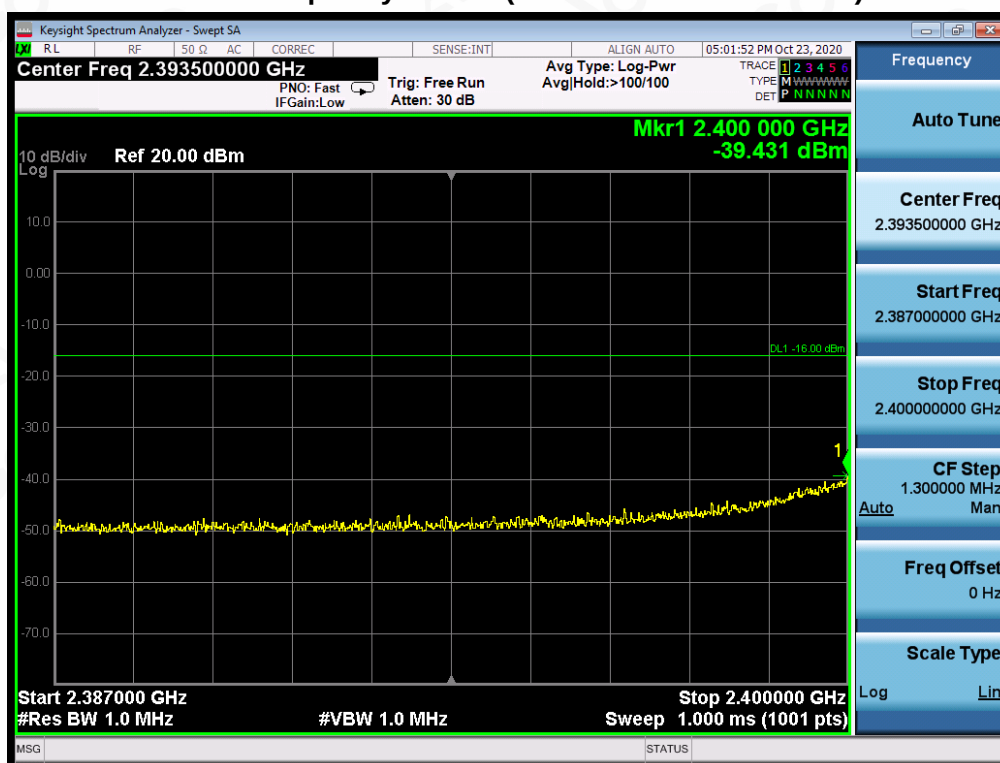
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CH 00- Frequency Band 2 (1000 MHz < f ≤ 2387 MHz)



CH 00- Frequency Band 3 (2387 MHz < f ≤ 2400 MHz)

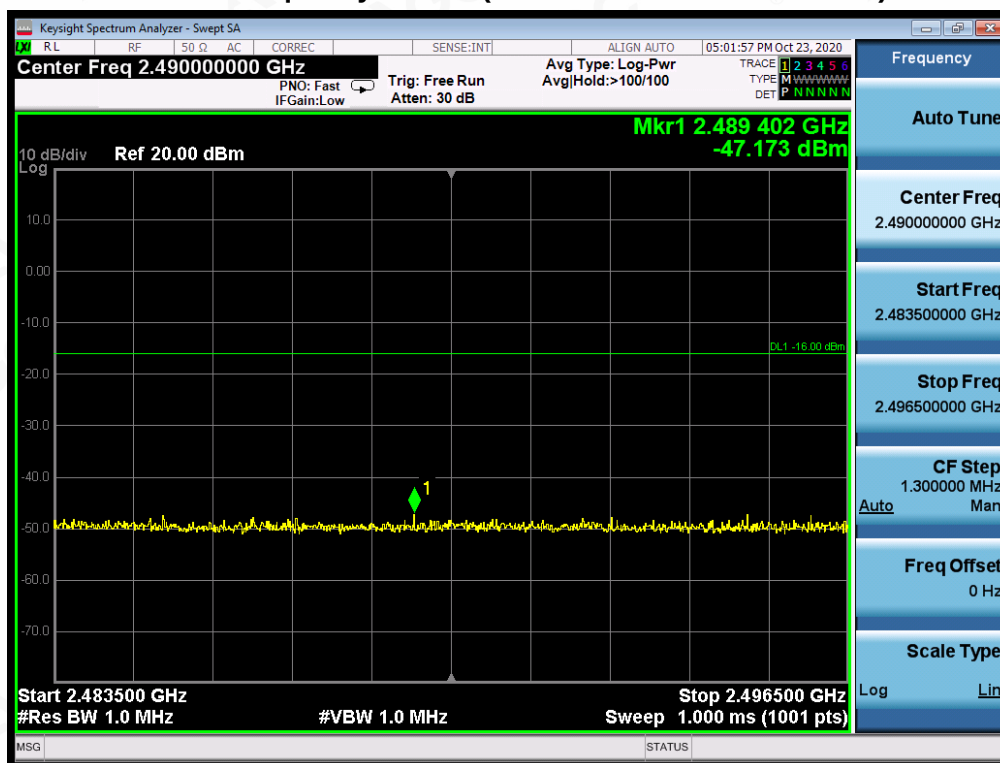


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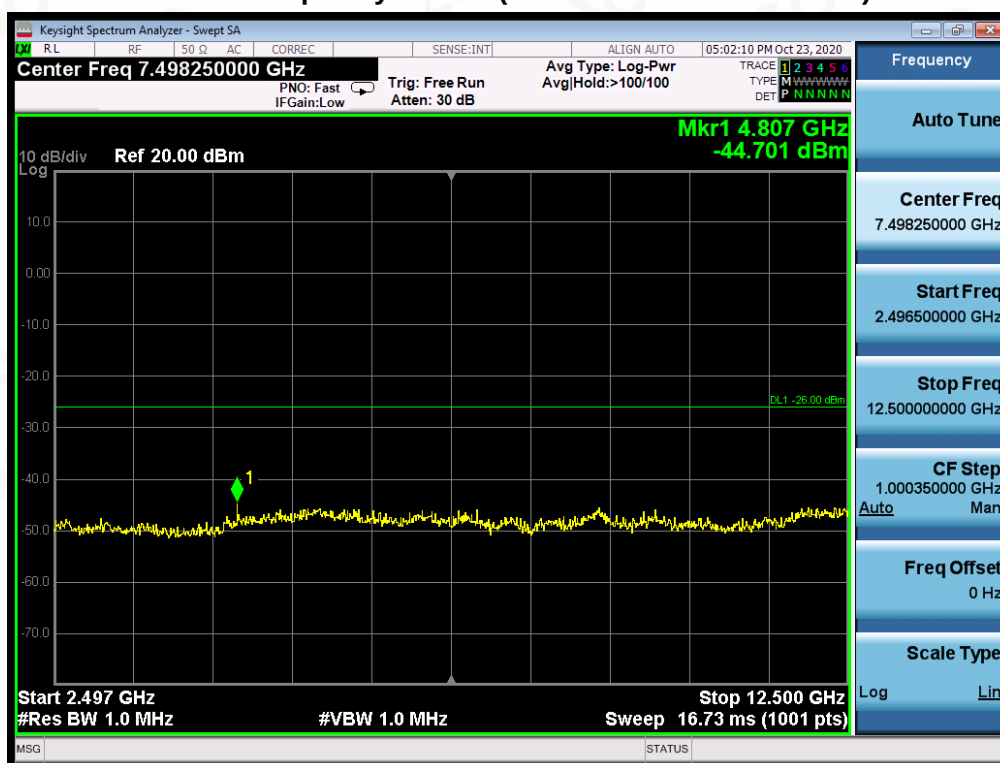
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CH 00- Frequency Band 4 (2483.5 MHz $\leq$ f < 2496.5 MHz)



CH 00- Frequency Band 5 (2496.5 MHz $\leq$ f < 12.5 GHz)

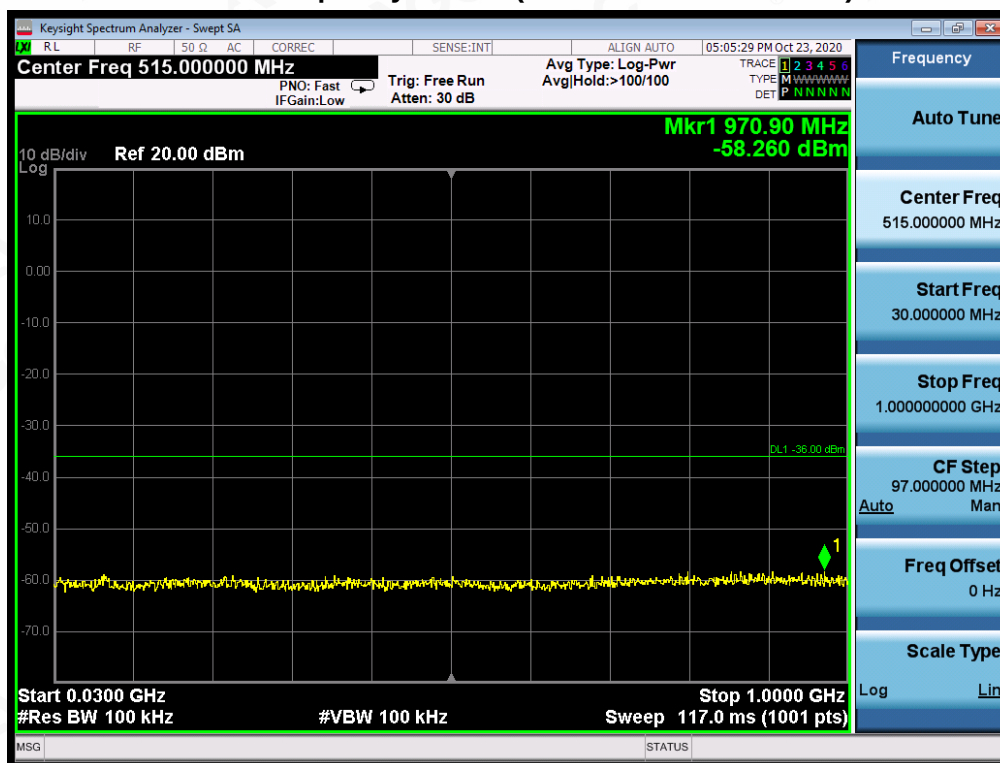


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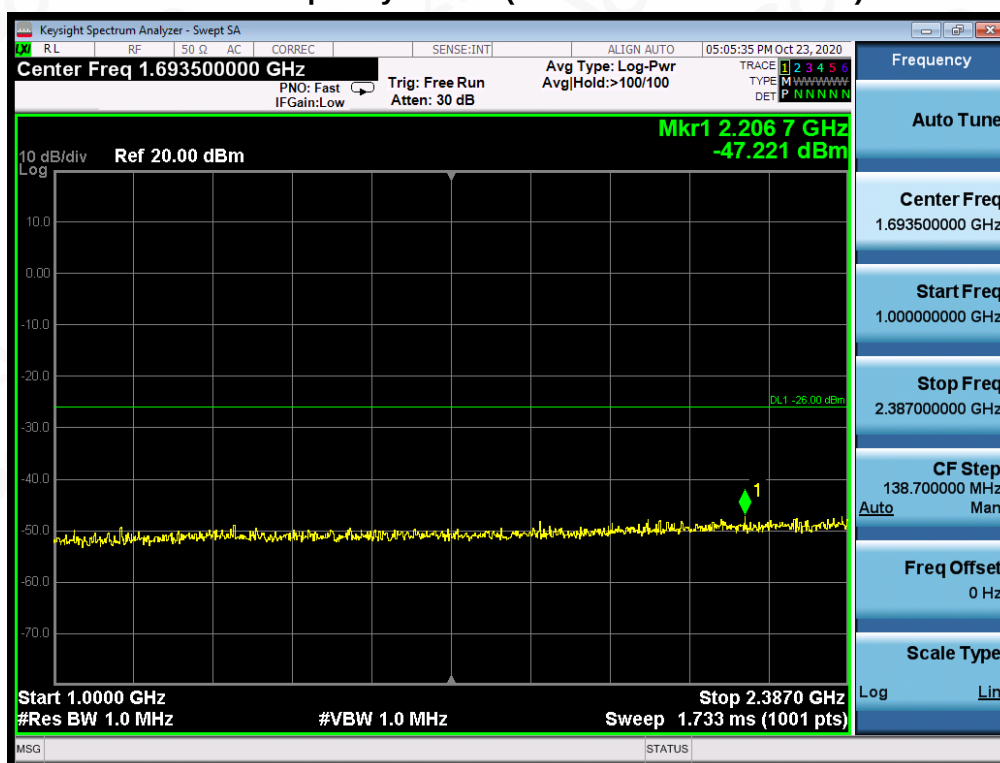
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CH 19- Frequency Band 1 (30 MHz $\leq$ f $\leq$ 1000 MHz)



CH 19- Frequency Band 2 (1000 MHz < f $\leq$ 2387 MHz)

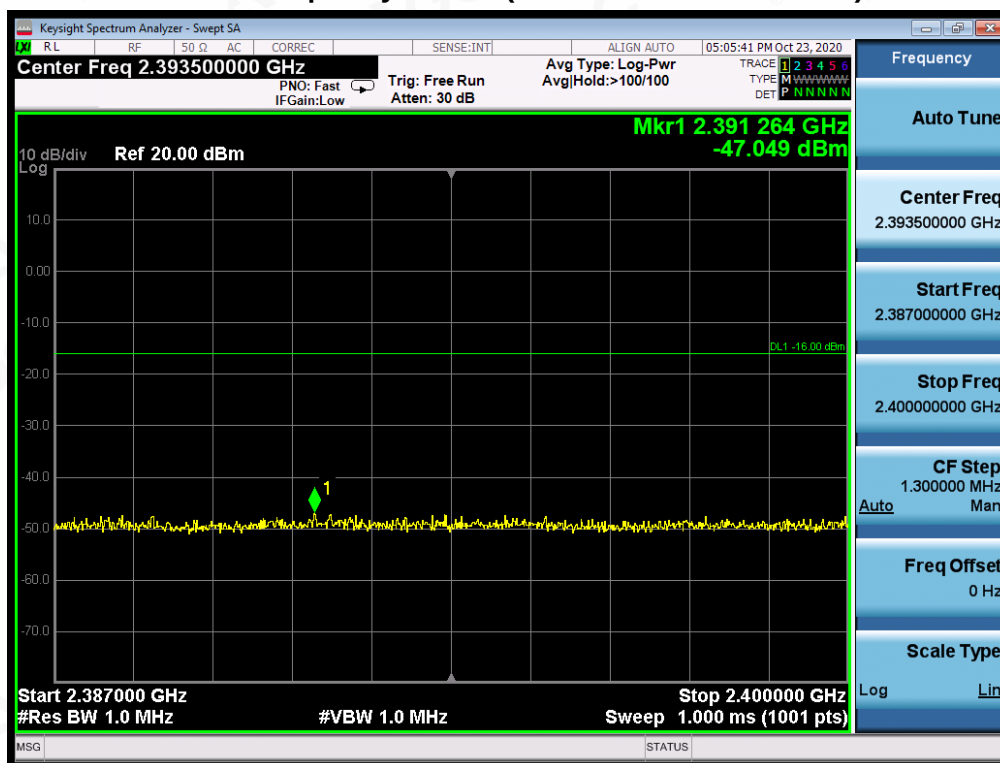


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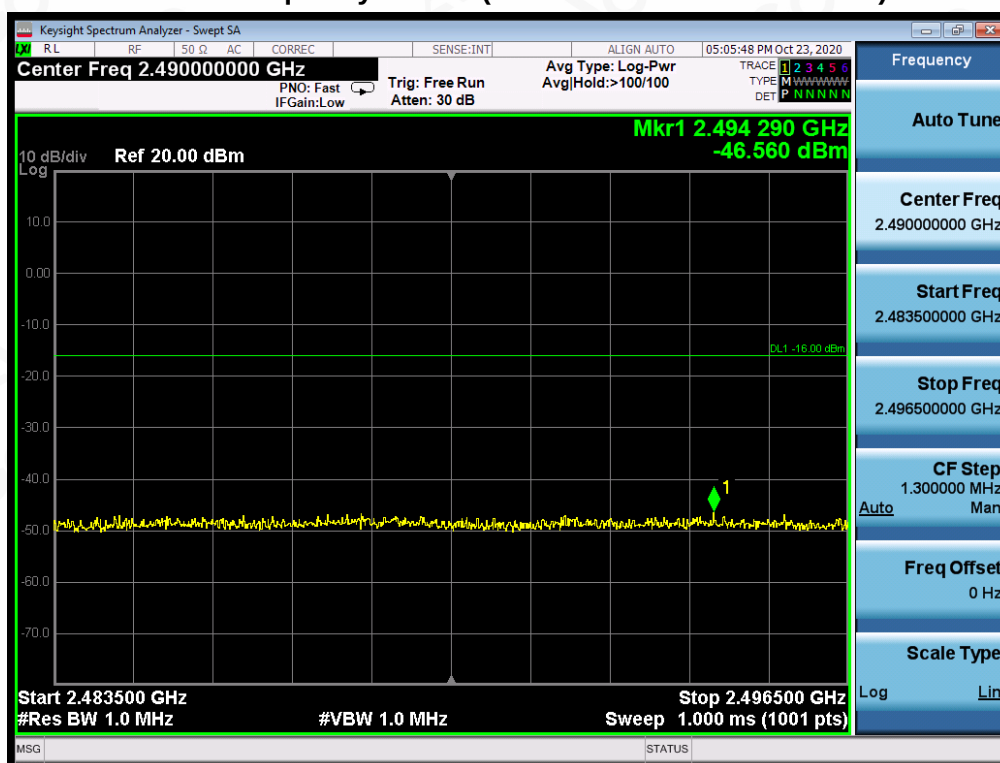
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CH 19- Frequency Band 3 (2387 MHz < f ≤ 2400 MHz)



CH 19- Frequency Band 4 (2483.5 MHz ≤ f < 2496.5 MHz)

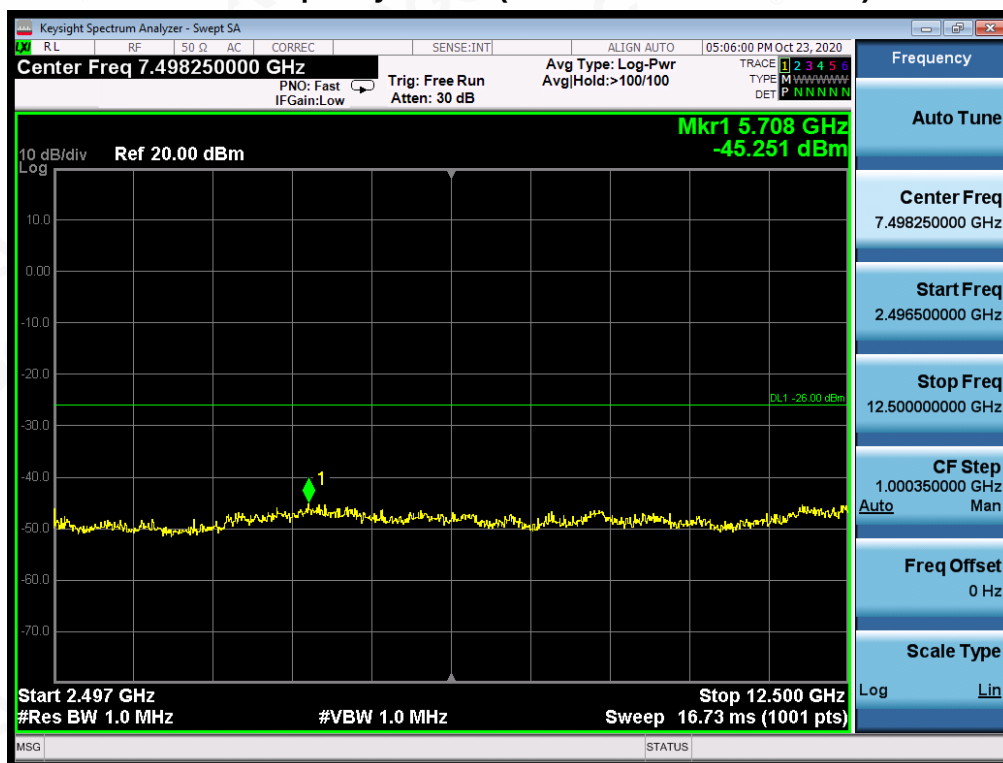


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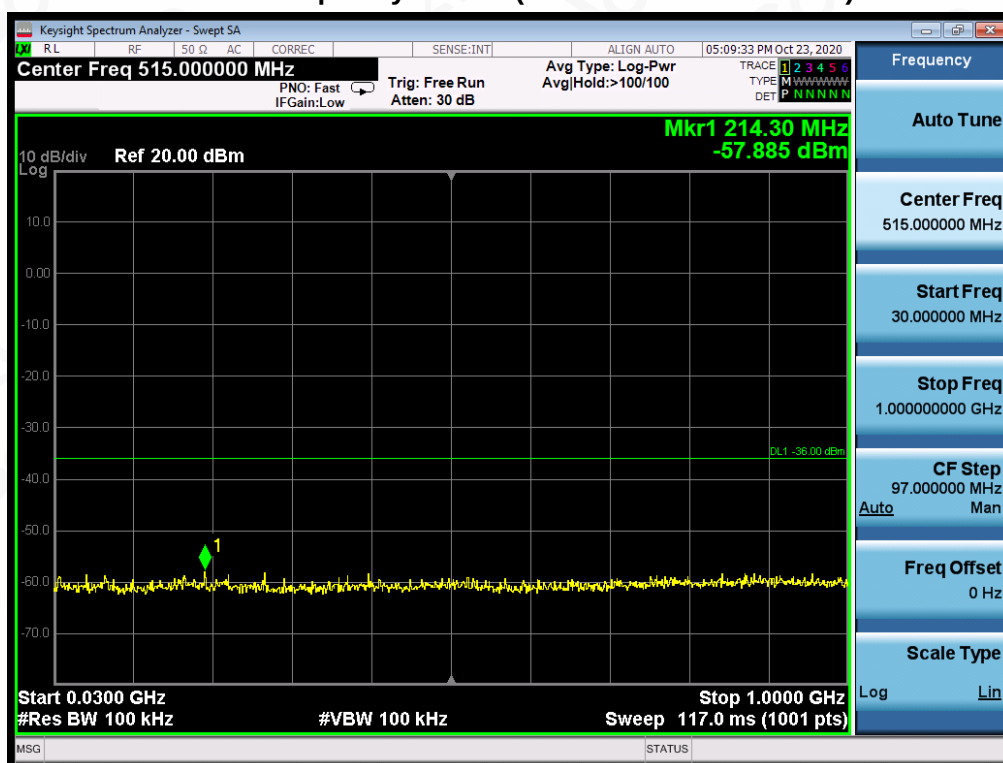
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CH 19- Frequency Band 5 ($2496.5 \text{ MHz} \leq f < 12.5 \text{ GHz}$)



CH 39- Frequency Band 1 ($30 \text{ MHz} \leq f \leq 1000 \text{ MHz}$)

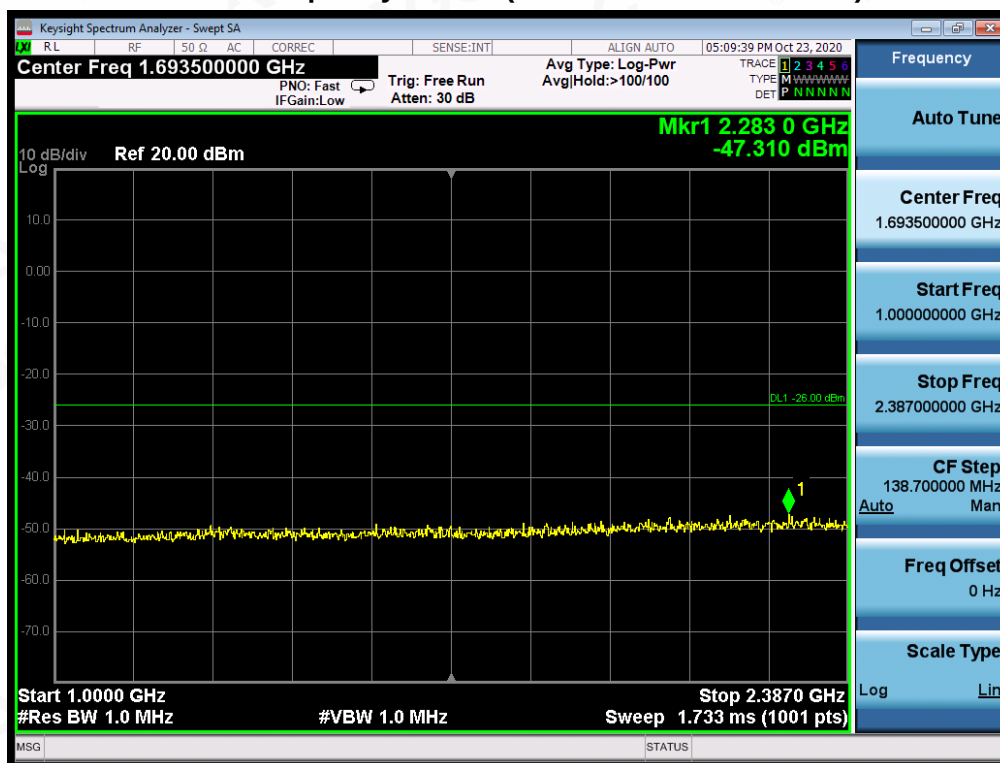


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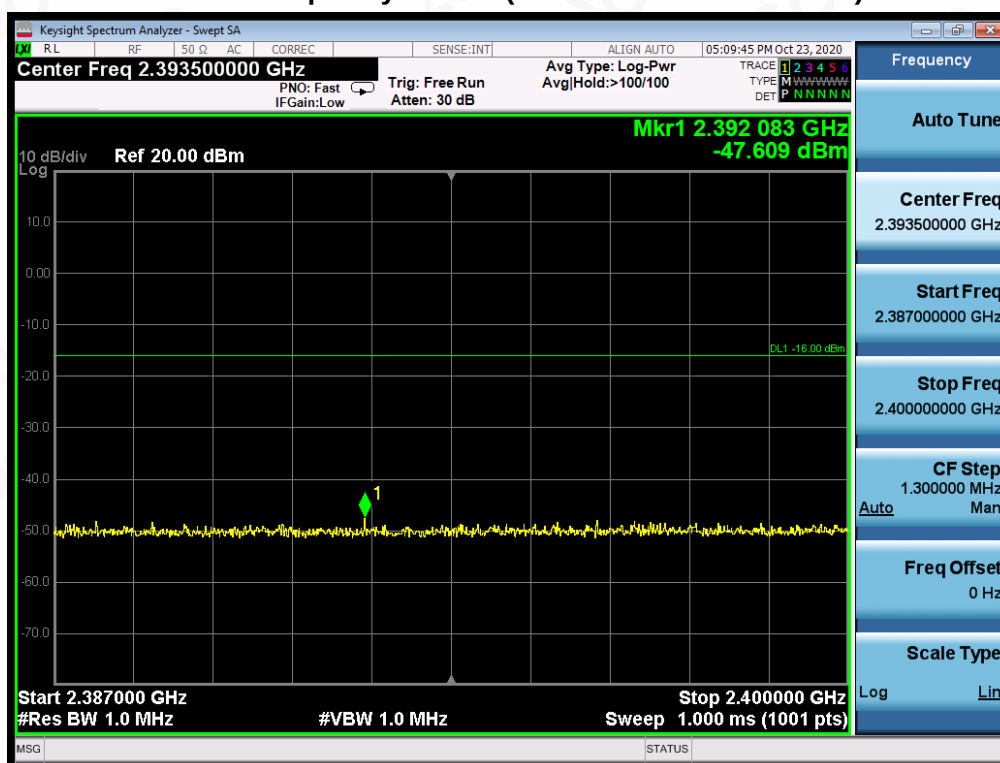
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CH 39- Frequency Band 2 (1000 MHz < f ≤ 2387 MHz)



CH 39- Frequency Band 3 (2387 MHz < f ≤ 2400 MHz)

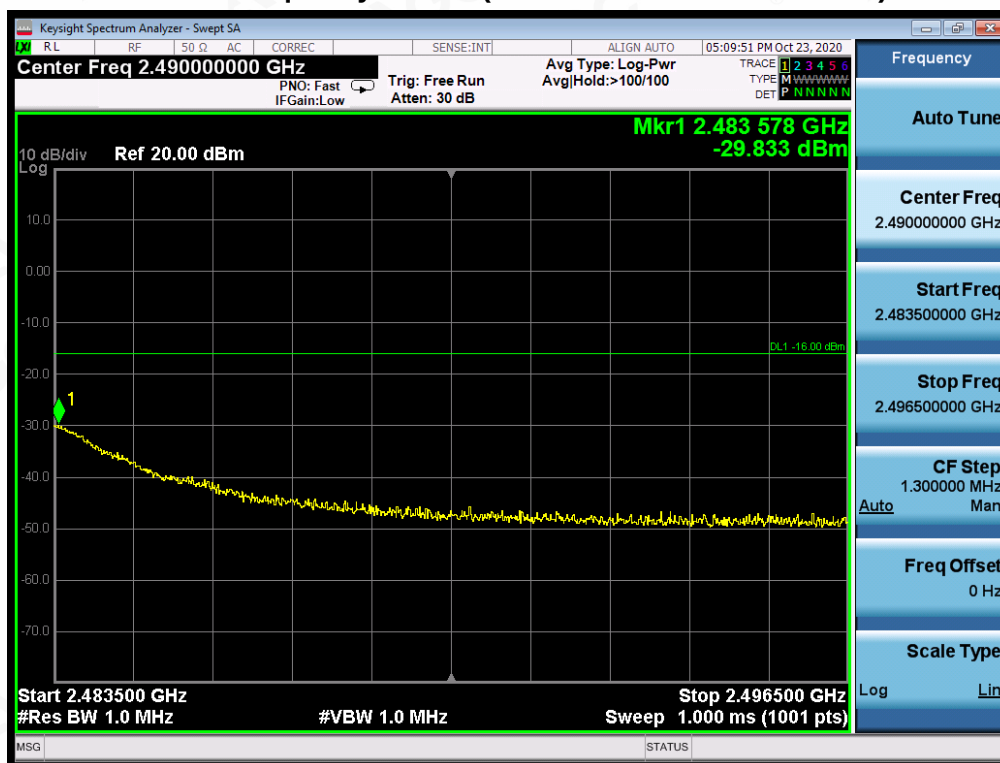


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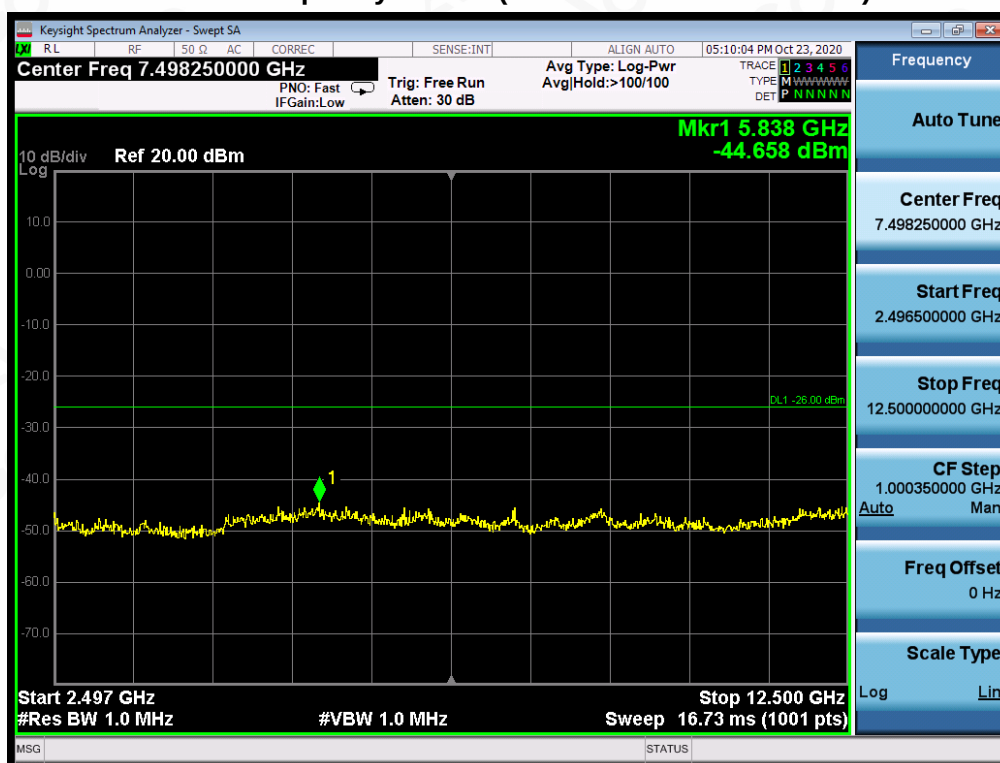
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CH 39- Frequency Band 4 (2483.5 MHz $\leq$ f < 2496.5 MHz)



CH 39- Frequency Band 5 (2496.5 MHz $\leq$ f < 12.5 GHz)



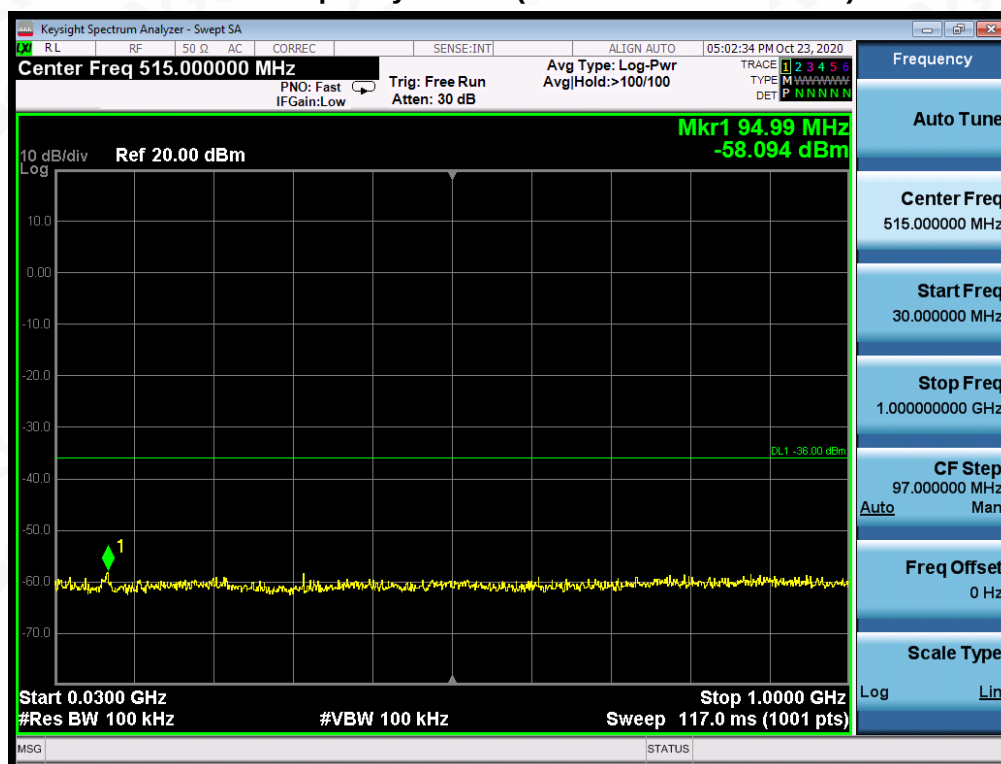
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EUT	NINA-B400	Test Date	Aug. 03, 2020
Temperature	25°C	Tested by	Erik
Humidity	55 % RH	Test Voltage	Low Voltage
Operation Mode	TX (CH00, CH07, CH15)		

CH 00- Frequency Band 1 (30 MHz $\leq$ f $\leq$ 1000 MHz)

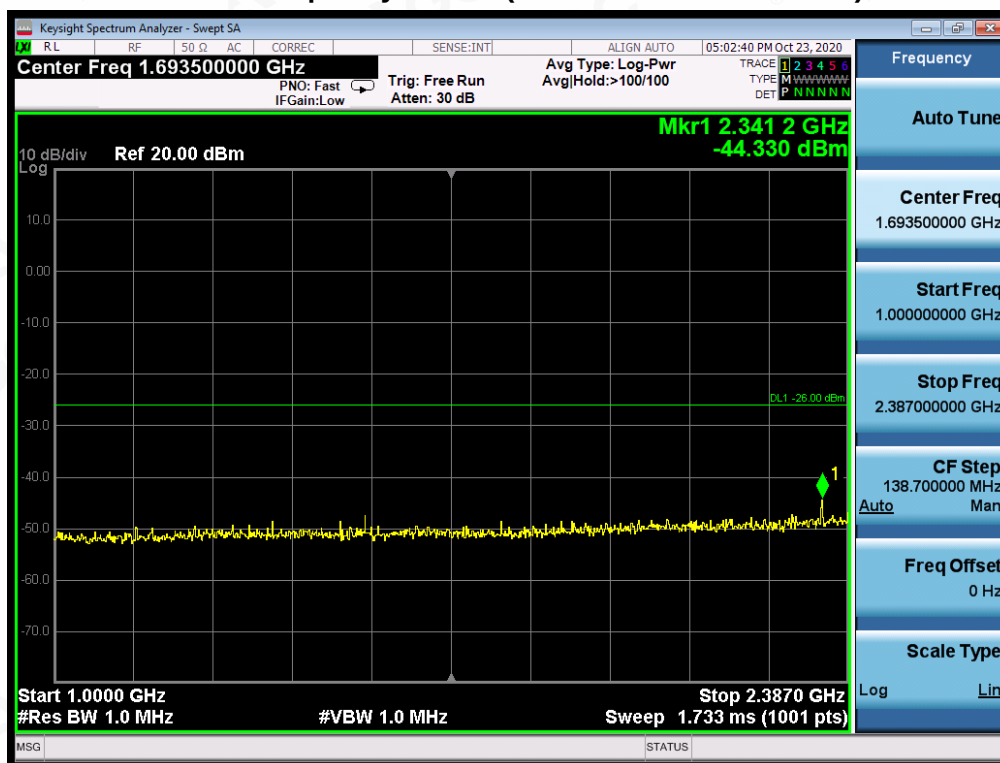


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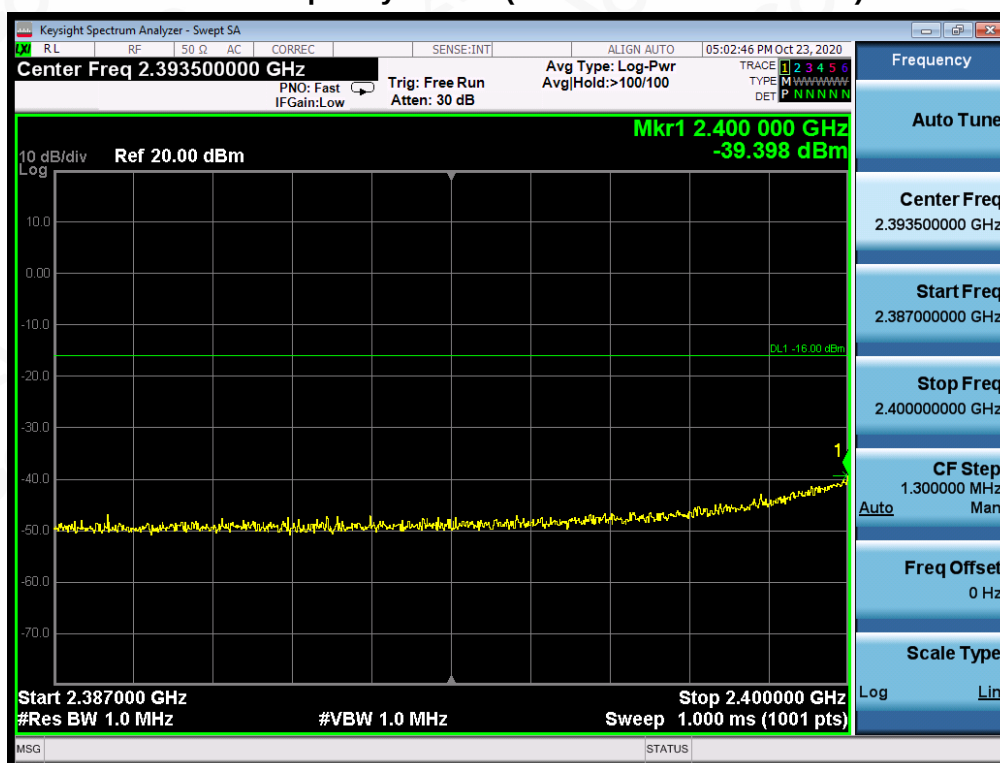
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CH 00- Frequency Band 2 (1000 MHz < f ≤ 2387 MHz)



CH 00- Frequency Band 3 (2387 MHz < f ≤ 2400 MHz)

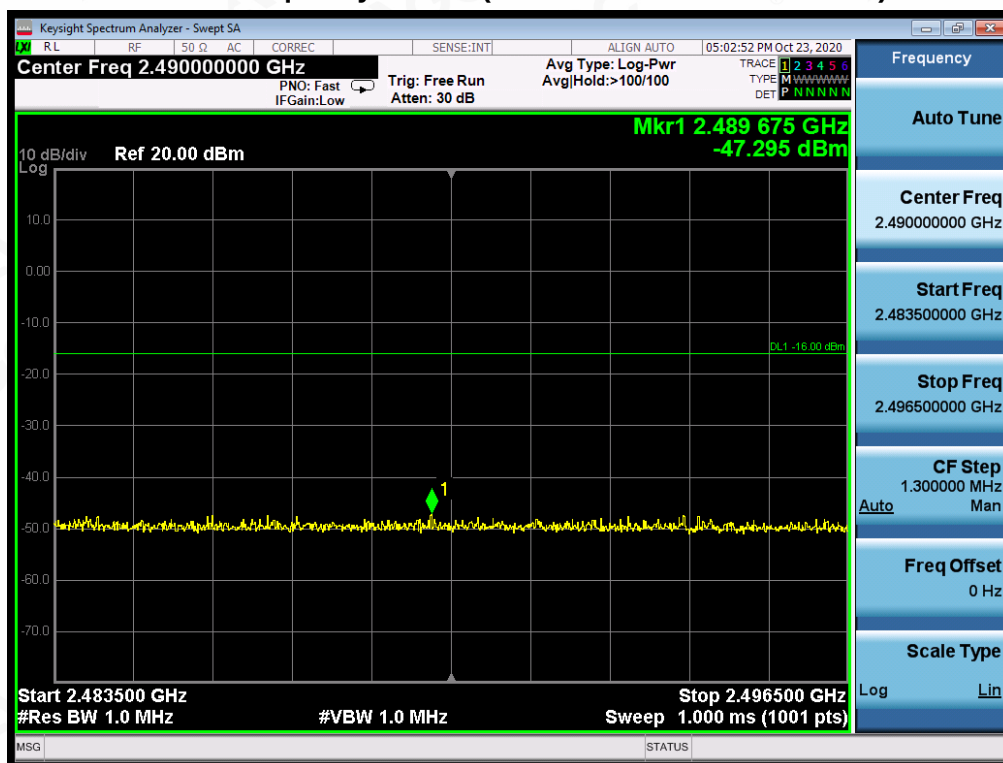


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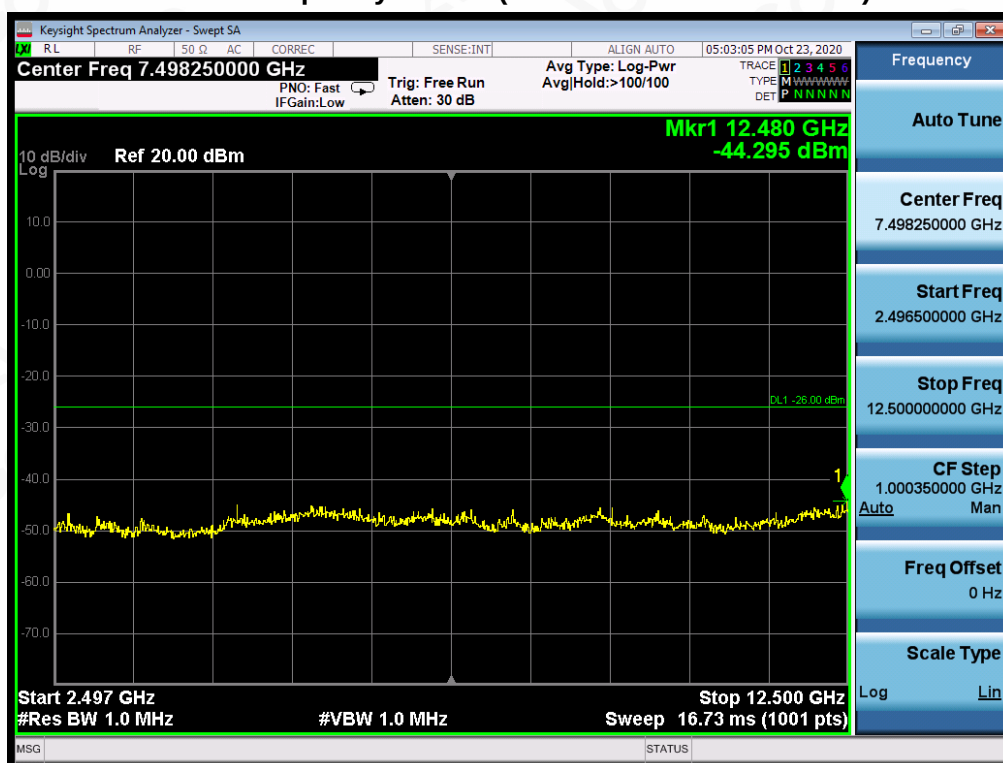
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CH 00- Frequency Band 4 (2483.5 MHz $\leq$ f < 2496.5 MHz)



CH 00- Frequency Band 5 (2496.5 MHz $\leq$ f < 12.5 GHz)

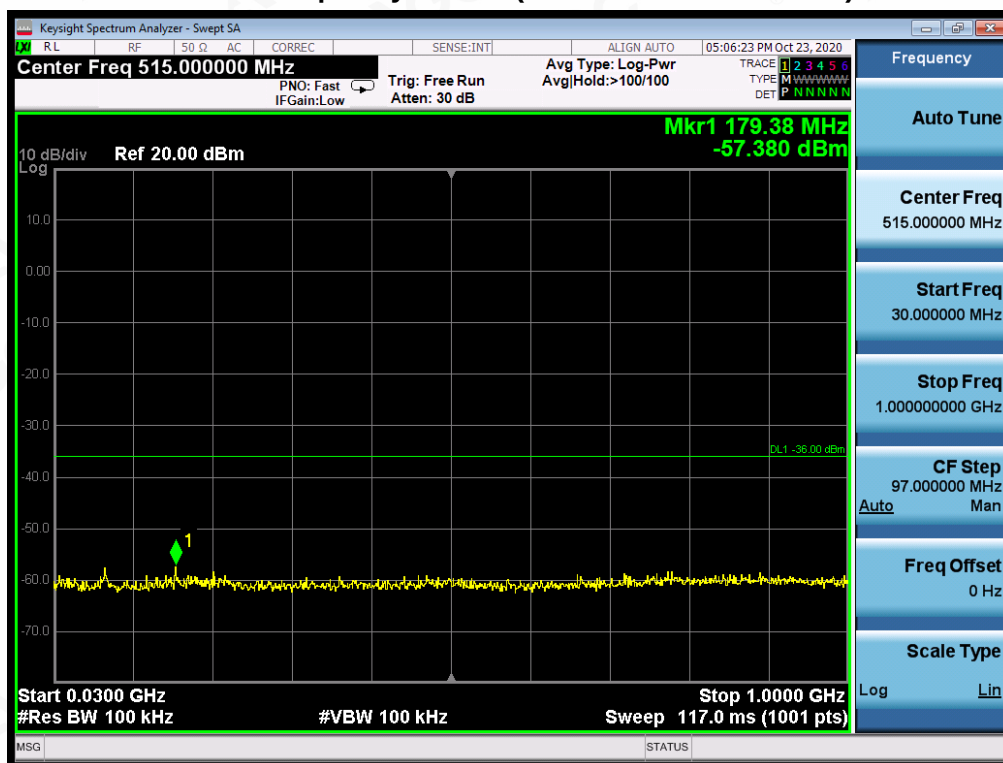


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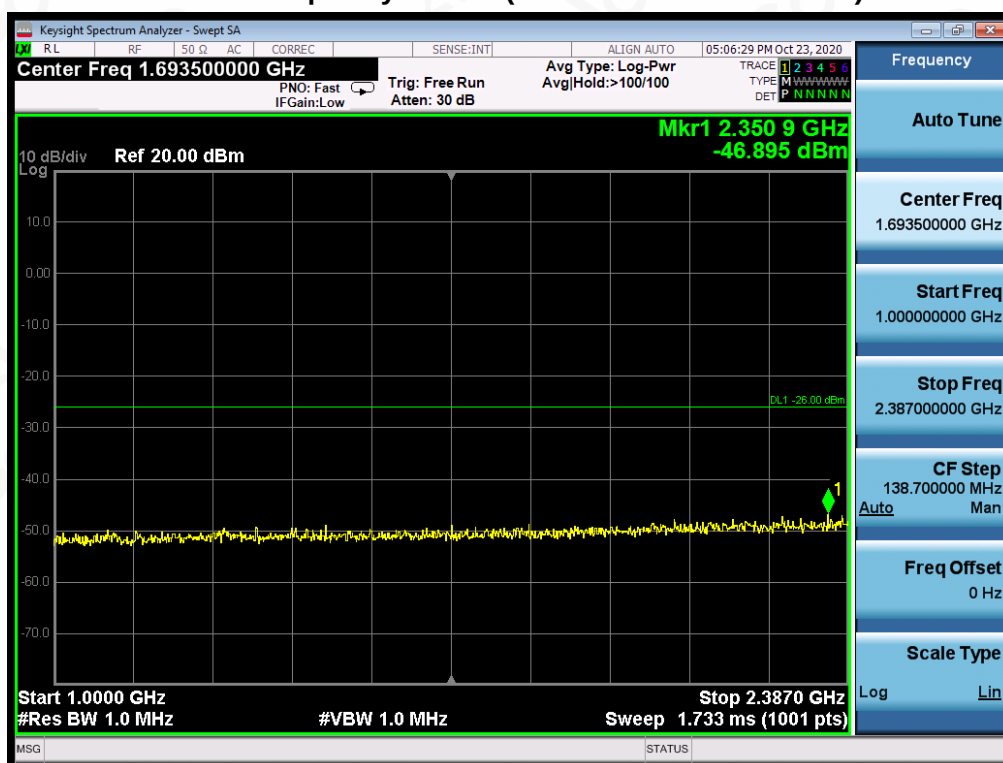
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CH 19- Frequency Band 1 (30 MHz $\leq$ f $\leq$ 1000 MHz)



CH 19- Frequency Band 2 (1000 MHz < f $\leq$ 2387 MHz)

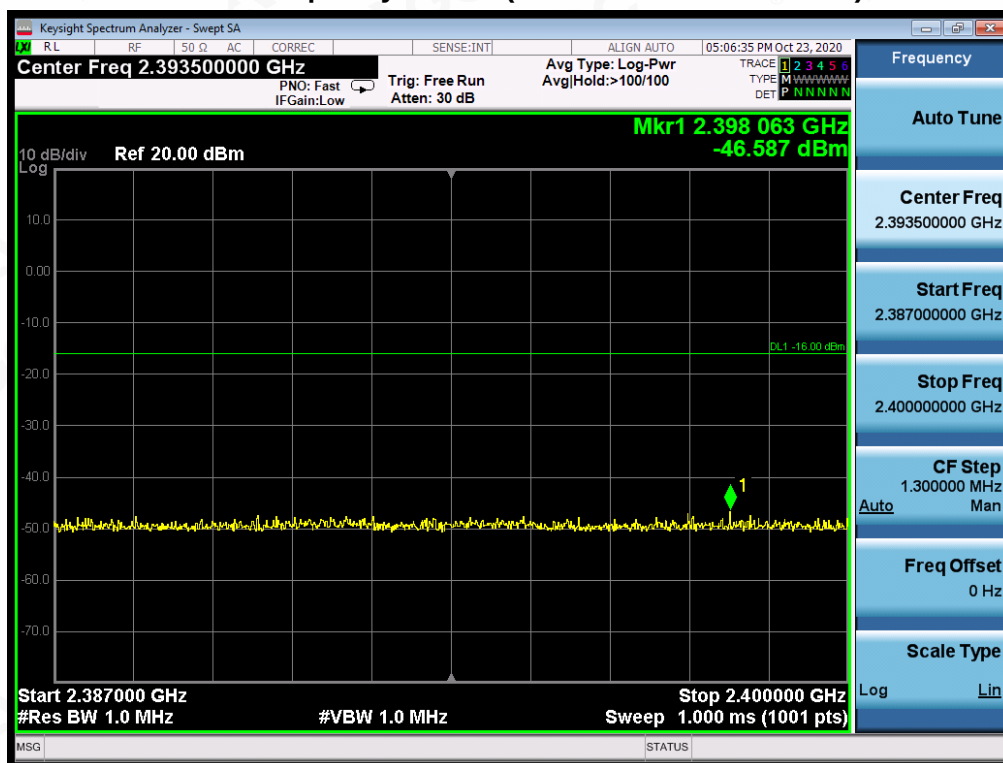


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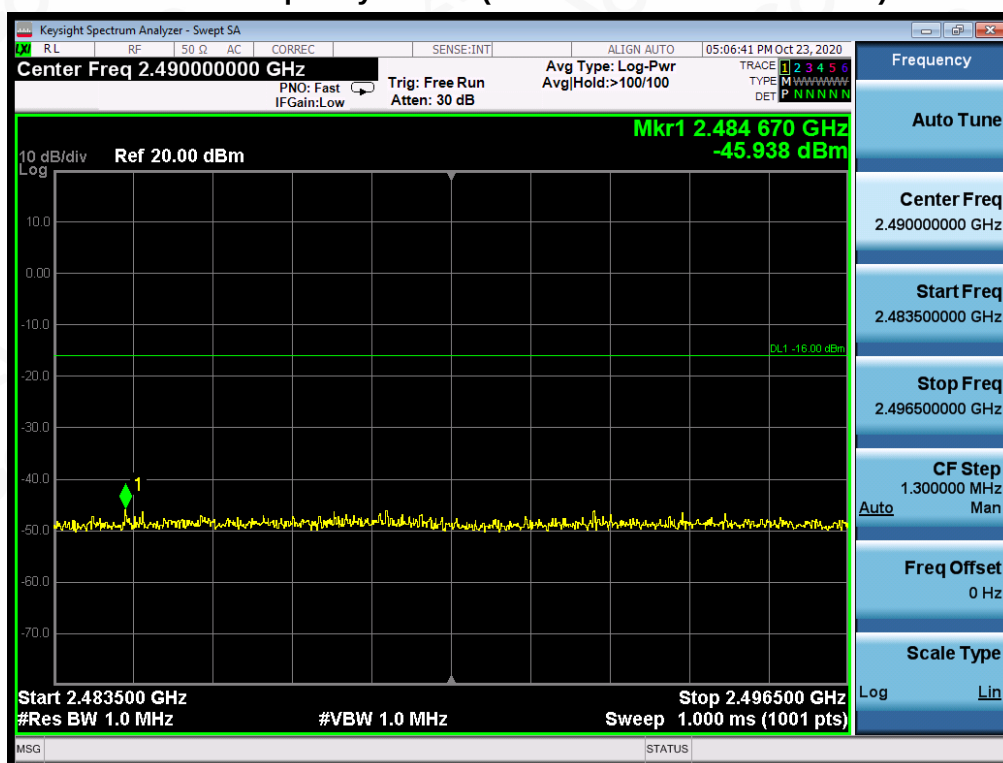
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CH 19- Frequency Band 3 (2387 MHz < f ≤ 2400 MHz)



CH 19- Frequency Band 4 (2483.5 MHz ≤ f < 2496.5 MHz)

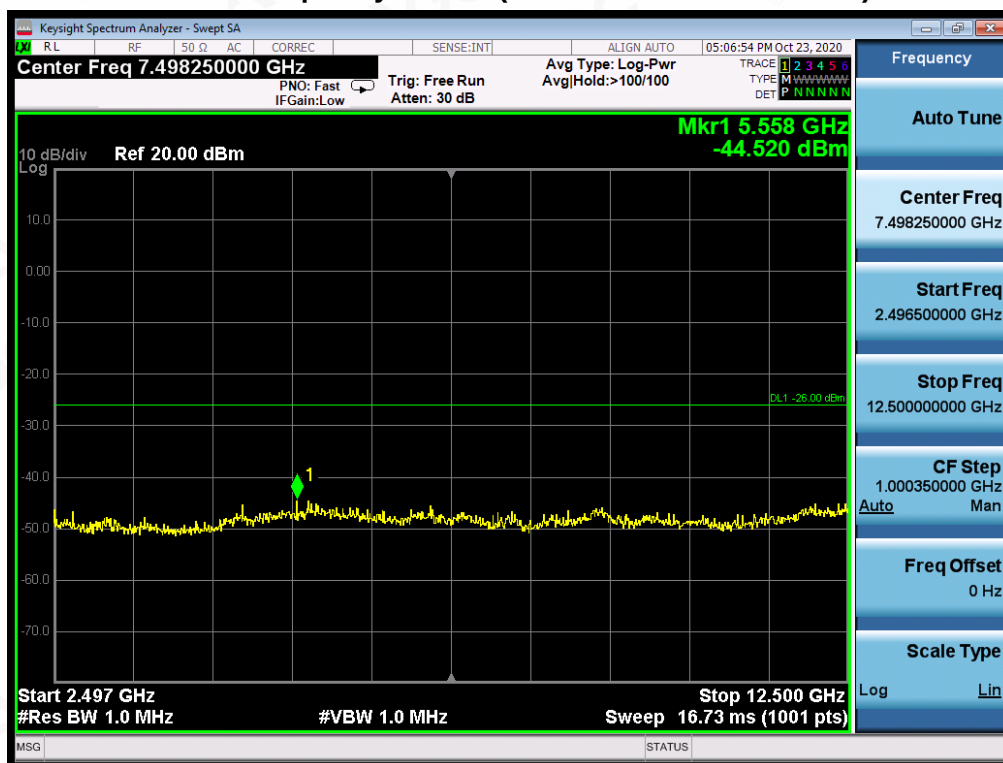


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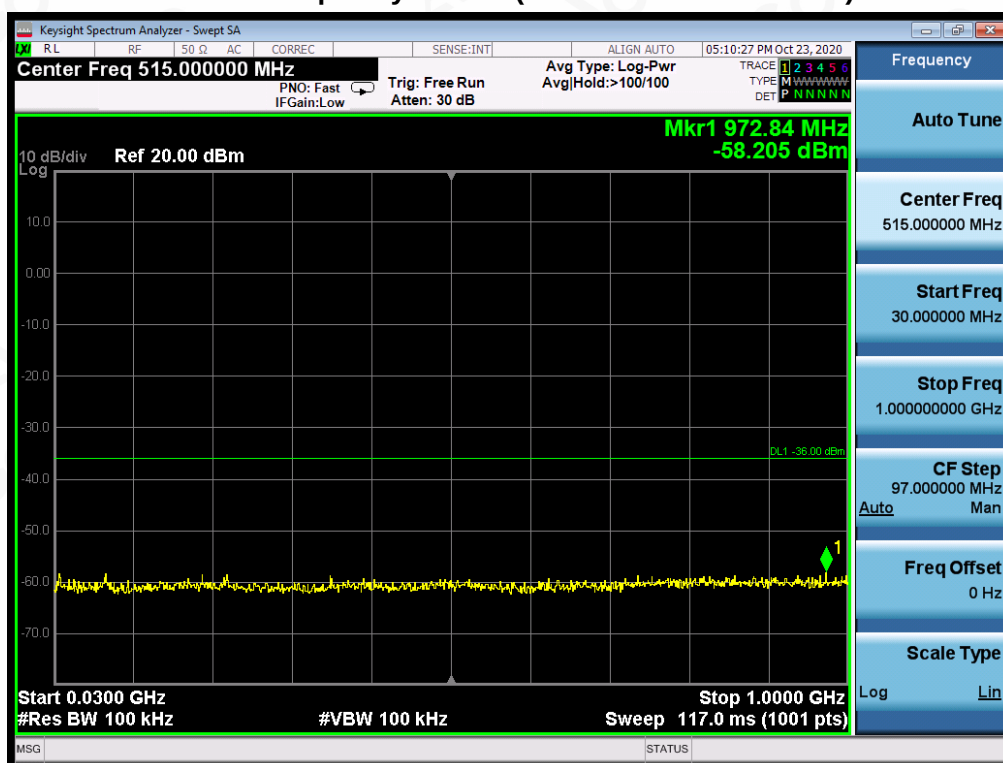
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CH 19- Frequency Band 5 (2496.5 MHz $\leq$ f < 12.5 GHz)



CH 39- Frequency Band 1 (30 MHz $\leq$ f $\leq$ 1000 MHz)

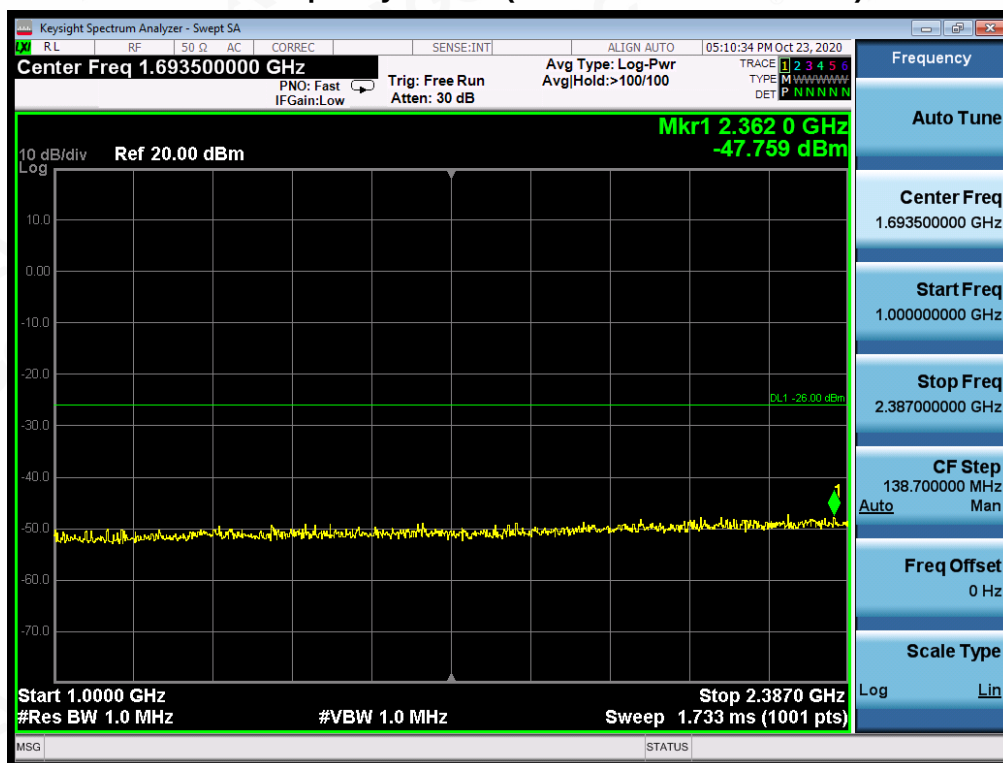


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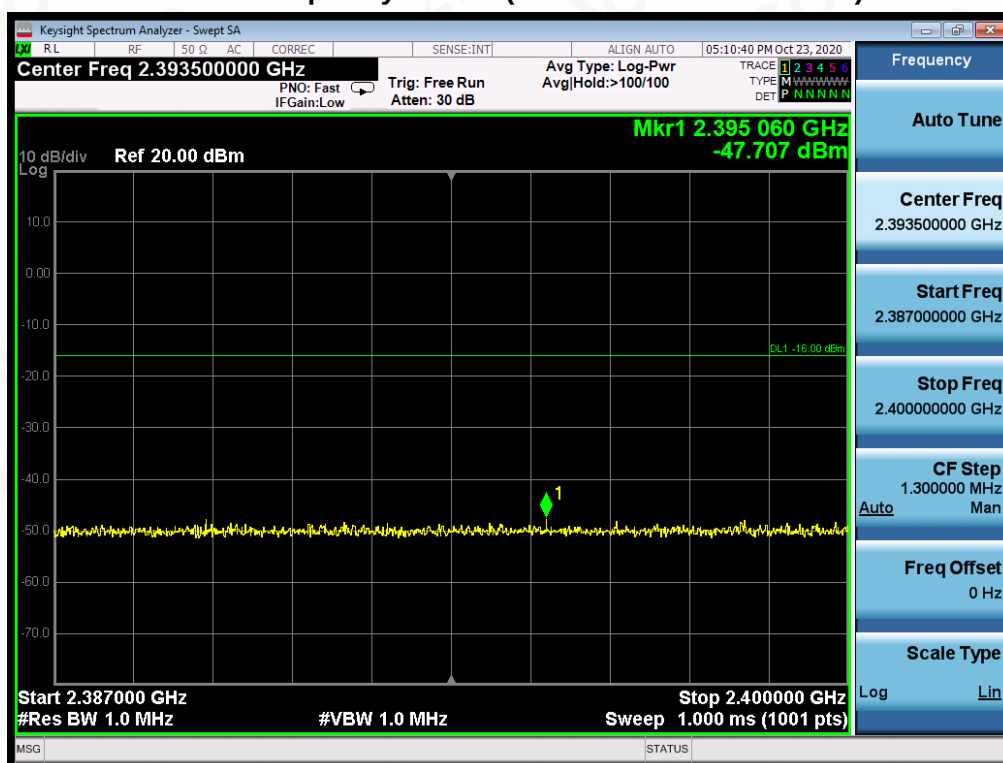
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CH 39- Frequency Band 2 (1000 MHz < f ≤ 2387 MHz)



CH 39- Frequency Band 3 (2387 MHz < f ≤ 2400 MHz)

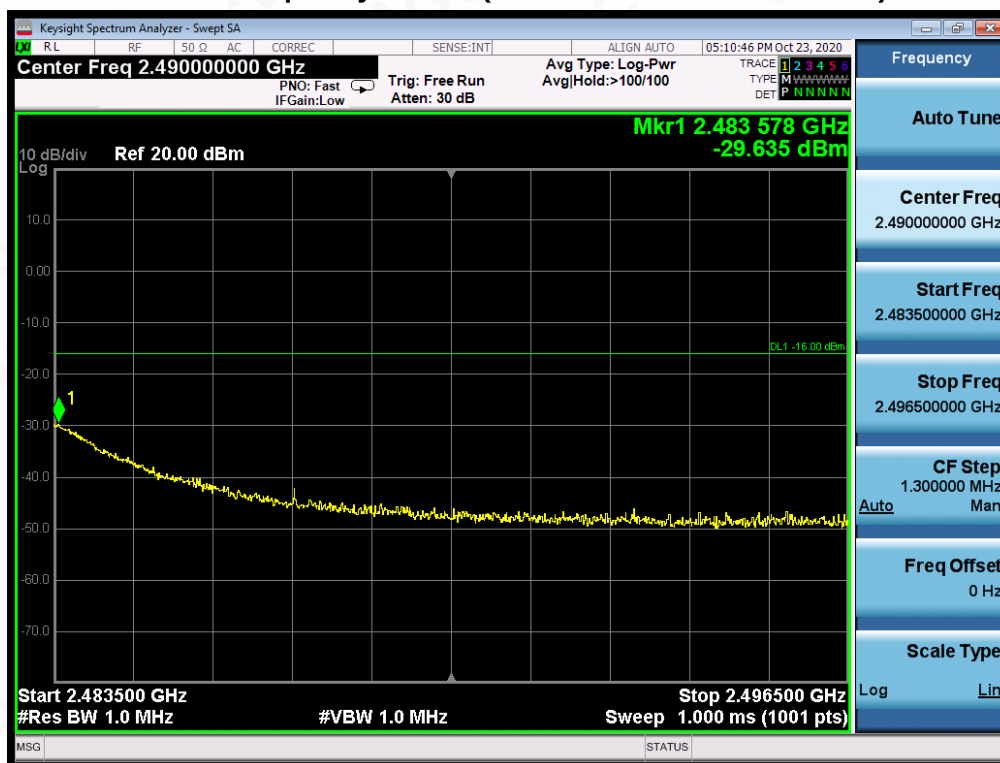


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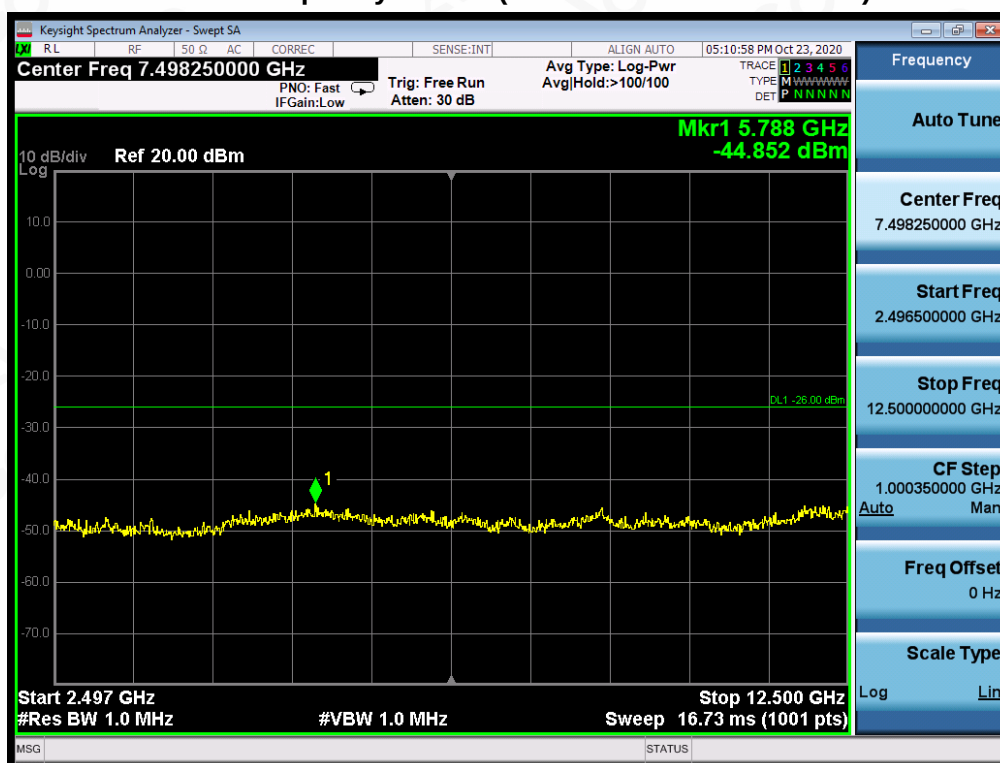
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CH 39- Frequency Band 4 (2483.5 MHz $\leq$ f < 2496.5 MHz)



CH 39- Frequency Band 5 (2496.5 MHz $\leq$ f < 12.5 GHz)



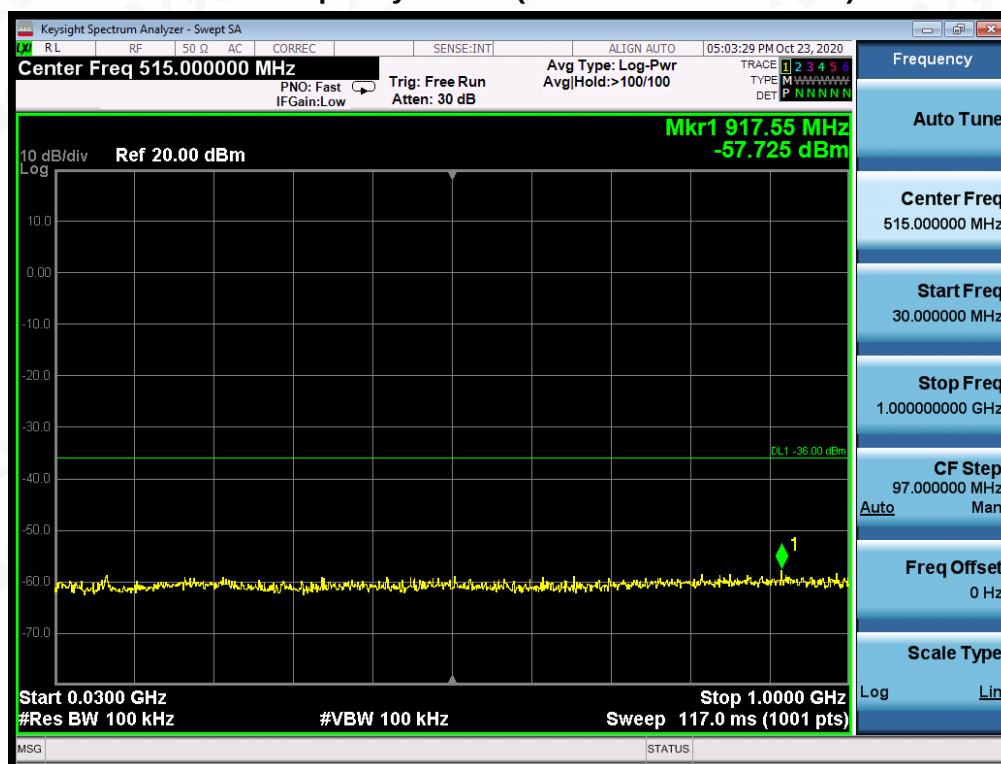
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EUT	NINA-B400	Test Date	Aug. 03, 2020
Temperature	25°C	Tested by	Erik
Humidity	55 % RH	Test Voltage	High Voltage
Operation Mode	TX (CH00, CH07, CH15)		

CH 00- Frequency Band 1 ($30 \text{ MHz} \leq f \leq 1000 \text{ MHz}$)

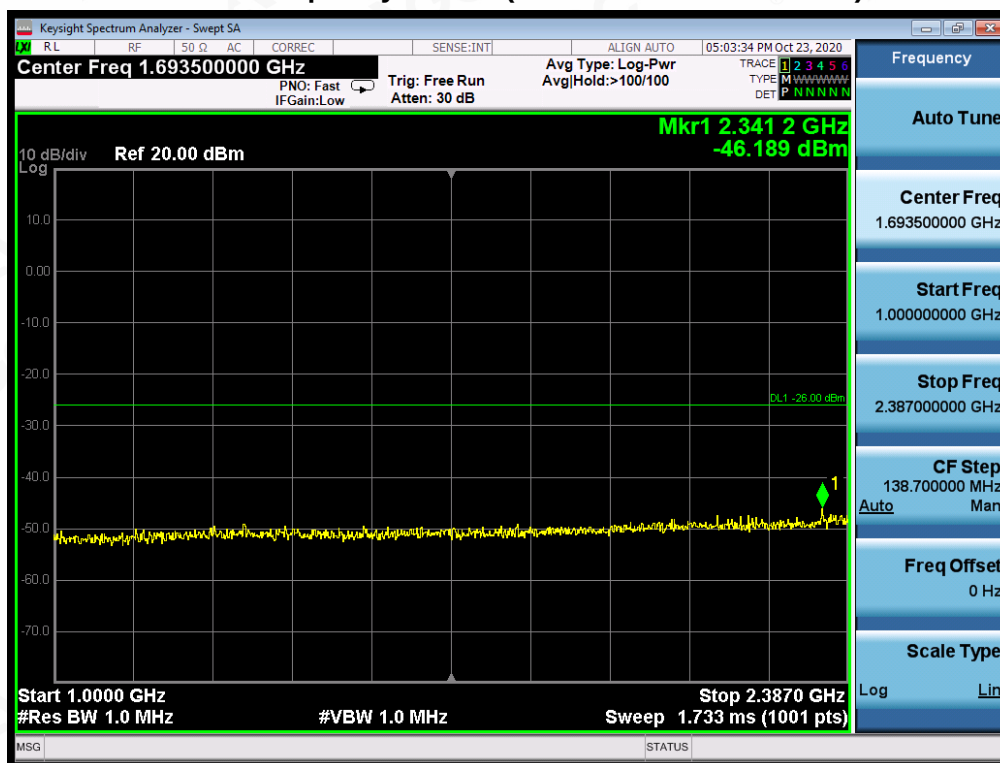


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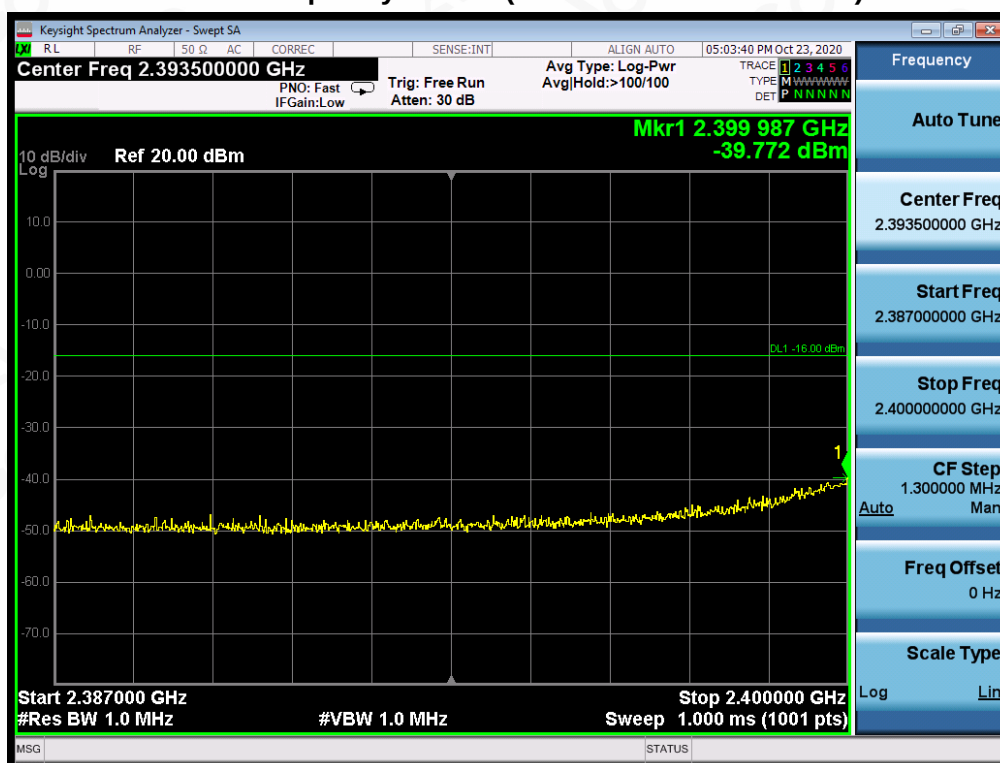
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CH 00- Frequency Band 2 (1000 MHz < f ≤ 2387 MHz)



CH 00- Frequency Band 3 (2387 MHz < f ≤ 2400 MHz)

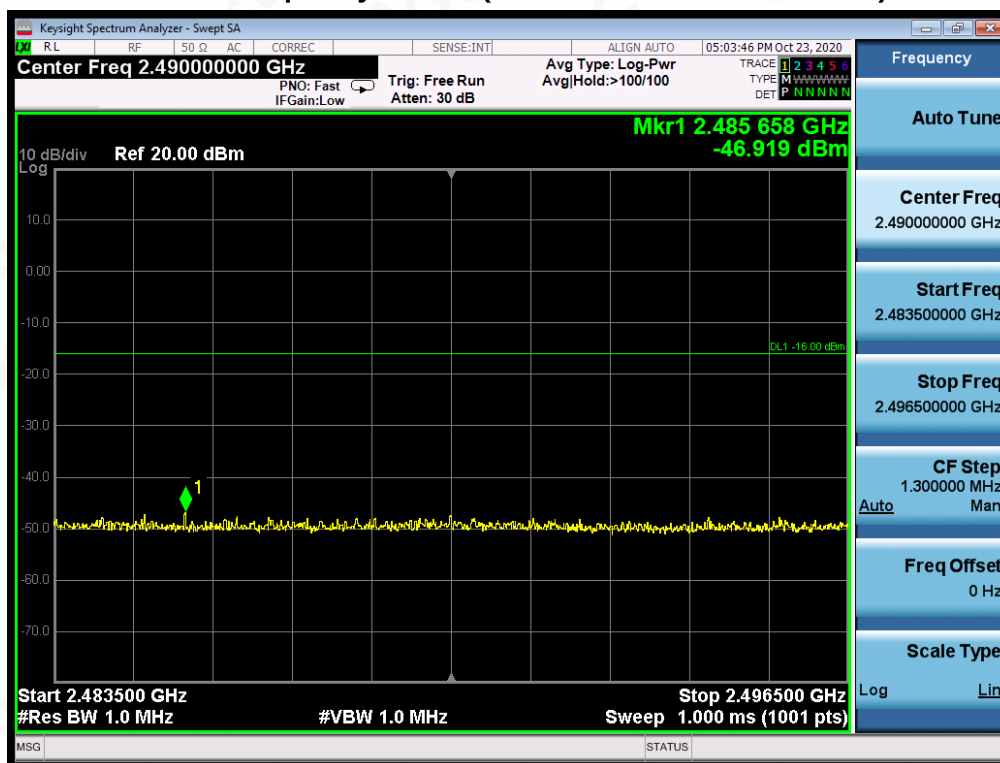


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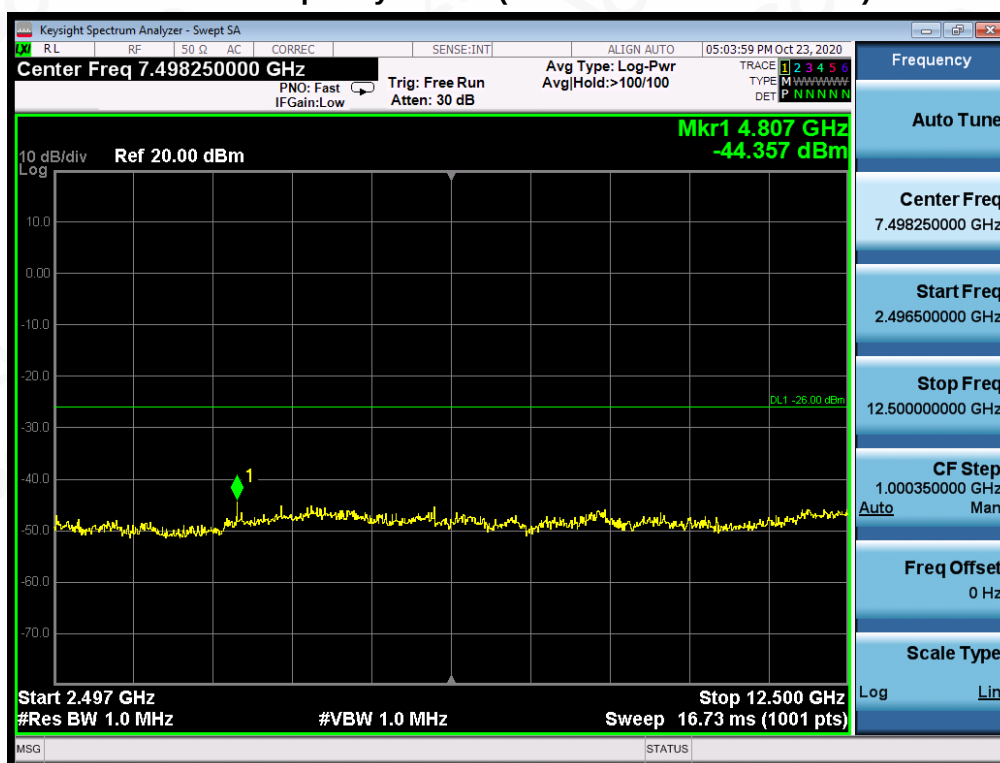
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CH 00- Frequency Band 4 (2483.5 MHz $\leq$ f < 2496.5 MHz)



CH 00- Frequency Band 5 (2496.5 MHz $\leq$ f < 12.5 GHz)

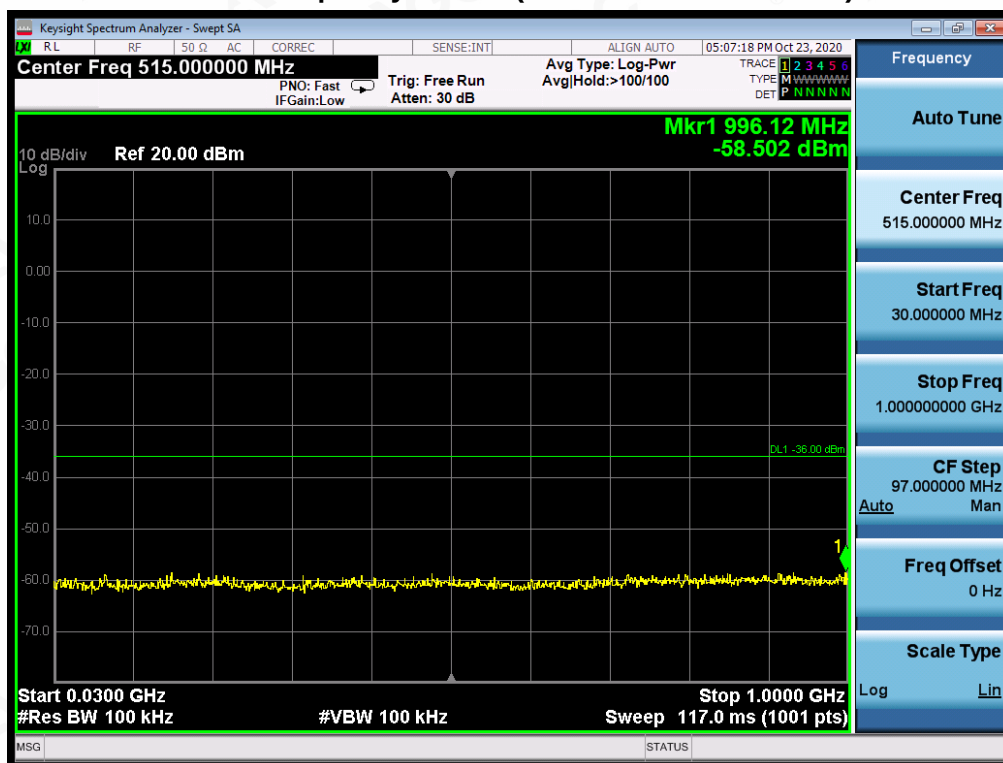


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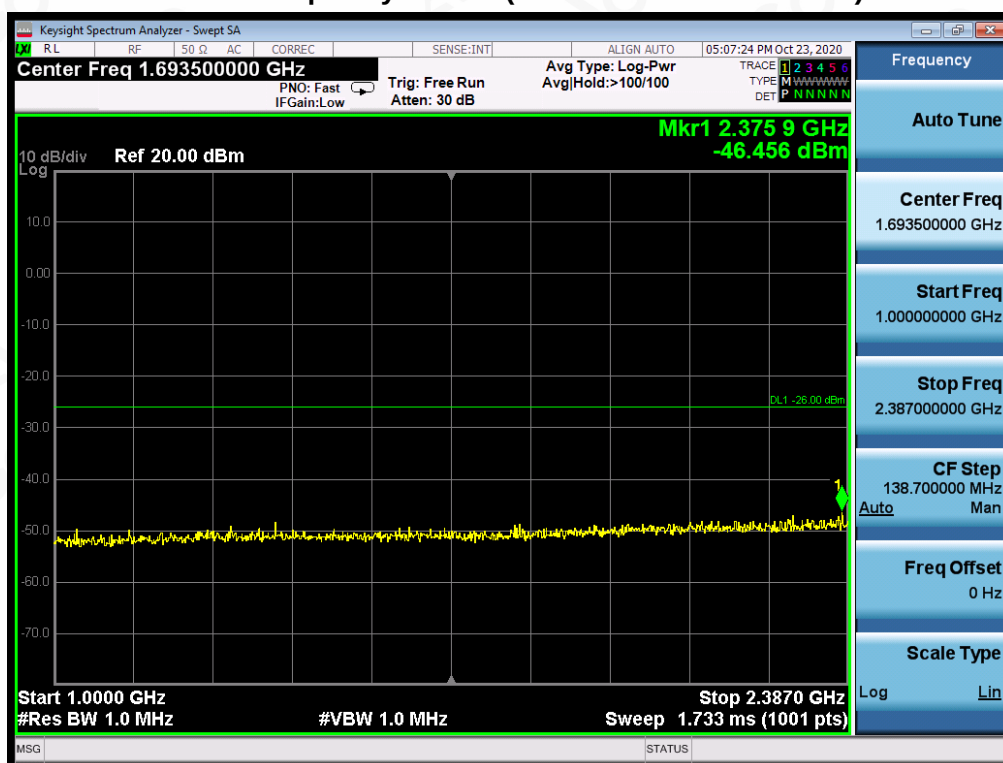
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CH 19- Frequency Band 1 (30 MHz $\leq$ f $\leq$ 1000 MHz)



CH 19- Frequency Band 2 (1000 MHz < f $\leq$ 2387 MHz)

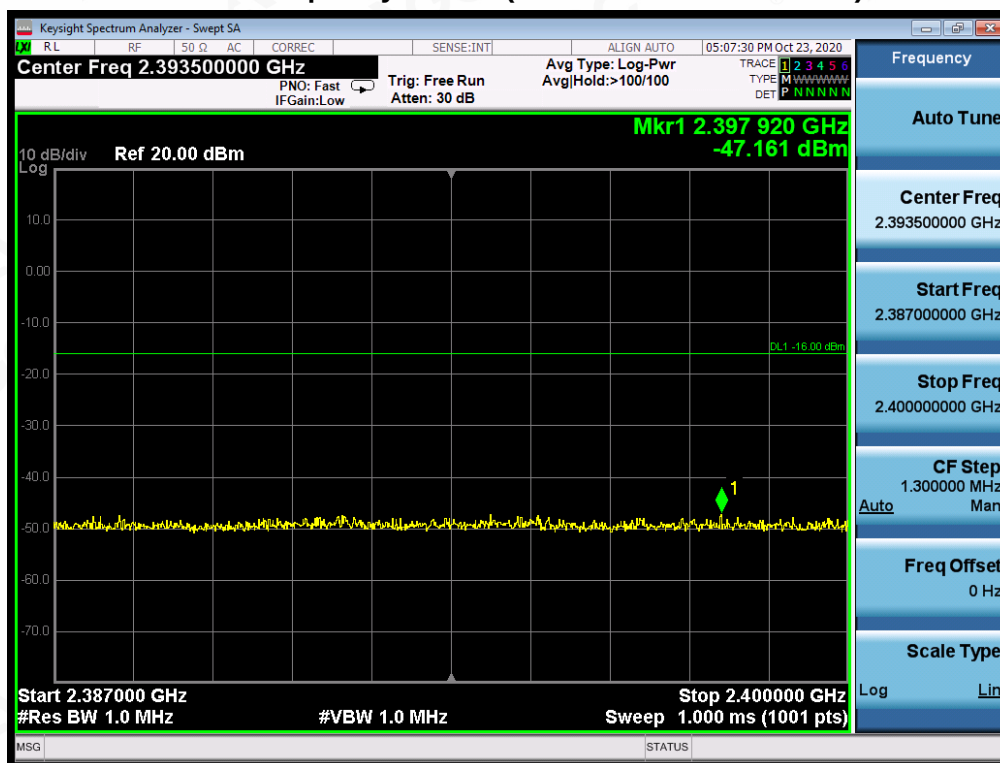


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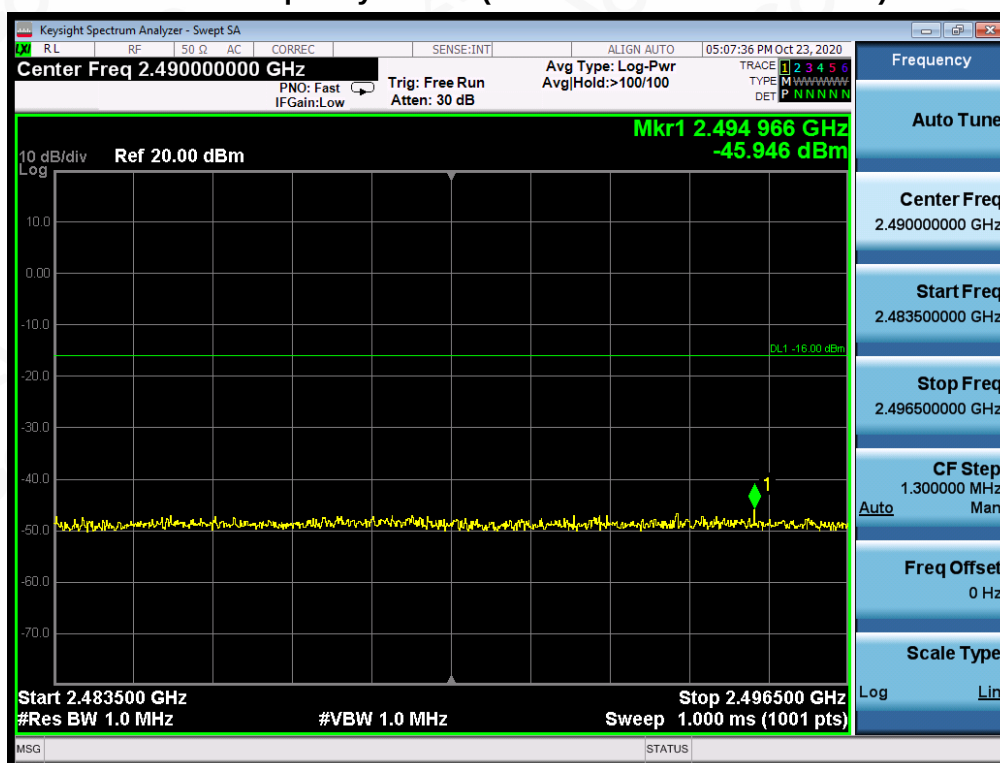
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CH 19- Frequency Band 3 (2387 MHz < f ≤ 2400 MHz)



CH 19- Frequency Band 4 (2483.5 MHz ≤ f < 2496.5 MHz)

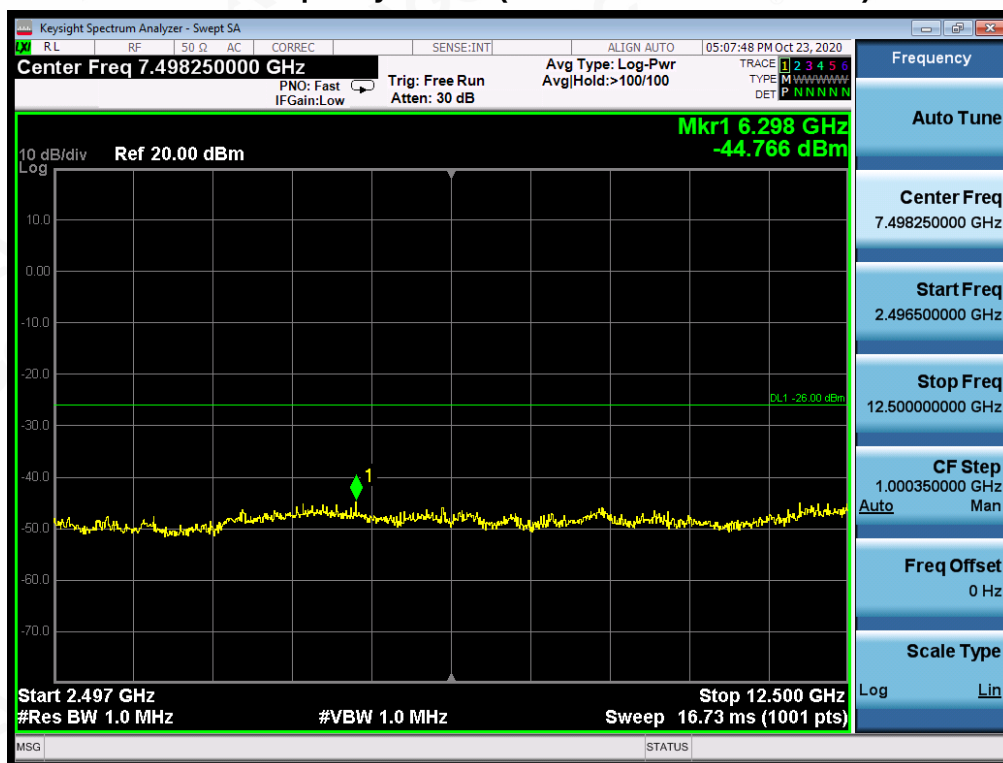


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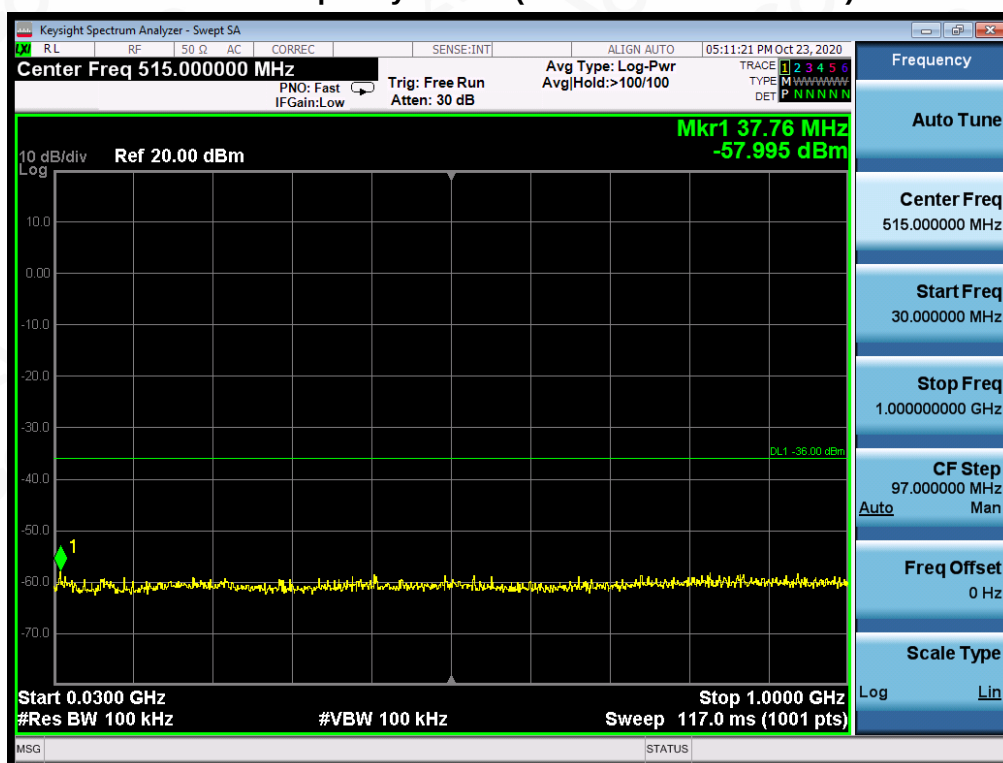
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CH 19- Frequency Band 5 (2496.5 MHz $\leq$ f < 12.5 GHz)



CH 39- Frequency Band 1 (30 MHz $\leq$ f $\leq$ 1000 MHz)

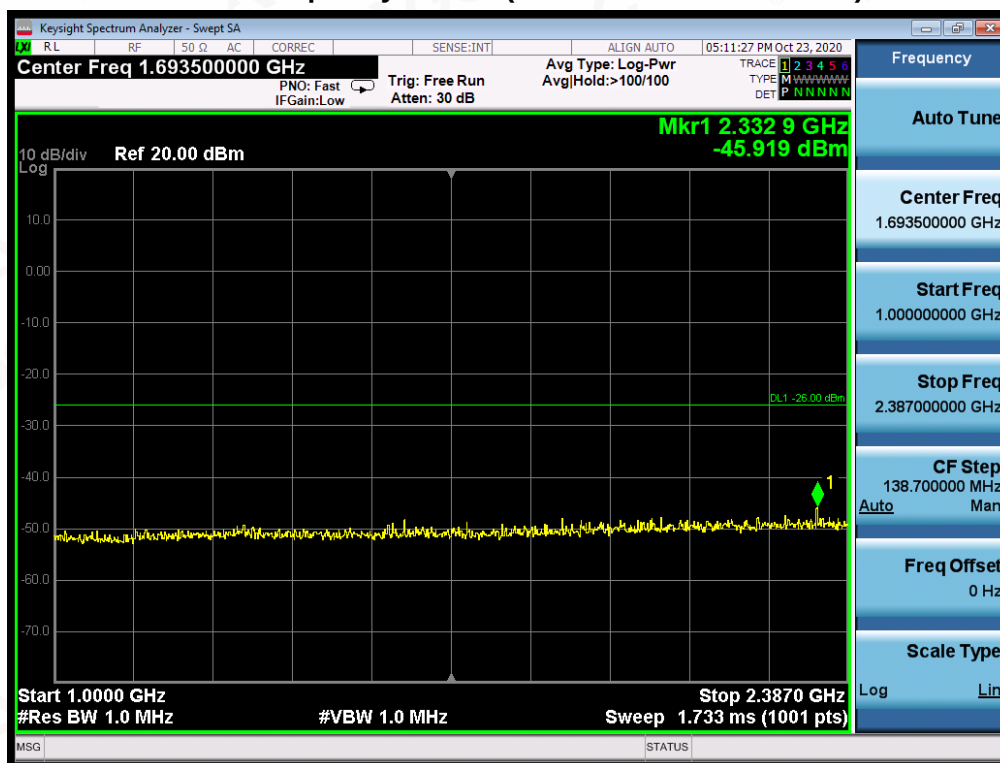


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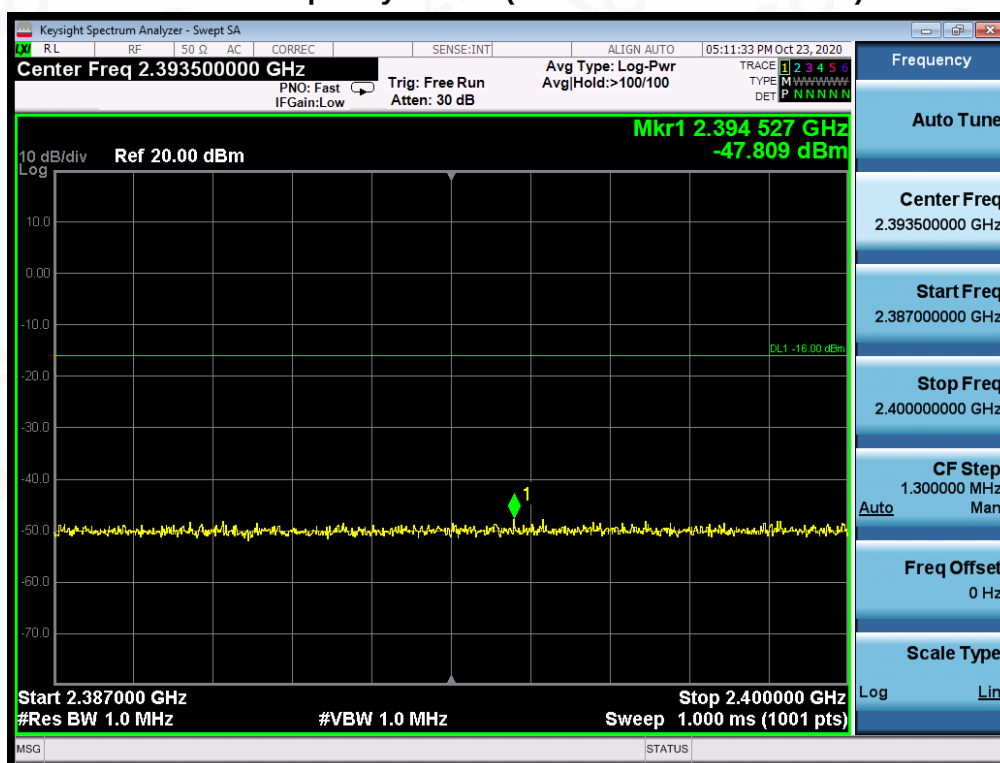
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CH 39- Frequency Band 2 (1000 MHz < f ≤ 2387 MHz)



CH 39- Frequency Band 3 (2387 MHz < f ≤ 2400 MHz)



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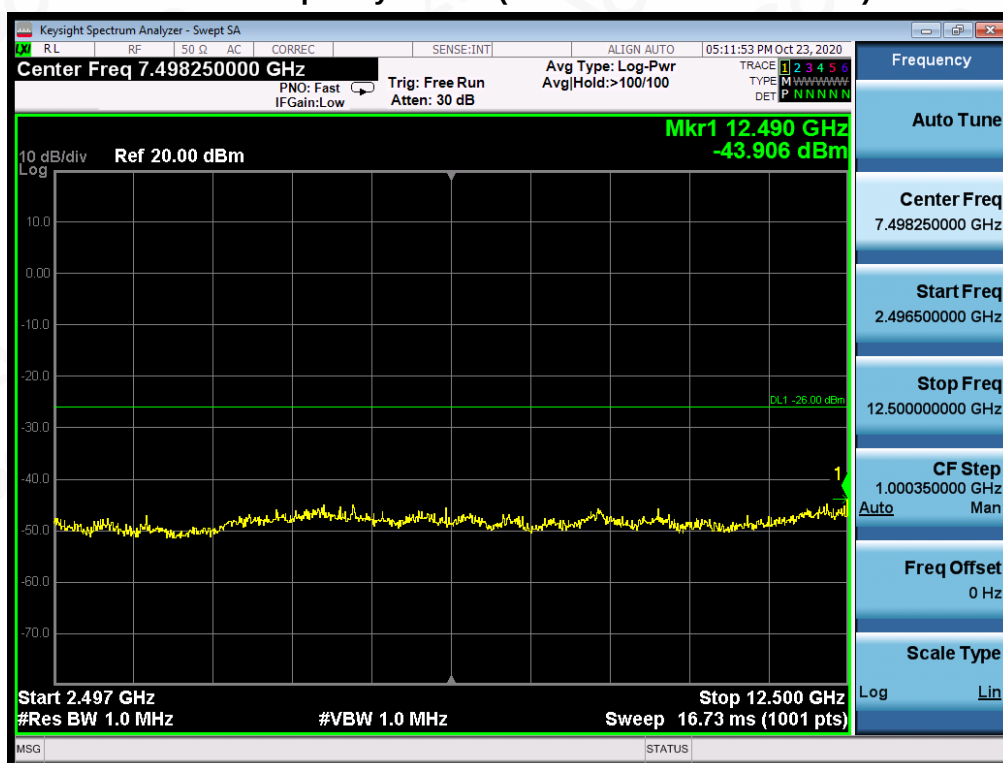
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CH 39- Frequency Band 4 (2483.5 MHz $\leq$ f < 2496.5 MHz)



CH 39- Frequency Band 5 (2496.5 MHz $\leq$ f < 12.5 GHz)



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5.4. ANTENNA POWER ERROR MEASUREMENT

5.4.1. LIMIT

Item	Limits
Antenna Power Density	$\leq 3\text{mW/MHz}$ (FH system from 2400 to 2483.5MHz) $\leq 10\text{mW/MHz}$ (FH system from 2400 to 2427MHz and from 2470.75 to 2483.5MHz, OFDM, DS 20MHz system) $\leq 10\text{mW}$ (Others) $\leq 5\text{mW}$ for OFDM (40 MHz system)
Antenna Power Error	+20%, -80% (Base on manufacturer declare antenna power density)

5.4.2. MEASURING INSTRUMENTS AND SETTING

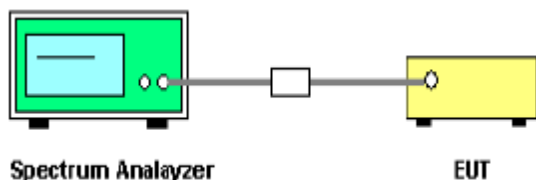
The following table is the setting of spectrum analyzer.

Spectrum Parameter	Setting
RB / VB	1 MHz
Detector	Peak
Trace	Max Hold
Sweep Time	Auto

5.4.3. TEST PROCEDURES

1. EUT have transmitted continuous maximum power of hopping mode (For FHSS Device). then connected to the spectrum analyzer
2. Adjust the spectrum analyzer to have the center frequency the same with the measured carrier. RBW=VBW=1MHz, detector mode is positive peak.
3. Antenna Power Error is definition that actual measure antenna power tolerance between + 20% to - 80% power range that base on manufacturer declare the conducted power density.

5.4.4. TEST SETUP LAYOUT



5.4.5. EST DEVIATION

There is no deviation with the original standard.

5.4.6. EUT OPERATION DURING TEST

The EUT was programmed to be in continuously transmitting mode.

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5.4.7. TEST RESULT OF ANTENNA POWER ERROR

EUT:	NINA-B400	Test Date:	Aug. 03, 2020
Temperature:	25°C	Tested by:	Erik
Humidity:	55 % RH		

CRYSTAL A

Test Voltage	Test Frequency	Conducted RF output power (mW)	Rated power (mW)	Antenna Power Error (%)
Normal	2405MHz	2.082	4	-47.95
	2440MHz	2.412	4	-39.70
	2480MHz	2.885	4	-27.88
Low	2405MHz	2.093	4	-47.68
	2440MHz	2.414	4	-39.65
	2480MHz	2.885	4	-27.88
High	2405MHz	2.088	4	-47.80
	2440MHz	2.410	4	-39.75
	2480MHz	2.897	4	-27.58
Limit: +20%, -80% (Base on manufacturer declare antenna power density)				

CRYSTAL B

Test Voltage	Test Frequency	Conducted RF output power (mW)	Rated power (mW)	Antenna Power Error (%)
Normal	2405MHz	2.136	4	-46.60
	2440MHz	2.790	4	-30.25
	2480MHz	3.347	4	-16.33
Low	2405MHz	2.050	4	-48.75
	2440MHz	2.753	4	-31.18
	2480MHz	3.305	4	-17.38
High	2405MHz	2.015	4	-49.63
	2440MHz	2.793	4	-30.18
	2480MHz	3.324	4	-16.90
Limit: +20%, -80% (Base on manufacturer declare antenna power density)				

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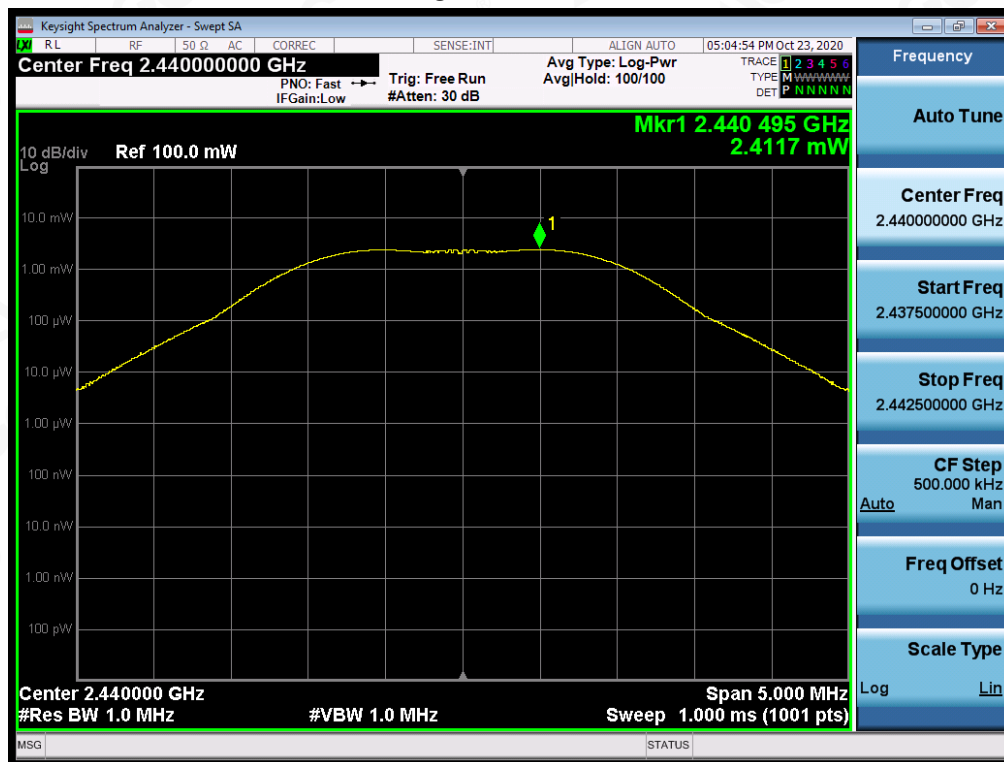


CRYSTAL A

Normal Voltage-Antenna Power CH00



Normal Voltage- Antenna Power CH19

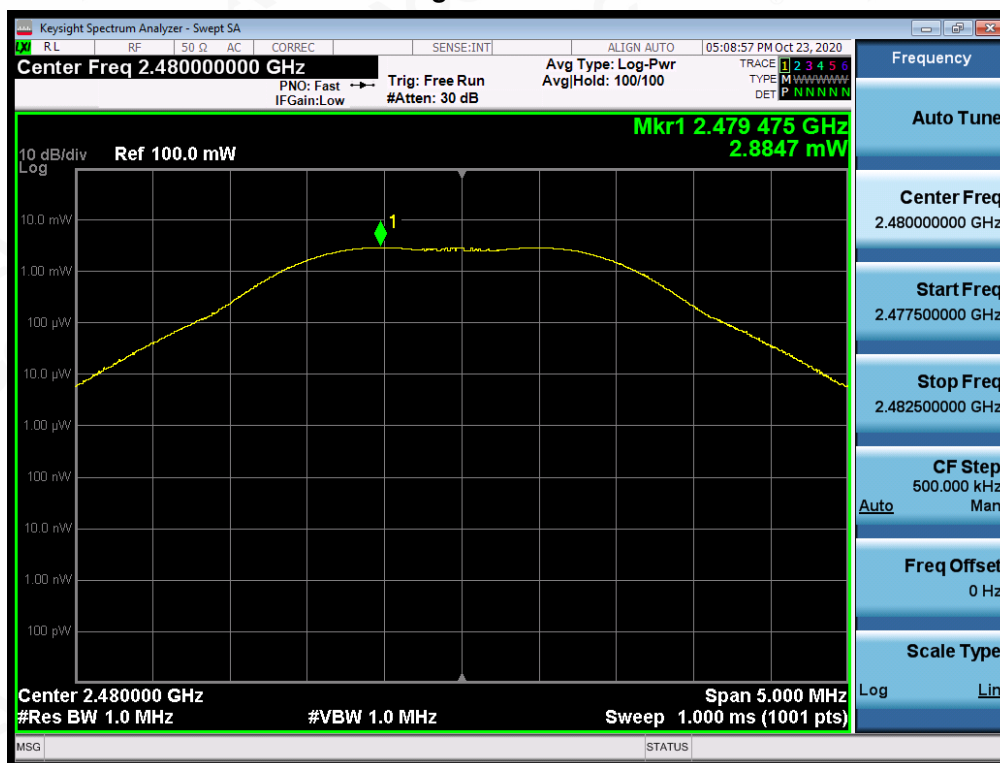


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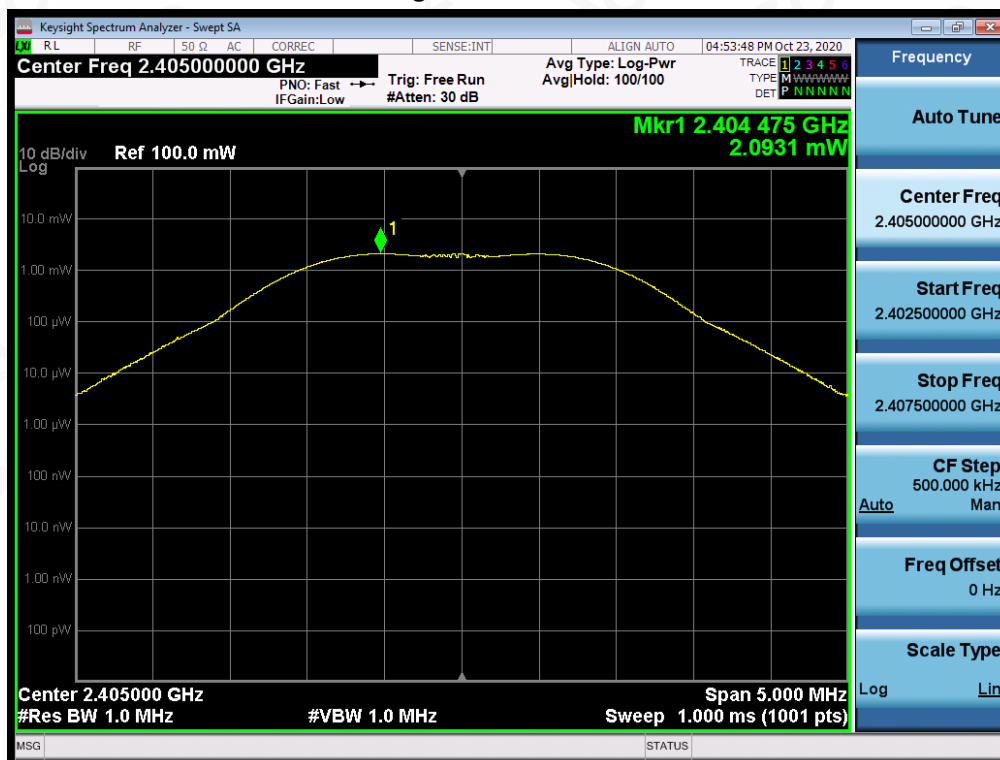
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Normal Voltage- Antenna Power CH39



Low Voltage- Antenna Power CH00

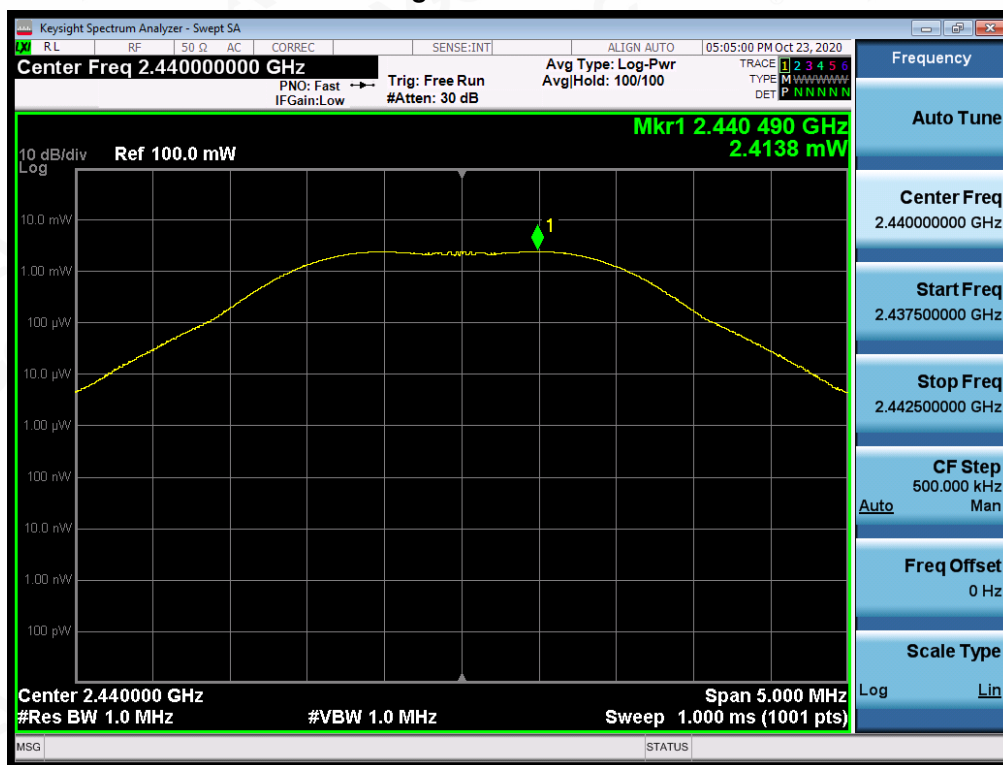


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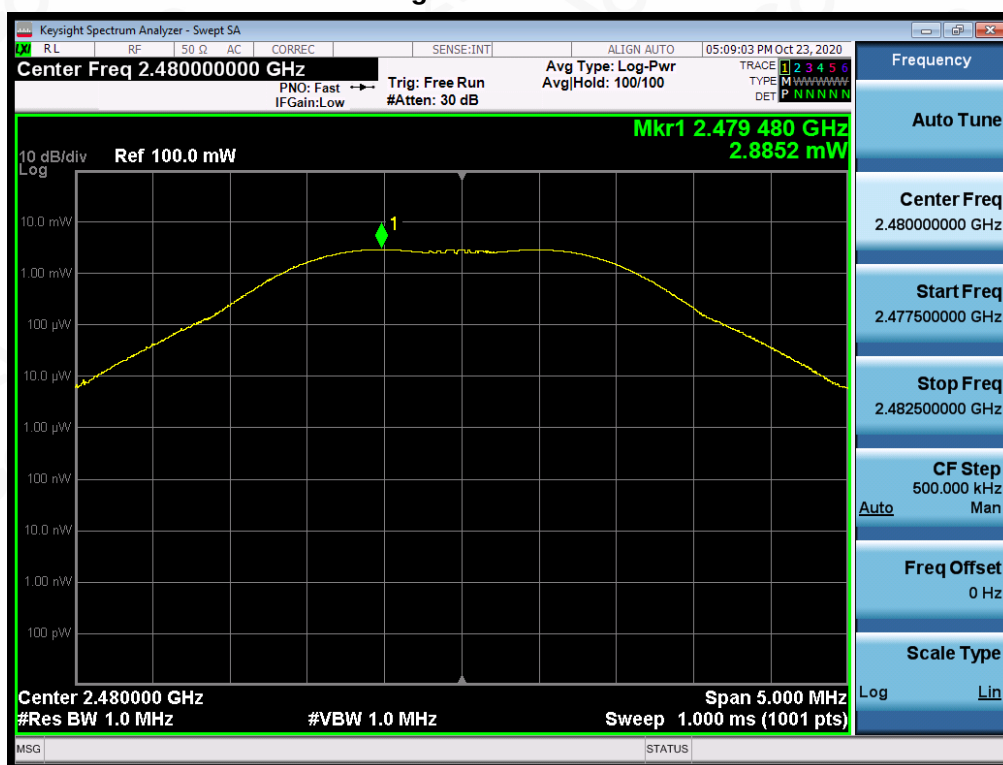
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Low Voltage- Antenna Power CH19



Low Voltage- Antenna Power CH39

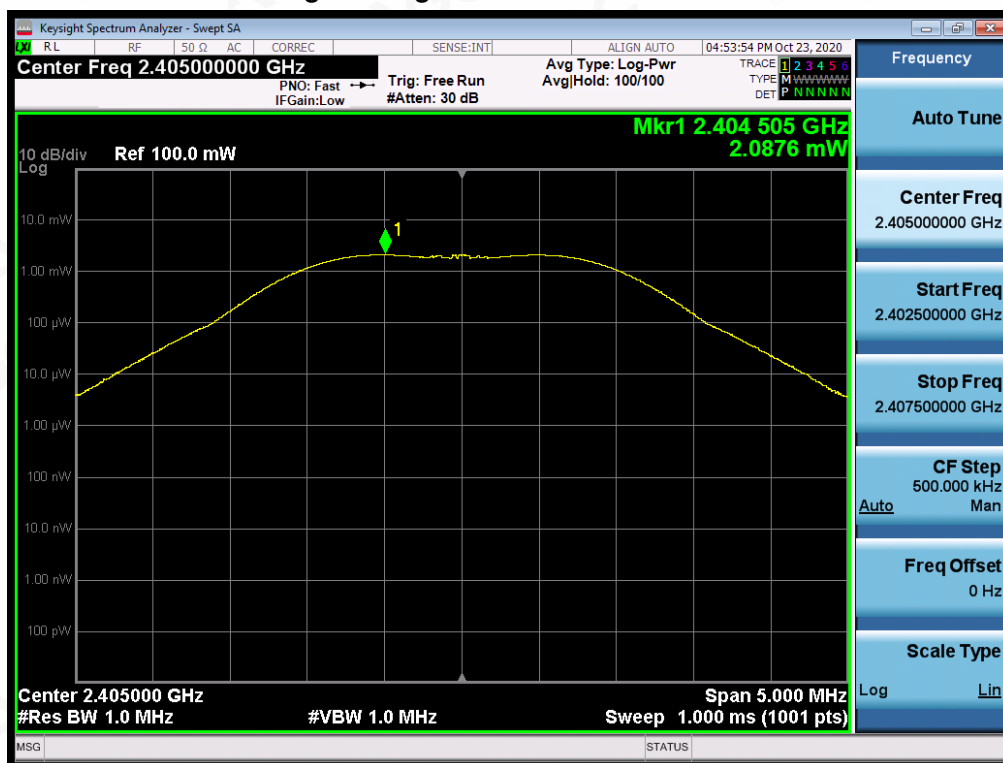


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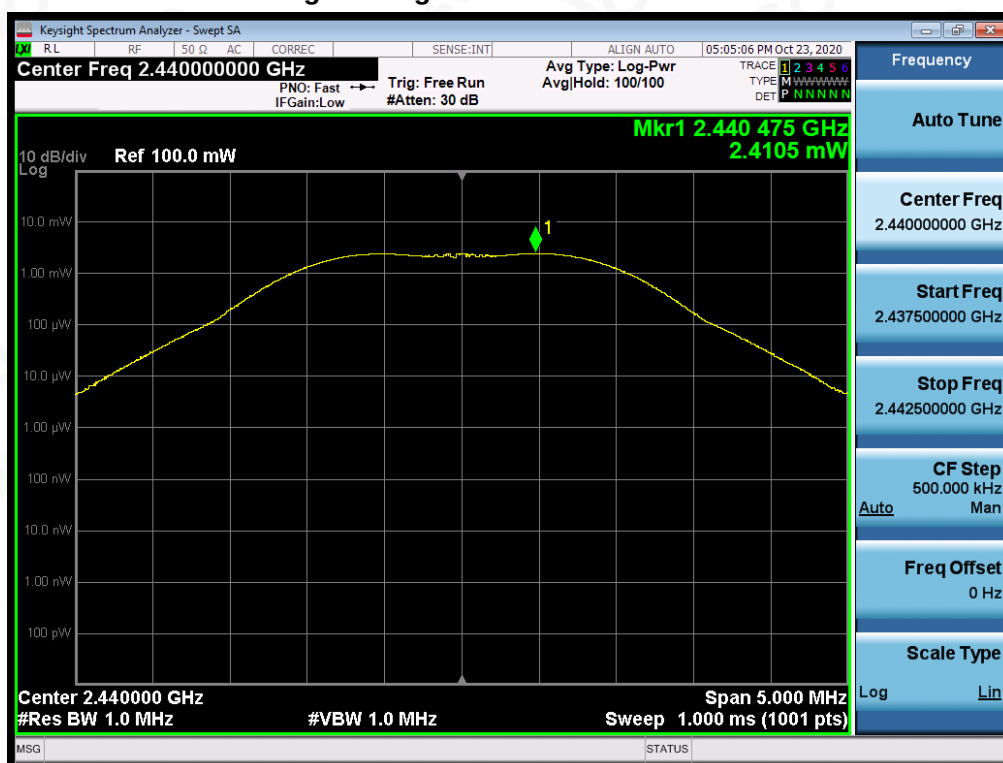
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High Voltage- Antenna Power CH00



High Voltage- Antenna Power CH19

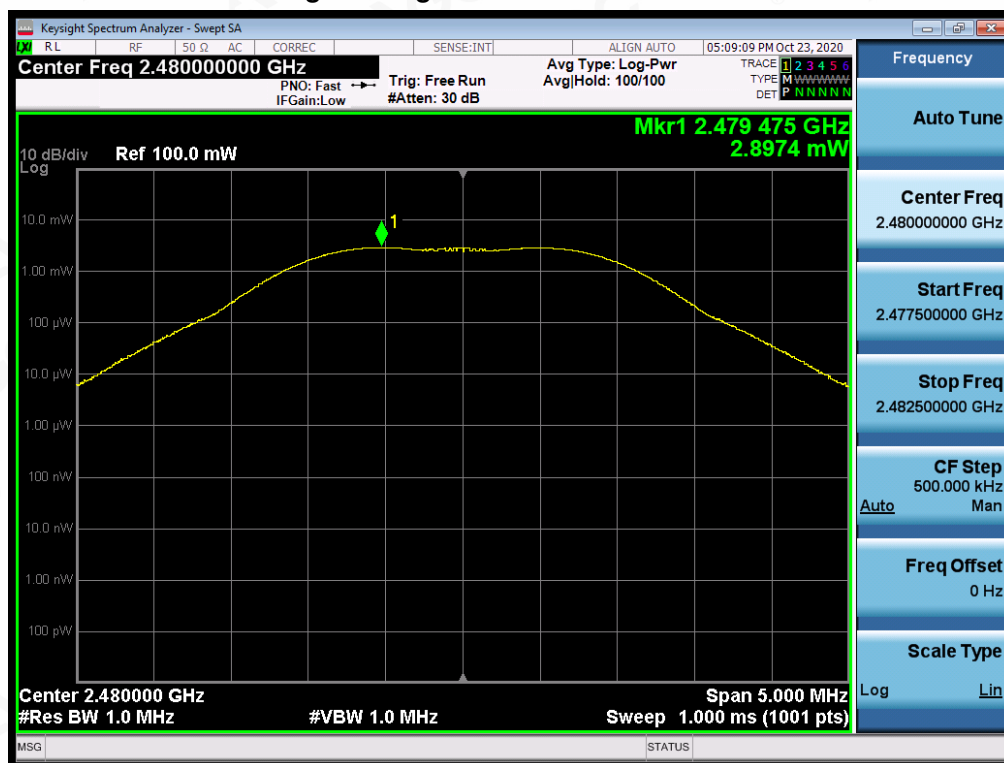


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High Voltage- Antenna Power CH39



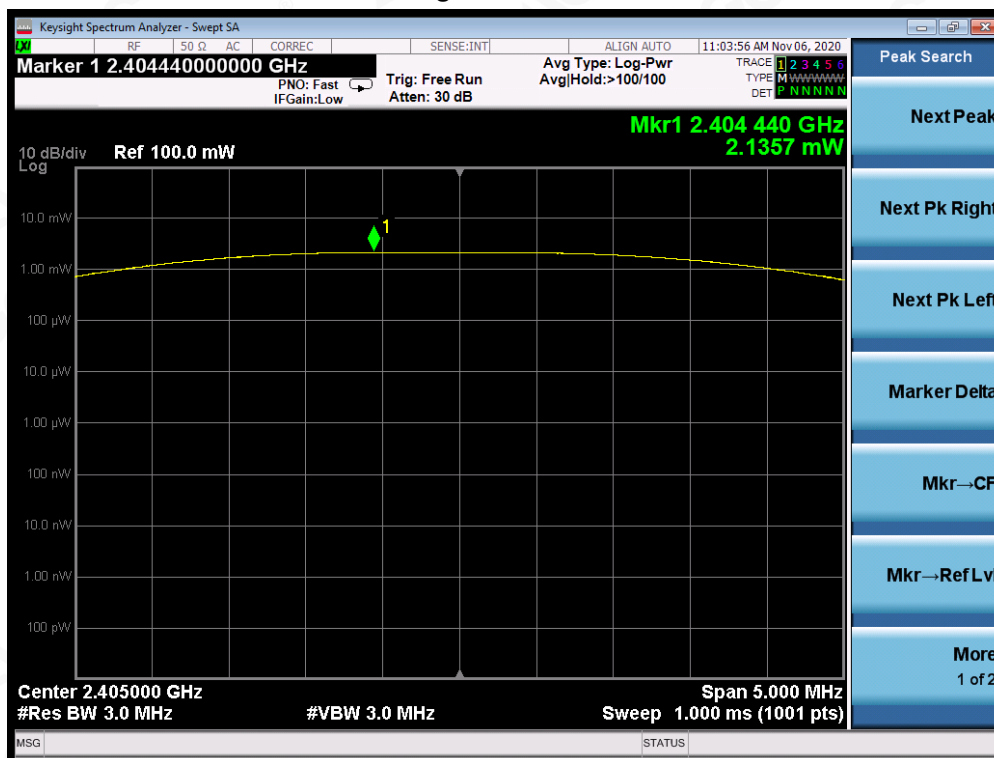
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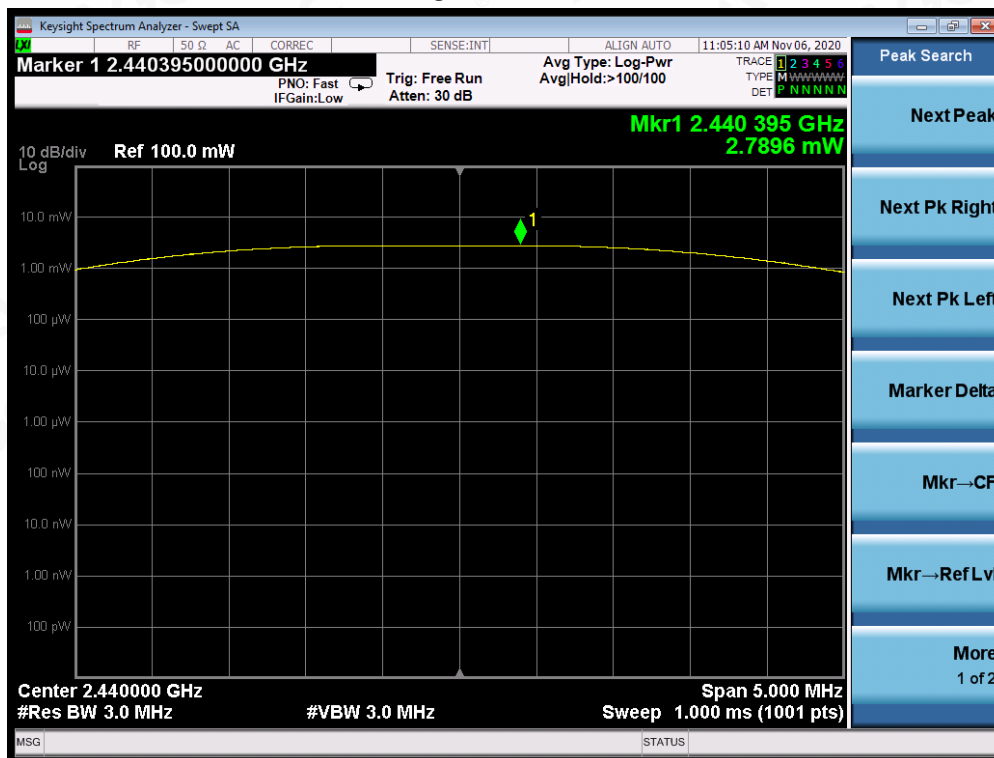


CRYSTAL B

Normal Voltage-Antenna Power CH00



Normal Voltage- Antenna Power CH19

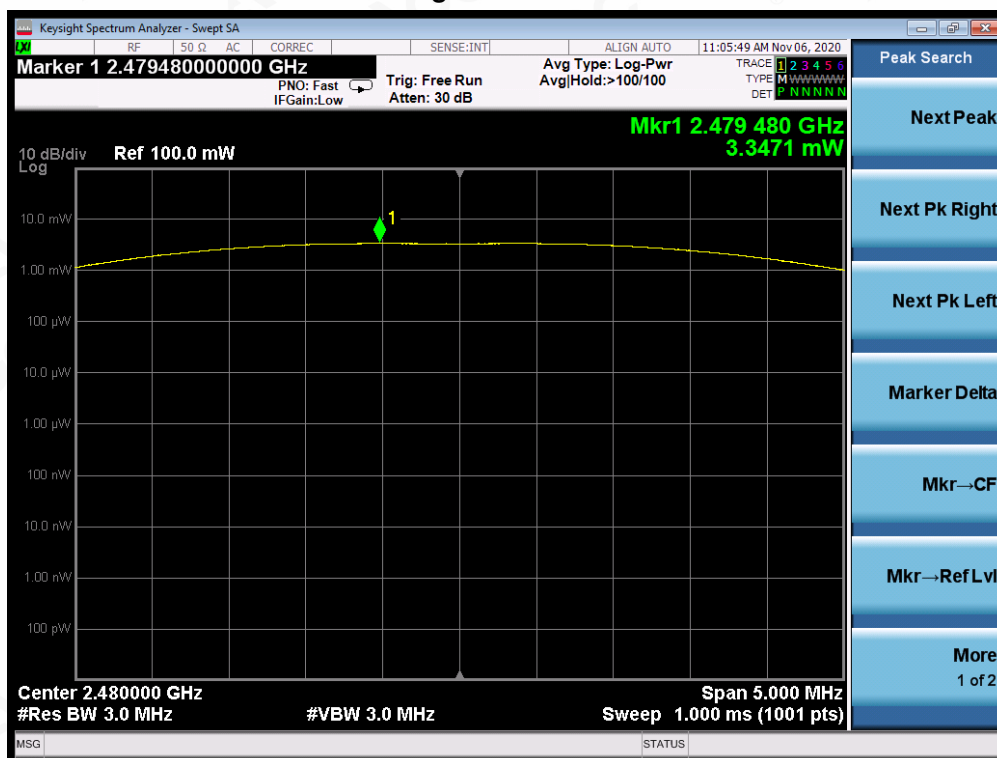


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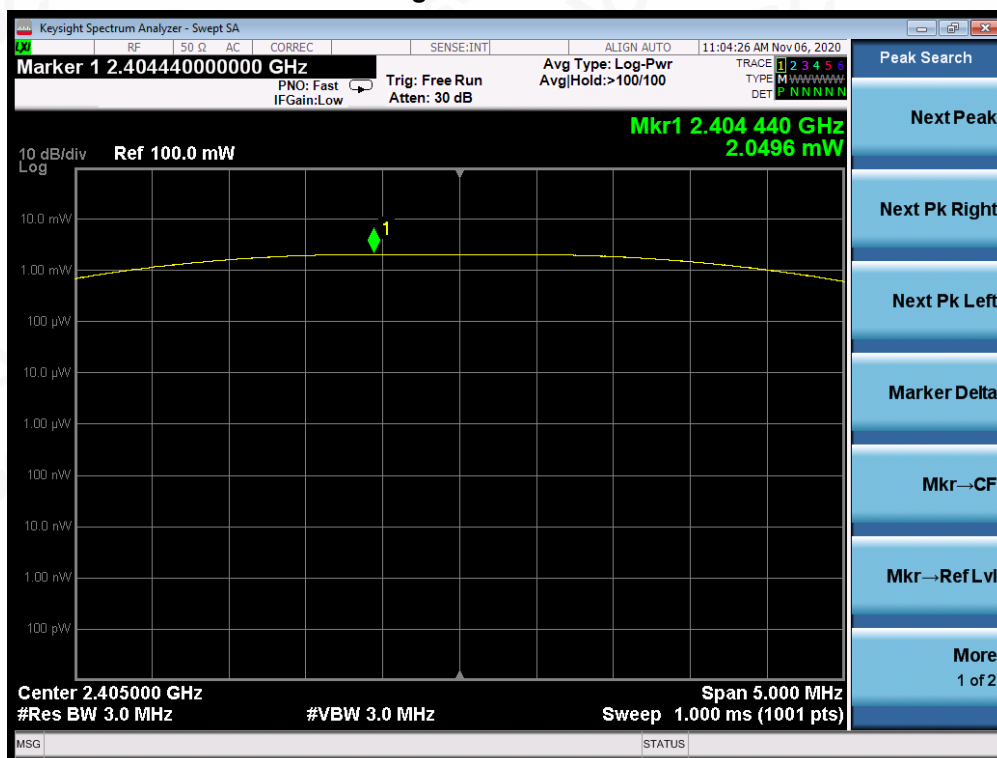
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Normal Voltage- Antenna Power CH39



Low Voltage- Antenna Power CH00

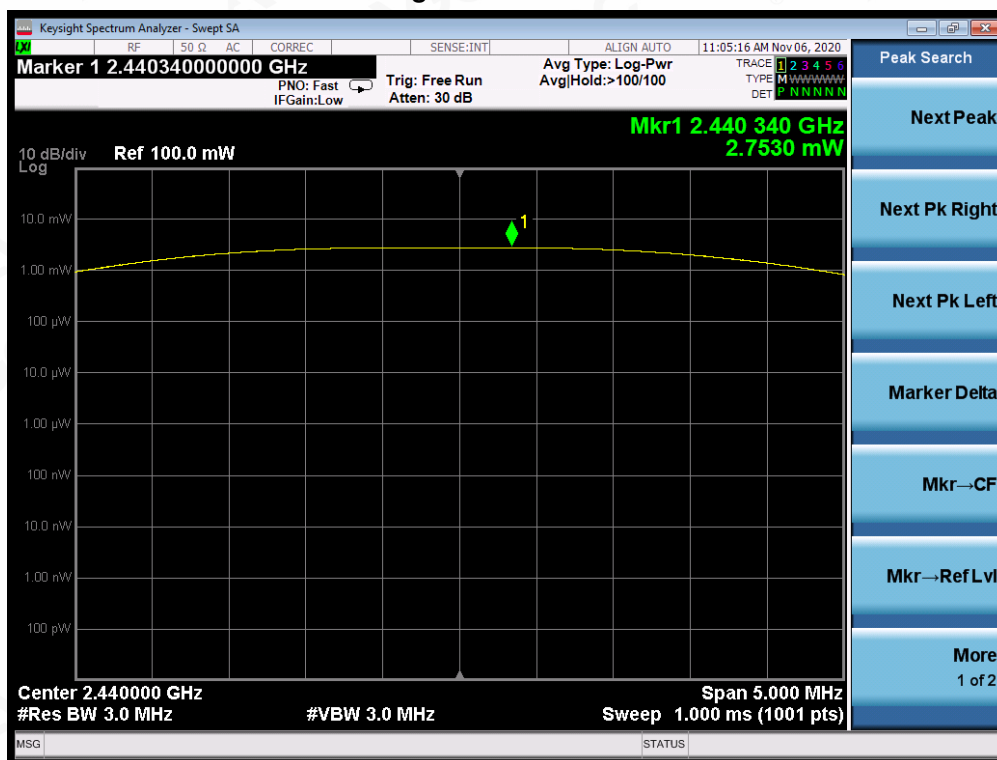


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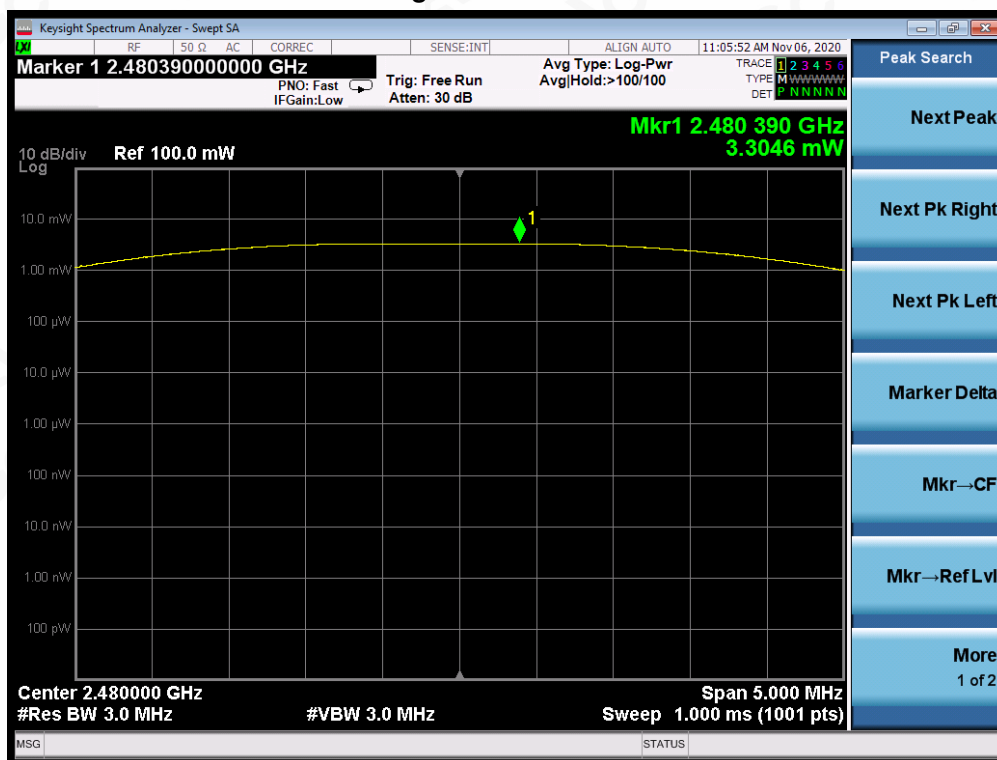
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Low Voltage- Antenna Power CH19



Low Voltage- Antenna Power CH39

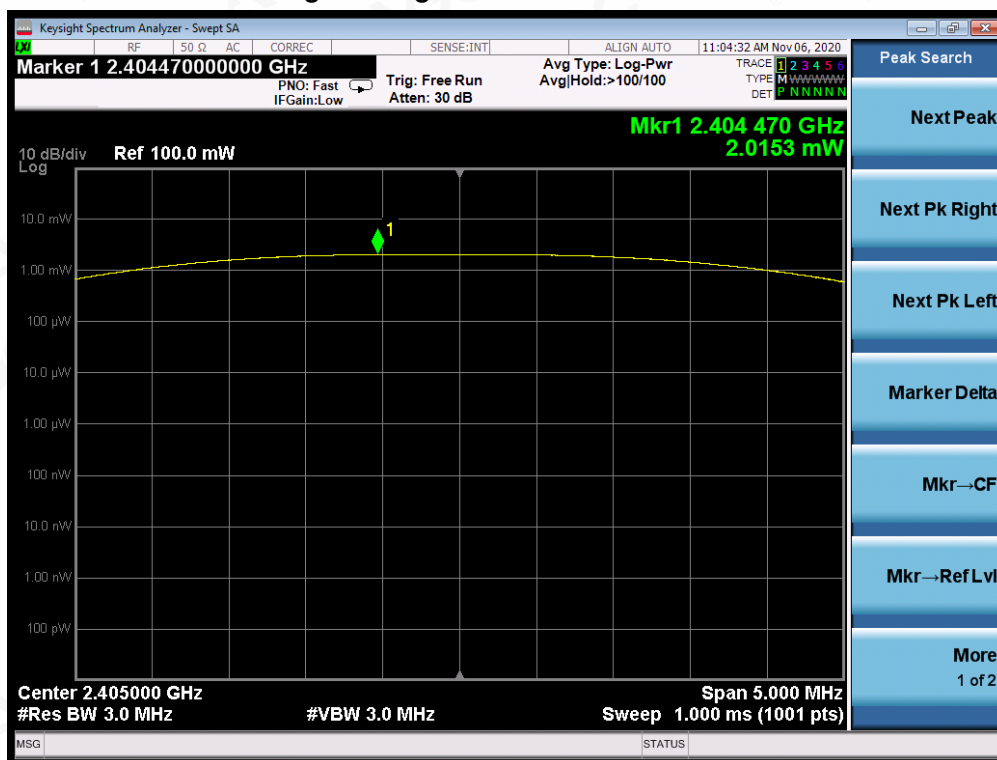


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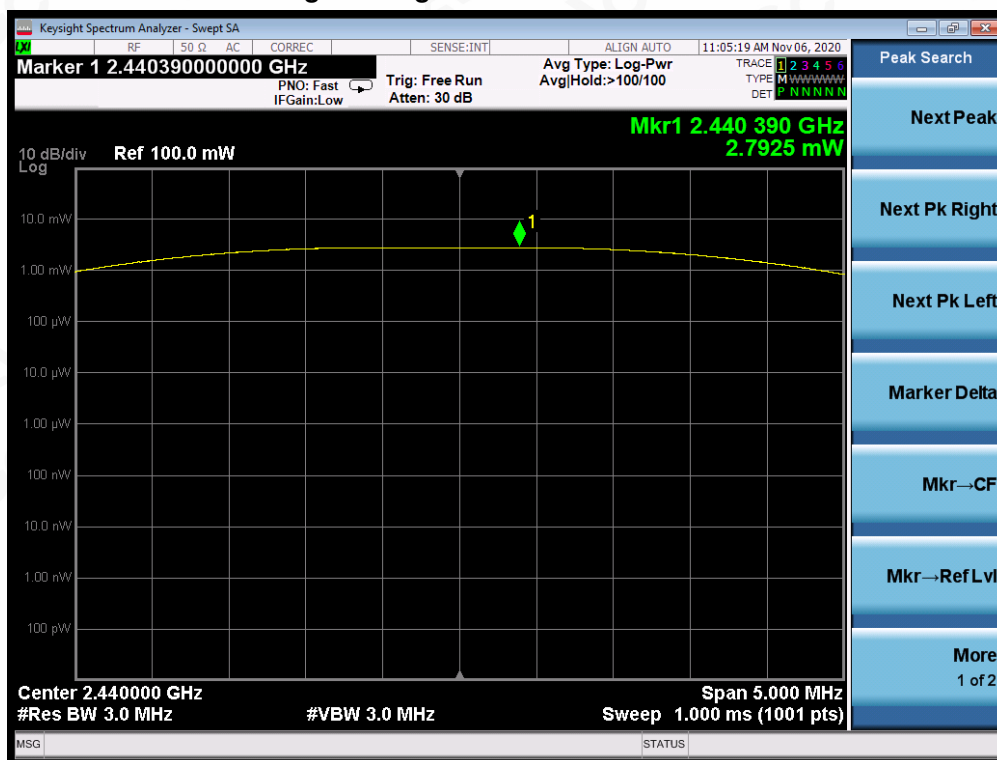
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High Voltage- Antenna Power CH19

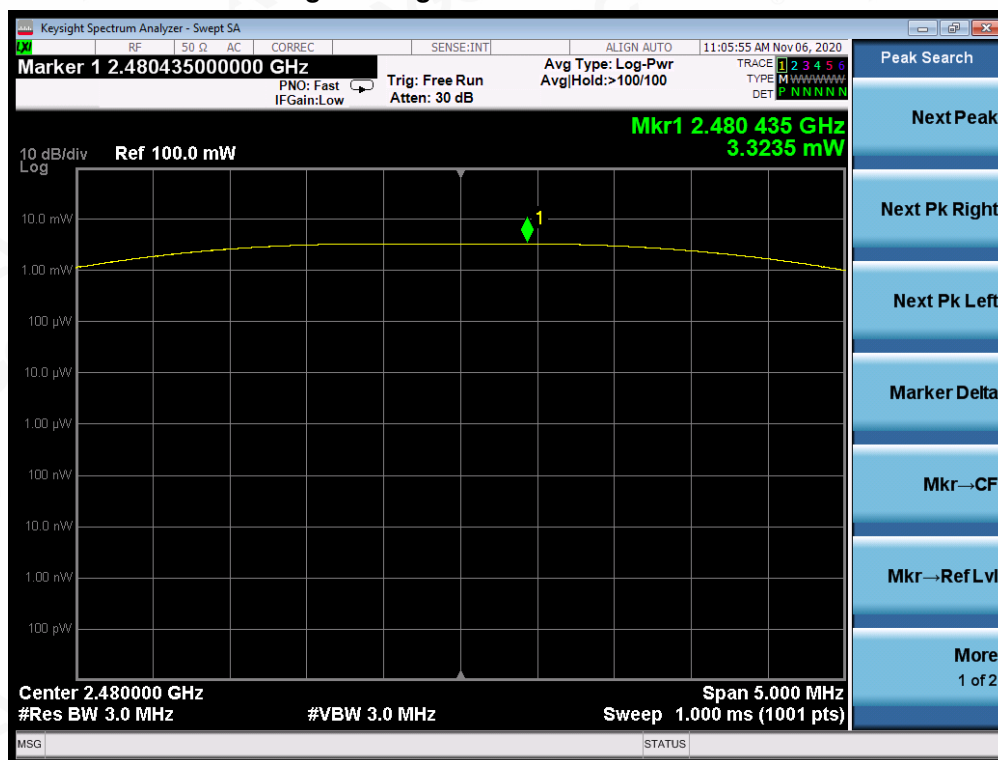


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5.5. LIMITATION OF COLLATERAL EMISSION OF RECEIVER MEASUREMENT

5.5.1. LIMIT

Item	Limits
RX Spurious Emission	$\leq 4\text{nW}$ ($f < 1\text{GHz}$)
	$\leq 20\text{nW}$ ($1\text{GHz} \leq f$)

5.5.2. MEASURING INSTRUMENTS AND SETTING

The following table is the setting of spectrum analyzer.

Spectrum Parameter	Setting
RB	100 kHz (below 1GHz emissions) 1 MHz (above 1GHz emissions)
VB	100 kHz (below 1GHz emissions) 1 MHz (above 1GHz emissions)
Detector	Peak
Trace	Max Hold
Sweep Time	Auto

5.5.3. TEST PROCEDURES

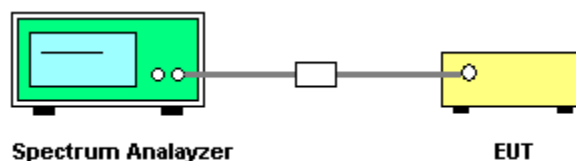
- EUT have the continuous reception mode and fixed only one channelize.
- Setting of SA is following as RB / VB: 100 kHz (below 1GHz emissions) / 1 MHz (above 1GHz emissions) / Sweep time: Auto / Sweep Mode: Continuous sweep / Detect mode: Positive peak / Trace mode: Max hold
- SA set RB: 100kHz and VB: 100kHz. Then adjust to start frequency 30MHz and stop frequency 1000MHz. Search to mark peak reading value + cable loss shall be less than 4nW
- SA set RB: 1MHz and VB: 1MHz. Then adjust to start frequency 1000MHz and stop frequency 12500MHz. Search to mark peak reading value + cable loss shall be less than 20nW
- If power level of lower emissions are more than 1/10 of limit (.0.4nW for $f < 1\text{GHz}$, 2nW for $f \geq 1\text{GHz}$), all those are to be indicated in the 2nd and 3rd lines. If others are 1/10 or less more of the limit, no necessary to be indicated.

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5.5.4. TEST SETUP LAYOUT



5.5.6. TEST DEVIATION

There is no deviation with the original standard.

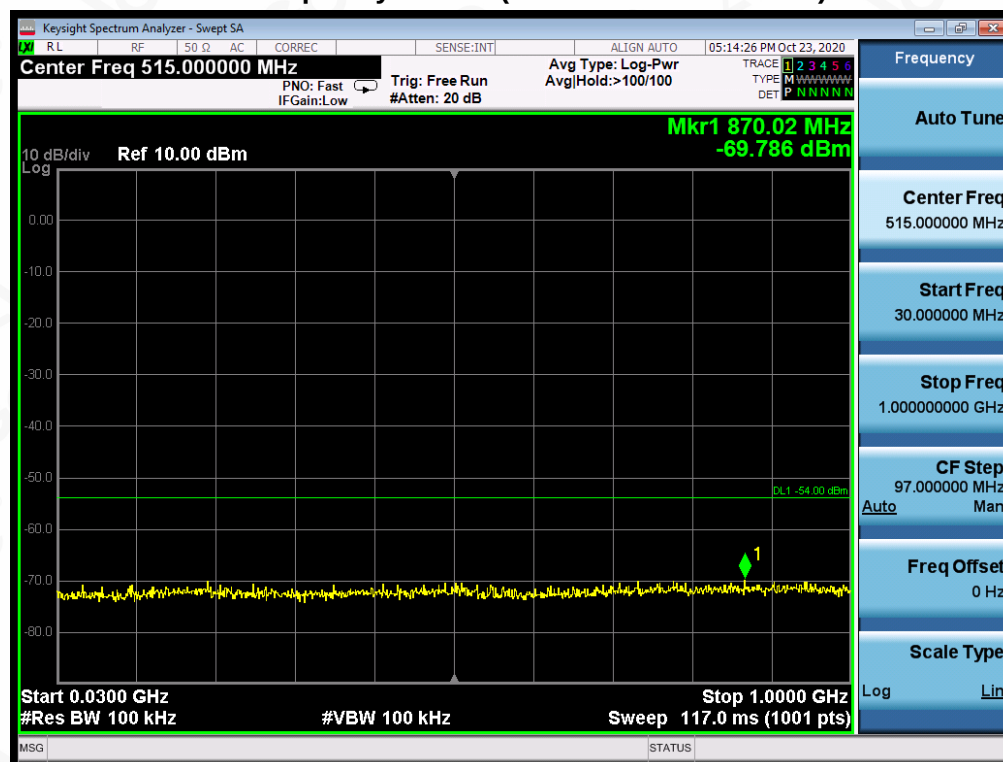
5.5.7. EUT OPERATION DURING TEST

The EUT was programmed to be in continuously reception mode.

5.5.8. TEST RESULT OF LIMITATION OF COLLATERAL EMISSION OF RECEIVER

EUT	NINA-B400	Test Date	Aug. 03, 2020
Temperature	25°C	Tested by	Erik
Humidity	55 % RH	Test Voltage	Normal Voltage
Operation Mode	Continuous receiving condition at low channel (Worst case)		

RX-Frequency Band 1 (30 MHz $\leq$ f < 1000 MHz)

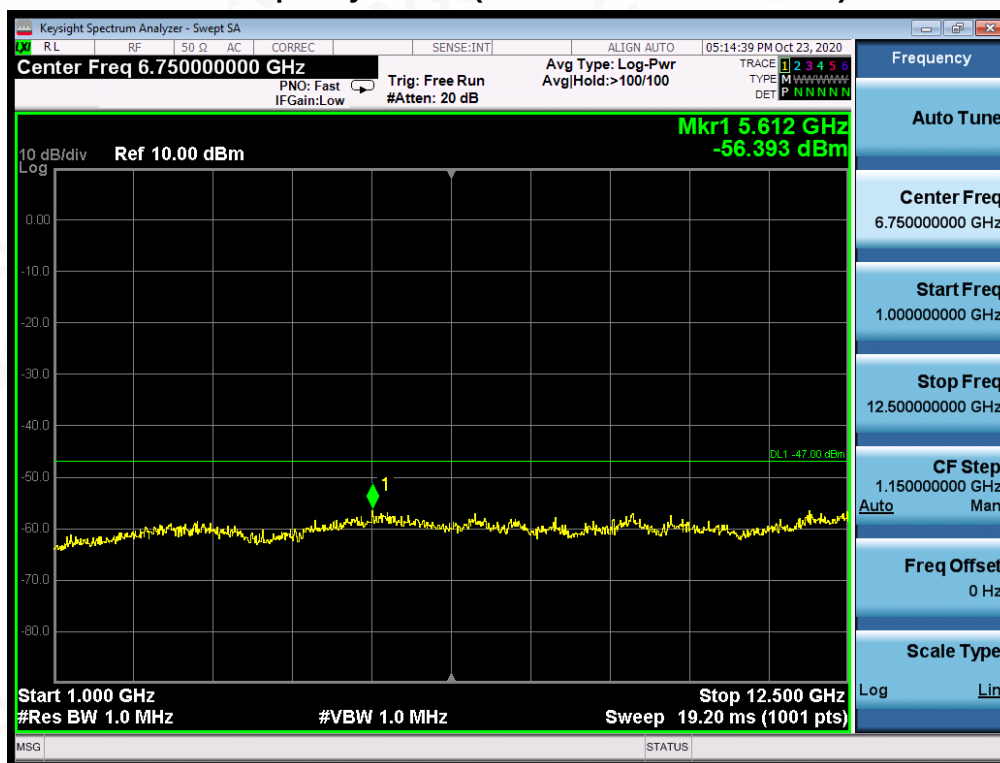


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RX-Frequency Band 2 (1000 MHz $\leq$ f < 12500 MHz)



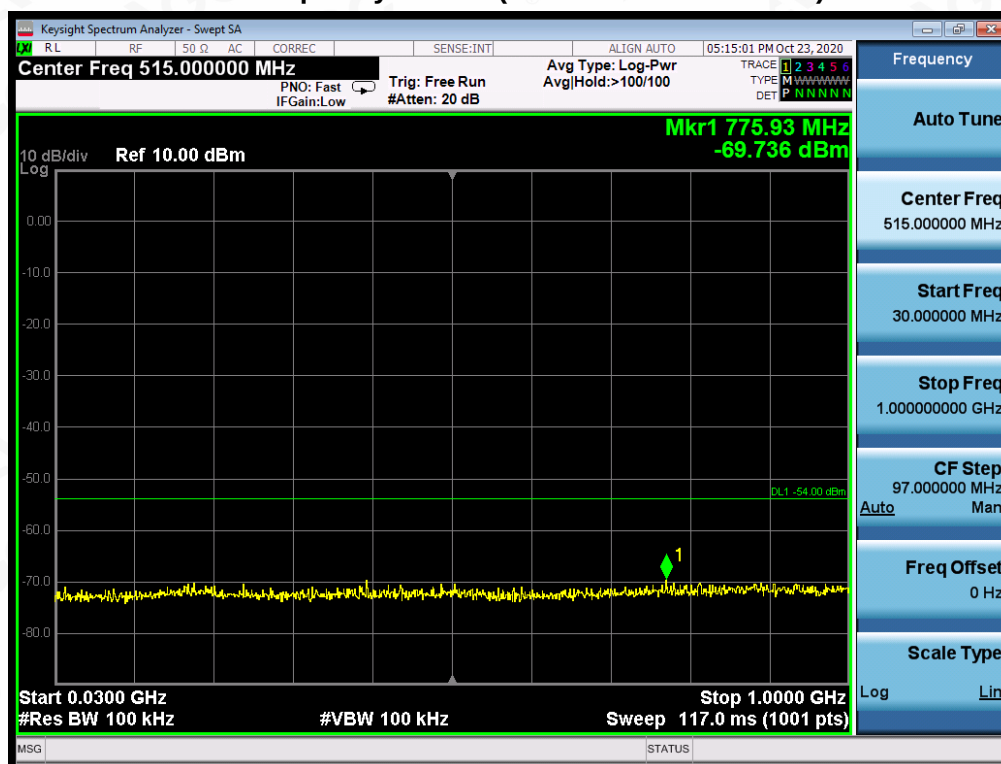
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EUT	NINA-B400	Test Date	Aug. 03, 2020
Temperature	25°C	Tested by	Erik
Humidity	55 % RH	Test Voltage	Low Voltage
Operation Mode	Continuous receiving condition at low channel (Worst case)		

RX-Frequency Band 1 (30 MHz $\leq$ f < 1000 MHz)



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RX-Frequency Band 2 (1000 MHz $\leq$ f < 12500 MHz)



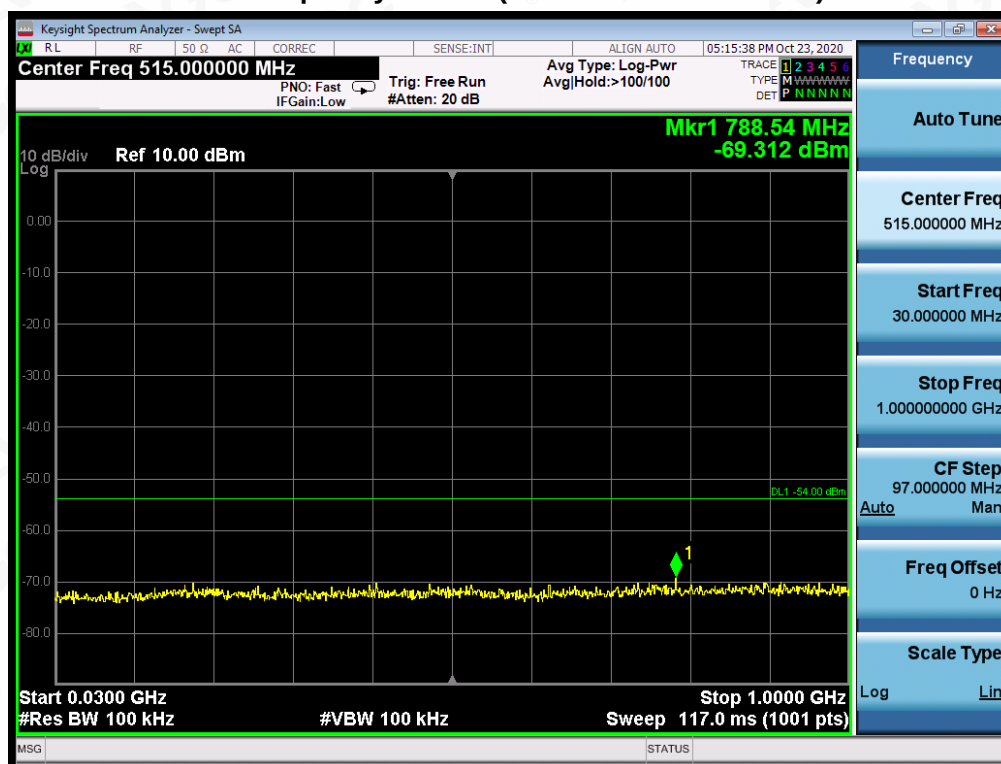
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EUT	NINA-B400	Test Date	Aug. 03, 2020
Temperature	25°C	Tested by	Erik
Humidity	55 % RH	Test Voltage	High Voltage
Operation Mode	Continuous receiving condition at low channel (Worst case)		

RX-Frequency Band 1 (30 MHz $\leq$ f < 1000 MHz)



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5.6. TRANSMISSION ANTENNA GAIN (EIRP ANTENNA POWER) MEASUREMENT

5.6.1. LIMIT

Item	Limits
EIRP Power Density	$\leq 6.91\text{dBm/MHz}$ (FH) $\leq 12.14\text{dBm/MHz}$ (FH system from 2400 to 2427MHz and from 2470.75 to 2483.5MHz, OFDM, DS 20MHz system) $\leq 12.14\text{dBm}$ (Others) $\leq 9.14\text{dBm/MHz}$ (OFDM 40MHz system)
Note: This test item is not applied for radio equipment with equivalent isotropic radiation power lower than 12.14dBm, but Antenna Power (Conducted) limit is 10mW (10dBm), So the test item will not be applied to the transmission antenna which has a gain of 2.14dBi or less	

5.6.2. MEASURING INSTRUMENTS AND SETTING

The following table is the setting of spectrum analyzer.

Spectrum Parameter	Setting
Attenuation	Auto
RB/VB	1 MHz
Detector	Peak
Trace	Max Hold
Sweep Time	Auto

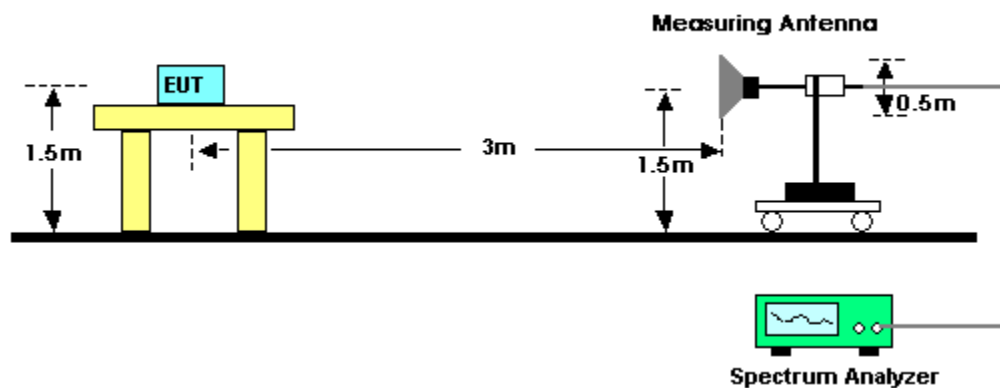
5.6.3. TEST PROCEDURES

1. Set EUT ad measuring antenna at the same height and roughly facing each other.
2. Move the measuring antenna height up and down within $\pm 50\text{cm}$ of EUT height and swing it to find the maximum output of the measuring antenna. The output level at the spectrum analyzer is read say "E".
3. Remove the EUT from the turn table and put the replacing antenna facing to measuring antenna at same height. Set the standard signal generator (SSG) at same frequency and transmit on then receive the signal
4. Swing the replacing antenna give a maximum receiving level.
5. Move the measuring antenna height up and down within $\pm 50\text{cm}$ of replacing antenna height and swing it to find the maximum receiving level.
6. Set SSG output power at Pt to give the equivalent output level of "E" or calculate Pt with SSG output which gives the nearest of "E" and difference ($\pm 1\text{dB}$). Record the Pt.
7. Calculate EIRP by the formula below $\text{EIRP} = \text{Gt} - \text{L} + \text{Pt}$.
Gt: gain of replacing antenna (dBi)
L: feeder loss between SSG and replacing antenna
Pt: Output power of the SSG
8. If the antenna for the EUT has circular polarization, sum of V-field and H-field will be result if measuring antenna is linear polarization.

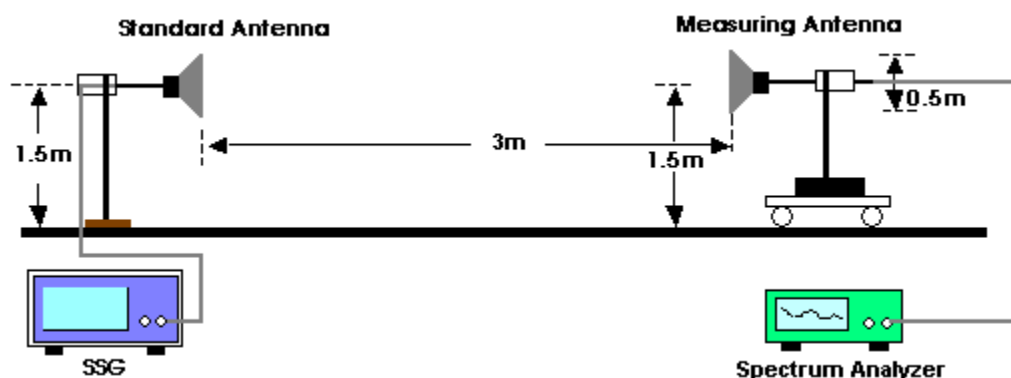
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5.6.4. TEST SETUP LAYOUT For EUT radiation measurement



For standard antenna measurement



5.6.5. TEST DEVIATION

There is no deviation with the original standard.

5.6.6. EUT OPERATION DURING TEST

The EUT was programmed to be in continuously transmitting mode.

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5.6.7. RESULTS OF TRANSMISSION ANTENNA GAIN

TEST CONDITION	EIRP Power Density dBm/MHz
Normal Voltage (DC3.3V)	7.601
Normal Voltage -10%(2.97V)	7.601
Normal Voltage +10% (3.63V)	7.619
Remarks: Low/Mid/High of test frequency range; Limit $\leq$ 16.37mW (12.14dBm)	

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5.7. TRANSMISSION RADIATION ANGLE WIDTH (3DB BEAMWIDTH) MEASUREMENT

5.7.1. LIMIT

Item	Limits
3dB antenna beam width	360/A (If $A < 1$; then $A = 1$) $A = \{\text{EIRP Power [mW]} / 16.36 \text{ for DS, OFDM}\}$ or $A = \{\text{EIRP Power [mW]} / 4.9 \text{ for FH}\}$
Note: This test item is not applied for radio equipment with equivalent isotropic radiation power lower than 12.14dBm, but Antenna Power (Conducted) limit is 10mW (10dBm), So the test item will not be applied to the transmission antenna which has a gain of 2.14dBi or less	

5.7.2. MEASURING INSTRUMENTS AND SETTING

Spectrum Parameter	Setting
Attenuation	Auto
Span Frequency	0 MHz
RB	1 MHz
VB	1 kHz
Detector	Peak
Trace	Max Hold
Sweep Time	Auto

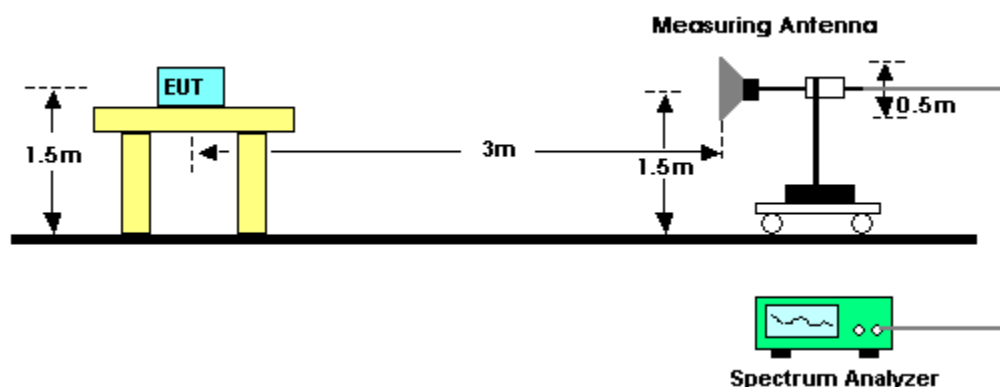
5.7.3. TEST PROCEDURES

1. Set EUT and measuring antenna at the same height and roughly facing each other.
2. Set spectrum analyzer with condition in section 4.7.2 and tune reference level to observe receiving signal position.
3. Rotate directions of the EUT horizontally and vertically to find the maximum receiving power.
4. Move the measuring antenna height up and down within $\pm 50\text{cm}$ of EUT height and swing it to find the maximum output of measuring antenna. The output level at the spectrum analyzer is read as "E"
5. Calculate permitted radiation angle in horizontal and vertical using EIRP measured in another test method.
6. Calculate 3dB antenna beam width by the formula below $360/A$ (If $A < 1$; then $A = 1$).
 $A = \{\text{EIRP Power [mW]} / 16.36 \text{ for DS, OFDM}\}$ or
 $A = \{\text{EIRP Power [mW]} / 4.9 \text{ for FH}\}$

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5.7.4. TEST SETUP LAYOUT



5.7.5. TEST DEVIATION

There is no deviation with the original standard.

5.7.6. EUT OPERATION DURING TEST

The EUT was programmed to be in continuously transmitting mode.

5.7.7. TEST RESULT OF TRANSMISSION RADIATION ANGLE WIDTH (3DB BEAMWIDTH)

Note: This test item is not applied for radio equipment with equivalent isotropic radiation power lower than 12.14dBm.

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5.8. RADIO INTERFERENCE PREVENTION CAPABILITY MEASUREMENT

5.8.1. LIMIT

Item	Limits
Identification code	≥ 48 bits

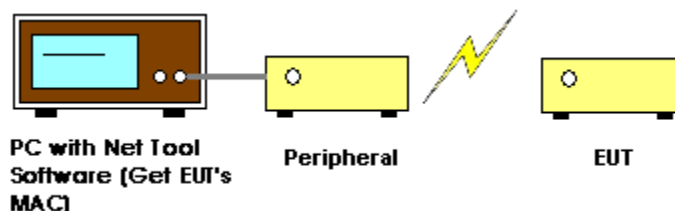
5.8.2. MEASURING ID CODE SOFTWARE

Item	Limits
MAC IP List	MAC Scan

5.8.3. TEST PROCEDURES

- In the case that the EUT has the function of automatically transmitting the identification code: a. Transmit the predetermined identification codes from EUT. b. Check the transmitted identification codes with the demodulator.
- In the case of receiving the identification code: a. Transmit the predetermined identification codes from the counterpart. b. Check if communication is normal. c. Transmit the signals other than predetermined ID codes from the counterpart. d. Check if the EUT stops the transmission, or if it displays that identification codes are different from the predetermined ones.

5.8.4. TEST SETUP LAYOUT



5.8.5. TEST DEVIATION

There is no deviation with the original standard.

5.8.6. EUT OPERATION DURING TEST

The EUT was programmed to be in normal transmitting mode.

5.8.7. TEST RESULT OF RADIO INTERFERENCE PREVENTION CAPABILIT

EUT		Test Date	Aug. 03, 2020
Temperature	25°C	Tested by	Erik
Humidity	55 % RH	Test Voltage	Normal
Test result	CONFORM		
MAC address	88:F8:72:63:FB:7F		

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5.9 CONSTRUCTION PROTECTION CONFIRMATION METHOD

5.9.1. LIMIT

The high-frequency section and modulation section of the radio equipment except for the antenna system shall not be capable of being opened easily.

5.9.2. CONFIRMATION METHOD

The RF and modulation portions are protected against illegal modification as following method:

Protected Method	Description
BT Module Package	BT Module Package of RF (U1: nRF52833) and Modulation (X1: 32 MHz) portions is QFN type.
Enclosure	The upper enclosure is blocked through buckles, the enclosure is not easily open, otherwise the device will be damage.
User Manual	we will add some warning statements on the user manual to against illegal modification.

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APPENDIX A: PHOTOGRAPHS OF TEST SETUP



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APPENDIX B: PHOTOGRAPHS OF EUT

Refer to Attached file (APPENDIX I).

----END OF REPORT----

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Conditions of Issuance of Test Reports

1. All samples and goods are accepted by the Attestation of Global Compliance (Shenzhen) Co., Ltd (the “Company”) solely for testing and reporting in accordance with the following terms and conditions. The company provides its services on the basis that such terms and conditions constitute express agreement between the company and any person, firm or company requesting its services (the “Clients”).
2. Any report issued by Company as a result of this application for testing services (the “Report”) shall be issued in confidence to the Clients and the Report will be strictly treated as such by the Company. It may not be reproduced either in its entirety or in part and it may not be used for advertising or other unauthorized purposes without the written consent of the Company. The Clients to whom the Report is issued may, however, show or send it, or a certified copy thereof prepared by the Company to its customer, supplier or other persons directly concerned. The Company will not, without the consent of the Clients, enter into any discussion or correspondence with any third party concerning the contents of the Report, unless required by the relevant governmental authorities, laws or court orders.
3. The Company shall not be called or be liable to be called to give evidence or testimony on the Report in a court of law without its prior written consent, unless required by the relevant governmental authorities, laws or court orders.
4. The non-CMA report issued by AGC is only permitted to be used by the client as internal reference use and shall not be used for public demonstration purpose.
5. In the event of the improper use of the report as determined by the Company, the Company reserves the right to withdraw it, and to adopt any other additional remedies which may be appropriate.
6. Samples submitted for testing are accepted on the understanding that the Report issued cannot form the basis of, or be the instrument for, any legal action against the Company.
7. The Company will not be liable for or accept responsibility for any loss or damage however arising from the use of information contained in any of its Reports or in any communication whatsoever about its said tests or investigations.
8. Clients wishing to use the Report in court proceedings or arbitration shall inform the Company to that effect prior to submitting the sample for testing.
9. The Company is not responsible for recalling the electronic version of the original report when any revision is made to them. The Client assumes the responsibility to providing the revised version to any interested party who uses them.
10. Subject to the variable length of retention time for test data and report stored hereinto as otherwise specifically required by individual accreditation authorities, the Company will only keep the supporting test data and information of the test report for a period of six years. The data and information will be disposed of after the aforementioned retention period has elapsed. Under no circumstances shall we provide any data and information which has been disposed of after retention period. Under no circumstances shall we be liable for damage of any kind, including (but not limited to) compensatory damages, lost profits, lost data, or any form of special, incidental, indirect, consequential or punitive damages of any kind, whether based on breach of contract of warranty, tort (including negligence), product liability or otherwise, even if we are informed in advance of the possibility of such damages.

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