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FCC/ISED Test Report

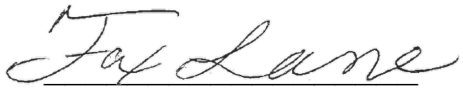
Prepared for: **Garmin International, Inc.**

Address: **1200 E. 151st Street**
Olathe, Kansas, 66062, USA

Product: **A04448**

Test Report No: **R20230808-00-E8A**

Approved by:



Fox Lane,
EMC Test Engineer

DATE: **September 29, 2023**

Total Pages: **64**

REVISION PAGE

Rev. No.	Date	Description
0	29 September 2023	Issued by FLane Reviewed by KVepuri Prepared by ESchmidt
A	29 September 2023	Corrected Customer information Page 5 - FL

CONTENTS

1.0 SUMMARY OF TEST RESULTS

The worst-case measurements were reported in this report. Summary of test results presented in this report correspond to the following section (Please see the checked box below for the rule part used):

FCC Part 15.247

The EUT has been tested according to the following specifications:

(1) US Code of Federal Regulations, Title 47, Part 15
(2) ISED RSS-Gen, Issue 5
(3) ISED RSS-247, Issue 3

APPLIED STANDARDS AND REGULATIONS		
Standard Section	**Test Type**	**Result**
FCC Part 15.35 RSS Gen, Issue 5, Section 6.10	Duty Cycle	Pass
FCC Part 15.247(b)(3) RSS-247 Issue 3 Section 5.4(d)	Peak output power	Pass
FCC Part 15.247(a)(2) RSS-247 Issue 3 Section 5.2 (a)	Bandwidth	Pass
FCC Part 15.209 RSS-Gen Issue 5, Section 7.3	Receiver Radiated Emissions	Pass
FCC Part 15.209 (restricted bands), 15.247 (unrestricted) RSS-247 Issue 3 Section 5.5, RSS-Gen Issue 5, Section 8.9	Transmitter Radiated Emissions	Pass
FCC Part 15.247(e) RSS-247 Issue 3 Section 5.2 (b)	Power Spectral Density	Pass
FCC Part 15.209, 15.247(d) RSS-247 Issue 3 Section 5.5	Band Edge Measurement	Pass
FCC Part 15.207 RSS-Gen Issue 5, Section 8.8	Conducted Emissions	Pass

2.0 EUT DESCRIPTION

2.1 EQUIPMENT UNDER TEST

Summary and Operating Condition:

EUT	A04448
FCC ID	IPH-04448
IC	1792A-04448
EUT Received	24 August 2023
EUT Tested	28 August 2023 - 14 September 2023
Serial No.	3451928865 (Radiated Measurements) 3451928680 (Radiated Measurements) 3451928690 (Conducted Measurements)
Operating Band	2400 – 2483.5 MHz
Device Type	☐ GMSK ☐ GFSK ☐ BT BR ☒ BT EDR 2MB ☒ BT EDR 3MB ☐ 802.11x
Power Supply / Voltage	Internal Battery / 5VDC Charger: Garmin (Phi Hong) Model: AQ27A-59CFA GPN: 362-00118-00 (Representative Power Supply)

NOTE: For more detailed features description, please refer to the manufacturer's specifications or user's manual.

2.2 DESCRIPTION OF TEST MODES

The operating range of the EUT is dependent on the device type found in section 2.1:

For Bluetooth Transmissions:

Channel	Frequency
Low	2402 MHz
Mid	2440 MHz
High	2480 MHz

These are the only representative channels tested in the frequency range according to FCC Part 15.31 and RSS-Gen Table A1. See the operational description for a list of all channel frequency and designations.

2.3 DESCRIPTION OF SUPPORT UNITS

None

3.0 LABORATORY AND GENERAL TEST DESCRIPTION

3.1 LABORATORY DESCRIPTION

All testing was performed at the following Facility:

The Nebraska Center for Excellence in Electronics (NCEE Labs)
4740 Discovery Drive
Lincoln, NE 68521

A2LA Certificate Number:	1953.01
FCC Accredited Test Site Designation No:	US1060
Industry Canada Test Site Registration No:	4294A-1
NCC CAB Identification No:	US0177

Environmental conditions varied slightly throughout the tests:

Relative humidity of 35 ± 4%
Temperature of 22 ± 3° Celsius

3.2 TEST PERSONNEL

No.	PERSONNEL	TITLE	ROLE
1	Fox Lane	Test Engineer	Testing, Review, and Report
2	Blake Winter	Test Engineer	Testing
3	Ethan Schmidt	Test Technician	Testing and Report
4	Karthik Vepuri	Test Engineer	Review/Testing

Notes:
All personnel are permanent staff members of NCEE Labs. No testing or review was sub-contracted or performed by sub-contracted personnel.

3.3 TEST EQUIPMENT

DESCRIPTION AND MANUFACTURER	MODEL NO.	SERIAL NO.	LAST CALIBRATION DATE	CALIBRATION DUE DATE
Keysight MXE Signal Analyzer (44GHz)	N9038A	MY59050109	July 17, 2023	July 17, 2025
Keysight MXE Signal Analyzer (26.5GHz)	N9038A	MY56400083	July 17, 2023	July 17, 2025
Keysight EXA Signal Analyzer	N9010A	MY56070862	July 18, 2023	July 17, 2025
SunAR RF Motion	JB1	A091418	July 27, 2023	July 26, 2024
ETS-Lindgren Red Horn Antenna	3115	218576	July 31, 2023	July 30, 2024
EMCO Horn Antenna	3116	2576	July 31, 2023	July 30, 2024
Com-Power LISN, Single Phase	LI-220C	20070017	July 17, 2023	July 17, 2025
Agilent Preamp*	87405A	3950M00669	June 5, 2023	June 5, 2025
Rohde & Schwarz Preamplifier*	TS-PR18	3545700803	June 5, 2023	June 5, 2025
Trilithic High Pass Filter*	6HC330	23042	June 5, 2023	June 5, 2025
RF Cable (antenna to 10m chamber bulkhead)	FSCM 64639	01E3872	June 5, 2023	June 5, 2025
RF Cable (10m chamber bulkhead to control room bulkhead)	FSCM 64639	01E3874	June 5, 2023	June 5, 2025
RF Cable (control room bulkhead to test receiver)	FSCM 64639	01F1206	June 5, 2023	June 5, 2025
N connector bulkhead (10m chamber)	PE9128	NCEEBH1	June 5, 2023	June 5, 2025
N connector bulkhead (control room)	PE9128	NCEEBH2	June 5, 2023	June 5, 2025
TDK Emissions Lab Software	V11.25	700307	NA	NA
ETS – Lindgren- VSWR on 10m Chamber	10m Semi-anechoic chamber-VSWR	4740 Discovery Drive	July 30, 2020	July 30, 2024
NCEE Labs-NSA on 10m Chamber	10m Semi-anechoic chamber-NSA	NCEE-001	May 25, 2022	May 25, 2025

*Internal Characterization

Notes:
All equipment is owned by NCEE Labs and stored permanently at NCEE Labs facilities.

3.4 GENERAL TEST PROCEDURE AND SETUP FOR RADIO MEASUREMNTS

Measurement type presented in this report (Please see the checked box below):

Conducted ☒

The conducted measurements were performed by connecting the output of the transmitter directly into a spectrum analyzer using an impedance matched cable and connector soldered to the EUT in place of the antenna. The information regarding resolution bandwidth, video bandwidth, span and the detector used can be found in the graphs provided in the Appendix C. All the radio measurements were performed using the sections from ANSI C63.10, details about the section used can be found in the spectrum analyzer titles on the graph.

Figure 1 - Bandwidth Measurements Test Setup

Radiated ☒

All the radiated measurements were taken at a distance of 3m from the EUT. The information regarding resolution bandwidth, video bandwidth, span and the detector used can be found in the graphs provided in the Appendix C. All the radio measurements were performed using the sections from ANSI C63.10, details about the section used can be found in the spectrum analyzer titles on the graph.

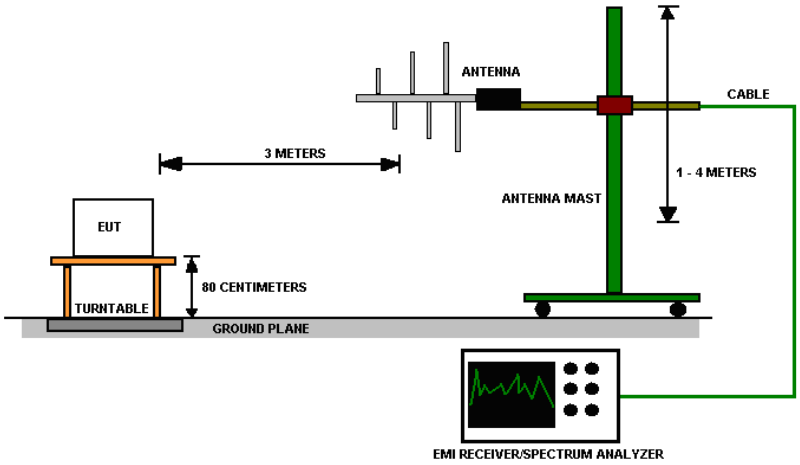


Figure 2 - Radiated Emissions Test Setup

4.0 RESULTS

DTS Radio Measurements							
CH.	Mode	Occupied Bandwidth (MHz)	6 dB Bandwidth (MHz)	AVG Output Power	AVG Output Power (mW)	PSD (dBm)	RESULT
Low	2EDR	1205.10	1066.00	11.110	12.912	-2.099	PASS
Mid	2EDR	1201.50	1066.00	9.190	8.299	-3.99	PASS
High	2EDR	1203.00	1068.00	9.160	8.241	-3.939	PASS
Low	3EDR	1248.30	973.10	9.500	8.913	-3.304	PASS
Mid	3EDR	1240.80	971.40	9.010	7.962	-3.817	PASS
High	3EDR	1241.20	970.50	8.920	7.798	-3.682	PASS
Occupied Bandwidth = N/A; 6 dB Bandwidth Limit > 500 kHz			Peak Output Power Limit = 30 dBm; PSD Limit = 8 dBm				

Unrestricted Band-Edge							
CHANNEL	Mode	Band edge /Measurement Frequency (MHz)	Relative Highest out of band level (dBuV)	Relative Fundamental (dBuV)	Delta (dB)	Min Delta (dB)	Result
Low	2EDR	2400.00	76.43	115.76	39.33	30.00	PASS
High	2EDR	2483.50	56.62	113.87	57.25	30.00	PASS
Low	3EDR	2400.00	73.89	114.59	40.71	30.00	PASS
High	3EDR	2483.50	54.98	114.00	59.02	30.00	PASS
Peak Restricted Band-Edge							
CHANNEL	Mode	Band edge /Measurement Frequency (MHz)	Highest out of band level (dBuV/m @ 3m)	Measurement Type	Limit (dBuV/m @ 3m)	Margin	Result
Low	2EDR	2390.00	51.10	Peak	73.98	22.88	PASS
High	2EDR	2483.50	50.93	Peak	73.98	23.05	PASS
Low	3EDR	2390.00	50.83	Peak	73.98	23.15	PASS
High	3EDR	2483.50	51.49	Peak	73.98	22.49	PASS
*Limit shown is the peak limit taken from FCC Part 15.209							
Average Restricted Band-Edge							
CHANNEL	Mode	Band edge /Measurement Frequency (MHz)	Highest out of band level (dBuV/m @ 3m)	Measurement Type	Limit (dBuV/m @ 3m)	Margin	Result
Low	2EDR	2390.00	39.67	Peak	73.98	14.31	PASS
High	2EDR	2483.50	40.56	Peak	73.98	13.43	PASS
Low	3EDR	2390.00	39.31	Peak	73.98	14.67	PASS
High	3EDR	2483.50	40.69	Peak	73.98	13.29	PASS
*Limit shown is the peak limit taken from FCC Part 15.209							

4.1 OUTPUT POWER

Test Method: All the radio measurements were performed using the sections from ANSI C63.10, Sec. 11.9.2.2.4

Limits of power measurements:
For FCC Part 15.247 Device:
The maximum allowed output power is 30 dBm.

Test procedures:
Details can be found in section 3.4 of this report.

Deviations from test standard:
No deviation.

Test setup:
Details can be found in section 3.4 of this report.

EUT operating conditions:
Details can be found in section 2.1 of this report.

Test results:

Pass

Comments:

1. All the output power plots can be found in Appendix C.
2. All the measurements were found to be compliant.
3. Compiled values can be found in the Results section, 4.0.

4.2 BANDWIDTH

Test Method: All the radio measurements were performed using the sections from ANSI C63.10, details about the section used can be found in the spectrum analyzer titles on the graph.

Limits of bandwidth measurements:
For FCC Part 15.247 Device:
The 99% occupied bandwidth is for informational purpose only. The 6dB bandwidth of the signal must be greater than 500 kHz.

Test procedures:
Details can be found in section 3.4 of this report.

Deviations from test standard:
No deviation.

Test setup:
Test setup details can be found in section 3.4 of this report.

EUT operating conditions:
Details can be found in section 2.1 of this report.

Test results:

Pass

Comments:

1. All the bandwidth plots can be found in Appendix C.
2. All the measurements were found to be compliant.

4.3 DUTY CYCLE

Manufacture declares worst case duty cycle for the transmitters in this report will be 80%

DCCF (For Emissions) = 20*log(.8) = **-1.94dB**

4.4 RADIATED EMISSIONS

Test Method: ANSI C63.10-2013, Section 6.5, 6.6

Limits for radiated emissions measurements:
Emissions radiated outside of the specified bands shall be applied to the limits in 15.209 as followed:

FREQUENCIES (MHz)	FIELD STRENGTH (μV/m)	MEASUREMENT DISTANCE (m)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	3
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

NOTE:
1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBuV/m) = 20 * log * Emission level (μV/m).
3. As shown in 15.35(b), for frequencies above 1000MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits by more than 20dB under any condition of modulation.
4. The EUT was tested for spurious emissions while running off of battery power and external USB power. The worse-case emissions were produced while running off of USB power, so results from this mode are presented.

Test procedures:

a. The EUT was placed on the top of a rotating table above the ground plane in a 10 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation. The table was 0.8m high for measurements from 30MHz-1Ghz and 1.5m for measurements from 1GHz and higher.

b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.

c. The antenna was a broadband antenna, and its height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are used to make the measurement.

d. For each suspected emission, the EUT was arranged to maximize its emissions and then the antenna height was varied from 1 meter to 4 meters and the rotating table was turned from 0 degrees to 360 degrees to find the maximum emission reading.

e. The test-receiver system was set to use a peak detector with a specified resolution bandwidth. For spectrum analyzer measurements, the composite maximum of several analyzer sweeps was used for final measurements.

f. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10 dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

g. The EUT was maximized in all 3 orthogonal positions. The results are presented for the axis that had the highest emissions.

Test setup:

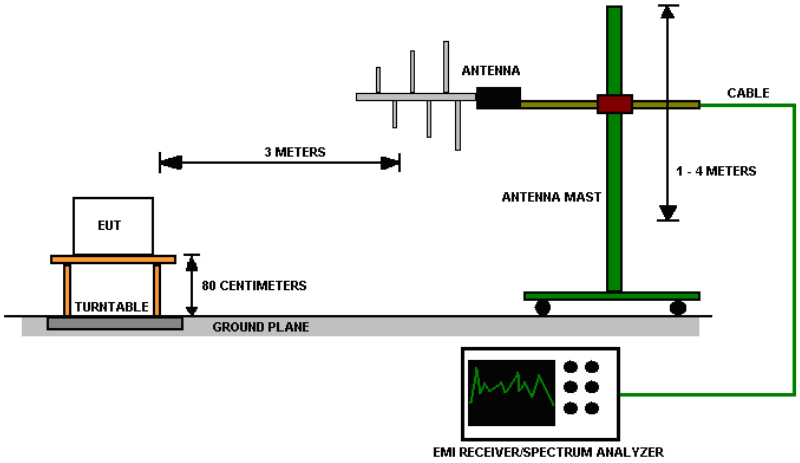


Figure 3 - Radiated Emissions Test Setup

NOTE:
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Peak detection (PK) and Quasi-peak detection (QP) at frequencies below 1GHz.

2. The resolution bandwidth 1 MHz for all measurements and at frequencies above 1GHz, A peak detector was used for all measurements above 1GHz. Measurements were made with an EMI Receiver.

Deviations from test standard:

No deviation.

EUT operating conditions
Details can be found in section 2.1 of this report.

Test results:

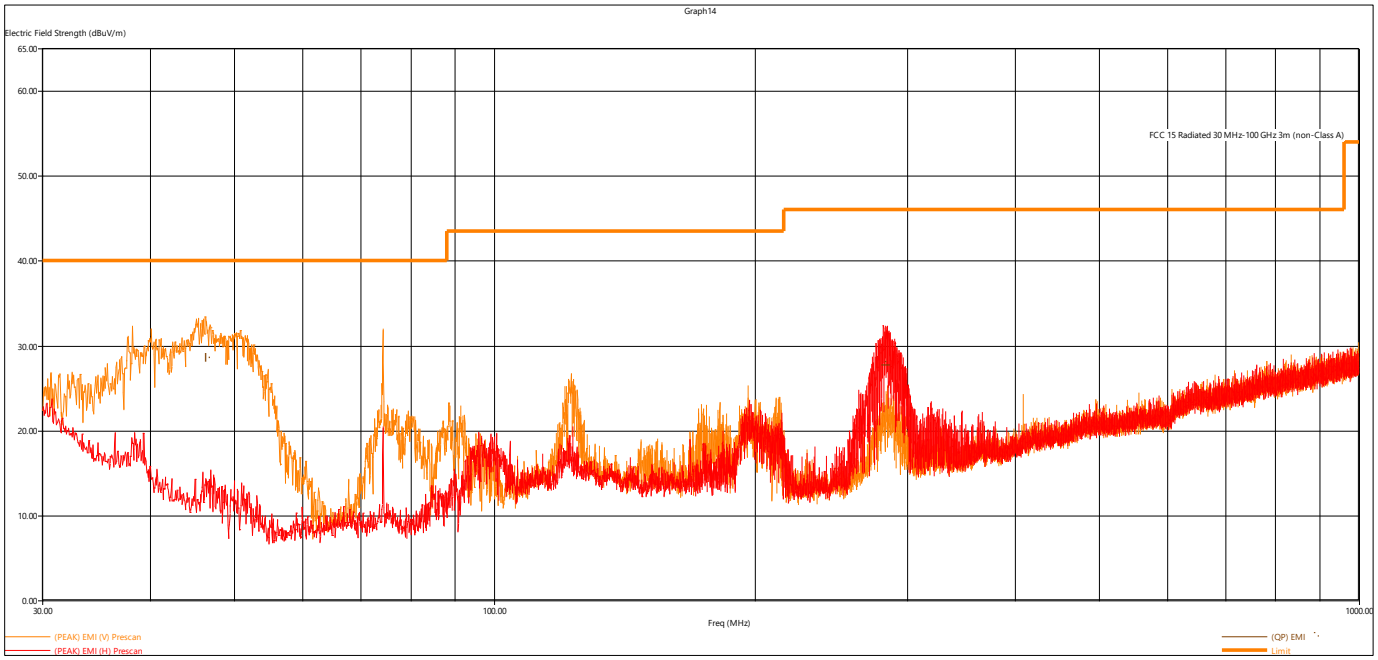


Figure 4 - Radiated Emissions Plot, Receive

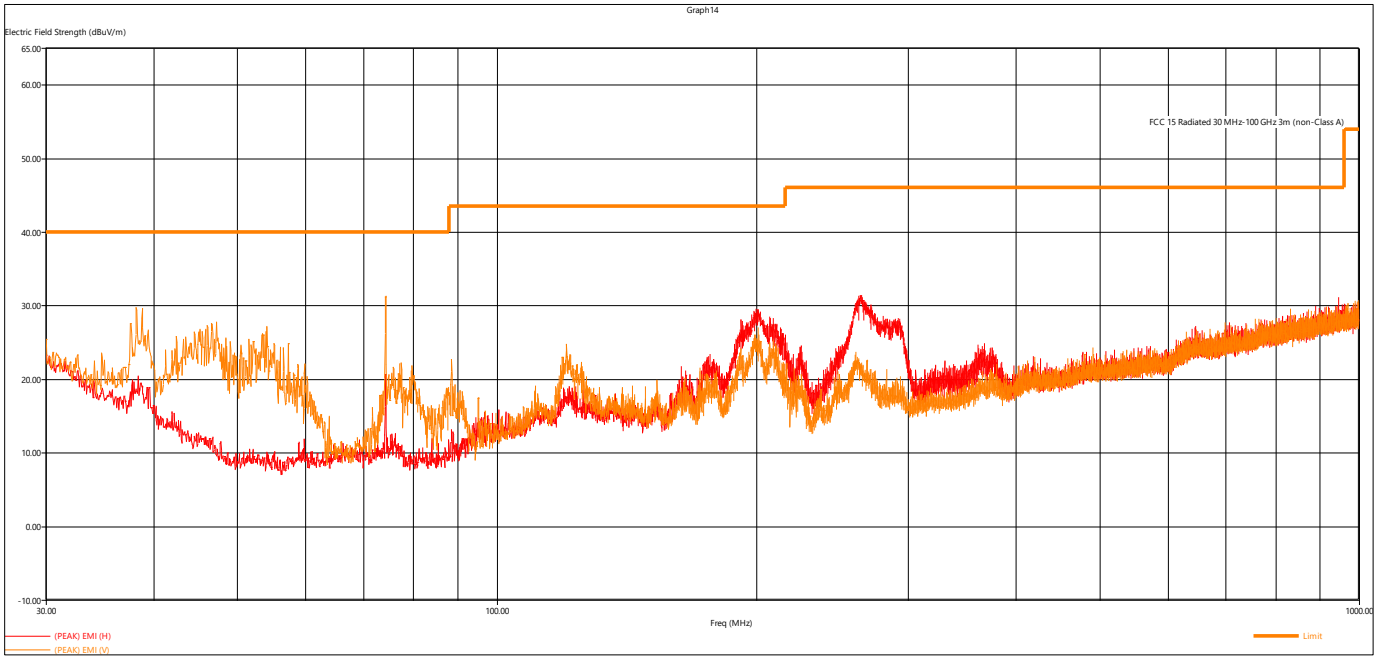


Figure 5 - Radiated Emissions Plot, BT EDR 2MB

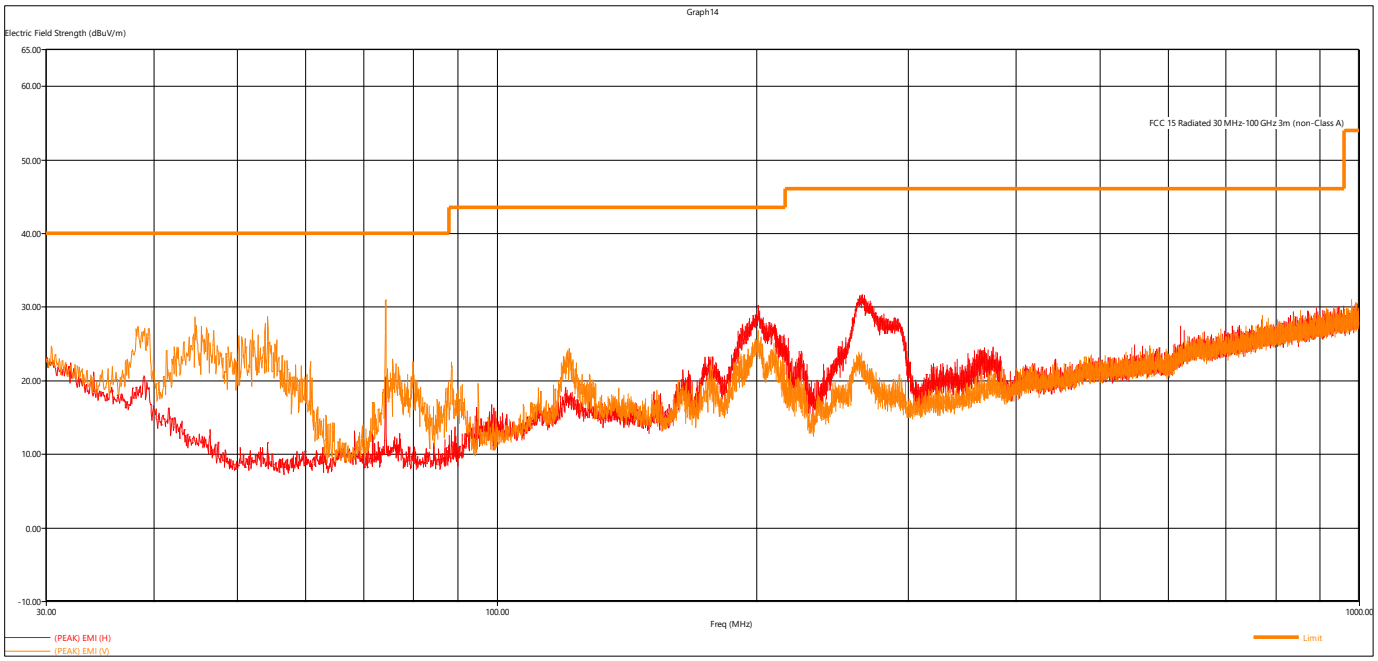


Figure 6 - Radiated Emissions Plot, BT EDR 3MB

REMARKS:
1. Emission level (dBuV/m) = Raw Value (dBuV) + Correction Factor (dB)
2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value

Quasi-Peak Measurements								
Frequency	**Level**	**Limit**	**Margin**	**Height**	**Angle**	**Pol**	**Channel**	**Modulation**
MHz	**dBµV/m**	**dBµV/m**	**dB**	**cm.**	**deg.**			
283.217520	27.69	46.02	18.33	104.14	278.50	H	Rx	
46.266000	28.49	40.00	11.51	104.38	67.50	V	Rx	

The EUT was maximized in all 3 orthogonal axes. The worst-case is shown in the table above.
All other emissions found to be at least 6dB below limit line

Peak Measurements								
Frequency	**Level**	**Limit**	**Margin**	**Height**	**Angle**	**Pol**	**Channel**	**Modulation**
MHz	**dBµV/m**	**dBµV/m**	**dB**	**cm.**	**deg.**			
7205.562000	64.00	NA	NA	527.43	100.50	H	Low	2EDR
7319.512000	62.60	73.98	11.38	551.97	102.75	H	Mid	2EDR
7439.632000	60.43	73.98	13.55	124.08	105.75	H	High	2EDR
7320.376000	62.10	73.98	11.88	552.62	102.75	H	Low	3EDR
7439.672000	60.40	73.98	13.58	554.35	92.00	H	Mid	3EDR
7206.430000	63.85	NA	NA	545.00	88.00	H	High	3EDR

The EUT was maximized in all 3 orthogonal axes. The worst-case is shown in the table above.
All other emissions found to be at least 6dB below limit line

Average Measurements										
Frequency	**Level**	**DCCF**	**Corrected Level**	**Limit**	**Margin**	**Height**	**Angle**	**Pol**	**Channel**	**Modulation**
MHz	**dBµV/m**	**dB**	**dBµV/m**	**dBµV/m**	**dB**	**cm.**	**deg.**			
7205.562000	54.32	-1.94	52.38	NA	NA	527.43	100.5	H	Low	2EDR
7319.512000	**55.33**	**-1.94**	**53.39**	**53.98**	**0.59**	**551.97**	**102.75**	**H**	**Mid**	**2EDR**
7439.632000	54.77	-1.94	52.83	53.98	1.15	124.08	105.75	H	High	2EDR
7320.376000	55.17	-1.94	53.23	53.98	0.75	552.62	102.75	H	Low	3EDR
7439.672000	54.58	-1.94	52.64	53.98	1.34	554.35	92	H	Mid	3EDR
7206.430000	54.17	-1.94	52.23	NA	NA	545	88	H	High	3EDR
Corrected Level = Level + DCCF										

The EUT was maximized in all 3 orthogonal axes. The worst-case is shown in the table above.
All other emissions found to be at least 6dB below limit line

4.5 CONDUCTED SPURIOUS EMISSIONS

Test Method: ANSI C63.10-2013, Section 6.7

Limits of spurious emissions:
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in § 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in § 15.205(a), must also comply with the radiated emission limits specified in § 15.209(a) (see § 15.205(c)).

Test procedures:
The highest emissions level was measured and recorded. All spurious measurements were evaluated to 20dB below the fundamental. More details can be found in section 3.4 of this report.

Deviations from test standard:
None.

Test setup:
Test setup details can be found in section 3.4 of this report.

EUT operating conditions:
Details can be found in section 2.1 of this report.

Test results:
Please note; the line shown in the plot is merely a reference line, not a limit line

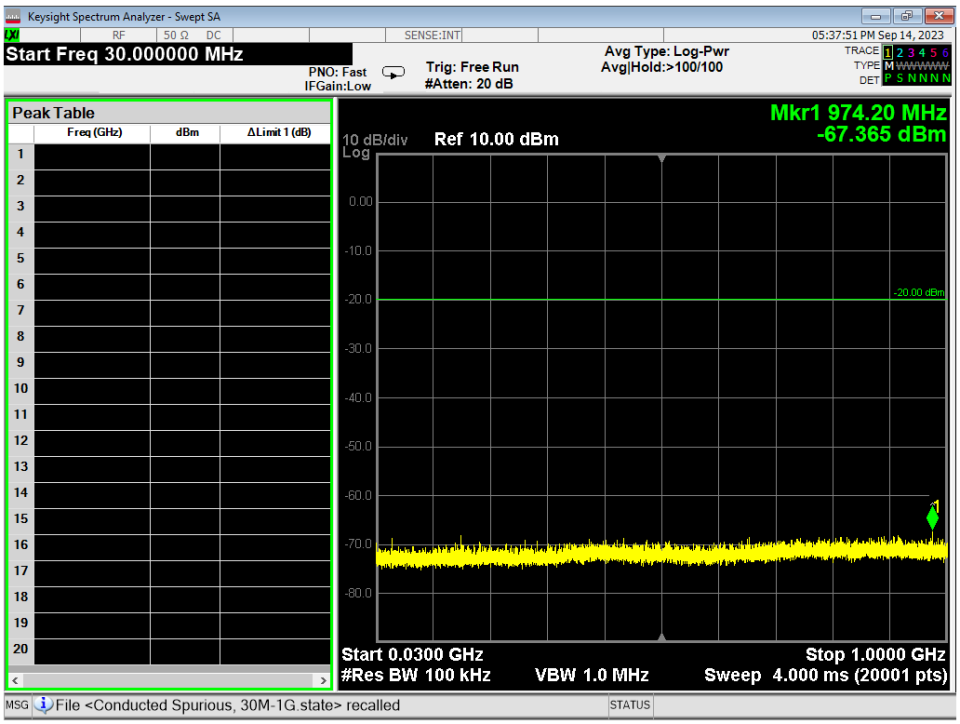


Figure 7 - Radiated Emissions Plot, 2EDR, 30M – 1G

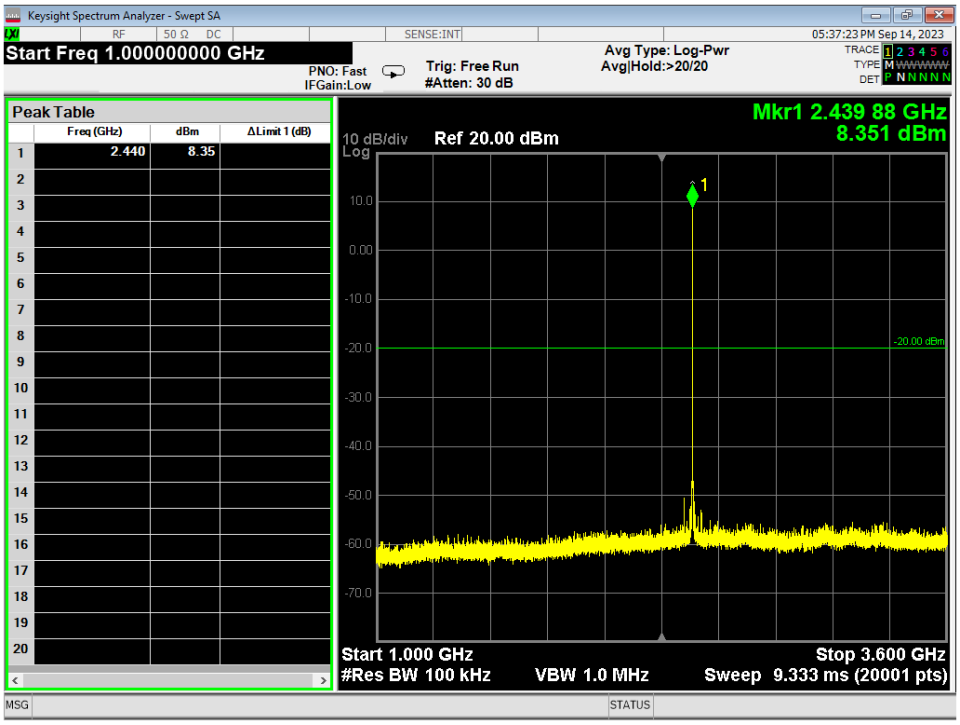


Figure 8 - Radiated Emissions Plot, 2EDR, 1G – 3.6G

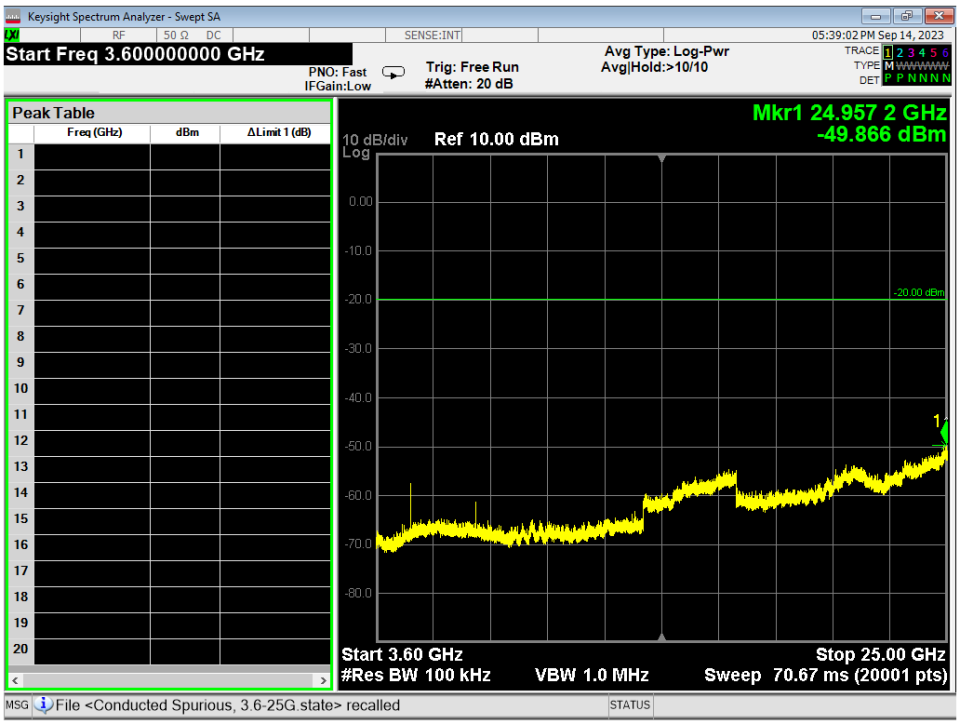


Figure 9 - Radiated Emissions Plot, 2EDR, 3.6G – 25G

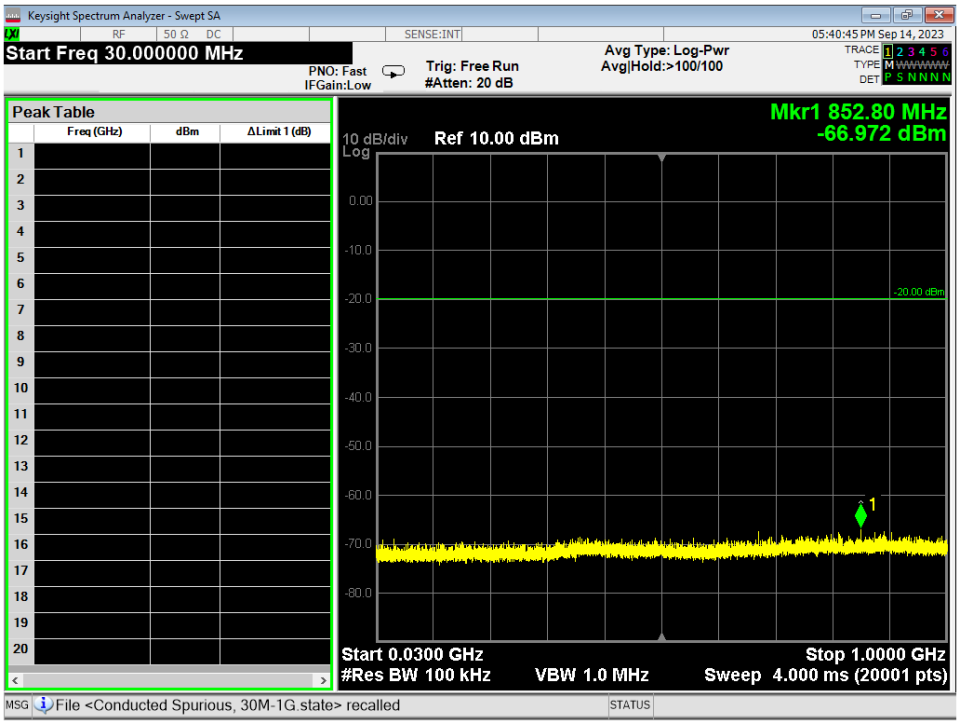


Figure 10 - Radiated Emissions Plot, 3EDR, 30M – 1G

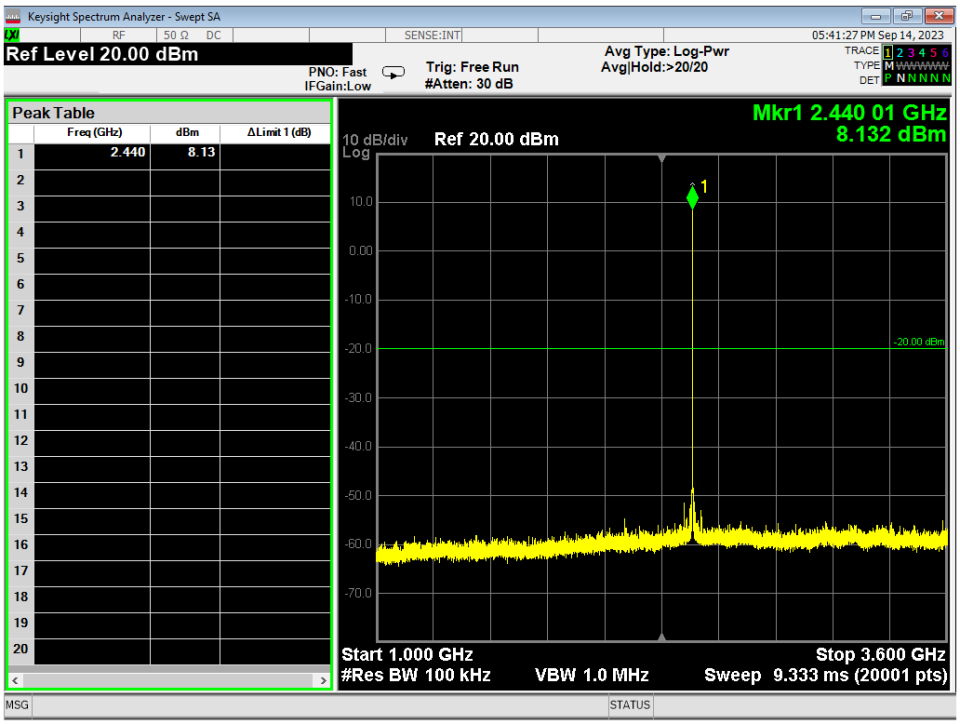


Figure 11 - Radiated Emissions Plot, 3EDR, 1G – 3.6G

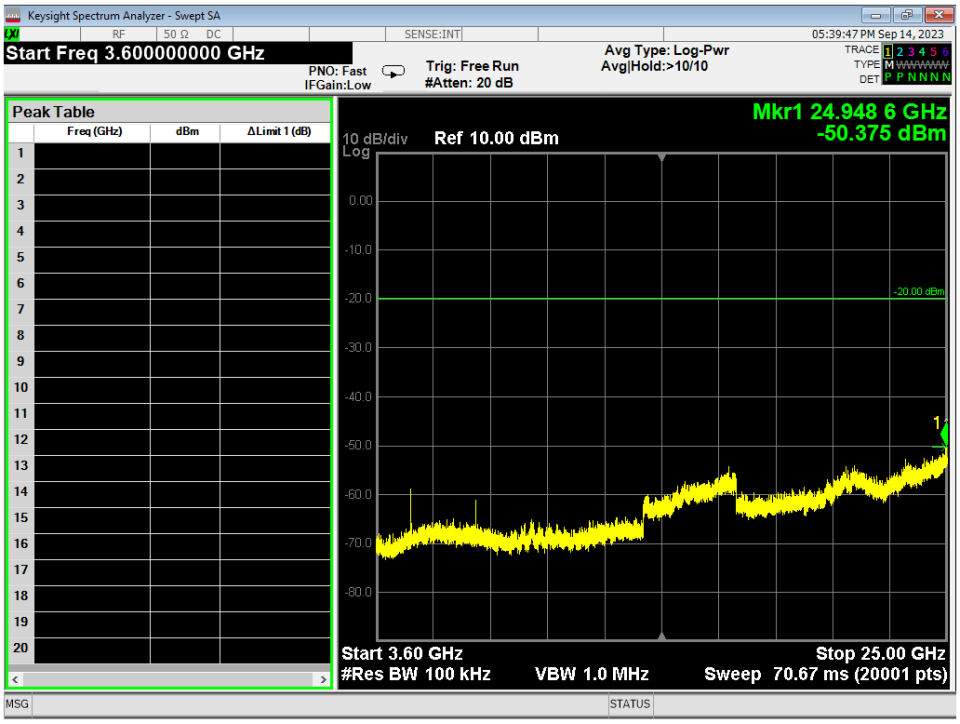


Figure 12 - Radiated Emissions Plot, 3EDR, 3.6G – 25G

4.6 BAND EDGES

Test Method: All the radio measurements were performed using the sections from ANSI C63.10, details about the section used can be found in the spectrum analyzer titles on the graph.

Limits of band-edge measurements:
For FCC Part 15.247 Device:
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c))

Test procedures:
The highest emissions level beyond the band-edge was measured and recorded. All band edge measurements were evaluated to the general limits in Part 15.209. More details can be found in section 3.4 of this report.

Deviations from test standard:
No deviation.

Test setup:
Test setup details can be found in section 3.4 of this report.

EUT operating conditions:
Details can be found in section 2.1 of this report.

Test results:

Pass

Comments:

1. All the band edge plots can be found in Appendix C.
2. If the device falls under FCC Part 15.247 (Details can be found in summary of test results), compliance is shown in the unrestricted band edges by showing minimum delta of 20 dB between peak and the band edge.
3. The restricted band edge compliance is shown by comparing to the general limit defined in Part 15.209. The limit shown in the graph accounts for the antenna gain of the device.

4.7 POWER SPECTRAL DENSITY

Test Method: All the radio measurements were performed using the sections from ANSI C63.10, details about the section used can be found in the spectrum analyzer titles on the graph.

Limits of power measurements:

For FCC Part 15.247 Device:
The maximum PSD allowed is 8 dBm.

Test procedures:
Details can be found in section 3.4 of this report.

Deviations from test standard:
No deviation.

Test setup:
Details can be found in section 3.4 of this report.

EUT operating conditions:
Details can be found in section 2.1 of this report.

Test results:

Pass

Comments:

1. All the Power Spectral Density (PSD) plots can be found in Appendix C.
2. All the measurements were found to be compliant.
3. The measurements are reported on the graph.

4.8 CONDUCTED AC MAINS EMISSIONS

Test Method: ANSI C63.10, Section(s) 6.2

Limits for conducted emissions measurements:

FREQUENCY OF EMISSION (MHz)	CONDUCTED LIMIT (dBµV)	
	Quasi-peak	Average
0.15-0.5	66 to 56	56 to 46
0.5-5	56	46
5-30	60	50

Notes:
1. The lower limit shall apply at the transition frequencies.
2. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50 MHz
3. All emanations from a class A/B digital device or system, including any network of conductors and apparatus connected thereto, shall not exceed the level of field strengths specified above.

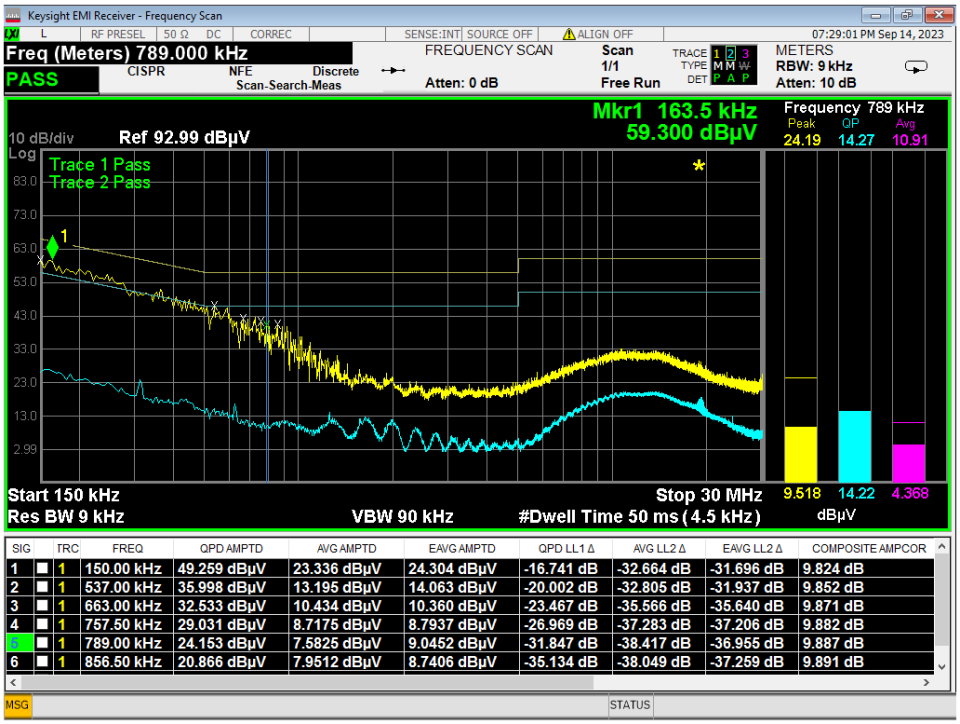
Test Procedures:

a. The EUT was placed 0.8m above a ground reference plane and 0.4 meters from the conducting wall of a shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). The LISN provides 50 ohm/ 50uH of coupling impedance for the measuring instrument.
b. Both lines of the power mains connected to the EUT were checked for maximum conducted interference as well as the ground.
c. The frequency range from 150 kHz to 30 MHz was searched. Emission levels over 10dB under the prescribed limits are not reported.
d. Results were compared to the 15.207 limits.

Deviation from the test standard:
No deviation

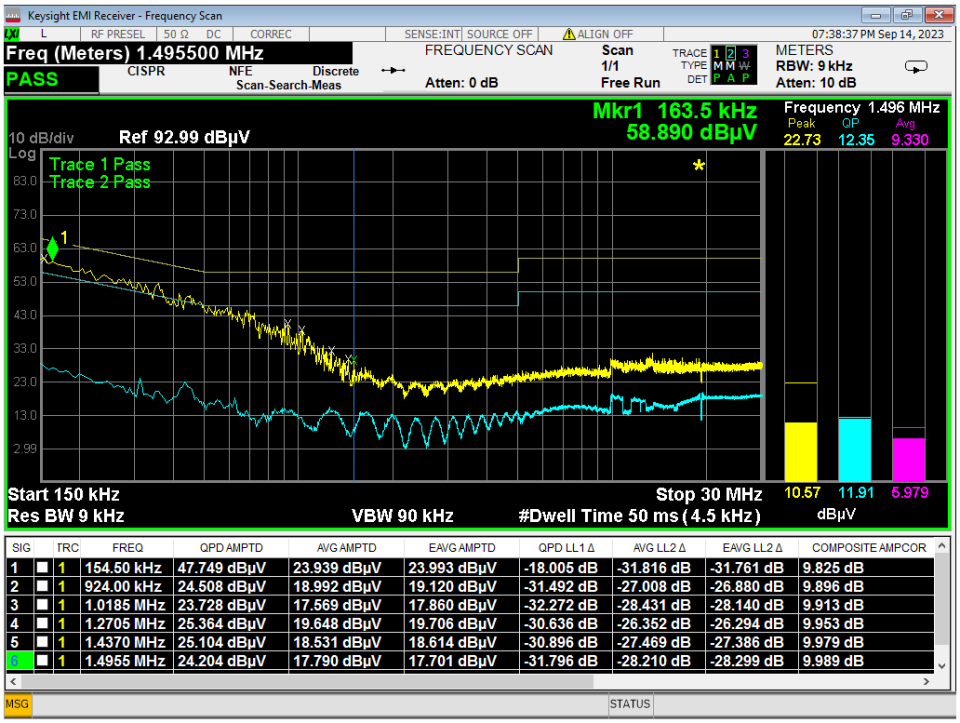
EUT operating conditions:
Details can be found in section 2.1 of this report.
.

Test Results:



SIG	TRC	FREQ	QPD AMPTD	AVG AMPTD	EAVG AMPTD	QPD LL1 Δ	AVG LL2 Δ	EAVG LL2 Δ	COMPOSITE AMPCOR
1	1	150.00 kHz	49.259 dBµV	23.336 dBµV	24.304 dBµV	-16.741 dB	-32.664 dB	-31.696 dB	9.824 dB
2	1	537.00 kHz	35.998 dBµV	13.195 dBµV	14.063 dBµV	-20.002 dB	-32.805 dB	-31.937 dB	9.852 dB
3	1	663.00 kHz	32.533 dBµV	10.434 dBµV	10.360 dBµV	-23.467 dB	-35.566 dB	-35.640 dB	9.871 dB
4	1	757.50 kHz	29.031 dBµV	8.7175 dBµV	8.7937 dBµV	-26.969 dB	-37.283 dB	-37.206 dB	9.882 dB
5	1	789.00 kHz	24.153 dBµV	7.5825 dBµV	9.0452 dBµV	-31.847 dB	-38.417 dB	-36.955 dB	9.887 dB
6	1	856.50 kHz	20.866 dBµV	7.9512 dBµV	8.7406 dBµV	-35.134 dB	-38.049 dB	-37.259 dB	9.891 dB

Figure 13 - Conducted Emissions Plot, Line, TX



SIG	TRC	FREQ	QPD AMPTD	AVG AMPTD	EAVG AMPTD	QPD LL1 Δ	AVG LL2 Δ	EAVG LL2 Δ	COMPOSITE AMPCOR
1	1	154.50 kHz	47.749 dBµV	23.939 dBµV	23.993 dBµV	-18.005 dB	-31.816 dB	-31.761 dB	9.825 dB
2	1	924.00 kHz	24.508 dBµV	18.992 dBµV	19.120 dBµV	-31.492 dB	-27.008 dB	-26.880 dB	9.896 dB
3	1	1.0185 MHz	23.728 dBµV	17.569 dBµV	17.860 dBµV	-32.272 dB	-28.431 dB	-28.140 dB	9.913 dB
4	1	1.2705 MHz	25.364 dBµV	19.648 dBµV	19.706 dBµV	-30.636 dB	-26.352 dB	-26.294 dB	9.953 dB
5	1	1.4370 MHz	25.104 dBµV	18.531 dBµV	18.614 dBµV	-30.896 dB	-27.469 dB	-27.386 dB	9.979 dB
6	1	1.4955 MHz	24.204 dBµV	17.790 dBµV	17.701 dBµV	-31.796 dB	-28.210 dB	-28.299 dB	9.989 dB

Figure 14 - Conducted Emissions Plot, Neutral, TX

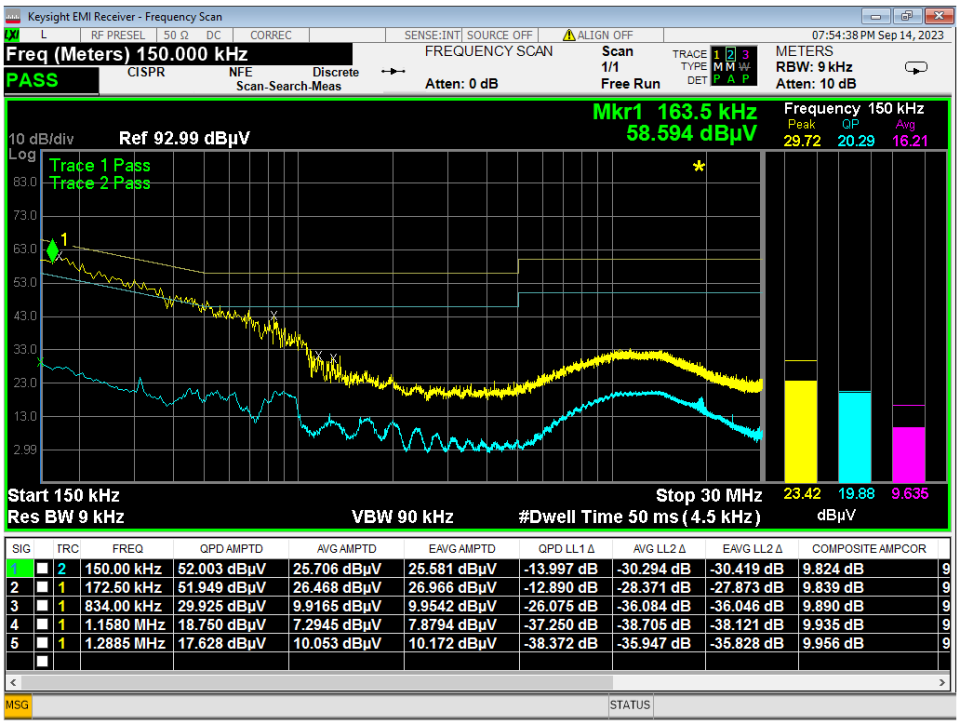


Figure 15 - Conducted Emissions Plot, Line, IDLE

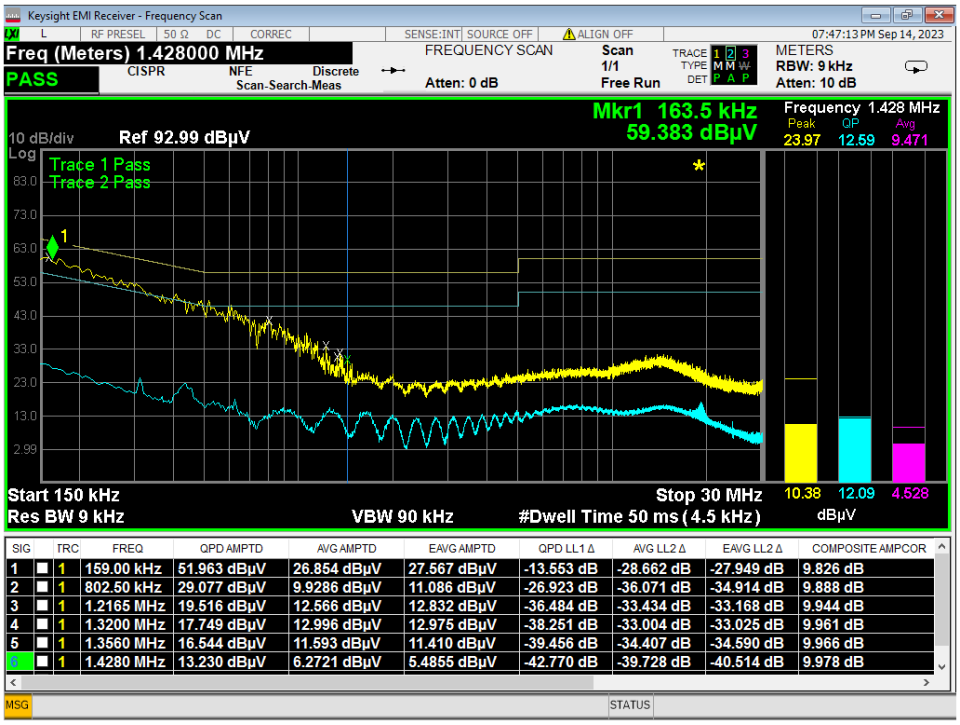


Figure 16 - Conducted Emissions Plot, Neutral, IDLE

APPENDIX A: SAMPLE CALCULATION

Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation with a sample calculation is as follows:
FS = RA + AF – (-CF + AG) + AV

where FS = Field Strength
RA = Receiver Amplitude
AF = Antenna Factor
CF = Cable Attenuation Factor
AG = Amplifier Gain
AV = Averaging Factor (if applicable)

Assume a receiver reading of 55 dBμV is obtained. The Antenna Factor of 12 and a Cable Factor of 1.1 is added. The Amplifier Gain of 20 dB is subtracted, giving a field strength of 48.1 dBμV/m.
FS = 55 + 12 – (-1.1 + 20) + 0 = 48.1 dBμV/m
The 48.1 dBμV/m value can be mathematically converted to its corresponding level in μV/m.
Level in μV/m = Common Antilogarithm [(48.1 dBμV/m)/20]= 254.1 μV/m
AV is calculated by taking the 20*log(T_{on}/100) where T_{on} is the maximum transmission time in any 100ms window.

EIRP Calculations

In cases where direct antenna port measurement is not possible or would be inaccurate, output power is measured in EIRP. The maximum field strength is measured at a specified distance and the EIRP is calculated using the following equation.

EIRP (Watts) = [Field Strength (V/m) x antenna distance (m)]^2 / 30
Power (watts) = 10^[Power (dBm)/10] / 1000
Voltage (dBµV) = Power (dBm) + 107 (for 50Ω measurement systems)
Field Strength (V/m) = 10^[Field Strength (dBµV/m) / 20] / 10^6
Gain = 1 (numeric gain for isotropic radiator)
Conversion from 3m field strength to EIRP (d=3):
EIRP = [FS(V/m) x d^2]/30 = FS [0.3] for d = 3
EIRP(dBm) = FS(dBµV/m) – 10(log 10^9)+ 10log[0.3] = FS(dBµV/m) - 95.23
10log(10^9) is the conversion from micro to milli

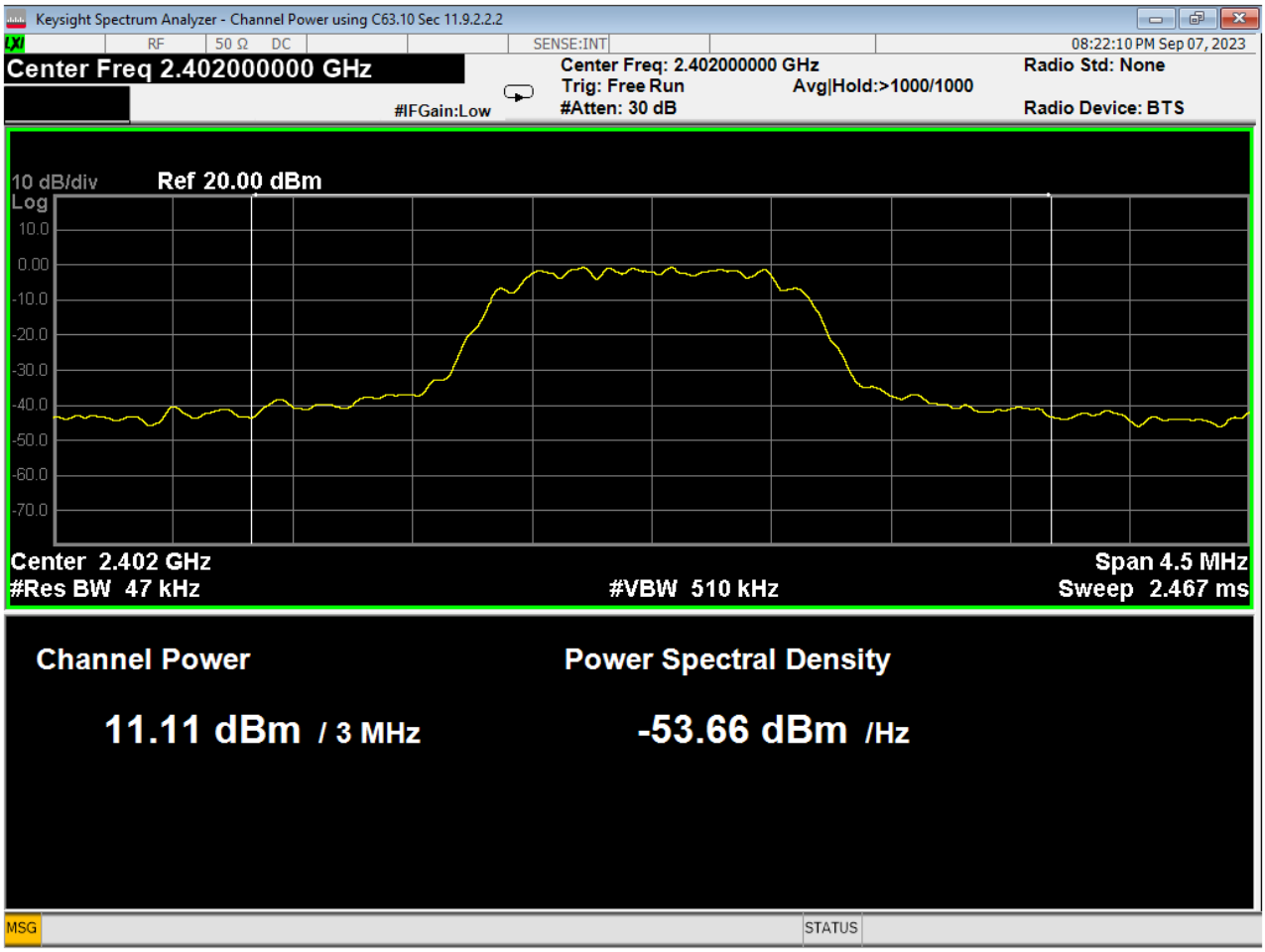
APPENDIX B – MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been for tests performed in this test report:

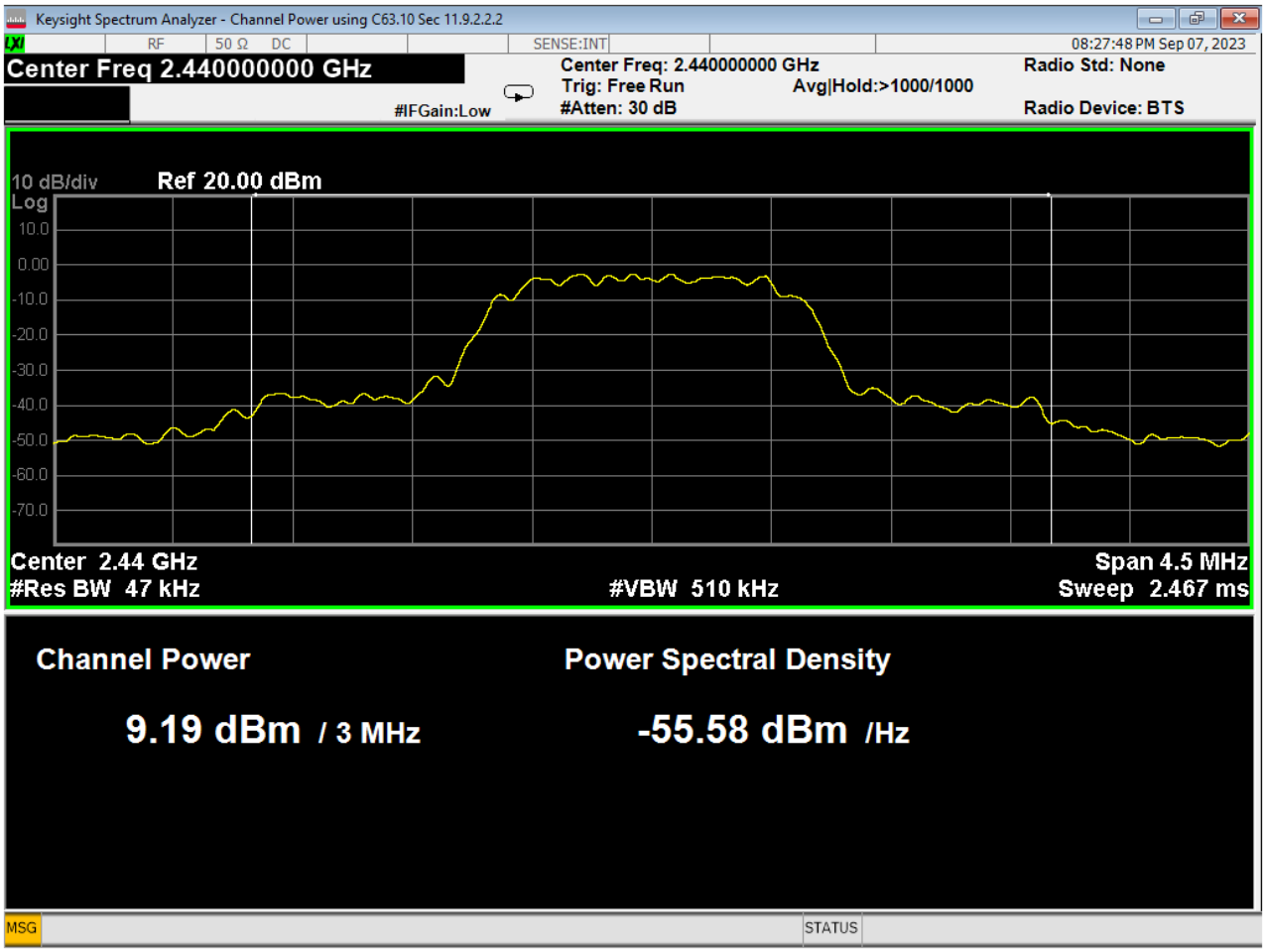
Test	Frequency Range	Uncertainty Value (dB)
Radiated Emissions, 3m	30MHz - 1GHz	±4.31
Radiated Emissions, 3m	1GHz - 18GHz	±5.08
Emissions limits, conducted	30MHz – 18GHz	±3.03

Expanded uncertainty values are calculated to a confidence level of 95%.

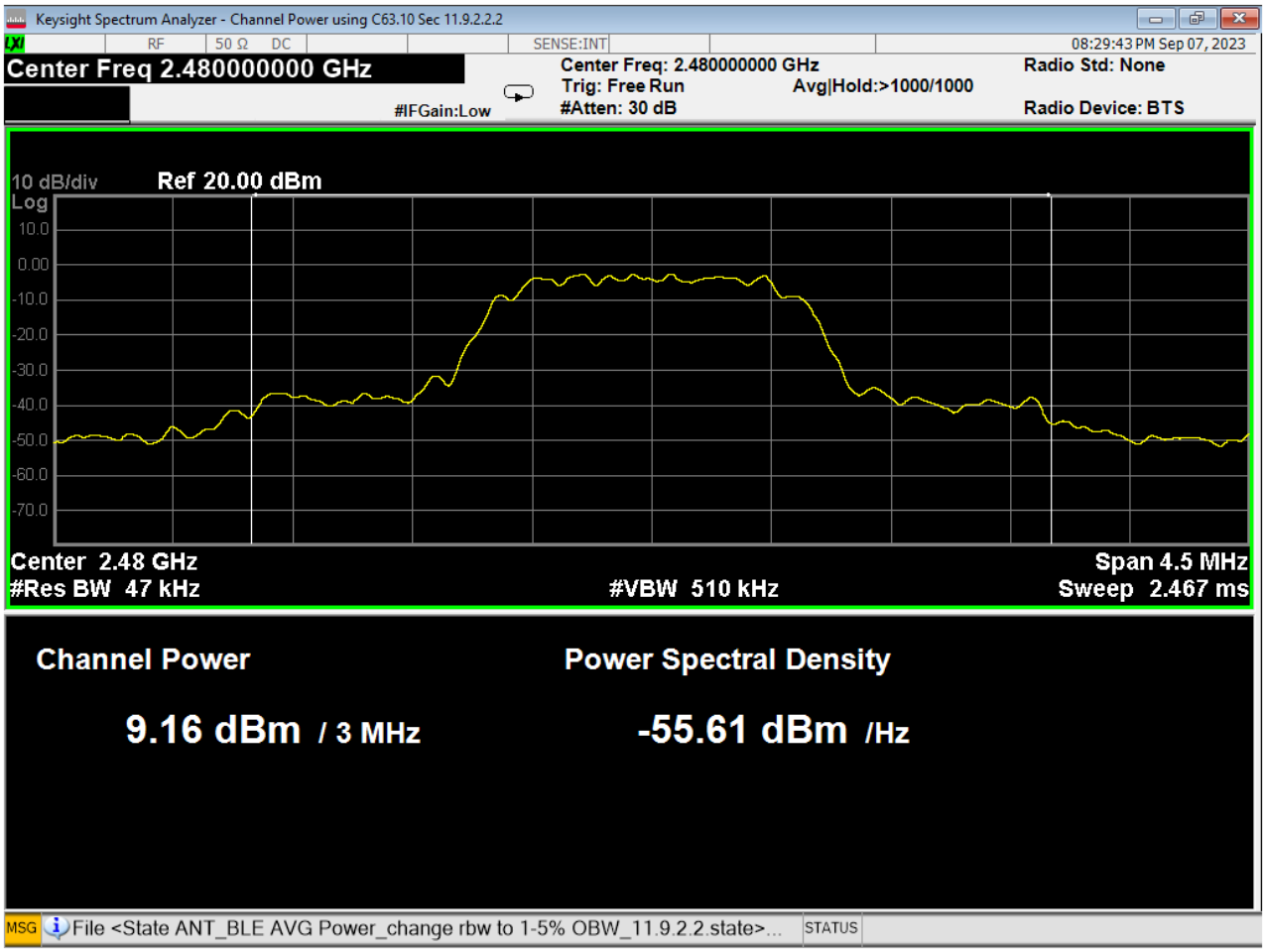
APPENDIX C – GRAPHS AND TABLES



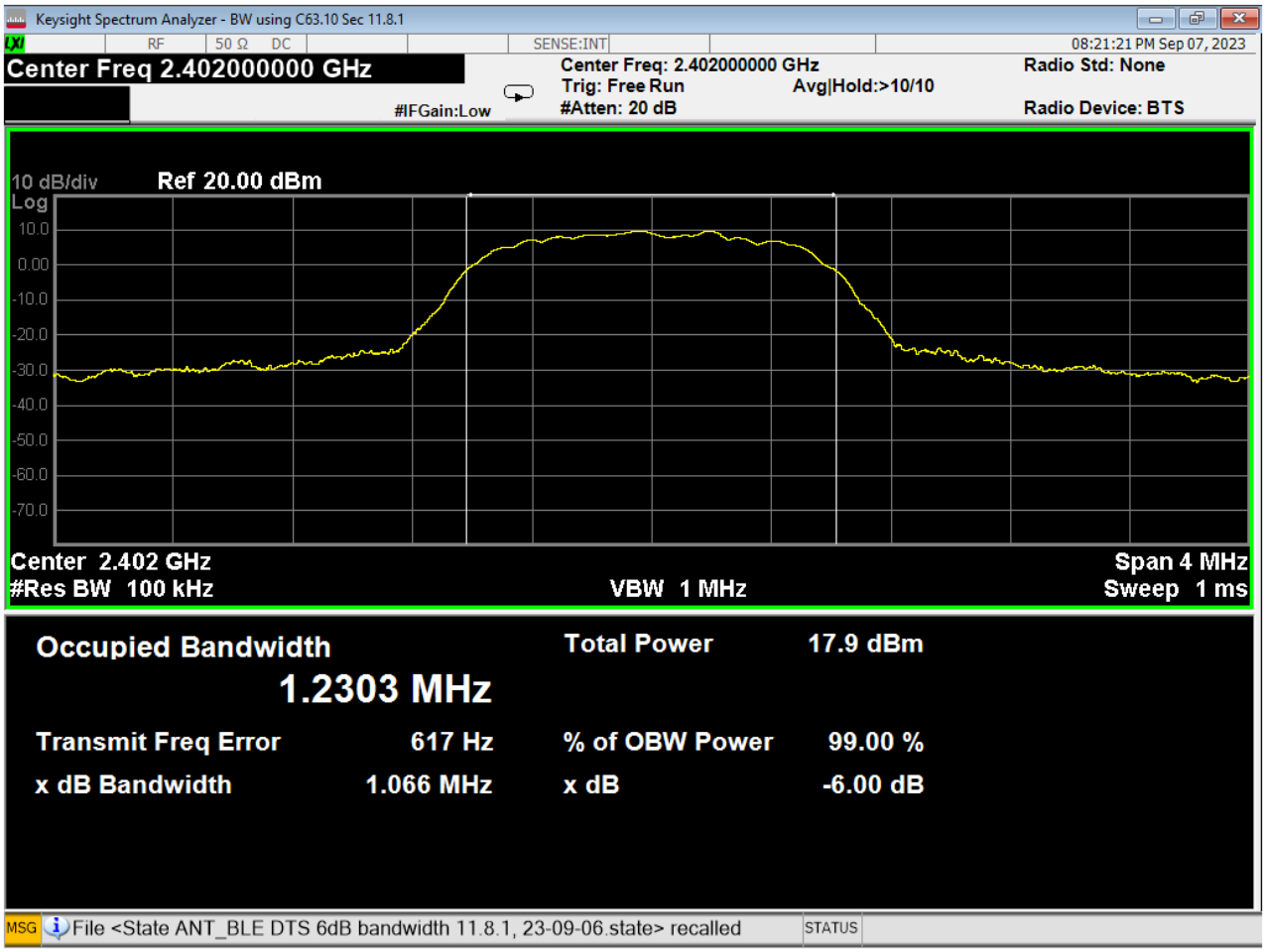
01 Average Power, Low Channel, 2EDR



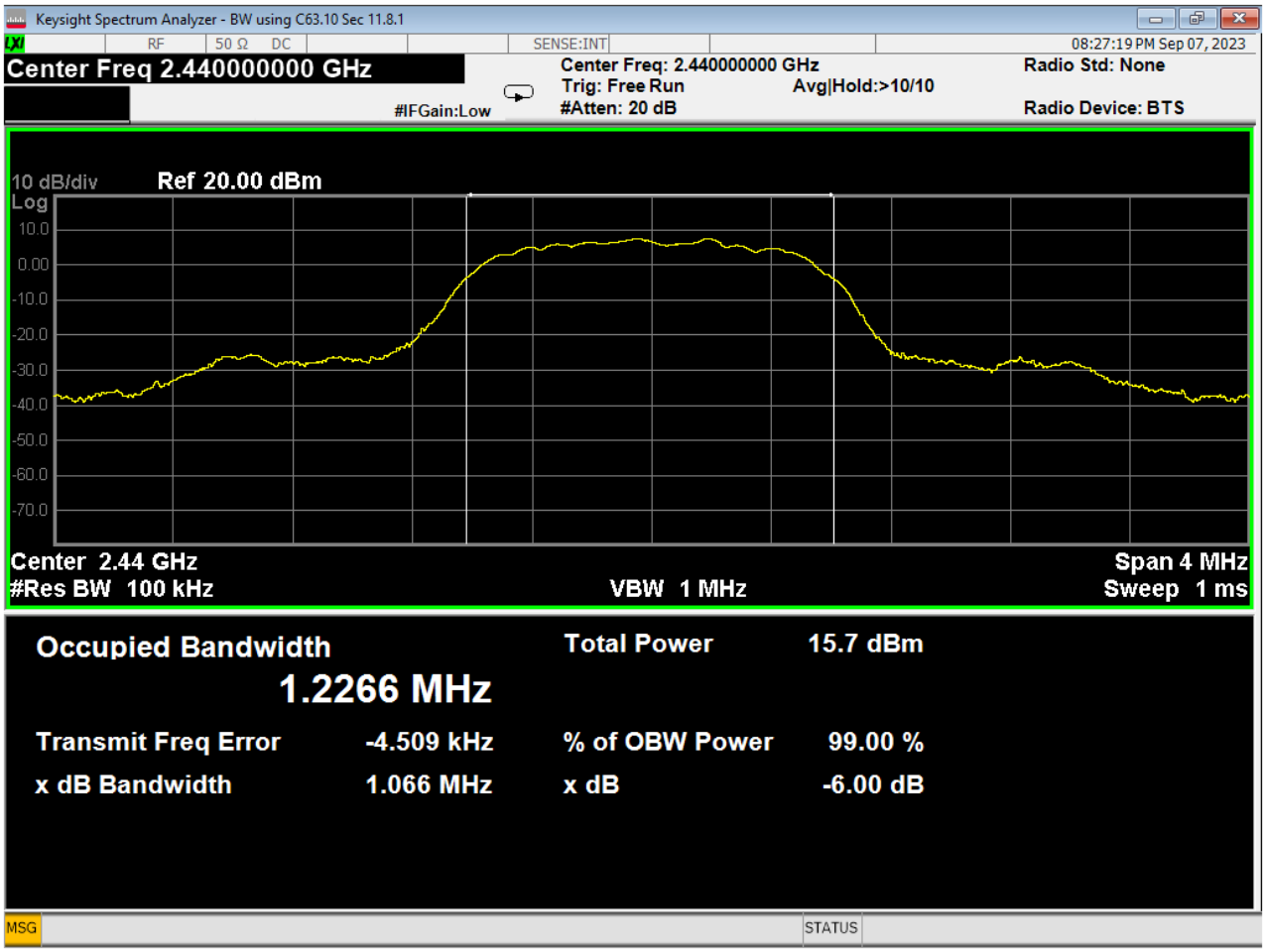
02 Average Power, Mid Channel, 2EDR



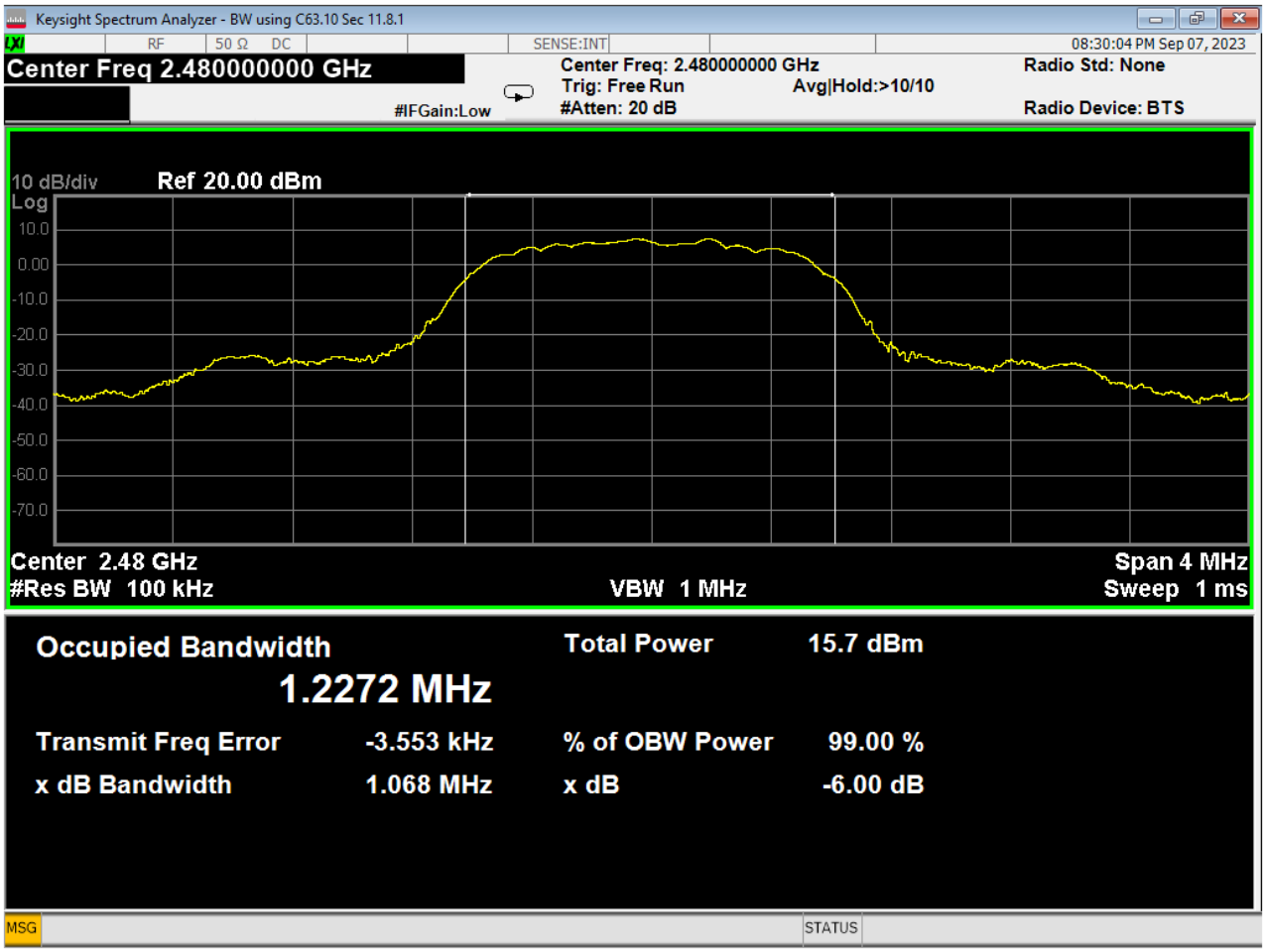
03 Average Power, High Channel, 2EDR



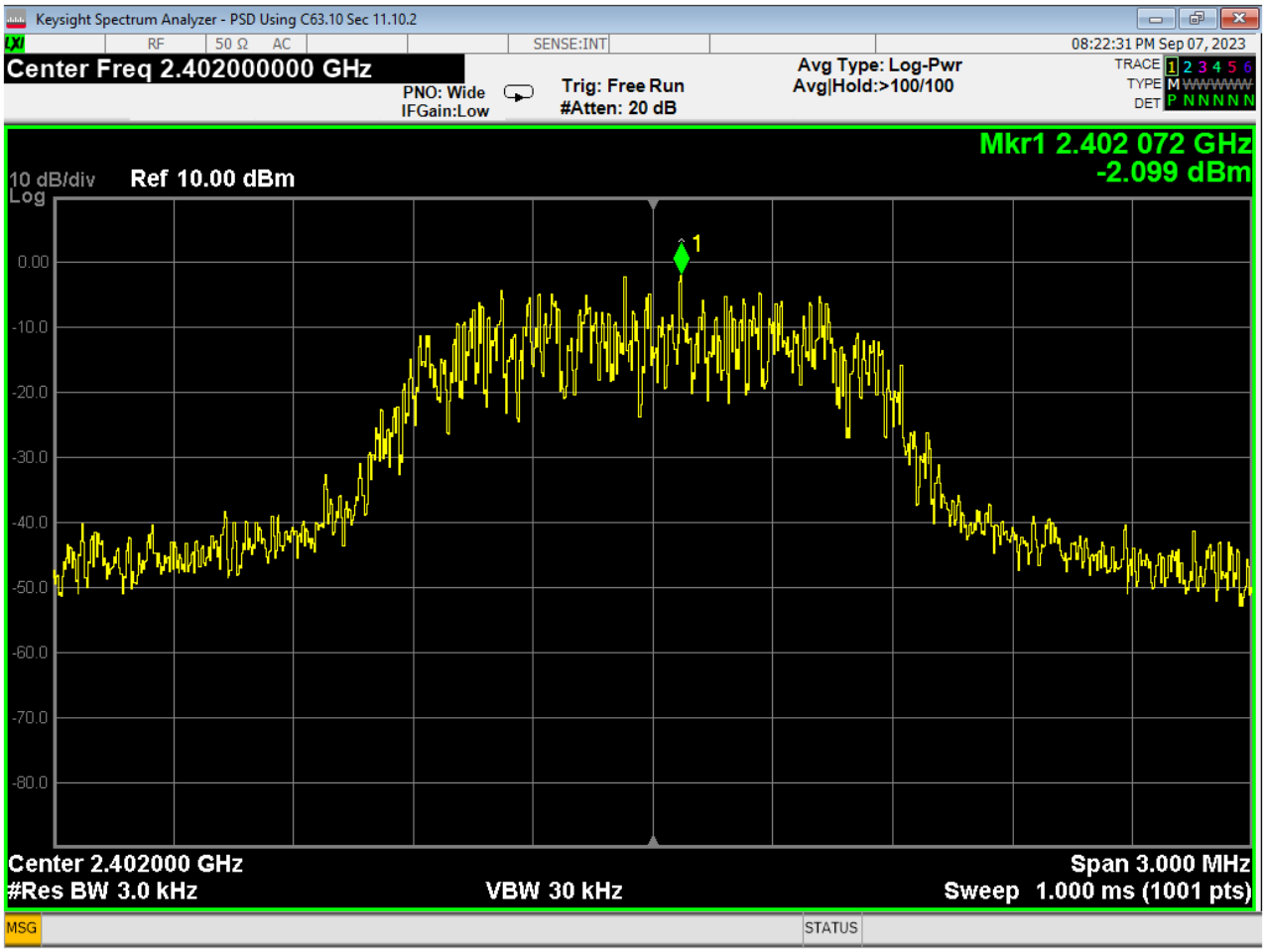
04 6dB Bandwidth, Low Channel, 2EDR



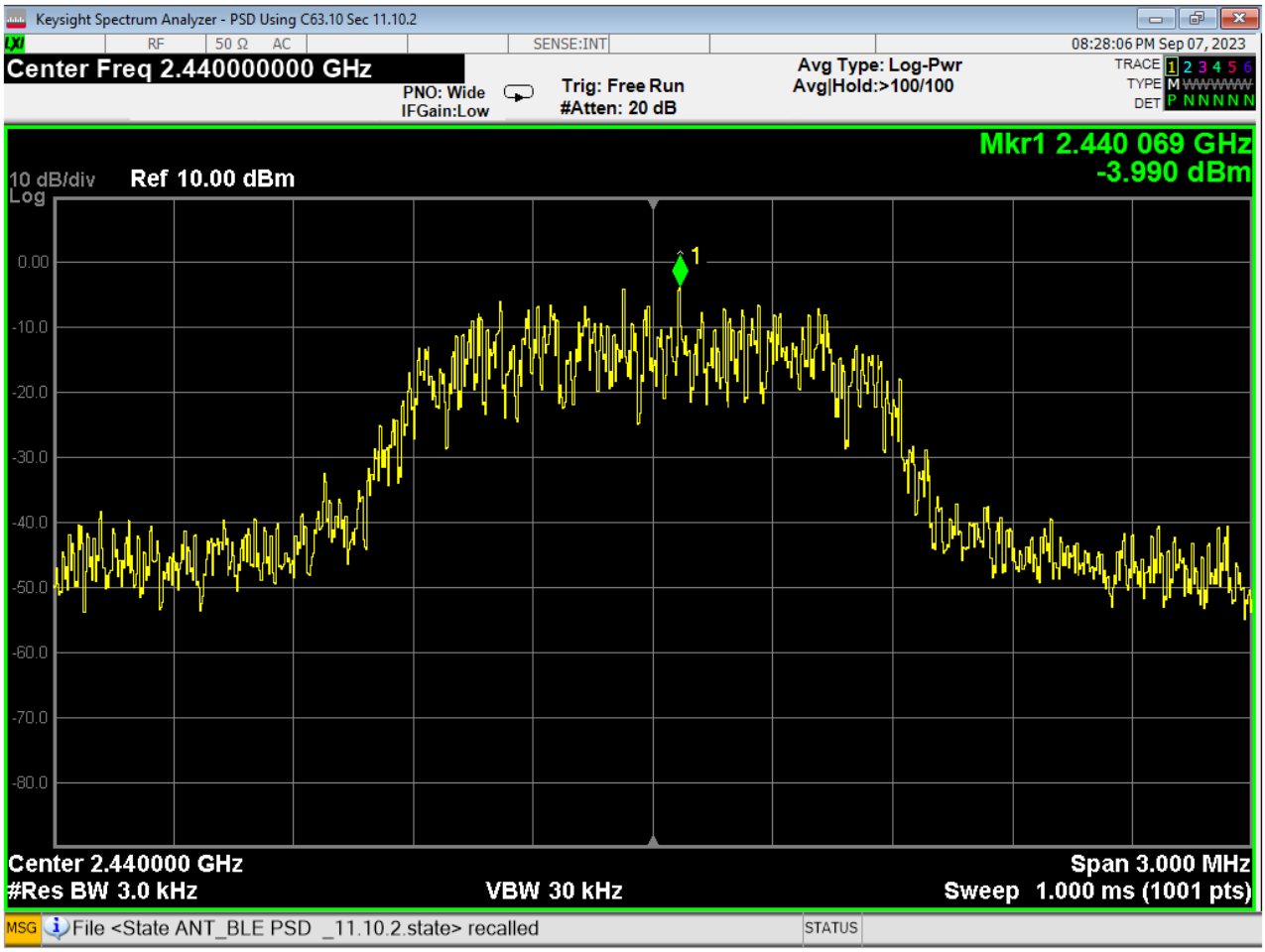
05 6dB Bandwidth, Mid Channel, 2EDR



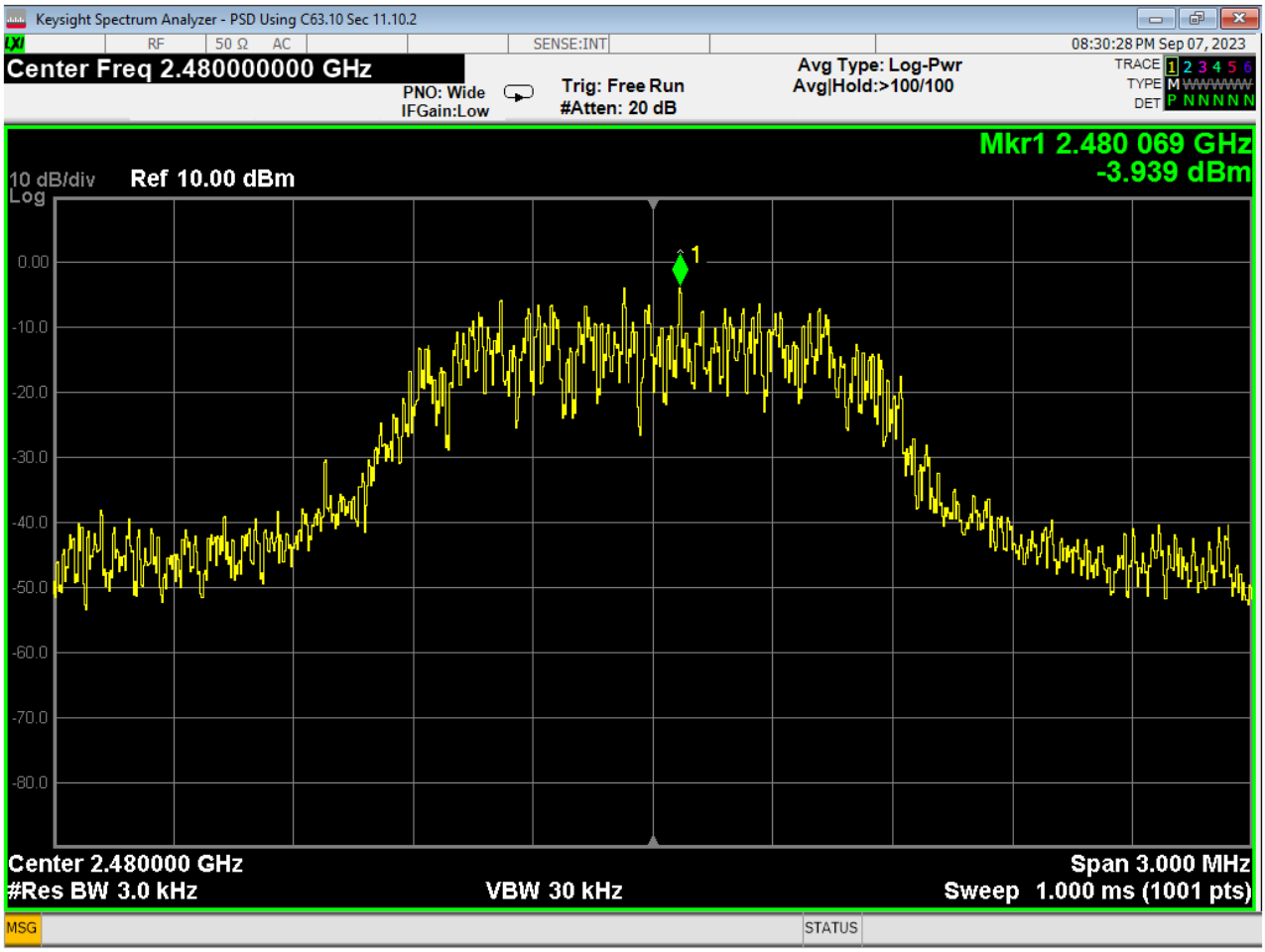
06 6dB Bandwidth, High Channel, 2EDR



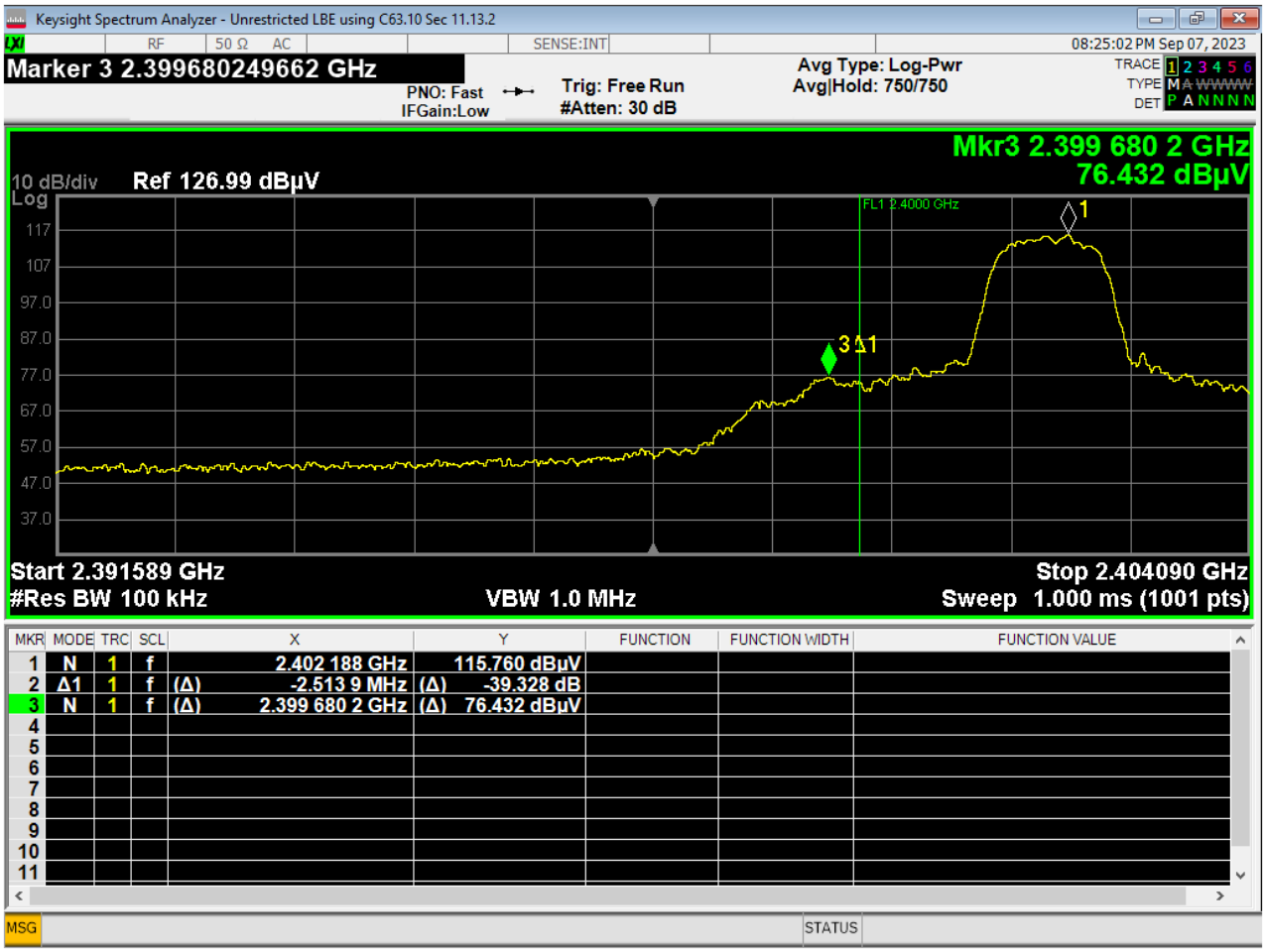
07 PSD, Low Channel, 2EDR



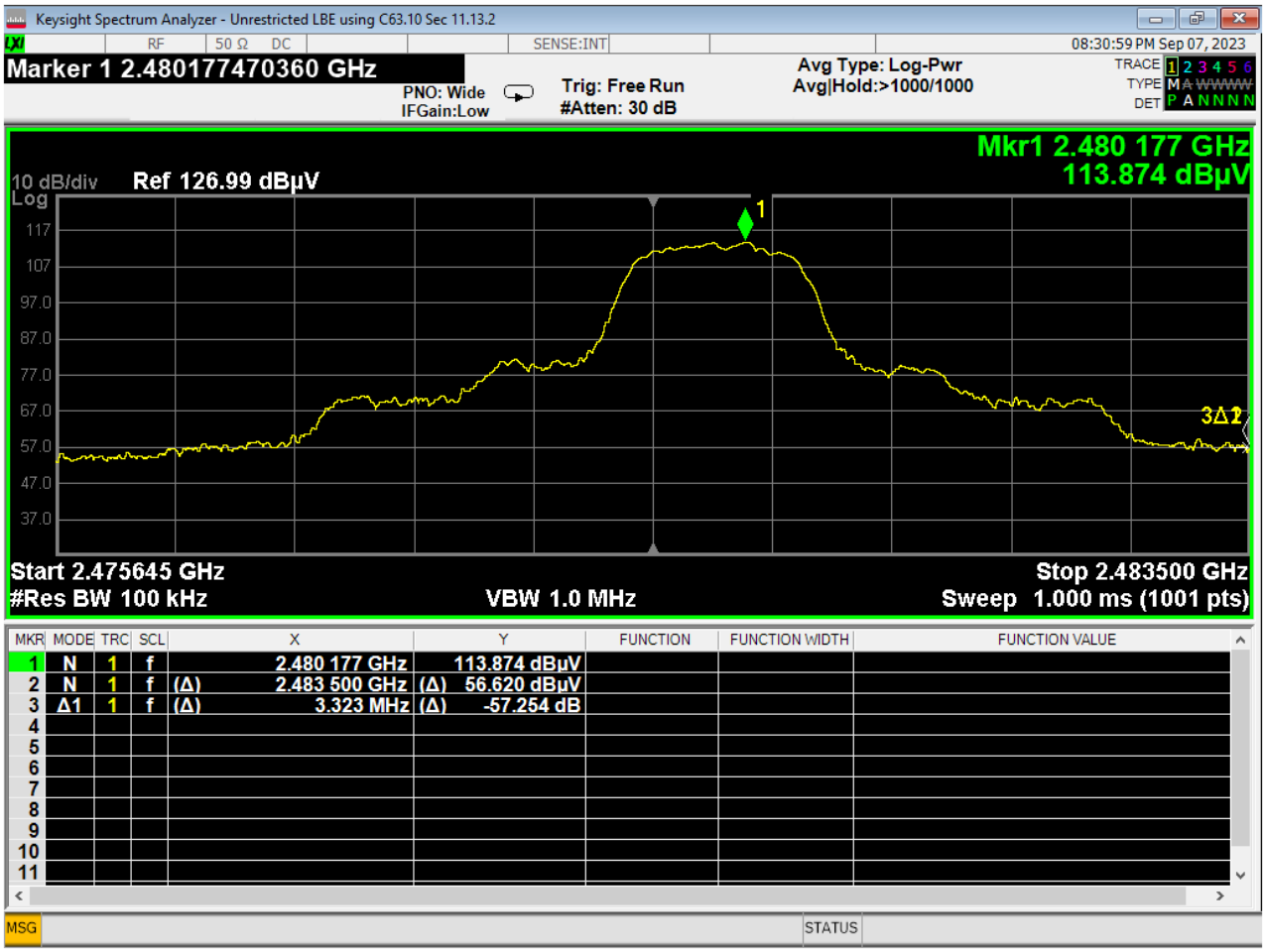
08 PSD, Mid Channel, 2EDR



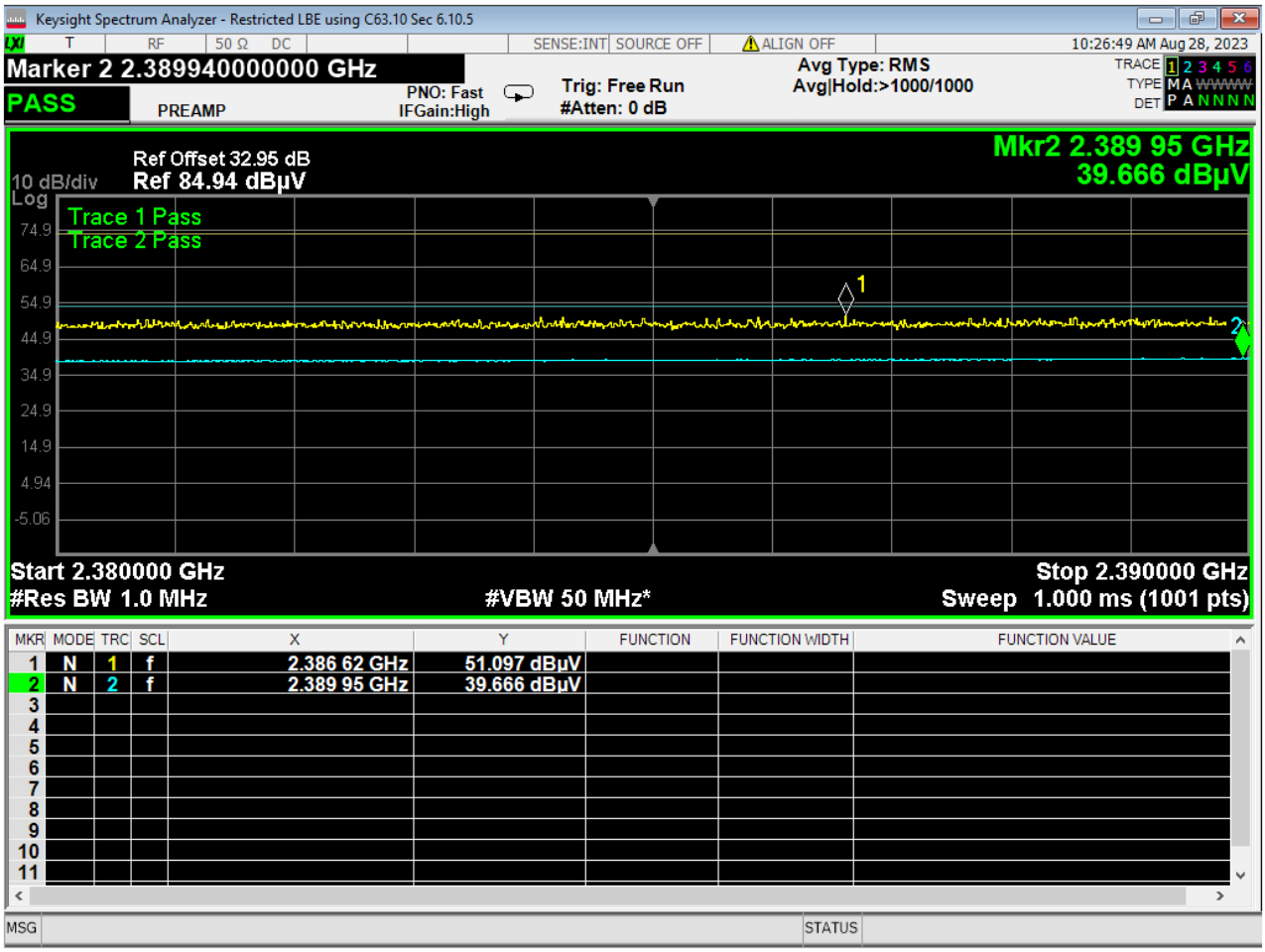
09 PSD, High Channel, 2EDR



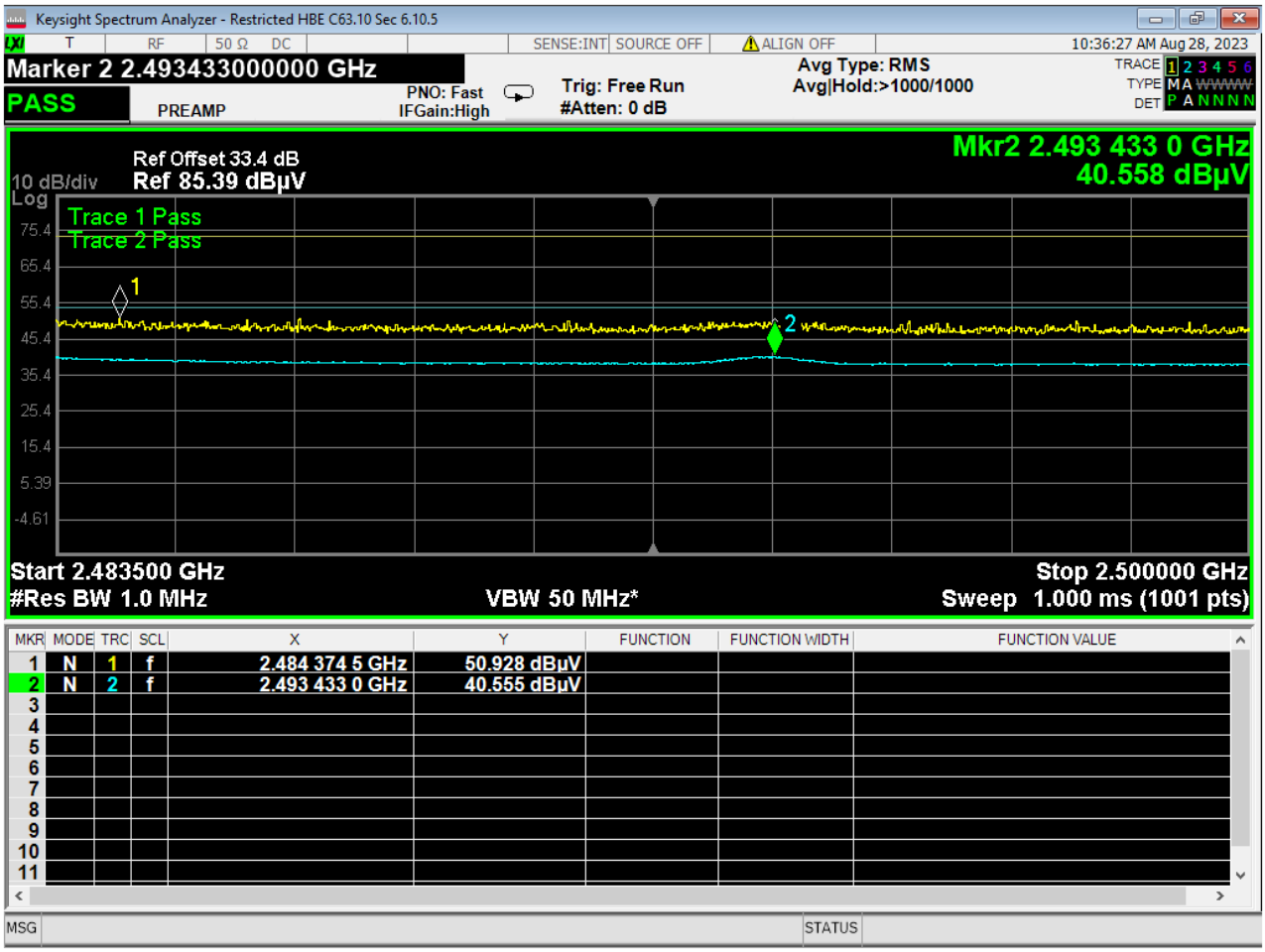
10 Lower Bandedge, Unrestricted, 2EDR



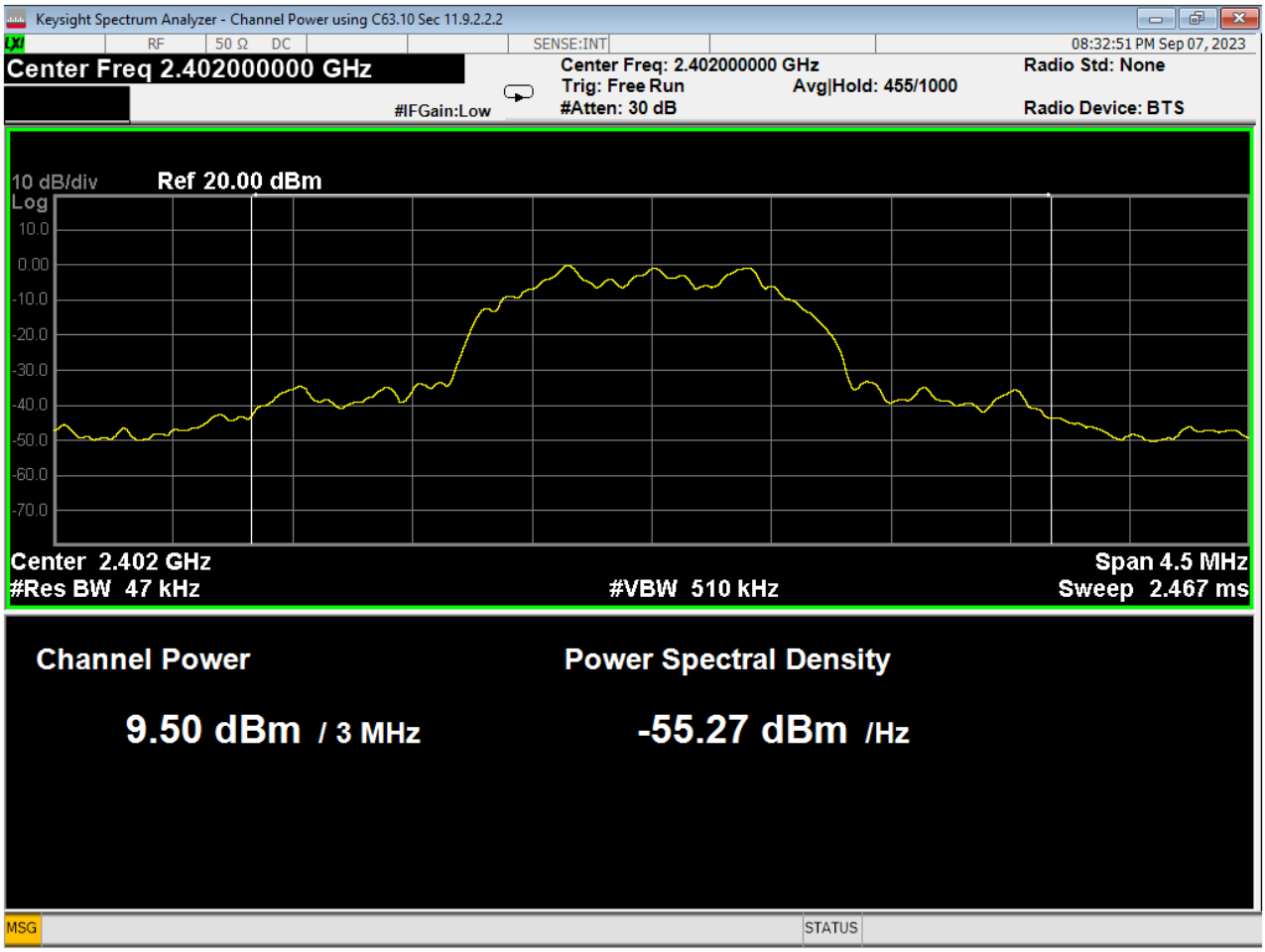
11 Higher Bandedge, Unrestricted, 2EDR



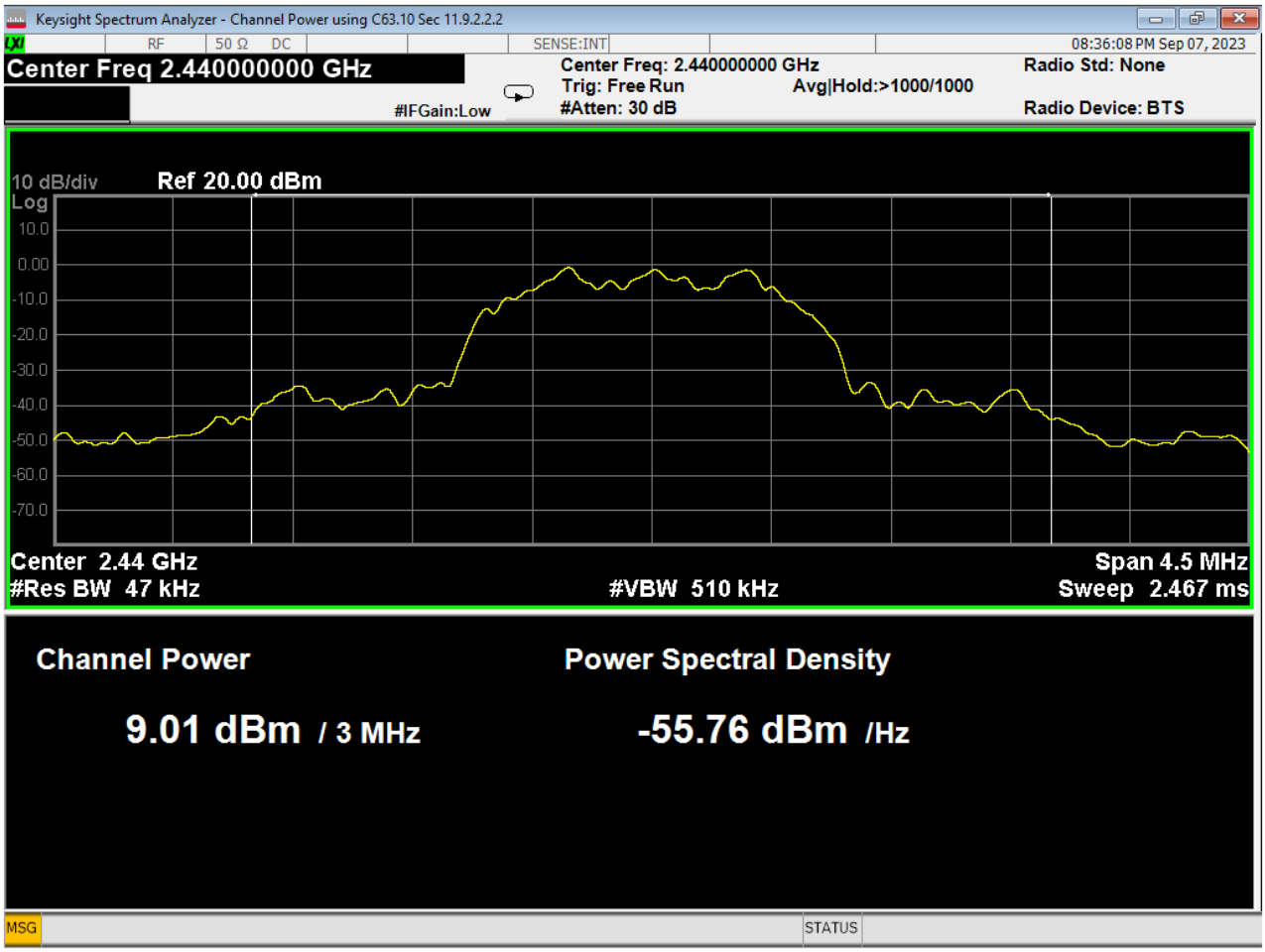
12 Lower Bandedge, Restricted, 2EDR



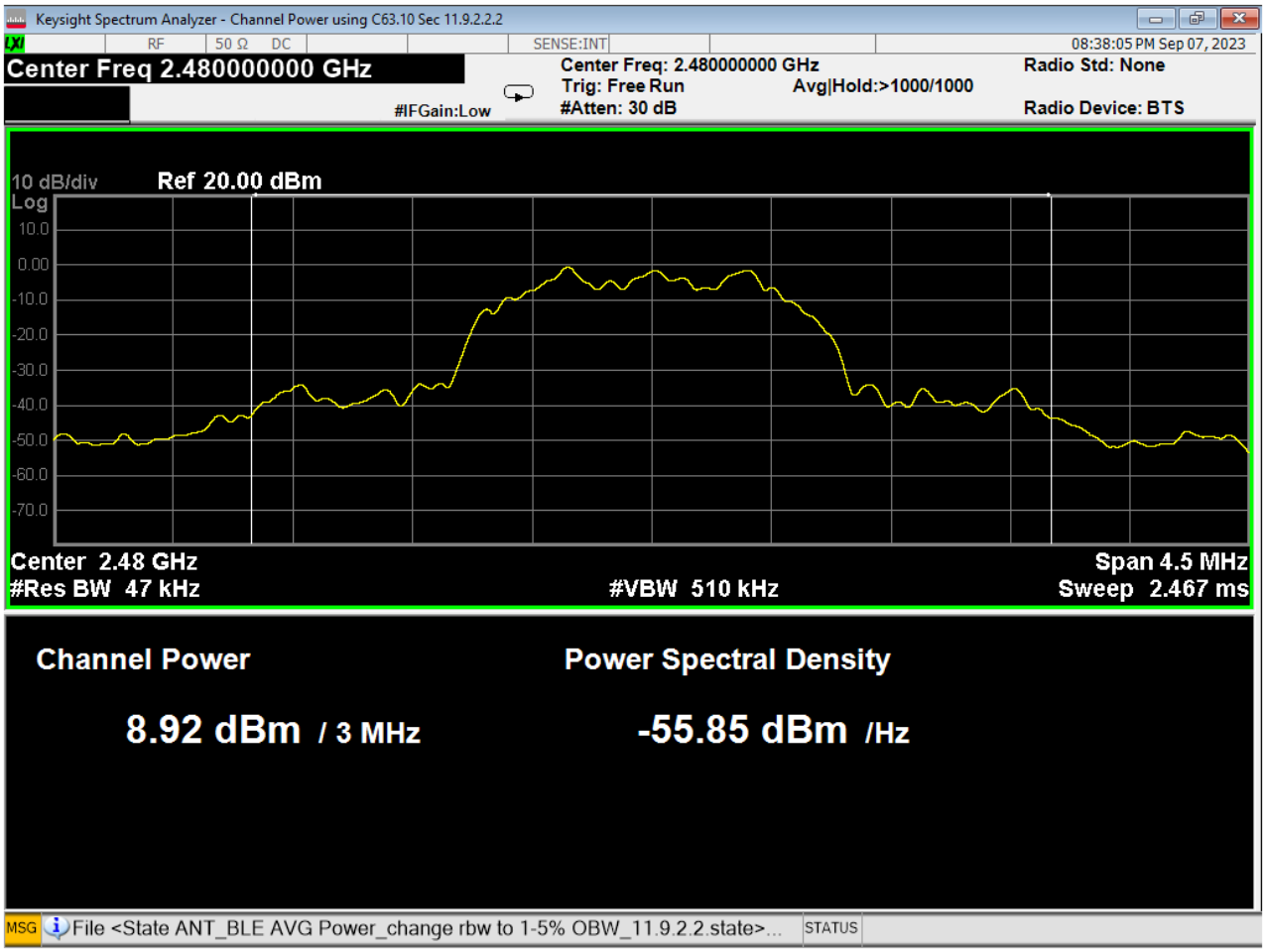
13 Higher Bandedge, Restricted, 2EDR



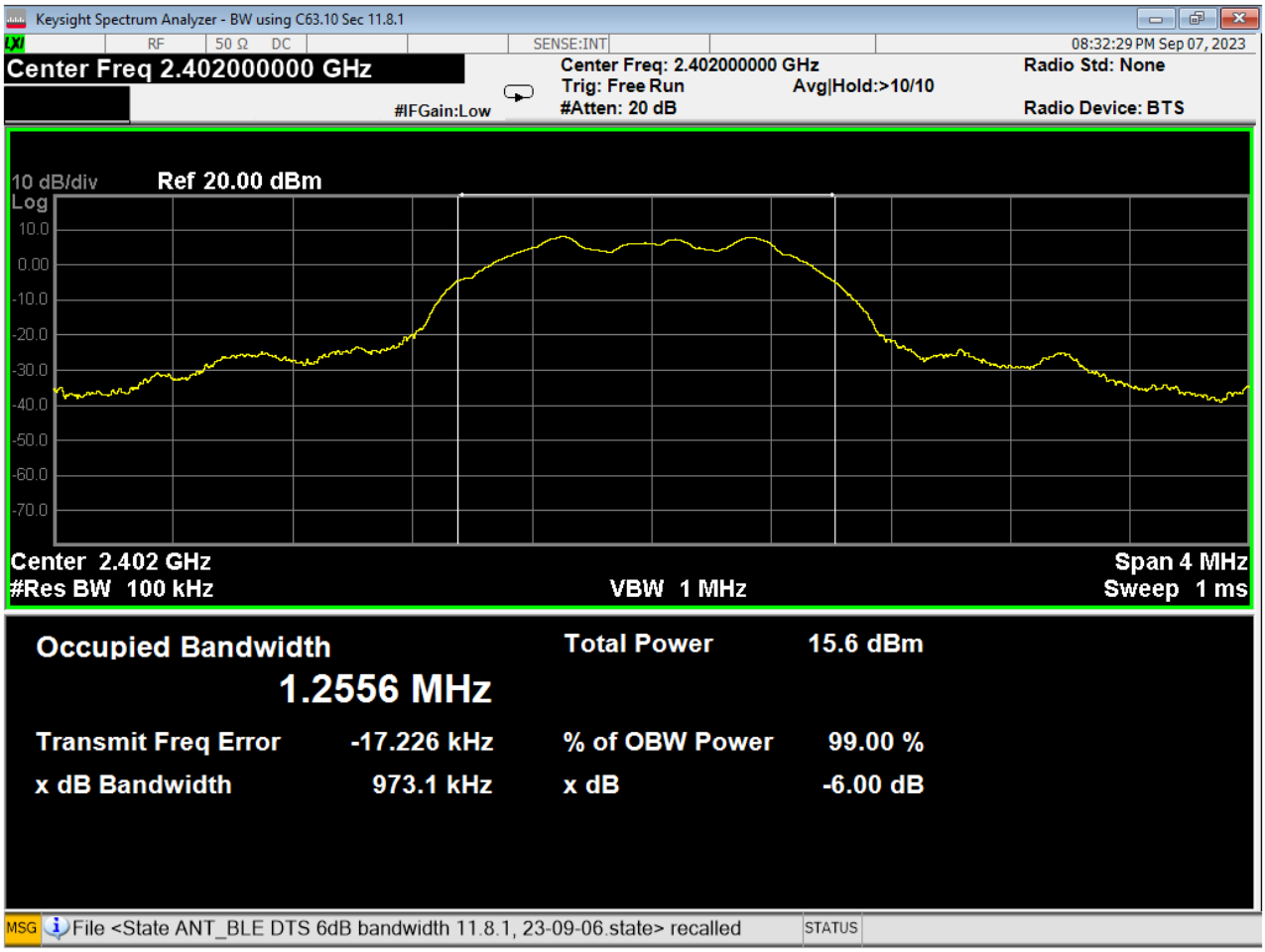
14 Average Power, Low Channel, 3EDR



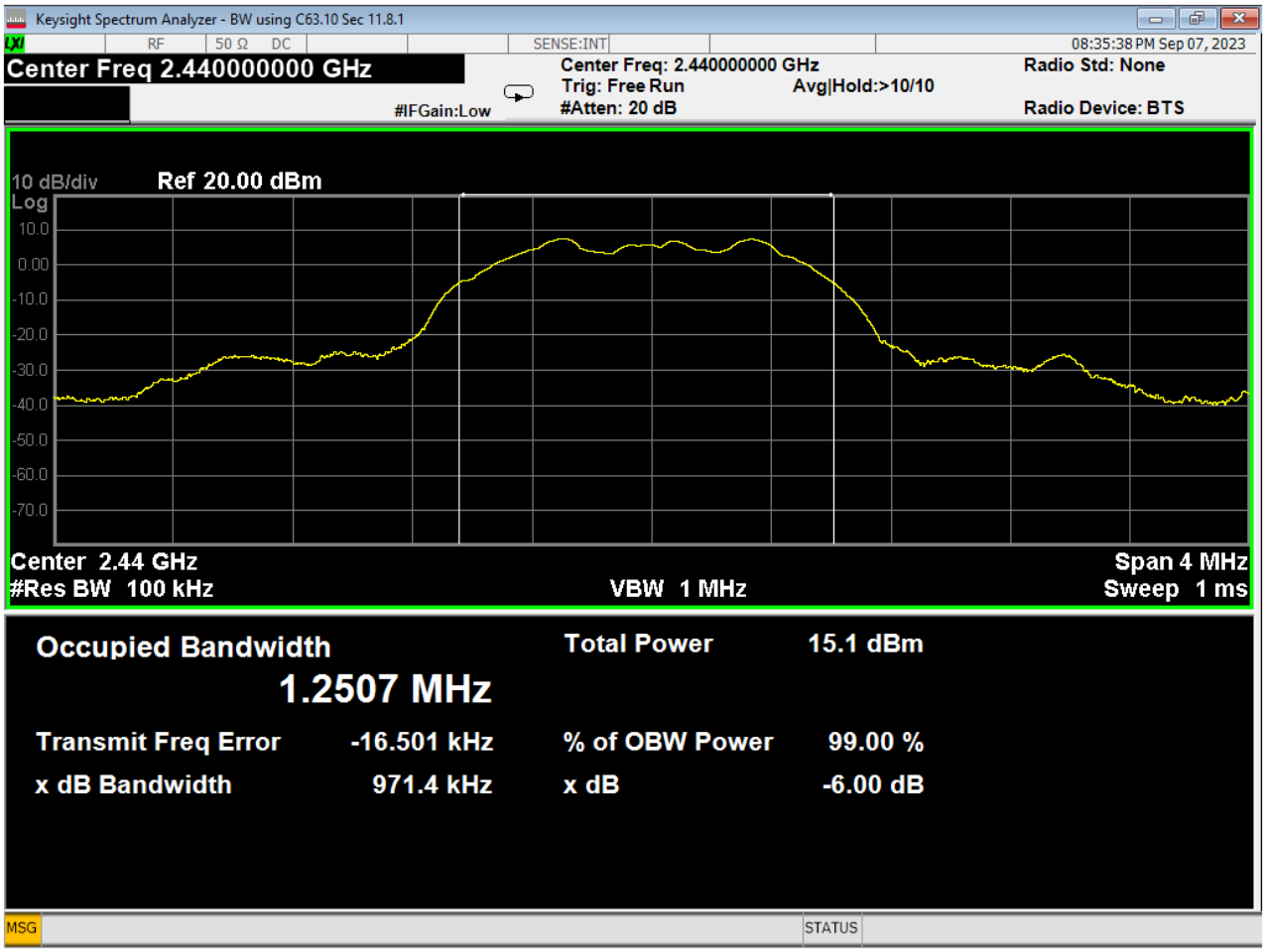
15 Average Power, Mid Channel, 3EDR



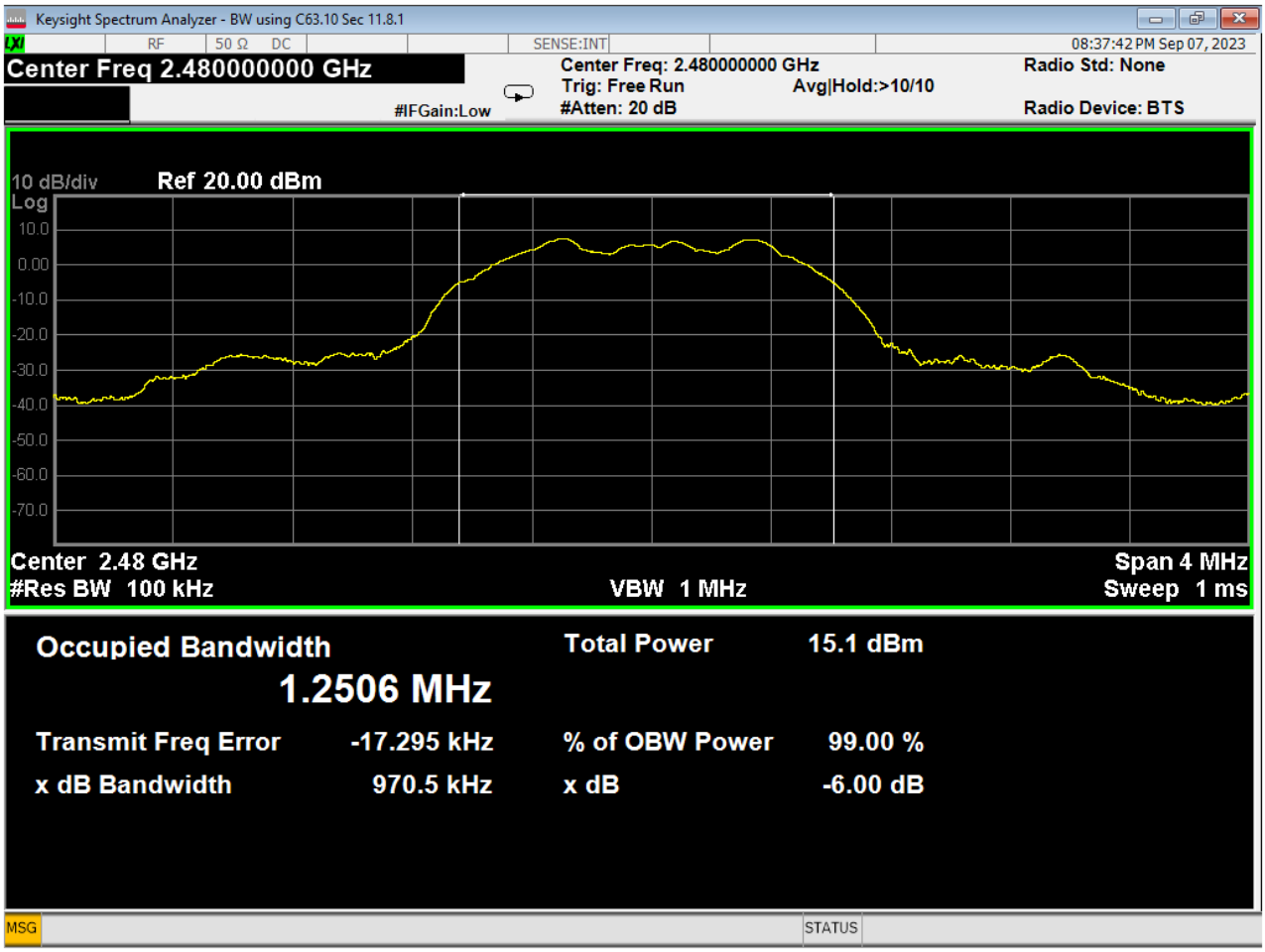
16 Average Power, High Channel, 3EDR



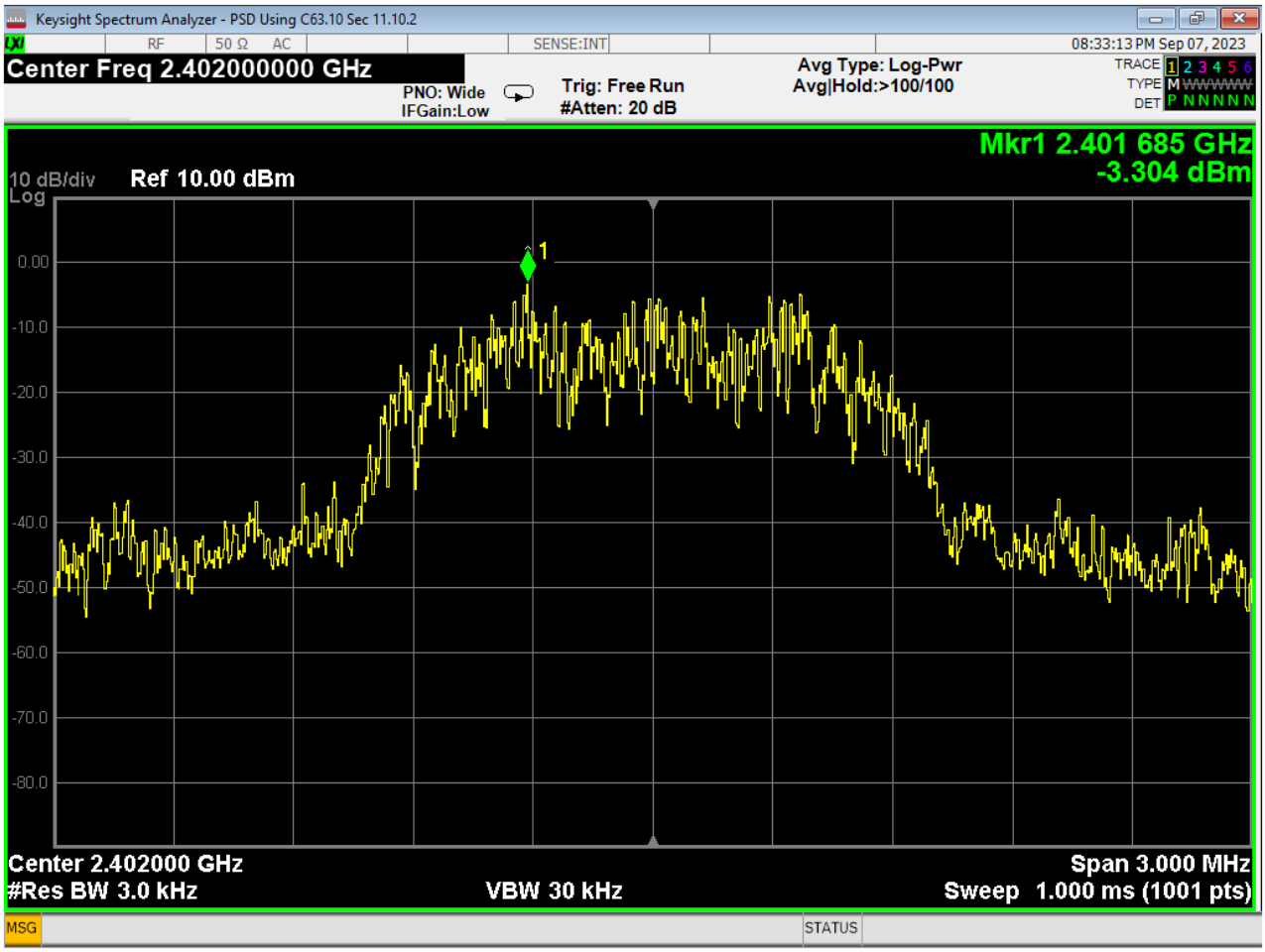
17 6dB Bandwidth, Low Channel, 3EDR



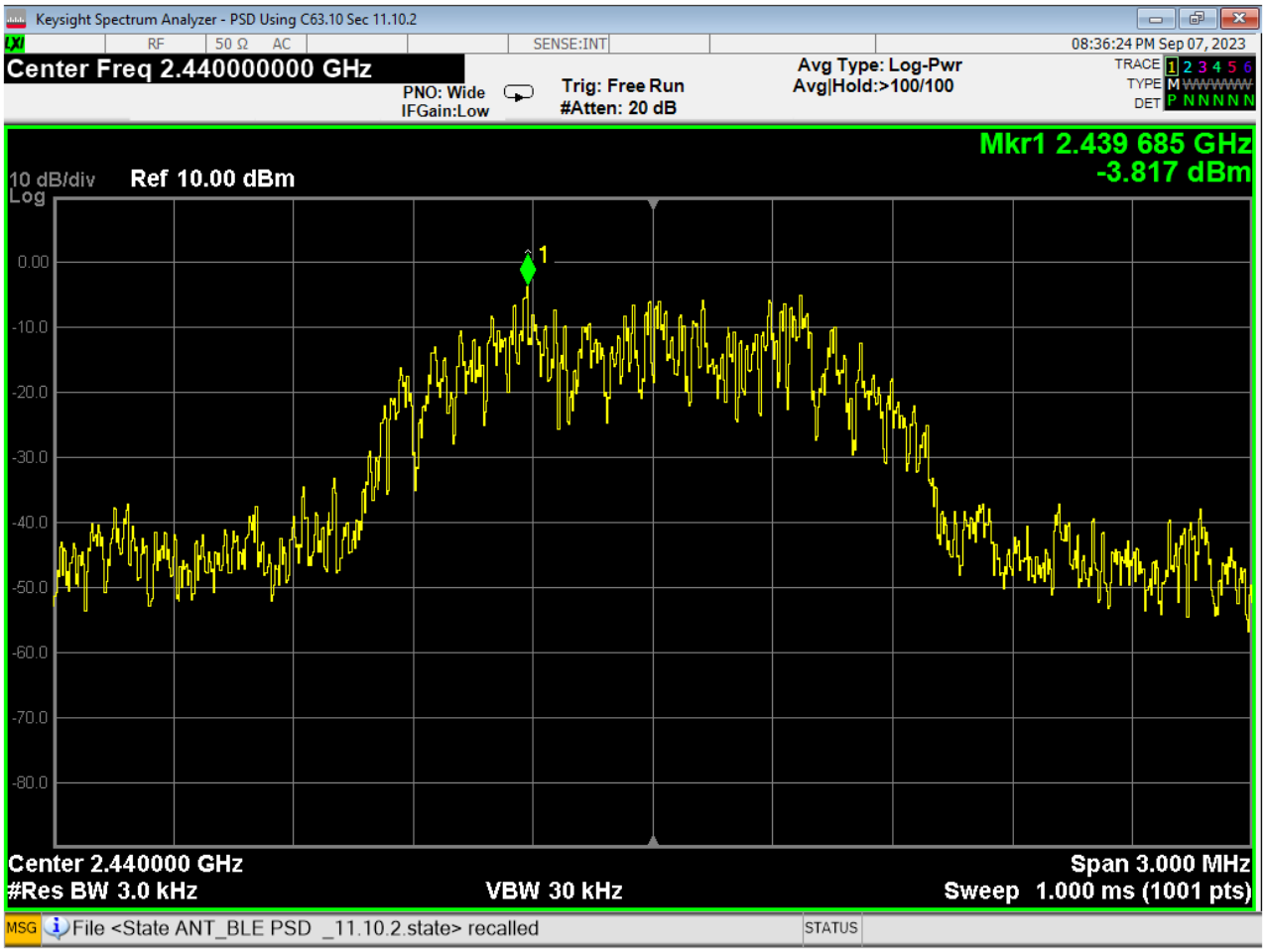
18 6dB Bandwidth, Mid Channel, 3EDR



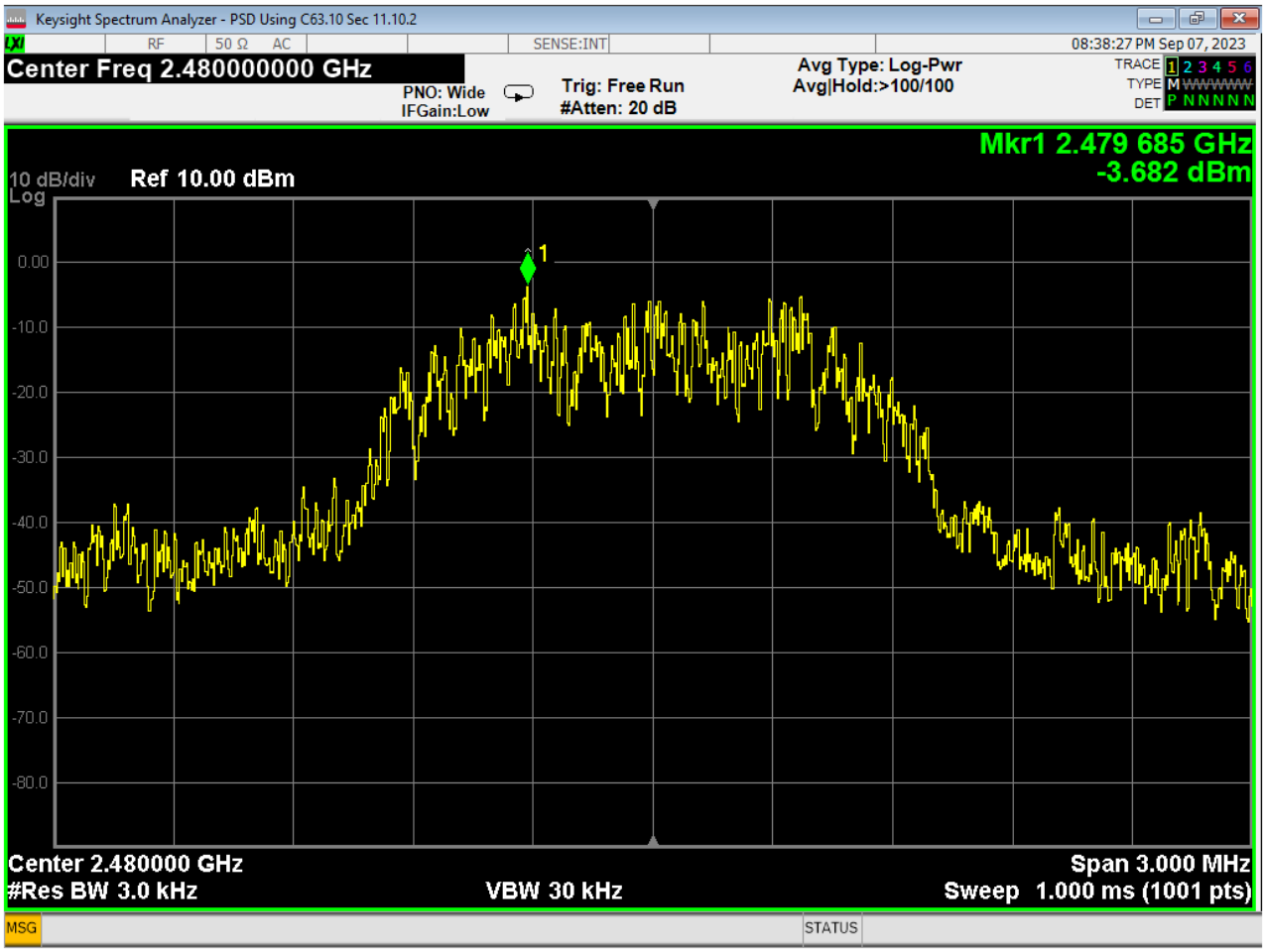
19 6dB Bandwidth, High Channel, 3EDR



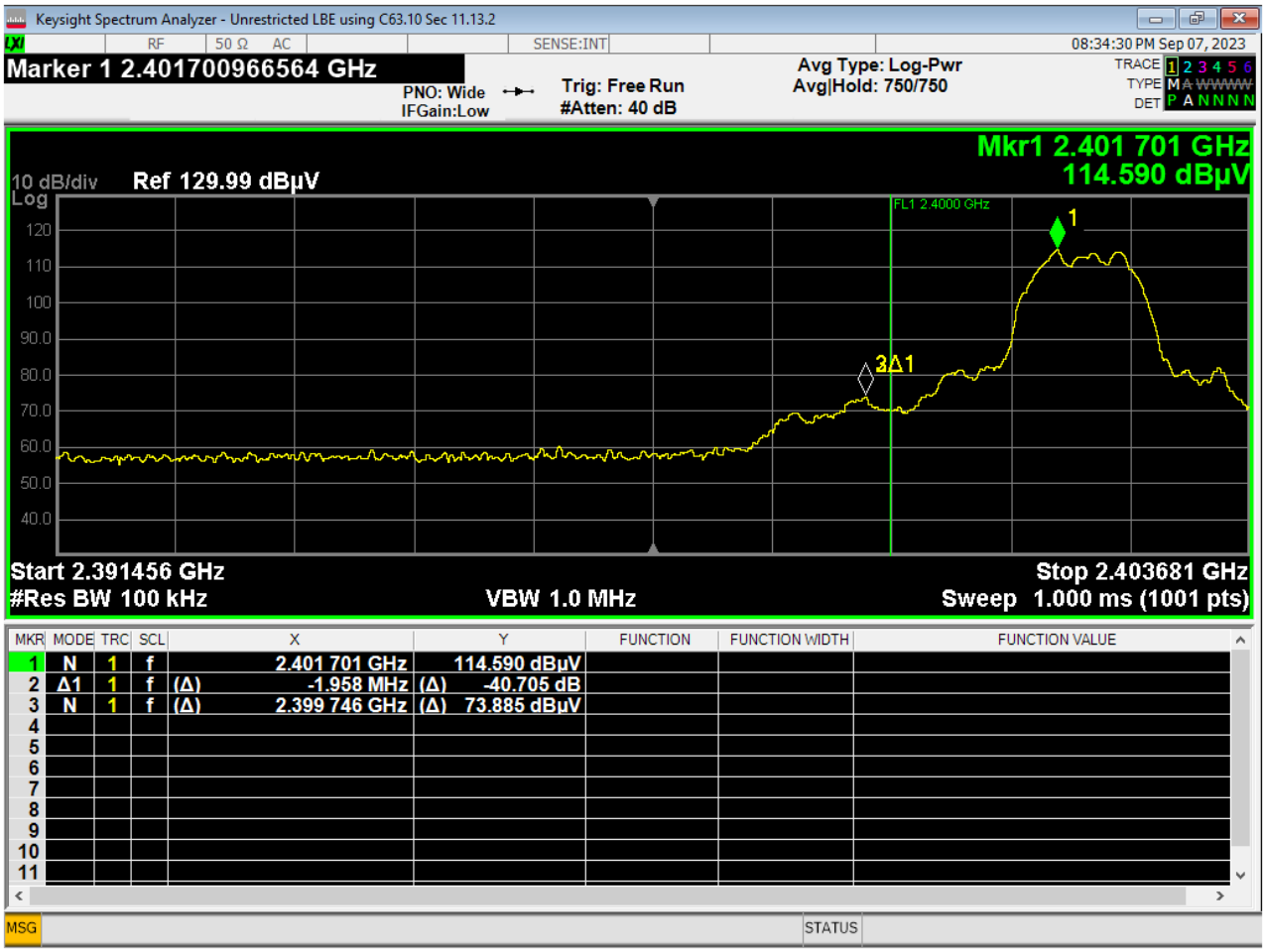
20 PSD, Low Channel, 3EDR



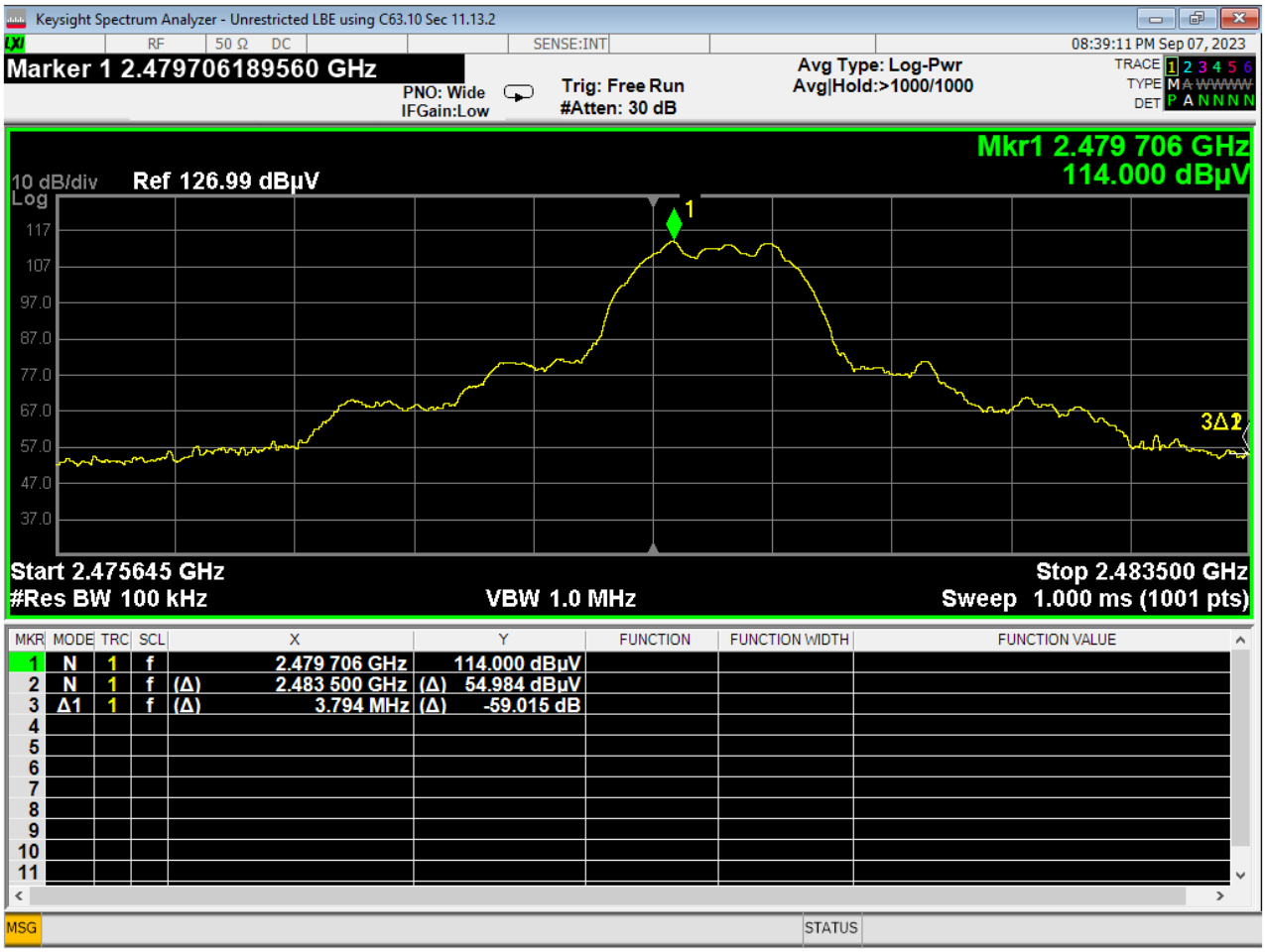
21 PSD, Mid Channel, 3EDR



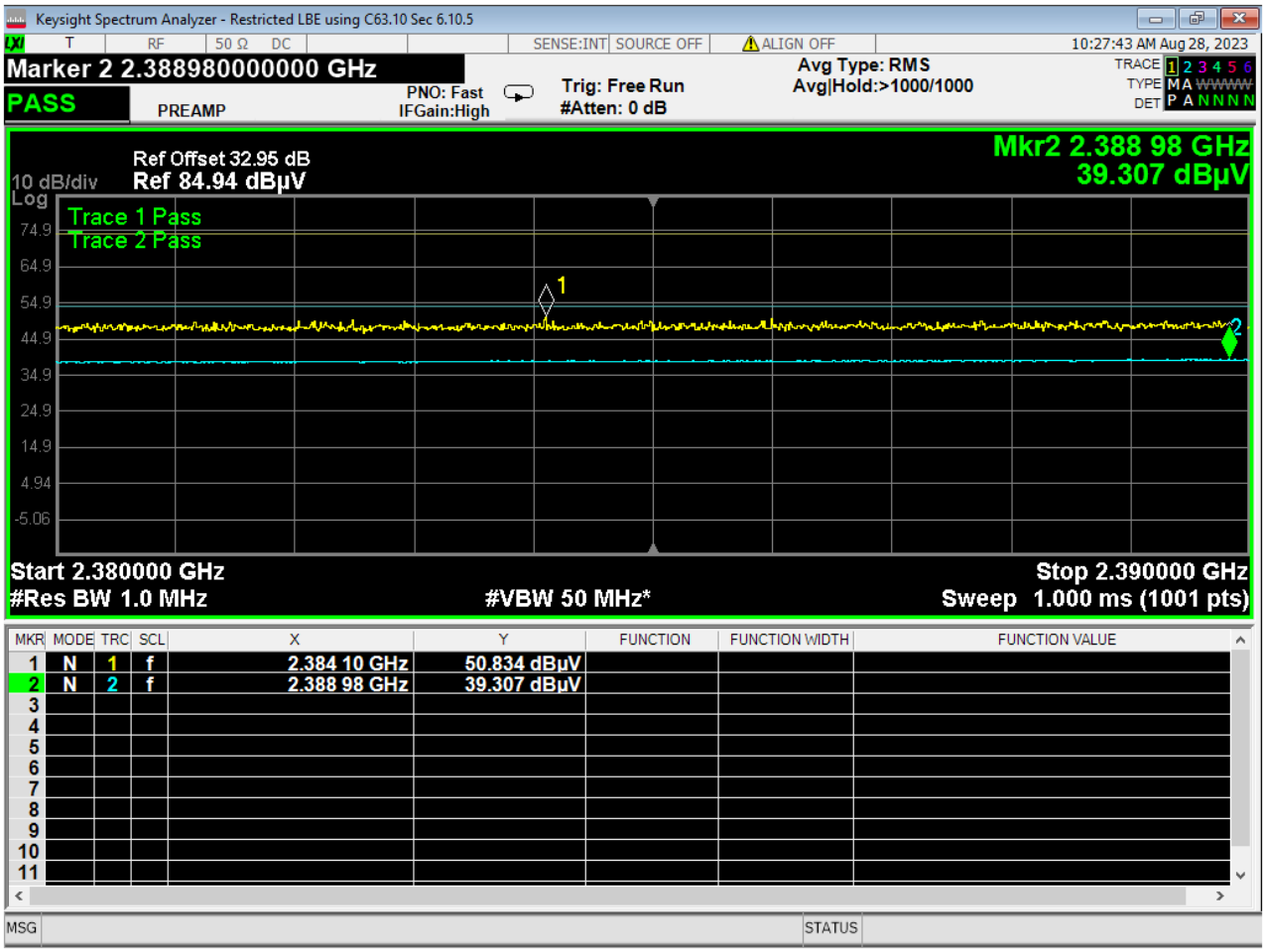
22 PSD, High Channel, 3EDR



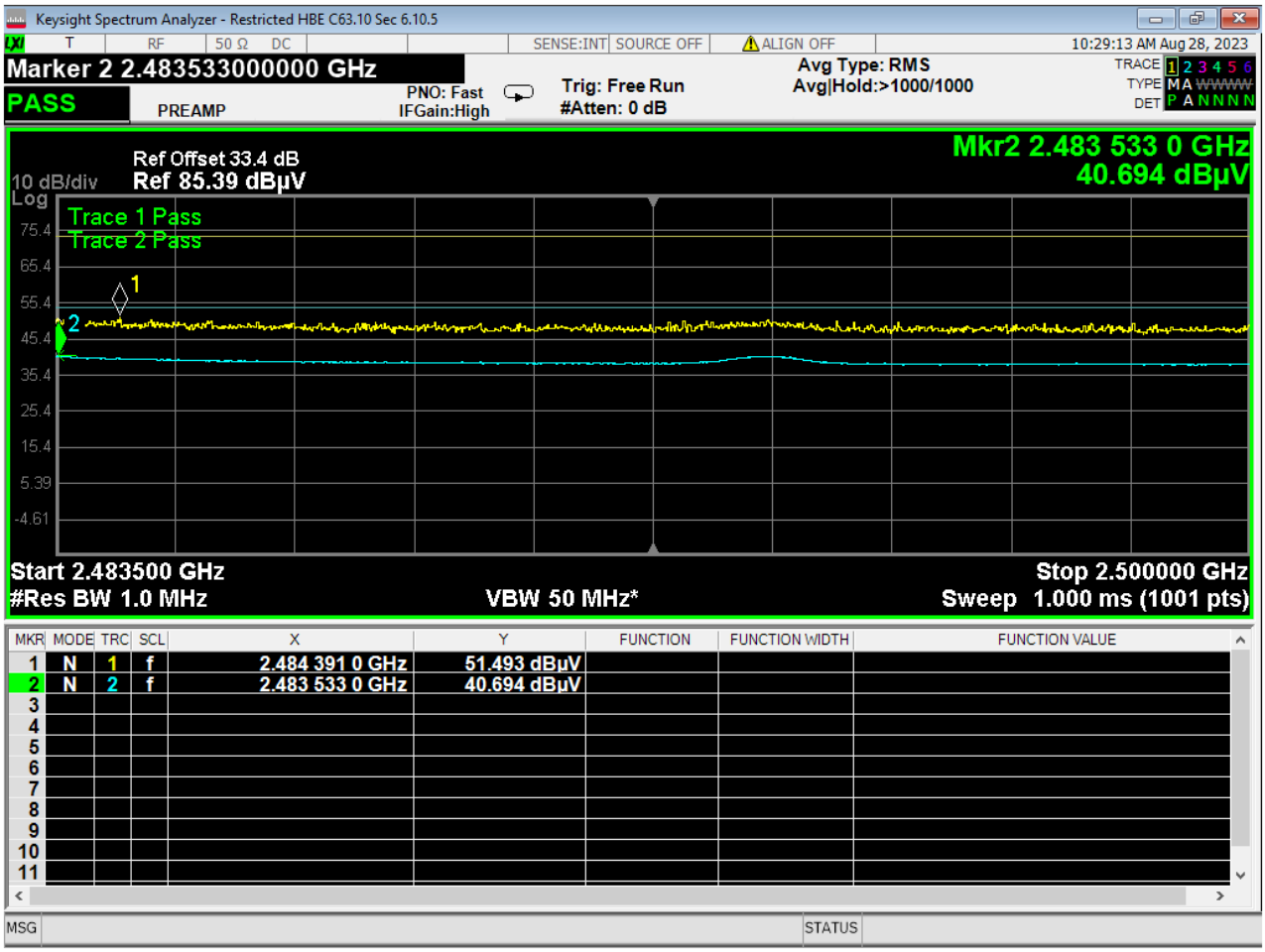
23 Lower Bandedge, Unrestricted, 3EDR



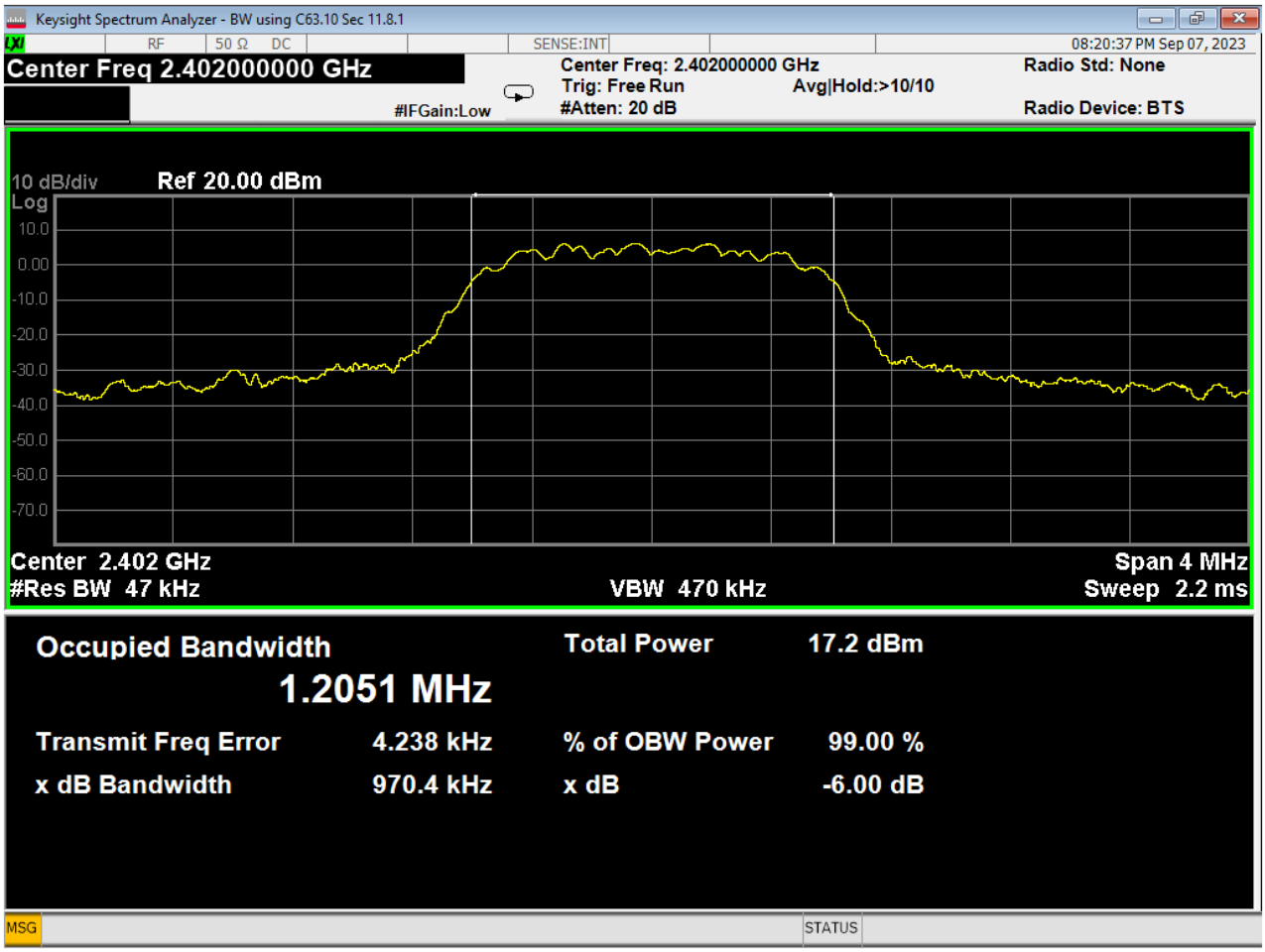
24 Higher Bandedge, Unrestricted, 3EDR



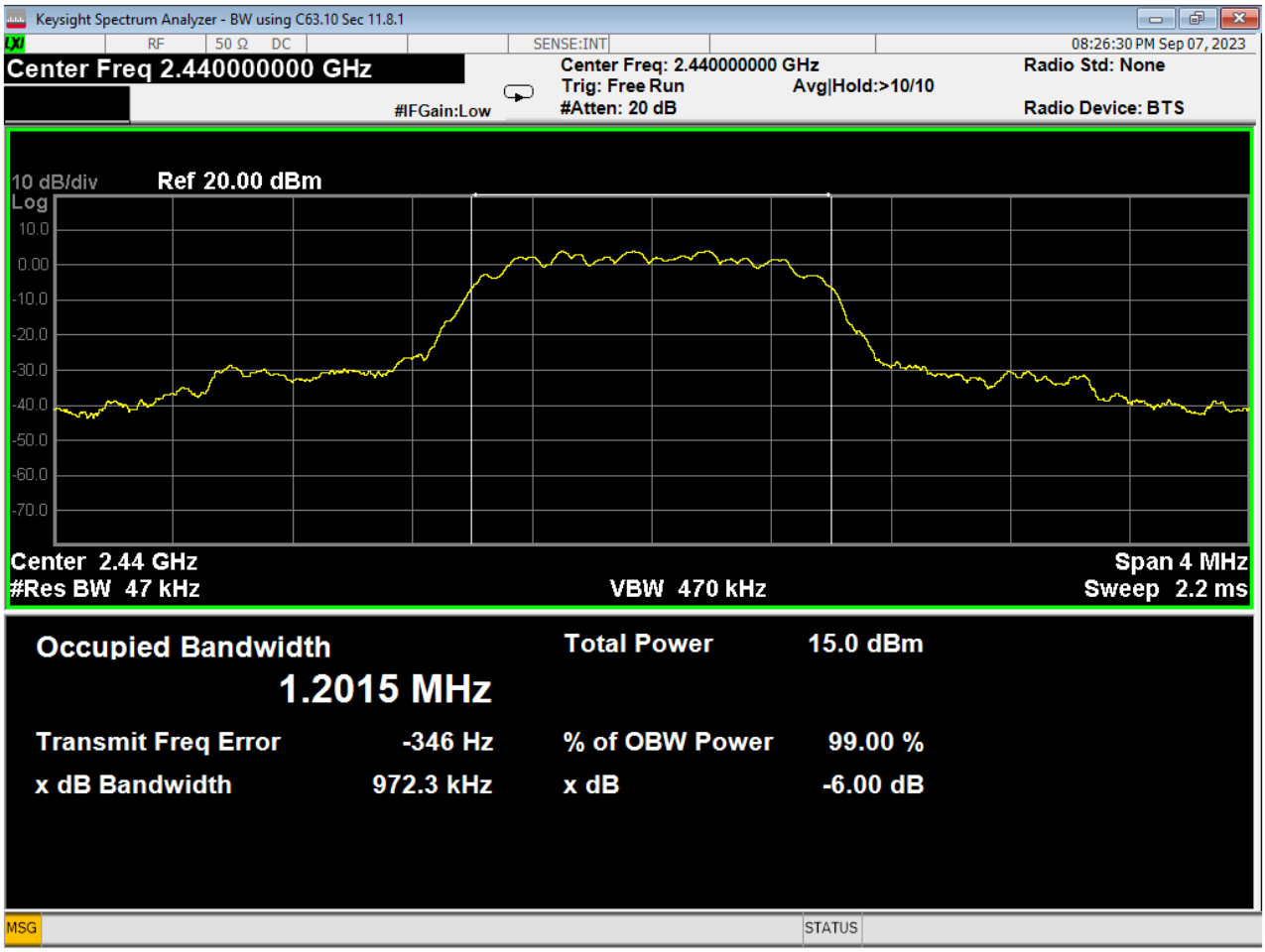
25 Lower Bandedge, Restricted, 3EDR



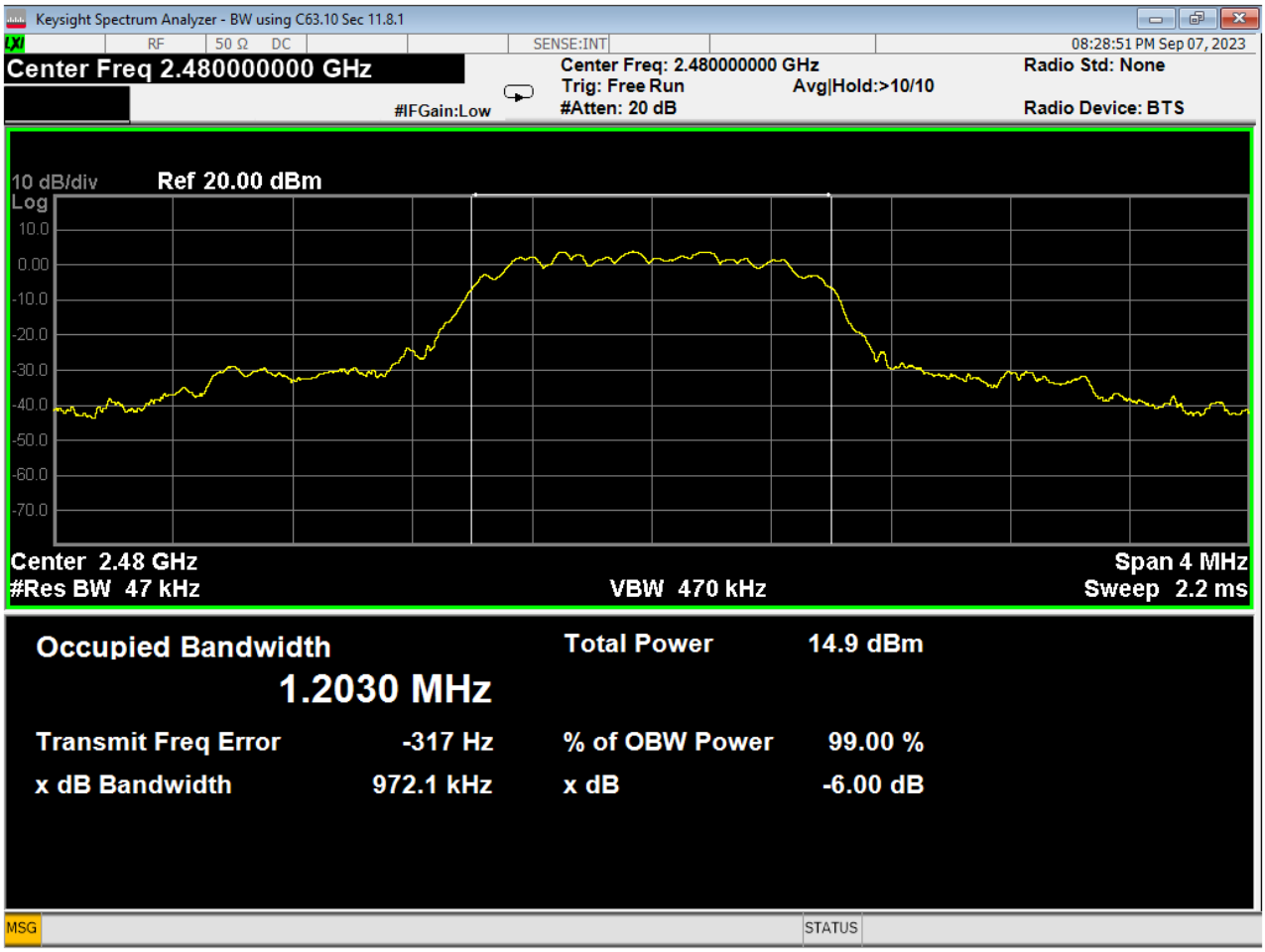
26 Higher Bandedge, Restricted, 3EDR



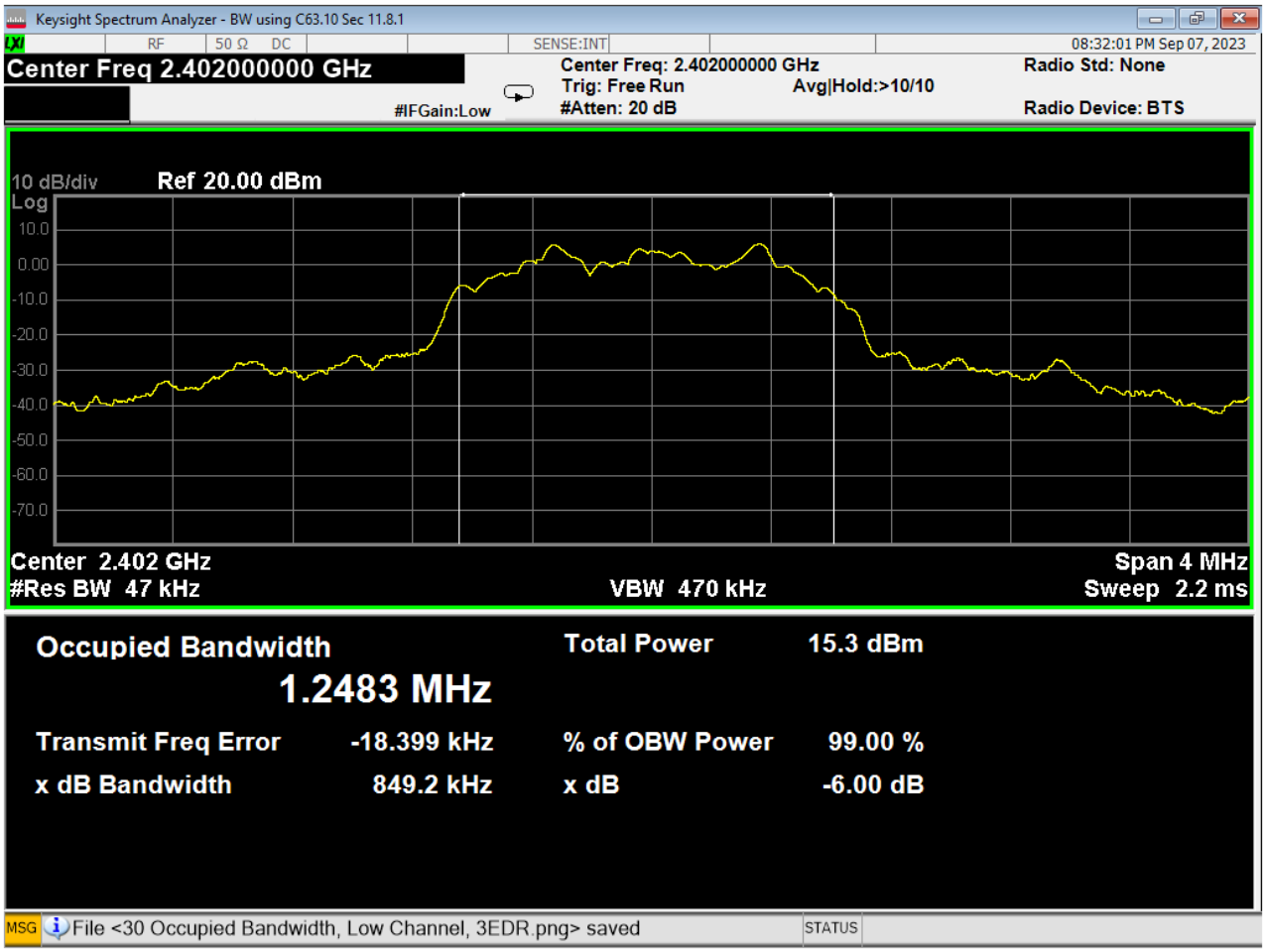
27 Occupied Bandwidth, Low Channel, 2EDR



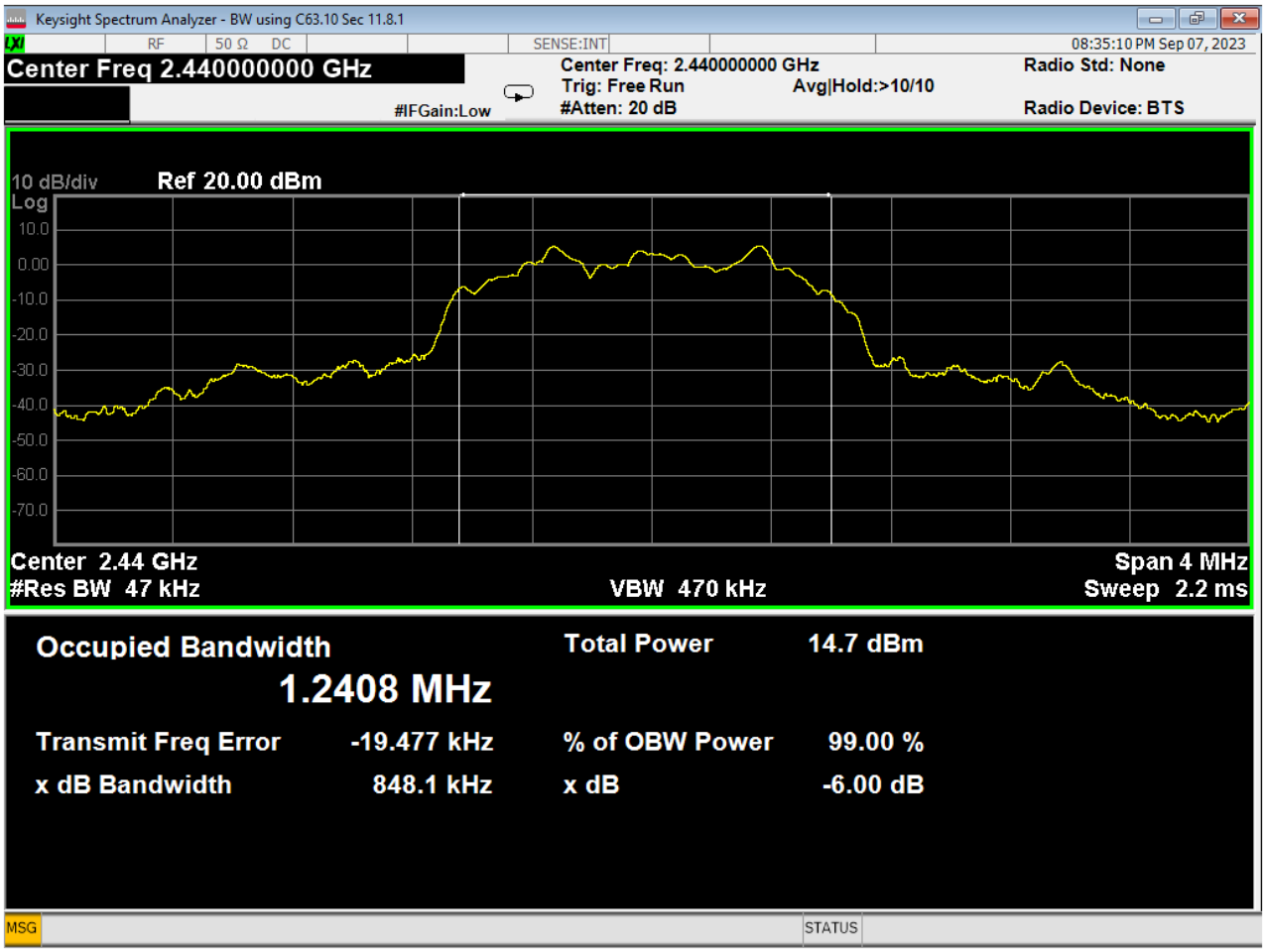
28 Occupied Bandwidth, Mid Channel, 2EDR



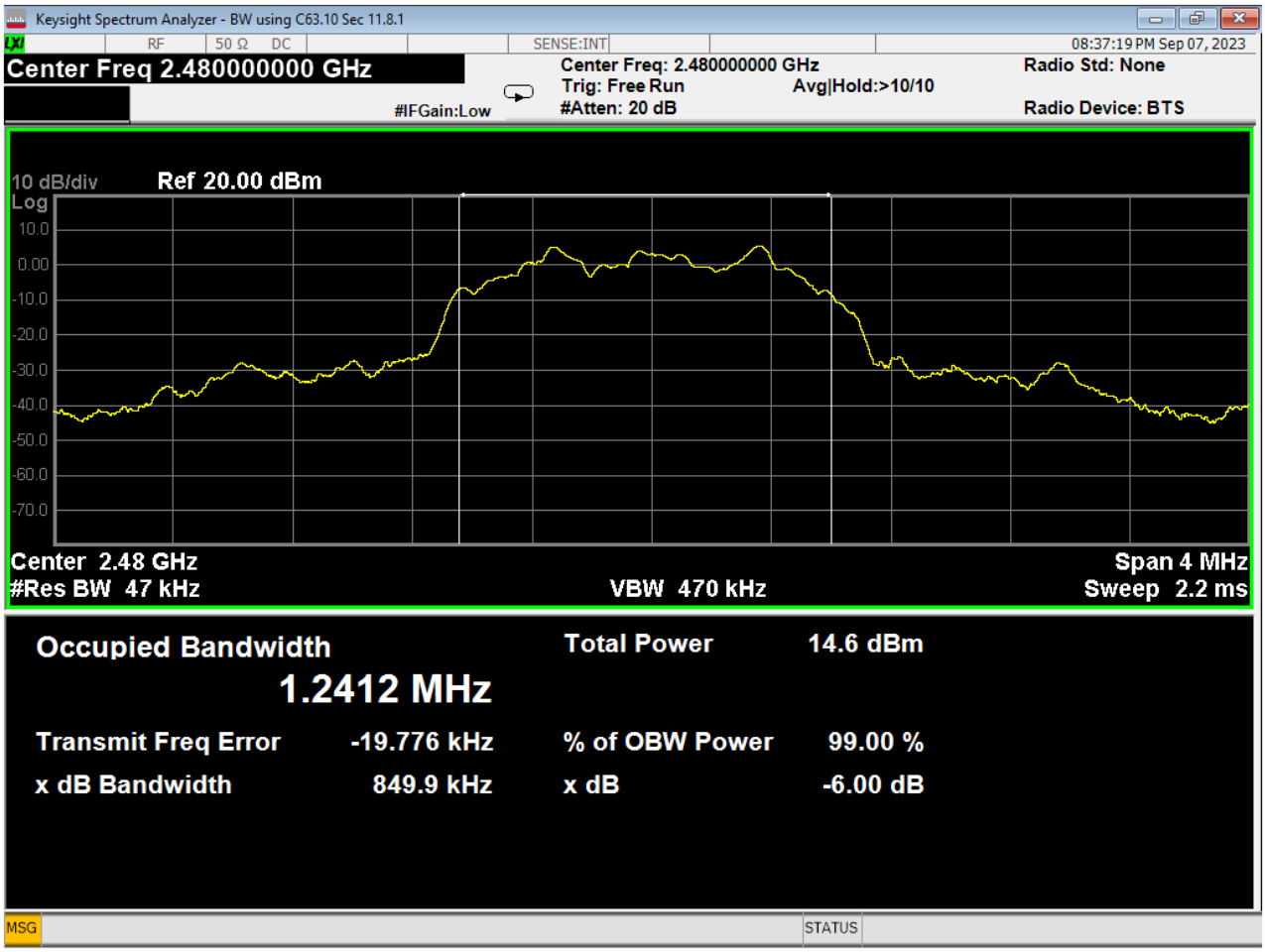
29 Occupied Bandwidth, High Channel, 2EDR



30 Occupied Bandwidth, Low Channel, 3EDR



31 Occupied Bandwidth, Mid Channel, 3EDR



32 Occupied Bandwidth, High Channel, 3EDR

REPORT END