



427 West 12800 South
Draper, UT 84020

Test Report Certification

FCC ID	SWX-UKPRO
IC ID	6545A-UKPRO
Equipment Under Test	U7-Outdoor
Test Report Serial Number	TR8854_03
Date of Test(s)	22, 28 – 30 November; 4 – 8 December 2023 15 – 16 February 2024
Report Issue Date	17 February 2024

Test Specification	Applicant
47 CFR FCC Part 15, Subpart C	Ubiquiti Inc. 685 Third Avenue New York, NY 10017 U.S.A.



NVLAP LAB CODE 600241-0

Certification of Engineering Report

This report has been prepared by Unified Compliance Laboratory (UCL) to document compliance of the device described below with the requirement of Federal Communication Commissions (FCC) Part 15, Subpart C. This report may be reproduced in full. Partial reproduction of this report may only be made with the written consent of the laboratory. The results in this report apply only to the sample tested.

Applicant	Ubiquiti Inc.
Manufacturer	Ubiquiti Inc.
Brand Name	UBIQUITI
Model Number	U7-Outdoor
FCC ID	SWX-UKPRO
IC ID	6545A-UKPRO

On this 17th day of February 2024, I individually and for Unified Compliance Laboratory certify that the statements made in this engineering report are true, complete, and correct to the best of my knowledge and are made in good faith.

Although NVLAP has accredited the Unified Compliance Laboratory testing facilities, this report must not be used to claim product certification, approval, or endorsement by NVLAP, NIST or any agency of the U.S. federal government.

Unified Compliance Laboratory



Written By: Joseph W. Jackson



Reviewed By: Richard L. Winter

Revision History		
Revision	Description	Date
01	Original Report Release	17 February 2024
02	Correct IC Number on Title Page and Page 2	22 April 2024
03	New Model Number	10 May 2024

Table of Contents

1	Client Information.....	5
1.1	Applicant.....	5
1.2	Manufacturer.....	5
2	Equipment Under Test (EUT).....	6
2.1	Identification of EUT	6
2.2	Description of EUT	6
2.3	EUT and Support Equipment.....	6
2.4	Interface Ports on EUT	6
2.5	Operating Environment.....	7
2.6	Operating Modes.....	7
2.7	EUT Exercise Software.....	7
2.8	Block Diagram of Test Configuration	8
2.9	Modification Incorporated/Special Accessories on EUT.....	8
2.10	Deviation, Opinions Additional Information or Interpretations from Test Standard.....	8
3	Test Specification, Method and Procedures.....	9
3.1	Test Specification.....	9
3.2	Methods & Procedures.....	9
3.3	FCC Part 15, Subpart C	9
3.4	Results.....	10
3.5	Test Location	10
4	Test Equipment	11
4.1	Conducted Emissions at Mains Ports.....	11
4.2	Direct Connect at the Antenna Port Tests.....	11
4.3	Radiated Emissions.....	12
4.4	Equipment Calibration	13
4.5	Measurement Uncertainty.....	13
5	Test Results.....	14
5.1	§15.203 Antenna Requirements.....	14
5.2	Conducted Emissions at Mains Ports Data	15
5.3	§15.247(a)(2) Emissions Bandwidth.....	17
5.4	§15.247(b)(3) Maximum Average Output Power.....	19
5.5	§15.247(d) Spurious Emissions	23
5.6	§15.247(e) Maximum Average Power Spectral Density	46

1 Client Information

1.1 Applicant

Company	Ubiquiti Inc. 685 Third Avenue New York, NY 10017 U.S.A.
Contact Name	Alex Macon
Title	Compliance

1.2 Manufacturer

Company	Ubiquiti Inc. 685 Third Avenue New York, NY 10017 U.S.A.
Contact Name	Alex Macon
Title	Compliance

2 Equipment Under Test (EUT)

2.1 Identification of EUT

Brand Name	UBIQUITI
Model Number	U7_outdoor
Serial Number	68D79A05C391
Dimensions (cm)	17.0 x 20.8 x 5.5

2.2 Description of EUT

The U7-Outdoor is a PoE powered WiFi 7 access point with a 2.5 GbE PoE port. The U7-Outdoor provides a 3.6 Gbps aggregate throughput rate. The U7-Outdoor transmits in the 2.4 (2x2) GHz and 5 (2x2) GHz frequency bands and uses an internal integrated or external dipole antenna. The U7-Outdoor is powered by an 802.3at PoE power adapter. The U7-Outdoor is an outdoor device.

This report covers the circuitry of the device subject to FCC Part 15, Subpart C. The circuitry of the device subject to FCC Part 15 Subpart B was found to be compliant and is covered under a separate Unified Compliance Laboratory test report.

2.3 EUT and Support Equipment

The EUT and support equipment used during the test are listed below.

Brand Name Model Number Serial Number	Description	Name of Interface Ports / Interface Cables
BN: UBIQUITI MN: U7-Outdoor (Note 1) SN: 68D79A05C391	WiFi Access Point	See Section 2.4
BN: UBIQUITI MN: U-POE-at SN: N/A	PoE Power Adapter	Unshielded Cat 5e cable/1 meters
BN: Dell MN: XPS 13 SN: N/A	Laptop Personal Computer	Unshielded Cat 5e cable/1 meters

Notes: (1) EUT

(2) Interface port connected to EUT (See Section 2.4)

The support equipment listed above was not modified in order to achieve compliance with this standard.

2.4 Interface Ports on EUT

Name of Ports	No. of Ports Fitted to EUT	Cable Description/Length
AC Mains	1	3 conductor power cord/80 cm

POE (POE Injector)	1	Unshielded Cat 5e cable/8 meters
LAN (POE Injector)	1	Unshielded Cat 5e cable/1 meters

2.5 Operating Environment

Power Supply	120 Volts AC Mains to 48 Volts PoE
AC Mains Frequency	60 Hz
Temperature	21.7 – 22.8 °C
Humidity	23.4 – 31.3 %
Barometric Pressure	1015 mBar

2.6 Operating Modes

The U7_outdoor was connected to a personal computer laptop and tested using test software in order to enable to constant duty cycle greater or equal to 98% of the WiFi transceiver. All emission modes of 802.11 b/g/n/ax were investigated. All measurements are reported with the worst-case mode (802.11ax) unless otherwise stated.

2.7 EUT Exercise Software

EUT firmware version 1.0 was used to operate the transmitter using a constant transmit mode.

2.8 Block Diagram of Test Configuration

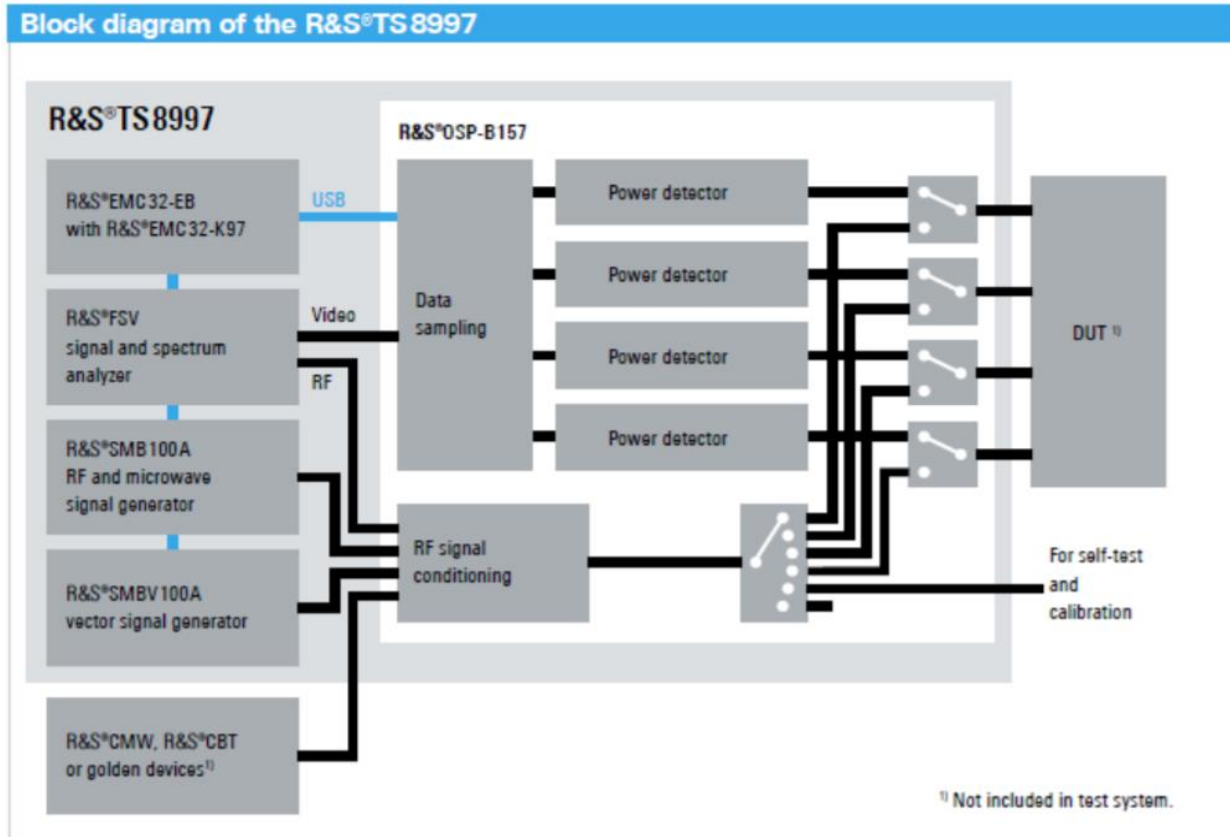


Diagram 1: Test Configuration Block Diagram

2.9 Modification Incorporated/Special Accessories on EUT

There were no modifications made to the EUT during testing to comply with the specification.

2.10 Deviation, Opinions Additional Information or Interpretations from Test Standard

There were no deviations, opinions, additional information or interpretations from the test specification.

3 Test Specification, Method and Procedures

3.1 Test Specification

Title	47 CFR FCC Part 15, Subpart C 15.203, 15.207 and 15.247 Limits and methods of measurement of radio interference characteristics of radio frequency devices.
Purpose of Test	The tests were performed to demonstrate initial compliance

3.2 Methods & Procedures

3.2.1 47 CFR FCC Part 15 Section 15.203

See test standard for details.

3.2.2 47 CFR FCC Part 15 Section 15.207

See test standard for details.

3.2.3 47 CFR FCC Part 15 Section 15.247

See test standard for details.

3.3 FCC Part 15, Subpart C

3.3.1 Summary of Tests

FCC Section	ISED Section	Environmental Phenomena	Frequency Range (MHZ)	Result
15.203	N/A	Antenna requirements	Structural Requirement	Compliant
15.207	RSS-Gen	Conducted Disturbance at Mains Port	0.15 to 30	Compliant
15.247(a)	RSS-247 § 5.2	Bandwidth Requirement	2412 to 2462	Compliant
15.247(b)	RSS-247 § 5.4	Peak Output Power	2412 to 2462	Compliant
15.247(d)	RSS-247 § 5.4	Antenna Conducted Spurious Emissions	0.009 to 26000	N/A
15.247(d)	RSS-247 § 5.4	Radiated Spurious Emissions	0.009 to 26000	Compliant
15.247(e)	RSS-247 § 5.2	Peak Power Spectral Density	2412 to 2462	Compliant

The testing was performed according to the procedures in ANSI C63.10-2013, KDB 558074 and 47 CFR Part 15. Where applicable, KDB 662911 was followed to sum required measurements.

3.4 Results

In the configuration tested, the EUT complied with the requirements of the specification.

3.5 Test Location

Testing was performed at the Unified Compliance Laboratory 3-Meter and 10-Meter chambers located at 427 West 12800 South, Draper, UT 84020. Unified Compliance Laboratory is accredited by National Voluntary Laboratory Accreditation Program (NVLAP); NVLAP Code 600241-0 which is effective until 30 June 2024. This site has also been registered with Innovations, Science and Economic Development (ISED) department and was accepted under Appendix B, Phase 1 procedures of the APEC Tel MRA for Canadian recognition. ISED No.: 25346, effective until 30 June 2024.

Unified Compliance Laboratory has been assigned Designation Number US5037 by the FCC and Conformity Assessment Number US0223 by ISED.

4 Test Equipment

4.1 Conducted Emissions at Mains Ports

Type of Equipment	Manufacturer	Model Number	Asset Number	Date of Last Calibration	Due Date of Calibration
EMI Receiver	AFJ	FFT3010	UCL-2500	7/13/2023	7/13/2024
LISN	AFJ	LS16C/10	UCL-2512	5/26/2023	5/26/2024
ISN	Teseq	ISN T800	UCL-2974	6/27/2022	6/27/2024
LISN	AFJ	LS16C\10	UCL-6749	1/29/2024	1/29/2025
AC Power Source	Laplace Instruments	AC1000A	UCL-2857	N/A	N/A
Test Software	UCL	Revision 1	UCL-3107	N/A	N/A

Table 1: List of equipment used for Conducted Emissions Testing at Mains Port

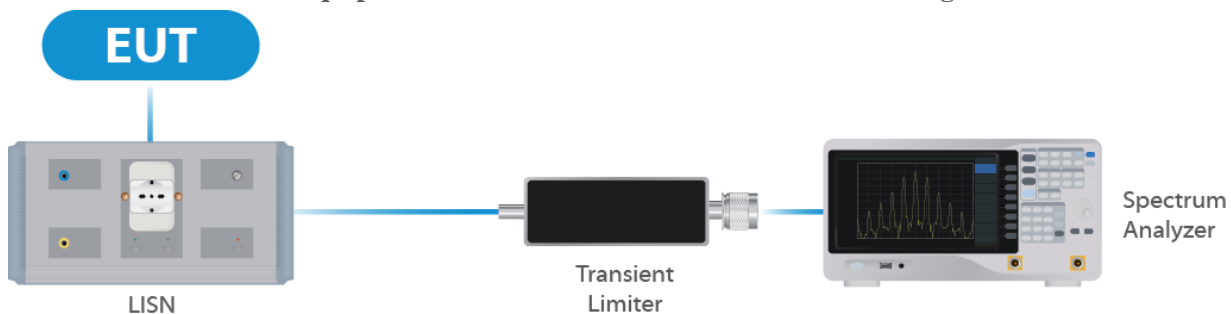


Figure 1: Conducted Emissions Test

4.2 Direct Connect at the Antenna Port Tests

Type of Equipment	Manufacturer	Model Number	Asset Number	Date of Last Calibration	Due Date of Calibration
Spectrum Analyzer	R&S	FSV40	UCL-2861	11/27/2023	11/27/2024
Signal Generator	R&S	SMB100A	UCL-2864	N/A	N/A
Vector Signal Generator	R&S	SMBV100A	UCL-2873	N/A	N/A
Switch Extension	R&S	OSP-B157WX	UCL-2867	2/22/2023	3/20/2024
Switch Extension	R&S	OSP-150W	UCL-2870	2/22/2023	2/22/2024

Table 2: List of equipment used for Direct Connect at the Antenna Port

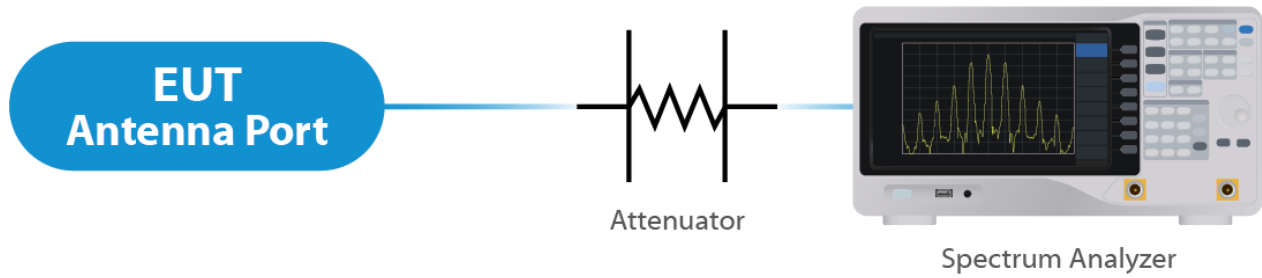


Figure 2: Direct Connect at the Antenna Port Test

4.3 Radiated Emissions

Type of Equipment	Manufacturer	Model Number	Asset Number	Date of Last Calibration	Due Date of Calibration
EMI Receiver	Keysight	N9038A	UCL-2778	1/25/2024	1/29/2025
Pre-Amplifier 9 kHz – 1 GHz	Sonoma Instruments	310N	UCL-2889	1/19/2024	1/19/2026
Broadband Antenna	Scwarzbeck	VULB 9163	UCL-3062	2/22/2023	2/22/2025
Broadband Antenna	Scwarzbeck	VULB 9163	UCL-3071	1/11/2023	1/11/2025
Double Ridge Horn Antenna	Scwarzbeck	BBHA 9120D	UCL-3065	9/22/2022	9/22/2024
Log Periodic	Scwarzbeck	STLP 9129	UCL-3068	1/27/2023	1/27/2025
15 - 40 GHz Horn Antenna	Scwarzbeck	BBHA 9170	UCL-2487	6/09/2022	6/09/2024
1 – 18 GHz Amplifier	Com-Power	PAM 118A	UCL-3833	1/19/2024	1/19/2026
Test Software	UCL	Revision 1	UCL-3108	N/A	N/A

Table 3: List of equipment used for Radiated Emissions

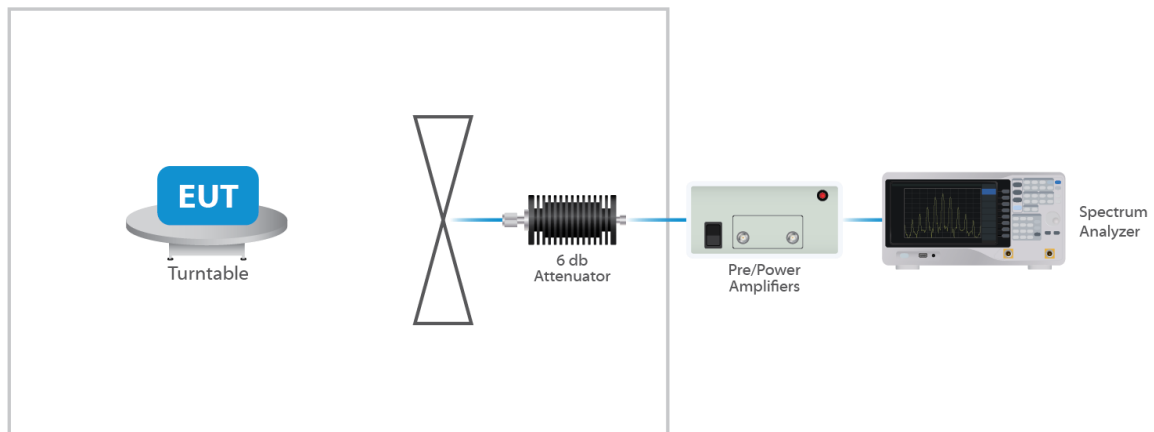


Figure 3: Radiated Emissions Test

4.4 Equipment Calibration

All applicable equipment is calibrated using either an independent calibration laboratory or Unified Compliance Laboratory personnel at intervals defined in ANSI C63.4:2014 following outlined calibration procedures. All measurement instrumentation is traceable to the National Institute of Standards and Technology (NIST). Supporting documentation relative to traceability is on file and is available for examination upon request.

4.5 Measurement Uncertainty

Test	Uncertainty (\pm dB)	Confidence (%)
Conducted Emissions	1.44	95
Radiated Emissions (9 kHz to 30 MHz)	2.50	95
Radiated Emissions (30 MHz to 1 GHz)	4.38	95
Radiated Emissions (1 GHz to 18 GHz)	4.37	95
Radiated Emissions (18 GHz to 40 GHz)	3.93	95
Direct Connect Tests	K Factor	Value
Emissions Bandwidth	2	2.0%
Output Power	2	1.0 dB
Peak Power Spectral Density	2	1.3 dB
Band Edge	2	0.8 dB
Transmitter Spurious Emissions	2	1.8 dB

5 Test Results

5.1 §15.203 Antenna Requirements

The EUT uses an internal antenna and an optional external antenna. Per the manufacturer, the Maximum gain of the internal antenna per chain is 8 dBi and the Maximum gain of the external antenna per chain is 3.59 dBi. This is an 802.11 device and utilizes CDD as described in KDB 662911 D01. The internal antenna is not user replaceable, the external antenna is user replaceable. For CDD transmissions, directional gain is calculated as follows.

Array Gain = $10 \log(\text{NANT}/\text{NSS})$ dB

NANT = number of transmit antennas and

NSS = number of spatial streams. NSS = 1 considered worst case.

For power measurements on IEEE 802.11 devices, Array Gain = 0 dB for $\text{NANT} \leq 4$;

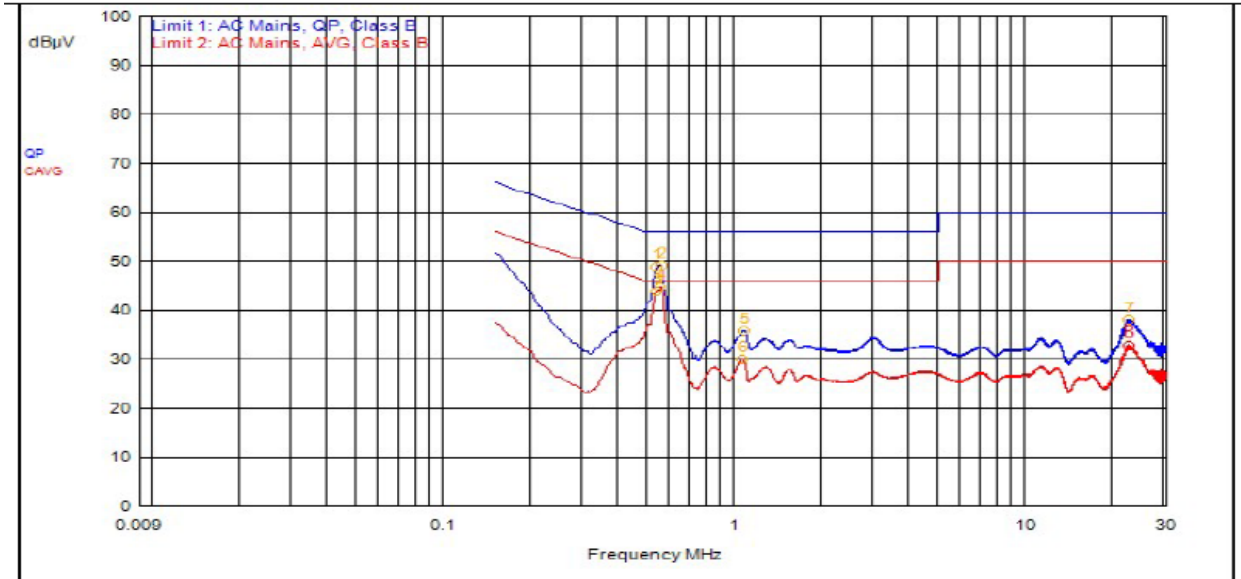
For PSD measurements when $\text{Nss}=1$: Array Gain = $10 \log(\text{NANT}/\text{NSS})$ dB + Antenna Gain (dBi).

Or $3.01 \text{ dB} + 8 \text{ dBi} = 15.01 \text{ dBi}$ for the internal antenna and $3.01 \text{ dB} + 3.59 \text{ dBi} = 6.60 \text{ dBi}$ for the external antenna.

Results

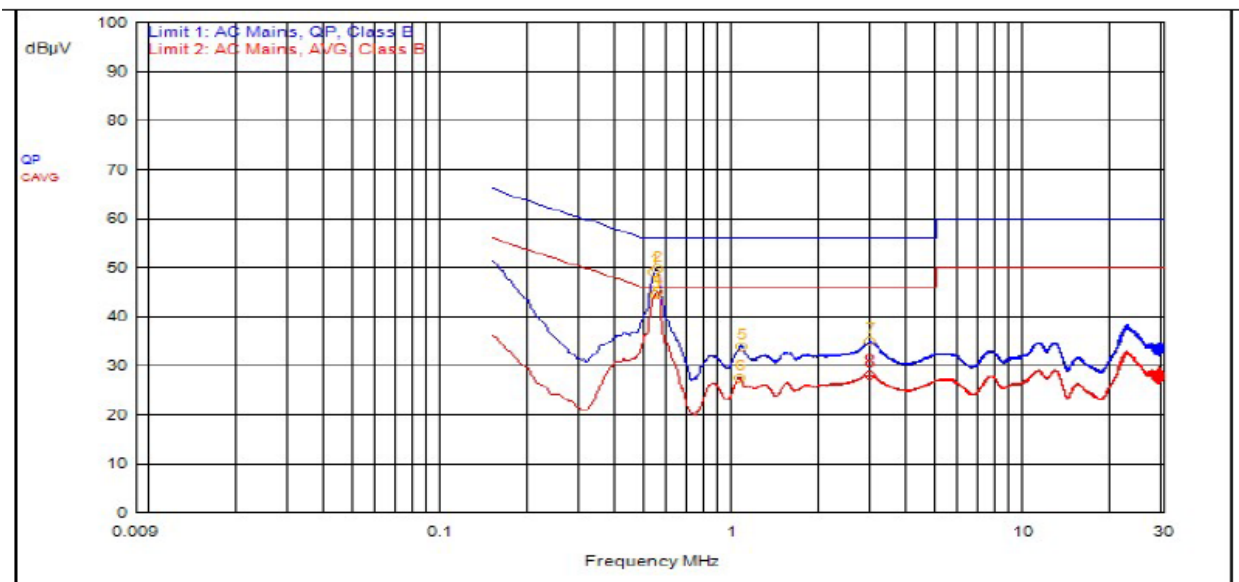
The EUT complied with the specification

5.2 Conducted Emissions at Mains Ports Data



ID	Frequency	Probe	Cable	Atten.	Detector	Meter Read	Meas Level	Limit 1	Limit 1 Dist.	Limit 2	Limit 2 Dist.	P/F
MU	MHz	dB	dB	dB	Type	dBµV	dBµV	dBµV	dB	dBµV	dB	P/F
2	555,000kHz	12.41	0.00		QPeak	36.62	49.03	56.00	-6.97			
1	537,000kHz	12.42	0.00		QPeak	36.51	48.93	56.00	-7.07			
5	1.065	12.39	0.10		QPeak	23.39	35.88	56.00	-20.12			
7	22.383	12.39	0.20		QPeak	25.60	38.19	60.00	-21.81			
3	537,000kHz	12.42	0.00		C_AVG	31.47	43.89			46.00	-2.11	
4	552,000kHz	12.41	0.00		C_AVG	32.38	44.79			46.00	-1.21	
6	1.050	12.39	0.10		C_AVG	17.54	30.03			46.00	-15.97	
8	22.386	12.39	0.20		C_AVG	20.28	32.87			50.00	-17.13	

Graph 1: Conducted Emissions Plot - Neutral



Graph 2: Conducted Emissions Plot – Line 1

Result

The EUT complied with the specification limit.

5.3 §15.247(a)(2) Emissions Bandwidth

All chains were measured under the guidance of KDB 558074 Section 8.2. and KDB 66291 D01. Please see associated annex for details on instrument settings.

5.3.1 Internal Antenna

Mode	Frequency (MHz)	99% Bandwidth (MHz)	6 dB Bandwidth (MHz)
b	2412	12.9	8.2
	2437	12.7	7.2
	2462	12.9	6.8
g	2412	16.7	15.7
	2437	16.9	15.8
	2462	16.8	16.4
n 20	2412	17.7	17.7
	2437	19.0	18.9
	2462	17.7	17.7
n 40	2422	36.5	36.4
	2437	36.5	36.4
	2452	36.3	35.4
ax 20	2412	18.9	19.1
	2437	18.9	18.4
	2462	19.0	18.9
ax 40	2422	38.0	38.2
	2437	38.0	36.0
	2452	37.8	34.6

5.3.2 External Antenna

Mode	Frequency (MHz)	99% Bandwidth (MHz)	6 dB Bandwidth (MHz)
b	2412	13.0	7.2
	2437	12.9	8.2
	2462	12.9	6.8
g	2412	16.7	16.4
	2437	16.7	14.2
	2462	16.6	16.5
n 20	2412	17.8	17.7
	2437	17.7	16.4
	2462	17.7	17.7

Mode	Frequency (MHz)	99% Bandwidth (MHz)	6 dB Bandwidth (MHz)
n 40	2422	36.3	36.4
	2437	36.5	14.9
	2452	36.3	36.4
ax 20	2412	18.9	18.8
	2437	18.9	16.9
	2462	18.9	14.9
ax 40	2422	37.8	37.7
	2437	37.8	37.8
	2452	38.0	37.9

Result

All chains were tested and the highest bandwidth per chain is reported above.

In the configuration tested, the 6 dB bandwidth was greater than 500 kHz; therefore, the EUT complied with the requirements of the specification (see spectrum analyzer plot within the Annex).

5.4 §15.247(b)(3) Maximum Average Output Power

All chains were measured and summed under the guidance of KDB 558074 Section 8.3.2.3. and KDB 66291 D01. Please see associated annex for details on instrument settings.

For the internal antenna the maximum average RF conducted output power measured for this device was 25.06 dBm or 0.321 Watts. The limit is 30 dBm or 1 Watt when using antennas with 6 dBi or less gain. The internal antenna has a gain of 8 dBi so the conducted output power was adjusted to 28 dBm or 0.631 Watts.

For the external antenna the maximum average RF conducted output power measured for this device was 26.23 dBm or 0.420 Watts. The limit is 30 dBm or 1 Watt when using antennas with 6 dBi or less gain. The external antenna has a gain of 3.59 dBi.

5.4.1 Internal Antenna

Modulation (BW)	Frequency (MHz)	Data Rate	TP Setting	Conducted Output Power *	Measured EIRP
b 20	2412	Mcs0	22	23.45	31.45
	2417	Mcs0	22	23.47	31.47
	2422	Mcs0	22	23.61	31.61
	2427	Mcs0	22	23.66	31.66
	2432	Mcs0	22	23.71	31.71
	2437	Mcs0	22	23.48	31.48
	2442	Mcs0	22	23.85	31.85
	2447	Mcs0	22	23.88	31.88
	2452	Mcs0	22	23.63	31.63
	2457	Mcs0	22	23.87	31.87
2462	Mcs0	23	25.06	33.06	
g 20	2412	Mcs0	18	19.87	27.87
	2417	Mcs0	20	22.06	30.06
	2422	Mcs0	21	22.63	30.63
	2427	Mcs0	21	22.69	30.69
	2432	Mcs0	22	23.41	31.41
	2437	Mcs0	22	23.41	31.41
	2442	Mcs0	22	23.56	31.56
	2447	Mcs0	21	22.82	30.82
2452	Mcs0	21	22.89	30.89	

	2457	Mcs0	21	22.92	30.92
	2462	Mcs0	18	20.02	28.02
n 20	2412	Mcs0	18	19.91	27.91
	2417	Mcs0	19	20.65	28.65
	2422	Mcs0	21	22.01	30.01
	2427	Mcs0	21	22.65	30.65
	2432	Mcs0	21	22.74	30.74
	2437	Mcs0	22	23.44	31.44
	2442	Mcs0	22	23.41	31.41
	2447	Mcs0	21	22.71	30.71
	2452	Mcs0	21	22.82	30.82
	2457	Mcs0	20	22.14	30.14
	2462	Mcs0	18	20.08	28.08
n 40	2422	Mcs0	17	19.12	27.12
	2437	Mcs0	18	20.12	28.12
	2452	Mcs0	17	19.33	27.33
ax 20	2412	Mcs0	18	19.83	27.83
	2417	Mcs0	19	20.64	28.64
	2422	Mcs0	20	21.87	29.87
	2427	Mcs0	21	22.68	30.68
	2432	Mcs0	21	22.67	30.67
	2437	Mcs0	22	23.40	31.40
	2442	Mcs0	21	22.80	30.80
	2447	Mcs0	21	22.83	30.83
	2452	Mcs0	20	22.18	30.18
	2457	Mcs0	20	22.15	30.15
2462	Mcs0	18	19.94	27.94	
ax 40	2422	Mcs0	17	19.00	27.00
	2437	Mcs0	17	19.06	27.06
	2452	Mcs0	17	19.35	27.35

5.4.2 External Antenna

Modulation (BW)	Frequency (MHz)	Data Rate	TP Setting	Conducted Output Power *	Measured EIRP
b 20	2412	Mcs0	23	24.35	27.94
	2417	Mcs0	23	24.20	27.79

	2422	Mcs0	24	25.39	283.98
	2427	Mcs0	25	26.19	29.78
	2432	Mcs0	25	26.23	29.82
	2437	Mcs0	25	26.17	29.76
	2442	Mcs0	25	25.96	29.55
	2447	Mcs0	25	26.01	29.60
	2452	Mcs0	25	26.03	29.62
	2457	Mcs0	24	25.33	28.92
	2462	Mcs0	24	25.27	28.86
g 20	2412	Mcs0	19	20.52	24.11
	2417	Mcs0	20	21.27	24.86
	2422	Mcs0	21	21.98	25.57
	2427	Mcs0	21	21.98	25.57
	2432	Mcs0	22	23.60	27.19
	2437	Mcs0	23	24.32	27.91
	2442	Mcs0	22	23.50	27.09
	2447	Mcs0	22	23.41	27.00
	2452	Mcs0	21	21.83	25.42
	2457	Mcs0	21	21.82	24.41
2462	Mcs0	19	20.45	24.04	
n 20	2412	Mcs0	18	19.06	22.65
	2417	Mcs0	20	21.22	24.81
	2422	Mcs0	21	21.84	25.43
	2427	Mcs0	21	21.82	25.41
	2432	Mcs0	22	23.56	27.15
	2437	Mcs0	22	23.49	27.08
	2442	Mcs0	22	23.45	27.04
	2447	Mcs0	21	21.74	25.33
	2452	Mcs0	21	21.74	25.33
	2457	Mcs0	21	21.78	25.37
2462	Mcs0	19	20.38	23.97	
n 40	2422	Mcs0	16	17.51	21.10
	2437	Mcs0	18	19.48	23.07
	2452	Mcs0	18	19.47	23.06
ax 20	2412	Mcs0	18	19.23	22.82
	2417	Mcs0	19	20.53	24.12

	2422	Mcs0	20	21.27	24.86
	2427	Mcs0	21	21.98	25.57
	2432	Mcs0	21	22.00	25.59
	2437	Mcs0	22	23.58	27.17
	2442	Mcs0	22	23.39	26.98
	2447	Mcs0	21	21.87	25.46
	2452	Mcs0	21	21.90	25.49
	2457	Mcs0	20	21.18	24.77
	2462	Mcs0	18	19.08	22.67
ax 40	2422	Mcs0	16	17.58	21.17
	2437	Mcs0	18	19.43	23.02
	2452	Mcs0	18	19.47	23.06

Result

In the configuration tested, the maximum average RF output power was less than 0.631 or 1 watt respectfully; therefore, the EUT complied with the requirements of the specification (see spectrum analyzer plot within the Annex).

* Gated EIRP shown in the Annex is the conducted measurement

5.5 §15.247(d) Spurious Emissions

5.5.1 Conducted Spurious Emissions

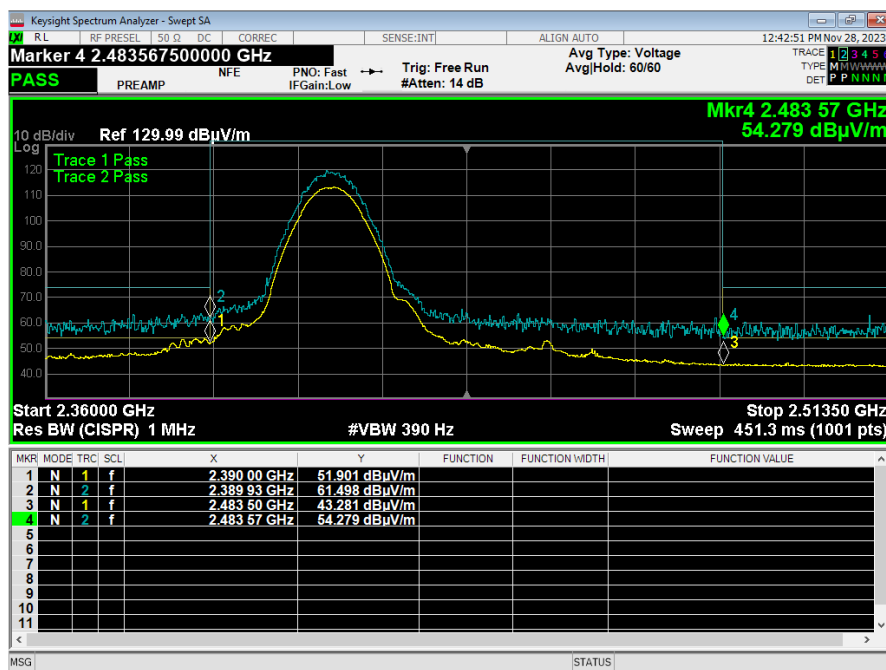
The frequency range from the lowest frequency generated or used in the device to the tenth harmonic of the highest fundamental frequency was investigated to measure any antenna-conducted emissions. The table show the measurement data from spurious emissions noted across the frequency range when transmitting at the lowest frequency, middle frequency and upper frequency. Shown below are plot(s) with the EUT tuned to the upper and lower channels. These demonstrate compliance with the provisions of this section at the band edges.

The emissions must be attenuated 30 dB below the highest power spectral density level measured within the authorized band as measured with a 100 kHz RBW.

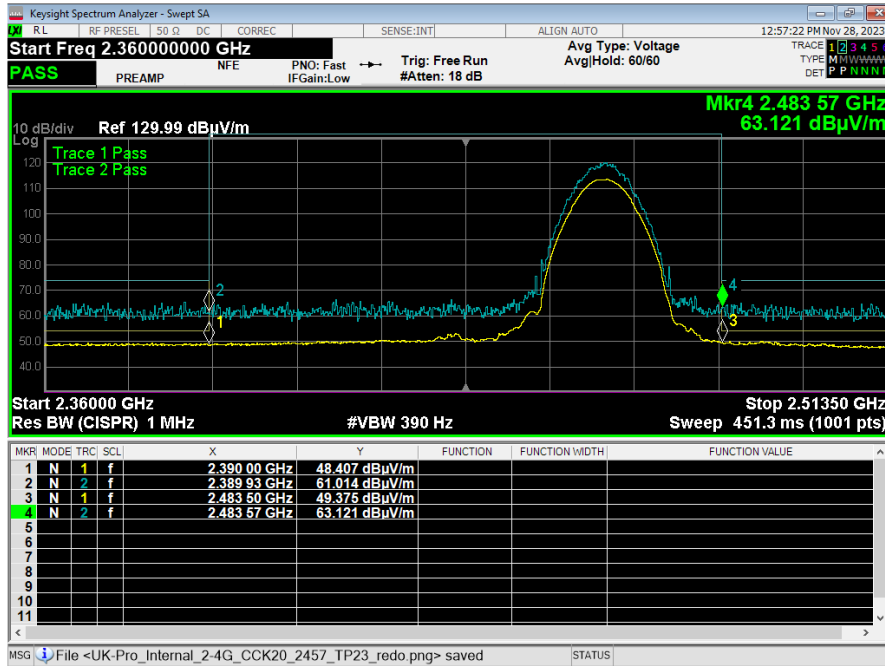
Result

Conducted spurious emissions were attenuated 30 dB or more below the fundamental; therefore, the EUT complies with the specification.

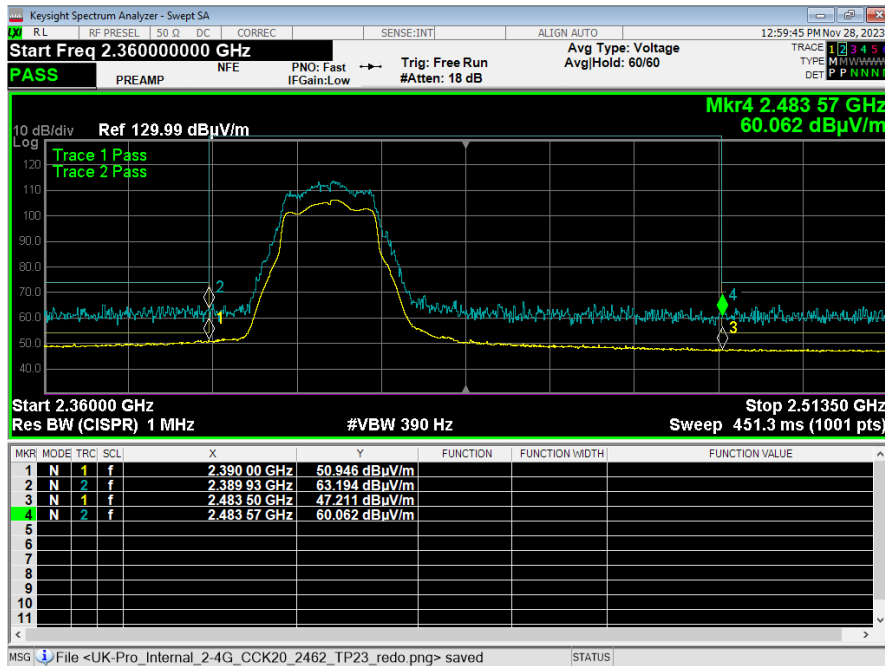
5.5.2 Internal Antenna



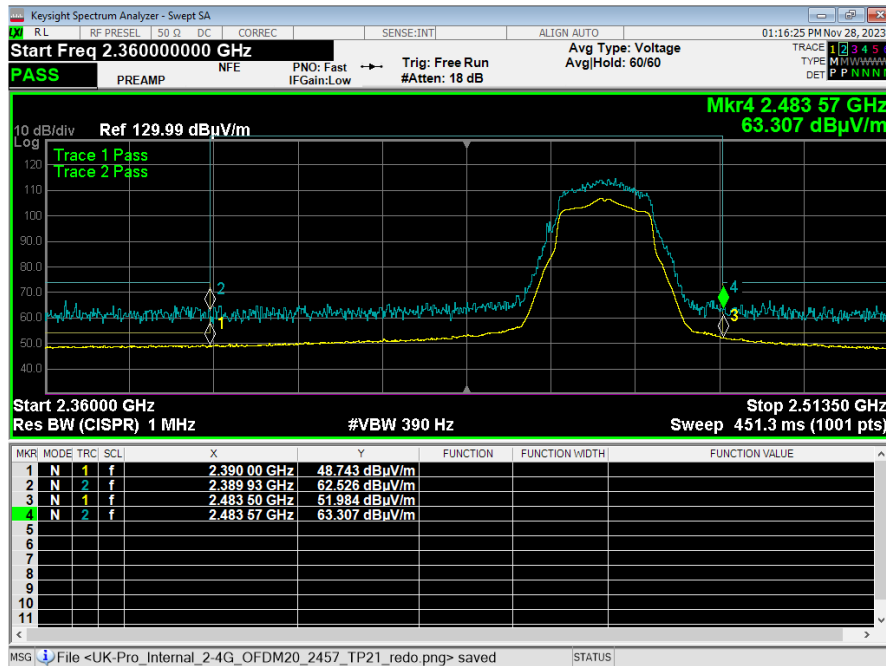
Graph 3: Band Edge Low b Mode 20 MHz



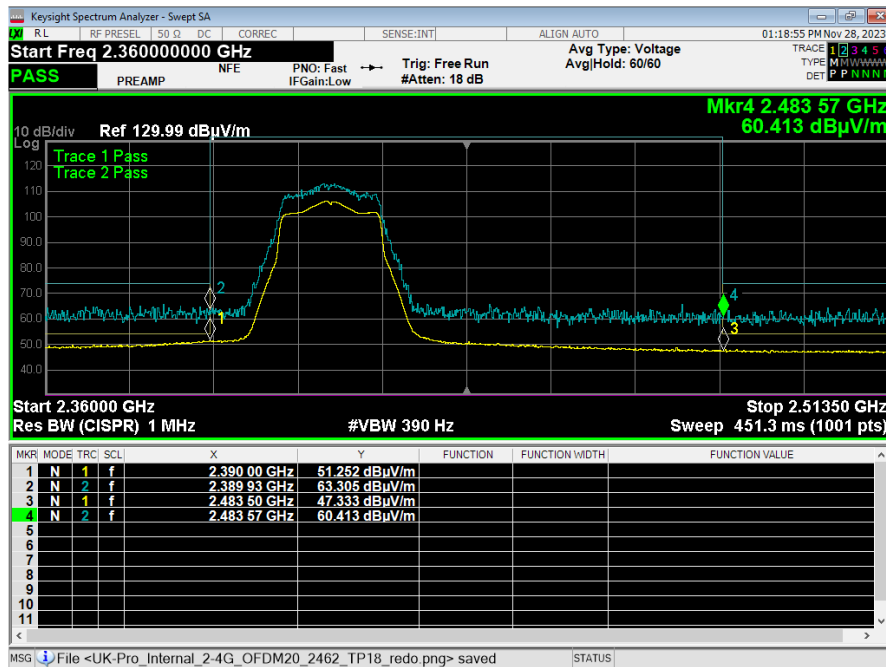
Graph 4: Band Edge High b Mode 20 MHz



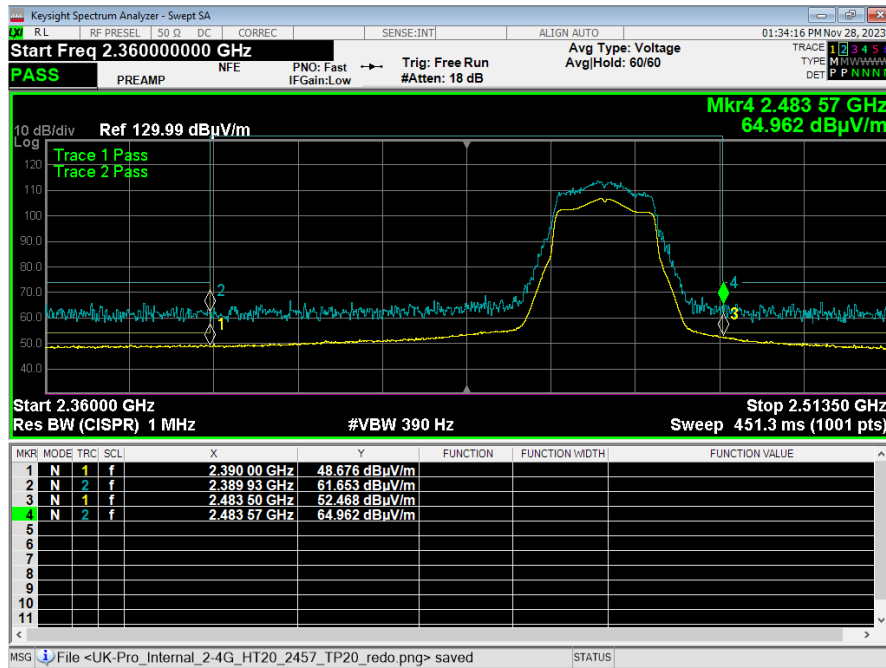
Graph 5: Band Edge Low g Mode 20 MHz



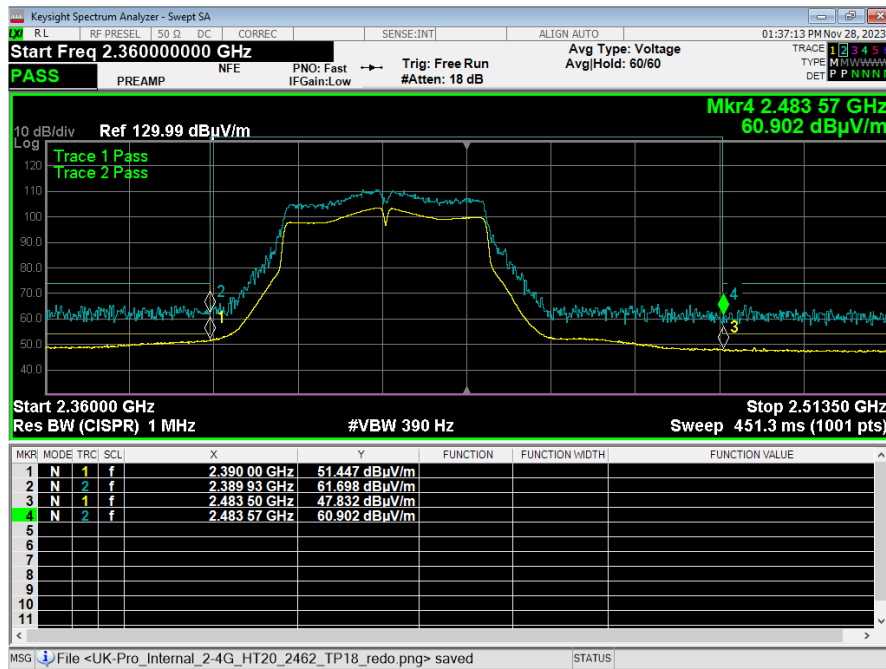
Graph 6: Band Edge High g Mode 20 MHz



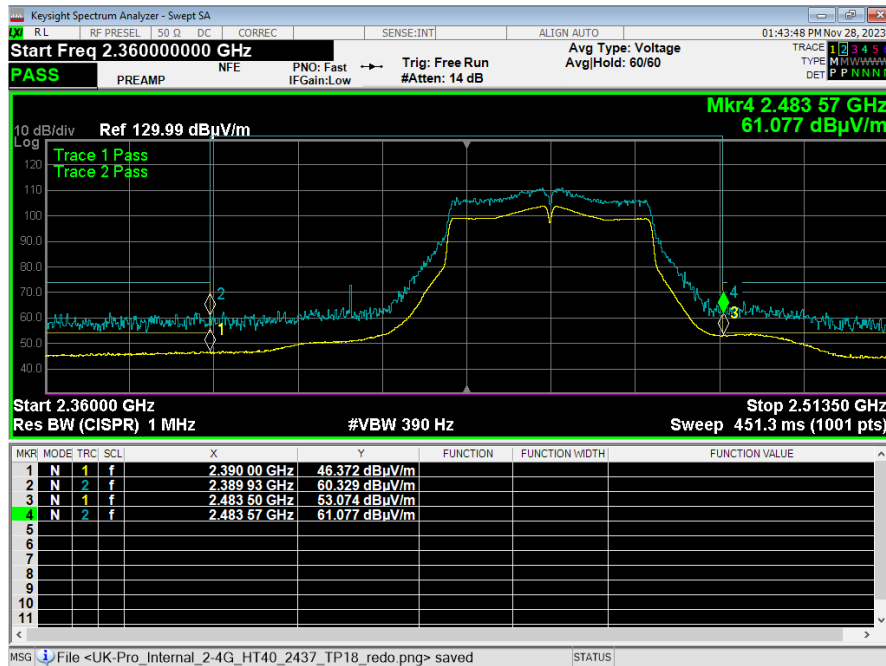
Graph 7: Band Edge Low n Mode 20 MHz



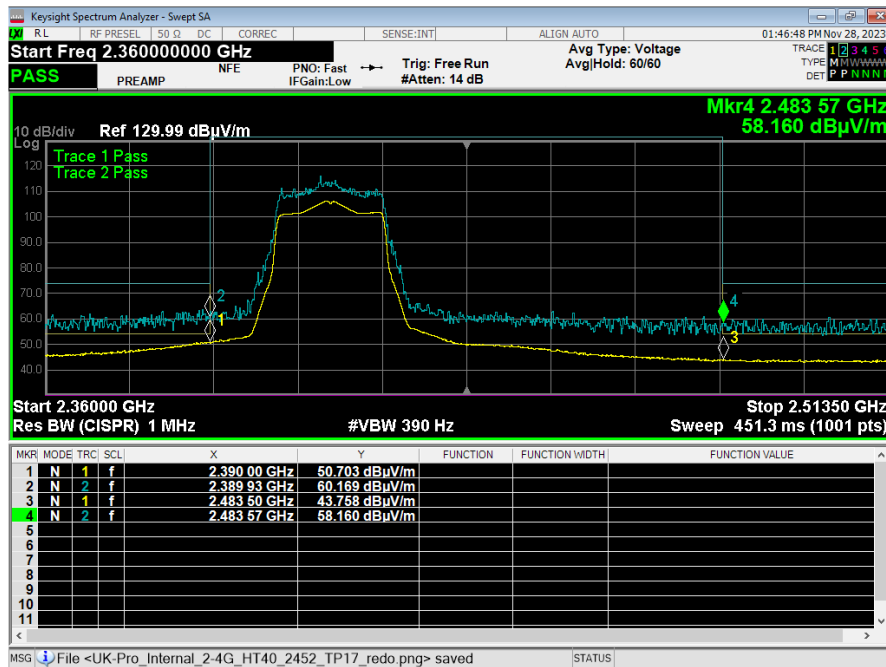
Graph 8: Band Edge High n Mode 20 MHz



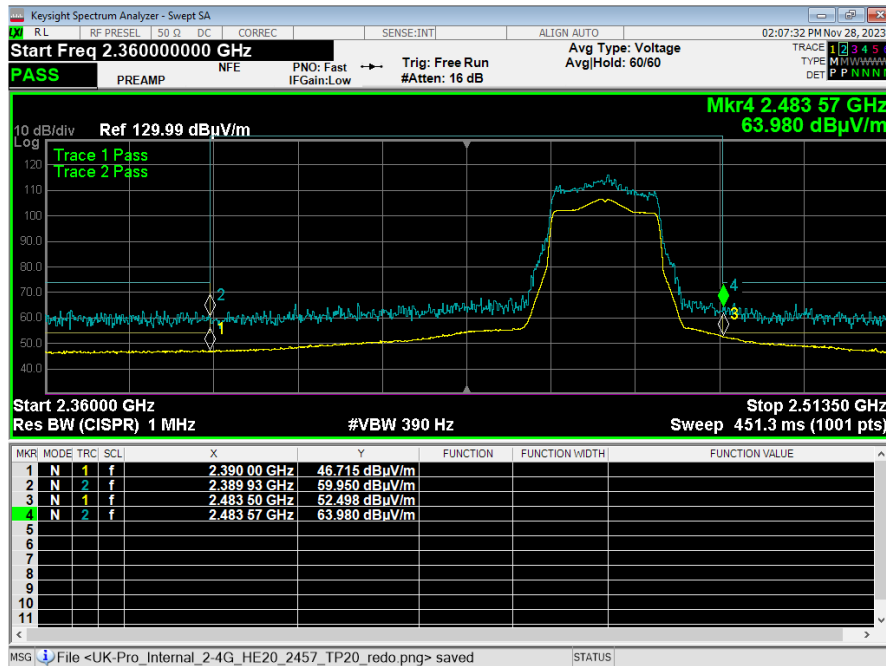
Graph 9: Band Edge Low n Mode 40 MHz



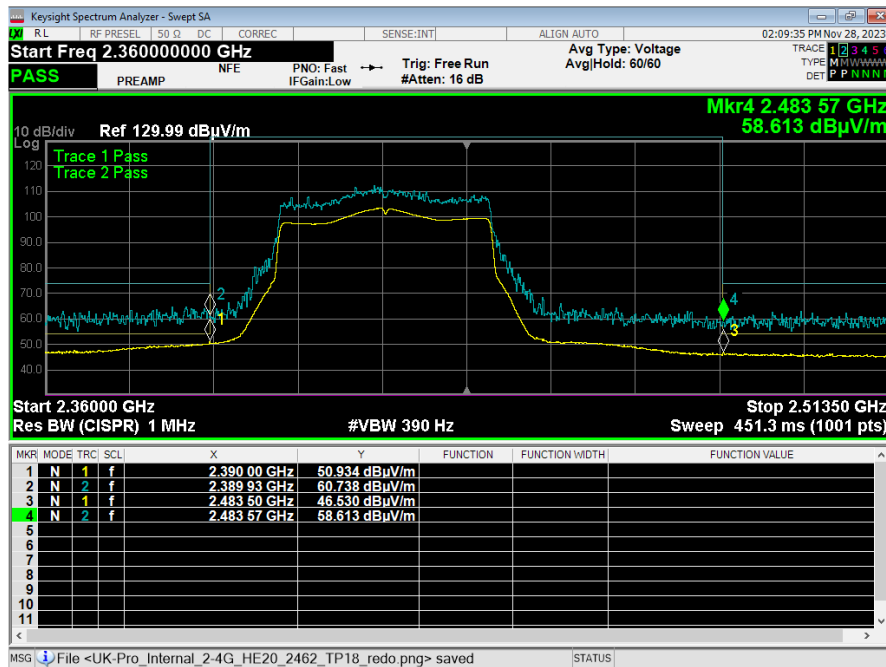
Graph 10: Band Edge High n Mode 40 MHz



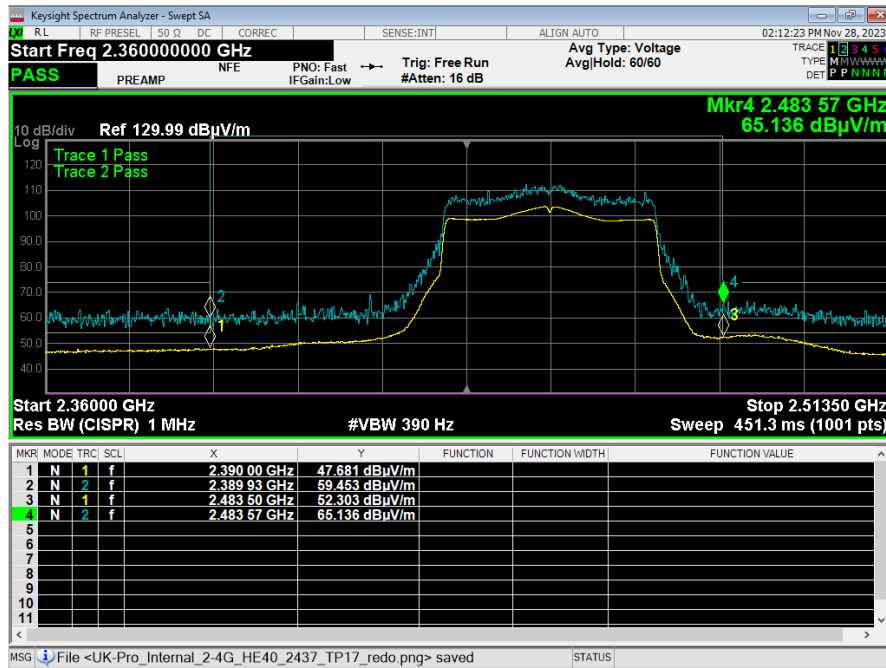
Graph 11: Band Edge Low ax Mode 20 MHz



Graph 12: Band Edge High ax Mode 20 MHz

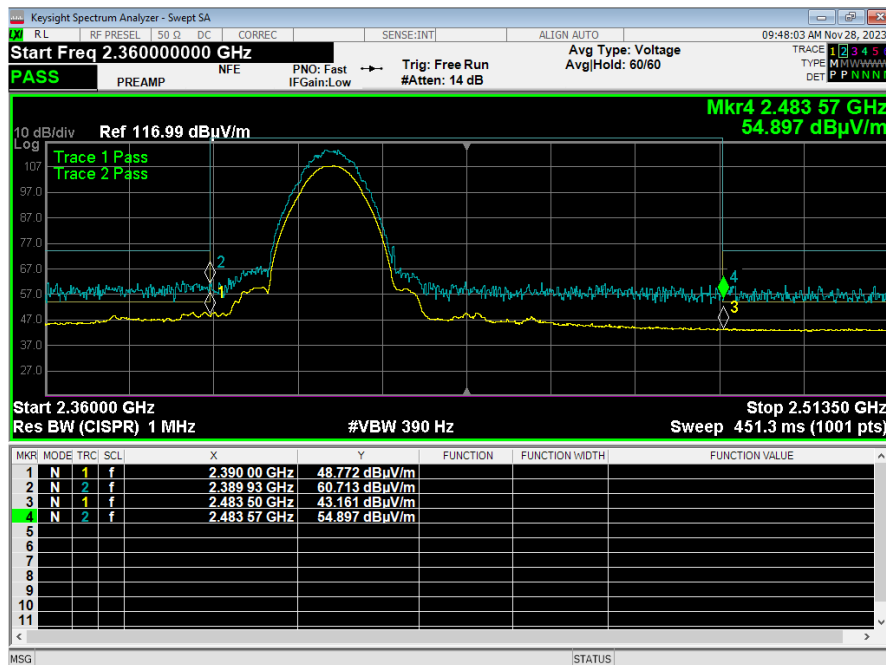


Graph 13: Band Edge Low ax Mode 40 MHz

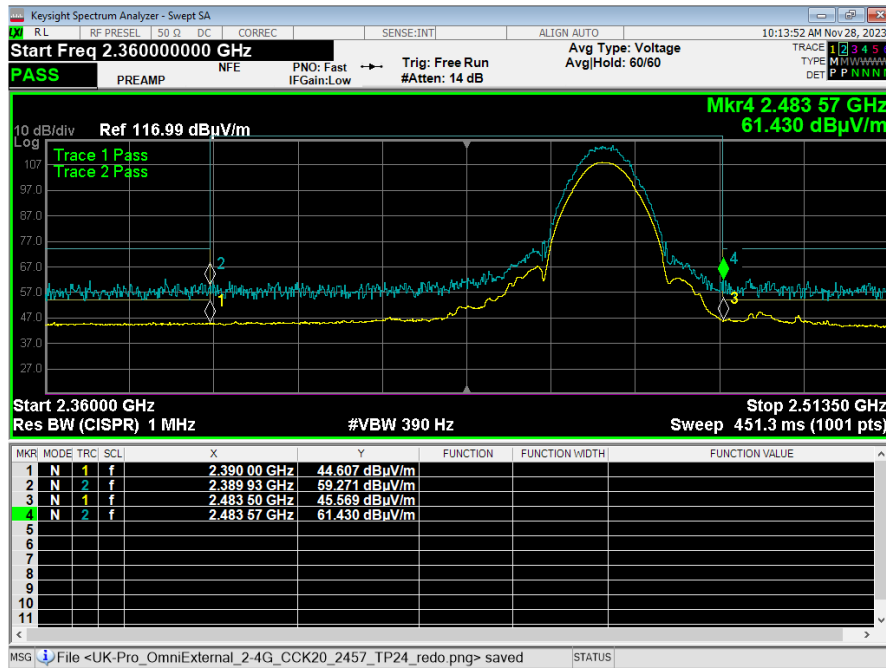


Graph 14: Band Edge High ax Mode 40 MHz

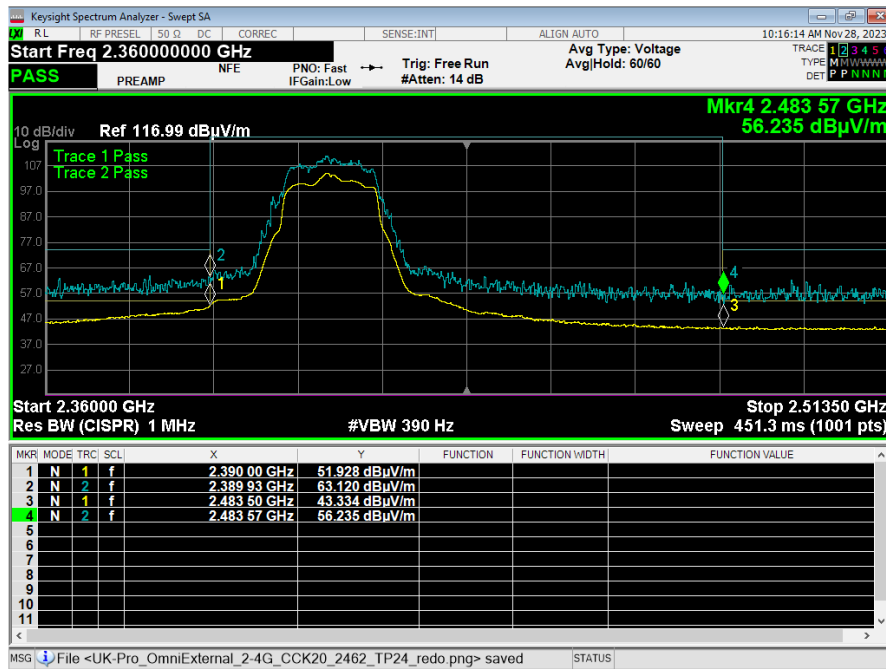
5.5.3 Internal Antenna



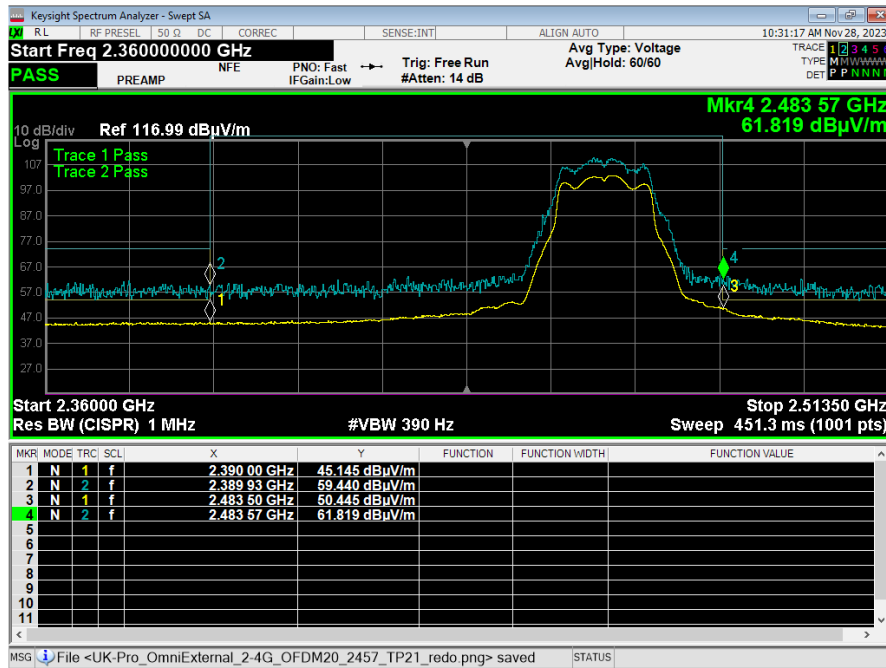
Graph 15: Band Edge Low b Mode 20 MHz



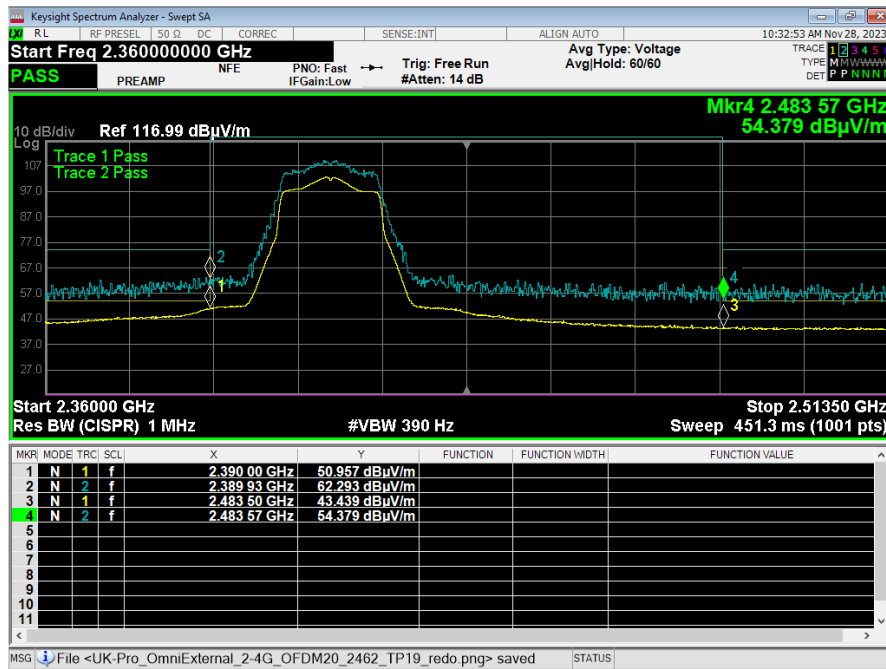
Graph 16: Band Edge High b Mode 20 MHz



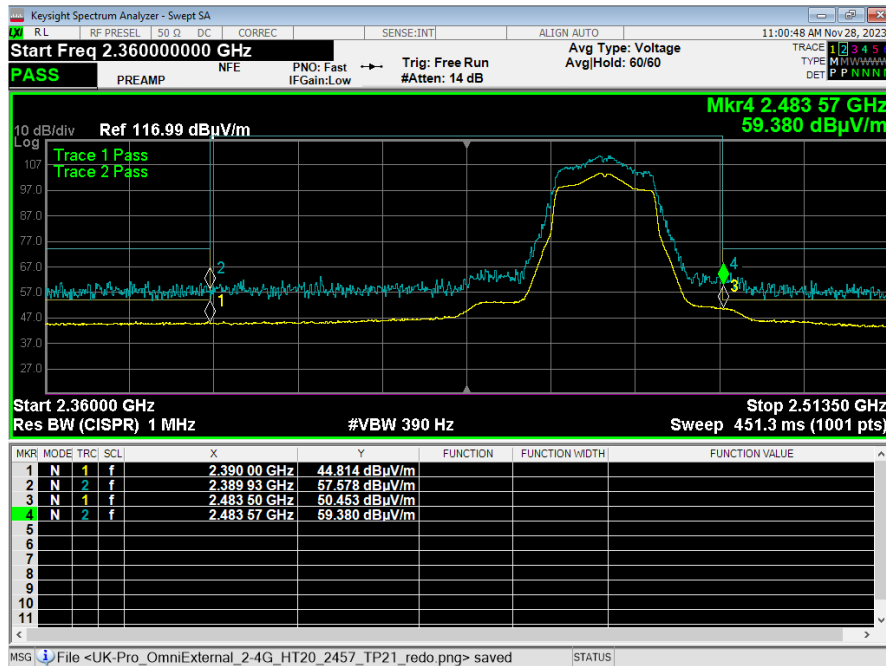
Graph 17: Band Edge Low g Mode 20 MHz



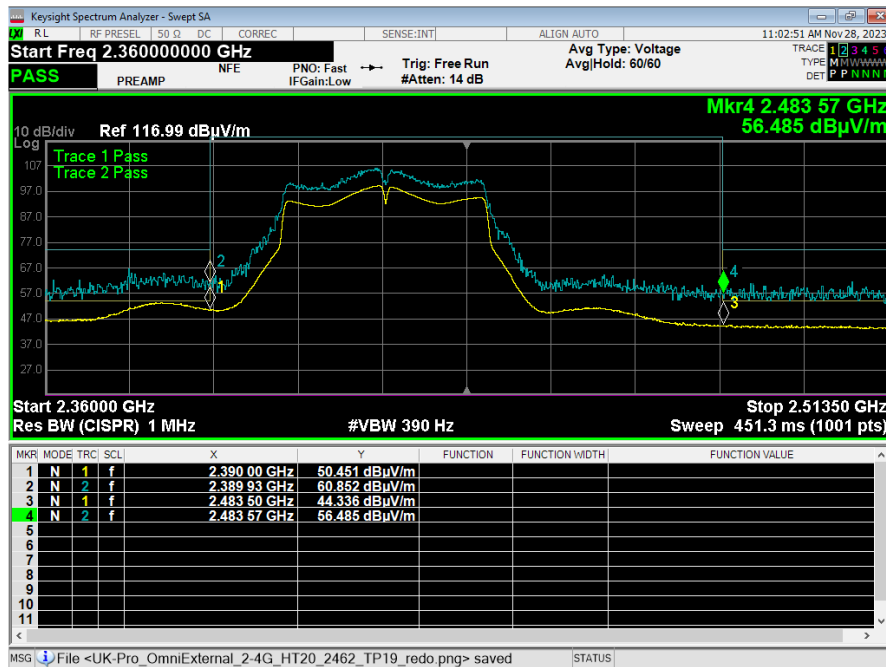
Graph 18: Band Edge High g Mode 20 MHz



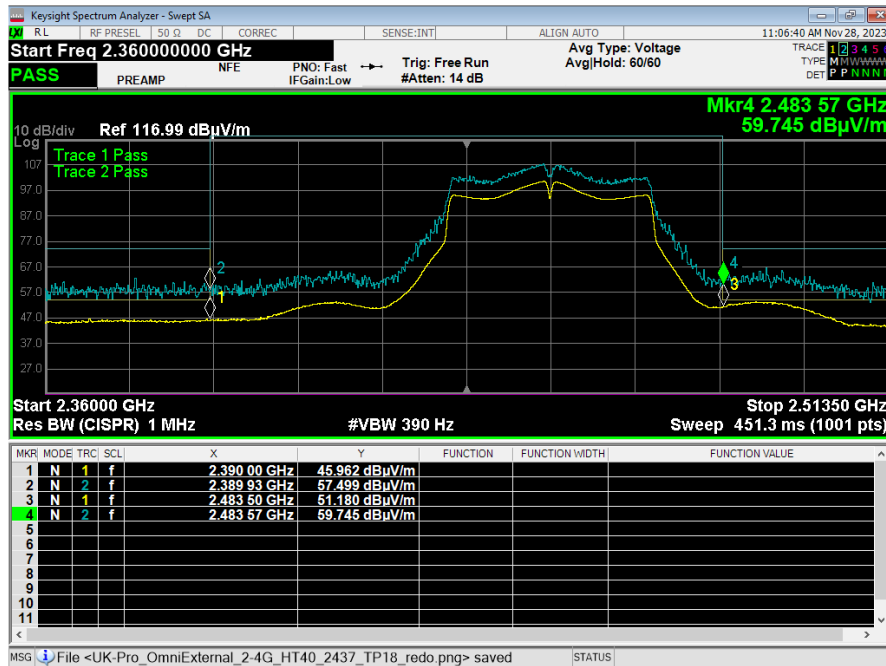
Graph 19: Band Edge Low n Mode 20 MHz



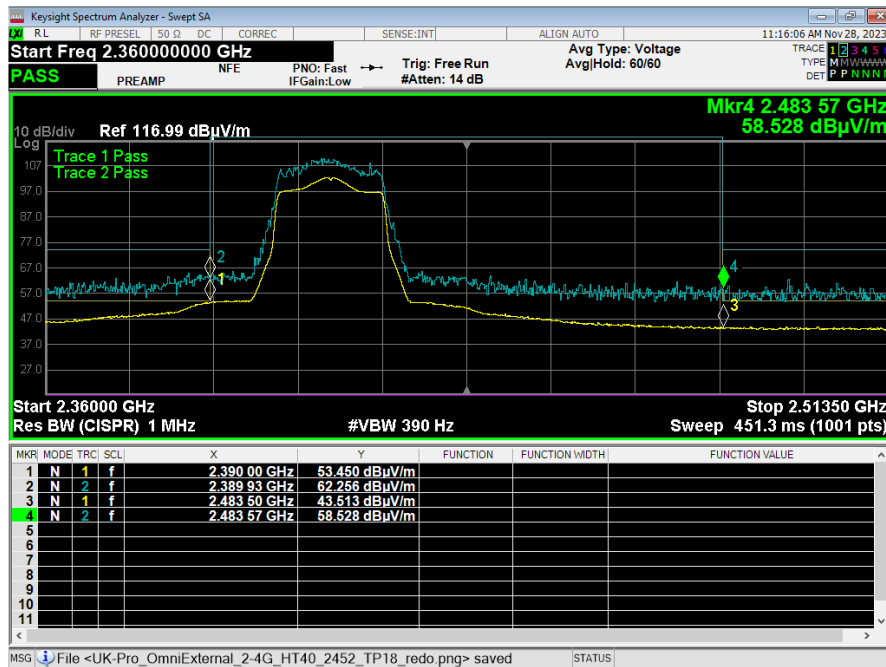
Graph 20: Band Edge High n Mode 20 MHz



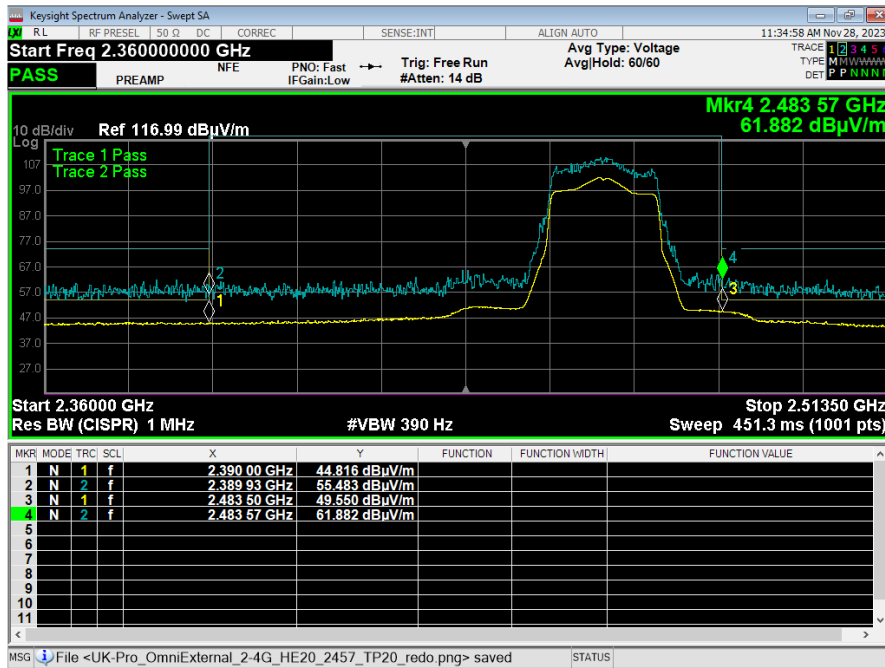
Graph 21: Band Edge Low n Mode 40 MHz



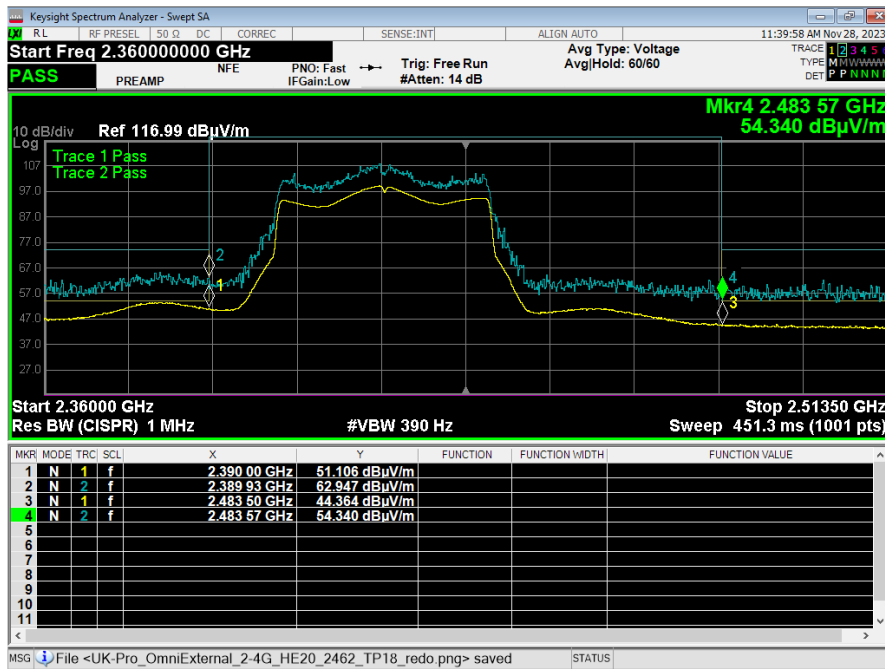
Graph 22: Band Edge High n Mode 40 MHz



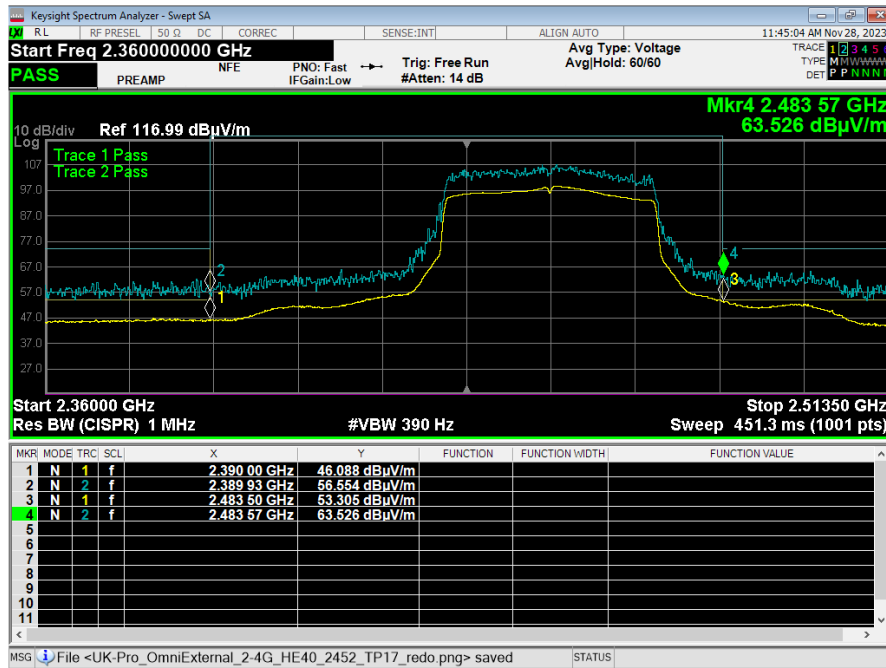
Graph 23: Band Edge Low ax Mode 20 MHz



Graph 24: Band Edge High ax Mode 20 MHz



Graph 25: Band Edge Low ax Mode 40 MHz



Graph 26: Band Edge High ax Mode 40 MHz

5.5.4 Radiated Spurious Emissions in the Restricted Bands of §15.205

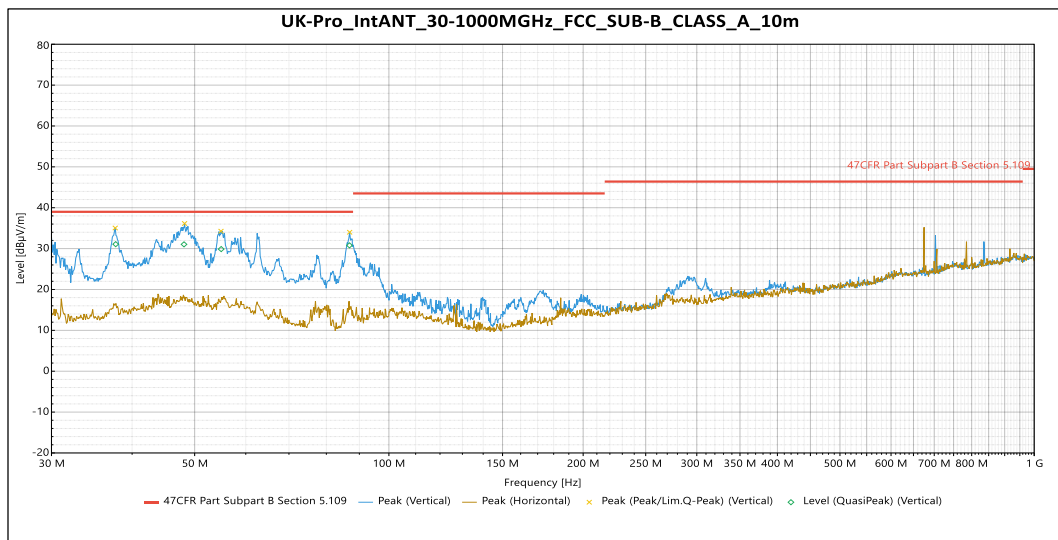
The frequency range from the lowest frequency generated or used in the device to the tenth harmonic of the highest fundamental emissions was investigated to measure any radiated emissions in the restricted bands. The following tables show measurements of any emissions that fell into the restricted bands of §15.205. The tables show the worst-case emissions measured from the EUT. For frequencies above 18.0 GHz, a measurement distance of 1 meter was used. The noise floor was a minimum of 6 dB below the limits. The emissions in the restricted bands must meet the limits specified in §15.209. Tabular data for each of the spurious emissions is shown below for each of the units. Plots of the band edges are also shown.

Correction Factor = Antenna Factor + Cable Loss - Pre-Amplifier Gain, and is added to the Receiver reading.

Result

All emissions in the restricted bands of §15.205 met the limits specified in §15.209; therefore, the EUT complies with the specification.

Internal Antenna

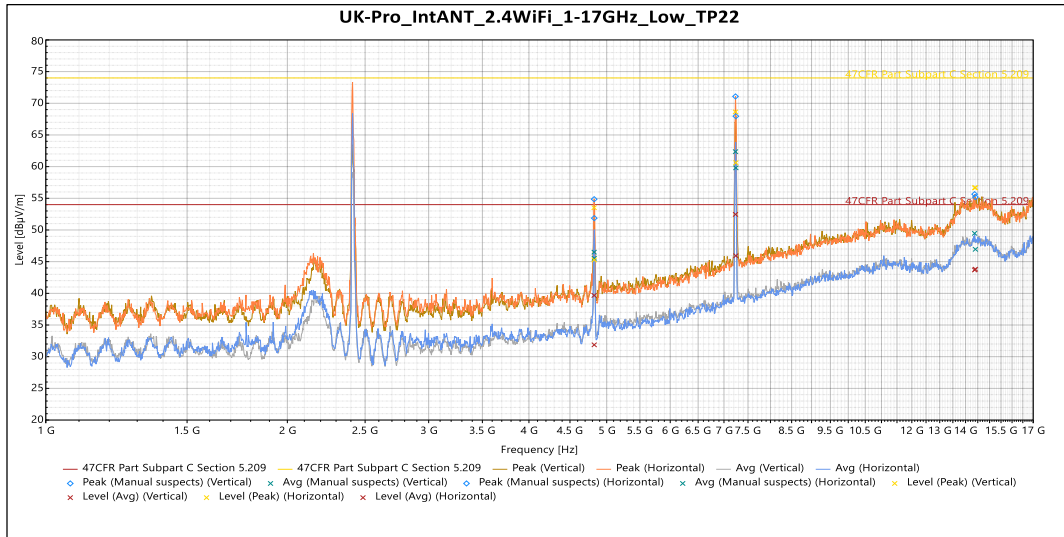


QuasiPeak

Frequency	Level (dBµV/m)	Limit (dBµV/m)	Margin	Azimuth (°)	Height	Pol.	Correction (dB)
37.726 MHz	31.084	39	-7.916	98	1.019	Vertical	-14.6
48.139 MHz	31.043	39	-7.957	76	2.405	Vertical	-12.303
54.963 MHz	29.877	39	-9.123	306	3.932	Vertical	-12.674
86.879 MHz	30.788	39	-8.212	178	1.35	Vertical	-17.381

Note: No Significant emissions were observed in the horizontal orientation of the antenna

Table 4: Radiated Emissions 30 – 1000 MHz



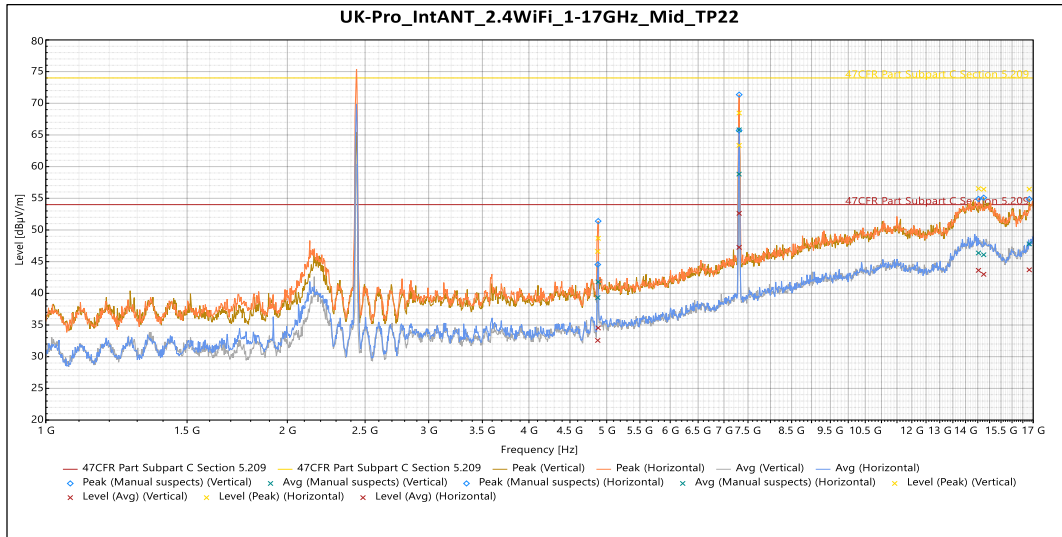
Peak

Frequency	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	Correction (dB)
4.8245 GHz	45.274	74	-28.726	8	2.645	Vertical	-5.972
7.243 GHz	60.616	74	-13.384	76	3.657	Vertical	0.897
14.402 GHz	56.669	74	-17.331	65	3.802	Vertical	12.031
4.823 GHz	53.523	74	-20.477	70	1.5	Horizontal	-5.973
7.2355 GHz	68.635	74	-5.365	55	2.65	Horizontal	0.84
14.37 GHz	56.661	74	-17.339	215	2.645	Horizontal	11.957

Avg

Frequency	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	Correction (dB)
4.8245 GHz	31.873	54	-22.127	8	2.645	Vertical	-5.972
7.243 GHz	45.931	54	-8.069	76	3.657	Vertical	0.897
14.402 GHz	43.814	54	-10.186	65	3.802	Vertical	12.031
4.823 GHz	39.67	54	-14.33	70	1.5	Horizontal	-5.973
7.2355 GHz	52.458	54	-1.542	55	2.65	Horizontal	0.84
14.37 GHz	43.687	54	-10.313	215	2.645	Horizontal	11.957

Table 5: Radiated Emissions 1 – 17 GHz Transmitting on the Lowest Frequency

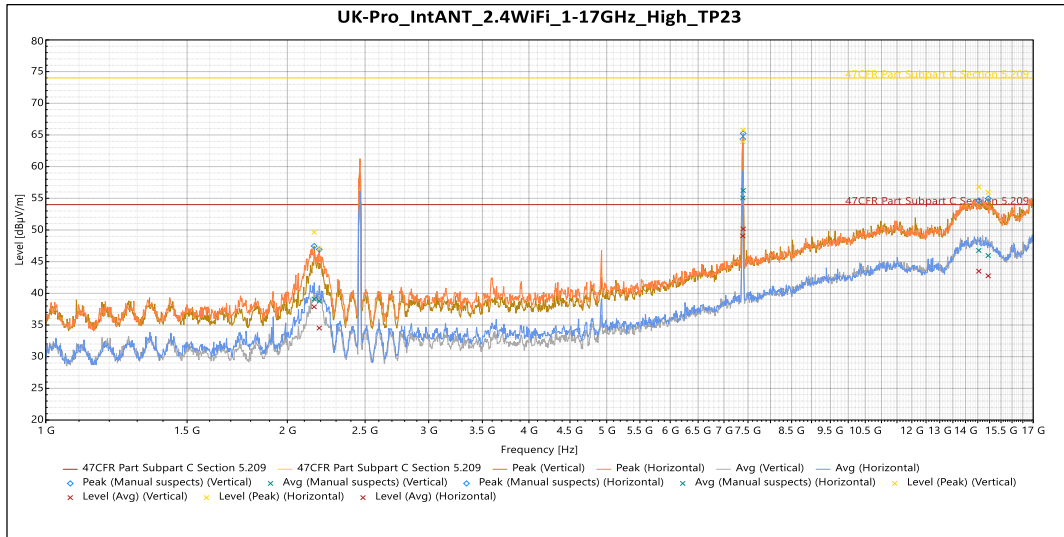

Peak

Frequency	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	Correction (dB)
4.8736 GHz	46.622	74	-27.378	61	1.643	Vertical	-5.917
7.3111 GHz	63.35	74	-10.65	44	1.638	Vertical	0.855
14.749 GHz	56.435	74	-17.565	202	1.643	Vertical	11.399
16.809 GHz	56.452	74	-17.548	101	3.153	Vertical	12.943
4.8798 GHz	48.689	74	-25.311	356	2.816	Horizontal	-5.909
7.312 GHz	68.467	74	-5.533	64	1.638	Horizontal	0.854
14.531 GHz	56.526	74	-17.474	308	3.798	Horizontal	11.853

Avg

Frequency	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	Correction (dB)
4.8736 GHz	32.57	54	-21.43	61	1.643	Vertical	-5.917
7.3111 GHz	47.264	54	-6.736	44	1.638	Vertical	0.855
14.749 GHz	42.996	54	-11.004	202	1.643	Vertical	11.399
16.809 GHz	43.707	54	-10.293	101	3.153	Vertical	12.943
4.8798 GHz	34.543	54	-19.457	356	2.816	Horizontal	-5.909
7.312 GHz	52.628	54	-1.372	64	1.638	Horizontal	0.854
14.531 GHz	43.625	54	-10.375	308	3.798	Horizontal	11.853

Table 6: Radiated Emissions 1 – 17 GHz Transmitting on the Middle Frequency



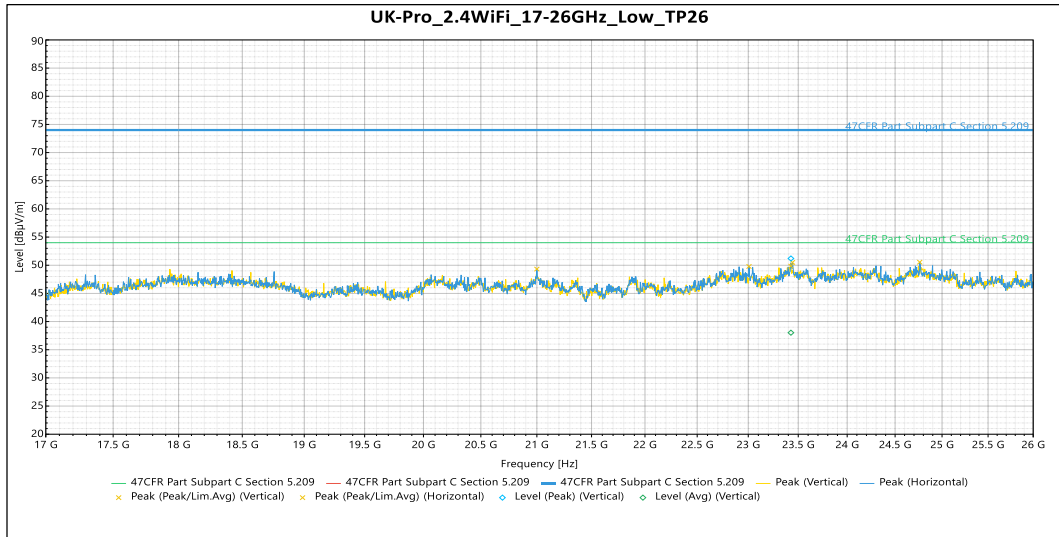
Peak

Frequency	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	Correction (dB)
2.1599 GHz	49.639	74	-24.361	34	1.5	Vertical	-10.195
7.3893 GHz	63.938	74	-10.062	63	3.149	Vertical	0.801
14.943 GHz	55.949	74	-18.051	79	1.643	Vertical	11.545
2.1918 GHz	47.079	74	-26.921	8	2.142	Horizontal	-9.876
7.3975 GHz	65.789	74	-8.211	12	2.82	Horizontal	0.796
14.543 GHz	56.8	74	-17.2	185	1.638	Horizontal	11.848

Avg

Frequency	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	Correction (dB)
2.1599 GHz	37.874	54	-16.126	34	1.5	Vertical	-10.195
7.3893 GHz	49.068	54	-4.932	63	3.149	Vertical	0.801
14.943 GHz	42.763	54	-11.237	79	1.643	Vertical	11.545
2.1918 GHz	34.52	54	-19.48	8	2.142	Horizontal	-9.876
7.3975 GHz	50.169	54	-3.831	12	2.82	Horizontal	0.796
14.543 GHz	43.49	54	-10.51	185	1.638	Horizontal	11.848

Table 7: Radiated Emissions 1 – 17 GHz Transmitting on the Highest Frequency


Peak

Frequency	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Pol.	Correction (dB)
23.426 GHz	51.201	74	-22.799	231	Vertical	0.648

No significant emissions were observed in the horizontal orientation of the antenna

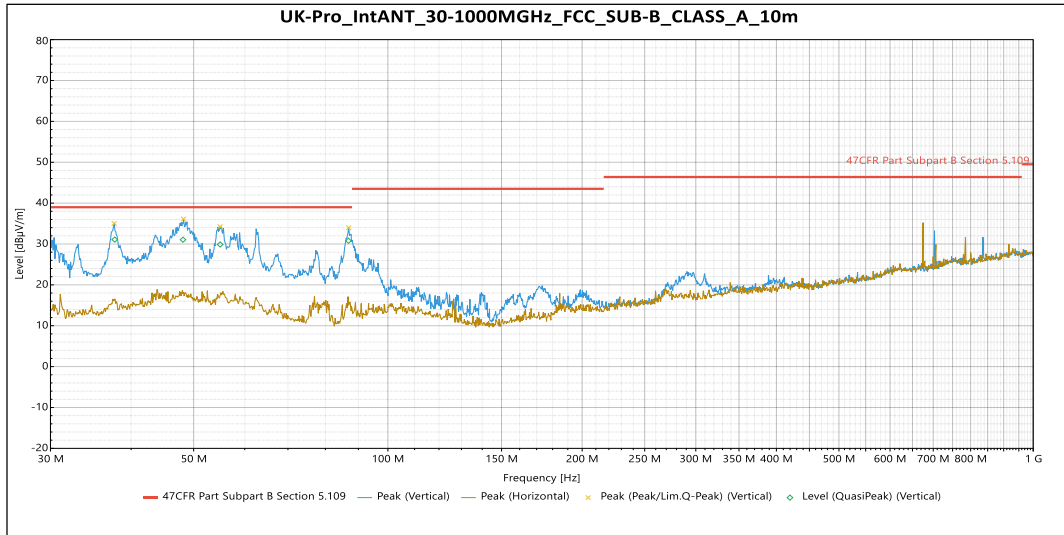
Avg

Frequency	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Pol.	Correction (dB)
23.426 GHz	38.016	54	-15.984	231	Vertical	0.648

No significant emissions were observed in the horizontal orientation of the antenna

Table 8: Radiated Emissions 17 – 26 GHz on the Lowest Frequency (worse case)

External Antenna

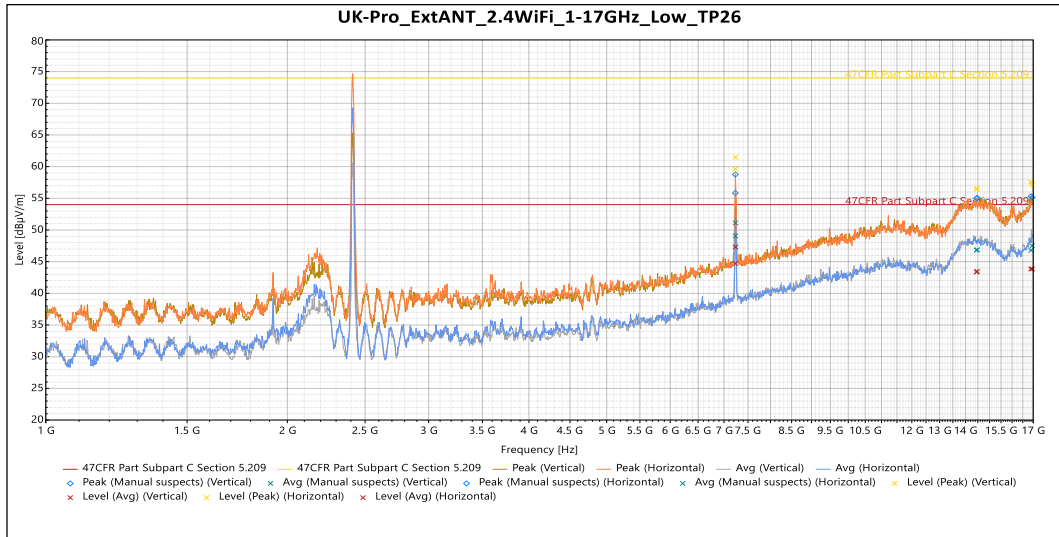


QuasiPeak

Frequency	Level (dBµV/m)	Limit (dBµV/m)	Margin	Azimuth (°)	Height	Pol.	Correction (dB)
37.726 MHz	31.084	39	-7.916	98	1.019	Vertical	-14.6
48.139 MHz	31.043	39	-7.957	76	2.405	Vertical	-12.303
54.963 MHz	29.877	39	-9.123	306	3.932	Vertical	-12.674
86.879 MHz	30.788	39	-8.212	178	1.35	Vertical	-17.381

Note: No Significant emissions were observed in the horizontal orientation of the antenna

Table 9: Radiated Emissions 30 – 1000 MHz

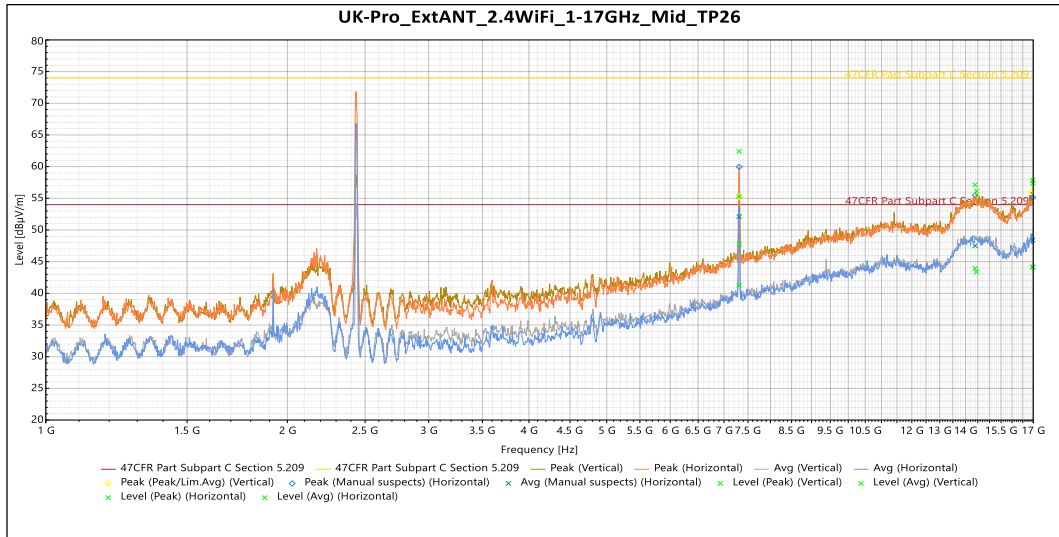

Peak

Frequency	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	Correction (dB)
7.2324 GHz	59.627	74	-14.373	73	2.65	Vertical	0.816
14.474 GHz	56.53	74	-17.47	94	1.638	Vertical	11.622
16.89 GHz	57.529	74	-16.471	228	1.638	Vertical	13.212
7.2338 GHz	61.467	74	-12.533	3	1.638	Horizontal	0.827
14.45 GHz	56.4	74	-17.6	280	1.638	Horizontal	11.666
16.953 GHz	57.09	74	-16.91	222	2.65	Horizontal	13.465

Avg

Frequency	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	Correction (dB)
7.2324 GHz	44.699	54	-9.301	73	2.65	Vertical	0.816
14.474 GHz	43.456	54	-10.544	94	1.638	Vertical	11.622
16.89 GHz	43.838	54	-10.162	228	1.638	Vertical	13.212
7.2338 GHz	47.318	54	-6.682	3	1.638	Horizontal	0.827
14.45 GHz	43.346	54	-10.654	280	1.638	Horizontal	11.666
16.953 GHz	43.839	54	-10.161	222	2.65	Horizontal	13.465

Table 10: Radiated Emissions 1 – 17 GHz Transmitting on the Lowest Frequency



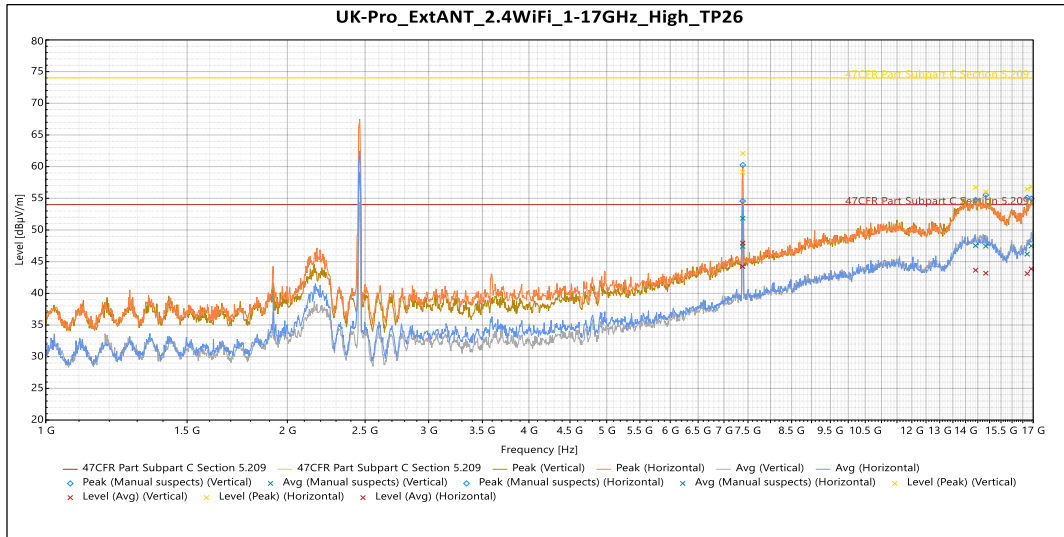
Peak

Frequency	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	Correction (dB)
7.3129 GHz	55.275	74	-18.725	89	2.816	Vertical	0.854
14.45 GHz	56.131	74	-17.869	134	2.329	Vertical	11.666
7.3134 GHz	62.41	74	-11.59	29	2.65	Horizontal	0.853
14.39 GHz	57.138	74	-16.862	354	2.645	Horizontal	12.017
16.979 GHz	57.817	74	-16.183	47	4	Horizontal	13.544
16.98 GHz	57.415	74	-16.585	48	1.638	Horizontal	13.542

Avg

Frequency	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	Correction (dB)
7.3129 GHz	41.262	54	-12.738	89	2.816	Vertical	0.854
14.45 GHz	43.389	54	-10.611	134	2.329	Vertical	11.666
7.3134 GHz	47.763	54	-6.237	29	2.65	Horizontal	0.853
14.39 GHz	43.931	54	-10.069	354	2.645	Horizontal	12.017
16.979 GHz	44.167	54	-9.833	47	4	Horizontal	13.544
16.98 GHz	44.149	54	-9.851	48	1.638	Horizontal	13.542

Table 11: Radiated Emissions 1 – 17 GHz Transmitting on the Middle Frequency

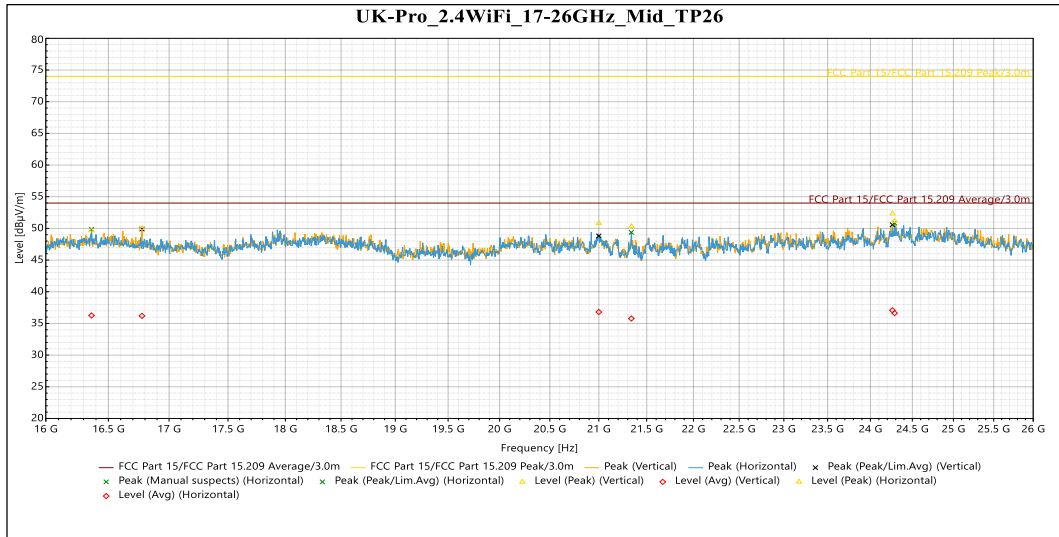

Peak

Frequency	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	Correction (dB)
7.3859 GHz	59.113	74	-14.887	58	3.153	Vertical	0.802
14.839 GHz	56.021	74	-17.979	244	3.802	Vertical	11.569
16.71 GHz	56.46	74	-17.54	247	1.834	Vertical	12.498
7.3891 GHz	62.079	74	-11.921	67	1.643	Horizontal	0.801
14.411 GHz	56.729	74	-17.271	237	1.643	Horizontal	11.956
16.909 GHz	56.809	74	-17.191	149	3.153	Horizontal	13.186

Avg

Frequency	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	Correction (dB)
7.3859 GHz	44.241	54	-9.759	58	3.153	Vertical	0.802
14.839 GHz	43.185	54	-10.815	244	3.802	Vertical	11.569
16.71 GHz	43.122	54	-10.878	247	1.834	Vertical	12.498
7.3891 GHz	47.942	54	-6.058	67	1.643	Horizontal	0.801
14.411 GHz	43.652	54	-10.348	237	1.643	Horizontal	11.956
16.909 GHz	43.864	54	-10.136	149	3.153	Horizontal	13.186

Table 12: Radiated Emissions 1 – 17 GHz Transmitting on the Highest Frequency


Peak

Frequency	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Pol.	Correction (dB)
16.775 GHz	50.029	74	-23.971	339	Vertical	-0.093
21 GHz	50.833	74	-23.167	355	Vertical	0.836
24.261 GHz	52.332	74	-21.668	357	Vertical	1.764
16.364 GHz	49.645	74	-24.355	194	Horizontal	0.559
21.339 GHz	50.329	74	-23.671	168	Horizontal	0.283
24.287 GHz	51.15	74	-22.85	126	Horizontal	1.962

Avg

Frequency	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Pol.	Correction (dB)
16.775 GHz	36.193	54	-17.807	339	Vertical	-0.093
21 GHz	36.801	54	-17.199	355	Vertical	0.836
24.261 GHz	37.08	54	-16.92	357	Vertical	1.764
16.364 GHz	36.257	54	-17.743	194	Horizontal	0.559
21.339 GHz	35.782	54	-18.218	168	Horizontal	0.283
24.287 GHz	36.633	54	-17.367	126	Horizontal	1.962

Table 13: Radiated Emissions 17 – 40 GHz on the Middle Frequency (worse case)

5.6 §15.247(e) Maximum Average Power Spectral Density

All chains were measured and summed under the guidance of KDB 558074 Section 8.4. and KDB 66291 D01. Please see associated annex for details on instrument settings.

The maximum average power spectral density conducted from the intentional radiator of the antenna shall not be greater than 8 dBm (Nss1 limit of 2.99 for the internal antenna and Nss1 limit of 7.40 dBm for the external antenna) in any 3 kHz band during any time interval of continuous transmission.

The internal antenna gain is 8 dBi + Array gain of 3.01 dB which is a total of 11.01 dBi.

The external antenna gain is 3.59 dBi + Array gain of 3.01 dB which is a total of 6.60 dBi.

5.6.1 Internal Antenna

Mode	Frequency (MHz)	Measurement (dBm)	Criteria (dBm)
b	2412	-3.50	8.0
	2437	-3.44	8.0
	2462	-2.03	8.0
g	2412	-14.18	8.0
	2437	-10.58	8.0
	2462	-13.77	8.0
n 20	2412	-15.05	8.0
	2437	-12.29	8.0
	2462	-15.21	8.0
n 40	2422	-19.07	8.0
	2437	-17.97	8.0
	2452	-18.86	8.0
ax 20	2412	-15.93	8.0
	2437	-11.97	8.0
	2462	-15.84	8.0
ax 40	2422	-18.74	8.0

	2437	-19.08	8.0
	2452	-18.13	8.0

5.6.2 External Antenna

Mode	Frequency (MHz)	Measurement (dBm)	Criteria (dBm)
b	2412	-2.26	8.0
	2437	-0.38	8.0
	2462	-1.52	8.0
g	2412	-13.49	8.0
	2437	-9.09	8.0
	2462	-13.65	8.0
n 20	2412	-15.74	8.0
	2437	-11.53	8.0
	2462	-14.63	8.0
n 40	2422	-20.26	8.0
	2437	-18.63	8.0
	2452	-18.74	8.0
ax 20	2412	-16.03	8.0
	2437	-11.81	8.0
	2462	-16.24	8.0
ax 40	2422	-20.50	8.0
	2437	-18.78	8.0
	2452	-18.16	8.0

Result

The maximum average power spectral density was less than the limit of 8 dBm (Nss1 limit of 2.99 for the internal antenna and Nss1 limit of 7.40 dBm for the external antenna); therefore, the EUT complies with the specification.

-- End of Test Report --