UNIFIED COMPLIANCE LABORATORY

427 West 12800 South
Draper, UT 84020

Test Report

Certification

FCC ID	SWX-UMRID
IC ID	6545A-UMRID
Equipment Under Test	UMR-Industrial
Test Report Serial Number	TR8690_01
Date of Test(s)	December 18 – 27, 2023
Report Issue Date	December 27, 2023

Test Specification	Applicant
47 CFR FCC Part 15, Subpart C RSS-GEN Issue 5	Ubiquiti Inc. 685 Third Avenue New York, NY 10017 U.S.A.

NVLAP TESTING ilac-MRA

NVLAP LAB CODE 600241-0

Certification of Engineering Report

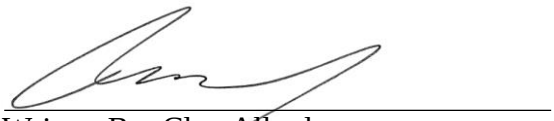
This report has been prepared by Unified Compliance Laboratory (UCL) to document compliance of the device described below with the requirement of Federal Communication Commissions (FCC) Part 15, Subpart C. This report may be reproduced in full. Partial reproduction of this report may only be made with 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	UMR-Industrial
FCC ID	SWX-UMRID
IC ID	6545A-UMRID

On this 27th day of December 2023, 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: Clay Allred

Reviewed By: Joseph W. Jackson

Revision History		
Revision	**Description**	**Date**
01	Original Report Release	December 27, 2023

Table of Contents

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	UMR-Industrial
Serial Number	942a6f0c1c2 & 942a6F0C01FB
Dimensions (cm)	11.5 x 9.4 x 3.2

2.2 Description of EUT

The UMR-Industrial is a compact and robust LTE Gateway that provides 2.4 GHz WAN over LTE WiFi designed to provide fast and reliable internet in areas where the mobile network is the only option. The UMR-Industrial has one Ethernet port for PoE power and data transfer and a second Ethernet port that provides a PoE passthrough function when powered from a PoE power supply. The UMR-Industrial provides a slot for a mobile network Nano SIM card. The UMR-Industrial is powered from an 802.3at PoE power supply, an USB-C connector or 4-pin DC power socket.

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: UMR-Industrial SN: 942a6f0c1c2 & 942a6F0C01FB	LTE Gateway	See Section 2.5
BN: UBIQUITI MN: GP-M015-QC SN: N/A	USB-C Power Adapter	See Section 2.4
BN: UBIQUITI MN: U-POE-at SN: N/A	PoE Power Adapter	See Section 2.4
BN: Dell MN: XPS 13 SN: N/A	Laptop Personal Computer	5e cable Ethernet/Unshielded Cat 5e cable (Note 2)

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 (PoE Injector)	1	3 conductor power cord/80cm
Data	1	Shielded Cat 5e cable/8meters
LAN (PoE Injector)	1	Un-shielded Cat 5e cable/1 meter
AC (USB-C)	1	2 conductor/2 meters

2.5 Operating Environment

Power Supply	120 VAC / PoE
AC Mains Frequency	60 Hz / PoE
Temperature	22.5 – 23.5 °C
Humidity	22 - 27 %
Barometric Pressure	1019 mBar

2.6 Operating Modes

The UMR-Industrial 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 were investigated. All measurements are reported with the worst-case mode (802.11n) 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

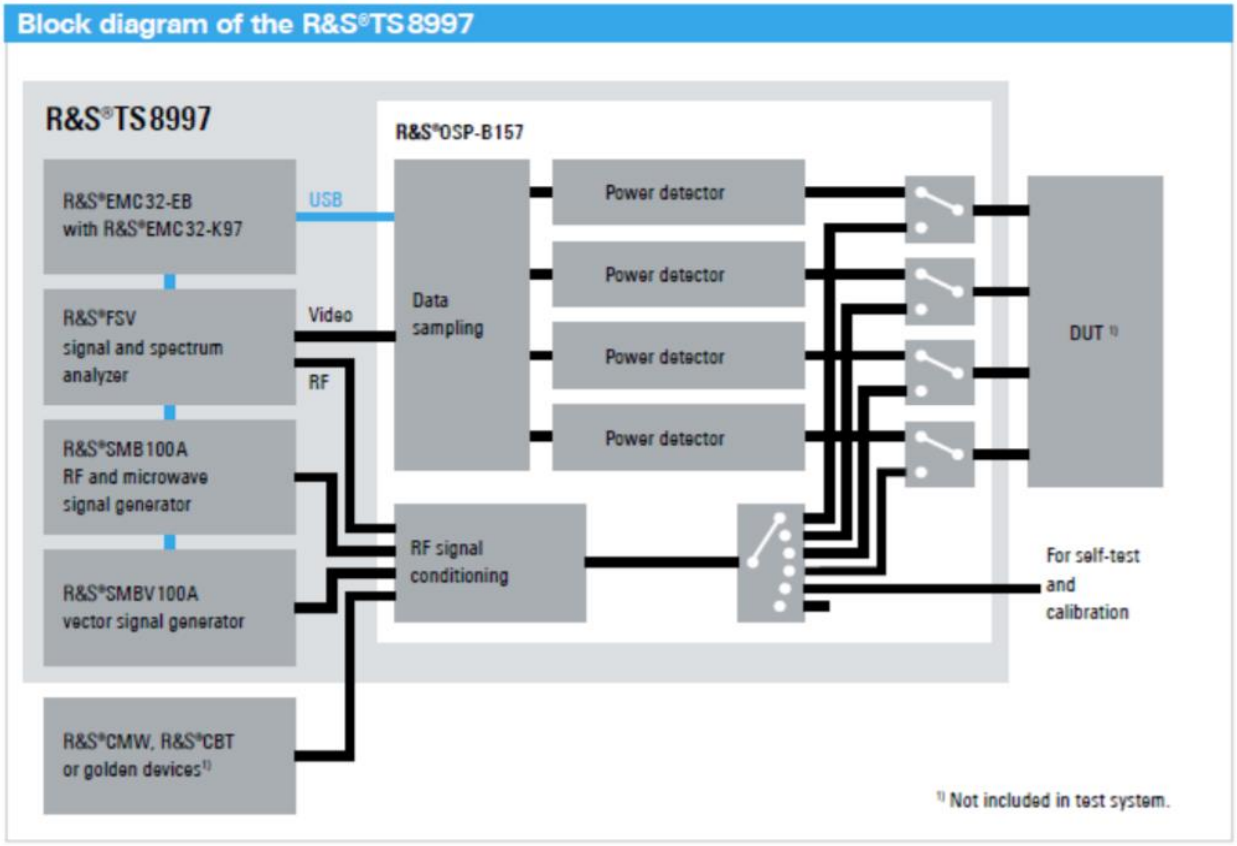


Diagram 1: Test Configuration Block Diagram

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 40000	N/A
15.247(d)	RSS-247 § 5.4	Radiated Spurious Emissions	0.009 to 40000	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 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	6/272024
LISN	Com-Power	LIN-120C	UCL-2612	1/24/2023	1/24/2024
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

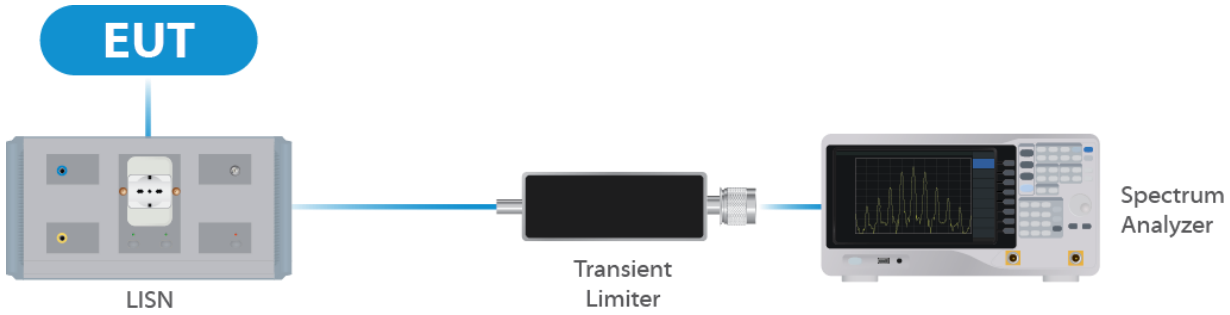


Figure 1: Conducted Emissions Test

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	2/22/2024
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

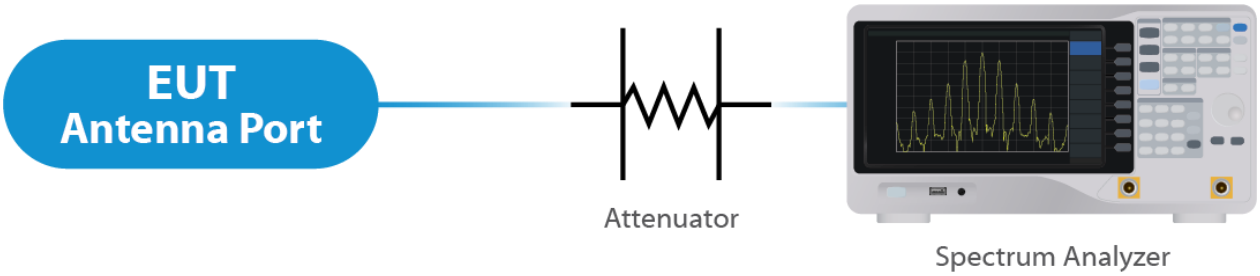


Figure 2: Direct Connect at the Antenna Port Test

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	1/27/2023	1/27/2024
Pre-Amplifier 9 kHz – 1 GHz	Sonoma Instruments	310N	UCL-2889	10/7/2023	1/7/2024
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	129/2023	1/9/2024
Test Software	UCL	Revision 1	UCL-3108	N/A	N/A

Table 3: List of equipment used for Radiated Emissions

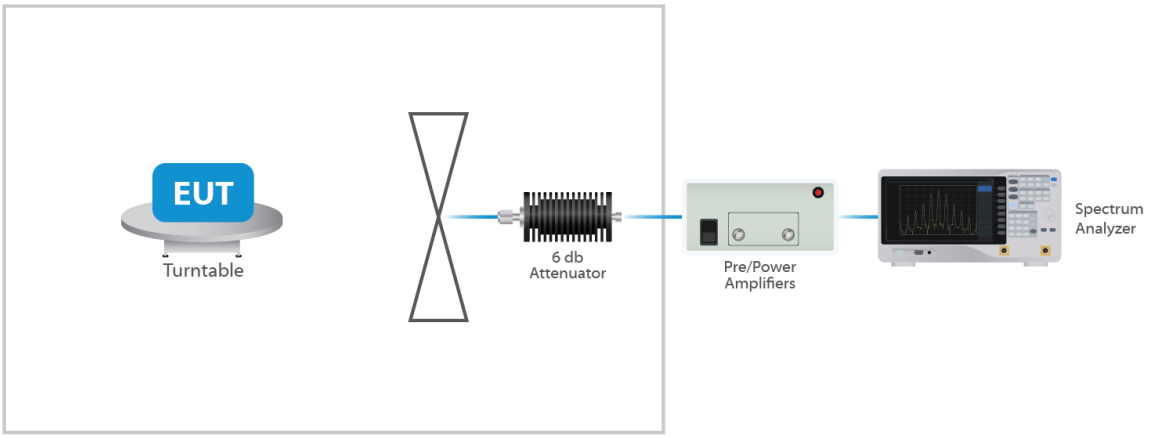


Figure 3: Radiated Emissions Test

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 (± 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

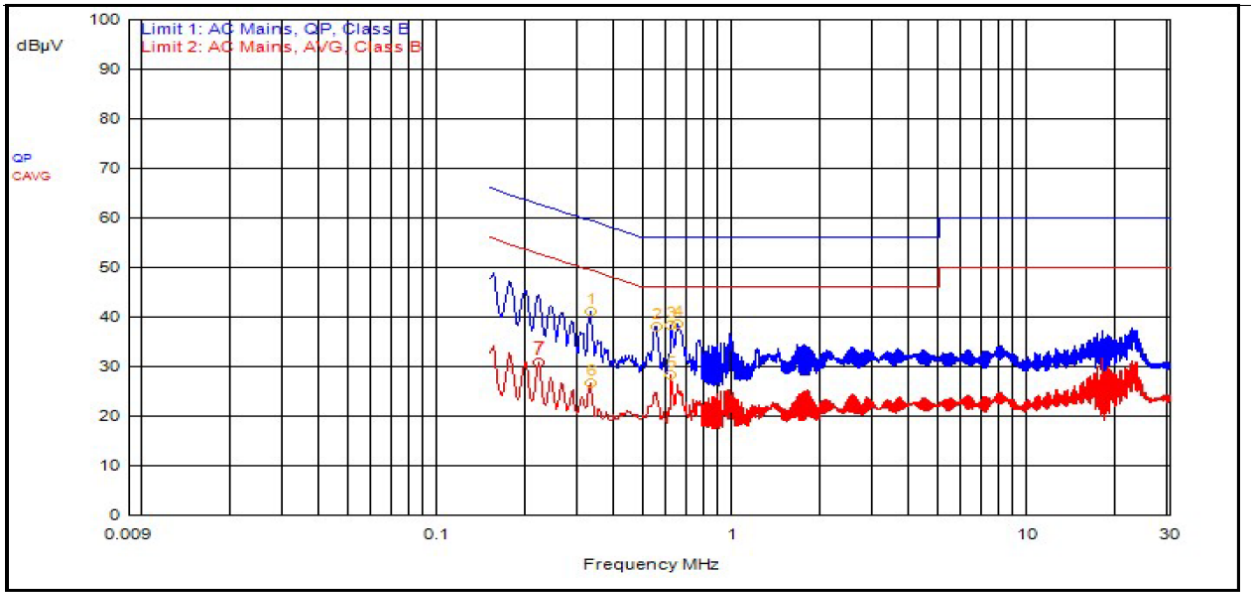
The EUT uses an external Monopol antenna. As per the manufacturer, the maximum gain of the antenna per chain is 4.0 dBi. This is an 802.11 device and utilizes CDD as described in KDB 662911 D01. The antenna is user replaceable.

For power measurements on IEEE 802.11 devices, Array Gain = 0 dB for NANT ≤ 4;
For PSD measurements Array Gain = 10 log(NANT/NSS) dB = 3.01dB, for a total directional gain of 7.01dBi (Antenna Gain + Array Gain = directional gain (4.0 + 3.01 = 7.01)

Results

The EUT complied with the specification

5.2 Conducted Emissions at Mains Ports (Hot Lead)



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
4	645,000kHz	12.38	0.00		QPeak	26.23	38.61	56.00	-17.39			
3	615,000kHz	12.38	0.00		QPeak	25.89	38.27	56.00	-17.73			
2	546,000kHz	12.41	0.00		QPeak	25.56	37.97	56.00	-18.03			
1	327,000kHz	12.37	0.00		QPeak	28.69	41.06	59.53	-18.47			
5	615,000kHz	12.38	0.00		C_AVG	16.03	28.41			46.00	-17.59	
6	327,000kHz	12.37	0.00		C_AVG	14.42	26.79			49.53	-22.74	
7	219,000kHz	12.37	0.00		C_AVG	18.47	30.84			52.86	-22.01	

Sample Field Strength Calculation

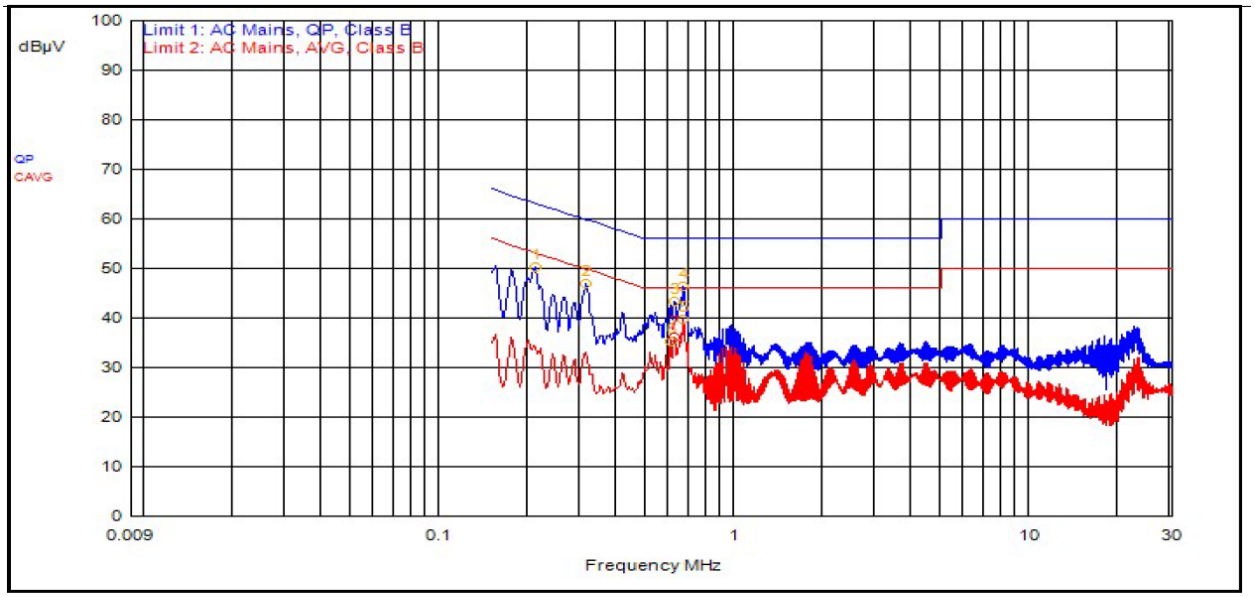
Correction Factor = LISN Insertion Loss + Cable Insertion Loss + Transient Limiter Insertion Loss

Conducted Emissions Amplitude = Receiver Reading + Correction Factor

Result

The EUT complied with the specification limit by a margin of -17.39 dB.

5.3 Conducted Emissions at Mains Ports (Neutral Lead)



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
4	666,000kHz	12.41	0.00		QPeak	34.10	46.51	56.00	-9.49			
3	621,000kHz	12.40	0.00		QPeak	30.92	43.32	56.00	-12.68			
2	312,000kHz	12.40	0.00		QPeak	34.52	46.92	59.92	-13.00			
1	210,000kHz	12.41	0.00		QPeak	37.77	50.18	63.21	-13.03			
5	666,000kHz	12.41	0.00		C_AVG	27.26	39.67			46.00	-6.33	
6	600,000kHz	12.40	0.00		C_AVG	22.99	35.39			46.00	-10.61	
7	621,000kHz	12.40	0.00		C_AVG	23.74	36.14			46.00	-9.86	

Sample Field Strength Calculation

Correction Factor = LISN Insertion Loss + Cable Insertion Loss + Transient Limiter Insertion Loss

Conducted Emissions Amplitude = Receiver Reading + Correction Factor

Result

The EUT complied with the specification limit by a margin of -6.33 dB.

5.4 §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.

Mode	Frequency (MHz)	99% Bandwidth (MHz)	6 dB Bandwidth (MHz)
b	2412	16.8	10.15
	2437	16.9	9.15
	2462	12.5	7.15
g	2412	16.7	15.35
	2437	28.8	16.1
	2462	16.4	15.8
n 20	2412	17.6	15.75
	2437	29.4	16.85
	2462	17.6	16.4
n 40	2422	36.25	28.75
	2437	36.75	32.85
	2452	35.75	27.25

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).

5.5 §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.

The maximum average RF conducted output power measured for this device was 26.76 dBm or 476.2 mW. The limit is 30 dBm or 1 Watt when using antennas with 6 dBi or less gain. The antenna gain is 4.0 dBi + Array gain of 3.01 dB which is a total of 7.01 dBi therefore the limit is 28.99dBm or 792.5mW.

Modulation (BW)	Frequency (MHz)	Data Rate	TP Setting	Conducted Output Power *	Measured EIRP
b 20	2412	Mcs0	30	26.20	30.20
	2417	Mcs0	29	26.07	30.07
	2422	Mcs0	30	26.58	30.58
	2427	Mcs0	30	26.45	30.45
	2432	Mcs0	30	26.23	30.23
	2437	Mcs0	30	26.02	30.02
	2442	Mcs0	29	25.99	29.99
	2447	Mcs0	27	25.38	29.38
	2452	Mcs0	25	24.83	28.83
	2457	Mcs0	24	24.48	28.48
	2462	Mcs0	22	23.48	27.48
g 20	2412	Mcs0	20	22.97	26.97
	2417	Mcs0	26	25.88	29.88
	2422	Mcs0	29	26.76	30.76
	2427	Mcs0	27	26.12	30.12
	2432	Mcs0	29	26.43	30.43
	2437	Mcs0	29	26.18	30.18
	2442	Mcs0	28	26.02	30.02
	2447	Mcs0	26	25.59	29.59
	2452	Mcs0	23	24.76	28.76
	2457	Mcs0	21	23.80	27.80
	2462	Mcs0	18	21.73	25.73
n 20	2412	Mcs0	19	22.23	26.23
	2417	Mcs0	23	24.59	28.59
	2422	Mcs0	25	25.53	29.53
	2427	Mcs0	27	26.13	30.13

Modulation (BW)	Frequency (MHz)	Data Rate	TP Setting	Conducted Output Power *	Measured EIRP
	2432	Mcs0	29	26.39	30.39
	2437	Mcs0	29	26.14	30.14
	2442	Mcs0	30	26.44	30.44
	2447	Mcs0	25	25.12	29.12
	2452	Mcs0	24	25.09	29.09
	2457	Mcs0	21	23.57	27.57
	2462	Mcs0	19	22.22	26.22
n 40	2422	Mcs0	18	20.80	24.80
	2437	Mcs0	21	22.69	26.69
	2452	Mcs0	16	18.74	22.74

Result

In the configuration tested, the maximum average RF output power was less than 1 watt; 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

5.6 §15.247(d) Spurious Emissions

5.6.1 Conducted Spurious Emissions

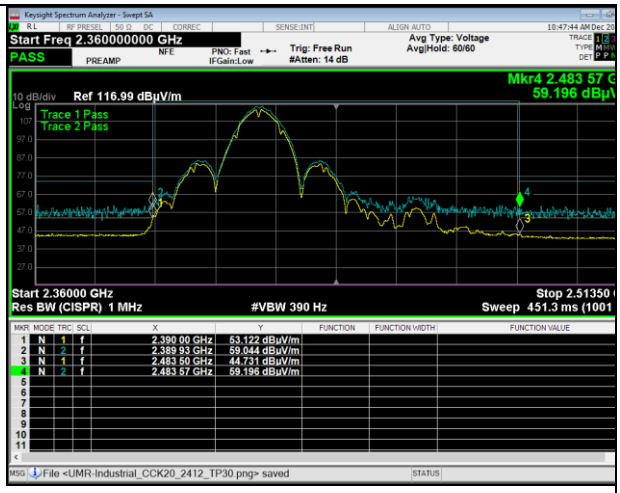
The frequency range from the lowest frequency generated or used in the device to the tenth harmonic of the highest fundamental frequency was investigated to measure any antenna-conducted emissions. The table show the measurement data from spurious emissions noted across the frequency range when transmitting 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

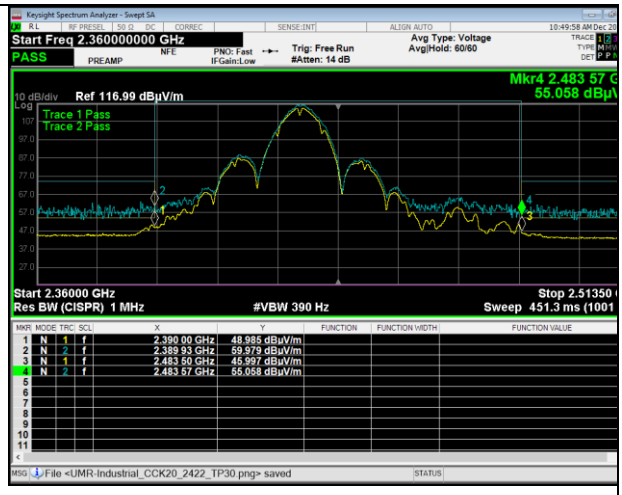
Conducted spurious emissions were attenuated 30 dB or more below the fundamental; therefore, the EUT complies with the specification.

CCK 20 2412

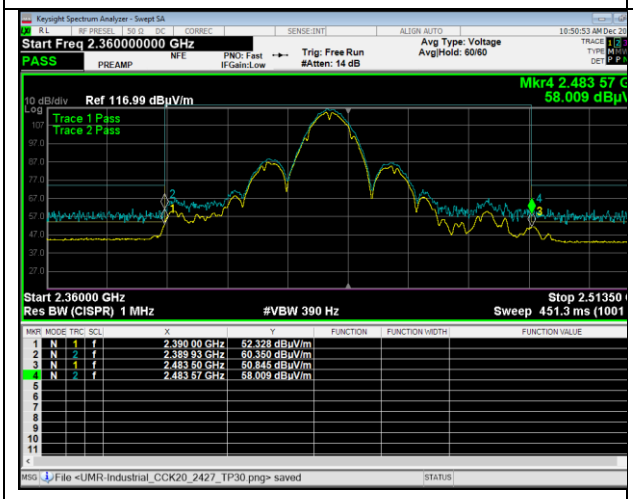


CCK 20 2417

CCK 20 2422

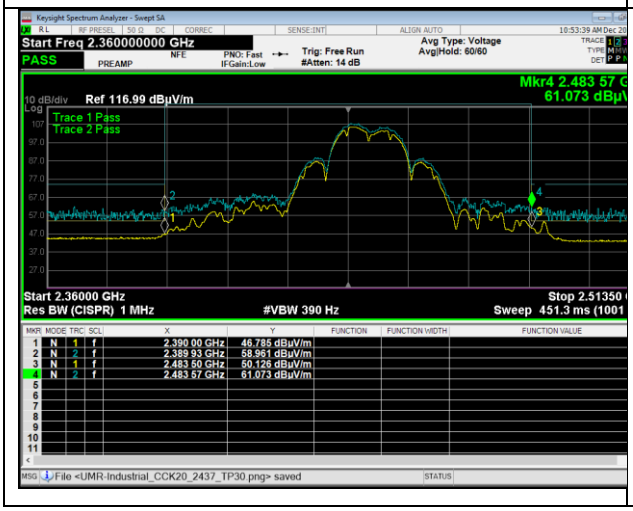


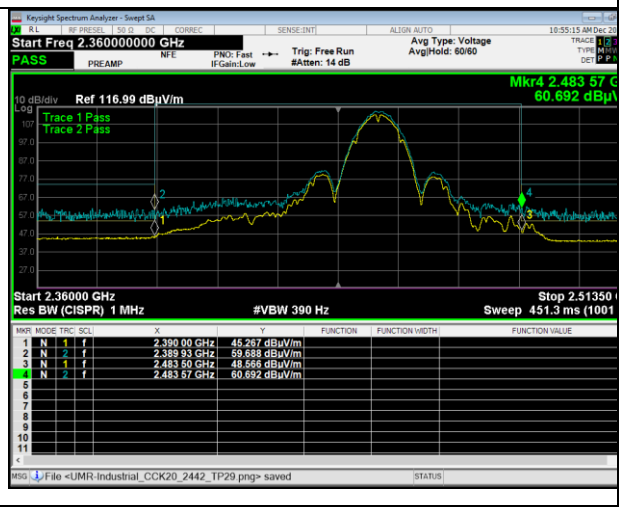
CCK 20 2427

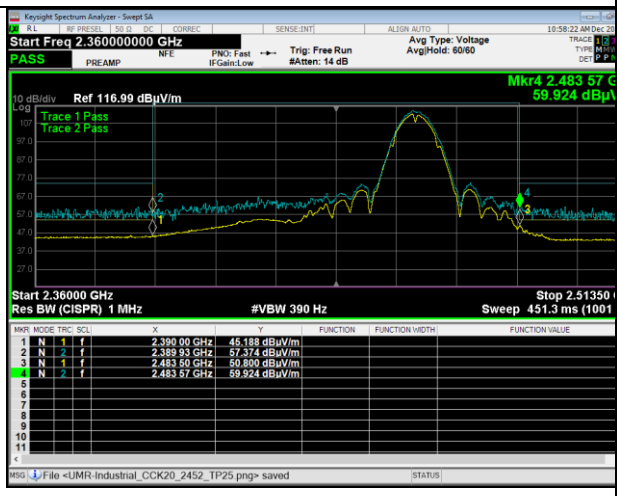
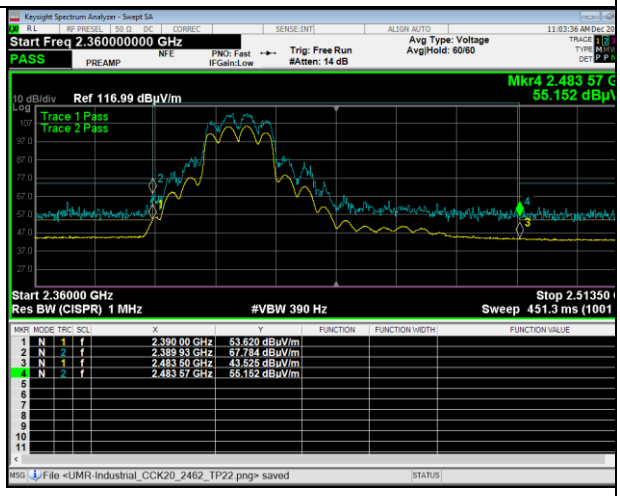


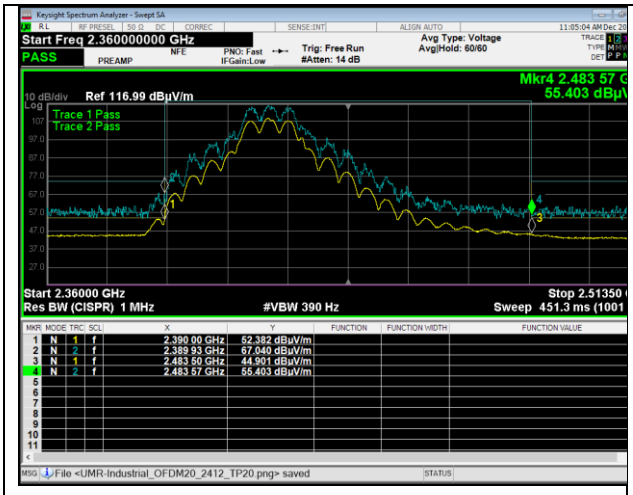
CCK 20 2432

CCK 20 2437



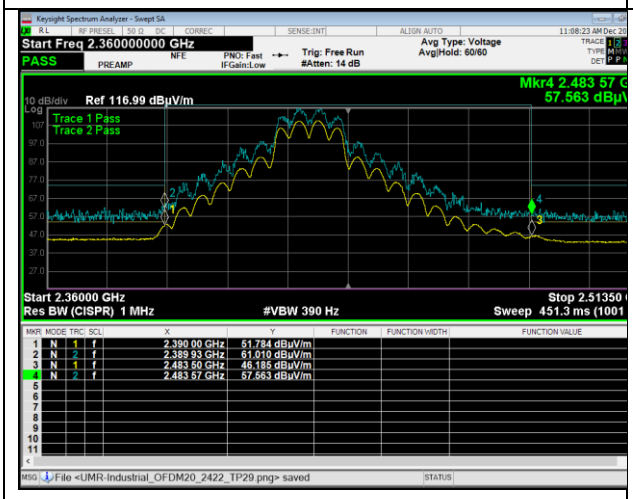


CCK 20 2442	CCK 20 2447
	
CCK 20 2452	**CCK 20 2457**
	
CCK 20 2462	**OFDM 20 2412**



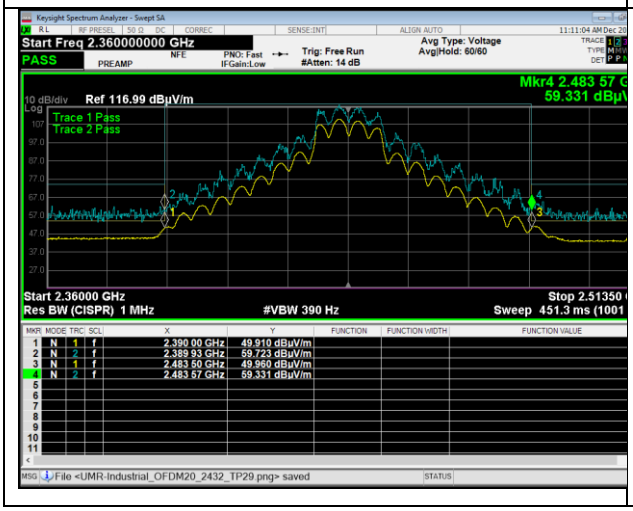
OFDM 20 2417

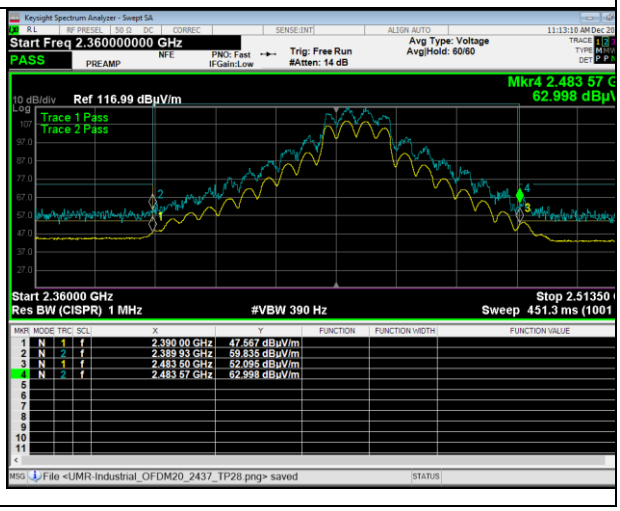
OFDM 20 2422

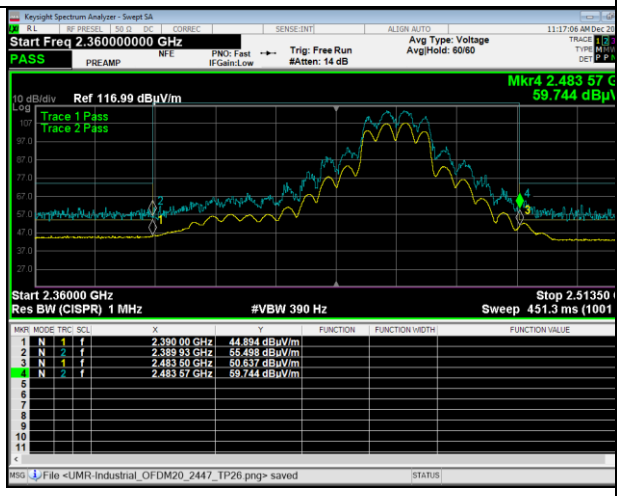


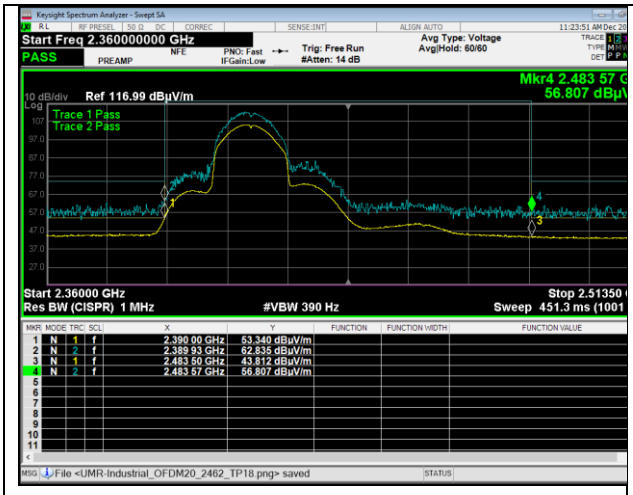
OFDM 20 2427

OFDM 20 2432





OFDM 20 2437	OFDM 20 2442
	
OFDM 20 2447	**OFDM 20 2452**
	
OFDM 20 2457	**OFDM 20 2462**

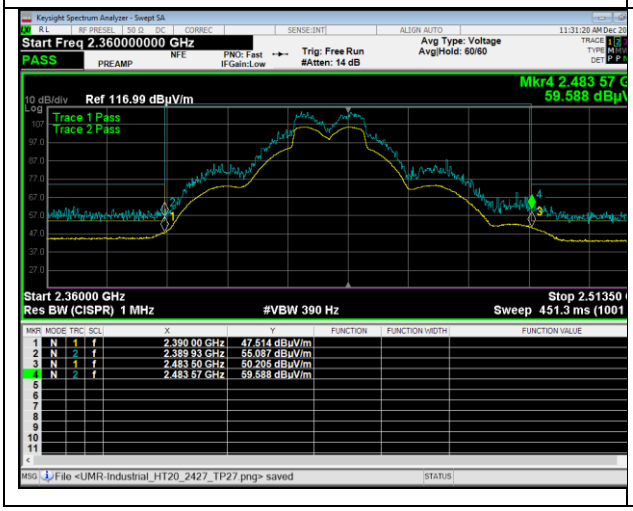


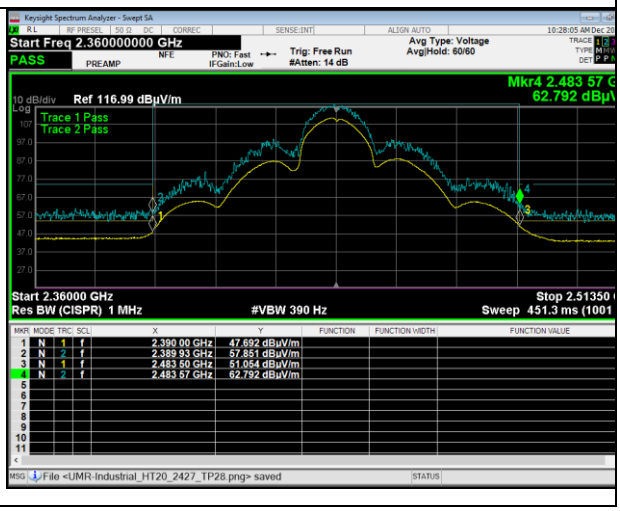
HT 20 2412

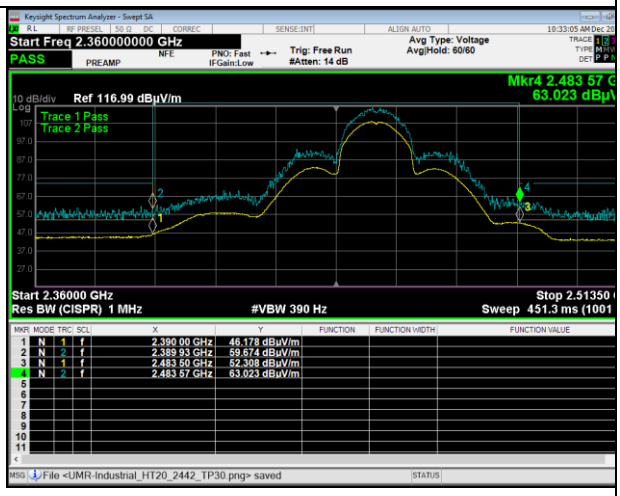
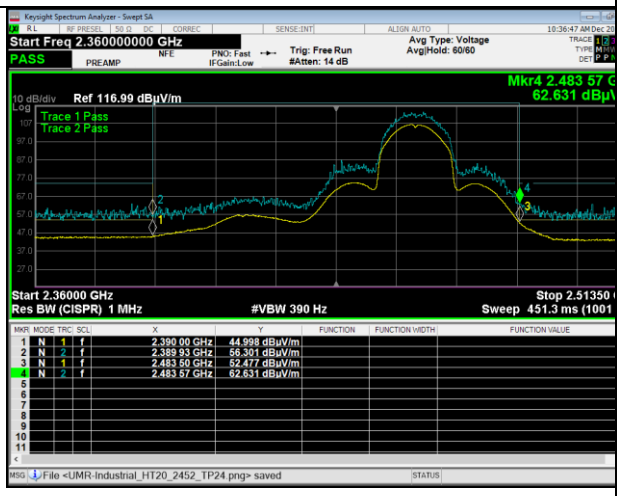
HT 20 2417

HT 20 2422

HT 20 2427



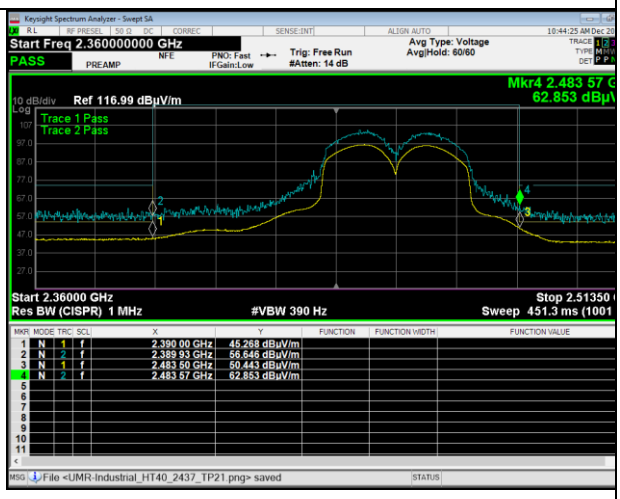


HT 20 2432	HT 20 2437
	
HT 20 2442	**HT 20 2447**
	
HT 20 2452	**HT 20 2457**

HT 20 2462

HT 40 2422

HT 40 2437



HT 40 2452

5.6.2 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 bans 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.

Frequency	Det.	Level (dBµV/m)	Limit (dBµV/m)	Margin	Azimuth (°)	Height	Pol.	Correction (dB)
37.372 MHz	QP	29.472	40	-10.528	321	2.884	Vertical	-14.626
41.849 MHz	QP	30.86	40	-9.14	48	3.067	Vertical	-13.392
45.489 MHz	QP	30.573	40	-9.427	122	2.522	Vertical	-12.694
54.244 MHz	QP	30.331	40	-9.669	115	3.841	Vertical	-12.531
669.03 MHz	QP	28.579	47	-18.421	287	2.503	Horizontal	-6.148

Note 1: Correction Factor = Antenna Factor + Cable Loss - Pre-Amplifier Gain, and is added to the Receiver reading.

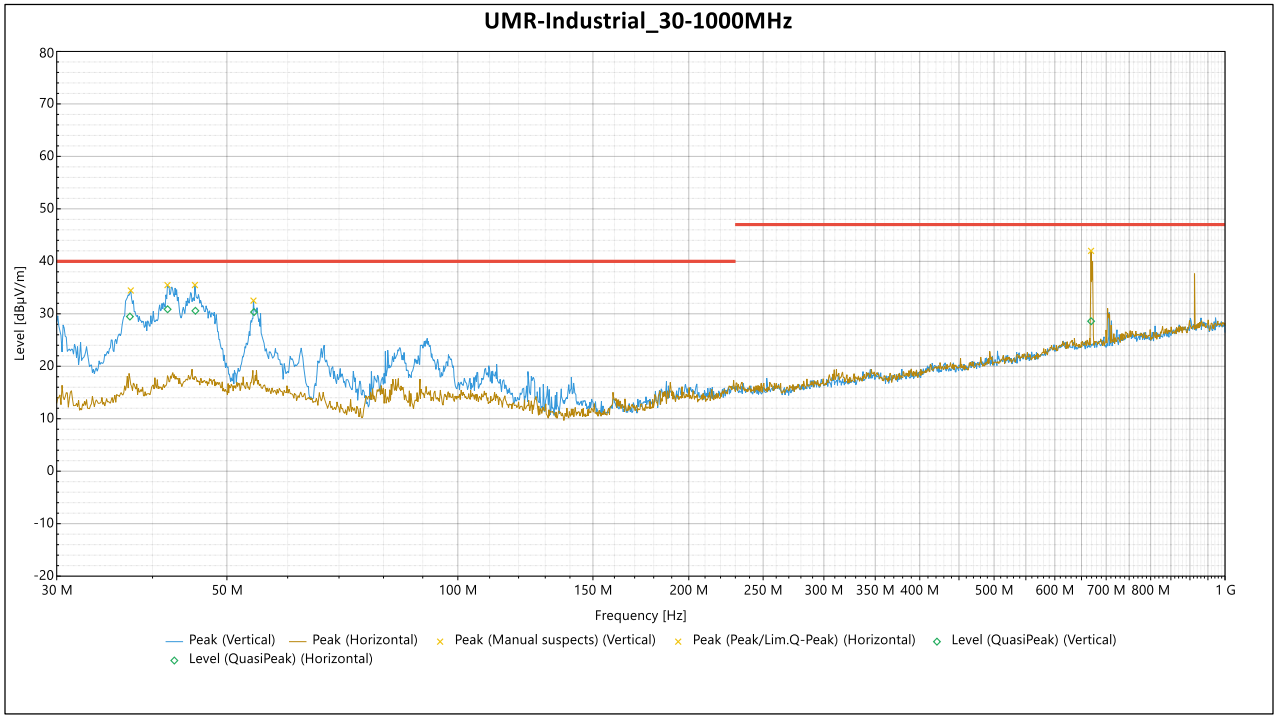
Note 2: For radiated emissions above 1000 MHz, the reference detector used for the measurements was average and peak and the data was compared to the respective limits.

Note 3: The limits of CISPR 32/22 and CFR 47 Part 15.109 were applied.

Sample Field Strength Calculation

Level = Receiver Reading – Correction factor

Correction Factor = Antenna Factor + Cable Factor – Amplifier Gain



Graph 1: 30-1000MHz

Frequency	Det.	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	Correction (dB)
4.823 GHz	Pk	52.872	74	-21.128	116	2.645	Vertical	-5.973
9.6427 GHz	Pk	52.758	74	-21.242	282	1.638	Vertical	5.562
12.056 GHz	Pk	57.366	74	-16.634	101	3.657	Vertical	8.514
15.98 GHz	Pk	56.584	74	-17.416	344	1.5	Vertical	10.691
4.823 GHz	Av	39.512	54	-14.488	116	2.645	Vertical	-5.973
9.6427 GHz	Av	39.68	54	-14.32	282	1.638	Vertical	5.562
12.056 GHz	Av	43.327	54	-10.673	101	3.657	Vertical	8.514
15.98 GHz	Av	43.681	54	-10.319	344	1.5	Vertical	10.691
4.8192 GHz	Pk	47.852	74	-26.148	116	2.146	Horizontal	-5.976
12.053 GHz	Pk	58.944	74	-15.056	324	2.142	Horizontal	8.514
4.8192 GHz	Av	34.456	54	-19.544	116	2.146	Horizontal	-5.976
12.053 GHz	Av	44.864	54	-9.136	324	2.142	Horizontal	8.514
4.8729 GHz	Pk	50.498	74	-23.502	112	2.65	Vertical	-5.918
9.7524 GHz	Pk	56.108	74	-17.892	118	2.645	Vertical	5.809
4.8729 GHz	Av	36.775	54	-17.225	112	2.65	Vertical	-5.918
9.7524 GHz	Av	41.232	54	-12.768	118	2.645	Vertical	5.809
12.204 GHz	Pk	54.297	74	-19.703	100	2.65	Horizontal	8.276
12.204 GHz	Av	40.677	54	-13.323	100	2.65	Horizontal	8.276
4.9211 GHz	Pk	53.17	74	-20.83	122	1.638	Vertical	-5.863
8.1516 GHz	Pk	49.023	74	-24.977	84	2.645	Vertical	2.729

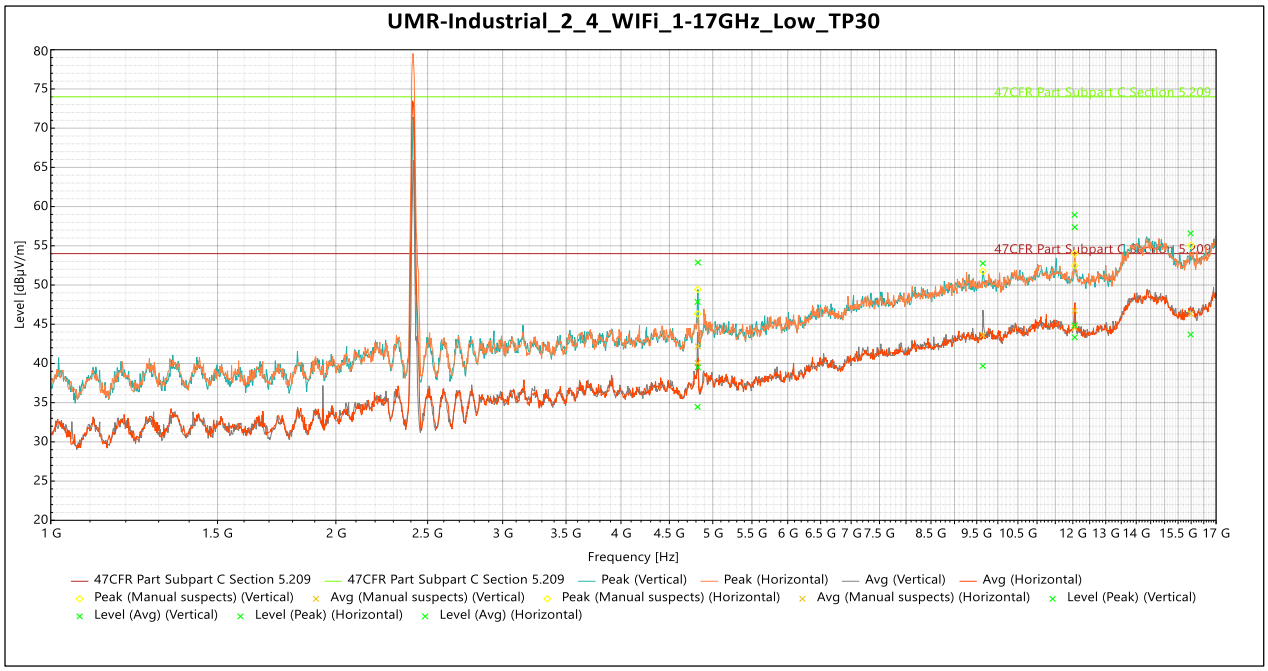
Frequency	Det.	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	Correction (dB)
16.993 GHz	Pk	57.609	74	-16.391	112	1.638	Vertical	13.51
4.9211 GHz	Av	39.023	54	-14.977	122	1.638	Vertical	-5.863
8.1516 GHz	Av	36.186	54	-17.814	84	2.645	Vertical	2.729
16.993 GHz	Av	44.537	54	-9.463	112	1.638	Vertical	13.51
4.9263 GHz	Pk	48.277	74	-25.723	55	1.638	Horizontal	-5.859
10.329 GHz	Pk	52.072	74	-21.928	74	1.638	Horizontal	6.461
4.9263 GHz	Av	34.902	54	-19.098	55	1.638	Horizontal	-5.859
10.329 GHz	Av	39.044	54	-14.956	74	1.638	Horizontal	6.461

Note 1: Correction Factor = Antenna Factor + Cable Loss - Pre-Amplifier Gain, and is added to the Receiver reading.
Note 2: For radiated emissions above 1000 MHz, the reference detector used for the measurements was average and peak and the data was compared to the respective limits.

Sample Field Strength Calculation

Level = Receiver Reading – Correction factor

Correction Factor = Antenna Factor + Cable Factor – Amplifier Gain



Graph 2: 1-17GHz (Worst Case)

Frequency	Det.	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	Correction (dB)
16.88 GHz	Pk	54.51	74	-19.49	170	1.5	Vertical	-0.329
17.976 GHz	Pk	50.047	74	-23.953	229	1.5	Vertical	-0.647

Frequency	Det.	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	Correction (dB)
21.01 GHz	Pk	49.854	74	-24.146	353	1.5	Vertical	0.884
24.858 GHz	Pk	50.744	74	-23.256	316	1.5	Vertical	1.102
16.88 GHz	Av	40.242	54	-13.758	170	1.5	Vertical	-0.329
17.976 GHz	Av	36.277	54	-17.723	229	1.5	Vertical	-0.647
21.01 GHz	Av	36.218	54	-17.782	353	1.5	Vertical	0.884
24.858 GHz	Av	35.773	54	-18.227	316	1.5	Vertical	1.102
16.568 GHz	Pk	49.733	74	-24.267	2	1.5	Horizontal	0.044
16.882 GHz	Pk	52.736	74	-21.264	2	1.5	Horizontal	-0.34
18.1 GHz	Pk	50.141	74	-23.859	37	1.5	Horizontal	-0.805
23.728 GHz	Pk	51.212	74	-22.788	40	1.5	Horizontal	1.538
24.242 GHz	Pk	50.558	74	-23.442	296	1.5	Horizontal	1.302
16.568 GHz	Av	36.303	54	-17.697	2	1.5	Horizontal	0.044
16.882 GHz	Av	38.22	54	-15.78	2	1.5	Horizontal	-0.34
18.1 GHz	Av	35.914	54	-18.086	37	1.5	Horizontal	-0.805
23.728 GHz	Av	36.182	54	-17.818	40	1.5	Horizontal	1.538
24.242 GHz	Av	36.04	54	-17.96	296	1.5	Horizontal	1.302
17.05 GHz	Pk	51.708	74	-22.292	169	1.5	Vertical	-0.197
18.511 GHz	Pk	49.918	74	-24.082	140	1.5	Vertical	-0.281
21.015 GHz	Pk	50.418	74	-23.582	224	1.5	Vertical	0.881
24.902 GHz	Pk	51.512	74	-22.488	294	1.5	Vertical	1.045
17.05 GHz	Av	38.061	54	-15.939	169	1.5	Vertical	-0.197
18.511 GHz	Av	36.009	54	-17.991	140	1.5	Vertical	-0.281
21.015 GHz	Av	36.041	54	-17.959	224	1.5	Vertical	0.881
24.902 GHz	Av	35.898	54	-18.102	294	1.5	Vertical	1.045
17.056 GHz	Pk	51.679	74	-22.321	168	1.5	Horizontal	-0.178
20.992 GHz	Pk	50.363	74	-23.637	62	1.5	Horizontal	0.794
21.747 GHz	Pk	49.233	74	-24.767	125	1.5	Horizontal	-0.838
24.648 GHz	Pk	50.545	74	-23.455	158	1.5	Horizontal	1.446
17.056 GHz	Av	37.601	54	-16.399	168	1.5	Horizontal	-0.178
20.992 GHz	Av	36.37	54	-17.63	62	1.5	Horizontal	0.794
21.747 GHz	Av	34.563	54	-19.437	125	1.5	Horizontal	-0.838
24.648 GHz	Av	36.1	54	-17.9	158	1.5	Horizontal	1.446
17.243 GHz	Pk	50.852	74	-23.148	206	1.5	Vertical	-0.291
21.004 GHz	Pk	49.927	74	-24.073	146	1.5	Vertical	0.855
23.551 GHz	Pk	49.557	74	-24.443	72	1.5	Vertical	1.179
23.741 GHz	Pk	50.853	74	-23.147	245	1.5	Vertical	1.618
24.635 GHz	Pk	50.825	74	-23.175	276	1.5	Vertical	1.443
17.243 GHz	Av	36.634	54	-17.366	206	1.5	Vertical	-0.291
21.004 GHz	Av	36.135	54	-17.865	146	1.5	Vertical	0.855
23.551 GHz	Av	35.375	54	-18.625	72	1.5	Vertical	1.179
23.741 GHz	Av	35.686	54	-18.314	245	1.5	Vertical	1.618

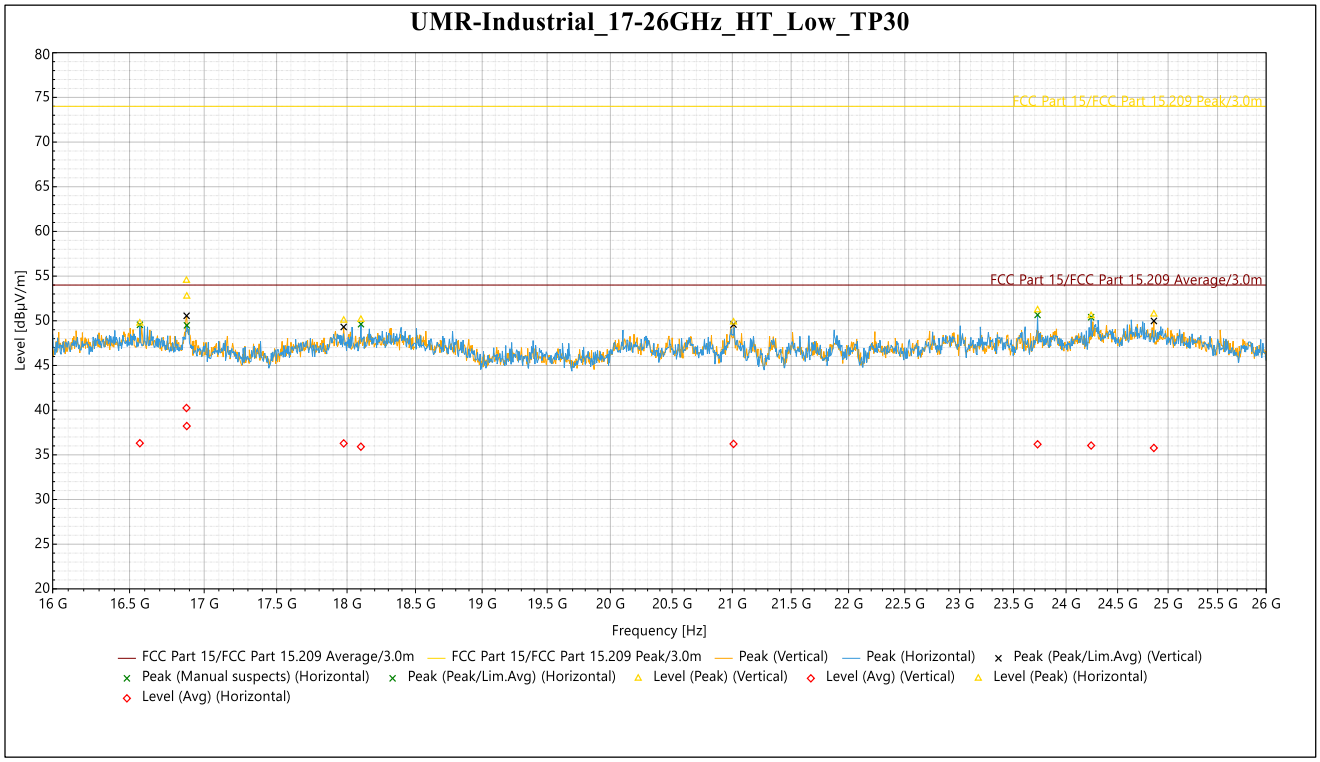
Frequency	Det.	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	Correction (dB)
24.635 GHz	Av	36.051	54	-17.949	276	1.5	Vertical	1.443
17.242 GHz	Pk	51.606	74	-22.394	168	1.5	Horizontal	-0.275
18.169 GHz	Pk	50.324	74	-23.676	13	1.5	Horizontal	-0.522
21.89 GHz	Pk	50.22	74	-23.78	359	1.5	Horizontal	0.839
24.451 GHz	Pk	50.719	74	-23.281	288	1.5	Horizontal	1.389
17.242 GHz	Av	37.214	54	-16.786	168	1.5	Horizontal	-0.275
18.169 GHz	Av	36.415	54	-17.585	13	1.5	Horizontal	-0.522
21.89 GHz	Av	36.005	54	-17.995	359	1.5	Horizontal	0.839
24.451 GHz	Av	35.922	54	-18.078	288	1.5	Horizontal	1.389

Note 1: Correction Factor = Antenna Factor + Cable Loss - Pre-Amplifier Gain, and is added to the Receiver reading.
Note 2: For radiated emissions above 1000 MHz, the reference detector used for the measurements was average and peak and the data was compared to the respective limits.

Sample Field Strength Calculation

Level = Receiver Reading – Correction factor

Correction Factor = Antenna Factor + Cable Factor – Amplifier Gain



Graph 3: 17-26GHz (Worst Case)

5.7 §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 in any 3 kHz band during any time interval of continuous transmission. The antenna gain is 4.0 dBi + Array gain of 3.01 dB which is a total of 7.01 dBi therefore the limit is 6.99dBm.

Modulation (BW)	Frequency (MHz)	Data Rate	TP Setting	PSD
b 20	2412	Mcs0	30	-7.24
	2417	Mcs0	29	-6.47
	2422	Mcs0	30	-6.71
	2427	Mcs0	30	-6.61
	2432	Mcs0	30	-6.80
	2437	Mcs0	30	-7.52
	2442	Mcs0	29	-7.80
	2447	Mcs0	27	-7.76
	2452	Mcs0	25	-7.46
	2457	Mcs0	24	-7.29
	2462	Mcs0	22	-9.64
g 20	2412	Mcs0	20	-13.21
	2417	Mcs0	26	-10.09
	2422	Mcs0	29	-9.51
	2427	Mcs0	27	-9.86
	2432	Mcs0	29	-9.58
	2437	Mcs0	29	-10.16
	2442	Mcs0	28	-9.77
	2447	Mcs0	26	-10.74
	2452	Mcs0	23	-11.38
	2457	Mcs0	21	-12.42
	2462	Mcs0	18	-14.41
n 20	2412	Mcs0	19	-14.02
	2417	Mcs0	23	-11.75
	2422	Mcs0	25	-11.05
	2427	Mcs0	27	-10.19

Modulation (BW)	Frequency (MHz)	Data Rate	TP Setting	PSD
	2432	Mcs0	29	-9.82
	2437	Mcs0	29	-10.04
	2442	Mcs0	30	-9.93
	2447	Mcs0	25	-10.91
	2452	Mcs0	24	-11.18
	2457	Mcs0	21	-12.52
	2462	Mcs0	19	-14.21
n 40	2422	Mcs0	18	-18.04
	2437	Mcs0	21	-16.40
	2452	Mcs0	16	-19.60

Result

The maximum average power spectral density was less than the limit of 6.99 dBm; therefore, the EUT complied with the requirements of the specification (see spectrum analyzer plot within the Annex).

-- End of Test Report --