



TEST REPORT

Test Report No. : UL-RPT-RP13962567-316A

Customer : Eseye Design Ltd
Model No. : Hera604 with EM7411
FCC ID : 2AASBH604V4 (contains: N7NEM74B)
Technology : WLAN 5 GHz, UMTS Bands II & IV & LTE Bands 5, 7, 12, 13 & 48
Test Standard(s) : FCC Parts 2.1053, 15.209(a), 15.407(b), 22.917(a), 24.238(a), 27.53(c)(2), 27.53(f), 27.53(g), 27.53(h)(1), 27.53(m) & 96.41(e)
Test Laboratory : UL International (UK) Ltd, Basingstoke, Hampshire, RG24 8AH, United Kingdom

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2. The results in this report apply only to the sample(s) tested.
3. The sample tested is in compliance with the above standard(s).
4. The test results in this report are traceable to the national or international standards.
5. Version 1.0.

Date of Issue: 11 November 2021

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Report Revision History

Version Number	Issue Date	Revision Details	Revised By
1.0	11/11/2021	Initial Version	Sarah Williams

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1 Attestation of Test Results

1.1 Description of EUT

The equipment under test was an M2M WLAN router with cellular radio and 5 GHz WLAN functionality, containing module FCC ID N7NEM74B.

1.2 General Information

Specification Reference:	47CFR15.407
Specification Title:	Code of Federal Regulations Volume 47 (Telecommunications): Part 15 Subpart E (Unlicensed National Information Infrastructure Devices) – Section 15.407
Specification Reference:	47CFR15.209
Specification Title:	Code of Federal Regulations Volume 47 (Telecommunications): Part 15 Subpart C (Intentional Radiators) - Section 15.209
Specification Reference:	47CFR22
Specification Title:	Code of Federal Regulations Volume 47 (Telecommunications): Part 22 Subpart H (Cellular Radiotelephone Service)
Specification Reference:	47CFR24
Specification Title:	Code of Federal Regulations Volume 47 (Telecommunications): Part 24 Subpart E (Broadband PCS)
Specification Reference:	47CFR27
Specification Title:	Code of Federal Regulations Volume 47 (Telecommunications): Part 27 Subpart C (Miscellaneous Wireless Communication Services)
Specification Reference:	47CFR96
Specification Title:	Code of Federal Regulations Volume 47 (Telecommunications): Part 96 Subpart E (Citizens Broadband Radio Service)
Site Registration:	685609
Lab. Designation No.:	UK2011
Location of Testing:	Unit 3 Horizon, Wade Road, Kingsland Business Park, Basingstoke, Hampshire, G24 8AH, United Kingdom
Test Dates:	18 September 2021 to 07 November 2021

1.3 Summary of Test Results

FCC Reference (47CFR)	Measurement	Result
WLAN & UMTS Band II		
Part 2.1053 / 15.209(a) / 15.407(b) / 24.238(a)	Transmitter Out of Band Radiated Emissions	✓
WLAN & UMTS Band IV		
Part 2.1053 / 15.209(a) / 15.407(b) / 27.53(h)(1)	Transmitter Out of Band Radiated Emissions	✓
WLAN & LTE Band 5		
Part 2.1053 / 15.209(a) / 15.407(b) / 22.917(a)	Transmitter Out of Band Radiated Emissions	✓
WLAN & LTE Band 7		
Part 2.1053 / 15.209(a) / 15.407(b) / 27.53(m)	Transmitter Out of Band Radiated Emissions	✓
WLAN & LTE Band 12		
Part 2.1053 / 15.209(a) / 15.407(b) / 27.53(g)	Transmitter Out of Band Radiated Emissions	✓
WLAN & LTE Band 13		
Part 2.1053 / 15.209(a) / 15.407(b) / 27.53(c)(2) & 27.53(f)	Transmitter Out of Band Radiated Emissions	✓
WLAN & LTE Band 48		
Part 2.1053 / 15.209(a) / 15.407(b) / 96.41(e)	Transmitter Out of Band Radiated Emissions	✓
Key to Results		
✓ = Complied	✗ = Did not comply	

1.4 Deviations from the Test Specification

For the measurements contained within this test report, there were no deviations from, additions to, or exclusions from the test specification identified above.

2 Summary of Testing

2.1 Facilities and Accreditation

The test site and measurement facilities used to collect data are located at Unit 3 Horizon, Wade Road, Kingsland Business Park, Basingstoke, Hampshire, RG24 8AH, United Kingdom. The following table identifies which facilities were utilised for radiated emission measurements documented in this report. Specific facilities are also identified in the test results sections.

Site 1	X
Site 2	-
Site 17	X

UL International (UK) Ltd is accredited by the United Kingdom Accreditation Service (UKAS). UKAS is one of the signatories to the International Laboratory Accreditation Co-operation (ILAC) Arrangement for the mutual recognition of test reports. The tests reported herein have been performed in accordance with its terms of accreditation.

2.2 Methods and Procedures

Reference:	ANSI/TIA-603-E 2016
Title:	Land Mobile FM or PM Communications Equipment Measurement and Performance Standards
Reference:	ANSI C63.10-2013
Title:	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices
Reference:	ANSI C63.26-2015
Title:	American National Standard for Compliance Testing of Transmitters Used in Licensed Radio Services
Reference:	ANSI C63.4-2014
Title:	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.
Reference:	FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01 December 14, 2017
Title:	Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E
Reference:	FCC KDB 971168 D01 v03r01, April 9, 2018
Title:	Measurement Guidance for Certification of Licensed Digital Transmitters
Reference:	Notice 2020 - DRS0023
Title:	Guidance on magnetic field strength radiated emission measurements (9 kHz - 30 MHz)

2.3 Calibration and Uncertainty

Measuring Instrument Calibration

In accordance with UKAS requirements all the measurement equipment is on a calibration schedule. All equipment was within the calibration period on the date of testing.

Measurement Uncertainty & Decision Rule

Overview

No measurement or test can ever be perfect and the imperfections give rise to error of measurement in the results. Consequently the result of a measurement is only an approximation to the value of the measurand (the specific quantity subject to measurement) and is only complete when accompanied by a statement of the uncertainty of the approximation.

The expression of uncertainty of a measurement result allows realistic comparison of results with reference values and limits given in specifications and standards.

Decision Rule

The decision rule applied is based upon the accuracy method criteria. The measurement uncertainty is met and the result is considered in conformance with the requirement criteria if the observed value is within the prescribed limit.

Measurement Uncertainty

The reported expanded uncertainties below are based on a standard uncertainty multiplied by an appropriate coverage factor such that a confidence level of approximately 95% is maintained. For the purposes of this document "approximately" is interpreted as meaning "effectively" or "for most practical purposes".

Measurement Type	Range	Confidence Level (%)	Calculated Uncertainty
Radiated Spurious Emissions	9 kHz to 30 MHz	95%	±5.32 dB
Radiated Spurious Emissions	30 MHz to 1 GHz	95%	±3.30 dB
Radiated Spurious Emissions	1 GHz to 18 GHz	95%	±2.94 dB

The methods used to calculate the above uncertainties are in line with those recommended within the various measurement specifications. Where measurement specifications do not include guidelines for the evaluation of measurement uncertainty the published guidance of the appropriate accreditation body is followed.

2.4 Test and Measurement Equipment

Test Equipment Used for Transmitter Radiated Emissions Tests

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M2040	Thermohygrometer	Testo	608-H1	45124934	10 Dec 2021	12
M2003	Thermohygrometer	Testo	608-H1	45046641	10 Dec 2021	12
K0001	5m RSE Chamber	Rainford EMC	N/A	N/A	06 Sep 2022	12
K0017	3m RSE Chamber	Rainford EMC	N/A	N/A	21 Oct 2021	12
M2044	Test Receiver	Rohde & Schwarz	ESU 26	100122	29 Apr 2022	12
M2077	Test Receiver	Rohde & Schwarz	ESW44	102026	01 Feb 2022	12
M1995	Test Receiver	Rohde & Schwarz	ESU 40	100428	12 Oct 2022	12
A3179	Pre-Amplifier	Hewlett Packard	8449B	3008A00934	24 Aug 2022	12
A3154	Pre-Amplifier	Com-Power	PAM-103	18020012	24 Aug 2022	12
A3155	Pre-Amplifier	Com-Power	PAM-118A	18040037	24 Aug 2022	12
A3265	Pre-Amplifier	Schwarzbeck	BBV 9721	9721-069	16 Feb 2022	12
A2948	Pre-Amplifier	Com-Power	PAM-118	551087	21 Oct 2021	12
A2896	Pre-Amplifier	Schwarzbeck	BBV 9721	9721 - 023	16 Feb 2022	12
A3138	Antenna	Schwarzbeck	BBHA 9120B	00702	28 Aug 2022	12
A3139	Antenna	Schwarzbeck	HWRD750	00027	27 Aug 2022	12
A553	Antenna	Chase	CBL6111A	1593	15 Mar 2022	12
A2892	Antenna	Schwarzbeck	BBHA 9170	9170-727	31 Oct 2021	12
A2889	Antenna	Schwarzbeck	BBHA 9120B	00653	23 Oct 2021	12
A2890	Antenna	Schwarzbeck	HWRD 750	014	27 Oct 2021	12
A2895	Antenna	Schwarzbeck	BBHA 9170	9170-728	16 Feb 2022	12
A3198	Magnetic Loop Antenna	ETS-Lindgren	6502	00221887	12 Aug 2022	12
A2924	Attenuator	AtlanTecRF	AN18W5-20	832828#7	03 Feb 2022	12
A2523	Attenuator	AtlanTecRF	AN18W5-10	832827#1	03 Feb 2022	12
A2916	Attenuator	AtlanTecRF	AN18W5-10	832827#2	01 Feb 2022	12
A3087	Low Pass Filter	AtlanTecRF	AFL-04000	18051600007	03 Feb 2022	12
A3085	Low Pass Filter	AtlanTecRF	AFL-02000	18051600014	03 Feb 2022	12
A3083	Low Pass Filter	AtlanTecRF	AFL-01000	18010900076	03 Feb 2022	12
A2134	Low Pass Filter	AtlanTecRF	AFL-05000	300195	26 Nov 2021	12
A2915	Low Pass Filter	AtlanTecRF	AFL-04000	2156	01 Feb 2022	12
A3093	High Pass Filter	AtlanTecRF	AFH-03000	18051800077	03 Feb 2022	12
A3095	High Pass Filter	AtlanTecRF	AFH-07000	18051600012	03 Feb 2022	12
A2947	High Pass Filter	AtlanTecRF	AFH-07000	1601900001	01 Feb 2022	12
A2972	High Pass Filter	AtlanTecRF	AFH-01000	02371	19 Nov 2021	12
A1981	High Pass Filter	AtlanTecRF	AFH-05000	9110200090	17 Nov 2021	12

Test Equipment Used for Transmitter Radiated Emissions Tests (continued)

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
A2914	High Pass Filter	AtlanTecRF	AFH-03000	2155	01 Feb 2022	12
A3014	High Pass Filter	AtlanTecRF	AFH-06000	17042400007	01 Feb 2022	12
A2482	Band Reject Cavity Filter	AtlanTecRF	WRCJV8-5665-5725-5850-5910-50SS	2	23 Dec 2021	12

3 Equipment Under Test (EUT)

3.1 Identification of Equipment Under Test (EUT)

Brand Name:	Eseye
Model Name or Number:	Hera604 with EM7411
Test Sample Serial Number:	00125152820170100213
Hardware Version:	EPCB251003
Firmware Version:	1.1.6 + u-boot Dataflex_mod3
FCC ID:	2AASBH604V4

3.2 Modifications Incorporated in the EUT

No modifications were applied to the EUT during testing.

3.3 Additional Information Related to Testing

Technology Tested:	UMTS Band II		
Channel Bandwidth:	5 MHz		
Modulation:	QPSK		
Transmit Frequency Range:	1850 MHz to 1910 MHz		
Transmit Channels Tested:	Channel ID	N_{ul}	Frequency of Uplink (MHz)
	Middle	9400	1880.0

Technology Tested:	UMTS Band IV		
Channel Bandwidth:	5 MHz		
Modulation:	QPSK		
Transmit Frequency Range:	1710 MHz to 1755 MHz		
Transmit Channels Tested:	Channel ID	N_{ul}	Frequency of Uplink (MHz)
	Middle	1413	1732.5

Technology Tested:	LTE Band 5		
Channel Bandwidth:	1.4 MHz		
Modulation:	QPSK		
Transmit Frequency Range:	824 MHz to 849 MHz		
Transmit Channels Tested:	Channel ID	N_{ul}	Frequency of Uplink (MHz)
	Middle	20525	836.5

Technology Tested:	LTE Band 7		
Channel Bandwidth:	1.4 MHz		
Modulation:	QPSK		
Transmit Frequency Range:	2500 MHz to 2570 MHz		
Transmit Channels Tested:	Channel ID	N_{ul}	Frequency of Uplink (MHz)
	Middle	21100	2535

Additional Information Related to Testing (continued)

Technology Tested:	LTE Band 12		
Channel Bandwidth:	1.4 MHz		
Modulation:	QPSK		
Transmit Frequency Range:	699 MHz to 716 MHz		
Transmit Channels Tested:	Channel ID	N_{ul}	Frequency of Uplink (MHz)
	Middle	23095	707.5

Technology Tested:	LTE Band 13		
Channel Bandwidth:	1.4 MHz		
Modulation:	QPSK		
Transmit Frequency Range:	777 MHz to 787 MHz		
Transmit Channels Tested:	Channel ID	N_{ul}	Frequency of Uplink (MHz)
	Bottom	23205	779.5
	Middle	23230	782.0
	Top	23255	784.5

Technology Tested:	LTE Band 48		
Channel Bandwidth:	1.4 MHz		
Modulation:	QPSK		
Transmit Frequency Range:	3550 MHz to 3700 MHz		
Transmit Channels Tested:	Channel ID	N_{ul}	Frequency of Uplink (MHz)
	Middle	55990	3625

Technology Tested:	WLAN (IEEE 802.11a) / U-NII / LE-LAN		
Modulation Type:	QPSK		
Channel Bandwidth	20 MHz		
Data Rate	9 Mbit/s (MIMO)		
Transmit Frequency Range:	5725 MHz to 5850 MHz		
Transmit Channels Tested:	Channel ID	Channel Number	Channel Frequency (MHz)
	Middle	157	5785

3.4 Description of Available Antennas

The table below lists the antennas that the manufacturer intends to use with this product when operating in the 5725 to 5850 MHz bands. It additionally shows the cellular antennas utilised on their respective ports:

Type	Stated Antenna Gain (dBi)	Manufacturer	Antenna Name	Used for Testing	Note
AN2450-5505BRS	3.5	Cortec	Wireless LAN	X	1
GA-4G-M06-01	3.5	G-Antetech Industrial	Cellular	X	2
GA-4G-M06-01	3.5	G-Antetech Industrial	Rx Diversity	X	3

X = This antenna was used for testing purposes

Note(s):

1. WLAN antennas used for radiated emission measurements
2. Cellular primary antenna
3. Cellular receiver diversity

3.5 Description of Test Setup

Support Equipment

The following support equipment was used to exercise the EUT during testing:

Description:	Laptop
Brand Name:	Dell
Model Name or Number:	VOSTRO
Serial Number:	00144-469-237-913

Description:	Ethernet Hub
Brand Name:	HERA 601
Model Name or Number:	HERA 601n2-018-52-001
Serial Number:	00123352816120200028

Description:	Ethernet Hub
Brand Name:	HERA 601
Model Name or Number:	HERA 601n2-018-52-001
Serial Number:	00123352816120200105

Description:	Power Supply
Brand Name:	Power Solve
Model Name or Number:	PIJ15-12-13
Serial Number:	Not marked or stated

Description:	Antenna (Bee Sting) x2
Brand Name:	G-Antetech Industrial
Model Name or Number:	GA-4G-M06-01
Serial Number:	Not marked or stated

Description:	Antenna (Rubber Duck) x2
Brand Name:	Cortec
Model Name or Number:	AN2450-5505BRS
Serial Number:	Not marked or stated

Description:	Ethernet Cable. Quantity 6. Length 2.5 m
Brand Name:	Cabletech Technology
Model Name or Number:	Not marked or stated
Serial Number:	Not marked or stated

Operating Modes

The EUT was tested in the following operating mode(s):

- Transmitting simultaneously with WLAN and LTE all at maximum power.
- Transmitting simultaneously with WLAN and UMTS all at maximum power.

Configuration and Peripherals

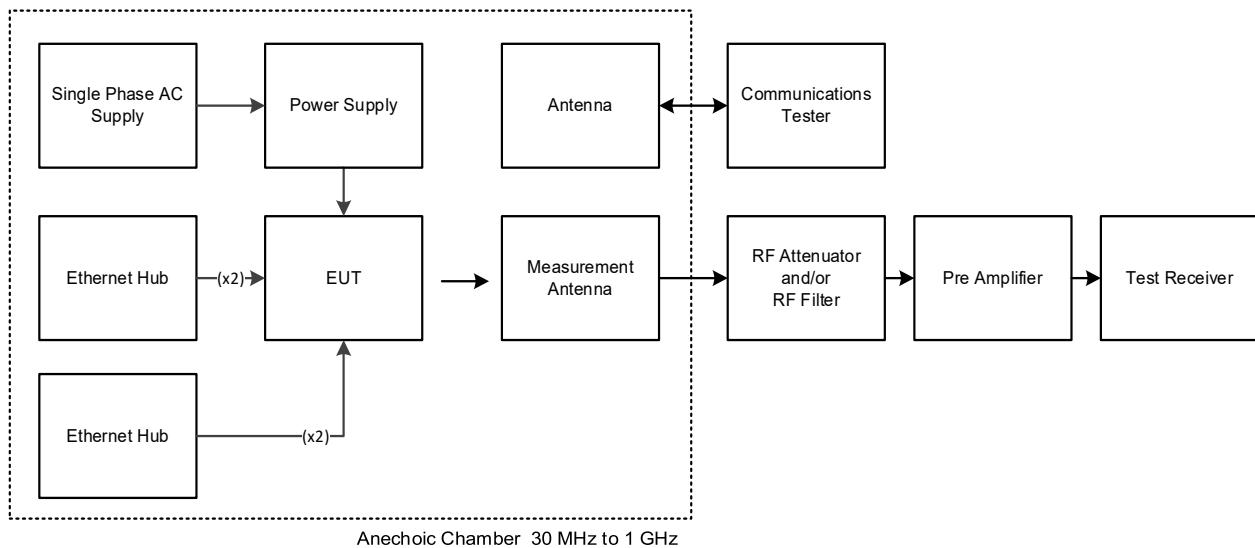
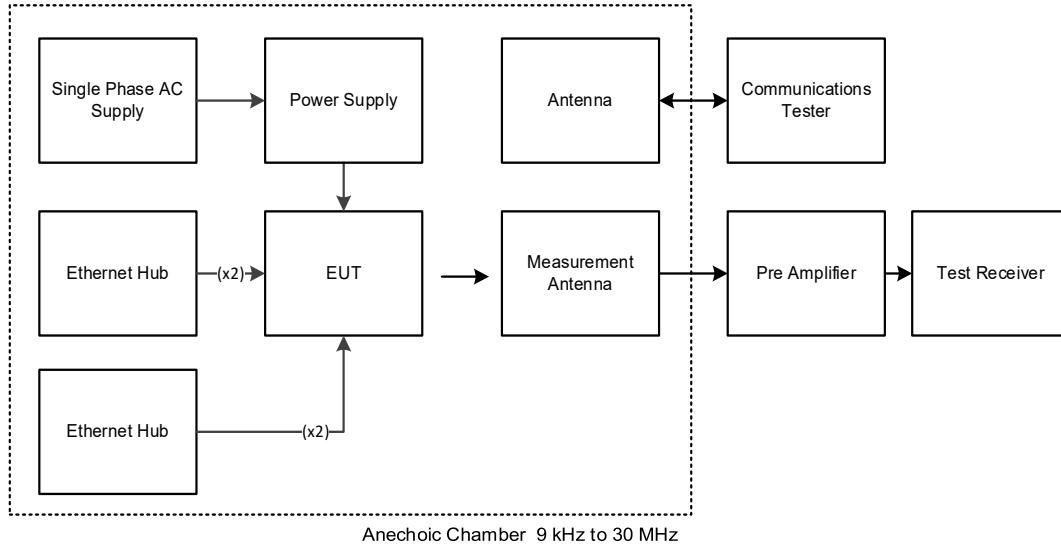
The EUT was tested in the following configuration(s):

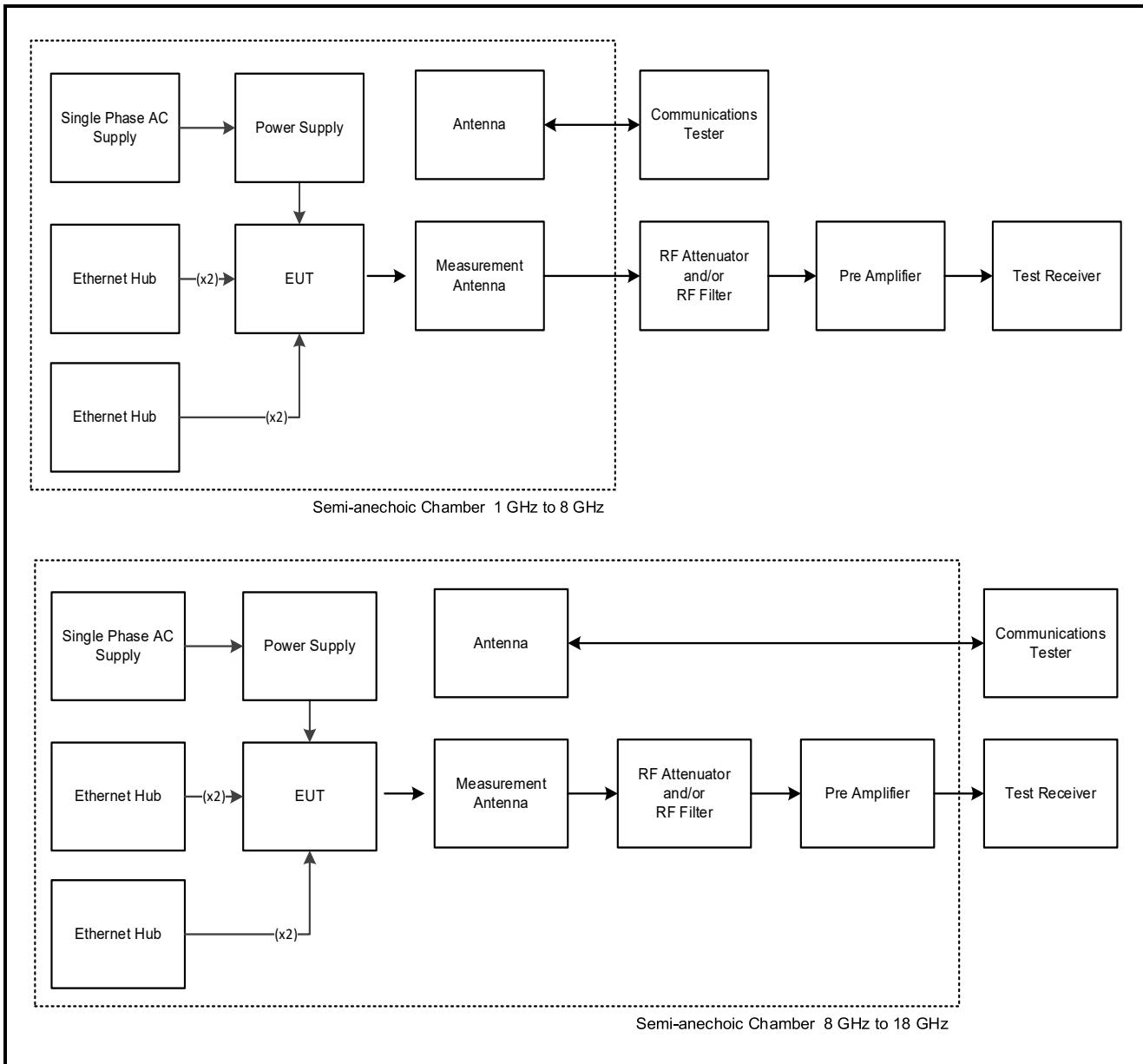
- UMTS Band II and WLAN co-location, with EUT configured to simultaneously transmit two signals (UMTS Band II QPSK / 5 MHz Channel bandwidth on channel 9400 / 1880 MHz and 5 GHz WLAN U-NII Band 3 802.11a 9 Mbit/s (MIMO) carrier on middle channel 157 / 5785 MHz).
- UMTS Band IV and WLAN co-location, with EUT configured to simultaneously transmit two signals (UMTS Band IV QPSK / 5 MHz Channel bandwidth on channel 1413 / 1732.5 MHz and 5 GHz WLAN U-NII Band 3 802.11a 9 Mbit/s (MIMO) carrier on middle channel 157 / 5785 MHz).
- LTE Band 5 and WLAN co-location, with EUT configured to simultaneously transmit two signals (LTE Band 5 QPSK / 1.4 MHz Channel bandwidth / 1 RB offset 0 on channel 20525 / 836.5 MHz and 5 GHz WLAN U-NII Band 3 802.11a 9 Mbit/s (MIMO) carrier on middle channel 157 / 5785 MHz).
- LTE Band 7 and WLAN co-location, with EUT configured to simultaneously transmit two signals (LTE Band 7 QPSK / 1.4 MHz Channel bandwidth / 1 RB offset 0 on channel 21100 / 2535 MHz and 5 GHz WLAN U-NII Band 3 802.11a 9 Mbit/s (MIMO) carrier on middle channel 157 / 5785 MHz).
- LTE Band 12 and WLAN co-location, with EUT configured to simultaneously transmit two signals (LTE Band 12 QPSK / 1.4 MHz Channel bandwidth / 1 RB offset 0 on channel 23095 / 707.5MHz and 5 GHz WLAN U-NII Band 3 802.11a 9 Mbit/s (MIMO) carrier on middle channel 157 / 5785 MHz).
- LTE Band 13 and WLAN co-location, with EUT configured to simultaneously transmit two signals (LTE Band 13 QPSK / 1.4 MHz Channel bandwidth / 1 RB offset 0 on channel 23230 / 782 MHz and 5 GHz WLAN U-NII Band 3 802.11a 9 Mbit/s (MIMO) carrier on middle channel 157 / 5785 MHz).
- LTE Band 48 and WLAN co-location, with EUT configured to simultaneously transmit two signals (LTE Band 48 QPSK / 1.4 MHz Channel bandwidth / 1 RB offset 0 on channel 55990 / 3625 MHz and 5 GHz WLAN U-NII Band 3 802.11a 9 Mbit/s (MIMO) carrier on middle channel 157 / 5785 MHz).
- The UMTS / LTE link was controlled using an Anritsu MT8821C.
- WLAN 802.11a was controlled using a bespoke application on the laptop PC supplied by the customer. The application was used to enable continuous transmission and receive modes and to select the test channels, data rates and modulation schemes as required. The instructions were called '*Configuration Notes for Hera 600 Regulatory testing.docx* dated 03 April 2019.
- All active ports were terminated. A test USIM was used.

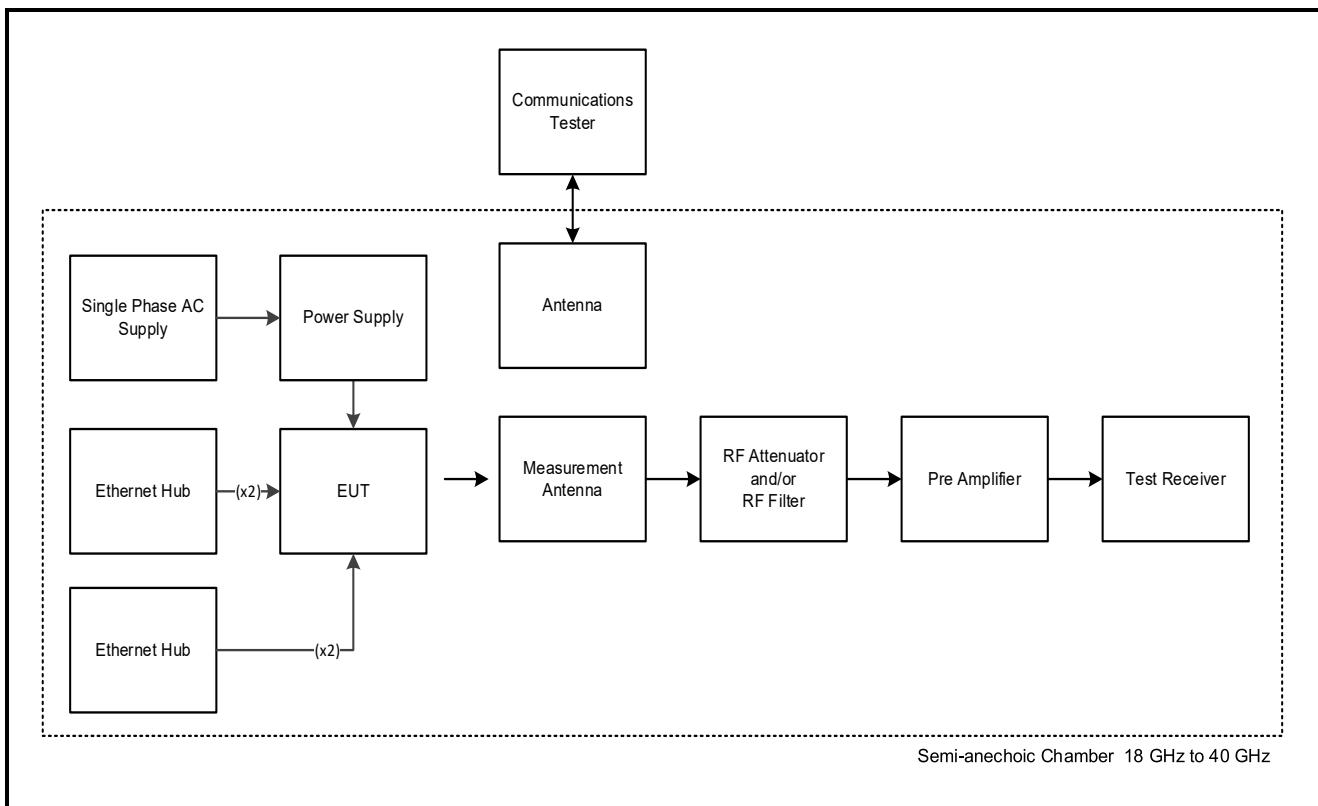
Test Setup Diagrams

Radiated Tests:

Test Setup for Transmitter Radiated Emissions



Test Setup Diagrams (continued)**Test Setup for Transmitter Radiated Emissions (continued)**

Test Setup Diagrams (continued)**Test Setup for Transmitter Radiated Emissions (continued)**

4 Radiated Test Results

4.1 Transmitter Out of Band Radiated Emissions – 5 GHz WLAN / UMTS Band II

Test Summary:

Test Engineers:	Mark Perry & Mohamed Toubella	Test Dates:	05 November 2021 to 07 November 2021
Test Sample Serial Number:	00125152820170100213		

FCC Reference:	Parts 2.1053, 15.209(a), 15.407(b) & 24.238(a)
Test Method Used:	KDB 971168 Section 6 referencing ANSI C63.26 Section 5.7, KDB 789033 II.G. & ANSI C63.10 Sections 6.3, 6.4, 6.5 and 6.6
Frequency Range	9 kHz to 40 GHz

Environmental Conditions:

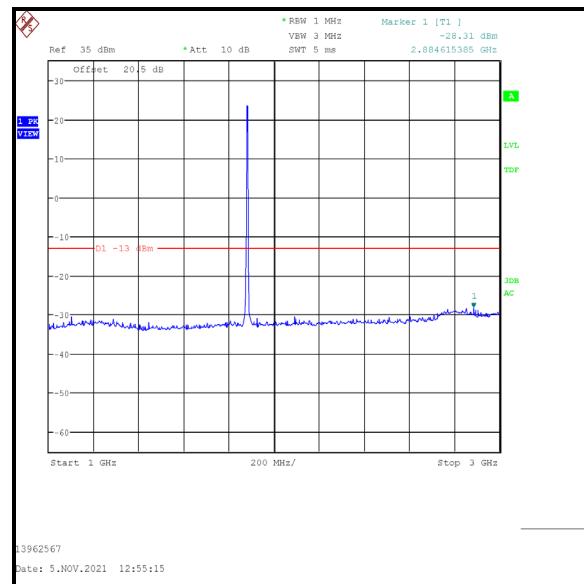
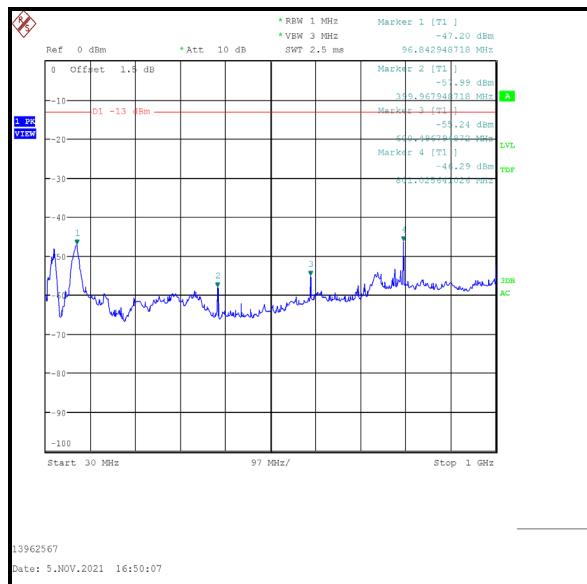
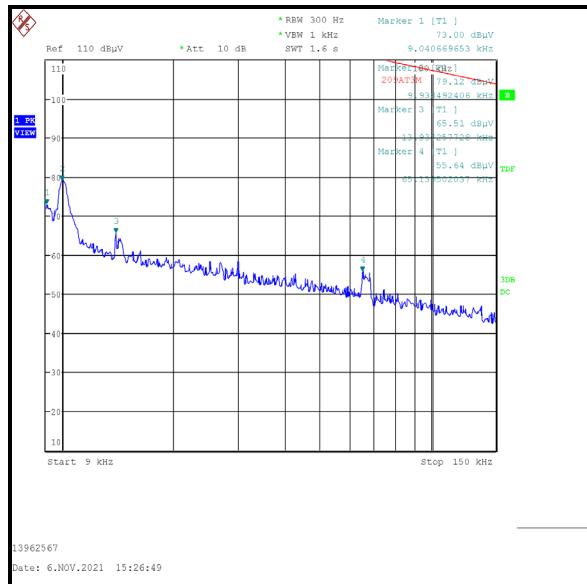
Temperature (°C):	21 to 22
Relative Humidity (%):	39 to 43

Note(s):

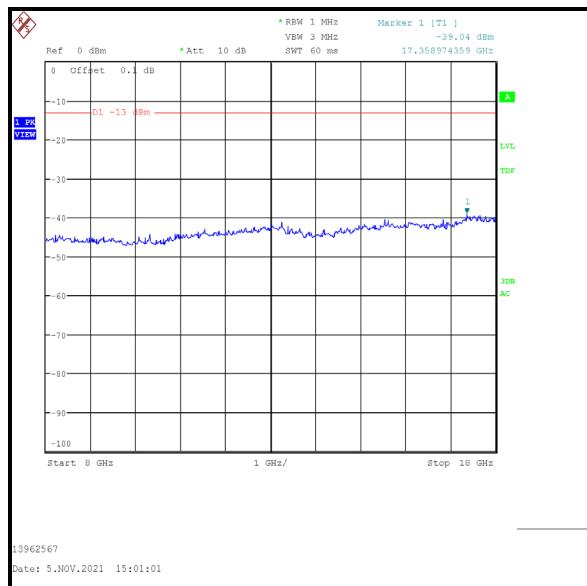
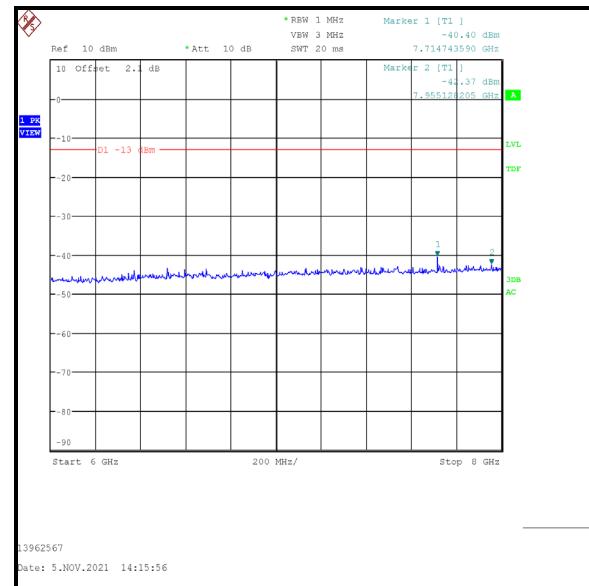
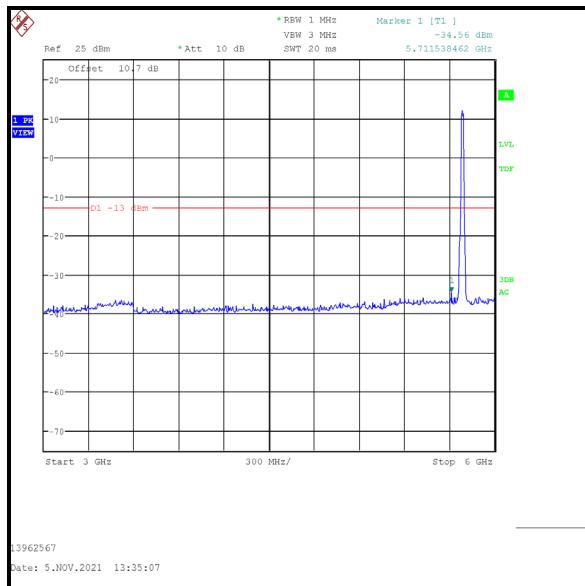
1. All emissions and intermodulation products shown on the pre-scans were investigated and found to be ambient, or > 20 dB below the appropriate limit or below the noise floor of the measurement system.
2. The uplink UMTS Band II traffic channel is shown on the 1 GHz to 3 GHz plot.
3. The 5 GHz uplink is shown on the 3 GHz to 6 GHz plot.
4. Measurements were made using appropriate RF attenuators and filters where required.
5. For measurements above 30 MHz, the resolution bandwidth was set 1 MHz and video bandwidth 3 MHz, with the sweep time set to auto. A peak detector and trace mode of Max Hold were used to perform pre-scans, with markers placed on the highest measured levels.
6. Measurements below 30 MHz were performed in a semi-anechoic chamber (Asset Number K0001) at 3 metres. The EUT was placed at a height of 80 cm above the reference ground plane in the centre of the chamber turntable. The limit was extrapolated to 3 metres in accordance ANSI C63.10 clause 6.4.3; measurements may be performed at a closer distance and the measured level extrapolated to the specified measurement distance using the method described in clause 6.4.4.2.
7. Measurements from 30 MHz to 1 GHz were performed in a semi-anechoic chamber (Asset Number K0001) at a distance of 3 metres. The EUT was placed at a height of 80 cm above the reference ground plane in the centre of the chamber turntable. Maximum emission levels were determined by height searching the measurement antenna over the range 1 metre to 4 metres.
8. Pre-scans above 1 GHz were performed in a fully-anechoic chamber (Asset Number K0001) at a distance of 3 metres. The EUT was placed at a height of 1.5 metres above the test chamber floor in the centre of the chamber turntable. Maximum emission levels were determined by height searching the measurement antenna over the range 1 metre to 4 metres.

Transmitter Out of Band Radiated Emissions – 5 GHz WLAN / UMTS Band II (continued)**Results: UMTS Band II Middle Channel / WLAN Middle Channel**

Emission Frequency (MHz)	Emission Level (dBm)	Applicable Limit (dBm)	Margin (dB)	Result
See Note 1				



Transmitter Out of Band Radiated Emissions – 5 GHz WLAN / UMTS Band II (continued)



4.2 Transmitter Out of Band Radiated Emissions – 5 GHz WLAN / UMTS Band IV

Test Summary:

Test Engineers:	Mark Perry & Mohamed Toubella	Test Dates:	05 November 2021 to 07 November 2021
Test Sample Serial Number:	00125152820170100213		

FCC Reference:	Parts 2.1053, 15.209(a), 15.407(b) & 27.53(h)(1)
Test Method Used:	KDB 971168 Section 6 referencing ANSI C63.26 Section 5.7, KDB 789033 II.G. & ANSI C63.10 Sections 6.3, 6.4, 6.5 and 6.6
Frequency Range	9 kHz to 40 GHz

Environmental Conditions:

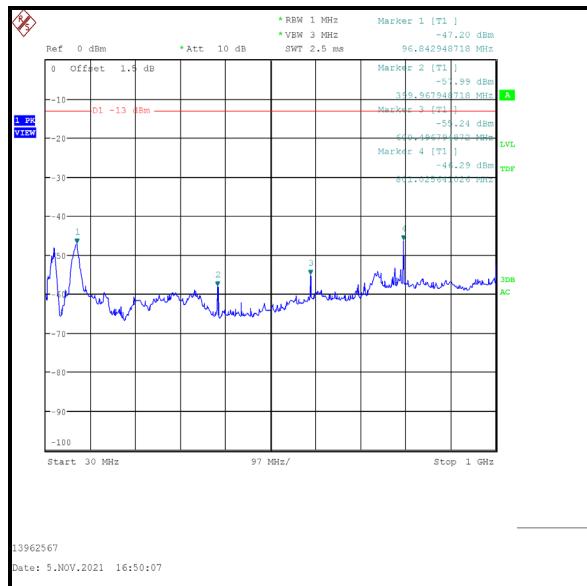
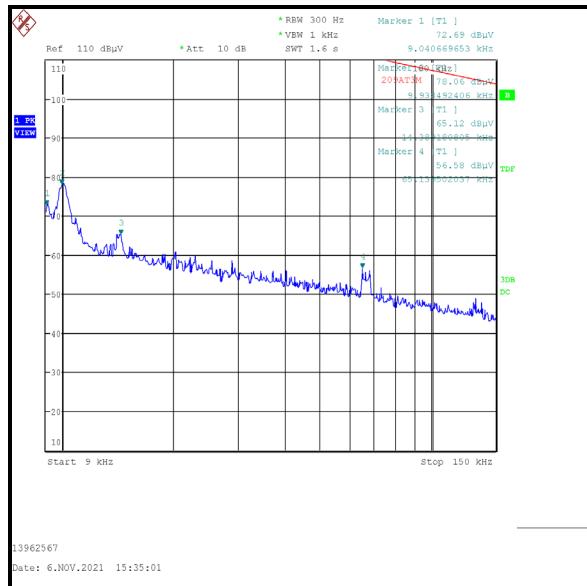
Temperature (°C):	21 to 22
Relative Humidity (%):	39 to 43

Note(s):

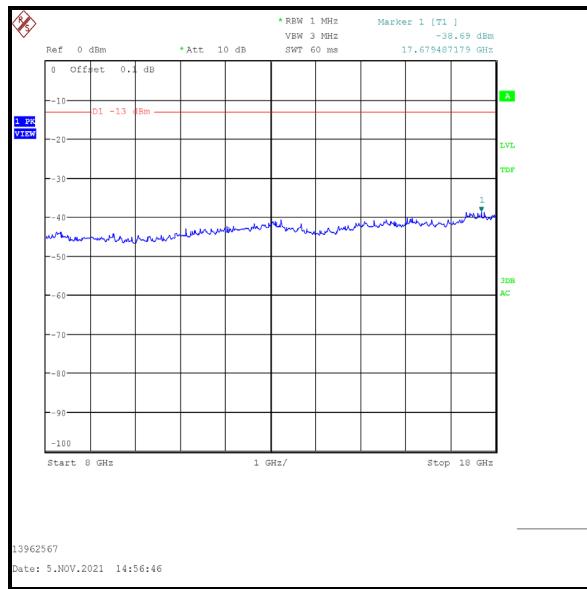
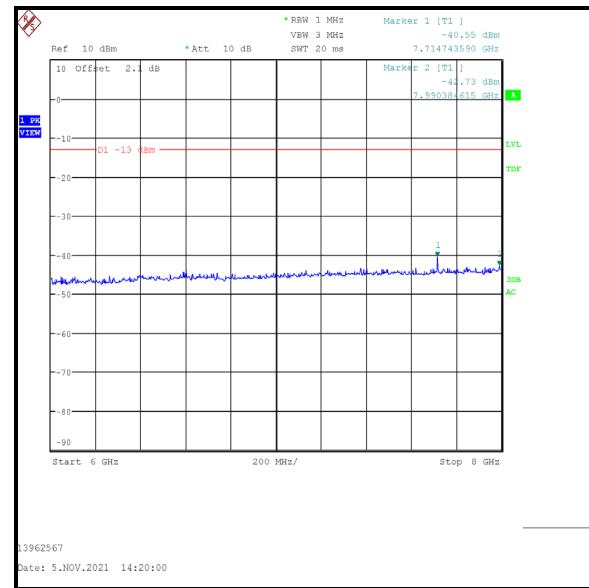
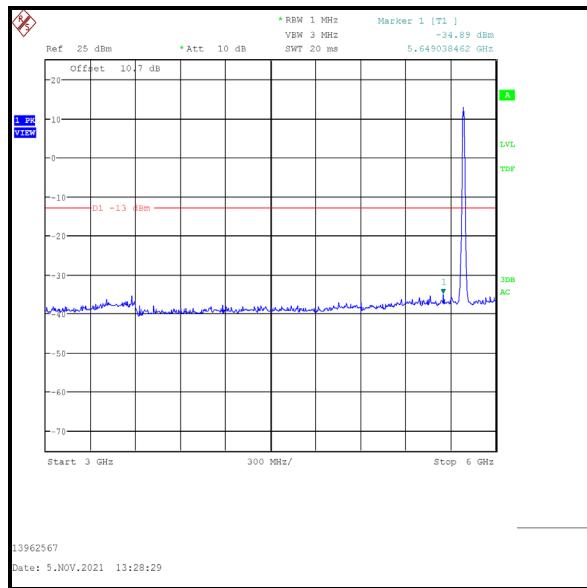
1. All emissions and intermodulation products shown on the pre-scans were investigated and found to be ambient, or > 20 dB below the appropriate limit or below the noise floor of the measurement system.
2. The uplink UMTS Band IV traffic channel is shown on the 1 GHz to 3 GHz plot.
3. The 5 GHz uplink is shown on the 3 GHz to 6 GHz plot.
4. Measurements were made using appropriate RF attenuators and filters where required.
5. For measurements above 30 MHz, the resolution bandwidth was set 1 MHz and video bandwidth 3 MHz, with the sweep time set to auto. A peak detector and trace mode of Max Hold were used to perform pre-scans, with markers placed on the highest measured levels.
6. Measurements below 30 MHz were performed in a semi-anechoic chamber (Asset Number K0001) at 3 metres. The EUT was placed at a height of 80 cm above the reference ground plane in the centre of the chamber turntable. The limit was extrapolated to 3 metres in accordance ANSI C63.10 clause 6.4.3; measurements may be performed at a closer distance and the measured level extrapolated to the specified measurement distance using the method described in clause 6.4.4.2.
7. Measurements from 30 MHz to 1 GHz were performed in a semi-anechoic chamber (Asset Number K0001) at a distance of 3 metres. The EUT was placed at a height of 80 cm above the reference ground plane in the centre of the chamber turntable. Maximum emission levels were determined by height searching the measurement antenna over the range 1 metre to 4 metres.
8. Pre-scans above 1 GHz were performed in a fully-anechoic chamber (Asset Number K0001) at a distance of 3 metres. The EUT was placed at a height of 1.5 metres above the test chamber floor in the centre of the chamber turntable. Maximum emission levels were determined by height searching the measurement antenna over the range 1 metre to 4 metres.

Transmitter Out of Band Radiated Emissions – 5 GHz WLAN / UMTS Band IV (continued)**Results: UMTS Band IV Middle Channel / WLAN Middle Channel**

Emission Frequency (MHz)	Emission Level (dBm)	Applicable Limit (dBm)	Margin (dB)	Result
See Note 1				



Transmitter Out of Band Radiated Emissions – 5 GHz WLAN / UMTS Band IV (continued)



4.3 Transmitter Out of Band Radiated Emissions – 5 GHz WLAN / LTE Band 5

Test Summary:

Test Engineers:	Mark Perry, Jose Bayona & Mohamed Toubella	Test Dates:	18 September 2021 to 06 November 2021
Test Sample Serial Number:	00125152820170100213		

FCC Reference:	Parts 2.1053, 15.209(a), 15.407(b) & 22.917(a)
Test Method Used:	KDB 971168 Section 6 referencing ANSI C63.26 Section 5.7, KDB 789033 II.G. & ANSI C63.10 Sections 6.3, 6.4, 6.5 and 6.6
Frequency Range	9 kHz to 40 GHz

Environmental Conditions:

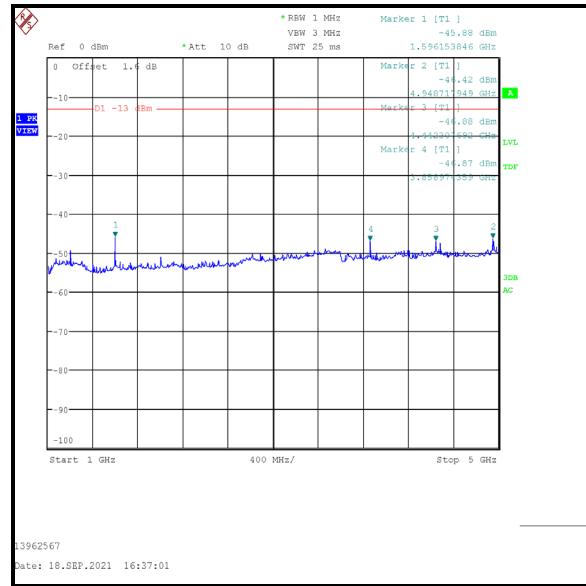
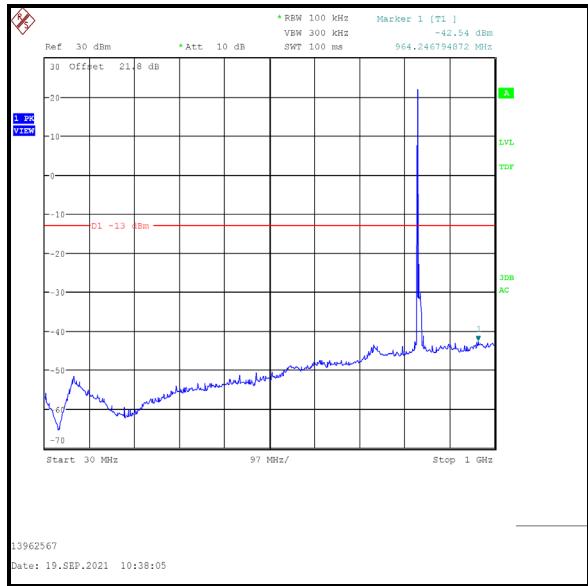
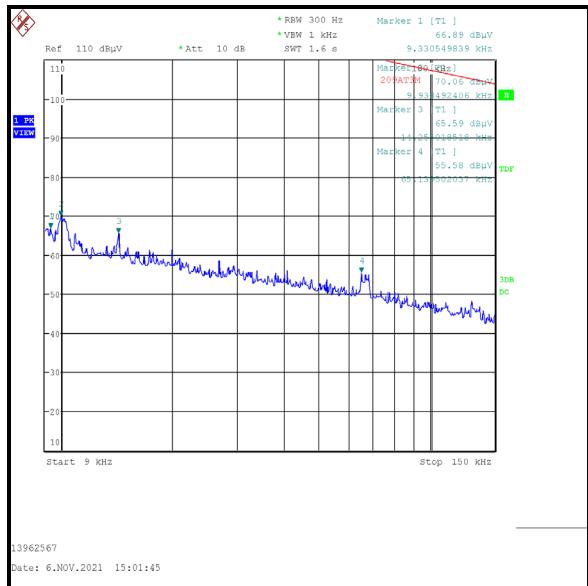
Temperature (°C):	21 to 24
Relative Humidity (%):	39 to 51

Note(s):

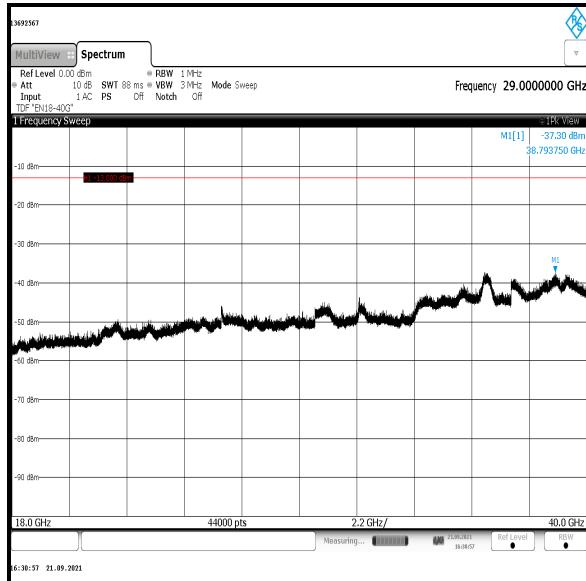
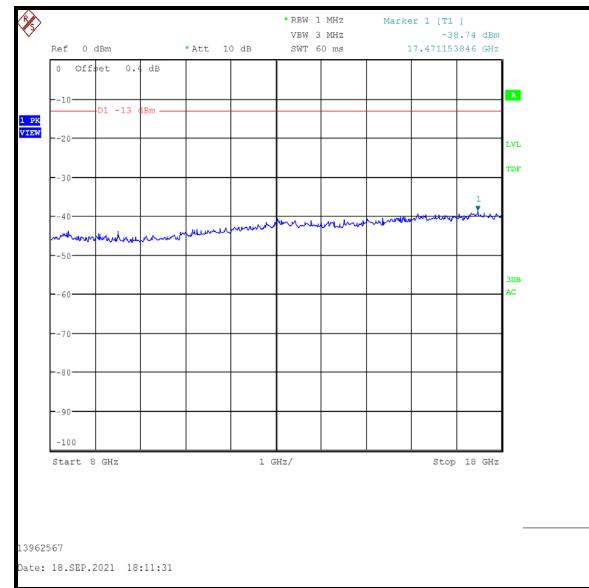
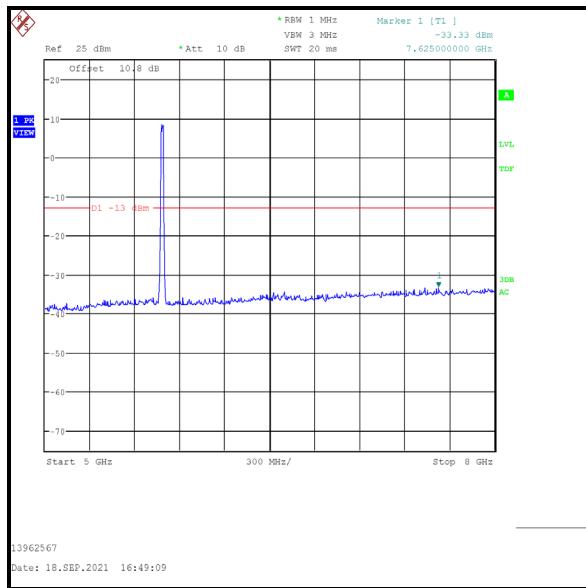
1. All emissions and intermodulation products shown on the pre-scans were investigated and found to be ambient, or > 20 dB below the appropriate limit or below the noise floor of the measurement system.
2. The uplink LTE Band 5 traffic channel is shown on the 30 MHz to 1 GHz plot.
3. The 5 GHz uplink is shown on the 3 GHz to 6 GHz plot.
4. Measurements were made using appropriate RF attenuators and filters where required.
5. The test receiver resolution bandwidth was set 100 kHz and video bandwidth 300 kHz for measurements from 30 MHz to 1 GHz. For measurements above 1 GHz the resolution bandwidth was set to 1 MHz and video bandwidth 3 MHz. The sweep time was set to auto. A peak detector and trace mode of Max Hold were used to perform pre-scans, with markers placed on the highest measured levels.
6. Measurements below 30 MHz were performed in a semi-anechoic chamber (Asset Number K0001) at 3 metres. The EUT was placed at a height of 80 cm above the reference ground plane in the centre of the chamber turntable. The limit was extrapolated to 3 metres in accordance ANSI C63.10 clause 6.4.3; measurements may be performed at a closer distance and the measured level extrapolated to the specified measurement distance using the method described in clause 6.4.4.2.
7. Measurements from 30 MHz to 1 GHz were performed in semi-anechoic chambers (Asset Numbers K0017/K0001) at a distance of 3 metres. The EUT was placed at a height of 80 cm above the reference ground plane in the centre of the chamber turntable. Maximum emission levels were determined by height searching the measurement antenna over the range 1 metre to 4 metres.
8. Pre-scans above 1 GHz were performed in fully-anechoic chambers (Asset Numbers K0017/K0001) at a distance of 3 metres. The EUT was placed at a height of 1.5 metres above the test chamber floor in the centre of the chamber turntable. Maximum emission levels were determined by height searching the measurement antenna over the range 1 metre to 4 metres.

Transmitter Out of Band Radiated Emissions – 5 GHz WLAN / LTE Band 5 (continued)**Results: LTE Band 5 Middle Channel / WLAN Middle Channel**

Emission Frequency (MHz)	Emission Level (dBm)	Applicable Limit (dBm)	Margin (dB)	Result
See Note 1				



Transmitter Out of Band Radiated Emissions – 5 GHz WLAN / LTE Band 5 (continued)



4.4 Transmitter Out of Band Radiated Emissions – 5 GHz WLAN / LTE Band 7

Test Summary:

Test Engineers:	Mark Perry, Jose Bayona & Mohamed Toubella	Test Dates:	20 September 2021 to 06 November 2021
Test Sample Serial Number:	00125152820170100213		

FCC Reference:	Parts 2.1053, 15.209(a), 15.407(b) & 27.53(m)
Test Method Used:	KDB 971168 Section 6 referencing ANSI C63.26 Section 5.7, KDB 789033 II.G. & ANSI C63.10 Sections 6.3, 6.4, 6.5 and 6.6
Frequency Range	9 kHz to 40 GHz

Environmental Conditions:

Temperature (°C):	23 to 24
Relative Humidity (%):	43 to 51

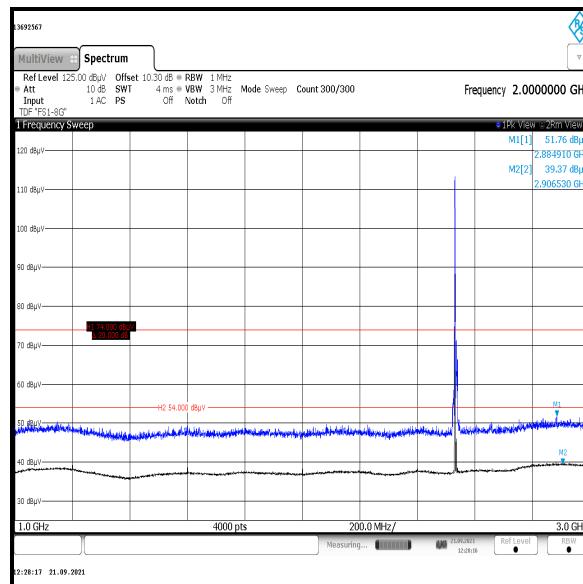
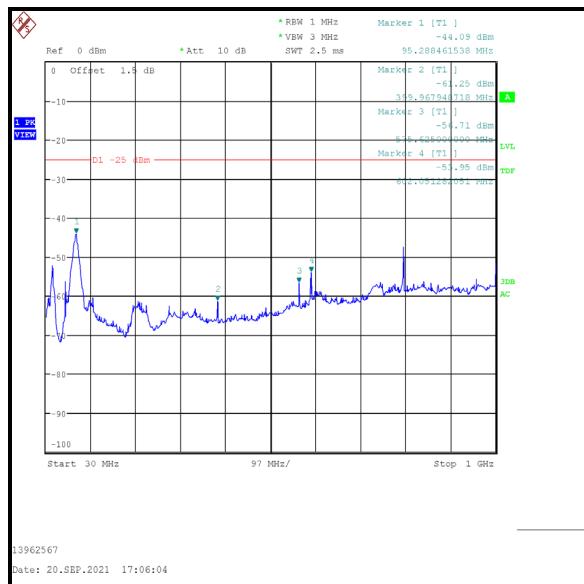
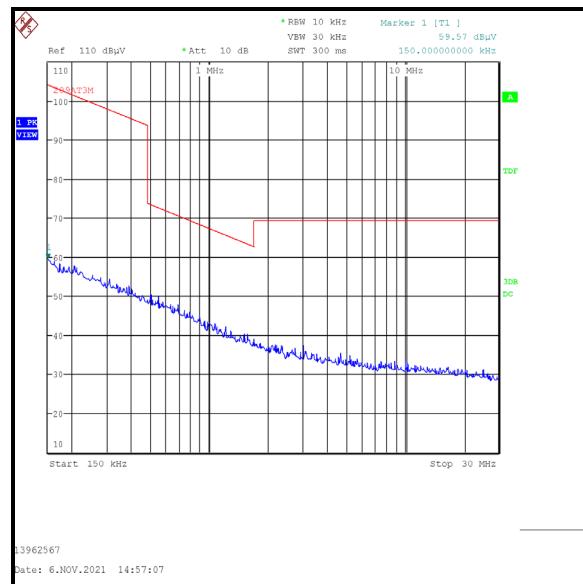
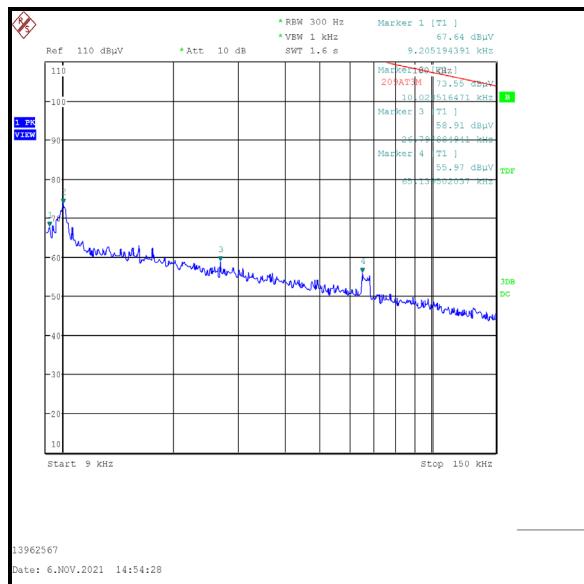
Note(s):

1. The emission shown on the 6 GHz to 8 GHz plot at 7712 MHz was investigated and was found not to be either a harmonic or intermodulation product but related to the 5 GHz WLAN fundamental. The 5 GHz WLAN was further investigated and found to comply with the relevant limits.
2. All other emissions and intermodulation products shown on the pre-scans were investigated and found to be ambient, or > 20 dB below the appropriate limit or below the noise floor of the measurement system.
3. The uplink LTE Band 7 traffic channel is shown on the 1 GHz to 3 GHz plot.
4. The 5 GHz uplink is shown on the 3 GHz to 6 GHz plot.
5. Measurements were made using appropriate RF attenuators and filters where required.
6. Measurements below 30 MHz were performed in a semi-anechoic chamber (Asset Number K0001) at 3 metres. The EUT was placed at a height of 80 cm above the reference ground plane in the centre of the chamber turntable. The limit was extrapolated to 3 metres in accordance ANSI C63.10 clause 6.4.3; measurements may be performed at a closer distance and the measured level extrapolated to the specified measurement distance using the method described in clause 6.4.4.2.
7. Measurements from 30 MHz to 1 GHz were performed in semi-anechoic chambers (Asset Numbers K0017/K0001) at a distance of 3 metres. The EUT was placed at a height of 80 cm above the reference ground plane in the centre of the chamber turntable. Maximum emission levels were determined by height searching the measurement antenna over the range 1 metre to 4 metres.
8. Pre-scans above 1 GHz were performed in fully-anechoic chambers (Asset Numbers K0017/K0001) at a distance of 3 metres. The EUT was placed at a height of 1.5 metres above the test chamber floor in the centre of the chamber turntable. Maximum emission levels were determined by height searching the measurement antenna over the range 1 metre to 4 metres.

Transmitter Out of Band Radiated Emissions – 5 GHz WLAN / LTE Band 7 (continued)

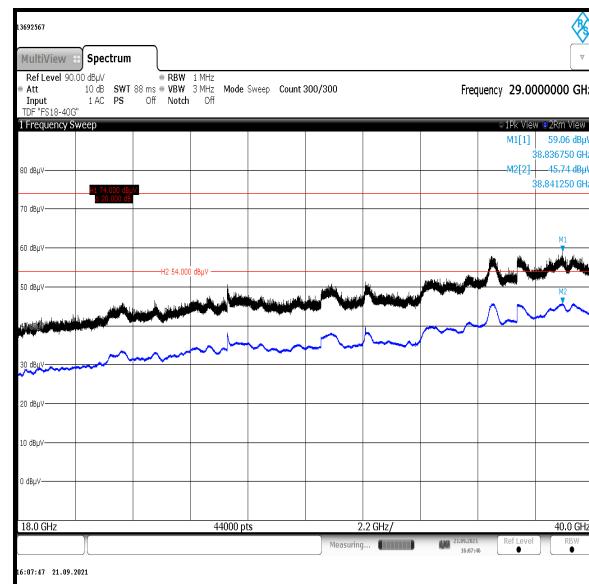
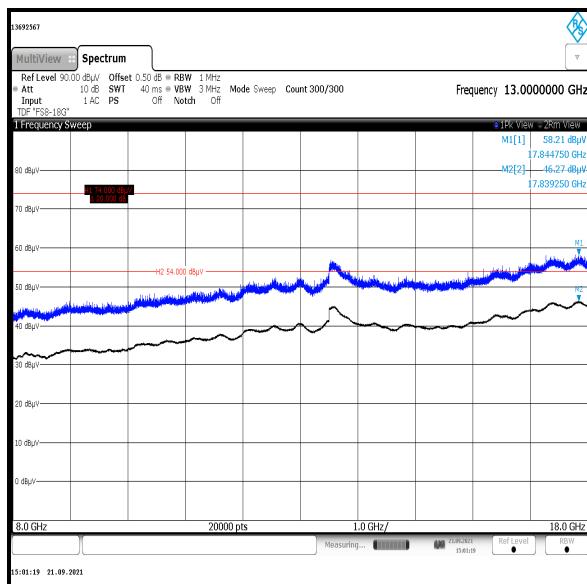
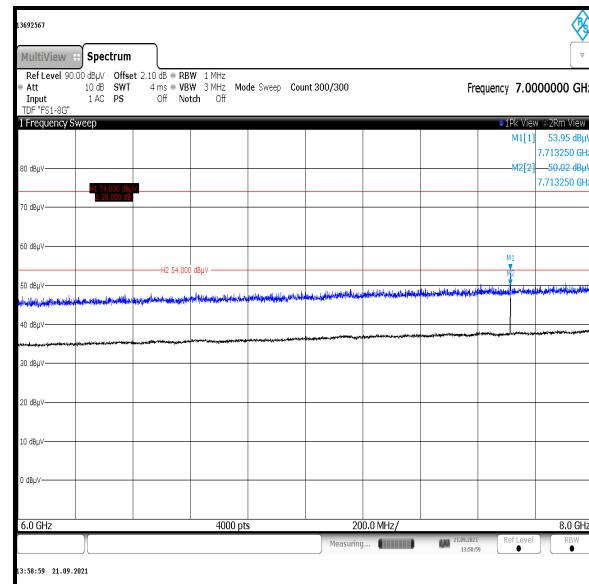
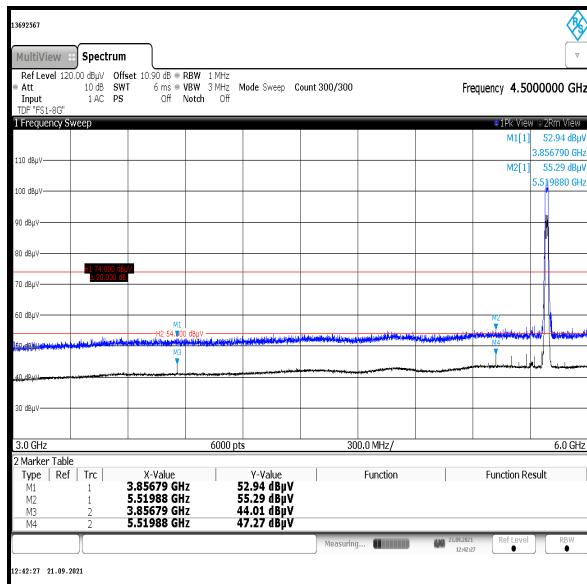
Results: LTE Band 7 Middle Channel / WLAN Middle Channel

Emission Frequency (MHz)	Emission Level (dB μ V/m)	Applicable Limit (dB μ V/m)	Margin (dB)	Result
7712.967	56.2	74.0	17.8	Complied
7713.057	52.6	54.0	1.4	Complied



Note: This plot is a pre-scan and for indication purposes only. For final measurements, see accompanying table.

Transmitter Out of Band Radiated Emissions – 5 GHz WLAN / LTE Band 7 (continued)



Note: This plot is a pre-scan and for indication purposes only. For final measurements, see accompanying table.

4.5 Transmitter Out of Band Radiated Emissions – 5 GHz WLAN / LTE Band 12

Test Summary:

Test Engineers:	Mark Perry, Jose Bayona & Mohamed Toubella	Test Dates:	18 September 2021 to 06 November 2021
Test Sample Serial Number:	00125152820170100213		

FCC Reference:	Parts 2.1053, 15.209(a), 15.407(b) & 27.53(g)
Test Method Used:	KDB 971168 Section 6 referencing ANSI C63.26 Section 5.7, KDB 789033 II.G. & ANSI C63.10 Sections 6.3, 6.4, 6.5 and 6.6
Frequency Range	9 kHz to 40 GHz

Environmental Conditions:

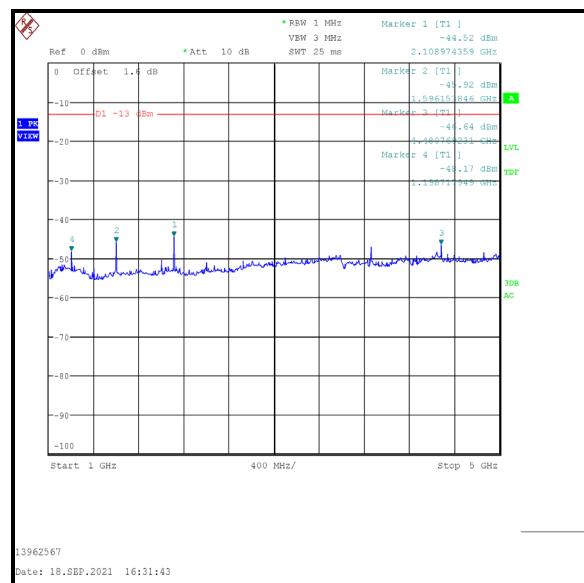
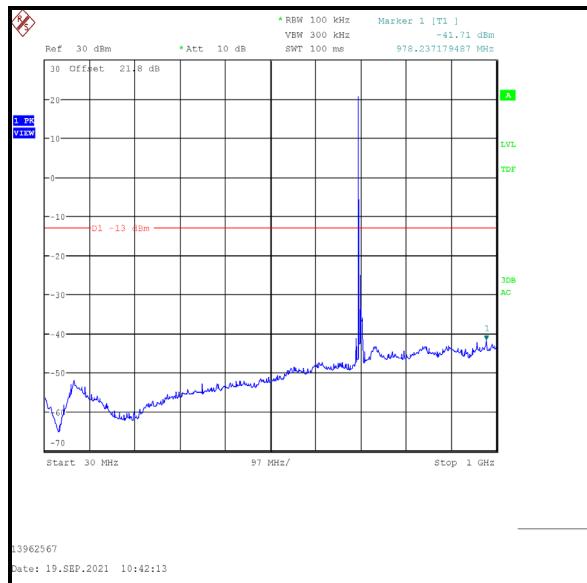
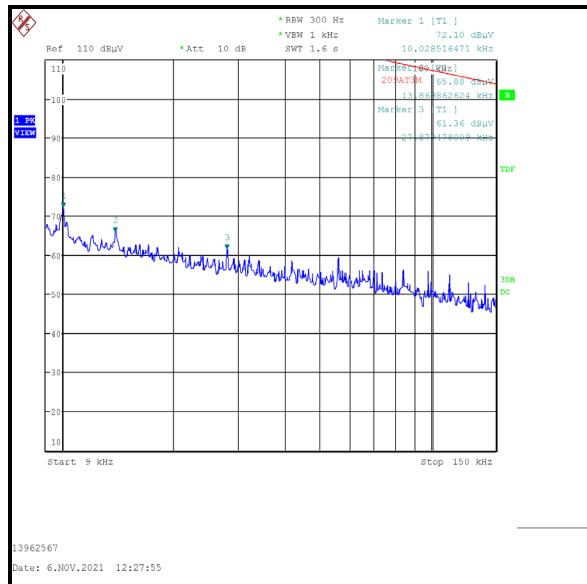
Temperature (°C):	21 to 24
Relative Humidity (%):	39 to 51

Note(s):

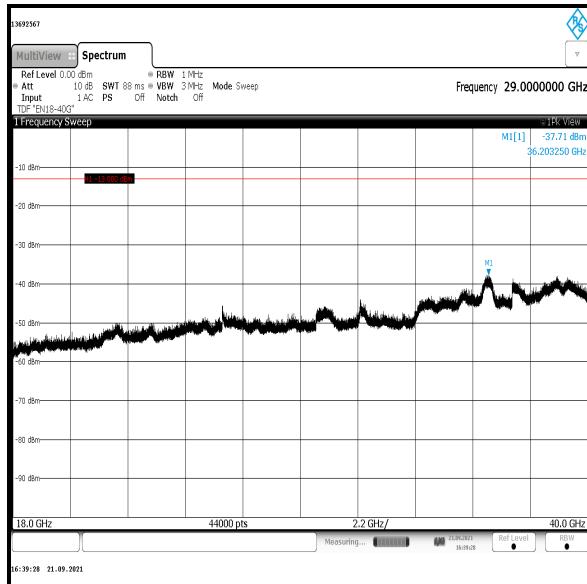
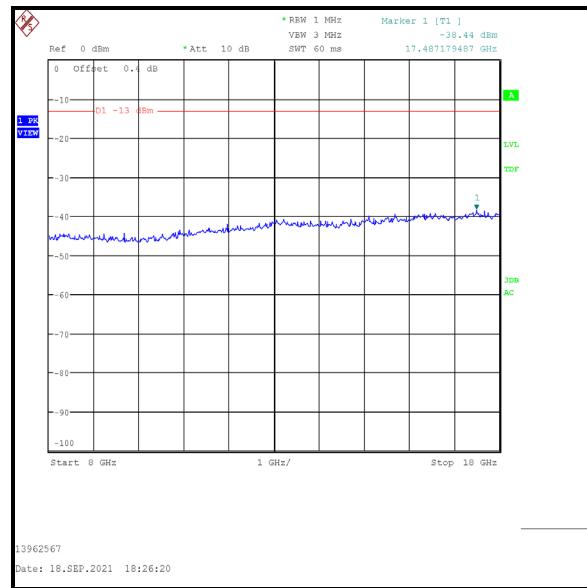
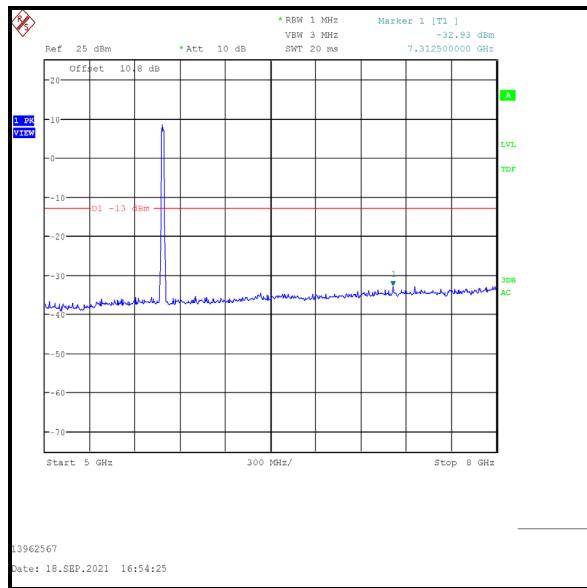
1. All emissions and intermodulation products shown on the pre-scans were investigated and found to be ambient, or > 20 dB below the appropriate limit or below the noise floor of the measurement system.
2. The uplink LTE Band 12 traffic channel is shown on the 30 MHz to 1 GHz plot.
3. The 5 GHz uplink is shown on the 3 GHz to 6 GHz plot.
4. Measurements were made using appropriate RF attenuators and filters where required.
5. The test receiver resolution bandwidth was set 100 kHz and video bandwidth 300 kHz for measurements from 30 MHz to 1 GHz. For measurements above 1 GHz the resolution bandwidth was set to 1 MHz and video bandwidth 3 MHz. The sweep time was set to auto. A peak detector and trace mode of Max Hold were used to perform pre-scans, with markers placed on the highest measured levels.
6. Measurements below 30 MHz were performed in a semi-anechoic chamber (Asset Number K0001) at 3 metres. The EUT was placed at a height of 80 cm above the reference ground plane in the centre of the chamber turntable. The limit was extrapolated to 3 metres in accordance ANSI C63.10 clause 6.4.3; measurements may be performed at a closer distance and the measured level extrapolated to the specified measurement distance using the method described in clause 6.4.4.2.
7. Measurements from 30 MHz to 1 GHz were performed in semi-anechoic chambers (Asset Numbers K0017/K0001) at a distance of 3 metres. The EUT was placed at a height of 80 cm above the reference ground plane in the centre of the chamber turntable. Maximum emission levels were determined by height searching the measurement antenna over the range 1 metre to 4 metres.
8. Pre-scans above 1 GHz were performed in fully-anechoic chambers (Asset Numbers K0017/K0001) at a distance of 3 metres. The EUT was placed at a height of 1.5 metres above the test chamber floor in the centre of the chamber turntable. Maximum emission levels were determined by height searching the measurement antenna over the range 1 metre to 4 metres.

Transmitter Out of Band Radiated Emissions – 5 GHz WLAN / LTE Band 12 (continued)**Results: LTE Band 12 Middle Channel / WLAN Middle Channel**

Emission Frequency (MHz)	Emission Level (dBm)	Applicable Limit (dBm)	Margin (dB)	Result
See Note 1				



Transmitter Out of Band Radiated Emissions – 5 GHz WLAN / LTE Band 12 (continued)



4.6 Transmitter Out of Band Radiated Emissions – 5 GHz WLAN / LTE Band 13

Test Summary:

Test Engineers:	Mark Perry, Jose Bayona & Mohamed Toubella	Test Dates:	18 September 2021 to 06 November 2021
Test Sample Serial Number:	00125152820170100213		

FCC Reference:	Parts 2.1053, 15.209(a), 15.407(b), 27.53(c)(2) & 27.53(f)
Test Method Used:	KDB 971168 Section 6 referencing ANSI C63.26 Section 5.7, KDB 789033 II.G. & ANSI C63.10 Sections 6.3, 6.4, 6.5 and 6.6
Frequency Range	9 kHz to 40 GHz

Environmental Conditions:

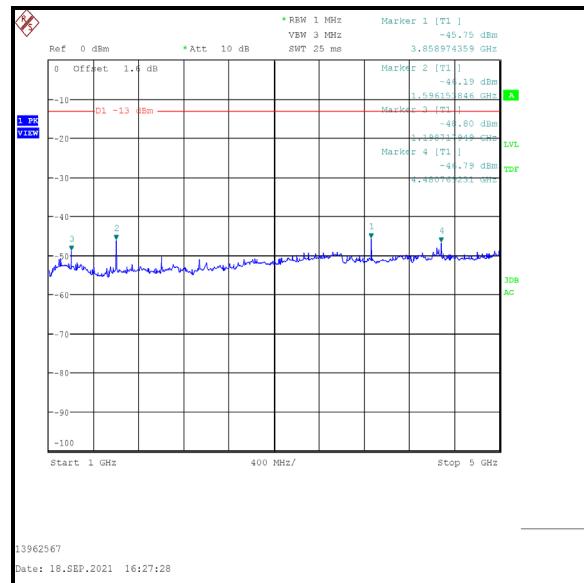
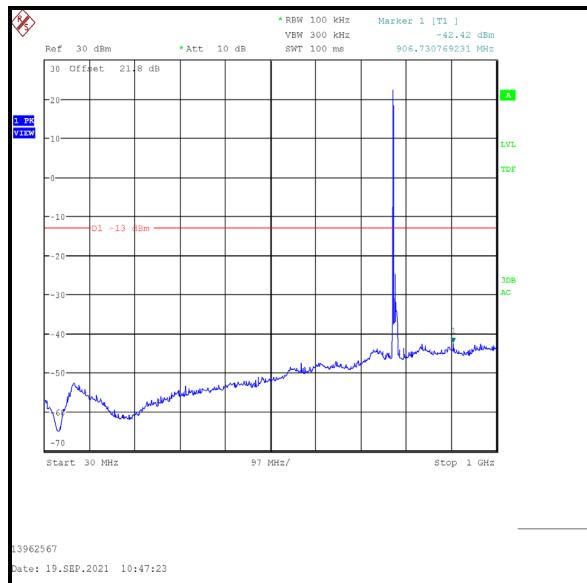
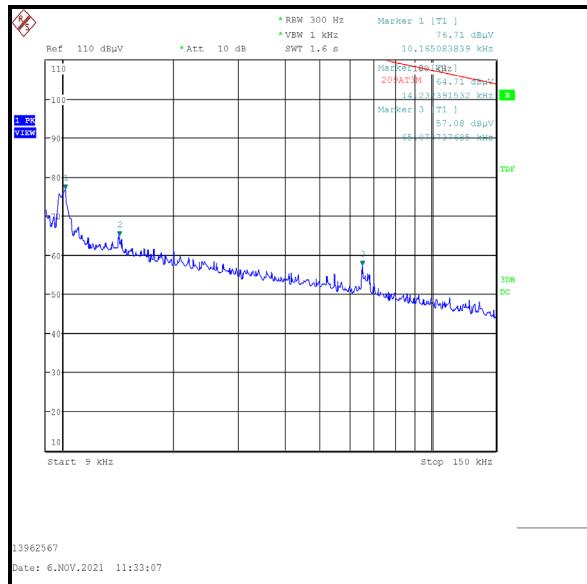
Temperature (°C):	21 to 24
Relative Humidity (%):	39 to 51

Note(s):

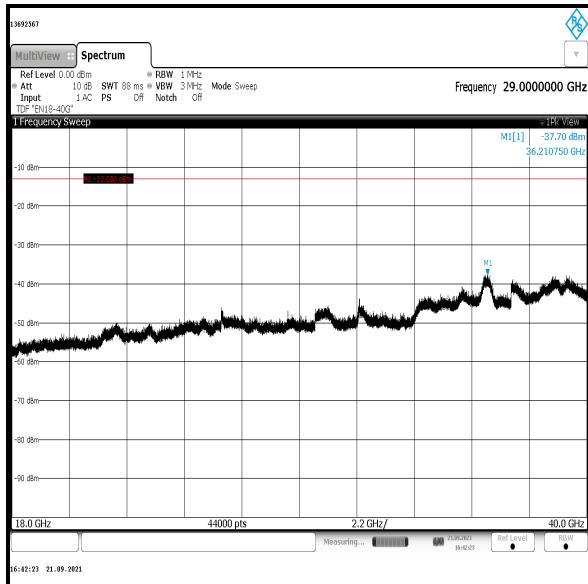
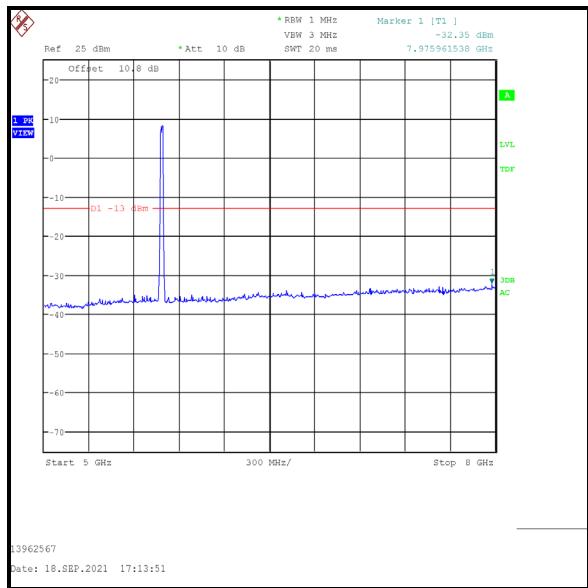
1. All emissions and intermodulation products shown on the pre-scans were investigated and found to be ambient, or > 20 dB below the appropriate limit or below the noise floor of the measurement system.
2. The uplink LTE Band 13 traffic channel is shown on the 30 MHz to 1 GHz plot.
3. The 5 GHz uplink is shown on the 3 GHz to 6 GHz plot.
4. Measurements were made using appropriate RF attenuators and filters where required.
5. The test receiver resolution bandwidth was set 100 kHz and video bandwidth 300 kHz for measurements from 30 MHz to 1 GHz. For measurements above 1 GHz the resolution bandwidth was set to 1 MHz and video bandwidth 3 MHz. The sweep time was set to auto. A peak detector and trace mode of Max Hold were used to perform pre-scans, with markers placed on the highest measured levels.
6. Measurements below 30 MHz were performed in a semi-anechoic chamber (Asset Number K0001) at 3 metres. The EUT was placed at a height of 80 cm above the reference ground plane in the centre of the chamber turntable. The limit was extrapolated to 3 metres in accordance ANSI C63.10 clause 6.4.3; measurements may be performed at a closer distance and the measured level extrapolated to the specified measurement distance using the method described in clause 6.4.4.2.
7. Measurements from 30 MHz to 1 GHz were performed in semi-anechoic chambers (Asset Numbers K0017/K0001) at a distance of 3 metres. The EUT was placed at a height of 80 cm above the reference ground plane in the centre of the chamber turntable. Maximum emission levels were determined by height searching the measurement antenna over the range 1 metre to 4 metres.
8. Pre-scans above 1 GHz were performed in fully-anechoic chambers (Asset Numbers K0017/K0001) at a distance of 3 metres. The EUT was placed at a height of 1.5 metres above the test chamber floor in the centre of the chamber turntable. Maximum emission levels were determined by height searching the measurement antenna over the range 1 metre to 4 metres.
9. In accordance with FCC part 27.53(f), additional plots for 1559 MHz to 1610 MHz are required. Results tables and plots can be seen below.

Transmitter Out of Band Radiated Emissions – 5 GHz WLAN / LTE Band 13 (continued)**Results: LTE Band 13 Middle Channel / WLAN Middle Channel**

Emission Frequency (MHz)	Emission Level (dBm)	Applicable Limit (dBm)	Margin (dB)	Result
See Note 1				



Transmitter Out of Band Radiated Emissions – 5 GHz WLAN / LTE Band 13 (continued)



Transmitter Out of Band Radiated Emissions – 5 GHz WLAN / LTE Band 13 (continued)**Results: 1559 MHz to 1610 MHz / Bottom Channel**

Frequency (MHz)	Level (dBm)	Limit (dBm)	Margin (dB)	Result
1599.947	-49.5	-40.0	9.5	Complied

Results: 1559 MHz to 1610 MHz / Middle Channel

Frequency (MHz)	Peak Level (dBm)	Limit (dBm)	Margin (dB)	Result
1559.654	-65.9	-40.0	22.9	Complied
1599.947	-49.6	-40.0	9.6	Complied

Results: 1559 MHz to 1610 MHz / Top Channel

Frequency (MHz)	Level (dBm)	Limit (dBm)	Margin (dB)	Result
1564.721	-62.5	-40.0	22.5	Complied
1600.029	-49.9	-40.0	9.9	Complied

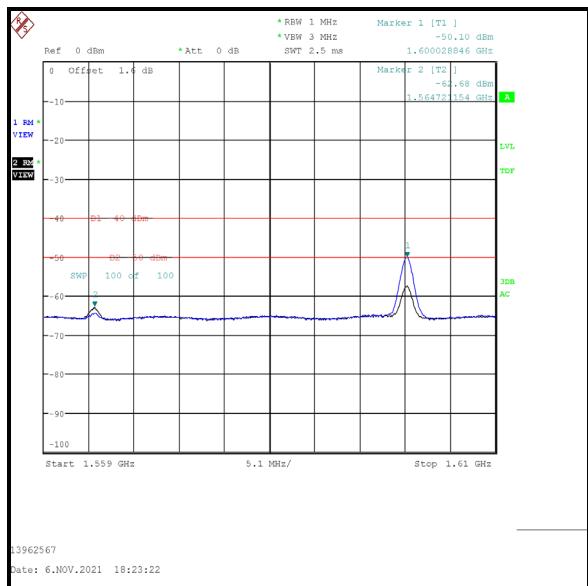
Transmitter Out of Band Radiated Emissions – 5 GHz WLAN / LTE Band 13 (continued)



Bottom Channel



Middle Channel



Top Channel

Note: This plot is a pre-scan and for indication purposes only. For final measurements, see accompanying table.

4.7 Transmitter Out of Band Radiated Emissions – 5 GHz WLAN / LTE Band 48

Test Summary:

Test Engineers:	Mark Perry, Jose Bayona & Mohamed Toubella	Test Dates:	18 September 2021 to 06 November 2021
Test Sample Serial Number:	00125152820170100213		

FCC Reference:	Parts 2.1053, 15.209(a), 15.407(b) & 96.41(e)
Test Method Used:	KDB 971168 Section 6 referencing ANSI C63.26 Section 5.7, KDB 789033 II.G. & ANSI C63.10 Sections 6.3, 6.4, 6.5 and 6.6
Frequency Range	9 kHz to 40 GHz

Environmental Conditions:

Temperature (°C):	21 to 24
Relative Humidity (%):	39 to 51

Note(s):

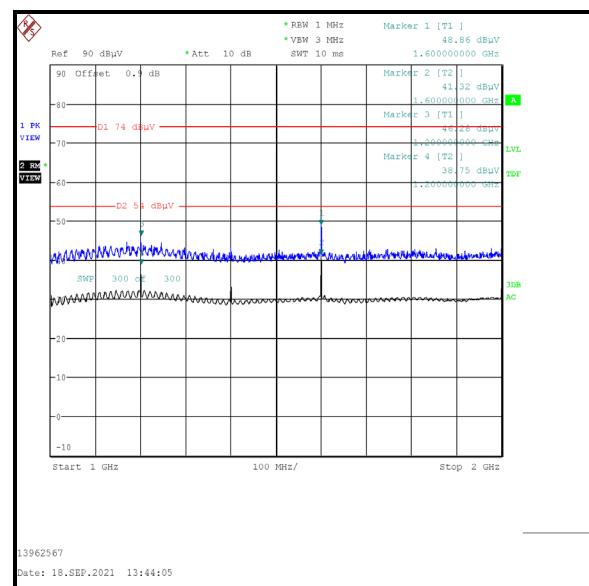
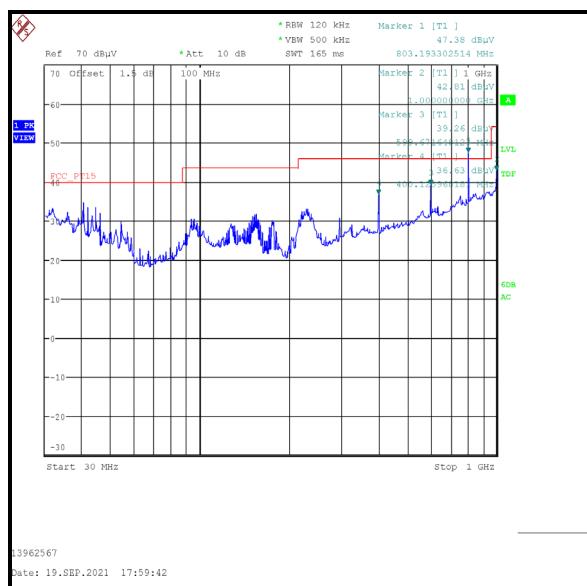
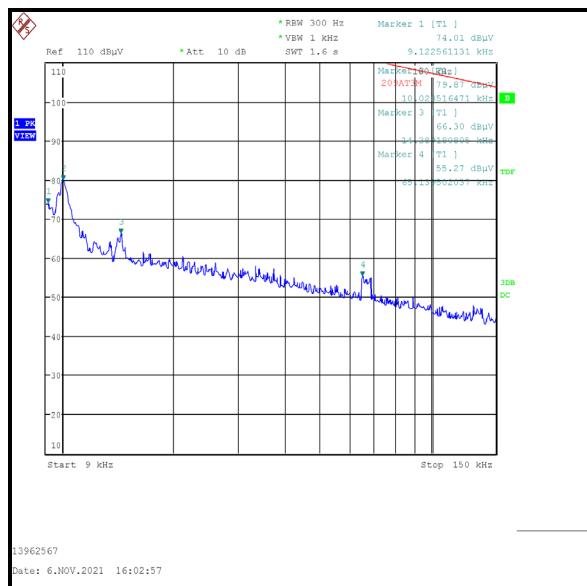
1. The emission shown on the 6 GHz to 8 GHz plot at 7712 MHz was investigated and was found not to be either a harmonic or intermodulation product but related to the 5 GHz WLAN fundamental. The 5 GHz WLAN was further investigated and found to comply with the relevant limits.
2. All other emissions and intermodulation products shown on the pre-scans were investigated and found to be ambient, or > 20 dB below the appropriate limit or below the noise floor of the measurement system.
3. The uplink LTE Band 48 traffic channel is shown on the 5 GHz to 6 GHz plot.
4. The 5 GHz uplink is shown on the 3 GHz to 6 GHz plot.
5. Measurements were made using appropriate RF attenuators and filters where required.
6. The test receiver resolution bandwidth was set 120 kHz and video bandwidth 500 kHz for measurements from 30 MHz to 1 GHz. For measurements above 1 GHz the resolution bandwidth was set to 1 MHz and video bandwidth 3 MHz. The sweep time was set to auto. A peak detector and trace mode of Max Hold were used to perform pre-scans, with markers placed on the highest measured levels.
7. Measurements below 30 MHz were performed in a semi-anechoic chamber (Asset Number K0001) at 3 metres. The EUT was placed at a height of 80 cm above the reference ground plane in the centre of the chamber turntable. The limit was extrapolated to 3 metres in accordance ANSI C63.10 clause 6.4.3; measurements may be performed at a closer distance and the measured level extrapolated to the specified measurement distance using the method described in clause 6.4.4.2.
8. Measurements from 30 MHz to 1 GHz were performed in semi-anechoic chambers (Asset Numbers K0017/K0001) at a distance of 3 metres. The EUT was placed at a height of 80 cm above the reference ground plane in the centre of the chamber turntable. Maximum emission levels were determined by height searching the measurement antenna over the range 1 metre to 4 metres.
9. Pre-scans above 1 GHz were performed in fully-anechoic chambers (Asset Numbers K0017/K0001) at a distance of 3 metres. The EUT was placed at a height of 1.5 metres above the test chamber floor in the centre of the chamber turntable. Maximum emission levels were determined by height searching the measurement antenna over the range 1 metre to 4 metres.

Transmitter Out of Band Radiated Emissions – 5 GHz WLAN / LTE Band 48 (continued)**Results: LTE Band 48 Middle Channel / WLAN Middle Channel / Peak**

Emission Frequency (MHz)	Emission Level (dB μ V/m)	Applicable Limit (dB μ V/m)	Margin (dB)	Result
40.417	31.7	40.0	8.3	Complied
41.793	30.7	40.0	9.3	Complied
44.459	32.1	40.0	7.9	Complied
228.336	30.3	46.0	15.7	Complied
399.984	34.9	46.0	11.7	Complied
599.979	36.0	46.0	10.0	Complied
799.956	45.1	46.0	0.9	Complied
999.962	41.1	54.0	12.9	Complied
3758.308	58.1	74.0	15.9	Complied
5559.300	60.5	68.2	6.7	Complied
5679.605	61.6	68.2	6.6	Complied
5699.040	60.8	68.2	7.4	Complied
5720.000	60.8	68.2	7.4	Complied
7712.790	57.6	74.0	16.4	Complied

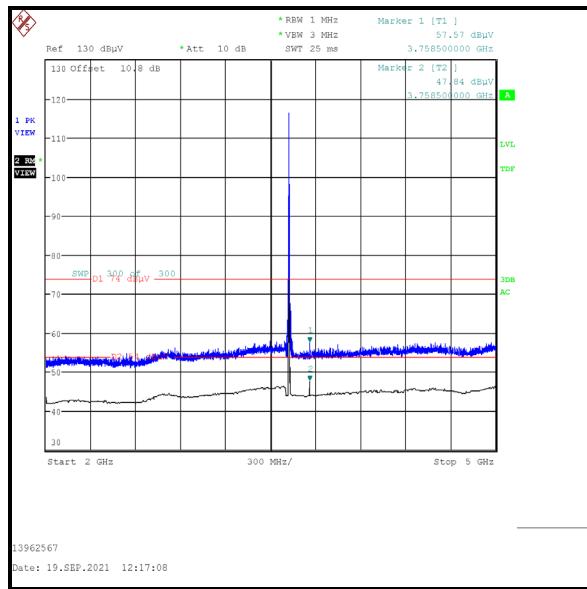
Results: LTE Band 48 Middle Channel / WLAN Middle Channel / Average

Emission Frequency (MHz)	Emission Level (dB μ V/m)	Applicable Limit (dB μ V/m)	Margin (dB)	Result
3758.210	47.5	54.0	6.5	Complied
7712.973	53.4	54.0	0.6	Complied

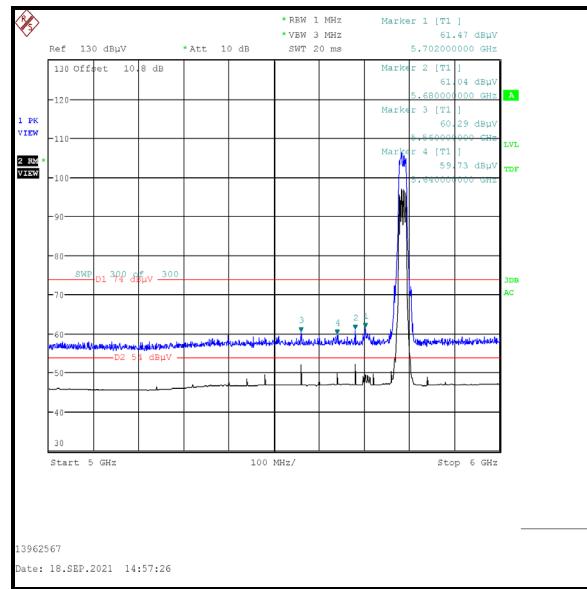
Transmitter Out of Band Radiated Emissions – 5 GHz WLAN / LTE Band 48 (continued)**Results: LTE Band 48 Middle Channel / WLAN Middle Channel**

Note: This plot is a pre-scan and for indication purposes only. For final measurements, see accompanying table.

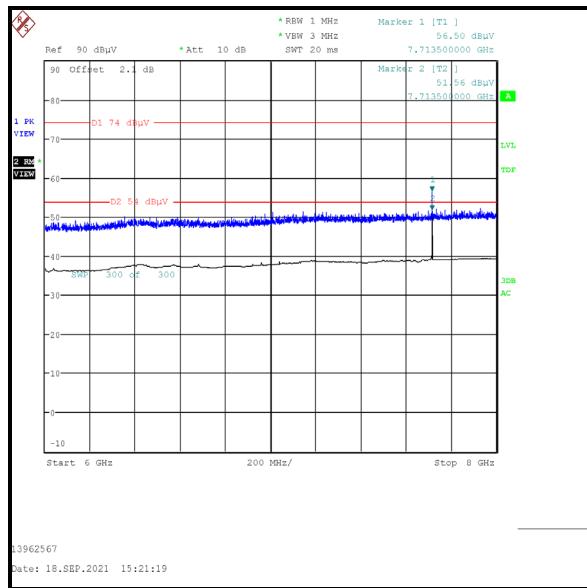
Transmitter Out of Band Radiated Emissions – 5 GHz WLAN / LTE Band 48 (continued)



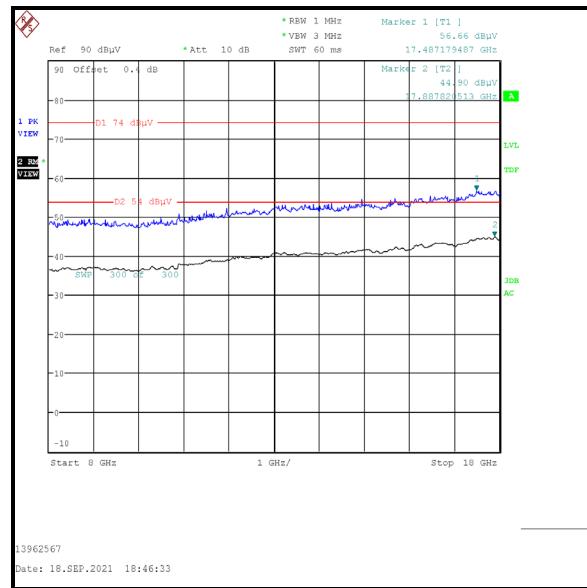
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Date: 19.SEP.2021 12:17:08



13962567
Date: 18.SEP.2021 14:57:26

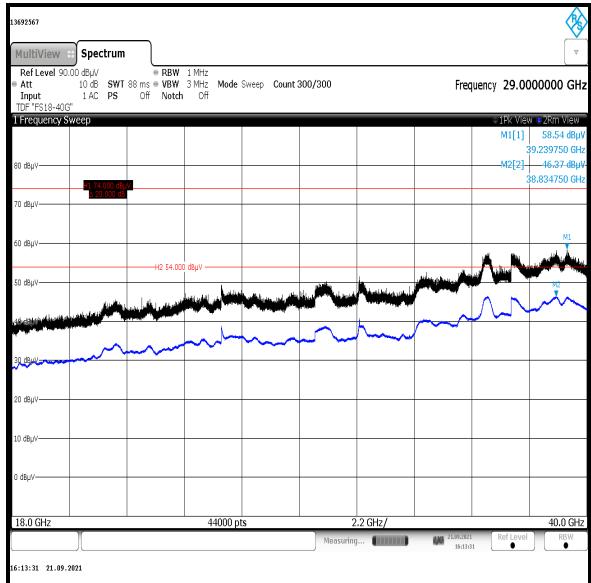


13962567
Date: 18.SEP.2021 15:21:19



13962567
Date: 18.SEP.2021 18:46:33

Note: This plot is a pre-scan and for indication purposes only. For final measurements, see accompanying table.

Transmitter Out of Band Radiated Emissions – 5 GHz WLAN / LTE Band 48 (continued)

Note: This plot is a pre-scan and for indication purposes only. For final measurements, see accompanying table.

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