

Prüfbericht-Nr.: Test report no.:	SE238RII-002	Auftrags-Nr.: Order no.:	0290100320	Seite 1 von 30 Page 1 of 30
Kunden-Referenz-Nr.: Client reference no.:	1288994	Auftragsdatum: Order date:	2022.12.02	
Auftraggeber: Client:	ASSA ABLOY Entrance Systems AB			
Prüfgegenstand: Test item:	Wireless IoT Gateway			
Bezeichnung / Typ-Nr.: Identification / Type no.:	IoT Gateway 2.0, FCC ID: 2A8JO-IOT20A			
Auftrags-Inhalt: Order content:	Accredited Testing			
Prüfgrundlage: Test specification:	FCC 47 CFR Part 22/24/27, ISSED RSS-130/132/133/139 ANSI C63.26: 2015			
Wareneingangsdatum: Date of sample receipt:	2023.03.16			
Prüfmuster-Nr.: Test sample no.:	See section 2.3			
Prüfzeitraum: Testing period:	2023.03.16 – 2024.02.19			
Ort der Prüfung: Place of testing:	Lund, Sweden			
Prüflaboratorium: Testing laboratory:	TÜV Rheinland Sweden			
Prüfergebnis*: Test result*:	Pass			
überprüft von: reviewed by:	X 	genehmigt von: authorized by:	X 	
Datum: 2024.04.15 Date:	Signed by: Maria Nytlun	Datum: 2024.04.15 Date:	Signed by: Hakan Ahlberg	
Stellung / Position:	Test Engineer	Stellung / Position:	Lab Manager	
Sonstiges / Other:				
Zustand des Prüfgegenstandes bei Anlieferung: Condition of the test item at delivery:		Prüfmuster vollständig und unbeschädigt Test item complete and undamaged		
* Legende:	1 = sehr gut P(ass) = entspricht o.g. Prüfgrundlage(n)	2 = gut F(ail) = entspricht nicht o.g. Prüfgrundlage(n)	3 = befriedigend 3 = satisfactory F(ail) = failed a.m. test specification(s)	4 = ausreichend N/A = nicht anwendbar 4 = sufficient N/A = not applicable
* Legend:	1 = very good P(ass) = passed a.m. test specification(s)	2 = good 2 = good	3 = satisfactory 3 = satisfactory	4 = sufficient N/A = not applicable
Dieser Prüfbericht bezieht sich nur auf das o.g. Prüfmuster und darf ohne Genehmigung der Prüfstelle nicht auszugsweise vervielfältigt werden. Dieser Bericht berechtigt nicht zur Verwendung eines Prüfzeichens. <i>This test report only relates to the a. m. test sample. Without permission of the test center this test report is not permitted to be duplicated in extracts.</i>				

Revision History

REVISION	DATE	REMARKS	AUTHOR
001	2024-03-26	First Release	Niall Forrester /Maria Nyltun
002	2024-04-15	Updated version	Maria Nyltun
Note: Latest revision report will replace all previous reports			
This report based on FCC Part 22-24-27 Emissions Template version 1.1			

Summary of Test Results

FCC 47 CFR / ISED Rule Parts*	Test Description	Applicability	Report Section	RESULT	REMARKS
2.1049 / RSS-GEN 6.7	Occupied Bandwidth	YES	4.1	N.P.	
2.1053 / RSS-GEN 6.13	Radiated Spurious Emissions	YES	42	PASS	*See Note 1
2.1051 / RSS-GEN 6.13	Band Edge Compliance / Emission Mask	YES	4.3	PASS	
2.1046 / RSS-GEN 6.12	Maximum Output Power	YES	4.4	N.P.	
KDB 971168 D01 5.7 / -	Peak to Average Ratio	YES	4.5	N.P.	
2.1055 / RSS-GEN 6.11	Frequency Stability	YES	4.6	N.P.	
2.1047 / -	Modulation Characteristics	YES	4.7	N.P.	

* For details of rule parts and test method references per frequency band, see section 3.3

Possible test case verdicts:

- | | |
|--|-----------------------|
| - Test case does not apply to the test object: | N/A |
| - Test object complies with the requirement: | PASS or COMPLIANT |
| - Test object does not meet the requirement: | FAIL or NOT COMPLIANT |
| - Test case not performed on the test object: | N.P. |

Note 1: These measurements are intended to verify the performance of the certified cellular module when placed in the host device. A limited test scope has been applied, covering only certain bands for radiated emissions tests between 30MHz and 18GHz. Other tests have not been performed.

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1. GENERAL INFORMATION

1.1 Test Site

Test Facility:	TÜV Rheinland Sweden AB
Address:	Mobilvägen 10
	223 62 Lund
	Sweden
Swedac Registration Number:	10325
FCC Test Firm Registration Number:	517458
ISED Test Site Registration Number:	24753

1.2 Client Information

Company Name:	ASSA ABLOY Entrance Systems AB
Address:	PO Box 822
	SE-261 27 Landskrona
	Sweden
Contact Person:	Fredrik Brödje
Contact e-Mail / Telephone	fredrik.brodje@assaabloy.com +46 10 47 48 907

2. PRODUCT INFORMATION

2.1 General Description

Model name:	IoT Gateway 2
Manufacturer:	ASSA ABLOY Entrance Systems AB
Model number / Marketing name:	IoT Gateway 2
FCC ID:	2A8JO-IOT20A
IC ID:	-
Description:	Wireless IoT Gateway
Ancillary Equipment:	See section 2.7

2.2 Device Characteristics

Type of Power Supply	DC via Jack or RJ45 connector
Nominal Supply Voltage	24V DC
Supply Voltage Range	5 to 28V DC
Operating Temperature Range	-
Operating Air Humidity Range	-
Highest Internal Frequency Source	2690 MHz

2.3 Test Samples

EUT #	EUT ID	Description	Used For:
1	A003435986-004	Standard sample	Radiated Emissions Conducted RF
2	A003435986-005	Standard sample	Radiated Emissions

2.4 Wireless Technologies and Bands Supported by the EUT

Technology	Band	Frequency Range (Tx)	Evaluation Performed*
Bluetooth Low Energy	2.4 GHz	2402.0 MHz – 2480.0 MHz	N/A
LTE FDD	1	1920.0 MHz – 1980.0 MHz	NO
LTE FDD	2	1840.0 MHz – 1910.0 MHz	YES
LTE FDD	3	1710.0 MHz – 1785.0 MHz	NO
LTE FDD	4	1710.0 MHz – 1755.0 MHz	NO
LTE FDD	5	824.0 MHz – 849.0 MHz	NO
LTE FDD	7	2500.0 MHz – 2570.0 MHz	NO
LTE FDD	8	880.0 MHz – 915.0 MHz	NO
LTE FDD	12	699.0 MHz – 716.0 MHz	YES
LTE FDD	13	777.0 MHz – 787.0 MHz	NO
LTE FDD	18	815.0MHz – 830.0 MHz	NO
LTE FDD	19	830.0 MHz – 845.0 MHz	NO
LTE FDD	20	832.0 MHz – 862.0 MHz	NO
LTE FDD	26	814.0MHz – 849.0 MHz	YES
LTE FDD	28	703.0MHz – 748.0 MHz	NO
LTE TDD	38	2570.0 MHz – 2620.0 MHz	NO
LTE TDD	39	1880.0 MHz – 1920.0 MHz	NO
LTE TDD	40	2300.0 MHz – 2400.0 MHz	NO
LTE TDD	41	2496.0 MHz – 2690.0 MHz	NO

*This statement refers only to this report. Other wireless technologies may be covered by other reports.

2.5 Antenna Information

Technology	Band	Number of Antennas	Antenna Type(s)	Gain
Bluetooth Low Energy	2.4 GHz	1	PCB antenna	2.9 dBi
LTE FDD LTE FDD	5, 8, 12, 13, 18, 19, 20, 26, 28	1	FPC Embedded Antenna	2.9 dBi
LTE FDD LTE TDD	1, 2, 3, 4, 7 38, 39, 40, 41			4.3 dBi

2.6 Wireless Technology Details

Technology*	Band	Modulation Type(s)	No. of Channels	Channel Spacing	FCC Part (ISED PART)
Bluetooth Low Energy	2.4 GHz	GFSK	40	2 MHz	15.247 (RSS-247)
LTE FDD LTE FDD LTE TDD	1, 3, 8, 18, 19, 20, 28 39, 40	QPSK 16-QAM 64-QAM 256-QAM	According to LTE specs	According to LTE specs	N/A
LTE FDD	5	QPSK 16-QAM 64-QAM 256-QAM	According to LTE specs	According to LTE specs	22 (RSS-132)
LTE FDD	2	QPSK 16-QAM 64-QAM 256-QAM	According to LTE specs	According to LTE specs	24 (RSS-133)
LTE FDD	4	QPSK 16-QAM 64-QAM 256-QAM	According to LTE specs	According to LTE specs	27 (RSS-139)
LTE FDD	12, 13	QPSK 16-QAM 64-QAM 256-QAM	According to LTE specs	According to LTE specs	27 RSS-130
LTE FDD LTE TDD	7 38	QPSK 16-QAM 64-QAM 256-QAM	According to LTE specs	According to LTE specs	27 RSS-199
LTE TDD	41	QPSK 16-QAM 64-QAM 256-QAM	According to LTE specs	According to LTE specs	27 (-)
LTE FDD	26	QPSK 16-QAM 64-QAM 256-QAM	According to LTE specs	According to LTE specs	22, 90 (RSS-132)

*Note: No simultaneous transmissions for BLE and LTE.

2.7 Ancillary Equipment

A003435986-001	Assa Abloy 1007773 Control Unit
A003435986-002	Phihong PSM050-320A Switching Power Supply

2.8 EUT Diagrams

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3. TEST METHODS

3.1 Test Standards

Testing was performed according to the following standards / references

Standard	Version	Description
FCC 47 CFR 22	-	Public Mobile Services [824MHz–849MHz, 869MHz–894MHz]
FCC 47 CFR 24	-	Personal Communications Services [1850MHz–1915MHz, 1930MHz–1995MHz]
FCC 47 CFR 27	-	Miscellaneous Wireless Communications Services [617-652MHz, 663-758MHz, 775-788MHz, 805-806MHz] [897.5-900.5MHz, 936.5-939.5MHz, 1390-1395MHz, 1432-1435MHz] [1670-1675MHz, 1695-1780MHz, 2000-2020MHz, 2110-2200MHz] [2305-2320MHz, 2345-2360MHz, 2496-2690MHz] [3450-3550MHz, 3700-3980MHz]
ISED RSS-130	Issue 2	Equipment Operating in the Frequency Bands 617-652 MHz, 663-698 MHz, 698-756 MHz and 777-787 MHz
ISED RSS-132	Issue 4	Cellular Systems Operating in the Bands 824-849 MHz and 869-894 MHz
ISED RSS-133	Issue 6 Amendment 1	2 GHz Personal Communications Services [1850MHz – 1915MHz, 1930MHz – 1995MHz]
ISED RSS-139	Issue 4	Advanced Wireless Services Equipment Operating in the Bands 1710-1780 MHz and 2110-2200 MHz

3.2 Additional references

The following standards / references were also considered for the testing

Standard	Version	Description
ANSI C63.26	2015	American National Standard for Compliance Testing of Transmitters Used in Licensed Radio Services
ISED RSS-GEN	Issue 5	General Requirements for Compliance of Radio Apparatus

3.3 Limits

FCC 47 CFR Part		2.1049	2.1053	2.1051
ISED Part		(RSS-GEN 6.7)	(RSS-GEN 6.13)	(RSS-GEN 6.13)
Band	FCC Part (ISED Part)	Occupied Bandwidth	Radiated Spurious Emissions	Band Edge Compliance / Emission Mask
GSM 850 UMTS B5 LTE FDD 5	Part 22 (RSS-132)	-	22.917(a) (RSS-132 5.5)	22.917(a) (RSS-132 5.5)
GSM 1900 UMTS B2 LTE FDD 2, 25, 35, 36	Part 24 (RSS-133)	-	24.238(a) (RSS-133 6.5)	24.238(b) (RSS-133 6.5)
UMTS B4 LTE FDD 4, 10, 66	Part 27 (RSS-139)	-	27.53(h)(1) (RSS-139 5.6)	27.53(h)(1) (RSS-139 5.6)
LTE FDD 7 LTE TDD 38	Part 27 (RSS-199)	-	27.53(m)(4) (RSS-139 4.5)	27.53(m)(4) (RSS-139 4.5)
LTE FDD 12, 17, 71, 85	Part 27 (RSS-130)	-	27.53(g) (RSS-130 4.7)	27.53(g) (RSS-130 4.7)
LTE FDD 13	Part 27 (RSS-130)	-	27.53(c) (RSS-130 4.7)	27.53(c) (RSS-130 4.7)
LTE FDD 26	Part 22 Part 90 (-)	-	22.917(a), 90.691 (-)	22.917(a), 90.691 (-)
LTE FDD 30	Part 27 (RSS-195)	-	27.53(a) (RSS-195 5.6)	27.53(a) (RSS-195 5.6)
LTE TDD 41	Part 27 (-)	-	27.53(m)(4) (-)	27.53(m)(4) (-)
LTE TDD 48	Part 96 (RSS-192) (RSS-197)	- RSS-197 5.2	96.41(e) (RSS-192 5.6) (RSS-197 5.7)	96.41(e) (RSS-192 5.6) (RSS-197 5.7)
LTE FDD 70	Part 27 (-)	-	27.53(h)(1) (-)	27.53(h)(1) (-)

FCC 47 CFR Part		2.1046	-	2.1055	2.1047
ISED Part		RSS-GEN 6.12	-	RSS-GEN 6.11	-
Band	FCC Part (ISED Part)	Maximum Output Power	Peak to Average Ratio	Frequency Stability	Modulation Characteristics
GSM 850 UMTS B5 LTE FDD 5	Part 22 (RSS-132)	22.913(a) (RSS-132 5.4)	22.913(d) (RSS-132 5.4)	22.355 (RSS-132 5.3)	2.1047 (-)
GSM 1900 UMTS B2 LTE FDD 2, 25, 35, 36	Part 24 (RSS-133)	24.232(c) (SRSP-510 5.1)	24.232(d) (RSS-133 6.4)	24.235 (RSS-133 6.3)	2.1047 (-)
UMTS B4 LTE FDD 4, 10, 66	Part 27 (RSS-139)	27.50(d)(4) (RSS-139 5.5)	27.50(d)(5) (RSS-139 5.5)	27.54 (RSS-139 5.4)	2.1047 (-)
LTE FDD 7 LTE TDD 38	Part 27 (RSS-199)	27.50(h)(2) (RSS-139 4.4)	- (RSS-139 4.4)	27.54 (RSS-199 4.3)	2.1047 (-)
LTE FDD 12, 17, 71, 85	Part 27 (RSS-130)	27.50(c)(10) (RSS-130 4.6)	- (RSS-130 4.6)	27.54 (RSS-130 4.5)	2.1047 (-)
LTE FDD 13	Part 27 (RSS-130)	27.50(b)(10) (RSS-130 4.6)	- (RSS-130 4.6)	27.54 (RSS-130 4.5)	2.1047 (-)
LTE FDD 26	Part 22 Part 90 (RSS-132)	22.913(a), 90.635(b) (-)	22.913(d) (-)	22.355, 90.213 (-)	2.1047 (-)
LTE FDD 30	Part 27 (RSS-195)	27.50(a)(3) (RSS-195 5.5)	- (RSS-195 5.5)	27.54 (RSS-195 5.4)	2.1047 (-)
LTE TDD 41	Part 27 (-)	27.50(h)(2) (-)	-	27.54 (-)	2.1047 (-)
LTE TDD 48	Part 96 (RSS-192) (RSS-197)	96.41(b) (RSS-192 5.5) (RSS-197 5.6)	96.41(g) (RSS-192 5.5)	- (RSS-192 5.4) (RSS-197 5.3)	2.1047 (-)
LTE FDD 70	Part 27 (-)	27.50(d)(4) (-)	27.50(d)(5) (-)	27.54 (-)	2.1047 (-)

Interpretation of the measurement results has been performed in accordance with ANSI C63.26 section A.2.9.2

Compliance with the requirements has been based on the results of the measurements compared to the specified limits, not taking into account measurement instrumentation uncertainty.

Measurement Uncertainty figures are stated in section 6

3.4 Description of Test Methods and Equipment Setup

3.4.1 General Description

Testing was performed in accordance with the various requirements of ANSI C63.26. Any deviations from the test methods are described in section 3.7

Where different arrangements of equipment were used for different types of measurements, these are tabulated in section 3.4.2 and details of each arrangement are included in subsequent sections

3.4.2 Test Equipment Setup Used by Test Type

FCC 47 CFR / ISED Rule Parts*	Test Description	Test Equipment Used
2.1049 / RSS-GEN 6.7	Occupied Bandwidth	N.P.
2.1053 / RSS-GEN 6.13	Radiated Spurious Emissions	SAC 5
2.1051 / RSS-GEN 6.13	Band Edge Compliance / Emission Mask	CTE
2.1046 / RSS-GEN 6.12	Maximum Output Power	N.P.
KDB 971168 D01 5.7 / -	Peak to Average Ratio	N.P.
2.1055 / RSS-GEN 6.11	Frequency Stability	N.P.
2.1047 / -	Modulation Characteristics	N.P.

* For details of rule parts and test method references per frequency band, see section 3.3

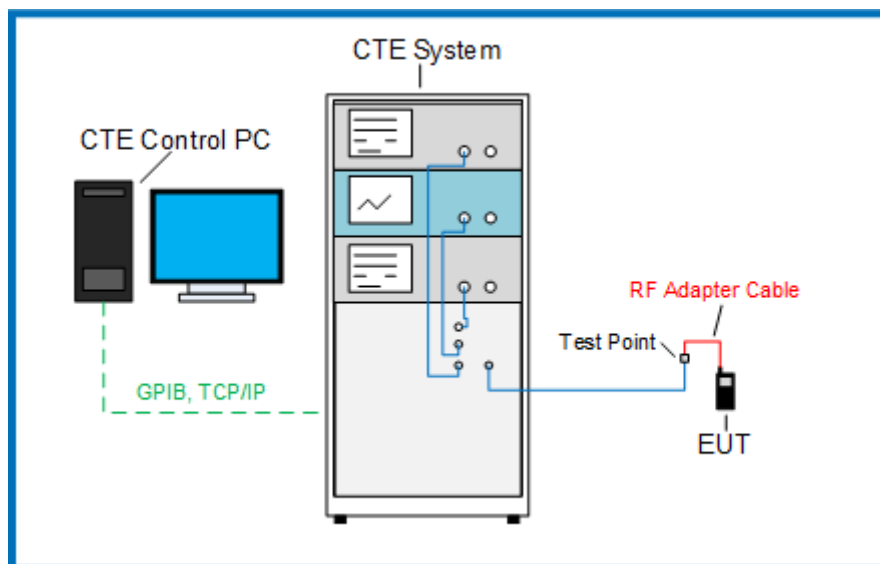
3.4.3 Test Equipment Setup – CTE System

The Comprehensive Test Environment (CTE) system consists of a number of instruments (see section) mounted in a rack together with automated relays and interconnecting hardware. The instruments and other equipment are controlled from a standard PC running software provided by the manufacturer. The RF output of the EUT is connected to the test system via a coaxial cable.

Tests are in the form of pre-defined scripts that can be loaded on the PC. The scripts, as well as the hardware setup, have been verified for conformance with the relevant test specifications.

Losses in the cables and interconnects have been measured using the system's own automated routines and are compensated for automatically. Any additional loss in RF adapter cables supplied together with the EUT can be compensated for using the known characteristics of that adapter.

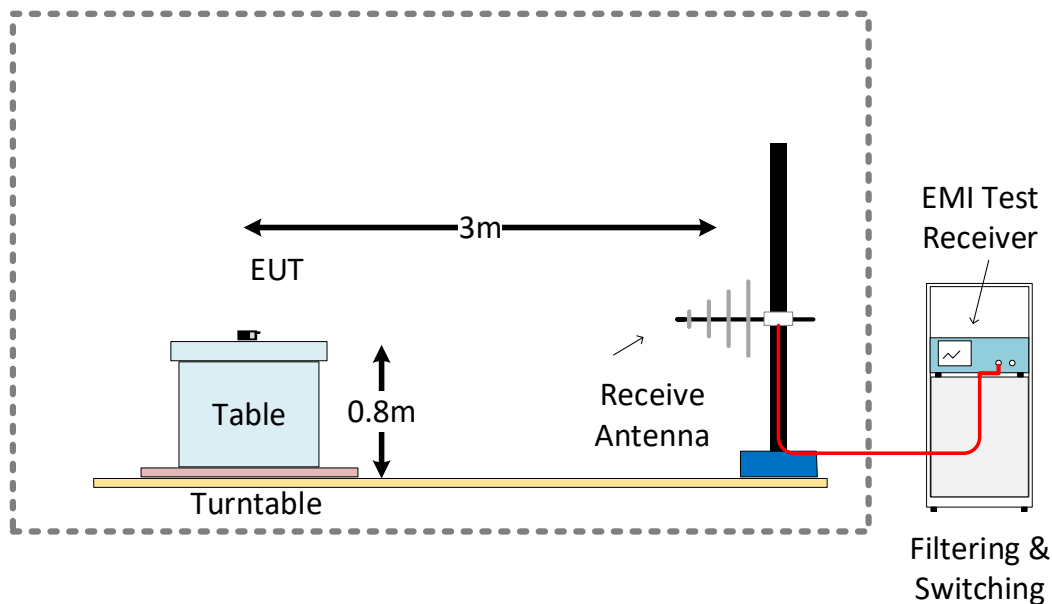
CTE Block Diagram



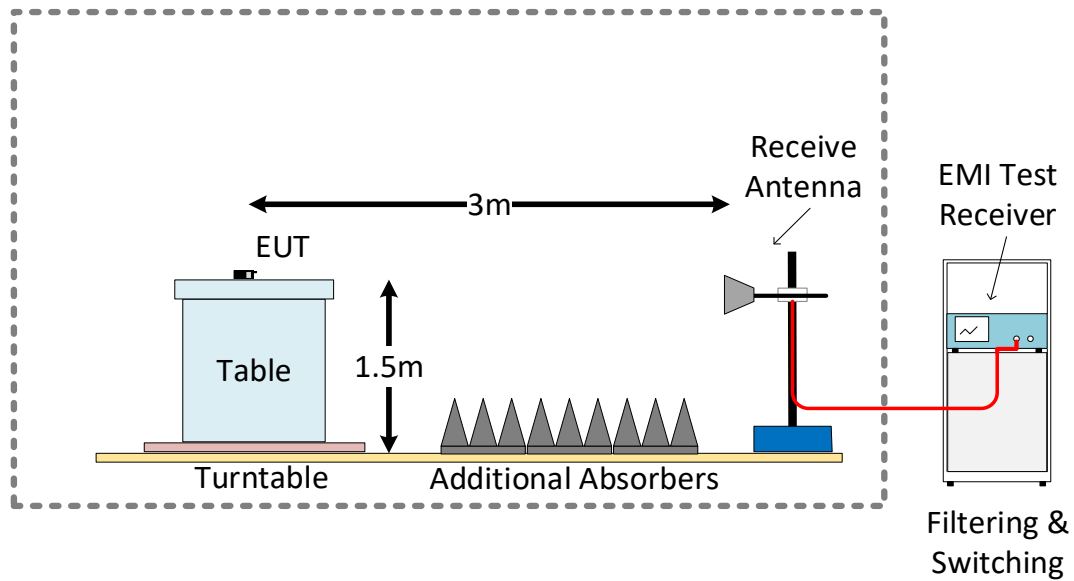
3.4.4 Test Equipment Setup – SAC 5 (Radiated Emissions and Restricted Band Edge)

- For frequency range 30MHz-1GHz Log-Periodic Antenna was used. Antenna elevated from 100 cm from floor to 400 cm from floor, and was placed at 3 m from center of turntable in tilted position. The equipment under test (EUT) was placed at the middle of the turntable at 80 cm height from floor. The antenna rotated to repeat the measurements for both the horizontal and vertical antenna polarizations. Repeat the measurement steps until the maximum emissions were obtained.
- For frequency range 1GHz-18GHz horn Antenna was used. Antenna elevated from 100 cm from floor to 200 cm from floor, and was placed at 3 m from center of turntable. The equipment under test (EUT) was placed at the middle of the turntable at 150 cm height from floor. The antenna rotated to repeat the measurements for both the horizontal and vertical antenna polarizations. Repeat the measurement steps until the maximum emissions were obtained.
- For frequency range 18GHz-40GHz double horn Antenna was used. Antenna's height was adjusted to 150 cm from floor, and 1 m distance to center of turntable. The equipment under test (EUT) was placed at the middle of the turntable on at 150 cm height from floor.
- For all frequency ranges the turntable was rotated 360° for obtaining the maximum emission.

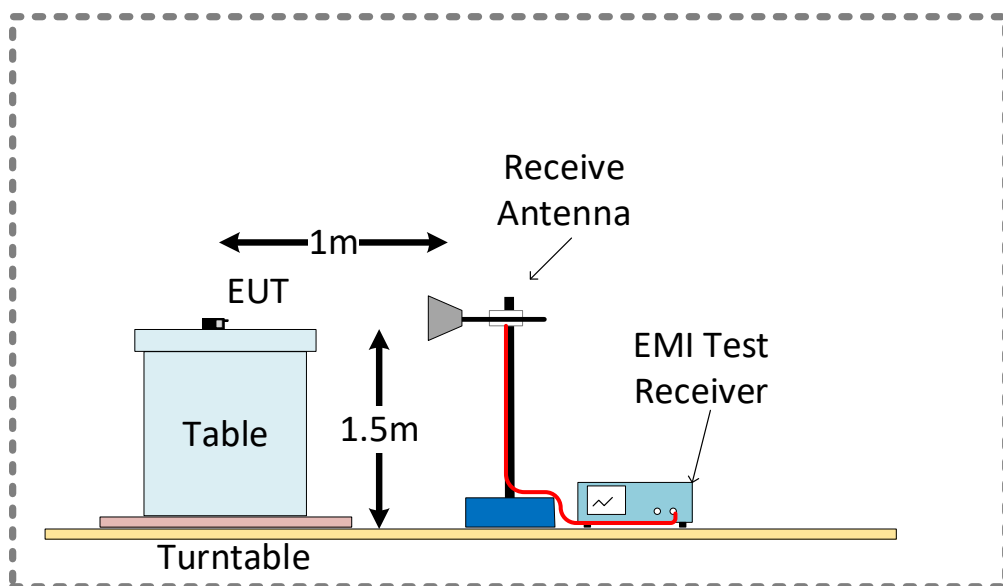
SAC 5 Test Setup Configuration 30MHz – 1GHz



SAC 5 Test Setup Configuration 1GHz – 18GHz

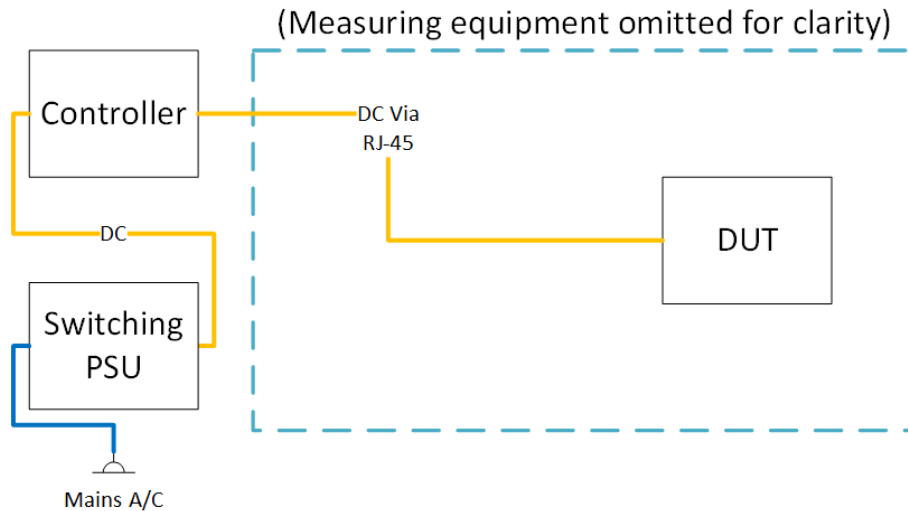


SAC 5 Test Setup Configuration 18GHz – 40GHz



3.5 EUT Configuration During Test

3.5.1 Block Diagram for Radiated Emissions EUT Setup



3.6 EUT Operation Modes

Operation mode	Description
LTE Tx - Continuous	Device is powered up and a test mode is used to set the device to continuously transmit dummy data on an appropriate. Other transmitters are not actively transmitting. Power supplied via RJ-45

3.7 Deviations from the Test Standard

Note 1: These measurements are intended to verify the performance of the certified cellular module when placed in the host device. A limited test scope has been applied, covering only certain bands for radiated emissions tests between 30MHz and 18GHz. Other tests have not been performed.

3.8 Environmental Conditions

3.8.1 Environmental Conditions – SAC5 (Radiated Emissions)

Date	Time	Temperature (°C)	Relative Humidity (%)
2023.03.16	09:50	19.5	34
2023.03.21	08:00	18.6	35
2023.03.22	09:20	19.6	36
2023.03.23	07:50	18.7	41

3.8.2 Environmental Conditions – CTE

Date	Time	Temperature (°C)	Relative Humidity (%)
2024.02.16	08:45	21.7	28.3
2024.02.19	12:20	21.5	28.6

4. TEST RESULTS

4.1 Test Results – Occupied Bandwidth

4.1.1 Occupied Bandwidth – Test Summary

No testing performed

4.2 Test Results – Radiated Spurious Emissions

4.2.1 Radiated Spurious Emissions – Test Summary

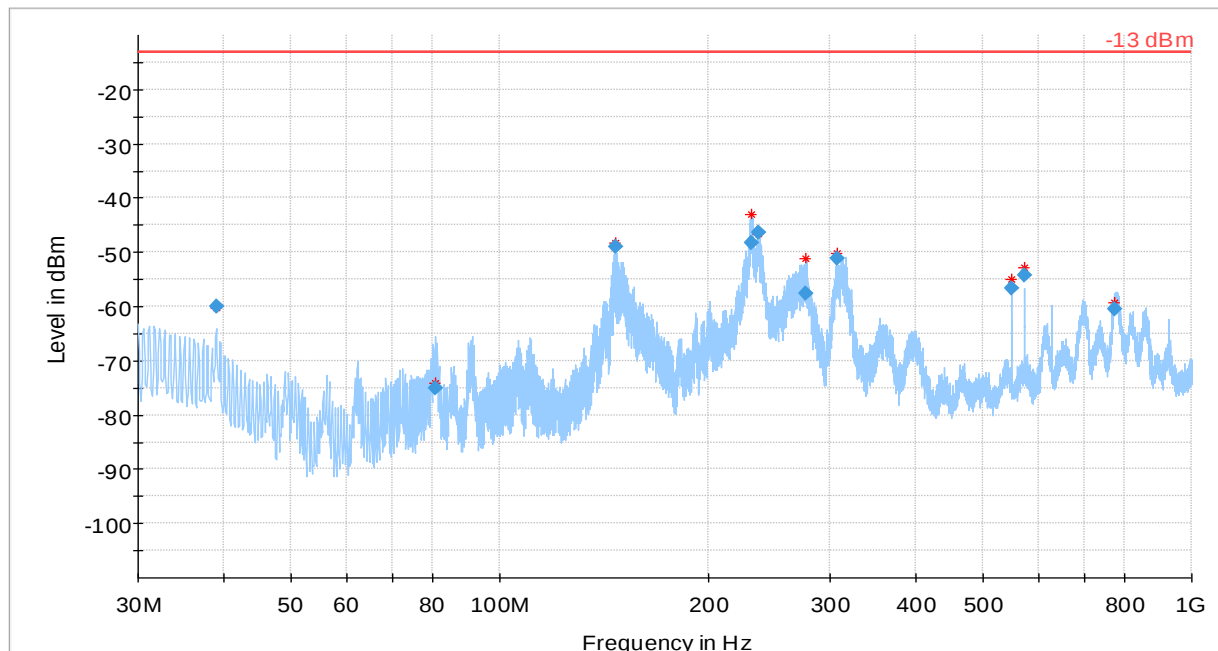
Test Specification		FCC 47 CFR 2.1053 / RSS-GEN 6.13	
Test Engineer & Date		Niall Forrester	2023.03.16 – 2023.03.23
EUT and Ancillary Equipment IDs		A003435986-004 A003435986-005	A003435986-001 A003435986-002
EUT Operation Mode(s)		LTE Tx - Continuous	
EUT Wireless Configuration(s)		LTE – see below for details	
EUT Hardware Configuration(s)		N/A	
Overall Result		PASS	

Test Parameter	Wireless Configuration	Frequency Range	Result
Radiated Emissions	LTE B2 5MHz Bandwidth QPSK Ch. 18625 (1852.5MHz) 1RB Pos. 12	30 MHz – 1 GHz	PASS
Radiated Emissions	LTE B2 5MHz Bandwidth QPSK Ch. 18625 (1852.5MHz) 1RB Pos. 12	1 GHz – 18 GHz	PASS
Radiated Emissions	LTE B12 5MHz Bandwidth QPSK Ch. 23155 (713.5MHz) 1RB Pos. 12	30 MHz – 1 GHz	PASS
Radiated Emissions	LTE B12 5MHz Bandwidth QPSK Ch. 23155 (713.5MHz) 1RB Pos. 12	1 GHz – 18 GHz	PASS
Radiated Emissions	LTE B26 5MHz Bandwidth QPSK Ch. 26715 (816.5MHz) 1RB Pos. 12	30 MHz – 1 GHz	PASS
Radiated Emissions	LTE B26 5MHz Bandwidth QPSK Ch. 26715 (816.5MHz) 1RB Pos. 12	1 GHz – 18 GHz	PASS

4.2.2 Radiated Emissions (Intentional) – Test Details

LTE B2 5MHz BW QPSK CH. 18625 1RB Pos. 12 30MHz – 1GHz

Test mode condition	LTE B2 5MHz BW, QPSK, CH. 18625, 1RB, Pos 12	
Antenna orientation	Horizontal and Vertical	
Sweep frequency	30 MHz – 1 GHz	
Standard	47 CFR FCC Part 24 / RSS-133	
EUT	A003435986-005	
Ancillary Equipment	A003435986-001, A003435986-002	
Test Engineer	Niall Forrester	Date: 2023.03.16
Chamber details	Chamber: SAC 5	

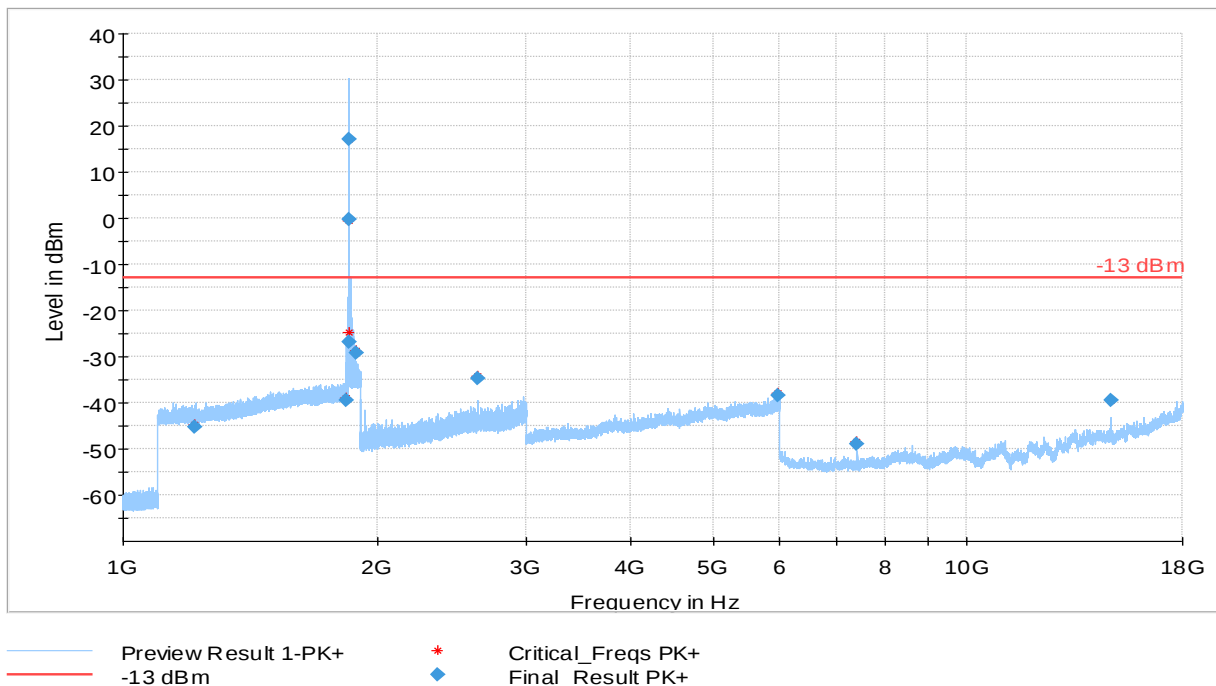


— Preview Result 1-PK+ * Critical_Freqs PK+
— -13 dBm ◆ Final_Result PK+

Frequency (MHz)	MaxPeak (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
38.980400	-60.11	-13.00	47.11	1000.0	100.000	100.0	V	221.0
80.749200	-75.09	-13.00	62.09	1000.0	100.000	129.0	V	248.0
146.928100	-49.08	-13.00	36.08	1000.0	100.000	329.0	H	296.0
231.043500	-48.34	-13.00	35.34	1000.0	100.000	129.0	H	252.0
236.650000	-46.41	-13.00	33.41	1000.0	100.000	129.0	H	292.0
277.208600	-57.53	-13.00	44.53	1000.0	100.000	100.0	V	209.0
306.765500	-51.04	-13.00	38.04	1000.0	100.000	100.0	H	296.0
549.641100	-56.69	-13.00	43.69	1000.0	100.000	100.0	H	87.0
573.267900	-54.16	-13.00	41.16	1000.0	100.000	100.0	H	176.0
775.189000	-60.57	-13.00	47.57	1000.0	100.000	129.0	H	289.0

LTE B2 5MHz BW QPSK CH. 18625 1RB Pos. 12 30MHz – 1GHz

Test mode condition	LTE B2 5MHz BW, QPSK, CH. 18625, 1RB, Pos 12	
Antenna orientation	Horizontal and Vertical	
Sweep frequency	1 GHz – 18 GHz	
Standard	47 CFR FCC Part 24 / RSS-133	
EUT	A003435986-004	
Ancillary Equipment	A003435986-001, A003435986-002	
Test Engineer	Niall Forrester	Date: 2023.03.21
Chamber details	Chamber: SAC 5	

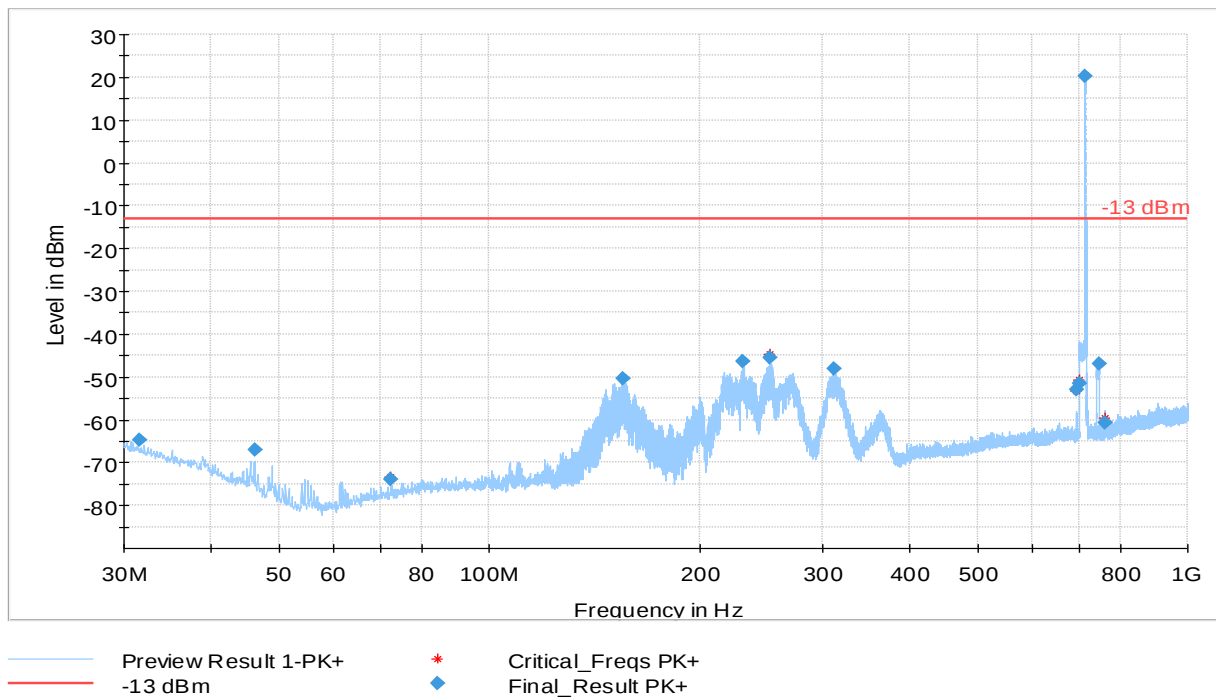


NOTE: Peak around 1852.5 MHz is the carrier, not a spurious emission

Frequency (MHz)	MaxPeak (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
1214.613000	-45.28	-13.00	32.28	1000.0	1000.000	263.0	V	64.0
1836.994000	-39.60	-13.00	26.60	1000.0	1000.000	208.0	V	54.0
1849.969360	-26.87	-13.00	13.87	1000.0	1000.000	100.0	V	41.0
1888.771000	-29.14	-13.00	16.14	1000.0	1000.000	175.0	V	22.0
2629.696000	-34.66	-13.00	21.66	1000.0	1000.000	175.0	V	42.0
5974.923000	-38.37	-13.00	25.37	1000.0	1000.000	104.0	V	248.0
7410.813000	-48.84	-13.00	35.84	1000.0	1000.000	375.0	V	129.0
14821.438000	-39.39	-13.00	26.39	1000.0	1000.000	125.0	H	40.0

LTE B12 5MHz BW QPSK CH. 23155 1RB Pos. 12 30MHz – 1GHz

Test mode condition	LTE B12 5MHz BW, QPSK, CH. 23155, 1RB, Pos 12	
Antenna orientation	Horizontal and Vertical	
Sweep frequency	30 MHz – 1 GHz	
Standard	47 CFR FCC Part 27 / RSS-130	
EUT	A003435986-005	
Ancillary Equipment	A003435986-001, A003435986-002	
Test Engineer	Niall Forrester	Date: 2023.03.21
Chamber details	Chamber: SAC 5	

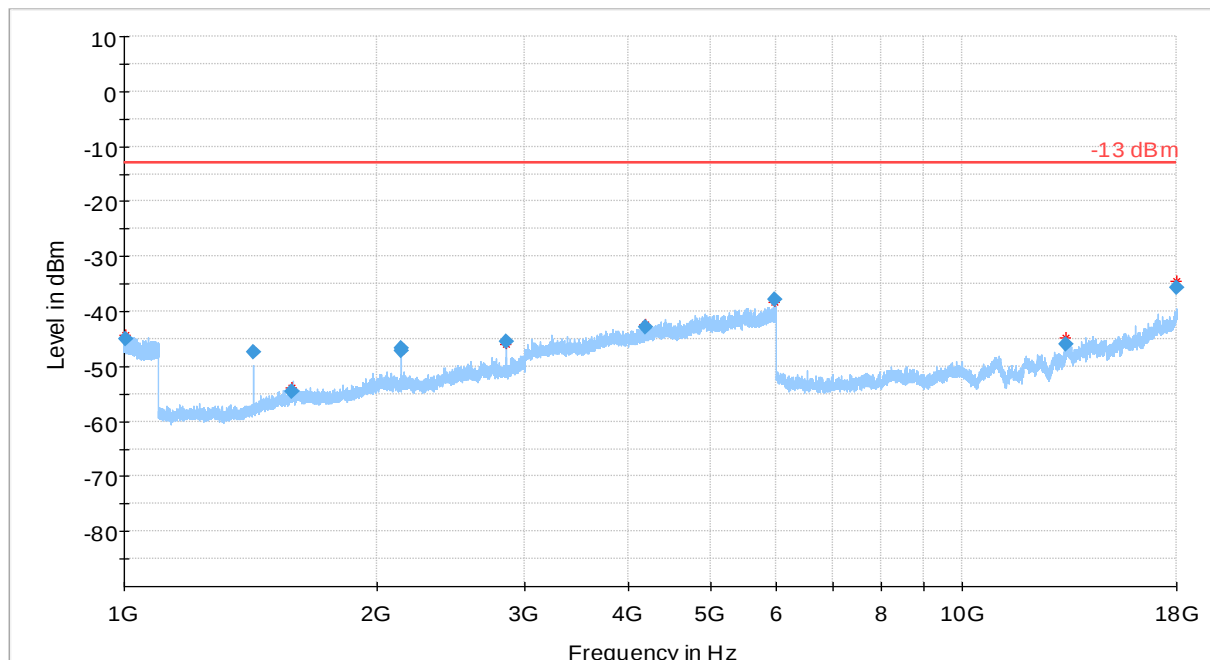


NOTE: Peak around 713.5 MHz is the carrier, not a spurious emission

Frequency (MHz)	MaxPeak (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
31.632300	-64.86	-13.00	51.86	1000.0	100.000	257.0	V	338.0
46.159000	-67.03	-13.00	54.03	1000.0	100.000	100.0	V	338.0
72.294400	-73.90	-13.00	60.90	1000.0	100.000	225.0	V	289.0
155.777300	-50.50	-13.00	37.50	1000.0	100.000	125.0	V	19.0
230.831600	-46.35	-13.00	33.35	1000.0	100.000	100.0	V	9.0
252.507300	-45.61	-13.00	32.61	1000.0	100.000	100.0	V	162.0
311.477800	-47.98	-13.00	34.98	1000.0	100.000	125.0	H	311.0
694.521700	-53.08	-13.00	40.08	1000.0	100.000	100.0	V	112.0
699.852700	-51.47	-13.00	38.47	1000.0	100.000	325.0	V	177.0
745.479500	-46.98	-13.00	33.98	1000.0	100.000	179.0	V	248.0
762.703700	-60.74	-13.00	47.74	1000.0	100.000	100.0	H	68.0

LTE B12 5MHz BW QPSK CH. 23155 1RB Pos. 12 30MHz – 1GHz

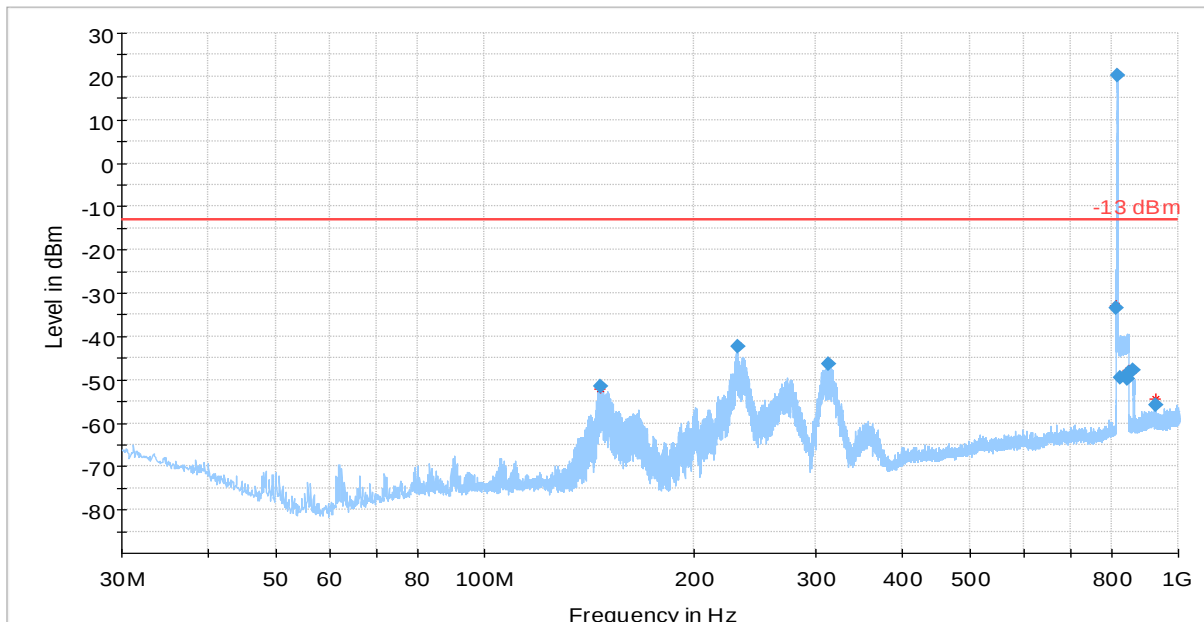
Test mode condition	LTE B12 5MHz BW, QPSK, CH. 23155, 1RB, Pos 12	
Antenna orientation	Horizontal and Vertical	
Sweep frequency	1 GHz – 18 GHz	
Standard	47 CFR FCC Part 27 / RSS-130	
EUT	A003435986-004	
Ancillary Equipment	A003435986-001, A003435986-002	
Test Engineer	Niall Forrester	Date: 2023.03.22
Chamber details	Chamber: SAC 5	



Frequency (MHz)	MaxPeak (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
1002.627376	-45.04	-13.00	32.04	1000.0	1000.000	100.0	V	87.0
1427.196000	-47.51	-13.00	34.51	1000.0	1000.000	329.0	H	292.0
1584.931000	-54.50	-13.00	41.50	1000.0	1000.000	125.0	H	54.0
2140.870000	-47.15	-13.00	34.15	1000.0	1000.000	125.0	V	54.0
2141.054000	-46.64	-13.00	33.64	1000.0	1000.000	104.0	V	54.0
2854.924000	-45.57	-13.00	32.57	1000.0	1000.000	225.0	V	-18.0
4192.889000	-42.96	-13.00	29.96	1000.0	1000.000	410.0	V	289.0
5972.210000	-37.93	-13.00	24.93	1000.0	1000.000	125.0	V	296.0
13293.670000	-45.87	-13.00	32.87	1000.0	1000.000	225.0	V	56.0
17987.893000	-35.67	-13.00	22.67	1000.0	1000.000	375.0	H	175.0

LTE B26 5MHz BW QPSK CH. 26715 1RB Pos. 12 30MHz – 1GHz

Test mode condition	LTE B26 5MHz BW, QPSK, CH. 26715, 1RB, Pos 12	
Antenna orientation	Horizontal and Vertical	
Sweep frequency	30 MHz – 1 GHz	
Standard	47 CFR FCC Part 22, 90 / RSS-132	
EUT	A003435986-005	
Ancillary Equipment	A003435986-001, A003435986-002	
Test Engineer	Niall Forrester	Date: 2023.03.16
Chamber details	Chamber: SAC 5	



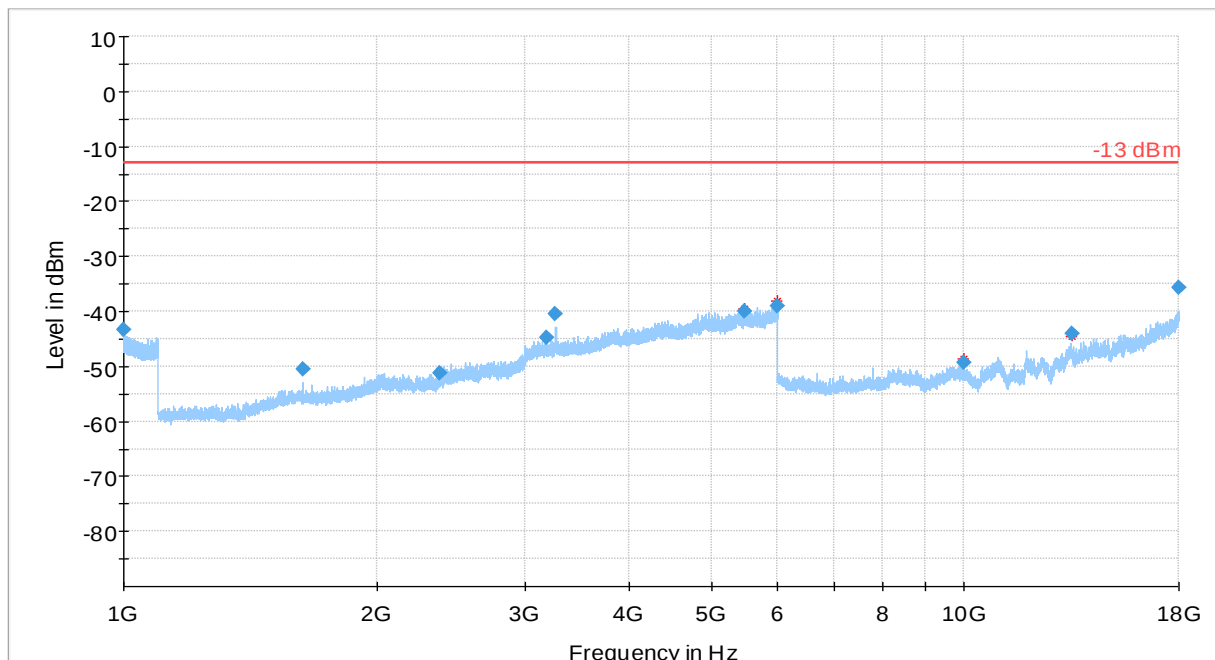
— Preview Result 1-PK+ * Critical_Freqs PK+
— -13 dBm ◆ Final_Result PK+

NOTE: Peak around 816.5 MHz is the carrier, not a spurious emission

Frequency (MHz)	MaxPeak (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
146.833400	-51.51	-13.00	38.51	1000.0	100.000	325.0	H	292.0
231.374800	-42.28	-13.00	29.28	1000.0	100.000	125.0	H	267.0
313.168400	-46.22	-13.00	33.22	1000.0	100.000	104.0	H	296.0
814.675880	-33.40	-13.00	20.40	1000.0	100.000	175.0	V	87.0
823.371400	-49.38	-13.00	36.38	1000.0	100.000	229.0	V	248.0
843.737500	-49.70	-13.00	36.70	1000.0	100.000	325.0	V	87.0
848.780779	-48.42	-13.00	35.42	1000.0	100.000	257.0	V	68.0
861.942000	-47.67	-13.00	34.67	1000.0	100.000	100.0	V	248.0
928.409200	-55.77	-13.00	42.77	1000.0	100.000	258.0	H	221.0

LTE B26 5MHz BW QPSK CH. 26715 1RB Pos. 12 30MHz – 1GHz

Test mode condition	LTE B26 5MHz BW, QPSK, CH. 26715, 1RB, Pos 12	
Antenna orientation	Horizontal and Vertical	
Sweep frequency	1 GHz – 18 GHz	
Standard	47 CFR FCC Part 22, 90 / RSS-132	
EUT	A003435986-004	
Ancillary Equipment	A003435986-001, A003435986-002	
Test Engineer	Niall Forrester	Date: 2023.03.21
Chamber details	Chamber: SAC 5	



— Preview Result 1-PK+ * Critical_Freqs PK+
— -13 dBm ◆ Final_Result PK+

Frequency (MHz)	MaxPeak (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
1000.258300	-43.47	-13.00	30.47	1000.0	1000.000	325.0	V	234.0
1633.181000	-50.43	-13.00	37.43	1000.0	1000.000	105.0	H	10.0
2380.605000	-51.31	-13.00	38.31	1000.0	1000.000	375.0	H	68.0
3179.730000	-44.79	-13.00	31.79	1000.0	1000.000	325.0	H	10.0
3266.781000	-40.44	-13.00	27.44	1000.0	1000.000	129.0	V	-18.0
5471.786000	-40.12	-13.00	27.12	1000.0	1000.000	325.0	H	-22.0
5992.220000	-38.99	-13.00	25.99	1000.0	1000.000	325.0	H	296.0
9981.000000	-49.31	-13.00	36.31	1000.0	1000.000	175.0	V	22.0
13410.660000	-43.95	-13.00	30.95	1000.0	1000.000	275.0	H	236.0
17998.117500	-35.68	-13.00	22.68	1000.0	1000.000	175.0	H	22.0

4.3 Test Results – Band Edge Compliance

4.3.1 Band Edge Compliance / Emission Mask – Test Summary

Test Specification	FCC 47 CFR 27.53 / ISSED RSS-139 6.6	
Test Engineer & Date	Maria Nytlun	2024.02.16 – 2024.02.19
EUT and Ancillary Equipment IDs	A003435986-004	A003435986-001 A003435986-002
EUT Operation Mode(s)	Connected	
EUT Wireless Configuration(s)	LTE B2 / B12 / B26 (see below for details)	
EUT Hardware Configuration(s)	-	
Overall Result	PASS	

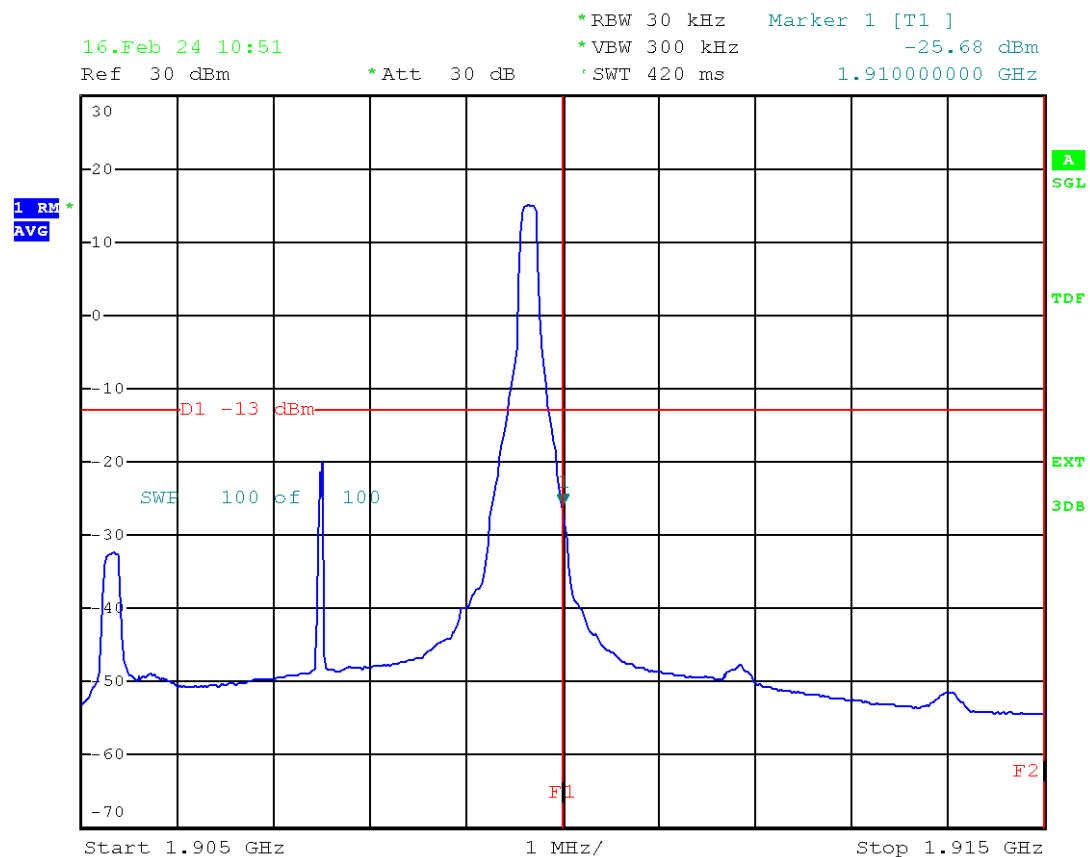
Test Parameter	Wireless Configuration	Measured Level (dBm)	Limit (dBm)	Result
Emissions at Band Edge (Low Edge)	LTE B2 5MHz Bandwidth QPSK Ch.18625 (1852.50 MHz) 1RB Pos. 0	-27.56	-13.00	PASS
Emissions at Band Edge (Low Edge)	LTE B2 5MHz Bandwidth QPSK Ch.18625 (1852.50 MHz) 25RB Pos 0	-31.85	-13.00	PASS
Emissions at Band Edge (High Edge)	LTE B2 5MHz Bandwidth QPSK Ch. 19175 (1907.50 MHz) 1RB Pos. 24	-25.68	-13.00	PASS
Emissions at Band Edge (High Edge)	LTE B2 5MHz Bandwidth QPSK Ch. 19175 (1907.50 MHz) 25RB Pos. 0	-32.08	-13.00	PASS

Test Parameter	Wireless Configuration	Measured Level (dBm)	Limit (dBm)	Result
Emissions at Band Edge (Low Edge)	LTE B12 5MHz Bandwidth QPSK Ch.23035 (701.50 MHz) 1RB Pos. 0	-27.03	-13.00	PASS
Emissions at Band Edge (Low Edge)	LTE B12 5MHz Bandwidth QPSK Ch.23035 (701.50 MHz) 25RB Pos 0	-33.64	-13.00	PASS
Emissions at Band Edge (High Edge)	LTE B12 5MHz Bandwidth QPSK Ch. 23155 (713.50 MHz) 1RB Pos. 24	-25.55	-13.00	PASS
Emissions at Band Edge (High Edge)	LTE B12 5MHz Bandwidth QPSK Ch. 23155 (713.50 MHz) 25RB Pos. 0	-32.70	-13.00	PASS

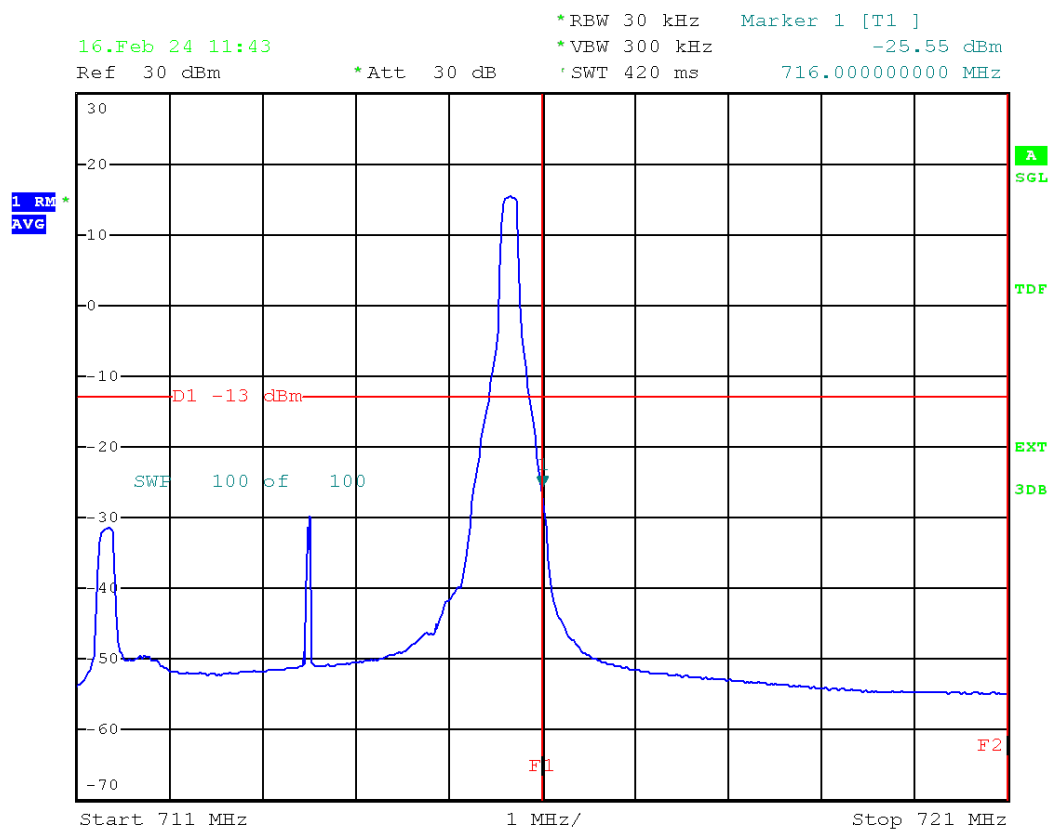
Test Parameter	Wireless Configuration	Measured Level (dBm)	Limit (dBm)	Result
Emissions at Band Edge (Low Edge)	LTE B26 5MHz Bandwidth QPSK Ch.26715 (816.50 MHz) 1RB Pos. 0	-26.92	-13.00	PASS
Emissions at Band Edge (Low Edge)	LTE B26 5MHz Bandwidth QPSK Ch.26715 (816.50 MHz) 25RB Pos 0	-32.59	-13.00	PASS
Emissions at Band Edge (High Edge)	LTE B26 5MHz Bandwidth QPSK Ch. 27015 (846.50 MHz) 1RB Pos. 24	-25.14	-13.00	PASS
Emissions at Band Edge (High Edge)	LTE B26 5MHz Bandwidth QPSK Ch. 27015 (846.50 MHz) 25RB Pos. 0	-31.91	-13.00	PASS

4.3.2 Band Edge Compliance – Test Details (Worst Case Plots)

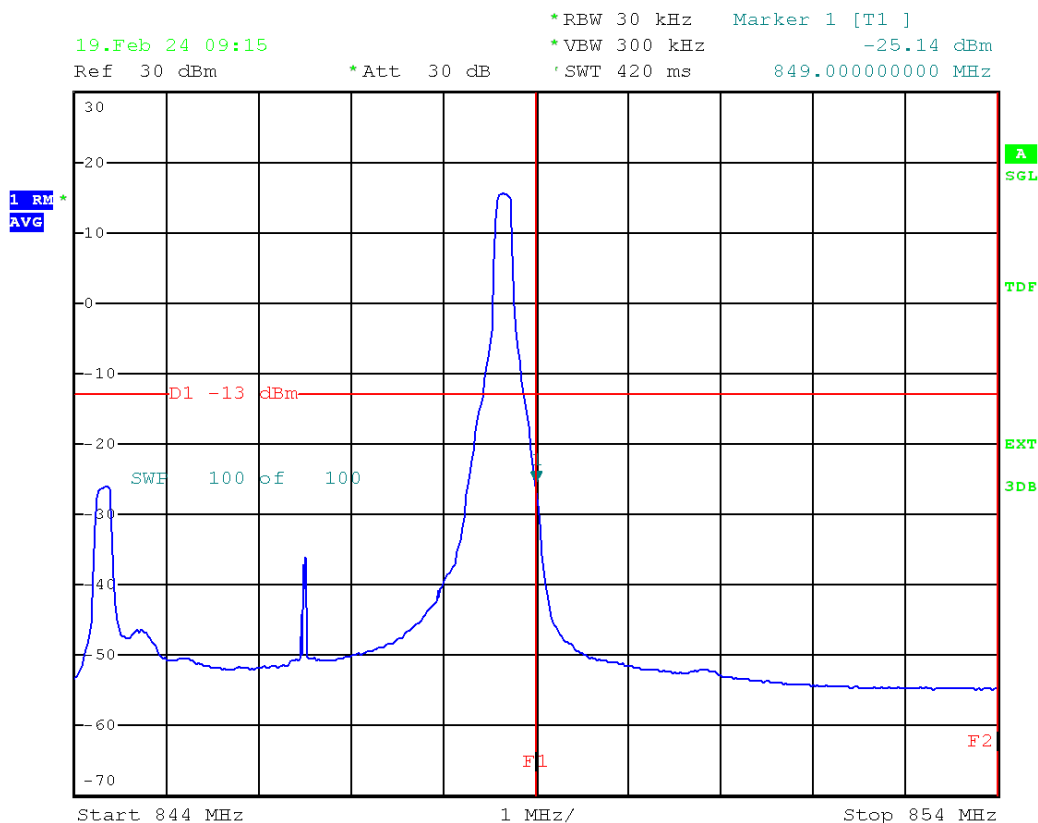
LTE B2 5MHz bandwidth QPSK Channel 19175 1RB Pos. 24



LTE B12 5MHz bandwidth QPSK Channel 23155 1RB Pos. 24



LTE B26 5MHz bandwidth QPSK Channel 27015 1RB Pos. 24



4.4 Test Results – Maximum Output Power

4.4.1 Maximum Output Power – Test Summary

No testing performed

4.5 Test Results – Peak to Average Ratio

4.5.1 Peak to Average Ratio – Test Summary

No testing performed

4.6 Test Results – Frequency Stability

4.6.1 Frequency Stability – Test Summary

No testing performed

4.7 Test Results – Modulation Characteristics

4.7.1 Modulation Characteristics – Test Summary

No testing performed

5. TEST EQUIPMENT STATUS

5.1 List of Hardware with Calibration Dates

5.1.1 Hardware List – SAC5 System

Type	Manufacturer	Model	Serial Number / ID	Calibration Date	Calibration Due
EMI Test Receiver	Rohde & Schwarz	ESW44	101760 2881044	2022.07.21	2023.07.21
Ultra Broadband Antenna	Rohde & Schwarz	HL562E	100988 2823181	2021.07.26	2023.07.26
Double Ridged Waveguide Horn Antenna	Rohde & Schwarz	HF907	102678 2823164	2021.07.26	2023.07.26
Horn Antenna	ETS Lindgren	UG-596A/U	20898 2814839	2022.07.26	2024.07.26
Horn Antenna – 40 GHz	ETS Lindgren	UG-600A/U	20623 2814834	2022.07.26	2024.07.26
Control Device	Maturo	NCD	NCD/393/2372.01 2884216	N/A	N/A
Open Switch & Control Unit	Rohde & Schwarz	OSP150	100081 2884198	2022.08.01	2023.08.01
Open Switch & Control Unit	Rohde & Schwarz	OSP120	100084 2761253	2022.08.01	2023.08.01
Shielded Filter Unit	Rohde & Schwarz	OSP-F Extension 1	101333 2761265	2022.08.01	2023.08.01
Shielded Filter Unit	Rohde & Schwarz	OSP-F Extension 2	101335 2761266	2022.08.01	2023.08.01
Shielded Filter Unit	Rohde & Schwarz	OSP-F Base Unit	101330 2761262	2022.08.01	2023.08.01
Humidity Temperature Probe	Lufft	OPUS 20	146.0216.0802.030 2703980	2022.07.27	2024.07.27

5.1.2 Hardware List – CTE

Type	Manufacturer	Model	Serial Number / ID	Calibration Date	Calibration Due
Comprehensive Testing Environment (CTE)	TÜV Rheinland	HWE 6000	00139	N/A	N/A
Bluetooth Signaling Unit	Rohde & Schwarz	CMW500	163750 2711468	2023-07-17	2024-07-17
Spectrum Analyzer	Rohde & Schwarz	FSP30	100308 2704108	2023-08-16	2024-08-16
Vector Signal Generator	Rohde & Schwarz	SMU200A	101584 2704111	2023-07-13	2024-07-13
Power Supply	Keithley	2700	995343 2704115	2023-07-21	2024-07-21
Multimeter	Fluke	87	61320241 2744110	2023-06-12	2024-06-12
Average Power Sensor	Rohde & Schwarz	NRP-Z31	102145 2704104	2023-07-12	2024-07-12
Temperature Chamber	Vötsch	VT4002	58566032870010 2709706	N/A	N/A
Temp. & Humidity Logger	Lufft	Opus 20	146.0216.0802.030 2703980	2022-07-27	2024-07-27

5.2 Software / Firmware Versions

Equipment	Software / Firmware Name	Version
SAC 5	EMC 32	V10.60.20
Comprehensive Testing Environment (CTE)	CTE – TMF CTE – BT	V52.0 V44.0

6. MEASUREMENT UNCERTAINTY

6.1 Measurement Uncertainty for CTE

Parameter	Uncertainty (Coverage Factor k=2)
Band Edge Compliance (2.1051 / RSS-GEN 6.13)	1.04 dB

6.2 Measurement Uncertainty for SAC 5 (Radiated Emissions & Band Edge)

Parameter	Uncertainty (Coverage Factor k=2)
Field Strength 9 kHz -30 MHz (2.1053 / RSS-GEN 6.13)	3.38 dB
Field Strength 30 MHz -1000 MHz (2.1053 / RSS-GEN 6.13)	3.38 dB
Field Strength 1 GHz -18 GHz (2.1053 / RSS-GEN 6.13)	4.88 dB
Field Strength 18 GHz - 40 GHz (2.1053 / RSS-GEN 6.13)	5.14 dB

7. PHOTOGRAPHS

For photographs, please see Appendix 1