DEKRA Testing and Certification, S.A.U.
Parque Tecnológico de Andalucía,
c/ Severo Ochoa nº 2 · 29590 Campanillas · Málaga · España
C.I.F. A29507456

Test Report No:
72676RRF.004A2

Test Report
USA FCC Part 90

(*) Identification of item tested	Continuous Positive Airway Pressure (CPAP) Device
(*) Trademark	ResMed
(*) Model and /or type reference	39485
(*) Derived model not tested	39523,39524,39525,39526,39527,39528
Other identification of the product	FCC ID: 2ACHL-AIR11M1U IC: 9103A-AIR11M1U
(*) Features	LTE Cat-M1, BLE HW version: R390-7667 SW version: SW04600
Applicant	ResMed Pty Ltd 1 Elizabeth Macarthur Drive, Bella Vista, NSW, 2153, Australia
Test method requested, standard	USA FCC Part 90 (10-1-21 Edition). ANSI C63.26-2015. KDB 971168 D01 Power Meas License Digital Systems v03r01, April. 2018.
Summary	IN COMPLIANCE
Approved by (name / position & signature)	José Manuel Gómez Galván EMC Consumer & RF Lab. Manager Firmado digitalmente por 53680346W JOSE MANUEL GOMEZ (C:A29507456)
Date of issue	2023-03-27
Report template No	FDT08_24 (*) "Data provided by the client"

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Uncertainty

Uncertainty (factor k=2) was calculated according to the DEKRA Testing and Certification S.A.U. internal document PODT000.

Data provided by the client

The following data has been provided by the client:

1. Information relating to the description of the sample ("Identification of the item tested", "Trademark", "Model and/or type reference tested").
2. The sample of the model 39485 is a CPAP device with integrated cellular and Bluetooth connectivity.
3. Derived models not tested. These models have been declared by the supplier of the sample as being the same as the model under test.

ResMed
Changing lives with every breath

Date: 30-Nov-2022

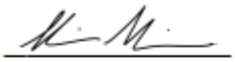
DECLARATION OF EQUIVALENCE

This document declares that the following designated products are equivalent to the unit under test **39485**.

Model Name / Product Code	Marketing Name
39523	AirSense 11 AutoSet USA
39524	AirSense 11 CPAP USA
39525	AirSense 11 Elite USA
39526	AirSense 11 AutoSet CAN
39527	AirSense 11 CPAP CAN
39528	AirSense 11 Elite CAN

All the above stated products and the unit under test - 39485 have the same cellular hardware and firmware.

Applicant:
Company Name: ResMed Pty Ltd
Address: 1 Elizabeth Macarthur Drive,
Bella Vista NSW 2153
Australia
By,



Christopher Jenkins
Title: Manager – Systems Engineering
Company: ResMed Pty Ltd
Telephone: +61 2 8884 1517
e-mail: Christopher.jenkins@resmed.com.au

Usage of samples

Samples undergoing test have been selected by: The client.

- Sample S/01 is composed of the following elements:

Control Nº	Description	Model	Serial Nº	Date of reception
72676/003	Continuous Positive Airway Pressure (CPAP) Device	39485	22222172432	2022/10/03
72676/007	AC/DC Adapter	390000	02GNXL04	2022/10/03
72676/009	Power Cord	-	-	2022/10/03
66427/006	Climate line	AIR11	-	2020/12/29

Sample S/01 has undergone the following test(s): The radiated tests indicated in Appendix A.

- Sample S/02 is composed of the following elements:

Control Nº	Description	Model	Serial Nº	Date of reception
72676/001	Continuous Positive Airway Pressure (CPAP) Device	39485	22222172433	2022/10/03
72676/003	Continuous Positive Airway Pressure (CPAP) Device	39485	22222172432	2022/10/03
72676/007	AC/DC Adapter	390000	02GNXL04	2022/10/03

Sample S/02 has undergone the following test(s): The RF Output Power, Spurious Emissions at Antenna Terminals (Emission mask requirements for EA-based systems) conducted tests indicated in Appendix A.

- Sample S/03 is composed of the following elements:

Control Nº	Description	Model	Serial Nº	Date of reception
72676/002	Continuous Positive Airway Pressure (CPAP) Device	39485	22222172424	2022/10/03
72676/008	AC/DC Adapter	390000	02GNXH04	2022/10/03
72676/010	Power Cord	-	-	2022/10/03

Sample S/03 has undergone the following test(s): The Modulation Characteristics, Frequency Stability, Occupied Bandwidth, Spurious Emissions at Antenna Terminals, Spurious Emissions at Antenna Terminals at Block Edges conducted tests indicated in Appendix A.

Test sample description

Ports……:	Port name and description	Cable					
		Specified max length [m]	Attached during test	Shielded	Coupled to patient(3)		
	Power		☒	☐	☐		
Supplementary information to the ports……:	-						
Rated power supply ..... :	Voltage and Frequency	Reference poles					
		L1	L2	L3	N	PE	

	☒	AC: 100-240V~50-60 Hz 2.0A	☒	☐	☐	☒	☐
	☒	AC: 115V~400Hz 1.5A	☒	☐	☐	☒	☐
	☒	DC: 12V (DC-DC for Vehicle Use)					
	☒	DC: 24V (DC-DC for Vehicle Use)					
Rated Power..... :	-						
Clock frequencies..... :	N/A						
Other parameters ..... :	390000 (PSU Model Number)						
Software version..... :	SW04600 (DUT)						
Hardware version ..... :	R390-7667						
Dimensions in cm (W x H x D) ... :	138.5 mm x 259.4 mm x 94.5 mm						
Mounting position ..... :	☒	Table top equipment					
	☐	Wall/Ceiling mounted equipment					
	☐	Floor standing equipment					
	☐	Hand-held equipment					
	☐	Other:					
Modules/parts..... :	Module/parts of test item			Type		Manufacturer	
	Wireless Module			SARA-R5		U-blox	
	Bluetooth LE			EFR32BG22		SiLabs	
Accessories (not part of the test item) ..... :	Description			Type		Manufacturer	
	-			-		-	
Documents as provided by the applicant..... :	Description			File name		Issue date	
	-			-		-	

(3) Only for Medical Equipment

Identification of the client

ResMed Pty Ltd

1 Elizabeth Macarthur Drive, Bella Vista, NSW, 2153, Australia

Testing period and place

Test Location	DEKRA Testing and Certification S.A.U.
Date (start)	2022-10-13
Date (finish)	2023-03-08

Document history

Report number	Date	Description
72676RRF.004	2022-12-29	First release.
72676RRF.004A1	2023-01-31	Second release. The following tests are included: - FCC 90.635 (b): RF output power. - FCC 90.691: Spurious emissions at antenna terminals (Emission mask requirements for EA-based systems).
72676RRF.004A2	2023-03-27	Third release. The following tests are included: - FCC 2.1047: Modulation characteristics. - FCC 90.213: Frequency stability. - FCC 2.1049: Occupied Bandwidth. - FCC 90.691: Spurious emissions at antenna terminals.

Environmental conditions

In the control chamber, the following limits were not exceeded during the test:

Temperature	Min. = 15 ºC Max. = 35 ºC
Relative humidity	Min. = 20 % Max. = 75 %

In the semi-anechoic chamber, the following limits were not exceeded during the test:

Temperature	Min. = 15 ºC Max. = 35 ºC
Relative humidity	Min. = 20 % Max. = 75 %

In the chamber for conducted measurements, the following limits were not exceeded during the test:

Temperature	Min. = 15 ºC Max. = 35 ºC
Relative humidity	Min. = 20 % Max. = 75 %

Remarks and comments

The tests have been performed by the technical personnel: Rafael Fernández.

Used instrumentation:

Conducted Measurements:

		Last Calibration	Due Calibration
1.	Shielded Room ETS LINDGREN S101	N/A	N/A
2.	Wideband Radio Communication Tester ROHDE AND SCHWARZ CMW500	2022-03	2023-03
3.	Attenuator DC, 26.5 GHz, 10 dB, 2W TECHNIWAVE TWSMAG2	2022-05	2023-05
4.	Attenuator DC, 26.5 GHz, 6 dB, 2W TECHNIWAVE TWSMAG2	2022-02	2023-02
5.	Power Divider, DC-25 GHz TEKTRONIX 5333	2022-02	2023-02
6.	Climatic Chamber BINDER MK 56	2022-03	2023-03
7.	Signal and Spectrum Analyzer 10 Hz - 40 GHz ROHDE AND SCHWARZ FSV40	2021-02	2023-02
8.	Attenuator 5 dB 2W DC-26.5GHz	2022-07	2023-07
9.	Attenuator DC, 26.5 GHz, 6 dB, 2W TECHNIWAVE TWSMAG2	2023-03	2024-03

Radiated Measurements:

		Last Calibration	Due Calibration
1.	Semianechoic Absorber Lined Chamber ETS LINDGREN FACT 3 200 STP	N/A	N/A
2.	Shielded Room ETS LINDGREN S101	N/A	N/A
3.	Biconical/Log Antenna 30 MHz - 6 GHz ETS LINDGREN 3142E	2020-10	2023-10
4.	Horn Antenna 1-18 GHz SCHWARZBECK MESS-ELEKTRONIK BBHA 9120 D	2020-08	2023-08
5.	RF Preamplifier G>30dB, 1-18GHz BONN ELEKTRONIK BLMA 0118-3A	2021-12	2022-12
6.	EMI Test Receiver 2Hz-44GHz, ROHDE AND SCHWARZ ESW44	2021-12	2023-12
7.	Wideband Radio Communication Tester ROHDE AND SCHWARZ CMW500	N/A	N/A
8.	AC Power Supply CHROMA 6490	2020-12	2022-12
9.	Digital Multimeter, FLUKE 175	2021-11	2022-11
10.	EMC/RF Testing SW ROHDE AND SCHWARZ EMC32	N/A	N/A

Testing verdicts

Not applicable:	N/A
Pass:	P
Fail:	F
Not measured:	N/M

Summary

FCC PART 90		
Requirement – Test case	**Verdict**	**Remark**
FCC 90.635 (b): RF output power	P	
FCC 2.1047: Modulation characteristics	P	
FCC 90.213: Frequency stability	P	
FCC 2.1049: Occupied Bandwidth	P	
FCC 90.691: Spurious emissions at antenna terminals	P	
FCC 90.691: Spurious emissions at antenna terminals (Emission mask requirements for EA-based systems)	P	
FCC 90.691: Radiated emissions	P	
Supplementary information and remarks: (1) Test not requested.		

Appendix A: Test results for FCC 90

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TEST CONDITIONS

(*): Declared by the Applicant.

POWER SUPPLY (*):

Vnormal: Preliminary scan determined 115Vac / 60Hz as worst case of power supply.
Type of Power Supply: Mains Supply.

ANTENNA (*):

Bands	Gain (dBi)	Type
LTE 26	+2.2	Ceramic

TEST FREQUENCIES:

LTE Band 26 sub-band 814-824 MHz. QPSK and 16QAM modulations:

	Channel (Frequency, MHz)				
	BW=1.4 MHz	BW=3 MHz	BW=5 MHz	BW=10 MHz	BW=15 MHz
Low	26697 (814.7)	26705 (815.5)	26715 (816.5)	N/A	N/A
Middle	26740 (819)	26740 (819)	26740 (819)	26740 (819)	N/A
High	26783 (823.3)	26775 (822.5)	26765 (821.5)	N/A	N/A

LTE Band 26 Cross-rule Channel (824 MHz). QPSK and 16QAM modulations:

Channel (Frequency, MHz)				
BW=1.4 MHz	BW=3 MHz	BW=5 MHz	BW=10 MHz	BW=15 MHz
26790 (824)	26790 (824)	26790 (824)	26790 (824)	26790 (824)

RF Output Power

Limits:

FCC §90.635 (b): The maximum output power of the transmitter for mobile stations is 100 Watts (20 dBW).

Method:

The conducted RF output power measurements were made at the RF output terminals of the EUT using the power meter of the Universal Radio Communication tester R&S CMW500, selecting maximum transmission power of the EUT and different modes of modulation.

The maximum equivalent isotropically radiated power (e.i.r.p.) is calculated by adding the declared maximum antenna gain (dBi).

The maximum effective radiated power e.r.p. is calculated from the maximum equivalent isotropically radiated power (e.i.r.p.) by subtracting 2.15 dB:

E.R.P. = E.I.R.P. - 2.15 dB

Test setup:

Results:

CONDUCTED AVERAGE POWER:

LTE Band 26. Sub-band 814-824 MHz:

Measurements required on one frequency near top channel and one frequency near bottom channel, according to FCC § 15.31 (m).

LTE Band 26. Sub-band 814-824 MHz. QPSK modulation. BW=1.4 MHz.

Channel	Low	High
Maximum declared antenna gain (dBi)	2.2	
Measured maximum average power (dBm) at antenna port	22.22	22.22
Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm)	24.42	24.42
Maximum effective radiated power E.R.P. (dBm)	22.27	22.27
Measurement uncertainty (dB)	<±0.94	

Average Power Worst Case: Modulation QPSK. RB Size: 1. RB Offset: 0.

LTE Band 26. Sub-band 814-824 MHz. 16QAM modulation. BW=1.4 MHz.

Channel	Low	High
Maximum declared antenna gain (dBi)	2.2	
Measured maximum average power (dBm) at antenna port	22.38	22.33
Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm)	24.58	24.53
Maximum effective radiated power E.R.P. (dBm)	22.43	22.38
Measurement uncertainty (dB)	<±0.94	

Average Power Worst Case: Modulation 16QAM. RB Size: 5. RB Offset: 0.

LTE Band 26. Sub-band 814-824 MHz. QPSK modulation. BW=3 MHz.

Channel	Low	High
Maximum declared antenna gain (dBi)	2.2	
Measured maximum average power (dBm) at antenna port	22.19	22.20
Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm)	24.39	24.40
Maximum effective radiated power E.R.P. (dBm)	22.24	22.25
Measurement uncertainty (dB)	<±0.94	

Average Power Worst Case: Modulation QPSK. RB Size: 1. RB Offset: 0.

LTE Band 26. Sub-band 814-824 MHz. 16QAM modulation. BW=3 MHz.

Channel	Low	High
Maximum declared antenna gain (dBi)	2.2	
Measured maximum average power (dBm) at antenna port	22.42	22.37
Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm)	24.62	24.57
Maximum effective radiated power E.R.P. (dBm)	22.47	22.42
Measurement uncertainty (dB)	<±0.94	

Average Power Worst Case: Modulation 16QAM. RB Size: 5. RB Offset: 0.

LTE Band 26. Sub-band 814-824 MHz. QPSK modulation. BW=5 MHz.

Channel	Low	High
Maximum declared antenna gain (dBi)	2.2	
Measured maximum average power (dBm) at antenna port	22.20	22.20
Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm)	24.40	24.40
Maximum effective radiated power E.R.P. (dBm)	22.25	22.25
Measurement uncertainty (dB)	<±0.94	

Average Power Worst Case: Modulation QPSK. RB Size: 1. RB Offset: 0.

LTE Band 26. Sub-band 814-824 MHz. 16QAM modulation. BW=5 MHz.

Channel	Low	High
Maximum declared antenna gain (dBi)	2.2	
Measured maximum average power (dBm) at antenna port	22.39	22.38
Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm)	24.59	24.58
Maximum effective radiated power E.R.P. (dBm)	22.44	22.43
Measurement uncertainty (dB)	<±0.94	

Average Power Worst Case: Modulation 16QAM. RB Size: 5. RB Offset: 0.

LTE Band 26. Sub-band 814-824 MHz. QPSK modulation. BW=10 MHz.

Channel	Middle
Maximum declared antenna gain (dBi)	2.2
Measured maximum average power (dBm) at antenna port	22.24
Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm)	24.44
Maximum effective radiated power E.R.P. (dBm)	22.29
Measurement uncertainty (dB)	<±0.94

Average Power Worst Case: Modulation QPSK. RB Size: 1. RB Offset: 0.

LTE Band 26. Sub-band 814-824 MHz. 16QAM modulation. BW=10 MHz.

Channel	Middle
Maximum declared antenna gain (dBi)	2.2
Measured maximum average power (dBm) at antenna port	22.37
Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm)	24.57
Maximum effective radiated power E.R.P. (dBm)	22.42
Measurement uncertainty (dB)	<±0.94

Average Power Worst Case: Modulation 16QAM. RB Size: 5. RB Offset: 0.

LTE Band 26. Cross-rule Channel 824 MHz:

LTE Band 26 Cross-rule Channel 824 MHz. QPSK modulation. BW=1.4 MHz.

Channel	824 MHz
Maximum declared antenna gain (dBi)	2.2
Measured maximum average power (dBm) at antenna port	22.20
Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm)	24.40
Maximum effective radiated power E.R.P. (dBm)	22.25
Measurement uncertainty (dB)	<±0.94

Average Power Worst Case: Modulation QPSK. RB Size: 1. RB Offset: 0.

LTE Band 26 Cross-rule Channel 824 MHz. 16QAM modulation. BW=1.4 MHz.

Channel	824 MHz
Maximum declared antenna gain (dBi)	2.2
Measured maximum average power (dBm) at antenna port	22.38
Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm)	24.58
Maximum effective radiated power E.R.P. (dBm)	22.43
Measurement uncertainty (dB)	<±0.94

Average Power Worst Case: Modulation 16QAM. RB Size: 5. RB Offset: 0.

LTE Band 26 Cross-rule Channel 824 MHz. QPSK modulation. BW=3 MHz.

Channel	824 MHz
Maximum declared antenna gain (dBi)	2.2
Measured maximum average power (dBm) at antenna port	22.26
Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm)	24.46
Maximum effective radiated power E.R.P. (dBm)	22.31
Measurement uncertainty (dB)	<±0.94

Average Power Worst Case: Modulation QPSK. RB Size: 1. RB Offset: 0.

LTE Band 26 Cross-rule Channel 824 MHz. 16QAM modulation. BW=3 MHz.

Channel	824 MHz
Maximum declared antenna gain (dBi)	2.2
Measured maximum average power (dBm) at antenna port	22.38
Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm)	24.58
Maximum effective radiated power E.R.P. (dBm)	22.43
Measurement uncertainty (dB)	<±0.94

Average Power Worst Case: Modulation 16QAM. RB Size: 5. RB Offset: 0.

LTE Band 26 Cross-rule Channel 824 MHz. QPSK modulation. BW=5 MHz.

Channel	824 MHz
Maximum declared antenna gain (dBi)	2.2
Measured maximum average power (dBm) at antenna port	22.20
Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm)	24.40
Maximum effective radiated power E.R.P. (dBm)	22.25
Measurement uncertainty (dB)	<±0.94

Average Power Worst Case: Modulation QPSK. RB Size: 1. RB Offset: 0.

LTE Band 26 Cross-rule Channel 824 MHz. 16QAM modulation. BW=5 MHz.

Channel	824 MHz
Maximum declared antenna gain (dBi)	2.2
Measured maximum average power (dBm) at antenna port	22.39
Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm)	24.59
Maximum effective radiated power E.R.P. (dBm)	22.44
Measurement uncertainty (dB)	<±0.94

Average Power Worst Case: Modulation 16QAM. RB Size: 5. RB Offset: 0.

LTE Band 26 Cross-rule Channel 824 MHz. QPSK modulation. BW=10 MHz.

Channel	824 MHz
Maximum declared antenna gain (dBi)	2.2
Measured maximum average power (dBm) at antenna port	22.19
Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm)	24.39
Maximum effective radiated power E.R.P. (dBm)	22.24
Measurement uncertainty (dB)	<±0.94

Average Power Worst Case: Modulation QPSK. RB Size: 1. RB Offset: 0.

LTE Band 26 Cross-rule Channel 824 MHz. 16QAM modulation. BW=10 MHz.

Channel	824 MHz
Maximum declared antenna gain (dBi)	2.2
Measured maximum average power (dBm) at antenna port	22.37
Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm)	24.57
Maximum effective radiated power E.R.P. (dBm)	22.42
Measurement uncertainty (dB)	<±0.94

Average Power Worst Case: Modulation 16QAM. RB Size: 5. RB Offset: 0.

LTE Band 26 Cross-rule Channel 824 MHz. QPSK modulation. BW=15 MHz.

Channel	824 MHz
Maximum declared antenna gain (dBi)	2.2
Measured maximum average power (dBm) at antenna port	22.17
Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm)	24.37
Maximum effective radiated power E.R.P. (dBm)	22.22
Measurement uncertainty (dB)	<±0.94

Average Power Worst Case: Modulation QPSK. RB Size: 1. RB Offset: 0.

LTE Band 26 Cross-rule Channel 824 MHz. 16QAM modulation. BW=15 MHz.

Channel	824 MHz
Maximum declared antenna gain (dBi)	2.2
Measured maximum average power (dBm) at antenna port	22.34
Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm)	24.54
Maximum effective radiated power E.R.P. (dBm)	22.39
Measurement uncertainty (dB)	<±0.94

Average Power Worst Case: Modulation QPSK. RB Size: 5. RB Offset: 0.

Verdict

Pass

Frequency Stability

SPECIFICATION:

FCC § 90.213: Frequency stability.

The applicant shall ensure frequency stability by showing that fL minus the frequency offset and fH plus the frequency offset shall be within the frequency range in which the equipment is designed to operate.

METHOD:

The frequency tolerance measurements over temperature variations were made over the temperature range of –30ºC to +50ºC. The EUT was placed inside a climatic chamber and the temperature was raised hourly in 10ºC steps from –30ºC up to +50ºC.
The supply voltage was varied between 85% and 115% of nominal voltage.

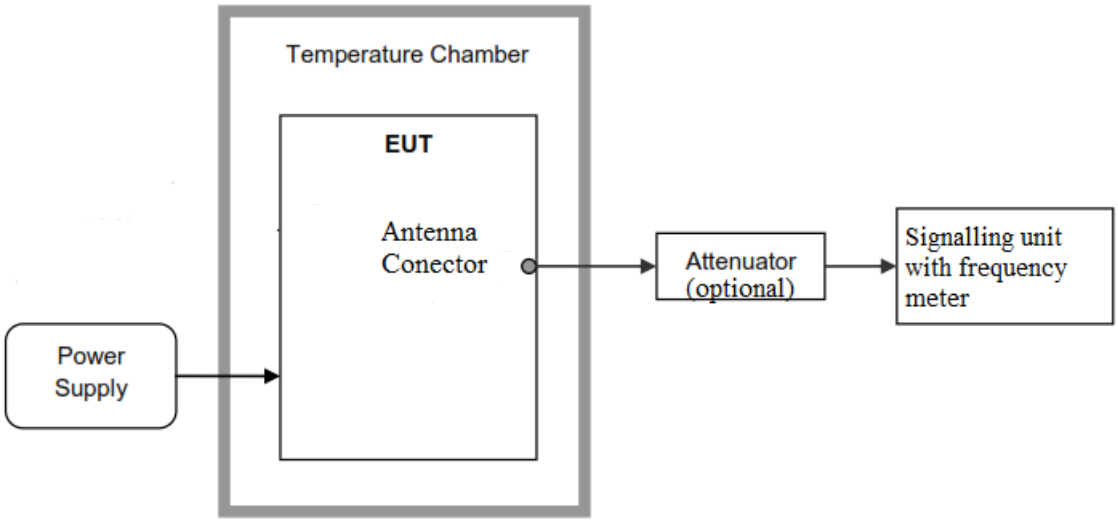
The EUT was set in “Radio Resource Control (RRC) mode” in the middle channel using the Universal Radio Communication tester R&S CMW500 and the maximum frequency error was measured using the built-in calibrated frequency meter.
The worst case LTE mode for conducted power was used for the test.

In order to check that the frequency stability is sufficient such that the fundamental emissions stay within the authorized bands of operation, a reference point is established at the applicable unwanted emissions limit using a RBW equal to the RBW required by the unwanted emissions specification of the applicable regulatory standard. These reference points measured using the lowest and highest channel of operation are identified as fL and fH respectively. The worst-case frequency offset determined in the above methods is added or subtracted from the values of fL and fH to check that the resulting frequencies remain within the band.

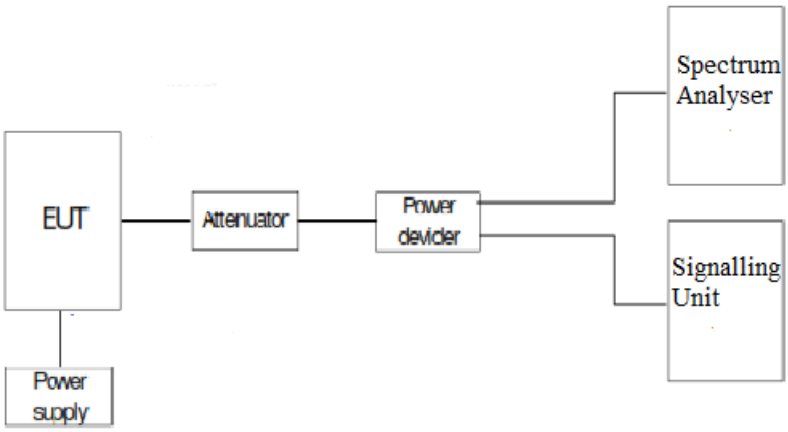
The reference point measurements were made at the RF output terminals of the EUT using an attenuator. power splitter and spectrum analyser. The EUT was controlled via the Universal Radio Communication tester R&S CMW500 selecting maximum transmission power of the EUT and different modes of modulation.

TEST SETUP:

1. Frequency Tolerance:



2. Reference Frequency Points fL and fH:



RESULTS:

1. Frequency Tolerance:

- **Frequency Stability over Temperature Variations:**

LTE Band 26. QPSK MODULATION. Nominal Bandwidth 1.4 MHz. RB = 6. Narrowband 0. Offset 0.

Temperature (ºC)	Frequency Error (Hz)	Frequency Error (ppm)
+50	6.79	0.008334356
+40	7.24	0.008886707
+30	7.66	0.009402234
+20	5.93	0.007278753
+10	4.79	0.005879465
0	5.05	0.006198601
-10	6.54	0.008027495
-20	8.01	0.00983184
-30	4.93	0.006051307

- **Frequency Stability over Voltage Variations.**

LTE Band 26.

Battery Supply voltage	Voltage (V)	Frequency Error (Hz)	Frequency Error (ppm)
Vmax	240	6.57	0.008064318
Vmin (*)	100	6.55	0.008039769

(*): Operating end point specified by the manufacturer.

2. Reference Frequency Points fL and fH:

The worst-case frequency offsets added or subtracted per band and bandwidth:

LTE Band 26: QPSK. Nominal Bandwidth 1.4 MHz.

*f*L (MHz)	814.0050
*f*H (MHz)	823.9950

The reference frequency points fL and fH stay within the authorized blocks for all the band above.

Measurement uncertainty (Hz): <±207.77

Verdict: PASS

Modulation Characteristics

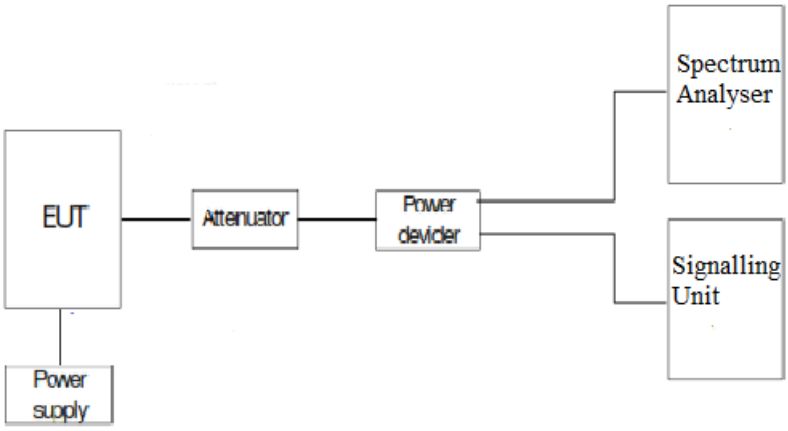
SPECIFICATION:

FCC §2.1047 Measurements required: Modulation characteristics.

METHOD:

For LTE the EUT operates with QPSK and 16QAM modulation modes in which the information is digitised and coded into a bit stream. The RF transmission is multiplexed using *Orthogonal Frequency Division Multiplexing (OFDM)* using different possible arrangement of subcarriers (Resource Blocks RB).

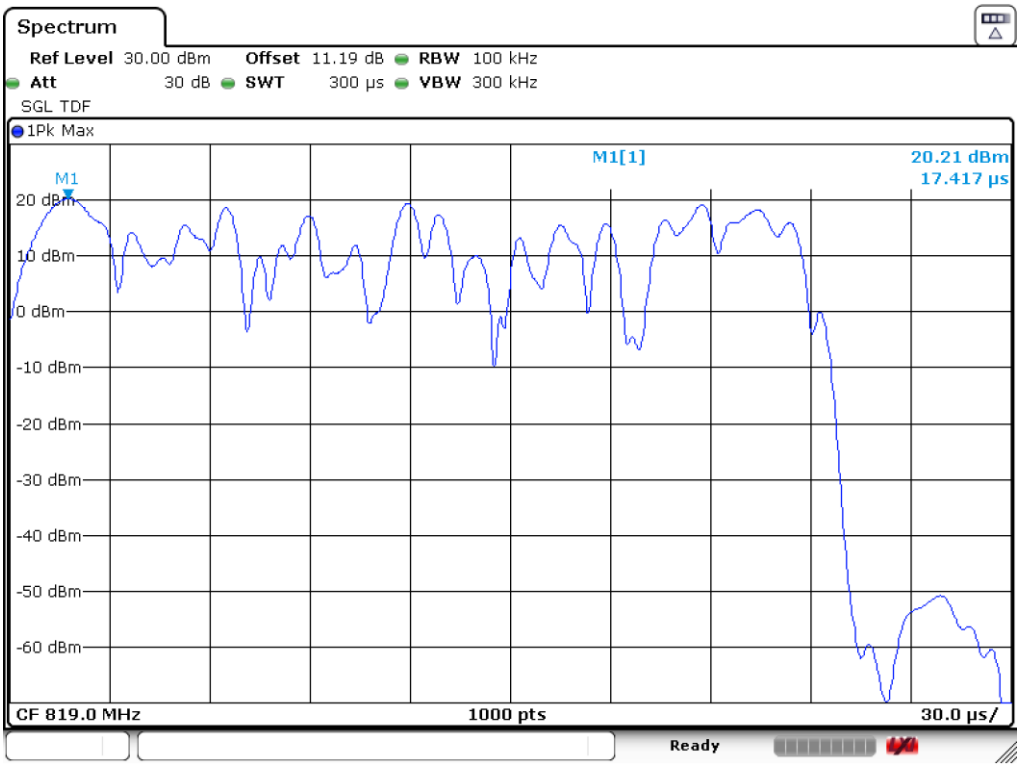
TEST SETUP:



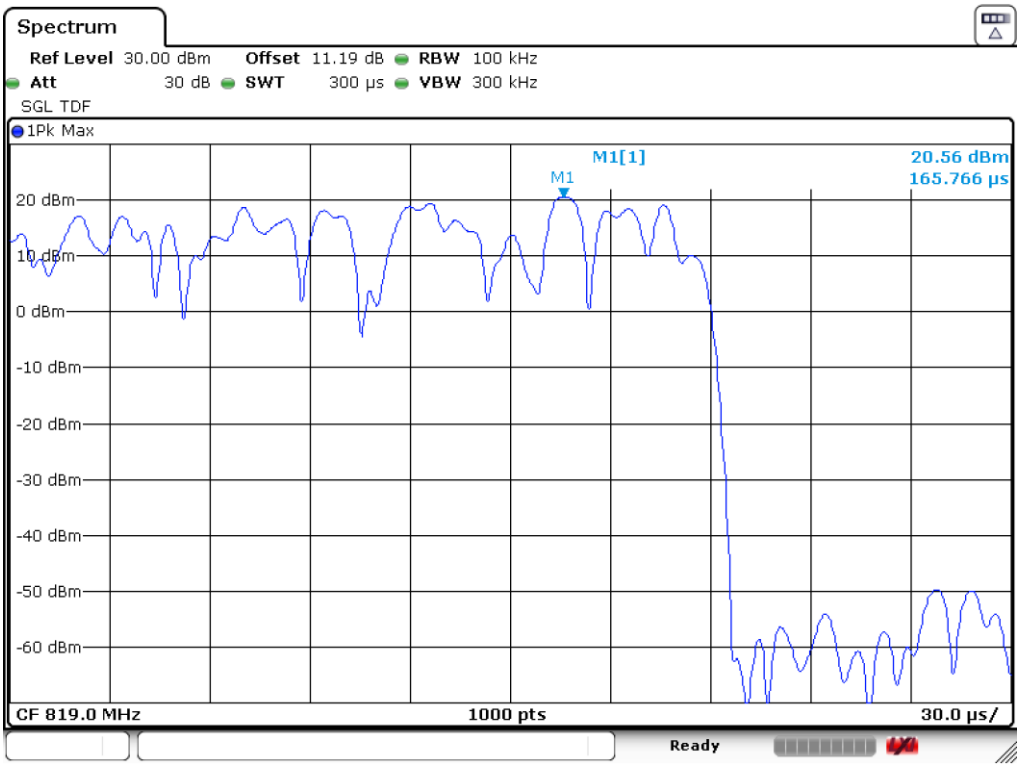
RESULTS:

The following plots show the modulation schemes in the EUT.

LTE Band 26. QPSK. BW = 1.4 MHz.



LTE Band 26. 16QAM. BW = 1.4 MHz.



Occupied Bandwidth

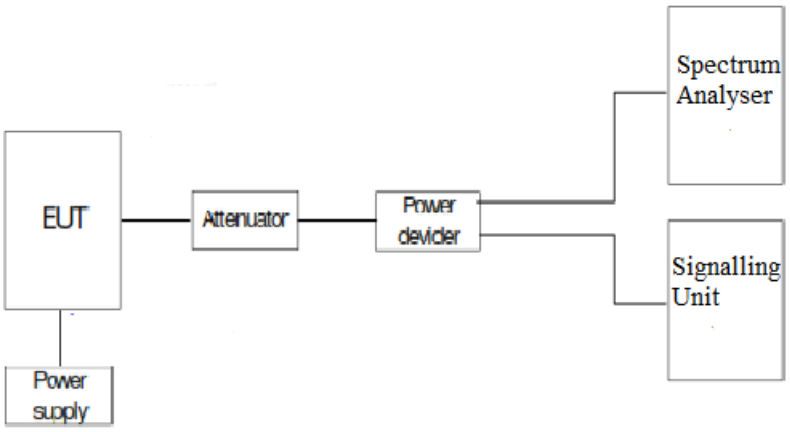
SPECIFICATION:

FCC §2.1049. Measurements required: Occupied bandwidth.

METHOD:

The occupied bandwidth measurement was performed at the output terminals of the EUT using an attenuator. power splitter and spectrum analyser. The EUT was controlled via the Universal Radio Communication tester R&S CMW500 selecting maximum transmission power of the EUT and different modes of modulation. The 99% occupied bandwidth and the -26 dBc bandwidth were measured directly using the built-in bandwidth measuring option of spectrum analyser.

TEST SETUP:



RESULTS:

LTE Bands: The worst case of Occupied Bandwidth corresponds to all Resource Blocks (RB) with Offset 0, regardless the nominal bandwidth selected.

LTE Band 26:

LTE Band 26. QPSK MODULATION. BW = 1.4 MHz.

	Lowest Channel	Middle Channel	Highest Channel
99% Occupied bandwidth (MHz)	1.115000	N/A	1.107000
-26 dBc bandwidth (MHz)	1.472000	N/A	1.525660
Measurement uncertainty (kHz)	<±4.67		

LTE Band 26. 16QAM MODULATION. BW = 1.4 MHz.

	Lowest Channel	Middle Channel	Highest Channel
99% Occupied bandwidth (MHz)	0.950000	N/A	0.947000
-26 dBc bandwidth (MHz)	1.436000	N/A	1.433340
Measurement uncertainty (kHz)	<±4.67		

LTE Band 26. Cross-rule Channel 824 MHz:

LTE Band 26. Cross-rule Channel 824 MHz. QPSK MODULATION. BW = 1.4 MHz.

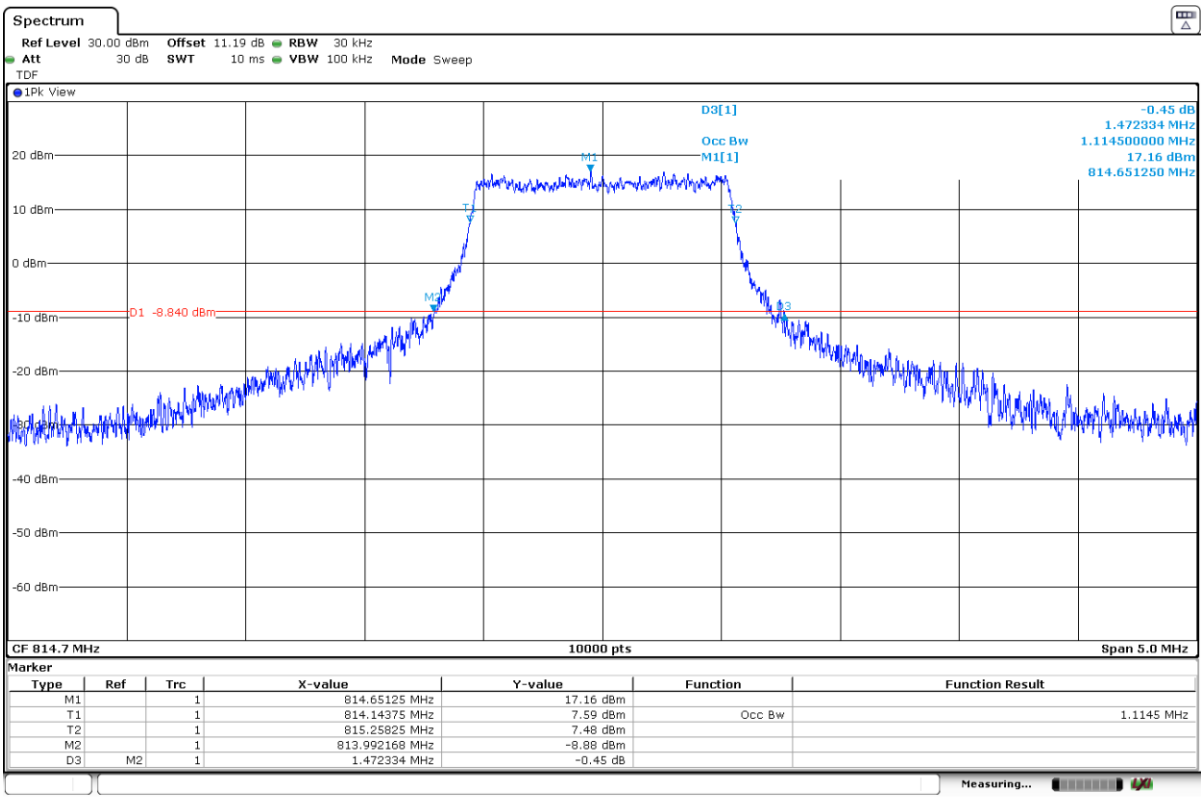
	Single Channel
99% Occupied bandwidth (MHz)	1.112000
-26 dBc bandwidth (MHz)	1.446000
Measurement uncertainty (kHz)	<±4.67

LTE Band 26. Cross-rule Channel 824 MHz. 16QAM MODULATION. BW = 1.4 MHz.

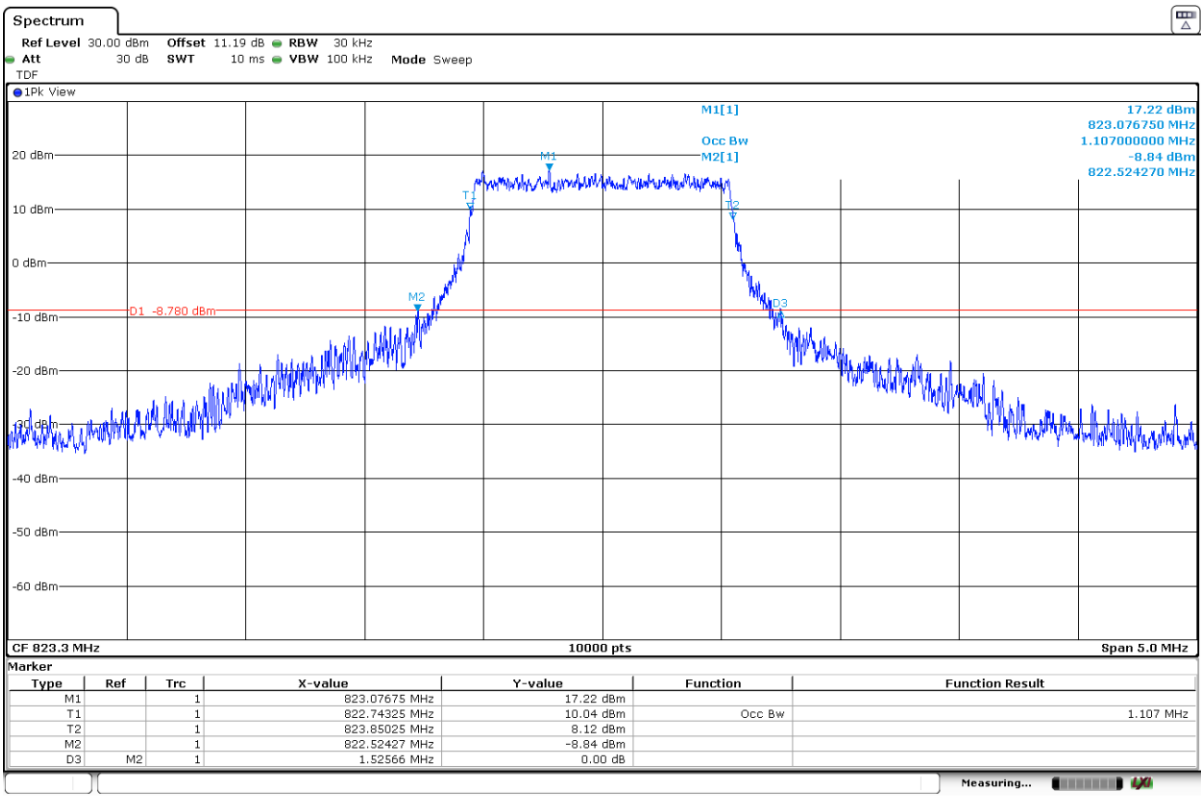
	Single Channel
99% Occupied bandwidth (MHz)	0.954000
-26 dBc bandwidth (MHz)	1.343000
Measurement uncertainty (kHz)	<±4.67

LTE Band 26. QPSK MODULATION. BW = 1.4 MHz.

Lowest Channel:

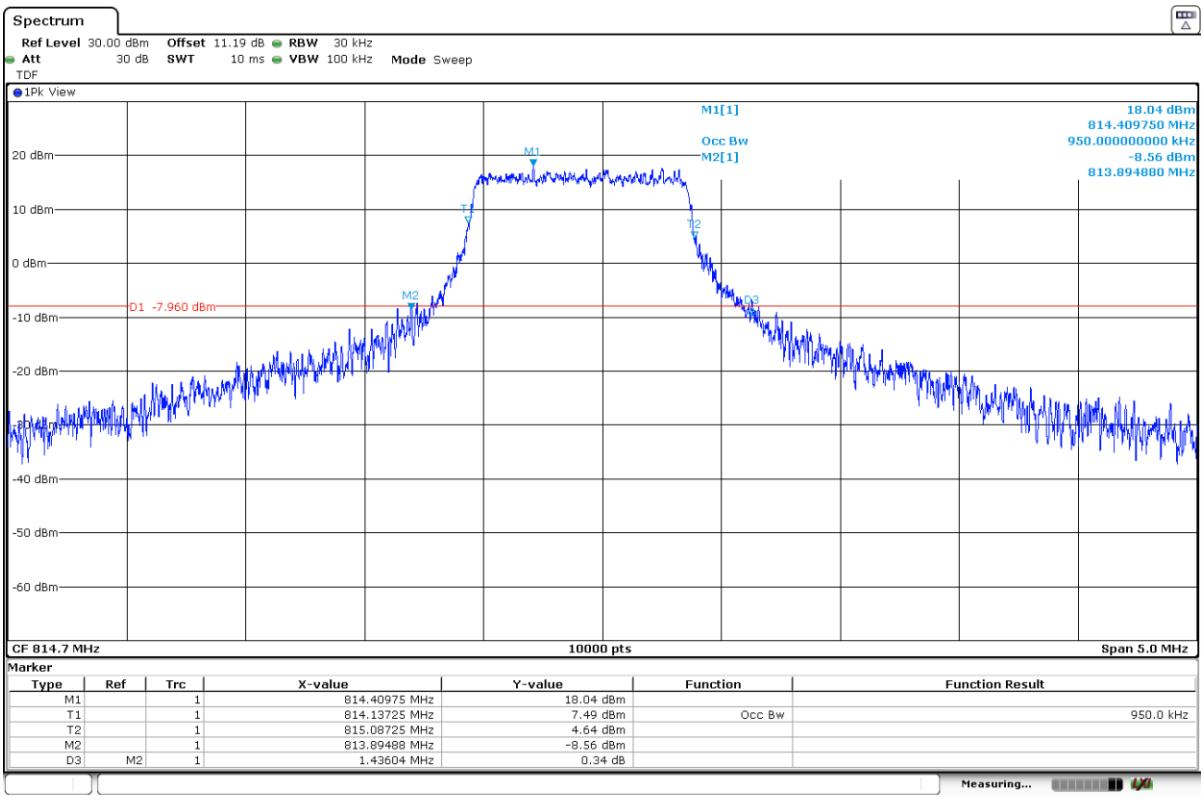


Highest Channel:

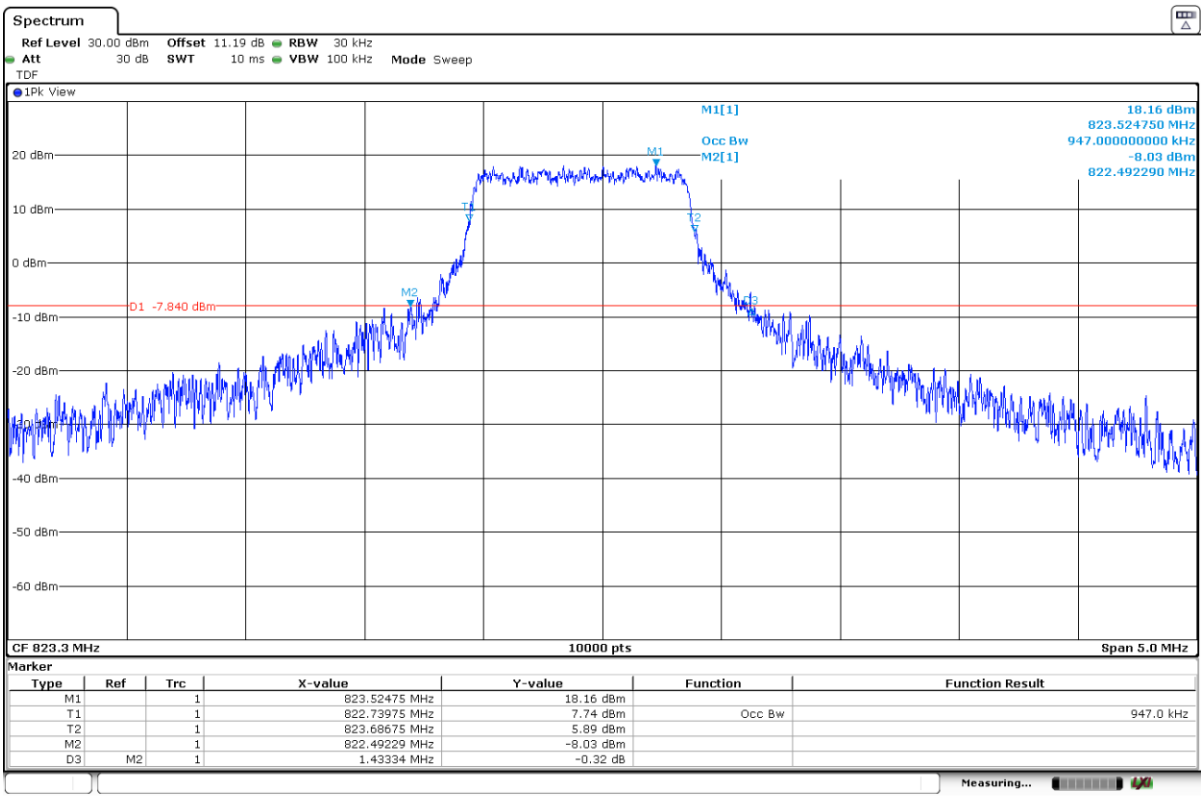


LTE Band 26. 16QAM MODULATION. BW = 1.4 MHz.

Lowest Channel:

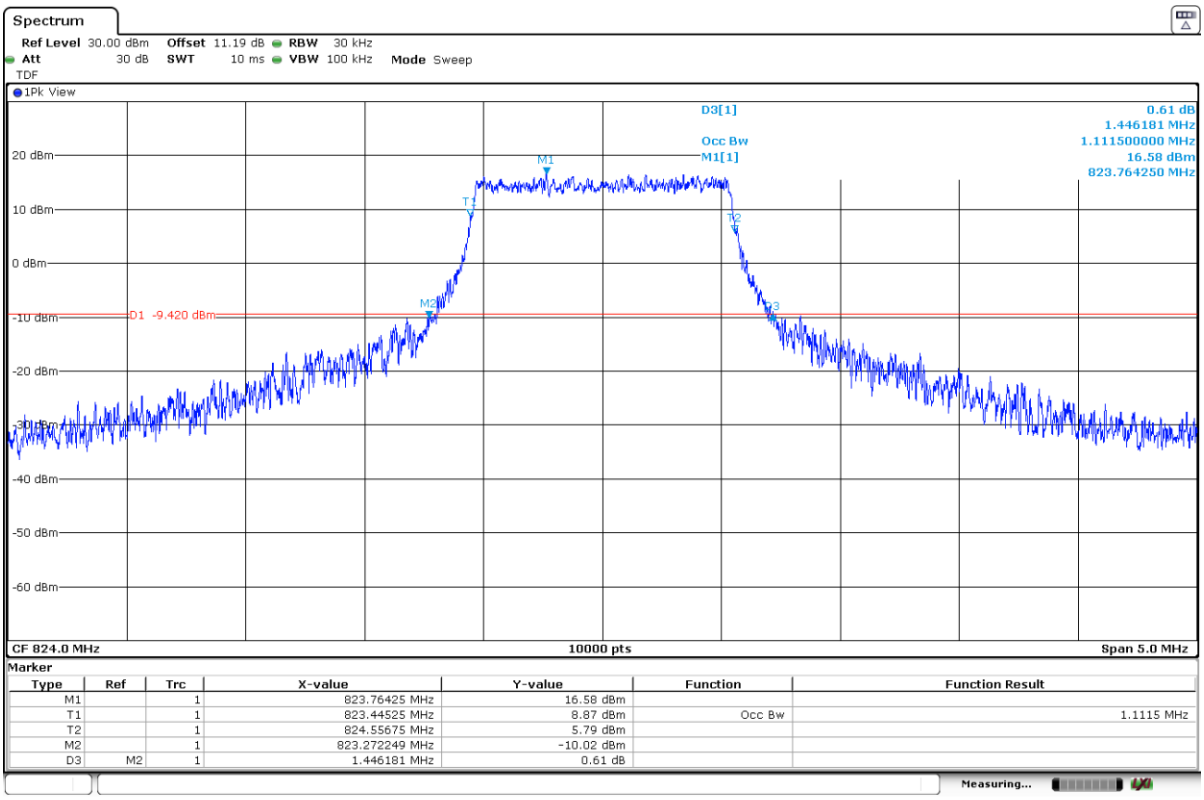


Highest Channel:



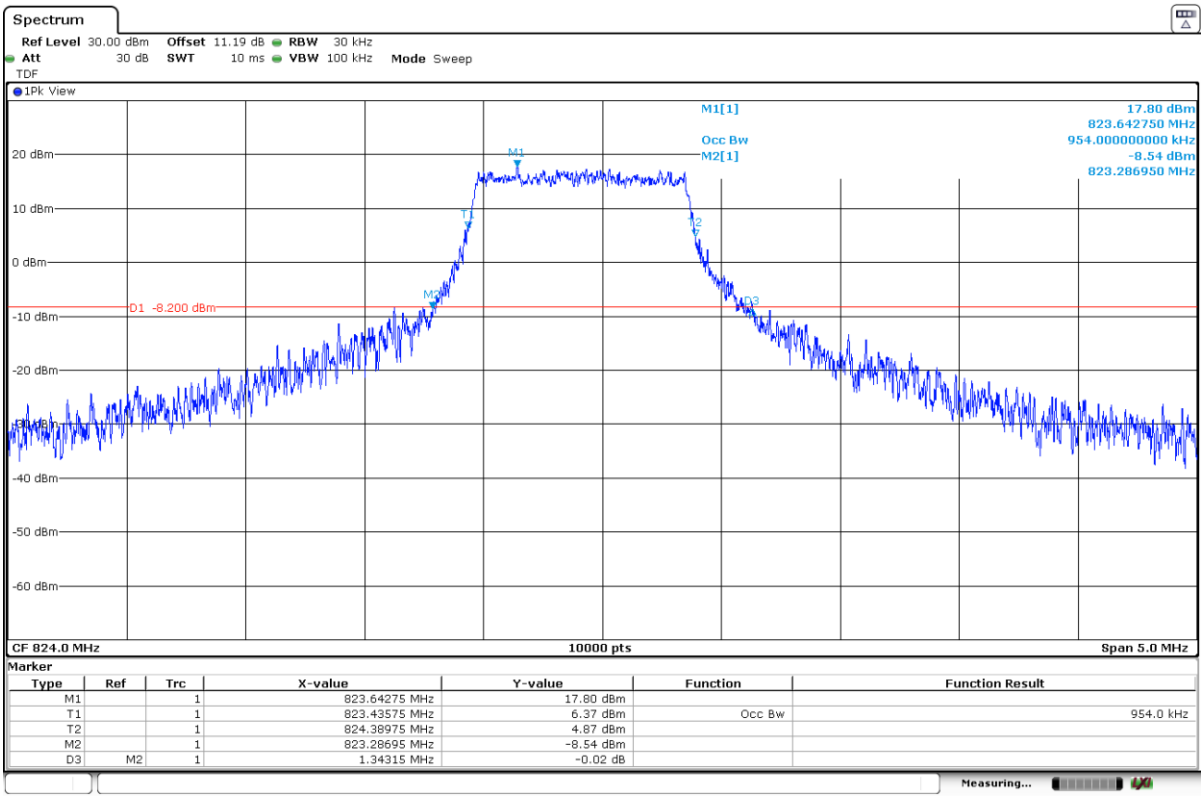
LTE Band 26. Cross-rule Channel 824 MHz. QPSK MODULATION. BW = 1.4 MHz.

Cross-rule Channel 824 MHz:



LTE Band 26. Cross-rule Channel 824 MHz. 16QAM MODULATION. BW = 1.4 MHz.

Cross-rule Channel 824 MHz:



Spurious emissions at antenna terminals

SPECIFICATION:

FCC §2.1051. Measurements required: Spurious emissions at antenna terminals.

FCC §90.543 (e) (2) (3) & (5):

(e) For operations in the 758-768 MHz and the 788-798 MHz bands, the power of any emission outside the licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, in accordance with the following:

(2) On all frequencies between 769-775 MHz and 799-805 MHz, by a factor not less than 65 + 10 log (P) dB in a 6.25 kHz band segment, for mobile and portable stations.

(3) On any frequency between 775-788 MHz, above 805 MHz, and below 758 MHz, by at least 43 + 10 log (P) dB.

(5) Compliance with the provisions of paragraph (e)(3) of this section is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater. However, in the 100 kHz bands immediately outside and adjacent to the frequency block, a resolution bandwidth of 30 kHz may be employed.

FCC §90.691:

(a) Out-of-band emission requirement shall apply only to the “outer” channels included in an EA license and to spectrum adjacent to interior channels used by incumbent licensees. The emission limits are as follows:

(1) For any frequency removed from the EA licensee's frequency block by up to and including 37.5 kHz, the power of any emission shall be attenuated below the transmitter power (P) in watts by at least 116 Log10(f/6.1) decibels or 50 + 10 Log10(P) decibels or 80 decibels, whichever is the lesser attenuation, where f is the frequency removed from the center of the outer channel in the block in kilohertz and where f is greater than 12.5 kHz.

(2) For any frequency removed from the EA licensee's frequency block greater than 37.5 kHz, the power of any emission shall be attenuated below the transmitter power (P) in watts by at least 43 + 10Log10(P) decibels or 80 decibels, whichever is the lesser attenuation, where f is the frequency removed from the center of the outer channel in the block in kilohertz and where f is greater than 37.5 kHz.

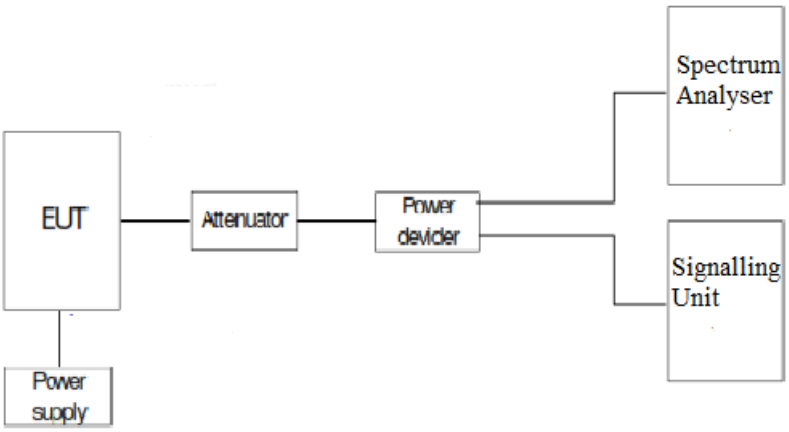
(b) When an emission outside of the authorized bandwidth causes harmful interference, the Commission may, at its discretion, require greater attenuation than specified in this section.

METHOD:

The EUT RF output connector was connected to a spectrum analyser and to the Universal Radio Communication tester R&S CMW500 (selecting maximum transmission power of the EUT and different modes of modulation) using a 50 Ohm attenuator and a power divider.
The spectrum was investigated from 9 kHz to 18 GHz for 3G Band IV and from 9 kHz to 8 GHz for LTE Band 13.
The reading of the spectrum analyser is corrected with the attenuation loss of connection between output terminal of EUT and input of the spectrum analyser.

The configuration of Resource Blocks and modulation which is the worst case for conducted power was used.

TEST SETUP:



RESULTS:

LTE BANDS: Test performed on the worst-case modulation and worst RB and worst Offset for all the nominal BW of each LTE band.

LTE Band 26. 16QAM MODULATION. BW = 1.4 MHz.

Frequency range 9 KHz - 9 GHz:

- Lowest Channel:

No spurious frequencies detected at less than 20 dB below the limit.

- Highest Channel:

No spurious frequencies detected at less than 20 dB below the limit.

LTE Band 26. Cross-rule Channel 824 MHz. 16QAM MODULATION. BW = 5 MHz.

Frequency range 9 KHz - 9 GHz:

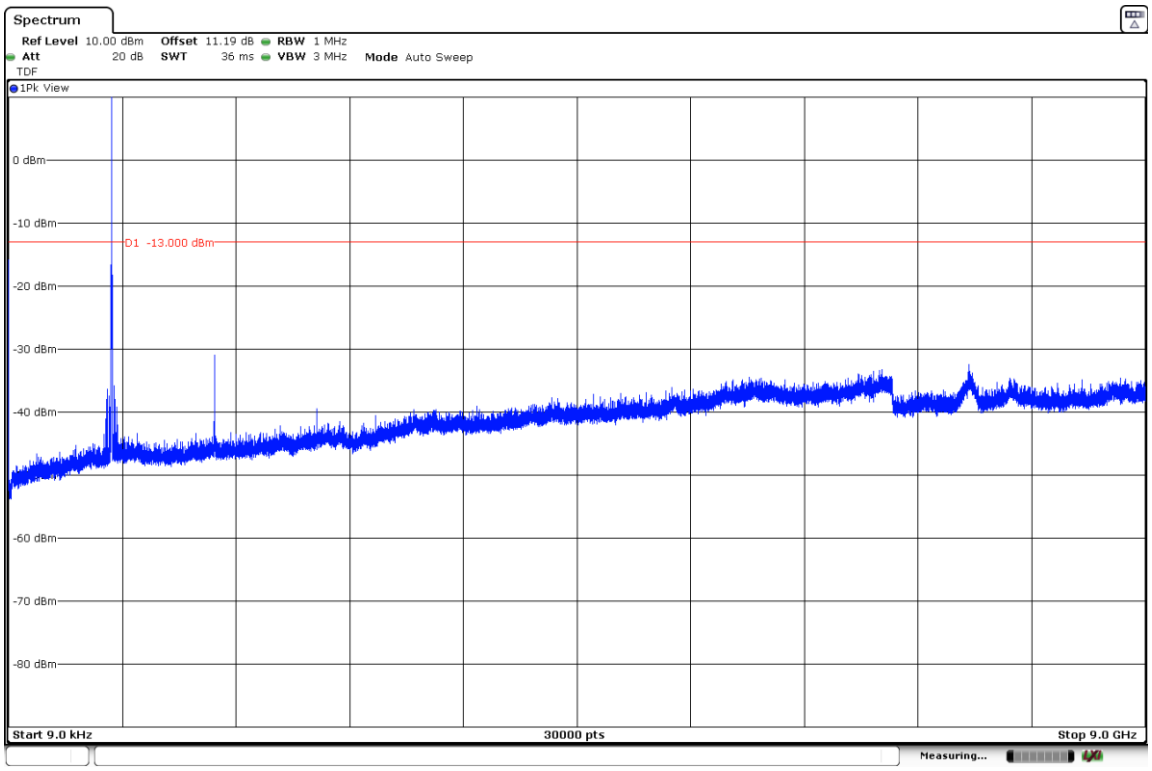
- Single Channel:

No spurious frequencies detected at less than 20 dB below the limit.

Verdict: PASS

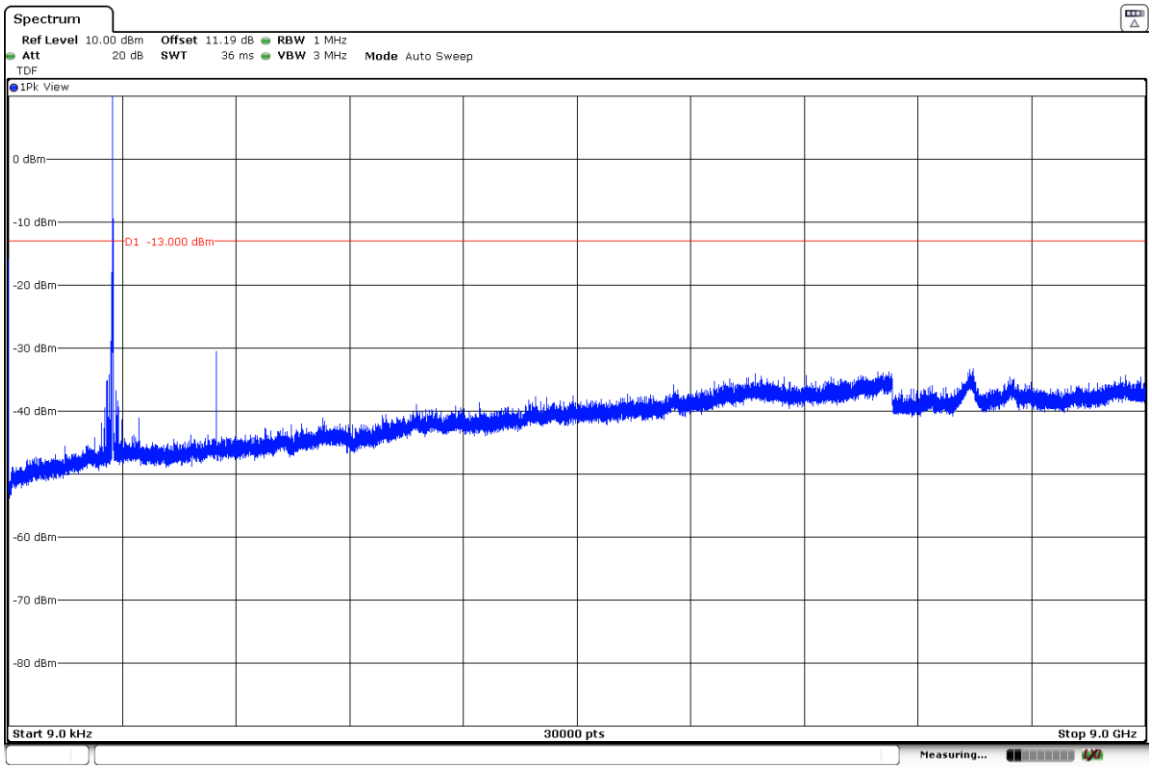
LTE Band 26. 16QAM MODULATION. BW = 1.4 MHz.

Lowest Channel:



The peak above the limit is the carrier frequency.

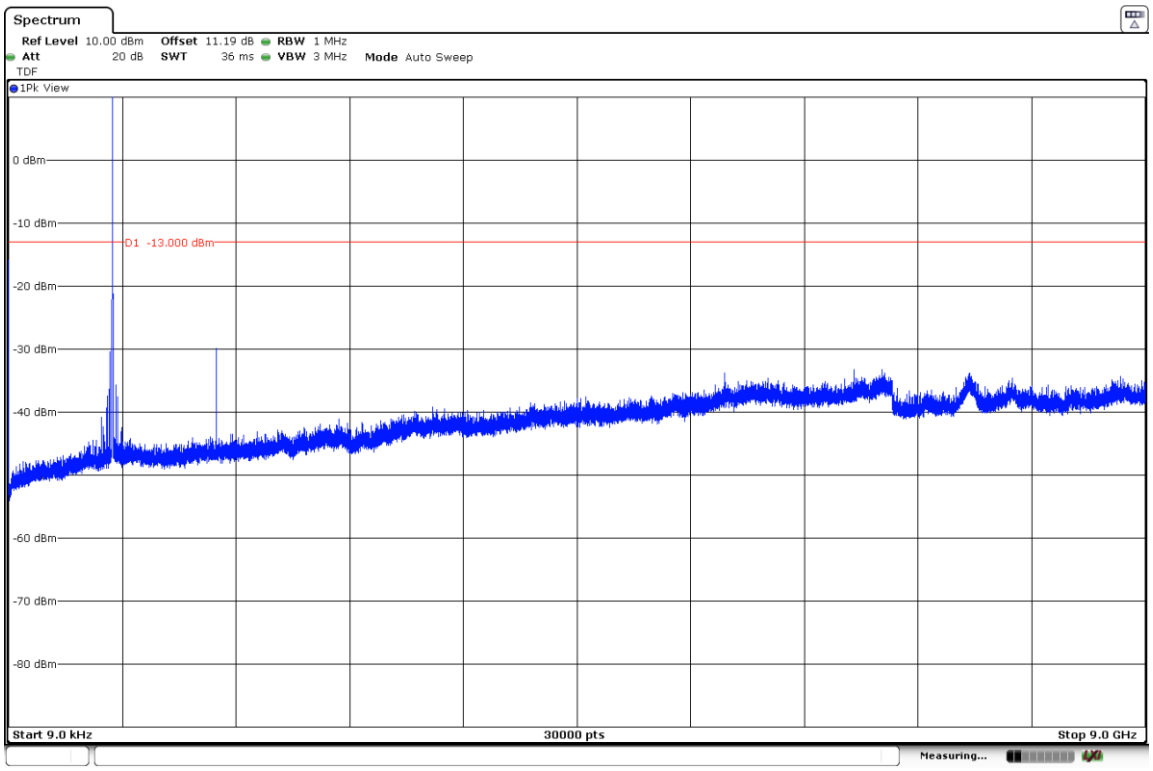
Highest Channel:



The peak above the limit is the carrier frequency.

LTE Band 26. Cross-rule Channel 824 MHz. 16QAM MODULATION. BW = 5 MHz.

Single Channel:



The peak above the limit is the carrier frequency.

Spurious Emissions at Antenna Terminals at Block Edges

Limits:

* FCC §2.1051 and §22.917:

The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB.

Compliance with these rules is based on the use of measurement instrumentation employing a reference bandwidth as follows:

In the spectrum below 1 GHz, instrumentation should employ a reference bandwidth of 100 kHz or greater. In the 1 MHz bands immediately outside and adjacent to the frequency block, a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed.

* RSS-132. Clause 5.5:

Mobile and base station equipment shall comply with the limits below.

In the first 1.0 MHz band immediately outside and adjacent to each of the sub-bands, the power of emissions per any 1% of the occupied bandwidth shall be attenuated (in dB) below the transmitter output power P (dBW) by at least 43 + 10 log 10 p (watts).

FCC §90.691.

(a) Out-of-band emission requirement shall apply only to the “outer” channels included in an EA license and to spectrum adjacent to interior channels used by incumbent licensees. The emission limits are as follows:

> (1) For any frequency removed from the EA licensee's frequency block by up to and including 37.5 kHz, the power of any emission shall be attenuated below the transmitter power (P) in watts by at least 116 Log10(f/6.1) decibels or 50 + 10 Log10(P) decibels or 80 decibels, whichever is the lesser attenuation, where f is the frequency removed from the center of the outer channel in the block in kilohertz and where f is greater than 12.5 kHz.
>
> (2) For any frequency removed from the EA licensee's frequency block greater than 37.5 kHz, the power of any emission shall be attenuated below the transmitter power (P) in watts by at least 43 + 10Log10(P) decibels or 80 decibels, whichever is the lesser attenuation, where f is the frequency removed from the center of the outer channel in the block in kilohertz and where f is greater than 37.5 kHz.

Method:

The EUT RF output connector was connected to a spectrum analyzer and to the Universal Radio Communication tester R&S CMW500 (selecting maximum transmission power of the EUT and different modes of modulation) using a 50-Ohm attenuator and a power splitter.

The reading of the spectrum analyser is corrected with the path loss of the connection between the output terminal of the EUT and the input of the spectrum analyzer.

The configuration of modulation which is the worst case for conducted power was used.

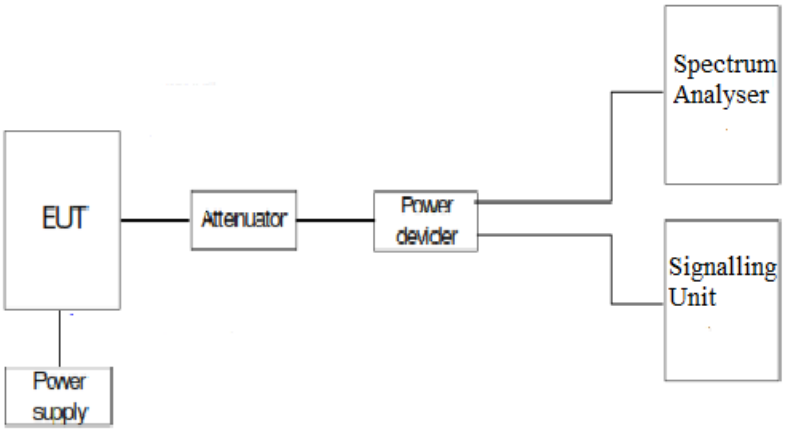
As stated in FCC part 22.917 / RSS-132 Clause 5.5, in the 1 MHz bands immediately outside and adjacent to the frequency block or band a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed.

Measurement Limit:

At Po transmitting power, the specified minimum attenuation 43 + 10 log10 p (watts) becomes:

Po (dBm) - [43 + 10 log (Po in mwatts) - 30] = -13 dBm

Test setup:



Results:

Sub-bands 814-824 MHz & 824-849 MHz:

Preliminary measurements determined the Nominal Bandwidth 1.4 MHz, QPSK modulation as the worst case. Results attached are for this worst-case configuration.

Measurement uncertainty (dB): <±2.76

Verdict

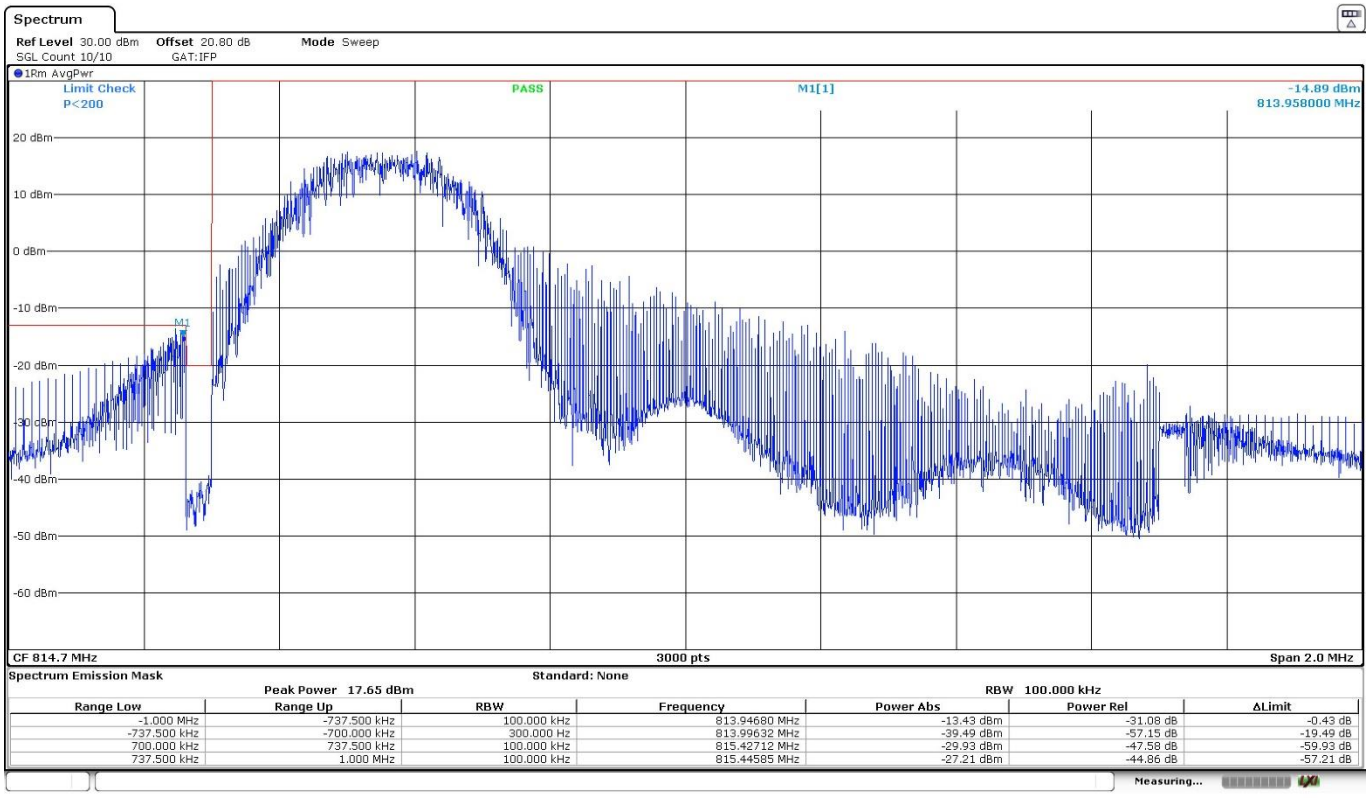
Pass

Attachments

Sub-band 814-824 MHz. EA MASK:

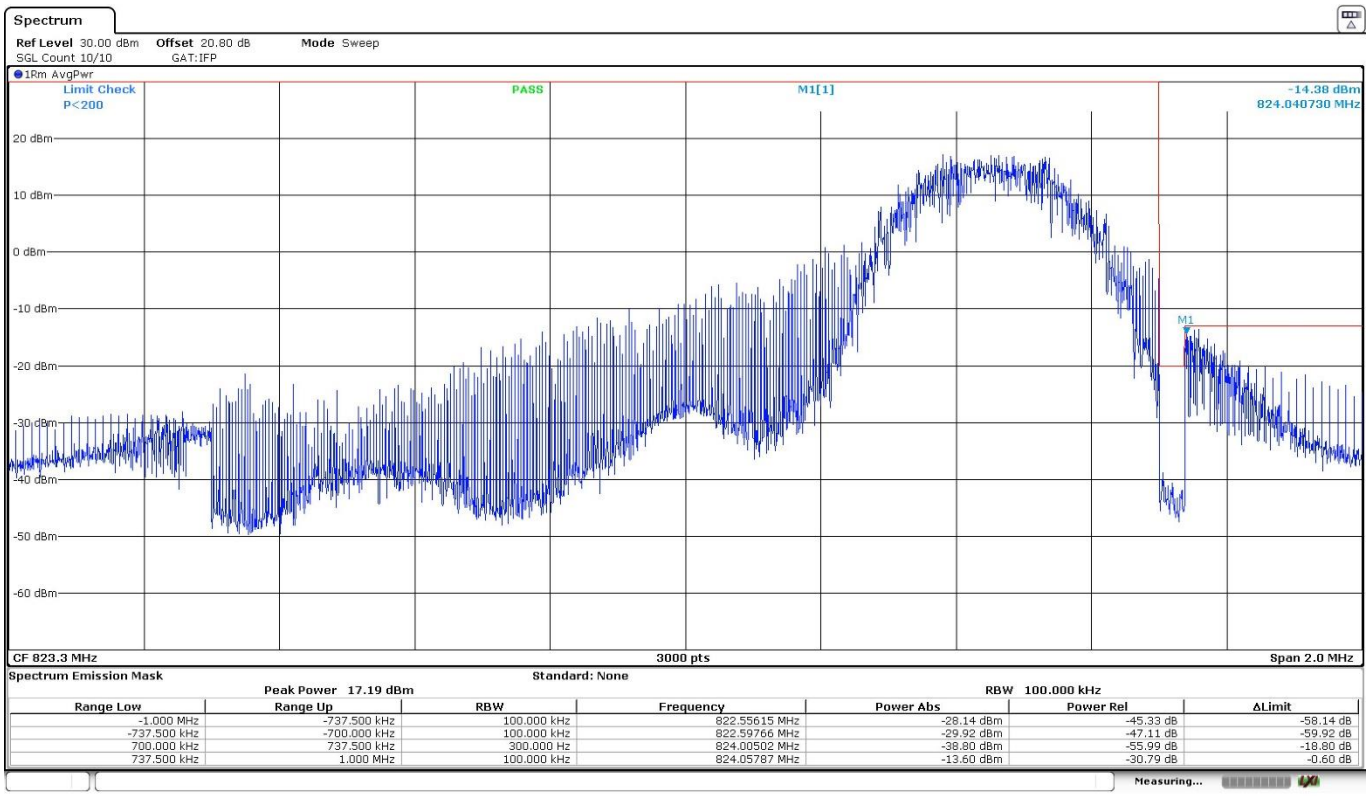
Narrow band = 1. RB = 1. Offset = 0. BW = 1.4 MHz

Low Channel:



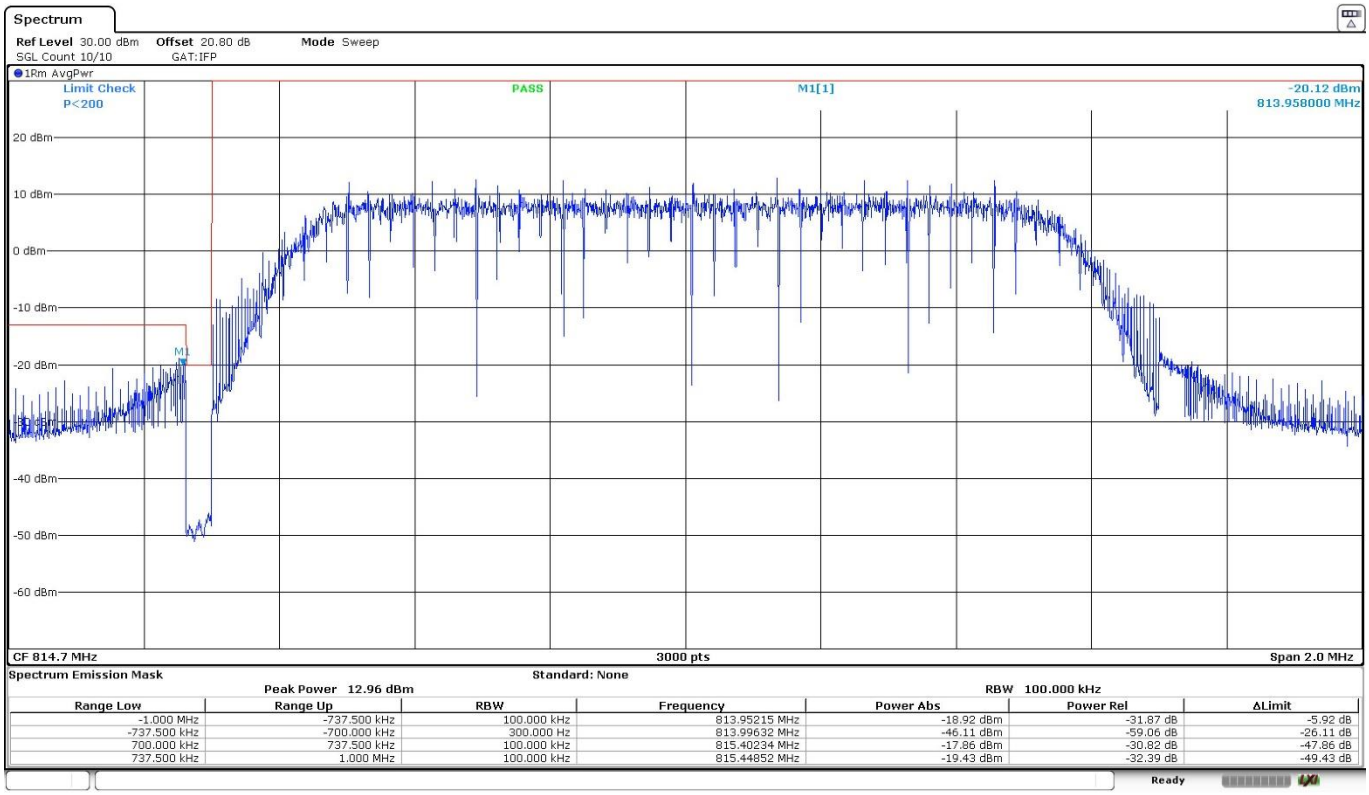
Narrow band = 1. RB = 1. Offset = Max. BW = 1.4 MHz

High Channel:



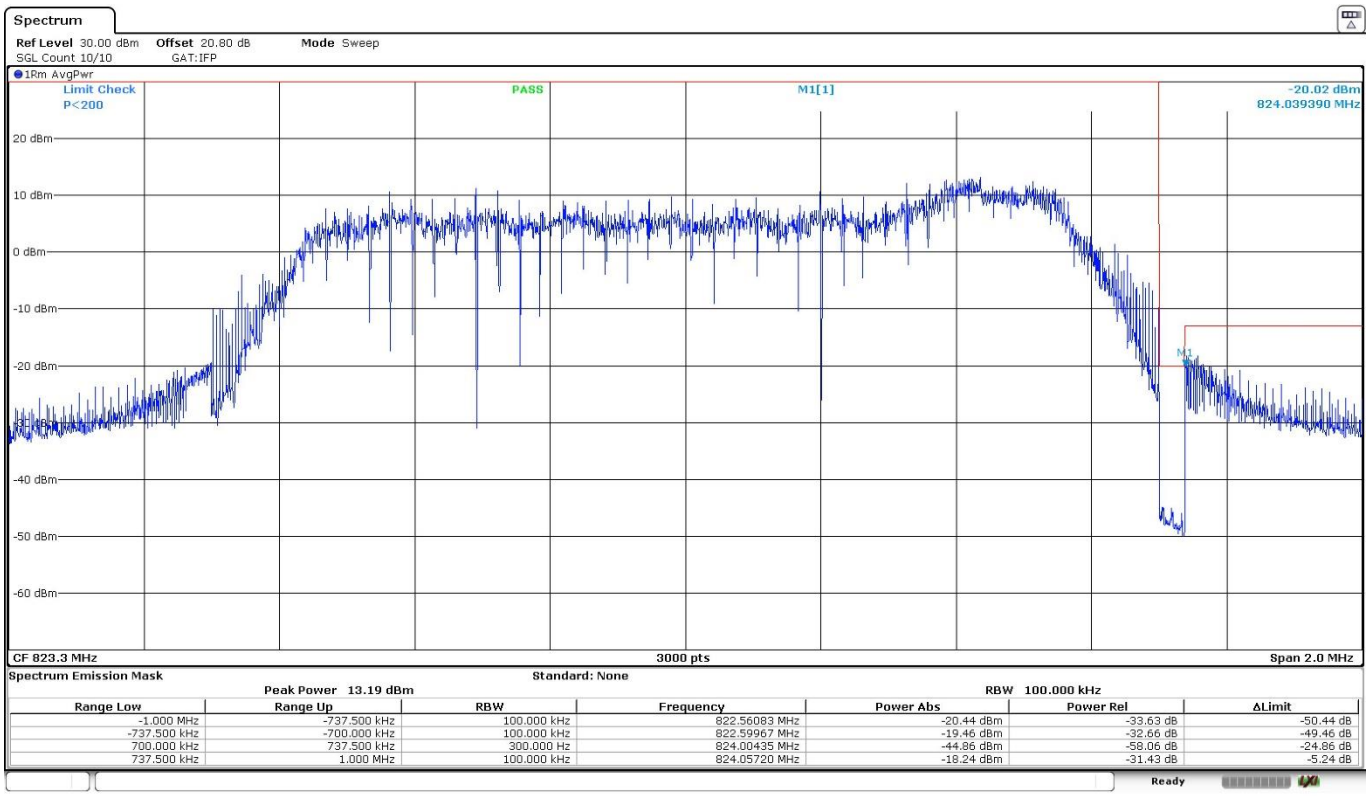
Narrow band = 1. RB = All. Offset = 0. BW = 1.4 MHz

Low Channel:



Narrow band = 1. RB = All. Offset = 0. BW = 1.4 MHz

High Channel:



Radiated Emissions

SPECIFICATION:

FCC §90.691:

For any frequency removed from the EA licensee's frequency block greater than 37.5 kHz, the power of any emission shall be attenuated below the transmitter power (P) in watts by at least 43 + 10 log10 (P) decibels or 80 decibels, whichever is the lesser attenuation, where f is the frequency removed from the center of the outer channel in the block in kilohertz and where f is greater than 37.5 kHz.

METHOD:

The measurement was performed with the EUT inside an anechoic chamber. The spectrum was scanned from 30 MHz to at least the 10th harmonic of the highest frequency generated within the equipment.

The EUT was placed on a 1 meter high non-conductive stand at a 3 meter distance from the measuring antenna. Detected emissions were maximized at each frequency by rotating the EUT and adjusting the height and polarization of the measuring antenna. The maximum meter reading was recorded.

MEASUREMENT LIMIT:

According to specification, the power of emissions shall be attenuated below the transmitter power (P) by a factor of at least 43 + 10 log (P) dB, P in watts.
At Po transmitting power, the specified minimum attenuation becomes 43+10log (Po), and the level in dBm relative Po becomes:

$$Po\ (dBm) - [43 + 10 \log (Po\ in\ mwatts) - 30] = -13\ dBm$$

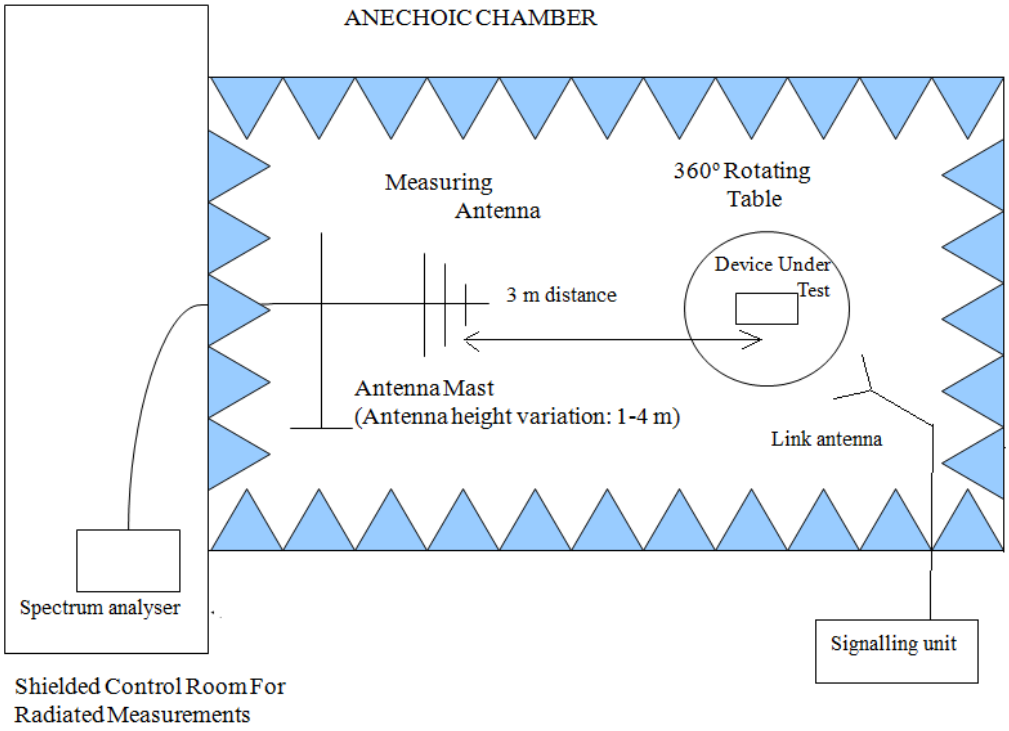
The maximum field strength (dBµV/m) of each detected emission at less than 20 dB respect to the limit is converted to an equivalent EIRP level (dBm) according to ANSI C63.26 with the formula:

EIRP (dBm) = E (dBµV/m) + 20 log(D) - 104.8; where D is the measurement distance (in the far field region) in m. D = 3 m

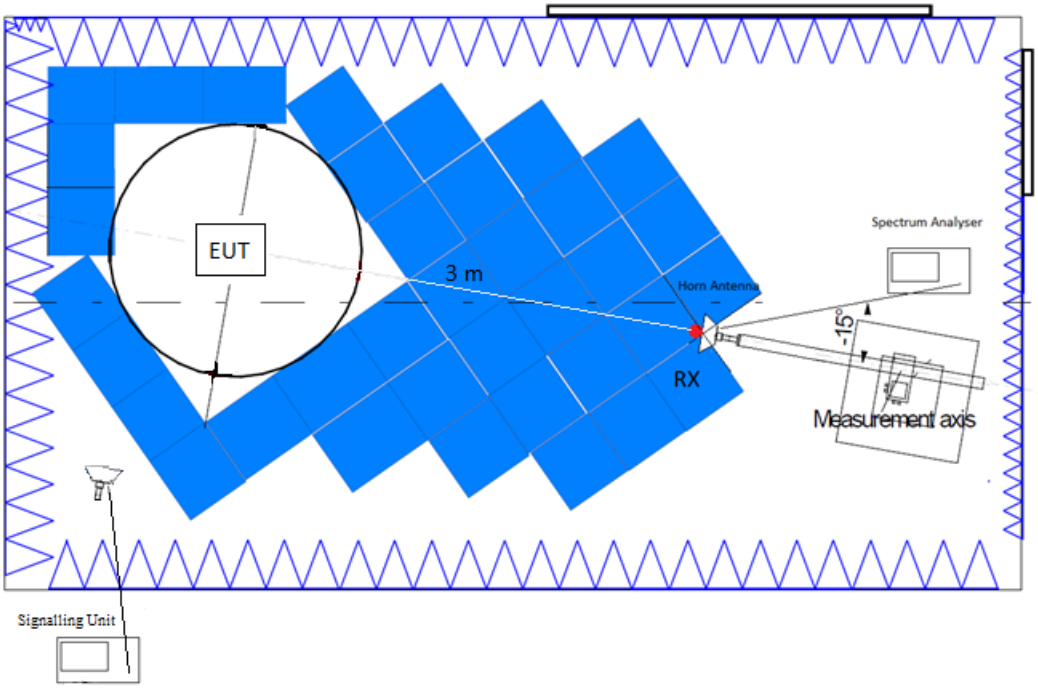
A resolution bandwidth / video bandwidth of 100 kHz / 300 kHz was used for frequencies below 1 GHz and 1 MHz / 3 MHz for frequencies above 1 GHz.

TEST SETUP:

Radiated measurements below 1 GHz:



Radiated measurements above 1 GHz:



RESULTS:

LTE Band 26. Sub-band 814-824 MHz:

A preliminary scan determined the QPSK modulation, BW=1.4 MHz, RB Size=3, RB Offset=0, Narrow Band=0 as the worst case. The next results are for this worst-case configuration.

Measurements required on one frequency near top channel and one frequency near bottom channel, according to FCC § 15.31 (m).

- LOW CHANNEL:

Frequency range 30 MHz - 1 GHz:

No spurious frequencies at less than 20 dB below the limit.

Frequency range 1 - 8.5 GHz:

No spurious frequencies at less than 20 dB below the limit.

- HIGH CHANNEL:

Frequency range 30 MHz - 1 GHz:

No spurious frequencies at less than 20 dB below the limit.

Frequency range 1 - 8.5 GHz:

No spurious frequencies at less than 20 dB below the limit.

Measurement uncertainty (dB): < ±5.35 for f ≥ 30 MHz up to 1 GHz
< ±4.32 for f ≥ 1 GHz up to 8.5 GHz

Verdict

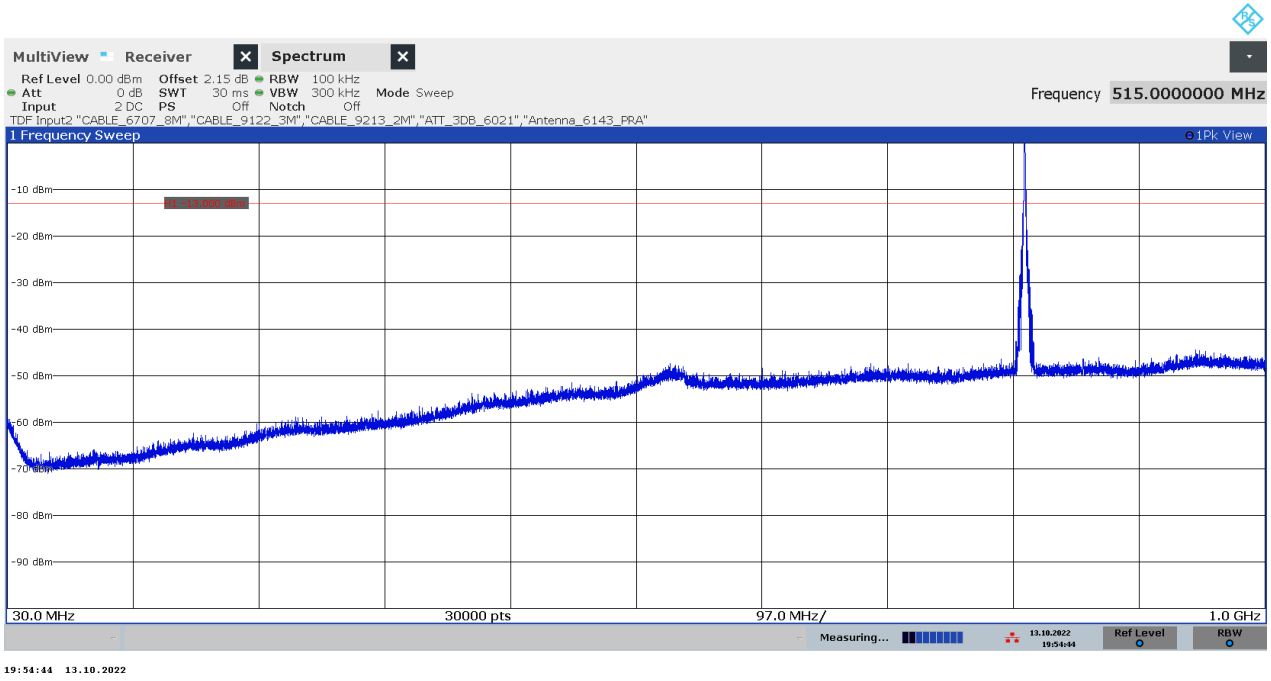
Pass

Attachments

LTE Band 26. Sub-band 814-824 MHz:

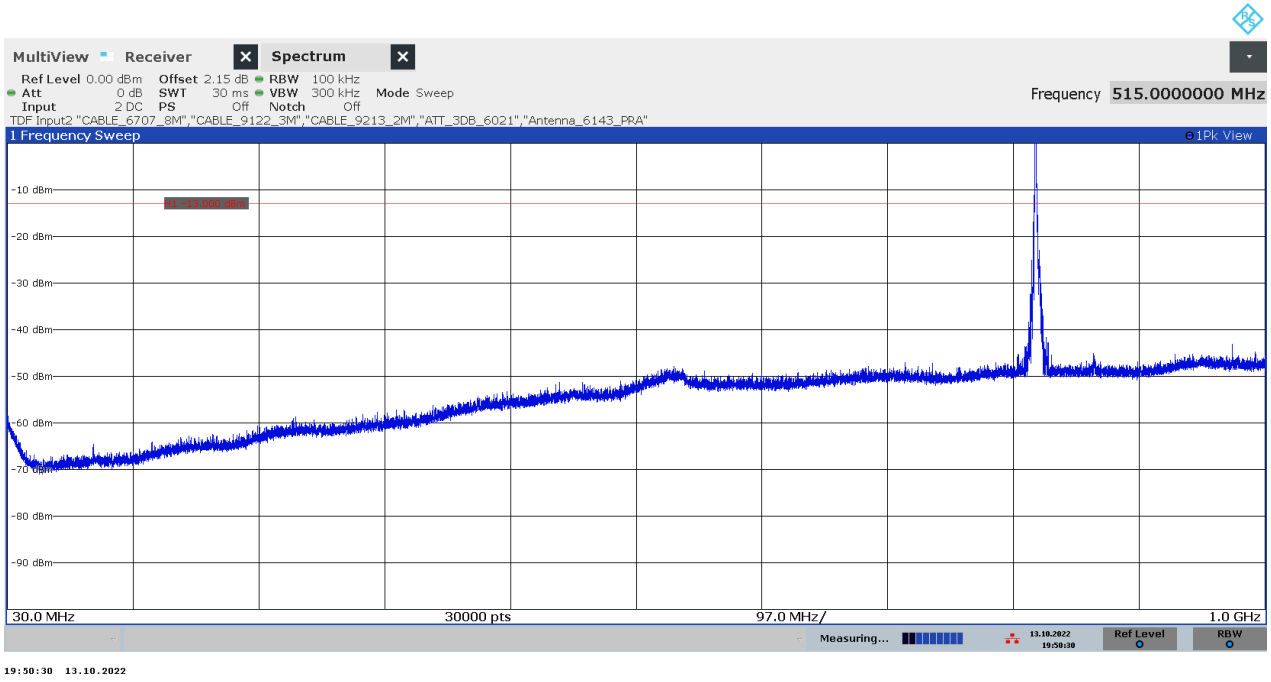
FREQUENCY RANGE 30 MHz - 1 GHz

- LOW CHANNEL:



The peak above the limit is the carrier frequency:
LTE Band 26, 814.7 MHz

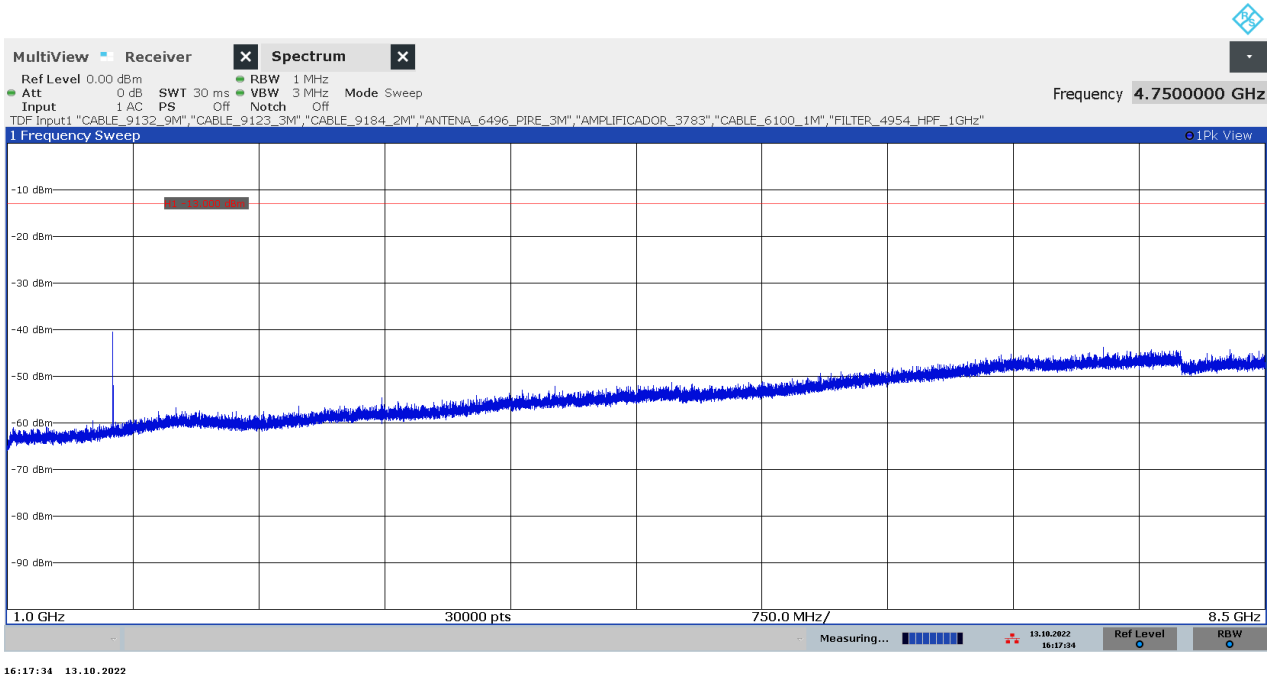
- HIGH CHANNEL:



The peak above the limit is the carrier frequency:
LTE Band 26, 823.3 MHz

FREQUENCY RANGE 1 - 8.5 GHz

- LOW CHANNEL:



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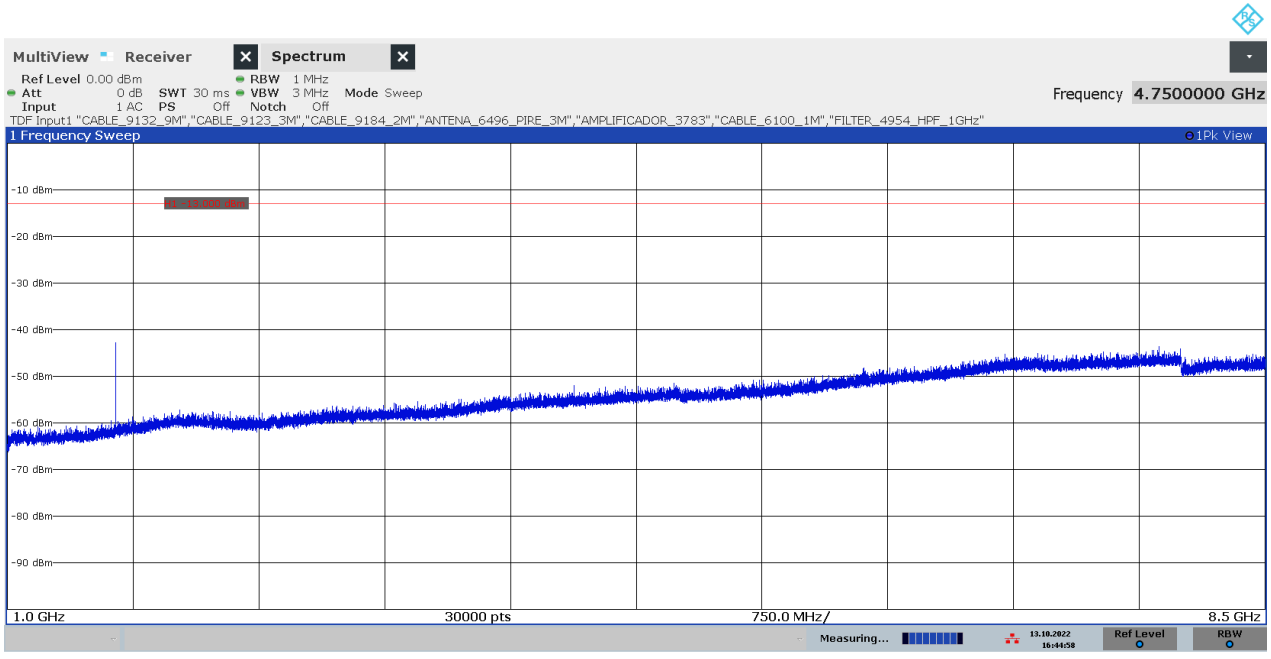
- HIGH CHANNEL:



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LTE Band 26. Cross-rule Channel 824 MHz:

A preliminary scan determined the QPSK modulation, BW=1.4 MHz, RB Size=3, RB Offset=0, Narrow Band=0 as the worst case. The next results are for this worst-case configuration.

- SINGLE CHANNEL (Cross-rule Channel 824 MHz):

Frequency range 30 MHz - 1 GHz:

No spurious frequencies at less than 20 dB below the limit.

Frequency range 1 - 8.5 GHz:

No spurious frequencies at less than 20 dB below the limit.

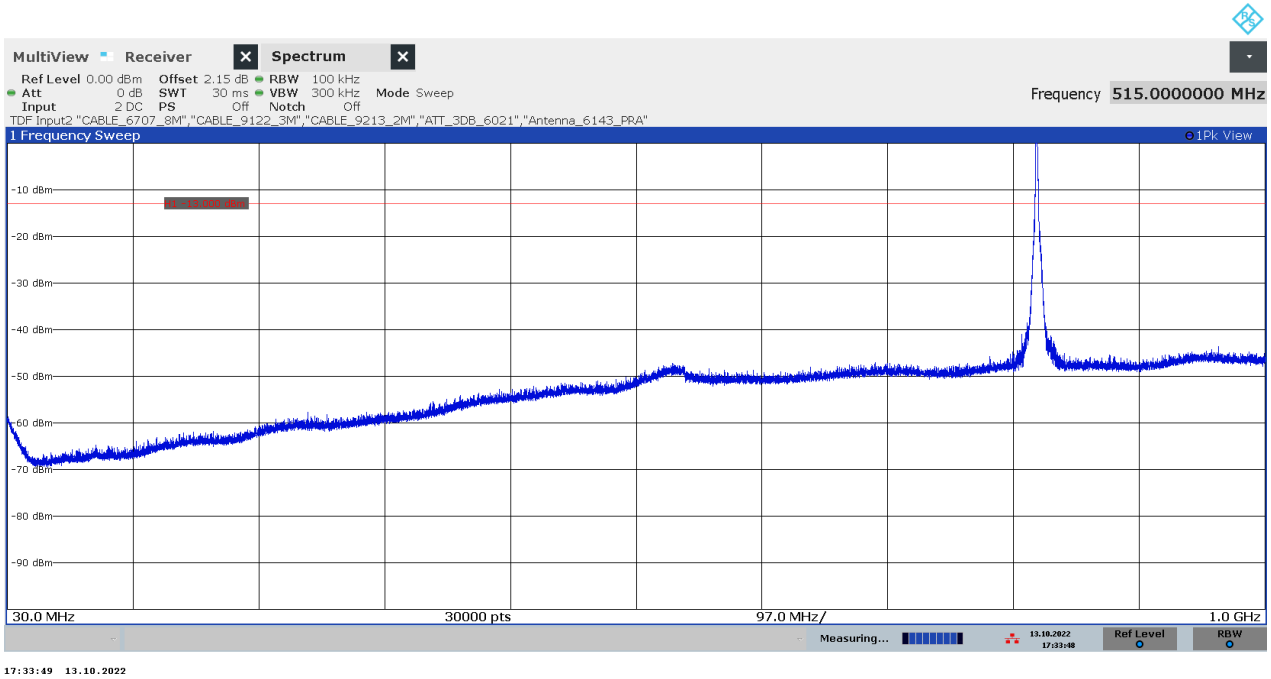
Measurement uncertainty (dB): < ±5.35 for f ≥ 30 MHz up to 1 GHz
< ±4.32 for f ≥ 1 GHz up to 8.5 GHz

Verdict

Pass

FREQUENCY RANGE 30 MHz - 1 GHz

- SINGLE CHANNEL (Cross-rule Channel 824 MHz):



The peak above the limit is the carrier frequency:
LTE Band 26, 824 MHz

FREQUENCY RANGE 1 - 8.5 GHz

- SINGLE CHANNEL (Cross-rule Channel 824 MHz):