

ISED CABid: ES1909
Lab. Company Number: 4621A

Test Report No:
82302RRF.001

Test Report

USA FCC Part 22

CANADA RSS-132

(*) Identification of item tested	LTE NB2 module
(*) Trademark	ST87M01
(*) Model and/or type reference	ST87M01
Other identification of the product	FCC ID: S9N-ST87M01 IC: 8976C-ST87M01
(*) Features	LTE NB2, GNSS HW version: MA_641 SW version: M:2.6.0
Applicant	ST Microelectronics SRL Via Camillo Olivetti n. 2 - 20864 Agrate Brianza (MB) ITALY
Test method requested, standard	USA FCC Part 22 (10-1-24 Edition). CANADA RSS-132 Issue 4, Jan. 2023. 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	2025-09-29
Report template No	FDT08_24 (*) "Data provided by the client"

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Competences and guarantees

DEKRA Testing and Certification is a testing laboratory accredited by the National Accreditation Body (ENAC - Entidad Nacional de Acreditación) to perform the tests indicated in the Certificate No. 51/LE 147.

DEKRA Testing and Certification is an FCC-recognized accredited testing laboratory with appropriate scope of accreditation that covers the performed tests in this report.

DEKRA Testing and Certification is an ISED-recognized accredited testing laboratory, CABid: ES1909, Company Number: 4621A, with the appropriate scope of accreditation that covers the performed tests in this report.

In order to assure the traceability to other national and international laboratories, DEKRA Testing and Certification has a calibration and maintenance program for its measurement equipment.

DEKRA Testing and Certification guarantees the reliability of the data presented in this report, which is the result of the measurements and the tests performed to the item under test on the date and under the conditions stated on the report and it is based on the knowledge and technical facilities available at DEKRA Testing and Certification at the time of performance of the test.

DEKRA Testing and Certification is liable to the client for the maintenance of the confidentiality of all information related to the item under test and the results of the test.

The results presented in this Test Report apply only to the particular item under test established in this document.

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General conditions

1. This report is only referred to the item that has undergone the test.
2. This report does not constitute or imply on its own an approval of the product by the Certification Bodies or competent Authorities.
3. This document is only valid if complete; no partial reproduction can be made without previous written permission of DEKRA Testing and Certification S.A.U.
4. This test report cannot be used partially or in full for publicity and/or promotional purposes without previous written permission of DEKRA Testing and Certification S.A.U. and the Accreditation Bodies.

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 consists of a Module for NB-IOT NB2 and GNSS.

DEKRA Testing and Certification S.A.U. declines any responsibility with respect to the information provided by the client and that may affect the validity of results.

Usage of samples

Samples undergoing test have been selected by: The client.

Id	Control Number	Description	Model	Serial N°	Date of Reception	Application
S/01	82302_1	Module Circuit Board	ST87M01	-	2025-03-03	Element Under Test
S/01	81088_2	Evaluation board	TEKIT 600- PTCRB0	-	2024-11-12	Auxiliary Element
S/02	82302_2	Module Circuit Board	ST87M01	-	2025-03-03	Element Under Test
S/02	78078_6	Antenna GPS	-	-	2024-02-16	Auxiliary Element
S/02	78078_8	Antenna	-	-	2024-02-16	Auxiliary Element

Id	Type
S/01	Conducted tests.
S/02	Radiated tests.

Test sample description

Ports.....:	Port name and description	Cable		
		Specified max length [m]	Attached during test	Shielded
	MAIN Antenna		☒	☒
	GNSS Antenna		☐	☐
Supplementary information to the ports.....:	-			
Rated power supply..... :	Voltage and Frequency			
	☒ DC: Min: 2.2V - Nom: 2.5 V - Max: 3V			
Rated Power	-			
Clock frequencies..... :	Reference clocks: 38.4MHz - 32 kHz			
Other parameters	Temperature: -40/+25/+85°C			
Software version	M: 2.6.0			
Hardware version	EVKITST87M01-1 - Version: LA_711			
Dimensions in cm (W x H x D)...	6 * 2* 8			
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
	MA_633_EV_LA_711_#591/IMEI:352825350057562		Module	STMicroelectronic
	MA_633_EV_LA_711_#593/IMEI:352825350057885		Module	STMicroelectronic
	MA_633_EV_LA_711_#600/IMEI:352825350057893		Module	STMicroelectronic
	MA_633_EV_LA_711_#601/IMEI:352825350057653		Module	STMicroelectronic
	MA_633_EV_LA_711_#602/IMEI:352825350057729		Module	STMicroelectronic
Accessories (not part of the test item)..... :	Description		Type	Manufacturer
	-		-	-
Documents as provided by the applicant	Description		File name	Issue date
	EVKITST87M01-1 User Manual		EVKITST87M01	2024-06-18
	ST87MXX UM AT commands description		ST87MXX_UM_	2025-02-18
	DataSheet ST87M01			

(3) Only for Medical Equipment

Identification of the client

ST Microelectronics
10 Rue de Jouanet. 35700 RENNES. FRANCE

Testing period and place

Test Location	DEKRA Testing and Certification S.A.U.
Date (start)	2024-11-28
Date (finish)	2025-02-22

Document history

Report number	Date	Description
82302RRF.001	2025-09-29	First release

Environmental conditions

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

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

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

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

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

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

Remarks and comments

The tests have been performed by the technical personnel: Pablo Redondo, Carmen Vázquez.

Used instrumentation:

Control No.	Equipment	Model	Manufacturer	Next Calibration
7760	Digital Multimeter	175	FLUKE	2025-11-07
7445	DC POWER Supply 30V/5A	U8002A	KEYSIGHT TECHNOLOGIES	N/A
7794	SIGNAL AND SPECTRUM ANALYZER 10 Hz - 40 GHz	FSV40	ROHDE AND SCHWARZ	2025-04-21
6157	Signal and Spectrum Analyzer 10 Hz - 40 GHz	FSV40	ROHDE AND SCHWARZ	2027-03-17
9227	Wideband Radio Communication Tester	CMW500	ROHDE AND SCHWARZ	2025-10-29
6254	Attenuator 6 dB 2W DC-26.5 GHz	TWSMAG2	TECHNIWAVE	2025-03-30
6794	Shielded Room	S101	ETS LINDGREN	N/A
6791	SEMIANECHOIC ABSORBER LINED	FACT 3 200 STP	ETS LINDGREN	N/A
6792	SHIELDED ROOM	S101	ETS LINDGREN	N/A
6614	TEMPERATURE AND HUMIDITY PROBE	HWg-STE	HW GROUP	2025-04-22
6666	EMI TEST RECEIVER 2Hz-44GHz	ESW44	ROHDE AND SCHWARZ	2026-07-12
3783	PRE-AMPLIFIER G>30dB 1GHz-18GHz	BLMA 0118-3A	BONN ELEKTRONIK	2026-03-17
6496	HORN ANTENNA 1-18GHz	BBHA 9120 D	SCHWARZBECK	2026-12-01
6143	Biconical/Log Antenna 30 MHz - 6 GHz	3142E	ETS LINDGREN	2027-01-22
4848	SOFTWARE FOR EMC/RF TESTING	EMC32	ROHDE AND SCHWARZ	N/A

Testing verdicts

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

Summary

LTE Cat NB2 Bands 5.

FCC PART 22 / RSS-132 PARAGRAPH		
Requirement – Test case	Verdict	Remark
FCC 22.913 / RSS-132 5.4: RF Output Power	P	
FCC 2.1047 / RSS-132 5.2: Modulation Characteristics	P	
FCC 22.355 / RSS-132 5.3: Frequency Stability	P	
FCC 2.1049: Occupied Bandwidth	P	
FCC 22.917 / RSS-132 5.5: Spurious Emissions at Antenna Terminals	P	
FCC 22.917 / RSS-132 5.5: Spurious Emissions at Antenna Terminals at Block Edges	P	
FCC 22.917 / RSS-132 5.5: Radiated Emissions	P	
<u>Supplementary information and remarks:</u> None.		

Appendix A: Test results for FCC 22 / RSS-132: LTE Cat NB2 Bands 5

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TEST CONDITIONS

(*): Data provided by the Applicant.

POWER SUPPLY (*):

Vnormal: 2.5 Vdc
Vminimum: 2.2 Vdc
Vmaximum: 3 Vdc

Type of Power Supply: Internal DC.

ANTENNA (*):

Bands	Gain (dBi)	Type
LTE Cat NB2 Band 5	1	External

TEST FREQUENCIES:

LTE Cat NB2 Band 5. Pi/2-BPSK, Pi/4-QPSK, QPSK modulations:

Channel. Number (Frequency, MHz)		
Low	Middle	High
20402 (824.20)*	20525 (836.50)	20648 (848.80)*
*The outermost channel which is in compliance with Block edge testing.		

RF Output Power

Limits

* FCC §2.1046 and FCC §22.913. The Effective Radiated Power (E.R.P) of mobile transmitter and auxiliary test transmitter must not exceed 7 Watts (38.45 dBm E.R.P.).

* RSS-132 Issue 4. Clause 5.4. The transmitter output power shall be measured in terms of average power. The equivalent radiated power (e.r.p.) shall not exceed 7 watts for mobile equipment and 3 watts for portable equipment.

The effective isotropic radiated power (e.i.r.p.) shall not exceed the limits specified in SRSP-503 for base station equipment.

In addition, the peak-to-average power ratio (PAPR) of the transmitter shall not exceed 13 dB for more than 0.1% of the time using a signal corresponding to the highest PAPR during periods of continuous transmission.

In addition, the peak-to-average power ratio (PAPR) of the transmitter shall not exceed 13 dB for more than 0.1% of the time using a signal corresponding to the High PAPR during periods of continuous transmission.

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 peak-to-average power ratio (PAPR) is measured using an attenuator, power splitter and spectrum analyser with a Complementary Cumulative Distribution Function implemented.

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:

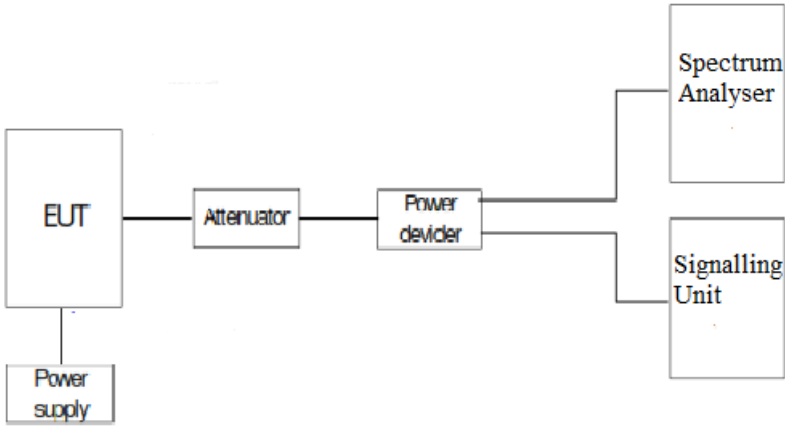
$$\text{E.R.P.} = \text{E.I.R.P.} - 2.15 \text{ dB}$$

Test Setup

1. CONDUCTED AVERAGE POWER:



2. PEAK-TO-AVERAGE POWER RATIO (PAPR) and Conducted Average power:



Results

1. CONDUCTED AVERAGE POWER

LTE Cat NB2 Band 5:

CHANNEL	FREQUENCY (MHz)	MODULATION	BW	Tone Number	Tone Offset (Start SubCarrier)	MCS / TBS	AVERAGE POWER (dBm)
Low 26792	824.2 MHz	Pi/2-BPSK	3.75 kHz	1	0	0	22,36
				1	47	0	22,33
			15 kHz	1	0	0	22,36
				1	11	0	22,35
		Pi/4-QPSK	3.75 kHz	1	0	3	22,31
				1	47	3	22,6
			15 kHz	1	0	3	22,53
				1	11	3	22,65
		QPSK	15 kHz	3	0	5	22,41
				3	6	5	22,52
				6	0	5	21,82
				6	6	5	21,85
				12	0	5	20,88
Middle 26915	836.50 MHz	Pi/2-BPSK	3.75 kHz	1	0	0	17,01
				1	47	0	16,96
			15 kHz	1	0	0	17,11
				1	11	0	16,97
		Pi/4-QPSK	3.75 kHz	1	0	3	22,57
				1	47	3	22,66
			15 kHz	1	0	3	22,61
				1	11	3	22,73
		QPSK	15 kHz	3	0	5	22,67
				3	6	5	22,68
				6	0	5	21,88
				6	6	5	21,91
				12	0	5	20,92
High 27038	848.8 MHz	Pi/2-BPSK	3.75 kHz	1	0	0	17,2
				1	47	0	17,19
			15 kHz	1	0	0	17,39
				1	11	0	17,41
		Pi/4-QPSK	3.75 kHz	1	0	3	22,42
				1	47	3	22,52
			15 kHz	1	0	3	22,45
				1	11	3	22,58
		QPSK	15 kHz	3	0	5	22,54
				3	6	5	22,66
				6	0	5	21,79
				6	6	5	21,8
				12	0	5	20,58

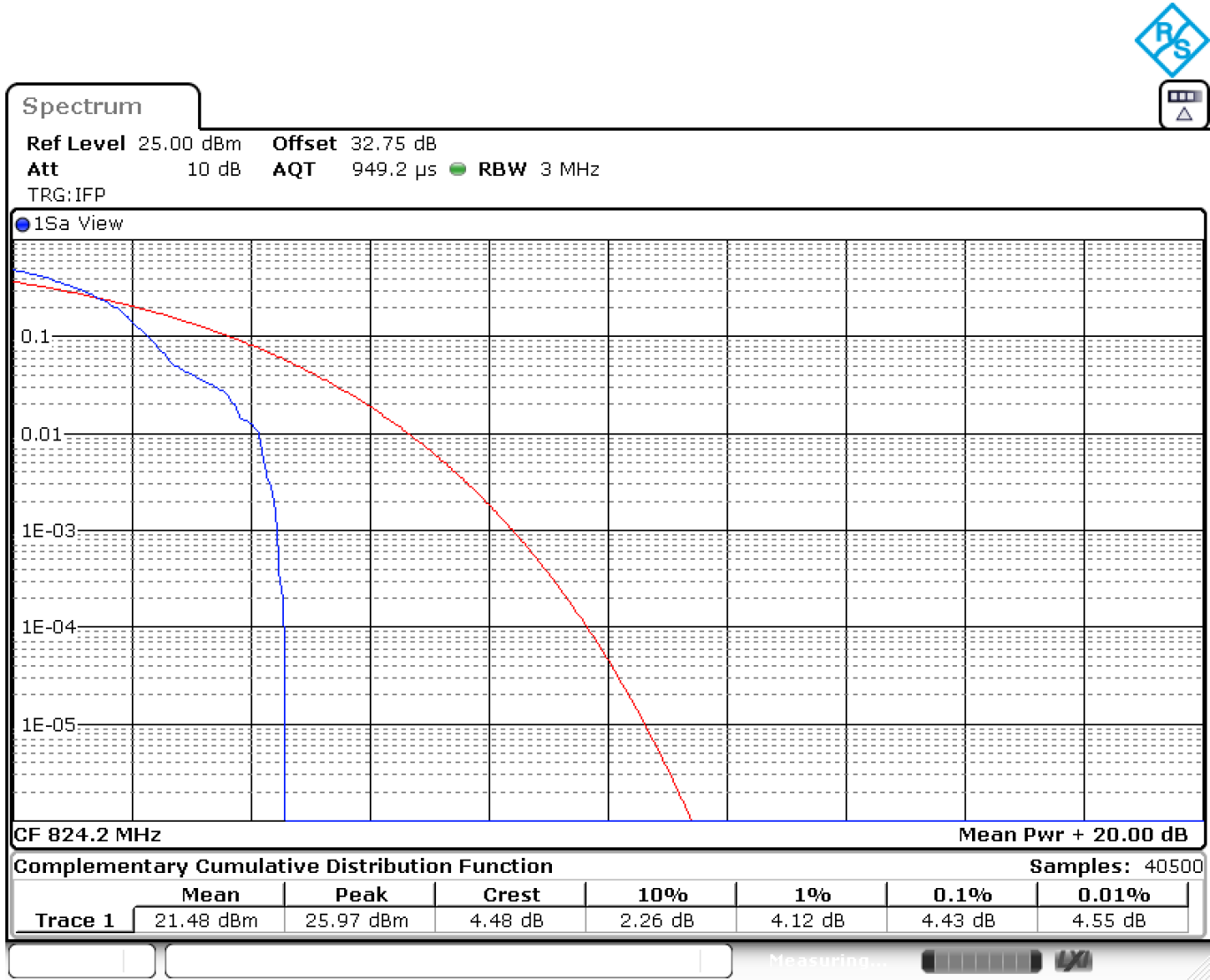
MAX POWER	COND. POWER AVG (dBm)	ANTENNA GAIN (dBi)	RAD. POWER AVG EIRP (dBm)	RAD. POWER AVG ERP (dBm)
LOW	22.65	1	23,65	21,5
MIDDLE	22.73	1	23,73	21,58
HIGH	22.66	1	23,66	21,51
MAX:	22.73		23,73	21.58

2. PEAK-TO-AVERAGE POWER RATIO (PAPR)

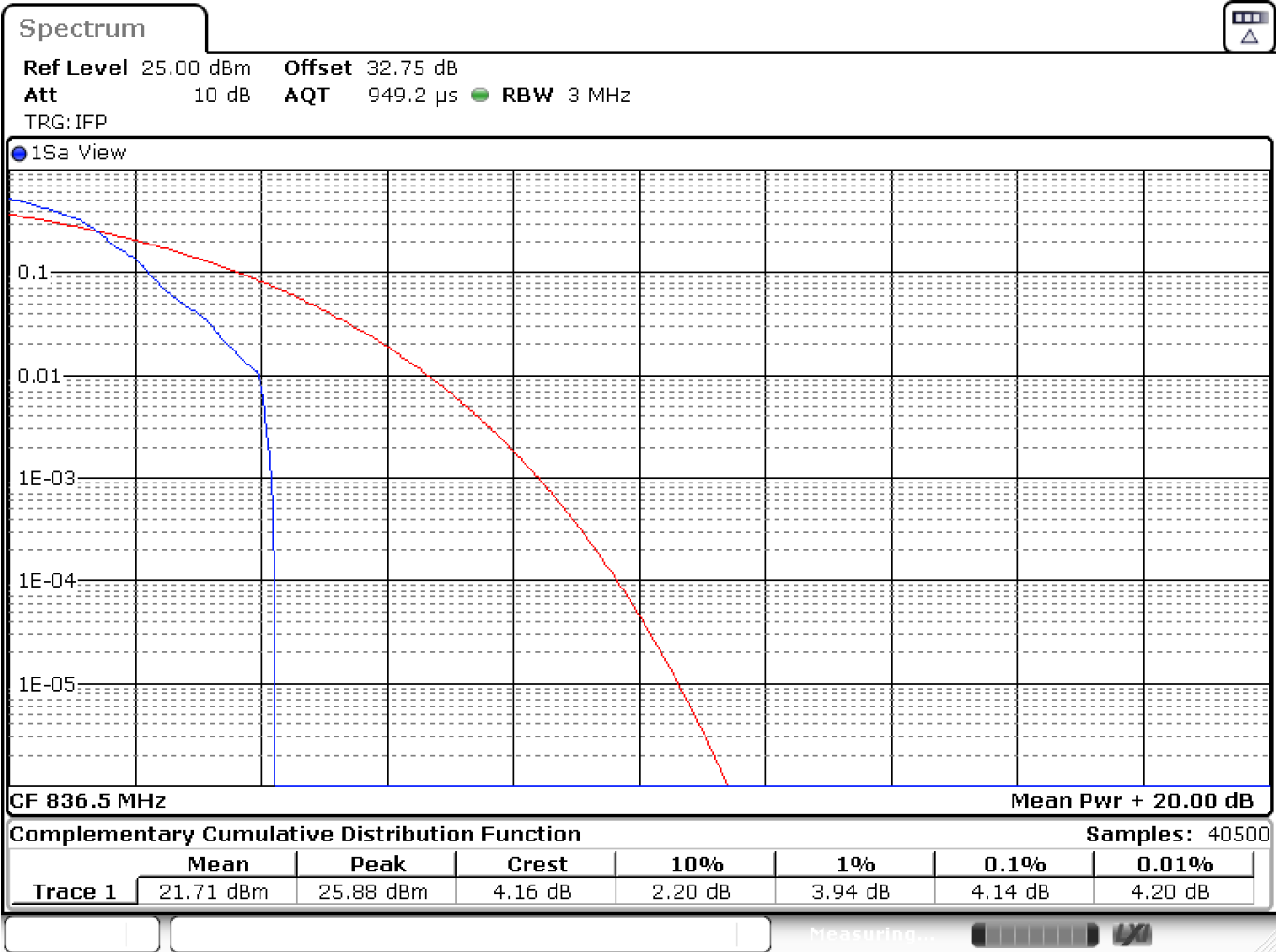
LTE Cat NB2 Band 5:

Preliminary measurements determined the worst-case of PAPR is High Channel, QPSK, BW=15 kHz, Tone Number=6, Tone Offset=6, MSC/TBS=5.

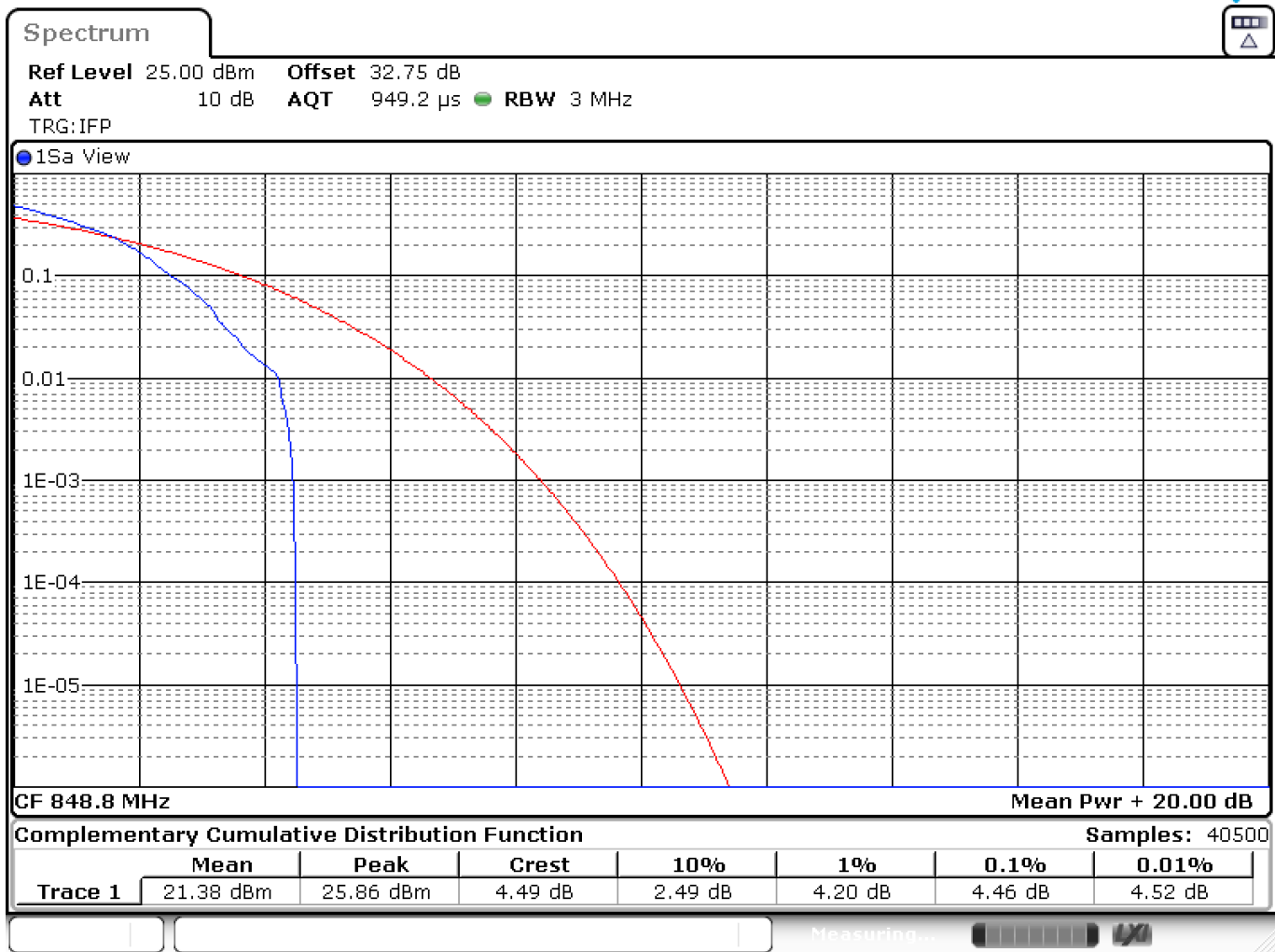
Low Channel:



Middle Channel:



High Channel:



QPSK	Low	Middle	High
PAPR (dB)	4.43	4.14	4.46

Measurement uncertainty (dB) <±1.11

Verdict

Pass

Frequency Stability

Limits

- * FCC §2.1055 and §22.355. ± 2.5 ppm for mobile stations operating in the range 821 to 896 MHz.
- * RSS-132 Issue 4. Clause 5.3. The frequency stability shall be sufficient to ensure that the occupied bandwidth stays within each of the sub-bands when tested at the temperature and supply voltage variations specified in RSS-Gen.

Method

The frequency tolerance measurements over temperature variations were made over the temperature range of -40°C to $+85^{\circ}\text{C}$. The EUT was placed inside a climatic chamber and the temperature was raised hourly in 10°C steps from -40°C up to $+85^{\circ}\text{C}$.

The supply voltage was varied between 85% and 115% of nominal voltage.

Temperature and voltage range of testing has been extended to the maximum and minimum values declared by customer.

The EUT was set in "Radio Resource Control (RRC) mode" on 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.

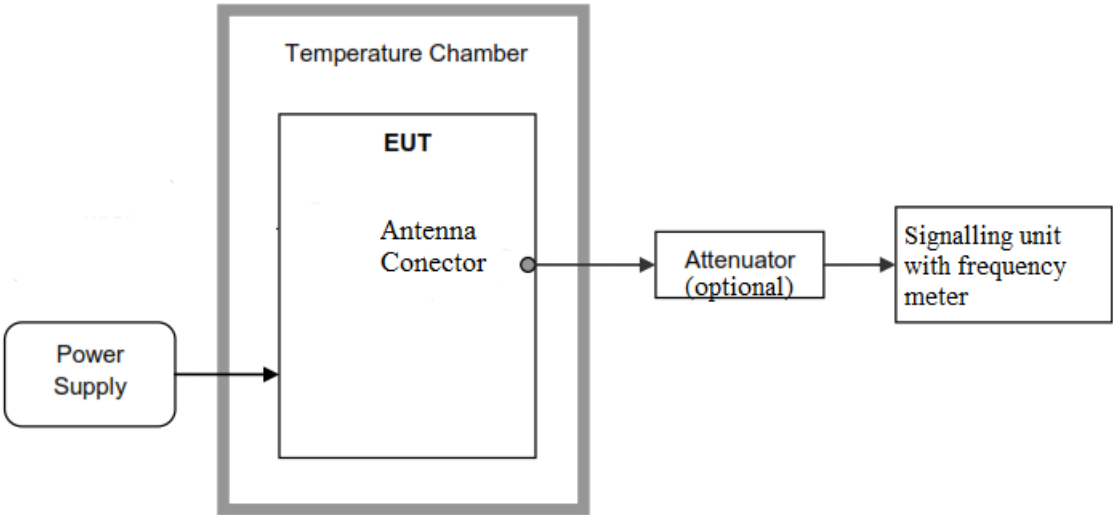
The worst-case LTE mode for conducted power was used for the test.

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 Low and High channels 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.

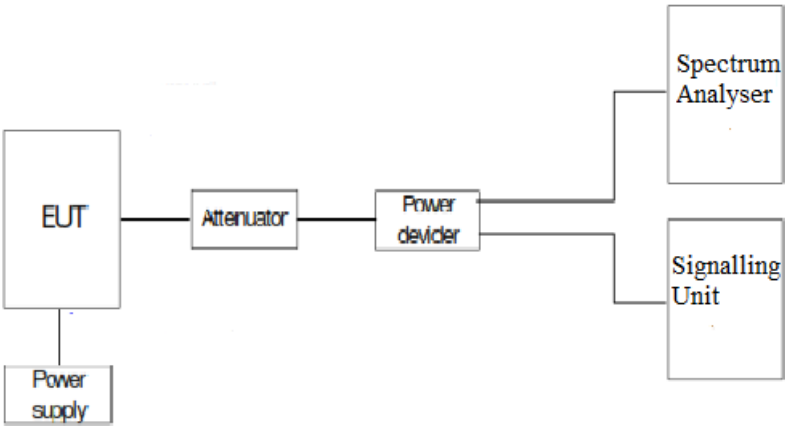
The reference point measurements were made at the RF output terminals of the EUT using an attenuator, power splitter and spectrum analyser. The EUT was controlled via the Universal Radio Communication tester R&S CMW500 selecting maximum transmission power of the EUT and different modes of modulation.

Test Setup

Frequency tolerance:



Reference points f_L and f_H :



Results

LTE Cat NB2 Band 5:

The worst case modulation in terms of Frequency Stability is QPSK, BW=15 kHz, Tone Number=3, Tone Offset=6, MSC/TBS=5.

1. Frequency Tolerance:

- Frequency Stability over Temperature Variations:

Temperature (°C)	Frequency Error (Hz)	Frequency Error (ppm)
+85 [#]	4.16	0.004973102
+80 [#]	5.73	0.00684997
+70 [#]	5.06	0.006049014
+60 [#]	4.71	0.005630604
+50	4.58	0.005475194
+40	-1.77	-0.002115959
+30	0.37	0.000442319
+20	0.69	0.000824866
+10	-0.76	-0.000908548
0	5.95	0.007112971
-10	2.25	0.002689779
-20	-1.49	-0.001781231
-30	-3.56	-0.004255828
-40 [#]	4.64	0.005546922

Test conditions marked with “#” are out of the scope of ENAC accreditation

- Frequency Stability over Voltage Variations.

Supply voltage	Voltage (V)	Frequency Error (Hz)	Frequency Error (ppm)
Vmax	3	0.54	0.000645547
Vmin	2.2	4.95	0.005917513

2. Reference Frequency Points fL and fH:

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

fL (MHz)	824.046800
fH (MHz)	848.957800

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

Measurement uncertainty (Hz) $< \pm 249.55$

Verdict: Pass

Modulation Characteristics

Limits

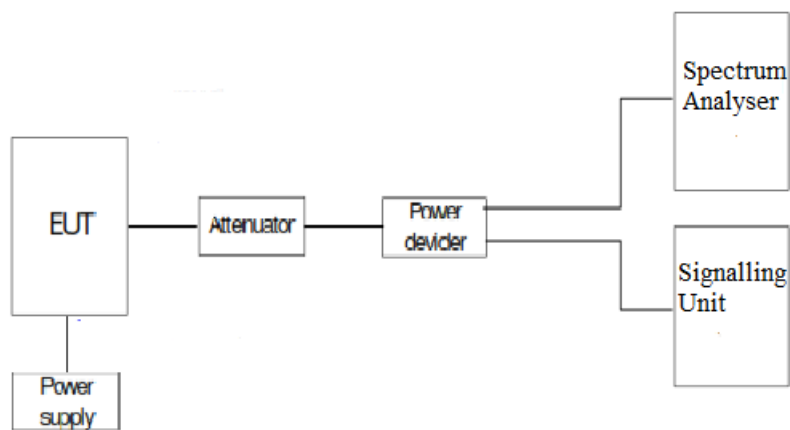
FCC §2.1047.

RSS-132. Clause 5.2: Equipment certified under this standard shall use digital modulation.

Method

For LTE NB2 the EUT operates with $\pi/2$ -BPSK, $\pi/4$ -QPSK, QPSK modulations in which the information is digitized and coded into a bit stream.

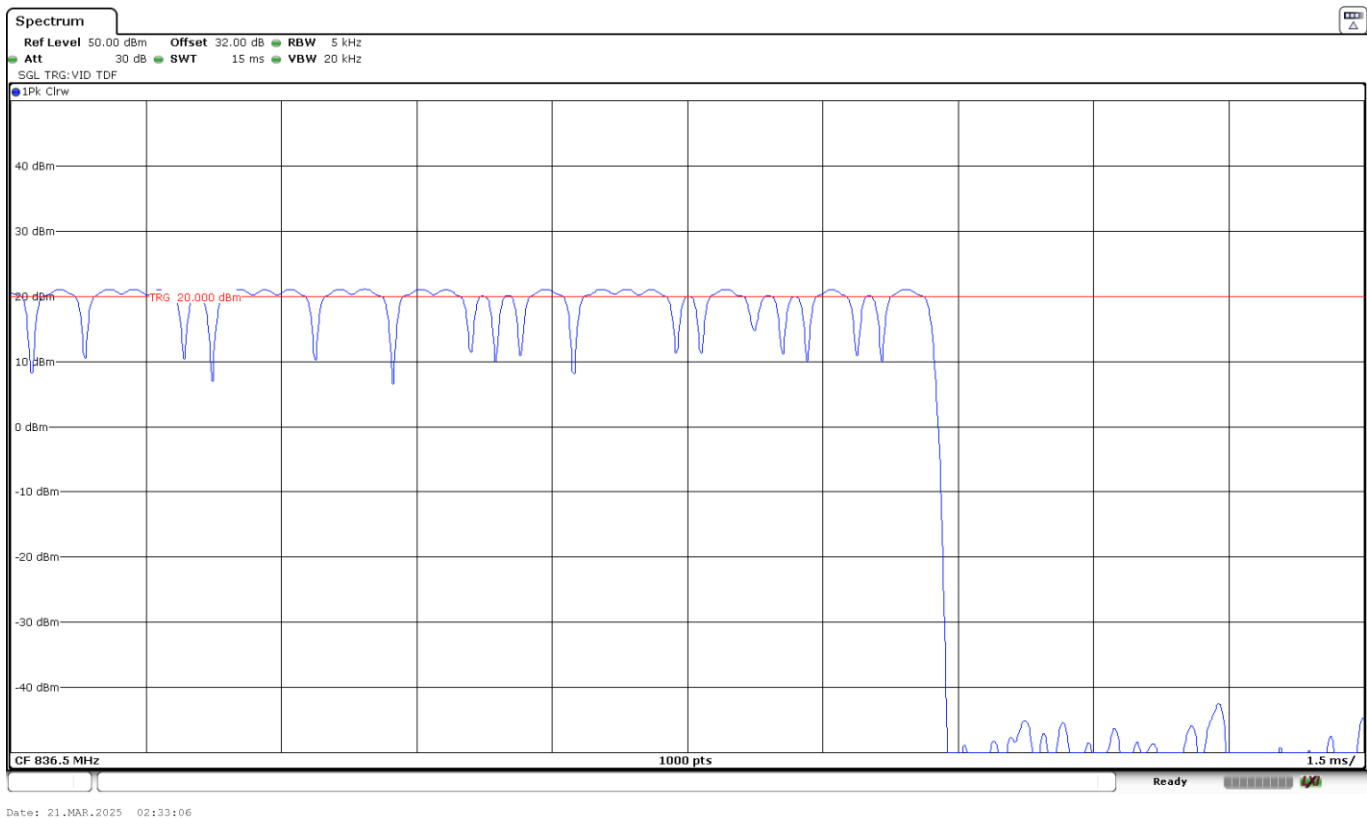
Test Setup



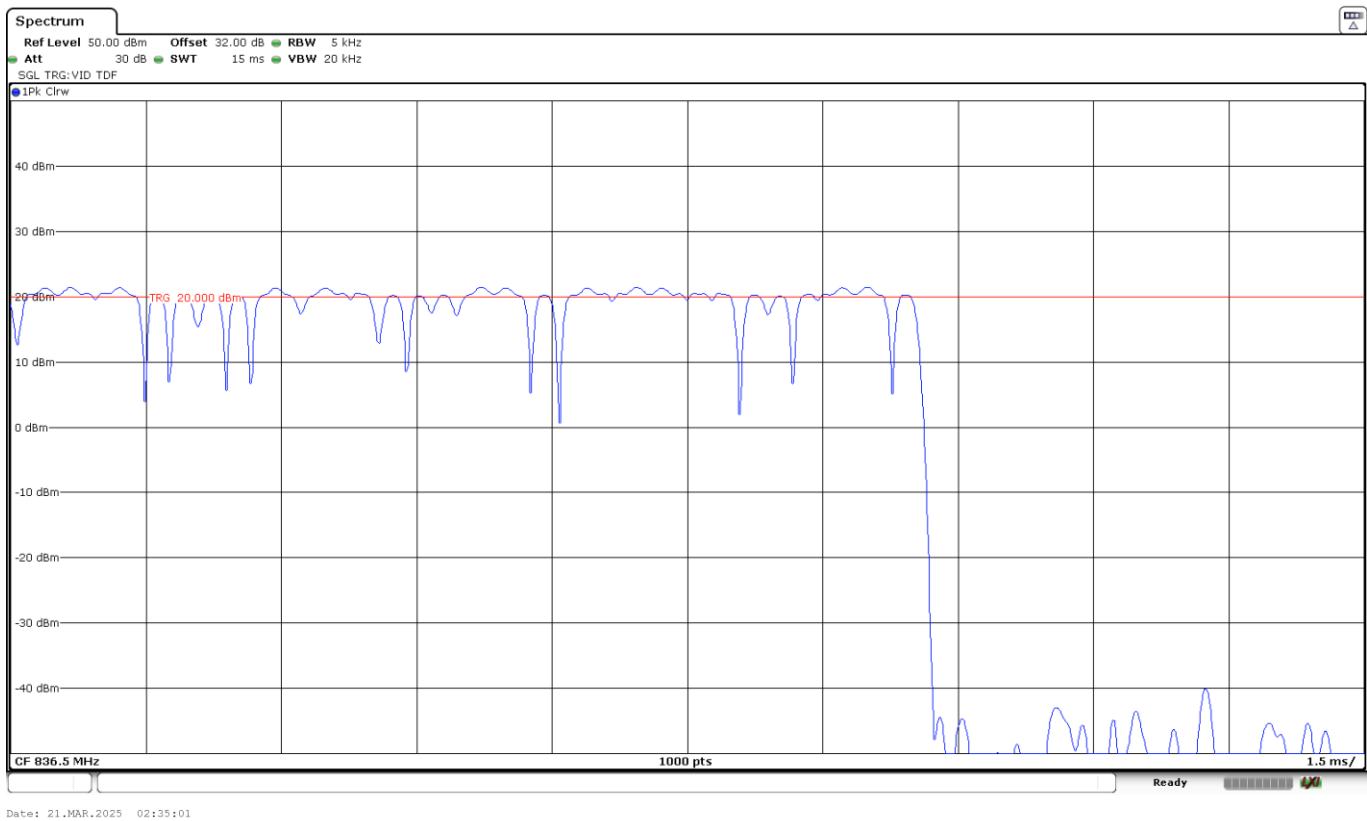
Results

The following plots show the modulation schemes in the EUT.

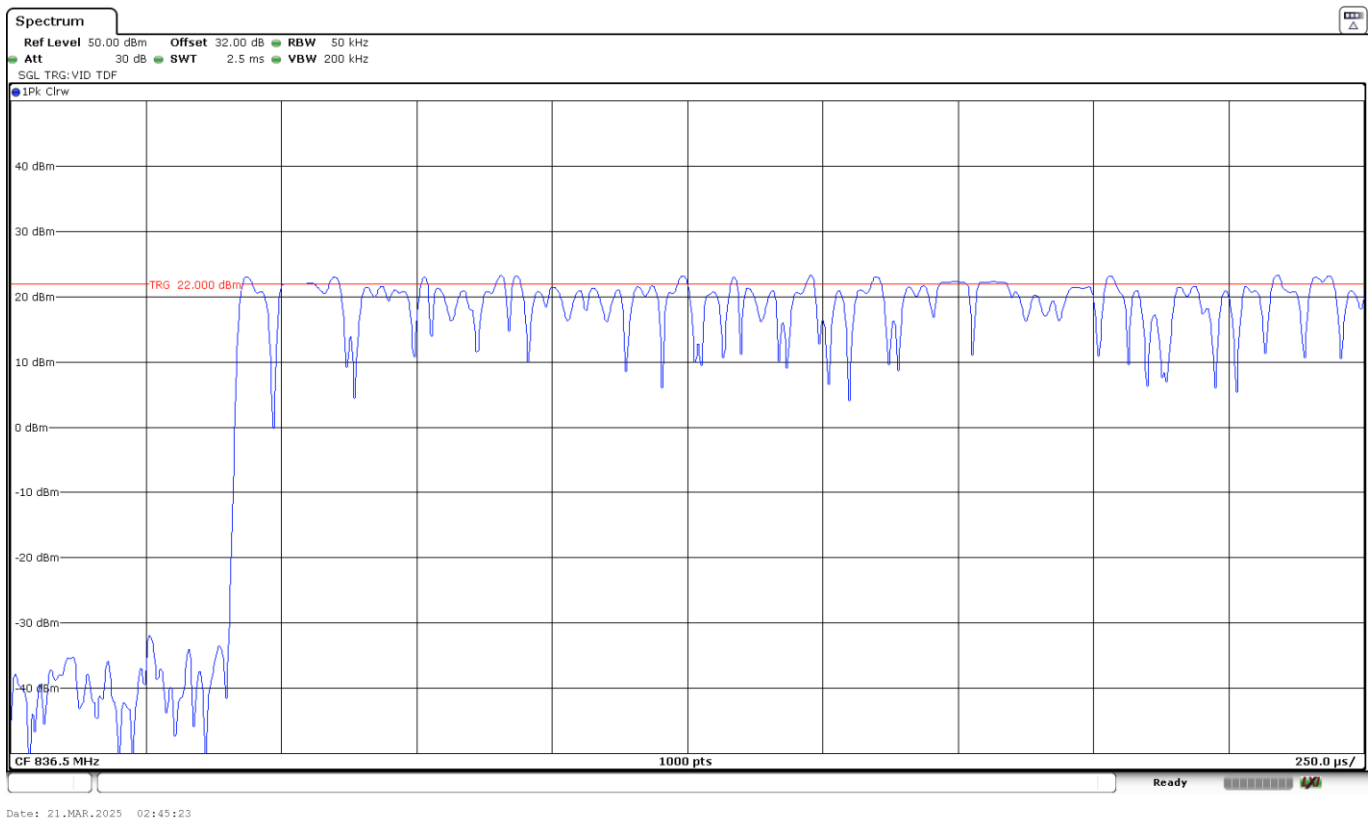
LTE Cat NB2 Band 5: Pi/2-BPSK. Middle Channel. BW=3.75 kHz. Tone Number=1. Tone Offset=0. MSC/TBS=0.



LTE Cat NB2 Band 5: Pi/4-QPSK. Middle Channel. BW=3.75 kHz. Tone Number=1. Tone Offset=0. MSC/TBS=3.



LTE Cat NB2 Band 5: QPSK. Middle Channel. BW=15 kHz. Tone Number=3. Tone Offset=0. MSC/TBS=5.



Occupied Bandwidth

Limits

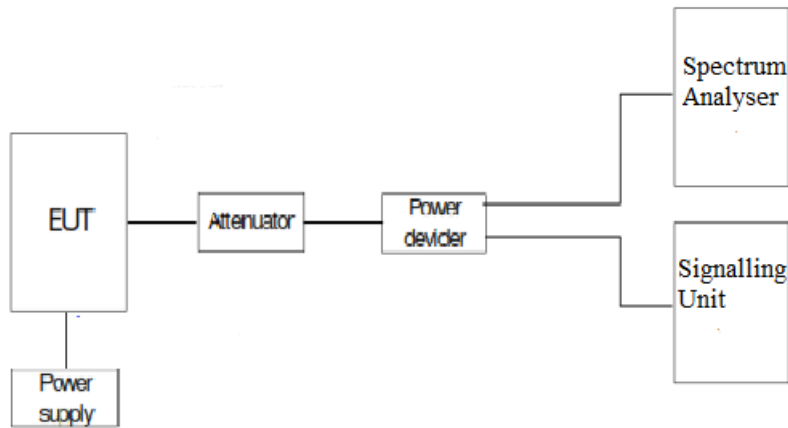
FCC §2.1049. Measurements required: Occupied bandwidth.

RSS-Gen, Clause 6.7.

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

The worst case per modulation is:

LTE Cat NB2 Band 5:

LTE Cat NB2 Band 5. Pi/2-BPSK. BW=3.75 kHz. Tone Number=1. Tone Offset=23. MSC/TBS=0.

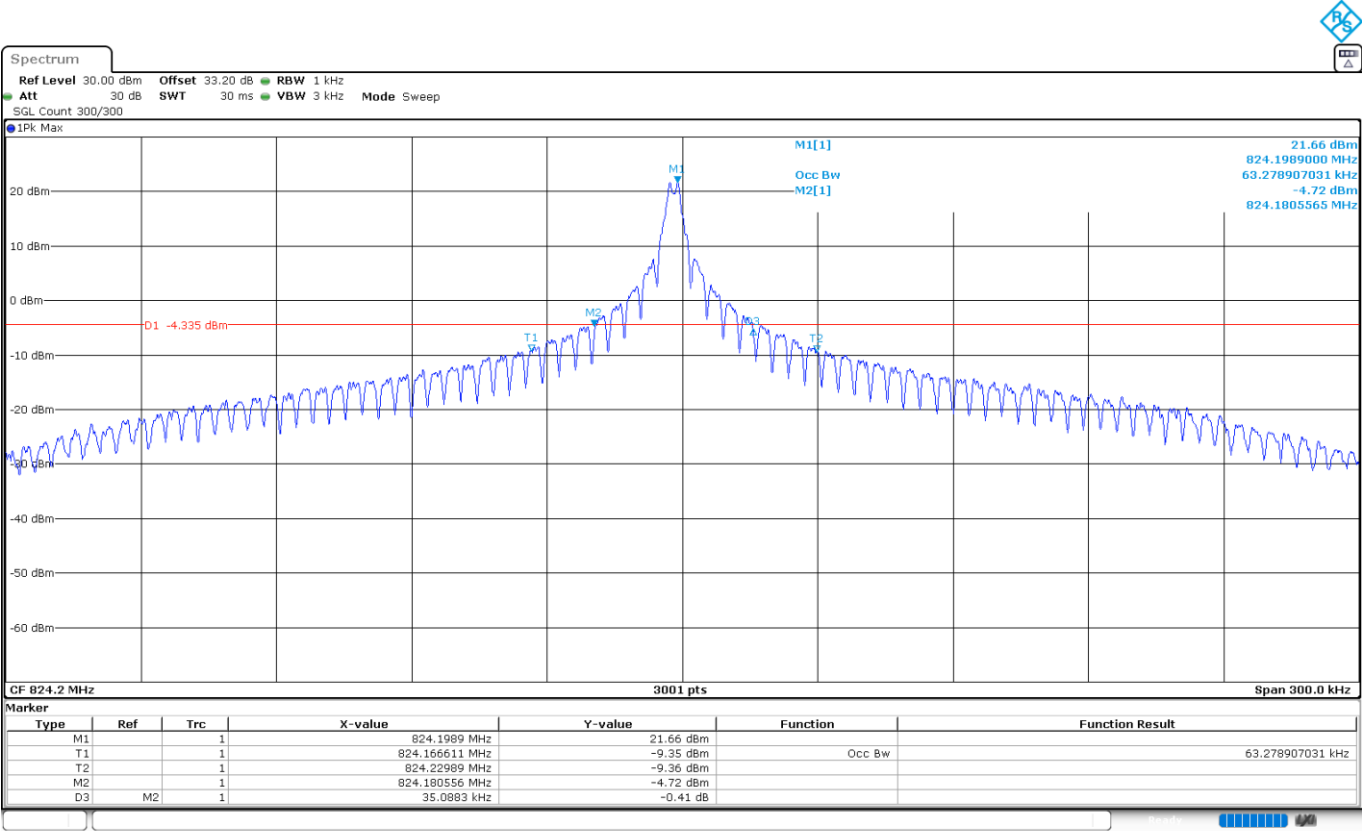
	Low Channel	Middle Channel	High Channel
99% Occupied Bandwidth (kHz)	63.27890	63.97867	61.87937
-26 dBc Bandwidth (kHz)	35.08830	35.08830	34.98830
Measurement uncertainty (kHz)	<±3.75		

LTE Cat NB2 Band 5. Pi/4-QPSK. BW=3.75 kHz. Tone Number=1. Tone Offset=23. MSC/TBS=3.

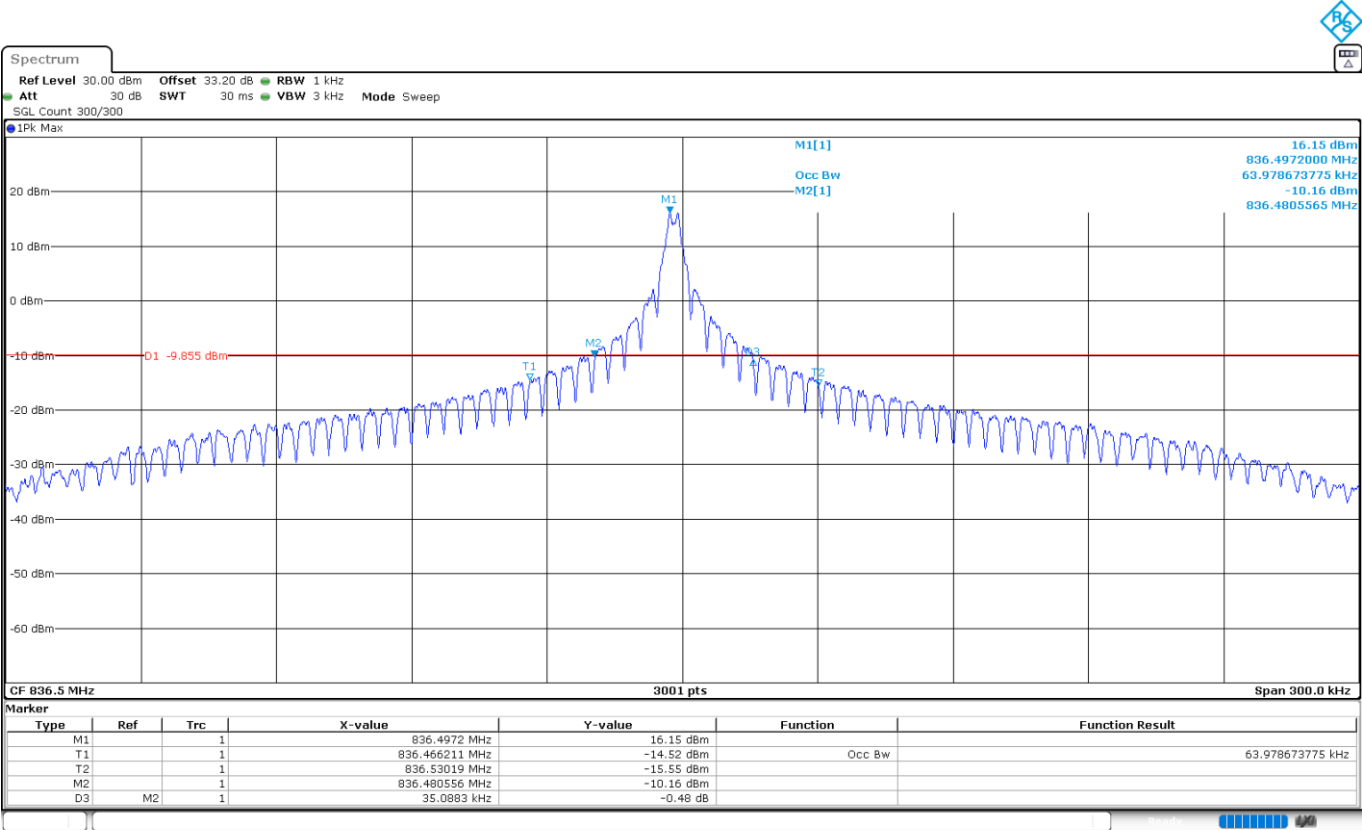
	Low Channel	Middle Channel	High Channel
99% Occupied Bandwidth (kHz)	61.27957	61.67944	60.87971
-26 dBc Bandwidth (kHz)	41.08630	41.48620	41.18630
Measurement uncertainty (kHz)	<±3.75		

LTE Cat NB2 Band 5. Pi/2-BPSK. BW=3.75 kHz. Tone Number=1. Tone Offset=23. MSC/TBS=0.

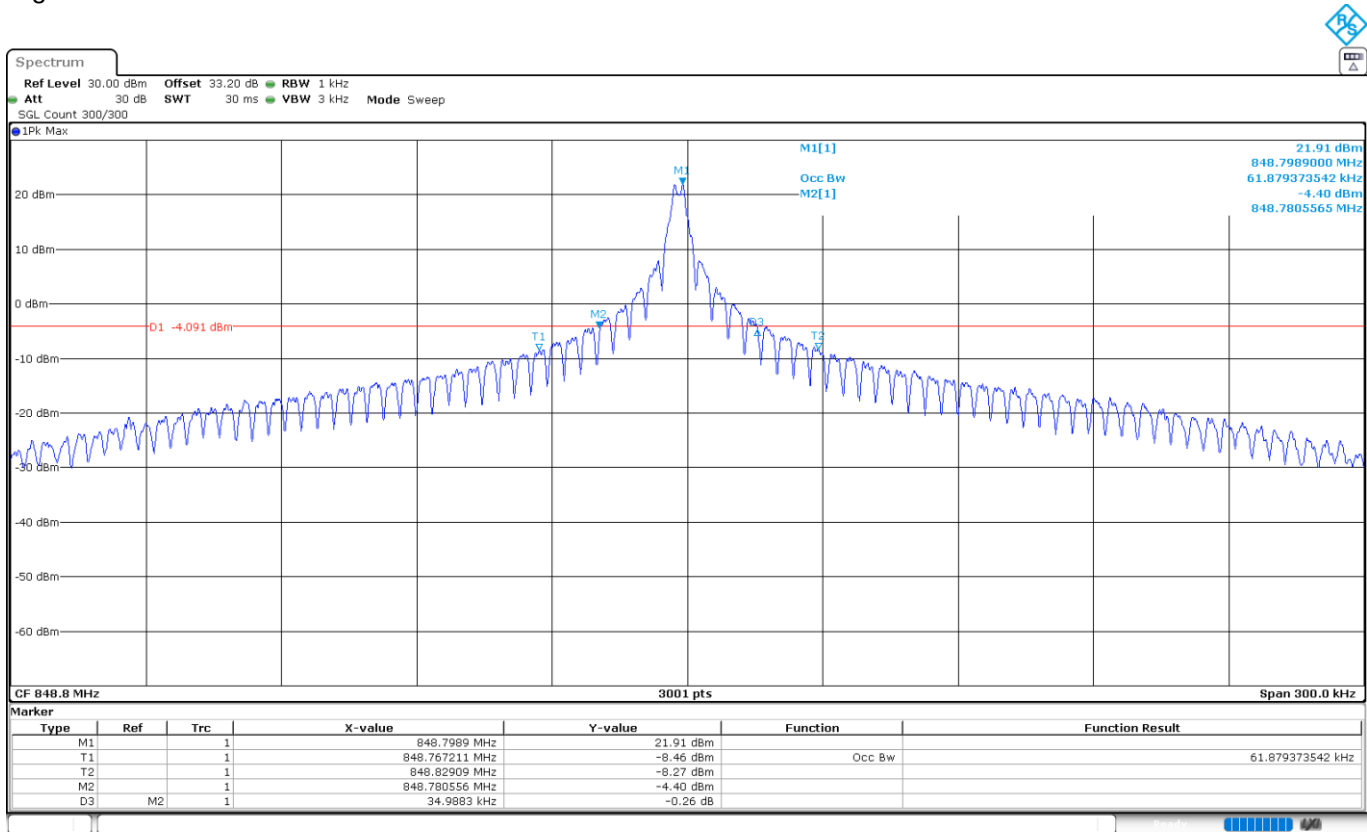
Low Channel:



Middle Channel:

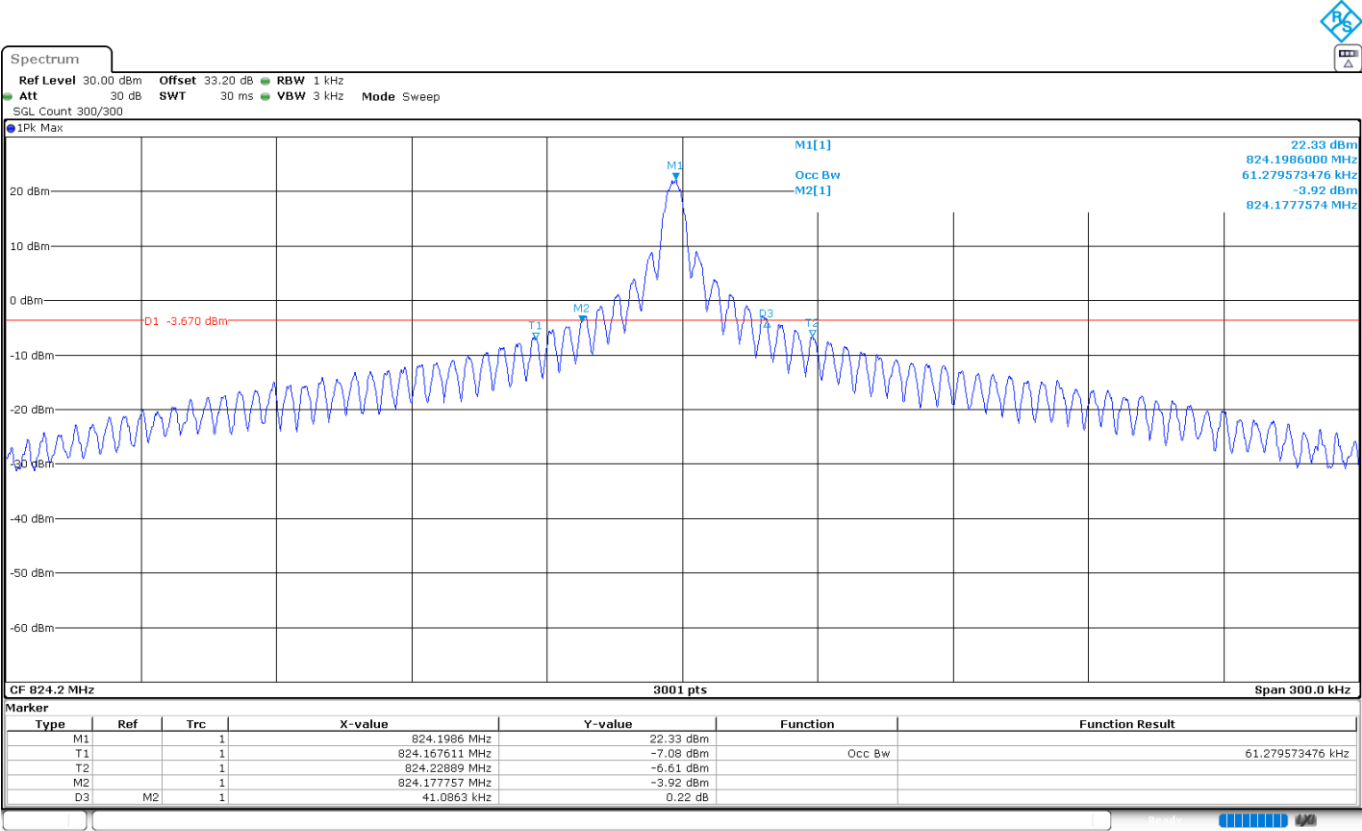


High Channel:



LTE Cat NB2 Band 5. Pi/4-QPSK. BW=3.75 kHz. Tone Number=1. Tone Offset=23. MSC/TBS=3.

Low Channel:



Middle Channel:

