TEST REPORT

No.I23N00436-RF LTE

for

TCL Communication Ltd.

LINKHUB

Model Name: HH40L2

FCC ID: 2ACCJB202

with

Hardware Version: TZ7.823.397

Software Version: HH40L2.1.01

Issued Date: 2023-04-18

Note:

The test results in this test report relate only to the devices specified in this report. This report shall not be reproduced except in full without the written approval of SAICT.

Test Laboratory:

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REPORT HISTORY

Report Number	Revision	Description	Issue Date
I23N00436-RF LTE	Rev.0	1st edition	2023-04-18

CONTENTS

1. SUMMARY OF TEST REPORT

1.1. Test Items

Description	LINKHUB
Model Name	HH40L2
Brand Name	TCL
Applicant's name	TCL Communication Ltd.
Manufacturer's Name	TCL Communication Ltd.

1.2. Test Standards

FCC Part 2/22/27	10-1-20 Edition
ANSI C63.26	2015
KDB971168 D01	v03r01

1.3. Test Result

All test items are passed. Please refer to "6 Summary of Test Results" for detail.

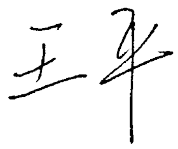
1.4. Testing Location

Address: Building G, Shenzhen International Innovation Center, No.1006 Shennan Road, Futian District, Shenzhen, Guangdong, P. R. China 518000

1.5. Project Data

Testing Start Date: 2023-04-01 Testing End Date: 2023-04-09

1.6. Signature

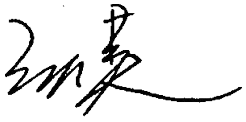


Wang Ping

(Prepared this test report)

Huang Qiuqin

(Reviewed this test report)



Zhang Hao

(Approved this test report)

2. CLIENT INFORMATION

2.1. Applicant Information

Company Name:	TCL Communication Ltd.
Address /Post:	5/F, Building 22E, 22 Science Park East Avenue, Hong Kong Science Park, Shatin, NT, Hong Kong
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2.2. Manufacturer Information

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3. EQUIPMENT UNDER TEST (EUT) AND ANCILLARY EQUIPMENT (AE)

3.1. About EUT

Description	LINKHUB
Model Name	HH40L2
FCC ID	2ACCJB202
Frequency Bands	LTE Bands 5/41
Antenna	Integrated
Extreme vol. Limits	6.60V to 15.00V (nominal: 12.00V)
Condition of EUT as received	No abnormality in appearance

Note1: Components list, please refer to documents of the manufacturer; it is also included in the original test record of SAICT.

3.2. Internal Identification of EUT used during the test

EUT ID*	SN or IMEI	HW Version	SW Version	Date of receipt
UT01aa	355197410026434	TZ7.823.397	HH40L2.1.01	2023-03-27
UT05aa	355197410026798	TZ7.823.397	HH40L2.1.01	2023-03-27

*EUT ID: is used to identify the test sample in the lab internally.

UT01aa is used for conduction test, UT05aa is used for radiation test.

3.3. Internal Identification of AE used during the test

AE ID*	Description
AE1	Battery
AE2	Charger

AE1

Model	Z2000
Manufacturer	ShenzhenAerospaceElectronic Co.,Ltd
Capacity	2000mAh
Nominal Voltage	7.4 V

AE2

Model	1-CHUSB102-131
Manufacturer	Huizhou Puan electronics Co.,Ltd

*AE ID: is used to identify the test sample in the lab internally.

AE: ancillary equipment

3.4. General Description

The Equipment Under Test (EUT) is a model Mobile Phone with integrated antenna. It consists of normal options: lithium battery, charger. Manual and specifications of the EUT were provided to fulfil the test. Samples undergoing test were selected by the Client.

4. REFERENCE DOCUMENTS

The following documents listed in this section are referred for testing.

Reference	Title	Version
FCC Part 2	FREQUENCY ALLOCATIONS AND RADIO TREATY MATTERS; GENERAL RULES AND REGULATIONS	10-1-20 Edition
FCC Part 22	PUBLIC MOBILE SERVICES	10-1-20 Edition
FCC Part 27	MISCELLANEOUS WIRELESS COMMUNICATIONS SERVICES	10-1-20 Edition
ANSI C63.26	American National Standard for Compliance Testing of Transmitters Used in Licensed Radio Services	2015
KDB971168 D01	Power Meas License Digital Systems	v03r01

5. LABORATORY ENVIRONMENT

Shielded room did not exceed following limits along the RF testing:

Temperature	Min. = 15 ℃, Max. = 35 ℃
Relative humidity	Min. = 20 %, Max. = 75 %
Shielding effectiveness	0.014MHz-1MHz>60 dB; 1MHz-18000MHz>90 dB
Electrical insulation	>2 MΩ
Ground system resistance	< 4 Ω

Fully-anechoic chamber did not exceed following limits along the EMC testing

Temperature	Min. = 15 ℃, Max. = 35 ℃
Relative humidity	Min. = 20 %, Max. = 75 %
Shielding effectiveness	0.014MHz-1MHz> 60 dB; 1MHz-18000MHz>90 dB
Electrical insulation	> 2MΩ
Ground system resistance	< 4 Ω
Voltage Standing Wave Ratio （VSWR）	≤ 6 dB, from 1 to 18 GHz，3 m distance
Uniformity of field strength	Between 0 and 6 dB, from 80 to 6000 MHz

6. SUMMARY OF TEST RESULTS

Abbreviations used in this clause:		
Verdict Column	P	Pass
	F	Fail
	NA	Not applicable
	NM	Not measured

LTE band 5

Items	Test Name	Clause in FCC rules	Section in this report	Verdict
1	Output Power	2.1046/22.913	A.1	P
2	Field Strength of Spurious Radiation	2.1053/22.917	A.2	P
3	Frequency Stability	2.1055/22.355	A.3	P
4	Occupied Bandwidth	2.1049/22.917	A.4	P
5	Emission Bandwidth	2.1049/22.917	A.5	P
6	Band Edge Compliance	2.1051/22.917	A.6	P
7	Conducted Spurious Emission	2.1051/22.917	A.7	P
8	Peak-to-Average Power Ratio	KDB971168 D01	A.8	P

LTE Band 41

Items	Test Name	Clause in FCC rules	Section in this report	Verdict
1	Output Power	2.1046/27.50(h)	A.1	P
2	Field Strength of Spurious Radiation	2.1053/27.53(m)	A.2	P
3	Frequency Stability	2.1055/27.54	A.3	P
4	Occupied Bandwidth	2.1049/27.53(m)	A.4	P
5	Emission Bandwidth	2.1049/27.53(m)	A.5	P
6	Band Edge Compliance	2.1051/27.53(m)	A.6	P
7	Conducted Spurious Emission	2.1051/27.53(m)	A.7	P
8	Peak-to-Average Power Ratio	27.50(a)/ KDB971168 D01	A.8	P

7. STATEMENT

Since the information of samples in this report is provided by the client, the laboratory is not responsible for the authenticity of sample information.

This report takes measured values as criterion of test conclusion. The test conclusion meets the limit requirements.

8. TEST EQUIPMENTS UTILIZED

NO.	Description	TYPE	Manufacture	series number	Cal Due Date
1	Test Receiver	ESR7	R&S	101676	2023-11-23
2	BiLog Antenna	3142E	ETS-Lindgren	0224831	2024-05-27
3	Horn Antenna	3117	ETS-Lindgren	00066585	2025-03-15
4	Horn Antenna	QSH-SL-18-26-S-20	Q-par	17013	2026-01-30
5	Antenna	BBHA 9120D	Schwarzbeck	1593	2025-10-24
6	Antenna	VUBA 9117	Schwarzbeck	207	2023-07-15
7	Antenna	QWH-SL-18-40-K-SG	Q-par	15979	2026-01-30
8	preamplifier	83017A	Agilent	MY39501110	/
9	Signal Generator	SMB100A	R&S	179725	2023-11-23
10	Fully Anechoic Chamber	FACT3-2.0	ETS-Lindgren	1285	2023-05-29
11	Spectrum Analyzer	FSV40	R&S	101192	2024-01-11
12	Universal Radio Communication Tester	CMU200	R&S	114545	2024-01-11
13	Universal Radio Communication Tester	CMW500	R&S	152499	2023-07-14
14	Universal Radio Communication Tester	CMW500	R&S	129146	2023-04-24
15	Spectrum Analyzer	FSU	R&S	101506	2023-12-13
16	Temperature Chamber	SH-241	ESPEC	92007516	2023-10-15
17	DC Power Supply	U3606A	Agilent Technologies	MY50450012	2023-11-13
18	Spectrum Analyzer	FSW26	R&S	102197	2023-11-24

Test software

Item	Name	Version
Radiated	EMC32	V10.50.40

ANNEX A: MEASUREMENT RESULTS

A.1 OUTPUT POWER

Reference

FCC: CFR Part 2.1046, 22.913, 27.50.

A.1.1 Summary

During the process of testing, the EUT was controlled via Rhode & Schwarz Digital Radio Communication tester (CMW500) to ensure max power transmission and proper modulation.

This result contains peak output power and ERP/EIRP measurements for the EUT.

In all cases, output power is within the specified limits.

A.1.2 Conducted

A.1.2.1 Method of Measurements

The EUT was set up for the max output power with pseudo random data modulation.

These measurements were done at 3 frequencies (bottom, middle and top of operational frequency range) for each bandwidth.

A.1.2.2 Measurement result

LTE band 5

Bandwidth	RB size/offset	Frequency (MHz)	Power(dBm)	
			QPSK	16QAM
1.4MHz	1 RB high	848.3	22.06	21.19
		836.5	22.41	21.3
		824.7	22.36	20.9
	1 RB low	848.3	22.15	21.6
		836.5	22.57	21.9
		824.7	22.17	21.69
	50% RB mid	848.3	22.12	21.65
		836.5	22.34	22.09
		824.7	22.13	21.73
	100% RB	848.3	21.63	21.62
		836.5	21.84	22.03
		824.7	21.65	21.99
3MHz	1 RB high	847.5	21.8	20.66
		836.5	21.91	20.71
		825.5	22.04	20.42
	1 RB low	847.5	21.95	20.72
		836.5	22.17	20.73
		825.5	21.5	20.51
	50% RB mid	847.5	21.15	21.53
		836.5	21.22	21.81
		825.5	20.95	21.06
	100% RB	847.5	21.12	21.37
		836.5	21.2	21.57

Bandwidth	RB size/offset	Frequency (MHz)	Power(dBm)	
			QPSK	16QAM
		825.5	20.91	21.62
5MHz	1 RB high	846.5	21.63	20.65
		836.5	21.85	20.68
		826.5	21.99	20.6
	1 RB low	846.5	21.7	20.59
		836.5	21.77	20.64
		826.5	21.29	20.52
	50% RB mid	846.5	21.02	21.31
		836.5	21.05	21.46
		826.5	20.98	21.04
	100% RB	846.5	21.1	21.46
		836.5	21.15	21.61
		826.5	21.05	21.67
10MHz	1 RB high	844.0	22.13	20.7
		836.5	22.19	20.87
		829.0	22.56	20.95
	1 RB low	844.0	22.21	20.57
		836.5	22.65	20.65
		829.0	21.75	20.9
	50% RB mid	844.0	20.98	22.03
		836.5	21.11	22.26
		829.0	21.35	21.56
	100% RB	844.0	21.16	21.84
		836.5	21.31	21.99
		829.0	21.44	22.15

Note: Expanded measurement uncertainty is U = 0.49dB, k = 1.96

LTE band 41

Bandwidth	RB size/offset	Frequency (MHz)	Power(dBm)	
			QPSK	16QAM
5MHz	1 RB high	2687.5	20.09	19.74
		2593.0	20.72	20.59
		2498.5	20.78	20.36
	1 RB low	2687.5	20.39	20.28
		2593.0	20.86	20.57
		2498.5	20.76	20.38
	50% RB mid	2687.5	19.5	18.79
		2593.0	20.05	19.66
		2498.5	20.06	19.67
	100% RB	2687.5	19.63	19.03
		2593.0	20.15	19.71
		2498.5	20.17	19.7
10MHz	1 RB high	2685.0	20.61	20.23
		2593.0	21.42	20.57
		2501.0	21.72	21.09
	1 RB low	2685.0	21.26	20.86
		2593.0	21.26	20.66
		2501.0	21.61	20.88
	50% RB mid	2685.0	19.7	18.99
		2593.0	20.04	19.55
		2501.0	20.03	19.54
	100% RB	2685.0	19.88	19.26
		2593.0	20.23	19.78
		2501.0	20.25	19.75
15MHz	1 RB high	2682.5	20.54	20.08
		2593.0	21.2	20.88
		2503.5	21.79	21.3
	1 RB low	2682.5	21.65	21.01
		2593.0	21.27	21.04
		2503.5	21.34	20.83
	50% RB mid	2682.5	19.87	19.18
		2593.0	20.05	19.53
		2503.5	20.18	19.7

Bandwidth	RB size/offset	Frequency (MHz)	Power(dBm)	
			QPSK	16QAM
	100% RB	2682.5	20.12	19.47
		2593.0	20.29	19.83
		2503.5	20.48	19.99
20MHz	1 RB high	2680.0	20.77	20.37
		2593.0	21.35	21.12
		2506.0	22.5	22.04
	1 RB low	2680.0	21.23	20.98
		2593.0	21.27	21
		2506.0	21.15	20.77
	50% RB mid	2680.0	20.09	19.48
		2593.0	20.09	19.6
		2506.0	20.42	19.94
	100% RB	2680.0	20.4	19.71
		2593.0	20.38	19.89
		2506.0	20.78	20.29

Note: Expanded measurement uncertainty is U = 0.49dB, k = 1.96

A.1.3 Radiated

A.1.3.1 Description

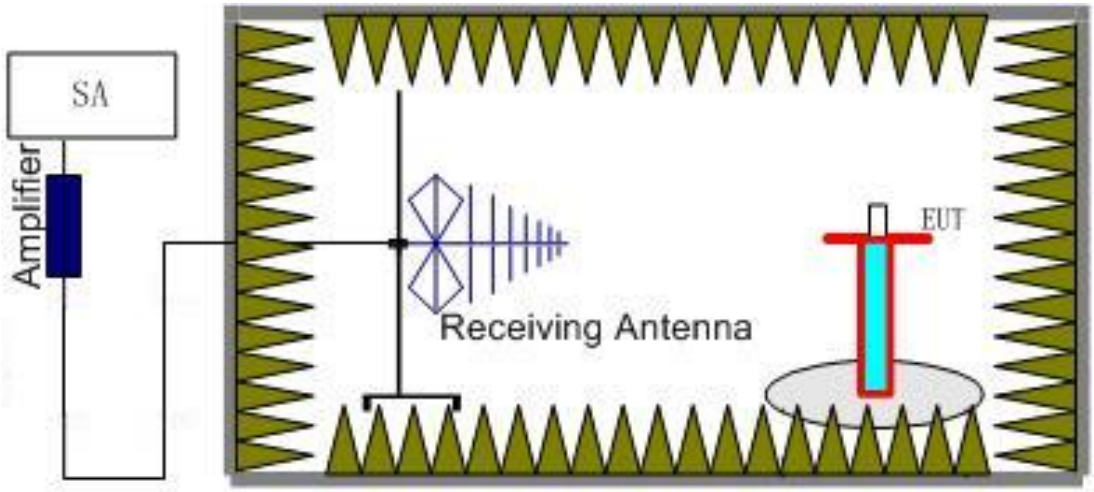
This is the test for the maximum radiated power from the EUT.

Rule Part 27.50(h)(2) specifies “Mobile stations are limited to 2.0 watts EIRP.”.

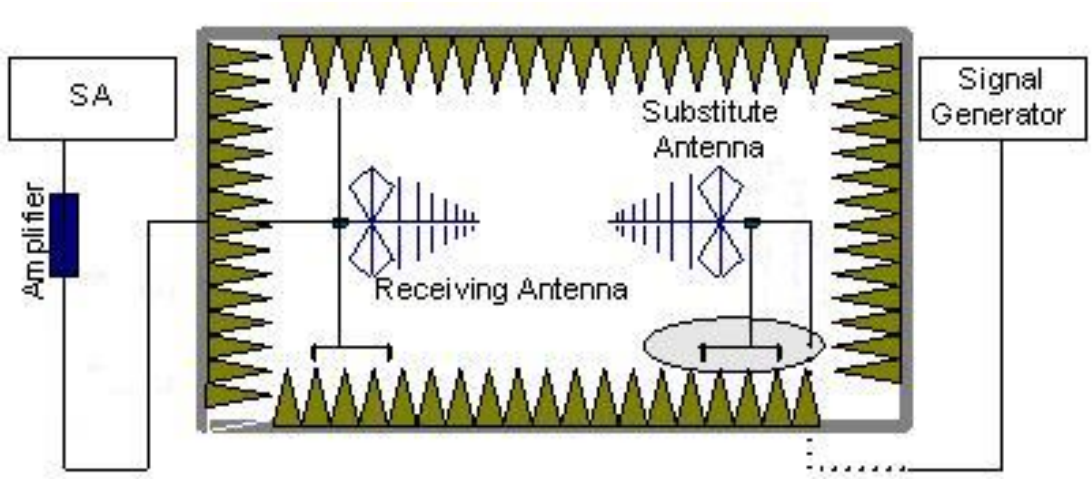
Rule Part 22.913(a) specifies "The ERP of mobile transmitters and auxiliary test transmitters must not exceed 7 Watts."

A.1.3.2 Method of Measurement

1. For radiated emissions measurements performed at frequencies less than or equal to 1 GHz, EUT was placed on a 80 cm high non-conductive stand at a 3 meter test distance from the receive antenna. For radiated measurements performed at frequencies above 1 GHz, EUT was placed on a 1.5 meter high non-conductive stand at a 3 meter test distance from the receive antenna. Receiving antenna was placed on the antenna mast 3 meters from the EUT. For emission measurements. The receiving antenna shall be varied from 1 m to 4 m in height above the reference ground in a search for the relative positioning that produces the maximum radiated signal level. The test setup refers to figure below. Detected emissions were maximized at each frequency by rotating the EUT through 360° and adjusting the receiving antenna polarization. The radiated emission measurements of all transmit frequencies in three channels (High, Middle, Low) were measured with peak detector.



2. The EUT is then put into continuously transmitting mode at its maximum power level during the test. And the maximum value of the receiver should be recorded as (Pr).
3. The EUT shall be replaced by a substitution antenna. The test setup refers to figure below.



In the chamber, a substitution antenna for the frequency band of interest is placed at the reference point of the chamber. An RF signal source for the frequency band of interest is connected to the substitution antenna with a cable that has been constructed to not interfere with the radiation pattern of the antenna. A power (P_{Mea}) is applied to the input of the substitution antenna and adjusts the level of the signal generator output until the value of the receiver reaches the previously recorded (P_r). The power of signal source (P_{Mea}) is recorded. The test should be performed by rotating the test item and adjusting the receiving antenna polarization.

4. An amplifier should be connected to the Signal Source output port. And the cable should be connected between the amplifier and the substitution antenna.
   The cable loss (P_{cl}), the substitution Antenna Gain(dBi) (G_a) and the amplifier Gain (P_{Ag}) should be recorded after test.
   The measurement results are obtained as described below:
   Power (EIRP) = $P_{Mea} - P_{Ag} - P_{cl} + G_a$
5. This value is EIRP since the measurement is calibrated using an antenna of known gain (unit dBi) and known input power.
6. ERP can be calculated from EIRP by subtracting the gain of the dipole, ERP = EIRP -2.15dB.

A.1.3.3 Measurement result

LTE Band 5- ERP Part 22.913(a)

Limits: ≤38.45dBm (7W)

LTE Band 5_1.4MHz_QPSK

Frequency(MHz)	P_{Mea}(dBm)	P_{cl}(dB)+ P_{Ag}(dB)	Ga Antenna Gain(dBi)	Correction (dB)	ERP(dBm)	Limit(dBm)	Polarization
824.70	-9.48	-33.60	-0.79	2.15	21.18	38.45	V
836.50	-8.33	-33.50	-0.74	2.15	22.29	38.45	V
848.30	-9.60	-33.50	-0.73	2.15	21.02	38.45	V

LTE Band 5_3MHz_QPSK

Frequency(MHz)	P_{Mea}(dBm)	P_{cl}(dB)+ P_{Ag}(dB)	Ga Antenna Gain(dBi)	Correction (dB)	ERP(dBm)	Limit(dBm)	Polarization
825.50	-9.49	-33.60	-0.84	2.15	21.12	38.45	V
836.50	-8.38	-33.50	-0.74	2.15	22.23	38.45	V
847.50	-9.65	-33.50	-0.73	2.15	20.97	38.45	V

LTE Band 5_5MHz_QPSK

Frequency(MHz)	P_{Mea}(dBm)	P_{cl}(dB)+ P_{Ag}(dB)	Ga Antenna Gain(dBi)	Correction (dB)	ERP(dBm)	Limit(dBm)	Polarization
826.50	-9.53	-33.60	-0.84	2.15	21.08	38.45	V
836.50	-8.46	-33.50	-0.74	2.15	22.15	38.45	V
846.50	-9.69	-33.50	-0.73	2.15	20.93	38.45	V

LTE Band 5_10MHz_QPSK

Frequency(MHz)	P_{Mea}(dBm)	P_{cl}(dB)+ P_{Ag}(dB)	Ga Antenna Gain(dBi)	Correction (dB)	ERP(dBm)	Limit(dBm)	Polarization
829.00	-9.58	-33.60	-0.84	2.15	21.03	38.45	V
836.50	-8.51	-33.50	-0.74	2.15	22.10	38.45	V
844.00	-9.67	-33.50	-0.78	2.15	20.90	38.45	V

LTE Band 5_1.4MHz_16QAM

Frequency(MHz)	P_{Mea}(dBm)	P_{cl}(dB)+ P_{Ag}(dB)	Ga Antenna Gain(dBi)	Correction (dB)	ERP(dBm)	Limit(dBm)	Polarization
824.70	-11.18	-33.60	-0.79	2.15	19.48	38.45	V
836.50	-10.38	-33.50	-0.74	2.15	20.23	38.45	V
848.30	-11.26	-33.50	-0.73	2.15	19.36	38.45	V

LTE Band 5_3MHz_16QAM

Frequency(MHz)	P_{Mea}(dBm)	P_{cl}(dB)+ P_{Ag}(dB)	Ga Antenna Gain(dBi)	Correction (dB)	ERP(dBm)	Limit(dBm)	Polarization
825.50	-11.18	-33.60	-0.84	2.15	19.43	38.45	V
836.50	-10.43	-33.50	-0.74	2.15	20.18	38.45	V
847.50	-11.31	-33.50	-0.73	2.15	19.31	38.45	V

LTE Band 5_5MHz_16QAM

Frequency(MHz)	P_{Mea}(dBm)	P_{cl}(dB)+ P_{Ag}(dB)	Ga Antenna Gain(dBi)	Correction (dB)	ERP(dBm)	Limit(dBm)	Polarization
826.50	-11.20	-33.60	-0.84	2.15	19.41	38.45	V
836.50	-10.47	-33.50	-0.74	2.15	20.14	38.45	V
846.50	-11.35	-33.50	-0.73	2.15	19.27	38.45	V

LTE Band 5_10MHz_16QAM

Frequency(MHz)	P_{Mea}(dBm)	P_{cl}(dB)+ P_{Ag}(dB)	Ga Antenna Gain(dBi)	Correction (dB)	ERP(dBm)	Limit(dBm)	Polarization
829.00	-11.27	-33.60	-0.84	2.15	19.34	38.45	V
836.50	-10.57	-33.50	-0.74	2.15	20.04	38.45	V
844.00	-11.32	-33.50	-0.78	2.15	19.25	38.45	V

LTE Band 41- EIRP Part 27.50(d)(2)

Limits: ≤33dBm (2W)

LTE Band 41_5MHz_QPSK

Frequency(MHz)	P_{Mea}(dBm)	P_{cl}(dB)+ P_{Ag}(dB)	Ga Antenna Gain(dBi)	EIRP(dBm)	Limit(dBm)	Polarization
2498.50	-16.80	-28.70	10.70	22.60	33.00	H
2593.00	-16.54	-28.60	10.70	22.76	33.00	H
2687.50	-16.74	-28.50	10.70	22.46	33.00	H

LTE Band 41_10MHz_QPSK

Frequency(MHz)	P_{Mea}(dBm)	P_{cl}(dB)+ P_{Ag}(dB)	Ga Antenna Gain(dBi)	EIRP(dBm)	Limit(dBm)	Polarization
2501.00	-16.84	-28.70	10.70	22.56	33.00	H
2593.00	-16.58	-28.60	10.70	22.72	33.00	H
2685.00	-16.80	-28.50	10.70	22.40	33.00	H

LTE Band 41_15MHz_QPSK

Frequency(MHz)	P_{Mea}(dBm)	P_{cl}(dB)+ P_{Ag}(dB)	Ga Antenna Gain(dBi)	EIRP(dBm)	Limit(dBm)	Polarization
2503.50	-16.88	-28.70	10.70	22.52	33.00	H
2593.00	-16.63	-28.60	10.70	22.67	33.00	H
2682.50	-16.85	-28.50	10.70	22.35	33.00	H

LTE Band 41_20MHz_QPSK

Frequency(MHz)	P_{Mea}(dBm)	P_{cl}(dB)+ P_{Ag}(dB)	Ga Antenna Gain(dBi)	EIRP(dBm)	Limit(dBm)	Polarization
2506.00	-16.94	-28.70	10.70	22.46	33.00	H
2593.00	-16.68	-28.60	10.70	22.62	33.00	H
2680.00	-16.90	-28.50	10.70	22.30	33.00	H

LTE Band 41_5MHz_16QAM

Frequency(MHz)	P_{Mea}(dBm)	P_{cl}(dB)+ P_{Ag}(dB)	Ga Antenna Gain(dBi)	EIRP(dBm)	Limit(dBm)	Polarization
2498.50	-17.61	-28.70	10.70	21.79	33.00	H
2593.00	-17.44	-28.60	10.70	21.86	33.00	H
2687.50	-17.50	-28.50	10.70	21.70	33.00	H

LTE Band 41_10MHz_16QAM

Frequency(MHz)	P_{Mea}(dBm)	P_{cl}(dB)+ P_{Ag}(dB)	Ga Antenna Gain(dBi)	EIRP(dBm)	Limit(dBm)	Polarization
2501.00	-17.65	-28.70	10.70	21.75	33.00	H
2593.00	-17.48	-28.60	10.70	21.82	33.00	H
2685.00	-17.54	-28.50	10.70	21.66	33.00	H

LTE Band 41_15MHz_16QAM

Frequency(MHz)	P_{Mea}(dBm)	P_{cl}(dB)+ P_{Ag}(dB)	Ga Antenna Gain(dBi)	EIRP(dBm)	Limit(dBm)	Polarization
2503.50	-17.68	-28.70	10.70	21.72	33.00	H
2593.00	-17.52	-28.60	10.70	21.78	33.00	H
2682.50	-17.61	-28.50	10.70	21.59	33.00	H

LTE Band 41_20MHz_16QAM

Frequency(MHz)	P_{Mea}(dBm)	P_{cl}(dB)+ P_{Ag}(dB)	Ga Antenna Gain(dBi)	EIRP(dBm)	Limit(dBm)	Polarization
2506.00	-17.75	-28.70	10.70	21.65	33.00	H
2593.00	-17.55	-28.60	10.70	21.75	33.00	H
2680.00	-17.63	-28.50	10.70	21.57	33.00	H

ANALYZER SETTINGS:

RBW = VBW = 8MHz for occupied bandwidths equal to or less than 5MHz.

RBW = VBW = 20MHz for occupied bandwidths equal to or greater than 10MHz.

Note: The maximum value of expanded measurement uncertainty for this test item is U = 2.87dB(30MHz-3GHz)/3.35dB(3GHz-18GHz)/2.68dB(18GHz-40GHz), k = 2

Note: Both of Vertical and Horizontal polarizations are evaluated, but only the worst case is recorded in this report.

A.2 FIELD STRENGTH OF SPURIOUS RADIATION

Reference

FCC: CFR 2.1053, 22.917, 27.53.

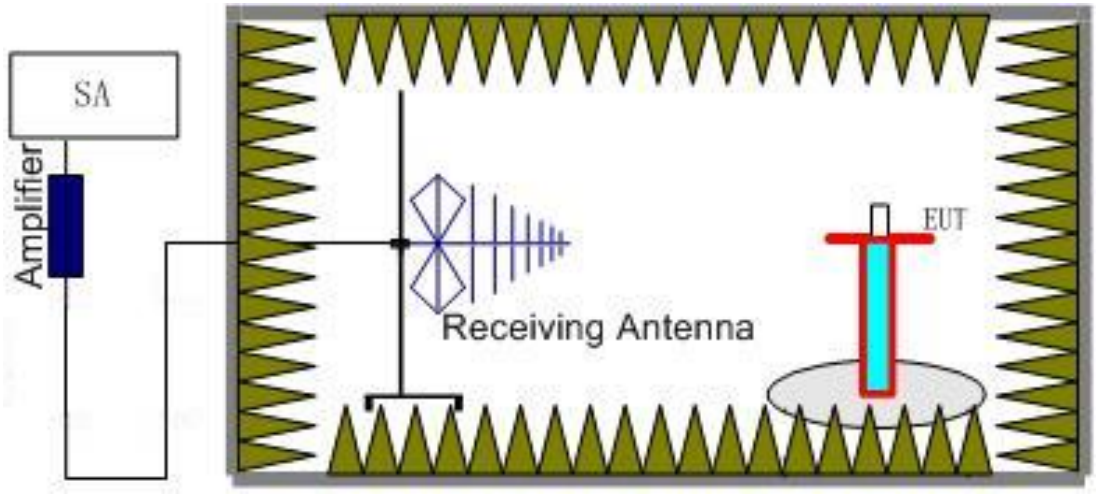
A.2.1 Measurement Method

This measurement is carried out in fully-anechoic chamber FAC-3.

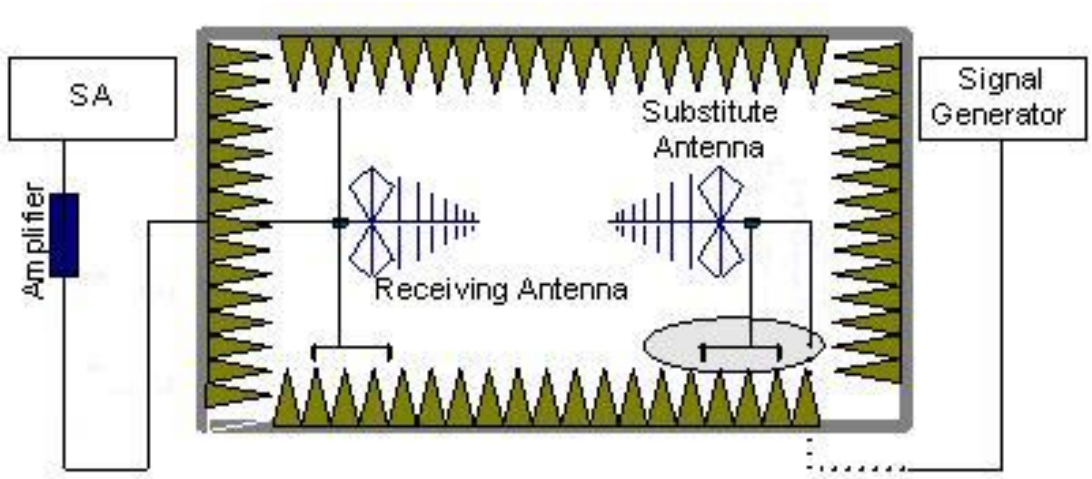
The spectrum was scanned from 30 MHz to the 10th harmonic of the highest frequency generated within the equipment, which is the transmitted carrier. The resolution bandwidth is set 1MHz as outlined in Part 22.917, 27.53(h). The spectrum was scanned with the mobile station transmitting at carrier frequencies that pertain to low, mid and high channels of the all LTE Bands

The procedure of radiated spurious emissions is as follows:

1. For radiated emissions measurements performed at frequencies less than or equal to 1 GHz, EUT was placed on a 80 cm high non-conductive stand at a 3 meter test distance from the receive antenna. For radiated measurements performed at frequencies above 1 GHz, EUT was placed on a 1.5 meter high non-conductive stand at a 3 meter test distance from the receive antenna. Receiving antenna was placed on the antenna mast 3 meters from the EUT. For emission measurements. The receiving antenna shall be varied from 1 m to 4 m in height above the reference ground in a search for the relative positioning that produces the maximum radiated signal level. The test setup refers to figure below. Detected emissions were maximized at each frequency by rotating the EUT through 360° and adjusting the receiving antenna polarization. The radiated emission measurements of all transmit frequencies in three channels (High, Middle, Low) were measured with peak detector.



2. The EUT is then put into continuously transmitting mode at its maximum power level during the test. And the maximum value of the receiver should be recorded as (Pr).
3. The EUT shall be replaced by a substitution antenna. The test setup refers to figure below.



In the chamber, an substitution antenna for the frequency band of interest is placed at the reference point of the chamber. An RF Signal source for the frequency band of interest is connected to the substitution antenna with a cable that has been constructed to not interfere with the radiation pattern of the antenna. A power (P_{Mea}) is applied to the input of the substitution antenna and adjusts the level of the signal generator output until the value of the receiver reaches the previously recorded (P_r). The power of signal source (P_{Mea}) is recorded. The test should be performed by rotating the test item and adjusting the receiving antenna polarization.

4. The Path loss (P_{pl}) between the Signal Source with the Substitution Antenna and the Substitution Antenna Gain(dBi) (G_a) should be recorded after test.
   An amplifier should be connected in for the test.
   The Path loss (P_{pl}) is the summation of the cable loss and the gain of the amplifier.
   The measurement results are obtained as described below:
   Power (EIRP)=P_{Mea} - P_{pl} + G_a
5. This value is EIRP since the measurement is calibrated using an antenna of known gain (unit: dBi) and known input power.
6. ERP can be calculated from EIRP by subtracting the gain of the dipole, ERP = EIRP -2.15dB.

A.2.2 Measurement Results

Radiated emissions measurements were made only at the upper, middle, and lower carrier frequencies of the test LTE Bands. It was decided that measurements at these three carrier frequencies would be sufficient to demonstrate compliance with emissions limits because it was seen that all the significant spurs occur well outside the band and no radiation was seen from a carrier in one block of the test LTE Bands. into any of the other blocks. The equipment must still, however, meet emissions requirements with the carrier at all frequencies over which it is capable of operating and it is the manufacturer's responsibility to verify this.

Only worst case result is given below.

LTE Band 5, 1.4MHz, QPSK, Channel 20407

Frequency(MHz)	P_{Mea}(dBm)	Path Loss	Antenna Gain	Peak ERP(dBm)	Limit (dBm)	Polarization
8398.75	-51.36	1.80	11.30	-44.01	-13.00	H
9150.50	-51.91	2.10	11.60	-44.56	-13.00	H
9225.50	-51.24	2.10	11.60	-43.89	-13.00	H
9299.75	-50.75	2.00	11.60	-43.30	-13.00	H
9423.50	-51.59	2.10	11.60	-44.24	-13.00	H
9475.00	-51.62	2.10	11.60	-44.27	-13.00	V

LTE Band 5, 1.4MHz, QPSK, Channel 20525

Frequency(MHz)	P_{Mea}(dBm)	Path Loss	Antenna Gain	Peak ERP(dBm)	Limit (dBm)	Polarization
7329.25	-52.49	1.70	12.00	-44.34	-13.00	H
9220.75	-51.73	2.10	11.60	-44.38	-13.00	H
9302.50	-51.29	2.00	11.60	-43.84	-13.00	H
9368.75	-52.08	2.00	11.60	-44.63	-13.00	V
9474.00	-51.52	2.10	11.60	-44.17	-13.00	V
9732.50	-51.31	2.20	11.20	-44.46	-13.00	H

LTE Band 5, 1.4MHz, QPSK, Channel 20643

Frequency(MHz)	P_{Mea}(dBm)	Path Loss	Antenna Gain	Peak ERP(dBm)	Limit (dBm)	Polarization
8475.75	-52.43	1.80	11.30	-45.08	-13.00	H
9153.75	-51.97	2.10	11.60	-44.62	-13.00	H
9221.25	-51.15	2.10	11.60	-43.80	-13.00	H
9297.50	-51.44	2.00	11.60	-43.99	-13.00	H
9423.50	-51.71	2.10	11.60	-44.36	-13.00	H
9474.00	-51.16	2.10	11.60	-43.81	-13.00	V

LTE Band 5, 1.4MHz, 16QAM, Channel 20407

Frequency(MHz)	P_{Mea}(dBm)	Path Loss	Antenna Gain	Peak ERP(dBm)	Limit (dBm)	Polarization
8523.00	-52.30	2.10	12.00	-44.55	-13.00	H
9100.00	-51.92	2.20	11.60	-44.67	-13.00	H
9223.50	-50.66	2.10	11.60	-43.31	-13.00	H
9300.50	-51.32	2.00	11.60	-43.87	-13.00	H
9424.75	-51.57	2.10	11.60	-44.22	-13.00	H
9475.25	-51.09	2.10	11.60	-43.74	-13.00	V

LTE Band 5, 1.4MHz, 16QAM, Channel 20525

Frequency(MHz)	P_{Mea}(dBm)	Path Loss	Antenna Gain	Peak ERP(dBm)	Limit (dBm)	Polarization
9147.25	-52.02	2.10	11.60	-44.67	-13.00	H
9221.75	-51.17	2.10	11.60	-43.82	-13.00	H
9303.25	-50.63	2.00	11.60	-43.18	-13.00	H
9420.75	-52.06	2.10	11.60	-44.71	-13.00	H
9475.25	-51.16	2.10	11.60	-43.81	-13.00	V
9761.25	-51.45	2.20	11.20	-44.60	-13.00	H

LTE Band 5, 1.4MHz, 16QAM, Channel 20643

Frequency(MHz)	P_{Mea}(dBm)	Path Loss	Antenna Gain	Peak ERP(dBm)	Limit (dBm)	Polarization
9097.50	-51.96	2.20	11.60	-44.71	-13.00	H
9182.00	-51.57	2.10	11.60	-44.22	-13.00	V
9221.50	-50.93	2.10	11.60	-43.58	-13.00	H
9296.00	-51.30	2.00	11.60	-43.85	-13.00	H
9364.75	-52.05	2.00	11.60	-44.60	-13.00	V
9480.50	-51.66	2.10	11.60	-44.31	-13.00	V

LTE Band 41, 5MHz, QPSK, Channel 39675

Frequency(MHz)	P_{Mea}(dBm)	Path Loss	Antenna Gain	Peak EIRP(dBm)	Limit (dBm)	Polarization
4992.80	-42.52	1.30	12.50	-31.32	-25.00	H
12482.00	-43.03	2.60	12.60	-33.03	-25.00	H
17270.50	-46.22	3.20	14.50	-34.92	-25.00	H
17497.50	-46.32	2.90	14.50	-34.72	-25.00	H
17614.00	-44.04	3.30	12.80	-34.54	-25.00	H
17729.50	-44.02	3.30	12.80	-34.52	-25.00	H

LTE Band 41, 5MHz, QPSK, Channel 40620

Frequency(MHz)	P_{Mea}(dBm)	Path Loss	Antenna Gain	Peak EIRP(dBm)	Limit (dBm)	Polarization
5181.90	-43.44	1.60	12.50	-32.54	-25.00	H
17183.50	-46.37	2.90	14.50	-34.77	-25.00	H
17357.00	-45.76	3.20	14.50	-34.46	-25.00	H
17459.00	-46.01	2.90	14.50	-34.41	-25.00	H
17593.00	-43.68	3.30	12.80	-34.18	-25.00	H
17839.50	-43.93	3.60	12.80	-34.73	-25.00	H

LTE Band 41, 5MHz, QPSK, Channel 41565

Frequency(MHz)	P_{Mea}(dBm)	Path Loss	Antenna Gain	Peak EIRP(dBm)	Limit (dBm)	Polarization
5371.12	-42.66	1.30	12.50	-31.46	-25.00	H
10741.00	-42.37	2.40	10.80	-33.97	-25.00	V
17011.25	-46.32	2.90	14.50	-34.72	-25.00	H
17455.62	-46.40	2.90	14.50	-34.80	-25.00	H
17610.00	-43.81	3.30	12.80	-34.31	-25.00	H
17776.88	-43.24	3.60	12.80	-34.04	-25.00	H

LTE Band 41, 5MHz, 16QAM, Channel 39675

Frequency(MHz)	P_{Mea}(dBm)	Path Loss	Antenna Gain	Peak EIRP(dBm)	Limit (dBm)	Polarization
7491.00	-41.68	1.90	12.00	-31.58	-25.00	V
16981.88	-47.73	2.90	16.50	-34.13	-25.00	H
17368.12	-45.60	3.20	14.50	-34.30	-25.00	H
17518.75	-44.25	2.90	12.80	-34.35	-25.00	H
17627.50	-43.52	3.30	12.80	-34.02	-25.00	H
17823.75	-43.79	3.60	12.80	-34.59	-25.00	H

LTE Band 41, 5MHz, 16QAM, Channel 40620

Frequency(MHz)	P_{Mea}(dBm)	Path Loss	Antenna Gain	Peak EIRP(dBm)	Limit (dBm)	Polarization
5181.90	-45.63	1.60	12.50	-34.73	-25.00	H
17207.00	-46.26	2.90	14.50	-34.66	-25.00	H
17238.50	-45.37	3.20	14.50	-34.07	-25.00	H
17511.50	-44.32	2.90	12.80	-34.42	-25.00	H
17625.00	-43.96	3.30	12.80	-34.46	-25.00	H
17833.50	-43.34	3.60	12.80	-34.14	-25.00	H

LTE Band 41, 5MHz, 16QAM, Channel 41565

Frequency(MHz)	P_{Mea}(dBm)	Path Loss	Antenna Gain	Peak EIRP(dBm)	Limit (dBm)	Polarization
5370.38	-43.53	1.30	12.50	-32.33	-25.00	H
10741.50	-42.73	2.40	10.80	-34.33	-25.00	V
17003.12	-46.37	2.90	14.50	-34.77	-25.00	H
17446.88	-46.33	2.90	14.50	-34.73	-25.00	H
17565.62	-44.30	3.30	12.80	-34.80	-25.00	H
17836.88	-43.64	3.60	12.80	-34.44	-25.00	H

Note: The maximum value of expanded measurement uncertainty for this test item is U = 2.87dB(30MHz-3GHz)/3.35dB(3GHz-18GHz)/2.68dB(18GHz-40GHz), k = 2

A.3 FREQUENCY STABILITY

Reference

FCC: CFR Part 2.1055, 22.355, 27.54.

A.3.1 Method of Measurement

In order to measure the carrier frequency under the condition of AFC lock, it is necessary to make measurements with the EUT in a “call mode”. This is accomplished with the use of R&S CMW500.

1. Measure the carrier frequency at room temperature.
2. Subject the EUT to overnight soak at -30℃.
3. With the EUT, powered via nominal voltage, connected to the CMW500 and in a simulated call on mid channel of all bands, measure the carrier frequency. These measurements should be made within 2 minutes of Powering up the EUT, to prevent significant self-warming.
4. Repeat the above measurements at 10℃ increments from -30℃ to +50℃. Allow at least 1.5 hours at each temperature, unpowered, before making measurements.
5. Remeasure carrier frequency at room temperature with nominal voltage. Vary supply voltage from minimum voltage to maximum voltage, in 0.1Volt increments remeasuring carrier frequency at each voltage. Pause at nominal voltage for 1.5 hours unpowered, to allow any self-heating to stabilize, before continuing.
6. Subject the EUT to overnight soak at +50℃.
7. With the EUT, powered via nominal voltage, connected to the CMW500 and in a simulated call on the center channel, measure the carrier frequency. These measurements should be made within 2 minutes of Powering up the EUT, to prevent significant self-warming.
8. Repeat the above measurements at 10℃ increments from -30℃ to +50℃. Allow at least 1 1/2 hours at each temperature, unpowered, before making measurements.
9. At all temperature levels hold the temperature to +/- 0.5℃ during the measurement procedure.

The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block. As this transceiver is considered "Hand carried, battery powered equipment" Section 2.1055(d)(2) applies. This requires that the lower voltage for frequency stability testing be specified by the manufacturer. This transceiver is specified to operate with an input voltage of the lower, higher and nominal voltage. Operation above or below these voltage limits is prohibited by transceiver software in order to prevent improper operation as well as to protect components from overstress.

A.3.2 Measurement results

LTE Band 5, 5MHz bandwidth (worst case of all bandwidths)

Frequency Error vs Temperature

Temperature(℃)	Voltage(V)	FL(MHz)	FH(MHz)	Offset(Hz)	Frequency error(ppm)
50	12.00	824.360	848.670		
40				-1.02	0.0012
30				-0.47	0.0006
20				-3.09	0.0037
10				-3.19	0.0038
0				-3.79	0.0045
-10				-3.88	0.0046
-20				-5.65	0.0068
-30				-4.64	0.0055

Frequency Error vs Voltage

Voltage(V)	Temperature(℃)	FL(MHz)	FH(MHz)	Offset(Hz)	Frequency error(ppm)
6.60	20	824.360	848.670	-6.37	0.0076
15.00				-6.58	0.0079

Expanded measurement uncertainty is 10 Hz, *k* = 2

LTE band 41, 20MHz bandwidth QPSK(worst case of all bandwidths)

Frequency Error vs Temperature

Temperature(℃)	Voltage(V)	FL(MHz)	FH(MHz)	Offset(Hz)	Frequency error(ppm)
20	12.00	2496.560	2689.340		
50				2.89	0.0011
40				2.07	0.0008
30				1.89	0.0007
10				0.12	0.0000
0				1.66	0.0006
-10				4.15	0.0016
-20				-2.29	0.0009
-30				1.03	0.0004

Frequency Error vs Voltage

Voltage(V)	Temperature(℃)	FL(MHz)	FH(MHz)	Offset(Hz)	Frequency error(ppm)
6.60	20	2496.560	2689.340	2.83	0.0011
15.00				-0.54	0.0002

Expanded measurement uncertainty is 10 Hz, k = 2

A.4 OCCUPIED BANDWIDTH

Reference

FCC: CFR Part 2.1049, 22.917, 27.53.

A.4.1 Occupied Bandwidth Results

Occupied bandwidth measurements are only provided for selected frequencies in order to reduce the amount of submitted data. Data were taken at the extreme and mid frequencies of the US Cellular/PCS frequency bands. The table below lists the measured 99% BW. Spectrum analyzer plots are included on the following pages.

a) The spectrum analyzer center frequency is set to the nominal EUT channel center frequency. The frequency span for the spectrum analyzer shall be set wide enough to capture all modulation products including the emission skirts (i.e., two to five times the OBW).

b) The nominal IF filter bandwidth (3 dB RBW) shall be in the range of 1 to 5 % of the anticipated OBW, and the VBW shall be at least 3 times the RBW.

c) Set the reference level of the instrument as required to keep the signal from exceeding the maximum input mixer level for linear operation. In general, the peak of the spectral envelope must be at least 10log (OBW / RBW) below the reference level.

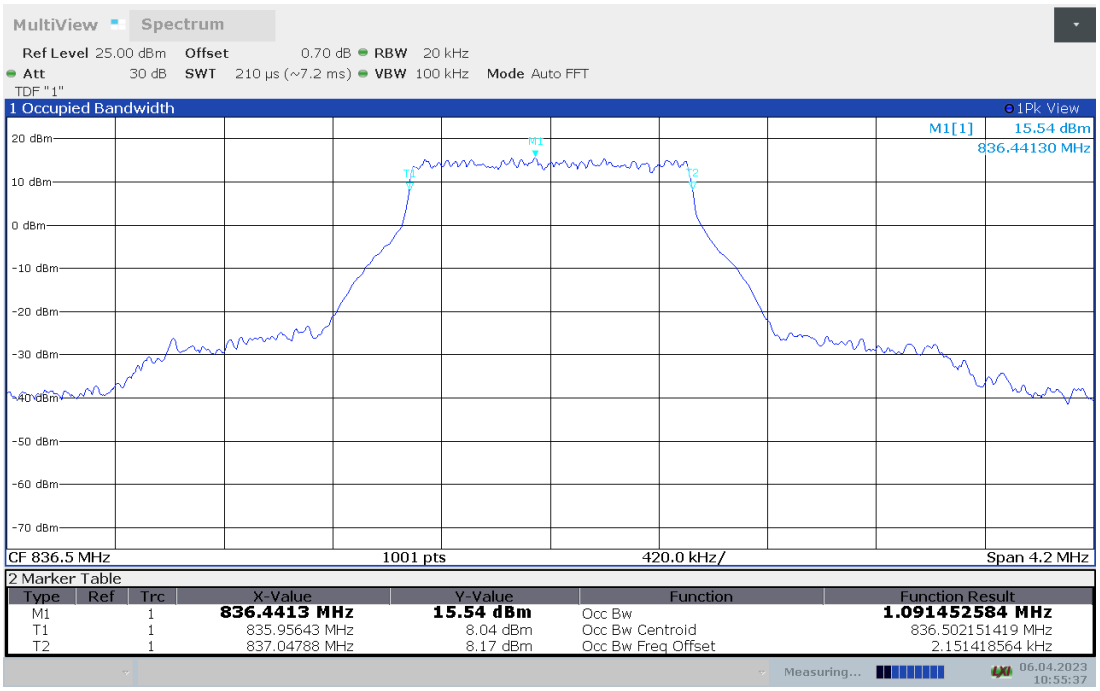
d) Set the detection mode to peak, and the trace mode to max hold.

e) Use the 99 % power bandwidth function of the spectrum analyzer and report the measured bandwidth.

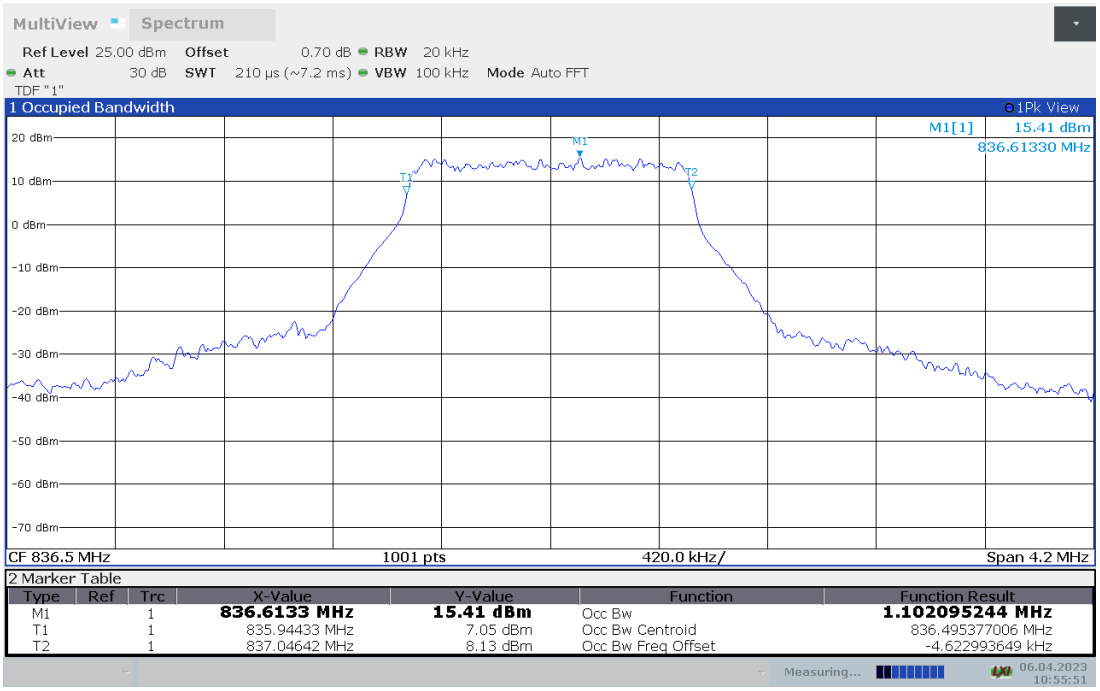
LTE band 5,1.4MHz(99%)

Frequency (MHz)	Occupied Bandwidth (99%)(MHz)	
	QPSK	16QAM
836.5	1.091	1.102

LTE band 5 , 1.4MHz Bandwidth,MID,QPSK (99% BW)



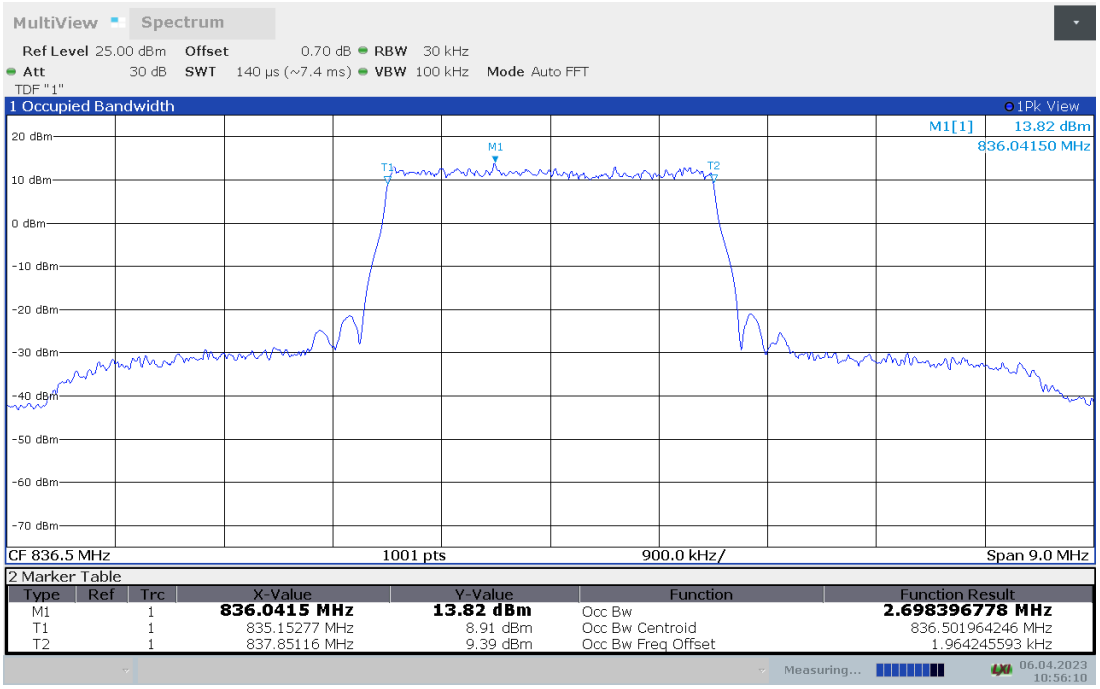
LTE band 5 , 1.4MHz Bandwidth,MID,16QAM (99% BW)



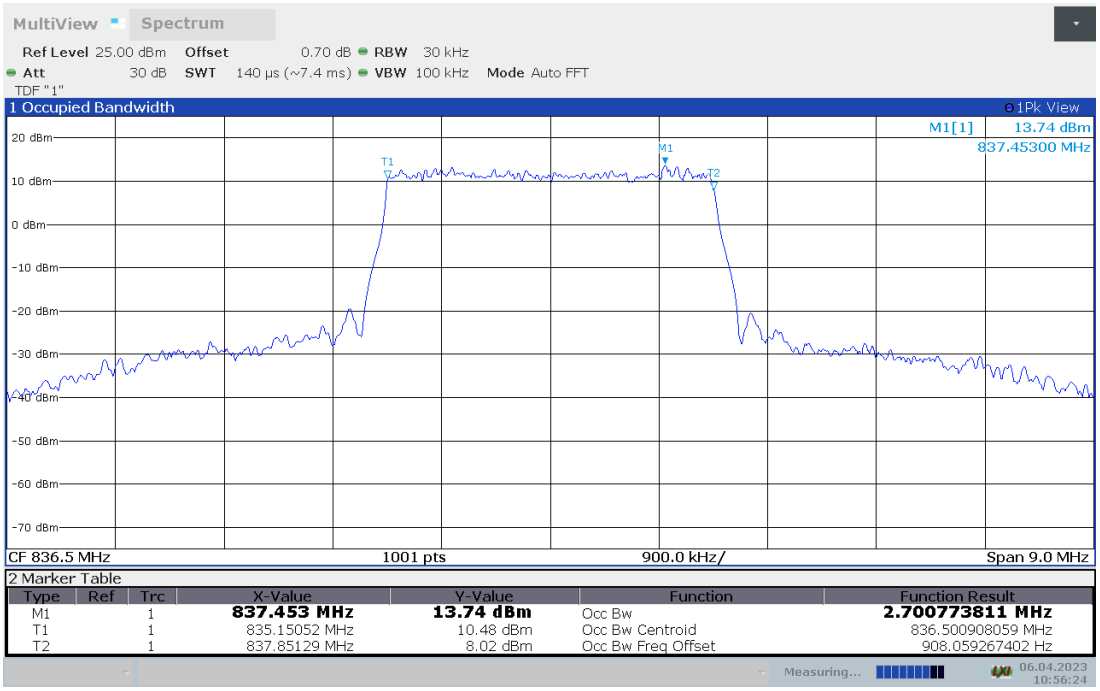
LTE band 5,3MHz(99%)

Frequency (MHz)	Occupied Bandwidth (99%)(MHz)	
	QPSK	16QAM
836.5	2.698	2.701

LTE band 5 , 3MHz Bandwidth,MID,QPSK (99% BW)



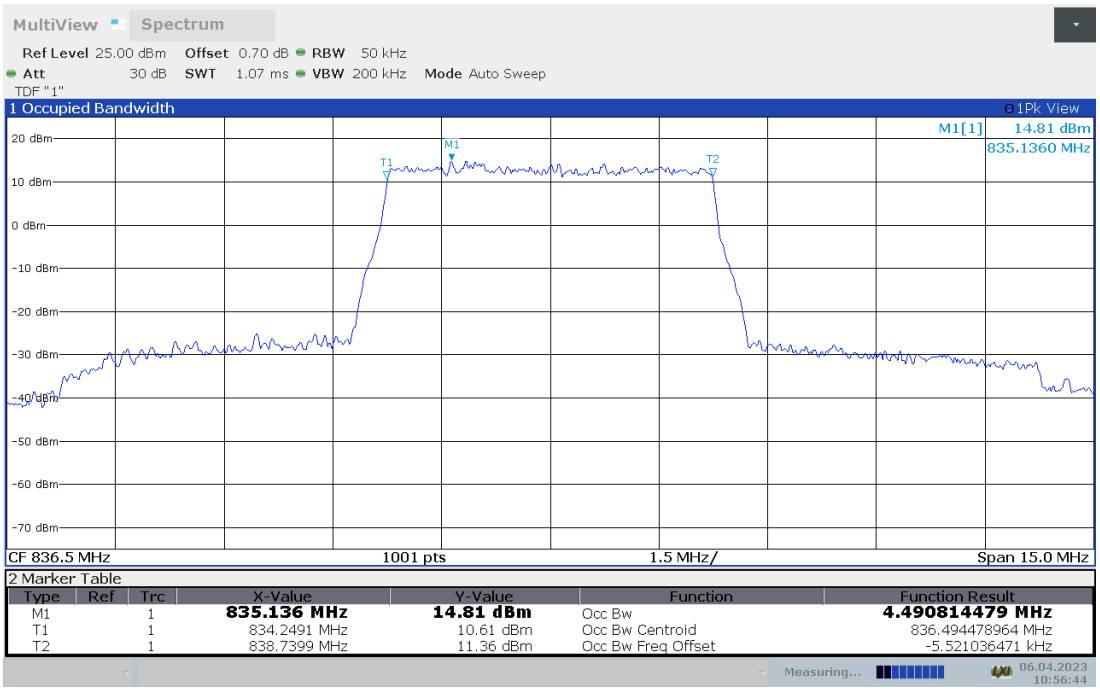
LTE band 5 , 3MHz Bandwidth,MID,16QAM (99% BW)



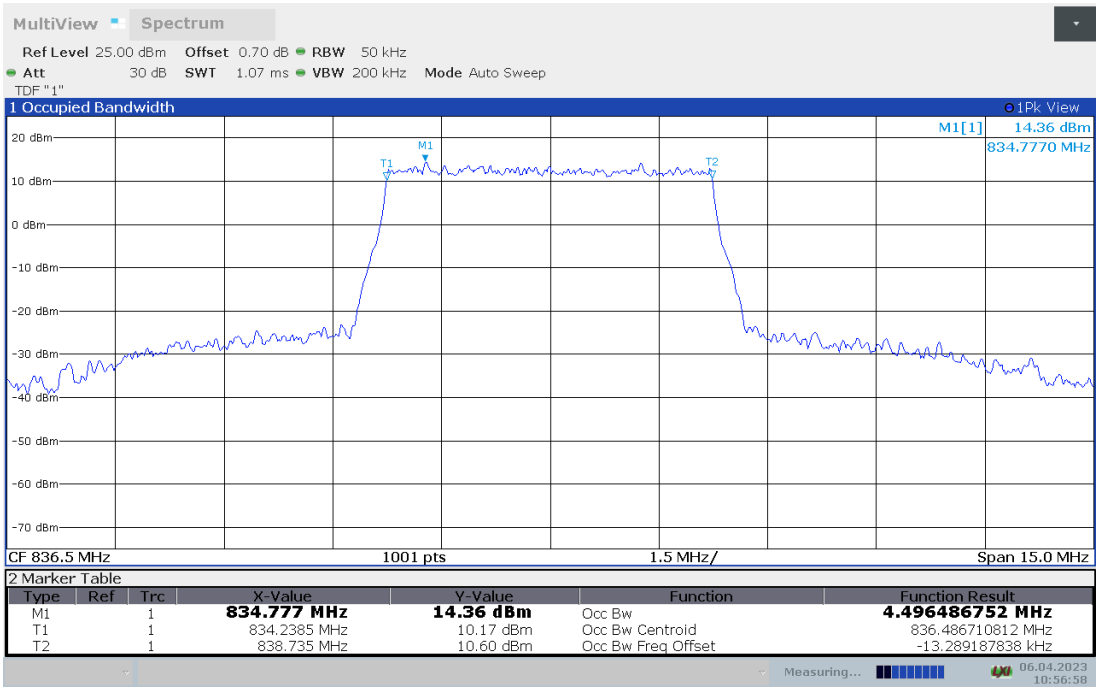
LTE band 5,5MHz(99%)

Frequency (MHz)	Occupied Bandwidth (99%)(MHz)	
	QPSK	16QAM
836.5	4.491	4.496

LTE band 5 , 5MHz Bandwidth,MID,QPSK (99% BW)



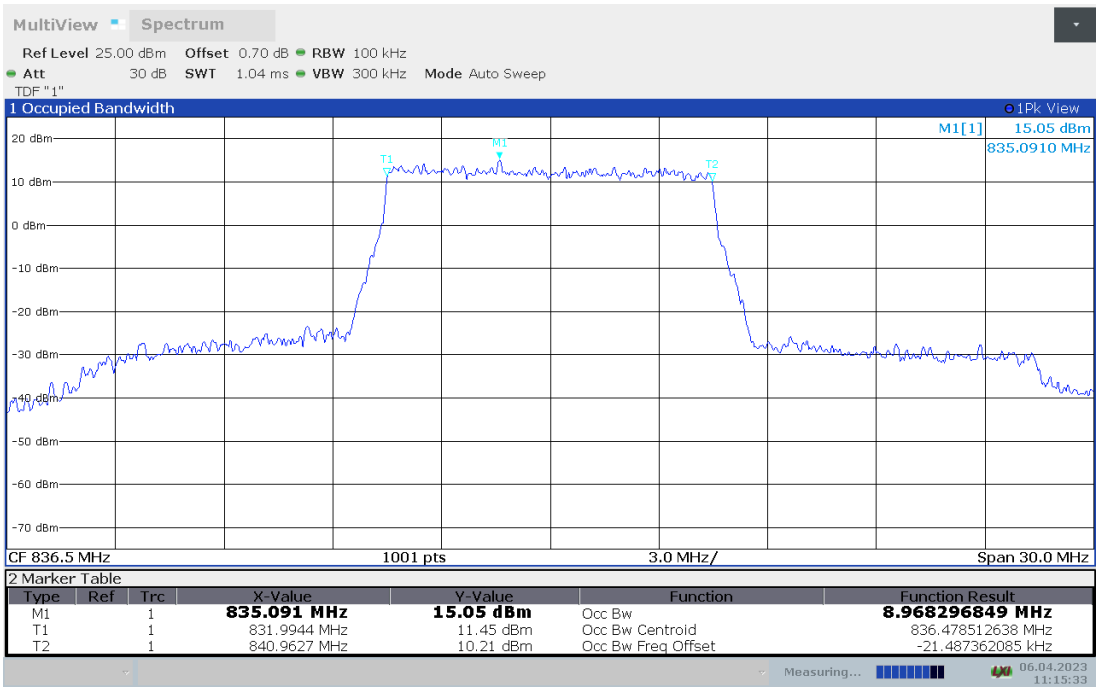
LTE band 5 , 5MHz Bandwidth,MID,16QAM (99% BW)



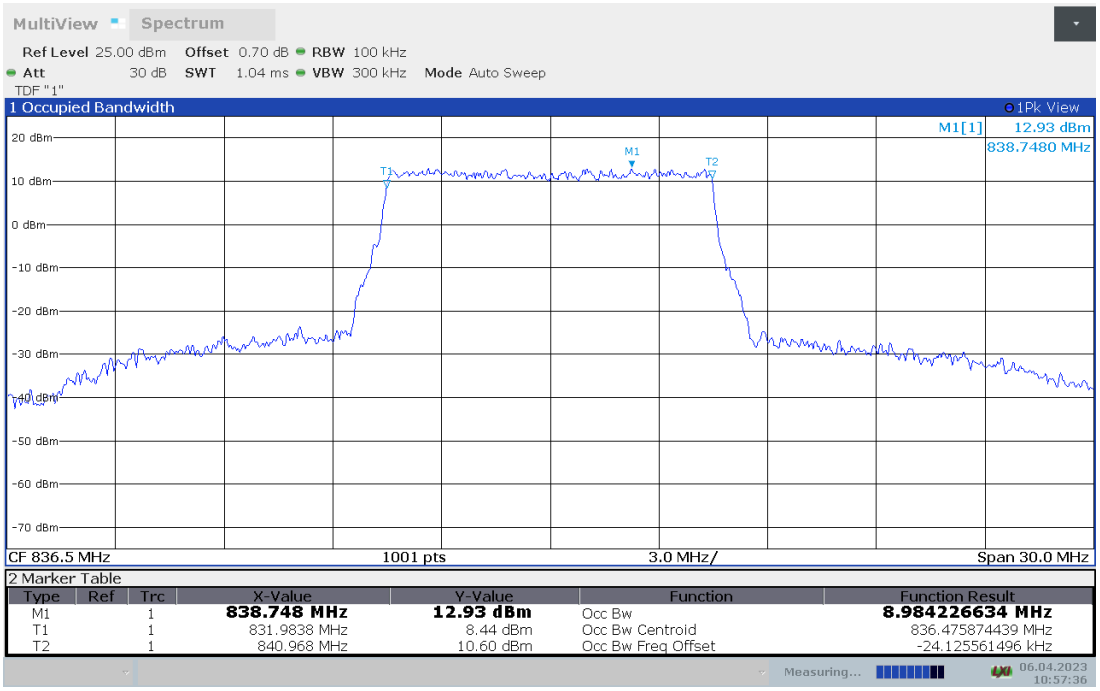
LTE band 5,10MHz(99%)

Frequency (MHz)	Occupied Bandwidth (99%)(MHz)	
	QPSK	16QAM
836.5	8.968	8.984

LTE band 5 , 10MHz Bandwidth,MID,QPSK (99% BW)



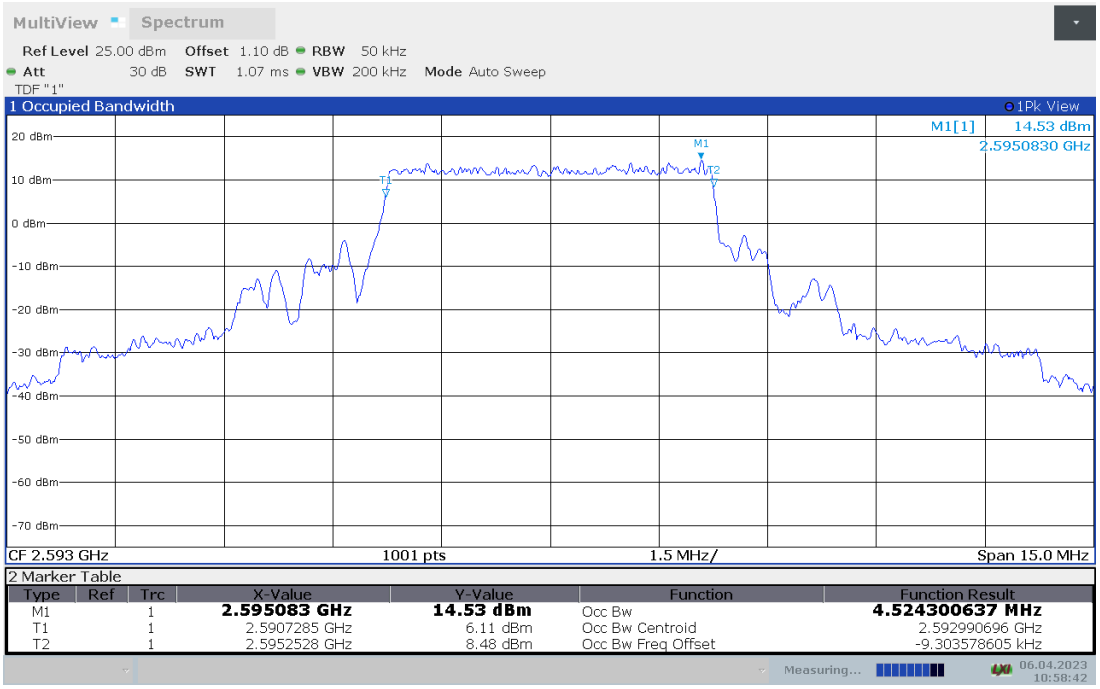
LTE band 5 , 10MHz Bandwidth,MID,16QAM (99% BW)



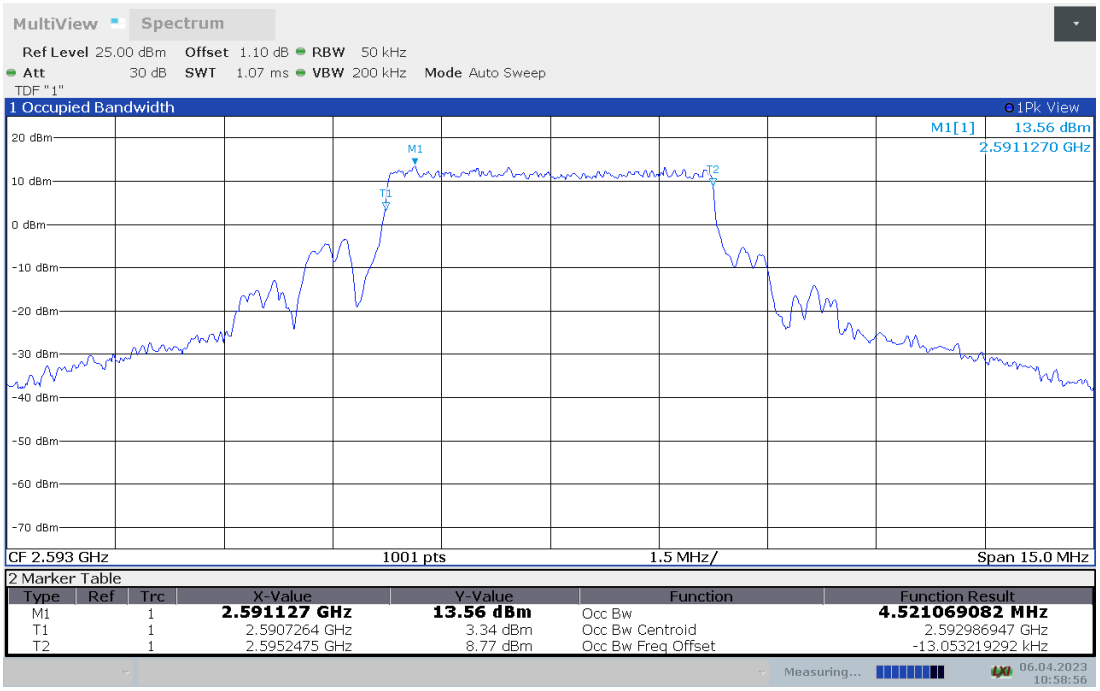
LTE band 41,5MHz(99%)

Frequency (MHz)	Occupied Bandwidth (99%)(MHz)	
	QPSK	16QAM
2593	4.524	4.521

LTE band 41 , 5MHz Bandwidth,MID,QPSK (99% BW)



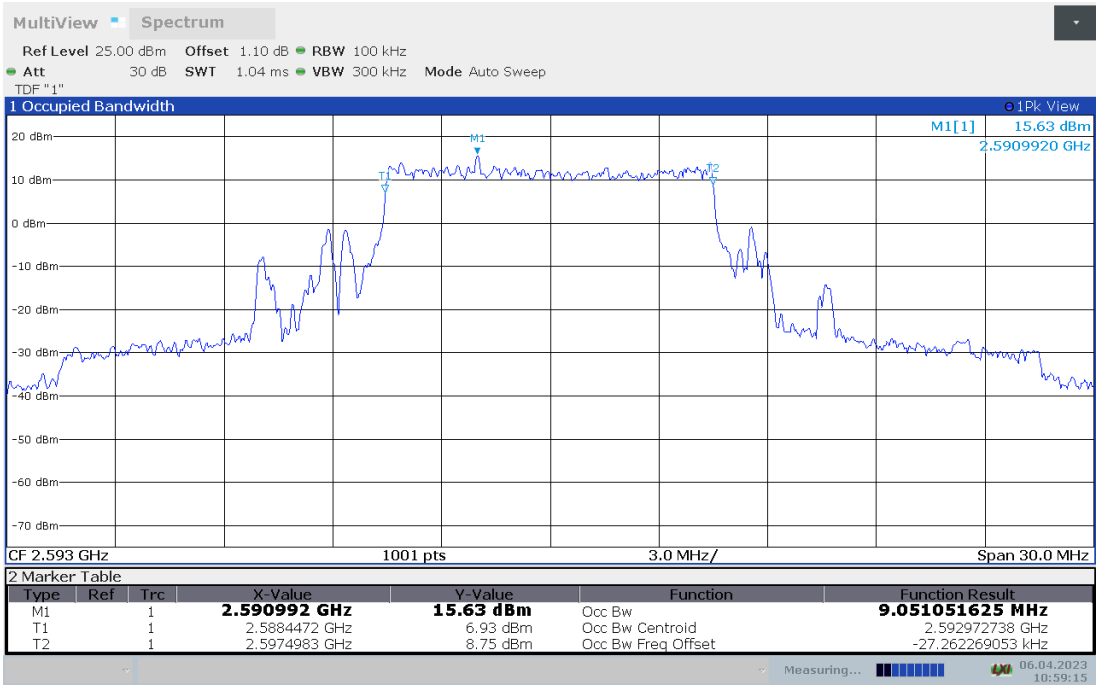
LTE band 41 , 5MHz Bandwidth,MID,16QAM (99% BW)



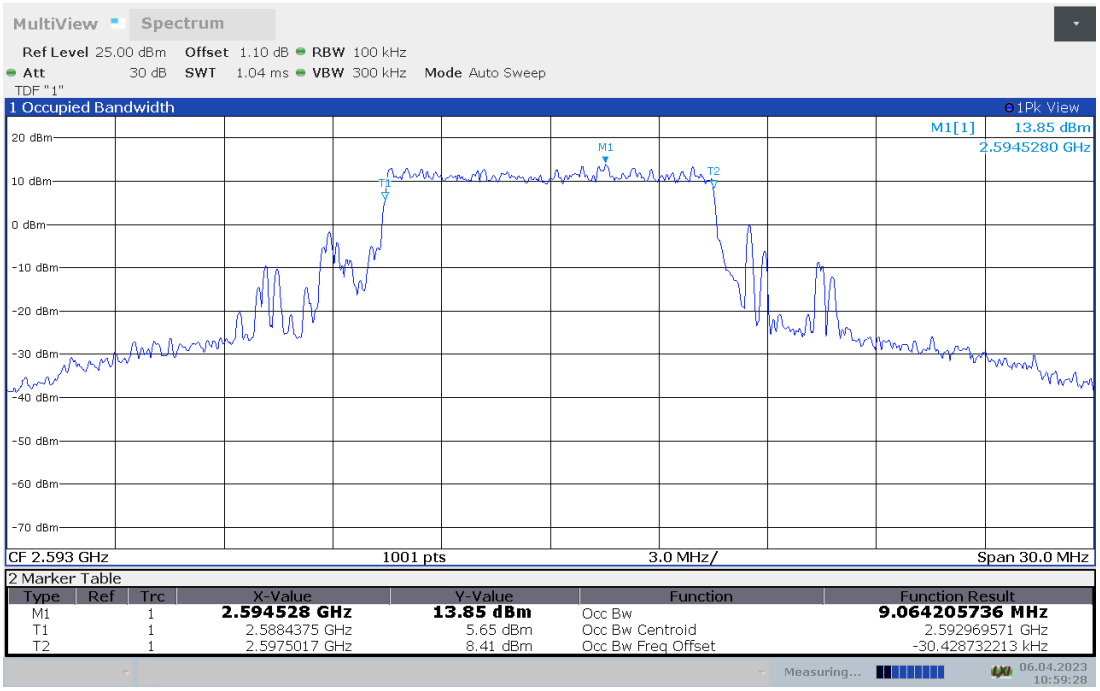
LTE band 41,10MHz(99%)

Frequency (MHz)	Occupied Bandwidth (99%)(MHz)	
	QPSK	16QAM
2593	9.051	9.064

LTE band 41 , 10MHz Bandwidth,MID,QPSK (99% BW)



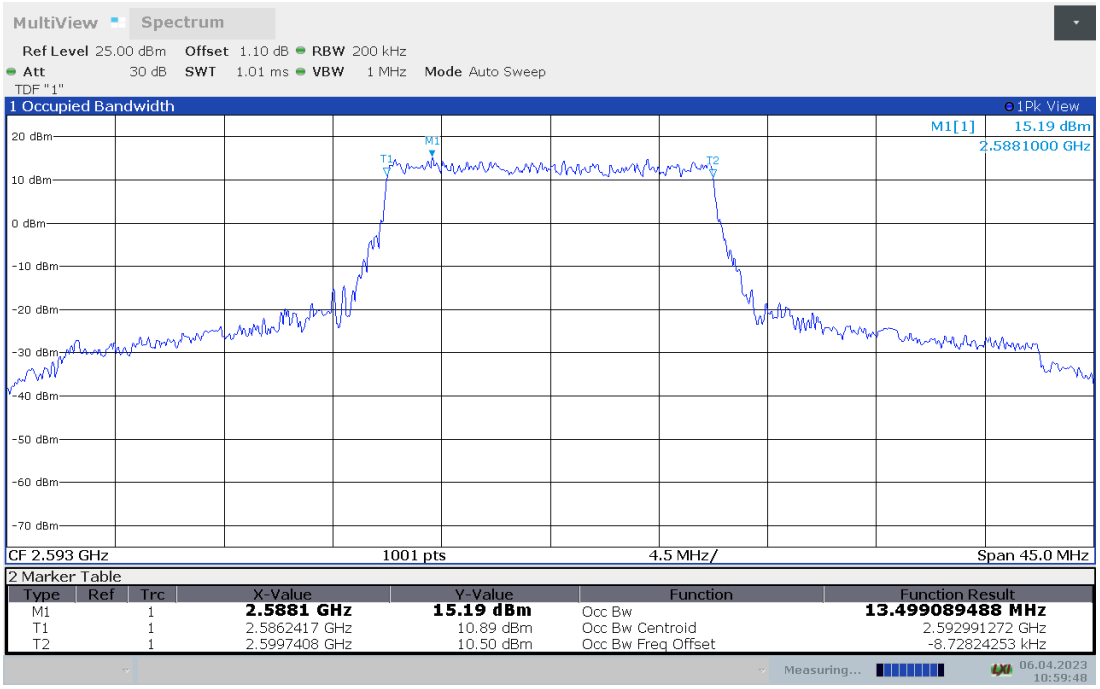
LTE band 41 , 10MHz Bandwidth,MID,16QAM (99% BW)



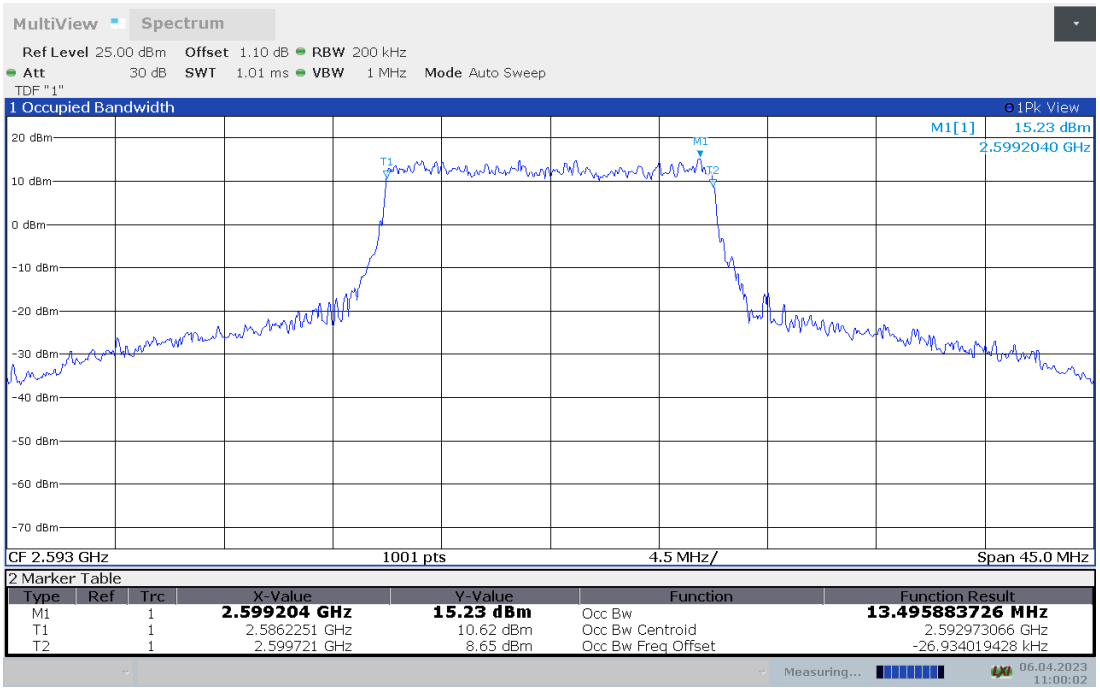
LTE band 41,15MHz(99%)

Frequency (MHz)	Occupied Bandwidth (99%)(MHz)	
	QPSK	16QAM
2593	13.499	13.496

LTE band 41 , 15MHz Bandwidth,MID,QPSK (99% BW)



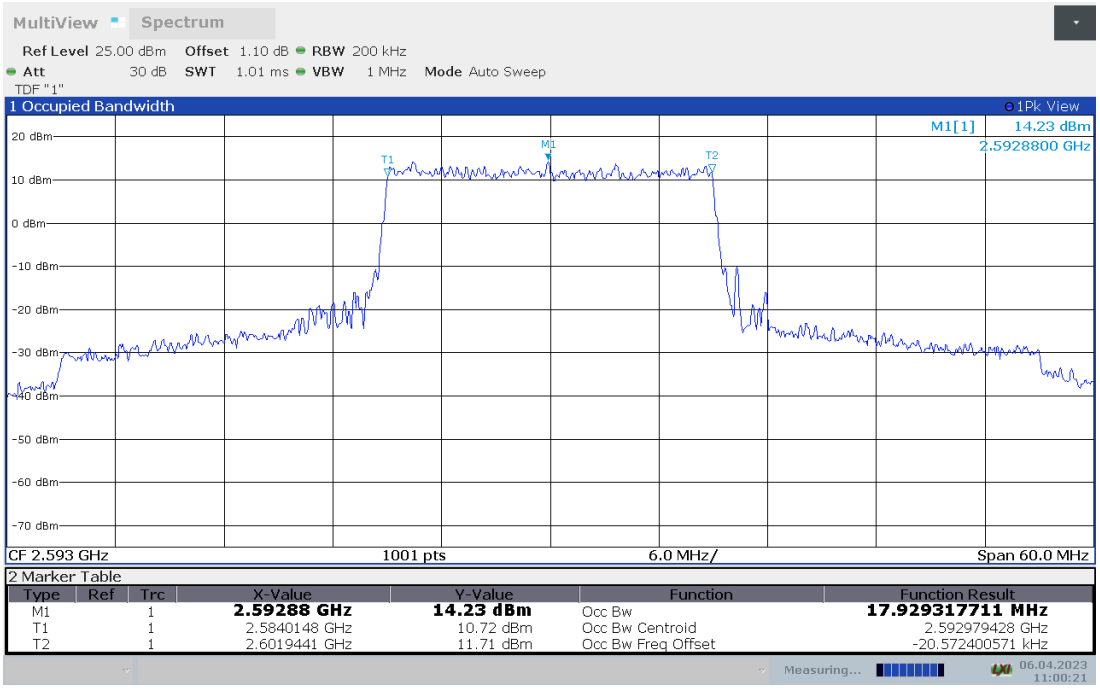
LTE band 41 , 15MHz Bandwidth,MID,16QAM (99% BW)



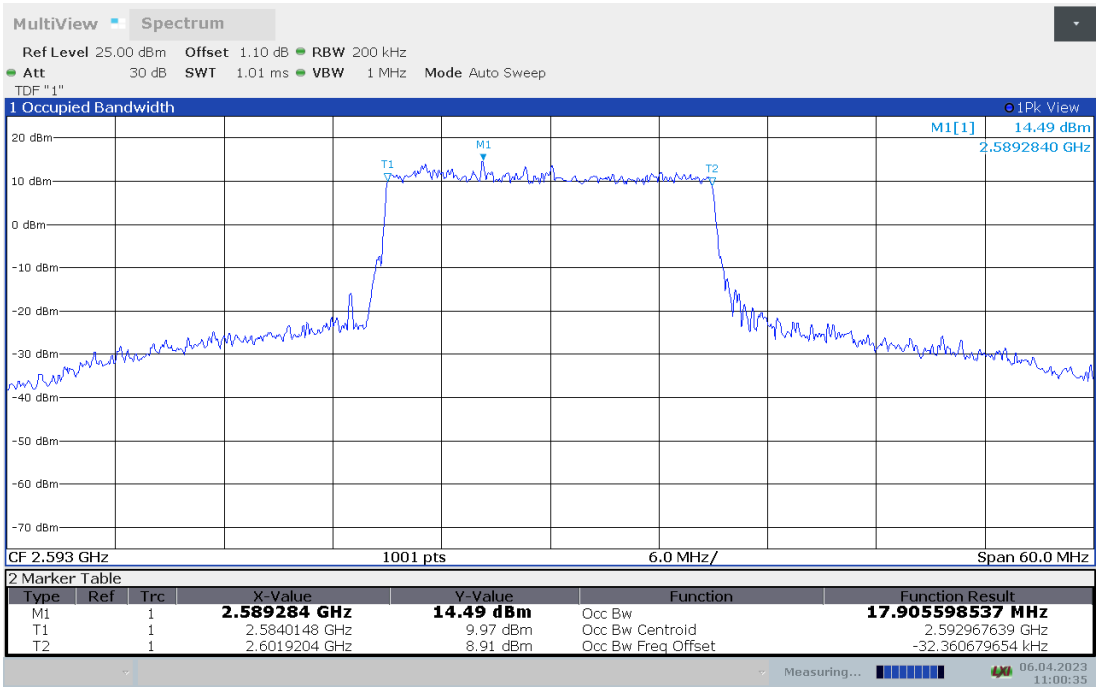
LTE band 41,20MHz(99%)

Frequency (MHz)	Occupied Bandwidth (99%)(MHz)	
	QPSK	16QAM
2593	17.929	17.906

LTE band 41 , 20MHz Bandwidth,MID,QPSK (99% BW)



LTE band 41 , 20MHz Bandwidth,MID,16QAM (99% BW)



Note: Expanded measurement uncertainty is U = 3428 Hz, k = 2

A.5 EMISSION BANDWIDTH

Reference

FCC: CFR Part 2.1049, 22.917, 27.53.

A.5.1 Measurement Procedure

The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

a) The spectrum analyzer center frequency is set to the nominal EUT channel center frequency. The frequency span for the spectrum analyzer shall be set wide enough to capture all modulation products including the emission skirts (i.e., two to five times the OBW).

b) The nominal IF filter bandwidth (3 dB RBW) shall be in the range of 1 to 5 % of the anticipated OBW, and the VBW shall be at least 3 times the RBW.

c) Set the reference level of the instrument as required to keep the signal from exceeding the maximum input mixer level for linear operation. In general, the peak of the spectral envelope must be at least 10log (OBW / RBW) below the reference level.

d) Set the detection mode to peak, and the trace mode to max hold.

e) Use the 26dB bandwidth function of the spectrum analyzer and report the measured bandwidth.

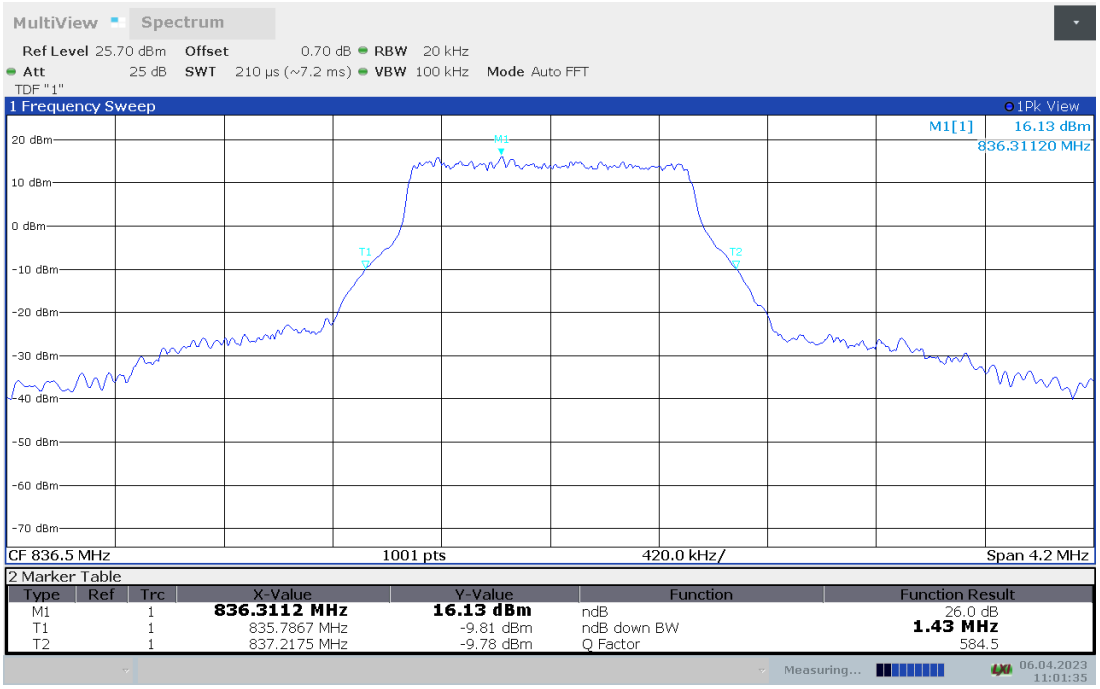
A.5.2Emission Bandwidth Results

Similar to conducted emissions; Emission bandwidth measurements are only provided for selected frequencies in order to reduce the amount of submitted data. Data were taken at the extreme and mid frequencies. Table below lists the measured -26dBc BW. Spectrum analyzer plots are included on the following pages.

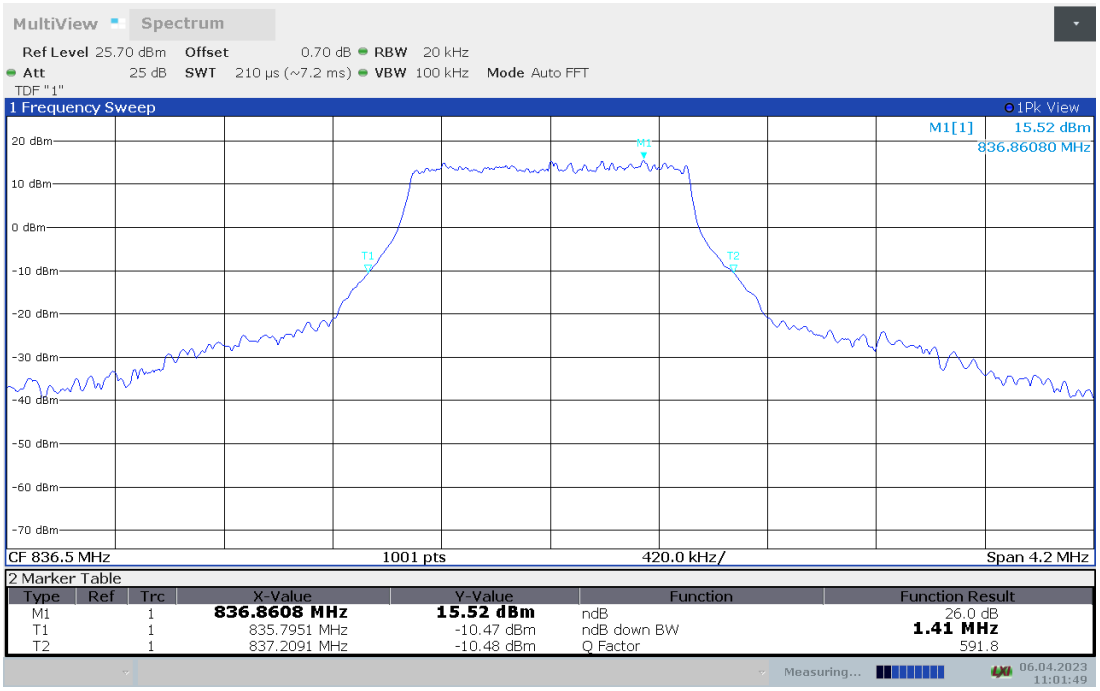
LTE band 5,1.4MHz(-26dBc)

Frequency(MHz)	Emission Bandwidth (-26dBc)(MHz)	
	QPSK	16QAM
836.5	1.431	1.414

LTE band 5 , 1.4MHz Bandwidth,MID,QPSK (-26dBc BW)



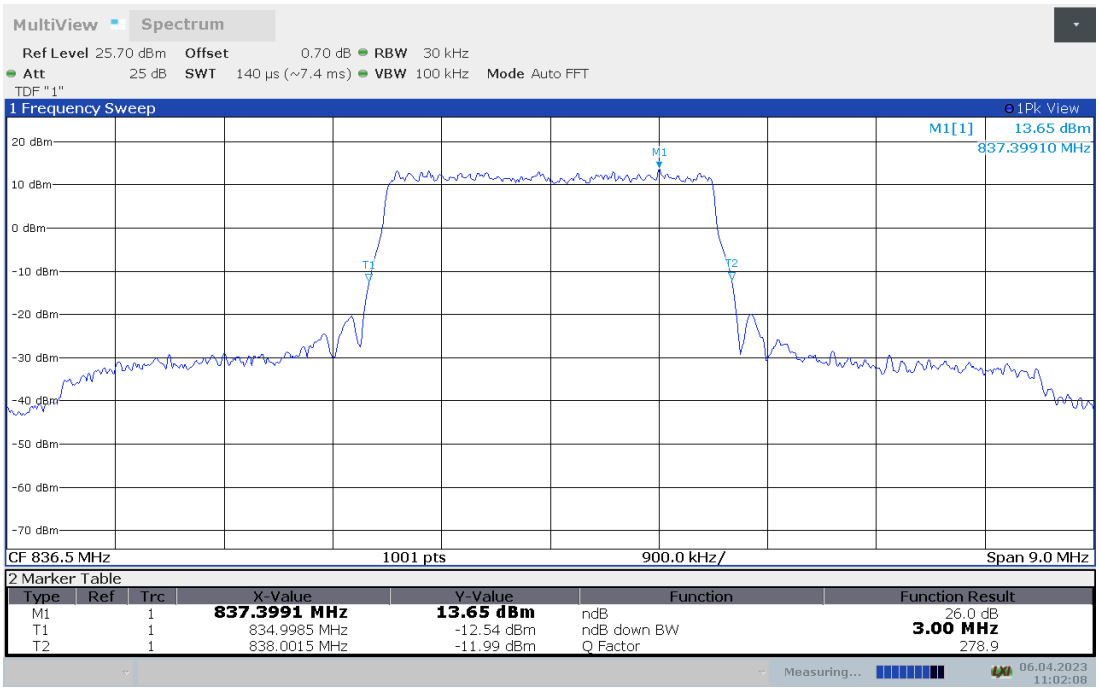
LTE band 5 , 1.4MHz Bandwidth,MID,16QAM (-26dBc BW)



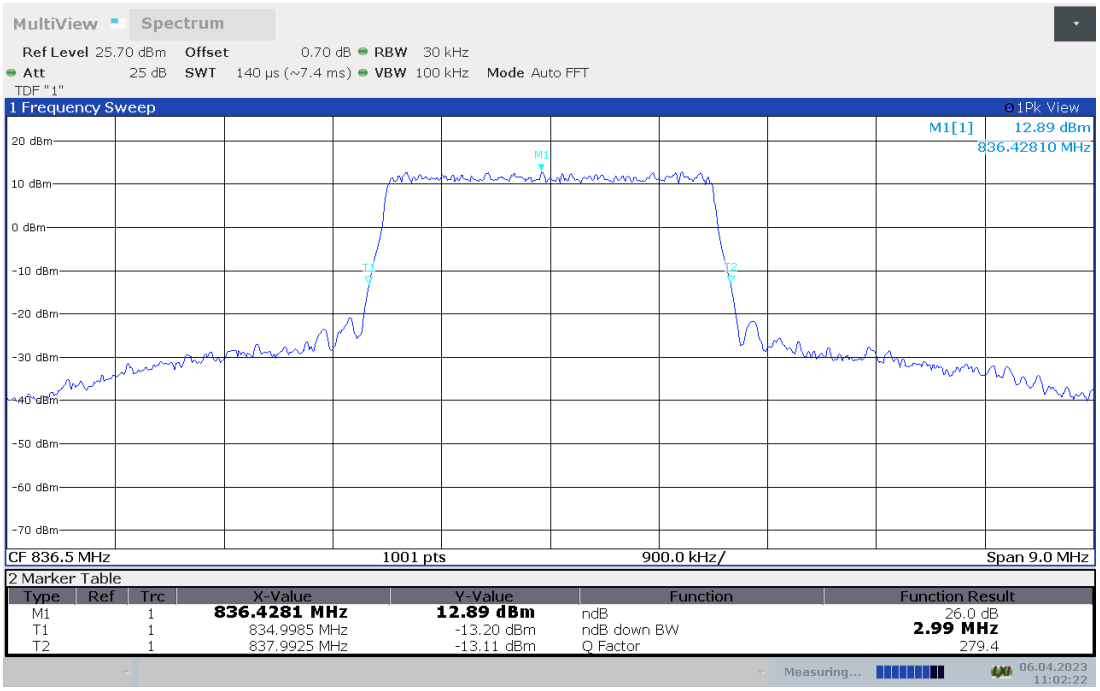
LTE band 5,3MHz(-26dBc)

Frequency(MHz)	Emission Bandwidth (-26dBc)(MHz)	
	QPSK	16QAM
836.5	3.003	2.994

LTE band 5 , 3MHz Bandwidth,MID,QPSK (-26dBc BW)



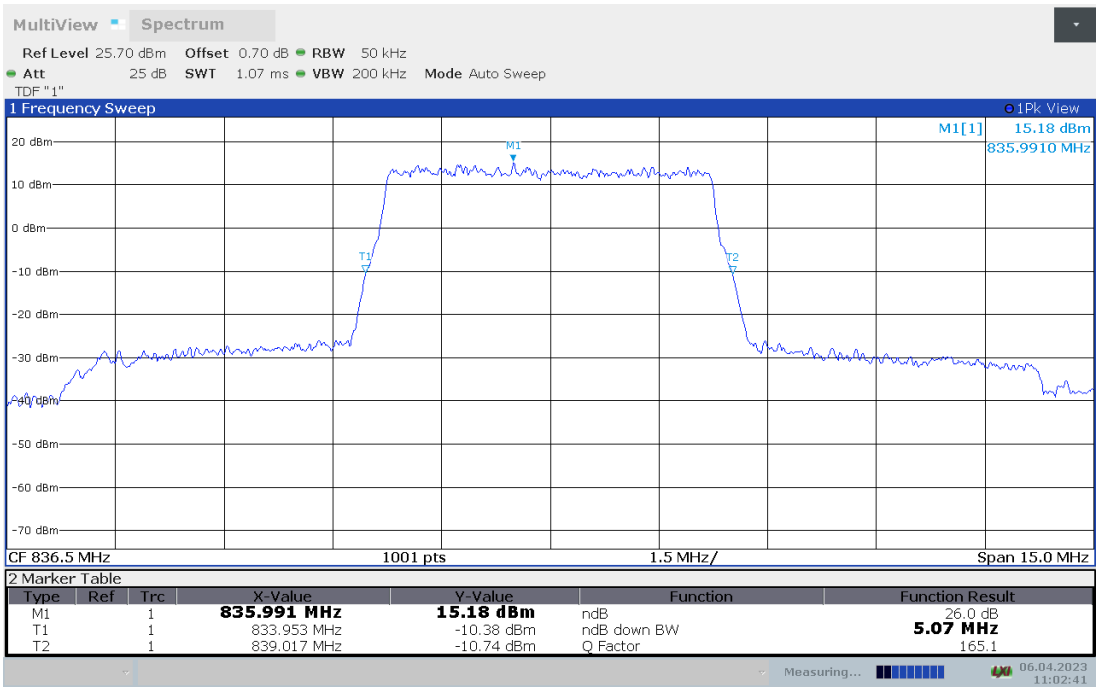
LTE band 5 , 3MHz Bandwidth,MID,16QAM (-26dBc BW)



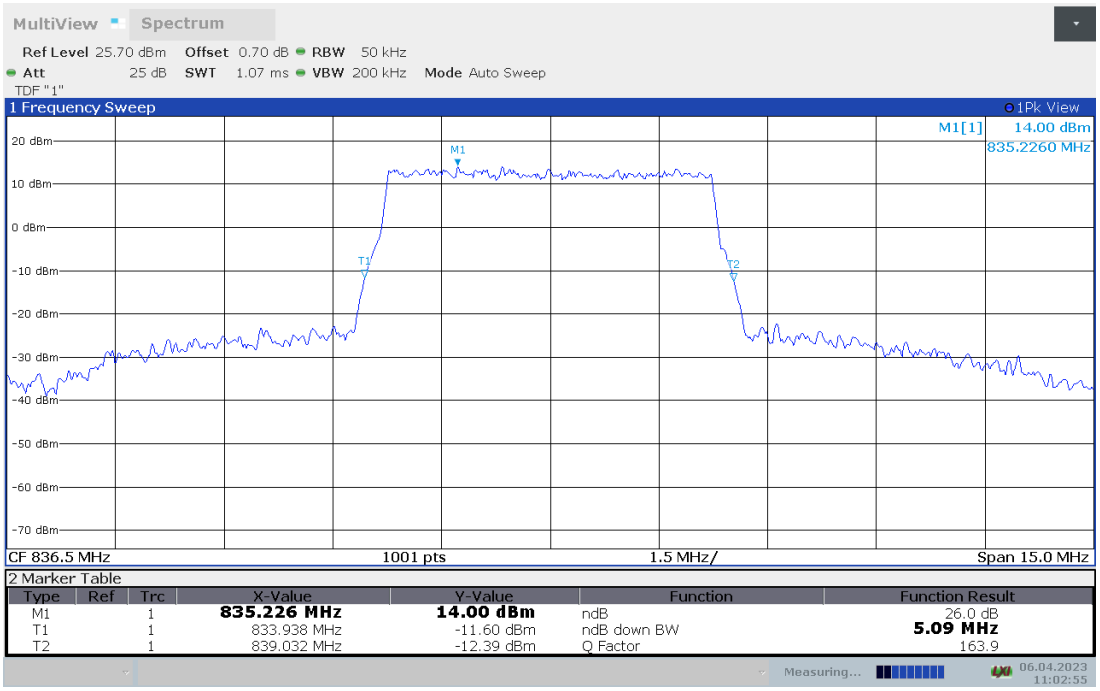
LTE band 5,5MHz(-26dBc)

Frequency(MHz)	Emission Bandwidth (-26dBc)(MHz)	
	QPSK	16QAM
836.5	5.065	5.095

LTE band 5 , 5MHz Bandwidth,MID,QPSK (-26dBc BW)



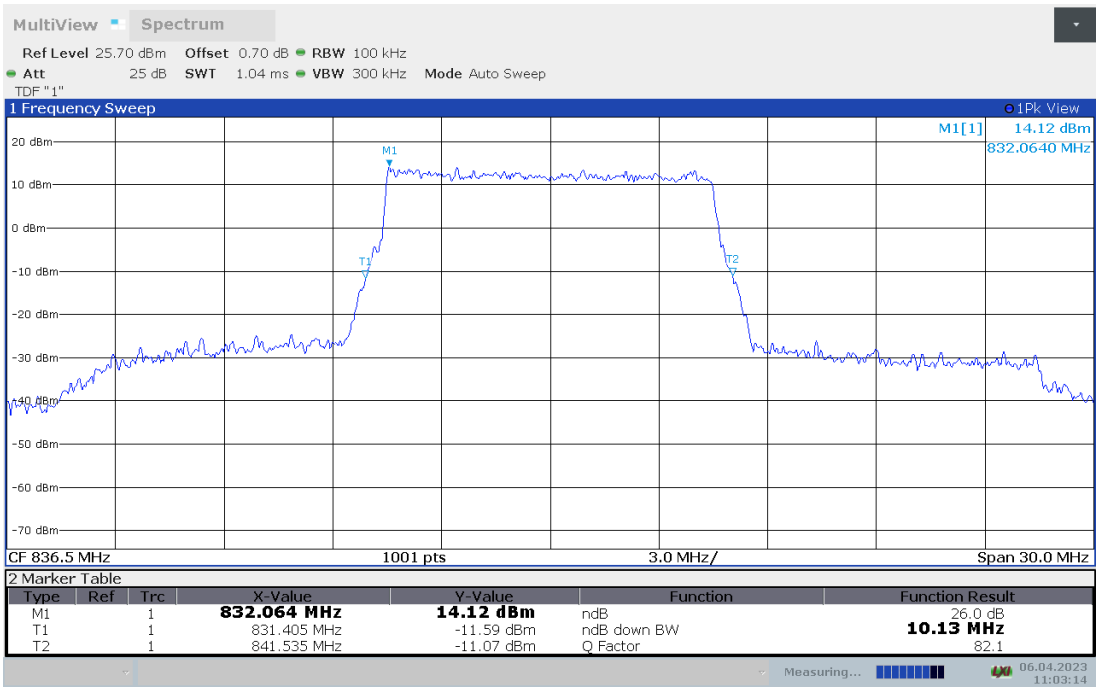
LTE band 5 , 5MHz Bandwidth,MID,16QAM (-26dBc BW)



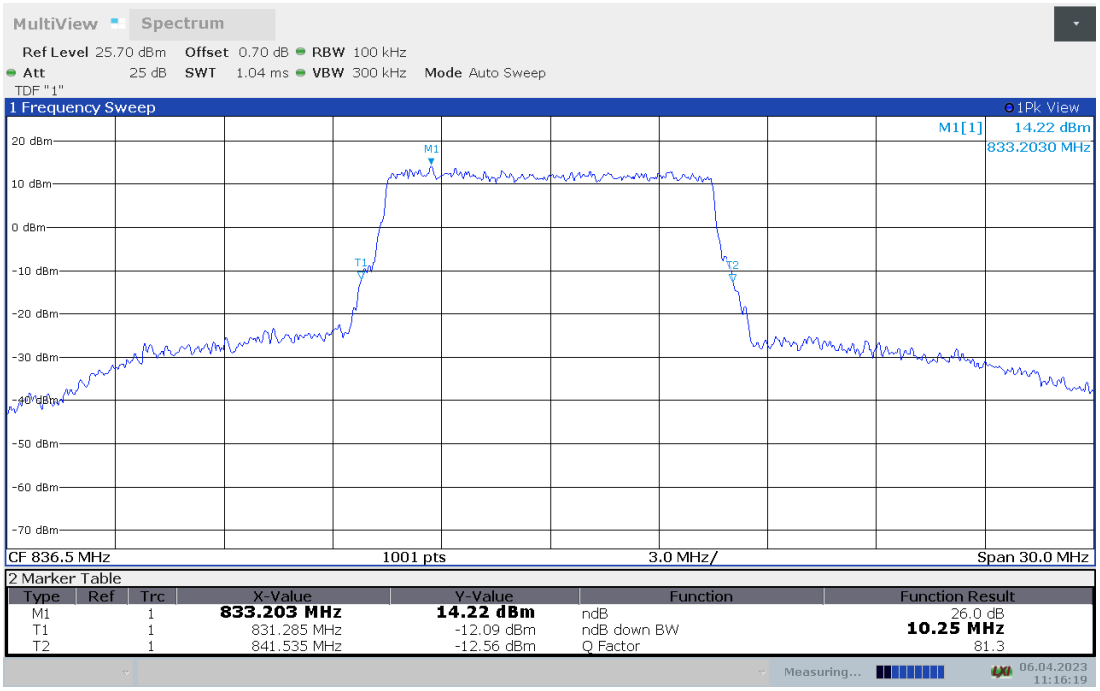
LTE band 5,10MHz(-26dBc)

Frequency(MHz)	Emission Bandwidth (-26dBc)(MHz)	
	QPSK	16QAM
836.5	10.130	10.250

LTE band 5 , 10MHz Bandwidth,MID,QPSK (-26dBc BW)



LTE band 5 , 10MHz Bandwidth,MID,16QAM (-26dBc BW)

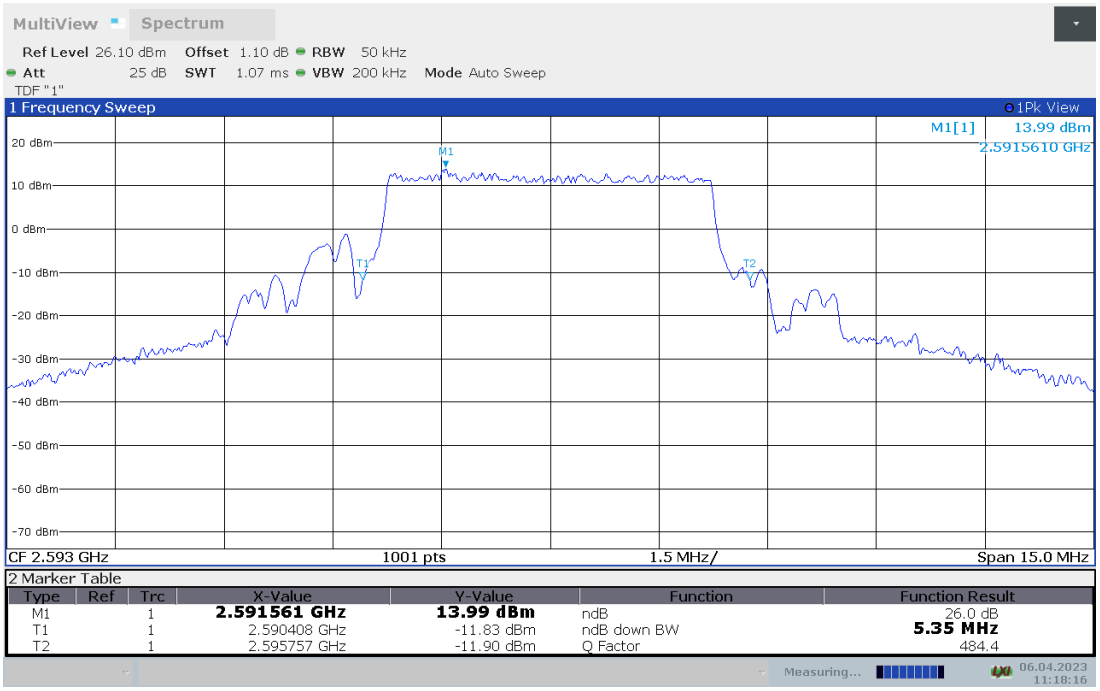


LTE band 41,5MHz(-26dBc)

Frequency(MHz)	Emission Bandwidth (-26dBc)(MHz)	
	QPSK	16QAM
2593	5.095	5.350

LTE band 41 , 5MHz Bandwidth,MID,QPSK (-26dBc BW)

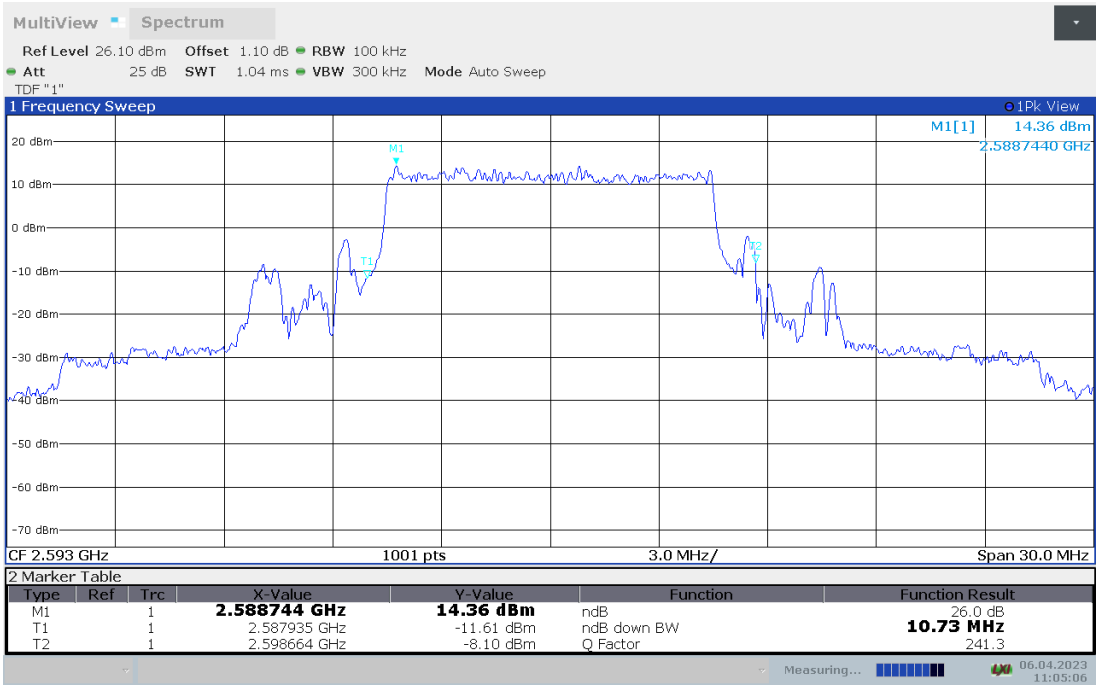
LTE band 41 , 5MHz Bandwidth,MID,16QAM (-26dBc BW)



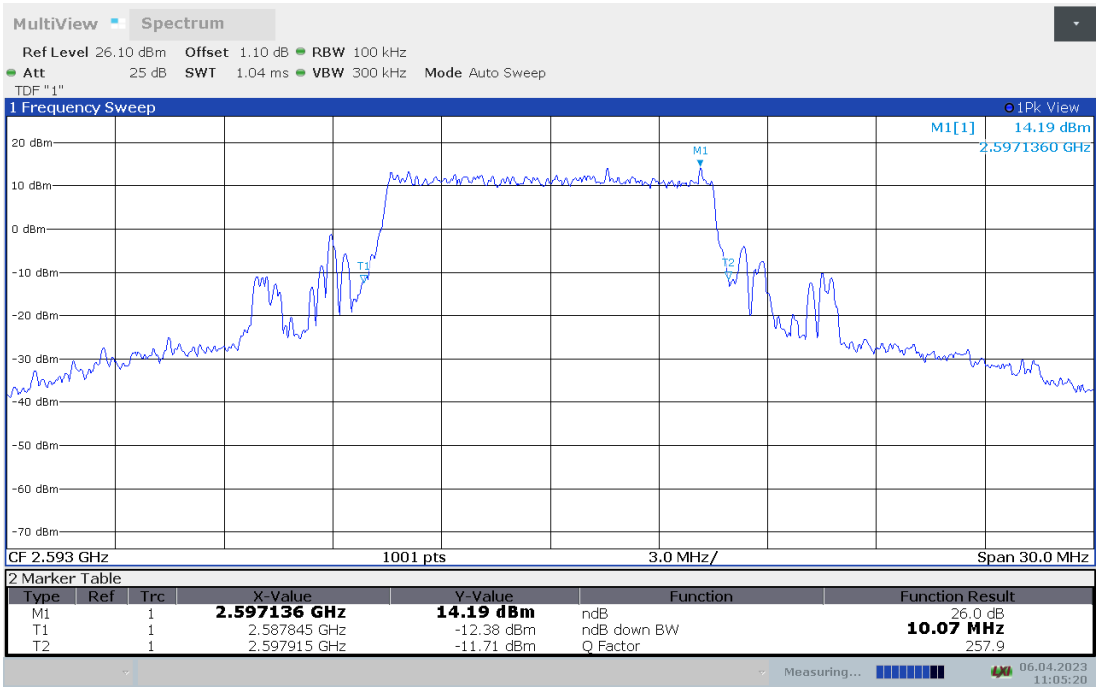
LTE band 41,10MHz(-26dBc)

Frequency(MHz)	Emission Bandwidth (-26dBc)(MHz)	
	QPSK	16QAM
2593	10.729	10.070

LTE band 41 , 10MHz Bandwidth,MID,QPSK (-26dBc BW)



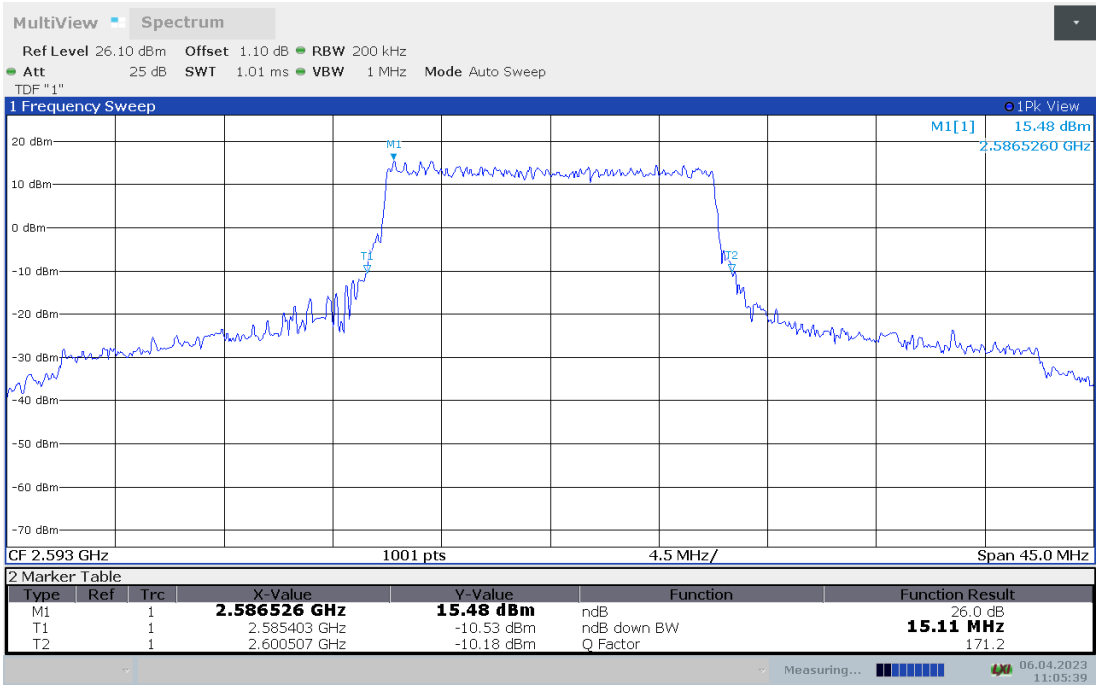
LTE band 41 , 10MHz Bandwidth,MID,16QAM (-26dBc BW)



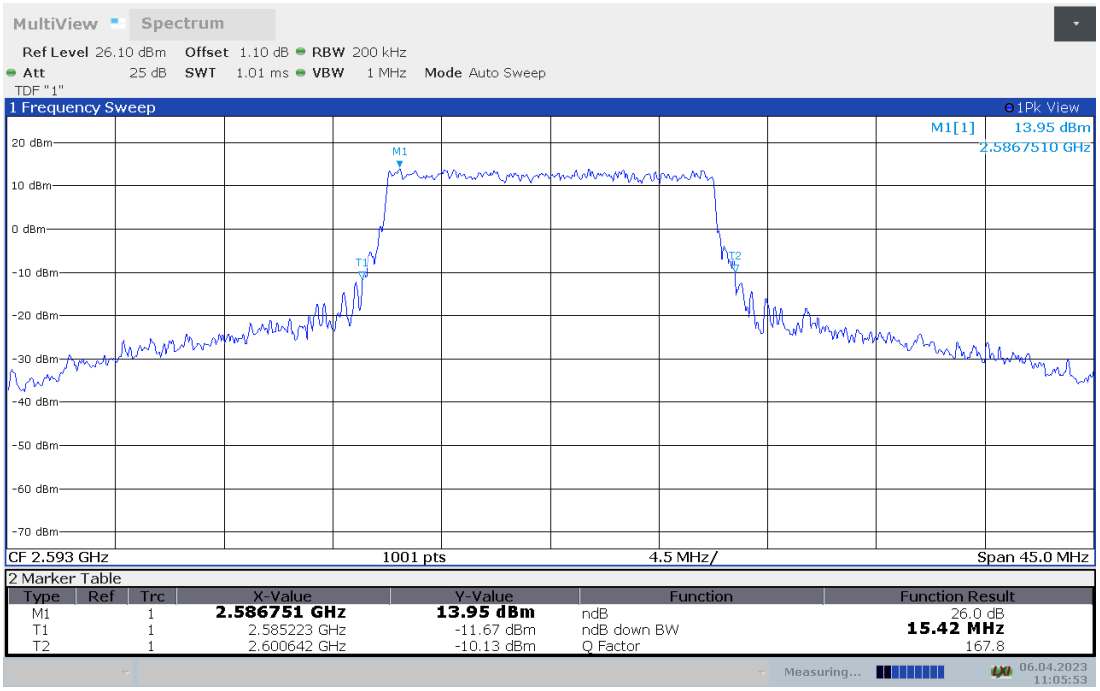
LTE band 41,15MHz(-26dBc)

Frequency(MHz)	Emission Bandwidth (-26dBc)(MHz)	
	QPSK	16QAM
2593	15.105	15.420

LTE band 41 , 15MHz Bandwidth,MID,QPSK (-26dBc BW)



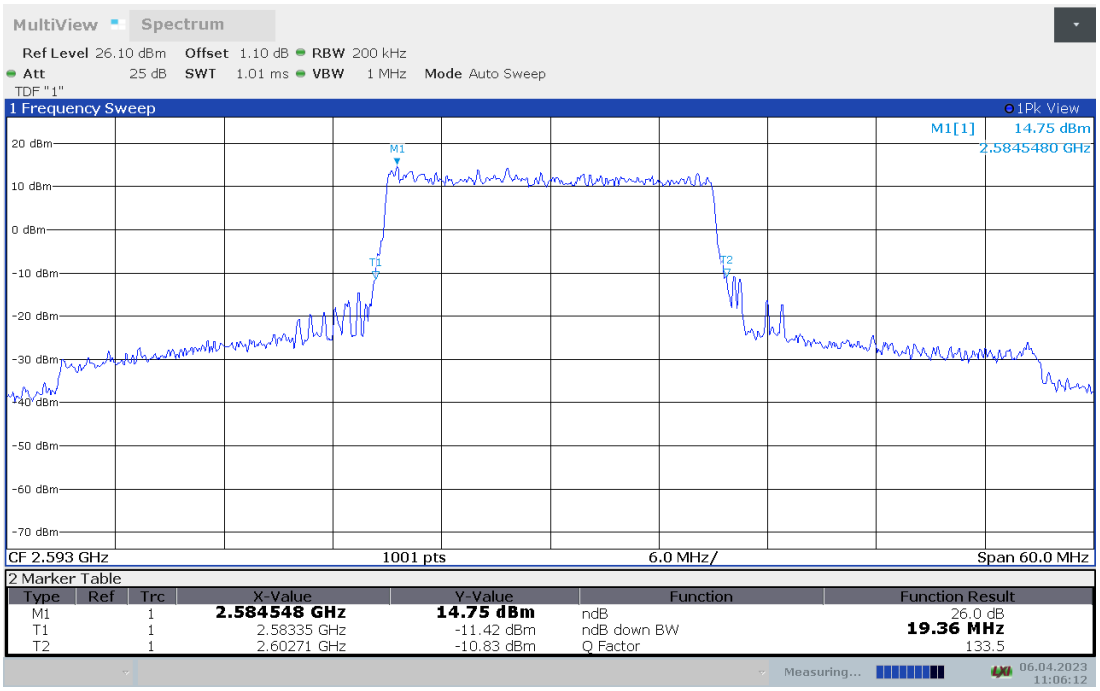
LTE band 41 , 15MHz Bandwidth,MID,16QAM (-26dBc BW)



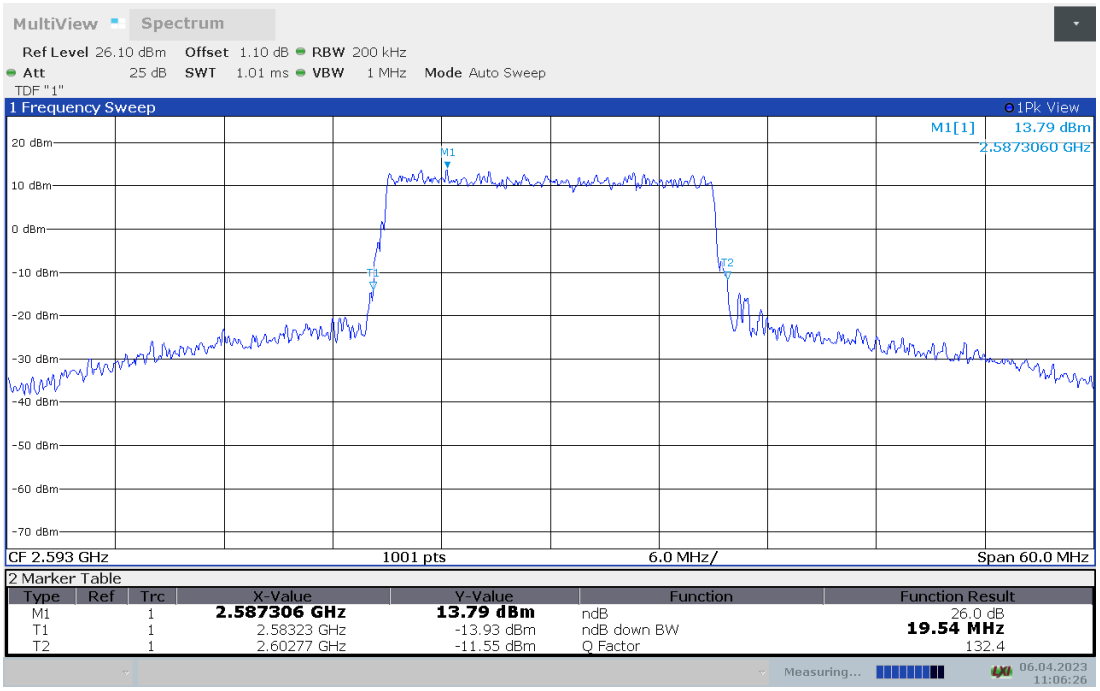
LTE band 41,20MHz(-26dBc)

Frequency(MHz)	Emission Bandwidth (-26dBc)(MHz)	
	QPSK	16QAM
2593	19.361	19.540

LTE band 41 , 20MHz Bandwidth,MID,QPSK (-26dBc BW)



LTE band 41 , 20MHz Bandwidth,MID,16QAM (-26dBc BW)



Note: Expanded measurement uncertainty is U = 3428 Hz, k = 2

A.6 BAND EDGE COMPLIANCE

Reference

FCC: CFR Part 2.1051, 22.917, 27.53.

A.6.1 Measurement limit

Part 22.917 For operations in the 824–849MHz band, the FCC limit is 43 +10 log (P)dB below the transmitter power(P) in a 100kHz bandwidth. However, in the 1MHz bands immediately outside and adjacent to the licensee's frequency block, a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed.

Part 27.53(h) specify that 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.

Part 27.53(m) specifies for mobile digital stations, the attenuation factor shall be not less than 40+ 10 log (P) dB on all frequencies between the channel edge and 5 megahertz from the channel edge, 43 + 10 log (P) dB on all frequencies between 5 megahertz and X megahertz from the channel edge, and 55 + 10 log (P) dB on all frequencies more than X megahertz from the channel edge, where X is the greater of 6 megahertz or the actual emission bandwidth as defined in paragraph (m)(6) of this section. In addition, the attenuation factor shall not be less that 43 + 10log (P) dB on all frequencies between 2490.5 MHz and 2496 MHz and 55 + 10 log (P) dB at or below 2490.5MHz. Mobile Satellite Service licensees operating on frequencies below 2495 MHz may also submit a documented interference complaint against BRS licensees operating on channel BRS Channel 1 on the same terms and conditions as adjacent channel BRS or EBS licensees.

Part 27.53(g) states for operations in the 600 MHz band and the 698–746 MHz band, the power of any emission outside a 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, by at least 43 +10 log (P) dB. Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kilohertz or greater. However, in the 100 kilohertz bands immediately outside and adjacent to a licensee’s frequency block, a resolution bandwidth of at least 30 kHz may be employed.

A.6.2Measurement Procedure

The testing follows ANSI C63.26

a) The EUT was connected to spectrum analyzer and system simulator via a power divider.

b) The band edges of low and high channels for the highest RF powers were measured.

c) Set RBW >= 1% EBW in the 1MHz band immediately outside and adjacent to the band edge.

d) Set spectrum analyzer with RMS detector.

e) The RF fundamental frequency should be excluded against the limit line in the operating frequency band.

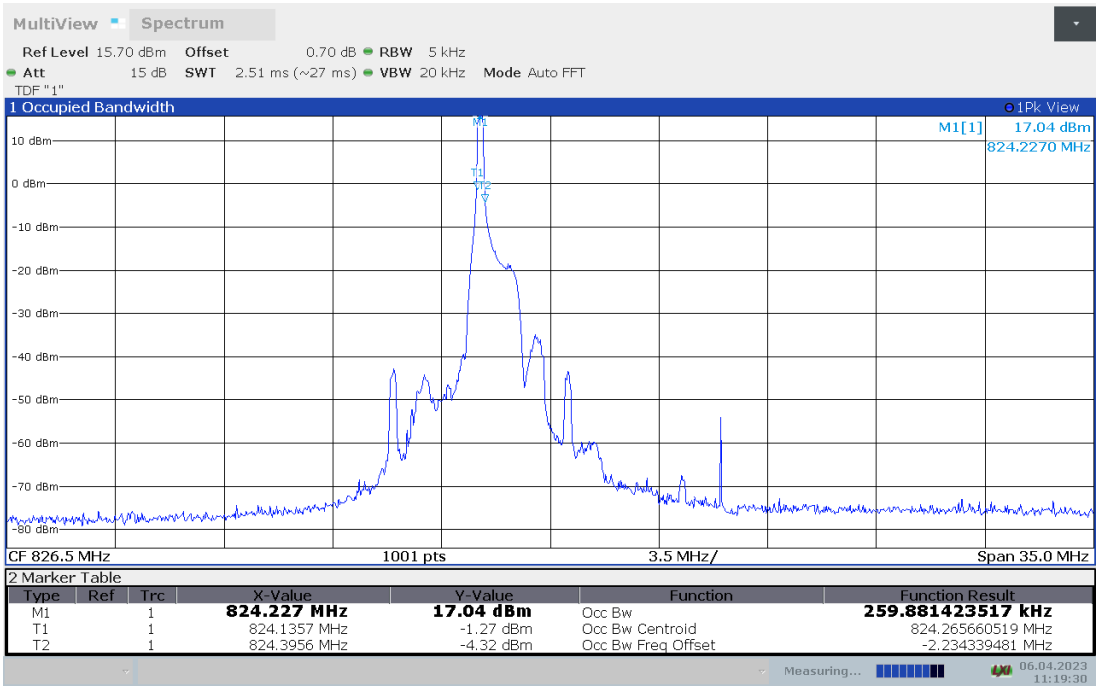
f) Checked that all the results comply with the emission limit line.

A.6.3 Measurement result

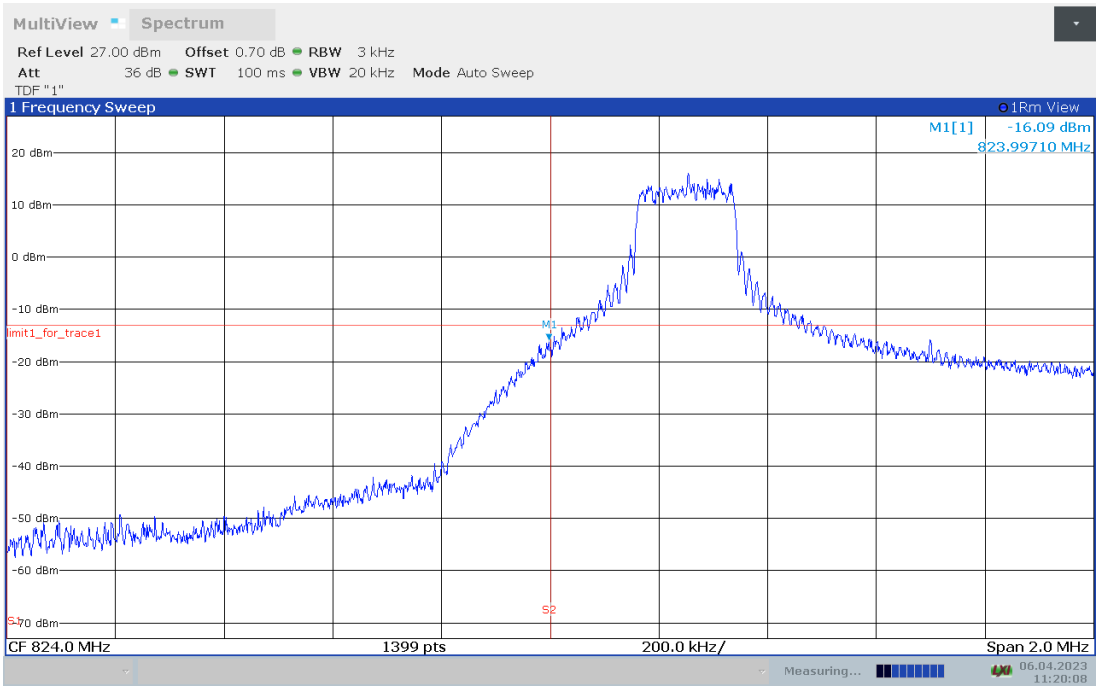
Only worst case result is given below

LTE band 5

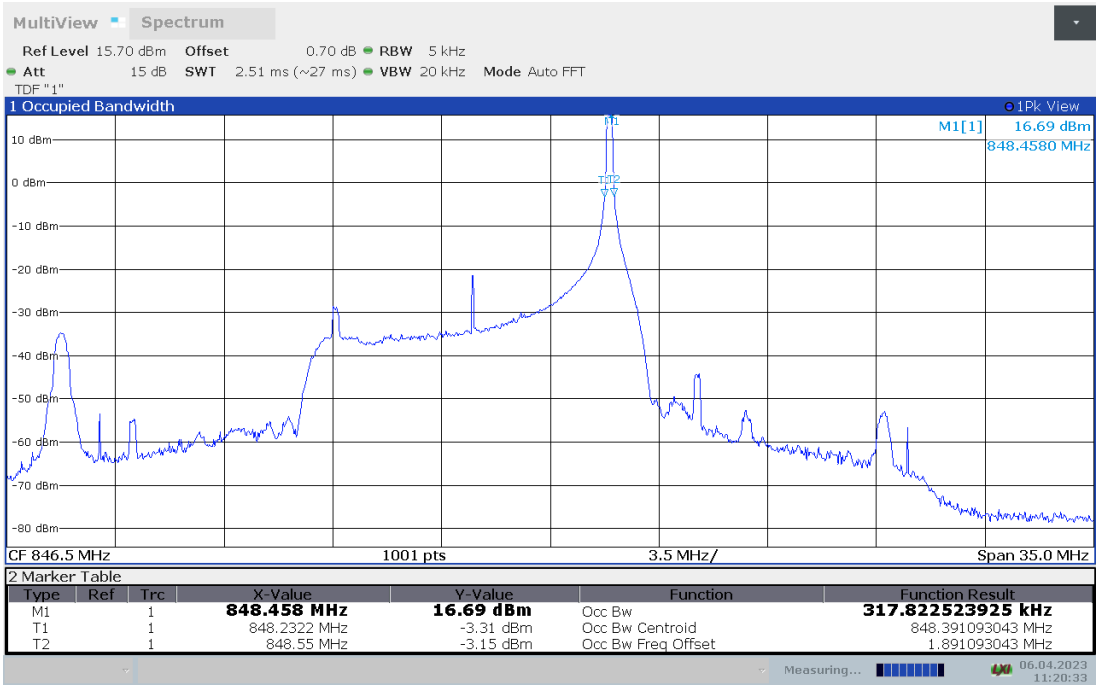
OBW: 1RB-LOW_offset



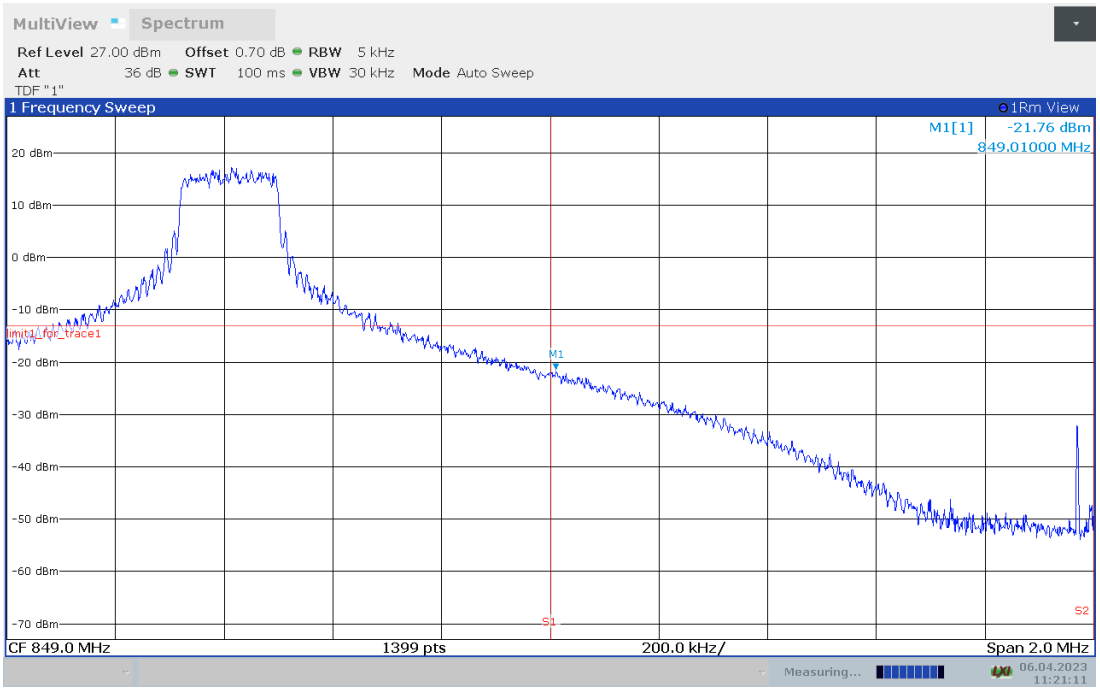
LOW BAND EDGE BLOCK-1RB-LOW_offset



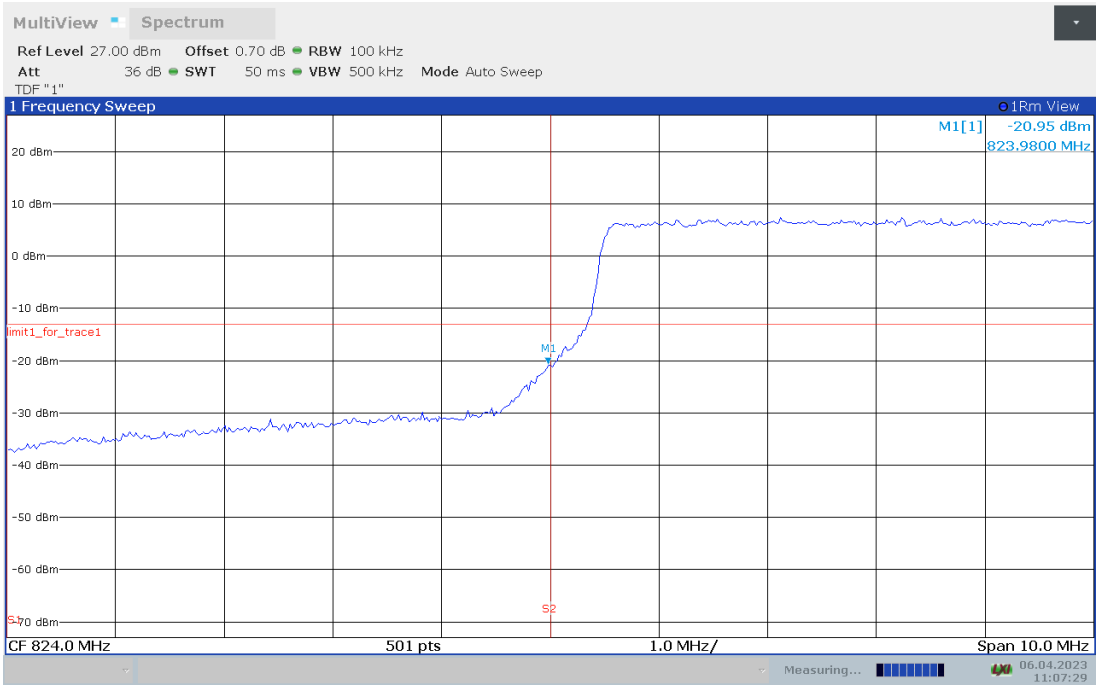
OBW: 1RB-HIGH_offset



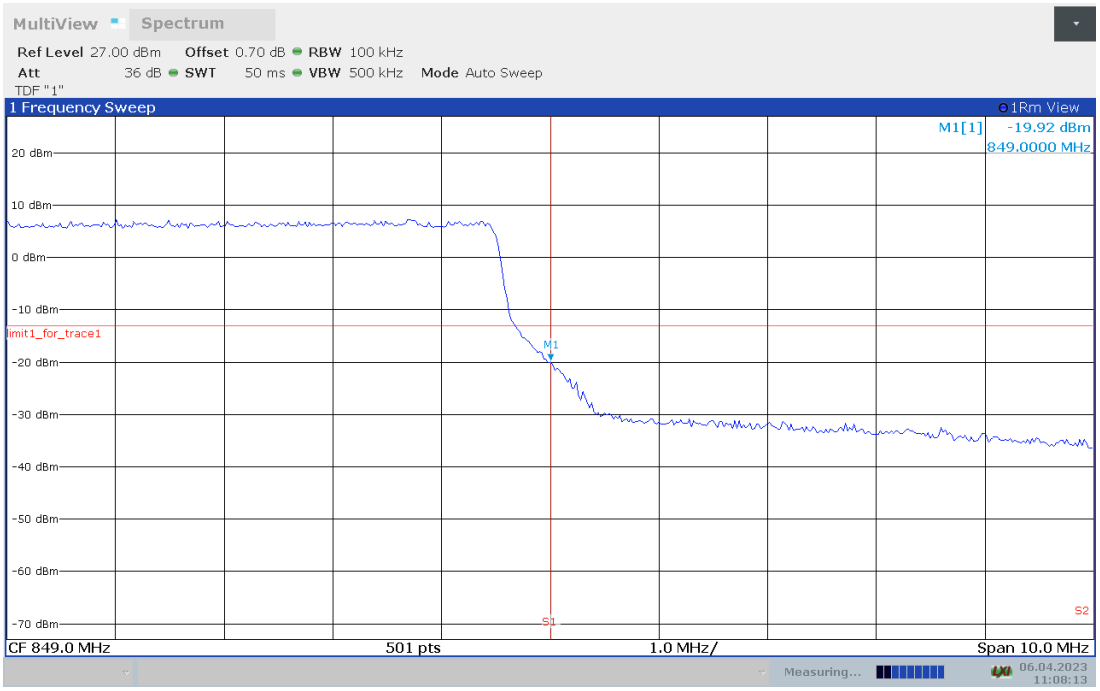
HIGH BAND EDGE BLOCK-1RB-HIGH_offset



LOW BAND EDGE BLOCK-10M-100%RB



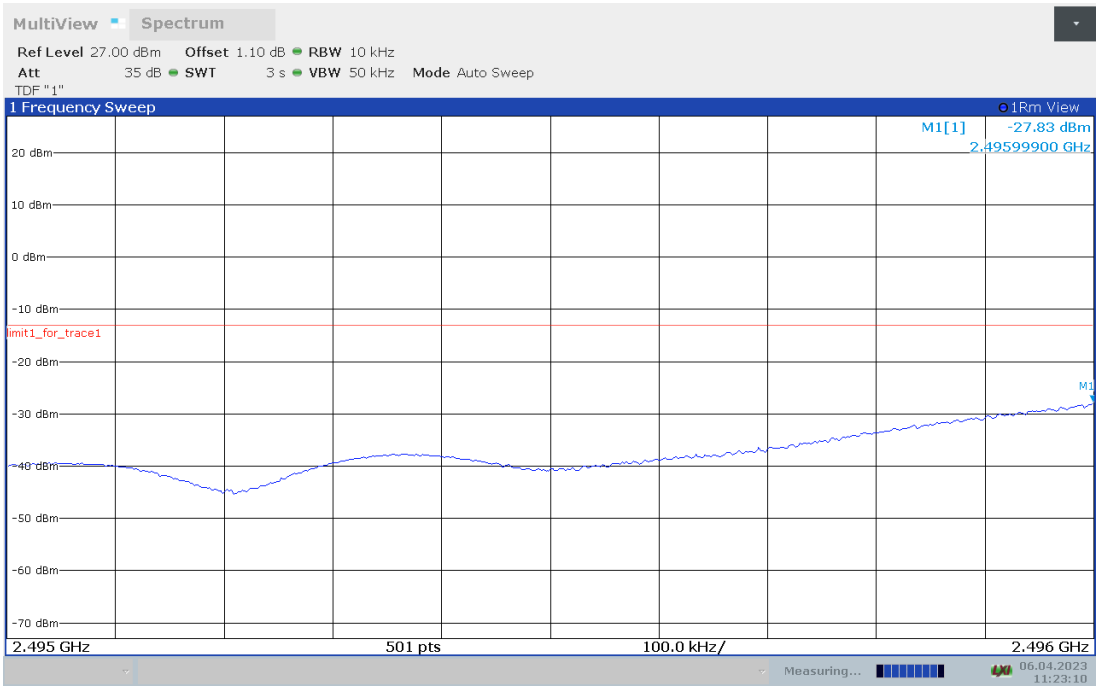
HIGH BAND EDGE BLOCK-10M-100%RB



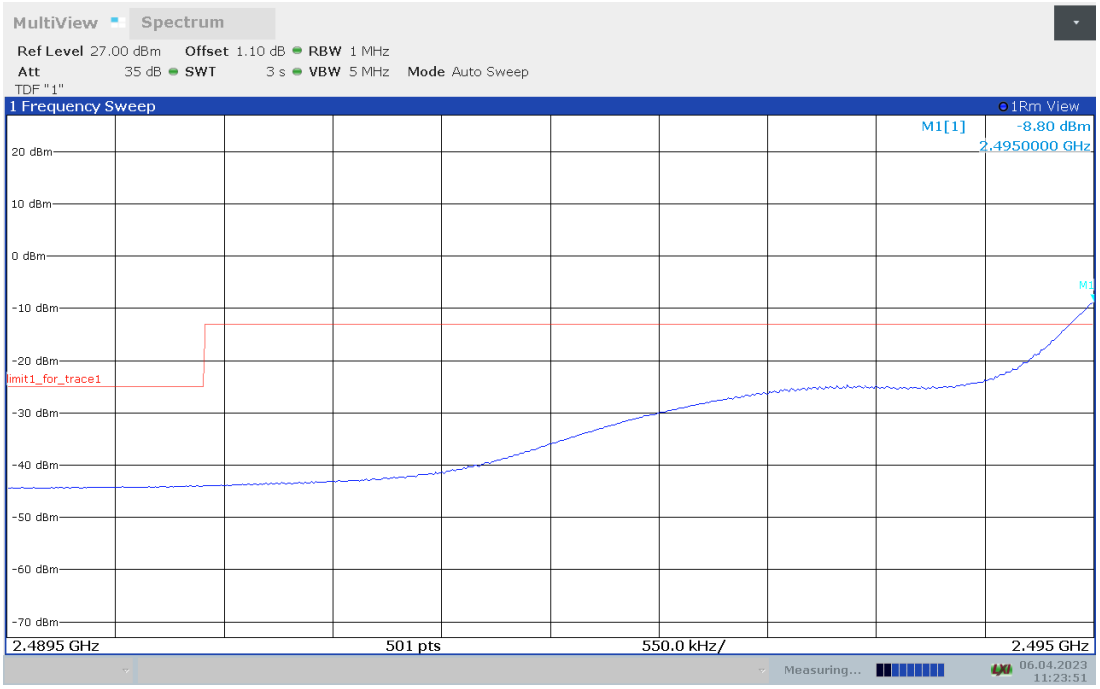
LTE band 41

OBW: 1RB-LOW_offset

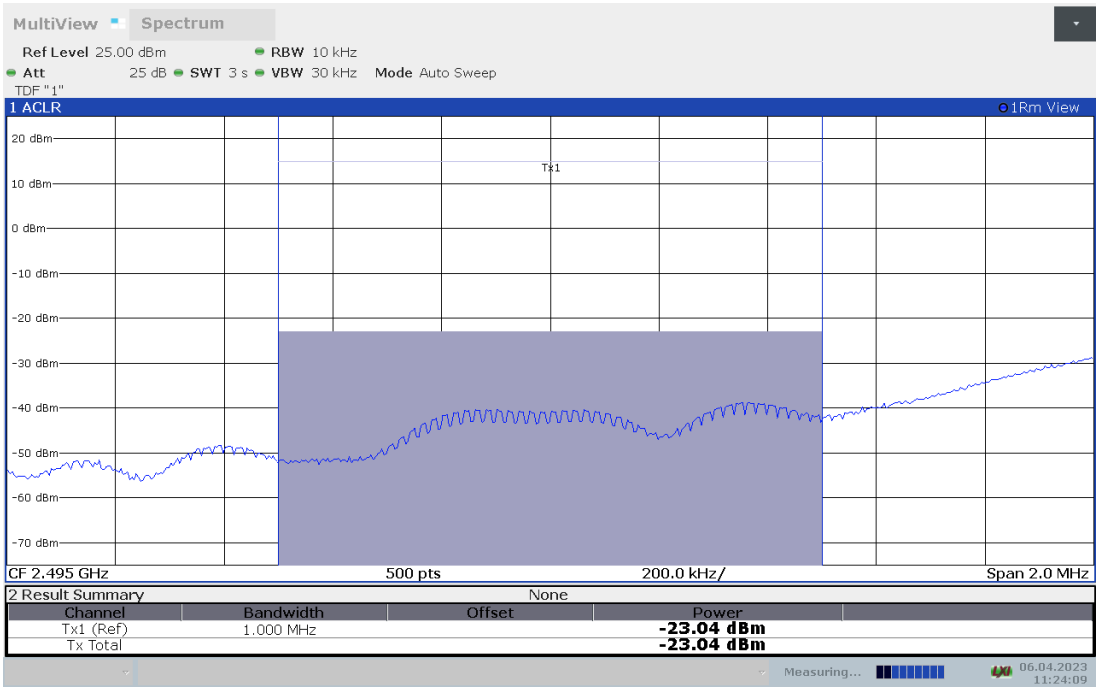
LOW BAND EDGE BLOCK-1RB-LOW_offset



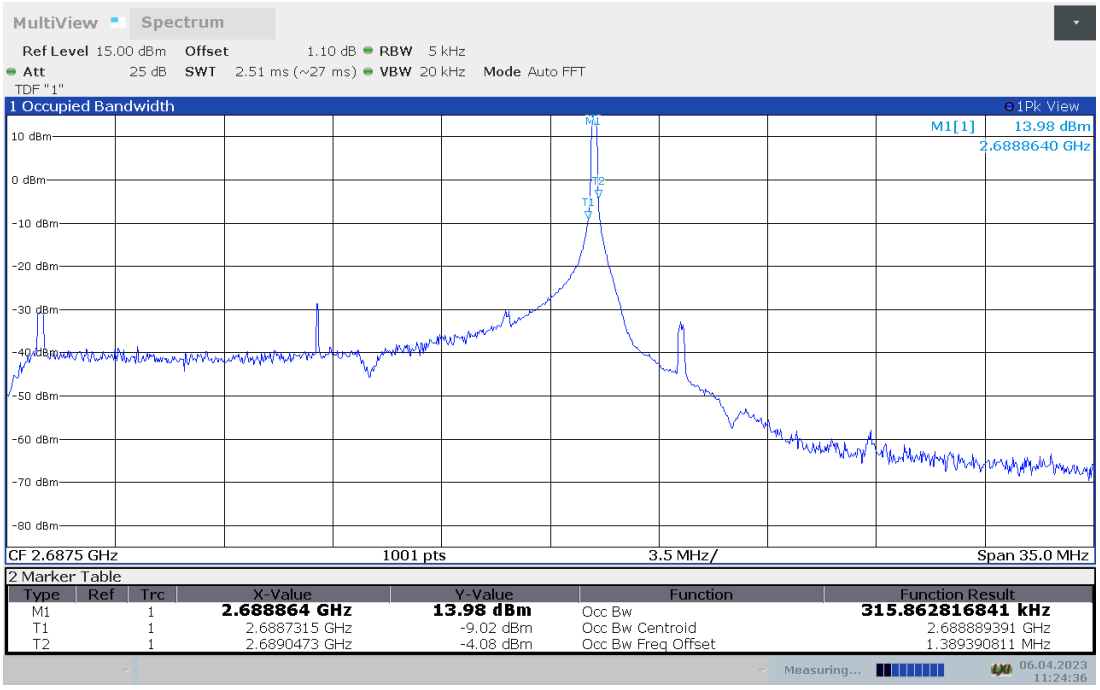
LOW BAND EDGE BLOCK-1RB-LOW_offset



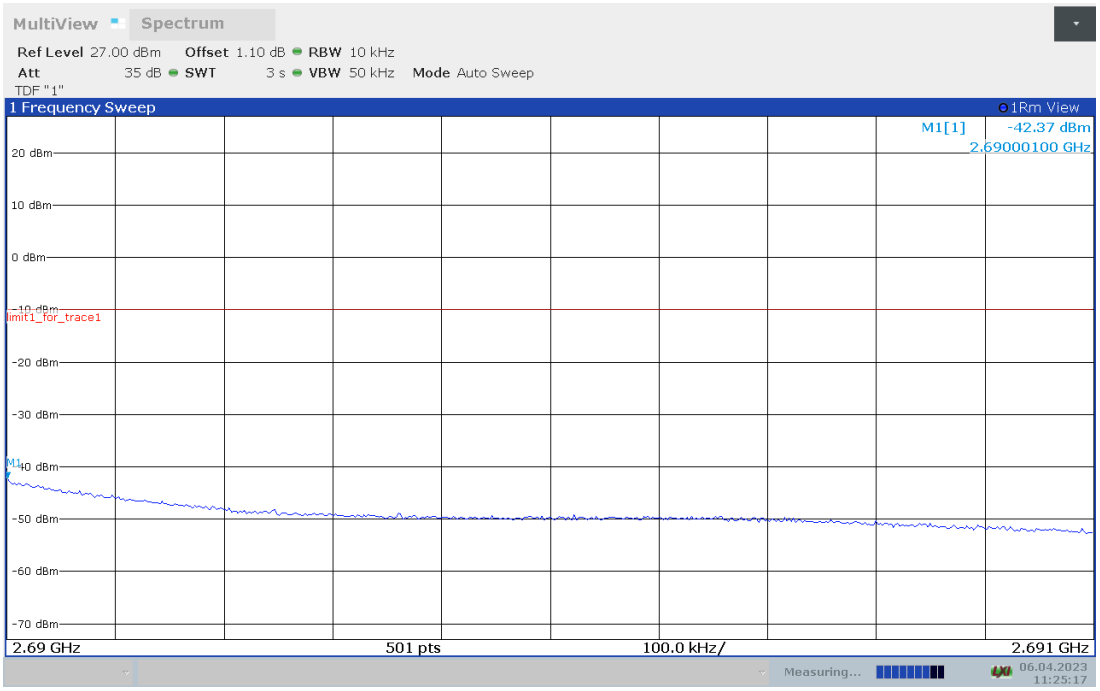
Channel power



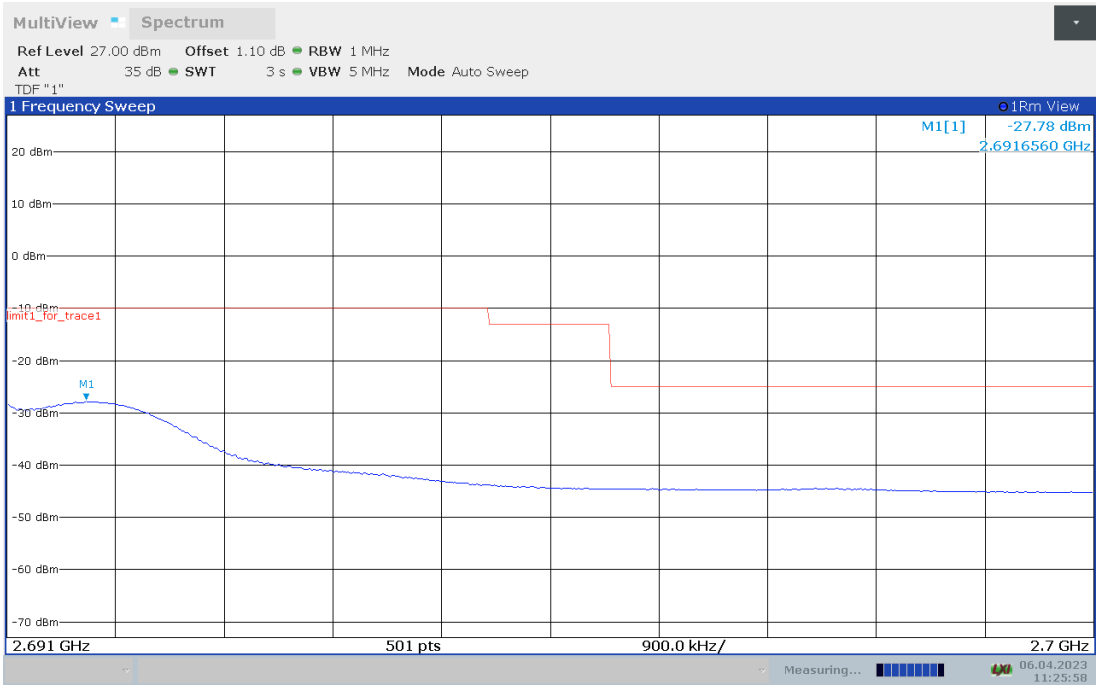
OBW: 1RB-HIGH_offset



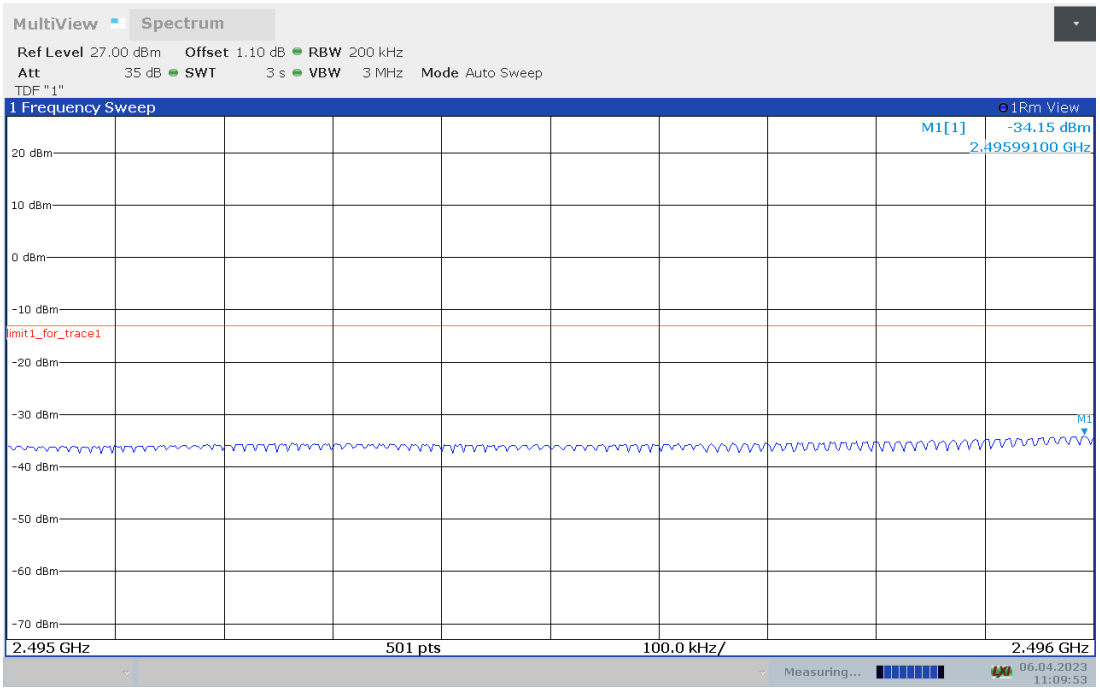
HIGH BAND EDGE BLOCK-1RB-HIGH_offset



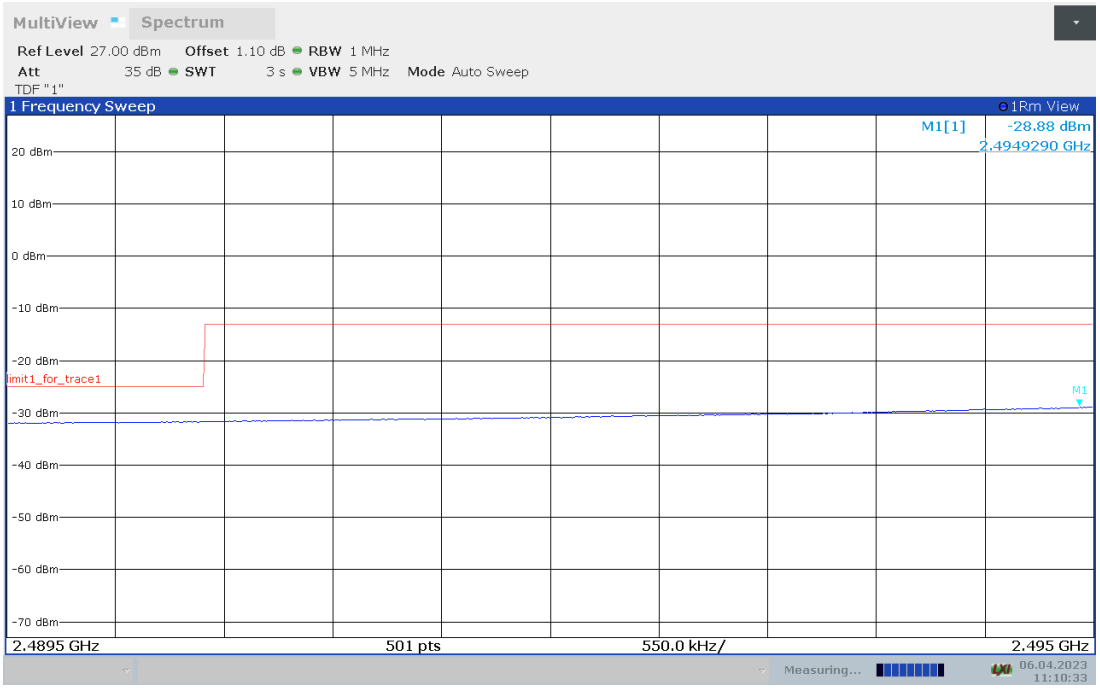
HIGH BAND EDGE BLOCK-1RB-HIGH_offset



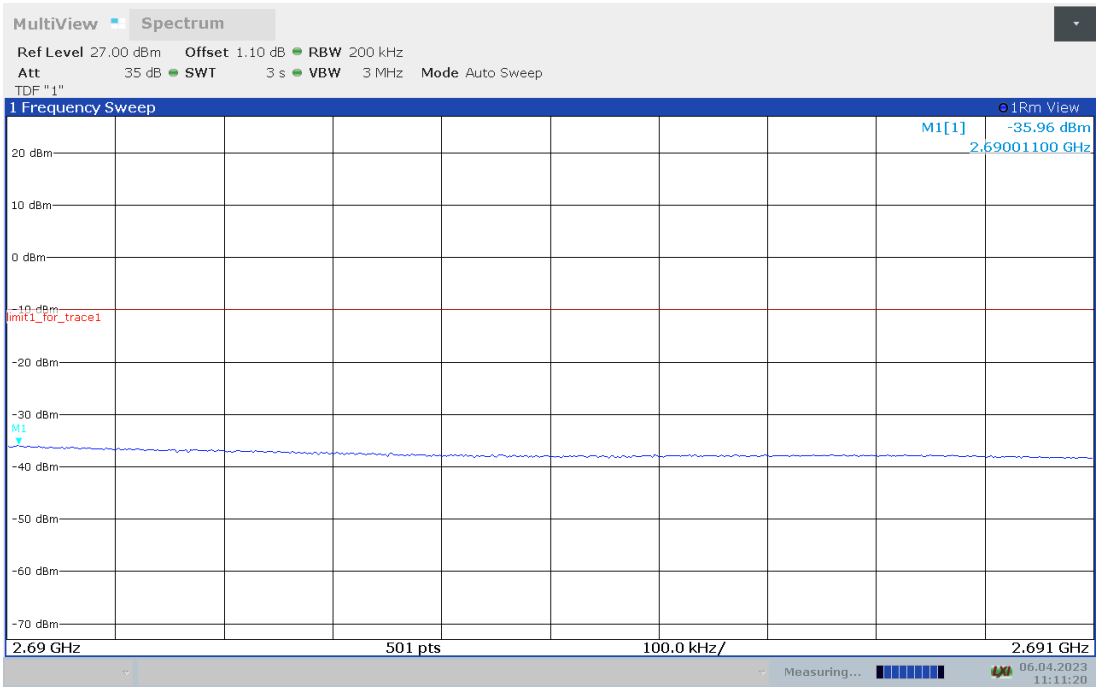
LOW BAND EDGE BLOCK-20M-100%RB



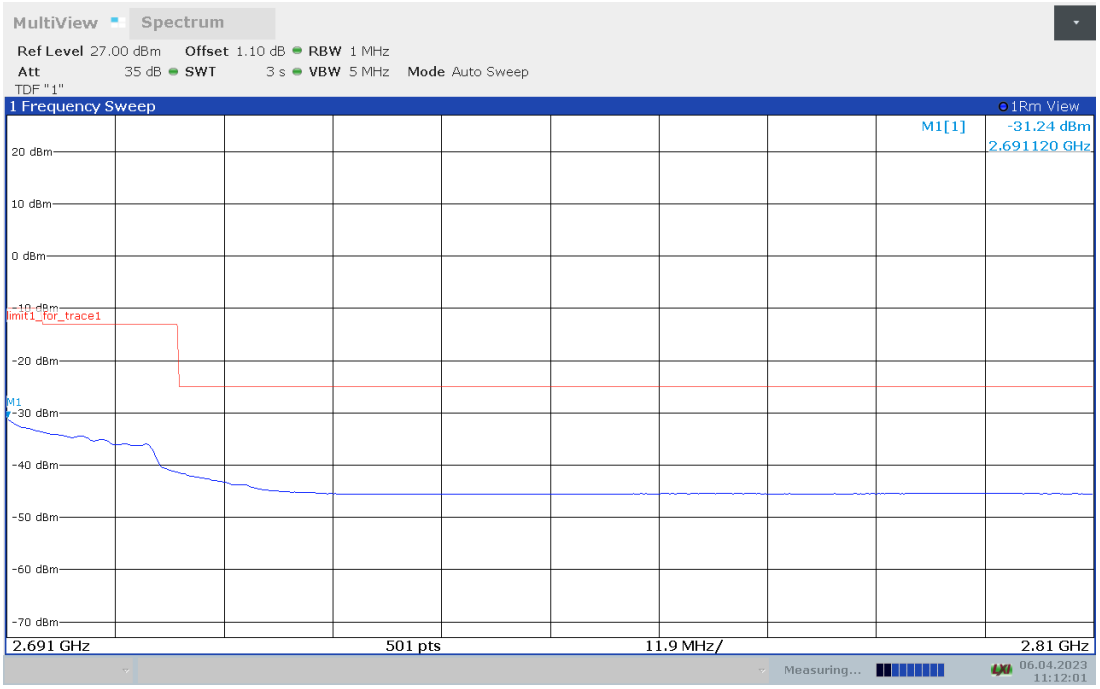
LOW BAND EDGE BLOCK-20M-100%RB



HIGH BAND EDGE BLOCK-20M-100%RB



HIGH BAND EDGE BLOCK-20M-100%RB



Note: Expanded measurement uncertainty is U = 0.49 dB(100KHz-2GHz)/1.21dB(2GHz-26.5GHz), k = 1.96

A.7 CONDUCTED SPURIOUS EMISSION

Reference

FCC: CFR Part 2.1051, 22.917, 27.53.

A.7.1 Measurement Method

The following steps outline the procedure used to measure the conducted emissions from the EUT.

1. Determine frequency range for measurements: From CFR 2.1051 the spectrum should be investigated from the lowest radio frequency generated in the equipment up to at least the 10th harmonic of the carrier frequency. For the mobile station equipment tested, this equates to a frequency range of 13 MHz to 9 GHz, data taken from 10 MHz to 25 GHz.
2. Determine EUT transmit frequencies: below outlines the band edge frequencies pertinent to conducted emissions testing.
3. The number of sweep points of spectrum analyzer is set to 30001 which is greater than span/RBW.

A. 7.2 Measurement Limit

Part 22.917 and Part 27.53(h) specify that 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.

The specification that emissions shall be attenuated below the transmitter power (P) by at least 43 + 10 log (P) dB, translates in the relevant power range (1 to 0.001 W) to -13 dBm. At 1 W the specified minimum attenuation becomes 43 dB and relative to a 30 dBm (1 W) carrier becomes a limit of -13 dBm. At 0.001 W (0 dBm) the minimum attenuation is 13 dB, which again yields a limit of -13 dBm. In this way a translation of the specification from relative to absolute terms is carried out.

Part 27.53(m)(4) specifies for mobile digital stations, the attenuation factor shall be not less than 40 + 10 log (P) dB on all frequencies between the channel edge and 5 megahertz from the channel edge, 43 + 10 log (P) dB on all frequencies between 5 megahertz and X megahertz from the channel edge, and 55 + 10 log (P) dB on all frequencies more than X megahertz from the channel edge, where X is the greater of 6 megahertz or the actual emission bandwidth as defined in paragraph (m)(6) of this section. In addition, the attenuation factor shall not be less that 43 + 10 log (P) dB on all frequencies between 2490.5 MHz and 2496 MHz and 55 + 10 log (P) dB at or below 2490.5 MHz. Mobile Satellite Service licensees operating on frequencies below 2495 MHz may also submit a documented interference complaint against BRS licensees operating on channel BRS Channel 1 on the same terms and conditions as adjacent channel BRS or EBS licensees.

Part 27.53(a) states for mobile and portable stations operating in the 2305–2315 MHz and 2350–2360 MHz bands: By a factor of not less than: 43 +10 log (P) dB on all frequencies between 2305 and 2320 MHz and on all frequencies between 2345 and 2360 MHz that are outside the licensed band(s) of operation, not less than 55 + 10 log (P) dB on all frequencies between 2320 and 2324 MHz and on all frequencies between 2341 and 2345 MHz, not less than 61 + 10 log (P) dB on all frequencies between 2324 and 2328 MHz and on all frequencies between 2337 and 2341 MHz, and not less than 67 + 10 log (P) dB onall frequencies between 2328 and 2337MHz; By a factor of not less than 43+10 log (P)dB on all frequencies between 2300 and 2305MHz, 55+ 10 log (P)dB on all frequencies between 2296 and 2300MHz, 61+10 log (P) dB on all frequencies

between 2292 and 2296 MHz, 67 + 10 log (P) dB on all frequencies between 2288 and 2292 MHz, and 70 + 10 log (P) dB below 2288 MHz; By a factor of not less than 43 + 10 log (P) dB on all frequencies between 2360 and 2365 MHz, and not less than 70 + 10 log (P) dB above 2365 MHz.

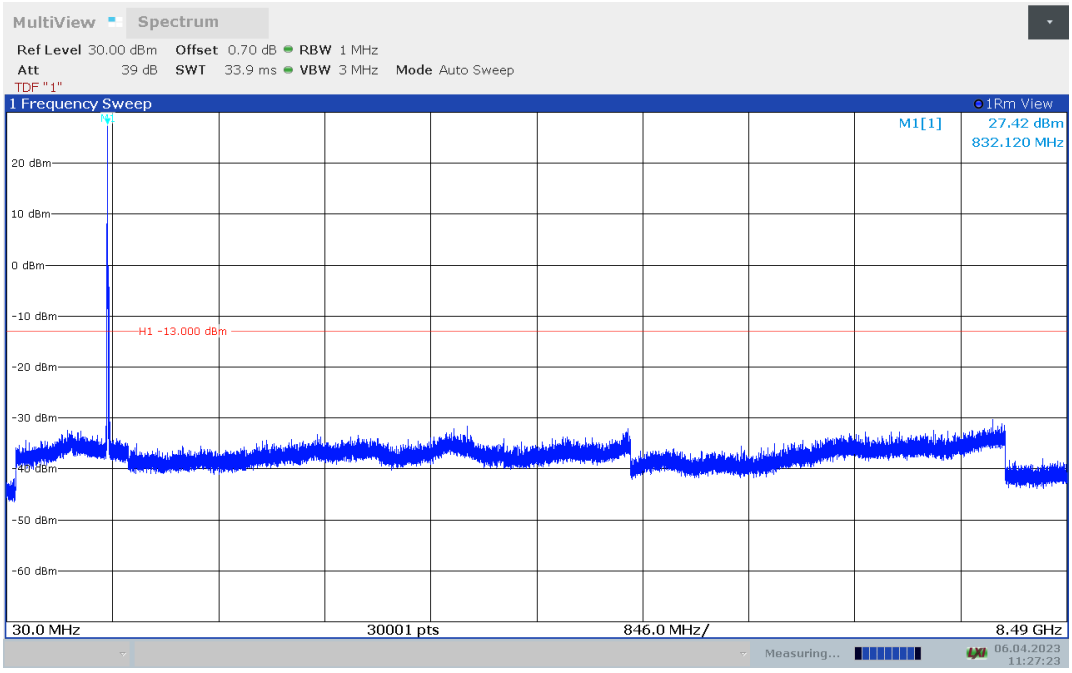
A. 7.3 Measurement result

Only worst case result is given below

LTE band 5 10MHz QPSK: 30MHz – 8.49GHz

Spurious emission limit –25dBm.

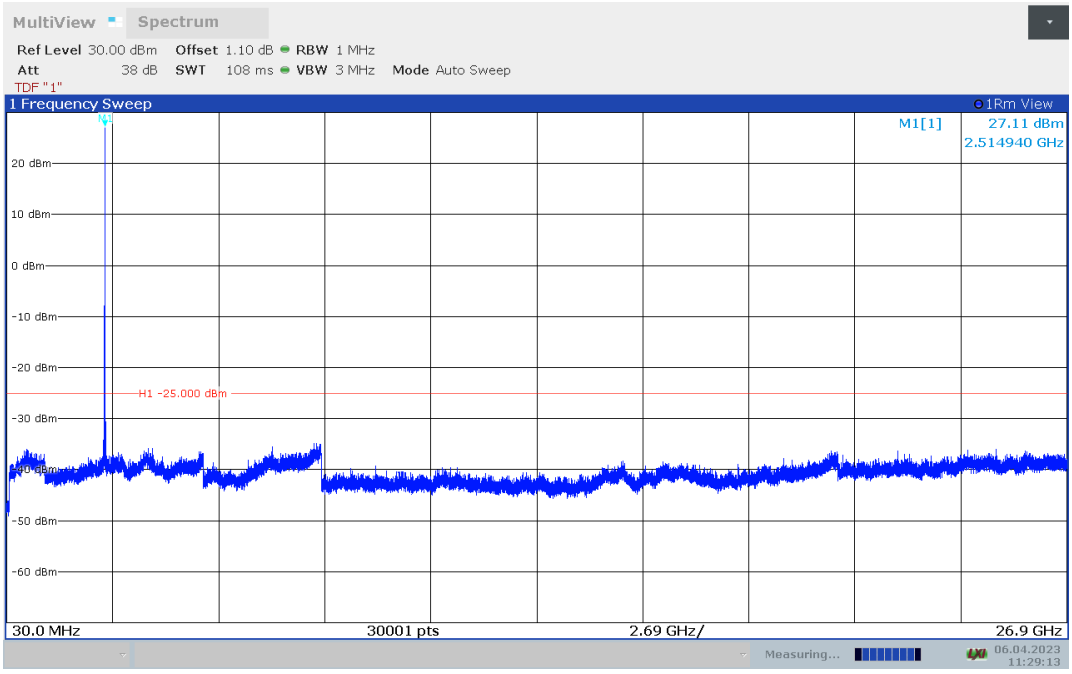
NOTE: peak above the limit line is the carrier frequency.



LTE band 41: 30MHz – 26.9GHz

Spurious emission limit –25dBm.

NOTE: peak above the limit line is the carrier frequency.



A.8 PEAK-TO-AVERAGE POWER RATIO

Reference

FCC: CFR Part 27.50(d), KDB971168 D01(5.7).

The peak-to-average power ratio (PAPR) of the transmitter output power must not exceed 13dB. The PAPR measurements should be made using either an instrument with complementary cumulative distribution function (CCDF) capabilities to determine that PAPR will not exceed 13 dB for more than 0.1 percent of the time or other Commission approved procedure. The measurement must be performed using a signal corresponding to the highest PAPR expected during periods of continuous transmission.

a)Refer to instrument's analyzer instruction manual for details on how to use the power statistics/CCDF function;

b) Set resolution/measurement bandwidth ≥ signal's occupied bandwidth;

c) Set the number of counts to a value that stabilizes the measured CCDF curve;

d) Set the measurement interval to 1ms.

e) Record the maximum PAPR level associated with a probability of 0.1%

A.8.1 Measurement limit

not exceed 13dB

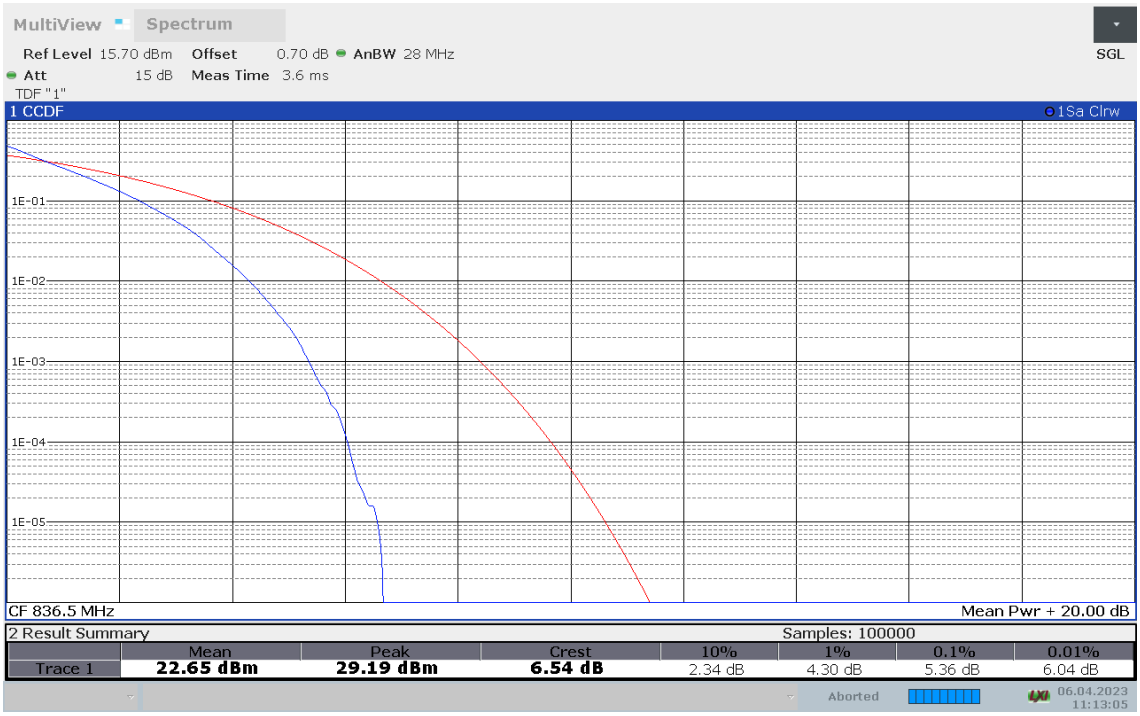
A.8.2 Measurement results

Only worst case result is given below

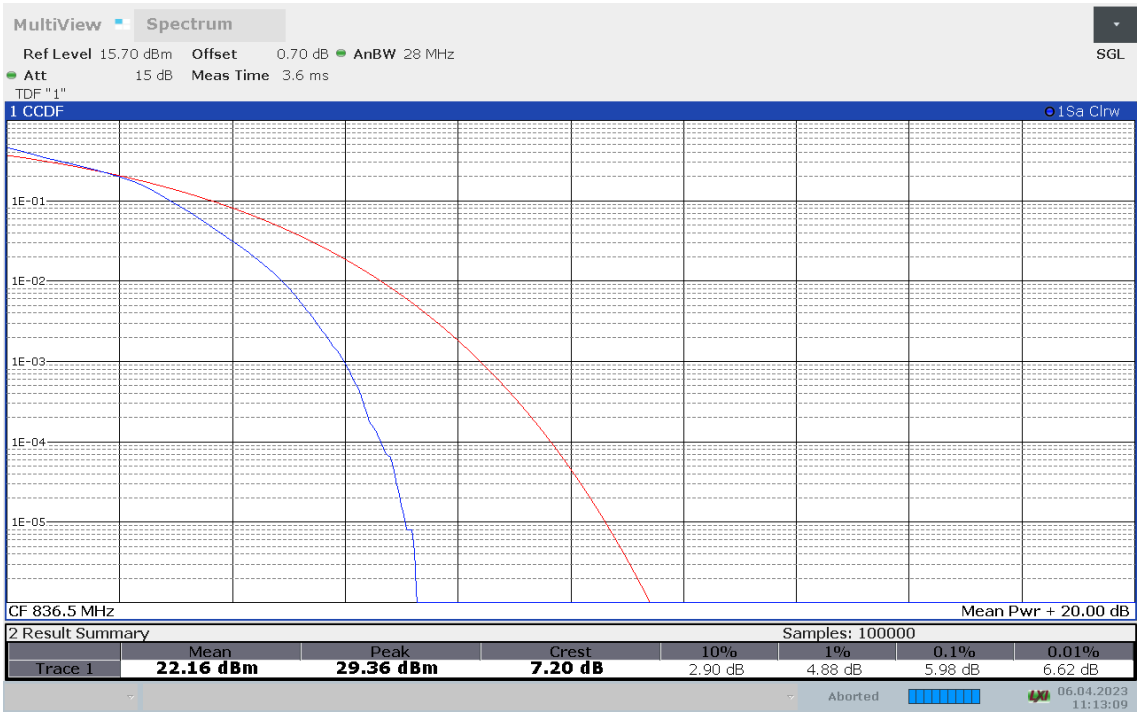
LTE band 5

Frequency(MHz)	Bandwidth(MHz)	PAPR(dB)	
		QPSK	16QAM
826.5	10	5.36	5.98

LTE band 5, 10MHz Bandwidth, QPSK (PAPR)



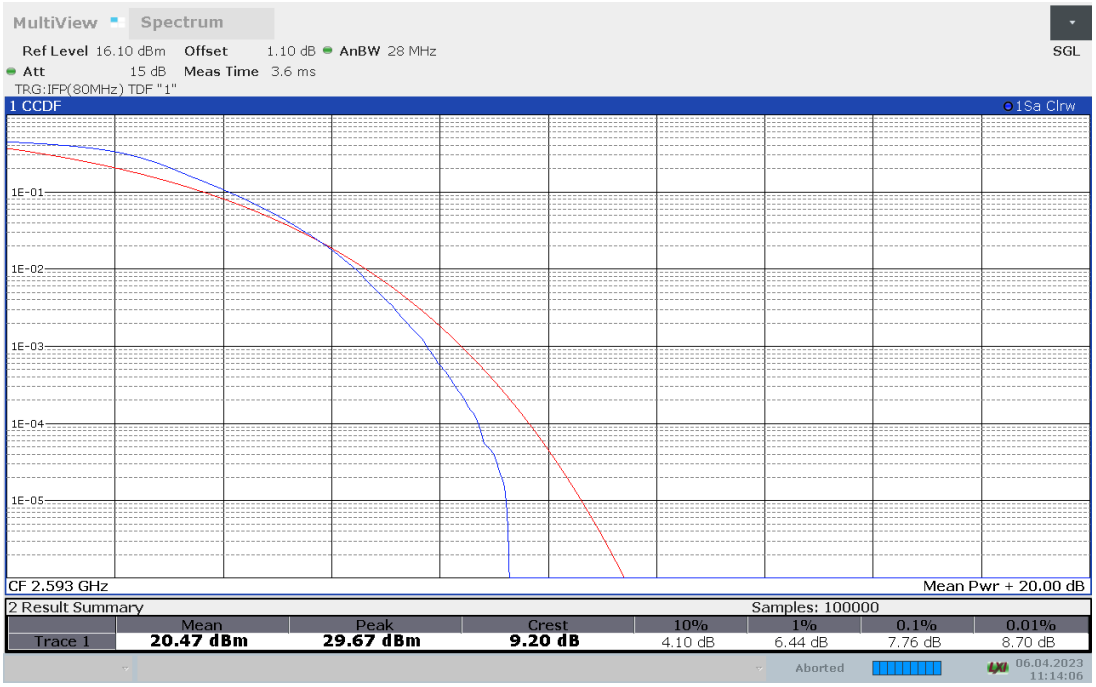
LTE band 5, 10MHz Bandwidth, 16QAM (PAPR)



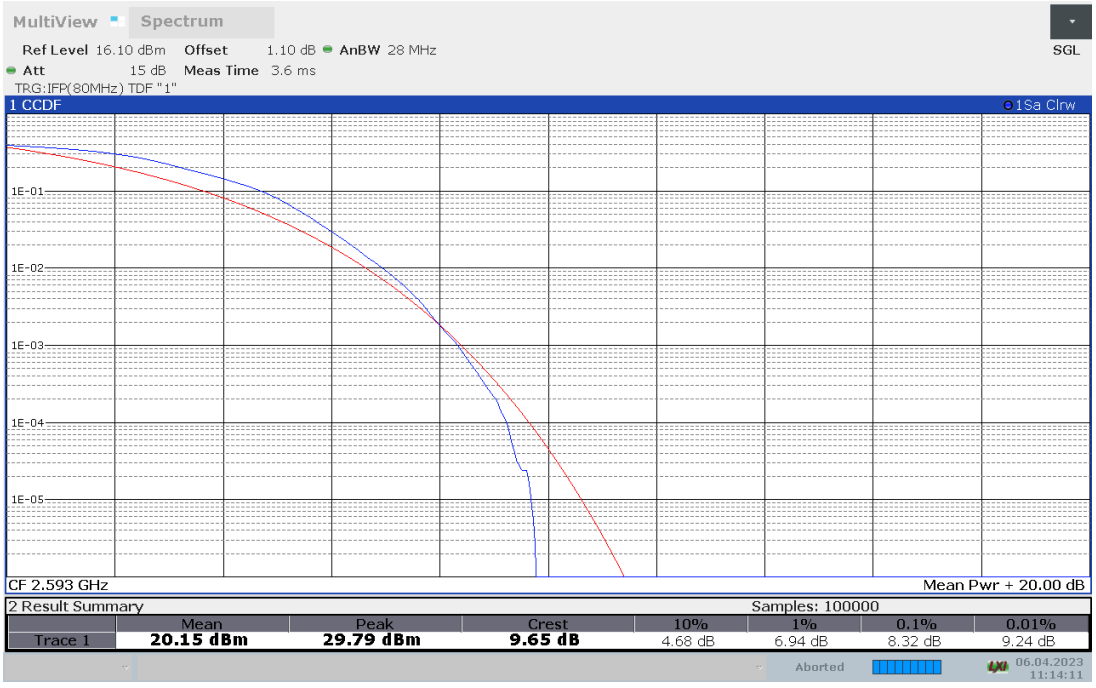
LTE band 41

Frequency(MHz)	Bandwidth(MHz)	PAPR(dB)	
		QPSK	16QAM
2593.0	20	7.76	8.32

LTE band 41, 20MHz Bandwidth, QPSK (PAPR)



LTE band 41, 20MHz Bandwidth, 16QAM (PAPR)



Note: Expanded measurement uncertainty is U = 0.48, k = 2

ANNEX B: Accreditation Certificate

Accredited Laboratory

A2LA has accredited

SHENZHEN ACADEMY OF INFORMATION AND COMMUNICATIONS TECHNOLOGY

Shenzhen, People's Republic of China

for technical competence in the field of

Electrical Testing

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017 *General requirements for the competence of testing and calibration laboratories*. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (*refer to joint ISO-ILAC-IAF Communiqué dated April 2017*).

Presented this 23rd day of November 2021.

Vice President, Accreditation Services
For the Accreditation Council
Certificate Number 4353.01
Valid to November 30, 2023

For the tests to which this accreditation applies, please refer to the laboratory's Electrical Scope of Accreditation.

ANNEX C: Certificate of Brand Authorization

编号 No.：CTTL-001

TTL泰尔实验室

品牌授权书

Certificate of Brand Authorization

兹授权 **深圳信息通信研究院** 为“泰尔实验室”品牌实验室，可以使用“泰尔实验室”品牌开展检验检测相关业务，本授权书有效期至 **2024** 年 **10** 月 **31** 日。

This is to certify that **Shenzhen Academy of Information and Communications Technology** is authorized as the brand laboratory of “CTTL”, which may undertake inspection and testing related business using the “CTTL” brand. This certificate is valid for the period to **31 October 2024**.

“泰尔实验室”品牌是属于中国信息通信研究院所有的检验检测品牌，为了维护良好的品牌形象，不断提高品牌的价值，被授权机构必须严格遵照《“泰尔实验室”品牌管理手册》要求开展相关业务活动。

The brand “CTTL” is the inspection and testing brand owned by China Academy of Information and Communication Technology. In order to maintain a good brand image, and continuously improve the brand value, the authorized institutions must strictly comply with the requirements of *"CTTL" brand management manual* to carry out relevant business activities.

授权单位：中国信息通信研究院

China Academy of Information and Communication Technology（CAICT）

授权日期：2019 年 10 月 30 日

*****END OF REPORT*****