



# TEST REPORT

## No. I23Z70141-WMD03

for

**SAMSUNG Electronics Co., Ltd.**

**Multi-band GSM/WCDMA/LTE phone with Bluetooth, WLAN**

**Model Name: SM-A057F/DS, SM-A057F**

**FCC ID: ZCasma057F**

with

**Hardware Version: REV1.0**

**Software Version: A057F.001**

**Issued Date: 2023-07-25**

**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 CTTL.

The report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the U.S. Government.

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## **REPORT HISTORY**

<b>Report Number</b>	<b>Revision</b>	<b>Description</b>	<b>Issue Date</b>
I23Z70141-WMD03	Rev.0	1 <sup>st</sup> edition	2023-07-25

Note: the latest revision of the test report supersedes all previous version.

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## **1. Test Laboratory**

### **1.1. Introduction & Accreditation**

Telecommunication Technology Labs, CAICT is an ISO/IEC 17025:2017 accredited test laboratory under NATIONAL VOLUNTARY LABORATORY ACCREDITATION PROGRAM (NVLAP) with lab code 600118-0 and is also an FCC accredited test laboratory (CN5017), and ISED accredited test laboratory (ISED#: 24849). The detail accreditation scope can be found on NVLAP website.

### **1.2. Testing Location**

Location 1: CTTL (huayuan North Road)

Address: No. 52, Huayuan North Road, Haidian District, Beijing,  
P. R. China 100191

Location 2: CTTL(BDA)

Address: No.18A, Kangding Street, Beijing Economic-Technology  
Development Area, Beijing, P. R. China 100176

### 1.3. Testing Environment

Normal Temperature: 15-35°C  
Relative Humidity: 20-75%

### 1.4. Project Data

Testing Start Date: 2023-07-04  
Testing End Date: 2023-07-24

### 1.5. Signature



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Dong Yuan  
(Prepared this test report)



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Zhou Yu  
(Reviewed this test report)



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Zhao Hui Lin  
Deputy Director of the laboratory  
(Approved this test report)



## **2. Client Information**

### **2.1. Applicant Information**

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### **2.2. Manufacturer Information**

Company Name: Samsung Electronics Co., Ltd.  
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Contact: Sunghoon Cho  
Email: ggobi.cho@samsung.com  
Telephone: +82-10-2722-4159

### **3. Equipment Under Test (EUT) and Ancillary Equipment (AE)**

#### **3.1. About EUT**

Description	Multi-band GSM/WCDMA/LTE phone with Bluetooth, WLAN
Model Name	SM-A057F/DS, SM-A057F
FCC ID	ZCASMA057F
Antenna	Embedded
Output power	26.70dBm maximum EIRP measured for LTE B7
Extreme vol. Limits	3.6VDC to 4.1VDC (nominal: 3.85VDC)
Extreme temp. Tolerance	-10°C to +55°C

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

#### **3.2. Internal Identification of EUT used during the test**

<b>EUT ID*</b>	<b>IMEI</b>	<b>HW Version</b>	<b>SW Version</b>	<b>Date of receipt</b>
UT06a	2370141UT06a	REV1.0	A057F.001	2023-07-05
UT03a	2370141UT03a	REV1.0	A057F.001	2023-07-03

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

#### **3.3. Internal Identification of AE used during the test**

<b>AE ID*</b>	<b>Description</b>
AE1	Battery
AE1	
Model	SLC-51
Manufacturer	Ningde Amperex Technology Limited
Capacitance	4900mAh

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

## **4. Reference Documents**

### **4.1. Documents supplied by applicant**

EUT parameters are supplied by the customer, which are the bases of testing. CAICT is not responsible for the accuracy of customer supplied technical information that may affect the test results (for example, antenna gain and loss of customer supplied cable).

### **4.2. Reference Documents for testing**

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

<b>Reference</b>	<b>Title</b>	<b>Version</b>
FCC Part 22	PUBLIC MOBILE SERVICES	10-1-21 Edition
FCC Part 27	MISCELLANEOUS WIRELESS COMMUNICATIONS SERVICES	10-1-21 Edition
ANSI/TIA-603-E	Land Mobile FM or PM Communications Equipment Measurement and Performance Standards	2016
ANSI C63.26	American National Standard for Compliance Testing of Transmitters Used in Licensed Radio Services	2015
KDB 971168 D01	MEASUREMENT GUIDANCE FOR CERTIFICATION OF LICENSED DIGITAL TRANSMITTERS	v03r01



## 5. Summary Of Test Result

### LTE Band 5

Items	Test Name	Clause in FCC rules	Verdict
1	Output Power	22.913	P
2	Emission Limit	22.917	P
3	Frequency Stability	2.1055	P
4	Occupied Bandwidth	2.1049	P
5	Emission Bandwidth	22.917	P
6	Band Edge Compliance	22.917	P
7	Conducted Spurious Emission	22.917	P

### LTE Band 7

Items	Test Name	Clause in FCC rules	Verdict
1	Output Power	27.50	P
2	Emission Limit	27.53	P
3	Frequency Stability	2.1055	P
4	Occupied Bandwidth	2.1049	P
5	Emission Bandwidth	27.53	P
6	Band Edge Compliance	27.53	P
7	Conducted Spurious Emission	27.53	P
8	Peak-to-Average Power Ratio	27.50	P

### LTE Band 41 (38)

Items	Test Name	Clause in FCC rules	Verdict
1	Output Power	27.50	P
2	Emission Limit	27.53	P
3	Frequency Stability	2.1055	P
4	Occupied Bandwidth	2.1049	P
5	Emission Bandwidth	27.53	P
6	Band Edge Compliance	27.53	P
7	Conducted Spurious Emission	27.53	P
8	Peak-to-Average Power Ratio	27.50	P

## Terms used in Verdict column

P	Pass. The EUT complies with the essential requirements in the standard.
NP	Not Performed. The test was not performed by CTTL.
NA	Not Applicable. The test was not applicable.
BR	Re-use test data from basic model report.
F	Fail. The EUT does not comply with the essential requirements in the standard.

All the test results are based on normal power.

LTE Band 41 overlaps the entire frequency range of LTE Band 38. Therefore, test data provided in this report covers Band 41 as well as Band 38.

LTE Band 41 is tested by power class 3.

## Explanation of worst-case configuration

The worst-case scenario for all measurements is based on the conducted output power measurement investigation results. Output power was measured on QPSK, 16QAM and 64QAM modulations. It was found that QPSK was the worst case. All testing was performed using QPSK modulations to represent the worst case unless otherwise stated. The test results shown in the following sections represent the worst case emission.

## 6. Test Equipment Utilized

Description	Type	Series Number	Manufacture	Cal Due Date	Calibration Interval
Wideband Radio Communication Tester	CMW500	159082	R&S	2024-01-09	1 year
Spectrum Analyzer	FSU	200030	R&S	2024-05-25	1 year
Climate Chamber	SH-242	93008556	ESPEC	2023-12-23	3 years
Test Receiver	FSV40	101047	R&S	2024-06-25	1 year
EMI Antenna	VULB9163	9163-482	Schwarzbeck	2023-11-28	1 year
EMI Antenna	LB-7180-NF	J20300130005	A-INFO	2024-05-25	1 year
EMI Antenna	LB-180400-25-C-KF	J211060826	A-INFO	2024-03-02	1 year
EMI Antenna	3115	00167252	ETS-Lindgren	2024-01-28	1 year
EMI Antenna	3116	2663	ETS-Lindgren	2023-11-22	1 year
Signal Generator	SMF100A	101295	R&S	2024-02-08	1 year
Universal Radio Communication Tester	CMW500	143008	R&S	2024-01-03	1 year

## **Annex A: Measurement Results**

### **A.1 Output Power**

#### **A.1.1 Summary**

During the process of testing, the EUT was controlled via communication tester to ensure max power transmission and proper modulation.

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.

The results below include a correction factor for cable loss that is provided by the customer.

##### **A.1.2.2 Measurement Result**

#### **LTE band 5**

Bandwidth	RB size/offset	Frequency (MHz)	Power (dBm)		
			QPSK	16QAM	64QAM
1.4MHz	1 RB high	848.3	24.93	23.12	22.55
		836.5	24.87	23.35	23.15
		824.7	24.83	23.28	23.22
	1 RB low	848.3	24.77	23.12	22.20
		836.5	24.91	23.27	23.31
		824.7	24.91	23.23	23.07
	50% RB mid	848.3	24.91	23.54	23.65
		836.5	25.00	23.79	23.08
		824.7	25.01	23.57	22.99
	100% RB	848.3	23.22	22.48	22.65
		836.5	23.37	22.68	21.14
		824.7	23.23	22.60	21.14
3MHz	1 RB high	847.5	25.05	23.10	22.40
		836.5	24.83	23.27	22.97
		825.5	24.83	23.19	23.16
	1 RB low	847.5	24.98	23.22	22.57
		836.5	24.87	23.28	22.70
		825.5	24.67	23.35	22.91
	50% RB mid	847.5	23.28	22.56	22.56
		836.5	23.37	22.64	22.68
		825.5	23.35	22.52	21.23

	100% RB	847.5	23.42	22.46	22.50
		836.5	23.35	22.46	22.60
		825.5	23.26	22.11	21.17
5MHz	1 RB high	846.5	25.04	23.09	22.32
		836.5	24.63	23.11	22.85
		826.5	24.72	23.15	22.73
	1 RB low	846.5	24.66	23.11	22.48
		836.5	24.74	23.17	22.71
		826.5	24.95	23.26	23.12
	50% RB mid	846.5	23.44	22.53	22.64
		836.5	23.52	22.61	21.46
		826.5	23.48	22.57	21.05
	100% RB	846.5	23.35	22.50	22.50
		836.5	23.49	22.73	21.11
		826.5	23.37	22.63	21.13
10MHz	1 RB high	844.0	24.62	23.10	22.45
		836.5	24.40	23.16	22.86
		829.0	24.43	23.12	22.74
	1 RB low	844.0	24.47	23.09	22.60
		836.5	24.73	23.15	22.40
		829.0	24.73	23.05	22.53
	50% RB mid	844.0	23.17	22.46	22.34
		836.5	23.25	22.38	22.52
		829.0	23.04	22.42	22.34
	100% RB	844.0	23.08	22.30	22.35
		836.5	23.06	22.34	22.33
		829.0	23.02	22.42	22.33

**LTE band 7**

Bandwidth	RB size/offset	Frequency (MHz)	Power (dBm)		
			QPSK	16QAM	64QAM
5MHz	1 RB high	2567.5	24.53	22.76	22.01
		2535.0	24.47	22.74	22.60
		2502.5	25.02	23.09	22.32
	1 RB low	2567.5	24.51	22.86	22.12
		2535.0	24.52	22.99	21.80
		2502.5	25.02	23.42	22.61
	50% RB mid	2567.5	22.23	21.18	21.01
		2535.0	22.00	20.95	20.98
		2502.5	22.54	21.59	21.48
	100% RB	2567.5	22.09	21.11	21.06
		2535.0	21.94	20.79	20.91
		2502.5	22.47	21.58	21.42
10MHz	1 RB high	2565.0	24.74	23.01	22.95
		2535.0	24.47	22.86	21.71
		2505.0	25.01	23.00	21.91
	1 RB low	2565.0	24.86	22.88	22.33
		2535.0	24.72	22.75	21.93
		2505.0	25.05	23.27	22.59
	50% RB mid	2565.0	22.15	21.07	21.09
		2535.0	21.99	21.16	20.17
		2505.0	22.47	21.45	20.62
	100% RB	2565.0	22.20	20.99	21.12
		2535.0	21.98	20.85	19.93
		2505.0	22.46	21.37	20.40
15MHz	1 RB high	2562.5	24.88	22.83	22.51
		2535.0	24.81	22.88	22.08
		2507.5	24.63	22.92	22.61
	1 RB low	2562.5	24.63	22.78	21.88
		2535.0	24.53	22.71	22.41
		2507.5	24.98	23.31	22.59
	50% RB mid	2562.5	22.13	21.09	21.01
		2535.0	21.96	20.91	21.00
		2507.5	22.36	21.28	20.51
	100% RB	2562.5	22.13	21.00	21.00
		2535.0	21.99	20.82	20.93
		2507.5	22.37	21.27	20.35
20MHz	1 RB high	2560.0	24.67	22.72	22.06
		2535.0	24.04	22.72	22.05
		2510.0	24.19	22.79	21.82
	1 RB low	2560.0	24.50	22.93	21.88



		2535.0	24.32	22.75	21.72
		2510.0	24.09	22.71	21.94
	50% RB mid	2560.0	21.78	21.16	19.99
		2535.0	21.65	20.96	19.88
		2510.0	22.09	20.95	19.90
	100% RB	2560.0	21.85	21.19	20.29
		2535.0	21.62	20.80	19.93
		2510.0	22.00	20.90	19.94

**LTE band 41**

Bandwidth	RB size/offset	Frequency (MHz)	Power (dBm)		
			QPSK	16QAM	64QAM
5MHz	1 RB high	2687.5	24.89	22.98	20.93
		2593.0	24.55	22.61	21.04
		2498.5	24.80	23.13	21.32
	1 RB low	2687.5	24.89	23.10	21.06
		2593.0	24.81	22.68	20.27
		2498.5	24.60	23.10	21.23
	50% RB mid	2687.5	23.50	22.61	21.01
		2593.0	23.48	22.64	20.87
		2498.5	23.58	22.80	21.30
	100% RB	2687.5	23.52	22.51	21.06
		2593.0	23.39	22.75	21.16
		2498.5	23.63	23.06	21.45
10MHz	1 RB high	2685.0	24.89	22.67	22.18
		2593.0	24.79	22.50	22.12
		2501.0	24.81	22.24	22.49
	1 RB low	2685.0	24.95	22.81	22.37
		2593.0	24.82	22.87	21.88
		2501.0	24.77	22.82	21.93
	50% RB mid	2685.0	23.50	22.87	22.68
		2593.0	23.46	22.60	22.65
		2501.0	23.59	22.82	22.72
	100% RB	2685.0	23.56	22.50	22.73
		2593.0	23.57	22.48	22.54
		2501.0	23.65	22.82	22.89
15MHz	1 RB high	2682.5	24.85	23.18	22.11
		2593.0	24.59	22.81	21.93
		2503.5	24.59	22.64	21.66
	1 RB low	2682.5	25.06	22.75	22.50
		2593.0	24.82	22.87	21.92
		2503.5	24.60	22.99	21.76
	50% RB mid	2682.5	23.61	22.69	22.81
		2593.0	23.45	22.58	22.66
		2503.5	23.69	22.69	22.78
	100% RB	2682.5	23.56	22.67	22.60
		2593.0	23.47	22.53	22.47
		2503.5	23.41	22.64	22.70
20MHz	1 RB high	2680.0	24.07	22.64	21.20
		2593.0	24.35	22.30	20.86
		2506.0	24.00	22.95	21.18
	1 RB low	2680.0	24.38	22.14	21.18



		2593.0	24.47	22.38	20.93
		2506.0	23.96	22.55	20.71
	50% RB mid	2680.0	23.24	22.76	21.24
		2593.0	23.31	22.38	20.78
		2506.0	23.36	22.81	21.01
	100% RB	2680.0	23.17	22.56	20.88
		2593.0	23.33	22.33	20.84
		2506.0	23.33	22.47	20.97

Note: Expanded measurement uncertainty is  $U = 0.578$  dB,  $k = 2$ .

### A.1.3 Radiated

#### A.1.3.1 Description

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

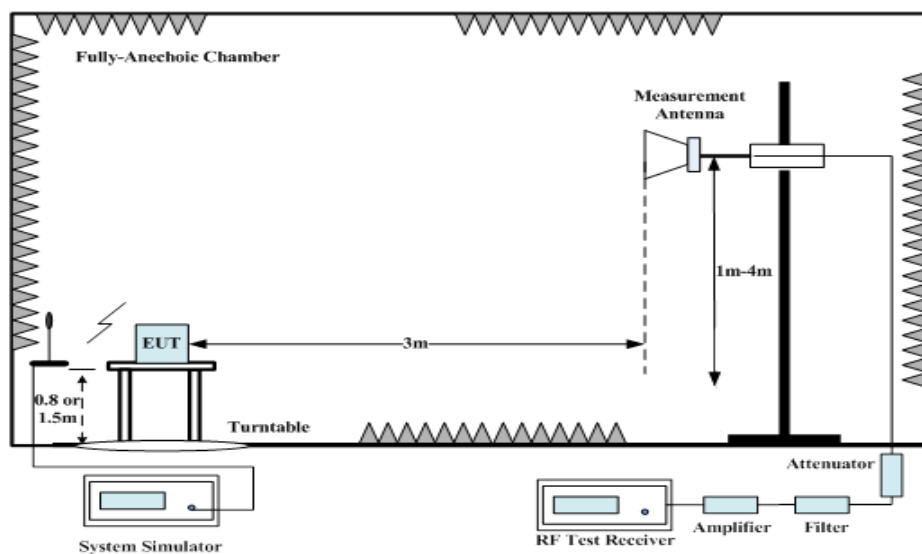
**FDD Band 5:** Part 22.913(a) specifies "The ERP of mobile transmitters and auxiliary test transmitters must not exceed 7 watts".

**FDD Band 7/TDD Band 41:** Part 27.50(h)(2) specifies "Mobile stations are limited to 2.0 watts EIRP".

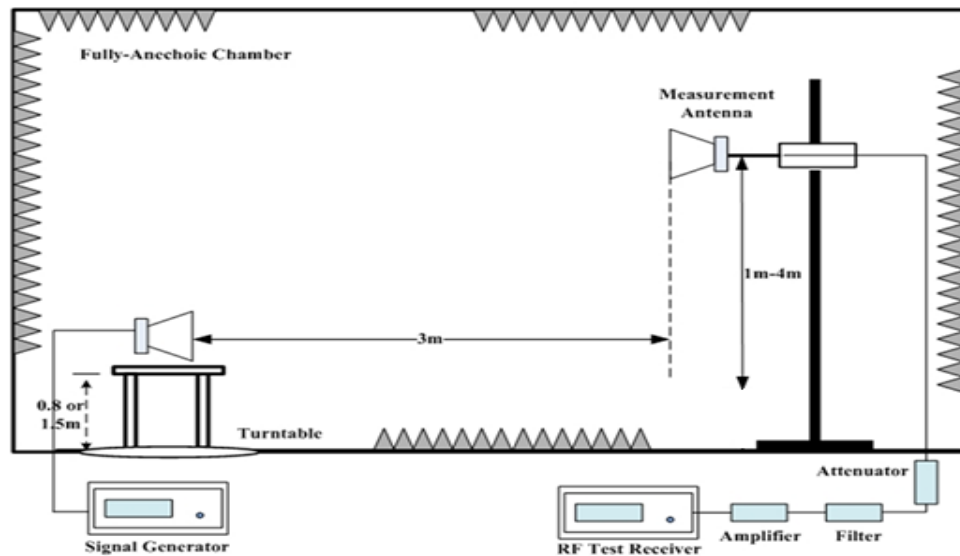
#### A.1.3.2 Method of Measurement

The measurements procedures in ANSI C63.26 are used.

1. EUT was placed on a 0.8/1.5 meter high non-conductive stand at a 3 meter test distance from the receive antenna. A receiving antenna was placed on the antenna mast 3 meters from the EUT for emission measurements. The receiving antenna shall be varied from 1 to 4m in height above the reference ground. The test setup refers to figure below. Detected emissions were maximized at each frequency by rotating the EUT through 360° and the EUT is manipulated through all orthogonal planes representative of its typical use. The test is carried out with both vertical and horizontal polarization of the receiving antenna. The radiated emission measurements of all transmit frequencies in three channels (High, Middle, Low) were measured with rms 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. Adjust 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 ( $G_a$ ) and the amplifier Gain ( $P_{Ag}$ ) should be recorded after test.

The measurement results are obtained as described below:

$$\text{Power (EIRP)} = P_{Mea} + P_{Ag} - P_{cl} + G_a$$

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,  $ERP = EIRP - 2.15$ .

### A.1.3.3 Measurement result

#### LTE Band 5-ERP

Limits:  $\leq 38.45\text{dBm}$  (7W)

Mod.	Bandwidth (MHz)	Frequency (MHz)	P <sub>Mea</sub> (dBm)	P <sub>cl</sub> (dB)	P <sub>Ag</sub> (dB)	G <sub>a</sub> (dBi)	Correction (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)	Ant.Pol
QPSK	1.4	824.70	-23.27	2.26	45.79	0.95	2.15	19.06	38.45	19.39	H
		836.50	-22.93	2.26	45.66	0.82	2.15	19.14	38.45	19.31	H
		848.30	-22.84	2.27	45.55	0.80	2.15	19.09	38.45	19.36	H
	3	825.50	-23.49	2.26	45.79	0.94	2.15	18.83	38.45	19.62	H
		836.50	-23.09	2.26	45.66	0.82	2.15	18.98	38.45	19.47	H
		847.50	-23.04	2.27	45.56	0.81	2.15	18.91	38.45	19.54	H
	5	826.50	-23.34	2.25	45.77	0.93	2.15	18.96	38.45	19.49	H
		836.50	-22.94	2.26	45.66	0.82	2.15	19.13	38.45	19.32	H
		846.50	-23.36	2.26	45.56	0.82	2.15	18.61	38.45	19.84	H
	10	829.00	-22.84	2.25	45.77	0.90	2.15	19.43	38.45	19.02	H
836.50		-22.90	2.26	45.66	0.82	2.15	19.17	38.45	19.28	H	
844.00		-23.00	2.26	45.59	0.82	2.15	19.00	38.45	19.45	H	
16QAM	1.4	824.70	-23.30	2.26	45.79	0.95	2.15	19.03	38.45	19.42	H
		836.50	-22.68	2.26	45.66	0.82	2.15	19.39	38.45	19.06	H
		848.30	-23.05	2.27	45.55	0.80	2.15	18.88	38.45	19.57	H
	3	825.50	-23.66	2.26	45.79	0.94	2.15	18.66	38.45	19.79	H
		836.50	-23.21	2.26	45.66	0.82	2.15	18.86	38.45	19.59	H
		847.50	-23.16	2.27	45.56	0.81	2.15	18.79	38.45	19.66	H
	5	826.50	-23.50	2.25	45.77	0.93	2.15	18.80	38.45	19.65	H
		836.50	-23.15	2.26	45.66	0.82	2.15	18.92	38.45	19.53	H
		846.50	-23.38	2.26	45.56	0.82	2.15	18.59	38.45	19.86	H
	10	829.00	-22.99	2.25	45.77	0.90	2.15	19.28	38.45	19.17	H
836.50		-23.08	2.26	45.66	0.82	2.15	18.99	38.45	19.46	H	
844.00		-23.03	2.26	45.59	0.82	2.15	18.97	38.45	19.48	H	
16QAM	1.4	824.70	-24.81	2.26	45.79	0.95	2.15	17.52	38.45	20.93	H
		836.50	-24.59	2.26	45.66	0.82	2.15	17.48	38.45	20.97	H
		848.30	-24.61	2.27	45.55	0.80	2.15	17.32	38.45	21.13	H
	3	825.50	-25.18	2.26	45.79	0.94	2.15	17.14	38.45	21.31	H
		836.50	-24.78	2.26	45.66	0.82	2.15	17.29	38.45	21.16	H
		847.50	-24.75	2.27	45.56	0.81	2.15	17.20	38.45	21.25	H
	5	826.50	-25.02	2.25	45.77	0.93	2.15	17.28	38.45	21.17	H
		836.50	-24.75	2.26	45.66	0.82	2.15	17.32	38.45	21.13	H
		846.50	-24.90	2.26	45.56	0.82	2.15	17.07	38.45	21.38	H
	10	829.00	-24.61	2.25	45.77	0.90	2.15	17.66	38.45	20.79	H
836.50		-24.64	2.26	45.66	0.82	2.15	17.43	38.45	21.02	H	
844.00		-24.73	2.26	45.59	0.82	2.15	17.27	38.45	21.18	H	

**LTE Band 7- EIRP**
**Limits: ≤33 dBm (2W)**

Mod.	Bandwidth (MHz)	Frequency (MHz)	P <sub>Mea</sub> (dBm)	P <sub>cl</sub> (dB)	P <sub>Ag</sub> (dB)	G <sub>a</sub> (dBi)	EIRP (dBm)	Limit (dBm)	Margin (dB)	Ant.Pol
QPSK	5	2502.50	-26.01	3.58	45.68	6.10	22.19	33.00	10.81	H
		2535.00	-24.72	3.63	44.82	6.16	22.63	33.00	10.37	H
		2567.50	-26.32	3.65	44.92	6.22	21.17	33.00	11.83	H
	10	2505.00	-25.78	3.59	45.64	6.11	22.38	33.00	10.62	H
		2535.00	-24.25	3.63	44.82	6.16	23.10	33.00	9.90	H
		2565.00	-26.22	3.65	44.97	6.22	21.32	33.00	11.68	H
	15	2507.50	-25.09	3.59	44.92	6.11	22.35	33.00	10.65	H
		2535.00	-24.81	3.63	44.82	6.16	22.54	33.00	10.46	H
		2562.50	-26.98	3.65	45.67	6.21	21.25	33.00	11.75	H
	20	2510.00	-25.27	3.58	45.36	6.12	22.63	33.00	10.37	H
		2535.00	-24.75	3.63	44.82	6.16	22.60	33.00	10.40	H
		2560.00	-26.94	3.63	45.98	6.21	21.62	33.00	11.38	V
16QAM	5	2502.50	-26.77	3.58	45.68	6.10	21.43	33.00	11.57	H
		2535.00	-25.33	3.63	44.82	6.16	22.02	33.00	10.98	H
		2567.50	-26.81	3.65	44.92	6.22	20.68	33.00	12.32	H
	10	2505.00	-26.14	3.59	45.64	6.11	22.02	33.00	10.98	H
		2535.00	-25.23	3.63	44.82	6.16	22.12	33.00	10.88	H
		2565.00	-26.49	3.65	44.97	6.22	21.05	33.00	11.95	H
	15	2507.50	-25.65	3.59	44.92	6.11	21.79	33.00	11.21	H
		2535.00	-24.74	3.63	44.82	6.16	22.61	33.00	10.39	H
		2562.50	-27.57	3.65	45.67	6.21	20.66	33.00	12.34	H
	20	2510.00	-25.90	3.58	45.36	6.12	22.00	33.00	11.00	H
		2535.00	-25.25	3.63	44.82	6.16	22.10	33.00	10.90	H
		2560.00	-27.30	3.63	45.98	6.21	21.26	33.00	11.74	H
64QAM	5	2502.50	-27.24	3.58	45.68	6.10	20.96	33.00	12.04	H
		2535.00	-26.38	3.63	44.82	6.16	20.97	33.00	12.03	H
		2567.50	-27.92	3.65	44.92	6.22	19.57	33.00	13.43	H
	10	2505.00	-27.40	3.59	45.64	6.11	20.76	33.00	12.24	H
		2535.00	-25.79	3.63	44.82	6.16	21.56	33.00	11.44	H
		2565.00	-27.71	3.65	44.97	6.22	19.83	33.00	13.17	H
	15	2507.50	-26.54	3.59	44.92	6.11	20.90	33.00	12.10	H
		2535.00	-26.00	3.63	44.82	6.16	21.35	33.00	11.65	H
		2562.50	-28.45	3.65	45.67	6.21	19.78	33.00	13.22	H
	20	2510.00	-26.88	3.58	45.36	6.12	21.02	33.00	11.98	H
		2535.00	-25.89	3.63	44.82	6.16	21.46	33.00	11.54	H
		2560.00	-28.43	3.63	45.98	6.21	20.13	33.00	12.87	H

**LTE band 41- EIRP**
**Limits:** ≤33dBm (2W)

Mod.	Bandwidth (MHz)	Frequency (MHz)	P <sub>Mea</sub> (dBm)	P <sub>cl</sub> (dB)	P <sub>Ag</sub> (dB)	G <sub>a</sub> (dBi)	EIRP (dBm)	Limit (dBm)	Margin (dB)	Ant.Pol
QPSK	5	2498.50	-25.13	3.58	45.59	6.10	22.98	33.00	10.02	H
		2593.00	-26.94	3.69	44.93	6.27	20.57	33.00	12.43	H
		2687.50	-26.51	3.73	44.98	6.44	21.18	33.00	11.82	H
	10	2501.00	-25.13	3.58	45.65	6.10	23.04	33.00	9.96	H
		2593.00	-27.01	3.69	44.93	6.27	20.50	33.00	12.50	H
		2685.00	-26.94	3.73	44.98	6.43	20.74	33.00	12.26	H
	15	2503.50	-24.87	3.58	45.65	6.11	23.31	33.00	9.69	H
		2593.00	-26.93	3.69	44.93	6.27	20.58	33.00	12.42	H
		2682.50	-26.80	3.73	44.98	6.43	20.88	33.00	12.12	H
	20	2506.00	-24.28	3.59	45.15	6.11	23.39	33.00	9.61	H
		2593.00	-26.79	3.69	44.93	6.27	20.72	33.00	12.28	V
		2680.00	-26.95	3.73	44.97	6.42	20.71	33.00	12.29	H
16QAM	5	2498.50	-25.83	3.58	45.59	6.10	22.28	33.00	10.72	H
		2593.00	-27.68	3.69	44.93	6.27	19.83	33.00	13.17	V
		2687.50	-27.42	3.73	44.98	6.44	20.27	33.00	12.73	H
	10	2501.00	-25.63	3.58	45.65	6.10	22.54	33.00	10.46	H
		2593.00	-27.71	3.69	44.93	6.27	19.80	33.00	13.20	H
		2685.00	-27.74	3.73	44.98	6.43	19.94	33.00	13.06	H
	15	2503.50	-25.93	3.58	45.65	6.11	22.25	33.00	10.75	H
		2593.00	-27.87	3.69	44.93	6.27	19.64	33.00	13.36	H
		2682.50	-28.02	3.73	44.98	6.43	19.66	33.00	13.34	H
	20	2506.00	-24.86	3.59	45.15	6.11	22.81	33.00	10.19	H
		2593.00	-27.56	3.69	44.93	6.27	19.95	33.00	13.05	H
		2680.00	-27.64	3.73	44.97	6.42	20.02	33.00	12.98	H
64QAM	5	2498.50	-26.33	3.58	45.59	6.10	21.78	33.00	11.22	H
		2593.00	-28.67	3.69	44.93	6.27	18.84	33.00	14.16	H
		2687.50	-28.36	3.73	44.98	6.44	19.33	33.00	13.67	H
	10	2501.00	-26.24	3.58	45.65	6.10	21.93	33.00	11.07	H
		2593.00	-28.76	3.69	44.93	6.27	18.75	33.00	14.25	H
		2685.00	-28.68	3.73	44.98	6.43	19.00	33.00	14.00	H
	15	2503.50	-25.98	3.58	45.65	6.11	22.20	33.00	10.80	H
		2593.00	-28.95	3.69	44.93	6.27	18.56	33.00	14.44	H
		2682.50	-28.86	3.73	44.98	6.43	18.82	33.00	14.18	H
	20	2506.00	-25.16	3.59	45.15	6.11	22.51	33.00	10.49	H
		2593.00	-28.73	3.69	44.93	6.27	18.78	33.00	14.22	H
		2680.00	-28.58	3.73	44.97	6.42	19.08	33.00	13.92	H

Frequency: 2680.00MHz

$$\text{Peak EIRP (dBm)} = P_{\text{Mea}} (-28.58\text{dBm}) + G_a (6.42\text{dBi}) + P_{\text{Ag}} (44.97\text{dB}) - P_{\text{cl}} (3.58\text{dB}) = 19.08\text{dBm}$$

Note: Expanded measurement uncertainty is U = 5.76 dB, k = 2.

## A.2 Emission Limit

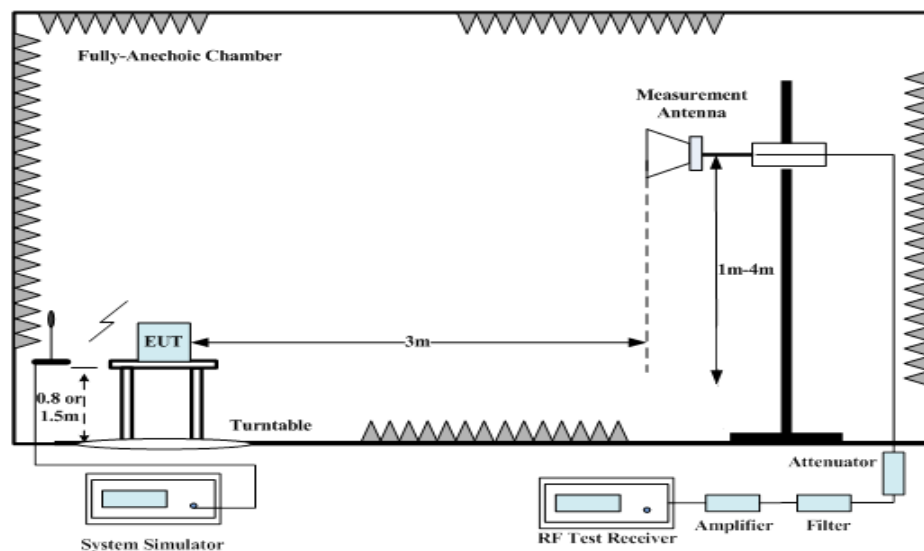
### **A.2.1 Measurement Method**

The measurement procedures in ANSI C63.26 are used.

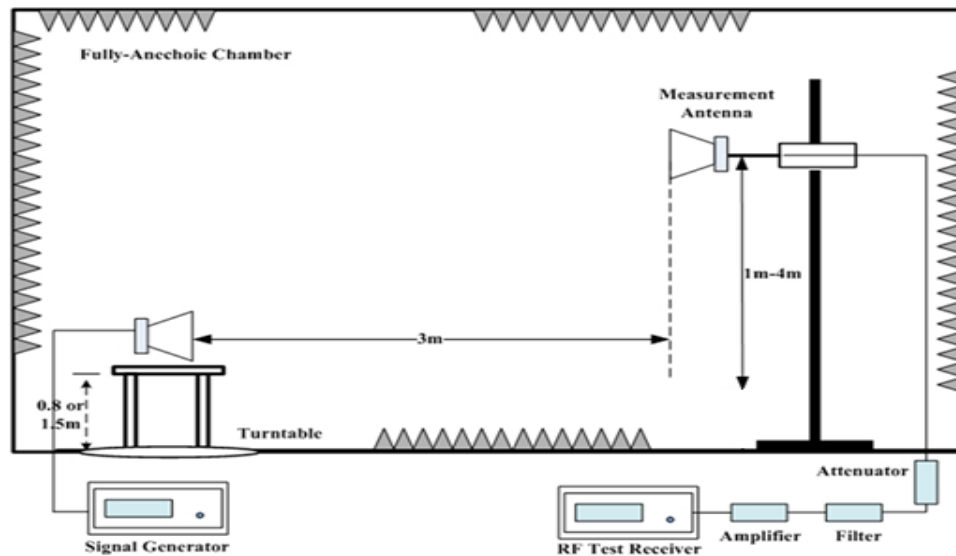
The spectrum was scanned from 30 MHz to the 10th harmonic of the highest frequency generated within the equipment, which is the transmitted carrier. The resolution bandwidth is set 1MHz. The spectrum was scanned with the mobile station transmitting at carrier frequencies that pertain to low, mid and high channels of each LTE Band.

#### **The procedure of radiated spurious emissions is as follows:**

For measurements performed at frequencies less than or equal to 1 GHz, the EUT was placed on a 80cm-high non-conductive support; For measurements performed at frequencies above 1GHz,EUT was placed on a 1.5-meter-high non-conductive support. A measurement antenna was placed on the antenna mast 3 meters from the EUT for emission measurements. In the initial test, the height of the measurement antenna was varied from 1 m to 4 m 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 non-harmonic and harmonics of the transmit frequency through the 10th harmonic were measured with peak detector.



1. 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).
2. 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. The height of measurement antenna varied between 1 m to 4 m to maximize the received signal amplitude for each emission that was detected and measured in the initial test. 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 reach the previously recorded ( $P_r$ ). The power of signal source ( $P_{Mea}$ ) is recorded. The test was performed with the measurement antenna in both vertical and horizontal polarization.

3. The Path loss ( $P_{pl}$ ) between the Signal Source and the Substitution Antenna and the Substitution Antenna Gain ( $G_a$ ) were recorded after test. A amplifier was connected in for the test. The Path loss ( $P_{pl}$ ) is the summation of the cable loss and the gain of the amplifier.
4. The measurement results are obtained as described below:

$$\text{Power (EIRP)} = P_{Mea} - P_{pl} + G_a$$

This value is EIRP since the measurement is calibrated using an antenna of known gain (2.15 dBi) and known input power. ERP can be calculated from EIRP by subtracting the gain of the dipole,  $ERP = EIRP - 2.15\text{dBi}$ .

### A.2.2 Measurement Limit

**FDD Band 5:** Part 22.917 specifies 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.

**FDD Band 7/TDD Band 41:** 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  $43 + 10 \log(P)$  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.

**A.2.3 Measurement Results**

Radiated emissions measurements were made only at the upper, middle, and lower carrier frequencies of each LTE Band. 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 each LTE Band 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. The range of evaluated frequency is from 9 kHz to 26GHz.

Note 1: Both of Vertical and Horizontal polarizations are evaluated, but only the worst case is recorded in this report.

**A.2.4 Measurement Results Table**

Frequency	Channel	Frequency Range	Result
LTE Bands	Low	9kHz-26GHz	Pass
	Middle	9kHz-26GHz	Pass
	High	9kHz-26GHz	Pass

**A.2.5 Sweep Table**

Subrange	RBW	VBW
9~150 kHz	0.2kHz	0.6kHz
150kHz~30MHz	9kHz	27kHz
30MHz~1 GHz	100KHz	300KHz
1~26 GHz	1 MHz	3 MHz

**A.2.6 Measurement Result**

**LTE Band 5, 1.4MHz, QPSK, Channel 20407**

Frequency (MHz)	SG (dBm)	CableLoss (dB)	AntennaGain (dBi)	Correction	Peak ERP (dBm)	Limit (dBm)	Margin (dB)	Polorization
1649.01	-53.97	3.56	9.50	2.15	-50.18	-13.00	37.18	H
2474.00	-47.63	4.60	10.30	2.15	-44.08	-13.00	31.08	H
4123.02	-60.97	6.04	10.40	2.15	-58.76	-13.00	45.76	V
4949.01	-60.79	6.69	11.20	2.15	-58.43	-13.00	45.43	V
5774.01	-58.70	7.23	11.05	2.15	-57.03	-13.00	44.03	V
6598.01	-57.28	7.79	10.60	2.15	-56.62	-13.00	43.62	H

**LTE Band 5, 1.4MHz, QPSK, Channel 20525**

Frequency (MHz)	SG (dBm)	CableLoss (dB)	AntennaGain (dBi)	Correction	Peak ERP (dBm)	Limit (dBm)	Margin (dB)	Polorization
1673.01	-54.59	3.58	9.55	2.15	-50.77	-13.00	37.77	H
2510.00	-45.43	4.63	10.18	2.15	-42.03	-13.00	29.03	H
3360.02	-64.27	5.33	10.50	2.15	-61.25	-13.00	48.25	H
4183.02	-59.74	6.17	10.47	2.15	-57.59	-13.00	44.59	V
5015.01	-58.85	6.58	11.33	2.15	-56.25	-13.00	43.25	V
1673.01	-54.59	3.58	9.55	2.15	-50.77	-13.00	37.77	H

**LTE Band 5, 1.4MHz, QPSK, Channel 20643**

Frequency (MHz)	SG (dBm)	CableLoss (dB)	AntennaGain (dBi)	Correction	Peak ERP (dBm)	Limit (dBm)	Margin (dB)	Polorization
1697.01	-55.86	3.60	9.59	2.15	-52.02	-13.00	39.02	H
2545.00	-43.50	4.66	10.11	2.15	-40.20	-13.00	27.20	H
3406.02	-62.62	5.37	10.49	2.15	-59.65	-13.00	46.65	H
4243.02	-57.42	6.25	10.59	2.15	-55.23	-13.00	42.23	V
5103.01	-59.52	6.78	11.51	2.15	-56.94	-13.00	43.94	H
5924.01	-57.97	7.47	10.50	2.15	-57.09	-13.00	44.09	V

**LTE Band 7, 5 MHz, QPSK, Channel 20775**

Frequency (MHz)	SG (dBm)	CableLoss (dB)	AntennaGain (dBi)	Peak EIRP (dBm)	Limit (dBm)	Margin (dB)	Polorization
5016.02	-61.17	6.58	11.33	-56.42	-25.00	31.42	H
7510.01	-48.95	8.35	10.30	-47.00	-25.00	22.00	H
9997.01	-54.21	9.18	11.91	-51.48	-25.00	26.48	H
12503.01	-52.28	10.18	13.30	-49.16	-25.00	24.16	V
15001.00	-52.63	11.22	14.50	-49.35	-25.00	24.35	V
17537.00	-44.25	12.87	13.11	-44.01	-25.00	19.01	H

**LTE Band 7, 5 MHz, QPSK, Channel 21100**

Frequency (MHz)	SG (dBm)	CableLoss (dB)	AntennaGain (dBi)	Peak EIRP (dBm)	Limit (dBm)	Margin (dB)	Polorization
5089.02	-60.71	6.74	11.48	-55.97	-25.00	30.97	V
7608.01	-47.65	8.01	10.42	-45.24	-25.00	20.24	H
10145.01	-53.33	9.39	12.00	-50.72	-25.00	25.72	V
12669.01	-53.14	10.35	13.16	-50.33	-25.00	25.33	H
15210.00	-52.69	11.39	14.91	-49.17	-25.00	24.17	H
17749.00	-46.81	12.45	13.55	-45.71	-25.00	20.71	H

**LTE Band 7, 5 MHz, QPSK, Channel 21425**

Frequency (MHz)	SG (dBm)	CableLoss (dB)	AntennaGain (dBi)	Peak EIRP (dBm)	Limit (dBm)	Margin (dB)	Polorization
5126.02	-60.29	6.84	11.55	-55.58	-25.00	30.58	V
7705.01	-49.68	8.42	10.70	-47.40	-25.00	22.40	H
10261.01	-53.24	9.51	12.00	-50.75	-25.00	25.75	H
12852.01	-51.84	10.63	12.85	-49.62	-25.00	24.62	V
15399.00	-52.74	11.39	15.10	-49.03	-25.00	24.03	H
17970.00	-46.12	12.89	13.40	-45.61	-25.00	20.61	H

**LTE Band 41, 5MHz, QPSK, Channel 39657**

Frequency (MHz)	SG (dBm)	CableLoss (dB)	AntennaGain (dBi)	Peak EIRP (dBm)	Limit (dBm)	Margin (dB)	Polorization
4993.02	-61.80	6.62	11.29	-57.13	-25.00	32.13	V
7495.01	-55.72	8.38	10.29	-53.81	-25.00	28.81	V
9995.01	-54.44	9.18	11.91	-51.71	-25.00	26.71	V
12491.01	-52.80	10.20	13.31	-49.69	-25.00	24.69	V
14994.00	-53.32	11.21	14.48	-50.05	-25.00	25.05	V
17492.00	-45.42	12.71	13.03	-45.10	-25.00	20.10	V

**LTE Band 41, 5MHz, QPSK, Channel 40620**

Frequency (MHz)	SG (dBm)	CableLoss (dB)	AntennaGain (dBi)	Peak EIRP (dBm)	Limit (dBm)	Margin (dB)	Polorization
5178.02	-61.78	6.93	11.66	-57.05	-25.00	32.05	V
7783.01	-54.18	8.31	10.83	-51.66	-25.00	26.66	V
10368.01	-52.18	9.75	12.07	-49.86	-25.00	24.86	V
12987.01	-52.59	10.47	12.71	-50.35	-25.00	25.35	H
15579.00	-54.08	11.49	15.38	-50.19	-25.00	25.19	V
16851.00	-50.96	12.05	14.05	-48.96	-25.00	23.96	V

**LTE Band 41, 5MHz, QPSK, Channel 41565**

Frequency (MHz)	SG (dBm)	CableLoss (dB)	AntennaGain (dBi)	Peak EIRP (dBm)	Limit (dBm)	Margin (dB)	Polorization
5378.02	-50.05	6.88	11.44	-45.49	-25.00	20.49	H
8069.01	-54.99	8.32	11.26	-52.05	-25.00	27.05	H
10753.01	-52.29	9.43	12.15	-49.57	-25.00	24.57	H
13440.01	-51.03	10.60	12.44	-49.19	-25.00	24.19	H
16125.00	-53.50	11.82	15.32	-50.00	-25.00	25.00	H
17473.00	-45.05	12.66	13.11	-44.60	-25.00	19.60	H

Note: Peak EIRP (dBm) = P<sub>Mea</sub>(dBm) - Path Loss(dB) + Antenna Gain(dBi)

Note: Expanded measurement uncertainty is U = 5.76 dB, k = 2.

## **A.3 Frequency Stability**

### **A.3.1 Method of Measurement**

Frequency stability is a measure of the frequency drift due to temperature and supply voltage variations, with reference to the frequency measured at +20 °C and rated supply voltage. Two reference points are 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 shall be identified as  $F_L$  and  $F_H$  respectively.

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 CMW500.

1. Measure the carrier frequency at room temperature.
2. Subject the EUT to overnight soak at -30°C.
3. With the EUT, powered via nominal voltage, connected to the CMW500, and in a simulated call on middle channel for each LTE band, 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°C increments from -30°C to +50°C. Allow at least 1.5 hours at each temperature, unpowered, before making measurements.
5. Re-measure carrier frequency at room temperature with nominal voltage. Vary supply voltage from minimum voltage to maximum voltage, in 0.1Volt increments re-measuring 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°C.
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 °C decrements from +50°C to -30°C. Allow at least 1.5 hours at each temperature, unpowered, before making measurements.
9. At all temperature levels hold the temperature to +/- 0.5°C 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, 10MHz bandwidth QPSK (worst case of all bandwidths)

##### Frequency Error vs Temperature

Temperature(°C)	Voltage(V)	F <sub>L</sub> (MHz)	F <sub>H</sub> (MHz)	Offset(Hz)	Frequency error(ppm)
20	3.85	824.417	848.583		
50				0.56	0.0007
40				0.39	0.0005
30				0.62	0.0007
10				0.59	0.0007
0				0.43	0.0005
-10				-0.46	0.0005
-20				0.04	0.0000
-30				-0.79	0.0009

##### Frequency Error vs Voltage

Voltage(V)	Temperature(°C)	F <sub>L</sub> (MHz)	F <sub>H</sub> (MHz)	Offset(Hz)	Frequency error(ppm)
3.6	20	824.417	848.583	1.02	0.0012
4.1				0.51	0.0006

#### LTE Band 7, 20MHz bandwidth QPSK (worst case of all bandwidths)

##### Frequency Error vs Temperature

Temperature(°C)	Voltage(V)	F <sub>L</sub> (MHz)	F <sub>H</sub> (MHz)	Offset(Hz)	Frequency error(ppm)
20	3.85	2500.641	2569.327		
50				-1.72	0.0007
40				0.64	0.0003
30				-2.23	0.0009
10				-3.25	0.0013
0				-1.26	0.0005
-10				-1.92	0.0008
-20				-0.26	0.0001
-30				-21.50	0.0085

##### Frequency Error vs Voltage

Voltage(V)	Temperature(°C)	F <sub>L</sub> (MHz)	F <sub>H</sub> (MHz)	Offset(Hz)	Frequency error(ppm)
3.6	20	2500.641	2569.327	-0.44	0.0002
4.1				-1.17	0.0005

**LTE Band 41, 20MHz bandwidth QPSK (worst case of all bandwidths)**
**Frequency Error vs Temperature**

Temperature(°C)	Voltage(V)	F <sub>L</sub> (MHz)	F <sub>H</sub> (MHz)	Offset(Hz)	Frequency error(ppm)
20	3.85	2496.417	2689.487		
50				-1.26	0.0005
40				-0.30	0.0001
30				-5.32	0.0021
10				2.07	0.0008
0				-5.12	0.0020
-10				-5.06	0.0020
-20				-3.83	0.0015
-30				-2.25	0.0009

**Frequency Error vs Voltage**

Voltage(V)	Temperature(°C)	F <sub>L</sub> (MHz)	F <sub>H</sub> (MHz)	Offset(Hz)	Frequency error(ppm)
3.6	20	2496.417	2689.487	-3.68	0.0014
4.1				-0.76	0.0003

Note: Expanded measurement uncertainty is U = 0.01 PPM, k = 2.

#### **A.4 Occupied Bandwidth**

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

The measurement method is from ANSI C63.26:

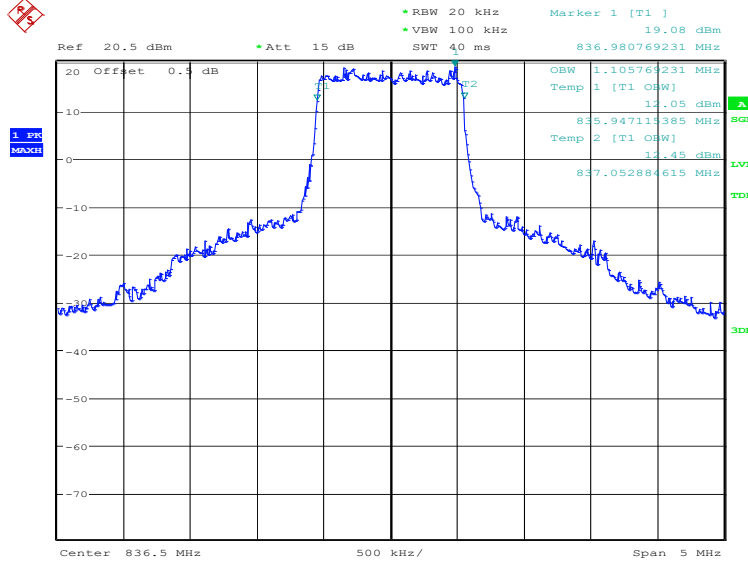
- a) The spectrum analyzer center frequency is set to the nominal EUT channel center frequency. The frequency span for the spectrum analyzer shall be set wide enough to capture all modulation products including the emission skirts.
- b) The nominal IF filter 3 dB bandwidth (RBW) shall be in the range of 1% to 5% of the anticipated OBW, and the VBW shall be set  $\geq 3 \times$  RBW.
- c) Set the reference level of the instrument as required to prevent the signal amplitude from exceeding the maximum spectrum analyzer input mixer level for linear operation.
- d) Set the detection mode to peak, and the trace mode to max-hold.



**LTE band 5, 1.4MHz (99%)**

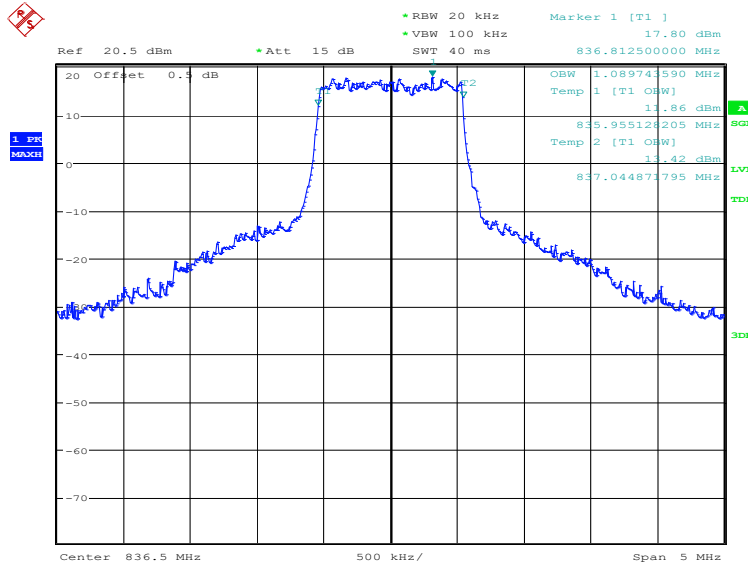
Frequency(MHz)	Occupied Bandwidth (99%)(kHz)	
	836.5	QPSK
1105.77		1089.74

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



Date: 5.JUL.2023 15:51:26

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

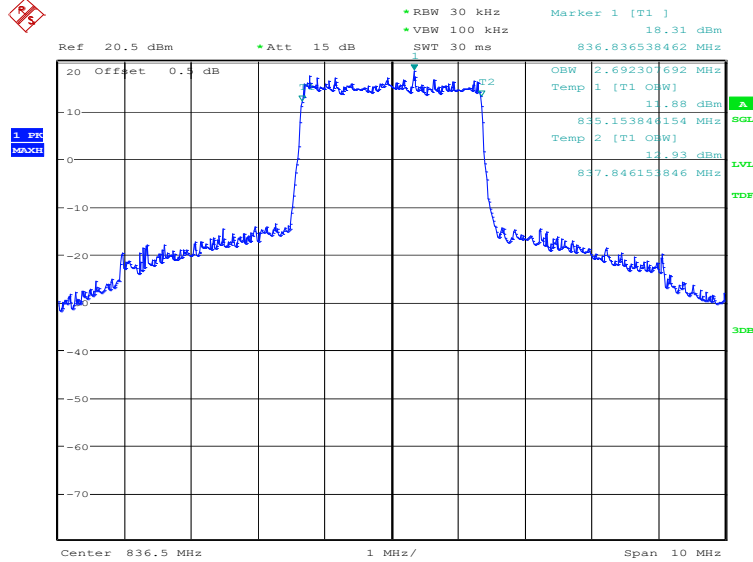


Date: 5.JUL.2023 15:52:06

### LTE band 5, 3MHz (99%)

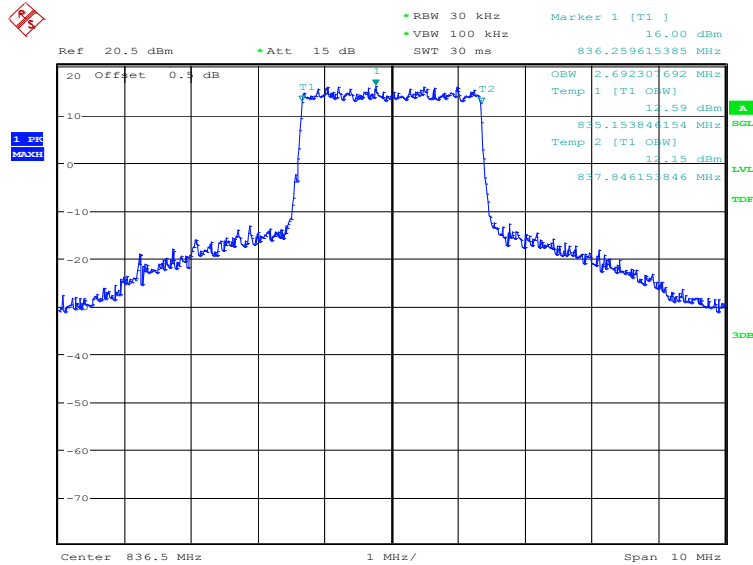
Frequency(MHz)	Occupied Bandwidth (99%)(kHz)	
836.5	QPSK	16QAM
	2692.31	2692.31

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



Date: 5.JUL.2023 15:52:48

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

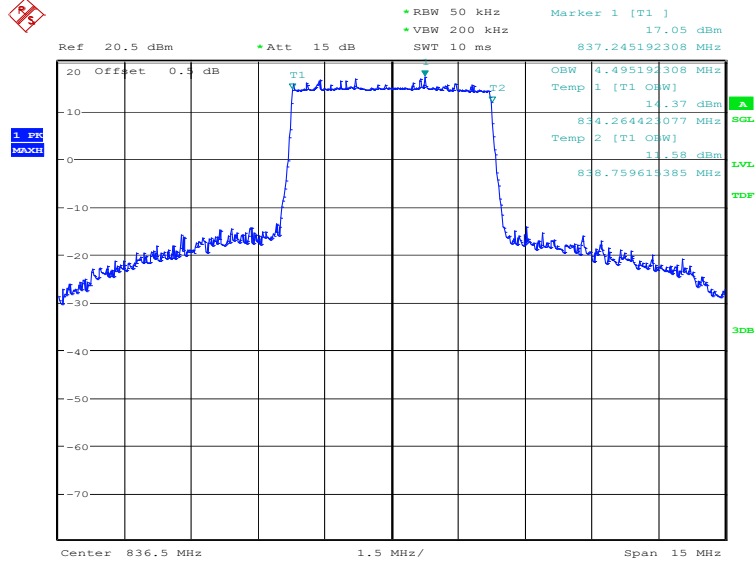


Date: 5.JUL.2023 15:53:28

### LTE band 5, 5MHz (99%)

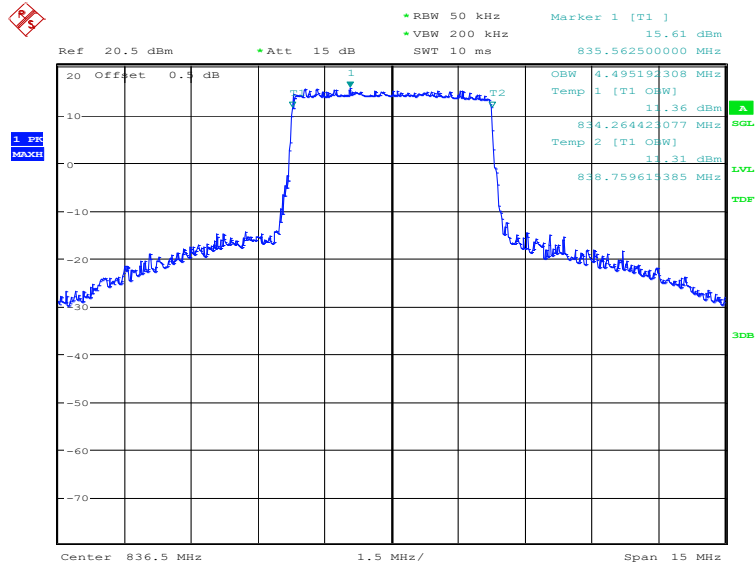
Frequency(MHz)	Occupied Bandwidth (99%)(kHz)	
836.5	QPSK	16QAM
	4495.19	4495.19

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



Date: 5.JUL.2023 15:54:10

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

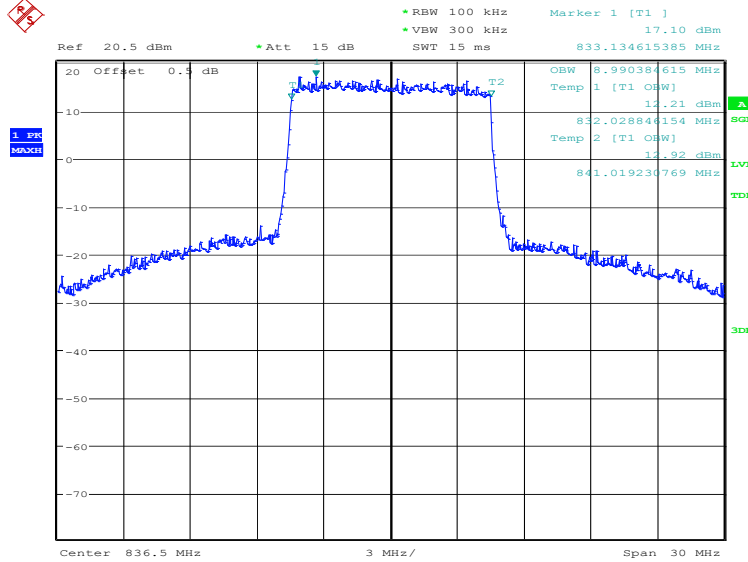


Date: 5.JUL.2023 15:54:50

**LTE band 5, 10MHz (99%)**

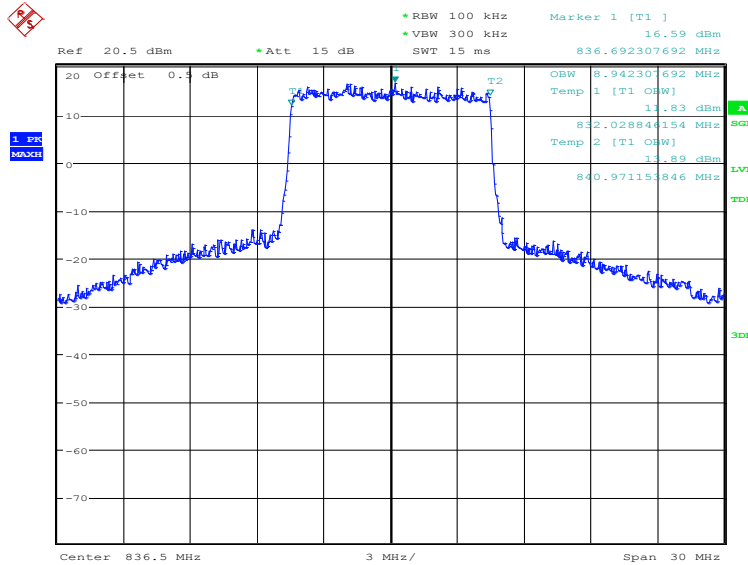
Frequency(MHz)	Occupied Bandwidth (99%)(kHz)	
836.5	QPSK	16QAM
	8990.38	8942.31

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



Date: 5.JUL.2023 15:55:32

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

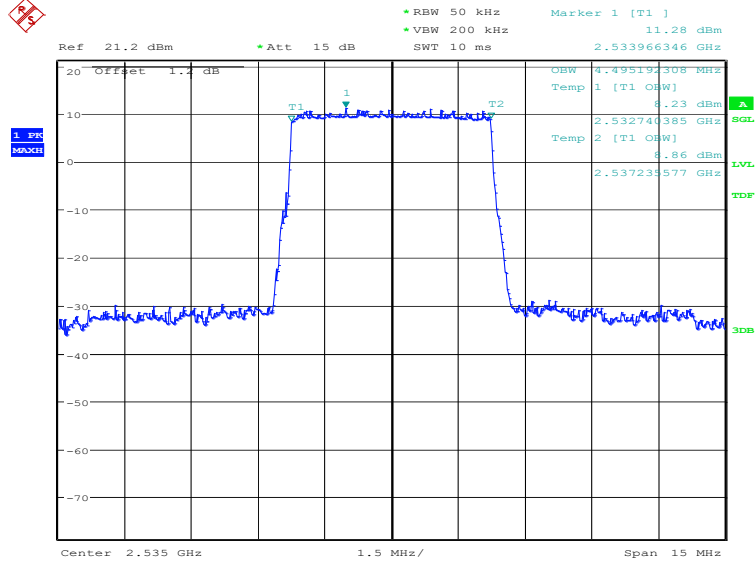


Date: 5.JUL.2023 15:56:13

### LTE band 7, 5MHz (99%)

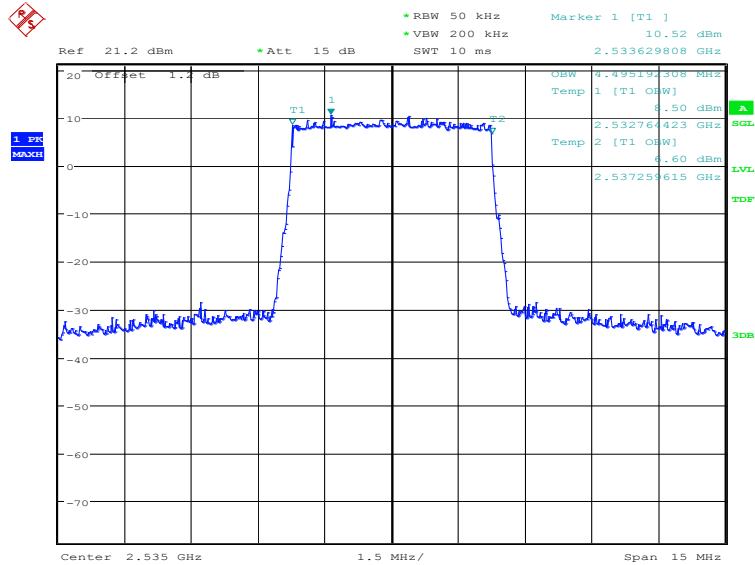
Frequency(MHz)	Occupied Bandwidth (99%)(kHz)	
2535.0	QPSK	16QAM
	4495.19	4495.19

### LTE band 7, 5MHz Bandwidth, QPSK (99% BW)



Date: 5.JUL.2023 15:56:56

### LTE band 7, 5MHz Bandwidth, 16QAM (99% BW)

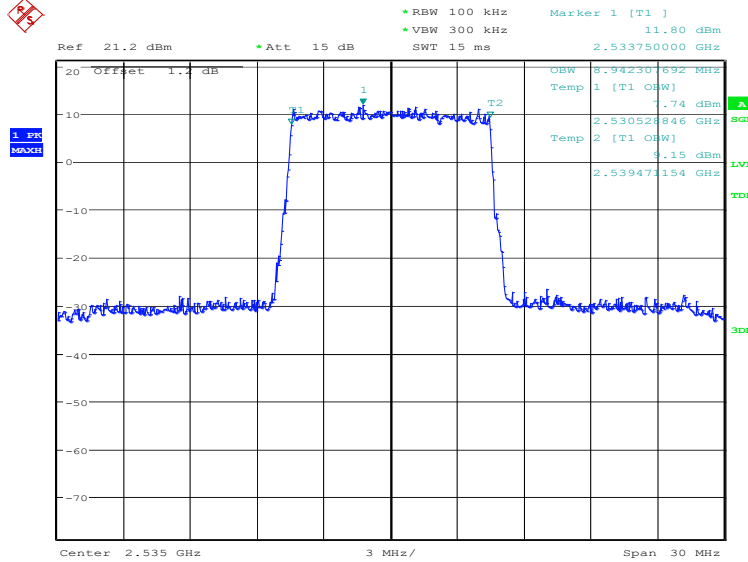


Date: 5.JUL.2023 15:57:37

**LTE band 7, 10MHz (99%)**

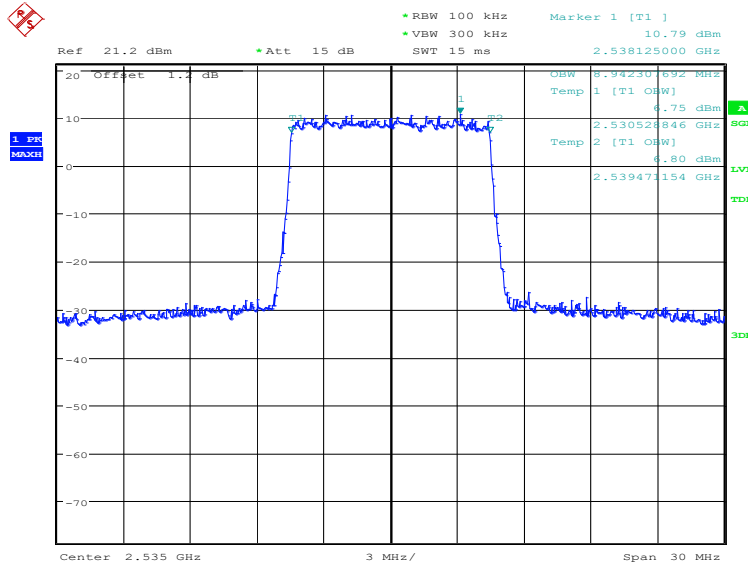
Frequency(MHz)	Occupied Bandwidth (99%)(kHz)	
2535.0	QPSK	16QAM
	8942.31	8942.31

**LTE band 7, 10MHz Bandwidth, QPSK (99% BW)**



Date: 5.JUL.2023 15:58:18

**LTE band 7, 10MHz Bandwidth, 16QAM (99% BW)**

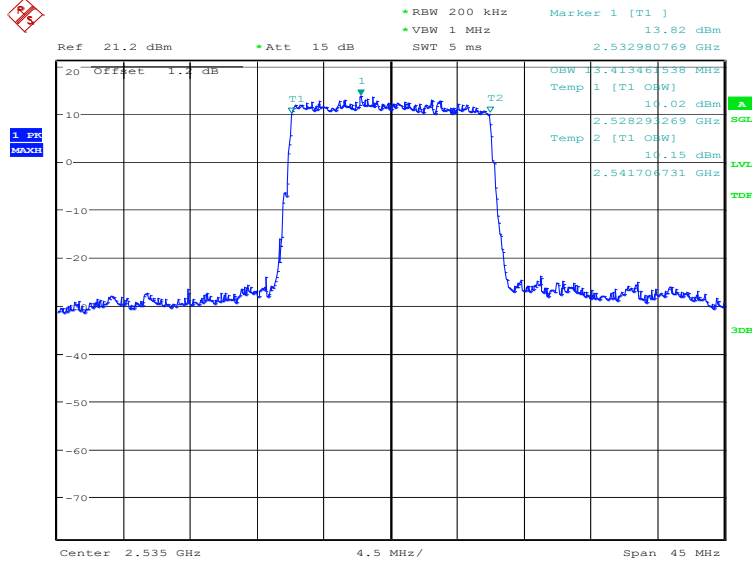


Date: 5.JUL.2023 15:58:59

### LTE band 7, 15MHz (99%)

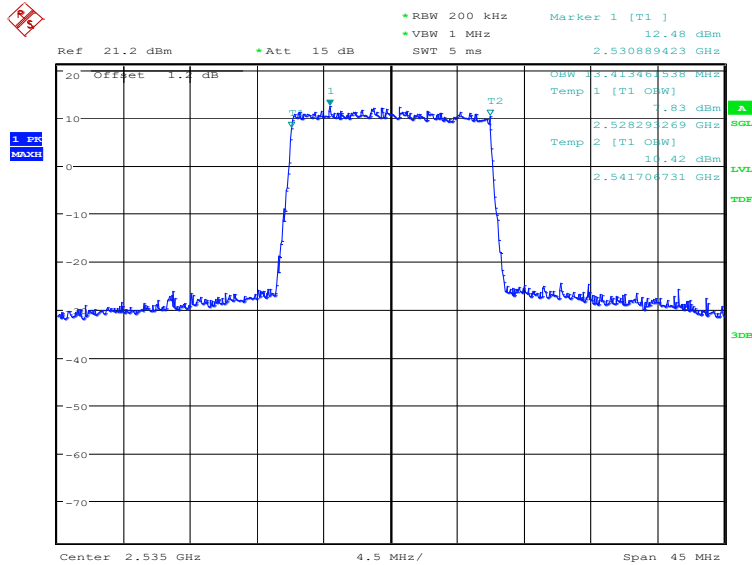
Frequency(MHz)	Occupied Bandwidth (99%)(kHz)	
2535.0	QPSK	16QAM
	13413.46	13413.46

### LTE band 7, 15MHz Bandwidth, QPSK (99% BW)



Date: 5.JUL.2023 15:59:41

### LTE band 7, 15MHz Bandwidth, 16QAM (99% BW)

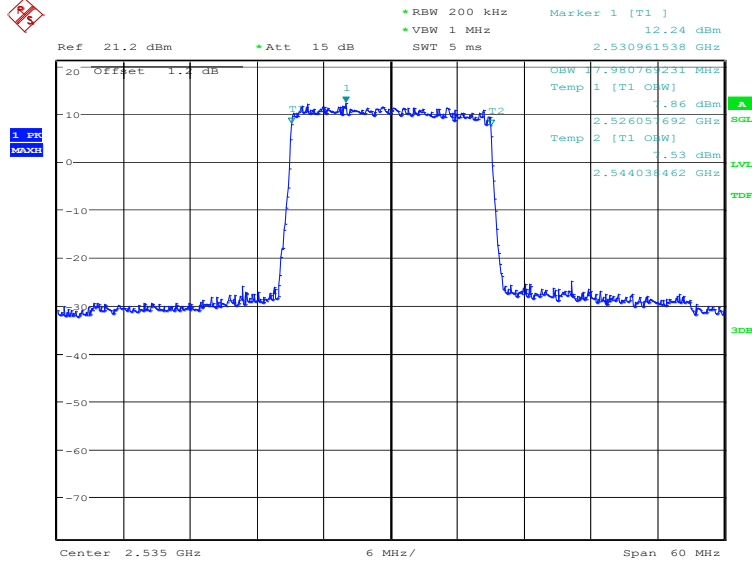


Date: 5.JUL.2023 16:00:21

**LTE band 7, 20MHz (99%)**

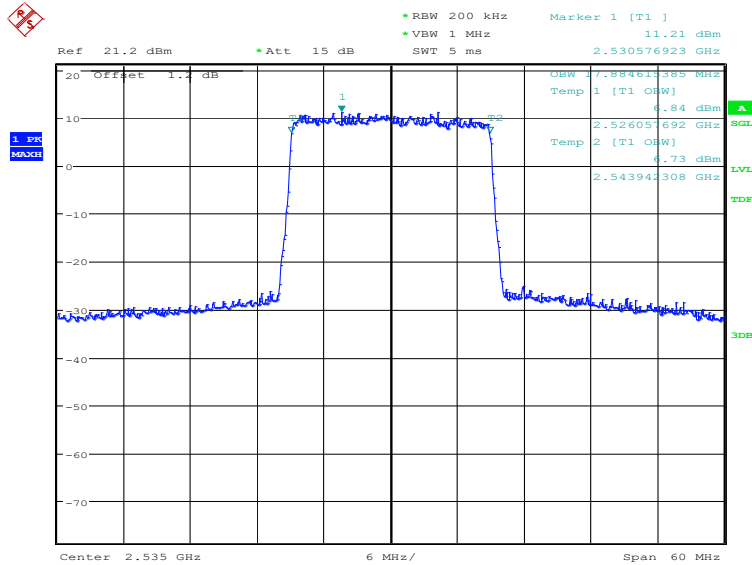
Frequency(MHz)	Occupied Bandwidth (99%)(kHz)	
2535.0	QPSK	16QAM
	17980.77	17884.62

**LTE band 7, 20MHz Bandwidth, QPSK (99% BW)**



Date: 5.JUL.2023 16:01:03

**LTE band 7, 20MHz Bandwidth, 16QAM (99% BW)**



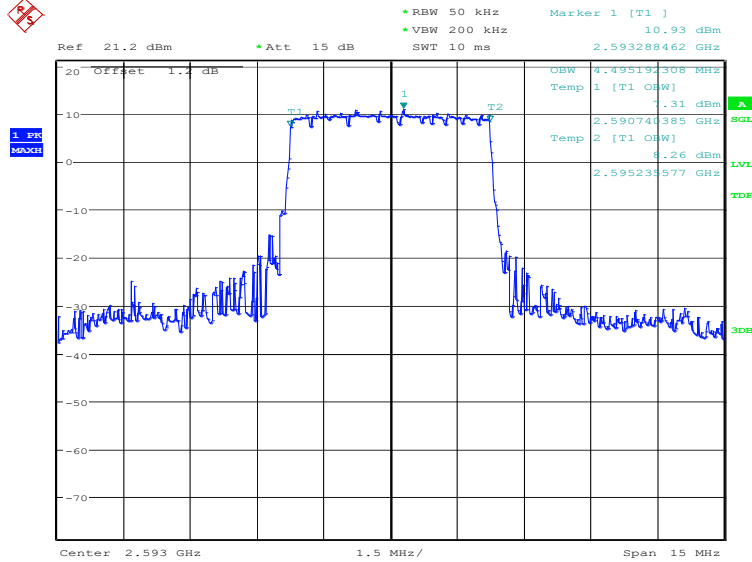
Date: 5.JUL.2023 16:01:43



**LTE band 41, 5MHz (99%)**

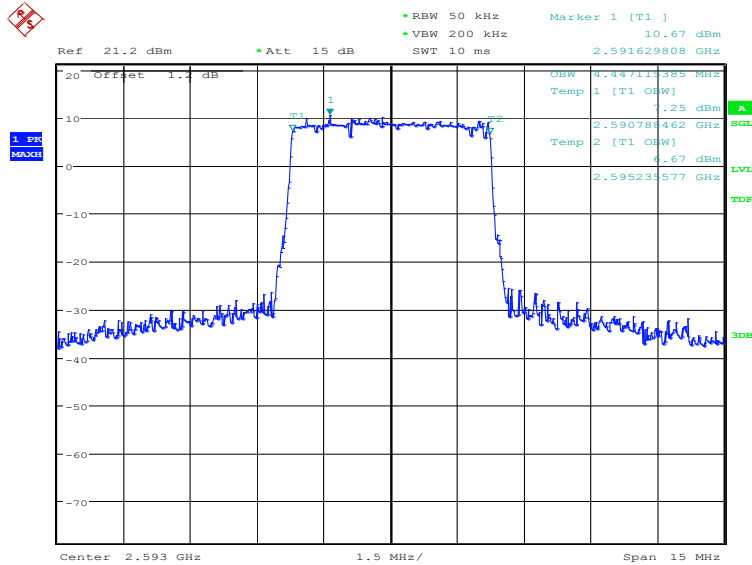
Frequency(MHz)	Occupied Bandwidth (99%)(kHz)	
2593.0	QPSK	16QAM
	4495.19	4447.12

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



Date: 5.JUL.2023 16:03:11

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

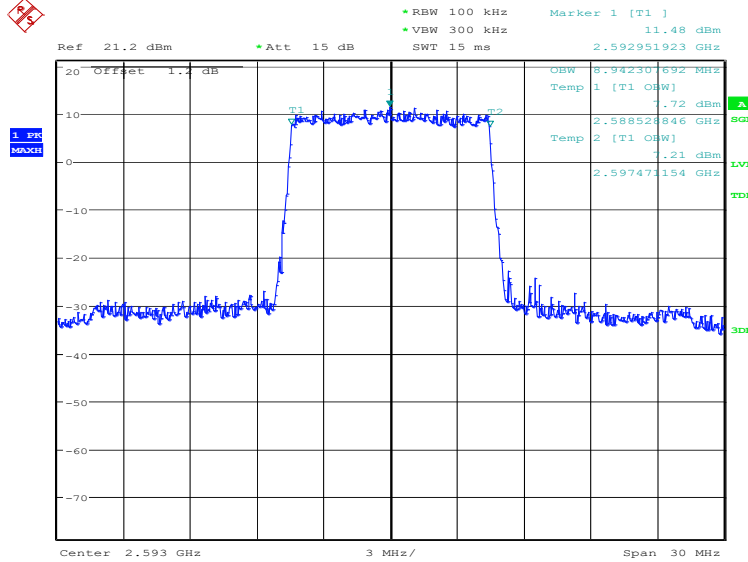


Date: 5.JUL.2023 16:03:51

**LTE band 41, 10MHz (99%)**

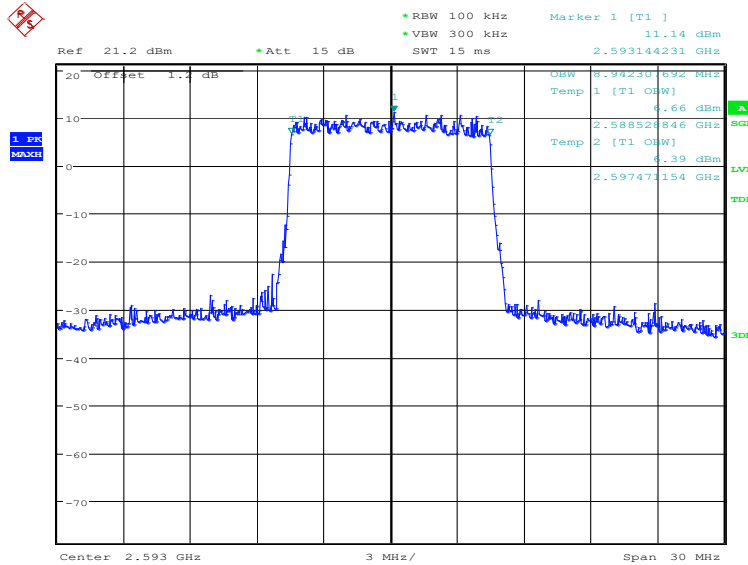
Frequency(MHz)	Occupied Bandwidth (99%)(kHz)	
2593.0	QPSK	16QAM
	8942.31	8942.31

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



Date: 5.JUL.2023 16:04:33

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

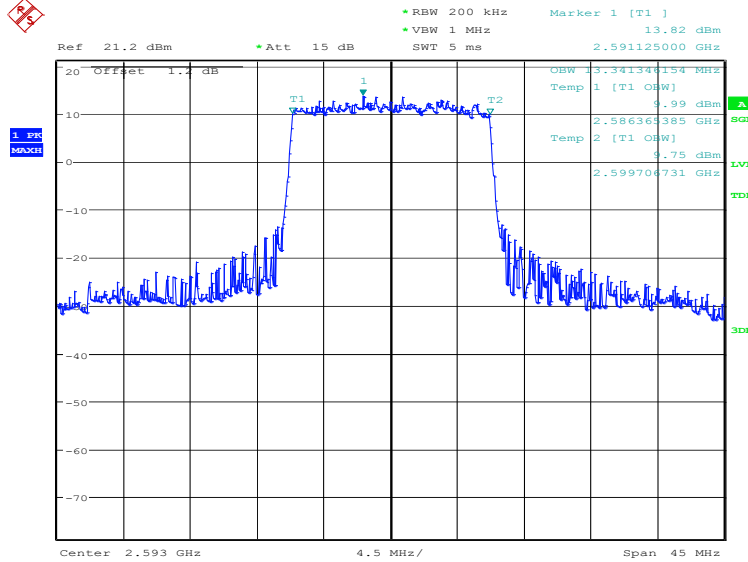


Date: 5.JUL.2023 16:05:14

**LTE band 41, 15MHz (99%)**

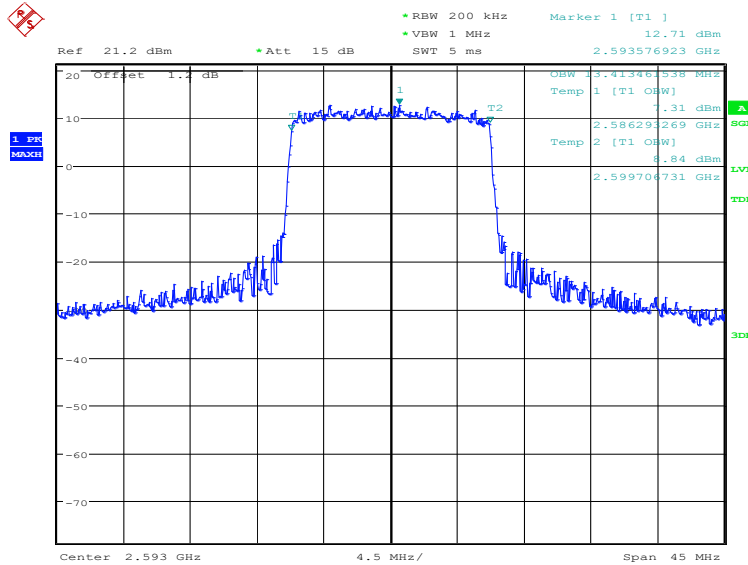
Frequency(MHz)	Occupied Bandwidth (99%)(kHz)	
2593.0	QPSK	16QAM
	13341.35	13413.46

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



Date: 5.JUL.2023 16:05:56

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

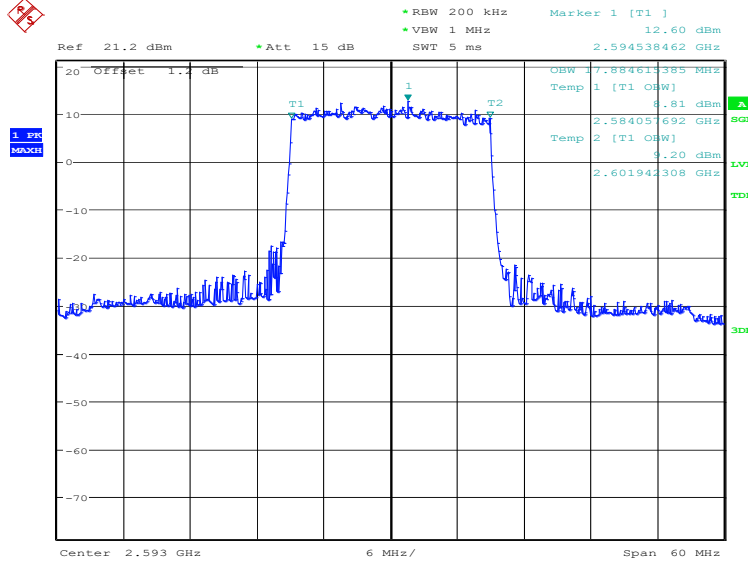


Date: 5.JUL.2023 16:06:36

**LTE band 41, 20MHz (99%)**

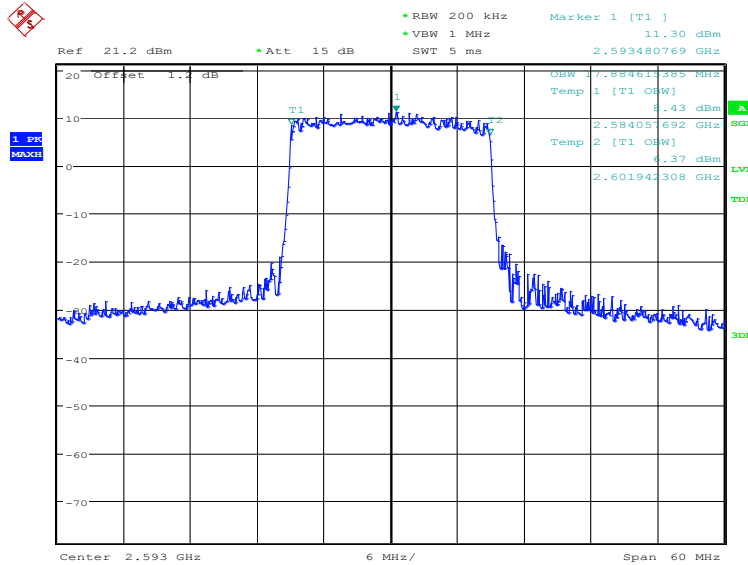
Frequency(MHz)	Occupied Bandwidth (99%)(kHz)	
2593.0	QPSK	16QAM
	17884.62	17884.62

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



Date: 5.JUL.2023 16:07:18

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



Date: 5.JUL.2023 16:07:59

Note: Expanded measurement uncertainty is  $U = 3428 \text{ Hz}$ ,  $k = 2$ .

## **A.5 Emission Bandwidth**

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. Table below lists the measured -26dBc BW. Spectrum analyzer plots are included on the following pages.

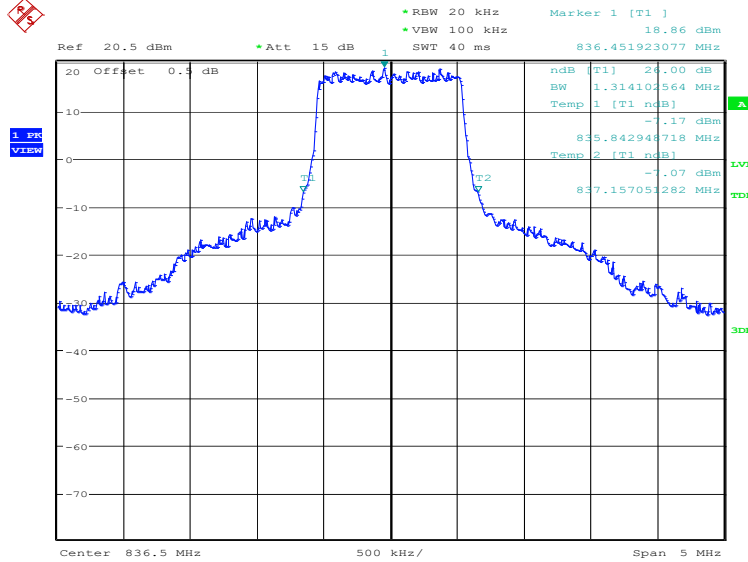
The measurement method is from ANSI C63.26:

- a) The spectrum analyzer center frequency is set to the nominal EUT channel center frequency. The span range for the spectrum analyzer shall be wide enough to see sufficient roll off of the signal to make the measurement.
- b) The nominal RBW shall be in the range of 1% to 5% of the anticipated OBW, and the VBW shall be set  $\geq 3 \times$  RBW.
- c) Set the reference level of the instrument as required to prevent the signal amplitude from exceeding the maximum spectrum analyzer input mixer level for linear operation.
- d) The dynamic range of the spectrum analyzer at the selected RBW shall be more than 10 dB below the target “-X dB” requirement, i.e., if the requirement calls for measuring the -26 dB OBW, the spectrum analyzer noise floor at the selected RBW shall be at least 36 dB below the reference level.
- e) Set spectrum analyzer detection mode to peak, and the trace mode to max hold.

**LTE band 5, 1.4MHz (-26dBc)**

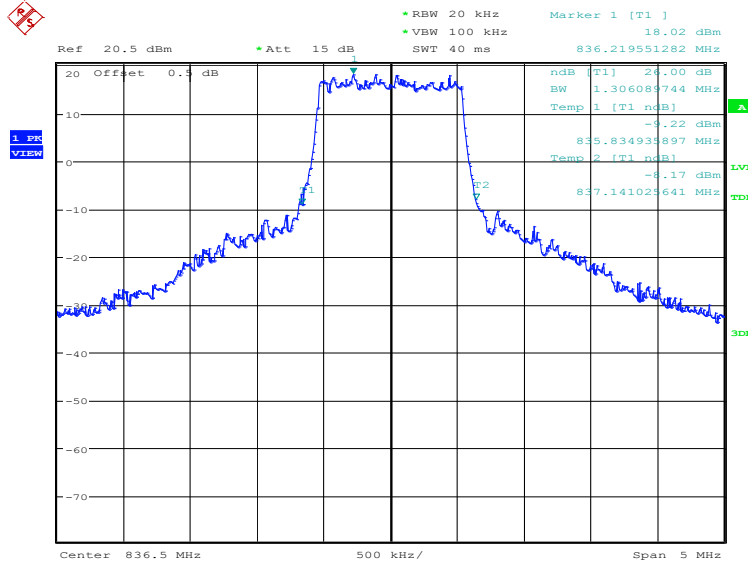
Frequency(MHz)	Emission Bandwidth (-26dBc)(kHz)	
	836.5	QPSK
	1314.10	1306.09

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



Date: 5.JUL.2023 16:09:18

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

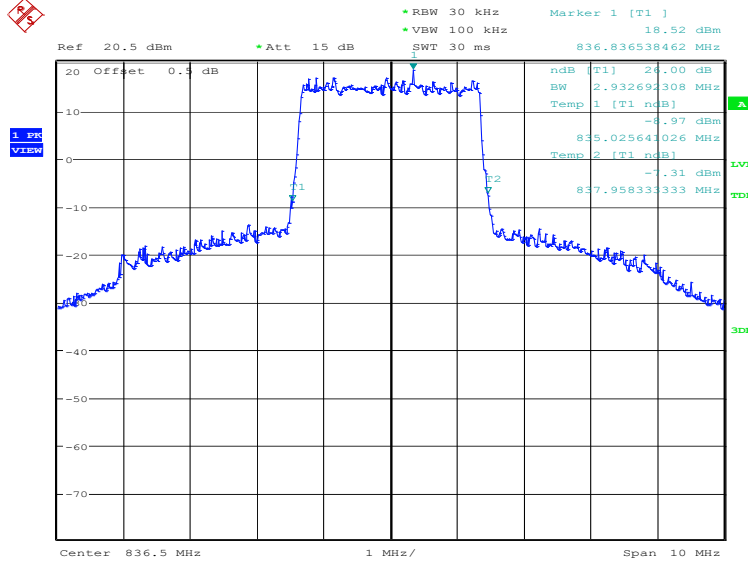


Date: 5.JUL.2023 16:09:59

### LTE band 5, 3MHz (-26dBc)

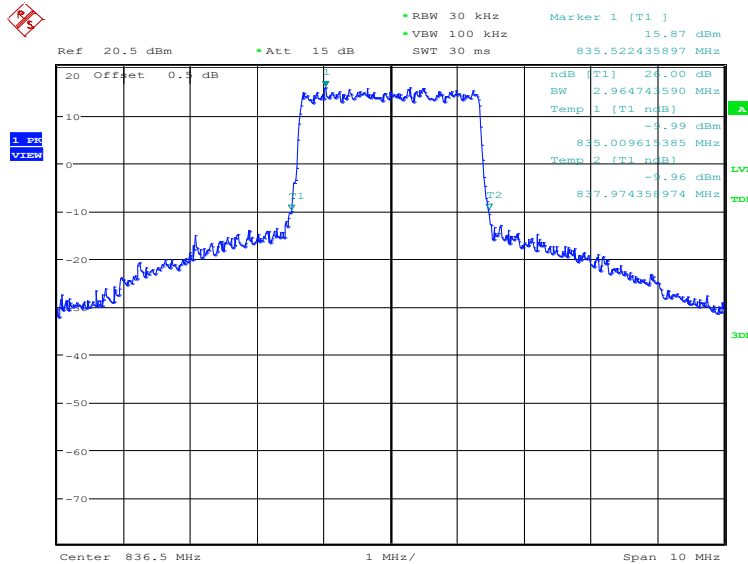
Frequency(MHz)	Emission Bandwidth (-26dBc)(kHz)	
836.5	QPSK	16QAM
	2932.69	2964.74

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



Date: 5.JUL.2023 16:10:41

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

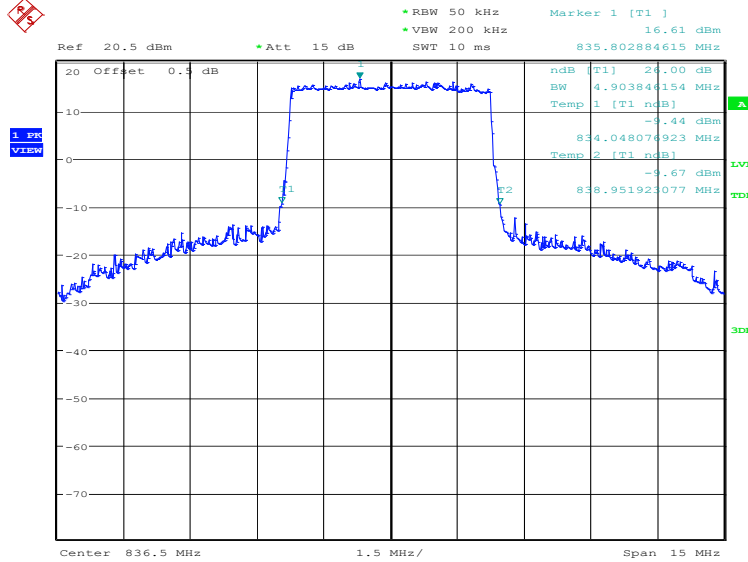


Date: 5.JUL.2023 16:11:22

**LTE band 5, 5MHz (-26dBc)**

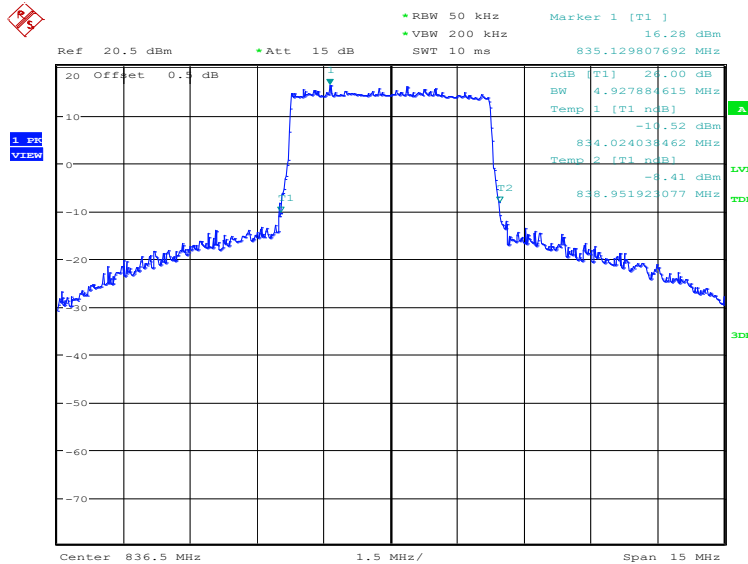
Frequency(MHz)	Emission Bandwidth (-26dBc)(kHz)	
836.5	QPSK	16QAM
	4903.85	4927.88

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



Date: 5.JUL.2023 16:12:04

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



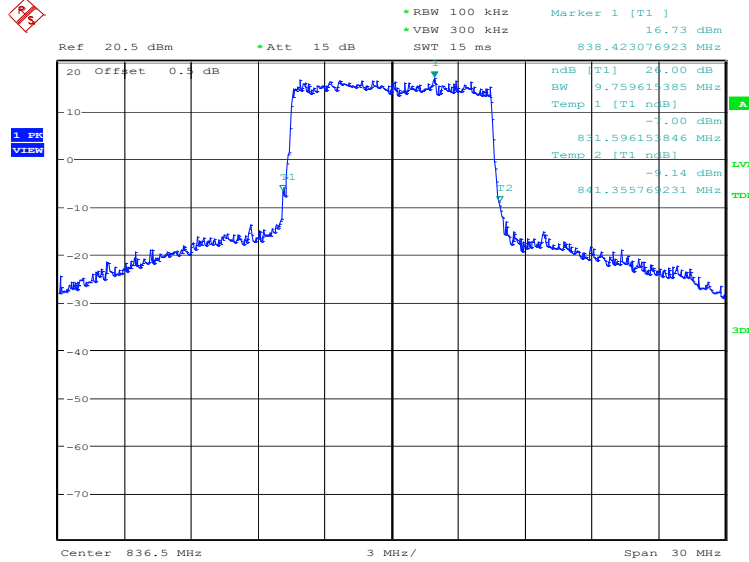
Date: 5.JUL.2023 16:12:45



### LTE band 5, 10MHz (-26dBc)

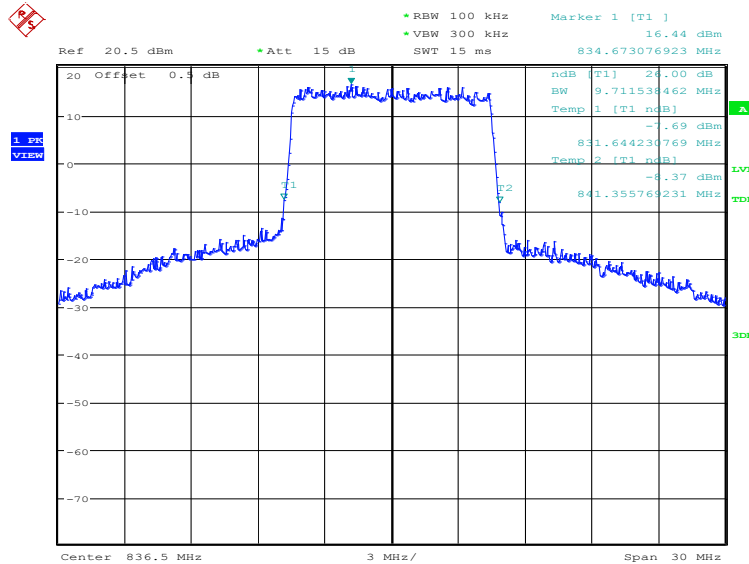
Frequency(MHz)	Emission Bandwidth (-26dBc)(kHz)	
836.5	QPSK	16QAM
	9759.62	9711.54

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



Date: 5.JUL.2023 16:13:27

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

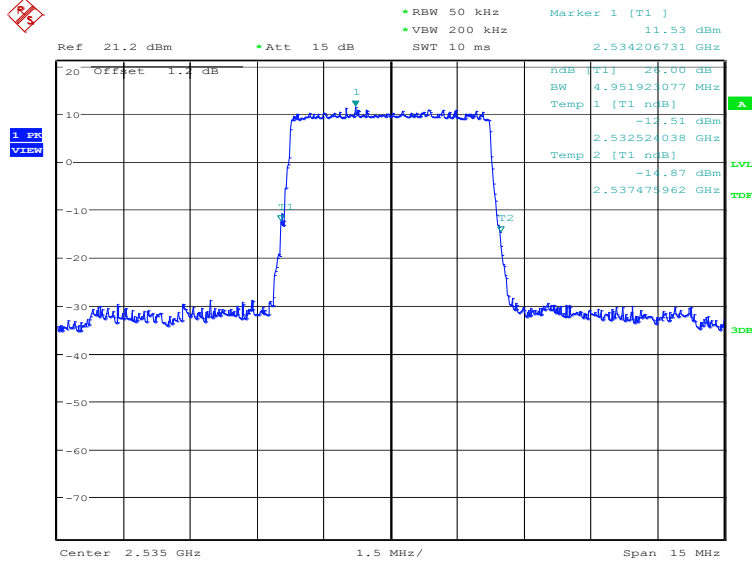


Date: 5.JUL.2023 16:14:08

**LTE band 7, 5MHz (-26dBc)**

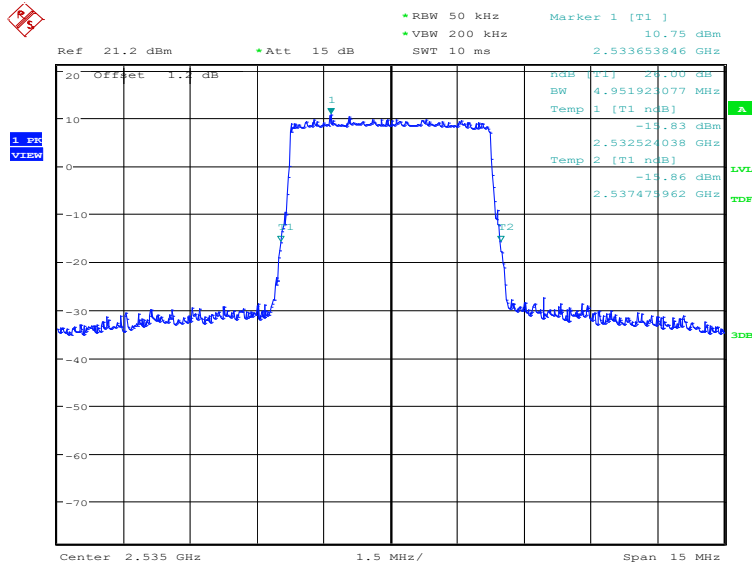
Frequency(MHz)	Emission Bandwidth (-26dBc)(kHz)	
2535.0	QPSK	16QAM
	4951.92	4951.92

**LTE band 7, 5MHz Bandwidth, QPSK (-26dBc BW)**



Date: 5.JUL.2023 16:14:51

**LTE band 7, 5MHz Bandwidth, 16QAM (-26dBc BW)**

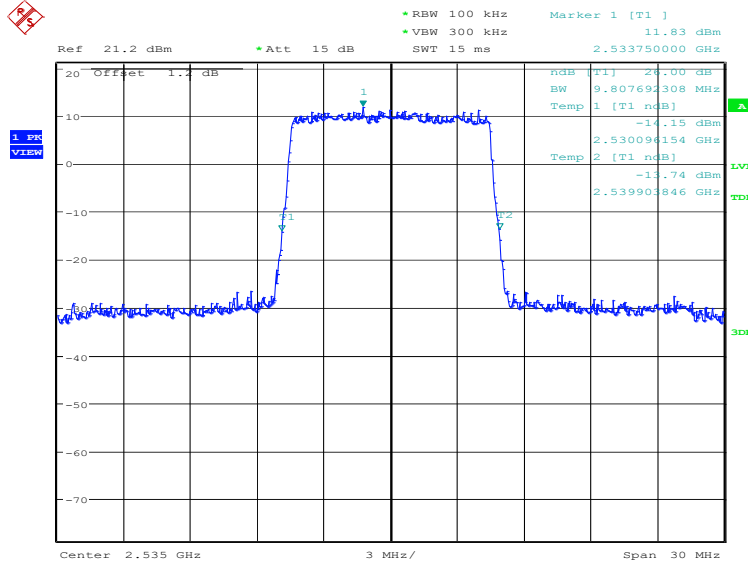


Date: 5.JUL.2023 16:15:32

**LTE band 7, 10MHz (-26dBc)**

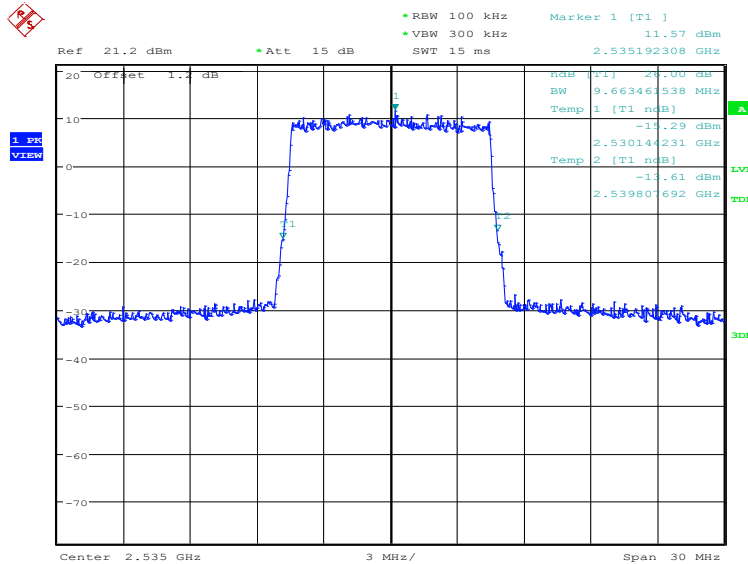
Frequency(MHz)	Emission Bandwidth (-26dBc)(kHz)	
2535.0	QPSK	16QAM
	9807.69	9663.46

**LTE band 7, 10MHz Bandwidth, QPSK (-26dBc BW)**



Date: 5.JUL.2023 16:16:14

**LTE band 7, 10MHz Bandwidth, 16QAM (-26dBc BW)**

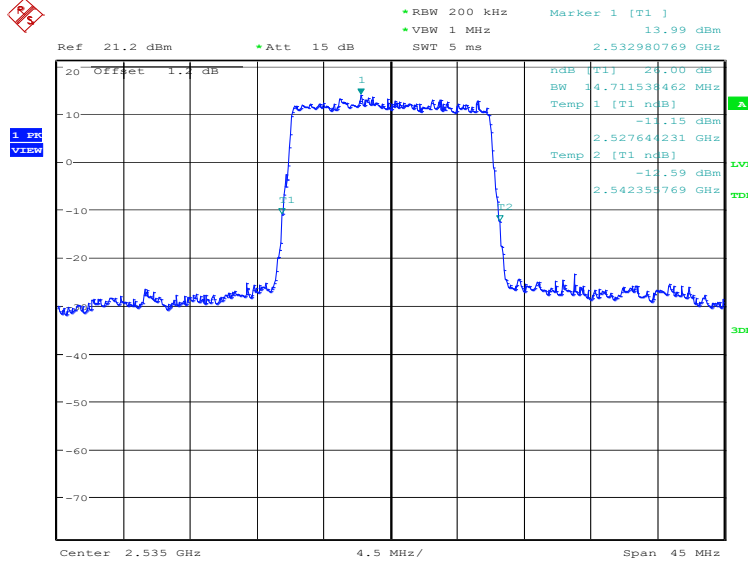


Date: 5.JUL.2023 16:16:55

**LTE band 7, 15MHz (-26dBc)**

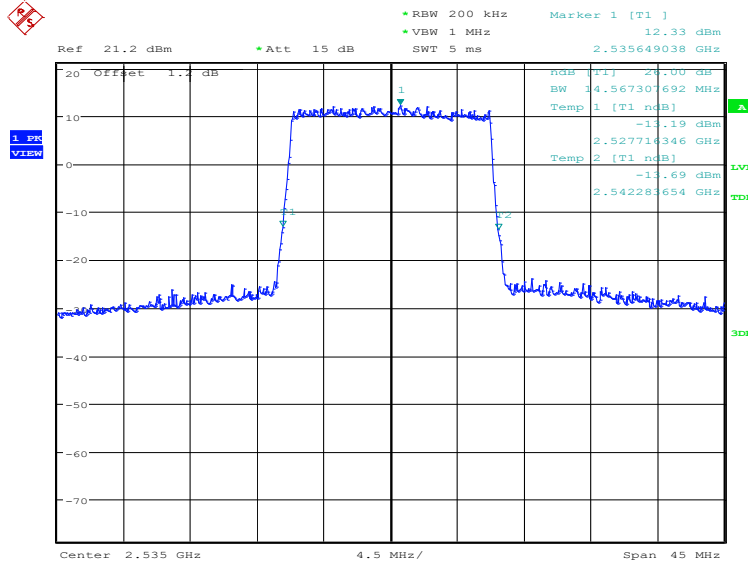
Frequency(MHz)	Emission Bandwidth (-26dBc)(kHz)	
2535.0	QPSK	16QAM
	14711.54	14567.31

**LTE band 7, 15MHz Bandwidth, QPSK (-26dBc BW)**



Date: 5.JUL.2023 16:17:38

**LTE band 7, 15MHz Bandwidth, 16QAM (-26dBc BW)**

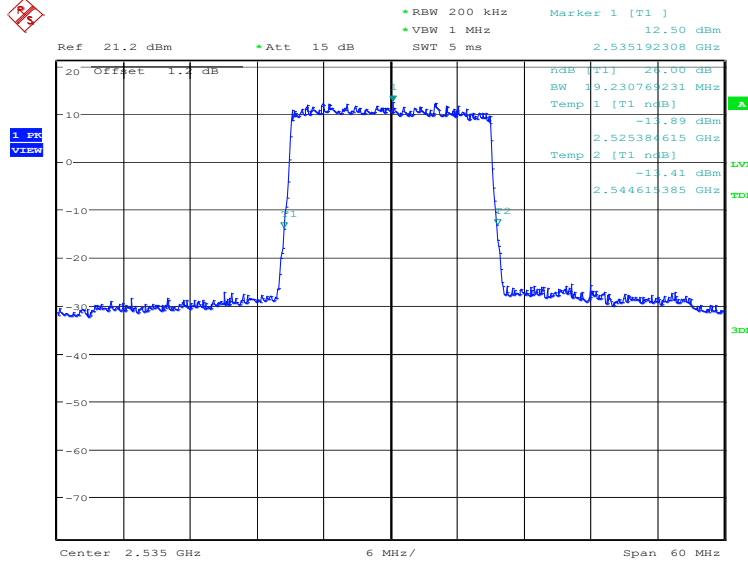


Date: 5.JUL.2023 16:18:18

**LTE band 7, 20MHz (-26dBc)**

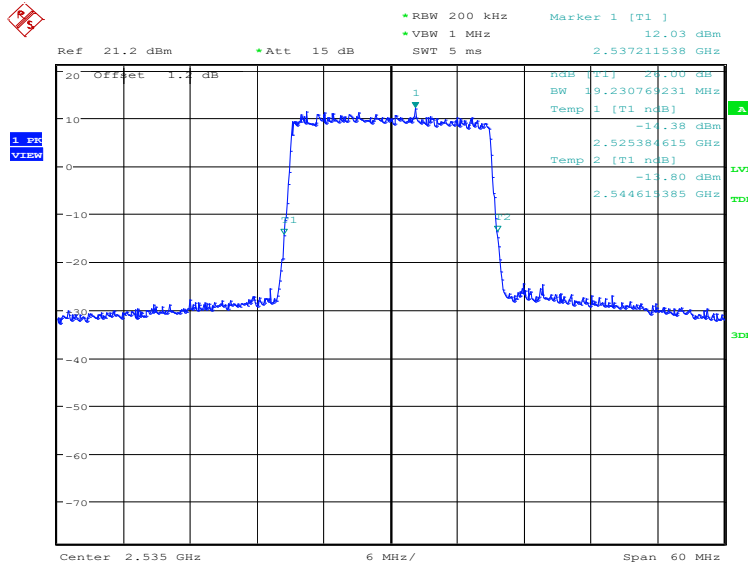
Frequency(MHz)	Emission Bandwidth (-26dBc)(kHz)	
2535.0	QPSK	16QAM
	19230.77	19230.77

**LTE band 7, 20MHz Bandwidth, QPSK (-26dBc BW)**



Date: 5.JUL.2023 16:19:01

**LTE band 7, 20MHz Bandwidth, 16QAM (-26dBc BW)**

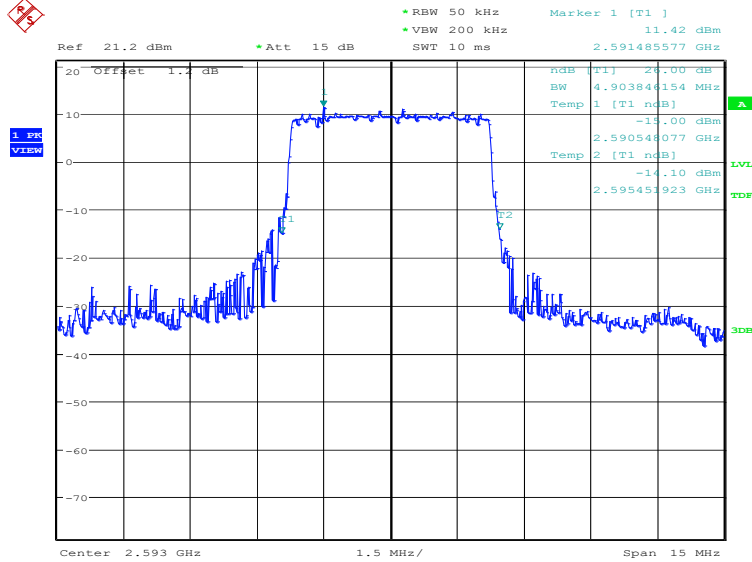


Date: 5.JUL.2023 16:19:41

**LTE band 41, 5MHz (-26dBc)**

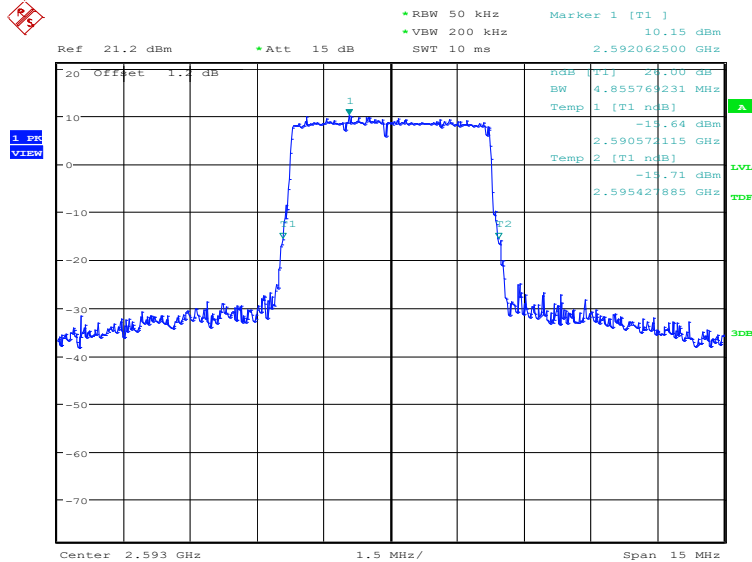
Frequency(MHz)	Emission Bandwidth (-26dBc)(kHz)	
2593.0	QPSK	16QAM
	4903.85	4855.77

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



Date: 5.JUL.2023 16:21:09

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

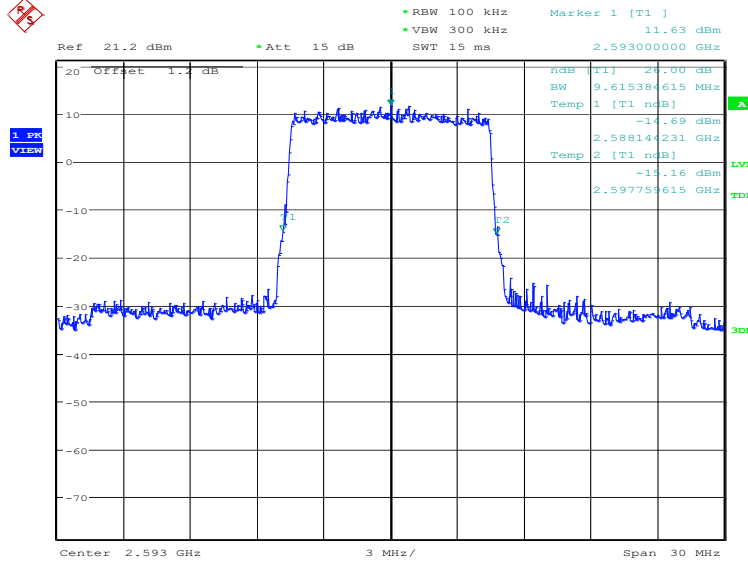


Date: 5.JUL.2023 16:21:50

**LTE band 41, 10MHz (-26dBc)**

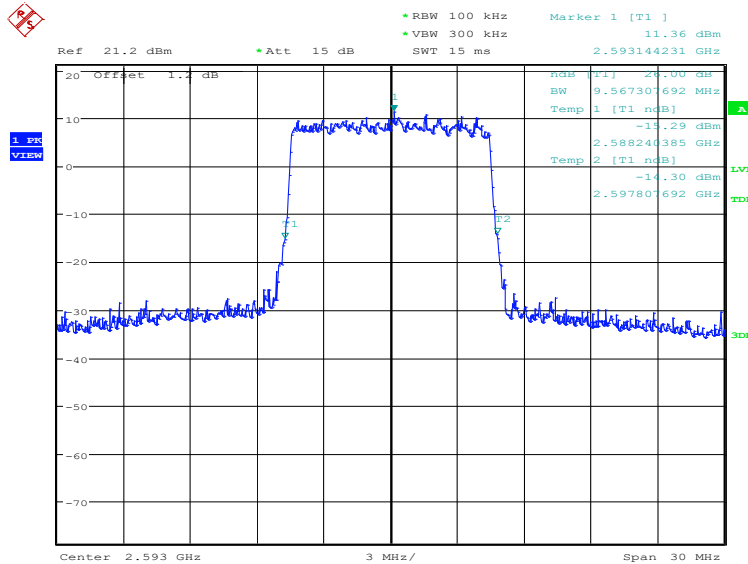
Frequency(MHz)	Emission Bandwidth (-26dBc)(kHz)	
2593.0	QPSK	16QAM
	9615.38	9567.31

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



Date: 5.JUL.2023 16:22:32

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

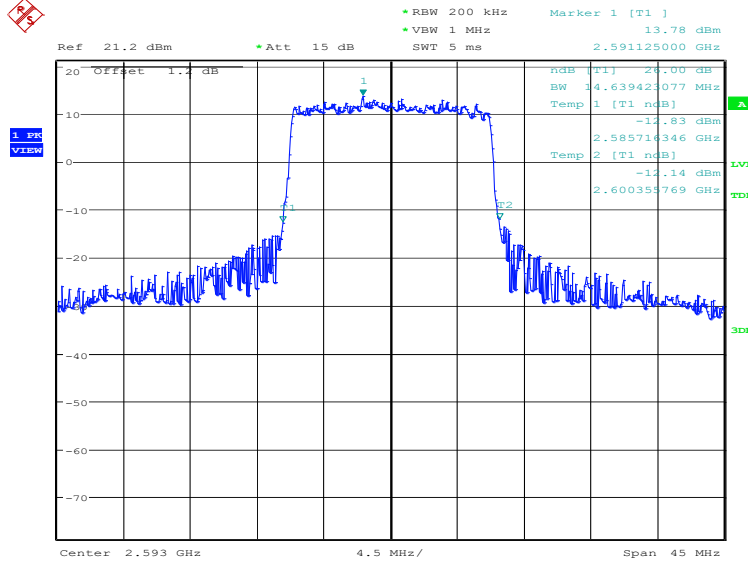


Date: 5.JUL.2023 16:23:13

**LTE band 41, 15MHz (-26dBc)**

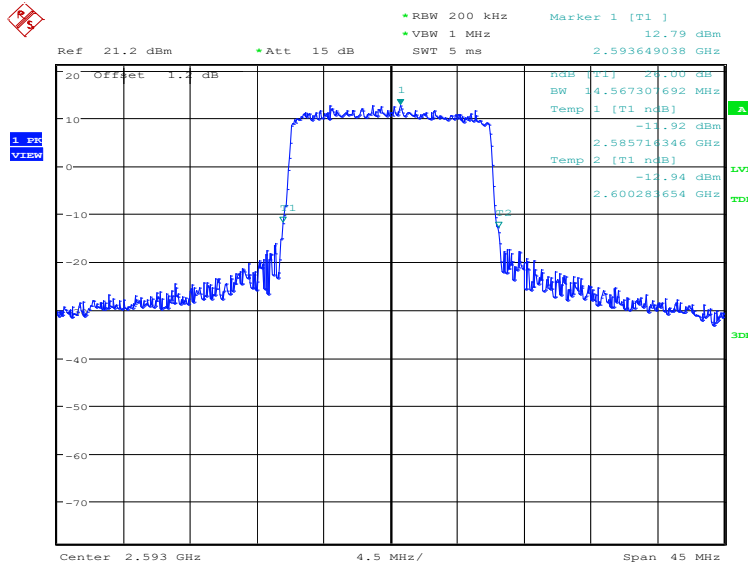
Frequency(MHz)	Emission Bandwidth (-26dBc)(kHz)	
2593.0	QPSK	16QAM
	14639.42	14567.31

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



Date: 5.JUL.2023 16:23:56

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



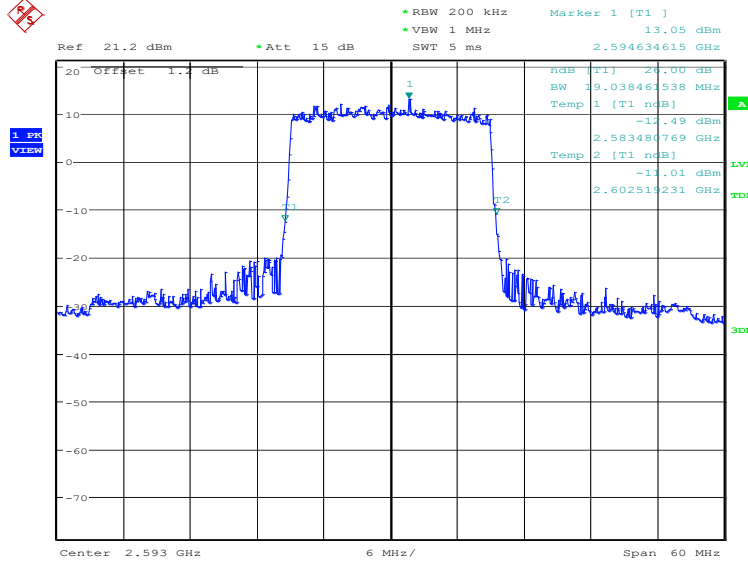
Date: 5.JUL.2023 16:24:36



**LTE band 41, 20MHz (-26dBc)**

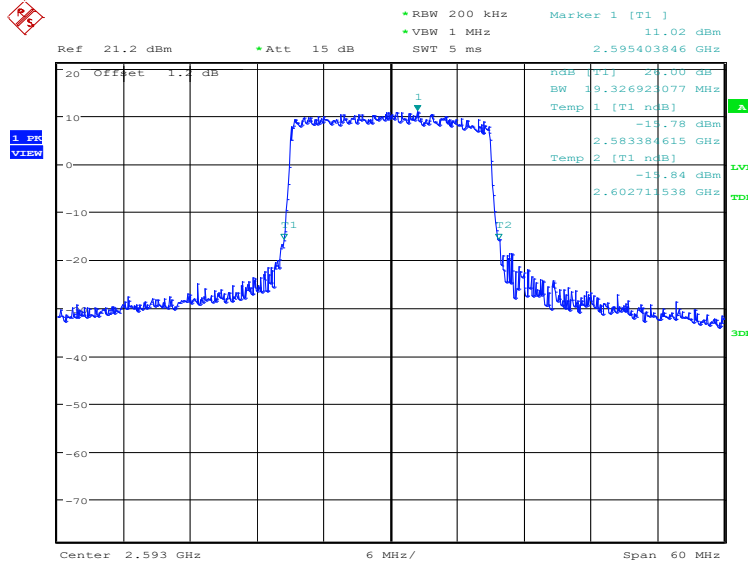
Frequency(MHz)	Emission Bandwidth (-26dBc)(kHz)	
2593.0	QPSK	16QAM
	19038.46	19326.92

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



Date: 5.JUL.2023 16:25:19

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



Date: 5.JUL.2023 16:26:00

Note: Expanded measurement uncertainty is  $U = 3428 \text{ Hz}$ ,  $k = 2$ .

## **A.6 Band Edge Compliance**

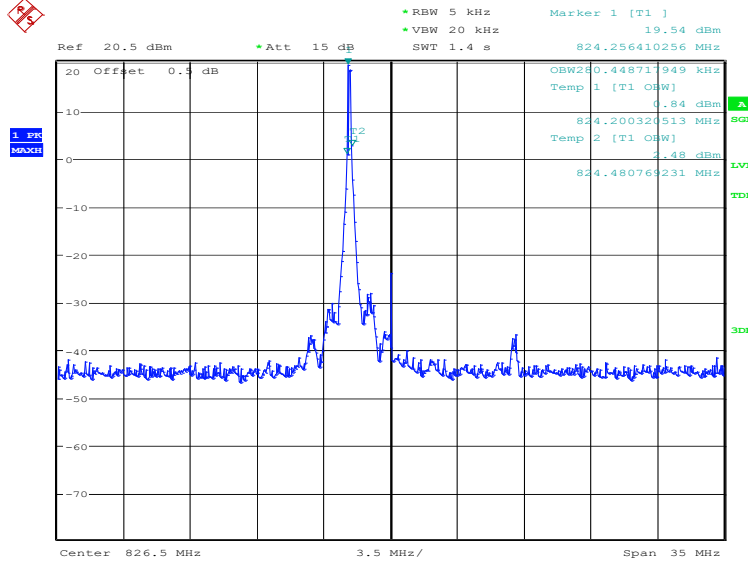
### **A.6.1 Measurement limit**

Part 22.917 specifies 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 than  $43 + 10 \log(P)$  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.

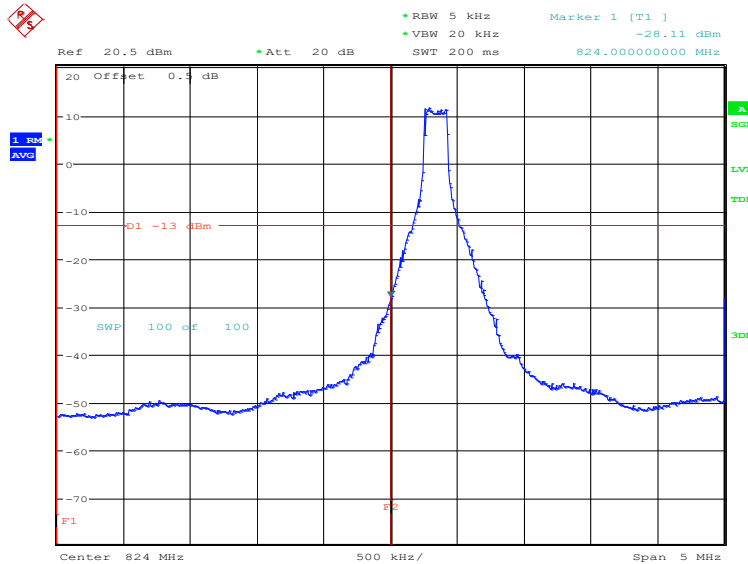
The spectrum analyzer readings are corrected by  $[10 \log(1/\text{duty cycle})]$  for the non-continuous transmitting scenario.

**A.6.2 Measurement result**  
**Only the worst case result is given below**  
**LTE band 5**  
**OBW: 1RB-low\_offset**



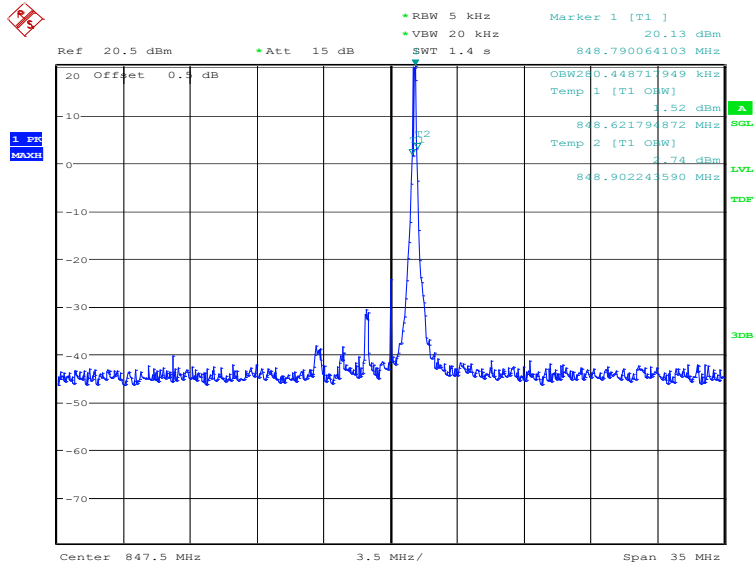
Date: 21.JUL.2023 11:23:31

**LOW BAND EDGE BLOCK-1RB-low\_offset**



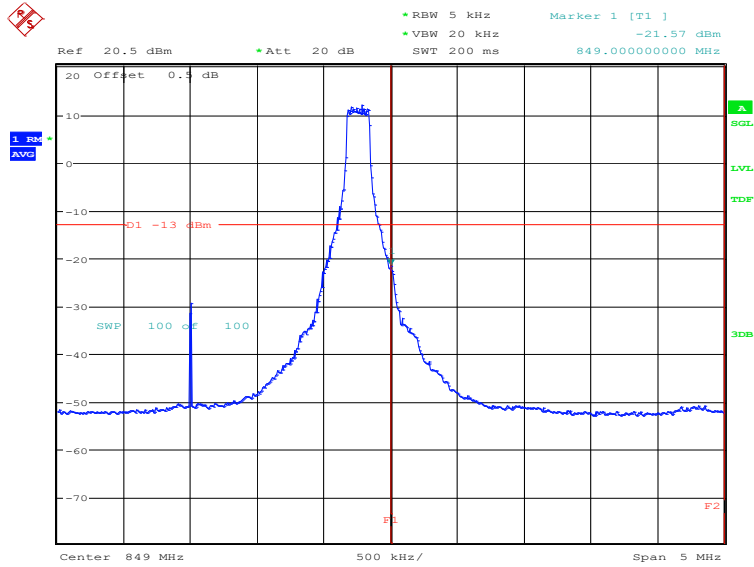
Date: 21.JUL.2023 11:24:46

**OBW: 1RB-high\_offset**



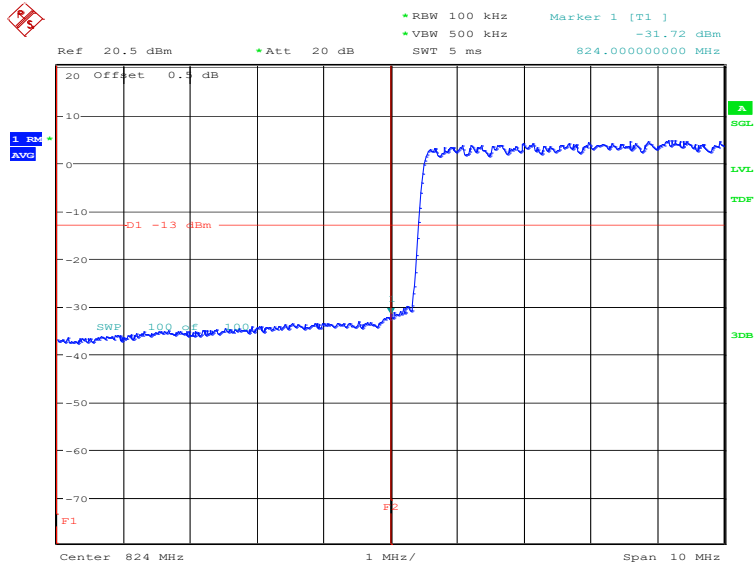
Date: 21.JUL.2023 11:26:05

**HIGH BAND EDGE BLOCK-1RB-high\_offset**



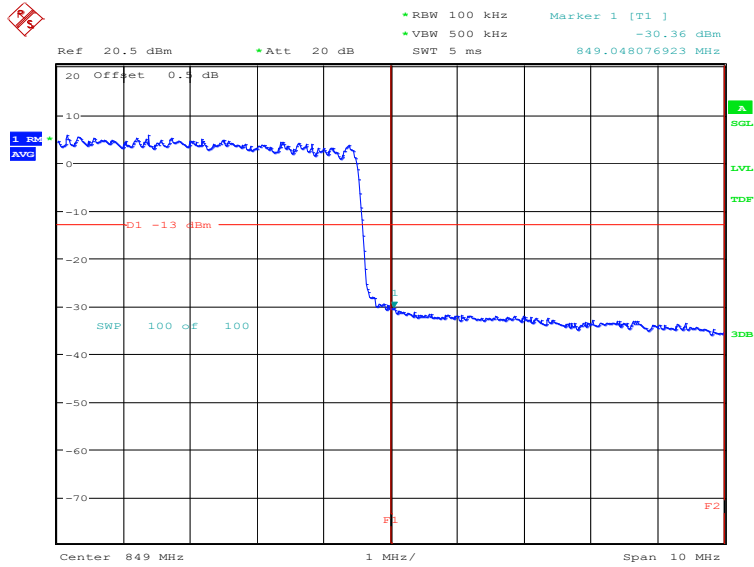
Date: 21.JUL.2023 11:27:19

### LOW BAND EDGE BLOCK-10MHz-100%RB



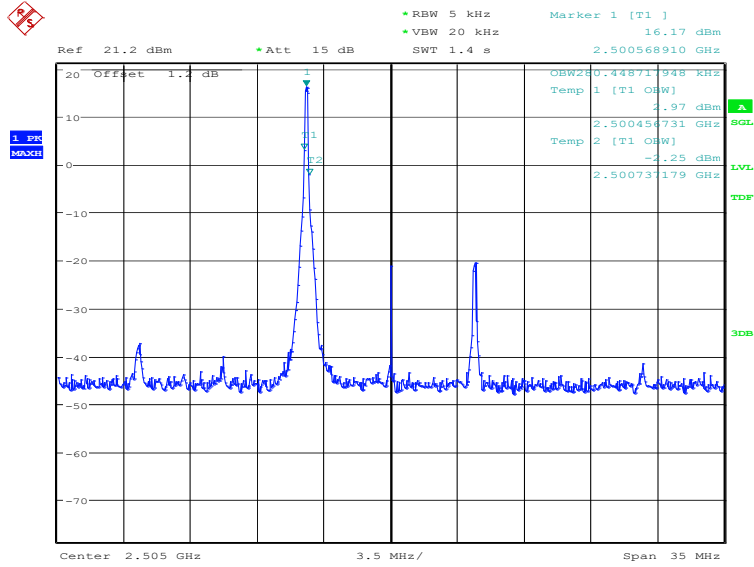
Date: 5.JUL.2023 16:27:26

### HIGH BAND EDGE BLOCK-10MHz-100%RB



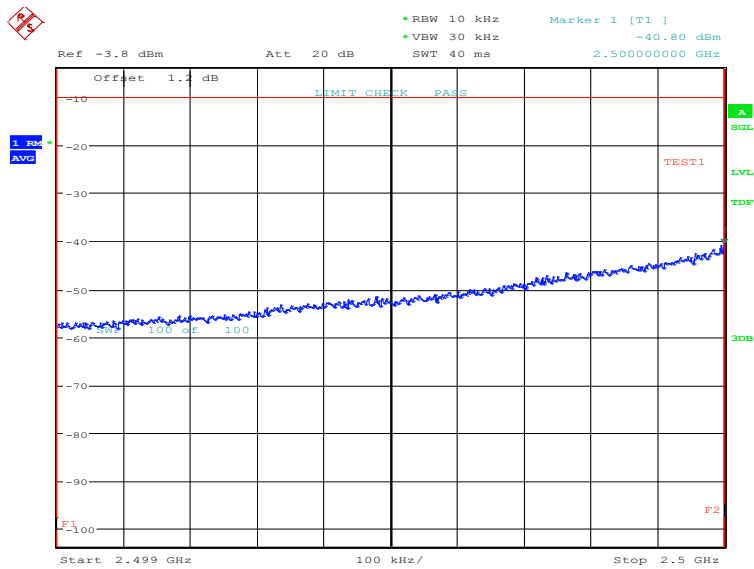
Date: 5.JUL.2023 16:28:58

**LTE band 7**  
**OBW: 1RB-low\_offset**

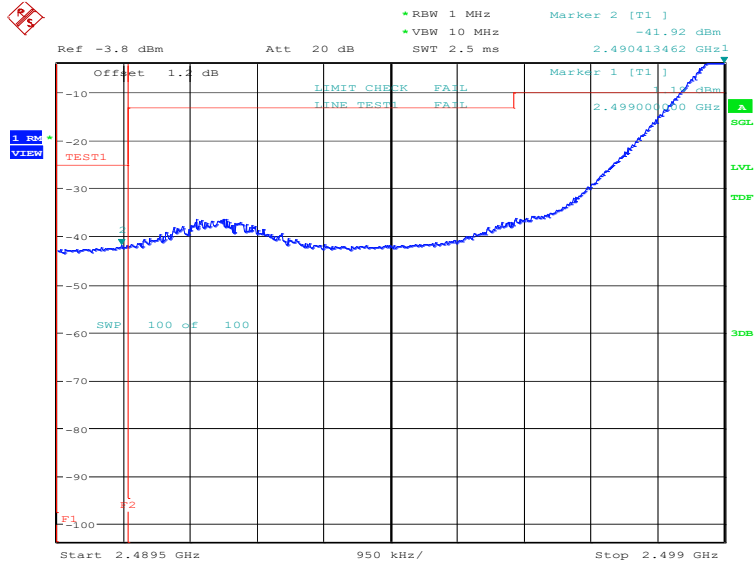


Date: 21.JUL.2023 11:28:53

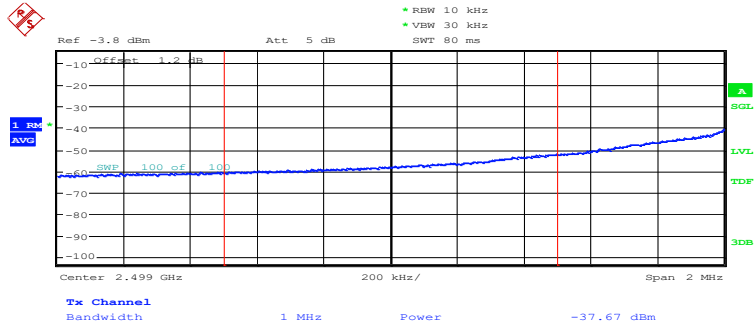
**LOW BAND EDGE BLOCK-1RB-low\_offset**



Date: 21.JUL.2023 11:30:15

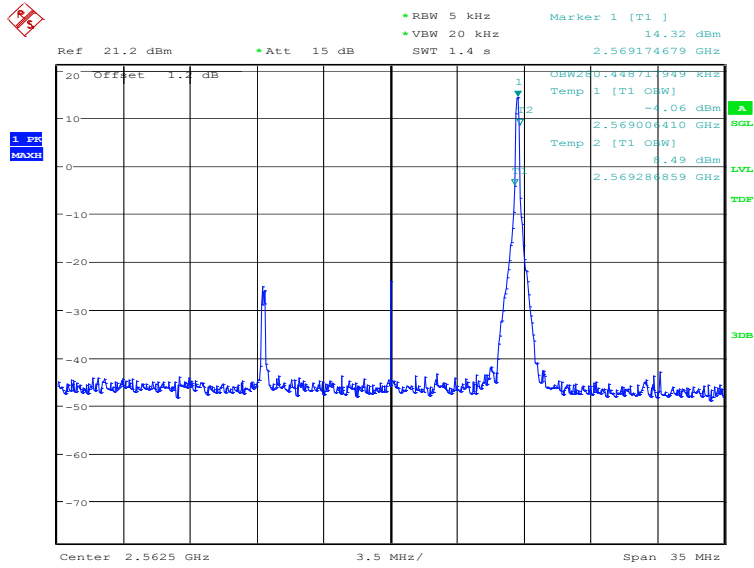


Date: 21.JUL.2023 11:32:04



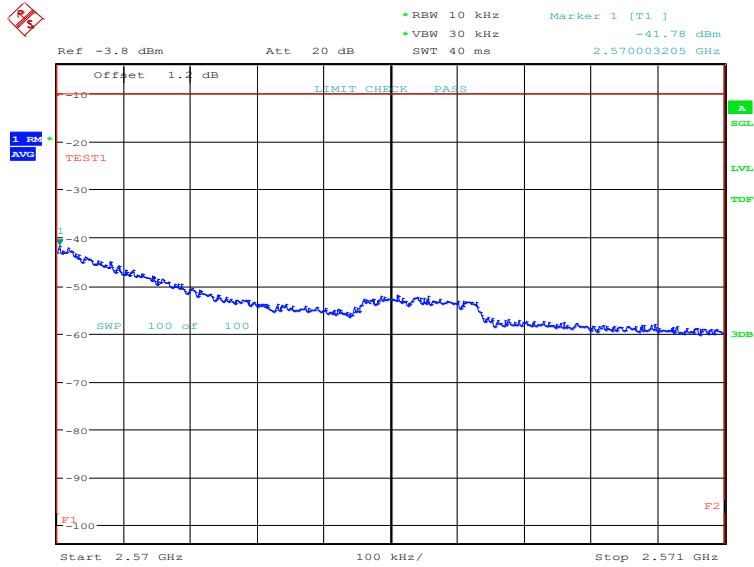
Date: 21.JUL.2023 11:32:32

### OBW: 1RB-high\_offset



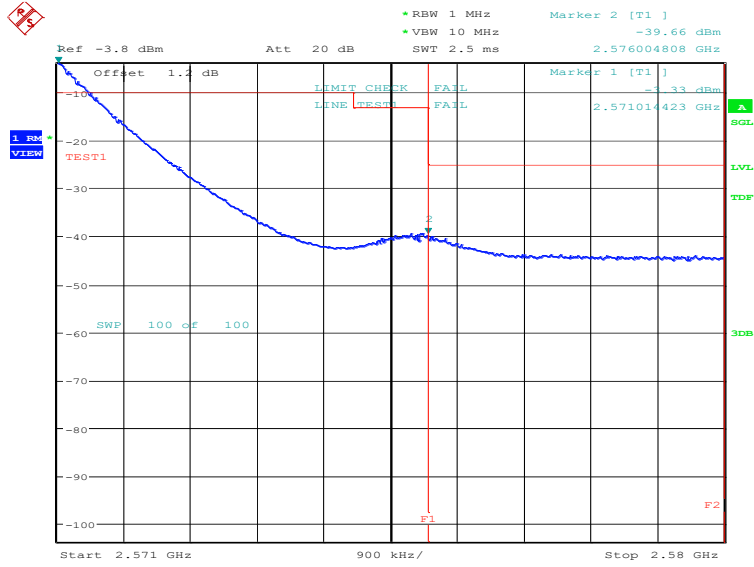
Date: 21.JUL.2023 11:33:09

### HIGH BAND EDGE BLOCK-1RB-high\_offset

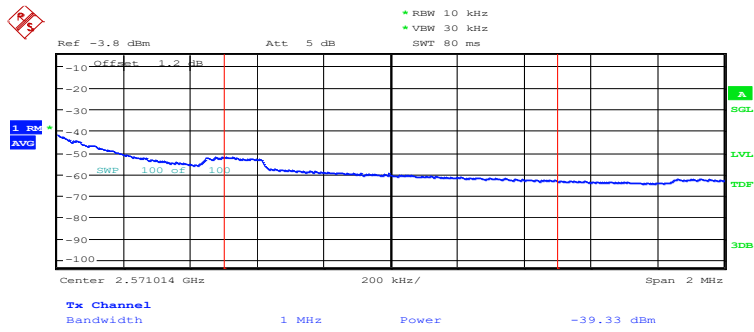


Date: 21.JUL.2023 11:34:30



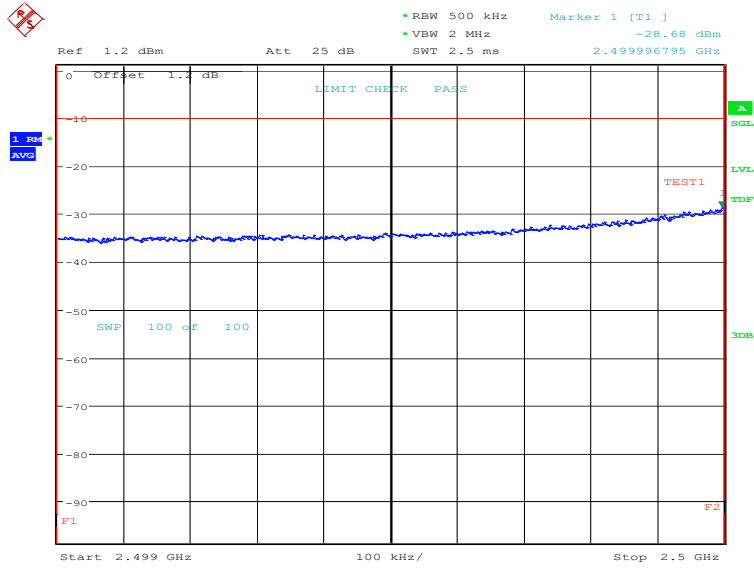


Date: 21.JUL.2023 11:36:19

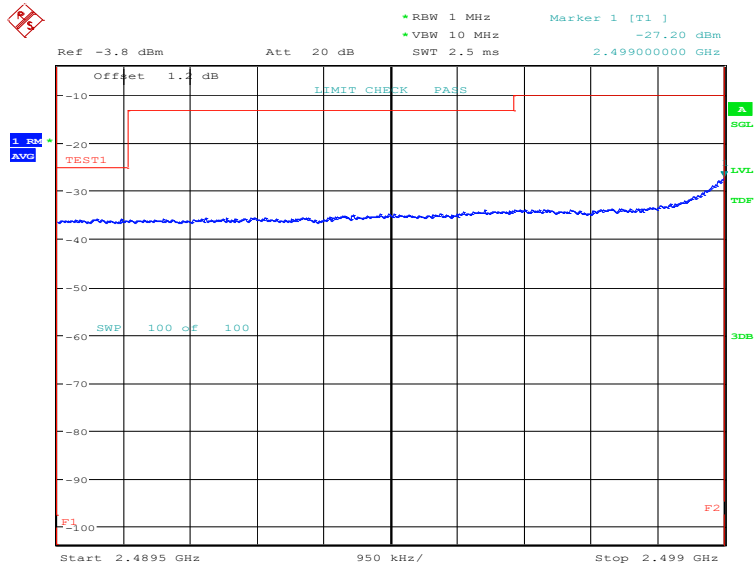


Date: 21.JUL.2023 11:36:47

### LOW BAND EDGE BLOCK-20MHz-100%RB

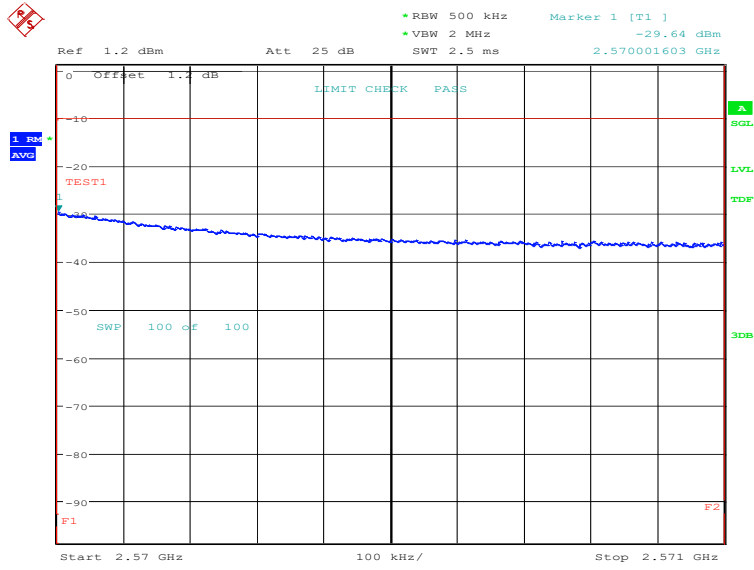


Date: 5.JUL.2023 16:31:58

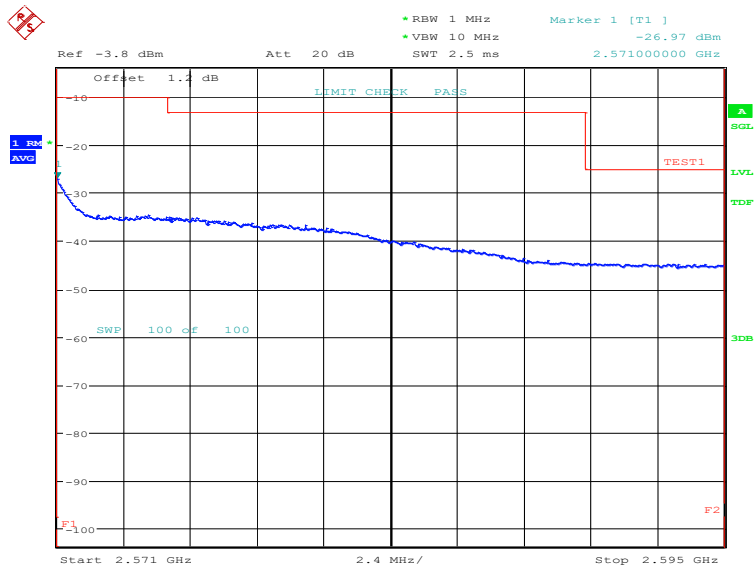


Date: 5.JUL.2023 16:33:39

### HIGH BAND EDGE BLOCK-20MHz-100%RB

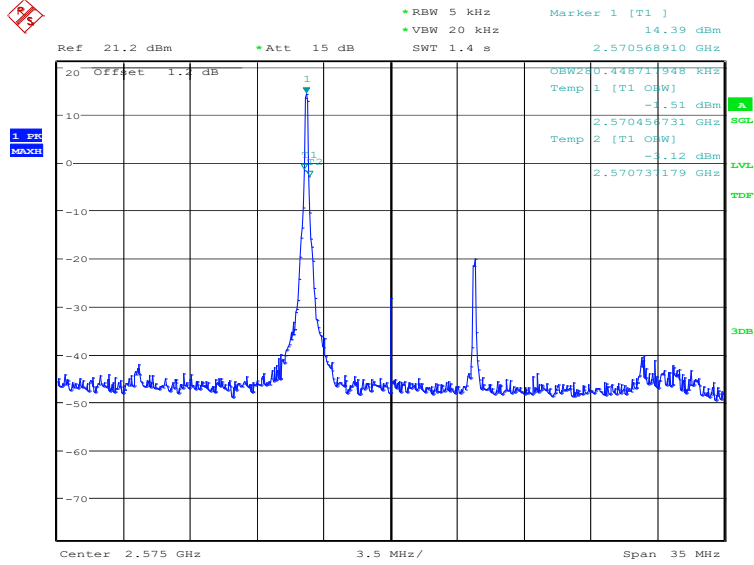


Date: 5.JUL.2023 16:36:38



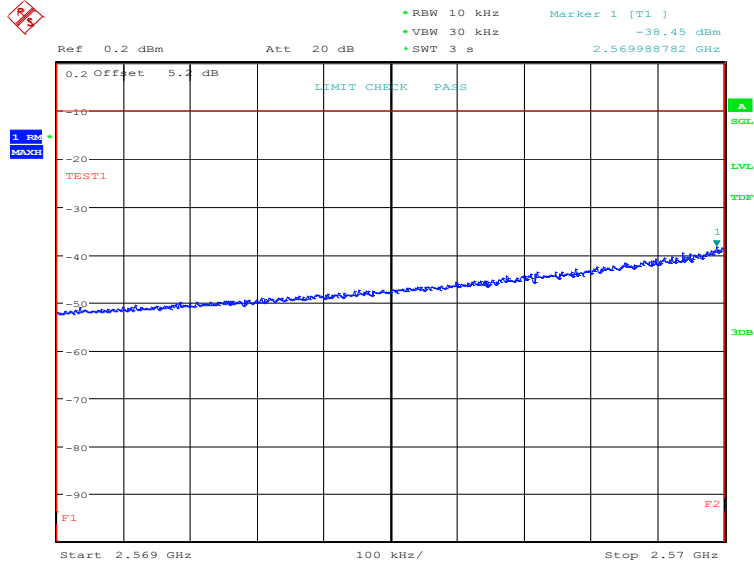
Date: 5.JUL.2023 16:38:19

**LTE band 38**  
**OBW: 1RB-low\_offset**

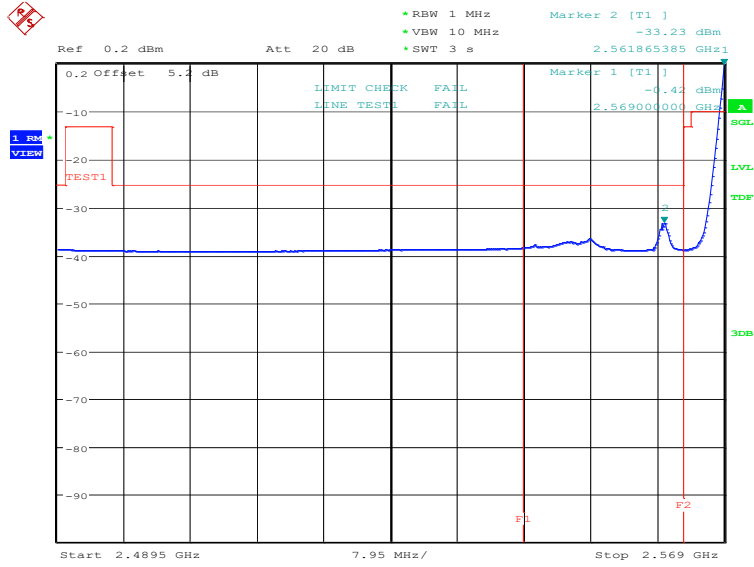


Date: 21.JUL.2023 11:38:09

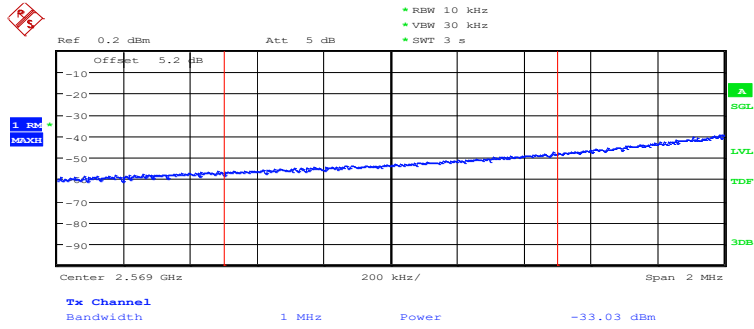
**LOW BAND EDGE BLOCK-1RB-low\_offset**



Date: 21.JUL.2023 11:38:51

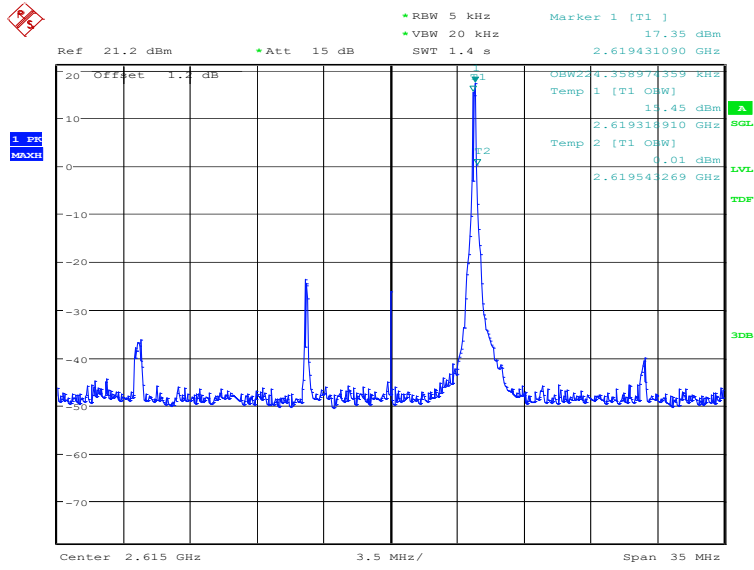


Date: 21.JUL.2023 11:39:38



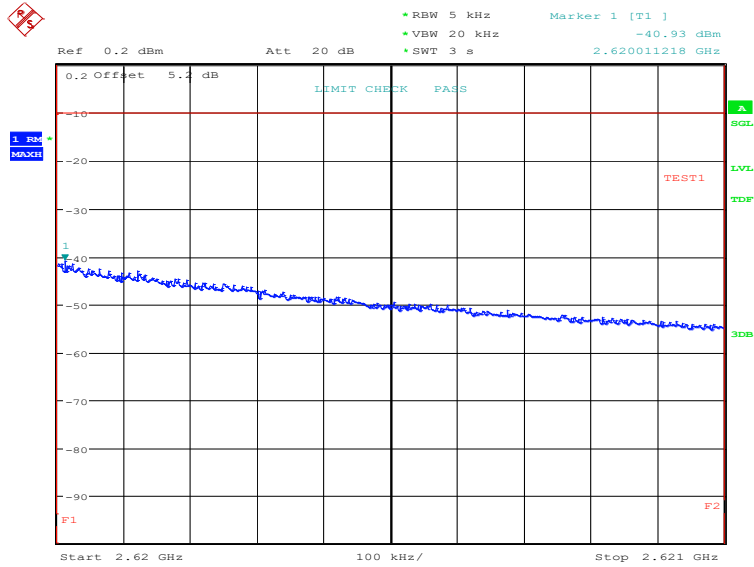
Date: 21.JUL.2023 11:39:55

### OBW: 1RB-high\_offset

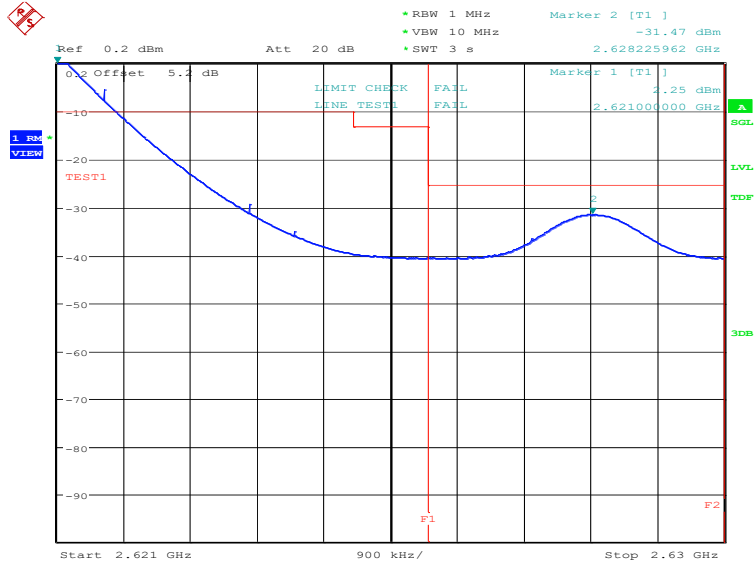


Date: 21.JUL.2023 11:40:31

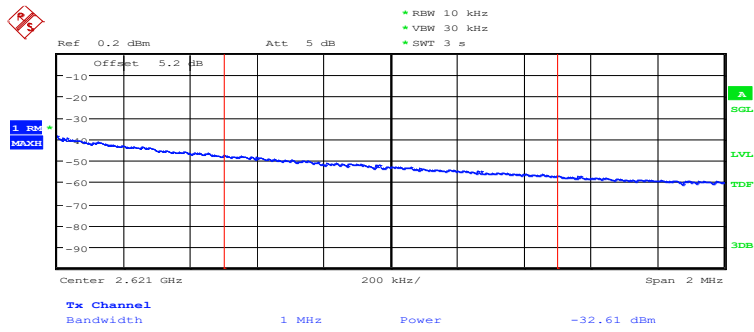
### HIGH BAND EDGE BLOCK-1RB-high\_offset



Date: 21.JUL.2023 11:41:13

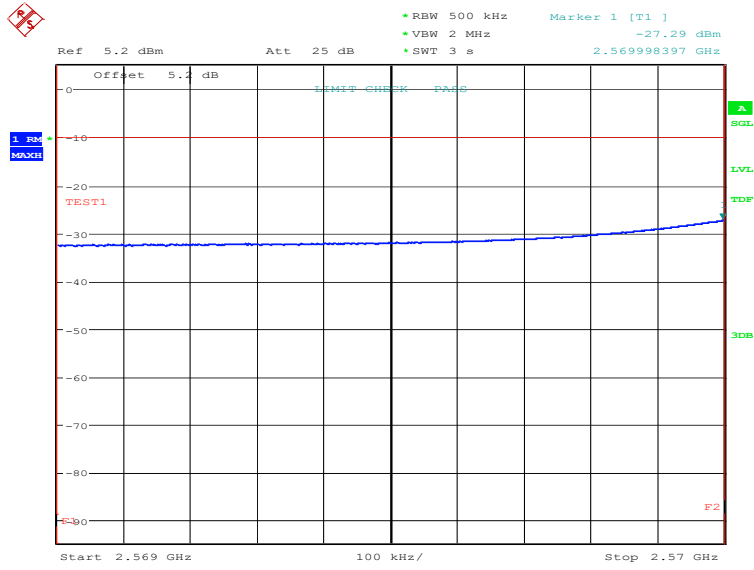


Date: 21.JUL.2023 11:42:00

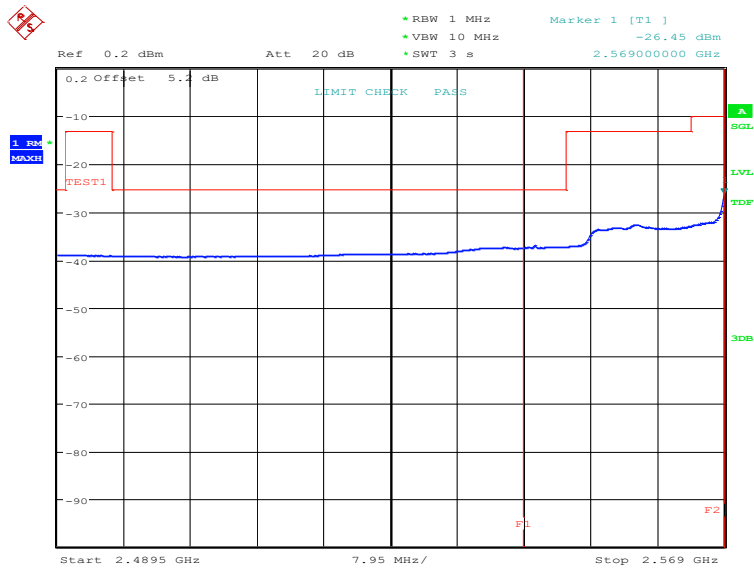


Date: 21.JUL.2023 11:42:17

### LOW BAND EDGE BLOCK-20MHz-100%RB



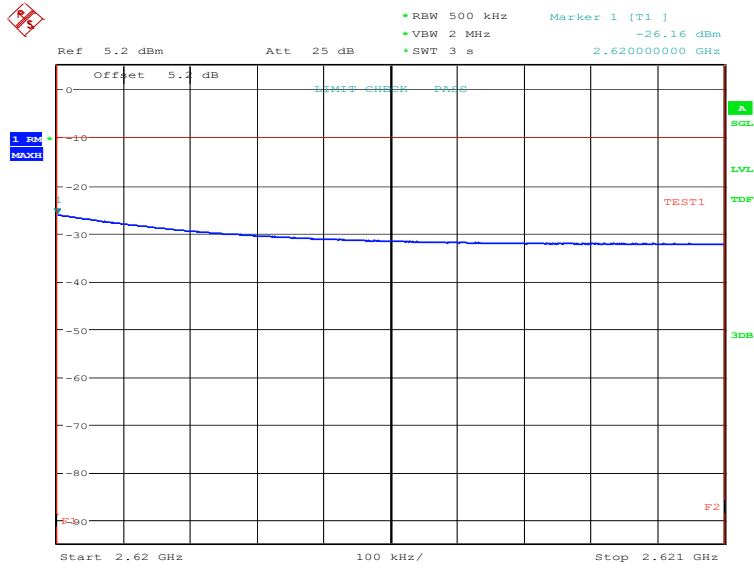
Date: 6.JUL.2023 08:35:18



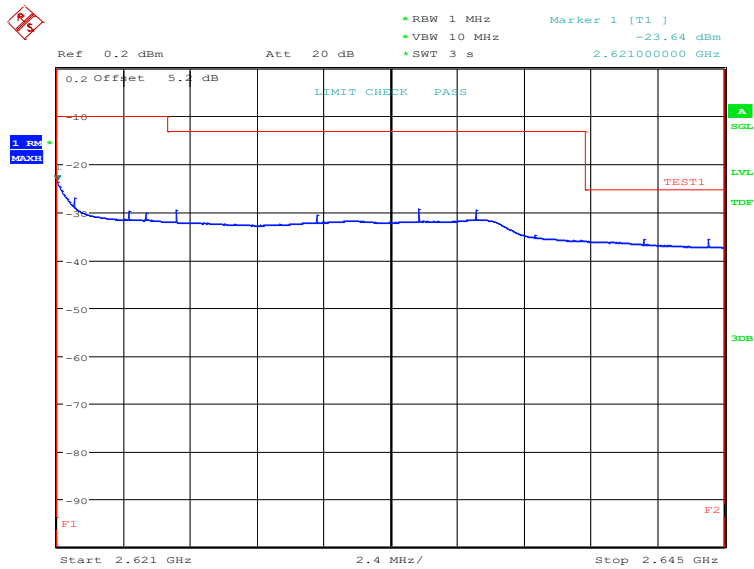
Date: 6.JUL.2023 08:35:57



### HIGH BAND EDGE BLOCK-20MHz-100%RB

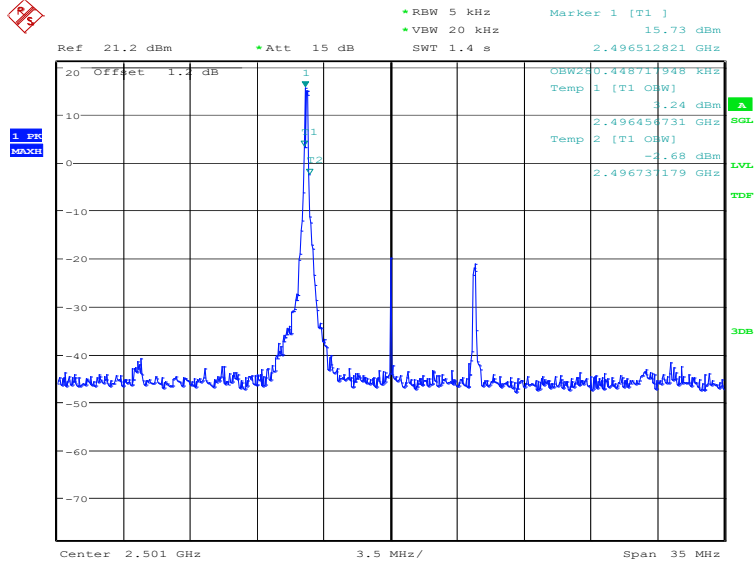


Date: 6.JUL.2023 08:37:52



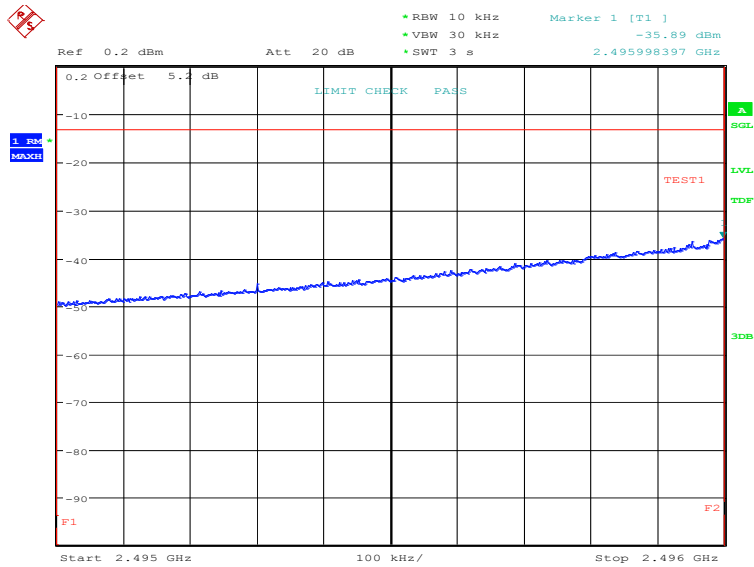
Date: 6.JUL.2023 08:38:31

**LTE band 41**  
**OBW: 1RB-low\_offset**

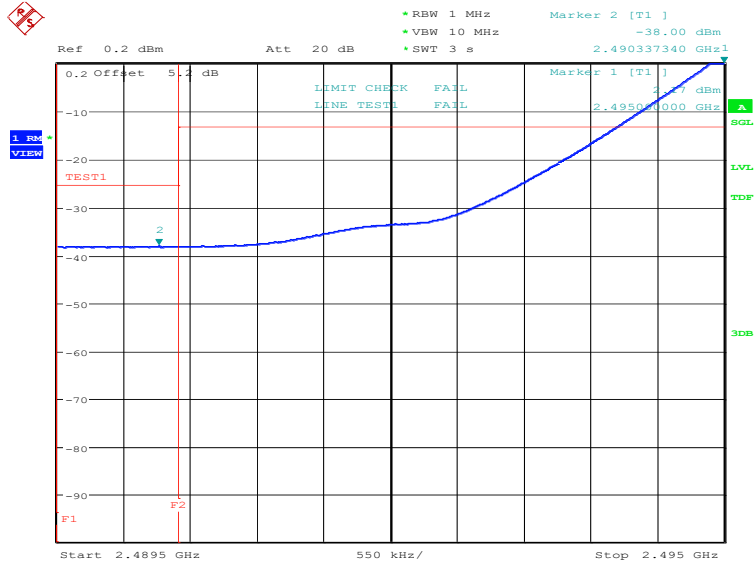


Date: 21.JUL.2023 11:42:55

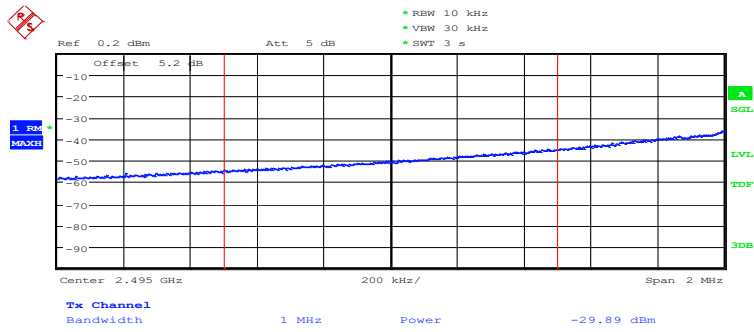
**LOW BAND EDGE BLOCK-1RB-low\_offset**



Date: 21.JUL.2023 11:43:36

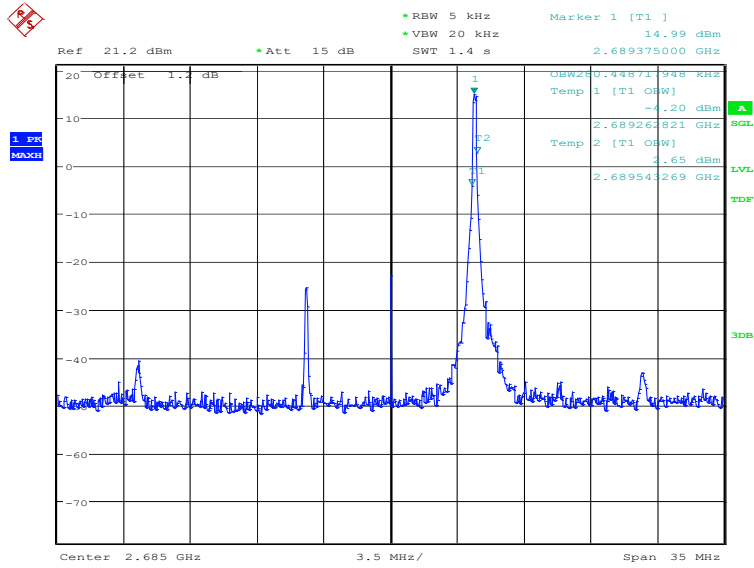


Date: 21.JUL.2023 11:44:21



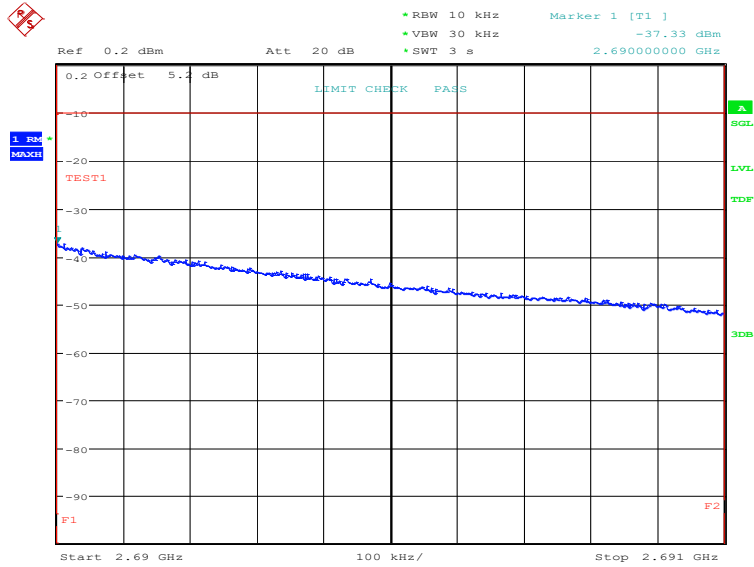
Date: 21.JUL.2023 11:44:38

### OBW: 1RB-high\_offset

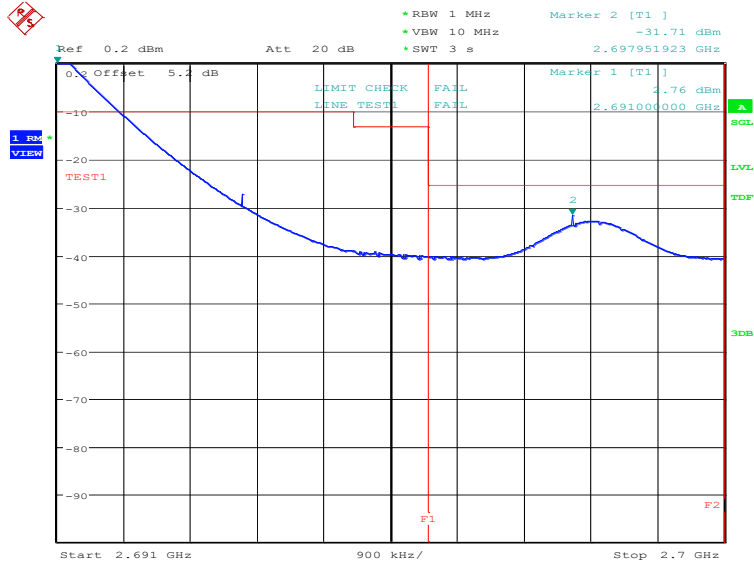


Date: 21.JUL.2023 11:45:14

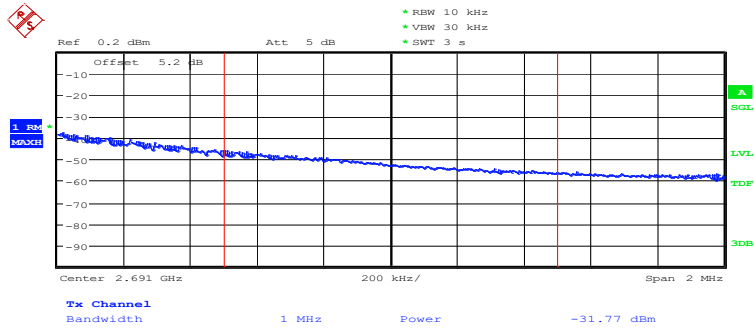
### HIGH BAND EDGE BLOCK-1RB-high\_offset



Date: 21.JUL.2023 11:45:56

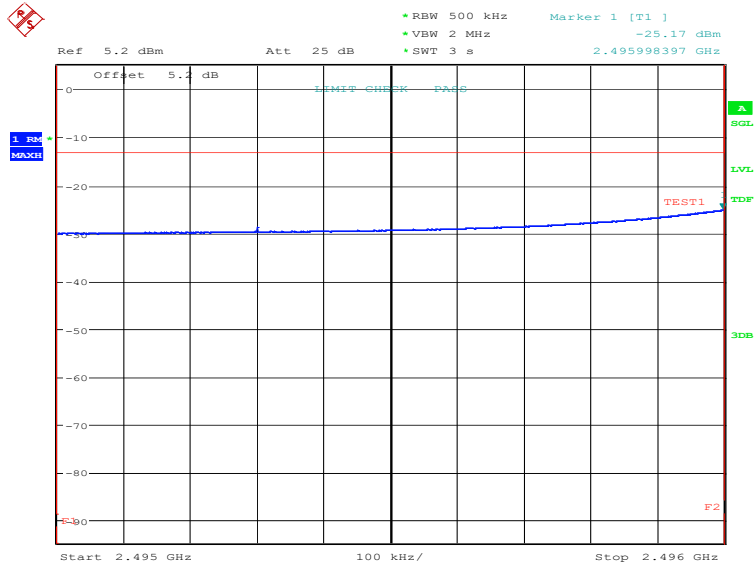


Date: 21.JUL.2023 11:46:43

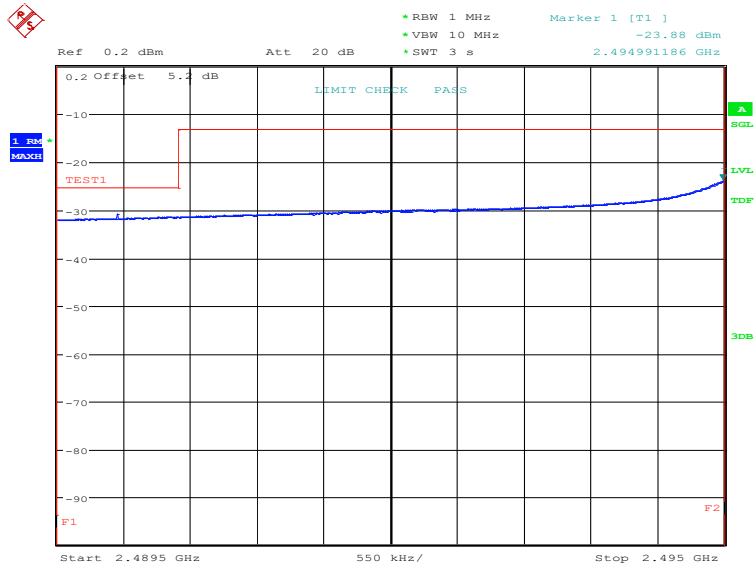


Date: 21.JUL.2023 11:47:00

### LOW BAND EDGE BLOCK-20MHz-100%RB

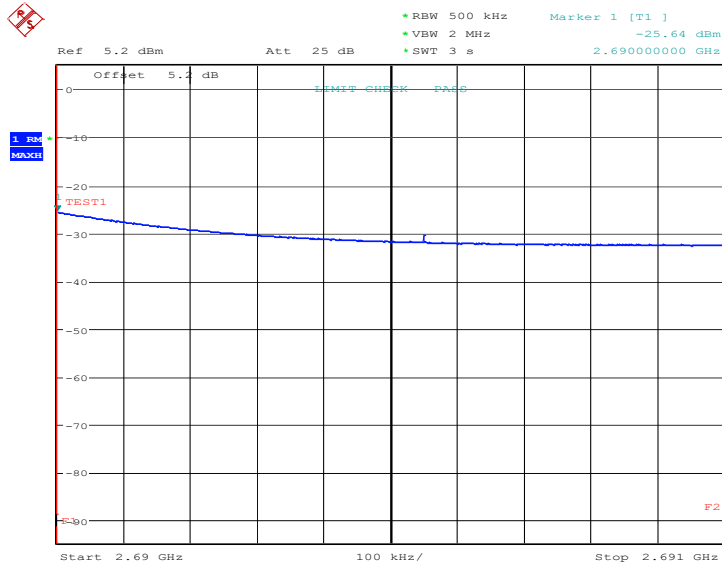


Date: 5.JUL.2023 16:41:01

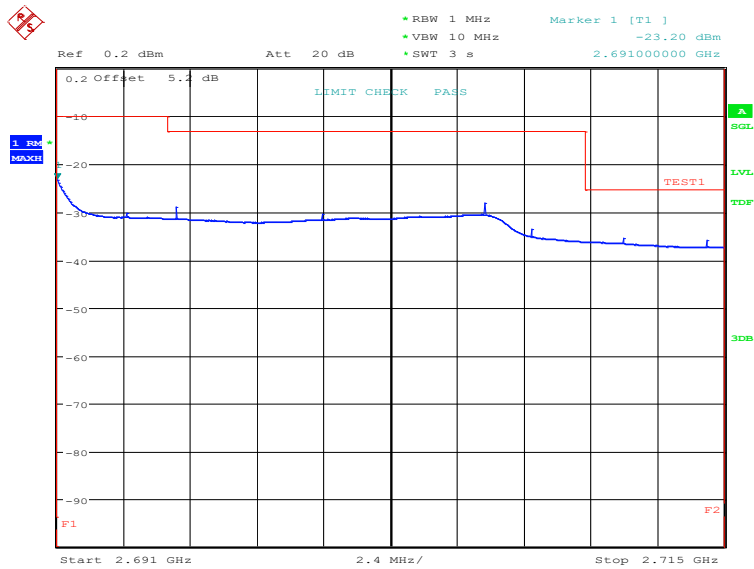


Date: 5.JUL.2023 16:41:41

### HIGH BAND EDGE BLOCK-20MHz-100%RB



Date: 5.JUL.2023 16:43:37



Date: 5.JUL.2023 16:44:16

Note: Expanded measurement uncertainty is  $U = 0.622$  dB,  $k = 2$ .

## **A.7 Conducted Spurious Emission**

### **A.7.1 Measurement Method**

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

1. In measuring unwanted emissions, the spectrum shall be investigated from 30 MHz or the lowest radio frequency signal generated in the equipment, whichever is lower, without going below 9 kHz, up to at least the frequency given below:
  - (a) If the equipment operates below 10 GHz: to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.
  - (b) If the equipment operates at or above 10 GHz: to the fifth harmonic of the highest fundamental frequency or to 100 GHz, whichever is lower.
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 greater than  $2 \times \text{span/RBW}$ .

### **A. 7.2 Measurement Limit**

Part 22.917 specifies 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 than  $43 + 10 \log(P)$  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.

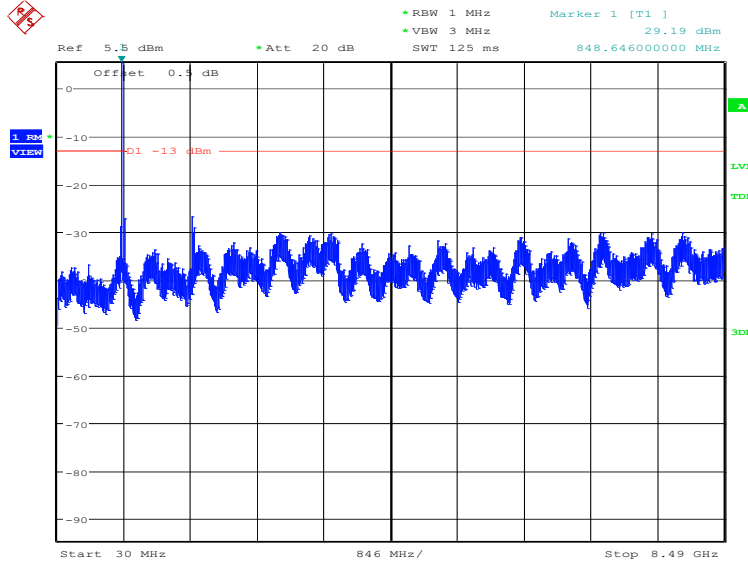


### A. 7.3 Measurement result

Only the worst case result is given below

#### LTE band 5: 30MHz – 8.49GHz

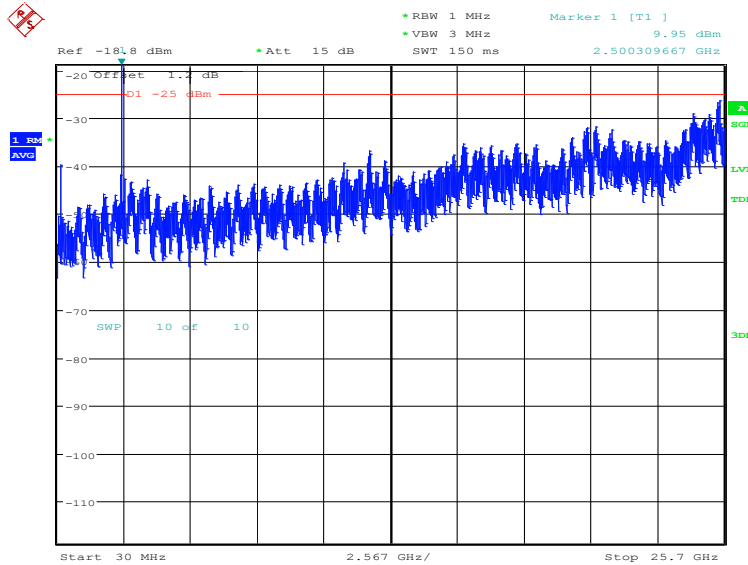
NOTE: peak above the limit line is the carrier frequency.



Date: 21.JUL.2023 11:48:20

#### LTE band 7: 30MHz – 25.7GHz

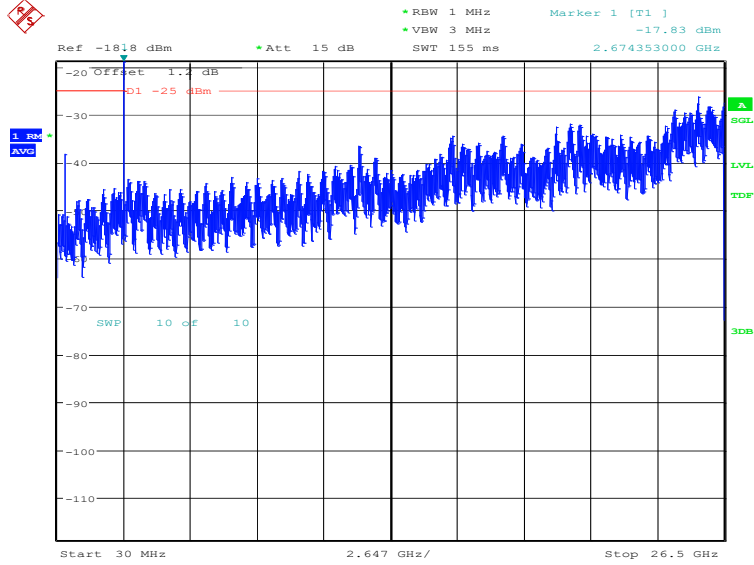
NOTE: peak above the limit line is the carrier frequency.



Date: 21.JUL.2023 11:49:43

### LTE band 41: 30MHz – 26.5GHz

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



Date: 21.JUL.2023 13:55:14

Note: Expanded measurement uncertainty is  $U = 0.622$  dB,  $k = 2$ .

### **A.8 Peak-to-Average Power Ratio**

The peak-to-average ratio (PAR) of the transmission may not exceed 13 dB

- a) Refer to instrument's analyzer instruction manual for details on how to use the power statistics/CCDF function;
- b) Set resolution/measurement bandwidth  $\geq$  signal's occupied bandwidth;
- c) Set the number of counts to a value that stabilizes the measured CCDF curve;
- d) Record the maximum PAPR level associated with a probability of 0.1%.

#### **LTE band 7, 20MHz**

Frequency(MHz)	PAPR(dB)		
2535.0	QPSK	16QAM	64QAM
	6.89	7.40	7.66

#### **LTE band 41, 20MHz**

Frequency (MHz)	PAPR (dB)		
2593.0	QPSK	16QAM	64QAM
	8.14	8.81	8.91

Note: Expanded measurement uncertainty is  $U = 0.578$  dB,  $k = 2$ .

## **Annex B: Accreditation Certificate**

<p><b>United States Department of Commerce National Institute of Standards and Technology</b></p> <p><b>NVLAP</b>® </p> <hr/> <p><b>Certificate of Accreditation to ISO/IEC 17025:2017</b></p> <hr/> <p><b>NVLAP LAB CODE: 600118-0</b></p> <p><b>Telecommunication Technology Labs, CAICT</b> Beijing China</p> <p><i>is accredited by the National Voluntary Laboratory Accreditation Program for specific services, listed on the Scope of Accreditation, for:</i></p> <p><b>Electromagnetic Compatibility &amp; Telecommunications</b></p> <p><i>This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017. 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 January 2009).</i></p> <hr/> <p>2022-10-01 through 2023-09-30 <i>Effective Dates</i></p> <p style="text-align: center;"></p> <p style="text-align: right;"> <i>For the National Voluntary Laboratory Accreditation Program</i></p>	
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