LTE TEST REPORT

No.25T04Z100068-001

for

Runione Tech Co., Ltd

Rugged handheld

Model Name: UA60

FCC ID: 2BOTS-UA60

with

Hardware Version: V1.01

Software Version: R00.90.A8.33

Issued Date: 2025-05-09

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.

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REPORT HISTORY

Report Number	Revision	Description	Issue Date
25T04Z100068-001	Rev.0	1st edition	2025-04-22
25T04Z100068-001	Rev.1	Updated the results in chapter A.1.3	2025-05-09

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 American Association for Laboratory Accreditation (A2LA) with lab code 7049.01, and is also an FCC accredited test laboratory (CN1349), and ISED accredited test laboratory (CAB identifier:CN0066). The detail accreditation scope can be found on A2LA 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℃

Relative Humidity: 20-75%

1.4. Project Data

Testing Start Date: 2025-02-17

Testing End Date: 2025-03-18

1.5. Signature

Wang Xing

(Prepared this test report)

Zhou Yu

(Reviewed this test report)

Zhao Hui Lin

(Approved this test report)

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2. Client Information

2.1. Applicant Information

Company Name:	Runione Tech Co., Ltd
Address /Post:	Building D, 3rd Floor, No.599 Gaojing Road,Qingpu District, Shanghai, China
Contact:	Lily zheng
Email:	ll.zheng@runione.com
Telephone:	/
Fax:	/

2.2. Manufacturer Information

Company Name:	Runione Tech Co., Ltd
Address /Post:	Building D, 3rd Floor, No.599 Gaojing Road,Qingpu District, Shanghai, China
Contact:	Lily zheng
Email:	ll.zheng@runione.com
Telephone:	/
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3. Equipment Under Test (EUT) and Ancillary Equipment (AE)

3.1. About EUT

Description	Rugged handheld
Model Name	UA60
FCC ID	2BOTS-UA60
Antenna	Embedded
Output power	21.22dBm/10MHz maximum EIRP measured for LTE Band 48
Extreme Voltage	3.5VDC to 4.5VDC (nominal: 3.8VDC)
Extreme Temperature	-20°C to +60°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

EUT ID*	IMEI	HW Version	SW Version	Date of receipt
UT01a	869547070000633/ 869547070000641	V1.01	R00.90.A8.33	2025-01-13
UT04a	869547070000658/ 869547070000666	V1.01	R00.90.A8.33	2025-03-14

UT04a was used for emission limit test and UT01a was used for other testing cases.

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

3.3. Internal Identification of AE used during the test

AE ID*	Description
AE1	Battery

AE1

Model	BA7800S
Manufacturer	Shenzhen Sai Jiao Yang Energy & Science Technology Co., Ltd
Capacitance	8000mAh

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

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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.

Reference	Title	Version
FCC Part 96	CITIZENS BROADBAND RADIO SERVICE	10-1-23 Edition
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
KDB 940660 D01	CERTIFICATION AND TEST PROCEDURES FOR CITIZENS BROADBAND RADIO SERVICE DEVICES AUTHORIZED UNDER PART 96	v03

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5. Summary of Test Result

LTE Band 48

Items	Test Name	Clause in FCC rules	Verdict
1	Output Power	96.41	P
2	Emission Limit	96.41	P
3	Frequency Stability	2.1055	P
4	Occupied Bandwidth	2.1049	P
5	Emission Bandwidth	96.41	P
6	Band Edge Compliance	96.41	P
7	Conducted Spurious Emission	96.41	P
8	Peak-to-Average Power Ratio	96.41	P
9	End User Device Additional Requirements (CBSD Protocol)	96.47	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.

Measurement uncertainty is not taken into account when stating conformity with a specified requirement.

LTE Band 48 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, 64QAM and 256QAM 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.

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6. Test Equipment Utilized

Description	Type	Series Number	Manufacture	Cal Due Date	Calibration Interval
Wideband Radio Communication Tester	CMW500	159082	R&S	2025-12-03	1 year
Spectrum Analyzer	FSV	101576	R&S	2025-05-08	1 year
Signal&Spectrum Analyzer	FSW	104038	R&S	2025-07-02	1 year
Climate chamber	SH-241	92004642	ESPEC	2025-10-29	1 year
Spectrum Analyzer	ESW44	103144	R&S	2026-01-05	1 year
Antenna	VULB9163	9163-482	Schwarzbeck	2025-05-19	1 year
Antenna	9117	167	Schwarzbeck	2026-10-15	1 year
Antenna	LB-7180-NF	J2030013000005	A-INFO	2025-05-16	1 year
Antenna	3115	00146404	ETS-Lindgren	2025-05-16	1 year
Signal generator	SMF100A	101295	R&S	2026-02-16	1 year
Antenna	LB-180400-25-C-KF	2110084000006	A-INFO	2025-05-15	1 year
Antenna	3116	2663	ETS-Lindgren	2026-03-03	1 year
Radiated test system	ELEKTRA V 5.00.2	/	R&S	/	/

Note: Only the latest Cal Due Dates of equipment are listed above and all equipment is in valid calibration period when used.

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7. Measurement Uncertainty

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI C63.26. All measurement uncertainty values are shown with a coverage factor of k = 2 to indicate a 95% level of confidence. Measurement uncertainty is not taken into account when stating conformity with a specified requirement.

Test item		Measurement uncertainty
Output Power(dB)		1.90
Emission Limit(dB)		3.44dB(max)
Frequency Stability	FE(ppm)	1.16
	F_LF_H(kHz)	173.51
Occupied Bandwidth(%)		0.72
Emission Bandwidth(%)		0.75
Band Edge Compliance(dB)		1.94
Conducted Spurious Emission(dB)		4.77(0-20GHz)
		6.27(20-30GHz)
Peak-to-Average Power Ratio(dB)		2.10

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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 48

Bandwidth	RB size/offset	Frequency (MHz)	Power (dBm)			
			QPSK	16QAM	64QAM	256QAM
5MHz	1 RB high	3697.5	22.85	22.17	21.28	18.14
		3625.0	22.33	21.55	20.91	17.77
		3552.5	22.87	21.92	20.93	18.03
	1 RB low	3697.5	22.85	22.16	21.17	18.11
		3625.0	22.30	21.48	20.83	17.75
		3552.5	22.86	21.94	21.01	17.98
	50% RB mid	3697.5	21.93	20.93	20.12	18.07
		3625.0	21.39	20.50	19.66	17.63
		3552.5	21.84	20.95	20.05	17.94
	100% RB	3697.5	21.92	20.95	20.07	18.03
		3625.0	21.41	20.41	19.65	17.60
		3552.5	21.89	20.91	19.96	17.91
10MHz	1 RB high	3695.0	22.88	22.05	21.03	18.09
		3625.0	22.33	21.50	20.86	17.78
		3555.0	22.79	21.92	20.94	17.83
	1 RB low	3695.0	22.80	21.96	21.41	17.98
		3625.0	22.29	21.50	20.63	17.72
		3555.0	22.85	22.08	21.23	18.00
	50% RB mid	3695.0	21.90	20.85	20.07	17.96
		3625.0	21.42	20.46	19.65	17.57

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		3555.0	21.85	20.91	20.02	17.96
	100% RB	3695.0	21.81	20.82	20.01	17.91
		3625.0	21.40	20.40	19.64	17.59
		3555.0	21.85	20.93	19.99	17.89
15MHz	1 RB high	3692.5	22.60	21.72	21.00	17.99
		3625.0	22.13	21.32	20.55	17.67
		3557.5	22.46	21.58	20.78	17.90
	1 RB low	3692.5	22.48	21.56	20.66	17.84
		3625.0	22.12	21.18	20.62	17.56
		3557.5	22.65	21.67	20.68	17.74
	50% RB mid	3692.5	21.68	20.61	19.85	17.75
		3625.0	21.20	20.22	19.45	17.44
		3557.5	21.56	20.61	19.70	17.64
	100% RB	3692.5	21.60	20.59	19.78	17.74
		3625.0	21.21	20.20	19.45	17.40
		3557.5	21.59	20.61	19.66	17.67
20MHz	1 RB high	3690.0	22.61	21.74	20.97	18.01
		3625.0	22.16	21.39	20.69	17.63
		3560.0	22.46	21.66	20.69	17.68
	1 RB low	3690.0	22.53	21.75	21.02	17.85
		3625.0	22.17	21.45	20.37	17.57
		3560.0	22.67	21.86	21.06	17.81
	50% RB mid	3690.0	21.70	20.63	19.86	17.75
		3625.0	21.22	20.24	19.48	17.45
		3560.0	21.57	20.61	19.64	17.64
	100% RB	3690.0	21.58	20.58	19.73	17.75
		3625.0	21.21	20.22	19.47	17.41
		3560.0	21.57	20.58	19.65	17.61

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A.1.3 Radiated

A.1.3.1 Description

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

Band 48: Part 96.11(b) specifies "Mobile and portable stations are limited to 23dBm/10megahertz".

A.1.3.2 Method of Measurement

According to KDB 412172 D01 and ANSI C63.26 the relevant equation for determining the maximum ERP or EIRP from the measured RF output power is given in Equation as follows:

$$\mathbf{ERP\ or\ EIRP} = P_T + G_T - L_C$$

where;

- $\mathbf{ERP\ or\ EIRP} =$ effective radiated power or equivalent isotropically radiated power(expressed in the same units as P_T.
- $P_T =$ transmitter output power, in this report the unit express as dBm;
- $G_T =$ gain of the transmitting antenna, in dBd(ERP) or dBi(EIRP);
- $L_C =$ signal attenuation in the connecting cable between the transmitter and antenna, in dB.

Alternatively, the EIRP can be determined from Equation above and then converted to ERP based on the maximum antenna gain relationship by applying the following equation:

$$\mathbf{ERP} = \mathbf{EIRP} - 2.15\mathrm{dB}$$

Note: The antenna gain information was provided by the client. The laboratory is not responsible for identifying its authenticity during the test.

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Band 48- EIRP

Max EIRP: 19.48dBm

Bandwidth	RB size/offset	Frequency (MHz)	Conducted Power (dBm)				Radiated Power (dBm) GT = -3.4dBi			
			QPSK	16QAM	64QAM	256QAM	QPSK	16QAM	64QAM	256QAM
5MHz	1 RB high	3697.50	22.85	22.17	21.28	18.14	19.45	18.77	17.88	14.74
		3625.00	22.33	21.55	20.91	17.77	18.93	18.15	17.51	14.37
		3552.50	22.87	21.92	20.93	18.03	19.47	18.52	17.53	14.63
	1 RB low	3697.50	22.85	22.16	21.17	18.11	19.45	18.76	17.77	14.71
		3625.00	22.3	21.48	20.83	17.75	18.90	18.08	17.43	14.35
		3552.50	22.86	21.94	21.01	17.98	19.46	18.54	17.61	14.58
	50% RB mid	3697.50	21.93	20.93	20.12	18.07	18.53	17.53	16.72	14.67
		3625.00	21.39	20.5	19.66	17.63	17.99	17.10	16.26	14.23
		3552.50	21.84	20.95	20.05	17.94	18.44	17.55	16.65	14.54
	100% RB	3697.50	21.92	20.95	20.07	18.03	18.52	17.55	16.67	14.63
		3625.00	21.41	20.41	19.65	17.6	18.01	17.01	16.25	14.20
		3552.50	21.89	20.91	19.96	17.91	18.49	17.51	16.56	14.51
10MHz	1 RB high	3695.00	22.88	22.05	21.03	18.09	19.48	18.65	17.63	14.69
		3625.00	22.33	21.5	20.86	17.78	18.93	18.10	17.46	14.38
		3555.00	22.79	21.92	20.94	17.83	19.39	18.52	17.54	14.43
	1 RB low	3695.00	22.8	21.96	21.41	17.98	19.40	18.56	18.01	14.58
		3625.00	22.29	21.5	20.63	17.72	18.89	18.10	17.23	14.32
		3555.00	22.85	22.08	21.23	18	19.45	18.68	17.83	14.60
	50% RB mid	3695.00	21.9	20.85	20.07	17.96	18.50	17.45	16.67	14.56
		3625.00	21.42	20.46	19.65	17.57	18.02	17.06	16.25	14.17
		3555.00	21.85	20.91	20.02	17.96	18.45	17.51	16.62	14.56
	100% RB	3695.00	21.81	20.82	20.01	17.91	18.41	17.42	16.61	14.51
		3625.00	21.4	20.4	19.64	17.59	18.00	17.00	16.24	14.19
		3555.00	21.85	20.93	19.99	17.89	18.45	17.53	16.59	14.49
15MHz	1 RB high	3692.50	22.6	21.72	21	17.99	19.20	18.32	17.60	14.59
		3625.00	22.13	21.32	20.55	17.67	18.73	17.92	17.15	14.27
		3557.50	22.46	21.58	20.78	17.9	19.06	18.18	17.38	14.50
	1 RB low	3692.50	22.48	21.56	20.66	17.84	19.08	18.16	17.26	14.44
		3625.00	22.12	21.18	20.62	17.56	18.72	17.78	17.22	14.16
		3557.50	22.65	21.67	20.68	17.74	19.25	18.27	17.28	14.34
	50% RB mid	3692.50	21.68	20.61	19.85	17.75	18.28	17.21	16.45	14.35
		3625.00	21.2	20.22	19.45	17.44	17.80	16.82	16.05	14.04
		3557.50	21.56	20.61	19.7	17.64	18.16	17.21	16.30	14.24
	100% RB	3692.50	21.6	20.59	19.78	17.74	18.20	17.19	16.38	14.34
		3625.00	21.21	20.2	19.45	17.4	17.81	16.80	16.05	14.00
		3557.50	21.59	20.61	19.66	17.67	18.19	17.21	16.26	14.27
20MHz	1 RB high	3690.00	22.61	21.74	20.97	18.01	19.21	18.34	17.57	14.61
		3625.00	22.16	21.39	20.69	17.63	18.76	17.99	17.29	14.23

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		3560.00	22.46	21.66	20.69	17.68	19.06	18.26	17.29	14.28
	1 RB low	3690.00	22.53	21.75	21.02	17.85	19.13	18.35	17.62	14.45
		3625.00	22.17	21.45	20.37	17.57	18.77	18.05	16.97	14.17
		3560.00	22.67	21.86	21.06	17.81	19.27	18.46	17.66	14.41
	50% RB mid	3690.00	21.7	20.63	19.86	17.75	18.30	17.23	16.46	14.35
		3625.00	21.22	20.24	19.48	17.45	17.82	16.84	16.08	14.05
		3560.00	21.57	20.61	19.64	17.64	18.17	17.21	16.24	14.24
	100% RB	3690.00	21.58	20.58	19.73	17.75	18.18	17.18	16.33	14.35
		3625.00	21.21	20.22	19.47	17.41	17.81	16.82	16.07	14.01
		3560.00	21.57	20.58	19.65	17.61	18.17	17.18	16.25	14.21

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Band 48- EIRP

Limits: ≤23dBm/10MHz

Max EIRP: 21.22dBm/10MHz

Bandwidth	Frequency (MHz)	Modulation	RB size/offset	Conducted Power (dBm/10MHz)	Antenna Gain(dBi)	EIRP (dBm/10MHz)	Margin (dB)
5MHz	3552.5	QPSK	1,0	24.59	-3.4	21.19	1.81
		QPSK	1,MAX-1	24.62	-3.4	21.22	1.78
		QPSK	100%,0	23.42	-3.4	20.02	2.98
		16QAM	1,0	23.86	-3.4	20.46	2.54
		16QAM	1,MAX-1	23.71	-3.4	20.31	2.69
		16QAM	100%,0	22.47	-3.4	19.07	3.93
		64QAM	1,0	22.85	-3.4	19.45	3.55
		64QAM	1,MAX-1	22.82	-3.4	19.42	3.58
		64QAM	100%,0	21.44	-3.4	18.04	4.96
		256QAM	1,0	19.81	-3.4	16.41	6.59
		256QAM	1,MAX-1	19.68	-3.4	16.28	6.72
		256QAM	100%,0	19.36	-3.4	15.96	7.04
	3625.0	QPSK	1,0	24.18	-3.4	20.78	2.22
		QPSK	1,MAX-1	24.15	-3.4	20.75	2.25
		QPSK	100%,0	23.10	-3.4	19.70	3.30
		16QAM	1,0	23.39	-3.4	19.99	3.01
		16QAM	1,MAX-1	23.24	-3.4	19.84	3.16
		16QAM	100%,0	22.12	-3.4	18.72	4.28
		64QAM	1,0	22.53	-3.4	19.13	3.87
		64QAM	1,MAX-1	22.39	-3.4	18.99	4.01
		64QAM	100%,0	21.04	-3.4	17.64	5.36
		256QAM	1,0	19.39	-3.4	15.99	7.01
		256QAM	1,MAX-1	19.40	-3.4	16.00	7.00
		256QAM	100%,0	19.00	-3.4	15.60	7.40
	3697.5	QPSK	1,0	24.01	-3.4	20.61	2.39
		QPSK	1,MAX-1	24.12	-3.4	20.72	2.28
		QPSK	100%,0	22.91	-3.4	19.51	3.49
		16QAM	1,0	23.23	-3.4	19.83	3.17
		16QAM	1,MAX-1	23.25	-3.4	19.85	3.15
		16QAM	100%,0	22.00	-3.4	18.60	4.40
		64QAM	1,0	22.17	-3.4	18.77	4.23
		64QAM	1,MAX-1	22.39	-3.4	18.99	4.01
		64QAM	100%,0	20.90	-3.4	17.50	5.50
		256QAM	1,0	19.09	-3.4	15.69	7.31
		256QAM	1,MAX-1	19.08	-3.4	15.68	7.32
		256QAM	100%,0	18.81	-3.4	15.41	7.59

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10MHz	3555.0	QPSK	1,0	24.58	-3.4	21.18	1.82
		QPSK	1,MAX-1	24.46	-3.4	21.06	1.94
		QPSK	100%,0	22.82	-3.4	19.42	3.58
		16QAM	1,0	23.72	-3.4	20.32	2.68
		16QAM	1,MAX-1	23.69	-3.4	20.29	2.71
		16QAM	100%,0	21.79	-3.4	18.39	4.61
		64QAM	1,0	22.85	-3.4	19.45	3.55
		64QAM	1,MAX-1	22.75	-3.4	19.35	3.65
		64QAM	100%,0	20.77	-3.4	17.37	5.63
		256QAM	1,0	19.57	-3.4	16.17	6.83
		256QAM	1,MAX-1	19.66	-3.4	16.26	6.74
		256QAM	100%,0	18.67	-3.4	15.27	7.73
	3625.0	QPSK	1,0	24.17	-3.4	20.77	2.23
		QPSK	1,MAX-1	24.03	-3.4	20.63	2.37
		QPSK	100%,0	22.44	-3.4	19.04	3.96
		16QAM	1,0	23.32	-3.4	19.92	3.08
		16QAM	1,MAX-1	23.28	-3.4	19.88	3.12
		16QAM	100%,0	21.48	-3.4	18.08	4.92
		64QAM	1,0	22.40	-3.4	19.00	4.00
		64QAM	1,MAX-1	22.42	-3.4	19.02	3.98
		64QAM	100%,0	20.44	-3.4	17.04	5.96
		256QAM	1,0	19.26	-3.4	15.86	7.14
		256QAM	1,MAX-1	19.20	-3.4	15.80	7.20
		256QAM	100%,0	18.39	-3.4	14.99	8.01
	3695.0	QPSK	1,0	24.01	-3.4	20.61	2.39
		QPSK	1,MAX-1	24.05	-3.4	20.65	2.35
		QPSK	100%,0	22.18	-3.4	18.78	4.22
		16QAM	1,0	23.20	-3.4	19.80	3.20
		16QAM	1,MAX-1	23.24	-3.4	19.84	3.16
		16QAM	100%,0	21.25	-3.4	17.85	5.15
		64QAM	1,0	22.34	-3.4	18.94	4.06
		64QAM	1,MAX-1	22.41	-3.4	19.01	3.99
		64QAM	100%,0	20.25	-3.4	16.85	6.15
		256QAM	1,0	19.12	-3.4	15.72	7.28
		256QAM	1,MAX-1	19.11	-3.4	15.71	7.29
		256QAM	100%,0	18.15	-3.4	14.75	8.25
15MHz	3557.5	QPSK	1,0	24.26	-3.4	20.86	2.14
		QPSK	1,MAX-1	24.25	-3.4	20.85	2.15
		QPSK	100%,0	21.68	-3.4	18.28	4.72
		16QAM	1,0	23.44	-3.4	20.04	2.96
		16QAM	1,MAX-1	23.28	-3.4	19.88	3.12
		16QAM	100%,0	20.69	-3.4	17.29	5.71
		64QAM	1,0	22.43	-3.4	19.03	3.97

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		64QAM	1,MAX-1	22.30	-3.4	18.90	4.10
		64QAM	100%,0	19.54	-3.4	16.14	6.86
		256QAM	1,0	19.51	-3.4	16.11	6.89
		256QAM	1,MAX-1	19.32	-3.4	15.92	7.08
		256QAM	100%,0	17.60	-3.4	14.20	8.80
	3625.0	QPSK	1,0	23.99	-3.4	20.59	2.41
		QPSK	1,MAX-1	23.77	-3.4	20.37	2.63
		QPSK	100%,0	21.39	-3.4	17.99	5.01
		16QAM	1,0	23.11	-3.4	19.71	3.29
		16QAM	1,MAX-1	22.90	-3.4	19.50	3.50
		16QAM	100%,0	20.34	-3.4	16.94	6.06
		64QAM	1,0	22.30	-3.4	18.90	4.10
		64QAM	1,MAX-1	22.10	-3.4	18.70	4.30
		64QAM	100%,0	19.38	-3.4	15.98	7.02
		256QAM	1,0	18.98	-3.4	15.58	7.42
		256QAM	1,MAX-1	18.96	-3.4	15.56	7.44
		256QAM	100%,0	17.31	-3.4	13.91	9.09
	3692.5	QPSK	1,0	23.83	-3.4	20.43	2.57
		QPSK	1,MAX-1	23.69	-3.4	20.29	2.71
		QPSK	100%,0	21.19	-3.4	17.79	5.21
		16QAM	1,0	22.95	-3.4	19.55	3.45
		16QAM	1,MAX-1	22.87	-3.4	19.47	3.53
		16QAM	100%,0	20.25	-3.4	16.85	6.15
		64QAM	1,0	21.92	-3.4	18.52	4.48
		64QAM	1,MAX-1	21.93	-3.4	18.53	4.47
		64QAM	100%,0	19.23	-3.4	15.83	7.17
		256QAM	1,0	18.85	-3.4	15.45	7.55
		256QAM	1,MAX-1	18.89	-3.4	15.49	7.51
		256QAM	100%,0	17.18	-3.4	13.78	9.22
20MHz	3560.0	QPSK	1,0	24.28	-3.4	20.88	2.12
		QPSK	1,MAX-1	24.08	-3.4	20.68	2.32
		QPSK	100%,0	20.63	-3.4	17.23	5.77
		16QAM	1,0	23.36	-3.4	19.96	3.04
		16QAM	1,MAX-1	23.32	-3.4	19.92	3.08
		16QAM	100%,0	19.61	-3.4	16.21	6.79
		64QAM	1,0	22.46	-3.4	19.06	3.94
		64QAM	1,MAX-1	22.30	-3.4	18.90	4.10
		64QAM	100%,0	18.65	-3.4	15.25	7.75
		256QAM	1,0	19.33	-3.4	15.93	7.07
		256QAM	1,MAX-1	19.16	-3.4	15.76	7.24
		256QAM	100%,0	16.57	-3.4	13.17	9.83
	3625.0	QPSK	1,0	23.96	-3.4	20.56	2.44
		QPSK	1,MAX-1	23.81	-3.4	20.41	2.59

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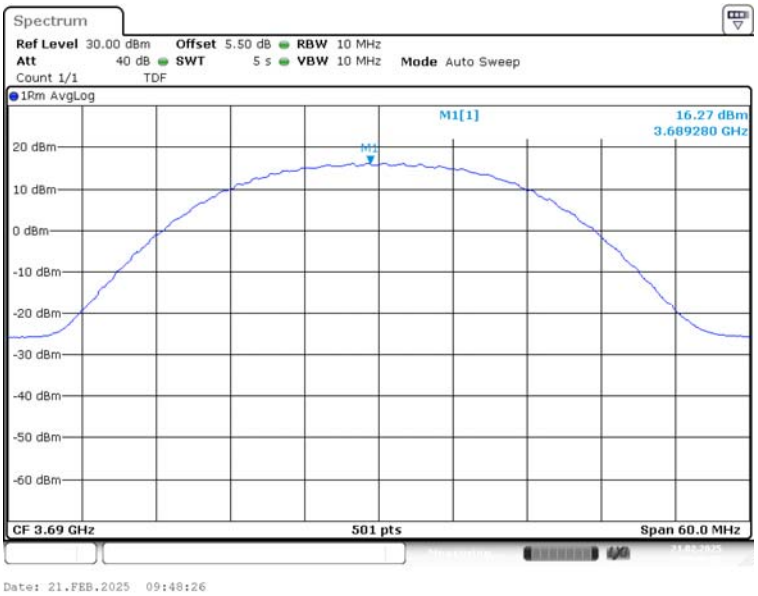
		QPSK	100%,0	20.44	-3.4	17.04	5.96
		16QAM	1,0	23.08	-3.4	19.68	3.32
		16QAM	1,MAX-1	22.83	-3.4	19.43	3.57
		16QAM	100%,0	19.44	-3.4	16.04	6.96
		64QAM	1,0	22.17	-3.4	18.77	4.23
		64QAM	1,MAX-1	22.04	-3.4	18.64	4.36
		64QAM	100%,0	18.45	-3.4	15.05	7.95
		256QAM	1,0	19.09	-3.4	15.69	7.31
		256QAM	1,MAX-1	19.01	-3.4	15.61	7.39
		256QAM	100%,0	16.36	-3.4	12.96	10.04
	3690.0	QPSK	1,0	18.27	-3.4	14.87	8.13
		QPSK	1,MAX-1	18.26	-3.4	14.86	8.14
		QPSK	100%,0	18.24	-3.4	14.84	8.16
		16QAM	1,0	18.24	-3.4	14.84	8.16
		16QAM	1,MAX-1	18.24	-3.4	14.84	8.16
		16QAM	100%,0	18.23	-3.4	14.83	8.17
		64QAM	1,0	18.23	-3.4	14.83	8.17
		64QAM	1,MAX-1	18.25	-3.4	14.85	8.15
		64QAM	100%,0	18.29	-3.4	14.89	8.11
		256QAM	1,0	19.03	-3.4	15.63	7.37
		256QAM	1,MAX-1	18.90	-3.4	15.50	7.50
		256QAM	100%,0	16.27	-3.4	12.87	10.13



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A.2 Emission Limit

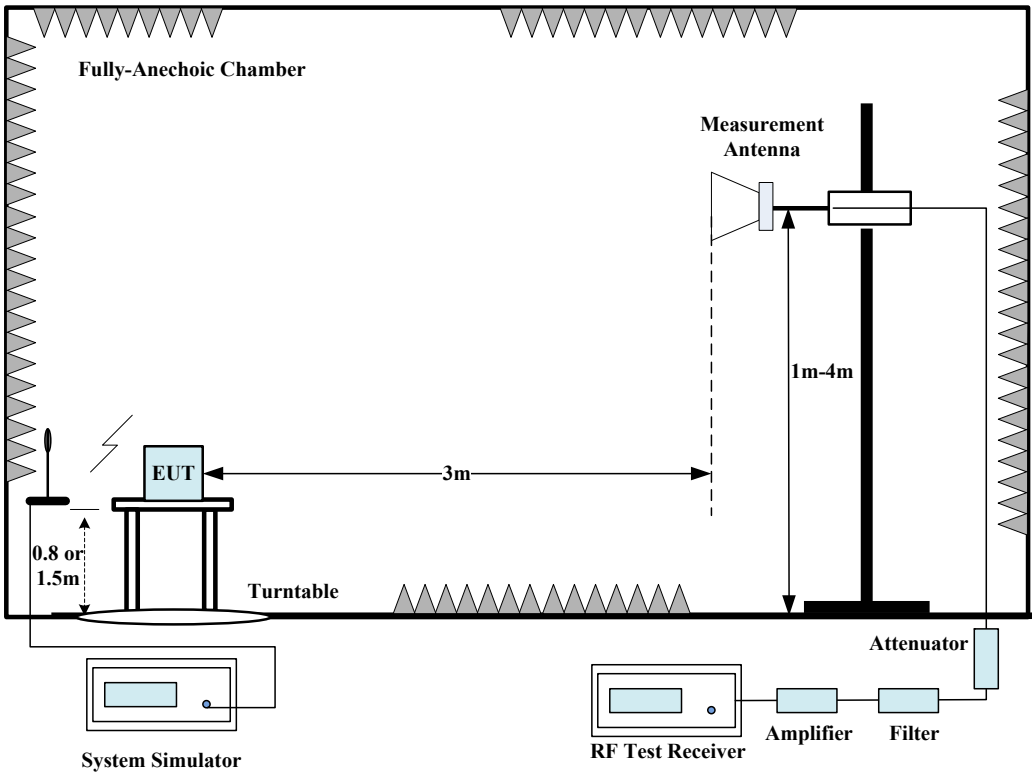
A.2.1 Measurement Method

The measurement procedures in 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.

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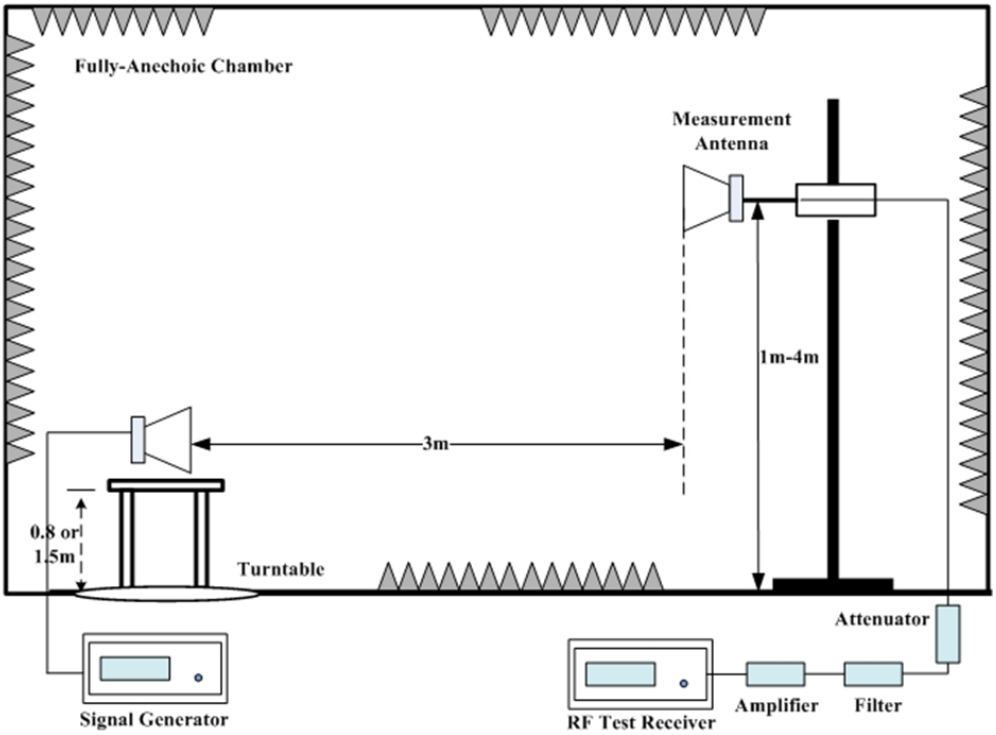

In the chamber, a substitution antenna for the frequency band of interest is placed at the reference point of the chamber. An RF Signal source for the frequency band of interest is connected to the substitution antenna with a cable that has been constructed to not interfere with the radiation pattern 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 -2.15dBi.

A.2.2 Measurement Limit

Band 48: Part 96.41(e)(1)(ii) specifies that at all frequencies greater than B megahertz above the upper CBSD assigned channel edge and less than B megahertz below the lower CBSD-assigned channel edge, the conducted power of any End User Device emission shall not exceed −25dBm/MHz.

Part 96.41(e)(2) specifies that notwithstanding paragraph (e)(1) of this section, for CBSDs and End User Devices, the conducted power of emissions below 3540 MHz or above 3710 MHz shall

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not exceed −25 dBm/MHz, and the conducted power of emissions below 3530 MHz or above 3720 MHz shall not exceed −40dBm/MHz.

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 30MHz to 26GHz.

Note : 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

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A.2.6 Measurement Result

LTE Band 48, 5MHz,CH55265,QPSK

Frequency (MHz)	SG (dBm)	CableLoss (dB)	AntennaGain (dBi)	Peak EIRP (dBm)	Limit (dBm)	Margin (dB)	Polarization
7079.25	-76.84	8.19	11.70	-73.33	-40.00	33.33	H
8895.00	-69.32	8.84	13.08	-65.08	-40.00	25.08	V
10666.88	-66.30	9.30	13.13	-62.47	-40.00	22.47	H
12459.75	-62.52	10.28	13.18	-59.62	-40.00	19.62	H
14185.88	-62.82	10.90	14.46	-59.26	-40.00	19.26	V
15983.25	-61.34	11.79	13.70	-59.43	-40.00	19.43	H

LTE Band 48, 5MHz,CH55990,QPSK

Frequency (MHz)	SG (dBm)	CableLoss (dB)	AntennaGain (dBi)	Peak EIRP (dBm)	Limit (dBm)	Margin (dB)	Polarization
7278.75	-76.83	8.12	11.93	-73.02	-40.00	33.02	V
9035.63	-69.02	9.11	13.12	-65.01	-40.00	25.01	H
10882.50	-66.45	9.61	13.18	-62.88	-40.00	22.88	V
12665.63	-63.30	10.36	13.30	-60.36	-40.00	20.36	V
14473.88	-62.25	10.96	14.41	-58.80	-40.00	18.80	H
16320.75	-58.91	11.82	13.64	-57.09	-40.00	17.09	H

LTE Band 48, 5MHz,CH56715,QPSK

Frequency (MHz)	SG (dBm)	CableLoss (dB)	AntennaGain (dBi)	Peak EIRP (dBm)	Limit (dBm)	Margin (dB)	Polarization
7411.50	-76.40	8.15	12.09	-72.46	-40.00	32.46	V
9217.13	-68.77	8.97	13.23	-64.51	-40.00	24.51	H
11062.50	-64.52	9.91	13.19	-61.24	-40.00	21.24	V
12948.75	-62.31	10.49	13.47	-59.33	-40.00	19.33	H
14771.25	-62.67	11.15	14.18	-59.64	-40.00	19.64	H
16612.50	-59.49	11.99	13.65	-57.83	-40.00	17.83	V

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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℃.
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℃ increments from -30℃ to +50℃. 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℃.
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 ℃ decrements from +50℃ to -30℃. Allow at least 1.5 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.

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A.3.2 Measurement results

LTE band 48, 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	3.8	3550.976	3699.024		
50				-1.13	0.0003
40				-0.43	0.0001
30				-0.47	0.0001
10				-0.12	0.0000
0				-0.66	0.0002
-10				-0.74	0.0002
-20				-0.09	0.0000
-30				-1.76	0.0005

Frequency Error vs Voltage

Voltage(V)	Temperature(℃)	FL(MHz)	FH(MHz)	Offset(Hz)	Frequency error(ppm)
3.5	20	3550.976	3699.024	-0.79	0.0002
4.5				0.00	0.0000

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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 extreme and mid 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 ≥ 3 × 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.

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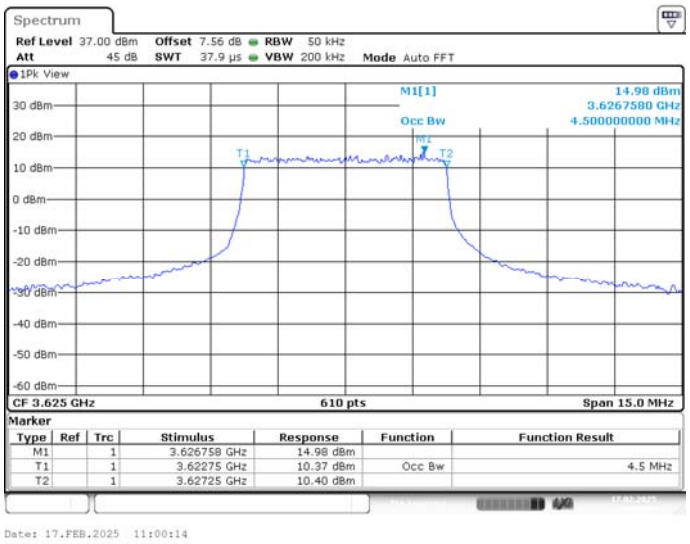
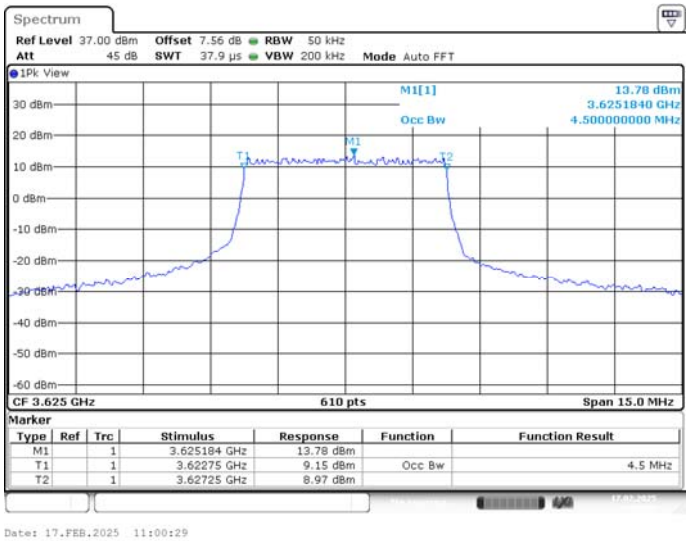
LTE band 48,5MHz(99%)

Frequency (MHz)	Occupied Bandwidth (99%)(MHz)	
	QPSK	16QAM
3625	4.500	4.500

LTE band 48 , 5MHz Bandwidth,MID,QPSK (99% BW)



LTE band 48 , 5MHz Bandwidth,MID,16QAM (99% BW)



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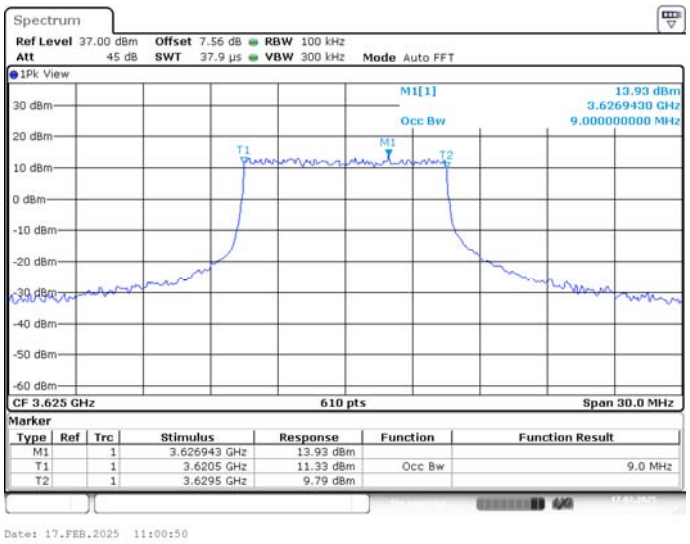
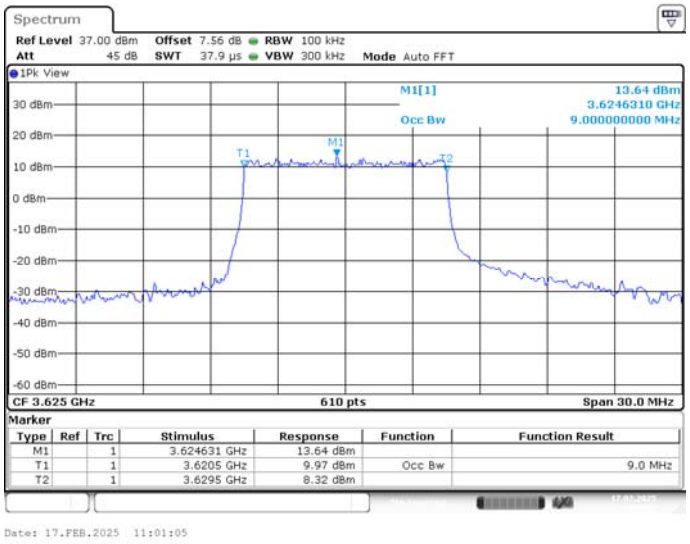
LTE band 48,10MHz(99%)

Frequency (MHz)	Occupied Bandwidth (99%)(MHz)	
	QPSK	16QAM
3625	9.000	9.000

LTE band 48 , 10MHz Bandwidth,MID,QPSK (99% BW)



LTE band 48 , 10MHz Bandwidth,MID,16QAM (99% BW)



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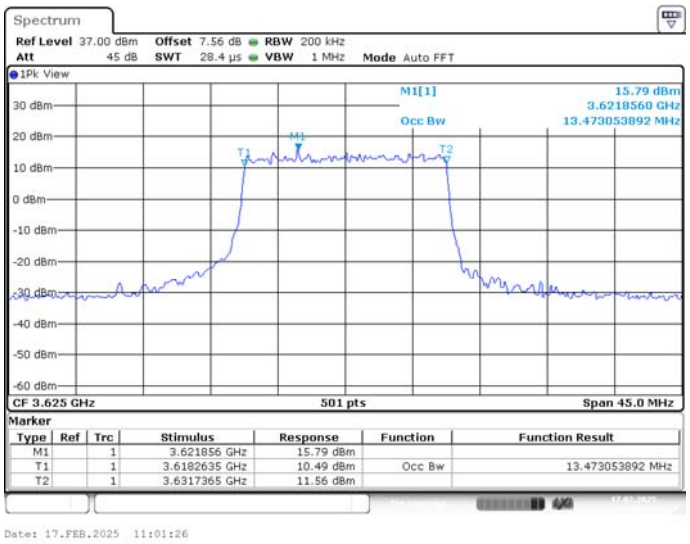
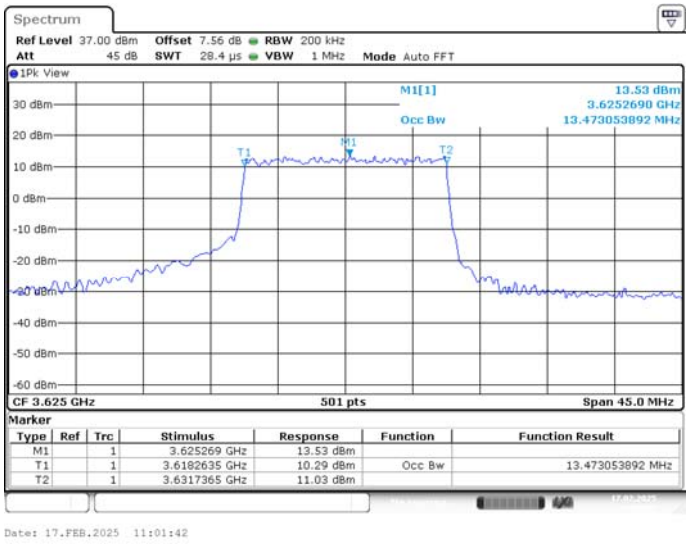
LTE band 48,15MHz(99%)

Frequency (MHz)	Occupied Bandwidth (99%)(MHz)	
	QPSK	16QAM
3625	13.473	13.473

LTE band 48 , 15MHz Bandwidth,MID,QPSK (99% BW)



LTE band 48 , 15MHz Bandwidth,MID,16QAM (99% BW)



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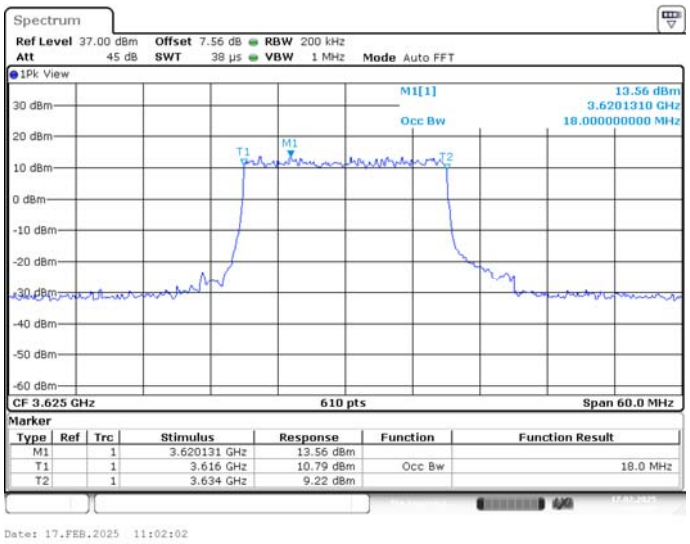
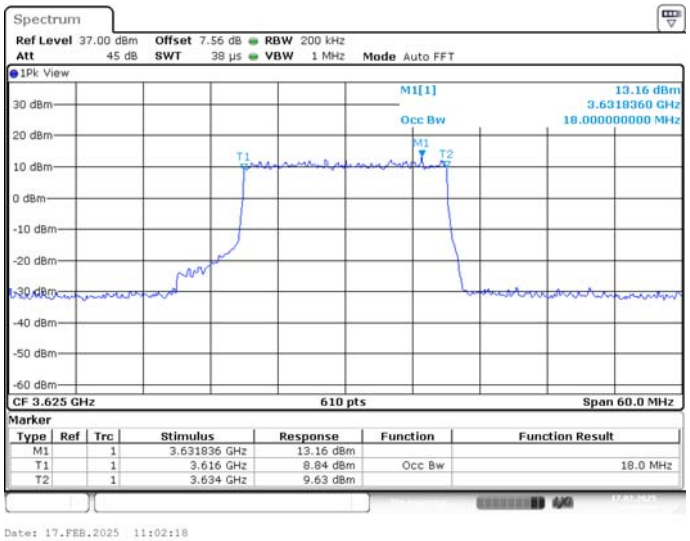
LTE band 48,20MHz(99%)

Frequency (MHz)	Occupied Bandwidth (99%)(MHz)	
	QPSK	16QAM
3625	18.000	18.000

LTE band 48 , 20MHz Bandwidth,MID,QPSK (99% BW)



LTE band 48 , 20MHz Bandwidth,MID,16QAM (99% BW)



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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.

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 ≥ 3 × 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.

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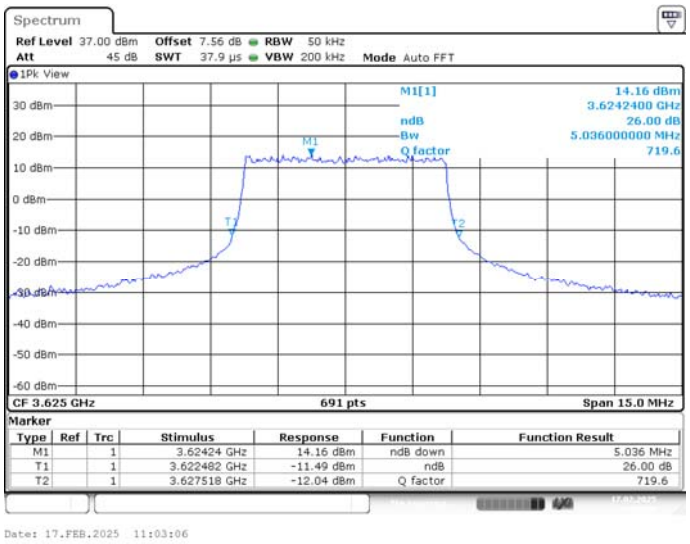
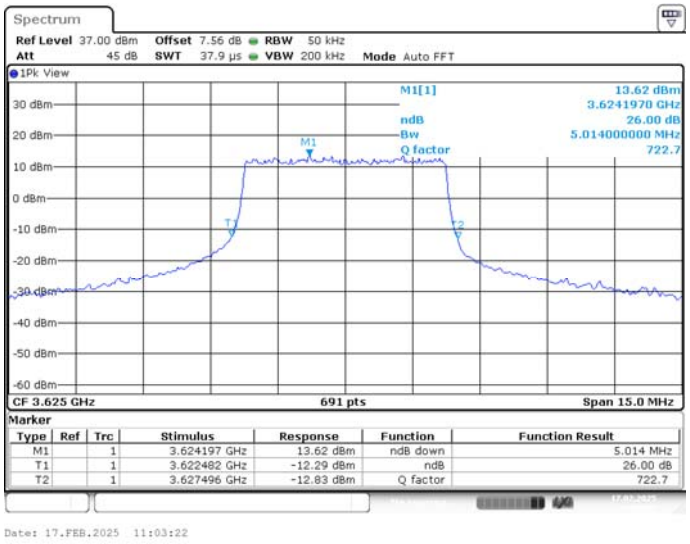
LTE band 48,5MHz(-26dBc)

Frequency(MHz)	Emission Bandwidth (-26dBc)(MHz)	
	QPSK	16QAM
3625	5.036	5.014

LTE band 48 , 5MHz Bandwidth,MID,QPSK (-26dBc BW)



LTE band 48 , 5MHz Bandwidth,MID,16QAM (-26dBc BW)



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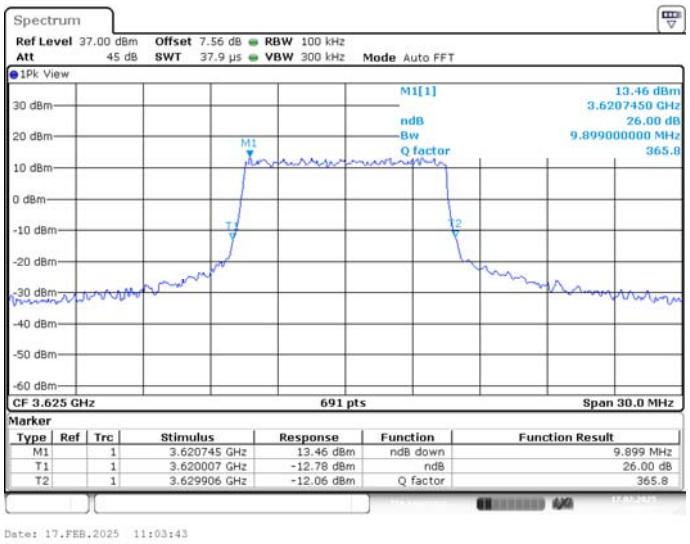
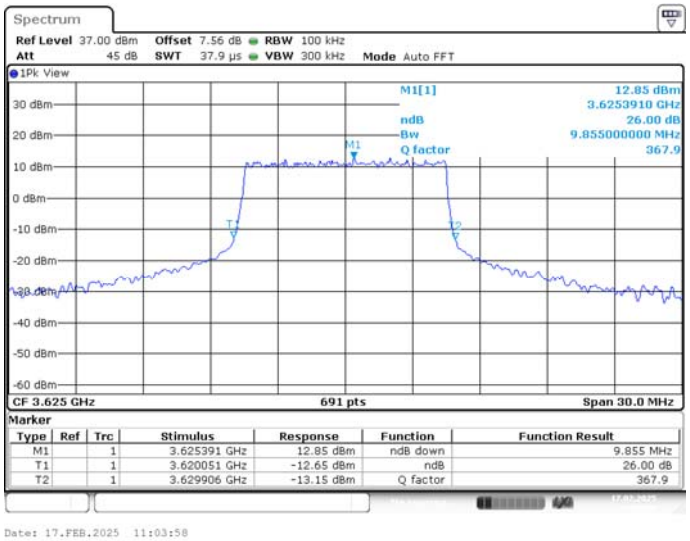
LTE band 48,10MHz(-26dBc)

Frequency(MHz)	Emission Bandwidth (-26dBc)(MHz)	
	QPSK	16QAM
3625	9.899	9.855

LTE band 48 , 10MHz Bandwidth,MID,QPSK (-26dBc BW)



LTE band 48 , 10MHz Bandwidth,MID,16QAM (-26dBc BW)



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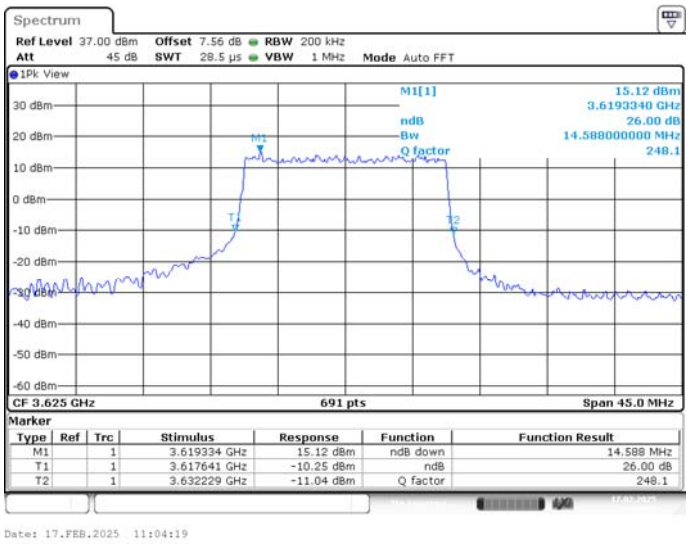
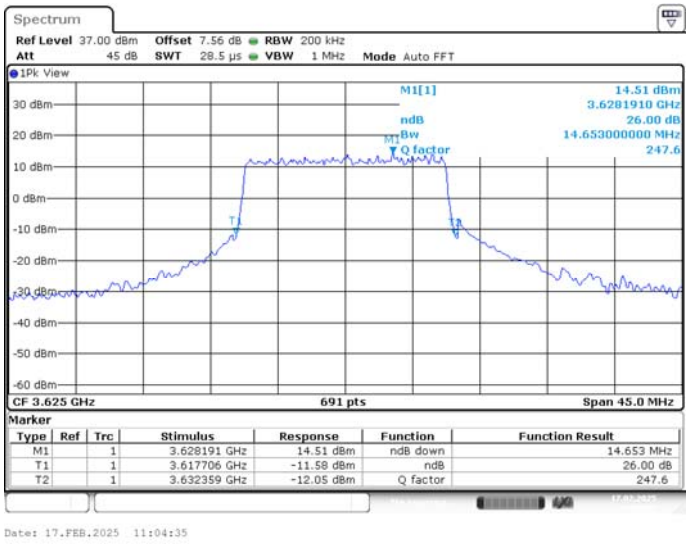
LTE band 48,15MHz(-26dBc)

Frequency(MHz)	Emission Bandwidth (-26dBc)(MHz)	
	QPSK	16QAM
3625	14.588	14.653

LTE band 48 , 15MHz Bandwidth,MID,QPSK (-26dBc BW)



LTE band 48 , 15MHz Bandwidth,MID,16QAM (-26dBc BW)



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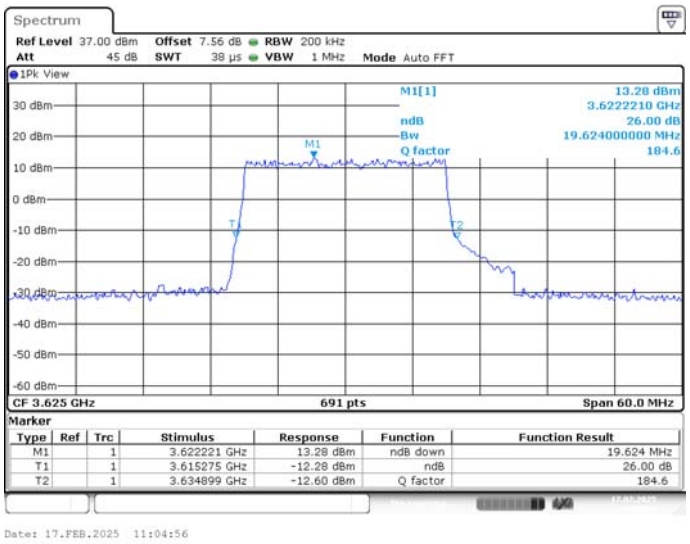
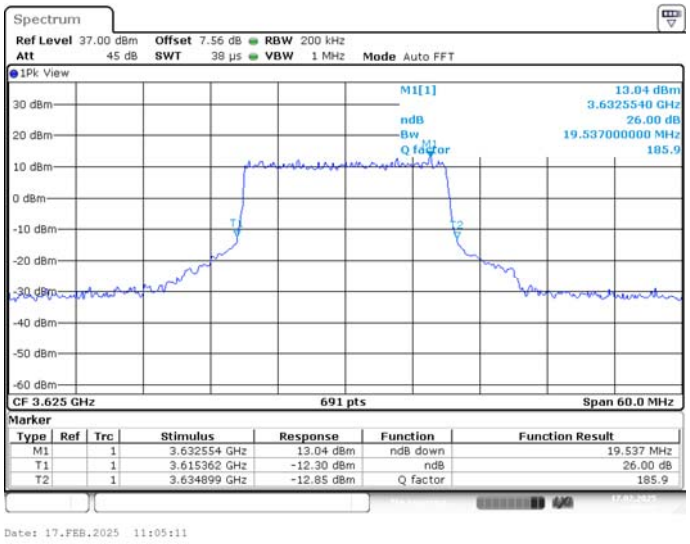
LTE band 48,20MHz(-26dBc)

Frequency(MHz)	Emission Bandwidth (-26dBc)(MHz)	
	QPSK	16QAM
3625	19.624	19.537

LTE band 48 , 20MHz Bandwidth,MID,QPSK (-26dBc BW)



LTE band 48 , 20MHz Bandwidth,MID,16QAM (-26dBc BW)



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A.6 Band Edge Compliance

A.6.1 Measurement limit

Part 96.41(e) states for channel and frequency assignments made by a CBSD to End User Devices, the conducted power of any End User Device emission outside the fundamental emission (whether in or outside of the authorized band) shall not exceed −13 dBm/MHz within 0 to B megahertz (where B is the bandwidth in megahertz of the assigned channel or multiple contiguous channels of the End User Device) above the upper CBSD-assigned channel edge and within 0 to B megahertz below the lower CBSD-assigned channel edge. At all frequencies greater than B megahertz above the upper CBSD assigned channel edge and less than B megahertz below the lower CBSD-assigned channel edge, the conducted power of any End User Device emission shall not exceed −25 dBm/MHz. Notwithstanding the emission limits in this paragraph, the Adjacent Channel Leakage Ratio for End User Devices shall be at least 30 dB. The conducted power of emissions below 3540 MHz or above 3710 MHz shall not exceed -25dBm/MHz, and the conducted power of emissions below 3530 MHz or above 3720 MHz shall not exceed -40dBm/MHz.

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

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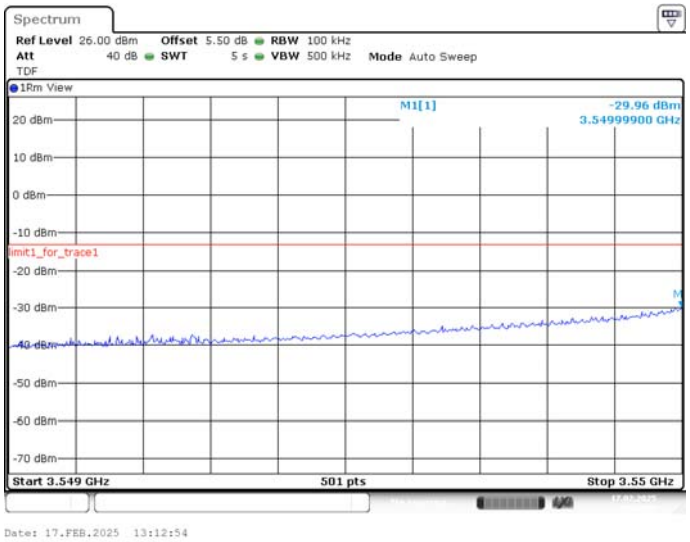
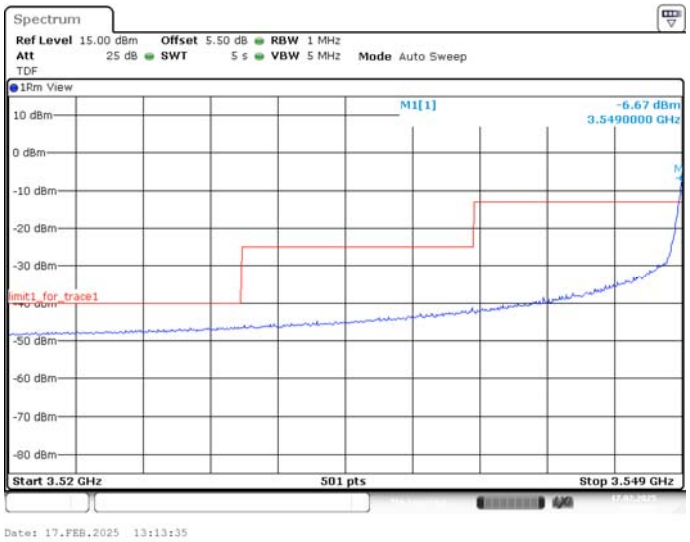
A.6.2 Measurement result

LTE band 48

LOW BAND EDGE BLOCK-1RB-LOW_offset



LOW BAND EDGE BLOCK-1RB-LOW_offset



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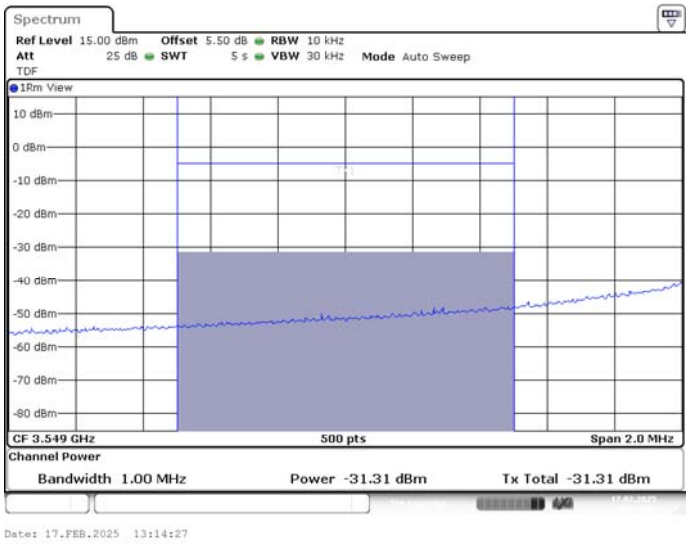
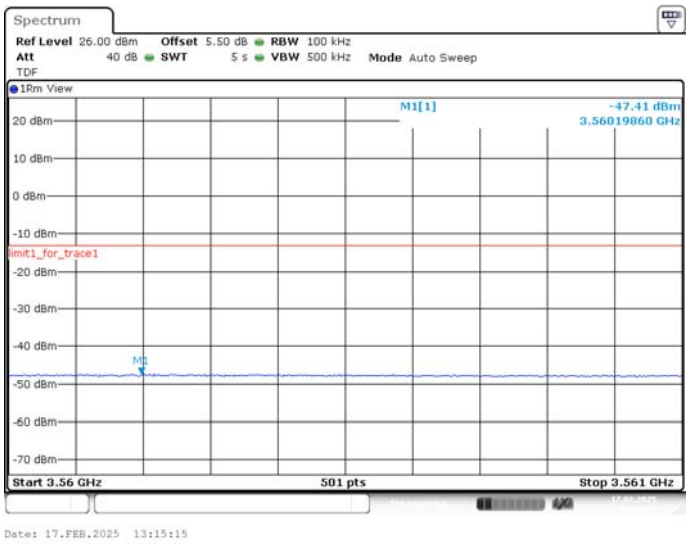
Channel power



LOW BAND EDGE BLOCK-1RB-LOW_offset



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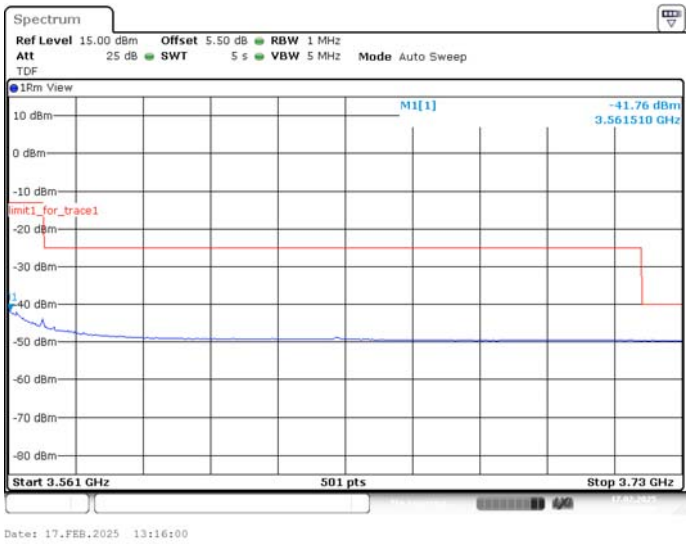
LOW BAND EDGE BLOCK-1RB-LOW_offset



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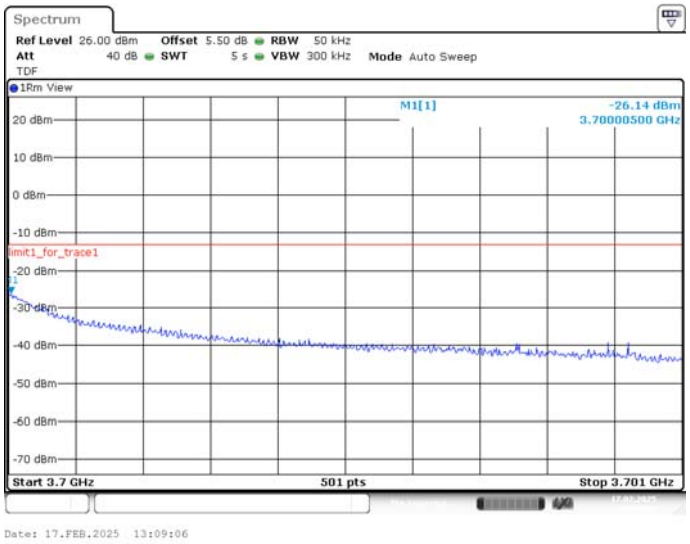
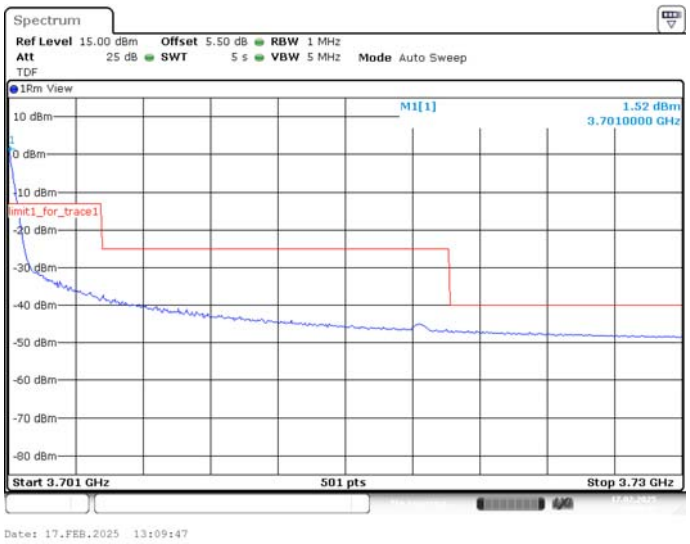
HIGH BAND EDGE BLOCK-1RB-HIGH_offset



HIGH BAND EDGE BLOCK-1RB-HIGH_offset



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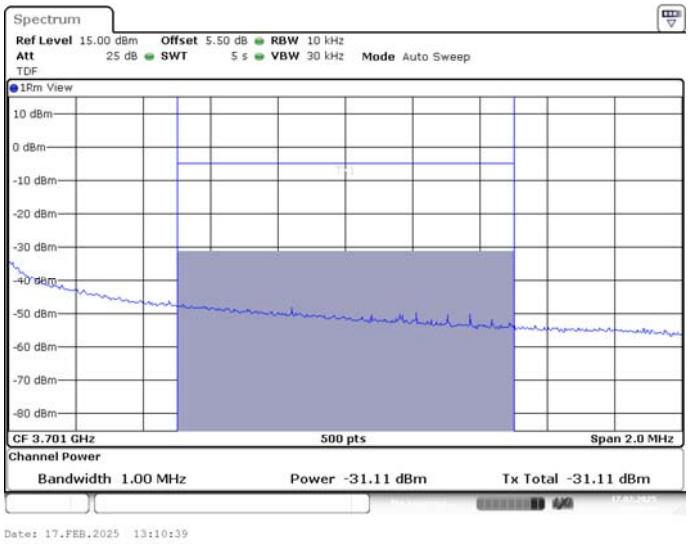
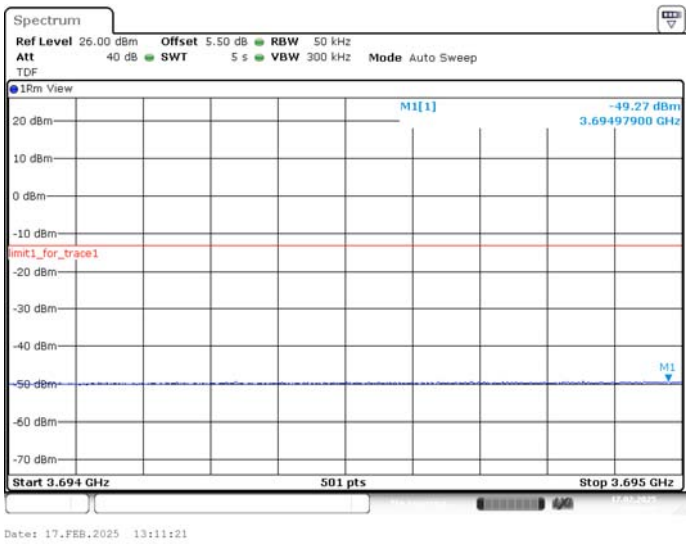
Channel power



HIGH BAND EDGE BLOCK-1RB-HIGH_offset



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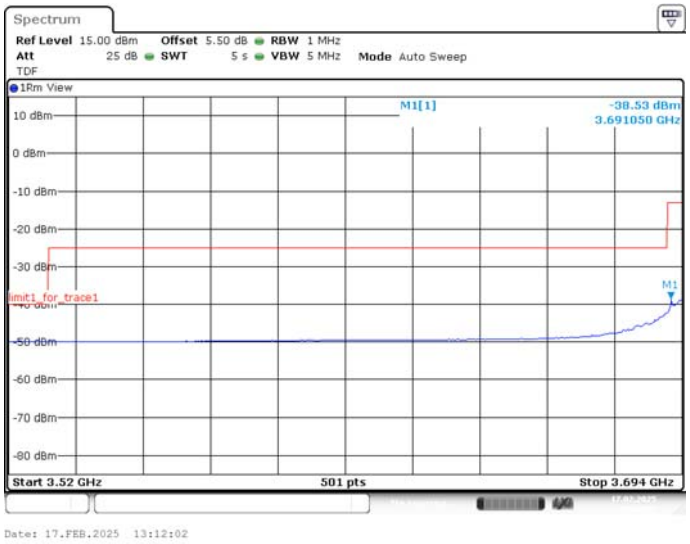
HIGH BAND EDGE BLOCK-1RB-HIGH_offset



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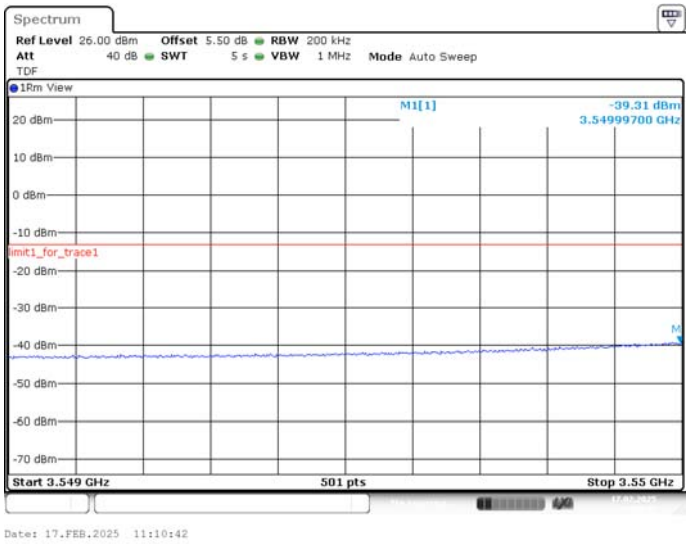
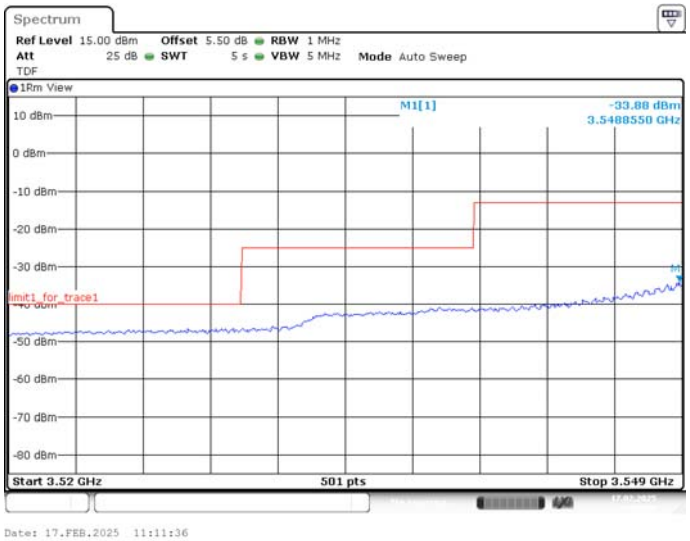
LOW BAND EDGE BLOCK-20MHz-100%RB



LOW BAND EDGE BLOCK-20MHz-100%RB



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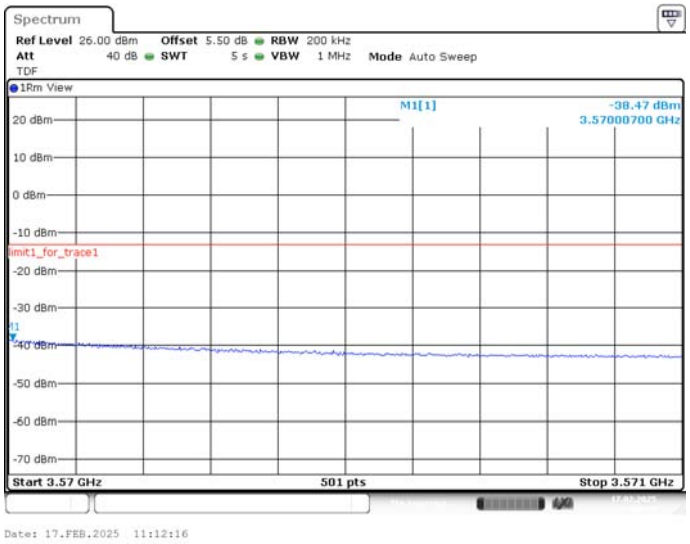
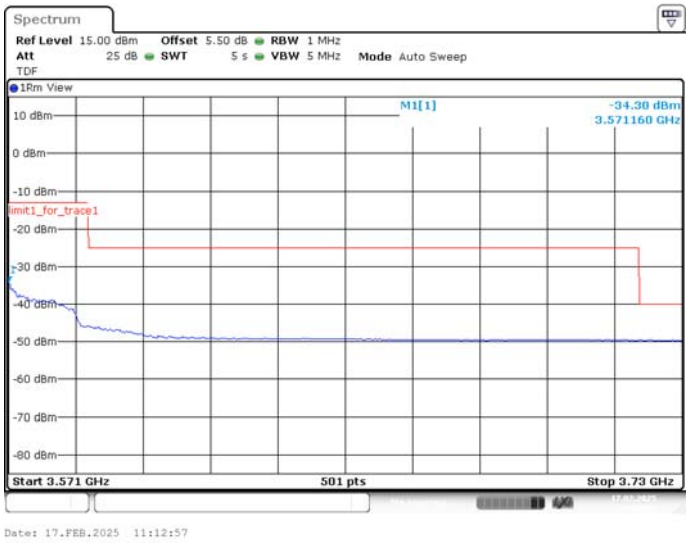
LOW BAND EDGE BLOCK-20MHz-100%RB



LOW BAND EDGE BLOCK-20MHz-100%RB



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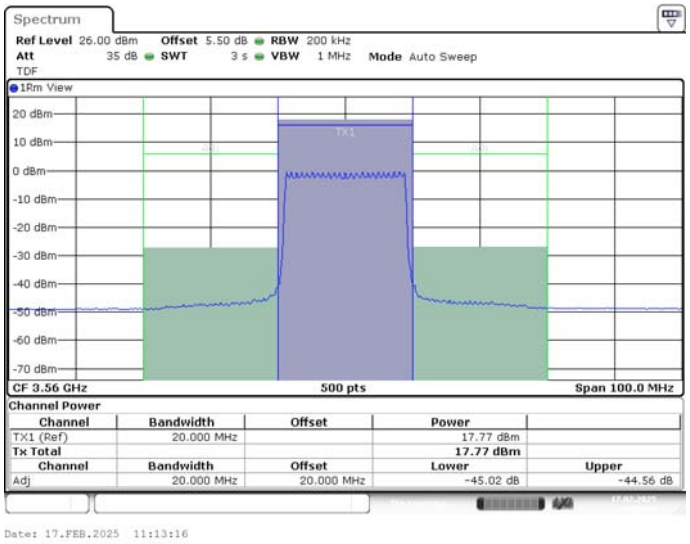
ACLR



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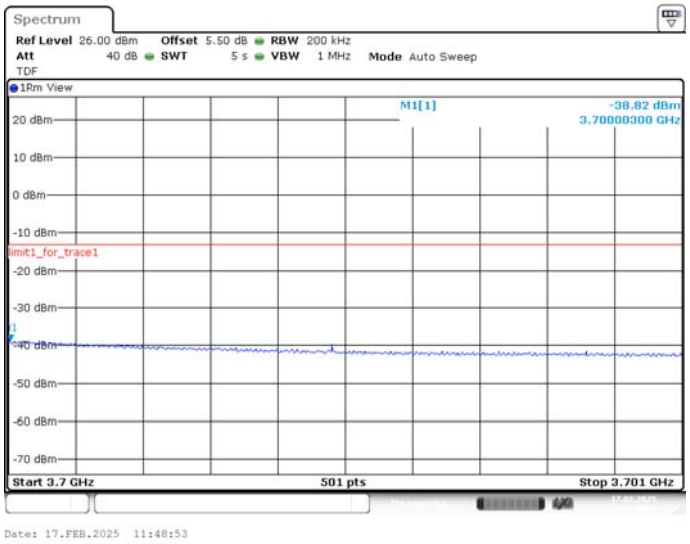
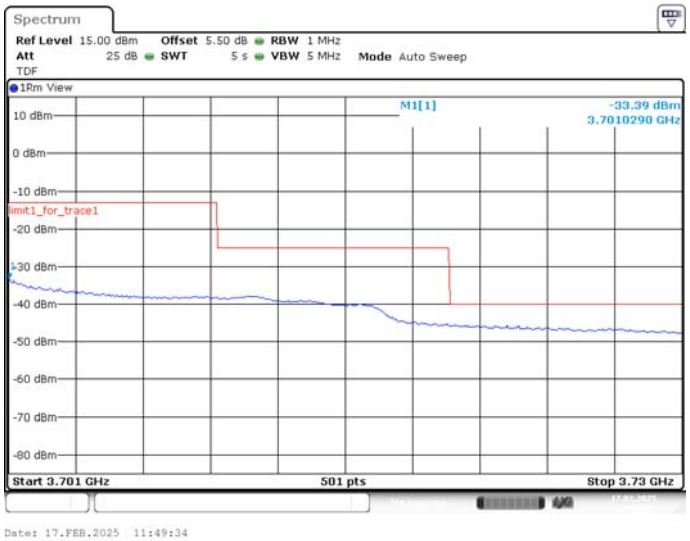
HIGH BAND EDGE BLOCK-20MHz-100%RB



HIGH BAND EDGE BLOCK-20MHz-100%RB



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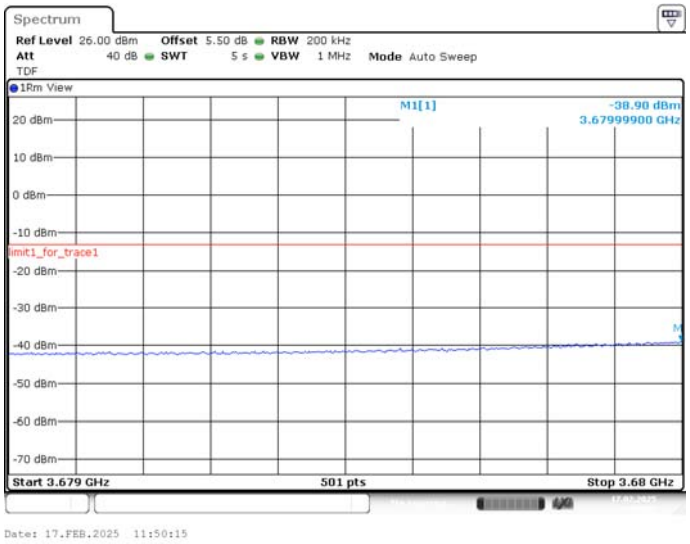
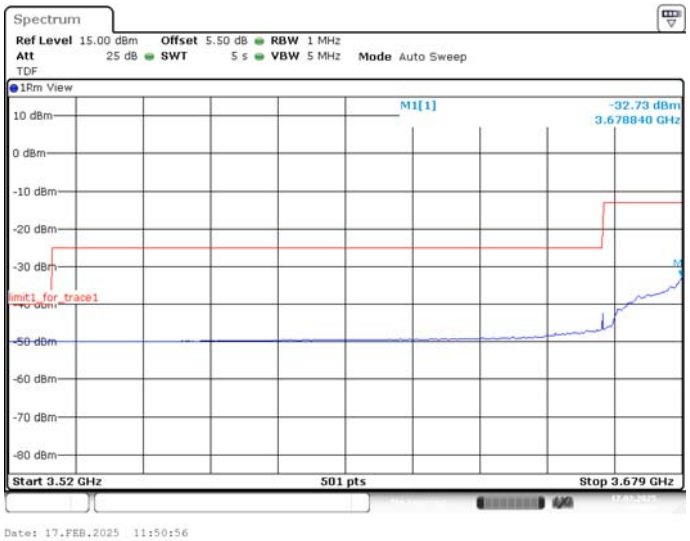
HIGH BAND EDGE BLOCK-20MHz-100%RB



HIGH BAND EDGE BLOCK-20MHz-100%RB



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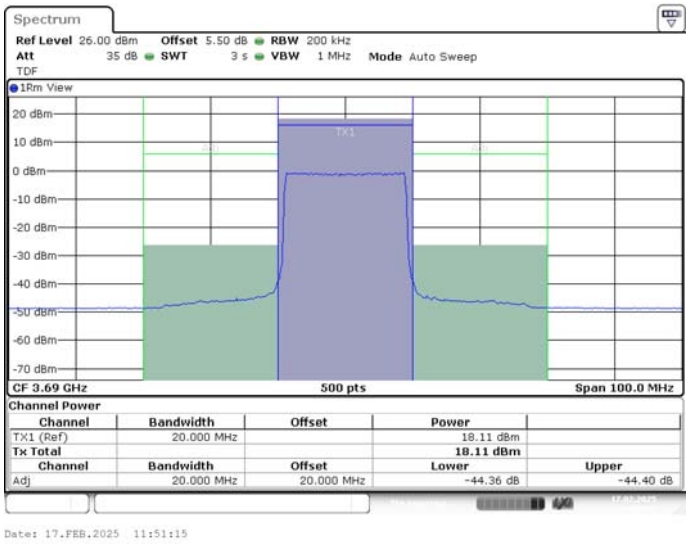
ACLR



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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×span/RBW.

A. 7.2 Measurement Limit

Part 96.41(e) states for channel and frequency assignments made by a CBSD to End User Devices, the conducted power of any End User Device emission outside the fundamental emission (whether in or outside of the authorized band) shall not exceed −13 dBm/MHz within 0 to B megahertz (where B is the bandwidth in megahertz of the assigned channel or multiple contiguous channels of the End User Device) above the upper CBSD-assigned channel edge and within 0 to B megahertz below the lower CBSD-assigned channel edge. At all frequencies greater than B megahertz above the upper CBSD assigned channel edge and less than B megahertz below the lower CBSD-assigned channel edge, the conducted power of any End User Device emission shall not exceed −25 dBm/MHz. The conducted power of emissions below 3540 MHz or above 3710 MHz shall not exceed -25dBm/MHz, and the conducted power of emissions below 3530 MHz or above 3720 MHz shall not exceed -40dBm/MHz.

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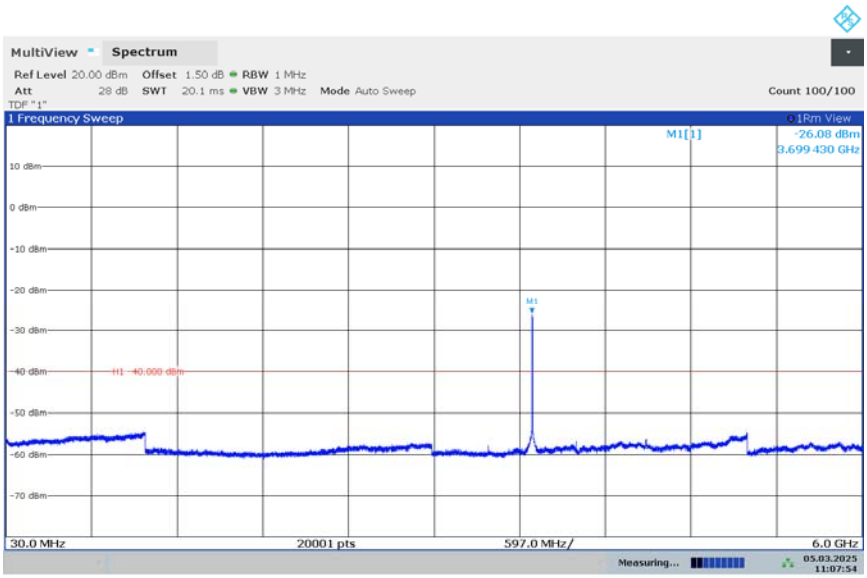
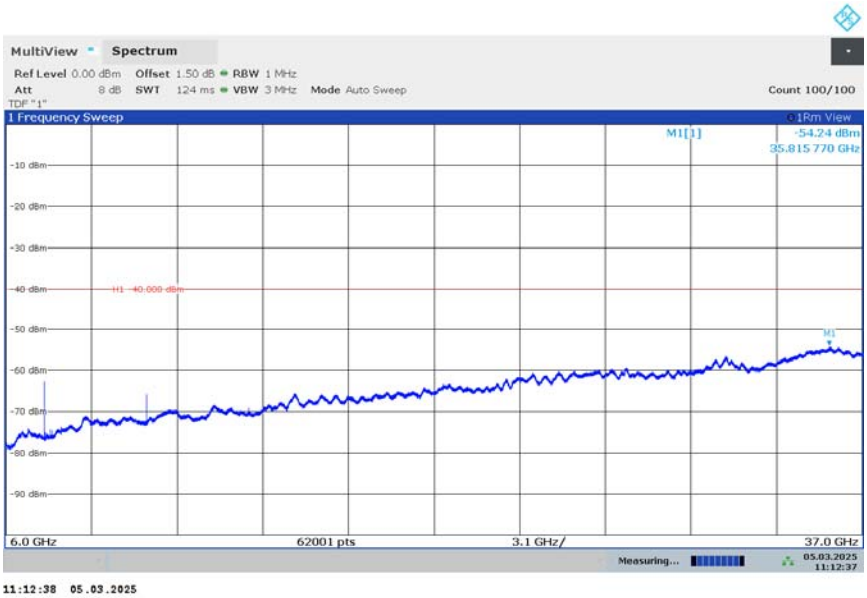
A.7.3 Measurement result

Only the worst case result is given below

LTE band 48:

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





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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 ≥ 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%.

Measurement results

LTE Band 48, 20MHz

Frequency (MHz)	RB	PAPR (dB)			
		QPSK	16QAM	64QAM	256QAM
3625	100%,0	5.65	6.41	6.46	6.58

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Annex B: Accreditation Certificate

Accredited Laboratory

A2LA has accredited

TELECOMMUNICATION TECHNOLOGY LABS, CAICT

Beijing, 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 July 2024.

Mr. Trace McInturff, Vice President, Accreditation Services
For the Accreditation Council
Certificate Number 7049.01
Valid to July 31, 2026

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

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

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