

TEST REPORT

	CTK Co., Ltd. (Ho-dong), 113, Yejik-ro, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea Tel: +82-31-339-9970 Fax: +82-31-624-9501	Report No.: CTK-2026-00647 Page (1) / (97) pages	
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1. Applicant

- Name : Samsung Electronics Co., Ltd.
- Address : 129, Samsung-ro, Yeongtong-gu, Suwon-si Gyeonggi-do, 16677, Korea
- Date of Receipt : 2026-02-02

2. Manufacturer

- Name : Samsung Electronics Co., Ltd.
- Address : 129, Samsung-ro, Yeongtong-gu, Suwon-si Gyeonggi-do, 16677, Korea

3. Use of Report : For FCC Class II permissive change

4. Test Sample / Model: RRU (RF4487d) / RF4487d-25A

5. Date of Test : 2026-02-02 to 2026-03-09

6. Test Standard(method) used : FCC 47 CFR Part 24E, Part 27, ANSI C63.26-2015

7. Testing Environment: refer to 9 page

8. Test Results : Compliance

9. Location of Test : ☒ Permanent Testing Lab ☐ On Site Testing

(Address : 5, Dongbu-ro 221beon-gil, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea)

The results shown in this test report refer only to the sample(s) tested unless otherwise stated. This report cannot be reproduced or copied without the written consent of CTK.

Approval	Tested by Won-Jae Jang: (Signature) 	Technical Manager Byung-Kwon In: (Signature) 
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2026-03-10

CTK Co., Ltd.

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MEASUREMENT REPORT

FCC Rule Part 24E & 27

Mode	Tx Frequency (MHz)	Total Conducted output power		Max Emission Designator	Modulation
		Max. Power (dBm)	Max. Power (W)		
LTE_B25_ 1C_10M_NB-IoT Guard band	1 930 MHz to 1 995 MHz	53.44	220.62	9M28G7D	QPSK
		53.38	217.86	9M28W7D	QAM
LTE_B25_ 1C_15M_NB-IoT Guard band		53.58	227.83	13M8G7D	QPSK
		53.56	226.92	13M7W7D	QAM
LTE_B25_ 1C_20M_NB-IoT Guard band		54.75	298.44	18M3G7D	QPSK
		54.76	298.95	18M3W7D	QAM
LTE_B25_2C_10M_NB-IoT Guard band+5M		53.66	232.33	14M5G7D	QPSK
		53.63	230.86	14M5W7D	QAM
LTE_B25_4C_15M_NB-IoT Guard band+15M+15M+20M		55.88	386.88	63M3G7D	QPSK
		55.82	381.69	63M3W7D	QAM
MSR_2C_B/n25_LTE_10M_ NB-IoT Guard band+NR_5M		53.48	222.63	14M5G7D	QPSK
		53.49	223.53	14M5W7D	QAM
MSR_4C_B/n25_LTE_15M_ NB-IoT Guard band+15M+ NR_15M+20M		55.77	377.88	63M2G7D	QPSK
		55.84	383.36	63M2W7D	QAM
LTE_B66_1C_10M_NB-IoT Guard band	2 110 MHz to 2 180 MHz	53.75	237.02	9M30G7D	QPSK
		53.72	235.36	9M27W7D	QAM
LTE_B66_1C_15M_NB-IoT Guard band		53.78	238.58	13M8G7D	QPSK
		53.73	236.10	13M8W7D	QAM
LTE_B66_1C_20M_NB-IoT Guard band		54.81	302.95	18M3G7D	QPSK
		54.81	302.96	18M3W7D	QAM
LTE_B66_2C_10M_NB-IoT Guard band+5M		53.80	239.82	14M5G7D	QPSK
		53.74	236.84	14M5W7D	QAM
LTE_B66_3C_20M_NB-IoT Guard band+20M+20M		54.91	309.99	58M2G7D	QPSK
		54.92	310.51	58M2W7D	QAM
MSR_2CB/n66_LTE_10M_ NB-IoT Guard band+NR_5M		53.82	241.05	14M5G7D	QPSK
		53.61	229.80	14M5W7D	QAM
MSR_3C_B/n66_LTE_20M_ NB-IoT Guard band +NR_20M+30M		54.71	296.01	68M4G7D	QPSK
		54.66	292.22	68M5W7D	QAM

EUT Overview

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1.0 REVISION RECORD

Issue Number	Issued Date	Revision History
CTK-2026-00647	03/10/2026	Initial Issue

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2.0 INTRODUCTION

2.1 Scope

Measurement and determination of electromagnetic emissions (EMC) of radio frequency devices including intentional and/or unintentional radiators for compliance with the technical rules and regulations of the Federal Communications Commission and the Innovation, Science and Economic Development Canada.

2.2 Laboratory Accreditations and Listings

Country	Agency	Registration Number
USA	FCC	805871
CANADA	ISED	CN : 8737A CAB ID : KR0025
KOREA	NRRA	KR0025

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3.0 PRODUCT INFORMATION

3.1 Equipment Description

The Equipment Under Test (EUT) is the **Samsung RRU (RF4487d) FCC ID: A3LRF4487D-25A**. The test data contained in this report pertains only to the emissions due to the EUT's licensed transmitters that operate under the provisions of Part 24E and 27. A Class II Permissive Change (C2PC) to the original filing is being pursued to enable NB-IoT without hardware modifications.

3.2 Device Capabilities

This device supports the following conditional features and filter information:

FCC ID:	A3LRF4487D-25A		
FCC Classification	PCS Licensed Transmitter		
EUT Type:	RRU (RF4487d)		
Model Name:	RF4487d-25A		
Test Device Serial No:	S61V913273, DKN2508012		
Device Capabilities:	LTE, 5G NR, NB-IoT		
Operating Band/Frequency Range:	Band	Tx (Downlink)	Rx (Uplink)
	B/n25:	1 930 MHz to 1 995 MHz	1 850 MHz to 1 915 MHz
	B/n66:	2 110 MHz to 2 180 MHz	1 710 MHz to 1 780 MHz
Supported Modulation:	QPSK, 16QAM, 64QAM, 256QAM		
B/n25_Supported Number of Carriers and Channel Bandwidth:	LTE supports 5/10/15/20 MHz bandwidth modes with up to 4CC max aggregated BW of 65 MHz NB-IoT Guard Band supports LTE 10/15/20 MHz bandwidth modes NR supports 5/10/15/20/25/30 MHz bandwidth modes with up to 4CC max aggregated BW of 65 MHz		
B/n66_Supported Number of Carriers and Channel Bandwidth:	LTE supports 5/10/15/20 MHz bandwidth modes with up to 3CC max aggregated BW of 60 MHz NB-IoT Guard Band supports LTE 10/15/20 MHz bandwidth modes NR supports 5/10/15/20/25/30 MHz bandwidth modes with up to 3CC max aggregated BW of 70 MHz		
Multi-Band Supported Number of Carriers and Channel Bandwidth:	Multi-Band with B/n25 and B/n66 supports up to 7CC and a maximum bandwidth of 135 MHz		
Supported Configurations:	Single carrier, Multi carrier, Multi-Band		
Maximum Output Power	B/n25: 400W/Unit B/n66: 320W/Unit Multi-Band: 720W/Unit		
TRX path configuration	4T4R, 2T4R, 2T2R, 1T1R x 2sector, 1T1R No change in radio parameters has occurred for any TRX path configuration.		
Antenna Gain:	Antenna gain is not provided by manufacture.		
Input Voltage:	DC -48V		

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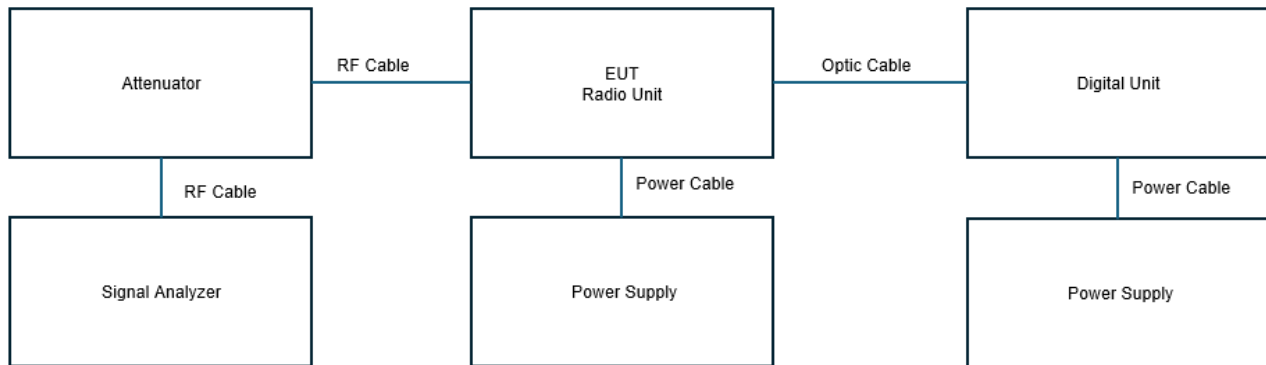
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3.3 Test Configuration

The setup block diagram is as follows:

- The EUT (RRU) and a Data Unit (DU) are each powered by -48V DC power supply.
- The DU is connected to a test laptop via an ethernet cable acting as backhaul.
- DU connects to the EUT through a fiber optic cable.
- An RF cable connects the signal analyzer and the EUT Ports for respective measurement.

EUT setup block diagram



The EUT was tested per the guidance of ANSI C63.26-2015 and KDB 971168 D01 v03r01. See Section 8.0 of this test report for a description of the radiated and antenna port conducted emissions tests.

Distribution unit (DU) which were used in test, that authorized under the SDoC procedure.

The following information is about configurations of carrier frequency and output power per port declared by the manufacturer.

* Abbreviations:

1C: Single carrier

2C: Contiguous 2 carriers in multi-carrier operation / 2NC: Non-Contiguous 2 carriers in multi-carrier operation

3C: Contiguous 3 carriers in multi-carrier operation / 3NC: Non-Contiguous 3 carriers in multi-carrier operation

4C: Contiguous 4 carriers in multi-carrier operation / 4NC: Non-Contiguous 4 carriers in multi-carrier operation

Configuration	No. of Carrier s	Total Bandwidth (MHz)	Carrier Frequency Configuration (MHz)			Rated Power (W/Unit)
			Lowest	Middle	Highest	
LTE_B25_ 1C_10M_NB-IoT Guard band	1	10	NB-IoT_1 935.0	NB-IoT_1 962.5	1 990.0_NB-IoT	240
LTE_B25_ 1C_15M_NB-IoT Guard band	1	15	NB-IoT_1 937.5	NB-IoT_1 962.5	1 987.5_NB-IoT	240
LTE_B25_ 1C_20M_NB-IoT Guard band	1	20	NB-IoT_1 940.0	NB-IoT_1 962.5	1 985.0_NB-IoT	320
LTE_B25_2C_10M_NB-IoT Guard band+5M	2	15	NB-IoT_1 937.5	NB-IoT_1 962.5	1 987.5_NB-IoT	240
LTE_B25_2NC_10M_NB-IoT Guard band+5M			NB-IoT_1 935.0_+1 992.5			
LTE_B25_4C_15M_NB-IoT Guard band+15M+15M+20M	4	65	NB-IoT_1 937.5 + 1 952.5 + 1 967.5 + 1 985.0 (Note 1)			400
MSR_2C_B/n25_LTE_10M_ NB-IoT Guard band+NR_5M	2	15	NB-IoT_1 937.5	NB-IoT_1 962.5	1 987.5_NB-IoT	240
MSR_2NC_B/n25_LTE_10M_ NB-IoT Guard band+NR_5M			NB-IoT_1 935.0_+1 992.5			
MSR_4C_B/n25_LTE_15M_ NB-IoT Guard band+15M+ NR_15M+20M	4	65	NB-IoT_1 937.5 + 1 952.5 + 1 967.5 + 1 985.0 (Note 1)			400



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Configuration	No. of Carrier s	Total Bandwidth (MHz)	Carrier Frequency Configuration (MHz)			Rated Power (W/Unit)
			Lowest	Middle	Highest	
LTE_B66_1C_10M_NB-IoT Guard band	1	10	NB-IoT_2 115.0	NB-IoT_2 145.0	2 175.0_NB-IoT	240
LTE_B66_1C_15M_NB-IoT Guard band	1	15	NB-IoT_2 117.5	NB-IoT_2 145.0	2 172.5_NB-IoT	240
LTE_B66_1C_20M_NB-IoT Guard band	1	20	NB-IoT_2 120.0	NB-IoT_2 145.0	2 170.0_NB-IoT	320
LTE_B66_2C_10M_NB-IoT Guard band+5M	2	15	NB-IoT_2 117.5	NB-IoT_2 145.0	2 172.5_NB-IoT	240
LTE_B66_2NC_10M_NB-IoT Guard band+5M			NB-IoT_2 115.0 + 2 177.5			
LTE_B66_3C_20M_NB-IoT Guard band+20M+20M	3	60	NB-IoT_2 120.0	2 145.0	2150.0	320
LTE_B66_3NC_20M_NB-IoT Guard band+20M+20M			NB-IoT_2 120.0 + 2 145.0 + 2 170.0			
MSR_2C_B/n66_LTE_10M_NB-IoT Guard band+NR_5M	2	15	NB-IoT_2 117.5	NB-IoT_2 145.0	2 172.5_NB-IoT	240
MSR_2NC_B/n66_LTE_10M_NB-IoT Guard band+NR_5M			NB-IoT_2 115.0 + 2 177.5			
MSR_3C_B/n66_LTE_20M_NB-IoT Guard band+NR_20M+30M	3	70	NB-IoT_2 120.0 + 2 140.0 + 2 165.0 (Note 1)			320

Multi Band Configuration	No. of Carrier s	Total Bandwidth (MHz)	Carrier Frequency Configuration (MHz)	Rated Power (W/Unit)
			Middle	
Multi Band_2C_B25_LTE_10M_NB-IoT Guard band+B66_LTE_10M_NB-IoT Guard band	2	10	NB-IoT_1 935.0 + 2 175.0_NB-IoT	480
Multi Band_7C_B/n25_LTE_15M_NB-IoT Guard band+15M+NR_15M+20M+B/n66_NR_20M+30M+LTE_20M_NB-IoT Guard band	7	135	NB-IoT_1 937.5 + 1 952.5 + 1 967.5 + 1 985.0 + 2 125.0 + 2 150.0 + 2 170.0_NB-IoT	720

Notes

1. Frequency range over which the device operates in each operating band ≤ 1 MHz
2. For NB-IoT guard band operation, the NB-IoT carrier is placed at the lower and upper operating band edges.
3. Added an operating mode for the NB-IoT Guard band as described in this Class II Permissive Change test report.
4. The Class II Permissive Change was tested using the worst-case modulation for each band, based on the original equipment test results.

3.4 EMI Suppression Device(s)/Modifications

No EMI suppression device(s) were added, and no modifications were made during testing.

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4.0 DESCRIPTION OF TESTS

4.1 Measurement Procedure

The measurement procedures described in the document titled “American National Standard for Compliance Testing of Transmitter Used in Licensed Radio Service” (ANSI C63.26-2015) and the guidance provided in KDB 971168 D01 v03r01, and KDB 662911 D01 v02r01 and KDB 940660 D01 v03 were used in the measurement of the EUT.

Occupied Bandwidth:

KDB 971168 D01 v03r01 – Section 4.3
ANSI C63.26-2015 – Section 5.4.4

Modulation Characteristics:

ANSI C63.26 - Section 5.3

Conducted Power Measurement and EIRP and PSD

KDB 971168 D01 v03r01 – Section 5.3
KDB 971168 D01 v03r01 – Section 5.4
KDB 662911 D01 v02r01 – Section E)2) In-Band Power Spectral Density (PSD) Measurements
b) Measure and sum spectral maxima across the outputs
ANSI C63.26-2015 – Section 5.2.5
ANSI C63.26-2015 – Section 5.2.4

Peak-to-Average Power Ratio:

KDB 971168 D01 v03r01 – Section 5.7
ANSI C63.26-2015 – Section 5.2.3.4

Channel Edge Emissions at Antenna Terminal

KDB 971168 D01 v03r01 – Section 6
KDB 662911 D01 v02r01 – Section E)3) Out-of-Band and Spurious Emission Measurements
a) Absolute Emission Limits
ii) Measure and sum spectral maxima across the outputs
ANSI C63.26-2015 – Section 5.7

Spurious and Harmonic Emissions at Antenna Terminal

KDB 971168 D01 v03r01 – Section 6
KDB 662911 D01 v02r01 – Section E)3) Out-of-Band and Spurious Emission Measurements
a) Absolute Emission Limits
ii) Measure and sum spectral maxima across the outputs
ANSI C63.26-2015 – Section 5.7

Radiated unwanted emission

KDB 971168 D01 v03r01 – Section 7
ANSI C63.26-2015 – Section 5.8

Frequency Stability / Temperature Variation

KDB 971168 D01 v03r01 – Section 9
ANSI C63.26-2015 – Section 5.6

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4.2 Measurement Software

Test item	Name	Version
Conducted Measurement	Node B automation	1.0
Radiated Measurement	EP5RE	6.0.1.0
	ES10	10.001

4.3 Environmental Conditions

The temperature is controlled within the range of 15°C to 35°C. The relative humidity is controlled within the range of 10% to 75%. The atmospheric pressure is monitored within the range 86-106kPa (860-1060mbar).

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5.0 MEASUREMENT UNCERTAINTY

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI C63.4-2014. All measurement uncertainty values are shown with a coverage factor of $k = 2$ to indicate a 95% level of confidence. The measurement uncertainty shown below meets or exceeds the U_{CISPR} measurement uncertainty values specified in CISPR 16-4-2 and, thus, can be compared directly to specified limits to determine compliance.

Description	Uncertainty
Conducted Power Measurement and EIRP	1.5 dB (C.L. : Approx. 95%, $k = 2$)
Occupied bandwidth	0.1 MHz (C.L. : Approx. 95%, $k = 2$)
Peak-to-average power ratio	1.0 dB (C.L. : Approx. 95%, $k = 2$)
Band Edge Emissions at Antenna Terminal	3.0 dB (C.L. : Approx. 95%, $k = 2$)
Spurious and Harmonic Emissions at Antenna Terminal	3.0 dB (C.L. : Approx. 95%, $k = 2$)
Radiated Emissions ($f \leq 1$ GHz)	4.11 dB (C.L. : Approx. 95%, $k = 2$)
Radiated Emissions ($f > 1$ GHz)	4.64 dB (C.L. : Approx. 95%, $k = 2$)
Frequency Stability	0.1 kHz (C.L. : Approx. 95%, $k = 2$)

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6.0 TEST EQUIPMENT CALIBRATION DATA

Test Equipment Calibration is traceable to the National Institute of Standards and Technology (NIST).
Measurement antennas used during testing were calibrated in accordance to the requirements of ANSI C63.5-2017.

Manufacture	Model	Description	Cal Date	Interval	Cal Due	Serial Number
Rohde&Schwarz	FSV30	Signal Analyzer	2025-11-25	Annual	2026-11-25	100925
Rohde&Schwarz	FSV40	Spectrum Analyzer	2026-01-13	Annual	2027-01-13	101574
Rohde&Schwarz	ESW44	EMI TEST RECEIVER	2025-04-28	Annual	2026-04-28	102039
TESEQ	CBL6111D	Bilog Antenna	2025-08-21	Biennial	2027-08-21	60654
PASTERNAK	PE7AP006-06	Attenuator	2025-07-28	Annual	2026-07-28	L20210504000023
SONOMA	310N	AMPLIFIER	2025-07-28	Annual	2026-07-28	411011
Agilent	8449B	Preamplifier	2025-03-11	Annual	2026-03-11	3008A00620
ETS-Lindgren	3115	Ridged Guide Antenna	2025-03-13	Annual	2026-03-13	00078895
TESTEK	TK-PA1840H	AMPLIFIER	2025-09-30	Annual	2026-09-30	210124-L
SCHWARZBECK	BBHA9170	HORN ANTENNA	2025-09-30	Annual	2026-09-30	01153
Keysight	N9020B	Signal Analyzer	2026-01-08	Annual	2027-01-08	MY58100015
Keysight	N9020B	Signal Analyzer	2025-11-19	Annual	2026-11-19	MY55470135
Keysight	N9020B	Signal Analyzer	2025-03-14	Annual	2026-03-14	MY57431080
Rohde&Schwarz	FSW	Signal Analyzer	2025-03-28	Annual	2026-03-28	101250
REACHLINE	250W18NN-40	Attenuator	2025-03-13	Annual	2026-03-13	ey40db001
REACHLINE	250W18NN-40	Attenuator	2025-03-13	Annual	2026-03-13	ey40db004
REACHLINE	250W18NN-40	Attenuator	2025-03-13	Annual	2026-03-13	ey40db006
REACHLINE	250W18NN-40	Attenuator	2025-10-02	Annual	2026-10-02	ey40db015
emtest	RLAN50040-18-F	Attenuator	2025-08-08	Annual	2026-08-08	RLAN50040-18-F-0001
emtest	RLAN50040-18-F	Attenuator	2025-08-08	Annual	2026-08-08	RLAN50040-18-F-0002
emtest	RLAN50040-18-F	Attenuator	2025-08-08	Annual	2026-08-08	RLAN50040-18-F-0003
emtest	RLAN50040-18-F	Attenuator	2025-08-08	Annual	2026-08-08	RLAN50040-18-F-0004
emtest	RLA29210010-40-F	Attenuator	2025-08-08	Annual	2026-08-08	RLA29210010-40-F-0003
emtest	RLA29210010-40-F	Attenuator	2025-08-08	Annual	2026-08-08	RLA29210010-40-F-0004
WAINWRIGHT	WHKX3.0/18G-10SS	High Pass Filter	2025-11-10	Annual	2026-11-10	78
WAINWRIGHT	WHW-13000-18000-40000-40CC	High Pass Filter	2025-03-14	Annual	2026-03-14	0002
Agilent	6674A	DC Power Supply	2025-03-13	Annual	2026-03-13	US36372372
AC POWER KOREA	ACPD-60150	DC Power Supply	2025-11-07	Annual	2026-11-07	DC-2

Table 6-1. Summary of Test Results

Notes:

1. For equipment listed above that has a calibration date or calibration due date that falls within the test date range, care was taken to ensure that this equipment was used after the calibration date and before the calibration due date.
2. All testing was performed before the calibration due date.

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7.0 SAMPLE CALCULATIONS

Emission Designator

QPSK Modulation

Emission Designator = 9M28G7D

Occupied Bandwidth = 9.28 MHz

G = Phase Modulation

7 = Quantized/Digital Info

D = Data transmission, telemetry, telecommand

QAM Modulation

Emission Designator = 9M28W7D

Occupied Bandwidth = 9.28 MHz

W = Amplitude/Angle Modulated

7 = Quantized/Digital Info

D = Data transmission, telemetry, telecommand

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8.0 TEST RESULTS

8.1 Summary

Company Name: SAMSUNG Electronics Co., Ltd.
FCC ID: A3LRF4487D-25A
FCC Classification: PCS Licensed Transmitter
Mode(s): LTE, NR

FCC Part Section(s)	Test Description	Limit	Test Condition	Test Result	Reference
§ 2.1046	Conducted Average Output Power	N/A	CONDUCTED	PASS	Annex A
§ 2.1049	Occupied Bandwidth	N/A		PASS	Section 8.2
§ 2.1046, § 24.232, § 27.50(d)	Equivalent Isotropic Radiated Power	< 1640 W/MHz		PASS	Section 8.3 (Note 4)
§ 2.1046, § 24.232, § 27.50(d)	Peak-to-average ratio	≤ 13 dB		PASS	Section 8.4
§ 2.1051, § 24.238, § 27.53(h)	Band Edge Emissions at Antenna Terminal	< 43 + log10(P[Watts]) at Band Edge and all out-of-band emissions		PASS	Section 8.5
§ 2.1051, § 24.238, § 27.53(h)	Spurious and Harmonic Emissions at Antenna Terminal			PASS	Section 8.6
§ 2.1055 § 24.235 § 27.54	Frequency Stability	Fundamental emissions stay within authorized frequency block		PASS	(Note 5)
§ 2.1055, § 24.238, § 27.53(h)	Radiated unwanted emission	< 43 + log10(P[Watts]) at Band Edge and all out-of-band emissions	RADIATED	PASS	Section 8.8

Table 8-1. Summary of Test Results

Notes:

- 1) All modes of operation and data rates were investigated. The test results shown in the following sections represent the worst case emissions.
- 2) The analyzer plots were all taken with a correction table loaded into the analyzer.
- 3) All antenna port conducted emissions testing was performed on a test bench with the antenna port of the EUT connected to the spectrum analyzer through calibrated cables and attenuators.
- 4) The maximum antenna gain and Limit are determined at the time of licensing depending on the Geographical Location of the base station
- 5) This is a variant report for enabling the channel bandwidth by software without any hardware modification. Frequency Stability test is not affected by this change item, and it was already performed in the original report.

8.2 Occupied Bandwidth

Test Overview

The occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission shall be measured. All modes of operation were investigated and the worst case configuration results are reported in this section.

Test Procedures Used

KDB 971168 D01 v03r01 – Section 4.3

ANSI C63.26-2015 – Section 5.4.4

Test Setting

The measurement was made using a direct connection between the RF output of the EUT and the spectrum analyzer. The spectrum analyzer settings were as follows:

1. The signal analyzer's automatic bandwidth measurement capability was used to perform the 99% occupied bandwidth and the 26dB bandwidth. The bandwidth measurement was not influenced by any intermediate power nulls in the fundamental emission.
2. RBW = 1 – 5% of the expected OBW
3. VBW $\geq 3 \times$ RBW
4. Detector = Peak
5. Trace mode = max hold
6. Sweep = auto couple
7. The trace was allowed to stabilize
8. If necessary, steps 2 – 7 were repeated after changing the RBW such that it would be within 1 – 5% of the 99% occupied bandwidth observed in Step 7

Test Setup

The EUT and measurement equipment were set up as shown in the diagram below.

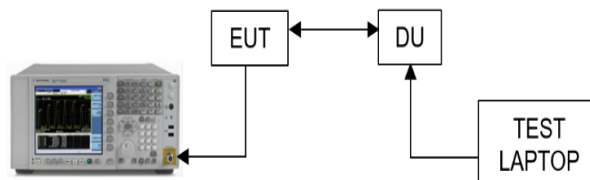


Figure 8-1. Test Instrument & Measurement Setup

Test Notes

None



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Channel	Port	OBW (MHz)	
		QPSK	16QAM
Low	0	9.27	9.26
	1	9.27	9.26
	2	9.28	9.26
	3	9.27	9.26
Middle	0	9.27	9.27
	1	9.28	9.27
	2	9.27	9.27
	3	9.27	9.26
High	0	9.26	9.27
	1	9.28	9.28
	2	9.27	9.27
	3	9.27	9.28

Table 8-2. Occupied Bandwidth Summary Data (LTE_B25_1C_10M_NB-IoT Guard band)

Channel	Port	OBW (MHz)	
		QPSK	16QAM
Low	0	13.72	13.71
	1	13.74	13.72
	2	13.74	13.72
	3	13.72	13.73
Middle	0	13.72	13.72
	1	13.74	13.73
	2	13.70	13.74
	3	13.73	13.72
High	0	13.72	13.73
	1	13.74	13.72
	2	13.73	13.71
	3	13.77	13.71

Table 8-3. Occupied Bandwidth Summary Data (LTE_B25_1C_15M_NB-IoT Guard band)

Channel	Port	OBW (MHz)	
		QPSK	16QAM
Low	0	18.32	18.28
	1	18.27	18.30
	2	18.28	18.28
	3	18.28	18.26
Middle	0	18.25	18.29
	1	18.26	18.31
	2	18.29	18.27
	3	18.27	18.24
High	0	18.28	18.30
	1	18.27	18.31
	2	18.29	18.31
	3	18.26	18.29

Table 8-4. Occupied Bandwidth Summary Data (LTE_B25_1C_20M_NB-IoT Guard band)



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Channel	Port	OBW (MHz)			
		LTE_B25_2C_10M_NB-IoT Guard band+5M		LTE_B25_4C_15M_NB-IoT Guard band+15M+15M+20M	
		QPSK	16QAM	QPSK	16QAM
Low	0	14.50	14.49		
	1	14.50	14.48		
	2	14.52	14.48		
	3	14.50	14.50		
Middle	0	14.50	14.46	63.22	63.21
	1	14.50	14.45	63.25	63.20
	2	14.50	14.46	63.18	63.29
	3	14.51	14.49	63.19	63.12
High	0	14.50	14.47		
	1	14.50	14.50		
	2	14.52	14.49		
	3	14.51	14.49		

Table 8-5. Occupied Bandwidth Summary Data (LTE_B25_Multi carrier)

Channel	Port	OBW (MHz)			
		MSR_2C_B/n25_LTE_10M_NB-IoT Guard band+NR_5M		MSR_4C_B/n25_LTE_15M_NB-IoT Guard band+15M+NR_15M+20M	
		QPSK	16QAM	QPSK	16QAM
Low	0	14.48	14.47		
	1	14.47	14.46		
	2	14.48	14.46		
	3	14.51	14.46		
Middle	0	14.49	14.45	63.19	63.12
	1	14.48	14.48	63.20	63.20
	2	14.49	14.50	63.15	63.17
	3	14.47	14.47	63.18	63.21
High	0	14.50	14.47		
	1	14.48	14.49		
	2	14.50	14.46		
	3	14.51	14.47		

Table 8-6. Occupied Bandwidth Summary Data (MSR_B/n25_Multi carrier)



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Channel	Port	OBW (MHz)	
		QPSK	16QAM
Low	0	9.28	9.26
	1	9.27	9.27
	2	9.27	9.27
	3	9.27	9.26
Middle	0	9.28	9.26
	1	9.27	9.26
	2	9.28	9.26
	3	9.27	9.26
High	0	9.27	9.27
	1	9.28	9.27
	2	9.27	9.26
	3	9.30	9.27

Table 8-7. Occupied Bandwidth Summary Data (LTE_B66_1C_10M_NB-IoT Guard band)

Channel	Port	OBW (MHz)	
		QPSK	16QAM
Low	0	13.72	13.74
	1	13.75	13.73
	2	13.72	13.71
	3	13.72	13.73
Middle	0	13.73	13.72
	1	13.74	13.73
	2	13.75	13.72
	3	13.72	13.70
High	0	13.73	13.74
	1	13.76	13.71
	2	13.74	13.76
	3	13.77	13.70

Table 8-8. Occupied Bandwidth Summary Data (LTE_B66_1C_15M_NB-IoT Guard band)

Channel	Port	OBW (MHz)	
		QPSK	16QAM
Low	0	18.26	18.31
	1	18.32	18.29
	2	18.28	18.30
	3	18.29	18.30
Middle	0	18.27	18.26
	1	18.30	18.25
	2	18.30	18.31
	3	18.28	18.28
High	0	18.31	18.28
	1	18.27	18.28
	2	18.25	18.29
	3	18.28	18.28

Table 8-9. Occupied Bandwidth Summary Data (LTE_B66_1C_20M_NB-IoT Guard band)



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Channel	Port	OBW (MHz)			
		LTE_B66_2C_10M_NB-IoT Guard band+5M		LTE_B66_3C_20M_NB-IoT Guard band+20M+20M	
		QPSK	16QAM	QPSK	16QAM
Low	0	14.49	14.48	58.00	58.05
	1	14.52	14.47	58.11	58.01
	2	14.50	14.49	58.02	58.06
	3	14.50	14.47	58.11	58.07
Middle	0	14.50	14.50	57.96	58.16
	1	14.50	14.47	58.16	58.02
	2	14.50	14.50	58.04	58.12
	3	14.50	14.49	58.03	58.13
High	0	14.51	14.49	58.09	58.06
	1	14.51	14.49	58.05	58.10
	2	14.49	14.48	58.02	57.99
	3	14.51	14.49	58.11	58.04

Table 8-10. Occupied Bandwidth Summary Data (LTE_B66_Multi carrier)

Channel	Port	OBW (MHz)			
		MSR_2C_B/n66_LTE_10M_NB-IoT Guard band+NR_5M		MSR_3C_B/n66_LTE_20M_NB-IoT Guard band+NR_20M+30M	
		QPSK	16QAM	QPSK	16QAM
Low	0	14.49	14.47		
	1	14.49	14.46		
	2	14.49	14.47		
	3	14.51	14.47		
Middle	0	14.48	14.47	68.38	68.33
	1	14.49	14.49	68.40	68.30
	2	14.50	14.47	68.32	68.45
	3	14.49	14.47	68.30	68.30
High	0	14.52	14.48		
	1	14.51	14.46		
	2	14.51	14.46		
	3	14.50	14.47		

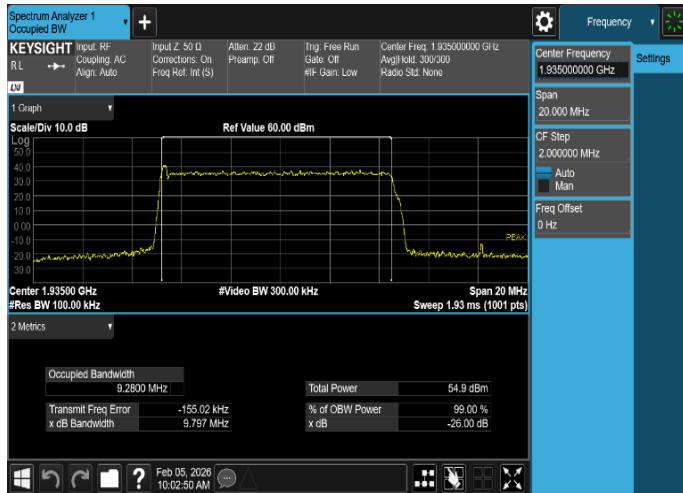
Table 8-11. Occupied Bandwidth Summary Data (MSR_B/n66_Multi carrier)



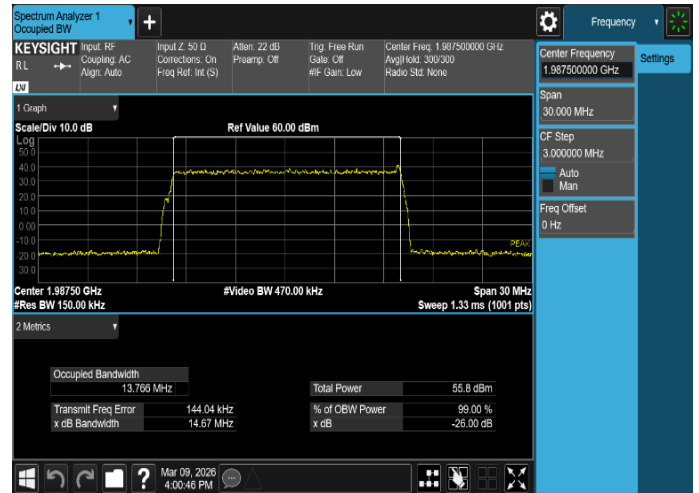
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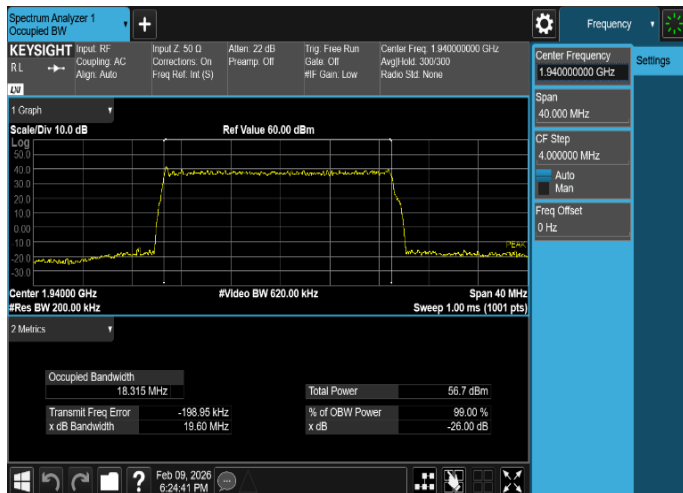
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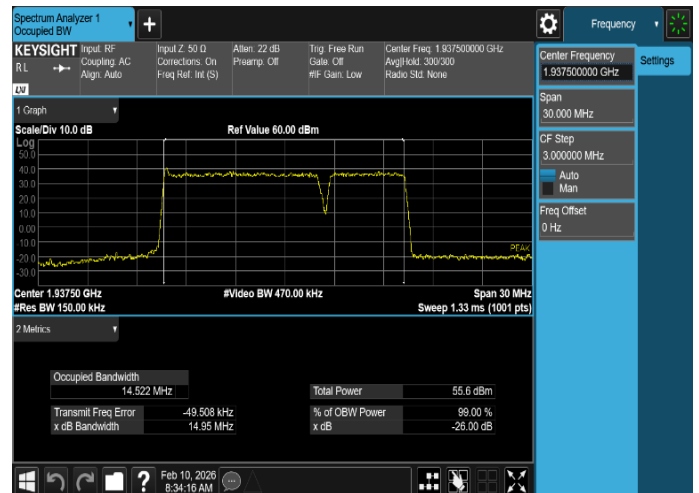
Plot 8-1. Occupied Bandwidth Plot
(LTE_B25_1C_10M_NB-IoT Guard band_QPSK - Low
Channel, Port 2)



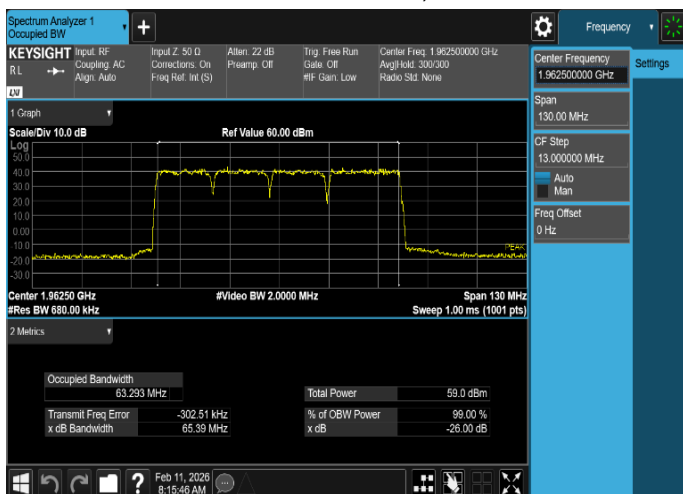
Plot 8-2. Occupied Bandwidth Plot
(LTE_B25_1C_15M_NB-IoT Guard band_QPSK - High
Channel, Port 3)



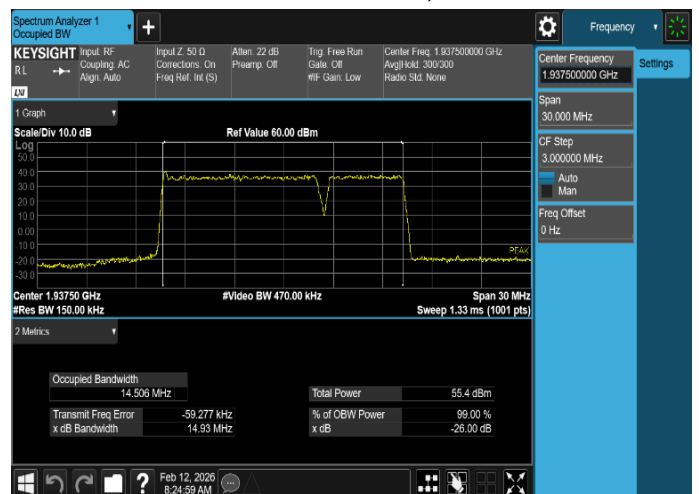
Plot 8-3. Occupied Bandwidth Plot
(LTE_B25_1C_20M_NB-IoT Guard band_QPSK - Low
Channel, Port 0)



Plot 8-4. Occupied Bandwidth Plot
(LTE_B25_2C_10M_NB-IoT Guard band+5M_QPSK - Low
Channel, Port 2)



Plot 8-5. Occupied Bandwidth Plot
(LTE_B25_4C_15M_NB-IoT Guard
band+15M+15M+20M_16QAM - Mid Channel, Port 2)



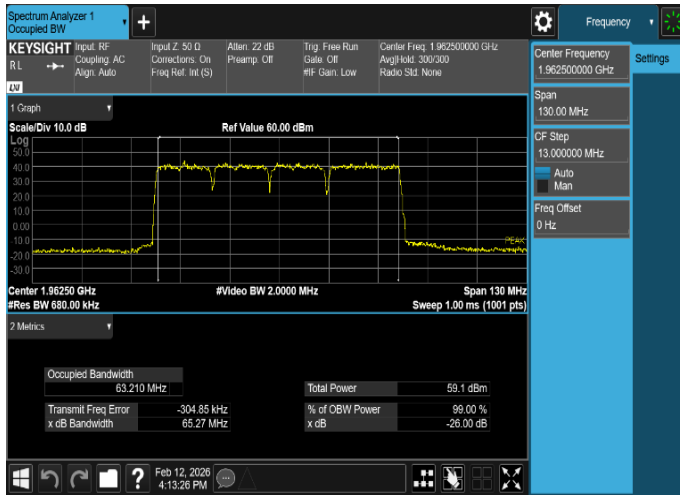
Plot 8-6. Occupied Bandwidth Plot
(MSR_2C_B/n25_LTE_10M_NB-IoT Guard
band+NR_5M_QPSK - Low Channel, Port 3)



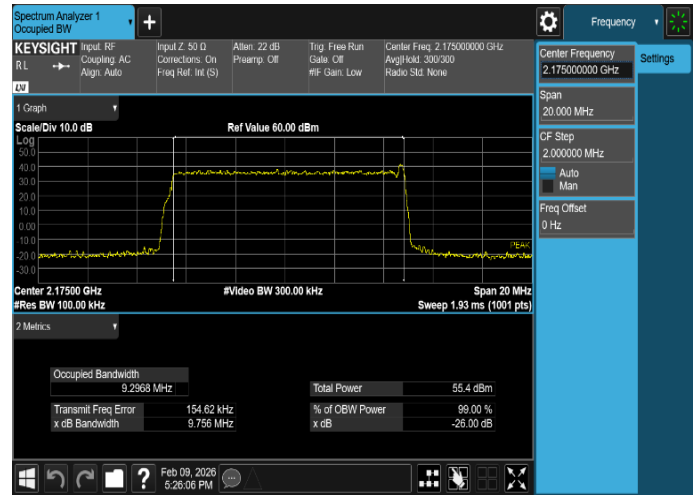
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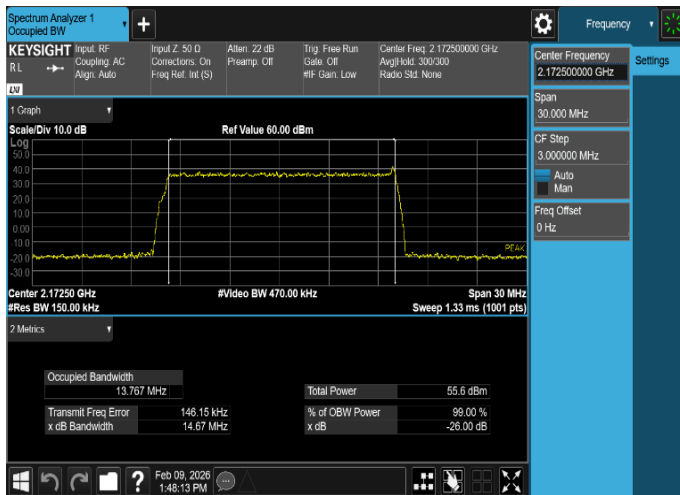
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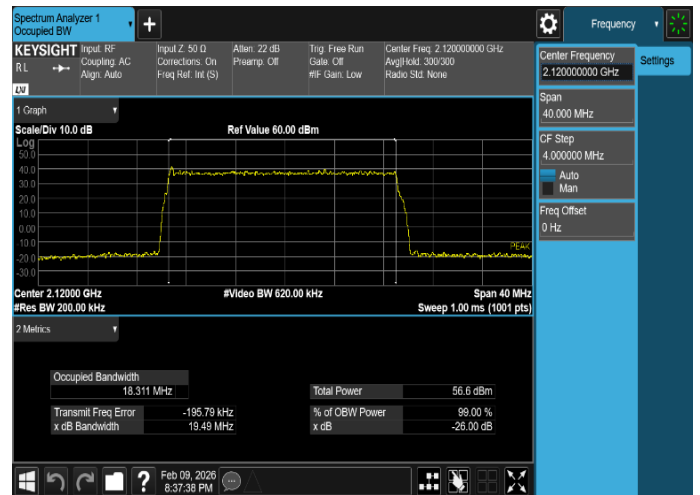
Plot 8-7. Occupied Bandwidth Plot
(MSR_4C_B/n25_LTE_15M_NB-IoT Guard
band+15M+NR_15M+20M_16QAM - Mid Channel, Port 3)



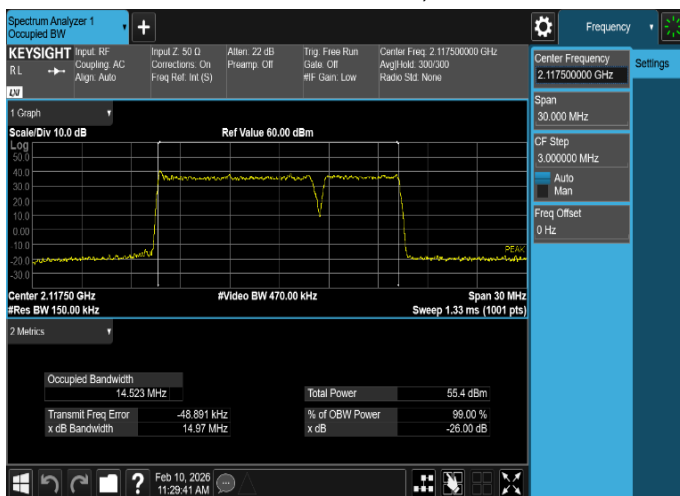
Plot 8-8. Occupied Bandwidth Plot
(LTE_B66_1C_10M_NB-IoT Guard band_QPSK - High
Channel, Port 3)



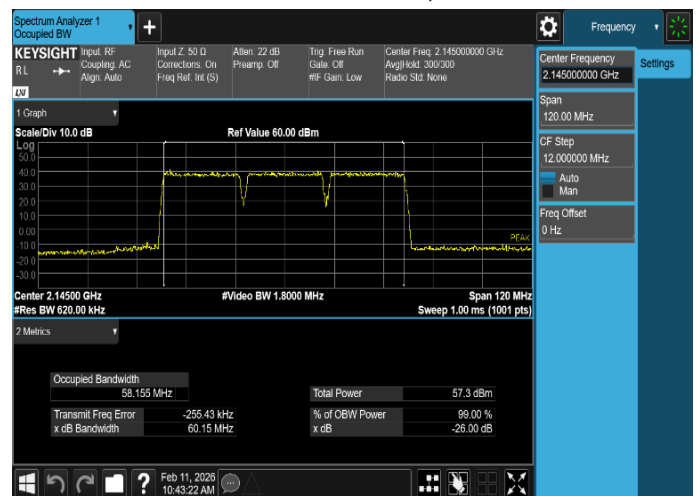
Plot 8-9. Occupied Bandwidth Plot
(LTE_B66_1C_15M_NB-IoT Guard band_QPSK - High
Channel, Port 3)



Plot 8-10. Occupied Bandwidth Plot
(LTE_B66_1C_20M_NB-IoT Guard band_QPSK - Low
Channel, Port 1)



Plot 8-11. Occupied Bandwidth Plot
(LTE_B66_2C_10M_NB-IoT Guard band+5M_QPSK - Low
Channel, Port 1)



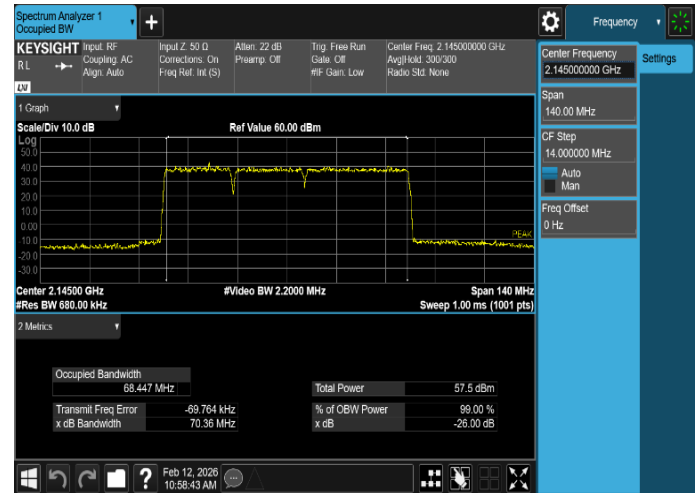
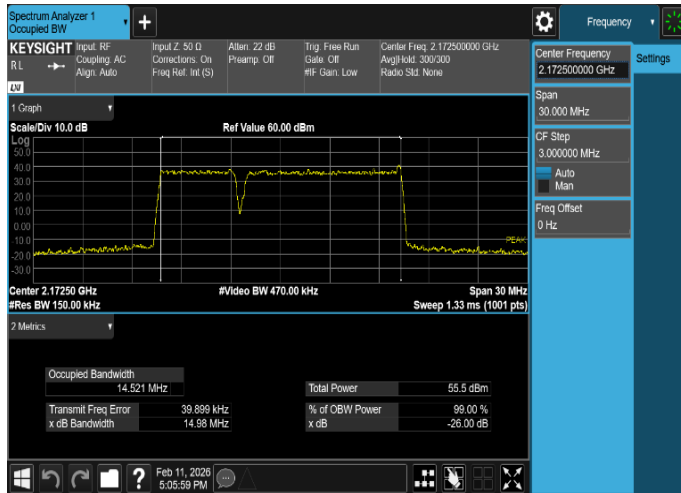
Plot 8-12. Occupied Bandwidth Plot
(LTE_B66_3C_20M_NB-IoT Guard band+20M+20M_QPSK -
Mid Channel, Port 1)



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8.3 Equivalent Isotropically Radiated Power

Test Overview

A transmitter port of EUT is connected to the input of a signal analyzer. All measurements are performed as RMS average measurements while the EUT is operating at its maximum duty cycle, at maximum power, and at the appropriate frequencies.

Test Description

KDB 971168 D01 v03r01 – Section 5

KDB 662911 D01 v02r01 – Section E)1) In-Band Power Measurements

ANSI C63.26-2015 – Section 5.2.4.5, Section 5.2.4.4.1

The measurement was made using a direct connection between the RF output of the EUT and the spectrum analyzer. The spectrum analyzer settings were as follows:

1. Conducted power measurements are performed using the signal analyzer's "SA" measurement capability for signals with continuous operation.
2. Set span to $2 \times$ to $3 \times$ the OBW.
3. Set RBW = 1 MHz (the reference bandwidth)
4. Set VBW $\geq 3 \times$ RBW.
5. Set number of measurement points in sweep $\geq 2 \times$ span / RBW.
6. Sweep time:
 - a) Set $\geq$ auto-couple, and enable trace averaging, or
 - b) Set $\geq [10 \times (\text{number of points in sweep}) \times (\text{transmission symbol period})]$ and enable a single sweep (automation-compatible) measurement. The sweep time should never be faster than the auto-coupled sweep time.
7. Detector = power averaging (rms).
8. The trace was allowed to stabilize
9. Use the peak marker function to determine the maximum amplitude level. ($=P_{\text{Meas}}$)
10. The relevant equation for determining the maximum EIRP from the measured RF output power is given in Equation as follows:

$$\text{EIRP} = P_{\text{Meas}} + G_T$$
 where
 GT: gain of the transmitting antenna, in dBi (EIRP).

Test Setup

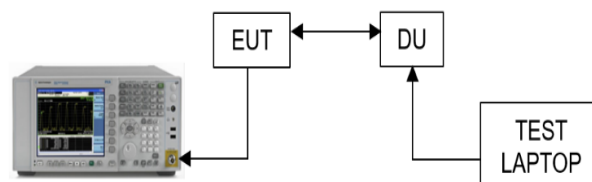


Figure 8-2. Test Instrument & Measurement Setup

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Limit**§ 24.232(a) (2)**

Base stations with an emission bandwidth greater than 1 MHz are limited to 1640 watts/MHz equivalent isotropically radiated power (EIRP) with an antenna height up to 300 meters HAAT, except as described in paragraph (b) below.

§ 27.50(d) (2) (ii)

An EIRP of 1640 watts/MHz when transmitting with an emission bandwidth greater than 1 MHz.

Note: The maximum antenna gain and EIRP limit are determined at the time of licensing depending on the geographical location of the base station.

Test Notes

1. For test results, an estimated calculated maximum permissible conducted output power is reported. The required reduction measurements will be performed after the installation.
2. Consider the following factors for MIMO:
The output power per each port is measured as dBm/MHz or dBm, the output powers are summed up in linear using the measure-and-sum technique defined in KDB 971168 D01 v03r01 - Section E) 2).
3. The output power per port (dBm/MHz or dBm) is converted to a linear value (mW). A summation of linear powers for all ports gives us the total MIMO Conducted Power (mW). We convert this back to logarithmic scale for further output power calculations.
4. Sample Calculation for LTE_B25_1C_10M_NB-IoT Guard band_QPSK - Low Channel:
Let us assume the following numbers:
 - a) Total MIMO Conducted Power as 25975.2 milliWatts
 - b)

Factors		Value	Unit
Summed MIMO Conducted Power (linear sum)		25975.2	mW
Summed MIMO Conducted Power (dBm)	$= 10 * \log (25975.2) =$	44.15	dBm



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Low Channel	Port	QPSK	16QAM
Power Spectral Density(dBm/MHz)	0	38.11	38.31
	1	38.02	38.38
	2	38.13	38.41
	3	38.24	38.53
Total MIMO PSD (mW/MHz)		25975.20	27715.81
Total MIMO PSD(dBm/MHz)		44.15	44.43
Middle Channel	Port	QPSK	16QAM
Power Spectral Density(dBm/MHz)	0	38.13	38.37
	1	38.16	38.57
	2	38.17	38.45
	3	38.42	38.64
Total MIMO PSD (mW/MHz)		26551.62	28374.78
Total MIMO PSD(dBm/MHz)		44.24	44.53
High Channel	Port	QPSK	16QAM
Power Spectral Density(dBm/MHz)	0	37.98	38.28
	1	38.17	38.52
	2	38.06	38.42
	3	38.32	38.55
Total MIMO PSD (mW/MHz)		26017.98	27958.52
Total MIMO PSD(dBm/MHz)		44.15	44.47

Table 8-12. Equivalent Isotropically Radiated Power Table (LTE_B25_1C_10M_NB-IoT Guard band)

Low Channel	Port	QPSK	16QAM
Power Spectral Density(dBm/MHz)	0	36.70	37.27
	1	36.66	37.37
	2	36.80	37.49
	3	36.72	37.43
Total MIMO PSD (mW/MHz)		18789.50	21937.36
Total MIMO PSD (dBm/MHz)		42.74	43.41
Middle Channel	Port	QPSK	16QAM
Power Spectral Density(dBm/MHz)	0	36.68	37.40
	1	37.00	37.43
	2	36.87	37.47
	3	37.10	37.45
Total MIMO PSD (mW/MHz)		19664.86	22163.78
Total MIMO PSD (dBm/MHz)		42.94	43.46
High Channel	Port	QPSK	16QAM
Power Spectral Density(dBm/MHz)	0	36.47	37.28
	1	36.98	37.38
	2	36.70	37.54
	3	37.04	37.47
Total MIMO PSD (mW/MHz)		19149.80	22069.58
Total MIMO PSD (dBm/MHz)		42.82	43.44

Table 8-13. Equivalent Isotropically Radiated Power Table (LTE_B25_1C_15M_NB-IoT Guard band)



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Low Channel	Port	QPSK	16QAM
Power Spectral Density(dBm/MHz)	0	36.70	36.79
	1	36.78	37.07
	2	36.79	36.97
	3	36.71	36.88
Total MIMO PSD (mW/MHz)		18898.56	19720.28
Total MIMO PSD (dBm/MHz)		42.76	42.95
Middle Channel	Port	QPSK	16QAM
Power Spectral Density(dBm/MHz)	0	36.73	36.88
	1	36.79	37.13
	2	36.77	37.03
	3	36.96	37.15
Total MIMO PSD (mW/MHz)		19215.18	20278.76
Total MIMO PSD (dBm/MHz)		42.84	43.07
High Channel	Port	QPSK	16QAM
Power Spectral Density(dBm/MHz)	0	36.51	36.86
	1	36.78	37.08
	2	36.62	37.11
	3	36.71	37.06
Total MIMO PSD (mW/MHz)		18520.57	20171.95
Total MIMO PSD (dBm/MHz)		42.68	43.05

Table 8-14. Equivalent Isotropically Radiated Power Table (LTE_B25_1C_20M_NB-IoT Guard band)

Mode		LTE_B25_2C_10M_NB-IoT Guard band+5M		LTE_B25_4C_15M_NB-IoT Guard band+15M+15M+20M	
Low Channel	Port	QPSK	16QAM	QPSK	16QAM
Power Spectral Density(dBm/MHz)	0	36.75	37.10		
	1	37.11	37.33		
	2	36.94	37.26		
	3	36.82	37.24		
Total MIMO PSD (mW/MHz)		19614.53	21147.82		
Total MIMO PSD (dBm/MHz)		42.93	43.25		
Middle Channel	Port	QPSK	16QAM	QPSK	16QAM
Power Spectral Density(dBm/MHz)	0	36.83	37.05	32.91	33.26
	1	36.88	37.24	32.89	33.61
	2	36.86	37.11	32.82	33.36
	3	36.82	37.21	32.90	33.70
Total MIMO PSD (mW/MHz)		19363.83	20760.11	7761.10	8925.50
Total MIMO PSD (dBm/MHz)		42.87	43.17	38.90	39.51
High Channel	Port	QPSK	16QAM	QPSK	16QAM
Power Spectral Density(dBm/MHz)	0	36.70	37.08		
	1	36.96	37.51		
	2	36.86	37.13		
	3	36.79	37.11		
Total MIMO PSD (mW/MHz)		19268.07	21043.82		
Total MIMO PSD (dBm/MHz)		42.85	43.23		

Table 8-15. Equivalent Isotropically Radiated Power Table (LTE_B25_Multi carrier)



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Low Channel	Port	MSR_2C_B/n25_LTE_10M_NB-IoT Guard band+NR_5M		MSR_4C_B/n25_LTE_15M_NB-IoT Guard band+15M+NR_15M+20M	
		QPSK	16QAM	QPSK	16QAM
Power Spectral Density(dBm/MHz)	0	36.65	36.73		
	1	36.76	36.98		
	2	36.93	36.86		
	3	36.86	36.86		
Total MIMO PSD (mW/MHz)		19146.30	19401.17		
Total MIMO PSD (dBm/MHz)		42.82	42.88		
Middle Channel	Port	QPSK	16QAM	QPSK	16QAM
Power Spectral Density(dBm/MHz)	0	36.52	36.67	32.67	33.40
	1	36.65	36.85	32.90	33.68
	2	36.67	36.89	32.66	33.46
	3	36.96	36.78	32.86	33.47
Total MIMO PSD (mW/MHz)		18719.23	19122.30	7579.06	8956.04
Total MIMO PSD (dBm/MHz)		42.72	42.82	38.80	39.52
High Channel	Port	QPSK	16QAM	QPSK	16QAM
Power Spectral Density(dBm/MHz)	0	36.71	36.78		
	1	36.70	36.78		
	2	36.73	36.83		
	3	36.76	36.88		
Total MIMO PSD (mW/MHz)		18823.10	19221.17		
Total MIMO PSD (dBm/MHz)		42.75	42.84		

Table 8-16. Equivalent Isotropically Radiated Power Table (MSR_B/n25_Multi carrier)

Low Channel	Port	QPSK	16QAM
Power Spectral Density(dBm/MHz)	0	38.25	38.57
	1	38.21	38.53
	2	38.46	38.73
	3	38.17	38.51
Total MIMO PSD (mW/MHz)		26885.99	28880.04
Total MIMO PSD (dBm/MHz)		44.30	44.61
Middle Channel	Port	QPSK	16QAM
Power Spectral Density(dBm/MHz)	0	38.68	38.84
	1	38.47	38.63
	2	38.58	39.03
	3	38.51	38.66
Total MIMO PSD (mW/MHz)		28708.28	30280.05
Total MIMO PSD (dBm/MHz)		44.58	44.81
High Channel	Port	QPSK	16QAM
Power Spectral Density(dBm/MHz)	0	38.63	38.87
	1	38.54	38.64
	2	38.79	38.93
	3	38.47	38.68
Total MIMO PSD (mW/MHz)		29045.17	30210.61
Total MIMO PSD (dBm/MHz)		44.63	44.80

Table 8-17. Equivalent Isotropically Radiated Power Table (LTE_B66_1C_10M_NB-IoT Guard band)



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Low Channel	Port	QPSK	16QAM
Power Spectral Density(dBm/MHz)	0	36.85	37.41
	1	36.73	37.34
	2	37.00	37.54
	3	36.81	37.48
Total MIMO PSD (mW/MHz)		19357.20	22197.32
Total MIMO PSD (dBm/MHz)		42.87	43.46
Middle Channel	Port	QPSK	16QAM
Power Spectral Density(dBm/MHz)	0	37.21	37.52
	1	37.14	37.61
	2	37.28	37.66
	3	37.11	37.52
Total MIMO PSD (mW/MHz)		20932.08	22894.24
Total MIMO PSD (dBm/MHz)		43.21	43.60
High Channel	Port	QPSK	16QAM
Power Spectral Density(dBm/MHz)	0	37.33	37.66
	1	36.95	37.52
	2	37.40	37.65
	3	36.85	37.50
Total MIMO PSD (mW/MHz)		20691.99	22911.13
Total MIMO PSD (dBm/MHz)		43.16	43.60

Table 8-18. Equivalent Isotropically Radiated Power Table (LTE_B66_1C_15M_NB-IoT Guard band)

Low Channel	Port	QPSK	16QAM
Power Spectral Density(dBm/MHz)	0	36.71	36.87
	1	36.69	36.81
	2	36.82	37.25
	3	36.57	36.89
Total MIMO PSD (mW/MHz)		18688.43	19850.97
Total MIMO PSD (dBm/MHz)		42.72	42.98
Middle Channel	Port	QPSK	16QAM
Power Spectral Density(dBm/MHz)	0	36.78	37.20
	1	36.68	37.05
	2	37.03	37.15
	3	36.80	36.96
Total MIMO PSD (mW/MHz)		19253.29	20479.09
Total MIMO PSD (dBm/MHz)		42.85	43.11
High Channel	Port	QPSK	16QAM
Power Spectral Density(dBm/MHz)	0	36.77	37.07
	1	36.59	36.97
	2	36.96	37.15
	3	36.65	37.08
Total MIMO PSD (mW/MHz)		18893.76	20350.72
Total MIMO PSD (dBm/MHz)		42.76	43.09

Table 8-19. Equivalent Isotropically Radiated Power Table (LTE_B66_1C_20M_NB-IoT Guard band)



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Low Channel	Port	LTE_B66_2C_10M_NB-IoT Guard band+5M		LTE_B66_3C_20M_NB-IoT Guard band+20M+20M	
		QPSK	16QAM	QPSK	16QAM
Power Spectral Density(dBm/MHz)	0	36.93	37.39	32.13	32.32
	1	36.96	37.14	32.11	32.38
	2	37.10	37.13	32.29	32.42
	3	36.67	36.96	32.07	32.32
Total MIMO PSD (mW/MHz)		19654.34	20790.34	6559.43	6888.64
Total MIMO PSD (dBm/MHz)		42.93	43.18	38.17	38.38
Middle Channel	Port	QPSK	16QAM	QPSK	16QAM
		QPSK	16QAM	QPSK	16QAM
Power Spectral Density(dBm/MHz)	0	36.96	37.31	32.05	32.61
	1	36.94	37.22	32.12	32.44
	2	37.04	37.43	32.27	32.66
	3	36.78	37.13	32.04	32.67
Total MIMO PSD (mW/MHz)		19726.91	21343.01	6520.56	7267.85
Total MIMO PSD (dBm/MHz)		42.95	43.29	38.14	38.61
High Channel	Port	QPSK	16QAM	QPSK	16QAM
		QPSK	16QAM	QPSK	16QAM
Power Spectral Density(dBm/MHz)	0	36.91	37.25	32.15	32.54
	1	36.88	37.23	32.19	32.79
	2	37.12	37.43	32.35	32.62
	3	36.98	37.10	32.19	32.37
Total MIMO PSD (mW/MHz)		19930.04	21249.33	6669.26	7248.49
Total MIMO PSD (dBm/MHz)		43.00	43.27	38.24	38.60

Table 8-20. Equivalent Isotropically Radiated Power Table (LTE_B66_Multi carrier)

Low Channel	Port	MSR_2C_B/n66_LTE_10M_NB-IoT Guard band+NR_5M		MSR_3C_B/n66_LTE_20M_NB-IoT Guard band+NR_20M+30M	
		QPSK	16QAM	QPSK	16QAM
Power Spectral Density(dBm/MHz)	0	36.93	36.97		
	1	36.86	37.12		
	2	36.98	36.92		
	3	36.82	36.84		
Total MIMO PSD (mW/MHz)		19575.01	19870.44		
Total MIMO PSD (dBm/MHz)		42.92	42.98		
Middle Channel	Port	QPSK	16QAM	QPSK	16QAM
		QPSK	16QAM	QPSK	16QAM
Power Spectral Density(dBm/MHz)	0	36.93	36.83	30.91	31.13
	1	37.16	36.95	31.10	31.31
	2	37.04	36.86	31.32	31.29
	3	36.98	36.91	31.14	31.22
Total MIMO PSD (mW/MHz)		20171.75	19532.45	5178.50	5315.15
Total MIMO PSD (dBm/MHz)		43.05	42.91	37.14	37.26
High Channel	Port	QPSK	16QAM	QPSK	16QAM
		QPSK	16QAM	QPSK	16QAM
Power Spectral Density(dBm/MHz)	0	36.83	36.61		
	1	37.11	36.60		
	2	37.00	36.69		
	3	37.07	36.58		
Total MIMO PSD (mW/MHz)		20075.56	18365.58		
Total MIMO PSD (dBm/MHz)		43.03	42.64		

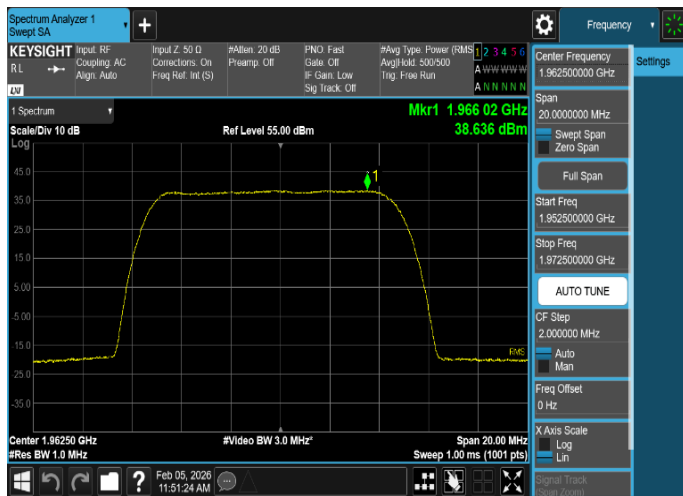
Table 8-21. Equivalent Isotropically Radiated Power Table (MSR_B/n66_Multi carrier)



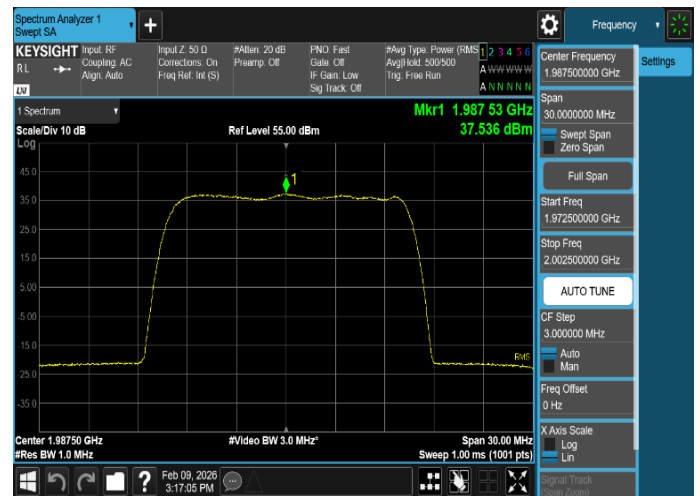
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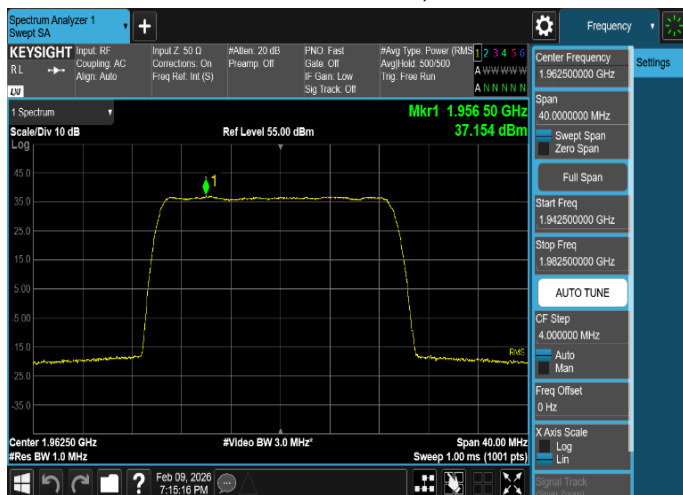
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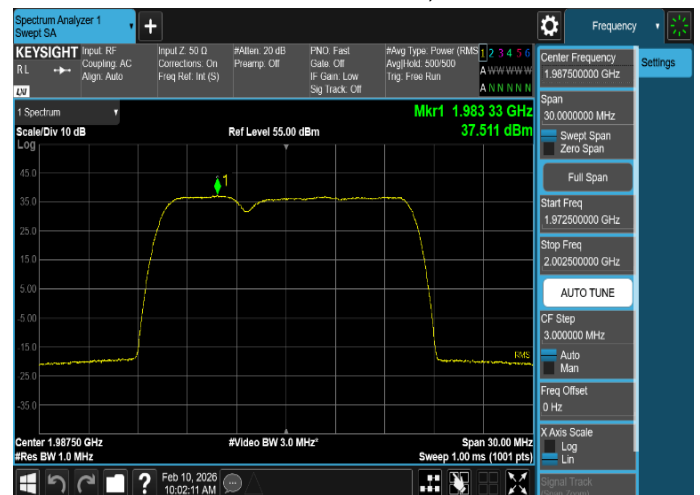
Plot 8-15. Equivalent Isotropically Radiated Power Plot
(LTE_B25_1C_10M_NB-IoT Guard band_16QAM - Mid
Channel, Port 3)



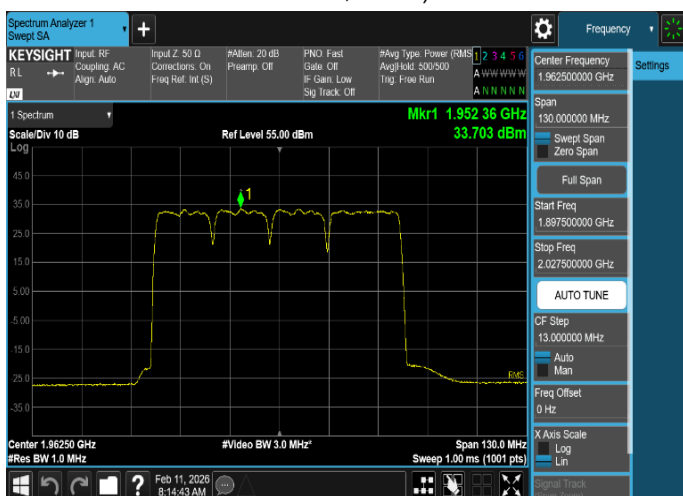
Plot 8-16. Equivalent Isotropically Radiated Power Plot
(LTE_B25_1C_15M_NB-IoT Guard band_16QAM - High
Channel, Port 2)



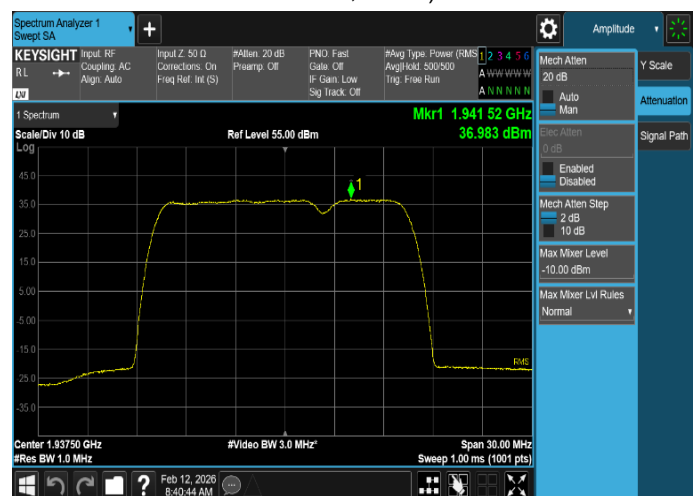
Plot 8-17. Equivalent Isotropically Radiated Power Plot
(LTE_B25_1C_20M_NB-IoT Guard band_16QAM - Mid
Channel, Port 3)



Plot 8-18. Equivalent Isotropically Radiated Power Plot
(LTE_B25_2C_10M_NB-IoT Guard band+5M_16QAM - High
Channel, Port 1)



Plot 8-19. Equivalent Isotropically Radiated Power Plot
(LTE_B25_4C_15M_NB-IoT Guard
band+15M+15M+20M_16QAM - Mid Channel, Port 3)



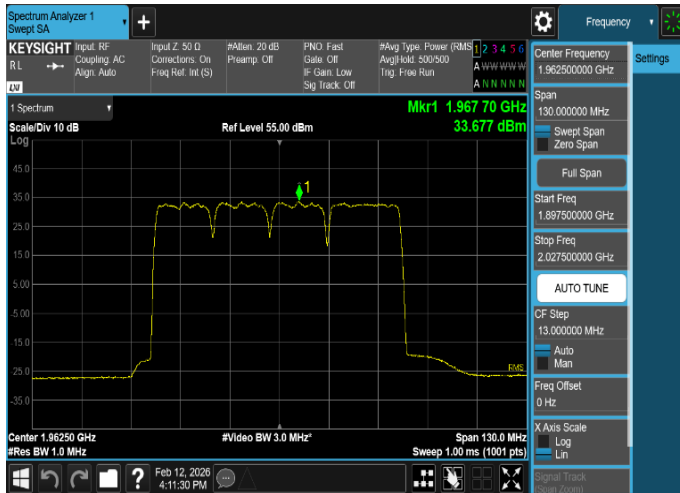
Plot 8-20. Equivalent Isotropically Radiated Power Plot
(MSR_2C_B/n25_LTE_10M_NB-IoT Guard
band+NR_5M_16QAM - Low Channel, Port 1)



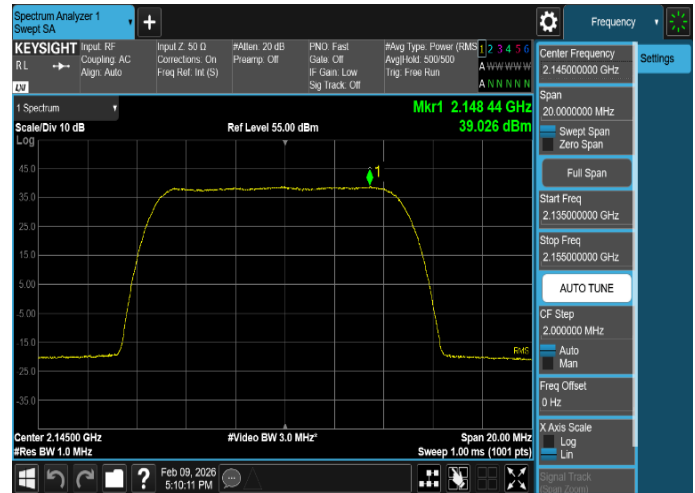
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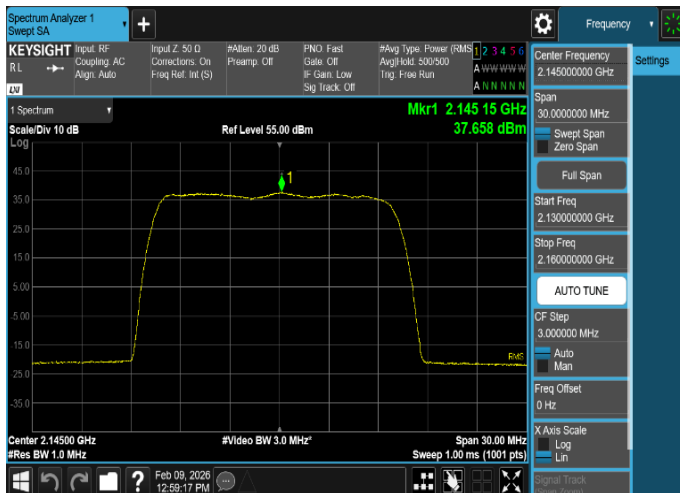
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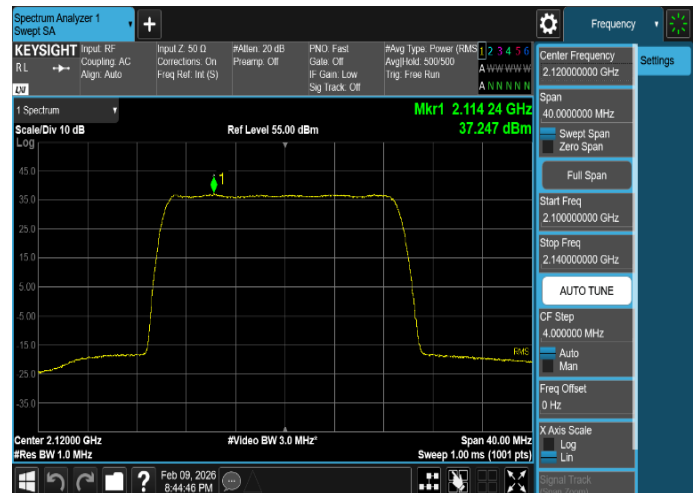
Plot 8-21. Equivalent Isotropically Radiated Power Plot
(MSR_4C_B/n25_LTE_15M_NB-IoT Guard
band+15M+NR_15M+20M_16QAM - Mid Channel, Port 1)



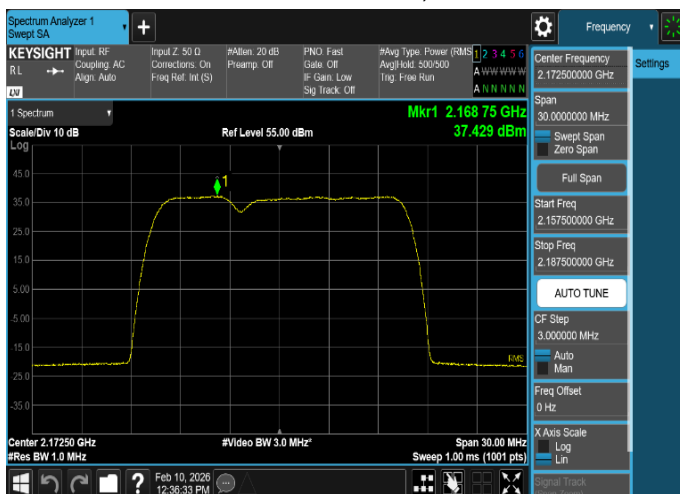
Plot 8-22. Equivalent Isotropically Radiated Power Plot
(LTE_B66_1C_10M_NB-IoT Guard band_16QAM - Mid
Channel, Port 2)



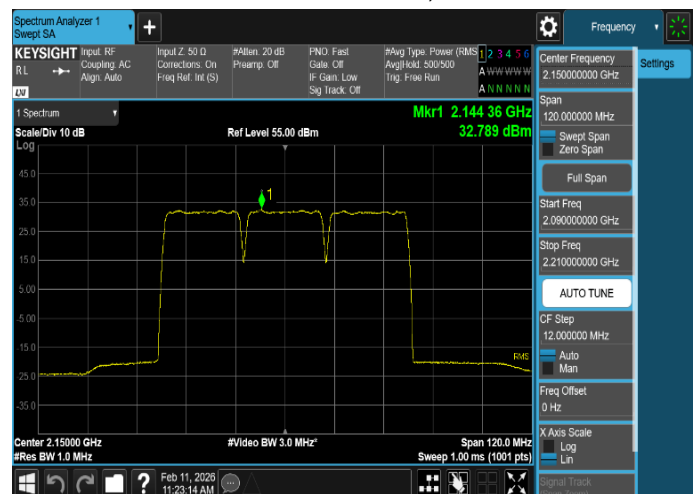
Plot 8-23. Equivalent Isotropically Radiated Power Plot
(LTE_B66_1C_15M_NB-IoT Guard band_16QAM - Mid
Channel, Port 2)



Plot 8-24. Equivalent Isotropically Radiated Power Plot
(LTE_B66_1C_20M_NB-IoT Guard band_16QAM - Low
Channel, Port 2)



Plot 8-25. Equivalent Isotropically Radiated Power Plot
(LTE_B66_2C_10M_NB-IoT Guard band+5M_16QAM - High
Channel, port 2)



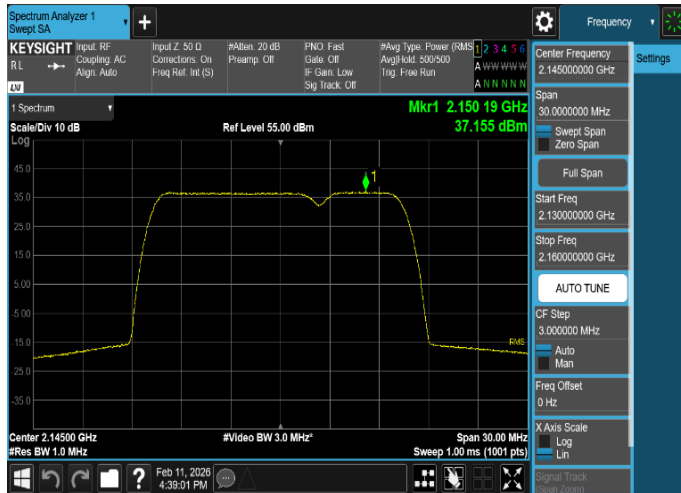
Plot 8-26. Equivalent Isotropically Radiated Power Plot
(LTE_B66_3C_20M_NB-IoT Guard band+20M+20M_16QAM -
High Channel, Port 1)



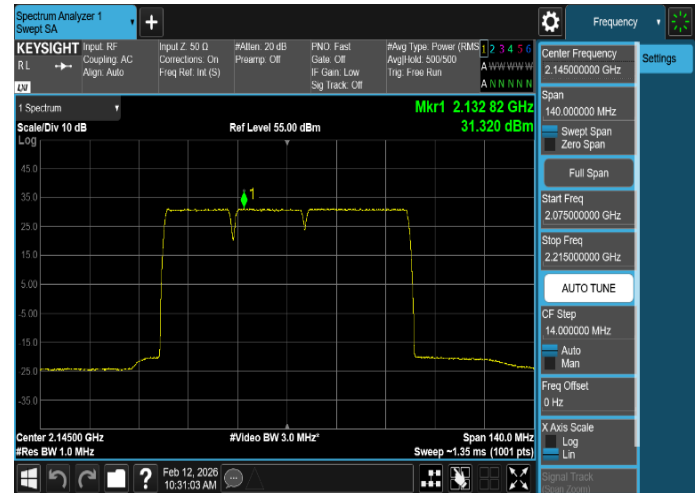
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Plot 8-27. Equivalent Isotropically Radiated Power Plot
(MSR_2C_B/n66_LTE_10M_NB-IoT Guard
band+NR_5M_QPSK - Mid Channel, Port 1)



Plot 8-28. Equivalent Isotropically Radiated Power Plot
(MSR_3C_B/n66_LTE_20M_NB-IoT Guard
band+NR_20M+30M_QPSK - Mid Channel, Port 2)

8.4 Peak To Average Ratio

Test Overview

The peak to average ratio measurement is performed at the conducted port of the EUT. The spectrum analyzers Complementary Cumulative Distribution Function (CCDF) measurement profile is used to determine the largest deviation between the average and the peak power of the EUT in a given bandwidth. The CCDF curve shows how much time the peak waveform spends at or above a given average power level. The percent of time the signal spends at or above the level defines the probability for that particular power level.

Test Procedure Used

KDB 971168 D01 v03r01 – Section 5.7

ANSI C63.26-2015 – Section 5.2.3.4

Test Setting

The measurement was made using a direct connection between the RF output of the EUT and the spectrum analyzer. The spectrum analyzer settings were as follows:

1. The signal analyzer's CCDF function is enabled.
2. Frequency = carrier center frequency
3. Measurement BW $\geq$ OBW or specified reference bandwidth
4. The signal analyzer was set to collect one million samples to generate the CCDF curve
5. The measurement interval was set depending on the type of signal analyzed. For continuous signals (>98% duty cycle), the measurement interval was set to 1ms.

Test Setup

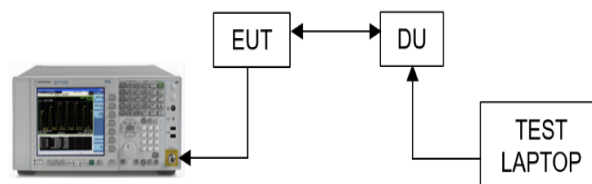


Figure 8-3. Test Instrument & Measurement Setup

Limit

§ 24.232,
 § 27.50(d)

The peak-to-average power ratio (PAPR) limit shall not exceed 13 dB for more than 0.1% of the time.



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Channel	Port	Peak To Average Power Ratio (PAPR) (dB)	
		QPSK	16QAM
LTE_B25_ 1C_10M_NB-IoT Guard band Low Channel	0	7.49	7.52
	1	7.53	7.54
	2	7.54	7.55
	3	7.56	7.57
LTE_B25_ 1C_10M_NB-IoT Guard band Mid Channel	0	7.49	7.51
	1	7.48	7.50
	2	7.49	7.49
	3	7.50	7.51
LTE_B25_ 1C_10M_NB-IoT Guard band High Channel	0	7.48	7.51
	1	7.48	7.50
	2	7.48	7.51
	3	7.47	7.50
LTE_B25_ 1C_15M_NB-IoT Guard band Low Channel	0	7.54	7.51
	1	7.55	7.52
	2	7.54	7.54
	3	7.55	7.55
LTE_B25_ 1C_15M_NB-IoT Guard band Mid Channel	0	7.44	7.44
	1	7.43	7.43
	2	7.44	7.43
	3	7.44	7.44
LTE_B25_ 1C_15M_NB-IoT Guard band High Channel	0	7.44	7.42
	1	7.45	7.45
	2	7.44	7.45
	3	7.43	7.42
LTE_B25_ 1C_20M_NB-IoT Guard band Low Channel	0	7.96	7.93
	1	7.94	7.93
	2	7.96	7.94
	3	7.93	7.94
LTE_B25_ 1C_20M_NB-IoT Guard band Mid Channel	0	7.92	7.93
	1	7.92	7.94
	2	7.87	7.91
	3	7.92	7.91
LTE_B25_ 1C_20M_NB-IoT Guard band High Channel	0	7.93	7.89
	1	7.91	7.92
	2	7.90	7.93
	3	7.89	7.95
Worst Margin		-5.04	

Table 8-22. Peak To Average Power Ratio Summary Data (LTE_B25_Single carrier)

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Channel	Port	Peak To Average Power Ratio (PAPR) (dB)
		QPSK
LTE_B25_ 2C_10M_NB-IoT Guard band+5M Low Channel	0	7.59
	1	7.58
	2	7.61
	3	7.60
LTE_B25_ 2C_10M_NB-IoT Guard band+5M Mid Channel	0	7.48
	1	7.50
	2	7.49
	3	7.49
LTE_B25_ 2C_5M+10M_NB-IoT Guard band High Channel	0	7.46
	1	7.48
	2	7.46
	3	7.47
LTE_B25_ 4C_15M_NB-IoT Guard band+15M+15M+20M Mid Channel	0	7.94
	1	7.99
	2	7.97
	3	8.00
MSR_2C B/n25_LTE_10M_ NB-IoT Guard band+NR_5M Low Channel	0	7.60
	1	7.59
	2	7.55
	3	7.64
MSR_2C B/n25_LTE_10M_ NB-IoT Guard band+NR_5M Mid Channel	0	7.49
	1	7.50
	2	7.48
	3	7.48
MSR_2C B/n25_NR_5M+LTE_10M_ NB-IoT Guard band High Channel	0	7.47
	1	7.49
	2	7.47
	3	7.47
MSR_4C B/n25_LTE_15M_ NB-IoT Guard band+15M+ NR_15M+20M Mid Channel	0	7.99
	1	7.94
	2	7.95
	3	8.00
Worst Margin		-5.00

Table 8-23. Peak To Average Power Ratio Summary Data (MSR_B/n25_Multi carrier)



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Channel	Port	Peak To Average Power Ratio (PAPR) (dB)	
		QPSK	16QAM
LTE_B66_ 1C_10M_NB-IoT Guard band Low Channel	0	7.84	7.86
	1	7.86	7.88
	2	7.85	7.88
	3	7.86	7.89
LTE_B66_ 1C_10M_NB-IoT Guard band Mid Channel	0	7.85	7.88
	1	7.86	7.90
	2	7.85	7.88
	3	7.89	7.87
LTE_B66_ 1C_10M_NB-IoT Guard band High Channel	0	7.86	7.89
	1	7.87	7.85
	2	7.88	7.87
	3	7.86	7.90
LTE_B66_ 1C_15M_NB-IoT Guard band Low Channel	0	7.82	7.83
	1	7.83	7.84
	2	7.82	7.85
	3	7.80	7.82
LTE_B66_ 1C_15M_NB-IoT Guard band Mid Channel	0	7.84	7.82
	1	7.84	7.83
	2	7.84	7.83
	3	7.81	7.84
LTE_B66_ 1C_15M_NB-IoT Guard band High Channel	0	7.85	7.83
	1	7.84	7.85
	2	7.85	7.83
	3	7.84	7.84
LTE_B66_ 1C_20M_NB-IoT Guard band Low Channel	0	7.51	7.53
	1	7.51	7.53
	2	7.53	7.52
	3	7.52	7.51
LTE_B66_ 1C_20M_NB-IoT Guard band Mid Channel	0	7.50	7.51
	1	7.49	7.53
	2	7.51	7.51
	3	7.51	7.52
LTE_B66_ 1C_20M_NB-IoT Guard band High Channel	0	7.49	7.51
	1	7.50	7.53
	2	7.51	7.51
	3	7.49	7.52
Worst Margin		-5.10	

Table 8-24. Peak To Average Power Ratio Summary Data (LTE_B66_Single carrier)



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Channel	Port	Peak To Average Power Ratio (PAPR) (dB)
		QPSK
LTE_B66_ 2C_10M_NB-IoT Guard band+5M Low Channel	0	7.85
	1	7.85
	2	7.88
	3	7.86
LTE_B66_ 2C_10M_NB-IoT Guard band+5M Mid Channel	0	7.92
	1	7.87
	2	7.87
	3	7.88
LTE_B66_ 2C_5M+10M_NB-IoT Guard band High Channel	0	7.92
	1	7.88
	2	7.88
	3	7.86
LTE_B66_ 3C_20M_NB-IoT Guard band +20M+20M Low Channel	0	7.53
	1	7.57
	2	7.52
	3	7.52
LTE_B66_ 3C_20M_NB-IoT Guard band +20M+20M Mid Channel	0	7.45
	1	7.48
	2	7.45
	3	7.44
LTE_B66_ 3C_20M+20M+20M_NB-IoT Guard band High Channel	0	7.41
	1	7.40
	2	7.40
	3	7.40
MSR_2C B/n66_LTE_10M_ NB-IoT Guard band+NR_5M Low Channel	0	7.86
	1	7.88
	2	7.88
	3	7.86
MSR_2C B/n66_LTE_10M_ NB-IoT Guard band+NR_5M Mid Channel	0	7.89
	1	7.90
	2	7.90
	3	7.89
MSR_2C B/n66_NR_5M+LTE_10M_ NB-IoT Guard band High Channel	0	7.92
	1	7.91
	2	7.90
	3	7.91
MSR_3C B/n66_LTE_20M_ NB-IoT Guard band+NR_20M+30M Mid Channel	0	7.51
	1	7.55
	2	7.50
	3	7.50
Worst Margin		-5.08

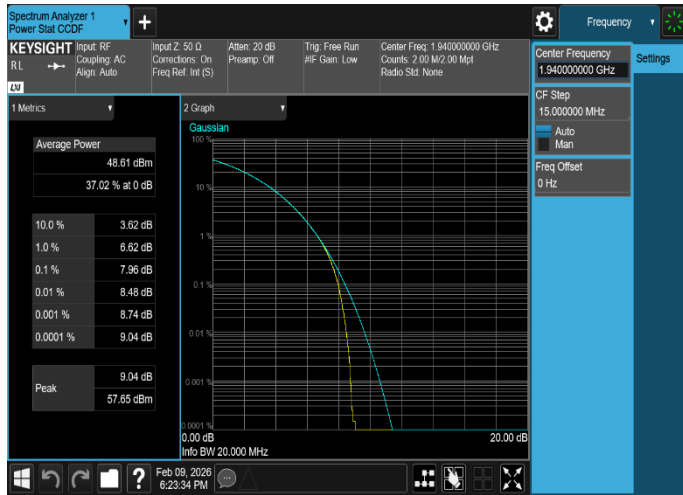
Table 8-25. Peak To Average Power Ratio Summary Data (MSR_B/n66_Multi carrier)



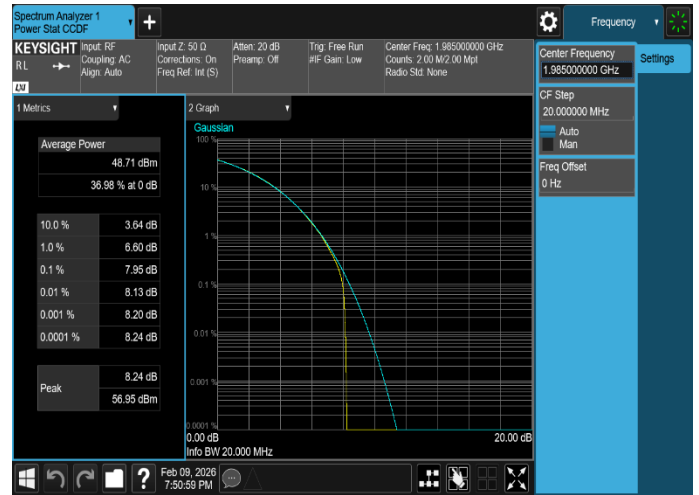
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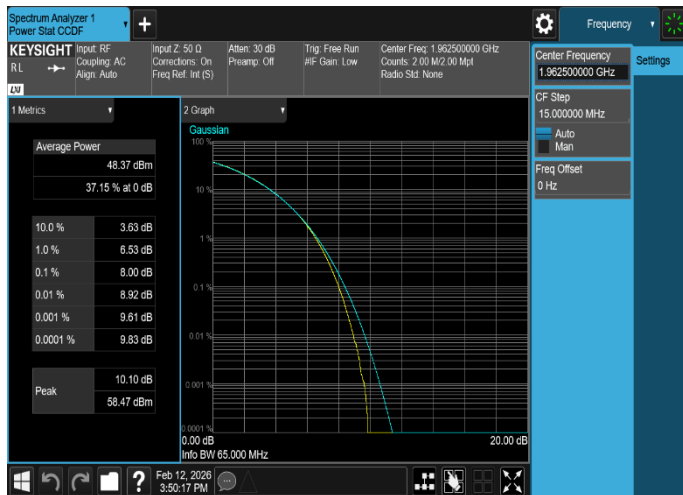
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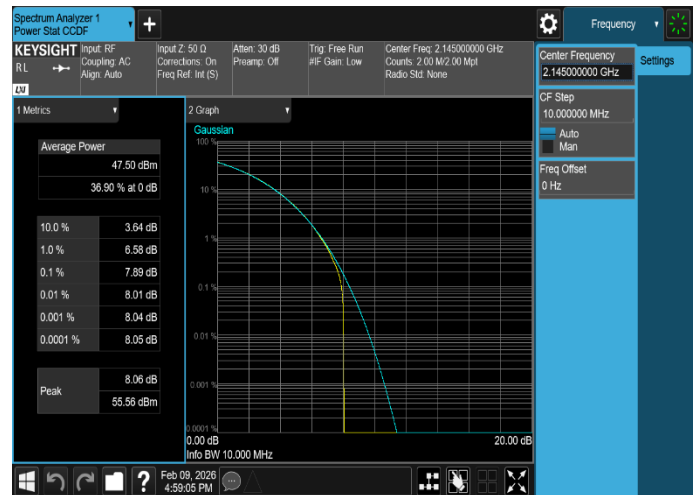
Plot 8-29. Peak To Average Power Ratio Plot
(LTE_B25_1C_20M_NB-IoT Guard band_QPSK - Low
Channel, Port 0)



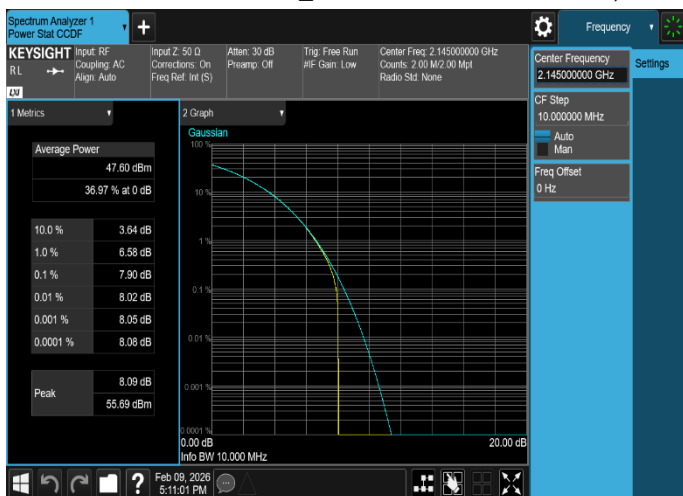
Plot 8-30. Peak To Average Power Ratio Plot
(LTE_B25_1C_20M_NB-IoT Guard band_16QAM - High
Channel, Port 3)



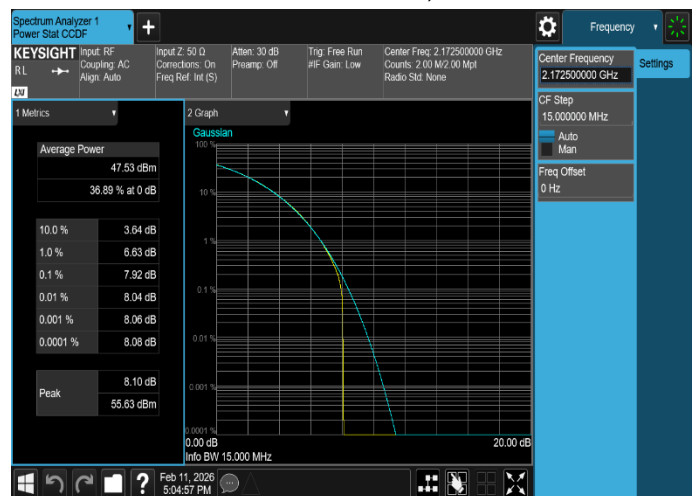
Plot 8-31. Peak To Average Power Ratio Plot
(LTE_B25_4C_15M_NB-IoT Guard
band+15M+15M+20M_QPSK - Mid Channel, Port 3)



Plot 8-32. Peak To Average Power Ratio Plot
(LTE_B66_1C_10M_NB-IoT Guard band_QPSK - Mid
Channel, Port 3)



Plot 8-33. Peak To Average Power Ratio Plot
(LTE_B66_1C_10M_NB-IoT Guard band_16QAM - Mid
Channel, Port 1)



Plot 8-34. Peak To Average Power Ratio Plot
(MSR_2C_B/n66_NR_5M+ LTE_10M_
NB-IoT Guard band_QPSK - High Channel, Port 0)

8.5 Band Edge Emissions at Antenna Terminal

Test Overview

All out of band emissions are measured with a spectrum analyzer connected to the antenna terminal of the EUT while the EUT is operating at its maximum duty cycle, at maximum power, and at the appropriate frequencies. All data rates were investigated to determine the worst case configuration. All modes of operation were investigated and the worst case configuration results are reported in this section.

Test Procedure Used

KDB 971168 D01 v03r01 – Section 6

KDB 662911 D01 v02r01 – Section E)3) Out-of-Band and Spurious Emission Measurements

a) Absolute Emission Limits

iii) Measure and sum spectral maxima across the outputs as described in section E)2)b).

ANSI C63.26-2015 – Section 5.7.3

Test Setting

1. Start and stop frequency were set such that the band edge would be placed in the center of the plot
2. Span was set large enough so as to capture all out of band emissions near the band edge
3. RBW: Please see test notes below.
4. $VBW \geq 3 \times RBW$
5. Detector = RMS
6. Number of sweep points $\geq 2 \times \text{Span}/RBW$
7. Trace mode = trace average
8. Sweep time = auto couple
9. The trace was allowed to stabilize

Test Setup

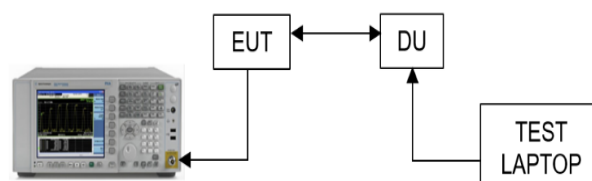


Figure 8-4. Test Instrument & Measurement Setup

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Limit**§ 24.238**

(a) Out of band emissions. 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.

§ 27.53

(1) General protection levels. Except as otherwise specified below, for operations in the 1695–1710 MHz, 1710–1755 MHz, 1755–1780 MHz, 1915–1920 MHz, 1995–2000 MHz, 2000–2020 MHz, 2110–2155 MHz, 2155–2180 MHz, and 2180–2200 bands, the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) in watts by at least $43 + 10 \log_{10}(P)$ dB.

Test Notes

1. Per Part 24, Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 1 MHz or greater. However, in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is integrated over the full required measurement bandwidth (i.e. 1 MHz or 1 percent of emission bandwidth, as specified). 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.
2. Per Part 27, Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 1 megahertz or greater. However, in the 1 megahertz bands immediately outside and adjacent to the licensee's frequency block, a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. 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.
3. Detect with a margin of under 1dB to limit, the integration method was performed using the spectrum analyzer's band power functions according to ANSI C63.26-2015 – Section 5.7. The integration value was set to a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter.
4. Consider the following factors for MIMO:
Measure and sum spectral maxima across the outputs as described in section E)2)b).
5. The output power per port (dBm/MHz or dBm) is converted to a linear value (mW). A summation of linear powers for all ports gives us the total MIMO Conducted Power (mW). We convert this back to logarithmic scale for further output power calculations.
6. Sample Calculation for LTE_B25_1C_10_NB-IoT Guard band_QPSK - Low Edge:
Let us assume the following numbers:
 - c) Total MIMO emission Power (dBm) as $-23.43 + -23.68 + -23.43 + -23.44 = 0.0179$ mW
 - d)

Factors		Value	Unit
Summed MIMO Conducted Power (linear sum)		0.0179	mW
Summed MIMO Conducted Power (dBm)	$= 10 * \log(0.0179) =$	-17.47	dBm

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Mode	Measured Range	Modulation	Max. Value (dBm) / Antenna port					Limit (dBm)	Worst Margin (dB)
			0	1	2	3	SUM		
LTE_B25_1C_10M_NB-IoT Guard band	1 MHz Outside Low Edge	QPSK	-23.43	-23.68	-23.43	-23.44	-17.47	-13.00	-4.47
		16QAM	-23.71	-23.53	-24.20	-24.15	-17.87	-13.00	-4.87
	1 MHz Outside High Edge	QPSK	-23.69	-24.11	-24.07	-24.05	-17.96	-13.00	-4.96
		16QAM	-24.08	-23.70	-24.22	-24.00	-17.98	-13.00	-4.98
LTE_B25_1C_15M_NB-IoT Guard band	1 MHz Outside Low Edge	QPSK	-27.33	-28.02	-27.76	-27.68	-21.67	-13.00	-8.67
		16QAM	-25.91	-27.19	-28.01	-26.94	-25.91	-13.00	-8.72
	1 MHz Outside High Edge	QPSK	-27.20	-27.25	-27.91	-27.67	-20.93	-13.00	-7.93
		16QAM	-27.20	-27.25	-27.91	-27.67	-21.48	-13.00	-8.48
LTE_B25_1C_20M_NB-IoT Guard band	1 MHz Outside Low Edge	QPSK	-26.84	-27.75	-25.57	-28.31	-20.97	-13.00	-7.97
		16QAM	-26.85	-28.08	-27.44	-28.08	-21.56	-13.00	-8.56
	1 MHz Outside High Edge	QPSK	-25.71	-25.91	-26.04	-27.77	-20.26	-13.00	-7.26
		16QAM	-25.62	-25.30	-27.16	-28.63	-20.46	-13.00	-7.46

Table 8-26. Band Edge Emission Summary Data (LTE_B25_1C_20M)

Mode	Measured Range	Modulation	Max. Value (dBm) / Antenna port					Limit (dBm)	Worst Margin (dB)
			0	1	2	3	SUM		
LTE_B25_2C_10M_NB-IoT Guard band+5M	1 MHz Outside Low Edge	QPSK	-24.17	-24.70	-24.09	-24.45	-18.33	-13.00	-5.33
	1 MHz Outside High Edge	QPSK	-24.04	-23.96	-24.74	-24.67	-18.31	-13.00	-5.31
LTE_B25_2NC_10M_NB-IoT Guard band+5M	1 MHz Outside Low Edge	QPSK	-23.77	-23.67	-23.55	-23.87	-17.69	-13.00	-4.69
	1 MHz Outside High Edge	QPSK	-22.41	-22.27	-22.56	-22.44	-16.40	-13.00	-3.40
LTE_B25_4C_15M_NB-IoT Guard band+15M+15M+20M	1 MHz Outside Low Edge	QPSK	-22.32	-22.84	-23.20	-22.09	-17.52	-13.00	-4.52
	1 MHz Outside High Edge	QPSK	-22.41	-22.39	-23.24	-23.22	-16.78	-13.00	-3.78
MSR_2C_B/n25_LTE_10M_NB-IoT Guard band+NR_1C_5M	1 MHz Outside Low Edge	QPSK	-24.66	-24.67	-24.43	-24.64	-18.58	-13.00	-5.58
	1 MHz Outside High Edge	QPSK	-24.57	-24.68	-25.11	-24.88	-18.78	-13.00	-5.78
MSR_2NC_B/n25_LTE_10M_NB-IoT Guard band+NR_1C_5M	1 MHz Outside Low Edge	QPSK	-24.29	-23.97	-24.21	-24.25	-18.16	-13.00	-5.16
	1 MHz Outside High Edge	QPSK	-22.81	-22.47	-22.50	-22.37	-16.51	-13.00	-3.51
MSR_4C_B/n25_LTE_15M_NB-IoT Guard band+15M+NR_1C_15M+20M	1 MHz Outside Low Edge	QPSK	-22.02	-22.90	-24.42	-24.23	-17.26	-13.00	-4.26
	1 MHz Outside High Edge	QPSK	-22.65	-22.48	-23.26	-22.99	-16.81	-13.00	-3.81

Table 8-27. Band Edge Emission Summary Data (LTE_B25_Multi carrier)

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Mode	Measured Range	Modulation	Max. Value (dBm) / Antenna port					Limit (dBm)	Worst Margin (dB)
			0	1	2	3	SUM		
LTE_B66_1C_10M_NB-IoT Guard band	1 MHz Outside Low Edge	QPSK	-22.16	-23.31	-21.81	-23.35	-16.58	-13.00	-3.58
		16QAM	-22.40	-23.35	-22.85	-23.46	-16.97	-13.00	-3.97
	1 MHz Outside High Edge	QPSK	-22.91	-23.64	-22.57	-23.65	-17.15	-13.00	-4.15
		16QAM	-23.97	-24.35	-23.11	-24.30	-17.88	-13.00	-4.88
LTE_B66_1C_15M_NB-IoT Guard band	1 MHz Outside Low Edge	QPSK	-25.86	-27.55	-25.29	-26.99	-20.31	-13.00	-7.31
		16QAM	-26.34	-27.26	-26.02	-27.14	-20.63	-13.00	-7.63
	1 MHz Outside High Edge	QPSK	-27.99	-28.07	-27.55	-27.94	-21.86	-13.00	-8.86
		16QAM	-27.94	-28.57	-27.92	-28.75	-22.26	-13.00	-9.26
LTE_B66_1C_20M_NB-IoT Guard band	1 MHz Outside Low Edge	QPSK	-26.05	-27.19	-25.91	-26.82	-20.44	-13.00	-7.44
		16QAM	-24.04	-26.48	-24.64	-26.22	-19.20	-13.00	-6.20
	1 MHz Outside High Edge	QPSK	-27.63	-28.39	-28.07	-28.44	-22.10	-13.00	-9.10
		16QAM	-26.26	-27.09	-26.32	-27.31	-20.70	-13.00	-7.70

Table 8-28. Band Edge Emission Summary Data (NR_n25_1C_20M)

Mode	Measured Range	Modulation	Max. Value (dBm) / Antenna port					Limit (dBm)	Worst Margin (dB)
			0	1	2	3	SUM		
LTE_B66_2C_10M_NB-IoT Guard band+5M	1 MHz Outside Low Edge	QPSK	-23.13	-23.83	-23.36	-23.74	-17.49	-13.00	-4.49
	1 MHz Outside High Edge	QPSK	-23.85	-23.86	-23.68	-23.28	-17.64	-13.00	-4.64
LTE_B66_2NC_10M_NB-IoT Guard band+5M	1 MHz Outside Low Edge	QPSK	-22.07	-22.44	-22.21	-23.32	-16.46	-13.00	-3.46
	1 MHz Outside High Edge	QPSK	-22.44	-22.56	-21.95	-21.57	-16.09	-13.00	-3.09
LTE_B66_3C_20M_NB-IoT Guard band +20M+20M	1 MHz Outside Low Edge	QPSK	-23.19	-24.25	-22.90	-23.27	-17.35	-13.00	-4.35
	1 MHz Outside High Edge	QPSK	-23.28	-22.93	-23.27	-23.35	-17.18	-13.00	-4.18
LTE_B66_3NC_20M_NB-IoT Guard band +20M+20M	1 MHz Outside Low Edge	QPSK	-22.55	-24.21	-23.19	-22.63	-17.08	-13.00	-4.08
	1 MHz Outside High Edge	QPSK	-21.72	-22.06	-22.31	-21.55	-15.88	-13.00	-2.88
MSR_2C_B/n66_LTE_10M_NB-IoT Guard band+NR_5M	1 MHz Outside Low Edge	QPSK	-22.53	-23.31	-22.22	-23.18	-16.77	-13.00	-3.77
	1 MHz Outside High Edge	QPSK	-24.00	-23.88	-23.29	-23.58	-17.66	-13.00	-4.66
MSR_2NC_B/n66_LTE_10M_NB-IoT Guard band+NR_5M	1 MHz Outside Low Edge	QPSK	-22.37	-22.64	-21.29	-22.13	-16.06	-13.00	-3.06
	1 MHz Outside High Edge	QPSK	-21.54	-21.80	-21.53	-21.46	-15.56	-13.00	-2.56
MSR_3C_B/n66_LTE_20M_NB-IoT Guard band+NR_20M+30M	1 MHz Outside Low Edge	QPSK	-23.40	-23.34	-22.83	-23.72	-17.29	-13.00	-4.29
	1 MHz Outside High Edge	QPSK	-22.77	-23.30	-21.98	-22.75	-16.65	-13.00	-3.65

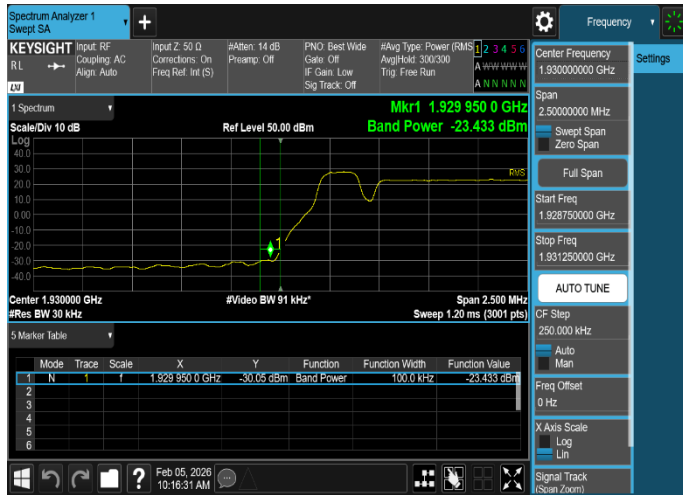
Table 8-29. Band Edge Emission Summary Data (LTE_B25_Multi carrier)



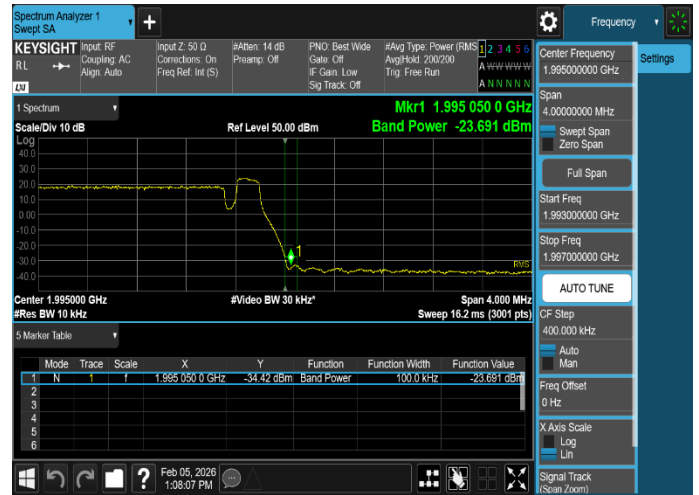
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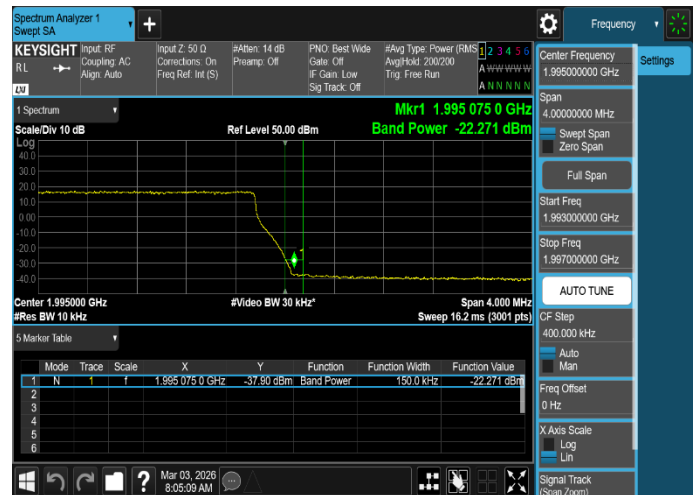
Plot 8-35. Band Edge Emission Summary Data Plot
(LTE_B25_1C_10M_NB-IoT Guard band_QPSK - Low Edge,
Port 0)



Plot 8-36. Band Edge Emission Summary Data Plot
(LTE_B25_1C_10M_NB-IoT Guard band_QPSK - High Edge,
Port 0)



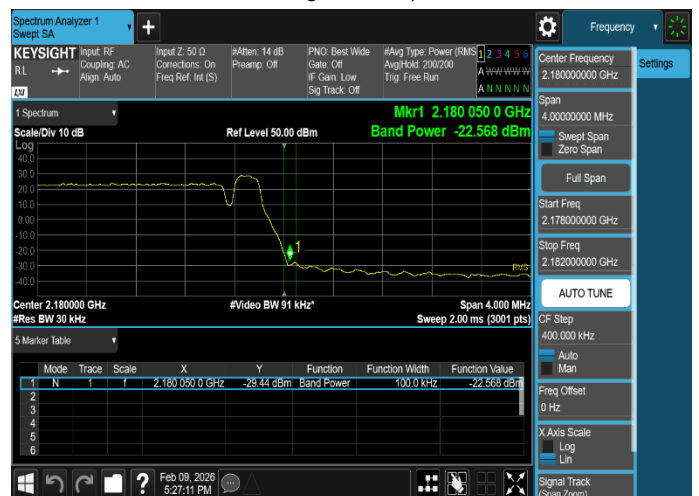
Plot 8-37. Band Edge Emission Summary Data Plot
(MSR_4C_B/n25_LTE_15M_NB-IoT Guard
band+15M+NR_1C_15M+20M_QPSK - Low Edge, Port 0)



Plot 8-38. Band Edge Emission Summary Data Plot
(LTE_B25_2NC_5M+10M_NB-IoT Guard band_QPSK - High
Edge, Port 1)



Plot 8-39. Band Edge Emission Summary Data Plot
(LTE_B66_1C_10M_NB-IoT Guard band_QPSK - Low Edge,
Port 2)



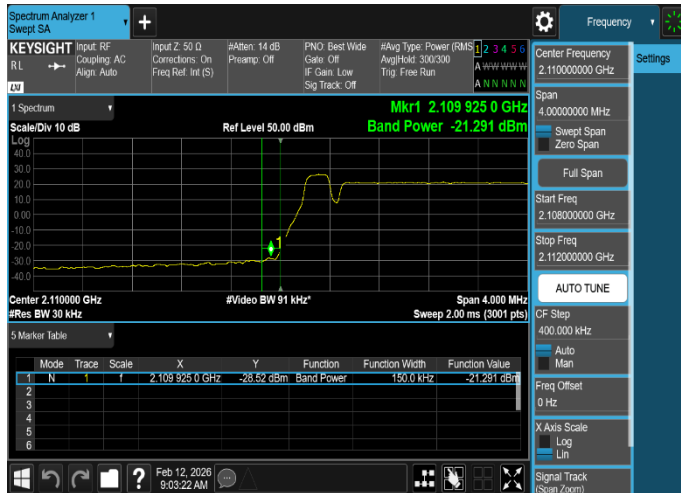
Plot 8-40. Band Edge Emission Summary Data Plot
(LTE_B66_1C_10M_NB-IoT Guard band_QPSK - High Edge,
Port 2)



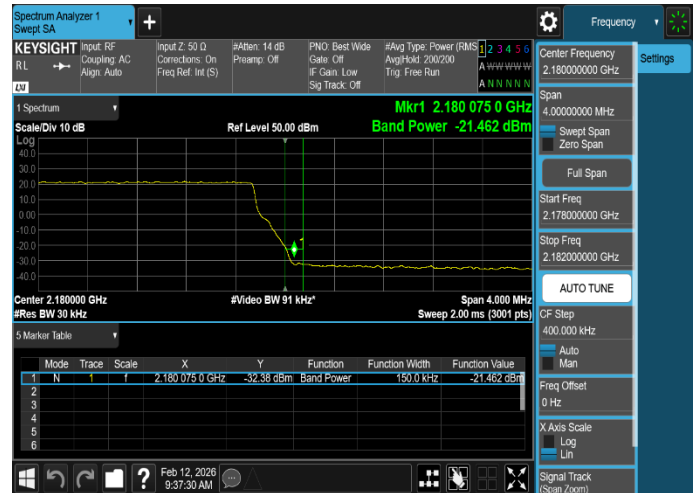
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Plot 8-41. Band Edge Emission Summary Data Plot
(MSR_2NC_B/n66_LTE_10M_NB-IoT Guard
band+NR_5M_QPSK - Low Edge, Port 2)



Plot 8-42. Band Edge Emission Summary Data Plot
(MSR_2NC_B/n66_LTE_10M_NB-IoT Guard
band+NR_5M_QPSK - High Edge, Port 2)

8.6 Spurious and Harmonic Emissions at Antenna Terminal

Test Overview

The level of the carrier and the various conducted spurious and harmonic frequencies is measured by means of a calibrated spectrum analyzer. The spectrum is scanned from the lowest frequency generated in the equipment up to a frequency including its 10th harmonic. All out of band emissions are measured with a spectrum analyzer connected to the antenna terminal of the EUT while the EUT is operating at its maximum duty cycle, at maximum power, and at the appropriate frequencies. All data rates were investigated to determine the worst case configuration. All modes of operation were investigated and the worst case configuration results are reported in this section.

Test Procedure Used

KDB 971168 D01 v03r01 – Section 6

KDB 662911 D01 v02r01 – Section E)3) Out-of-Band and Spurious Emission Measurements

a) Absolute Emission Limits

iii) Measure and sum spectral maxima across the outputs as described in section E)2)b).

ANSI C63.26-2015 – Section 5.7

Test Setting

1. Start frequency was set to 9 kHz and stop frequency was set to at least 10 * the fundamental frequency excluding the frequency range of the band edge measurement.
2. RBW: Please see test notes below.
3. VBW $\geq 3 \times$ RBW
4. Detector = RMS
5. Number of sweep points $\geq 2 \times$ Span/RBW
6. Trace mode = trace average
7. Sweep time = auto couple
8. The trace was allowed to stabilize

Test Setup

The EUT and measurement equipment were set up as shown in the diagram below.

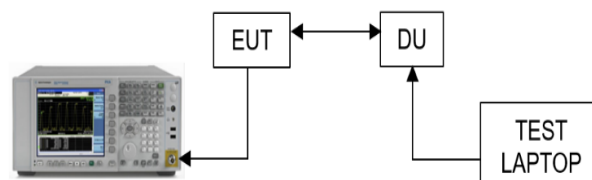


Figure 8-5. Test Instrument & Measurement Setup

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Limit**§ 24.238**

(a) Out of band emissions. 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.

§ 27.53

(1) General protection levels. Except as otherwise specified below, for operations in the 1695–1710 MHz, 1710–1755 MHz, 1755–1780 MHz, 1915–1920 MHz, 1995–2000 MHz, 2000–2020 MHz, 2110–2155 MHz, 2155–2180 MHz, and 2180–2200 bands, the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) in watts by at least $43 + 10 \log_{10}(P)$ dB.

Test Notes

1. Per Part 24, Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 1 MHz or greater. However, in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is integrated over the full required measurement bandwidth (i.e. 1 MHz or 1 percent of emission bandwidth, as specified). 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.
2. Per Part 27, Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 1 megahertz or greater. However, in the 1 megahertz bands immediately outside and adjacent to the licensee's frequency block, a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. 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.
3. Detect with a margin of under 1dB to limit, the integration method was performed using the spectrum analyzer's band power functions according to ANSI C63.26-2015 – Section 5.7. The integration value was set to a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter.
4. Consider the following factors for MIMO:
Measure and sum spectral maxima across the outputs as described in section E)2)b).
5. The output power per port (dBm/MHz or dBm) is converted to a linear value (mW). A summation of linear powers for all ports gives us the total MIMO Conducted Power (mW). We convert this back to logarithmic scale for further output power calculations.
6. Sample Calculation for LTE_B25_1C_10_NB-IoT Guard band_QPSK - 9 kHz to 150 kHz:
Let us assume the following numbers:
 - e) Total MIMO emission Power (dBm) as $-28.71 + -28.85 + -28.72 + -29.19 = 0.0052$ mW
 - f)

Factors		Value	Unit
Summed MIMO Conducted Power (linear sum)		0.0052	mW
Summed MIMO Conducted Power (dBm)	$= 10 * \log(0.0052) =$	-22.84	dBm

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7. Narrower RBW parameter is applied according to Section 5.7 of ANSI C63.26-2015 for some edge channels due to improving measurement accuracy. RBW factor was applied as a correction factor to each data point of the Ext gain, as calculated below:

RBW Factor = $10 \cdot \log(\text{reference bandwidth} / \text{measurement bandwidth})$

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Mode	Mode	Measurement Range	Level (dBm)					Limit (dBm)	Margin (dB)
			0	1	2	3	SUM		
LTE_B25_1C_10M_NB-IoT Guard band Low Channel	QPSK	9 kHz to 150 kHz	-28.71	-28.85	-28.72	-29.19	-22.84	-13.00	-9.84
		150 kHz to 30 MHz	-25.08	-24.47	-23.88	-25.46	-18.66	-13.00	-5.66
		30 MHz to 1.923 GHz	-29.61	-29.54	-30.27	-29.75	-23.76	-13.00	-10.76
		1.923 GHz to 1.929 GHz	-21.11	-20.52	-20.53	-21.11	-14.79	-13.00	-1.79
		1.995 GHz to 2.3 GHz	-25.14	-25.32	-25.36	-25.35	-19.27	-13.00	-6.27
		2.3 GHz to 3.2 GHz	-31.46	-32.05	-32.40	-31.48	-25.81	-13.00	-12.81
		3.2 GHz to 18 GHz	-40.59	-40.47	-40.78	-40.62	-34.59	-13.00	-21.59
		18 GHz to 22 GHz	-35.40	-35.62	-35.76	-35.24	-29.48	-13.00	-16.48
	16 QAM	9 kHz to 150 kHz	-28.59	-28.38	-28.64	-28.78	-22.57	-13.00	-9.57
		150 kHz to 30 MHz	-24.25	-24.47	-24.56	-25.02	-18.55	-13.00	-5.55
		30 MHz to 1.923 GHz	-29.23	-29.65	-30.09	-29.40	-23.56	-13.00	-10.56
		1.923 GHz to 1.929 GHz	-19.94	-19.47	-20.41	-20.46	-14.03	-13.00	-1.03
		1.995 GHz to 2.3 GHz	-25.26	-25.20	-25.07	-25.41	-19.21	-13.00	-6.21
		2.3 GHz to 3.2 GHz	-31.43	-32.06	-32.00	-31.63	-25.75	-13.00	-12.75
		3.2 GHz to 18 GHz	-40.67	-40.48	-40.60	-40.23	-34.47	-13.00	-21.47
		18 GHz to 22 GHz	-35.64	-35.56	-35.36	-35.45	-29.48	-13.00	-16.48
LTE_B25_1C_10M_NB-IoT Guard band Mid Channel	QPSK	9 kHz to 150 kHz	-28.80	-28.57	-28.41	-28.66	-22.59	-13.00	-9.59
		150 kHz to 30 MHz	-23.91	-23.56	-24.80	-23.29	-17.83	-13.00	-4.83
		30 MHz to 1.930 GHz	-25.07	-25.73	-25.89	-25.60	-19.54	-13.00	-6.54
		1.995 GHz to 2.3 GHz	-24.97	-25.34	-24.68	-25.02	-18.98	-13.00	-5.98
		2.3 GHz to 3.2 GHz	-31.31	-31.61	-32.53	-31.70	-25.74	-13.00	-12.74
		3.2 GHz to 18 GHz	-40.47	-40.50	-40.59	-40.35	-34.45	-13.00	-21.45
		18 GHz to 22 GHz	-35.62	-35.58	-35.58	-35.68	-29.59	-13.00	-16.59
	16 QAM	9 kHz to 150 kHz	-28.52	-28.54	-28.11	-28.79	-22.46	-13.00	-9.46
		150 kHz to 30 MHz	-24.19	-24.89	-24.19	-23.89	-18.25	-13.00	-5.25
		30 MHz to 1.930 GHz	-25.55	-25.63	-25.17	-25.46	-19.43	-13.00	-6.43
		1.995 GHz to 2.3 GHz	-25.16	-25.26	-24.68	-25.51	-19.12	-13.00	-6.12
		2.3 GHz to 3.2 GHz	-31.60	-31.75	-32.38	-31.59	-25.80	-13.00	-12.80
		3.2 GHz to 18 GHz	-40.64	-40.46	-40.61	-40.65	-34.57	-13.00	-21.57
		18 GHz to 22 GHz	-35.74	-35.60	-35.68	-35.46	-29.60	-13.00	-16.60
LTE_B25_1C_10M_NB-IoT Guard band High Channel	QPSK	9 kHz to 150 kHz	-28.71	-28.70	-28.66	-29.03	-22.75	-13.00	-9.75
		150 kHz to 30 MHz	-23.62	-23.89	-23.97	-25.12	-18.09	-13.00	-5.09
		30 MHz to 1.930 GHz	-25.62	-26.31	-25.41	-25.76	-19.74	-13.00	-6.74
		1.996 GHz to 2.002 GHz	-18.95	-19.44	-19.82	-20.21	-13.56	-13.00	-0.56
		2.002 GHz to 2.3 GHz	-21.33	-21.40	-22.67	-22.93	-16.00	-13.00	-3.00
		2.3 GHz to 3.2GHz	-31.33	-31.77	-32.58	-31.72	-25.80	-13.00	-12.80
		3.2 GHz to 18 GHz	-40.54	-40.72	-40.49	-40.26	-34.48	-13.00	-21.48
		18 GHz to 22 GHz	-35.58	-35.52	-35.52	-35.76	-29.57	-13.00	-16.57
	16 QAM	9 kHz to 150 kHz	-28.24	-29.22	-28.84	-28.78	-22.73	-13.00	-9.73
		150 kHz to 30 MHz	-24.16	-24.84	-24.13	-24.23	-18.31	-13.00	-5.31
		30 MHz to 1.930 GHz	-25.67	-25.84	-25.61	-25.95	-19.74	-13.00	-6.74
		1.996 GHz to 2.002 GHz	-20.09	-19.48	-20.17	-19.74	-13.84	-13.00	-0.84
		2.002 GHz to 2.3 GHz	-22.12	-21.44	-22.25	-22.42	-16.02	-13.00	-3.02
		2.3 GHz to 3.2GHz	-31.75	-31.92	-32.46	-31.68	-25.92	-13.00	-12.92
		3.2 GHz to 18 GHz	-40.28	-40.62	-40.37	-40.62	-34.45	-13.00	-21.45
		18 GHz to 22 GHz	-35.13	-35.61	-35.17	-35.38	-29.29	-13.00	-16.29

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LTE_B25_ 1C_15M_NB-IoT Guard band Low Channel	QPSK	9 kHz to 150 kHz	-31.26	-30.95	-30.63	-30.88	-24.90	-13.00	-11.90
		150 kHz to 30 MHz	-24.61	-24.06	-24.83	-25.32	-18.66	-13.00	-5.66
		30 MHz to 1.923 GHz	-28.99	-29.40	-29.88	-29.67	-23.45	-13.00	-10.45
		1.923 GHz to 1.929 GHz	-21.58	-22.09	-22.39	-21.85	-15.94	-13.00	-2.94
		1.995 GHz to 2.3 GHz	-24.80	-25.26	-24.68	-24.99	-18.91	-13.00	-5.91
		2.3 GHz to 3.2 GHz	-31.14	-31.70	-32.19	-31.00	-25.46	-13.00	-12.46
		3.2 GHz to 18 GHz	-40.44	-40.27	-40.50	-40.48	-34.40	-13.00	-21.40
		18 GHz to 22 GHz	-35.53	-35.26	-35.48	-35.45	-29.41	-13.00	-16.41
	16 QAM	9 kHz to 150 kHz	-30.85	-30.27	-30.06	-30.97	-24.50	-13.00	-11.50
		150 kHz to 30 MHz	-23.48	-25.01	-24.36	-24.38	-18.25	-13.00	-5.25
		30 MHz to 1.923 GHz	-29.30	-29.19	-29.51	-29.43	-23.33	-13.00	-10.33
		1.923 GHz to 1.929 GHz	-21.86	-21.83	-21.99	-21.67	-15.82	-13.00	-2.82
		1.995 GHz to 2.3 GHz	-24.86	-25.34	-24.53	-25.22	-18.95	-13.00	-5.95
		2.3 GHz to 3.2 GHz	-31.20	-31.57	-32.29	-31.48	-25.60	-13.00	-12.60
		3.2 GHz to 18 GHz	-40.46	-40.43	-40.17	-40.05	-34.25	-13.00	-21.25
		18 GHz to 22 GHz	-34.98	-35.01	-35.40	-35.52	-29.20	-13.00	-16.20
LTE_B25_ 1C_15M_NB-IoT Guard band Mid Channel	QPSK	9 kHz to 150 kHz	-31.08	-30.59	-29.77	-31.02	-24.56	-13.00	-11.56
		150 kHz to 30 MHz	-24.90	-25.38	-24.71	-24.72	-18.90	-13.00	-5.90
		30 MHz to 1.930 GHz	-24.71	-24.87	-24.68	-24.97	-18.78	-13.00	-5.78
		1.995 GHz to 2.3 GHz	-24.55	-24.68	-24.14	-24.45	-18.43	-13.00	-5.43
		2.3 GHz to 3.2 GHz	-31.48	-31.34	-32.28	-31.32	-25.56	-13.00	-12.56
		3.2 GHz to 18 GHz	-40.42	-40.28	-40.34	-40.50	-34.36	-13.00	-21.36
		18 GHz to 22 GHz	-35.36	-35.48	-35.55	-35.48	-29.45	-13.00	-16.45
	16 QAM	9 kHz to 150 kHz	-31.12	-30.96	-30.23	-30.62	-24.70	-13.00	-11.70
		150 kHz to 30 MHz	-24.44	-23.63	-24.14	-24.20	-18.07	-13.00	-5.07
		30 MHz to 1.930 GHz	-24.85	-25.05	-24.41	-24.65	-18.71	-13.00	-5.71
		1.995 GHz to 2.3 GHz	-24.45	-24.06	-24.46	-24.39	-18.32	-13.00	-5.32
		2.3 GHz to 3.2 GHz	-31.46	-31.68	-32.55	-31.46	-25.74	-13.00	-12.74
		3.2 GHz to 18 GHz	-40.08	-40.32	-40.54	-40.47	-34.32	-13.00	-21.32
		18 GHz to 22 GHz	-35.19	-35.61	-35.21	-35.07	-29.24	-13.00	-16.24
LTE_B25_ 1C_15M_NB-IoT Guard band High Channel	QPSK	9 kHz to 150 kHz	-31.16	-30.70	-30.29	-30.94	-24.74	-13.00	-11.74
		150 kHz to 30 MHz	-24.14	-24.28	-24.63	-24.75	-18.42	-13.00	-5.42
		30 MHz to 1.930 GHz	-25.38	-26.24	-25.64	-25.53	-19.66	-13.00	-6.66
		1.996 GHz to 2.002 GHz	-20.62	-20.87	-21.41	-21.71	-15.11	-13.00	-2.11
		2.002 GHz to 2.3 GHz	-22.43	-22.15	-23.05	-23.04	-16.63	-13.00	-3.63
		2.3 GHz to 3.2GHz	-31.19	-31.55	-32.33	-31.35	-25.56	-13.00	-12.56
		3.2 GHz to 18 GHz	-40.37	-40.21	-40.44	-40.38	-34.33	-13.00	-21.33
		18 GHz to 22 GHz	-35.26	-35.32	-35.32	-35.58	-29.35	-13.00	-16.35
	16 QAM	9 kHz to 150 kHz	-30.64	-30.08	-29.59	-30.51	-24.17	-13.00	-11.17
		150 kHz to 30 MHz	-23.43	-24.26	-24.65	-24.40	-18.14	-13.00	-5.14
		30 MHz to 1.930 GHz	-25.33	-25.77	-25.70	-25.87	-19.64	-13.00	-6.64
		1.996 GHz to 2.002 GHz	-21.40	-21.30	-22.08	-21.93	-15.64	-13.00	-2.64
		2.002 GHz to 2.3 GHz	-22.54	-21.50	-23.04	-23.68	-16.60	-13.00	-3.60
		2.3 GHz to 3.2GHz	-31.29	-31.71	-32.31	-31.50	-25.67	-13.00	-12.67
		3.2 GHz to 18 GHz	-40.41	-40.44	-40.40	-40.34	-34.38	-13.00	-21.38
		18 GHz to 22 GHz	-35.39	-35.20	-35.34	-35.51	-29.34	-13.00	-16.34