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# Radio Test report – LPRU 4420 B25B66

Type of assessment: FCC: Class II Permissive Change ISED: Class III Permissive Change			
Report ID		Project ID	
REP033400		PRJ0054747	
Applicant: Ericsson Canada Inc.			
Product name:	Model (PMN):		Part number:
Radio Unit	LPRU 4420 B25B66		KRC 161 906/1
FCC Identifier TA8AKRC161906-1	ISED certification numb	ber: .9061	HVIN: AS1619061

Requirements/Summary:

Standard	Environmental phenomenon	
FCC 47 CFR Part 24, Subpart E	Broadband Personal Communications Services (PCS)	Yes
RSS-133 Issue 6 A1, Jan 18, 2018	2 GHz Personal Communications Services	Yes

Date of issue: April 1, 2024

Nimish Kapoor, EMC/RF Test Specialist

Tested by

Kevin Rose, EMC/RF Test Specialist

Reviewed by

Signature

Signature

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ANAB File Number: AT-3195 (Ottawa); AT-3193 (Pointe-Claire); AT-3194 (Cambridge)

FCC 24 and RSS-133.docx; Date: Jul 2017



Two test location:	s	
Company name	Nemko Canada Inc.	
Address	303 River Road	349 Terry Fox
City	Ottawa	Ottawa
Province	Ontario	Ontario
Postal code	K1V 1H2	К2К 2V6
Country	Canada	Canada
Telephone	+1 613 737 9680	+1 613 963 8000
Facsimile	+1 613 737 9691	
Toll free	+1 800 563 6336	
Website	www.nemko.com	
Site number	FCC test site registration numb	er: CA2040, IC: 2040A-4 (3 m semi anechoic chamber)

Limits of responsibility

Note that the results contained in this report relate only to the items tested and were obtained in the period between the date of initial receipt of samples and the date of issue of the report.

This test report has been completed in accordance with the requirements of ISO/IEC 17025. All results contain in this report are within Nemko Canada's ISO/IEC 17025 accreditation.

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# **Section 1.** Report summary

## 1.1 Applicant and manufacturer

Company name	Ericsson Canada Inc.
Address	349 Terry Fox Drive, Ottawa, ON, Canada, K2K 2V6

### 1.2 Test specifications

FCC 47 CED Davt 2	Greenener Allesstiens and Padie Treaty Maters, Constal Pulse and Pagulations		
FCC 47 CFR Part 2	Frequency Allocations and Radio Treaty Maters; General Rules and Regulations		
FCC 47 CFR Part 24, Subpart E	Broadband Personal Communications Services (PCS)		
RSS-133 Issue 6 A1, Jan. 18, 2018	2 GHz Personal Communications Services		
SPSD E10 Jacua E. Eabruary 2000	Technical Requirements for Personal Communications Services (PCS) in the Bands 1850–1915 MHz and 1930–1995		
5K3F-510, ISSUE 5, FEBTUALY 2005	MHz		
RSS-Gen, Issue 5, April 2018	General Requirements for Compliance of Radio Apparatus		

# 1.3 Test method

ANSI C63.26-2015	American National Standard for Compliance Testing of Transmitters Used in Licensed Radio Services
KDB 662911 D01	Multiple Transmitter Output v02r01
KDB 662911 D02	MIMO with Cross-Polarized Antennas v01

# 1.4 Statement of compliance

In the configuration tested, the EUT was found compliant. Testing was completed against customer test plan. Results obtained indicate that the product under test complies in full with the requirements tested.

This test report (REP033400) applies to the LPRU 4420 B25B66 with part number KRC 161 906/1. See "Summary of test results" for full details.

#### EUT Configuration(s) SRO/MRO:

*B25:* NR : 25, 30, 35, 40 MHz, Max 3 Carriers per branch

### 1.5 Test report revision history

Table 1.5-1: Test report revision history			
Report ID	Date of issue	Details of changes made to test report	
REP033400	April 1, 2024	Original report issued	



# Section 2. Summary of test results

# 2.1 Testing location

Test location (s)	Ottawa		
2.2 Testing period			
Test start date	March 20, 2024	Test end date	March 20, 2024
2.3 Sample information			
Receipt date	March 20, 2024	Nemko sample ID number	PRJ00547470001



#### FCC Part 24 test results 2.4

## Table 2.4-1: FCC results summary

Part	Test description	Verdict
§24.229	Frequencies	Pass <sup>1</sup>
§24.232(a)(	<ol><li>Power and antenna height limits for base stations with BW greater than 1 MHz</li></ol>	Pass
§24.238(a	Emission limitations for Broadband PCS equipment – out of band emissions (conducted)	Pass
§2.1049	Occupied bandwidth	Pass
Notes:	Only tests requested by the client have been performed	

<sup>1</sup>EUT transmits within 1930–1995 MHz frequency range

#### RSS-133 test results 2.5

### Table 2.5-1: ISED results summary

Part	Test description	Verdict
RSS-133, 6.1	Frequency Plan	Pass <sup>1</sup>
RSS-133, 6.2	Types of Modulation	Pass <sup>2</sup>
RSS-133, 6.4	Transmitter Output Power and Equivalent Isotropically Radiated Power	Pass
RSS-133, 6.5	Transmitter Unwanted Emissions (conducted and radiated)	Pass
RSS-Gen, 6.7	Occupied bandwidth	Pass
Notes: On	ly tests requested by the client have been performed	

Only tests requested by the client have been performed

<sup>1</sup>EUT transmits within 1930–1995 MHz frequency range

<sup>2</sup>EUT employs digital modulation (QPSK)



# Section 3. Equipment under test (EUT) details

# 3.1 EUT information

Product name	Radio Unit		
Model	LPRU 4420 B25B66		
Part number	KRC 161 906/1		
Revision	R2A		
Serial number	TD3F090346		
Antenna ports	4 TX/RX for B25	;	
	4 TX/RX for B66	;	
RF BW / IBW	B25 IBW DL: 65	MHz B6	6 IBW DL: 70 MHz
	B25 IBW UL: 65	MHz B6	6 IBW UL: 70 MHz
FDD	B25: 80 MHz	B6	6: 400 MHz
Frequency	B25 TX (DL): 19	30 – 1995 MHz B6	6 TX (DL): 2110 – 2200 MHz
	B25 RX (UL): 18	50 – 1915 MHz B6	6 RX (UL): 1710 – 1780 MHz
Nominal O/P per Antenna port	0.159 W (22 dB	m)	
Accuracy (nominal)	±0.1 ppm		
Nominal voltage	110 VAC or -48	VDC	
RAT	B25: LTE (LTE+N	IB-IOT), NR B6	6: LTE (LTE+NB-IOT), NR
Modulation	LTE: QPSK, 16Q	AM, 64QAM, 256QAM	
	NR: QPSK, 16Q	AM, 64QAM, 256QAM	
Channel bandwidth	LTE: 5, 10, 15, 2	0 MHz	
	NR: 5, 10, 15, 2	0, 25, 30, 35, 40 MHz	
Channel bandwidth LTE + NB-IoT	LTE with NB-Io1	GB: 10, 15, 20 MHz	
Maximum combined OBW per port	B25: 65 MHz B66: 70 MHz		
CPRI	10.1 Gbps		
Channel raster	LTE: 100 kHz		
	NR: 100 kHz		
Regulatory requirements	Radio: FCC Part 2, 24, 27, RSS-Gen, RSS-133, RSS-139		
	EMC: FCC Part 2	15, ICES-003	
	Safety: IEC/EN	52368-1, UL/CSA 62368-1	
Emission Designator	LTE: 5M00W7D	, 10M0W7D, 15M00W7D, 20M0W7	D
	NR: 5M00F9W, 10M0F9W, 15M0F9W, 20M0F9W, 25M0F9W, 30M0F9W, 35M0F9W, 40M0F9W		
Supported Configurations	Single Antenna, TX Diversity, MIMO, Carrier Aggregation		
Operating temperature	0 °C to 55 °C		
Max RF Power	8 x 0.159 W (22 dBm)		
Supported carriers /band/ port	Up to 3 carriers per branch		
Carrier Configuration:	R222-		
	SRO: LTE, NR SRO: LTE, NR		
	MRO: NR + LTE MRO: NR + LTE		
RAT SC Carrier Power (max)	RAT BW PWR/Port		
	LTE	5, 10, 15, 20 MHz	22 dBm
NR 5, 10, 15, 20, 25, 30, 35, 40 MHz 22 dBm			22 dBm



# 3.2 Product description and theory of operation

### EUT description of the methods used to exercise the EUT and all relevant ports:

Description/theory of operation	LPRU 4420 B25B66 (KRC 161 906 equipment. The LPRU provides ra The radio operates over 8 Transm maximum rated RF Output of 0.1 to be rack mounted.	i/1) is a Remote Radio Unit forming part of the Ericsson Radio Base Station (RBS) adio access for mobile and fixed devices and is intended for the indoor environment. nit ports in MRO (LTE, NBIOT, and NR); Single, and Multi-Carrier transmission with a .59W per port over an operational temperature of 0°C to +55°C. The unit is designed				
Ports/Interface	Port Description					
	AC-IN	AC Power Supply				
	DC-IN-A/B	DC Power Supply, A and B feed inputs				
	Alarm	External Alarm Input 1 and 2				
	Data-1/2	CPRI 1 & 2				
	dRDI 1-8	Proprietary ports				
	1A / 1B / 1C / 1D	RF I/O ports - Band 25				
	2A / 2B / 2C / 2D	RF I/O ports - Band 66				
Physical	Dimensions	132 x 442 x 366 mm				
	Weight	13.6 kg				
	Operating Temperature	0 °C to 55 °C				
	Mounting	Rack mounted				
Software details	CXP2030045/28_R18C294					
Product Identification / Markings and Labels	Markings         (1P)KRC 161 906/1         (21P)R2A           LPRU 4420 B25B66         (5)TD3F090346           Made in China         20201229					
	LPRU 4420 -48V	ETL LISTED         INFORMATION         Deck       Enclosed         Control number 113613         complies with Part 15 of the FCC Rules.         subject to the following two conditions:         communication in the following two c				



# 3.3 EUT test details

## EUT setup/configuration rationale for Down link:

RAT	Modulation	Test Model / Configuration
LTE	QPSK	TM1.1
LTE	16QAM	TM3.2
LTE	64QAM	TM3.1
LTE	256QAM	TM3.1a
NR	QPSK	TM1.1
NR	16QAM	TM3.2
NR	64QAM	TM3.1
NR	256QAM	TM3.1a

#### NR Single Carrier B25

Bandwidth MHz	Transmit / DL, MHz							
Danawiath, whiz	В	NR-ARFCN	М	NR-ARFCN T		NR-ARFCN		
5	1932.5	386500	1962.5	392500	1992.5	398500		
10	1935.0	387000	1962.5	392500	1990.0	398000		
15	1937.5	387500	1962.5	392500	1987.5	397500		
20	1940.0	388000	1962.5	392500	1985.0	397000		
25	1942.5	388500	1962.5	392500	1982.5	396500		
30	1945.0	389000	1962.5	392500	1980.0	396000		
35	1947.5	389500	1962.5	392500	1977.5	395500		
40	1950.0	390000	1962.5	392500	1975.0	395000		

Pandwidth MHz	Receive / UL, MHz							
Balluwiuth, MHZ	В	NR-ARFCN	М	NR-ARFCN	т	NR-ARFCN		
5	1852.5	370500	1882.5	376500	1912.5	382500		
10	1855.0	371000	1882.5	376500	1910.0	382000		
15	1857.5	371500	1882.5	376500	1907.5	381500		
20	1860.0	372000	1882.5	376500	1905.0	381000		
25	1862.5	372500	1882.5	376500	1902.5	380500		
30	1865.0	373000	1882.5	376500	1900.0	380000		
35	1867.5	373500	1882.5	376500	1897.5	379500		
40	1870.0	374000	1882.5	376500	1895.0	379000		



# EUT test details, continued

### B25 NR Configurations Tested:

Carrier configurations	Transmit / DL, MHz
SC, 25MHz, Bottom	1942.5
SC, 25MHz, Middle	1962.5
SC, 25MHz, Top	1982.5
SC, 30MHz, Bottom	1945.0
SC, 30MHz, Middle	1962.5
SC, 30MHz, Top	1980.0
SC, 35MHz, Bottom	1947.5
SC, 35MHz, Middle	1962.5
SC, 35MHz, Top	1977.5
SC, 40MHz, Bottom	1950.0
SC, 40MHz, Middle	1962.5
SC, 40MHz, Top	1975.0
2C, 25MHz, Bottom	1942.5+1967.5
2C, 25MHz, Middle	1950.0+1975.0
2C, 25MHz, Top	1957.5+1982.5



# 3.4 EUT setup diagram



Figure 3.4-1: Setup diagram – Radio Compliance



# 3.5 Setup photographs



Figure 3.5-1: Set up photo for Radio Compliance Testing



# Section 4. Engineering considerations

# 4.1 Modifications incorporated in the EUT

There were no modifications performed to the EUT during this assessment.

# 4.2 Technical judgment

None

# 4.3 Deviations from laboratory tests procedures

No deviations were made from laboratory procedures.



# Section 5. Test conditions

# 5.1 Atmospheric conditions

Temperature	15–30 °C
Relative humidity	20–75 %
Air pressure	860–1060 mbar

When it is impracticable to carry out tests under these conditions, a note to this effect stating the ambient temperature and relative humidity during the tests shall be recorded and stated.

# 5.2 Power supply range

The normal test voltage for equipment to be connected to the mains shall be the nominal mains voltage. For the purpose of the present document, the nominal voltage shall be the declared voltage, or any of the declared voltages ±5 %, for which the equipment was designed.



# Section 6. Measurement uncertainty

# 6.1 Uncertainty of measurement

Measurement uncertainty budgets for the tests are detailed below. Measurement uncertainty calculations assume a coverage factor of K = 2 with 95% certainty.

Test name	Measurement uncertainty, dB
All antenna port measurements	0.55
Conducted spurious emissions	1.13



#### Section 7. Test equipment

#### Test equipment list 7.1

	-	Table 7.1-1: Equipment lis	t		
Equipment	Manufacturer	Model no.	Asset no.	Cal cycle	Next cal.
PXA Signal Analyzer	Keysight	N9030B	MY57144347	1 year	30-Mar-24
Power Meter	Rohde & Schwarz	NRP2	101814	1 year	21-Mar-25
Power Sensor	Rohde & Schwarz	NRP-Z11	100070	1 year	31-Mar-25
CT11*	Ericsson	LPC 102 494/1	T01G495060	—	NCR
Notes: NCR - no calibration required.					

NCR - no calibration required.

 $\ensuremath{^*}$  CT11 is the test equipment that drives the radios traffic.



# Section 8. Testing data

# 8.1 Transmitter output power (EIRP) and antenna height (Band 2/25)

#### 8.1.1 Definitions and limits

#### FCC §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.

(2) Base station antenna heights may exceed 300 meters HAAT with a corresponding reduction in power; see table below.

(b)(1) Base stations that are located in counties with population densities of 100 persons or fewer per square mile, based upon the most recently available population statistics from the Bureau of the Census, with an emission bandwidth of 1 MHz or less are limited to 3280 watts equivalent isotropically radiated power (EIRP) with an antenna height up to 300 meters HAAT.

(d) Power measurements for transmissions by stations authorized under this section may be made either in accordance with a Commission-approved average power technique or in compliance with paragraph (e) of this section. In both instances, equipment employed must be authorized in accordance with the provisions of §24.51. In measuring transmissions in this band using an average power technique, the peak-to-average ratio (PAR) of the transmission may not exceed 13 dB.

#### RSS-133, Section 6.4

The equivalent isotropically radiated power (e.i.r.p.) for transmitters shall not exceed the limits given in SRSP-510.

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

SRSP-510, Section 5.1

5.1.1 Base stations

For base stations with a channel bandwidth greater than 1 MHz, the maximum e.i.r.p. is limited to 3280 watts/MHz e.i.r.p. (i.e., no more than 3280 watts e.i.r.p. in any 1 MHz band segment) with an antenna height above average terrain (HAAT) up to 300 metres. Fixed or base stations operating in urban areas are limited to a maximum allowable e.i.r.p. of 1640 watts/MHz e.i.r.p. Base station antenna heights above average terrain may exceed 300 metres with a corresponding reduction in e.i.r.p. according to the following table.

#### Table 8.1-1: Reduction to Maximum Allowable E.I.R.P. for HAAT > 300 m

HAAT (m)	Maximum EIRP, W/MHz
HAAT ≤ 300	1640
300 < HAAT ≤ 500	1070
500 < HAAT ≤ 1000	490
1000 < HAAT ≤ 1500	270
1500 < HAAT ≤ 2000	160

#### 8.1.2 Test summary

Test date	March 20, 2024
Test engineer	Nimish Kapoor



### 8.1.3 Observations, settings, and special notes

Output power was measured with RMS power meter per ANSI C63.26 Paragraph 5.2.4.2 method. PSD was measured using method described in paragraph 5.2.4.4.

- Randomly selected sample plots provided for information and settings only
- Total MIMO PSD was calculated as follows: PSD from one antenna port + 10 × Log<sub>10</sub> (4)
- RBS (Radio Base Station) EIRP Limits are deployment dependent. To ensure compliance with legal limits detailed in section 8.1.2, RBS set up and carrier configurations are addressed during site commissioning.
- Report results are compiled for the maximum output rated power for worst case emission assessment. EIRP, based on possible beam configuration, indicate the maximum power / worst case beam configuration based on ideal antenna parameters. Customer carrier configuration and power will be limited to comply with legal limits of 1640 W/MHz or 3280 W/MHz during RBS site set up and commissioning. Non-compliant configurations will be restricted to lower carrier power to ensure compliance.
- The LPRU 4420 B25B66 product will only be installed with its RF output ports connected to Active Distributed Antenna Systems (DAS). The
  product will not be directly connected to antennas.
- To ensure compliance under worst case conditions with maximum output power based on a MIMO configuration, the maximum antenna gain for an RBS (Radio Base Station) system with LPRU 4420 B25B66 is 0.00 dBi with 2.50 dB path loss. Maximum measured PSD to EIRP margin 48.76 dB.

Spectrum analyzer settings for PSD:

Detector mode	RMS
Resolution bandwidth	1 MHz
Video bandwidth	>RBW
Measurement mode	Power over emission bandwidth
Trace mode	Averaging



### 8.1.1 Test data

#### Table 8.1-2: EIRP calculation based on the worst-case PSD measurement.

Frequency,	RF power density,	Total MIMO		Antenna gain,	EIRP PSD,	EIRP limit,	
MHz	dBm/MHz	PSD, dBm/MHz	Cable loss, dB	dBi	dBm/MHz	dBm/MHz	Margin, dB
1982.5	9.87	15.89	2.50	0.00	13.39	62.15	48.76

Table 8.1-3: RF power density measurement results of a single-carrier operation for NR on 25 MHz channel

Frequency, MHz	RF power density, dBm/MHz	Total MIMO PSD, dBm/MHz	EIRP limit, dBm/MHz	Margin, dB
1942.5	9.74	15.76	62.15	46.39
1962.5	9.53	15.55	62.15	46.60
1982.5	9.87	15.89	62.15	46.26

Table 8.1-4: RF power density measurement results of a single-carrier operation for NR on 30 MHz channel

Frequency, MHz	RF power density, dBm/MHz	Total MIMO PSD, dBm/MHz	EIRP limit, dBm/MHz	Margin, dB
1945.0	8.93	14.95	62.15	47.20
1962.5	8.74	14.76	62.15	47.39
1980.0	9.21	15.23	62.15	46.92

Table 8.1-5: RF power density measurement results of a single-carrier operation for NR on 35 MHz channel

Frequency, MHz	RF power density, dBm/MHz	Total MIMO PSD, dBm/MHz	EIRP limit, dBm/MHz	Margin, dB
1947.5	8.18	14.20	62.15	47.95
1962.5	8.14	14.16	62.15	47.99
1977.5	8.35	14.37	62.15	47.78

Table 8.1-6: RF power density measurement results of a single-carrier operation for NR on 40 MHz channel

Frequency, MHz	RF power density, dBm/MHz	Total MIMO PSD, dBm/MHz	EIRP limit, dBm/MHz	Margin, dB
1950.0	7.76	13.78	62.15	48.37
1962.5	7.95	13.97	62.15	48.18
1975.0	7.94	13.96	62.15	48.19

Table 8.1-7: RF power density measurement results of a multi-carrier operation for NR on 25 MHz channel [Contiguous]

Notes	Channel	RF power density, dBm/MHz	Total MIMO PSD, dBm/MHz	EIRP limit, dBm/MHz	Margin, dB
	Bottom	6.80	12.82	62.15	49.33
2 carriers	Middle	7.26	13.28	62.15	48.87
	Тор	7.05	13.07	62.15	49.08



Table 8.1-8: RF total channel power measurement results for NR [25 MHz]

25 MHz channel (0.159 W)
22.00
22.10
22.16

Note: all results in the table are in dBm units

Table 8.1-9: RF total channel power measurement results for NR [30 MHz]

Remarks	30 MHz channel (0.159 W)
Low channel, QPSK	22.05
Mid channel, QPSK	22.16
Top channel, QPSK	22.25
Note: all results in the table are in dBm units	

Table 8.1-10: RF total channel power measurement results for NR [35 MHz]

Remarks	35 MHz channel (0.159 W)
Low channel, QPSK	22.04
Mid channel, QPSK	22.14
Top channel, QPSK	22.16
Network and the second s	

Note: all results in the table are in dBm units

Table 8.1-11: RF total channel power measurement results for NR [40 MHz]

Remarks	40 MHz channel (0.159 W)
Low channel, QPSK	22.04
Mid channel, QPSK	22.12
Top channel, QPSK	22.18

Note: all results in the table are in dBm units

#### Table 8.1-12: RF total channel power measurement results for NR Multi-carrier [25 MHz bandwidth Contiguous]

Carriers	Channel	25 MHz channel (0.159 W)
	Low Channel	22.14
2 Carriers, QPSK	Middle Channel	22.23
	Top Channel	22.26

Note: all results in the table are in dBm units

Section 8 Test name Specification Testing data Transmitter output power (EIRP) and antenna height (Band 2/25) FCC Part 24 and RSS-133 Issue 6



#### Test data, continued



Figure 8.1-1: PSD of NR 25 MHz channel bandwidth, single carrier operation, sample plot



Figure 8.1-3: PSD of NR 35 MHz channel bandwidth, single carrier operation, sample plot



Figure 8.1-2: PSD of NR 30 MHz channel bandwidth, single carrier operation, sample plot



Figure 8.1-4: PSD of NR 40 MHz channel bandwidth, single carrier operation, sample plot

 Section 8
 Testing data

 Test name
 Transmitter output power (EIRP) and antenna height (Band 2/25)

 Specification
 FCC Part 24 and RSS-133 Issue 6



### Test data, continued



Figure 8.1-5: PSD of NR 25 MHz channel bandwidth, multi-carrier operation, sample plot, Contiguous



Table 8.1-13: Complementary Cumulative Distribution Function (CCDF) of the PAPR reduction measurement results for single carrier operation for NR 25 MHz

Remarks	Frequency, MHz	0.1% CCDF, dB	PAPR reduction limit, dB	Margin, dB
Low channel	1942.5	8.31	13.00	4.69
Mid channel	1962.5	8.29	13.00	4.71
Top channel	1982.5	8.28	13.00	4.72

Table 8.1-14: Complementary Cumulative Distribution Function (CCDF) of the PAPR reduction measurement results for single carrier operation for NR 30 MHz

Remarks	Frequency, MHz	0.1% CCDF, dB	PAPR reduction limit, dB	Margin, dB
Low channel	1945.0	8.31	13.00	4.69
Mid channel	1962.5	8.34	13.00	4.66
Top channel	1980.0	8.28	13.00	4.72

Table 8.1-15: Complementary Cumulative Distribution Function (CCDF) of the PAPR reduction measurement results for single carrier operation for NR 35 MHz

Remarks	Frequency, MHz	0.1% CCDF, dB	PAPR reduction limit, dB	Margin, dB
Low channel	1947.5	8.30	13.00	4.70
Mid channel	1962.5	8.32	13.00	4.68
Top channel	1977.5	8.32	13.00	4.68

Table 8.1-16: Complementary Cumulative Distribution Function (CCDF) of the PAPR reduction measurement results for single carrier operation for NR 40 MHz

Remarks	Frequency, MHz	0.1% CCDF, dB	PAPR reduction limit, dB	Margin, dB
Low channel	1950.0	8.26	13.00	4.74
Mid channel	1962.5	8.30	13.00	4.70
Top channel	1975.0	8.28	13.00	4.72



Figure 8.1-6: CCDF sample plot, NR



# 8.2 Spurious out-of-band emissions (Band 2/25)

#### 8.2.1 Definitions and limits

#### FCC §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.

(b) Measurement procedure. 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.

#### RSS-133, Section 6.5.1:

i. In the first 1.0 MHz bands immediately outside and adjacent to the equipment's operating frequency block, the emission power per any 1% of the emission bandwidth shall be attenuated below the transmitter output power P (in dBW) by at least 43 + 10 log<sub>10</sub> p (watts) dB.
ii. After the first 1.0 MHz, the emission power in any 1 MHz bandwidth shall be attenuated below the transmitter output power P (in dBW) by at least 43 + 10 log<sub>10</sub> p (watts) dB.
10 log<sub>10</sub> p (watts) dB. If the measurement is performed using 1% of the emission bandwidth, power integration over 1.0 MHz is required.

#### 8.2.2 Test summary

Test date	March 20, 2024
Test engineer	Nimish Kapoor

#### 8.2.3 Observations, settings and special notes

- The spectrum was searched from 30 MHz to the 10<sup>th</sup> harmonic.
- All measurements were performed using an average (RMS) detector per ANSI C63.26 Paragraph 5.7.2 method.
- − Limit line (43 + 10 log<sub>10</sub> (P) or −13 dBm) was adjusted for MIMO operation by 6 dB\*: −13 dBm − 6 dB = −19 dBm
- \*MIMO correction factor for 4 antenna ports: 10 × Log<sub>10</sub>(4) = 6 dB
- RBW 1 MHz, VBW was wider than RBW.



### 8.2.4 Test data







Figure 8.2-3: Conducted spurious emissions of NR 25 MHz top channel, single-carrier operation



Figure 8.2-2: Conducted spurious emissions of NR 25 MHz mid channel, single-carrier operation



Figure 8.2-4: Conducted spurious emissions of NR 30 MHz low channel, single-carrier operation

Section 8Testing dataTest nameSpurious out-of-band emissions (Band 2/25)SpecificationFCC Part 24 and RSS-133, Issue 6



#### Test data, continued







Figure 8.2-7: Conducted spurious emissions of NR 35 MHz low channel, single-carrier operation



Figure 8.2-6: Conducted spurious emissions of NR 30 MHz top channel, single-carrier operation



Figure 8.2-8: Conducted spurious emissions of NR 35 MHz mid channel, single-carrier operation

Section 8Testing dataTest nameSpurious out-of-band emissions (Band 2/25)SpecificationFCC Part 24 and RSS-133, Issue 6



#### Test data, continued







Figure 8.2-11: Conducted spurious emissions of NR 40 MHz mid channel, single-carrier operation



Figure 8.2-10: Conducted spurious emissions of NR 40 MHz low channel, single-carrier operation



Figure 8.2-12: Conducted spurious emissions of NR 40 MHz top channel, single-carrier operation

Section 8Testing dataTest nameSpurious out-of-band emissions (Band 2/25)SpecificationFCC Part 24 and RSS-133, Issue 6



#### Test data, continued











Figure 8.2-15: Conducted spurious emissions of NR 25 MHz two contiguous top channels, two-carrier operation





#### On the plots below the measured Channel Power value in the "Total Channel Power" column must be -19 dBm and lower.

Figure 8.2-16: Conducted emission at the lower band edge

Frequency:	1930 MHz	
Meas. BW:	1% of EBW	
Limit:	–19 dBm/250 kHz	

Mode: Single carrier operation Tech.: NR 25 MHz Notes: None

BE 1 MHz Channel Po	wer	CCDF Power Stat CCDF	UBE 1PC Channel P	ower UB	E 1M annel Power	+
KEYSIGHT	Input: RF Coupling: DC Align: Auto	Input Z: 50 Ω Atten: 10 dB Corr Preamp: Off Freq Ref: Ext (S) μW Path: St NFE: Off #PNO: Fast	Trig: Free Run Gate: Off andard #IF Gain: Low	Center Freq: 1.995125000 GHz Avg[Hold: 100/100 Radio Std: None		
1 Graph					Mkr1 1.9950	00000 GHz
Scale/Div 10.0	dB		Ref Value 6.40 d	Bm		-52.50 dBm
_og						
-13.6						
23.6						
33.6						
43.6			<b></b> 1-			
53.6						
63.6				and the second se		
73.6						
-83.6						
enter 1.99513 Res BW 51.00	3 GHz 00 kHz		#Video BW 200.00	kHz*	Sweep 26.3	ipan 56.25 MHz 3 ms (5001 pts)
2 Metrics	,					
Total Chann	el Power	-46.70 dBm / 250 kHz				
Total Power	Spectral Densi	ty -100.7 dBm/Hz				
15	a 🔳 1	Mar 20, 2024			.:: 🛯	

Figure 8.2-18: Conducted emission at the upper band edge

Frequency:	1995 MHz	Mode:	Single carrier operation	
Meas. BW:	1% of EBW	Tech.:	NR 25 MHz	
Limit:	–19 dBm/250 kHz	Notes:	None	



Figure 8.2-17: Conducted emission 1 MHz away from the lower band edge

Frequency:	1929 MHz
Meas. BW:	1 MHz
Limit:	–19 dBm/MHz

Mode:Single carrier operationTech.:NR 25 MHzNotes:None

BE 1 MH Channel I	z Power	CCDF Power Stat CO	DF	UBE 1PC Channel F	Power	UBE 1M Channel Power	· +
KEYSIGH	T Input: RF Coupling: DC Align: Auto	Input Z: 50 Ω At Corr Pr Freq Ref: Ext (S) μV NFE: Off #F	ten: 10 dB Trig: eamp: Off Gate V Path: Standard #IF C NO: Fast	Free Run : Off Sain: Low	Center Freq: 1.996500000 Avg[Hold: 100/100 Radio Std: None	GHz	
1 Graph	,					Mkr1 1.	996000000 GHz
Scale/Div 10	).0 dB		Ref	Value 6.40 d	IBm		-51.41 dBm
Log							
-3.00							
-13.0							
-23.0							
-33.6							
-43.0				- C.	Children et al.		
-53.6					and the second se		
73.6						and the second s	
83.6							
-03.0							
Center 1.996 #Res BW 10	550 GHz 0.00 kHz		#Vide	o BW 300.00	) kHz*	Swe	Span 56.25 MHz ep 7.00 ms (5001 pts)
2 Metrics	,						
Total Cha	annel Power	-42.08 dBm / 1.00 M	Hz				
Total Day	and Constant Descri	400.4 - 10	-				
Total Pov	ver spectral Densi	-102.1 dbm/	nz				
	T						
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Figure 8.2-19: Conducted emission 1 MHz away from the upper band edge

Frequency: 1996 MHz Meas. BW: 1 MHz Limit: -19 dBm/MHz Mode: Single carrier operation Tech.: NR 25 MHz Notes: None





#### On the plots below the measured Channel Power value in the "Total Channel Power" column must be -19 dBm and lower.



Frequency:	1930 MHz	Mode
Meas. BW:	1% of EBW	Tech.
Limit:	–19 dBm/300 kHz	Notes

Mode: Single carrier operation Tech.: NR 30 MHz Notes: None

BE 1 MHz Channel Po	wer	CCDF Power St	at CCDF	UB	E 1PC annel Powe	r	UBE 1M Channel Power		+
KEYSIGHT	Input: RF Coupling: DC Align: Auto	Input Z: 50 Ω Corr Freq Ref: Ext (S) NFE: Off	Atten: 10 dB Preamp: Off µW Path: Standard #PNO: Fast	Trig: Free F Gate: Off #IF Gain: L	Run Cer Avg ow Ra:	nter Freq: 1.995150000  Hold: 100/100 dio Std: None	GHz		
1 Graph	•						Mkr	1 1.9950000	00 GHz
scale/Div 10.0	dB			Ref Value	16.40 dBm			-54.0	09 dBm
6.40									
3.60									
13.6					7				
23.6									
33.6			-						
43.6					-¥1				
53.6			-		-				
63.6							-		
73.6									
enter 1.99515 Res BW 51.00	i GHz I0 kHz			Video BW	200.00 kHz	ť		Spar Sweep 31.7 ms	1 67.5 MHz (5001 pts)
2 Metrics	•								
Total Chann	el Power	-47.03 dBm / 30	0 kHz						
Total Power	Spectral Densi	y -101.8 dE	im/Hz						
		. 1							
45	r 🔳 🕯	Mar 20, 2024 7:43:45 AM							88

Figure 8.2-22: Conducted emission at the upper band edge

Frequency:	1995 MHz	Mode:	Single carrier operation	
Meas. BW:	1% of EBW	Tech.:	NR 30 MHz	
Limit:	–19 dBm/300 kHz	Notes:	None	



Figure 8.2-21: Conducted emission 1 MHz away from the lower band edge

Frequency:	1929 MHz
Meas. BW:	1 MHz
Limit:	–19 dBm/MHz

Mode:Single carrier operationTech.:NR 30 MHzNotes:None

BE 1 MHz Channel Po	wer	CCDF Power Stat	CCDF	1	UBE 1P0 Channel	) Power		UBE 1M Channel Power		· +
KEYSIGHT	Input: RF Coupling: DC Align: Auto	Input Z: 50 Ω Corr Freq Ref: Ext (S) NFE: Off	Atten: 10 dB Preamp: Off µW Path: Standard #PNO: Fast	Trig: Fre Gate: O #IF Gain	te Run ff to Low	Center Frei Avg[Hold: 1 Radio Std:	1.996500000 0 00/100 None	äHz		
1 Graph	•							м	kr1 1.9960	00000 GHz
Scale/Div 10.0	dB			Ref Val	ue 16.40	dBm			-	-52.95 dBm
Log										
3.60										
-3.00										
-13.0										
-23.6										
-33.6										
-43.6										
-53.6						and the second se	~			
-63.6										
-73.6										
Center 1.99650 #Res BW 100.0	0 GHz 00 kHz		#	Video E	SW 300.0	0 kHz*			Sweep 8.3	Span 67.5 MHz 3 ms (5001 pts)
2 Metrics	•									
Total Chann	nel Power	-42.61 dBm / 1.00	) MHz							
Total Power	r Spectral Densi	ty -102.6 dB	8m/Hz							
Line To										
<b>4</b> N	C 🔳 1	Mar 20, 2024 7:44:15 AM	DA						.:: እ	388

Figure 8.2-23: Conducted emission 1 MHz away from the upper band edge

Frequency: 1996 MHz Meas. BW: 1 MHz Limit: –19 dBm/MHz Mode: Single carrier operation Tech.: NR 30 MHz Notes: None

Report ID: REP033400





## On the plots below the measured Channel Power value in the "Total Channel Power" column must be -19 dBm and lower.

Figure 8.2-24: Conducted emission at the lower band edge

Frequency:	1930 MHz
Meas. BW:	1% of EBW
Limit:	–19 dBm/350 kHz

Mode: Single carrier operation Tech.: NR 35 MHz Notes: None

	out: RF supling: DC gn: Auto	Input Z: 50 Ω Corr Erea Ref: Ext ()	Atten: 10 dB	Tria: Eree E				
		NFE: Off	<ul> <li>μW Path: Standard</li> <li>#PNO: Fast</li> </ul>	Gate: Off #IF Gain: L	un Cento AvglH w Radio	r Freq: 1.995175000 lold: 100/100 std: None	GHz	
1 Graph	•						Mkr1 1.9	95000000 GHz
Scale/Div 10.0 dB	3			Ref Value	16.40 dBm			-53.77 dBm
640								
3.60								
-13.6					<b>1</b>			
-23.6								
33.6								
43.6					<b>∦</b> 1			
53.6						and man		
63.6								
/3.6								
Center 1.99518 GI	Hz KHz		*	Wideo BW	200.00 kHz*		Swee	Span 78.5 MHz 36.7 ms (5001 pts)
2 Metrics	,							<u>, ( ,</u>
Total Channel I	Power	-46.53 dBm /	350 kHz					
Total Power Sp	pectral Density	-102.0	dBm/Hz					
	T							
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Figure 8.2-26: Conducted emission at the upper band edge

Frequency:	1995 MHz	Mode:	Single carrier operation	
Meas. BW:	1% of EBW	Tech.:	NR 35 MHz	
Limit:	–19 dBm/350 kHz	Notes:	None	



Figure 8.2-25: Conducted emission 1 MHz away from the lower band edge

Frequency:	1929 MHz
Meas. BW:	1 MHz
Limit:	–19 dBm/MHz

Mode:Single carrier operationTech.:NR 35 MHzNotes:None

BE 1 MHz Channel Po	wer	CC Pov	DF wer Stat CCDF		UBE 1PC Channel	) Power		UBE 1M Channel Power		· +
KEYSIGHT	Input: RF Coupling: DC Align: Auto	Input Z: 50 Corr Freq Ref: I NFE: Off	Ω Atten: 10 dB Preamp: Off Ext (S) μW Path: Stande #PNO: Fast	Trig: F Gate: I #IF Ga	ree Run Off in: Low	Center Freq: Avg[Hold: 100 Radio Std: No	1.996500000 0 V100 ine	iHz		
1 Graph	•							Mkr	1 1.99600	00000 GHz
Scale/Div 10.0	dB			Ref Va	lue 16.40	dBm				53.22 dBn
LUG										
3.60										
-3.00									Span	
-13.6									78.500 MH	z –
-23.6									Sweep Time	e
-33.6									10.0 ms	-
-43.6									Auto Man	_
-63.6							and the second se		Points	
Center 1.99650	GHz			#Video	EW 300.0	0 kHz*				Span 78.5 MH
#Res BW 100.0	IO KHZ								Sweep 10.0	ms (5001 pts
2 Moures										
Total Chann	el Power	-43.21 dB	m / 1.00 MHz							
Total Power	Spectral Densi	ty -1	03.2 dBm/Hz							
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Figure 8.2-27: Conducted emission 1 MHz away from the upper band edge

Frequency:	1996 MHz
Meas. BW:	1 MHz
Limit:	–19 dBm/MHz

Mode: Single carrier operation Tech.: NR 35 MHz Notes: None





## On the plots below the measured Channel Power value in the "Total Channel Power" column must be -19 dBm and lower.



Frequency:	1930 MHz	
Meas. BW:	1% of EBW	
Limit:	–19 dBm/400 kHz	

Mode: Single carrier operation Tech.: NR 40 MHz Notes: None

BE 1 MHz Channel Pov	wer	CCDF Power Sta	I CCDF	UBE 1 Chann	PC el Power	UBE 1M Channel Power	+
(EYSIGHT .++·	Input: RF Coupling: DC Align: Auto	Input Z: 50 Ω Corr Freq Ref: Ext (S) NFE: Off	Atten: 20 dB Preamp: Off µW Path: Standard #PNO: Fast	Trig: Free Run Gate: Off #IF Gain: Low	Center Freq: 1.995 Avg[Hold: 100/100 Radio Std: None	200000 GHz	
I Graph	,					Mkr1 1.	995000000 GHz
cale/Div 10.0	dB			Ref Value 16.	10 dBm		-53.21 dBm
.0g 6.40							
3.60							
13.6							
23.6							
33.6							
43.6					1		
53.6			-		and the second sec		
33.6							
/3.6							
enter 1.99520 Res BW 51.00	GHz I0 kHz			Video BW 200	.00 kHz*	Swe	Span 90 MHz p 42.3 ms (5001 pts)
! Metrics	•						
Total Chann	el Power	-46.02 dBm / 400	kHz				
Total Power	Spectral Densi	y -102.0 dB	n/Hz				
	т						
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Figure 8.2-30: Conducted emission at the upper band edge

Frequency:	1995 MHz	Mode:	Single carrier operation	
Meas. BW:	1% of EBW	Tech.:	NR 40 MHz	
Limit:	–19 dBm/400 kHz	Notes:	None	



Figure 8.2-29: Conducted emission 1 MHz away from the lower band edge

Frequency:	1929 MHz
Meas. BW:	1 MHz
Limit:	–19 dBm/MHz

Mode:Single carrier operationTech.:NR 40 MHzNotes:None

BE 1 MHz Channel Po	wer	CCDF Power SI	at CCDF	UB	E 1PC annel	; Power	UBE 1M Channel Power	· +
KEYSIGHT	Input: RF Coupling: DC Align: Auto	Input Z: 50 Ω Corr Freq Ref: Ext (S) NFE: Off	Atten: 20 dB Preamp: Off µW Path: Standard #PNO: Fast	Trig: Free F Gate: Off #IF Gain: L	tun ow	Center Freq: 1.9965000 Avg Hold: 100/100 Radio Std: None	10 GHz	
1 Graph	•						Mkr1_1	.99600000 GHz
Scale/Div 10.0	dB			Ref Value	16.40	dBm		-52.45 dBm
Log								
6.40								
-3.60								
-13.6								
-23.6								
-33.6								
-43.6					61			
-53.6					-	and the second s		
-63.6								
-73.6								
Center 1.9965 #Res BW 100.	0 GHz 00 kHz		#	Video BW	300.0	0 kHz*	Sw	Span 90 MHz eep 11.3 ms (5001 pts)
2 Metrics	•							
Total Chan	nel Power	-43.17 dBm / 1.	00 MHz					
Total Powe	r Spectral Densit	y -103.2	iBm/Hz					
Line T	т	. 1						
<b>4</b> N	? 🔳 ?	Mar 20, 2024 8:33:28 AM	$\square$					: 🕃 🗄 🔀

Figure 8.2-31: Conducted emission 1 MHz away from the upper band edge

Frequency:	1996 MHz
Meas. BW:	1 MHz
Limit:	–19 dBm/MHz

Mode: Single carrier operation Tech.: NR 40 MHz Notes: None





#### On the plots below the measured Channel Power value in the "Total Channel Power" column must be -19 dBm and lower.



1930 MHz	М
1% of EBW	T
–19 dBm/250 kHz	No
	1930 MHz 1% of EBW –19 dBm/250 kHz

Mode: Multi-carrier operation Tech.: 2× NR 25 MHz Notes: None

BE 1 MHz Channel Po	wer	CCDF Power Stat	CCDF	UBE 1 Chann	PC el Power	T UE	BE 1M hannel Power	+
KEYSIGHT	Input: RF Coupling: DC Align: Auto	Input Z: 50 Ω Corr Freq Ref: Ext (S) NFE: Off	Atten: 10 dB Preamp: Off µW Path: Standard #PNO: Fast	Trig: Free Run Gate: Off #IF Gain: Low	Center Free Avg[Hold: 1 Radio Std: 1	q: 1.995125000 GHz 100/100 None	2	
1 Graph	•						Mkr1 1.	95000000 GHz
Scale/Div 10.0	dB			Ref Value 6.4	40 dBm			-53.58 dBm
3.60								
-13.6				*****				
-23.6								
-33.6		<u>l</u> /						
-43.6					1			
-53.6					and the second s			
63.6								
-73.6								
-83.6								
Center 1.99513 #Res BW 51.00	GHz 0 kHz		#	Video BW 20	0.00 kHz*		Sweet	Span 103 MHz 49.3 ms (20001 pts)
2 Metrics	۲							· · · · · · · · · · · · · · · · · · ·
Total Chann	el Power	-48.00 dBm / 250	kHz					
Total Power	Spectral Densit	-102.0 dBr	n/Hz					
4 h	? 🔳	Mar 20, 2024 8:46:13 AM					.::	

Figure 8.2-34: Conducted emission at the upper band edge

Frequency:	1995 MHz	Mode:	Multi-carrier operation	
Meas. BW:	1% of EBW	Tech.:	2× NR 25 MHz	
Limit:	–19 dBm/250 kHz	Notes:	None	



Figure 8.2-33: Conducted emission 1 MHz away from the lower band edge

Frequency:	1929 MHz
Meas. BW:	1 MHz
Limit:	–19 dBm/MHz

Mode:Multi-carrier operationTech.:2× NR 25 MHzNotes:None

BE 1 MHz Channel Pt	ower	CCDF Power Sta	I CCDF	u c	JBE 1P Channel	D Power	UBE 1M Channel Pov	ver 🕇 🕇	
KEYSIGHT	Input: RF Coupling: DC Align: Auto	Input Z: 50 Ω Corr Freq Ref: Ext (S) NFE: Off	Atten: 10 dB Preamp: Off µW Path: Standard #PNO: Fast	Trig: Fre Gate: Ot #IF Gain	e Run f Low	Center Freq: 1.9 Avg[Hold: 100/10 Radio Std: None	96500000 GHz 10		
1 Graph				_				Mkr1 1.996000000	3Hz
Scale/Div 10.	an			Ref val	ue 6.40	an		-55.95 0	ы
3.60									
-13.6									
23.6									
22.6		V							
42.6									
52.6									
63.6						- Andrews			
-73.6									
-83.6									
Contar 4 0064	0.011-			fidee D		O Lillet		Suc. 110	
#Res BW 100	.00 kHz			VIGeo B	W 300.0	JU KHZ		Sweep 14.7 ms (2000)	pts
2 Metrics	,								-
Total Chan	nel Power	-43.94 dBm / 1.0	0 MHz						
Total Powe	er Spectral Densi	ty -103.9 dl	3m/Hz						
	_								
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Figure 8.2-35: Conducted emission 1 MHz away from the upper band edge

Frequency: 1996 MHz Meas. BW: 1 MHz Limit: –19 dBm/MHz Mode:Multi-carrier operationTech.:2× NR 25 MHzNotes:None



## 8.3 Occupied bandwidth (Band 2/25)

#### 8.3.1 Definitions and limits

#### FCC §2.1049:

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.

#### RSS-Gen, 6.7

The occupied bandwidth or the "99% emission bandwidth" is defined as the frequency range between two points, one above and the other below the carrier frequency, within which 99% of the total transmitted power of the fundamental transmitted emission is contained. The occupied bandwidth shall be reported for all equipment in addition to the specified bandwidth required in the applicable RSSs.

#### 8.3.2 Test summary

Test date	March 20, 2024
Test engineer	Nimish Kapoor

#### 8.3.3 Observations, settings and special notes

Testing was performed per ANSI C63.26 Paragraphs 5.4.3 and 5.4.4 methods.

#### Spectrum analyzer settings:

Detector mode	Peak
Resolution bandwidth	≥1 % of EBW
Video bandwidth	RBW × 3
Trace mode	Max Hold



## 8.3.4 Test data

### Table 8.3-1: Occupied bandwidth results for NR 25 MHz channel

Remarks	Frequency, MHz	26 dB BW, MHz	99% OBW, MHz
25 MHz, Low channel	1942.5	24.670	23.699
25 MHz, Mid channel	1962.5	24.670	23.698
25 MHz, Top channel	1982.5	24.670	23.696

## Table 8.3-2: Occupied bandwidth results for NR 30 MHz channel

Remarks	Frequency, MHz	26 dB BW, MHz	99% OBW, MHz
30 MHz, Low channel	1945.0	29.640	28.521
30 MHz, Mid channel	1962.5	29.670	28.520
30 MHz, Top channel	1980.0	29.630	28.415

### Table 8.3-3: Occupied bandwidth results for NR 35 MHz channel

Remarks	Frequency, MHz	26 dB BW, MHz	99% OBW, MHz
25 MHz, Low channel	1947.5	34.770	33.466
25 MHz, Mid channel	1962.5	34.780	33.524
25 MHz, Top channel	1977.5	34.760	33.472

### Table 8.3-4: Occupied bandwidth results for NR 40 MHz channel

Remarks	Frequency, MHz	26 dB BW, MHz	99% OBW, MHz
40 MHz, Low channel	1950.0	39.890	38.469
40 MHz, Mid channel	1962.5	39.890	38.482
40 MHz, Top channel	1975.0	39.880	38.374





Figure 8.3-1: Sample plot for NR 25 MHz channel





Figure 8.3-3: Sample plot for NR 35 MHz channel

Figure 8.3-4: Sample plot for NR 40 MHz channel

#### End of report