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Radio Test report – AIR 3246 B66

Project number:

421512-1TRFWL-R1

Applicant:

Ericsson Canada Inc.

Product:	Model:	Part number:
AIR 3246	AIR 3246 B66	KRD 901 190/1

FCC ID:	ISED Reg. Number	HVIN:
TA8AKRD901190-1	287AB-AS9011901	AS9011901

Requirements/Summary:

Standard	Environmental phenomenon	Compliance
FCC 47 CFR Part 27	Miscellaneous wireless communications services	Yes
RSS-139 Issue 3, July 16, 2015	Advanced Wireless Services (AWS) Equipment Operating in the Bands 1710–1780 MHz and 2110–2180 MHz	Yes
RSS-170 Issue 3, July 9, 2015	Ancillary Terrestrial Component (ATC) Equipment Operating in the Mobile-Satellite Service (MSS) Bands Limitations specified under Industry Canada P9 Licensing Agreement applied as per https://www.ic.gc.ca/eic/site/smt-gst.nsf/eng/sf11536.html	Yes

Date of issue: April 26, 2021

Andrey Adelberg, Senior EMC/Wireless Specialist
Tested by


Signature

David Duchesne, Senior EMC/Wireless Specialist
Reviewed by


Signature

Two test locations

Company name	Nemko Canada Inc.	
Address	303 River Road	349 Terry Fox
City	Ottawa	Ottawa
Province	Ontario	Ontario
Postal code	K1V 1H2	K2K 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 number: 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.

Copyright notification

Table of contents

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 CFR Part 2	Frequency Allocations and Radio Treaty Maters; General Rules and Regulations
FCC 47 CFR Part 27	Miscellaneous wireless communications services (2110–2200 MHz)
RSS-139 Issue 3, July 16, 2015	Advanced Wireless Services (AWS) equipment operating in the bands 1710–1780 MHz and 2110–2180 MHz
SRSP-513, Issue 3, July 2015	Technical Requirements for Advanced Wireless Services (AWS) in the Bands 1710–1780 MHz and 2110–2180 MHz
SRSP-519, Issue 1, July 2015	Technical Requirements for the Ancillary Terrestrial Component (ATC) of Mobile-Satellite Service (MSS) Systems Operating in the Bands 2000-2020 MHz and 2180-2200 MHz
RSS-170 Issue 3, July 9, 2015*	Ancillary Terrestrial Component (ATC) Equipment Operating in the Mobile-Satellite Service (MSS) Bands
RSS-Gen, Issue 5, April 2018	General Requirements for Compliance of Radio Apparatus

*Equipment operating in the ancillary terrestrial component (ATC) of the frequency bands 2000–2020 MHz and 2180–2200 MHz is certified under RSS-170. Limitations specified under Industry Canada P9 Licensing Agreement applied as per https://www.ic.gc.ca/eic/site/smt-gst.nsf/eng/sf11536.html

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 CIIPC test report (421512-1TRFWL-R1) applies to the AIR 3246 B66 with part number KRD 901 190/1. See “Summary of test results” for full details.
EUT Configuration(s) SRO/MRO:
SRO SC/MC: NR: 5, 10, 15,20 MHz (1–3 Carriers)
MRO: NR+LTE 5, 10, 15, 20 MHz
Report Reference(s): 356913-1TRFWL-R1; 356914-1TRFWL-R1
Notes:
CIIPC adding NR 5, 10, 15, 20 MHz
MRO: L+NR (LTE Configurations include NB-IoT (IB, GB))

1.5 Test report revision history

Table 1.5-1: *Test report revision history*

Revision #	Date of issue	Details of changes made to test report
TRF	April 26, 2021	Original report issued

Section 2. Summary of test results

2.1 Testing location

Test location (s)	Ottawa

2.2 Testing period

Test start date	February 17, 2021	Test end date	January 27, 2021

2.3 Sample information

Receipt date	February 17, 2021	Nemko sample ID number	1

2.4 FCC test results

Table 2.4-1: *FCC results summary*

FCC Part	Test description	Verdict
§27.50(b)	Maximum output power at RF antenna connector	Pass
§27.53	Spurious emissions at RF antenna connector	Pass
§27.53	Radiated spurious emissions	Pass
§2.1049	Occupied bandwidth	Pass

Notes: Only tests requested by the client have been performed

2.5 ISED test results

Table 2.5-1: *ISED results summary*

ISED Part	Test description	Verdict
RSS-139, 4.1 / RSS-170, 5.3	Transmitter output power and Equivalent Isotropic Radiated Power (e.i.r.p.)	Pass
RSS-139, 4.2 / RSS-170, 5.4	Spurious emissions at RF antenna connector	Pass
RSS-139, 4.2 / RSS-170, 5.4	Radiated spurious emissions	Pass
RSS-Gen, 6.7	Occupied bandwidth	Pass

Notes: Only tests requested by the client have been performed

Limitations specified under Industry Canada P9 Licensing Agreement applied as per https://www.ic.gc.ca/eic/site/smt-gst.nsf/eng/sf11536.html

ATC Base Station Equipment operating in bands 2000–2020 MHz and 2180–2200 MHz

The unwanted emissions of ATC base station equipment transmitting in the bands 2000–2020 MHz and 2180–2200 MHz shall comply with the following:	(1) The power of any unwanted emissions at frequencies outside the equipment's operating frequency block shall be attenuated below the transmitter power P (dBW), by 43 + 10 log p (watts), dB. (2) For equipment operating in the band 2180–2200 MHz, in addition to (1), the power of any emissions on all frequencies between 2200 MHz and 2290 MHz shall not exceed an e.i.r.p. of −100.6 dBW/4 kHz (−70.6 dBm/4 kHz).*

*** This requirement is for implementation and is enforced at the time of licensing. Therefore, results are not included in this report.**

Section 3. Equipment under test (EUT) details

3.1 EUT information

Product name	AIR 3246
Model	AIR 3246 B66
Part number	KRD 901 190/1
Revision	R2F
Serial number	E23B593893
Antenna ports	32 TX/RX Ports
RF BW / IBW	IBW DL: 90 MHz IBW UL: 70 MHz
FDD	400 MHz
Frequency	LTE / NR TX (DL): 2110–2200 MHz LTE / NR RX (UL): 1710–1780 MHz
Nominal O/P per antenna port Up to 20 MHz Carrier BW	Single Carrier: 1 × 5 W (37 dBm) 2 Carrier: 2 × 2.5 W (37 dBm total) 3 Carrier: 3 × 1.67 W (37 dBm total)
Accuracy (nominal)	±0.1 ppm
Nominal voltage	−48 V_{DC} @ 40 A
RAT	LTE/NR: SC, MC, SRO/MRO (LTE+NB-IoT (GB, IB))
Modulation	LTE/NR: QPSK, 16 QAM, 64 QAM, 256 QAM
Channel bandwidth	LTE/NR: 5, 10, 15, 20 MHz
Channel bandwidth LTE + NB IoT	LTE + NB IoT: GB, IB (200 kHz) LTE BW: 5, 10, 15, 20 MHz (IB, GB)
Maximum combined OBW per port	90MHz
CPRI	10 Gbps
Channel raster	LTE/NR: 100 kHz
Regulatory requirements	Radio: FCC Part 2, 27, RSS-Gen, RSS-139, RSS-170 Limitations specified under Industry Canada P9 Licensing Agreement applied as per https://www.ic.gc.ca/eic/site/smt-gst.nsf/eng/sf11536.html
	EMC: FCC Part 15, ICES-003
	Safety: IEC/EN 62368-1, UL/CSA 62368-1 IEC/EN 60950-22, UL 50E /CAN/CSA, IEC/EN 60529
Emission Designator	LTE: 5M00W7D, 10M0W7D, 15M0W7D, 20M0W7D NR: 5M00W7D, 10M0W7D, 15M0W7D, 20M0W7D
Supported Configurations	Single Antenna, TX Diversity, MIMO, Carrier Aggregation, ESS (Ericsson Spectral Sharing)
Operating temperature	−40 °C to +55 °C
Total Power based on IBW	32 × 5 W
Supported carrier / port	LTE/NR: (1-3) (LTE + NB-IoT: GB (1-2), IB (1-6))

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	The AIR 3246 B66 (KRD 901 190/1) is a multi-standard remote radio forming part of the Ericsson RBS (Radio Base Station) equipment. The AIR 3246 provides radio access for mobile and fixed devices and is designed for the outdoor environment. The AIR 3246 operates over 32 TX/RX ports connected directly into an integrated antenna. Radio unit installation is designed for pole, wall or mast mount options. A fiber optic interface provides the RRU/RBS control and digital interface between the Radio and the RBS. The AIR 3246 product is convection cooled and shall be mounted vertically. Output RF Power is rated at 32 × 5 W. Altitude during operation: Below 4000 m ***Test Configuration:*** KRC 161 714/1: The radio functionality and performance are evaluated without the antenna attached. This alternate configuration replaces the antenna with the Ericsson RDNB (Radio Distribution Network Board) to allow access to the RF Ports for compliance measurements. All RF paths / components are identical. The RDNB is an ODM supplied assembly.

Ant Description

Port	Description
ANT 1-32	RF Output ports from 1 to 32
Alarm	Alarm
Data 1	Optical Interface Data 1
Data 2	Optical Interface Data 2
Data 3	Optical Interface Data 3
Data 4	Optical Interface Data 4
DC Input	−48 V_{DC}
MMI	Display - Radio Status
GND	Ground

Physical

Dimensions	1490mm x 400mm x 240mm (H x W x D)
Weight	100kg
Operating Temperature	−40 to +55 °C
Mounting	Pole, Wall Mount
Cooling	Convection (forced air)

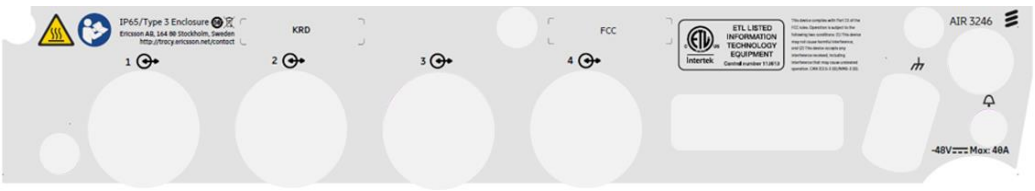
Software details: CXP9017316%25-R72XE

Radio Hardware Configuration

Product: KRD 901 190/1	R2F	KRC 161 714/1		Description
KRY 901 410/66	R2E	KRY 901 410/66		Radio Unit (2)
ROA 128 6510/66	R1L	ROA 128 6510/66		PCB/Radio Board B66
NTB 101 0110/66	R2A	NTB 101 0110/66		Parts
KRF 901 320	R1A	KRF 901 320		Filter Unit
KRY 901 420/66	R2F	KRY 901 420/66		FIB/PSU
ROA 128 6520/66	R1M	ROA 128 6520/66		PCB FIB/PSU
NTB 101 0120/66	R2A	NTB 101 0120/66		Parts
KRE 105 290	R1D	*KRE 105 288/2*		Antenna / *RDNB Fixture*
NTB 101 0100/66	R2A	NTB 101 0100/66		Parts

Product Identification Label

FCC ID: TA8AKRD901190-1
IC: 287AB-AS9011901
AS9011901



3.3 EUT test details

EUT setup/configuration rationale:

Down link

RAT	Modulation	Performance Requirement	Test Model / Configuration
LTE/NR	QPSK	N/A	E-TM1.1
LTE/NR	16QAM	N/A	E-TM3.2
LTE/NR	64QAM	N/A	E-TM3.1
LTE/NR	256QAM	N/A	E-TM3.1a

Up link

RAT	Modulation	Performance Requirement	Input Signal	Test Model / Configuration
LTE/NR	QPSK	N/A		E-UTRA-UL

Carrier Configurations:

LTE Single carrier

Bandwidth, MHz	LTE Transmit / DL, MHz					
	B	EARFCN	M	EARFCN	T	EARFCN
5	2112.5	*66461*	2155.0	*66886*	2197.5	*67311*
10	2115.0	*66486*	2155.0	*66886*	2195.0	*67286*
15	2117.5	*66511*	2155.0	*66886*	2192.5	*67261*
20	2120.0	*66536*	2155.0	*66886*	2190.0	*67236*

Bandwidth, MHz	LTE Receive / UL, MHz					
	B	EARFCN	M	EARFCN	T	EARFCN
5	1712.5	*131997*	1745.0	*132322*	1777.5	*132647*
10	1715.0	*132022*	1745.0	*132322*	1775.0	*132622*
15	1717.5	*132047*	1745.0	*132322*	1772.5	*132597*
20	1720.0	*132072*	1745.0	*132322*	1770.0	*132572*

NR Single Carrier

Bandwidth, MHz	NR Transmit / DL, MHz					
	B	NR-ARFCN	M	NR-ARFCN	T	NR-ARFCN
5	2112.5	*422500*	2155.0	*431000*	2197.5	*439500*
10	2115.0	*423000*	2155.0	*431000*	2195.0	*439000*
15	2117.5	*423500*	2155.0	*431000*	2192.5	*438500*
20	2120.0	*424000*	2155.0	*431000*	2190.0	*438000*

Bandwidth, MHz	NR Receive / UL, MHz					
	B	NR-ARFCN	M	NR-ARFCN	T	NR-ARFCN
5	1712.5	*342500*	1755.0	*351000*	1797.5	*359500*
10	1715.0	*343000*	1755.0	*351000*	1795.0	*359000*
15	1717.5	*343500*	1755.0	*351000*	1792.5	*358500*
20	1720.0	*344000*	1755.0	*351000*	1790.0	*358000*

LTE Multi-Carrier for Band Edge Emissions

Bandwidth, MHz	LTE Transmit / DL, MHz								
	B1	EARFCN	B2	EARFCN		T1	EARFCN	T2	EARFCN
5	2112.5	***66461***	2117.5	***66511***		2192.5	***67261***	2197.5	***67311***
10	2115.0	***66486***	2125.0	***66586***		2185.0	***67186***	2195.0	***67286***
15	2117.5	***66511***	2132.5	***66661***		2177.5	***67111***	2192.5	***67261***
20	2120.0	***66536***	2140.0	***66736***		2170.0	***67036***	2190.0	***67236***

Bandwidth, MHz	LTE Receive / UL, MHz								
	B1	EARFCN	B2	EARFCN		T1	EARFCN	T2	EARFCN
5	1712.5	*131997*	1717.5	*132047*		1772.5	*132597*	1777.5	*132647*
10	1715.0	*132022*	1725.0	*132122*		1765.0	*132522*	1775.0	*132622*
15	1717.5	*132047*	1732.5	*132197*		1757.5	*132447*	1772.5	*132597*
20	1720.0	*132072*	1740.0	*132272*		1750.0	*132372*	1770.0	*132572*

NR Multi-Carrier for Band Edge Emissions:

Bandwidth, MHz	NR Transmit / DL, MHz								
	B1	NR-ARFCN	B2	NR-ARFCN		T2	NR-ARFCN	T1	NR-ARFCN
5	2112.5	*422500*	2117.5	*423500*		2192.5	*438500*	2197.5	*439500*
10	2115.0	*423000*	2125.0	*425000*		2185.0	*437000*	2195.0	*439000*
15	2117.5	*423500*	2132.5	*426500*		2177.5	*435500*	2192.5	*438500*
20	2120.0	*424000*	2140.0	*428000*		2170.0	*434000*	2190.0	*438000*

Bandwidth, MHz	NR Receive / UL, MHz								
	B1	NR-ARFCN	B2	NR-ARFCN		T2	NR-ARFCN	T1	NR-ARFCN
5	**1712.5**	***342500***	**1717.5**	***343500***		1797.5	*359500*	1792.5	*358500*
10	**1715.0**	***343000***	**1725.0**	***345000***		1795.0	*359000*	1785.0	*357000*
15	**1717.5**	***343500***	**1732.5**	***346500***		1792.5	*358500*	1777.5	*355500*
20	**1720.0**	***344000***	**1740.0**	***348000***		1790.0	*358000*	1770.0	*354000*

LTE Multiple-Carriers (3C) for spurious emissions

Bandwidth, MHz	LTE Transmit / DL, MHz					
	C1	EARFCN	C2	EARFCN	C3	EARFCN
5	2112.5	*66461*	2155.0	*66886*	2197.5	*67311*
10	2115.0	*66486*	2155.0	*66886*	2195.0	*67286*
15	2117.5	*66511*	2155.0	*66886*	2192.5	*67261*
20	2120.0	*66536*	2155.0	*66886*	2190.0	*67236*

Bandwidth, MHz	LTE Receive / UL, MHz					
	C1	EARFCN	C2	EARFCN	C3	EARFCN
5	1712.5	*131997*	1745.0	*132322*	1777.5	*132647*
10	1715.0	*132022*	1745.0	*132322*	1775.0	*132622*
15	1717.5	*132047*	1745.0	*132322*	1772.5	*132597*
20	1720.0	*132072*	1745.0	*132322*	1770.0	*132572*

NR Multiple-Carriers (3C) for spurious emissions

Bandwidth, MHz	NR Transmit / DL, MHz					
	C1	EARFCN	C2	EARFCN	C3	EARFCN
5	2112.5	422500	2117.5	423500	2197.5	439500
10	2115.0	423000	2125.0	425000	2195.0	439000
15	2117.5	423500	2132.5	426500	2192.5	438500
20	2120.0	424000	2140.0	428000	2190.0	438000

Bandwidth, MHz	NR Receive / UL, MHz					
	C1	EARFCN	C2	EARFCN	C3	EARFCN
5	1712.5	342500	1717.5	343500	1797.5	359500
10	1715.0	343000	1725.0	345000	1795.0	359000
15	1717.5	343500	1732.5	346500	1792.5	358500
20	1720.0	344000	1740.0	348000	1790.0	358000

3.4 EUT setup diagram

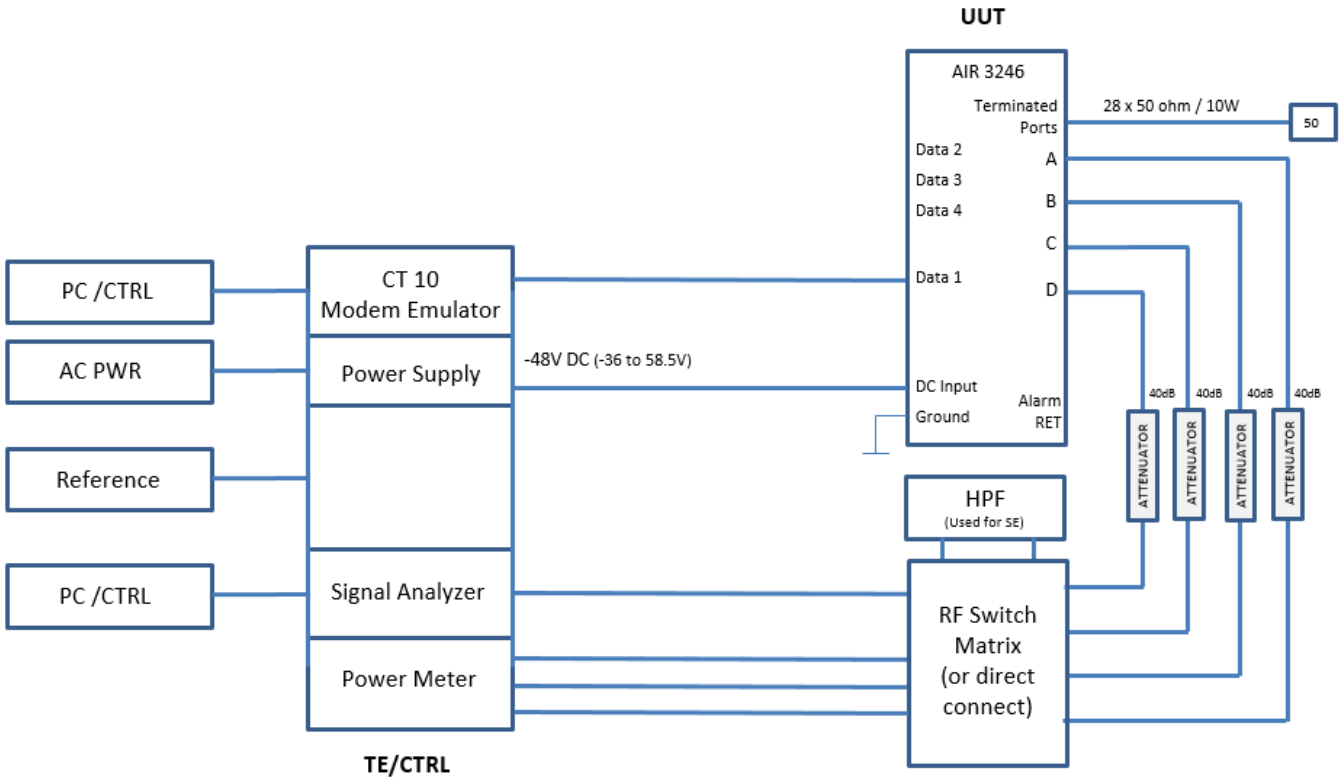


Figure 3.4-1: *Setup diagram – Radio Compliance*

3.5 Setup photographs

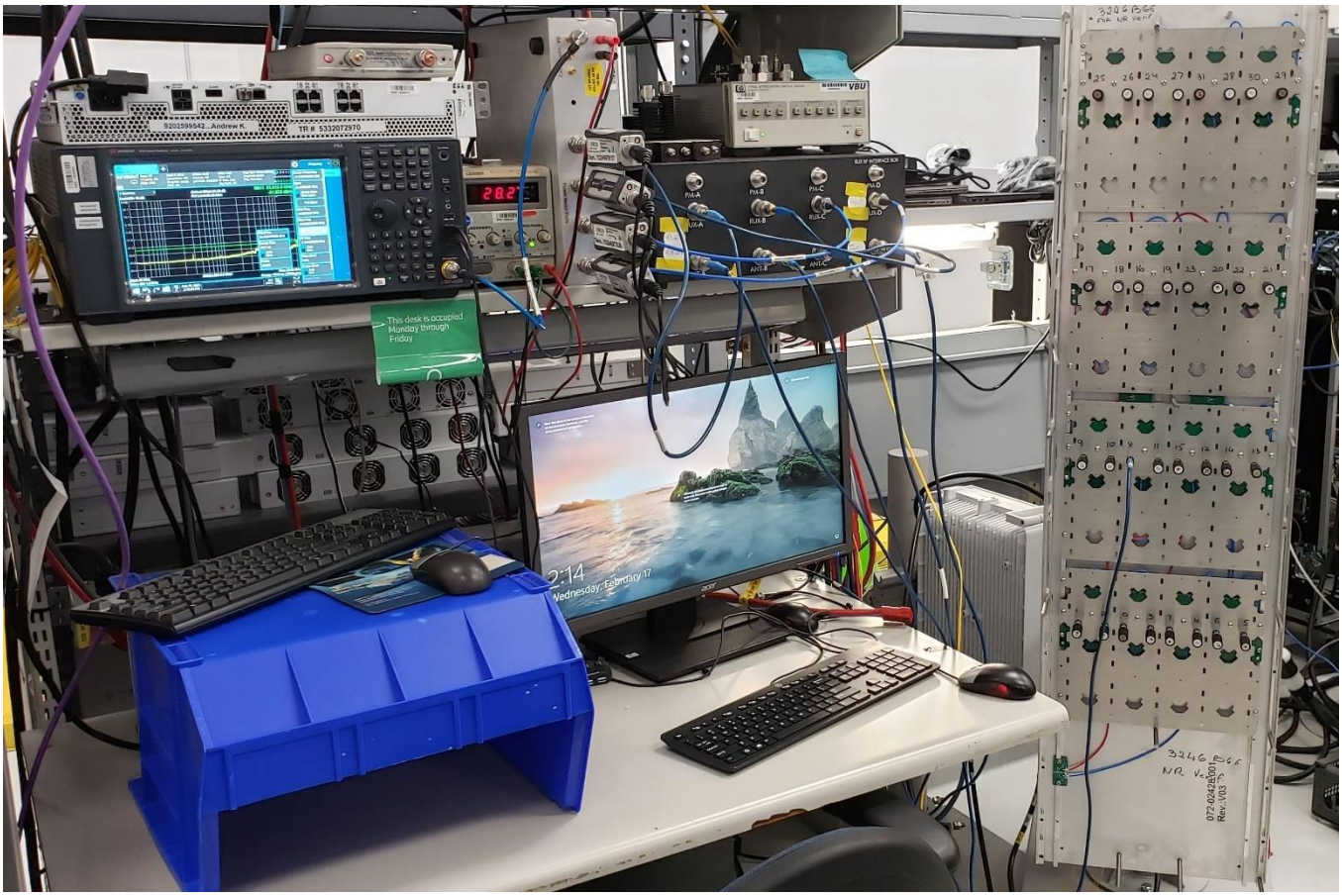


Figure 3.5-1: *Test / Measurement Equipment - Set up for Radio Compliance Testing*

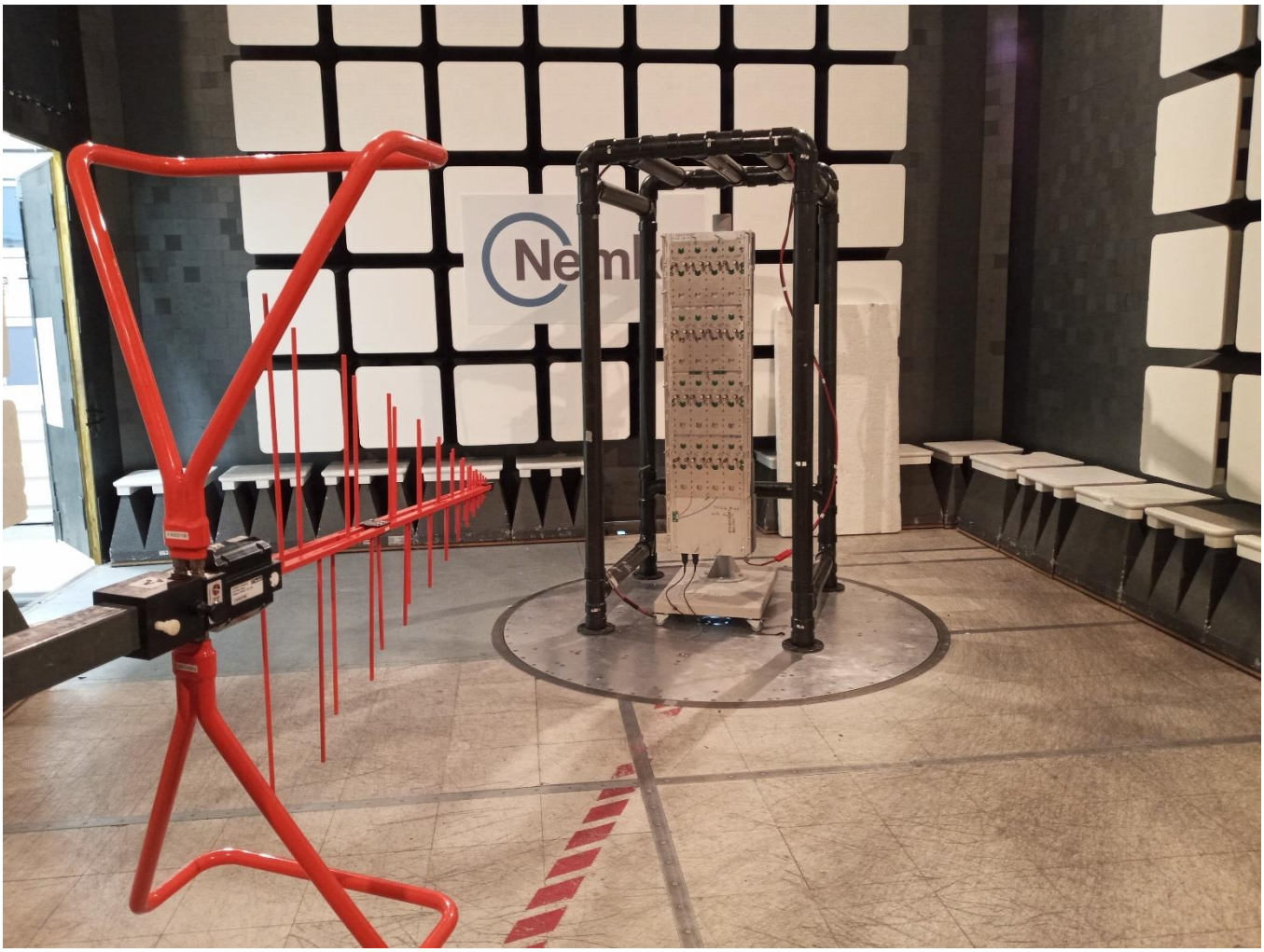


Figure 3.5-2: *EUT Set-up for Radiated Compliance Testing*

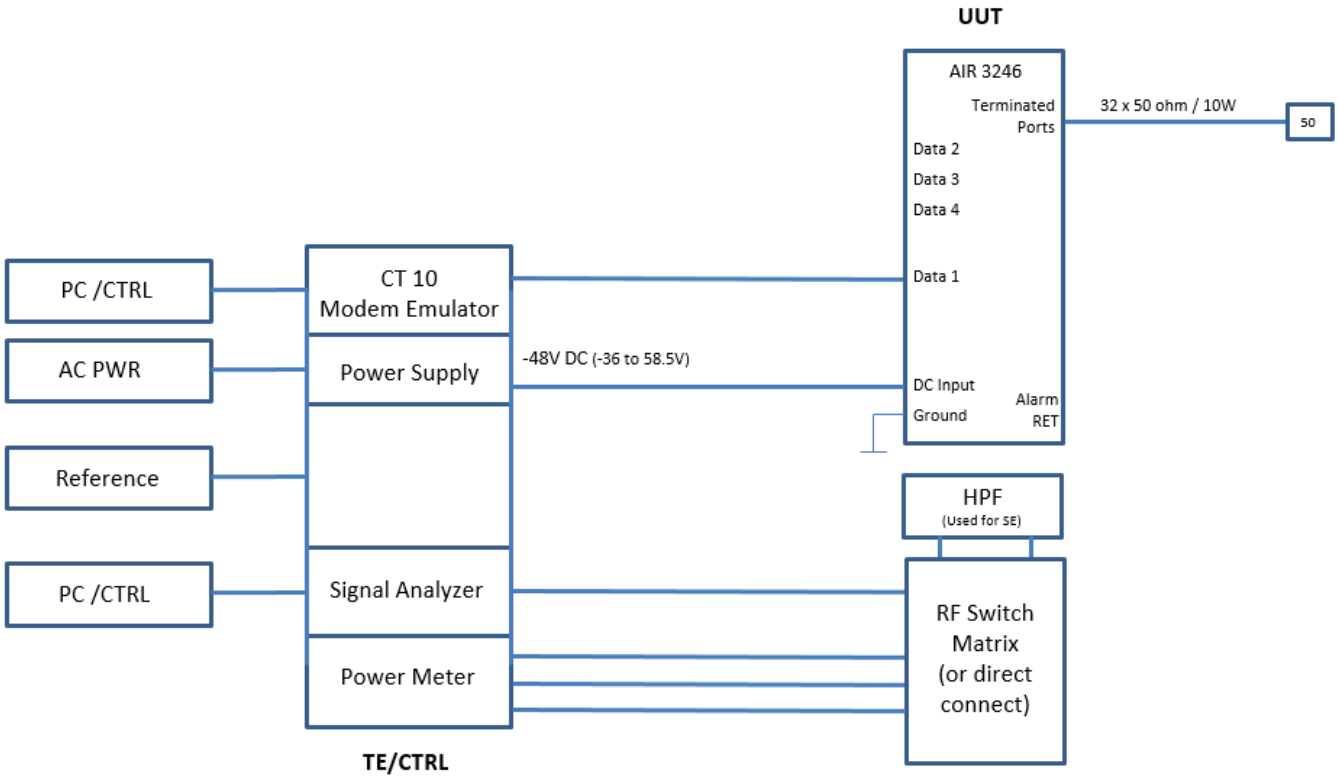


Figure 3.5-3: *EUT Set-up for Radiated Compliance Testing*

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

The testing was performed in accordance with the test plan, which suggested to measure output power on all 32 antenna ports, to find the port with the highest output power and perform the rest of the testing on that one representing antenna port. Reference power testing was performed with 5 MHz NR QPSK signal. Port number 8 showed the worst-case power measurement therefore it was selected as a representative one.

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
Radiated spurious emissions	3.78

Section 7. Test equipment

7.1 Test equipment list

Table 7.1-1: *Equipment list*

Equipment	Manufacturer	Model no.	Asset no.	Cal cycle	Next cal.
3 m EMI test chamber	TDK	SAC-3	FA002047	1 year	April 24, 2021
Flush mount turntable	Sunol	FM2022	FA002082	—	NCR
Controller	Sunol	SC104V	FA002060	—	NCR
Antenna mast	Sunol	TLT2	FA002061	—	NCR
DC Power source	Ametek	SGA80X125C-0AAA	FA002737	—	VOU
Receiver/spectrum analyzer	Rohde & Schwarz	ESU 26	FA002043	1 year	November 6, 2021
Biconical antenna (30–300 MHz)	Sunol	BC2	FA002078	1 year	April 30, 2021
Log periodic antenna (200–5000 MHz)	Sunol	LP5	FA002077	1 year	April 30, 2021
Horn antenna (18–40 GHz)	EMCO	3116	FA001847	1 year	May 7, 2021
Pre-amplifier (18–26 GHz)	Narda	BBS-1826N612	FA001550	—	VOU
Horn antenna (1–18 GHz)	EMCO	3115	FA000825	1 year	April 30, 2021
Preamp (1–18 GHz)	ETS Lindgren	124334	FA002873	1 year	October 13, 2021
50 Ω coax cable	C.C.A.	None	FA002556	1 year	April 9, 2021
High pass filter (3-18 GHz)	Thilithic Inc.	6HC3000/18000-1.3-KK	FA002231	—	VOU
Spectrum analyzer (Ericsson)	Keysight	PXA N9030B	MY57144347	1 year	04-April-2021
Testing Equipment*	Ericsson	CT11	T01G495060	—	NCR

Notes: NCR - no calibration required, VOU - verify on use.

* Testing equipment (CT11) is the test equipment that drives the radios traffic.

Section 8. Testing data

8.1 Maximum output power at RF antenna connector

8.1.1 Definitions and limits

FCC §27.50(d) Operation within the bands: 2110–2155 MHz and 2155–2180 MHz.

(1) The power of each fixed or base station transmitting in the 1995–2000 MHz, 2110–2155 MHz, 2155–2180 MHz or 2180–2200 MHz band and located in any county with population density of 100 or fewer persons per square mile, based upon the most recently available population statistics from the Bureau of the Census, is limited to:

(i) An equivalent isotropically radiated power (EIRP) of 3280 watts when transmitting with an emission bandwidth of 1 MHz or less;

(ii) An EIRP of 3280 watts/MHz when transmitting with an emission bandwidth greater than 1 MHz.

(2) The power of each fixed or base station transmitting in the 1995–2000 MHz, the 2110–2155 MHz 2155–2180 MHz band, or 2180–2200 MHz band and situated in any geographic location other than that described in paragraph (d)(1) of this section is limited to:

(i) An equivalent isotropically radiated power (EIRP) of 1640 watts when transmitting with an emission bandwidth of 1 MHz or less;

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

(3) A licensee operating a base or fixed station in the 2110–2155 MHz band utilizing a power greater than 1640 watts EIRP and greater than 1640 watts/MHz EIRP must coordinate such operations in advance with all Government and non-Government satellite entities in the 2025–2110 MHz band. A licensee operating a base or fixed station in the 2110–2180 MHz band utilizing power greater than 1640 watts EIRP and greater than 1640 watts/MHz EIRP must be coordinated in advance with the following licensees authorized to operate within 120 kilometers (75 miles) of the base or fixed station operating in this band: All Broadband Radio Service (BRS) licensees authorized under this part in the 2155–2160 MHz band and all advanced wireless services (AWS) licensees authorized to operate on adjacent frequency blocks in the 2110–2180 MHz band.

(5) Equipment employed must be authorized in accordance with the provisions of §24.51. 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 (d)(6) of this section. 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.

(6) Peak transmit power must be measured over any interval of continuous transmission using instrumentation calibrated in terms of an rms-equivalent voltage. The measurement results shall be properly adjusted for any instrument limitations, such as detector response times, limited resolution bandwidth capability when compared to the emission bandwidth, sensitivity, etc., so as to obtain a true peak measurement for the emission in question over the full bandwidth of the channel.

8.1.1 Definitions and limits, continued

RSS-139, Section 4.1

The transmitter power shall be measured in terms of a root-mean-square (RMS) average value.

RSS-139, Section 6.5

Consult SRSP-513 for e.i.r.p. limits on fixed and base stations operating in the band 2110–2180 MHz.

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

RSS-170, Section 5.3.1

Consult SRSP-519 for e.i.r.p. limits on ATC base stations operating in the bands 2000–2020 MHz and 2180–2200 MHz.

SRSP-513, Section 5.1

5.1.1 Fixed and base stations

5.1.1.1 For fixed and base stations operating within the frequency range 2110–2180 MHz with a channel bandwidth equal to or less than 1 MHz, the maximum permissible equivalent isotropically radiated power (e.i.r.p.) is 1640 watts with an antenna height above average terrain (HAAT) up to 300 metres.

5.1.1.2 For fixed and base stations operating within the frequency range 2110–2180 MHz with a channel bandwidth greater than 1 MHz, the maximum permissible e.i.r.p. is 1640 watts/MHz e.i.r.p. (i.e. no more than 1640 watts e.i.r.p. in any 1 MHz band segment) with an antenna height above average terrain (HAAT) up to 300 metres.

5.1.1.3 Fixed and base stations located in geographic areas at a distance greater than 26 km from large or medium population centres, and transmitting within the frequency range 2110–2180 MHz, may increase their e.i.r.p. up to a maximum of 3280 watts/MHz (i.e. no more than 3280 watts e.i.r.p. in any 1 MHz band segment), with an antenna HAAT up to 300 metres.

Within 26 km of any large or medium population centre, fixed and base stations may operate at increased e.i.r.p. if more than 50% of the population within a particular sector's coverage is located outside these large and medium population centres.

Fixed and base stations with increased e.i.r.p. must not be used to provide coverage to large and medium population centres. However, some incidental coverage of these large and medium population centres by stations with increased e.i.r.p. is permitted.

This provision also applies for fixed and base stations with a channel bandwidth equal to or less than 1 MHz (i.e. the e.i.r.p. may be increased up to a maximum of 3280 watts).

5.1.1.4 Fixed and base station antenna heights above average terrain may exceed 300 metres with a reduction in e.i.r.p. The maximum permissible e.i.r.p. for installations with antenna HAAT in excess of 300 metres is given in 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 (or 3280[1])
300 < HAAT ≤ 500	1070
500 < HAAT ≤ 1000	490
1000 < HAAT ≤ 1500	270
1500 < HAAT ≤ 2000	160

Note: [1]for fixed and base stations with a channel bandwidth equal to or less than 1 MHz

8.1.1 Definitions and limits, continued

SRSP-519, Section 5.1

The equivalent isotropically radiated power (e.i.r.p.) of base stations shall not exceed 1640 W when transmitting with an emission bandwidth of 1 MHz or less, and 1640 W/MHz when transmitting with an emission bandwidth greater than 1 MHz.

Base stations located outside of large or medium population may increase their e.i.r.p. to a maximum of 3280 W when transmitting with an emission bandwidth of 1 MHz or less, and to 3280 W/MHz when transmitting with an emission bandwidth greater than 1 MHz.

A licensee operating a base station utilizing an e.i.r.p greater than 1640 W/MHz must coordinate in advance with all AWS–4 licensees authorized to operate on adjacent frequency blocks within the same band.

Base station antenna heights above average terrain may exceed 300 m with a corresponding reduction in e.i.r.p. in accordance with Table above

8.1.2 Test summary

Test date	February 17, 2021
Test engineer	Andrey Adelberg

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.
- Antenna sub-array gain is 10.5 dBi with uncorrelated signals.

Spectrum analyzer settings for PSD:

Detector mode	RMS
Resolution bandwidth	1 MHz (integrated)
Video bandwidth	>RBW
Measurement mode	Power over emission bandwidth
Trace mode	Averaging
Measurement time	Auto

8.1.4 Test data

Table 8.1-2: *Output power density measurement results of a single-carrier operation for 5 MHz channel*

Remarks	Frequency, MHz	Total RF power, dBm	RF power density, dBm/MHz	Antenna gain, dBi	EIRP, dBm/MHz	EIRP limit, dBm/MHz	Margin, dB
QPSK, 5 MHz, Low channel	2112.5	37.10	31.87	10.50	42.37	62.15	19.78
16QAM, 5 MHz, Low channel	2112.5	37.20	32.06	10.50	42.56	62.15	19.59
64QAM, 5 MHz, Low channel	2112.5	37.10	31.84	10.50	42.34	62.15	19.81
256QAM, 5 MHz, Low channel	2112.5	37.13	31.79	10.50	42.29	62.15	19.86
QPSK, 5 MHz, Mid channel	2155.0	36.90	31.94	10.50	42.44	62.15	19.71
QPSK, 5 MHz, High channel	2197.5	36.85	**32.27**	10.50	42.77	62.15	19.38

Table 8.1-3: *Total EIRP calculation for a single-carrier operation and a single Macro Narrow traffic beam operation for 5 MHz channel*

Maximum PSD, dBm/MHz	Maximum PSD sum[1], dBm/MHz	Antenna Gain, dBi	Antenna Array Column Gain[2], dB	EIRP per polarization[3], dBm/MHz	EIRP per polarization, W/MHz
32.27	44.31	10.50	6.02	60.83	1210.933

Maximum PSD sum, dBm/MHz	Directional beam gain, dBi	Total EIRP, dBm/MHz	Total EIRP, W/MHz
44.31	22.00	66.31	4276.810

Notes: [1]Linear sum of 16 ports of each polarization was based on the worst-case scenario, when all ports transmit at the maximum found power density:
Maximum PSD sum = Maximum RF power density + 10 × Log_{10}(16)
[2]Antenna Array Column Gain = 10 × Log_{10}(4)
[3]EIRP = PSD Sum + Antenna Gain + Antenna Array Column Gain
EIRP Limits for the specific RBS (Radio Base Station) are deployment dependent. To ensure compliance with legal limits detailed in section 8.1.1, RBS set up and carrier configurations are addressed during site commissioning.

Table 8.1-4: *Output power density measurement results of a single-carrier operation for 10 MHz channel*

Remarks	Frequency, MHz	Total RF power, dBm	RF power density, dBm/MHz	Antenna gain, dBi	EIRP, dBm/MHz	EIRP limit, dBm/MHz	Margin, dB
QPSK, 10 MHz, Low channel	2115.0	37.20	28.53	10.50	39.03	62.15	23.12
16QAM, 10 MHz, Low channel	2115.0	37.21	**29.28**	10.50	39.78	62.15	22.37
64QAM, 10 MHz, Low channel	2115.0	37.15	28.50	10.50	39.00	62.15	23.15
256QAM, 10 MHz, Low channel	2115.0	37.16	28.72	10.50	39.22	62.15	22.93
QPSK, 10 MHz, Mid channel	2155.0	36.95	28.95	10.50	39.45	62.15	22.70
QPSK, 10 MHz, High channel	2195.0	36.94	28.97	10.50	39.47	62.15	22.68

Table 8.1-5: *Total EIRP calculation for a single-carrier operation and a single Macro Narrow traffic beam operation for 10 MHz channel*

Maximum PSD, dBm/MHz	Maximum PSD sum[1], dBm/MHz	Antenna Gain, dBi	Antenna Array Column Gain[2], dB	EIRP per polarization[3], dBm/MHz	EIRP per polarization, W/MHz
29.28	41.32	10.50	6.02	57.84	608.303

Maximum PSD sum, dBm/MHz	Directional beam gain, dBi	Total EIRP, dBm/MHz	Total EIRP, W/MHz
41.32	22.00	63.32	2148.424

Notes: [1]Linear sum of 16 ports of each polarization was based on the worst-case scenario, when all ports transmit at the maximum found power density:
Maximum PSD sum = Maximum RF power density + 10 × Log_{10}(16)
[2]Antenna Array Column Gain = 10 × Log_{10}(4)
[3]EIRP = PSD Sum + Antenna Gain + Antenna Array Column Gain
EIRP Limits for the specific RBS (Radio Base Station) are deployment dependent. To ensure compliance with legal limits detailed in section 8.1.1, RBS set up and carrier configurations are addressed during site commissioning.

Test data, continued

Table 8.1-6: *Output power density measurement results of a single-carrier operation for 15 MHz channel*

Remarks	Frequency, MHz	Total RF power, dBm	RF power density, dBm/MHz	Antenna gain, dBi	EIRP, dBm/MHz	EIRP limit, dBm/MHz	Margin, dB
QPSK, 15 MHz, Low channel	2117.5	37.19	26.76	10.50	37.26	62.15	24.89
16QAM, 15 MHz, Low channel	2117.5	37.20	**28.10**	10.50	38.60	62.15	23.55
64QAM, 15 MHz, Low channel	2117.5	37.14	26.81	10.50	37.31	62.15	24.84
256QAM, 15 MHz, Low channel	2117.5	37.16	26.82	10.50	37.32	62.15	24.83
16QAM, 15 MHz, Mid channel	2155.0	36.95	27.78	10.50	38.28	62.15	23.87
16QAM, 15 MHz, High channel	2192.5	36.93	27.70	10.50	38.20	62.15	23.95

Table 8.1-7: *Total EIRP calculation for a single-carrier operation and a single Macro Narrow traffic beam operation for 15 MHz channel*

Maximum PSD, dBm/MHz	Maximum PSD sum[1], dBm/MHz	Antenna Gain, dBi	Antenna Array Column Gain[2], dB	EIRP per polarization[3], dBm/MHz	EIRP per polarization, W/MHz
28.10	40.14	10.50	6.02	56.66	463.575

Maximum PSD sum, dBm/MHz	Directional beam gain, dBi	Total EIRP, dBm/MHz	Total EIRP, W/MHz
40.14	22.00	62.14	1637.269

Notes: [1]Linear sum of 16 ports of each polarization was based on the worst-case scenario, when all ports transmit at the maximum found power density:
Maximum PSD sum = Maximum RF power density + 10 × $Log_{10}(16)$
[2]Antenna Array Column Gain = 10 × $Log_{10}(4)$
[3]EIRP = PSD Sum + Antenna Gain + Antenna Array Column Gain
EIRP Limits for the specific RBS (Radio Base Station) are deployment dependent. To ensure compliance with legal limits detailed in section 8.1.1, RBS set up and carrier configurations are addressed during site commissioning.

Table 8.1-8: *Output power density measurement results of a single-carrier operation for 20 MHz channel*

Remarks	Frequency, MHz	Total RF power, dBm	RF power density, dBm/MHz	Antenna gain, dBi	EIRP, dBm/MHz	EIRP limit, dBm/MHz	Margin, dB
QPSK, 20 MHz, Low channel	2120.0	37.25	25.63	10.50	36.13	62.15	26.02
16QAM, 20 MHz, Low channel	2120.0	37.23	**27.06**	10.50	37.56	62.15	24.59
64QAM, 20 MHz, Low channel	2120.0	37.24	25.73	10.50	36.23	62.15	25.92
256QAM, 20 MHz, Low channel	2120.0	37.26	25.62	10.50	36.12	62.15	26.03
QPSK, 20 MHz, Mid channel	2155.0	37.01	27.04	10.50	37.54	62.15	24.61
QPSK, 20 MHz, High channel	2190.0	36.98	27.00	10.50	37.50	62.15	24.65

Table 8.1-9: *Total EIRP calculation for a single-carrier operation and a single Macro Narrow traffic beam operation for 20 MHz channel*

Maximum PSD, dBm/MHz	Maximum PSD sum[1], dBm/MHz	Antenna Gain, dBi	Antenna Array Column Gain[2], dB	EIRP per polarization[3], dBm/MHz	EIRP per polarization, W/MHz
27.06	39.10	10.50	6.02	55.62	364.855

Maximum PSD sum, dBm/MHz	Directional beam gain, dBi	Total EIRP, dBm/MHz	Total EIRP, W/MHz
39.10	22.00	61.10	1288.606

Notes: [1]Linear sum of 16 ports of each polarization was based on the worst-case scenario, when all ports transmit at the maximum found power density:
Maximum PSD sum = Maximum RF power density + 10 × $Log_{10}(16)$
[2]Antenna Array Column Gain = 10 × $Log_{10}(4)$
[3]EIRP = PSD Sum + Antenna Gain + Antenna Array Column Gain
EIRP Limits for the specific RBS (Radio Base Station) are deployment dependent. To ensure compliance with legal limits detailed in section 8.1.1, RBS set up and carrier configurations are addressed during site commissioning.

Test data, continued

Table 8.1-10: *Output power density measurement results of a two-carrier operation for 5 MHz channel*

Frequency, MHz	Total RF power, dBm	RF power density, dBm/MHz	Antenna gain, dBi	EIRP, dBm/MHz	EIRP limit, dBm/MHz	Margin, dB
2112.5 + 2117.5	37.21	**29.06**	10.50	39.56	62.15	22.59
2152.5 + 2157.5	36.90	28.84	10.50	39.34	62.15	22.81
2192.5 + 2197.5	36.95	28.92	10.50	39.42	62.15	22.73

Table 8.1-11: *Total EIRP calculation for a two-carrier operation for 5 MHz channel*

Maximum PSD, dBm/MHz	Maximum PSD sum[1], dBm/MHz	Antenna Gain, dBi	Antenna Array Column Gain[2], dB	EIRP per polarization[3], dBm/MHz	EIRP per polarization, W/MHz
29.06	41.10	10.50	6.02	57.62	578.256

Notes: [1]Linear sum of 16 ports of each polarization was based on the worst-case scenario, when all ports transmit at the maximum found power density:
Maximum PSD sum = Maximum RF power density + $10 \times \text{Log}_{10}(16)$
[2]Antenna Array Column Gain = $10 \times \text{Log}_{10}(4)$
[3]EIRP = PSD Sum + Antenna Gain + Antenna Array Column Gain
EIRP Limits for the specific RBS (Radio Base Station) are deployment dependent. To ensure compliance with legal limits detailed in section 8.1.1, RBS set up and carrier configurations are addressed during site commissioning.

Table 8.1-12: *Output power density measurement results of a two-carrier operation for 10 MHz channel*

Frequency, MHz	Total RF power, dBm	RF power density, dBm/MHz	Antenna gain, dBi	EIRP, dBm/MHz	EIRP limit, dBm/MHz	Margin, dB
2115 + 2125	37.18	**26.18**	10.50	36.68	62.15	25.47
2150 + 2160	36.90	25.80	10.50	36.30	62.15	25.85
2185 + 2195	36.90	25.80	10.50	36.30	62.15	25.85

Table 8.1-13: *Total EIRP calculation for a two-carrier operation for 10 MHz channel*

Maximum PSD, dBm/MHz	Maximum PSD sum[1], dBm/MHz	Antenna Gain, dBi	Antenna Array Column Gain[2], dB	EIRP per polarization[3], dBm/MHz	EIRP per polarization, W/MHz
26.18	38.22	10.50	6.02	54.74	297.934

Notes: [1]Linear sum of 16 ports of each polarization was based on the worst-case scenario, when all ports transmit at the maximum found power density:
Maximum PSD sum = Maximum RF power density + $10 \times \text{Log}_{10}(16)$
[2]Antenna Array Column Gain = $10 \times \text{Log}_{10}(4)$
[3]EIRP = PSD Sum + Antenna Gain + Antenna Array Column Gain
EIRP Limits for the specific RBS (Radio Base Station) are deployment dependent. To ensure compliance with legal limits detailed in section 8.1.1, RBS set up and carrier configurations are addressed during site commissioning.

Test data, continued

Table 8.1-14: *Output power density measurement results of a two-carrier operation for 15 MHz channel*

Frequency, MHz	Total RF power, dBm	RF power density, dBm/MHz	Antenna gain, dBi	EIRP, dBm/MHz	EIRP limit, dBm/MHz	Margin, dB
2117.5 + 2132.5	37.13	**25.00**	10.50	35.50	62.15	26.65
2147.5 + 2162.5	36.90	24.78	10.50	35.28	62.15	26.87
2177.5 + 2192.5	36.91	24.88	10.50	35.38	62.15	26.77

Table 8.1-15: *Total EIRP calculation for a two-carrier operation for 15 MHz channel*

Maximum PSD, dBm/MHz	Maximum PSD sum[1], dBm/MHz	Antenna Gain, dBi	Antenna Array Column Gain[2], dB	EIRP per polarization[3], dBm/MHz	EIRP per polarization, W/MHz
25.00	37.04	10.50	6.02	53.56	227.049

Notes: [1]Linear sum of 16 ports of each polarization was based on the worst-case scenario, when all ports transmit at the maximum found power density:
Maximum PSD sum = Maximum RF power density + 10 × Log_{10}(16)
[2]Antenna Array Column Gain = 10 × Log_{10}(4)
[3]EIRP = PSD Sum + Antenna Gain + Antenna Array Column Gain
EIRP Limits for the specific RBS (Radio Base Station) are deployment dependent. To ensure compliance with legal limits detailed in section 8.1.1, RBS set up and carrier configurations are addressed during site commissioning.

Table 8.1-16: *Output power density measurement results of a two-carrier operation for 20 MHz channel*

Frequency, MHz	Total RF power, dBm	RF power density, dBm/MHz	Antenna gain, dBi	EIRP, dBm/MHz	EIRP limit, dBm/MHz	Margin, dB
2120 + 2140	37.11	**24.04**	10.50	34.54	62.15	27.61
2145 + 2165	36.88	23.63	10.50	34.13	62.15	28.02
2170 + 2190	36.96	23.68	10.50	34.18	62.15	27.97

Table 8.1-17: *Total EIRP calculation for a two-carrier operation for 20 MHz channel*

Maximum PSD, dBm/MHz	Maximum PSD sum[1], dBm/MHz	Antenna Gain, dBi	Antenna Array Column Gain[2], dB	EIRP per polarization[3], dBm/MHz	EIRP per polarization, W/MHz
24.04	36.08	10.50	6.02	52.60	182.020

Notes: [1]Linear sum of 16 ports of each polarization was based on the worst-case scenario, when all ports transmit at the maximum found power density:
Maximum PSD sum = Maximum RF power density + 10 × Log_{10}(16)
[2]Antenna Array Column Gain = 10 × Log_{10}(4)
[3]EIRP = PSD Sum + Antenna Gain + Antenna Array Column Gain
EIRP Limits for the specific RBS (Radio Base Station) are deployment dependent. To ensure compliance with legal limits detailed in section 8.1.1, RBS set up and carrier configurations are addressed during site commissioning.

Test data, continued

Table 8.1-18: *Output power density measurement results of a three-carrier operation for 5 MHz channel*

Frequency, MHz	Total RF power, dBm	RF power density, dBm/MHz	Antenna gain, dBi	EIRP, dBm/MHz	EIRP limit, dBm/MHz	Margin, dB
2112.5 + 2117.5 + 2122.5	36.92	**27.12**	10.50	37.62	62.15	24.53
2150.0 + 2155.0 + 2160.0	36.70	27.10	10.50	37.60	62.15	24.55
2187.5 + 2192.5 + 2197.5	36.66	26.77	10.50	37.27	62.15	24.88

Table 8.1-19: *Total EIRP calculation for a three-carrier operation for 5 MHz channel*

Maximum PSD, dBm/MHz	Maximum PSD sum[1], dBm/MHz	Antenna Gain, dBi	Antenna Array Column Gain[2], dB	EIRP per polarization[3], dBm/MHz	EIRP per polarization, W/MHz
27.12	39.16	10.50	6.02	55.68	369.930

Notes: [1]Linear sum of 16 ports of each polarization was based on the worst-case scenario, when all ports transmit at the maximum found power density:
Maximum PSD sum = Maximum RF power density + 10 × Log_{10}(16)
[2]Antenna Array Column Gain = 10 × Log_{10}(4)
[3]EIRP = PSD Sum + Antenna Gain + Antenna Array Column Gain
EIRP Limits for the specific RBS (Radio Base Station) are deployment dependent. To ensure compliance with legal limits detailed in section 8.1.1, RBS set up and carrier configurations are addressed during site commissioning.

Table 8.1-20: *Output power density measurement results of a three-carrier operation for 10 MHz channel*

Frequency, MHz	Total RF power, dBm	RF power density, dBm/MHz	Antenna gain, dBi	EIRP, dBm/MHz	EIRP limit, dBm/MHz	Margin, dB
2115 + 2125 + 2135	37.12	**24.24**	10.50	34.74	62.15	27.41
2145 + 2155 + 2165	36.92	24.22	10.50	34.72	62.15	27.43
2175 + 2185 + 2195	36.95	24.08	10.50	34.58	62.15	27.57

Table 8.1-21: *Total EIRP calculation for a three-carrier operation for 10 MHz channel*

Maximum PSD, dBm/MHz	Maximum PSD sum[1], dBm/MHz	Antenna Gain, dBi	Antenna Array Column Gain[2], dB	EIRP per polarization[3], dBm/MHz	EIRP per polarization, W/MHz
24.24	36.28	10.50	6.02	52.80	190.599

Notes: [1]Linear sum of 16 ports of each polarization was based on the worst-case scenario, when all ports transmit at the maximum found power density:
Maximum PSD sum = Maximum RF power density + 10 × Log_{10}(16)
[2]Antenna Array Column Gain = 10 × Log_{10}(4)
[3]EIRP = PSD Sum + Antenna Gain + Antenna Array Column Gain
EIRP Limits for the specific RBS (Radio Base Station) are deployment dependent. To ensure compliance with legal limits detailed in section 8.1.1, RBS set up and carrier configurations are addressed during site commissioning.

Test data, continued

Table 8.1-22: *Output power density measurement results of a three-carrier operation for 15 MHz channel*

Frequency, MHz	Total RF power, dBm	RF power density, dBm/MHz	Antenna gain, dBi	EIRP, dBm/MHz	EIRP limit, dBm/MHz	Margin, dB
2117.5 + 2132.5 + 2147.5	37.02	**23.30**	10.50	33.80	62.15	28.35
2140.0 + 2155.0 + 2170.0	36.82	22.79	10.50	33.29	62.15	28.86
2162.5 + 2177.5 + 2192.5	36.86	23.12	10.50	33.62	62.15	28.53

Table 8.1-23: *Total EIRP calculation for a three-carrier operation for 15 MHz channel*

Maximum PSD, dBm/MHz	Maximum PSD sum[1], dBm/MHz	Antenna Gain, dBi	Antenna Array Column Gain[2], dB	EIRP per polarization[3], dBm/MHz	EIRP per polarization, W/MHz
23.30	35.34	10.50	6.02	51.86	153.504

Notes: [1]Linear sum of 16 ports of each polarization was based on the worst-case scenario, when all ports transmit at the maximum found power density:
Maximum PSD sum = Maximum RF power density + $10 \times \text{Log}_{10}(16)$
[2]Antenna Array Column Gain = $10 \times \text{Log}_{10}(4)$
[3]EIRP = PSD Sum + Antenna Gain + Antenna Array Column Gain
EIRP Limits for the specific RBS (Radio Base Station) are deployment dependent. To ensure compliance with legal limits detailed in section 8.1.1, RBS set up and carrier configurations are addressed during site commissioning.

Table 8.1-24: *Output power density measurement results of a three-carrier operation for 20 MHz channel*

Frequency, MHz	Total RF power, dBm	RF power density, dBm/MHz	Antenna gain, dBi	EIRP, dBm/MHz	EIRP limit, dBm/MHz	Margin, dB
2120 + 2140 + 2160	36.91	**21.99**	10.50	32.49	62.15	29.66
2135 + 2155 + 2175	36.76	21.64	10.50	32.14	62.15	30.01
2150 + 2170 + 2190	36.85	21.70	10.50	32.20	62.15	29.95

Table 8.1-25: *Total EIRP calculation for a three-carrier operation for 20 MHz channel*

Maximum PSD, dBm/MHz	Maximum PSD sum[1], dBm/MHz	Antenna Gain, dBi	Antenna Array Column Gain[2], dB	EIRP per polarization[3], dBm/MHz	EIRP per polarization, W/MHz
21.99	34.03	10.50	6.02	50.55	113.532

Notes: [1]Linear sum of 16 ports of each polarization was based on the worst-case scenario, when all ports transmit at the maximum found power density:
Maximum PSD sum = Maximum RF power density + $10 \times \text{Log}_{10}(16)$
[2]Antenna Array Column Gain = $10 \times \text{Log}_{10}(4)$
[3]EIRP = PSD Sum + Antenna Gain + Antenna Array Column Gain
EIRP Limits for the specific RBS (Radio Base Station) are deployment dependent. To ensure compliance with legal limits detailed in section 8.1.1, RBS set up and carrier configurations are addressed during site commissioning.

Test data, continued

Table 8.1-26: *Output power density measurement results of LTE + NR* operation for 5 MHz channel*

Frequency, MHz	Total RF power, dBm	RF power density, dBm/MHz	Antenna gain, dBi	EIRP, dBm/MHz	EIRP limit, dBm/MHz	Margin, dB
2112.5 + 2117.5	37.25	**29.00**	10.50	39.50	62.15	22.65
2152.5 + 2157.5	37.00	28.70	10.50	39.20	62.15	22.95
2192.5 + 2197.5	36.96	28.65	10.50	39.15	62.15	23.00

Note: *NR 5 MHz + LTE 5 MHz

Table 8.1-27: *Total EIRP calculation for LTE + NR operation for 5 MHz channel*

Maximum PSD, dBm/MHz	Maximum PSD sum[1], dBm/MHz	Antenna Gain, dBi	Antenna Array Column Gain[2], dB	EIRP per polarization[3], dBm/MHz	EIRP per polarization, W/MHz
29.00	41.04	10.50	6.02	57.56	570.322

Notes: [1]Linear sum of 16 ports of each polarization was based on the worst-case scenario, when all ports transmit at the maximum found power density:
Maximum PSD sum = Maximum RF power density + $10 \times \text{Log}_{10}(16)$
[2]Antenna Array Column Gain = $10 \times \text{Log}_{10}(4)$
[3]EIRP = PSD Sum + Antenna Gain + Antenna Array Column Gain
EIRP Limits for the specific RBS (Radio Base Station) are deployment dependent. To ensure compliance with legal limits detailed in section 8.1.1, RBS set up and carrier configurations are addressed during site commissioning.

Table 8.1-28: *Output power density measurement results of LTE + NR* operation for 10 MHz channel*

Frequency, MHz	Total RF power, dBm	RF power density, dBm/MHz	Antenna gain, dBi	EIRP, dBm/MHz	EIRP limit, dBm/MHz	Margin, dB
2115 + 2125	37.17	27.15	10.50	37.65	62.15	24.50
2150 + 2160	36.95	**27.24**	10.50	37.74	62.15	24.41
2185 + 2195	36.95	26.54	10.50	37.04	62.15	25.11

Note: *NR 10 MHz + LTE 10 MHz with IoT

Table 8.1-29: *Total EIRP calculation for LTE + NR operation for 10 MHz channel*

Maximum PSD, dBm/MHz	Maximum PSD sum[1], dBm/MHz	Antenna Gain, dBi	Antenna Array Column Gain[2], dB	EIRP per polarization[3], dBm/MHz	EIRP per polarization, W/MHz
27.24	39.28	10.50	6.02	55.80	380.294

Notes: [1]Linear sum of 16 ports of each polarization was based on the worst-case scenario, when all ports transmit at the maximum found power density:
Maximum PSD sum = Maximum RF power density + $10 \times \text{Log}_{10}(16)$
[2]Antenna Array Column Gain = $10 \times \text{Log}_{10}(4)$
[3]EIRP = PSD Sum + Antenna Gain + Antenna Array Column Gain
EIRP Limits for the specific RBS (Radio Base Station) are deployment dependent. To ensure compliance with legal limits detailed in section 8.1.1, RBS set up and carrier configurations are addressed during site commissioning.

Test data, continued

Table 8.1-30: *Output power density measurement results of LTE + NR* operation for 15 MHz channel*

Frequency, MHz	Total RF power, dBm	RF power density, dBm/MHz	Antenna gain, dBi	EIRP, dBm/MHz	EIRP limit, dBm/MHz	Margin, dB
2117.5 + 2132.5	37.17	24.97	10.50	35.47	62.15	26.68
2147.5 + 2162.5	36.96	**25.00**	10.50	35.50	62.15	26.65
2177.5 + 2192.5	37.01	24.72	10.50	35.22	62.15	26.93

Note: *NR 15 MHz + LTE 15 MHz with IoT

Table 8.1-31: *Total EIRP calculation for LTE + NR operation for 15 MHz channel*

Maximum PSD, dBm/MHz	Maximum PSD sum[1], dBm/MHz	Antenna Gain, dBi	Antenna Array Column Gain[2], dB	EIRP per polarization[3], dBm/MHz	EIRP per polarization, W/MHz
25.00	37.04	10.50	6.02	53.56	227.049

Notes: [1]Linear sum of 16 ports of each polarization was based on the worst-case scenario, when all ports transmit at the maximum found power density:
Maximum PSD sum = Maximum RF power density + 10 × $Log_{10}(16)$
[2]Antenna Array Column Gain = 10 × $Log_{10}(4)$
[3]EIRP = PSD Sum + Antenna Gain + Antenna Array Column Gain
EIRP Limits for the specific RBS (Radio Base Station) are deployment dependent. To ensure compliance with legal limits detailed in section 8.1.1, RBS set up and carrier configurations are addressed during site commissioning.

Table 8.1-32: *Output power density measurement results of LTE + NR* operation for 20 MHz channel*

Frequency, MHz	Total RF power, dBm	RF power density, dBm/MHz	Antenna gain, dBi	EIRP, dBm/MHz	EIRP limit, dBm/MHz	Margin, dB
2120 + 2140	36.98	23.61	10.50	34.11	62.15	28.04
2145 + 2165	36.90	**23.81**	10.50	34.31	62.15	27.84
2170 + 2190	36.94	23.56	10.50	34.06	62.15	28.09

Note: *NR 20 MHz + LTE 20 MHz with IoT

Table 8.1-33: *Total EIRP calculation for LTE + NR operation for 20 MHz channel*

Maximum PSD, dBm/MHz	Maximum PSD sum[1], dBm/MHz	Antenna Gain, dBi	Antenna Array Column Gain[2], dB	EIRP per polarization[3], dBm/MHz	EIRP per polarization, W/MHz
23.81	35.85	10.50	6.02	52.37	172.631

Notes: [1]Linear sum of 16 ports of each polarization was based on the worst-case scenario, when all ports transmit at the maximum found power density:
Maximum PSD sum = Maximum RF power density + 10 × $Log_{10}(16)$
[2]Antenna Array Column Gain = 10 × $Log_{10}(4)$
[3]EIRP = PSD Sum + Antenna Gain + Antenna Array Column Gain
EIRP Limits for the specific RBS (Radio Base Station) are deployment dependent. To ensure compliance with legal limits detailed in section 8.1.1, RBS set up and carrier configurations are addressed during site commissioning.

Test data, continued

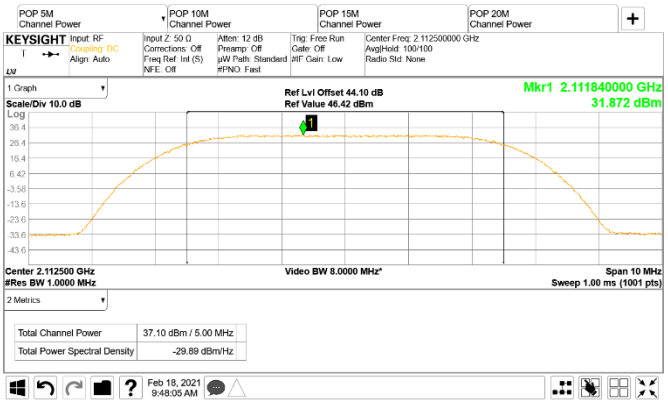


Figure 8.1-1: *PSD of 5 MHz channel bandwidth, single carrier operation, sample plot*

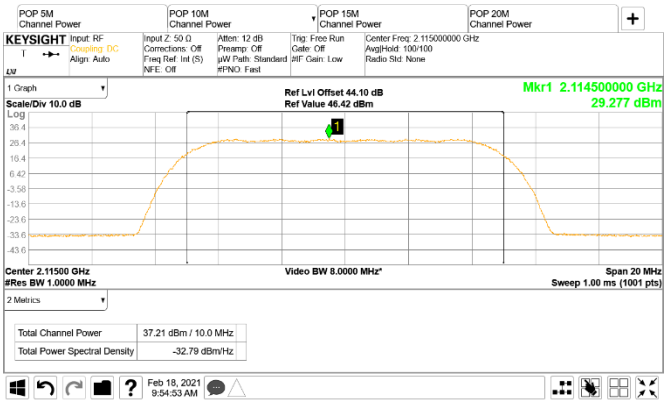


Figure 8.1-2: *PSD of 10 MHz channel bandwidth, single carrier operation, sample plot*

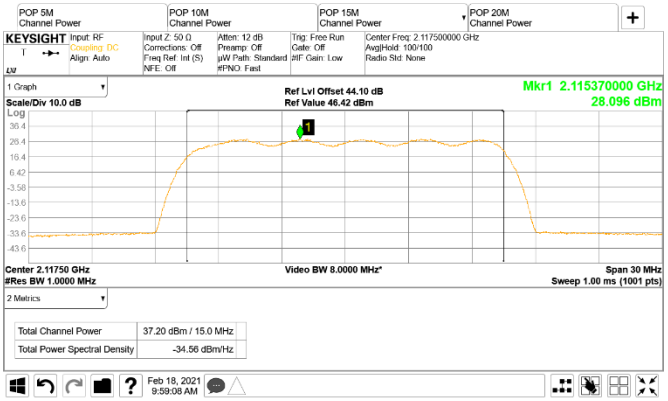


Figure 8.1-3: *PSD of 15 MHz channel bandwidth, single carrier operation, sample plot*

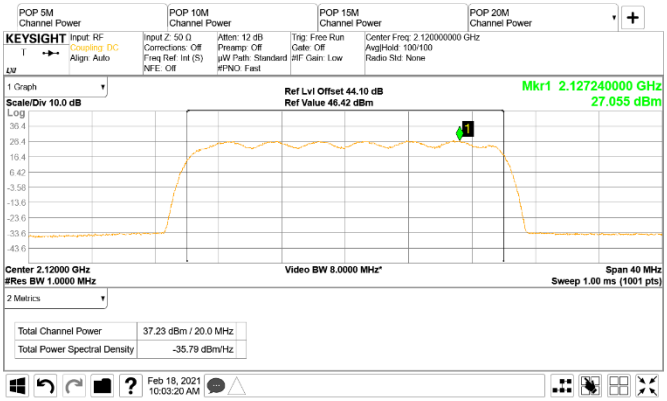


Figure 8.1-4: *PSD of 20 MHz channel bandwidth, single carrier operation, sample plot*

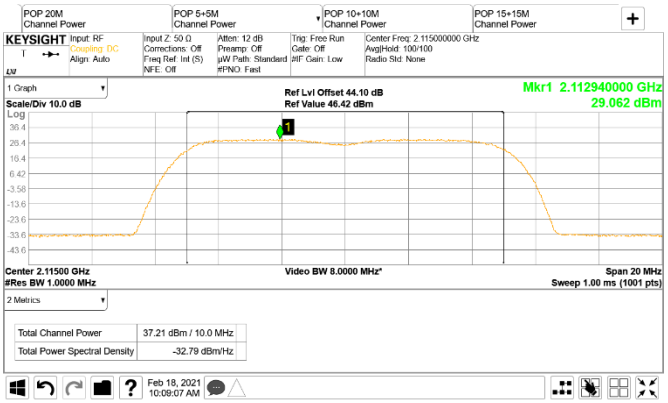


Figure 8.1-5: *PSD of 5 MHz channel bandwidth, two-carrier operation, sample plot*

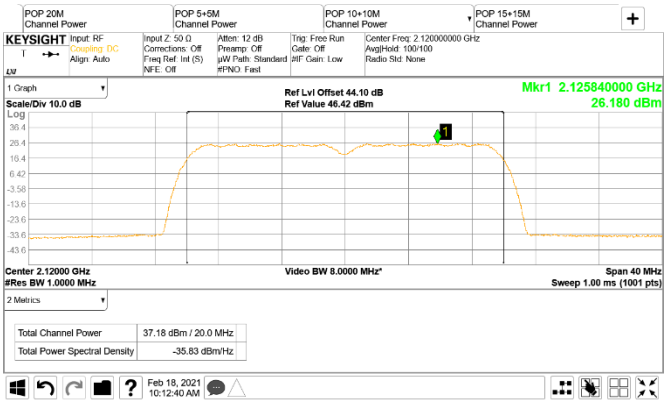


Figure 8.1-6: *PSD of 10 MHz channel bandwidth, two-carrier operation, sample plot*

Test data, continued

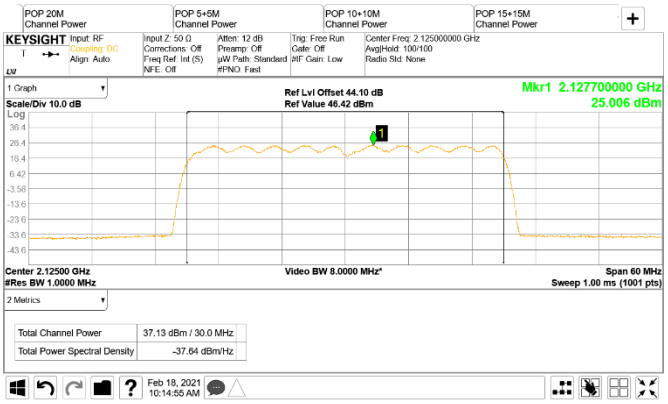


Figure 8.1-7: *PSD of 15 MHz channel bandwidth, two-carrier operation, sample plot*

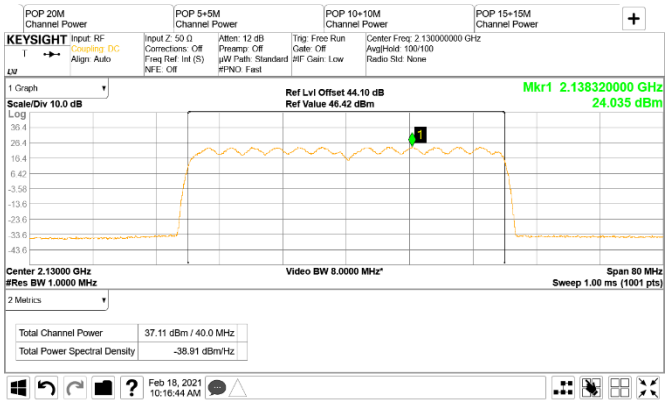


Figure 8.1-8: *PSD of 20 MHz channel bandwidth, two-carrier operation, sample plot*

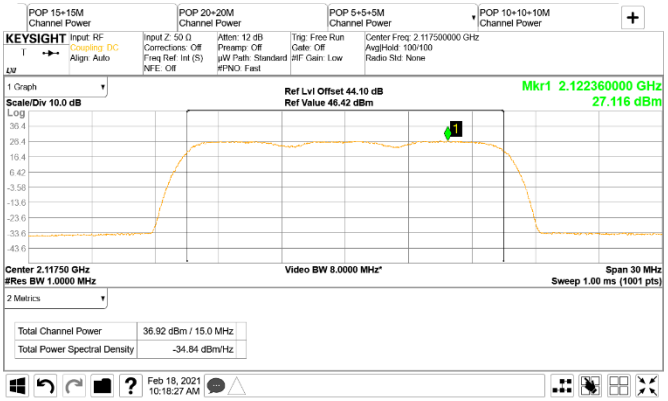


Figure 8.1-9: *PSD of 5 MHz channel bandwidth, three-carrier operation, sample plot*

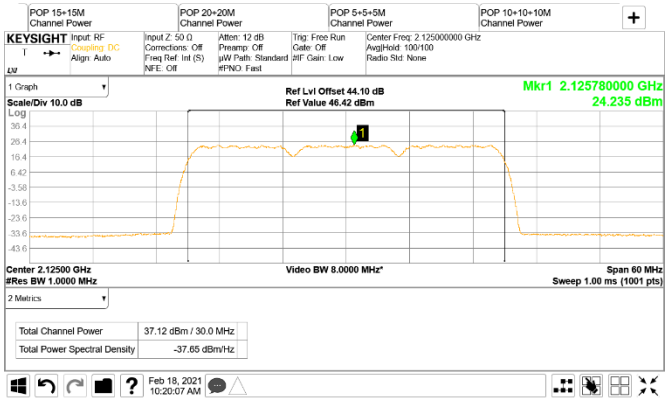


Figure 8.1-10: *PSD of 10 MHz channel bandwidth, three-carrier operation, sample plot*

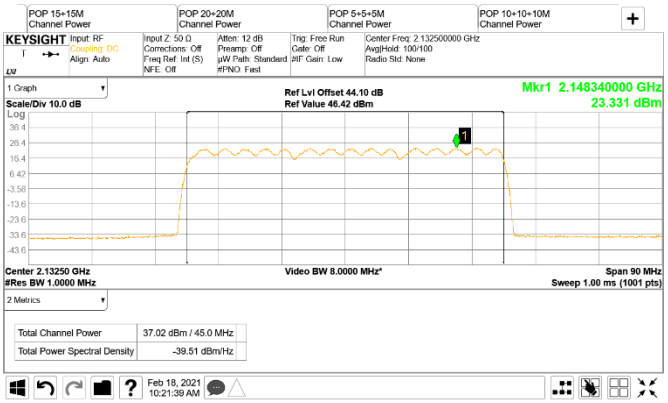


Figure 8.1-11: *PSD of 15 MHz channel bandwidth, three-carrier operation, sample plot*

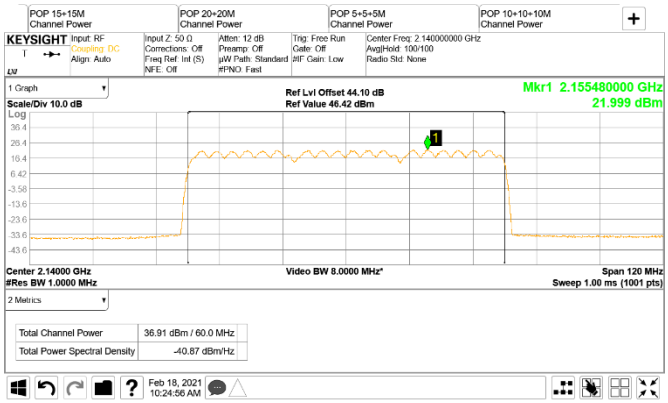


Figure 8.1-12: *PSD of 20 MHz channel bandwidth, three-carrier operation, sample plot*

Test data, continued

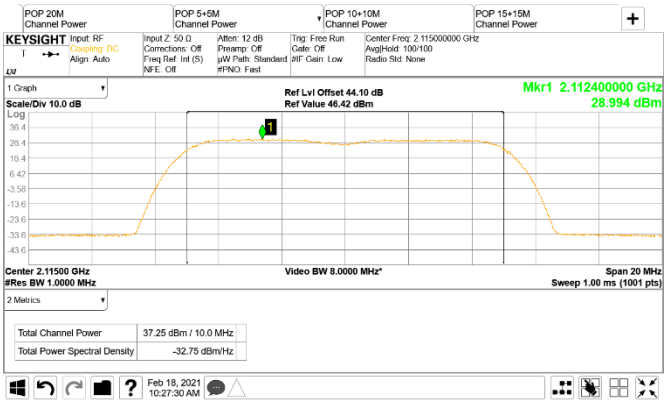


Figure 8.1-13: *PSD of 5 MHz channel bandwidth, LTE + NR operation, sample plot*

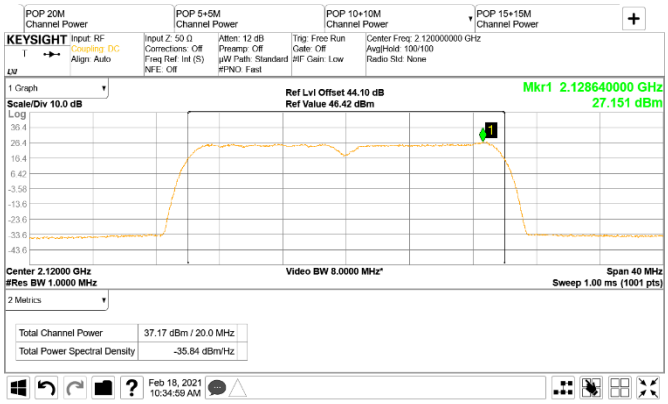


Figure 8.1-14: *PSD of 10 MHz channel bandwidth, LTE + NR operation, sample plot*

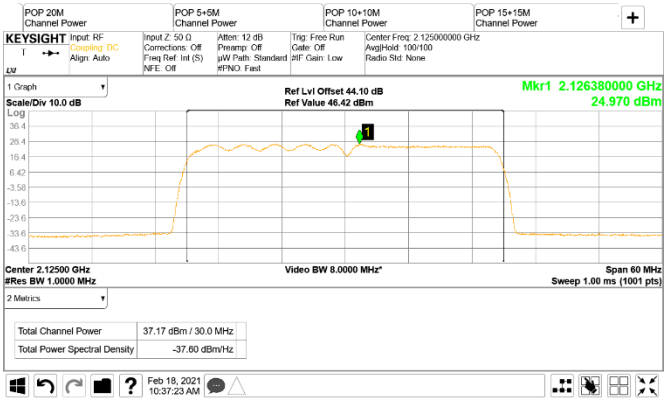


Figure 8.1-15: *PSD of 15 MHz channel bandwidth, LTE + NR operation, sample plot*

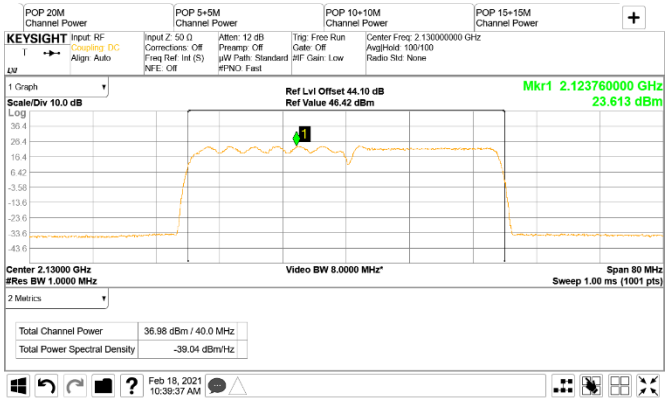


Figure 8.1-16: *PSD of 20 MHz channel bandwidth, LTE + NR operation, sample plot*

Test data, continued

Table 8.1-34: *Complementary Cumulative Distribution Function (CCDF) of the PAPR reduction measurement results for single carrier operation for 5 MHz*

Remarks	Frequency, MHz	0.1% CCDF, dB	PAPR reduction limit, dB	Margin, dB
QPSK, 5 MHz, Low channel	2112.5	7.25	13.00	5.75
16QAM, 5 MHz, Low channel	2112.5	7.24	13.00	5.76
64QAM, 5 MHz, Low channel	2112.5	7.30	13.00	5.70
256QAM, 5 MHz, Low channel	2112.5	7.31	13.00	5.69
QPSK, 5 MHz, Mid channel	2155.0	7.24	13.00	5.76
QPSK, 5 MHz, High channel	2197.5	7.23	13.00	5.77

Table 8.1-35: *Complementary Cumulative Distribution Function (CCDF) of the PAPR reduction measurement results for single carrier operation for 10 MHz*

Remarks	Frequency, MHz	0.1% CCDF, dB	PAPR reduction limit, dB	Margin, dB
QPSK, 10 MHz, Low channel	2115.0	7.28	13.00	5.72
16QAM, 10 MHz, Low channel	2115.0	7.28	13.00	5.72
64QAM, 10 MHz, Low channel	2115.0	7.32	13.00	5.68
256QAM, 10 MHz, Low channel	2115.0	7.29	13.00	5.71
QPSK, 10 MHz, Mid channel	2155.0	7.29	13.00	5.71
QPSK, 10 MHz, High channel	2195.0	7.30	13.00	5.70

Table 8.1-36: *Complementary Cumulative Distribution Function (CCDF) of the PAPR reduction measurement results for single carrier operation for 15 MHz*

Remarks	Frequency, MHz	0.1% CCDF, dB	PAPR reduction limit, dB	Margin, dB
QPSK, 15 MHz, Low channel	2117.5	7.35	13.00	5.65
16QAM, 15 MHz, Low channel	2117.5	7.33	13.00	5.67
64QAM, 15 MHz, Low channel	2117.5	7.37	13.00	5.63
256QAM, 15 MHz, Low channel	2117.5	7.35	13.00	5.65
16QAM, 15 MHz, Mid channel	2155.0	7.30	13.00	5.70
16QAM, 15 MHz, High channel	2192.5	7.34	13.00	5.66

Table 8.1-37: *Complementary Cumulative Distribution Function (CCDF) of the PAPR reduction measurement results for single carrier operation for 20 MHz*

Remarks	Frequency, MHz	0.1% CCDF, dB	PAPR reduction limit, dB	Margin, dB
QPSK, 20 MHz, Low channel	2120.0	7.34	13.00	5.66
16QAM, 20 MHz, Low channel	2120.0	7.32	13.00	5.68
64QAM, 20 MHz, Low channel	2120.0	7.32	13.00	5.68
256QAM, 20 MHz, Low channel	2120.0	7.35	13.00	5.65
QPSK, 20 MHz, Mid channel	2155.0	7.27	13.00	5.73
QPSK, 20 MHz, High channel	2190.0	7.36	13.00	5.64

Test data, continued

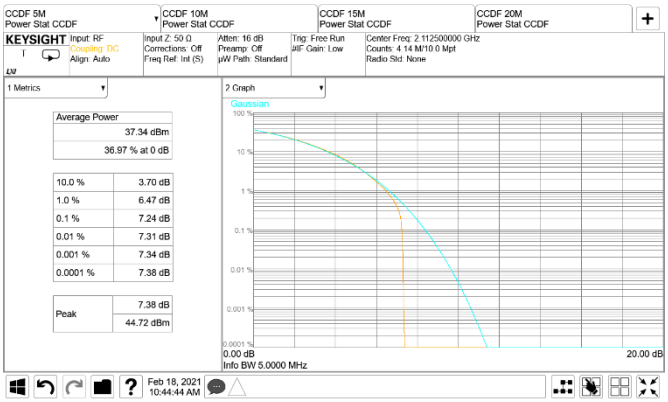


Figure 8.1-17: *CCDF sample plot, 5 MHz channel*

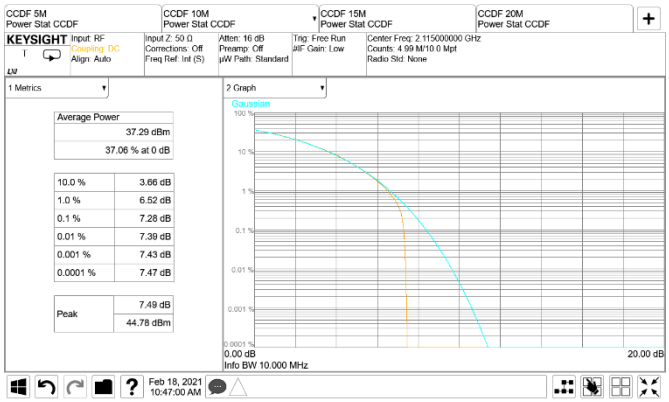


Figure 8.1-18: *CCDF sample plot, 10 MHz channel*

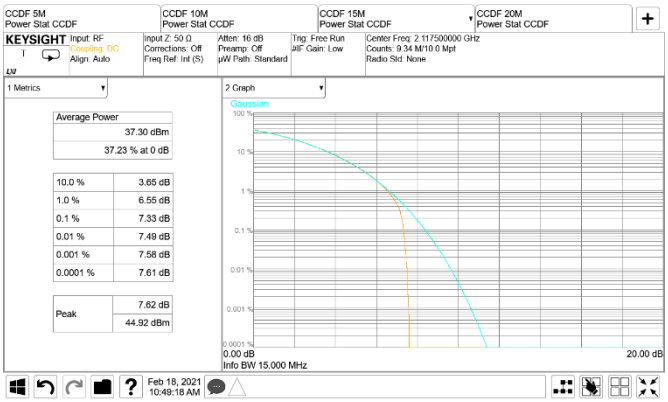


Figure 8.1-19: *CCDF sample plot, 15 MHz channel*

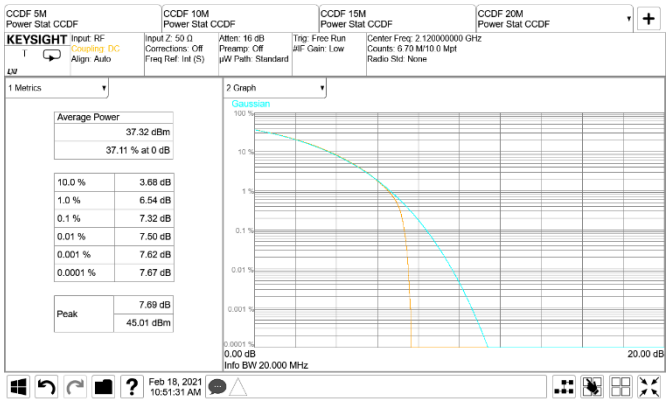


Figure 8.1-20: *CCDF sample plot, 20 MHz channel*

8.2 Spurious emissions at RF antenna connector

8.2.1 Definitions and limits

FCC §27.53:
(h) AWS emission limits
(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.

(3) Measurement procedure.

(i) 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.
(ii) When measuring the emission limits, the nominal carrier frequency shall be adjusted as close to the licensee's frequency block edges, both upper and lower, as the design permits.
(iii) The measurements of emission power can be expressed in peak or average values, provided they are expressed in the same parameters as the transmitter power.

RSS-139, Section 6.6:
i. In the first 1.0 MHz bands immediately outside and adjacent to the equipment's smallest operating frequency block, which can contain the equipment's occupied bandwidth, the emission power per any 1% of the emission bandwidth shall be attenuated below the transmitter output power P (in dBW) by at least $43 + 10 \log_{10}$ p (watts) dB.
ii. After the first 1.0 MHz outside the equipment's smallest operating frequency block, which can contain the equipment's occupied bandwidth, the emission power in any 1 MHz bandwidth shall be attenuated below the transmitter output power P (in dBW) by at least $43 + 10 \log_{10}$ p (watts) dB.

RSS-170, Section 5.4:
The transmitter unwanted emissions shall be measured for all channel bandwidths with the carrier frequency set at both the highest and lowest channels in which the equipment is designed to operate.

The e.i.r.p. density of unwanted and carrier-off state emissions outlined in this section (Section 5.4) shall be averaged over any 2-ms active transmission using an RMS detector with a resolution bandwidth of 1 MHz for broadband emissions and a resolution bandwidth of 1 kHz for discrete emissions, unless stated otherwise.

For ATC equipment operating in the bands 2000–2020 MHz and 2180–2200 MHz, the unwanted emission limits shall be determined using a measurement bandwidth of 1 MHz or greater. However, in the 1 MHz band immediately outside and adjacent to the equipment's operating frequency block, a resolution bandwidth of at least 1% of the occupied bandwidth may be employed.
5.4.1.2 ATC Base Station Equipment operating in bands 2000–2020 MHz and 2180–2200 MHz
The unwanted emissions of ATC base station equipment transmitting in the bands 2000-2020 MHz and 2180-2200 MHz shall comply with the following:

(1) The power of any unwanted emissions at frequencies outside the equipment's operating frequency block shall be attenuated below the transmitter power P (dBW), by 43 + 10 log p (watts), dB.
(2) *For equipment operating in the band 2180–2200 MHz, in addition to (1), the power of any emissions on all frequencies between 2200 MHz and 2290 MHz shall not exceed an e.i.r.p. of −100.6 dBW/4 kHz (−70.6 dBm/4 kHz).

**** This requirement is for implementation and is enforced at the time of licensing. Therefore, results are not included in this report.***

8.2.2 Test summary

Test date	February 17, 2021
Test engineer	Andrey Adelberg

8.2.3 Observations, settings and special notes

- The spectrum was searched from 30 MHz to the 10th harmonic.
- All measurements were performed using an average (RMS) detector per ANSI C63.26 Paragraph 5.7.2 method.
- Limit line (43 + 10 $\log_{10}$ (P) or −13 dBm) was adjusted for MIMO operation by 15.05 dB*: −13 dBm – 15.05 dB = −28.05 dBm
  *MIMO correction factor for 32 antenna ports: 10 × Log_{10}(32) = 15.05 dB
- RBW 1 MHz, VBW was wider than RBW.

8.2.4 Test data

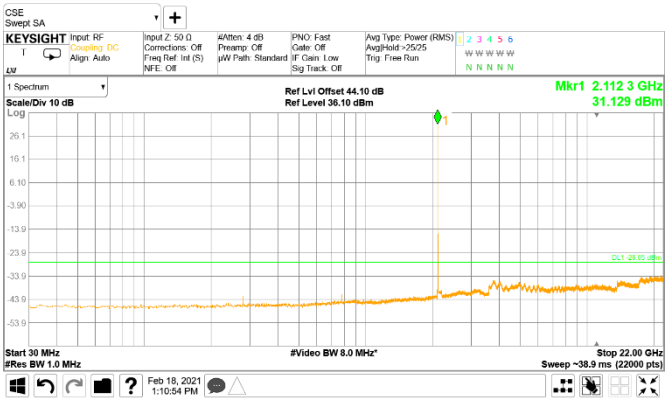


Figure 8.2-1: *Conducted spurious emissions of 5 MHz low channel, single carrier operation*

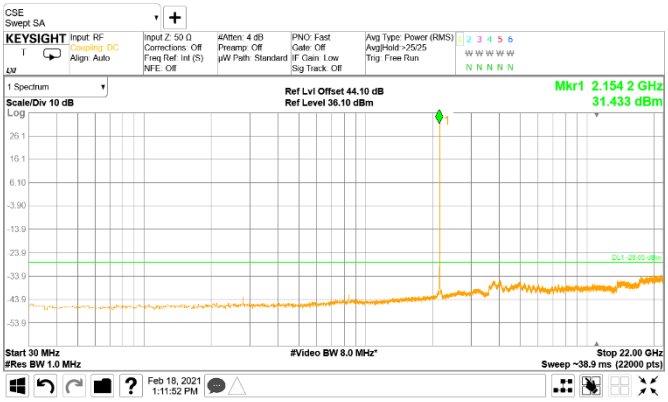


Figure 8.2-2: *Conducted spurious emissions of 5 MHz mid channel, single carrier operation*

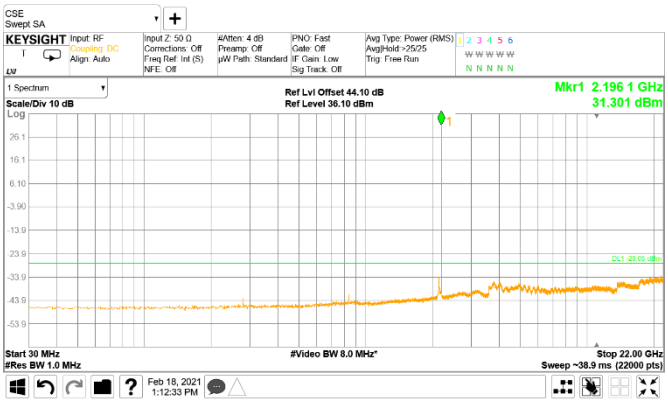


Figure 8.2-3: *Conducted spurious emissions of 5 MHz top channel, single carrier operation*

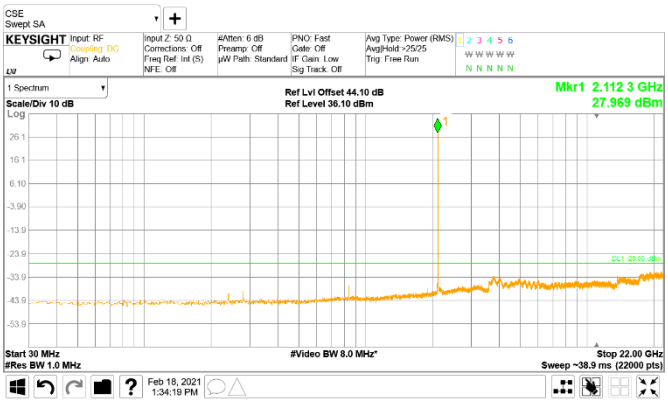


Figure 8.2-4: *Conducted spurious emissions of 10 MHz low channel, single carrier operation*

Test data, continued

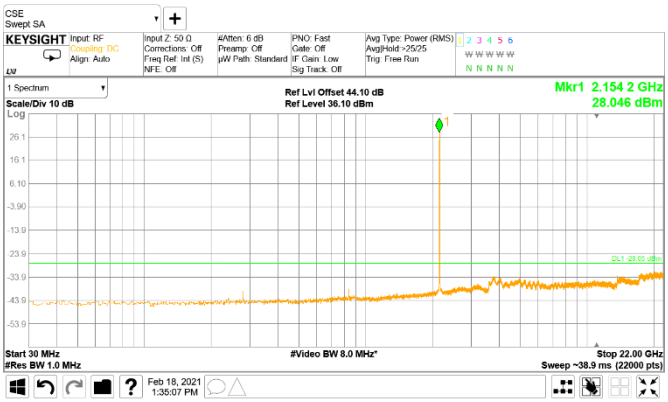


Figure 8.2-5: *Conducted spurious emissions of 10 MHz mid channel, single carrier operation*

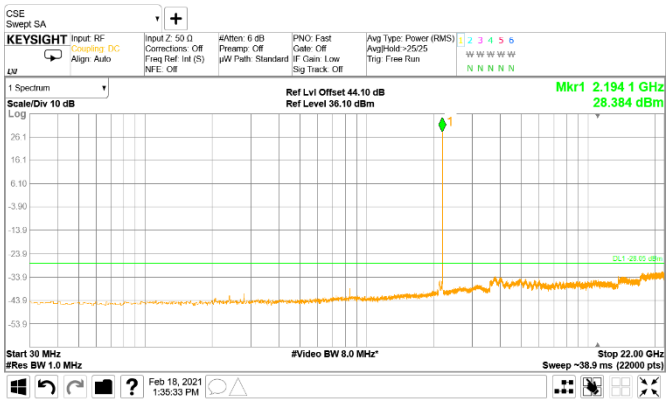


Figure 8.2-6: *Conducted spurious emissions of 10 MHz top channel, single carrier operation*

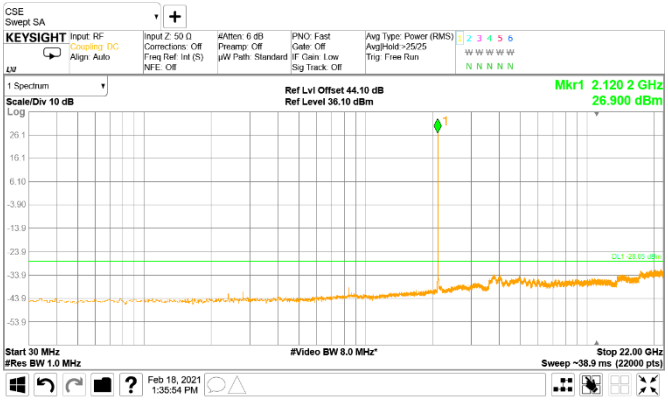


Figure 8.2-7: *Conducted spurious emissions of 15 MHz low channel, single carrier operation*

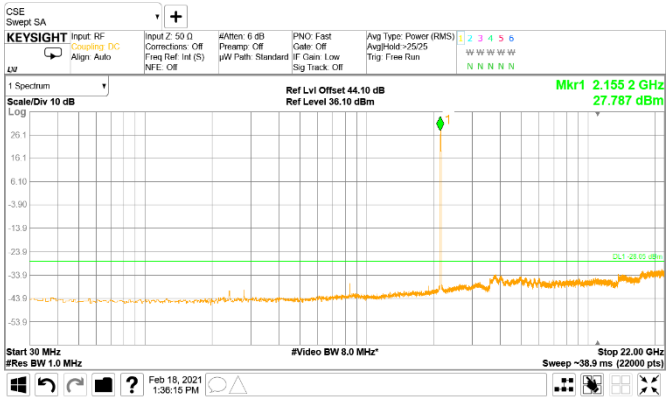


Figure 8.2-8: *Conducted spurious emissions of 15 MHz mid channel, single carrier operation*

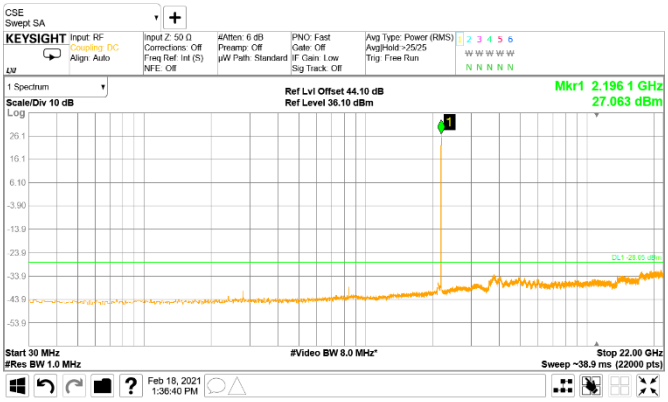


Figure 8.2-9: *Conducted spurious emissions of 15 MHz top channel, single carrier operation*

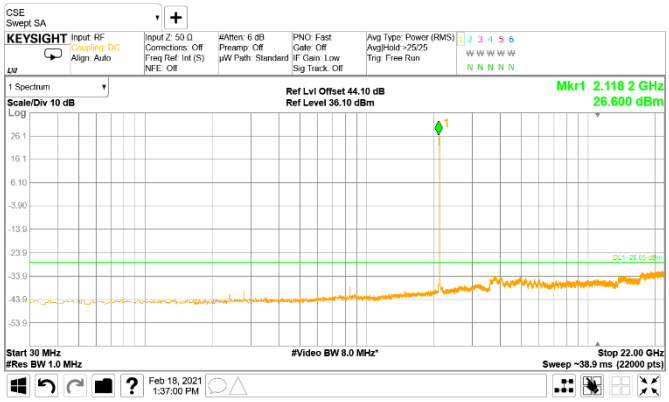


Figure 8.2-10: *Conducted spurious emissions of 20 MHz low channel, single carrier operation*

Test data, continued

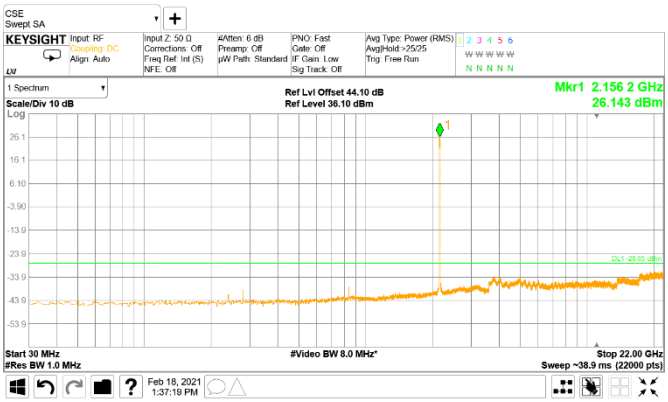


Figure 8.2-11: *Conducted spurious emissions of 20 MHz mid channel, single carrier operation*

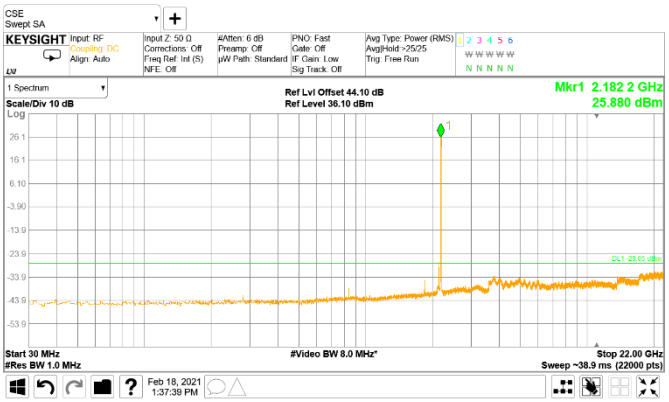


Figure 8.2-12: *Conducted spurious emissions of 20 MHz top channel, single carrier operation*

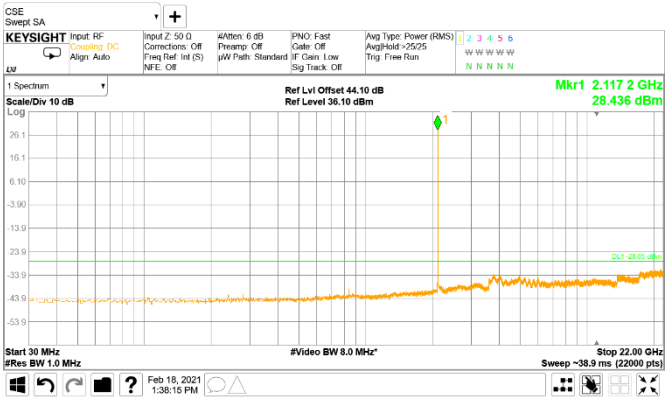


Figure 8.2-13: *Conducted spurious emissions of 5 MHz two low channels, two-carrier operation*

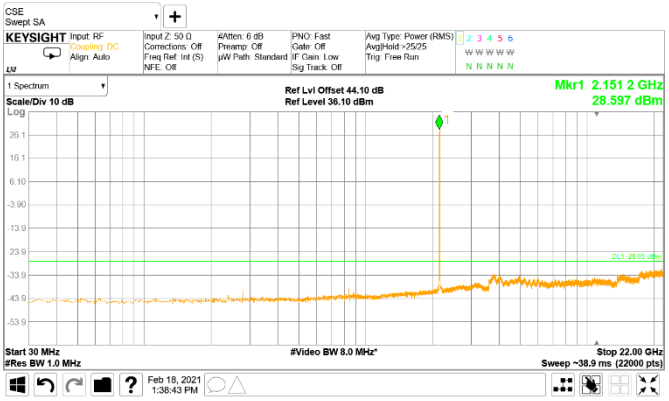


Figure 8.2-14: *Conducted spurious emissions of 5 MHz two mid channels, two-carrier operation*

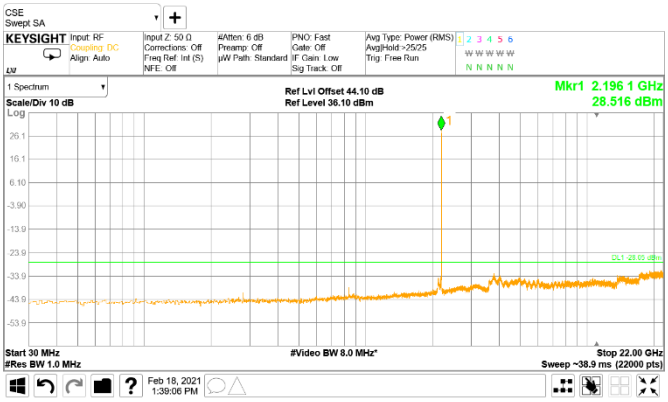


Figure 8.2-15: *Conducted spurious emissions of 5 MHz two top channels, two-carrier operation*

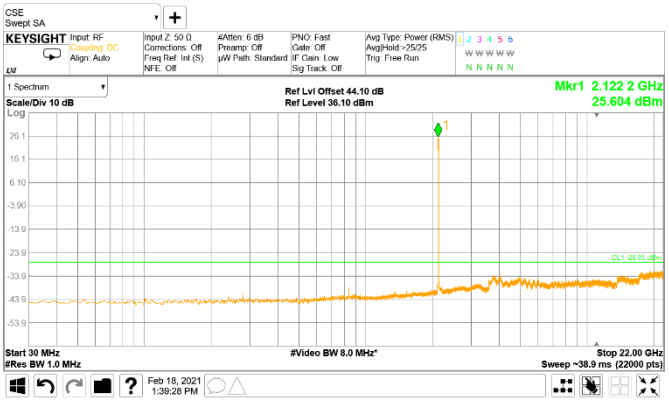


Figure 8.2-16: *Conducted spurious emissions of 10 MHz two low channels, two-carrier operation*

Test data, continued

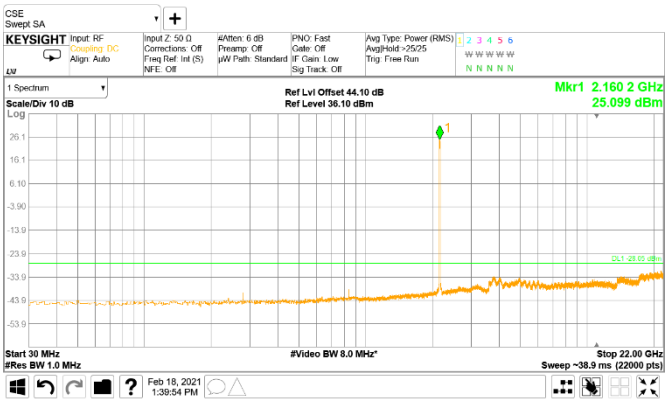


Figure 8.2-17: *Conducted spurious emissions of 10 MHz two mid channels, two-carrier operation*

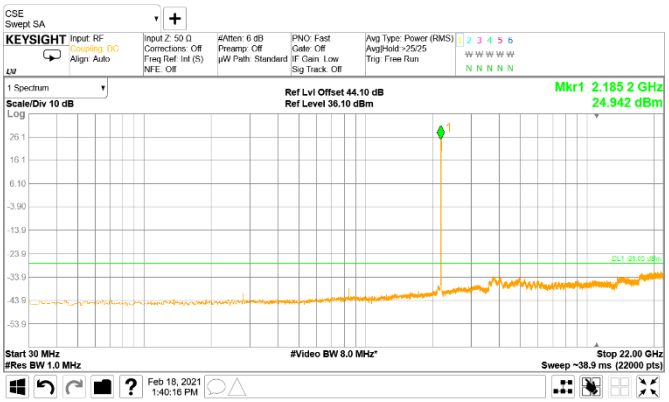


Figure 8.2-18: *Conducted spurious emissions of 10 MHz two top channels, two-carrier operation*

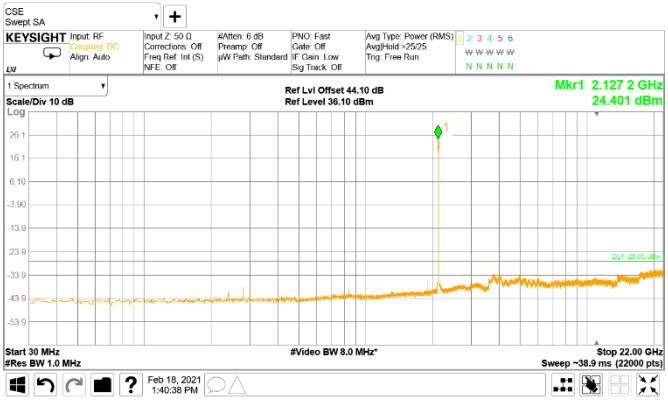


Figure 8.2-19: *Conducted spurious emissions of 15 MHz two low channels, two-carrier operation*

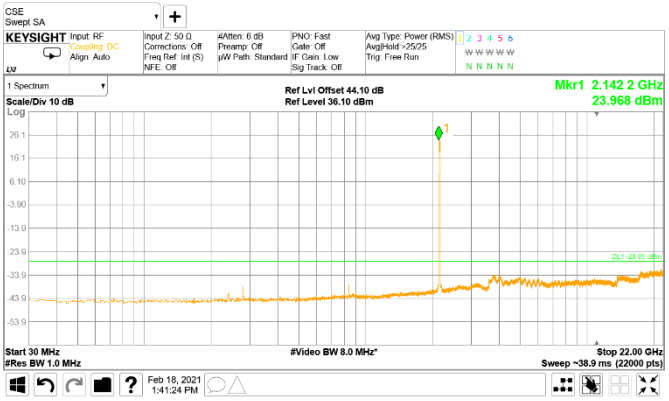


Figure 8.2-20: *Conducted spurious emissions of 15 MHz two mid channels, two-carrier operation*

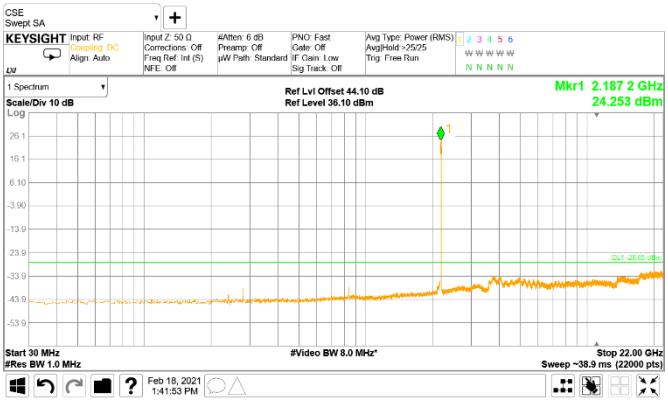


Figure 8.2-21: *Conducted spurious emissions of 15 MHz two top channels, two-carrier operation*

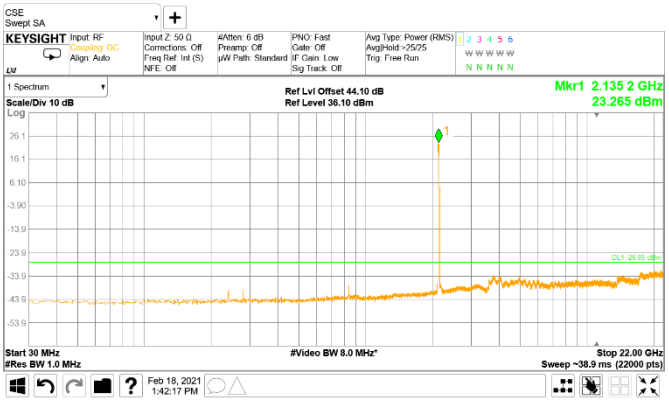


Figure 8.2-22: *Conducted spurious emissions of 20 MHz two low channels, two-carrier operation*

Test data, continued

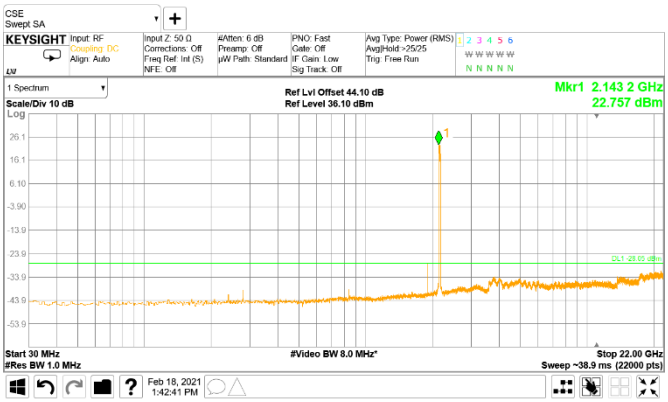


Figure 8.2-23: *Conducted spurious emissions of 20 MHz two mid channels, two-carrier operation*

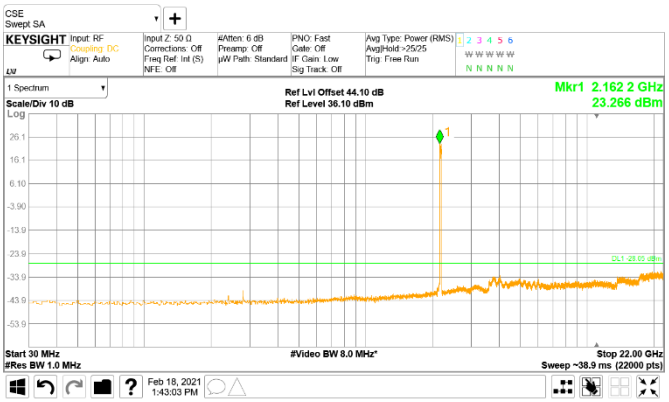


Figure 8.2-24: *Conducted spurious emissions of 20 MHz two top channels, two-carrier operation*

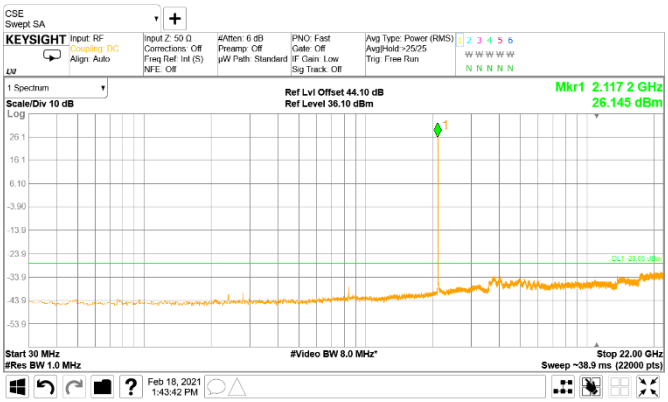


Figure 8.2-25: *Conducted spurious emissions of 5 MHz three low channels, three-carrier operation*

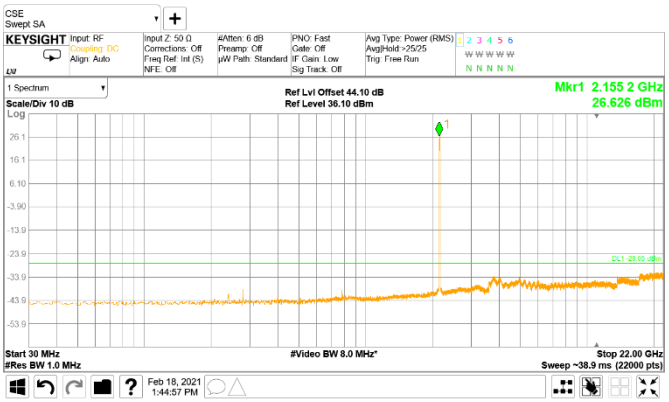


Figure 8.2-26: *Conducted spurious emissions of 5 MHz three mid channels, three-carrier operation*

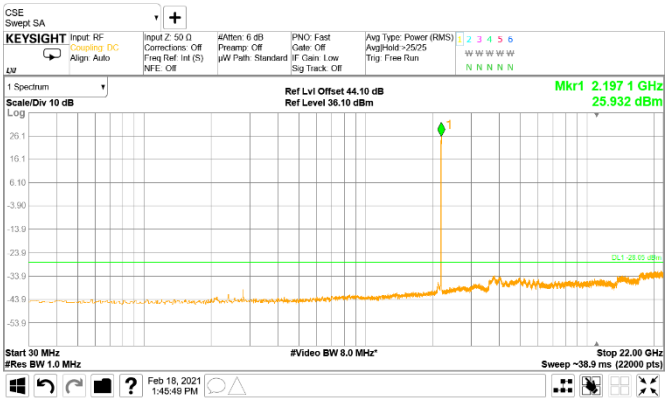


Figure 8.2-27: *Conducted spurious emissions of 5 MHz three top channels, three-carrier operation*

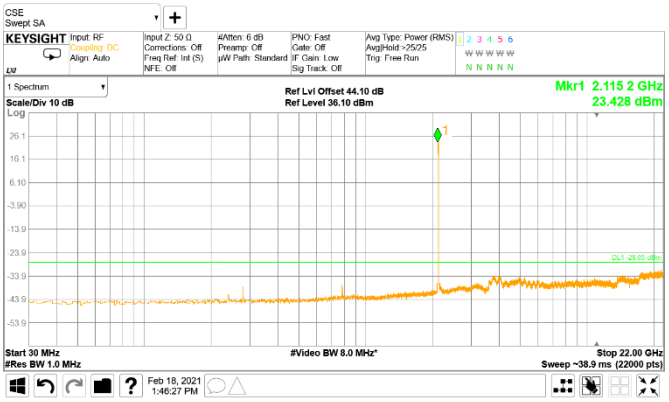


Figure 8.2-28: *Conducted spurious emissions of 10 MHz three low channels, three-carrier operation*

Test data, continued

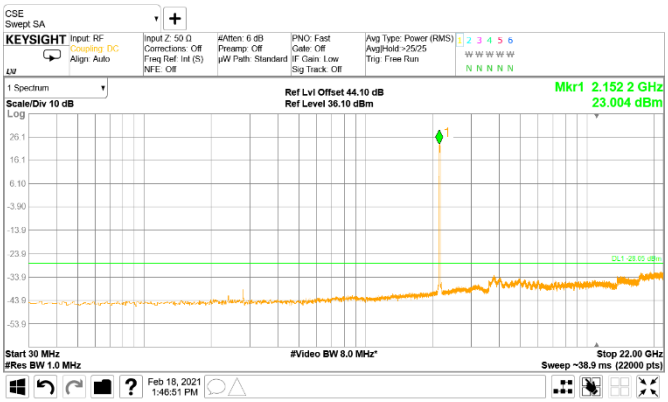


Figure 8.2-29: *Conducted spurious emissions of 10 MHz three mid channels, three-carrier operation*

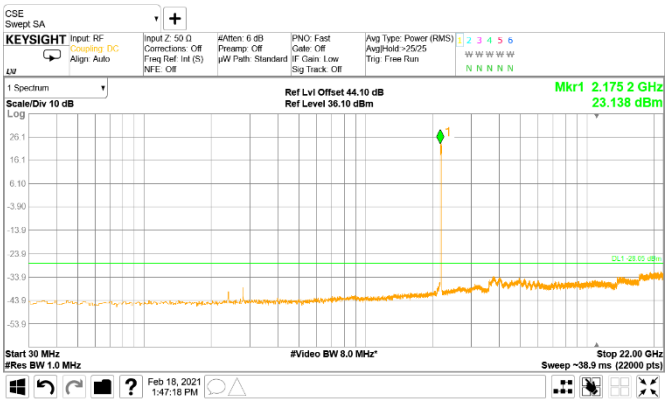


Figure 8.2-30: *Conducted spurious emissions of 10 MHz three top channels, three-carrier operation*

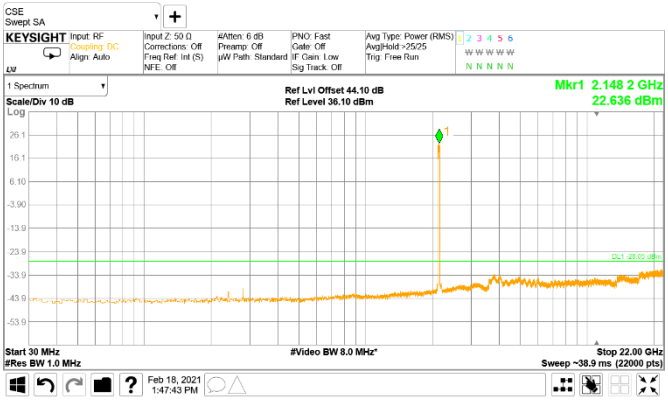


Figure 8.2-31: *Conducted spurious emissions of 15 MHz three low channels, three-carrier operation*

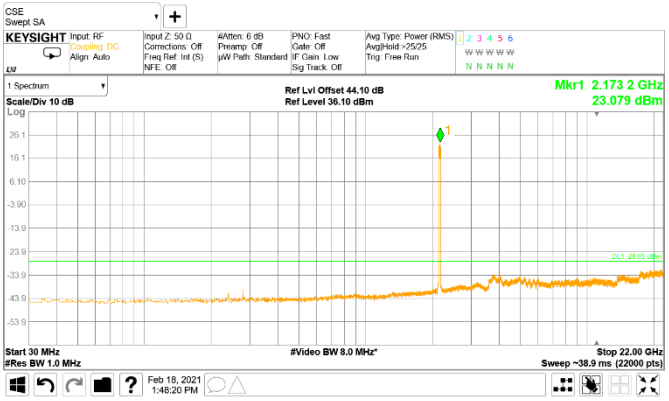


Figure 8.2-32: *Conducted spurious emissions of 15 MHz three mid channels, three-carrier operation*

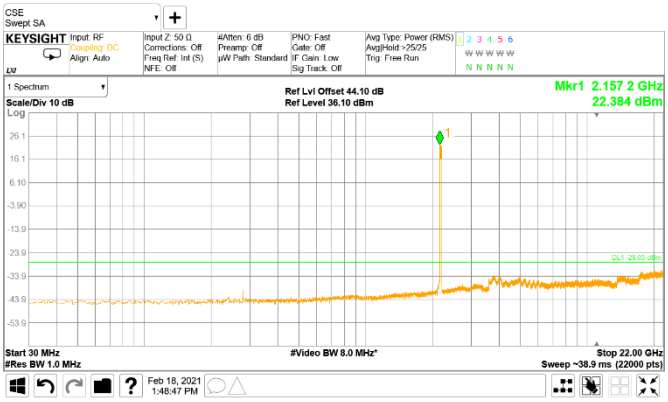


Figure 8.2-33: *Conducted spurious emissions of 15 MHz three top channels, three-carrier operation*

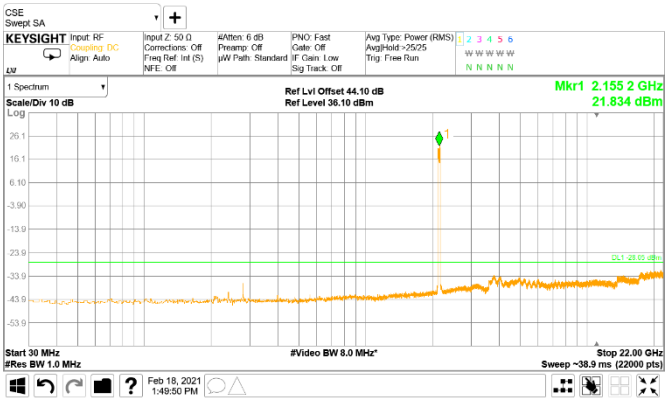


Figure 8.2-34: *Conducted spurious emissions of 20 MHz three low channels, three-carrier operation*

Test data, continued

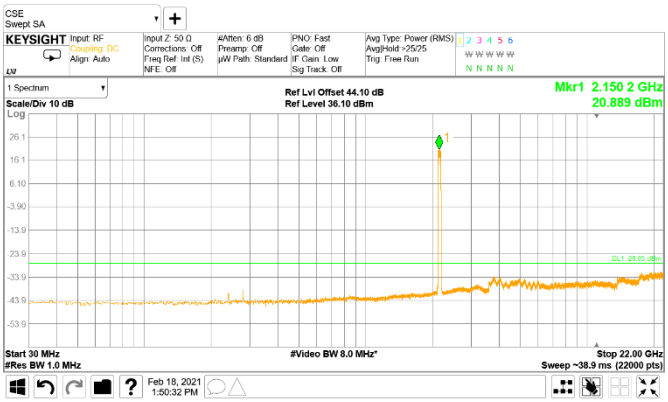


Figure 8.2-35: *Conducted spurious emissions of 20 MHz three mid channels, three-carrier operation*

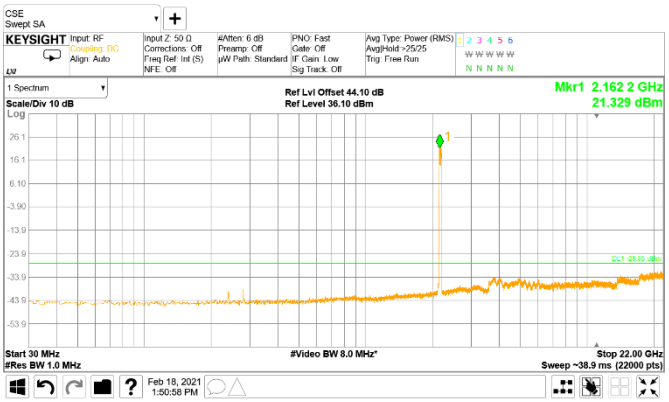


Figure 8.2-36: *Conducted spurious emissions of 20 MHz three top channels, three-carrier operation*

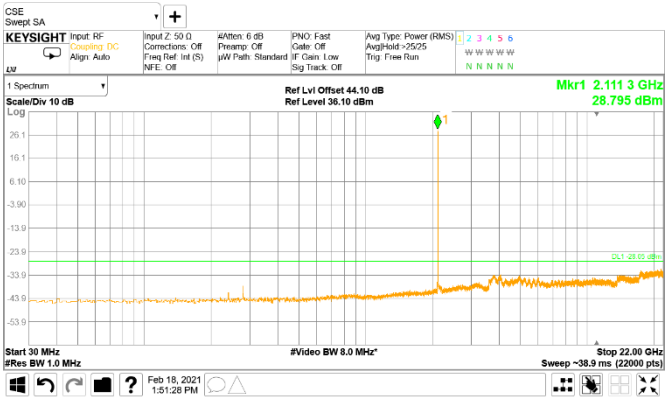


Figure 8.2-37: *Conducted spurious emissions of 5 MHz two low channels, LTE + NR operation*

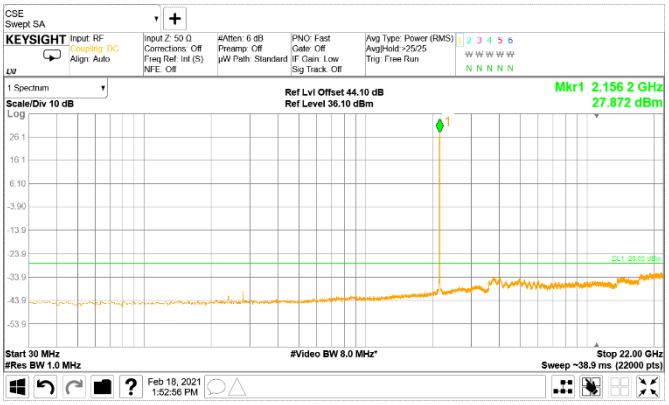


Figure 8.2-38: *Conducted spurious emissions of 5 MHz two mid channels, LTE + NR operation*

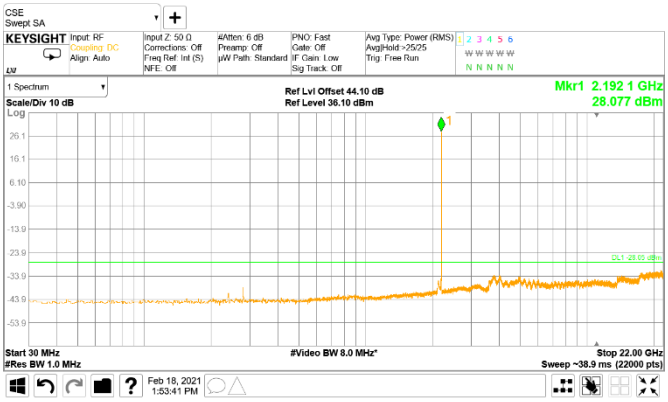


Figure 8.2-39: *Conducted spurious emissions of 5 MHz two top channels, LTE + NR operation*

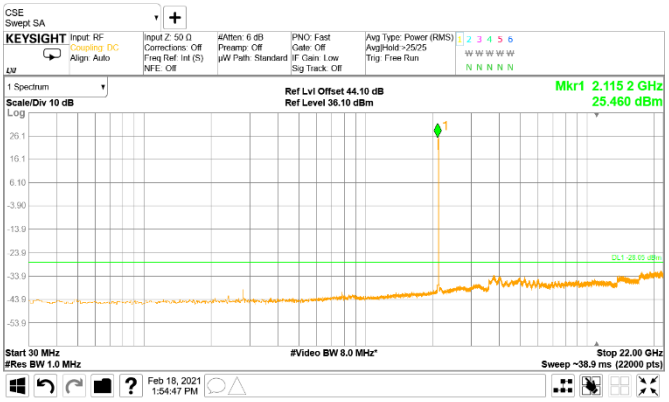


Figure 8.2-40: *Conducted spurious emissions of 10 MHz two low channels, LTE + NR operation*

Test data, continued

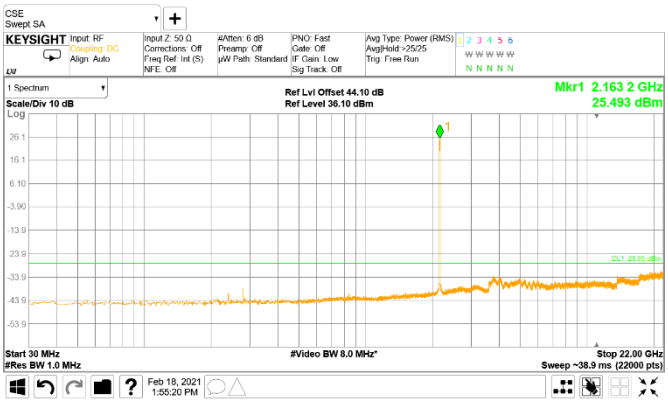


Figure 8.2-41: *Conducted spurious emissions of 10 MHz two mid channels, LTE + NR operation*

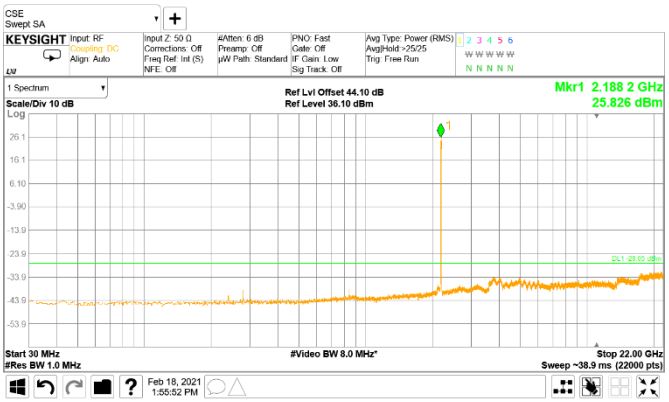


Figure 8.2-42: *Conducted spurious emissions of 10 MHz two top channels, LTE + NR operation*

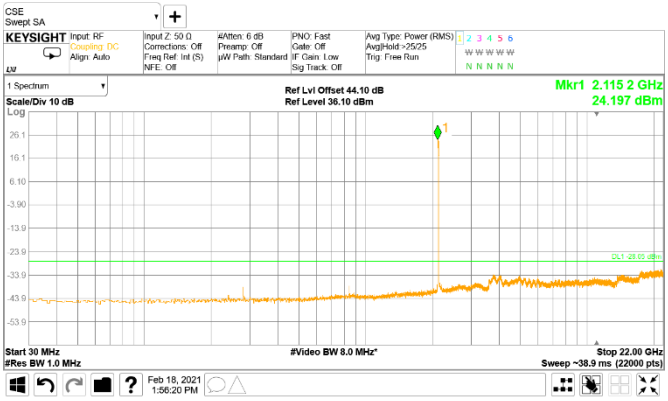


Figure 8.2-43: *Conducted spurious emissions of 15 MHz two low channels, LTE + NR operation*

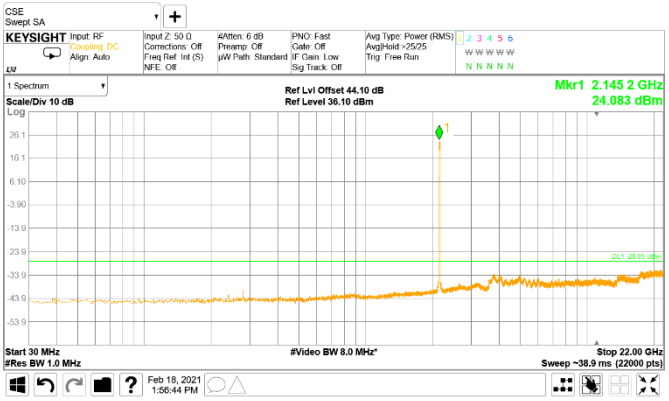


Figure 8.2-44: *Conducted spurious emissions of 15 MHz two mid channels, LTE + NR operation*

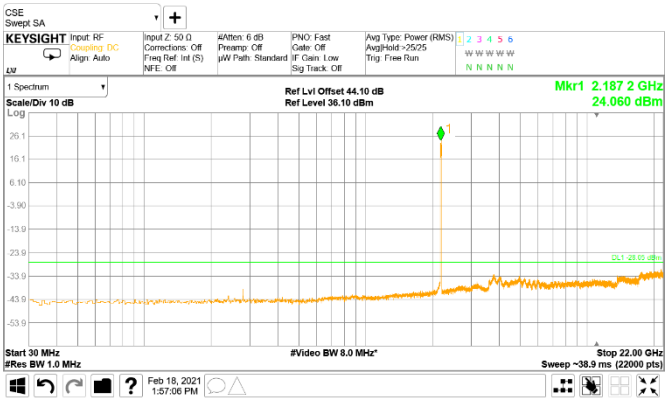


Figure 8.2-45: *Conducted spurious emissions of 15 MHz two top channels, LTE + NR operation*

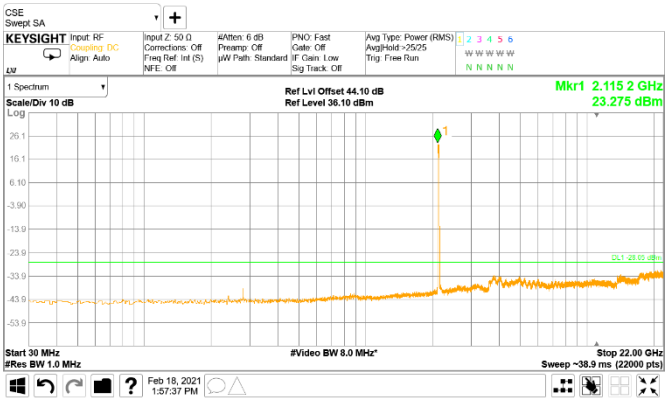


Figure 8.2-46: *Conducted spurious emissions of 20 MHz two low channels, LTE + NR operation*

Test data, continued

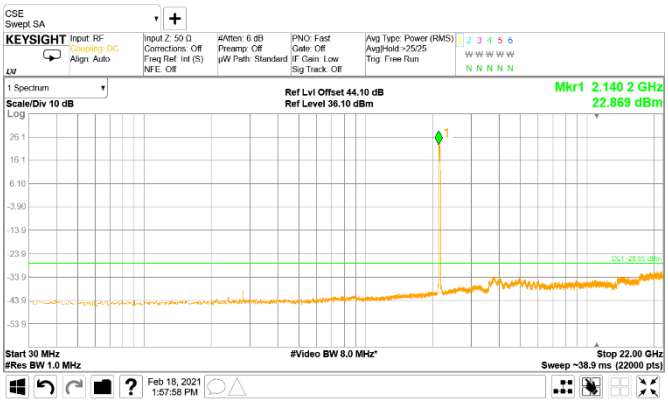


Figure 8.2-47: *Conducted spurious emissions of 20 MHz two mid channels, LTE + NR operation*

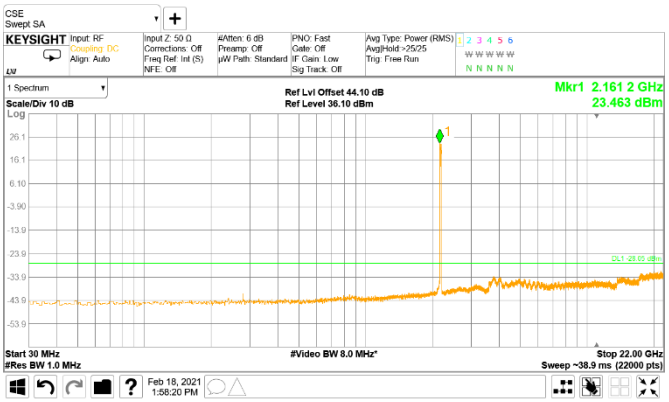


Figure 8.2-48: *Conducted spurious emissions of 20 MHz two top channels, LTE + NR operation*

Test data, continued

On the plots below the measured "Total Channel Power" value must be lower than −28.05 dBm

Figure 8.2-49: *Conducted band edge emission at 2110 MHz, 5 MHz channel single-carrier operation (RBW = 1% of EBW)*

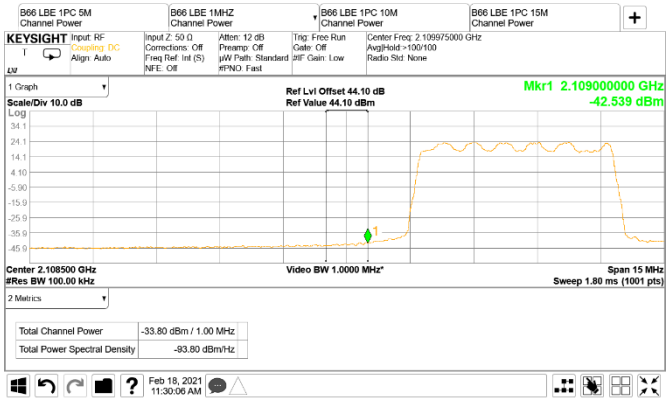


Figure 8.2-50: *Conducted band edge emission at 2109 MHz, 5 MHz channel single-carrier operation (RBW = 1 MHz)*

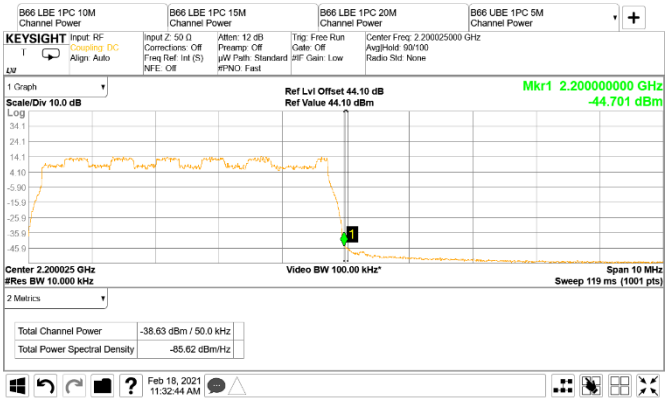


Figure 8.2-51: *Conducted band edge emission at 2200 MHz, 5 MHz channel single-carrier operation (RBW = 1% of EBW)*

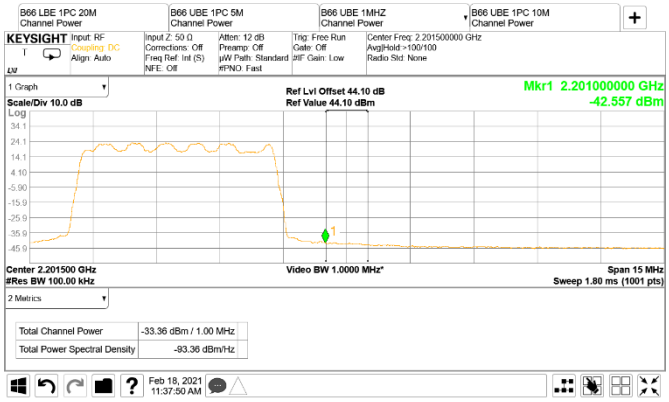


Figure 8.2-52: *Conducted band edge emission at 2201 MHz, 5 MHz channel single-carrier operation (RBW = 1 MHz)*