C2PC TEST REPORT

Report Number: 14790372-E4V2

Applicant	:	APPLE, INC 1 APPLE PARK WAY CUPERTINO, CA 95014, U.S.A.
Model	:	A2483 (Parent Model, Full Test) A2636, A2638, A2639, A2640 (Variant Models)
Brand	:	APPLE
FCC ID	:	BCG-E4000A (Parent Model) BCG-E4002A, BCG-E4034A, BCG-E4034A (Variant Models)
EUT Description	:	SMARTPHONE
Test Standard(s)	:	FCC CFR47 PART 2, PART 96

Date Of Issue:
JUNE 22, 2023

Prepared by:
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CERT #0751.05

Revision History

Rev.	Issue Date	Revisions	Revised By
V1	6/21/2023	Initial Review	Mengistu Mekuria
V2	6/22/2023	Addressed All TCB Questions at Section 5.4, 6.3, and 6.8	Mengistu Mekuria

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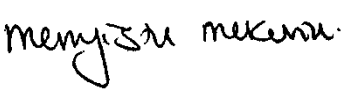
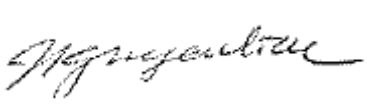
1. ATTESTATION OF TEST RESULTS

Applicant Name and Address	APPLE, INC 1 APPLE PARK WAY CUPERTINO, CA 95014, U.S.A.
Model	A2483 (PARENT MODEL, FULL TEST) A2636, A2638, A2639, A2640 (Variant Models)
Brand	APPLE
FCC ID	BCG-E4000A (PARENT MODEL) BCG-E4002A, BCG-E4033A, BCG-E4034A (Variant Models)
EUT Description	SMARTPHONE
Serial Number	C070514009F0G492 (Conducted), HXKPFXHXK2 (Radiated)
Sample Receipt Date	3/5/2021 (CONDUCTED), 6/1/2021 (RADIATED)
Date Tested	MARCH 18, 2021 TO MAY 30, 2021
Applicable Standards	FCC CFR47 PART 2, PART 96
Test Results	COMPLIES

UL Verification Services Inc. tested the above equipment in accordance with the requirements set forth in the above standards. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical components. All samples tested were in good operating condition throughout the entire test program. Measurement Uncertainties are published for informational purposes only and were not taken into account unless noted otherwise.

This document may not be altered or revised in any way unless done so by UL Verification Services Inc. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL Verification Services Inc. will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by A2LA, NIST, any agency of the Federal Government, or any agency of the U.S. government.

Approved & Released By:	Reviewed By:	Prepared By:
		
Mengistu Mekuria Senior Test Engineer UL Verification Services Inc.	Lieu Nguyen Test Engineer UL Verification Services Inc.	Tony Li Test Engineer UL Verification Services Inc.

2. SUMMARY OF TEST RESULTS

This report contains data provided by the customer which can impact the validity of results. UL Verification Services Inc. is only responsible for the validity of results after the integration of the data provided by the customer.

Requirement Description	Band	Requirement Clause Number (FCC)	Result	Remarks
Equivalent Isotropic Radiated	48	96.41 (b)	Complies	

Requirement Description	Requirement Clause Number (FCC)	Result	Remarks
Occupied Bandwidth	2.1049	Complies	
Band Edge and Emission Mask	96.41(e)	Complies	
Out of Band Emissions	96.41(e)	Complies	
Frequency Stability	2.1055	Complies	
Peak-to-Average Ratio	96.41 (g)	Complies	
Field Strength of Spurious Radiation	96.41(e)	Complies	

3. TEST METHODOLOGY

The tests documented in this report were performed in accordance with the following:

- ANSI C63.26:2015
- FCC CFR 47 Part 2, Part 96
- FCC KDB 971168 D01 v03r01: Power Meas License Digital Systems
- FCC KDB 971168 D02 v02r01: Misc Rev Approv License Devices
- FCC KDB 412172 D01 v01r01. Determining ERP and EIRP

4. FACILITIES AND ACCREDITATION

UL Verification Services Inc. is accredited by A2LA, certification #0751.05, for all testing performed within the scope of this report. Testing was performed at the locations noted below.

	Address	ISED CABID	ISED Company Number	FCC Registration
☒	Building 1: 47173 Benicia Street, Fremont, CA 94538, USA	US0104	2324A	208313
☒	Building 2: 47266 Benicia Street, Fremont, CA 94538, USA	US0104	22541	208313
☐	Building 4: 47658 Kato Rd, Fremont, CA 94538, USA	US0104	2324B	208313

5. DECISION RULES AND MEASUREMENT UNCERTAINTY

5.1. METROLOGICAL TRACEABILITY

All test and measuring equipment utilized to perform the tests documented in this report are calibrated on a regular basis, with a maximum time between calibrations of one year or the manufacturers' recommendation, whichever is less, and where applicable is traceable to recognized national standards.

5.2. DECISION RULES

The Decision Rule is based on Simple Acceptance in accordance with ISO Guide 98-4:2012 Clause 8.2. (measurement uncertainty is not taken into account when stating conformity with a specified requirement.)

5.3. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

PARAMETER	U_{Lab}
Worst Case Radiated Disturbance, 9KHz to 30 MHz	2.87 dB
Worst Case Radiated Disturbance, 30 to 1000 MHz	6.01 dB
Worst Case Radiated Disturbance, 1000 to 18000 MHz	4.73 dB
Worst Case Radiated Disturbance, 18000 to 26000 MHz	4.51 dB
Worst Case Radiated Disturbance, 26000 to 40000 MHz	5.29 dB
Occupied Channel Bandwidth	±1.22 %
Temperature	±2.26%
Supply voltages	±0.57 %
Time	±3.39 %

Uncertainty figures are valid to a confidence level of 95%.

5.4. SAMPLE CALCULATION

RADIATED EMISSIONS

Where relevant, the following sample calculation is provided:
Field Strength (dBuV/m) = Measured Voltage (dBuV) + Antenna Factor (dB/m) + Cable Loss (dB) – Preamp Gain (dB)
36.5 dBuV + 18.7 dB/m + 0.6 dB – 26.9 dB = 28.9 dBuV/m

6. EQUIPMENT UNDER TEST

6.1. DESCRIPTION OF EUT

The Apple iPhone is a smartphone with multimedia functions (music, application support, and video), cellular GSM, GPRS, EGPRS, UMTS, LTE, 5G, CDMA, IEEE 802.11a/b/g/n/ac/ax, Bluetooth, Ultra-Wideband, GPS and NFC. All models support at least one UICC based SIM. The second SIM is either an UICC based p-SIM (physical SIM) or e-SIM (electronic SIM). The device supports a built-in inductive charging transmitter and receiver. The rechargeable battery is not user accessible.

Testing was performed on the parent model and is used to support the application for the parent and variants identified in this report based on the test plan submitted and approved via KDB inquiry by the FCC.

6.2. INTRODUCTION

This application for certification is leveraging the data reuse procedures from KDB 484596 D01 based on reference FCC ID: BCG-E4000A to cover variant model FCC ID: BCG-E4002A, FCC ID: BCG-E4033A, and FCC ID: BCG-E4034A. The major difference between the parent/reference model and the variant model is the depopulation in the variant model of the mmWave transmitter, and some LTE and 5G NR Bands. All other circuitry and features are identical. The data reuse test plan was approved via manufacturer KDB inquiry.

6.3. MODEL DIFFERENCES

The manufacturer hereby declares the following for models A2483, A2636, A2638, A2639, A2640.

A2483, A2636, A2638, A2639, and A2640 are highly similar, with the only differences being listed on the table below:

Model	FCC ID	Model Changes
A2483	BCG-E4000A	Reference model
A2636	BCG-E4002A	Variant model. Removed FR2 from the reference model
A2638	BCG-E4033A	Variant model. Removed FR2, LTE B11/14/29/71, and 5G n71 from the reference model
A2639/A2640	BCG-E4034A	Variant model. Removed FR2, LTE B11/14/29/53/71, MSS, and 5G NR n53/n71 from the reference Model.

*Note:

They have the same PCB layout, design, common components, antennas, antenna locations and housing cases.

More specifically, their cellular modem, Wi-Fi, BT, NFC, WPT and UWB transmitters are identical, and removal of cellular bands is done by software and depopulation of band-specific components associated with the removed bands.

Spot check verification has been done on models A2636, A2638, A2639 and A2640 in accordance with the test plan approved via KDB inquiry. Comparison of the models, upper deviation is within 0.5dB range, and all

tests are under FCC Technical Limits. The results documented for model A2484 may be applied as representative to models A2636, A2638, A2639 and A2640.

6.4. MAXIMUM OUTPUT POWER

EIRP/ERP TEST PROCEDURE

ANSI C63.26:2015
KDB 971168 D01 Section 5.6

ERP/EIRP = PMeas + GT − LC
where: ERP/EIRP = effective or equivalent radiated power, respectively (expressed in the same units as PMeas, typically dBW or dBm);
PMeas = measured transmitter output power or PSD, in dBm or dBW;
GT = gain of the transmitting antenna, in dBd (ERP) or dBi (EIRP);
LC = signal attenuation in the connecting cable between the transmitter and antenna, in dB.

For devices utilizing multiple antennas, KDB 662911 provides guidance for determining the effective array transmit antenna gain term to be used in the above equation.

EUT includes different power levels for head use configuration and body use configuration and the below tables contain the highest of all configurations average conducted and ERP/EIRP output powers as follows:

5G NR n48 (Ant 7)

Part 96	
EIRP Limit (W)	0.20
Antenna Gain (dBi)	-3.10

Bandwidth (MHz)	Modulation	Low Frequency (MHz)	Upper Frequency (MHz)	Conducted Average (dBm)	EIRP Average (dBm)	EIRP Average (W)	99% BW (kHz)	Emission Designator
10.0	BPSK	3555.0	3695.0	25.57	22.47	0.177	8601	8M60G7W
	QPSK			25.60	22.50	0.178	86123	86M1G7W
	16QAM			25.29	22.19	0.166	8559	8M56D7W
20.0	BPSK	3560.0	3690.0	25.60	22.50	0.178	17842	17M8G7W
	QPSK			25.57	22.47	0.177	17870	17M9G7W
	16QAM			25.14	22.04	0.160	17903	17M9D7W
40.0	BPSK	3570.0	3680.0	25.43	22.33	0.171	35667	35M7G7W
	QPSK			25.60	22.50	0.178	35713	35M7G7W
	16QAM			24.44	21.34	0.136	35733	35M7D7W

6.5. SPOT CHECK VERIFICATION RESULTS SUMMARY FOR A2636

A2636 SPOT CHECK RESULTS							
Technology	Worst Mode	Test Item	Measured	Original Model: A2483	Sub Model: A2636	Delta (dB)	Remarks
			Frequency (MHz)	FCC ID: BCG-E4000A Power (dBm)	FCC ID: BCG-E4002A Power (dBm)		
5G NR n48	QPSK @ 40 MHz BW	Cond Power	3550-3700	25.60	25.60	0.00	Ant7

6.6. SPOT CHECK VERIFICATION RESULTS SUMMARY FOR A2638

A2638 SPOT CHECK RESULTS							
Technology	Worst Mode	Test Item	Measured	Original Model: A2483	Sub Model: A2638	Delta (dB)	Remarks
			Frequency (MHz)	FCC ID: BCG-E4000A Power (dBm)	FCC ID: BCG-E4033A Power (dBm)		
5G NR n48	QPSK @ 40 MHz BW	Cond Power	3550-3700	25.60	25.60	0.00	Ant7

6.7. SPOT CHECK VERIFICATION RESULTS SUMMARY FOR A2639 AND A2640

A2639 SPOT CHECK RESULTS							
Technology	Worst Mode	Test Item	Measured	Original Model: A2483	Sub Model: A2639/A2640	Delta (dB)	Remarks
			Frequency (MHz)	FCC ID: BCG-E4000A Power (dBm)	FCC ID: BCG-E4034A Power (dBm)		
5G NR n48	QPSK @ 40 MHz BW	Cond Power	3550-3700	25.60	25.60	0.00	Ant7

6.8. SOFTWARE AND FIRMWARE

The EUT firmware installed during testing was version 0.21.02-1.

6.9. MAXIMUM ANTENNA GAIN

The antenna(s) gain and type, as provided by the manufacturer' are as follows:

LTE Bands	ANT 1 Antenna Gain (dBi)	ANT 2 Antenna Gain (dBi)	ANT 3 Antenna Gain (dBi)	ANT 4 Antenna Gain (dBi)	ANT 7 Antenna Gain (dBi)	ANT 8 Antenna Gain (dBi)	ANT 9 Antenna Gain (dBi)
5G NR n48, 3550 – 3700 MHz				-1.4	-3.1	-3.1	-3.8

6.10. WORST-CASE CONFIGURATION AND MODE

The EUT supports the different LTE and 5G NR Bands. However, this report only applied to 5G NR n48.

BPSK modulation applied only for 5G NR frequencies and has the same tune up power as QPSK modulations.

The DFT-s-OFDM and CP-OFDM waveforms were investigated, and DFT-s-OFDM was found to be the worst case.

For 5G NRs, conducted spurious emission tests were conducted on wider bandwidth with inner 1RB since this is the worst bandwidth and the highest output power.

The worst-case scenario for all measurements is based on an engineering evaluation and QPSK was observed as the worst one and set for all conducted and radiated. Output power measurements were measured on QPSK, 16QAM, 64QAM, 256QAM, and BPSK, modulations. For testing purposes emissions on sections 8 and 9 were measured while QPSK was set at or above target power for all bands. Conducted tests were performed on the worst-case antenna because it has the highest conducted power. For bands 48 ANT7 is the worst-case antenna.

The EUT was investigated in three orthogonal orientations X/Y/Z on all ANT4, ANT7, ANT8 and ANT 9 antennas to determine the worst-case orientation. The following table exabit the worst-case orientation for different frequency bands. The full tests of the EUT have made upon the orientations that shown in the table below.

Frequency Bands	ANT1	ANT2	ANT3	ANT4	ANT7	ANT8	ANT9
5G NR n48 (FCC) 3300 – 3980 MHz	N/A	N/A	N/A	X	X	Z	X

Radiated spurious emissions were investigated from 9kHz to 30MHz, 30MHz-1GHz and above 1GHz. There were no emissions found with less than 20dB of margin from 9kHz to 1GHz.

For simultaneous transmission of multiple channels in the 2.4GHz/5GH WLAN, UWB, and Cellular bands, tests were conducted for various configurations having the highest power, least separation in frequencies and widest operation bandwidths. No noticeable new emission was found.

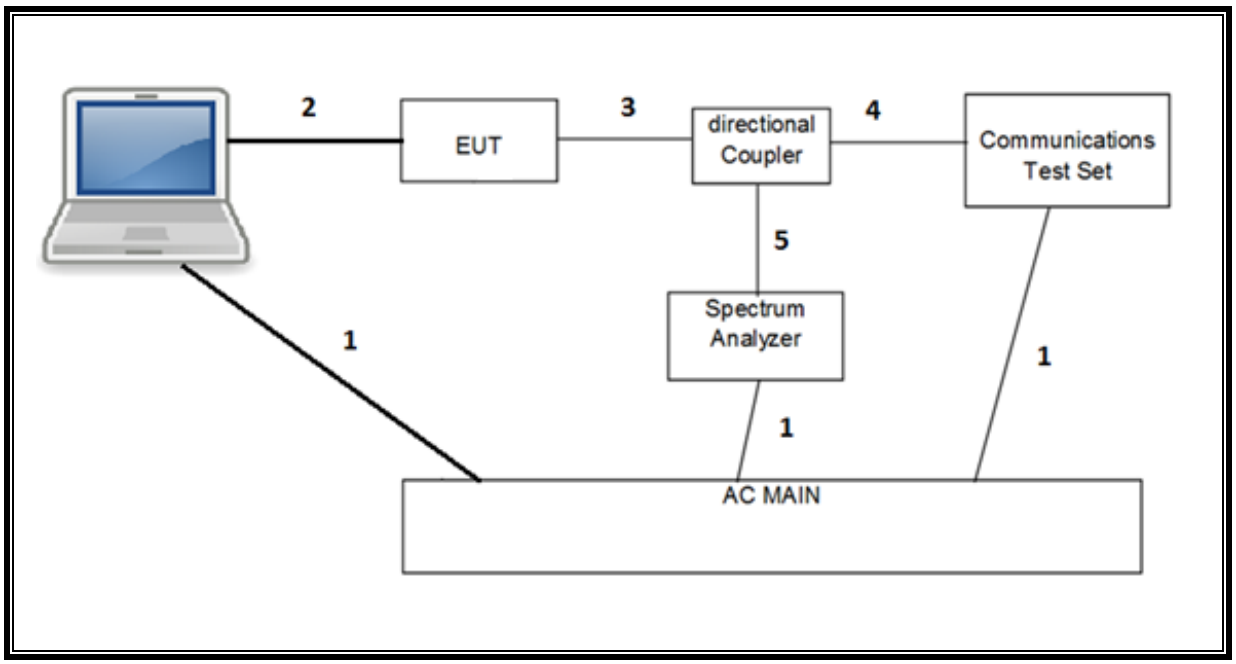
6.11. DESCRIPTION OF TEST SETUP

SUPPORT TEST EQUIPMENT				
Description	**Manufacturer**	**Model**	**Serial Number**	**FCC ID/ DoC**
Laptop	A1398	C02PM012G3QD	QDS-BRCM1069	A1398
AC/DC adapter	PA-1450-BA1	B123	N/A	PA-1450-BA1

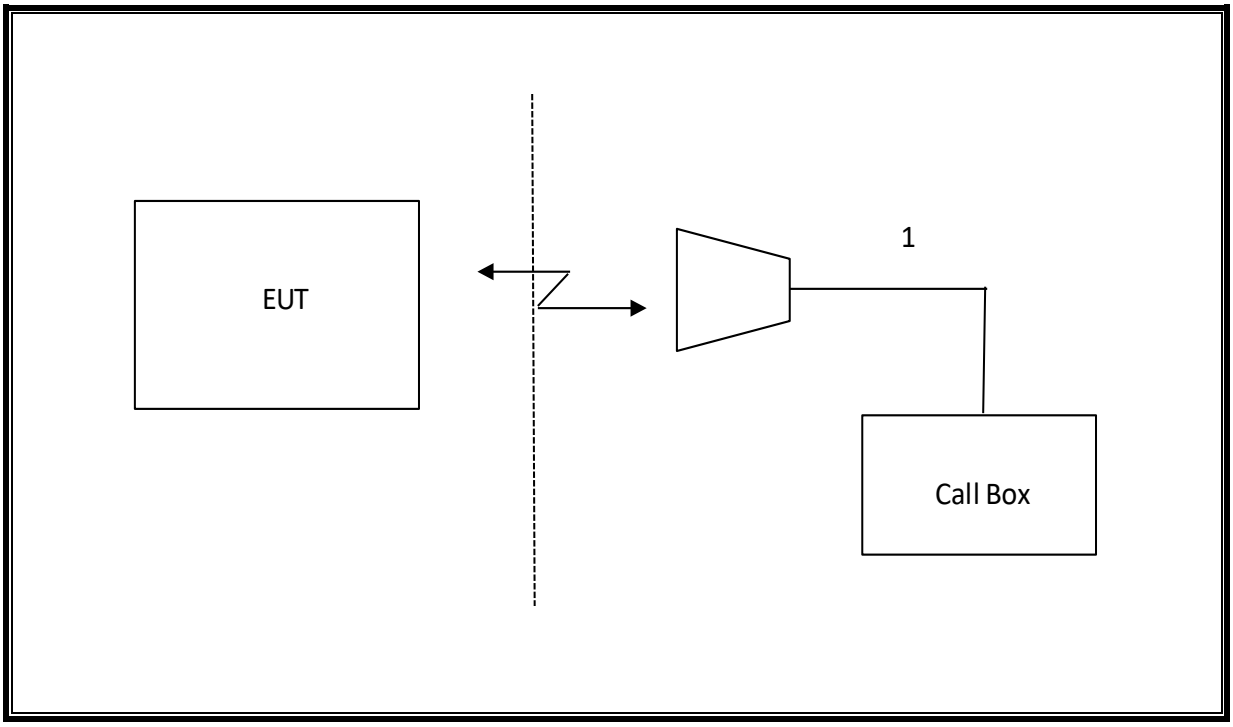
I/O CABLES (RF CONDUCTED TEST)						
Cable No.	**Port**	**# of Identical Ports**	**Connector Type**	**Cable Type**	**Cable Length (m)**	**Remarks**
1	AC	3	US 115V	Un-shielded	2.0	N/A
2	USB	1	DC	Un-shielded	1.0	N/A
3	RF In/Out	1	EUT	Un-shielded	0.6	N/A
4	RF In/Out	1	Communication Test Set	Un-shielded	1.2	N/A
5	RF In/Out	1	Barrel	N/A	N/A	N/A

I/O CABLES (RF RADIATED TEST)						
Cable No.	**Port**	**# of Identical Ports**	**Connector Type**	**Cable Type**	**Cable Length (m)**	**Remarks**
1	RF In/Out	1	Antenna	Un-shielded	5.0	N/A

CONDUCTED SETUP



RADIATED SETUP



7. TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment was utilized for the tests documented in this report:

TEST EQUIPMENT LIST				
Description	**Manufacturer**	**Model**	**Asset**	**Cal Due**
Antenna, Horn 1-18GHz	ETS Lindgren	3117	T136	7/21/2022
Antenna, Broadband Hybrid, 30MHz to 2000MHz	Sunol Sciences Corp.	JB3	T899	9/14/2021
RF Amplifier, 1-18GHz	MITEQ	AFS42-00101800-25-S-42	T1165	6/12/2022
Amplifier, 100KHz to 1GHz, 32dB	Keysight Technologies Inc	8447D	T15	1/14/2022
Spectrum Analyzer, PXA, 3Hz to 44GHz	Keysight Technologies Inc	N9030A	T1450	1/21/2022
Chamber, Environmental	Cincinnati Sub Zero	ZPHS-8-3.5-SCT/WC	T754	6/21/2022
Filter, BRF 3400 to 3800MHz	MICRO-TRONICS	BRM50711-02	T1792	6/23/2022
Antenna, Horn 18 to 26.5GHz	ARA	MWH-1826/B	T449	4/22/2022
Amplifier, 1 to 26.5GHz, 23.5dB Gain minimum	Keysight Technologies Inc	8449B	T404	4/19/2022
Antenna, Horn 26.5 to 40GHz	A.R.A.	MWH-2640/B	PRE0182201	4/22/2022
Amplifier, 26 - 40GHz	MITEQ	TTA2640-35-HG	T1864	4/19/2022
Spectrum Analyzer, PXA, 3Hz to 44GHz	Keysight Technologies Inc	N9030A	T1454	1/27/2022
Power Meter, P-series single channel	Keysight Technologies Inc	N1911A	T1271	1/20/2022
Power Sensor, P - series, 50MHz to 18GHz, Wideband	Keysight Technologies Inc	N1921A	T1228	4/13/2022
Power Meter, P-series single channel	Keysight Technologies Inc	N1912A	T1245	1/21/2022
Power Sensor, P - series, 50MHz to 18GHz, Wideband	Keysight Technologies Inc	N1921A	T1226	2/19/2022
Antenna, Active Loop 9KHz to 30MHz	EMCO	6502	T35	11/23/2021
UL AUTOMATION SOFTWARE				
CLT Software	UL	UL RF	Ver 3.2.5, 4/13/2021	
Power Measurement Software	UL	UL RF	Ver 3.1.2 5/17/2021	
Radiated test software	UL	UL RF	Ver 9.5, 4/14/2021	

NOTES:

* Testing is completed before equipment expiration date.

8. RF OUTPUT POWER VERIFICATION

CONDUCTED OUTPUT POWER MEASUREMENT PROCEDURE

All LTE bands conducted average power is obtained from the CMW500 telecommunication test set.

The following tests were conducted according to the test requirements outlined in section 6.2 of the 3GPP TS136.101 specification.

UE Power Class: 3 (23 +/- 2dBm). Band 41 UE Power Class: 2 (26 +/-2 dBm).The allowed Maximum Power Reduction (MPR) for the maximum output power due to higher order modulation and transmit bandwidth configuration (resource blocks) is specified in Table 6.2.3-1 of the 3GPP TS136.101.

Table 6.2.3-1: Maximum Power Reduction (MPR) for Power Class 1, 2 and 3

Modulation	Channel bandwidth / Transmission bandwidth (N_{RB})						MPR (dB)
	1.4 MHz	3.0 MHz	5 MHz	10 MHz	15 MHz	20 MHz	
QPSK	> 5	> 4	> 8	> 12	> 16	> 18	≤ 1
16 QAM	≤ 5	≤ 4	≤ 8	≤ 12	≤ 16	≤ 18	≤ 1
16 QAM	> 5	> 4	> 8	> 12	> 16	> 18	≤ 2
64 QAM	≤ 5	≤ 4	≤ 8	≤ 12	≤ 16	≤ 18	≤ 2
64 QAM	> 5	> 4	> 8	> 12	> 16	> 18	≤ 3
256 QAM	≥ 1						≤ 5

The following tests were conducted according to the test requirements outlined in section 6.2 of the 3GPP TS138.521-1 specification.

The allowed MPR for SRS, PUCCH formats 0, 1, 3 and 4, and PRACH shall be as specified for QPSK modulated DFTs-OFDM of equivalent RB allocation. The allowed MPR for PUCCH format 2 shall be as specified for QPSK modulated CP-OFDM of equivalent RB allocation.

Table 6.2.2.3-1: Maximum power reduction (MPR) for power class 3

Modulation		MPR (dB)		
		Edge RB allocations	Outer RB allocations	Inner RB allocations
DFT-s-OFDM	Pi/2 BPSK	≤ 3.5[1]	≤ 1.2[1]	≤ 0.2[1]
		≤ 0.5[2]		0[2]
	Pi/2 BPSK w Pi/2 BPSK DMRS	≤ 0.5[2]		0[2]
	QPSK	≤ 1		0
	16 QAM	≤ 2		≤ 1
	64 QAM	≤ 2.5		
	256 QAM	≤ 4.5		
CP-OFDM	QPSK	≤ 3		≤ 1.5
	16 QAM	≤ 3		≤ 2
	64 QAM	≤ 3.5		
	256 QAM	≤ 6.5		

NOTE 1: Applicable for UE operating in TDD mode with Pi/2 BPSK modulation and UE indicates support for UE capability *powerBoosting-pi2BPSK* and if the IE *powerBoostPi2BPSK* is set to 1 and 40 % or less slots in radio frame are used for UL transmission for bands n40, n41, n77, n78 and n79. The reference power of 0dB MPR is 26dBm.

NOTE 2: Applicable for UE operating in FDD mode, or in TDD mode in bands other than n40, n41, n77, n78 and n79 with Pi/2 BPSK modulation and if the IE *powerBoostPi2BPSK* is set to 0 and if more than 40% of slots in radio frame are used for UL transmission for bands n40, n41, n77, n78 and n79.

Table 6.2.2.3-2: Maximum power reduction (MPR) for power class 2

Modulation		MPR (dB)		
		Edge RB allocations	Outer RB allocations	Inner RB allocations
DFT-s-OFDM	Pi/2 BPSK	≤ 3.5	≤ 0.5	0
	QPSK	≤ 3.5	≤ 1	0
	16 QAM	≤ 3.5	≤ 2	≤ 1
	64 QAM	≤ 3.5	≤ 2.5	
	256 QAM	≤ 4.5		
CP-OFDM	QPSK	≤ 3.5	≤ 3	≤ 1.5
	16 QAM	≤ 3.5	≤ 3	≤ 2
	64 QAM	≤ 3.5		
	256 QAM	≤ 6.5		

The allowed A-MPR values specified below in Table 6.2.4.-1 of 3GPP TS136.101 are in addition to the allowed MPR requirements. All the measurements below were performed with A-MPR disabled, by using Network Signaling Value of "NS_01".

Table 6.2.4-1: Additional Maximum Power Reduction (A-MPR)

Network Signalling value	Requirements (subclause)	E-UTRA Band	Channel bandwidth (MHz)	Resources Blocks (N_{RB})	A-MPR (dB)
NS_01	6.6.2.1.1	Table 5.5-1	1.4, 3, 5, 10, 15, 20	Table 5.6-1	N/A
NS_03	6.6.2.2.1	2, 4,10, 23, 25, 35, 36, 66, 70	3	>5	≤ 1
			5	>6	≤ 1
			10	>6	≤ 1
			15	>8	≤ 1
			20	>10	≤ 1
NS_04	6.6.2.2.2, 6.6.3.3.19	41	5, 10, 15, 20	Table 6.2.4-4, Table 6.2.4-4a	

The allowed A-MPR values specified below in Table 6.2.3.3.1-1 of 3GPP TS 38.521-1 are in addition to the allowed MPR requirements. All the measurements below were performed with A-MPR disabled, by using Network Signaling Value of "NS_01".

Table 6.2.3.3.1-1: Additional maximum power reduction (A-MPR)

Network signalling label	Requirements (subclause)	NR Band	Channel bandwidth (MHz)	Resources blocks (N_{RB})	A-MPR (dB)
NS_01		Table 5.2-1	5, 10, 15, 20, 25, 30, 40, 50, 60, 80, 90, 100	Table 5.3.2-1	N/A
NS_03	6.5.2.3.3.3	n2, n25, n66, n70, n86			Clause 6.2.3.3.7
NS_03U	6.5.2.3.3.3, 6.5.2.4.2.3	n2, n25, n66, n86			Clause 6.2.3.3.7
NS_04	6.5.2.3.3.2, 6.5.3.3.3.1	n41	10, 15, 20, 40, 50, 60, 80, 90, 100		Clause 6.2.3.3.2

RESULTS

EUT includes different power levels for head use configuration and body use configuration and the below tables contain the highest of all configurations average conducted output powers as follows:

8.1. 5G NR n48

Test Engineer ID:	10641	Test Date:	5/30/2021

OUTPUT POWER FOR 5G NR n48 (10.0 MHz)

Bandwidth (MHz)	Modulation	RB Allocation	RB Offset	Conducted Average (dBm)											
				ANT 7			ANT 8			ANT 9			ANT 4		
				637000	641666	646333	637000	641666	646333	637000	641666	646333	637000	641666	646333
				3555.0	3625.0	3695.0	3555.0	3625.0	3695.0	3555.0	3625.0	3695.0	3555.0	3625.0	3695.0
10.0	BPSK	1	0	25.52	25.51	25.37	22.48	21.67	21.88	24.51	24.49	24.30	22.07	21.99	21.81
		1	1	**25.57**	25.53	25.38	22.46	21.76	21.76	24.84	**24.95**	24.79	**22.61**	22.45	22.33
		1	22	24.95	25.41	25.29	22.94	22.32	22.39	24.91	24.83	24.74	21.75	22.39	22.20
		1	23	25.51	25.38	25.29	22.97	22.22	22.11	24.49	24.42	24.20	22.03	21.89	21.70
		12	6	25.45	25.38	25.22	**23.18**	22.27	22.29	24.95	24.80	24.67	22.42	22.33	22.17
		24	0	25.52	25.33	25.24	22.71	21.84	21.75	24.49	24.30	24.15	22.00	21.87	21.68
	QPSK	1	0	25.32	25.24	25.06	22.16	20.54	21.32	24.15	23.93	23.83	21.65	21.54	21.37
		1	1	**25.60**	25.49	25.39	21.98	21.23	21.18	**25.20**	24.98	24.86	**22.70**	22.56	22.36
		1	22	25.52	25.37	25.24	22.95	22.14	22.36	25.05	24.91	24.77	22.61	22.45	22.28
		1	23	25.23	25.07	24.94	23.12	22.21	22.10	23.94	23.88	23.77	21.55	21.47	21.23
		12	6	25.52	25.41	25.20	**23.20**	22.29	22.33	24.90	24.88	24.66	22.48	22.32	21.74
		24	0	25.16	25.04	24.89	22.22	21.34	21.26	23.93	23.80	23.66	21.46	21.35	21.15
	16QAM	1	0	24.27	24.12	23.80	20.02	19.89	20.21	23.13	22.92	22.74	20.67	20.57	20.43
		1	1	**25.29**	25.06	24.97	20.17	20.09	19.90	**24.02**	23.91	23.69	**21.69**	21.56	21.42
		1	22	25.13	25.07	24.96	21.00	21.06	21.11	23.93	23.85	23.67	21.61	21.47	21.34
		1	23	24.10	24.01	23.92	21.89	20.81	20.88	22.91	22.87	22.63	20.60	20.45	20.34
		12	6	25.19	25.16	24.94	**22.24**	21.30	21.23	23.99	23.82	23.68	21.35	21.36	21.09
		24	0	24.09	23.95	23.14	21.24	20.38	20.33	22.89	22.71	22.57	20.37	20.24	20.09
	64QAM	1	0	23.73	23.51	23.43	20.70	19.99	20.18	**22.82**	22.73	22.59	**20.24**	20.18	19.96
		1	1	**23.73**	23.45	23.48	20.56	20.05	20.02	22.80	22.74	22.58	20.18	20.18	20.00
		1	22	23.45	23.56	23.18	20.71	20.07	20.25	22.65	22.52	22.51	20.16	20.12	19.81
		1	23	23.50	23.50	23.11	**21.00**	19.95	20.00	22.73	22.39	22.46	20.11	20.06	19.79
		12	6	23.52	23.44	23.33	20.78	19.94	19.84	22.47	22.37	22.18	20.04	19.84	19.65
		24	0	23.69	23.55	23.40	20.64	19.87	19.80	22.44	22.29	22.10	19.99	19.82	19.70
	256QAM	1	0	21.72	21.60	21.51	18.62	17.84	18.01	20.36	20.20	20.13	17.93	17.73	17.58
		1	1	21.70	21.63	21.55	18.43	17.88	17.84	20.38	20.26	20.10	**18.03**	17.78	17.62
		1	22	21.74	21.46	21.49	18.52	17.86	17.97	20.33	20.24	20.05	17.97	17.80	17.58
		1	23	21.57	21.50	21.46	18.56	17.82	17.92	20.44	20.15	20.01	17.90	17.78	17.61
		12	6	**21.77**	21.55	21.48	**18.67**	17.76	17.71	**20.53**	20.30	20.05	17.97	17.80	13.80
		24	0	21.66	21.49	21.45	18.65	17.89	17.83	20.21	20.32	20.09	17.95	17.84	17.57

OUTPUT POWER FOR 5G NR n48 (20.0 MHz)

Bandwidth (MHz)	Modulation	RB Allocation	RB Offset	Conducted Average (dBm)											
				ANT 7			ANT 8			ANT 9			ANT 4		
				637333	641666	646000	637333	641666	646000	637333	641666	646000	637333	641666	646000
				3560.0	3625.0	3690.0	3560.0	3625.0	3690.0	3560.0	3625.0	3690.0	3560.0	3625.0	3690.0
20.0	BPSK	1	0	**25.60**	25.39	25.29	22.68	21.68	21.63	24.62	24.56	24.30	22.12	22.04	21.91
		1	1	25.57	25.42	25.24	22.60	21.58	21.24	**25.20**	25.13	24.80	**22.65**	22.53	22.40
		1	49	25.47	25.23	25.20	**23.20**	22.16	22.06	24.87	24.84	24.69	22.64	22.35	22.20
		1	50	25.49	25.20	25.02	23.07	22.05	21.56	24.53	24.41	24.19	22.14	21.89	21.75
		25	12	25.40	25.25	24.07	23.09	22.14	21.87	24.90	24.89	24.62	22.62	22.40	22.31
		50	0	25.47	25.23	25.10	22.67	21.70	21.30	24.36	24.41	24.10	22.07	21.89	21.80
	QPSK	1	0	25.30	25.09	24.95	22.13	21.21	21.14	24.64	24.11	23.79	21.75	21.67	21.48
		1	1	**25.57**	25.50	25.30	22.07	21.02	20.67	**25.14**	25.08	24.83	**22.70**	22.60	22.46
		1	49	25.49	25.26	25.22	**23.12**	22.13	21.99	25.11	24.92	24.65	22.67	22.45	22.28
		1	50	25.12	24.89	24.88	23.03	22.08	21.65	24.54	23.88	23.65	21.74	21.43	21.25
		25	12	25.39	25.35	25.20	**23.12**	22.20	21.89	24.91	24.83	24.62	22.58	22.41	22.30
		50	0	25.12	24.97	24.80	22.12	21.22	20.85	24.39	23.84	23.57	21.55	21.40	21.25
	16QAM	1	0	24.12	24.13	23.87	20.91	20.05	19.92	23.04	23.14	22.69	20.72	20.73	20.40
		1	1	25.11	25.05	24.85	21.00	19.90	19.37	**24.09**	23.95	23.59	21.68	21.65	21.48
		1	49	**25.14**	24.79	24.83	21.93	20.82	20.79	23.39	23.97	23.57	**21.69**	21.44	21.27
		1	50	24.12	23.78	23.77	21.67	20.85	20.14	22.91	22.61	22.49	20.71	20.58	20.25
		25	12	25.01	24.94	24.92	**22.11**	21.19	20.92	23.90	23.90	23.56	21.55	21.40	21.27
		50	0	24.15	23.92	23.74	21.14	20.28	19.89	22.91	22.84	18.59	20.52	20.42	20.23
	64QAM	1	0	**23.65**	23.45	23.50	20.96	20.12	19.52	**22.86**	22.78	22.51	20.24	20.18	19.90
		1	1	23.54	23.36	23.47	**20.98**	19.94	19.41	22.80	22.77	22.38	20.05	20.16	19.94
		1	49	23.61	23.11	23.37	20.88	19.96	19.88	22.64	22.54	22.34	20.17	20.07	19.81
		1	50	23.50	23.23	23.21	20.91	19.97	19.43	22.71	22.57	22.30	**20.26**	20.00	19.83
		25	12	23.56	23.45	23.51	20.65	19.67	19.33	22.36	22.35	22.09	20.02	19.91	19.72
		50	0	23.64	23.43	23.31	20.61	19.52	19.07	22.34	22.30	22.06	19.99	19.88	19.77
	256QAM	1	0	**21.84**	21.48	21.52	18.67	17.88	17.74	20.39	20.42	20.05	**18.14**	17.99	17.92
		1	1	21.71	21.60	21.52	18.69	17.76	17.26	20.27	**20.43**	20.03	17.88	17.97	17.85
		1	49	21.69	21.34	21.31	18.72	17.72	17.53	20.32	20.27	19.93	17.94	17.85	17.70
		1	50	21.52	21.53	21.49	**18.87**	17.88	17.29	20.20	20.24	19.95	17.94	17.76	17.67
		25	12	21.52	21.41	21.40	18.60	17.71	17.39	20.38	20.37	20.17	18.07	17.90	17.74
		50	0	21.54	21.42	21.29	18.61	17.67	17.22	20.33	20.24	20.09	18.00	17.86	17.72

OUTPUT POWER FOR 5G NR n48 (40.0 MHz)

Bandwidth (MHz)	Modulation	RB Allocation	RB Offset	Conducted Average (dBm)											
				ANT 7			ANT 8			ANT 9			ANT 4		
				638000	641666	645333	638000	641666	645333	638000	641666	645333	638000	641666	645333
				3570.0	3625.0	3680.0	3570.0	3625.0	3680.0	3570.0	3625.0	3680.0	3570.0	3625.0	3680.0
40.0	BPSK	1	0	24.90	23.93	24.78	22.48	22.51	22.62	24.76	24.54	24.26	22.08	22.04	21.11
		1	1	25.27	23.86	25.20	23.12	22.93	22.84	25.01	24.74	24.78	22.62	22.46	21.51
		1	104	24.71	23.85	24.97	22.95	**23.20**	22.45	24.43	24.34	24.28	22.07	21.88	20.97
		1	105	**25.43**	23.97	24.38	22.48	22.48	22.12	**25.20**	24.98	24.73	**22.70**	22.53	21.68
		50	25	25.30	25.07	24.97	22.77	22.76	22.51	24.79	24.73	24.57	22.35	22.26	21.37
		100	0	21.13	24.97	22.61	18.55	22.57	19.62	20.45	24.42	21.29	18.87	22.33	19.57
	QPSK	1	0	24.46	23.66	24.18	21.92	21.96	22.08	24.15	23.92	23.75	21.68	21.55	20.61
		1	1	**25.60**	23.79	25.17	22.94	22.94	22.56	25.06	24.66	24.79	22.56	22.36	21.54
		1	104	24.56	23.64	24.90	22.90	**23.00**	22.50	23.97	23.72	23.77	21.57	21.40	20.66
		1	105	25.23	23.93	24.07	21.93	21.98	21.60	**25.11**	24.97	24.77	**22.64**	22.50	21.61
		50	25	25.23	25.06	25.08	22.76	22.75	22.62	24.74	24.73	24.58	22.33	22.27	21.38
		100	0	21.32	24.35	22.65	18.15	21.72	19.55	20.43	24.05	21.15	18.73	21.13	19.34
	16QAM	1	0	23.35	22.59	23.51	20.91	20.77	20.72	22.99	22.91	22.67	19.58	20.55	19.89
		1	1	24.03	23.61	24.42	21.76	21.74	21.54	23.91	23.67	23.81	21.65	21.50	20.68
		1	104	24.16	22.97	24.18	21.85	**21.93**	21.35	22.80	22.60	22.72	20.59	20.30	19.68
		1	105	**24.44**	23.19	23.09	20.77	20.94	20.29	24.21	**24.27**	23.71	21.65	**21.67**	20.75
		50	25	24.11	24.20	24.34	21.79	21.79	21.63	23.76	23.75	23.62	21.28	21.23	20.42
		100	0	21.46	23.05	22.74	18.32	20.62	19.48	20.60	22.34	21.04	18.80	20.27	19.15
	64QAM	1	0	23.01	21.90	22.74	20.88	**20.93**	20.54	22.80	22.73	22.49	**20.29**	20.09	19.25
		1	1	23.03	21.95	22.78	20.88	20.76	20.71	22.62	22.52	22.56	20.19	19.97	19.25
		1	104	22.91	21.96	22.62	20.72	20.67	20.34	22.72	22.48	22.48	20.20	19.95	19.24
		1	105	**23.45**	21.88	22.56	20.85	20.89	20.37	**22.84**	22.61	22.60	20.19	20.18	19.24
		50	25	22.47	22.69	22.80	20.25	20.29	20.12	22.20	22.27	22.11	19.72	19.68	18.91
		100	0	21.47	22.47	22.55	18.52	20.05	19.47	20.56	22.11	21.33	18.69	19.28	19.75
	256QAM	1	0	**21.66**	20.00	20.31	18.76	18.64	18.42	20.21	20.16	20.08	18.04	17.97	17.24
		1	1	20.40	19.91	20.78	18.90	18.66	17.98	20.01	19.97	20.11	18.03	17.69	16.94
		1	104	20.23	19.94	20.44	18.39	18.57	18.04	20.09	19.90	20.07	17.83	17.58	17.17
		1	105	21.30	20.46	20.31	18.76	18.51	18.15	20.30	20.22	20.19	18.03	17.93	17.17
		50	25	20.72	20.59	20.50	18.29	18.31	18.17	20.15	20.16	19.88	17.72	17.64	16.89
		100	0	21.02	20.02	21.31	**18.98**	18.11	18.79	**20.89**	20.06	20.71	18.51	17.21	**18.89**

9. CONDUCTED TEST RESULTS

9.1. OCCUPIED BANDWIDTH

RULE PART(S)
FCC: §2.1049

LIMITS
For reporting purposes only.

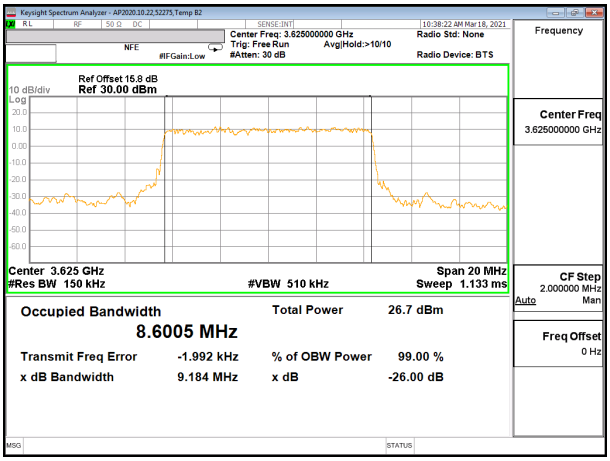
TEST PROCEDURE
The transmitter output was connected to a calibrated coaxial cable and coupler, the other end of which was connected to a spectrum analyzer. The occupied bandwidth was measured with the spectrum analyzer at the middle channel in each band. The 99% and -26dB bandwidths was also measured and recorded.

RESULTS
There is no limit required and power is the same for low, middle and high channel; therefore, only middle channel was tested. Worst-case plots (highest bandwidth) are reported only.

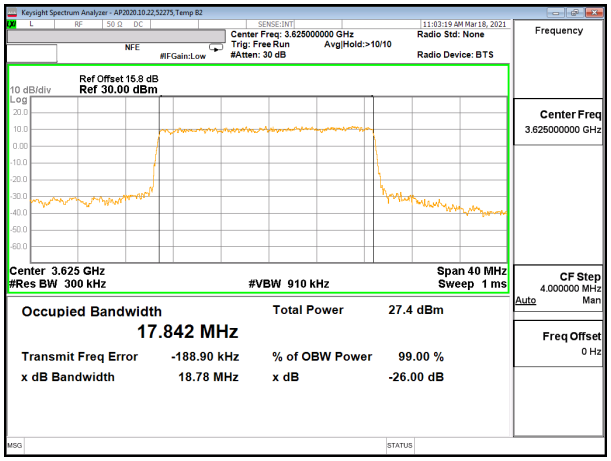
5G NR n48

Band	Mode	RB Allocation/RB Offset	f(MHz)	99% BW (MHz)	-26dB BW (MHz)
5G NR n48 (FCC)	10MHz, BPSK	24/0	3625.0	8.601	9.184
	10MHz, QPSK			8.613	9.104
	10MHz, 16QAM			8.559	9.132
	20MHz, BPSK	50/0		17.842	18.78
	20MHz, QPSK			17.870	18.72
	20MHz, 16QAM			17.903	18.85
	40MHz, BPSK	100/0		35.667	36.89
	40MHz, QPSK			35.713	36.90
	40MHz, 16QAM			35.733	36.89
	40MHz, BPSK	1/0		0.4755	0.748

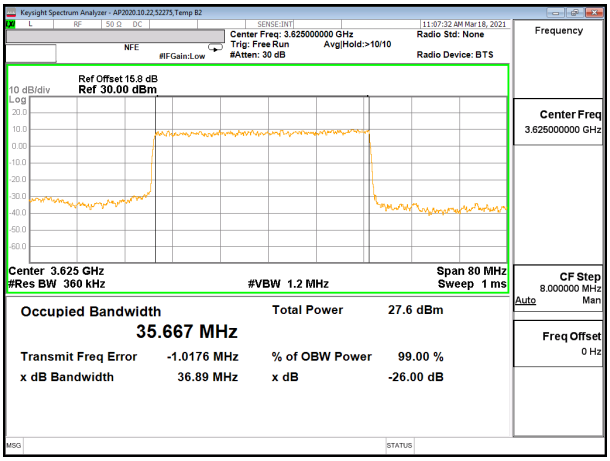
9.1.1. 5G NR n48



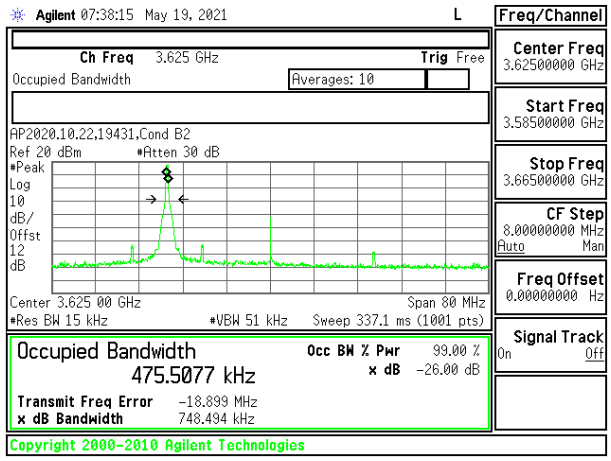
5G NR n48 10MHz BPSK Middle Channel RB24-0



5G NR n48 20MHz BPSK Middle Channel RB50-0



5G NR n48 40MHz BPSK Middle Channel RB100-0



5G NR n48 40MHz BPSK Middle Channel RB1-0

9.2. EMISSION MASK AND ADJACENT CHANNEL POWER

TEST PROCEDURE (5G NR n48)

(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 authorized frequency channel, a resolution bandwidth of no less than one percent of the fundamental emission bandwidth 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 reference 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.

(ii) When measuring unwanted emissions to demonstrate compliance with the limits, the CBSD and End User Device nominal carrier frequency/channel shall be adjusted as close to the licensee's authorized frequency block edges, both upper and lower, as the design permits.

(iii) Compliance with emission limits shall be demonstrated using either average (RMS)-detected or peak-detected power measurement techniques.

RESULTS

9.2.1. 5G NR n48 ADJACENT CHANNEL POWER

LIMITS

FCC: §96.41

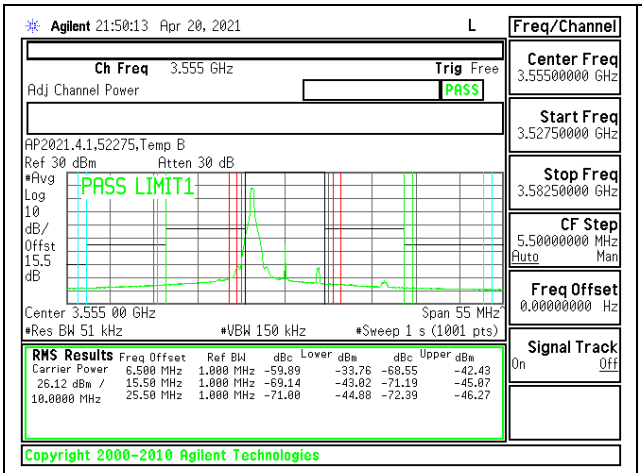
(e) 3.5 GHz Emissions and Interference Limits—

(1) General protection levels

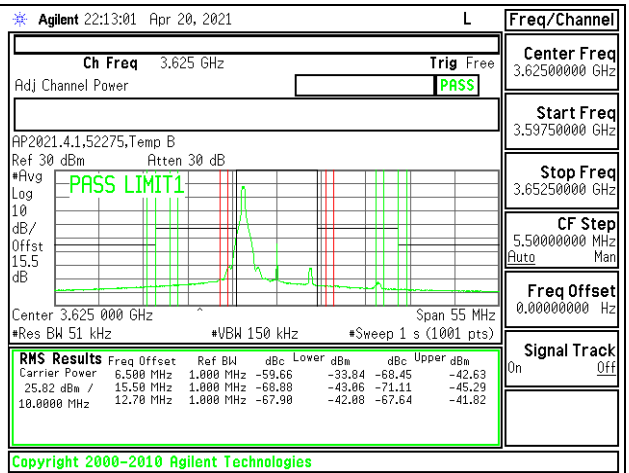
(ii) Except as otherwise specified in paragraph (e)(2) of this section, for channel and frequency assignments made by a CBSD to End User Devices, the conducted power of any End User Device emission outside the fundamental emission (whether in or outside of the authorized band) shall not exceed −13 dBm/MHz within 0 to B megahertz (where B is the bandwidth in megahertz of the assigned channel or multiple contiguous channels of the End User Device) above the upper CBSD-assigned channel edge and within 0 to B megahertz below the lower CBSD-assigned channel edge. At all frequencies greater than B megahertz above the upper CBSD assigned channel edge and less than B megahertz below the lower CBSD-assigned channel edge, the conducted power of any End User Device emission shall not exceed −25 dBm/MHz. Notwithstanding the emission limits in this paragraph, the Adjacent Channel Leakage Ratio for End User Devices shall be at least 30 dB.

(2) Additional protection levels. Notwithstanding paragraph (e)(1) of this section, for CBSDs and End User Devices, the conducted power of emissions below 3540 MHz or above 3710 MHz shall not exceed −25 dBm/MHz, and the conducted power of emissions below 3530 MHz or above 3720 MHz shall not exceed −40dBm/MHz.

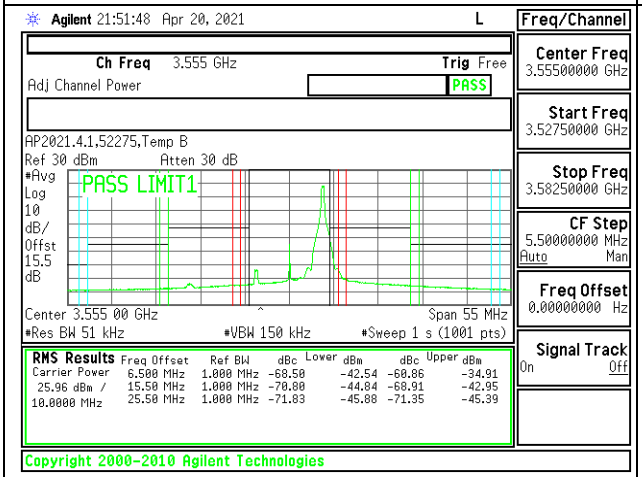
5G NR n48 ADJACENT CHANNEL POWER



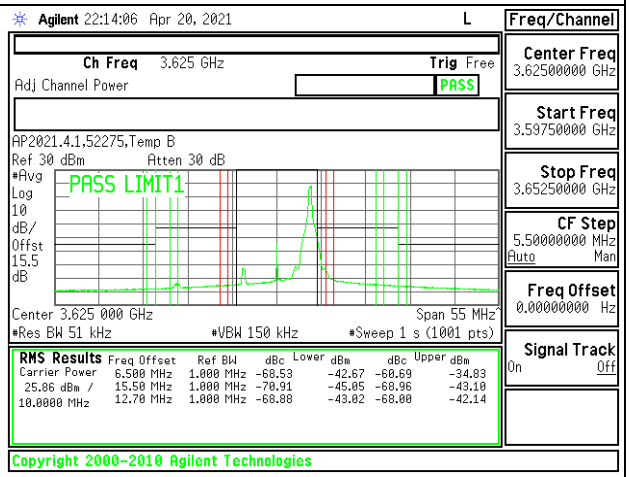
5G NR n48 10MHz BPSK Low Channel RB1-0



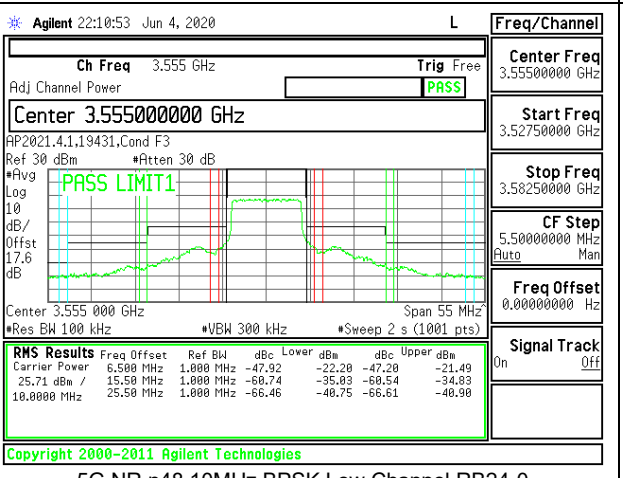
5G NR n48 10MHz BPSK Middle Channel RB1-0



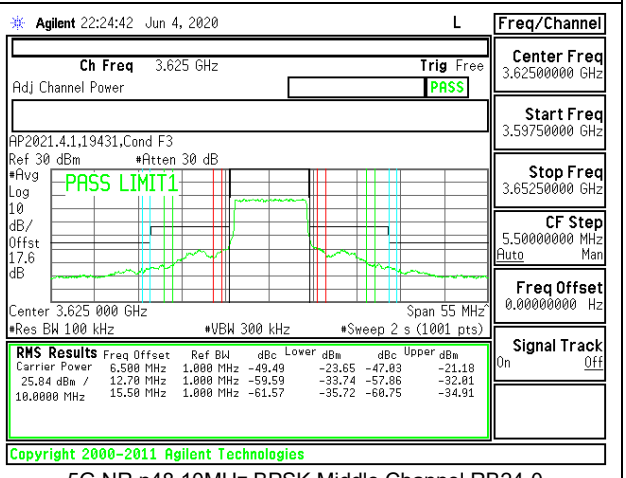
5G NR n48 10MHz BPSK Low Channel RB1-23



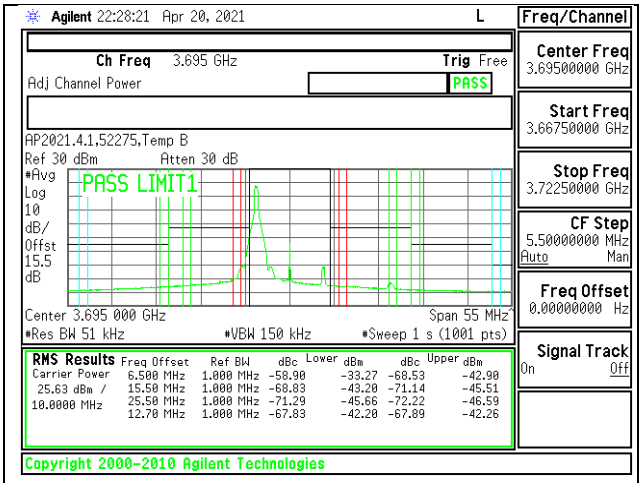
5G NR n48 10MHz BPSK Middle Channel RB1-23



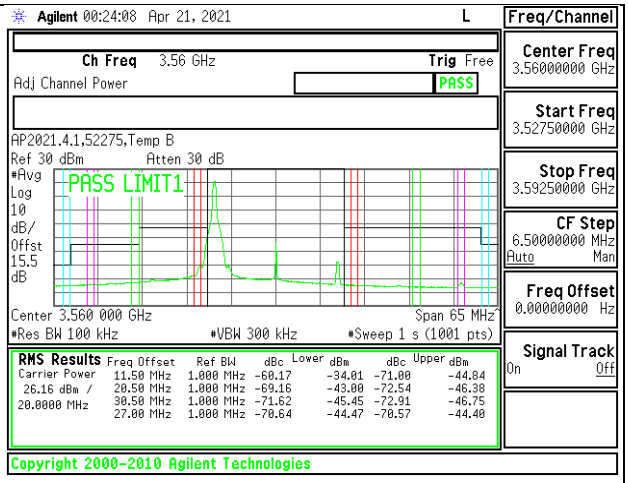
5G NR n48 10MHz BPSK Low Channel RB24-0



5G NR n48 10MHz BPSK Middle Channel RB24-0



5G NR n48 10MHz BPSK High Channel RB1-0



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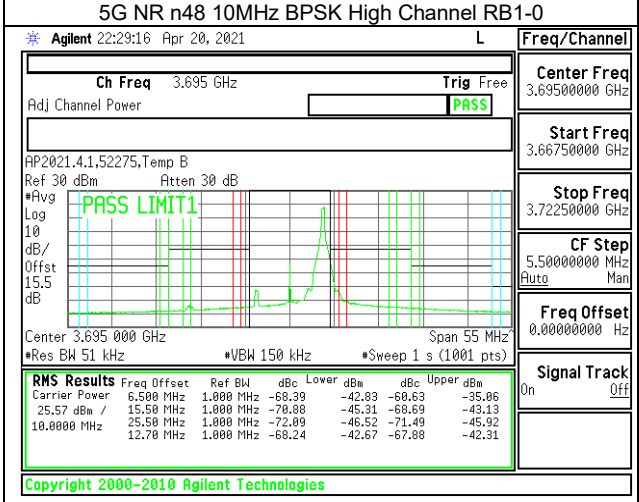

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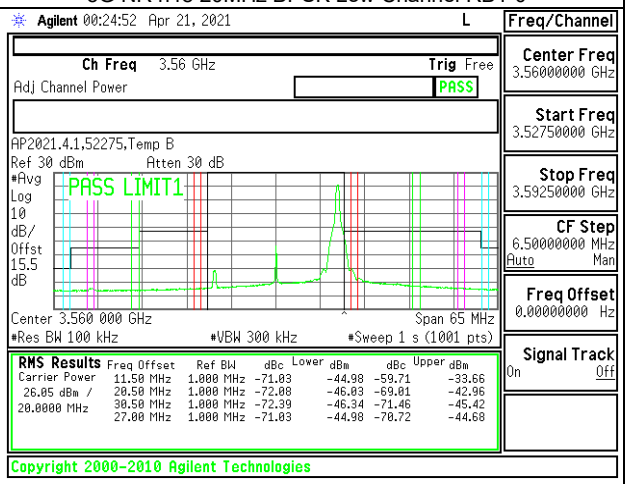

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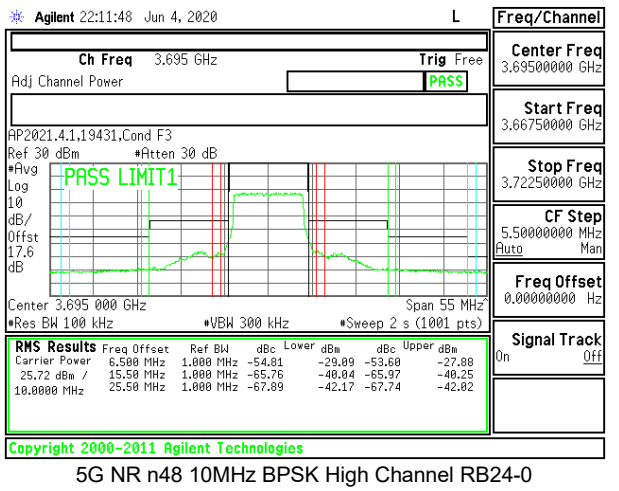

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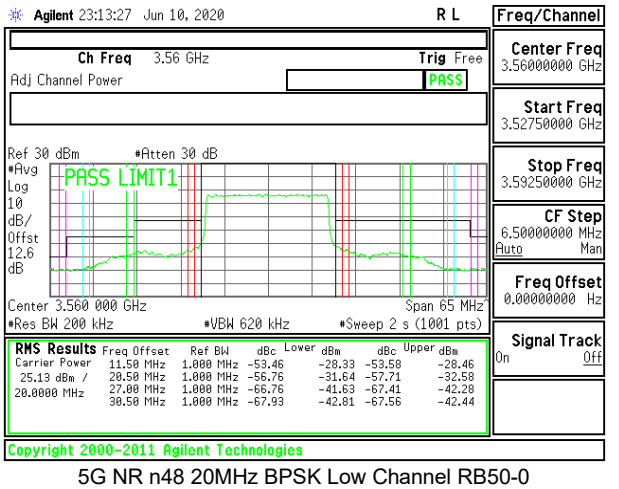

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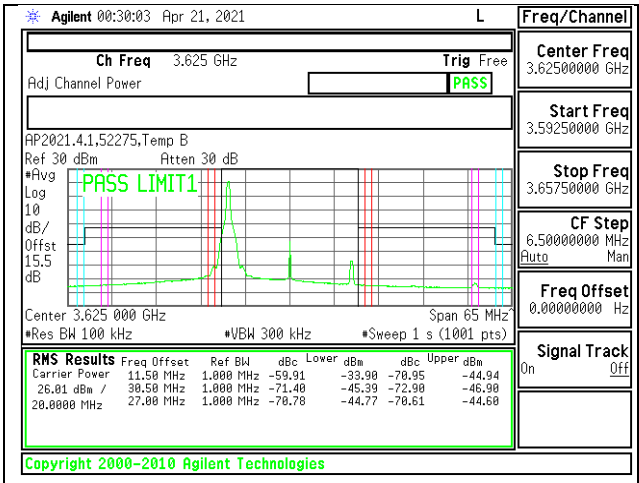
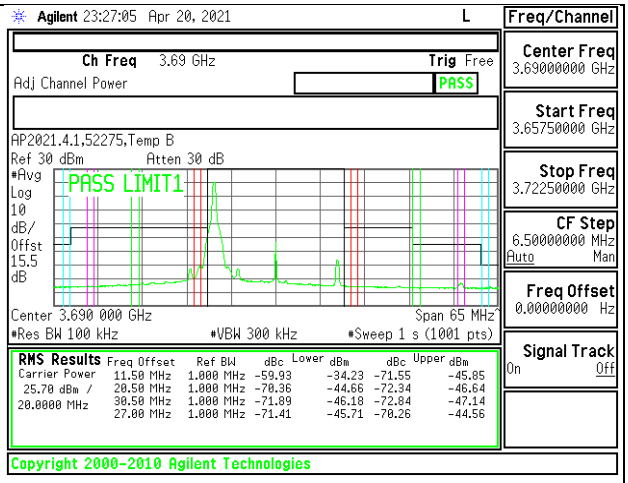


5G NR n48 20MHz BPSK Middle Channel RB1-0



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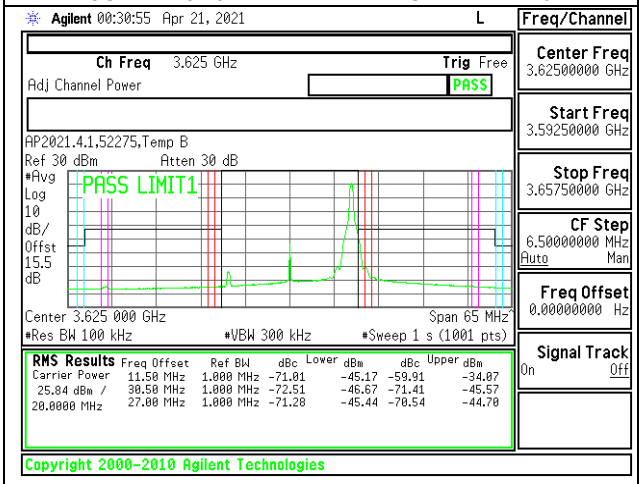
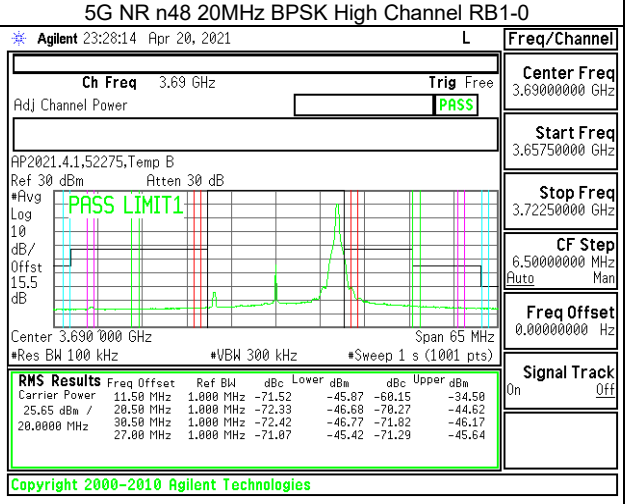
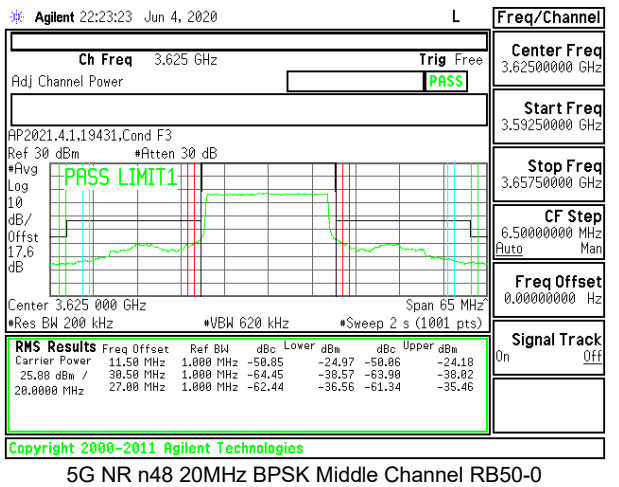


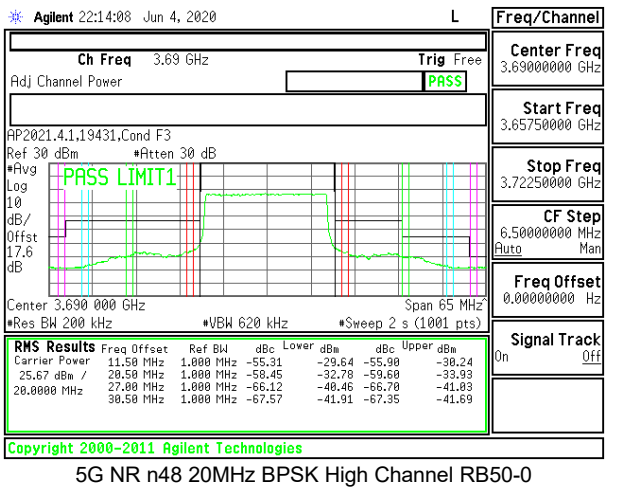
5G NR n48 20MHz BPSK Middle Channel RB1-50



5G NR n48 20MHz BPSK High Channel RB1-50



5G NR n48 20MHz BPSK Middle Channel RB50-0



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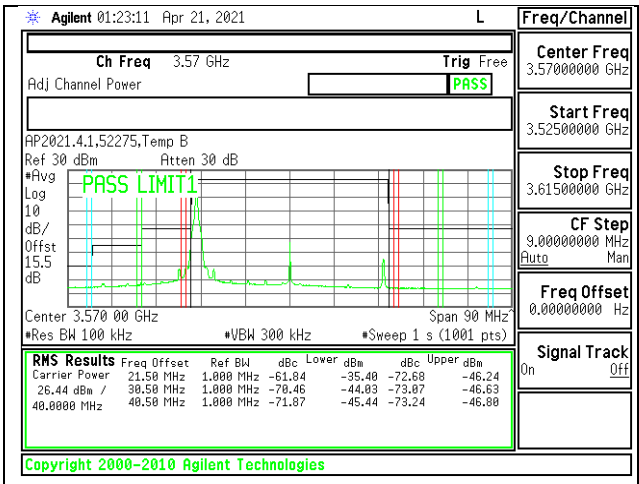
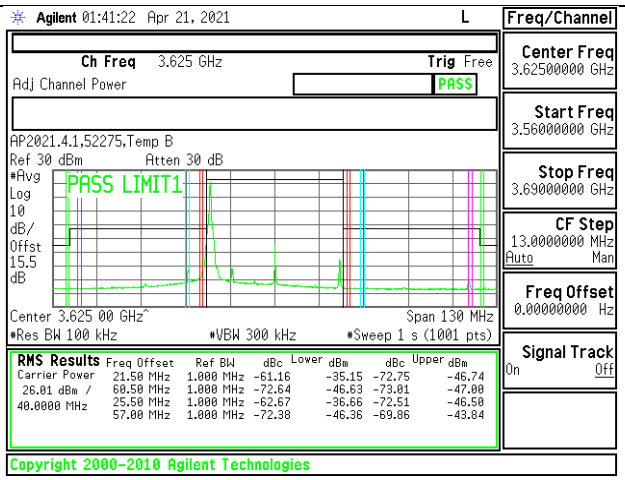
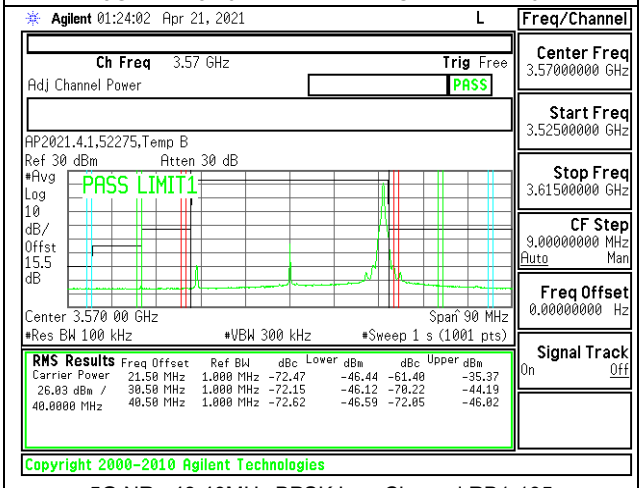


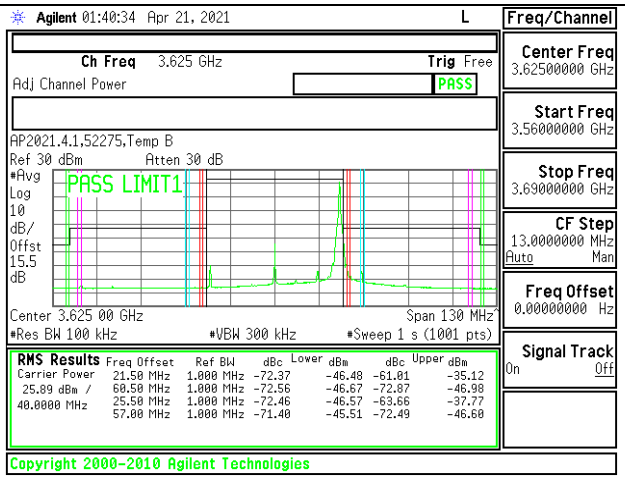
5G NR n48 40MHz BPSK Low Channel RB1-0



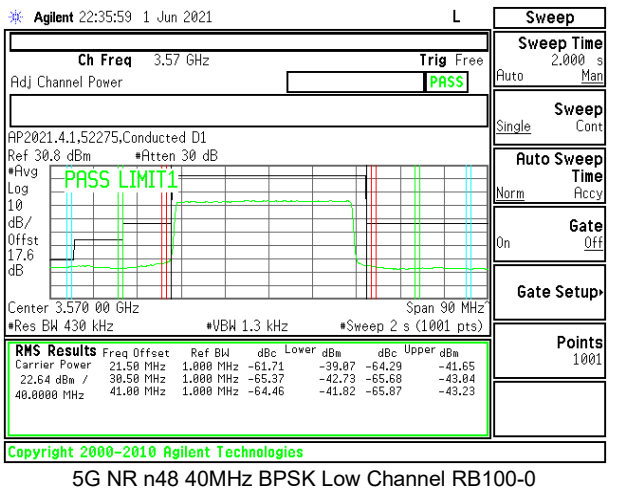
5G NR n48 40MHz BPSK Middle Channel RB1-0



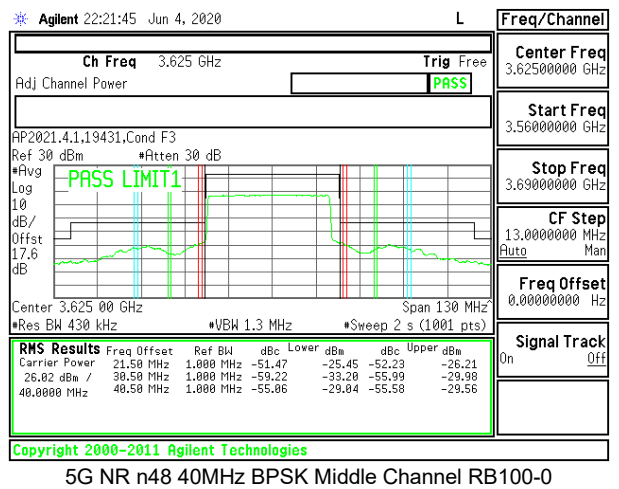
5G NR n48 40MHz BPSK Low Channel RB1-105



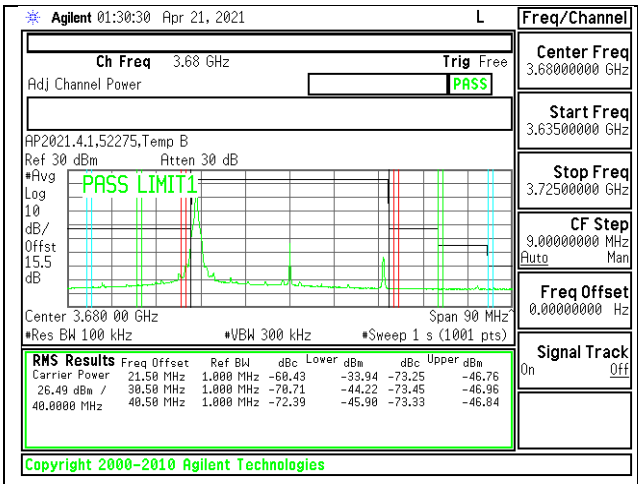
5G NR n48 40MHz BPSK Middle Channel RB1-105



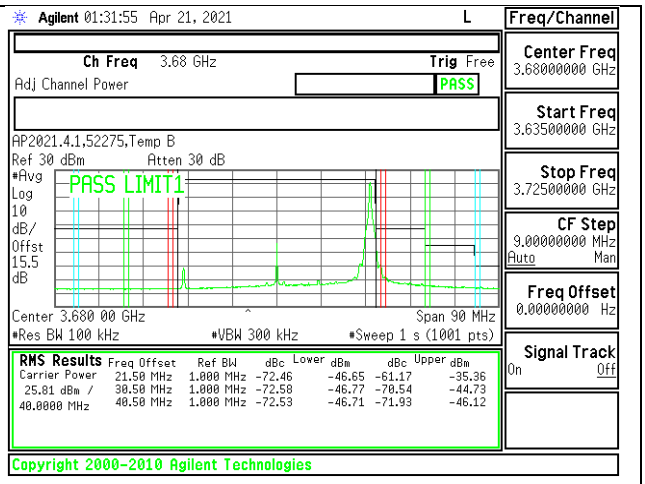
5G NR n48 40MHz BPSK Low Channel RB100-0



5G NR n48 40MHz BPSK Middle Channel RB100-0



5G NR n48 40MHz BPSK High Channel RB1-0



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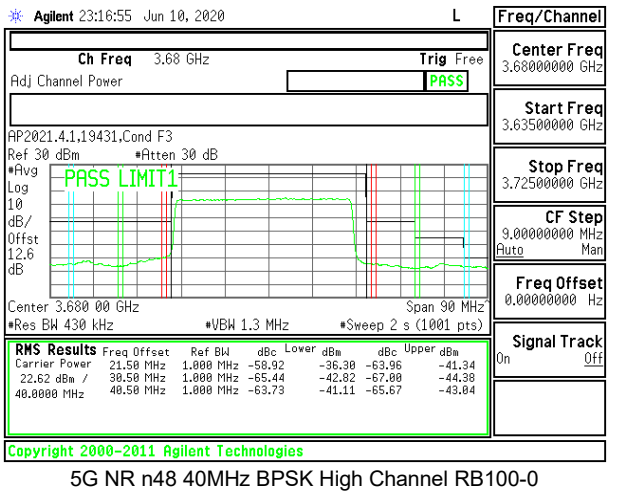


5G NR n48 40MHz BPSK High Channel RB100-0

Intentionally Blank

9.3. OUT OF BAND EMISSIONS

TEST PROCEDURE

The RF output of the transmitter was connected to a spectrum analyzer through a calibrated coaxial cable. Sufficient scans were taken to show the out-of-band Emissions, if any, up to 10th harmonic. Multiple sweeps were recorded in maximum hold mode using a peak detector to ensure that the worst-case emissions were caught.

For each out of band emissions measurement:

- Set display line at -40dBm according to the band Limit
- Set RBW & VBW to 100 kHz for the measurement below 1 GHz, and 1 MHz for the measurement above 1 GHz. (NOTE: Worst case set RBW/VBW to 1MHz/3MHz)

RESULTS

9.3.1. 5G NR n48

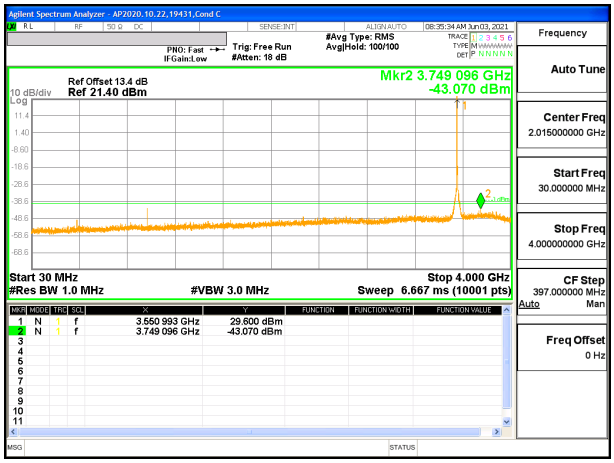
LIMITS

FCC: §96.41

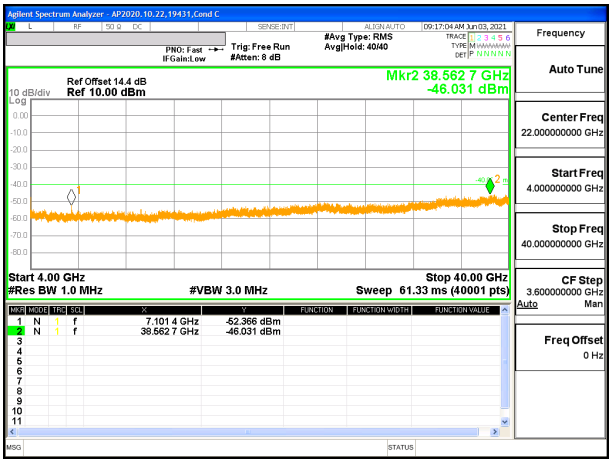
(e) 3.5 GHz Emissions and Interference Limits—

(2) Additional protection levels. Notwithstanding paragraph (e)(1) of this section, for CBSDs and End User Devices, the conducted power of emissions below 3540 MHz or above 3710 MHz shall not exceed −25 dBm/MHz, and the conducted power of emissions below 3530 MHz or above 3720 MHz shall not exceed −40dBm/MHz.

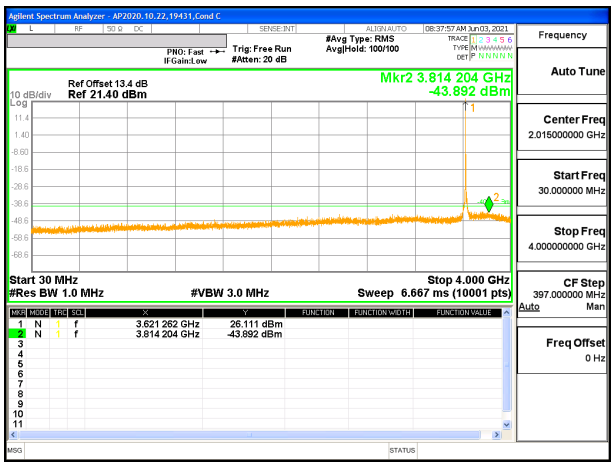
5G NR n48



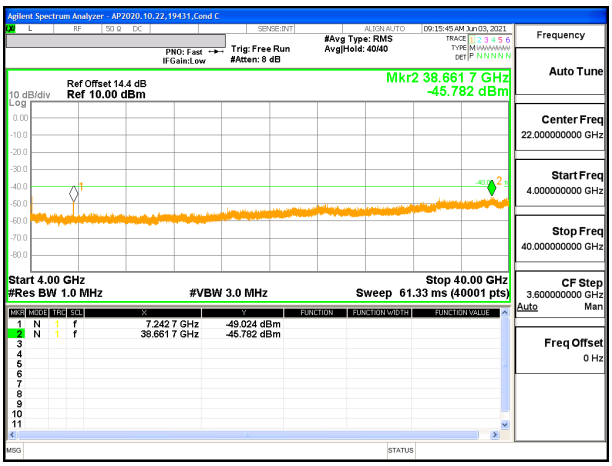
5G NR n48 10MHz BPSK Low Channel RB1-0 (30MHz to 4GHz)



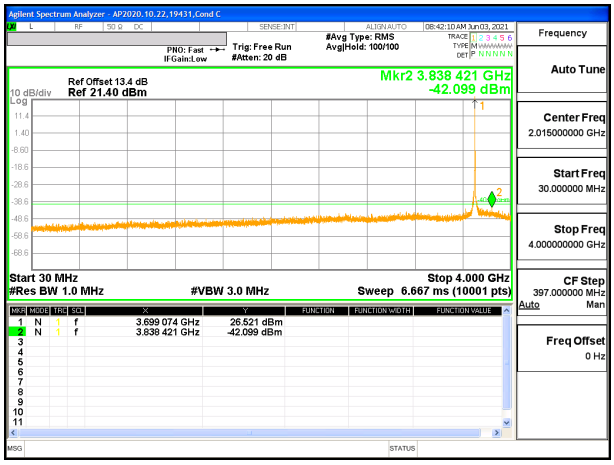
5G NR n48 10MHz BPSK Low Channel RB1-0 (4G to 40G)



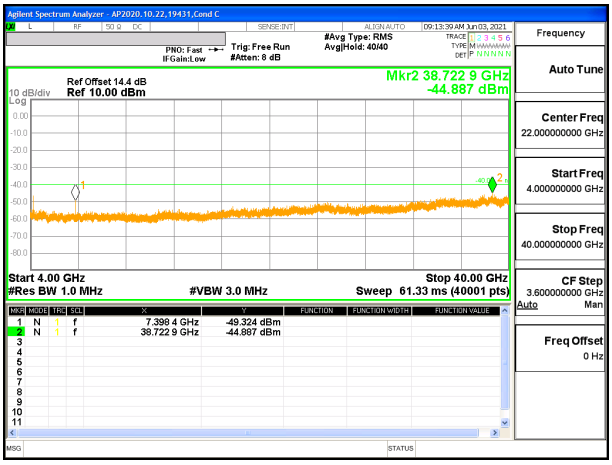
5G NR n48 10MHz BPSK Mid Channel RB1-1 (30MHz to 4GHz)



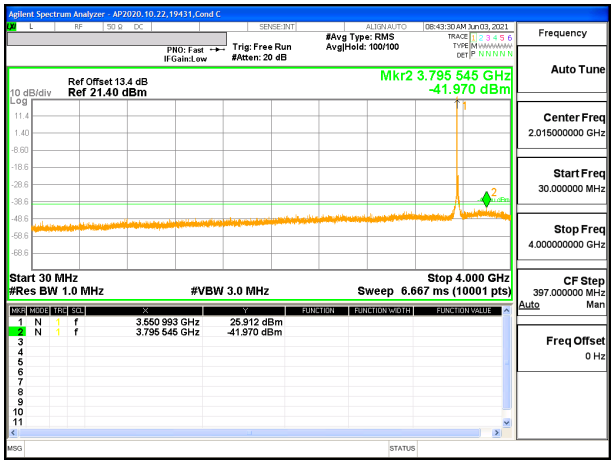
5G NR n48 10MHz BPSK Middle Channel RB1-1 (4G to 40G)



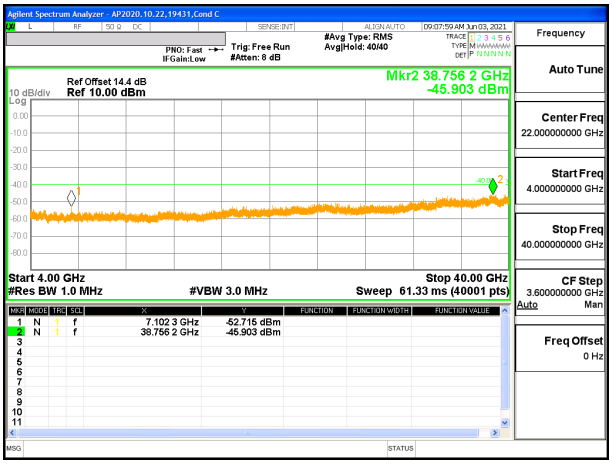
5G NR n48 10MHz BPSK High Channel RB1-23 (30MHz to 4GHz)



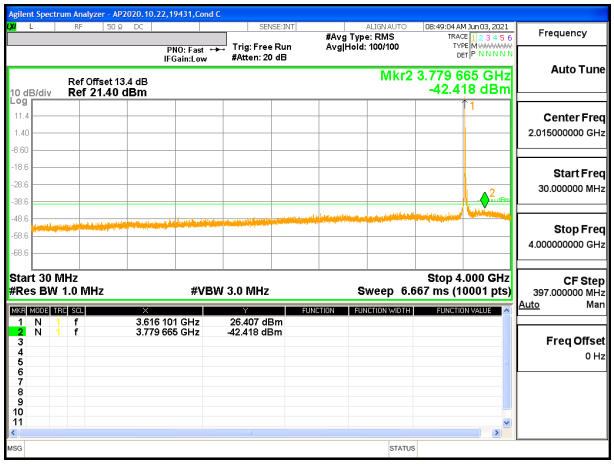
5G NR n48 10MHz BPSK High Channel RB1-23 (4G to 40G)



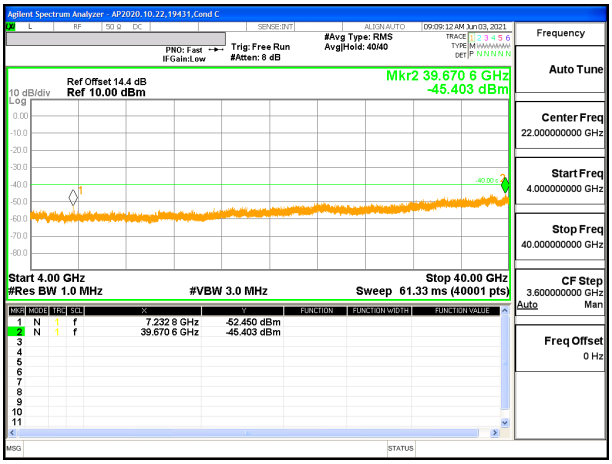
5G NR n48 20MHz BPSK Low Channel RB1-0 (30MHz to 4GHz)



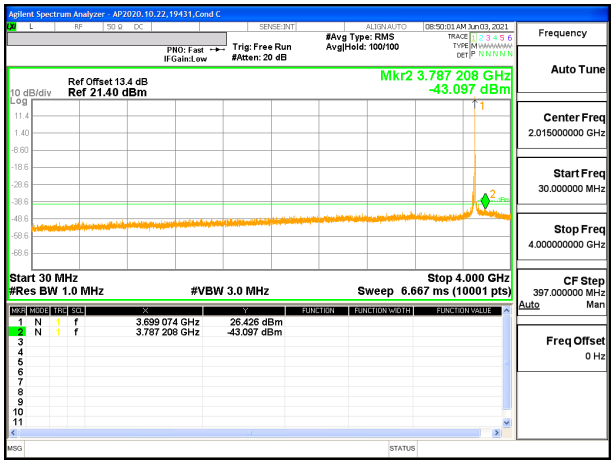
5G NR n48 20MHz BPSK Low Channel RB1-0 (4G to 40G)



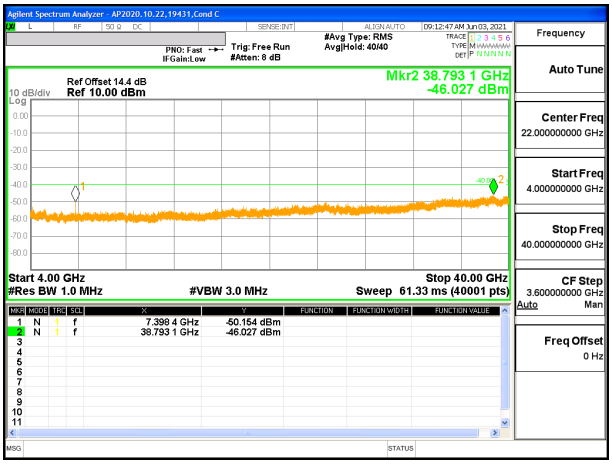
5G NR n48 20MHz BPSK Mid Channel RB1-1 (30MHz to 4GHz)



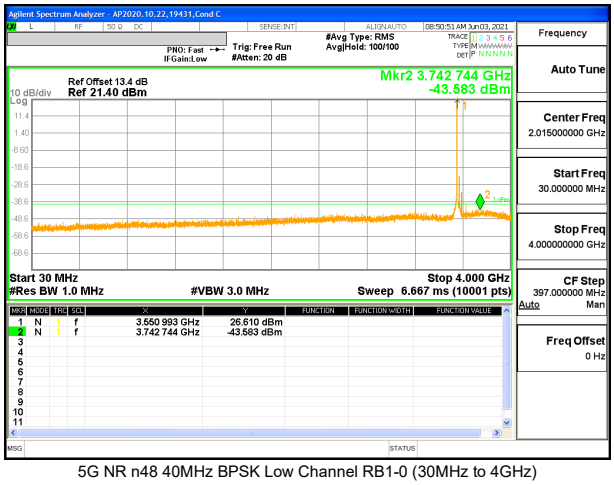
5G NR n48 20MHz BPSK Middle Channel RB1-1 (4G to 40G)



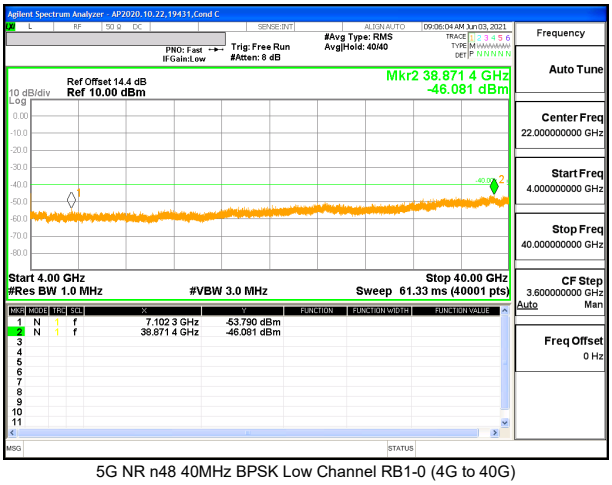
5G NR n48 20MHz BPSK High Channel RB1-50 (30MHz to 4GHz)



5G NR n48 20MHz BPSK High Channel RB1-50 (4G to 40G)

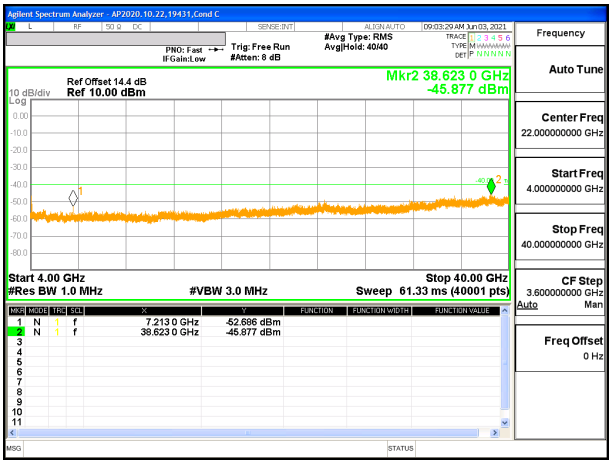


5G NR n48 40MHz BPSK Low Channel RB1-0 (30MHz to 4GHz)

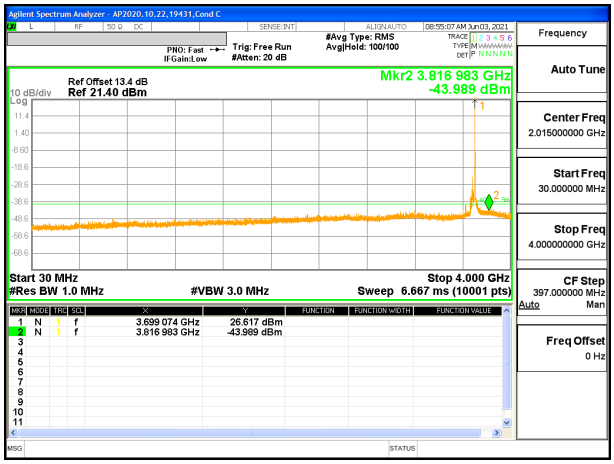


5G NR n48 40MHz BPSK Low Channel RB1-0 (4G to 40G)

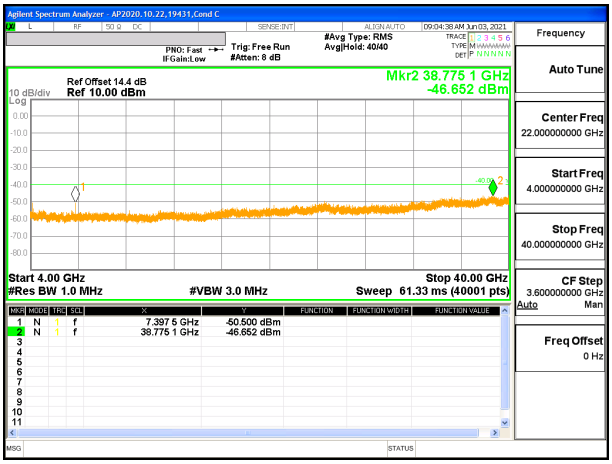
5G NR n48 40MHz BPSK Mid Channel RB1-1 (30MHz to 4GHz)



5G NR n48 40MHz BPSK Middle Channel RB1-1 (4G to 40G)



5G NR n48 40MHz BPSK High Channel RB1-105 (30MHz to 4GHz)



5G NR n48 40MHz BPSK High Channel RB1-105 (4G to 40G)

9.4. FREQUENCY STABILITY

TEST PROCEDURE

Use CMW 500 with Frequency Error measurement capability.

- Temp. = −30°C to +50°C
- Voltage = (85% - 115%)

  Low voltage, 3.23VDC, Normal, 3.8VDC and High voltage, 4.37VDC.
  End Voltage, 3.2VDC.

Frequency Stability vs Temperature:
The EUT is place inside a temperature chamber. The temperature is set to 20ºC and allowed to stabilize. After sufficient soak time, the transmitting frequency error is measured. The temperature is increased by 10 degrees, allowed to stabilize and soak, and then the measurement is repeated. This is repeated until +50ºC is reached.

Frequency Stability vs Voltage:
The peak frequency error is recorded (worst-case).

RESULTS

9.4.1. 5G NR n48

Test Engineer ID:	12981	Test Date:	5/6/2021

5G NR n48 BPSK (40MHz BANDWIDTH)

Limit		3550	3700	Delta (Hz)	Frequency Stability (ppm)
Condition		F low @ -13dBm	F high @ -13dBm		
Temperature	2.8	(MHz)	(MHz)		
Normal (20C)	Normal	3550.9829	3698.2100		
Extreme (50C)		3550.9829	3698.2100	-15.1	-0.004
Extreme (40C)		3550.9829	3698.2100	-8.7	-0.002
Extreme (30C)		3550.9829	3698.2100	-7.1	-0.002
Extreme (10C)		3550.9829	3698.2100	14.7	0.004
Extreme (0C)		3550.9829	3698.2100	-11.1	-0.003
Extreme (-10C)		3550.9829	3698.2100	-14.2	-0.004
Extreme (-20C)		3550.9829	3698.2100	-8.6	-0.002
Extreme (-30C)		3550.9829	3698.2100	-7.9	-0.002
20C	15%	3550.9829	3698.2100	-27.4	-0.008
	-15%	3550.9829	3698.2100	-29.6	-0.008
	End Point Voltage	3550.9829	3698.2100	-31.3	-0.009

9.5. PEAK-TO-AVERAGE POWER RATIO

LIMIT

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

RESULT

Antenna 1 was used to measure as the worst case; full resource block (FRB) for each bandwidth was used to measure as the worst case. The results from all CCDF measurements are passed with 13dB peak-to-average power ratio criteria.

9.5.1. 5G NR n48

Test Engineer ID:	10641	Test Date:	5/27/2021

Band	Bandwidth (MHz)	Frequency (MHz)	RB Allocation	RB OffSet	Modulation	Conducted Power (dBm)		Peak-to-Average Power Ratio (dB)
						Peak	Average	
5G NR Band n48	10MHz	3625.0	24	0	BPSK	31.87	25.93	5.94
					16QAM	31.87	25.93	5.94
	20MHz		50	0	BPSK	31.99	26.1	5.89
					16QAM	32.03	25.09	6.94
	40MHz		100	0	BPSK	31.81	26.2	5.61
					16QAM	31.81	25.19	6.62
Duty Cycle Correction Factor (dB) =			0.00					
Peak-to-Average Power Ratio= Peak Reading - Average Reading - Duty Cycle Correction Factor								

10. RADIATED TEST RESULTS

Radiated measurement using the Field Strength Method

Using the test configuration shown in Figure 6 below, We measure the radiated emissions directly from the EUT and convert the measured field strength or received power to ERP or EIRP, as required, for comparison to the applicable limits. As stated in 5.5.1 of ANSI C63.26-2015, the field strength measurement method using a test site validated to the requirements of ANSI C63.4 is an alternative to the substitution measurement method.

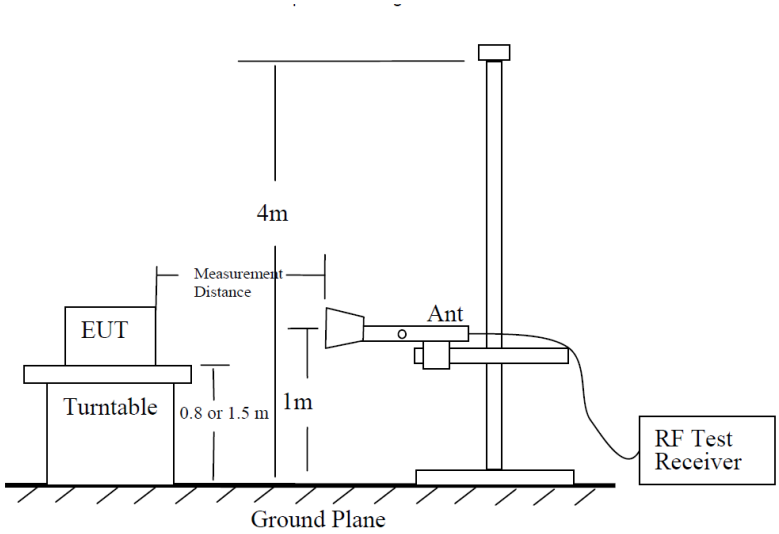


Figure 6 —Test site-up for radiated ERP and/or EIRP measurements

Radiated Power Measurement Calculation According to ANSI C63.26-2015

a) E (dBµV/m) = Measured amplitude level (dBµV) + Cable Loss (dB) + Antenna Factor (dB/m).

b) E (dBµV/m) = Measured amplitude level (dBm) + 107 + Cable Loss (dB) + Antenna Factor (dB/m).

c) E (dBµV/m) = EIRP (dBm) − 20log(D) + 104.8; where D is the measurement distance (in the far field region) in m.

d) EIRP (dBm) = E (dBµV/m) + 20log(D) − 104.8; where D is the measurement distance (in the far field region) in m.

So, from d)

The measuring distance is usually at 3m, then 20*Log(3)=9.5424

Then, EIRP (dBm) = E (dBµV/m) + 9.5424 − 104.8 = E (dBµV/m) – 95.2576

Note that: we do confidence check to our chambers every day to see if any degradation from expected/normal reading reference data. Also we do ambient check to all our chambers every month.

TEST PROCEDURE

KDB 971168 D01 v03r01/D02 v02/r01

All tests above 1GHz were done with a Resolution Bandwidth of 1MHz, and a Video Bandwidth of 3MHz.

LIMITS

FCC: §96.41

(e) 3.5 GHz Emissions and Interference Limits—

(2) Additional protection levels. Notwithstanding paragraph (d)(1) of this section, the conducted power of any emissions below 3530 MHz or above 3720 MHz shall not exceed −40dBm/MHz.

RESULTS

10.1. FIELD STRENGTH OF SPURIOUS RADIATION, ANT 4

BPSK 5G NR n48 (40.0MHZ BANDWIDTH)

Project #:	13571601
Date:	5/28/2021
Test Engineer:	45258 JL
Configuration:	EUT Only
Mode	5G NR n48 BPSK 40MHz
Chamber #:	A

Frequency (GHz)	Meter Reading (dBuV)	Det	AF T136	Amp/Cbl (dB)	T1792 3400-3800MHz BRF	EIRP CF	Corrected Reading (dBm)	Limit	Margin (dB)	Polarity
Low Channel, 3560MHz										
7.13809	28.59	RMS	36.1	-23.1	.5	-95.2	-53.11	-40	-13.11	V
7.14018	28.64	RMS	36.1	-23.1	.5	-95.2	-53.06	-40	-13.06	H
10.71148	26.91	RMS	37.8	-19.7	.5	-95.2	-49.69	-40	-9.69	V
10.71184	26.63	RMS	37.8	-19.7	.5	-95.2	-49.97	-40	-9.97	H
14.2789	26.65	RMS	39.4	-18.5	.7	-95.2	-46.95	-40	-6.95	H
14.28131	26.82	RMS	39.4	-18.5	.7	-95.2	-46.78	-40	-6.78	V
Mid Channel, 3625MHz										
7.2486	28.58	RMS	36.1	-23.1	.5	-95.2	-53.12	-40	-13.12	V
7.25051	28.9	RMS	36.1	-23.1	.5	-95.2	-52.8	-40	-12.8	H
10.87638	26.19	RMS	37.7	-19.1	.5	-95.2	-49.91	-40	-9.91	V
10.87707	27.03	RMS	37.8	-19.1	.5	-95.2	-48.97	-40	-8.97	H
14.49924	27.32	RMS	39.8	-19	.8	-95.2	-46.28	-40	-6.28	H
14.5003	25.99	RMS	39.8	-19	.8	-95.2	-47.61	-40	-7.61	V
High Channel, 3690MHz										
7.35912	28.89	RMS	36.1	-22.8	.6	-95.2	-52.41	-40	-12.41	H
7.3613	29.2	RMS	36.1	-22.9	.6	-95.2	-52.2	-40	-12.2	V
11.04202	26.64	RMS	37.8	-18.9	.6	-95.2	-49.06	-40	-9.06	H
11.04232	26.89	RMS	37.8	-18.9	.6	-95.2	-48.81	-40	-8.81	V
14.71952	26.06	RMS	40	-18	.9	-95.2	-46.24	-40	-6.24	V
14.71978	26.99	RMS	40	-18	.9	-95.2	-45.31	-40	-5.31	H

RMS - RMS detection

10.2. FIELD STRENGTH OF SPURIOUS RADIATION, ANT 7

BPSK 5G NR n48 (40.0MHZ BANDWIDTH)

Project #:	13571601
Date:	5/27/2021
Test Engineer:	45258 JL
Configuration:	EUT Only
Mode	5G NR n48 BPSK 40MHz
Chamber #:	A

Frequency (GHz)	Meter Reading (dBuV)	Det	AF T136	Amp/Cbl (dB)	T1792 3400-3800MHz BRF	EIRP CF	Corrected Reading (dBm)	Limit	Margin (dB)	Polarity
Low Channel, 3570MHz										
7.14211	28.15	RMS	36.1	-23	.5	-95.2	-53.45	-40	-13.45	H
7.14216	29.1	RMS	36.1	-23	.5	-95.2	-52.5	-40	-12.5	V
10.7085	26.52	RMS	37.8	-19.7	.5	-95.2	-50.08	-40	-10.08	H
10.7094	26.15	RMS	37.8	-19.7	.5	-95.2	-50.45	-40	-10.45	V
14.28086	27.47	RMS	39.4	-18.5	.7	-95.2	-46.13	-40	-6.13	V
14.28151	26.37	RMS	39.4	-18.5	.7	-95.2	-47.23	-40	-7.23	H
Mid Channel, 2595MHz										
7.25002	28.33	RMS	36.1	-23.1	.5	-95.2	-53.37	-40	-13.37	H
7.251	28	RMS	36.1	-23.1	.5	-95.2	-53.7	-40	-13.7	V
10.87353	25.86	RMS	37.7	-19.2	.5	-95.2	-50.34	-40	-10.34	H
10.87453	25.35	RMS	37.7	-19.1	.5	-95.2	-50.75	-40	-10.75	V
14.50089	26.57	RMS	39.8	-19	.8	-95.2	-47.03	-40	-7.03	V
14.50097	26.17	RMS	39.8	-19	.8	-95.2	-47.43	-40	-7.43	H
High Channel, 2680MHz										
7.36134	28.1	RMS	36.1	-22.9	.6	-95.2	-53.3	-40	-13.3	H
7.3614	28.26	RMS	36.1	-22.9	.6	-95.2	-53.14	-40	-13.14	V
11.04161	26.04	RMS	37.8	-18.9	.6	-95.2	-49.66	-40	-9.66	V
11.04179	26.15	RMS	37.8	-18.9	.6	-95.2	-49.55	-40	-9.55	H
14.72037	25.84	RMS	40	-18	.9	-95.2	-46.46	-40	-6.46	H
14.72195	26.42	RMS	40	-18	.9	-95.2	-45.88	-40	-5.88	V

RMS – RMS detection

10.3. FIELD STRENGTH OF SPURIOUS RADIATION, ANT 8

BPSK 5G NR n48 (40.0MHZ BANDWIDTH)

Project #:	13571601
Date:	5/28/2021
Test Engineer:	45258 JL
Configuration:	EUT Only
Mode	5G NR n48 BPSK 40MHz
Chamber #:	A

Frequency (GHz)	Meter Reading (dBuV)	Det	AF T136	Amp/Cbl (dB)	T1792 3400-3800MHz BRF	EIRP CF	Corrected Reading (dBm)	Limit	Margin (dB)	Polarity
Low Channel, 3570MHz										
7.13975	28.3	RMS	36.1	-23.1	.5	-95.2	-53.4	-40	-13.4	H
7.14046	28.87	RMS	36.1	-23.1	.5	-95.2	-52.83	-40	-12.83	V
10.70909	26.59	RMS	37.8	-19.7	.5	-95.2	-50.01	-40	-10.01	H
10.71086	26.54	RMS	37.8	-19.7	.5	-95.2	-50.06	-40	-10.06	V
14.27992	27.51	RMS	39.4	-18.5	.7	-95.2	-46.09	-40	-6.09	H
14.28095	27.33	RMS	39.4	-18.5	.7	-95.2	-46.27	-40	-6.27	V
Mid Channel, 3625MHz										
7.2481	36.95	RMS	36.1	-23.1	.5	-95.2	-44.75	-40	-4.75	H
7.24868	28.74	RMS	36.1	-23.1	.5	-95.2	-52.96	-40	-12.96	V
10.87396	22.73	RMS	37.7	-19.2	.5	-95.2	-53.47	-40	-13.47	V
10.87524	26.62	RMS	37.7	-19.1	.5	-95.2	-49.48	-40	-9.48	H
14.50031	27.66	RMS	39.8	-19	.8	-95.2	-45.94	-40	-5.94	V
14.5014	27.19	RMS	39.8	-19	.8	-95.2	-46.41	-40	-6.41	H
High Channel, 3680MHz										
7.35936	27.96	RMS	36.1	-22.8	.6	-95.2	-53.34	-40	-13.34	H
7.36108	27.81	RMS	36.1	-22.9	.6	-95.2	-53.59	-40	-13.59	V
11.03833	26.21	RMS	37.8	-19	.6	-95.2	-49.59	-40	-9.59	H
11.04	26.15	RMS	37.8	-18.9	.6	-95.2	-49.55	-40	-9.55	V
14.71954	26.46	RMS	40	-18	.9	-95.2	-45.84	-40	-5.84	H
14.72082	26.46	RMS	40	-18	.9	-95.2	-45.84	-40	-5.84	V

RMS - RMS detection

10.4. FIELD STRENGTH OF SPURIOUS RADIATION, ANT 9

BPSK 5G NR n48 (40.0MHZ BANDWIDTH)

Project #:	13571601
Date:	5/28/2021
Test Engineer:	45258 JL
Configuration:	EUT Only
Mode	5G NR n48 BPSK 40MHz
Chamber #:	A

Frequency (GHz)	Meter Reading (dBuV)	Det	AF T136	Amp/Cbl (dB)	T1792 3400-3800MHz BRF	EIRP CF	Corrected Reading (dBm)	Limit	Margin (dB)	Polarity
Low Channel, 3570MHz										
7.14029	28.82	RMS	36.1	-23.1	.5	-95.2	-52.88	-40	-12.88	V
7.14074	28.45	RMS	36.1	-23.1	.5	-95.2	-53.25	-40	-13.25	H
10.40907	26.37	RMS	37.7	-19.4	.6	-95.2	-49.93	-40	-9.93	V
10.41054	26.31	RMS	37.7	-19.4	.6	-95.2	-49.99	-40	-9.99	H
14.27879	26.96	RMS	39.4	-18.5	.7	-95.2	-46.64	-40	-6.64	H
14.28077	27.35	RMS	39.4	-18.5	.7	-95.2	-46.25	-40	-6.25	V
Mid Channel, 3625MHz										
7.2507	28.45	RMS	36.1	-23.1	.5	-95.2	-53.25	-40	-13.25	V
7.25115	28.7	RMS	36.1	-23.1	.5	-95.2	-53.00	-40	-13.00	H
10.87569	26.14	RMS	37.7	-19.1	.5	-95.2	-49.96	-40	-9.96	H
10.87708	25.8	RMS	37.8	-19.1	.5	-95.2	-50.2	-40	-10.2	V
14.49824	26.39	RMS	39.8	-19	.8	-95.2	-47.21	-40	-7.21	V
14.50032	26.76	RMS	39.8	-19	.8	-95.2	-46.84	-40	-6.84	H
High Channel, 3680MHz										
7.36122	28.28	RMS	36.1	-22.9	.6	-95.2	-53.12	-40	-13.12	H
7.36171	28.62	RMS	36.1	-22.9	.6	-95.2	-52.78	-40	-12.78	V
11.03957	25.94	RMS	37.8	-18.9	.6	-95.2	-49.76	-40	-9.76	H
11.03999	26.19	RMS	37.8	-18.9	.6	-95.2	-49.51	-40	-9.51	V
14.72287	25.98	RMS	39.9	-18.1	.9	-95.2	-46.52	-40	-6.52	V
14.72309	26.46	RMS	39.9	-18.1	.9	-95.2	-46.04	-40	-6.04	H

RMS - RMS detection

11. SETUP PHOTOS

Please refer to 14790372-EP1V1 FCC Setup Photo for setup photos

END OF REPORT