TEST REPORT

Report Number: 14040866-E12V3

Applicant	:	APPLE, INC 1 APPLE PARK WAY CUPERTINO, CA 95014, U.S.A.
Model	:	A2651 (Parent Model) A2893, A2894 (Variant Models)
Brand	:	APPLE
FCC ID	:	BCG-E8141A BCG-E8154A, BCG-E8155A (Variant Models)
IC	:	579C-E8141A 579C-E8154A, 579C-E8155A (Variant Models)
EUT Description	:	SMARTPHONE
Test Standard(s)	:	FCC CFR 47 Part 2, Part 25 ISED RSS-GEN ISSUE 5, RSS-170 Issue 3

Date Of Issue:
AUGUST 02, 2022

Prepared by:
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ACCREDITED
CERT #0751.05

Revision History

Rev.	Issue Date	Revisions	Revised By
V1	7/26/2022	Initial Review	Mengistu Mekuria
V2	8/1/2022	Addressed TCB feedback on Sec. 5.4	Binod Sitaula
V3	8/2/2022	Added Variant Models	Thu Chan

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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	A2651 (Parent Model, Full Test) A2893, A2894 (Variant Models)
Brand	APPLE
FCC ID	BCG-E8141A (Parent Model) BCG-E8154A, BCG-E8155A (Variant Models)
IC	579C-E8141A (Parent Model) 579C-E8154A, 579C-E8155A (Variant Models)
EUT Description	SMARTPHONE
Serial Number	CT656X3X0G, G334W7MRYL (CONDUCTED) AND CQ5LW17XLX (RADIATED)
Sample Receipt Date	APRIL 15, 2022
Date Tested	APRIL 15, 2022 to JULY 05, 2022
Applicable Standards	FCC CFR 47 Part 2, Part 25 ISED RSS-GEN ISSUE 5, RSS-170 Issue 3
Test Results	COMPLIES

UL LLC 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 LLC and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL LLC 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 Staff Engineer UL LLC.	Tewodros Woldemichael Laboratory Engineer UL LLC.	Binod Sitaula Laboratory Engineer UL LLC.

2. SUMMARY OF TEST RESULTS

This report contains data provided by the customer which can impact the validity of results. UL LLC 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)	Requirement Clause Number (ISED)	Result	Remarks
RF Conducted Output Power	53	25.149 (c)(4)(iii)	SMSE-009-20 Annex A 9.d	Complies	
Equivalent Isotropic Radiated	53	25.149 (c)(4)(iii)	SMSE-009-20 Annex A 9.e	Complies	
Maximum Power Spectral Density	53	25.149 (c)(4)(iv)	SMSE-009-20 Annex A 9.f	Complies	
Duty Cycle	53	Reporting purpose	Reporting purpose	Complies	
Occupied Bandwidth		2.1049	Reporting purpose	Complies	
6 dB Bandwidth	53	25.149 (c)(4) (ii)	SMSE-009-20 Annex A 9.c	Complies	
Band Edge and Emission Mask	53	2.1051, 25.149 (c) (4) (v), (vi)	SMSE-009-20 Annex A 9.g and h	Complies	
Out of Band Emissions	53	2.1051, 25.149 (c) (4) (v), (vi)	SMSE-009-20 Annex A 9.g	Complies	
Frequency Stability	53	25.202 (d)	--	Complies	
Field Strength of Spurious Radiation	53	2.1053, 25.149 (c) (4) (v), (vi)	SMSE-009-20 Annex A 9.g, h and i	Complies	
Carrier-Off-State Emissions Radiation	53	25.216 (i)	--	Complies	

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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 25
- 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
- ISED RSS-GEN ISSUE 5, RSS-170 Issue 3 as amended by SMSE-009-20

4. FACILITIES AND ACCREDITATION

UL LLC 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	550739
☒	Building 2: 47266 Benicia Street, Fremont, CA 94538, USA	US0104	22541	550739
☐	Building 4: 47658 Kato Rd, Fremont, CA 94538, USA	US0104	2324B	550739

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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	2.84 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

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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 FR1, IEEE 802.11a/b/g/n/ac/ax, Bluetooth, Ultra-Wideband, GPS, NFC, and MSS. All models except reference model 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 and by ISED-Canada.

Parent Model: A2651, FCC ID: BCG-E8141A, IC: 579C-E8141A
Variant Models: A2893, FCC ID: BCG-E8154A, IC: 579C-E8154A
A2894; FCC ID: BCG-E8155A, IC: 579C-E8155A

6.2. 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 peak EIRP output powers as follows:

LTE BAND 53

FCC: §25.149 (c)(4) (iii): The maximum transmit power is no more than 1 W with a peak EIRP of no more than 6 dBW (36dBm or 3.98W).

ISED: SMSE-009-20 Annex A 9.e: The maximum equivalent isotropically radiated power (e.i.r.p.) shall not exceed 6 dBW (36dBm or 3.98W).

FCC Part 25/ SMSE-009-20	
Peak EIRP Limit (W)	3.98
Conducted Average Limit (W)	1.00
Antenna Gain (dBi)	-1.80

Bandwidth (MHz)	Modulation	Low Frequency (MHz)	Upper Frequency (MHz)	Conducted Average (dBm)	EIRP Average (dBm)	EIRP Average (W)	99% BW (kHz)	Emission Designator
1.4	QPSK	2484.2	2494.3	20.70	18.90	0.078	1087	1M09G7W
	16QAM			20.70	18.90	0.078	1091	1M09D7W
3.0	QPSK	2485.0	2493.5	20.70	18.90	0.078	2708	2M71G7W
	16QAM			20.70	18.90	0.078	2709	2M71D7W
5.0	QPSK	2486.0	2492.5	20.70	18.90	0.078	4504	4M50G7W
	16QAM			20.70	18.90	0.078	4511	4M51D7W
10.0	QPSK	2488.5	2490.0	20.70	18.90	0.078	8975	8M98G7W
	16QAM			20.70	18.90	0.078	8966	8M97D7W

5G NR n53

FCC: §25.149 (c)(4) (iii): The maximum transmit power is no more than 1 W with a peak EIRP of no more than 6 dBW (36dBm or 3.98W).

ISED: SMSE-009-20 Annex A 9.e: The maximum equivalent isotropically radiated power (e.i.r.p.) shall not exceed 6 dBW (36dBm or 3.98W).

FCC Part 25 / SMSE-900-20	
Peak EIRP Limit (W)	3.98
Conducted Average Limit (W)	1.00
Antenna Gain (dBi)	-1.80

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	2488.5	2490.0	20.70	18.90	0.078	8667	8M67G7W
	QPSK			20.70	18.90	0.078	8608	8M61G7W
	16QAM			20.70	18.90	0.078	8598	8M60D7W

6.3. SOFTWARE AND FIRMWARE

The EUT firmware installed during testing was version: 0.15.02.

6.4. MAXIMUM ANTENNA GAIN

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

LTE Bands	Frequency Range (MHz)	ANT 1 Antenna Gain (dBi)	ANT 2 Antenna Gain (dBi)
LTE BAND 53, 5G NR n5	2483.5 – 2495 MHz	-1.8	-5.2

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6.5. WORST-CASE CONFIGURATION AND MODE

The EUT supports the following LTE and 5G NR Bands:
Band 53, and 5G NR n53

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.

The worst-case scenario for all measurements is based on an engineering evaluation made on different modulations. All modulations had the same target power for the worst-case antenna, so QPSK and BPSK were used to represent the worst mode for LTE bands and 5G NR bands respectively and were set for all conducted and radiated tests. Output power measurements were measured on BPSK, QPSK, 16QAM, 64QAM, and 256QAM modulations. For testing purposes emissions on sections 8 and 9 were measured while QPSK/BPSK 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. The worst-case antenna is shown in the table below.

LTE and 5G NR Bands	Worst case Antenna Port For Conducted Power
LTE BAND 53, and 5G NR n53	Ant 1

The EUT was investigated in three orthogonal orientations X/Y/Z on both ANT 1 and ANT2 antennas to determine the worst-case orientation. The full tests of the EUT have made upon the orientations that shown in the table below.

Frequency Bands	ANT1	ANT2
2300 – 2700 MHz	Y	X

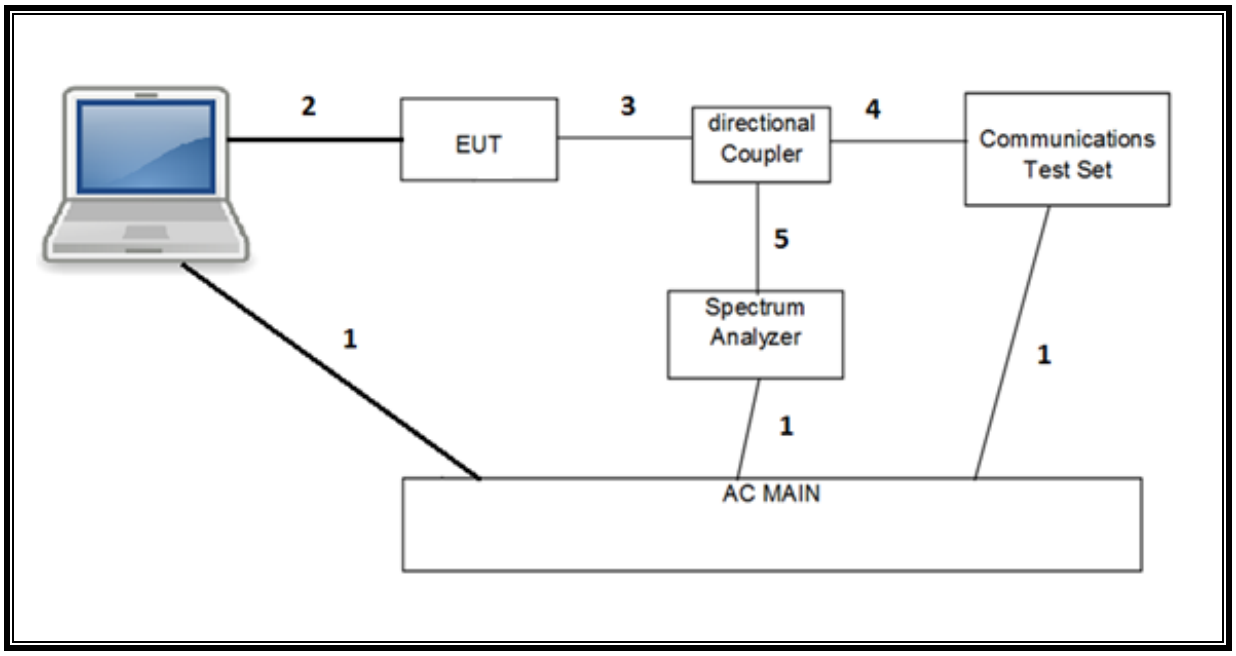
Radiated spurious emissions were investigated from 9kHz to 30MHz, 30MHz-1GHz and above 1GHz. There were no emissions found with less than 20dB of margin from 9kHz to 1GHz.

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.

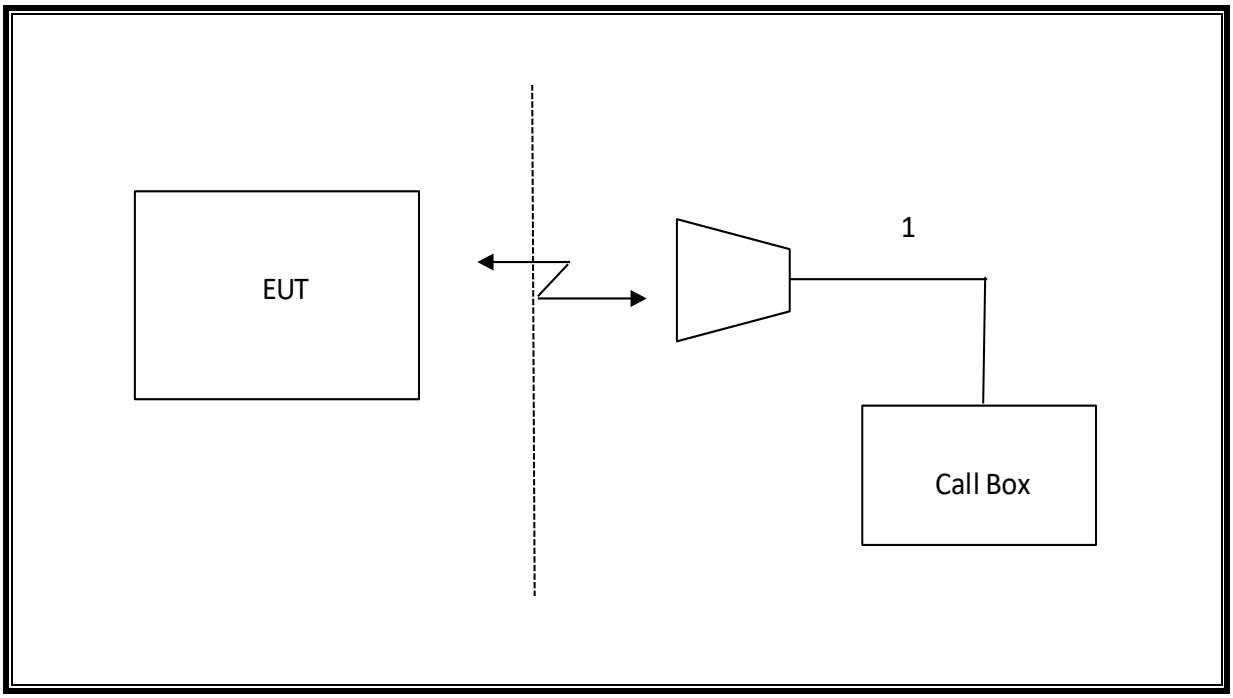
6.6. DESCRIPTION OF TEST SETUP

SUPPORT TEST EQUIPMENT						
Description		**Manufacturer**	**Model**	**Serial Number**		**FCC ID/ DoC**
Laptop		Apple	MacBook Pro	HRP082673		BCGA1708
AC/DC adapter		Apple	A1718	C4H64450HH3GN8RA6		--
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	80402	6/14/2022
Antenna, Broadband Hybrid, 30MHz to 2000MHz	Sunol Sciences Corp.	JB3	85151	3/21/2023
*RF Amplifier, 1-18GHz	T1165	AFS42-00101800-25-S-42	T1165	6/12/2022
*Amplifier, 1 to 18GHz	Miteq	AFS42-00101800-25-S-42	T1165	6/12/2022
Spectrum Analyzer, PXA, 3Hz to 44GHz	Keysight	N9030A	85212	1/30/2023
Wideband Communication Test Set, Call Box	Rohde & Schwarz	CMW500	85827	connection purpose only
Antenna, Horn 1-18GHz	ETS Lindgren	3117	80403	5/26/2023
Spectrum Analyzer, PXA, 3Hz to 44GHz	Keysight	N9030A	125178	1/24/2023
Wideband Communication Test Set, Call Box	R&S GmbH & Co. KG	CMW500	80105	connection purpose only
Antenna, Broadband Hybrid, 30MHz to 3GHz	Sunol Sciences Corp.	JB3	203089	1/31/2023
Amplifier, 9KHz to 1GHz, 32dB	SONOMA INSTRUMENT	310	170649	7/07/2022
Directional Coupler	KRYTAR	152613	T1536	9/23/2022
Directional Coupler	KRYTAR	152613	T1537	9/23/2022
Power Meter, P-series single channel	Keysight	N1911A	82174	1/24/2023
Power Sensor, P - series, 50MHz to 18GHz, Wideband	Keysight	N1921A	90388	1/24/2023
Filter, HPF 1.2GHz	Micro-Tronics	152043	152043	7/29/2022
Filter, BRF 1850 – 1910 MHz	Micro-Tronics	155055	155055	12/20/2022
Filter, BRF 2495 – 2690 MHz	Micro-Tronics	155050	155055	7/30/2022
Filter, BRF 3.4 – 3.8GHz	Micro-Tronics	208398	208398	7/30/2022
Spectrum Analyzer, PXA, 3Hz to 44GHz	Keysight	N9030A	80397	2/1/2023
Spectrum Analyzer, PXA, 3Hz to 44GHz	Keysight	N9030A	85201	2/1/2023
Spectrum Analyzer, PXA, 3Hz to 44GHz	Keysight	N9030A	85214	2/2/2023
Spectrum Analyzer, PXA, 3Hz to 50GHz w/Ext. Mixer	Keysight	N9030A	80400	2/1/2023
Wideband Communication Test Set, Call Box	R&S GmbH & Co. KG	CMW500	85806	2/22/2023
Wideband Communication Test Set, Call Box	R&S GmbH & Co. KG	CMW500	85943	2/20/2023
Wireless Test Platform, UXM 5G	Keysight	E7515B	207269	1/24/2023
*Environmental Chamber	Cincinnati Sub Zero	ZPHS-8-3.5-SCT/WC	82472	6/15/2022
Antenna, Active Loop 100KHz to 30MHz	ELECTRO-METRICS	EM-6872	219911	05/10/2023
Antenna, Active Loop 30Hz to 1MHz	ELECTRO-METRICS	EM-6871	219909	05/10/2023
UL AUTOMATION SOFTWARE				
CLT Software	UL	UL RF	Ver 3.7.6, Match 1, 2022	
Power Measurement Software	UL	UL RF	Ver 3.4.9, April 29, 2022	
Radiated test software	UL	UL RF	Ver 9.5 June 15, 2022	

NOTES:

1. * 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 TS 36.101 specification.

UE Power Class: 3 (23 +/- 2dBm). 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 TS 36.101.

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 TS 38.521-1 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 TS 36.101 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

AVERAGE OUTPUT POWER TEST PROCEDURE

The transmitter output is connected to a power meter.

The power output was measured on the EUT antenna port using SMA cable with directional coupler connected to a power meter via wideband average power sensor. Gated average output power was read directly from power meter.

PEAK OUTPUT POWER TEST PROCEDURE

The transmitter output is connected to a power meter.

The power output was measured on the EUT antenna port using SMA cable with directional coupler connected to a power meter via wideband peak power sensor. Peak output power was read directly from power meter.

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 and peak conducted output powers as follows:

8.1. LTE BAND 53

RULE PART(S) AND LIMITS

FCC: §25.149 (c)(4) (iii): The maximum transmit power is no more than 1 W (30dBm) with a peak EIRP of no more than 6 dBW.

ISED: SMSE-009-20 Annex A 9.d: Transmitter output power shall not exceed 0 dBW (30dBm).

Test Engineer ID:	25780	Test Date:	4/2/2022

OUTPUT POWER FOR LTE BAND 53 (1.4 MHz)

Bandwidth (MHz)	Modulation	RB Allocation	RB Offset	Ant 1			Ant 2		
				Conducted Average (dBm)			Conducted Average (dBm)		
				60147	60195	60248	60147	60195	60248
				2484.2 MHz	2489.0 MHz	2494.3 MHz	2484.2 MHz	2489.0 MHz	2494.3 MHz
1.4	QPSK	1	0	20.63	20.66	20.60	20.65	20.63	20.64
		1	2	**20.70**	20.66	20.64	20.66	20.68	20.68
		1	5	20.63	20.63	20.62	20.64	20.62	20.65
		3	0	20.65	20.67	20.63	20.63	20.69	20.67
		3	1	20.65	20.67	20.64	20.66	20.69	20.67
		3	2	20.66	20.68	20.65	20.65	20.68	**20.70**
		6	0	19.93	19.97	19.93	19.66	19.67	19.67
	16QAM	1	0	20.49	20.62	20.69	20.67	20.66	**20.70**
		1	2	20.52	**20.70**	20.57	20.56	20.67	20.57
		1	5	20.49	20.62	20.50	20.54	20.62	20.54
		3	0	20.34	20.43	20.47	20.43	20.47	20.45
		3	1	20.34	20.47	20.37	20.48	20.44	20.45
		3	2	20.33	20.46	20.34	20.34	20.49	20.54
		6	0	19.27	19.38	19.31	19.34	19.37	19.38
	64QAM	1	0	20.56	20.63	20.61	20.66	20.62	20.61
		1	2	20.59	20.65	20.66	20.69	20.65	20.67
		1	5	20.57	20.60	**20.70**	**20.70**	20.60	20.60
		3	0	20.47	20.57	20.57	20.58	20.54	20.53
		3	1	20.49	20.56	20.54	20.61	20.62	20.55
		3	2	20.51	20.55	20.57	20.58	20.60	20.54
		6	0	19.45	19.48	19.34	19.57	19.46	19.48
	256QAM	1	0	20.54	20.60	20.65	**20.70**	20.62	20.65
		1	2	20.58	**20.70**	20.61	20.68	20.65	20.69
		1	5	20.56	20.59	20.66	20.69	20.65	20.64
		3	0	20.55	20.61	20.55	20.56	20.53	20.54
		3	1	20.57	20.61	20.56	20.58	20.55	20.55
		3	2	20.57	20.63	20.58	20.59	20.56	20.53
		6	0	20.43	20.43	20.59	20.52	20.49	20.53

OUTPUT POWER FOR LTE BAND 53 (3.0 MHz)

Bandwidth (MHz)	Modulation	RB Allocation	RB Offset	Ant 1			Ant 2		
				Conducted Average (dBm)			Conducted Average (dBm)		
				60155	60195	60240	60155	60195	60240
				2485.0 MHz	2489.0 MHz	2493.5 MHz	2485.0 MHz	2489.0 MHz	2493.5 MHz
3.0	QPSK	1	0	20.61	20.61	20.57	20.55	20.62	20.58
		1	7	**20.70**	20.68	20.67	20.66	**20.70**	20.65
		1	14	20.66	20.58	20.59	20.59	20.61	20.55
		8	0	20.01	20.04	20.01	19.64	19.71	19.69
		8	4	20.06	20.07	20.04	19.68	19.74	19.72
		8	7	20.05	20.06	20.06	19.69	19.73	19.73
		15	0	19.99	20.03	19.99	19.64	19.70	19.65
	16QAM	1	0	20.64	20.58	20.55	20.54	20.62	20.50
		1	7	**20.70**	20.69	20.64	20.67	**20.70**	20.62
		1	14	20.59	20.52	20.56	20.53	20.60	20.51
		8	0	19.37	19.38	19.39	19.35	19.39	19.38
		8	4	19.40	19.42	19.42	19.39	19.46	19.41
		8	7	19.39	19.42	19.41	19.39	19.43	19.41
		15	0	19.35	19.37	19.38	19.28	19.34	19.35
	64QAM	1	0	20.56	20.51	20.56	19.59	**20.70**	19.58
		1	7	20.65	20.58	**20.70**	19.68	19.68	19.72
		1	14	20.60	20.52	20.56	19.55	19.57	19.57
		8	0	19.37	19.33	19.39	18.42	18.49	18.48
		8	4	19.42	19.40	19.42	18.47	18.52	18.49
		8	7	19.41	19.40	19.42	18.47	18.54	18.51
		15	0	19.30	19.33	19.34	18.43	18.43	18.40
	256QAM	1	0	20.59	20.54	20.58	20.52	20.55	20.59
		1	7	**20.70**	20.60	20.62	20.66	20.66	**20.70**
		1	14	20.62	20.49	20.58	20.58	20.63	20.61
		8	0	20.48	20.50	20.50	20.50	20.51	20.49
		8	4	20.54	20.53	20.55	20.56	20.57	20.52
		8	7	20.54	20.54	20.54	20.54	20.53	20.54
		15	0	20.50	20.47	20.47	20.51	20.49	20.48

OUTPUT POWER FOR LTE BAND 53 (5.0 MHz)

Bandwidth (MHz)	Modulation	RB Allocation	RB Offset	LAT			UAT		
				Conducted Average (dBm)			Conducted Average (dBm)		
				60165	60195	60230	60165	60195	60230
				2486.0 MHz	2489.0 MHz	2492.5 MHz	2486.0 MHz	2489.0 MHz	2492.5 MHz
5.0	QPSK	1	0	20.56	20.58	20.54	20.53	20.58	20.57
		1	12	20.67	**20.70**	20.62	20.64	**20.70**	20.66
		1	24	20.56	20.58	20.58	20.54	20.55	20.56
		12	0	19.90	19.92	19.90	19.58	19.64	19.59
		12	6	19.86	19.95	19.94	19.66	19.66	19.64
		12	11	19.85	19.97	19.91	19.52	19.69	19.62
		25	0	19.85	19.93	19.91	19.52	19.63	19.61
	16QAM	1	0	20.60	20.61	20.57	20.51	20.42	20.41
		1	12	**20.70**	20.69	20.67	**20.70**	20.59	20.48
		1	24	20.62	20.58	20.60	20.53	20.43	20.46
		12	0	19.45	19.37	19.38	19.25	19.30	19.28
		12	6	19.39	19.38	19.41	19.23	19.32	19.28
		12	11	19.40	19.40	19.43	19.18	19.25	19.32
		25	0	19.33	19.34	19.37	19.09	19.21	19.21
	64QAM	1	0	20.63	20.63	20.61	19.72	19.64	**20.70**
		1	12	20.69	20.67	**20.70**	19.82	19.77	19.79
		1	24	20.58	20.63	20.67	19.70	19.69	19.70
		12	0	19.34	19.39	19.45	18.48	18.52	18.48
		12	6	19.29	19.43	19.42	18.51	18.57	18.49
		12	11	19.28	19.41	19.47	18.41	18.55	18.52
		25	0	19.32	19.41	19.39	18.42	18.48	18.50
	256QAM	1	0	20.63	20.63	20.64	20.60	20.67	20.57
		1	12	**20.70**	20.69	**20.70**	**20.70**	20.64	20.65
		1	24	20.58	20.58	20.66	20.56	20.68	20.61
		12	0	20.55	20.55	20.56	20.50	20.51	20.50
		12	6	20.51	20.59	20.60	20.48	20.54	20.56
		12	11	20.50	20.56	20.58	20.43	20.53	20.55
		25	0	20.48	20.54	20.56	20.43	20.52	20.53

OUTPUT POWER FOR LTE BAND 53 (10.0 MHz)

Bandwidth (MHz)	Modulation	RB Allocation	RB Offset	Ant 1			Ant 2		
				Conducted Average (dBm)			Conducted Average (dBm)		
				60190	60195	60205	60190	60195	60205
				2488.5 MHz	2489.0 MHz	2490.0 MHz	2488.5 MHz	2489.0 MHz	2490.0 MHz
10.0	QPSK	1	0	20.64	20.65	20.61	20.62	20.65	20.61
		1	24	**20.70**	**20.70**	20.66	20.66	**20.70**	20.68
		1	49	20.64	20.64	20.61	20.66	20.68	20.63
		25	0	20.06	20.05	20.01	19.72	19.76	19.72
		25	12	20.02	20.07	20.07	19.77	19.80	19.77
		25	24	19.99	19.99	20.05	19.75	19.71	19.77
		50	0	19.99	20.07	20.04	19.75	19.77	19.75
	16QAM	1	0	**20.70**	20.69	20.65	20.54	20.60	**20.70**
		1	24	**20.70**	20.65	20.64	20.56	20.66	20.63
		1	49	20.66	20.65	20.69	20.61	20.63	20.59
		25	0	19.50	19.47	19.44	19.41	19.44	19.40
		25	12	19.45	19.50	19.47	19.43	19.49	19.43
		25	24	19.46	19.40	19.46	19.45	19.39	19.43
		50	0	19.38	19.46	19.46	19.41	19.44	19.42
	64QAM	1	0	20.56	20.60	20.66	20.60	20.68	20.64
		1	24	20.64	20.61	20.67	**20.70**	20.69	20.67
		1	49	20.61	20.65	**20.70**	20.65	20.65	20.59
		25	0	19.43	19.44	19.42	19.49	19.48	19.49
		25	12	19.39	19.46	19.48	19.52	19.55	19.53
		25	24	19.40	19.39	19.45	19.53	19.46	19.51
		50	0	19.38	19.43	19.42	19.49	19.51	19.49
	256QAM	1	0	20.67	20.61	20.62	20.60	20.56	20.58
		1	24	20.69	**20.70**	20.69	20.66	20.63	**20.70**
		1	49	20.65	20.60	20.66	20.57	20.63	20.65
		25	0	20.62	20.62	20.57	20.51	20.49	20.49
		25	12	20.58	20.68	20.61	20.47	20.53	20.52
		25	24	20.56	20.58	20.62	20.46	20.54	20.53
		50	0	20.56	20.62	20.58	20.53	20.49	20.49

8.2. 5G NR n53

RULE PART(S) AND LIMITS

FCC: §25.149 (c)(4) (iii): The maximum transmit power is no more than 1 W (30dBm) with a peak EIRP of no more than 6 dBW.

ISED: SMSE-009-20 Annex A 9.d: Transmitter output power shall not exceed 0 dBW (30dBm).

Test Engineer ID:	25602	**Test Date:**	2/22/2022

OUTPUT POWER FOR 5G NR n53 (10.0 MHz)

Bandwidth (MHz)	Modulation	RB Allocation	RB Offset	Ant 1			Ant 2		
				Conducted Average (dBm)			Conducted Average (dBm)		
				497700	497800	498000	497700	497800	498000
				2488.5 MHz	2489.0 MHz	2490.0 MHz	2488.5 MHz	2489.0 MHz	2490.0 MHz
10.0	BPSK	1	0	20.66	20.65	20.62	20.62	20.68	**20.70**
		1	1	20.58	20.63	20.64	20.55	**20.70**	20.65
		1	22	20.58	20.64	20.54	20.68	20.64	20.64
		1	23	20.61	20.57	20.58	20.66	20.58	20.61
		12	6	20.67	20.47	20.53	20.63	20.67	20.54
		24	0	**20.70**	20.56	20.53	20.64	20.67	20.64
	QPSK	1	0	**20.70**	20.67	20.69	20.67	20.63	20.66
		1	1	20.67	20.60	20.66	20.68	20.63	20.67
		1	22	20.56	20.61	20.63	**20.70**	20.67	20.57
		1	23	20.50	20.57	20.57	20.69	20.58	20.60
		12	6	20.55	20.55	20.56	20.63	20.67	20.58
		24	0	20.52	20.57	20.52	20.60	20.61	20.56
	16QAM	1	0	20.39	**20.70**	20.39	20.30	20.60	**20.70**
		1	1	20.51	20.55	20.61	20.17	20.51	20.59
		1	22	20.56	20.63	20.54	20.28	20.62	20.60
		1	23	20.47	20.55	20.54	20.19	20.60	20.60
		12	6	20.30	20.20	20.34	20.35	20.43	20.37
		24	0	20.25	20.26	20.31	20.36	20.46	20.37
	64QAM	1	0	20.64	20.62	**20.70**	20.61	20.45	20.61
		1	1	20.51	20.67	20.63	20.67	20.62	20.63
		1	22	20.58	20.46	20.26	20.67	20.64	20.68
		1	23	20.43	20.43	20.57	20.66	**20.70**	20.55
		12	6	20.26	20.27	20.26	20.40	20.46	20.47
		24	0	20.20	20.27	20.26	20.45	20.37	20.39
	256QAM	1	0	20.47	20.56	20.65	**20.70**	20.52	20.56
		1	1	20.47	**20.70**	20.56	20.56	20.37	20.54
		1	22	20.57	20.49	20.43	20.50	20.52	20.66
		1	23	20.49	20.49	20.41	20.52	20.56	20.48
		12	6	20.50	20.55	20.39	20.40	20.49	20.43
		24	0	20.54	20.42	20.42	20.46	20.47	20.53

9. CONDUCTED TEST RESULTS

9.1. ON TIME AND DUTY CYCLE

LIMITS

None; for reporting purposes only.

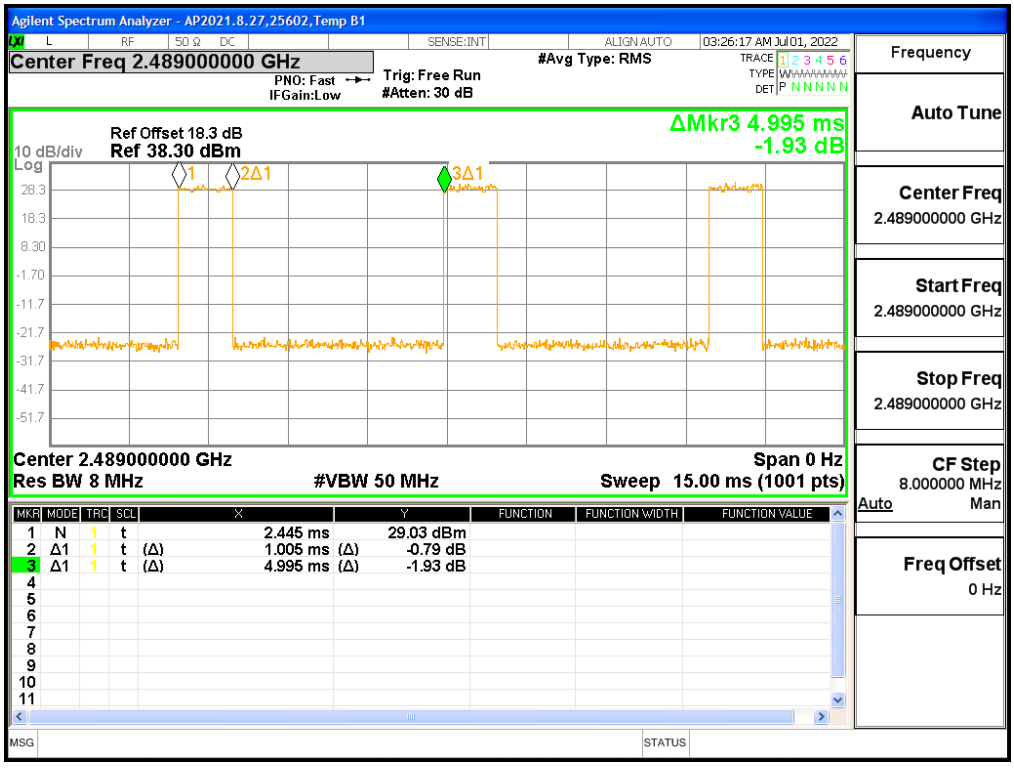
PROCEDURE

Zero-Span Spectrum Analyzer Method.

ON TIME AND DUTY CYCLE RESULTS

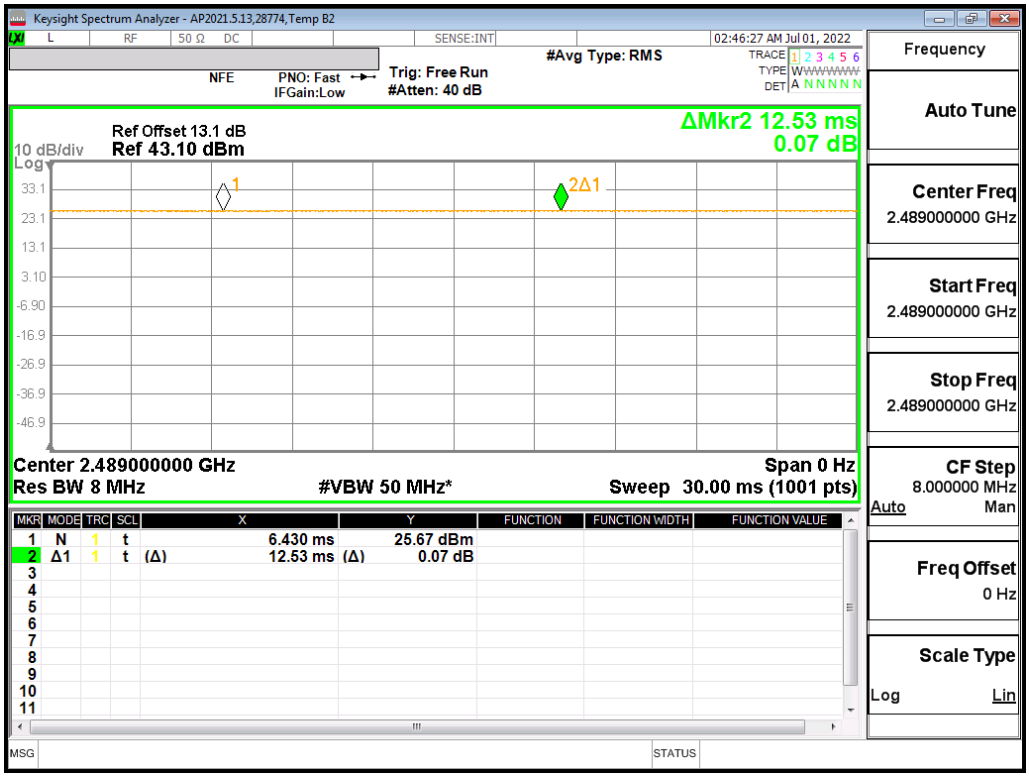
Band	RB Allocation / Offset	ON Time B (msec)	Period (msec)	Duty Cycle x (linear)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)
LTE Band 53	1 / 0	0.990	5.010	0.20	19.76	7.04
LTE Band 53	50 / 0	1.005	4.995	0.20	20.12	6.96
5G NR n53	1 / 1	N.A.	N.A.	1.00	100.00	0.00
5G NR n53	24 / 0	N.A.	N.A.	1.00	100.00	0.00

LTE Band 53 RB1-0



LTE Band 53 RB50-0

5G NR n53 RB1-1



5G NR n53 RB24-0

9.2. 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.

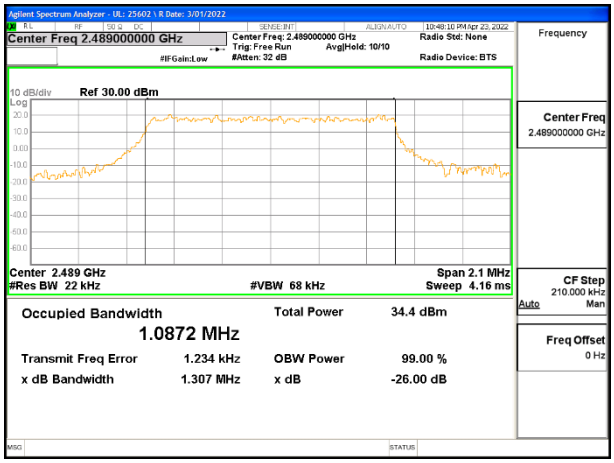
LTE BAND 53

Band	Mode	RB Allocation/RB Offset	f(MHz)	99% BW (MHz)	-26dB BW (MHz)
LTE BAND 53	1.4MHz, QPSK	6/0	836.5	1.087	1.31
	1.4MHz,16QAM			1.091	1.36
	3MHz, QPSK	15/0		2.708	3.40
	3MHz, 16QAM			2.709	3.11
	5MHz, QPSK	25/0		4.504	5.41
	5MHz, 16QAM			4.511	5.36
	10MHz, QPSK	50/0		8.975	9.91
	10MHz, 16QAM			8.966	9.94
	10MHz, QPSK	1/0		0.231	0.40

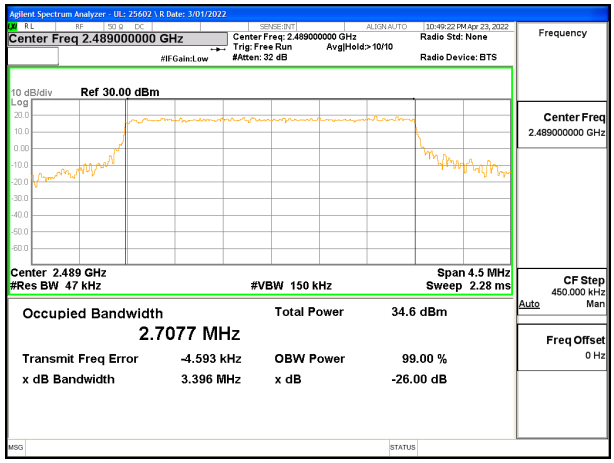
5G NR n53

Band	Mode	RB Allocation/RB Offset	f(MHz)	99% BW (MHz)	-26dB BW (MHz)
5G NR n53	10MHz, BPSK	24/0	2489.0	8.667	9.90
	10MHz, QPSK			8.608	9.74
	10MHz, 16QAM			8.598	9.50
	10MHz, BPSK	1/0		0.494	0.74

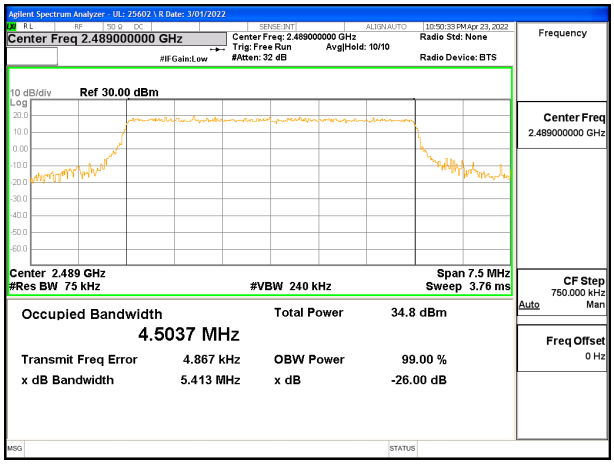
9.2.1. LTE BAND 53



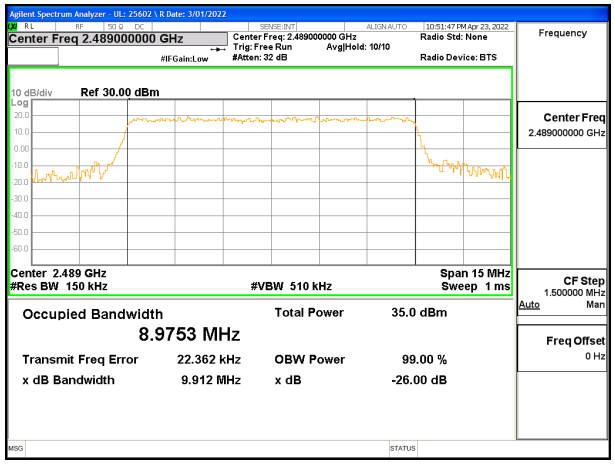
LTE B53 1.4MHz QPSK Middle Channel RB6-0



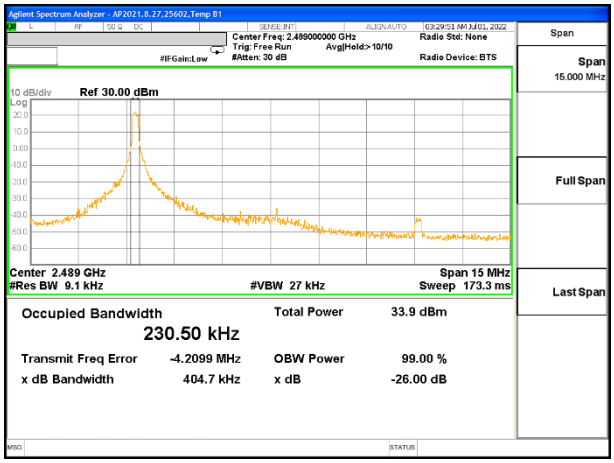
LTE B53 3MHz QPSK Middle Channel RB15-0



LTE B53 5MHz QPSK Middle Channel RB25-0

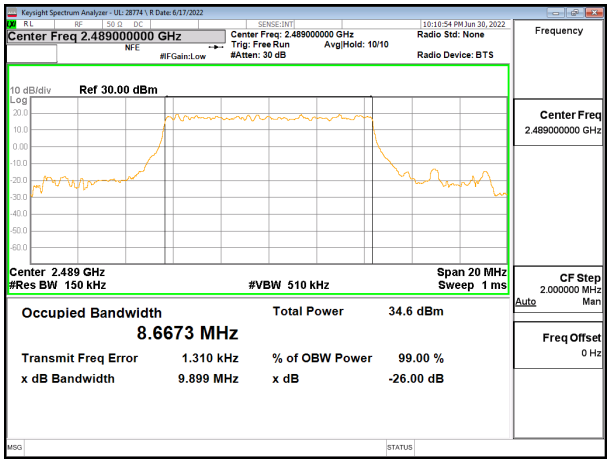


LTE B53 10MHz QPSK Middle Channel RB50-0

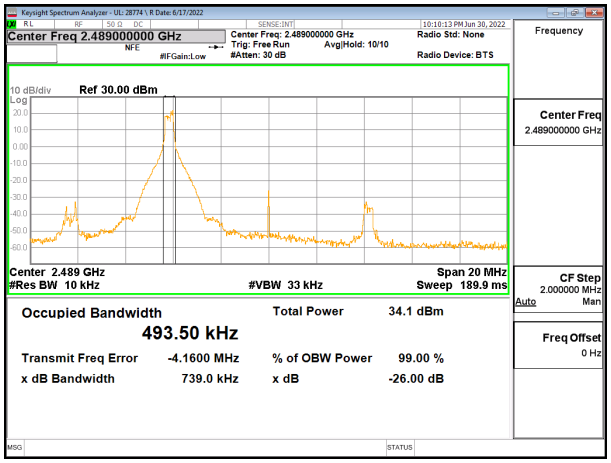


LTE B53 10MHz QPSK Middle Channel RB1-0

9.2.2. 5G NR n53



5G NR n53 10MHz BPSK Middle Channel RB24-0



5G NR n53 10MHz BPSK Middle Channel RB1-0

9.3. MAXIMUM POWER SPECTRAL DENSITY

RULE PART(S)

FCC: §25.149 (c)(4) (iv)
ISED: SMSE-009-20 Annex A 9.f

LIMITS

FCC: The maximum power spectral density conducted to the antenna is not greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

ISED: The equipment's maximum power spectral density conducted to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

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 PSD was measured with the spectrum analyzer at the low/ middle/high channel in each band where RBW=3kHz, VBW ≥ 3 * RBW, detector= RMS (power averaging).

RESULTS

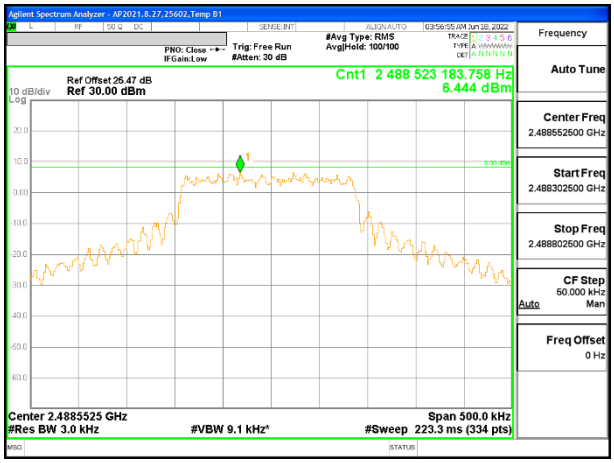
LTE BAND 53

Band	Mode	RB Allocation/RB Offset	f(MHz)	PSD (dBm/3kHz)	PSD Limit (dBm/3kHz)
LTE BAND 53	1.4MHz, QPSK	1/0	2484.2	5.459	8.0
			2489.0	6.444	
			2494.3	6.711	
	3MHz, QPSK	1/0	2485.0	6.213	
			2489.0	6.755	
			2493.5	6.869	
	5MHz, QPSK	1/0	2486.0	6.859	
			2489.0	6.024	
			2492.5	6.084	
	10MHz, QPSK	1/0	2488.5	6.187	
			2489.0	6.874	
			2490.0	6.660	
		50/0	2488.5	-5.864	
			2489.0	-5.103	
			2490.0	-5.611	

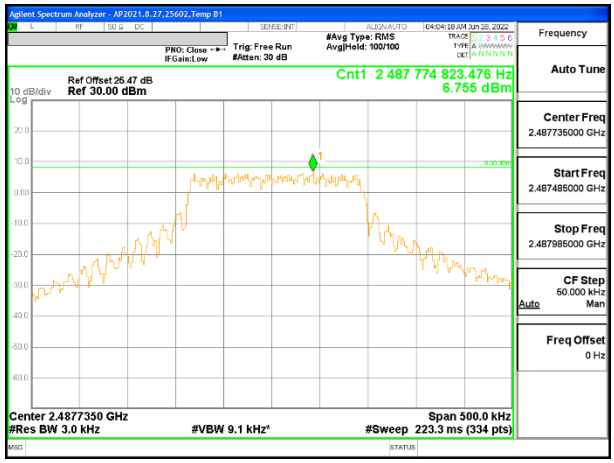
5G NR n53

Band	Mode	RB Allocation/RB Offset	f(MHz)	PSD (dBm/3kHz)	PSD Limit (dBm/3kHz)
5G NR n53	10MHz, BPSK	1/1	2488.5	7.642	8.0
			2489.0	7.004	
			2490.0	7.203	
		24/0	2488.5	-0.325	
			2489.0	-0.140	
			2490.0	-0.129	

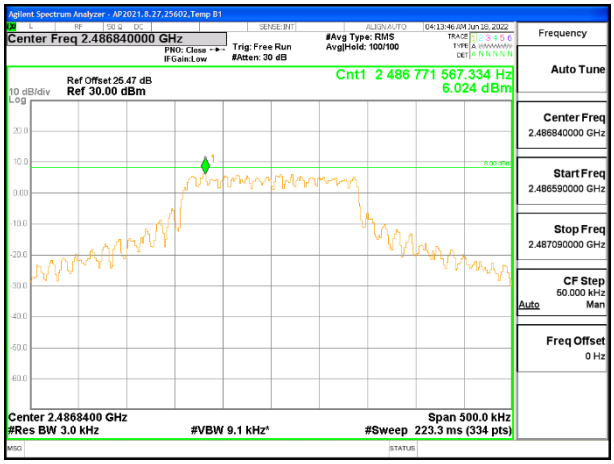
9.3.1. LTE BAND 53



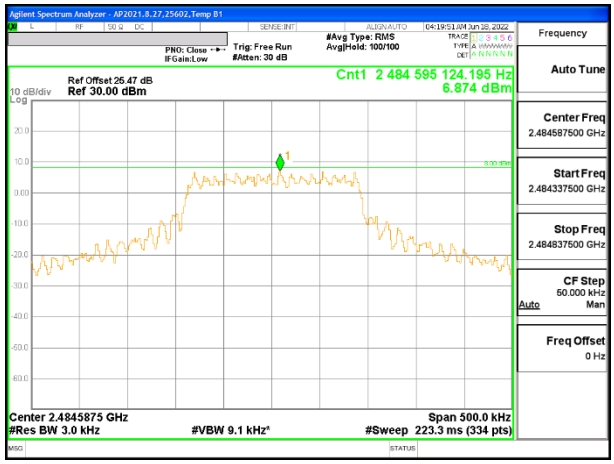
LTE B53 1.4MHz QPSK Middle Channel RB1-0



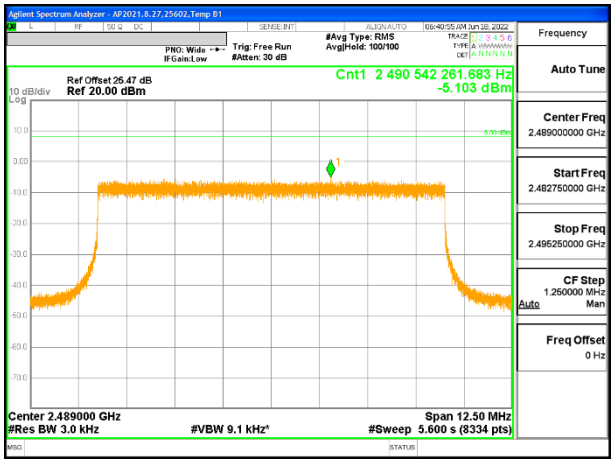
LTE B53 3MHz QPSK Middle Channel RB1-0



LTE B53 5MHz QPSK Middle Channel RB1-0

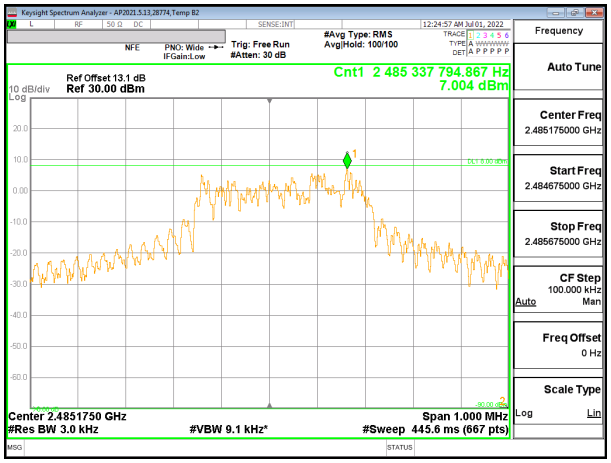


LTE B53 10MHz QPSK Middle Channel RB1-0

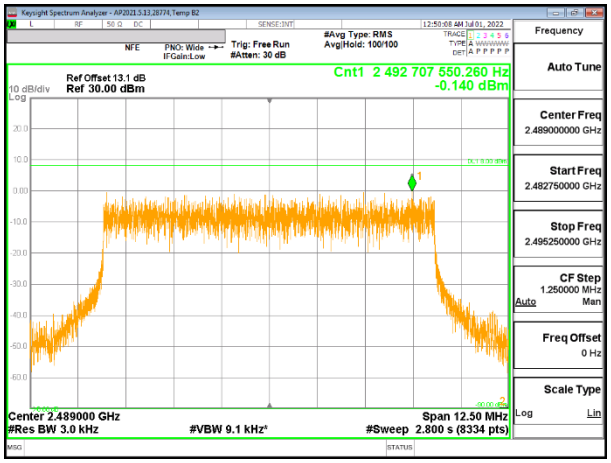


LTE B53 10MHz QPSK Middle Channel RB50-0

9.3.2. 5G NR n53



5G NR n53 10MHz BPSK Middle Channel RB1-1



5G NR n53 10MHz BPSK Middle Channel RB24-0

9.4. 6dB BANDWIDTH

RULE PART(S)

FCC: §25.149 (c)(4) (ii)
ISED: SMSE-009-20 Annex A 9.c

LIMITS

The 6 dB bandwidth shall be at least 500 kHz.

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 6dB bandwidth was measured with the spectrum analyzer at the low/ middle/high channel in each band where RBW is 1%-5% of EBW, VBW ≥ 3 * RBW, Peak detector and max hold.

RESULTS

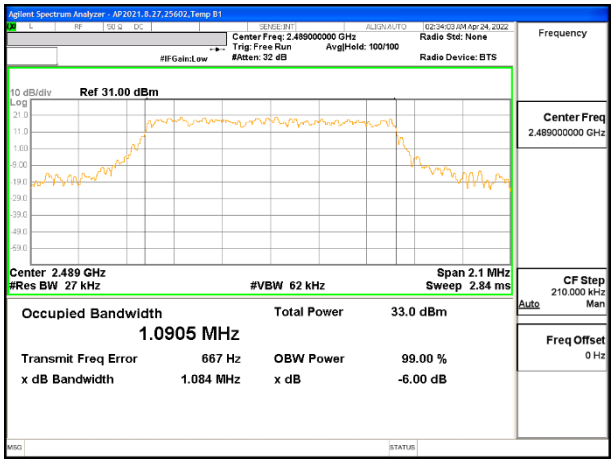
LTE BAND 53

Band	Mode	RB Allocation/RB Offset	f(MHz)	6dB BW (MHz)	6dB BW Limit (MHz)
LTE BAND 53	1.4MHz, QPSK	6/0	2489	1.084	0.5
	1.4MHz,16QAM			1.072	
	3MHz, QPSK	15/0		2.693	
	3MHz, 16QAM			2.696	
	5MHz, QPSK	25/0		4.495	
	5MHz, 16QAM			4.498	
	10MHz, QPSK	50/0		9.006	
	10MHz, 16QAM			8.932	

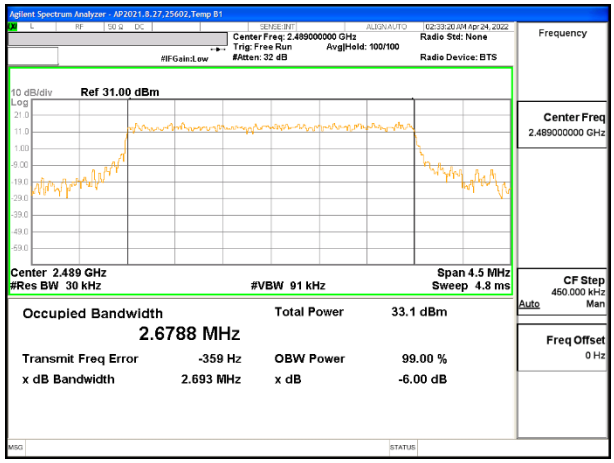
5G NR n53

Band	Mode	RB Allocation/RB Offset	f(MHz)	6dB BW (MHz)	6dB BW Limit (MHz)
5G NR n53	10MHz, BPSK	24/0	2489	8.610	0.5
	10MHz, QPSK	24/0		8.627	
	10MHz, 16QAM	24/0		8.615	

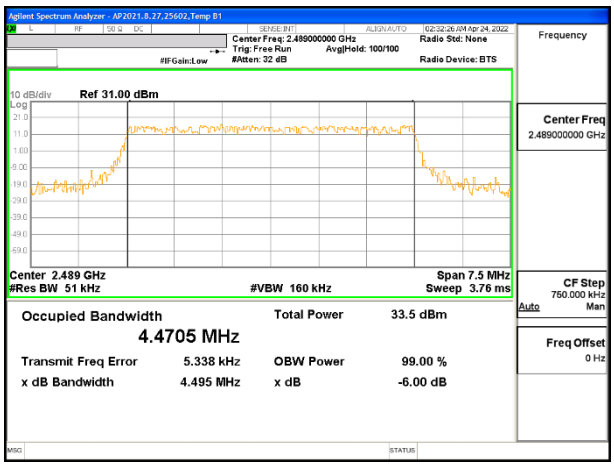
9.4.1. LTE BAND 53



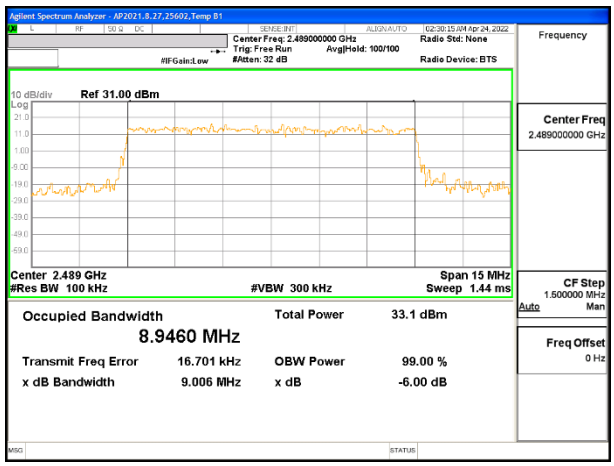
LTE B53 1.4MHz QPSK Middle Channel RB6-0



LTE B53 3MHz QPSK Middle Channel RB15-0

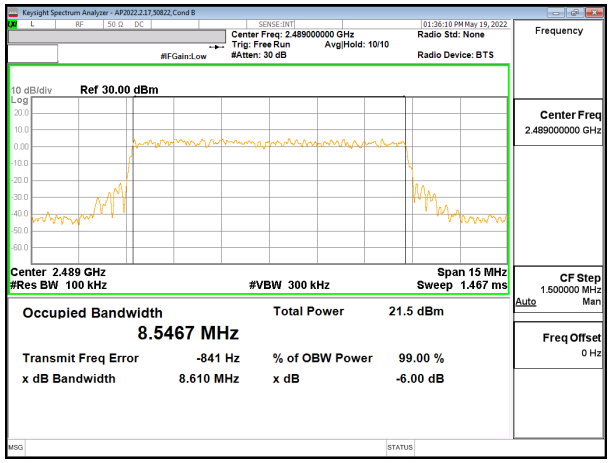


LTE B53 5MHz QPSK Middle Channel RB25-0



LTE B53 10MHz QPSK Middle Channel RB50-0

9.4.2. 5G NR n53



5G NR n53 10MHz BPSK Middle Channel RB24-0

9.5. EMISSION MASK AND BANDEDGE

For Spectrum Emission Mask plots, the Keysight PXA N9030A is configured to sweep with a moving integration window, the width of which can be adjusted to different sizes across the sweep. The window width is configured to be greater than or equal to the required reference bandwidth. The center frequencies of the integration window for the different integration windows was set such that the upper and lower edges of the windows are aligned with the transition points in the reference bandwidths. This is achieved by setting the start / stop frequencies of the window with an offset equal to the reference bandwidth / 2 from the transition point.

RULE PART(S)

FCC: §25.149 (c)(4)
ISED: SMSE-009-20 Annex A 9

LIMITS

FCC: §25.149
(c) Equipment certification. (4) Applications for equipment authorization of terrestrial low-power system equipment that will operate in the 2483.5-2495 MHz band shall demonstrate the following:

(v) Emissions below 2483.5 MHz are attenuated below the transmitter power (P) measured in watts by a factor of at least 40 + 10 log (P) dB at the channel edge at 2483.5 MHz, 43 + 10 log (P) dB at 5 MHz from the channel edge, and 55 + 10 log (P) dB at X MHz from the channel edge where X is the greater of 6 MHz or the actual emission bandwidth.

(vi) Emissions above 2495 MHz are attenuated below the transmitter power (P) measured in watts by a factor of at least 43 + 10 log (P) dB on all frequencies between the channel edge at 2495 MHz and X MHz from this channel edge and 55 + 10 log (P) dB on all frequencies more than X MHz from this channel edge, where X is the greater of 6 MHz or the actual emission bandwidth.

FCC: §25.149 (c)(4)
(vii) Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 1 MHz or greater. However, in the 1 MHz bands immediately above and adjacent to the 2495 MHz a resolution bandwidth of at least 1 percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. If 1 percent of the emission bandwidth of the fundamental emission is less than 1 MHz, the power measured must be integrated over the required measurement bandwidth of 1 MHz. A resolution bandwidth narrower than 1 MHz is permitted to improve measurement accuracy, provided the measured power is integrated over the full required measurement bandwidth (i.e., 1 MHz). The emission bandwidth of the fundamental emission of a transmitter 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. When an emission outside of the authorized bandwidth causes harmful interference, the Commission may, at its discretion, require greater attenuation than specified in this section.

ISED: SMSE-900-20 Annex A 9:

(g) For the unwanted emission below 2483.5 MHz, the ATC system's transmitter power, P (Watt), shall be attenuated by at least:

i. 40 + 10 log(P) dB at the channel edge at 2483.5 MHz
ii. 43 + 10 log(P) dB at 5 MHz from the channel edge
iii. 55 + 10 log(P) dB at X MHz from the channel edge

where X is the greater of 6 MHz or the actual emission bandwidth.

(h) For the unwanted emission above 2495 MHz, the ATC system's transmitter power, P (Watt), shall be attenuated by at least:

i. 43 + 10 log(P) dB on all frequencies between the channel edge at 2495 MHz and X MHz from this channel edge
ii. 55 + 10 log(P) dB on all frequencies more than X MHz from this channel edge

where X is the greater of 6 MHz or the actual emission bandwidth.

TEST PROCEDURE FOR UNWANTED EMISSIONS

The transmitter output was connected to a CMW500Test Set and configured to operate at maximum power. The band edge emissions were measured at the required operating frequencies in each band on the Spectrum Analyzer.

For each Emission Mask measurement:

1. Set the spectrum analyzer span to include the block edge frequency.
2. Set the Spectrum Emission Mask to cover all frequencies at their respective limits
3. Set the Spectrum Emission Mask to use the required Measurement Bandwidth
4. Set resolution bandwidth to at least 1% of emission bandwidth.

TEST PROCEDURE For EIRP DENSITY LIMIT

The transmitter output was connected to a CMW500Test Set and configured to operate at maximum power. The band edge emissions were measured at the required operating frequencies in each band on the Spectrum Analyzer.

For each Emission Mask measurement:

1. Set the spectrum analyzer span to include the block edge frequency.
2. Set the Spectrum Emission Mask to cover all frequencies at their respective limits
3. Set the Spectrum Emission Mask to use the Measurement Bandwidth of 30kHz

RESULTS

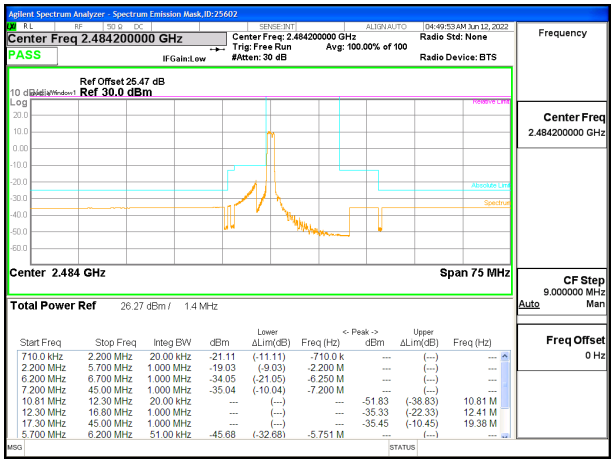
LTE BAND 53

Band	Mode	RB Allocation/ RB Offset	f (MHz)	Highest Cond Power Density (dBm/30kHz)	Highest Antenna Gain (dBi)	Highest EIRP Density (dBm/30kHz)	EIRP Density Limit (dBm/30kHz)
LTE BAND 53	1.4MHz, QPSK	1/0	2484.2	-14.10	-1.80	-15.90	-14.1
		6/0	2484.2	-18.43		-20.23	
		1/5	2494.3	-14.77		-16.57	
		6/0	2494.3	-17.90		-19.70	
	3MHz, QPSK	1/0	2485.0	-16.15		-17.95	
		15/0	2485.0	-20.83		-22.63	
		1/14	2493.5	-16.43		-18.23	
		15/0	2493.5	-20.60		-22.40	
	5MHz, QPSK	1/0	2486.0	-18.57		-20.37	
		25/0	2486.0	-23.91		-25.71	
		1/24	2492.5	-17.27		-19.07	
		25/0	2492.5	-22.56		-24.36	
	10MHz, QPSK	1/0	2488.5	-23.41		-25.21	
		50/0	2488.5	-29.41		-31.21	
		1/49	2490.0	-33.30		-35.10	
		50/0	2490.0	-28.01		-29.81	

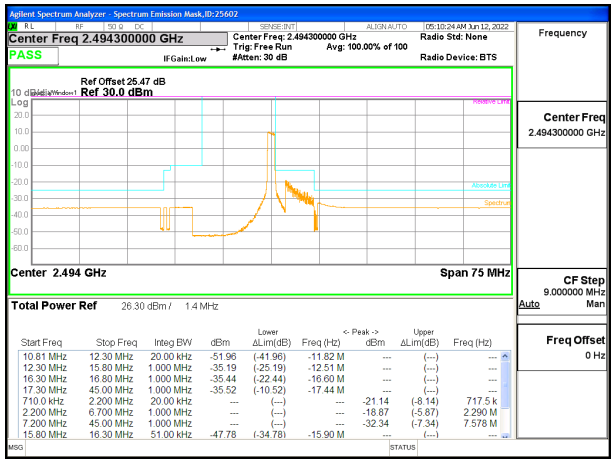
5G NR n53

Band	Mode	RB Allocation/ RB Offset	f (MHz)	Highest Cond Power Density (dBm/30kHz)	Highest Antenna Gain (dBi)	Highest EIRP Density (dBm/30kHz)	EIRP Density Limit (dBm/30kHz)
5G NR n53	10MHz, BPSK	1/0	2488.5	-22.90	-1.80	-24.70	-14.1
		24/0	2488.5	-20.41		-22.21	
		1/23	2490.0	-25.16		-26.96	
		24/0	2490.0	-20.62		-22.42	

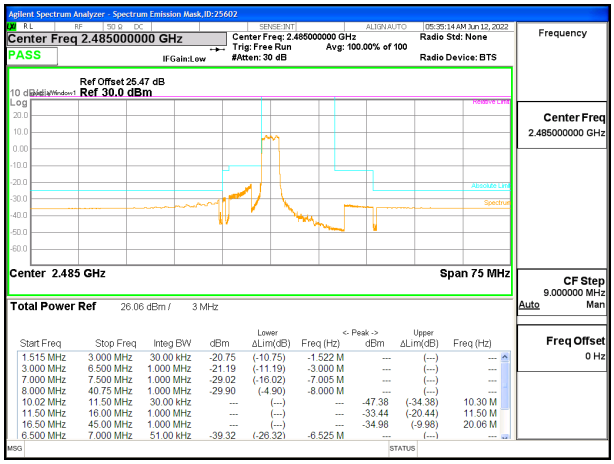
9.5.1. LTE BAND 53 BANDEGE



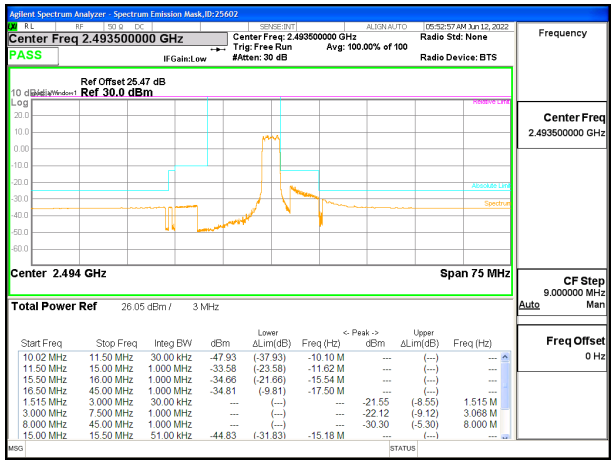
LTE B53 1.4MHz QPSK Low Channel RB6-0



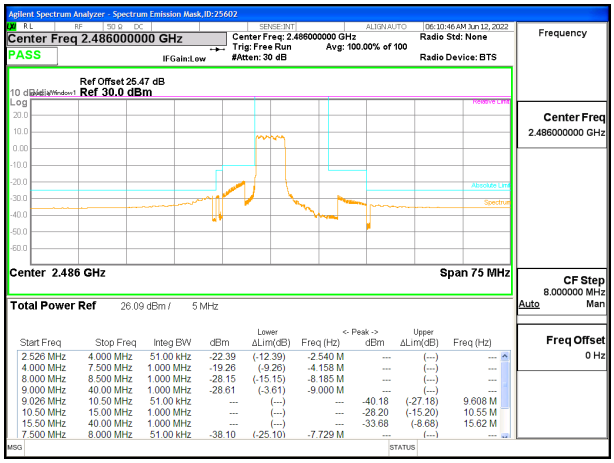
LTE B53 1.4MHz QPSK High Channel RB6-0



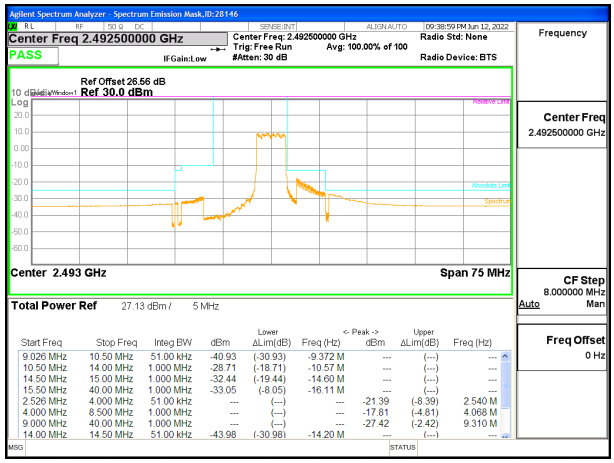
LTE B53 3MHz QPSK Low Channel RB15-0



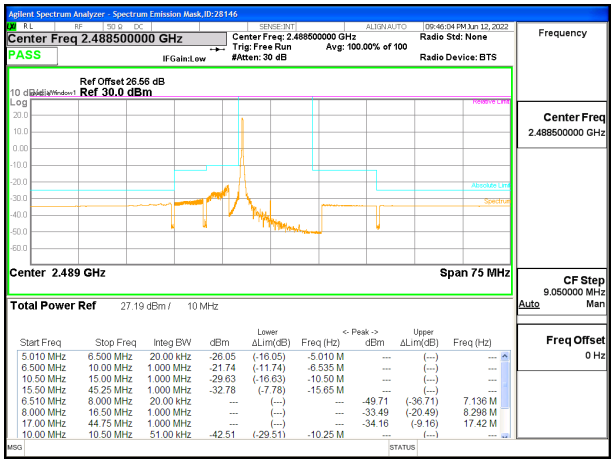
LTE B53 3MHz QPSK High Channel RB15-0



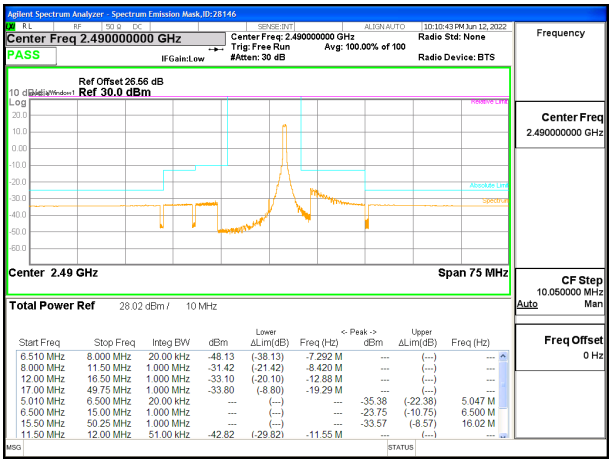
LTE B53 5MHz QPSK Low Channel RB25-0



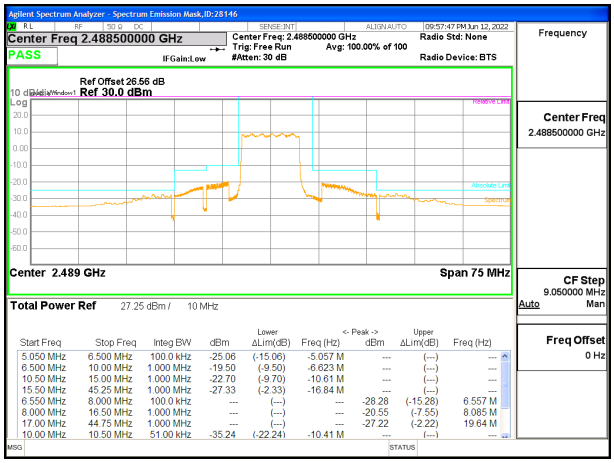
LTE B53 5MHz QPSK High Channel RB25-0



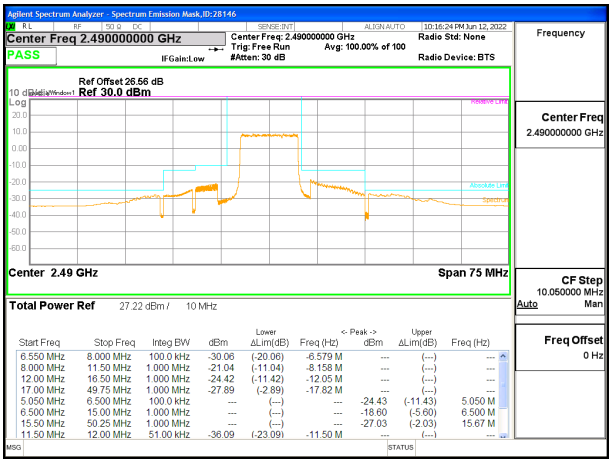
LTE B53 10MHz QPSK Low Channel RB1-0



LTE B53 10MHz QPSK High Channel RB1-49

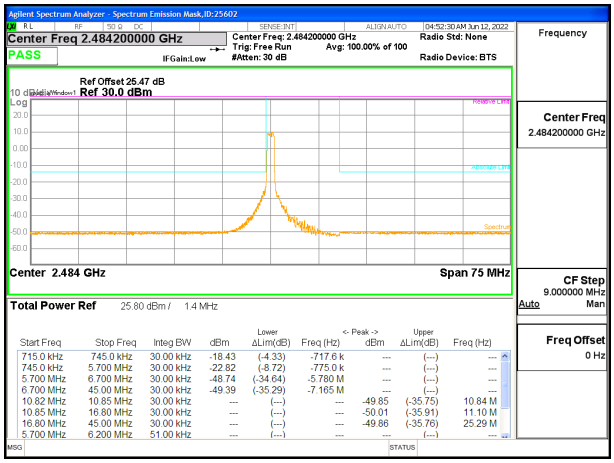


LTE B53 10MHz QPSK Low Channel RB50-0

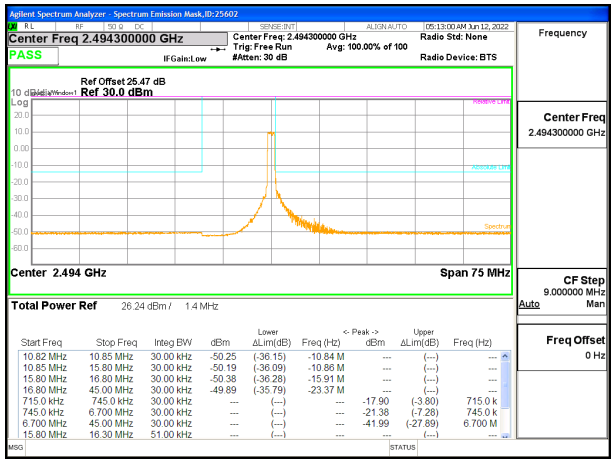


LTE B53 10MHz QPSK High Channel RB50-0

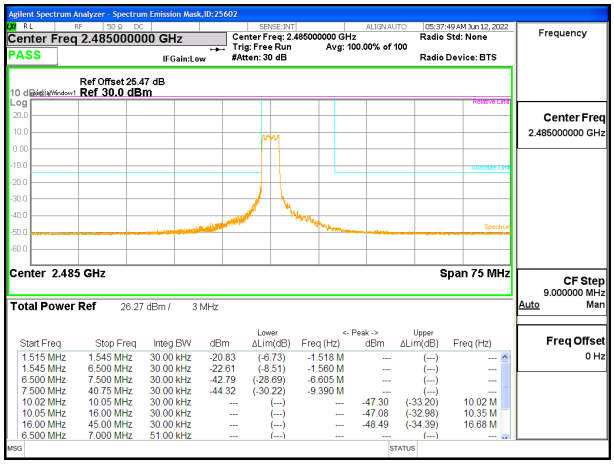
9.5.2 LTE BAND 53 EIRP DENSITY



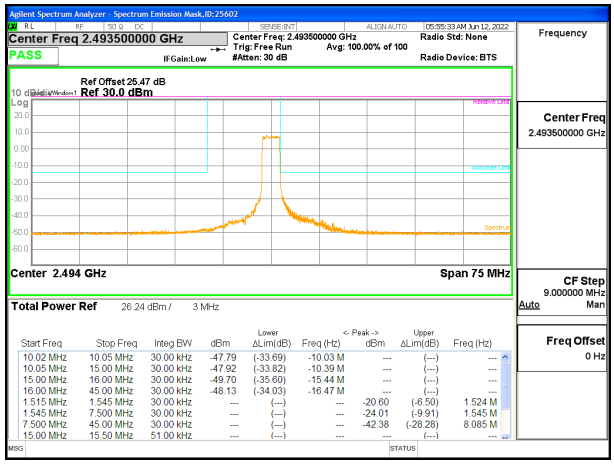
LTE B53 1.4MHz QPSK Low Channel RB6-0



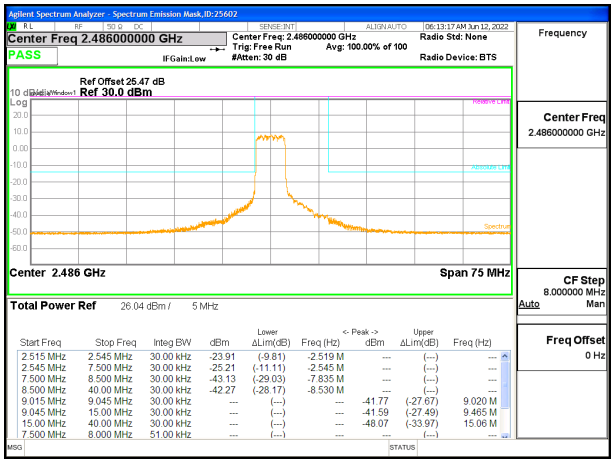
LTE B53 1.4MHz QPSK High Channel RB6-0



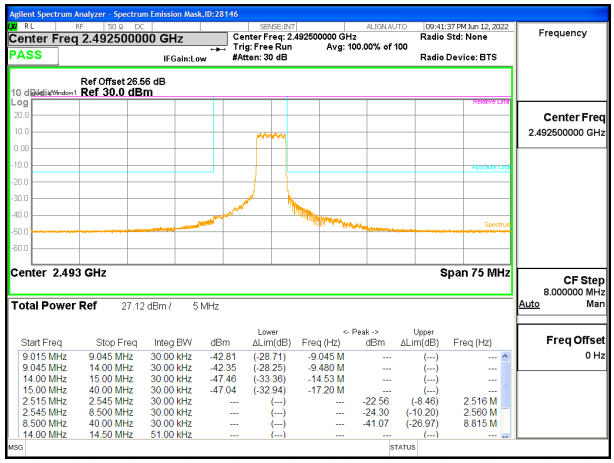
LTE B53 3MHz QPSK Low Channel RB15-0



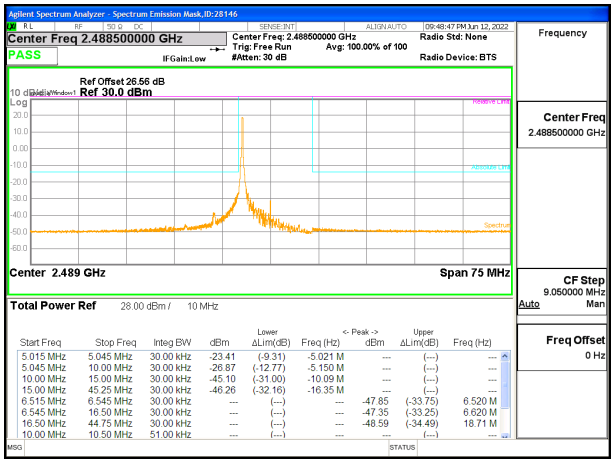
LTE B53 3MHz QPSK High Channel RB15-0



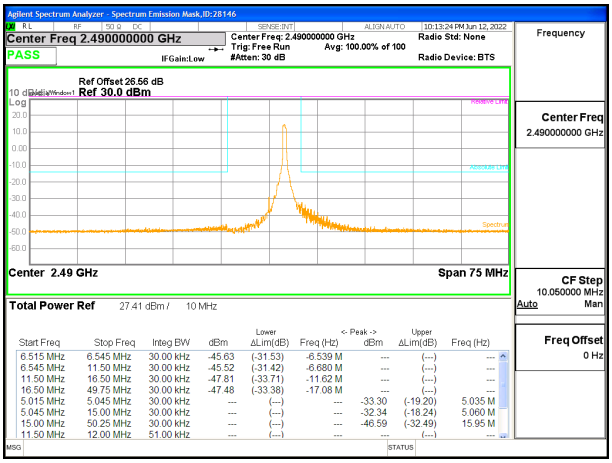
LTE B53 5MHz QPSK Low Channel RB25-0



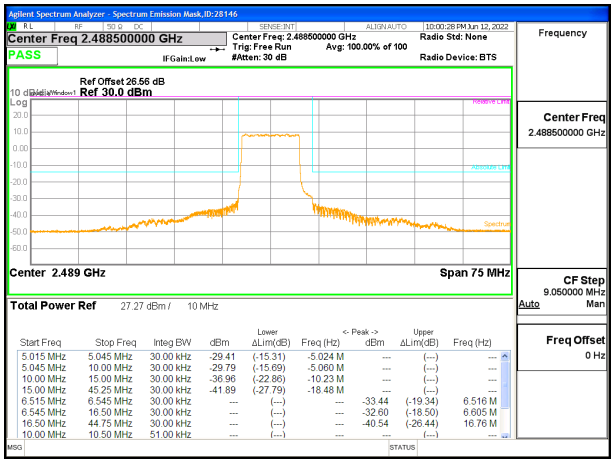
LTE B53 5MHz QPSK High Channel RB25-0



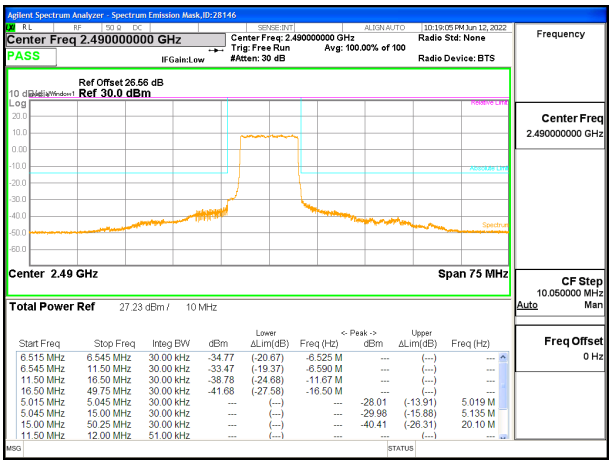
LTE B53 10MHz QPSK Low Channel RB1-0



LTE B53 10MHz QPSK High Channel RB1-49

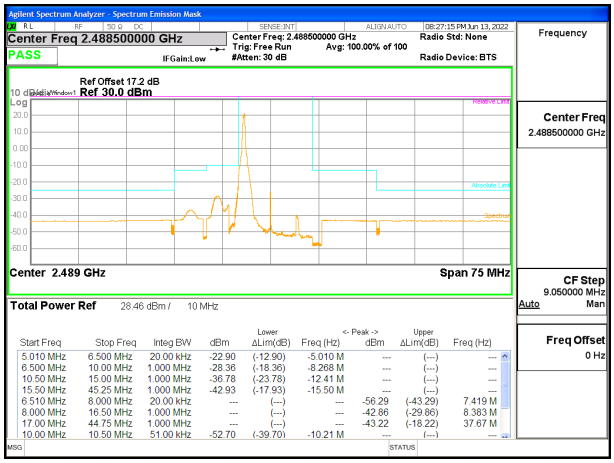


LTE B53 10MHz QPSK Low Channel RB50-0

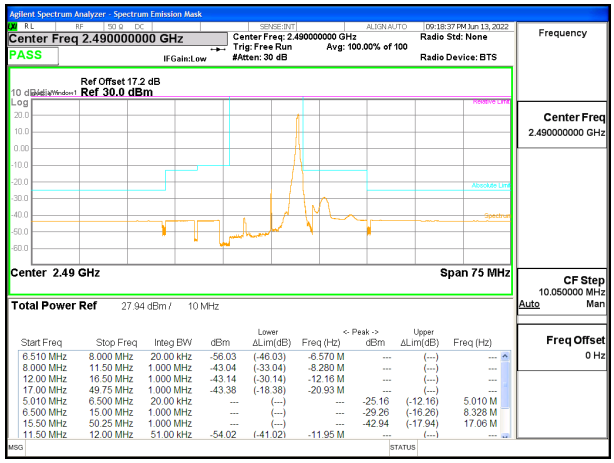


LTE B53 10MHz QPSK High Channel RB50-0

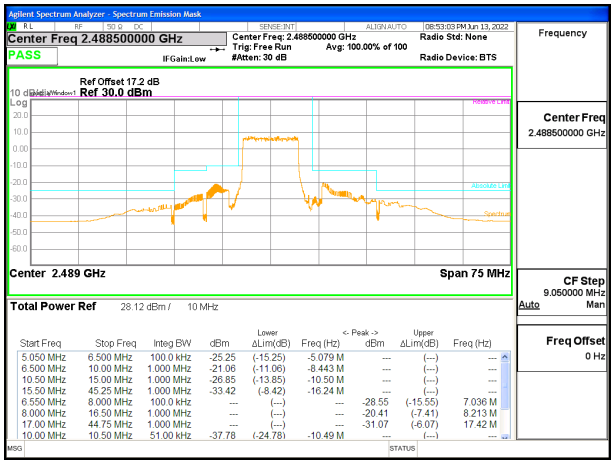
9.5.3 5G NR n53



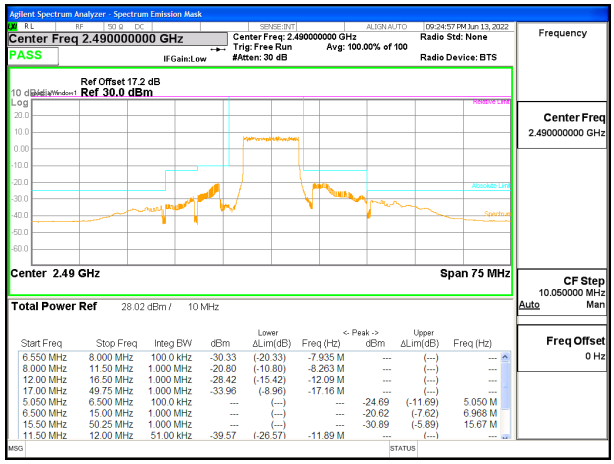
5G NR n53 10MHz BPSK Low Channel RB1-0



5G NR n53 10MHz BPSK High Channel RB1-23

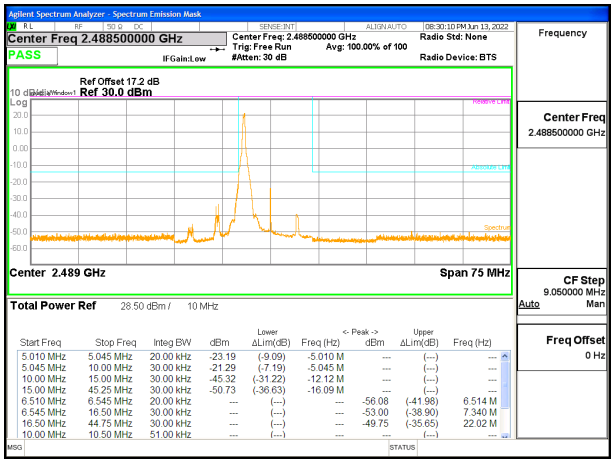


5G NR n53 10MHz BPSK Low Channel RB24-0

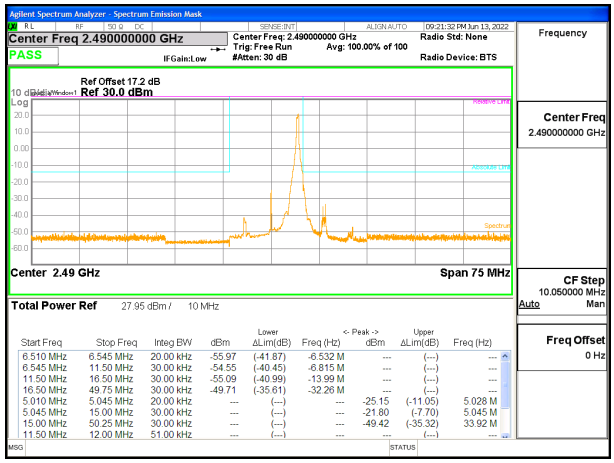


5G NR n53 10MHz BPSK High Channel RB24-0

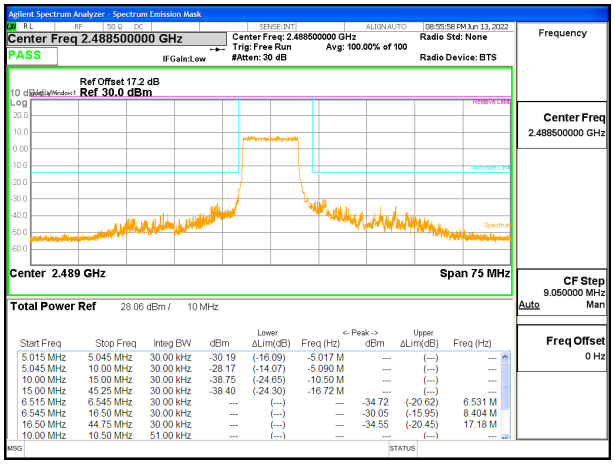
9.5.4 5G NR n53 EIRP DENSITY



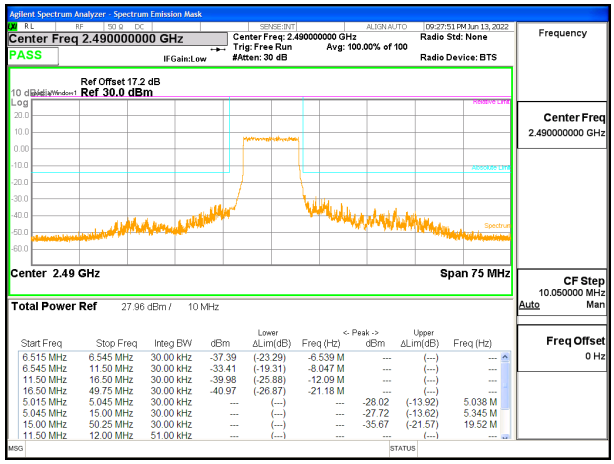
5G NR n53 10MHz BPSK Low Channel RB1-0



5G NR n53 10MHz BPSK High Channel RB1-23



5G NR n53 10MHz BPSK Low Channel RB24-0



5G NR n53 10MHz BPSK High Channel RB24-0

9.6. 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 -25dBm 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

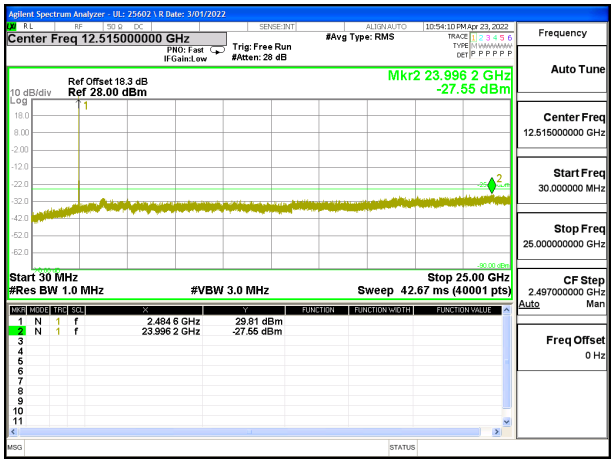
9.6.1. LTE BAND 53 AND 5G NR 53

LIMITS

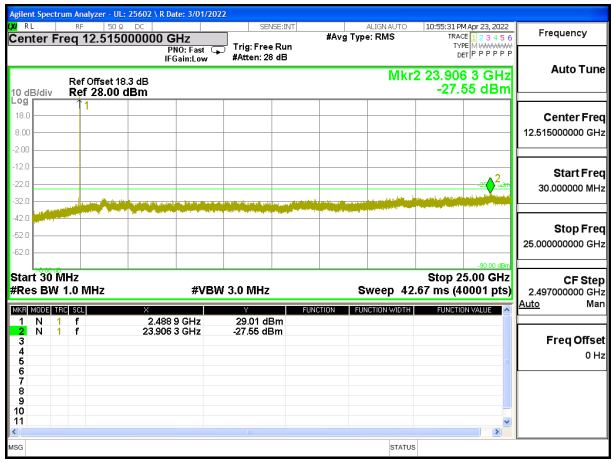
FCC: §25.149 (c)(4)
The minimum permissible attenuation level of any spurious emissions is 55 + 10 log (P) dB where transmitting power (P) in Watts.

ISED: SMSE-900-20 Annex A 9.g
The minimum permissible attenuation level of any spurious emissions is 55 + 10 log (P) dB where transmitting power (P) in Watts.

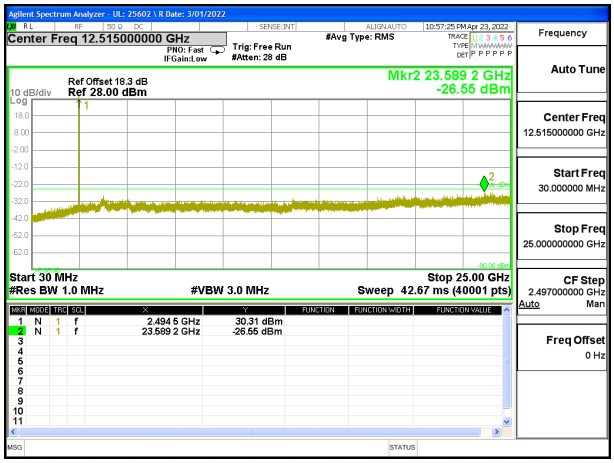
LTE BAND 53



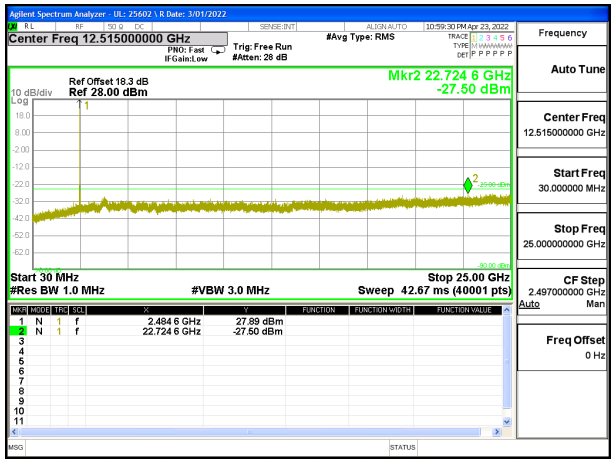
LTE B53 1.4MHz QPSK Low Channel RB1-0



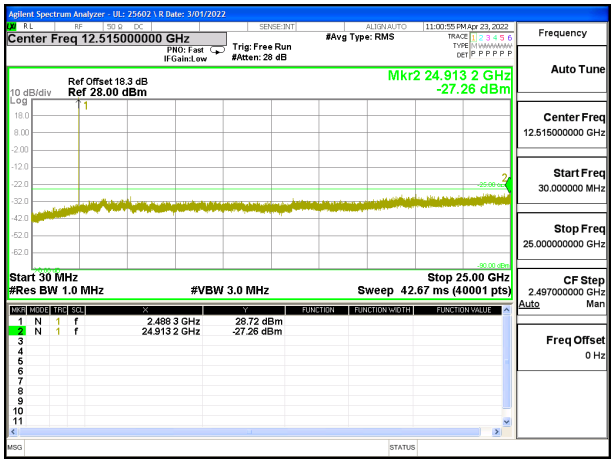
LTE B53 1.4MHz QPSK Middle Channel RB1-0



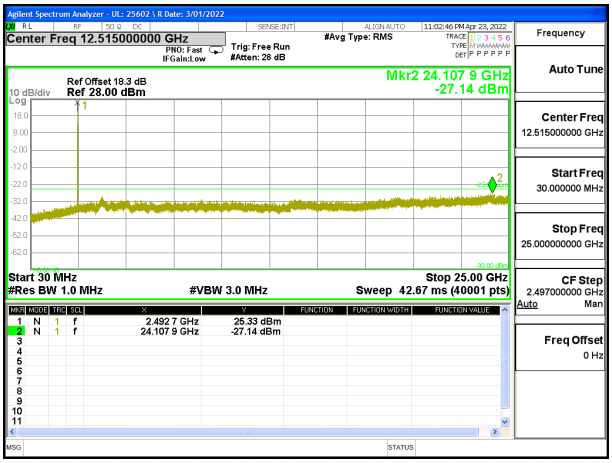
LTE B53 1.4MHz QPSK High Channel RB1-0



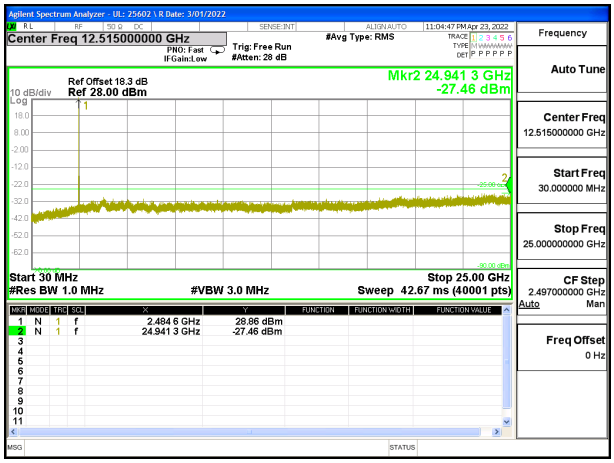
LTE B53 3MHz QPSK Low Channel RB1-0



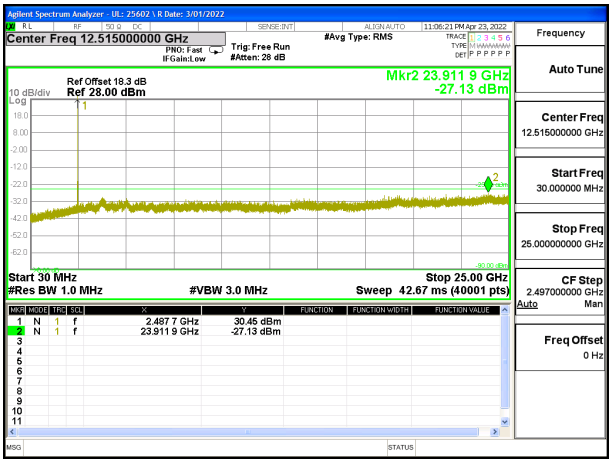
LTE B53 3MHz QPSK Middle Channel RB1-0



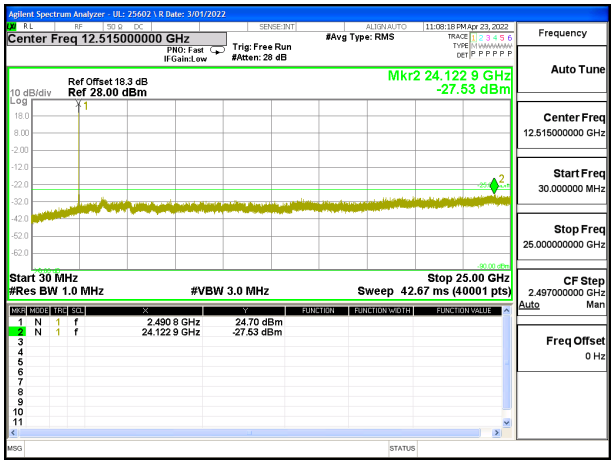
LTE B53 3MHz QPSK High Channel RB1-0



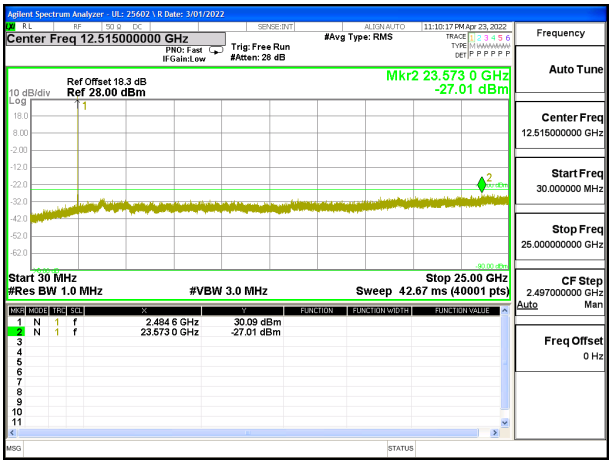
LTE B53 5MHz QPSK Low Channel RB1-0



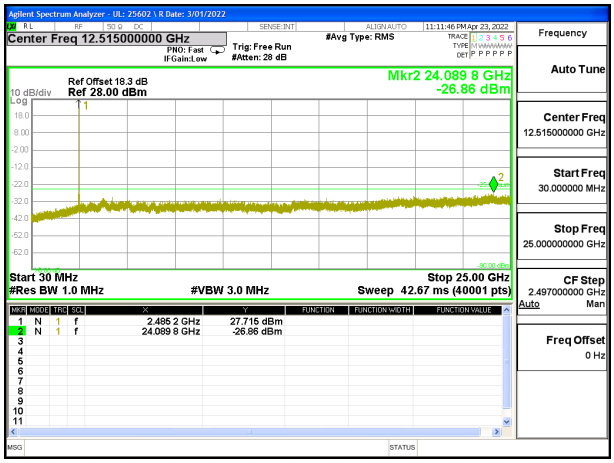
LTE B53 5MHz QPSK Middle Channel RB1-0



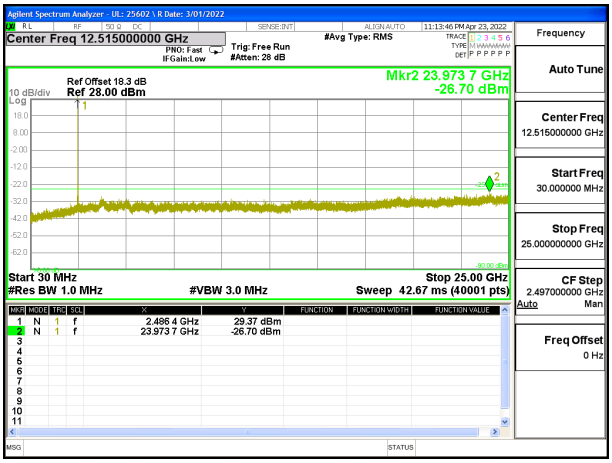
LTE B53 5MHz QPSK High Channel RB1-0



LTE B53 10MHz QPSK Low Channel RB1-0

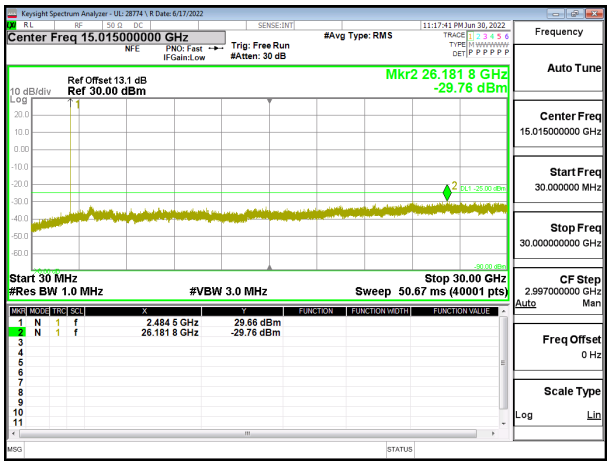


LTE B53 10MHz QPSK Middle Channel RB1-0

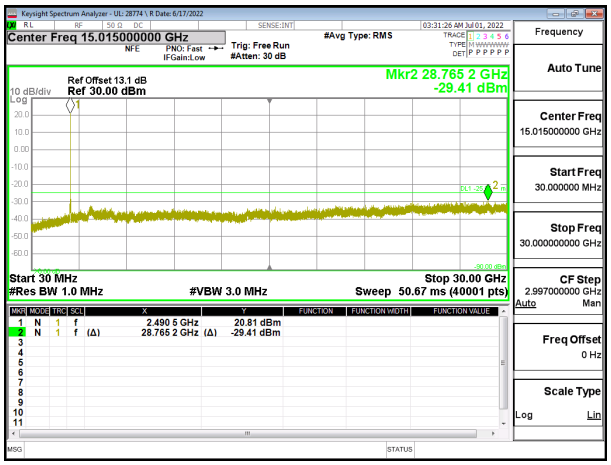


LTE B53 10MHz QPSK High Channel RB1-0

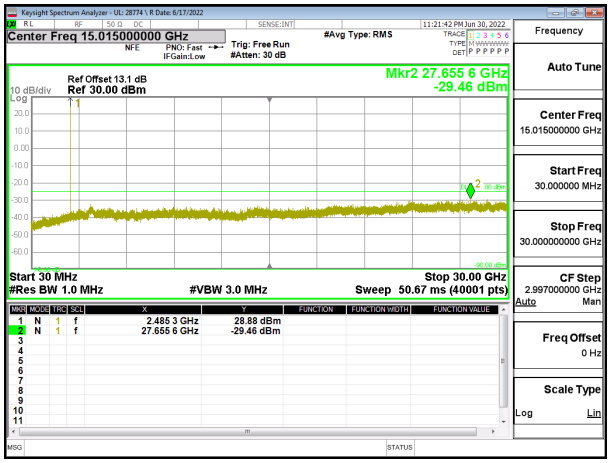
5G NR n53



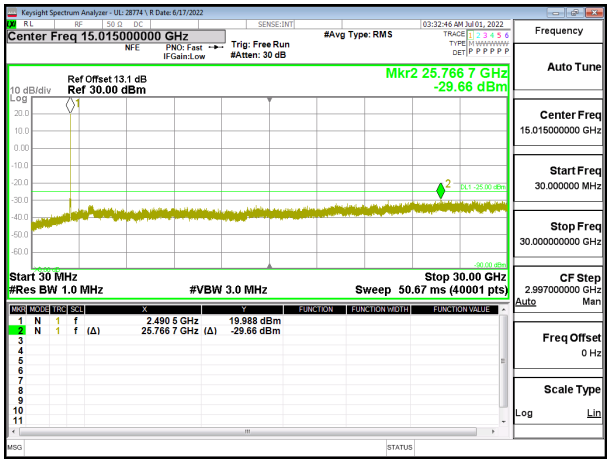
5G NR n53 10MHz BPSK Low Channel RB1-0



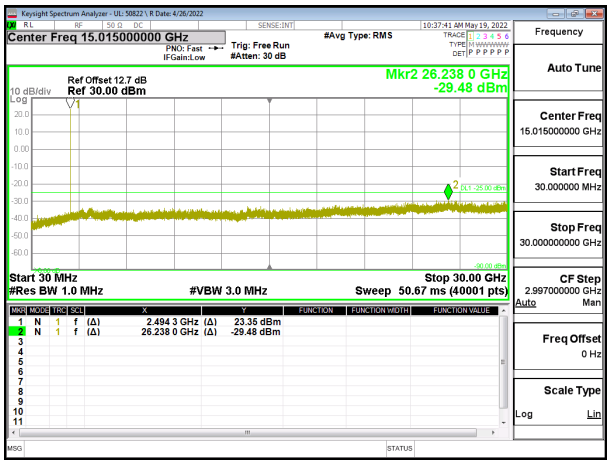
5G NR n53 10MHz BPSK Low Channel RB24-0



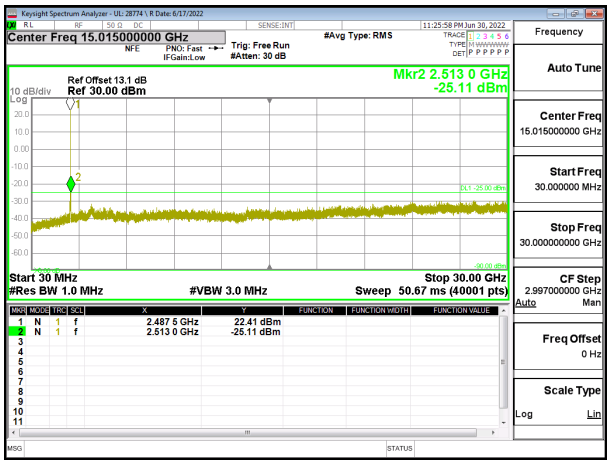
5G NR n53 10MHz BPSK Mid Channel RB1-1



5G NR n53 10MHz BPSK Middle Channel RB24-0



5G NR n53 10MHz BPSK High Channel RB1-23



5G NR n53 10MHz BPSK High Channel RB24-0

9.7. 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, 2.90VDC.

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

See the following pages.

9.7.1. LTE BAND 53 AND 5G NR n53

LIMITS

FCC: §25.202 (d)
(d) Frequency tolerance, Earth stations. The carrier frequency of each earth station transmitter authorized in these services shall be maintained within 0.001 percent of the reference frequency.

Test Engineer ID:	28146	Test Date:	6/14/2022

LTE BAND 53 QPSK (10MHz BANDWIDTH)

Band	53	Frequency Range		Frequency Error Reading (Hz)	Limit	
Condition		2483.5	2495		10	
Temperature	Voltage	Freq Reading @ Low End (MHz)	Freq Reading @ High End (MHz)		Frequency Stability (ppm)	Within Authorized Frequency Block (Hz)
Normal (20°C)		2484.0203	2494.5404			
Extreme (50°C)		2484.0203	2494.5404	-9.7	-0.004	Yes
Extreme (40°C)		2484.0203	2494.5404	-8.9	-0.004	Yes
Extreme (30°C)		2484.0203	2494.5404	-9.8	-0.004	Yes
Extreme (10°C)	Normal	2484.0203	2494.5404	-9.0	-0.004	Yes
Extreme (0°C)		2484.0203	2494.5404	10.2	0.004	Yes
Extreme (-10°C)		2484.0203	2494.5404	-8.1	-0.003	Yes
Extreme (-20°C)		2484.0203	2494.5404	-7.9	-0.003	Yes
Extreme (-30°C)		2484.0203	2494.5404	-10.6	-0.004	Yes
20°C	15%	2484.0203	2494.5404	-9.7	-0.004	Yes
	-15%	2484.0203	2494.5404	-8.4	-0.003	Yes
	End Point Voltage	2484.0202	2494.5404	-18.8	-0.008	Yes

5G NR n53 BPSK (10MHz BANDWIDTH)

Band	53	Frequency Range		Frequency Error Reading (Hz)	Limit	
Condition		2483.5	2495		10	
Temperature	Voltage	Freq Reading @ Low End (MHz)	Freq Reading @ High End (MHz)		Frequency Stability (ppm)	Within Authorized Frequency Block (Hz)
Normal (20°C)	Normal	2483.8500	2494.9550			
Extreme (50°C)		2483.8500	2494.9550	9.9	0.004	Yes
Extreme (40°C)		2483.8500	2494.9550	-12.3	-0.005	Yes
Extreme (30°C)		2483.8500	2494.9550	-7.8	-0.003	Yes
Extreme (10°C)		2483.8500	2494.9550	-11.6	-0.005	Yes
Extreme (0°C)		2483.8500	2494.9550	-8.4	-0.003	Yes
Extreme (-10°C)		2483.8500	2494.9550	-8.8	-0.004	Yes
Extreme (-20°C)		2483.8500	2494.9550	-8.7	-0.004	Yes
Extreme (-30°C)		2483.8500	2494.9550	9.0	0.004	Yes
20°C	15%	2483.8500	2494.9550	-10.1	-0.004	Yes
	-15%	2483.8500	2494.9550	-8.4	-0.003	Yes
	End Point Voltage	2483.8500	2494.9550	9.9	0.004	Yes

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.

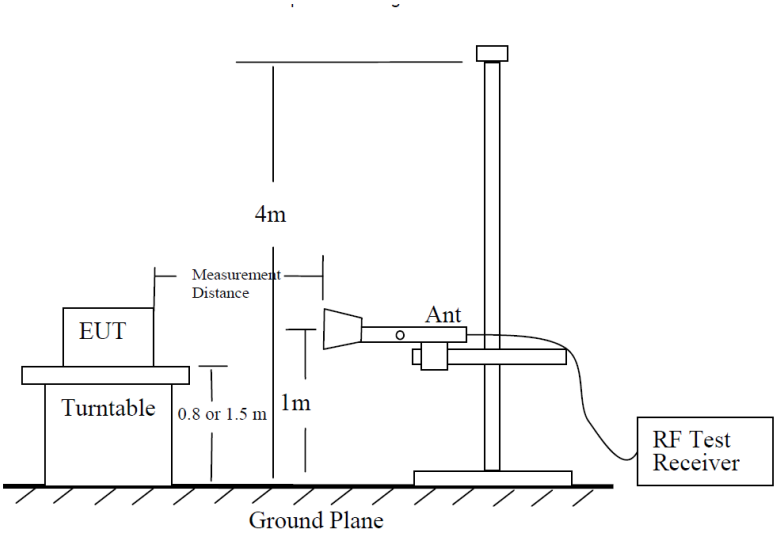


Figure 6—Test site-up for radiated ERP and/or EIRP measurements

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.

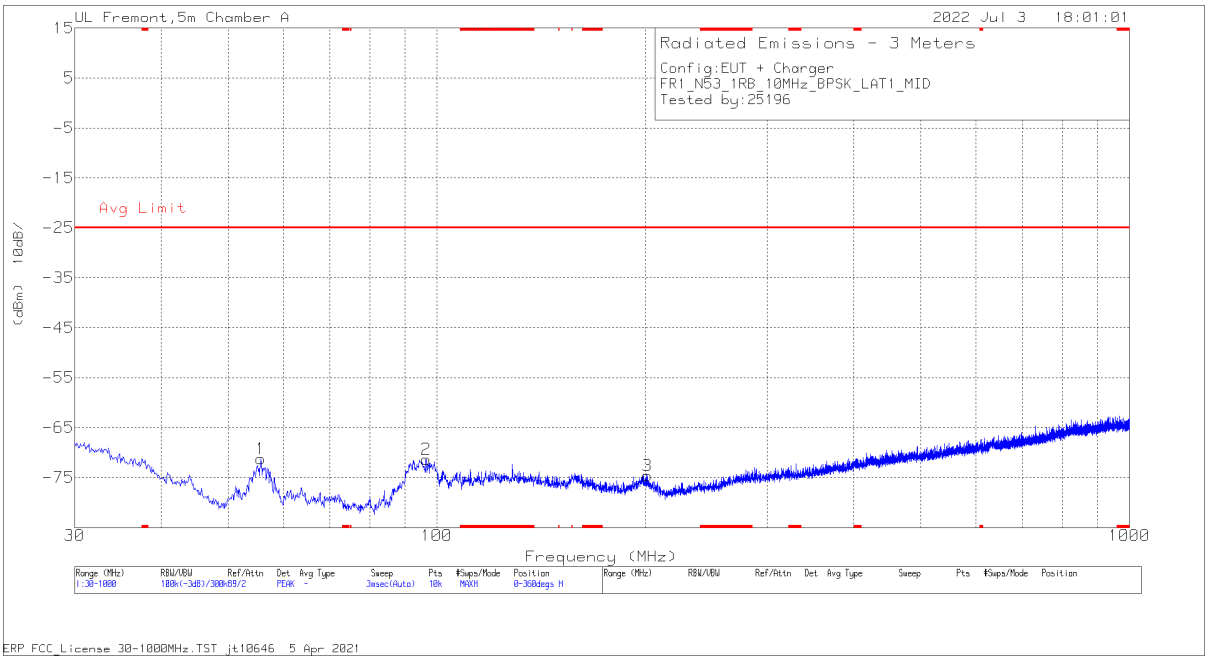
So, from d)

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

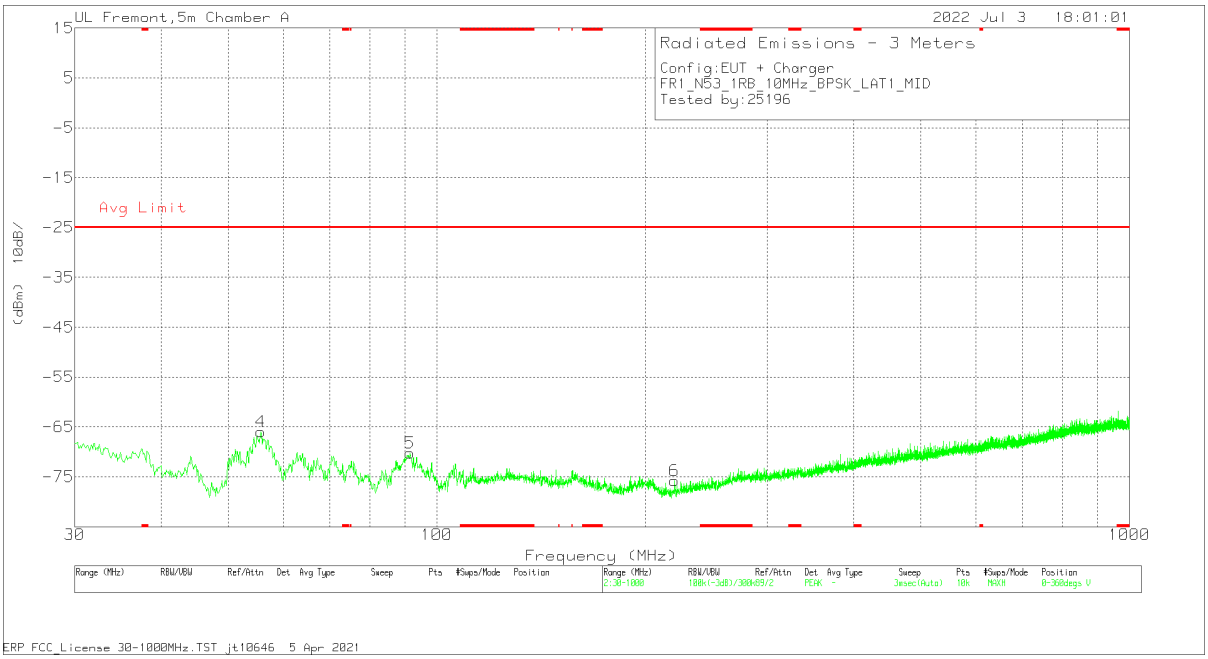
Then, EIRP (dBm) = E (dBμV/m) + 9.5424 − 104.8 = E (dBμV/m) – 95.2576

Note: Confidence check of each chamber is performed daily to see if any degradation from expected/normal reading reference data. Ambient check of each chamber is performed monthly.

Example Plot Below 1GHz



Horizontal Polarity

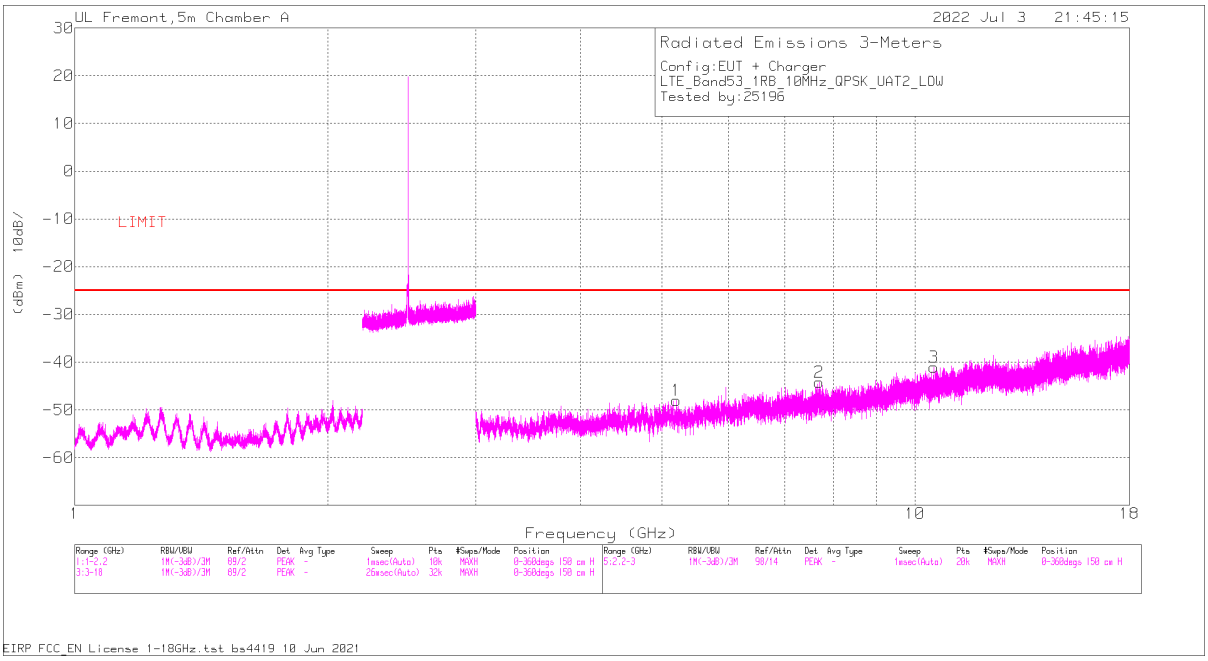


Vertical Polarity

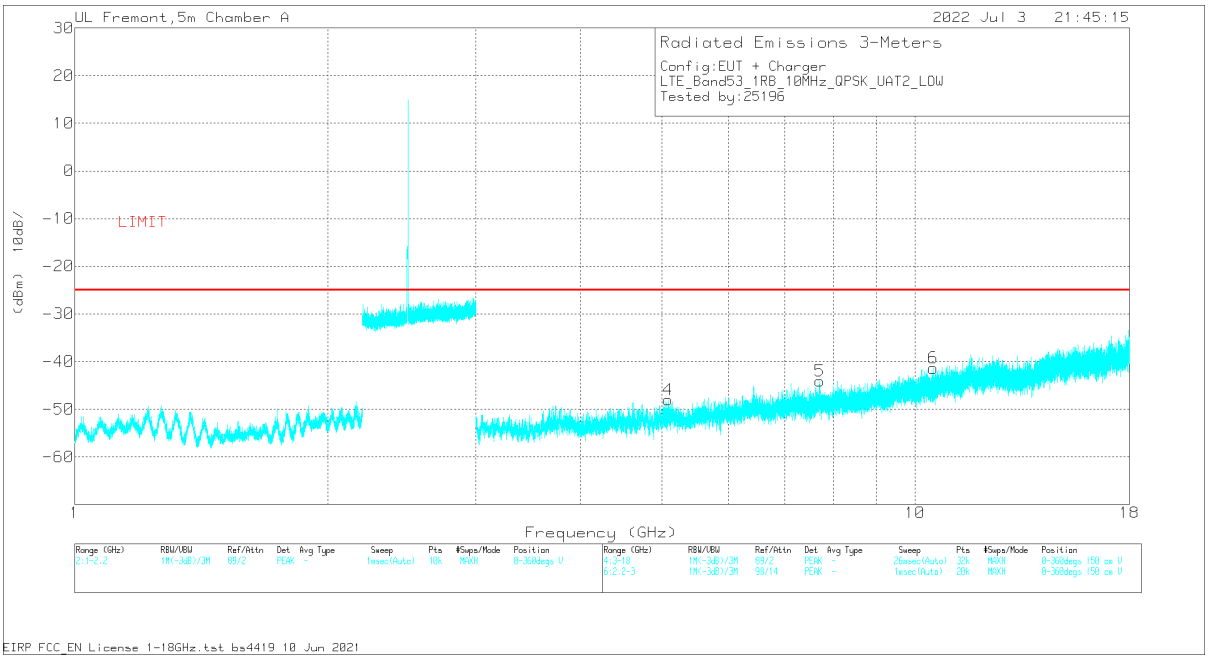
Trace Markers

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	85151 ACF (dB)_3m	Amp/Cbl (dB/m)	EIRP CF	Corrected Reading (dBm)	Avg Limit	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	55.705	37.09	Pk	13.8	-26.9	-95.2	-71.21	-25	-46.21	0-360	298	H
4	55.705	42.35	Pk	13.8	-26.9	-95.2	-65.95	-25	-40.95	0-360	101	V
5	91.401	37.16	Pk	14.2	-26.4	-95.2	-70.24	-25	-45.24	0-360	101	V
2	96.445	34.98	Pk	15.3	-26.4	-95.2	-71.32	-25	-46.32	0-360	298	H
3	201.496	27.11	Pk	18.6	-25.1	-95.2	-74.59	-25	-49.59	0-360	198	H
6	220.411	27.01	Pk	17.3	-24.9	-95.2	-75.79	-25	-50.79	0-360	299	V

Example Plot Above 1GHz



Horizontal Polarity



Vertical Polarity

Trace Markers

Frequency (GHz)	Meter Reading (dBuV)	Det	AF T348 (dB/m)	Amp/Cbl (dB)	BRF 2.4-2.5GHz T1786 1-18GHz	EIRP CF	Corrected Reading (dBm)	Harmonics limit	Margin (dB)	Polarity
Low Channel, 2488.5MHz										
5.084531	36.32	Pk	34.3	-23.8	.3	-95.2	-48.08	-25	-23.08	V
5.195625	35.92	Pk	34.5	-23.5	.3	-95.2	-47.98	-25	-22.98	H
7.691719	34.45	Pk	35.6	-19.5	.5	-95.2	-44.15	-25	-19.15	H
7.703906	34.61	Pk	35.6	-19.5	.4	-95.2	-44.09	-25	-19.09	V
10.510781	33.32	Pk	37.3	-17.4	.6	-95.2	-41.38	-25	-16.38	V
10.530938	33.55	Pk	37.3	-17.3	.6	-95.2	-41.05	-25	-16.05	H

UL VERIFICATION SERVICES INC.
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 319-4000 FAX: (510) 661-0888

10.1. FIELD STRENGTH OF SPURIOUS RADIATION, ANT 1

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.

The transmitter output was connected to a CMW500Test Set and configured to operate at maximum power. The band edge emissions were measured at the required operating frequencies in each band on the Spectrum Analyzer.

FCC: §25.149 (c)(4)
(vii) Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 1 MHz or greater. However, in the 1 MHz bands immediately above and adjacent to the 2495 MHz a resolution bandwidth of at least 1 percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. If 1 percent of the emission bandwidth of the fundamental emission is less than 1 MHz, the power measured must be integrated over the required measurement bandwidth of 1 MHz. A resolution bandwidth narrower than 1 MHz is permitted to improve measurement accuracy, provided the measured power is integrated over the full required measurement bandwidth (*i.e.,* 1 MHz). The emission bandwidth of the fundamental emission of a transmitter 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. When an emission outside of the authorized bandwidth causes harmful interference, the Commission may, at its discretion, require greater attenuation than specified in this section.

ISED: SMSE-009-20 Annex A 9
j. Compliance with this limit may be based on the use of a measurement resolution bandwidth of at least 1% of the occupied bandwidth. If 1% of the occupied bandwidth is less than 1 MHz, the power measured shall be integrated over the required measurement bandwidth of 1 MHz

RESULTS

10.1.1. LTE BAND 53

QPSK LTE BAND 53 (10.0MHZ BANDWIDTH), 1 RB

Project #:	14040866
Date:	7/3/2022
Test Engineer:	25196
Configuration:	EUT Only
Mode	LTE53 QPSK 10MHz
Chamber #:	Chamber A

Frequency (GHz)	Meter Reading (dBuV)	Det	AF T348 (dB/m)	Amp/Cbl (dB)	BRF 2.4-2.5GHz T1786 1-18GHz	EIRP CF	Corrected Reading (dBm)	Harmonics limit	Margin (dB)	Polarity
Low Channel, 2488.5MHz										
5.076094	35.63	Pk	34.3	-23.7	.3	-95.2	-48.67	-25	-23.67	V
5.086406	36.16	Pk	34.3	-23.8	.3	-95.2	-48.24	-25	-23.24	H
7.537969	34.28	Pk	35.5	-20.3	.4	-95.2	-45.32	-25	-20.32	H
7.585313	32.94	Pk	35.5	-19.9	.5	-95.2	-46.16	-25	-21.16	V
10.174219	33.2	Pk	37	-17.5	1	-95.2	-41.50	-25	-16.50	V
10.199531	33.03	Pk	37	-17.5	.8	-95.2	-41.87	-25	-16.87	H
Mid Channel, 2489.0MHz										
5.024063	35.82	Pk	34.3	-24.2	.2	-95.2	-49.08	-25	-24.08	H
5.139375	35.94	Pk	34.4	-23.9	.4	-95.2	-48.36	-25	-23.36	V
7.544531	35.19	Pk	35.5	-20.3	.4	-95.2	-44.41	-25	-19.41	H
7.676719	33.61	Pk	35.6	-19.6	.5	-95.2	-45.09	-25	-20.09	V
9.781406	33.27	Pk	36.6	-18	.9	-95.2	-42.43	-25	-17.43	V
9.8925	31.7	Pk	36.7	-17.2	.8	-95.2	-43.20	-25	-18.20	H
High Channel, 2490.0MHz										
5.078906	36.01	Pk	34.3	-23.7	.3	-95.2	-48.29	-25	-23.29	H
5.138906	35.99	Pk	34.4	-23.9	.4	-95.2	-48.31	-25	-23.31	V
7.633594	33.32	Pk	35.6	-19.6	.4	-95.2	-45.48	-25	-20.48	H
7.665469	34.07	Pk	35.5	-19.8	.4	-95.2	-45.03	-25	-20.03	V
9.773906	32.54	Pk	36.7	-18	.9	-95.2	-43.06	-25	-18.06	V
9.892031	33.62	Pk	36.7	-17.2	.8	-95.2	-41.28	-25	-16.28	H

QPSK LTE BAND 53 (10.0MHZ BANDWIDTH), 50 RB

Project #:	14040866
Date:	7/3/2022
Test Engineer:	27661
Configuration:	EUT only
Mode	LTE53 QPSK 10MHz
Chamber #:	Chamber A

Frequency (GHz)	Meter Reading (dBuV)	Det	AF T348 (dB/m)	Amp/Cbl (dB)	BRF 2.4-2.5GHz T1786 1-18GHz	EIRP CF	Corrected Reading (dBm)	Harmonics limit	Margin (dB)	Polarity
Low Channel, 2488.5MHz										
5.025469	35.95	Pk	34.3	-24.2	.2	-95.2	-48.95	-25	-23.95	V
5.035781	35.94	Pk	34.2	-24.2	.3	-95.2	-48.96	-25	-23.96	H
7.195781	35.36	Pk	35.5	-20.6	.4	-95.2	-44.54	-25	-19.54	V
7.351406	34.62	Pk	35.5	-20.1	.5	-95.2	-44.68	-25	-19.68	H
10.183594	32.64	Pk	37	-17.5	1	-95.2	-42.06	-25	-17.06	H
10.282031	32.64	Pk	37.1	-17.2	.8	-95.2	-41.86	-25	-16.86	V
Mid Channel, 2489.0MHz										
5.083594	35.58	Pk	34.3	-23.7	.3	-95.2	-48.72	-25	-23.72	V
5.199375	36.22	Pk	34.5	-23.5	.3	-95.2	-47.68	-25	-22.68	H
7.534219	33.6	Pk	35.5	-20.2	.4	-95.2	-45.90	-25	-20.90	H
7.683281	34.57	Pk	35.6	-19.5	.6	-95.2	-43.93	-25	-18.93	V
9.951094	32.01	Pk	36.8	-17	.8	-95.2	-42.59	-25	-17.59	H
10.168125	32.63	Pk	37	-17.6	.9	-95.2	-42.27	-25	-17.27	V
High Channel, 2490.0MHz										
5.030625	37.08	Pk	34.2	-24.2	.2	-95.2	-47.92	-25	-22.92	V
5.098594	35.32	Pk	34.4	-23.9	.3	-95.2	-49.08	-25	-24.08	H
7.5525	33.79	Pk	35.6	-20.2	.4	-95.2	-45.61	-25	-20.61	H
7.650938	33.5	Pk	35.6	-19.7	.4	-95.2	-45.40	-25	-20.40	V
10.185	33.12	Pk	37	-17.5	.9	-95.2	-41.68	-25	-16.68	H
10.288125	33.07	Pk	37.2	-17.1	.8	-95.2	-41.23	-25	-16.23	V

10.1.2. 5G NR n53

BPSK 5G NR n53 (10.0MHZ BANDWIDTH), 1 RB

Project #:	14040866
Date:	7/2/2022
Test Engineer:	27661
Configuration:	EUT only
Mode	5G NR n53 10MHz
Chamber #:	Chamber B

Frequency (GHz)	Meter Reading (dBuV)	Det	AF T348 (dB/m)	Amp/Cbl (dB)	BRF 2.4-2.5GHz T1786 1-18GHz	EIRP CF	Corrected Reading (dBm)	Harmonics limit	Margin (dB)	Polarity
Low Channel, 2488.5MHz										
4.953281	40.12	Pk	34.1	-31	.4	-95.2	-51.58	-25	-26.58	V
4.973906	39.58	Pk	34.1	-30.9	.3	-95.2	-52.12	-25	-27.12	H
7.477969	36.15	Pk	36	-26.9	.4	-95.2	-49.55	-25	-24.55	V
7.484531	35.14	Pk	36	-26.9	.4	-95.2	-50.56	-25	-25.56	H
9.963281	34.23	Pk	37.3	-24.7	.8	-95.2	-47.57	-25	-22.57	H
9.978281	34.61	Pk	37.3	-24.9	.8	-95.2	-47.39	-25	-22.39	V
Mid Channel, 2489.0MHz										
4.978594	39.71	Pk	34.1	-30.9	.3	-95.2	-51.99	-25	-26.99	H
4.984219	39.3	Pk	34.1	-30.8	.4	-95.2	-52.20	-25	-27.20	V
7.485	35.59	Pk	36	-26.9	.4	-95.2	-50.11	-25	-25.11	H
7.498125	35.1	Pk	36	-26.8	.4	-95.2	-50.50	-25	-25.50	V
9.923438	34.6	Pk	37.3	-24.9	.6	-95.2	-47.60	-25	-22.60	V
9.961406	34.13	Pk	37.3	-24.7	.8	-95.2	-47.67	-25	-22.67	H
High Channel, 2490.0MHz										
4.984219	38.88	Pk	34.1	-30.8	.4	-95.2	-52.62	-25	-27.62	H
4.984219	38.85	Pk	34.1	-30.8	.4	-95.2	-52.65	-25	-27.65	V
7.486875	36.78	Pk	36	-26.8	.4	-95.2	-48.82	-25	-23.82	H
7.487344	33.89	Pk	36	-26.8	.4	-95.2	-51.71	-25	-26.71	V
9.942656	35.24	Pk	37.3	-24.9	.7	-95.2	-46.86	-25	-21.86	H
9.967969	33.46	Pk	37.3	-24.7	.8	-95.2	-48.34	-25	-23.34	V

BPSK 5G NR n53 (10.0MHZ BANDWIDTH), 24 RB

Project #:	14040866
Date:	7/2/2022
Test Engineer:	27661
Configuration:	EUT only
Mode	5G NR n53 10MHz
Chamber #:	Chamber B

Frequency (GHz)	Meter Reading (dBuV)	Det	AF T348 (dB/m)	Amp/Cbl (dB)	BRF 2.4-2.5GHz T1786 1-18GHz	EIRP CF	Corrected Reading (dBm)	Harmonics limit	Margin (dB)	Polarity
Low Channel, 2488.5MHz										
4.977188	39.97	Pk	34.1	-30.9	.3	-95.2	-51.73	-25	-26.73	V
4.98000	38.46	Pk	34.1	-31	.3	-95.2	-53.34	-25	-28.34	H
7.472813	34.76	Pk	36	-26.9	.4	-95.2	-50.94	-25	-25.94	V
7.473281	36.58	Pk	36	-26.9	.4	-95.2	-49.12	-25	-24.12	H
9.94500	34.39	Pk	37.3	-24.9	.7	-95.2	-47.71	-25	-22.71	H
9.984375	34.33	Pk	37.3	-24.9	.8	-95.2	-47.67	-25	-22.67	V
Mid Channel, 2489.0MHz										
4.951875	39.55	Pk	34.1	-30.9	.4	-95.2	-52.05	-25	-27.05	V
4.963594	39.18	Pk	34.1	-31	.3	-95.2	-52.62	-25	-27.62	H
7.456406	35.27	Pk	36	-26.8	.4	-95.2	-50.33	-25	-25.33	H
7.491094	35.3	Pk	36	-26.8	.4	-95.2	-50.30	-25	-25.30	V
9.955781	33.41	Pk	37.3	-24.8	.8	-95.2	-48.49	-25	-23.49	V
9.969844	34.52	Pk	37.3	-24.7	.8	-95.2	-47.28	-25	-22.28	H
High Channel, 2490.0MHz										
4.985625	39.42	Pk	34.1	-30.8	.4	-95.2	-52.08	-25	-27.08	V
4.996406	39.15	Pk	34.1	-30.9	.4	-95.2	-52.45	-25	-27.45	H
7.465781	34.97	Pk	36	-26.9	.4	-95.2	-50.73	-25	-25.73	V
7.487344	36.28	Pk	36	-26.8	.4	-95.2	-49.32	-25	-24.32	H
9.9225	34.33	Pk	37.3	-25	.6	-95.2	-47.97	-25	-22.97	V
9.948281	35.58	Pk	37.3	-24.8	.8	-95.2	-46.32	-25	-21.32	H

10.2. FIELD STRENGTH OF SPURIOUS RADIATION, ANT 2

10.2.1. LTE BAND 53

QPSK LTE BAND 53 (10.0MHZ BANDWIDTH), 1 RB

Project #:	14040866
Date:	7/3/2022
Test Engineer:	25196
Configuration:	EUT Only
Mode	LTE53 QPSK 10MHz
Chamber #:	Chamber A

Frequency (GHz)	Meter Reading (dBuV)	Det	AF T348 (dB/m)	Amp/Cbl (dB)	BRF 2.4-2.5GHz T1786 1-18GHz	EIRP CF	Corrected Reading (dBm)	Harmonics limit	Margin (dB)	Polarity
Low Channel, 2488.5MHz										
5.084531	36.32	Pk	34.3	-23.8	.3	-95.2	-48.08	-25	-23.08	V
5.195625	35.92	Pk	34.5	-23.5	.3	-95.2	-47.98	-25	-22.98	H
7.691719	34.45	Pk	35.6	-19.5	.5	-95.2	-44.15	-25	-19.15	H
7.703906	34.61	Pk	35.6	-19.5	.4	-95.2	-44.09	-25	-19.09	V
10.510781	33.32	Pk	37.3	-17.4	.6	-95.2	-41.38	-25	-16.38	V
10.530938	33.55	Pk	37.3	-17.3	.6	-95.2	-41.05	-25	-16.05	H
Mid Channel, 2489.0MHz										
4.962656	36.74	Pk	34.2	-24.6	.3	-95.2	-48.56	-25	-23.56	V
5.041875	36.68	Pk	34.3	-24.1	.4	-95.2	-47.92	-25	-22.92	H
7.583906	34.1	Pk	35.5	-19.9	.5	-95.2	-45.00	-25	-20.00	H
7.616719	34.03	Pk	35.5	-19.9	.4	-95.2	-45.17	-25	-20.17	V
10.178906	33.82	Pk	37.1	-17.5	1	-95.2	-40.78	-25	-15.78	H
10.205625	31.98	Pk	37.1	-17.6	.8	-95.2	-42.92	-25	-17.92	V
High Channel, 2490.0MHz										
5.084063	35.71	Pk	34.3	-23.8	.3	-95.2	-48.69	-25	-23.69	V
5.127188	36.02	Pk	34.4	-23.9	.4	-95.2	-48.28	-25	-23.28	H
7.63125	34.45	Pk	35.6	-19.7	.4	-95.2	-44.45	-25	-19.45	H
7.642031	32.16	Pk	35.6	-19.6	.4	-95.2	-46.64	-25	-21.64	V
10.183125	32.77	Pk	37	-17.5	1	-95.2	-41.93	-25	-16.93	H
10.304063	32.94	Pk	37.2	-17	.8	-95.2	-41.26	-25	-16.26	V

QPSK LTE BAND 53 (10.0MHZ BANDWIDTH), 50 RB

Project #:	14040866
Date:	7/3/2022
Test Engineer:	25196
Configuration:	EUT only
Mode	LTE53 QPSK 10MHz
Chamber #:	Chamber A

Frequency (GHz)	Meter Reading (dBuV)	Det	AF T348 (dB/m)	Amp/Cbl (dB)	BRF 2.4-2.5GHz T1786 1-18GHz	EIRP CF	Corrected Reading (dBm)	Harmonics limit	Margin (dB)	Polarity
Low Channel, 2488.5MHz										
5.019375	36.19	Pk	34.2	-24.2	.2	-95.2	-48.81	-25	-23.81	V
5.070469	35.92	Pk	34.3	-23.7	.3	-95.2	-48.38	-25	-23.38	H
7.182188	36.09	Pk	35.5	-20.5	.4	-95.2	-43.71	-25	-18.71	V
7.257656	34.06	Pk	35.5	-20.3	.5	-95.2	-45.44	-25	-20.44	H
10.5975	32.81	Pk	37.3	-16.8	.7	-95.2	-41.19	-25	-16.19	V
10.705781	33.03	Pk	37.5	-17	.7	-95.2	-40.97	-25	-15.97	H
Mid Channel, 2489.0MHz										
5.020313	36.38	Pk	34.2	-24.2	.2	-95.2	-48.62	-25	-23.62	H
5.139844	36.47	Pk	34.4	-23.9	.4	-95.2	-47.83	-25	-22.83	V
7.380469	34.56	Pk	35.5	-20.4	.4	-95.2	-45.14	-25	-20.14	H
7.584375	33.54	Pk	35.5	-19.9	.5	-95.2	-45.56	-25	-20.56	V
10.167188	32.91	Pk	37	-17.6	.9	-95.2	-41.99	-25	-16.99	V
10.2225	33.15	Pk	37.1	-17.4	.7	-95.2	-41.65	-25	-16.65	H
High Channel, 2490.0MHz										
5.020313	36.21	Pk	34.2	-24.2	.2	-95.2	-48.79	-25	-23.79	V
5.08875	36.02	Pk	34.3	-23.8	.3	-95.2	-48.38	-25	-23.38	H
7.633125	34.43	Pk	35.6	-19.6	.4	-95.2	-44.37	-25	-19.37	H
7.701563	34.64	Pk	35.6	-19.5	.5	-95.2	-43.96	-25	-18.96	V
10.250625	32.73	Pk	37.1	-17.3	.7	-95.2	-41.97	-25	-16.97	V
10.305938	33.02	Pk	37.2	-17	.7	-95.2	-41.28	-25	-16.28	H

10.2.2. 5G NR n53

BPSK 5G NR n53 (10.0MHZ BANDWIDTH), 1 RB

Project #:	14040866
Date:	7/3/2022
Test Engineer:	27661
Configuration:	EUT only
Mode	5G NR n53 10MHz
Chamber #:	Chamber B

Frequency (GHz)	Meter Reading (dBuV)	Det	AF T348 (dB/m)	Amp/Cbl (dB)	BRF 2.4-2.5GHz T1786 1-18GHz	EIRP CF	Corrected Reading (dBm)	Harmonics limit	Margin (dB)	Polarity
Low Channel, 2488.5MHz										
4.984219	38.44	Pk	34.1	-30.8	.4	-95.2	-53.06	-25	-28.06	H
5.002031	38.04	Pk	34.1	-30.8	.3	-95.2	-53.56	-25	-28.56	V
7.41375	35.13	Pk	35.9	-26.7	.3	-95.2	-50.57	-25	-25.57	V
7.440938	37.28	Pk	36	-26.7	.4	-95.2	-48.22	-25	-23.22	H
9.962813	34.94	Pk	37.3	-24.8	.8	-95.2	-46.96	-25	-21.96	V
9.974063	35.11	Pk	37.3	-24.8	.8	-95.2	-46.79	-25	-21.79	H
Mid Channel, 2489MHz										
4.982813	39.46	Pk	34.1	-30.9	.4	-95.2	-52.14	-25	-27.14	V
4.984219	39.88	Pk	34.1	-30.8	.4	-95.2	-51.62	-25	-26.62	H
7.474219	36.1	Pk	36	-26.9	.4	-95.2	-49.60	-25	-24.60	H
7.48875	35.17	Pk	36	-26.9	.4	-95.2	-50.53	-25	-25.53	V
9.954844	34.84	Pk	37.3	-24.7	.8	-95.2	-46.96	-25	-21.96	H
9.983438	34.78	Pk	37.3	-24.9	.8	-95.2	-47.22	-25	-22.22	V
High Channel, 2490MHz										
4.959844	39.05	Pk	34.1	-31	.3	-95.2	-52.75	-25	-27.75	V
4.99125	39.3	Pk	34.1	-31	.4	-95.2	-52.40	-25	-27.40	H
7.460625	35.5	Pk	36	-26.9	.4	-95.2	-50.20	-25	-25.20	V
7.503281	35.83	Pk	36	-26.8	.4	-95.2	-49.77	-25	-24.77	H
9.9525	33.19	Pk	37.3	-24.7	.8	-95.2	-48.61	-25	-23.61	V
9.962344	34.22	Pk	37.3	-24.8	.8	-95.2	-47.68	-25	-22.68	H

BPSK 5G NR n53 (10.0MHZ BANDWIDTH), 24 RB

Project #:	14040866
Date:	7/3/2022
Test Engineer:	27661
Configuration:	EUT only
Mode	5G NR n53 10MHz
Chamber #:	Chamber B

Frequency (GHz)	Meter Reading (dBuV)	Det	AF T348 (dB/m)	Amp/Cbl (dB)	BRF 2.4-2.5GHz T1786 1-18GHz	EIRP CF	Corrected Reading (dBm)	Harmonics limit	Margin (dB)	Polarity
Low Channel, 2488.5MHz										
4.985156	39	Pk	34.1	-30.8	.4	-95.2	-52.50	-25	-27.50	H
4.993125	38.92	Pk	34.1	-30.9	.4	-95.2	-52.68	-25	-27.68	V
7.468125	35.42	Pk	36	-26.9	.4	-95.2	-50.28	-25	-25.28	V
7.486406	36.39	Pk	36	-26.8	.4	-95.2	-49.21	-25	-24.21	H
9.936563	34.05	Pk	37.3	-24.9	.7	-95.2	-48.05	-25	-23.05	V
9.942656	34.44	Pk	37.3	-24.9	.7	-95.2	-47.66	-25	-22.66	H
Mid Channel, 2489MHz										
4.935938	37.13	Pk	34.1	-30.8	.4	-95.2	-54.37	-25	-29.37	V
4.951406	37.95	Pk	34.1	-30.9	.4	-95.2	-53.65	-25	-28.65	H
7.506094	35.57	Pk	36	-26.8	.4	-95.2	-50.03	-25	-25.03	H
7.510313	35.17	Pk	36	-26.9	.4	-95.2	-50.53	-25	-25.53	V
9.958125	35.86	Pk	37.3	-24.7	.8	-95.2	-45.94	-25	-20.94	H
10.044844	34.84	Pk	37.3	-24.9	.9	-95.2	-47.06	-25	-22.06	V
High Channel, 2490MHz										
4.990781	38.36	Pk	34.1	-31	.4	-95.2	-53.34	-25	-28.34	H
4.994063	39.94	Pk	34.1	-30.9	.4	-95.2	-51.66	-25	-26.66	V
7.434844	35.56	Pk	36	-26.7	.4	-95.2	-49.94	-25	-24.94	V
7.456406	36.59	Pk	36	-26.8	.4	-95.2	-49.01	-25	-24.01	H
9.955781	33.99	Pk	37.3	-24.8	.8	-95.2	-47.91	-25	-22.91	H
9.955781	33.11	Pk	37.3	-24.8	.8	-95.2	-48.79	-25	-23.79	V

11. SETUP PHOTOS

Please refer to 14040866-EP1V1 for setup photos.

END OF REPORT

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