TEST REPORT

Report Number. : 14523740-E24V3

Applicant	:	APPLE, INC 1 APPLE PARK WAY CUPERTINO, CA 95014, U.S.A
Model	:	A2848
Brand	:	APPLE
FCC ID	:	579C-E8435A
IC	:	579C-E8435A
EUT Description	:	SMARTPHONE
Test Standard(s)	:	FCC 47 CFR Part 2, Part 25 ISED RSS-GEN Issue 5, RSS-170 Issue 4

Date Of Issue:
2023-08-01

Prepared by:
UL LLC
47173 Benicia Street
Fremont, CA 94538, U.S.A.
TEL: (510) 319-4000
FAX: (510) 661-0888

CERT #0751.05

Revision History

Rev.	Issue Date	Revisions	Revised By
V1	2023-07-13	Initial Review	Mengistu Mekuria
V2	2023-07-28	Addressed TCB Feedback Section 1, 6.2, 10.2	Andrew Le
V3	2023-08-01	Adding Peak Power Data at Section 6.2 and 8	Mengistu Mekuria

UL Verification Services Inc.
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 319-4000 FAX: (510) 661-0888

TABLE OF CONTENTS

UL Verification Services Inc.
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 319-4000 FAX: (510) 661-0888

UL Verification Services Inc.
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 319-4000 FAX: (510) 661-0888

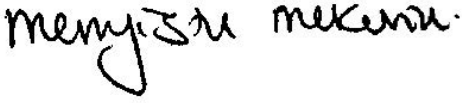
1. ATTESTATION OF TEST RESULTS

Applicant Name and Address	APPLE, INC 1 APPLE PARK WAY CUPERTINO, CA 95014, U.S.A
Model	A2848
Brand	APPLE
FCC ID	579C-E8435A
IC	579C-E8435A
EUT Description	SMARTPHONE
Serial Number	XMXVQGQ61Q, W65Q19WKHQ,CGYYK1Q2H7, PW29XTVX25 (CODUCTED) AND JK757KHXGW, L924YC39V4 (RADIATED)
Sample Receipt Date	2022-11-04
Date Tested	2022-11-07 to 2023-06-27
Applicable Standards	FCC 47 CFR Part 2, Part 25 ISED RSS-GEN Issue 5, RSS-170 Issue 4
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 Staff Engineer UL Verification Services Inc.	Eric Ting Senior Test Engineer UL Verification Services Inc.	Andrew Le Senior Laboratory Technician UL Verification Services Inc.

UL Verification Services Inc.
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 319-4000 FAX: (510) 661-0888

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."
Below is a list of the data provided by the customer:

1. Antenna gain and type (see section 6.4)

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	

UL Verification Services Inc.
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 319-4000 FAX: (510) 661-0888

3. TEST METHODOLOGY

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

- ANSI C63.26:2015
- FCC 47 CFR Part 2 and 25
- FCC KDB 971168 D01 v03r01: Power Meas License Digital Systems
- FCC KDB 971168 D02 v02r02: Misc Rev Approv License Devices
- FCC KDB 412172 D01 v01r01. Determining ERP and EIRP
- ISED RSS-GEN ISSUE 5, RSS-170 Issue 3
- SMSE-009-20

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	550739
☒	Building 2: 47266 Benicia Street, Fremont, CA 94538, USA			
☐	Building 3: 843 Auburn Court, Fremont, CA 94538 USA			
☒	Building 4: 47658 Kato Rd, Fremont, CA 94538, USA			
☒	Building 5: 47670 Kato Rd, Fremont, CA 94538 USA			

UL Verification Services Inc.
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 319-4000 FAX: (510) 661-0888

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}
Conducted Antenna Port Emission Measurement	1.940 db
Power Spectral Density	2.466 db
Time Domain Measurements Using SA	3.39 %
RF Power Measurement Direct Method Using Power Meter	0.450 db Peak 1.300 db Ave.
Radio Frequency (Spectrum Analyzer)	141.16 Hz
Occupied Bandwidth	1.22%
Worst Case Conducted Disturbance, 9KHz to 0.15 MHz	3.78 db
Worst Case Conducted Disturbance, 0.15 to 30 MHz	3.40 db
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

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

UL Verification Services Inc.
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 319-4000 FAX: (510) 661-0888

6. EQUIPMENT UNDER TEST

6.1. DESCRIPTION OF EUT

The Apple iPhone is a smartphone with cellular GSM, GPRS, EGPRS, UMTS, LTE, 5GNR1, 5GNR2, IEEE 802.11a/b/g/n/ac/ax, Bluetooth (BT), Ultra-Wideband (UWB), GPS, NFC, NB UNII, 802.15.4, 802.15.4ab-NB and MSS technologies. The rechargeable battery is not user accessible.

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.

The transmitter has a maximum 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)_(Ant 2)	0.40

Bandwidth (MHz)	Modulation	Low Frequency (MHz)	Upper Frequency (MHz)	Conducted Average (dBm)	EIRP Average (dBm)	EIRP Average (W)	Conducted Peak (dBm)	EIRP Peak (dBm)	EIRP Peak (W)	99% BW (kHz)	Emission Designator
1.4	QPSK	2484.2	2494.3	20.70	21.10	0.129	24.52	24.92	0.310	1093	1M09G7W
	16QAM			20.70	21.10	0.129	24.29	24.69	0.294	1093	1M09D7W
3.0	QPSK	2485.0	2493.5	20.70	21.10	0.129	24.35	24.75	0.299	2698	2M70G7W
	16QAM			20.70	21.10	0.129	24.21	24.61	0.289	2700	2M70D7W
5.0	QPSK	2486.0	2492.5	20.70	21.10	0.129	24.66	25.06	0.321	4502	4M50G7W
	16QAM			20.70	21.10	0.129	24.57	24.97	0.314	4504	4M50D7W
10.0	QPSK	2488.5	2490.0	20.70	21.10	0.129	24.69	25.09	0.323	8977	8M98G7W
	16QAM			20.70	21.10	0.129	24.53	24.93	0.311	8982	8M98D7W

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) (Ant 2)	0.40

Bandwidth (MHz)	Modulation	Low Frequency (MHz)	Upper Frequency (MHz)	Conducted Average (dBm)	EIRP Average (dBm)	EIRP Average (W)	Conducted Peak (dBm)	EIRP Peak (dBm)	EIRP Peak (W)	99% BW (kHz)	Emission Designator
10.0	BPSK	2488.5	2490.0	20.70	21.10	0.129	24.96	25.36	0.344	86147	86M1G7W
	QPSK			20.70	21.10	0.129	24.93	25.33	0.341	85957	86M0G7W
	16QAM			20.70	21.10	0.129	24.01	24.41	0.276	89190	89M2D7W

6.3. SOFTWARE AND FIRMWARE

The EUT firmware installed during testing was version 0.13.02.

6.4. MAXIMUM ANTENNA GAIN

The antenna(s) gain 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 n53	2483.5 – 2495 MHz	-5.5	0.4

UL Verification Services Inc.
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 319-4000 FAX: (510) 661-0888

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 2

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	X	Y

Radiated spurious emissions were investigated from 9kHz to 30MHz, 30MHz-1GHz and above 18GHz. 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.

UL Verification Services Inc.
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 319-4000 FAX: (510) 661-0888

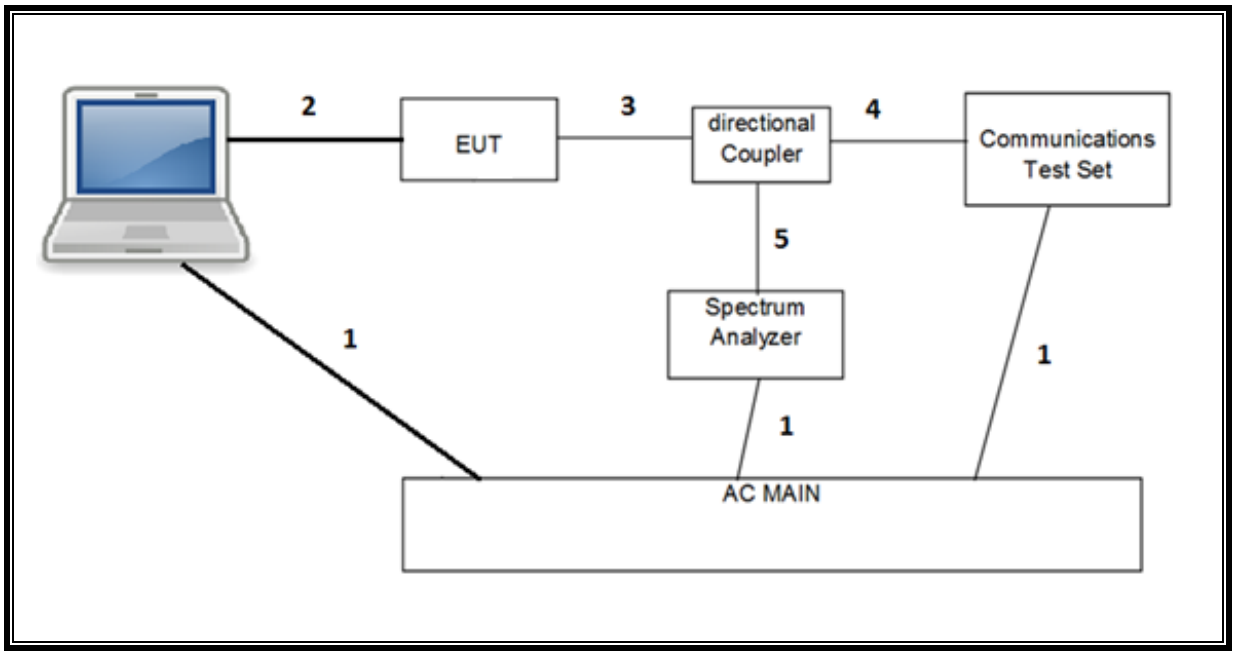
6.6. DESCRIPTION OF TEST SETUP

SUPPORT TEST EQUIPMENT					
Description	**Manufacturer**	**Model**	**Serial Number**		**FCC ID/ DoC**
Laptop	Apple	MacBook Pro	HRP082673		BCGA1708
AC/DC adapter	Apple	A1718	C4H64450HH3GN8RA6		--

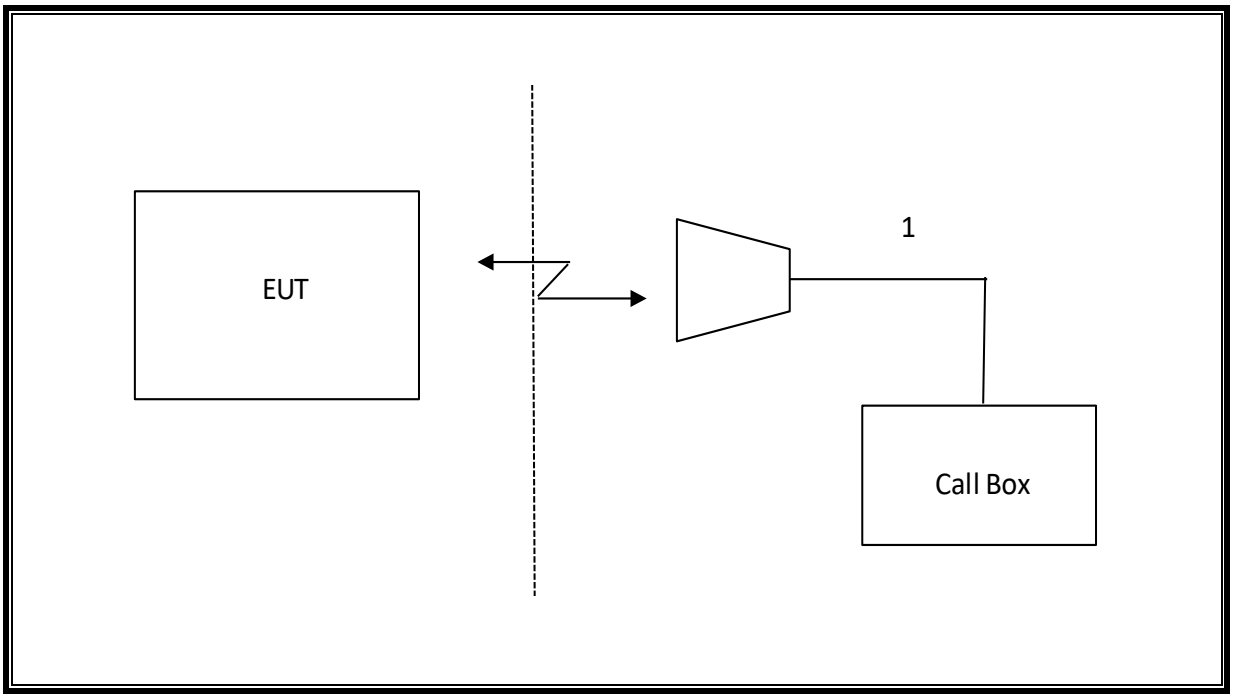
I/O CABLES (RF CONDUCTED TEST)						
Cable No.	**Port**	**# of Identical Ports**	**Connector Type**	**Cable Type**	**Cable Length (m)**	**Remarks**
1	AC	3	US 115V	Un-shielded	2.0	N/A
2	USB	1	DC	Un-shielded	1.0	N/A
3	RF In/Out	1	EUT	Un-shielded	0.6	N/A
4	RF In/Out	1	Communication Test Set	Un-shielded	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	79834	06/082203
*Antenna, Broadband Hybrid, 30MHz to 2000MHz	Sunol Sciences	JB3	85151	04/30/2024
Spectrum Analyzer, PXA, 3Hz to 44GHz	Keysight	N9030A	85313	02/29/2024
Spectrum Analyzer, PXA	Keysight	N9030B	222074	07/16/2023
Spectrum Analyzer, PXA	Keysight	N9030B	85214	07/18/2023
Spectrum Analyzer, PXA	Keysight	N9030B	222073	07/22/2023
PXA Signal Analyzer	Keysight	N9030B	222073	07/22/2023
EMI TEST RECEIVER	Rohde & Schwarz	ESW44	230548	02/29/2024
EMI TEST RECEIVER	Rohde & Schwarz	ESW44	201498	02/29/2024
Directional Coupler	KRYTAR	152610	198816	09/23/2023
Directional Coupler	KRYTAR	152610	135712	09/23/2023
Power Meter, P-series single channel	Keysight	N1912A	90630	01/24/2024
Power Meter, P-series single channel	Keysight	N1912A	90719	01/31/2024
Power Meter, P-series single channel	Agilent	N1911A	82174	01/31/2024
Power Sensor, P – series, 50MHz to 18GHz, Wideband	Keysight	N1921A	90389	01/31/2024
Wideband Communication Test Set, Call Box	Rohde & Schwarz	CMW500	222792	02/29/2024
Wideband Communication Test Set, Call Box	Rohde & Schwarz	CMW500	22796	02/29/2024
Wideband Communication Test Set, Call Box	Rohde & Schwarz	CMW500	230297	02/29/2024
*5G NR Communication Test Set, Call Box	Keysight	UXM	207269	01/31/2024
*5G NR Communication Test Set, Call Box	Keysight	UXM	199836	01/31/2024
*Chamber, Environmental	Cincinnati Sub Zero	ZPHS-8-3.5-SCT/WC	82472	11/16/2023
*Amplifier, 218GHz to 26.5GHz	Amplical	AMP18G26.5-60	215705	02/26/2023
*Amplifier, 26.5GHz to 40GHz	Amplical	AMP26G40-65	172346	02/29/20224
Antenna, Horn 18 to 26.5GHz	ARA	MWH-1826/B	172362	03/31/2024
Antenna, Horn 26.5GHz to 40GHz	ARA	MWH-2640/B	172365	03/31/2024
*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
10dB Fixed Attenuator	Pasternack Enterprises	PE7087-10	236360	Verified/Characterized before use
10dB Fixed Attenuator	Pasternack Enterprises	PE7087-10	236285	Verified/Characterized before use
10dB Fixed Attenuator	Pasternack Enterprises	PE7087-10	236355	Verified/Characterized before use
UL AUTOMATION SOFTWARE				
CLT Software	UL	UL RF	Ver 3.4, May 20, 2022	
Power Measurement Software	UL	UL RF	Ver 3.1.4, April 29, 2022	
Radiated test software	UL	UL RF	Ver 9.5, Jan 21, 2022	

NOTES:

1. * Testing is completed before equipment expiration date.
2. ** Equipment listed above that has a calibration due date during the testing period, the testing is completed before equipment expiration date.

UL Verification Services Inc.
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 319-4000 FAX: (510) 661-0888

8. RF OUTPUT POWER VERIFICATION

LIMITS

FCC: §25.204
(a) In bands shared coequally with terrestrial radio communication services, the equivalent isotropically radiated power transmitted in any direction towards the horizon by an earth station, other than an ESV, operating in frequency bands between 1 and 15 GHz, shall not exceed the following limits except as provided for in paragraph (c) of this section:

+ 40 dBW in any 4 kHz band for $\theta \leq 0°$
+ 40 + 3θ dBW in any 4 kHz band for $0° < \theta \leq 5°$

where θ is the angle of elevation of the horizon viewed from the center of radiation of the antenna of the earth station and measured in degrees as positive above the horizontal plane and negative below it.

ISED RSS-170:
5.3.2 Mobile Earth Stations (MESs)
The application for MES certification shall state the MES e.i.r.p. that is necessary for satisfactory communication. The maximum permissible e.i.r.p. will be the stated e.i.r.p. plus a 2 dB margin. If a detachable antenna is used, the certification application shall state the recommended antenna type and manufacturer, the antenna gain and the maximum transmitter output power at the antenna terminal.

TEST PROCEDURE

The transmitter output is connected to a wideband power meter/sensor which is greater than the occupied bandwidth as worst-case scenario, also the total power readings still comply with the required limit.

The cable assembly insertion loss of 13.2 dB (ANT 1) / 12.32 dB (ANT 4) (including 10.70 dB coupler and 2.5 dB cable (ANT 1) / 10 dB pad and 2.32 dB cable (ANT 4)) was entered as an offset in the power meter to allow for a gated average reading of power.

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).

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

Test Engineer ID:	27342	Test Date:	11/17/2022

OUTPUT POWER FOR LTE BAND 53 (1.4 MHz)

Bandwidth (MHz)	Modulation	RB Allocation	RB Offset	Ant 1 Conducted Average (dBm)			Ant 2 Conducted Average (dBm)			Ant 1 Conducted Peak (dBm)			Ant 2 Conducted Peak (dBm)		
				60147	60195	60248	60147	60195	60248	60147	60195	60248	60147	60195	60248
				2484.2 MHz	2489.0 MHz	2494.3 MHz	2484.2 MHz	2489.0 MHz	2494.3 MHz	2484.2	2489.0	2494.3	2484.2	2489.0	2494.3
1.4	QPSK	1	0	20.63	20.61	20.65	20.64	20.65	20.68	24.59	24.65	24.65	23.90	23.83	23.90
		1	2	**20.70**	20.64	20.69	20.65	20.67	**20.70**	24.53	24.55	24.58	23.80	23.70	23.80
		1	5	20.65	20.65	20.65	20.69	20.66	20.67	24.61	24.68	24.65	23.92	23.80	23.88
		3	0	20.64	20.68	20.67	20.67	20.67	20.62	24.92	25.03	24.99	24.17	24.15	24.14
		3	1	20.68	20.68	**20.70**	**20.70**	**20.70**	20.64	24.85	24.92	24.93	24.11	24.06	24.04
		3	2	20.68	**20.70**	**20.70**	20.65	20.64	**20.70**	24.84	24.92	24.91	24.05	23.96	24.10
		6	0	19.96	19.99	19.99	19.64	19.72	19.65	25.59	**25.66**	25.62	**24.52**	24.44	24.43
	16QAM	1	0	20.67	20.61	20.64	20.58	20.52	20.42	25.15	25.03	25.03	24.01	23.74	23.91
		1	2	20.53	20.65	**20.70**	20.66	**20.70**	20.53	24.85	24.89	24.96	23.74	23.83	23.79
		1	5	20.52	20.61	20.67	20.46	20.37	20.55	24.96	24.98	25.06	23.83	23.73	23.88
		3	0	20.53	20.42	20.41	20.44	20.45	20.50	25.26	25.16	25.15	24.00	23.97	23.98
		3	1	20.50	20.44	20.42	20.36	20.48	20.46	25.14	25.09	25.06	23.81	23.84	23.88
		3	2	20.55	20.46	20.42	20.45	20.53	20.52	25.17	25.10	25.08	23.91	23.83	23.88
		6	0	19.34	19.30	19.40	19.47	19.48	19.44	25.42	25.45	**25.50**	24.29	**24.29**	24.27
	64QAM	1	0	**20.70**	20.62	20.67	20.53	20.68	20.59	24.80	24.73	24.74	23.81	23.69	23.62
		1	2	20.69	20.64	20.59	20.57	20.68	20.57	24.73	24.61	24.63	23.41	23.61	23.66
		1	5	20.64	20.67	20.64	20.56	20.58	20.49	24.83	24.71	24.74	23.84	23.69	23.68
		3	0	20.59	20.52	20.45	20.58	**20.70**	20.58	24.89	24.90	24.86	23.87	23.80	23.78
		3	1	20.61	20.54	20.46	20.62	20.66	20.53	24.86	24.86	24.80	23.83	23.78	23.82
		3	2	20.64	20.50	20.48	20.55	20.61	20.61	24.86	24.82	24.83	23.73	23.75	23.79
		6	0	19.52	19.43	19.53	19.61	19.66	19.59	24.89	24.90	**24.95**	23.97	**23.94**	**24.12**
	256QAM	1	0	20.67	20.52	20.49	20.21	20.44	20.10	22.77	22.54	23.14	21.63	21.52	21.45
		1	2	**20.70**	20.57	20.50	20.23	20.41	20.48	22.78	23.11	22.86	21.68	21.77	21.88
		1	5	20.51	20.52	20.53	20.21	20.52	20.23	22.85	23.06	22.49	21.13	21.66	21.03
		3	0	20.62	20.54	20.46	20.22	20.48	20.37	23.12	23.37	23.06	21.81	22.26	22.44
		3	1	20.62	20.53	20.49	20.26	20.52	20.41	23.15	23.29	23.07	21.82	21.73	22.30
		3	2	20.61	20.55	20.50	20.33	20.41	**20.70**	23.12	23.37	23.11	21.84	22.09	22.04
		6	0	20.67	20.46	20.33	20.19	20.36	20.36	**23.66**	23.21	23.01	**22.55**	22.35	22.41

OUTPUT POWER FOR LTE BAND 53 (3.0 MHz)

Bandwidth (MHz)	Modulation	RB Allocation	RB Offset	Ant 1 Conducted Average (dBm)			Ant 2 Conducted Average (dBm)			Ant 1 Conducted Peak (dBm)			Ant 2 Conducted Peak (dBm)		
				60155	60195	60240	60155	60195	60240	60147	60195	60248	60147	60195	60248
				2485.0 MHz	2489.0 MHz	2493.5 MHz	2485.0 MHz	2489.0 MHz	2493.5 MHz	2484.2	2489.0	2494.3	2484.2	2489.0	2494.3
3.0	QPSK	1	0	20.60	20.61	20.62	20.65	20.64	20.60	24.59	24.59	24.60	23.72	23.79	23.76
		1	7	**20.70**	**20.70**	**20.70**	**20.70**	**20.70**	**20.70**	24.57	24.57	24.57	23.66	23.74	23.76
		1	14	20.62	20.61	20.61	20.60	20.59	20.60	24.59	24.60	24.60	23.65	23.72	23.78
		8	0	19.99	20.04	20.01	19.75	19.73	19.73	25.14	25.18	25.14	23.96	24.00	24.00
		8	4	20.03	20.08	20.06	19.76	19.76	19.74	25.23	25.24	25.22	24.01	24.08	24.05
		8	7	20.02	20.06	20.07	19.77	19.75	19.74	25.17	25.20	25.22	23.97	24.03	24.03
		15	0	19.97	20.03	20.00	19.73	19.72	19.70	25.20	**25.27**	25.22	24.02	**24.35**	24.07
	16QAM	1	0	20.54	20.57	20.58	20.59	20.37	20.41	25.00	25.07	25.00	23.75	23.81	23.82
		1	7	20.64	**20.70**	20.66	**20.70**	20.43	20.49	24.97	25.07	24.95	23.72	23.78	23.79
		1	14	20.52	20.52	20.54	20.59	20.41	20.44	24.99	25.05	25.02	23.75	23.78	23.82
		8	0	19.34	19.38	19.41	19.53	19.55	19.55	25.18	25.20	25.17	23.92	23.99	23.97
		8	4	19.35	19.47	19.44	19.58	19.58	19.59	25.17	25.21	25.16	23.93	24.00	23.98
		8	7	19.36	19.41	19.43	19.55	19.60	19.60	25.19	25.20	25.15	23.88	23.99	23.98
		15	0	19.30	19.34	19.32	19.52	19.55	19.56	**25.39**	25.35	25.35	24.10	24.18	**24.21**
	64QAM	1	0	20.62	20.58	20.61	20.59	20.53	20.45	24.78	24.66	24.71	23.61	23.68	23.66
		1	7	**20.70**	20.67	20.67	**20.70**	20.53	20.56	24.73	24.64	24.66	23.60	23.57	23.61
		1	14	20.63	20.61	20.63	20.57	20.57	20.49	24.75	24.65	24.71	23.58	23.63	23.60
		8	0	19.50	19.54	19.53	19.72	19.60	19.60	24.85	24.88	24.86	23.79	23.79	23.82
		8	4	19.50	19.58	19.54	19.72	19.65	19.63	24.84	24.87	24.87	23.77	23.80	23.81
		8	7	19.51	19.55	19.52	19.72	19.67	19.65	24.83	24.84	24.85	23.77	23.82	23.85
		15	0	19.51	19.50	19.46	19.68	19.65	19.63	25.08	**25.12**	25.12	24.02	**24.02**	**24.07**
	256QAM	1	0	20.60	20.51	20.49	20.56	20.56	20.48	22.76	22.68	22.54	21.37	21.35	21.46
		1	7	20.66	**20.70**	20.57	20.56	20.53	20.56	22.66	22.59	22.46	21.33	21.61	21.39
		1	14	20.59	20.65	20.50	20.54	20.52	20.50	22.68	22.68	22.47	21.35	21.43	21.67
		8	0	20.55	20.55	20.54	20.65	20.66	20.59	23.34	23.45	23.52	22.35	22.42	22.34
		8	4	20.57	20.60	20.58	**20.70**	20.66	20.66	23.36	23.49	**23.57**	22.30	22.44	22.37
		8	7	20.58	20.60	20.61	**20.70**	20.68	20.63	23.40	23.35	23.46	22.34	22.46	22.36
		15	0	20.53	20.54	20.52	20.64	20.65	20.60	23.55	23.51	23.54	22.37	**22.56**	22.46

UL Verification Services Inc.
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 319-4000 FAX: (510) 661-0888

OUTPUT POWER FOR LTE BAND 53 (5.0 MHz)

Bandwidth (MHz)	Modulation	RB Allocation	RB Offset	LAT			UAT			Ant 1			Ant 2		
				Conducted Average (dBm)			Conducted Average (dBm)			Conducted Peak (dBm)			Conducted Peak (dBm)		
				60165	60195	60230	60165	60195	60230	60147	60195	60248	60147	60195	60248
				2486.0 MHz	2489.0 MHz	2492.5 MHz	2486.0 MHz	2489.0 MHz	2492.5 MHz	2484.2	2489.0	2494.3	2484.2	2489.0	2494.3
5.0	QPSK	1	0	20.58	20.57	20.63	20.59	20.56	20.62	24.21	24.15	24.16	23.85	23.89	23.84
		1	12	**20.70**	**20.70**	**20.70**	**20.70**	**20.70**	**20.70**	24.22	24.17	24.15	23.85	23.92	23.84
		1	24	20.63	20.61	20.65	20.62	20.54	20.58	24.21	24.19	24.21	23.83	23.85	23.84
		12	0	19.98	19.95	19.97	19.63	19.66	19.75	24.61	24.62	24.61	23.95	23.99	24.02
		12	6	19.97	19.99	20.00	19.68	19.69	19.75	24.53	24.61	24.61	23.94	23.97	23.97
		12	11	19.99	19.93	19.96	19.66	19.64	19.72	24.61	24.57	24.59	23.94	23.96	23.98
		25	0	19.99	19.94	20.00	19.66	19.67	19.71	25.02	25.04	**25.07**	24.38	**24.66**	24.37
	16QAM	1	0	20.39	20.33	20.58	20.53	20.49	20.58	24.50	24.54	24.61	23.83	23.91	23.87
		1	12	20.52	20.43	**20.70**	20.66	20.64	**20.70**	24.53	24.56	24.72	23.88	23.91	23.93
		1	24	20.44	20.35	20.59	20.61	20.52	20.58	24.51	24.55	24.64	23.80	23.82	23.86
		12	0	19.12	19.19	19.14	19.59	19.56	19.68	24.63	24.72	24.63	23.99	24.08	24.05
		12	6	19.21	19.19	19.17	19.63	19.59	19.71	24.60	24.57	24.57	23.93	23.91	23.93
		12	11	19.16	19.19	19.15	19.59	19.56	19.70	24.63	24.62	24.58	23.92	23.96	24.02
		25	0	19.15	19.09	19.13	19.54	19.54	19.62	25.16	25.11	**25.21**	24.50	**24.57**	24.47
	64QAM	1	0	20.64	20.65	20.52	20.60	20.65	20.60	24.25	24.19	24.15	23.75	23.72	23.66
		1	12	20.68	**20.70**	20.58	20.64	**20.70**	20.62	24.28	24.17	24.17	23.72	23.72	23.66
		1	24	20.66	20.61	20.52	20.57	20.59	20.60	24.22	24.15	24.17	23.63	23.65	23.66
		12	0	19.47	19.43	19.45	19.58	19.59	19.67	24.39	24.38	24.36	23.89	23.85	23.85
		12	6	19.52	19.47	19.49	19.64	19.62	19.69	24.36	24.33	24.33	23.86	23.83	23.81
		12	11	19.50	19.44	19.47	19.61	19.63	19.66	24.37	24.34	24.36	23.85	23.87	23.83
		25	0	19.50	19.42	19.45	19.62	19.60	19.68	**24.71**	24.68	24.65	**24.18**	**24.17**	24.15
	256QAM	1	0	20.56	20.51	20.50	20.61	20.56	20.58	22.25	22.26	22.41	21.56	21.64	21.56
		1	12	**20.70**	20.61	20.56	20.63	20.60	20.67	22.38	22.23	22.44	21.48	21.53	21.56
		1	24	20.62	20.62	20.51	20.58	20.47	20.57	22.24	22.40	22.37	21.45	21.47	21.52
		12	0	20.54	20.52	20.50	20.62	20.62	20.65	23.23	23.21	**23.34**	22.73	22.68	22.75
		12	6	20.57	20.53	20.51	20.66	20.63	**20.70**	23.24	23.26	23.26	22.70	22.71	22.70
		12	11	20.53	20.49	20.51	20.63	20.60	20.68	23.17	23.27	23.27	22.68	22.66	22.56
		25	0	20.53	20.47	20.50	20.63	20.60	20.66	23.26	23.25	23.24	22.76	22.75	**22.81**

OUTPUT POWER FOR LTE BAND 53 (10.0 MHz)

Bandwidth (MHz)	Modulation	RB Allocation	RB Offset	Ant 1			Ant 2			Ant 1			Ant 2		
				Conducted Average (dBm)			Conducted Average (dBm)			Conducted Peak (dBm)			Conducted Peak (dBm)		
				60190	60195	60205	60190	60195	60205	60147	60195	60248	60147	60195	60248
				2488.5 MHz	2489.0 MHz	2490.0 MHz	2488.5 MHz	2489.0 MHz	2490.0 MHz	2484.2	2489.0	2494.3	2484.2	2489.0	2494.3
10.0	QPSK	1	0	20.65	20.67	20.65	20.58	20.62	20.68	24.20	24.11	24.14	23.80	23.90	23.89
		1	24	**20.70**	**20.70**	**20.70**	**20.70**	**20.70**	**20.70**	24.17	24.09	24.11	23.82	23.89	23.84
		1	49	20.65	20.65	20.64	20.63	20.65	20.69	24.15	24.09	24.12	23.73	23.85	23.84
		25	0	19.96	20.02	20.06	19.73	19.72	19.76	24.63	24.62	24.69	24.01	24.09	24.05
		25	12	20.06	20.11	20.09	19.75	19.77	19.81	24.69	24.66	24.67	23.99	24.07	24.03
		25	24	20.06	20.09	20.07	19.73	19.73	19.70	24.71	24.67	24.66	23.99	24.05	23.94
		50	0	20.04	20.10	20.06	19.73	19.72	19.77	**25.21**	25.19	25.19	24.50	24.51	**24.69**
	16QAM	1	0	20.58	20.56	20.65	20.64	20.52	20.48	24.58	24.55	24.54	23.86	23.96	23.93
		1	24	20.59	20.63	**20.70**	**20.70**	20.49	20.62	24.48	24.47	24.50	23.78	23.84	23.83
		1	49	20.56	20.68	20.61	20.68	20.48	20.54	24.51	24.60	24.50	23.78	23.80	23.80
		25	0	19.27	19.32	19.38	19.70	19.63	19.71	24.75	24.72	24.83	24.10	24.09	24.08
		25	12	19.35	19.44	19.40	19.71	19.65	19.74	24.60	24.62	24.61	23.92	23.94	23.92
		25	24	19.34	19.39	19.38	19.71	19.67	19.65	24.84	24.83	24.84	24.14	24.13	24.04
		50	0	19.31	19.39	19.35	19.68	19.65	19.72	**25.19**	25.17	25.15	24.52	24.52	**24.53**
	64QAM	1	0	20.60	20.60	20.51	20.63	20.56	20.67	24.41	24.24	24.21	23.78	23.79	23.79
		1	24	20.66	**20.70**	20.51	20.68	20.65	**20.70**	24.34	24.20	24.13	23.73	23.74	23.70
		1	49	20.59	20.62	20.45	20.59	20.61	20.69	24.26	24.15	24.12	23.61	23.63	23.65
		25	0	19.41	19.42	19.48	19.73	19.67	19.75	24.31	24.26	24.36	23.88	23.86	23.85
		25	12	19.50	19.52	19.48	19.74	19.73	19.76	24.34	24.30	24.28	23.80	23.81	23.79
		25	24	19.47	19.50	19.48	19.74	19.72	19.66	24.43	24.39	24.42	23.93	23.91	23.78
		50	0	19.45	19.52	19.46	19.73	19.70	19.76	**24.80**	24.75	24.75	24.23	**24.28**	24.25
	256QAM	1	0	20.47	20.62	20.63	20.49	20.43	20.50	22.04	22.37	22.34	21.67	21.63	21.55
		1	24	20.62	**20.70**	20.65	20.62	20.57	20.62	22.02	22.50	22.01	21.64	21.56	21.54
		1	49	20.48	20.61	20.61	20.50	20.43	20.51	21.82	22.25	22.20	21.35	21.43	21.38
		25	0	20.52	20.57	20.61	20.65	20.63	20.66	23.42	23.40	23.39	22.93	23.01	22.97
		25	12	20.62	20.65	20.62	**20.70**	20.65	**20.70**	23.52	23.56	23.41	**23.04**	22.98	22.99
		25	24	20.58	20.64	20.62	20.67	20.65	20.60	23.53	23.57	23.43	22.91	22.88	22.88
		50	0	20.60	20.64	20.60	20.65	20.64	20.68	23.54	**23.59**	23.54	23.03	23.01	22.95

UL Verification Services Inc.
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 319-4000 FAX: (510) 661-0888

8.2. 5G NR n53

Test Engineer ID:	27342	Test Date:	12/20/2022

OUTPUT POWER FOR 5G NR n53 (10.0 MHz)

Bandwidth (MHz)	Modulation	RB Allocation	RB Offset	Ant 1 Conducted Average (dBm)			Ant 2 Conducted Average (dBm)			Ant 1 Conducted Peak (dBm)			Ant 2 Conducted Peak (dBm)		
				497700	497800	498000	497700	497800	498000	497700	497800	498000	497700	497800	498000
				2488.5 MHz	2489.0 MHz	2490.0 MHz	2488.5 MHz	2489.0 MHz	2490.0 MHz	2488.5	2489.0 MHz	2490.0	2488.5	2489.0	2490.0
10.0	BPSK	1	0	20.13	20.15	20.25	20.05	20.14	19.96	23.97	24.04	24.05	24.30	24.38	24.22
		1	1	20.64	**20.70**	**20.70**	20.60	20.65	20.50	24.48	**24.59**	24.50	24.85	24.89	24.76
		1	22	20.63	20.66	20.68	**20.70**	**20.70**	**20.70**	24.47	24.55	24.48	24.95	24.94	**24.96**
		1	23	20.12	20.08	20.21	20.13	20.13	20.05	23.96	23.97	24.01	24.38	24.37	24.31
		12	6	20.63	20.58	20.60	20.64	20.58	20.54	24.47	24.47	24.40	24.89	24.82	24.80
		24	0	20.13	20.12	20.17	20.09	20.03	20.05	23.97	24.01	23.97	24.34	24.27	24.31
	QPSK	1	0	19.69	19.58	19.67	19.58	19.56	19.59	23.53	23.47	23.47	23.83	23.80	23.85
		1	1	20.67	20.54	**20.70**	20.60	20.59	20.56	24.51	24.43	24.50	24.85	24.83	24.82
		1	22	**20.70**	20.56	20.68	20.66	20.60	**20.70**	**24.54**	24.45	24.48	24.91	24.84	**24.93**
		1	23	19.63	19.45	19.60	19.54	19.60	19.55	23.47	23.34	23.40	23.79	23.84	23.81
		12	6	20.62	20.55	20.66	20.57	20.54	20.50	24.46	24.44	24.46	24.82	24.78	24.76
		24	0	19.58	19.53	19.61	19.51	19.56	19.50	23.42	23.42	23.41	23.76	23.80	23.76
	16QAM	1	0	19.49	19.09	19.57	19.44	19.62	19.55	22.36	22.01	22.40	22.76	22.93	22.88
		1	1	20.59	20.08	20.47	20.42	20.54	20.50	23.46	23.00	23.30	23.74	23.85	23.83
		1	22	20.57	20.22	**20.70**	20.42	**20.70**	20.56	23.44	23.14	**23.53**	23.74	**24.01**	23.89
		1	23	19.62	19.34	19.60	19.33	19.52	19.52	22.49	22.26	22.43	22.65	22.83	22.85
		12	6	20.54	20.58	20.49	20.46	20.37	20.57	23.41	23.50	23.32	23.78	23.68	23.90
		24	0	19.61	19.49	19.64	18.47	18.52	18.58	22.48	22.41	22.47	22.72	22.76	22.84
	64QAM	1	0	20.58	20.55	20.64	20.59	20.46	20.64	22.00	22.02	22.02	22.17	22.03	22.23
		1	1	20.56	20.48	20.61	**20.70**	20.51	20.68	21.98	21.95	21.99	**22.28**	22.08	22.27
		1	22	20.52	20.61	**20.70**	20.49	20.54	20.62	21.94	**22.08**	**22.08**	22.07	22.11	22.21
		1	23	20.57	20.50	20.64	20.66	20.40	20.61	21.99	21.97	22.02	22.24	21.97	22.20
		12	6	20.53	20.51	20.62	**20.70**	20.61	20.66	21.95	21.98	22.00	**22.28**	22.18	22.25
		24	0	20.51	20.55	20.57	20.69	20.63	20.62	21.93	22.02	21.95	22.27	22.20	22.21
	256QAM	1	0	20.15	20.41	**20.70**	20.66	20.34	20.51	19.74	20.05	**20.25**	20.41	20.08	20.27
		1	1	20.07	20.44	20.37	20.50	20.31	20.53	19.66	20.08	19.92	20.25	20.05	20.29
		1	22	20.12	20.31	20.53	20.49	20.39	20.44	19.71	19.95	20.08	20.24	20.13	20.20
		1	23	20.03	20.33	20.33	20.46	20.16	20.46	19.62	19.97	19.88	20.21	19.90	20.22
		12	6	20.36	20.40	20.51	**20.70**	20.65	20.66	19.95	20.04	20.06	**20.45**	20.39	20.42
		24	0	20.30	20.33	20.32	20.55	20.57	20.57	19.89	19.97	19.87	20.30	20.31	20.33

UL Verification Services Inc.
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 319-4000 FAX: (510) 661-0888

9. CONDUCTED TEST RESULTS

9.1. ON TIME AND DUTY CYCLE

LIMITS

None; for reporting purposes only.

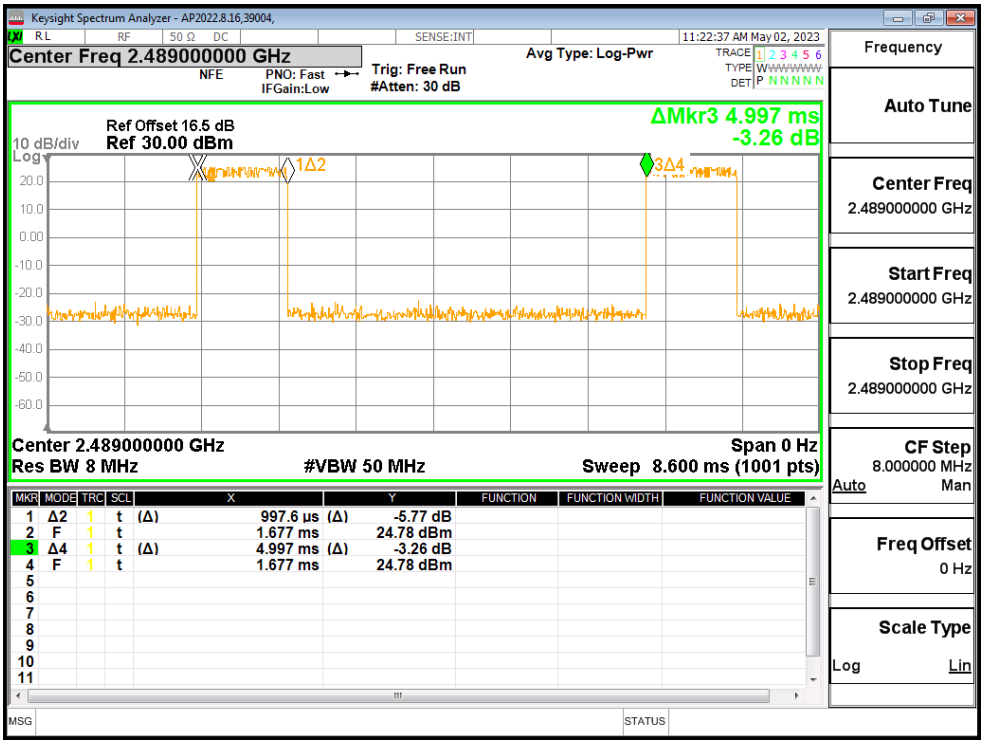
PROCEDURE

Zero-Span Spectrum Analyzer Method.

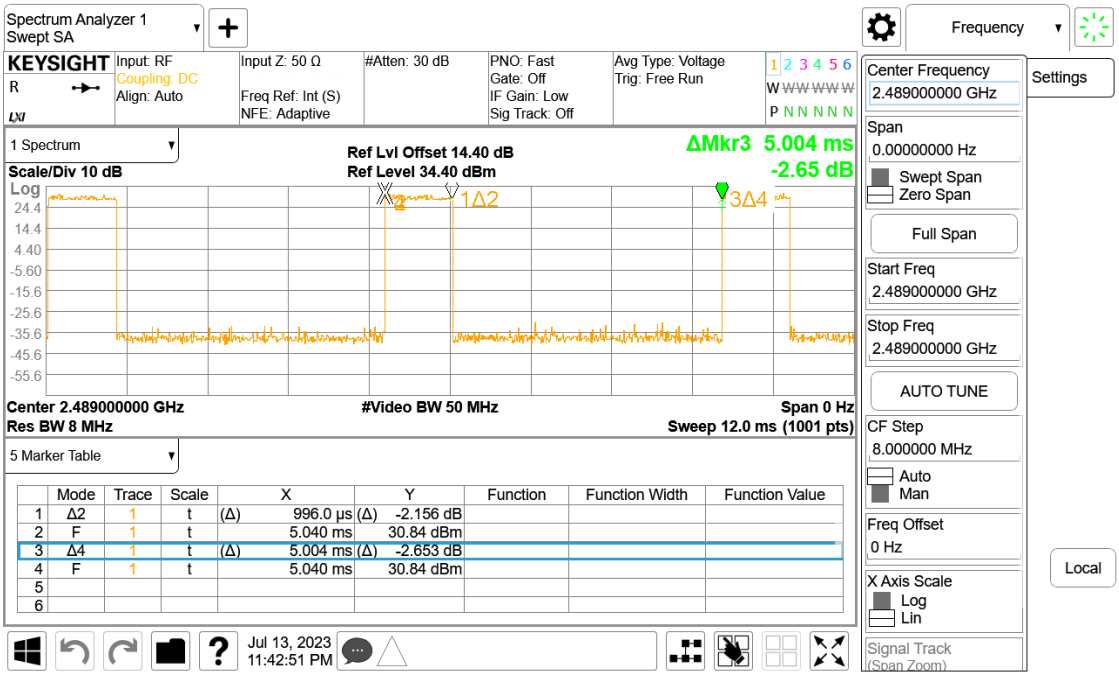
ON TIME AND DUTY CYCLE RESULTS

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	0.945	4.995	0.189	18.92	7.23
LTE Band 53	50 / 0	0.996	5.004	0.20	19.90	7.01
5G NR n53	1 / 1	0.29	0.3	1.00	100.00	0.00
5G NR n53	24 / 0	0.29	0.3	1.00	100.00	0.00

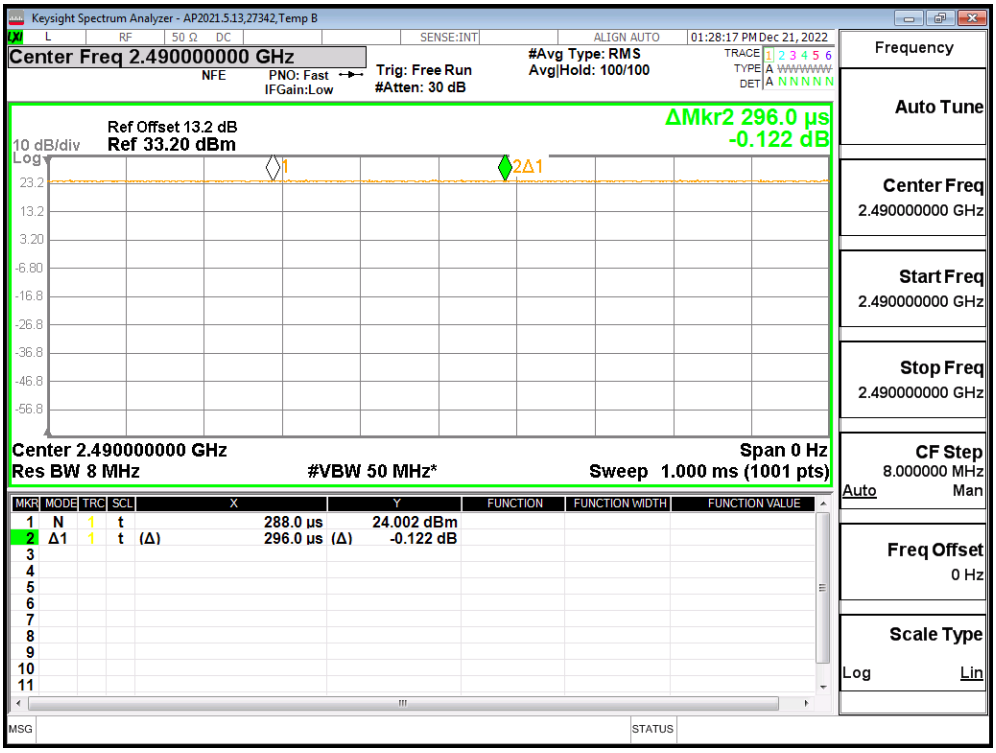
UL Verification Services Inc.
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 319-4000 FAX: (510) 661-0888



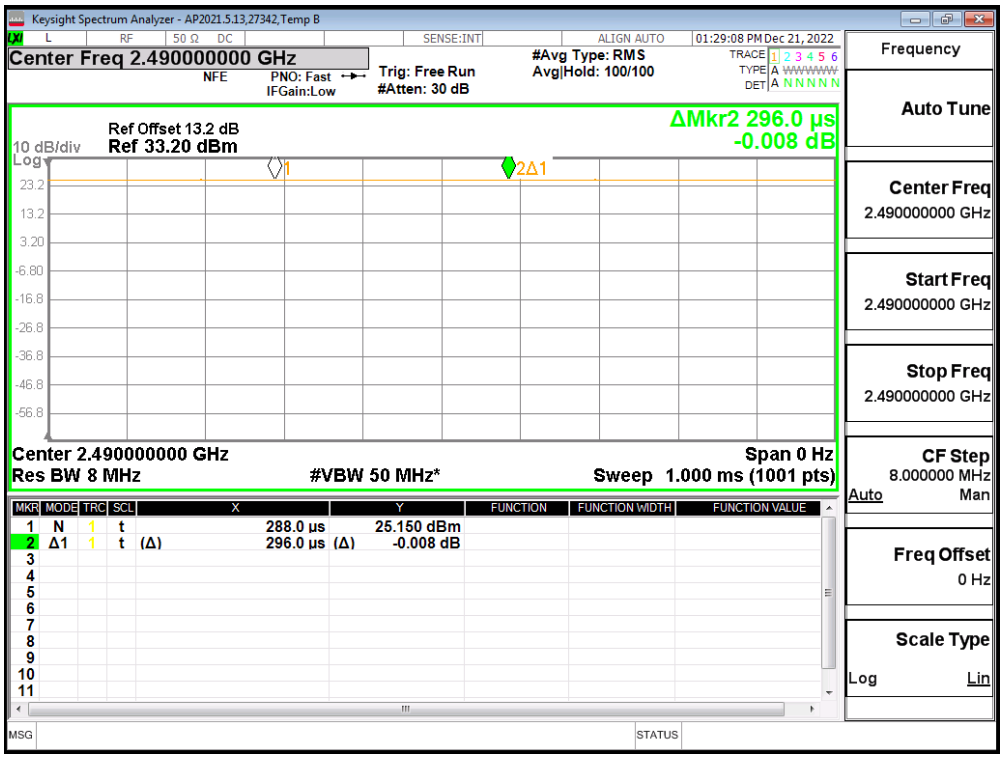
LTE Band 53 RB1-0



LTE Band 53 RB50-0, ID:28567



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.

UL Verification Services Inc.
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 319-4000 FAX: (510) 661-0888

LTE BAND 53

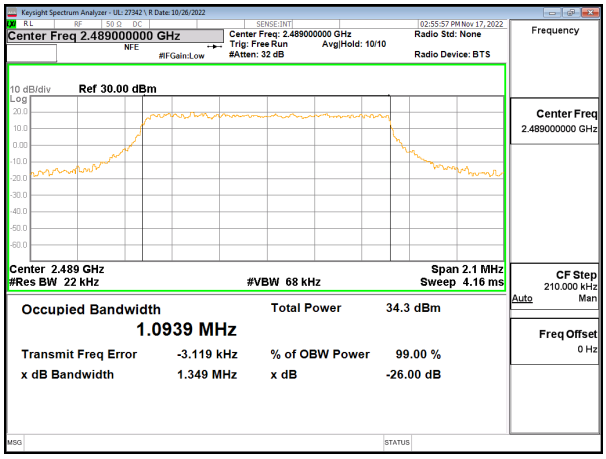
Band	Mode	RB Allocation/RB Offset	f(MHz)	99% BW (MHz)	-26dB BW (MHz)
LTE BAND 53	1.4MHz, QPSK	6/0	2489	1.094	1.349
	1.4MHz,16QAM			1.094	1.353
	3MHz, QPSK	15/0		2.698	3.053
	3MHz, 16QAM			2.700	3.038
	5MHz, QPSK	25/0		4.502	5.088
	5MHz, 16QAM			4.505	5.089
	10MHz, QPSK	50/0		8.977	9.993
	10MHz, 16QAM			8.983	9.944
	10MHz, QPSK	1/0		0.249	0.400

5G NR n53

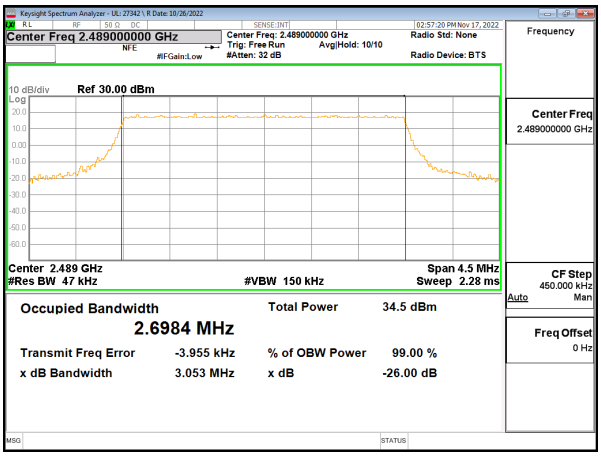
Band	Mode	RB Allocation/RB Offset	f(MHz)	99% BW (MHz)	-26dB BW (MHz)
5G NR n53	10MHz, BPSK	24/0	2489.0	8.615	9.663
	10MHz, QPSK			8.596	9.857
	10MHz, 16QAM			8.919	9.590
	10MHz, QPSK	1/0		0.451	0.718

UL Verification Services Inc.
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 319-4000 FAX: (510) 661-0888

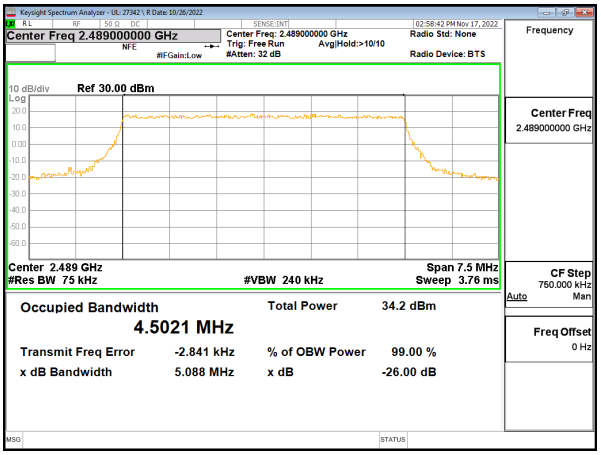
9.2.1. LTE BAND 53



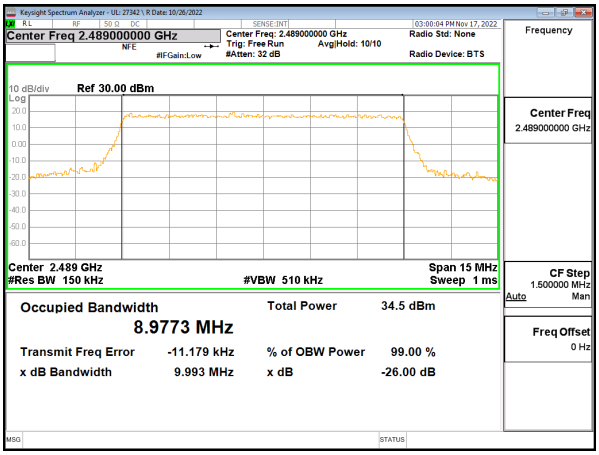
LTE B53 1.4MHz QPSK Middle Channel RB6-0



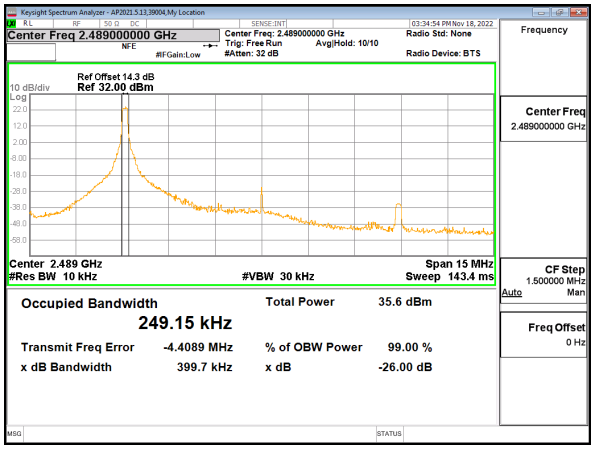
LTE B53 3MHz QPSK Middle Channel RB15-0



LTE B53 5MHz QPSK Middle Channel RB25-0



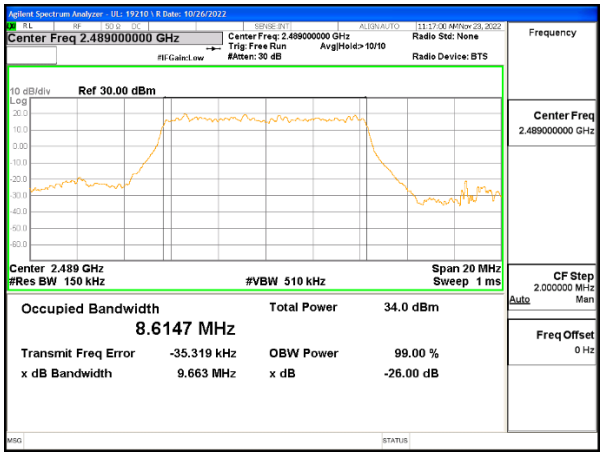
LTE B53 10MHz QPSK Middle Channel RB50-0



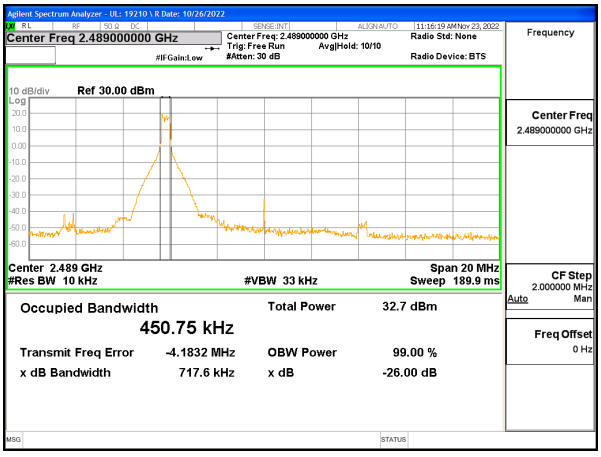
LTE B53 10MHz QPSK Middle Channel RB1-0

Intentionally Blank

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

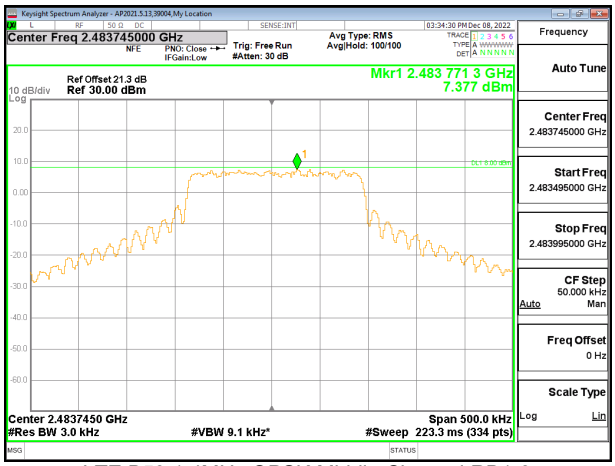
LTE BAND 53

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	7.33	8.0
			2489.0	7.38	
			2494.3	6.82	
	3MHz, QPSK	1/0	2485.0	7.09	
			2489.0	6.65	
			2493.5	6.90	
	5MHz, QPSK	1/0	2486.0	7.26	
			2489.0	7.15	
			2492.5	6.19	
	10MHz, QPSK	1/0	2488.5	7.00	
			2489.0	5.80	
			2490.0	7.51	
		50/0	2488.5	-4.20	
			2489.0	-4.69	
			2490.0	-4.48	

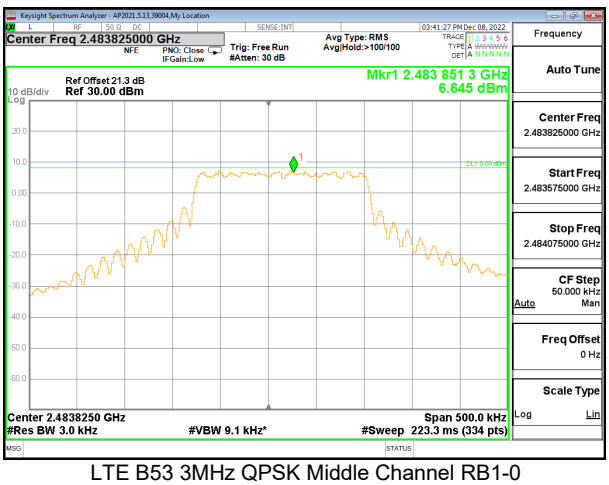
5G NR n53

Band	Mode	RB Allocation/RB Offset	f(MHz)	PSD (dBm/3kHz)	PSD Limit (dBm/3kHz)
5G NR n53	10MHz, BPSK	1/1	2488.5	7.48	8.0
			2489.0	7.48	
			2490.0	7.48	
		24/0	2488.5	-0.53	
			2489.0	-0.71	
			2490.0	-0.79	

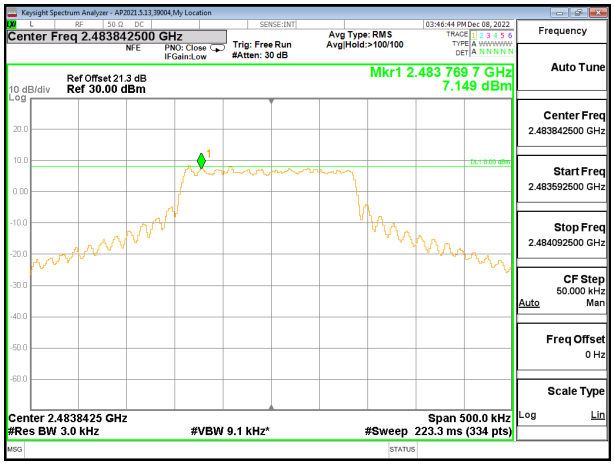
9.3.1. LTE BAND 53



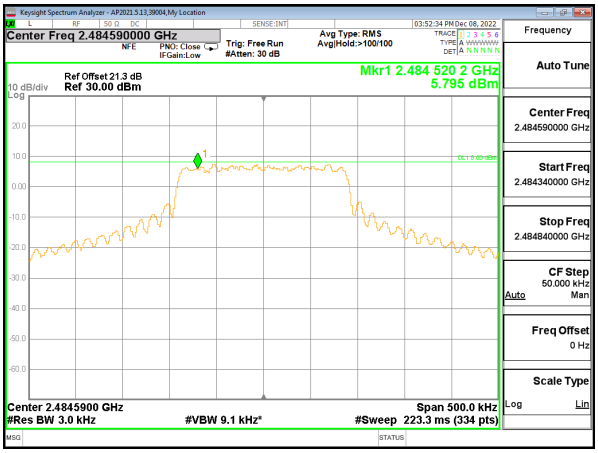
LTE B53 1.4MHz QPSK Middle Channel RB1-0



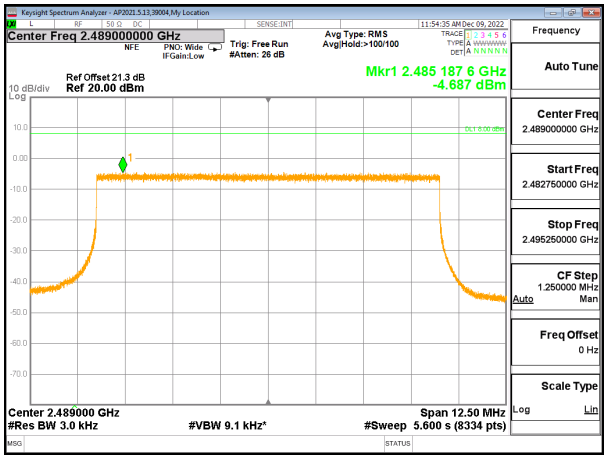
LTE B53 3MHz QPSK Middle Channel RB1-0



LTE B53 5MHz QPSK Middle Channel RB1-0



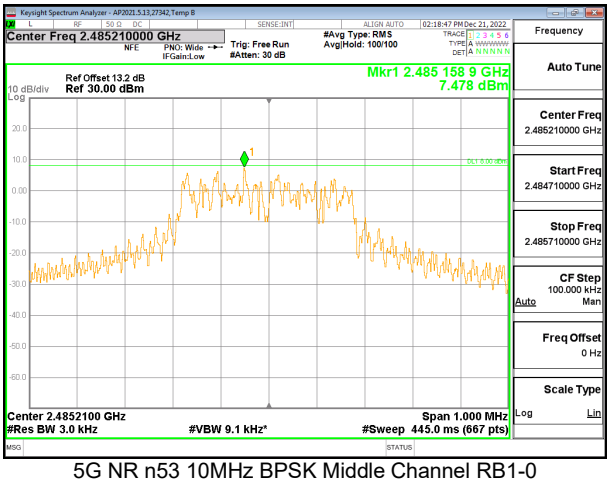
LTE B53 10MHz QPSK Middle Channel RB1-0



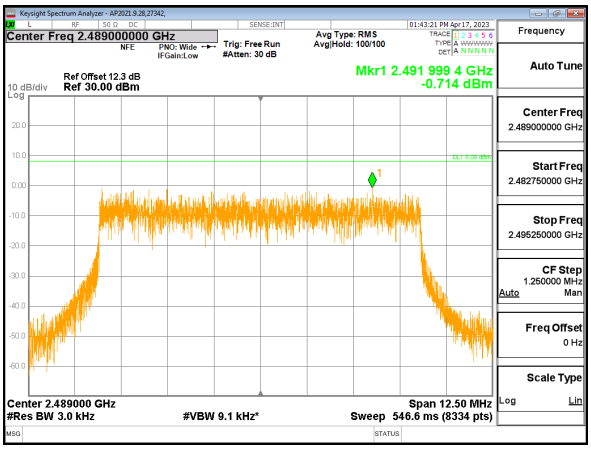
LTE B53 10MHz QPSK Middle Channel RB50-0

Intentionally Blank

9.3.2. 5G NR n53



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



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

UL Verification Services Inc.
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 319-4000 FAX: (510) 661-0888

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

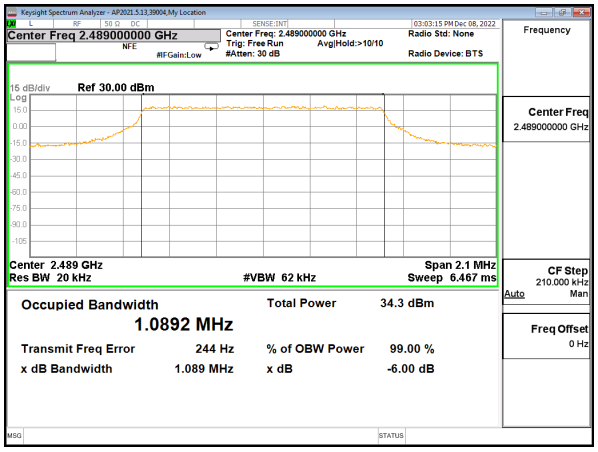
Band	Mode	RB Allocation/RB Offset	f(MHz)	6dB BW (MHz)	6dB BW Limit (MHz)
LTE BAND 53	1.4MHz, QPSK	6/0	2489	1.089	0.5
	1.4MHz,16QAM			1.087	
	3MHz, QPSK	15/0		2.685	
	3MHz, 16QAM			2.697	
	5MHz, QPSK	25/0		4.471	
	5MHz, 16QAM			4.480	
	10MHz, QPSK	50/0		8.940	
	10MHz, 16QAM			8.951	

5G NR n53

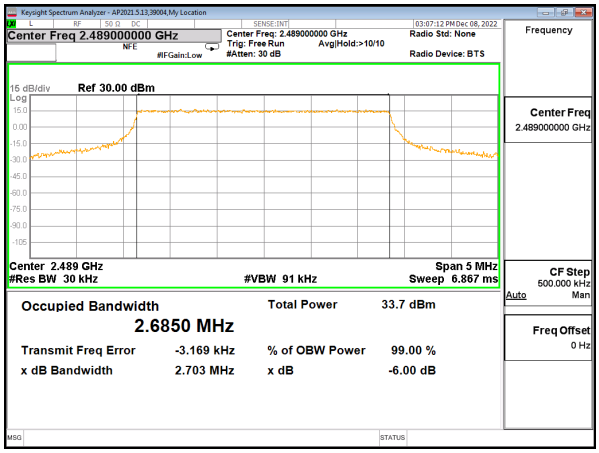
Band	Mode	RB Allocation/RB Offset	f(MHz)	6dB BW (MHz)	6dB BW Limit (MHz)
5G NR n53	10MHz, BPSK	24/0	2489	8.656	0.5
	10MHz, QPSK	24/0		8.580	
	10MHz, 16QAM	24/0		8.634	

UL Verification Services Inc.
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 319-4000 FAX: (510) 661-0888

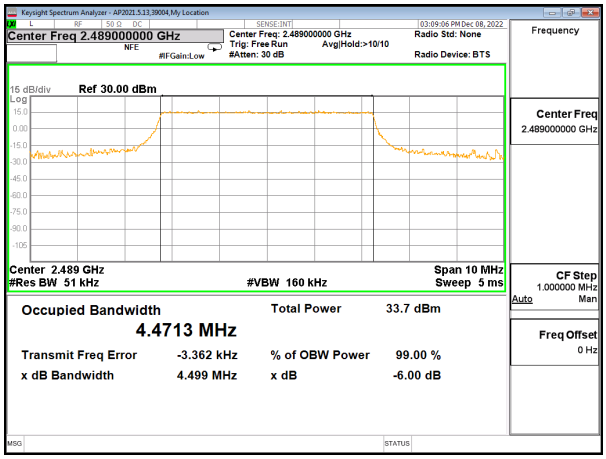
9.4.1. LTE BAND 53



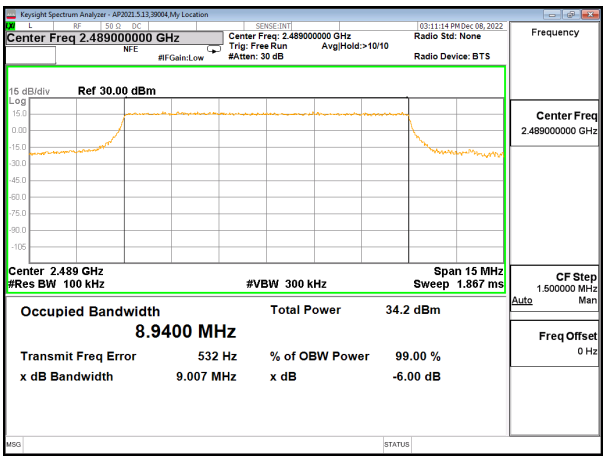
LTE B53 1.4MHz QPSK Middle Channel RB6-0



LTE B53 3MHz QPSK Middle Channel RB15-0



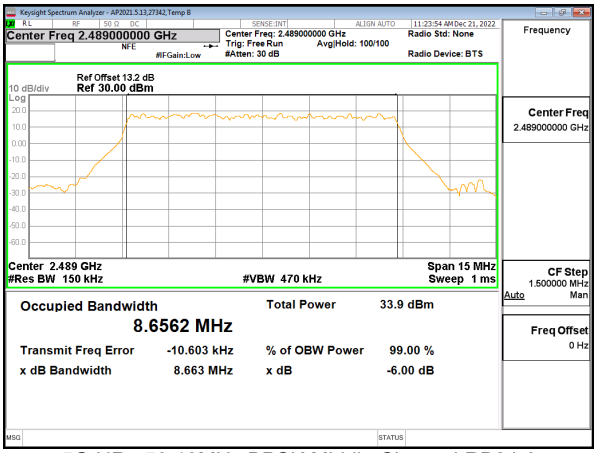
LTE B53 5MHz QPSK Middle Channel RB25-0



LTE B53 10MHz QPSK Middle Channel RB50-0

UL Verification Services Inc.
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 319-4000 FAX: (510) 661-0888

9.4.2. 5G NR n53



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

Intentionally Blank

UL Verification Services Inc.
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 319-4000 FAX: (510) 661-0888

9.5. EMISSION MASK AND BANDEDGE

RULE PART(S)

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

LIMITS

FCC §25.202 and ISED RSS-170: 5.4.3.1

(f) Emission limitations. Except for SDARS terrestrial repeaters and as provided for in paragraph (i), the mean power of emissions shall be attenuated below the mean output power of the transmitter in accordance with the schedule set forth in paragraphs (f)(1) through (f)(4) of this section. The out-of-band emissions of SDARS terrestrial repeaters shall be attenuated in accordance with the schedule set forth in paragraph (h) of this section.

(1) In any 4 kHz band, the center frequency of which is removed from the assigned frequency by more than 50 percent up to and including 100 percent of the authorized bandwidth: 25 dB;

(2) In any 4 kHz band, the center frequency of which is removed from the assigned frequency by more than 100 percent up to and including 250 percent of the authorized bandwidth: 35 dB;

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 channel edge emissions were measured on the low, mid and high channels. The limits within 250% of the authorized bandwidth are relative to the total in-band (channel) power. The measurement bandwidth (RBW) is set to >= 4kHz and VBW set to at least 3 times the RBW. To measure the average value of the emissions the detector is set to rms while observing the minimum required number of points as detailed in ANSI C63.26 for average rms measurements. The sweep time is set to 2ms multiplied by the number of points to obtain the average over 2ms. Multiple sweeps with max hold enabled are made to capture the maximum average value.

RESULTS

UL Verification Services Inc.
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 319-4000 FAX: (510) 661-0888

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	-15.16	0.4	-14.76	-14.1
		6/0	2484.2	-20.89		-20.49	
		1/5	2494.3	-15.75		-15.35	
		6/0	2494.3	-21.34		-20.94	
	3MHz, QPSK	1/0	2485.0	-19.48		-19.08	
		15/0	2485.0	-22.29		-21.89	
		1/14	2493.5	-19.20		-18.80	
		15/0	2493.5	-23.10		-22.70	
	5MHz, QPSK	1/0	2486.0	-21.88		-21.48	
		25/0	2486.0	-25.21		-24.81	
		1/24	2492.5	-21.23		-20.83	
		25/0	2492.5	-26.64		-26.24	
	10MHz, QPSK	1/0	2488.5	-31.24		-30.84	
		50/0	2488.5	-30.68		-30.28	
		1/49	2490.0	-40.21		-39.81	
		50/0	2490.0	-33.21		-32.81	

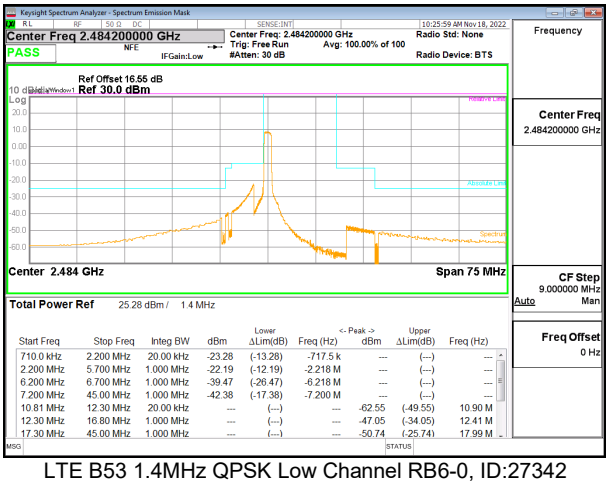
5G NR n53

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	-24.28	0.4	-23.88	-14.1
		24/0	2488.5	-29.65		-29.25	
		1/23	2490.0	-26.32		-25.92	
		24/0	2490.0	-30.70		-30.30	

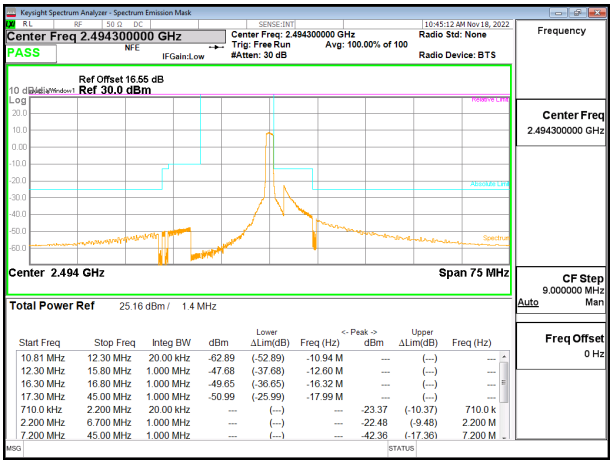
UL Verification Services Inc.
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 319-4000 FAX: (510) 661-0888

9.5.1. LTE BAND 53

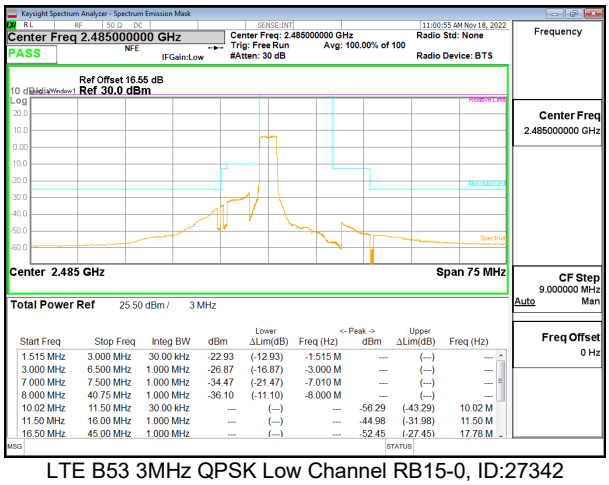
LTE BAND 53 BANDEGE



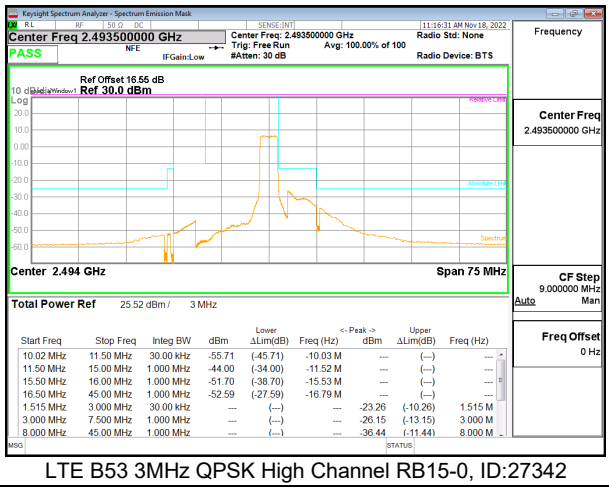
LTE B53 1.4MHz QPSK Low Channel RB6-0, ID:27342



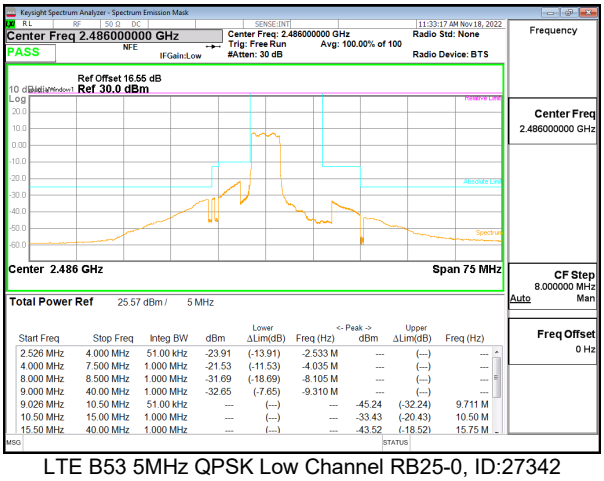
LTE B53 1.4MHz QPSK High Channel RB6-0, ID:27342



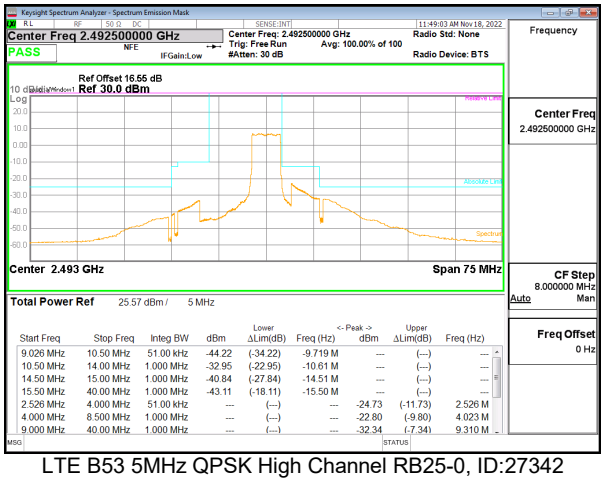
LTE B53 3MHz QPSK Low Channel RB15-0, ID:27342



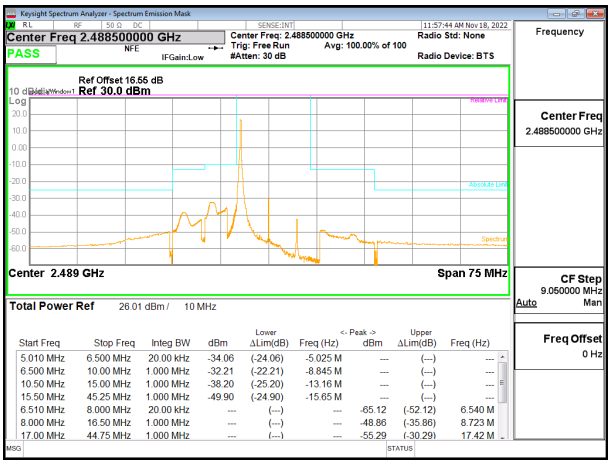
LTE B53 3MHz QPSK High Channel RB15-0, ID:27342



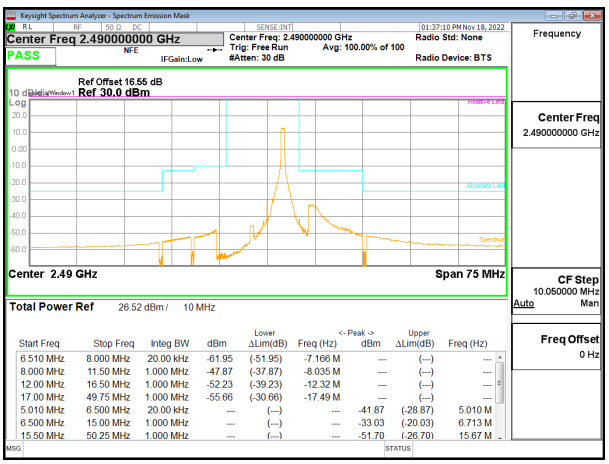
LTE B53 5MHz QPSK Low Channel RB25-0, ID:27342



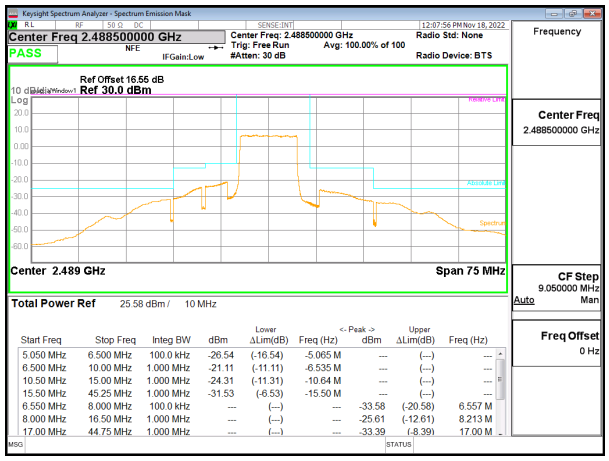
LTE B53 5MHz QPSK High Channel RB25-0, ID:27342



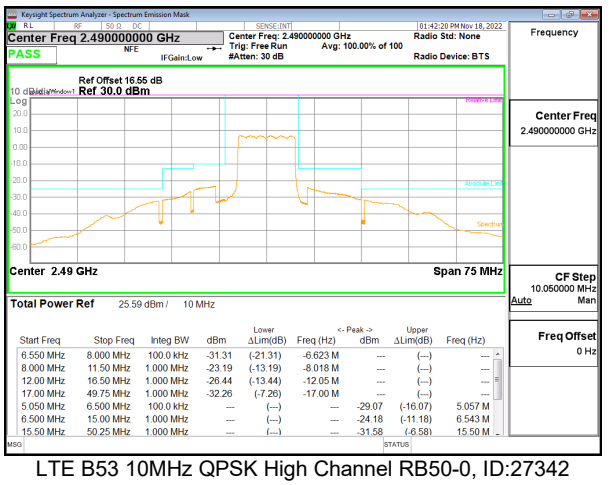
LTE B53 10MHz QPSK Low Channel RB1-0, ID:27342



LTE B53 10MHz QPSK High Channel RB1-49, ID:27342

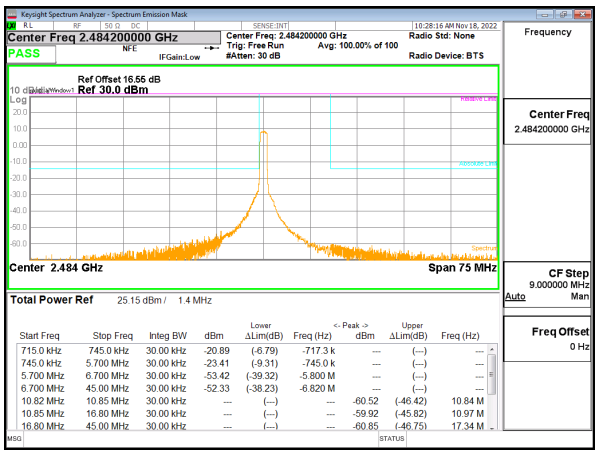


LTE B53 10MHz QPSK Low Channel RB50-0, ID:27342

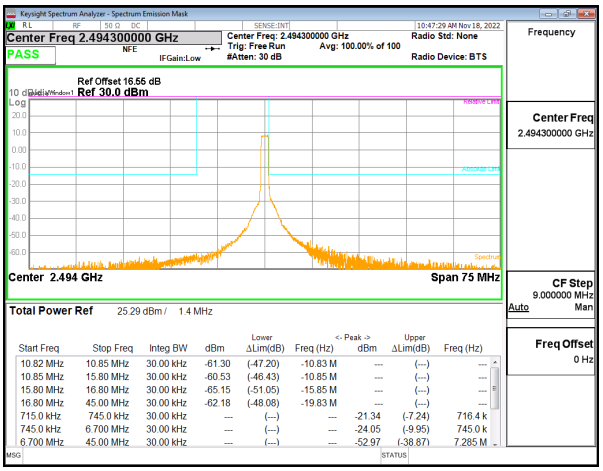


LTE B53 10MHz QPSK High Channel RB50-0, ID:27342

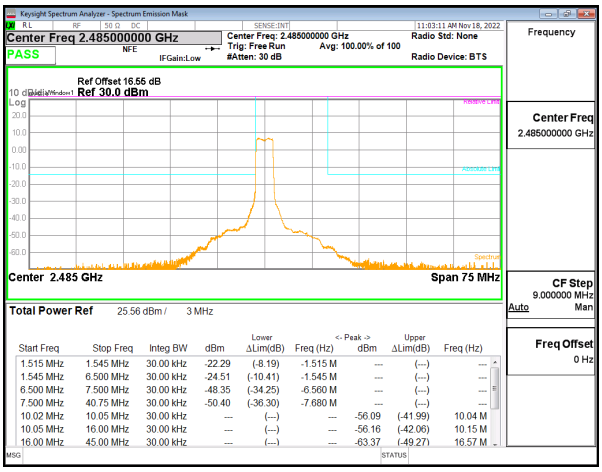
LTE BAND 53 EIRP DENSITY



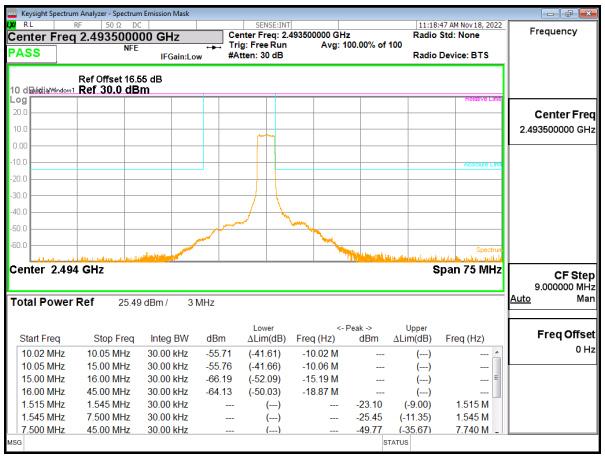
LTE B53 1.4MHz QPSK Low Channel RB6-0, ID:27342



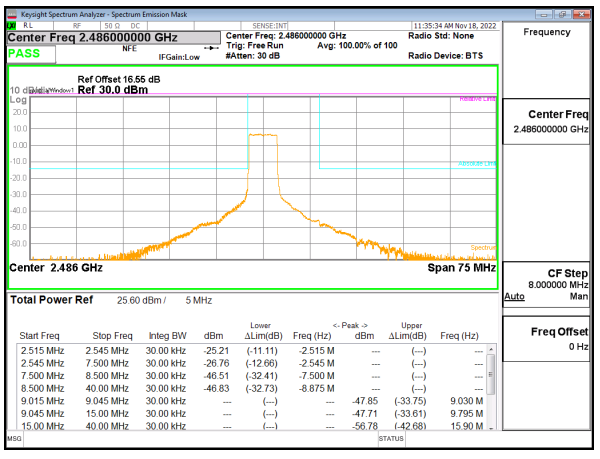
LTE B53 1.4MHz QPSK High Channel RB6-0, ID:27342



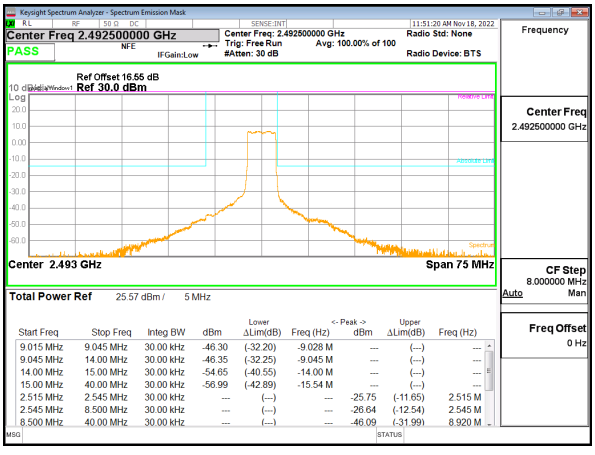
LTE B53 3MHz QPSK Low Channel RB15-0, ID:27342



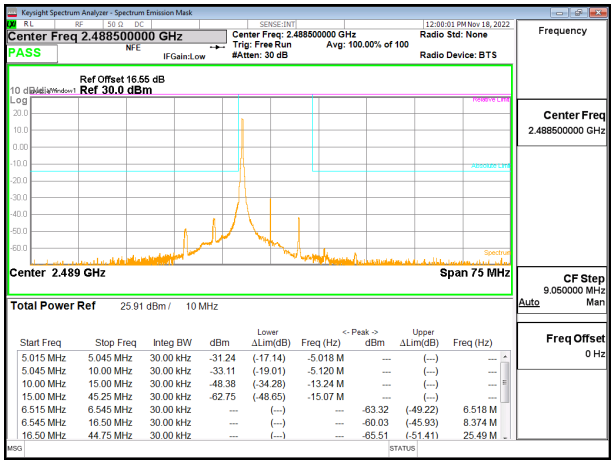
LTE B53 3MHz QPSK High Channel RB15-0, ID:27342



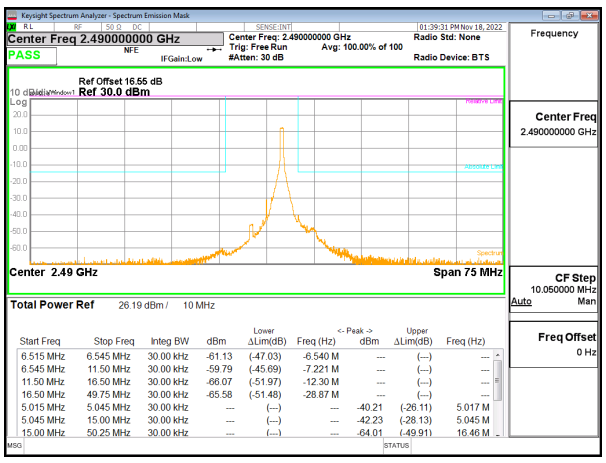
LTE B53 5MHz QPSK Low Channel RB25-0, ID:27342



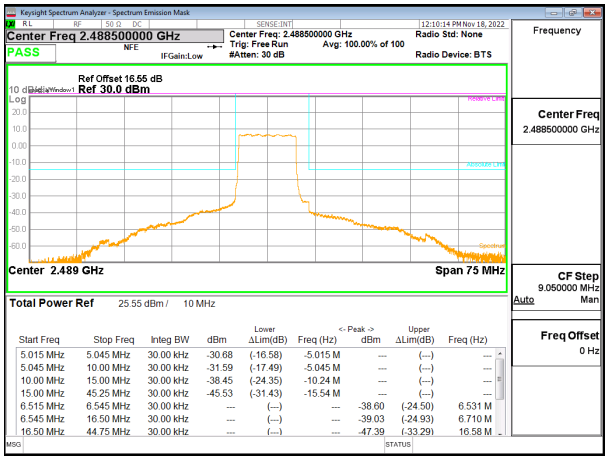
LTE B53 5MHz QPSK High Channel RB25-0, ID:27342



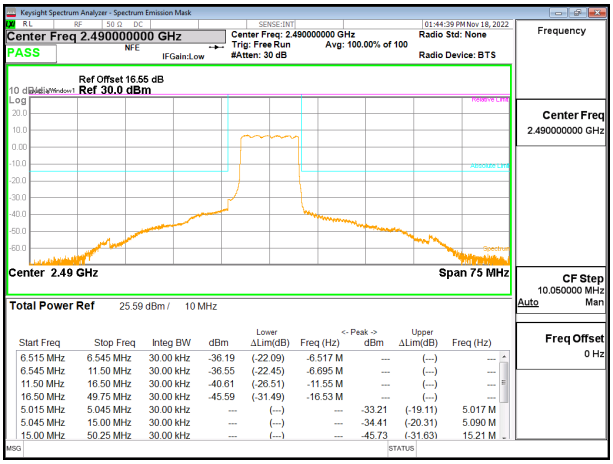
LTE B53 10MHz QPSK Low Channel RB1-0, ID:27342



LTE B53 10MHz QPSK High Channel RB1-49, ID:27342



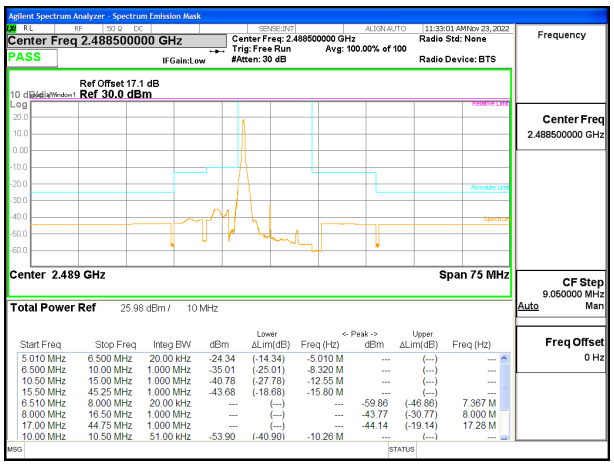
LTE B53 10MHz QPSK Low Channel RB50-0, ID:27342



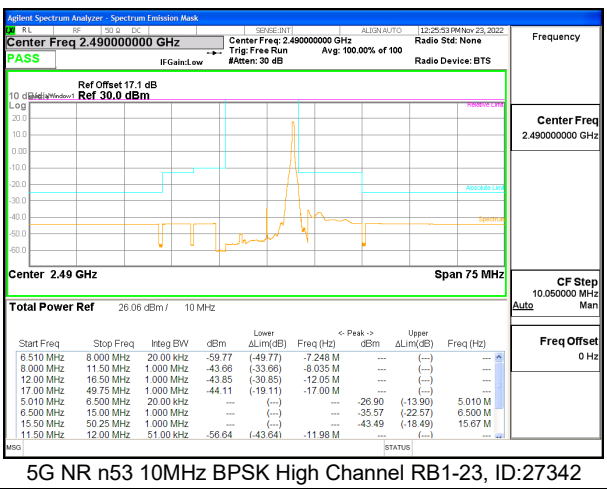
LTE B53 10MHz QPSK High Channel RB50-0, ID:27342

9.5.2. 5G NR n53

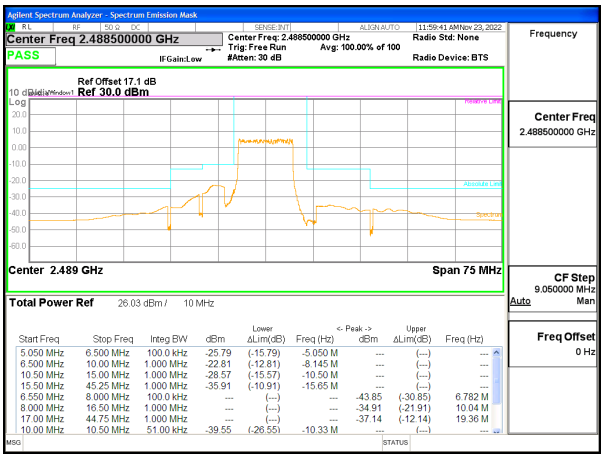
5G NR n53 BANDEDGE



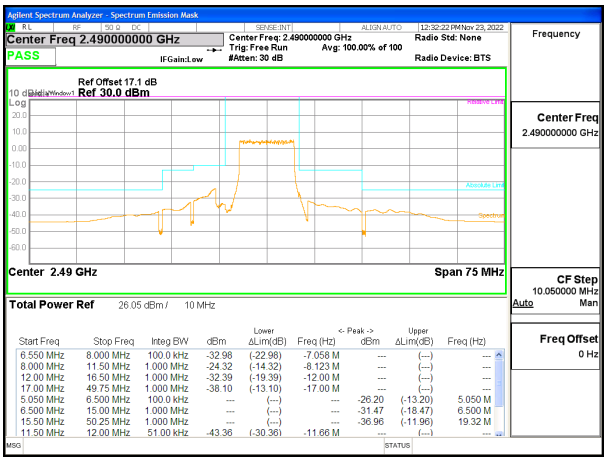
5G NR n53 10MHz BPSK Low Channel RB1-0, ID:27342



5G NR n53 10MHz BPSK High Channel RB1-23, ID:27342

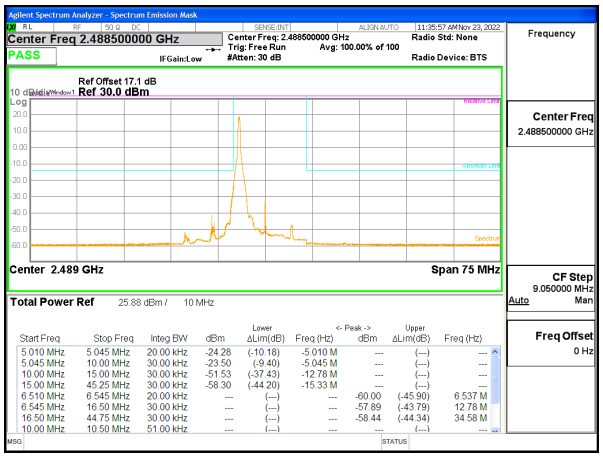


5G NR n53 10MHz BPSK Low Channel RB24-0, ID:27342

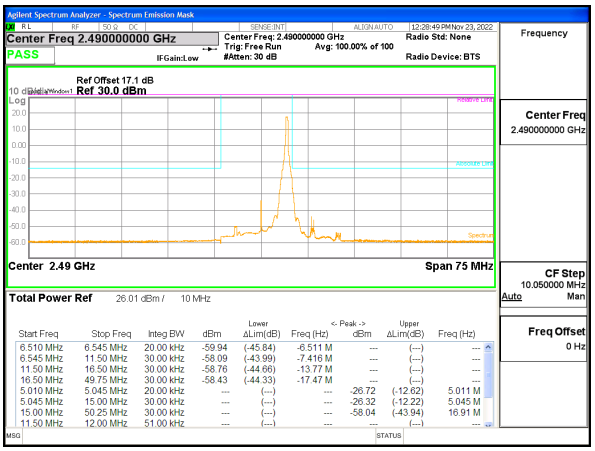


5G NR n53 10MHz BPSK High Channel RB24-0, ID:27342

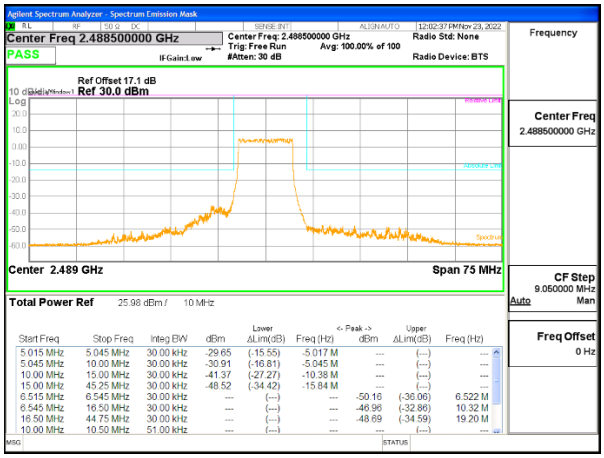
5G NR n53 EIRP DENSITY



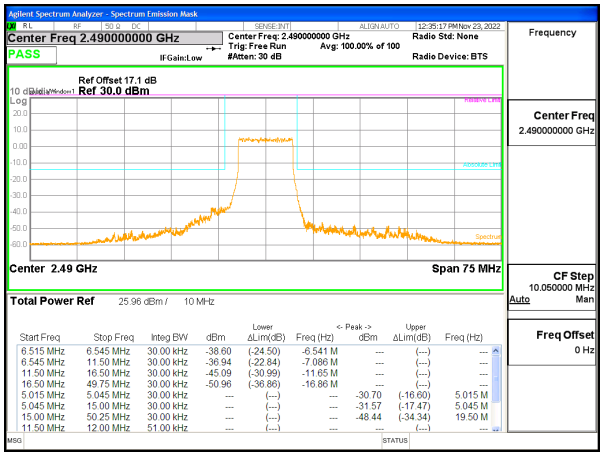
5G NR n53 10MHz BPSK Low Channel RB1-0, ID:27342



5G NR n53 10MHz BPSK High Channel RB1-23, ID:27342



5G NR n53 10MHz BPSK Low Channel RB24-0, ID:27342



5G NR n53 10MHz BPSK High Channel RB24-0, ID:27342

9.6. OUT OF BAND EMISSIONS

LIMITS

FCC §25.202 and ISED RSS-170: 5.4.3.1

(f) Emission limitations. Except for SDARS terrestrial repeaters and as provided for in paragraph (i), the mean power of emissions shall be attenuated below the mean output power of the transmitter in accordance with the schedule set forth in paragraphs (f)(1) through (f)(4) of this section. The out-of-band emissions of SDARS terrestrial repeaters shall be attenuated in accordance with the schedule set forth in paragraph (h) of this section.

(3) In any 4 kHz band, the center frequency of which is removed from the assigned frequency by more than 250 percent of the authorized bandwidth: An amount equal to 43 dB plus 10 times the logarithm (to the base 10) of the transmitter power in watts.

TEST PROCEDURE

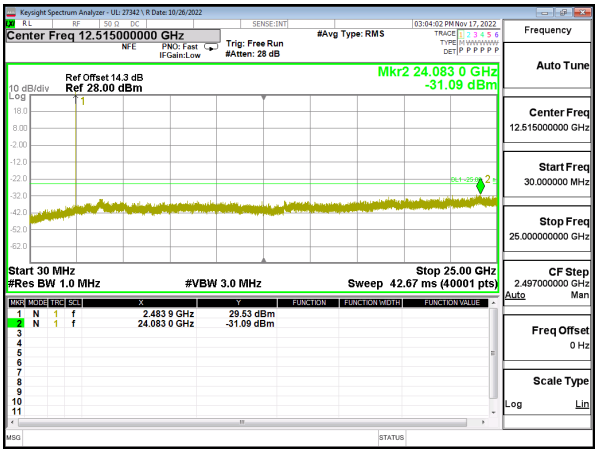
The RF output of the transmitter was connected to a spectrum analyzer through a calibrated coaxial cable. Sufficient scans were taken to show the out-of-band Emissions, if any, up to 10th harmonic. Multiple sweeps were recorded in maximum hold mode using a peak detector to ensure that the worst-case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

For each out of band emissions measurement:

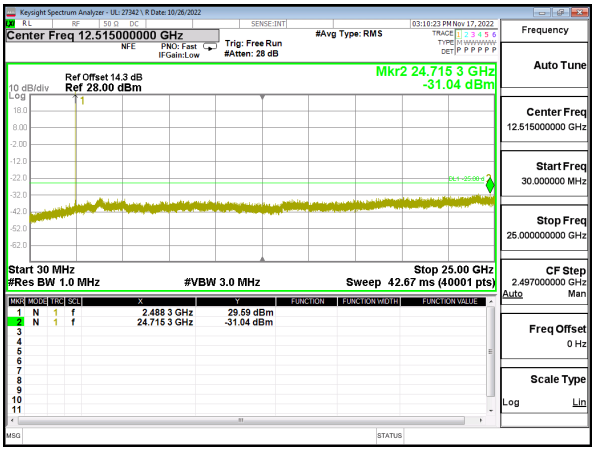
- Set display line at -25dBm according to the band Limit
- Set RBW & VBW to 100 kHz for the measurement below 1 GHz, and 1 MHz for the measurement above 1 GHz. (NOTE: Worst case set RBW/VBW to 1MHz/3MHz)

RESULTS

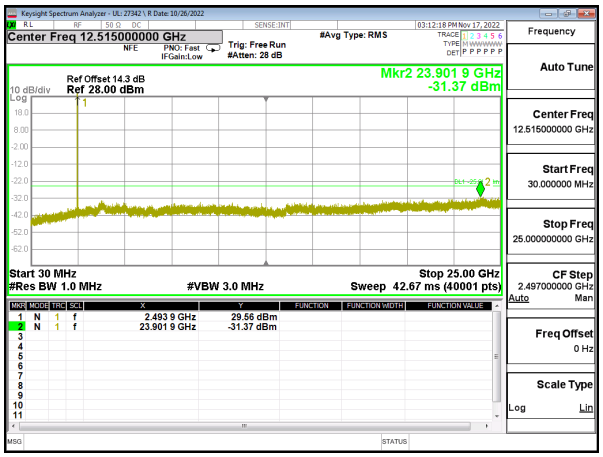
9.6.1. LTE BAND 53



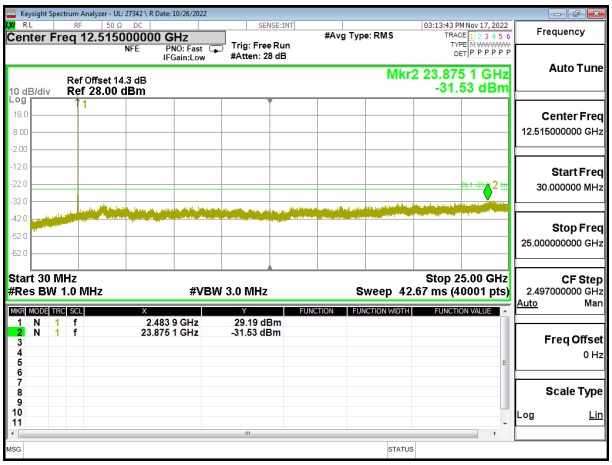
LTE B53 1.4MHz QPSK Low Channel RB1-0



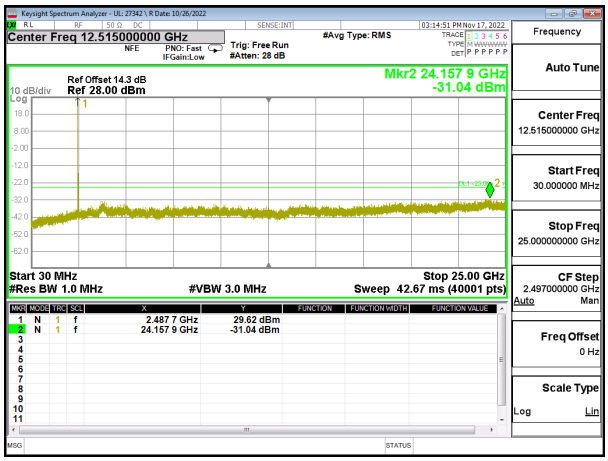
LTE B53 1.4MHz QPSK Middle Channel RB1-0



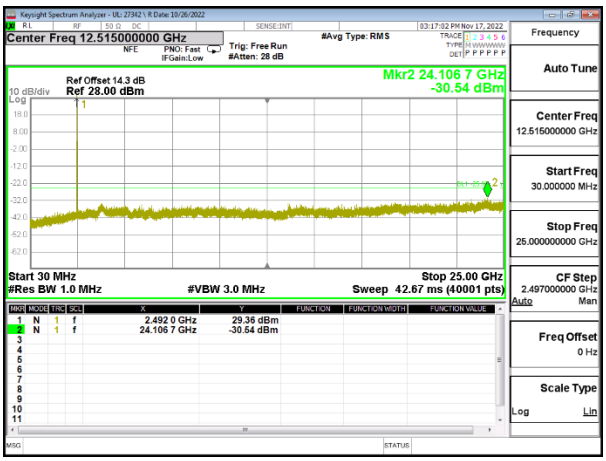
LTE B53 1.4MHz QPSK High Channel RB1-0



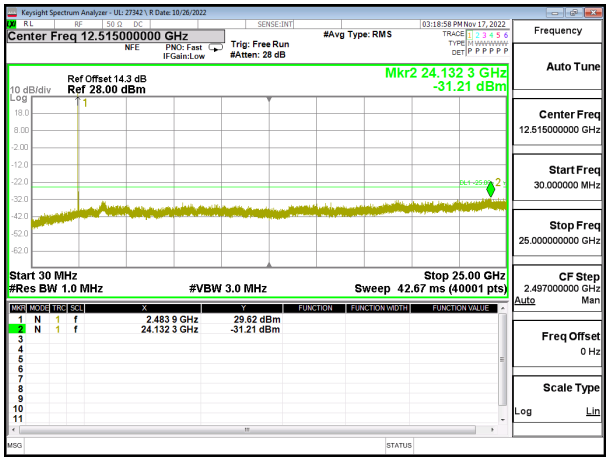
LTE B53 3MHz QPSK Low Channel RB1-0



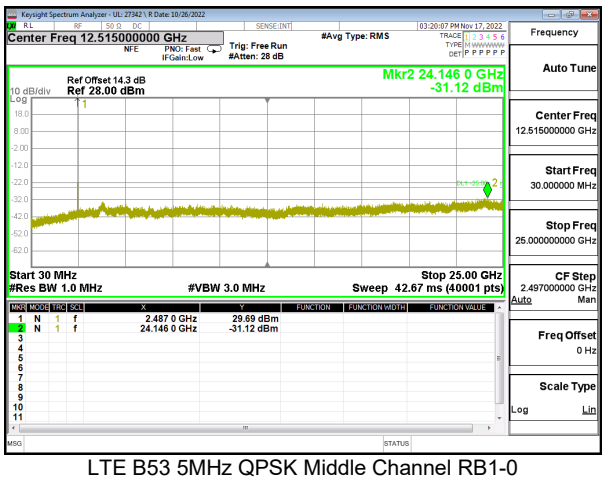
LTE B53 3MHz QPSK Middle Channel RB1-0



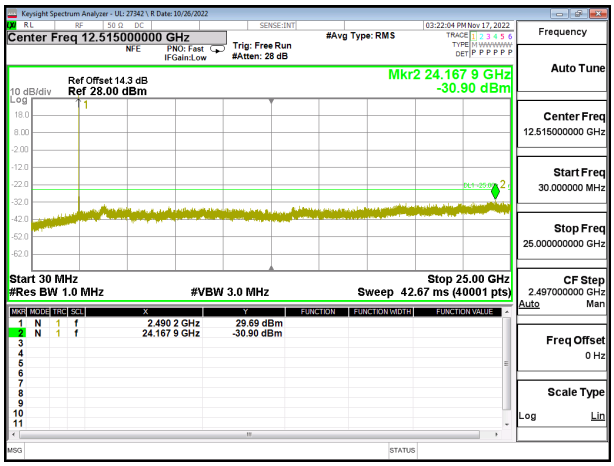
LTE B53 3MHz QPSK High Channel RB1-0



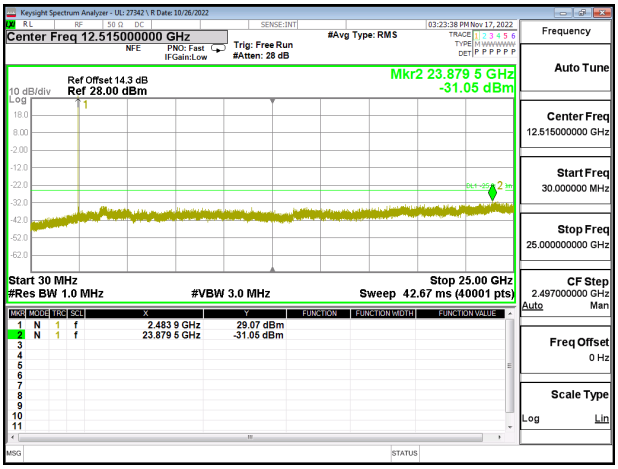
LTE B53 5MHz QPSK Low Channel RB1-0



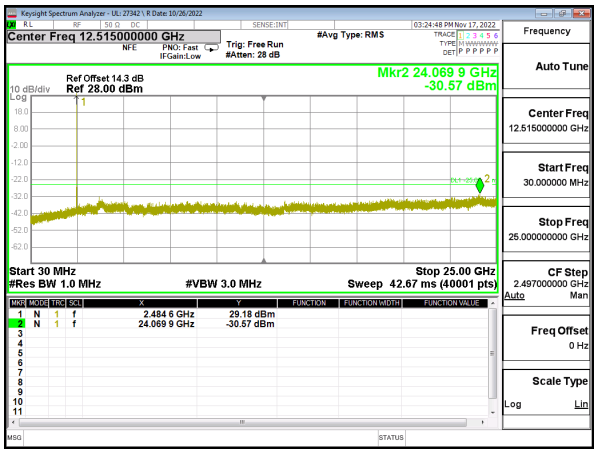
LTE B53 5MHz QPSK Middle Channel RB1-0



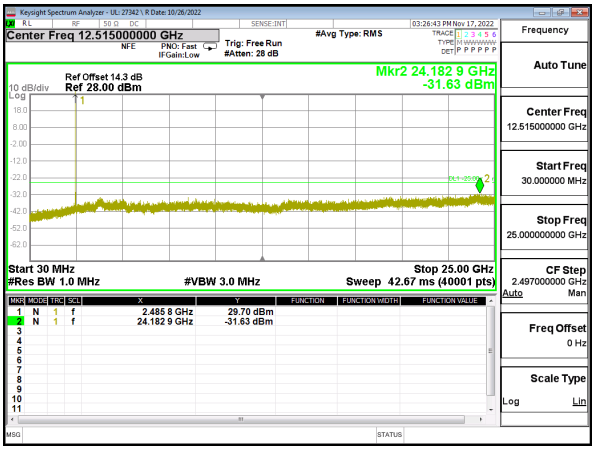
LTE B53 5MHz QPSK High Channel RB1-0



LTE B53 10MHz QPSK Low Channel RB1-0

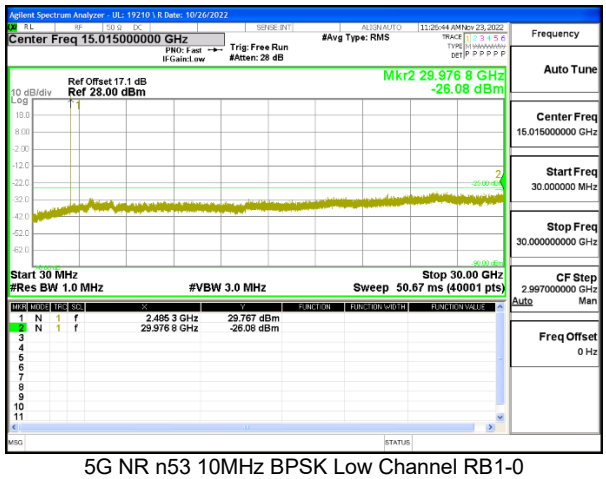


LTE B53 10MHz QPSK Middle Channel RB1-0

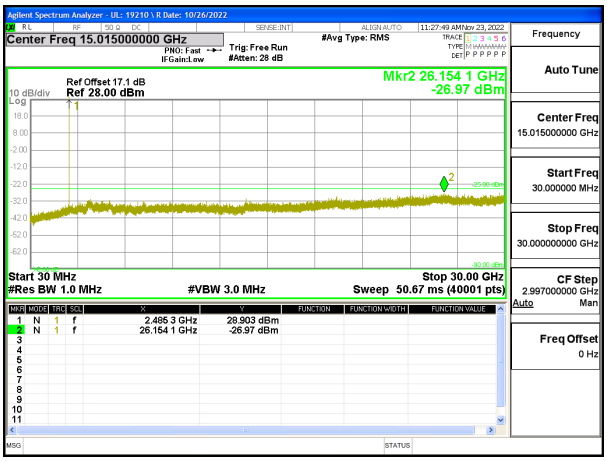


LTE B53 10MHz QPSK High Channel RB1-0

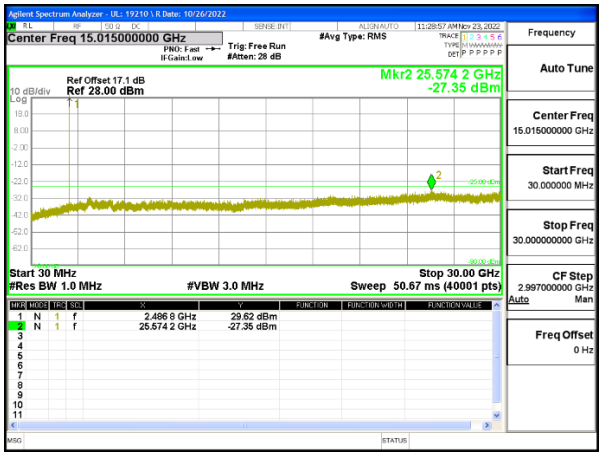
9.6.2. 5G NR n53



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



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



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

Intentionally Blank

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, 2.95VDC.

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).

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.

RESULTS

9.7.1. LTE BAND 53

LTE BAND 53 QPSK (10MHz BANDWIDTH)

Test Engineer ID:	27979	Test Date:	5/25/2022

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	2483.7250	2494.7225			
Extreme (50°C)		2483.7250	2494.7225	1.2	0.000	Yes
Extreme (40°C)		2483.7250	2494.7225	1.8	0.001	Yes
Extreme (30°C)		2483.7250	2494.7225	2.4	0.001	Yes
Extreme (10°C)		2483.7250	2494.7225	2.2	0.001	Yes
Extreme (0°C)		2483.7250	2494.7225	1.5	0.001	Yes
Extreme (-10°C)		2483.7250	2494.7225	3.6	0.001	Yes
Extreme (-20°C)		2483.7250	2494.7225	4.1	0.002	Yes
Extreme (-30°C)		2483.7250	2494.7225	5.3	0.002	Yes
20°C	15%	2483.7250	2494.7225	3.2	0.001	Yes
	-15%	2483.7250	2494.7225	4.3	0.002	Yes
	End Point Voltage	2483.7250	2494.7225	3.7	0.001	Yes

9.7.2. 5G NR n53

5G NR n53 BPSK (10MHz BANDWIDTH)

Test Engineer ID:	27979	Test Date:	5/25/2022

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)		2484.1803	2494.3046			
Extreme (50°C)		2484.1803	2494.3046	-4.32	-0.002	Yes
Extreme (40°C)		2484.1803	2494.3046	-2.27	-0.001	Yes
Extreme (30°C)		2484.1803	2494.3046	-1.69	-0.001	Yes
Extreme (10°C)	Normal	2484.1803	2494.3046	-1.41	-0.001	Yes
Extreme (0°C)		2484.1803	2494.3046	-2.12	-0.001	Yes
Extreme (-10°C)		2484.1803	2494.3046	-3.76	-0.002	Yes
Extreme (-20°C)		2484.1803	2494.3046	3.02	0.001	Yes
Extreme (-30°C)		2484.1803	2494.3046	2.07	0.001	Yes
20°C	15%	2484.1803	2494.3046	-3.39	-0.001	Yes
	-15%	2484.1803	2494.3046	-1.03	0.000	Yes
	End Point Voltage	2484.1803	2494.3046	1.47	0.001	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.

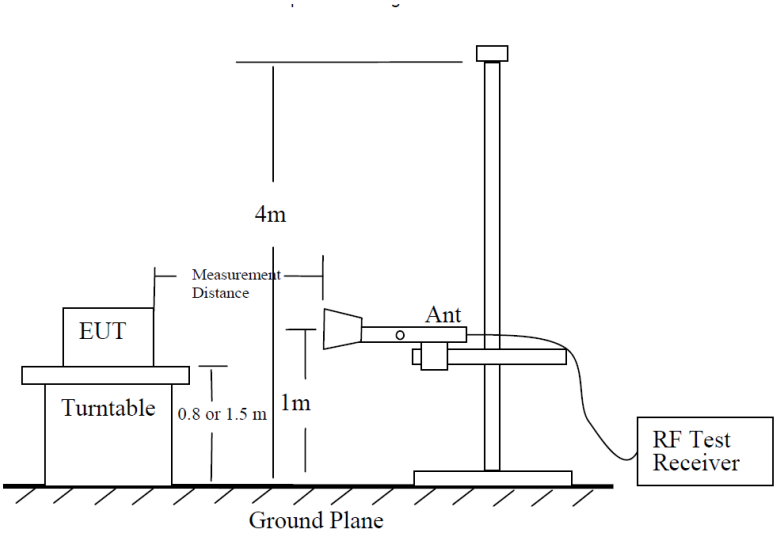


Figure 6—Test site-up for radiated ERP and/or EIRP measurements

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.

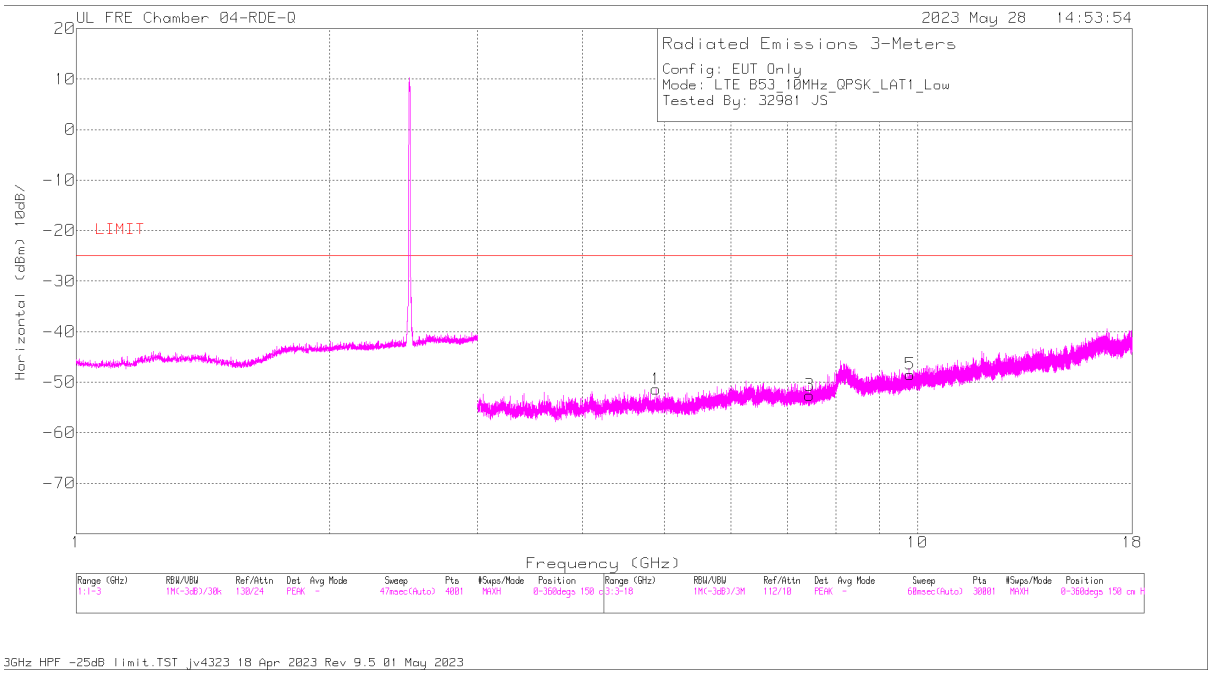
So, from d)

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

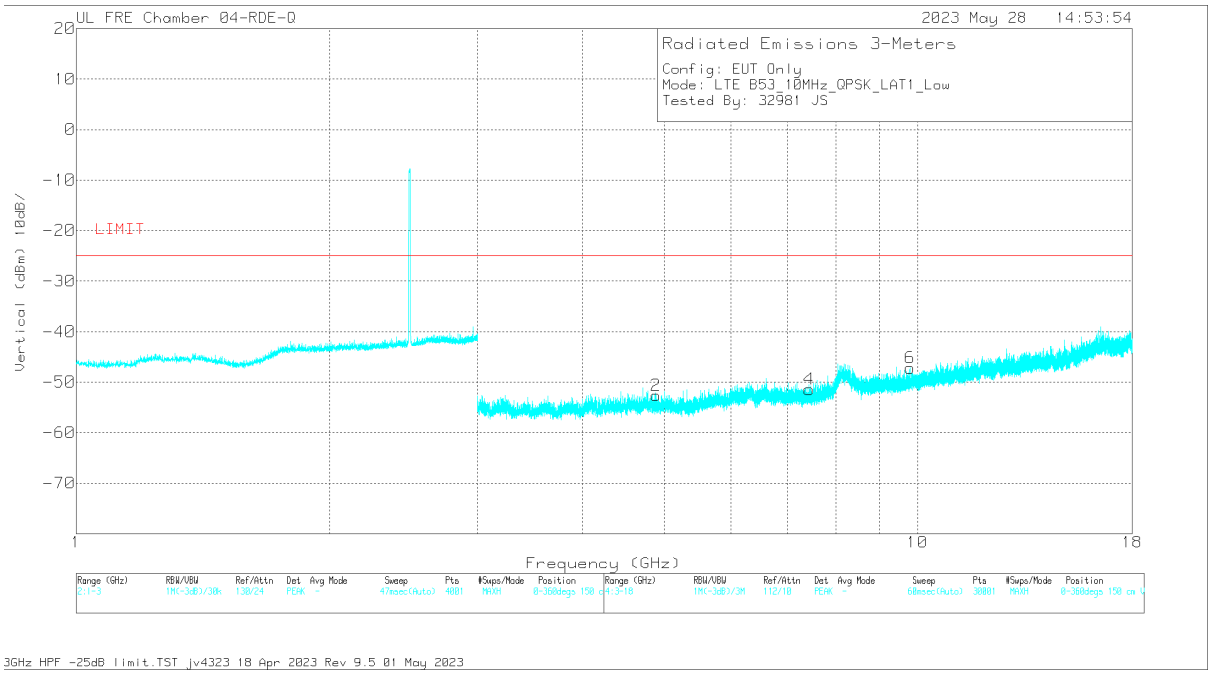
Then, EIRP (dBm) = E (dBμV/m) + 9.5424 − 104.8 = E (dBμV/m) – 95.2576

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 Above 1GHz



Horizontal Polarity



Vertical Polarity

UL Verification Services Inc.
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 319-4000 FAX: (510) 661-0888

Trace Markers

Frequency (GHz)	Meter Reading (dBuV)	Det	84796 ACF (dB) - 3mH	EIRP CF	Gain/Loss (dB)	Corrected Reading (dBm)	LIMIT	Margin (dB)	Polarity
Low Channel, 2488.5MHz									
4.887	54.62	Pk	34.3	-95.2	-46.36	-52.64	-25	-27.64	V
4.8885	55.92	Pk	34.3	-95.2	-46.39	-51.37	-25	-26.37	H
7.4365	52.85	Pk	35.4	-95.2	-44.47	-51.42	-25	-26.42	V
7.437	51.7	Pk	35.4	-95.2	-44.48	-52.58	-25	-27.58	H
9.7975	54.92	Pk	37	-95.2	-43.89	-47.17	-25	-22.17	V
9.8055	53.61	Pk	37	-95.2	-43.85	-48.44	-25	-23.44	H

UL Verification Services Inc.
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 319-4000 FAX: (510) 661-0888

TEST PROCEDURE

KDB 971168 D01 v03r01/D02 v02r02

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. FIELD STRENGTH OF SPURIOUS RADIATION, ANT 1

10.1.1. LTE BAND 53

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

Project #:	14523740
Date:	03/07/2023
Test Engineer:	19226
Configuration:	EUT Only
Mode	LTE_B53_10MHz_QPSK_1RB
Chamber #:	05-RDE-D

Frequency (GHz)	Meter Reading (dBuV)	Det	84796 ACF (dB) - 3mH	EIRP CF	Gain/Loss (dB)	Corrected Reading (dBm)	LIMIT	Margin (dB)	Polarity
Low Channel, 2488.5MHz									
4.888500	55.92	Pk	34.3	-95.2	-46.39	-51.37	-25	-26.37	H
4.887000	54.62	Pk	34.3	-95.2	-46.36	-52.64	-25	-27.64	V
7.437000	51.7	Pk	35.4	-95.2	-44.48	-52.58	-25	-27.58	H
7.436500	52.85	Pk	35.4	-95.2	-44.47	-51.42	-25	-26.42	V
9.805500	53.61	Pk	37	-95.2	-43.85	-48.44	-25	-23.44	H
9.797500	54.92	Pk	37	-95.2	-43.89	-47.17	-25	-22.17	V
Mid Channel, 2489MHz									
4.958000	53.7	Pk	34.3	-95.2	-46.68	-53.88	-25	-28.88	V
4.974500	54.73	Pk	34.3	-95.2	-46.64	-52.81	-25	-27.81	H
7.449000	52.53	Pk	35.4	-95.2	-44.92	-52.19	-25	-27.19	H
7.493000	52.18	Pk	35.5	-95.2	-44.89	-52.41	-25	-27.41	V
9.184500	55.56	Pk	36.4	-95.2	-43.84	-47.08	-25	-22.08	V
9.206500	54.02	Pk	36.4	-95.2	-43.64	-48.42	-25	-23.42	H
High Channel, 2490MHz									
4.970000	53.47	Pk	34.3	-95.2	-46.27	-53.70	-25	-28.70	H
4.969500	52.45	Pk	34.3	-95.2	-46.27	-54.72	-25	-29.72	V
7.455000	51.27	Pk	35.4	-95.2	-44.62	-53.15	-25	-28.15	H
7.455500	52.67	Pk	35.4	-95.2	-44.62	-51.75	-25	-26.75	V
9.941000	51.78	Pk	37.1	-95.2	-43.93	-50.25	-25	-25.25	H
9.940500	53.02	Pk	37.1	-95.2	-43.93	-49.01	-25	-24.01	V

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

Project #:	14523740
Date:	5/28/2023
Test Engineer:	32981
Configuration:	EUT only
Mode	LTE53 QPSK 10MHz
Chamber #:	04-RDE-Q

Frequency (GHz)	Meter Reading (dBuV)	Det	200786 ACF (dB/m)	BRF 2.4-2.5GHz T1786 1-18GHz	EIRP CF	Gain/Loss (dB)	Corrected Reading (dBm)	LIMIT	Margin (dB)	Polarity
Low Channel, 2488.5MHz										
4.977188	36.17	Pk	34.3	.3	-95.2	-31.15	-55.58	-25	-30.58	H
4.977188	36.11	Pk	34.3	.3	-95.2	-31.15	-55.64	-25	-30.64	V
7.465313	32.71	Pk	35.9	.4	-95.2	-26.93	-53.12	-25	-28.12	H
7.465313	32.65	Pk	35.9	.4	-95.2	-26.93	-53.18	-25	-28.18	V
9.954375	31.62	Pk	37.2	.8	-95.2	-24.91	-50.49	-25	-25.49	H
9.954375	31.88	Pk	37.2	.8	-95.2	-24.91	-50.23	-25	-25.23	V
Mid Channel, 2489MHz										
4.978125	38.17	Pk	34.3	.3	-95.2	-31.09	-53.52	-25	-28.52	H
4.978125	37.92	Pk	34.3	.3	-95.2	-31.09	-53.77	-25	-28.77	V
7.469063	35.52	Pk	35.9	.4	-95.2	-26.8	-50.18	-25	-25.18	H
7.469063	33.72	Pk	35.9	.4	-95.2	-26.8	-51.98	-25	-26.98	V
4.978125	38.17	Pk	34.3	.3	-95.2	-31.09	-53.52	-25	-28.52	H
4.978125	37.92	Pk	34.3	.3	-95.2	-31.09	-53.77	-25	-28.77	V
High Channel, 2490MHz										
4.980469	36.82	Pk	34.3	.3	-95.2	-31.08	-54.86	-25	-29.86	H
4.978125	36.16	Pk	34.3	.3	-95.2	-31.09	-55.53	-25	-30.53	V
7.470469	35.05	Pk	35.9	.4	-95.2	-26.88	-50.73	-25	-25.73	H
7.470469	32.13	Pk	35.9	.4	-95.2	-26.88	-53.65	-25	-28.65	V
9.960000	31.11	Pk	37.2	.8	-95.2	-24.94	-51.03	-25	-26.03	H
9.959531	31.75	Pk	37.2	.8	-95.2	-24.94	-50.39	-25	-25.39	V

10.1.2. 5G NR n53

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

Project #:	14523740
Date:	05/26/2023
Test Engineer:	19226
Configuration:	EUT Only
Mode	FR1_n53_10MHz_BPSK 1RB
Chamber #:	05-RDE-D

Frequency (GHz)	Meter Reading (dBuV)	Det	80402 ACF(dB) - 3mH	EIRP CF	Gain/Loss (dB)	Corrected Reading (dBm)	LIMIT	Margin (dB)	Polarity
Low Channel, 2488.5MHz									
4.977898	57.99	Pk	34.3	-95.2	-47.43	-50.34	-25	-25.34	H
4.975323	56.65	Pk	34.2	-95.2	-47.51	-51.86	-25	-26.86	V
7.465061	55.35	Pk	35.8	-95.2	-45.85	-49.90	-25	-24.9	H
7.464751	55.03	Pk	35.8	-95.2	-45.84	-50.21	-25	-25.21	V
9.956346	55.9	Pk	37.3	-95.2	-45.16	-47.16	-25	-22.16	H
9.954398	55.55	Pk	37.3	-95.2	-45.09	-47.44	-25	-22.44	V
Mid Channel, 2489MHz									
4.977699	57.83	Pk	34.3	-95.2	-48.62	-51.69	-25	-26.69	H
4.979285	56.96	Pk	34.3	-95.2	-48.66	-52.60	-25	-27.60	V
7.468787	57.04	Pk	35.8	-95.2	-47.25	-49.61	-25	-24.61	H
7.467292	56.71	Pk	35.8	-95.2	-47.22	-49.91	-25	-24.91	V
9.956964	57.61	Pk	37.3	-95.2	-46.87	-47.16	-25	-22.16	H
9.957541	57.24	Pk	37.3	-95.2	-46.88	-47.54	-25	-22.54	V
High Channel, 2490MHz									
4.98203	57.08	Pk	34.3	-95.2	-47.55	-51.37	-25	-26.37	H
4.979606	57.01	Pk	34.3	-95.2	-47.43	-51.32	-25	-26.32	V
7.456843	55.84	Pk	35.8	-95.2	-45.95	-49.51	-25	-24.51	H
7.457497	56.83	Pk	35.8	-95.2	-45.96	-48.53	-25	-23.53	V
9.961498	55.49	Pk	37.4	-95.2	-45.18	-47.49	-25	-22.49	H
9.960872	55.65	Pk	37.4	-95.2	-45.28	-47.43	-25	-22.43	V

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

Project #:	14523740
Date:	5/31/2023
Test Engineer:	19226
Configuration:	EUT only
Mode	5G NR n53 10MHz
Chamber #:	05-RDE-D

Frequency (GHz)	Meter Reading (dBuV)	Det	80402 ACF(dB) - 3mH	EIRP CF	Gain/Loss (dB)	Corrected Reading (dBm)	LIMIT	Margin (dB)	Polarity
Low Channel, 2488.5MHz									
4.977500	55.19	Pk	34.3	-95.2	-47.49	-53.20	-25	-28.20	H
4.977500	54.87	Pk	34.3	-95.2	-47.49	-53.52	-25	-28.52	V
7.465500	52.97	Pk	35.8	-95.2	-45.85	-52.28	-25	-27.28	H
7.465500	52.76	Pk	35.8	-95.2	-45.85	-52.49	-25	-27.49	V
9.954500	53.11	Pk	37.3	-95.2	-45.10	-49.89	-25	-24.89	H
9.954500	52.38	Pk	37.3	-95.2	-45.10	-50.62	-25	-25.62	V
Mid Channel, 2489MHz									
4.979000	53.7	Pk	34.3	-95.2	-47.39	-54.59	-25	-29.59	H
4.979000	55.2	Pk	34.3	-95.2	-47.39	-53.09	-25	-28.09	V
7.467500	52.8	Pk	35.8	-95.2	-45.87	-52.47	-25	-27.47	H
7.467500	52.58	Pk	35.8	-95.2	-45.87	-52.69	-25	-27.69	V
9.957000	53.92	Pk	37.3	-95.2	-45.26	-49.24	-25	-24.24	H
9.957000	52.55	Pk	37.3	-95.2	-45.26	-50.61	-25	-25.61	V
High Channel, 2490MHz									
4.980500	56.4	Pk	34.3	-95.2	-47.51	-52.01	-25	-27.01	H
4.980500	55.78	Pk	34.3	-95.2	-47.51	-52.63	-25	-27.63	V
7.471000	53.26	Pk	35.8	-95.2	-45.81	-51.95	-25	-26.95	H
7.471000	52.11	Pk	35.8	-95.2	-45.81	-53.10	-25	-28.10	V
9.960500	53.56	Pk	37.4	-95.2	-45.26	-49.50	-25	-24.50	H
9.960500	52.74	Pk	37.4	-95.2	-45.26	-50.32	-25	-25.32	V

10.2. FIELD STRENGTH OF SPURIOUS RADIATION, ANT 2

10.2.1. LTE BAND 53

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

Project #:	14523740
Date:	2/16/2023
Test Engineer:	12501
Configuration:	EUT Only
Mode	LTE_B53_10MHz_QPSK_1RB
Chamber #:	05-RDE-D

Frequency (GHz)	Meter Reading (dBuV)	Det	80402 ACF(dB) - 3mH	EIRP CF	Gain/Loss (dB)	Corrected Reading (dBm)	LIMIT	Margin (dB)	Polarity
Low Channel, 2488.5MHz									
4.977500	54.83	Pk	34.3	-95.2	-46.42	-52.49	-25	-27.49	H
4.977500	55.11	Pk	34.3	-95.2	-46.42	-52.21	-25	-27.21	V
7.465500	52.74	Pk	35.8	-95.2	-44.48	-51.14	-25	-26.14	H
7.465500	54.08	Pk	35.8	-95.2	-44.48	-49.80	-25	-24.80	V
9.954500	53.26	Pk	37.3	-95.2	-44.24	-48.88	-25	-23.88	H
9.954500	53.18	Pk	37.3	-95.2	-44.24	-48.96	-25	-23.96	V
Mid Channel, 2489MHz									
4.979438	58.64	Pk	34.3	-95.2	-48.66	-50.92	-25	-25.92	H
4.980184	58.82	Pk	34.3	-95.2	-48.67	-50.75	-25	-25.75	V
7.456118	57.42	Pk	35.8	-95.2	-47.26	-49.24	-25	-24.24	H
7.454939	58.04	Pk	35.8	-95.2	-47.17	-48.53	-25	-23.53	V
9.955222	56.85	Pk	37.3	-95.2	-46.89	-47.94	-25	-22.94	H
9.957221	56.9	Pk	37.3	-95.2	-46.87	-47.87	-25	-22.87	V
High Channel, 2490MHz									
4.981000	55.49	Pk	34.3	-95.2	-46.36	-51.77	-25	-26.77	H
4.981000	54.19	Pk	34.3	-95.2	-46.36	-53.07	-25	-28.07	V
7.470000	53.59	Pk	35.8	-95.2	-44.57	-50.38	-25	-25.38	H
7.470000	54.87	Pk	35.8	-95.2	-44.57	-49.10	-25	-24.10	V
9.961000	53.05	Pk	37.4	-95.2	-44.15	-48.90	-25	-23.90	H
9.961000	54.12	Pk	37.4	-95.2	-44.15	-47.83	-25	-22.83	V

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

Project #:	14523740
Date:	6/7/2023
Test Engineer:	32545
Configuration:	EUT only
Mode	LTE53 QPSK 10MHz
Chamber #:	01-RDE-B

Frequency (GHz)	Meter Reading (dBuV)	Det	200786 ACF (dB/m)	BRF 2.4-2.5GHz T1786 1-18GHz	EIRP CF	Gain/Loss (dB)	Corrected Reading (dBm)	LIMIT	Margin (dB)	Polarity
Low Channel, 2488.5MHz										
4.977188	36.5	Pk	34.3	.3	-95.2	-31.15	-55.25	-25	-30.25	H
4.976719	38.52	Pk	34.3	.3	-95.2	-31.15	-53.23	-25	-28.23	V
7.465781	34.33	Pk	35.9	.4	-95.2	-27.00	-51.57	-25	-26.57	H
7.465781	34.2	Pk	35.9	.4	-95.2	-27.00	-51.70	-25	-26.70	V
9.954375	33.45	Pk	37.2	.8	-95.2	-24.91	-48.66	-25	-23.66	H
9.953906	31.64	Pk	37.2	.8	-95.2	-24.91	-50.47	-25	-25.47	V
Mid Channel, 2489MHz										
4.979531	37.72	Pk	34.3	.3	-95.2	-31.11	-53.99	-25	-28.99	H
4.979063	37.07	Pk	34.3	.3	-95.2	-31.12	-54.65	-25	-29.65	V
7.469063	34.04	Pk	35.9	.4	-95.2	-26.80	-51.66	-25	-26.66	H
7.469063	33.81	Pk	35.9	.4	-95.2	-26.80	-51.89	-25	-26.89	V
9.958594	33.52	Pk	37.2	.8	-95.2	-24.94	-48.62	-25	-23.62	H
9.958125	32.86	Pk	37.2	.8	-95.2	-24.95	-49.29	-25	-24.29	V
High Channel, 2490MHz										
4.980469	38.38	Pk	34.3	.3	-95.2	-31.08	-53.30	-25	-28.30	H
4.980469	36.12	Pk	34.3	.3	-95.2	-31.08	-55.56	-25	-30.56	V
7.470469	34.69	Pk	35.9	.4	-95.2	-26.88	-51.09	-25	-26.09	H
7.470469	33.61	Pk	35.9	.4	-95.2	-26.88	-52.17	-25	-27.17	V
9.960469	30.6	Pk	37.2	.8	-95.2	-24.98	-51.58	-25	-26.58	H
9.960469	31.86	Pk	37.2	.8	-95.2	-24.98	-50.32	-25	-25.32	V

10.2.2. 5G NR n53

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

Project #:	14523740
Date:	05/26/2023
Test Engineer:	19226
Configuration:	EUT Only
Mode	FR1_n53_10MHz_BPSK 1RB
Chamber #:	05-RDE-D

Frequency (GHz)	Meter Reading (dBuV)	Det	80402 ACF(dB) - 3mH	EIRP CF	Gain/Loss (dB)	Corrected Reading (dBm)	LIMIT	Margin (dB)	Polarity
Low Channel, 2488.5MHz									
4.977390	57.76	Pk	34.3	-95.2	-47.50	-50.64	-25	-25.64	H
4.978944	57.51	Pk	34.3	-95.2	-47.39	-50.78	-25	-25.78	V
7.466248	55.55	Pk	35.8	-95.2	-45.86	-49.71	-25	-24.71	V
7.467370	55.28	Pk	35.8	-95.2	-45.88	-50.00	-25	-25.00	H
9.954873	55.62	Pk	37.3	-95.2	-45.10	-47.38	-25	-22.38	V
9.956069	55.88	Pk	37.3	-95.2	-45.11	-47.13	-25	-22.13	H
Mid Channel, 2489MHz									
4.980863	57.39	Pk	34.3	-95.2	-48.65	-52.16	-25	-27.16	H
4.980557	58.12	Pk	34.3	-95.2	-48.66	-51.44	-25	-26.44	V
7.465650	56.62	Pk	35.8	-95.2	-47.23	-50.01	-25	-25.01	H
7.466754	57.19	Pk	35.8	-95.2	-47.22	-49.43	-25	-24.43	V
9.957212	56.75	Pk	37.3	-95.2	-46.87	-48.02	-25	-23.87	H
9.956560	57.20	Pk	37.3	-95.2	-46.87	-47.57	-25	-22.57	V
High Channel, 2490MHz									
* 4.971500	56.89	Pk	34.2	-95.2	-47.32	-51.43	-25	-26.43	H
* 4.971500	55.41	Pk	34.2	-95.2	-47.32	-52.91	-25	-27.91	V
* 7.470500	52.32	Pk	35.8	-95.2	-45.36	-52.44	-25	-27.44	H
* 7.470000	52.14	Pk	35.8	-95.2	-45.37	-52.63	-25	-27.63	V
9.960500	52.92	Pk	37.4	-95.2	-45.92	-50.80	-25	-25.80	H
9.967000	55.30	Pk	37.4	-95.2	-45.69	-48.19	-25	-23.19	V

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

Project #:	14523740
Date:	5/31/2023
Test Engineer:	19226
Configuration:	EUT only
Mode	5G NR n53 10MHz
Chamber #:	05-RDE-D

Frequency (GHz)	Meter Reading (dBuV)	Det	80402 ACF(dB) - 3mH	EIRP CF	Gain/Loss (dB)	Corrected Reading (dBm)	LIMIT	Margin (dB)	Polarity
Low Channel, 2488.5MHz									
4.977500	54.86	Pk	34.3	-95.2	-47.49	-53.53	-25	-28.53	H
4.977500	54.3	Pk	34.3	-95.2	-47.49	-54.09	-25	-29.09	V
7.465500	52.73	Pk	35.8	-95.2	-45.85	-52.52	-25	-27.52	H
7.465500	52.21	Pk	35.8	-95.2	-45.85	-53.04	-25	-28.04	V
9.954500	52.87	Pk	37.3	-95.2	-45.10	-50.13	-25	-25.13	H
9.954500	52.74	Pk	37.3	-95.2	-45.10	-50.26	-25	-25.26	V
Mid Channel, 2489MHz									
4.978500	54.18	Pk	34.3	-95.2	-47.40	-54.12	-25	-29.12	H
4.978500	54.89	Pk	34.3	-95.2	-47.40	-53.41	-25	-28.41	V
7.467500	54.4	Pk	35.8	-95.2	-45.87	-50.87	-25	-25.87	H
7.467500	53.71	Pk	35.8	-95.2	-45.87	-51.56	-25	-26.56	V
9.956500	54.07	Pk	37.3	-95.2	-45.18	-49.01	-25	-24.01	H
9.956500	54.88	Pk	37.3	-95.2	-45.18	-48.2	-25	-23.2	V
High Channel, 2490MHz									
4.980500	53.58	Pk	34.3	-95.2	-47.51	-54.83	-25	-29.83	H
4.980500	54.07	Pk	34.3	-95.2	-47.51	-54.34	-25	-29.34	V
7.470500	53.09	Pk	35.8	-95.2	-45.86	-52.17	-25	-27.17	H
7.470500	53.14	Pk	35.8	-95.2	-45.86	-52.12	-25	-27.12	V
9.960500	53.27	Pk	37.4	-95.2	-45.26	-49.79	-25	-24.79	H
9.960500	53.42	Pk	37.4	-95.2	-45.26	-49.64	-25	-24.64	V

11. SETUP PHOTOS

Please refer to 14523740-EP1V1 for Setup Photo Report for setup photos.

END OF REPORT

.

UL Verification Services Inc.
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 319-4000 FAX: (510) 661-0888