TEST REPORT

Report Number: 14523778-E20V2

Applicant	:	APPLE, INC 1 APPLE PARK WAY CUPERTINO, CA 95014, U.S.A
Model	:	A2847
Brand	:	APPLE
FCC ID	:	BCG-E8431A
IC	:	597C-E8431A
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:
2023-08-24

Prepared by:
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ACCREDITED
CERT #0751.05

Revision History

Rev.	Issue Date	Revisions	Revised By
V1	2023-08-14	Initial Review	Mengistu Mekuria
V2	2023-08-24	Address TCB Question section 6.2	Mengistu Mekuria

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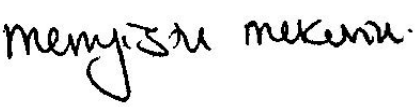
1. ATTESTATION OF TEST RESULTS

Applicant Name and Address	APPLE, INC 1 APPLE PARK WAY CUPERTINO, CA 95014, U.S.A
Model	A2847
Brand	APPLE
FCC ID	BCG-E8431A
IC	579C-E8431A
EUT Description	SMARTPHONE
Serial Number	HVGGRN0004H00004CC, HVGGUG0003R00004CA (CONDUCTED) AND FC2F7V909F, R409717T71 (RADIATED)
Sample Receipt Date	2023-02-05
Date Tested	2023-02-05 to 2023-07-27
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.

Approved & Released By:	Reviewed By:	Prepared By:
		
Mengistu Mekuria Project Engineer UL Verification Services Inc.	Tewodros Woldemichael Laboratory Engineer UL Verification Services Inc.	Binod Sitaula Lab Engineer Associate UL Verification Services Inc.

2. SUMMARY OF TEST RESULTS

This report contains data provided by the customer which can impact the validity of results. UL Verification Services Inc. is only responsible for the validity of results after the integration of the data provided by the customer."
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)	RSS-170 5.4; SMSE-009-20 Annex A 9.d	Complies	
Equivalent Isotropic Radiated	53	25.149 (c)(4)(iii)	RSS-170 5.4; 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)	RSS-170 5.7.3; SMSE-009-20 Annex A 9.g and h	Complies	
Out of Band Emissions	53	2.1051, 25.149 (c) (4) (v), (vi)	RSS-170 5.7.3; SMSE-009-20 Annex A 9.g, h, and i	Complies	
Frequency Stability	53	25.202 (d)	RSS-170 5.3	Complies	
Field Strength of Spurious Radiation	53	2.1053, 25.149 (c) (4) (v), (vi)	RSS-170 5.7.3; SMSE-009-20 Annex A 9.g, h, and i	Complies	
Carrier-Off-State Emissions Radiation	53	25.216 (i)	RSS-170 5.10	Complies	

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 4
- 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			

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

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, 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

EIRP = PMeas + GT − LC
where: EIRP = effective isotropic 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 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:

Limit

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).

LTE BAND 53

FCC Part 25/ SMSE-009-20	
Peak EIRP Limit (W)	3.98
Conducted Average Limit (W)	1.00
Antenna Gain (dBi)_(Ant 1)	-1.70

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	20.7	19.00	0.079	24.47	22.77	0.189	1094	1M09G7W
	16QAM			20.7	19.00	0.079	24.46	22.76	0.189	1091	1M09D7W
3.0	QPSK	2485.0	2493.5	20.7	19.00	0.079	24.79	23.09	0.204	2702	2M70G7W
	16QAM			20.7	19.00	0.079	24.71	23.01	0.200	2697	2M70D7W
5.0	QPSK	2486.0	2492.5	20.7	19.00	0.079	25.01	23.31	0.214	4492	4M49G7W
	16QAM			20.7	19.00	0.079	24.98	23.28	0.213	4494	4M49D7W
10.0	QPSK	2488.5	2490.0	20.7	19.00	0.079	25.09	23.39	0.218	9016	9M02G7W
	16QAM			20.7	19.00	0.079	25.09	23.39	0.218	8990	8M99D7W

5G NR n53

FCC Part 25 / SMSE-900-20	
Peak EIRP Limit (W)	3.98
Conducted Average Limit (W)	1.00
Antenna Gain (dBi)_(Ant 1)	-1.70

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	20.7	19.00	0.079	26.11	24.41	0.276	8620	8M62G7W
	QPSK			20.7	19.00	0.079	25.98	24.28	0.268	8602	8M60G7W
	16QAM			20.7	19.00	0.079	26.10	24.40	0.275	8631	8M63D7W

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	-1.7	-2.7

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 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

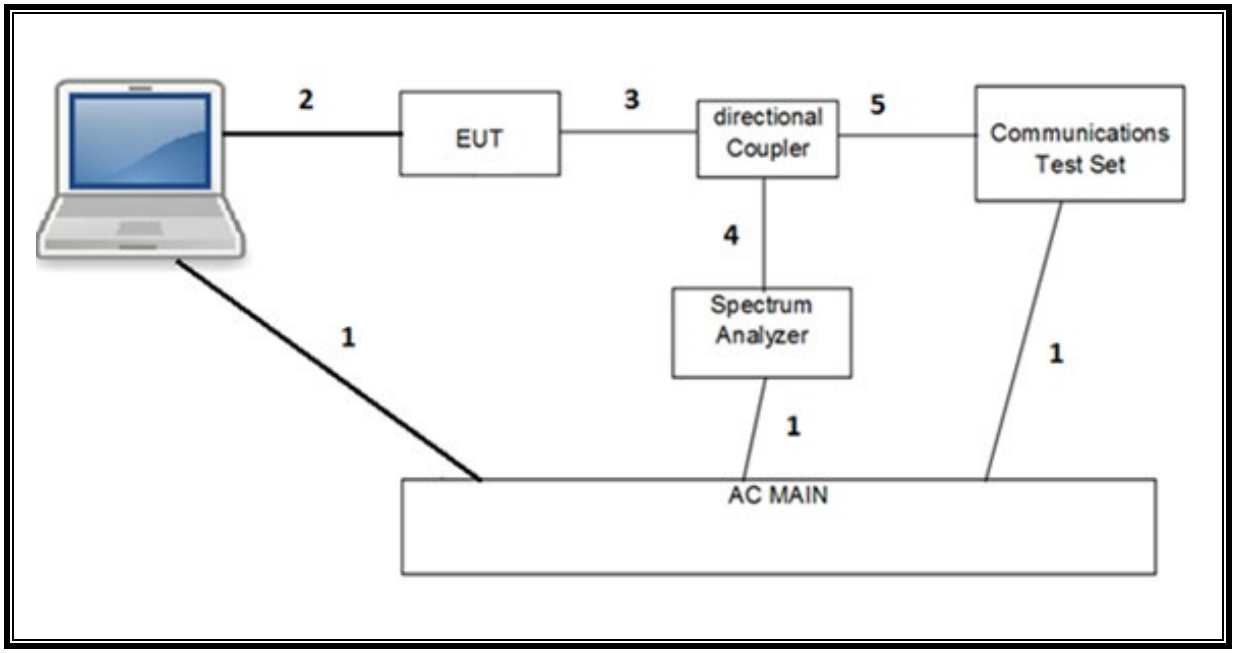
Radiated spurious emissions were investigated from 9kHz to 30MHz, 30MHz-1GHz and above 1GHz. There were no emissions found with less than 20dB of margin from 9kHz to 1GHz.

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.

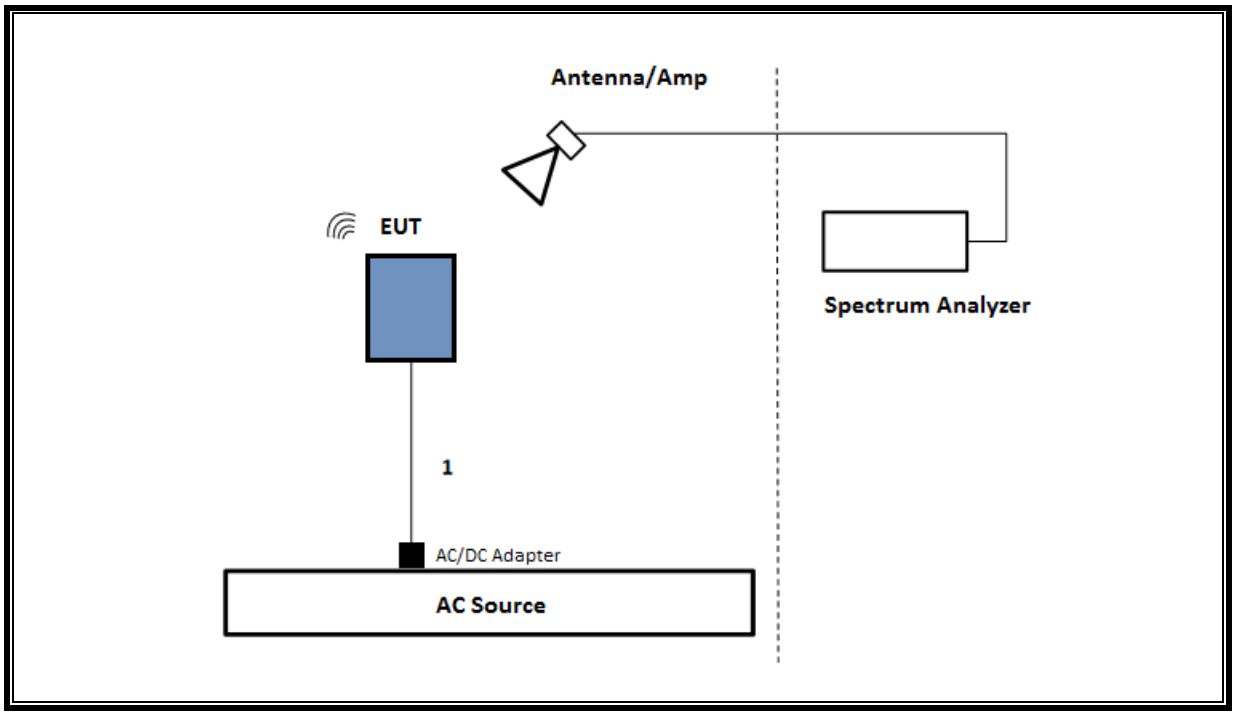
6.6. DESCRIPTION OF TEST SETUP

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	79834	06/08/2023
*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, 3Hz to 44GHz	Keysight	N9030A	85201	02/29/2024
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
Directional Coupler	KRYTAR	152610	198817	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 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	230298	02/29/2024
Wideband Communication Test Set, Call Box	Rohde & Schwarz	CMW500	230295	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.

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:	25780	Test Date:	3/17/2023

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 MHz	2489.0 MHz	2494.3 MHz	2484.2 MHz	2489.0 MHz	2494.3 MHz
1.4	QPSK	1	0	20.53	20.69	20.62	20.62	20.66	20.66	23.89	24.02	23.97	23.94	24.03	23.99
		1	2	20.55	**20.70**	20.65	20.62	20.65	**20.70**	23.90	24.02	24.00	23.91	24.01	24.06
		1	5	20.54	20.67	20.57	20.62	20.62	20.68	23.92	24.04	23.96	23.93	24.00	24.06
		3	0	20.53	20.64	20.55	20.67	20.63	20.67	23.98	24.09	24.02	24.04	23.99	24.07
		3	1	20.54	20.63	20.61	20.68	20.66	**20.70**	23.98	24.08	24.07	24.06	24.01	24.09
		3	2	20.55	20.67	20.60	20.65	20.64	**20.70**	23.97	24.12	24.08	24.01	23.99	24.08
		6	0	19.85	19.93	19.86	19.59	19.60	19.67	24.32	**24.47**	24.40	24.00	24.03	**24.14**
	16QAM	1	0	20.65	20.64	20.63	**20.70**	20.54	20.56	24.38	24.34	24.30	**24.22**	24.02	24.06
		1	2	20.49	**20.70**	20.63	20.68	20.55	20.63	24.20	24.37	24.32	24.19	24.00	24.07
		1	5	20.67	20.67	20.64	20.45	20.57	20.62	24.42	24.39	24.34	23.93	24.03	24.10
		3	0	20.32	20.47	20.36	20.35	20.30	20.40	24.24	24.40	24.29	24.00	23.98	24.06
		3	1	20.33	20.49	20.42	20.48	20.36	20.42	24.24	24.42	24.33	24.09	24.03	24.06
		3	2	20.35	20.54	20.40	20.34	20.31	20.38	24.24	**24.46**	24.30	23.97	23.98	24.03
		6	0	19.29	19.43	19.33	19.19	19.23	19.37	24.28	24.44	24.34	23.95	23.96	24.11
	64QAM	1	0	20.64	**20.70**	20.58	20.51	20.65	20.54	24.12	24.24	24.16	23.87	23.97	23.97
		1	2	20.64	20.66	20.61	20.58	20.64	**20.70**	24.13	24.25	24.18	23.85	23.93	**24.06**
		1	5	20.61	**20.70**	20.65	20.62	20.58	20.54	24.22	24.30	24.28	23.90	23.90	24.00
		3	0	20.57	20.61	20.57	20.47	20.49	20.53	24.20	24.27	24.26	23.90	23.92	23.98
		3	1	20.50	20.64	20.61	20.46	20.50	20.56	24.13	24.30	24.30	23.87	23.89	24.00
		3	2	20.55	20.63	20.60	20.44	20.47	20.58	24.17	24.29	24.28	23.85	23.88	24.03
		6	0	19.57	19.69	19.62	19.41	19.39	19.49	24.18	**24.35**	24.24	23.84	23.89	24.03
	256QAM	1	0	20.57	20.61	20.64	19.71	19.71	19.71	22.28	22.36	22.40	22.10	22.16	22.15
		1	2	20.61	**20.70**	20.65	19.76	19.74	19.72	22.23	22.42	22.44	22.13	22.06	22.03
		1	5	20.59	20.67	20.63	19.64	19.64	19.71	22.26	22.38	22.37	22.07	21.94	22.14
		3	0	20.61	20.67	20.64	19.67	19.64	19.66	22.65	22.68	22.80	22.61	22.44	22.40
		3	1	20.58	20.68	20.59	19.70	19.72	**19.78**	22.57	22.74	22.86	22.37	22.40	22.63
		3	2	20.59	20.66	20.68	19.60	19.64	19.71	22.56	22.76	22.95	22.40	22.47	22.64
		6	0	20.64	20.66	20.53	19.49	19.42	19.69	22.55	**23.53**	23.14	23.14	21.90	**23.14**

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	60155	60195	60240	60155	60195	60240
				2485.0 MHz	2489.0 MHz	2493.5 MHz	2485.0 MHz	2489.0 MHz	2493.5 MHz	2485.0 MHz	2489.0 MHz	2493.5 MHz	2485.0 MHz	2489.0 MHz	2493.5 MHz
3.0	QPSK	1	0	20.39	20.52	20.52	20.56	20.58	20.60	23.82	23.96	23.95	23.97	23.96	23.96
		1	7	20.54	**20.70**	20.65	20.69	20.69	**20.70**	23.90	24.06	24.02	24.04	24.01	23.98
		1	14	20.50	20.59	20.49	20.58	20.61	20.60	23.97	24.07	23.97	23.96	24.05	24.01
		8	0	19.85	19.93	19.89	19.71	19.68	19.72	24.46	24.59	24.56	24.25	24.23	24.29
		8	4	19.88	19.95	19.94	19.66	19.63	19.75	24.53	24.65	24.65	24.24	24.21	24.35
		8	7	19.88	19.98	19.92	19.67	19.64	19.74	24.51	24.65	24.60	24.22	24.21	24.32
		15	0	19.82	19.96	19.89	19.60	19.58	19.70	24.54	**24.79**	24.67	24.30	24.30	**24.41**
	16QAM	1	0	20.49	20.59	20.62	20.55	20.53	20.56	24.26	24.37	24.38	24.07	24.13	24.14
		1	7	20.62	**20.70**	20.66	20.67	20.60	**20.70**	24.29	24.38	24.37	24.13	24.08	24.15
		1	14	20.55	20.64	20.56	20.55	20.52	20.56	24.38	24.48	24.43	24.13	24.15	24.17
		8	0	19.28	19.41	19.40	19.33	19.31	19.36	24.46	24.55	24.57	24.27	24.23	24.31
		8	4	19.31	19.45	19.45	19.28	19.27	19.35	24.44	24.58	24.59	24.18	24.17	24.29
		8	7	19.32	19.46	19.41	19.26	19.26	19.37	24.44	24.60	24.55	24.16	24.14	24.30
		15	0	19.27	19.35	19.34	19.27	19.22	19.34	24.62	24.71	**24.74**	24.37	24.36	**24.47**
	64QAM	1	0	20.53	20.59	20.58	20.54	20.47	20.57	24.07	24.25	24.24	23.92	23.99	23.97
		1	7	20.67	20.64	**20.70**	20.64	20.55	**20.70**	24.15	24.25	24.32	23.91	24.00	24.03
		1	14	20.57	20.69	20.51	20.61	20.54	20.55	24.18	24.38	24.29	23.90	24.01	24.08
		8	0	19.49	19.52	19.49	19.49	19.49	19.55	24.33	24.42	24.43	24.08	24.12	24.18
		8	4	19.57	19.58	19.59	19.44	19.44	19.52	24.35	24.46	24.45	24.04	24.08	24.15
		8	7	19.49	19.54	19.58	19.49	19.45	19.55	24.34	24.39	24.47	24.06	24.04	24.18
		15	0	19.48	19.54	19.55	19.44	19.41	19.51	24.59	24.68	**24.71**	24.39	24.31	**24.45**
	256QAM	1	0	20.53	20.56	20.58	19.70	19.67	19.81	22.13	22.17	22.21	22.20	21.91	22.18
		1	7	**20.70**	**20.70**	20.65	19.80	19.83	**19.87**	22.21	22.46	22.45	21.94	21.84	21.97
		1	14	20.54	20.69	20.57	19.69	19.62	19.65	22.21	22.41	22.34	21.91	22.08	22.06
		8	0	20.51	20.57	20.56	19.72	19.70	19.69	22.93	22.95	23.11	22.91	22.84	22.92
		8	4	20.58	20.63	20.60	19.64	19.62	19.72	23.06	23.24	23.06	22.77	22.72	22.82
		8	7	20.57	20.61	20.60	19.66	19.63	19.71	22.91	23.14	22.98	22.82	22.74	22.82
		15	0	20.49	20.58	20.57	19.59	19.57	19.69	23.05	**23.29**	23.16	22.71	22.78	**22.97**

OUTPUT POWER FOR LTE BAND 53 (5.0 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)		
				60165	60195	60230	60165	60195	60230	60165	60195	60230	60165	60195	60230
				2486.0 MHz	2489.0 MHz	2492.5 MHz	2486.0 MHz	2489.0 MHz	2492.5 MHz	2486.0 MHz	2489.0 MHz	2492.5 MHz	2486.0 MHz	2489.0 MHz	2492.5 MHz
5.0	QPSK	1	0	20.44	20.50	20.53	20.42	20.52	20.54	23.95	23.97	24.00	23.88	23.94	24.01
		1	12	20.64	**20.70**	20.69	20.50	20.66	**20.70**	24.10	24.13	24.13	23.94	24.03	24.14
		1	24	20.54	20.58	20.52	20.47	20.56	20.55	24.11	24.14	24.08	23.98	24.06	24.07
		12	0	19.77	19.84	19.91	19.50	19.54	19.60	24.33	24.45	24.56	24.03	24.07	24.16
		12	6	19.89	19.95	19.91	19.55	19.60	19.66	24.44	24.52	24.51	24.01	24.07	24.15
		12	11	19.86	19.90	19.90	19.56	19.53	19.64	24.45	24.52	24.55	24.06	24.06	24.18
		25	0	19.87	19.92	19.88	19.51	19.52	19.61	24.85	**25.01**	24.89	24.50	24.46	**24.59**
	16QAM	1	0	20.38	20.48	20.50	20.29	20.43	20.49	24.21	24.29	24.30	23.87	23.96	23.95
		1	12	20.69	20.69	**20.70**	20.43	20.51	**20.70**	24.44	24.49	24.51	24.02	23.98	24.17
		1	24	20.55	20.50	20.49	20.37	20.46	20.56	24.43	24.40	24.46	23.98	24.07	24.08
		12	0	19.17	19.29	19.46	19.14	19.18	19.30	24.39	24.46	24.54	24.15	24.06	24.21
		12	6	19.32	19.43	19.52	19.15	19.22	19.35	24.40	24.50	24.51	24.05	24.03	24.13
		12	11	19.31	19.41	19.50	19.16	19.17	19.28	24.47	24.51	24.54	24.10	24.02	24.19
		25	0	19.20	19.24	19.25	19.09	19.11	19.18	24.94	24.95	**24.98**	24.45	**24.77**	24.70
	64QAM	1	0	20.45	20.42	20.56	20.40	20.57	20.61	24.11	24.12	24.19	23.71	23.88	23.89
		1	12	20.45	20.57	**20.70**	20.51	**20.70**	**20.70**	24.20	24.30	24.38	23.88	24.05	24.10
		1	24	20.51	20.46	20.47	20.45	20.59	20.65	24.28	24.31	24.30	23.83	24.03	24.06
		12	0	19.26	19.35	19.40	19.37	19.42	19.45	24.24	24.33	24.41	23.93	24.01	24.04
		12	6	19.38	19.46	19.43	19.42	19.49	19.49	24.30	24.40	24.40	23.93	24.02	24.06
		12	11	19.41	19.43	19.41	19.42	19.40	19.47	24.36	24.40	24.40	23.98	23.99	24.11
		25	0	19.39	19.40	19.39	19.37	19.34	19.47	24.68	24.74	**24.74**	24.29	24.28	**24.43**
	256QAM	1	0	20.51	20.56	20.66	19.58	19.54	19.61	22.12	22.13	22.29	21.78	21.78	21.82
		1	12	20.69	**20.70**	**20.70**	19.67	19.74	**19.78**	22.36	22.29	22.27	21.89	22.12	22.23
		1	24	20.59	20.54	20.54	19.61	19.60	19.63	22.37	22.17	22.29	21.94	22.12	22.12
		12	0	20.41	20.48	20.51	19.45	19.50	19.57	23.05	23.08	23.24	22.76	22.86	22.97
		12	6	20.54	20.57	20.58	19.50	19.53	19.63	23.23	23.30	23.26	22.89	22.85	23.01
		12	11	20.55	20.57	20.53	19.50	19.47	19.58	23.27	23.30	23.23	22.81	22.78	22.96
		25	0	20.53	20.54	20.51	19.47	19.44	19.56	23.33	**23.38**	23.35	22.84	22.89	**23.16**

OUTPUT POWER FOR LTE BAND 53 (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)		
				60190	60195	60205	60190	60195	60205	60190	60195	60205	60190	60195	60205
				2488.5 MHz	2489.0 MHz	2490.0 MHz	2488.5 MHz	2489.0 MHz	2490.0 MHz	2488.5 MHz	2489.0 MHz	2490.0 MHz	2488.5 MHz	2489.0 MHz	2490.0 MHz
10.0	QPSK	1	0	20.53	20.61	20.56	20.54	20.59	20.54	23.99	23.96	23.91	23.88	23.91	23.86
		1	24	20.67	20.69	**20.70**	20.67	20.66	20.68	24.20	24.11	24.13	24.04	24.03	24.04
		1	49	20.62	20.66	20.65	20.68	20.67	**20.70**	24.24	24.18	24.16	24.15	24.14	24.14
		25	0	19.88	19.92	19.92	19.61	19.59	19.61	24.50	24.52	24.51	24.12	24.10	24.12
		25	12	20.03	20.04	20.04	19.67	19.66	19.67	24.63	24.64	24.64	24.14	24.13	24.17
		25	24	20.03	19.97	19.93	19.67	19.67	19.68	24.70	24.62	24.58	24.26	24.26	24.26
		50	0	19.92	19.93	19.91	19.60	19.64	19.65	25.07	**25.09**	25.06	24.68	24.75	**24.75**
	16QAM	1	0	20.62	20.63	20.64	20.51	20.50	20.52	24.39	24.35	24.36	23.96	23.94	23.96
		1	24	**20.70**	20.69	20.68	20.63	20.60	20.62	24.51	24.49	24.48	24.07	24.06	24.09
		1	49	20.65	20.69	20.63	20.58	20.60	**20.70**	24.60	24.59	24.58	24.21	24.20	24.29
		25	0	19.29	19.33	19.33	19.27	19.20	19.20	24.64	24.67	24.70	24.30	24.24	24.25
		25	12	19.41	19.43	19.44	19.31	19.25	19.27	24.56	24.54	24.55	24.06	24.08	24.11
		25	24	19.40	19.36	19.35	19.33	19.28	19.31	24.74	24.71	24.70	24.33	24.31	24.35
		50	0	19.29	19.31	19.30	19.24	19.22	19.23	25.07	**25.09**	25.08	24.70	24.72	**24.73**
	64QAM	1	0	20.49	20.55	20.62	20.57	20.55	20.57	24.18	24.23	24.26	23.90	23.84	23.88
		1	24	20.61	20.68	**20.70**	20.66	**20.70**	**20.70**	24.42	24.43	24.44	24.03	24.05	24.11
		1	49	20.56	20.65	20.63	20.67	**20.70**	20.67	24.50	24.54	24.52	24.17	24.18	24.20
		25	0	19.40	19.44	19.42	19.39	19.41	19.43	24.38	24.43	24.41	23.99	24.01	24.05
		25	12	19.53	19.55	19.54	19.48	19.49	19.47	24.43	24.43	24.42	23.98	23.99	23.99
		25	24	19.53	19.43	19.45	19.48	19.47	19.49	24.55	24.44	24.46	24.12	24.11	24.12
		50	0	19.41	19.40	19.43	19.45	19.43	19.44	24.81	24.77	**24.82**	**24.50**	24.46	24.47
	256QAM	1	0	20.54	20.52	20.53	19.56	19.52	19.52	22.26	22.18	22.26	21.83	21.92	21.91
		1	24	20.69	20.65	**20.70**	**19.75**	19.66	19.68	22.58	22.54	22.61	22.10	22.20	22.19
		1	49	20.57	20.61	20.54	19.65	19.60	19.62	22.56	22.62	22.58	22.14	22.27	22.21
		25	0	20.47	20.46	20.49	19.44	19.47	19.45	23.52	23.52	23.63	23.13	23.21	23.10
		25	12	20.57	20.59	20.61	19.48	19.51	19.53	23.68	23.73	**23.73**	23.22	23.27	23.18
		25	24	20.58	20.51	20.49	19.49	19.51	19.53	23.73	23.64	23.67	23.27	23.27	23.22
		50	0	20.48	20.49	20.48	19.48	19.50	19.49	23.66	23.60	23.63	**23.33**	23.31	23.32

8.2. 5G NR n53

Test Engineer ID:	32061	Test Date:	3/10/2023

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 MHz	2489.0 MHz	2490.0 MHz	2488.5 MHz	2489.0 MHz	2490.0 MHz
10.0	BPSK	1	0	20.61	**20.70**	20.60	20.50	20.59	20.46	26.21	**26.30**	26.20	25.84	25.81	25.76
		1	1	20.53	20.61	20.59	20.44	20.58	20.49	26.13	26.21	26.19	25.93	25.76	25.85
		1	22	20.68	20.56	20.64	20.54	**20.70**	20.55	26.28	26.16	26.24	25.89	**26.11**	**26.11**
		1	23	20.61	20.62	20.64	20.46	20.62	20.51	26.21	26.22	26.24	25.78	25.89	25.82
		12	6	20.59	20.46	20.61	20.48	20.59	20.53	26.19	26.06	26.21	25.78	25.86	25.80
		24	0	20.58	20.59	20.61	20.53	20.61	20.34	26.18	26.19	26.21	25.74	25.88	25.76
	QPSK	1	0	20.60	20.62	20.69	20.46	20.64	20.49	26.18	26.20	26.27	25.82	25.75	25.77
		1	1	20.62	20.62	20.60	20.51	20.63	20.62	26.20	26.20	26.18	25.85	25.88	25.92
		1	22	**20.70**	20.58	20.62	20.51	20.67	20.66	**26.28**	26.16	26.20	**25.98**	25.94	25.85
		1	23	20.61	20.53	20.55	20.52	20.57	**20.70**	26.19	26.11	26.13	25.82	25.86	25.68
		12	6	20.56	20.54	20.57	20.48	20.62	20.65	26.14	26.12	26.15	25.82	25.83	25.75
		24	0	20.53	20.55	20.61	20.54	20.66	20.67	26.11	26.13	26.19	25.76	25.76	25.78
	16QAM	1	0	20.09	20.51	20.10	20.47	20.62	20.48	26.01	26.43	26.02	25.77	26.08	25.97
		1	1	**20.70**	20.07	20.23	20.20	20.16	20.60	**26.62**	25.99	26.15	25.94	26.06	25.58
		1	22	20.59	20.40	20.23	20.29	20.57	**20.70**	26.51	26.32	26.15	25.61	**26.10**	25.92
		1	23	20.48	20.34	20.18	20.07	20.59	20.50	26.40	26.26	26.10	25.53	25.59	26.09
		12	6	20.21	20.23	20.31	20.34	20.43	20.54	26.13	26.15	26.23	25.80	25.79	25.86
		24	0	20.27	20.19	20.20	20.31	20.43	20.61	26.19	26.11	26.12	25.86	25.84	25.90
	64QAM	1	0	20.46	20.33	20.64	20.45	20.48	20.69	26.27	26.14	26.45	25.65	25.63	25.76
		1	1	20.46	20.40	**20.70**	20.55	20.55	20.53	26.27	26.21	**26.51**	25.70	25.84	25.74
		1	22	20.41	20.61	20.55	20.47	20.52	20.66	26.22	26.42	26.36	25.83	25.87	25.54
		1	23	20.34	20.65	20.55	20.42	20.63	**20.70**	26.15	26.46	26.36	25.80	**25.88**	25.87
		12	6	20.34	20.35	20.35	20.23	20.40	20.57	26.15	26.16	26.16	25.65	25.67	25.78
		24	0	20.24	20.32	20.39	20.24	20.40	20.42	26.05	26.13	26.20	25.85	25.82	25.73
	256QAM	1	0	20.27	20.21	20.22	19.81	20.03	20.16	26.23	26.17	26.18	25.07	24.94	24.92
		1	1	20.10	20.11	**20.70**	20.00	20.24	19.99	26.06	26.07	**26.66**	25.11	25.28	25.03
		1	22	20.41	20.11	20.19	20.18	**20.29**	20.23	26.37	26.07	26.15	24.92	25.06	24.92
		1	23	20.31	20.10	20.44	19.69	19.66	20.03	26.27	26.06	26.40	25.22	25.20	25.08
		12	6	20.19	20.16	20.16	19.79	19.03	20.22	26.15	26.12	26.12	25.27	25.35	**25.36**
		24	0	20.16	20.19	20.17	19.88	18.54	20.19	26.12	26.15	26.13	25.18	25.35	25.34

9. CONDUCTED TEST RESULTS

9.1. ON TIME AND DUTY CYCLE

LIMITS

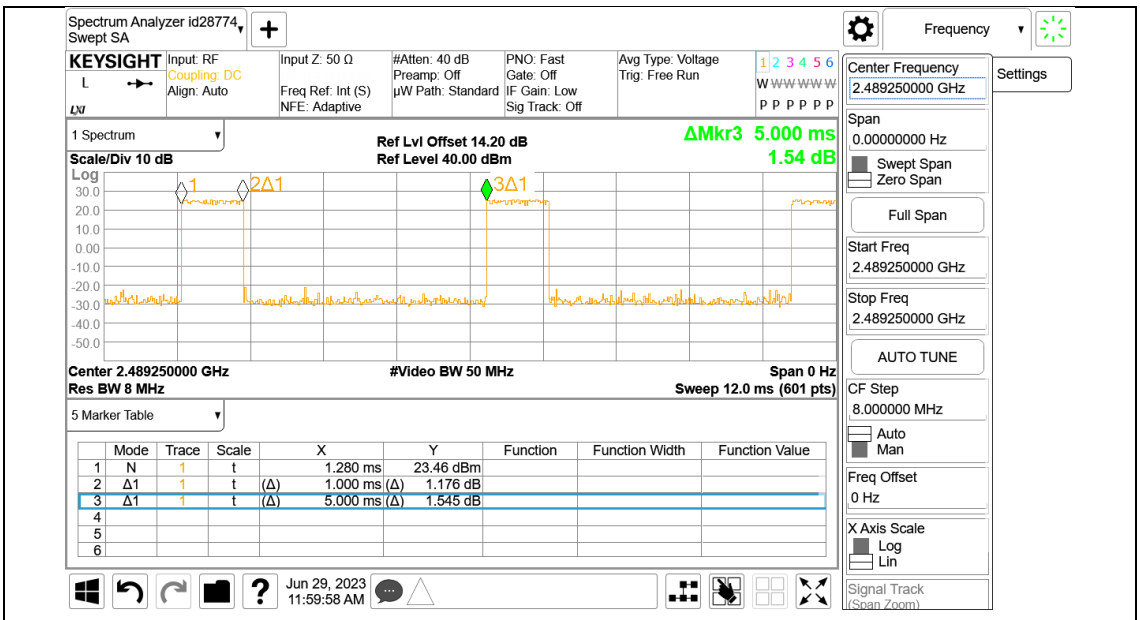
None; for reporting purposes only.

PROCEDURE

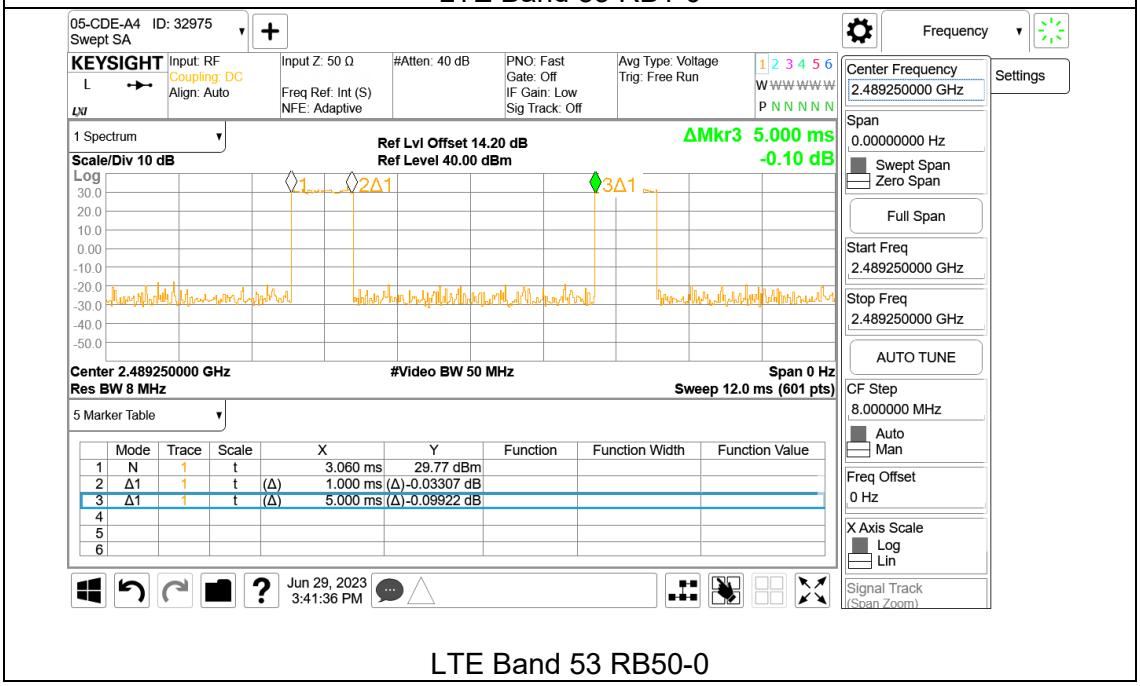
Zero-Span Spectrum Analyzer Method.

ON TIME AND DUTY CYCLE RESULTS

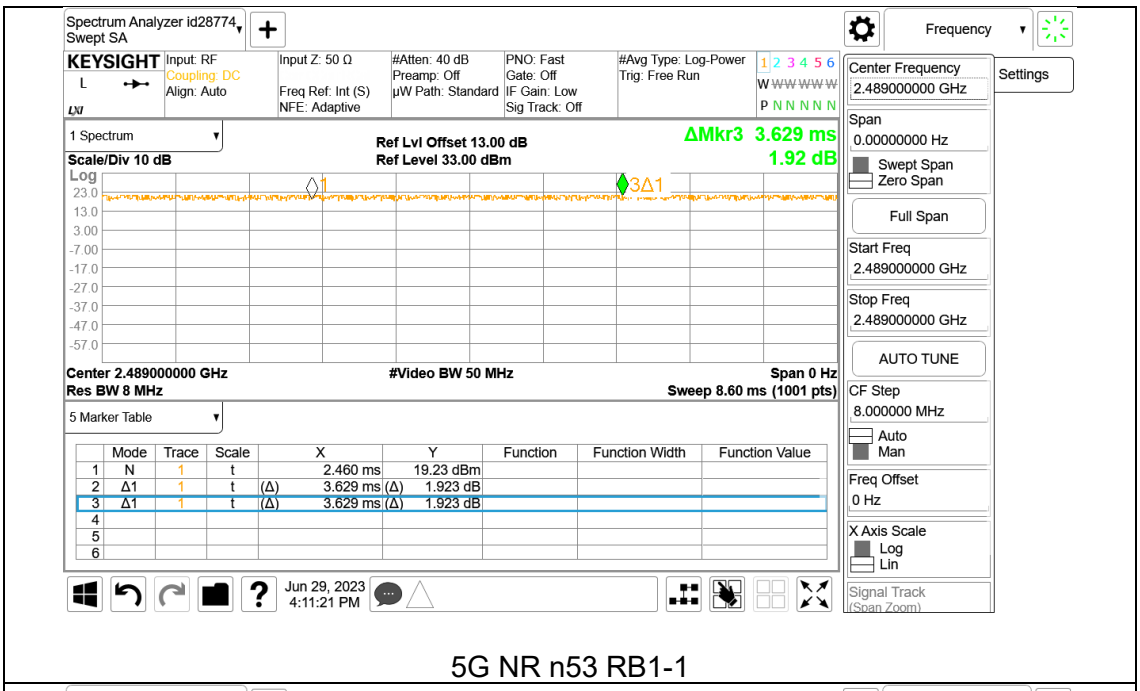
Band	RB Allocation / Offset	ON Time B (msec)	Period (msec)	Duty Cycle x (linear)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)
LTE Band 53	1 / 0	1.000	5.000	0.20	20.00	6.99
LTE Band 53	50 / 0	1.000	5.000	0.20	20.00	6.99
5G NR n53	1 / 1	N.A.	N.A.	1.00	100.00	0.00
5G NR n53	24 / 0	N.A.	N.A.	1.00	100.00	0.00



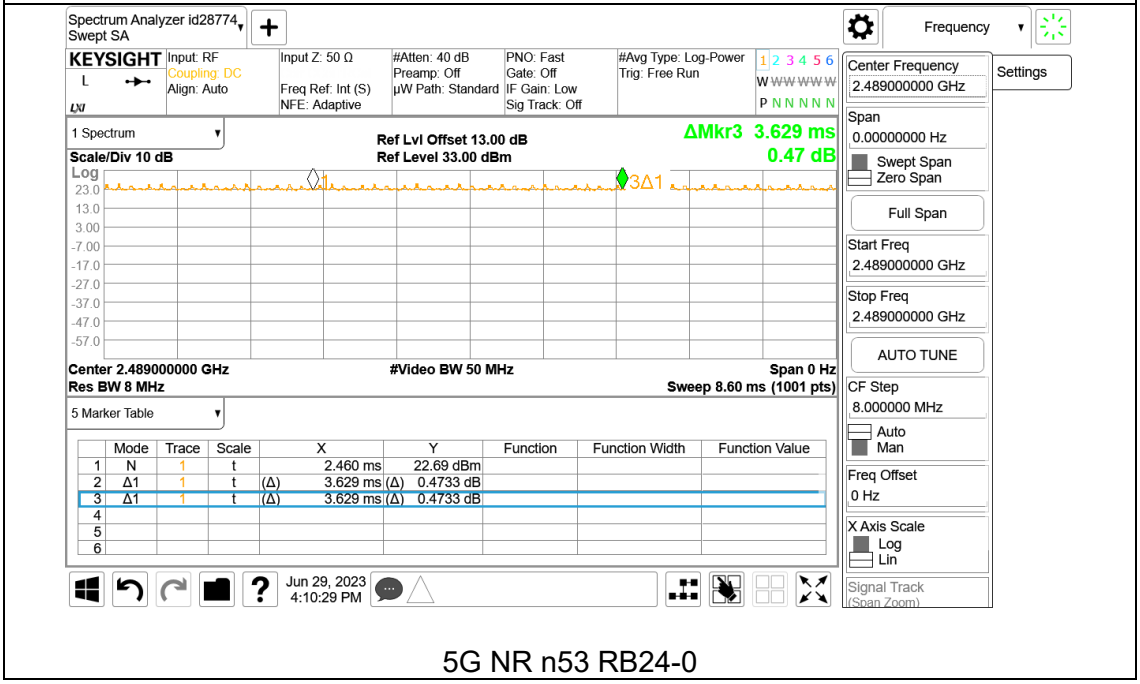
LTE Band 53 RB1-0



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
ISED RSS-170 and RSS-GEN

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 nominal RBW shall be in the range of 1% to 5% of the anticipated OBW, and the VBW shall be set ≥ 3 × RBW. The 99% bandwidths were measured and recorded.

RESULTS

There is no limit required; therefore, only one port of higher power, ANT1, was tested.

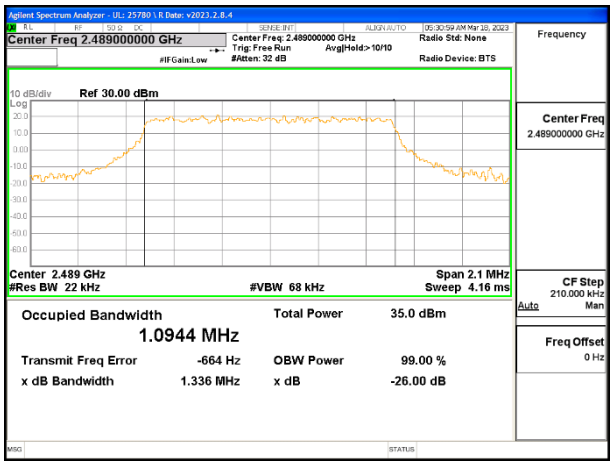
LTE BAND 53

Band	Mode	RB Allocation/RB Offset	f(MHz)	99% BW (MHz)	-26dB BW (MHz)
LTE BAND 53	1.4MHz, QPSK	6/0	2489.0	1.094	1.34
	1.4MHz,16QAM			1.091	1.33
	3MHz, QPSK	15/0		2.702	3.07
	3MHz, 16QAM			2.697	3.03
	5MHz, QPSK	25/0		4.492	5.09
	5MHz, 16QAM			4.494	5.03
	10MHz, QPSK	50/0		9.016	9.81
	10MHz, 16QAM			8.990	10.05
	10MHz, QPSK	1/0		0.255	0.42

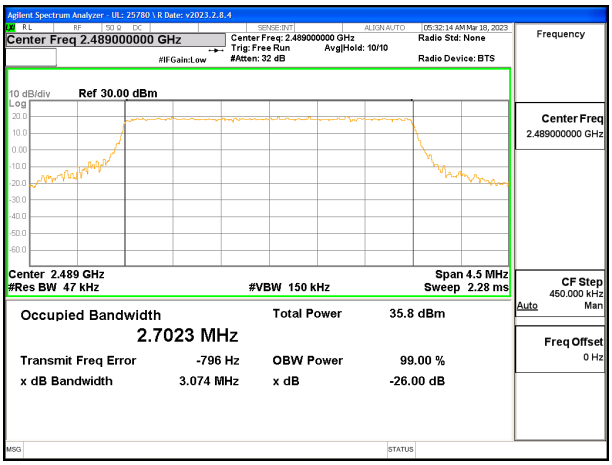
5G NR n53

Band	Mode	RB Allocation/RB Offset	f(MHz)	99% BW (MHz)	-26dB BW (MHz)
5G NR n53	10MHz, BPSK	24/0	2489.0	8.620	9.92
	10MHz, QPSK			8.602	9.87
	10MHz, 16QAM			8.631	9.79
	10MHz, QPSK	1/0		0.490	0.81

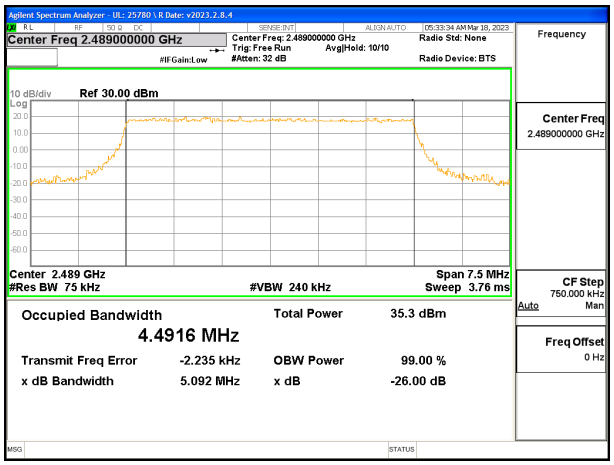
9.2.1. LTE BAND 53



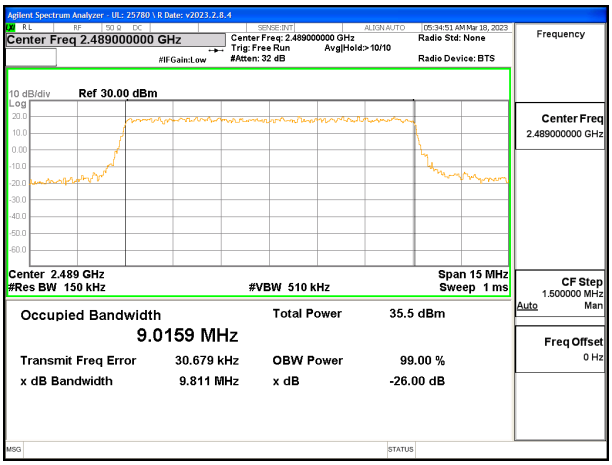
LTE B53 1.4MHz QPSK Middle Channel RB6-0



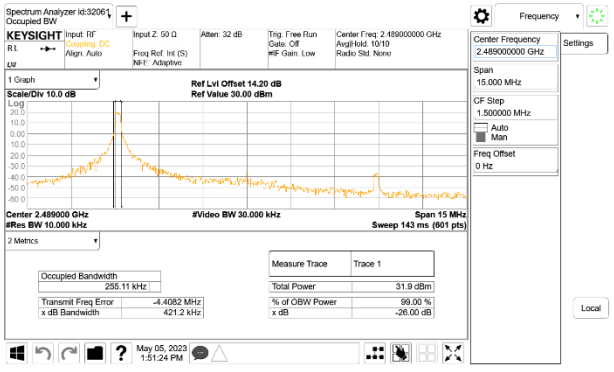
LTE B53 3MHz QPSK Middle Channel RB15-0



LTE B53 5MHz QPSK Middle Channel RB25-0



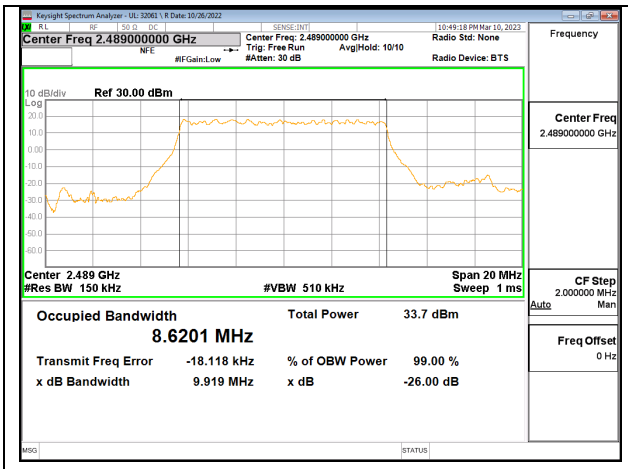
LTE B53 10MHz QPSK Middle Channel RB50-0



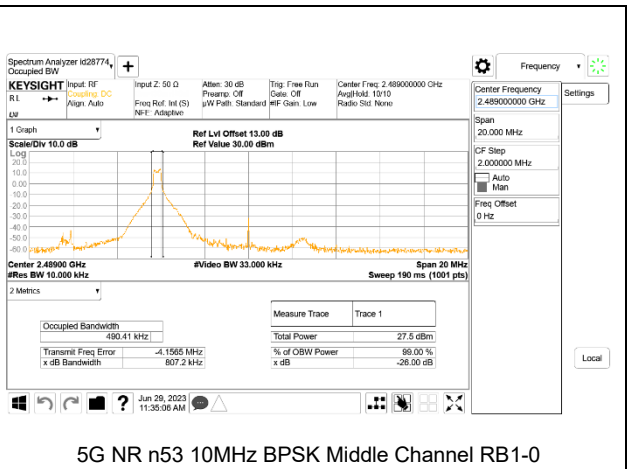
LTE B53 10MHz QPSK Middle Channel RB1-0

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).

Note: The PSD measured values are corrected by duty cycle correction factors values that shows in section 9.1.

RESULTS

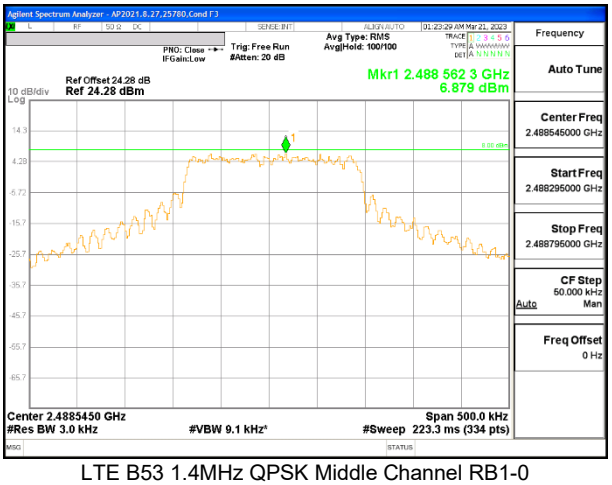
LTE BAND 53

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	7.597	8.0
			2489.0	6.879	
			2494.3	7.209	
	3MHz, QPSK	1/0	2485.0	7.369	
			2489.0	7.826	
			2493.5	7.373	
	5MHz, QPSK	1/0	2486.0	7.372	
			2489.0	7.283	
			2492.5	7.177	
	10MHz, QPSK	1/0	2488.5	7.661	
			2489.0	7.620	
			2490.0	7.800	
		50/0	2488.5	-8.645	
			2489.0	-8.538	
			2490.0	-7.958	

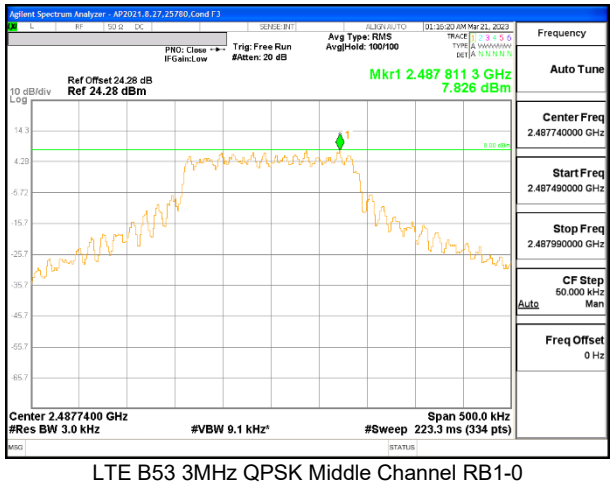
5G NR n53

Band	Mode	RB Allocation/RB Offset	f(MHz)	PSD (dBm/3kHz)	PSD Limit (dBm/3kHz)
5G NR n53	10MHz, BPSK	1/1	2488.5	7.446	8.0
			2489.0	7.682	
			2490.0	7.601	
		24/0	2488.5	-0.422	
			2489.0	-0.762	
			2490.0	-0.457	

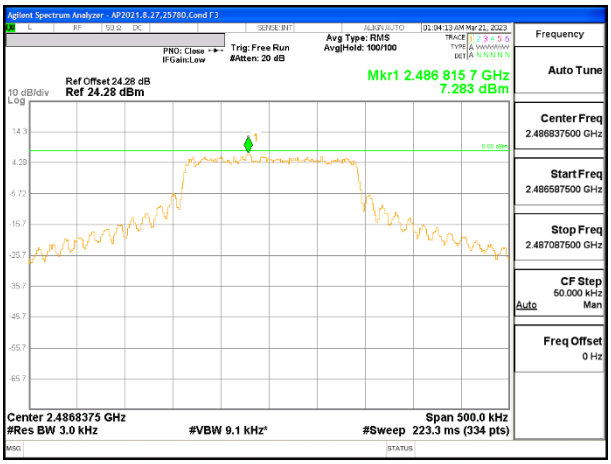
9.3.1. LTE BAND 53



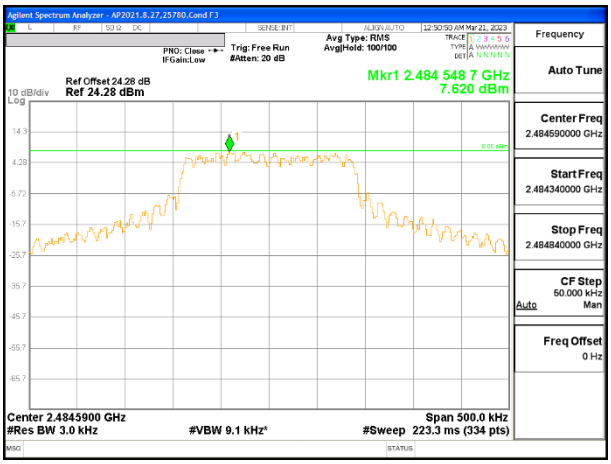
LTE B53 1.4MHz QPSK Middle Channel RB1-0



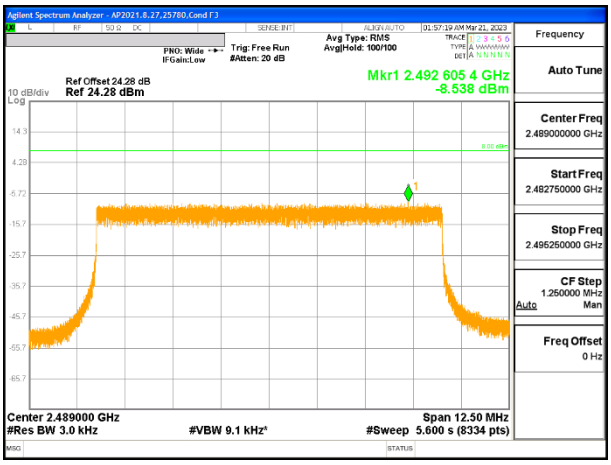
LTE B53 3MHz QPSK Middle Channel RB1-0



LTE B53 5MHz QPSK Middle Channel RB1-0



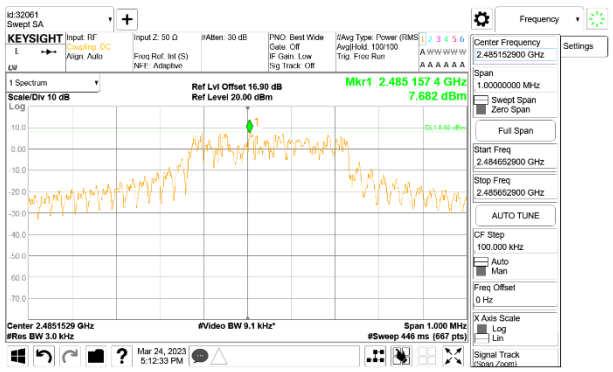
LTE B53 10MHz QPSK Middle Channel RB1-0



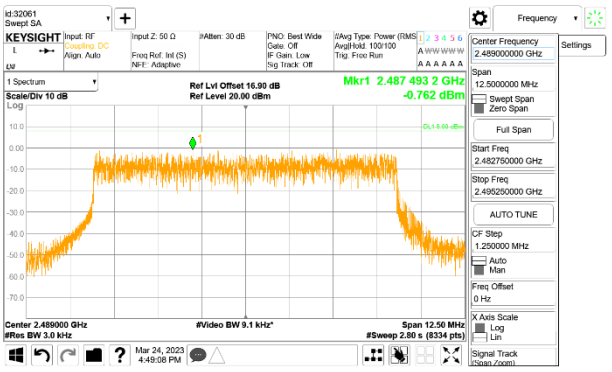
LTE B53 10MHz QPSK Middle Channel RB50-0

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

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

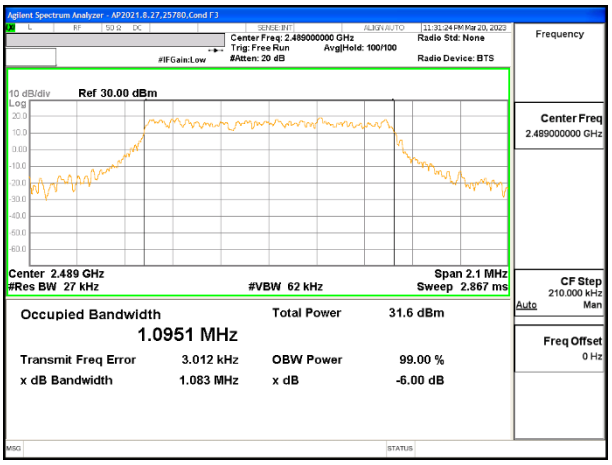
LTE BAND 53

Band	Mode	RB Allocation/RB Offset	f(MHz)	6dB BW (MHz)	6dB BW Limit (MHz)
LTE BAND 53	1.4MHz, QPSK	6/0	2489	1.083	0.5
	1.4MHz,16QAM			1.061	
	3MHz, QPSK	15/0		2.665	
	3MHz, 16QAM			2.697	
	5MHz, QPSK	25/0		4.508	
	5MHz, 16QAM			4.491	
	10MHz, QPSK	50/0		9.013	
	10MHz, 16QAM			8.926	

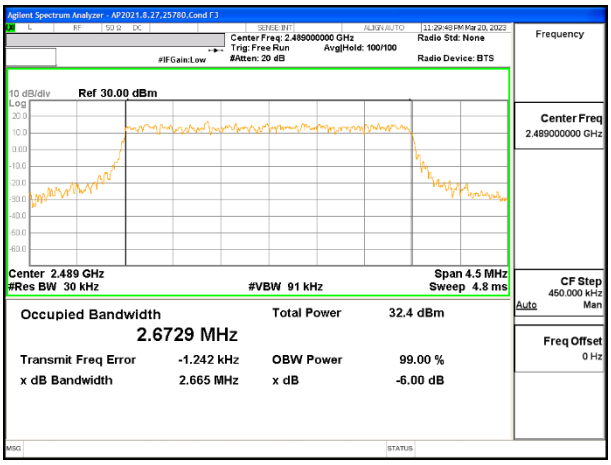
5G NR n53

Band	Mode	RB Allocation/RB Offset	f(MHz)	6dB BW (MHz)	6dB BW Limit (MHz)
5G NR n53	10MHz, BPSK	24/0	2489	8.662	0.5
	10MHz, QPSK	24/0		8.646	
	10MHz, 16QAM	24/0		8.663	

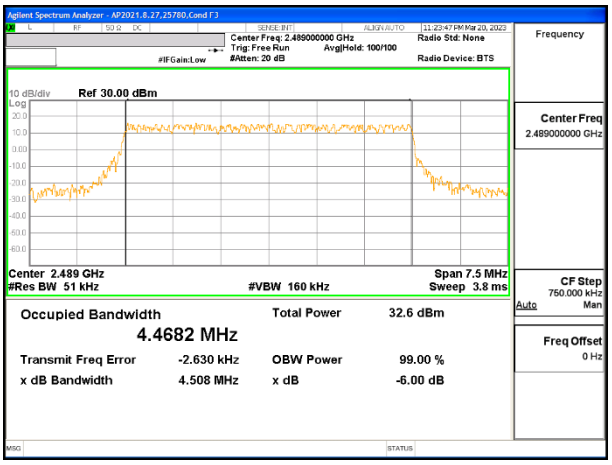
9.4.1. LTE BAND 53



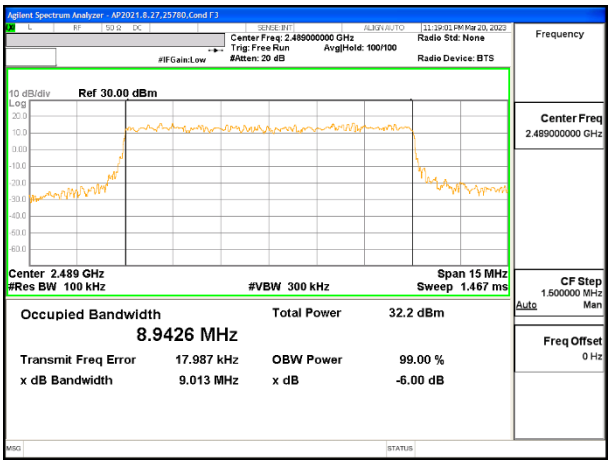
LTE B53 1.4MHz QPSK Middle Channel RB6-0



LTE B53 3MHz QPSK Middle Channel RB15-0

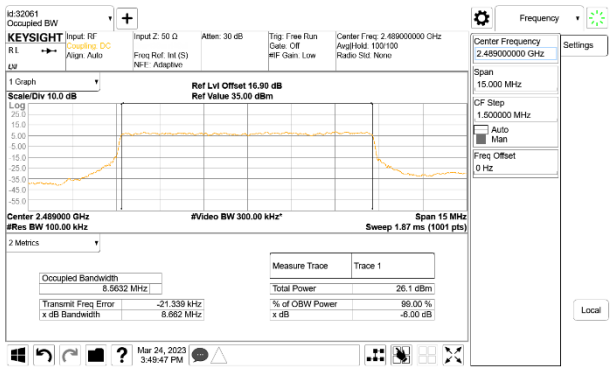


LTE B53 5MHz QPSK Middle Channel RB25-0



LTE B53 10MHz QPSK Middle Channel RB50-0

9.4.2. 5G NR n53



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

Intentionally Blank

9.5. EMISSION MASK AND BANDEDGE

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;

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.

Notwithstanding the above requirements, the e.i.r.p. density of the ATC system's unwanted emission shall not exceed:

i. -44.1 dBW/30 kHz measured from the edge of the equipment channel bandwidth.
ii. -70 dBW/MHz for broadband emissions and -80 dBW/kHz for discrete emissions in the band 1559-1610 MHz

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

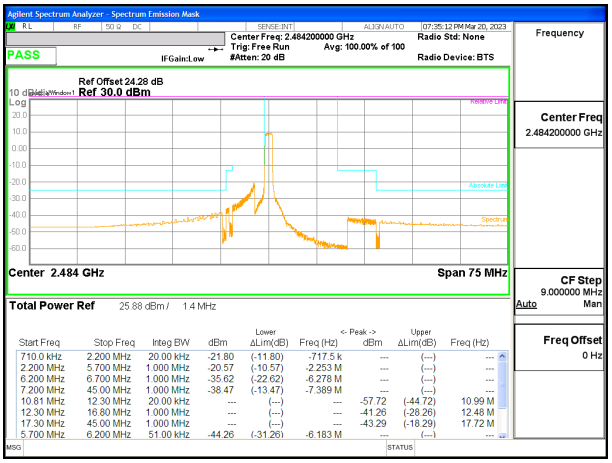
The transmitter output was connected to a CMW500Test Set and configured to operate at maximum power. The band edge emissions were measured at the required operating frequencies in each band on the Spectrum Analyzer.

For each Emission Mask measurement:

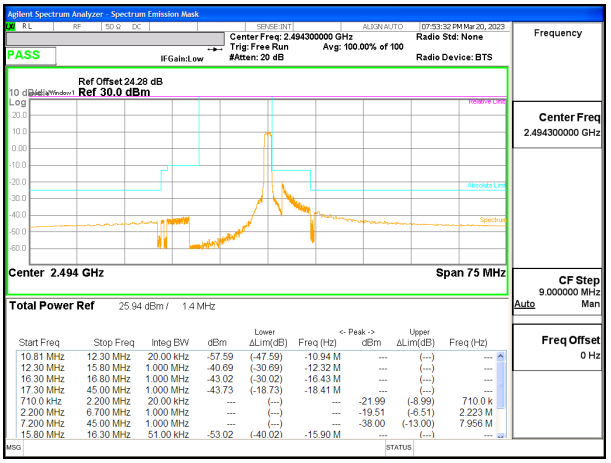
1. Set the Spectrum analyzer span to include the block edge frequency.
2. Set the Spectrum Emission Mask to cover all frequencies at their respective limits
3. Set the Spectrum Emission Mask to use the Measurement Bandwidth of 30kHz

9.5.1. LTE BAND 53

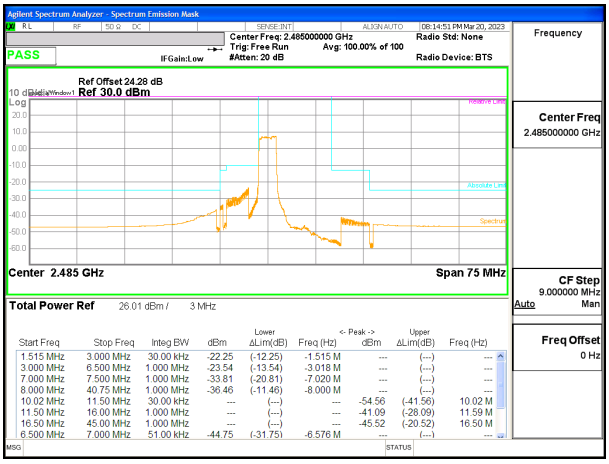
LTE BAND 53 BANDEGE



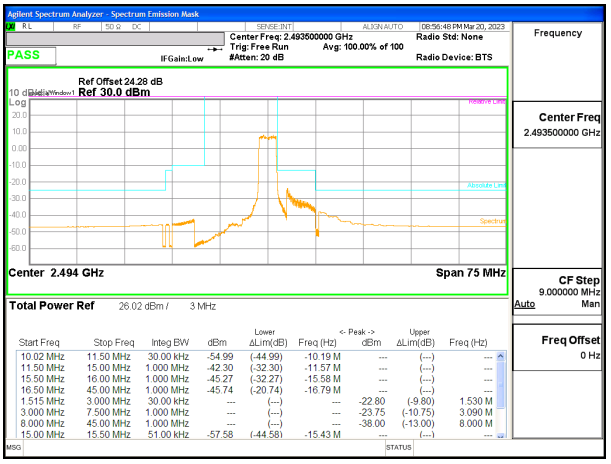
LTE B53 1.4MHz QPSK Low Channel RB6-0, ID: 25780



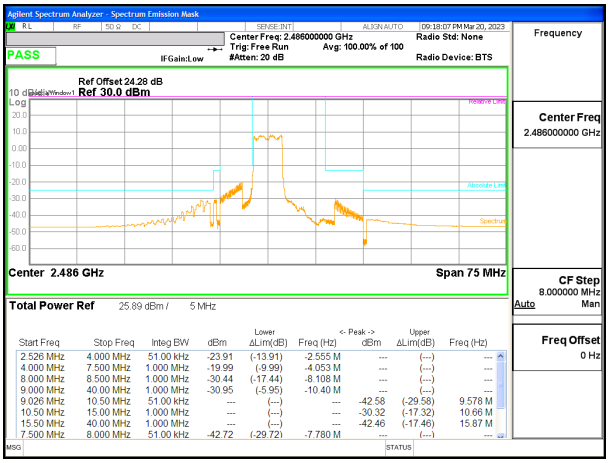
LTE B53 1.4MHz QPSK High Channel RB6-0, ID: 25780



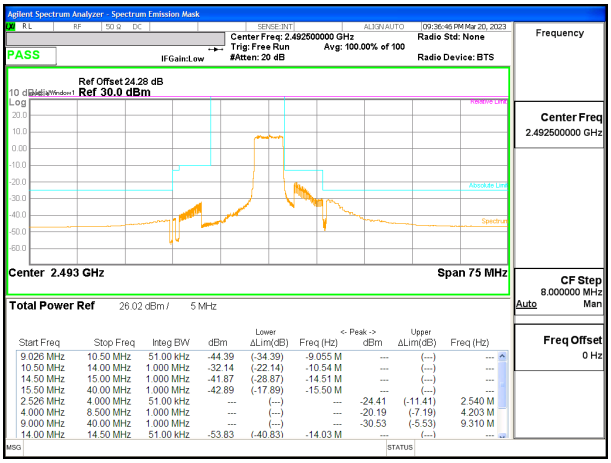
LTE B53 3MHz QPSK Low Channel RB15-0, ID: 25780



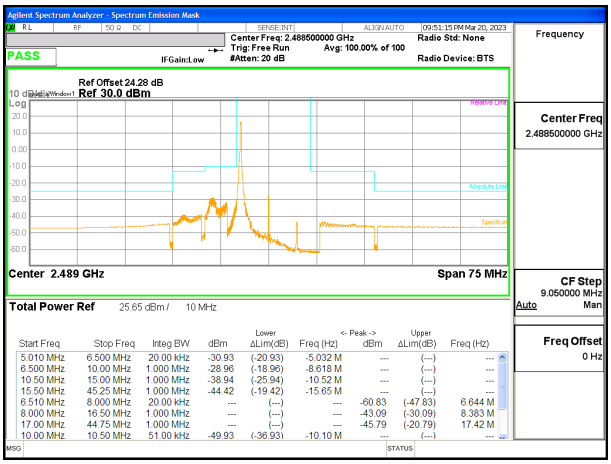
LTE B53 3MHz QPSK High Channel RB15-0, ID: 25780



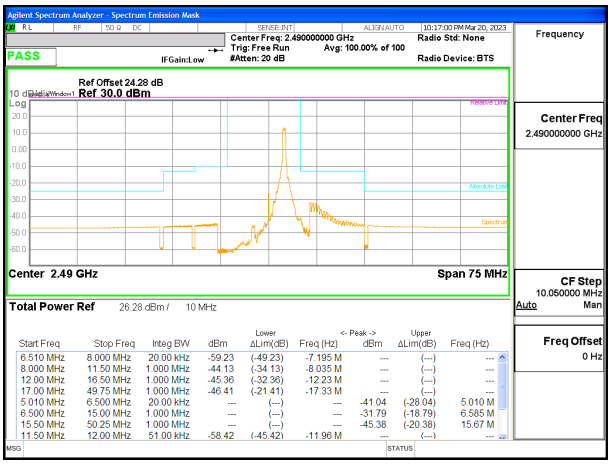
LTE B53 5MHz QPSK Low Channel RB25-0, ID: 25780



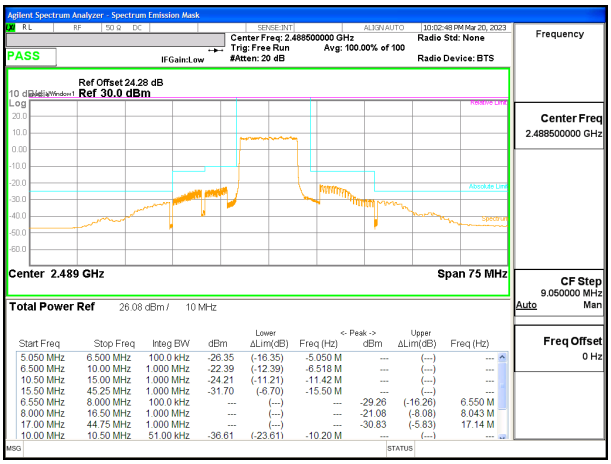
LTE B53 5MHz QPSK High Channel RB25-0, ID: 25780



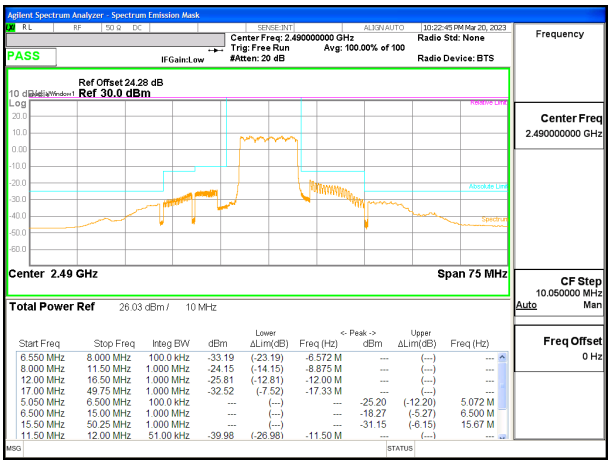
LTE B53 10MHz QPSK Low Channel RB1-0, ID: 25780



LTE B53 10MHz QPSK High Channel RB1-49, ID: 25780



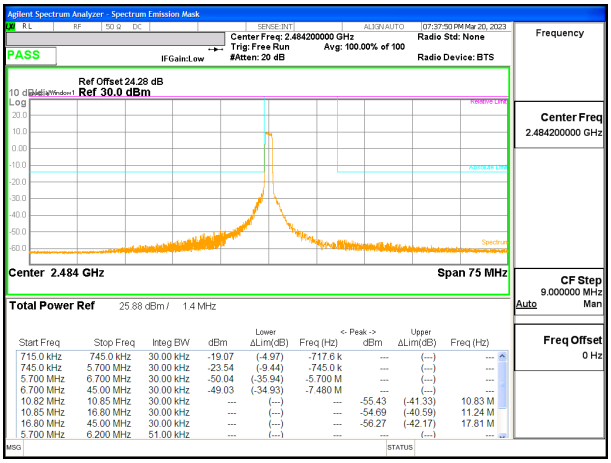
LTE B53 10MHz QPSK Low Channel RB50-0, ID: 25780



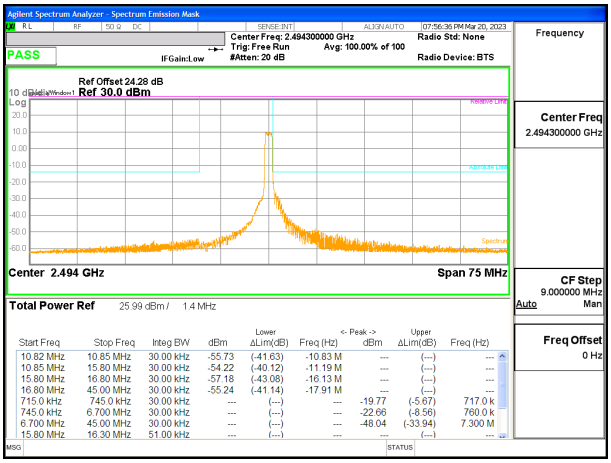
LTE B53 10MHz QPSK High Channel RB50-0, ID: 25780

LTE BAND 53 EIRP DENSITY

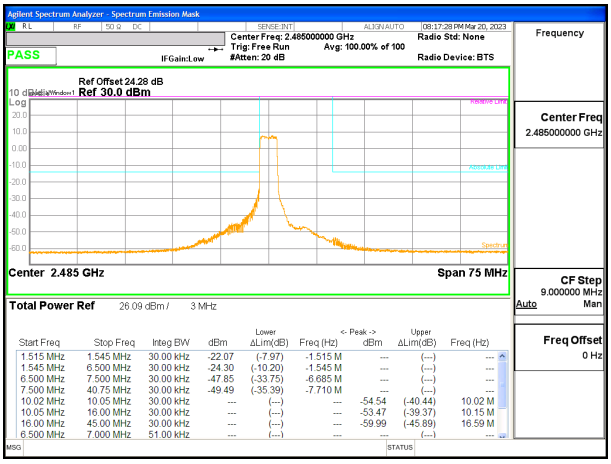
Band	Mode	RB Allocation/ RB Offset	f (MHz)	Highest Cond Power Density (dBm/30kHz)	Highest Antenna Gain (dBi)	Highest EIRP Density (dBm/30kHz)	EIRP Density Limit (dBm/30kHz)
LTE BAND 53	1.4MHz, QPSK	1/0	2484.2	-14.41	-1.7	-16.11	-14.1
		6/0	2484.2	-19.07		-20.77	
		1/5	2494.3	-14.59		-16.29	
		6/0	2494.3	-19.77		-21.47	
	3MHz, QPSK	1/0	2485.0	-18.02		-19.72	
		15/0	2485.0	-22.07		-23.77	
		1/14	2493.5	-17.96		-19.66	
		15/0	2493.5	-21.56		-23.26	
	5MHz, QPSK	1/0	2486.0	-20.73		-22.43	
		25/0	2486.0	-25.00		-26.70	
		1/24	2492.5	-19.79		-21.49	
		25/0	2492.5	-25.35		-27.05	
	10MHz, QPSK	1/0	2488.5	-29.11		-30.81	
		50/0	2488.5	-31.15		-32.85	
		1/49	2490	-38.97		-40.67	
		50/0	2490	-29.08		-30.78	



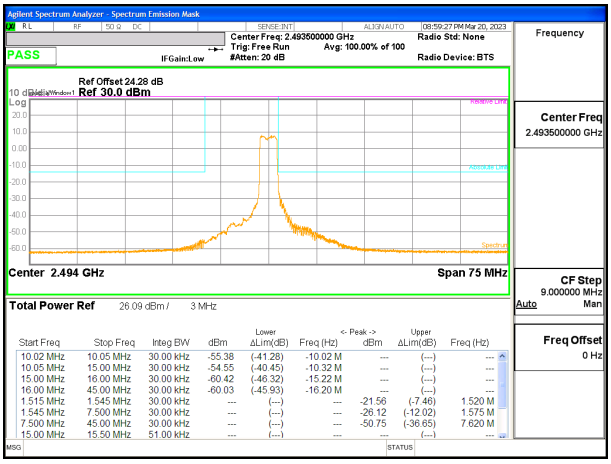
LTE B53 1.4MHz QPSK Low Channel RB6-0, ID: 25780



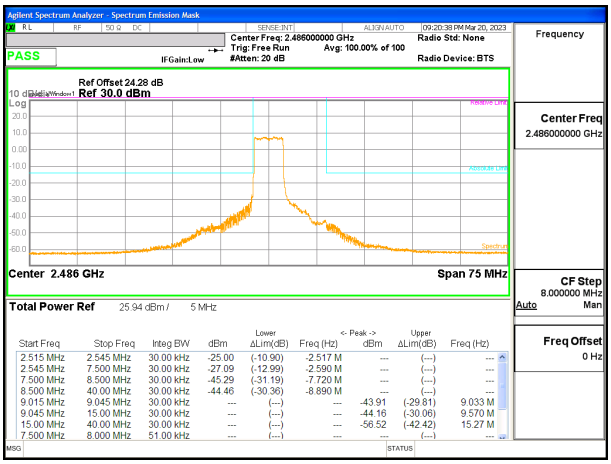
LTE B53 1.4MHz QPSK High Channel RB6-0, ID: 25780



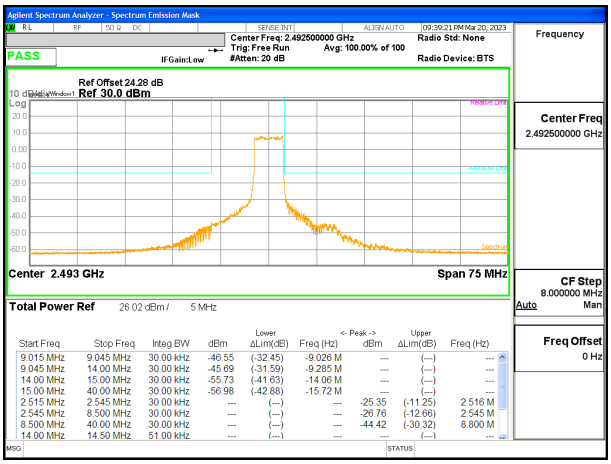
LTE B53 3MHz QPSK Low Channel RB15-0, ID: 25780



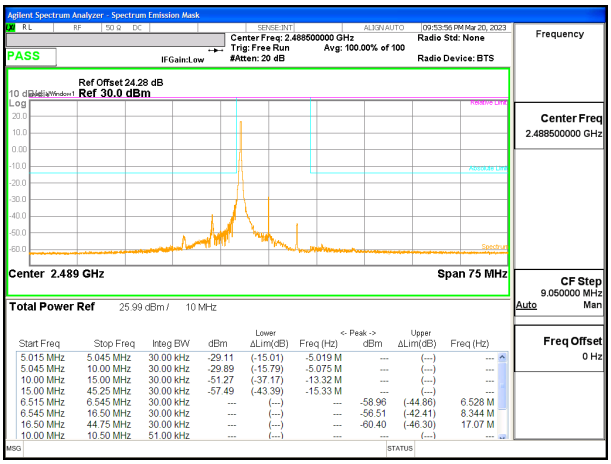
LTE B53 3MHz QPSK High Channel RB15-0, ID: 25780



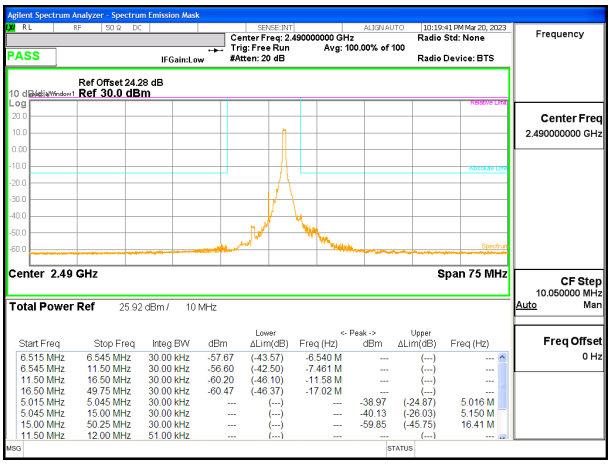
LTE B53 5MHz QPSK Low Channel RB25-0, ID: 25780



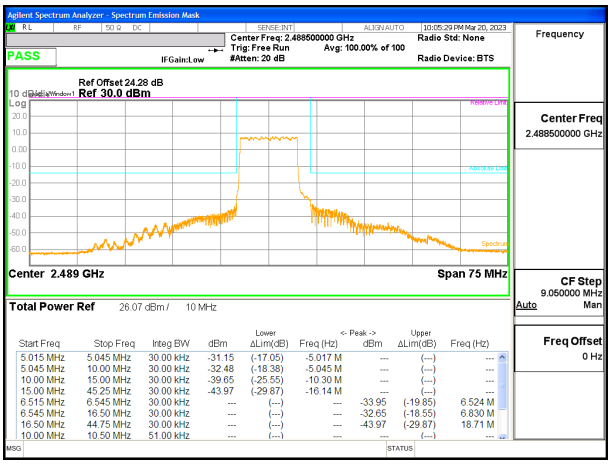
LTE B53 5MHz QPSK High Channel RB25-0, ID: 25780



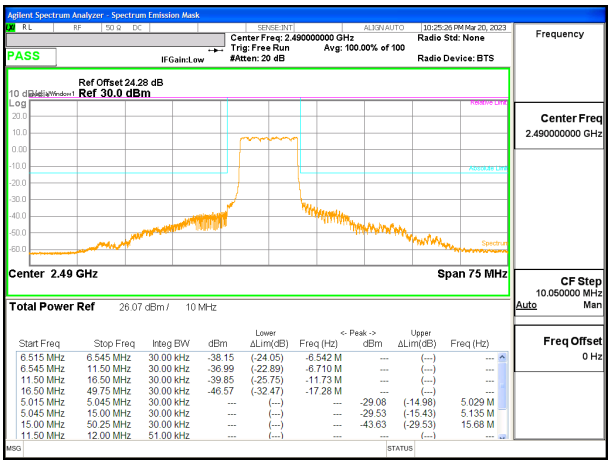
LTE B53 10MHz QPSK Low Channel RB1-0, ID: 25780



LTE B53 10MHz QPSK High Channel RB1-49, ID: 25780



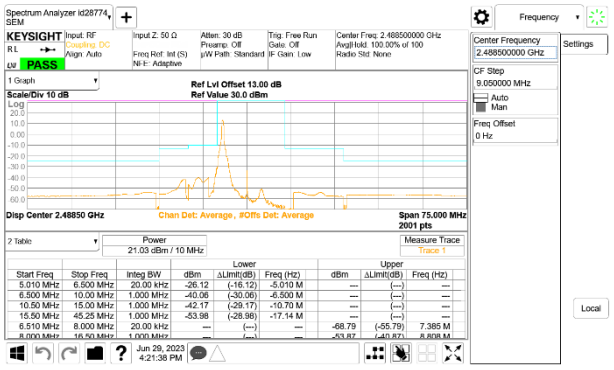
LTE B53 10MHz QPSK Low Channel RB50-0, ID: 25780



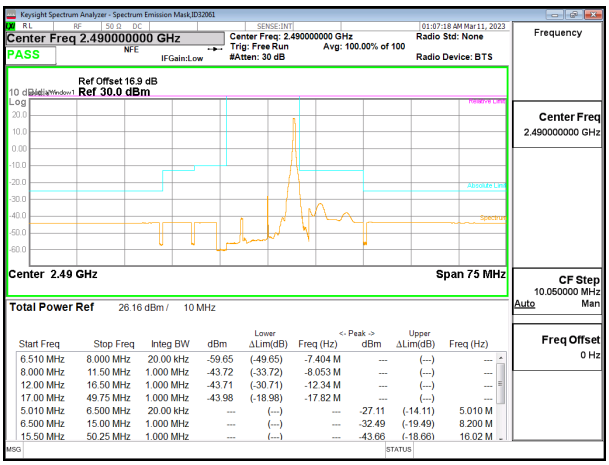
LTE B53 10MHz QPSK High Channel RB50-0, ID: 25780

9.5.2. 5G NR n53

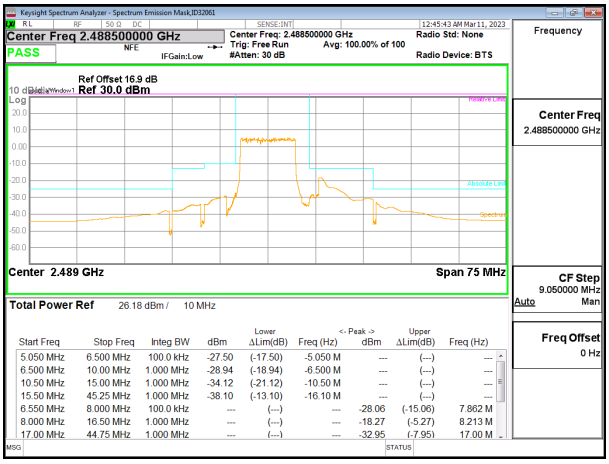
5G NR n53 BANDEGE



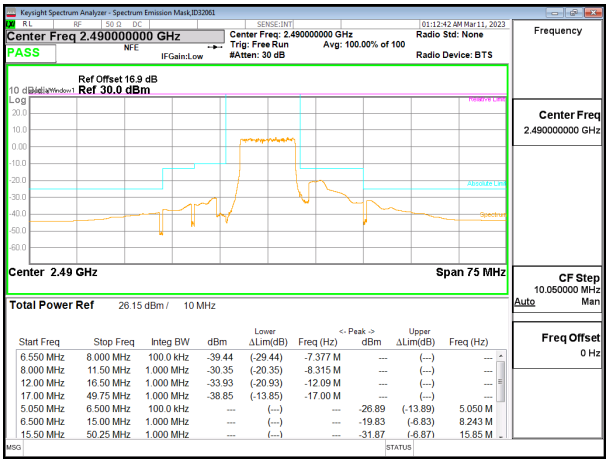
5G NR n53 10MHz BPSK Low Channel RB1-0



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



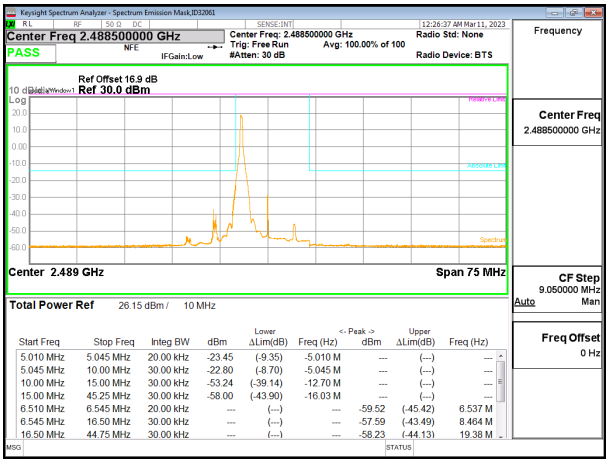
5G NR n53 10MHz BPSK Low Channel RB24-0



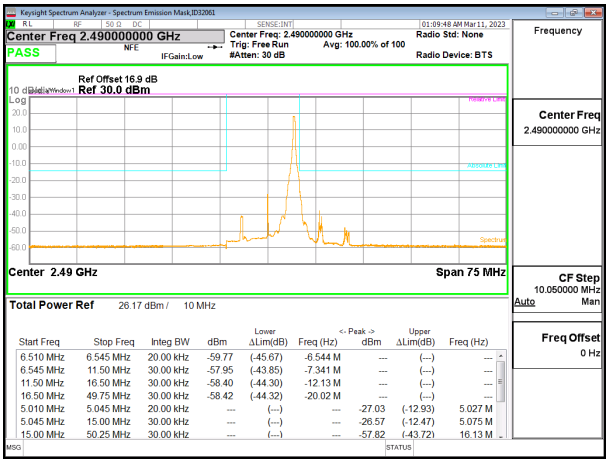
5G NR n53 10MHz BPSK High Channel RB24-0

5G NR n53 EIRP DENSITY

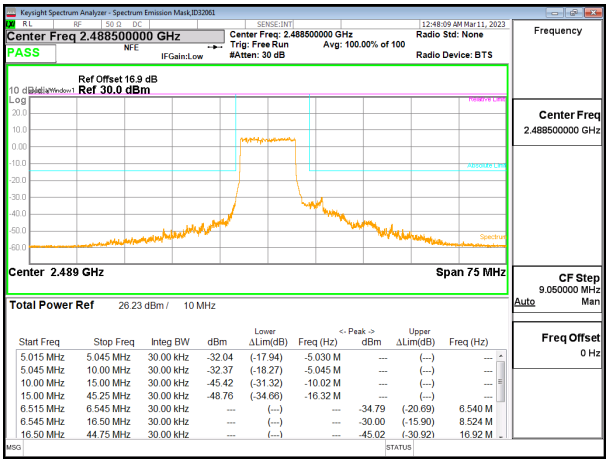
Band	Mode	RB Allocation/ RB Offset	f (MHz)	Highest Cond Power Density (dBm/30kHz)	Highest Antenna Gain (dBi)	Highest EIRP Density (dBm/30kHz)	EIRP Density Limit (dBm/30kHz)
5G NR n53	10MHz, BPSK	1/0	2488.5	-22.80	-1.7	-24.50	-14.1
		24/0	2488.5	-32.04		-33.74	
		1/23	2490	-26.57		-28.27	
		24/0	2490	-31.09		-32.79	



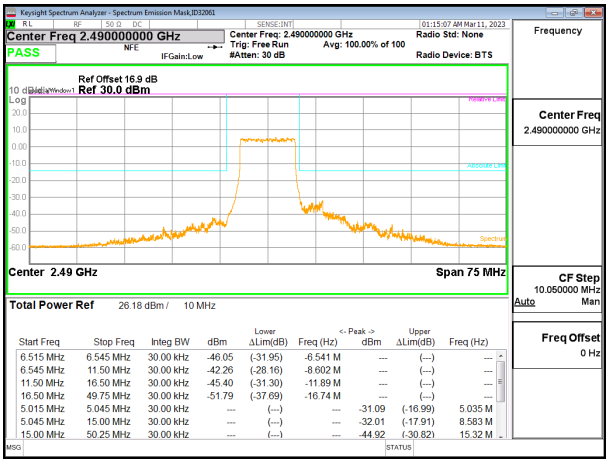
5G NR n53 10MHz BPSK Low Channel RB1-0



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

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-009-20 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.

Notwithstanding the above requirements, the e.i.r.p. density of the ATC system's unwanted emission shall not exceed:

iii. -44.1 dBW/30 kHz measured from the edge of the equipment channel bandwidth.
iv. -70 dBW/MHz for broadband emissions and -80 dBW/kHz for discrete emissions in the band 1559-1610 MHz

Note: Radiated data in section 10 confirms a compliance for the emissions in GPS 1559-1610 MHz band were both wideband and discreate emissions therefore the -50dBm/MHz limit was used.

TEST PROCEDURE

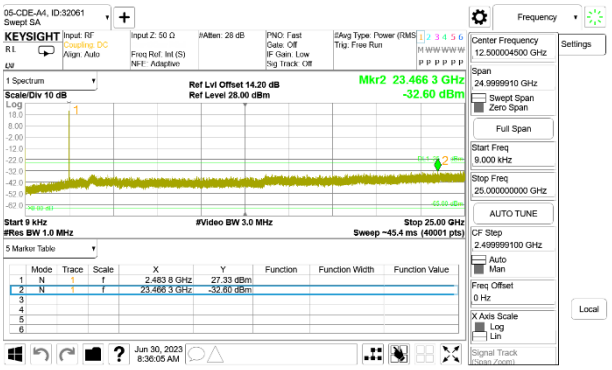
The RF output of the transmitter was connected to a spectrum analyzer through a calibrated coaxial cable. Sufficient scans were taken to show the out-of-band Emissions, if any, up to 10th harmonic. Multiple sweeps were recorded in maximum hold mode using a peak detector to ensure that the worst-case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

For each out of band emissions measurement:

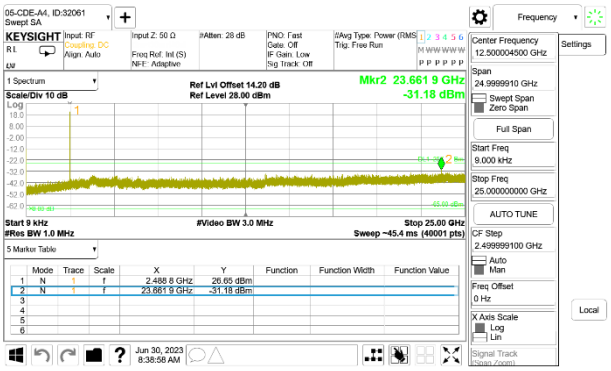
- Set display line at -25dBm according to the band Limit.
- Set RBW & VBW to 100 kHz for the measurement below 1 GHz, and 1 MHz for the measurement above 1 GHz. (NOTE: Worst case set RBW/VBW to 1MHz/3MHz)

RESULTS

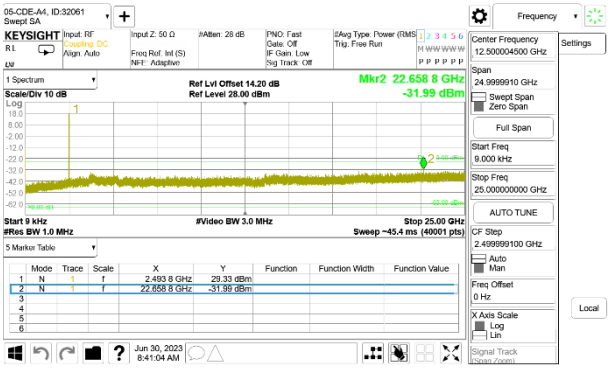
9.6.1. LTE BAND 53



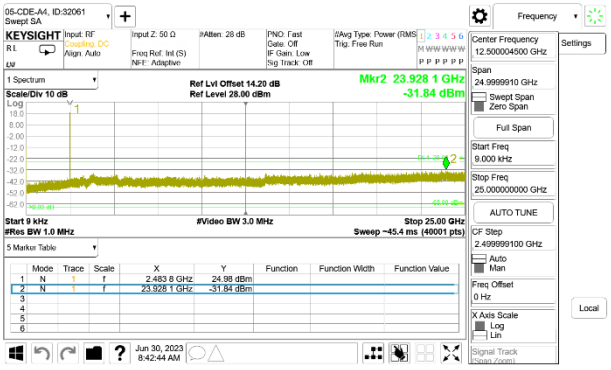
LTE B53 1.4MHz QPSK Low Channel RB1-0



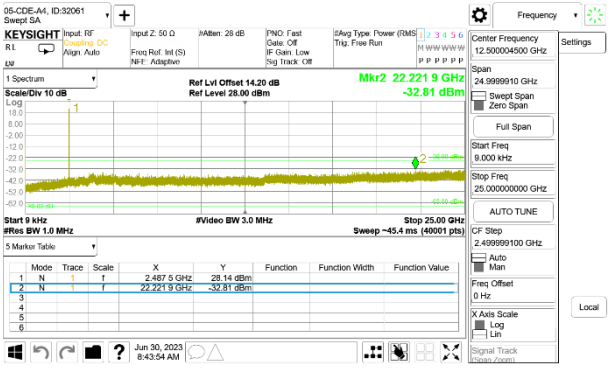
LTE B53 1.4MHz QPSK Middle Channel RB1-0



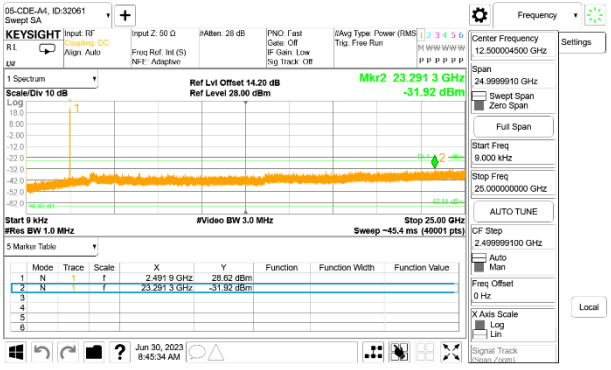
LTE B53 1.4MHz QPSK High Channel RB1-0



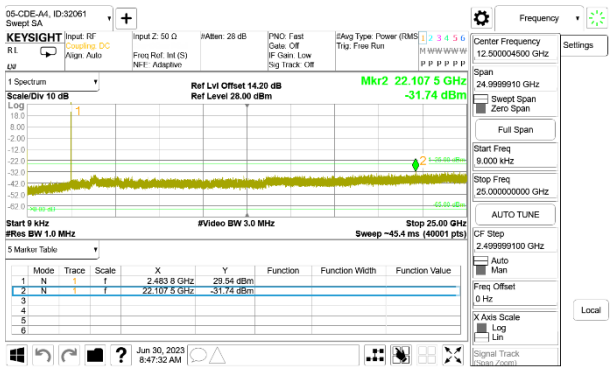
LTE B53 3MHz QPSK Low Channel RB1-0



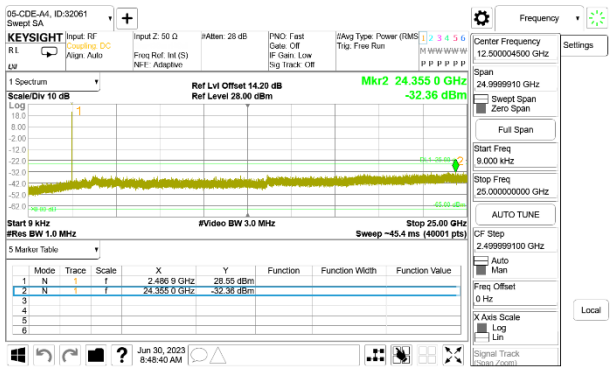
LTE B53 3MHz QPSK Middle Channel RB1-0



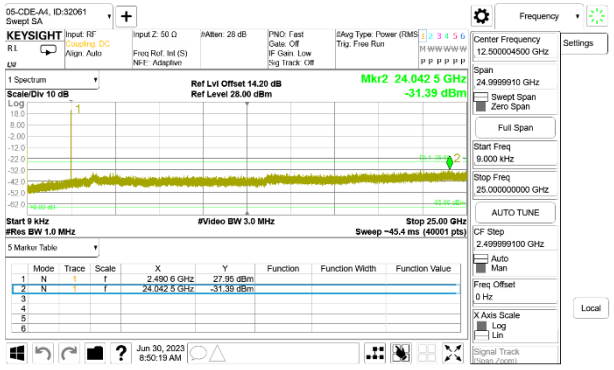
LTE B53 3MHz QPSK High Channel RB1-0



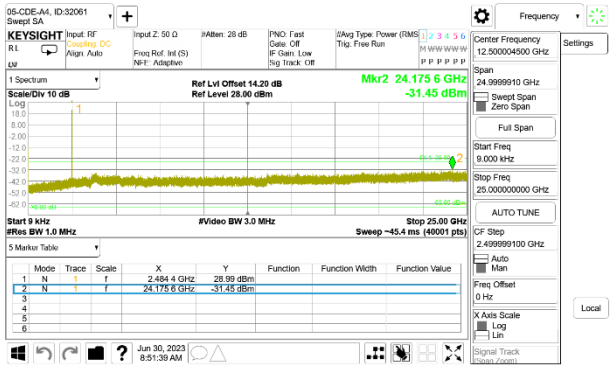
LTE B53 5MHz QPSK Low Channel RB1-0



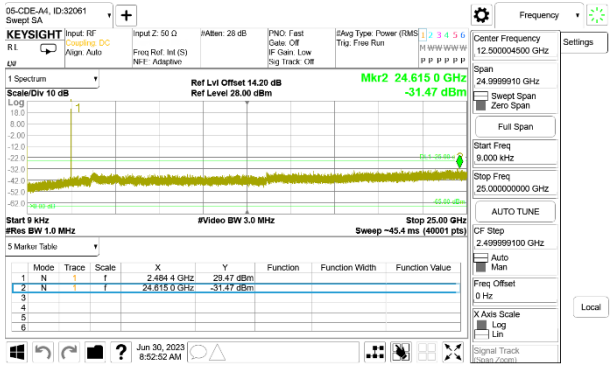
LTE B53 5MHz QPSK Middle Channel RB1-0



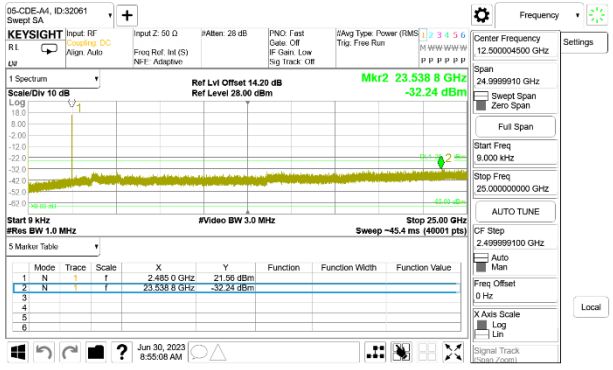
LTE B53 5MHz QPSK High Channel RB1-0



LTE B53 10MHz QPSK Low Channel RB1-0



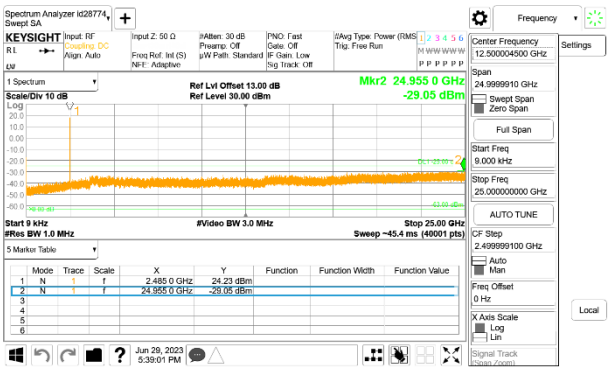
LTE B53 10MHz QPSK Middle Channel RB1-0



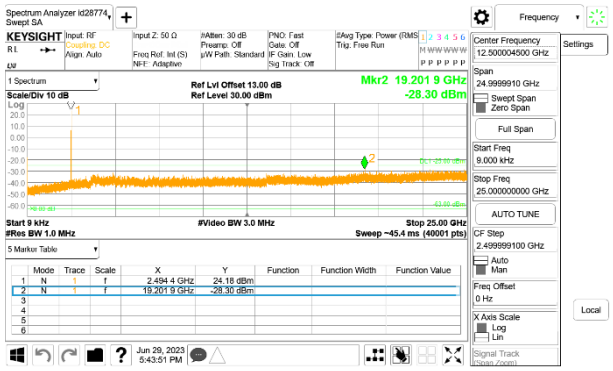
LTE B53 10MHz QPSK High Channel RB1-0

9.6.2. 5G NR 53

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



5G NR n53 10MHz BPSK Mid 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.

ISED: RSS-170 5.3
For all other ATC equipment, the carrier frequency shall not drift from the reference frequency in excess of ±2.5 ppm for mobile equipment and ±1.5 ppm for base station equipment.

RESULTS

9.7.1. LTE BAND 53

LTE BAND 53 QPSK (10MHz BANDWIDTH)

Test Engineer ID:	32061	Test Date:	3/13/2023

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	2483.9896	2494.2811			
Extreme (50°C)		2483.9896	2494.2811	-6.2	-0.002	Yes
Extreme (40°C)		2483.9896	2494.2811	6.3	0.003	Yes
Extreme (30°C)		2483.9896	2494.2811	7.5	0.003	Yes
Extreme (10°C)		2483.9896	2494.2811	8.8	0.004	Yes
Extreme (0°C)		2483.9896	2494.2811	5.8	0.002	Yes
Extreme (-10°C)		2483.9896	2494.2811	9.3	0.004	Yes
Extreme (-20°C)		2483.9896	2494.2811	-4.3	-0.002	Yes
Extreme (-30°C)		2483.9896	2494.2811	5.5	0.002	Yes
20°C	15%	2483.9896	2494.2811	5.9	0.002	Yes
	-15%	2483.9896	2494.2811	5.8	0.002	Yes
	End Point Voltage	2483.9896	2494.2811	5.4	0.002	Yes

9.7.2. 5G NR n53

5G NR n53 BPSK (10MHz BANDWIDTH)

Test Engineer ID:	32061	Test Date:	3/13/2023

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	2483.9400	2494.5775			
Extreme (50°C)		2483.9400	2494.5775	-8.1	-0.003	Yes
Extreme (40°C)		2483.9400	2494.5775	-10.3	-0.004	Yes
Extreme (30°C)		2483.9400	2494.5775	-9.9	-0.004	Yes
Extreme (10°C)		2483.9400	2494.5775	-11.5	-0.005	Yes
Extreme (0°C)		2483.9400	2494.5775	-9.8	-0.004	Yes
Extreme (-10°C)		2483.9400	2494.5775	-10.7	-0.004	Yes
Extreme (-20°C)		2483.9400	2494.5775	-10.8	-0.004	Yes
Extreme (-30°C)		2483.9400	2494.5775	-10.9	-0.004	Yes
20°C	15%	2483.9400	2494.5775	-9.4	-0.004	Yes
	-15%	2483.9400	2494.5775	-11.3	-0.005	Yes
	End Point Voltage	2483.9400	2494.5775	-5.7	-0.002	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.

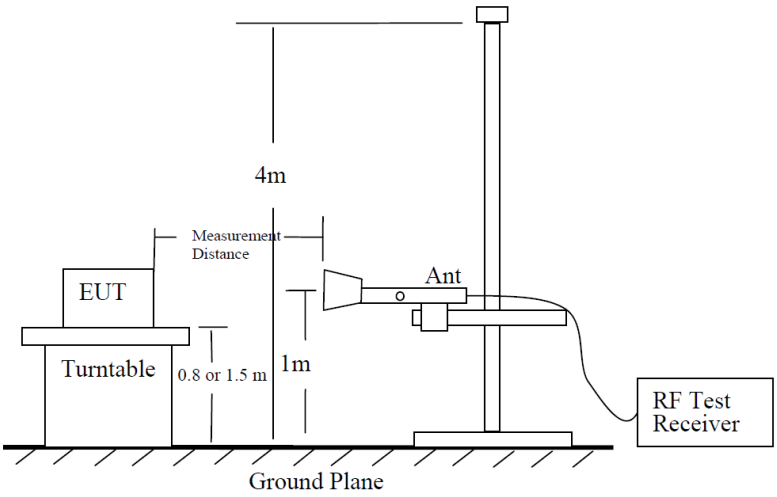


Figure 6—Test site-up for radiated ERP and/or EIRP measurements

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.

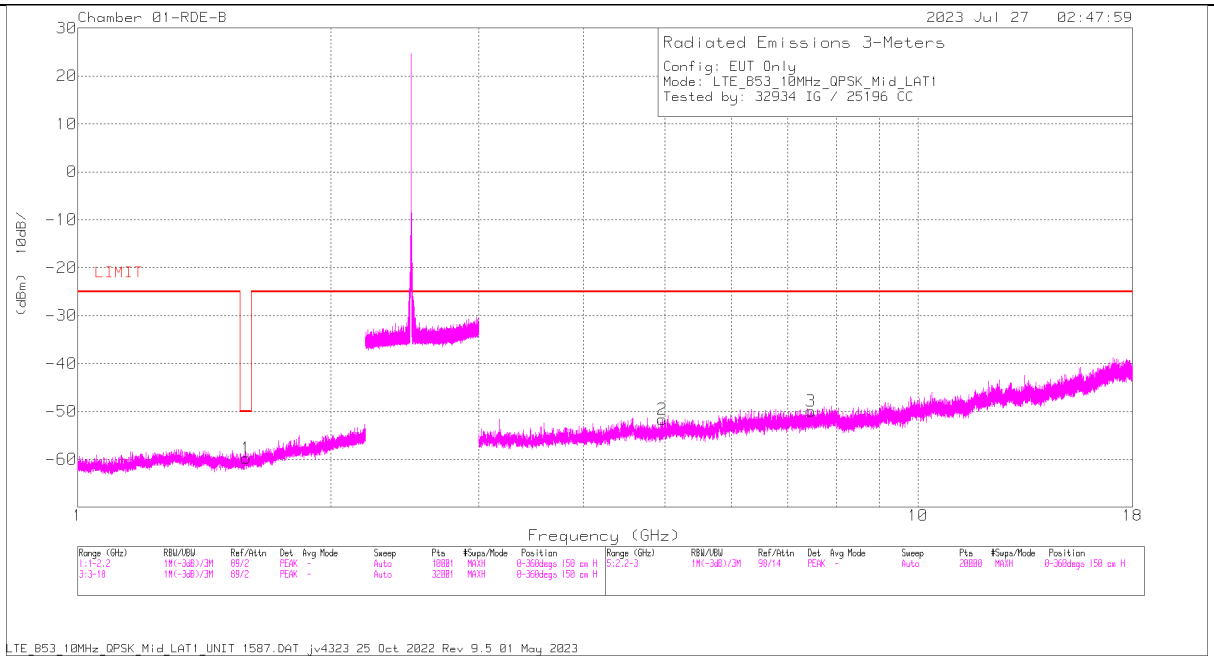
So, from d)

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

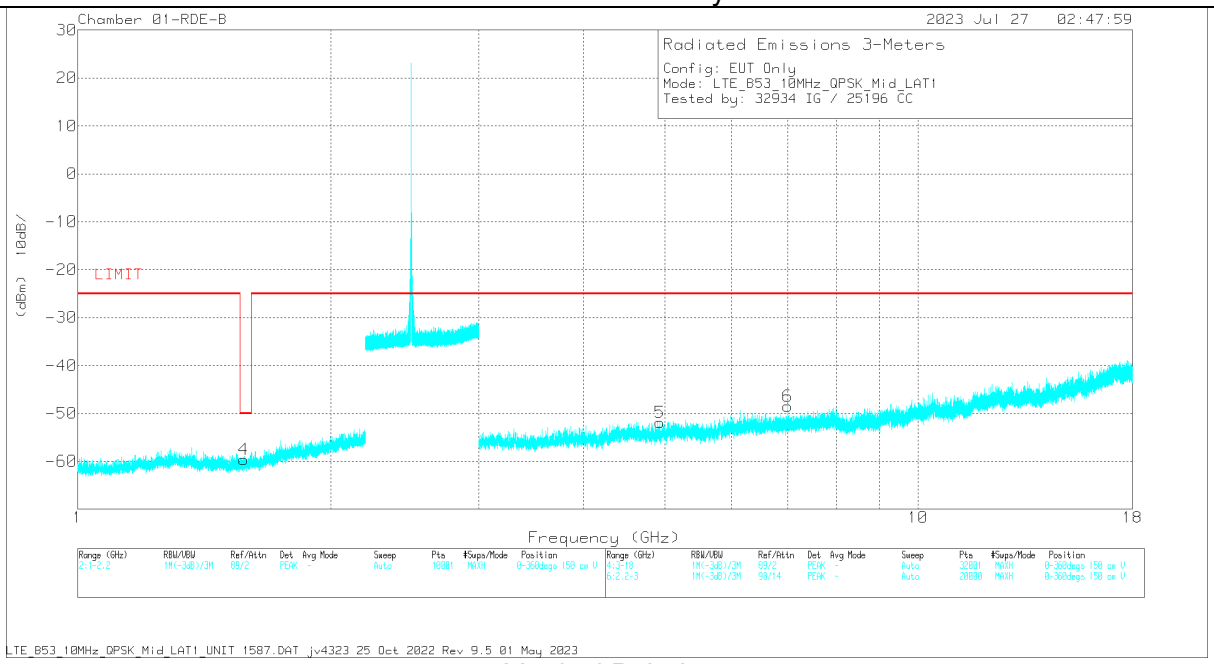
Then, EIRP (dBm) = E (dBµV/m) + 9.5424 − 104.8 = E (dBµV/m) – 95.2576

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

Note: Emission in the 1559 – 1610 MHz GPS band where wideband emissions (-40dBm/MHz), discreate emissions (-50dBm/MHz) and Carrier-off-State Radiation Emissions (-50dBm/MHz) limits meet while the Transmitter ON/OFF.

Trace Markers

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										
1.577080	42.48	Pk	27.8	.5	-95.2	-35.16	-59.58	-50	-9.58	V
1.586080	42.27	Pk	27.8	.5	-95.2	-35.13	-59.76	-50	-9.76	H
4.931719	39.61	Pk	34.2	.4	-95.2	-30.92	-51.91	-25	-26.91	V
4.964063	39.99	Pk	34.3	.3	-95.2	-31.06	-51.67	-25	-26.67	H
6.995362	38.01	Pk	35.7	.3	-95.2	-27.29	-48.48	-25	-23.48	V
7.458281	35.71	Pk	35.9	.4	-95.2	-26.78	-49.97	-25	-24.97	H

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), 1 RB

Project #:	4790592300
Date:	7/27/2023
Test Engineer:	32934
Configuration:	EUT Only
Mode	LTE_B53_10MHz_QPSK_1RB
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										
1.583440	42.57	Pk	27.8	.5	-95.2	-35.02	-59.35	-50	-9.35	V
1.587880	42.91	Pk	27.8	.5	-95.2	-35.17	-59.16	-50	-9.16	H
4.961719	39.60	Pk	34.3	.3	-95.2	-31.02	-52.02	-25	-27.02	H
4.985625	38.95	Pk	34.4	.4	-95.2	-31.05	-52.50	-25	-27.50	V
7.436719	36.42	Pk	35.9	.4	-95.2	-26.93	-49.41	-25	-24.41	V
7.442344	35.58	Pk	35.9	.4	-95.2	-26.87	-50.19	-25	-25.19	H
Mid Channel, 2489MHz										
1.577080	42.48	Pk	27.8	.5	-95.2	-35.16	-59.58	-50	-9.58	V
1.586080	42.27	Pk	27.8	.5	-95.2	-35.13	-59.76	-50	-9.76	H
4.931719	39.61	Pk	34.2	.4	-95.2	-30.92	-51.91	-25	-26.91	V
4.964063	39.99	Pk	34.3	.3	-95.2	-31.06	-51.67	-25	-26.67	H
6.995362	38.01	Pk	35.7	.3	-95.2	-27.29	-48.48	-25	-23.48	V
7.458281	35.71	Pk	35.9	.4	-95.2	-26.78	-49.97	-25	-24.97	H
High Channel, 2490MHz										
1.578400	43.70	Pk	27.8	.5	-95.2	-35.31	-58.51	-50	-8.51	V
1.592920	42.87	Pk	27.8	.6	-95.2	-35.08	-59.01	-50	-9.01	H
4.918594	39.02	Pk	34.1	.3	-95.2	-30.83	-52.61	-25	-27.61	V
4.945313	38.54	Pk	34.2	.4	-95.2	-30.82	-52.88	-25	-27.88	H
7.468594	35.54	Pk	35.9	.4	-95.2	-26.82	-50.18	-25	-25.18	V
7.477969	35.64	Pk	35.9	.4	-95.2	-26.88	-50.14	-25	-25.14	H

*** Emissions in the GPS band were wideband and discreate emissions therefore the -50dBm/MHz limit was used.**

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

Project #:	4790592300
Date:	6/14/2023
Test Engineer:	32934
Configuration:	EUT only
Mode	LTE_B53_10MHz_QPSK_50RB
Chamber #:	01-RDE-B

Frequency (GHz)	Meter Reading (dBuV)	Det	81886 ACF (dB) 3mH	BRF 2.4-2.5GHz T1786 1-18GHz	EIRP CF	Gain/Loss (dB)	Corrected Reading (dBm)	LIMIT	Margin (dB)	Polarity
Low Channel, 2488.5MHz										
1.580080	42.52	Pk	27.8	.5	-95.2	-35.19	-59.57	-50	-9.57	H
1.583560	43.40	Pk	27.8	.5	-95.2	-35.01	-58.51	-50	-8.51	V
4.979063	39.08	Pk	34.3	.3	-95.2	-31.12	-52.64	-25	-27.64	V
4.980938	39.64	Pk	34.3	.3	-95.2	-31.05	-52.01	-25	-27.01	H
7.396406	35.68	Pk	35.8	.4	-95.2	-27.01	-50.33	-25	-25.33	V
7.432500	36.16	Pk	35.9	.4	-95.2	-26.91	-49.65	-25	-24.65	H
Mid Channel, 2489MHz										
1.590640	43.21	Pk	27.8	.6	-95.2	-35.07	-58.66	-50	-8.66	H
1.591000	42.49	Pk	27.8	.6	-95.2	-35.06	-59.37	-50	-9.37	V
4.975781	38.80	Pk	34.3	.3	-95.2	-31.08	-52.88	-25	-27.88	H
4.981875	39.31	Pk	34.3	.4	-95.2	-31.03	-52.22	-25	-27.22	V
7.447500	36.21	Pk	35.9	.4	-95.2	-26.87	-49.56	-25	-24.56	V
7.459688	35.89	Pk	35.9	.4	-95.2	-26.81	-49.82	-25	-24.82	H
High Channel, 2490MHz										
1.579840	42.33	Pk	27.8	.5	-95.2	-35.2	-59.77	-50	-9.77	H
1.583440	43.26	Pk	27.8	.5	-95.2	-35.02	-58.66	-50	-8.66	V
4.957031	39.55	Pk	34.2	.3	-95.2	-31.00	-52.15	-25	-27.15	V
4.994531	38.83	Pk	34.4	.4	-95.2	-31.07	-52.64	-25	-27.64	H
7.454531	36.16	Pk	35.9	.4	-95.2	-26.84	-49.58	-25	-24.58	V
7.462031	36.2	Pk	35.9	.4	-95.2	-26.81	-49.51	-25	-24.51	H

*** Emissions in the GPS band were wideband and discreate emissions therefore the -50dBm/MHz limit was used.**

10.1.2. 5G NR n53

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

Project #:	4790592300
Date:	7/12/2023
Test Engineer:	32934
Configuration:	EUT only
Mode	FR1_n53_10MHz_BPSK_1RB
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										
1.579480	42.33	Pk	27.8	.5	-95.2	-35.24	-59.81	-50	-9.81	H
1.592560	41.88	Pk	27.8	.6	-95.2	-35.08	-60.00	-50	-10.00	V
4.983750	38.07	Pk	34.3	.4	-95.2	-31.10	-53.53	-25	-28.53	V
5.004844	39.01	Pk	34.4	.3	-95.2	-30.89	-52.38	-25	-27.38	H
7.434844	35.48	Pk	35.9	.4	-95.2	-26.87	-50.29	-25	-25.29	V
7.453594	35.8	Pk	35.9	.4	-95.2	-26.85	-49.95	-25	-24.95	H
Mid Channel, 2489MHz										
1.577680	42.18	Pk	27.8	.5	-95.2	-35.27	-59.99	-50	-9.99	H
1.584400	42.23	Pk	27.8	.5	-95.2	-35.04	-59.71	-50	-9.71	V
4.972500	38.97	Pk	34.3	.3	-95.2	-31.07	-52.70	-25	-27.7	V
4.988906	38.15	Pk	34.4	.4	-95.2	-31.10	-53.35	-25	-28.35	H
7.455469	35.62	Pk	35.9	.4	-95.2	-26.78	-50.06	-25	-25.06	V
7.461563	35.22	Pk	35.9	.4	-95.2	-26.87	-50.55	-25	-25.55	H
High Channel, 2490MHz										
1.582120	41.70	Pk	27.8	.5	-95.2	-35.14	-60.34	-50	-10.34	H
1.595440	41.63	Pk	27.8	.6	-95.2	-35.22	-60.39	-50	-10.39	V
4.955625	39.00	Pk	34.2	.3	-95.2	-30.94	-52.64	-25	-27.64	V
4.960313	38.71	Pk	34.2	.3	-95.2	-30.94	-52.93	-25	-27.93	H
7.423594	34.99	Pk	35.9	.3	-95.2	-26.94	-50.95	-25	-25.95	H
7.466719	35.43	Pk	35.9	.4	-95.2	-26.88	-50.35	-25	-25.35	V

*** Emissions in the GPS band were wideband and discreate emissions therefore the -50dBm/MHz limit was used.**

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

Project #:	4790592300
Date:	6/14/2023
Test Engineer:	32934
Configuration:	EUT only
Mode	FR1_n53_10MHz_BPSK_24RB
Chamber #:	01-RDE-B

Frequency (GHz)	Meter Reading (dBuV)	Det	81886 ACF (dB) 3mH	BRF 2.4-2.5GHz T1786 1-18GHz	EIRP CF	Gain/Loss (dB)	Corrected Reading (dBm)	LIMIT	Margin (dB)	Polarity
Low Channel, 2488.5MHz										
1.577680	42.81	Pk	27.8	.5	-95.2	-35.27	-59.36	-50	-9.36	H
1.589320	43.03	Pk	27.8	.6	-95.2	-35.17	-58.94	-50	-8.94	V
4.995000	39.43	Pk	34.4	.4	-95.2	-31.07	-52.04	-25	-27.04	H
5.003906	39.23	Pk	34.4	.3	-95.2	-31.01	-52.28	-25	-27.28	V
7.435781	36.31	Pk	35.9	.4	-95.2	-26.91	-49.50	-25	-24.50	V
7.457813	35.26	Pk	35.9	.4	-95.2	-26.79	-50.43	-25	-25.43	H
Mid Channel, 2489MHz										
1.577920	43.14	Pk	27.8	.5	-95.2	-35.32	-59.08	-50	-9.08	V
1.592920	43.00	Pk	27.8	.6	-95.2	-35.08	-58.88	-50	-8.88	H
4.936875	39.03	Pk	34.2	.4	-95.2	-30.83	-52.40	-25	-27.40	H
4.944375	38.96	Pk	34.2	.4	-95.2	-30.84	-52.48	-25	-27.48	V
7.445156	36.06	Pk	35.9	.4	-95.2	-26.86	-49.70	-25	-24.70	V
7.507031	36.43	Pk	35.9	.4	-95.2	-26.99	-49.46	-25	-24.46	H
High Channel, 2490MHz										
1.579840	43.26	Pk	27.8	.5	-95.2	-35.2	-58.84	-50	-8.84	V
1.583680	42.44	Pk	27.8	.5	-95.2	-35.01	-59.47	-50	-9.47	H
4.969688	39.92	Pk	34.3	.3	-95.2	-31.11	-51.79	-25	-26.79	V
4.978125	40.09	Pk	34.3	.3	-95.2	-31.09	-51.60	-25	-26.60	H
7.413281	36.17	Pk	35.8	.3	-95.2	-26.87	-49.80	-25	-24.80	H
7.457813	35.74	Pk	35.9	.4	-95.2	-26.79	-49.95	-25	-24.95	V

*** Emissions in the GPS band were wideband and discreate emissions therefore the -50dBm/MHz limit was used.**

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 #:	4790592300
Date:	3/29/2023
Test Engineer:	19226
Configuration:	EUT only
Mode	LTE_B53_10MHz_QPSK_1RB
Chamber #:	05-RDE-D

Frequency (GHz)	Meter Reading (dBm)	Det	80402 ACF(dB) - 3mH	EIRP CF	Gain/Loss (dB)	Corrected Reading (dBm)	LIMIT	Margin (dB)	Polarity
Low Channel, 2488.5MHz									
1.581127	59.83	Pk	27.3	-95.2	-48.92	-56.99	-50	-6.99	H
1.586414	58.82	Pk	27.3	-95.2	-49.00	-58.08	-50	-8.08	V
4.941500	56.81	Pk	34.2	-95.2	-47.49	-51.68	-25	-26.68	H
4.989500	56.31	Pk	34.3	-95.2	-47.49	-52.08	-25	-27.08	V
7.478000	54.16	Pk	35.8	-95.2	-45.58	-50.82	-25	-25.82	V
7.516000	54.60	Pk	35.8	-95.2	-45.77	-50.57	-25	-25.57	H
Mid Channel, 2489MHz									
1.581127	59.28	Pk	27.3	-95.2	-48.92	-57.54	-50	-7.54	H
1.591294	58.32	Pk	27.4	-95.2	-48.89	-58.37	-50	-8.37	V
4.714000	55.97	Pk	34.2	-95.2	-47.51	-52.54	-25	-27.54	V
4.724000	56.20	Pk	34.2	-95.2	-47.52	-52.32	-25	-27.32	H
7.449500	55.39	Pk	35.8	-95.2	-45.95	-49.96	-25	-24.96	V
7.465000	54.66	Pk	35.8	-95.2	-45.85	-50.59	-25	-25.59	H
High Channel, 2490MHz									
1.582347	59.08	Pk	27.3	-95.2	-48.93	-57.75	-50	-7.75	H
1.590887	58.82	Pk	27.4	-95.2	-48.89	-57.87	-50	-7.87	V
4.944000	56.12	Pk	34.2	-95.2	-47.43	-52.31	-25	-27.31	H
4.972000	55.81	Pk	34.2	-95.2	-47.58	-52.77	-25	-27.77	V
7.459000	54.32	Pk	35.8	-95.2	-45.86	-50.94	-25	-25.94	V
7.459500	54.61	Pk	35.8	-95.2	-45.93	-50.72	-25	-25.72	H

*** Emissions in the GPS band were wideband and discreate emissions therefore the -50dBm/MHz limit was used.**

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

Project #:	4790592300
Date:	6/14/2023
Test Engineer:	32934
Configuration:	EUT only
Mode	LTE_B53_10MHz_QPSK_50RB
Chamber #:	01-RDE-B

Frequency (GHz)	Meter Reading (dBuV)	Det	81886 ACF (dB) 3mH	BRF 2.4-2.5GHz T1786 1-18GHz	EIRP CF	Gain/Loss (dB)	Corrected Reading (dBm)	LIMIT	Margin (dB)	Polarity
Low Channel, 2488.5MHz										
1.582480	43.21	Pk	27.8	.5	-95.2	-35.10	-58.79	-50	-8.79	V
1.591600	42.48	Pk	27.8	.6	-95.2	-35.08	-59.40	-50	-9.40	H
4.953750	38.40	Pk	34.2	.4	-95.2	-30.97	-53.17	-25	-28.17	H
4.970156	40.38	Pk	34.3	.3	-95.2	-31.12	-51.34	-25	-26.34	V
7.509375	35.37	Pk	35.9	.4	-95.2	-26.93	-50.46	-25	-25.46	H
7.516875	36.04	Pk	35.9	.4	-95.2	-26.96	-49.82	-25	-24.82	V
Mid Channel, 2489MHz										
1.584040	42.96	Pk	27.8	.5	-95.2	-35.00	-58.94	-50	-8.94	V
1.592800	42.90	Pk	27.8	.6	-95.2	-35.08	-58.98	-50	-8.98	H
4.985156	39.56	Pk	34.4	.4	-95.2	-31.07	-51.91	-25	-26.91	V
4.994063	40.45	Pk	34.4	.4	-95.2	-31.07	-51.02	-25	-26.02	H
7.390313	37.09	Pk	35.8	.4	-95.2	-26.95	-48.86	-25	-23.86	V
7.402500	35.54	Pk	35.8	.4	-95.2	-26.96	-50.42	-25	-25.42	H
High Channel, 2490MHz										
1.584280	42.79	Pk	27.8	.5	-95.2	-35.03	-59.14	-50	-9.14	H
1.592320	42.60	Pk	27.8	.6	-95.2	-35.09	-59.29	-50	-9.29	V
4.963125	38.93	Pk	34.3	.3	-95.2	-31.10	-52.77	-25	-27.77	V
4.974844	39.72	Pk	34.3	.3	-95.2	-31.03	-51.91	-25	-26.91	H
7.433438	37.11	Pk	35.9	.4	-95.2	-26.86	-48.65	-25	-23.65	V
7.449844	35.6	Pk	35.9	.4	-95.2	-26.90	-50.2	-25	-25.20	H

*** Emissions in the GPS band were wideband and discreate emissions therefore the -50dBm/MHz limit was used.**

10.2.2. 5G NR n53

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

Project #:	4790592300
Date:	3/29/2023
Test Engineer:	32145
Configuration:	EUT only
Mode	FR1_n53_10MHz_BPSK_1RB
Chamber #:	04-RDE-P

Frequency (GHz)	Meter Reading (dBm)	Det	222740 ACF(dB) - 3mH	EIRP CF	Gain/Loss (dB)	Corrected Reading (dBm)	LIMIT	Margin (dB)	Polarity
Low Channel, 2488.5MHz									
1.586007	57.81	Pk	28	-95.2	-48.91	-58.30	-50	-8.30	V
1.58682	58.09	Pk	28	-95.2	-48.93	-58.04	-50	-8.04	H
4.952000	56.43	Pk	33.9	-95.2	-47.95	-52.82	-25	-27.82	H
4.952000	55.25	Pk	33.9	-95.2	-47.95	-54.00	-25	-29.00	V
7.394500	54.65	Pk	35.7	-95.2	-45.96	-50.81	-25	-25.81	V
7.433500	54.40	Pk	35.7	-95.2	-46.19	-51.29	-25	-26.29	H
Mid Channel, 2489MHz									
1.580314	58.78	Pk	28	-95.2	-48.90	-57.32	-50	-7.32	V
1.583974	57.50	Pk	28	-95.2	-48.89	-58.59	-50	-8.59	H
4.945000	56.16	Pk	33.9	-95.2	-47.97	-53.11	-25	-28.11	V
4.956500	55.34	Pk	33.9	-95.2	-47.80	-53.76	-25	-28.76	H
7.498000	55.02	Pk	35.6	-95.2	-46.29	-50.87	-25	-25.87	H
7.506500	54.71	Pk	35.6	-95.2	-46.27	-51.16	-25	-26.16	V
High Channel, 2490MHz									
1.579907	58.05	Pk	28	-95.2	-48.89	-58.04	-50	-8.04	V
1.580720	57.38	Pk	28	-95.2	-48.90	-58.72	-50	-8.72	H
4.943500	55.38	Pk	33.9	-95.2	-47.99	-53.91	-25	-28.91	H
4.946000	56.31	Pk	33.9	-95.2	-47.90	-52.89	-25	-27.89	V
7.488500	54.71	Pk	35.7	-95.2	-46.22	-51.01	-25	-26.01	H
7.496500	53.80	Pk	35.6	-95.2	-46.26	-52.06	-25	-27.06	V

*** Emissions in the GPS band were wideband and discreate emissions therefore the -50dBm/MHz limit was used.**

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

Project #:	14523778
Date:	6/14/2023
Test Engineer:	32934
Configuration:	EUT only
Mode	FR1_n53_10MHz_BPSK_24RB
Chamber #:	01-RDE-B

Frequency (GHz)	Meter Reading (dBuV)	Det	81886 ACF (dB) 3mH	BRF 2.4-2.5GHz T1786 1-18GHz	EIRP CF	Gain/Loss (dB)	Corrected Reading (dBm)	LIMIT	Margin (dB)	Polarity
Low Channel, 2488.5MHz										
1.578040	42.81	Pk	27.8	.5	-95.2	-35.33	-59.42	-50	-9.42	V
1.594960	42.03	Pk	27.8	.6	-95.2	-35.26	-60.03	-50	-10.03	H
4.948594	39.77	Pk	34.2	.4	-95.2	-30.92	-51.75	-25	-26.75	V
4.967344	39.50	Pk	34.3	.3	-95.2	-31.04	-52.14	-25	-27.14	H
7.475156	35.83	Pk	35.9	.4	-95.2	-26.81	-49.88	-25	-24.88	V
7.488750	36.40	Pk	35.9	.4	-95.2	-26.85	-49.35	-25	-24.35	H
Mid Channel, 2489MHz										
1.582600	42.77	Pk	27.8	.5	-95.2	-35.08	-59.21	-50	-9.21	V
1.586320	43.14	Pk	27.8	.5	-95.2	-35.16	-58.92	-50	-8.92	H
4.946250	39.58	Pk	34.2	.4	-95.2	-30.84	-51.86	-25	-26.86	V
4.967813	39.51	Pk	34.3	.3	-95.2	-31.04	-52.13	-25	-27.13	H
7.449375	35.80	Pk	35.9	.4	-95.2	-26.88	-49.98	-25	-24.98	V
7.452188	36.15	Pk	35.9	.4	-95.2	-26.87	-49.62	-25	-24.62	H
High Channel, 2490MHz										
1.579720	43.06	Pk	27.8	.5	-95.2	-35.22	-59.06	-50	-9.06	H
1.588840	43.33	Pk	27.8	.5	-95.2	-35.20	-58.77	-50	-8.77	V
4.993125	39.90	Pk	34.4	.4	-95.2	-31.13	-51.63	-25	-26.63	H
5.000156	38.75	Pk	34.4	.4	-95.2	-30.98	-52.63	-25	-27.63	V
7.437656	35.77	Pk	35.9	.4	-95.2	-26.88	-50.01	-25	-25.01	V
7.448438	35.37	Pk	35.9	.4	-95.2	-26.84	-50.37	-25	-25.37	H

*** Emissions in the GPS band were wideband and discreate emissions therefore the -50dBm/MHz limit was used.**

11. SETUP PHOTOS

Please refer to 14523778-EP1V1 Setup Photo Report for setup photos

END OF REPORT