TEST REPORT

Report Number	:	R14176161-E1V5
Applicant	:	SONY CORPORATION 1-7-1 KONAN MINATO-KU TOKYO, 108-0076, JAPAN
FCC ID	:	PY7-24116L
EUT Description	:	GSM/WCDMA/LTE Phone with BT, DTS/UNII a/b/g/n/ac/ax, GPS, WPT & NFC
Test Standard(s)	:	FCC CFR47 Part 2, Part 22, Part 24, and Part 27.

Date Of Issue:
2022-04-11

Prepared by:
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CERT #0751.06

Revision History

Rev.	Issue Date	Revisions	Revised By
V1	2022-03-29	Initial Review	Noah Bennett
V2	2022-04-04	-Added Bands 13 and 41 to Section 6.2 -Rephrased Section 7 Reuse of Test Data for more clarity	Noah Bennett
V3	2022-04-05	-Added remaining supported bands to Section 6.2 -Rephrased Section 7.3 more. -Combined Table in Section 2	Noah Bennett
V4	2022-04-06	-Updated TOC -Added KDB reference to Section 3 -Fixed Typo in Section 6.2	Noah Bennett
V5	2022-04-11	-Updated Typo in WCDMA Emission Designator	Noah Bennett

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1. ATTESTATION OF TEST RESULTS

Applicant Name and Address	SONY CORPORATION 1-7-1 KONAN MINATO-KU TOKYO, 108-0076, JAPAN
FCC ID	PY7-24116L
EUT Description	GSM/WCDMA/LTE Phone with BT, DTS/UNII a/b/g/n/ac/ax, GPS, WPT & NFC
Serial Number	QV7700JSBB, QV77006YBB, QV7700B6BB
Sample(s) Receipt Date	2022-012022-02-23
Date Tested	2022-01-21 TO 2022-03-24
Applicable Standards	FCC CFR47 Part 2, Part 22, Part 24, and Part 27.
Test Results	COMPLIES

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

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

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

Approved & Released By:	Reviewed By:	Prepared By:
		
Dan Coronia Operations Leader UL LLC.	Senior Project Engineer Project Engineer UL LLC.	Noah Bennett Engineer UL LLC.

2. SUMMARY OF TEST RESULTS

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

Requirement Description	Requirement Clause Number (FCC)	Result	Remarks
Effective Radiated Power	27.50 (c) (10)	Pass	Note: Full testing was only done on Bands WCDMA2, WCDMA4, and LTE17. Please see Section 7 for Data-Reuse justification.
Equivalent Isotropic Radiated Power	24.232 (c) 27.50		
Occupied Bandwidth	2.1049	Pass	
Band Edge and Emission Mask	2.1051, 22.917 (a), 24.238 (a) (c) 27.53 (g), 27.53 (c) (f),	Pass	
Out of Band Emissions	2.1051, 22.917 (a), 24.238 (a) (c) 27.53 (g), 27.53 (c) (f),	Pass	
Frequency Stability	2.1055, 22.355, 24.135, 27.54	Pass	
Peak-to-Average Ratio	22.913 (d), 24.232 (d),	Pass	
Field Strength of Spurious Radiation	2.1053, 22.917 (a), 24.236, 27.53 (g), 27.53 (c) (f),	Pass	None

3. TEST METHODOLOGY

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

- ANSI C63.26:2015
- FCC CFR 47 Part 2, Part 22, Part 24, Part 27
- FCC KDB 971168 D01 v03r01: Power Meas License Digital Systems
- FCC KDB 971168 D02 v02r01: Misc Rev Approv License Devices
- FCC KDB 412172 D01 v01r01. Determining ERP and EIRP
- FCC KDB 484596 D01: Referencing Test Data v01

4. FACILITIES AND ACCREDITATION

UL LLC is accredited by A2LA, certification # 0751.06, for all testing performed within the scope of this report. Testing was performed at the locations noted below. All testing with the exception of RF Conducted Output Power was performed at the below site.

	Address	ISED CABID	ISED Company Number	FCC Registration
☒	Building: 12 Laboratory Dr RTP, NC 27709, U.S.A	US0067	2180C	825374
☒	Building: 2800 Perimeter Park Dr. Suite B Morrisville, NC 27560, U.S.A		27265	

UL Verification Services Inc. is accredited by A2LA, Certificate Number #0751.05, for all testing performed within the scope of this report. Testing was performed at the locations noted below. RF Conducted Output Power was the only test performed at the below site.

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

5. DECISION RULES AND MEASUREMENT UNCERTAINTY

5.1. METROLOGICAL TRACEABILITY

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

5.2. DECISION RULES

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

5.3. MEASUREMENT UNCERTAINTY

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

PARAMETER	U_{Lab}
Radio Frequency (Spectrum Analyzer)	141.2 Hz
Occupied Channel Bandwidth	1.22%
RF output power, conducted	1.3 dB (PK) 0.45 dB (AV)
Power Spectral Density, conducted	2.47 dB
Unwanted Emissions, conducted	1.94 dB
All emissions, radiated	6.01 dB
Conducted Emissions (0.150-30MHz) - LISN	3.40 dB
Temperature	0.57°C
Humidity	3.39%
DC Supply voltages	1.70%

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

MAINS CONDUCTED EMISSIONS

Where relevant, the following sample calculation is provided:
Final Voltage (dBuV) = Measured Voltage (dBuV) + Cable Loss (dB) + Limiter Factor (dB) + LISN Insertion Loss.
36.5 dBuV + 0 dB +10.1 dB+ 0 dB = 46.6 dBuV

6. EQUIPMENT UNDER TEST

6.1. DESCRIPTION OF EUT

The EUT is a GSM/WCDMA/LTE Phone with BT, DTS/UNII a/b/g/n/ac/ax, GPS, WPT & NFC. This report covers GSM/WCDMA/LTE.

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 ERP / EIRP output powers as follows:

GSM MODES

Part 22 850MHz								
Frequency range (MHz)	Modulation	Conducted (Average) (dBm)	Antenna Gain (dBi)	Limit (W)	ERP		99% BW (kHz)	Emission Designator
					(dBm)	(W)		
824.2-848.8	GPRS	32.8	-2.80	7.0	27.85	0.610	240.2	240KGXW
	EGPRS	27.1			22.15	0.164	247.1	247KG7W
Part 24 1900MHz								
Frequency range (MHz)	Modulation	Conducted (Average) (dBm)	Antenna Gain (dBi)	Limit (W)	EIRP		99% BW (kHz)	Emission Designator
					(dBm)	(W)		
1850.2-1909.8	GPRS	27.4	-2.70	2.0	24.70	0.295	239.8	240KGXW
	EGPRS	26.6			23.90	0.245	244.1	244KG7W

WCDMA MODE

Part 22 Band 5

Frequency range (MHz)	Modulation	Conducted (Average) (dBm)	Antenna Gain (dBi)	Limit (W)	ERP		99% BW (kHz)	Emission Designator
					(dBm)	(W)		
826.4-846.6	REL 99	21.7	-2.80	7.0	16.75	0.047	4133	4M13F9W
	HSDPA	20.9			15.95	0.039	4161	4M16F9W

Part 24 Band 2

Frequency range (MHz)	Modulation	Conducted (Average) (dBm)	Antenna Gain (dBi)	Limit (W)	EIRP		99% BW (kHz)	Emission Designator
					(dBm)	(W)		
1852.4-1907.6	REL 99	19.7	-2.70	2.0	17.00	0.050	4159.9	4M16F9W
	HSDPA	18.7			16.00	0.040	4145.11	4M15F9W

Part 27 Band 4

Frequency range (MHz)	Modulation	Conducted (Average) (dBm)	Antenna Gain (dBi)	Limit (W)	EIRP		99% BW (kHz)	Emission Designator
					(dBm)	(W)		
1712.4-1752.6	REL 99	19.7	-4.40	1.0	15.30	0.034	4412.4	4M41F9W
	HSDPA	18.7			14.30	0.027	4164.4	4M16F9W

LTE BAND 4

Part 27	
EIRP Limit (W)	1.00
Antenna Gain (dBi)	-4.40

Bandwidth (MHz)	Modulation	Low Frequency (MHz)	Upper Frequency (MHz)	Conducted Average (dBm)	EIRP Average (dBm)	EIRP Average (W)	99% BW (kHz)	Emission Designator
1.4	QPSK	1710.7	1754.3	19.7	15.30	0.034	1090	1M09G7W
	16QAM			20.0	15.60	0.036	1090	1M09D7W
3.0	QPSK	1711.5	1753.5	19.7	15.30	0.034	2690	2M69G7W
	16QAM			20.0	15.60	0.036	2690	2M69D7W
5.0	QPSK	1712.5	1752.5	19.8	15.40	0.035	4500	4M50G7W
	16QAM			20.0	15.60	0.036	4510	4M51D7W
10.0	QPSK	1715.0	1750.0	19.7	15.30	0.034	8950	8M95G7W
	16QAM			20.0	15.60	0.036	8970	8M97D7W
15.0	QPSK	1717.5	1747.5	19.6	15.20	0.033	13420	13M4G7W
	16QAM			19.9	15.50	0.035	13460	13M5D7W
20.0	QPSK	1720.0	1745.0	19.6	15.20	0.033	17920	17M9G7W
	16QAM			20.0	15.60	0.036	17880	17M9D7W

LTE BAND 5

Part 22H	
ERP Limit (W)	7.00
Antenna Gain (dBi)	-2.80

Bandwidth (MHz)	Modulation	Low Frequency (MHz)	Upper Frequency (MHz)	Conducted Average (dBm)	ERP Average (dBm)	ERP Average (W)	99% BW (kHz)	Emission Designator
1.4	QPSK	824.7	848.3	21.6	16.65	0.046	1090	1M09G7W
	16QAM			21.9	16.95	0.050	1090	1M09D7W
3.0	QPSK	825.5	847.5	21.6	16.65	0.046	2690	2M69G7W
	16QAM			21.9	16.95	0.050	2690	2M69D7W
5.0	QPSK	826.5	846.5	21.7	16.75	0.047	4500	4M50G7W
	16QAM			22.0	17.05	0.051	4500	4M50D7W
10.0	QPSK	829.0	844.0	21.6	16.65	0.046	8960	8M96G7W
	16QAM			22.0	17.05	0.051	8940	8M94D7W

LTE BAND 13

Part 27	
ERP Limit (W)	3.00
Antenna Gain (dBi)	-3.30

Bandwidth (MHz)	Modulation	Low Frequency (MHz)	Upper Frequency (MHz)	Conducted Average (dBm)	ERP Average (dBm)	ERP Average (W)	99% BW (kHz)	Emission Designator
5.0	QPSK	779.5	784.5	21.6	16.15	0.041	4500	4M50G7W
	16QAM			22.0	16.55	0.045	4500	4M50D7W
10.0	QPSK	782.0	782.0	21.5	16.05	0.040	8930	8M93G7W
	16QAM			21.9	16.45	0.044	8960	8M96D7W

LTE BAND 17

Part 27 / RSS 130	
ERP Limit (W)	3.00
Antenna Gain (dBi)	-9.50

Bandwidth (MHz)	Modulation	Low Frequency (MHz)	Upper Frequency (MHz)	Conducted Average (dBm)	ERP Average (dBm)	ERP Average (W)	99% BW (kHz)	Emission Designator
5.0	QPSK	706.5	713.5	21.7	10.05	0.010	4488.8	4M49G7W
	16QAM			22.0	10.35	0.011	4489.1	4M49D7W
10.0	QPSK	709.0	711.0	21.6	9.95	0.010	8969	8M97G7W
	16QAM			22.0	10.35	0.011	8961	8M96D7W

LTE BAND 41

Part 27	
EIRP Limit (W)	2.00
Antenna Gain (dBi)	-4.40

Bandwidth (MHz)	Modulation	Low Frequency (MHz)	Upper Frequency (MHz)	Conducted Average (dBm)	EIRP Average (dBm)	EIRP Average (W)	99% BW (kHz)	Emission Designator
5.0	QPSK	2498.5	2687.5	19.7	15.30	0.034	4500	4M50G7W
	16QAM			19.8	15.40	0.035	4510	4M51D7W
10.0	QPSK	2501.0	2685.0	19.7	15.30	0.034	8940	8M94G7W
	16QAM			19.7	15.30	0.034	8960	8M96D7W
15.0	QPSK	2503.5	2682.5	19.6	15.20	0.033	13400	13M4G7W
	16QAM			19.6	15.20	0.033	13440	13M4D7W
20.0	QPSK	2506.0	2680.0	19.6	15.20	0.033	17830	17M8G7W
	16QAM			19.9	15.50	0.035	17900	17M9D7W

6.3. SOFTWARE AND FIRMWARE

The EUT firmware installed during testing was version 0.492 for conducted sample and 0.502 for radiated sample.

6.4. MAXIMUM ANTENNA GAIN

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

Antenna	Support bands	Frequency range (MHz)	Peak gain (dBi)
Main Antenna 1	GSM850/WCDMA5/LTE B5	824 -849	-2.8
Main Antenna 1	LTE B17	704-716	-9.5
Main Antenna 1	LTE B13	777-787	-3.3
Main Antenna 1	GSM1900/WCDMA2/LTE B2	1850-1910	-2.7
Main Antenna 1	WCDMA4/LTE B4	1710-1755	-4.4
Main Antenna 1	LTE B41	2496-2690	-4.4

6.5. WORST-CASE CONFIGURATION AND MODE

The EUT supports LTE Bands of:
Band 4, Band 5, Band 13, Band 17, and Band 41.

The EUT supports 2G and 3G Bands of:
WCDMA Band II, Band IV and Band V, GSM 850 and GSM 1900.

The worst-case scenario for all measurements is based on the average conducted output power measurement investigation results. Output power measurements were measured on QPSK, 16QAM and 64QAM modulations. It was found that QPSK and 16QAM results were worst case. All testing was performed using QPSK and 16QAM modulations to represent the worst case. All Conduced Spurious emissions testing was done with the EUT set to RB1-0.

The EUT was investigated in three orthogonal orientations X/Y/Z for both Low Band (Fc <1GHz) and Mid Band (1GHz < Fc < 3GHz). For Low Band, it was determined that (Y) orientation was the worst-case orientation. For Mid Band, it was determined that X orientation was the worst-case orientation. For Radiated measurements the EUT was tested with the AC/DC adaptor and headphones connected as this represents a worst-case mode of operation.

The worst-case scenario for below 1GHz and above 18GHz measurements are as followed:

- GSM GPRS
- WCDMA REL 99
- LTE QPSK

Simultaneous transmission worst case modes selected are as follows:

- LTE Band 4, 20300, 1745MHz, 20MHz, 1RB and 2442MHz 11ax HE20 26T/8 C0/C1 and 5240MHz C0/C1 HE20 26T/0
- LTE Band 4, 20300, 1745MHz, 20MHz, 1RB and 2442MHz 11ax HE20 106T/R54 C0/C1
- LTE Band 4, 20300, 1745MHz, 20MHz, 1RB and 5240MHz 11ax HE20 26T/0 C0/C1
- LTE Band 12, 23060, 704MHz, 10MHz, 1RB and 2462MHz 106T/R54 C0/C1

6.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	**Manufacturer**	**Model**	**Serial Number**	**FCC ID**
Laptop	HP	14-dk1003dx	5CG016B4XM	TX2-RTL8821CE
Headphones	Sony	MDR-EX15AP	NA	NA
AC Adapter	Sony	XQZ-UC11-010-236-21	1821W34209742	NA
AC Adapter	Sony	XQZ-UC11-010-236-21	1821W34209856	NA
USB Cable Type C	Sony	XQZ-UB1	NA	NA

I/O CABLES

I/O Cable List						
Cable No.	**Port**	**# of Identical Ports**	**Connector Type**	**Cable Type**	**Cable Length (m)**	**Remarks**
1	USB	1	USB-C	Non-Shielded	<3m	Connected to Power Supply
2	3.5mm	1	3.5mm Audio	Non-Shielded	<1m	Connected to headphones

TEST SETUP

The EUT was powered on and configured to be connected to a communications device before the test. The EUT was connected and communicating with the device during the entire test suite. The EUT was connected to AC Mains via power supply and had headphones connected.

SETUP DIAGRAMS

Please refer to UL Report R14176161-EP2 for Setup Diagrams.

7. REUSE OF TEST DATA

7.1. INTRODUCTION

According to the manufacturer, FCC ID: PY7-83262V (Lead Model) and FCC ID: PY7-24116L (This Model)'s PCB layout and the components except for antenna for licensed band (GSM, WCDMA and LTE) is identical. The FCC ID: PY7-83262V conducted test data shall remain representative of FCC ID: PY7-24116L so, FCC ID: PY7-24116L leverages conducted test data from FCC ID: PY7-83262V.

The applicant takes full responsibility that the test data as referenced in this section represents compliance for this FCC ID.

7.2. DEVICES DIFFERENCES

Difference between PY7-83262V and PY7-24116L:

Sony Corporation hereby declares that the PCB layout and the components except for antenna for licensed band (GSM, WCDMA and LTE) is identical between PY7-83262V (lead model) and PY7-24116L (this model). Therefore, the conducted test data of licensed band for PY7-83262V can be re-used to PY7-24116L except for LTE B17, WCDMA B2 and WCDMA B4.

7.3. REFERENCE DETAIL

Equipment Class	Reference FCC ID	Report Title	Referenced Testing
Licensed (WWAN)	PY7-83262V	R14176139-E1V3 FCC Report WWAN_Final	Conducted antenna port data for all supported bands excluding LTE B17, WCDMA B2 and WCDMA B4.

*Notes:

1. Full radiated testing was done on all supported bands by the EUT.
2. ERP/EIRP is updated in this report due to changes in antenna gain. ERP/EIRP is based on conducted power plus antenna gain.

7.4. SPOT CHECK VERIFICATION RESULTS SUMMARY

Spot check verification has been done on device PY7-24116L for conducted output power. The data from the application has been verified through appropriate spot checks to demonstrate compliance for this device in accordance with FCC public KDB 484596 D01 as shown in the summary below.

PY7-24116L SPOT CHECK RESULTS							
Technology	Test Item	Cellular Band	Channel	Measured Frequency (MHz)	PY7-83262V AV Reading (dBm)	PY7-24116L AV Reading (dBm)	Delta (dB) <+3dB
GSM	Power	850	190	836.6	32.8	32.8	0.0
	Power	1900	661	1880.0	27.4	27.4	0.0
WCDMA	Power	V	4183	836.6	21.7	21.4	-0.3
4G LTE	Power	LTE4	20175	1732.5	19.6	19.6	0.0
	Power	LTE5	20525	836.5	22.0	21.6	-0.4
	Power	LTE13	23230	782	21.9	21.5	-0.4
	Power	LTE41	40620	2593	19.9	19.6	-0.3

8. TEST AND MEASUREMENT EQUIPMENT

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

Test Equipment Used - Wireless Conducted Measurement Equipment

Equipment ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
	Common Equipment				
	Conducted Room 2				
T177	Spectrum Analyzer	Keysight Technologies	N9030A	2021-05-19	2022-05-19
212967	Wideband Radio Communication Tester	Rohde & Schwarz	CMW500	2021-11-15	2022-11-15
51845	Temp/Humid Chamber	Thermotron	SM-32-8200	2022-01-25	2023-01-25
HI0090	Environmental Meter	Fisher Scientific	15-077-963	2021-07-12	2022-07-12
MY61466084	DC Regulated Power Supply	Keysight	E3633A	NA	NA
SOFTEMI	Antenna Port Software	UL	Version 2021.11.03	NA	NA
	Additional Equipment used				
MM0167 (PRE0126458)	True RMS Multimeter	Agilent	U1232A	2021-08-17	2021-08-17

Test Equipment Used - Radiated Disturbance Emissions Test Equipment (Morrisville – Chamber 2)

Equip. ID	Description	Manufacturer/Brand	Model Number	Last Cal.	Next Cal.
	0.009-30MHz				
AT0079	Active Loop Antenna	ETS-Lindgren	6502	2021-08-19	2022-08-19
	1-18 GHz				
AT0072	Double-Ridged Waveguide Horn Antenna, 1 to 18 GHz	ETS Lindgren	3117	2021-05-03	2022-05-03
	18-40 GHz				
AT0063	Horn Antenna, 18-26.5GHz	ARA	MWH-1826/B	2021-11-04	2022-11-04
AT0061	Horn Antenna, 26-40GHz	ARA	MWH-2640/B	2021-11-04	2022-11-04
	Gain-Loss Chains				
C2-SAC01	Gain-loss string: 0.009-30MHz	Various	Various	2021-07-09	2022-07-09
C2-SAC03	Gain-loss string: 1-18GHz	Various	Various	2021-07-09	2022-07-09
C2-SAC04	Gain-loss string: 18-40GHz	Various	Various	2021-07-09	2022-07-09
	Receiver & Software				
197955	Spectrum Analyzer	Rohde & Schwarz	ESW44	2022-03-08	2023-03-08
SA0027	Spectrum Analyzer	Agilent	N9030A	2021-06-25	2022-06-25
SOFTEMI	EMI Software	UL	Version 9.5 (18 Oct 2021)		
	Additional Equipment used				
s/n 181474409	Environmental Meter	Fisher Scientific	15-077-963	2021-09-27	2022-09-27
BRF008	1710-1785MHz notch filter, 2W, F_{high} = 9GHz	Micro-Tronics	BRM50713-01	2022-02-17	2023-02-17
BRF011	2.495-2.690GHz notch filter, 2W, F_{high} = 18GHz	Micro-Tronics	BRM50709-01	2022-02-17	2023-02-17
213025	Wideband Radio Communications Tester	Rohde and Schwartz	CMW500	2021-11-18	2022-11-18
HPF012	1GHz high-pass filter, 2W, F_{high} =18GHz	Micro-Tronics	HPM18129	2022-02-17	2023-02-17
BRF001	900MHz notch filter, 2W, F_{high} =6GHz	Micro-Tronics	BRM50706	2021-07-22	2022-07-22

Test Equipment Used - Radiated Disturbance Emissions Test Equipment (Morrisville – Chamber 4) by 86150 02/28/2022

Equip. ID	Description	Manufacturer/Brand	Model Number	Last Cal.	Next Cal.
	1-18 GHz				
206211	Double-Ridged Waveguide Horn Antenna, 1 to 18 GHz	ETS Lindgren	3117	2021-03-11	2022-03-11
	Gain-Loss Chains				
C4-SAC03	Gain-loss string: 1-18GHz	Various	Various	2021-05-07	2022-05-07
	Receiver & Software				
206496	Spectrum Analyzer	Rohde & Schwarz	ESW44	2021-03-09	2022-03-09
SOFTEMI	EMI Software	UL	Version 9.5 (18 Oct 2021)		
	Additional Equipment used				
210642	Environmental Meter	Fisher Scientific	210701942	2021-8-16	2023-08-16
	Wideband Radio Communications Tester	Rohde and Schwartz	CMW500		
BRF011	2.495-2.690GHz notch filter, 2W, F_{high} = 18GHz	Micro-Tronics	BRM50709-01	2022-02-17	2023-02-17
BRF010	1.85-1.97GHz notch filter, 2W, F_{high} = 9GHz	Micro-Tronics	BRM50714-01	2022-02-17	2023-02-17
BRF008	1710-1785MHz notch filter, 2W, F_{high} = 9GHz	Micro-Tronics	BRM50713-01	2022-02-17	2023-02-17
HPF012	1GHz high-pass filter, 2W, F_{high} =18GHz	Micro-Tronics	HPM18129	2022-02-17	2023-02-17
213025	Wideband Radio Communications Tester	Rohde and Schwartz	CMW500	2021-11-18	2022-11-18

Test Equipment Used - Radiated Disturbance Emissions Test Equipment (RTP – Chamber A)

Equip. ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
AT0059	**Active Loop Antenna**	EMCO	6502	2021-09-24	2029-09-24
	Gain-Loss Chains				
SAC_E_LR (Loop & Rod 3m location)	Gain-Loss string for loop/rod antenna at 3m **200697 included in String**	Various	Various	2021-08-03	2022-08-03
200697	Cable	UL		2021-08-02	2022-08-02
	Receiver & Software				
SA0016	Spectrum Analyzer	Agilent	PXA N9030A	2021-12-06	2022-12-06
SOFTEMI	EMI Software	UL	Version 9.5	NA	NA
	Additional Equipment used				
207229	Temp/Humid/Pressure Meter	Extech	SD700	2021-04-20	2022-04-20
20870	Wideband Radio Communications Tester	Rohde and Schwartz	CMW500	2021-04-26	2022-04-26

Test Equipment Used - Radiated Disturbance Emissions Test Equipment (Morrisville – Chamber 1)

Equip. ID	Description	Manufacturer/Brand	Model Number	Last Cal.	Next Cal.
	0.009-30MHz				
AT0037	Passive Loop Antenna	Electro-Metrics	EM-6871	2021-07-20	2022-07-10
	30-1000 MHz				
AT0081	Hybrid Broadband Antenna	Sunol Sciences Corp.	JB3	2021-12-08	2022-12-08
	1-18 GHz				
AT0067	Double-Ridged Waveguide Horn Antenna, 1 to 18 GHz	ETS Lindgren	3117	2021-05-13	2022-05-13
	18-40 GHz				
AT0063	Horn Antenna, 18-26.5GHz	ARA	MWH-1826/B	2021-11-04	2022-11-04
AT006	Horn Antenna, 26-40GHz	ARA	MWH-2640/B	2021-11-04	2022-11-04
	Gain-Loss Chains				
C1-SAC01	Gain-loss string: 0.009-30MHz	Various	Various	2021-07-20	2022-07-20
C1-SAC02	Gain-loss string: 25-1000MHz	Various	Various	2021-07-20	2022-07-20
C1-SAC03	Gain-loss string: 1-18GHz	Various	Various	2021-07-20	2022-07-20
C1-SAC04	Gain-loss string: 18-40GHz	Various	Various	2021-07-20	2022-07-20
	Receiver & Software				
197954	Spectrum Analyzer	Rohde & Schwarz	ESW44	2021-03-30	2022-03-30
SOFTEMI	EMI Software	UL	Version 9.5 (18 Oct 2021)		
	Additional Equipment used				
s/n 200037610	Environmental Meter	Fisher Scientific	06-662-4	2020-01-22	2022-01-22
s/n 181474341	Environmental Meter	Fisher Scientific	15-077-963	2021-09-27	2022-09-27
212967	Wideband Radio Communications Tester	Rohde and Schwartz	CMW500	2021-11-15	2022-11-15
HPF012	1GHz high-pass filter, 2W, F_{high} =18GHz	Micro-Tronics	HPM18129	2022-02-17	2023-02-17
BRF011	2.495-2.690GHz notch filter, 2W, Fhigh = 18GHz	Micro-Tronics	BRM50709-01	2022-02-17	2023-02-17
BRF001	900MHz notch filter, 2W, F_{high} =6GHz	Micro-Tronics	BRM50706	2021-07-22	2022-07-22
HPF010	3GHz high-pass filter, 2W, F_{high} =18GHz	Micro-Tronics	HPM17543	2022-02-17	2023-02-17

Test Equipment Used - Wireless Conducted A Fremont Equipment List

Equipment ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
	Common Equipment				
	Conducted Room 2				
80396	Spectrum Analyzer	Keysight Technologies	PXA	2022-02-01	2023-02-01
85943	Wideband Radio Communication Tester	Rohde & Schwarz	CMW500	2022-02-20	2023-02-23
T1136	Directional Coupler	Mini-Circuits	ZUDC10-183+	2021-09-23	2022-09-23
PRE0179234	DC Regulated Power Supply	Keysight	XT15-4	NA	NA
SOFTEMI	Antenna Port Software	UL	Version 2021.11.03	NA	NA

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.

9. RF OUTPUT POWER VERIFICATION

9.1. LTE

CONDUCTED OUTPUT POWER MEASUREMENT PROCEDURE

All LTE bands conducted average power is obtained from the CMW500 telecommunication test set.
The following tests were conducted according to the test requirements outlined in section 6.2 of the 3GPP TS136.101 specification.
UE Power Class: 3 (23 +/- 2dBm). Band 41 UE Power Class: 2 (26 +/-2 dBm).The allowed Maximum Power Reduction (MPR) for the maximum output power due to higher order modulation and transmit bandwidth configuration (resource blocks) is specified in Table 6.2.3-1 of the 3GPP TS136.101.

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

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

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

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

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

RESULTS

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

9.1.1. OUTPUT POWER FOR LTE17 (5MHz)

Test Engineer ID:	20794	Test Date:	2022-01-31

BW (MHz)	Mode	RB Allocation	RB offset	Maximum Average Power (dBm)			MPR	Tune-up Limit
				23755	23790	23825		
				705 MHz	710 MHz	715 MHz		
5 MHz	QPSK	1	0	21.6	21.7	21.7	0	22
		1	12	21.6	21.7	21.7	0	22
		1	24	21.5	21.6	21.6	0	22
		12	0	21.6	21.6	21.6	0	22
		12	7	21.6	21.6	21.6	0	22
		12	13	21.6	21.6	21.6	0	22
		25	0	21.6	21.6	21.6	0	22
	16QAM	1	0	22.0	22.0	22.1	0	22
		1	12	21.9	22.0	22.1	0	22
		1	24	21.9	21.9	21.9	0	22
		12	0	21.6	21.6	21.8	0	22
		12	7	21.6	21.6	21.7	0	22
		12	13	21.6	21.6	21.7	0	22
		25	0	21.7	21.6	21.6	0	22
	64QAM	1	0	22.0	22.0	22.0	0	22
		1	12	21.9	22.0	21.9	0	22
		1	24	21.9	21.9	21.8	0	22
		12	0	21.4	21.5	21.6	0	22
		12	7	21.5	21.5	21.5	0	22
		12	13	21.4	21.5	21.5	0	22
		25	0	21.5	21.5	21.5	0	22

9.1.2. OUTPUT POWER FOR LTE17 (10MHz)

Test Engineer ID:	20794	Test Date:	2022-01-31

BW (MHz)	Mode	RB Allocation	RB offset	Maximum Average Power (dBm)				
				23780	23790 710 MHz	23800	MPR	Tune-up Limit
10 MHz	QPSK	1	0	21.6	21.6	21.6	0	22
		1	25	21.7	21.6	21.6	0	22
		1	49	21.6	21.6	21.6	0	22
		25	0	21.6	21.6	21.6	0	22
		25	12	21.7	21.6	21.6	0	22
		25	25	21.6	21.6	21.6	0	22
		50	0	21.6	21.6	21.6	0	22
	16QAM	1	0	21.9	22.0	21.9	0	22
		1	25	21.9	22.0	21.9	0	22
		1	49	21.9	22.0	21.9	0	22
		25	0	21.7	21.7	21.6	0	22
		25	12	21.6	21.6	21.6	0	22
		25	25	21.7	21.6	21.6	0	22
		50	0	21.6	21.6	21.6	0	22
	64QAM	1	0	21.8	21.8	21.8	0	22
		1	25	21.9	21.9	21.8	0	22
		1	49	21.8	21.8	21.8	0	22
		25	0	21.5	21.5	21.5	0	22
		25	12	21.5	21.5	21.5	0	22
		25	25	21.5	21.5	21.5	0	22
		50	0	21.5	21.5	21.5	0	22

9.2. WCDMA

TEST PROCEDURE

The transmitter output was connected to the input terminal of Directional Coupler via calibrated coaxial cable. The output coupling terminal of the Directional Coupler was directly connected to a spectrum analyzer while the output through terminal connected to the communication test set via calibrated coaxial cable.

The output power was measured with the spectrum analyzer at the low, middle and high channel in each band.

- Set the spectrum analyzer span wide enough or greater than the modulated signal BW.
- Set a spectrum analyzer at peak detection mode with VBW ≥ RBW.≥ 26dB BW, typically 5MHz.
- Set a marker to point the corresponding peak value.

REL 99

The following tests were completed according to the test requirements outlined in section 5.2 of the 3GPP TS34.121-1 specification. The DUT supports power Class 3, which has a nominal maximum output power of 24 dBm (+1.7/-3.7).

Mode	Subtest	Rel99
WCDMA General Settings	Loopback Mode	Test Mode 2
	Rel99 RMC	12.2kbps RMC
	Power Control Algorithm	Algorithm2
	βc/βd	8/15

HSDPA REL 5

The following 4 Sub-tests were completed according to Release 5 procedures in table C.10.1.4 of 3GPP TS 34.121-1 A summary of these settings are illustrated below:

Table C.10.1.4: β values for transmitter characteristics tests with HS-DPCCH

Sub-test	β_c	β_d	β_d (SF)	β_c/β_d	β_{HS} (Note1, Note 2)	CM (dB) (Note 3)	MPR (dB) (Note 3)
1	2/15	15/15	64	2/15	4/15	0.0	0.0
2	12/15 (Note 4)	15/15 (Note 4)	64	12/15 (Note 4)	24/15	1.0	0.0
3	15/15	8/15	64	15/8	30/15	1.5	0.5
4	15/15	4/15	64	15/4	30/15	1.5	0.5

Note 1: Δ_{ACK}, Δ_{NACK} and Δ_{CQI} = 30/15 with β_{hs} = 30/15 * β_c.

Note 2: For the HS-DPCCH power mask requirement test in clause 5.2C, 5.7A, and the Error Vector Magnitude (EVM) with HS-DPCCH test in clause 5.13.1A, and HSDPA EVM with phase discontinuity in clause 5.13.1AA, Δ_{ACK} and Δ_{NACK} = 30/15 with β_{hs} = 30/15 * β_c, and Δ_{CQI} = 24/15 with β_{hs} = 24/15 * β_c.

Note 3: CM = 1 for β_c/β_d =12/15, β_{hs}/β_c=24/15. For all other combinations of DPDCH, DPCCH and HS-DPCCH the MPR is based on the relative CM difference. This is applicable for only UEs that support HSDPA in release 6 and later releases.

Note 4: For subtest 2 the β_c/β_d ratio of 12/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signalled gain factors for the reference TFC (TF1, TF1) to β_c = 11/15 and β_d = 15/15.

HSPA REL 6 (HSDPA & HSUPA)

The following 5 Sub-tests were completed according to Release 6 procedures in table C.11.1.3 of 3GPP TS 34.121-1. A summary of these settings are illustrated below:

Table C.11.1.3: β values for transmitter characteristics tests with HS-DPCCH and E-DCH

Sub-test	β_c	β_d	β_d (SF)	β_c/β_d	β_{HS} (Note1)	β_{ec}	β_{ed} (Note 4) (Note 5)	β_{ed} (SF)	β_{ed} (Codes)	CM (dB) (Note 2)	MPR (dB) (Note 2) (Note 6)	AG Index (Note 5)	E-TFCI
1	11/15 (Note 3)	15/15 (Note 3)	64	11/15 (Note 3)	22/15	209/225	1309/225	4	1	1.0	0.0	20	75
2	6/15	15/15	64	6/15	12/15	12/15	94/75	4	1	3.0	2.0	12	67
3	15/15	9/15	64	15/9	30/15	30/15	$\beta_{ed}1$: 47/15 $\beta_{ed}2$: 47/15	4 4	2	2.0	1.0	15	92
4	2/15	15/15	64	2/15	4/15	2/15	56/75	4	1	3.0	2.0	17	71
5	15/15	0	-	-	5/15	5/15	47/15	4	1	1.0	0.0	12	67

Note 1: For sub-test 1 to 4, Δ_{ACK}, Δ_{NACK} and Δ_{CQI} = 30/15 with β_{hs} = 30/15 * β_c . For sub-test 5, Δ_{ACK}, Δ_{NACK} and Δ_{CQI} = 5/15 with β_{hs} = 5/15 * β_c .

Note 2: CM = 1 for β_c/β_d =12/15, β_{hs}/β_c=24/15. For all other combinations of DPDCH, DPCCH, HS- DPCCH, E-DPDCH and E-DPCCH the MPR is based on the relative CM difference.

Note 3: For subtest 1 the β_c/β_d ratio of 11/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signalled gain factors for the reference TFC (TF1, TF1) to β_c = 10/15 and β_d = 15/15.

Note 4: In case of testing by UE using E-DPDCH Physical Layer category 1, Sub-test 3 is omitted according to TS25.306 Table 5.1g.

Note 5: β_{ed} can not be set directly; it is set by Absolute Grant Value.

Note 6: For subtests 2, 3 and 4, UE may perform E-DPDCH power scaling at max power which could results in slightly smaller MPR values.

DUAL CARRIER HSDPA (DC-HSDPA (REL 8, CAT 24)

The following 4 Sub-tests were for DC-HSDPA were completed according to Release 8 procedures in table C08.1.12 of 3GPP TS 34.121-1. A summary of these settings are illustrated below:

Table C.8.1.12: Fixed Reference Channel H-Set 12

Parameter	Unit	Value
Nominal Avg. Inf. Bit Rate	kbps	60
Inter-TTI Distance	TTI's	1
Number of HARQ Processes	Processes	6
Information Bit Payload (N_{INF})	Bits	120
Number Code Blocks	Blocks	1
Binary Channel Bits Per TTI	Bits	960
Total Available SML's in UE	SML's	19200
Number of SML's per HARQ Proc.	SML's	3200
Coding Rate		0.15
Number of Physical Channel Codes	Codes	1
Modulation		QPSK
Note 1: The RMC is intended to be used for DC-HSDPA mode and both cells shall transmit with identical parameters as listed in the table. Note 2: Maximum number of transmission is limited to 1, i.e., retransmission is not allowed. The redundancy and constellation version 0 shall be used.		

HSPA+ REL 7

The following 1 Sub-test was completed according to Release 7 procedures in table C.11.1.4 of 3GPP TS34.121. A summary of these settings are illustrated below:

Table C.11.1.4: **β values for transmitter characteristics tests with HS-DPCCH and E-DCH with 16QAM**

Sub-test	β_c (Note3)	β_d	β_{HS} (Note1)	β_{ec}	β_{ed} (2xSF2) (Note 4)	β_{ed} (2xSF4) (Note 4)	CM (dB) (Note 2)	MPR (dB) (Note 2)	AG Index (Note 4)	E-TFCI (Note 5)	E-TFCI (boost)
1	1	0	30/15	30/15	$\beta_{ed}1$: 30/15 $\beta_{ed}2$: 30/15	$\beta_{ed}3$: 24/15 $\beta_{ed}4$: 24/15	3.5	2.5	14	105	105

Note 1: Δ_{ACK}, Δ_{NACK} and Δ_{CQI} = 30/15 with β_{hs} = 30/15 * β_c.
Note 2: CM = 3.5 and the MPR is based on the relative CM difference, MPR = MAX(CM-1,0).
Note 3: DPDCH is not configured, therefore the β_c is set to 1 and β_d = 0 by default.
Note 4: β_{ed} can not be set directly; it is set by Absolute Grant Value.
Note 5: All the sub-tests require the UE to transmit 2SF2+2SF4 16QAM EDCH and they apply for UE using E-DPDCH category 7. E-DCH TTI is set to 2ms TTI and E-DCH table index = 2. To support these E-DCH configurations DPDCH is not allocated. The UE is signalled to use the extrapolation algorithm.

RESULT

9.2.1. WCDMA BAND 2

Test Engineer ID:	27556	Test Date:	2022-03-01

Mode		UL Ch No.	Freq. (MHz)	Maximum Average Power (dBm)		
				Measured Pwr	MPR	Tune-up Limit
Release 99	Rel 99 (RMC, 12.2 kbps)	9262	1852.4	19.5	N/A	19.7
		9400	1880.0	19.7		
		9538	1907.6	19.6		
HSDPA	Subtest 1	9262	1852.4	18.5	0	19.0
		9400	1880.0	18.7		
		9538	1907.6	18.6		
	Subtest 2	9262	1852.4	18.4	0	19.0
		9400	1880.0	18.6		
		9538	1907.6	18.5		
	Subtest 3	9262	1852.4	17.9	0.5	18.5
		9400	1880.0	18.1		
		9538	1907.6	18.0		
	Subtest 4	9262	1852.4	17.9	0.5	18.5
		9400	1880.0	18.1		
		9538	1907.6	18.0		
HSUPA	Subtest 1	9262	1852.4	18.5	0	19.0
		9400	1880.0	18.6		
		9538	1907.6	18.6		
	Subtest 2	9262	1852.4	16.5	2	17.0
		9400	1880.0	16.7		
		9538	1907.6	16.6		
	Subtest 3	9262	1852.4	17.5	1	18.0
		9400	1880.0	17.7		
		9538	1907.6	17.6		
	Subtest 4	9262	1852.4	16.5	2	17.0
		9400	1880.0	16.7		
		9538	1907.6	16.6		
	Subtest 5	9262	1852.4	18.6	0	19.0
		9400	1880.0	18.7		
		9538	1907.6	18.6		

9.2.2. WCDMA BAND 4

Test Engineer ID:	27556	Test Date:	2022-03-01

Mode		UL Ch No.	Freq. (MHz)	Maximum Average Power (dBm)		
				Measured Pwr	MPR	Tune-up Limit
Release 99	Rel 99 (RMC, 12.2 kbps)	1312	1712.4	19.7	N/A	19.7
		1413	1732.6	19.6		
		1513	1752.6	19.6		
HSDPA	Subtest 1	1312	1712.4	18.6	0	19.0
		1413	1732.6	18.7		
		1513	1752.6	18.5		
	Subtest 2	1312	1712.4	18.7	0	19.0
		1413	1732.6	18.7		
		1513	1752.6	18.6		
	Subtest 3	1312	1712.4	18.2	0.5	18.5
		1413	1732.6	18.2		
		1513	1752.6	18.1		
	Subtest 4	1312	1712.4	18.2	0.5	18.5
		1413	1732.6	18.1		
		1513	1752.6	18.1		
HSUPA	Subtest 1	1312	1712.4	18.6	0	19.0
		1413	1732.6	18.6		
		1513	1752.6	18.6		
	Subtest 2	1312	1712.4	16.6	2	17.0
		1413	1732.6	16.6		
		1513	1752.6	16.5		
	Subtest 3	1312	1712.4	17.7	1	18.0
		1413	1732.6	17.6		
		1513	1752.6	17.5		
	Subtest 4	1312	1712.4	16.7	2	17.0
		1413	1732.6	16.6		
		1513	1752.6	16.5		
	Subtest 5	1312	1712.4	18.7	0	19.0
		1413	1732.6	18.7		
		1513	1752.6	18.7		

10. CONDUCTED TEST RESULTS

10.1. OCCUPIED BANDWIDTH

RULE PART(S)
FCC: §2.1049

LIMITS
For reporting purposes only.

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

RESULTS
There is no limit required and power is the same for low, middle and high channel; therefore, only middle channel was tested.

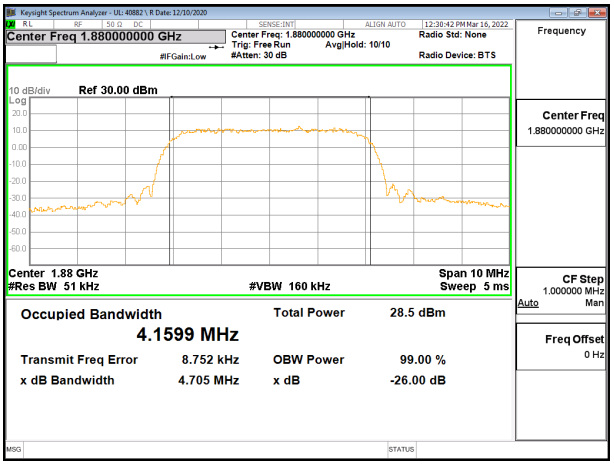
WCDMA

Band	Modulation	Channel	f(MHz)	99% BW (MHz)
BAND2	REL 99	9800	1880.0	4.1599
	HSDPA			4.1451
BAND4	REL 99	1638	1732.6	4.4124
	HSDPA			4.1644

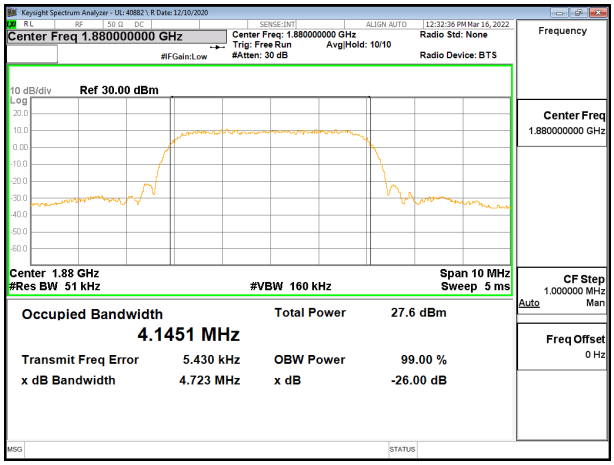
LTE17

Band	Mode	RB Allocation/RB Offset	f(MHz)	99% BW (MHz)
LTE BAND 17	5MHz, QPSK	25/0	710.0	4.4888
	5MHz, 16QAM			4.4891
	10MHz, QPSK	50/0		8.9690
	10MHz, 16QAM			8.9610

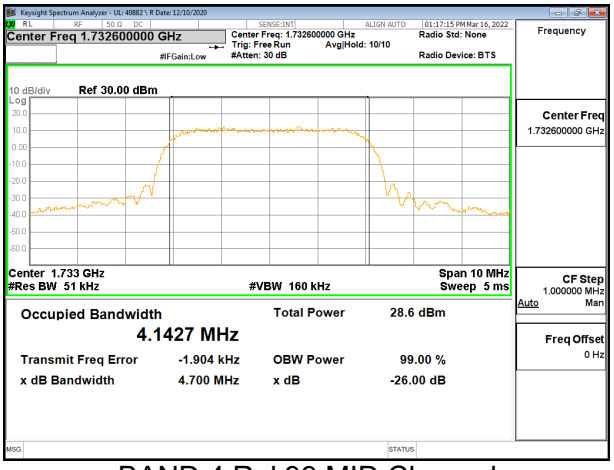
10.1.1. WCDMA



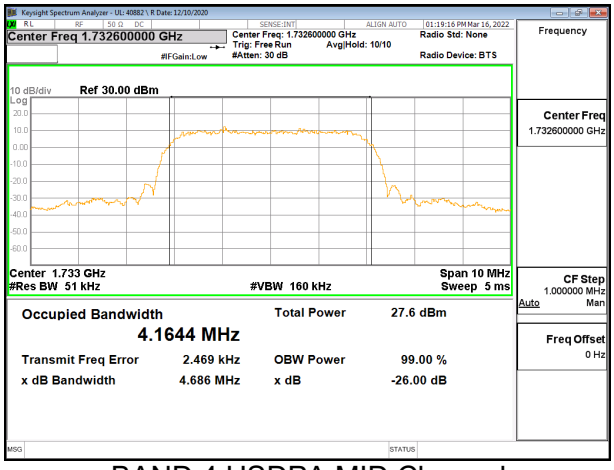
BAND 2 Rel 99 MID Channel



BAND 2 HSDPA MID Channel

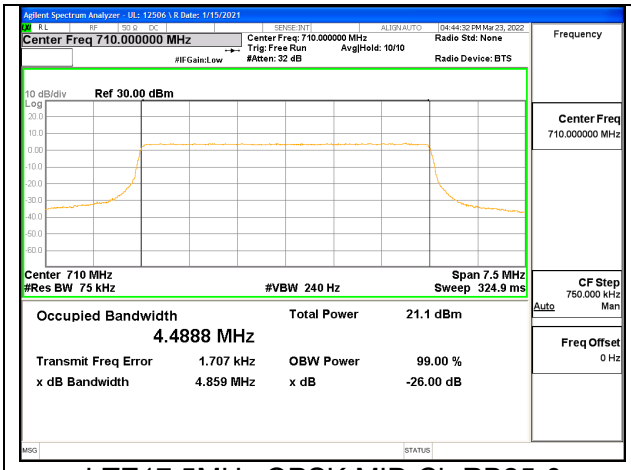


BAND 4 Rel 99 MID Channel

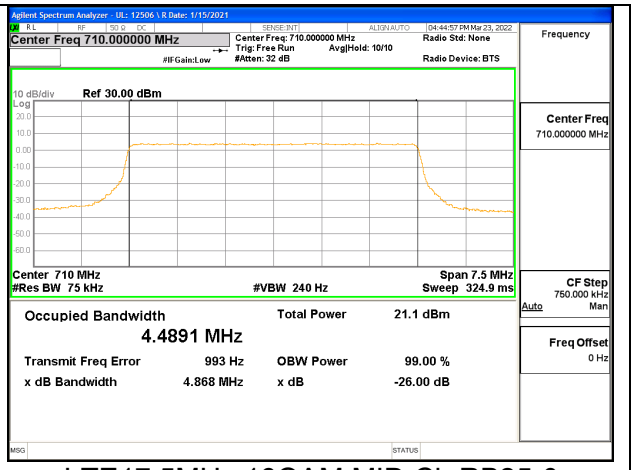


BAND 4 HSDPA MID Channel

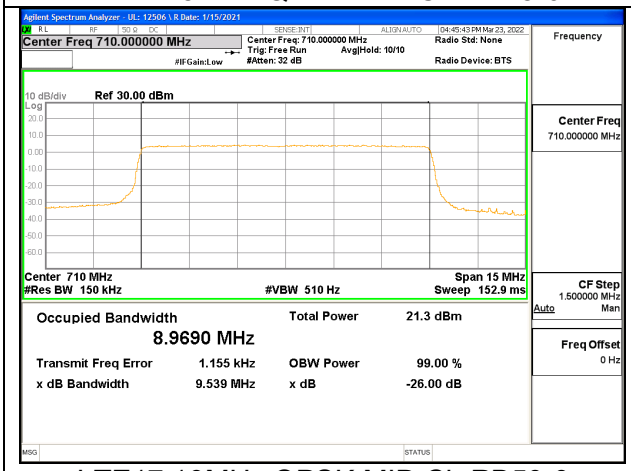
10.1.2. LTE17



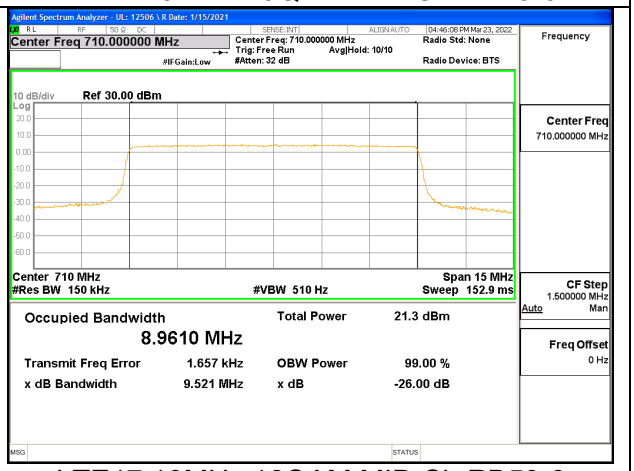
LTE17 5MHz QPSK MID Ch RB25-0



LTE17 5MHz 16QAM MID Ch RB25-0



LTE17 10MHz QPSK MID Ch RB50-0



LTE17 10MHz 16QAM MID Ch RB50-0

10.2. BAND EDGE AND EMISSION MASK

LIMITS

FCC: §22.917, §24.238, §27.53(h)

The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log (P) dB.

TEST PROCEDURE

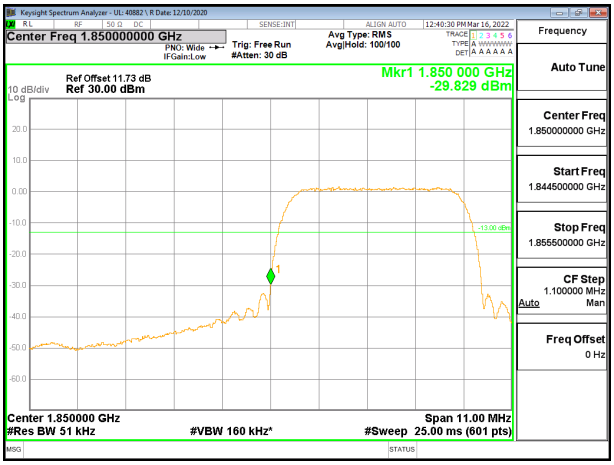
The transmitter output was connected to a R&S CMW500 Test Set and configured to operate at maximum power. The band edge emissions were measured at the required operating frequencies in each band on the Spectrum Analyzer.

For each band edge measurement:

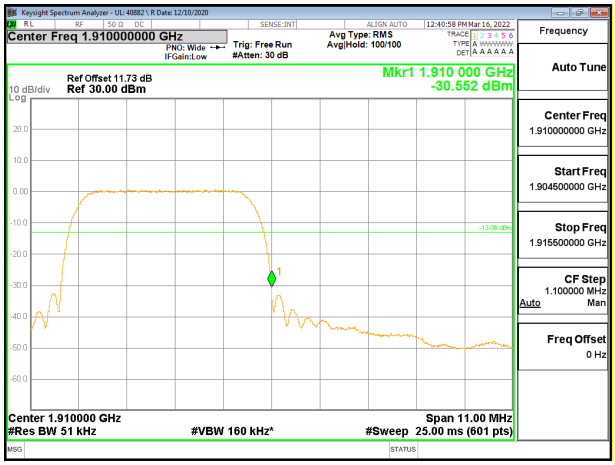
- Set the spectrum analyzer span to include the block edge frequency.
- Set a marker to point the corresponding band edge frequency in each test case.
- Set display line at -13 dBm
- Set resolution bandwidth to at least 1% of emission bandwidth.

RESULTS

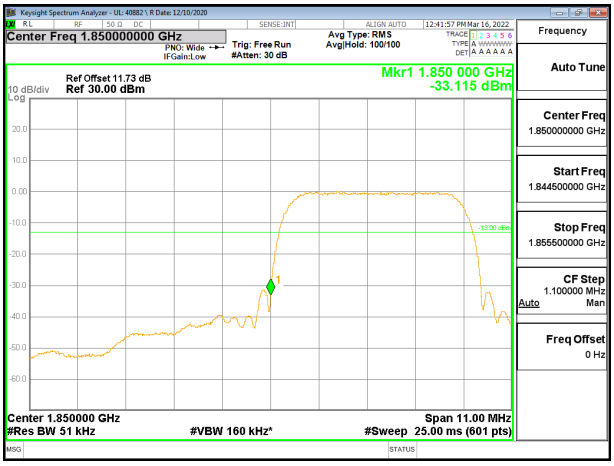
10.2.1. WCDMA BAND 2



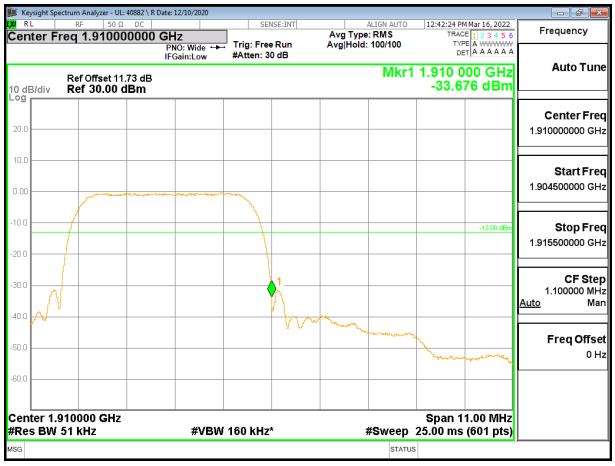
BAND 2 Rel 99 LOW Channel



BAND 2 Rel 99 HIGH Channel

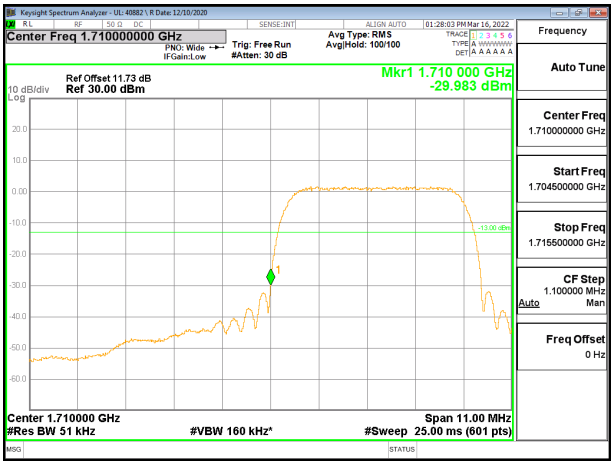


BAND 2 HSDPA LOW Channel

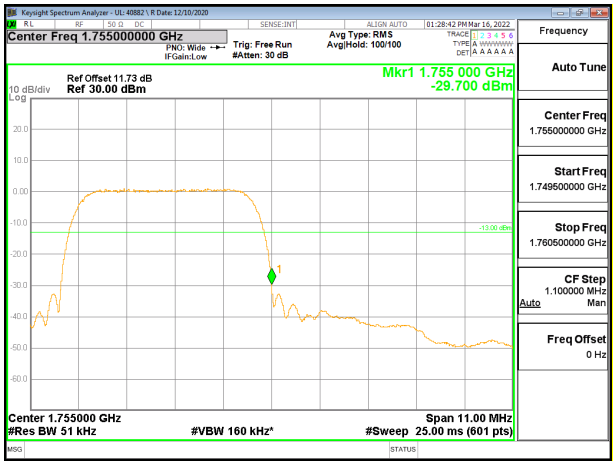


BAND 2 HSDPA HIGH Channel

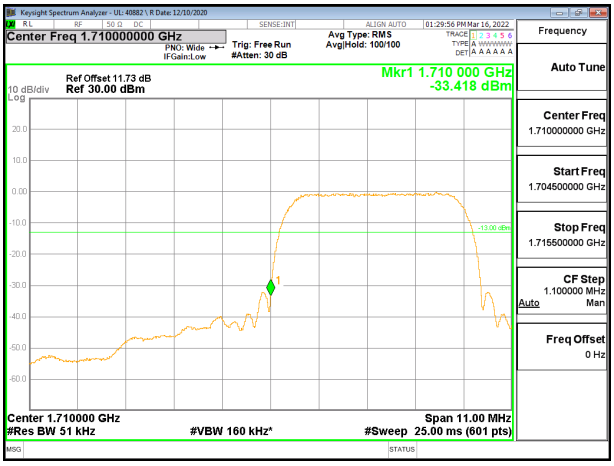
10.2.2. WCDMA BAND 4



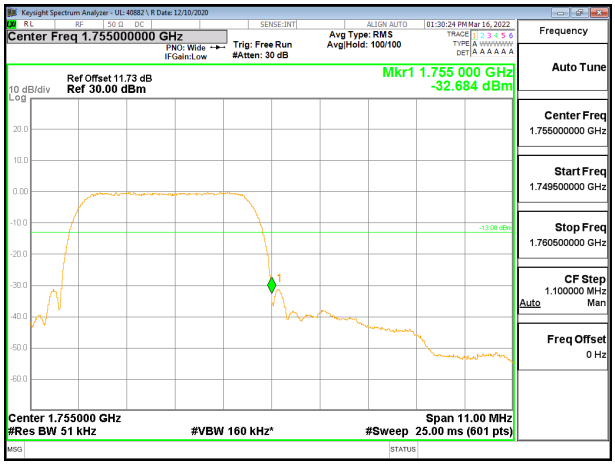
BAND 4 Rel 99 LOW Channel



BAND 4 Rel 99 HIGH Channel



BAND 4 HSDPA LOW Channel

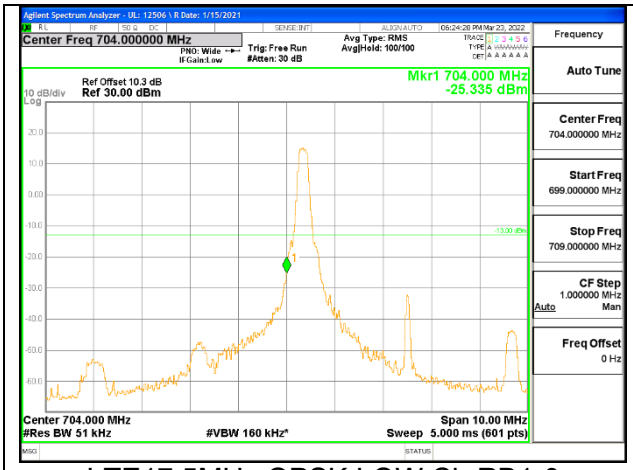


BAND 4 HSDPA HIGH Channel

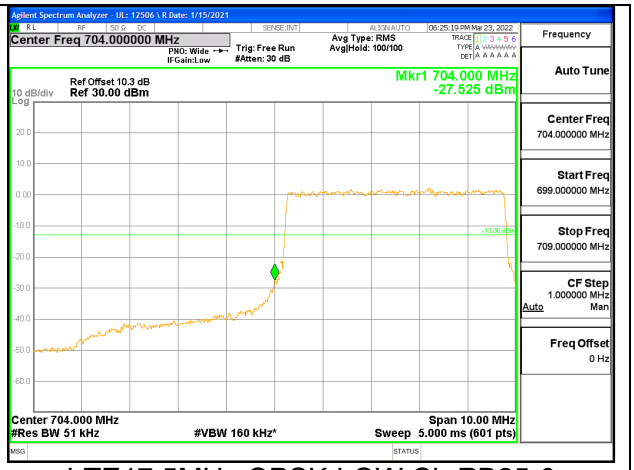
10.2.3. LTE17

LIMITS

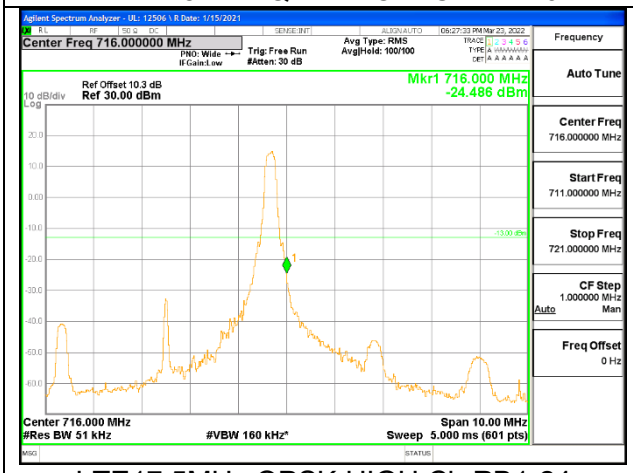
FCC: §27.53
(g) For operations in the 600 MHz band and the 698-746 MHz band, the power of any emission outside a licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, by at least 43 + 10 log (P) dB. Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kilohertz or greater. However, in the 100 kilohertz bands immediately outside and adjacent to a licensee's frequency block, a resolution bandwidth of at least 30 kHz may be employed.



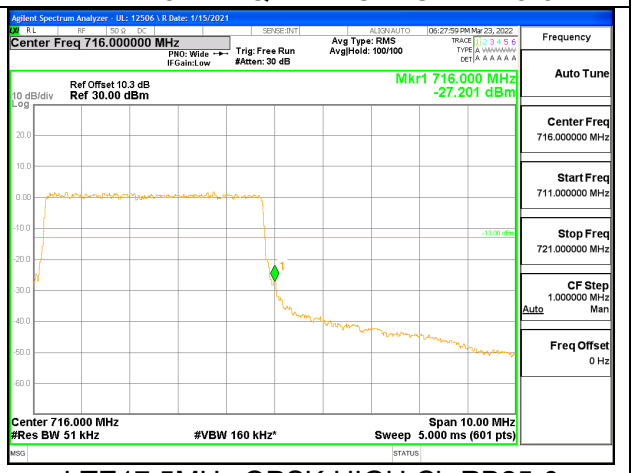
LTE17 5MHz QPSK LOW Ch RB1-0



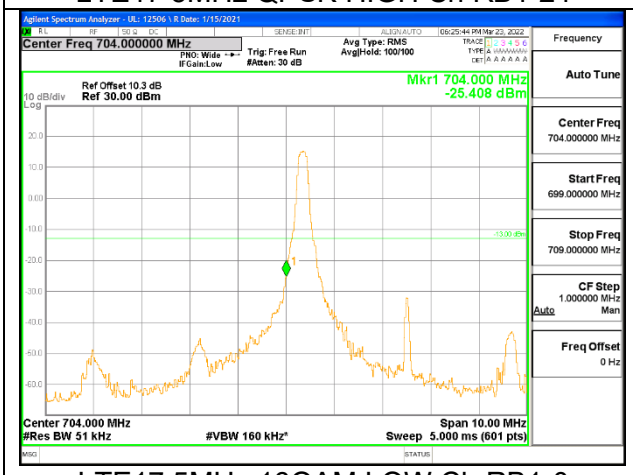
LTE17 5MHz QPSK LOW Ch RB25-0



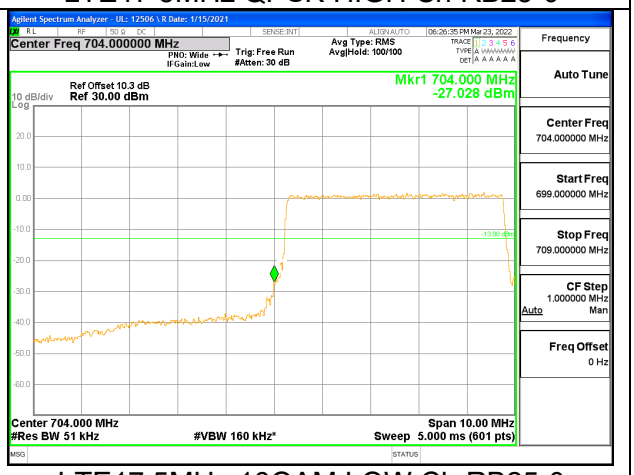
LTE17 5MHz QPSK HIGH Ch RB1-24



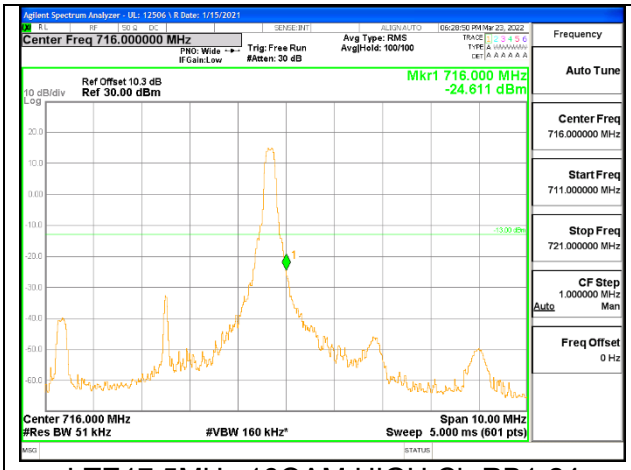
LTE17 5MHz QPSK HIGH Ch RB25-0



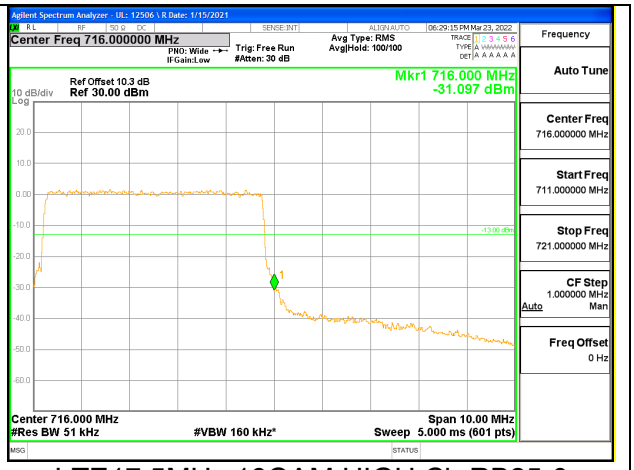
LTE17 5MHz 16QAM LOW Ch RB1-0



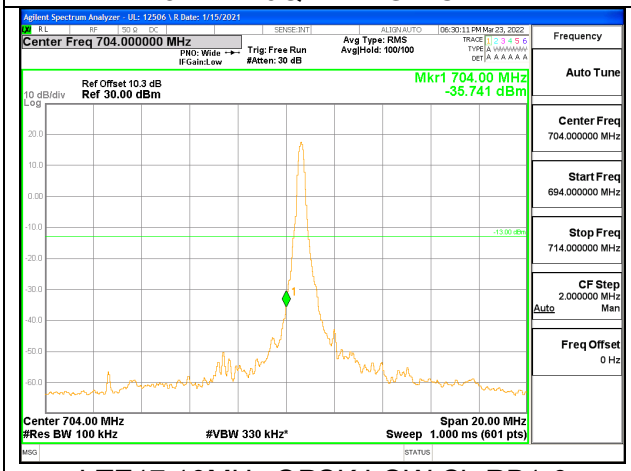
LTE17 5MHz 16QAM LOW Ch RB25-0



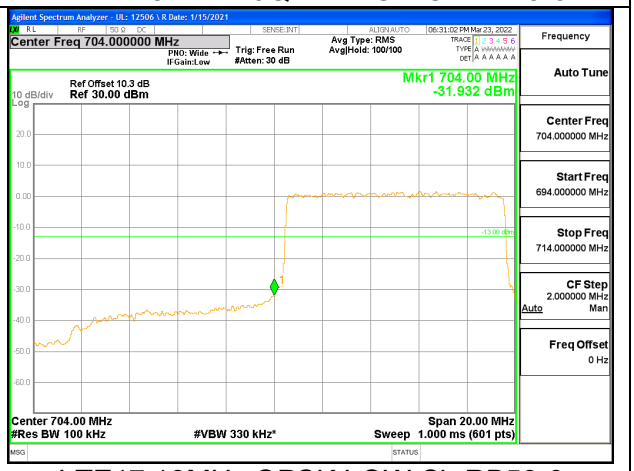
LTE17 5MHz 16QAM HIGH Ch RB1-24



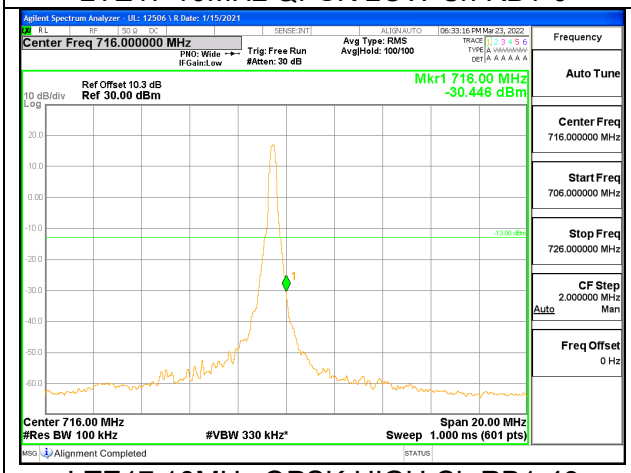
LTE17 5MHz 16QAM HIGH Ch RB25-0



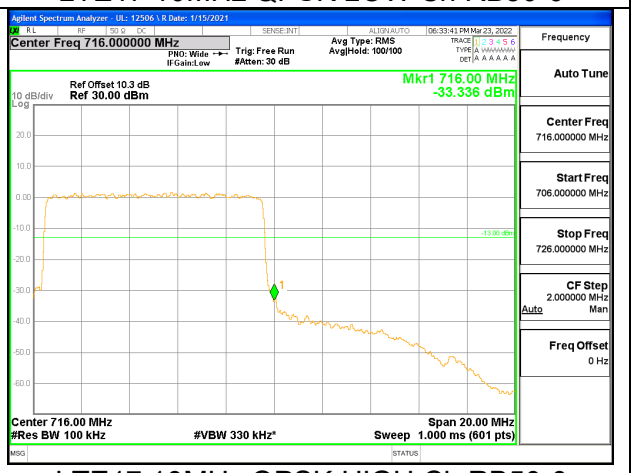
LTE17 10MHz QPSK LOW Ch RB1-0



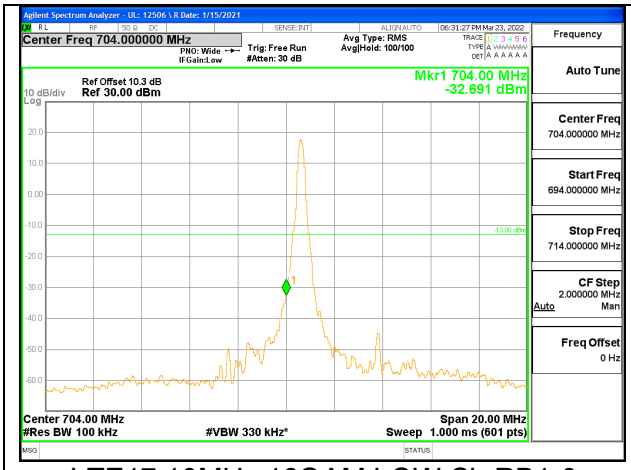
LTE17 10MHz QPSK LOW Ch RB50-0



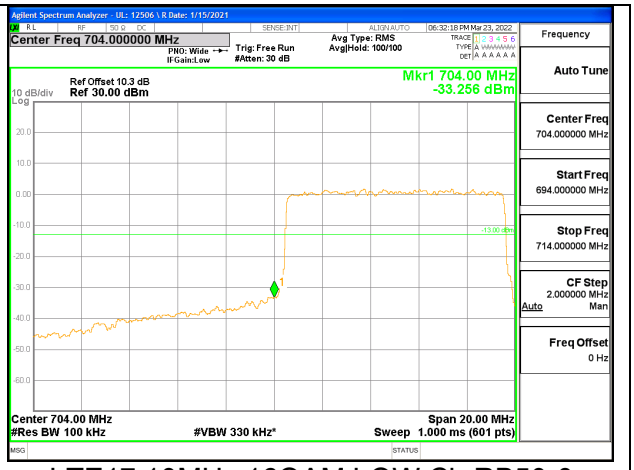
LTE17 10MHz QPSK HIGH Ch RB1-49



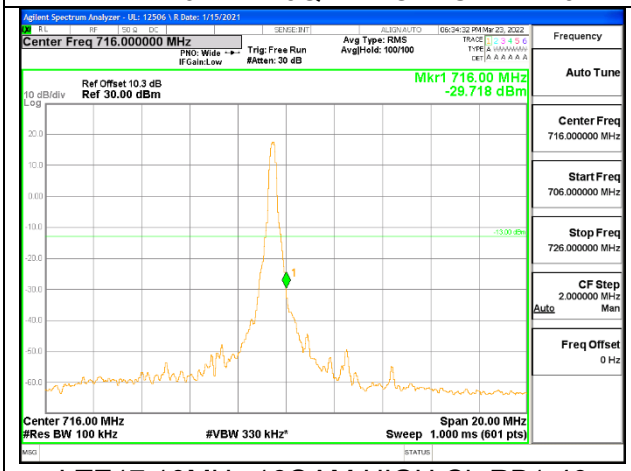
LTE17 10MHz QPSK HIGH Ch RB50-0



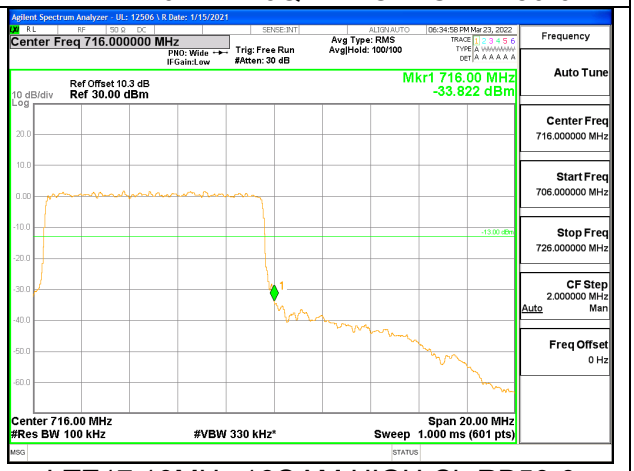
LTE17 10MHz 16QAM LOW Ch RB1-0



LTE17 10MHz 16QAM LOW Ch RB50-0



LTE17 10MHz 16QAM HIGH Ch RB1-49



LTE17 10MHz 16QAM HIGH Ch RB50-0

10.3. OUT OF BAND EMISSIONS

RULE PART(S)
FCC: §2.1051, §22.917, §24.238, §27.53 and §90.691

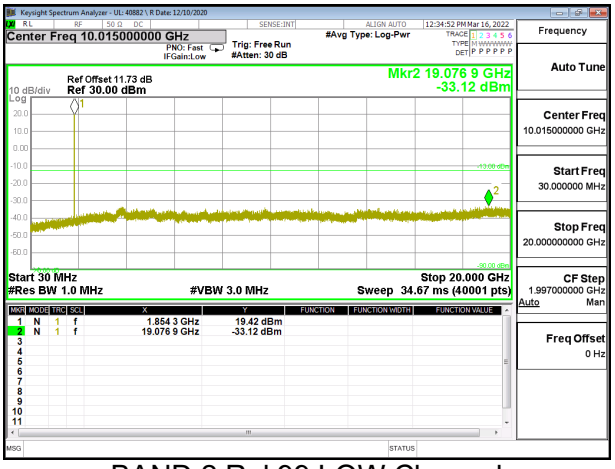
LIMITS
FCC: §22.917, §24.238, §27.53 (h)
The minimum permissible attenuation level of any spurious emissions is 43 + 10 log (P) dB where transmitting power (P) in Watts.

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.

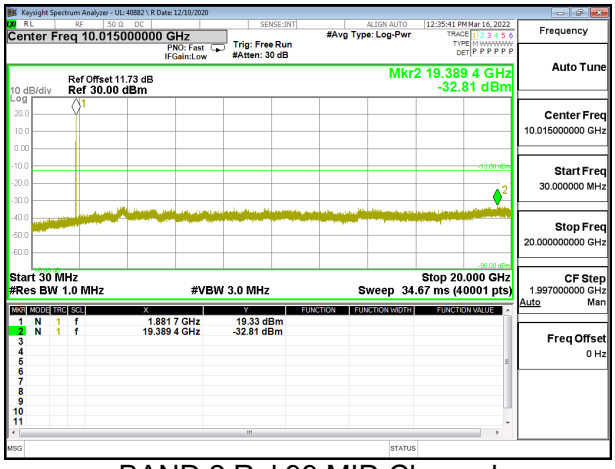
For each out of band emissions measurement:
- Set display line at -13 dBm
- Set RBW & VBW to 100 kHz for the measurement below 1 GHz, and 1 MHz for the measurement above 1 GHz. (NOTE: Worst case set RBW/VBW to 1MHz/3MHz)

RESULTS

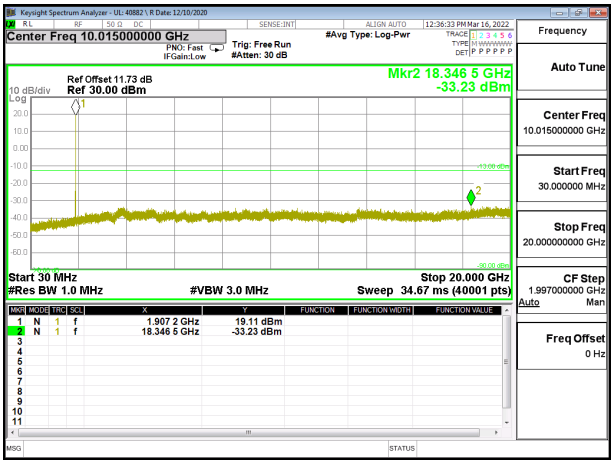
10.3.1. WCDMA BAND 2



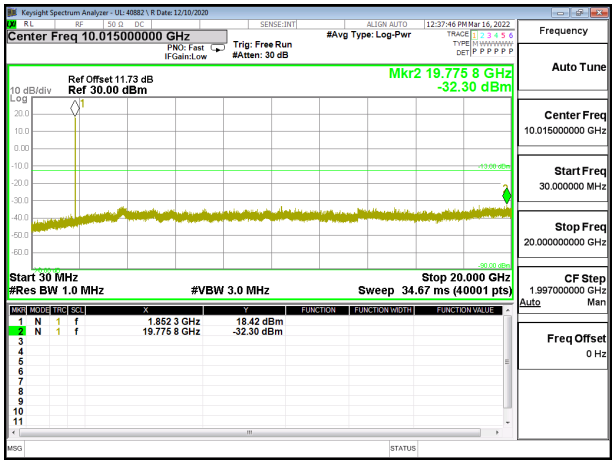
BAND 2 Rel 99 LOW Channel



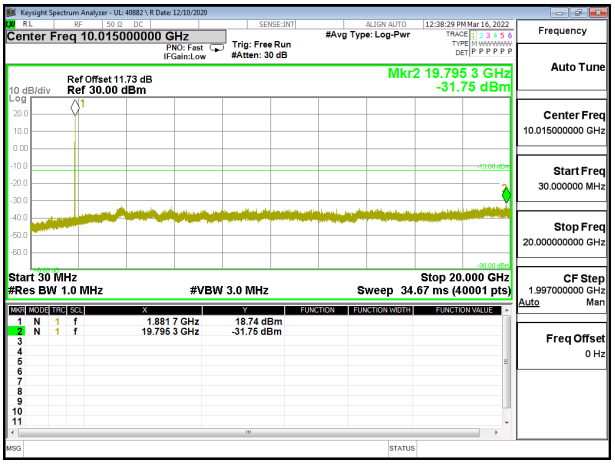
BAND 2 Rel 99 MID Channel



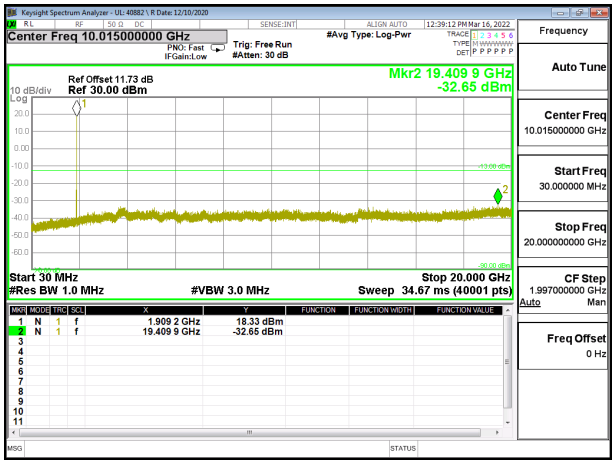
BAND 2 Rel 99 HIGH Channel



BAND 2 HSDPA LOW Channel

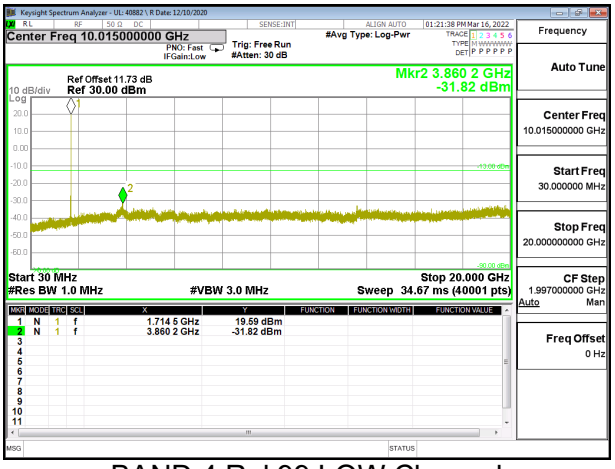


BAND 2 HSDPA MID Channel

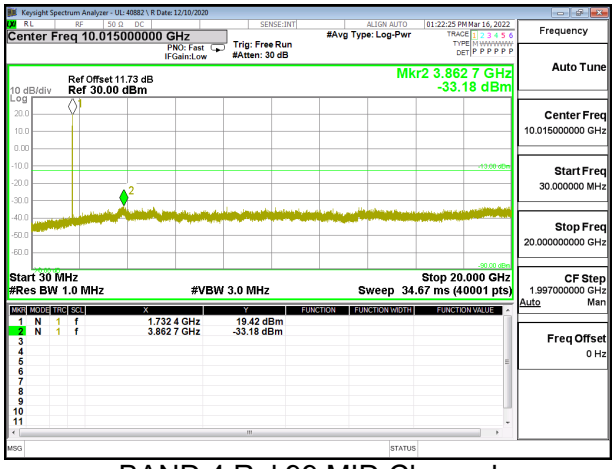


BAND 2 HSDPA HIGH Channel

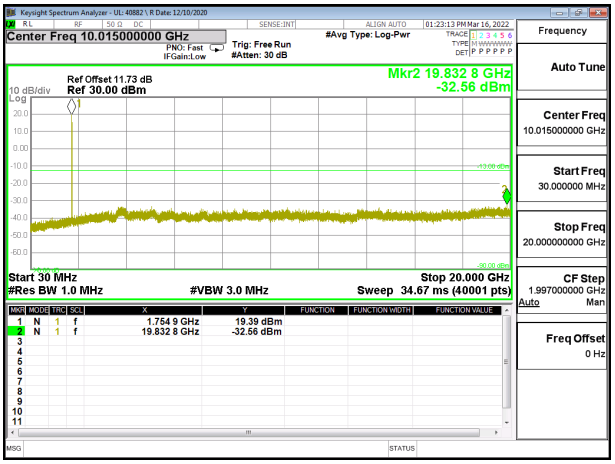
10.3.2. WCDMA BAND 4



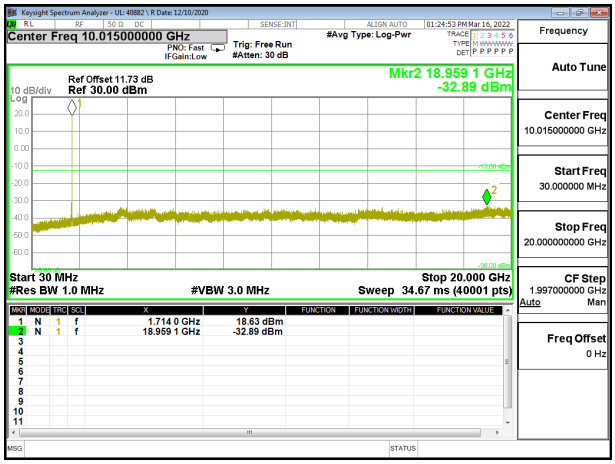
BAND 4 Rel 99 LOW Channel



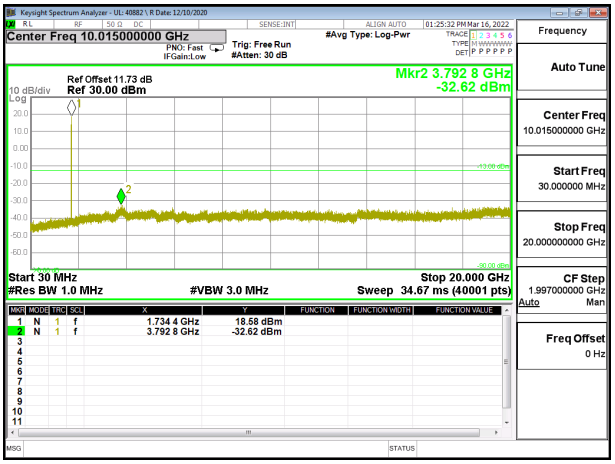
BAND 4 Rel 99 MID Channel



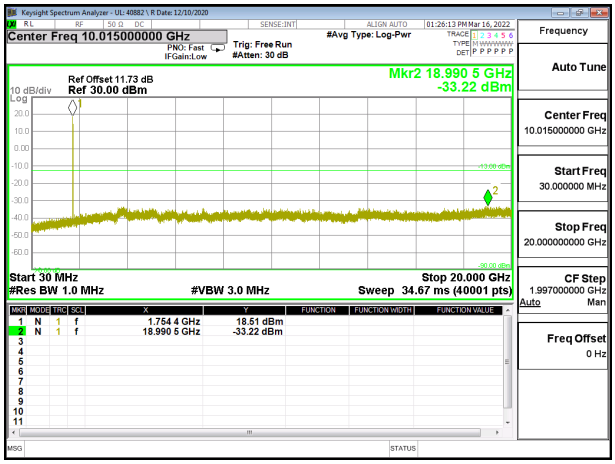
BAND 4 Rel 99 HIGH Channel



BAND 4 HSDPA LOW Channel



BAND 4 HSDPA MID Channel



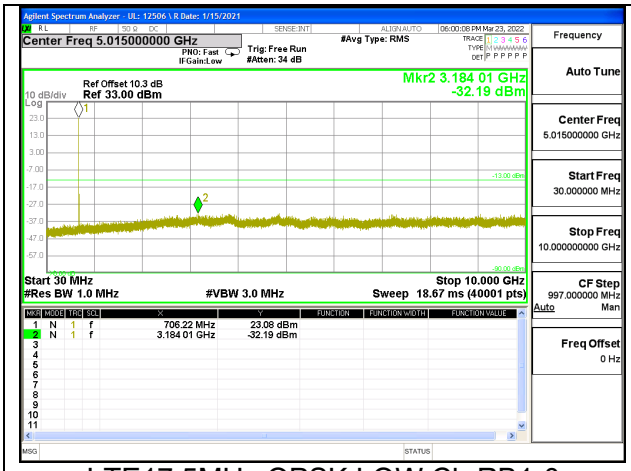
BAND 4 HSDPA HIGH Channel

10.3.3. LTE17

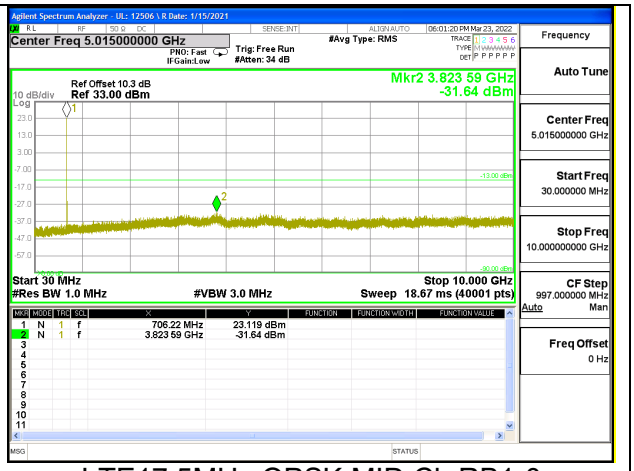
LIMITS

FCC: §27.53 (g)

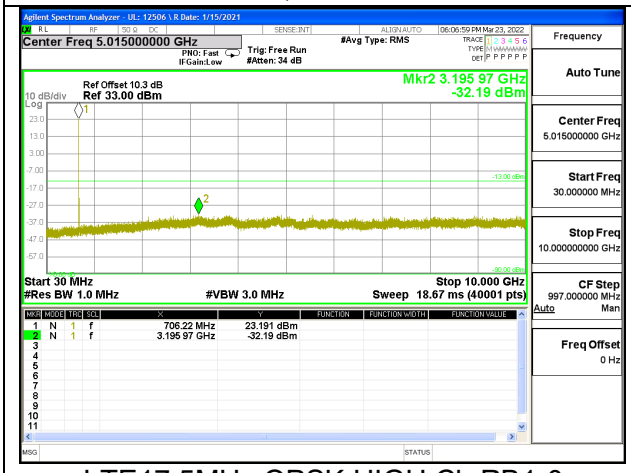
The minimum permissible attenuation level of any spurious emissions is 43 + 10 log (P) dB where transmitting power (P) in Watts.



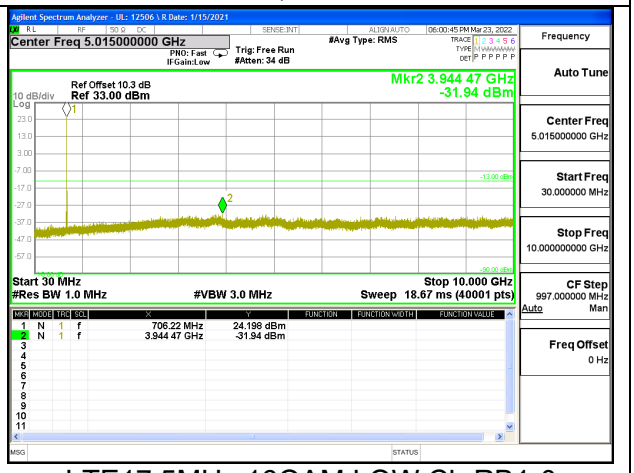
LTE17 5MHz QPSK LOW Ch RB1-0



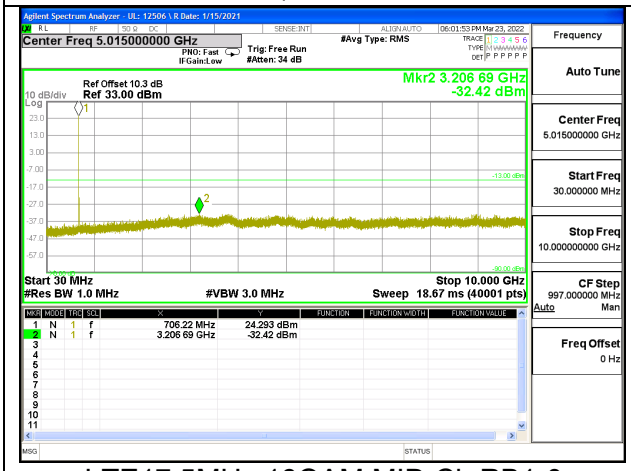
LTE17 5MHz QPSK MID Ch RB1-0



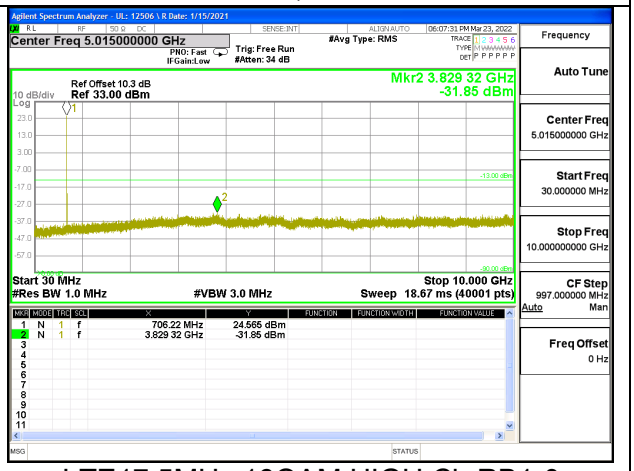
LTE17 5MHz QPSK HIGH Ch RB1-0



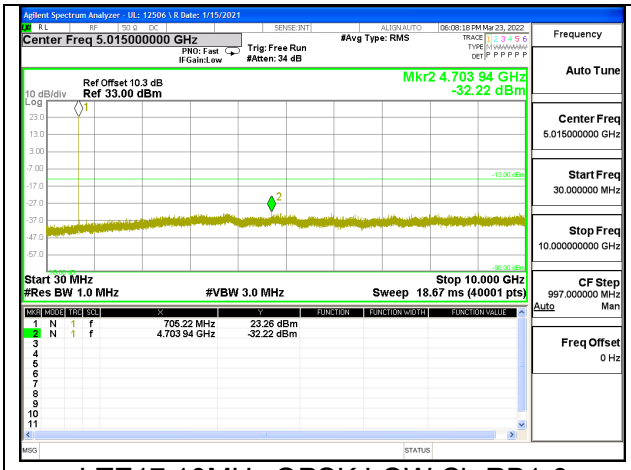
LTE17 5MHz 16QAM LOW Ch RB1-0



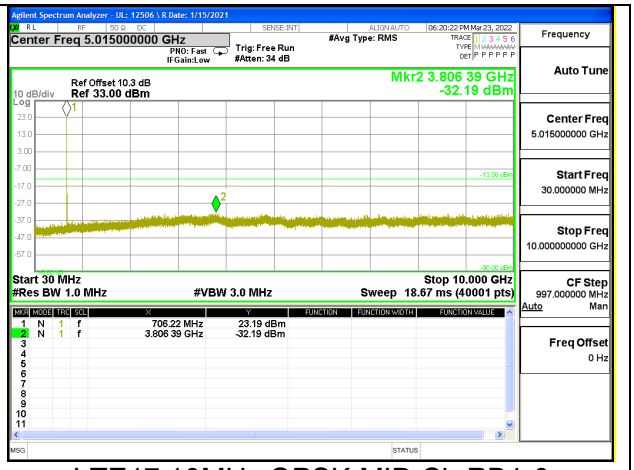
LTE17 5MHz 16QAM MID Ch RB1-0



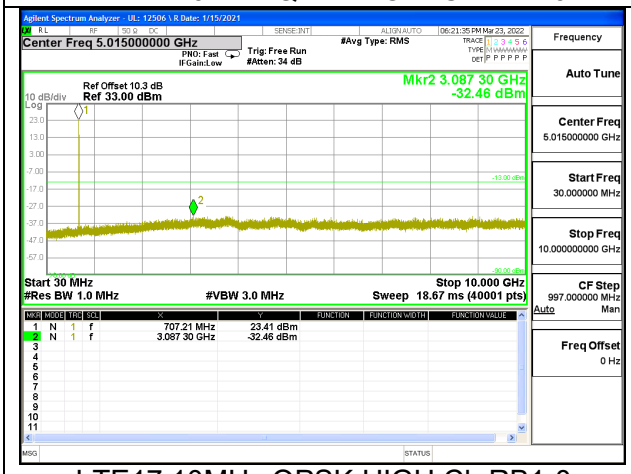
LTE17 5MHz 16QAM HIGH Ch RB1-0



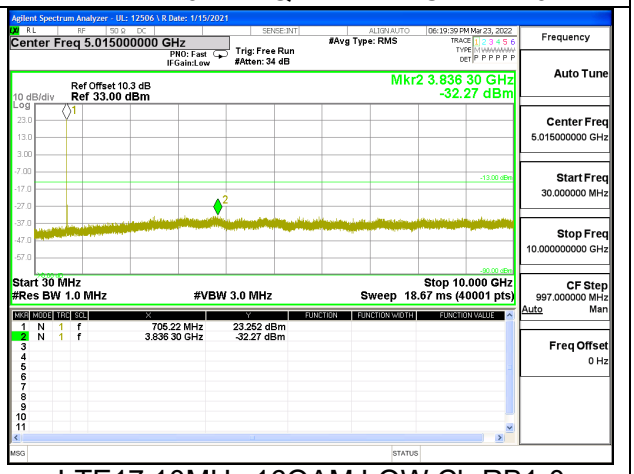
LTE17 10MHz QPSK LOW Ch RB1-0



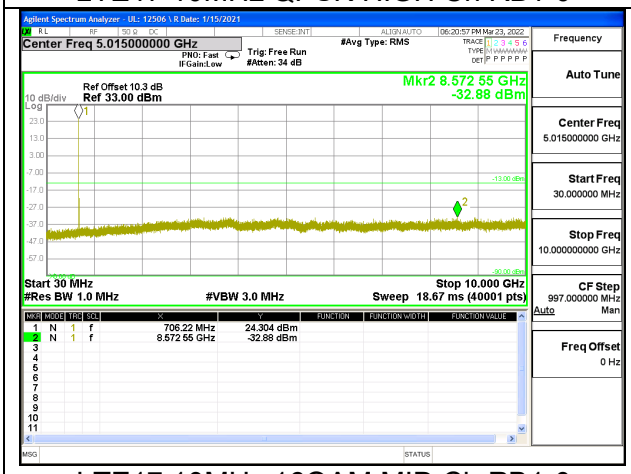
LTE17 10MHz QPSK MID Ch RB1-0



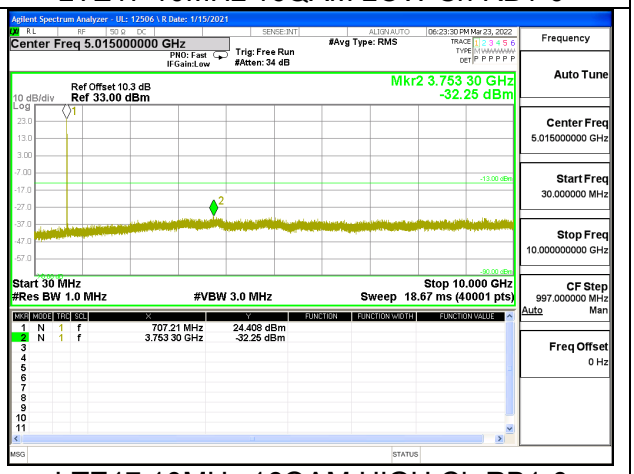
LTE17 10MHz QPSK HIGH Ch RB1-0



LTE17 10MHz 16QAM LOW Ch RB1-0



LTE17 10MHz 16QAM MID Ch RB1-0



LTE17 10MHz 16QAM HIGH Ch RB1-0

10.4. FREQUENCY STABILITY

RULE PART(S)
FCC: §2.1055, §22.355, §24.235, §27.54 and §90.213

LIMITS
FCC §22.355, §90.213
The carrier frequency shall not depart from the reference frequency in excess of ±2.5 ppm for mobile stations.

FCC §24.235 & §27.54
The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

TEST PROCEDURE
Use CMW 500 with Frequency Error measurement capability.

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

Normal, 3.89VDC.
End Voltage, 3.69VDC.

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

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

RESULTS
See the following pages.

10.4.1. WCDMA

Test Engineer ID:	27465/40882	Test Date:	3/17/2022

BAND 2

Limit		1850	1910	Delta (Hz) LOW	Delta (Hz) HIGH
Condition		F low @ -13dBm	F high @ -13dBm		
Temperature	Voltage	(MHz)	(MHz)		
Normal (20C)	Normal	1850.0000	1910.0000		
Extreme (50C)		1850.0000	1910.0000	12.2	-5.1
Extreme (40C)		1850.0000	1910.0000	8.4	-13.4
Extreme (30C)		1850.0000	1910.0000	6.0	-10.1
Extreme (10C)		1850.0000	1910.0000	1.2	-5.1
Extreme (0C)		1850.0000	1910.0000	1.8	-2.8
Extreme (-10C)		1850.0000	1910.0000	0.2	-2.7
Extreme (-20C)		1850.0000	1910.0000	3.1	-0.4
Extreme (-30C)		1850.0000	1910.0000	1.6	-3.9
20C	End Point	1850.0000	1910.0000	6.1	-1.4

BAND 4

Limit		1710	1755	Delta (Hz) LOW	Delta (Hz) HIGH
Condition		F low @ -13dBm	F high @ -13dBm		
Temperature	Voltage	(MHz)	(MHz)		
Normal (20C)	Normal	1710.0000	1755.0000		
Extreme (50C)		1710.0000	1755.0000	11.1	-19.7
Extreme (40C)		1710.0000	1755.0000	3.8	-12.8
Extreme (30C)		1710.0000	1755.0000	-3.4	0.1
Extreme (10C)		1710.0000	1755.0000	-8.1	15.1
Extreme (0C)		1710.0000	1755.0000	-10.5	8.2
Extreme (-10C)		1710.0000	1755.0000	-8.5	23.2
Extreme (-20C)		1710.0000	1755.0000	-10.1	12.1
Extreme (-30C)		1710.0000	1755.0000	-7.8	18.6
20C	End Point	1710.0000	1755.0000	11.5	-11.2

10.4.2. LTE17

LIMITS

FCC: §27.54
The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

Test Engineer ID:	12506 and 39703	Test Date:	3/23/2022

QPSK (10MHz)

Limit		704	716	Delta (Hz) LOW	Delta (Hz) HIGH	Frequency Stability (ppm) LOW	Frequency Stability (ppm) HIGH
Condition		F low @ -13dBm	F high @ -13dBm				
Temperature	Voltage	(MHz)	(MHz)				
Normal (20C)	Normal	704.4300	715.6300				
Extreme (50C)		704.4300	715.6300	15.6	25.6	0.04	0.07
Extreme (40C)		704.4300	715.6300	24.1	36.7	0.07	0.10
Extreme (30C)		704.4300	715.6300	16.0	34.7	0.05	0.10
Extreme (10C)		704.4300	715.6300	16.8	24.8	0.05	0.07
Extreme (0C)		704.4300	715.6300	32.6	26.8	0.09	0.07
Extreme (-10C)		704.4300	715.6300	27.0	13.7	0.08	0.04
Extreme (-20C)		704.4300	715.6300	38.9	43.7	0.11	0.12
Extreme (-30C)		704.4300	715.6300	22.6	16.8	0.06	0.05
20C	End Point	704.4300	715.6300	14.9	12.3	0.04	0.03

10.5. PEAK TO AVERAGE RATIO

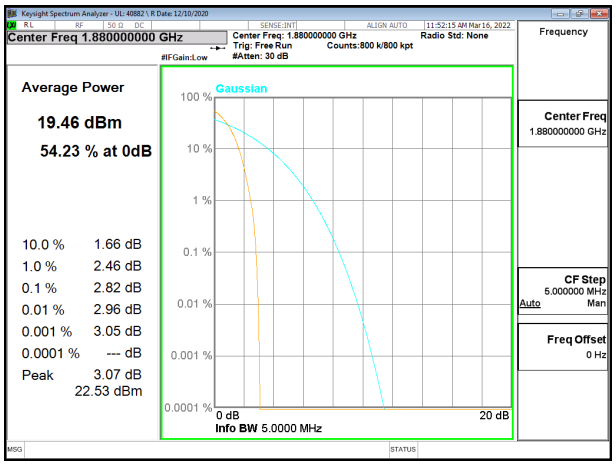
LIMITS

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

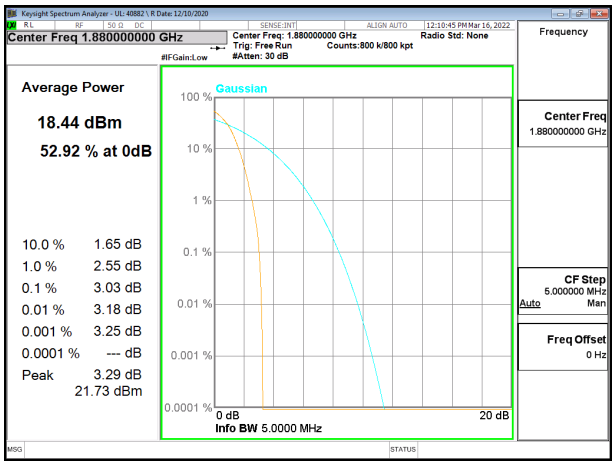
RESULT

Test Engineer ID:	40882 12506	Test Date:	2022-03-16 2022-03-23

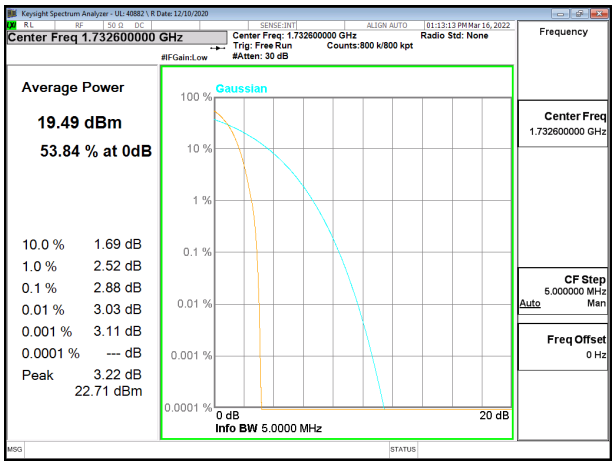
10.5.1. WCDMA



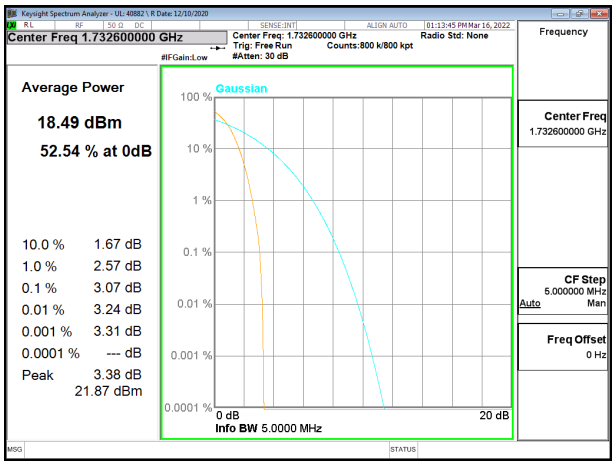
BAND 2 Rel 99 MID Channel



BAND 2 HSDPA MID Channel



BAND 4 Rel 99 MID Channel



BAND 4 HSDPA MID Channel