TEST REPORT

No. I19Z61344-WMD06

for

OnePlus Technology (Shenzhen) Co., Ltd.

Smart Phone

Model Name: HD1925

FCC ID: 2ABZ2-EE143

with

Hardware Version: 46

Software Version: Oxygen OS 10.0.HD61CB

Issued Date: 2019-11-01

Note:

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REPORT HISTORY

Report Number	Revision	Description	Issue Date
I19Z61344-WMD06	Rev.0	1st edition	2019-10-25
I19Z61344-WMD06	Rev.1	Adjust the EUT Voltage information.	2019-11-01

Note: the latest revision of the test report supersedes all previous version.

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1. Test Laboratory

1.1. Introduction & Accreditation

Telecommunication Technology Labs, CAICT is an ISO/IEC 17025:2005 accredited test laboratory under NATIONAL VOLUNTARY LABORATORY ACCREDITATION PROGRAM (NVLAP) with lab code 600118-0 and is also an FCC accredited test laboratory (CN5017), and ISED accredited test laboratory (CN0066). The detail accreditation scope can be found on NVLAP website.

1.2. Testing Location

Location 1: CTTL (huayuan North Road)

Address: No. 52, Huayuan North Road, Haidian District, Beijing, P. R. China 100191

Location 2: CTTL (Shouxiang)

Address: No. 51 Shouxiang Science Building, Xueyuan Road, Haidian District, Beijing, P. R. China 100191

Location 3: CTTL (BDA)

Address: No.18A, Kangding Street, Beijing Economic-Technology Development Area, Beijing, P. R. China 100176

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1.3. Testing Environment

Normal Temperature: 15-35℃

Relative Humidity: 20-75%

1.4. Project data

Testing Start Date: 2019-10-08

Testing End Date: 2019-10-25

1.5. Signature

Dong Yuan

(Prepared this test report)

Zhou Yu

(Reviewed this test report)

Zhao Hui Lin

Deputy Director of the laboratory

(Approved this test report)

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2. Client Information

2.1. Applicant Information

Company Name:	OnePlus Technology (Shenzhen) Co., Ltd.
Address /Post:	18C02, 18C03, 18C04 and 18C05, Shum Yip Terra Building, Binhe Avenue North, Futian District, Shenzhen
Contact:	Ariel Cheng
Email:	ariel.cheng@oneplus.com
Telephone:	13823398081

2.2. Manufacturer Information

Company Name:	OnePlus Technology (Shenzhen) Co., Ltd.
Address /Post:	18C02, 18C03, 18C04 and 18C05, Shum Yip Terra Building, Binhe Avenue North, Futian District, Shenzhen
Contact:	Ariel Cheng
Email:	ariel.cheng@oneplus.com
Telephone:	13823398081

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3. Equipment Under Test (EUT) and Ancillary Equipment (AE)

3.1. About EUT

Description	Smart Phone
Model Name	HD1925
FCC ID	2ABZ2-EE143
Antenna	Integrated
Output power	19.98dBm maximum ERP measured for n71
Extreme vol. Limits	3.6VDC to 4.3VDC (nominal: 3.87VDC)
Extreme temp. Tolerance	0°C to +35°C

Note: Components list, please refer to documents of the manufacturer; it is also included in the original test record of CTTL.

3.2. Internal Identification of EUT used during the test

EUT ID*	IMEI	HW Version	SW Version	Date of receipt
UT38b	990013820057870	46	Oxygen OS 10.0.HD61CB	2019-10-08
UT63a	990013820082035	46	Oxygen OS 10.0.HD61CB	2019-10-21
UT66a	990013820080781	46	Oxygen OS 10.0.HD61CB	2019-08-30

*EUT ID: is used to identify the test sample in the lab internally.

3.3. Internal Identification of AE used during the test

AE ID*	Description
AE1	Battery
AE2	Battery

AE1

Model	BLP745
Manufacturer	Sunwoda Electronic Co.,Ltd.
Capacitance	4010mAh

AE2

Model	BLP745
Manufacturer	Sunwoda Electronic India Private Limited
Capacitance	4010mAh

*AE ID: is used to identify the test sample in the lab internally.

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4. Reference Documents

4.1. Reference Documents for testing

The following documents listed in this section are referred for testing.

Reference	Title	Version
FCC Part 27	MISCELLANEOUS WIRELESS COMMUNICATIONS SERVICES	10-1-18 Edition
ANSI/TIA-603-E	Land Mobile FM or PM Communications Equipment Measurement and Performance Standards	2016
ANSI/TIA-102.CAAA-E	DIGITAL C4FMCQPSK TRANSCEIVER MEASUREMENT METHODS	2016
ANSI C63.26	American National Standard for Compliance Testing of Transmitters Used in Licensed Radio Services	2015
KDB 971168 D01	MEASUREMENT GUIDANCE FOR CERTIFICATION OF LICENSED DIGITAL TRANSMITTERS	v03r01

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5. LABORATORY ENVIRONMENT

Control room / conducted chamber did not exceed following limits along the EMC testing:

Temperature	Min. = 15 ˚C, Max. = 35 ˚C
Relative humidity	Min. =20 %, Max. = 80 %
Shielding effectiveness	> 110 dB
Electrical insulation	>2 M
Ground system resistance	< 0.5

Fully-anechoic chamber 2 (8.6 meters×6.1 meters×3.85 meters) did not exceed following limits along the EMC testing:

Temperature	Min. = 15 ˚C, Max. = 30 ˚C
Relative humidity	Min. = 35 %, Max. = 60 %
Shielding effectiveness	> 110 dB
Electrical insulation	>2 M
Ground system resistance	< 1
Site voltage standing-wave ratio (S_{VSWR})	Between 0 and 6 dB, from 1GHz to 18GHz
Uniformity of field strength	Between 0 and 6 dB, from 80 to 4000 MHz

Semi-anechoic chamber 2 / Fully-anechoic chamber 3 (10 meters×6.7 meters×6.15 meters) did not exceed following limits along the EMC testing:

Temperature	Min. = 15 ˚C, Max. = 30 ˚C
Relative humidity	Min. = 35 %, Max. = 60 %
Shielding effectiveness	> 100 dB
Electrical insulation	>2 M
Ground system resistance	< 0.5
Normalised site attenuation (NSA)	<±3.5 dB, 3 m distance
Site voltage standing-wave ratio (S_{VSWR})	Between 0 and 6 dB, from 1GHz to 18GHz
Uniformity of field strength	Between 0 and 6 dB, from 80 to 3000 MHz

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6. SUMMARY OF TEST RESULT

6.1. Summary of test results

n71

Items	Test Name	Clause in FCC rules	Verdict
1	Output Power	27.50	P
2	Emission Limit	2.1051/27.53	P
3	Frequency Stability	2.1055	P
4	Occupied Bandwidth	2.1049	P
5	Emission Bandwidth	27.53	P
6	Band Edge Compliance	27.53	P
7	Conducted Spurious Emission	27.53	P
8	Peak-to-Average Power Ratio	27.50	P

Terms used in Verdict column

P	Pass. The EUT complies with the essential requirements in the standard.
NP	Not Performed. The test was not performed by CTTL.
NA	Not Applicable. The test was not applicable.
BR	Re-use test data from basic model report.
F	Fail. The EUT does not comply with the essential requirements in the standard.

This device supports 5G NR (EN-DC) for LTE and n71. The technical specifications are as below:
Combination type: LTE B2-n71, LTE B66-n71
NR SCS: 15 kHz
NR modulation: DFT-s-OFDM QPSK / 16QAM / 64QAM
CP-OFDM QPSK / 16QAM / 64QAM / 256QAM
NR BW: 5/10/15/20MHz
The n71 result given in the report is tested under the LTE B2-n71 combination.

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7. Test Equipment Utilized

NO.	Description	TYPE	series number	MANUFACTURE	CAL DUE DATE	Calibration interval
1	UXM 5G Wireless Test Platform	E7515B	MY59020623	Keysight	2021-03-31	2 year
2	Signal Analyzer	FSV	101576	R&S	2020-05-03	1 year
3	Spectrum Analyzer	FSU26	200030	R&S	2020-06-03	1 year
4	Climate chamber	SH-242	93008556	ESPEC	2019-12-21	2 year
5	EMI Antenna	VULB9163	9163-235	Schwarzbeck	2019-11-20	1 year
6	EMI Antenna	3117	00058889	ETS-Lindgren	2020-01-02	1 year
7	EMI Antenna	3117	00119024	ETS-Lindgren	2020-02-25	1 year
8	EMI Antenna	9117	167	Schwarzbeck	2020-05-27	1 year
9	Signal Generator	N5183A	MY49060052	Agilent	2020-06-24	1 year
10	Test Receiver	E4440A	MY48250642	Agilent	2020-03-18	1 year
121	Power Amplifier	5S1G4	0341863	AR	/	/

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ANNEX A: MEASUREMENT RESULTS

A.1 OUTPUT POWER

A.1.1 Summary

During the process of testing, the EUT was set up for the max output power with proper modulation.

In all cases, output power is within the specified limits.

A.1.2 Conducted

A.1.2.1 Measurement result

n71

Test Freq Description	5G-n71						Power Results (dBm)
	SCS (kHz)	NR BW (MHz)	Modulation	RB allocation	NR Test Freq. (MHz)	NR Test CH.	n71
High	15	5	DFT-s-OFDM QPSK	Edge_1RB_Right	695.5	139100	19.27
Middle-1	15	5	DFT-s-OFDM QPSK	Inner_Full	688	137600	19.98
Middle-2	15	5	DFT-s-OFDM QPSK	Inner_Full	680.5	136100	19.44
Middle-3	15	5	DFT-s-OFDM QPSK	Inner_Full	673	134600	19.94
Low	15	5	DFT-s-OFDM QPSK	Edge_1RB_Left	665.5	133100	18.07
High	15	20	DFT-s-OFDM QPSK	Edge_1RB_Right	688	137600	19.00
Middle-1	15	20	DFT-s-OFDM QPSK	Inner_Full	684.25	136850	19.63
Middle-2	15	20	DFT-s-OFDM QPSK	Inner_Full	680.5	136100	19.77
Middle-3	15	20	DFT-s-OFDM QPSK	Inner_Full	676.75	135350	19.63
Low	15	20	DFT-s-OFDM QPSK	Edge_1RB_Left	673	134600	18.08
default	15	5	DFT-s-OFDM 16QAM	Inner_Full	688	137600	19.03
default	15	5	DFT-s-OFDM 64QAM	Inner_Full	688	137600	18.70
default	15	5	CP-OFDM QPSK	Inner_Full	688	137600	19.96
default	15	5	CP-OFDM 16QAM	Inner_Full	688	137600	19.02
default	15	5	CP-OFDM 64QAM	Inner_Full	688	137600	18.70
default	15	5	DFT-s-OFDM QPSK	Edge_Full_Right	688	137600	19.23
default	15	5	DFT-s-OFDM QPSK	Edge_Full_Left	688	137600	18.39
default	15	5	DFT-s-OFDM QPSK	Inner_1RB_Right	688	137600	19.39
default	15	5	DFT-s-OFDM QPSK	Inner_1RB_Left	688	137600	19.75
default	15	5	DFT-s-OFDM QPSK	Outer_Full	688	137600	18.68
default	15	10	DFT-s-OFDM QPSK	Inner_Full	688	137600	18.32
default	15	15	DFT-s-OFDM QPSK	Inner_Full	688	137600	18.62

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A.1.3 Radiated

A.1.3.1 Description

This is the test for the maximum radiated power from the EUT.

Rule Part 27.50(c) specifies "Portable stations (hand-held de-vices) are limited to 3 watts ERP.".

A.1.3.2 Method of Measurement

ANSI C63.26-2015 Subclause 5.2.5.5, For personal/portable radios utilizing an integral antenna, the factor LC is typically negligible. However, in a fixed station transmit system that utilizes a long cable run between the transmitter and the transmitting antenna, this factor can be significant. The minimum cable loss should be used in this equation.

ERP or EIRP = $P_{Meas} + G_T$

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A.1.3.3 Measurement result

n71- ERP

Limits: ≤34.77 dBm (3W)

Test Freq Description	5G-n71						Power Results (dBm)		
	SCS (kHz)	NR BW (MHz)	Modulation	RB allocation	NR Test Freq. (MHz)	NR Test CH.	Conducted n71	G_T	Radiated n71
High	15	5	DFT-s-OFDM QPSK	Edge_1RB_Right	695.5	139100	19.27	-3.00	16.27
Middle-1	15	5	DFT-s-OFDM QPSK	Inner_Full	688	137600	19.98	-3.00	16.98
Middle-2	15	5	DFT-s-OFDM QPSK	Inner_Full	680.5	136100	19.44	-3.00	16.44
Middle-3	15	5	DFT-s-OFDM QPSK	Inner_Full	673	134600	19.94	-3.00	16.94
Low	15	5	DFT-s-OFDM QPSK	Edge_1RB_Left	665.5	133100	18.07	-3.00	15.07
High	15	20	DFT-s-OFDM QPSK	Edge_1RB_Right	688	137600	19.00	-3.00	16.00
Middle-1	15	20	DFT-s-OFDM QPSK	Inner_Full	684.25	136850	19.63	-3.00	16.63
Middle-2	15	20	DFT-s-OFDM QPSK	Inner_Full	680.5	136100	19.77	-3.00	16.77
Middle-3	15	20	DFT-s-OFDM QPSK	Inner_Full	676.75	135350	19.63	-3.00	16.63
Low	15	20	DFT-s-OFDM QPSK	Edge_1RB_Left	673	134600	18.08	-3.00	15.08
default	15	5	DFT-s-OFDM 16QAM	Inner_Full	688	137600	19.03	-3.00	16.03
default	15	5	DFT-s-OFDM 64QAM	Inner_Full	688	137600	18.70	-3.00	15.70
default	15	5	CP-OFDM QPSK	Inner_Full	688	137600	19.96	-3.00	16.96
default	15	5	CP-OFDM 16QAM	Inner_Full	688	137600	19.02	-3.00	16.02
default	15	5	CP-OFDM 64QAM	Inner_Full	688	137600	18.70	-3.00	15.70
default	15	5	DFT-s-OFDM QPSK	Edge_Full_Right	688	137600	19.23	-3.00	16.23
default	15	5	DFT-s-OFDM QPSK	Edge_Full_Left	688	137600	18.39	-3.00	15.39
default	15	5	DFT-s-OFDM QPSK	Inner_1RB_Right	688	137600	19.39	-3.00	16.39
default	15	5	DFT-s-OFDM QPSK	Inner_1RB_Left	688	137600	19.75	-3.00	16.75
default	15	5	DFT-s-OFDM QPSK	Outer_Full	688	137600	18.68	-3.00	15.68
default	15	10	DFT-s-OFDM QPSK	Inner_Full	688	137600	18.32	-3.00	15.32
default	15	15	DFT-s-OFDM QPSK	Inner_Full	688	137600	18.62	-3.00	15.62

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A.2 EMISSION LIMIT

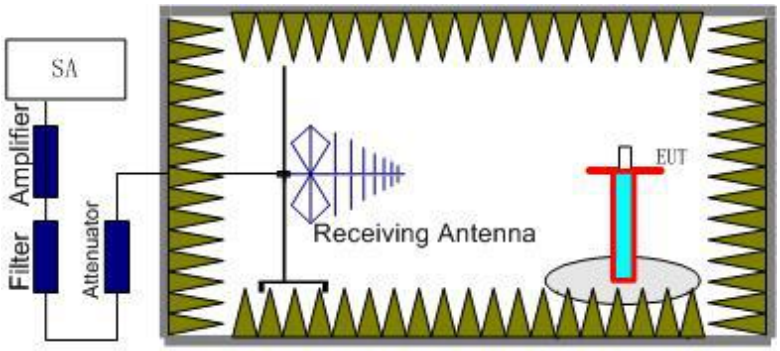
A.2.1 Measurement Method

The measurements procedures in C63.26-2015 are used. This measurement is carried out in fully anechoic chamber FAC-3.

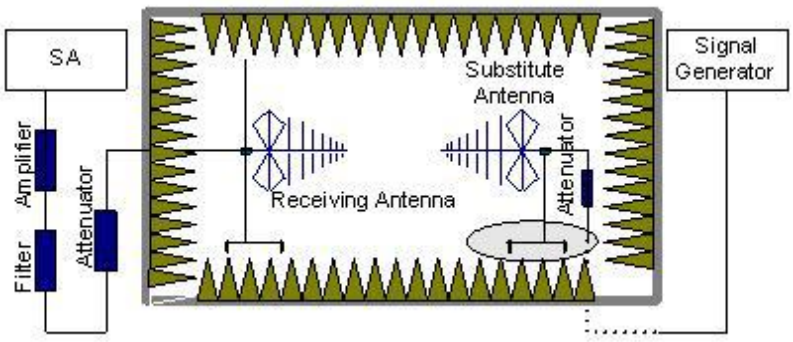
The spectrum was scanned from 30 MHz to the 10th harmonic of the highest frequency generated within the equipment, which is the transmitted carrier. The resolution bandwidth is set 1MHz. The spectrum was scanned with the mobile station transmitting at carrier frequencies that pertain to low, mid and high channels of the NR n71.

The procedure of radiated spurious emissions is as follows:

1. EUT was placed on a 1.5-meter-high non-conductive stand at a 3-meter test distance from the receive antenna. A receiving antenna was placed on the antenna mast 3 meters from the EUT for emission measurements. The height of receiving antenna is 1.5m. The test setup refers to figure below. Detected emissions were maximized at each frequency by rotating the EUT through 360 and adjusting the receiving antenna polarization, and vary the measurement antenna height again through 1 m to 4 m. The radiated emission measurements of all non-harmonic and harmonics of the transmit frequency through the 10th harmonic were measured with peak detector.



2. The EUT is then put into continuously transmitting mode at its maximum power level during the test. And the maximum value of the receiver should be recorded as (Pr).
3. The EUT shall be replaced by a substitution antenna. The test setup refers to figure below.



In the chamber, a substitution antenna for the frequency band of interest is placed at the reference point of the chamber. An RF Signal source for the frequency band of interest is

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connected to the substitution antenna with a cable that has been constructed to not interfere with the radiation pattern of the antenna. A power (P_{Mea}) is applied to the input of the substitution antenna. Adjust the level of the signal generator output until the value of the receiver reaches the previously recorded (P_r). The power of signal source (P_{Mea}) is recorded. The test should be performed by rotating the test item and adjusting the receiving antenna polarization.

4. The Path loss (P_{pl}) between the Signal Source with the Substitution Antenna and the Substitution Antenna Gain (G_a) should be recorded after test.
   An amplifier should be connected in for the test.
   The Path loss (P_{pl}) is the summation of the cable loss and the gain of the amplifier.
   The measurement results are obtained as described below:
   Power (EIRP)=P_{Mea}- P_{pl} + G_a
5. This value is EIRP since the measurement is calibrated using an antenna of known gain (unit: dBi) and known input power.
6. ERP can be calculated from EIRP by subtracting the gain of the dipole, ERP = EIRP - 2.15dB.

A.2.2 Measurement Limit

Part 27.53(g) specifies that 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.

A.2.3 Measurement Results

Radiated emissions measurements were made only at the upper, middle, and lower carrier frequencies of the NR n71. It was decided that measurements at these three carrier frequencies would be sufficient to demonstrate compliance with emissions limits because it was seen that all the significant spurs occur well outside the band and no radiation was seen from a carrier in one block of the NR n71 into any of the other blocks. The equipment must still, however, meet emissions requirements with the carrier at all frequencies over which it is capable of operating and it is the manufacturer's responsibility to verify this. The range of evaluated frequency is from 30MHz to 26GHz.

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LTE band 2- NR n71, 5MHz, QPSK, Channel 133100

Frequency (MHz)	P_{Mea} (dBm)	Path Loss(dB)	Antenna Gain(dBi)	Correction (dB)	Peak ERP (dBm)	Limit (dBm)	Margin (dB)	Polarization
1306.01	-60.43	3.12	4.49	2.15	-61.21	-13.00	48.21	V
1968.01	-49.12	3.96	4.66	2.15	-50.57	-13.00	37.57	H
2632.00	-51.88	4.73	6.34	2.15	-52.42	-13.00	39.42	H
3329.02	-54.33	5.30	7.79	2.15	-53.99	-13.00	40.99	H
3963.02	-55.08	6.10	8.85	2.15	-54.48	-13.00	41.48	H
4643.02	-54.22	6.46	9.54	2.15	-53.29	-13.00	40.29	H

LTE band 2- NR n71, 5MHz, QPSK, Channel 136100

Frequency (MHz)	P_{Mea} (dBm)	Path Loss(dB)	Antenna Gain(dBi)	Correction (dB)	Peak ERP (dBm)	Limit (dBm)	Margin (dB)	Polarization
1348.01	-60.63	3.17	4.71	2.15	-61.24	-13.00	48.24	V
2027.00	-56.82	4.13	4.68	2.15	-58.42	-13.00	45.42	V
2715.00	-52.70	4.80	6.49	2.15	-53.16	-13.00	40.16	V
3401.02	-55.71	5.36	7.96	2.15	-55.26	-13.00	42.26	V
4088.02	-55.66	6.04	8.99	2.15	-54.86	-13.00	41.86	H
4755.01	-55.25	6.58	9.66	2.15	-54.32	-13.00	41.32	H

LTE band 2- NR n71, 5MHz, QPSK, Channel 139100

Frequency (MHz)	P_{Mea} (dBm)	Path Loss(dB)	Antenna Gain(dBi)	Correction (dB)	Peak ERP (dBm)	Limit (dBm)	Margin (dB)	Polarization
1393.01	-61.12	3.23	4.94	2.15	-61.56	-13.00	48.56	H
2114.00	-56.75	4.20	4.94	2.15	-58.16	-13.00	45.16	V
2800.00	-53.29	4.91	6.64	2.15	-53.71	-13.00	40.71	H
3450.02	-55.20	5.43	8.08	2.15	-54.70	-13.00	41.70	H
4183.02	-55.09	6.17	9.08	2.15	-54.33	-13.00	41.33	V
4859.01	-55.14	6.72	9.76	2.15	-54.25	-13.00	41.25	H

Sample calculation: 1393.01 MHz

Power (EIRP)=P_{Mea}- P_{pl} + G_a

Peak ERP (dBm) = PMea(-61.12 dBm) - Pcl (3.23 dB) + Ga (4.94 dBi) -2.15dBm

=-61.56 dBm

Note: The maximum value of expanded measurement uncertainty for this test item is U = 5.16 dB, k = 2.

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LTE band 66- NR n71, 5MHz, QPSK, Channel 133100

Frequency (MHz)	P_{Mea} (dBm)	Path Loss(dB)	Antenna Gain(dBi)	Correction (dB)	Peak ERP (dBm)	Limit (dBm)	Margin (dB)	Polarization
1349.01	-54.27	3.17	4.71	2.15	-54.88	-13.00	41.88	H
2002.00	-56.77	4.06	4.61	2.15	-58.37	-13.00	45.37	V
2632.00	-52.53	4.73	6.34	2.15	-53.07	-13.00	40.07	V
3351.02	-54.27	5.32	7.84	2.15	-53.90	-13.00	40.90	H
3991.02	-55.37	6.07	8.89	2.15	-54.70	-13.00	41.70	H
4646.02	-54.13	6.46	9.55	2.15	-53.19	-13.00	40.19	V

LTE band 66- NR n71, 5MHz, QPSK, Channel 136100

Frequency (MHz)	P_{Mea} (dBm)	Path Loss(dB)	Antenna Gain(dBi)	Correction (dB)	Peak ERP (dBm)	Limit (dBm)	Margin (dB)	Polarization
1347.01	-55.18	3.17	4.70	2.15	-55.80	-13.00	42.80	H
2037.00	-57.09	4.13	4.71	2.15	-58.66	-13.00	45.66	V
2728.00	-52.68	4.81	6.51	2.15	-53.13	-13.00	40.13	V
3392.02	-55.25	5.35	7.94	2.15	-54.81	-13.00	41.81	V
4081.02	-55.21	6.04	8.98	2.15	-54.42	-13.00	41.42	H
4752.01	-55.75	6.58	9.65	2.15	-54.83	-13.00	41.83	V

LTE band 66- NR n71, 5MHz, QPSK, Channel 139100

Frequency (MHz)	P_{Mea} (dBm)	Path Loss(dB)	Antenna Gain(dBi)	Correction (dB)	Peak ERP (dBm)	Limit (dBm)	Margin (dB)	Polarization
1399.01	-61.26	3.23	4.97	2.15	-61.67	-13.00	48.67	H
2108.00	-56.77	4.20	4.92	2.15	-58.20	-13.00	45.20	V
2771.00	-52.71	4.87	6.59	2.15	-53.14	-13.00	40.14	V
3450.02	-55.73	5.43	8.08	2.15	-55.23	-13.00	42.23	H
4182.02	-54.68	6.17	9.08	2.15	-53.92	-13.00	40.92	V
4883.01	-54.59	6.72	9.78	2.15	-53.68	-13.00	40.68	H

Sample calculation: 1399.01 MHz

Power (EIRP)=P_{Mea}- P_{pl} + G_a

Peak ERP (dBm) = PMea(-61.26 dBm) - Pcl (3.23 dB) + Ga (4.97 dBi) -2.15dBm

=-61.67 dBm

Note: The maximum value of expanded measurement uncertainty for this test item is U = 5.16 dB, k = 2.

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A.3 FREQUENCY STABILITY

A.3.1 Method of Measurement

In order to measure the carrier frequency under the condition of AFC lock, it is necessary to make measurements with the EUT in a “call mode”. This is accomplished with the use of R&S CMW500 DIGITAL RADIO COMMUNICATION TESTER and Anritsu MT8821C Radio Communication Analyzer.

1. Measure the carrier frequency at room temperature.
2. Subject the EUT to overnight soak at 0℃.
3. With the EUT, powered via nominal voltage, connected to the CMW500 or MT8821C, and in a simulated call on middle channel for n71, measure the carrier frequency. These measurements should be made within 2 minutes of Powering up the EUT, to prevent significant self-warming.
4. Repeat the above measurements at 10℃ increments from 0℃ to +30℃. Allow at least 1.5 hours at each temperature, unpowered, before making measurements.
5. Re-measure carrier frequency at room temperature with nominal voltage. Vary supply voltage from minimum voltage to maximum voltage, in 0.1Volt increments re-measuring carrier frequency at each voltage. Pause at nominal voltage for 1.5 hours unpowered, to allow any self-heating to stabilize, before continuing.
6. Subject the EUT to overnight soak at +30℃.
7. With the EUT, powered via nominal voltage, connected to the CMW500 and in a simulated call on the center channel, measure the carrier frequency. These measurements should be made within 2 minutes of Powering up the EUT, to prevent significant self-warming.
8. Repeat the above measurements at 10 ℃increments from 0℃ to +30℃. Allow at least 1.5 hours at each temperature, unpowered, before making measurements.
9. At all temperature levels hold the temperature to +/- 0.5℃ during the measurement procedure.

The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block. As this transceiver is considered "Hand carried, battery powered equipment" Section 2.1055(d)(2) applies. This requires that the lower voltage for frequency stability testing be specified by the manufacturer. This transceiver is specified to operate with an input voltage of between 3.6VDC and 4.3VDC, with a nominal voltage of 3.87VDC. Operation above or below these voltage limits is prohibited by transceiver software in order to prevent improper operation as well as to protect components from overstress.

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A.3.2 Measurement results

n71, 20MHz bandwidth (worst case of all bandwidths)

Frequency Error vs Voltage

Voltage(V)	Frequency error (Hz)						
	CP-QPSK	CP-16QAM	CP-64QAM	CP-256QAM	DFT-s-QPSK	DFT-s-16QAM	DFT-s-64QAM
3.6	-8.11	-10.70	-25.39	-14.74	4.21	3.48	3.61
3.87	-17.42	-6.03	-14.46	-16.57	3.38	6.43	2.04
4.3	-6.71	-8.56	6.00	-13.90	9.01	5.62	1.38

Voltage(V)	Frequency error (ppm)						
	CP-QPSK	CP-16QAM	CP-64QAM	CP-256QAM	DFT-s-QPSK	DFT-s-16QAM	DFT-s-64QAM
3.6	0.012	0.016	0.037	0.022	0.006	0.005	0.005
4.0	0.026	0.009	0.021	0.024	0.005	0.009	0.003
4.3	0.010	0.013	0.009	0.020	0.013	0.008	0.002

Frequency Error vs Temperature

Temperature(℃)	Frequency error (Hz)						
	CP-QPSK	CP-16QAM	CP-64QAM	CP-256QAM	DFT-s-QPSK	DFT-s-16QAM	DFT-s-64QAM
30	5.27	-6.11	-3.37	-21.17	3.14	1.97	4.05
20	-17.09	-7.33	-6.41	-14.61	2.00	4.00	4.22
10	-3.74	-11.62	-8.80	-12.87	1.97	3.83	-3.28
0	-5.62	-9.60	-17.41	-9.92	5.06	-3.09	-1.62

Temperature(℃)	Frequency error (ppm)						
	CP-QPSK	CP-16QAM	CP-64QAM	CP-256QAM	DFT-s-QPSK	DFT-s-16QAM	DFT-s-64QAM
30	0.008	0.009	0.005	0.031	0.005	0.003	0.006
20	0.025	0.011	0.009	0.021	0.003	0.006	0.006
10	0.005	0.017	0.013	0.019	0.003	0.006	0.005
0	0.008	0.014	0.026	0.015	0.007	0.005	0.002

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A.4 OCCUPIED BANDWIDTH

A.4.1 Occupied Bandwidth Results

Occupied bandwidth measurements are only provided for selected frequencies in order to reduce the amount of submitted data. Data were taken at the extreme and mid frequencies of the US Cellular/PCS frequency bands. The table below lists the measured 99% BW. Spectrum analyzer plots are included on the following pages.

The measurement method is from KDB 971168 4.2:

a) The spectrum analyzer center frequency is set to the nominal EUT channel center frequency. The frequency span for the spectrum analyzer shall be set wide enough to capture all modulation products including the emission skirts (i.e., two to five times the OBW).

b) The nominal IF filter bandwidth (3 dB RBW) shall be in the range of 1 to 5 % of the anticipated OBW, and the VBW shall be at least 3 times the RBW.

c) Set the reference level of the instrument as required to keep the signal from exceeding the maximum input mixer level for linear operation. In general, the peak of the spectral envelope must be at least 10log (OBW / RBW) below the reference level.

d) Set the detection mode to peak, and the trace mode to max hold.

e) Use the 99 % power bandwidth function of the spectrum analyzer and report the measured bandwidth.

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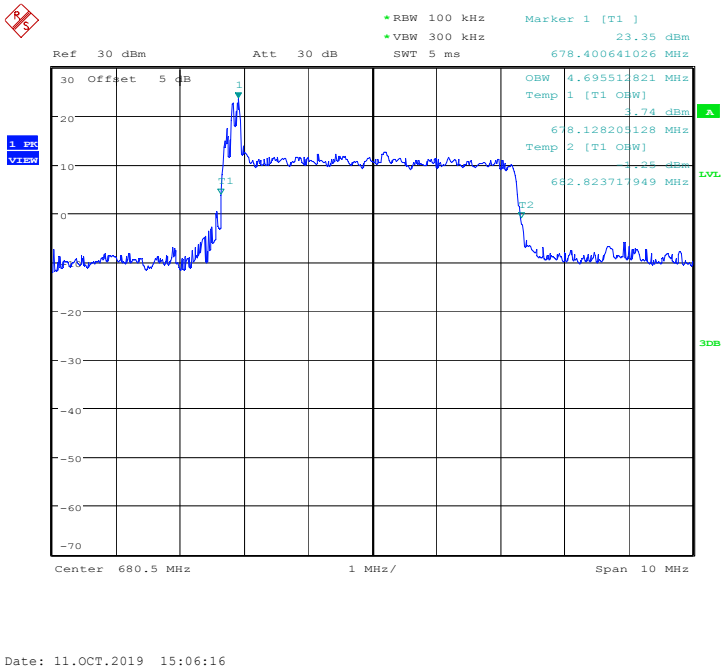
n71, 5MHz (99%)

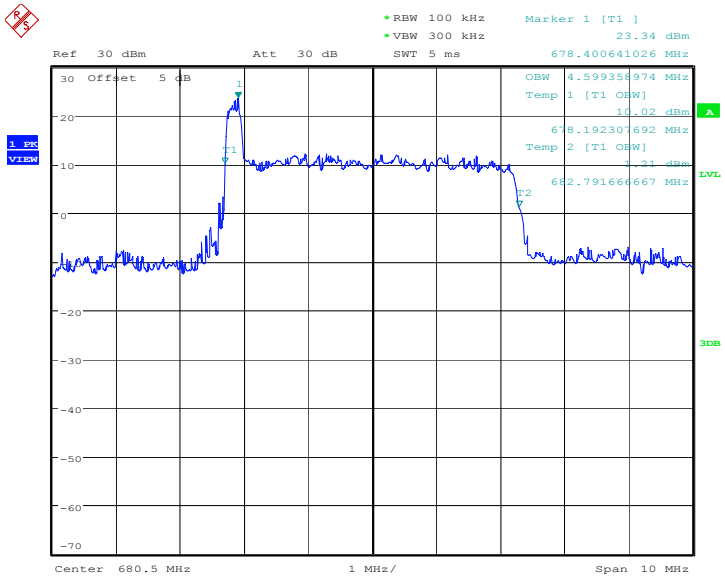
Frequency (MHz)	Occupied Bandwidth (99%) (kHz)						
	CP-QPSK	CP-16QAM	CP-64QAM	CP-256QAM	DFT-s-QPSK	DFT-s-16QAM	DFT-s-64QAM
680.5	4695.51	4599.35	4615.38	4535.26	4515.20	4529.67	4529.67

n71, 5MHz Bandwidth, CP-QPSK (99% BW)



Date: 11.OCT.2019 15:06:16

n71, 5MHz Bandwidth, CP-16QAM (99% BW)



Date: 11.OCT.2019 15:26:37

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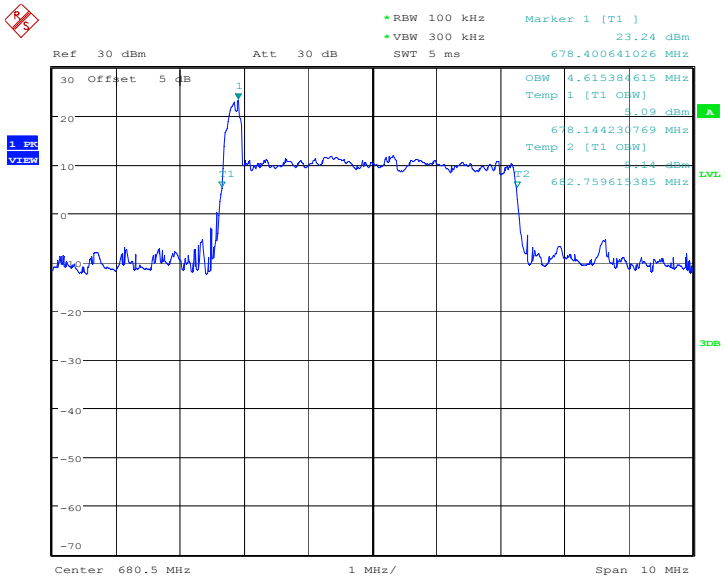
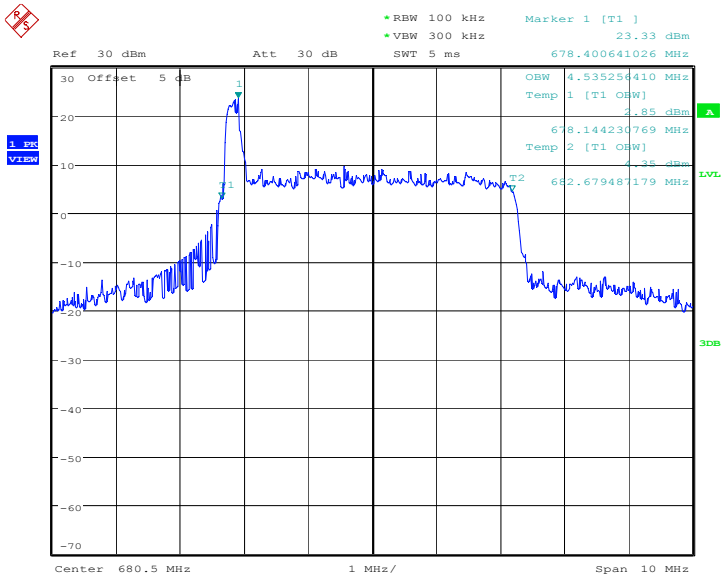
n71, 5MHz Bandwidth,CP-64QAM (99% BW)



Date: 11.OCT.2019 15:30:02

n71, 5MHz Bandwidth,CP-256QAM (99% BW)



Date: 11.OCT.2019 16:02:47

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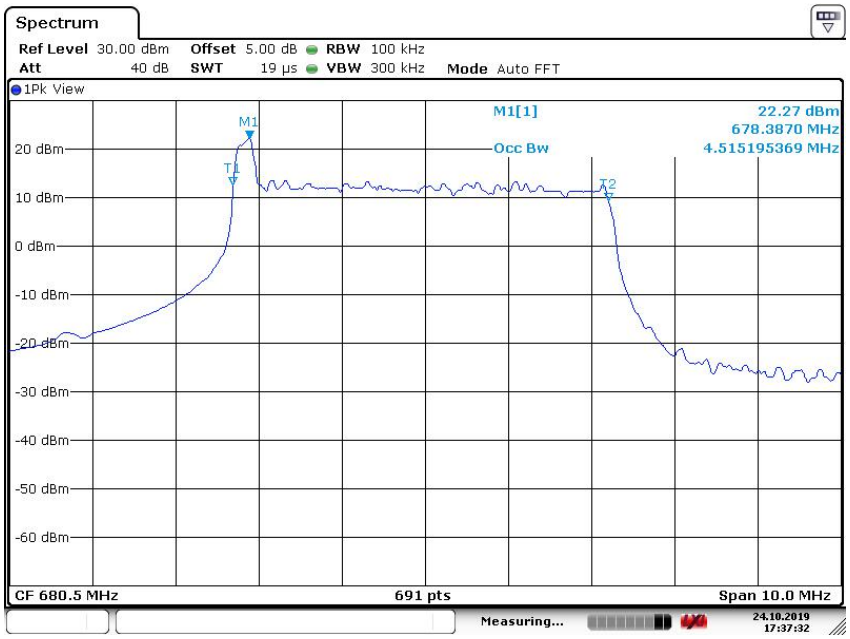
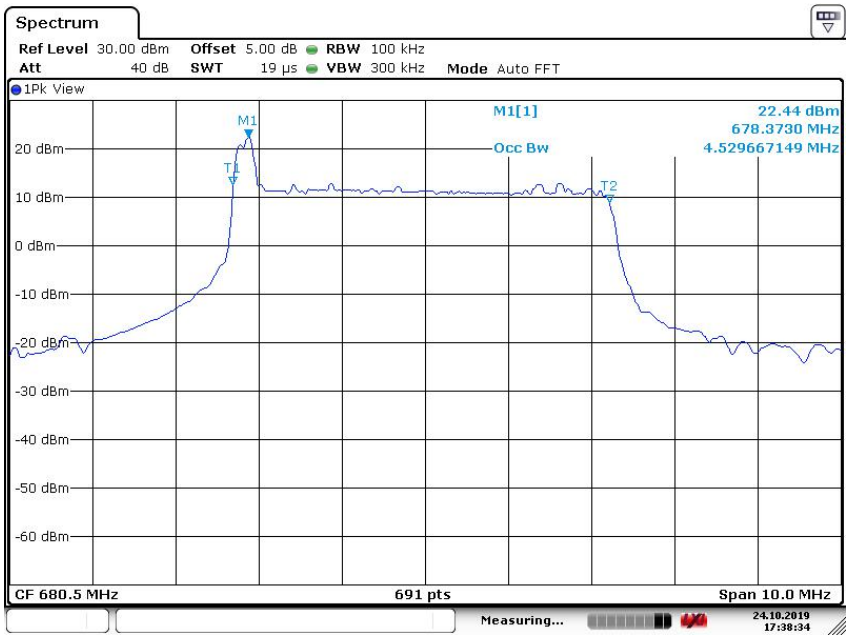
n71, 5MHz Bandwidth,DFT-s-QPSK (99% BW)



Date: 24.OCT.2019 17:37:32

n71, 5MHz Bandwidth,DFT-s-16QAM (99% BW)



Date: 24.OCT.2019 17:38:34

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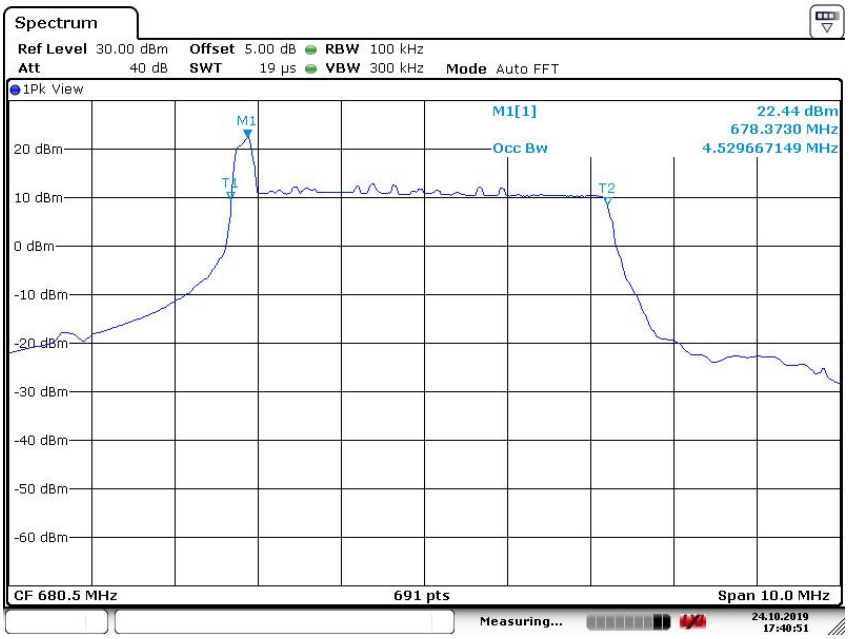
n71, 5MHz Bandwidth,DFT-s-64QAM (99% BW)



Date: 24.OCT.2019 17:40:51

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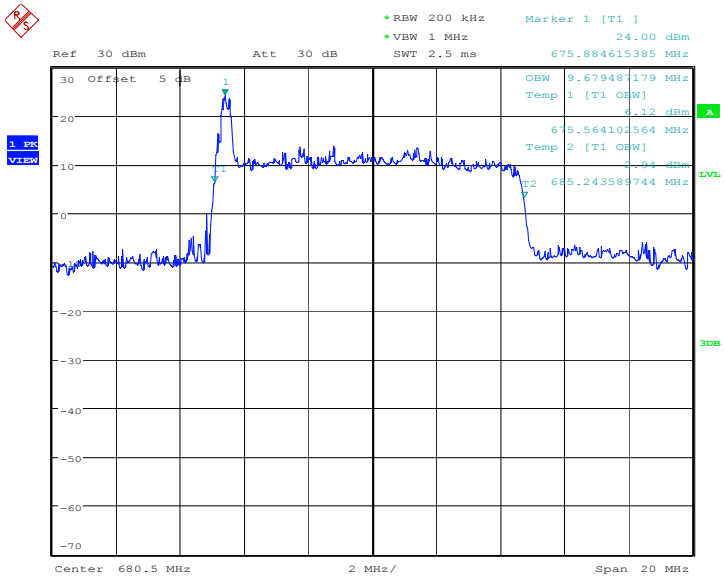
n71, 10MHz (99%)

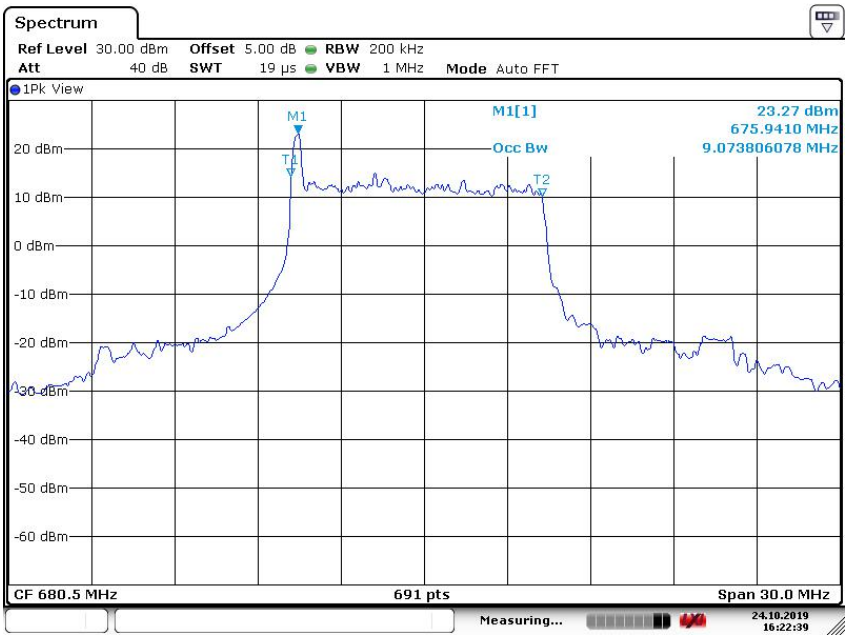
Frequency (MHz)	Occupied Bandwidth (99%) (kHz)	
	CP-QPSK	DFT-s-QPSK
680.5	9679.49	9073.81

n71, 10MHz Bandwidth, CP-QPSK (99% BW)



Date: 12.OCT.2019 11:09:01

n71, 10MHz Bandwidth, DFT-s-QPSK (99% BW)



Date: 24.OCT.2019 16:22:39

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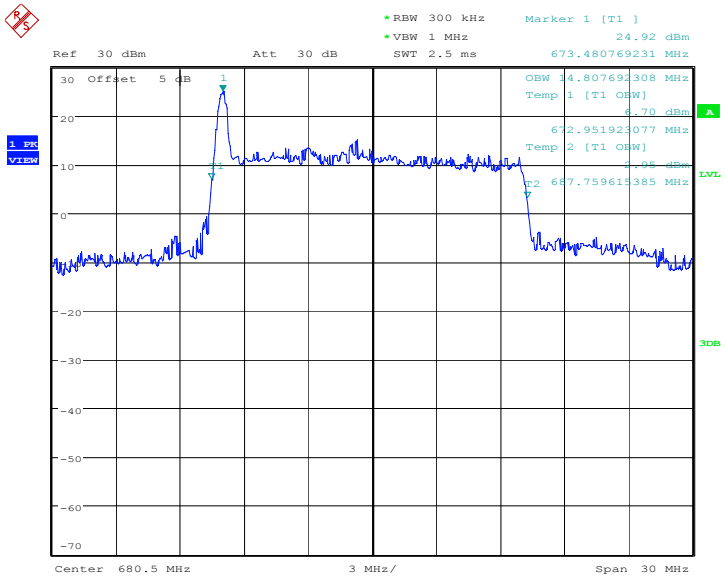
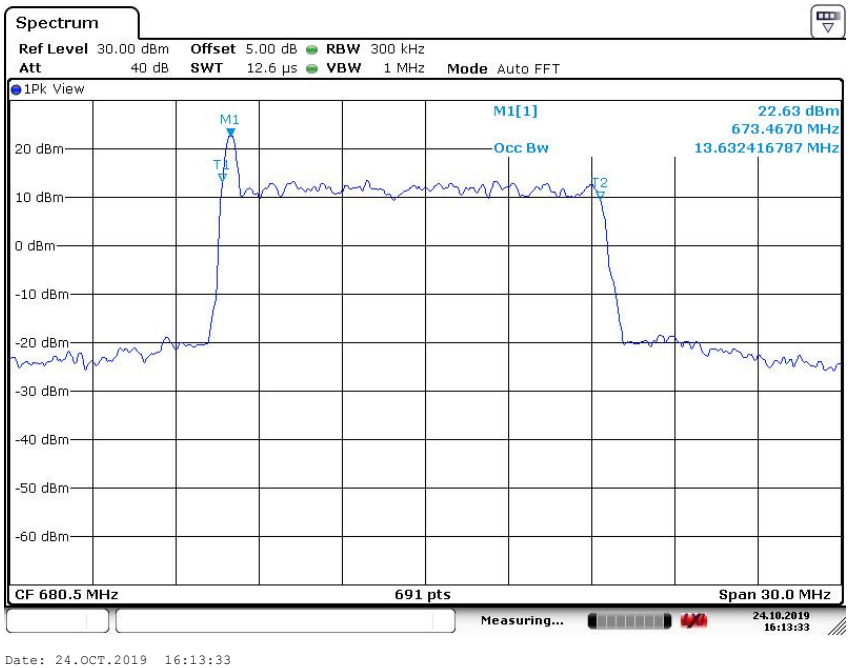
n71, 15MHz (99%)

Frequency (MHz)	Occupied Bandwidth (99%) (kHz)	
	CP-QPSK	DFT-s-QPSK
680.5	14807.69	13632.41

n71, 15MHz Bandwidth, CP-QPSK (99% BW)



n71, 15MHz Bandwidth, DFT-s-QPSK (99% BW)



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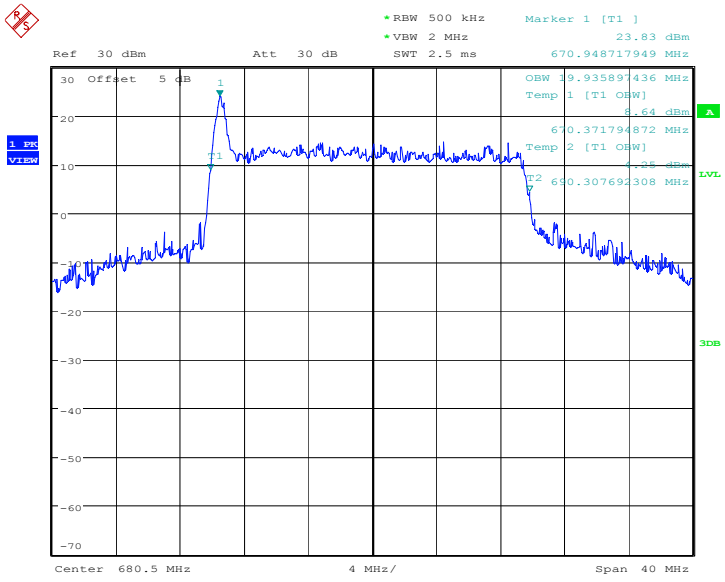
n71, 20MHz (99%)

Frequency (MHz)	Occupied Bandwidth (99%) (kHz)	
	CP-QPSK	DFT-s-QPSK
680.5	19935.90	18350.22

n71, 20MHz Bandwidth, CP-QPSK (99% BW)



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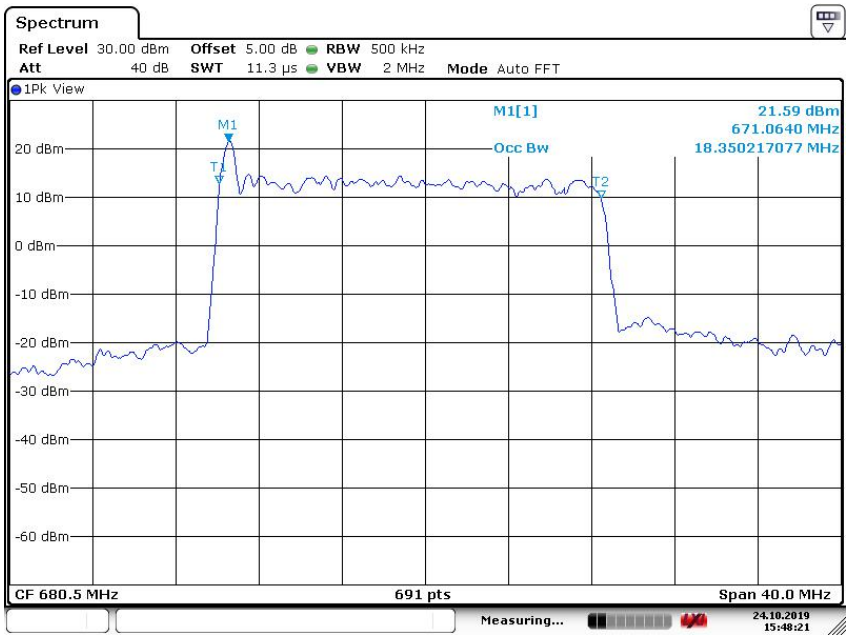
n71, 20MHz Bandwidth, DFT-s-QPSK (99% BW)



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A.5 EMISSION BANDWIDTH

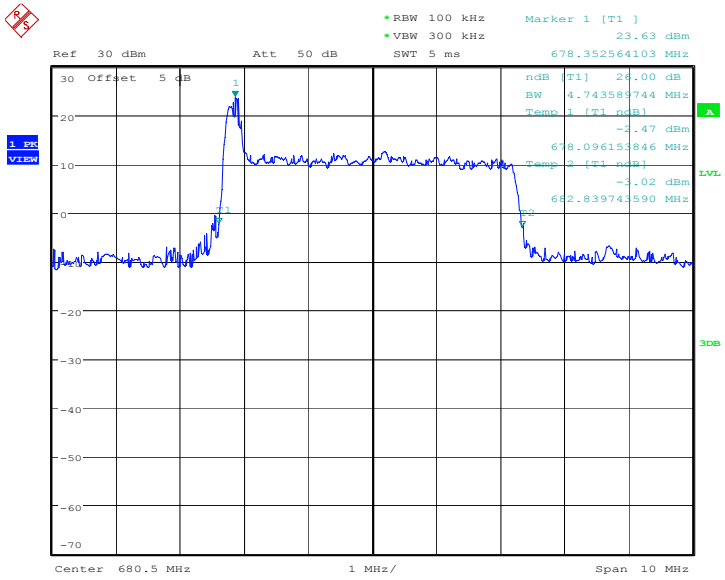
A.5.1Emission Bandwidth Results

The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power. Table below lists the measured -26dBc BW. Spectrum analyzer plots are included on the following pages.

n71, 5MHz (-26dBc)

Frequency (MHz)	Emission Bandwidth (-26dBc) (kHz)						
	CP-QPSK	CP-16QAM	CP-64QAM	CP-256QAM	DFT-s-QPSK	DFT-s-16QAM	DFT-s-64QAM
680.5	4743.59	4791.67	4759.62	4727.56	4877.00	4805.00	4863.00

n71, 5MHz Bandwidth, CP-QPSK (-26dBc BW)



Date: 11.OCT.2019 15:07:42

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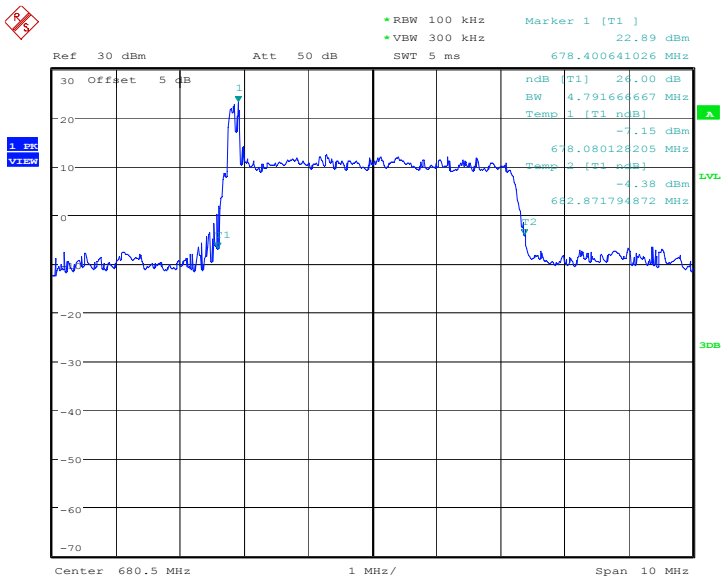
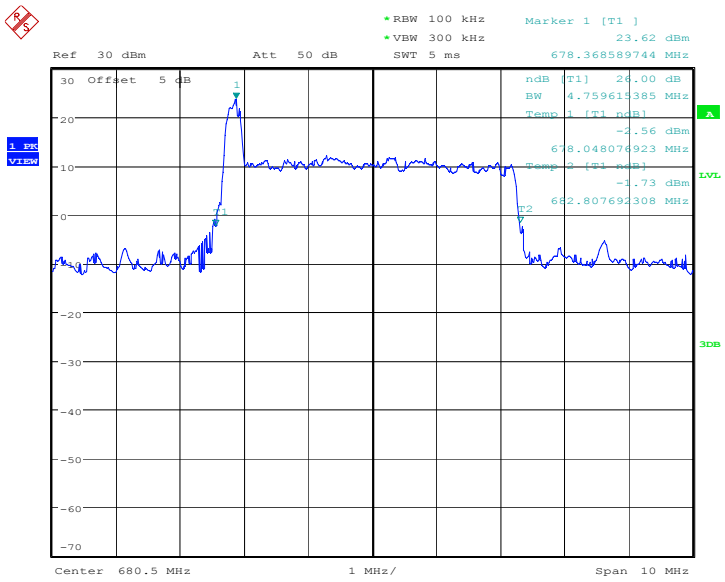
n71, 5MHz Bandwidth, CP-16QAM (-26dBc BW)



Date: 11.OCT.2019 15:25:47

n71, 5MHz Bandwidth,CP-64QAM (-26dBc BW)



Date: 11.OCT.2019 15:32:42

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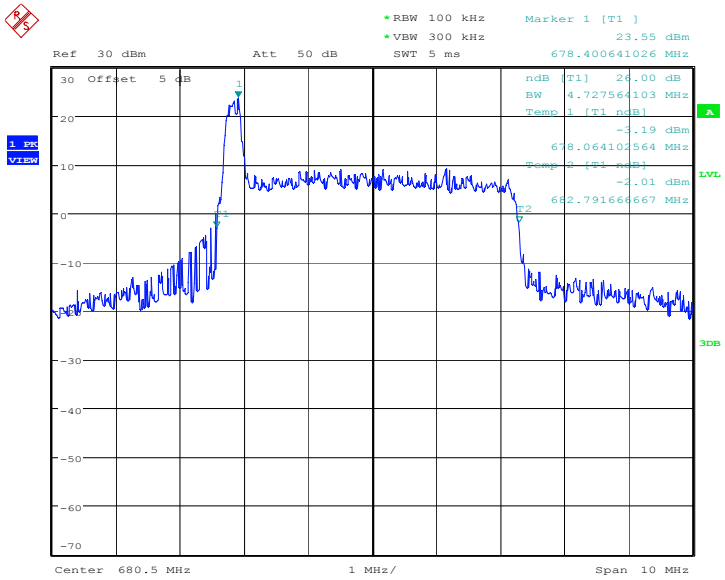
n71, 5MHz Bandwidth,CP-256QAM (-26dBc BW)



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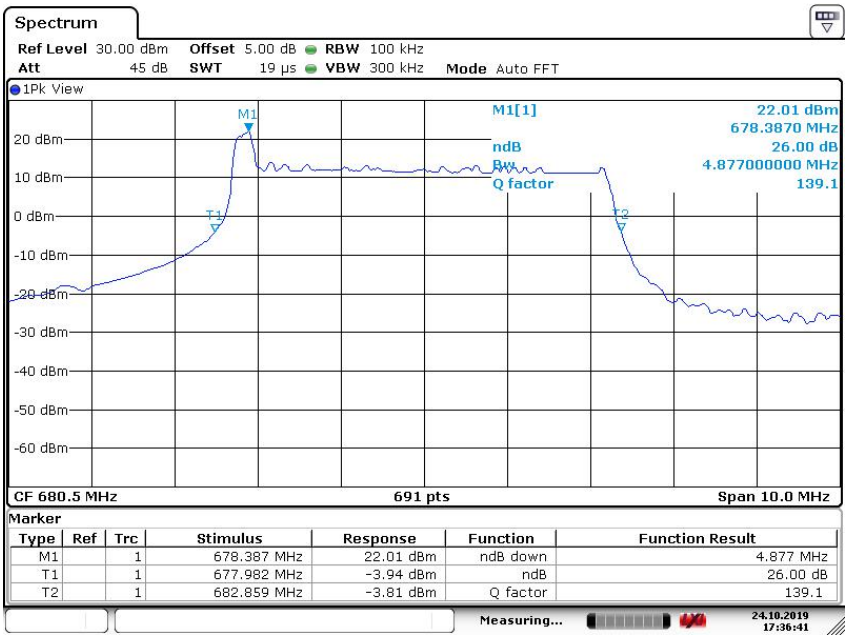
n71, 5MHz Bandwidth,DFT-s-QPSK (-26dBc BW)



Date: 24.OCT.2019 17:36:41

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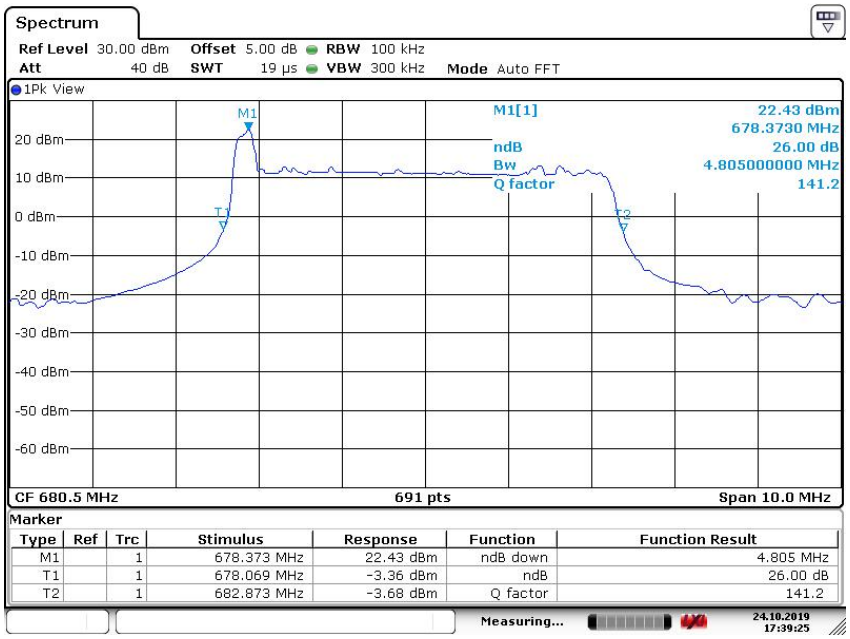
n71, 5MHz Bandwidth,DFT-s-16QAM (-26dBc BW)



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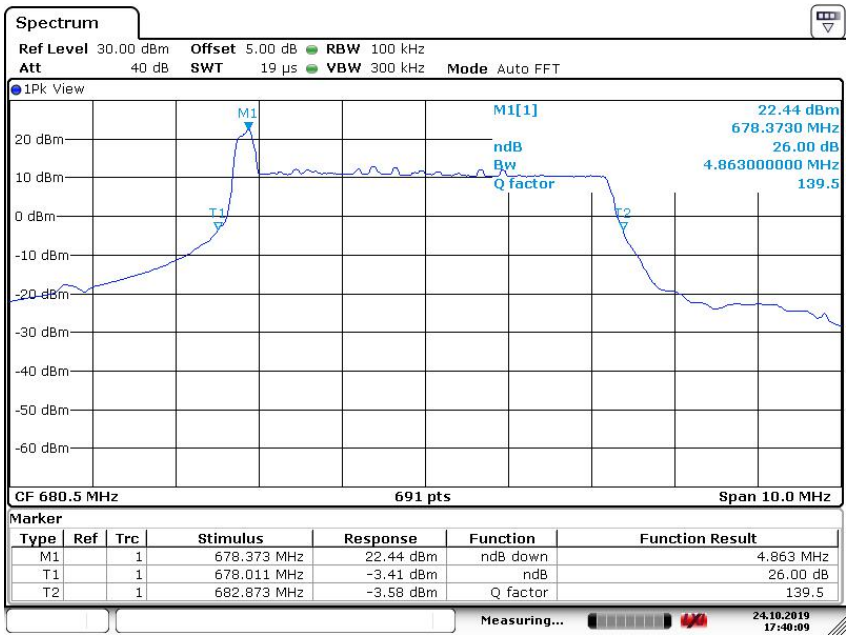
n71, 5MHz Bandwidth,DFT-s-64QAM (-26dBc BW)



Date: 24.OCT.2019 17:40:10

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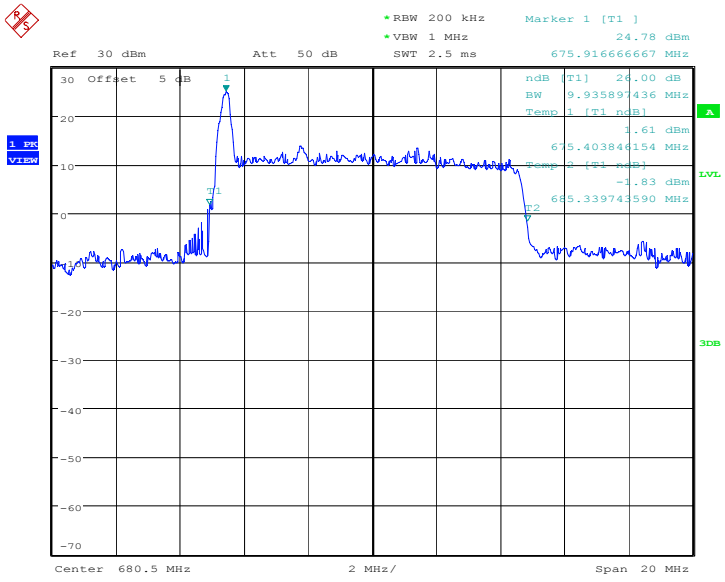
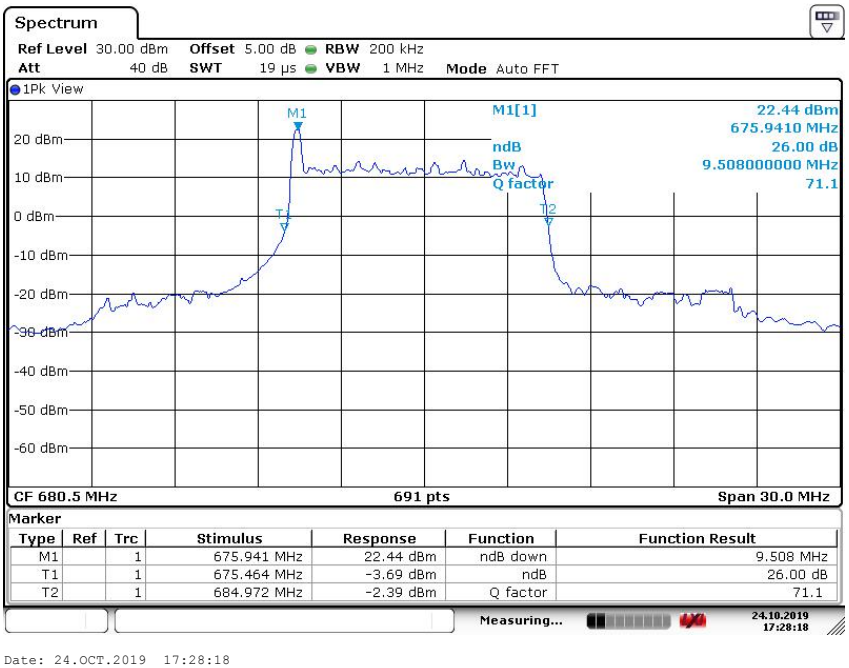
n71, 10MHz (-26dBc)

Frequency (MHz)	Emission Bandwidth (-26dBc) (kHz)	
	CP-QPSK	DFT-s-QPSK
680.5	9935.90	9508.00

n71, 10MHz Bandwidth, CP-QPSK (-26dBc BW)



n71, 10MHz Bandwidth, DFT-s-QPSK (-26dBc BW)



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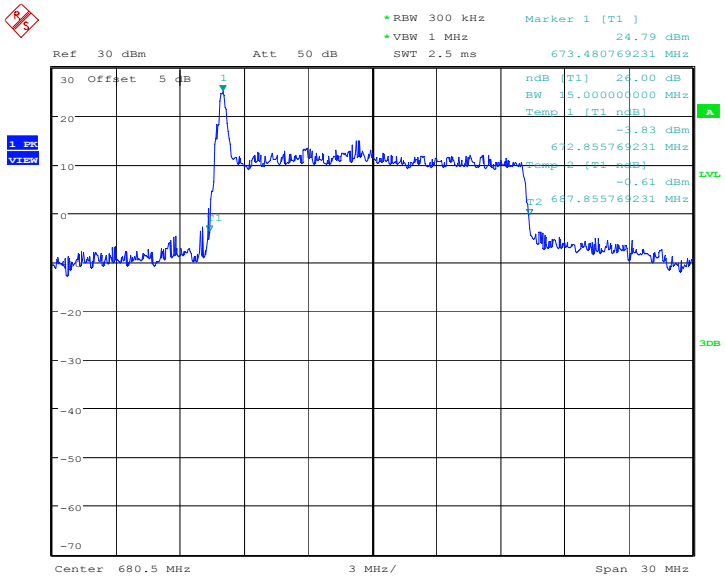
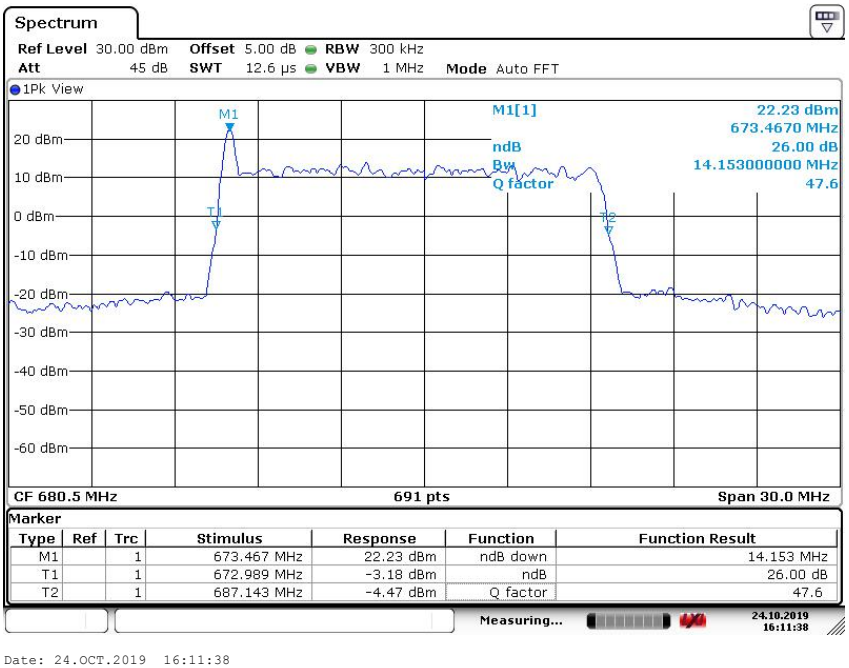
n71, 15MHz (-26dBc)

Frequency (MHz)	Emission Bandwidth (-26dBc) (kHz)	
	CP-QPSK	DFT-s-QPSK
680.5	15000.00	14153.00

n71, 15MHz Bandwidth, CP-QPSK (-26dBc BW)



n71, 15MHz Bandwidth, DFT-s-QPSK (-26dBc BW)



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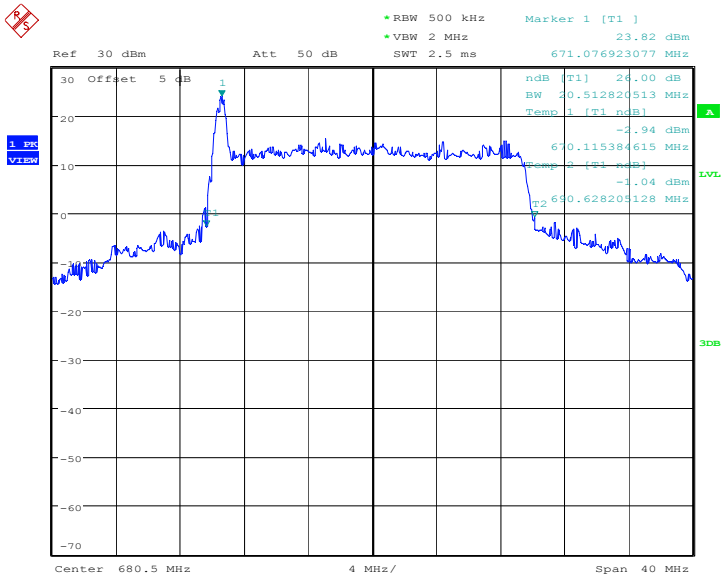
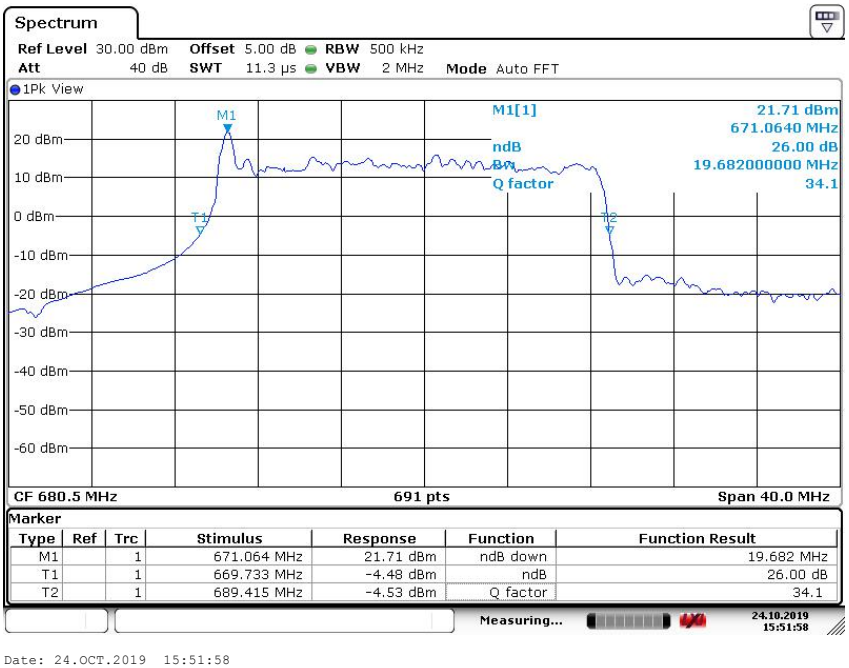
n71, 20MHz (-26dBc)

Frequency (MHz)	Emission Bandwidth (-26dBc) (kHz)	
	CP-QPSK	DFT-s-QPSK
680.5	20513.82	19682.00

n71, 20MHz Bandwidth, CP-QPSK (-26dBc BW)



n71, 20MHz Bandwidth, DFT-s-QPSK (-26dBc BW)



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A.6 BAND EDGE COMPLIANCE

A.6.1 Measurement limit

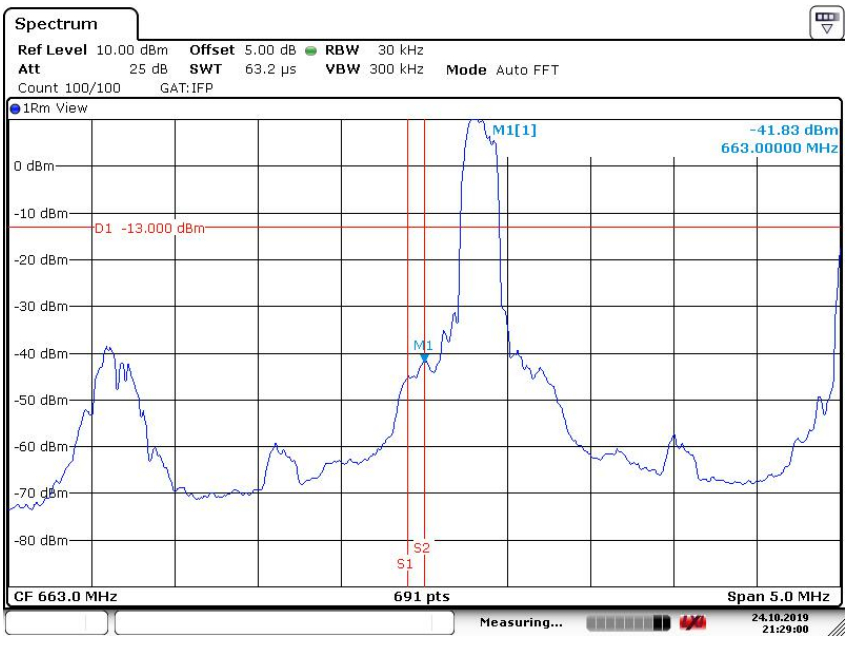
Part 27.53(g) specifies that for operations in the 600 MHz band and the 698–746 MHz band, the power of any emission outside a licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, by at least 43 + 10 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.

A.6.2 Measurement result

Only the worst case result is given below

n71

LOW BAND EDGE BLOCK-1RB-low_offset



Date: 24.OCT.2019 21:29:00

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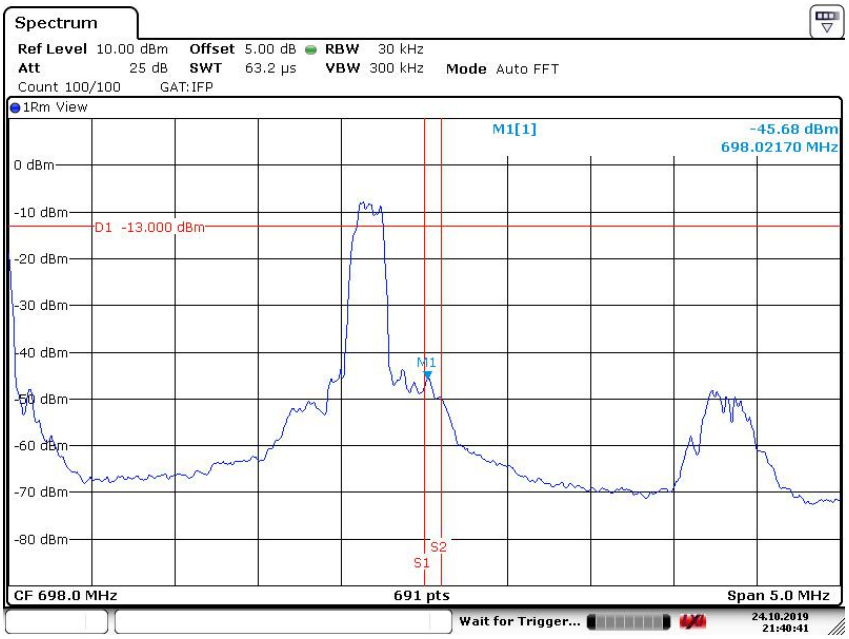
HIGH BAND EDGE BLOCK-1RB-high_offset



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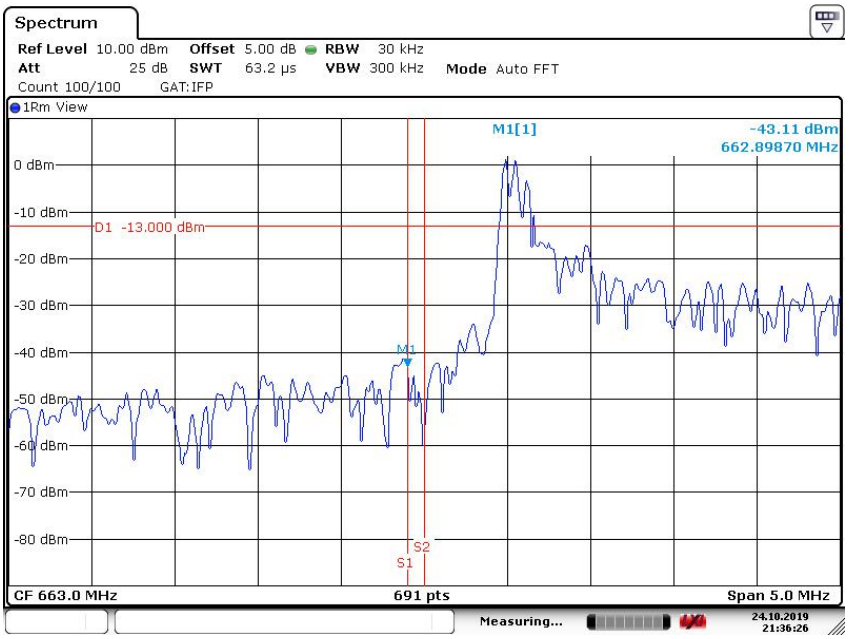
LOW BAND EDGE BLOCK-20MHz-100%RB



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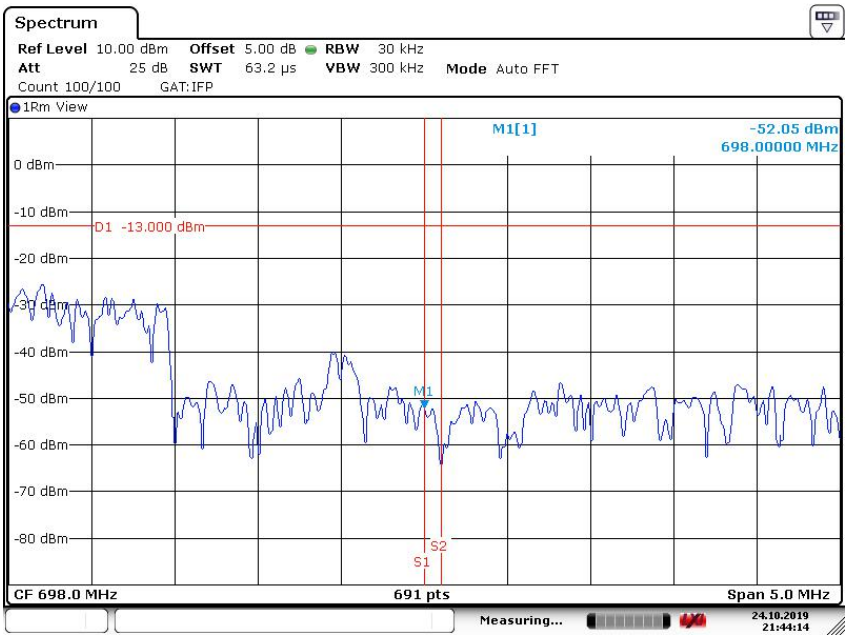
HIGH BAND EDGE BLOCK-20MHz-100%RB



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A.7 CONDUCTED SPURIOUS EMISSION

A.7.1 Measurement Method

The following steps outline the procedure used to measure the conducted emissions from the EUT.

1. Determine frequency range for measurements: From CFR 2.1057 the spectrum should be investigated from the lowest radio frequency generated in the equipment up to at least the 10th harmonic of the carrier frequency. For the mobile station equipment tested, this equates to a frequency range of 13 MHz to 9 GHz, data taken from 10 MHz to 25 GHz.
2. Determine EUT transmit frequencies below outlines the band edge frequencies pertinent to conducted emissions testing.
3. The number of sweep points of spectrum analyzer is set to 30001 which is greater than span/RBW.

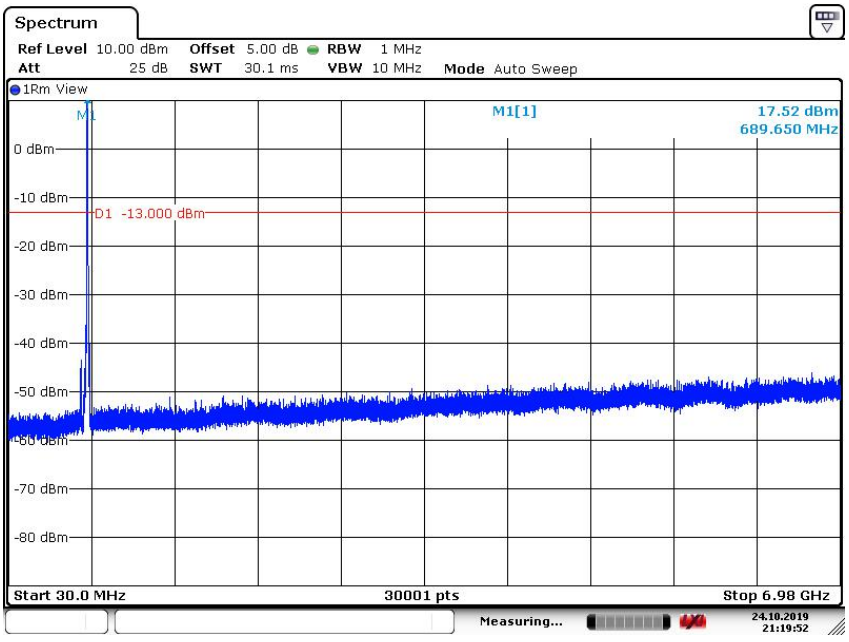
A. 7.2 Measurement Limit

Part 27.53(g) specifies that 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.

A. 7.3 Measurement result

Only the worst case result is given below

n71: 30MHz – 6.98GHz



Date: 24.OCT.2019 21:19:53

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A.8 PEAK-TO-AVERAGE POWER RATIO

The peak-to-average power ratio (PAPR) of the transmitter output power must not exceed 13 dB. The PAPR measurements should be made using either an instrument with complementary cumulative distribution function (CCDF) capabilities to determine that PAPR will not exceed 13 dB for more than 0.1 percent of the time or other Commission approved procedure. The measurement must be performed using a signal corresponding to the highest PAPR expected during periods of continuous transmission.

According to KDB 971168 5.7.1:

a) Refer to instrument's analyzer instruction manual for details on how to use the power statistics/CCDF function;

b) Set resolution/measurement bandwidth ⩾ signal's occupied bandwidth;

c) Set the number of counts to a value that stabilizes the measured CCDF curve;

d) Set the measurement interval to 1ms;

e) Record the maximum PAPR level associated with a probability of 0.1%.

A.8.1 Measurement limit

not exceed 13 dB

A.8.2 Measurement results

n71, 20MHz

Frequency (MHz)	PAPR (dB)						
	CP-QPSK	CP-16QAM	CP-64QAM	CP-256QAM	DFT-s-QPSK	DFT-s-16QAM	DFT-s-64QAM
680.5	7.05	7.17	7.46	8.00	4.72	6.05	5.61

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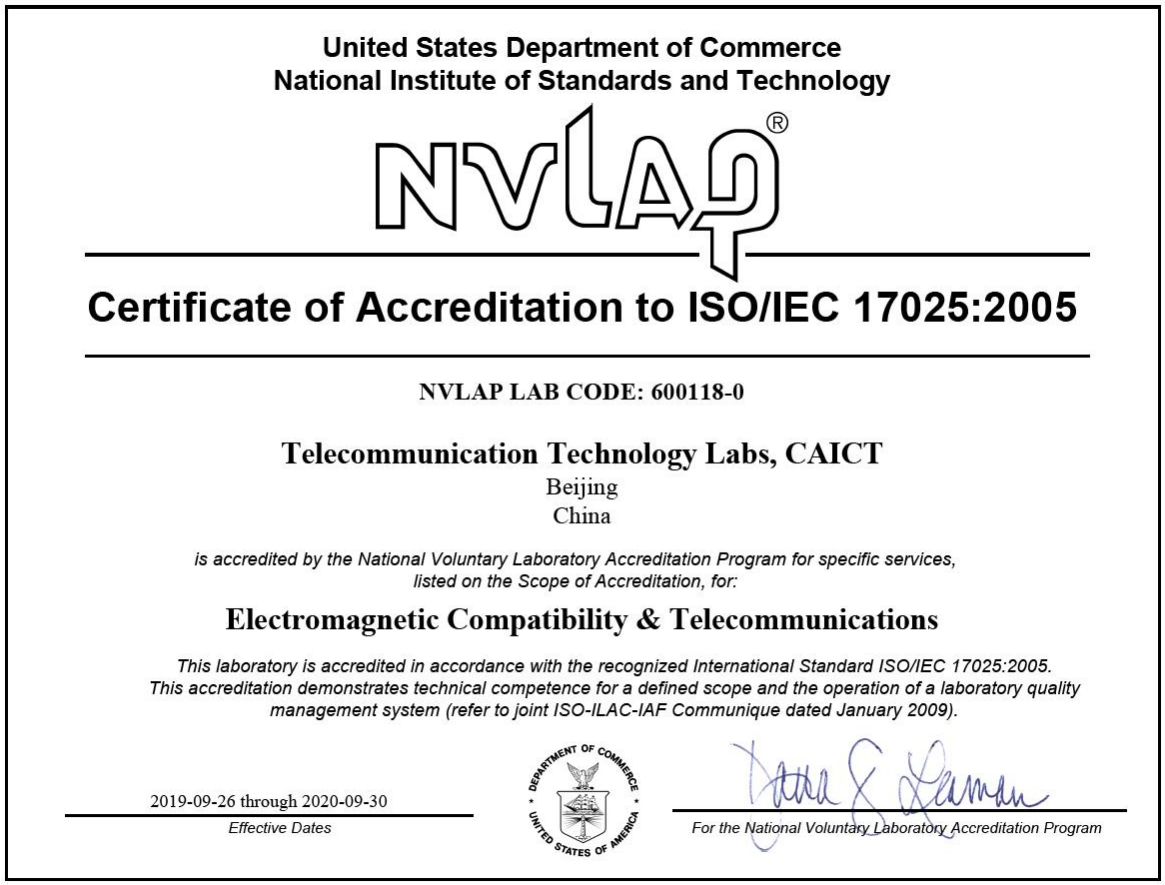
ANNEX B: Accreditation Certificate



United States Department of Commerce
National Institute of Standards and Technology

NVLAP®

Certificate of Accreditation to ISO/IEC 17025:2005

NVLAP LAB CODE: 600118-0

Telecommunication Technology Labs, CAICT
Beijing
China

is accredited by the National Voluntary Laboratory Accreditation Program for specific services, listed on the Scope of Accreditation, for:

Electromagnetic Compatibility & Telecommunications

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communique dated January 2009).

2019-09-26 through 2020-09-30
Effective Dates

DEPARTMENT OF COMMERCE * UNITED STATES OF AMERICA *

For the National Voluntary Laboratory Accreditation Program

*****END OF REPORT*****

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