



## **TEST REPORT**

**No. I18N00930-UMTS**

for

**Yulong Computer Telecommunication Scientific (Shenzhen) Co., Ltd**

**Mobile Hotspot**

**Model Name: cp331A**

**FCC ID: R38YLCP331A**

with

**Hardware Version: P1**

**Software Version: 2.0.158.P0.180824.cp331A**

**Issued Date: 2018-09-07**

**Note:**

The test results in this test report relate only to the devices specified in this report. This report shall not be reproduced except in full without the written approval of SAICT.

**Test Laboratory:**

Designation Number: CN1210

SAICT, Shenzhen Academy of Information and Communications Technology

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## **REPORT HISTORY**

<b>Report Number</b>	<b>Revision</b>	<b>Description</b>	<b>Issue Date</b>
I18N00930-UMTS	Rev.0	1st edition	2018-09-07

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## 1. Test Laboratory

### 1.1. Testing Location

Company Name: Shenzhen Academy of Information and Communications  
Technology  
Address: Building G, Shenzhen International Innovation Center, No.1006  
Shennan Road, Futian District, Shenzhen, Guangdong, P. R. China  
Postal Code: 518026  
Telephone: +86(0)755-33322000  
Fax: +86(0)755-33322001

### 1.2. Testing Environment

Normal Temperature: 15-35°C  
Relative Humidity: 20-75%

### 1.3. Project data

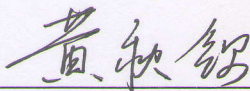
Testing Start Date: 2018-08-03  
Testing End Date: 2018-08-14

### 1.4. Signature



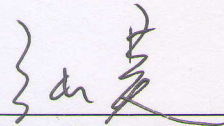
Lai Minghua

(Prepared this test report)



Huang Qiuqin

(Reviewed this test report)



Zhang Hao

(Approved this test report)

## **2. Client Information**

### **2.1. Applicant Information**

Company Name: Yulong Computer Telecommunication Scientific (Shenzhen) Co., Ltd  
Address /Post: Coolpad Information Harbor, High-tech Industrial Park (North),  
Nanshan District, Shenzhen, P.R.C.  
Contact Person: chen yanting  
Contact Email: chenyanting@yulong.com  
Telephone: +86 15927320221  
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### **2.2. Manufacturer Information**

Company Name: Yulong Computer Telecommunication Scientific (Shenzhen) Co., Ltd  
Address /Post: Coolpad Information Harbor, High-tech Industrial Park (North),  
Nanshan District, Shenzhen, P.R.C.  
Contact Person: chen yanting  
Contact Email: chenyanting@yulong.com  
Telephone: +86 15927320221  
Fax: /

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

#### **3.1. About EUT**

Description	Mobile Hotspot
Model Name	cp331A
FCC ID	R38YLCP331A
Frequency Bands	WCDMA Band 2,4
Antenna	Integrated
Extreme vol. Limits	3.6VDC to 4.4VDC (nominal: 3.85VDC)
Extreme temp. Tolerance	-30°C to +50°C
Condition of EUT as received	No abnormality in appearance

#### **3.2. Internal Identification of EUT used during the test**

<b>EUT ID*</b>	<b>IMEI</b>	<b>HW Version</b>	<b>SW Version</b>	<b>Sample Arrival Date</b>
UT02ab	860006040001402	P1	2.0.158.P0.180824.c p331A	2018-07-30

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

#### **3.3. Internal Identification of AE used during the test**

<b>AE ID*</b>	<b>Description</b>
AE1	Battery
AE2	Charger

AE1

Model	/
Manufacturer	/
Capacitance	/

AE2

Model	/
Manufacturer	/

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

#### **3.4. General Description**

The Equipment Under Test (EUT) is a model TD-LTE mobile phone with integrated antenna. It consists of normal options: lithium battery, charger. Manual and specifications of the EUT were provided to fulfil the test.

## 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 24	PERSONAL COMMUNICATIONS SERVICES	10-1-17 Edition
FCC Part 2	FREQUENCY ALLOCATIONS AND RADIO TREATY MATTERS; GENERAL RULES AND REGULATIONS	10-1-17 Edition
FCC Part 27	MISCELLANEOUS WIRELESS COMMUNICATIONS SERVICES	10-1-17 Edition
ANSI/TIA-603-E	Land Mobile FM or PM Communications Equipment Measurement and Performance Standards	2016
ANSI C63.26	American National Standard of Procedures for Compliance Testing of Licensed Transmitters Used in Licensed Radio Service	2015

## 5. LABORATORY ENVIRONMENT

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

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

**Fully-anechoic chamber** did not exceed following limits along the EMC testing

Temperature	Min. = 15 °C, Max. = 35 °C
Relative humidity	Min. = 15 %, Max. = 75 %
Shielding effectiveness	0.014MHz-1MHz> 60 dB; 1MHz-18000MHz>90 dB
Electrical insulation	> 2MΩ
Ground system resistance	< 4 Ω
Voltage Standing Wave Ratio (VSWR)	≤ 6 dB, from 1 to 18 GHz, 3 m distance
Uniformity of field strength	Between 0 and 6 dB, from 80 to 6000 MHz



## 6. SUMMARY OF TEST RESULTS

Abbreviations used in this clause:		
Verdict Column	P	Pass
	F	Fail
	NA	Not applicable
	NM	Not measured
Location Column	A/B/C/D	The test is performed in test location A, B, C or D which are described in section 1.1 of this report

### WCDMA Band II

Items	Test Name	Clause in FCC rules	Section in this report	Verdict
1	Output Power	2.1046/24.232	A.1	P
2	Frequency Stability	2.1055/24.235	A.2	P
3	Occupied Bandwidth	2.1049/24.238	A.3	P
4	Emission Bandwidth	2.1049/24.238	A.4	P
5	Band Edge Compliance	2.1051/24.238	A.5	P
6	Conducted Spurious Emission	2.1051/24.238	A.6	P
7	Peak-to-Average Power Ratio	24.232	A.7	P
*8	Radiated Results	2.1053/24.232/24.238	ANNEX B	P

\* mean radiated data refer to report No.BL-SZ1880381-501

### WCDMA Band IV

Items	Test Name	Clause in FCC rules	Section in this report	Verdict
1	Output Power	2.1046/27.50(d)	A.1	P
2	Frequency Stability	2.1055/27.54	A.2	P
3	Occupied Bandwidth	2.1049/27.53(g)	A.3	P
4	Emission Bandwidth	2.1049/27.53(g)	A.4	P
5	Band Edge Compliance	2.1051/27.53(h)	A.5	P
6	Conducted Spurious Emission	2.1051/27.53(h)	A.6	P
7	Peak-to-Average Power Ratio	27.50(d)	A.7	P
*8	Radiated Results	2.1053/27.50(d)/27.53(h)	ANNEX B	P

\* mean radiated data refer to report No.BL-SZ1880381-501

### 7. Test Equipments Utilized

NO.	Description	TYPE	Manufacture	series number	CAL DUE DATE
1	Universal Radio Communication Tester	CMU200	R&S	123210	2018-12-13
2	Spectrum Analyzer	FSU	R&S	200679	2018-12-13
3	Temperature Chamber	SH-241	ESPECs	92007516	2018-11-14
4	DC Power Supply	U3606A	Agilent Technologies	MY50450012	2018-11-14

## **ANNEX A: MEASUREMENT RESULTS**

### **A.1 OUTPUT POWER**

#### **Reference**

FCC: CFR Part 2.1046, 24.232, 27.50(d)

#### **A.1.1 Summary**

During the process of testing, the EUT was controlled via Rhode & Schwarz Digital Radio Communication tester (CMU-200 or CMW500) to ensure max power transmission and proper modulation.

This result contains peak output power and for the EUT. In all cases, output power is within the specified limits.

The radiated results are tested by Shenzhen BALUN Technology Co., Ltd. Address Block B, 1<sup>st</sup> FL, Baisha Science and Technology Park, Shahe Xi Road, Nanshan District, Shenzhen Guangdong Province, P.R.C. The results of radiated please see Annex B, that the partial report issued by Shenzhen BALUN Technology Co., Ltd and report No.BL-SZ1880381-501

#### **A.1.2 Conducted**

##### **A.1.2.1 Method of Measurements**

The EUT was set up for the max output power with pseudo random data modulation.

These measurements were done at 3 frequencies, 1852.4 MHz, 1880.0MHz and 1907.6MHz for WCDMA Band II;826.4MHz and 1712.4MHz, 1740.0MHz and 1752.6MHz for WCDMA Band IV (bottom, middle and top of operational frequency range).

#### **Limit**

According to FCC Part 2.1046

#### **WCDMA Band II**

##### **A.1.2.2 Measurement result**

#### **QPSK**

	CH	Frequency(MHz)	output power(dBm)
WCDMA (Band II)	9262	1852.4	23.83
	9400	1880.0	24.08
	9538	1907.6	24.06

#### **16QAM**

	CH	Frequency(MHz)	output power(dBm)
WCDMA (Band II)	9262	1852.4	23.18
	9400	1880.0	23.32
	9538	1907.6	23.26

**WCDMA Band IV**

**Measurement result**

**QPSK**

	CH	Frequency(MHz)	output power(dBm)
WCDMA (Band IV)	1312	1712.4	23.64
	1450	1740.0	23.71
	1513	1752.6	23.75

**16QAM**

	CH	Frequency(MHz)	output power(dBm)
WCDMA (Band IV)	1312	1712.4	23.11
	1450	1740.0	23.08
	1513	1752.6	23.06

Note: Expanded measurement uncertainty is  $U = 0.488\text{dB}$ ,  $k = 1.96$

## Annex B Radiated

### A.1.3.1 Description

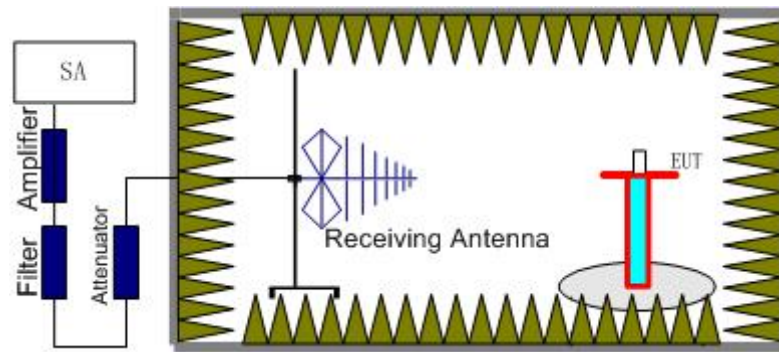
This is the test for the maximum radiated power from the EUT.

Rule Part 24.232(b) specifies, "Mobile/portable stations are limited to 2 watts e.i.r.p. Peak power" and 24.232(c) specifies that "Peak transmit power must be measured over any interval of continuous transmission using instrumentation calibrated in terms of an rms-equivalent voltage."

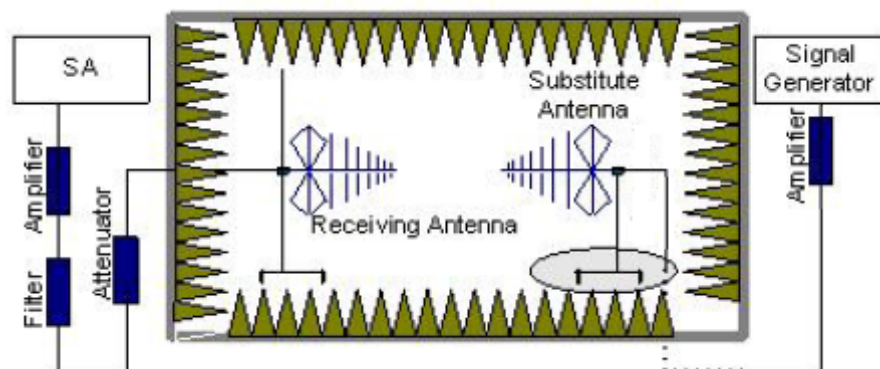
### A.1.3.2 Method of Measurement

The measurements procedures in TIA-603-E-2016 are used.

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. The radiated emission measurements of all transmit frequencies in three channels (High, Middle, Low) 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, an 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 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, and adjust the level of the signal generator output until the value of the

receiver reach 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. An amplifier should be connected to the Signal Source output port. And the cable should be connected between the Amplifier and the Substitution Antenna.

The cable loss ( $P_{cl}$ ), the Substitution Antenna Gain (dBi) ( $G_a$ ) and the Amplifier Gain ( $P_{Ag}$ ) should be recorded after test.

The measurement results are obtained as described below:

$$\text{Power(EIRP)} = P_{Mea} - P_{Ag} - P_{cl} + G_a$$

5. This value is EIRP since the measurement is calibrated using an antenna of known gain (2.15 dBi) and known input power.
6. ERP can be calculated from EIRP by subtracting the gain of the dipole,  $ERP = EIRP - 2.15\text{dB}$ .

### WCDMA Band II-EIRP

#### Limits

	Burst Peak EIRP (dBm)
WCDMA Band II	≤33dBm (2W)

#### Measurement result

##### QPSK

Frequency(MHz)	P <sub>Mea</sub> (dBm)	P <sub>cl</sub> (dB)+ P <sub>Ag</sub> (dB)	Ga Antenna Gain(dBi)	EIRP(dBm)	Limit(dBm)	Polarization
1852.40	-9.58	-29.40	0.15	19.97	33.00	H
1880.00	-9.32	-29.30	0.25	20.23	33.00	H
<b>1907.60</b>	<b>-9.09</b>	<b>-29.30</b>	<b>0.35</b>	<b>20.56</b>	<b>33.00</b>	<b>H</b>

##### 16QAM

Frequency(MHz)	P <sub>Mea</sub> (dBm)	P <sub>cl</sub> (dB)+ P <sub>Ag</sub> (dB)	Ga Antenna Gain(dBi)	EIRP(dBm)	Limit(dBm)	Polarization
1852.40	-9.41	-29.40	0.15	20.14	33.00	H
1880.00	-9.15	-29.30	0.25	20.40	33.00	H
1907.60	-9.19	-29.30	0.35	20.46	33.00	H

Frequency: 1907.6MHz

Peak EIRP(dBm)= P<sub>Mea</sub>(-9.09dBm)-(P<sub>cl</sub>+P<sub>Ag</sub>)(-29.30dB)+Ga (0.35dB) =20.56dBm

**ANALYZER SETTINGS: RBW = VBW = 5MHz**

### WCDMA Band IV-EIRP

#### Limits

	Burst Peak EIRP (dBm)
WCDMA Band IV	≤30.00dBm

#### Measurement result

##### QPSK

Frequency(MHz)	P <sub>Mea</sub> (dBm)	P <sub>cl</sub> (dB)+ P <sub>Ag</sub> (dB)	Ga Antenna Gain(dBi)	EIRP(dBm)	Limit(dBm)	Polarization
1712.40	-10.56	-29.40	0.39	19.23	30.00	H
1740.00	-10.61	-29.30	0.27	18.96	30.00	H
1752.60	-10.42	-29.30	0.17	19.05	30.00	H

##### 16QAM

Frequency(MHz)	P <sub>Mea</sub> (dBm)	P <sub>cl</sub> (dB)+ P <sub>Ag</sub> (dB)	Ga Antenna Gain(dBi)	EIRP(dBm)	Limit(dBm)	Polarization
<b>1712.40</b>	<b>-10.36</b>	<b>-29.40</b>	<b>0.39</b>	<b>19.43</b>	<b>30.00</b>	<b>H</b>
1740.00	-10.52	-29.30	0.27	19.05	30.00	H
1752.60	-10.37	-29.30	0.17	19.10	30.00	H

Frequency: 1712.40MHz

Peak EIRP(dBm)= P<sub>Mea</sub>(-10.36dBm)-(P<sub>cl</sub>+P<sub>Ag</sub>)(-29.40dB)+Ga (0.39dB)=19.43dBm

**ANALYZER SETTINGS: RBW = VBW = 5MHz**

Note: The maximum value of expanded measurement uncertainty for this test item is  $U = 2.44\text{dB}(30\text{MHz}-3\text{GHz})/4.04\text{dB}(3\text{GHz}-18\text{GHz})/4.6\text{dB}(18\text{GHz}-40\text{GHz})$ ,  $k = 2$

## **A.2 FREQUENCY STABILITY**

### **Reference**

FCC: CFR Part 2.1055, 24.235, 27.54

### **A.2.1 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 CMU200 DIGITAL RADIO COMMUNICATION TESTER.

1. Measure the carrier frequency at room temperature.
2. Subject the EUT to overnight soak at -30°C.
3. With the EUT, powered via nominal voltage, connected to the CMU200 and in a simulated call on mid channel of WCDMA Band II and WCDMA Band IV, 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°C increments from -30°C to +50°C. Allow at least 1 1/2 hours at each temperature, unpowered, before making measurements.
5. Remeasure carrier frequency at room temperature with nominal voltage. Vary supply voltage from minimum voltage to maximum voltage, in 0.1Volt increments remeasuring carrier frequency at each voltage. Pause at nominal voltage for 1 1/2 hours unpowered, to allow any self-heating to stabilize, before continuing.
6. Subject the EUT to overnight soak at +50°C.
7. With the EUT, powered via nominal voltage, connected to the CMU200 and in a simulated call on the centre 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°C increments from +50°C to -30°C. Allow at least 1 1/2 hours at each temperature, unpowered, before making measurements.
9. At all temperature levels hold the temperature to +/- 0.5°C during the measurement procedure.

### **A.2.2 Measurement Limit**

#### **A.2.2.1 For Hand carried battery powered equipment**

According to the JTC standard the frequency stability of the carrier shall be accurate to within 0.1 ppm of the received frequency from the base station. This accuracy is sufficient to meet Sec. 24.235, Frequency Stability. 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 4.4VDC, with a nominal voltage of 3.85VDC. 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. These voltages represent a tolerance of -10 % and +12.5 %. For the purposes of measuring frequency stability these voltage limits are to be used.

#### **A.2.2.2 For equipment powered by primary supply voltage**

According to the JTC standard the frequency stability of the carrier shall be accurate to within 0.1 ppm of the received frequency from the base station. This accuracy is sufficient to meet Sec.



24.235, Frequency Stability. The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block. For this EUT section 2.1055(d)(1) applies. This requires varying primary supply voltage from 85 to 115 percent of the nominal value for other than hand carried battery equipment.

**A.2.3 Measurement results**

**WCDMA Band II**

**Frequency Error vs Voltage-QPSK**

Voltage(V)	Frequency error(Hz)	Frequency error(ppm)
3.6	-6	0.003
3.85	-6	0.003
4.4	-8	0.004

**Frequency Error vs Temperature-QPSK**

temperature(°C)	Frequency error(Hz)	Frequency error(ppm)
-30	-5	0.003
-20	-5	0.003
-10	-8	0.004
0	-20	0.011
10	-5	0.003
20	-4	0.002
30	-6	0.003
40	-4	0.002
50	4	0.002

**Frequency Error vs Voltage-16QAM**

Voltage(V)	Frequency error(Hz)	Frequency error(ppm)
3.6	-6	0.003
3.85	-8	0.004
4.4	-6	0.003

**Frequency Error vs Temperature-16QAM**

temperature(°C)	Frequency error(Hz)	Frequency error(ppm)
-30	-8	0.004
-20	-5	0.002
-10	-7	0.003
0	8	0.004
10	8	0.004
20	-6	0.003
30	-5	0.003
40	-6	0.003
50	-13	0.007

**WCDMA Band IV**

**Frequency Error vs Voltage-QPSK**

Voltage(V)	Frequency error(Hz)	Frequency error(ppm)
3.6	8	0.005
3.85	-6	0.003
4.4	-11	0.006

**Frequency Error vs Temperature-QPSK**

temperature(°C)	Frequency error(Hz)	Frequency error(ppm)
-30	6	0.003
-20	-16	0.009
-10	6	0.003
0	7	0.004
10	5	0.003
20	6	0.004
30	5	0.003
40	-2	0.001
50	8	0.004

**Frequency Error vs Voltage-16QAM**

Voltage(V)	Frequency error(Hz)	Frequency error(ppm)
3.6	8	0.005
3.85	6	0.003
4.4	5	0.003

**Frequency Error vs Temperature-16QAM**

temperature(°C)	Frequency error(Hz)	Frequency error(ppm)
-30	5	0.003
-20	4	0.002
-10	5	0.003
0	4	0.002
10	5	0.003
20	5	0.003
30	4	0.002
40	4	0.003
50	5	0.003

Expanded measurement uncertainty is 10Hz, k = 2

### **A.3 OCCUPIED BANDWIDTH**

#### **Reference**

FCC: CFR Part 2.1049, 24.238, 27.53(g).

#### **A.3.1 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.

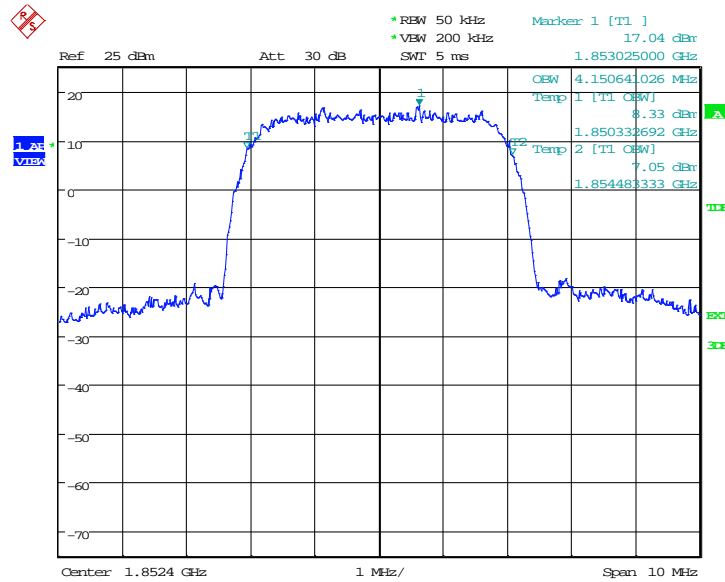
- a) The spectrum analyzer center frequency is set to the nominal EUT channel center frequency. The frequency span for the spectrum analyzer shall be set wide enough to capture all modulation products including the emission skirts (i.e., two to five times the OBW).
- b) The nominal IF filter bandwidth (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  $10\log(\text{OBW} / \text{RBW})$  below the reference level.
- e) Set the detection mode to peak, and the trace mode to max hold.
- d) Use the 99 % power bandwidth function of the spectrum analyzer and report the measured bandwidth.

**WCDMA Band II (99% BW)-QPSK**

Frequency(MHz)	Occupied Bandwidth (99% BW)( MHz)
1852.4	4.15
1880.0	4.13
1907.6	4.15

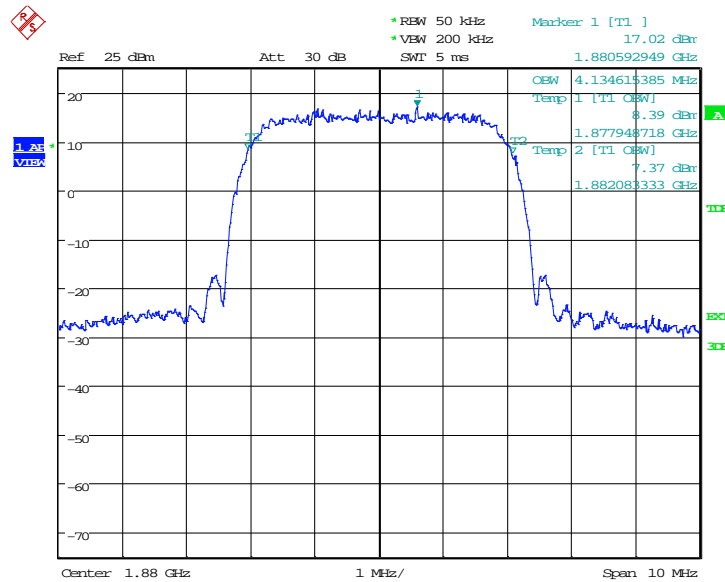
**WCDMA Band II**

**Channel 9262-Occupied Bandwidth (99% BW)-QPSK**



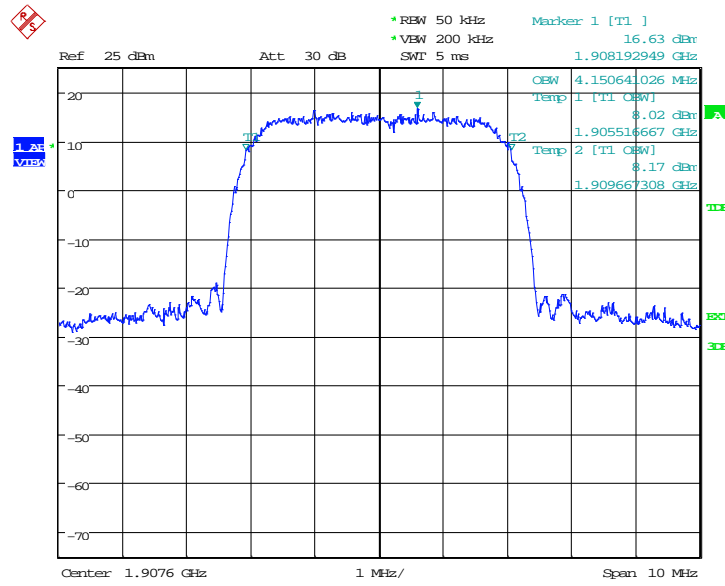
Date: 1.AUG.2018 06:13:41

**Channel 9400-Occupied Bandwidth (99% BW)-QPSK**



Date: 1.AUG.2018 06:14:14

**Channel 9538-Occupied Bandwidth (99% BW)-QPSK**



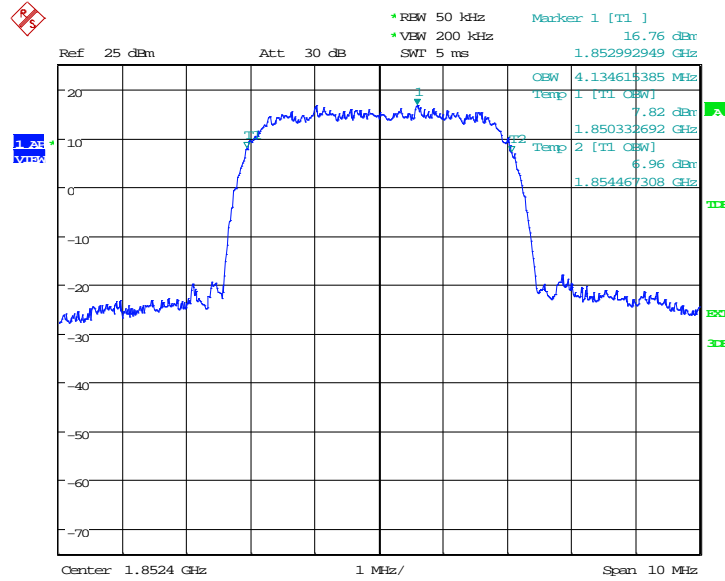
Date: 1.AUG.2018 06:14:48

**WCDMA Band II (99% BW)-16QAM**

Frequency(MHz)	Occupied Bandwidth (99% BW)( MHz)
1852.4	4.13
1880.0	4.12
1907.6	4.12

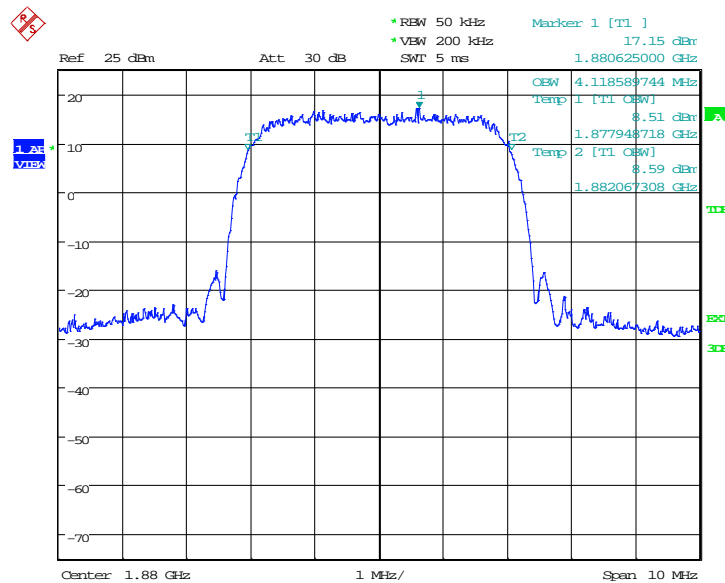
**WCDMA Band II**

**Channel 9262-Occupied Bandwidth (99% BW)-16QAM**



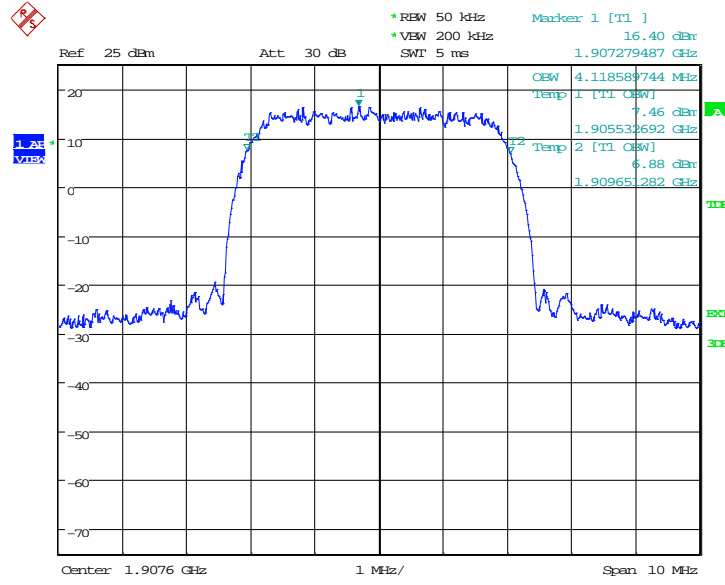
Date: 1.AUG.2018 12:19:19

**Channel 9400-Occupied Bandwidth (99% BW)-16QAM**



Date: 1.AUG.2018 12:19:53

### Channel 9538-Occupied Bandwidth (99% BW)-16QAM



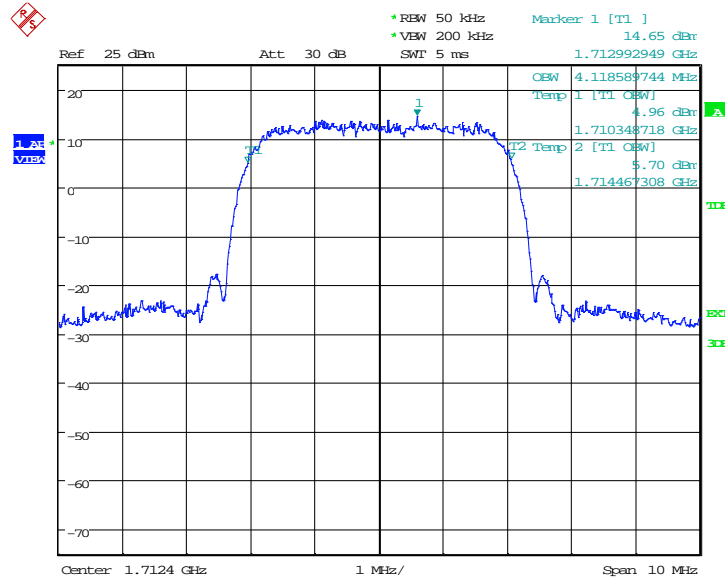
Date: 1.AUG.2018 12:20:26

**WCDMA Band IV(99% BW)-QPSK**

Frequency(MHz)	Occupied Bandwidth (99% BW)( MHz)
1712.4	4.12
1740.0	4.13
1752.6	4.13

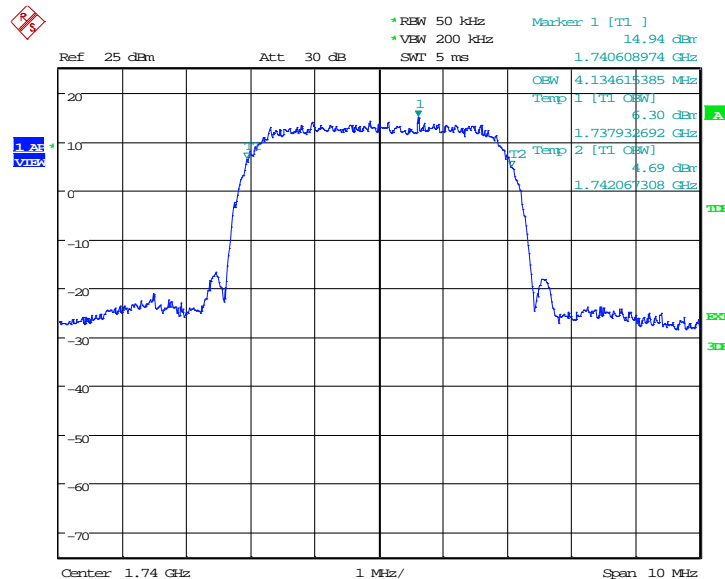
**WCDMA Band IV**

**Channel 1312-Occupied Bandwidth (99% BW)-QPSK**



Date: 1.AUG.2018 07:20:40

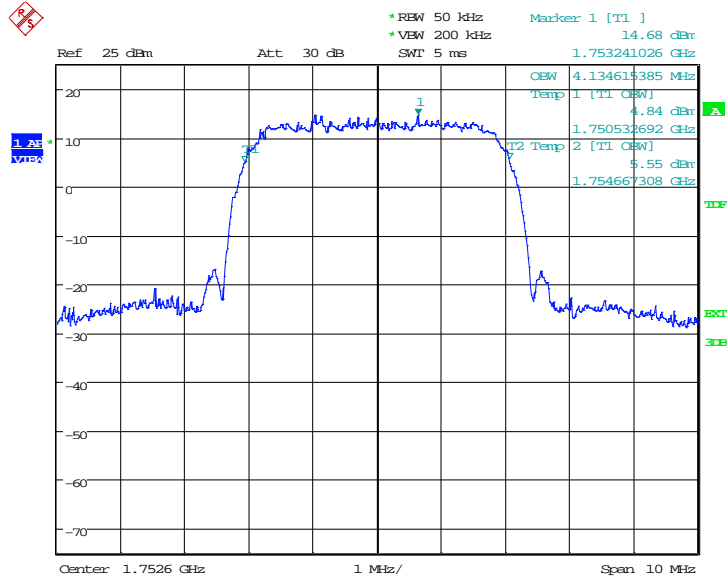
**Channel 1450-Occupied Bandwidth (99% BW)-QPSK**



Date: 1.AUG.2018 07:21:13



### Channel 1513-Occupied Bandwidth (99% BW)-QPSK



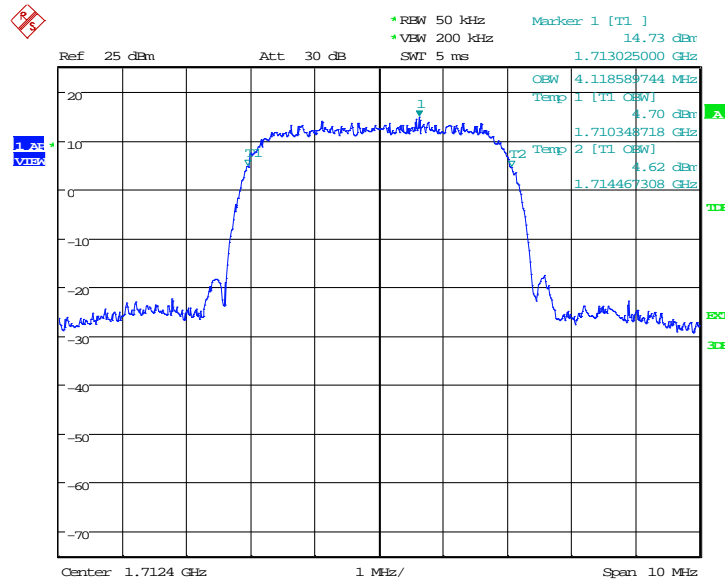
Date: 1.AUG.2018 07:21:47

**WCDMA Band IV(99% BW)-16QAM**

Frequency(MHz)	Occupied Bandwidth (99% BW)( MHz)
1712.4	4.12
1740.0	4.13
1752.6	4.13

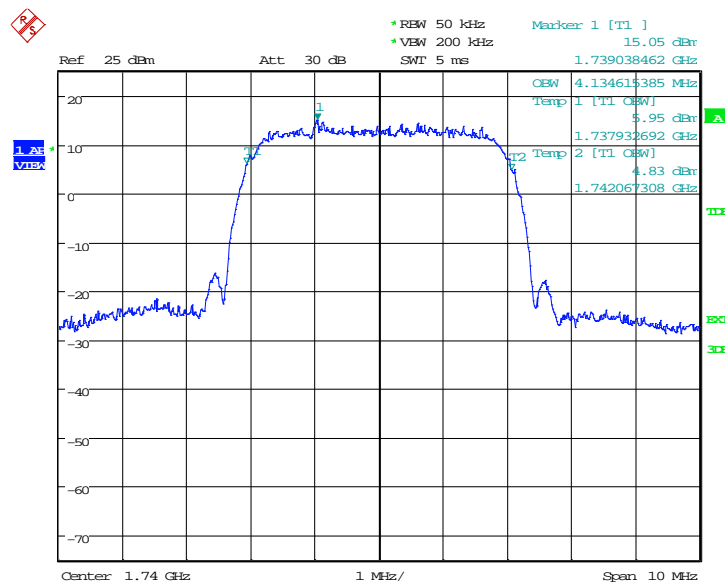
**WCDMA Band IV**

**Channel 1312-Occupied Bandwidth (99% BW)-16QAM**



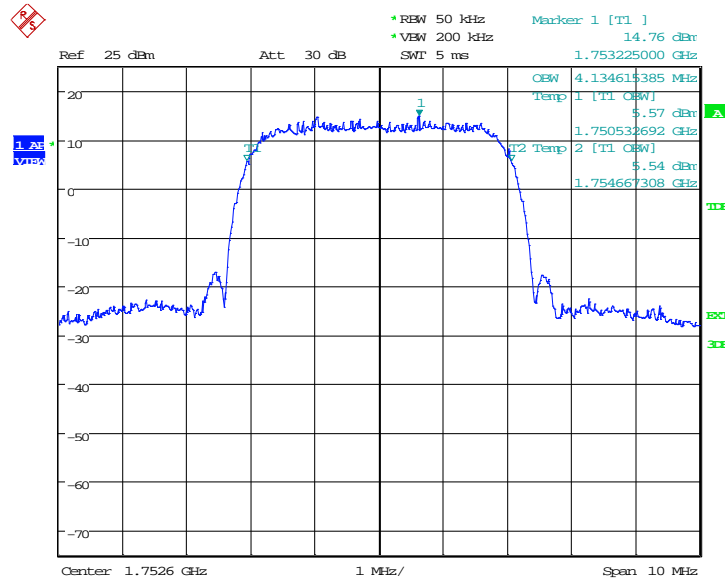
Date: 1.AUG.2018 11:38:50

**Channel 1450-Occupied Bandwidth (99% BW)-16QAM**



Date: 1.AUG.2018 11:39:24

### Channel 1513-Occupied Bandwidth (99% BW)-16QAM



Date: 1.AUG.2018 11:39:58

Note: Expanded measurement uncertainty is  $U = 3428\text{Hz}$ ,  $k = 2$

## A.4 EMISSION BANDWIDTH

### Reference

FCC: CFR Part 2.1049, 24.238, 27.53(g).

### A.4.1 Emission 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.

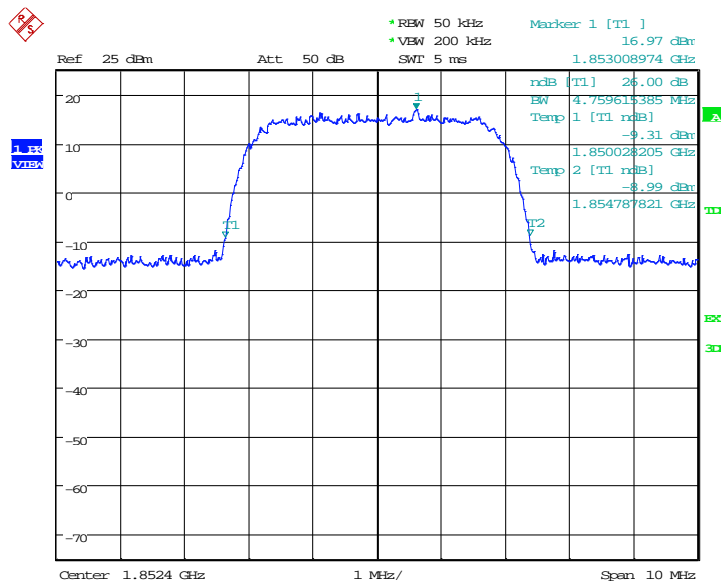
Similar to conducted emissions; Emission bandwidth measurements are only provided for selected frequencies in order to reduce the amount of submitted data. Data were taken at the extreme and mid frequencies. Table below lists the measured -26 dB BW. Spectrum analyzer plots are included on the following pages.

### WCDMA Band II (-26 dB BW)-QPSK

Frequency(MHz)	Emission Bandwidth (-26 dB BW)( MHz)
1852.4	4.76
1880.0	4.73
1907.6	4.78

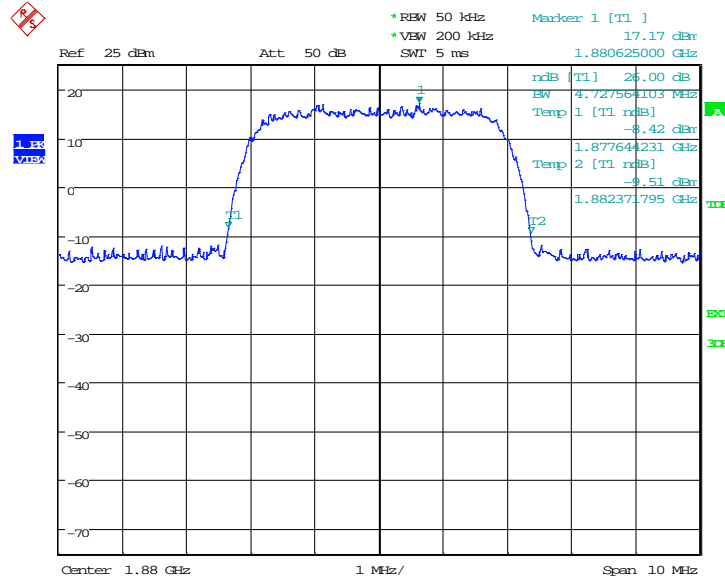
### WCDMA Band II

### Channel 9262-Emission Bandwidth (-26 dB BW)-QPSK

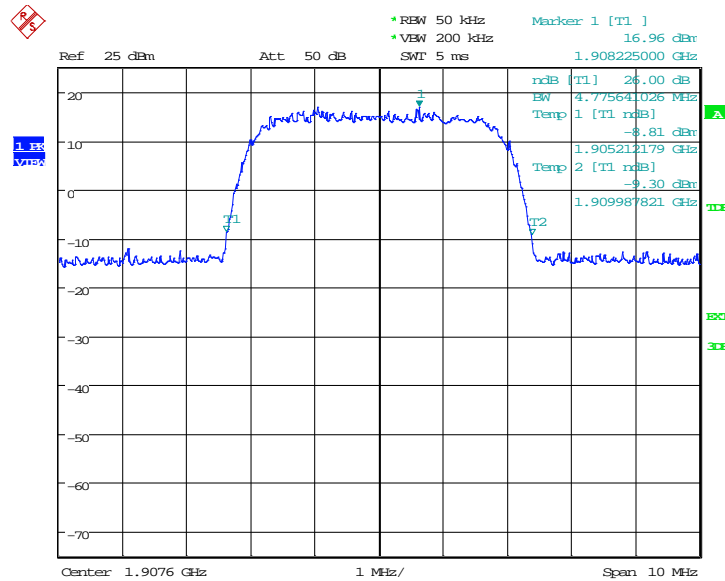


Date: 1.AUG.2018 06:15:58

### Channel 9400-Emission Bandwidth (-26 dB BW)-QPSK



### Channel 9538-Emission Bandwidth (-26 dB BW)-QPSK

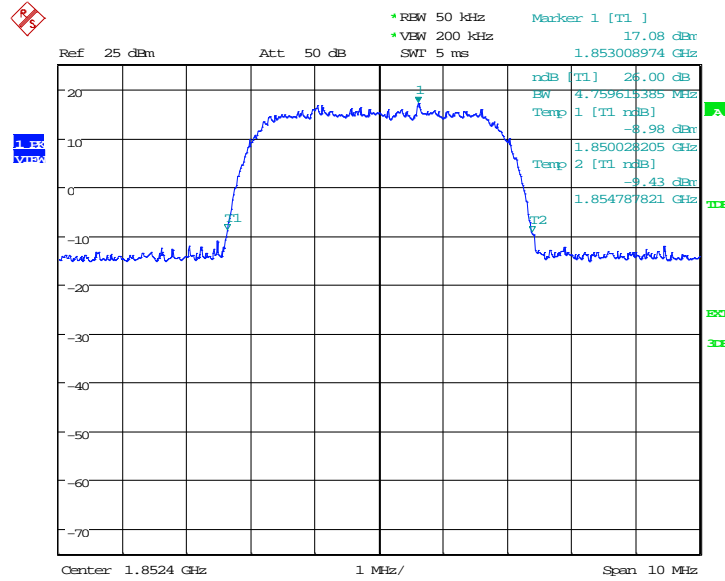


**WCDMA Band II (-26 dB BW)-16QAM**

Frequency(MHz)	Emission Bandwidth (-26 dB BW)( MHz)
1852.4	4.76
1880.0	4.71
1907.6	4.76

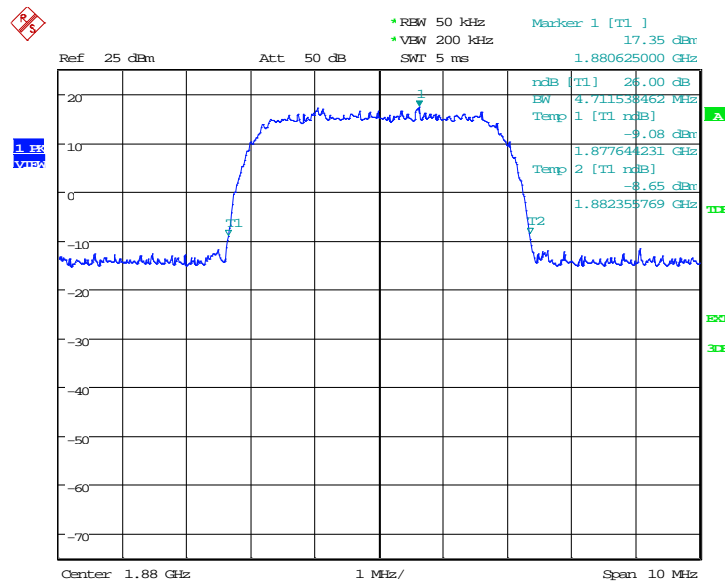
**WCDMA Band II**

**Channel 9262-Emission Bandwidth (-26 dB BW)-16QAM**



Date: 1.AUG.2018 12:21:36

**Channel 9400-Emission Bandwidth (-26 dB BW)-16QAM**



Date: 1.AUG.2018 12:22:46

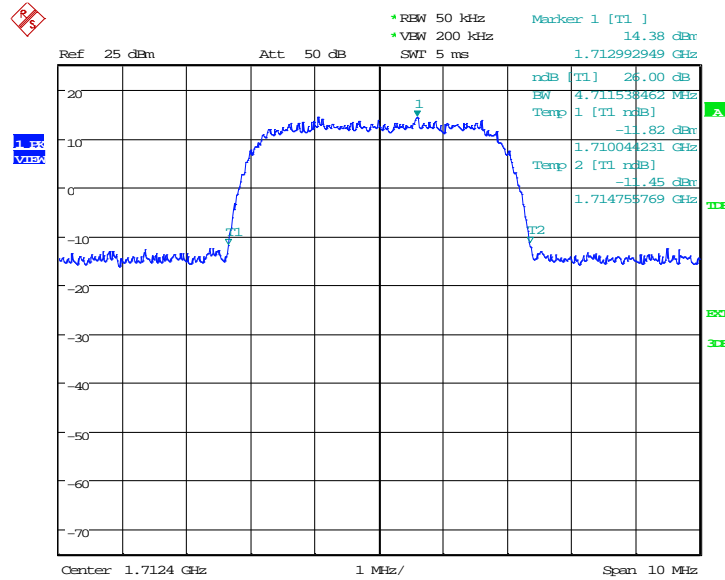


**WCDMA Band IV(-26 dB BW)-QPSK**

Frequency(MHz)	Emission Bandwidth (-26 dB BW)( MHz)
1712.4	4.71
1740.0	4.71
1752.6	4.73

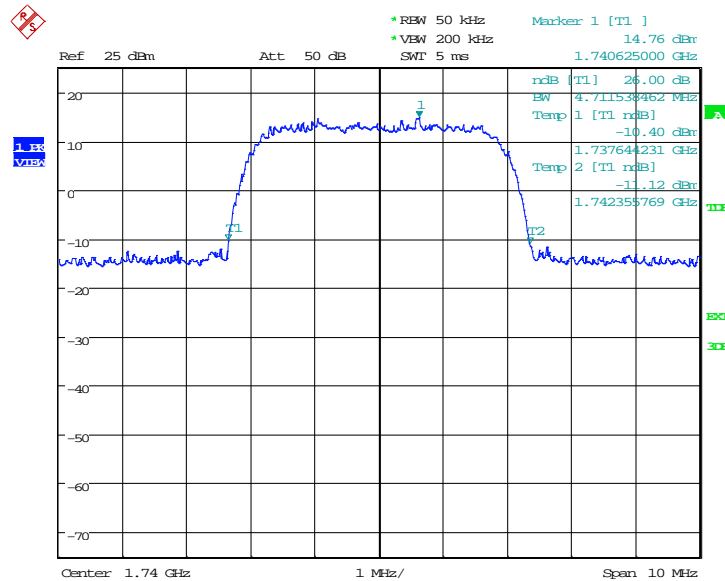
**WCDMA Band IV**

**Channel 1312-Emission Bandwidth (-26 dB BW)-QPSK**



Date: 1.AUG.2018 07:22:57

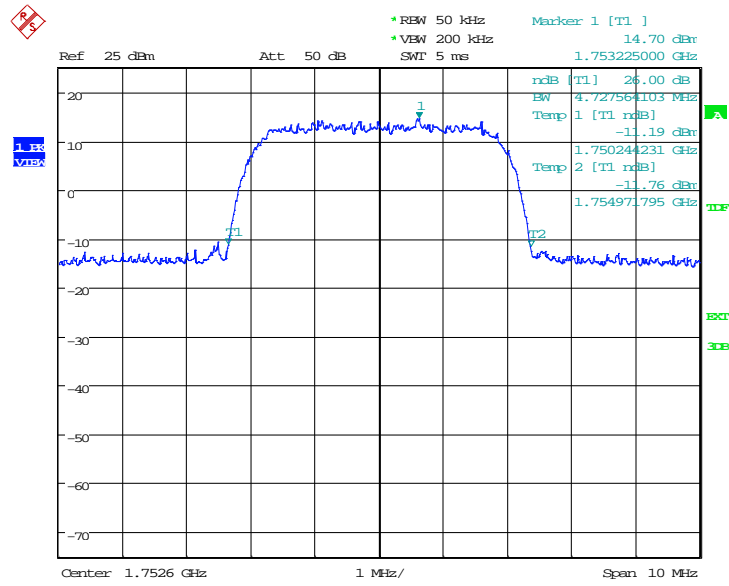
**Channel 1450-Emission Bandwidth (-26 dB BW)-QPSK**



Date: 1.AUG.2018 07:24:06



Channel 1513-Emission Bandwidth (-26 dB BW)-QPSK



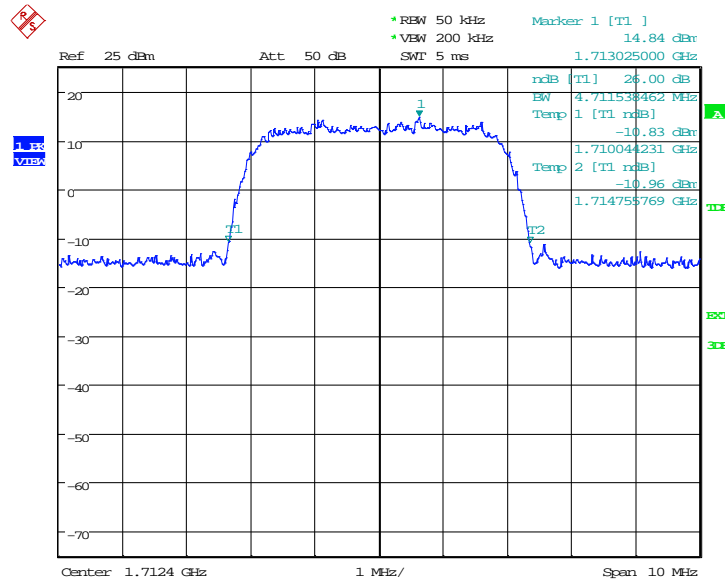
Date: 1.AUG.2018 07:25:16

**WCDMA Band IV(-26 dB BW)-16QAM**

Frequency(MHz)	Emission Bandwidth (-26 dB BW)( MHz)
1712.4	4.71
1740.0	4.71
1752.6	4.73

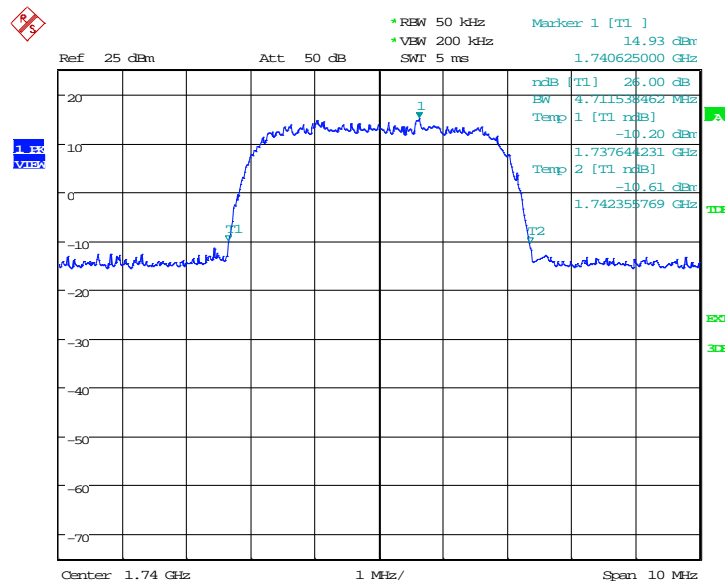
**WCDMA Band IV**

**Channel 1312-Emission Bandwidth (-26 dB BW)-16QAM**



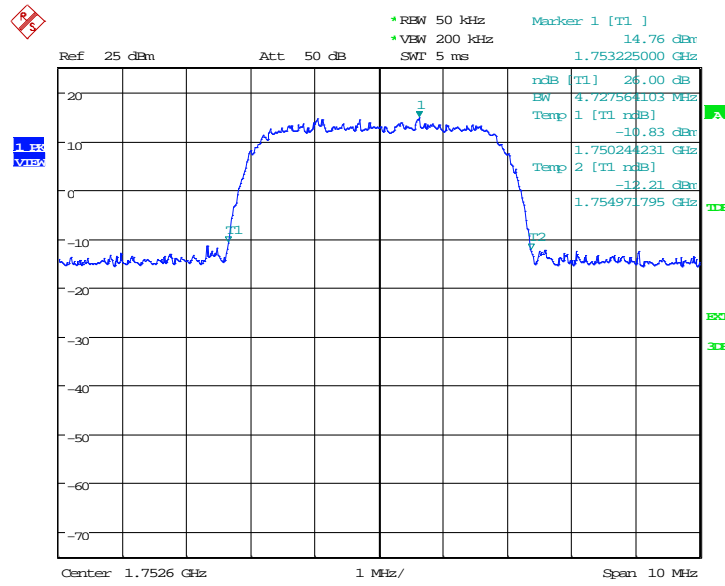
Date: 1.AUG.2018 11:41:08

**Channel 1450-Emission Bandwidth (-26 dB BW)-16QAM**



Date: 1.AUG.2018 11:42:17

Channel 1513-Emission Bandwidth (-26 dB BW)-16QAM



Date: 1.AUG.2018 11:43:26

Note: Expanded measurement uncertainty is  $U = 3428\text{Hz}$ ,  $k = 2$

## A.5 BAND EDGE COMPLIANCE

### Reference

FCC: CFR Part 2.1051, 24.238, 27.53(h).

### A.5.1 Measurement limit

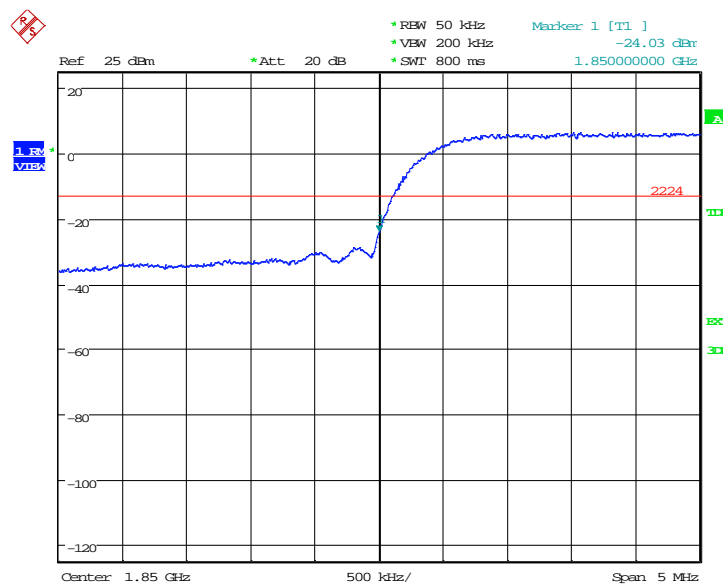
On any frequency outside frequency band of the US Cellular/PCS spectrum, the power of any emission shall be attenuated below the transmitter power (P, in Watts) by at least  $43+10\text{Log}(P)$  dB. For all power levels +30 dBm to 0 dBm, this becomes a constant specification limit of -13 dBm. A relaxation of the reference bandwidth is often provided for measurements within a specified frequency range at the edge of the authorized frequency block/band. This is often implemented by permitting the use of a narrower RBW (typically limited to a minimum RBW of 1% of the OBW) for measuring the out-of-band emissions without a requirement to integrate the result over the full reference bandwidth.

### A.5.2 Measurement result

Only worst case result is given below

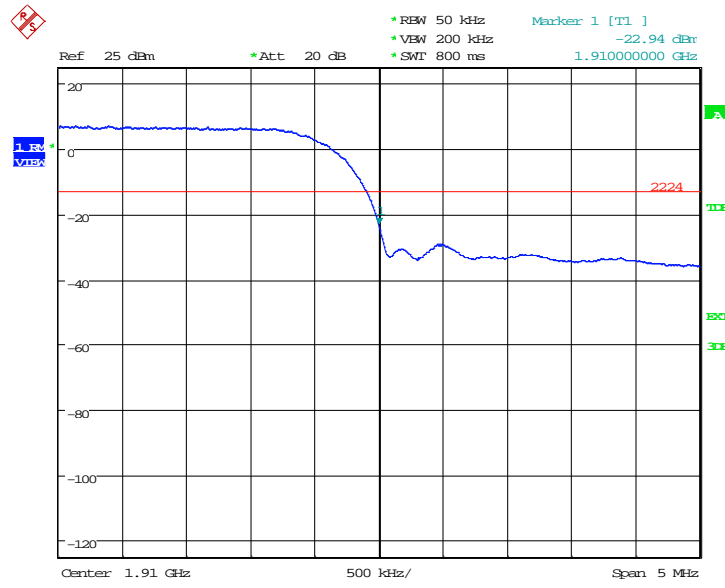
WCDMA Band II

LOW BAND EDGE BLOCK-A (WCDMA Band II)-Channel 9262



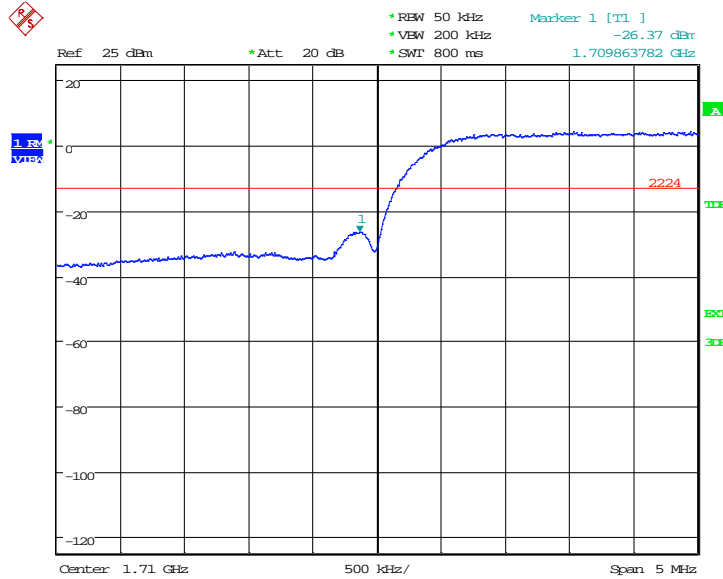
Date: 1.AUG.2018 06:18:26

**HIGH BAND EDGE BLOCK-C (WCDMA Band II) –Channel 9538**



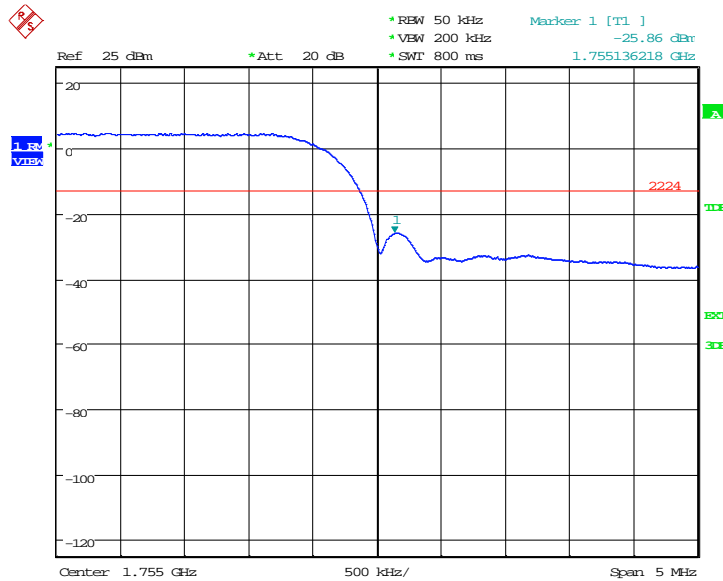
Date: 1.AUG.2018 06:20:31

**WCDMA Band IV  
LOW BAND EDGE BLOCK-A (WCDMA Band IV)-Channel 1312**



Date: 1.AUG.2018 07:25:26

**HIGH BAND EDGE BLOCK-C (WCDMA Band IV) –Channel 1513**



Date: 1.AUG.2018 07:27:30

Note: Expanded measurement uncertainty is  $U = 0.488\text{dB}(100\text{kHz}-2\text{GHz})/1.211\text{dB}(2\text{GHz}-26.5\text{GHz})$ ,  $k = 1.96$

## **A.6 CONDUCTED SPURIOUS EMISSION**

### **Reference**

FCC: CFR Part 2.1051, 24.238, 27.53(h).

### **A.6.1 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 2.1051 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.

#### **WCDMA Band II Transmitter**

Channel	Frequency (MHz)
9262	1852.40
9400	1880.00
9538	1907.60

#### **WCDMA Band IV Transmitter**

Channel	Frequency (MHz)
1312	1712.4
1450	1740.0
1513	1752.6

### **A.6.2 Measurement Limit**

Part 24.238 specify that 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.

The specification that emissions shall be attenuated below the transmitter power (P) by at least  $43 + 10 \log (P)$  dB, translates in the relevant power range (1 to 0.001 W) to -13 dBm. At 1 W the specified minimum attenuation becomes 43 dB and relative to a 30 dBm (1 W) carrier becomes a limit of -13 dBm. At 0.001 W (0 dBm) the minimum attenuation is 13 dB, which again yields a limit of -13 dBm. In this way a translation of the specification from relative to absolute terms is carried out.

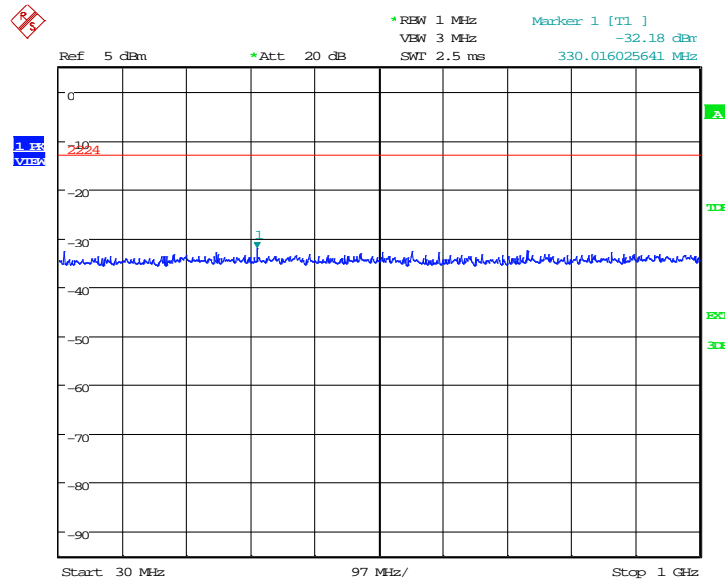
### A.6.3 Measurement result

Only worst case result is given below

WCDMA Band II

Channel 9262: 30MHz –1GHz

Spurious emission limit –13dBm.

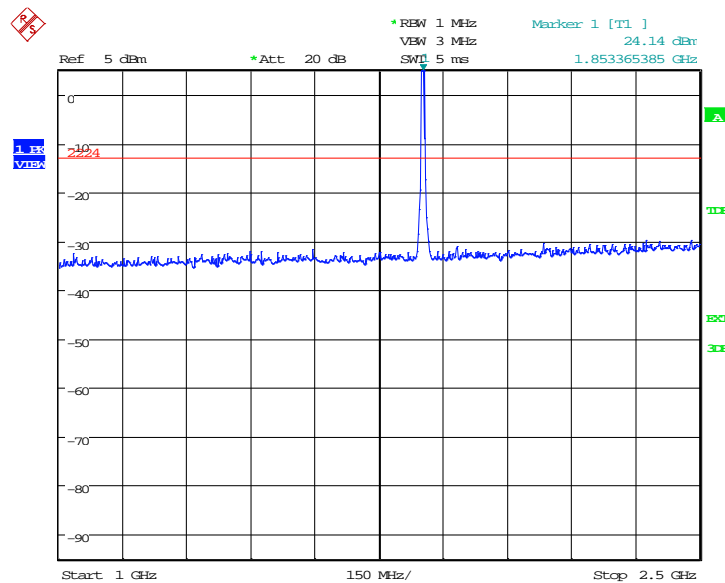


Date: 1.AUG.2018 06:21:23

Channel 9262: 1GHz –2.5GHz

Spurious emission limit –13dBm.

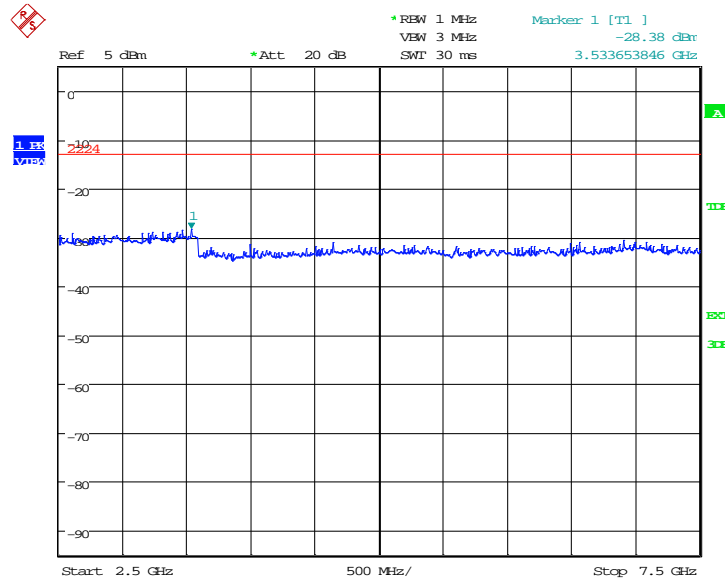
**NOTE: peak above the limit line is the carrier frequency.**



Date: 1.AUG.2018 06:21:50

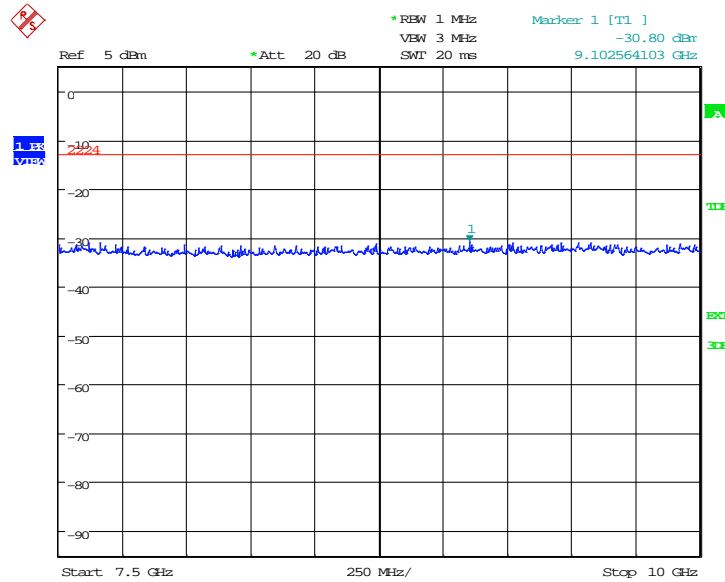


**Channel 9262: 2.5GHz –7.5GHz**  
Spurious emission limit –13dBm.



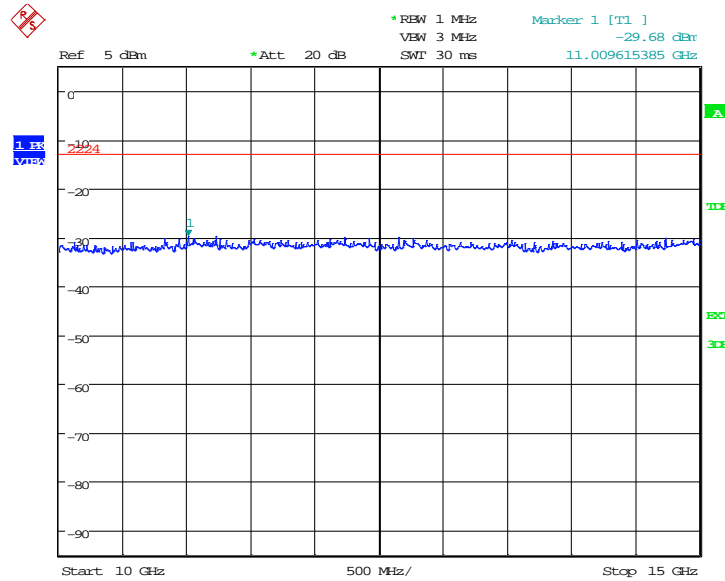
Date: 1.AUG.2018 06:22:17

**Channel 9262: 7.5GHz –10GHz**  
Spurious emission limit –13dBm.



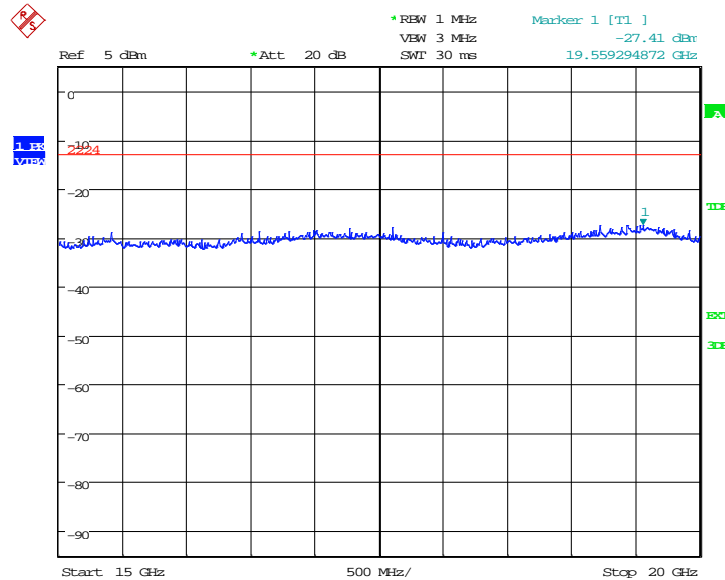
Date: 1.AUG.2018 06:22:44

**Channel 9262: 10GHz –15GHz**  
Spurious emission limit –13dBm.



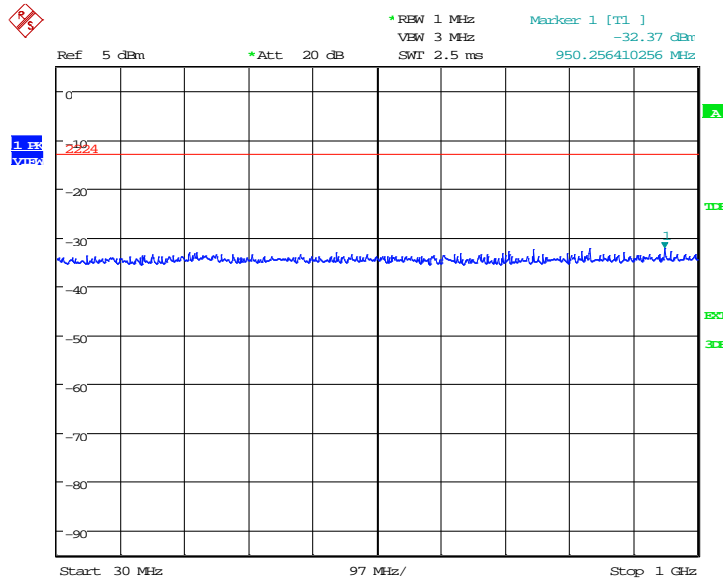
Date: 1.AUG.2018 06:23:11

**Channel 9262: 15GHz –20GHz**  
Spurious emission limit –13dBm.



Date: 1.AUG.2018 06:23:38

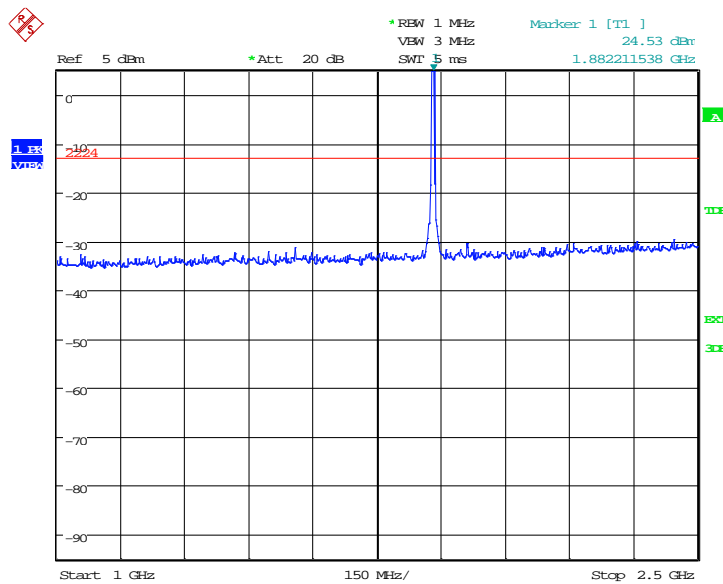
**Channel 9400: 30MHz –1GHz**  
Spurious emission limit –13dBm.



Date: 1.AUG.2018 06:24:07

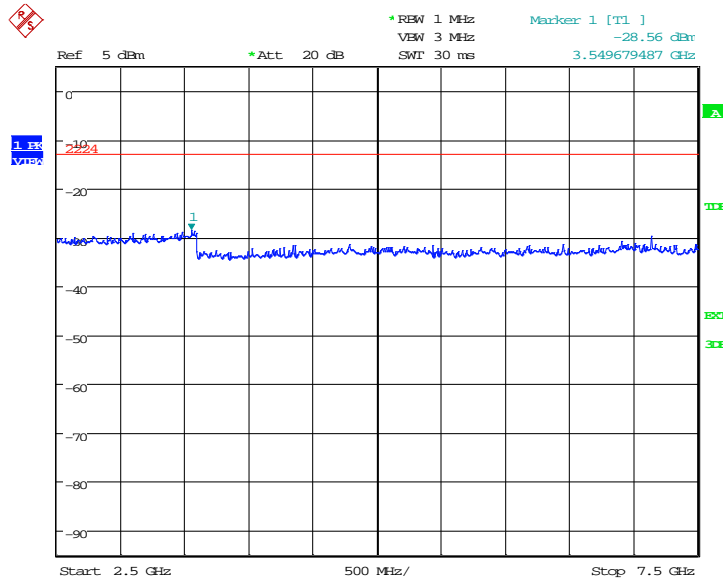
**Channel 9400: 1GHz –2.5GHz**  
Spurious emission limit –13dBm.

**NOTE: peak above the limit line is the carrier frequency.**



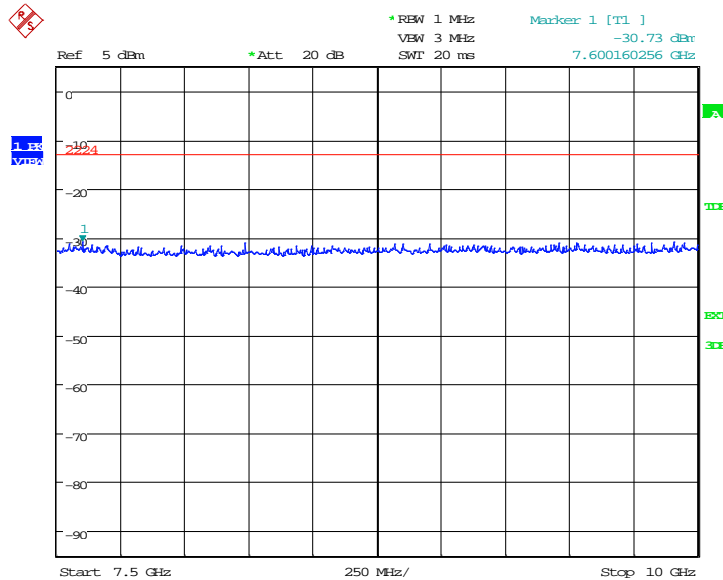
Date: 1.AUG.2018 06:24:34

**Channel 9400: 2.5GHz –7.5GHz**  
Spurious emission limit –13dBm.



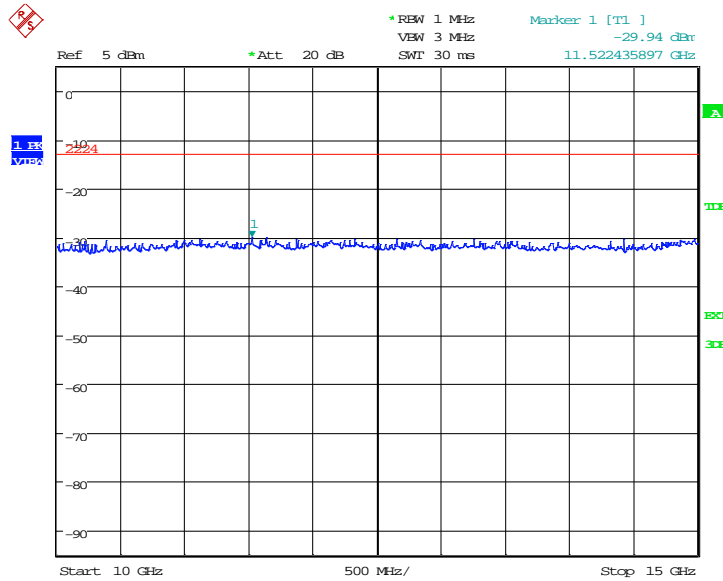
Date: 1.AUG.2018 06:25:01

**Channel 9400: 7.5GHz –10GHz**  
Spurious emission limit –13dBm.



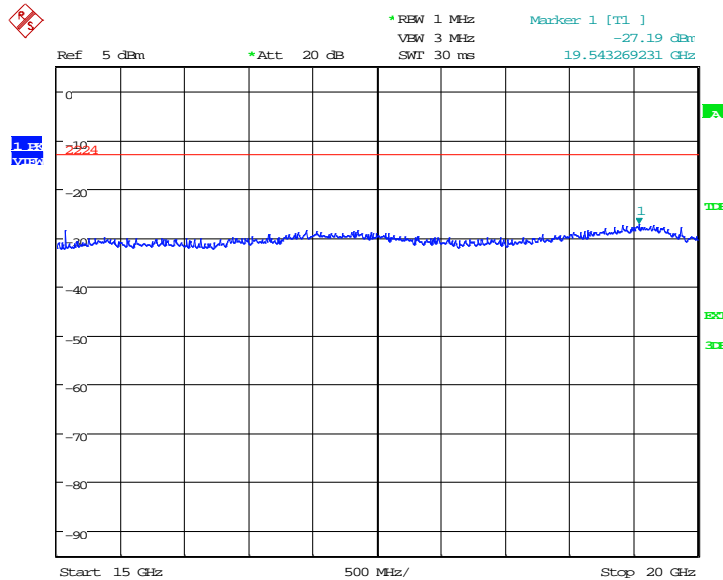
Date: 1.AUG.2018 06:25:28

**Channel 9400: 10GHz –15GHz**  
Spurious emission limit –13dBm.



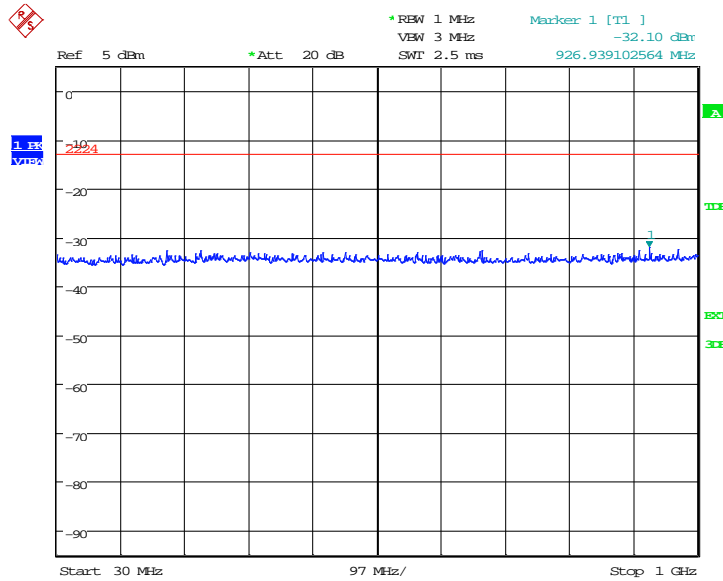
Date: 1.AUG.2018 06:25:55

**Channel 9400: 15GHz –20GHz**  
Spurious emission limit –13dBm.



Date: 1.AUG.2018 06:26:22

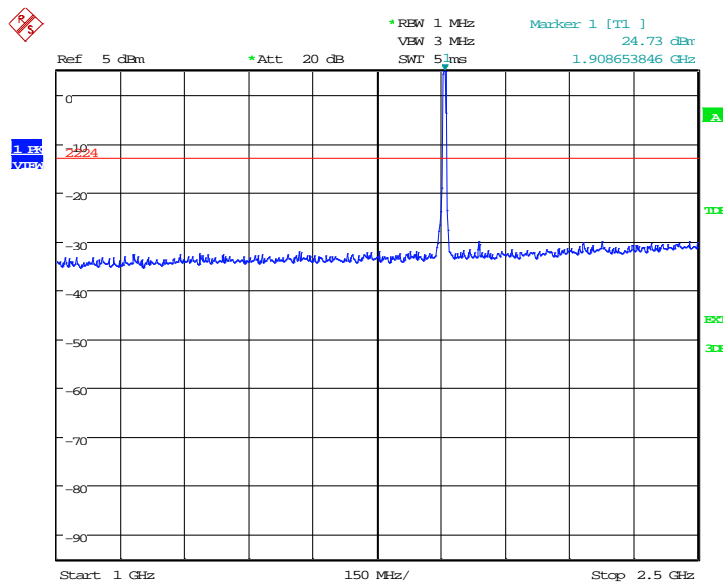
**Channel 9538: 30MHz –1GHz**  
Spurious emission limit –13dBm.



Date: 1.AUG.2018 06:26:51

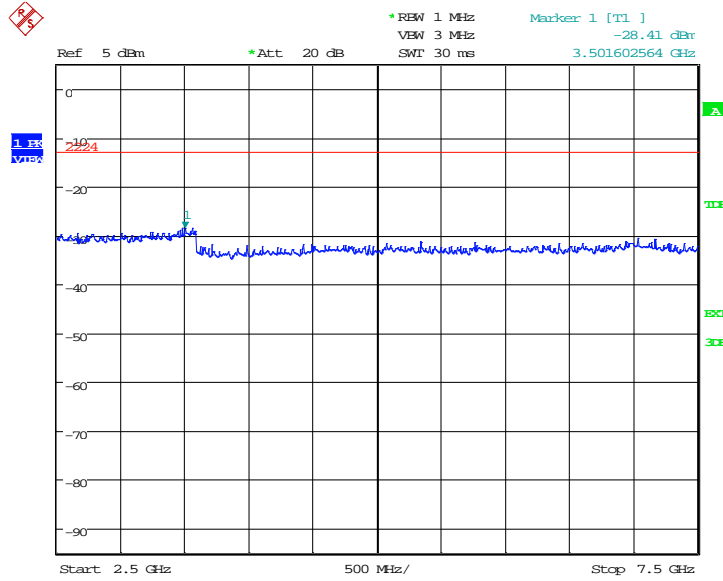
**Channel 9538: 1GHz –2.5GHz**  
Spurious emission limit –13dBm.

**NOTE: peak above the limit line is the carrier frequency.**



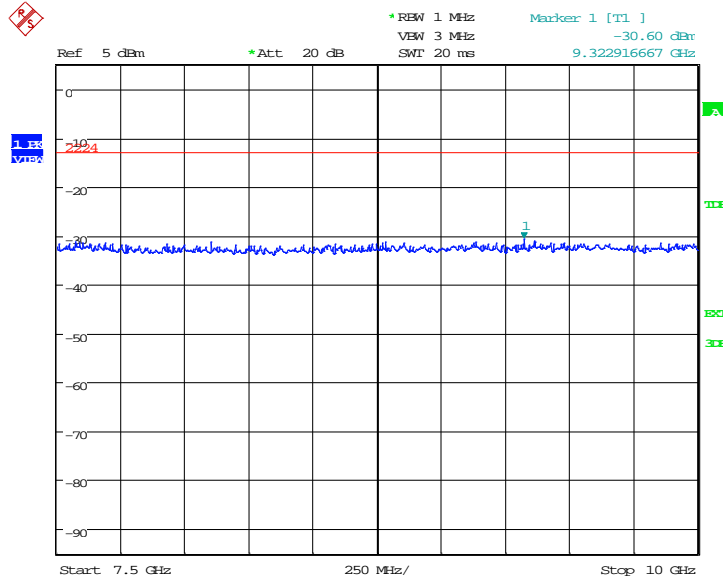
Date: 1.AUG.2018 06:27:18

**Channel 9538: 2.5GHz –7.5GHz**  
Spurious emission limit –13dBm.



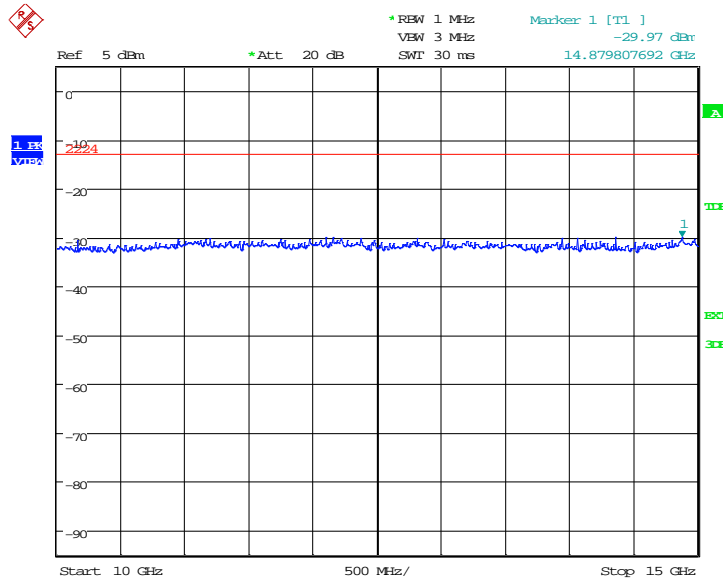
Date: 1.AUG.2018 06:27:45

**Channel 9538: 7.5GHz –10GHz**  
Spurious emission limit –13dBm.



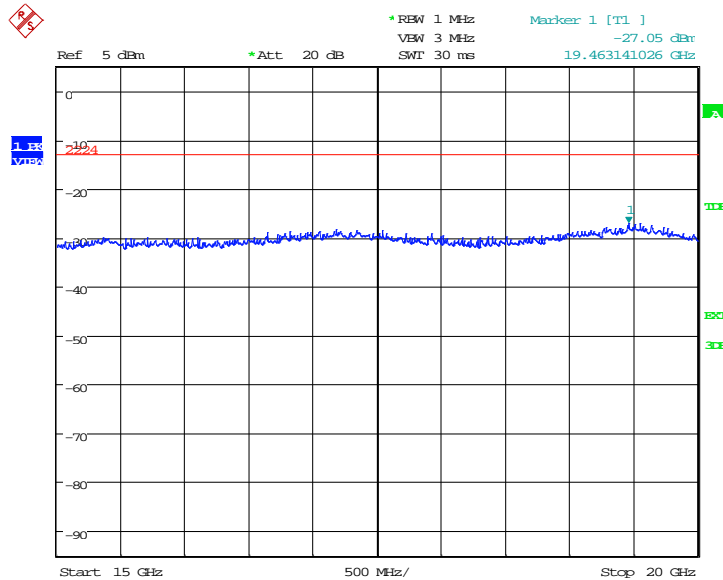
Date: 1.AUG.2018 06:28:12

**Channel 9538: 10GHz –15GHz**  
Spurious emission limit –13dBm.



Date: 1.AUG.2018 06:28:39

**Channel 9538: 15GHz –20GHz**  
Spurious emission limit –13dBm.



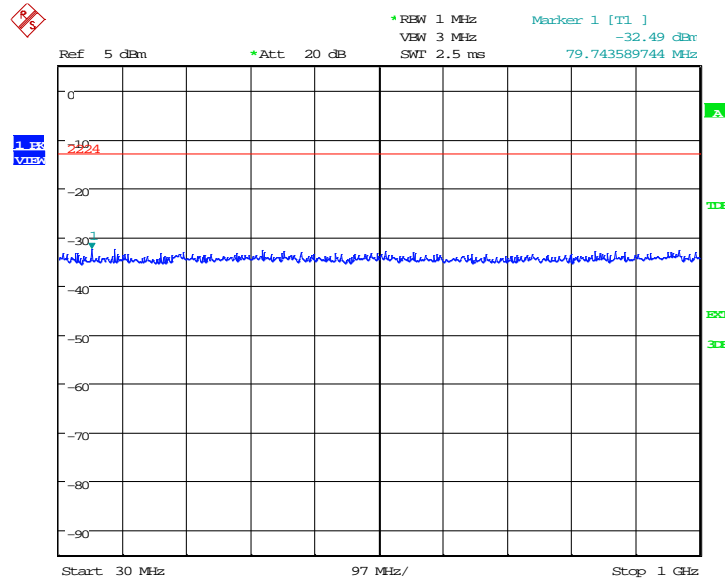
Date: 1.AUG.2018 06:29:06



**WCDMA Band IV**

**Channel 1312: 30MHz –1GHz**

Spurious emission limit –13dBm.

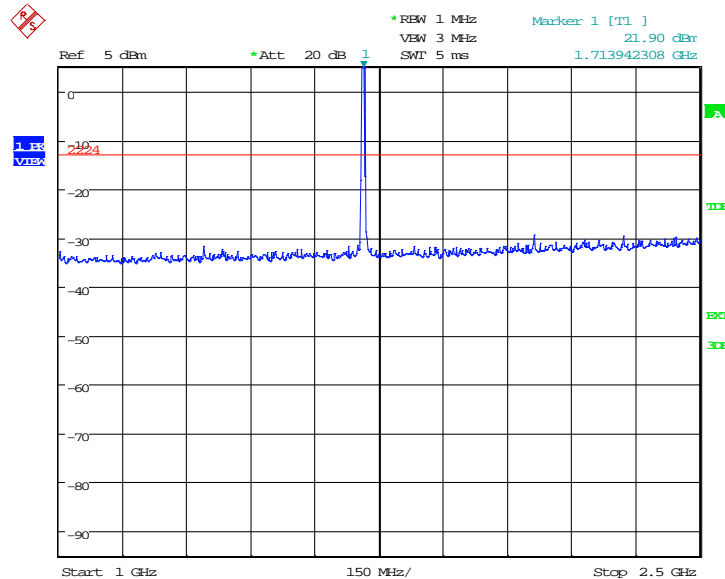


Date: 1.AUG.2018 07:28:23

**Channel 1312: 1GHz –2.5GHz**

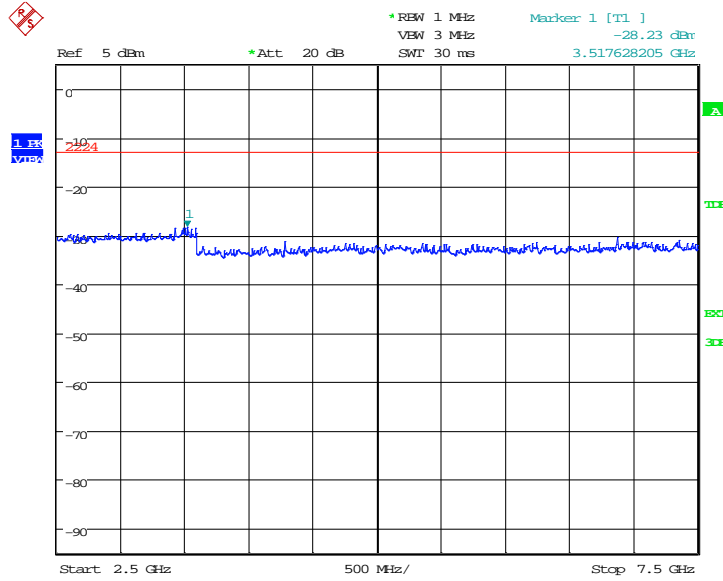
Spurious emission limit –13dBm.

**NOTE: peak above the limit line is the carrier frequency.**



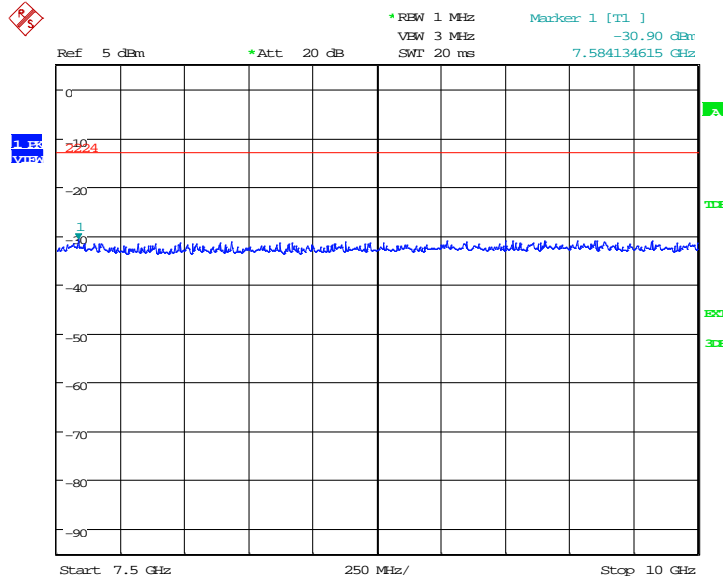
Date: 1.AUG.2018 07:28:50

**Channel 1312: 2.5GHz –7.5GHz**  
Spurious emission limit –13dBm.



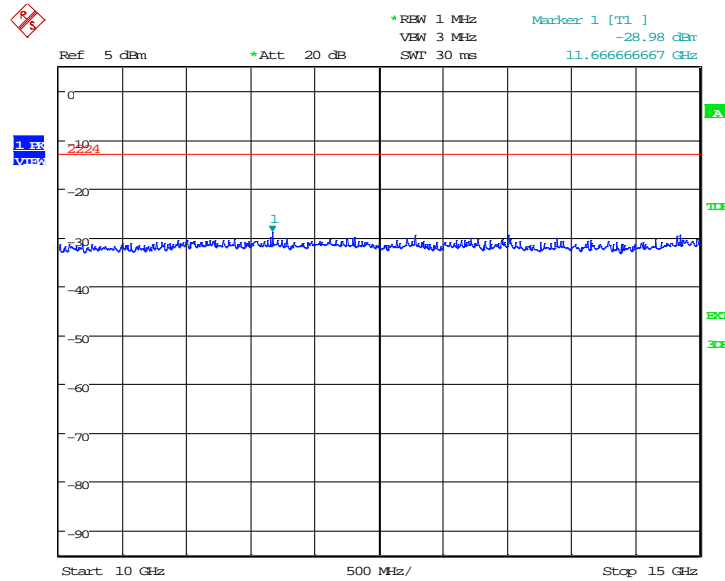
Date: 1.AUG.2018 07:29:16

**Channel 1312: 7.5GHz –10GHz**  
Spurious emission limit –13dBm.



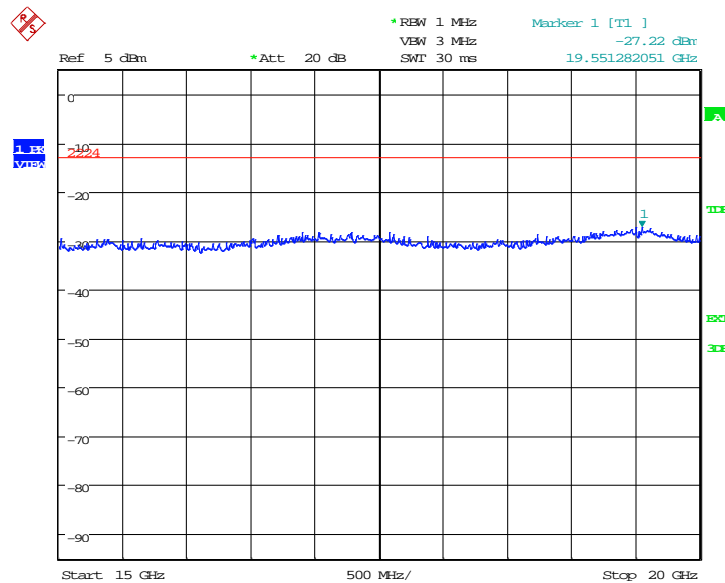
Date: 1.AUG.2018 07:29:43

**Channel 1312: 10GHz –15GHz**  
Spurious emission limit –13dBm.



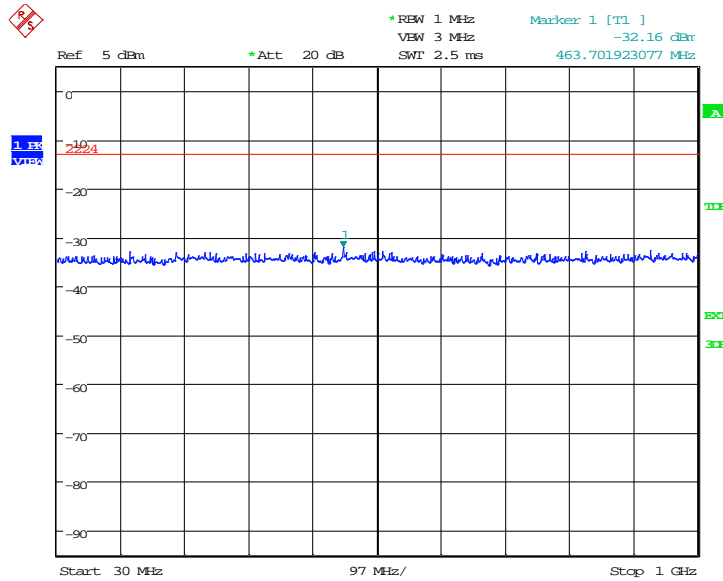
Date: 1.AUG.2018 07:30:10

**Channel 1312: 15GHz –20GHz**  
Spurious emission limit –13dBm.



Date: 1.AUG.2018 07:30:37

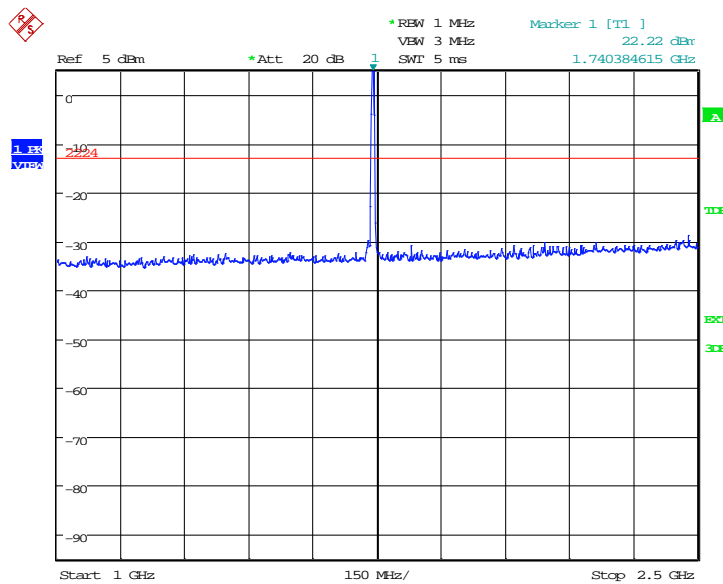
**Channel 1450: 30MHz –1GHz**  
Spurious emission limit –13dBm.



Date: 1.AUG.2018 07:31:07

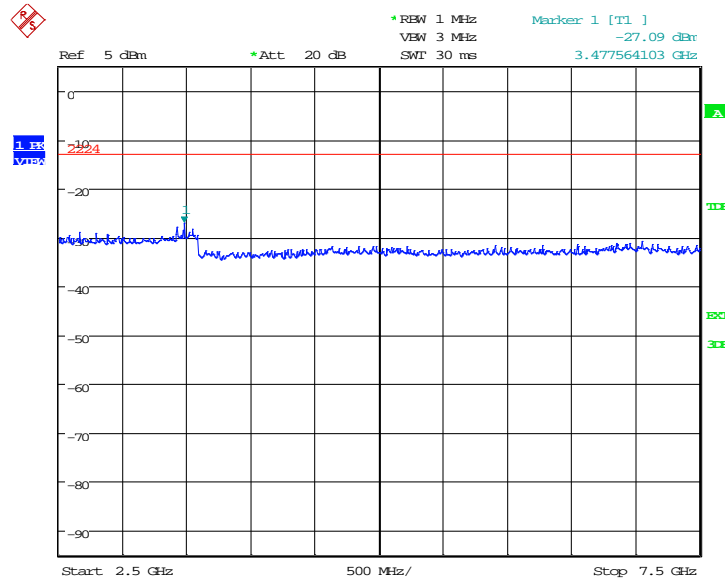
**Channel 1450: 1GHz –2.5GHz**  
Spurious emission limit –13dBm.

**NOTE: peak above the limit line is the carrier frequency.**



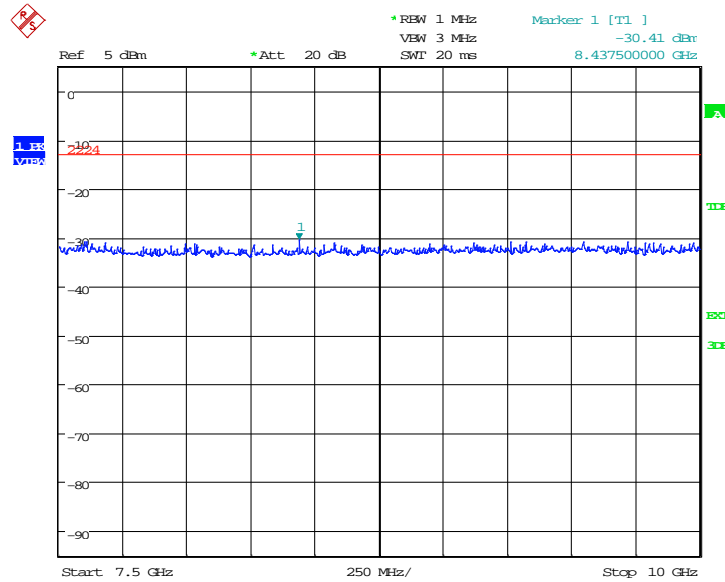
Date: 1.AUG.2018 07:31:34

**Channel 1450: 2.5GHz –7.5GHz**  
Spurious emission limit –13dBm.



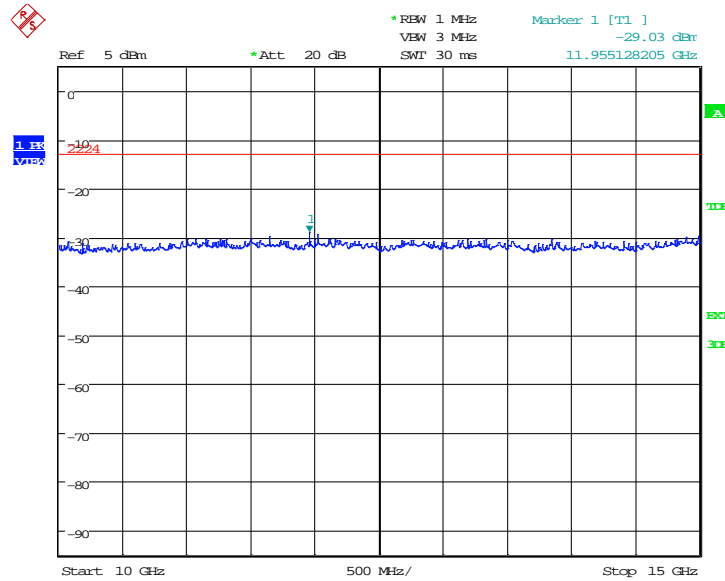
Date: 1.AUG.2018 07:32:01

**Channel 1450: 7.5GHz –10GHz**  
Spurious emission limit –13dBm.



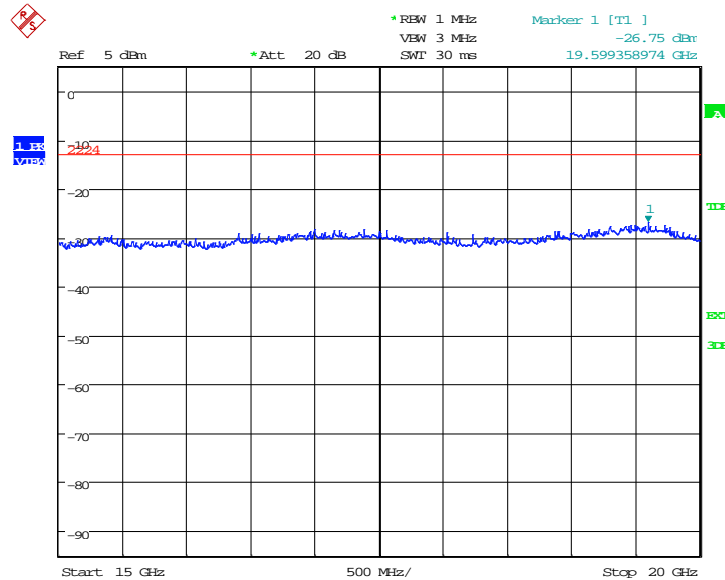
Date: 1.AUG.2018 07:32:27

**Channel 1450: 10GHz –15GHz**  
Spurious emission limit –13dBm.



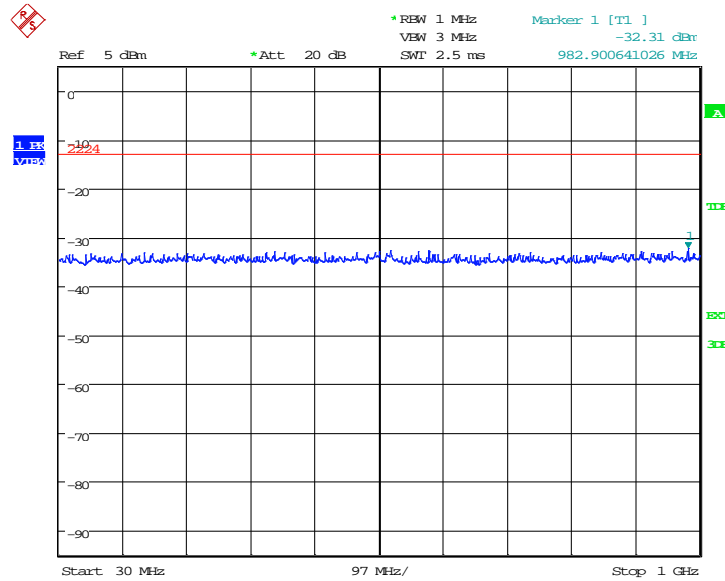
Date: 1.AUG.2018 07:32:55

**Channel 1450: 15GHz –20GHz**  
Spurious emission limit –13dBm.



Date: 1.AUG.2018 07:33:22

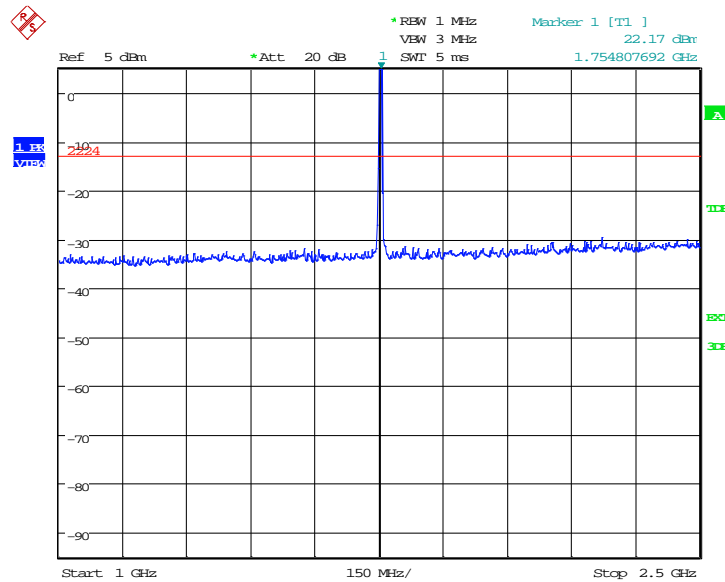
**Channel 1513: 30MHz –1GHz**  
Spurious emission limit –13dBm.



Date: 1.AUG.2018 07:33:51

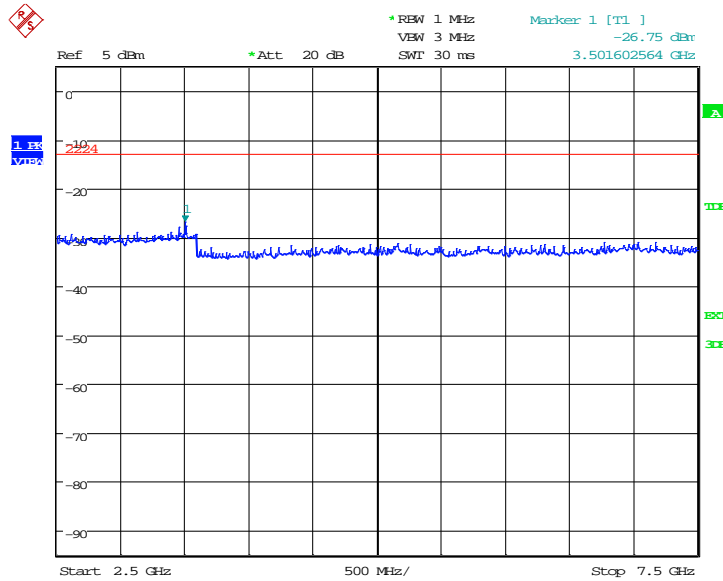
**Channel 1513: 1GHz –2.5GHz**  
Spurious emission limit –13dBm.

**NOTE: peak above the limit line is the carrier frequency.**



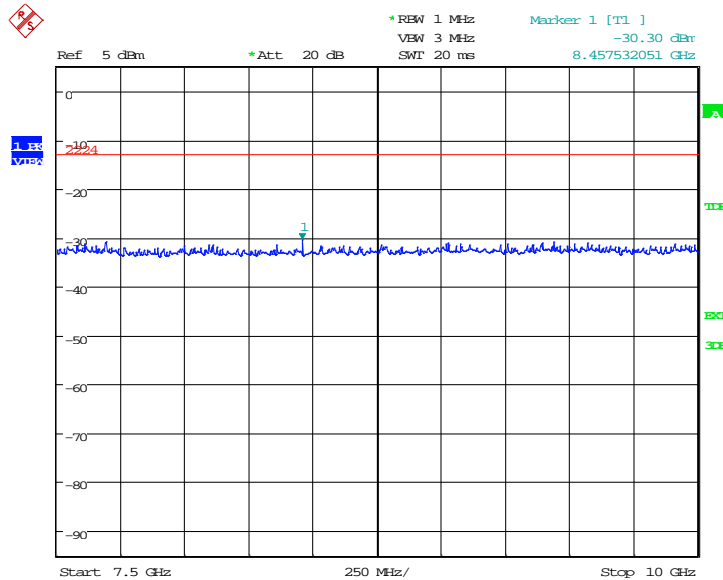
Date: 1.AUG.2018 07:34:18

**Channel 1513: 2.5GHz –7.5GHz**  
Spurious emission limit –13dBm.



Date: 1.AUG.2018 07:34:45

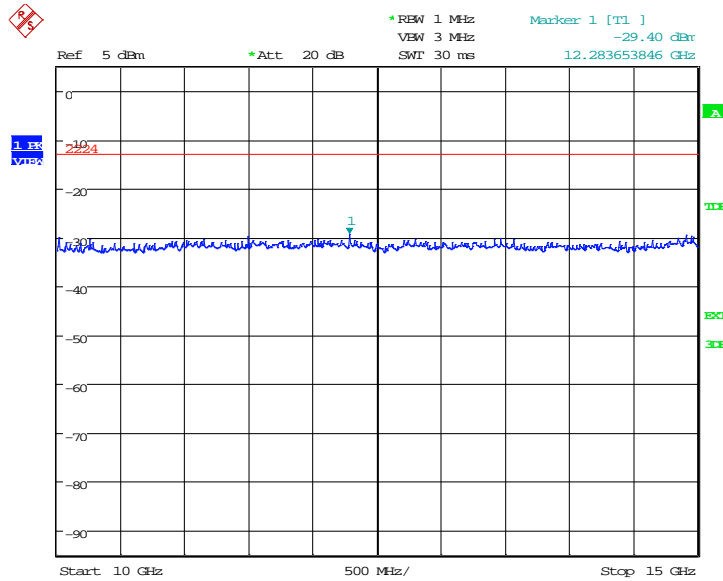
**Channel 1513: 7.5GHz –10GHz**  
Spurious emission limit –13dBm.



Date: 1.AUG.2018 07:35:12

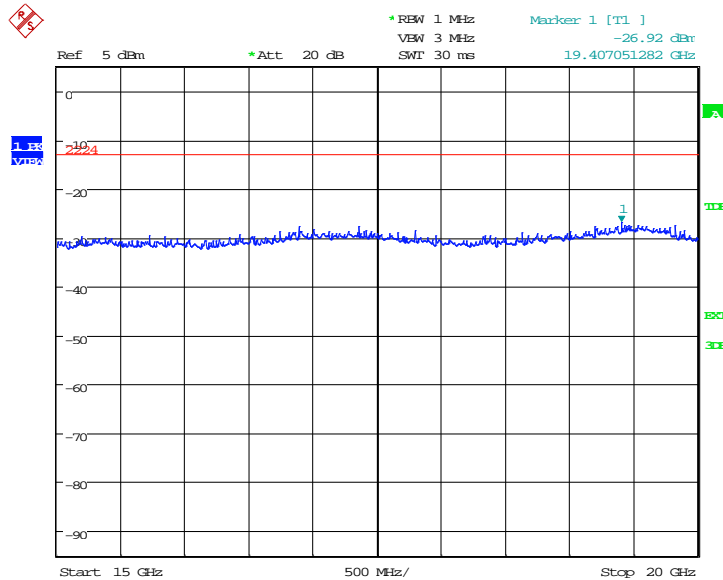


**Channel 1513: 10GHz –15GHz**  
Spurious emission limit –13dBm.



Date: 1.AUG.2018 07:35:39

**Channel 1513: 15GHz –20GHz**  
Spurious emission limit –13dBm.



Date: 1.AUG.2018 07:36:06

Note: Expanded measurement uncertainty is  $U = 0.488\text{dB}(100\text{KHz}-2\text{GHz})/1.211\text{dB}(2\text{GHz}-26.5\text{GHz})$ ,  $k = 1.96$

## **A.7 PEAK-TO-AVERAGE POWER RATIO**

### **Reference**

FCC: CFR Part 24.232, 27.50(d)

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.

- a) Refer to instrument's analyzer instruction manual for details on how to use the power statistics/CCDF function;
- b) Set resolution/measurement bandwidth  $\geq$  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 1 ms
- e) Record the maximum PAPR level associated with a probability of 0.1%

### **A.7.1 Measurement limit**

not exceed 13 dB

### **A.7.2 Measurement results**

#### **WCDMA Band II**

##### **Measurement result-QPSK**

	CH	Frequency(MHz)	PAPR(dB)
WCDMA (Band II)	9262	1852.4	3.85
	9400	1880.0	4.07
	9538	1907.6	3.91

##### **Measurement result-16QAM**

	CH	Frequency(MHz)	PAPR(dB)
WCDMA (Band II)	9262	1852.4	3.81
	9400	1880.0	4.04
	9538	1907.6	3.91

#### **WCDMA Band IV**

##### **Measurement result-QPSK**

	CH	Frequency(MHz)	PAPR(dB)
WCDMA (Band IV)	1312	1712.4	4.62
	1450	1740.0	4.52
	1513	1752.6	4.55

##### **Measurement result-16QAM**

	CH	Frequency(MHz)	PAPR(dB)
WCDMA (Band IV)	1312	1712.4	4.55
	1450	1740.0	4.49
	1513	1752.6	4.46

Note: Expanded measurement uncertainty is  $U = 0.483$ ,  $k = 2$

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