

## 8. Frequency Stability

### 8.1. Limit

#### FCC

- § 2.1055 (a), § 2.1055 (d) & following:

- §22.355, the carrier frequency of each transmitter in the Public Mobile Services must be maintained within the tolerances given in Table of this section.

For Mobile devices operating in the 824 to 849 MHz band at a power level less than or equal to 3 Watts, the limit specified in Table C-1 is +/- 2.5 ppm.

- §24.235, the frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

- §27.54, the frequency stability shall be sufficient to ensure that the fundamental emissions stay within the authorized bands of operation.

#### IC

- RSS-Gen Issue 5

6.11, for licensed devices, the following measurement conditions apply:

a. at the temperatures of -30°C (-22°F), +20°C (+68°F) and +50°C (+122°F), and at the manufacturer's rated supply voltage

- RSS-130 Issue 2

4.5, the transmitter frequency stability limit shall be determined as follows:

For equipment that is capable of transmitting numerous channels simultaneously for different applications (e.g. LTE and narrowband – internet of things (IoT)), the occupied bandwidth shall be the bandwidth representing the sum of the occupied bandwidths of these channels.

The frequency stability shall be sufficient to ensure that the occupied bandwidth remains within each frequency block range when tested at the temperature and supply voltage variations specified in RSS-Gen.

- RSS-132 Issue 3

5.3, the carrier frequency shall not depart from the reference frequency in excess of ±2.5 ppm for mobile stations and ±1.5 ppm for base stations.

- RSS-133 Issue 6

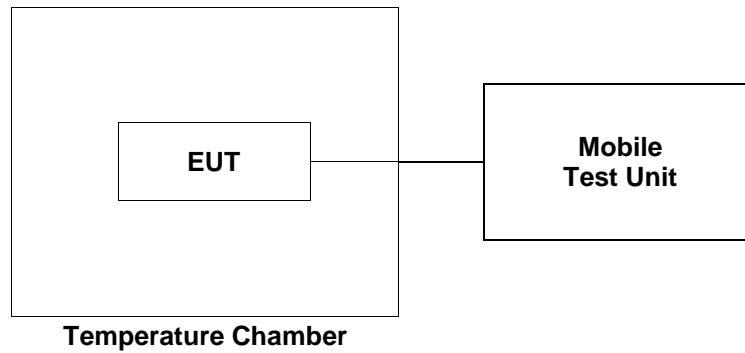
6.3, the carrier frequency shall not depart from the reference frequency, in excess of ±2.5 ppm for mobile stations and ±1.0 ppm for base stations.

- RSS-139 Issue 3

6.4, the frequency stability shall be sufficient to ensure that the occupied bandwidth stays within the operating frequency block when tested to the temperature and supply voltage variations specified in RSS-Gen.

## 8.2. Test Procedure

1. Frequency Stability vs. Temperature: The equipment under test was connected to an external DC power supply and the RF output was connected to a Mobile Test Unit via feed-through attenuators.
2. The EUT was placed inside the temperature chamber.
3. After the temperature stabilized for approximately 20 minutes, the frequency output was recorded from Mobile Test Unit.



### 8.3. Test Results

Ambient temperature : (23 ± 1) °C  
 Relative humidity : 47 % R.H.

#### SIM 1

#### NR band 25 at middle channel

Reference Frequency: 1 882.5 MHz			
Frequency Stability versus Temperature			
Environment Temperature (°C)	Power Supplied (V)	Frequency Measure with Time Elapse	
		Frequency Error (Hz)	ppm
50	12.5	-6.1	0.000 85
40		-6.7	0.000 53
30		-5.4	0.001 22
20(Ref.)		-7.7	-
10		-4.6	0.001 65
0		-6.5	0.000 64
-10		-5.9	0.000 96
-20		-5.7	0.001 06
-30		-5.6	0.001 12
Frequency Stability versus Power Supply			
Environment Temperature (°C)	Power Supplied (V)	Frequency Measure with Time Elapse	
		Frequency Error (Hz)	ppm
20	14.38 (115%)	-5.7	0.001 06
	10.63 (85%)	-5.5	0.001 17

**NR band 41(FCC) at middle channel**

Reference Frequency: 2 593.0 MHz			
Frequency Stability versus Temperature			
Environment Temperature (°C)	Power Supplied (V)	Frequency Measure with Time Elapse	
		Frequency Error (Hz)	ppm
50	12.5	-5.4	-0.001 20
40		-4.5	-0.000 85
30		-2.8	-0.000 19
20(Ref.)		-2.3	-
10		-4.1	-0.000 69
0		-5.9	-0.001 39
-10		-4.8	-0.000 96
-20		-2.9	-0.000 23
-30		-6.8	-0.001 74
Frequency Stability versus Power Supply			
Environment Temperature (°C)	Power Supplied (V)	Frequency Measure with Time Elapse	
		Frequency Error (Hz)	ppm
20	14.38 (115%)	-7.0	-0.001 81
	10.63 (85%)	-7.4	-0.001 97

**NR band 41(IC) at middle channel**

Reference Frequency: 2 595.0 MHz			
Frequency Stability versus Temperature			
Environment Temperature (°C)	Power Supplied (V)	Frequency Measure with Time Elapse	
		Frequency Error (Hz)	ppm
50	12.5	-5.0	-0.000 85
40		-4.3	-0.000 58
30		-2.9	-0.000 04
20(Ref.)		-2.8	-
10		-3.6	-0.000 31
0		-4.8	-0.000 77
-10		-4.9	-0.000 81
-20		-5.2	-0.000 92
-30		-5.6	-0.001 08
Frequency Stability versus Power Supply			
Environment Temperature (°C)	Power Supplied (V)	Frequency Measure with Time Elapse	
		Frequency Error (Hz)	ppm
20	14.38 (115%)	-6.1	-0.001 27
	10.63 (85%)	-6.0	-0.001 23

**NR band 66 at middle channel**

Reference Frequency: 1 745.0 MHz			
Frequency Stability versus Temperature			
Environment Temperature (°C)	Power Supplied (V)	Frequency Measure with Time Elapse	
		Frequency Error (Hz)	ppm
50	12.5	-1.4	-0.000 23
40		-3.4	-0.001 38
30		-3.9	-0.001 66
20(Ref.)		-1.0	-
10		-1.5	-0.000 29
0		-2.9	-0.001 09
-10		-0.8	0.000 11
-20		-2.8	-0.001 03
-30		-4.0	-0.001 72
Frequency Stability versus Power Supply			
Environment Temperature (°C)	Power Supplied (V)	Frequency Measure with Time Elapse	
		Frequency Error (Hz)	ppm
20	14.38 (115%)	-4.3	-0.001 89
	10.63 (85%)	-4.7	-0.002 12

**NR band 71 at middle channel**

Reference Frequency: 680.5 MHz			
Frequency Stability versus Temperature			
Environment Temperature (°C)	Power Supplied (V)	Frequency Measure with Time Elapse	
		Frequency Error (Hz)	ppm
50	12.5	-3.8	-0.002 20
40		-4.2	-0.002 79
30		-4.4	-0.003 09
20(Ref.)		-2.3	-
10		-4.6	-0.003 38
0		-2.2	0.000 15
-10		-2.7	-0.000 59
-20		-1.9	0.000 59
-30		-2.5	-0.000 29
Frequency Stability versus Power Supply			
Environment Temperature (°C)	Power Supplied (V)	Frequency Measure with Time Elapse	
		Frequency Error (Hz)	ppm
20	14.38 (115%)	-3.8	-0.002 20
	10.63 (85%)	-4.5	-0.003 23

**ENDC**

**13A-n2A at middle channel**

Reference Frequency: 1 880.0 MHz			
Frequency Stability versus Temperature			
Environment Temperature (°C)	Power Supplied (V)	Frequency Measure with Time Elapse	
		Frequency Error (Hz)	ppm
50	12.5	7.9	0.001 60
40		7.0	0.001 12
30		7.1	0.001 17
20(Ref.)		4.9	-
10		6.2	0.000 69
0		5.1	0.000 11
-10		5.8	0.000 48
-20		8.2	0.001 76
-30		6.7	0.000 96
Frequency Stability versus Power Supply			
Environment Temperature (°C)	Power Supplied (V)	Frequency Measure with Time Elapse	
		Frequency Error (Hz)	ppm
20	14.38 (115%)	6.4	0.000 80
	10.63 (85%)	5.6	0.000 37



**2A-n5A at middle channel**

Reference Frequency: 836.5 MHz			
Frequency Stability versus Temperature			
Environment Temperature (°C)	Power Supplied (V)	Frequency Measure with Time Elapse	
		Frequency Error (Hz)	ppm
50	12.5	-3.1	0.002 51
40		-5.1	0.000 12
30		-3.0	0.002 63
20(Ref.)		-5.2	-
10		-2.2	0.003 59
0		-0.2	0.005 98
-10		-1.2	0.004 78
-20		-2.7	0.002 99
-30		-0.7	0.005 38
Frequency Stability versus Power Supply			
Environment Temperature (°C)	Power Supplied (V)	Frequency Measure with Time Elapse	
		Frequency Error (Hz)	ppm
20	14.38 (115%)	-4.9	0.000 36
	10.63 (85%)	-4.8	0.000 48

**SIM 2**

**NR band 25 at middle channel**

Reference Frequency: 1 882.5 MHz			
Frequency Stability versus Temperature			
Environment Temperature (°C)	Power Supplied (V)	Frequency Measure with Time Elapse	
		Frequency Error (Hz)	ppm
50	12.5	-6.3	-0.000 48
40		-6.0	-0.000 32
30		-7.1	-0.000 90
20(Ref.)		-5.4	-
10		-4.8	0.000 32
0		-5.1	0.000 16
-10		-6.3	-0.000 48
-20		-6.6	-0.000 64
-30		-3.7	0.000 90
Frequency Stability versus Power Supply			
Environment Temperature (°C)	Power Supplied (V)	Frequency Measure with Time Elapse	
		Frequency Error (Hz)	ppm
20	14.38 (115%)	-3.2	0.001 17
	10.63 (85%)	-6.5	-0.000 58

**NR band 41(FCC) at middle channel**

Reference Frequency: 2 593.0 MHz			
Frequency Stability versus Temperature			
Environment Temperature (°C)	Power Supplied (V)	Frequency Measure with Time Elapse	
		Frequency Error (Hz)	ppm
50	12.5	-2.7	0.000 93
40		-2.3	0.001 08
30		-5.3	-0.000 08
20(Ref.)		-5.1	-
10		-6.1	-0.000 39
0		-4.5	0.000 23
-10		-3.7	0.000 54
-20		-3.3	0.000 69
-30		-2.2	0.001 12
Frequency Stability versus Power Supply			
Environment Temperature (°C)	Power Supplied (V)	Frequency Measure with Time Elapse	
		Frequency Error (Hz)	ppm
20	14.38 (115%)	-4.5	0.000 23
	10.63 (85%)	-6.8	-0.000 66

**NR band 41(IC) at middle channel**

Reference Frequency: 2 593.0 MHz			
Frequency Stability versus Temperature			
Environment Temperature (°C)	Power Supplied (V)	Frequency Measure with Time Elapse	
		Frequency Error (Hz)	ppm
50	12.5	-2.8	0.000 96
40		-3.1	0.000 85
30		-4.8	0.000 19
20(Ref.)		-5.3	-
10		-5.9	-0.000 23
0		-4.8	0.000 19
-10		-3.7	0.000 62
-20		-3.6	0.000 66
-30		-2.8	0.000 96
Frequency Stability versus Power Supply			
Environment Temperature (°C)	Power Supplied (V)	Frequency Measure with Time Elapse	
		Frequency Error (Hz)	ppm
20	14.38 (115%)	-4.2	0.000 42
	10.63 (85%)	-6.5	-0.000 46

**NR band 66 at middle channel**

Reference Frequency: 1 745.0 MHz			
Frequency Stability versus Temperature			
Environment Temperature (°C)	Power Supplied (V)	Frequency Measure with Time Elapse	
		Frequency Error (Hz)	ppm
50	12.5	1.7	0.002 98
40		-1.4	0.001 20
30		-1.6	0.001 09
20(Ref.)		-3.5	-
10		-4.3	-0.000 46
0		-2.9	0.000 34
-10		-1.3	0.001 26
-20		-2.7	0.000 46
-30		-4.6	-0.000 63
Frequency Stability versus Power Supply			
Environment Temperature (°C)	Power Supplied (V)	Frequency Measure with Time Elapse	
		Frequency Error (Hz)	ppm
20	14.38 (115%)	-6.3	-0.001 60
	10.63 (85%)	-2.4	0.000 63

**NR band 71 at middle channel**

Reference Frequency: 680.5 MHz			
Frequency Stability versus Temperature			
Environment Temperature (°C)	Power Supplied (V)	Frequency Measure with Time Elapse	
		Frequency Error (Hz)	ppm
50	12.5	-4.2	0.002 20
40		-3.9	0.002 65
30		-4.2	0.002 20
20(Ref.)		-5.7	-
10		-3.8	0.002 79
0		-3.7	0.002 94
-10		-3.3	0.003 53
-20		-3.0	0.003 97
-30		-1.2	0.006 61
Frequency Stability versus Power Supply			
Environment Temperature (°C)	Power Supplied (V)	Frequency Measure with Time Elapse	
		Frequency Error (Hz)	ppm
20	14.38 (115%)	-3.8	0.002 79
	10.63 (85%)	-3.5	0.003 23

**- End of the Test Report -**