

Diagram 3.45a LTE: E-TM1.1, T_{5LTE} , 9 kHz – 1 GHz, Port B:

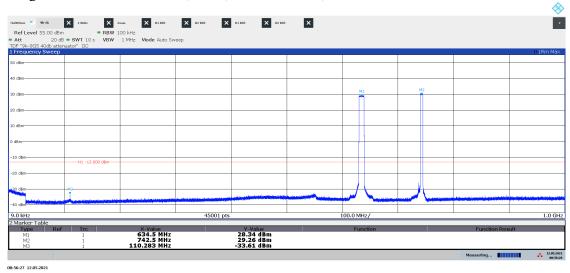


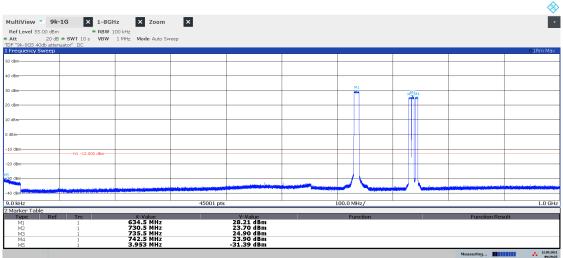
Diagram 3.45b LTE: E-TM1.1, T_{5LTE}, 1 – 8 GHz, Port B:

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GHz		35001 pts	700.0 MHz/	8.0

08:54:08 12.05.2021

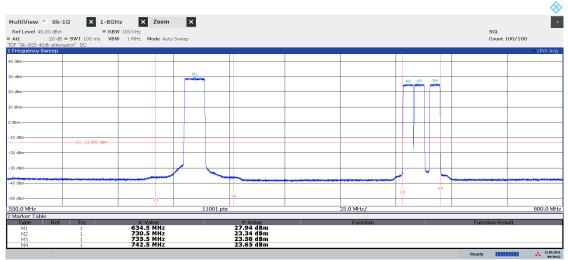
KI. SE

Diagram 3.46a LTE: E-TM1.1, Bim_{LTE}, 9 kHz – 1 GHz, Port B:



09:29:25 12.05.202

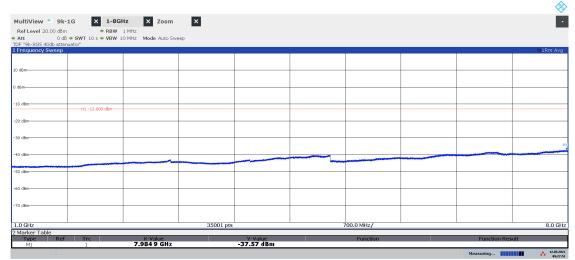
Diagram 3.46b LTE: E-TM1.1, Bim_{LTE}, 550 – 800 MHz, Port B:



9:30:13 12.05.20

Note: The purpose of this measurement is to find IM products, not to verify compliance at the Band edges.

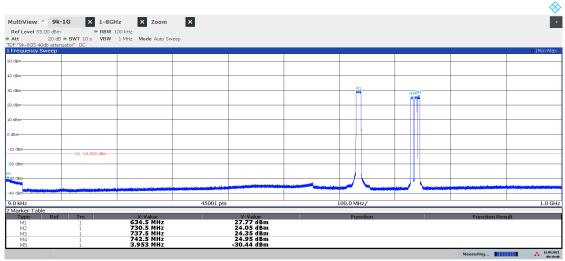
Diagram 3.46c LTE: E-TM1.1, Bim_{LTE}, 1 – 8 GHz, Port B:



09:27:52 12.05.2021

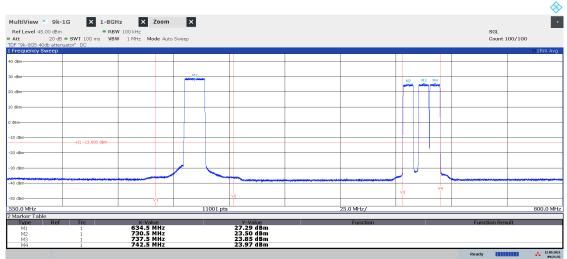
KI. SE

Diagram 3.47a LTE: E-TM1.1, Tim_{LTE}, 9 kHz – 1 GHz, Port B:



09:19:40 12.05.2021

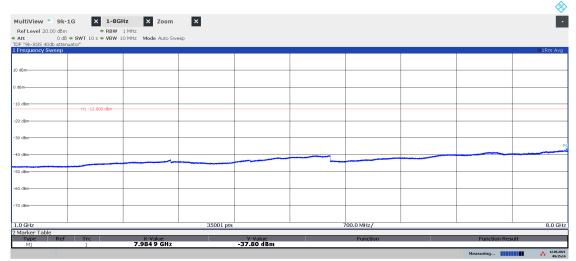
Diagram 3.47b LTE: E-TM1.1, TimLTE, 550 – 800 MHz, Port B:



09:21:32 12.05.20

Note: The purpose of this measurement is to find IM products, not to verify compliance at the Band edges.

Diagram 3.47c LTE: E-TM1.1, Tim_{LTE}, 1 – 8 GHz, Port B:



09:15:14 12.05.2021

Diagram 3.48a NB IoT SA: N-TM, LTE: E-TM3.1, B_{IoT+L}, 9 kHz – 1 GHz, Port B:

2021-06-29

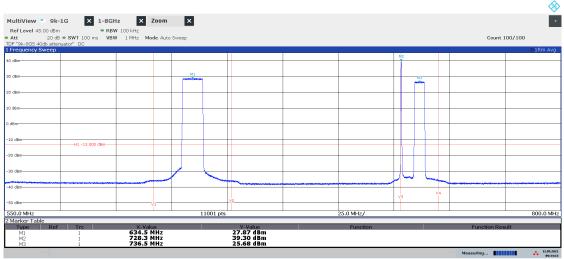
Reference

P110208-F27

Date

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be Ref	1 1	X-Value 634.5 MHz		Y-Value 27.87 dBm		Fui	nction			Function R	esuit
		728.3 MHz		40.07 dBm							

Diagram 3.48b NB IoT SA: N-TM, LTE: E-TM3.1, B_{IoT+L}, 550 – 800 MHz, Port B:



09:34:13 12.05.20

Note: The purpose of this measurement is to find IM products, not to verify compliance at the Band edges.

Diagram 3.48c NB IoT SA: N-TM, LTE: E-TM3.1, B_{IoT+L} , 1 – 8 GHz, Port B:

'9k-8G5 40db attenuator''				
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IBm-				
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GHz		35001 pts	700.0 MHz/	8

09:37:31 12.05.2021

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Diagram 3.49a NB IoT IB: N-TM, LTE: E-TM3.1, B_{IBIoT+L}, 9 kHz – 1 GHz, Port B:

2021-06-29

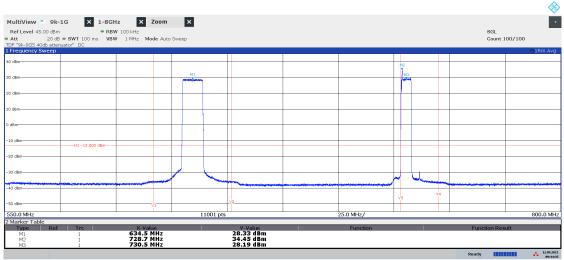
Date

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r Table			10001 pt3								
be Re	f Trc	X-Value 634.5 MHz		Y-Value 27.97 dBm		Fu	nction			Function Re	sult
2	1	728.686 MHz 730.5 MHz		35.08 dBm							
3	1	730.5 MHz 3.953 MHz		28.21 dBm -31.39 dBm							

Reference

P110208-F27

Diagram 3.49b NB IoT IB: N-TM, LTE: E-TM3.1, BIBIOT+L, 550 – 800 MHz, Port B:



09:44:35 12:05:202

Note: The purpose of this measurement is to find IM products, not to verify compliance at the Band edges.

Diagram 3.49c NB IoT SA: N-TM, LTE: E-TM3.1, $B_{IBIoT+L}$, 1 – 8 GHz, Port B:

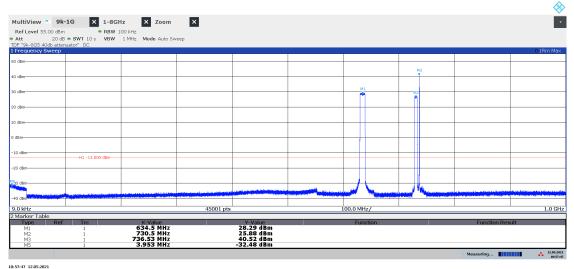
8G5 40db attenuator" uency Sweep					01
н1 -	13.000 dBm				
lz		35001 pts	700.0 MHz/	 	

09:42:00 12.05.2021

Diagram 3.50a NB IoT SA: N-TM, LTE: E-TM3.1, M_{IoT+L}, 9 kHz – 1 GHz, Port B:

2021-06-29

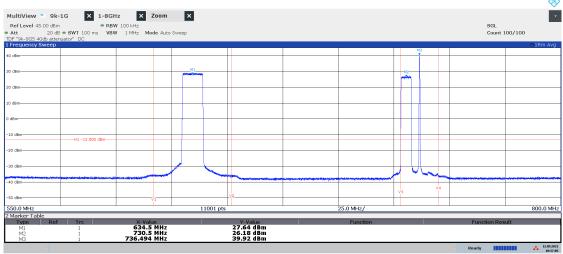
Date



Reference

P110208-F27

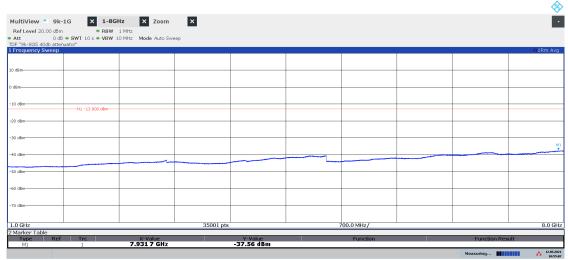
Diagram 3.50b NB IoT SA: N-TM, LTE: E-TM3.1, MIOT+L, 550 - 800 MHz, Port B:



10:57:05 12.05.202

Note: The purpose of this measurement is to find IM products, not to verify compliance at the Band edges.

Diagram 3.50c NB IoT SA: N-TM, LTE: E-TM3.1, M_{IoT+L} , 1 – 8 GHz, Port B:



10:55:08 12:05:2021

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Diagram 3.51a NB IoT IB: N-TM, LTE: E-TM3.1, M_{IBIoT+L}, 9 kHz – 1 GHz, Port B:

2021-06-29

Reference

P110208-F27

Date

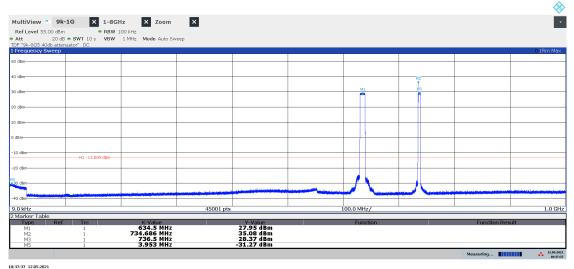
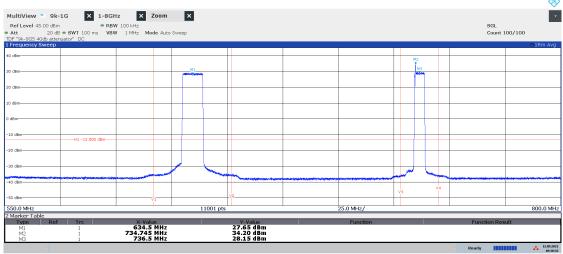


Diagram 3.51b NB IoT IB: N-TM, LTE: E-TM3.1, MIBIOT+L, 550 - 800 MHz, Port B:



10:38:32 12.05.202

Note: The purpose of this measurement is to find IM products, not to verify compliance at the Band edges.

Diagram 3.51c NB IoT IB: N-TM, LTE: E-TM3.1, $M_{IBIoT+L}$, 1 – 8 GHz, Port B:

N1-12.000 dBm	
35001 pts 700.0 MHz/	

10:40:38 12.05.2021

Diagram 3.52a NB IoT SA: N-TM, LTE: E-TM3.1, T_{IoT+L}, 9 kHz – 1 GHz, Port B:

2021-06-29

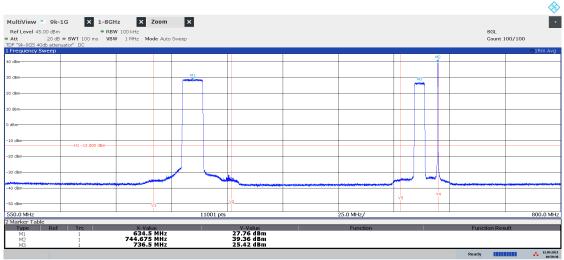
Reference

P110208-F27

Date

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M2 M3	1	744.708 MHz 736.5 MHz		40.14 dBm 25.88 dBm						
MS	î	3.953 MHz		-31.59 dBm						

Diagram 3.52b NB IoT SA: N-TM, LTE: E-TM3.1, T_{IoT+L}, 550 – 800 MHz, Port B:



10:50:36 12:05:202

Note: The purpose of this measurement is to find IM products, not to verify compliance at the Band edges.

Diagram 3.52c NB IoT SA: N-TM, LTE: E-TM3.1, T_{I_0T+L} , 1 – 8 GHz, Port B:

9k-8G5 40db attenuator quency Sweep	r"					01R
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rker Table		55001 pts		700.0 Mil 127		

10:53:28 12.05.2021

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Diagram 3.53a NB IoT IB: N-TM, LTE: E-TM3.1, T_{IBIoT+L}, 9 kHz – 1 GHz, Port B:

2021-06-29

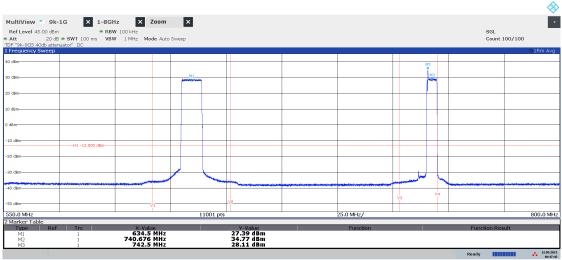
Date

ency Sweep											015
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	H1 -13.000 dBm										
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			45001 pts			100.0 N	1U-7/				
r Table			45001 pts			100.0 1	112/				
		X-Value 634.5 MHz		Y-Value			Inction			Function Re	

Reference

P110208-F27

Diagram 3.53b NB IoT IB: N-TM, LTE: E-TM3.1, T_{IBIoT+L}, 550 – 800 MHz, Port B:



10:47:42 12.05.202

Note: The purpose of this measurement is to find IM products, not to verify compliance at the Band edges.

Diagram 3.53c NB IoT IB: N-TM, LTE: E-TM3.1, $T_{IBIoT+L}$, 1 – 8 GHz, Port B:

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10:45:27 12.05.2021

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Diagram 3.54a NB IoT GB: N-TM, LTE: E-TM3.1, T10_{Guard}, 9 kHz – 1 GHz, Port B:

Reference

P110208-F27

Date

2021-06-29

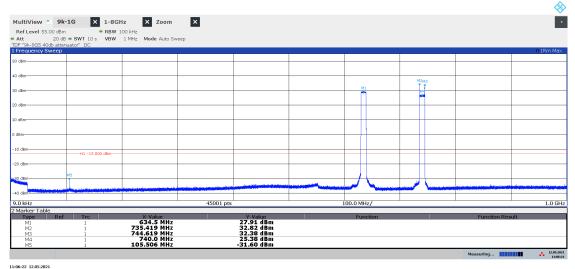
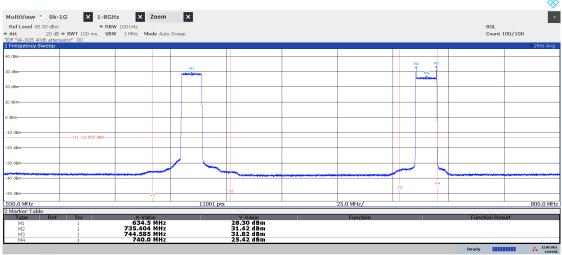


Diagram 3.54b NB IoT GB: N-TM, LTE: E-TM3.1, T10_{Guard}, 550 – 800 MHz, Port B:



11:04:51 12:05:20

Note: The purpose of this measurement is to find IM products, not to verify compliance at the Band edges.

Diagram 3.54c NB IoT GB: N-TM, LTE: E-TM3.1, T10_{Guard}, 1 - 8 GHz, Port B:

ency Sweep				c
H1 -13.000	dBm			

11:09:11 12:05:2021

Diagram 3.55a NB IoT SA: N-TM, LTE: E-TM3.1, Bim_{2IoT+LTE}, 9 kHz – 1 GHz, Port B:

Reference

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Date

2021-06-29

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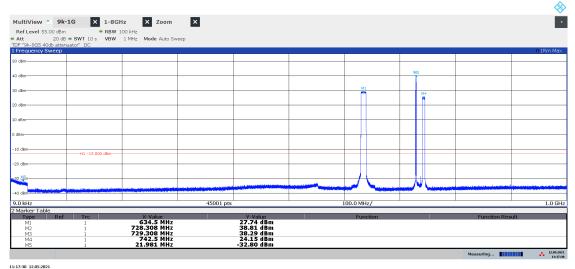
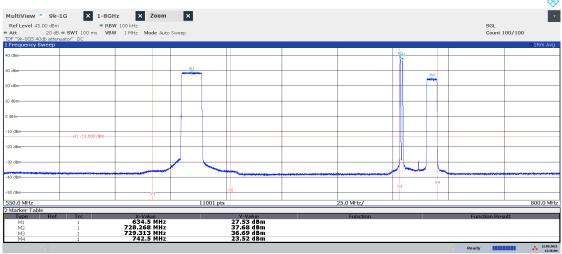


Diagram 3.55b NB IoT SA: N-TM, LTE: E-TM3.1, Bim_{2loT+LTE}, 550 – 800 MHz, Port B:



11:16:05 12:05:202

Note: The purpose of this measurement is to find IM products, not to verify compliance at the Band edges.

Diagram 3.55c NB IoT SA: N-TM, LTE: E-TM3.1, $Bim_{2loT+LTE}$, 1 – 8 GHz, Port B:

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m			Werning web		
m					
m					
m				-	

11:14:02 12:05:2021

Diagram 3.56a NB IoT SA: N-TM, LTE: E-TM3.1, Tim_{2IoT+LTE}, 9 kHz – 1 GHz, Port B:

Reference

P110208-F27

Date

2021-06-29

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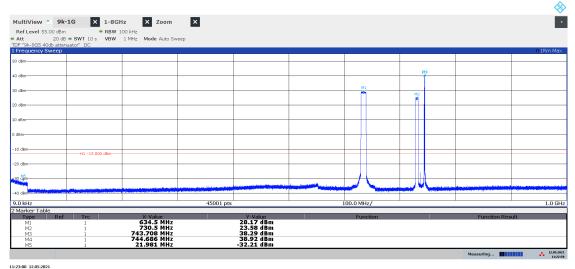
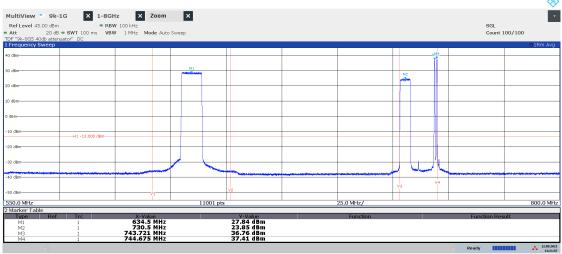


Diagram 3.56b NB IoT SA: N-TM, LTE: E-TM3.1, Tim_{2IoT+LTE}, 550 – 800 MHz, Port B:



11:21:57 12.05.202

Note: The purpose of this measurement is to find IM products, not to verify compliance at the Band edges.

Diagram 3.56c NB IoT SA: N-TM, LTE: E-TM3.1, Tim_{2IoT+LTE}, 1 - 8 GHz, Port B:

k-8G5 40db attenuator" quency Sweep						01
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n			and the second			
m						
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GHz		35001 pts		700.0 MHz/		

11:24:33 12:05:2021

Diagram 3.57a NB IoT SA: N-TM, LTE: E-TM3.1, M_{2IoT+3LTE}, 9 kHz – 1 GHz, Port B:

Reference

P110208-F27

Date

2021-06-29

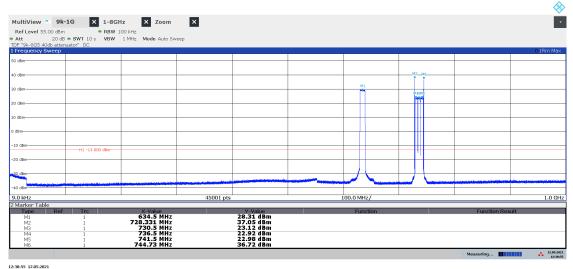
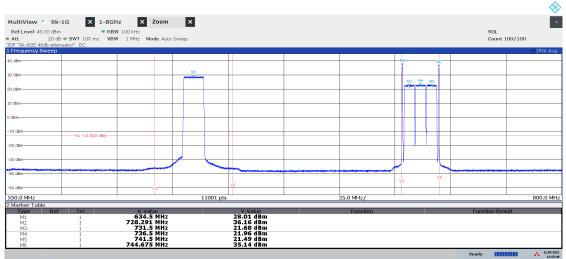


Diagram 3.57b NB IoT SA: N-TM, LTE: E-TM3.1, 550 – 800 MHz, Port B:



12:55:49 12.05.202

Note: The purpose of this measurement is to find IM products, not to verify compliance at the Band edges.

Diagram 3.57c NB IoT SA: N-TM, LTE: E-TM3.1, 1 – 8 GHz, Port B:

AultiView 📍 9k-1G	X 1-8GHz X	Zoom ×				
Ref Level 20.00 dBm	• RBW 1 MHz	_				
Att 0 dB • SWT : DF "9k-8G5 40db attenuator"	LOs = VBW 10 MHz Mod	e Auto Sweep				
Frequency Sweep						O1Rm A
dBm						
m						
1Bm				 		
81 -	13.000 dBm					
18m				 	 	
1Bm-				 		
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iBm						
JBm						
JBm-						
GHz		3	5001 pts	 700.0 MHz/	 	8.0
arker Table Type Ref Tro		alue 7 GHz	Y-Value -37.30 dBm	 Function	 Function Resul	

12:57:37 12:05:2021

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Field strength of spurious radiation measurements according to CFR 47 §27.53/RSS-130 6.7.1

Date	Temperature	Humidity
2021-04-14	$22 \degree C \pm 3 \degree C$	27 % ± 5 %
2021-04-15	$22 \ ^{\circ}C \pm 3 \ ^{\circ}C$	26 % ± 5 %
2021-04-16	$23 \ ^{\circ}C \pm 3 \ ^{\circ}C$	27 % ± 5 %

The test site conforms to the site validation criterion specified in ANSI C63.4.

The measurements were performed with both horizontal and vertical polarization of the antenna.

The antenna distance was 3 m in the frequency range 30 MHz - 8.2 GHz.

The EUT was placed 0.8 m above reference ground plane in frequency range 30 MHz - 1 GHz and 1.5 m above reference ground plane in frequency range 1 GHz - 8.2 GHz.

The measurement was performed with an RBW of 1 MHz.

A propagation loss in free space was calculated. The used formula was

 $\gamma = 20 \log \left(\frac{4\pi D}{\lambda}\right), \ \gamma$ is the propagation loss and D is the antenna distance.

The measurement procedure was as the following:

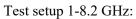
- A pre-measurement is performed with peak detector. For measurement < 1 GHz the test object was measured in eight directions with the antenna at three heights, 1.0 m, 1.5 m and 2.0 m. For measurements > 1 GHz the test object was measured in seventeen directions with the antenna height 1.5 m, 2.0 m and 2.5 m with elevation angle.
- Spurious radiation on frequencies closer than 20 dB to the limit in the premeasurement is scanned 0-360 degrees and the antenna is scanned 1-4 m for maximum response. The emission is then measured with the RMS detector and the RMS value is reported. Frequencies closer than 10 dB to the limit when measured with the RMS detector were measured with the substitution method according to ANSI 63.26.

RI. SE Date 2021-06-29

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The test set-up during the spurious radiation measurements is shown in the pictures below:

Test setup 30-1000 MHz:







Measurement equipment	RISE number
Test site Tesla	504 114
R&S ESU 26	902 210
Control computer with R&S software EMC32 version 10.60.15	503 889
High pass filter 1-20 GHz	901 501
Coaxial cable, Edison emission	BX91501
Coaxial cable	504 103
Coaxial cable	504 104
Teseq BiConiLog Antenna CBL6143A	504 079
ETS Lindgren Horn Antenna 3115	902 212
μComp Nordic, Low Noise Amplifier	504 160
Temperature and humidity meter, Testo 625	504 117

Test frequencies

Symbolic name:

B71	B85A				
B _{5L}	B _{5L}				
M5-20L	M _{5-10L}				
T _{5L}	T _{5L}				
B_{IoT+L}	T_{IoT+L}				
BIM1 _{IoT+L}	TIM _{IoT+L}				
BIM2 _{IoT+L}	2xSA _{IoT}				
B10 _{Guard}	$T10_{Guard}$				
M _{10NR}					
M _{NR5+LTE5}					
MAX _{NR5+LTE5}					

Results

Representing worst case:

Symbolic name BIM2_{IoT+L} + 2xSA_{IoT}, Diagram 4.1a-b

	Spurious emission level (dBm)			
Frequency (MHz)	Vertical	Horizontal		
30-8200	All emission > 20 dB below limit	All emission > 20 dB below limit		

Measurement uncertainty: 3.1 dB

Reference P110208-F27

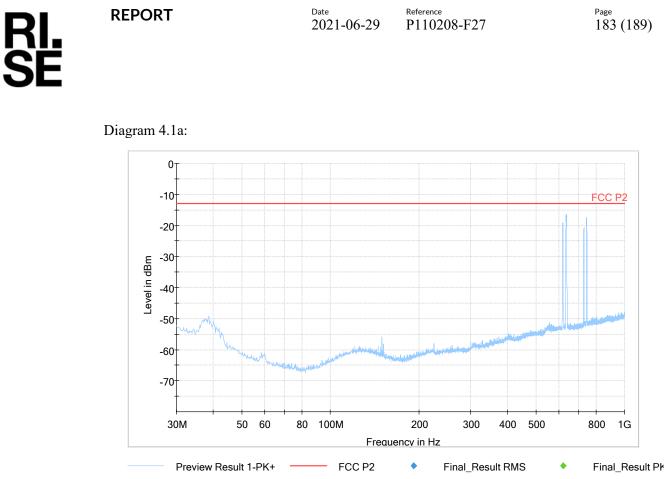
CFR 47 §27.53

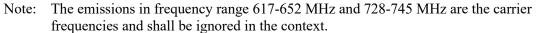
(g) Outside a licensee's frequency band(s) of operation the power of any emission shall be attenuated below the transmitter power (P) by at least $43 + 10 \log (P) dB$, resulting in a limit of -13 dBm.

RSS-130 6.7.1

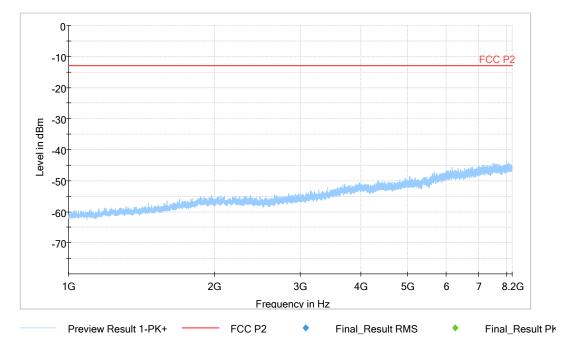
The unwanted emissions in any 100 kHz bandwidth on any frequency outside the low frequency edge and the high frequency edge of each frequency block range(s), shall be attenuated below the transmitter power, P (dBW), by at least $43 + 10 \log 10 p$ (watts), dB. However, in the 100 kHz band immediately outside of the equipment's frequency block range, a resolution bandwidth of 30 kHz may be employed.

Complies?	Yes
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Frequency stability measurements according to CFR 47 27.54 / RSS-130 4.5

Date	Temperature (test equipment)	Humidity (test equipment)
2021-05-19	$23 \text{ °C} \pm 3 \text{ °C}$	20 % ± 5 %
2021-05-20	$23 \ ^{\circ}C \pm 3 \ ^{\circ}C$	25 % ± 5 %
2021-05-21	$23 \ ^{\circ}C \pm 3 \ ^{\circ}C$	20 % ± 5 %
2021-06-23	$24 \ ^{\circ}C \pm 3 \ ^{\circ}C$	39 % ± 5 %

Test set-up and procedure

The measurements were made per definition in ANSI C63.26, 5.7.3. The test object was connected to a spectrum analyzer with the RMS detector activated.

The transmitter unwanted emissions shall be measured with a resolution bandwidth of at least 100 kHz. However, in the 100 kHz band immediately outside of the equipment's frequency block range, a resolution bandwidth of 30 kHz may be employed.

(for 4x 4MIMO -19 dBm) at the band edge of the lowest and highest channel was selected, and the frequency at these points was recorded as fL and fH respectively.

Measurement equipment	RISE number
R&S FSQ40	504 143
RF attenuator	902 282
Coaxial cable Sucoflex 102EA	BX50236
Coaxial cable Sucoflex 102EA	BX50237
Temperature Chamber	503 360
Testo 635, temperature and humidity meter	504 203
Multimeter Fluke 87	502 190

RI. SE

Results NR B71

Test conditions			Frequency margin to band edge at -19 dBm		
			Symbolic name: B _{10NR}	Symbolic name: T _{10NR}	
Supply voltage DC [V]	Temp [°C].	Carrier Bandwidth [MHz]	Margin for fL [kHz]	Margin for fH [kHz]	
-40.8	+20	10	43	65	
-55.2	+20	10	44	63	
-48.0	+20	10	41	64	
-48.0	+30	10	45	65	
-48.0	+40	10	43	64	
-48.0	+50	10	41	63	
-48.0	+10	10	46	65	
-48.0	0	10	45	65	
-48.0	-10	10	46	65	
-48.0	-20	10	45	62	
-48.0	-30	10	45	65	

Rated output power level at connector RF B (maximum): 47.8 dBm

Results LTE B71 and IoT GB

Nominal transmitter frequency was 634.5 MHz (M) with a bandwidth of 10 MHz. Rated output power level at connector RF B (maximum): 47.8 dBm.

Test condit	Test conditions		
Supply voltage DC (V)	Temp. (°C)	Frequency error (Hz)	
40.8	+20	3	
55.2	+20	3	
48	+20	3	
48	+30	1	
48	+40	1	
48	+50	1	
48	+10	2	
48	0	1	
48	-10	1	
48	-20	1	
48	-30	2	
Maximum freq.	error (Hz)	3	
Measurement un	Measurement uncertainty		

+20

+20

+20

-48.0 -48.0

-48.0

Rate	Rated output power level at connector RF B (maximum): 46 dBm(5MHz) 47.8 dBm(20MHz)							
Test conditions				Frequency margin	to band edge	e at -19dBm		
Supply	Temp	Symbolic Name	Test frequency			Test frequency		
voltage DC [V]	[°C].		fL	Offset to lower	fH	Offset to upper band		
			[MHz]	band edge (617 MHz) [kHz]	[MHz]	edge (652 MHz) [kHz]		
-48.0	+20	B _{5LTE} , T _{5LTE}	617.027	27	651.966	34		

617.219

617.018

617.154

Date

2021-06-29

Reference

P110208-F27

The frequency error results clearly shows that the frequency stability is good enough to ensure that the transmitted carrier stay within the operating band.

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154

651.773

651.974

651.831

Results LTE B85A and IoT GB

B20LTE, T20LTE

 $B_{10Guard,}\ T_{10Guard}$

B20Guard, T20Guard

Nominal transmitter frequency was 736.5 MHz (M) with a bandwidth of 5 MHz. Rated output power level at connector RF B (maximum): 46 dBm.

Test conditions			
Supply voltage DC (V)	Temp. (°C)	Frequency error (Hz)	
40.8	+20	2	
55.2	+20	2	
48	+20	2	
48	+30	1	
48	+40	1	
48	+50	1	
48	+10	1	
48	0	1	
48	-10	1	
48	-20	1	
48	-30	2	
Maximum freq. error (Hz)		2	
Measurement uncertainty		$< \pm 1 \text{ x } 10^{-7}$	

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Rated output power level at connector RF B (maximum): 46 dBm

Test conditions			Frequency margin to band edge at -19dBm			
Supply			t frequency	Test frequency		
voltage DC [V]	[°C].		fL	Offset to lower	fH	Offset to upper band
			[MHz]	band edge (728 MHz) [kHz]	[MHz]	edge (745 MHz) [kHz]
-48.0	+20	B _{5LTE} , T _{5LTE}	728.031	31	744.964	36
-48.0	+20	B _{10LTE} , T _{10LTE}	728.087	87	744.905	95
-48.0	+20	B _{10Guard} , T _{10Guard}	728.033	33	744.965	35

The frequency error results shows that the frequency stability is good enough to ensure that the transmitted carrier stay within the operating band.

Remark

It was deemed sufficient to test one combination of TX frequency, channel bandwidth configuration and test model (modulation), as all combinations share a common internal reference to derive the TX frequency from.

Remark

The measurements were performed with the bandwidth configuration 10 MHz representing worst case with regards to band edge compliance.

Limits

§27.54

The frequency stability shall be sufficient to ensure that the fundamental emissions stay within the authorized bands of operation.

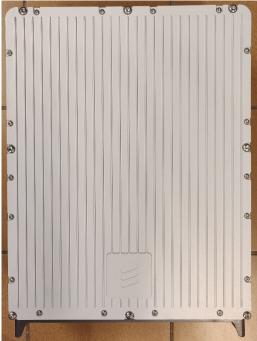
RSS-130 4.5

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.

Complies? Yes

Photos of test object

Front side



Left side



Rear side



Right side



Reference P110208-F27

Date 2021-06-29

SË

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Bottom side



Top side



Test object label:



End of report.