







Figure 8.5-7: Conducted spurious emissions of 20 MHz low channel, singlecarrier operation



Figure 8.5-6: Conducted spurious emissions of 15 MHz high channel, singlecarrier operation



Figure 8.5-8: Conducted spurious emissions of 20 MHz mid channel, singlecarrier operation









Figure 8.5-11: Conducted spurious emissions of 10 MHz mid channel, singlecarrier operation with IoT



Figure 8.5-10: Conducted spurious emissions of 10 MHz low channel, singlecarrier operation with IoT



Figure 8.5-12: Conducted spurious emissions of 10 MHz high channel, singlecarrier operation with IoT









Figure 8.5-15: Conducted spurious emissions of 15 MHz high channel, singlecarrier operation with IoT



Figure 8.5-14: Conducted spurious emissions of 15 MHz mid channel, singlecarrier operation with IoT



Figure 8.5-16: Conducted spurious emissions of 20 MHz low channel, singlecarrier operation with IoT









Figure 8.5-19: Conducted spurious emissions of 10 MHz bottom channels, two-carrier operation with IoT



Figure 8.5-18: Conducted spurious emissions of 20 MHz high channel, singlecarrier operation with IoT



Figure 8.5-20: Conducted spurious emissions of 10 MHz middle channels, two-carrier operation with IoT









Figure 8.5-23: Conducted spurious emissions of 10 MHz middle channels, two-carrier operation with IoT



Figure 8.5-22: Conducted spurious emissions of 10 MHz bottom channels, two-carrier operation with IoT



Figure 8.5-24: Conducted spurious emissions of 10 MHz top channels, twocarrier operation with IoT

Testing data FCC 24.238(a) and RSS-133, 6.5.1 Spurious out-of-band emissions FCC Part 24 and RSS-133, Issue 6









Figure 8.5-26: Conducted spurious emissions of 10 MHz middle channels, two-carrier operation with IoT

Keysight Spectrum Analyzer - Swept SA #Avg Type: RMS Avg|Hold:>100/100 Video BW 8.0 MHz PNO: Fast Trig: Free Run IFGain:Low #Atten: 6 dB Mkr1 1.976 4 GHz 24.290 dBm Ref Offset 44.2 dB Ref 40.20 dBm 10 dBi Log 30 20. 10. 1.20 DL1 -25.04 -29.8 -49. Stop 22.00 GHz Sweep 36.67 ms (22000 pts) Start 30 MHz #Res BW 1.0 MHz #VBW 8.0 MHz\* **STATUS** 

Figure 8.5-27: Conducted spurious emissions of 10 MHz top channels, twocarrier operation with IoT

Section 8	Testing data
Test name	FCC 24.238(a) and RSS-133, 6.5.1 Spurious out-of-band emissions
Specification	FCC Part 24 and RSS-133, Issue 6



## On the plots below the measured "Channel power" value must be lower, than –25.04 dBm



Figure 8.5-28: Conducted band edge emission at 1930 MHz, 10 MHz single carrier operation (RBW = 1% of EBW)

Keysight Spectr	rum Analyzer - Channel Po	wer			1				
Span 35.0	00 MHz			Center Fre	q: 1.92992500	0 GHz		Radio Std: N	AM Jan 22, 20
PASS		#IFG	ain:Low 🗣	#Atten: 6 c	Run JB	Avg Hold:>	100/100	Radio Devic	e: BTS
10 dB/div	Ref 44.20 dB	m						Mkr1 -42.	1.93 GH 775 dB
.og 34.2									
4.2									
4.2						~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	man	~~~~	1
20									-
0					1				1
					{				
.8					í1				
i.8									~
enter 1.9 Res BW 5	3 GHz 51 kHz			#VE	SW 1 MHz			Sp Sw	an 35 M eep 16 i
Channe	el Power			Power	r Spectra	I Density	,		
20	0 0 2 d B m		_		00 50	d D m	-		
-30	0.02 UDIII	/ 150 KH	z	-	90.56		z		
3						<b>STATUS</b>			

Figure 8.5-30: Conducted band edge emission at 1930 MHz, 15 MHz single carrier operation (RBW = 1% of EBW)

 
 Settol::IMT
 ALIGN AUTO

 Center Freq: 1.928500000 GHz
 Trig: Free Run

 Trig: Free Run
 Avg|Hold:>100/100

 #Atten: 6 dB
 Avg
 11:06:28 AM Ja Radio Std: None Span 25.000 MHz Radio Device: BTS #FGain:Lov Mkr1 1.929 GHz -44.623 dBm Ref 44.20 dBm 10 dB/di Center 1.929 GHz #Res BW 51 kHz Span 25 MHz Sweep 11.47 ms #VBW 1 MHz **Channel Power** Power Spectral Density -32.83 dBm / 1 MHz -92.83 dBm /Hz **STATU** 

Figure 8.5-29: Conducted band edge emission at 1929 MHz, 10 MHz single carrier operation (RBW = 1 MHz)

Key	/sight Spec	trum Analyz	er - Channel	ower										
L)XI	T	RF	50 Ω DC				SENSE:INT	_		AL	IGN AUTO		11:07:0	2 AM Jan 22, 2020
Spar	n 35.0	00 MH	z			_	Center I	Freq.	: 1.92860	0000	AvaiHold	100/100	Radio Std: N	lone
PAS	S	]			#IFGain:L		#Atten:	6 dB	8		Avginoid.>	100/100	Radio Devic	e: BTS
													Mkr1_1	929 GHz
10 dE	3/div	Ref	44.20 dl	Bm									-45.	139 dBm
34.2								11						
24.2								11						
14.2										~	caman,	harm	1 mm	n
4.20										-				
-5.80														
-15.8														
-25.8														
35.9									1					
-35.0									Ľ.T					5
-40.0					-	www.	A	11						
Cent	ter 1.9	929 GHz	2										Sp	an 35 MHz
#Res	s BW	51 kHz					#	VB	N 1 M	Hz			Sw	eep 16 ms
											Demaile			
L C	nann	el Pov	wer				Pow	er	Spec	tra	Density			
	•	2 72	dDm							<b>.</b>	Duna u			
	-3	2.73	aBn	1/1	MHz			-8	JZ.1	3 (	abm /F	z		
MSG											TATATUS.			
											Contration and a			

Figure 8.5-31: Conducted band edge emission at 1929 MHz, 15 MHz single carrier operation (RBW = 1 MHz)



Keysight Spectro	um Analyzer - Channel	Power							
ø ⊺ Spap 45.00	RF 50 Ω D	C		SENSE:INT Center Fre	a: 1.92990000	IGN AUTO		11:23:3 Radio Std: 1	7 AM Jan 22, 203
PASS	0 MI12	#1	FGain:Low	Trig: Free #Atten: 6 c	Run IB	Avg Hold:>	100/100	Radio Devic	e: BTS
I0 dB/div	Ref 44.20 d	Bm						Mkr1 -46.	1.93 GH 020 dBi
og									
4.2									
4.2									
1.2					mm	· ······	m		n
20									
0									+
8					1				$\vdash$
8					1				$\vdash$
.8	-				1			-	
.8	_							-	-
enter 1.93	3 GHz	• • • •						Sp	an 45 M
es BW 5	1 KHZ			#VE	SW 1 MHz			Swee	9 20.6 I
Channe	el Power			Power	Spectra	I Density	,		
-40	).85 dBn	n / 200 k	Hz	-	93.86 (	dBm /⊦	lz		
						-			
						STATUS			

**Figure 8.5-32:** Conducted band edge emission at 1930 MHz, 20 MHz single carrier operation (RBW = 1% of EBW)

Keysight Spec	ctrum Analyzer - Channe	el Power							
ра т	RF 50 Ω E	C		SENSE:INT	A	LIGN AUTO		11:35:	1 AM Jan 22, 2020
Integratio	n BW 100.00	kHz		Trig: Free	Run	AvalHold:>	100/100	Radio Std:	None
PASS		#16	Gain:Low	#Atten: 6	dB			Radio Devi	e: BTS
								Mkr1 1	.995 GHz
10 dB/div	Ref 44.20 c	iBm						-38	.271 dBm
Log					<u> </u>				
34.2		-			-			-	
24.2									
14.2								_	
4.20									
5.00	ł			1					
-5.00	1			1					
-15.8				1					
-25.8		-			1			-	-
-35.8		-							
-45.8	-								
Center 1.9	995 GHz			-40.0				Spar	1 23.33 MHz
#Res BW	51 KHZ			#VI	SW 1 MHZ			Swee	p 10.67 ms
Chann	nel Power			Power	r Spectra	I Density			
-3	6.60 dBr	n / 100 kl	Hz		86.60	dBm /ਮ	z		
						f .			
MSG						SIATUS			

Figure 8.5-34: Conducted band edge emission at 1995 MHz, 10 MHz single carrier operation (RBW = 1% of EBW)

Keysight Spectr	um Analyzer - Channel Power						
0 T	RF 50 Ω DC		Center Freq: 1.9	ALIGN AUTO		11:07:23 A	1 Jan 22, 2020
span 45.0			Trig: Free Run Avg Hold:>100/100				
PASS		#IFGain:Low	#Atten: 6 dB			Radio Device:	BTS
						Mkr1 1.9	29 GHz
10 dB/div	Ref 44.20 dBm					-44.6	33 dBm
Log							
34.2							
24.2							
14.2				maren processing			$\sim$
4.20					-	+ +	
-5.80				1			
-15.8				/			$\rightarrow$
-25.8				1			
-35.8			1				
45.9							5
40.0							
Center 1.9	29 GHz					Spa	n 45 MHz
#Res BW 💲	i1 kHz		#VBW 1	MHz		Sweep	20.6 ms
Channe	el Power		Power Sp	ectral Densit	y		
-32	2.49 dBm / 1	MHz	-92.	49 dBm /	Hz		
					-		
450				Th STATUS			
				NO STATUS			

Figure 8.5-33: Conducted band edge emission at 1929 MHz, 20 MHz single carrier operation (RBW = 1 MHz)

Keysight Spectrum Analyzer - Channel Power		cruce and		- 6
rker 1 1.9960 GHz		Center Freq: 1.99650	0000 GHz	Radio Std: None
SS	#IFGain:Low	#Atten: 6 dB	Avg Hold:>100/100	Radio Device: BTS
dB/div Ref 44.20 dBm				Mkr1 1.996 G -43.333 dE
g				
2				
2		~		
0				
3				
nter 1.997 GHz es BW 51 kHz		#VBW 1 M	łz	Span 25 N Sweep 11.47
Channel Power		Power Spect	ral Density	
-32.02 dBm /	1 MHz	-92.02	2 dBm /Hz	

Figure 8.5-35: Conducted band edge emission at 1996 MHz, 10 MHz single carrier operation (RBW = 1 MHz)



Keysight Spec	ctrum Analyzer - Channe	Power							
nan 25.0	RF 50 Ω E	C		SENSE:INT	1.99507500	LIGN AUTO		11:31: Radio Std:	19 AM Jan 22, 202
span 35.u				Trig: Free R	in	Avg Hold:>1	00/100	Radio ata.	
ASS			#IFGain:Low	#Atten: 6 dB				Radio Devi	ce: BTS
I0 dB/div	Ref 44.20 d	IBm						Mkr1 1 -45	.995 GH .759 dBr
og									
34.2									
4.2			+			+ +			
4.2	hann	mon	mann	mon				-	
20		-						_	-
80				1		++			
5.8	_/			\ <b>\</b>					
5.8									
5.8									
5.8				•					
enter 1.9	995 GHz							S	pan 35 M
Res BW	51 kHz			#VBV	V 1 MHz			Sv	/eep 16 i
Chann	nel Power			Power	Spectra	al Density			
-4	1.78 dBr	n / 150	kHz	-9	3.54	dBm /на	2		
						-4			
						STATUS			

Figure 8.5-36: Conducted band edge emission at 1995 MHz, 15 MHz single carrier operation (RBW = 1% of EBW)

Keysight Spectrum Analyze	r - Channel Power						
LXVIT RF	50 Ω DC	SENSE:INT	A	LIGN AUTO		11:21:1	5 AM Jan 22, 2020
Span 45.000 MHz	2	Center Fr	req: 1.99510000	0 GHz	00/400	Radio Std: I	lone
PASS	#IFG	iain:Low #Atten: 6	dB	Avginoid.>1	00/100	Radio Devic	e: BTS
						Mkr1_1	.995 GHz
10 dB/div Ref 4	4.20 dBm					-44.	238 dBm
34.2							
24.2							
14.2	- source and a second second	Laward	1				
4.20			+				
-5.80							
-15.8							
36.0							
20.0			1				
-35.8			<b>4</b> 1				
-45.8						-	
Contor 1 005 CHz							an 45 MHz
#Res BW 51 kHz		#V	BW 1 MHz			Swee	ep 20.6 ms
Channel Pov	ver	Powe	r Spectra	I Density			
-38.80	<b>dBm</b> / 200 kH	z	-91.81 (	авт /н	z		
MSG				STATUS			
				<b>•</b>			

Figure 8.5-38: Conducted band edge emission at 1995 MHz, 20 MHz single carrier operation (RBW = 1% of EBW)

Keysight Spectrum Analyzer - Channel Pow	er				
T RF 50 Ω DC		SENSE:INT	ALIGN AUTO		11:13:25 AM Jan 22, 2 Radio Std: None
Jan 35.000 MH2		Trig: Free Run	Avg Hold:	>100/100	
ASS	#IFGain:Low	#Atten: 6 dB	Radio Device: BTS		
					Mkr1 1.996 G
dB/div Ref 44.20 dBn	1				-45.468 dE
g					
2					
2					
	man				
		+ + +++			
		+ $+$ $+$ $+$ $+$ $+$ $+$ $+$ $+$ $+$			
		+ $+$ $+$ $+$ $+$ $+$ $+$ $+$ $+$ $+$			
- All I					
			man and a second se		
nter 1.997 GHz					Span 35 M
es BW 51 kHz		#VBW	1 MHz		Sweep 16
Channel Power		Power Sp	ectral Density	/	
-33 18 dBm	/ 1 MU-	-93	18 dBm //		
-55.10 abiii		-00		12	
			-4		

Figure 8.5-37: Conducted band edge emission at 1996 MHz, 15 MHz single carrier operation (RBW = 1 MHz)

Keysight Spectrum Analyzer - Channel Power				- 6		
pan 45.000 MHz	s	Center Freq: 1.996500	ALIGN AUTO	11:14:18 AM Jan 22, 20 Radio Std: None		
ASS	#IFGain:Low	Trig: Free Run #Atten: 6 dB	Avg Hold:>100/100	Radio Device: BTS		
0 dB/div Ref 44.20 dBm				Mkr1 1.996 GH -46.020 dB		
.og						
24.2						
42 ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~		~				
.20						
80		_ { _				
i.8 /						
i.8		- \				
i.8		1				
5.8			~			
enter 1.997 GHz Res BW 51 kHz		#VBW 1 MH	z	Span 45 Mi Sweep 20.6 n		
Channel Power		Power Spectr	al Density			
-33.52 dBm / 1	MHz	-93.52	dBm /Hz			
			flammer.			
3			SIAIUS			

Figure 8.5-39: Conducted band edge emission at 1996 MHz, 20 MHz single carrier operation (RBW = 1 MHz)



## On the plots below the measured "Channel power" value must be lower, than -25.04 dBm



**Figure 8.5-40:** Conducted band edge emission at 1930 MHz, 10 MHz single carrier operation with IoT (RBW = 1% of EBW)

ctrum Analyzer - Channel Power					- 6
RF 50 Ω DC		SENSE:INT ALIGN AUT	0	11:27:17 A	M Jan 22, 202
JOO MHz		Center Freq: 1.929920000 GHz Trig: Free Run Avg	Hold:>100/100	Radio Std: No	ne
	#IFGain:Low	#Atten: 6 dB		Radio Device:	BTS
ć				Mkr1 1	93 GH
Ref 44.20 dBm				-41.7	08 dBn
Ku the ucin					
				+ +	
	$\rightarrow$			I.	
					}
					1
		1			T
		1			
		1			1
				+ +	t
				+ +	- market and a second
02 CH7				Sna	n 35 MH
51 kHz		#VBW 1 MHz		Swee	en 16 m
01812					·P
el Power		Power Spectral Der	nsity		
		00.00 40.			
/8.33 dBm //	150 kHz	-90.09 dBn	n /Hz		
		1 STA	ATUS		
	Num Adugar - Chandel Poewer           Ref 44.20 dBm           Ref 44.20 dBm           33 GHz           51 kHz           iel Power           8.33 dBm /	Inin Adayse - Channel Power IOO MHz #FGainLow Ref 44.20 dBm Ref 44.20 dBm 100 MHz #FGainLow Ref 44.20 dBm 100 MHz 100 M	Norm Adapter: Channel Power Norm Market Channel Power Norm Market Channel Power Ref 44.20 dBm Ref 44.20 dBm Arg Ref 44.2	Non Addys:         Control (MHz)         NON AUTO           00 MHz         Center Freq: 1.2992000 Hz         Aug/Hold:>100/100           #FGainLow         Freq Auto:: 5 ab         Aug/Hold:>100/100           Ref 44.20 dBm         Image: 1.2992000 dbs         Image: 1.2992000 dbs           00 MHz         #FGainLow         Freq Auto:: 5 ab         Aug/Hold:>100/100           30 GHz         Image: 1.2992000 dbs         Image: 1.2992000 dbs         Image: 1.2992000 dbs           10 Joint Low         Image: 1.2992000 dbs         Aug/Hold:>100/100         Image: 1.2992000 dbs         Image: 1.2992000 dbs           10 Joint Low         Image: 1.2992000 dbs         Image: 1.2992000 dbs         Image: 1.2992000 dbs         Image: 1.2992000 dbs           10 Joint Low         Image: 1.2992000 dbs         Image: 1.2992000 dbs         Image: 1.2992000 dbs         Image: 1.2992000 dbs           30 GHz         #VBW 1 MHz         Image: 1.2992000 dbs         Image: 1.2992000 dbs         Image: 1.2992000 dbs           30 GHz         #VBW 1 MHz         Image: 1.2992000 dbs         Image: 1.2992000 dbs         Image: 1.2992000 dbs         Image: 1.2992000 dbs           30 GHz         Freq Aug         Image: 1.2992000 dbs         Image: 1.29920000000000000000000000000000000000	INDIANALY: Channel Power INDIANALY: Context Proc. 122922000 GHz Radio Stat. No. Ref 44.20 dBm Ref and a state of the sta

**Figure 8.5-42:** Conducted band edge emission at 1930 MHz, 15 MHz single carrier operation with IoT (RBW = 1% of EBW)



Figure 8.5-41: Conducted band edge emission at 1929 MHz, 10 MHz single carrier operation with IoT (RBW = 1 MHz)

Keysight Spectre	um Analyzer - Channel Power						@ E	
	RF 50 Ω DC		SENSE:INT	4 0285000	ALIGN AUTO	11:10:0 Redia Std.	8 AM Jan 22, 2020	
Span 35.00	JU MHZ		Trig: Free F	un	Avg Hold:>100/100	Radio Std. I	vone	
PASS		#IFGain:Low	#Atten: 6 dl	3	•	Radio Device: BTS		
						Mkr1 1	.929 GHz	
10 dB/div	Ref 44.20 dBm					-44.	509 dBm	
Log								
34.2								
24.2				0			0	
14.2				1 100			******	
4.20								
-5.80								
-15.8								
-25.8								
35.9				1				
-55.0								
-40.0								
Center 1.92	29 GHz					S	an 35 MHz	
#Res BW 5	1 kHz		#VB	W/1 MHz		Sw	eep 16 ms	
Channe	el Power		Power	Spectra	al Density			
-32	2.59 dBm /	1 MHz	-9	92.59	dBm /Hz			
MSG					STATUS			
					<b>V</b>			

Figure 8.5-43: Conducted band edge emission at 1929 MHz, 15 MHz single carrier operation with IoT (RBW = 1 MHz)



Keysight Spectrum Analyzer - Channel P	ower			
T RF 50 Ω DC		SENSE:INT Center Freq: 1.92990	ALIGN AUTO	11:24:37 AM Jan 22, 20 Radio Std: None
Span 45.000 MHz		Trig: Free Run	Avg Hold:>100/100	Radio Sta. None
PASS	#FGain:Low	#Atten: 6 dB		Radio Device: BTS
10 dB/div Ref 44.20 dE	3m			Mkr1 1.93 GH -43.258 dBi
og				
4.2				
24.2				λ.
4.2			*****	
.20				
80				
5.8		1		
5.8		1		
5.8		1		
5.8				h
enter 1.93 GHz Res BW 51 kHz		#VBW 1 M	Hz	Span 45 MH Sweep 20.6 n
Channel Power		Power Spect	tral Density	
-37.73 dBm	/ 200 kHz	-90.74	4 dBm /Hz	
			f	
'			NO OTATINO	

**Figure 8.5-44:** Conducted band edge emission at 1930 MHz, 20 MHz single carrier operation with IoT (RBW = 1% of EBW)

Keysight Spect	trum Analyzer - Channel	Power							
uyar ⊤	RF 50 Ω DC			SENSE:INT	AL	LIGN AUTO		11:35:1	4 AM Jan 22, 2020
Integration	n BW 100.00	kHz		Center Fre	Run	0 GHz	100/100	Radio Std:	None
PASS		#	IFGain:Low	#Atten: 6 d	B	Angli Iold.	100/100	Radio Devid	e: BTS
								Mkr1_1	.995 GHz
10 dB/div	Ref 44.20 d	Bm						-35	.807 aBm
34.2									
24.2	0			A					
14.2	Harmon	****		mannad					
4.20	1								
-5.80	1			1					
-15.8									
-25.8					1			+	
-35.8	/								
-45.8								-	
Center 1.9	95 GHz							Spar	23.33 MHz
#Res BW	51 kHz			#VE	SW 1 MHz			Swee	p 10.67 ms
				_	<b>.</b> .				
Chann	el Power			Power	r Spectra	I Density			
2	4 75 dBm				04 75	d D m u	-		
-3	4.75 UDI	1 / 100 K	HZ	-	04.75		z		
1									
MSG						STATUS			

**Figure 8.5-46:** Conducted band edge emission at 1995 MHz, 10 MHz single carrier operation with IoT (RBW = 1% of EBW)

Keysight S	RF 50 Ω DC		SENSE:INT	ALIGN AUTO	11:10:31 AM Jan 22, 2020			
Span 45	5.000 MHz		Center Freq: 1.928500000 GHz Radio Std: None					
PASS		#IFGain:Low	#Atten: 6 dB	Avginoid.>100/100	Radio Device: BTS			
					Mkr1 1.929 GHz			
Log	Rei 44.20 übili							
34.2								
24.2				1				
4.20				() () ()				
-5.80								
-15.8								
-25.8								
-35.8			<b>↓</b> 1/					
-45.8								
Center	1.929 GHz		#VBM 1	MHz	Span 45 MHz Sweep 20.6 ms			
miles Di	V OT KIL		#7817 11	1112	0400p 20.0 ma			
Char	nnel Power		Power Spe	ctral Density				
-	32.58 dBm /	1 MHz	-92.5	58 dBm /Hz				
MSG				<b>K</b> STATUS				

Figure 8.5-45: Conducted band edge emission at 1929 MHz, 20 MHz single carrier operation with IoT (RBW = 1 MHz)

Keysight Spectrum Analyzer - Channel Power				- 6		
Span 25.000 MHz		Center Freq: 1.9965000	ALIGN AUTO	Radio Std: None		
PASS	#IFGain:Low	Trig: Free Run #Atten: 6 dB	Avg Hold:>100/100	Radio Device: BTS		
10 dB/div Ref 44.20 dBm				Mkr1 1.996 G -42.084 dB		
Log						
24.2						
14.2		A				
420						
5.80						
15.8						
.25.8						
35.8		1				
458						
Center 1.997 GHz #Res BW 51 kHz		#VBW 1 MHz		Span 25 M Sweep 11.47		
Channel Power		Power Spectra	al Density			
-30.23 dBm / 1	MHz	-90.23	dBm /Hz			
MSG		TA STATUS				
			-			

Figure 8.5-47: Conducted band edge emission at 1996 MHz, 10 MHz single carrier operation with IoT (RBW = 1 MHz)



Keysight Spect	rum Analyzer - Channe	el Power							
1 an 35 0	RF 50 Ω 0	DC		SENSE:INT	a: 1.9950750	ALIGN AUTO		Radio Std:	10 AM Jan 22, 20 None
an 35.0				Trig: Free	Run	Avg Hold:>1	00/100		
155		#1	#IFGain:Low #Atten: 6 dB					Radio Devie	e: BTS
dB/div	Ref 44.20 (	iBm						Mkr1 1 -41	.995 GI .375 dB
9					1				
2									
2									
2	- Contractor					+ +			
0								_	
	1			1					
3	1								
					1				
					-				
°					~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~			-	
nter 1.9	95 GHz							S	pan 35 M
es BW 🖇	51 kHz			#VE	BW 1 MHz	!		Sw	eep 16
Chann	al Dower			Powe	r Spectr	al Deneity			
Inanin	errower			FOWE	opecua	al Density			
_3	8 03 dB	m / 150 k	u.,	_	89 79	dBm /u			
-01	0.05 001	11 / 150 K	<b>12</b>		00.70		2		
						1			
						STATUS			

**Figure 8.5-48:** Conducted band edge emission at 1995 MHz, 15 MHz single carrier operation with IoT (RBW = 1% of EBW)

Keysight Spectr	um Analyzer - Channel Power					×
LXI T	RF 50 Ω DC		SENSE:INT	ALIGN AUTO	11:19:46 AM Jan 22,	2020
Span 45.0	DO MHz		Center Freq: 1.99510	Availed >100/100	Radio Std: None	
PASS		لی #IFGain:Low	#Atten: 6 dB	Avginoid. Prodition	Radio Device: BTS	
					Mkr1 1.995 G	Hz
10 dB/div	Ref 44.20 dBm				-43.812 d	вm
34.2						_
24.2						_
14.2	ρ		hanne			_
4.20						_
-5.80						_
-15.8						_
-25.8						_
-35.8			1			_
-45.8						
Center 1.9 #Res BW 5	95 GHz 51 kHz		#VBW 1 MI	Hz	Span 45 M Sweep 20.6	VIHz i ms
Channe	el Power		Power Spect	tral Density		
-38	3.77 dBm / 2	00 kHz	-91.78	B dBm /Hz		
MSG				The STATUS		
				No otres and		

**Figure 8.5-50:** Conducted band edge emission at 1995 MHz, 20 MHz single carrier operation with IoT (RBW = 1% of EBW)

μα ⊺ Concern 21	RF 1	50 Ω DC	wer		SENS	E:INT	rea:	1 99650000			11:13:2 Radio Std:	5 AM Jan 22, 2020
PASS	5.000 MHZ		410	Gaintlow	₽Ì	Trig: Fre	e Ru 6 dB	In	Avg Hold:	>100/100	Radio Devid	e: BTS
10 dB/div	Ref 4	4.20 dBi	m	Gameow							Mkr1 1 -45	.996 GHz 468 dBm
Log 34.2												
24.2												
14.2	mon	w	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	~~~~~	~~~~	1						
4.20											_	
-5.80						1						
-25.8	1											
-35.8							1-			-	_	
-45.8					-	5	4-	-				
Center #Res B\	1.997 GHz N 51 kHz					#\	/ви	V 1 MHz			SI SW	oan 35 MHz eep 16 ms
Cha	nnel Pow	/er				Pow	er S	Spectra	I Density	,		
.	-33.18	dBm	/ 1 MHz	z			-9	3.18	dBm /I	lz		
MSG									The STATUS			
									Nor Allos			

Figure 8.5-49: Conducted band edge emission at 1996 MHz, 15 MHz single carrier operation with IoT (RBW = 1 MHz)

Keysight Spectrum Analyzer - Channel Power		- Ø 🗾
Span 45.000 MHz	Center Freq: 1.996500000 GHz	11:18:01 AM Jan 22, 2020 Radio Std: None
PASS	Trig: Free Run Avg Hold:>100/100 #FGain:Low #Atten: 6 dB	Radio Device: BTS
10 dB/div Ref 44.20 dBm		Mkr1 1.996 GHz -44.886 dBm
Log 34.2		
24.2		
14.2		
4.20		
5.80		
15.8		
25.8		
35.8		
40.0	and the second s	
Center 1.997 GHz ≭Res BW 51 kHz	#VBW 1 MHz	Span 45 MH Sweep 20.6 m
Channel Power	Power Spectral Density	
-32.59 dBm / 1 м	нz -92.59 dBm /нz	
	<b>1</b>	
34	Lo STATUS	

Figure 8.5-51: Conducted band edge emission at 1996 MHz, 20 MHz single carrier operation with IoT (RBW = 1 MHz)



## On the plots below the measured "Channel power" value must be lower, than -25.04 dBm



Figure 8.5-52: Conducted band edge emission at 1930 MHz, 10 MHz two-carrier operation (RBW = 1% of EBW)

Keysight Spect	trum Analyzer - Channel Power							
nan 65 0	RF 50 Ω DC		SENSE:INT	AL a; 1.92992500	IGN AUTO		11:29:1 Radio Std:	5 AM Jan 22, 20 None
ASS	]	#FGain:Low	Trig: Free #Atten: 6	Run dB	Avg Hold:>	100/100	Radio Devic	e: BTS
) dB/div	Ref 44.20 dBm						Mkr1 -45	1.93 GI 151 dB
g								
12								
2								
20					N CANSA	a have		- Marine
30								
.8				í		$  \rangle $		
.8				-		W-		
.8			-	1				+ +
i.8				ľ				<u> </u>
enter 1.9	3 GHz			DW 4 MIL-			SI	an 65 M
(es DW	J1 KH2		#VI				awee	5 29.75
Chann	el Power		Powe	r Spectra	I Density			
-4	1.07 dBm / 1	50 kHz						
4					STATUS			

Figure 8.5-54: Conducted band edge emission at 1930 MHz, 15 MHz two-carrier operation (RBW = 1% of EBW)



Figure 8.5-53: Conducted band edge emission at 1929 MHz, 10 MHz two-carrier operation (RBW = 1 MHz)

Keys	ight Spect	trum Analyzer - Channel	Power								- 6 ×
µ¤ Snan	T 0.65.0	RF 50 Ω DC			SENSE:INT Center	Freg: 1	.92850000	LIGN AUTO		Radio St	18:41 AM Jan 22, 2020 d: None
PAS	S	]		#IFGain:Low	Trig: Fi #Atten:	ree Run 6 dB		Avg Hold:>	100/100	Radio Device: BTS	
10 dB	/div	Ref 44.20 d	Bm							Mkr1 -4	1.929 GHz 4.523 dBm
Log						m					
34.2											
24.2											
14.2							L'ANN	www.	and he	the way	mound
4.20											
-5.80							1				
-15.8									V		
-25.0						1					
45.8									1		
-40.0											
Cente #Res	er 1.9 BW	929 GHz 51 kHz			#	VBW	1 MHz			Swe	Span 65 MHz ep 29.73 ms
Cł	nann	el Power			Pow	/er S	pectra	I Density	,		
	-3	2.28 dBn	n / 1 M	Hz		-92	2.28	dBm /⊦	Iz		
MSG								STATUS			

Figure 8.5-55: Conducted band edge emission at 1929 MHz, 15 MHz two-carrier operation (RBW = 1 MHz)



Keysight Spec	ctrum Analyzer - Channel P	ower						
ur ⊺ Snan 85 (	RF 50 Ω DC		SENSE:INT	AL 1.92990000	IGN AUTO		11:24:09 Radio Std: N	AM Jan 22, 2020
PASS		#IFGain:Low	Trig: Free #Atten: 6	Run dB	Avg Hold:>	100/100	Radio Devic	e: BTS
10 dB/div	Ref 44.20 dE	im					Mkr1 -44.	1.93 GHz 325 dBm
Log								
24.2								
14.2								
4.20				hand	www.www	m mar	murr	m
-5.80								
-15.8				1				
-25.8				í				
-35.8			-	1		L V		
-45.8				r		1		
Center 1.9 #Res BW	93 GHz 51 kHz	h	#VE	BW 1 MHz			Sp	an 85 MHz 38.87 m
Chann	nel Power		Powe	r Spectra	Density			
-3	8.74 dBm	/ 200 kHz	-	91.75 (	dBm /H	Iz		
					4			
MSG					STATUS			

Figure 8.5-56: Conducted band edge emission at 1930 MHz, 20 MHz two-carrier operation (RBW = 1% of EBW)

Keysight Spectrum Analyzer - Chan	nel Power		- 6 💌
<b>μα T</b> RF 50 Ω	DC	SENSE:INT ALIGN AUTO	11:36:23 AM Jan 22, 2020
Span 45.000 MHz		Tria: Free Run AvaiHold:>	100/100 Radio Std: None
PASS	#FGain:Low	#Atten: 6 dB	Radio Device: BTS
			Mkr1 1.995 GHz
10 dB/div Ref 44.20	dBm		-41.747 dBm
Log			
34.2			
24.2			
14.2	·		
4.20			
-5.80			
15.9		ł	
15.0	W I		
-25.8		1	
-35.8			
-45.8			
Conter 1 005 CHr		" And the second s	Coop 45 Mile
#Res BW 51 kHz		#VBW 1 MHz	Sweep 20.6 ms
Channel Power		Power Spectral Density	
-39.85 dB	m / 100 kHz	<b>-89.85 dBm</b> /н	z
MSQ		In STATUS	
		No offeros	

Figure 8.5-58: Conducted band edge emission at 1995 MHz, 10 MHz two-carrier operation (RBW = 1% of EBW)

Keysight spec			CTAUCT-TAUT					11.00.00	
pan 85.0	000 MHz		Center Freq: 1	.92850000	GHz			Radio Std: N	one
ASS	]	AIE Cainel and	Trig: Free Run #Atten: 6 dB		Avg Hold:>	100/100		Radio Device	BTS
,		#IFGain:Low	#Atten: 0 db					Naliced d	000 CL
								MKr1 1.	929 GH
0 dB/div	Ref 44.20 dBm		m m					-40.	4 <i>31</i> UBI
34.2							_		
4.2									
4.2									
20					www.	m	m	Arteriated	- or March
80									
8				l					
8									
						Υ			
						ļ			
enter 1.9	929 GHz							Sp	an 85 MH
Res BW	51 kHz		#VBW	1 MHz				Sweep	38.87 m
Chann	el Power		Power S	pectra	I Density				
-3	2.56 dBm / 1	MHz	-92	2.56 (	dBm /⊦	z			

Figure 8.5-57: Conducted band edge emission at 1929 MHz, 20 MHz two-carrier operation (RBW = 1 MHz)

Keysight Spectrum Analyzer - Channe	I Power			- 0
pan 45.000 MHz		Center Freq: 1.996500000 GHz	)	11:16:26 AM Jan 22, 202 Radio Std: None
PASS	#IFGain:Low	Trig: Free Run Avg  #Atten: 6 dB	Hold:>100/100	Radio Device: BTS
0 dB/div Ref 44.20 d	IBm			Mkr1 1.996 GH -44.532 dBn
og				
4.2				
12				
20				
80				
5.8	V V			
5.8		i		
5.8				
				0
Res BW 51 kHz		#VBW 1 MHz		Span 45 MH Sweep 20.6 m
Channel Power		Power Spectral Den	sity	
-32.32 dBr	n / 1 MHz	-92.32 dBm	1/Hz	
		ri-	n 10	
9		No SIAI	00	

Figure 8.5-59: Conducted band edge emission at 1996 MHz, 10 MHz two-carrier operation (RBW = 1 MHz)



Keysight Spect	rum Analyzer - Channel	Power							- 7
1	RF   50 Ω D0			SENSE:INT	A	LIGN AUTO		11:32:3 Dadio Std: 1	0 AM Jan 22, 20
an 65.0	00 MHz			Tric: Free	Run	AvaiHold:>100	/100	Radio Std: r	vone
SS		,	IFGain:Low	#Atten: 6	B	Anglinoid. Prod		Radio Devic	e: BTS
	D-6.44.00 d							Mkr1 1	.995 GH
a Biaiv	Ref 44.20 d	sm						-40.	
2					L				
2									
<u>^</u>									
2 M	and the second	many r		have					
					-				
					L				
				1					
		1 V							
		V							
	-		-		1			-	
8		1			anne i				
					-				
nter 1.9	95 GHz							_ Sp	ban 65 M
es BW 🔅	51 KHZ			#VE	SW 1 MHz			Swee	5 29.73
Chann	el Power			Powe	Spectra	I Density			
-4	1 11 dBn	1 / 150 1			92 87	dBm /u-			
		1 / 150 /			52.07				

Figure 8.5-60: Conducted band edge emission at 1995 MHz, 15 MHz two-carrier operation (RBW = 1% of EBW)

Keysight Spectrum Analyzer - Ch	annel Power		- e e 💌
00 T RF 50 Ω	DC	SENSE:INT ALIGN AUTO	11:22:06 AM Jan 22, 2020
Span 85.000 MHz		Trig: Free Run Avg Hold:>100	/100
PASS	#IFGain:Low	#Atten: 6 dB	Radio Device: BTS
			Mkr1 1.995 GHz
10 dB/div Ref 44.2	0 dBm		-46.314 dBm
Log			
34.2			
24.2			
14.2 martiner	many more man	manne	
4.20			
-5.80			
-15.8			
-25.8	- V		
-35.8	V	1	
458	Y	<b>♦</b> '	
Center 1.995 GHz			Span 85 MHz
#Res BW 51 kHz		#VBW 1 MHz	Sweep 38.87 ms
Channel Power		Power Spectral Density	
-40.54 dE	3m / 200 kHz	-93.55 dBm /нz	
MSG		STATUS	

Figure 8.5-62: Conducted band edge emission at 1995 MHz, 20 MHz two-carrier operation (RBW = 1% of EBW)

Center Free, 1.9850000 GHz Trig: Free Num Avg Hold:: #Atten: 6 dB	Radio Std: None Radio Device: 815 Mkr1 1.996 GH: -45.156 dBn
Trig: Free Run Avg Hold:	100/100 Radio Device: BTS Mkr1 1.996 GH; -45.156 dBn
	Mkr1 1.996 GH -45.156 dBn
<b>↓</b> 1	
40 (DW) 4 MU-	Span 65 MH
#VBW 1 MHZ	Sweep 29.73 m
Power Spectral Density	/
-92.98 dBm //	łz
STATUS	
	#VBW 1 MHz Power Spectral Density -92.98 dBm /H

Figure 8.5-61: Conducted band edge emission at 1996 MHz, 15 MHz two-carrier operation (RBW = 1 MHz)

Keysight Spectrum Analyzer - Channel Power	cic.			- 0 E
an 45.000 MHz		Center Freq: 1.996500	000 GHz	11:14:18 AM Jan 22, 2020 Radio Std: None
ASS	#IFGain:Low	Trig: Free Run #Atten: 6 dB	Avg Hold:>100/100	Radio Device: BTS
0 dB/div Ref 44.20 dBm				Mkr1 1.996 GH -46.020 dBn
og				
34.2				
24.2				
14.2 manufacture -	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	~~		
.20				
.80				
15.8		\		
5.8				
35.8		1		
45.8		Land Internet and		
Center 1.997 GHz				Span 45 MH
Res BW 51 kHz		#VBW 1 MH	Z	Sweep 20.6 m
Channel Power		Power Spect	ral Density	
-33.52 dBm /	1 MHz	-93.52	dBm /Hz	
			4	
JG			STATUS	

Figure 8.5-63: Conducted band edge emission at 1996 MHz, 20 MHz two-carrier operation (RBW = 1 MHz)



Figure 8.5-64: Conducted spurious emissions for dual band simultaneous transmission with 10 MHz low channel single-carrier (per band) operation

Keysight Spectrum Analyzer - Swept SA nput Mech Atten 8 dB #Avg Type: RMS Avg|Hold:>100/100 PNO: Fast Trig: Free Run IEGain: Low #Atten: 8 dB Mkr1 1.988 4 GHz 30.107 dBm Ref Offset 44.2 dB Ref 40.20 dBm 10 dBi 30 20. 19 DL1 -25.04 Stop 22.00 GHz Sweep 36.67 ms (22000 pts) Start 30 MHz #Res BW 1.0 MHz #VBW 8.0 MHz\* **K**STAT

*Figure 8.5-66:* Conducted spurious emissions for dual band simultaneous transmission with 10 MHz high channel single-carrier (per band) operation



*Figure 8.5-65:* Conducted spurious emissions for dual band simultaneous transmission with 10 MHz mid channel single-carrier (per band) operation



Figure 8.5-67: Conducted spurious emissions for dual band simultaneous transmission with 15 MHz low channel single-carrier (per band) operation

Testing data FCC 24.238(a) and RSS-133, 6.5.1 Spurious out-of-band emissions FCC Part 24 and RSS-133, Issue 6



Figure 8.5-68: Conducted spurious emissions for dual band simultaneous transmission with 15 MHz mid channel single-carrier (per band) operation

 Bit of the second set of

Figure 8.5-70: Conducted spurious emissions for dual band simultaneous transmission with 20 MHz low channel single-carrier (per band) operation



Figure 8.5-69: Conducted spurious emissions for dual band simultaneous transmission with 15 MHz high channel single-carrier (per band) operation



**Figure 8.5-71:** Conducted spurious emissions for dual band simultaneous transmission with 20 MHz mid channel single-carrier (per band) operation

Testing data FCC 24.238(a) and RSS-133, 6.5.1 Spurious out-of-band emissions FCC Part 24 and RSS-133, Issue 6



*Figure 8.5-72:* Conducted spurious emissions for dual band simultaneous transmission with 20 MHz high channel single-carrier (per band) operation



Figure 8.5-74: Conducted spurious emissions for dual band simultaneous transmission with 10 MHz middle channels dual-carrier (per band) operation



Figure 8.5-73: Conducted spurious emissions for dual band simultaneous transmission with 10 MHz bottom channels dual-carrier (per band) operation



Figure 8.5-75: Conducted spurious emissions for dual band simultaneous transmission with 10 MHz top channels dual-carrier (per band) operation

Testing data FCC 24.238(a) and RSS-133, 6.5.1 Spurious out-of-band emissions FCC Part 24 and RSS-133, Issue 6



Figure 8.5-76: Conducted spurious emissions for dual band simultaneous transmission with 15 MHz bottom channels dual-carrier (per band) operation



Figure 8.5-78: Conducted spurious emissions for dual band simultaneous transmission with 15 MHz top channels dual-carrier (per band) operation



Figure 8.5-77: Conducted spurious emissions for dual band simultaneous transmission with 15 MHz middle channels dual-carrier (per band) operation



Figure 8.5-79: Conducted spurious emissions for dual band simultaneous transmission with 20 MHz bottom channels dual-carrier (per band) operation



Testing data FCC 24.238(a) and RSS-133, 6.5.1 Spurious out-of-band emissions FCC Part 24 and RSS-133, Issue 6





Nèmko

*Figure 8.5-80:* Conducted spurious emissions for dual band simultaneous transmission with 20 MHz middle channels dual-carrier (per band) operation

*Figure 8.5-81:* Conducted spurious emissions for dual band simultaneous transmission with 20 MHz top channels dual-carrier (per band) operation



# 8.6 FCC Part 2.1049 and RSS-Gen, 6.7 Occupied bandwidth (Band 66)

#### 8.6.1 Definitions and limits

## FCC:

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.

#### RSS-Gen, 6.7

The occupied bandwidth or the "99% emission bandwidth" is defined as the frequency range between two points, one above and the other below the carrier frequency, within which 99% of the total transmitted power of the fundamental transmitted emission is contained. The occupied bandwidth shall be reported for all equipment in addition to the specified bandwidth required in the applicable RSSs.

#### 8.6.2 Test summary

Test date	January 21, 2020
Test engineer	Andrey Adelberg

#### 8.6.3 Observations, settings and special notes

Testing was performed per ANSI C63.26 Paragraphs 5.4.3 and 5.4.4 methods. Spectrum analyzer settings:

Detector mode	Peak
Resolution bandwidth	≥1% of span
Video bandwidth	RBW × 3
Trace mode	Max Hold

## 8.6.4 Test data

## Table 8.6-1: Occupied bandwidth results for Port 021

Remarks	Frequency, MHz	99% OBW, MHz	26 dB BW, MHz
QPSK, 10 MHz, Low channel	2115.0	9.58	8.926
16QAM, 10 MHz, Low channel	2115.0	9.56	8.962
64QAM, 10 MHz, Low channel	2115.0	9.58	8.966
256QAM, 10 MHz, Low channel	2115.0	9.55	8.946
16QAM, 10 MHz, Mid channel	2155.0	9.56	8.966
16QAM, 10 MHz, High channel	2195.0	9.52	8.942
QPSK, 15 MHz, Low channel	2117.5	14.29	13.417
16QAM, 15 MHz, Low channel	2117.5	14.21	13.424
64QAM, 15 MHz, Low channel	2117.5	14.33	13.413
256QAM, 15 MHz, Low channel	2117.5	14.17	13.405
16QAM, 15 MHz, Mid channel	2155.0	14.10	13.415
16QAM, 15 MHz, High channel	2192.5	14.11	13.409
QPSK, 20 MHz, Low channel	2120.0	19.00	17.839
16QAM, 20 MHz, Low channel	2120.0	19.02	17.883
64QAM, 20 MHz, Low channel	2120.0	19.07	17.862
256QAM, 20 MHz, Low channel	2120.0	19.09	17.895
16QAM, 20 MHz, Mid channel	2155.0	19.07	17.907
16QAM, 20 MHz, High channel	2190.0	18.83	17.816



## Table 8.6-2: Occupied bandwidth LTE + IoT results for Port 021

Remarks	Frequency, MHz	99% OBW, MHz	26 dB BW, MHz
10 MHz low channel with 2 × GB IoT	2115.0	9.71	9.383
10 MHz mid channel with 2 × GB IoT	2155.0	9.71	9.378
10 MHz high channel with 2 × GB IoT	2195.0	9.68	9.378
15 MHz low channel with 2 × GB IoT	2117.5	14.41	13.960
15 MHz mid channel with 2 × GB IoT	2155.0	14.42	13.966
15 MHz high channel with 2 × GB IoT	2192.5	14.41	13.967
20 MHz low channel with 2 × GB IoT	2120.0	19.18	18.440
20 MHz mid channel with 2 × GB IoT	2155.0	19.23	18.439
20 MHz high channel with 2 × GB IoT	2190.0	19.16	18.448

Keysight Spectrum Analyzer - Occupied BV	V	CENCE INT A	ION AUTO	02/27/17 DM 120 21 20
pter Freq 2 11500000	GHz	Center Freg: 2.11500000	0 GHz	Radio Std: None
	-+	Trig: Free Run	Avg Hold: 100/100	
	#IFGain:Low	#Atten: 12 dB		Radio Device: BTS
dB/div Ref 45.00 dBr	n .			
0	frank	a de la	and manager	
D	4			
0	/			
,				
	Jan V			and a stand and the second second second
)				
nter 2.115 GHz				Span 20 M
es BW 100 kHz		VBW 1 MHz		Sweep 1.867
Occupied Bandwidt	h	Total Power	45.3 dBm	
8.	9255 MHz			
Fransmit Freq Error	-244 Hz	% of OBW Power	99.00 %	
dB Bandwidth	9.582 MHz	x dB	-26.00 dB	
			STATUS	

Figure 8.6-1: Occupied bandwid	h for 10 MHz channel, sample plot

Keysight Spectrum Analyzer - Occupied T RF 50 Ω DC	BW		SENSE:INT	ALIGN AUTO		02:53:2	5 PM Jan 21, 20
enter Freq 2.1900000	U GHZ #F	Gain:Low	#Atten: 12 dB	Avg Hold:	100/100	Radio Devic	e: BTS
dB/div Ref 45.00 dE	im i i						
.0					++	-	
.0	ray	Vrana	man	marcher	sm		
10							
00					- Pik		
00	- /				r		
.0					+++		
i.0							
0 Mayna manash	w2%				why	hang	maria
i.0							
enter 2.19 GHz Res BW 200 kHz			VBW 2 MH	z		S	oan 40 Mi weep 1 n
Occupied Bandwig	ith		Total Power	46.5 c	lBm		
1	7.816	٨Hz					
Transmit Freq Error	32.38	3 kHz	% of OBW Pov	wer 99.0	0 %		
x dB Bandwidth	18.83	3 MHz	x dB	-26.00	) dB		

Figure 8.6-3: Occupied bandwidth for 20 MHz channel, sample plot

Keysight Spectrum Analyzer - Occupied BW		SENSE:INT	ALIGN AUTO	02:41:06 PM Jan 21, 20
enter Freq 2.117500000	GHz	Center Freq: 2.1175000	00 GHz	Radio Std: None
	#IFGain:Low	#Atten: 12 dB	Avginoid: 100/100	Radio Device: BTS
0 dB/div Ref 45.00 dBm				
<b>og</b>				
5.0		and another the second s	-	
5.0				
00	/		<u>\</u>	
00				
5.0	1		1	
5.0				
5.0 marty mark mark to the second second	ww.		V	www.www.
5.0				
enter 2.118 GHz				Span 30 M
Res BW 100 kHz		VBW 1 MHz		Sweep 2.8
Occupied Bandwidth	1	Total Power	45.5 dBm	
13	.417 MHz			
Transmit Freq Error	-7.287 kHz	% of OBW Powe	er 99.00 %	
x dB Bandwidth	14.29 MHz	x dB	-26.00 dB	

Figure 8.6-2: Occupied bandwidth for 15 MHz channel, sample plot

Keysight Spectrum Analyzer - O T RF 50 G	ccupied BW	SENSE:INT	ALIGN AUTO	03:09:36 PM Jan 21, 20
enter Freq 2.1150	00000 GHz	Center Freq: 2 Trig: Free Run	115000000 GHz AvaiHold: 100/	Radio Std: None
	#IFGai	n:Low #Atten: 12 dB	Avginoid, rook	Radio Device: BTS
0 dB/div Ref 45.0	00 dBm			
<b>og</b>				
50	have		- man and and	
50	1			
00	ł			
00	1			
50				
5.0	1			
a and and a second and a second	manyaya			Vale work walker
5.0				
5.0				
enter 2.115 GHz		VEW	Malu-	Span 20 M
Kes BW TOO KHZ		VBW	IVINZ	aweep 1.807
Occupied Band	dwidth	Total Pow	er 45.1 dBm	1
	9.3834 M	Hz		
Transmit Freq Er	ror -1.279	kHz % of OBW	Power 99.00 %	à
x dB Bandwidth	9.714	MHz xdB	-26.00 dE	3

Figure 8.6-4: Occupied bandwidth for 10 MHz channel LTE + IoT, sample plot

Testing data FCC Part 2.1049 and RSS-Gen, 6.7 Occupied bandwidth FCC Part 2, RSS-Gen, Issue 5



Key	sight Spectrum Analyzer - Occupied	BW								- 6 ×
XI	T RF 50 Ω DC			SENSE:INT	AL	IGN AUTO			03:07:1	5 PM Jan 21, 2020
Cen	ter Freq 2.11/50000	UU GHZ		. Trig: Free	q. 2.117000000 Run	Avg Hold: 1	100/1	00	Radio Stu. P	one
		荆FG	in:Low	#Atten: 12	dB				Radio Devic	e: BTS
							_			
10 45	Ref 45 00 dB	Bm								I
Log	Null Rel 45.00 ul	5					-			
35.0										
25.0		Anno	1	and the second s	alana and	ເກັບເວລາທາກົລເລັດກາ	-			
15.0		1.0			4.001					
5.00		1 1						l		
5.00		1						1		
-5.00								1		
-15.0								1		
-25.0								1		
-35.0	مريد المراجع ومراجع المراجع المريد	an and a failed at						~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	whentyphysia	water and the second second
45.0										
Cen	ter 2.118 GHz						· · · ·		Sp	an 30 MHz
#Res	s BW 100 kHz			VBV	V 1 MHz				Swe	ep 2.8 ms
0	counied Bandwig	dth		Total P	ower	45.5 di	Bm			
	ccupica Danama									
	1	3.960 N	IHZ							
Т	ansmit Freq Error	3.675	kHz	% of O	<b>3W Power</b>	99.00	) %			
	dD Dan duuidth	44.44	MLL	u dB		26.00	d D			
	ub Bandwiddi	14.41	WITZ	X UB		-20.00	uв			
MSG						STATUS				
_						-				

Keysight spec	RF 50.0 DC	J DVV	_		SENSE: INT	ΔI	IGN AUTO			02:57:33	PM lan 21, 20
enter Fr	eq 2.1200000	00 GHz	_	<u> </u>	Center Fre	q: 2.12000000	GHz			Radio Std: N	lone
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occup	leu Balluwi		~				1010 41				
	1	18.44	0	MHZ							
Fransm	nit Freg Error	3	3.8	68 kHz	% of O	BW Power	99.00	) %			
	an duui dab		0		n dB		26.00	-			
	inawiath	1	9.1		XUD		-20.00	uв			

Figure 8.6-5: Occupied bandwidth for 15 MHz channel LTE + IoT, sample plot Figure 8.6-6: Occupied bandwidth for 20 MHz channel LTE + IoT, sample plot



# 8.7 FCC Part 2.1049 and RSS-Gen, 6.7 Occupied bandwidth (Band 2/25a)

#### 8.7.1 Definitions and limits

## FCC:

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.

#### RSS-Gen, 6.7

The occupied bandwidth or the "99% emission bandwidth" is defined as the frequency range between two points, one above and the other below the carrier frequency, within which 99% of the total transmitted power of the fundamental transmitted emission is contained. The occupied bandwidth shall be reported for all equipment in addition to the specified bandwidth required in the applicable RSSs.

#### 8.7.2 Test summary

Test date	January 21, 2020
Test engineer	Andrey Adelberg

#### 8.7.3 Observations, settings and special notes

Testing was performed per ANSI C63.26 Paragraphs 5.4.3 and 5.4.4 methods. Spectrum analyzer settings:

Detector mode	Peak
Resolution bandwidth	≥1 % of span
Video bandwidth	RBW × 3
Trace mode	Max Hold

#### 8.7.4 Test data

## Table 8.7-1: Occupied bandwidth results for Port 021

Remarks	Frequency, MHz	99% OBW, MHz	26 dB BW, MHz
10 MHz, QPSK, low channel	1935.0	9.65	8.969
10 MHz, 16QAM, low channel	1935.0	9.61	8.970
10 MHz, 64QAM, low channel	1935.0	9.59	8.957
10 MHz, 256QAM, low channel	1935.0	9.49	8.962
10 MHz, QPSK, mid channel	1962.5	9.53	8.939
10 MHz, QPSK, high channel	1990.0	9.61	8.946
15 MHz, QPSK, low channel	1937.5	14.29	13.421
15 MHz, 16QAM, low channel	1937.5	14.30	13.413
15 MHz, 64QAM, low channel	1937.5	14.12	13.403
15 MHz, 256QAM, low channel	1937.5	14.18	13.404
15 MHz, 16QAM, mid channel	1962.5	14.19	13.415
15 MHz, 16QAM, high channel	1987.5	14.16	13.397
20 MHz, QPSK, low channel	1940.0	18.88	17.870
20 MHz, 16QAM, low channel	1940.0	18.88	17.968
20 MHz, 64QAM, low channel	1940.0	19.01	17.894
20 MHz, 256QAM, low channel	1940.0	18.96	17.827
20 MHz, 16QAM, mid channel	1962.5	19.06	17.958
20 MHz, 16QAM, high channel	1985.0	18.96	17.973



## Table 8.7-2: Occupied bandwidth results for single carrier operation with IoT Port 021

Remarks	Frequency, MHz	99% OBW, MHz	26 dB BW, MHz
10 MHz low channel with 2 × GB IoT	1935.0	9.72	9.379
10 MHz mid channel with 2 × GB IoT	1962.5	9.68	9.381
10 MHz high channel with 2 × GB IoT	1990.0	9.70	9.374
15 MHz low channel with 2 × GB loT	1937.5	14.42	13.951
15 MHz mid channel with 2 × GB IoT	1962.5	14.41	13.968
15 MHz high channel with 2 × GB IoT	1987.5	14.42	13.966
20 MHz low channel with 2 × GB IoT	1940.0	19.17	18.459
20 MHz mid channel with 2 × GB IoT	1962.5	19.15	18.416
20 MHz high channel with 2 × GB IoT	1985 0	19.28	18 475

vg/Hold Number 100 vg/Hold Number 100 #FGaleLow Center Preg. 1.8300000 Arg/Hold>100/100 Radio Device: BTS Arg/Hold>100/100 Radio Device: BTS Arg/Hold Arg/Hold>100/100 Radio Device: BTS Arg/Hold Arg/Ho	Keysight Spectrum Analyze	er - Occupied BW				- 6
Oddadiv         Ref 45.00 dBm         Trig::Free Run         AvglHold>100/100         Radio Device: BTS           00         00         0<		50 Ω DC		SENSE:INT A Center Freg: 1.93500000	LIGN AUTO	02:29:18 PM Jan 21, 2020 Radio Std: None
o dB/div Ref 45.00 dBm od de de de de de de de de de d		. 100	#IFGain:Low	Trig: Free Run #Atten: 12 dB	Avg Hold:>100/10	0 Radio Device: BTS
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so so so so so so so so so so	36.0					
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enter 1.935 GHz Res BW 100 kHz VBW 1 MHz Sweep 1.867 n Occupied Bandwidth Total Power 48.1 dBm 8.9687 MHz Transmit Freq Error 882 Hz % of OBW Power 99.00 % x dB Bandwidth 9.653 MHz x dB -26.00 dB	50 mmmmmmmmmmmmmmmmmmmmmmmmmmmmmmmmmmmm	annen and				man and the second and the second sec
Res BW 100 kHz Span 20 MH Res BW 100 kHz VBW 1 MHz Span 20 MH Occupied Bandwidth Total Power 48.1 dBm 8.9687 MHz Transmit Freq Error 882 Hz % of OBW Power 99.00 % x dB Bandwidth 9.653 MHz x dB -26.00 dB	5.0					
enter 1.935 GHz Span 20 MH Res BW 100 kHz VBW 1 MHz Span 20 MH Occupied Bandwidth Total Power 48.1 dBm 8.9687 MHz Transmit Freq Error 882 Hz % of OBW Power 99.00 % x dB Bandwidth 9.653 MHz x dB -26.00 dB	5.5					
Occupied Bandwidth Total Power 48.1 dBm 8.9687 MHz Transmit Freq Error 882 Hz % of OBW Power 99.00 % x dB Bandwidth 9.653 MHz x dB -26.00 dB	enter 1.935 GHz Res BW 100 kHz	2		VBW 1 MHz		Span 20 MH Sweep 1.867 m
8.9687 MHz Transmit Freq Error 882 Hz % of OBW Power 99.00 % x dB Bandwidth 9.653 MHz x dB -26.00 dB	Occupied Br	ndwidth		Total Power	48.1 dBm	
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Transmit Freq Error 882 Hz % of OBW Power 99.00 % x dB Bendwidth 9.653 MHz x dB -26.00 dB		8.96	87 WHZ			
x dB Bandwidth 9.653 MHz x dB -26.00 dB	Transmit Freq	Error	882 Hz	% of OBW Powe	r 99.00 %	
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Figure 8.7-3: Occupied bandwidth for 20 MHz channel, sample plot

Keysight Spectrum Analyzer - Occupied BW	AUCK.	crace and		
Center Freq 1.937500000	GHz	Center Freq: 1.93750	ALIGN AUTO	Radio Std: None
	#FGain:Low	#Atten: 12 dB	Avginoid: 100/100	Radio Device: BTS
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enter 1.938 GHz Res BW 100 kHz		VBW 1 MH	z	Span 30 M Sweep 2.8 r
Occupied Bandwidth	ı	Total Power	46.6 dBm	
13	.421 MHz			
Transmit Freq Error	-1.698 kHz	% of OBW Pov	wer 99.00 %	
x dB Bandwidth	14.29 MHz	x dB	-26.00 dB	
a			<b>STATUS</b>	

Figure 8.7-2: Occupied bandwidth for 15 MHz channel, sample plot

T RF 50 Ω DC	v		SENSE:INT	AL	IGN AUTO			03:11:2	🕞 🕼
enter Freq 1.93500000	GHz		Center Fre	q: 1.935000000 Run	GHz AvaiHold: 1	00/10	0	Radio Std: N	lone
	#IFG	ain:Low	#Atten: 12	dB			-	Radio Devic	e: BTS
dB/div Ref 45.00 dBn	n .								
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enter 1.935 GHz Res BW 100 kHz			VBN	V 1 MHz				Sp Sweep	oan 20 N 0 1.867
Occupied Bandwidt	h		Total P	ower	46.2 dE	Зm			
9.	3793 N	1Hz							
Transmit Freq Error	2.37	5 kHz	% of O	<b>3W Power</b>	99.00	%			
x dB Bandwidth	9.719	MHz	x dB		-26.00	dB			

Figure 8.7-4: Occupied bandwidth for 10 MHz channel LTE + IoT, sample plot

Testing data FCC Part 2.1049 and RSS-Gen, 6.7 Occupied bandwidth FCC Part 2, RSS-Gen, Issue 5



Keysight Spectrum Analyzer - Occupied BW				
X/ T RF 50Ω DC		SENSE:INT AL	IGN AUTO	03:05:47 PM Jan 21, 2020
RBW 100.00 KHZ		. Trig: Free Run	Avg Hold: 100/100	Radio Std. None
	#IFGain:Low	#Atten: 12 dB	-	Radio Device: BTS
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Center 1 938 GHz				Spap 30 MHz
#Res BW 100 kHz		VBW 1 MHz		Sweep 2.8 ms
Occupied Bandwidth		Total Power	46.6 dBm	
Occupied Ballowidth		rotarr ower	40.0 0.011	
13.9	51 MHz			
Transmit Freq Error	5.669 kHz	% of OBW Power	99.00 %	
v dB Bandwidth	14 42 MHz	x dB	-26 00 dB	
X db balldwiddi	14.42 MINZ	XUB	-20.00 uB	
MSG			STATUS	

T RF 50 Ω	DC		SENSE:INT	AL	IGN AUTO			02:59:3	7 PM Jan 21, 2
nter Freq 1.94000	0000 GHz		Center Fre	q: 1.94000000	GHz	00/100		Radio Std: N	lone
		#FGain:Low	#Atten: 12	dB	Avginoid: 1	00/100		Radio Devic	e: BTS
Bidiv Ref 45.0	0 dBm								
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Occupied Band	width		Total P	ower	46.8 dE	Bm			
beeupreu Darra	10 / 50								
	10.400								
ransmit Freq Err	or 24	.747 kHz	% of O	BW Power	99.00	%			
dB Bandwidth	19	.17 MHz	x dB		-26.00	dB			
					STATUS				
					<b>~</b>				

Figure 8.7-5: Occupied bandwidth for 15 MHz channel LTE + IoT, sample plot Figure 8.7-6: Occupied bandwidth for 20 MHz channel LTE + IoT, sample plot



# 8.8 FCC 27.54 and RSS-139, Section 6.4 Frequency stability (Band 66)

#### 8.8.1 Definitions and limits

## FCC:

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

#### RSS-139, Section 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.

8.8.2	Test summ	ary					
Test date		January 23, 2020					

## 8.8.3 Observations, settings and special notes

Testing was performed per ANSI C63.26 Paragraphs 5.6.3, 5.6.4 and 5.6.5 methods. 26 dBc points including frequency tolerance were assessed to remain within assigned band.

#### 8.8.4 Test data

Table 8.8-1: Frequency error results

Temperature, °C	Voltage, V <sub>DC</sub>	Frequency error, Hz
-40	48.0	0.241
-30	48.0	0.432
-20	48.0	0.424
-10	48.0	0.471
0	48.0	0.490
+10	48.0	0.084
+20	40.8	-0.074
+20	48.0	-0.395
+20	55.2	-0.477
+30	48.0	-0.184
+40	48.0	-0.307
+50	48.0	-0.415

Max negative drift: -0.477 Hz, Max positive drift: +0.490 Hz.



# 8.9 FCC 24.235 and RSS-133, 6.3 Frequency stability (Band 2/25a)

#### 8.9.1 Definitions and limits

## FCC:

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

#### RSS-133, Section 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.

In lieu of meeting the above stability values, the test report may show that the frequency stability is sufficient to ensure that the emission bandwidth stays within the operating frequency block when tested to the temperature and supply voltage variations specified in RSS-Gen.

8.9.2	Test summ	ary	
Test date		January 23, 2020	

## 8.9.3 Observations, settings and special notes

Testing was performed per ANSI C63.26 Paragraphs 5.6.3, 5.6.4 and 5.6.5 methods. 26 dBc points including frequency tolerance were assessed to remain within assigned band. The maximum allowed drift (±1.0 ppm) is ±1935 Hz

## 8.9.4 Test data

#### Table 8.9-1: Frequency error results

Tomporature °C	Voltage V	Fragmanny arrow 11-
Temperature, C	voltage, voc	Frequency error, Hz
-40	48.0	0.253
-30	48.0	0.249
-20	48.0	0.164
-10	48.0	0.363
0	48.0	0.431
+10	48.0	0.291
+20	40.8	-0.103
+20	48.0	-0.456
+20	55.2	-0.591
+30	48.0	-0.390
+40	48.0	-0.098
+50	48.0	0.037

Max negative drift: -0.591 Hz, Max positive drift: +0.431 Hz.



## 8.10 RSS-133, 6.6 Receiver Spurious Emissions

## 8.10.1 Definitions and limits

#### RSS-133, Section 6.6:

Receiver spurious emissions shall comply with the limits specified in RSS-Gen.

#### RSS-Gen, Section 7.4:

If the receiver has a detachable antenna of known impedance, an antenna-conducted spurious emissions measurement is permitted as an alternative to radiated measurement. However, the radiated method of section 7.3 is preferred.

The antenna-conducted test shall be performed with the antenna disconnected and with the receiver antenna port connected to a measuring instrument having equal input impedance to that specified for the antenna. The RF cable connecting the receiver under test to the measuring instrument shall also have the same impedance to that specified for the receiver's antenna.

The spurious emissions from the receiver at any discrete frequency, measured at the antenna port by the antenna-conducted method, shall not exceed 2 nW in the frequency range 30–1000 MHz and 5 nW above 1 GHz.

#### 8.10.2 Test summary

Test date	January 22, 2020
Test engineer	Andrey Adelberg

#### 8.10.3 Observations, settings and special notes

The spectrum was searched from 30 MHz to the 10th harmonic. All measurements were performed using an average (RMS) detector.

#### 8.10.4 Test data

T	RF	50 Ω	DC			SENS	E:INT	1		_	ALIGN AUTO				11:5	9:21 AM Jan 22, 20
arker 1	19.222	6660	30274 (	SHz PNO: IEGain	 Fast ⊂,		Trig: #Atte	Free n: 6	e Rui dB	n	#Avg T Avg Ho	ype: RMS ld:>100/100				TRACE 1 2 3 4 TYPE A WWW DET A N N N
dB/div	Ref Offs Ref -2.	et 2 di 00 dE	B Bm										N	lkr	1 19 -7	.222 7 GI 5.133 dB
9 										F	L1 1.0000 OHz					•
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.0								_				~~~w		~	****	
				~					T	T						
art 30 I	MHz					<u> </u>									St	op 22.00 GI

Figure 8.10-1: Receiver spurious emissions at Port 021



# Section 9. Block diagrams of test setups

# 9.1 Radiated emissions set-up for frequencies below 1 GHz



# 9.2 Radiated emissions set-up for frequencies above 1 GHz





# 9.3 Conducted emissions set-up

