4. FCC Section 2.1049 – Occupied Bandwidth/Edge of Band Emissions

4.1 Occupied Bandwidth

In 47CFR 2.1049 the FCC requires:

"The occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission shall be measured under the following conditions as applicable."

This required measurement is the 99% Occupied Bandwidth, also called the designated signal bandwidth and needs to be within the parameters of the products specified emissions designator. During these measurements it is customary to evaluate the Edge of Band emissions at block/band edges.

The transmitted signal occupied bandwidth was measured using a Keysight MXA Signal Analyzer. All emissions were within the parameters as required.

# of Carrier	Signal BW	Modulation	ТХ	Channel Frequency	99% Occupied BW MHz
	MHz		Port	MHz	
1	20	64QAM	3	3710	18.396
1	20	QPSK/16QAM	3	3800	18.866
1	20	256QAM	3	3970	18.470
1	30	64QAM	5	3715	27.685
1	30	QPSK/16QAM	5	3800	28.010
1	30	256QAM	4	3965	27.824
1	40	64QAM	5	3720	37.253
1	40	QPSK/16QAM	5	3800	37.610
1	40	64QAM	5	3960	37.944
1	50	64QAM	5	3725	47.184
1	50	QPSK/16QAM	5	3800	47.290
1	50	256QAM	5	3955	47.392
1	60	64QAM	5	3730	57.801
1	60	64QAM	5	3800	58.074
1	60	256QAM	5	3950	57.592
1	70	64QAM	5	3735	67.185
1	70	QPSK/16QAM	5	3800	67.573
1	70	256QAM	5	3945	67.035
1	80	64QAM	5	3740	77.109
1	80	QPSK/16QAM	5	3800	77.725
1	80	256QAM	5	3940	77.170
1	90	64QAM	5	3745	86.965
1	90	QPSK/16QAM	5	3800	87.493
1	90	256QAM	5	3935	86.800
1	100	64QAM	5	3750	96.780
1	100	QPSK/16QAM	5	3800	97.001
1	100	256QAM	5	3930	97.258
2	20+20	QPSK/16QAM	5	3710+3730	38.556
2	20+20	QPSK/16QAM	5	3710+3890	18.368+18.227
2	20+20	QPSK/16QAM	5	3790+3810	38.139
2	20+20	256QAM	5	3790+3970	18.166+18.110

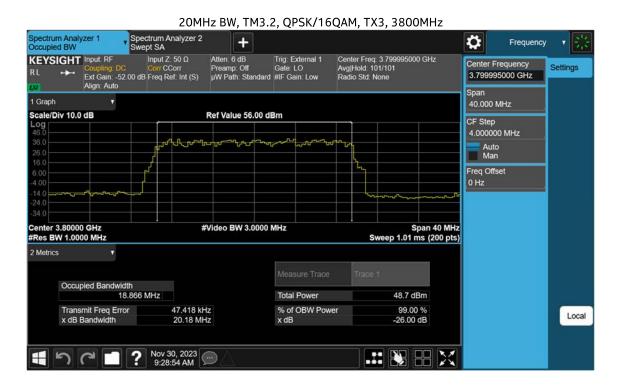
Global Product Compliance Laboratory

Report No.: TR-2023-0137-FCC2-27 Product: AKQW AirScale RRH 8T8R n77 320W

2	20+20	256QAM	1	3950+3970	37.836
2	100+100	QPSK/16QAM	5	3750+3850	196.24
2	100+100	256QAM	5	3830+3930	195.87

4.2 99% Occupied Bandwidth Plots

NOTE: Only the plot with the maximum bandwidth measured is used in this report. The full suite of raw data resides at the MH, New Jersey location.



30MHz BW, TM3.2, QPSK/16QAM, TX5, 3800MHz

Spectrum A Occupied B	w l	+				‡	Frequency 🔻 🔆
	HT Input: RF Coupling: DC Ext Gain: -52.00 Align: Auto	Input Z: 50 Ω Corr CCorr dB Freq Ref. Int (S)	Atten: 6 dB Preamp: Off μW Path: Standa	Trig: External 1 Gate: LO rd #IF Gain: Low	Center Freq: 3.799995000 GHz Avg[Hold: 100/100 Radio Std: None	Center Frequ 3.79999500 Span	
1 Graph	÷					60.000 MHz	
Scale/Div 1	10.0 dB		Ref Value 56.00	dBm		CF Step	
46.0 36.0 26.0 16.0		ر میلی میلی ک	᠕ᠬᡃᢆᡙᢪᠧᠬᠲᡘᢣ᠆ᠬ	vorte lloror		6.000000 M Auto Man	Hz
6.00 -4.00	ᢞᡊᡊ᠆ᠳ᠆ᢛᡔᠬᠼᠿᠮᠥ					Freq Offset 0 Hz	
-34.0 Center 3.80 #Res BW 1			≮Video BW 3.000) MHz	Span 6 Sweep 1.02 ms (30		
2 Metrics							
o	ccupied Bandwidth			Measure Trace	Trace 1		
		0 MHz		Total Power	49.8 dBm		
	ansmit Freq Error dB Bandwidth	19.900 k 30.05 M		% of OBW Pow x dB	er 99.00 % -26.00 dB		Local
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40MHz BW, TM3.1, 64QAM, TX5, 3960MHz

50MHz BW, TM3.1a, 256QAM, TX5, 3955MHz



Spectrum Ana Occupied BW		Spectrum A SEM	nalyzer 2	+						-	₽	Frequency	· · ·] 蒜
	Input: RF Coupling: DC Ext Gain: -52.0 Align: Auto	Input Z Corr C(0 dB Freq R	Corr	Atten: 6 dB Preamp: Off µW Path: Sta	Gat	: External 1 e: LO Gain: Low	Avg I	er Freq Hold: 11 o Std: N		GHz	Contraction of the local	Frequency 00000 GHz	Settings
1 Graph	•										Span 120.00	MHz	
Scale/Div 10. Log 36.0 26.0 16.0	.0 dB	hor		Ref Value 46		NAMANA ANA	Դեսկո				Au	000 MHz	
6.00 -4.00 -14.0 pro-tect. -24.0 -34.0	MARIONTHIM	won						-	han Mr. Jaw	rennent	Ma Freq Of 0 Hz	25.	
-44.0 Center 3.8000 #Res BW 1.00			#\	/ideo BW 3.	0000 MHz			. s	Spa weep 1.24 m	an 120 MHz s (600 pts)			
2 Metrics	•												
Occi	upied Bandwidth 58.0) 174 MHz				asure Trace		Trace	1 51.0 dB	m			
	smit Freq Error Bandwidth	5	55.511 kH 60.29 MH		% x c	of OBW Pov IB	ver		99.00 -26.00 c				
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60MHz BW, TM3.1, 64QAM, TX5, 3800MHz

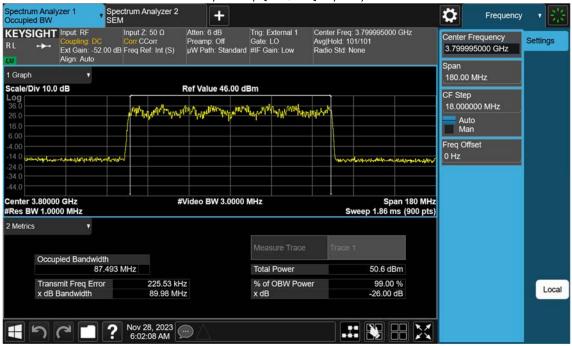
70MHz BW, TM3.2, QPSK/16QAM, TX5, 3800MHz



Spectrum	n Analyzer 1 d BW	Spectrum Analyzer : SEM	2 +		-			₽	Frequency	· • 🚟
RL	GHT Input: RF Coupling: DC Ext Gain: -52 Align: Auto	Input Z: 50 Ω Corr CCorr .00 dB Freq Ref: Int (S)	Atten: 6 dB Preamp: Off µW Path: Standa	Trig: External 1 Gate: LO ard #IF Gain: Low	Avg	er Freq: 3.799995 Hold: 101/101 o Std: None	5000 GHz	Center Fi 3.79999	requency 5000 GHz	Settings
1 Graph	Tigh Add							Span 160.00 M	ИНz	
	iv 10.0 dB		Ref Value 46.00	dBm						
Log 36.0 26.0 16.0		Myanet	work was and	aportest company many many	rdfogd ⁴ i			CF Step 16.0000 Auto Man		,
6.00 -4.00 -14.0	an and an and a strategy and	ad day				harden		Freq Offs 0 Hz	et	
-24.0	ar a d'Ardreffen (a rear ardel d'Il a s					hanalardyse	^^- <u>_</u>	Perchastored		
Center 3	3.80000 GHz N 1.0000 MHz		#Video BW 3.000	0 MHz			Span 160 MHz 5 ms (800 pts)			
2 Metrics	•									
				Measure Trace						
	Occupied Bandwid 77	th 7.725 MHz		Total Power		50.7	7 dBm			
	Transmit Freq Erro x dB Bandwidth	r 94.924 80.36 M		% of OBW Pow x dB	ver		.00 % 00 dB			Local
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80MHz BW, TM3.2, QPSK/16QAM, TX5, 3800MHz

90MHz BW, TM3.2, QPSK/16QAM, TX5, 3800MHz



Spectrui Occupie	m Analyzer 1 ed BW	Spectr	rum Analyzer 2	+				\$	Frequenc	y v 👫
RL	IGHT Input: RF Coupling Ext Gain Align: Au	DC C	nput Ζ: 50 Ω torr CCorr req Ref: Int (S)	Atten: 6 dB Preamp: Off µW Path: Stand	Trig: External 1 Gate: LO Jard #IF Gain: Low	Center Fr Avg Hold Radio Sto		Center Fr 3.93000	requency 0000 GHz	Settings
1 Graph								Span 200.00 M	ΛHz	
Log 36.0 26.0 16.0	0iv 10.0 dB			Ref Value 46.0	0 dBm \whithwoodydayhahaaa.	hevique		CF Step 20.0000 Auto Man		
6.00 -4.00 -14.0 -24.0 -34.0 -44.0	han-t-hachtahreatha	himmenter				-	Mary Second Antipersonal Second James	Freq Offs 0 Hz	et	
Center	3.9300 GHz W 1.0000 MHz		#	Video BW 3.00	000 MHz	 !	Span 200 I Sweep 2.06 ms (1000			
2 Metrics	s v									
	Occupied Band	lwidth 97.258 Mi	Hz		Measure Trace Total Power	e Trac	50.6 dBm			
	Transmit Freq x dB Bandwidt		-295.78 kH 100.3 MH		% of OBW Pov x dB	wer	99.00 % -26.00 dB			
	5 0		Nov 27, 2023					Z		

100MHz BW, TM3.1a, 256QAM, TX5, 3930MHz

20+20MHz BW, TM3.2, QPSK/16QAM, TX5, 3710+3730MHz



Spectrum Anal SEM	yzer 1	Spectrum Occupied	Analyzer 2 BW	• +	-					\$	Frequency	· · [#
RL ++-	Input: RF Coupling: DC Ext Gain: -52 Align: Auto	Corr	Z: 50 Ω CCorr Ref: Int (S)	Atten: 6 dB Preamp: Off µW Path: Star	Gate		Avg	er Freq: 3.79998 Iold: 100/100 Std: None	60000 GHz	performance and and	requency 00000 GHz	Settings
1 Graph	Aligh: Adio									Span 399.92 I	MHz	
Scale/Div 10.0	0 dB			Ref Value 46.	00 dBm					CF Step	00 MHz	
26.0 16.0 6.00		, Mi	the survey of	at a share the state of the sta	free must feel	they to get by h	p. Atrain			Auto	b	
-4.00									مەر بىلىرىمەر ئەر بىلىر	Freq Offs 0 Hz	set	
-24.0 -34.0 -44.0												
Center 3.8000 #Res BW 1.00			#	Video BW 3.0	0000 MHz				Span 399.9 MHz 3 ms (1999 pts)			
2 Metrics					1							
Occu	pied Bandwid					asure Trace	:	Trace 1	4 dDm			
Trop	19 smit Freq Erro	6.24 MHz	-320.08 kH			al Power f OBW Pow	or		4 dBm 9.00 %			
	Bandwidth	n	-320.08 KH 199.9 MH		% 0 x dE		er		9.00 % 6.00 dB			Local
1	C [05, 2023 48:22 PM	\Box								

100+100MHz BW, TM3.2, QPSK/16QAM, TX5, 3750+3850MHz

4.3 Edge of band Emissions

The Edge of Band emissions of the EUT at the external antenna connector (EAC) were measured using a Keysight MXA Signal Analyzer. Before measuring the Edge of Band emissions, the RF power level was confirmed with the Keysight MXA Signal Analyzer. The RF output from the EAC port to signal analyzer was reduced (to an amplitude usable by the signal analyzer) by using a calibrated attenuator and RF Switch. The path attenuation was offset on the display and the signal for the carrier was adjusted to the corrected RF power level for the resolution bandwidth used for the transmit signal. All mask values were adjusted based upon the designated signal bandwidth and measurement bandwidths. In accordance with KDB 662911 D01 Multiple Transmitter Output, the limit of -13 dBm has been adjusted to -22 dBm to reflect 10 log(n) where n=8 for the 8x8 MIMO operation.

4.3.1 Edge of Band Emissions – Plots

All of the measurements met the requirements of Part 27.53 when measured per Part 2.1049.

NOTE: The full suite of raw data resides at the MH, New Jersey location.



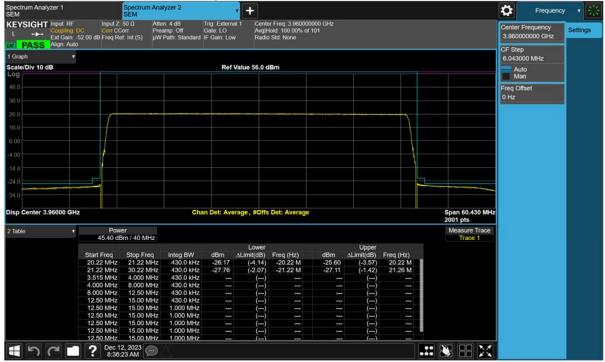
Edge of Band Emissions 20MHz BW

Product: AKQW AirScale RRH 8T8R n77 320W

Edge of Band Emissions 30MHz BW



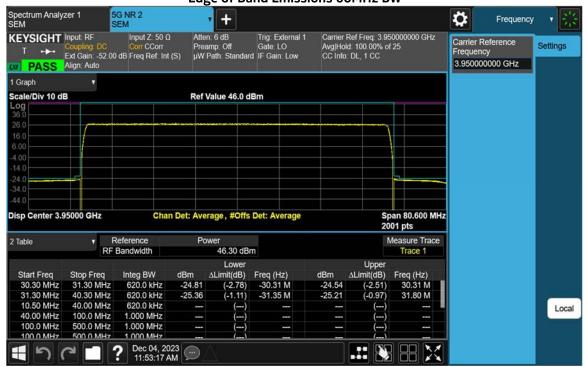
Edge of Band Emissions 40MHz BW



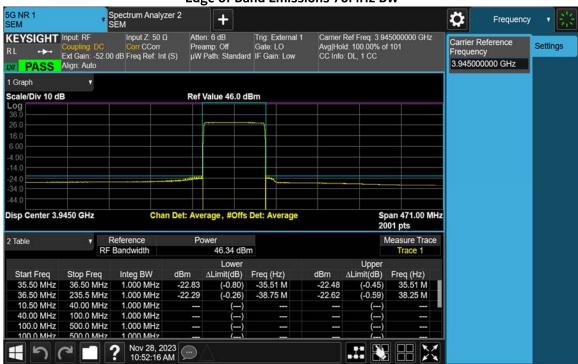
Edge of Band Emissions 50MHz BW



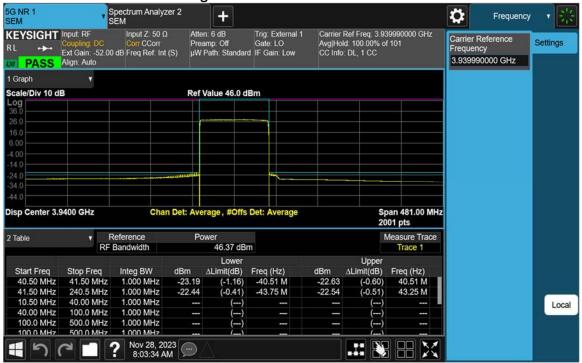
Edge of Band Emissions 60MHz BW



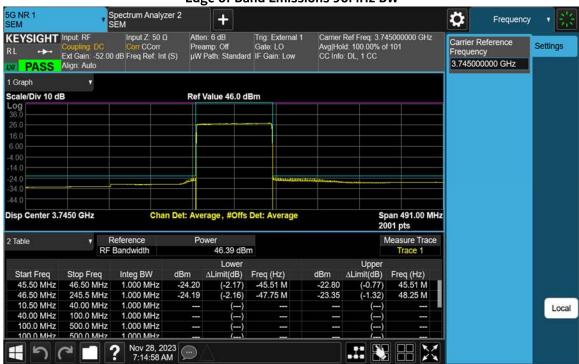
Edge of Band Emissions 70MHz BW



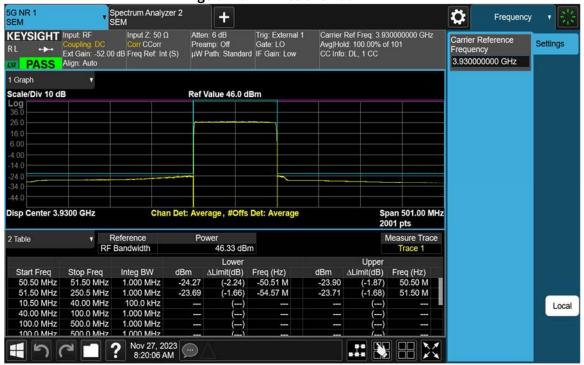
Edge of Band Emissions 80MHz BW



Edge of Band Emissions 90MHz BW



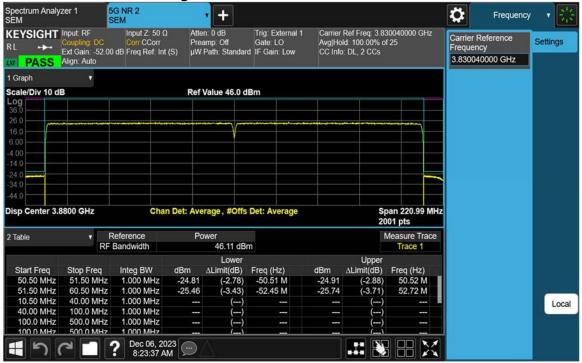
Edge of Band Emissions 100MHz BW





Edge of Band Emissions 20+20MHz BW

Edge of Band Emissions 100+100MHz BW



5. FCC Section 2.1051 - Spurious Emissions at Transmit Antenna Port

5.1 Measurement of Spurious Emissions at Transmit Antenna Port

Spurious Emissions at the transmit-antenna terminals were investigated over the frequency range of 10 MHz to beyond the 10th harmonic of the specific transmit band. Carrier Bandwidth is exempt. For this band of operation, the measurements were performed up to 40 GHz. Measurements were made using a Keysight MXA Signal Analyzer. The RF output from the transmitter was reduced (to an amplitude usable by the receivers) using calibrated attenuators. The RF power level was continuously monitored via a Keysight MXA Signal Analyzer.

The required emission limitation is specified as appropriate in 27.53. The measured spurious emission levels were plotted for the frequency range as specified in 2.1057. For 8 ports where 10log (8) = 9dBm, the limit is 22dBm/MHz. Data below documents performance up to 40 GHz.

5.1.1 Spurious Emissions at Tx Port – Plots

NOTES: Only Emissions plots with margin less than 20dBm for each frequency range are included in this report. The full suite of raw data resides at the MH, New Jersey location. The conducted spurious emissions in the frequency range of 150k -30GHz, 30MHz – 1GHz, and 10-20GHz have more than 20dB margins.



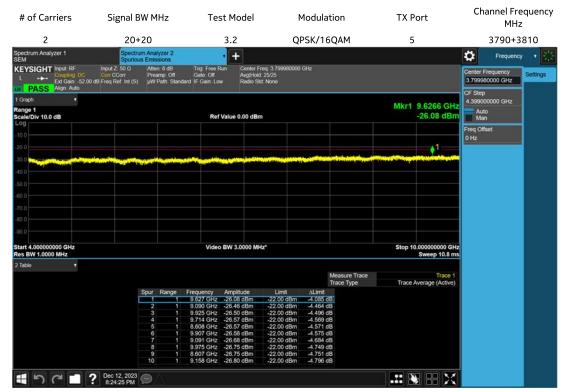
9kHz – 150kHz

# of Carriers	Signa	al BW MHz	Test Mod	el Mo	dulation	TX Port	Channel Fre MHz	• •
2	10	00+100	3.1a	2	56QAM	5	3830+3	930
Spectrum Analyzer 1 SEM		um Analyzer 2 us Emissions	• +				Frequency	• <mark> </mark>
	ing: DC Cr ain: -52.00 dB Fr	orr CCorr Pre		Trig: External 1 Gate: LO IF Gain: Low	Center Freq. 3 Avg Hold: 101/ Radio Std: Nor		Center Frequency 3.880020000 GHz CF Step	Settings
1 Graph Range 1 Scale/Div 10.0 dB	V	Ba	Value 0.00 dB	lana	M	(r1 3.7653 GHz -25.66 dBm	4.399000000 GHz	
10.0 -20							Man Freq Offset 0 Hz	
Start 1.000000000 GI Res BW 1.0000 MHz	Hz	Vide	o BW 3.0000 M	lHz*	s	top 3.770000000 GHz Sweep 100 ms		
2 Table				Measure Trace Trace Type		Trace 1 ace Average (Active)		
	Spur Ran	ge Frequency	Amplitude	Limit	∆Limit			
	1		-25.66 dBm	-22.00 dBm	-3.662 dB			
	2		-25.89 dBm	-22.00 dBm	-3.894 dB			
	3		-26.25 dBm	-22.00 dBm	-4.246 dB			Local
	4	1 3.710 GHz		-22.00 dBm	-5.030 dB			
	5	1 3.766 GHz	-27.04 dBm	-22.00 dBm	-5.036 dB			
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1GHz – 3.77GHz

3.75GHz – 4GHz

# of Carriers	Signal BW MHz	Test Model	Modulation	TX Port	Channel Frequency MHz
2	20+20	3.2	QPSK/16QAM	5	3710+3730
Spectrum Analyzer 1 SEM	Spectrum Analyzer 2 Spurious Emissions	• +			🔅 Frequency 🔹 🔆
KEYSIGHT Input: RF L ++ Coupling: DC Ext Gain: -52.00 PASS Align: Auto	Input Z 50 Ω Atten: 6 dB Corr CCorr Preamp Off dB Freq Ref. Int (S) μW Path. Stan	Trig External 1 Center Freq. Gate: LO Avg Hold: 25 dard IF Gain: Low Radio Std: N			Center Frequency 3.72000000 GHz
Graph v tange 1 cale/Div 10.0 dB		Ref Value 0.00 dBm		Mkr1 3.7525 GHz -22.02 dBm	
-og 10.0					Freq Offset 0 Hz
20.0 Munterstran			and a second and a second s		
0.0					
10.0 tart 3.751500000 GHz		Video BW 3.0000 MHz*		Stop 4.000000000 GHz	
Table				Sweep 2.53 ms	
table •			Measure Trace Trace Type	Trace 1 Trace Average (Active)	
	Spur Range	Frequency Amplitude 3.753 GHz -22.02 dBm	Limit ALimit 22.00 dBm -0.016 dB		
	2 1	3.753 GHz -22.18 dBm	22.00 dBm -0.180 dB		
	3 1		22.00 dBm -0.444 dB 22.00 dBm -1.484 dB		
	4 1 5 1		22.00 dBm -1.484 dB 22.00 dBm -2.611 dB		
	6 1	3.757 GHz -25.33 dBm	22.00 dBm -3.326 dB		
		3.761 GHz -25.76 dBm	22.00 dBm -3.760 dB		
	8 1		22.00 dBm -3.872 dB		Loc
	9 1 10 1		22.00 dBm -3.940 dB 22.00 dBm -4.264 dB		
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4GHz – 10GHz

20GHz – 37GHz

# of Carriers	Signal BW Mł	Hz Test Moo	del Mo	dulation	TX Port	Channel Frequency MHz
2	20+20	3.2	QPS	K/16QAM	5	3950+3970
pectrum Analyzer 1 purious Emissions	• +					Frequency 🔹 🛃
EYSIGHT Input: RF L ++ Ext Gain: - PASS Align: Auto	40.00 dB Freq Ref: Int	Preamp: Off	Trig: External 1 Gate: LO IF Gain: Low	Center Freq: 3.960 Avg Hold: 25/25 Radio Std: None	000000 GHz	Center Frequency 3.96000000 GHz
Graph v ange 1 cale/Div 10.0 dB		Ref Value 0.00 dE	₿m	Mkr1	36.747 GHz -41.74 dBm	CF Step 4.399000000 GHz Auto Man
0.0						Freq Offset 0 Hz
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0						
0.0 0.0 art 20.000000000 GHz		Video BW 3.0000 M	//Hz*	Stop 3	7.000000000 GHz	
s BW 1.0000 MHz					Sweep 171 ms	
			Measure Trace Trace Type	Trace	Trace 1 Average (Active)	
S	Spur Range Fre	equency Amplitude	Limit	∆Limit		
	1 1 3	6.75 GHz -41.74 dBm	-22.00 dBm	-19.74 dB		
		6.73 GHz -41.86 dBm	-22.00 dBm	-19.86 dB		
		6.75 GHz -41.87 dBm	-22.00 dBm	-19.87 dB		
		6.71 GHz -41.90 dBm	-22.00 dBm	-19.90 dB		
	5 1 3	6.72 GHz -41.93 dBm	-22.00 dBm	-19.93 dB		
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Photographs



Test Equipment

Asset ID	Manufacturer	Туре	Description	Model	Serial	Calibration Date	Calibration Due
E1338	KeySight Technologies	MXA Signal Analyzer	20 Hz-44 GHz (Analysis Bandwidth 125 MHz)	N9020B	MY57430927	2023-05-06	2025-05-06
E896	Agilent Technologies	Network Analyzer	10 MHz - 40 GHz	N5230C	MY49000897	2023-02-08	2025-02-08
1609	Traceable	Data Logger	Barometric Humidity Temp Data Logger	6453,98767-15	221743404	2022-08-25	2024-08-25
E1155	Weinschel	Attenuator	10dB 25Watt 0.05GHz - 26GHz	74-10-12	1068	CNR-V	CNR-V
E1587	Reactel, Inc.	Filter, High Pass	6 - 24 GHz	11HS-6G/24G-K11	20-02	CNR-V	CNR-V
			Customer Pro	ovide Equipment			
	Agilent	Attenuator	Attenuator Interconnect Kit, Type-N	11716A	MY42140029	CNR-V	CNR-V
	Weinschel	Attenuator	20dB/50W DC-8.5GHz	24-20-34	CG3785	CNR-V	CNR-V
	Weinschel	Attenuator	20dB/50W DC-8.5GHz	24-20-34	CG3744	CNR-V	CNR-V
	Weinschel	Attenuator	20dB 50W DC – 8.5GHz	24-20-34	CG3752	CNR-V	CNR-V
	Weinschel	Attenuator	20dB 50W DC – 8.5GHz	24-20-34	CG3766	CNR-V	CNR-V
	Weinschel	Attenuator	20dB 50W DC – 8.5GHz	24-20-12	CE5787	CNR-V	CNR-V
	Weinschel	Attenuator	20dB/50W DC-8.5GHz	24-20-34-LIM	CG3892	CNR-V	CNR-V
	Weinschel	Attenuator	20dB/50W DC-8.5GHz	24-20-34	CD9980	CNR-V	CNR-V
	Weinschel	Attenuator	20dB/50W DC-8.5GHz	24-20-34	CD9981	CNR-V	CNR-V
	Creo wave Filters, OY	Filter	Filter, Notch	CW-BSF-3300- 3700-E9-M2	2142001	CNR-V	CNR-V

Radio Test Equipment

CNR-V: Calibration Not Required; Must be Verified. Test Dates: 11/20/2023 - 12/13/2023.

6. FCC Section 2.1053 - Field strength of spurious radiation

6.1 Section 2.1053 Field Strength of Spurious Emissions

Field strength measurements of radiated spurious emissions were made in an FCC registered 3m Semi-Anechoic Chamber which is maintained by Nokia Bell Labs in Murray Hill, New Jersey. A complete description and full measurement data for the site is on file with the Commission (Site Registration Number: 515091).

The spectrum from 30 MHz to beyond the tenth harmonic of the carrier, 40 GHz, was searched for spurious radiation. Measurements were made using both horizontally and vertically polarized broadband antennas. Per FCC regulations, the comparison of out of band spurious emissions directly to the limit is appropriately made using the substitution method. However, when the emissions are more than 20 dB below the specification limit, the use of field strength measurements for compliance determination is acceptable and those emissions are considered not reportable (Section 2.1053 and the FCC Interpretive database for 2.1053). For this case the evaluation of acceptable radiated field strength is as follows.

6.2 Field Strength of Spurious Emissions - Limits

Sections 2.1053 and 27.53 contain the requirements for the levels of spurious radiation as a function of the level of the unmodulated carrier. The reference level for the unmodulated carrier is calculated as the field produced by an ideal dipole excited by the transmitter output power according to the following relation taken from Reference Data for Radio Engineers, page 676, 4th edition, IT&T Corp.

E= [(30*P)^{1/2}]/R

20 log (E*10⁶) – (43 + 10 log P) = 82.23 dBµV/meter

Where:

E = Field Intensity in Volts/meter P = Transmitted Power in Watts R = Measurement distance in meters = 3 m

The Part 27 Limit is 82.23 dBµV/m at 3m and 91.77 dBuV/m at 1m The Part 27 non-report level is 62.23 dBµV/m at 3m.

The calculated emission levels were found by:

Measured level (dB μ V) + Cable Loss(dB)+Antenna Factor(dB) = Field Strength (dB μ V/m)

RESULTS:

For compliance with 47CFR Parts 2 and 27, the field strength of any spurious radiation, measured at 3m, is required to be less than 82.23 dB μ V/meter (82.23 @ 3m). Emissions equal to or less than 62.23 dB μ V/meter at 3m are not reportable and may be verified using field strength measurements and broadband antennas. Over the out of band spectrum investigated from 30 MHz to beyond the tenth harmonic of the carrier (up to 40 GHz), no reportable spurious emissions were detected.

7. FCC Section 2.1055 - Measurement of Frequency Stability

Frequency Stability testing was completed on the AKWQ Unit with Center Frequency 3800MHz. Testing was performed from 12/12/2023 through 12/14/2023 on the radio, which was located in the T-14 Thermal chamber of the Global Product Compliance Laboratory (GPCL) test facility located in Building 4, Room 4-280, Murray Hill, NJ, by Joe Bordonaro from GPCL.

The temperatures to which the UUT were subjected ranged from a high temperature of +50°C system ambient to a low temperature of -30°C system ambient with measurements recorded at 10°C increments.

Transmit frequency error measures the deviation between the actual transmit frequency and the assigned frequency. The transmit frequency error in this case was measured by capturing the transmitted signal using a receiving antenna and then cabling it to an MXA signal analyzer. The system level frequency stability testing resulted in compliance with established design criteria.

Frequency Block Tested: <u>ASMR24 Extension (CF = 3799.99.000MHz)</u>

(a) Set the power supply to nominal Voltage. (b) Record the frequency at ~20°C. (c)Raise EUT operating temperature to 50°C. (d) Record the frequency difference. (e) Repeat step (d) at each 10°C step down to -30°C. Result will be 10 readings and take temperature readings to establish thermal stability at each point.

Baseline Measurement at +20°C

Transmit Frequency Deviation at	Transmit Frequency Deviation at +20°C at 100% of Nominal Voltage, -48VDC					
Time	Transmit Carrier Deviation					
(minutes)	(Hz)					
0	2.1833					
0.5	-3.0845					
1.0	3.1875					
1.5	-2.6596					
2.0	1.1059					
2.5	2.6944					
3.0	-1.5839					
SPECIFICATION	3799.99 MHz (±0.05ppm)					
	± 0.05 ppm = \pm 190 Hz					
RESULT	Pass					

Transmit Frequency Deviation a	Transmit Frequency Deviation at +50°C at 100% of Nominal Voltage, -48VDC	
Time	Transmit Carrier Deviation	
(minutes)	(Hz)	
0	2.0479	
0.5	4.9914	
1.0	2.1498	
1.5	-2.8900	
2.0	-1.2090	
2.5	1.0574	
3.0	-1.6410	
SPECIFICATION	3799.99 MHz (±0.05ppm)	
	± 0.05 ppm = \pm 190 Hz	
RESULT	Pass	

Transmit Frequency Deviation at +40°C at 100% of Nominal Voltage, -48VDC	
Time	Transmit Carrier Deviation
(minutes)	(Hz)
0	3.6015
0.5	2.1332
1.0	1.1655

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1.5	-1.5503
2.0	1.7476
2.5	1.1400
3.0	-1.4516
SPECIFICATION	3799.99 MHz (±0.05ppm)
	\pm 0.05ppm = \pm 190 Hz
RESULT	Pass

Transmit Frequency Deviation at +30°C at 100% of Nominal Voltage, -48VDC	
Time	Transmit Carrier Deviation
(minutes)	(Hz)
0	2.1709
0.5	3.5479
1.0	-242.8mHz
1.5	1.1038
2.0	3.3238
2.5	-1.0167
3.0	-1.3021
SPECIFICATION	3799.99 MHz (±0.05ppm)
	± 0.05 ppm = \pm 190 Hz
RESULT	Pass

Transmit Frequency Deviation at +20°C at 100% of Nominal Voltage, -48VDC	
Time	Transmit Carrier Deviation
(minutes)	(Hz)
0	-1.1001
0.5	-1.7681
1.0	808.59mHz
1.5	-1.4904
2.0	1.5214
2.5	-3.1066
3.0	-1.0686
SPECIFICATION	3799.99 MHz (±0.05ppm)
	\pm 0.05ppm = \pm 190 Hz
RESULT	Pass

Transmit Frequency Deviation at +10°C at 100% of Nominal Voltage, -48VDC	
Time	Transmit Carrier Deviation
(minutes)	(Hz)
0	-1.9018
0.5	3.2417
1.0	443.33mHz
1.5	3.7569

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Product: AKQW AirScale RRH 8T8R n77 320W

2.0	-1.4741
2.5	-1.7198
3.0	1.3160
SPECIFICATION	3799.99 MHz (±0.05ppm)
	\pm 0.05ppm = \pm 190 Hz
RESULT	Pass

Transmit Frequency Deviation a	Transmit Frequency Deviation at 0°C at 100% of Nominal Voltage, -48VDC	
Time	Transmit Carrier Deviation	
(minutes)	(Hz)	
0	-1.1125	
0.5	-2.8016	
1.0	-2.2448	
1.5	2.1046	
2.0	-4.0492	
2.5	1.1984	
3.0	-1.0414	
SPECIFICATION	3799.99 MHz (±0.05ppm)	
	\pm 0.05ppm = \pm 190 Hz	
RESULT	Pass	

Transmit Frequency Deviation a	Transmit Frequency Deviation at -10°C at 100% of Nominal Voltage, -48VDC	
Time	Transmit Carrier Deviation	
(minutes)	(Hz)	
0	1.4390	
0.5	649.36mHz	
1.0	-2.6777	
1.5	-2.3393	
2.0	-1.2571	
2.5	1.9572	
3.0	2.0344	
SPECIFICATION	3799.99 MHz (±0.05ppm)	
	±0.05ppm = ± 190 Hz	
RESULT	Pass	

Transmit Frequency Deviation at -20°C at 100% of Nominal Voltage, -48VDC	
Time	Transmit Carrier Deviation
(minutes)	(Hz)
0	-1.9001
0.5	1.4221
1.0	1.0747
1.5	-1.9459
2.0	2.6956

Product: AKQW AirScale RRH 8T8R n77 320W

2.5	-1.3131
3.0	-2.0688
SPECIFICATION	3799.99 MHz (±0.05ppm)
	\pm 0.05ppm = \pm 190 Hz
RESULT	Pass

Transmit Frequency Deviation at -30°C at 100% of Nominal Voltage, -48VDC	
Time	Transmit Carrier Deviation
(minutes)	(Hz)
0	-611.9mHz
0.5	-1.72129
1.0	1.1391
1.5	-2.3423
2.0	1.2862
2.5	2.5667
3.0	1.7607
SPECIFICATION	3799.99 MHz (±0.05ppm)
	± 0.05 ppm = \pm 190 Hz
RESULT	Pass

Upon return to +20°C.

At ambient, vary voltage to +15% and -15% of nominal VAC and record frequency difference. Result will be 12 readings for each voltage (nominal, ~+ 3%, ~+6%, ~+%9, ~+12%, +15%, and nominal, ~- 3%, ~-6%, ~-9%, ~-12%, -15%).

Transmit Frequency Deviation at +20°C at 100% of Nominal Voltage, -48VDC	
Time	Transmit Carrier Deviation
(minutes)	(Hz)
0	1.4116
0.5	1.1316
1.0	-1.7302
1.5	1.6012
2.0	-1.2681
2.5	-363.81mHz
3.0	1.4483
SPECIFICATION	3799.99 MHz (±0.05ppm)
	± 0.05 ppm = \pm 190 Hz
RESULT	Pass

Transmit Frequency Deviation at +20°C at 103% of Nominal Voltage, -49.44VDC	
Time	Transmit Carrier Deviation
(minutes)	(Hz)
0	3.1426
0.5	-943.6mHz
1.0	2.8582
1.5	1.5007
2.0	2.0405
2.5	-1.1687
3.0	2.2507
SPECIFICATION	3799.99 MHz (±0.05ppm)
	± 0.05 ppm = \pm 190 Hz
RESULT	Pass

Transmit Frequency Deviation at +20°C at 106% of Nominal Voltage, -50.88VDC	
Time	Transmit Carrier Deviation
(minutes)	(Hz)
0	-2.0211
0.5	-3.7839
1.0	2.9661
1.5	1.5126
2.0	-1.5646
2.5	1.0669
3.0	1.7145

SPECIFICATION	3799.99 MHz (±0.05ppm)
	\pm 0.05ppm = \pm 190 Hz
RESULT	Pass

Transmit Frequency Deviation at +20°C at 109% of Nominal Voltage, -52.32VDC	
Time	Transmit Carrier Deviation
(minutes)	(Hz)
0	2.0251
0.5	5.3126
1.0	3.3090
1.5	1.1157
2.0	-1.1538
2.5	- 2.6668
3.0	1.2311
SPECIFICATION	3799.99 MHz (±0.05ppm)
	\pm 0.05ppm = \pm 190 Hz
RESULT	Pass

Transmit Frequency Deviation at +20°C at 112% of Nominal Voltage, -53.76VDC	
Time	Transmit Carrier Deviation
(minutes)	(Hz)
0	731.59mHz
0.5	3.8276
1.0	1.1562
1.5	2.2895
2.0	-1.1890
2.5	1.3056
3.0	3.3744
SPECIFICATION	3799.99 MHz (±0.05ppm)
	\pm 0.05ppm = \pm 190 Hz
RESULT	Pass

Transmit Frequency Deviation at +20°C at 115% of Nominal Voltage, -55.20VDC	
Time	Transmit Carrier Deviation
(minutes)	(Hz)
0	-1.2595
0.5	1.8879
1.0	-1.1303
1.5	-1.7556
2.0	-1.4126
2.5	885.84mHz
3.0	-1.1911
SPECIFICATION	3799.99 MHz (±0.05ppm)
	\pm 0.05ppm = \pm 190 Hz
RESULT	Pass

Transmit Frequency Deviation at +20°C at 100% of Nominal Voltage, -48.0VDC	
Time	Transmit Carrier Deviation
(minutes)	(Hz)
0	2.1553
0.5	-1.4921
1.0	-1.0091
1.5	3.4964
2.0	-2.8366
2.5	2.8100
3.0	1.9694
SPECIFICATION	3799.99 MHz (±0.05ppm)
	\pm 0.05ppm = \pm 190 Hz
RESULT	Pass

Transmit Frequency Deviation at +20°C at -3% of Nominal Voltage, -46.56VDC	
Time	Transmit Carrier Deviation
(minutes)	(Hz)
0	-1.7021
0.5	1.8993
1.0	1.5187
1.5	-3.3971
2.0	2.0944
2.5	1.4746
3.0	-2.1544
SPECIFICATION	3799.99 MHz (±0.05ppm)
	\pm 0.05ppm = \pm 190 Hz
RESULT	Pass

Transmit Frequency Deviation a	Transmit Frequency Deviation at +20°C at -6% of Nominal Voltage, -45.12VDC	
Time	Transmit Carrier Deviation	
(minutes)	(Hz)	
0	-2.2075	
0.5	-1.5428	
1.0	2.2920	
1.5	-1.8419	
2.0	2.0196	
2.5	1.4896	
3.0	2.9533	
SPECIFICATION	3799.99 MHz (±0.05ppm)	
	\pm 0.05ppm = \pm 190 Hz	
RESULT	Pass	

Transmit Frequency Deviation at +20°C at -9% of Nominal Voltage, -43.68VDC	
Time	Transmit Carrier Deviation
(minutes)	(Hz)
0	1.0152
0.5	2.2640
1.0	-5.4792
1.5	1.6829
2.0	-1.3945
2.5	2.2285
3.0	-1.8034
SPECIFICATION	3799.99 MHz (±0.05ppm)
	± 0.05 ppm = \pm 190 Hz
RESULT	Pass

Transmit Frequency Deviation at +20°C at -12% of Nominal Voltage, -42.24VDC	
Time	Transmit Carrier Deviation
(minutes)	(Hz)
0	1.7085
0.5	-1.9778
1.0	-495.7mHz
1.5	-2.1123
2.0	1.9505
2.5	-3.6023
3.0	1.0717
SPECIFICATION	3799.99 MHz (±0.05ppm)
	\pm 0.05ppm = \pm 190 Hz
RESULT	Pass

Transmit Frequency Deviation at +20°C at -15% of Nominal Voltage, -40.80VDC					
Time	Transmit Carrier Deviation				
(minutes)	(Hz)				
0	1.8644				
0.5	2.3558				
1.0	-1.0783				
1.5	-1.4791				
2.0	3.7788				
2.5	2.5722				
3.0	-1.4219				
SPECIFICATION	3799.99 MHz (±0.05ppm)				
	±0.05ppm = ± 190 Hz				
RESULT	Pass				

Photographs

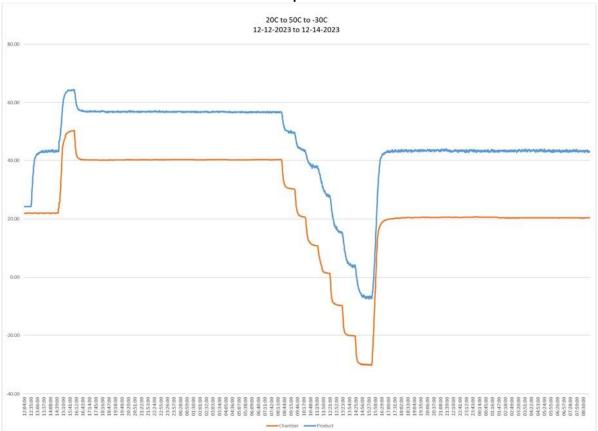


AKQW in Thermal Chamber





Frequency Stability Test Setup



Chamber Temperature Profile

Frequency Stability Test Equipment	Frequency	Stability 1	lest Equi	pment
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Asset ID	Manufacturer	Туре	Description	Model	Serial	Calibration Date	Calibration Due
TH536-T14	Envirotronics	Controller	Controller	SPPCM	SP001513	2023-03-23	2025-03-23
TH-T14	Thermotron	Thermal Chamber	Thermal Chamber	N/A	28431	N/R	N/R
TH090	Yokogawa	Data Logger	10 Channel Paperless Recorder	GP10	S5V108472	2023-07-25	2025-07-25
TH073	Fluke	DMM	Digital Multimeter	87V	25910080	2022-02-24	2024-02-24
MY59050106	KeySight Technologies	EMI Receiver	MXA EMI Receiver	N9020B	MY59050106	2022-10-22	2024-10-22
<u>TH069</u>	Extech	Data Logger	Barometric Pressure/Humidity/Temperature	SD700	Q690305	2023-07-24	2025-07-24

Test Dates: 12/12/2023 – 12/14/2023

8. NVLAP Certificate of Accreditation

