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FCC Testing of the Octasic Portable MIMO System in accordance with FCC CFR 47 Part 2, FCC CFR 47 Part 22H

COMMERCIAL-IN-CONFIDENCE

FCC: 2AQSOCBRSYS4450

PREPARED BY

Jose Martinez

APPROVED BY 590A Drysdale DATED Nov. 10, 21

Scott Drysdale

10-Nov-21

Page 1 of 44

Report Issued: 11/10/2021

Report File #: TR-7169009211P-CBRSYS4450- GSM_Band 850-FCC-Issue -003



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SECTION 1: REPORT INFORMATION

Document TR-7169009211P-CBRSYS4450-GSM_Band 850-FCC-Issue-04



1.1 REPORT DETAILS

Manufacturer	Octasic inc.
Manufacturer Description	CBRSYS4450
Address	2901 Rachel St. East, Suite 30. Montreal, QC, H1W 4A4
Product Name	Portable MIMO System
Product Number	CBRSYS4450
Serial Number(s)	F-01150
Hardware Version(s)	Version 1
Software Version(s)	BSP CBRBTS-BSP-02.07.03.02-B454
Test Specification/Issue/Date	FCC CFR 47 Part 2: August 16, 2021 FCC CFR 47 Part 22: September 1, 2021
Max Antenna Gain	5dBi
Start of Test	June 22, 2021
Finish of Test	November 11, 2021
Name of Test Personnel(s)	Jose Martinez
Related Document(s)	KDB 971168 D01 v02r02: April 2018 KDB 662911 D01 v02r01: October 2013
Test report revision history	 2021-09-20. Issue 000. Initial release. 2021-09-29. Issue 01. Added RSS-132 test standard 2021-10-19. Issue 02. Modifications: Removed RSS-132 Section 2.1. Power table arranged properly Section 2.3.5. Update RBW method section 2021-11-11. Issue 03. Modifications Section 2.3 – Added integrated band-edge graphs



1.2 BRIEF SUMMARY OF RESULTS

A summary of results for each configuration, in accordance with FCC CFR 47 Part 2, and $\frac{FCC}{CFR 47 Part 22H}$ as shown in Table 1.

-	Table 1 – Test Summary					
Section	FCC CFR 47 Part 2	FCC CFR 47 Part 22	Test Description	Result		
2.1	§2.1046	<u>§22.913(a)(1)(i)</u>	Maximum Peak Output Power	Pass		
2.1	§2.1049	<u>§ 22.917</u>	Occupied Bandwidth	Pass		
2.2	§2.1051	<u>§22.917 (a)</u>	Band Edge	Pass		
2.3	§2.1051	<u>§22.357</u>	Transceiver Spurious Emissions	Pass		
2.4	§2.1055	<u>§22.355</u>	Frequency Stability	Pass		
2.3	-	<u>§22.983</u>	Filed Strength Limit	Pass		

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Table	1 -	rest	Sum	imarv



1.3 **PRODUCT INFORMATION**

1.3.1 Technical Description

The EUT, hereafter referred as the Equipment Under Test (EUT) is a MIMO Station unit CBRSYS4450 of Octasic Inc.

1.3.1.1 The Transmission in the GSM on Band 850

The EUT transmitt in Block A: 869 – 880MHz and Block B: 891.5- 894MHz of the cellular services according to $\frac{\$ 22.905}{\$}$.

The channel configuration is as follows:

Channels	Frequency (MHz)	Target Power (dBm)	Power Measured (dBm)		
Bottom/Top	869.2	30	29.85 <note 1=""></note>		
Bottom/Top	893.8	30	29.81 <note 2=""></note>		
Note 1. See Table 3 in Section 2.1.6.1 Note 2. See Table 4 in Section 2.1.6.2					

A full technical description can be found in the Manufacturer's documentation guide and datasheet CBRSYS4450-User_Guide.pdf and CBRSYS4450-Datasheet.pdf, respectively.



1.3.2 Configuration Description

The EUT supports single mode operation having four transmitting ports (see Figure 3)

TX test cases: Maximum Conducted Output Power, Spurious Emissions at Antenna Terminals (\pm 1MHz) and Conducted Spurious Emissions, measurements were performed on the four RF Port. The test limits shown are representative of the worst case. All testing was performed with the EUT transmitting at maximum RF power unless as designated setting by client, otherwise stated.

The EUT was powered via a 120V/60Hz power AC/DC Adapter.

Channel Configurations:

GSM	No. Of		Carrier		er Frequend Juration (MI	-	
Band	No. Of Carriers	Modulation	Bandwidth	Bottom/B _R _{FBW} (MHz)	Middle/ M _{RFBW} (MHz)	Top/ T _{RFBW} (MHz)	
850	1	QPSK	250kHz	869.2	881.6	893.8	

Table 2 – Channel Configuration



1.4 DECLARATION OF BUILD STATUS

MAIN EUT				
MANUFACTURING DESCRIPTION	CBRSYS4450			
MANUFACTURER	Octasic inc.			
TYPE	Portable Transportable Amplification Unit (TAU)			
PART NUMBER(S)	CBRSYS4450			
SERIAL NUMBER(S)	F-01150			
HARDWARE VERSION(S)	Version 1			
SOFTWARE VERSIONS(S)	CBRBTS-BSP-02.07			
TRANSMITTER OPERATING RANGE (Band 5)	869.2MHz and 893.8MHz			
RECEIVER OPERATING RANGE(MHz)	663 to 2690			
EMISSION DESIGNATOR(S): (i.e. G1D, GXW)	194M			
Country of Origin	Bangalore, India			
MODULATION TYPES: (i.e. GMSK, QPSK)	QPSK			
HIGHEST INTERNALLY GENERATED FREQUENCY	2.7GHz			
OUTPUT POWER (W or dBm)	30dBm			
FCC ID:	2AQSOCBRSYS4450,			
TECHNICAL DESCRIPTION (a brief description of the intended use and operation)	The CBRSYS4450 is a base station solution build for the particular needs of application like search and Rescue (SRR), Network in Box (NiB) and Disaster Recovery. It integrates four transreceiver cellular base station (BTS) with all necessary RF, GPS and Wi-Fi antennas. The control is through an easy-to-use Android app on a smartphone or table for convenient on-the-go operation			



Equipment Under Test (EUT)



Figure 3. Top view of CBRSYS4450



1.5 GENERAL TEST SETUP

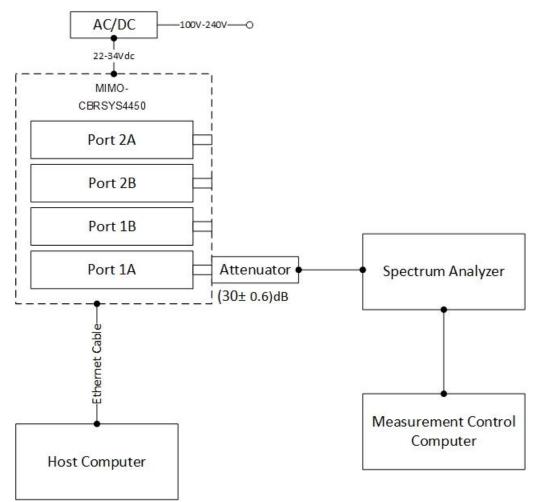


Figure 2. Block Diagram of Conducted Measurement Setup.



1.6 TEST CONDITIONS

For all tests the EUT was set up in accordance with the relevant test standard and to represent typical operating conditions. Tests were applied with the EUT situated as described in the Test Method for each Test.

The EUT was powered using the AC/DC adapter.

1.7 DEVIATION FROM THE STANDARD

No deviations from the applicable test standards or test plan were made during testing.

1.8 MODIFICATION RECORD

No modifications were made to the EUT during testing.

1.9 TEST FACILITY

FCC Measurement Facility Registration Number: CA4810

Under our group A2LA Accreditation, TÜV SÜD conducted the following tests at Kanata, Test Laboratory.

Test Name	Name of Test Specialist(s)
Maximum Peak Output Power and Peak to Average Ratio - Conducted	Jose Martinez
Occupied Bandwidth	Jose Martinez
Band Edge	Jose Martinez
Transmitter Spurious Emissions	Jose Martinez
Frequency Stability	Jose Martinez
Field Strength of Spurious Emissions - Radiated	Jose Martinez



SECTION 2: TEST DETAILS



2.1 MAXIMUM PEAK OUTPUT POWER AND PEAK TO AVERAGE RATIO - CONDUCTED

2.1.1 Specification Reference

FCC CFR 47 Part 2, Clause 2.1046 FCC CFR 47 Part 22H, <u>§22.913(a)(1)(i)</u>

2.1.2 Date of Test and Modification State

16 August 2021 - Modification State 0 17 August 2021 - Modification State 0

2.1.3 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.1.4 Environmental Conditions

Ambient Temperature	25.1°C
Relative Humidity	20.4%

2.1.5 Test Method

All measurements were made in accordance with FCC KDB 971168 D01, clause 5.2.1 and and summed in accordance with FCC KDB 662911 D01. The attenuation value used throughout this report is $30dB \pm 0.6dB$.

Measurements were performed with a Spectrum Analyser using the Band Power measurement function. The detector was set to RMS with an RBW of at least 1 % of the carrier bandwidth and a VBW of at least 3 times the RBW. The integration bandwidth was configured to be wider than the total bandwidth of the carrier or combinations of carriers, (multi-carrier). Using a sweep time of auto, measurements were performed over 200 samples, with the average measurement recorded.

Due to Average measurements being recorded, an additional Peak to Average power ratio (PAPR) measurement was made. This was achieved using the CCDF function of the Spectrum Analyser with the RBW being set to a value wider than the largest signal being measured – in this case – 20MHz.

The EUT was configured to transmit on maximum power on the configurations defined in the tables below.

The peak to average ratio measurement was performed at the conducted ports of the EUT. The spectrum analyzer's Complementary Cumulative Distribution Function (CCDF) was used, and 0.1% probability value recorded.

The RMS Power and Peak to Average Ratio were measured and recorded with the results being compared with the limits.

Measurements presented are the worst-case of measurements conducted in the four ports: TX1A, TX1B, Tx2A and Tx2B, respectively.



2.1.6 Test Results

2.1.6.1 Bottom/Top Channel - 869.2 MHz

Maximum Target Output Power: 30 dBm

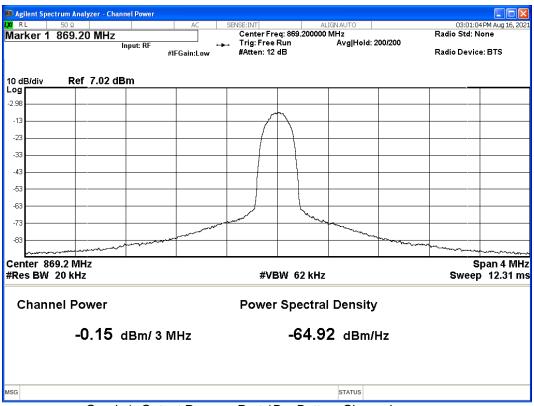
			Output Po	wer/PAPR		
Antenna	PAPR	Conducte Po	ed Average ower	ERP <note 2=""></note>	Limit <note 3=""></note>	Result
	(@ 0.1%)	(dBm)	(mW)	(dBm)	(W)	
TX1A	1.12	29.75	944.06	31.6		
TX1B	1.08	29.85 <note 1=""></note>	966.05	31.79		
TX2A	1.08	29.52	895.36	31.63	500	Pass
TX2B	1.09	29.72	937.56	31.7		
Total - 35.73 3743.04 -						
Note 1. See worst-case TX1B in Graph 1						
Note 2. ERP =EIRP -2.15 dB as per <u>412172 D01</u> Note 3 As per <u>§22.913(a)(1)(i)</u>						

Table 3 – Max Peak Output Power – Bottom/Top Channel



2.1.6.1.1 Worst Case – Port 1B

Carrier Power Modulation QPSK - Carrier Bandwidth 2.0 MHz - Channel Position: 869.2 MHz



Graph 1: Output Power – Port 1B – Bottom Channel

Calculation: 30dB - 0.15 dBm = 28.85 dBm.



PAgilent Spectrum Analyzer - Power Stat CCDF		
122 RL 50Ω A Center Freq 869.200000 MHz Input: RF #IFGain:	AC SENSEINT ALIGNAUTO 03:26:50 PM Aug 1 Center Freq: 869:200000 MHz Radio Std: None Trig: Free Run Counts:10.0 M/10.0 Mpt tlow #Atten: 12 dB	6,2021
Average Power	100 % Gaussian	
-0.20 dBm		
61.56 % at 0dB	10 %	
	1 %	
10.0 % 0.62 dB	0.1 %	
1.0 % 0.95 dB 0.1 % 1.12 dB	0.01 %	
0.01 % 1.21 dB 0.001 % 1.27 dB		
0.0001 % 1.30 dB	0.001 %	—
Peak 1.31 dB 1.11 dBm		
	0.0001 % 0 dB 2 Info BW 25.000 MHz	0 dB

PAPR - Carrier Bandwidth 2.0 MHz - Channel Position: 869.2 MHz

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2.1.6.2 Bottom/Top Channel: 893.8MHz

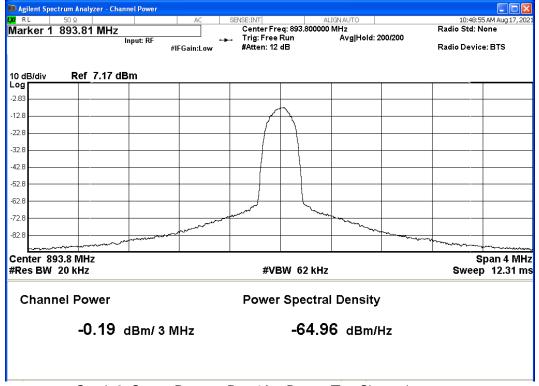
Maximum Target Output Power: 30 dBm

			Output Po	wer/PAPR								
Antenna	PAPR	Conducte Po	ed Average wer	ERP <note 2=""></note>	Limit <note 3=""></note>	Result						
	(@ 0.1%)	(dBm)	(mW)	(dBm)	(W)							
TX1A	1.10	29.81 <note 1=""></note>	957.19	31.85								
TX1B	1.09	29.7	933.25	31.73	500	Pass						
TX2A	1.08	29.74	941.89	31.8	500	1 035						
TX2B	1.09	29.76	946.24	31.75								
Total	-	35.77	3778.58	-								
Note 1. See worst-case TX2B in Graph 2												
Note 2. ERP =EIRP -2.15 dB as per <u>412172 D01</u> Note 3 As per <u>§22.913(a)(1)(i)</u>												

Table 4 – Max Peak Output Power – Bottom/Top Channel



2.1.6.2.1 Worst Case – Port 1A



Carrier Power - Modulation QPSK - Carrier Bandwidth 2.0 MHz – Channel Position: 893.8MHz

Graph 2: Output Power – Port 1A – Bottom/Top Channel

Calculation. 30dB - 0.19 dBm = 29.81 dBm.



Diagonal State Contract Analyzer - Power Stat CCDF		
102 RL 50 Ω Center Freq 893.800000 MHz Input: RF	AC SENSE:INT ALIGNAUTO 10:49:54 AB Center Freq: 893.800000 MHz Radio Std: Non 	1 Aug 17, 2021 e
Average Power	100 % Gaussian	
-0.18 dBm 60.51 % at 0dB	10 %	
	1 %	
10.0 % 0.61 dB 1.0 % 0.94 dB	0.1 %	
0.1 % 1.10 dB 0.01 % 1.19 dB	0.01 %	
0.001 % 1.24 dB 0.0001 % 1.26 dB Peak 1.27 dB	0.001 %	
Peak 1.27 dB 1.09 dBm	0.0001 % 0 dB Info BW 25.000 MHz	20 dB

PAPR - Modulation QPSK - Carrier Bandwidth 2.0 MHz – Channel Position: 893.8MHz



2.2 OCCUPIED BANDWIDTH

2.2.1 Specification Reference

FCC CFR 47 Part 2, Clause 2.1049 FCC CFR 47 Part 27, <u>Clause § 22.917(b)(2)</u>

2.2.2 Date of Test and Modification State

17 August 2021 - Modification State 0

2.2.3 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.2.4 Environmental Conditions

Ambient Temperature22.1°CRelative Humidity16.4%

2.2.5 Test Method

All measurements were made in accordance with FCC KDB 971168 D01.

2.2.6 Test Results

Maximum Output Power: Bottom- Middle- and Top- channels was 30 dBm; respectively. The worst-case scenario of all channels is provided below.



2.2.6.1 Bottom Channel – 869.2 MHz

2.2.6.1.1 Worst Case – Port 2B

		Result (kHz)	
Modulation	Carrier Bandwidth (kHz)	Channel Bandwi	dth
	(1112)	Occupied Bandwidth	-26 dB Bandwidth
QPSK	250	234	2.91

Bandwidth 250kHz – Modulation: QPSK – Channel Bottom/Top: 869.2 MHz

	ctrum Analyzer - Occupied	BW						
LXI RL	50 Q	AC	SENSE:INT		IGN AUTO		03:43:1: Radio Std: N	. PM Aug 16, 2021
Marker 1		t: RF ++	J Trig:Free	q: 869.200000 Run	Avg Hold: 2	00/200	Radio Sta: N	one
	inpu	#IFGain:Low	#Atten: 12		0.		Radio Devic	BTS
10 dB/div	Ref 7.58 dBm							
Log								
-2.42								
-12.4			سر	<u> </u>				
-22.4								
-32.4								
-42.4								
-52.4			ļ					
-62.4								
-72.4				~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	have a start of the start of th			
-82.4		- man and a second			- marine a	www	-	
m	www.www.www.www.www.www.						her was a second	www.
Center 8								pan 4 MHz
#Res BW	20 kHz		#VE	SW 62 kHz			Sweep	12.33 ms
Occur	pied Bandwidtl	h	Total P	ower	-0.30 dE	Rm		
Occu			i ottai i		0.00 41			
	2	34.42 kHz						
Transr	nit Freq Error	911 Hz	OBW P	ower	99.00	1%		
x dB B	andwidth	291.2 kHz	x dB		-26.00	dB		
					20.00			
MSG					STATUS			



2.2.6.1 Top Channel – 893.8 MHz

2.2.6.1.1 Worst Case - Port 1A

		Result (kHz)						
Modulation	Carrier Bandwidth	Channel Bandw	ridth					
		Occupied Bandwidth	-26 dB Bandwidth					
QPSK	250 kHz	237	290					

Bandwidth 250.0kHz - Modulation: QPSK - Channel Top: 893.8 MHz

Agilent Spectrum Analyzer - Occupie	d BW			
X/ RL 50Ω	AC	SENSE:INT	ALIGNAUTO	10:50:27 AM Aug 17, 202
Marker 1 893.80 MHz		Center Freq: 893.8000		Radio Std: None
	ut: RF 🛶		Avg Hold: 200/200	
	#IFGain:Low	#Atten: 12 dB		Radio Device: BTS
10 dB/div Ref 7.61 dBm	<u> </u>			
Log				
-2.39		<u>+</u>		
-12.4				
-12.4				
-22.4		+ $/$ $+$ $+$	_	
-32.4		+		
-42.4				
-42.4				
-52.4		+ + + +		
-62.4				
-72.4		~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	~~~~	
	and the second second		man market	
-82.4	~~~~~	<u>+</u>	- almanan - www.	~~~
man man man and the second sec				- marine and and a second
Center 893.8 MHz				Span 4 MHz
#Res BW 20 kHz		#VBW 62 kH	z	Sweep 12.33 ms
Occupied Bandwidt	:h	Total Power	-0.32 dBm	
2	36.47 kHz			
Transmit Freq Error	1.377 kHz	OBW Power	99.00 %	
x dB Bandwidth	290.0 kHz	x dB	-26.00 dB	
	290.0 KH2	X UD	-20.00 aB	



2.3 BAND EDGE

2.3.1 Specification Reference

FCC CFR 47 Part 2, Clause 2.1051 FCC CFR 47 Part 22, <u>Clause 22.91 7 (a)</u>

2.3.2 Date of Test and Modification State

16 August 2021 - Modification State 0 17 August 2021 - Modification State 0 9 November 2021 – Modification State 0 11 November 2021 – Modification State 0

2.3.3 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.3.4 Environmental Conditions

Ambient Temperature24.1°CRelative Humidity25.4%

2.3.5 Test Method

All measurements were made in accordance with FCC KDB 971168 D01, clause 6 and ANSI C63.26. The EUT was connected to a Spectrum Analyser via an attenuator. The path loss between the EUT and the Spectrum Analyser was measured using a Network Analyser. The measured path loss was entered as a Reference Level Offset in the Spectrum Analyser.

The Spectrum Analyser RBW was adjusted to be at least 1% of the measured 26dB Bandwidth. Using an RMS detector, the frequency spectrum up to 1MHz from the band edge was investigated. The worst-case path loss in the measured ranges was entered as a reference level offset. Over the measured ranges, the RBW was set to 10kHz, however the band power function of the SA was used with an integration of 50kHz bandwidth. All measurement results are specified as average with an RMS detector being used in conjunction with a trace setting of Max Hold or clear write if representative. Measurements were performed in configurations of the EUT as reported below.

The EUT has four transmit ports, testing was performed on each port with a test limit according to MIMO $43+10x\log_{10}(P) + 10xLog_{10}(4) = -19 \text{ dBm}$.



2.3.6 Test Results

Maximum Output Power for Bottom/Top channels were 30 dBm, respectively. The band edges of middle channels were determined and only the worst scenario is provided.

2.3.6.1 Bottom/Top Channel – 869.2 MHz

2.3.6.1.1 Worst Case – Port 1B

Maximum	Target	output	Power [.]	30 dBm
maximum	rarget	output	1 0 0001.	

	Carrier	Ba	and Edge (MHz	Band Power				
Modulation	Bandwidth	Channel Position:	Lower Band	Upper Band	30kHz	50kHz	100kHz	
		869.2	869.2					
LTE	234kHz	Bottom	869	880	-31.46	-30.59	-29.74	
		Тор			-66.44	-64.30	-61.13	

Modulation QPSK - Carrier Bandwidth 234 kHz – Bottom – Channel Position: 869.2 MHz (Band Power: 30kHz, 50kHz and 100kHz)

					1= 01110	1 0 1 01.						· · · · <u>· · · · · · · · · · · · · · · </u>		
N	gilent	Spec	trum	Analyzer - Swept SA										_ 7 🛛
L XI	RL		50 \$	2		AC	SENSE:I	NT		AL	IGN AUTO		12:19:4	B PM Nov 09, 2021
Sta	art F	rec	86	58.700000 MH Input:	RF P	NO: Far 🕞 Gain:High		g: Free tten: 0 d			Avg Ty	pe: Pwr(RMS)		RACE 1 2 3 4 5 6 TYPE WWWWWWW DET A N N N N N
10 (Log	dB/di	v		Offset 29.42 dB 9.42 dBm									kr1 868.9 Power -29	9.74 dBm
-0.5													and and a stand of the stand of the	and the property of the second
-10.	6											and the second second		
-20.	6													-19.02 dBm
-30.	6								▲ 1=	<u>^2\</u> 3	and the second	~~~~		
-40.	6							، استامہ روالدیارہ						
-50.	6 ~~	n in a ik	.	-	ปการสถายกลางสาว	and a state of the second second	~~~~							
-60.	6													
-70.	6													
-80.	6 –													
Sta		68 7	000	MHz			~						Stop 860	.2000 MHz
	es B					#VB	w					#S	weep 5.00 s	
мке	MODE	TRO	i sci	×		Y		ELIN	CTION	EUNCT	ION WIDTH		FUNCTION VALUE	
1	N	1	f		50 0 MHz	-42.49	dBm		Power		00.0 kHz			-29.74 dBm
2	Ň	1	f		75 0 MHz	-37.42			Powe		0.00 kHz			-30.59 dBm
3	Ň	1	f		B5 0 MHz	-35.71			Power		0.00 kHz			-31.46 dBm
4														
5										_				
6										_				
7		-								_				
8 9										_				
10		1	-											
11														
12														



Modulation QPSK - Carrier Bandwidth 234 kHz – Top – Channel Position: 869.2 MHz (Band Power: 30kHz, 50kHz and 100kHz)

Aoi	ent Si	nect	rum I	Analyzer - Swept S												
LXI RL		Jeer	50 Ω		·	AC	SENSE:1	INT		81	IGN AUTO			1	2·25·11 D	4Nov 09, 2021
	·	nai		00.000000	<u>4</u> H7		CENCER					pe: Pwr(RMS)			E 1 2 3 4 5 6
Dan	u J	Ja				PNO: Far	n Tri	ig: Free	Run				,		TYP	E WWWWWW
				mb		Gain:High	#A	tten:0d	в						DE	ANNNN
						3							b .4	k#2 00	0.045	
				Offset 29.42 dB												0 MHz
10 dE	3/div		Ref	9.42 dBm								E	sana	Power	-66.4	14 dBm
Log	ι															
-0.58																
-10.6	\rightarrow													_		
-20.6	1															-19.02 dBm
-20.6	1															
-30.6	+			<u> </u>												
-40.6																
	لرم															
-50.6		7	.													
-60.6			Mr.	4	· \											1
-70.6				money	hanner	Manager Marker	aline carbon									2
							· · ·							ALC: NO.		a and a second secon
-80.6																
Star																000 MHz
#Re	s BV	V 1	0 ki	Hz		#VB	W						#S∖	veep 5.	.00 s ('	1001 pts)
MKR N	INDE	TRC	SCI I	×		Y	_	E E I N	CTION	I FUNCT	ION WIDTH		F	UNCTION VA	LLIF	
	N	1	f		050 0 MHz	-71.21	dBm		Power		00.0 kHz					61.13 dBm
	N	1	f		025 0 MHz	-70.40			Power		0.00 kHz					4.30 dBm
3	Ν	1	f	880	015 0 MHz	-70.40	dBm	Band	Power	30	0.00 kHz				-6	6.44 dBm
4																
5 6		_														
7																
8																
9																
10		_														
11 12		_														
12																



2.3.6.2 Bottom/Top Channel – 893.8 MHz

2.3.6.2.1 Worst Case - Port 1B

	Carrier	Ba	and Edge (MHz	Band Power				
Modulation	Bandwidth	Channel Position:	Lower Band	Upper Band	30kHz	50kHz	100kHz	
		893.8						
LTE	234kHz	Bottom	891.5	894	-57.42	-60.52	-62.68	
		Тор			-31.89	-31.08	-30.39	

<u>Modulation QPSK - Carrier Bandwidth 234 kHz – Bottom – Channel Position: 893.8MHz</u> (Band Power: 10kHz, 50kHz and 100kHz)

M Agilor	at Spec	trum /	Analyzer - Swep	1 54	7-	Jan			(i i <u>i -</u> ,	oora			<u></u>		
LXI RL	n opec	50 Ω		C SK			AC	SENSE:	INT		81	IGNAUTO		12:36:1	2 PM Nov 09, 2021
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10 dB/	div		Offset 29.42 o 9.42 dBm	dB										kr1 891.4 Power -57	
-0.58 —															
-10.6															-19.02 dBm
-20.6															/
-40.6 —					+										and the second second
-50.6 —		1			╢.	13							and any of the second	Engle - along to an and the second second	
-60.6	man	 	and a start of the	×~~	ю.	henre	and and the second	na grande	n an the second s		r in an				
-80.6 —					+										
L Start #Res							#V	BW					#Sv	Stop 89 veep 5.00 s	3.800 MHz (1001 pts)
MKR MO	DE TRO	I SCL		x			Υ		l FUN	CTION	FUNCT	ION WIDTH	3	UNCTION VALUE	
1 N		f				MHz		0 dBm		Power		00.0 kHz			-57.42 dBm
2 N		f				MHz		7 dBm		Power).00 kHz			-60.52 dBm
3 N 4	1 1	f		91.48	35 0	MHz	-67.4	0 dBm	Band	Power	30).00 kHz			-62.68 dBm
5															
6															
7		+													
9															
10															
11 12	_	$\left \right $													
	_						1								



Modulation QPSK - Carrier Bandwidth 234 kHz – Top – Channel Position: 893.8MHz (Band Power: 30kHz and 50kHz)

		Spect		Analyzer - Swept	SA									
L XI R			50 \$	-		AC	SENSE:I	NT		ALI	IGN AUTO		09:	50:00 AMNov 10, 2021
Mar	ker	1	894	1.05000000 In	put: RF F	PNO: Far G Gain:High		g:Free ten:0 o			Avg Ty	pe: Pwr(RMS)		TRACE 1 2 3 4 5 6 TYPE WWWWWW DET A N N N N N
10 d Log	B/div	,		Offset 29.42 d 5 9.42 dBm	в							Band	/lkr1 894 I Power	.050 0 MHz -30.39 dBm
-0.58	~~~		⊶า เ ∳า	a warden and the second states	·			_						
-10.6					······································			_						
-20.6					A.	4		_						-19.02 dBm
-30.6						and the second second		2	1-					
-40.6							work .	×	?					
-50.6								_	a second second	hank man		****	Martin Augure	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
-60.6								_						
-70.6								_						
-80.6								_						
	rt 89 s Bi) MHz Hz		#VE	sw					#	Stop Sweep 5.0	894.300Ô MHz)0 s (1001 pts)
	MODE					Y	ļ		CTION		ION WIDTH		FUNCTION VAL	
1 2	N	1	f		4.050 0 MHz 4.025 0 MHz		dBm		Power Power		0.0 kHz 0.00 kHz			-30.39 dBm -31.08 dBm
3	Ň	1	f		4.015 0 MHz		dBm		Power).00 kHz			-31.89 dBm
5														
6		-												
8 9														
10														
11 12														



2.4 TRANSCEIVER SPURIOUS EMISSIONS

2.4.1 Specification Reference

FCC CFR 47 Part 2, Clause 2.1051 FCC CFR 47 Part 22, <u>Clause §22.357</u>

2.4.2 Date of Test and Modification State

16 August 2021- Modification State 0 17 August 2021- Modification State 0

2.4.3 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.4.4 Environmental Conditions

Ambient Temperature25.1°CRelative Humidity16.4%

2.4.5 Test Method

All measurements were made in accordance with FCC KDB 971168 D01.

All measurements were made in accordance with FCC KDB 971168 D01 Clause 6. The EUT was connected to a Spectrum Analyser via an attenuator and switching box. Prior to testing, a Network Analyser was used to calibrate the path loss between the EUT and the Spectrum Analyser. The worst-case path loss in the measured ranges was entered as a reference level offset. Over the measured ranges, the RBW was set to 1MHz with a VBW of 3MHz. All measurement results are specified as average with an RMS detector being used in conjunction with a trace setting of Max Hold. Measurements were performed in configurations of the EUT as reported below. Testing was performed on this port with a test limit of $43+10x\log_{10}(P) +10xLog_{10}(4) = -19$ dBm.



2.4.6 Test Results

Range Frequency	Limit (dBm)	Result					
9kHz to 1GHz	-19	Pass					
1GHz to 5G	-19	Pass					
5G to 26GHz	-19	Pass					
26GHz to 40GHz	-19	Pass <note 1=""></note>					
Note 1. The device was scanned up to 40Ghz with no emission (peak values less than 6Bd from the limit)							

2.4.6.1.1 Worst Case - Port 1B

Modulation QPSK - Carrier Bandwidth 250kHz - Range 9kHz to 500MHz

D Agilent Spe	ectrum	Analyzer - Swept S	5A	▲DC SE	NSE:INT	ALIGN			02:00.1	54 PM Aug 16, 202
d Marker 1		10965966 N	out: RF P	NO: Fast ↔ Gain:Low	Trig: Free Run #Atten: 0 dB			Pwr(RMS)	03.09	TYPE WWWWW DET A N N N N
10 dB/div		Offset 30 dB f 10.00 dBm							Mkr′ -6	1 2.0 MH 1.15 dBn
0.00										
10.0										-19.02 dE
20.0										
10.0										
io.o _ 1 —										
50.0 		1								
70.0 30.0			~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~		**************************************		atoologia /		in the second of the second o	
tart 9 kH	1-								Ctor	500 0 MIL
Res BW		kHz		#VBW	·			#Sw	eep 1.00/	s (1000 MH) 500.0 MH
ikr mode ti 1 n 1	RC SCL	×	2.0 MHz	Y -61.15 di	FUNCTION	FUNCTION	WIDTH	FL	JNCTION VALUE	
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4 5	+									
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11										



	- 44	and		Oumor	Danuwiu		$\pi 12 =$	nany	le 30			JI 12. 0	69.2 MHZ
🗩 Agile	nt Sp	ectrum	Analyzer - Swe	pt SA									
,XI	т	50			<u>≜</u> DC :	SENSE:INT		ALIG	6N AUTO			03:	:07:01 PM Aug 16, 2
RBW	/ 10	0 kl	łz				_		#Avg T	ype: Pwr	(RMS)		TRACE 1 2 3 4
					NO: Fast 🔸	. Trig:F #Atten	ree Run						DET A N N N
				IF	Gain:High	#Atten	. • •						,
		Re	f Offset 30 dE	3									864.4 MI
10 dB/	div	Re	f 10.00 dB	m									-59.14 dB
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40.0													
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80.0													
-00.0													
Start	500	.0 M	Hz									Sto	p 1.0000 GI
#Res					#VB	w					#Sv		00 s (1000 p
MKR MC		nel ee		X	Y		FUNCTION	FUNCTIO	NUMBER			UNCTION VALU	
			-	^			TONCHON						JC
		1 f		869 2 MHz	8.63	arm							
1 N 2 N	N 1 N 1	1 f		869.2 MHz 874.4 MHz	8.63 -59.88	dBm							
1 N 2 N 3 N	N .	1 f		869.2 MHz 874.4 MHz 864.4 MHz		dBm							
1 N 2 N 3 N 4	N 1 N 1	1 f		874.4 MHz	-59.88	dBm							
1 N 2 N 3 N 4 5 6	N 1 N 1	1 f		874.4 MHz	-59.88	dBm							
1 N 2 N 3 N 4 5 6 7	N 1 N 1	1 f		874.4 MHz	-59.88	dBm							
1 N 2 N 3 N 4 5 6 7 8	N 1 N 1	1 f		874.4 MHz	-59.88	dBm							
1 N 2 N 3 N 4 5 6 7 8 9 10	N 1 N 1	1 f		874.4 MHz	-59.88	dBm							
1 N 2 N 3 N 4 5 6 7 8	N 1 N 1	1 f		874.4 MHz	-59.88	dBm							

Modulation QPSK - Carrier Bandwidth 250kHz - Range 500MHz to 1GHz: 869.2 MHz

Modulation QPSK - Carrier Bandwidth 250kHz - Range 500MHz to 1GHz: 893.8 MHz

🗊 Agi	ilent S	ipect			er - Sw	rept S	A															
LXI	Т		50 Ω					<u>≜</u> D0		SEN	ISE:INT			A	LIGN AUTC					03:07	:01 PM Aug	
RBV	<u>N 1</u>	00	kН	z]		Triat	Free F			#Avg	Type:	Pwr(RMS)			TRACE 1 2 TYPE WW	
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_								 Gainti	ngn				-						B./	1/22	064.4	N 4 I I -
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-70.0		-					•	 		***		14-2-2-2	and the second		-		∽		harne	had the colleges		10-1-1-10-10-10-10-10-10-10-10-10-10-10-
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5								 														
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8																						
<u>9</u> 10											_											
11	_										-					-						
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🗩 Ag	🛾 Agilent Spectrum Analyzer - Swept SA 📃 🖸 🔀															
LXI	Т		50 Ω			<u> </u>	SENSE:	INT		AL	IGN AUTO					2 AM Aug 17, 2021
Mar	ker	1	25.8	873873873		PNO: Fast ↔	. Tri	ig: Free l	Run		#Avg I	ype: H	Pwr(RMS)		IF.	RACE 1 2 3 4 5 6
					nput: RF F	Gain:High		tten: 0 d								DET A N N N N N
														Mkr	1 25.	.874 GHz
10 d	B/div			Offset 30 dB 10.00 dBm	1).28 dBm
Ĺõĝ				10000 020	- 											
0.00																
-10.0																
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Modulation QPSK - Carrier Bandwidth 250.0 MHz - Range 5GHz to 26GHz



2.5 FREQUENCY STABILITY

2.5.1 Specification Reference

FCC CFR 47 Part 2, Clause 2.1055 FCC CFR 47 Part 27, <u>Clause 22.355</u>

2.5.2 Date of Test and Modification State

22 June 2021 - Modification State 0

2.5.3 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.5.4 Environmental Conditions

Ambient Temperature26.7°CRelative Humidity32.2%

2.5.5 Test Method

All measurements were made in accordance with FCC KDB 971168 D01.

2.5.6 Test Results

Maximum Target Output Power 30dBm

2.5.6.1.1 Worst Case – Port 1A

Temperature	Voltage (AC)	Frequency Error (Hz)	Limit ppm <note 2=""></note>	Error/Freq ppm	Result					
-30°C	115	Note 1	±1.5	N/A	<note 1=""></note>					
-20°C	115	87.24	±1.5	0.10	Pass					
-10°C	115	34.21	±1.5	0.04	Pass					
0°C	115	31.0	±1.5	0.03	Pass					
+10°C	115	20.50	±1.5	0.02	Pass					
+20°C	115	22.7	±1.5	0.03	Pass					
+20°C	90	21.22	±1.5	0.02	Pass					
+20°C	132	13.17	±1.5	0.01	Pass					
+30°C	115	16.34	±1.5	0.02	Pass					
+40°C	115	18.30	±1.5	0.02	Pass					
+55°C	+55°C 115 4.62 ±1.5 0.005 Pass									
The frequency sta the authorized ba	Note 1. EUT stop the operation and no transmission was recorded: Pass The frequency stability shall be sufficient to ensure that the fundamental emissions stay within the authorized bands of operation Note 2. Frequency Range 821 to 896 of Table C-1 in <u>§22.355</u>									



2.6 FIELD STRENGTH

2.6.1 Specification Reference

FCC CFR 47 Part 2.1053 FCC CFR 47 Part 90, Clause <u>§ 22.983</u>

2.6.2 Date of Test and Modification State

June 22, 2021 – Modification State 0 June 23, 2021 – Modification State 0 July 5th, 2021 – Modification State 0

2.6.3 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.6.4 Environmental Conditions

Ambient Temperature23.1°CRelative Humidity13.4%

2.6.5 Test Method

All measurements were made in accordance with:

- 971168 D01 Power Meas License Digital Systems v03r01 Clause 5.6
- 971168 D01 Power Meas License Digital Systems v03r01 Clause 7

From Clause 5:6, the field strength of the EUT can be calculated by:

 $EIRP = P_{meas} + A_{gain} = 30 \text{ dBm} + 5 \text{dBi} = 35 \text{dBm} \text{ (or } 127.23 \text{ dB}\mu\text{V/m at }3\text{m})$

Measurements were performed in configurations of the EUT as reported below. Testing was performed with RF on (Port TX1A) with a test limit of FCC 15 Subpart B Class B of 40 dB μ V/m, which is more restricted than -19 dBm or 76.23 dB μ V/m at 3m.



2.6.6 Test Results

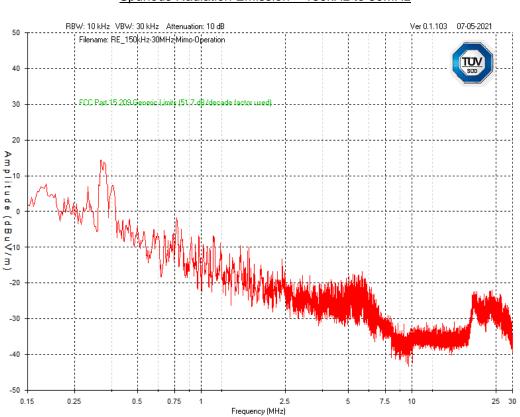
A summary of the test result is depicted in the table below.

Range Frequency	Test Limit (dBµV/m)	Limit <note 1=""> dBµV/m</note>	Result				
9kHz to 150kHz	40.0	76.23	Pass <note 2=""></note>				
150kHz to 30MHz	40.0	76.23	Pass				
30MHz to 1GHz	33.06	76.23	Pass				
1GHz to 10GHz	53.96	76.23	Pass				
10GHz to 18GHz	53.96	76.23	Pass				
18GHz to 40GHz	53.96	76.23	Pass <note 3=""></note>				
Note 1. As per CFR 47 27.55(a)(1)							

Note 2. No significant emission (> 20dB margin below the limit) was recorded according to FCC 15 Subpart B.

Note 3. The device was scanned up to 40Ghz with no emission (peak values less than 6Bd from the limit)





<u>Spurious Radiation</u> Spurious Radiation Emission – 150kHz to 30MHz

Note 1. The spurious emissions comply with the limit of 76.23 dB μ V/m at 3m.

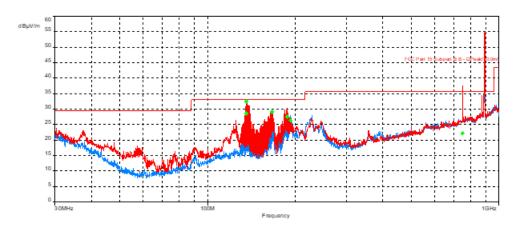
Frequency (MHz)	Detector	Raw Reading	Cable 27 - 10m LMR4 00 Factor	Loop - EM687 2 100k to 30M Factor	Pream p- LNA14 50 Factor	Level	FCC Part 15.209 Generic Limits (51.7 dB/decad e factor used) Limit	FCC Part 15.209 Generic Limits (51.7 dB/decade factor used) Margin
0.7642	PEAK	31.4	0	-2.3	-31	-1.9	93.3	95.2
1.6872	PEAK	28.5	0.1	-7.4	-31.1	-9.9	86.4	96.3
1.1427	PEAK	28.7	0.1	-4.5	-31	-6.7	89.8	96.5
1.5378	PEAK	28	0.1	-6.6	-31	-9.5	87.2	96.7



Spurious Radiation Emission -30MHz to 1GHz

"TÜV SÜD, by release of this raw data, does not imply that the tested product has demonstrated compliance to any standard. The raw data provided may not be complete and may require additional processing. If raw data provided includes engineering data, testing may not have been done according to a standard test method. "

Emi CC test:RE_30-1000 MHz 10	m - FCC- Class B Number:122 Execution date: 6/22/2021 1:42:24 PM
Limit	FCC Part 15 Subpart B
Class	Class : B
Test Plan Number	7169009211
Configuration Information	Mode: Operating: Band:891.5MHz (30dBm)
Results	Pass
Model	CBRSYS4450
Tested by	KP and SM
Comments	Port activated: TX1A



Red=Vertical, Blue=Horizontal

Finals

	Quasi-Peak Detector (6)									
Frequency	S	Level	Limit	Margin	Height (m)	Azimuth	Polarization	Correctio		
(MHz)	R	(dBµV/m)	(dBµV/m)	(dB)	(dB)	(°) (dB)	(dB)	n (dB)		
135.8700672	1	32.42	33.06	-0.64	1.00	117.75	Vertical	-9.37		
166.2925738	1	29.15	33.06	-3.91	1.11	175.25	Vertical	-10.68		
187.5651795	1	27.54	33.06	-5.52	1.06	119.75	Vertical	-11.92		
749.9822821	1	22.16	35.56	-13.40	1.84	220.75	Vertical	3.69		
135.8608141	2	28.49	33.06	-4.57	4.00	112.75	Horizontal	-9.37		
192.6622692	2	26.30	33.06	-6.76	3.40	127.25	Horizontal	-11.80		

uasi-Peak Detector (6)

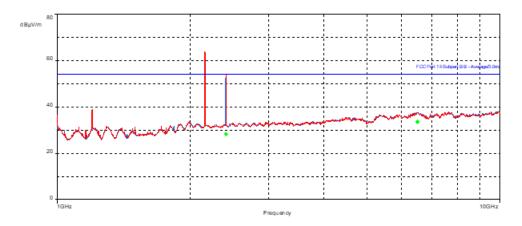
Note 1. The spurious emissions comply with the limit of 76.23 $dB\mu V/m$ at 3m. Note 2. Operating at 893.8MHz, thus emission excluded from FCC limit.



Spurious Radiation Emission -1GHz to 10GHz

"TÜV SÜD, by release of this raw data, does not imply that the tested product has demonstrated compliance to any standard. The raw data provided may not be complete and may require additional processing. If raw data provided includes engineering data, testing may not have been done according to a standard test method. "

Emi CC test:RE_1-10 GHz 3m - M	Emi CC test:RE_1-10 GHz 3m - MIMO- FCC Class B Number:129 Execution date: 6/22/2021 3:15:43 PM								
Limit	FCC Part 15 Subpart B								
Class	Class: B								
Test Plan Number	7169009211								
Configuration Information	Mode: Operating								
Results	Pass								
Model	CBRSYS4450								
Tested by	KP and SM								
Comments	Port activated: TX1A								





AVG (4)								
Frequency	SR	Level	Limit	Margin	Height (m)	Azimuth	Polarizatio	Correction
(MHz)		(dBµV/m)	(dBµV/m)	(dB)	(dB)	(°) (dB)	n (dB)	(dB)
2405.726603	1	28.27	53.96	-25.69	3.69	9.50	Vertical	-5.79
6492.401603	1	33.47	53.96	-20.49	2.08	343.00	Vertical	1.37
2403.416346	2	28.38	53.96	-25.58	1.00	356.75	Horizontal	-5.81
6513.693269	2	33.56	53.96	-20.40	2.42	2.25	Horizontal	1.35

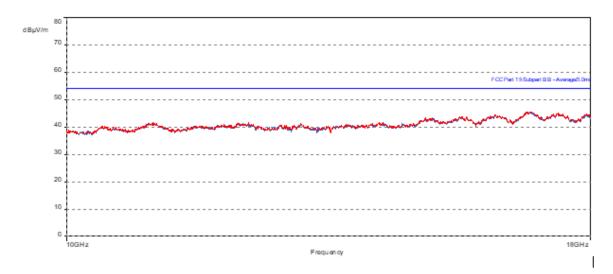
Note 1. The spurious emissions comply with the limit of 76.23 $dB\mu V/m$ at 3m. Note 2. 2.4GHz peak correspond to the computer WIFI communication.



Spurious Radiation Emission –10GHz to 18GHz

"TÜV SÜD, by release of this raw data, does not imply that the tested product has demonstrated compliance to any standard. The raw data provided may not be complete and may require additional processing. If raw data provided includes engineering data, testing may not have been done according to a standard test method. "

Emi CC test:RE_10-18 GHz 3m - MIMO - FCC Class B Number:135 Execution date: 6/23/2021 8:42:04 AM					
Limit	FCC Part 15 Subpart B				
Class	Class: B				
Test Plan Number	7169009211				
Configuration Information	Operation: Band:891.5MHz (30dBm)				
Results	Pass				
Model	CBRSYS4450				
Tested by	KP and SM				
Comments	Port activated: TX1A				



Red=Vertical, Blue=Horizontal

<u>Finals</u>

AVG Detector (4)

Frequency	S	Level	Limit	Margin	Height (m)	Azimuth	Polarizatio	Correction
(MHz)	R	(dBµV/m)	(dBµV/m)	(dB)	(dB)	(°) (dB)	n (dB)	(dB)
16750.52277	2	41.61	53.96	-12.35	1.00	10.50	Horizontal	14.25
16753.59519	1	41.97	53.96	-11.99	4.00	271.50	Vertical	14.29
17898.35513	2	41.39	53.96	-12.57	3.86	16.75	Horizontal	14.87
17916.38559	1	41.10	53.96	-12.86	1.00	0.00	Vertical	14.82

Note 1. The spurious emissions comply with the limit of 76.23 dB μ V/m at 3m.

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SECTION 3: TEST EQUIPMENT USED

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3.1 TEST EQUIPMENT USED

Instrument	Manufacturer	Type No.	Serial No.	Calibration Period (months)	Calibration Due
Bilog Antenna	TESEQ	CBL 6111D	SSG013965	2021-05-04	2022-05-04
Horn Antenna 3MCH 00003	ETS	3117	LAVE04211	2021-03-30	2022-03-30
EMI Receiver	Rohde & Schwarz	ESU26	SSG013729	2021-03-31	2022-03-31
EMI Receiver	Rohde & Schwarz	ESU40	SSG013672	2020-10-29	2021-10-29
Coaxial Cable	Huber & Suhner	106A	SSG012455	2021-01-05	2022-01-05
Coaxial Cable	Huber & Suhner	106A	SSG012711	2021-01-05	2022-01-05
Coaxial Cable	Huber & Suhner	104PEA	SSG012041	2021-01-05	2022-01-05
Coaxial Cable	Huber & Suhner	ST18/Nm/Nm/36	SSG012785	2021-01-06	2022-01-06
Coaxial Cable	Micro-Coax	UFA 210B-1- 1500-504504	SSG012376	2021-01-06	2022-01-06
Pre-Amplifier	Нр	8447D	LAVE04346	2020-09-10	2021-09-10
Pre-Amplifier	BNR	LNA	SSG012360	2020-11-16	2021-11-16
Power Supply	Hewlett Packard	6216A	SSG013063	not required	not required
N/A: No applicable O/P Mon – Output monitored with Calibrated Equipment					

List of absolute measurements and other principal items of test equipment.



3.2 MEASUREMENT UNCERTAINTY

For a 95% confidence level, the measurement uncertainties for defined systems are:

Test Discipline	Frequency / Parameter	MU
Conducted Maximum Peak Output Power	30 MHz to 20 GHz Amplitude	± 0.1 dB
Conducted Emissions	30 MHz to 20 GHz Amplitude	± 2.3 dB
Frequency Stability	30 MHz to 2 GHz	± 5.0 Hz
Occupied Bandwidth	Up to 20 MHz Bandwidth	± 1.1 Hz
Band Edge	30 MHz to 20 GHz Amplitude	± 2.3 dB



SECTION 5

ACCREDITATION, DISCLAIMERS AND COPYRIGHT



4.1 ACCREDITATION, DISCLAIMERS AND COPYRIGHT



Testing Laboratory Certificate #2955.19

This report relates only to the actual item/items tested.

This report does not imply product endorsement by any government, accreditation agency, or TÜV SÜD Canada Inc.

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