

FCC Radio Test Report

FCC ID: VSFMS3A

This report concerns: Original Grant

Equipment	Tablet
Brand Name	Juniper Systems
Test Model	MS3A
Series Model	N/A
Applicant	Juniper Systems
Address	1132 W 1700 N Logan, UT 84321
Manufacturer	Juniper Systems
Address	1132 W 1700 N Logan, UT 84321
Date of Receipt	Jul. 16, 2019
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Standard(s)	FCC Part15, Subpart C (15.247) ANSI C63.10-2013 KDB 558074 D01 15 247 Meas Guidance V05r02

The above equipment has been tested and found compliance with the requirement of the relative standards by BTL Inc.

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Limitation

For the use of the authority's logo is limited unless the Test Standard(s)/Scope(s)/Item(s) mentioned in this test report is (are) included in the conformity assessment authorities acceptance respective. Please note that the measurement uncertainty is provided for informational purpose only and are not use in determining the Pass/Fail results.



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REPORT ISSUED HISTORY

Report Version	Description	Issued Date
R00	Original Issue.	Nov. 07, 2019

1. SUMMARY OF TEST RESULTS

Test procedures according to the technical standard(s):

FCC Part15, Subpart C (15.247)						
Standard(s) Section	Test Item	Test Result	Judgment	Remark		
15.207	AC Power Line Conducted Emissions	APPENDIX A	N/A			
15.247(d) 15.205(a) 15.209(a)	Radiated Emission APPENDIX APPENDIX APPENDIX		PASS			
15.247 (a)(1)(iii)	Number of Hopping Frequency APPEN		PASS			
15.247 (a)(1)(iii)	Average Time Of Occupancy	APPENDIX F	PASS			
15.247(a)(1)	Hopping Channel Separation	APPENDIX G	PASS			
15.247(a)(1)	15.247(a)(1) Bandwidth APPENDIX H		PASS			
15.247(a)(1)Maximum Output Power& e.i.r.p.APPENDIX I15.247(d)Conducted Spurious EmissionAPPENDIX J		PASS				
		APPENDIX J	PASS			
15.203	Antenna Requirement		PASS			

Note:

(1) "N/A" denotes test is not applicable in this test report



1.1 TEST FACILITY

The test facilities used to collect the test data in this report is at the location of No. 29, Jintang Road, Tangzhen Industry Park, Pudong New Area, Shanghai 201210, China BTL's Test Firm Registration Number for FCC: 476765 BTL's Designation Number for FCC: CN1241

1.2 MEASUREMENT UNCERTAINTY

ISO/IEC 17025 requires that an estimate of the measurement uncertainties associated with the emissions test results be included in the report. The measurement uncertainties given below are based on a 95% confidence level (based on a coverage factor (k=2)) The BTL measurement uncertainty as below table:

A. AC power line conducted emissions test:

Test Site	Method	Measurement Frequency Range	U, (dB)
SH-C01	CISPR	150 kHz ~ 30 MHz	± 2.26

B. Radiated emissions test:

Test Site	Method	Measurement Frequency Range	Ant. H / V	U, (dB)
		9 KHz~30 MHz	V	3.79
		9 KHz~30 MHz	Н	3.57
		30 MHz~200 MHz	V	4.04
	CISPR	30 MHz~200 MHz	H	3.76
		200 MHz~1,000 MHz	V	4.24
3H-CD01		200 MHz~1,000 MHz	Н	3.84
		1 GHz~18 GHz	V	4.46
		1 GHz~18 GHz	Н	4.40
		18 GHz~40 GHz	V	3.95
		18 GHz~40 GHz	H	3.95

Note: Unless specifically mentioned, the uncertainty of measurement has not been taken into account to declare the compliance or non-compliance to the specification.

1.3 TEST ENVIRONMENT CONDITIONS

Test Item	Temperature	Humidity	Test Voltage	Tested By
AC Power Line Conducted Emissions	24°C	61%	AC 120V	Summer Xu
Radiated Emissions-9K-30MHz	23°C	55%	AC 120V	Summer Xu
Radiated Emissions-30 MHz to 1GHz	23°C	55%	AC 120V	Summer Xu
Radiated Emissions-Above 1000 MHz	23°C	55%	AC 120V	Summer Xu
Number of Hopping Frequency	24°C	61%	AC 120V	Summer Xu
Average Time Of Occupancy	24°C	61%	AC 120V	Summer Xu
Hopping Channel Separation	24°C	61%	AC 120V	Summer Xu
Bandwidth	24°C	61%	AC 120V	Summer Xu
Maximum Output Power & e.i.r.p.	24°C	61%	AC 120V	Summer Xu
Conducted Spurious Emission	23°C	55%	AC 120V	Summer Xu



2. GENERAL INFORMATION

2.1 GENERAL DESCRIPTION OF EUT

Equipment	lablet
Brand Name	Juniper Systems
Test Model	MS3A
Series Model	N/A
Model Difference(s)	N/A
Software Version	MS3A-userdebug 9.1.0.1-20190619 eng.mirror.20190619.093211 test-keys
Hardware Version	DVT1
Power Source	#1 DC voltage supplied from AC/DC adapter.Model: PSAA30R-120#2 Supplied from Li-ion battery pack.
Power Rating	#1 I/P: 100~240V 0.8A 50~60Hz O/P: 12V 2.5A #2 7.2V, 6.0A, 43.2W
Operation Frequency	2402 MHz ~ 2480 MHz
Modulation Technology	GFSK, π/4-DQPSK, 8-DPSK
Bit Rate of Transmitter	1/2/3Mbps
Max. Output Power	6.61 dBm (0.0046 W) For 1Mbps 5.35 dBm (0.0034 W) For 3Mbps

Note:

1. For a more detailed features description, please refer to the manufacturer's specifications or the user's manual.



2. Channel List:

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
00	2402	27	2429	54	2456
01	2403	28	2430	55	2457
02	2404	29	2431	56	2458
03	2405	30	2432	57	2459
04	2406	31	2433	58	2460
05	2407	32	2434	59	2461
06	2408	33	2435	60	2462
07	2409	34	2436	61	2463
08	2410	35	2437	62	2464
09	2411	36	2438	63	2465
10	2412	37	2439	64	2466
11	2413	38	2440	65	2467
12	2414	39	2441	66	2468
13	2415	40	2442	67	2469
14	2416	41	2443	68	2470
15	2417	42	2444	69	2471
16	2418	43	2445	70	2472
17	2419	44	2446	71	2473
18	2420	45	2447	72	2474
19	2421	46	2448	73	2475
20	2422	47	2449	74	2476
21	2423	48	2450	75	2477
22	2424	49	2451	76	2478
23	2425	50	2452	77	2479
24	2426	51	2453	78	2480
25	2427	52	2454		
26	2428	53	2455		

3 Table for Filed Antenna:

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Ant.	Brand	Model Name	Antenna Type	Connector	Gain (dBi)
1	N/A	N/A	PIFA	N/A	1.2



2.2 DESCRIPTION OF TEST MODES

The test system was pre-tested based on the consideration of all possible combinations of EUT operation mode.

Pretest Mode	Description	
Mode 1	TX Mode NOTE (1)	
Mode 2	TX Mode Channel 78 _1Mbps	

Following mode(s) was (were) found to be the worst case(s) and selected for the final test.

AC power line conducted emissions test		

Radiated emissions test - Below 1GHz		
Final Test Mode	Description	
Mode 2	TX Mode Channel 78 _1Mbps	

Radiated emissions test - Above 1GHz		
Final Test Mode	Description	
Mode 1	TX Mode NOTE (1)	

Conducted test		
Final Test Mode Description		
Mode 1	TX Mode NOTE (1)	

Note:

- (1) The measurements are performed at the high, middle, low available channels.
- (2) The measurements for Hopping Channel Separation, Bandwidth and Maximum Output Power were tested during 1Mbps, 2Mbps and 3Mbps, the worst case are 1Mbps and 3Mbps, only worst case was documented.
- (3) For radiated emission above 1 GHz test, 1GHz~26.5GHz have been pre-tested and in this report only recorded the worst case. The remaining spurious points are all below the limit value of 20dB.



2.3 PARAMETERS OF TEST SOFTWARE

During testing, channel & power controlling software provided by the customer was used to control the operating channel as well as the output power level. The RF output power selection is for the setting of RF output power expected by the customer and is going to be fixed on the firmware of the final end product power parameters of FHSS

Test Software	QRCT		
Frequency (MHz)	2402	2441	2480
Parameters(1Mbps)	8	8	8
Parameters(3Mbps)	9	9	9

2.4 BLOCK DIAGRAM SHOWING THE CONFIGURATION OF SYSTEM TESTED



2.5 SUPPORT UNITS

Item	Equipment	Mfr/Brand	Model/Type No.	Series No.
-	-	-	-	-

Item	Cable Type	Shielded Type	Ferrite Core	Length
1	DC Cable	N/A	N/A	1.5m



3. AC POWER LINE CONDUCTED EMISSIONS TEST

3.1 LIMIT

Frequency of Emission (MHz)	Limit (d	BμV)
Frequency of Emission (MHZ)	Quasi-peak	Average
0.15 - 0.5	66 to 56*	56 to 46*
0.50 - 5.0	56	46
5.0 - 30.0	60	50

Note:

- (1) The tighter limit applies at the band edges.
- (2) The limit of " * " marked band means the limitation decreases linearly with the logarithm of the frequency in the range.

The following table is the setting of the receiver

Receiver Parameters	Setting
Attenuation	10 dB
Start Frequency	0.15 MHz
Stop Frequency	30 MHz
IF Bandwidth	9 kHz

3.2 TEST PROCEDURE

- a. The EUT was placed 0.8 meters from the horizontal ground plane with EUT being connected to the power mains through a line impedance stabilization network (LISN). All other support equipment powered from additional LISN(s). The LISN provide 50 Ohm/ 50uH of coupling impedance for the measuring instrument.
- b. Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth in the center forming a bundle 30 to 40 cm long.
- c. I/O cables that are not connected to a peripheral shall be bundled in the center. The end of the cable may be terminated, if required, using the correct terminating impedance. The overall length shall not exceed 1 m.
- d. LISN at least 80 cm from nearest part of EUT chassis.
- e. For the actual test configuration, please refer to the related Item -EUT Test Photos.

3.3 DEVIATION FROM TEST STANDARD

No deviation



3.4 TEST SETUP



3.5 EUT OPERATING CONDITIONS

The EUT was configured for testing in a typical function (as a customer would normally use it), EUT was programmed to be in continuously transmitting data or hopping on mode.

3.6 TEST RESULTS

Please refer to the APPENDIX A.

Remark:

- (1) All readings are QP Mode value unless otherwise stated AVG in column of Note. If the QP Mode Measured value compliance with the QP Limits and lower than AVG Limits, the EUT shall be deemed to meet both QP & AVG Limits and then only QP Mode was measured, but AVG Mode didn't perform in this case, a "*" marked in AVG Mode column of Interference Voltage Measured.
- (2) Measuring frequency range from 150 kHz to 30 MHz.



4. RADIATED EMISSION TEST

4.1 LIMIT

In case the emission fall within the restricted band specified on 15.205(a), then the 15.209(a) limit in the table below has to be followed.

LIMITS OF RADIATED EMISSION MEASUREMENT (9 kHz-1000 MHz)

Frequency	Field Strength	Measurement Distance
(MHz)	(microvolts/meter)	(meters)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

LIMITS OF RADIATED EMISSION MEASUREMENT (9 kHz-30 MHz)

Frequency	Magnetic field strength (H-Field)	Measurement Distance
(MHz)	(μA/m)	(meters)
0.009-0.490	6.37/F(kHz)	300
0.490-1.705	6.37/F(kHz)	30
1.705-30.0	0.08	30

LIMITS OF RADIATED EMISSION MEASUREMENT (30 MHz-1000 MHz)

Frequency	Field Strength
(MHz)	(μV/m at 3m)
30-88	100
88-216	150
216-960	200
Above 960	500

LIMITS OF RADIATED EMISSION MEASUREMENT (Above 1000 MHz)

	(dBuV/m at 3 m)	
	Peak	Average
Above 1000	74	54

Note:

(1) The limit for radiated test was performed according to FCC PART 15C.

- (2) The tighter limit applies at the band edges.
- (3) Emission level (dBuV/m)=20log Emission level (uV/m).
- (4) The test result calculated as following:

Measurement Value = Reading Level + Correct Factor Correct Factor = Antenna Factor + Cable Loss - Amplifier Gain(if use) Margin Level = Measurement Value - Limit Value



Spectrum Parameter	Setting
Attenuation	Auto
Start Frequency	1000 MHz
Stop Frequency	10th carrier harmonic
RBW / VBW	RBW 1 MHz VBW 3 MHz peak detector for Pk value
(Emission in restricted band)	RMS detector for AV value

Receiver Parameter	Setting
Attenuation	Auto
Start ~ Stop Frequency	9 kHz~90 kHz for PK/AVG detector
Start ~ Stop Frequency	90 kHz~110 kHz for QP detector
Start ~ Stop Frequency	110 kHz~490 kHz for PK/AVG detector
Start ~ Stop Frequency	490 kHz~30 MHz for QP detector
Start ~ Stop Frequency	30 MHz~1000 MHz for QP detector

4.2 TEST PROCEDURE

- a. The measuring distance of 3 m shall be used for measurements. The EUT was placed on the top of a rotating table 0.8 meter above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.(below 1 GHz)
- b. The measuring distance of 3 m shall be used for measurements. The EUT was placed on the top of a rotating table 1.5 meter above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.(above 1 GHz)
- c. The height of the equipment or of the substitution antenna shall be 0.8m or 1.5m; the height of the test antenna shall vary between 1 m to 4 m. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights find the maximum reading (used Bore sight function).
- e. The receiver system was set to peak and average detect function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz.
- f. The initial step in collecting radiated emission data is a receiver peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured.
- g. All readings are Peak unless otherwise stated QP in column of Note. Peak denotes that the Peak reading compliance with the QP Limits and then QP Mode measurement didn't perform. (below 1 GHz)
- h. All readings are Peak Mode value unless otherwise stated AVG in column of Note. If the Peak Mode Measured value compliance with the Peak Limits and lower than AVG Limits, the EUT shall be deemed to meet both Peak & AVG Limits and then only Peak Mode was measured, but AVG Mode didn't perform. (above 1 GHz)
- i. For the actual test configuration, please refer to the related Item -EUT Test Photos.

4.3 DEVIATION FROM TEST STANDARD

No deviation



4.4 TEST SETUP



30 MHz to 1 GHz





3TL





4.5 EUT OPERATING CONDITIONS

The EUT was programmed to be in continuously transmitting mode.

4.6 TEST RESULTS - 9 kHz TO 30 MHz

Please refer to the APPENDIX B

Remark:

- (1) Distance extrapolation factor = 40 log (specific distance / test distance) (dB).
- (2) Limit line = specific limits (dBuV) + distance extrapolation factor.

4.7 TEST RESULTS - 30 MHz TO 1000 MHz

Please refer to the APPENDIX C.

4.8 TEST RESULTS - ABOVE 1000 MHz

Please refer to the APPENDIX D.

Remark:

(1) No limit: This is fundamental signal, the judgment is not applicable. For fundamental signal judgment was referred to Peak output test.



5. NUMBER OF HOPPING FREQUENCY

5.1 LIMIT

FCC Part15, Subpart C (15.247)		
Section	Test Item	
15.247(a)(1)(iii)	Number of Hopping Frequency	

Spectrum Parameters	Setting	
Attenuation	Auto	
Span Frequency	> Operating Frequency Range	
RBW	100 kHz	
VBW	100 kHz	
Detector	Peak	
Trace	Max Hold	
Sweep Time	Auto	

5.2 TEST PROCEDURE

- a. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below.
- b. Spectrum Setting: RBW=100 kHz, VBW=100 kHz, Sweep time = Auto.

5.3 DEVIATION FROM STANDARD

No deviation.

5.4 TEST SETUP



5.5 EUT OPERATION CONDITIONS

The EUT tested system was configured as the statements of 4.5 unless otherwise a special operating condition is specified in the follows during the testing.

5.6 TEST RESULTS

Please refer to the APPENDIX E



6. AVERAGE TIME OF OCCUPANCY

6.1 LIMIT

FCC Part15, Subpart C (15.247)		
Section	Test Item	Limit
15.247(a)(1)(iii)	Average Time of Occupancy	0.4sec

6.2 TEST PROCEDURE

- a. The transmitter output (antenna port) was connected to the spectrum analyzer
- b. Set RBW of spectrum analyzer to 1 MHz and VBW to 1 MHz
- c. Use a video trigger with the trigger level set to enable triggering only on full pulses
- d. Sweep Time is more than once pulse time
- e. Set the center frequency on any frequency would be measure and set the frequency span to zero span
- f. Measure the maximum time duration of one single pulse
- g. Set the EUT for DH1, DH3 and DH5 packet transmitting
- h. Measure the maximum time duration of one single pulse
- i. DH1 Packet permit maximum 1600 / 79 / 2 = 10.12 hops per second in each channel (1 time slot TX, 1 time slot RX). So, the dwell time is the time duration of the pulse times $10.12 \times 31.6 = 320$ within 31.6 seconds
- j. DH3 Packet permit maximum 1600 / 79 / 4 = 5.06 hops per second in each channel (3 time slots TX, 1 time slot RX). So, the dwell time is the time duration of the pulse times $5.06 \times 31.6 = 160$ within 31.6 seconds
- k. DH5 Packet permit maximum 1600/ 79 / 6 = 3.37 hops per second in each channel (5 time slots TX, 1 time slot RX). So, the dwell time is the time duration of the pulse times 3.37 x 31.6 = 106.6 within 31.6 seconds

6.3 DEVIATION FROM STANDARD

No deviation.

6.4 TEST SETUP



6.5 EUT OPERATION CONDITIONS

The EUT tested system was configured as the statements of 4.5 unless otherwise a special operating condition is specified in the follows during the testing.

6.6 TEST RESULTS

Please refer to the APPENDIX F



7. HOPPING CHANNEL SEPARATION MEASUREMENT

7.1 LIMIT

Frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

Spectrum Parameter	Setting	
Attenuation	Auto	
Span Frequency	> Measurement Bandwidth or Channel Separation	
RBW	30 kHz	
VBW	100 kHz	
Detector	Peak	
Trace	Max Hold	
Sweep Time	Auto	

7.2 TEST PROCEDURE

- a. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below.
- b. Span = wide enough to capture the peaks of two adjacent channels Resolution (or IF) Bandwidth (RBW) ≥ 1% of the span Video (or Average) Bandwidth (VBW) ≥ RBW Sweep = Auto Detector function = Peak Trace = Max Hold

7.3 DEVIATION FROM STANDARD

No deviation.

7.4 TEST SETUP



SPECTRUM ANALYZER

7.5 EUT OPERATION CONDITIONS

The EUT tested system was configured as the statements of 4.5 unless otherwise a special operating condition is specified in the follows during the testing.

7.6 TEST RESULTS

Please refer to the APPENDIX G



8. BANDWIDTH TEST

8.1 LIMIT

FCC Part15, Subpart C (15.247)		
Section	Test Item	
15.247(a)(1)	Bandwidth	

Spectrum Parameter	Setting
Attenuation	Auto
Span Frequency	> Measurement Bandwidth
RBW	30 kHz
VBW	100 kHz
Detector	Peak
Trace	Max Hold
Sweep Time	Auto

8.2 TEST PROCEDURE

a. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below.

b. Spectrum Setting: RBW= 30 kHz, VBW=100 kHz, Sweep Time = Auto.

8.3 DEVIATION FROM STANDARD

No deviation.

8.4 TEST SETUP



8.5 EUT OPERATION CONDITIONS

The EUT tested system was configured as the statements of 4.5 unless otherwise a special operating condition is specified in the follows during the testing.

8.6 TEST RESULTS

Please refer to the APPENDIX H



9. MAXIMUM OUTPUT POWER & E.I.R.P. TEST

9.1 LIMIT

FCC Part15 , Subpart C (15.247)		
Section	Test Item	Limit
15.247(a)(1)	Maximum Output Power	0.125 Watt or 21 dBm

Note: Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have

hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB band width of the hopping channel, whichever is greater, provided the systems operate with an output

power no greater than 125 mW.

9.2 TEST PROCEDURE

- a. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below.
- b. Spectrum Setting: RBW= 1 MHz/3 MHz, VBW= 1 MHz/3 MHz, Sweep time = Auto.

9.3 DEVIATION FROM STANDARD

No deviation.

9.4 TEST SETUP



9.5 EUT OPERATION CONDITIONS

The EUT tested system was configured as the statements of 4.5 unless otherwise a special operating condition is specified in the follows during the testing.

9.6 TEST RESULTS

Please refer to the APPENDIX I



10. CONDUCTED SPURIOUS EMISSION

10.1 LIMIT

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak Output Power limits. If the transmitter complies with the Output Power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

10.2 TEST PROCEDURE

- a. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below.
- b. Spectrum Setting: RBW= 100 kHz, VBW=100 kHz, Sweep time = Auto.

10.3 DEVIATION FROM STANDARD

No deviation.

10.4 TEST SETUP

EUT	SPECTRUM
	ANALYZER

10.5 EUT OPERATION CONDITIONS

The EUT tested system was configured as the statements of 4.5 unless otherwise a special operating condition is specified in the follows during the testing.

10.6 TEST RESULTS

Please refer to the APPENDIX J



11. MEASUREMENT INSTRUMENTS LIST

	AC Power Line Conducted Emissions									
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until					
1	Line Impedance Stabilisation Network	Schwarzbeck	NNLK 8121	8121-822	Mar. 29, 2020					
2	TWO-LINE V-NETWORK	R&S	ENV216	101340	Nov. 20, 2019					
3	Test Cable	emci	EMCRG400-BM- NM-10000	170628	Apr. 17, 2020					
4	EMI Test Receiver	R&S	ESCI	100082	Mar. 29, 2020					
5	50Ω Terminator	SHX	TF2-1G-A	17051602	Mar. 29, 2020					
6	50Ω coaxial switch	Anritsu	MP59B	6201750902	Mar. 29, 2020					
7	Measurement Software	Farad	EZ-EMC Ver.NB-03A1-01	N/A	N/A					

	Radiated Emissions - 9 kHz to 30 MHz									
Item	Kind of Equipment	Serial No.	Calibrated until							
1	Loop Antenna	EMCI	EMCI LPA600	275	Mar. 29, 2020					
2	EMI Test Receiver	R&S	ESCI	100082	Mar. 29, 2020					
3	3 Measurement Software Farad		EZ-EMC Ver.NB-03A1-01	N/A	N/A					

	Radiated Emissions - 30 MHz to 1 GHz								
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until				
1	TRILOG Broadband	Schwarzbeck	VULB 9168	719	Mar. 29, 2020				
2	Pre-Amplifier	emci	EMC9135	980400	Mar. 29, 2020				
3	MXE EMI Receiver	Keysight	N9038A	MY57150106	Mar. 29, 2020				
4	Test Cable	emci	EMC104-SM-SM- 7000	170330	Apr. 17, 2020				
5	Test Cable	emci	EMC104-SM-SM- 1000	170331	Apr. 17, 2020				
6	Test Cable	emci	EMC104-SM-NM- 3500	170621	Apr. 17, 2020				
7	Measurement Software	Farad	EZ-EMC Ver.NB-03A1-01	N/A	N/A				



	Radiated Emissions - Above 1 GHz								
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until				
1	Double-Ridged Waveguide Horn Antenna	ETS-Lindgren	9120D	00206960	Mar. 29, 2020				
2	Pre-Amplifier	emci	EMC012645SE	980421	Mar. 29, 2020				
3	EXA Spectrum Analyzer	Keysight	N9010A	MY56480545	Mar. 29, 2020				
4	Test Cable	emci	EMC104-SM-SM- 7000	170330	Apr. 17, 2020				
5	Test Cable	emci	EMC104-SM-SM- 1000	170331	Apr. 17, 2020				
6	Test Cable	emci	EMC104-SM-NM- 3500	170621	Apr. 17, 2020				
7	Measurement Software	Farad	EZ-EMC Ver.NB-03A1-01	EZ-EMC Ver.NB-03A1-01 N/A					
8	MXE EMI Receiver	Keysight	N9038A	MY57150106	Mar. 29, 2020				

Number of Hopping Frequency								
Item	tem Kind of Equipment Manufacturer Type No. Serial No. Calibrated u							
1	Spectrum Analyzer	100626	Mar. 29, 2020					

Average Time of Occupancy								
Item	em Kind of Equipment Manufacturer Type No. Serial No. Calibrated unti							
1 Spectrum Analyzer R&S FSP40 100626 Mar. 29, 2								

Hopping Channel Separation Measurement									
Item	em Kind of Equipment Manufacturer Type No. Serial No. Calibrated unti								
1 Spectrum Analyzer R&S FSP40 100626 Mar. 29,									

	Bandwidth									
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until					
1	Spectrum Analyzer	R&S	FSP40	100626	Mar. 29, 2020					

Maximum Output Power								
Item	Item Kind of Equipment Manufacturer Type No. Serial No. Calibrated ur							
1 Spectrum Analyzer R&S FSP40 100626 Ma								

Antenna Conducted Spurious Emission								
Item	Item Kind of Equipment Manufacturer Type No. Serial No. Calibrated							
1	Spectrum Analyzer	R&S	FSP40	100626	Mar. 29, 2020			

Remark: "N/A" denotes no model name, serial no. or calibration specified.

All calibration period of equipment list is one year.



APPENDIX A - AC POWER LINE CONDUCTED EMISSIONS





No. Mk.	Freq.	Level	Factor	ment	Limit	Margin		
	MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1	0.1635	31.80	9.78	41.58	65.28	-23.70	QP	
2	0.1635	22.90	9.78	32.68	55.28	-22.60	AVG	
3	0.1860	29.60	9.81	39.41	64.21	-24.80	QP	
4	0.1860	19.20	9.81	29.01	54.21	-25.20	AVG	
5	0.3570	17.60	9.87	27.47	58.80	-31.33	QP	
6	0.3570	13.70	9.87	23.57	48.80	-25.23	AVG	
7	0.8700	17.80	9.82	27.62	56.00	-28.38	QP	
8	0.8700	16.60	9.82	26.42	46.00	-19.58	AVG	
9	7.4355	20.90	10.14	31.04	60.00	-28.96	QP	
10	7.4355	16.90	10.14	27.04	50.00	-22.96	AVG	
11	14.9820	27.60	10.07	37.67	60.00	-22.33	QP	
12 *	14.9820	23.70	10.07	33.77	50.00	-16.23	AVG	

- Measurement Value = Reading Level + Correct Factor.
 Margin Level = Measurement Value Limit Value.





No. Mk.	Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Margin		
	MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1	0.1635	29.00	9.59	38.59	65.28	-26.69	QP	
2	0.1635	21.00	9.59	30.59	55.28	-24.69	AVG	
3	0.2175	20.20	9.68	29.88	62.91	-33.03	QP	
4	0.2175	12.00	9.68	21.68	52.91	-31.23	AVG	
5	0.4785	18.50	9.81	28.31	56.37	-28.06	QP	
6	0.4785	16.40	9.81	26.21	46.37	-20.16	AVG	
7	0.8700	13.20	9.75	22.95	56.00	-33.05	QP	
8	0.8700	12.30	9.75	22.05	46.00	-23.95	AVG	
9	6.1845	15.90	10.10	26.00	60.00	-34.00	QP	
10	6.1845	11.90	10.10	22.00	50.00	-28.00	AVG	
11	15.8145	24.50	10.11	34.61	60.00	-25.39	QP	
12 *	15.8145	20.70	10.11	30.81	50.00	-19.19	AVG	

- (1) Measurement Value = Reading Level + Correct Factor.
- (2) Margin Level = Measurement Value Limit Value.



APPENDIX B - RADIATED EMISSION - 9 KHZ-30 MHZ





- (1) Measurement Value = Reading Level + Correct Factor.
- (2) Margin Level = Measurement Value Limit Value.

3TL



- (1) Measurement Value = Reading Level + Correct Factor.
- (2) Margin Level = Measurement Value Limit Value.





- (1) Measurement Value = Reading Level + Correct Factor.
- (2) Margin Level = Measurement Value Limit Value.



Test Mode: TX Mode Ant 90° 160.0 dBuV/m 150 140 130 120 110 100 90 80 70 60 2 50 1 X з ain. 40 30 20 10 0.0 (MHz) 30.000 0.150 0.5 5 Correct Reading Measure-Limit No. Mk. Freq. Level Factor Margin ment MHz dBuV dB dBuV/m dBuV/m dB Detector Comment 0.3525 -3.80 43.75 1 47.55 96.66 -52.91 AVG 2 1.7790 5.54 39.33 44.87 69.54 -24.67 QP * 14.7930 5.42 43.48 3 38.06 69.54 -26.06 QP

- (1) Measurement Value = Reading Level + Correct Factor.
- (2) Margin Level = Measurement Value Limit Value.



APPENDIX C - RADIATED EMISSION - 30 MHZ TO 1000 MHZ





- (1) Measurement Value = Reading Level + Correct Factor.
- (2) Margin Level = Measurement Value Limit Value.




6

941.8000 31.82

(1) Measurement Value = Reading Level + Correct Factor.

-5.19

26.63

46.00

Peak

-19.37

APPENDIX D - RADIATED EMISSION - ABOVE 1000 MHZ



3

4 *

2401.9000 60.27

2401.9000 59.24

(1) Measurement Value = Reading Level + Correct Factor.

32.43

32.43

92.70

91.67

74.00

54.00

18. 7**0**

37.67

Peak

NO limit

AVG





- (1) Measurement Value = Reading Level + Correct Factor.
- (2) Margin Level = Measurement Value Limit Value.





		u					2000001	· · · · · · · · · · · · · · · · · · ·
1	2390.0000	21.36	32.39	53.75	74.00	-20.25	Peak	
2	2390.0000	5. 9 7	32.39	38.36	54. 00	-15.64	AVG	
3 *	2401.9000	59.46	32.43	91.89	54. 00	37.89	AVG	NO limit
4	2401.9500	61.46	32.43	93.89	74.00	19.89	Peak	NO limit

- (1) Measurement Value = Reading Level + Correct Factor.
- (2) Margin Level = Measurement Value Limit Value.





- (1) Measurement Value = Reading Level + Correct Factor.
- (2) Margin Level = Measurement Value Limit Value.





(1) Measurement Value = Reading Level + Correct Factor.





- (1) Measurement Value = Reading Level + Correct Factor.
- (2) Margin Level = Measurement Value Limit Value.





- (1) Measurement Value = Reading Level + Correct Factor.
- (2) Margin Level = Measurement Value Limit Value.





- (1) Measurement Value = Reading Level + Correct Factor.
- (2) Margin Level = Measurement Value Limit Value.





	MHz	dBuV/m	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1	2479.8500	62.22	32. 65	94.87	74.00	20.87	Peak	NO limit
2 *	2479.9000	60.23	32. 65	92.88	54. 00	38.88	AVG	NO limit
3	2483. 5000	21.70	32.66	54.36	74.00	-1 9.64	Peak	
4	2483. 5000	5. 65	32.66	38.31	54. 00	-15. 69	AVG	

(1) Measurement Value = Reading Level + Correct Factor.





- (1) Measurement Value = Reading Level + Correct Factor.
- (2) Margin Level = Measurement Value Limit Value.





	-	Level	ractor	ment		-		
	MHz	dBuV/m	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1	2479.8500	<mark>61.8</mark> 1	32.65	94.46	74.00	20.46	Peak	NO limit
2 *	2479.8500	59.73	32.65	92.38	54.00	38.38	AVG	NO limit
3	2483. 5000	21.54	32.66	54.20	74.00	-19.80	Peak	
4	2483. 5000	5. 56	32.66	38.22	54.00	-15.78	AVG	

- (1) Measurement Value = Reading Level + Correct Factor.
- (2) Margin Level = Measurement Value Limit Value.





- (1) Measurement Value = Reading Level + Correct Factor.
- (2) Margin Level = Measurement Value Limit Value.





	1112	abat/m	ub	ubut/m	ubut/m	ub	0000001	00mm0110
1	2390.0000	20. 53	32.39	52.92	74.00	-21.08	Peak	
2	2390.0000	5.61	32.39	38.00	54. 00	-16.00	AVG	
3 *	2402.0500	58. <u>68</u>	32.43	91.11	54.00	37.11	AVG	NO limit
4	2402.1500	61.15	32.43	93.58	74.00	19.58	Peak	NO limit

(1) Measurement Value = Reading Level + Correct Factor.





- (1) Measurement Value = Reading Level + Correct Factor.
- (2) Margin Level = Measurement Value Limit Value.





	2000.0000 0.0	01 52.	JJ JO. 00	J J1.00	10.0	0 410		
	2402.0500 50.	. 20 32.	43 82.63	3 74.00	8.63	Peak	NO	limit
*	2402.0500 48.	. 71 32.	43 81. 14	4 54.00	27.14	AVG	NO	limit

- (1) Measurement Value = Reading Level + Correct Factor.
- (2) Margin Level = Measurement Value Limit Value.





- (1) Measurement Value = Reading Level + Correct Factor.
- (2) Margin Level = Measurement Value Limit Value.





(1) Measurement Value = Reading Level + Correct Factor.





- (1) Measurement Value = Reading Level + Correct Factor.
- (2) Margin Level = Measurement Value Limit Value.





- (1) Measurement Value = Reading Level + Correct Factor.
- (2) Margin Level = Measurement Value Limit Value.





- (1) Measurement Value = Reading Level + Correct Factor.
- (2) Margin Level = Measurement Value Limit Value.





-20. 93

-15.14

Peak

AVG

74.00

54.00

REMARKS:

3

4

2483. 5000 20. 41

2483. 5000 6. 20

(1) Measurement Value = Reading Level + Correct Factor.

32.66

32.66

53.07

38.86





- (1) Measurement Value = Reading Level + Correct Factor.
- (2) Margin Level = Measurement Value Limit Value.





	MHz	dBuV/m	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1 *	2480.0000	56.20	32.65	88.85	54.00	34.85	AVG	NO limit
2	2480.0500	59.0 5	32.65	91.70	74.00	17.70	Peak	NO limit
3	2483. 5000	21.35	32.66	54.0 1	74.00	-19.99	Peak	
4	2483. 5000	6.04	32.66	38.70	54.00	-15. 30	AVG	

- (1) Measurement Value = Reading Level + Correct Factor.
- (2) Margin Level = Measurement Value Limit Value.





(1) Measurement Value = Reading Level + Correct Factor.



APPENDIX E - NUMBER OF HOPPING FREQUENCY





Date: 3.SEP.2019 11:09:15





APPENDIX F - AVERAGE TIME OF OCCUPANCY





Test Mode:	TX Mode_1Mbps				
	1			1	
Data Daakat	Frequency	Pulse Duration	Dwell Time	Limits	Toot Dooult
Dala Packel	(MHz)	(ms)	(s)	(s)	Test Result
DH1	2402	0.3800	0.1216	0.4000	Pass
DH3	2402	1.6400	0.2624	0.4000	Pass
DH5	2402	2.9200	0.3115	0.4000	Pass
DH1	2441	0.3850	0.1232	0.4000	Pass
DH3	2441	1.6400	0.2624	0.4000	Pass
DH5	2441	2.8800	0.3072	0.4000	Pass
DH1	2480	0.3800	0.1216	0.4000	Pass
DH3	2480	1.6400	0.2624	0.4000	Pass
DH5	2480	2.8800	0.3072	0.4000	Pass











Test Mode:	TX Mode_3Mbps				
				1	1
Data Backot	Fraguanay	Pulse	Dwell	Limite(c)	Tost Posult
Dala Fackel	Frequency	Duration(ms)	Time(s)		Test Result
3DH1	2402	0.3750	0.1200	0.4000	Pass
3DH3	2402	1.6200	0.2592	0.4000	Pass
3DH5	2402	2.8800	0.3072	0.4000	Pass
3DH1	2441	0.3850	0.1232	0.4000	Pass
3DH3	2441	1.6400	0.2624	0.4000	Pass
3DH5	2441	2.9200	0.3115	0.4000	Pass
3DH1	2480	0.3850	0.1232	0.4000	Pass
3DH3	2480	1.6400	0.2624	0.4000	Pass
3DH5	2480	2.9200	0.3115	0.4000	Pass







APPENDIX G - HOPPING CHANNEL SEPARATION MEASUREMENT



Fest Mode: Hopping on _1Mbps								
Channel	Frequency	Channel Separation	2/3 of 20 dB Bandwidth					
Channel	(MHz)	(MHz)	(MHz)	Test Result				
00	2402	1.005	0.448	Pass				
39	2441	1.005	0.501	Pass				
78	2480	1.002	0.432	Pass				







Date: 3.5EP.2019 11:05:16

Date: 3.SEP.2019 11:06:23

Date: 3.SEP.2019 11:07:27



Test Mode: Hopping on _3Mbps								
Channel	Frequency	Channel Separation	2/3 of 20 dB Bandwidth	Test Desult				
Channel	(MHz)	(MHz)	(MHz)	Test Result				
00	2402	1.003	0.725	Pass				
39	2441	1.003	0.719	Pass				
78	2480	1.002	0.733	Pass				







Date: 3.SEP.2019 11:43:33

Date: 3.SEP.2019 11:44:41

Date: 3.SEP.2019 11:45:44


APPENDIX H - BANDWIDTH





Te	est Mode: TX	Mode _1Mbps		
	Channel	Frequency	20 dB Bandwidth	99 % Emission
	Channel	(MHz)	(MHz)	Bandwidth (MHz)
	00	2402	0.672	0.784
	39	2441	0.752	0.792
	78	2480	0.648	0.752







Date: 3.5EP.2019 10:55:48

Date: 3.SEP.2019 10:58:19

Date: 3.SEP.2019 11:00:51



Test Mode: TX Mode _3Mbps Channel Frequency (MHz) 20 dB Bandwidth (MHz) 99 % Emission Bandwidth (MHz)

00	2402	1.088	1.036
39	2441	1.078	1.052
78	2480	1.100	1.056







Date: 3.5EP.2019 11:33:32

Date: 3.SEP.2019 11:35:39

Date: 3.SEP.2019 11:36:55



APPENDIX I - MAXIMUM OUTPUT POWER & E.I.R.P.





78

Т	Test Mode: TX Mode _1Mbps						
	Channel	Frequency	Output Power	Output Power	Max. Limit	Max. Limit	Test
		(MHz)	(dBm)	(VV)	(dBm)	(W)	Result
	00	2402	5.53	0.0036	21.00	0.125	Pass
	39	2441	4.37	0.0027	21.00	0.125	Pass

0.0046

21.00

Date: 3.SEP.2019 10:49:16



2480





0.125

Pass

Date: 3.SEP.2019 10:48:21

Date: 3.5EP.2019 10:48:43

6.61



Channel	Frequency	Output Power	Output Power	Max. Limit	Max. Limit	Test
Channel	(MHz)	(dBm)	(VV)	(dBm)	(W)	Result
00	2402	4.13	0.0026	21.00	0.125	Pass
39	2441	2.87	0.0019	21.00	0.125	Pass
78	2480	5.35	0.0034	21.00	0.125	Pass





Date: 3.SEP.2019 16:50:32



Date: 3.5EP.2019 17:03:09

Date: 3.SEP.2019 16:59:26



APPENDIX J - CONDUCTED SPURIOUS EMISSION







Date: 3.SEP.2019 10:55:08



Date: 3.SEP.2019 11:10:05

Hopping on mode (Upper)



Date: 3.SEP.2019 11:10:56





Date: 3.SEP.2019 11:01:04

Date: 3.5EP.2019 11:01:11

Date: 3.SEP.2019 11:01:18





Bandedge CH78 (Upper)



Date: 3.SEP.2019 11:36:18

Date: 3.SEP.2019 11:33:02

Date: 3.SEP.2019 11:48:07



Hopping on mode (Upper)



Date: 3.SEP.2019 11:48:41



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Date: 3.SEP.2019 11:37:08

Date: 3.SEP.2019 11:37:15

Date: 3.SEP.2019 11:37:22

End of Test Report