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Report On

FCC and Industry Canada Testing of the
Frontier Silicon Ltd Minuet/FS5332

In accordance with FCC 47 CFR Part 15, Industry Canada RSS-247
and Industry Canada RSS-GEN

COMMERCIAL-IN-CONFIDENCE

FCC ID: YYX-FS5332

IC: 11458A-FS5332

Document 75934517 Report 09 Issue 3

July 2016



Product Service

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Document 75934517 Report 09 Issue 3

July 2016

PREPARED FOR

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Ryan Henley
Authorised Signatory

DATED

29 July 2016

This report has been up-issued to Issue 3 to amend the FCC and IC ID's.

ENGINEERING STATEMENT

The measurements shown in this report were made in accordance with the procedures described on test pages. All reported testing was carried out on a sample equipment to demonstrate limited compliance with FCC 47 CFR Part 15, Industry Canada RSS-247 and Industry Canada RSS-GEN. The sample tested was found to comply with the requirements defined in the applied rules.

Test Engineer(s);

G Lawler





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SECTION 1

REPORT SUMMARY

FCC and Industry Canada Testing of the
Frontier Silicon Ltd Minuet/FS5332
In accordance with FCC 47 CFR Part 15, Industry Canada RSS-247
and Industry Canada RSS-GEN



1.1 INTRODUCTION

The information contained in this report is intended to show the verification of FCC and Industry Canada Testing of the Frontier Silicon Ltd Minuet/FS5332 to the requirements of FCC 47 CFR Part 15, Industry Canada RSS-247 and Industry Canada RSS-GEN.

Objective	To perform FCC and Industry Canada Testing to determine the Equipment Under Test's (EUT's) compliance with the Test Specification, for the series of tests carried out.
Manufacturer	Frontier Silicon Ltd
Model Number(s)	Minuet/FS5332
Serial Number(s)	RAD108621 (Module) & RAD108181 (Platform) - Radiated RAD108624 (Module), RAD108703 (Platform) and RAD108757 (Adaptor Board) - Radiated
Number of Samples Tested	2
Test Specification/Issue/Date	FCC 47 CFR Part 15 (2015) Industry Canada RSS-247 (Issue 1, 2015) Industry Canada RSS-GEN (Issue 4, 2014)
Incoming Release Date	Application Form 27 June 2016 and 11 July 2016
Disposal Reference Number Date	Held Pending Disposal Not Applicable Not Applicable
Order Number Date	FS160438 08 April 2016
Start of Test	5 July 2016
Finish of Test	10 July 2016
Name of Engineer(s)	G Lawler
Related Document(s)	KDB 789033 D02 General UNII Test Procedures New Rules v01 ETSI TR 100 028 (2001) ANCI C63.10 (2013)



Product Service

1.2 BRIEF SUMMARY OF RESULTS

A brief summary of the tests carried out in accordance with FCC 47 CFR Part 15, Industry Canada RSS-247 and Industry Canada RSS-GEN is shown below.

Section	Specification Clause			Test Description	Result	Comments/Base Standard
	Part 15	RSS-247	RSS-GEN			
Bluetooth and RLAN Simultaneous Transmission						
2.1	15.207	-	8.8	AC Line Conducted Emissions	Pass	
2.2	15.407 (b), 15.205, 15.209 and 15.247 (d)	6.2	-	Spurious Radiated Emissions	Pass	



1.3 APPLICATION FORM

EQUIPMENT DESCRIPTION	
Model Name/Number	Minuet/FS5332
Part Number	HA-FS5332-xxxxxx (where xxxxxx denotes the customer variant eg HA-FS5332-000001)
Hardware Version	Rev6
Software Version	NS1.0.13
FCC ID (if applicable)	YYX-FS5332
Industry Canada ID (if applicable)	11458A-FS5332
Technical Description (Please provide a brief description of the intended use of the equipment)	Minuet is a module, which when installed in a consumer audio product enables high-quality audio streaming over Wi-Fi, Bluetooth and Ethernet.

Types of Modulations used by the Equipment		
☒	FHSS	
☒	Other forms of modulation	
In case of FHSS Modulation		
In case of non-Adaptive Frequency Hopping equipment:		
Number of Hopping Frequencies: N/A		
In case of Adaptive Frequency Hopping Equipment:		
Maximum number of Hopping Frequencies: 79		
Minimum number of Hopping Frequencies: 20		
Dwell Time:		
Packet Type	Dwell Time ms (Adaptive)	Dwell Time ms (Non-adaptive)
XDH1	1.25	
XDH3	2.50	
XDH5	3.75	
Minimum Channel Occupation Time: Adaptive = 1.25ms, Non-Adaptive = 0.625		
Adaptive / non-adaptive equipment:		
☐	non-adaptive Equipment	
☒	adaptive Equipment without the possibility to switch to a non-adaptive mode	
☐	adaptive Equipment which can also operate in a non-adaptive mode	
In case of adaptive equipment:		
The Channel Occupancy Time implemented by the equipment: 12.5 ms		
☒	The equipment has implemented an LBT based DAA mechanism	
In case of equipment using modulation different from FHSS:		
☒	The equipment is Frame Based equipment	
☒	The equipment is Load Based equipment	
☐	The equipment can switch dynamically between Frame Based and Load Based equipment	
The CCA time implemented by the equipment: 20 µs		
☒	The equipment has implemented an non-LBT based DAA mechanism	
☐	The equipment can operate in more than one adaptive mode	



In case of non-adaptive Equipment:	
The maximum RF Output Power (e.i.r.p.): N/A dBm	
The maximum (corresponding) Duty Cycle: N/A %	
Equipment with dynamic behaviour, that behaviour is described here. (e.g. the different combinations of duty cycle and corresponding power levels to be declared):	
The worst case operational mode for each of the following tests:	
RF Output Power: BT:DH5, 802.11b:1Mbps, 802.11g:12Mbps, 802.11n(20MHz):MCS7, 802.11n(40MHz):MCS0	
Power Spectral Density: 802.11b:1Mbps, 802.11g:12Mbps, 802.11n(20MHz):MCS7, 802.11n(40MHz):MCS0	
Duty cycle, Tx-Sequence, Tx-gap: N/A	
Accumulated Transmit Time, Frequency Occupation & Hopping Sequence (only for FHSS equipment): BT:DH5/DH3/DH1	
Hopping Frequency Separation (only for FHSS equipment): BT:DH5/2DH5/3DH5	
Medium Utilisation: N/A	
Adaptivity & Receiver Blocking: 802.11b:1Mbps, 802.11g:6Mbps, 802.11n::MCS0	
Nominal Channel Bandwidth: BT:DH5/2DH5/3DH5, 802.11b:1Mbps, 802.11g:12Mbps, 802.11n(20MHz):MCS7, 802.11n(40MHz):MCS0	
Transmitter unwanted emissions in the OOB domain: BT:DH5, 802.11b:1Mbps, 802.11g:12Mbps, 802.11n(20MHz):MCS7, 802.11n(40MHz):MCS0	
Transmitter unwanted emissions in the spurious domain: BT:DH5, 802.11b:1Mbps, 802.11g:12Mbps, 802.11n(20MHz):MCS7, 802.11n(40MHz):MCS0	
Receiver spurious emissions: BT:DH5, 802.11b:1Mbps, 802.11g:12Mbps, 802.11n(20MHz):MCS7, 802.11n(40MHz):MCS0	
The different transmit operating modes (tick all that apply):	
☒	Operating mode 1: Single Antenna Equipment
☐	Equipment with only 1 antenna
☒	Equipment with 2 diversity antennas but only 1 antenna active at any moment in time
☐	Smart Antenna Systems with 2 or more antennas, but operating in a (legacy) mode where only 1 antenna is used. (e.g. IEEE 802.11™ [2012] legacy mode in smart antenna systems)
☐	Operating mode 2: Smart Antenna Systems - Multiple Antennas without beam forming
☐	Single spatial stream / Standard throughput / (e.g. IEEE 802.11™ [2012] legacy mode)
☐	High Throughput (> 1 spatial stream) using Nominal Channel Bandwidth 1
☐	High Throughput (> 1 spatial stream) using Nominal Channel Bandwidth 2
☐	High Throughput (> 1 spatial stream) using Nominal Channel Bandwidth 3
☐	High Throughput (> 1 spatial stream) using Nominal Channel Bandwidth 4
☐	High Throughput (> 1 spatial stream) using Nominal Channel Bandwidth 5
NOTE: Add more lines if more channel bandwidths are supported.	
☐	Operating mode 3: Smart Antenna Systems - Multiple Antennas with beam forming
☐	Single spatial stream / Standard throughput (e.g. IEEE 802.11™ [2012] legacy mode)
☐	High Throughput (> 1 spatial stream) using Nominal Channel Bandwidth 1
☐	High Throughput (> 1 spatial stream) using Nominal Channel Bandwidth 2
☐	High Throughput (> 1 spatial stream) using Nominal Channel Bandwidth 3
☐	High Throughput (> 1 spatial stream) using Nominal Channel Bandwidth 4
☐	High Throughput (> 1 spatial stream) using Nominal Channel Bandwidth 5
NOTE: Add more lines if more channel bandwidths are supported.	



In case of Smart Antenna Systems:		
The number of Receive chains:		
The number of Transmit chains:		
☐	symmetrical power distribution	
☐	asymmetrical power distribution	
In case of beam forming, the maximum (additional) beam forming gain: dB		
<i>NOTE: The additional beam forming gain does not include the basic gain of a single antenna.</i>		
Operating Frequency Range(s) of the equipment:		
Operating Frequency Range 1: 2400 MHz to 2483.5 MHz		
Operating Frequency Range 2:	MHz to	MHz
Operating Frequency Range 3:	MHz to	MHz
<i>NOTE: Add more lines if more Frequency Ranges are supported.</i>		
Nominal Channel Bandwidth(s):		
Nominal Channel Bandwidth1: BT: 1 - 2 MHz		
Nominal Channel Bandwidth2: 802.11b,g,n: 20 - 40 MHz		
Nominal Channel Bandwidth3:	MHz	
Nominal Channel Bandwidth4:	MHz	
Nominal Channel Bandwidth5:	MHz	
<i>NOTE: Add more lines if more channel bandwidths are supported.</i>		
Type of Equipment (stand-alone, combined, plug-in radio device, etc.):		
☐	Stand-alone	
☐	Combined Equipment (Equipment where the radio part is fully integrated within another type of equipment)	
☒	Plug-in radio device (Equipment intended for a variety of host systems)	
☐	Other	
The extreme operating conditions that apply to the equipment:		
Operating temperature range: 0 °C to +70 °C		
Details provided are for the:		
☐	stand-alone equipment	
☒	combined (or host) equipment	
☒	test jig	



The intended combination(s) of the radio equipment power settings and one or more antenna assemblies and their corresponding e.i.r.p levels:			
Antenna Type:			
☐ Integral Antenna			
Antenna Gain: dBi			
If applicable, additional beamforming gain (excluding basic antenna gain): dB			
☐ Temporary RF connector provided			
☐ No temporary RF connector provided			
☒ Dedicated Antennas (equipment with antenna connector)			
☐ Single power level with corresponding antenna(s)			
☐ Multiple power settings and corresponding antenna(s)			
Number of different Power Levels: 2			
Power Level 1: As reported dBm			
Power Level 2: As reported dBm			
Power Level 3: dBm			
<i>NOTE 1: Add more lines in case the equipment has more power levels.</i>			
<i>NOTE 2: These power levels are conducted power levels (at antenna connector).</i>			
For each of the Power Levels, provide the intended antenna assemblies, their corresponding gains (G) and the resulting e.i.r.p. levels also taking into account the beamforming gain (Y) if applicable			
Power Level 1: As reported dBm			
Number of antenna assemblies provided for this power level:			
Assembly #	Gain (dBi)	e.i.r.p (dBm)	Part number or model number
1	2.3	WLAN:20 BT:9.9	N12-2128-R0A SW700M (SW750M)
2	1.9	WLAN:20 BT:9.9Bm	RFPCA431223IMLB301
3			
4			
<i>NOTE: Add more rows in case more antenna assemblies are supported for this power level.</i>			
Power Level 2: dBm			
Number of antenna assemblies provided for this power level:			
Assembly #	Gain (dBi)	e.i.r.p (dBm)	Part number or model number
1			
2			
3			
4			
<i>NOTE: Add more rows in case more antenna assemblies are supported for this power level.</i>			
Power Level 3: dBm			
Number of antenna assemblies provided for this power level:			
Assembly #	Gain (dBi)	e.i.r.p (dBm)	Part number or model number
1			
2			
3			
4			
<i>NOTE: Add more rows in case more antenna assemblies are supported for this power level.</i>			



The nominal voltages of the stand-alone radio equipment or the nominal voltages of the combined (host) equipment or test jig in case of plug-in devices:	
Details provided are for the: ☐ stand-alone equipment	
☒ combined (or host) equipment	
☒ test jig	
Supply Voltage ☐ AC mains	State AC voltage V
☒ DC	State DC voltage 5 V
In case of DC, indicate the type of power source	
☐ Internal Power Supply	
☒ External Power Supply or AC/DC adapter	
☐ Battery	
☐ Other:	
Describe the test modes available which can facilitate testing:	
Continuous transmit test modes for Bluetooth and WLAN testing	
The equipment type (e.g. Bluetooth®, IEEE 802.11™ [2012] IEEE 802.15.4™ [2011], proprietary, etc.):	
Burst mode with >90% Duty Cycle	
If applicable, the statistical analysis referred in clause 5.3.1 q)	
To be provided as separate attachment, please state document name:	
If applicable, the statistical analysis referred in clause 5.3.1 r)	
To be provided as separate attachment, please state document name:	
Geo-location capability supported by the equipment:	
☐ Yes	
☐ The geographical location determined by the equipment as defined in clause 4.3.1.13.2 or clause 4.3.2.12.2 is not accessible to the user.	
☒ No	
Combination for testing (see clause 5.1.3.3 of EN 300 328 V1.9.1)	
From all combinations of conducted power settings and intended antenna assembly(ies) specified in clause 3.1 m), specify the combination resulting in the highest e.i.r.p. for the radio equipment.	
Unless otherwise specified in ETSI EN 300 328, this power setting is to be used for testing against the requirements of ETSI EN 300 328. In case there is more than one such conducted power setting resulting in the same (highest) e.i.r.p. level, the highest power setting is to be used for testing. See also ETS EN 300 328, clause 5.1.3.3.	
Highest overall e.i.r.p. value: dBm	
Corresponding Antenna assembly gain: dBi	Antenna Assembly #:
Corresponding conducted power setting: dB (also the power level to be used for testing)	Listed as Power Setting #:
Additional information provided by the applicant	
Modulation	
ITU Class(es) of emission: F1B	
Can the transmitter operate unmodulated? ☐ Yes ☒ No	
Duty Cycle	
The transmitter is intended for:	
☐ Continuous duty	
☒ Intermittent duty	
☐ Continuous operation possible for testing purposes	



Product Service

About the UUT	
☐	The equipment submitted are representative production models
☒	If not, the equipment submitted are pre-production models?
☒	If pre-production equipment are submitted, the final production equipment will be identical in all respects with the equipment tested
☐	If not, supply full details
☐	The equipment submitted is CE marked
☐	In addition to the CE mark, the Class-II identifier (Alert Sign) is affixed.
Additional items and/or supporting equipment provided	
☐	Spare batteries (e.g. for portable equipment)
☐	Battery charging device
☒	External Power Supply or AC/DC adapter
☒	Test Jig or interface box
☐	RF test fixture (for equipment with integrated antennas)
☐	Host System
	Manufacturer
	Model
	Model Name
☐	Combined equipment
	Manufacturer
	Model
	Model Name
☐	User Manual
☐	Technical documentation (Handbook and circuit diagrams)

I hereby declare that that the information supplied is correct and complete.

Name: Abdul Wahed Dewan Position held: Principal RF Engineer

Date: 27/06/2016



Product Service

EQUIPMENT DESCRIPTION	
Model Name/Number	Minuet/FS5332
Part Number	HA-FS5332-xxxxxx (where xxxxxx denotes the customer variant eg HA-FS5332-000001)
Hardware Version	Rev6
Software Version	NS1.0.13
FCC ID (if applicable)	YYX-FS5332
Industry Canada ID (if applicable)	11458A-FS5332
Technical Description (Please provide a brief description of the intended use of the equipment)	Minuet is a module, which when installed in a consumer audio product enables high-quality audio streaming over Wi-Fi, Bluetooth and Ethernet.

INFORMATION REQUIRED	
Modes:	
☒ 802.11(a)	☒ 802.11(ac)
☒ 802.11(n)	
a) The occupied channel bandwidth(s): ☒ Channel Bandwidth 1: 20MHz ☒ Channel Bandwidth 2:40MHz ☒ Channel Bandwidth 3: 80MHz	
NOTE: Add more lines if the equipment has more channel Bandwidths.	
b) The DFS related operating mode(s) of the equipment: ☐ Master ☐ Slave with radar detection ☒ Slave without radar detection	
NOTE: If the equipment has more than 1 operating mode, tick all that apply.	
c) The equipment can operate in ad-hoc mode: ☒ no ad-hoc operation ☐ ad-hoc operation in the frequency range 5150MHz to 5250MHz without DFS ☐ ad-hoc operation with DFS	
NOTE: If more than 1 is applicable, tick all that apply	
d) Operating Frequency Range(s):	
☒	Range 1: 5150MHz to 5250MHz
☒	Range 2: 5250MHz to 5350MHz
☒	Range 3: 5470MHz to 5725MHz
☒	Range 4: 5725MHz to 5825MHz
NOTE: If the equipment has more than 1 Operating Frequency Range, tick all that apply.	
e) TPC feature available: ☒ Yes ☐ No	



INFORMATION REQUIRED			
f) If the equipment has a TPC range, the lowest and highest power level (or lowest and highest EIRP level in case of integrated antenna equipment), intended antenna assemblies and corresponding operating frequency range for the TPC range (or for each of the TPC ranges if more than one is implemented).			
TPC range:			
Applicable Frequency Range:			
☒	5250MHz to 5350MHz		
☒	5470 MHz to 5725 MHz		
☐	A TPC mechanism is not required for systems with an e.i.r.p of less than 500 mW		
DFS Threshold level:		N/A as EUT is slave without radar detection. dBm	
☒	at the antenna connector		☐ in front of the antenna
NOTE: For equipment with a maximum EIRP below 200 mW, the DFS threshold level shall be -62 dBm or less, for equipment with an EIRP of 200 mW or above, the DFS threshold level shall be -64 dBm or less. These levels assume a 0 dBi antenna gain. To define the applicable threshold level at the (temporary) antenna connector, the gain of the antenna (in dBi) shall be added to the threshold level. If more than one antenna is intended for this TPC range or power setting, the antenna gain of the antenna with the lowest gain shall be used.			
Power Setting 1:			
Applicable Frequency Range: 5150 MHz to 5250 MHz			
Conducted Average Power	13 dBm	Average EIRP	17.6 dBm
Power Setting 2:			
Applicable Frequency Range: 5250 MHz to 5350 MHz			
Conducted Average Power	13 dBm	Average EIRP	17.6 dBm
Power Setting 3:			
Applicable Frequency Range: 5470 MHz to 5725MHz			
Conducted Average Power	13 dBm	Average EIRP	17.6 dBm
Power Setting 4:			
Applicable Frequency Range: 5725 MHz to 5825MHz			
Conducted Average Power	13 dBm	Average EIRP	17.6 dBm
Table 3: Intended Antenna Assemblies			
Antenna Assembly name		Antenna Gain (dBi)	
SW700M (SW750M)		4.6	
RFPCA431223IMLB301		4.3	



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INFORMATION REQUIRED	
h) The extreme operating temperature range that apply to the equipment:	
Please state conditions of normal operation as specified in the users manual: 0 °C to 70 °C	
<u>Supply Voltage:</u>	
☐	AC mains. State AC voltage
☒	DC. State DC voltage
☐	State DC current
In case of DC, indicate the type of power source:	
☐	Internal Power Supply
☒	External Power Supply or AC/DC adapter
☐	Battery Nickel Cadmium
☐	Alkaline
☐	Nickel-Metal Hydride
☐	Lithium-Ion
☐	Lead acid (Vehicle regulated)
☐	Other (please specify):

ADDITIONAL INFORMATION PROVIDED BY THE SUBMITTER			
a) Modulation:			
Continuous duty	☐	Yes	☒ No
Can the transmitter operate un-modulated?	☐	Yes	☒ No
b) Duty Cycle			
Is transmitter intended for :			
Continuous duty	☐	Yes	☒ No
Intermittent duty only	☒	Yes	☐ No
If intermittent duty state DUTY CYCLE			
Transmitter ON	Seconds	Transmitter OFF	Seconds
☐ Continuous operation possible for testing purposes			
Details:			

I hereby declare that that the information supplied is correct and complete.

Name: Abdul Wahed Dewan Position held: RF Principal Engineer

Date: 11/07/2016



Product Service

1.4 PRODUCT INFORMATION

1.4.1 Technical Description

The Equipment Under Test (EUT) was a Frontier Silicon Ltd Minuet/FS5332. A full technical description can be found in the manufacturer's documentation.

1.5 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 in a shielded enclosure.

The EUT was powered from a 5.00 V DC supply.

FCC Measurement Facility Registration Number
90987 Octagon House, Fareham Test Laboratory

Industry Canada Company Address Code
IC2932B-1 Octagon House, Fareham Test Laboratory

1.6 DEVIATIONS FROM THE STANDARD

No deviations from the applicable test standard were made during testing.

1.7 MODIFICATION RECORD

Modification 0 - No modifications were made to the test sample during testing.



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SECTION 2

TEST DETAILS

FCC and Industry Canada Testing of the
Frontier Silicon Ltd Minuet/FS5332
In accordance with FCC 47 CFR Part 15, Industry Canada RSS-247
and Industry Canada RSS-GEN



Product Service

2.1 AC LINE CONDUCTED EMISSIONS

2.1.1 Specification Reference

FCC 47 CFR Part 15, Clause 15.207
Industry Canada RSS-GEN, Clause 8.8

2.1.2 Equipment Under Test and Modification State

Minuet/FS5332 S/N: RAD108621 (Module) & RAD108181 (Platform) - Modification State 0

2.1.3 Date of Test

5 July 2016

2.1.4 Test Equipment Used

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

2.1.5 Test Procedure

The test was performed in accordance with ANSI C63.10, Clause 6.2 and RSS-GEN Clause 8.8.

Remarks

A mains supply cable of 1 m length was used to supply mains power to the EUT from the LISN.

The test was performed with Bluetooth and 5 GHz transmitters operating at the same time. Bluetooth channel 2441 MHz using packet type DH5 and 5 GHz WLAN channel 5500 MHz using data rate 6 Mbps were used to do this.

All final measurements were assessed against the limits in FCC 47 CFR Part 15, Clause 15.207 and RSS-GEN, Clause 8.8.

2.1.6 Environmental Conditions

Ambient Temperature	22.1°C
Relative Humidity	45.0%



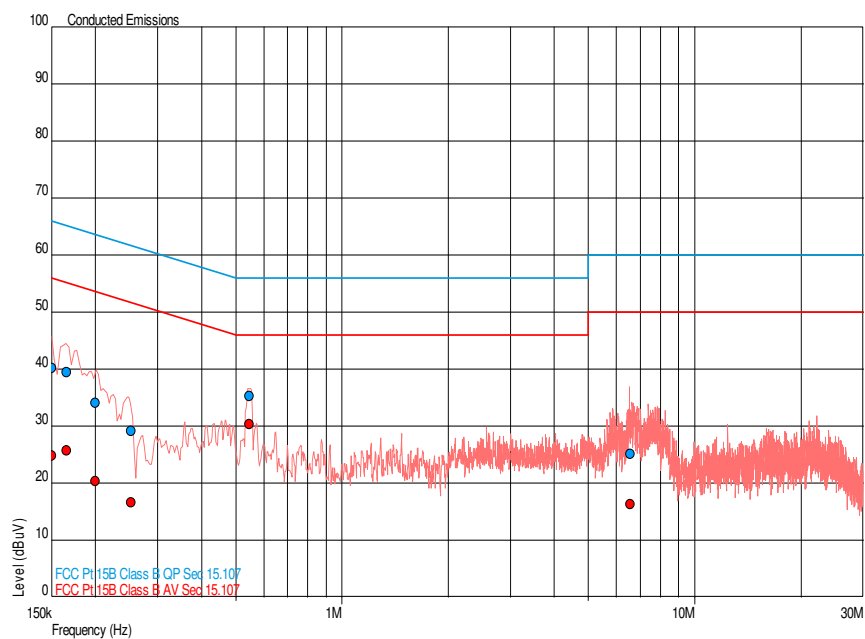
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2.1.7 Test Results

Bluetooth and RLAN Simultaneous Transmission, Live Line, AC Line Conducted Emissions Result

Frequency (MHz)	QP Level (dBuV)	QP Limit (dBuV)	QP Margin (dBuV)	AV Level (dBuV)	AV Limit (dBuV)	AV Margin (dBuV)
0.150	40.1	66.0	-25.9	24.9	56.0	-31.1
0.166	39.5	65.2	-25.7	25.7	55.2	-29.4
0.200	34.1	63.6	-29.5	20.4	53.6	-33.2
0.252	29.1	61.7	-32.6	16.6	51.7	-35.1
0.545	35.3	56.0	-20.7	30.4	46.0	-15.6
6.550	25.1	60.0	-34.9	16.4	50.0	-33.6

Bluetooth and RLAN Simultaneous Transmission, Live Line, AC Line Conducted Emissions Plot



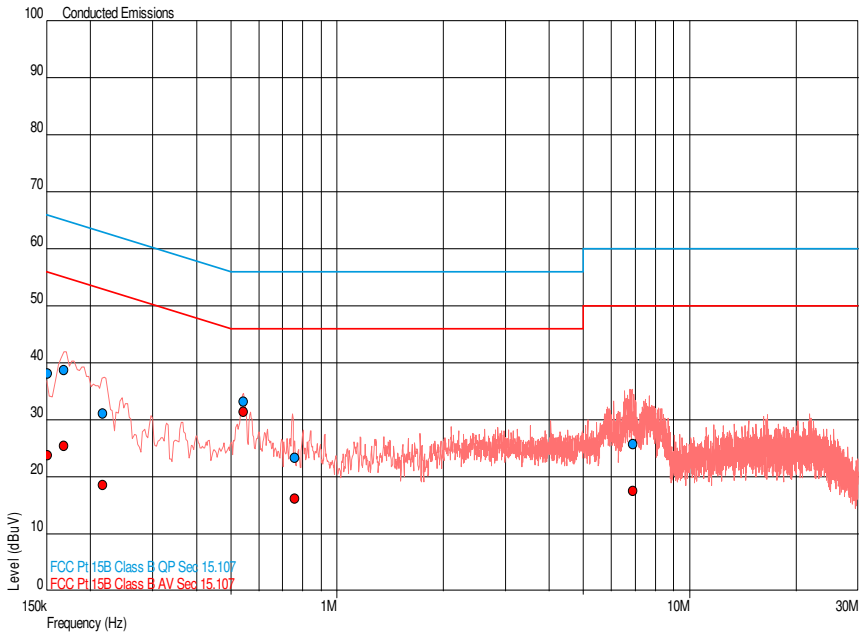


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Bluetooth and RLAN Simultaneous Transmission, Neutral Line, AC Line Conducted Emissions Result

Frequency (MHz)	QP Level (dBuV)	QP Limit (dBuV)	QP Margin (dBuV)	AV Level (dBuV)	AV Limit (dBuV)	AV Margin (dBuV)
0.151	38.2	65.9	-27.8	23.9	55.9	-32.1
0.169	38.7	65.0	-26.3	25.5	55.0	-29.6
0.216	31.2	63.0	-31.8	18.6	53.0	-34.4
0.542	33.2	56.0	-22.8	31.4	46.0	-14.6
0.759	23.3	56.0	-32.7	16.1	46.0	-29.9
6.890	25.8	60.0	-34.2	17.5	50.0	-32.5

Bluetooth and RLAN Simultaneous Transmission, Neutral Line, AC Line Conducted Emissions Plot





Product Service

FCC 47 CFR Part 15, Limit Clause 15.207

Frequency of Emission (MHz)	Conducted Limit (dBμV)	
	Quasi-Peak	Average
0.15 to 0.5	66 to 56*	56 to 46*
0.5 to 5	56	46
5 to 30	60	50

*Decreases with the logarithm of the frequency.

Industry Canada RSS-GEN, Limit Clause 8.8

Frequency of Emission (MHz)	Conducted Limit (dBμV)	
	Quasi-Peak	Average
0.15 to 0.5	66 to 56*	56 to 46*
0.5 to 5	56	46
5 to 30	60	50

*Decreases with the logarithm of the frequency.



Product Service

2.2 SPURIOUS RADIATED EMISSIONS

2.2.1 Specification Reference

FCC 47 CFR Part 15, Clause 15.407 (b), 15.205, 15.209 and 15.247 (d)
Industry Canada RSS-247, Clause 6.2

2.2.2 Equipment Under Test and Modification State

Minuet/FS5332 S/N: RAD108624 (Module), RAD108703 (Platform) and RAD108757 (Adaptor Board) - Modification State 0

2.2.3 Date of Test

10 July 2016

2.2.4 Test Equipment Used

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

2.2.5 Test Procedure

This test was performed in accordance with KDB 789033 D02 v01, Section II clause G1, G.2, G.3, G.4, G.5, G.6d Method VB and Industry Canada RSS-GEN, clause 6.13, 8.9 and 8.10.

Remarks

The test was performed with Bluetooth and 5 GHz transmitters operating at the same time. Bluetooth channel 2441 MHz using packet type DH5 and 5 GHz WLAN channel 5500 MHz using data rate 6 Mbps were used to do this.

2.2.6 Environmental Conditions

Ambient Temperature	20.8°C
Relative Humidity	65.0%



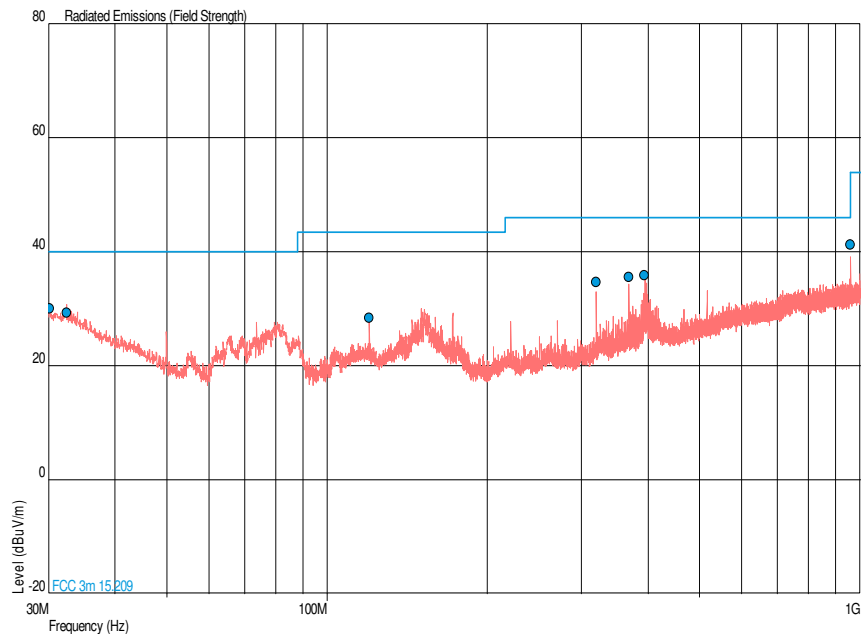
2.2.7 Test Results

5.00 V DC Supply

Bluetooth and RLAN Simultaneous Transmission, 30 MHz to 1 GHz, Spurious Radiated Emissions Results

Frequency (MHz)	QP Level (dBμV/m)	QP Margin (dBμV/m)	QP Level (μV/m)	QP Margin (μV/m)	Angle (°)	Height (m)	Polarisation
30.165	30.1	-9.9	32.0	-68.0	360	1.00	Horizontal
32.416	29.3	-10.7	29.2	-70.8	335	3.62	Horizontal
120.000	28.4	-15.1	26.3	-123.7	264	1.00	Vertical
319.474	34.8	-11.2	55.0	-145.0	214	1.00	Horizontal
368.649	35.6	-10.4	60.3	-139.7	65	1.00	Horizontal
393.217	35.9	-10.1	62.4	-137.6	70	2.24	Horizontal
960.000	41.2	-4.8	114.8	-85.2	31	1.00	Horizontal

Bluetooth and RLAN Simultaneous Transmission, 30 MHz to 1 GHz, Spurious Radiated Emissions Plot





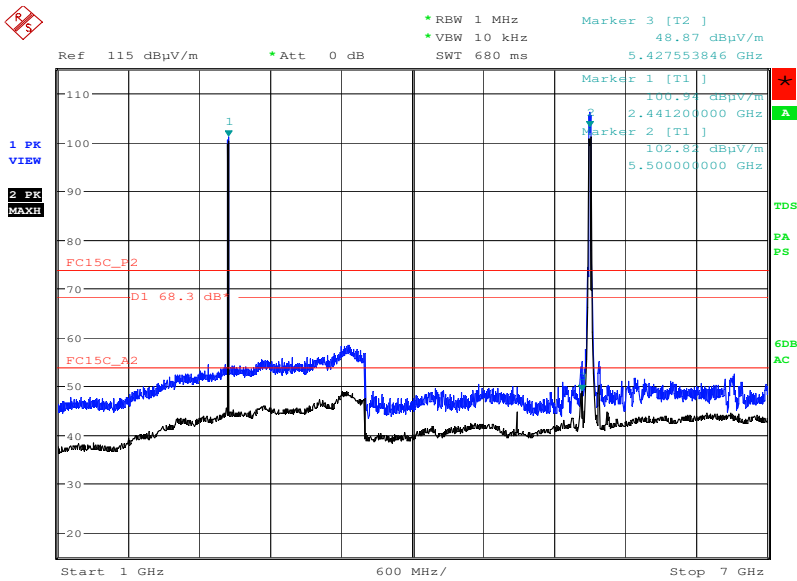
Product Service

Bluetooth and RLAN Simultaneous Transmission, 1 GHz to 40 GHz, Spurious Radiated Emissions Results

Frequency (MHz)	Final Peak (dBμV/m)	Final Average (dBμV/m)	Final Peak (μV/m)	Final Average (μV/m)	Angle (°)	Height (m)	Polarisation
*							

*No emissions were detected within 10 dB of the limit.

Bluetooth and RLAN Simultaneous Transmission, 1 GHz to 7 GHz, Spurious Radiated Emissions Plot

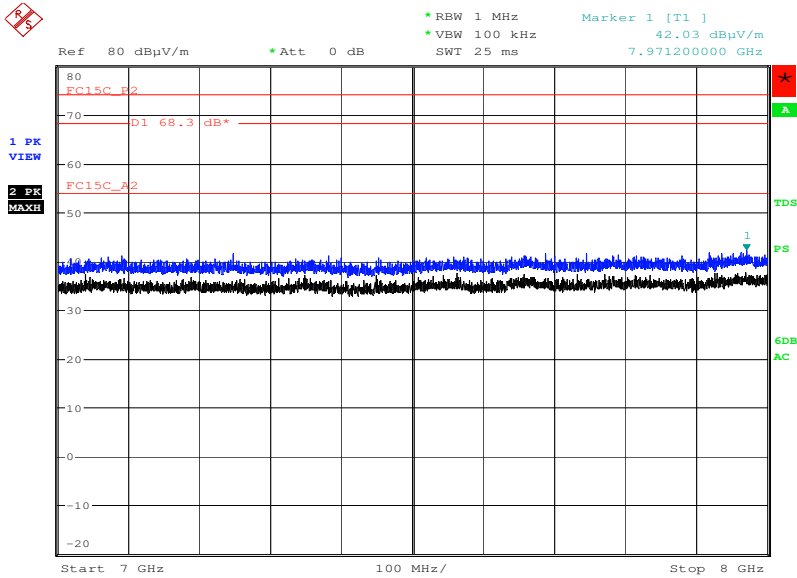


Date: 10.JUL.2016 19:59:04



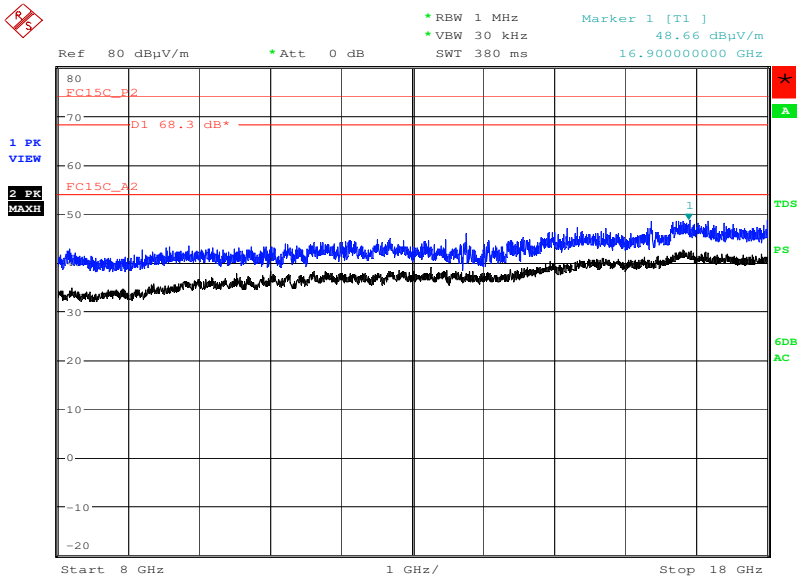
Product Service

Bluetooth and RLAN Simultaneous Transmission, 7 GHz to 8 GHz, Spurious Radiated Emissions Plot



Date: 10.JUL.2016 20:38:26

Bluetooth and RLAN Simultaneous Transmission, 8 GHz to 18 GHz, Spurious Radiated Emissions Plot

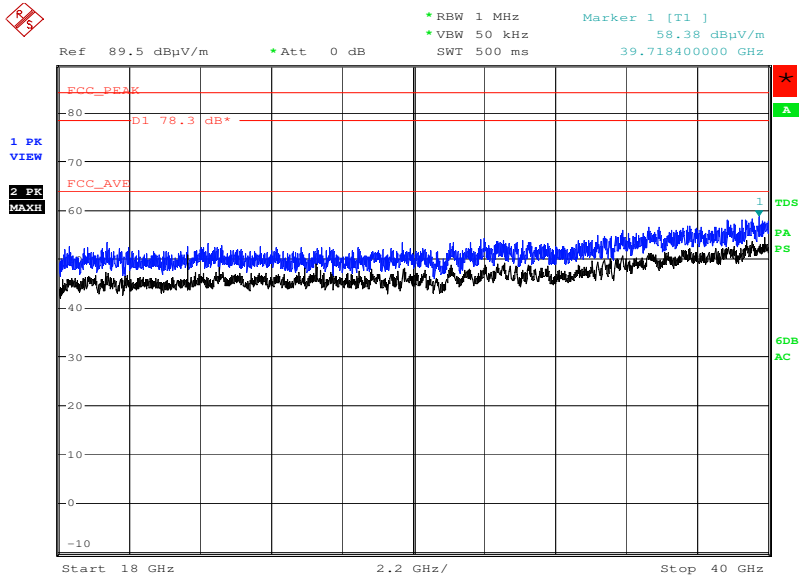


Date: 10.JUL.2016 20:54:26



Product Service

Bluetooth and RLAN Simultaneous Transmission, 18 GHz to 40 GHz, Spurious Radiated Emissions Plot



Date: 10.JUL.2016 21:42:15

FCC 47 CFR Part 15, Limit Clause 15.407 (b)(1)(2)(3)(4)(6)(7)

Outside the 5.15 GHz to 5.35 GHz band	-27 dBm/MHz
Outside the 5.25 GHz to 5.35 GHz band	-27 dBm/MHz
Outside the 5.47 GHz to 5.725 GHz band	-27 dBm/MHz
5.715 GHz to 5.725 GHz and 5.850 GHz to 5.860 GHz band	-17 dBm/MHz
Outside the 5.715 GHz to 5.860 GHz band	-27 dBm/MHz

FCC 47 CFR Part 15, Limit Clause 15.205

	Peak (dBμV/m)	Average (dBμV/m)
Restricted Bands of Operation	74	54

FCC 47 CFR Part 15, Limit Clause 15.209

Frequency (MHz)	Field Strength			Measurement Distance (m)
	(μV/m)	Average (dBμV/m)	Peak (dBμV/m)	
30-88	100	40.0	60.0	3
88-216	150	43.5	63.5	3
216-960	200	46.0	66.0	3
Above 960	500	54.0	74.0	3

Industry Canada RSS-247, Limit Clause 6.2

Outside the 5.15 GHz to 5.35 GHz band	-27 dBm/MHz
Outside the 5.25 GHz to 5.35 GHz band	-27 dBm/MHz
Outside the 5.47 GHz to 5.725 GHz band	-27 dBm/MHz
5.715 GHz to 5.725 GHz and 5.850 GHz to 5.860 GHz band	-17 dBm/MHz
Outside the 5.715 GHz to 5.860 GHz band	-27 dBm/MHz

Industry Canada RSS-GEN, Limit Clause 8.9

Frequency (MHz)	Field Strength			Measurement Distance (m)
	(μV/m)	Average (dBμV/m)	Peak (dBμV/m)	
30-88	100	40.0	60.0	3
88-216	150	43.5	63.5	3
216-960	200	46.0	66.0	3
Above 960	500	54.0	74.0	3

Industry Canada RSS-GEN, Limit Clause 8.10

	Peak (dBμV/m)	Average (dBμV/m)
Restricted Bands of Operation	74	54



Product Service

SECTION 3

TEST EQUIPMENT USED



3.1 TEST EQUIPMENT USED

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

Instrument	Manufacturer	Type No.	TE No.	Calibration Period (months)	Calibration Due
Section 2.1 – AC Line Conducted Emissions					
LISN	Rohde & Schwarz	ESH2-Z5	17	12	11-Feb-2017
Multimeter	Iso-tech	IDM-101	466	12	11-Sep-2016
Hygrometer	Rotronic	A1	1388	12	13-Apr-2017
Screened Room (5)	Rainford	Rainford	1545	36	20-Dec-2017
Transient Limiter	Hewlett Packard	11947A	2377	12	16-Feb-2017
EMI Test Receiver	Rohde & Schwarz	ESU40	3506	12	2-Nov-2016
7m Armoured RF Cable	SSI Cable Corp.	1501-13-13-7m WA(-)	3600	-	TU
Section 2.2 - Spurious Radiated Emissions					
Antenna 18-40GHz (Double Ridge Guide)	Link Microtek Ltd	AM180HA-K-TU2	230	24	12-Feb-2018
Antenna (Double Ridge Guide, 1GHz-18GHz)	EMCO	3115	234	12	29-Apr-2017
Multimeter	Iso-tech	IDM-101	466	12	11-Sep-2016
Hygrometer	Rotronic	A1	1388	12	13-Apr-2017
Antenna 18-40GHz (Double Ridge Guide)	Q-Par Angus Ltd	QSH 180K	1511	24	27-Nov-2016
Pre-Amplifier	Phase One	PS04-0086	1533	12	30-Jul-2016
18GHz - 40GHz Pre-Amplifier	Phase One	PSO4-0087	1534	12	23-Dec-2016
Screened Room (5)	Rainford	Rainford	1545	36	20-Dec-2017
Turntable Controller	Inn-Co GmbH	CO 1000	1606	-	TU
Hygrometer	Rotronic	A1	2138	12	9-Dec-2016
Cable (2m)	Rosenberger	FA147A2020002020	2195	12	19-Aug-2016
Multimeter	Iso-tech	IDM101	2417	12	29-Sep-2016
Filter (Hi Pass)	Lorch	9HP7-7000-SR	2833	12	5-Feb-2017
Antenna (Bilog)	Chase	CBL6143	2904	24	11-Jun-2017
Compliance 5 Emissions	Schaffner	C5e Software V.5.00.00	3275	-	N/A - Software
EMI Test Receiver	Rohde & Schwarz	ESU40	3506	12	2-Nov-2016
9m RF Cable (N Type)	Rhophase	NPS-2303-9000-NPS	3791	-	TU
Tilt Antenna Mast	matur GmbH	TAM 4.0-P	3916	-	TU
Mast Controller	matur GmbH	NCD	3917	-	TU
Cable 1503 2M 2.92(P)m 2.92(P)m	Rhophase	KPS-1503A-2000-KPS	4293	12	O/P MON
1GHz to 8GHz Low Noise Amplifier	Wright Technologies	APS04-0085	4365	12	6-Oct-2016
Suspended Substrate Highpass Filter	Advance Power Components	11SH10-3000/X18000-O/O	4411	12	23-Mar-2017
Cable (Yellow, Rx, Km-Km 2m)	Scott Cables	KPS-1501-2000-KPS	4527	-	TU
Double Ridged Waveguide Horn Antenna	ETS-Lindgren	3117	4722	12	29-Dec-2016

TU – Traceability Unscheduled

O/P MON – Output Monitored



Product Service

3.2 MEASUREMENT UNCERTAINTY

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

Test Discipline	MU
AC Line Conducted Emissions	± 3.2 dB
Spurious Radiated Emissions	30 MHz to 1 GHz: ± 5.1 dB 1 GHz to 40 GHz: ± 6.3 dB



Product Service

SECTION 4

ACCREDITATION, DISCLAIMERS AND COPYRIGHT



Product Service

4.1 ACCREDITATION, DISCLAIMERS AND COPYRIGHT



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

Our UKAS Accreditation does not cover opinions and interpretations and any expressed are outside the scope of our UKAS Accreditation.

Results of tests not covered by our UKAS Accreditation Schedule are marked NUA
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