EMC Test Report

Project Number: 4166661

Report Number: 4166661EMC01 **Revision Level:** 0

Client: Sanmina Corporation

Equipment Under Test: LoRa Module

Model: NIMBUS

FCC ID: 2AMS3NIMBUS

Applicable Standards: FCC Part 15 Subpart C, § 15.247

ANSI C63.10: 2013

Report issued on: 24 July 2017

Test Result: Compliant

Tested by: Jeremy Pickens, Senior EMC Engineer

Reviewed by: David Schramm, Operations Manager

Remarks: This report details the results of the testing carried out on one sample, the results contained in this test report do not relate to other samples of the same product. The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in this report.

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1 Summary of Test Results

Test Description	Test Specification	Test Result
Occupied Bandwidth	15.247(a) (1)	Compliant (1)
Peak Power Output	15.247(a) (1)	Compliant (1)
Power Spectral Density	15.247(f)	Compliant (1)
Conducted Spurious Emissions	15.247(d)	Compliant (1)
Radiated Spurious Emissions	15.247(d), 15.35(b),15.205, 15.209	Compliant
Dwell time	15.247(f)	Compliant (1)
Number of Hopping Frequencies	15.247(a) (1)(iii)	Compliant (1)
Channel separation	15.247(a)(1)	Compliant (1)
AC Power Line Conducted Emission	15.107, 15.207	N/A(2)

(1) This test was not part of this evaluation. Compliance to this test was demonstrated in the Single Modular Approval of the certified radio module. Radiated spurious emissions were performed to support a Class II Permissive Change due to the usage of a different type of antenna.
(2) Not Applicable – The device is powered via internal battery.

1.1 *Modifications Required for Compliance*

None

2 General Information

2.1 *Client Information*

Name:	Sanmina Corp
Address:	13000 Memorial Parkway SW
City, State, Zip, Country:	Huntsville, AL 35803, USA

2.2 *Test Laboratory*

Name:	SGS North America, Inc.
Address:	620 Old Peachtree Road NW, Suite 100
City, State, Zip, Country:	Suwanee, GA 30024, USA

2.3 *General Information of EUT*

EUT:	LoRa Module
Model Number:	NIMBUS
Serial Number:	Not labeled

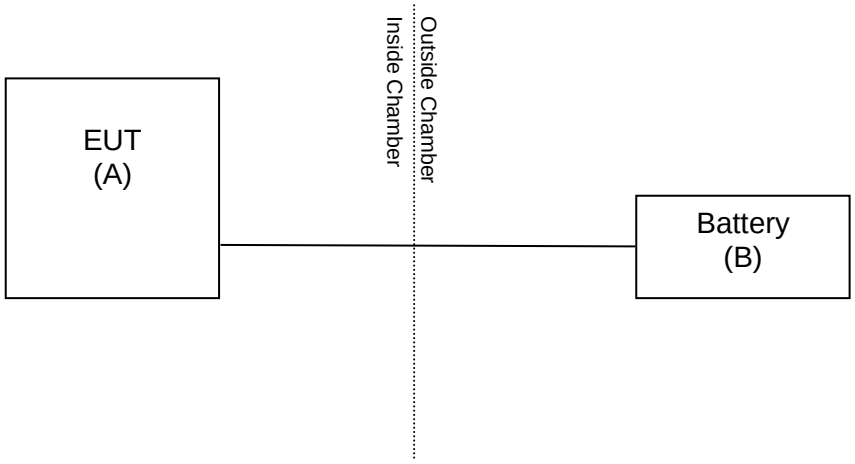
Frequency Range:	125kHz Channel: 902.3-914.9MHz 500kHz Channel: 903.0-914.2MHz
Number of channels:	125kHz Channel: 64 500kHz Channel: 8
Modulation type:	LoRa
Channel spacing:	125kHz Channel: 200kHz 500kHz Channel: 1.6MHz
Antenna:	SMT Loop Antenna (taoglas, P/N: ILA.01), 1dBi Peak Gain
Rated Voltage:	3.7Vdc Internal Battery
Sample Received Date:	13 July 2017
Dates of testing:	17 – 18 July 2017

2.4 *Operating Modes and Conditions*

During testing, the hopping sequence was stopped in accordance with Section 5.1 of ANSI C63.10-2013 so that the low, mid and high channels could be tested independently.

For this permissive change, the worst-case data rate (125kHz) was chosen for the radiated spurious emissions measurements

2.5 *EUT Connection Block Diagram*



2.6 *System Configurations*

Device reference	Manufacturer	Description	Model Number	Serial Number
A	Sanmina Corp	LoRa Board Assembly	NIMBUS	None
B	Rigol	DC Power Supply	DP711	DP7A182700833

2.7 *Cable List*

Cable reference	Port Name	Start	End	Cable Length (m)	Ferrite installed?	Shielded?
1	DC Power	DC Supply	EUT	15	N	N

3 Field Strength of Spurious Radiation

3.1 *Test Result*

Test Description	Test Specification	Test Result
Field strength of spurious radiation	15.247(d), 15.35(b),15.205, 15.209	Compliant

3.2 *Test Method*

Radiated spurious emissions measurements were recorded with the device configured to transmit at the lowest, middle, and highest channels. The frequency range investigated was up through the 10th harmonic of the fundamental transmit frequency. The methods defined in ANSI C63.10: 2013 were used.

For measurements below 1GHz, the device was manipulated through three orthogonal axes. Above 1GHz, the alternative method in Clause 6.6.5 was used.

Test distance:

30 MHz to 1 GHz - The EUT to measurement antenna distance is 3 meters
1 to 18 GHz - The EUT to measurement antenna distance is 3 meters
18 to 40 GHz - The EUT to measurement antenna distance is 1 meter

Frequency	Limits(1)		Peak Limits dBuV/m
	Microvolts/m	dBuV/m	
30 - 88 MHz	100	40 (2)	--
88 - 216 MHz	150	43.5 (2)	--
216 - 960 MHz	200	46 (2)	--
960 - 1000 MHz	500	54 (2)	--
1 - 40 GHz	500	54 (3)	74

(1) These limits are applicable to emissions within the restricted bands of operation defined in FCC §15.205.
(2) Quasi-peak limit
(3) Average limit

3.3 *Test Site*

10m Absorber Lined Shielded Enclosure (ALSE), Suwanee, GA (Measurements < 1GHz)

Environmental Conditions

Temperature: 23.8 °C
Relative Humidity: 47.6 %

3.4 *Test Equipment*

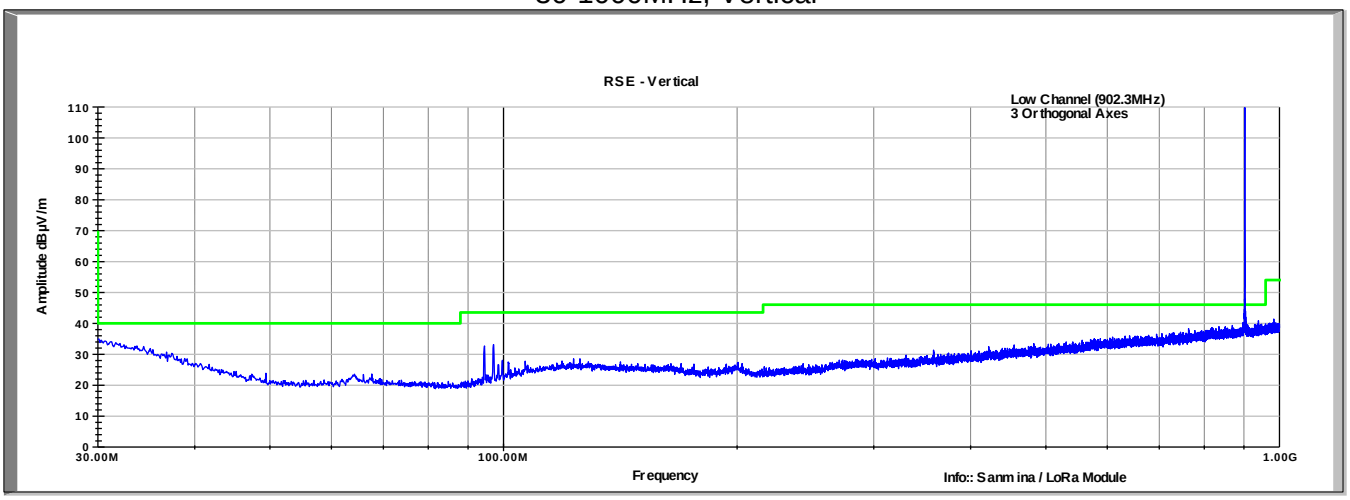
Test End Date: 18-Jul-2017 Tester: JOP

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
EMI TEST RECEIVER	ESU40	ROHDE & SCHWARZ	B079629	25-Apr-2018
ANTENNA, BILOG	JB6	SUNOL	B079689	8-Sep-2017
RF CABLE	NMS-290-236.2-NMS	FLORIDA RF LABS	B095020	24-Jul-2018
RF CABLE	NFS-290-78.7-NFS	FLORIDA RF LABS	B095019	24-Jul-2018
RF CABLE	SF106	HUBER & SUHNER	B079660	25-Jul-2017
ANTENNA, HORN	BBHA 9120 B	SCHWARZBECK	16001	16-Mar-2018
RF CABLE	104PE	HUBER & SUHNER	B079793	24-Jul-2018
LOW NOISE AMPLIFIER	TS-PR18	ROHDE & SCHWARZ	B094463	22-Feb-2018

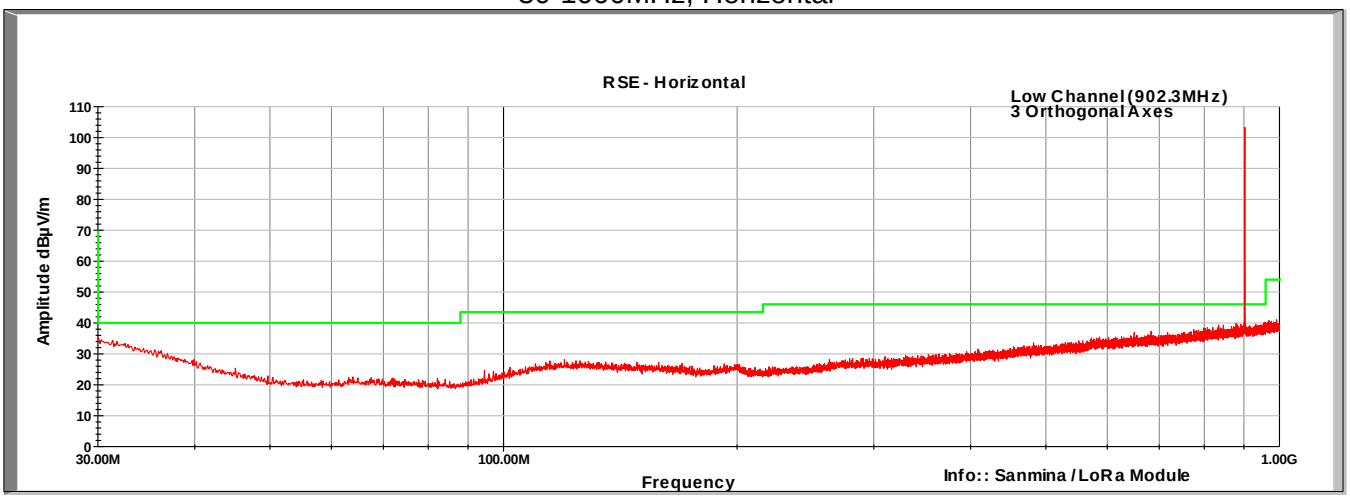
Note: The equipment calibration period is 1 year.

3.5 *Test Data – Peak Data*

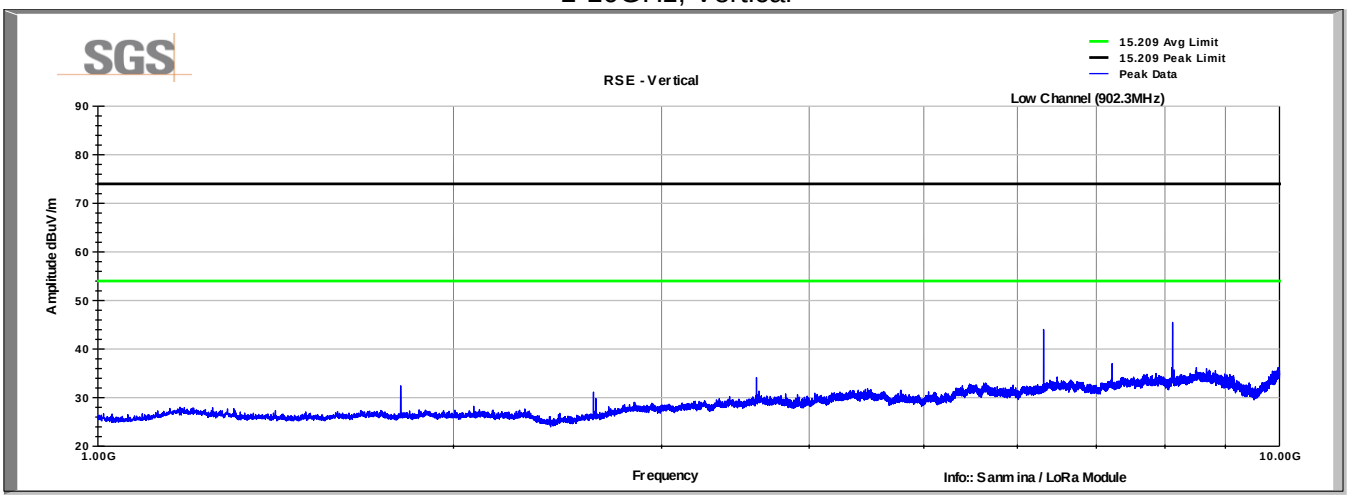
Low Channel
30-1000MHz, Vertical



Low Channel
30-1000MHz, Horizontal

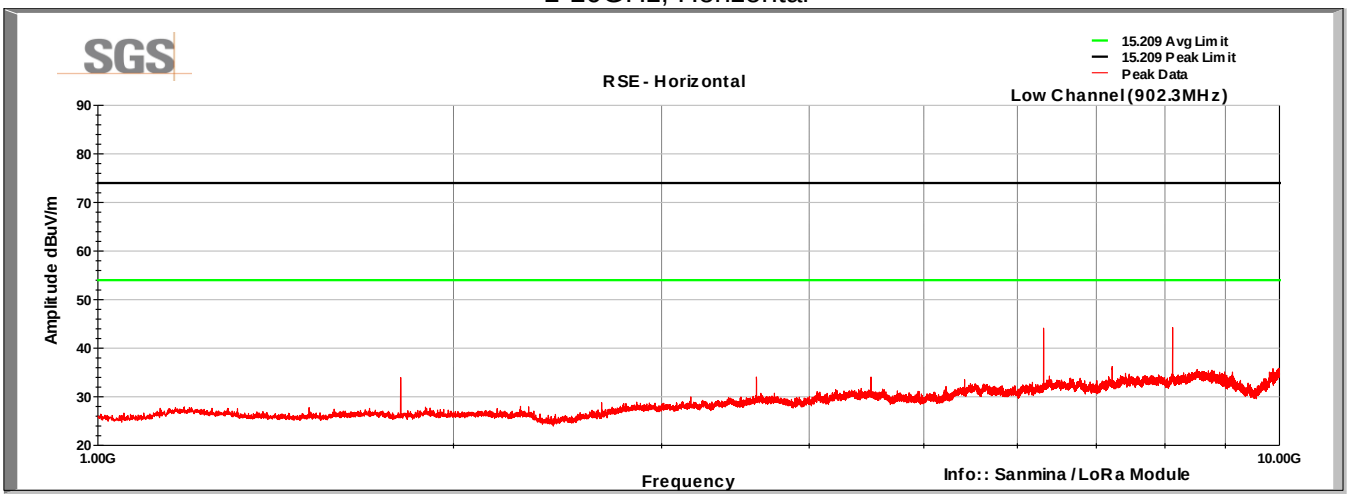


Low Channel
1-10GHz, Vertical



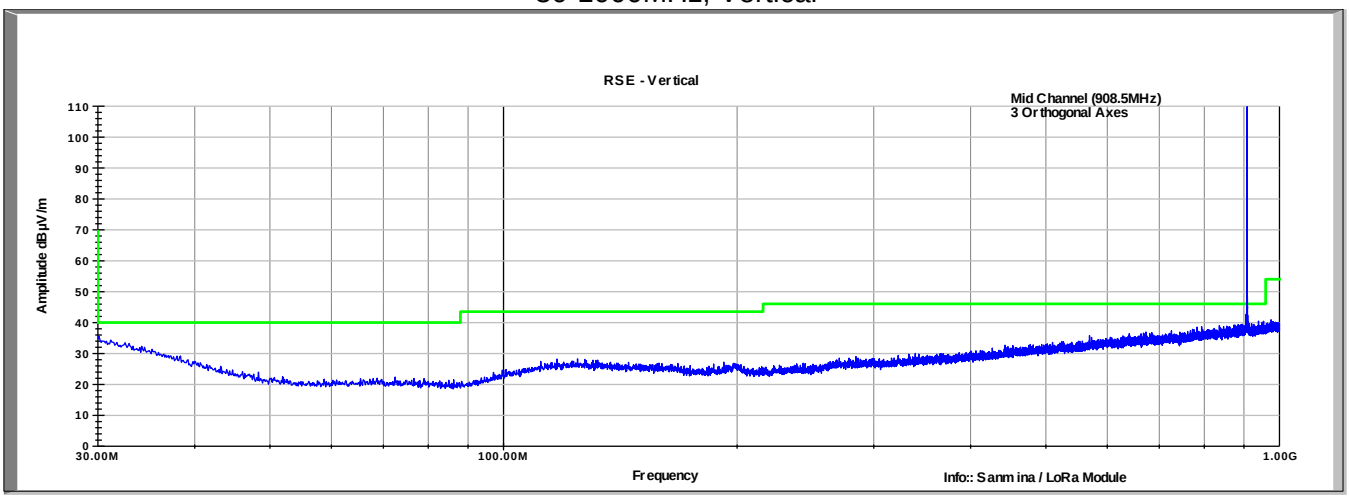
Worst Case Spur: 45.2dBµV/m (Peak) @ 8120.7MHz

Low Channel
1-10GHz, Horizontal

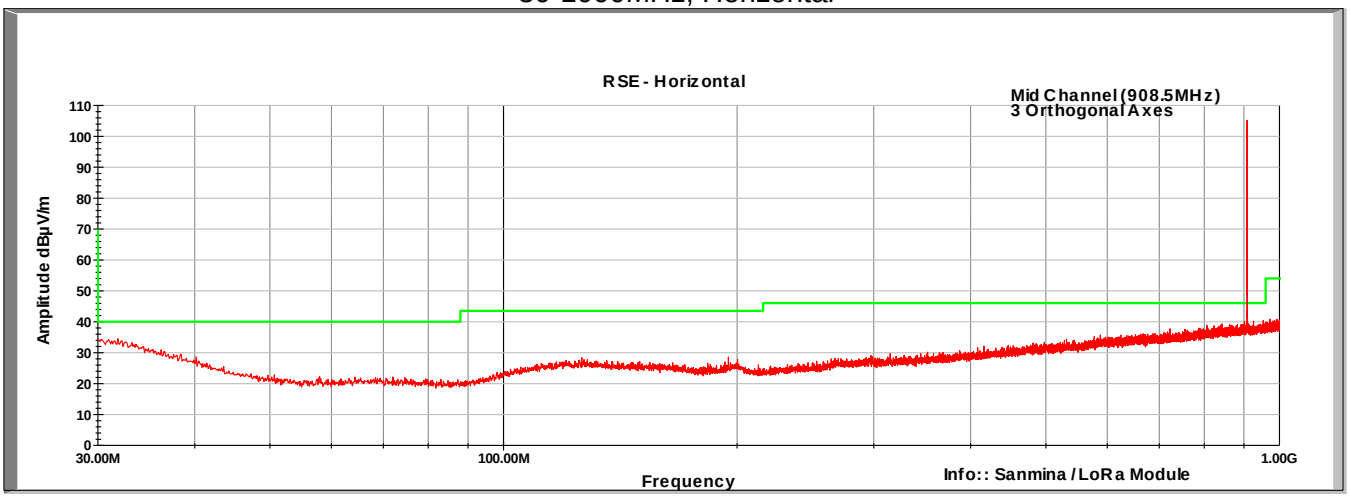


Worst Case Spur: 44.6dBµV/m (Peak) @ 8120.7MHz

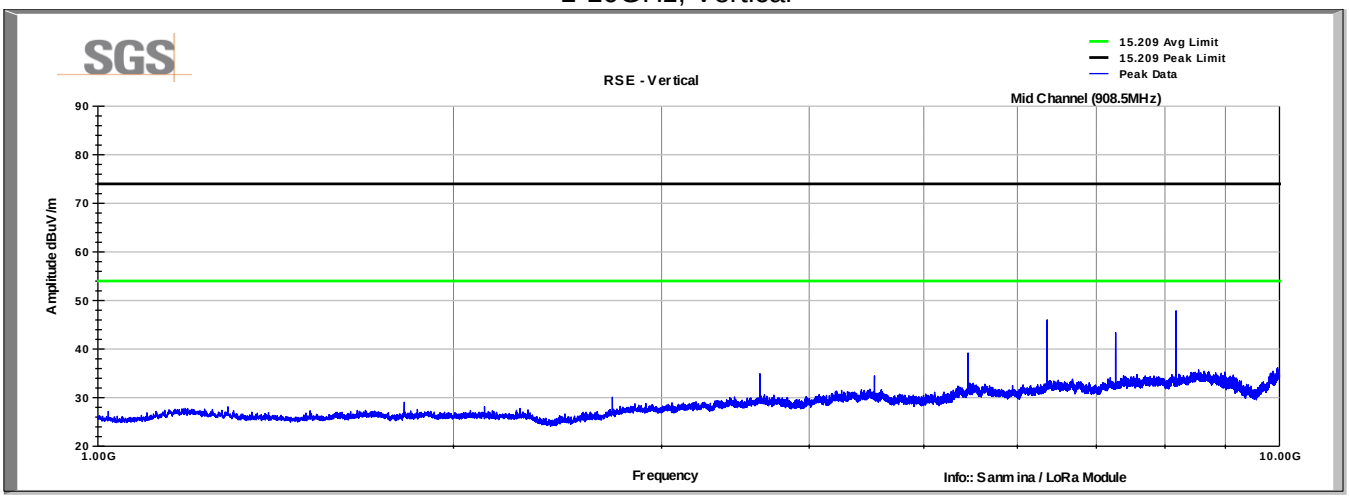
Mid Channel
30-1000MHz, Vertical



Mid Channel
30-1000MHz, Horizontal

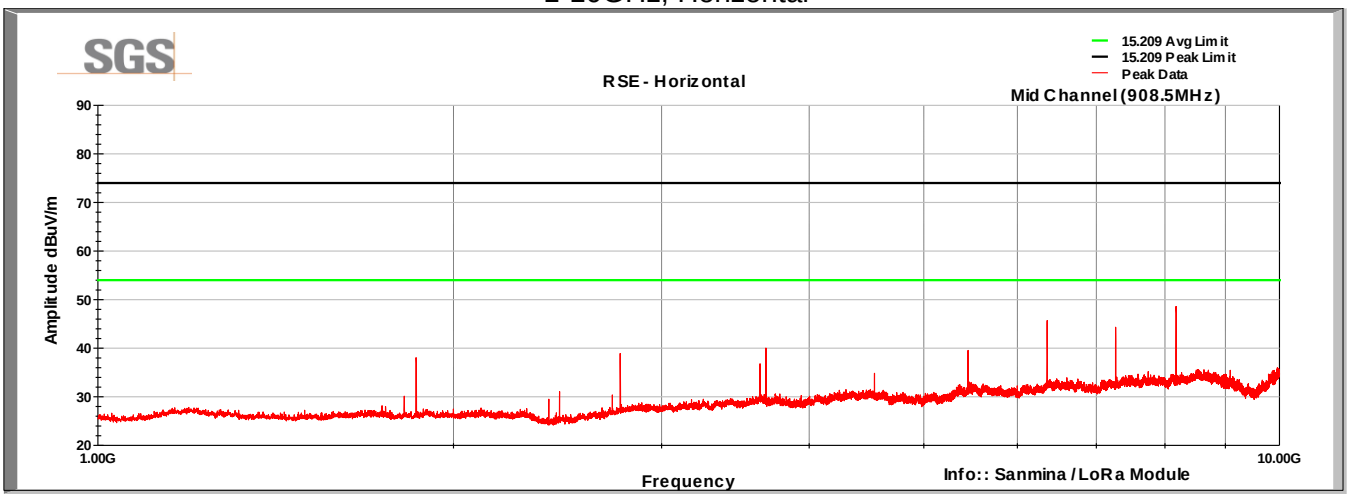


Mid Channel
1-10GHz, Vertical



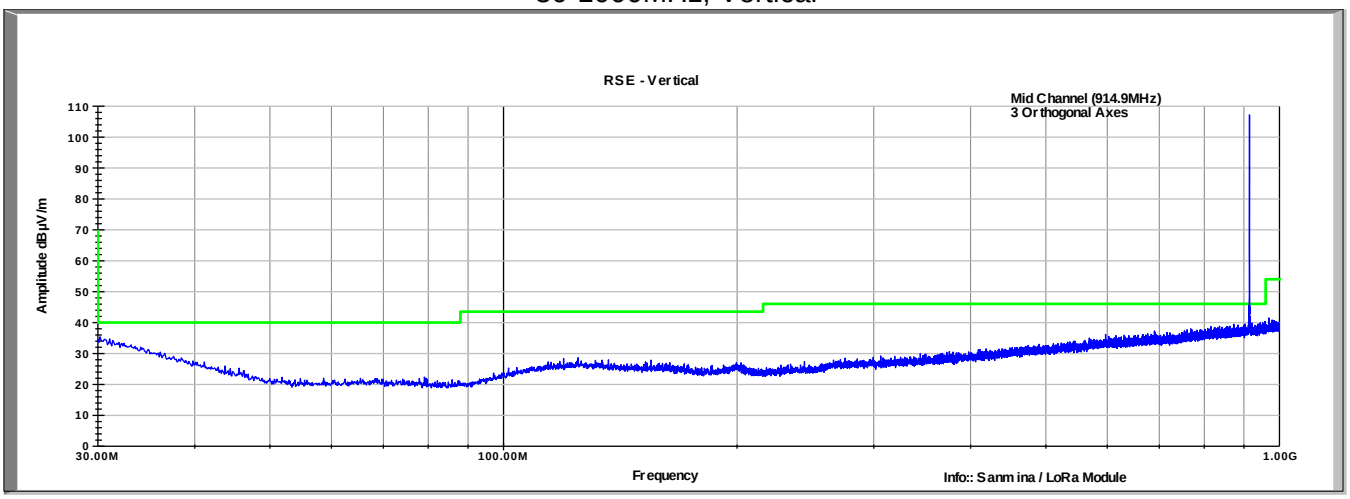
Worst Case Spur: 47.8dBµV/m (Peak) @ 8176.5MHz

Mid Channel
1-10GHz, Horizontal

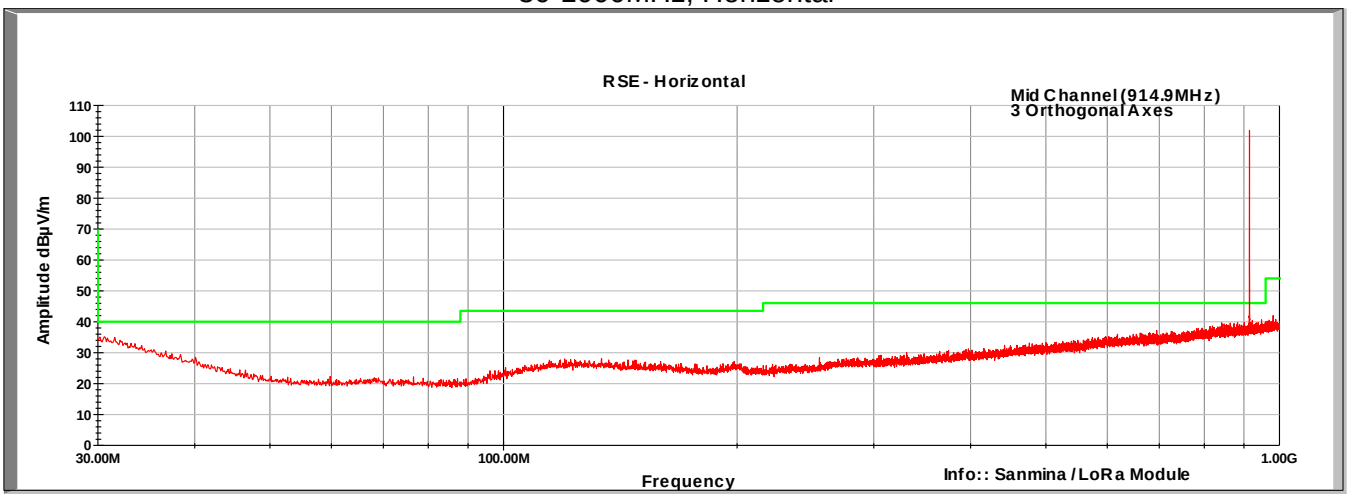


Worst Case Spur: 48.6dBµV/m (Peak) @ 8176.5MHz

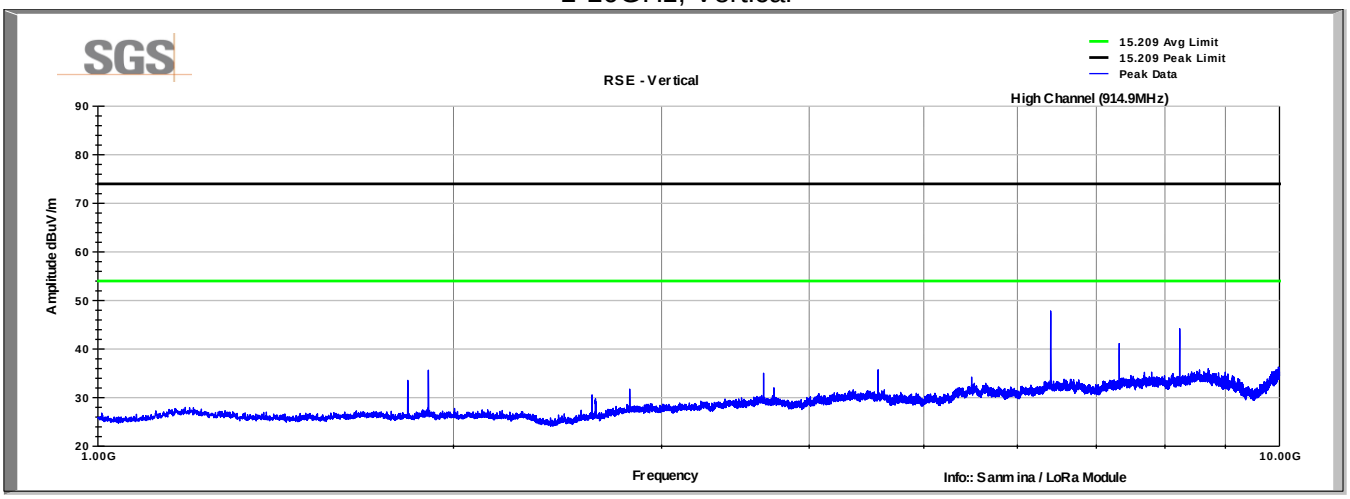
High Channel
30-1000MHz, Vertical



High Channel
30-1000MHz, Horizontal

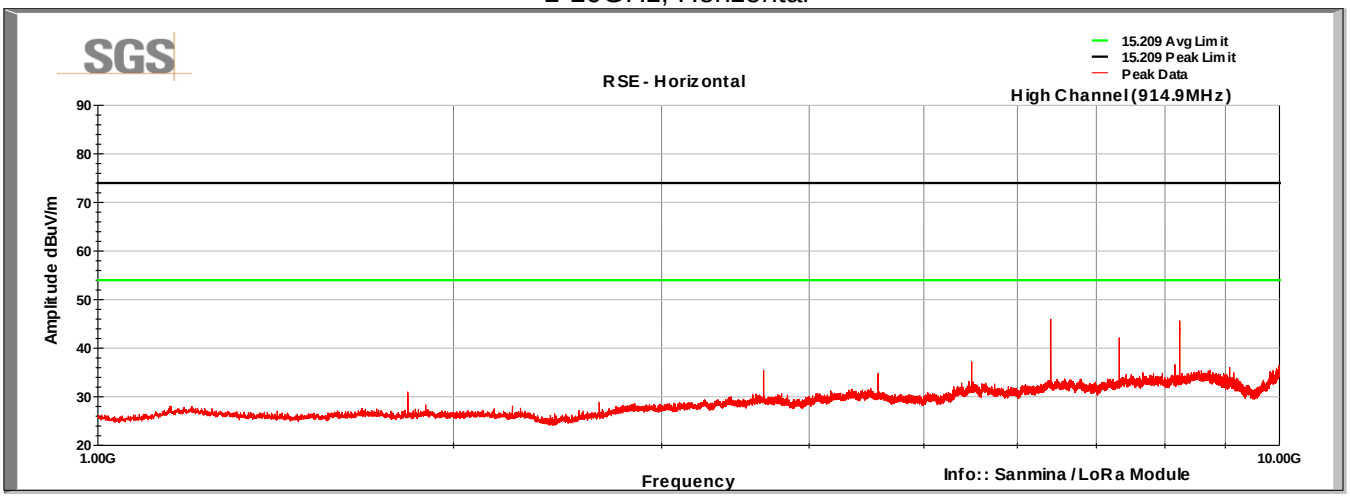


High Channel
1-10GHz, Vertical



Worst Case Spur: 47.8dBµV (Peak) @ 6404.3MHz

High Channel
1-10GHz, Horizontal



Worst Case Spur: 46.0dBµV (Peak) @ 6404.3MHz

4 Revision History

Revision Level	Description of changes	Revision Date
0	Initial release	24 July 2017