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United States of America
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CERTIFICATION TEST REPORT

Manufacturer: **WaveFlex, Inc.**
5480 Roesland Dr.
Galena, OH 43021 USA

Applicant: **Same As Above**

Product Name: **Quantum Picocell Gateway Radio**

Product Description: Picocell gateway radio with USB connector provides simultaneous communication on 8 LoRa channels.

Model: **MASM-100-1003-00: Quantum Picocell Gateway Radio**

FCC ID: **2ASYA-1001003**

Testing Commenced: July 17, 2018

Testing Ended: July 23, 2018

Summary of Test Results: **In Compliance**

The EUT complies with the EMC requirements when manufactured identically as the unit tested in this report, including any required modifications and/or manufacturer's statement. Any changes to the design or build of this unit subsequent to this testing may deem it non-compliant.

Standards:

- **FCC Part 15 Subpart C, Section 15.247**
- **FCC15.207 - Conducted Limits**
- **FCC Part 15.31(e)**
- **ANSI C63.10:2013**



Order Number: F2P19086C

Client: WaveFlex, Inc.
Model: MASM-100-1003-00

Evaluation Conducted by:

Julius Chiller, EMC/Wireless Engineer

Report Reviewed by:

Ken Littell, Director of EMC & Wireless Operations

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1 ADMINISTRATIVE INFORMATION

1.1 Measurement Location:

F2 Labs in Middlefield, Ohio. Site description and attenuation data are on file with the FCC's Sampling and Measurement Branch at the FCC Laboratory in Columbia, MD.

1.2 Measurement Procedure:

All measurements were performed according to the 2013 version of ANSI C63.10 and recommended FCC procedure of measurement of DTS operating under Section 15.247 and in KDB558074. A list of the measurement equipment can be found in Section 6.

1.3 Uncertainty Budget:

The uncertainty in EMC measurements arises from several factors which affect the results, some associated with environmental conditions in the measurement room, the test equipment being used and the measurement techniques adopted.

The measurement uncertainty budgets detailed below are calculated from the test and calibration data, and are expressed with a 95% confidence factor. Note: Only measurements listed below which relate to tests included in this Test Report are applicable to it.

Measurement Range	Expanded Uncertainty	Combined Uncertainty
Radiated Emissions <1 GHz @ 3m	±5.07dB	±2.54
Radiated Emissions <1 GHz @ 10m	±5.09dB	±2.55
Radiated Emissions 1 GHz to 2.7 GHz	±3.62dB	±1.81
Radiated Emissions 2.7 GHz to 18 GHz	±3.10dB	±1.55
AC Power Line Conducted Emissions, 150kHz to 30 MHz	±2.76dB	±1.38

This Uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

1.4 Document History

Document Number	Description	Issue Date	Approved By
F2P19086C-01E	First Issue	July 26, 2018	K. Littell



2 SUMMARY OF TEST RESULTS

Test Name	Standard(s)	Results
Occupied Bandwidth	CFR 47 Part 15.247(a)(2) / KDB558074	Complies
Conducted Output Power	CFR 47 Part 15.247(b)(3) / KDB558074	Complies
Voltage Variations	CFR 47 Part 15.31(e)	Complies
Conducted Spurious Emissions	CFR 47 Part 15.247(d) / Part 15.207 / KDB558074	Complies
Radiated Spurious Emissions	CFR 47 Part 15.247(d) / Part 15.209 / KDB558074	Complies
Peak Power Spectral Density	CFR 47 Part 15.247(e) / KDB558074	Complies
Conducted Emissions	CFR 47 Part 15.207(a)	Complies

Modifications Made to the Equipment
None



3 TABLE OF MEASURED RESULTS

SF7

Test	Low Channel 923.3 MHz	Mid Channel 925.7 MHz	High Channel 927.5 MHz
Conducted Output Power	602.5mW (27.8dBm)	599.8mW (27.78dBm)	598.4mW (27.77dBm)
Conducted Output Power Limit	1 Watt, (30dBm)	1 Watt, (30dBm)	1 Watt, (30dBm)
E.I.R.P. with 2.2dBi Whip Antenna	1000mW (30.0dBm)	995.4mW (29.98dBm)	993.1mW (29.97dBm)
E.I.R.P. Limit	4 Watts, (36.02dBm)	4 Watts, (36.02dBm)	4 Watts, (36.02dBm)
Peak Power Spectral Density	3.65 dBm	3.58 dBm	3.50 dBm
Peak Power Spectral Density Limit	8 dBm	8 dBm	8 dBm
-6dB Occupied Bandwidth	0.581MHz	0.583 MHz	0.583 MHz
-6dB Occupied Bandwidth Limit	≥ 500KHz	≥ 500KHz	≥ 500KHz
Voltage Variations	3.9V(dBm)	27.78	27.76
	3.9V(mW)	599.8	597.0
	5V(dBm)	27.79	27.77
	5V(mW)	601.1	598.4
Limit	1W 30dBm	1W 30dBm	1W 30dBm

*To meet the requirements of 15.31, voltage was varied by ±15% of the nominal voltage. All tests were then performed at the highest output power voltage setting.



SF12

Test	Low Channel 923.3 MHz	Mid Channel 925.7 MHz	High Channel 927.5 MHz
Conducted Output Power	76.0mW (18.81dBm)	71.5mW (18.54dBm)	45.2mW (16.55dBm)
Conducted Output Power Limit	1 Watt, (30dBm)	1 Watt, (30dBm)	1 Watt, (30dBm)
E.I.R.P. with 2.2dBi Whip Antenna	126.2mW (21.01dBm)	118.6mW (20.74dBm)	74.99mW (18.75dBm)
E.I.R.P. Limit	4 Watts, (36.02dBm)	4 Watts, (36.02dBm)	4 Watts, (36.02dBm)
Peak Power Spectral Density	7.84 dBm	7.74 dBm	6.58 dBm
Peak Power Spectral Density Limit	8 dBm	8 dBm	8 dBm
-6dB Occupied Bandwidth	0.537 MHz	0.544 MHz	0.605 MHz
-6dB Occupied Bandwidth Limit	≥ 500KHz	≥ 500KHz	≥ 500KHz
Voltage Variations	3.9V(dBm)	18.72	18.26
	3.9V(mW)	74.5	66.9
	5V(dBm)	18.75	18.29
	5V(mW)	74.98	67.45
Limit	1W 30dBm	1W 30dBm	1W 30dBm

*To meet the requirements of 15.31, voltage was varied by ±15% of the nominal voltage. All tests were then performed at the highest output power voltage setting.



Order Number: F2P19086C

Client: WaveFlex, Inc.

Model: MASM-100-1003-00

4 ENGINEERING STATEMENT

This report has been prepared on behalf of WaveFlex, Inc. to provide documentation for the testing described herein. This equipment has been tested and found to comply with Part 15.247 of the FCC Rules using ANSI C63.10:2013 and KDB558074 standards. The test results found in this test report relate only to the items tested.



5 EUT INFORMATION AND DATA

5.1 Equipment Under Test:

Product: Quantum Picocell Gateway Radio
Model: MASM-100-1003-00
Serial No.: None Specified
FCC ID: **2ASYA-1001003**

5.2 Trade Name:

WaveFlex, Inc.

5.3 Power Supply:

USB from Interface Power Supply

5.4 Applicable Rules:

CFR 47, Part 15.247, subpart C

5.5 Equipment Category:

Radio Transmitter-DTS

5.6 Antenna:

2.2dBi Whip

5.7 Accessories:

Raspberry Interface

5.8 Test Item Condition:

The equipment to be tested was received in good condition.

5.9 Testing Algorithm:

EUT tested at spreading factors of 7 and 12 on three frequencies, Low (923.3 MHz), Mid (925.7 MHz) and High (927.5 MHz). Maximum output for compliance was used. Settings for SF7: Mixer gain, 14; PA gain, 3. Settings for SF12: Mixer gain, 4; PA gain, 3. The highest emissions were recorded in the data tables.



Order Number: F2P19086C

Client: WaveFlex, Inc.
Model: MASM-100-1003-00

6 LIST OF MEASUREMENT INSTRUMENTATION

Equipment Type	Asset Number	Manufacturer	Model	Serial Number	Calibration Due Date
Shielded Chamber	CL166-E	AlbatrossProjects	B83117-DF435-T261	US140023	Jan. 9, 2019
Temp/Hum. Recorder	CL232	Extech	445814	01	Mar. 22, 2019
Receiver	CL151	Rohde & Schwarz	ESU40	100319	Nov. 17, 2019
Antenna, JB3 Combination	CL175	Sunol Sciences	JB3	A030315	Oct. 11, 2019
Pre-amplifier	CL136	Hewlett Packard	8447E	1937A01894	Mar. 26, 2019
Transient Limiter	CL102	Hewlett Packard	11947A	3107A03325	Feb. 7, 2020
Spectrum Analyzer	CL147	Agilnt	E7402A	MY45101241	Jan. 25, 2020
LISN	CL181	Com-Power	LI-125A	191226	July 3, 2021
LISN	CL182	Com-Power	LI-125A	191225	July 3, 2021
Software:	Tile Version 3.4.B.3			Software Verified: July 20, 2019	
Software:	EMC 32, Version 8.53.0			Software Verified: July 17, 2018	
Transient Limiter	CL102	Hewlett Packard	11947A	3107A03325	Feb. 7, 2020
Spectrum Analyzer	CL147	Agilnt	E7402A	MY45101241	Jan. 25, 2020
LISN	CL181	Com-Power	LI-125A	191226	July 3, 2021
LISN	CL182	Com-Power	LI-125A	191225	July 3, 2021
Software:	Tile Version 3.4.B.3			Software Verified: May 15, 2019; July 19, 2019	
Software:	EMC 32, Version 5.20.2			Software Verified: May 15, 2019	



Order Number: F2P19086C

Client: WaveFlex, Inc.
Model: MASM-100-1003-00

7 OCCUPIED BANDWIDTH

7.1 Requirements:

The 6dB bandwidth shall be greater than 500 kHz.

Bandwidth measurements were made at Low, Mid and High frequencies, with resolution bandwidth at 100kHz, video bandwidth at 300kHz, span set at 3X DTS bandwidth. The bandwidth was measured using the analyzer's marker function.



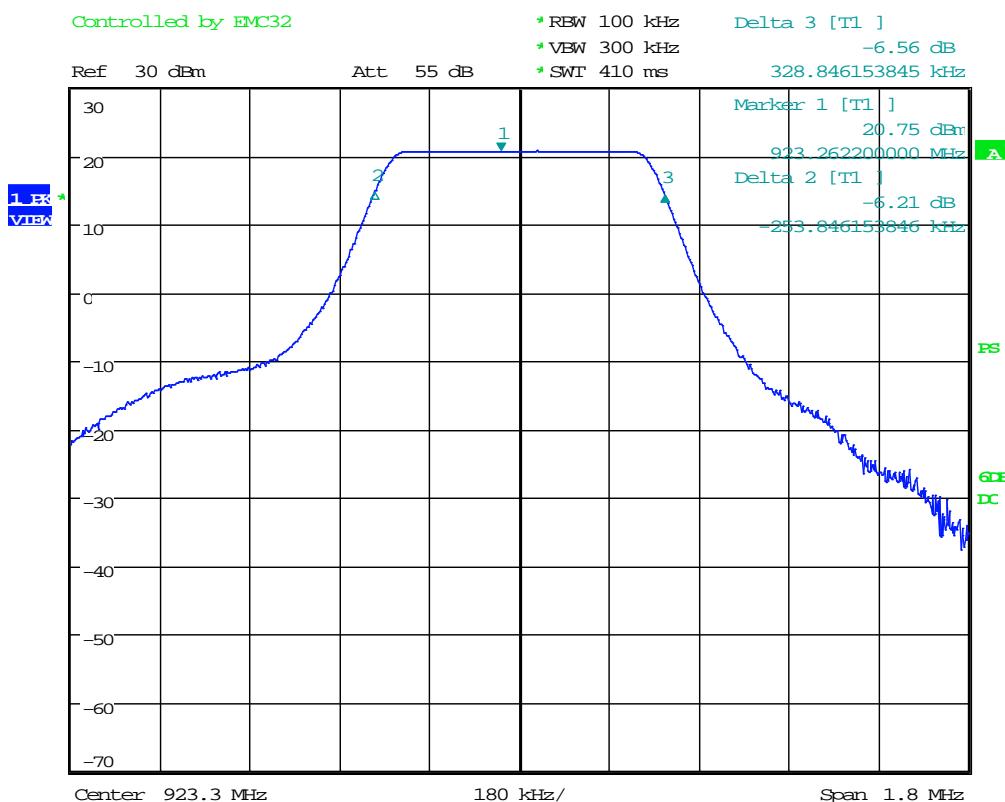
Order Number: F2P19086C

Client: WaveFlex, Inc.
Model: MASM-100-1003-00

7.2 Occupied Bandwidth Test Data

Test Date:	July 23, 2018	Test Engineer:	J. Chiller
Standards:	CFR 47 Part 15.247(a)(2); KDB558074	Air Temperature:	20.6°C
		Relative Humidity:	40%

SF7: -6dB, Low Channel



Date: 23.JUL.2018 12:18:07

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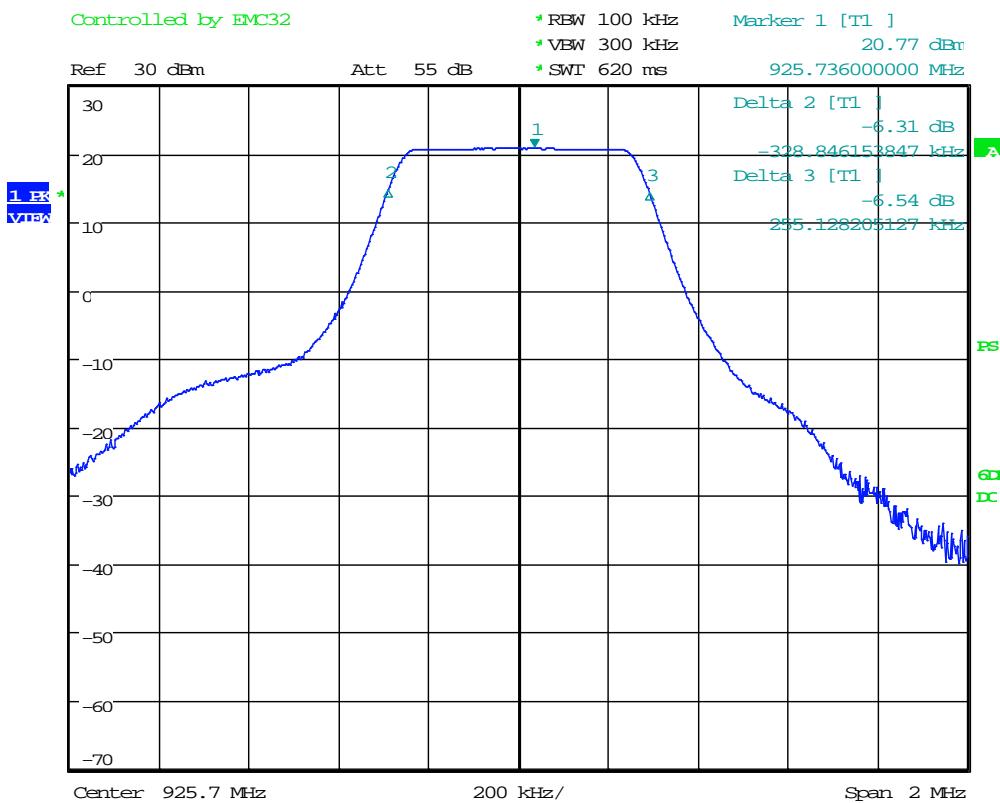
Issue Date: July 26, 2018



Order Number: F2P19086C

Client: WaveFlex, Inc.
Model: MASM-100-1003-00

SF7: -6dB, Mid Channel



Date: 23.JUL.2018 14:32:01

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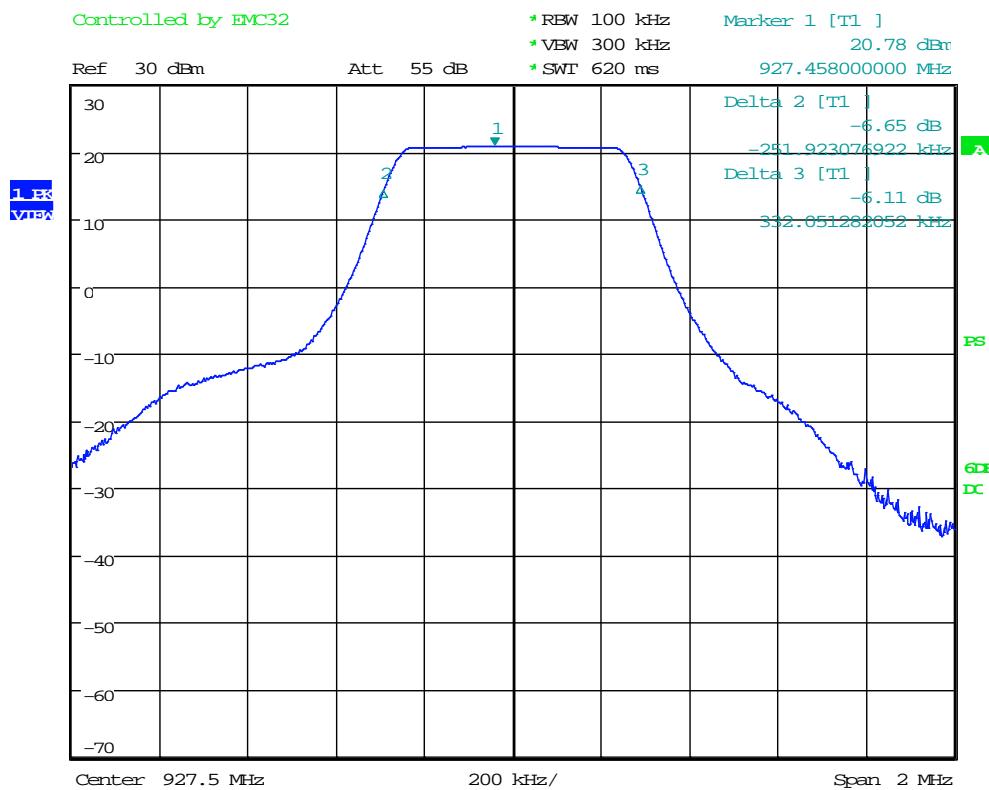
Issue Date: July 26, 2018



Order Number: F2P19086C

Client: WaveFlex, Inc.
Model: MASM-100-1003-00

SF7: -6dB, High Channel



Date: 23.JUL.2018 14:37:17

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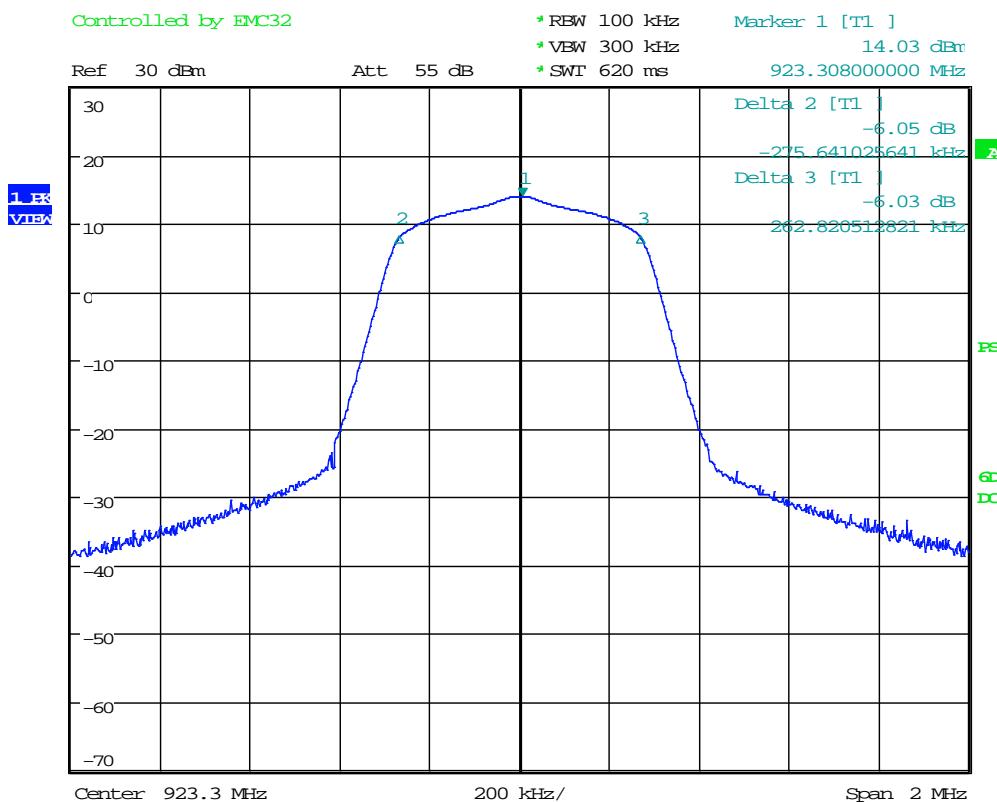


Order Number: F2P19086C

Client: WaveFlex, Inc.
Model: MASM-100-1003-00

Test Date:	July 23, 2018	Test Engineer:	J. Chiller
Standards:	CFR 47 Part 15.247(a)(2); KDB558074	Air Temperature:	22.1°C
		Relative Humidity:	41%

SF12: -6dB, Low Channel



Date: 23.JUL.2018 14:27:40

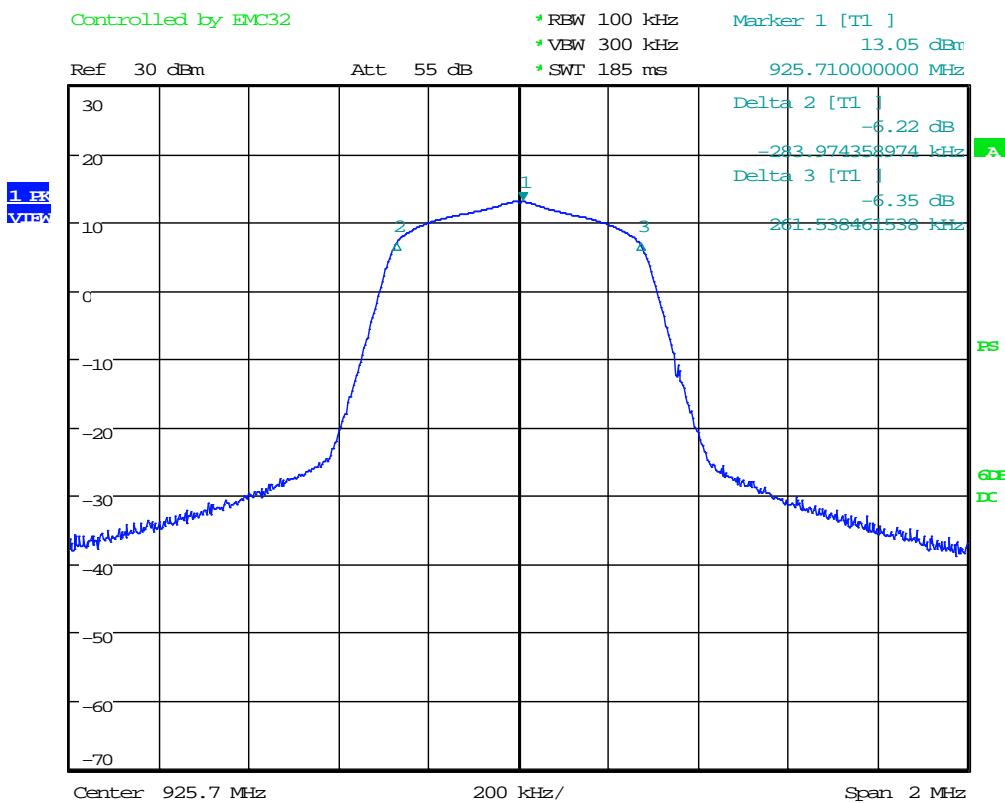
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SF12: -6dB, Mid Channel



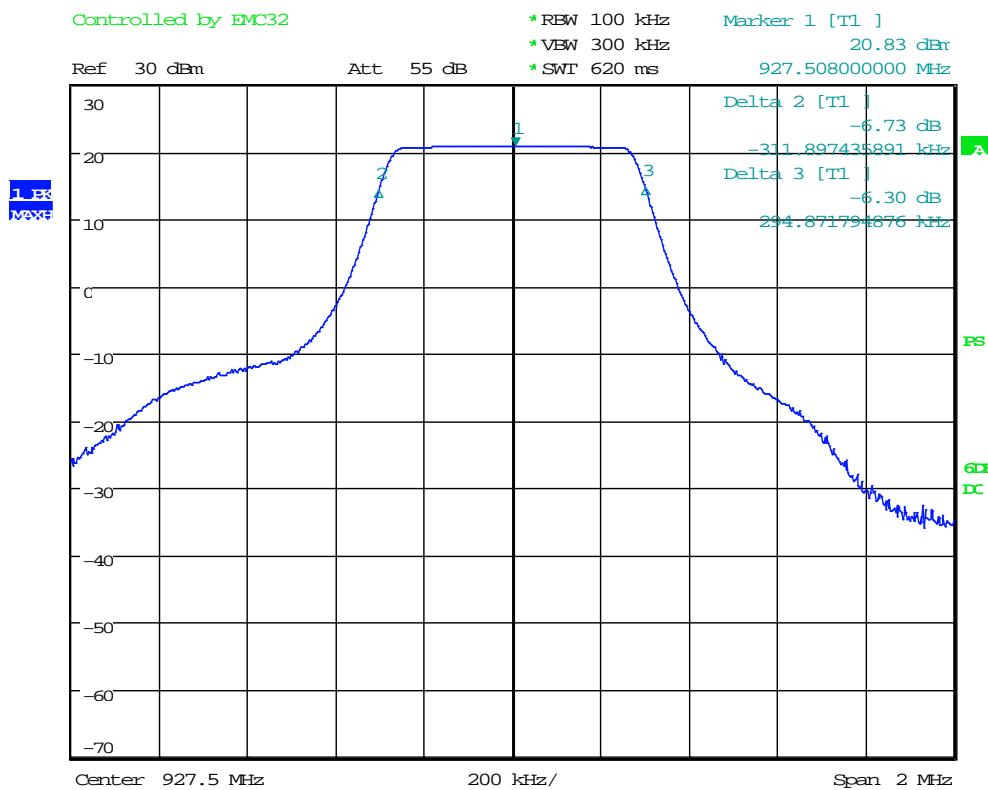
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Order Number: F2P19086C

Client: WaveFlex, Inc.
Model: MASM-100-1003-00

SF12: -6dB, High Channel



Date: 23.JUL.2018 14:45:30

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8 CONDUCTED OUTPUT POWER

The EUT antenna port was fitted with an SMA connector and directly connected to the input of the receiver. The peak power output was measured.

8.1 Requirements:

The peak power output shall be 1 watt (30 dBm) or less when using an antenna with a gain of less than 6dBi. For antennas having a gain of more than 6dBi, the limit is reduced by 1dB for every dB the antenna gain is over 6dBi.



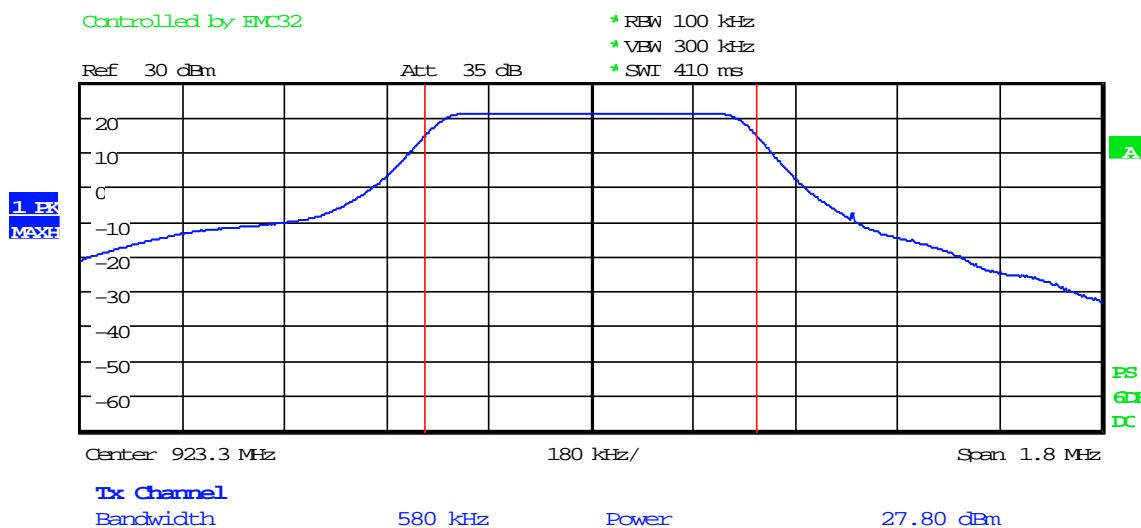
Order Number: F2P19086C

Client: WaveFlex, Inc.
Model: MASM-100-1003-00

8.2 Conducted Output Power Test Data

Test Date:	July 23, 2018	Test Engineer:	J. Chiller
Standards:	CFR 47 Part 15.247(b)(3); KDB558074	Air Temperature:	20.6°C
		Relative Humidity:	40%

SF7: Low Channel



Date: 23.JUL.2018 12:20:04

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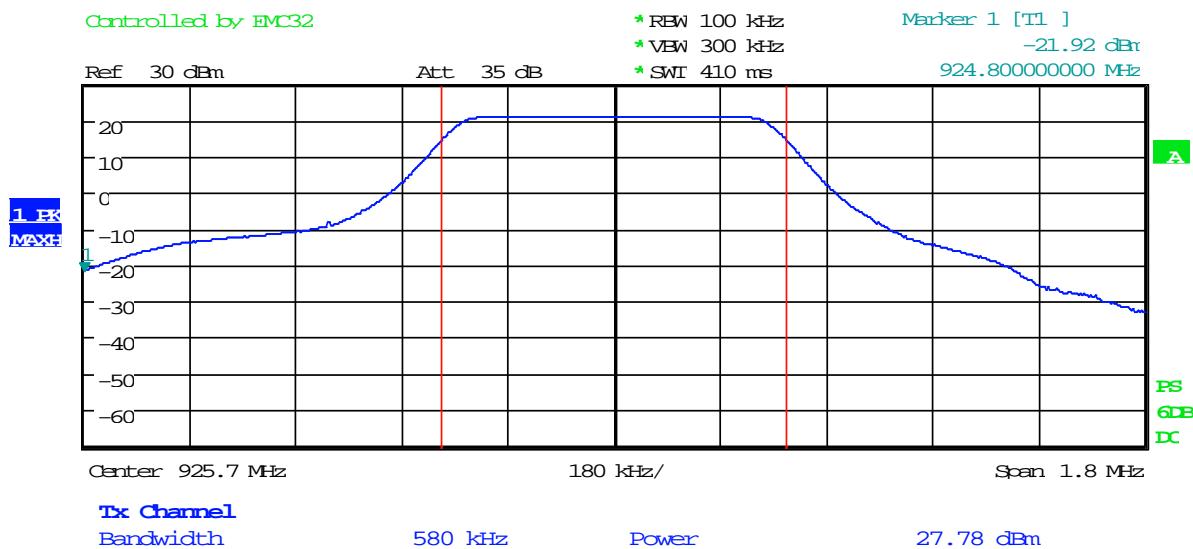
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Order Number: F2P19086C

Client: WaveFlex, Inc.
Model: MASM-100-1003-00

SF7: Mid Channel



Date: 23.JUL.2018 12:42:59

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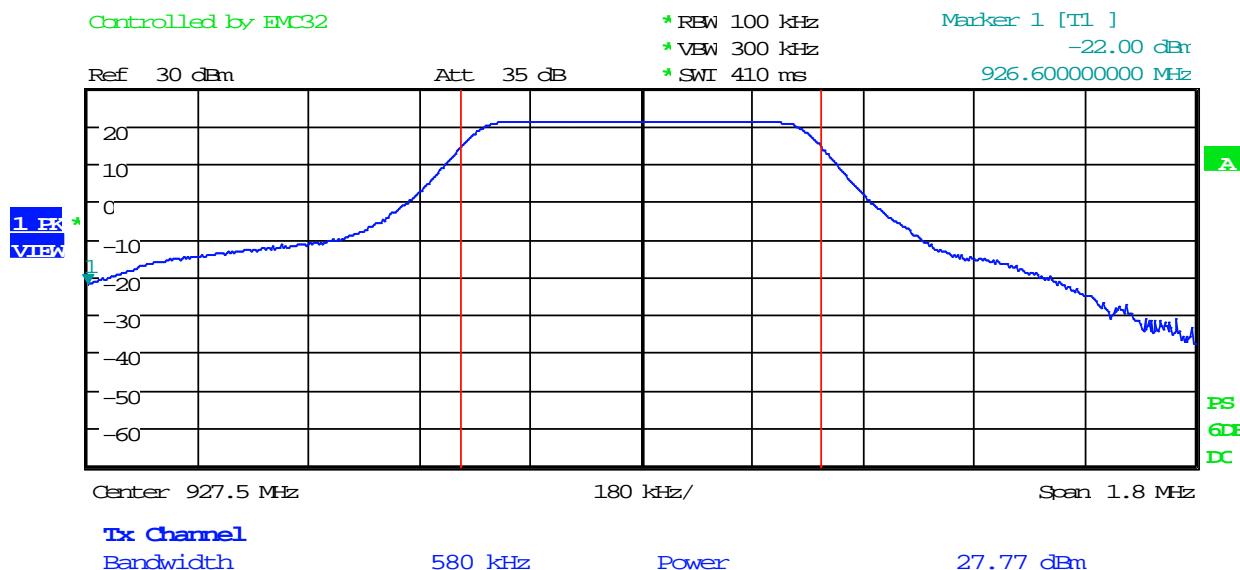
Issue Date: July 26, 2018



Order Number: F2P19086C

Client: WaveFlex, Inc.
Model: MASM-100-1003-00

SF7: High Channel



Date: 23.JUL.2018 12:49:24

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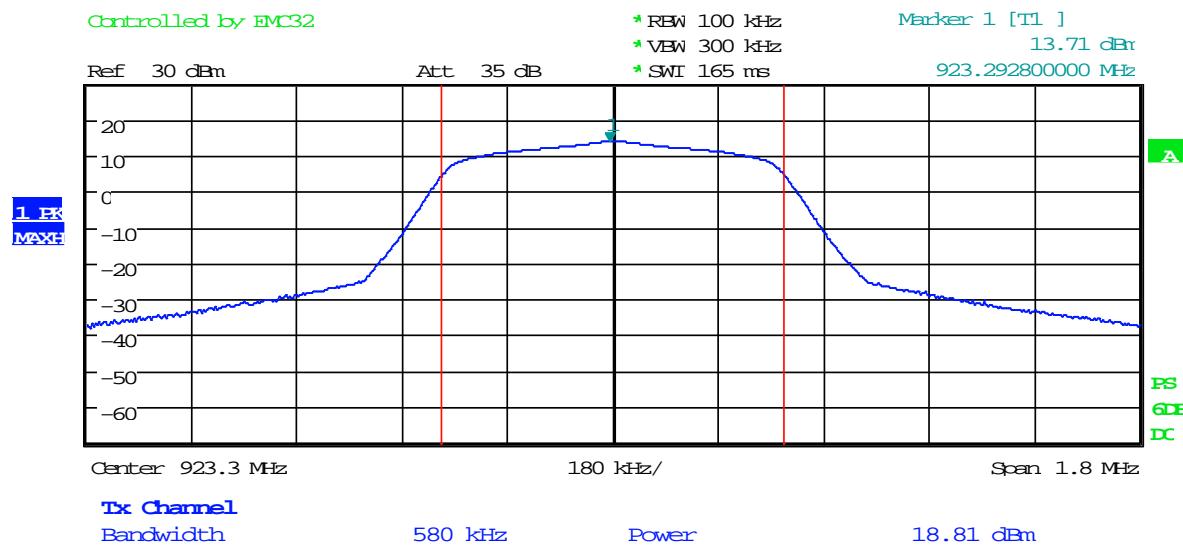
Issue Date: July 26, 2018



Order Number: F2P19086C

Client: WaveFlex, Inc.
Model: MASM-100-1003-00

SF12: Low Channel



Date: 23.JUL.2018 13:24:55

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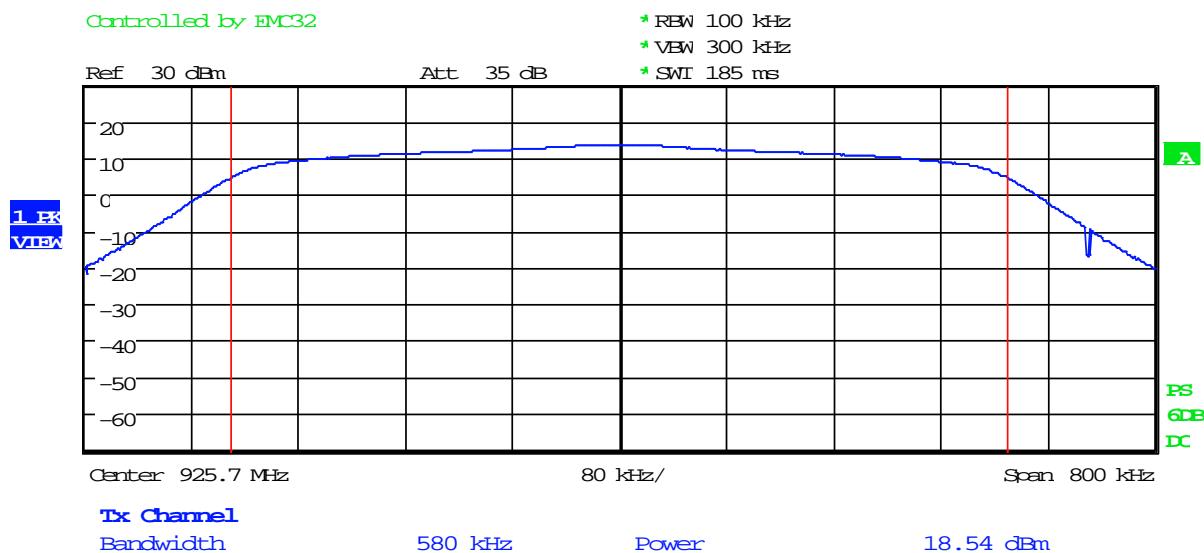
Issue Date: July 26, 2018



Order Number: F2P19086C

Client: WaveFlex, Inc.
Model: MASM-100-1003-00

SF12: Mid Channel



Date: 23.JUL.2018 13:44:11

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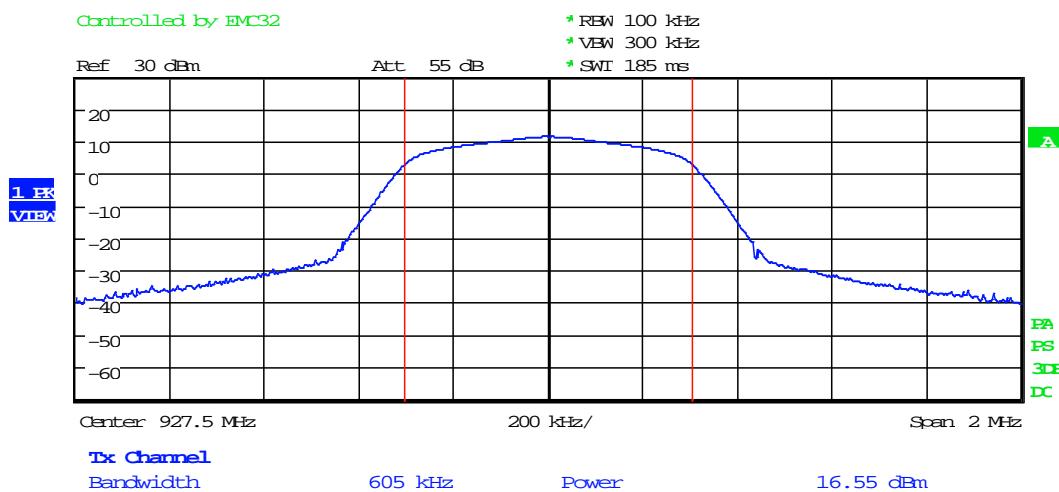
Issue Date: July 26, 2018



Order Number: F2P19086C

Client: WaveFlex, Inc.
Model: MASM-100-1003-00

SF12: High Channel





9 VOLTAGE VARIATIONS

9.1 Requirements

For intentional radiators, measurements of the variation of the input power or the radiated signal level of the fundamental frequency component of the emission, as appropriate, shall be performed with the supply voltage varied between 85% and 115% of the nominal rated supply voltage. For battery-operated equipment, the equipment tests shall be performed using a new battery.



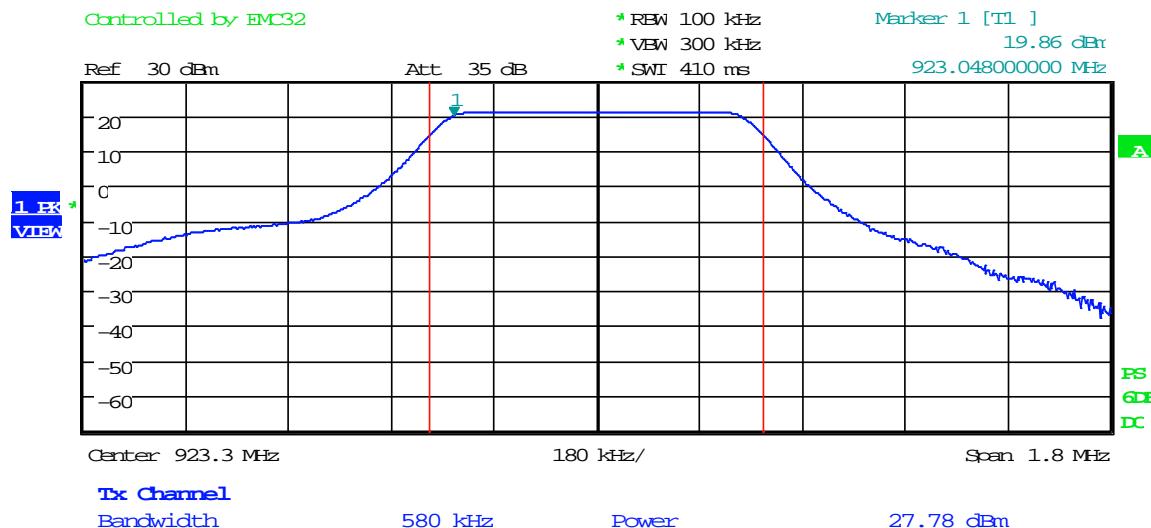
Order Number: F2P19086C

Client: WaveFlex, Inc.
Model: MASM-100-1003-00

9.2 Voltage Variations Test Data

Test Date(s):	July 23, 2018	Test Engineer:	J. Chiller
Rule:	15.31(e)	Air Temperature:	22.1° C
Test Results:	Complies	Relative Humidity:	41%

SF7: Low Channel, 3.9VDC



Date: 23.JUL.2018 13:19:57

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Report Number: F2P19086C-01E

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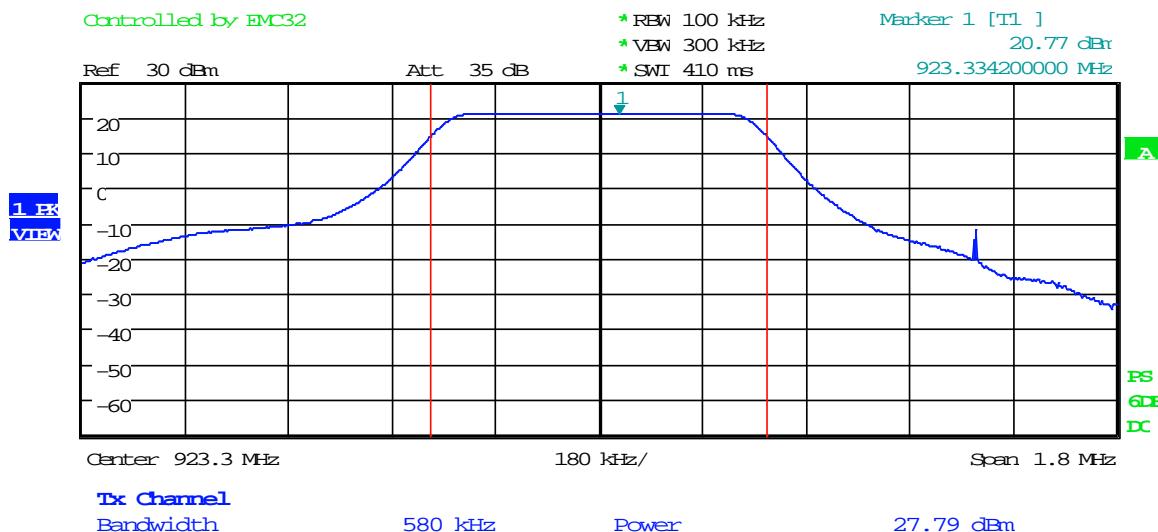
Issue Date: July 26, 2018



Order Number: F2P19086C

Client: WaveFlex, Inc.
Model: MASM-100-1003-00

SF7: Low Channel, 5VDC



Date: 23.JUL.2018 12:40:20

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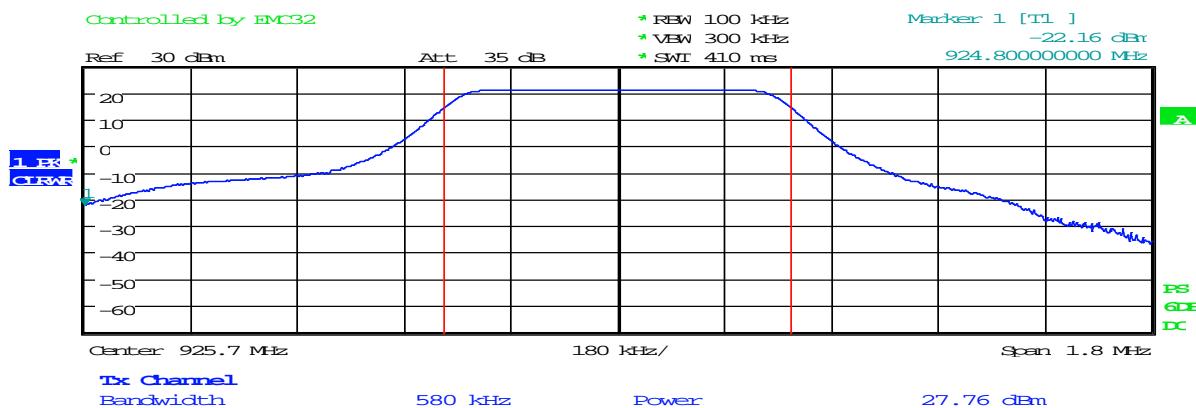
Issue Date: July 26, 2018



Order Number: F2P19086C

Client: WaveFlex, Inc.
Model: MASM-100-1003-00

SF7: Mid Channel, 3.9VDC



Date: 23.JUL.2018 12:43:54

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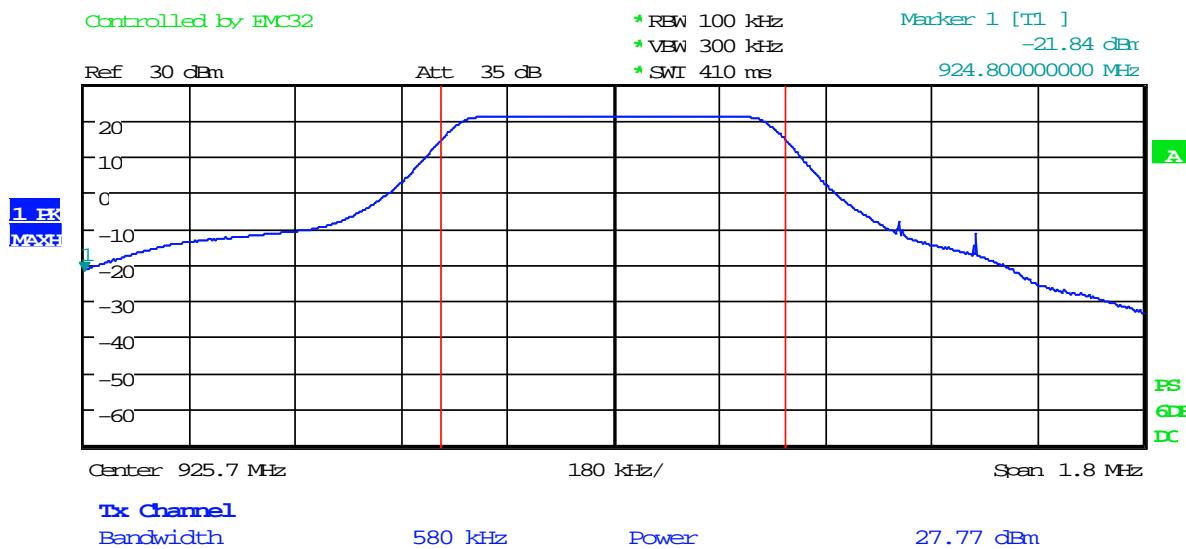
Issue Date: July 26, 2018



Order Number: F2P19086C

Client: WaveFlex, Inc.
Model: MASM-100-1003-00

SF7: Mid Channel, 5VDC



Date: 23.JUL.2018 12:44:58

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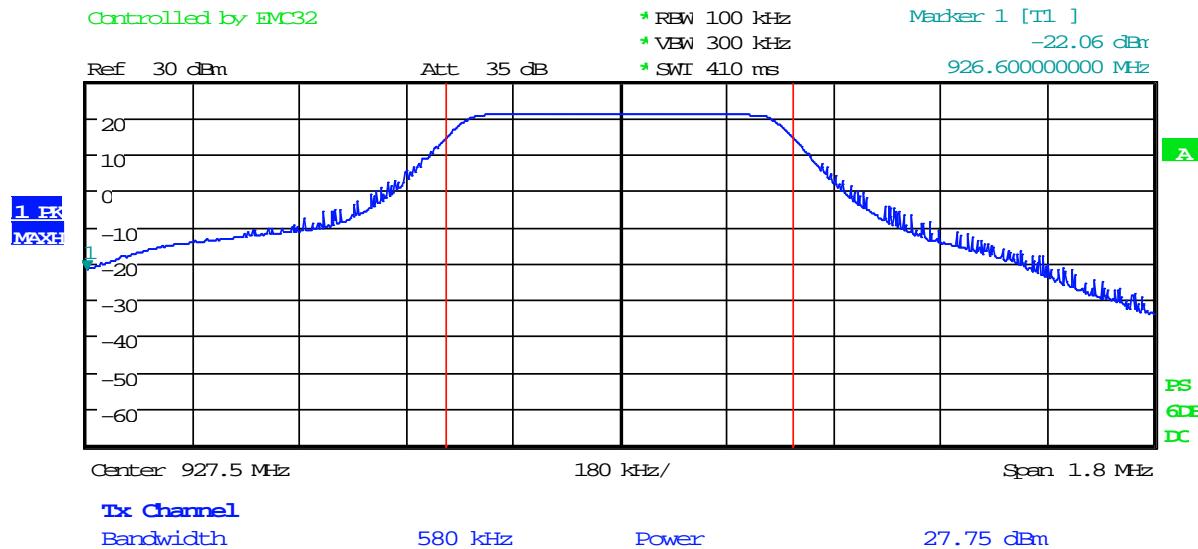
Issue Date: July 26, 2018



Order Number: F2P19086C

Client: WaveFlex, Inc.
Model: MASM-100-1003-00

SF7: High Channel, 3.9VDC



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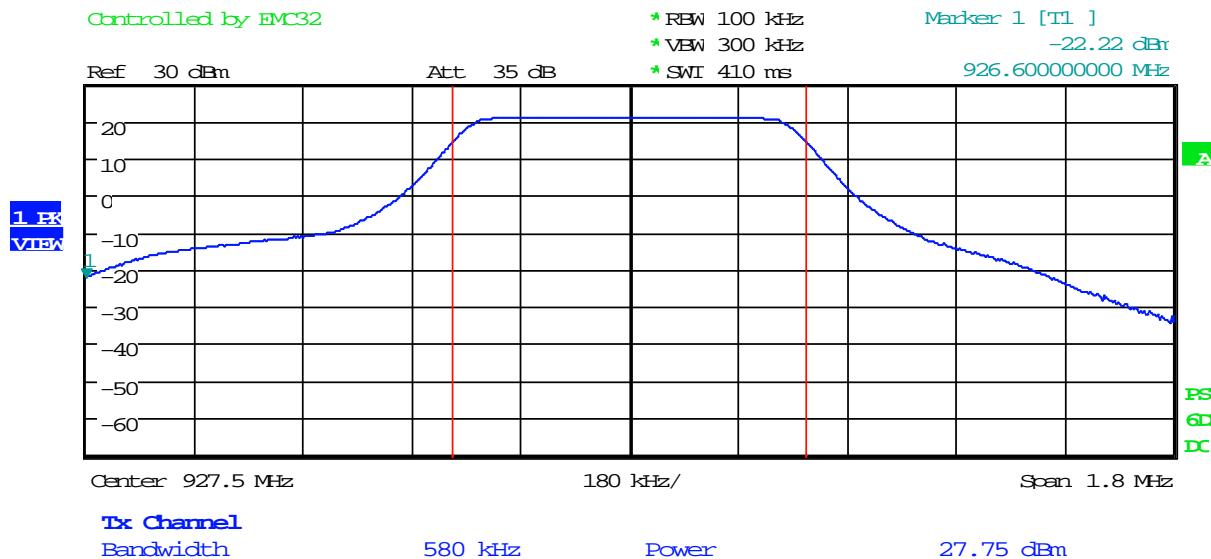
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Order Number: F2P19086C

Client: WaveFlex, Inc.
Model: MASM-100-1003-00

SF7: High Channel, 5VDC

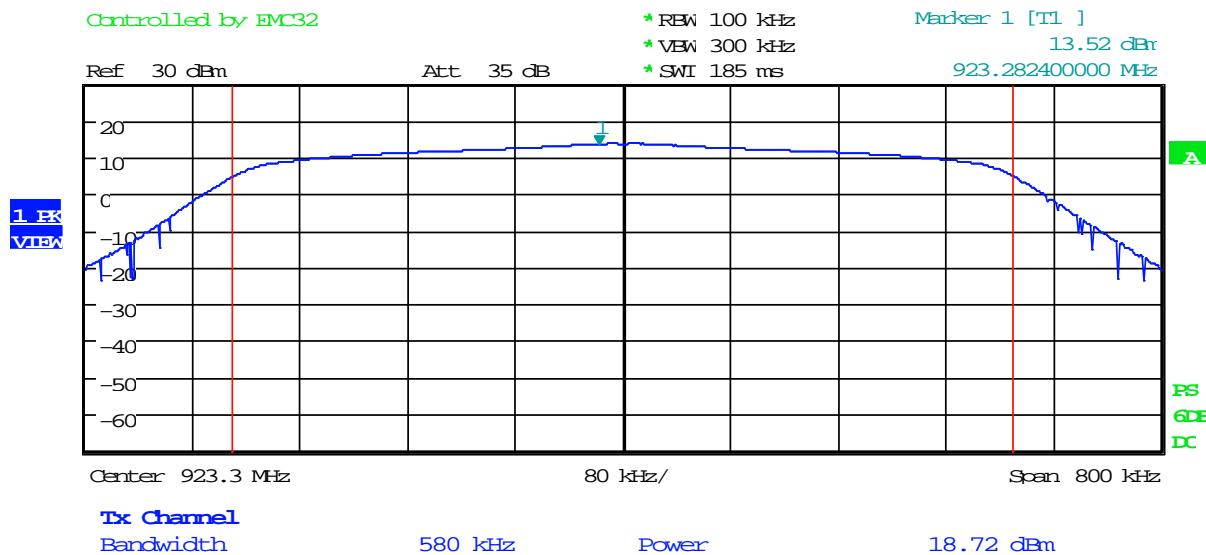




Order Number: F2P19086C

Client: WaveFlex, Inc.
Model: MASM-100-1003-00

SF12: Low Channel, 3.9VDC



Date: 23.JUL.2018 13:32:26

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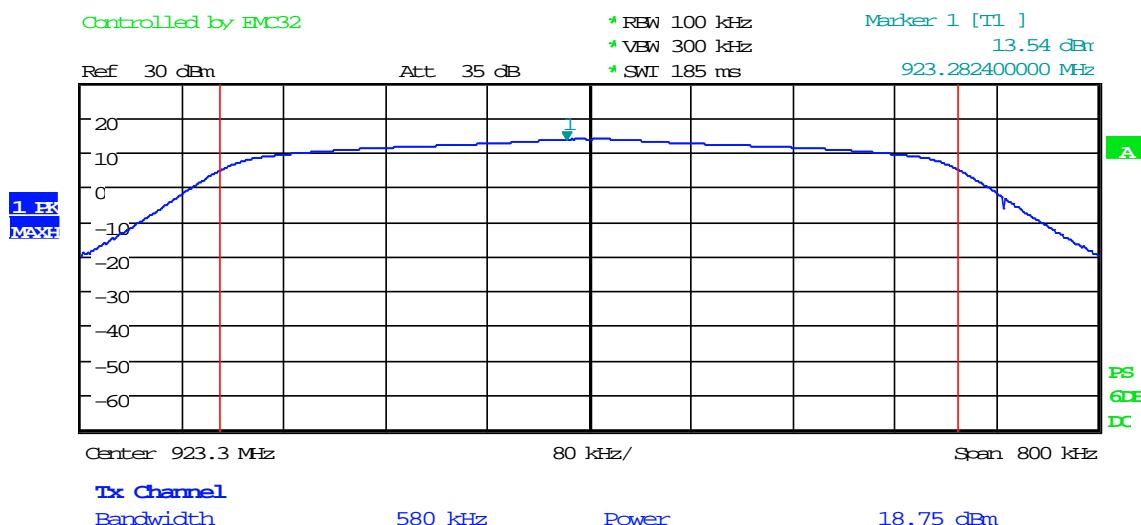
Issue Date: July 26, 2018



Order Number: F2P19086C

Client: WaveFlex, Inc.
Model: MASM-100-1003-00

SF12: Low Channel, 5VDC



Date: 23.JUL.2018 13:33:32

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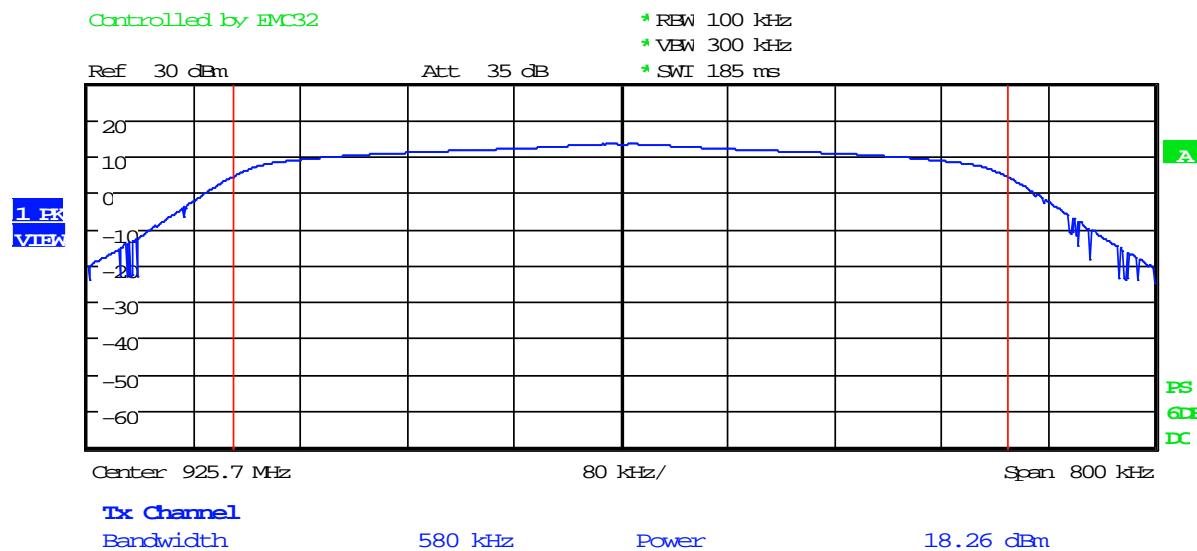
Issue Date: July 26, 2018



Order Number: F2P19086C

Client: WaveFlex, Inc.
Model: MASM-100-1003-00

SF12: Mid Channel, 3.9VDC



Date: 23.JUL.2018 13:47:41

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Report Number: F2P19086C-01E

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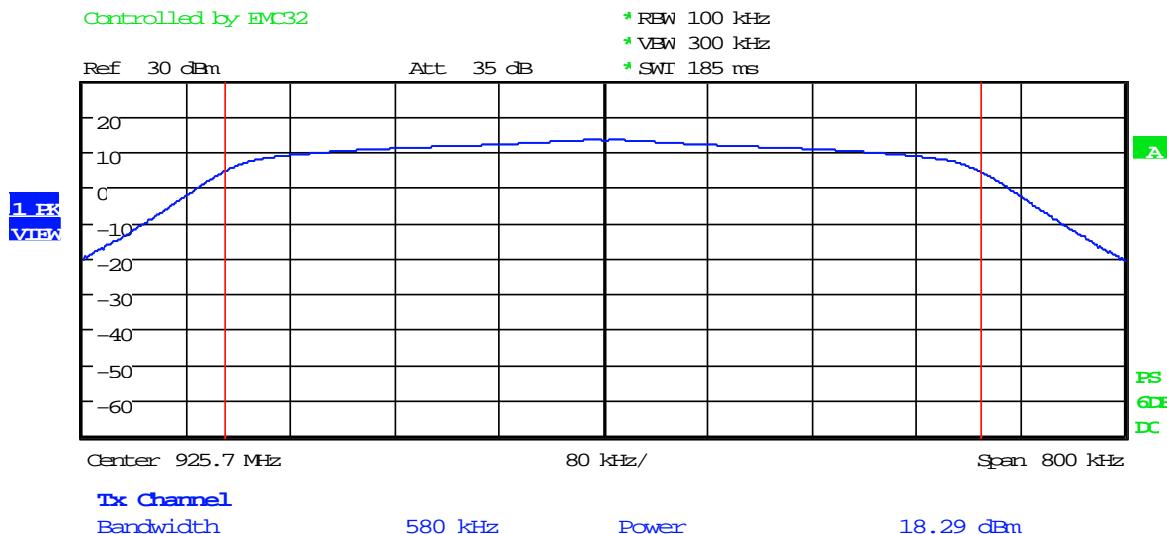
Issue Date: July 26, 2018



Order Number: F2P19086C

Client: WaveFlex, Inc.
Model: MASM-100-1003-00

SF12: Mid Channel, 5VDC



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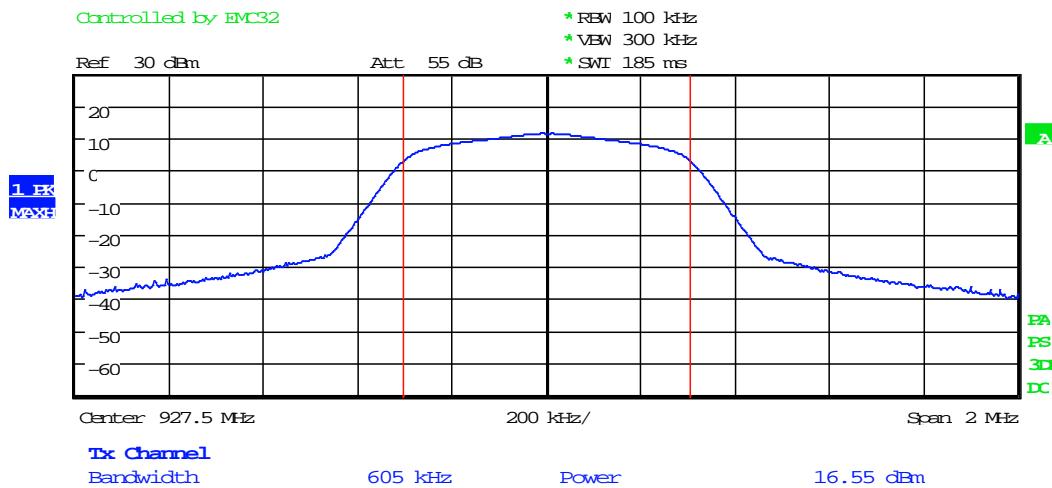
Issue Date: July 26, 2018



Order Number: F2P19086C

Client: WaveFlex, Inc.
Model: MASM-100-1003-00

SF12: High Channel, 3.9VDC



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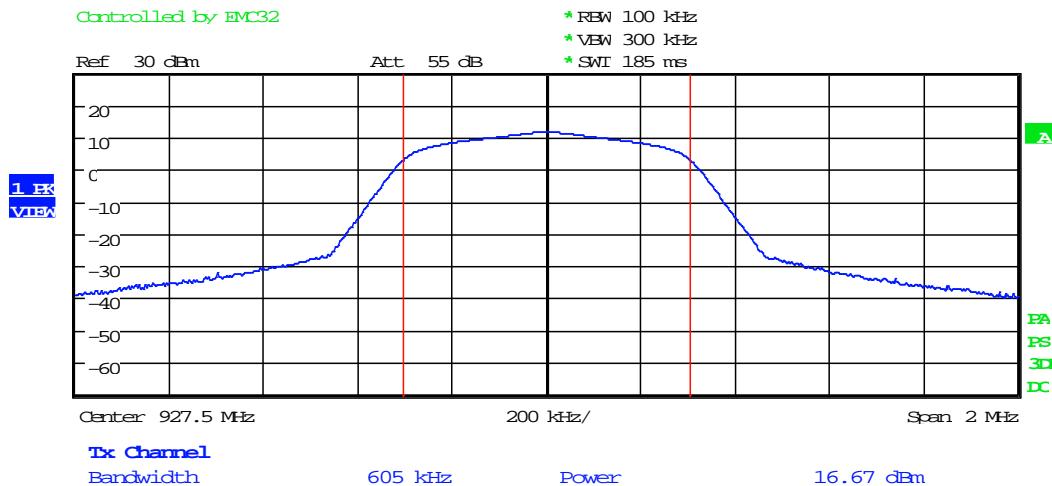
Issue Date: July 26, 2018



Order Number: F2P19086C

Client: WaveFlex, Inc.
Model: MASM-100-1003-00

SF12: High Channel, 5VDC





10 CONDUCTED SPURIOUS EMISSIONS

The following tests were performed to demonstrate compliance.

RF Antenna Conducted Test

The EUT antenna port was fitted with an SMA connector and directly connected to the input of the spectrum analyzer.

10.1 Requirements:

All Spurious Emissions must be at least 20dB down from the highest emission level measured within the authorized band up through the tenth harmonic.

Spurious emissions measurements were made at the low, mid, and upper channels with the appropriate spectrum analyzer impulse bandwidth. Additionally, 20dB down points were measured for the low and high channels to verify band edge compliance. SF12 determined to be worst-case.



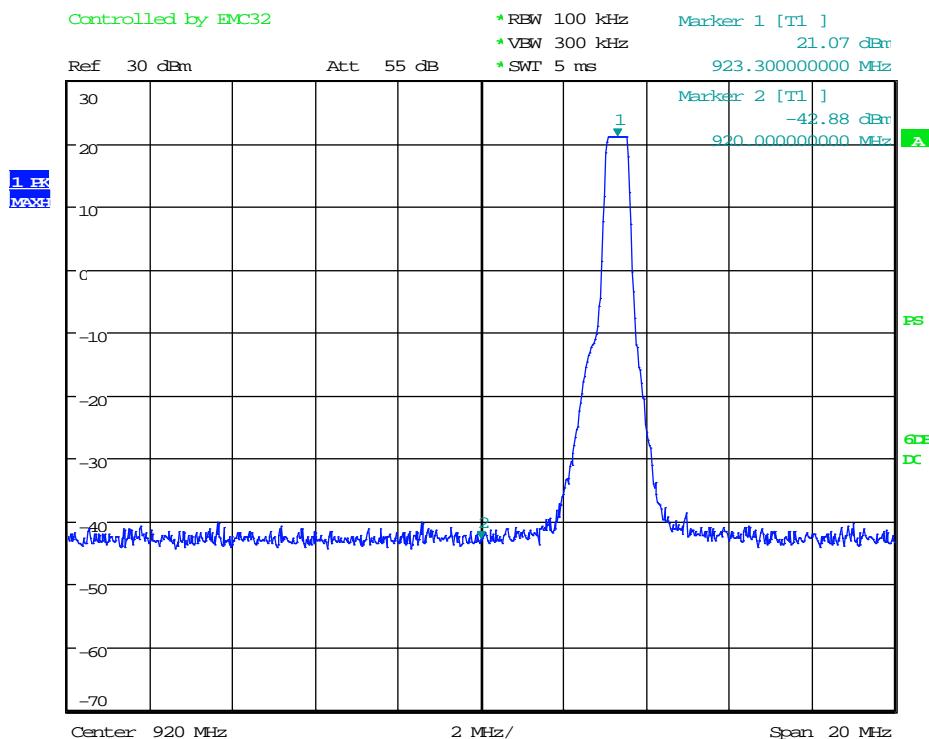
Order Number: F2P19086C

Client: WaveFlex, Inc.
Model: MASM-100-1003-00

10.2 Conducted Spurious Emissions Test Data

Test Date:	July 18, 2018; July 23, 2018	Test Engineer:	J. Chiller
Standards:	CFR 47 Part 15.247(d) /KDB558074	Air Temperature:	21.2°C

SF7: Low Band Edge



Date: 23.JUL.2018 17:10:08

051816

Report Number: F2P19086C-01E

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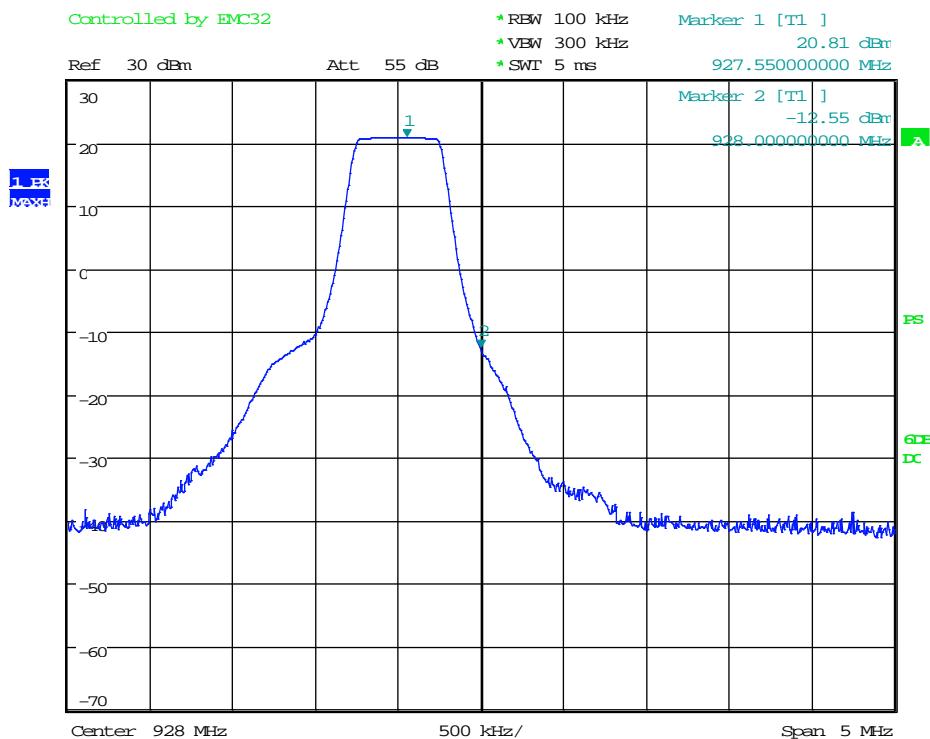
Issue Date: July 26, 2018



Order Number: F2P19086C

Client: WaveFlex, Inc.
Model: MASM-100-1003-00

SF7: High Band Edge



Date: 23.JUL.2018 17:16:54

051816

Report Number: F2P19086C-01E

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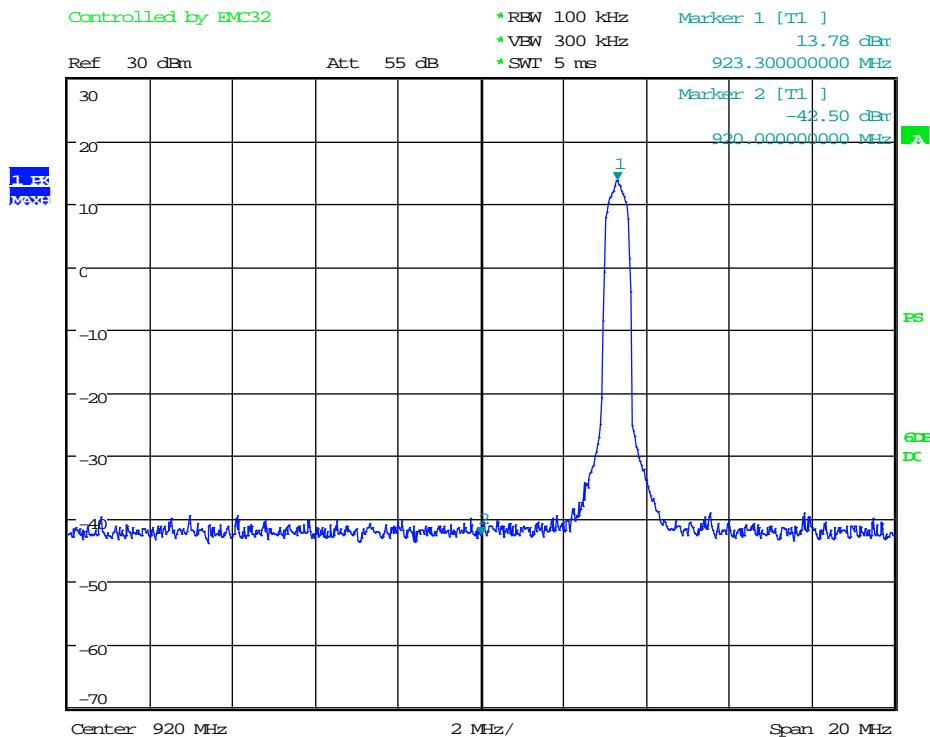
Issue Date: July 26, 2018



Order Number: F2P19086C

Client: WaveFlex, Inc.
Model: MASM-100-1003-00

SF12: Low Band Edge



Date: 23.JUL.2018 17:11:59

051816

Report Number: F2P19086C-01E

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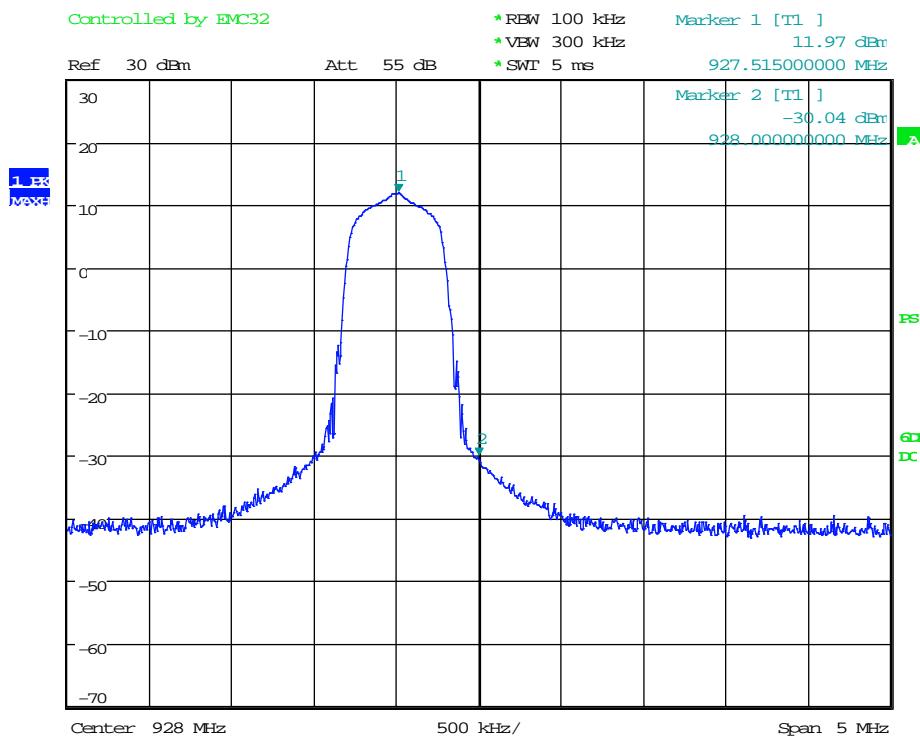
Issue Date: July 26, 2018



Order Number: F2P19086C

Client: WaveFlex, Inc.
Model: MASM-100-1003-00

SF12: High Band Edge



Date: 23.JUL.2018 17:18:31

051816

Report Number: F2P19086C-01E

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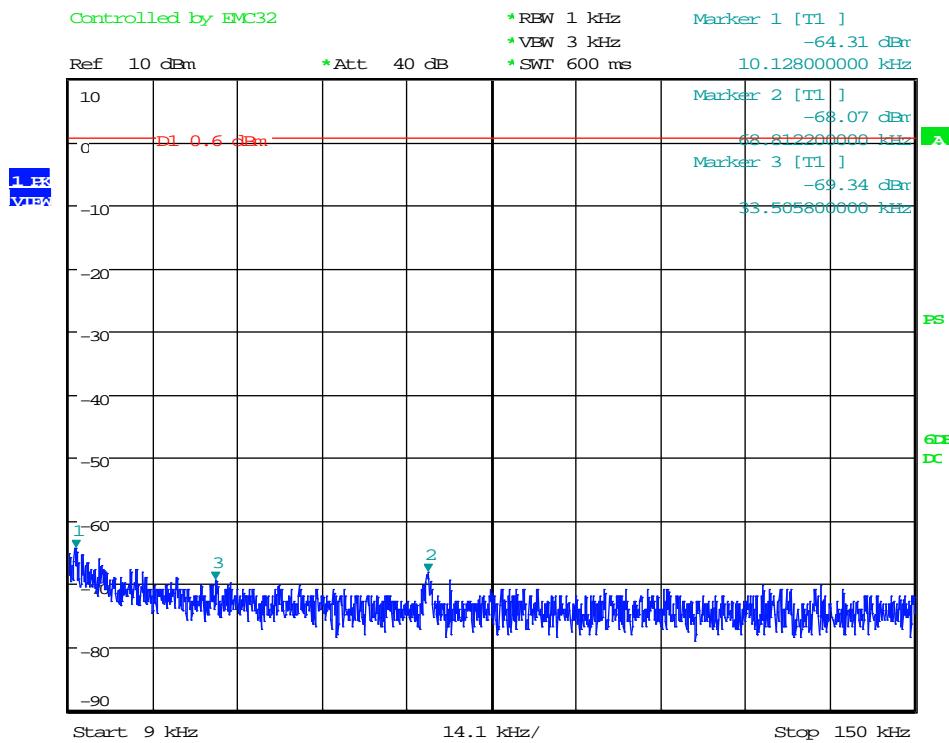
Issue Date: July 26, 2018



Order Number: F2P19086C

Client: WaveFlex, Inc.
Model: MASM-100-1003-00

Low Channel: 0.009 MHz to 0.15 MHz (SF12, worst-case)



Date: 18.JUL.2018 16:50:34

051816

Report Number: F2P19086C-01E

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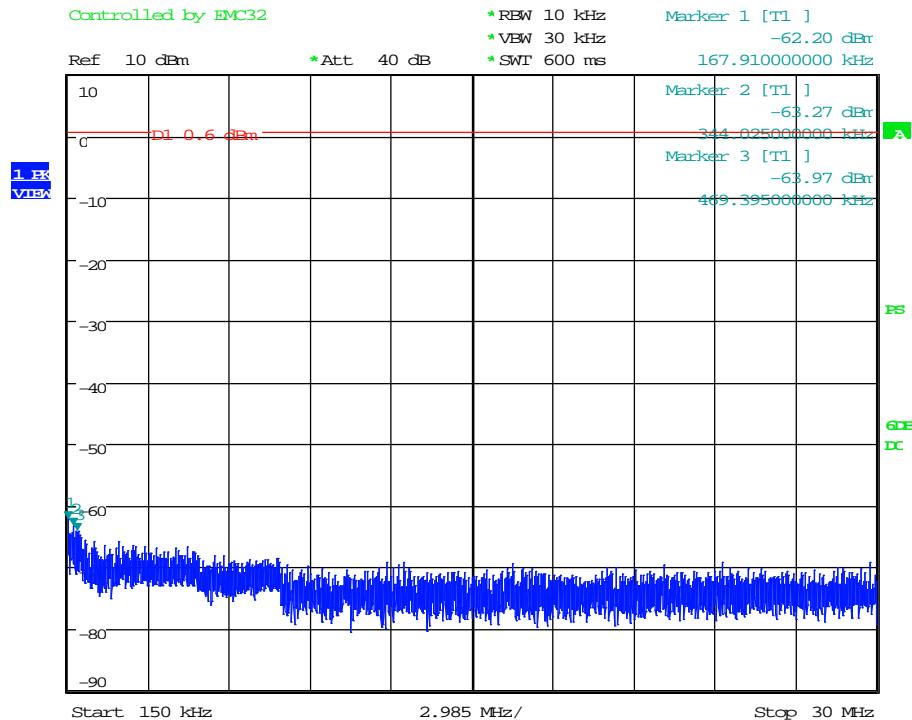
Issue Date: July 26, 2018



Order Number: F2P19086C

Client: WaveFlex, Inc.
Model: MASM-100-1003-00

Low Channel: 0.15 to 30.0 (SF12, worst-case)



Date: 18.JUL.2018 16:48:52

051816

Report Number: F2P19086C-01E

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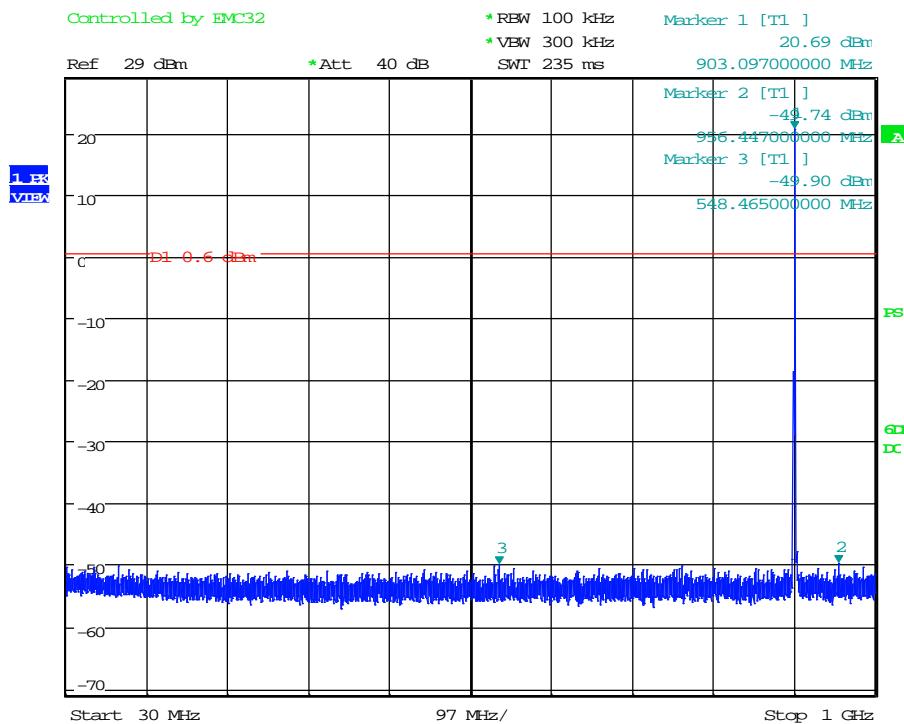
Issue Date: July 26, 2018



Order Number: F2P19086C

Client: WaveFlex, Inc.
Model: MASM-100-1003-00

Low Channel: 30 MHz to 1000 MHz (SF12, worst-case)



Date: 18.JUL.2018 16:46:45

051816

Report Number: F2P19086C-01E

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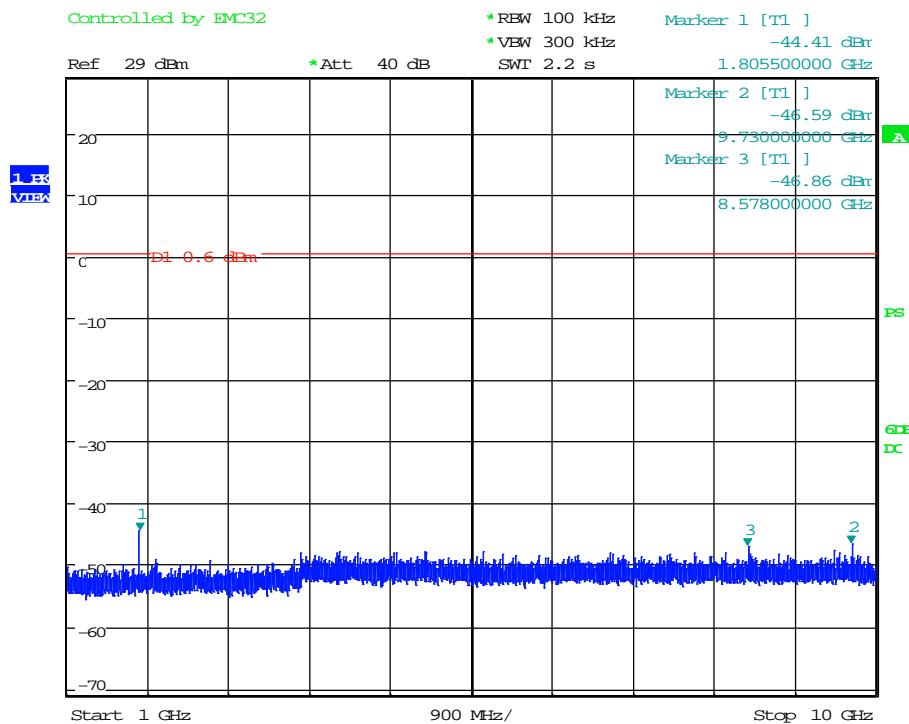
Issue Date: July 26, 2018



Order Number: F2P19086C

Client: WaveFlex, Inc.
Model: MASM-100-1003-00

Low Channel: 1 GHz to 10 GHz (SF12, worst-case)



Date: 18.JUL.2018 16:45:18

051816

Report Number: F2P19086C-01E

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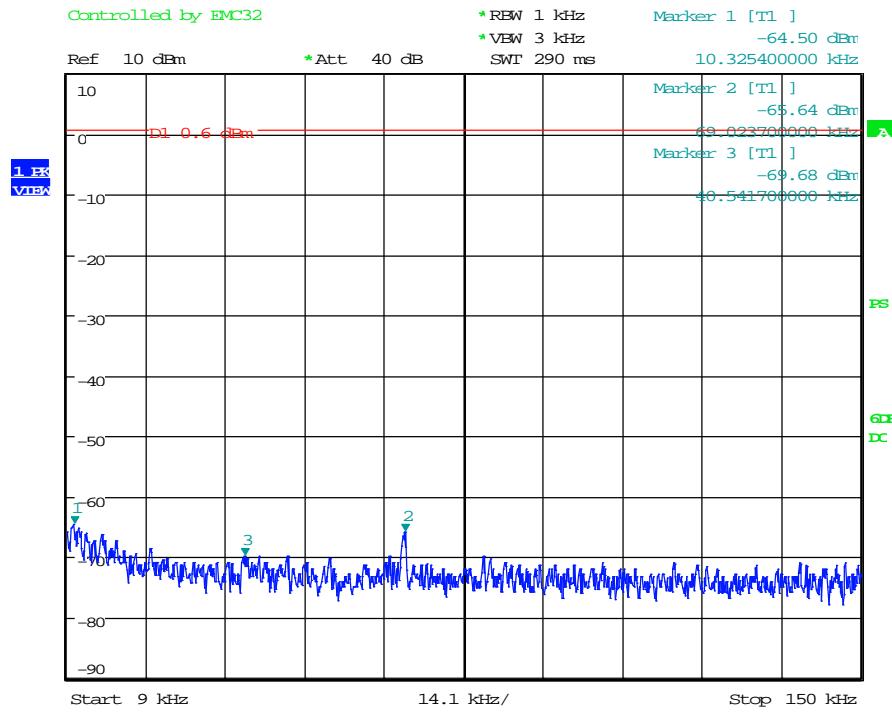
Issue Date: July 26, 2018



Order Number: F2P19086C

Client: WaveFlex, Inc.
Model: MASM-100-1003-00

Mid Channel: 0.009 MHz to 0.15 MHz (SF12, worst-case)



Date: 18.JUL.2018 16:40:14

051816

Report Number: F2P19086C-01E

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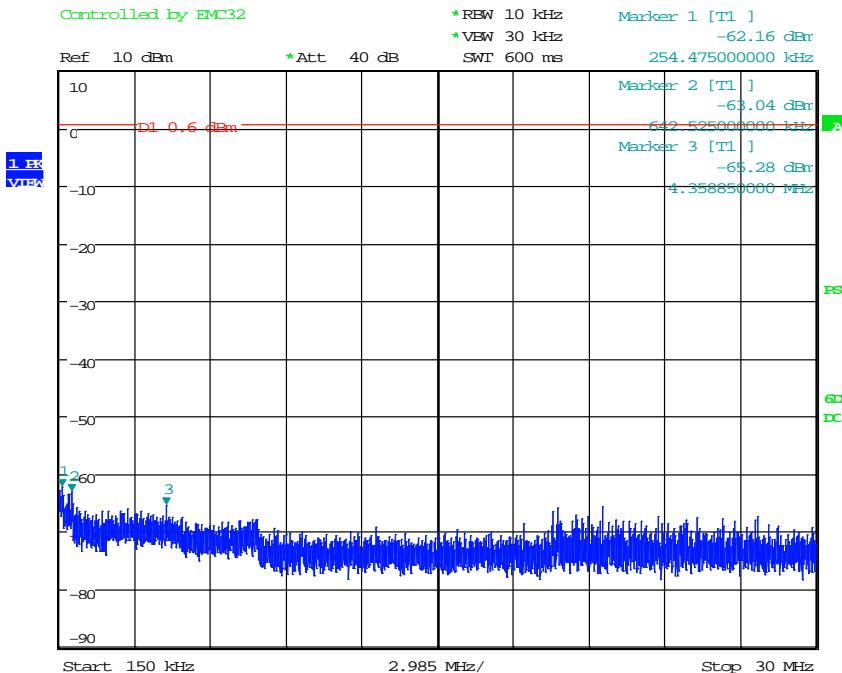
Issue Date: July 26, 2018



Order Number: F2P19086C

Client: WaveFlex, Inc.
Model: MASM-100-1003-00

Mid Channel: 0.15 to 30.0 (SF12, worst-case)



Date: 18.JUL.2018 16:38:45

051816

Report Number: F2P19086C-01E

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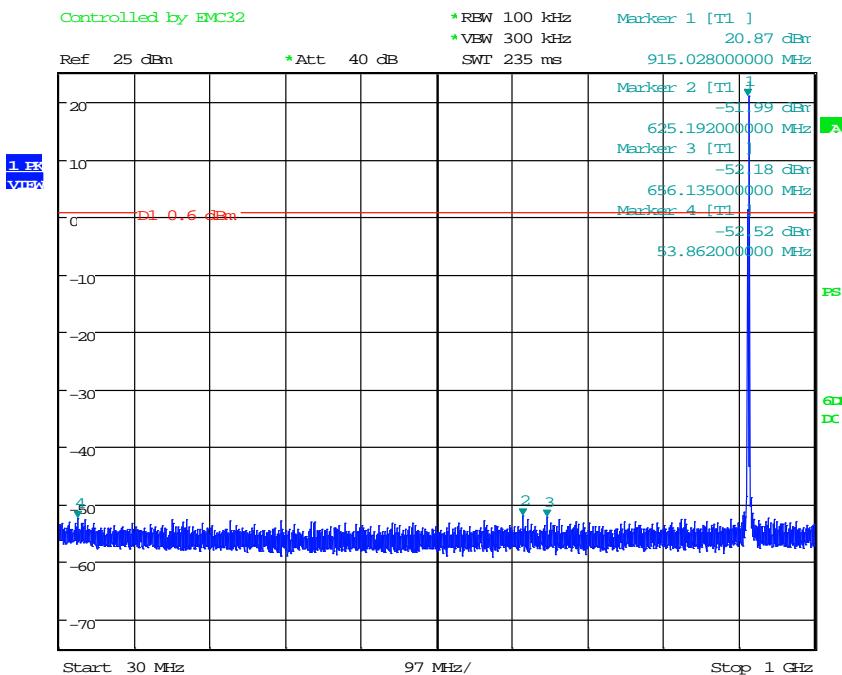
Issue Date: July 26, 2018



Order Number: F2P19086C

Client: WaveFlex, Inc.
Model: MASM-100-1003-00

Mid Channel: 30 MHz to 1000 MHz (SF12, worst-case)



Date: 18.JUL.2018 16:36:36

051816

Report Number: F2P19086C-01E

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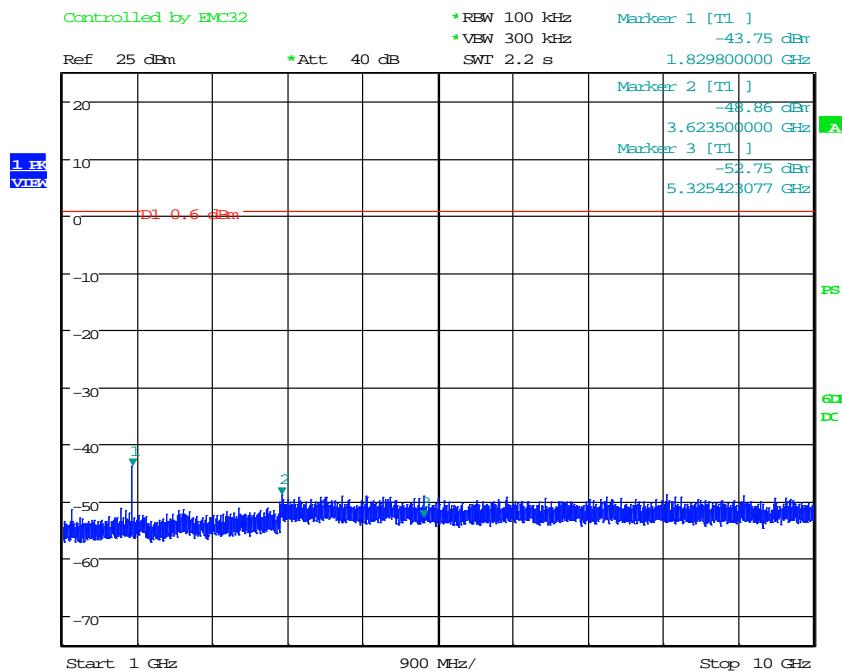
Issue Date: July 26, 2018



Order Number: F2P19086C

Client: WaveFlex, Inc.
Model: MASM-100-1003-00

Mid Channel: 1 GHz to 10 GHz (SF12, worst-case)



Date: 18.JUL.2018 16:34:22

051816

Report Number: F2P19086C-01E

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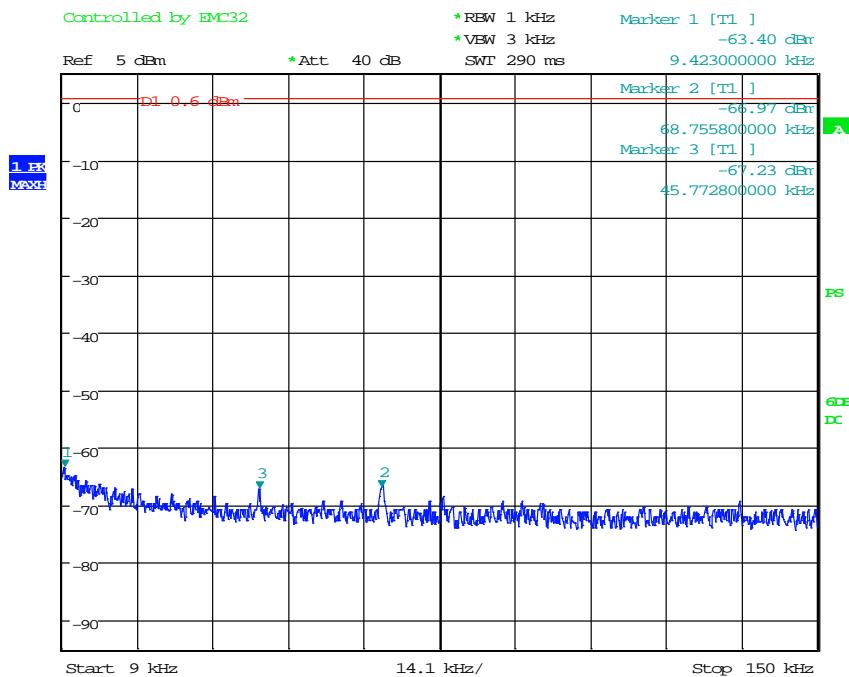
Issue Date: July 26, 2018



Order Number: F2P19086C

Client: WaveFlex, Inc.
Model: MASM-100-1003-00

High Channel: 0.009 MHz to 0.15 MHz (SF12, worst-case)



Date: 18.JUL.2018 16:21:58

051816

Report Number: F2P19086C-01E

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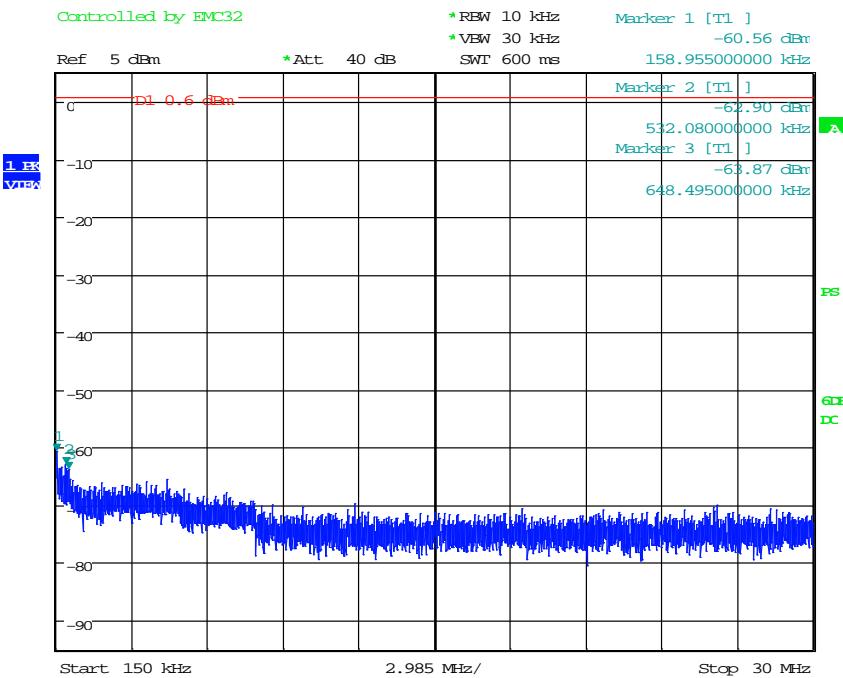
Issue Date: July 26, 2018



Order Number: F2P19086C

Client: WaveFlex, Inc.
Model: MASM-100-1003-00

High Channel: 0.15 to 30.0 (SF12, worst-case)



Date: 18.JUL.2018 16:27:18

051816

Report Number: F2P19086C-01E

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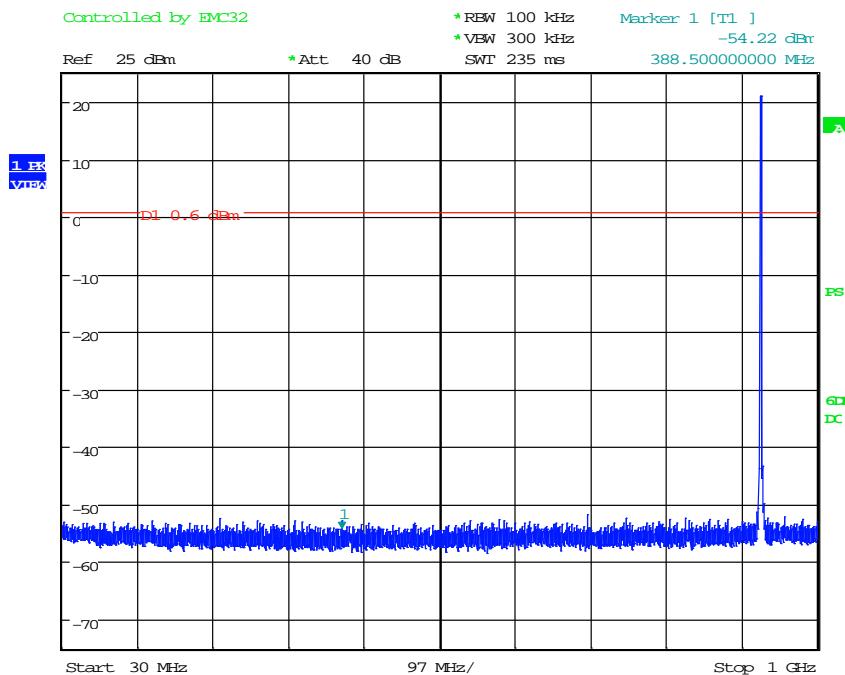
Issue Date: July 26, 2018



Order Number: F2P19086C

Client: WaveFlex, Inc.
Model: MASM-100-1003-00

High Channel: 30 MHz to 1000 MHz (SF12, worst-case)



Date: 18.JUL.2018 16:06:40

051816

Report Number: F2P19086C-01E

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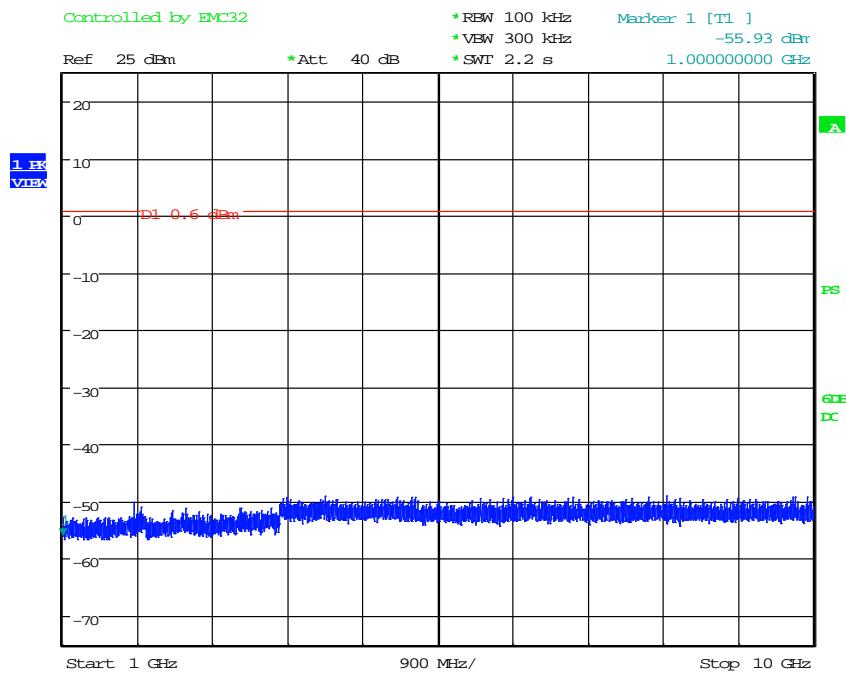
Issue Date: July 26, 2018



Order Number: F2P19086C

Client: WaveFlex, Inc.
Model: MASM-100-1003-00

High Channel: 1 GHz to 10 GHz (SF12, worst-case)



Date: 18.JUL.2018 16:02:59

051816

Report Number: F2P19086C-01E

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Issue Date: July 26, 2018



11 RADIATED SPURIOUS EMISSION

The EUT antenna port was fitted with its 2.2dBi gain Whip antenna. Radiated emissions were measured in a Semi-Anechoic Chamber. All emissions generated that fall in the restricted bands per FCC Part 15.205 were examined.

11.1 Requirements:

All emissions that fall in the restricted bands defined in FCC Part 15.205 shall not exceed the maximum field strength listed in FCC Part 15.209(a).



Order Number: F2P19086C

Client: WaveFlex, Inc.
Model: MASM-100-1003-00

11.2 Radiated Spurious Emission Test Data

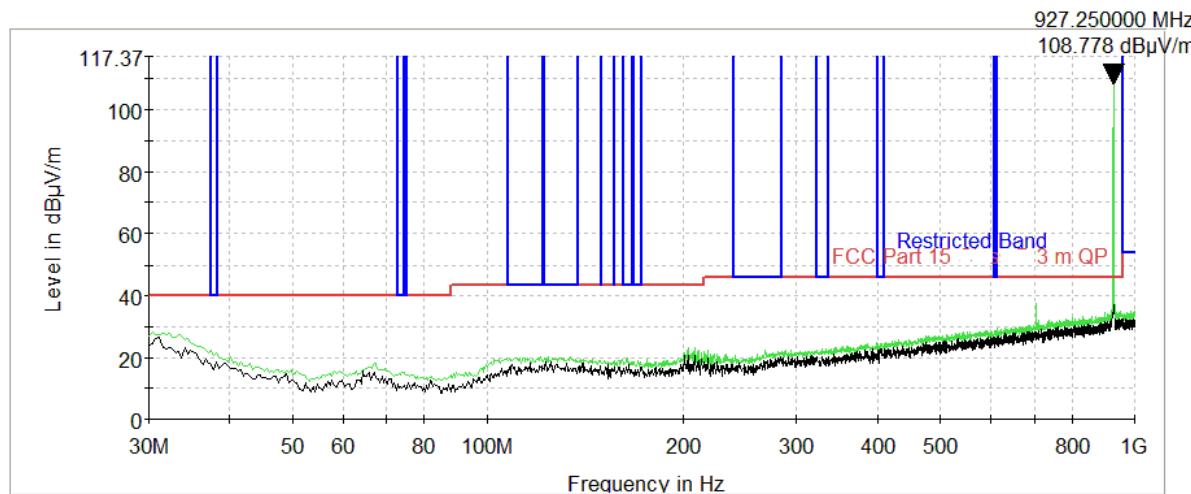
Test Date(s):	July 18, 2018	Test Engineer:	J. Chiller
Standards:	CFR 47 Part 15.247(d); Part 15.209 / KDB558074	Air Temperature:	21.6°C
		Relative Humidity:	41%

Measurements

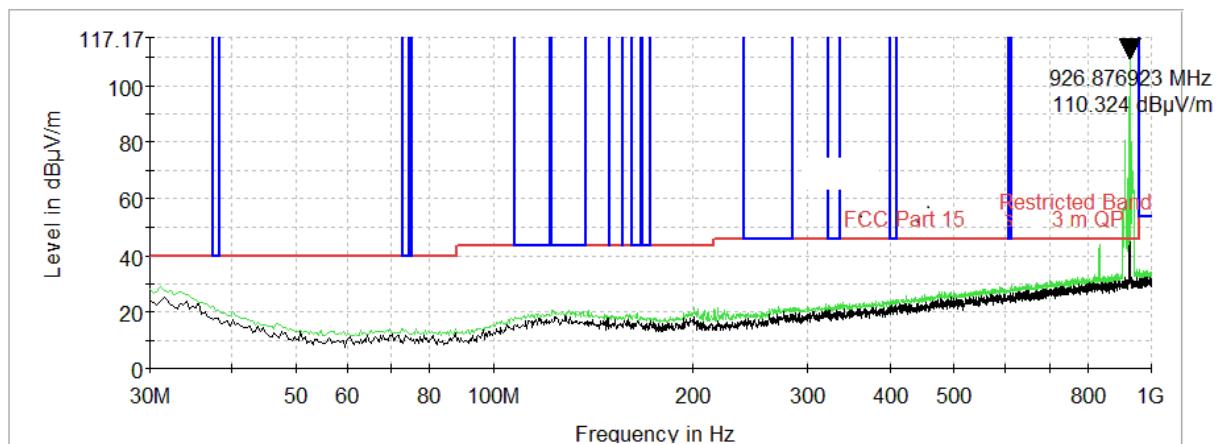
High Channel (worst case) – QuasiPeak

Frequency (MHz)	Antenna Polarization	Reading (dB μ V)	Correction Factors (dB)	Emission (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
30.760000	V	17.0	4.8	21.80	40.0	-18.2
33.000000	H	18.7	3.0	21.70	40.0	-18.3
60.600000	V	18.0	-8.4	9.60	40.0	-30.4
125.520000	H	14.9	-1.1	13.80	43.5	-29.7
201.240000	H	18.0	-1.5	16.50	43.5	-27.0
204.240000	V	21.8	-2.7	19.10	43.5	-24.4
498.960000	V	15.7	4.7	20.40	46.0	-25.6
704.880000	H	15.3	8.4	23.70	46.0	-22.3
704.880000	V	15.3	8.4	23.70	46.0	-22.3
849.280000	V	15.0	10.5	25.50	46.0	-20.5

30 MHz to 1000 MHz, Vertical, with antenna



30 MHz to 1000 MHz, Horizontal, with antenna



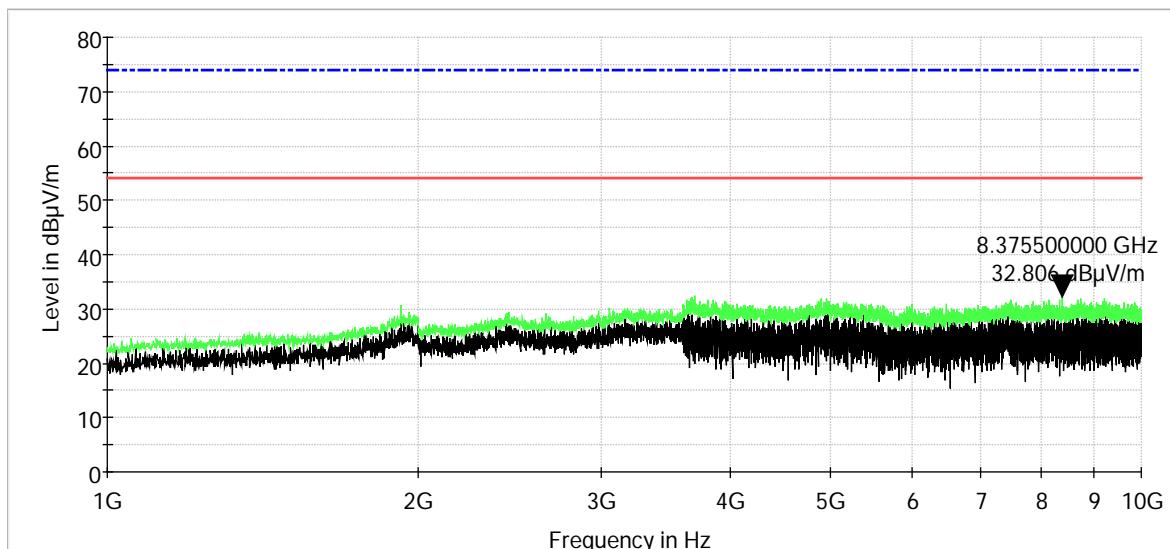


Order Number: F2P19086C

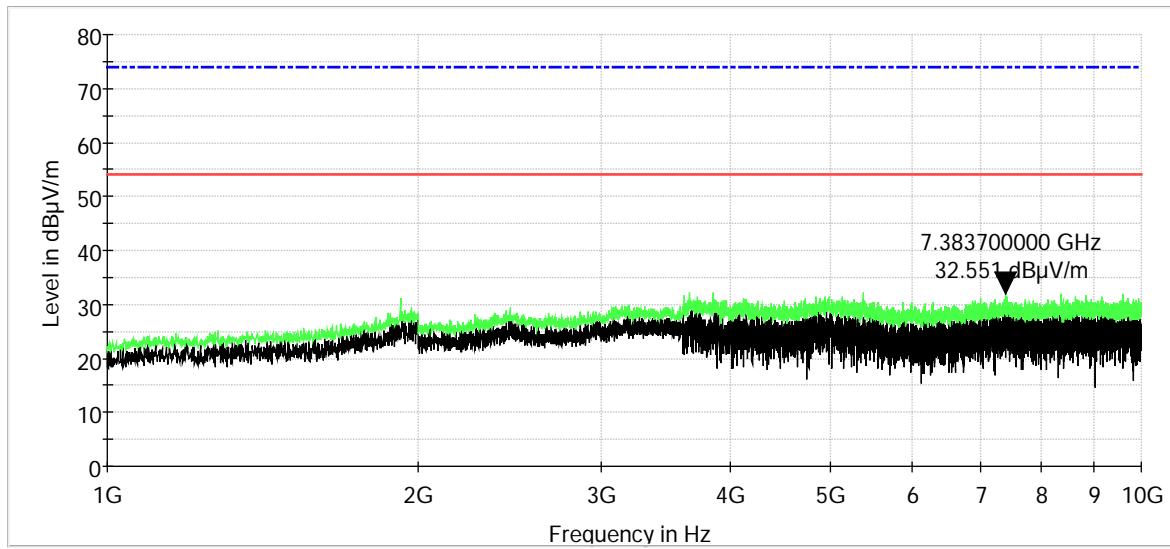
Client: WaveFlex, Inc.

Model: MASM-100-1003-00

1 to 10 GHz, Vertical



1 to 10 GHz, Horizontal





Notes: Plots are peak, max hold prescan data included only to determine what frequencies to investigate and measure. The EUT was initially placed in a semi-anechoic chamber and rotated in all three orthogonal positions to maximize the emissions. Characterization measurements were then performed to determine at which frequencies significant emissions occurred. These graphs are shown below.

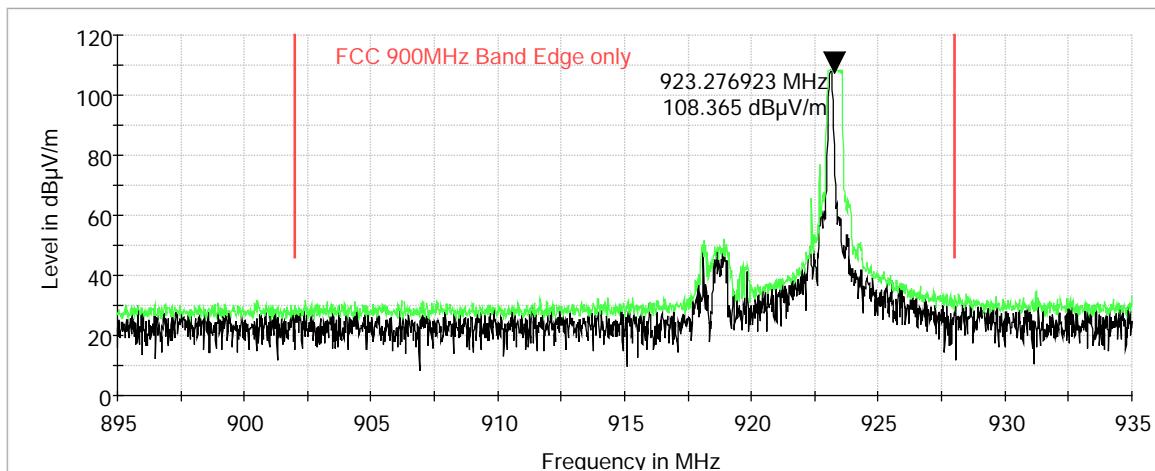
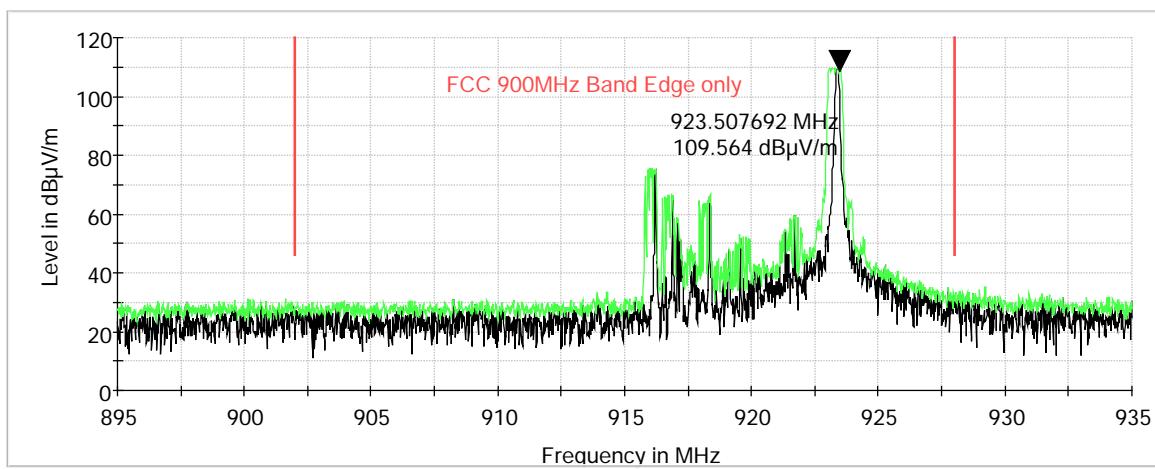
The equipment was fully exercised with all cabling attached to the EUT and was positioned on the non-conductive table for maximum emissions. While the equipment was energized, the receiving antenna was scanned from 1.0 meter to 4.0 meters in both vertical and horizontal polarities while the turntable was adjusted 360 degrees to determine the maximum field strength. The tables of measured results can be found below.

Some of the frequencies did not change with the EUT on or off. At those frequencies, the test distance was shortened to 1 meter and still no emissions from the EUT were visible or over the ambient or limit.

In the following plots, the black line indicates the active scan and the green line indicates the peak hold measurement with the EUT on. Emissions to be found by the EUT were measured and listed in tables.

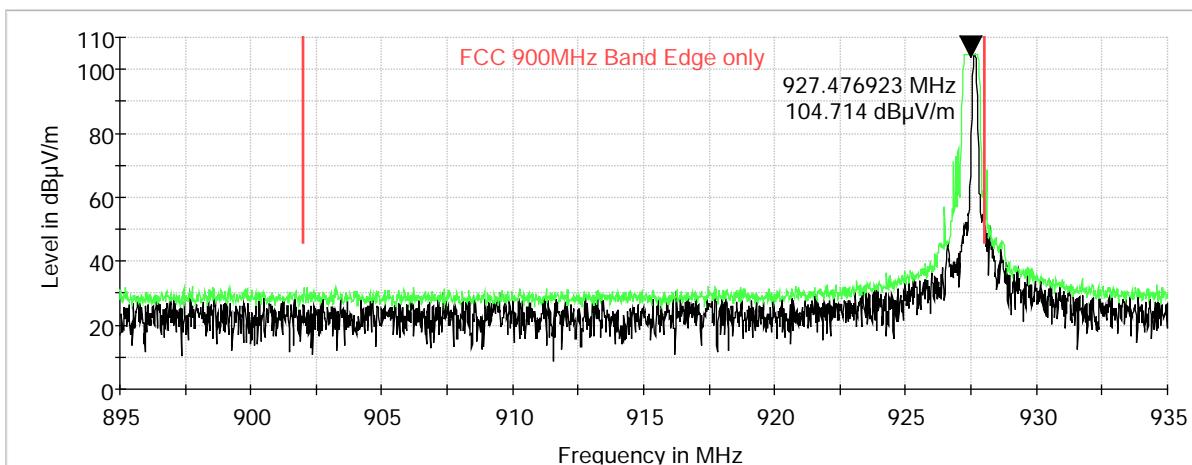
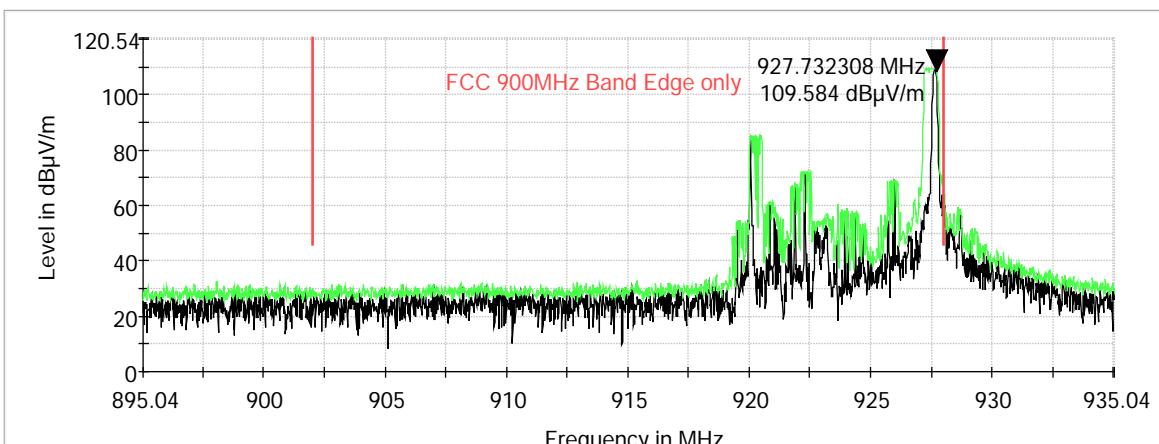
SF7: Band Edges, 902 MHz to 928 MHz

Frequency (MHz)	Antenna Polarization	Antenna Height (cm)	Azimuth (deg)	Reading (dB μ V)	Correction Factors (dB)	Emission (dB μ V/m)	Limit (dB μ V/m)	Margin (dB μ V/m)
901.800000	V	120.00	249.00	36.3	11.5	47.80	88.36	-40.56
901.800000	H	120.00	42.00	37.8	11.5	49.30	89.56	-40.26
902.000000	V	120.00	249.00	44.2	11.5	55.70	88.36	-32.66
902.000000	H	120.00	42.00	45.5	11.5	57.00	89.56	-32.56
928.000000	H	100.00	275.00	40.5	11.9	52.40	89.56	-37.16
928.000000	V	100.00	122.00	36.0	11.9	47.90	88.36	-40.46
928.120000	H	100.00	275.00	36.8	11.9	48.70	89.56	-40.86
928.120000	V	100.00	122.00	32.2	11.9	44.10	88.36	-44.26

923.3 MHz, Vertical

923.3 MHz, Horizontal


SF12: Band Edges, 923. M3Hz to 927.5 MHz

Frequency (MHz)	Antenna Polarization	Reading (dB μ V)	Correction Factors (dB)	Emission (dB μ V/m)	Limit (dB μ V/m)	Margin (dB μ V/m)
900.000000	V	14.0	11.5	25.50	84.71	-59.21
900.000000	H	14.3	11.5	25.80	89.58	-63.78
902.000000	H	14.3	11.5	25.80	89.58	-63.78
902.000000	V	14.0	11.5	25.50	84.71	-59.21
928.000000	H	56.4	11.9	68.30	89.58	-21.28
928.000000	V	60.5	1.9	62.40	84.71	-22.31
929.000000	V	23.7	12.0	35.70	84.71	-49.01
929.000000	H	29.4	12.0	41.40	89.58	-48.18

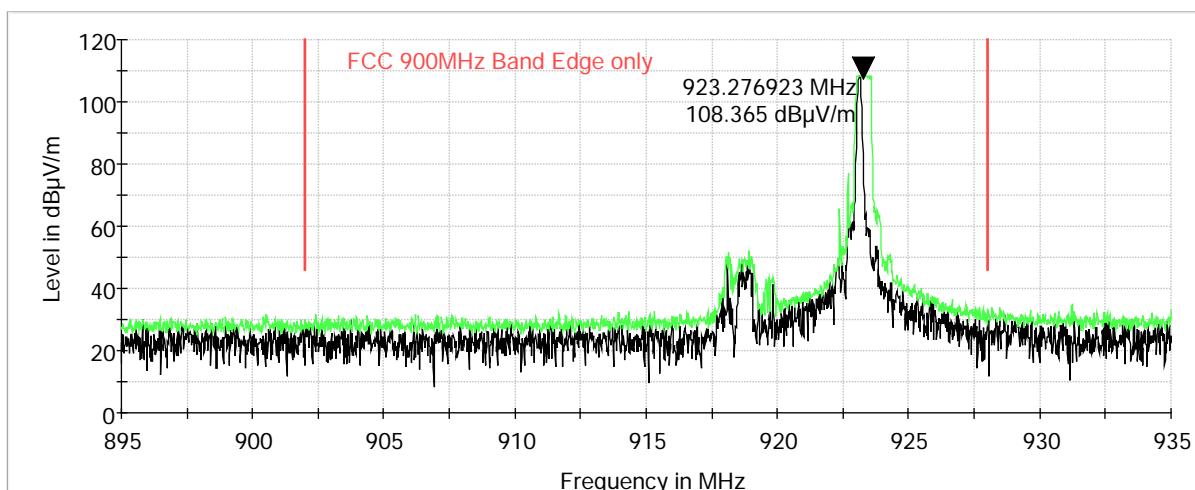
927.5 MHz, Vertical

927.5 MHz, Horizontal




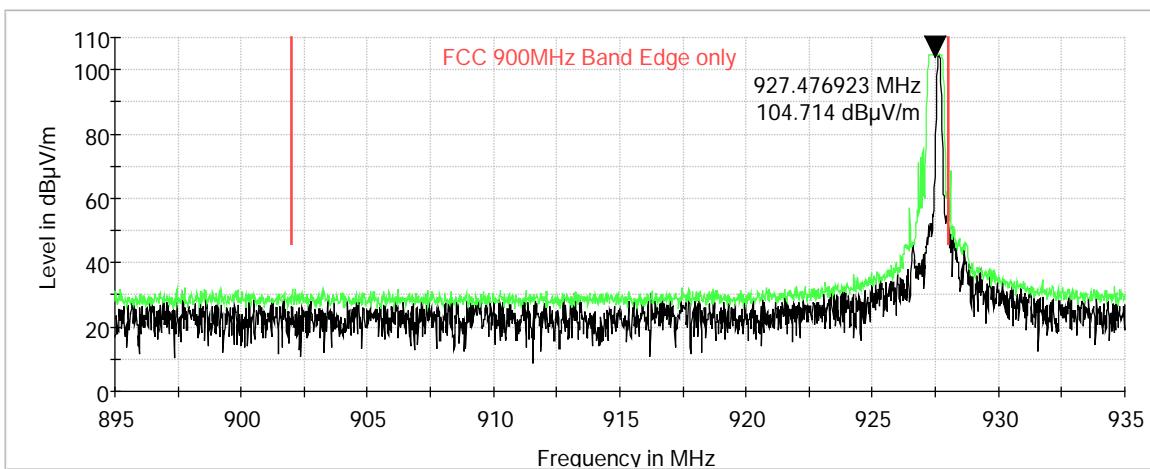
Order Number: F2P19086C

Client: WaveFlex, Inc.
Model: MASM-100-1003-00

923.3 MHz, Pre-scan, Vertical



923.3 MHz, Pre-scan, Horizontal





12 PEAK POWER SPECTRAL DENSITY (PSD)

Peak power spectral density measurements were performed.

12.1 Requirements:

The peak power spectral density shall not exceed +8dBm in any 3 kHz band during any time interval of continuous transmission.

Power spectral density measurements were performed at a resolution bandwidth of 3 kHz (video bandwidth set at 10 KHz). The peak spectral densities were measured at the low, mid, and upper channels.



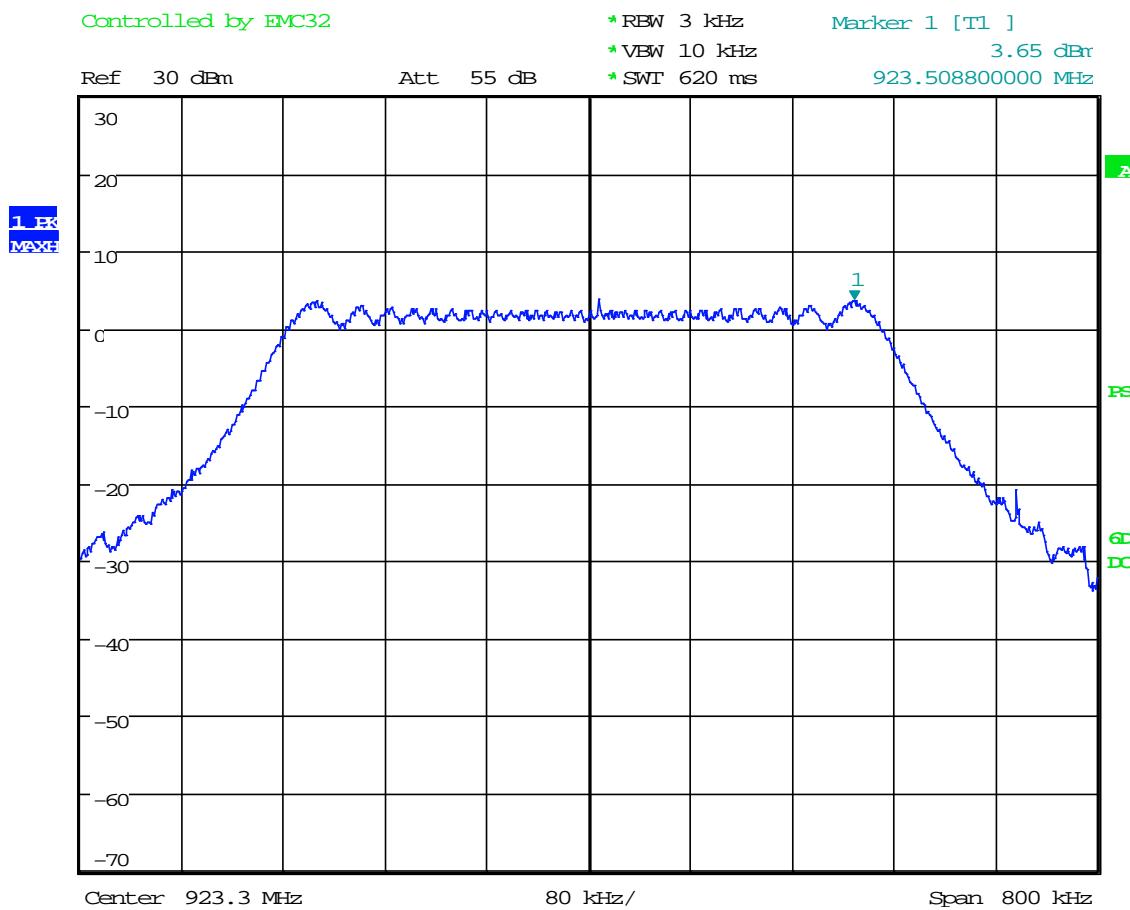
Order Number: F2P19086C

Client: WaveFlex, Inc.
Model: MASM-100-1003-00

12.2 Peak Power Spectral Density Test Data

Test Date(s):	July 23, 2018	Test Engineer:	J. Chiller
Standards:	CFR 47 Part 15.247(e); KDB558074	Air Temperature:	22.1°C
		Relative Humidity:	41%

SF7: Low Channel



Date: 23.JUL.2018 16:49:31

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Report Number: F2P19086C-01E

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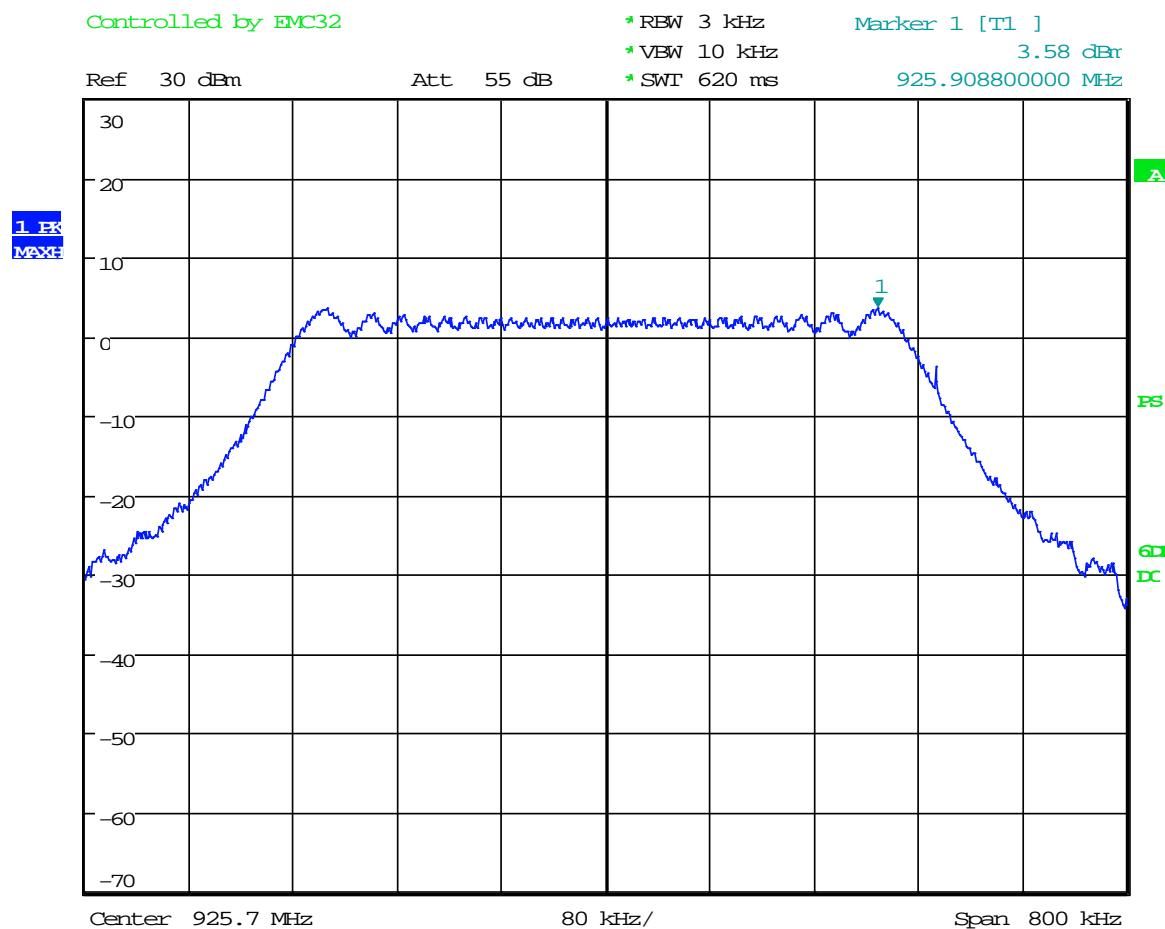
Issue Date: July 26, 2018



Order Number: F2P19086C

Client: WaveFlex, Inc.
Model: MASM-100-1003-00

SF7: Mid Channel



Date: 23.JUL.2018 16:51:02

051816

Report Number: F2P19086C-01E

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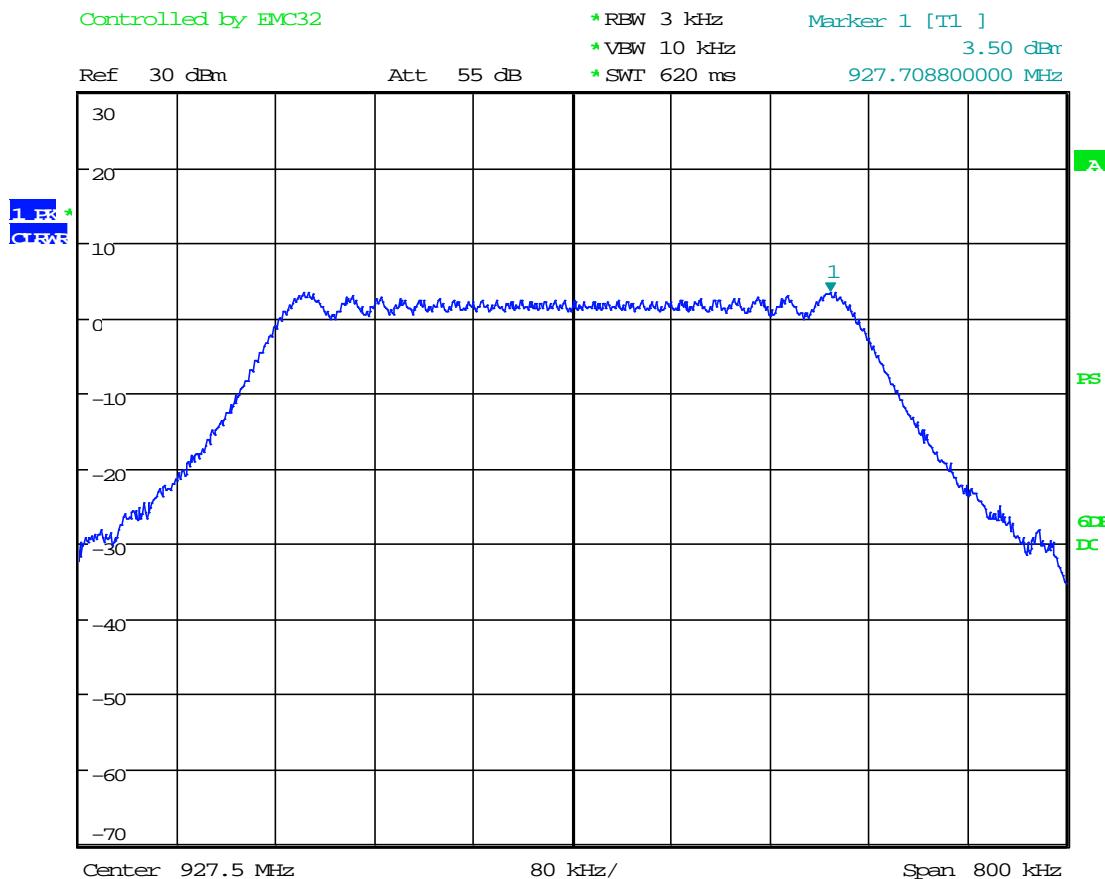
Issue Date: July 26, 2018



Order Number: F2P19086C

Client: WaveFlex, Inc.
Model: MASM-100-1003-00

SF7: High Channel



Date: 23.JUL.2018 16:52:56

051816

Report Number: F2P19086C-01E

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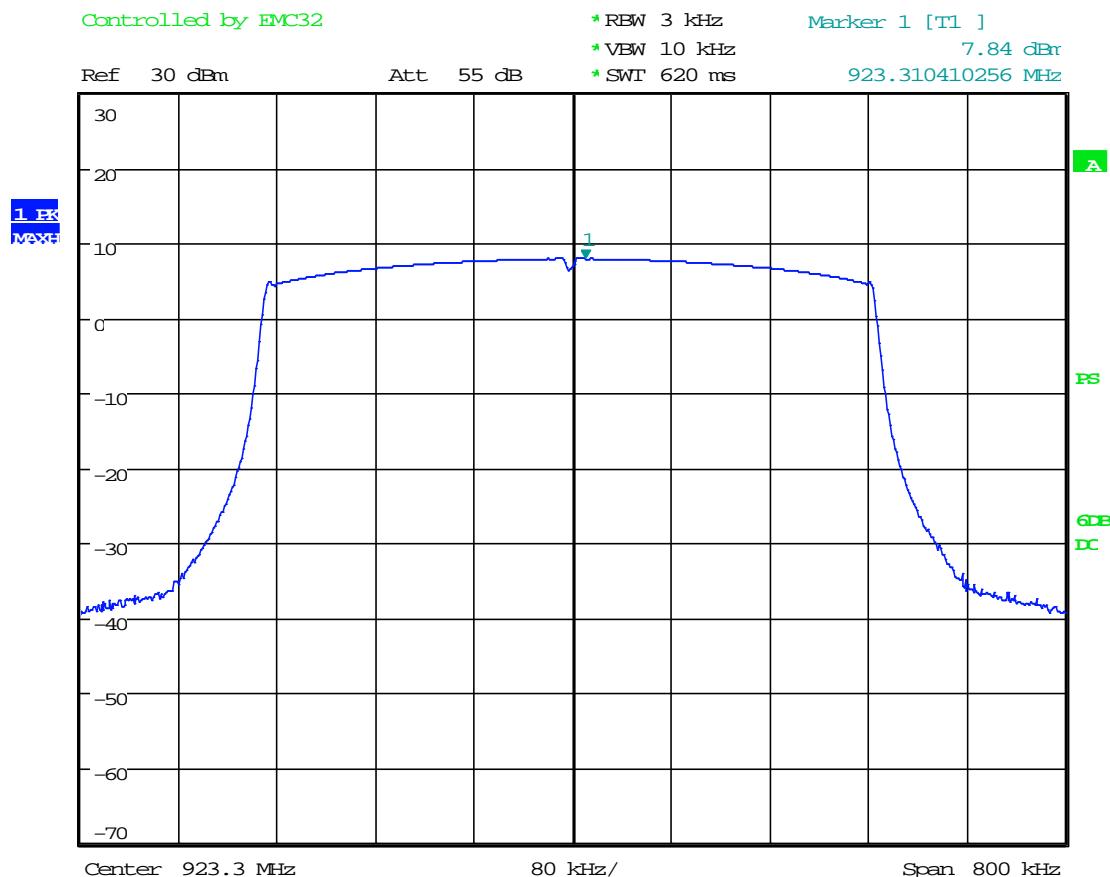
Issue Date: July 26, 2018



Order Number: F2P19086C

Client: WaveFlex, Inc.
Model: MASM-100-1003-00

SF12: Low Channel



Date: 23.JUL.2018 17:00:09

051816

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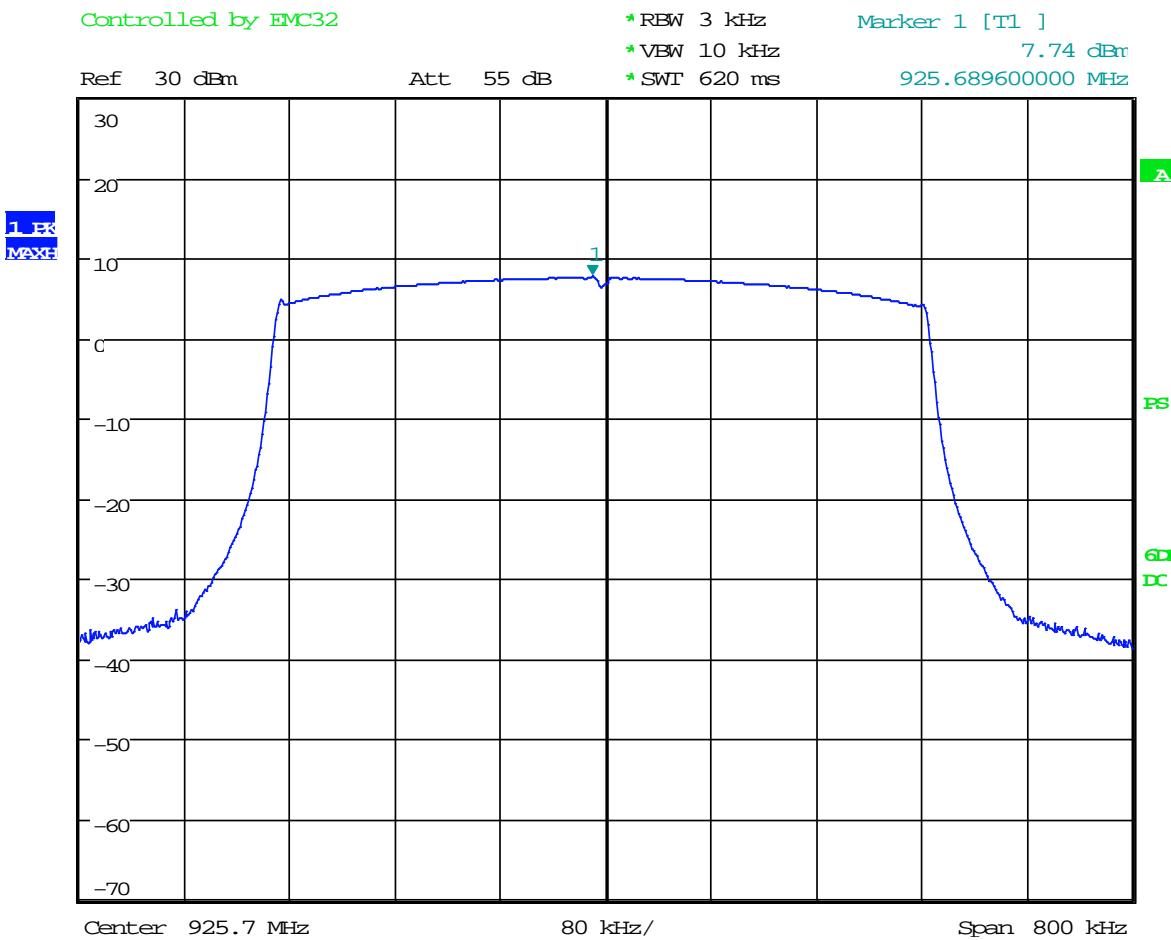
Issue Date: July 26, 2018



Order Number: F2P19086C

Client: WaveFlex, Inc.
Model: MASM-100-1003-00

SF12: Mid Channel



Date: 23.JUL.2018 16:56:52

051816

Report Number: F2P19086C-01E

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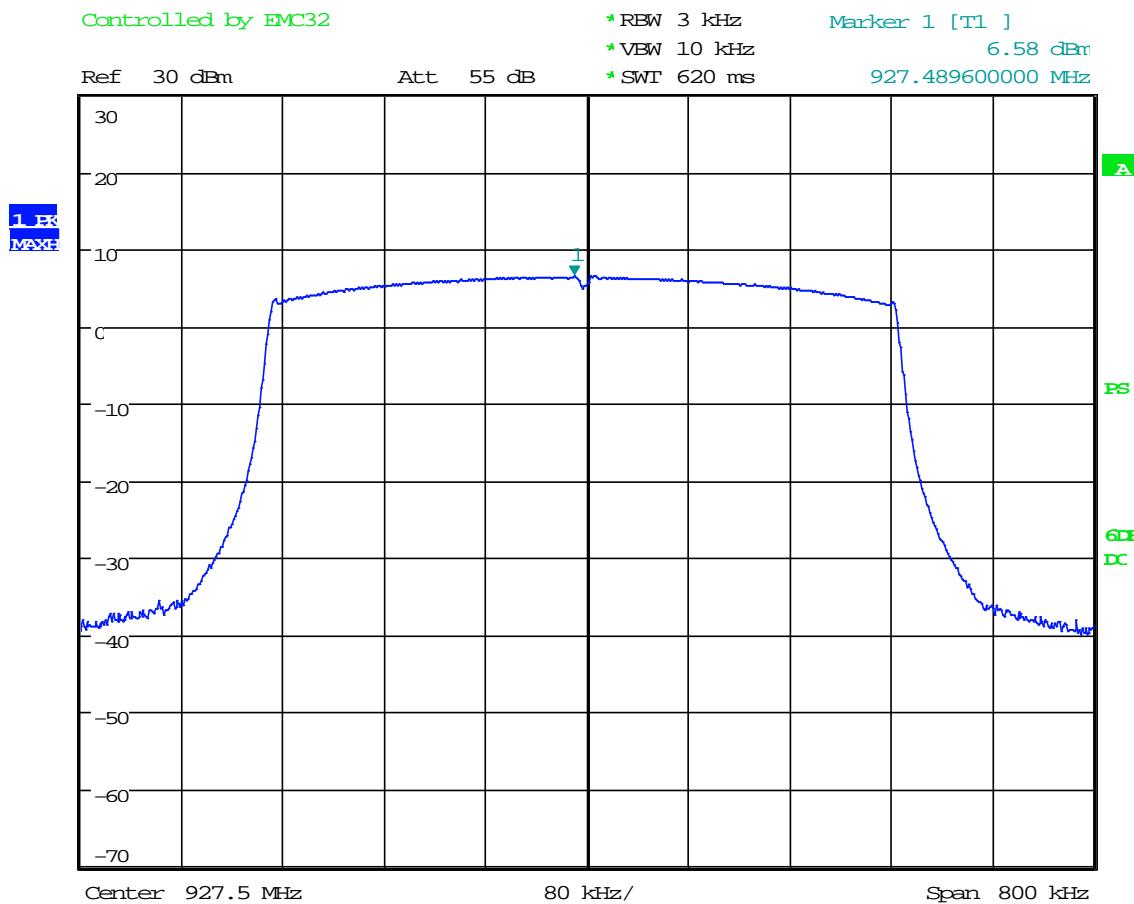
Issue Date: July 26, 2018



Order Number: F2P19086C

Client: WaveFlex, Inc.
Model: MASM-100-1003-00

SF12: High Channel



Date: 23.JUL.2018 16:54:45

051816

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Issue Date: July 26, 2018



13 CONDUCTED EMISSIONS

13.1 Requirements

In accordance with FCC CFR 47 Part 15.207(a), "Except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 μ H/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

Frequency of Emission (MHz)	Conducted Limit (dB μ V)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

*Decreases with the logarithm of the frequency.

13.2 Procedure

The EUT was placed on a 1.0 x 1.5 meter non-conductive table, 0.8 meter above a horizontal ground plane and 0.4 meter from a vertical ground plane. Power was provided to the EUT through a LISN bonded to a 3 x 2 meter ground plane. The LISN and peripherals were supplied power through a filtered AC power source. The output of the LISN was connected to the input of the receiver via a transient limiter, and emissions in the range 150 kHz to 30 MHz were measured. The measurements were recorded using the quasi-peak and average detectors as directed by the standard, and the resolution bandwidth during testing was 9 kHz. The raw measurements were corrected to allow for attenuation from the LISN, transient limiter and cables.



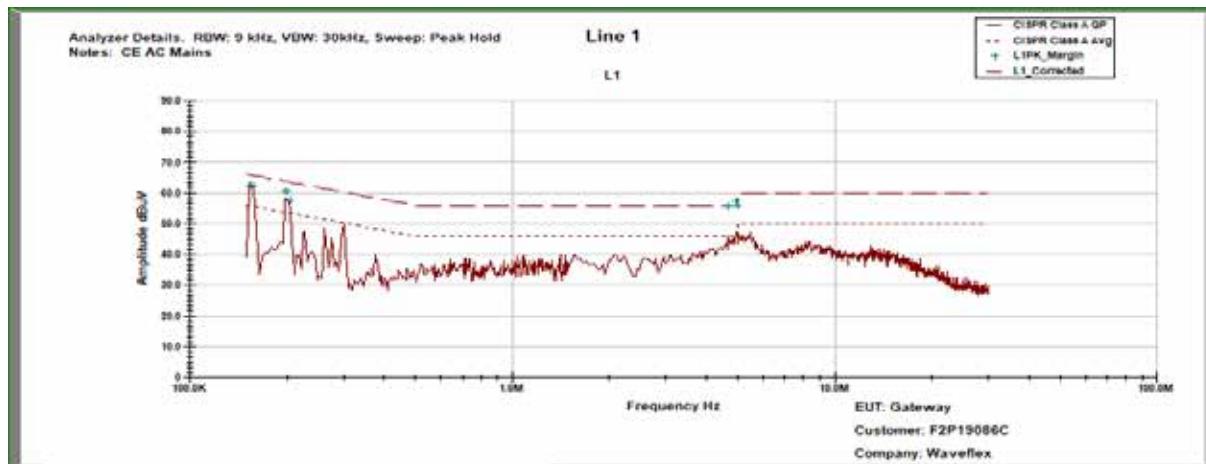
Order Number: F2P19086C

Client: WaveFlex, Inc.
Model: MASM-100-1003-00

13.3 Conducted Emissions Test Data

Test Date:	July 20, 2018	Test Engineer:	J. Chiller
Rule:	15.207	Air Temperature:	21.1° C
Test Results:	Complies	Relative Humidity:	40%

Conducted Test – Line 1: 0.150 MHz to 30.0 MHz



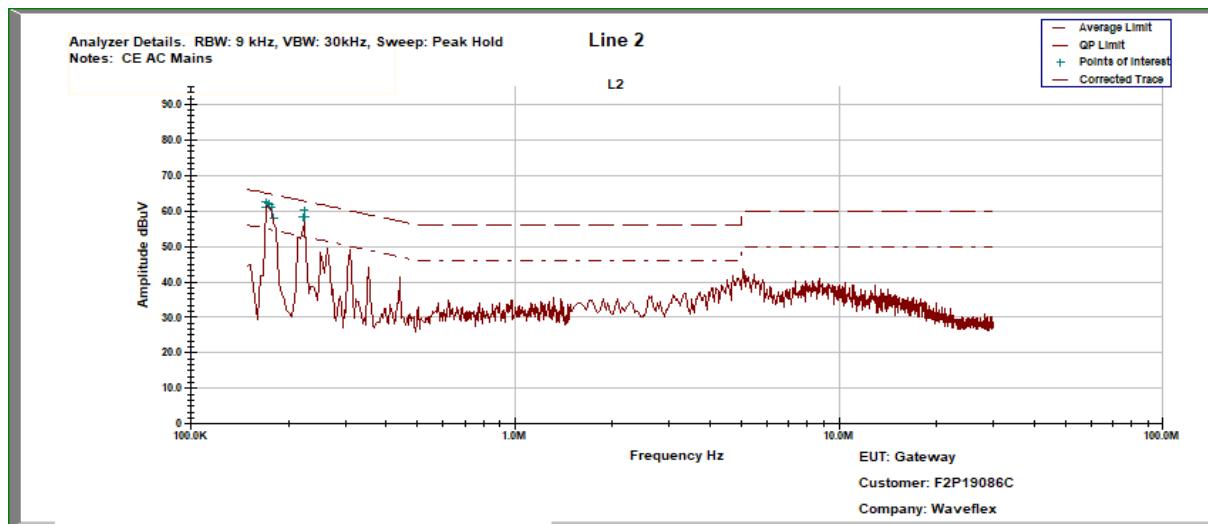
Top Discrete Measurements								
No.	Conductor	Frequency (MHz)	Detector	Level (dB μ V)	Adjustment (dB)	Results (dB μ V)	Limit (dB μ V)	Margin (dB)
1	Line 1	0.15	Quasi-Peak	45.334	11.614	56.948	66.0	-9.052
		0.15	Average	22.371	11.614	33.985	56.0	-22.015
2	Line 1	0.153375	Quasi-Peak	46.753	11.561	58.314	65.8	-7.506
		0.153375	Average	18.758	11.561	30.319	55.8	-25.481
3	Line 1	0.15675	Quasi-Peak	46.516	11.508	58.024	65.6	-7.616
		0.15675	Average	19.703	11.508	31.211	55.6	-24.429
4	Line 1	0.157045	Quasi-Peak	46.248	11.503	57.751	65.6	-7.871
		0.157045	Average	19.627	11.503	31.130	55.6	-24.492
5	Line 1	0.160125	Quasi-Peak	45.446	11.468	56.914	65.5	-8.54
		0.160125	Average	17.912	11.468	29.380	55.5	-26.070
6	Line 1	0.1635	Quasi-Peak	43.759	11.429	55.188	65.3	-10.112
		0.1635	Average	17.123	11.429	28.552	55.3	-26.748
7	Line 1	0.1905	Quasi-Peak	36.653	11.169	47.822	64.0	-16.198
		0.1905	Average	19.321	11.169	30.490	54.0	-23.530
8	Line 1	0.193875	Quasi-Peak	37.847	11.144	48.991	63.9	-14.884
		0.193875	Average	19.528	11.144	30.672	53.9	-23.203
9	Line 1	4.57125	Quasi-Peak	28.188	10.357	38.545	56.0	-17.455
		4.57125	Average	16.674	10.357	27.031	46.0	-18.969
10	Line 1	4.605	Quasi-Peak	28.234	10.359	38.593	56.0	-17.407
		4.605	Average	18.244	10.359	28.603	46.0	-17.397



Order Number: F2P19086C

Client: WaveFlex, Inc.
Model: MASM-100-1003-00

Conducted Test – Line 2: .150 MHz to 30 MHz



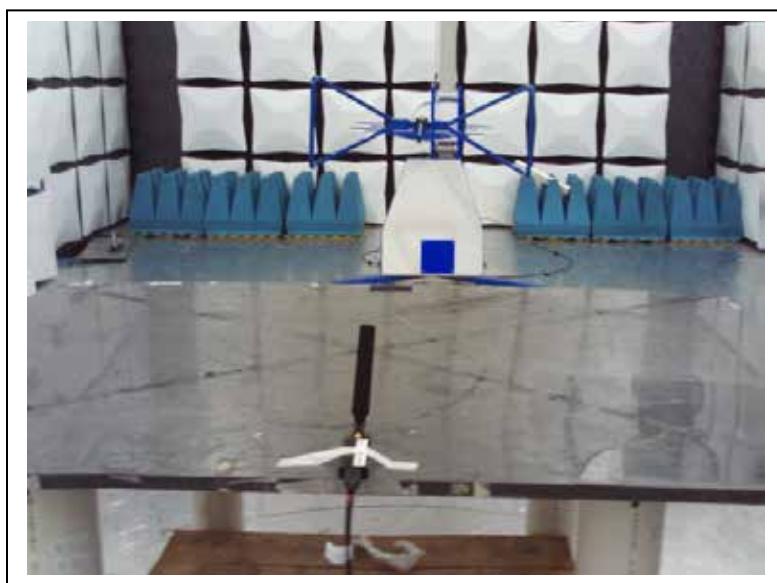
Top Discrete Measurements								
No.	Conductor	Frequency (MHz)	Detector	Level (dB μ V)	Adjustment (dB)	Results (dB μ V)	Limit (dB μ V)	Margin (dB)
1	Line 2	0.15	Quasi-Peak	45.377	11.614	56.991	66.0	-9.009
		0.15	Average	22.239	11.614	33.853	56.0	-22.147
2	Line 2	0.153375	Quasi-Peak	42.521	11.561	54.082	65.8	-11.748
		0.153375	Average	21.134	11.561	32.695	55.8	-23.135
3	Line 2	0.15675	Quasi-Peak	42.524	11.508	54.032	65.6	-11.608
		0.15675	Average	19.639	11.508	31.147	55.6	-24.493
4	Line 2	0.157045	Quasi-Peak	41.589	11.503	53.092	65.6	-12.488
		0.157045	Average	21.595	11.503	33.098	55.6	-22.482
5	Line 2	0.160125	Quasi-Peak	41.534	11.468	53.002	65.5	-12.45
		0.160125	Average	19.770	11.468	31.238	55.5	-24.212
6	Line 2	4.50375	Quasi-Peak	33.719	10.354	44.073	56.0	-11.927
		4.50375	Average	23.616	10.354	33.970	46.0	-12.030
7	Line 2	5.34	Quasi-Peak	35.418	10.383	45.801	60.0	-14.199
		5.34	Average	27.998	10.383	38.381	50.0	-11.619
8	Line 2	5.3475	Quasi-Peak	35.771	10.384	46.155	60.0	-13.845
		5.3475	Average	27.354	10.384	37.738	50.0	-12.262
9	Line 2	5.38125	Quasi-Peak	35.556	10.386	45.942	73.0	-27.058
		5.38125	Average	27.703	10.386	38.089	60.0	-21.911
10	Line 2	5.415	Quasi-Peak	34.493	10.388	44.881	73.0	-28.119
		5.415	Average	25.732	10.388	36.120	60.0	-23.880

14 PHOTOGRAHPS

Conducted Emissions



Radiated Spurious Emissions





Order Number: F2P19086C

Client: WaveFlex, Inc.
Model: MASM-100-1003-00

Voltage Variations



**Conducted Output Power, Peak Power Spectral Density,
Occupied Bandwidth, Conducted Spurious Emissions**

