EMC Test Report

Report Number: 1918EMC01 **Revision Level:** 0

Project Number: 1918 **SGS Reference:** 4011465

Client: Applied Micro Design Inc.

Equipment Under Test: 400 MHz Amplifier / LNA

Model Number: 1473PA-RMT

FCC Rule Parts: FCC Part 90.219

935210 D05 Indus Booster Basic Meas v01r01

Report issued on: 15 June 2016

Test Result: Compliant

Tested by: _____
Kent Stewart, Project Engineer

Reviewed by: _____
David Schramm, EMC/RF/SAR/HAC 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.

TABLE OF CONTENTS

1 General Information

1.1 *Client Information*

Name:	Applied Micro Design Inc.
Address:	19516 Amaranth Drive
City, State, Zip, Country:	Germantown, MD, 20874

1.2 *Test Laboratory*

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

Environmental Conditions over duration of testing

	Min	Max
Temperature:	20.2 °C	23.9 °C
Relative Humidity:	45.2 %	53.6 %

1.3 *General Information of EUT*

Type of Product:	400 MHz Amplifier / LNA
Model Number:	1473PA-RMT
Serial Number:	0616-201
Rated Voltage:	120Vac, 60Hz
Tested Voltage:	120Vac, 60Hz
Sample Received Date:	07 July 2016
Dates of testing:	12 to 15 July 2016

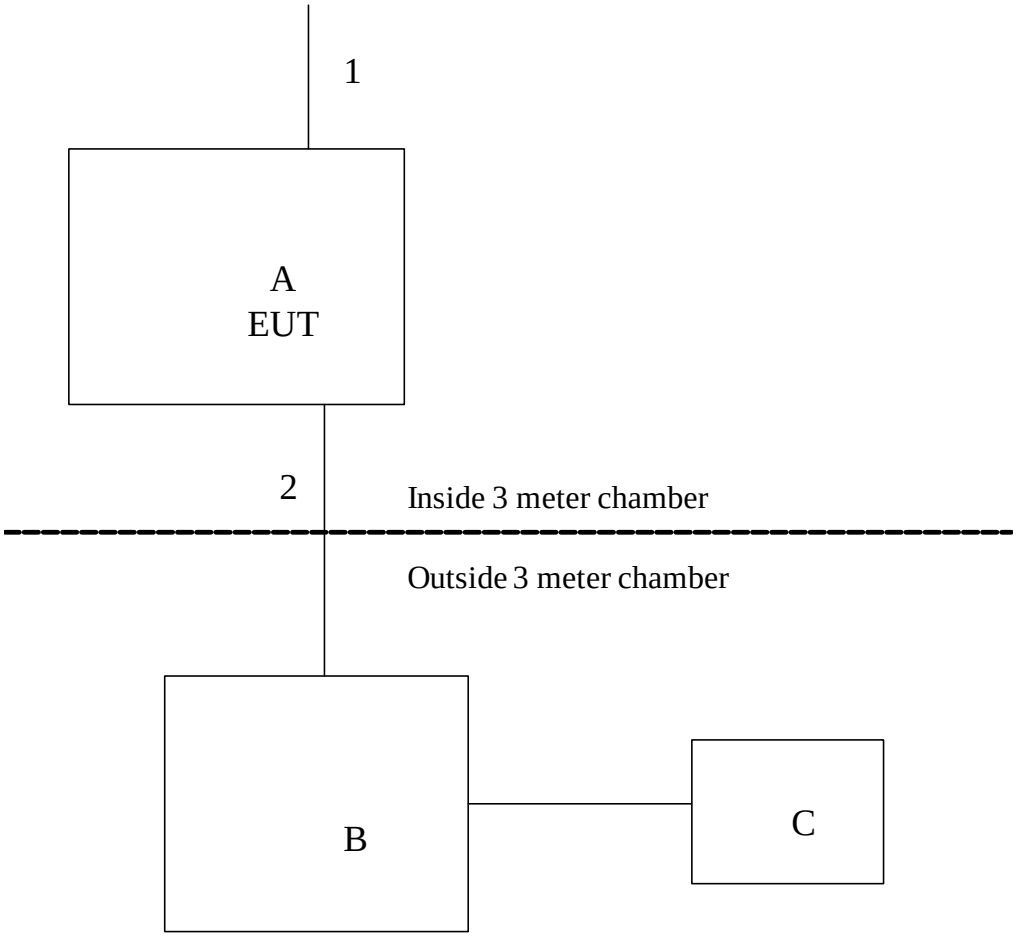
1.4 *Operating Modes and Conditions*

A signal generator was connected to the RF In of the 1473PAFOT. This RF signal was converted internally to a fiber optic interface and the fiber optic cable was connected to the FO IN port of the 1473PA-RMT (EUT). The Amplifier RF OUT port of the 1473PA-RMT was connected to the spectrum analyzer through 30 dB of attenuation. The RF signal fed to the input of the system was amplified at the output of the system.

1.5 *Modifications Required to Compliance*

None

1.6 *EUT Connection Block Diagram*



1.1 *System Configurations*

Device reference	Manufacturer	Description	Model Number	Serial Number
A	Applied Micro Design	LNA amplifier	1473PA-RMT	0616-201
B	Applied Micro Design	Fiber Optic Transmitter	1473FOT	0716-501
C	Rohde & Schwarz	Signal Generator	CMW-500	Asset # 15002

1.2 *Cable List*

Cable reference	Port Name	Start	End	Cable Length (m)	Ferrite installed?	Shielded?
1	AC Input	EUT	Power source	1.75	No	No
2	Fiber optic cable	EUT	Fiber Optic Transmitter	10	No	No

1.3 *Test Equipment*

Test Date: 12-Jul-2016

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
NETWORK/SPECTRUM ANALYZER	ZVL	ROHDE & SCHWARZ	B079799	17-Feb-2017
SIGNAL GENERATOR	SMBV100A	ROHDE & SCHWARZ	15002	18-Aug-2016
10DB ATTENUATOR	BW-S10W20+	MCL	B095595	5-Aug-2016
ATTENUATOR	BW-S10W2	MINI-CIRCUITS	15032	CNR
ATTENUATOR	BW-S10W2	MINI-CIRCUITS	15034	CNR
MULTIFLEX COAXIAL CABLE	141	HUBER&SUHNER	B095588	4-Aug-2016
MULTIFLEX COAXIAL CABLE	141	HUBER&SUHNER	B095585	4-Aug-2016
SIGNAL ANALYZER	FSV30	ROHDE & SCHWARZ	B085749	8-Oct-2017
SIGNAL GENERATOR	SMB 100A	ROHDE & SCHWARZ	B094876	2-Dec-2016
POWER SPLITTER	50PD-645	JFW INDUSTRIES	B079787	5-Aug-2016
ENVIRONMENTAL CHAMBER	SM-16-8200	THERMOTRON	39066	5-Apr-2017

Note: The calibration period equipment is 1 year, except for the FSV30, which is on a 3 year cal cycle based on manufacturer's recommendation.

Test Date: 15-Jul-2016 Tester: KS

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
EMI TEST RECEIVER	ESU40	ROHDE & SCHWARZ	B079629	4-Aug-2016
SIGNAL ANALYZER	FSV30	ROHDE & SCHWARZ	B085749	8-Oct-2017
ANTENNA, BILOG	JB6	SUNOL	B079689	11-Sep-2016
DRG HORN (MEDIUM)	3117	ETS-LINDGREN	B079699	26-Apr-2017
PREAMPLIFIER	TS-PR18	ROHDE & SCHWARZ	B094463	16-Feb-2017
RF CABLE	NFS-290-78.7-NFS	FLORIDA RF LABS	B095019	4-Aug-2016
RF CABLE	NMS-290-236.2-NMS	FLORIDA RF LABS	B095020	4-Aug-2016
17 FT N TYPE COAX CABLE	HS 84133232	HUBER&SUHNER	B079661	3-Aug-2016
ULTRAFLEX COAXIAL CABLE	LMR-240	MES MICROWAVE SYSTEM	B091046	4-Aug-2016

2 AGC Threshold

2.1 *Test Result*

Test Description	Basic Standards	Test Result
AGC Threshold	935210 D05 Indus Booster Basic Meas v01r01	Reported

2.2 *Test Method*

Testing was performed according to KDB 935210 D05 Indus Booster Basic Meas v01r01, Section 4.2

2.3 *Test Data*

Frequency, MHz	Input signal level, dBm	Power Output, dBm
460.3625	-24.3	19.32
478.2500	-24.6	18.76

3 Out-Of Band Rejection

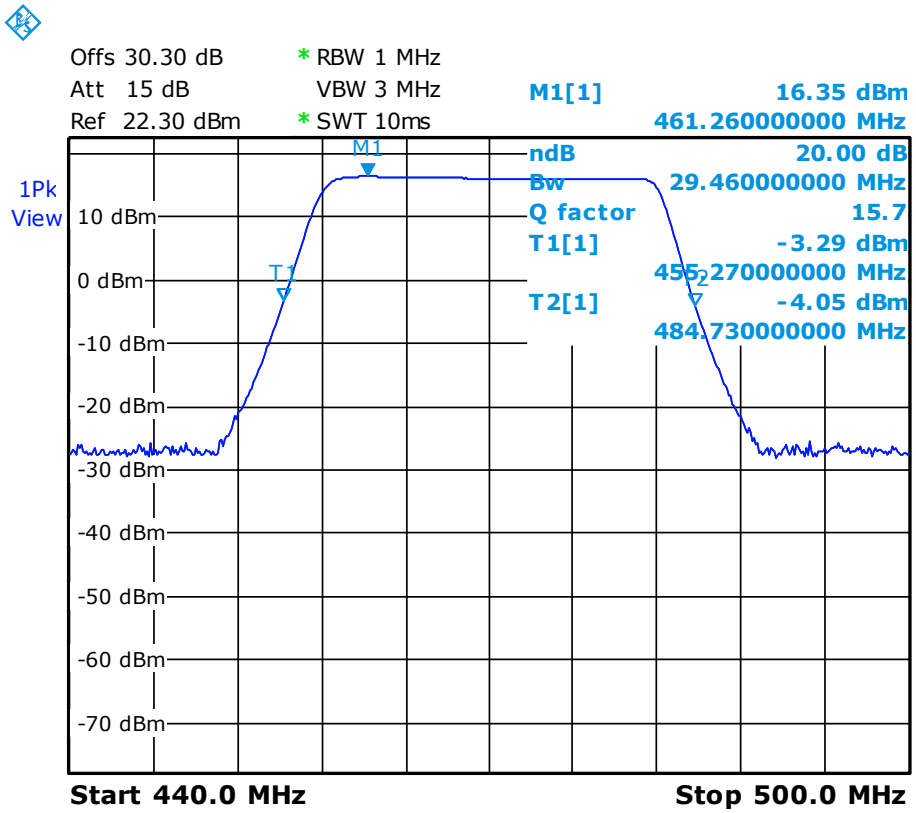
3.1 *Test Result*

Test Description	Basic Standards	Test Result
Out-Of Band Rejection	935210 D05 Indus Booster Basic Meas v01r01	Reported

3.2 *Test Method*

Testing was performed according to KDB 935210 D05 Indus Booster Basic Meas v01r01, Section 4.3

3.3 *Test Data*



Date: 13.JUL.2016 06:19:13

4 Input-versus-output signal comparison

4.1 *Test Result*

Test Description	Basic Standards	Test Result
Input-versus-output signal comparison	935210 D05 Indus Booster Basic Meas v01r01	Pass

4.2 *Test Method*

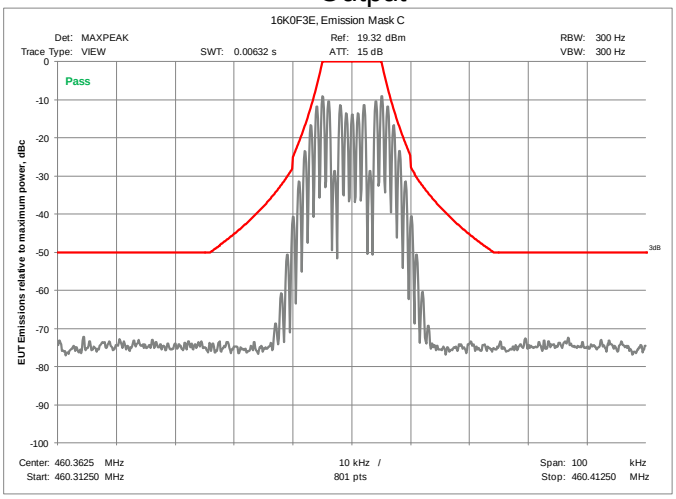
Testing was performed according to KDB 935210 D05 Indus Booster Basic Meas v01r01, Section 4.4

4.3 *Test Data*

Test data starts on the next page.

4.3.1 **16K0F3E at ACG**

Output



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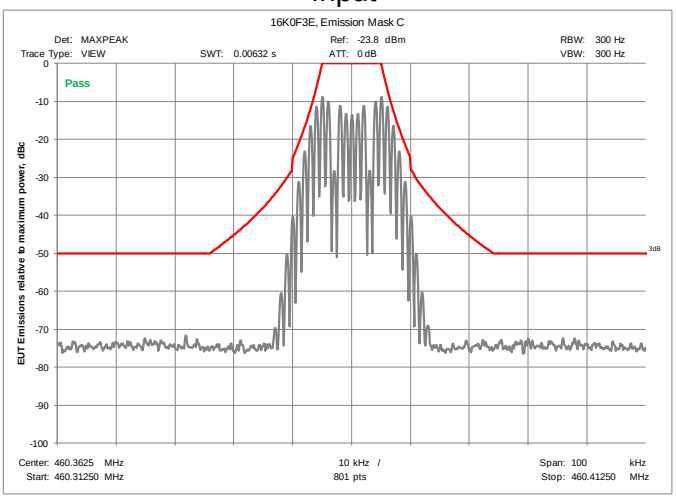
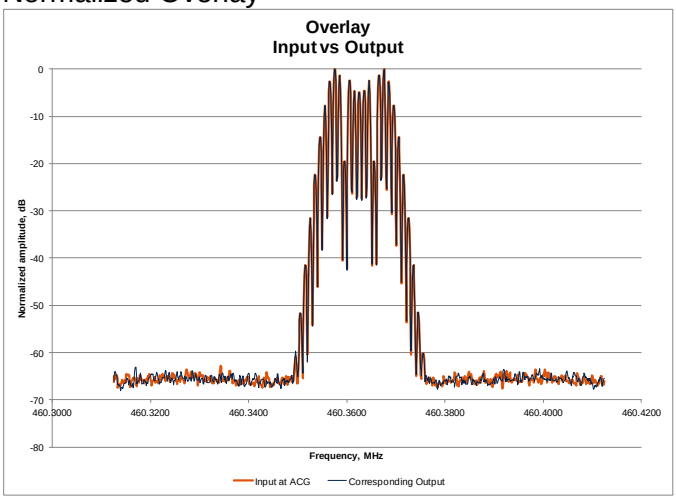


Normalized Overlay



4.3.2 16K0F3E at ACG Plus 3dB

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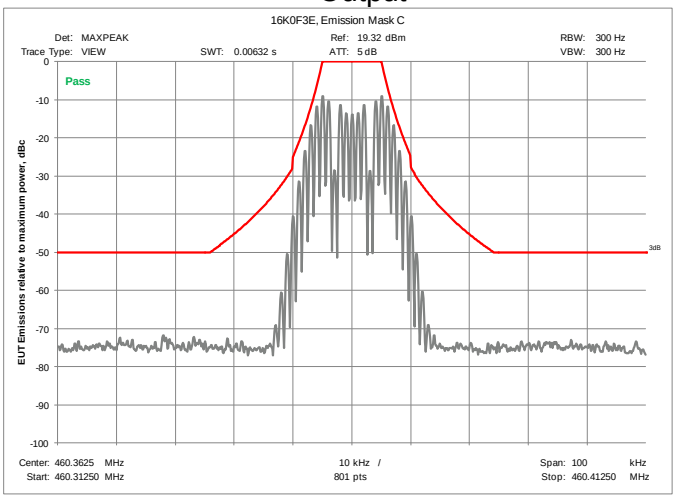

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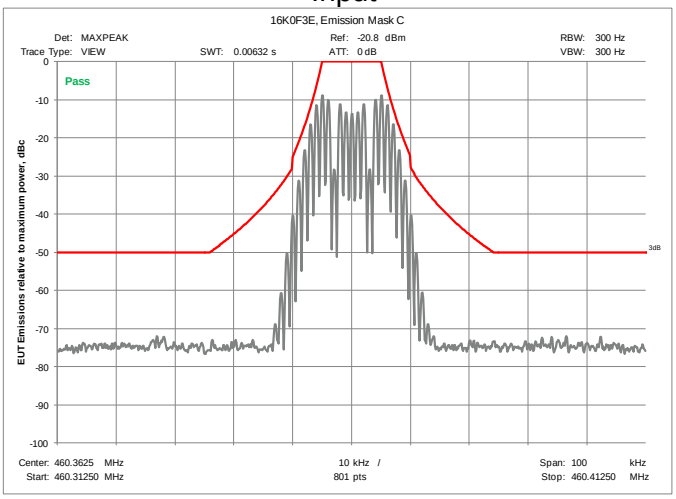

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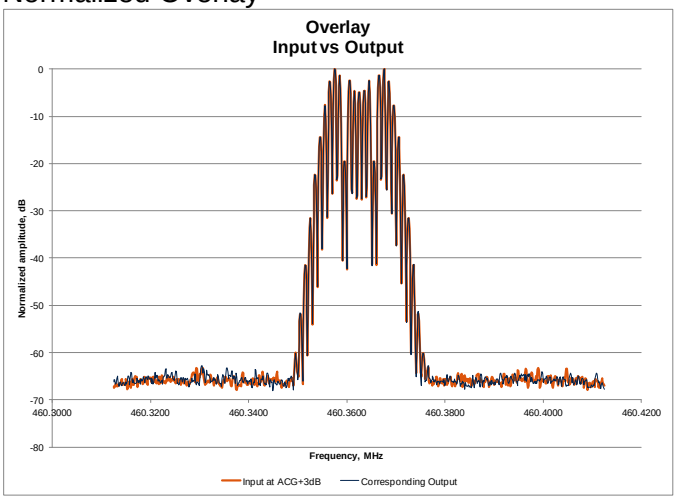
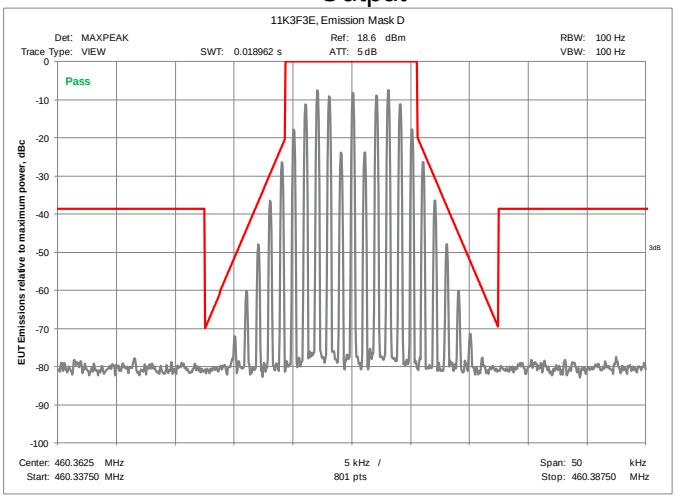


4.3.3 **11K3F3E at ACG**

Output



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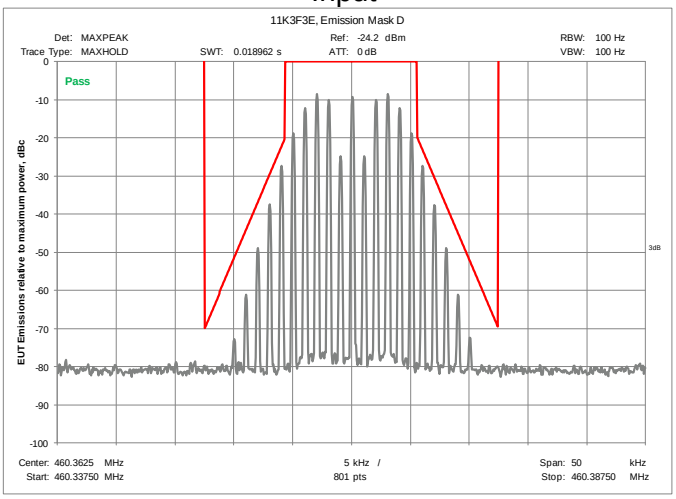

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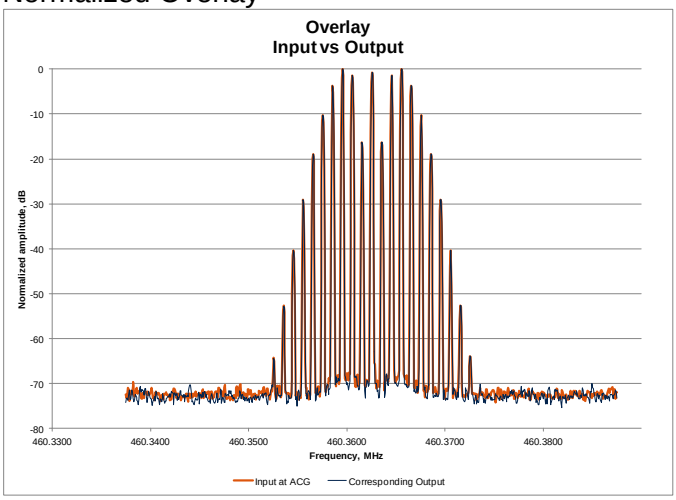
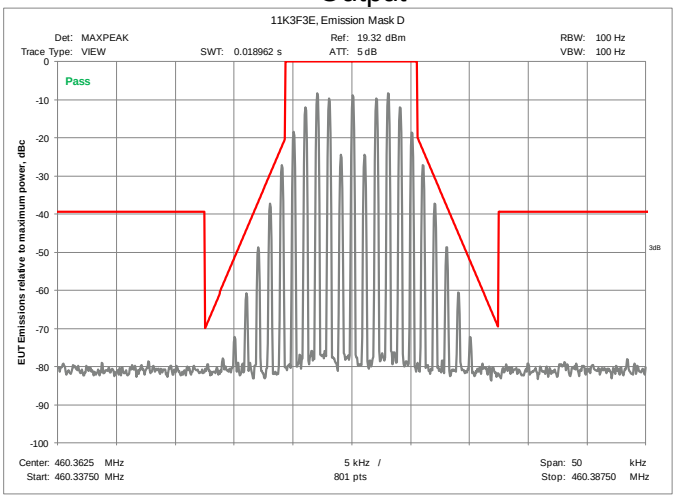


4.3.4 **11K3F3E at ACG Plus 3dB**

Output



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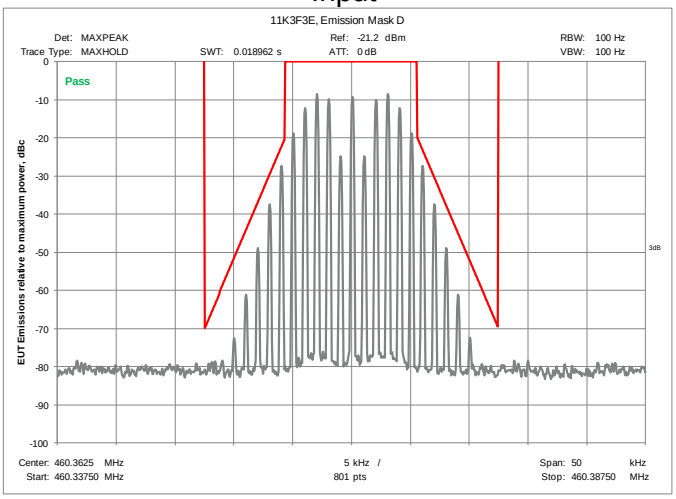

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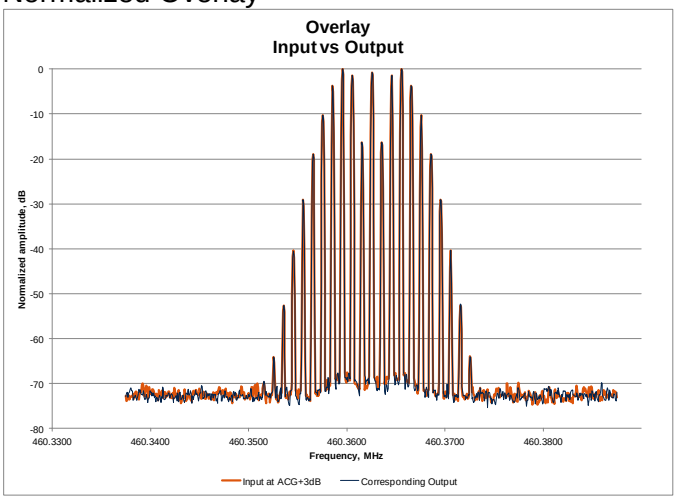
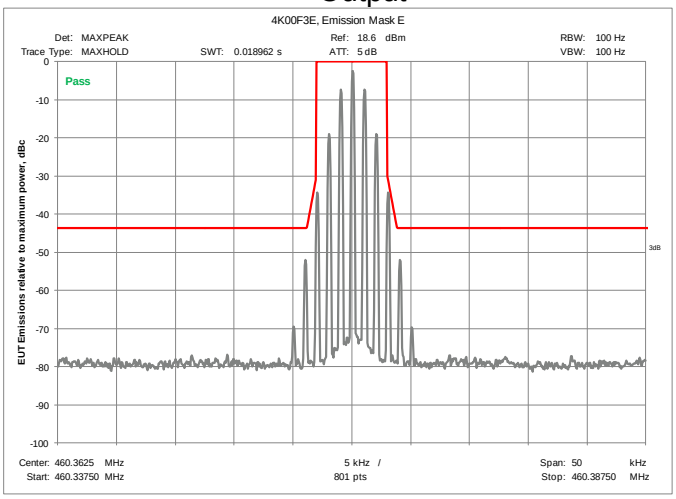


4.3.5 **4K00F1E at ACG**

Output



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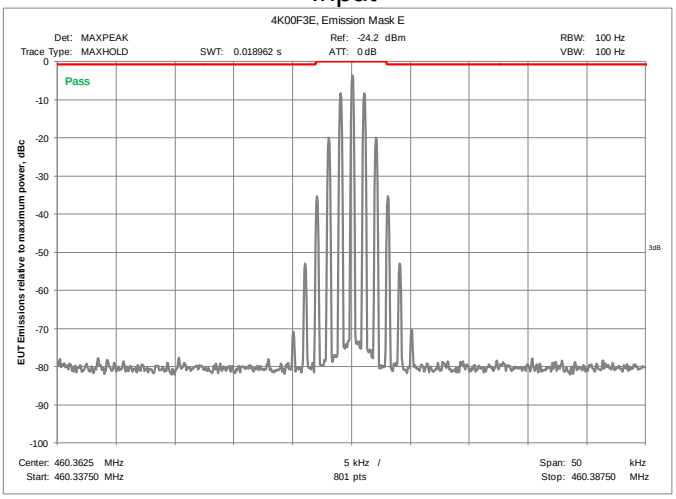

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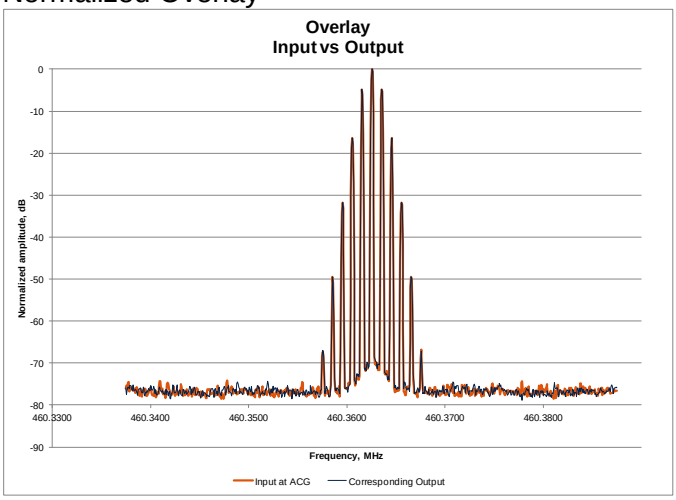
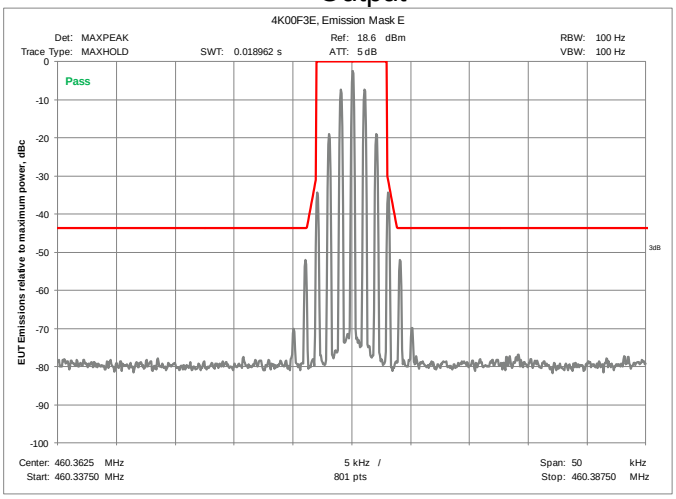
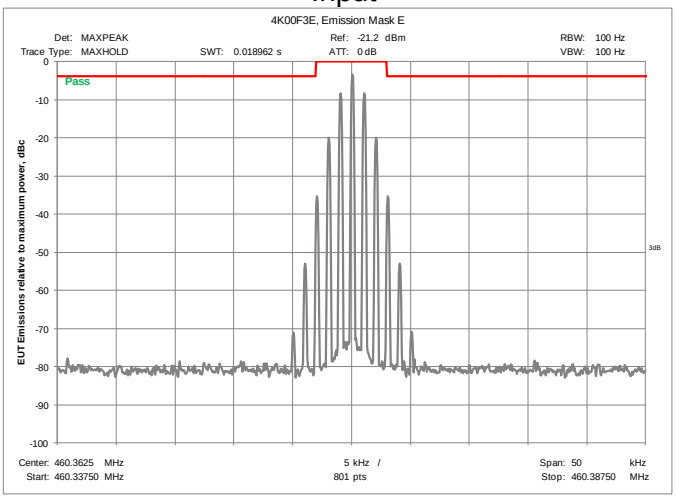


4.3.6 4K00F1E at ACG Plus 3dB

Output



Input



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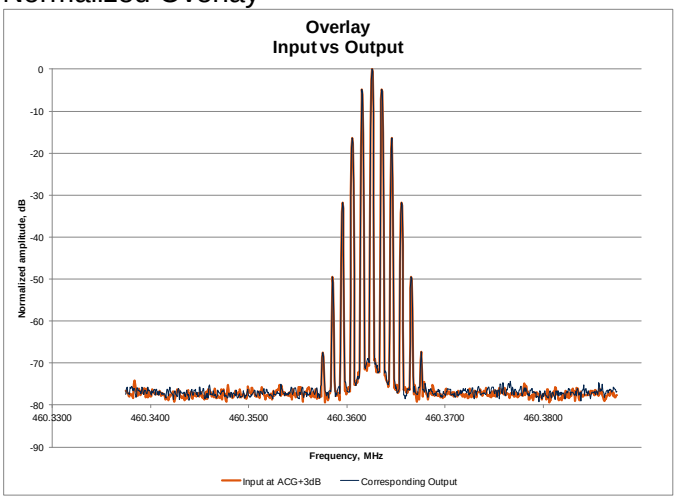


5 Input/output power and amplifier/booster gain

5.1 *Test Result*

Test Description	Basic Standards	Test Result
Input/output power and amplifier/booster gain	935210 D05 Indus Booster Basic Meas v01r01	Reported

5.2 *Test Method*

Testing was performed according to KDB 935210 D05 Indus Booster Basic Meas v01r01, Section 4.5

5.3 *Test Data*

Frequency, MHz	Input Level, dBm	Output Level, dBm	Gain
460.3625	-25.28	18.50	43.78
478.2500	-25.20	18.38	43.58

6 Noise figure measurements

6.1 *Test Result*

Test Description	Basic Standards	Test Result
Noise figure measurements	935210 D05 Indus Booster Basic Meas v01r01	Pass

6.2 *Test Method*

Testing was performed according to KDB 935210 D05 Indus Booster Basic Meas v01r01, Section 4.6.

Since a Noise figure analyzer was not available, an alternate method utilizing the definition of Noise Figure was utilized.

$$F_n = P_n / (kT_oBG)$$

Where:

F_n is the Noise Factor
P_n is the power of the channel noise
k is Boltzmann's constant 1.38E-23 J/K
T_0 is 290k
B is the channel bandwidth
G is the gain of the amplifier.

$$NF = 10\text{Log } F_n$$

Where:

F_n is the Noise Factor
NF is the Noise Figure

6.3 *Test Data*

NF	Pn, Watts	B (kHz)	Gain (dB)
1.2	1.57E-12	12.5	43.78

7 Measuring out-of-band/out-of-block (including intermodulation) and spurious emissions

7.1 *Test Result*

Test Description		Test Result
Measuring out-of-band/out-of-block (including intermodulation) and spurious emissions	935210 D05 Indus Booster Basic Meas v01r01	Pass

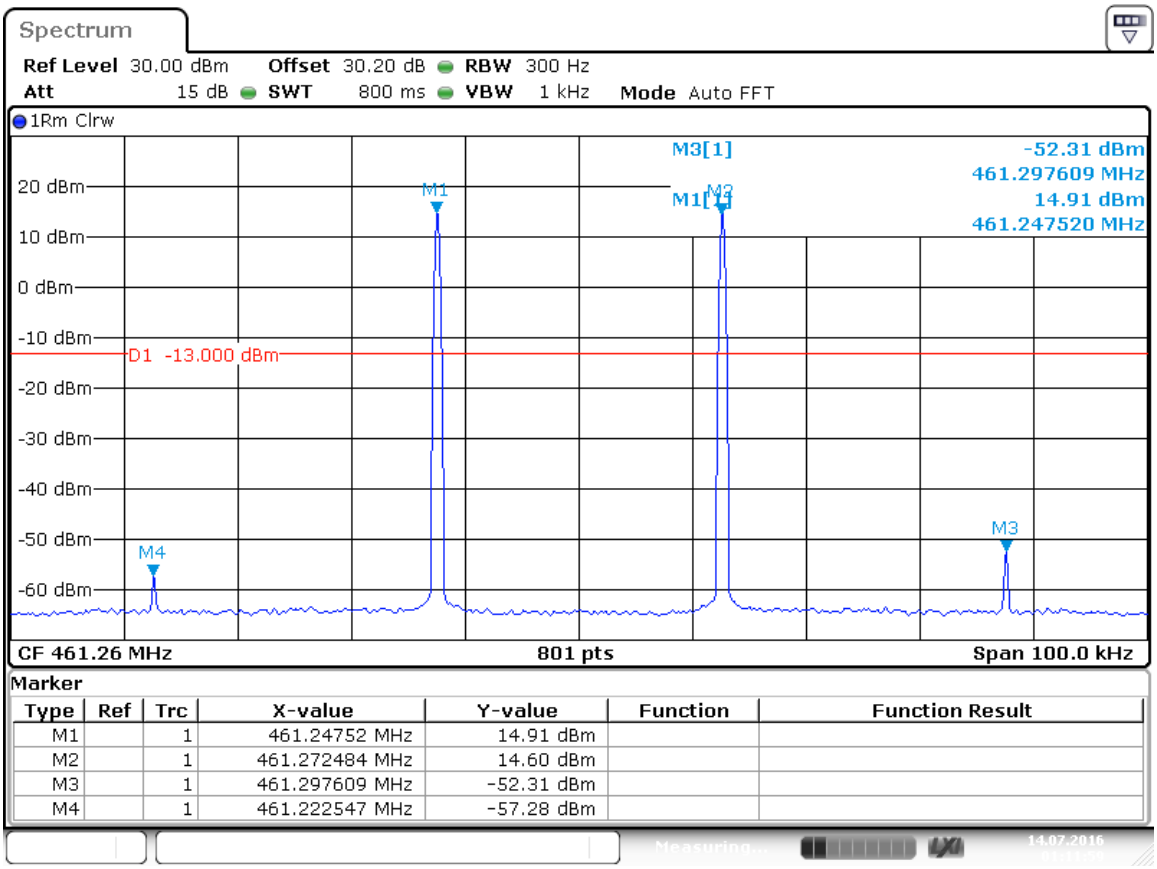
7.2 *Test Method*

Testing was performed according to KDB 935210 D05 Indus Booster Basic Meas v01r01, Section 4.7.

7.3 *Test Data – Intermodulation products*

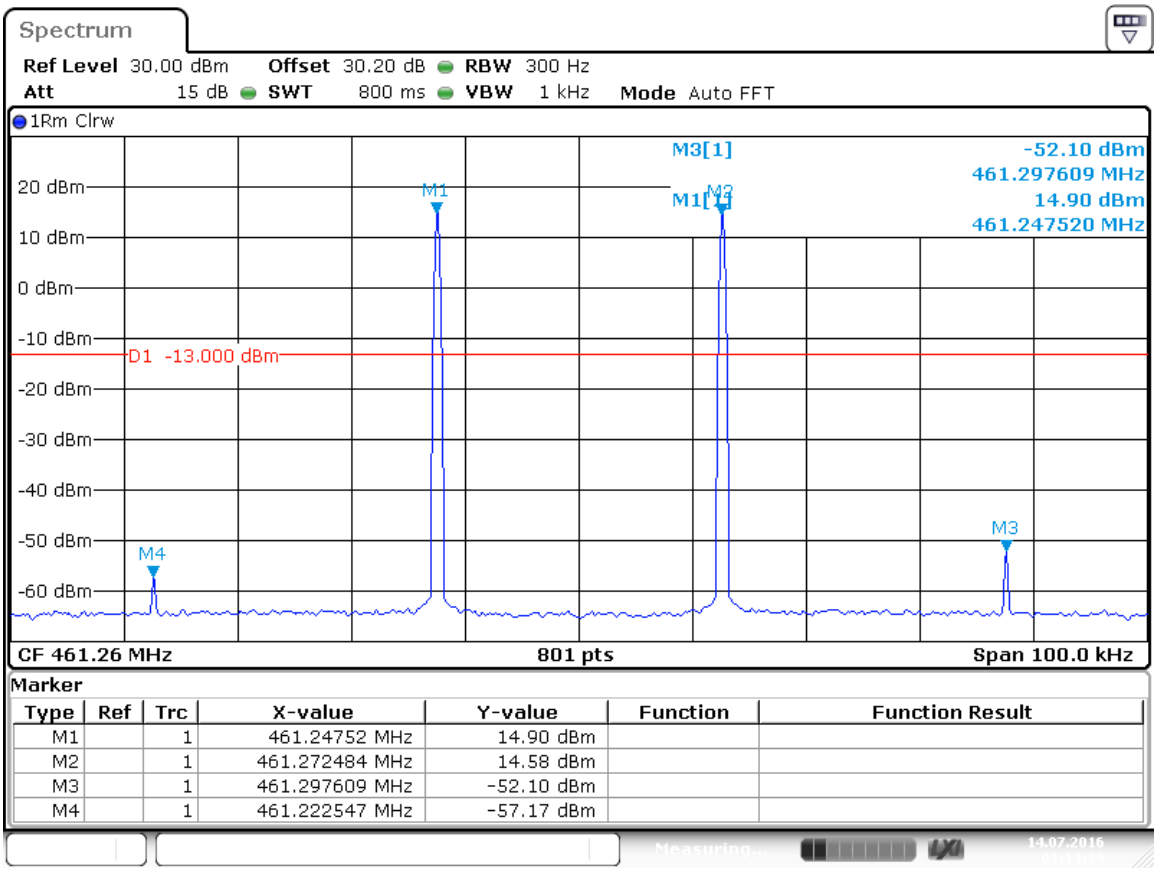
Test data starts on the next page.

7.3.1 Intermodulation products with rated input



Date: 14.JUL.2016 01:11:59

7.3.2 Intermodulation products with rated input increased by 3dB



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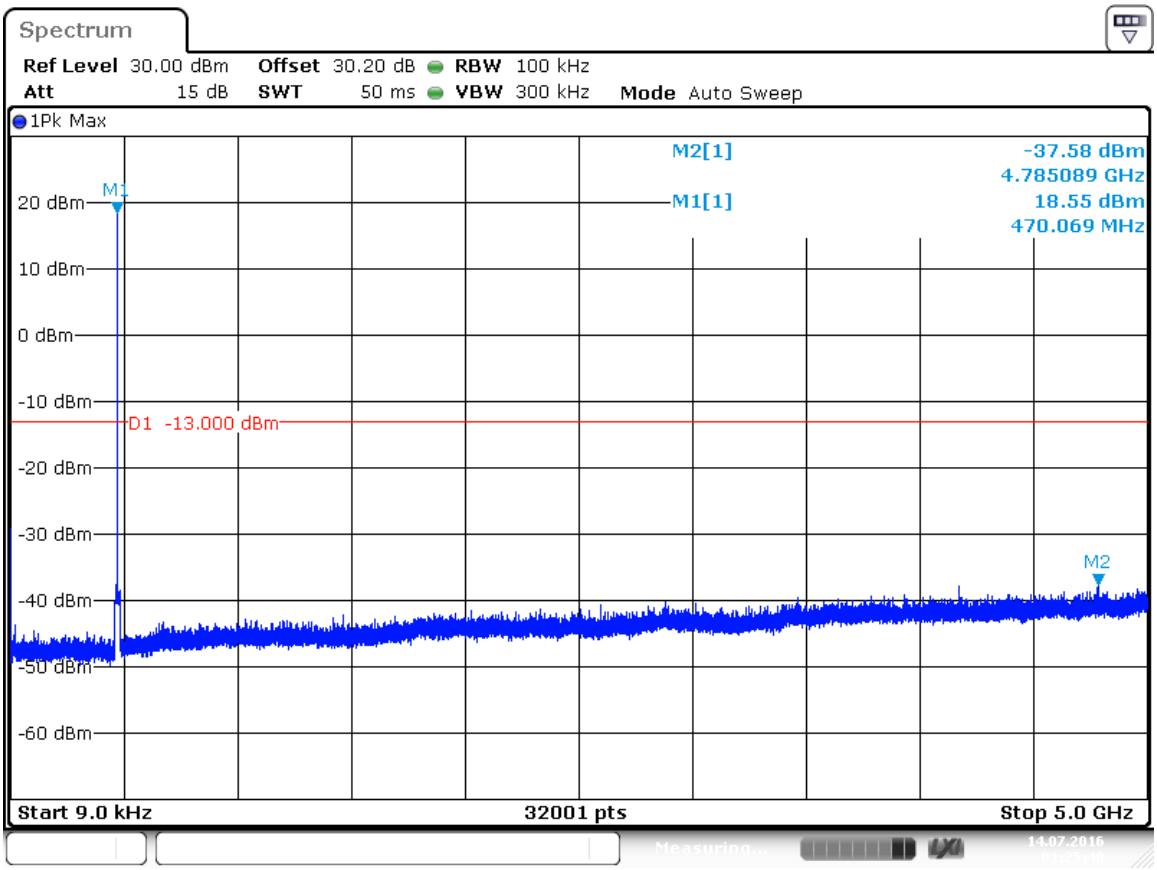
7.4 *Test Data – Spurious Emissions*



Date: 14.JUL.2016 01:25:40

8 Frequency stability measurements

8.1 *Test Result*

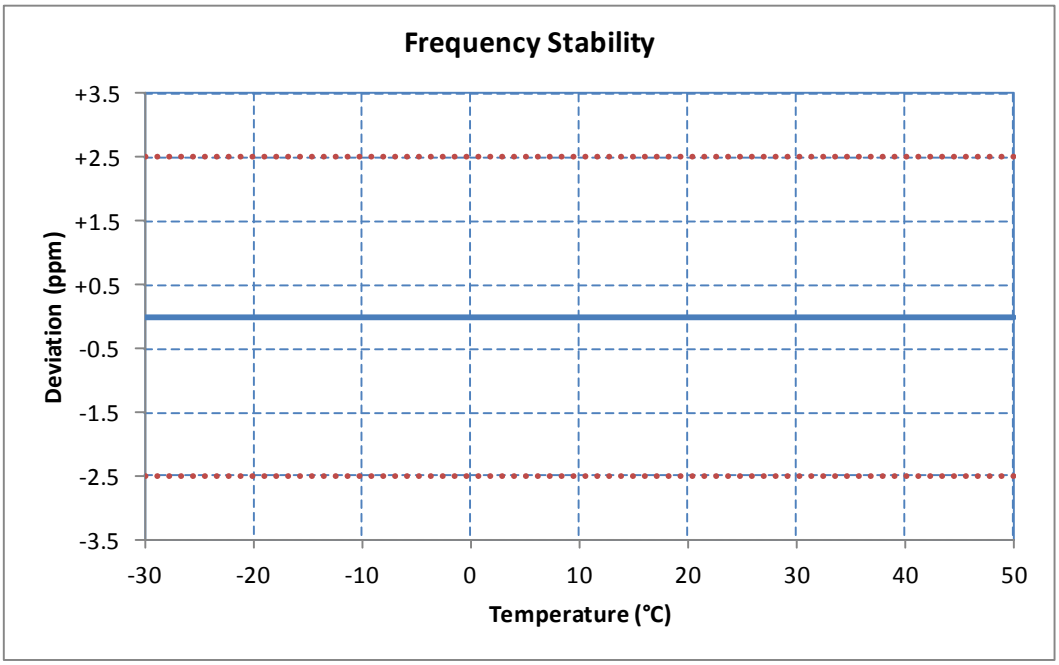
Test Description		Test Result
Frequency stability measurements	935210 D05 Indus Booster Basic Meas v01r01	Pass

8.2 *Test Method*

Testing was performed according to KDB 935210 D05 Indus Booster Basic Meas v01r01, Section 4.8

8.3 *Test Data*

Voltage %	Voltage V	Temp °C	Frequency MHz	Freq Dev Hz	Freq Dev ppm
100%	120.00	+20 (Ref)	470.0000000	+0	+0.00
100%	120.00	-30	470.0000000	+0	+0.00
100%	120.00	-20	470.0000000	+0	+0.00
100%	120.00	-10	470.0000000	+0	+0.00
100%	120.00	0	470.0000000	+0	+0.00
100%	120.00	+10	470.0000000	+0	+0.00
100%	120.00	+20	470.0000000	+0	+0.00
100%	120.00	+30	470.0000000	+0	+0.00
100%	120.00	+40	470.0000000	+0	+0.00
100%	120.00	+50	470.0000000	+0	+0.00
115%	138.00	+20	470.0000000	+0	+0.00
85%	102.00	+20	470.0000000	+0	+0.00



9 Spurious emissions radiated measurements

9.1 *Test Result*

Test Description		Test Result
Spurious emissions radiated measurements	935210 D05 Indus Booster Basic Meas v01r01	Pass

9.2 *Test Method*

Testing was performed according to KDB 935210 D05 Indus Booster Basic Meas v01r01, Section 4.9

9.3 *Test Site*

10m Absorber Lined Shielded Enclosure (ALSE), Suwanee, GA

Environmental Conditions
Temperature: 23.9 °C
Relative Humidity: 50.4 %

9.4 *Test Equipment*

Test Date: 15-Jul-2016 Tester: KS

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
EMI TEST RECEIVER	ESU40	ROHDE & SCHWARZ	B079629	4-Aug-2016
SIGNAL ANALYZER	FSV30	ROHDE & SCHWARZ	B085749	8-Oct-2017
ANTENNA, BILOG	JB6	SUNOL	B079689	11-Sep-2016
DRG HORN (MEDIUM)	3117	ETS-LINDGREN	B079699	26-Apr-2017
PREAMPLIFIER	TS-PR18	ROHDE & SCHWARZ	B094463	16-Feb-2017
RF CABLE	NFS-290-78.7-NFS	FLORIDA RF LABS	B095019	4-Aug-2016
RF CABLE	NMS-290-236.2-NMS	FLORIDA RF LABS	B095020	4-Aug-2016
17 FT N TYPE COAX CABLE	HS 84133232	HUBER&SUHNER	B079661	3-Aug-2016
ULTRAFLEX COAXIAL CABLE	LMR-240	MES MICROWAVE SYSTEM	B091046	4-Aug-2016

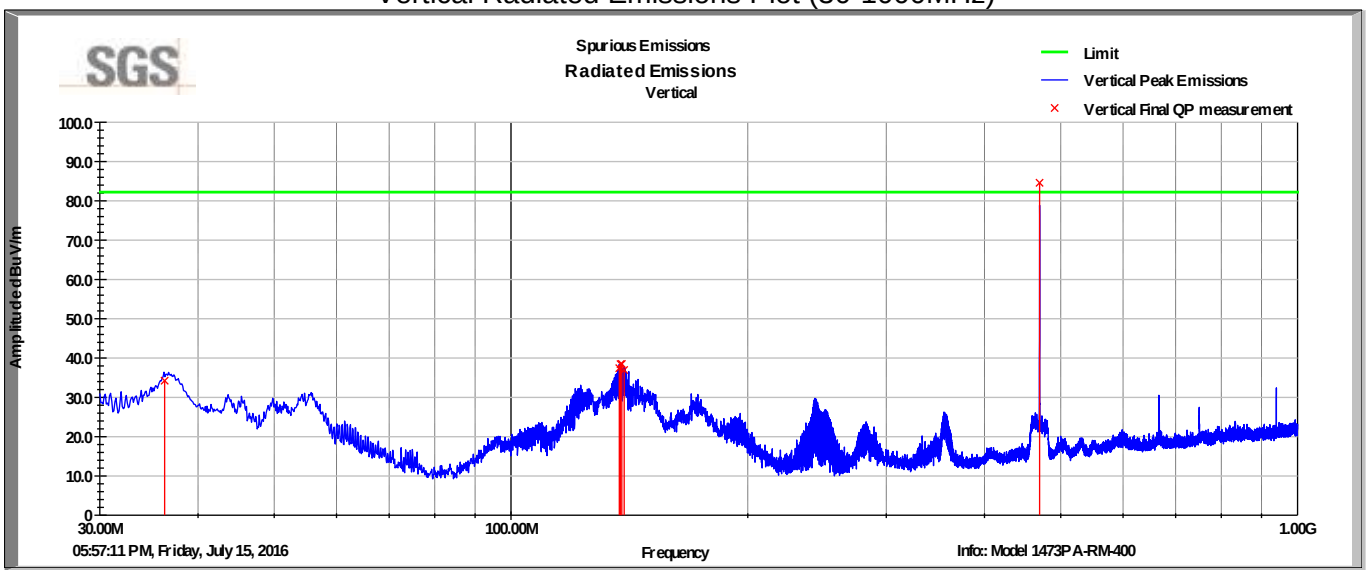
Note: The calibration period equipment is 1 year.

Software:
“RE 30-1000MHz ” TILE! profile dated 12 2015
“RE 1-18GHz ” TILE! profile dated 12 2015

9.5 *Test Setup Photographs*

9.6 *Test Data*

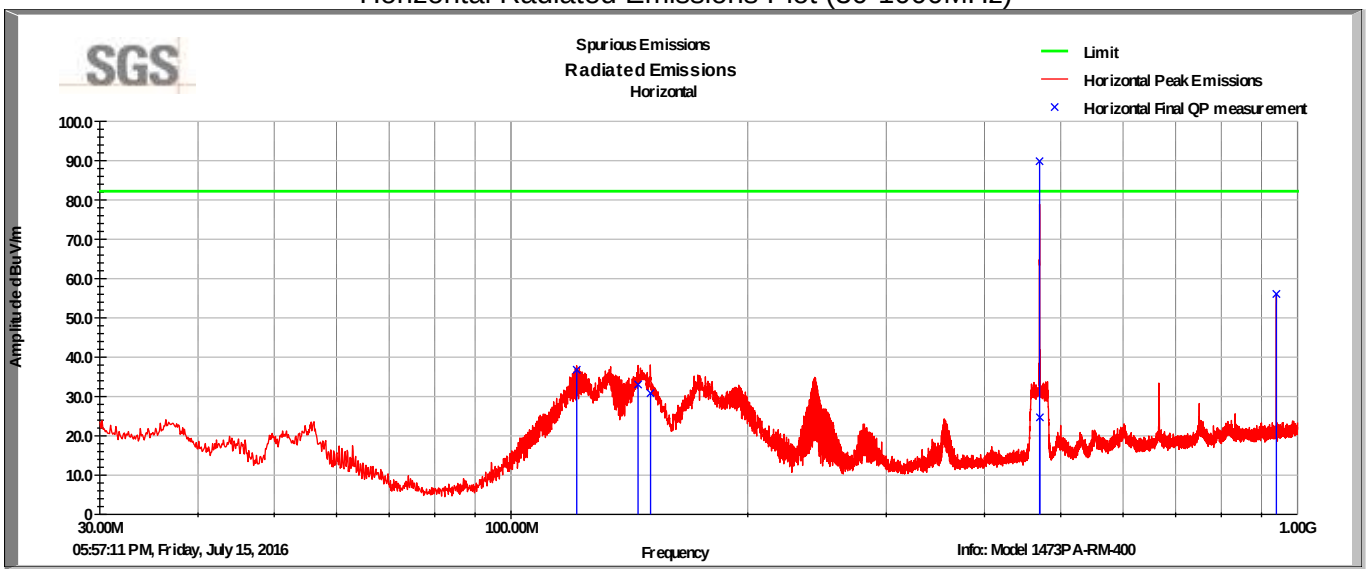
Vertical Radiated Emissions Plot (30-1000MHz)



Vertical Emissions Data

Frequency MHz	Raw QP (dBuV)	Polarity (V/H)	Azimuth (degrees)	Height (cm)	AF (dB/m)	Loss (dB)	Amp (dB)	QP Value (dBuV/m)	-13dBm Limit (dBuV/m)	Margin (dB)
36.27	48.5	V	1.0	100.0	17.3	0.6	32.2	34.2	82.2	-48.0
137.31	56.3	V	323.0	119.0	13.5	1.2	33.6	37.4	82.2	-44.8
137.82	57.4	V	302.0	100.0	13.4	1.2	33.6	38.4	82.2	-43.8
138.31	57.5	V	316.0	100.0	13.4	1.2	33.6	38.5	82.2	-43.7
139.28	56.0	V	283.0	100.0	13.3	1.2	33.6	36.9	82.2	-45.3
QP Value = Level + AF + CL - Amp										
Margin = QP Value - Limit										

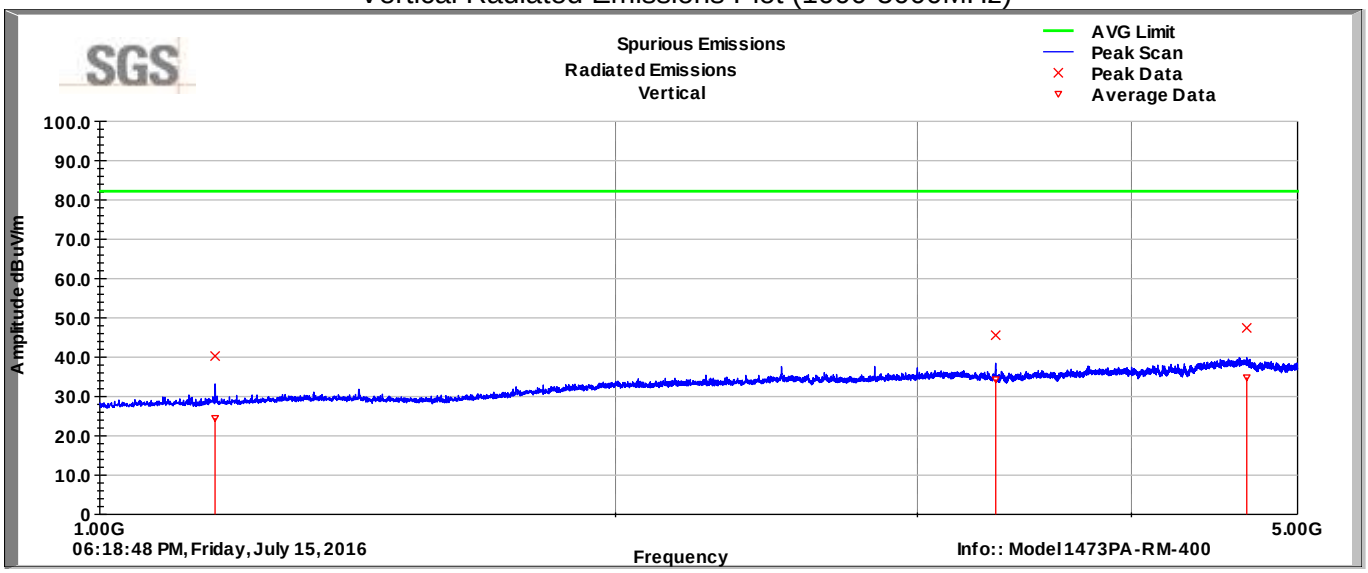
Horizontal Radiated Emissions Plot (30-1000MHz)



Horizontal Emissions Date

Frequency MHz	Raw QP (dBuV)	Polarity (V/H)	Azimuth (degrees)	Height (cm)	AF (dB/m)	Loss (dB)	Amp (dB)	QP Value (dBuV/m)	-13dBm Limit (dBuV/m)	Margin (dB)
121.23	55.4	H	252.0	259.0	13.9	1.1	33.6	36.8	82.2	-45.4
145.07	52.3	H	260.0	166.0	13.1	1.2	33.6	33.0	82.2	-49.2
150.47	50.0	H	282.0	260.0	13.1	1.2	33.6	30.8	82.2	-51.4
470.46	37.7	H	121.0	250.0	18.0	2.2	33.2	24.7	82.2	-57.5
940.00	62.5	H	322.0	184.0	23.6	3.1	33.1	56.1	82.2	-26.1
QP Value = Level + AF + CL - Amp										
Margin = QP Value - Limit										

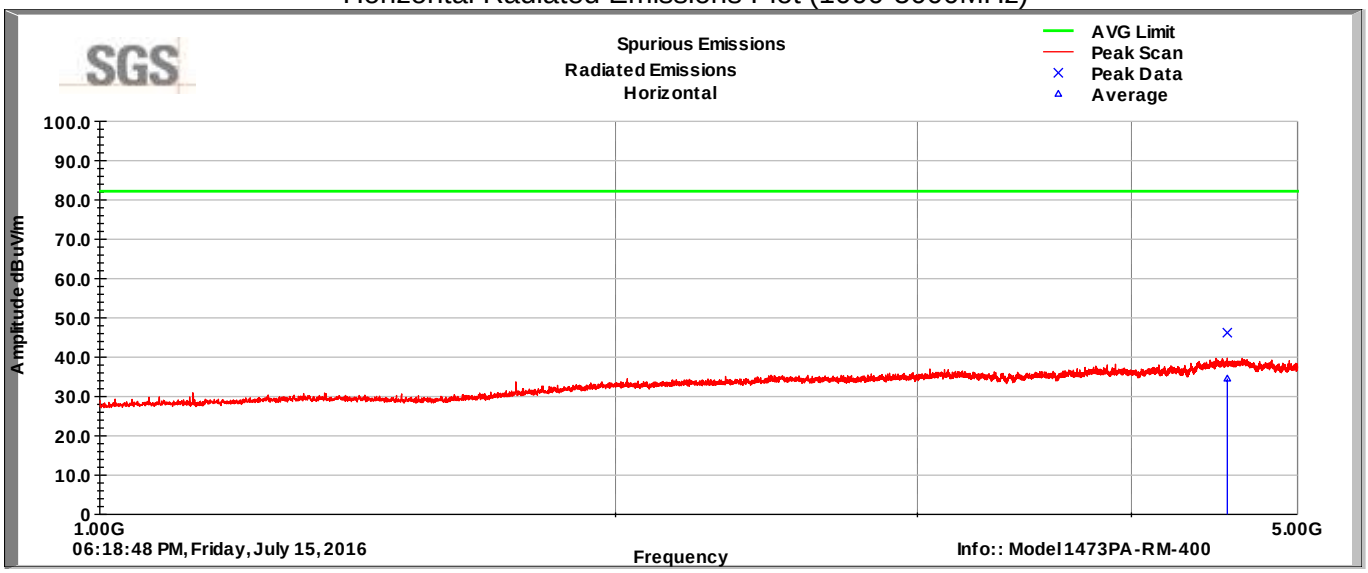
Vertical Radiated Emissions Plot (1000-5000MHz)



Vertical Radiated Emissions Data (1000-5000MHz)

Frequency MHz	Raw Avg (dBuV)	Polarity (V/H)	Azimuth (degrees)	Height (cm)	AF (dB/m)	CL (dB)	Amp (dB)	Avg Value dBuV/m	Limit (dBuV/m)	Margin (dB)
1167.60	26.2	V	222.0	228.0	27.9	2.3	33.1	24.5	82.2	-57.7
3333.20	28.6	V	10.0	341.0	32.8	4.0	33.2	34.4	82.2	-47.8
4670.80	25.8	V	137.0	333.0	34.6	4.9	33.4	34.9	82.2	-47.3
Avg Value = Level + AF + CL - Amp										
Margin = Avg Value - Limit										

Horizontal Radiated Emissions Plot (1000-5000MHz)



Horizontal Radiated Emissions Data (1000-5000MHz)

Frequency MHz	Raw Peak (dBuV)	Polarity (V/H)	Azimuth (degrees)	Height (cm)	AF (dB/m)	CL (dB)	Amp (dB)	Peak Value (dBuV/m)	-13dBm Limit (dBuV/m)	Margin (dB)
4549.60	37.7	H	143.0	100.0	34.3	4.9	33.3	46.2	82.2	-36.0
Avg Value = Level + AF + CL - Amp										
Margin = Avg Value - Limit										

10 Revision History

Revision Level	Description of changes	Revision Date
0	Initial release	15 July 2016