EMC Test Report

Report Number:	**2015EMC01**	**Revision Level:**	**0**
Project Number:	**2015**	**SGS Reference:**	**4018839**
Client:	**Applied Micro Design Inc.**		

Equipment Under Test:	**Power Amplifier / LNA**
Model Number:	**1473PA-HE-400**
FCC ID:	**2AES2-1473PA-HE-400**

FCC Rule Parts:	**FCC Part 90.219**
	935210 D05 Indus Booster Basic Meas v01r01

Report issued on:	**01 August 2016**
Test Result:	**Compliant**

Tested by: _____
Kent Stewart, Project Engineer

Reviewed by: _____
Jeremy Pickens, Senior EMC Engineer

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 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:	23.6 °C	26.6 °C
Relative Humidity:	38.8 %	53.9%

1.3 *General Information of EUT*

Type of Product:	Power Amplifier / LNA
Model Number:	1473PA-HE-400
Serial Number:	0616-101
Rated Voltage:	120Vac, 60Hz
Tested Voltage:	120Vac, 60Hz
Sample Received Date:	07 July 2016
Dates of testing:	27 July to 01 August 2016

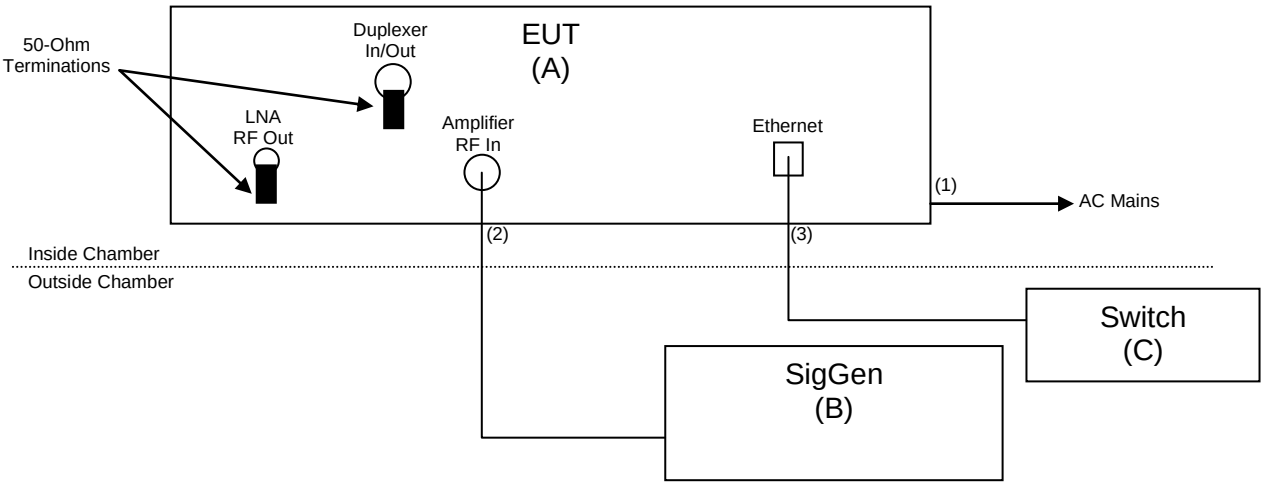
1.4 *Operating Modes and Conditions*

A signal generator was connected to the RF In of the EUT. 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	Power Amplifier / LNA	1473PA-HE-400	0616-101
B	Rohde & Schwarz	Signal Generator	SMB 100A	100350
C	TP-LINK	Gigabit Switch	TL-SG1005D	11B69306337

1.2 *Cable List*

Cable reference	Port Name	Start	End	Cable Length (m)	Ferrite installed?	Shielded?
1	AC Input	AC Mains	EUT	1.75	No	No
2	RF Cable	Signal Generator	EUT RF IN	15	No	Coax
3	Ethernet	EUT	Switch	10	No	No

1.3 *Test Equipment*

Test End Date: 1-Aug-2016

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
EMI TEST RECEIVER	ESU40	ROHDE & SCHWARZ	B079629	20-Jun-2017
SIGNAL GENERATOR	SMBV100A	ROHDE & SCHWARZ	15002	18-Aug-2016
10DB ATTENUATOR	BW-S10W20+	MCL	B095595	5-Aug-2016
ATTENUATOR	BW-S10W2	MINI-CIRCUITS	15035-30dB	CNR
EMI TEST RECEIVER	ESU8	ROHDE & SCHWARZ	B085759	21-Jul-2017
MULTIFLEX COAXIAL CABLE	141	HUBER&SUHNER	B095586	4-Aug-2016
MULTIFLEX COAXIAL CABLE	141	HUBER&SUHNER	B095585	4-Aug-2016
COAXIAL CABLE	1134	GORE	B094785	4-Aug-2016
SIGNAL GENERATOR	SMB 100A	ROHDE & SCHWARZ	B094876	2-Dec-2016
POWER SPLITTER	50PD-645	JFW INDUSTRIES	B079786	5-Aug-2016
ENVIRONMENTAL CHAMBER	SM-16-8200	THERMOTRON	B079727	24-Nov-2016
SIGNAL GENERATOR	SMB 100A	ROHDE & SCHWARZ	B094876	2-Dec-2016
10 FT N TYPE COAX	HS 84133215	HUBER&SUHNER	B079660	3-Aug-2016
ANTENNA, BILOG	JB6	SUNOL	B079689	11-Sep-2016
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
10 FT N TYPE COAX	HS 84133215	HUBER&SUHNER	B079659	3-Aug-2016
COAXIAL CABLE	SUCOFLEX 100	HUBER&SUHNER	B108523	27-Oct-2016
PREAMPLIFIER	TS-PR18	ROHDE & SCHWARZ	B094463	16-Feb-2017
DRG HORN (MEDIUM)	3117	ETS-LINDGREN	B079699	26-Apr-2017

Note: The equipment calibration period is 1 year.

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
481.2500	-10.8	29.7

3 Out-Of Band Rejection

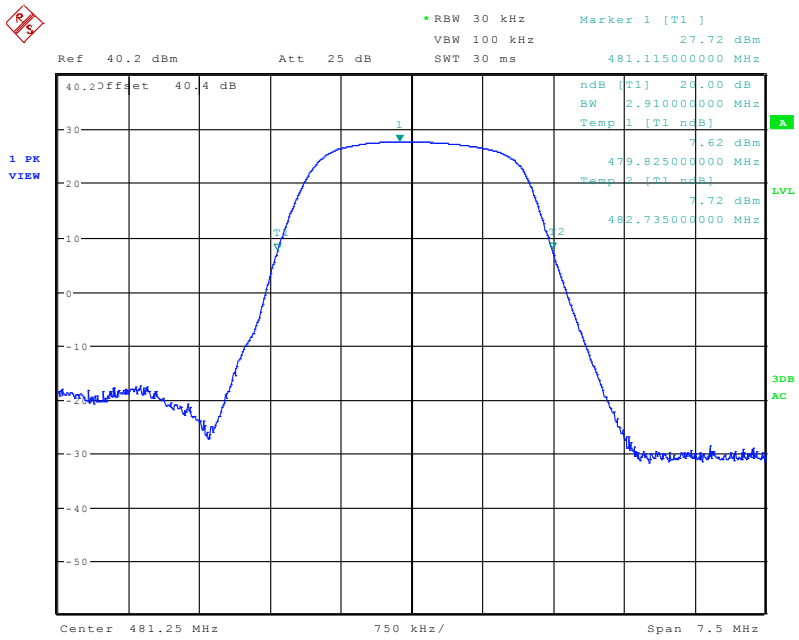
3.1 *Test Result*

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: 27.JUL.2016 23:17:00

20dB BW = 2.91MHz

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*

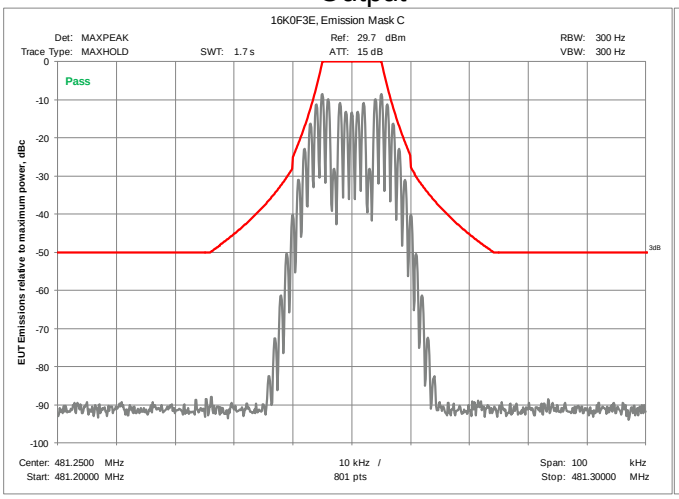
Testing was performed according to KDB 935210 D05 Indus Booster Basic Meas v01r01, Section 4.4

4.3 *Test Data*

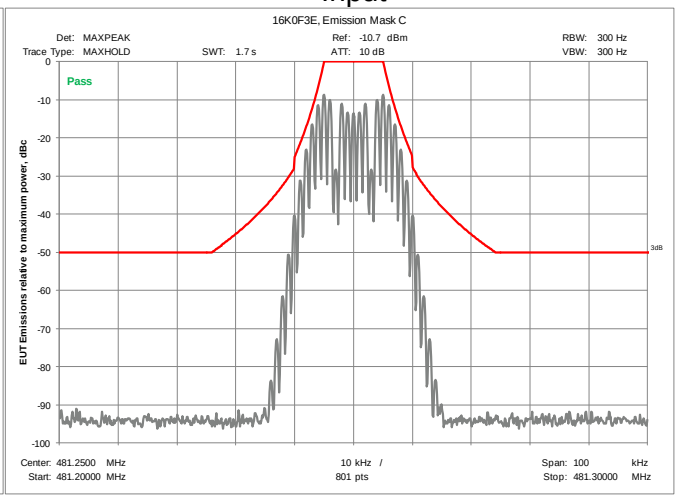
Test data starts on the next page.

4.3.1 **16K0F3E at ACG**

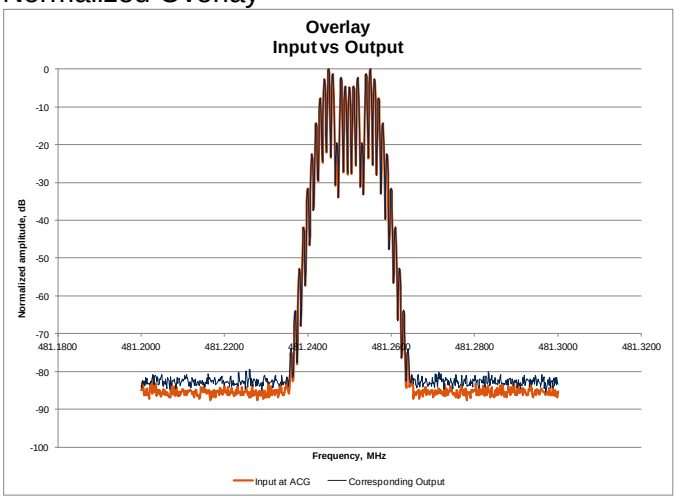
Output



Input

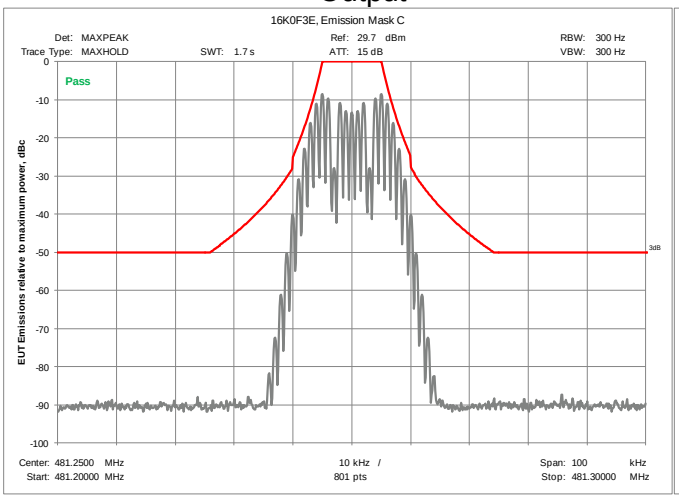


Normalized Overlay



4.3.2 16K0F3E at ACG Plus 3dB

Output



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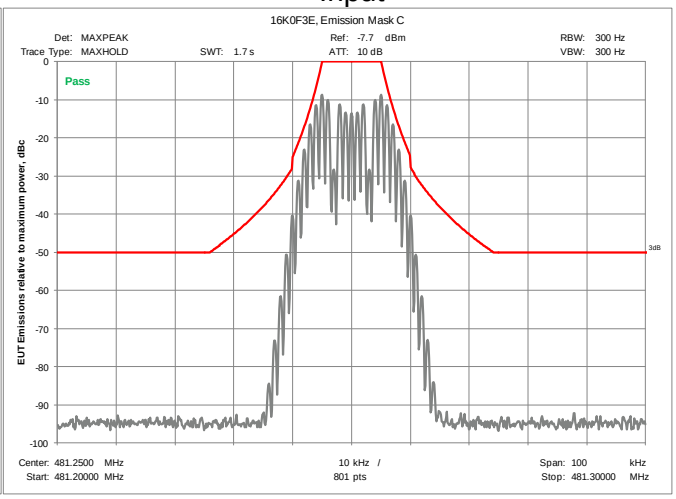
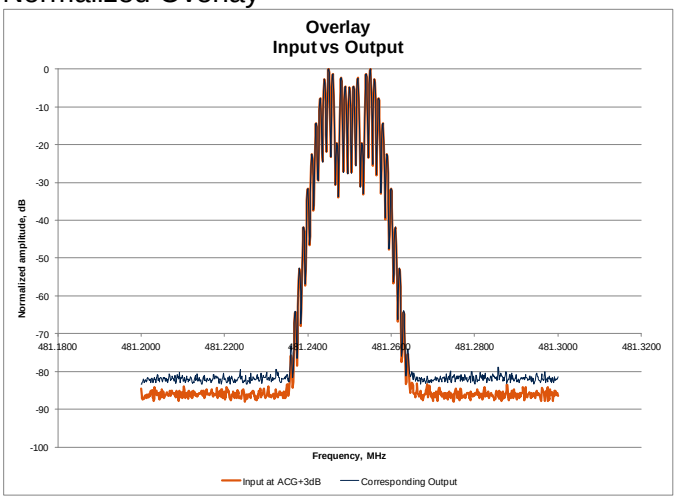
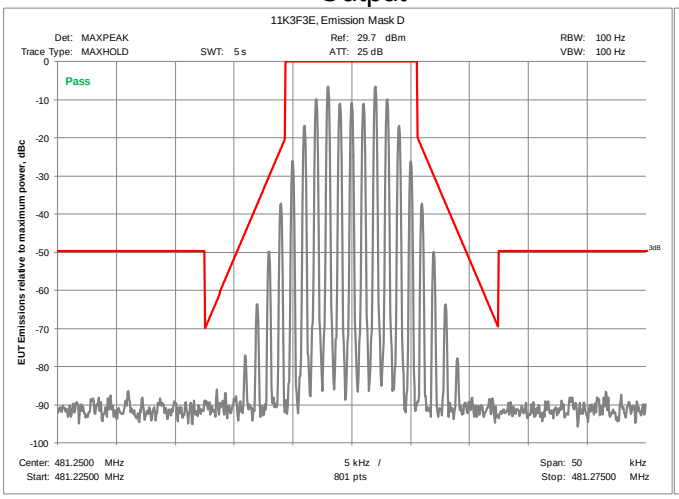


Normalized Overlay

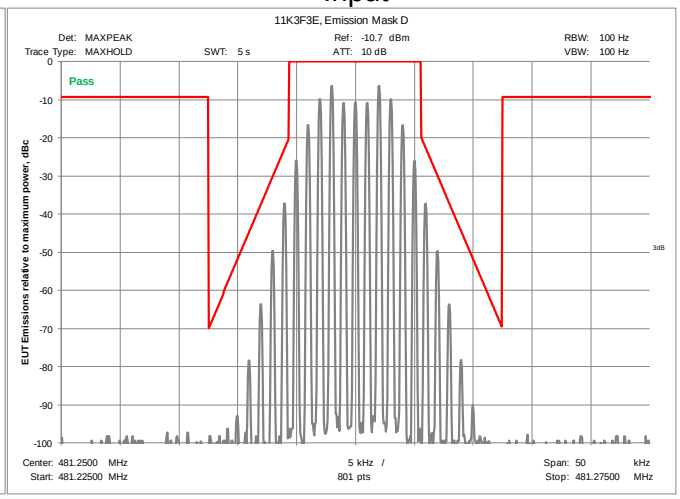


4.3.3 **11K3F3E at ACG**

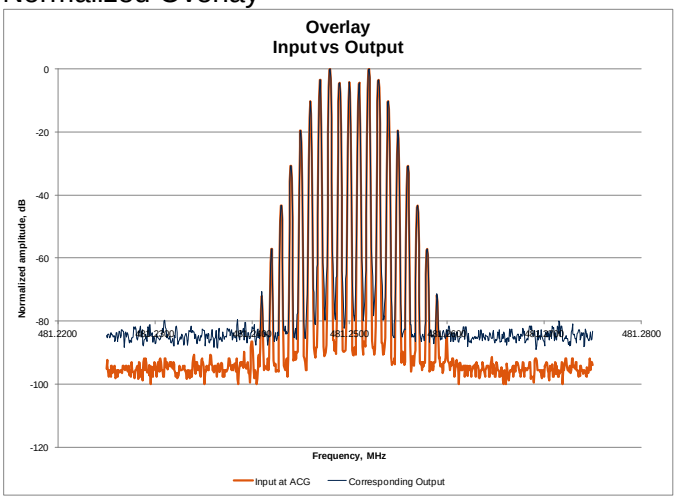
Output



Input

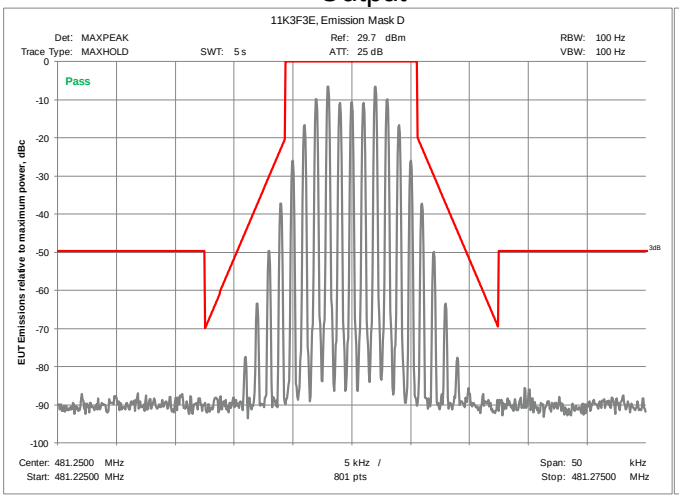


Normalized Overlay

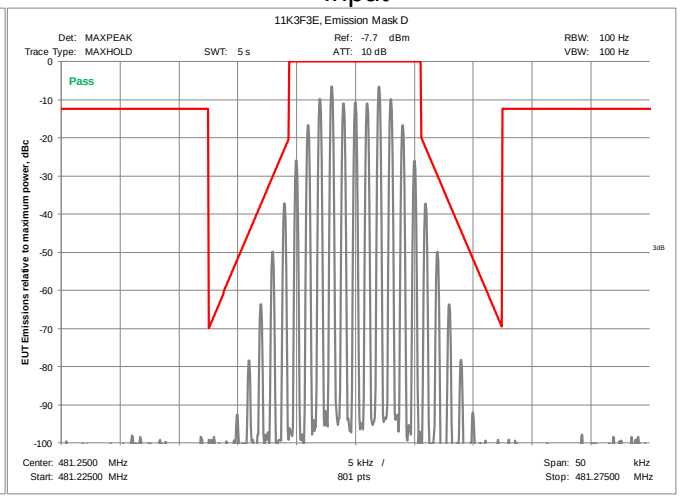


4.3.4 11K3F3E at ACG Plus 3dB

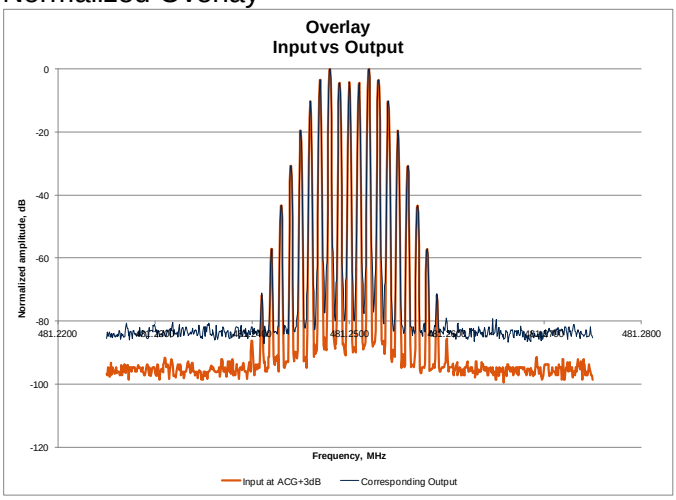
Output



Input

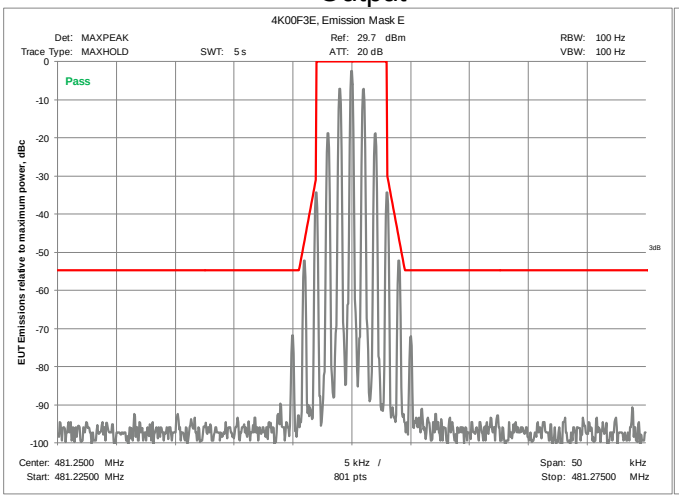


Normalized Overlay

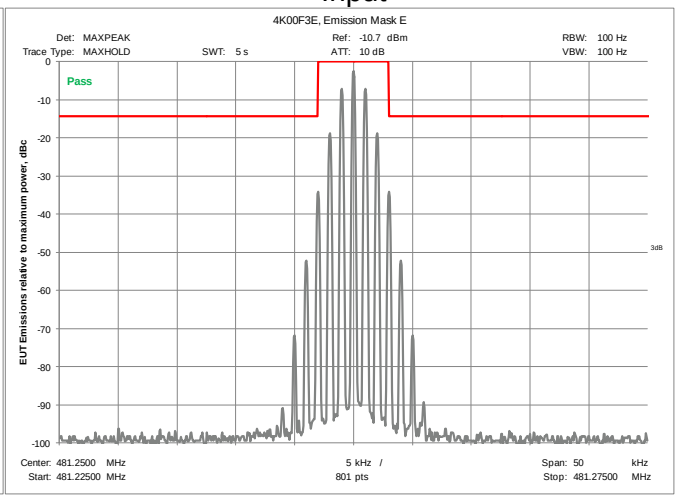


4.3.5 **4K00F1E at ACG**

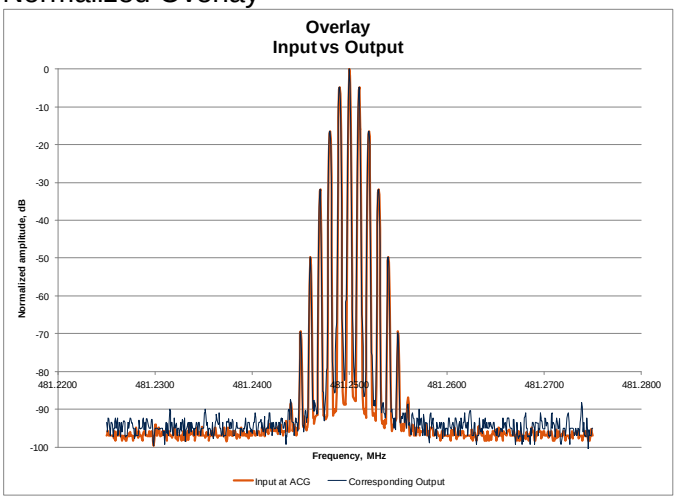
Output



Input

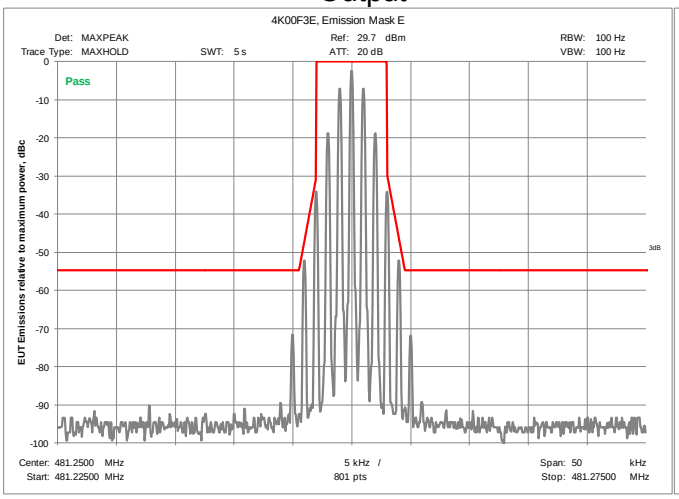


Normalized Overlay

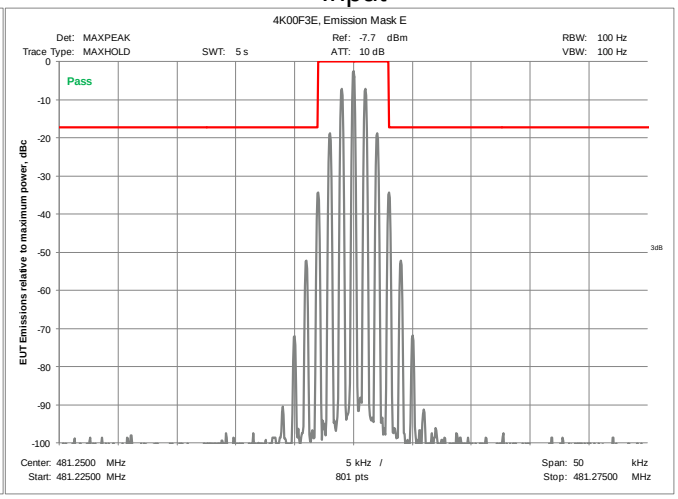


4.3.6 **4K00F1E at ACG Plus 3dB**

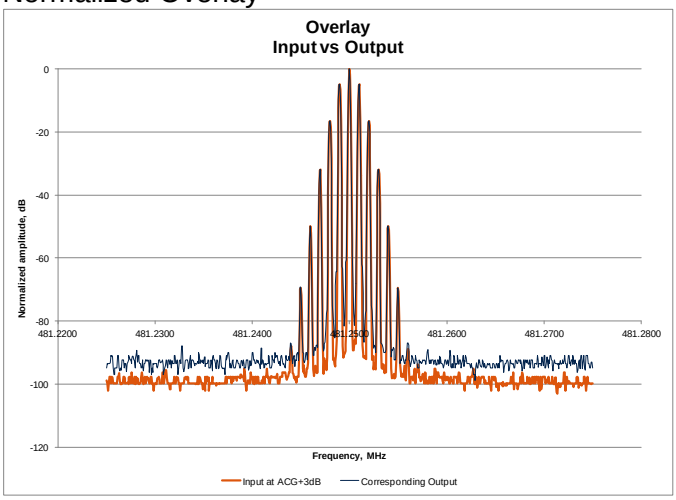
Output



Input



Normalized Overlay



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
481.25	-10.8	29.7	40.5

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)
7.9	3.50E-12	12.5	40.5
8.1	1.80E-12	6.25	40.5

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

7.1 *Test Result*

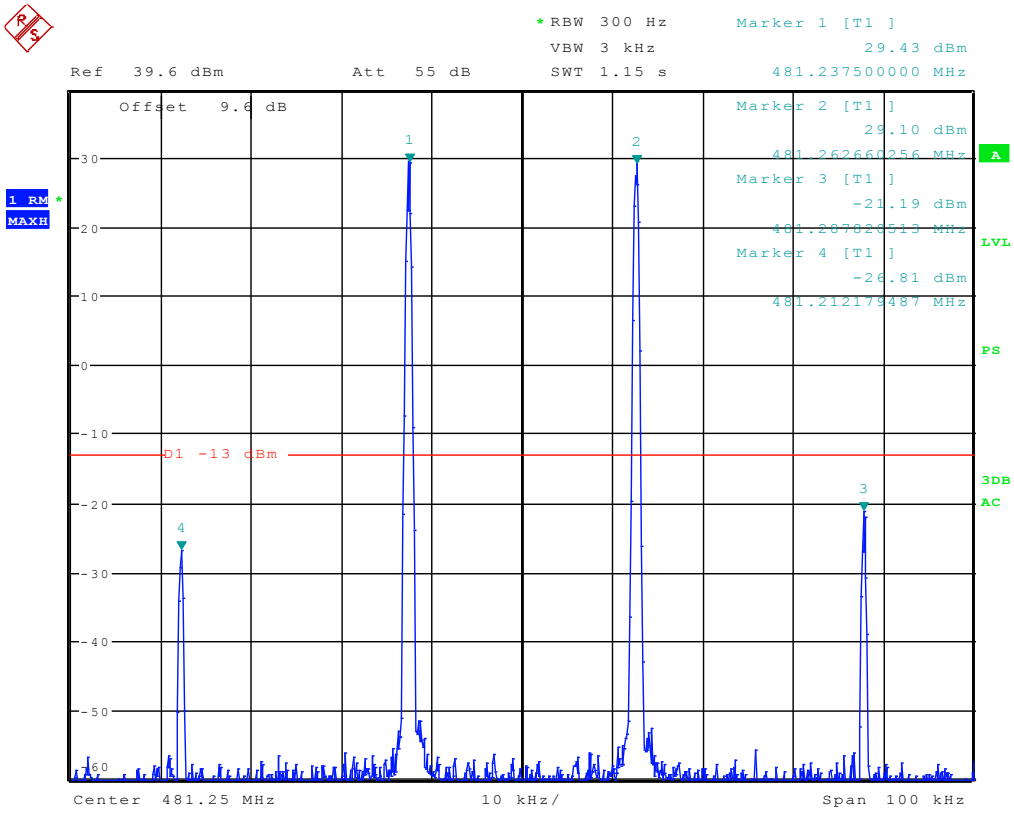
Test Description		Test Result
Measuring out-of-band/out-of-block (including intermodulation) and spurious emissions	935210 D05 Indus Booster Basic Meas v01r01	Pass

7.2 *Test Method*

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

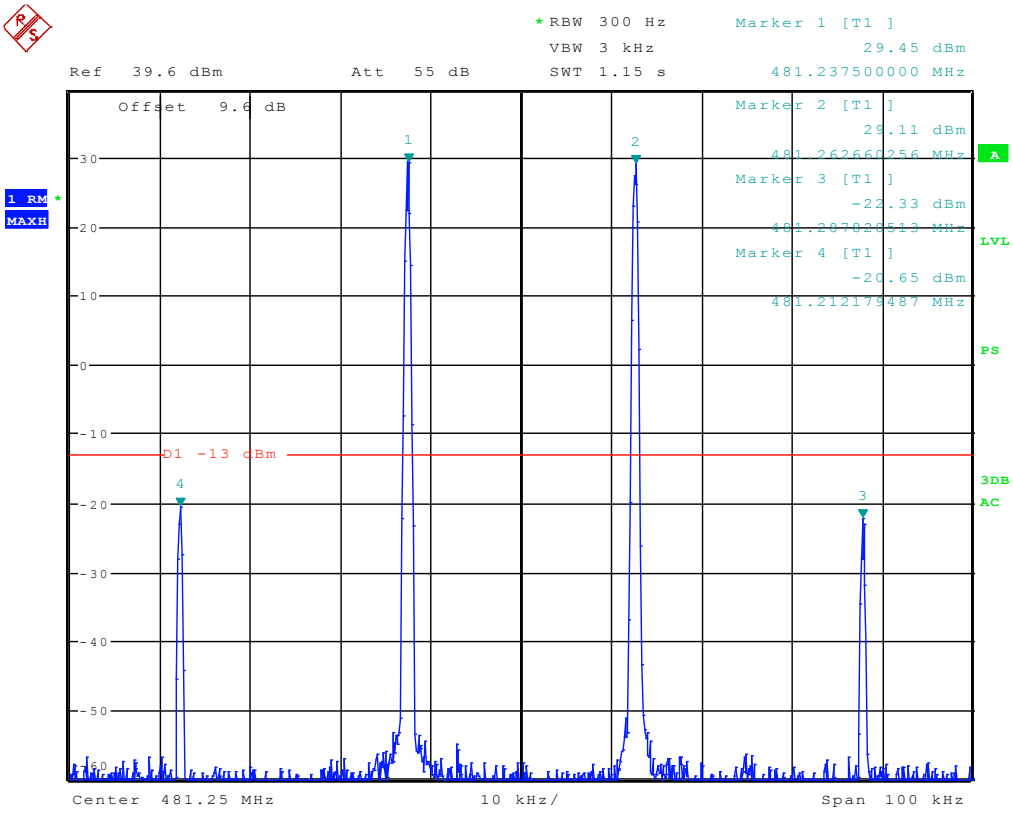
7.3 *Test Data – Intermodulation products*

7.3.1 Intermodulation products with rated input



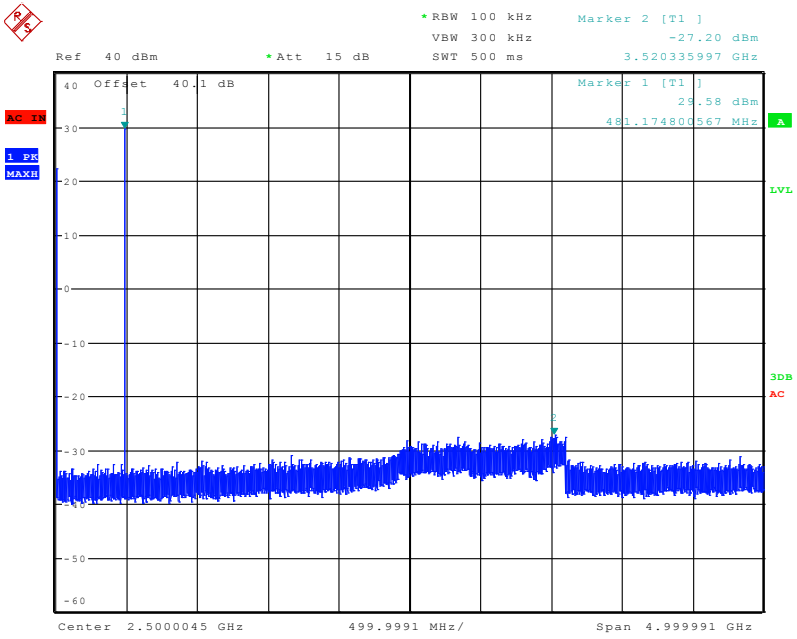
Date: 1.AUG.2016 11:42:06

7.3.2 Intermodulation products with rated input increased by 3dB



Date: 1.AUG.2016 11:43:10

7.4 *Test Data – Spurious Emissions*



Date: 28.JUL.2016 21:06:54

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

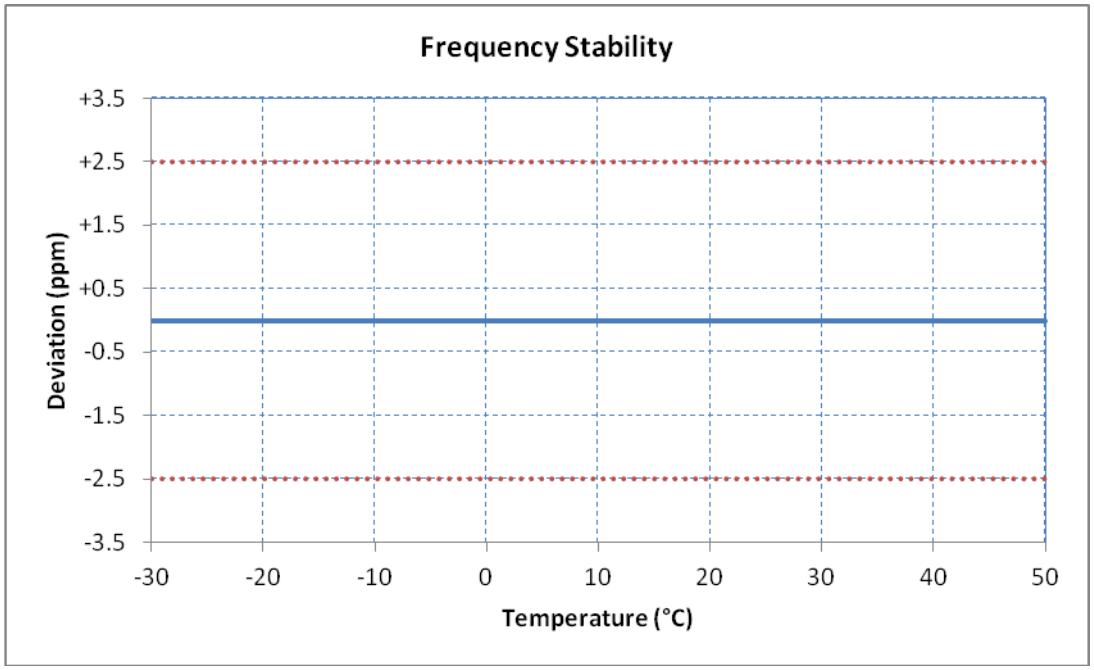
8.3 *Test Data*

perating Frequency (MHz): 481.25

481,250,000

Reference Voltage V_{AC}: 120
Deviation Limit (ppm): 2.5
Deviation Limit ± (%): 0.00015

Voltage %	Voltage V	Temp °C	Frequency MHz	Freq Dev Hz	Freq Dev ppm
100%	120.00	+20 (Ref)	481.2499600	+40	+0.08
100%	120.00	-30	481.2499600	+40	+0.08
100%	120.00	-20	481.2499600	+40	+0.08
100%	120.00	-10	481.2499700	+30	+0.06
100%	120.00	0	481.2499700	+30	+0.06
100%	120.00	+10	481.2499600	+40	+0.08
100%	120.00	+20	481.2499600	+40	+0.08
100%	120.00	+30	481.2499600	+40	+0.08
100%	120.00	+40	481.2499600	+40	+0.08
100%	120.00	+50	481.2499700	+30	+0.06
115%	138.00	+20	481.2499750	+25	+0.05
85%	102.00	+20	481.2499850	+15	+0.03



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*

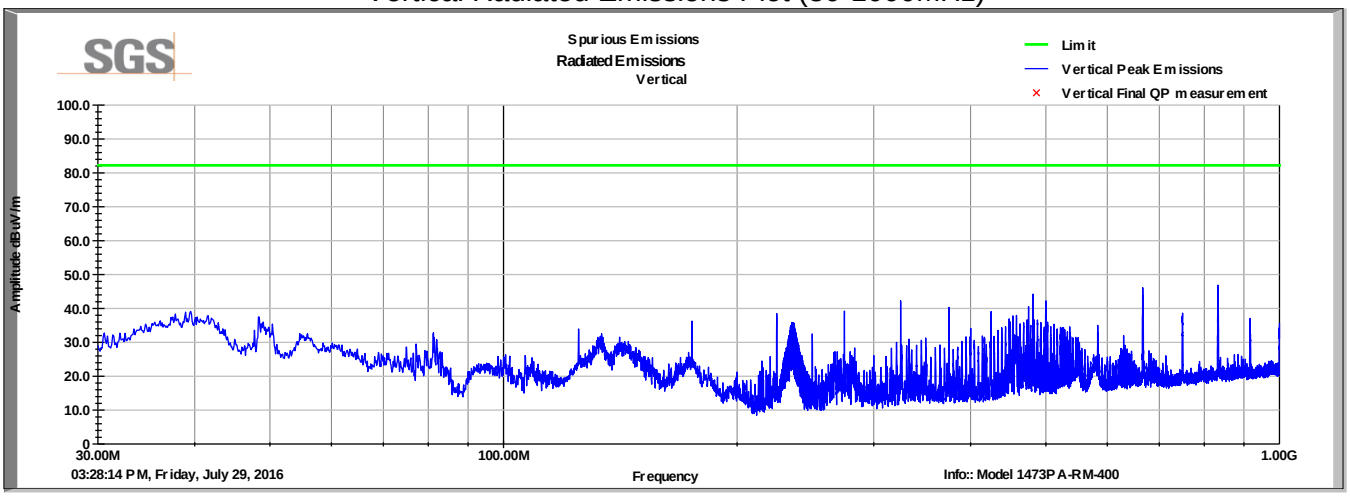
Testing was performed according to KDB 935210 D05 Indus Booster Basic Meas v01r01, Section 4.9

9.3 *Test Site*

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

9.4 *Test Data*

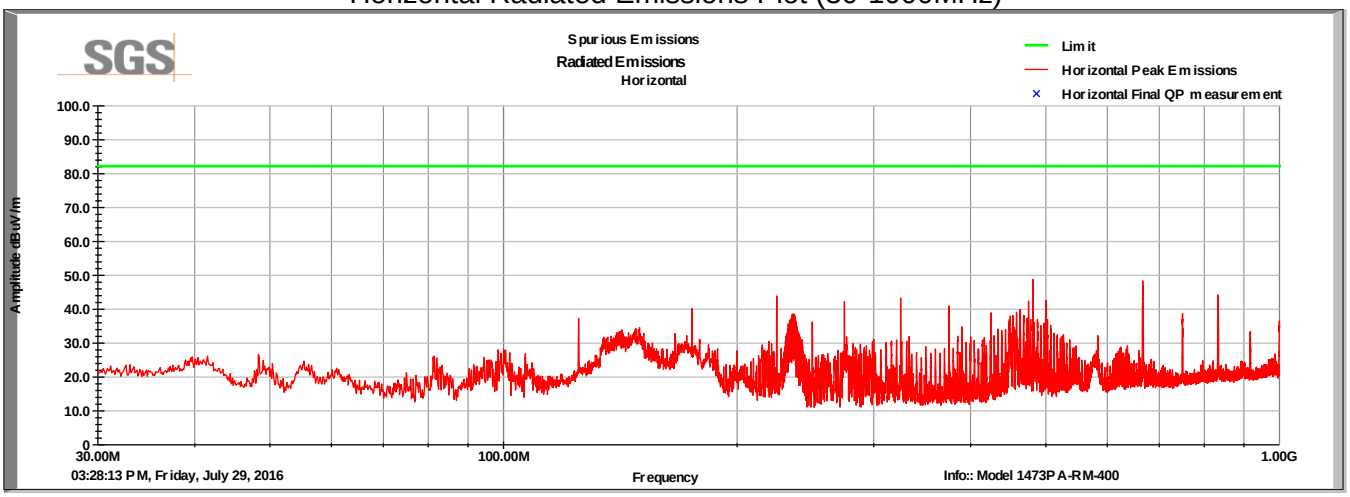
Vertical Radiated Emissions Plot (30-1000MHz)



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)	Limit (dBuV/m)	Margin (dB)
39.50	53.5	V	164.0	137.0	14.9	0.4	32.3	36.5	82.2	-45.7
48.41	56.5	V	270.0	137.0	9.3	0.5	32.6	33.7	82.2	-48.5
325.01	60.3	V	154.0	148.0	14.8	1.3	33.4	43.0	82.2	-39.2
481.25	58.5	V	75.0	100.0	18.1	1.6	33.2	45.0	82.2	-37.2
666.67	54.3	V	96.0	100.0	20.8	1.9	33.1	43.9	82.2	-38.3
833.20	49.7	V	146.0	110.0	22.9	2.2	33.1	41.6	82.2	-40.6
QP Value = Level + AF + CL - Amp										
Margin = QP Value - Limit										

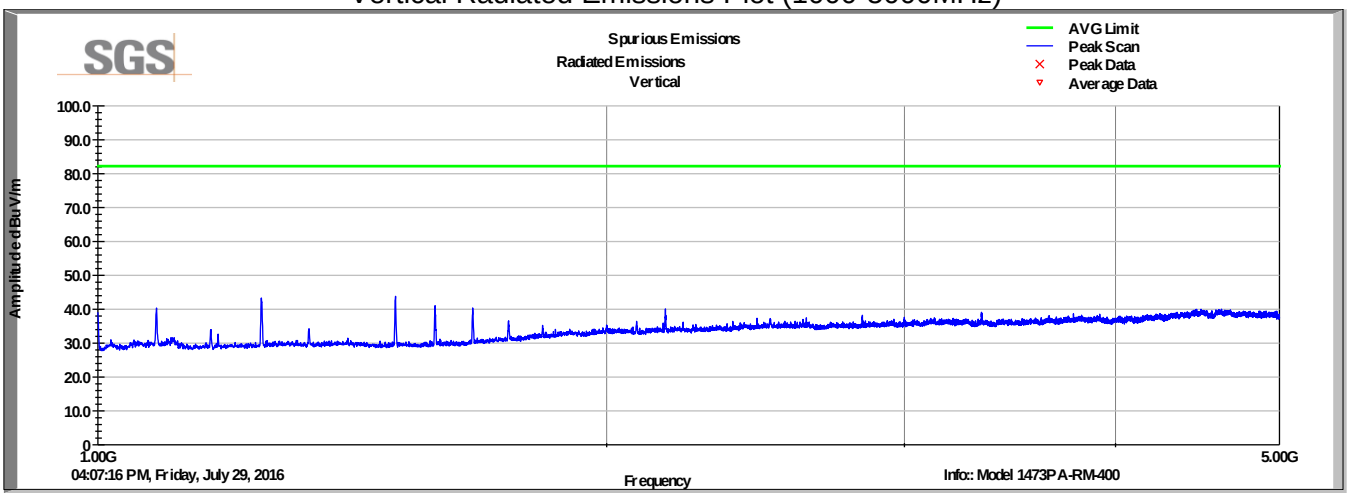
Horizontal Radiated Emissions Plot (30-1000MHz)



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)	Limit (dBuV/m)	Margin (dB)
175.01	60.9	H	237.0	148.0	11.8	0.9	33.5	40.1	82.2	-42.1
225.00	64.9	H	271.0	127.0	11.7	1.1	33.5	44.2	82.2	-38.0
325.01	62.0	H	166.0	100.0	14.8	1.3	33.4	44.7	82.2	-37.5
481.25	61.5	H	276.0	167.0	18.1	1.6	33.2	48.1	82.2	-34.1
666.67	53.8	H	256.0	184.0	20.8	1.9	33.1	43.5	82.2	-38.7
833.20	49.8	H	83.0	166.0	22.9	2.2	33.1	41.8	82.2	-40.4
QP Value = Level + AF + CL - Amp										
Margin = QP Value - Limit										

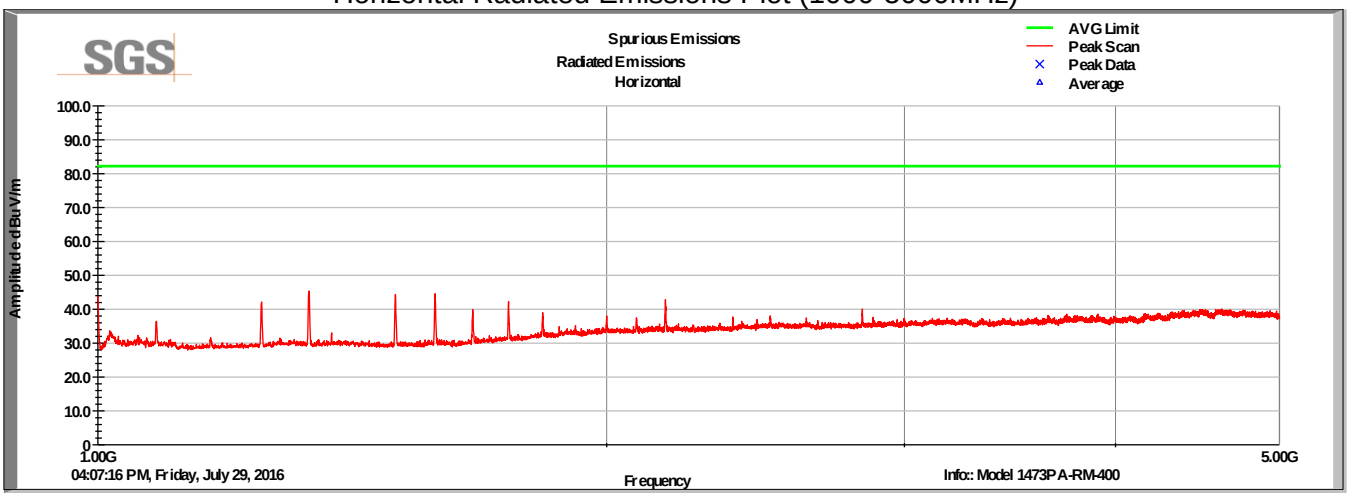
Vertical Radiated Emissions Plot (1000-5000MHz)



Vertical Radiated Emissions Data (1000-5000MHz)

Frequency MHz	Raw Peak (dBuV)	Polarity (V/H)	Azimuth (degrees)	Height (cm)	AF (dB/m)	CL (dB)	Amp (dB)	Peak Value (dBuV/m)	Limit (dBuV/m)	Margin (dB)
1249.60	48.6	V	5.0	100.0	28.4	2.6	33.1	46.7	82.2	-35.5
1500.00	44.5	V	326.0	150.0	28.0	2.9	33.1	42.5	82.2	-39.7
1583.20	47.5	V	32.0	100.0	28.1	3.0	33.1	45.6	82.2	-36.6
1666.40	43.3	V	156.0	100.0	28.8	3.1	33.1	42.2	82.2	-40.0
Peak Value = Level + AF + CL - Amp										
Margin = Peak 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)	Limit (dBuV/m)	Margin (dB)
1000.00	50.8	H	85.0	150.0	27.3	2.3	33.1	47.4	82.2	-34.8
1333.20	43.9	H	104.0	100.0	28.6	2.7	33.1	42.3	82.2	-39.9
1499.60	52.3	H	109.0	100.0	28.0	2.9	33.1	50.2	82.2	-32.0
1583.20	47.4	H	97.0	100.0	28.1	3.0	33.1	45.6	82.2	-36.6
Avg Value = Level + AF + CL - Amp										
Margin = Avg Value - Limit										

10 Revision History

Revision Level	Description of changes	Revision Date
0	Initial release	01 August 2016