

Report on the Radio Testing
For
Silicon Laboratories Finland Oy
on
Bluetooth radio module, model WT41-A
Report no. TRA-031596-02-47-00C
12th January 2017

RF916 6.0



Report Number: TRA-031596-02-47-00C
Issue: A

REPORT ON THE RADIO TESTING OF A
Silicon Laboratories Finland Oy
Bluetooth radio module, model WT41-A
WITH RESPECT TO SPECIFICATION
FCC 47CFR 15.247 & IC RSS-247

TEST DATE: 12-08-2016 to 26-09-2016

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Approved by:

John Charters
Department Manager- Radio

Date: 12th January 2017

Disclaimers:

- [1] THIS DOCUMENT MAY BE REPRODUCED ONLY IN ITS ENTIRETY AND WITHOUT CHANGE
- [2] THE RESULTS CONTAINED IN THIS DOCUMENT RELATE ONLY TO THE ITEM(S) TESTED

RF916 6.0

1 Revision Record

<i>Issue Number</i>	<i>Issue Date</i>	<i>Revision History</i>
A	10 th October 2016	Original
B	11 th October 2016	Update manufacturer details
C	12 th January 2017	Power supply

2 Summary

TEST REPORT NUMBER:	TRA-031596-02-47-00C
WORKS ORDER NUMBER	TRA-031596-02
PURPOSE OF TEST:	USA: Testing of radio frequency equipment per the relevant authorization procedure of chapter 47 of CFR (code of federal regulations) Part 2, subpart J. Canada: Testing of radio apparatus for TAC (technical acceptance certificate) per subsections 4(2) of the Radio communication Act and 21(1) of the Radio communication Regulations. Class II change
TEST SPECIFICATION(S):	47CFR15.247 & RSS-247
EQUIPMENT UNDER TEST (EUT):	Bluetooth radio module, model WT41-A
FCC IDENTIFIER:	QOQWT41
ISED IDENTIFIER:	5123A-BGTWT41
EUT SERIAL NUMBER:	not applicable
AGENT:	Druck Ltd t/a GE Measurement & Control
ADDRESS:	Fir Tree Lane Groby Leicester Leicestershire LE6 0FH United Kingdom
CLIENT CONTACT:	Tom Piggin ☎ 0116 231 7100 ✉ tom.piggin@ge.com
MANUFACTURER:	Silicon Laboratories Finland Oy
MANUFACTURER ADDRESS:	Sinikalliontie 5A, 5 th floor FI-02630, Espoo, Finland
ORDER NUMBER:	1010134444
TEST DATE:	12-08-2016 to 26-09-2016
TESTED BY:	Daniel Moncayola Element

2.1 Test Summary

Test Method and Description	Requirement Clause		Applicable to this equipment	Result / Note
	RSS	47CFR15		
Radiated spurious emissions (restricted bands of operation and cabinet radiation)	Gen, 8.10	15.205	☒	Pass
AC power line conducted emissions	Gen, 8.8	15.207	☐	N/A
Carrier frequency separation	247, 5.1 (2)	15.247(a)(1)	☐	N/A
Number of hopping channels	247, 5.1 (3), (4) and (5)	15.247(a)(1) (i), (ii) and (iii)	☐	N/A
Average time of occupancy	247, 5.1 (3), (4) and (5)	15.247(a)(1) (i), (ii) and (iii)	☐	N/A
Maximum peak conducted output power	247, 5.4 (1), (2) and (3)	15.247 (a)(1), (b)(1) and (b)(2)	☒	Pass
20dB emission bandwidth	247, 5.1 (1)	15.247(a)(1) (i) and (ii)	☐	N/A
Out-of-band emissions	247, 5.5	15.247(d)	☐	N/A

Notes:

The results contained in this report relate only to the items tested, in the condition at time of test, and were obtained in the period between the date of initial receipt of samples and the date of issue of the report.

The apparatus was set up and exercised using the configurations, modes of operation and arrangements defined in this report only. Any modifications made are identified in Section 8 of this report.

Particular operating modes, apparatus monitoring methods and performance criteria required by the standards tested to have been performed except where identified in Section 5.2 of this test report (Deviations from Test Standards).

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4 Introduction

This report TRA-031596-02-47-00C presents the results of the Radio testing on a Druck Ltd t/a GE Measurement & Control, Bluetooth radio module, model WT41-A to specification 47CFR15 Radio Frequency Devices and RSS-247 Licence-exempt Radio Apparatus (All Frequency Bands): Category I Equipment.

The testing was carried out for Druck Ltd t/a GE Measurement & Control by Element, at the address(es) detailed below.

☐	Element Hull Unit E South Orbital Trading Park Hedon Road Hull HU9 1NJ UK	☒	Element Skelmersdale Unit 1 Pendle Place Skelmersdale West Lancashire WN8 9PN UK
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This report details the configuration of the equipment, the test methods used and any relevant modifications where appropriate.

All test and measurement equipment under the control of the laboratory and requiring calibration is subject to an established programme and procedures to control and maintain measurement standards. The quality management system meets the principles of ISO 9001, and has quality control procedures for monitoring the validity of tests undertaken. Records and sufficient detail are retained to establish an audit trail of calibration records relating to its test results for a defined period. Under control of the established calibration programme, key quantities or values of the test & measurement instrumentation are within specification and comply with the relevant traceable internationally recognised and appropriate standard specifications, which are UKAS calibrated as such where these properties have a significant effect on results. Participation in inter-laboratory comparisons and proficiency testing ensures satisfactory correlation of results conform to Elements own procedures, as well as statistical techniques for analysis of test data providing the appropriate confidence in measurements.

Throughout this report EUT denotes equipment under test.

FCC Site Listing:

Element is accredited for the above sites under the US-EU MRA, Designation number UK0009.

IC Registration Number(s):

Element Hull 3483A

Element North West 3930B

The test site requirements of ANSI C63.4-2014 are met up to 1GHz.

The test site SVSWR requirements of CISPR 16-1-4:2010 are met over the frequency range 1 GHz to 18 GHz.

5 Test Specifications

5.1 Normative References

- FCC 47 CFR Ch. I – Part 15 – Radio Frequency Devices.
- ANSI C63.10-2013 – American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices.
- ANSI C63.4-2014 – American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.
- Industry Canada RSS-247, Issue 1, May 2015 – Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices
- Industry Canada RSS-Gen, Issue 4, November 2014 – General Requirements for Compliance of Radio Apparatus.

5.2 Deviations from Test Standards

Only radiated spurious emissions and RF output power were performed, to prove that the replacement of the module for a new pre-approved one the unit still meeting the requirements.

6 Glossary of Terms

§	denotes a section reference from the standard, not this document
AC	Alternating Current
ANSI	American National Standards Institute
BW	bandwidth
C	Celsius
CFR	Code of Federal Regulations
CW	Continuous Wave
dB	decibel
dBm	dB relative to 1 milliwatt
DC	Direct Current
DSSS	Direct Sequence Spread Spectrum
EIRP	Equivalent Isotropically Radiated Power
ERP	Effective Radiated Power
EUT	Equipment Under Test
FCC	Federal Communications Commission
FHSS	Frequency Hopping Spread Spectrum
Hz	hertz
IC	Industry Canada
ITU	International Telecommunication Union
LBT	Listen Before Talk
m	metre
max	maximum
MIMO	Multiple Input and Multiple Output
min	minimum
MRA	Mutual Recognition Agreement
N/A	Not Applicable
PCB	Printed Circuit Board
PDF	Portable Document Format
Pt-mpt	Point-to-multipoint
Pt-pt	Point-to-point
RF	Radio Frequency
RH	Relative Humidity
RMS	Root Mean Square
Rx	receiver
s	second
SVSWR	Site Voltage Standing Wave Ratio
Tx	transmitter
UKAS	United Kingdom Accreditation Service
V	volt
W	watt
Ω	ohm

7 Equipment Under Test

7.1 EUT Identification

- Name: Bluetooth radio module, model WT41-A
- Serial Number: not applicable
- Model Number: WT41-A
- Software Revision: Not Applicable
- Build Level / Revision Number: Not Applicable

7.2 System Equipment

Equipment listed below forms part of the overall test setup and is required for equipment functionality and/or monitoring during testing. The compliance levels achieved in this report relate only to the EUT and not items given in the following list.

Not Applicable – No support/monitoring equipment required.

7.3 EUT Mode of Operation

7.3.1 Transmission

The mode of operation for transmitter tests was as follows...

EUT transmitting permanent modulated carrier at bottom, middle and top channels.

7.4 EUT Radio Parameters

7.4.1 General

Frequency of operation:	2400 MHz to 2483.5 MHz
Modulation type(s):	DH5, 2DH5 and 3DH5
Occupied channel bandwidth(s):	1 MHz
Channel spacing:	1 MHz
Declared output power(s):	9 dBm
Nominal Supply Voltage:	3.3 Vdc

7.4.2 Antennas

Type:	GE patch antenna
Frequency range:	2.4 GHz to 2.5 GHz
Impedance:	50 Ω
Gain:	6.662dBi
Polarisation:	Horizontal
Connector type:	N/A
Mounting:	Integral

7.5 EUT Description

The EUT is a Bluetooth Classic radio module.

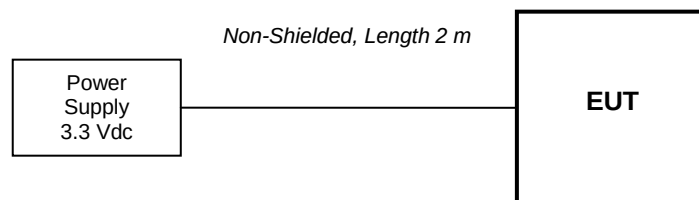
8 Modifications

No modifications were performed during this assessment.

9 EUT Test Setup

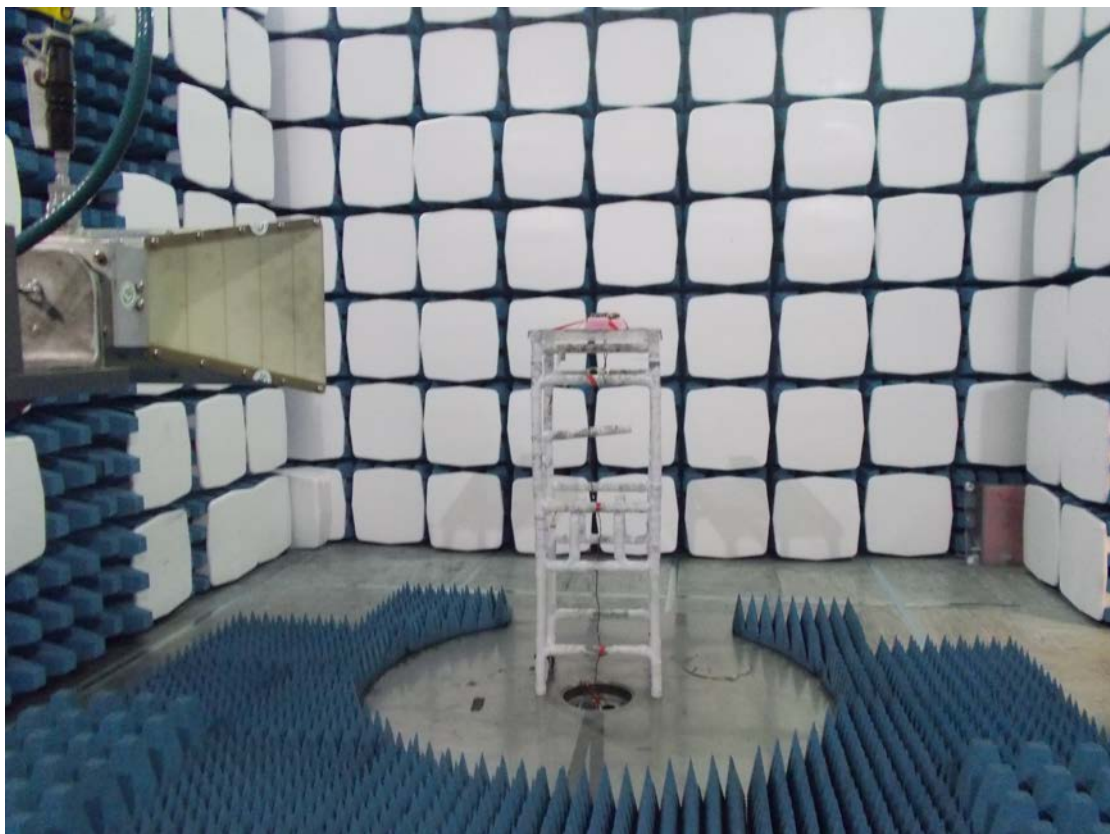
9.1 Block Diagram

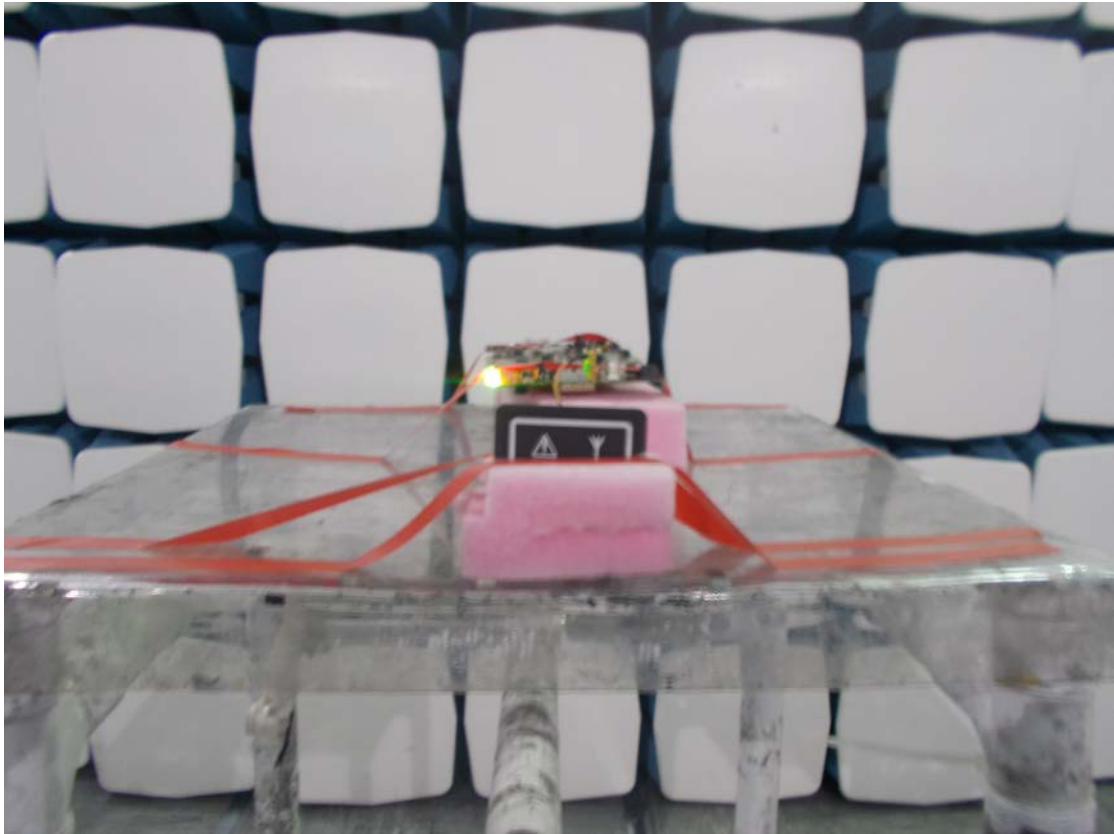
The following diagram shows basic EUT interconnections with cable type and cable lengths identified:



9.2 General Set-up Photograph

The following photograph shows basic EUT set-up:





10 General Technical Parameters

10.1 Normal Conditions

The E U T was tested under the normal environmental conditions of the test laboratory, except where otherwise stated. The normal power source applied was approx. 3.3 V dc from the adaptor.

Varying Test Conditions

There are no specific frequency stability requirements for the type of device. The results contained in this report demonstrate that the occupied bandwidth is contained within the authorised band and the manufacturer has declared sufficient frequency stability (refer to section 7.4).

Variation of supply voltage is required to ensure stability of the declared output power. During carrier power testing the following variations were made:

	Category	Nominal	Variation
☒	Power Supply	3.3 Vdc	N/A
☐	Battery	New battery	N/A

11 Radiated emissions

11.1 Definitions

Spurious emissions

Emissions on a frequency or frequencies, which are outside the necessary bandwidth and the level of which may be reduced without affecting the corresponding transmission of information. Spurious emissions include harmonic emissions, parasitic emissions, intermodulation products and frequency conversion products, but exclude out-of-band emissions.

Restricted bands

A frequency band in which intentional radiators are permitted to radiate only spurious emissions but not fundamental signals.

11.2 Test Parameters

Test Location:	Element Skelmersdale
Test Chamber:	Radio Chamber
Test Standard and Clause:	ANSI C63.10-2013, Clause 6.5 and 6.6
EUT Channels / Frequencies Measured:	2402 MHz, 2442 MHz and 2480 MHz
EUT Channel Bandwidths:	1 MHz
Deviations From Standard:	None
Measurement BW:	30 MHz to 1 GHz: 120 kHz Above 1 GHz: 1 MHz
Measurement Detector:	Up to 1 GHz: quasi-peak Above 1 GHz: RMS average and Peak

Environmental Conditions (Normal Environment)

Temperature: 24 °C	+15 °C to +35 °C (as declared)
Humidity: 42 % RH	20 % RH to 75 % RH (as declared)
Supply: 3.3 V dc	Via DC supply

11.3 Test Limit

Unwanted emissions that fall within the restricted frequency bands shall comply with the limits specified:

General Field Strength Limits for License-Exempt Transmitters at Frequencies above 30 MHz

Frequency (MHz)	Field Strength (μV/m at 3 m)
30 to 88	100
88 to 216	150
216 to 960	200
Above 960	500

11.4 Test Method

With the EUT setup as per section 9 of this report and connected as per Figure i, the emissions from the EUT were measured on a spectrum analyzer / EMI receiver.

Radiated electromagnetic emissions from the EUT are checked first by preview scans. Preview scans for all spectrum and modulation characteristics are checked, using a peak detector and where applicable worst-case determined for function, operation, orientation, etc. for both vertical and horizontal polarisations. Pre-scan plots are shown with a peak detector and 100 kHz RBW.

If the EUT connects to auxiliary equipment and is table or floor standing, the configurations prescribed in ANSI C63.10 are followed. Alternatively, a layout closest to normal use (as declared by the provider) is employed, (see EUT setup photographs for more detail).

Emissions between 30 MHz and 1 GHz are measured using calibrated broadband antennas. Emissions above 1 GHz are characterized using standard gain horn antennas. Pre-amplifiers and filters are used where required. Care is taken to ensure that test receiver resolution bandwidth, video bandwidth and detector type(s) meet the regulatory requirements.

For both horizontal and vertical polarizations, the EUT is then rotated through 360 degrees in azimuth until the highest emission is detected. At the previously determined azimuth the test antenna is raised and lowered from 1 to 4 m in height until a maximum emission level is detected, this maximum value is recorded.

Power values measured on the test receiver / analyzer are converted to field strength, FS, in dBμV/m at the regulatory distance, using:

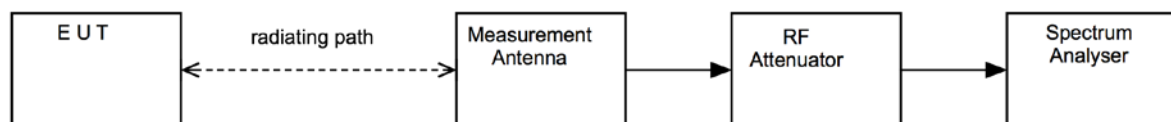
$$FS = PR + CL + AF - PA + DC - CF$$

Where,

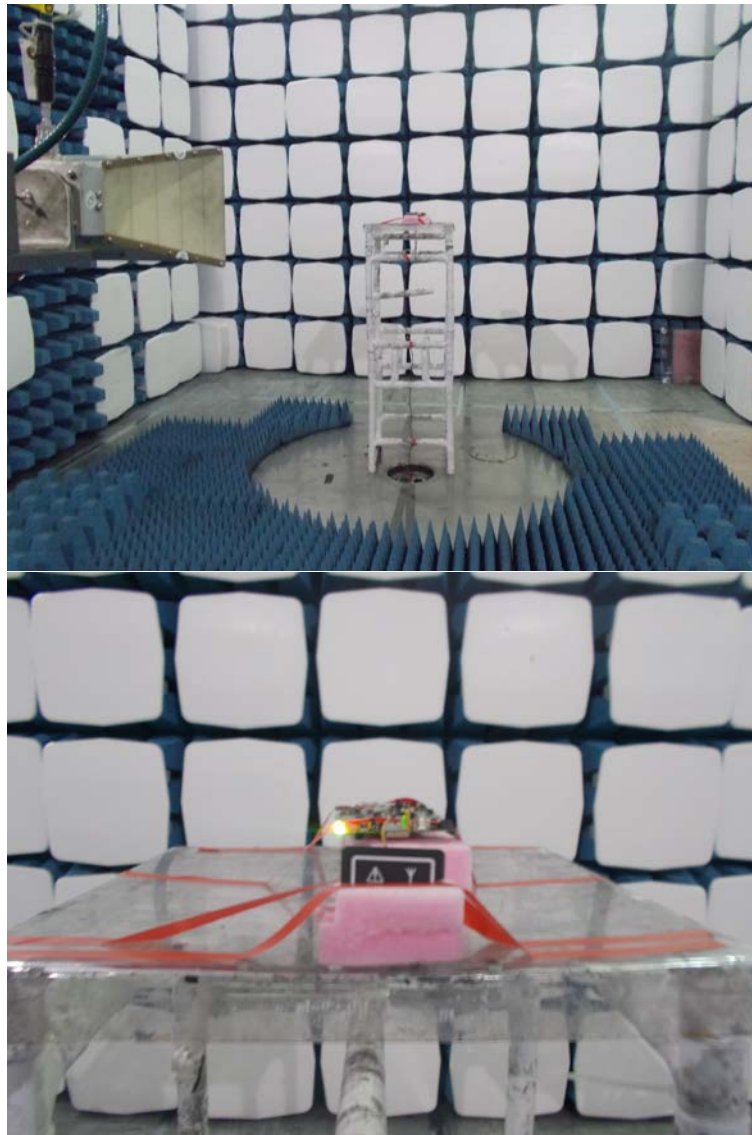
PR is the power recorded on the receiver / spectrum analyzer in dBμV;
 CL is the cable loss in dB;
 AF is the test antenna factor in dB/m;
 PA is the pre-amplifier gain in dB (where used);
 DC is the duty correction factor in dB (where used, e.g. harmonics of pulsed fundamental);
 CF is the distance factor in dB (where measurement distance different to limit distance);

This field strength value is then compared with the regulatory limit.

Figure i Test Setup



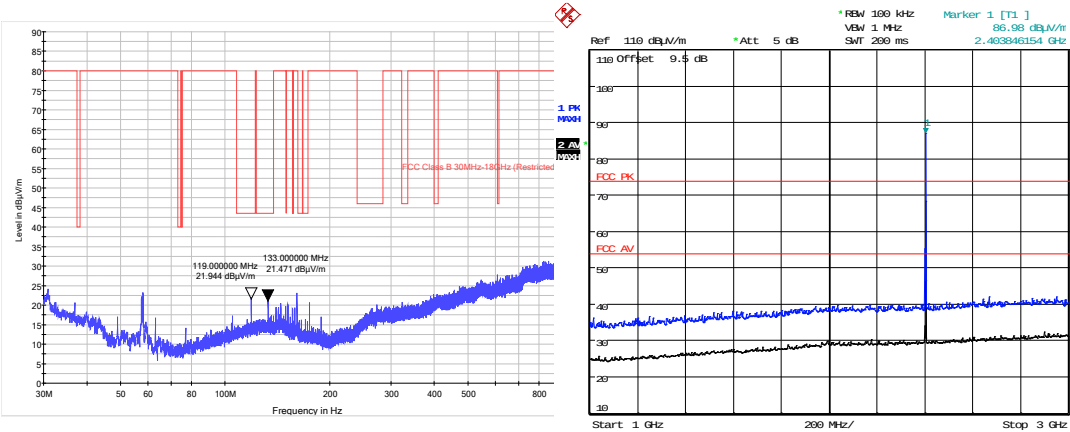
11.5 Test Set-up Photograph



11.6 Test Equipment

Equipment Type	Manufacturer	Equipment Description	Element No	Due For Calibration
8449B	Agilent	Pre Amp	L572	16/02/2017
20240-20	Flann	Horn 18-26GHz (&U330)	L300	07/04/2018
3115	EMCO	1-18GHz Horn	L139	25/09/2017
FSU46	R&S	Spectrum Analyser	U281	07/06/2017
ESVS10	R&S	Receiver	L352	14/07/2017
CBL611/A	Chase	Bilog	U191	26/02/2017

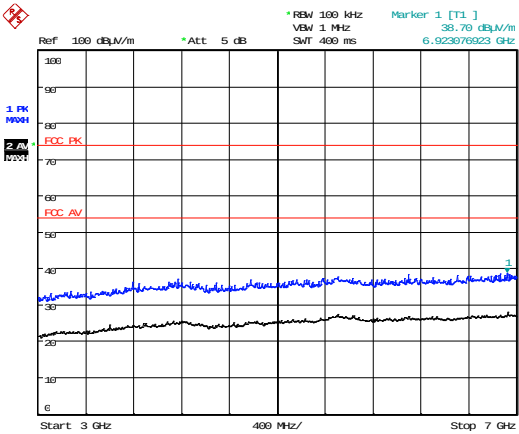
11.7 Test Results



Bottom Channel (30 MHz to 1 GHz).

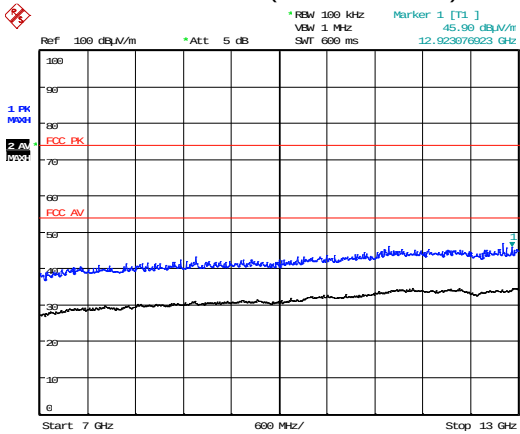
Date: 10.AUG.2016 16:28:49

Bottom Channel (1GHz to 3GHz).



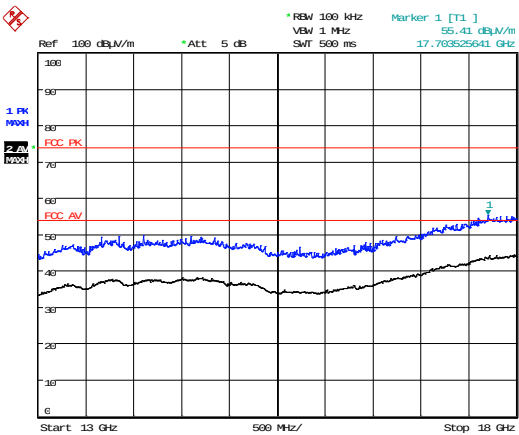
Date: 10.AUG.2016 11:52:40

Bottom Channel (3 GHz to 7 GHz).



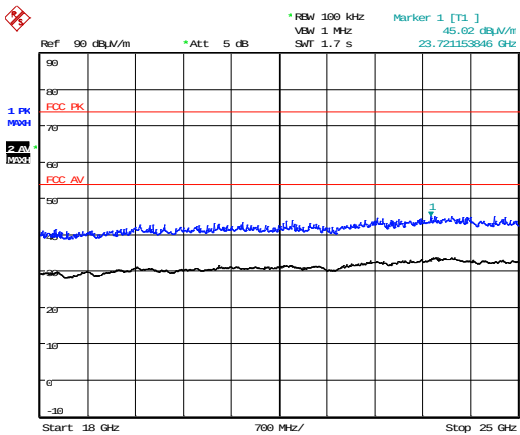
Date: 10.AUG.2016 11:51:12

Bottom Channel (7 GHz to 13 GHz).



Date: 10.AUG.2016 11:49:54

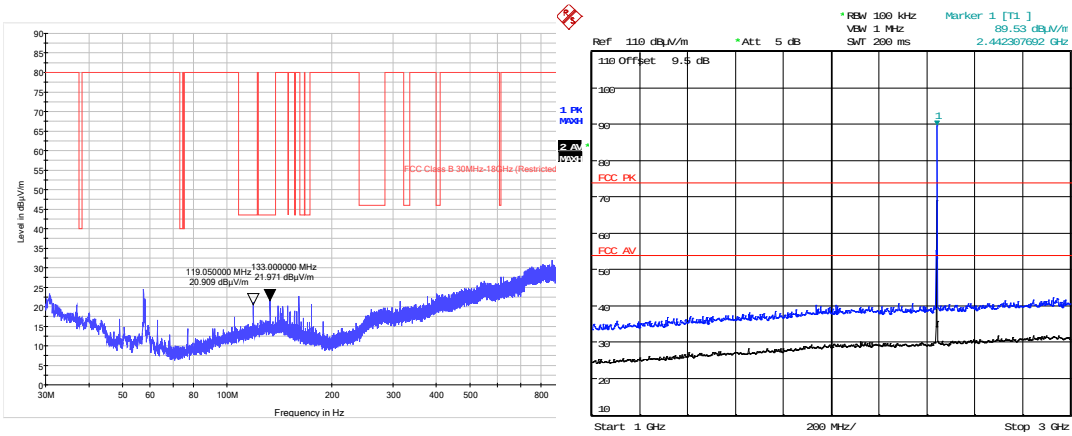
Bottom Channel (13 GHz to 18 GHz).



Date: 11.AUG.2016 16:11:24

Bottom Channel (18 GHz to 25 GHz).

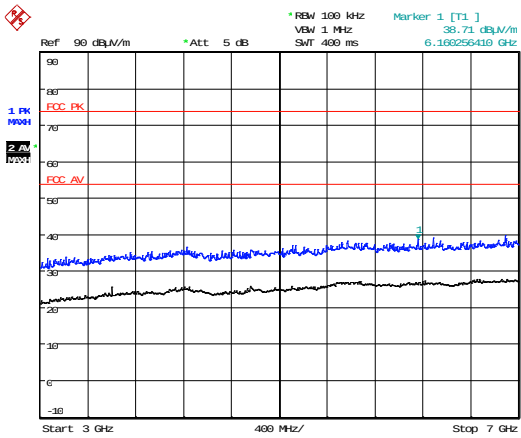
High Power; Frequency: 2402 MHz; Modulation: DH5										
Detector	Freq. (MHz)	Meas'd Emission (dBµV)	Cable Loss (dB)	Antenna Factor (dB/m)	Pre-amp Gain (dB)	Duty Cycle Corr'n (dB)	Distance Extrap'n Factor (dB)	Field Strength (dBµV/m)	Field Strength (µV/m)	Limit (µV/m)
No Emissions within 20 dB of the limit										



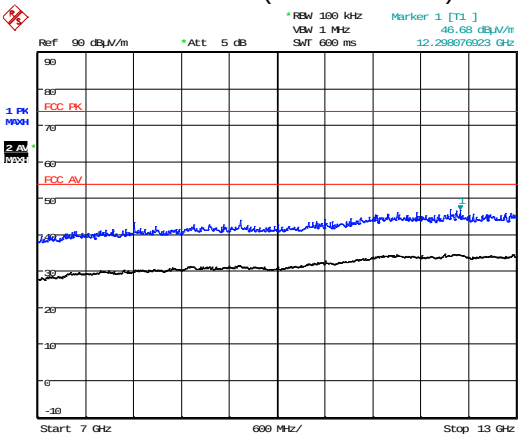
Middle Channel (30 MHz to 1 GHz).

Date: 10.AUG.2016 16:33:29

Middle Channel (1GHz to 3GHz).



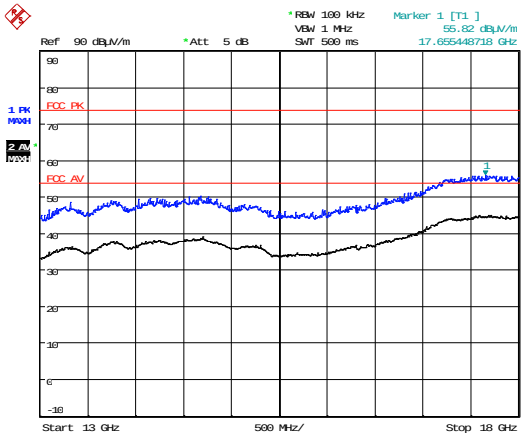
Date: 10.AUG.2016 13:11:35



Date: 10.AUG.2016 13:10:12

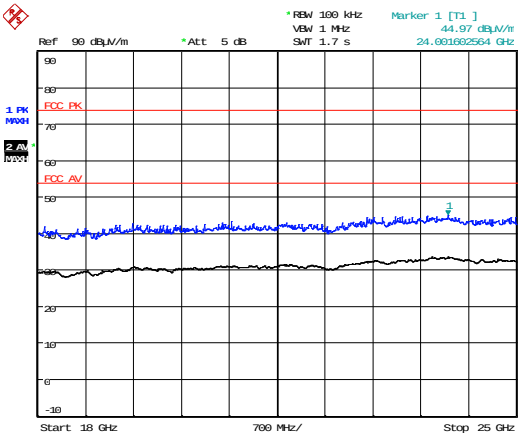
Middle Channel (3 GHz to 7 GHz).

Middle Channel (7 GHz to 13 GHz).



Date: 10.AUG.2016 13:08:50

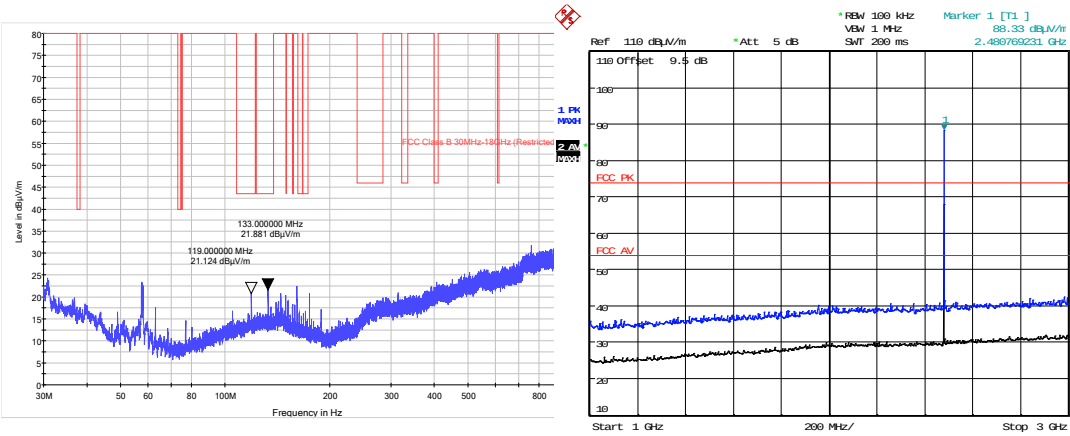
Middle Channel (13 GHz to 18 GHz).



Date: 11.AUG.2016 16:06:49

Middle Channel (18 GHz to 25 GHz).

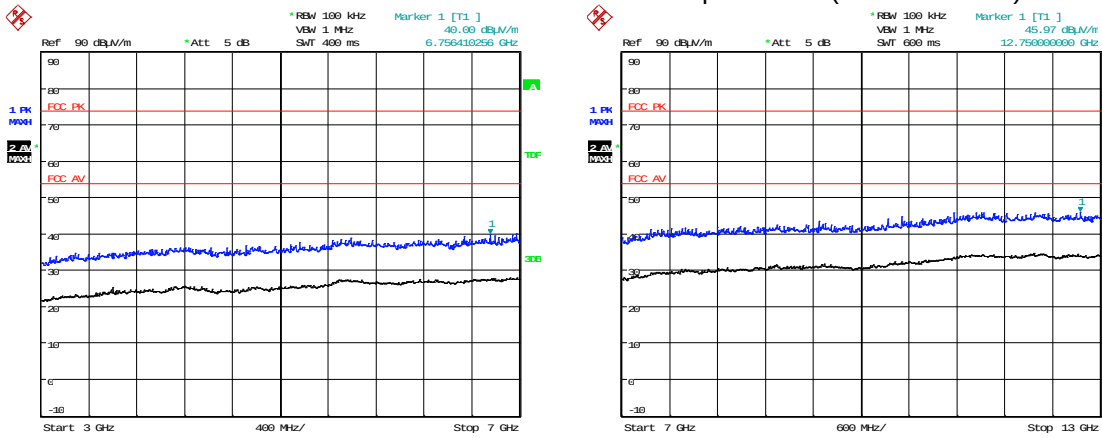
High Power; Frequency: 2442 MHz; Modulation: DH5										
Detector	Freq. (MHz)	Meas'd Emission (dBµV)	Cable Loss (dB)	Antenna Factor (dB/m)	Pre-amp Gain (dB)	Duty Cycle Corr'n (dB)	Distance Extrap'n Factor (dB)	Field Strength (dBµV/m)	Field Strength (µV/m)	Limit (µV/m)
No Emissions within 20 dB of the limit										



Top Channel (30 MHz to 1 GHz).

Date: 10.AUG.2016 16:36:00

Top Channel (1GHz to 3GHz).

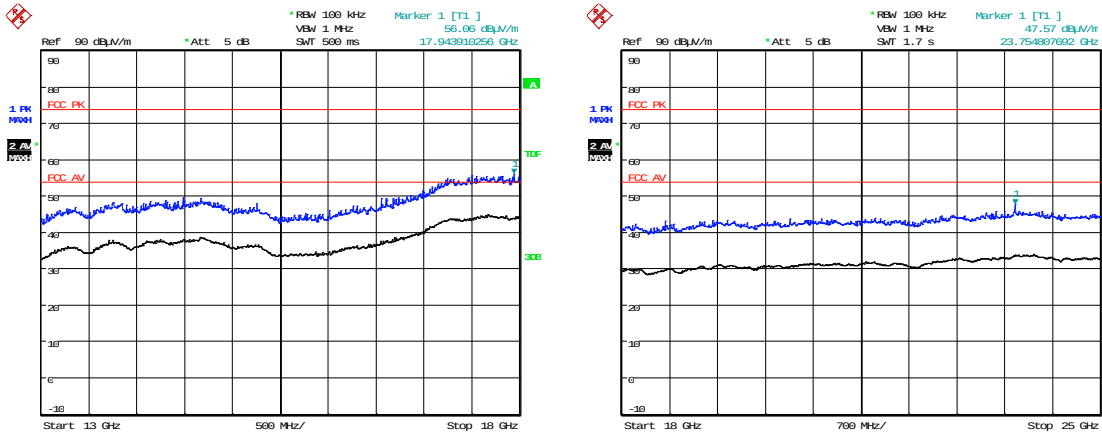


Date: 10.AUG.2016 13:26:34

Date: 10.AUG.2016 13:23:19

Top Channel (3 GHz to 7 GHz).

Top Channel (7 GHz to 13 GHz).



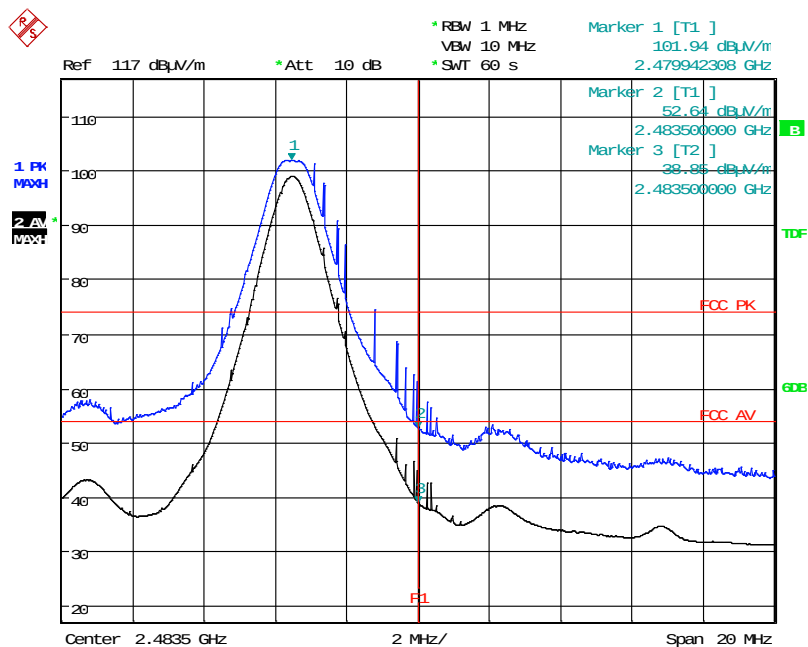
Date: 10.AUG.2016 13:21:58

Date: 11.AUG.2016 16:05:50

Top Channel (13 GHz to 18 GHz).

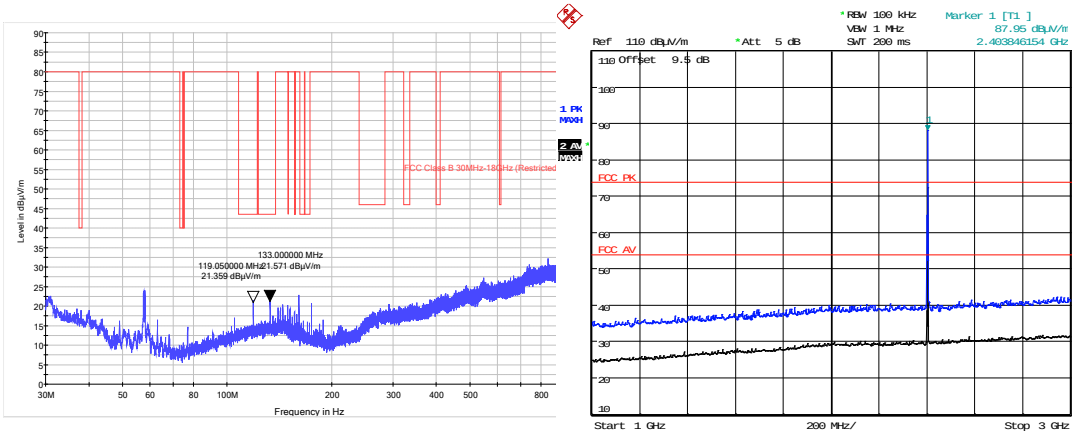
Top Channel (18 GHz to 25 GHz).

High Power; Frequency: 2480 MHz; Modulation: DH5										
Detector	Freq. (MHz)	Meas'd Emission (dBμV)	Cable Loss (dB)	Antenna Factor (dB/m)	Pre-amp Gain (dB)	Duty Cycle Corr'n (dB)	Distance Extrap'n Factor (dB)	Field Strength (dBμV/m)	Field Strength (μV/m)	Limit (μV/m)
No Emissions within 20 dB of the limit										



Date: 11.AUG.2016 14:41:30

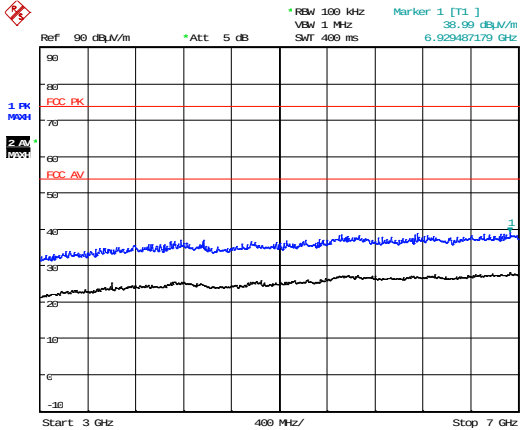
Radiated Upper Band Edge Modulation: DH5



Bottom Channel (30 MHz to 1 GHz).

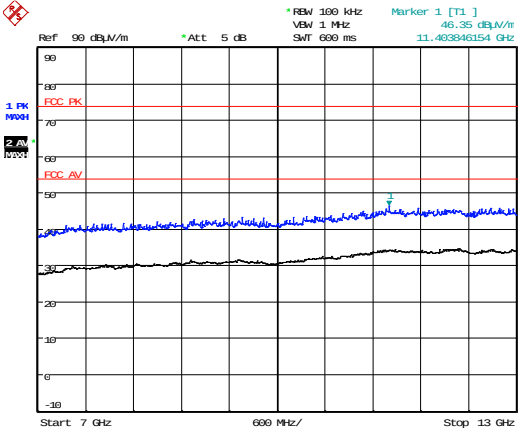
Date: 10.AUG.2016 16:14:36

Bottom Channel (1GHz to 3GHz).



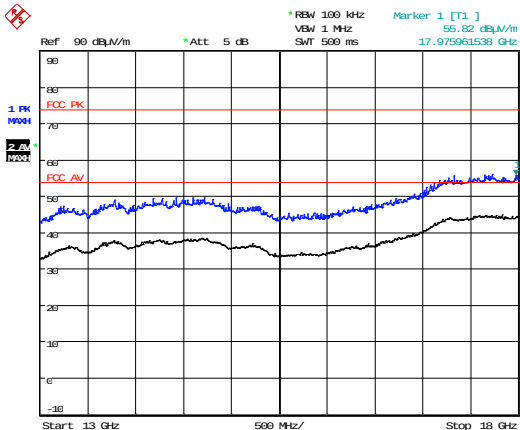
Date: 10.AUG.2016 14:25:04

Bottom Channel (3 GHz to 7 GHz).



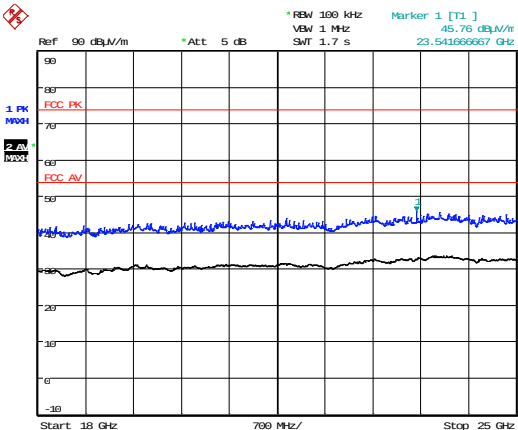
Date: 10.AUG.2016 14:26:47

Bottom Channel (7 GHz to 13 GHz).



Date: 10.AUG.2016 14:27:49

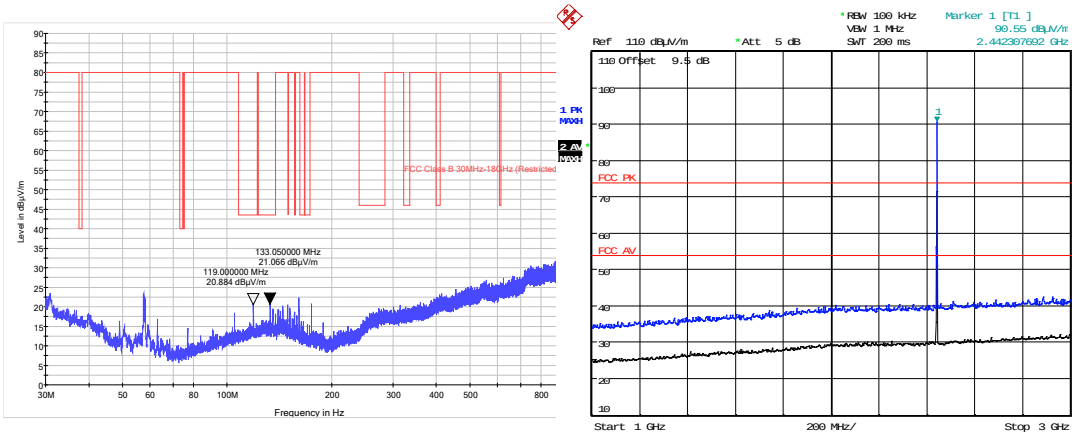
Bottom Channel (13 GHz to 18 GHz).



Date: 11.AUG.2016 15:48:57

Bottom Channel (18 GHz to 25 GHz).

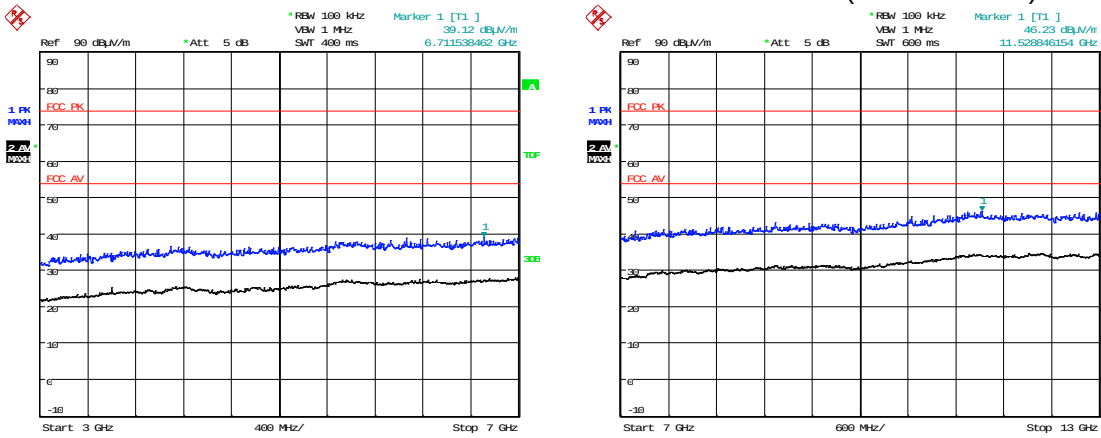
High Power; Frequency: 2402 MHz; Modulation: 2DH5										
Detector	Freq. (MHz)	Meas'd Emission (dBµV)	Cable Loss (dB)	Antenna Factor (dB/m)	Pre-amp Gain (dB)	Duty Cycle Corr'n (dB)	Distance Extrap'n Factor (dB)	Field Strength (dBµV/m)	Field Strength (µV/m)	Limit (µV/m)
No Emissions within 20 dB of the limit										



Middle Channel (30 MHz to 1 GHz).

Date: 10.AUG.2016 16:21:11

Middle Channel (1GHz to 3GHz).

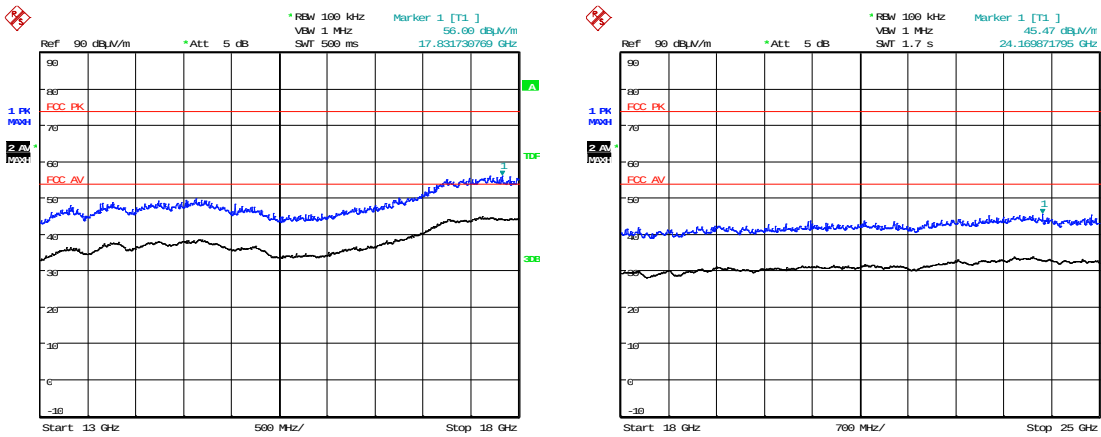


Date: 10.AUG.2016 14:41:57

Middle Channel (3 GHz to 7 GHz).

Date: 10.AUG.2016 14:48:15

Middle Channel (7 GHz to 13 GHz).



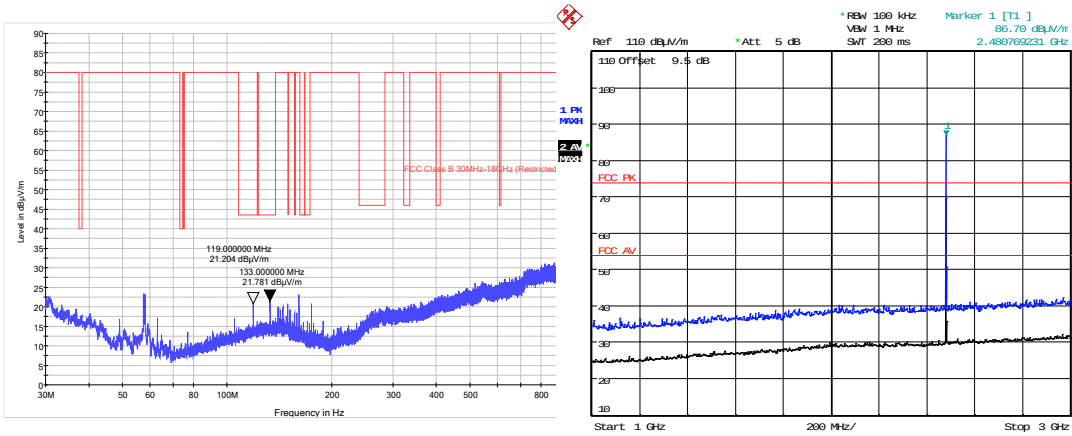
Date: 10.AUG.2016 14:38:26

Middle Channel (13 GHz to 18 GHz).

Date: 11.AUG.2016 15:42:45

Middle Channel (18 GHz to 25 GHz).

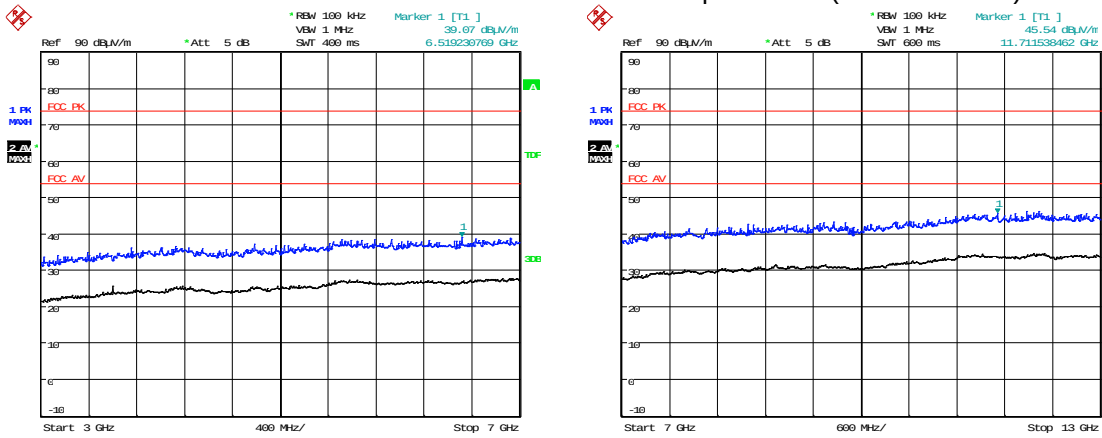
High Power; Frequency: 2442 MHz; Modulation: 2DH5										
Detector	Freq. (MHz)	Meas'd Emission (dBµV)	Cable Loss (dB)	Antenna Factor (dB/m)	Pre-amp Gain (dB)	Duty Cycle Corr'n (dB)	Distance Extrap'n Factor (dB)	Field Strength (dBµV/m)	Field Strength (µV/m)	Limit (µV/m)
No Emissions within 20 dB of the limit										



Top Channel (30 MHz to 1 GHz).

Date: 10.AUG.2016 16:26:04

Top Channel (1GHz to 3GHz).

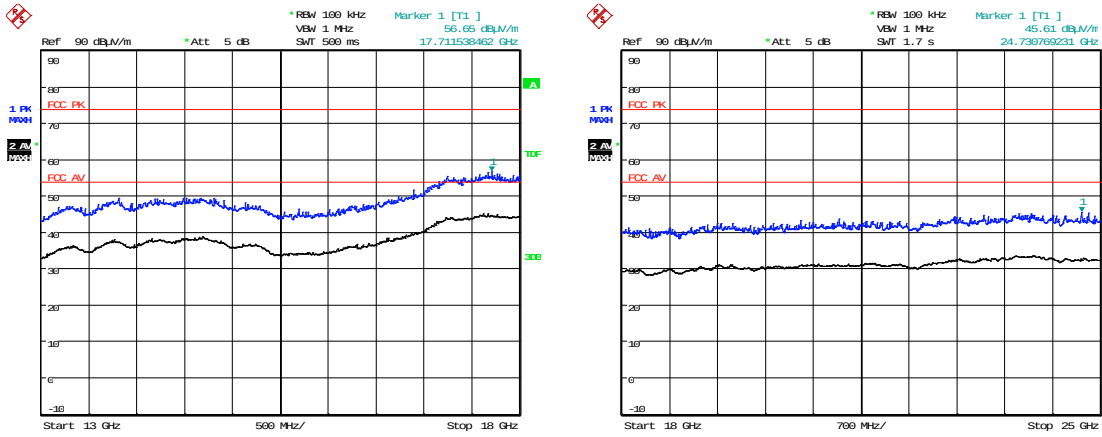


Date: 10.AUG.2016 14:45:36

Top Channel (3 GHz to 7 GHz).

Date: 10.AUG.2016 14:46:36

Top Channel (7 GHz to 13 GHz).



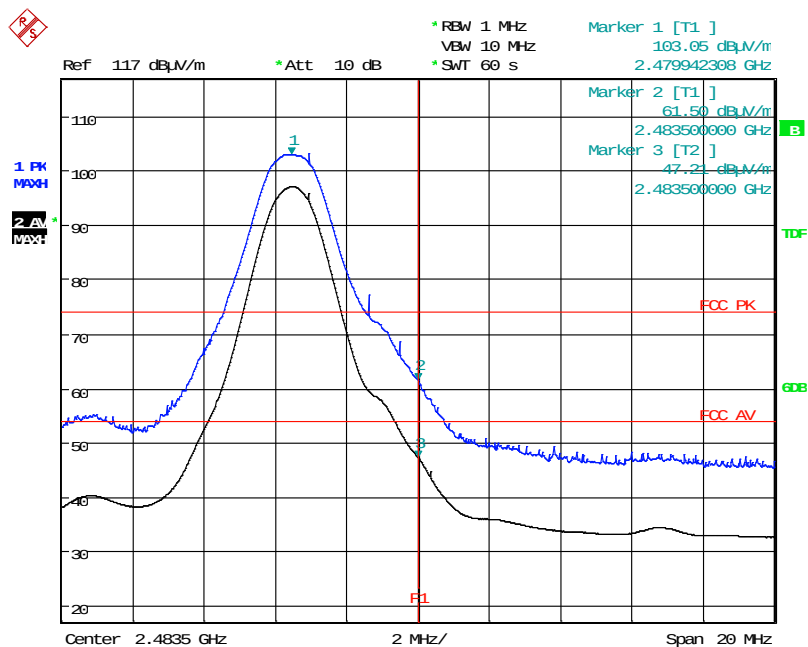
Date: 10.AUG.2016 14:48:48

Top Channel (13 GHz to 18 GHz).

Date: 11.AUG.2016 15:46:51

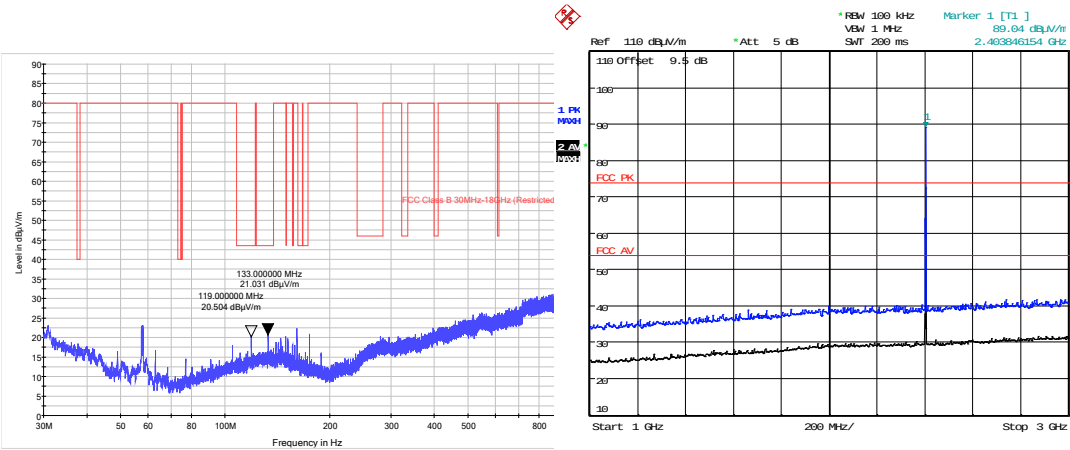
Top Channel (18 GHz to 25 GHz).

High Power; Frequency: 2480 MHz; Modulation: 2DH5										
Detector	Freq. (MHz)	Meas'd Emission (dBμV)	Cable Loss (dB)	Antenna Factor (dB/m)	Pre-amp Gain (dB)	Duty Cycle Corr'n (dB)	Distance Extrap'n Factor (dB)	Field Strength (dBμV/m)	Field Strength (μV/m)	Limit (μV/m)
No Emissions within 20 dB of the limit										



Date: 11.AUG.2016 14:44:19

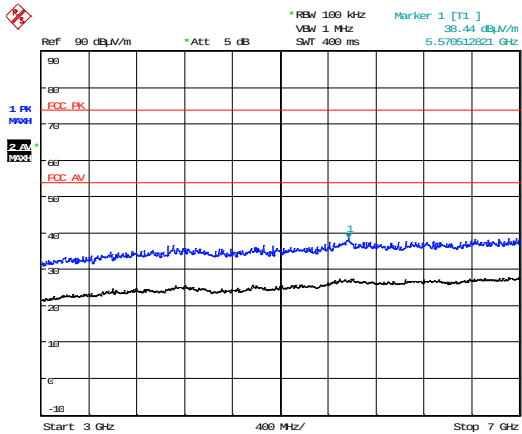
Radiated Upper Band Edge Modulation: 2DH5



Bottom Channel (30 MHz to 1 GHz).

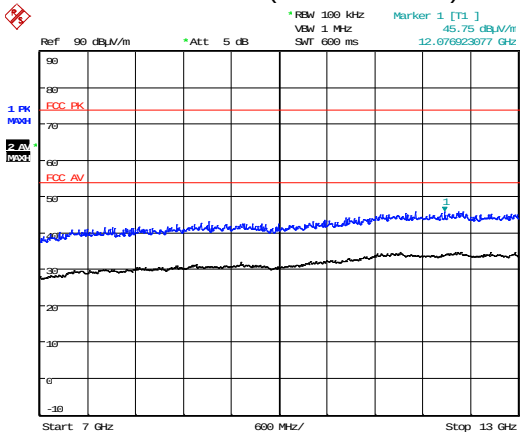
Date: 10.AUG.2016 16:08:33

Bottom Channel (1GHz to 3GHz).



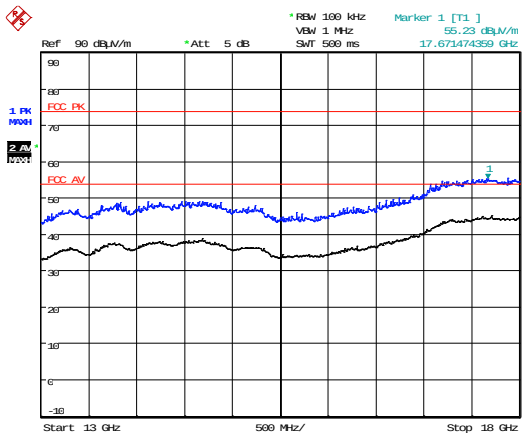
Date: 10.AUG.2016 15:03:24

Bottom Channel (3 GHz to 7 GHz).



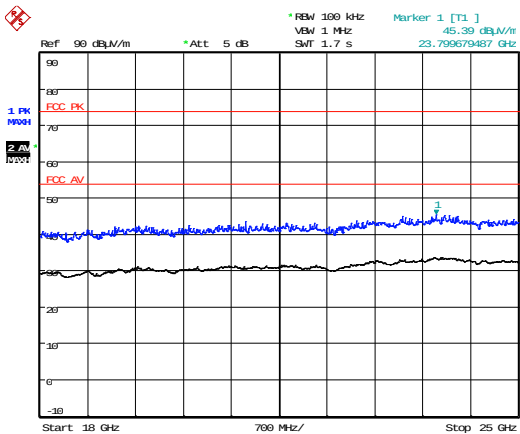
Date: 10.AUG.2016 15:02:32

Bottom Channel (7 GHz to 13 GHz).



Date: 10.AUG.2016 15:01:31

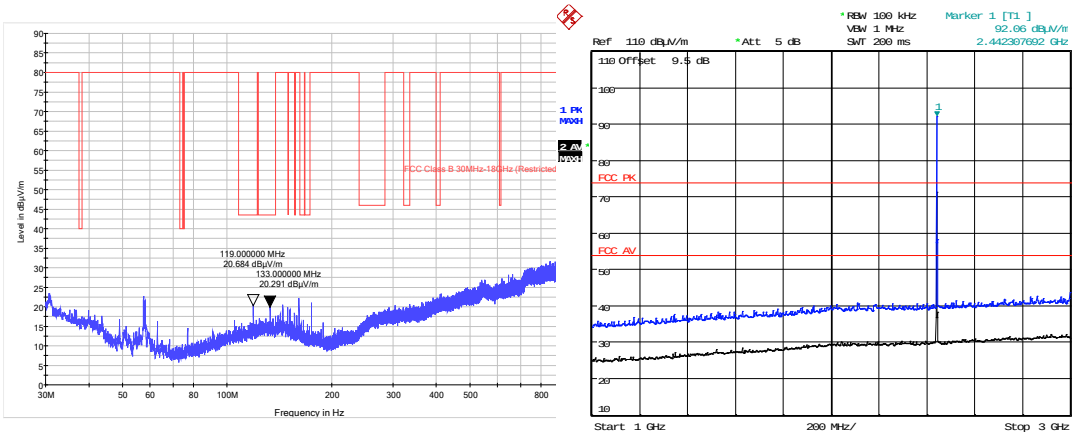
Bottom Channel (13 GHz to 18 GHz).



Date: 11.AUG.2016 15:34:38

Bottom Channel (18 GHz to 25 GHz).

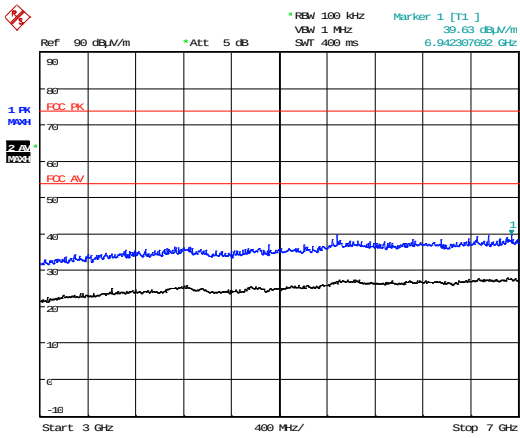
High Power; Frequency: 2402 MHz; Modulation: 3DH5										
Detector	Freq. (MHz)	Meas'd Emission (dBµV)	Cable Loss (dB)	Antenna Factor (dB/m)	Pre-amp Gain (dB)	Duty Cycle Corr'n (dB)	Distance Extrap'n Factor (dB)	Field Strength (dBµV/m)	Field Strength (µV/m)	Limit (µV/m)
No Emissions within 20 dB of the limit										



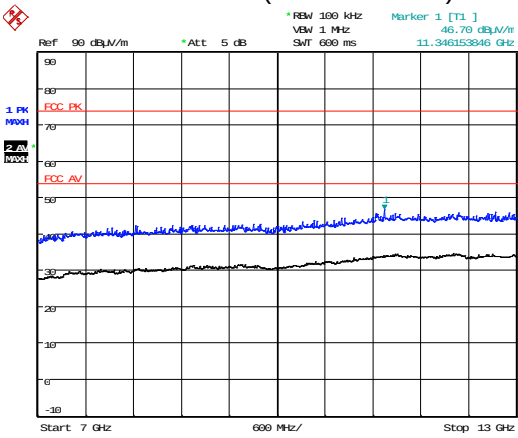
Middle Channel (30 MHz to 1 GHz).

Date: 10.AUG.2016 16:02:16

Middle Channel (1GHz to 3GHz).



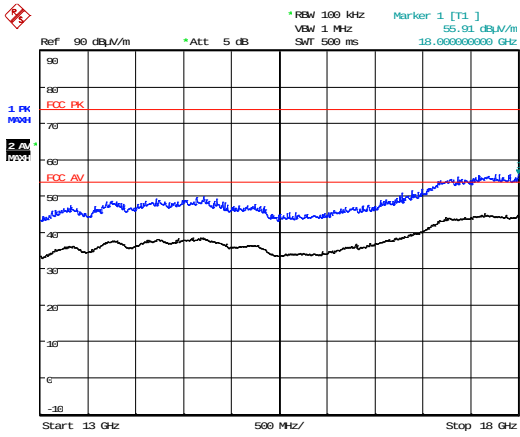
Date: 10.AUG.2016 15:08:34



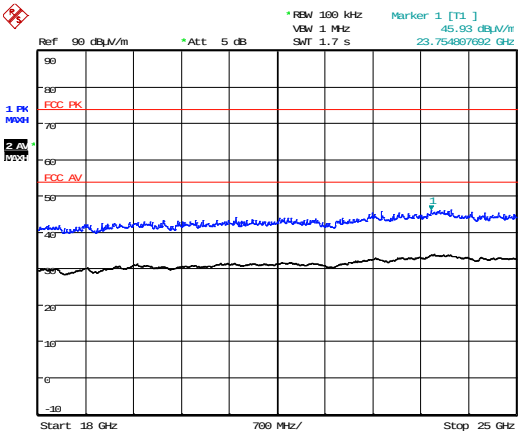
Date: 10.AUG.2016 15:09:48

Middle Channel (3 GHz to 7 GHz).

Middle Channel (7 GHz to 13 GHz).



Date: 10.AUG.2016 15:10:58

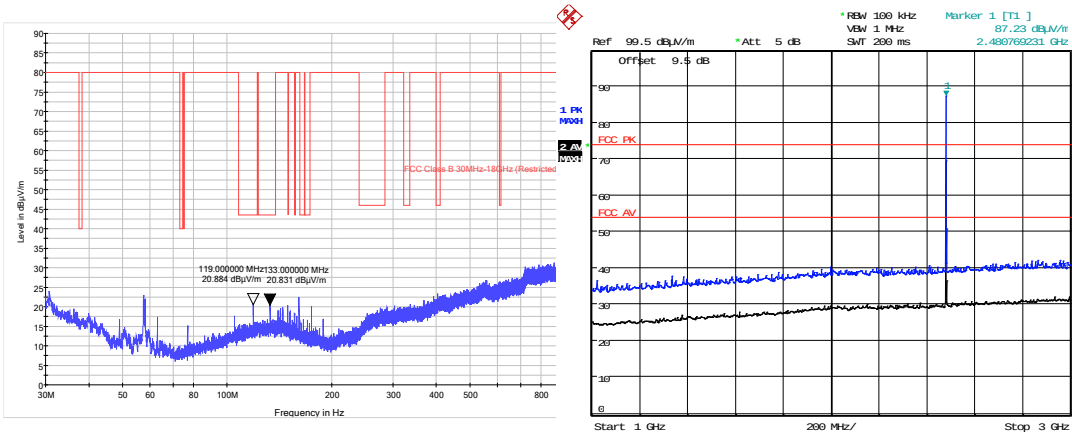


Date: 11.AUG.2016 15:32:35

Middle Channel (13 GHz to 18 GHz).

Middle Channel (18 GHz to 25 GHz).

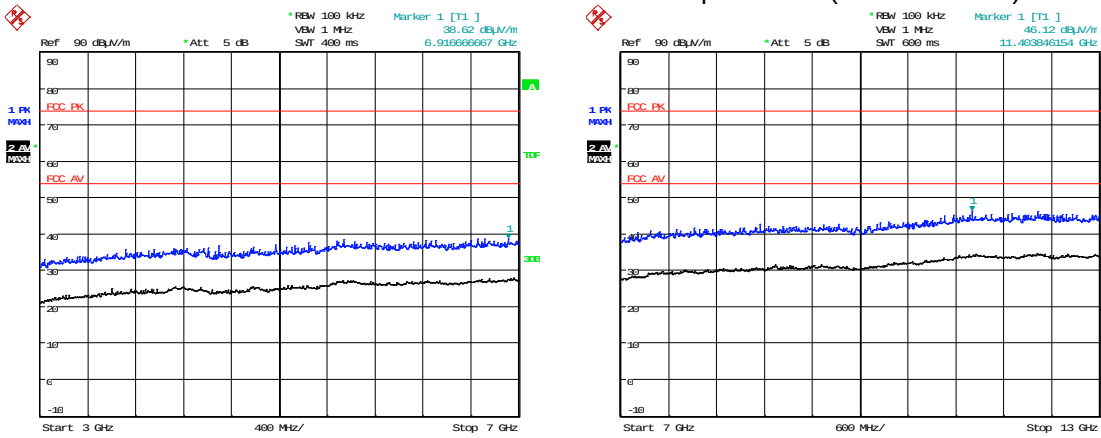
High Power; Frequency: 2442 MHz; Modulation: 3DH5										
Detector	Freq. (MHz)	Meas'd Emission (dBµV)	Cable Loss (dB)	Antenna Factor (dB/m)	Pre-amp Gain (dB)	Duty Cycle Corr'n (dB)	Distance Extrap'n Factor (dB)	Field Strength (dBµV/m)	Field Strength (µV/m)	Limit (µV/m)
No Emissions within 20 dB of the limit										



Top Channel (30 MHz to 1 GHz).

Date: 10.AUG.2016 15:42:31

Top Channel (1GHz to 3GHz).

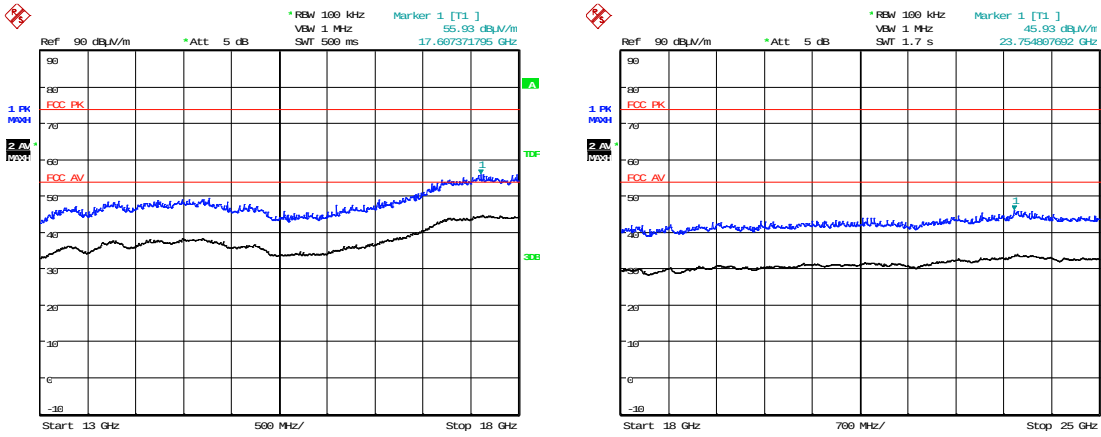


Date: 10.AUG.2016 15:28:33

Date: 10.AUG.2016 15:27:33

Top Channel (3 GHz to 7 GHz).

Top Channel (7 GHz to 13 GHz).



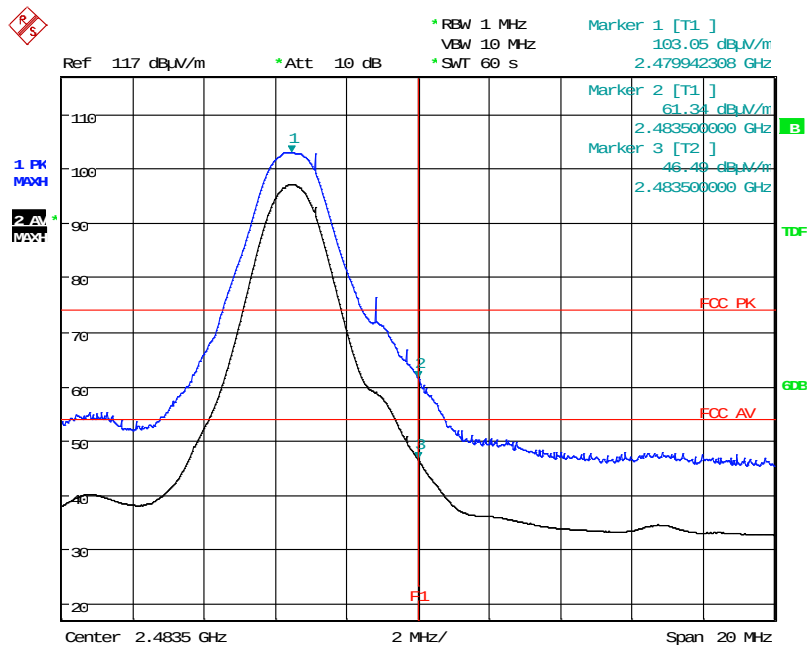
Date: 10.AUG.2016 15:26:34

Date: 11.AUG.2016 15:25:16

Top Channel (13 GHz to 18 GHz).

Top Channel (18 GHz to 25 GHz).

High Power; Frequency: 2480 MHz; Modulation: 3DH5										
Detector	Freq. (MHz)	Meas'd Emission (dBμV)	Cable Loss (dB)	Antenna Factor (dB/m)	Pre-amp Gain (dB)	Duty Cycle Corr'n (dB)	Distance Extrap'n Factor (dB)	Field Strength (dBμV/m)	Field Strength (μV/m)	Limit (μV/m)
No Emissions within 20 dB of the limit										



Date: 11.AUG.2016 14:49:15

Radiated Upper Band Edge Modulation: 3DH5

12 Maximum peak conducted output power

12.1 Definition

The maximum peak conducted output power is defined as the maximum power level measured with a peak detector using a filter with width and shape of which is sufficient to accept the signal bandwidth.

12.2 Test Parameters

Test Location:	Element Skelmersdale
Test Chamber:	Radio Laboratory
Test Standard and Clause:	ANSI C63.10-2013, Clause 7.8.5
EUT Channels / Frequencies Measured:	2402MHz / 2442MHz / 2480MHz – hopping disabled.
EUT Channel Bandwidths:	1MHz
Deviations From Standard:	None
Measurement BW:	2 MHz
Spectrum Analyzer Video BW:	5 MHz
Measurement Detector:	Peak
Voltage Extreme Environment Test Range:	Mains Power = 85 % and 115 % of Nominal (FCC only requirement);

Environmental Conditions (Normal Environment)

Temperature: 24 °C	+15 °C to +35 °C (as declared)
Humidity: 43 % RH	20 % RH to 75 % RH (as declared)

12.3 Test Limit

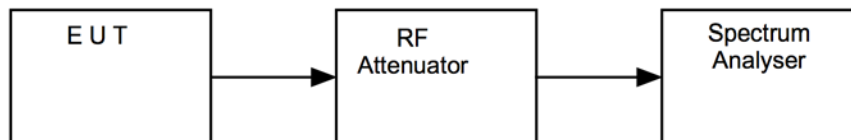
- For frequency hopping systems operating in the band 902 to 928 MHz, the maximum peak conducted output power shall not exceed 1 W, and the e.i.r.p. shall not exceed 4 W, if the hopset uses 50 or more hopping channels; the maximum peak conducted output power shall not exceed 0.25 W, and the e.i.r.p. shall not exceed 1 W, if the hopset uses less than 50 hopping channels.
- For frequency hopping systems operating in the band 2400 to 2483.5 MHz and employing at least ~~75 channels~~ ^{15 channels}, the maximum peak conducted output power shall not exceed 1 W; for all other frequency hopping systems in the band, the maximum peak conducted output power shall not exceed 0.125 W. The e.i.r.p. shall not exceed 4 W.
- For frequency hopping systems operating in the band 5725 to 5850 MHz, the maximum peak conducted output power shall not exceed 1 W. The e.i.r.p. shall not exceed 4 W.
- Point-to-point systems in the bands 2400-2483.5 MHz and 5725 to 5850 MHz are permitted to have an e.i.r.p. higher than 4 W provided that the higher e.i.r.p. is achieved by employing higher gain directional antennas and not higher transmitter output powers.

12.4 Test Method

With the EUT setup as per section 9 of this report and connected as per Figure vi, the resolution bandwidth of the spectrum analyser was increased above the EUT occupied bandwidth and the peak emission data noted.

The measurements were performed with EUT set at its maximum duty. All modulation schemes, data rates and power settings were used to observe the worst-case configuration in each bandwidth.

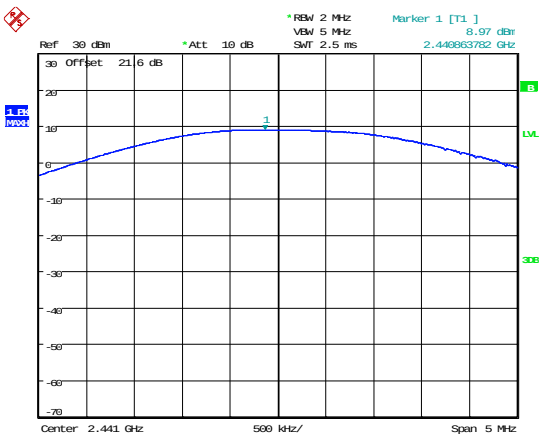
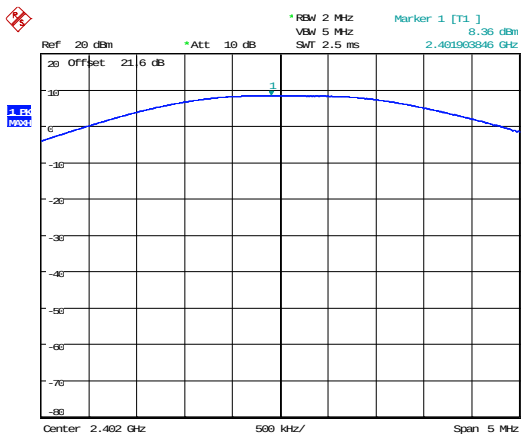
Figure vi Test Setup



12.5 Test Equipment

Equipment Type	Manufacturer	Equipment Description	Element No	Due For Calibration
FSU50	R&S	Spectrum Analyser	U544	16/03/2017

12.6 Test Results

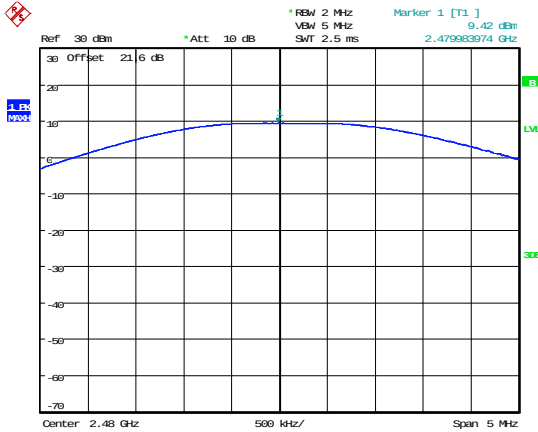


Date: 26.SEP.2016 09:57:28

Date: 26.SEP.2016 10:07:15

Bottom Channel

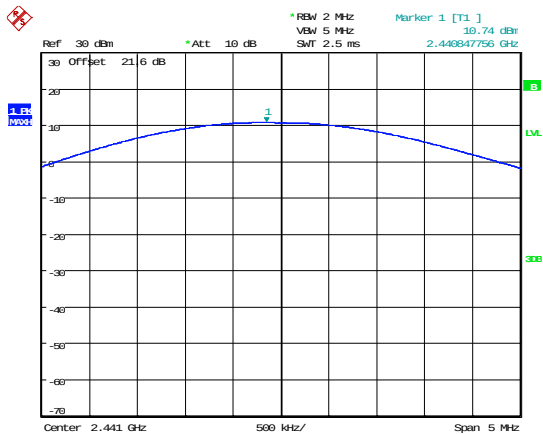
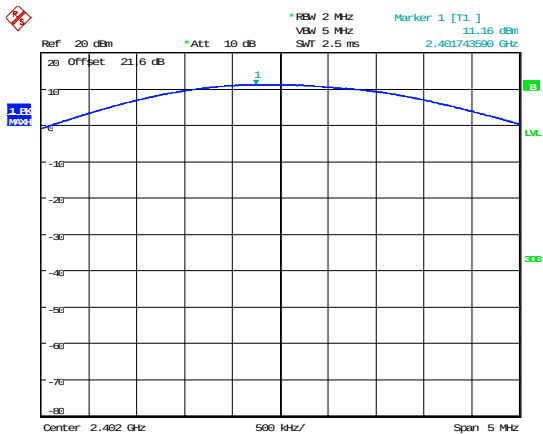
Middle Channel



Date: 26.SEP.2016 10:07:44

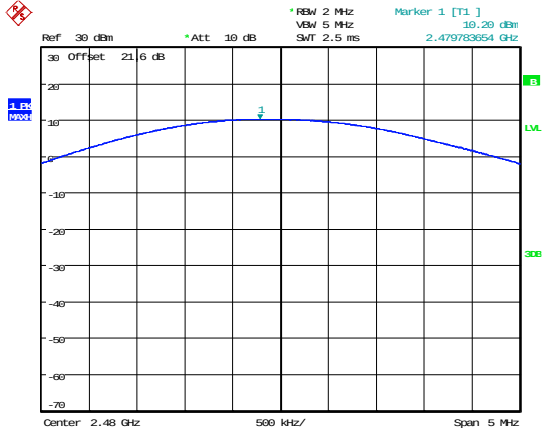
Top Channel

Modulation: DH5							
Channel Frequency (MHz)	Analyzer Level (dBm)	Cable loss (dB)	Maximum peak conducted output power (mW)	Antenna gain (dBi)	E.I.R.P. (mW)	Maximum peak conducted output power Limit (W)	Result
2402	-13.24	21.6	6.85	6.662	31.78337412	0.8586	PASS
2441	-12.63	21.6	7.89	6.662	36.5763193	0.8586	PASS
2480	-12.18	21.6	8.75	6.662	40.5695322	0.8586	PASS



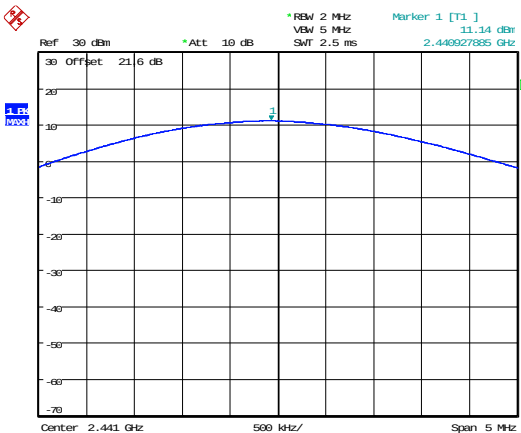
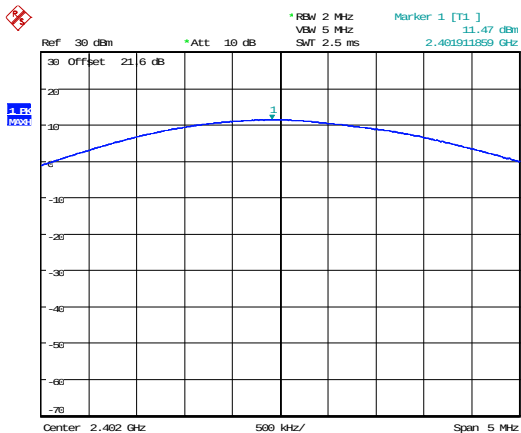
Bottom Channel

Middle Channel



Top Channel

Modulation: 2DH5							
Channel Frequency (MHz)	Analyzer Level (dBm)	Cable loss (dB)	Maximum peak conducted output power (mW)	Antenna gain (dBi)	E.I.R.P. (mW)	Maximum peak conducted output power Limit (W)	Result
2402	-10.44	21.6	13.06	6.662	60.56197087	0.8586	PASS
2441	-10.86	21.6	11.86	6.662	54.97940051	0.8586	PASS
2480	-11.4	21.6	10.47	6.662	48.55120352	0.8586	PASS

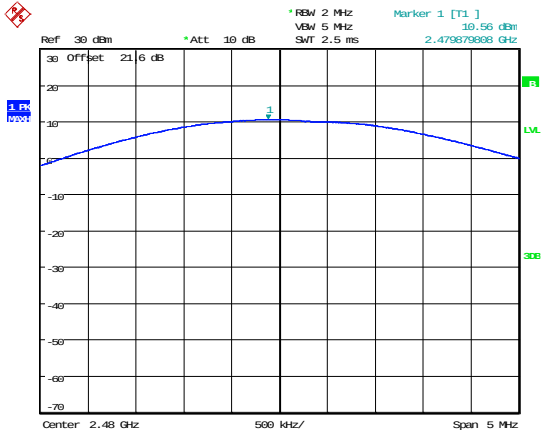


Date: 26.SEP.2016 10:03:07

Date: 26.SEP.2016 10:03:38

Bottom Channel

Middle Channel



Date: 26.SEP.2016 10:08:55

Top Channel

Modulation: 3DH5							
Channel Frequency (MHz)	Analyzer Level (dBm)	Cable loss (dB)	Maximum peak conducted output power (mW)	Antenna gain (dBi)	E.I.R.P. (mW)	Maximum peak conducted output power Limit (W)	Result
2402	-10.13	21.6	14.03	6.662	65.04291551	0.8586	PASS
2441	-10.46	21.6	13.00	6.662	60.28371389	0.8586	PASS
2480	-11.04	21.6	11.38	6.662	52.74727157	0.8586	PASS

13 Measurement Uncertainty

Calculated Measurement Uncertainties

All statements of uncertainty are expanded standard uncertainty using a coverage factor of 1.96 to give a 95 % confidence:

[1] Radiated spurious emissions

Uncertainty in test result (30 MHz to 1 GHz) = **4.6 dB**

Uncertainty in test result (1 GHz to 18 GHz) = **4.7 dB**

[2] AC power line conducted emissions

Uncertainty in test result = **3.4 dB**

[3] Occupied bandwidth

Uncertainty in test result = **15.5 %**

[4] Conducted carrier power

Uncertainty in test result (Power Meter) = **1.08 dB**

[5] Conducted / radiated RF power out-of-band

Uncertainty in test result – up to 8.1 GHz = **3.31 dB**

Uncertainty in test result – 8.1 GHz to 15.3 GHz = **4.43 dB**

Uncertainty in test result (30 MHz to 1 GHz) = **4.6 dB**

Uncertainty in test result (1 GHz to 18 GHz) = **4.7 dB**

[6] Frequency separation

Uncertainty in test result (Spectrum Analyser) = **3.6 kHz**

[7] Accumulated channel occupancy time

Uncertainty in test result = **7.98 %**