

Report on the Radio Testing
For
Paxton Access Ltd
on
Paxton10 Wireless Connector
Report no. TRA-041571-45-05A
18 January 2019

Report Number: TRA-041571-45-05A
Issue: A

REPORT ON THE RADIO TESTING OF A
Paxton Access Ltd
Paxton10 Wireless Connector
WITH RESPECT TO SELECTED PARTS OF SPECIFICATION
FCC 47CFR 15.247

TEST DATE: 2018-10-16 to 2019-01-02



Written by:

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Date: 18 January 2019

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

1 Revision Record

<i>Issue Number</i>	<i>Issue Date</i>	<i>Revision History</i>
A	18 January 2019	Original

2 Summary

TEST REPORT NUMBER:	TRA-041571-45-05A
WORKS ORDER NUMBER	TRA-041571-02
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..
TEST SPECIFICATION(S):	47CFR15.247
EQUIPMENT UNDER TEST (EUT):	Paxton10 Wireless Connector
FCC IDENTIFIER:	USE010592
EUT SERIAL NUMBER:	5909440
MANUFACTURER/AGENT:	Paxton Access Ltd
ADDRESS:	Paxton House Home Farm Road Brighton East Sussex BN1 9HU
CLIENT CONTACT:	Brett Glass ☎ 01273 811016 ✉ brett.glass@paxton-access.co.uk
ORDER NUMBER:	176518
TEST DATE:	From 2018-10-16 to 2019-01-02
TESTED BY:	Ian Broadwell / Dave Garvey / A. Wong Element

2.1 Test Summary

Test Method and Description		Requirement Clause	Applicable to this equipment	Result / Note
		47CFR15		
Radiated spurious emissions (restricted bands of operation and cabinet radiation)		15.205	<input checked="" type="checkbox"/>	PASS
AC power line conducted emissions		15.207	<input type="checkbox"/>	Note 1
Occupied bandwidth		15.247(a)(2)	<input type="checkbox"/>	Note 1
Conducted carrier power	Peak	15.247(b)(3)	<input type="checkbox"/>	Note 1
	Max.		<input type="checkbox"/>	
Conducted / radiated RF power out-of-band		15.247(d)	<input type="checkbox"/>	Note 1
Power spectral density, conducted		15.247(e)	<input type="checkbox"/>	Note 1
Calculation of duty correction		15.35(c)	<input type="checkbox"/>	Note 1

Notes:

Note 1: Tests not requested by the client.

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).

3 Contents

1	Revision Record.....	3
2	Summary.....	4
2.1	Test Summary.....	5
3	Contents.....	6
4	Introduction	7
5	Test Specifications	8
5.1	Normative References	8
5.2	Deviations from Test Standards	8
6	Glossary of Terms.....	9
7	Equipment Under Test	10
7.1	EUT Identification.....	10
7.2	System Equipment.....	10
7.3	EUT Mode of Operation	11
7.3.1	Transmission.....	11
7.4	EUT Radio Parameters	12
7.4.1	General	12
7.5	EUT Description	12
8	Modifications	13
9	EUT Test Setup.....	14
9.1	Block Diagram.....	14
9.2	General Set-up Photograph	15
10	General Technical Parameters.....	16
10.1	Normal Conditions.....	16
11	Radiated emissions.....	17
11.1	Definitions	17
11.2	Test Parameters.....	17
11.3	Test Limit	17
11.4	Test Method	18
11.5	Test Set-up Photograph	19
11.6	Test Equipment.....	20
11.7	Test Results	21
12	Measurement Uncertainty	30

4 Introduction

This report TRA-041571-45-05A presents the results of the Radio testing on a Paxton Access Ltd, Paxton10 Wireless Connector to selected parts of specification 47CFR15 Radio Frequency Devices.

The testing was carried out for Paxton Access Ltd by Element, at the address detailed below.

<input checked="" type="checkbox"/>	Element Hull Unit E South Orbital Trading Park Hedon Road Hull HU9 1NJ UK	<input type="checkbox"/>	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.

5.2 Deviations from Test Standards

As per request from the client, the EUT was only tested for radiated spurious emissions (restricted bands of operation and cabinet radiation).

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: Paxton10 Wireless Connector
- Serial Number: 5909440
- Model Number: 010-592
- Software Revision: Custom Radio test
- Build Level / Revision Number: Production

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.

Name: Paxton10 Wireless Connector
Model Number: 010-687
Serial Number: None given
Exercising / Monitoring: Acting as dummy load for the EUT's RS485 output port
Brief Description: Wireless connector unit configured to act as dummy load.

Name: Dell Support Laptop
Model Number: Vostro 15
Serial Number: JK17362
Exercising / Monitoring: Using Chrome on the desktop of the support laptop to enable the different functions of the EUT, Bluetooth, Z-Wave and the RS485 dummy load.
Brief Description: Support laptop.

Name: Intel Next Unit of Computing (NUC)
Model Number: DC3217IYE
Serial Number: 3401555
Exercising / Monitoring: Acting as a server for the laptop support unit.
Brief Description: Mini PC acting as a server.

Name: TP-Link Router
Model Number: TL-WR840N
Serial Number: 214A106007889
Exercising / Monitoring: Used for Ethernet for the PoE switch.
Brief Description: 300 Mbps Wireless N Router.

Name: TP-Link PoE Switch
Model Number: TL-SF1008P
Serial Number: 2151819001955
Exercising / Monitoring: PoE switch providing power to EUT and Ethernet traffic between the NUC and laptop.
Brief Description: PoE switch.

7.3 EUT Mode of Operation

7.3.1 Transmission

The mode of operation for transmitter tests was as follows. The EUT was powered from the Wireless Controller support unit (itself receiving power from the PoE switch). Once the unit was powered, the support laptop was used to initialise the BTLE radio.

7.4 EUT Radio Parameters

7.4.1 General

Frequency of operation:	2402 MHz – 2480 MHz
Declared output power(s):	10 dBm
Antenna type:	Integral
Antenna gain:	1 dBi

This report only covers the limited testing on Bluetooth Low Energy radio.

7.5 EUT Description

The EUT is a building automation hub.

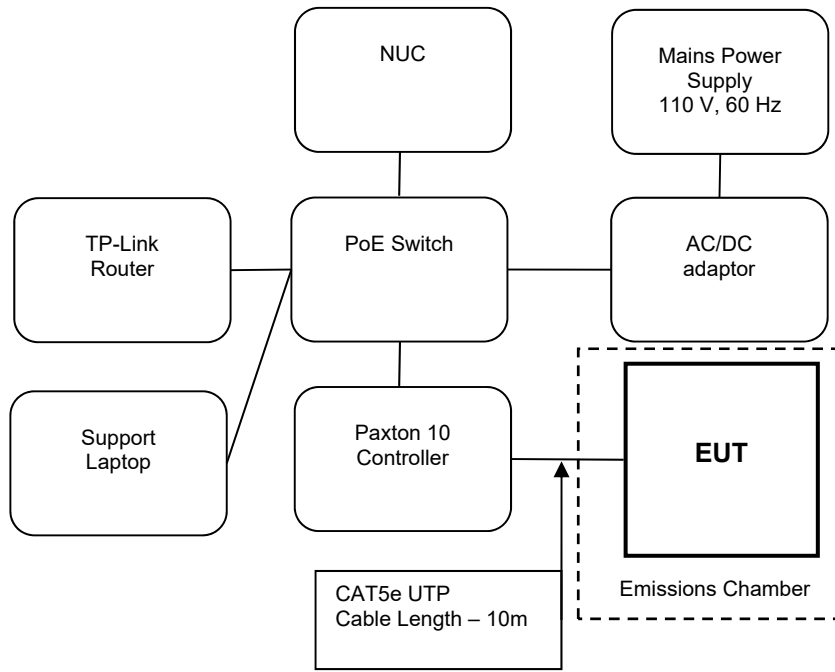
8 Modifications

No modifications were performed during this assessment.

9 EUT Test Setup

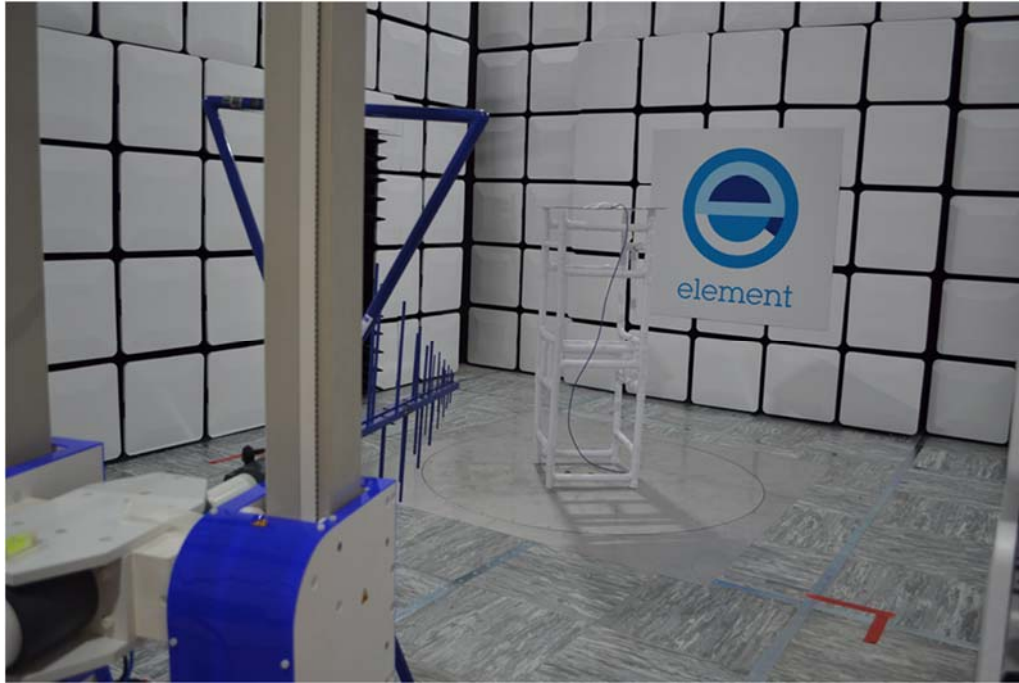
9.1 Block Diagram

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:



Sample on table close 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 PoE from the Paxton 10 Controller.

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 Hull
Test Chamber:	Wireless Lab 3
Test Standard and Clause:	ANSI C63.10-2013, Clause 6.5 and 6.6
Frequency Measured:	2402 / 2440 / 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: 20 °C	+15 °C to +35 °C (as declared)
Humidity: 50 % RH	20 % RH to 75 % RH (as declared)
Supply: PoE	

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

<i>Frequency (MHz)</i>	<i>Field Strength ($\mu\text{V/m}$ at 3 m)</i>
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;

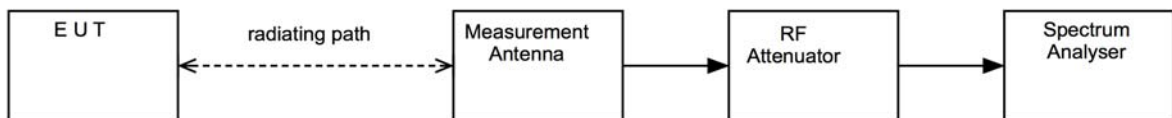
PA is the pre-amplifier gain in dB (where used);

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

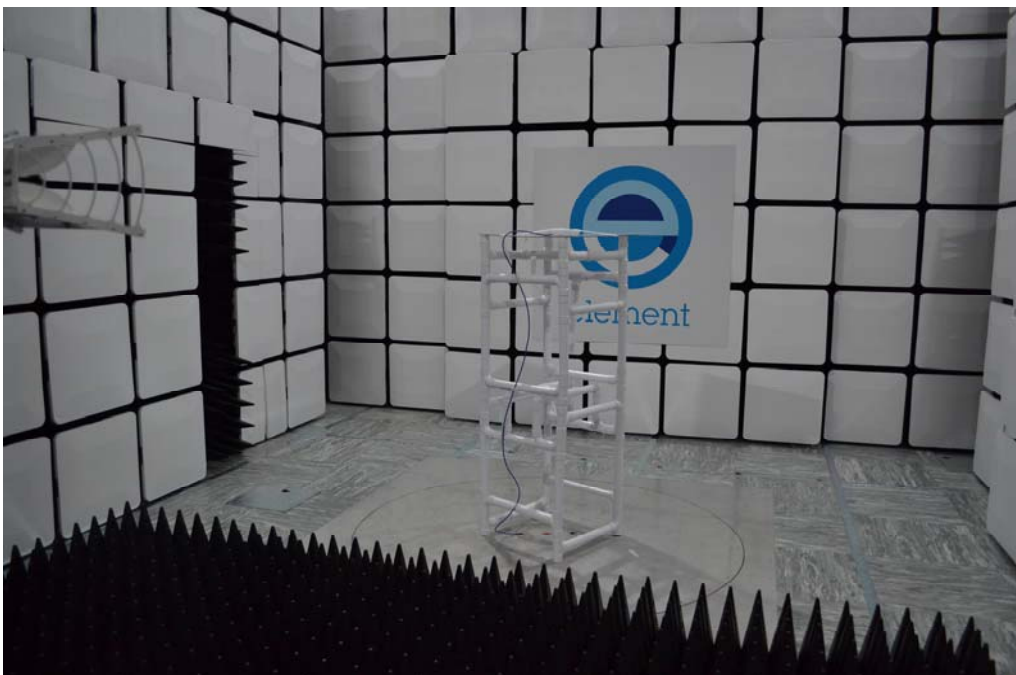


11.5 Test Set-up Photograph

Below 1GHz



Above 1GHz



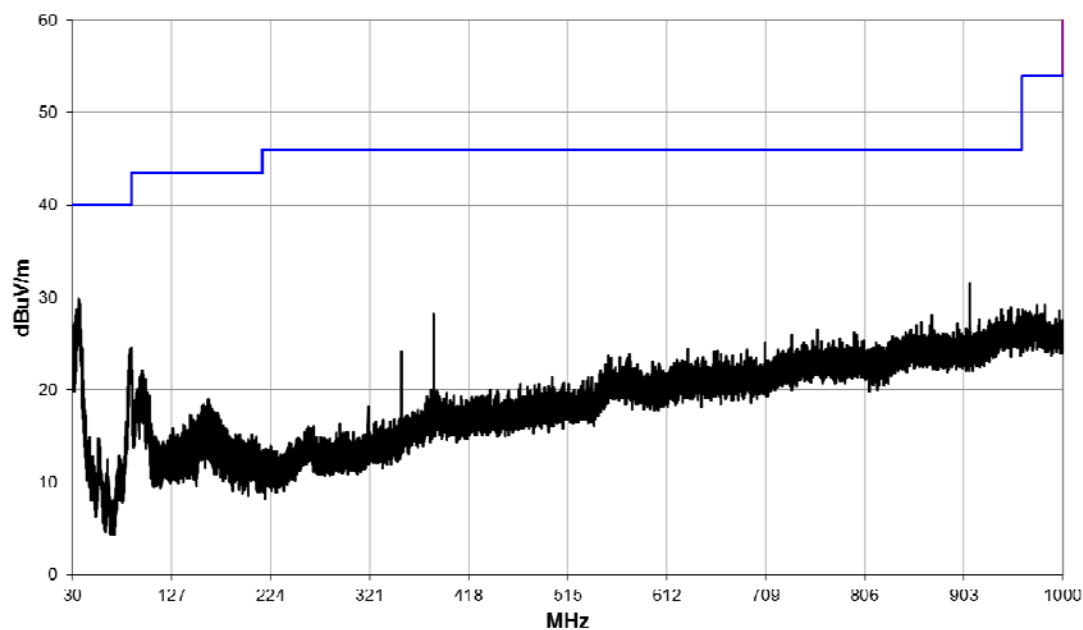
11.6 Test Equipment

Equipment Type	Manufacturer	Equipment Description	Element No	Due For Calibration
Ferrite Lined Chamber	Rainford	Chamber	REF2259	2020-08-03
Receiver	R&S	ESU40	RFG701	2019-12-17
Pre-Amp (9kHz – 1GHz)	Sonoma	310	REF927	2019-05-22
Pre-Amp (1 – 26.5GHz)	Agilent	8449B	REF913	2019-02-07
Bilog Antenna	Chase	CBL6111B	REF2218	2019-11-06
Horn Antenna	A Info Inc	LB-10180-NF	REF2241	2020-07-13

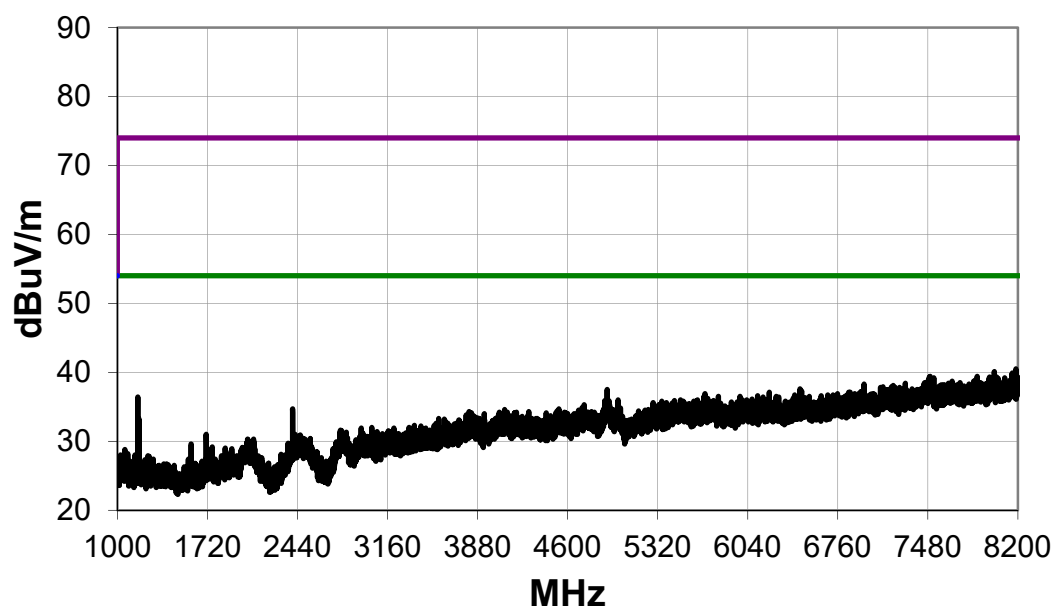
11.7 Test Results

High Power; Frequency: 2402 MHz;										
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 10dB of limit line										

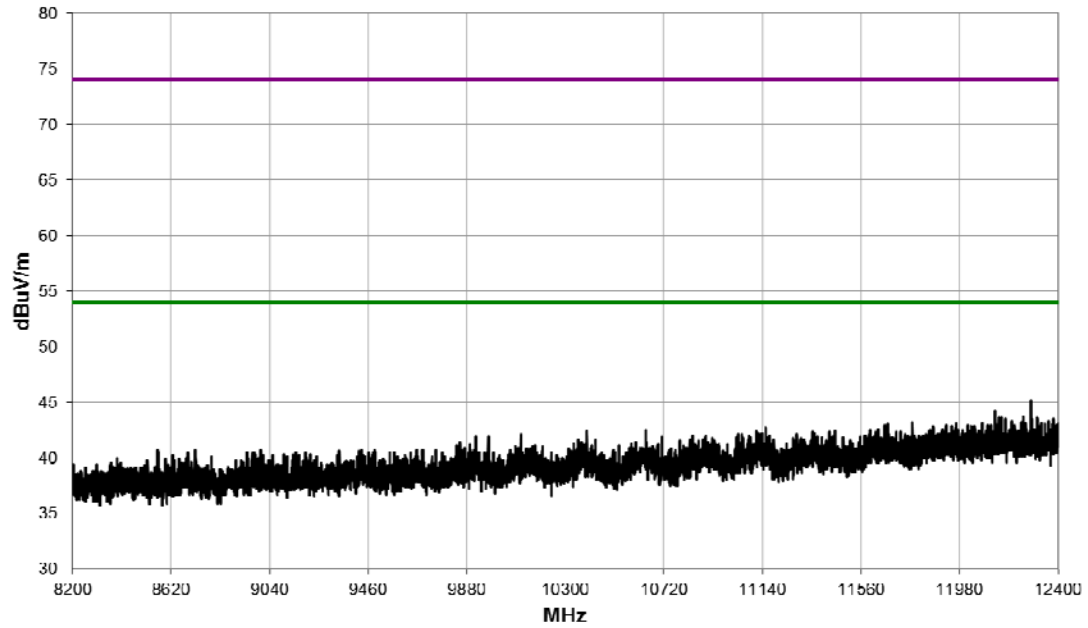
Plot of 30 MHz to 1 GHz



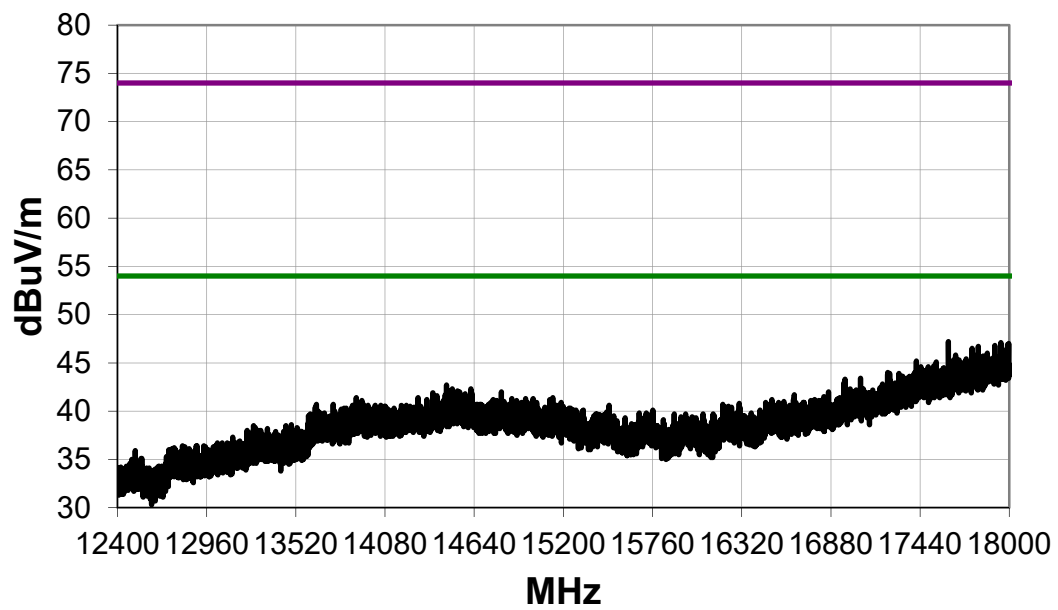
Plot of 1 GHz to 8.2 GHz with 2.4GHz band stop filter.



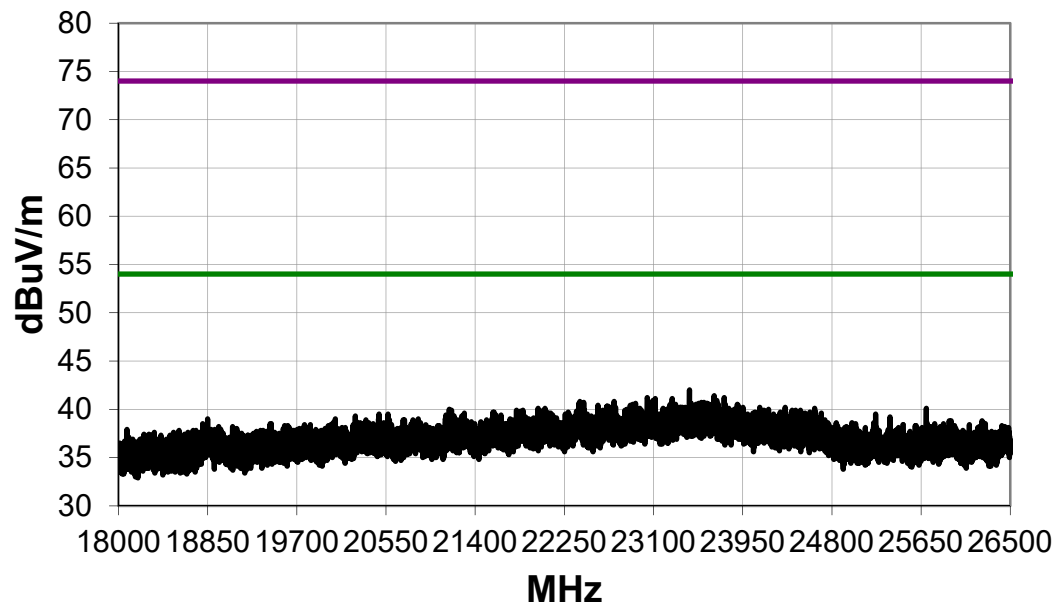
Plot of 8.2 GHz to 12.4 GHz with 7 GHz high pass filter



Plot of 12.4 GHz to 18 GHz with 7 GHz high pass filter

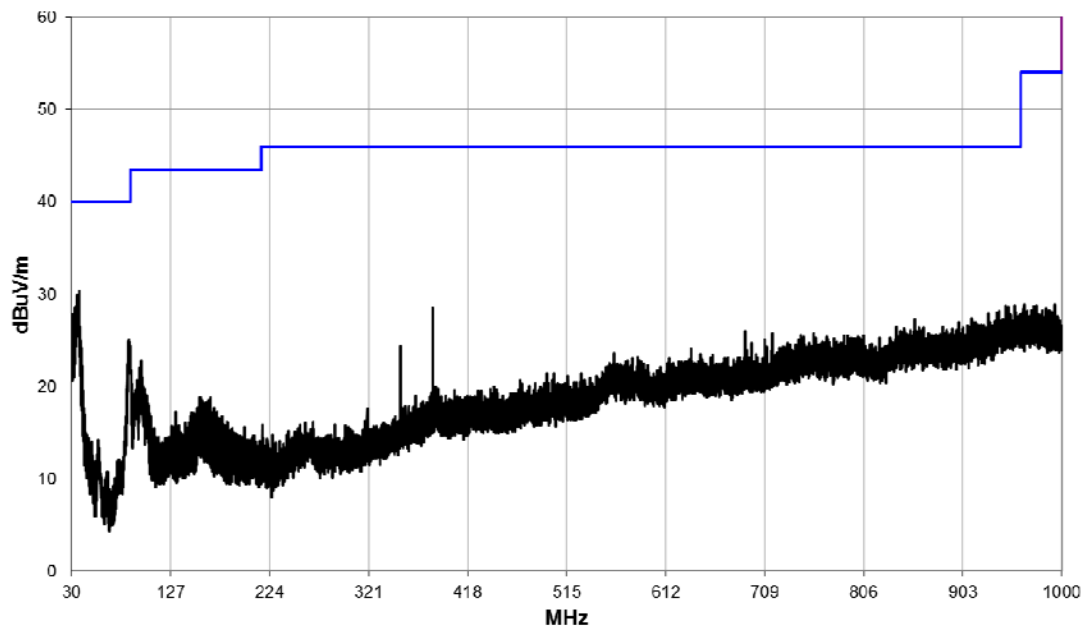


Plot of 18 GHz to 26.5 GHz without filter.

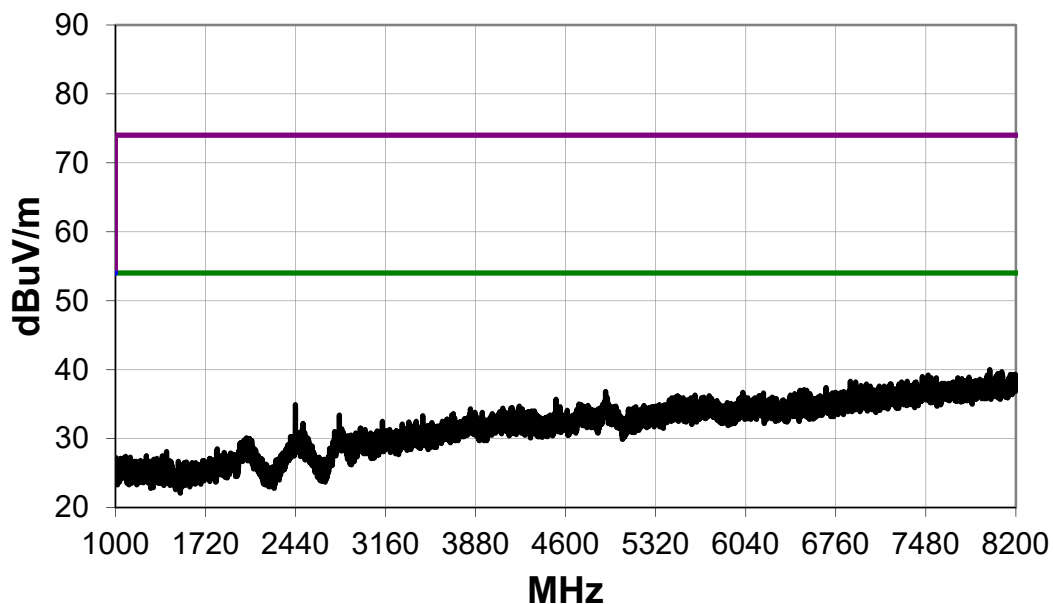


High Power; Frequency: 2440 MHz;										
Detector	Freq. (MHz)	Meas'd Emission (dBμV)	Cable Loss (dB)	Antenna Factor (dB/m)	Pre-amp Gain (dB)	Duty Cycle Corr'n (dB)	Distance Extrap'n Factor (dB)	Field Strength (dBμV/m)	Field Strength (μV/m)	Limit (μV/m)
No emissions within 10dB of limit line										

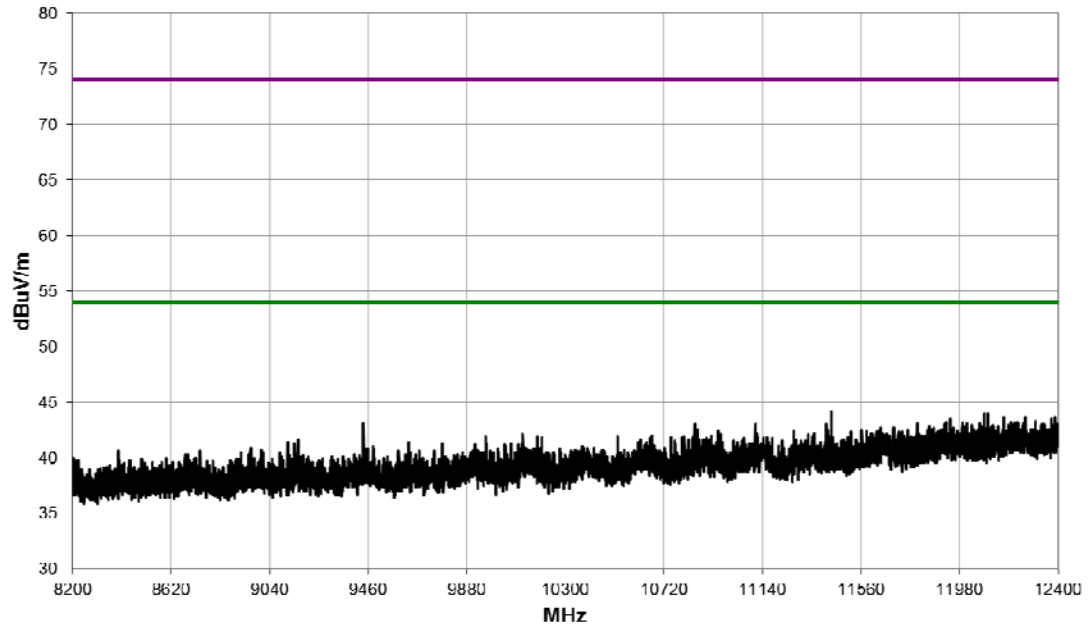
Plot of 30 MHz to 1 GHz



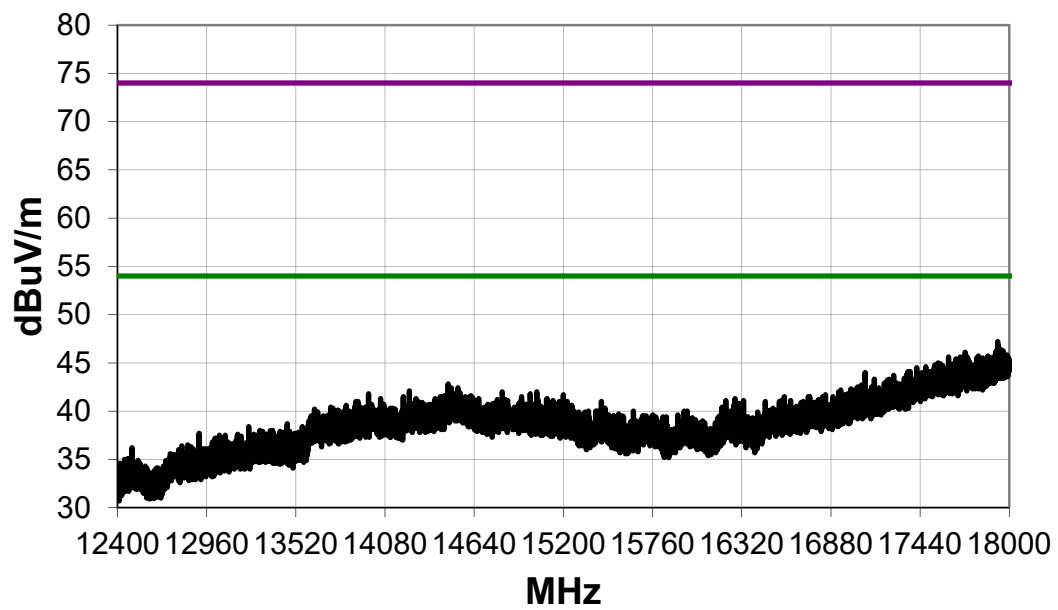
Plot of 1 GHz to 8.2 GHz with 2.4GHz band stop filter.



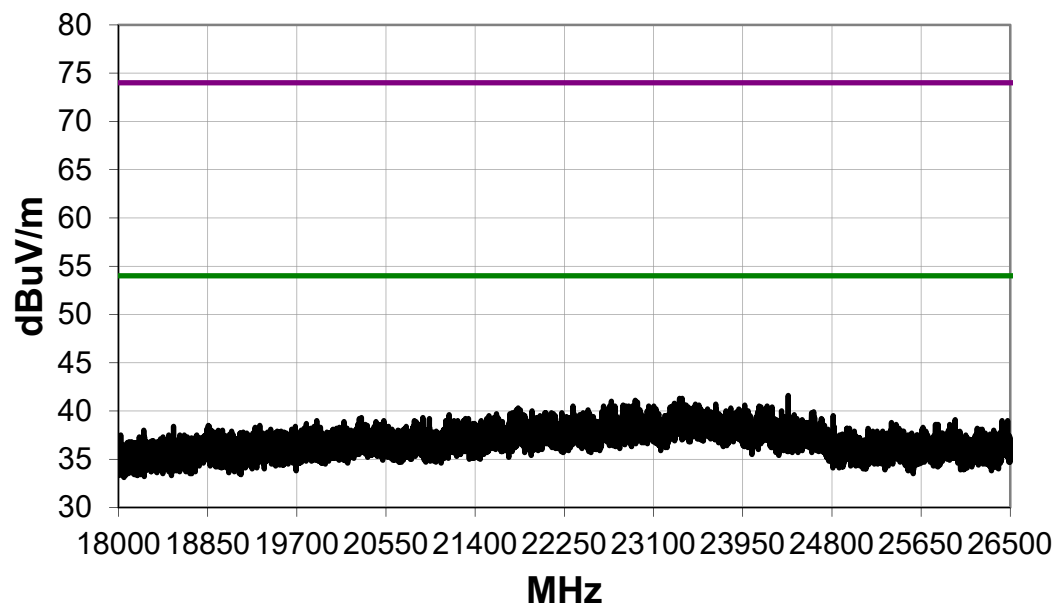
Plot of 8.2 GHz to 12.4 GHz with 7 GHz high pass filter



Plot of 12.4 GHz to 18 GHz with 7 GHz high pass filter

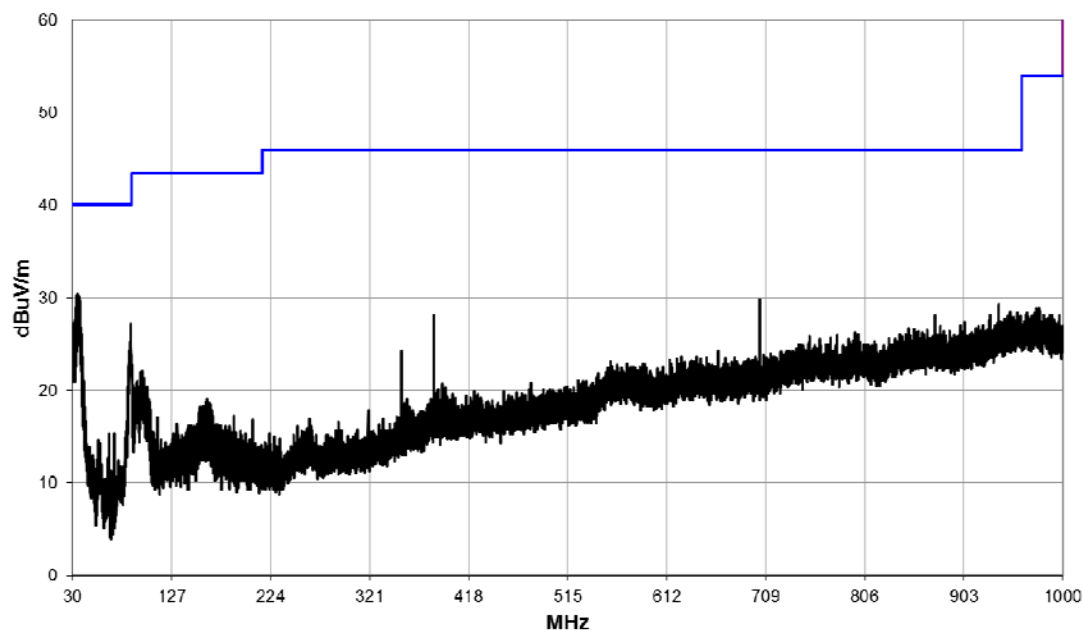


Plot of 18 GHz to 26.5 GHz without filter.

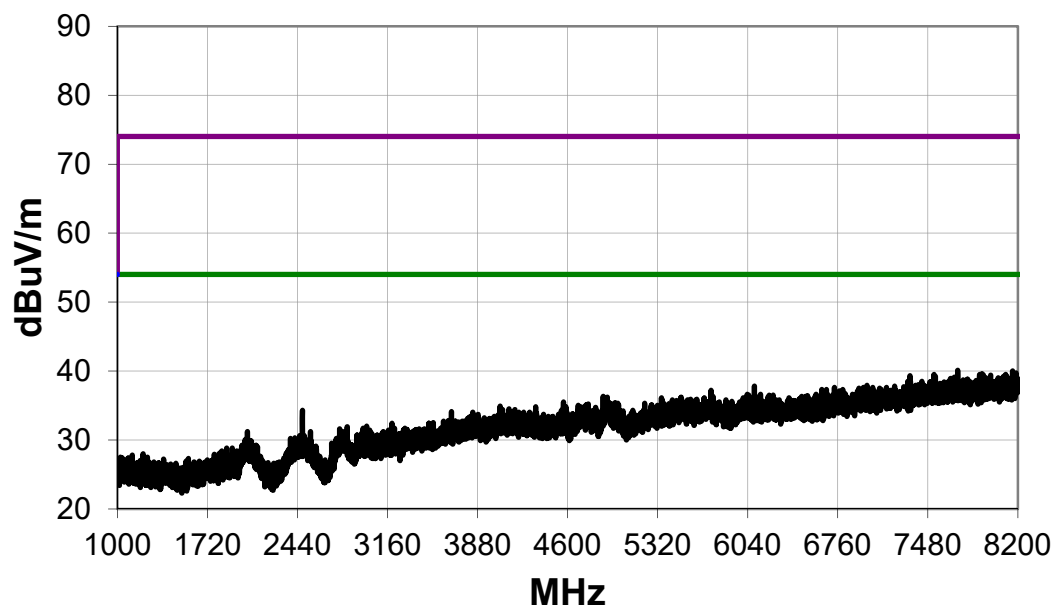


High Power; Frequency: 2480 MHz;										
Detector	Freq. (MHz)	Meas'd Emission (dBμV)	Cable Loss (dB)	Antenna Factor (dB/m)	Pre-amp Gain (dB)	Duty Cycle Corr'n (dB)	Distance Extrap'n Factor (dB)	Field Strength (dBμV/m)	Field Strength (μV/m)	Limit (μV/m)
No emissions within 10dB of limit line										

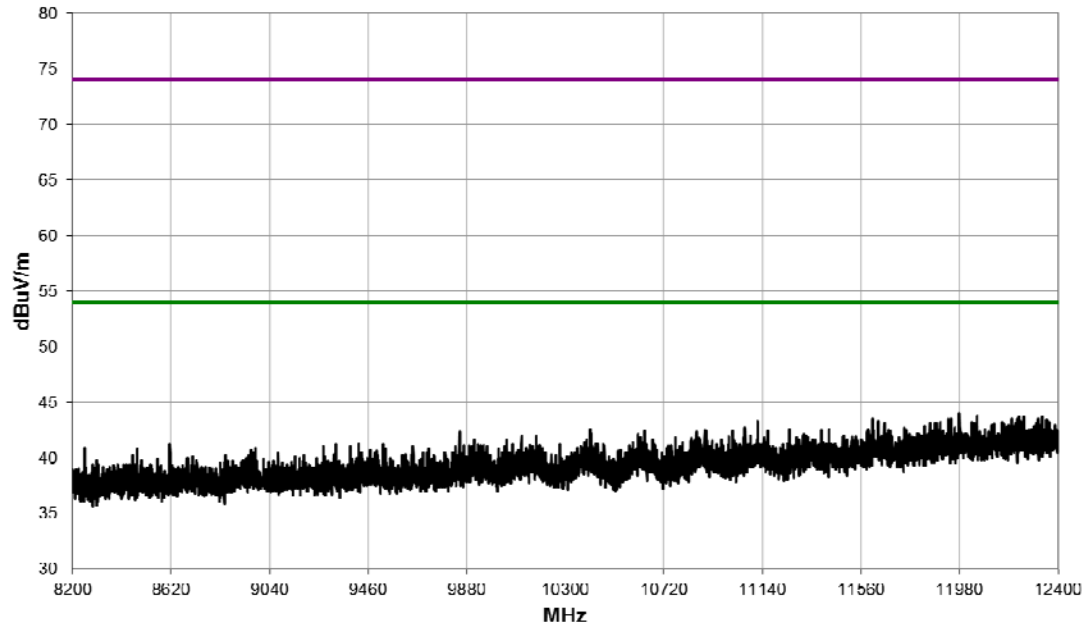
Plot of 30 MHz to 1 GHz



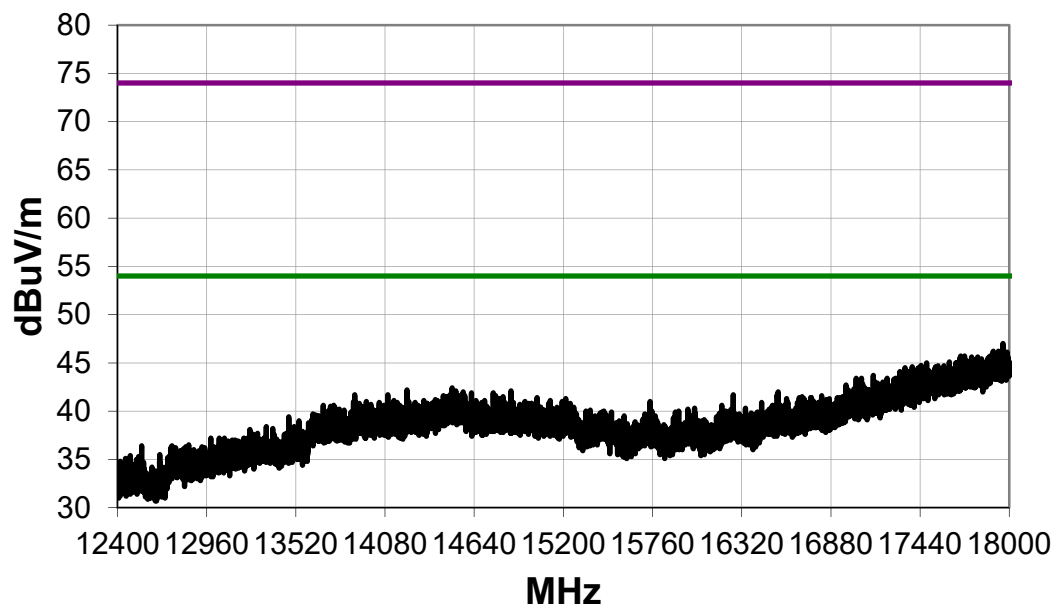
Plot of 1 GHz to 8.2 GHz with 2.4GHz band stop filter.



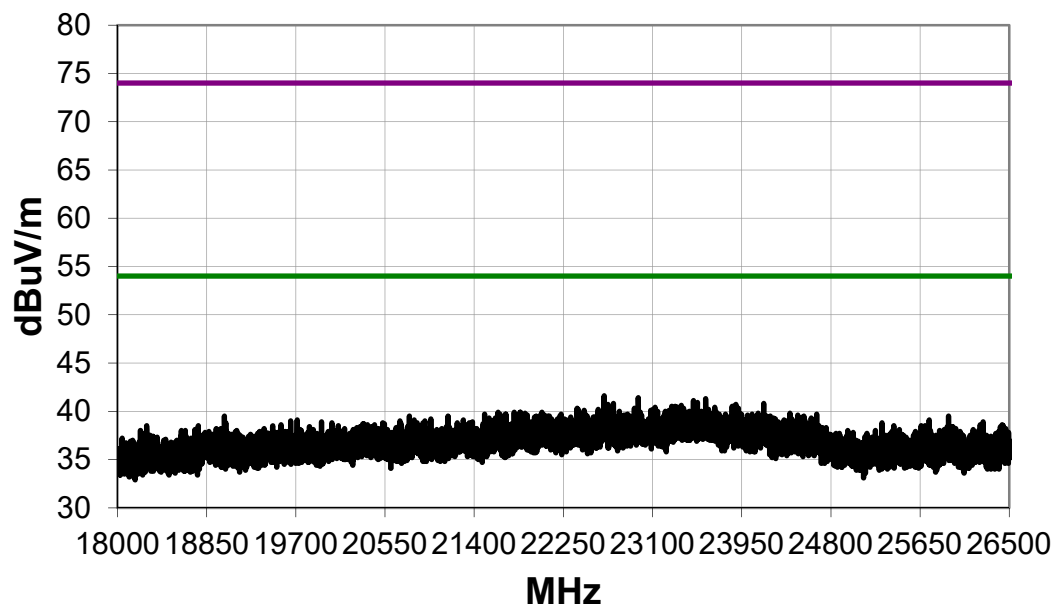
Plot of 8.2 GHz to 12.4 GHz with 7 GHz high pass filter



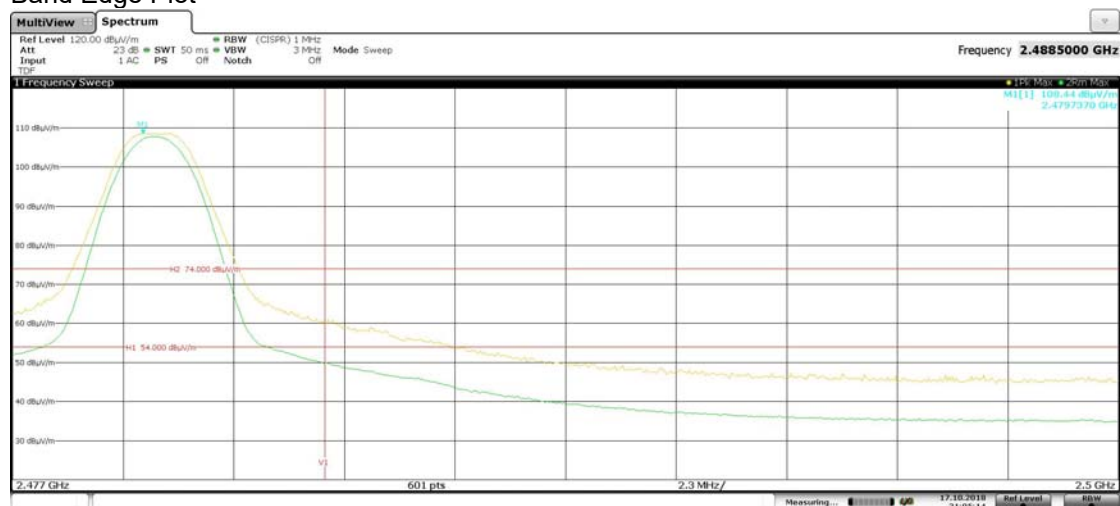
Plot of 12.4 GHz to 18 GHz with 7 GHz high pass filter



Plot of 18 GHz to 26.5 GHz without filter.



Band Edge Plot



12 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) = **4.75 dB**

Uncertainty in test result (1 GHz to 18 GHz) = **4.46 dB**

[2] AC power line conducted emissions

Uncertainty in test result = **3.2 dB**

[3] Occupied bandwidth

Uncertainty in test result = **15.58 %**

[4] Conducted carrier power

Uncertainty in test result (Power Meter) = **0.93 dB**

[5] Conducted 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**

[6] Radiated RF power out-of-band

Uncertainty in test result (30 MHz to 1 GHz) = **4.75 dB**

Uncertainty in test result (1 GHz to 18 GHz) = **4.46 dB**

[7] Power spectral density

Uncertainty in test result (Spectrum Analyser) = **3.11 dB**

[8] ERP / EIRP

Uncertainty in test result (Laboratory) = **4.71 dB**

Uncertainty in test result (Pershore OATS) = **4.26 dB**