

Report on the Radio Testing

For

Pace plc

on

Xi5

Report no. TRA-029286-02-45-03A

20th May 2016

Report Number: TRA-029286-02-45-03A
Issue: A

REPORT ON THE RADIO TESTING OF A
Pace plc
Xi5
WITH RESPECT TO SPECIFICATION
FCC 47CFR

TEST DATE: 01st March - 13th May 2016

Written by: A Tosif

A Tosif
Radio Test Engineer

Approved by: **John Charters**
Date: 20th May 2016

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Date: 2016.05.20 13:13:00 +01'00'

J Charters
Department Manager- Radio

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	20th May 2016	Original

2 Summary

TEST REPORT NUMBER:	TRA-029286-02-45-03A
WORKS ORDER NUMBER:	TRA-029286-02
PURPOSE OF TEST:	Certification
TEST SPECIFICATION:	47CFR15
EQUIPMENT UNDER TEST (EUT):	Xi5
FCC IDENTIFIER:	NQ8PX051AEI
EUT SERIAL NUMBER:	PAW400000759
MANUFACTURER/AGENT:	Pace plc
ADDRESS:	Victoria Road Saltaire Shipley West Yorkshire BD18 3LF United Kingdom
CLIENT CONTACT:	James Humphrey ☎ 01274 537259 ✉ James.Humphrey1@pace.com
ORDER NUMBER:	5185322
TEST DATE:	01st March - 13th May 2016
TESTED BY:	A Tosif Element

2.1 Test Summary

<i>Test Method and Description</i>	<i>Requirement Clause 47CFR15</i>	<i>Applicable to this equipment</i>	<i>Result / Note</i>
Multi Radio Radiated spurious emissions	15.205, 15.247 (d), 15.407(b)	☒	Pass
AC power line conducted emissions	15.207	☒	Pass

Notes:

This report covers the testing when all radio devices are transmitting simultaneously.

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-029286-02-45-03A presents the results of the Radio testing on a Pace plc, Xi5 to specification 47CFR15 Radio Frequency Devices.

The testing was carried out for Pace plc 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.

FCC Site Listing:

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

IC Registration Number(s):

Element Skelmersdale	3930B
Element Hull	3483A

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.
- FCC KDB Publication 905462 D02 v01r02 – Compliance measurement procedures for unlicensed-national information infrastructure devices operating in the 5250-5350 MHz and 5470-5725 MHz bands incorporating dynamic frequency selection.
- 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

There were no deviations from the test standard.

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
CAC	Channel Availability Check
CFR	Code of Federal Regulations
CW	Continuous Wave
dB	decibel
dBm	dB relative to 1 milliwatt
DC	Direct Current
DFS	Dynamic Frequency Selection
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
LE-LAN	Licence-Exempt Local Area Network
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
PSD	Power Spectral Density
RF	Radio Frequency
RH	Relative Humidity
RMS	Root Mean Square
Rx	receiver
s	second
SVSWR	Site Voltage Standing Wave Ratio
TPC	Transmitter Power Control
Tx	transmitter
UKAS	United Kingdom Accreditation Service
U-NII	Unlicensed-National Information Infrastructure
V	volt
W	watt
Ω	ohm

7 Equipment under Test

7.1 EUT Identification

- Name: Xi5
- Serial Number: PAW400000759
- Model Number: PX051AEI
- Software Revision: Not Applicable
- Build Level / Revision Number: DV

Incorporating the following external interconnecting cables, ports or terminals:

<i>Description</i>		<i>Cable Type</i>	<i>Test Length</i>	<i>Max. Length</i>
1	DC input	2 core unscreened	1.5m	1.5m
2	Ethernet	CAT5e UTP	10m	>3m
3	HDMI in	HDMI unscreened	1m	1m
4	HDMI out	HDMI unscreened	1m	1m
5	Micro USB*	None	N/A	N/A

*The micro USB port is not used in normal operation, so it wasn't terminated during the testing.

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.

EPS-2 (AC Adapter)
Pace HDMI Input Load
Sharp Television
Dell Latitude Laptop
Dell AC/DC Adapter

7.3 EUT Mode of Operation

7.3.1 Transmission

Bluetooth and RF4CE control was via DigDebug. Wi-Fi transmitter control was via commands sent through Tera Term. The commands provided by the manufacturer setup the device into a permanent transmit mode. Channels and modulation types were selected to use combinations with the highest output power levels.

Multi radio Intermodulation Emission - Frequency Set 1			
Radio	Frequency (MHz)	Software / Power Setting	Modulation
Bluetooth	2402 MHz	10	GFSK
RF4CE	2450 MHz	007	OQPSK
5 GHz Wi-Fi	5260 MHz	13	802.11n HT20
Multi radio Intermodulation Emission - Frequency Set 2			
Radio	Frequency (MHz)	Software / Power Setting	Modulation
Bluetooth	2402 MHz	10	GFSK
RF4CE	2450 MHz	007	OQPSK
5 GHz Wi-Fi	5620 MHz	13	802.11n HT20
Multi radio Intermodulation Emission - Frequency Set 3			
Radio	Frequency (MHz)	Software / Power Setting	Modulation
Bluetooth	2402 MHz	10	GFSK
RF4CE	2450 MHz	007	OQPSK
5 GHz Wi-Fi	5785 MHz	73	802.11n HT20
Multi radio Intermodulation Emission - Frequency Set 4			
Radio	Frequency (MHz)	Software / Power Setting	Modulation
Bluetooth	2480 MHz	10	GFSK
RF4CE	2450 MHz	007	OQPSK
5 GHz Wi-Fi	5260 MHz	13	802.11n HT20
Multi radio Intermodulation Emission - Frequency Set 5			
Radio	Frequency (MHz)	Software / Power Setting	Modulation
Bluetooth	2480 MHz	10	GFSK
RF4CE	2450 MHz	007	OQPSK
5 GHz Wi-Fi	5620 MHz	13	802.11n HT20
Multi radio Intermodulation Emission - Frequency Set 6			
Radio	Frequency (MHz)	Software / Power Setting	Modulation
Bluetooth	2480 MHz	10	GFSK
RF4CE	2450 MHz	007	OQPSK
5 GHz Wi-Fi	5785 MHz	73	802.11n HT20

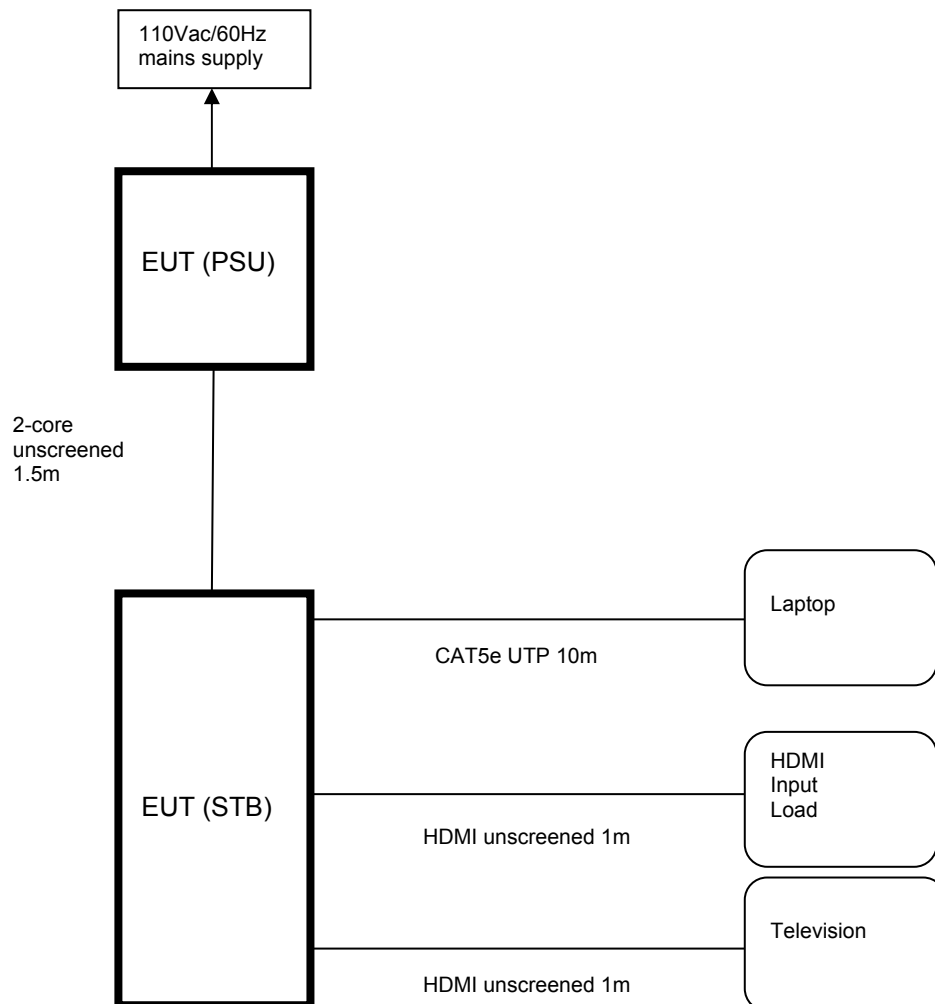
8 Modifications

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:



10 General Technical Parameters

10.1 Normal Conditions

The EUT was tested under the normal environmental conditions of the test laboratory, except where otherwise stated. The normal power source applied was approx. 110 Vac from the mains.

11 Multi Radio 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:	REF886
Test Standard and Clause:	ANSI C63.10-2013, Clause 6.5 and 6.6
EUT Channels / Frequencies Measured:	See section 7
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: 40 %RH	20%RH to 75%RH (as declared)
Supply: 110 Vac	110Vac +/-10% (as declared)

Test Limits

For transmitters operating in the 5.15–5.25 GHz band: All emissions outside of the 5.15–5.35 GHz band shall not exceed an e.i.r.p. of -27 dBm/MHz.

For transmitters operating in the 5.25–5.35 GHz band: All emissions outside of the 5.15–5.35 GHz band shall not exceed an e.i.r.p. of -27 dBm/MHz.

For transmitters operating in the 5.47–5.725 GHz band: All emissions outside of the 5.47–5.725 GHz band shall not exceed an e.i.r.p. of -27 dBm/MHz.

For transmitters operating in the 5.725–5.85 GHz band: All emissions within the frequency range from the band edge to 10 MHz above or below the band edge shall not exceed an e.i.r.p. of -17 dBm/MHz; for frequencies 10 MHz or greater above or below the band edge, emissions shall not exceed an e.i.r.p. of -27 dBm/MHz.

Where regulatory limits are defined as EIRP in dBm/MHz limits are converted to field strength values as per ANSI C63.10

Operating Band (GHz)	EIRP Limit (dBm / MHz)	Field Strength Limit (dB μ V/m@ 3m)
5.15–5.35 GHz	-27 dBm/MHz	68.2 dB μ V/m
5.47–5.725 GHz	-27 dBm/MHz	68.2 dB μ V/m
5.725–5.825 GHz	-17 dBm/MHz	78.2 dB μ V/m
	-27 dBm/MHz	68.2 dB μ V/m

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

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

Frequency (MHz)	Field Strength (μ V/m at 3m)
30-88	100
88-216	150
216-960	200
Above 960	500

11.3 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 100kHz 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 dB μ V/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 dB μ V;

CL is the cable loss in dB;

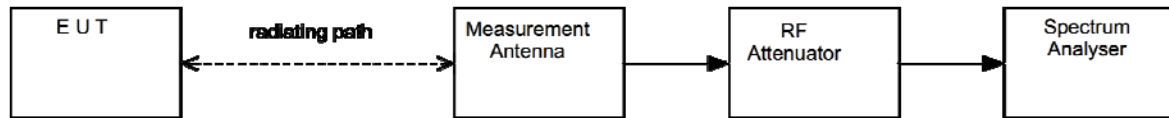
AF is the test antenna factor in dB/m;

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

DC is the duty correction factor in dB (where used, e.g. where average detector on pulsed harmonic understates the power);
 CF is the distance factor in dB (where measurement distances different to limit distance);

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

Figure i Test Setup



11.4 Test Equipment

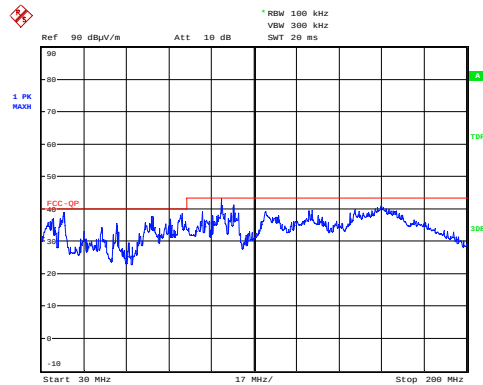
<i>Equipment Description</i>	<i>Manufacturer</i>	<i>Equipment Type</i>	<i>Element No</i>	<i>Last Cal Calibration</i>	<i>Calibration Period</i>	<i>Due For Calibration</i>
Ferrite Lined Chamber	Rainford	ATS	REF886	21/07/2014	24	21/07/2016
Biconical Antenna	EMCO	3109	RFG095	09/05/2013	36	09/05/2016
Log Periodic Antenna	EMCO	3146	RFG191	09/05/2013	36	09/05/2016
Horn Antenna	EMCO	3115	RFG129	09/02/2016	24	09/02/2018
Horn Antenna	Q-Par	0	RFG629	30/09/2015	24	30/09/2017
Horn Antenna	Flan	0	REF821	Note1		
Pre-Amp (9kHz – 1GHz)	Sonoma	310	REF927	01/07/2014	24	01/07/2016
Pre-Amp (1 – 26.5GHz)	Agilent	8449B	REF913	02/02/2016	24	02/02/2018
EMI Test Receiver	R&S	ESVS20	RFG126	17/04/2015	12	17/04/2016
Spectrum Analyser	R&S	FSU46	REF910	28/05/2015	12	28/05/2016
Band Stop Filter (5.15 - 5.35 GHz)	BSC	SN4832	REF841	Cal before use		
Band Stop Filter (5.47 - 5.725 GHz)	BSC	SN 4833	REF842	Cal before use		
Band Stop Filter (5.725 - 5.85 GHz)	BSC	SN 4834	REF843	Cal before use		

Note1: ANSI C63.10 - 4.4.3 a) Antenna calibration

Standard gain horns need not be periodically recalibrated, unless damage or deterioration is suspected or known to have occurred. If a standard gain horn is not periodically recalibrated, then its critical dimensions (see IEEE Std 1309-2005) shall be verified and documented on an annual basis.

11.5 Test Results

Multi radio Intermodulation Emission - Frequency Set 1									
Detector	Freq. (MHz)	Meas'd Emission (dBμV)	Cable Loss (dB)	Antenna Factor (dB/m)	Pre-amp Gain (dB)	Distance Extrap'n Factor (dB)	Field Strength (dBμV/m)	Field Strength (μV/m)	Limit (μV/m)
No Multi Radio Intermodulation Emissions Detected									



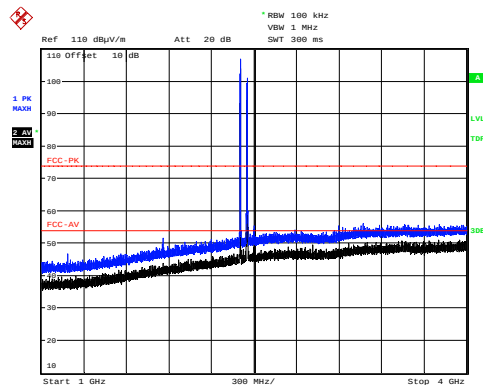
Date: 11.MAY.2016 14:07:25

30 MHz – 200 MHz



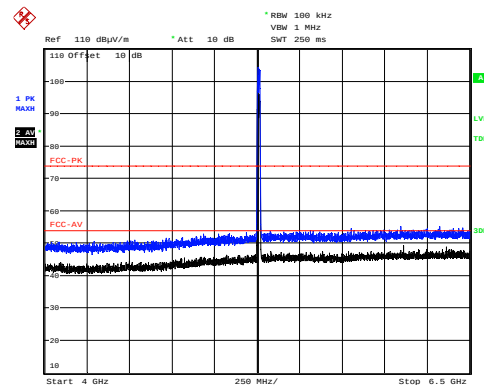
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200 MHz – 1 GHz



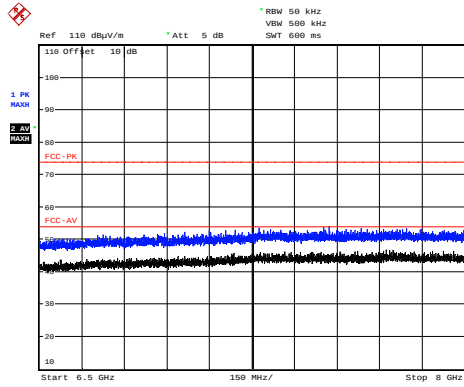
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1 GHz – 4 GHz



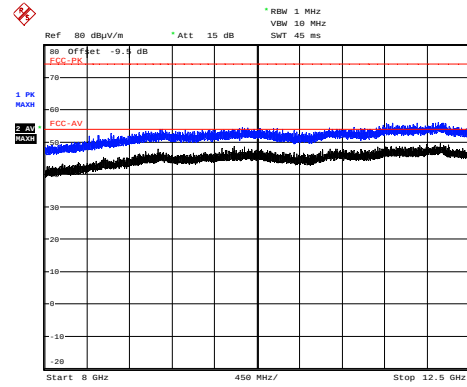
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4 GHz – 6.5 GHz



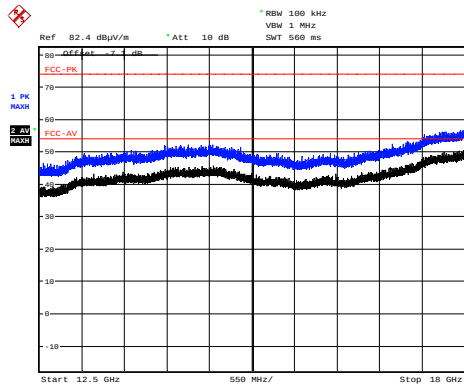
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6.5 GHz – 8 GHz



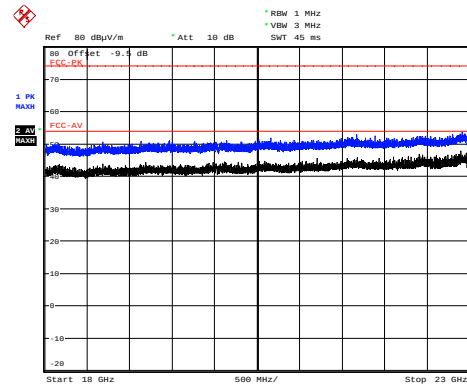
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8 GHz – 12.5 GHz



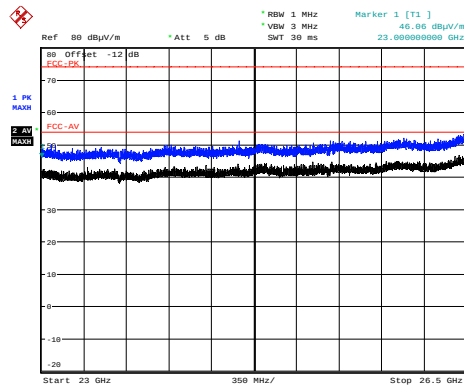
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12.5 GHz – 18 GHz



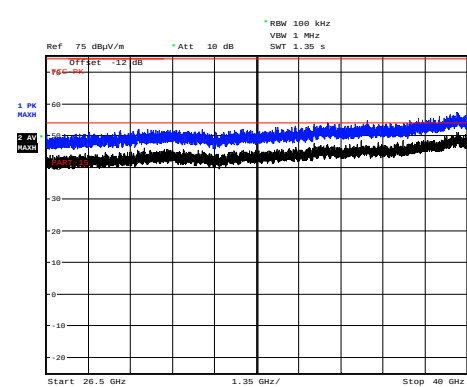
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18 GHz – 23 GHz



Date: 12.MAY.2016 12:33:13

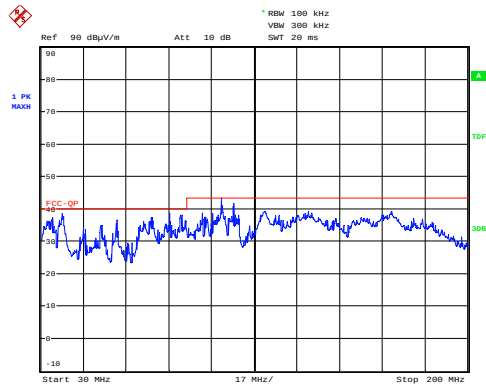
23 GHz – 26.5 GHz



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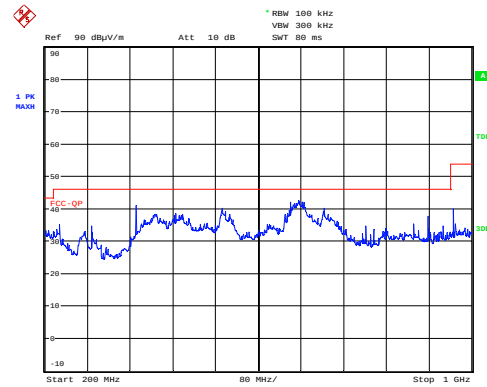
26.5 GHz – 40 GHz

Multi radio Intermodulation Emission - Frequency Set 2									
Detector	Freq. (MHz)	Meas'd Emission (dBμV)	Cable Loss (dB)	Antenna Factor (dB/m)	Pre-amp Gain (dB)	Distance Extrap'n Factor (dB)	Field Strength (dBμV/m)	Field Strength (μV/m)	Limit (μV/m)
No Multi Radio Intermodulation Emissions Detected									



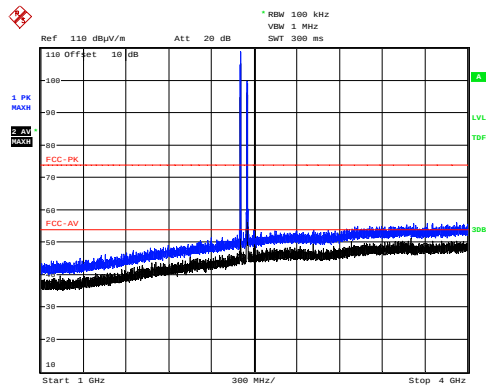
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30 MHz – 200 MHz



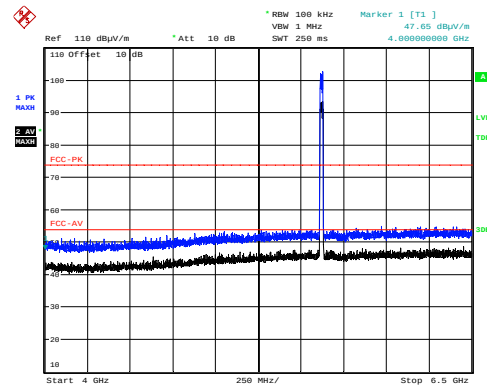
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200 MHz – 1 GHz



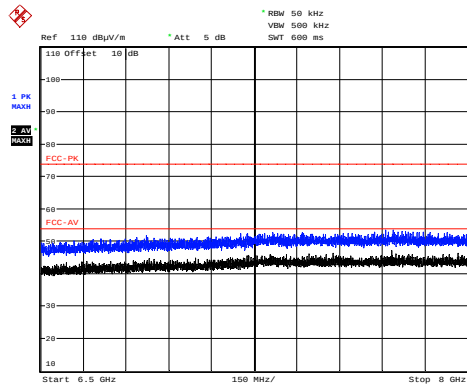
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1 GHz – 4 GHz



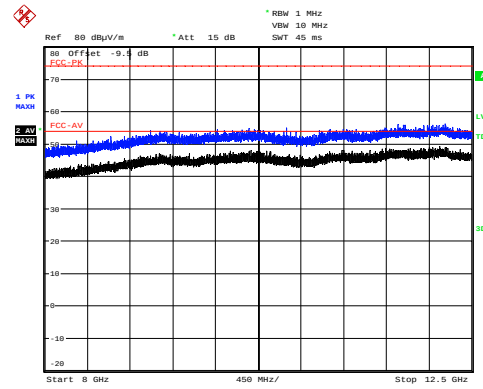
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4 GHz – 6.5 GHz



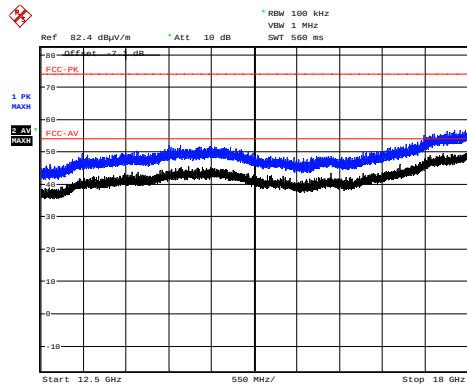
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6.5 GHz – 8 GHz



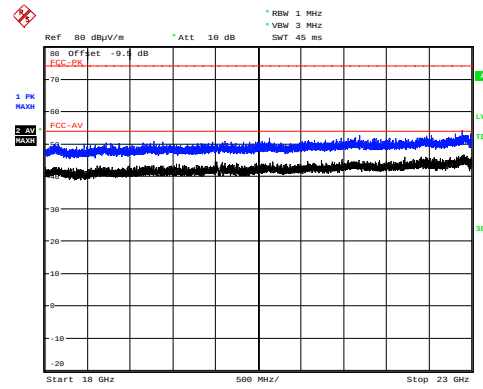
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8 GHz – 12.5 GHz



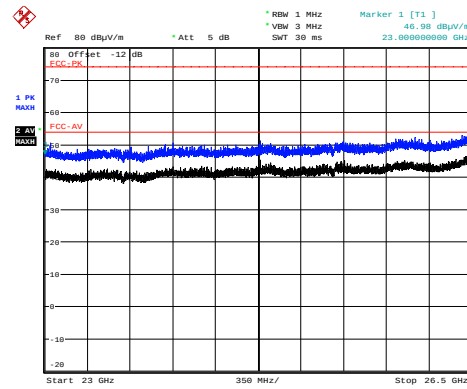
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12.5 GHz – 18 GHz



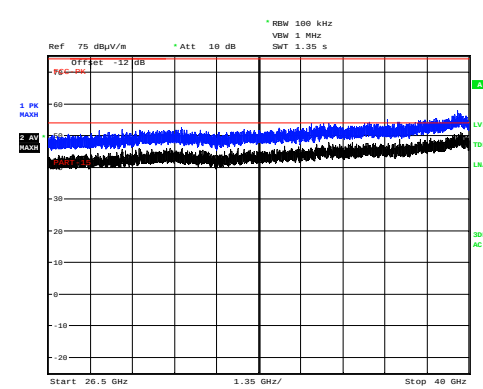
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18 GHz – 23 GHz



Date: 12.MAY.2016 12:35:19

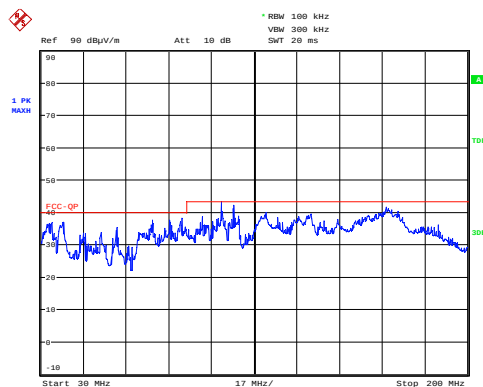
23 GHz – 26.5 GHz



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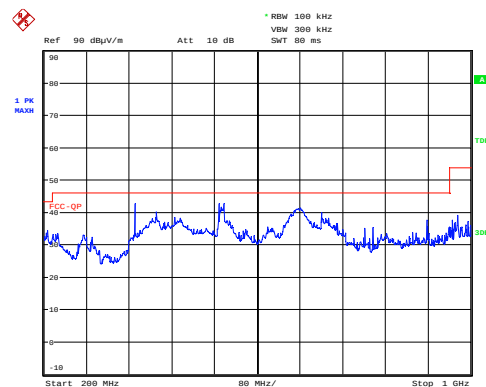
26.5 GHz – 40 GHz

Multi radio Intermodulation Emission - Frequency Set 3									
Detector	Freq. (MHz)	Meas'd Emission (dBμV)	Cable Loss (dB)	Antenna Factor (dB/m)	Pre-amp Gain (dB)	Distance Extrap'n Factor (dB)	Field Strength (dBμV/m)	Field Strength (μV/m)	Limit (μV/m)
No Multi Radio Intermodulation Emissions Detected									



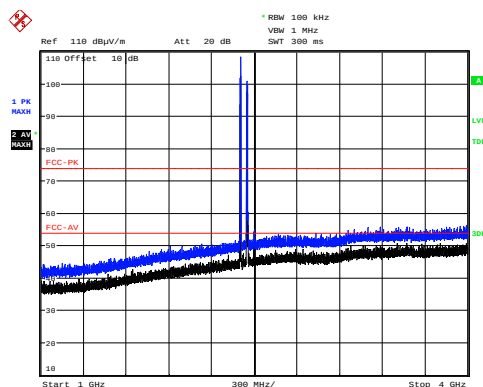
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30 MHz – 200 MHz



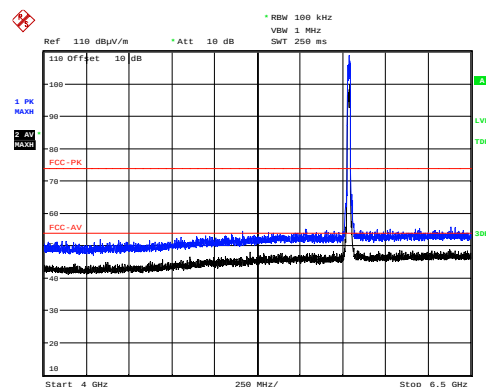
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200 MHz – 1 GHz



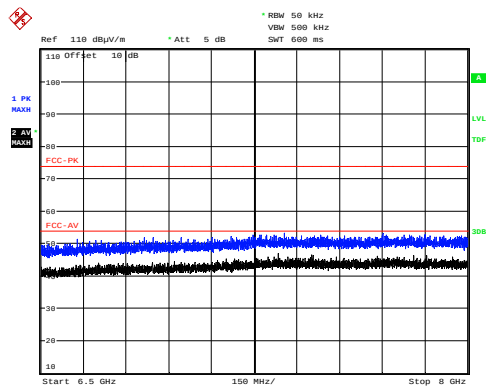
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1 GHz – 4 GHz



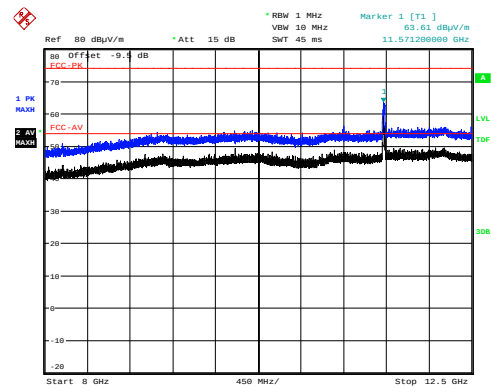
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4 GHz – 6.5 GHz



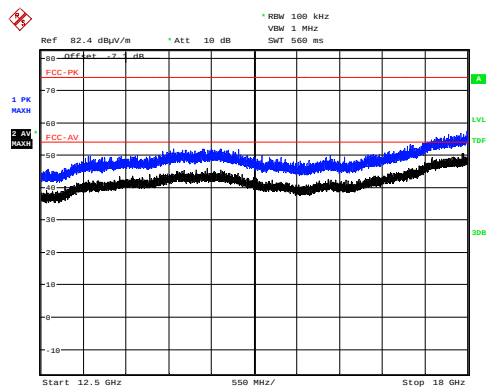
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6.5 GHz – 8 GHz



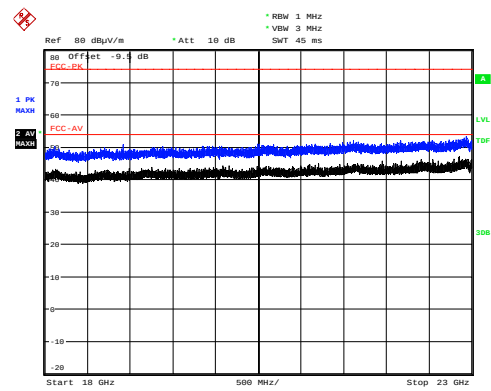
Date: 12.MAY.2016 09:02:39

8 GHz – 12.5 GHz



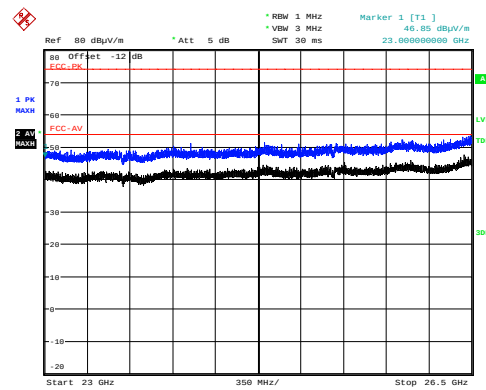
Date: 12.MAY.2016 09:21:05

12.5 GHz – 18 GHz



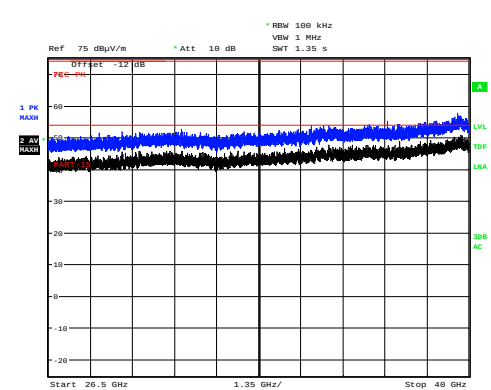
Date: 12.MAY.2016 12:40:41

18 GHz – 23 GHz



Date: 12.MAY.2016 12:38:03

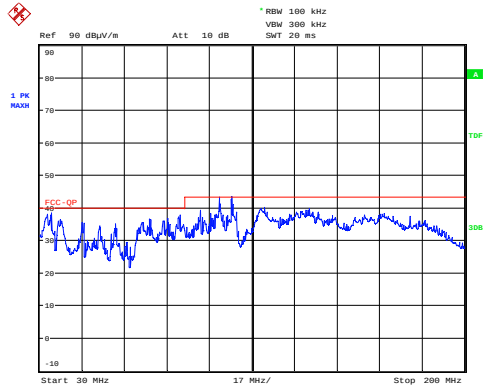
23 GHz – 26.5 GHz



Date: 26.MAY.2003 09:51:01

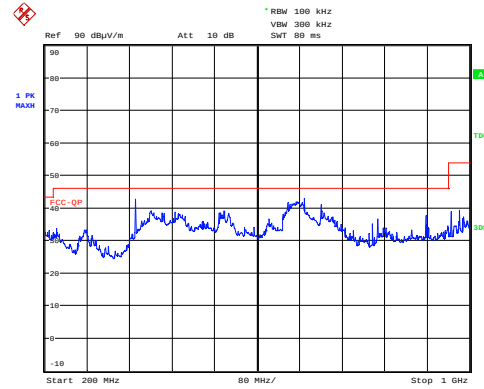
26.5 GHz – 40 GHz

Multi radio Intermodulation Emission - Frequency Set 4									
Detector	Freq. (MHz)	Meas'd Emission (dBμV)	Cable Loss (dB)	Antenna Factor (dB/m)	Pre-amp Gain (dB)	Distance Extrap'n Factor (dB)	Field Strength (dBμV/m)	Field Strength (μV/m)	Limit (μV/m)
No Multi Radio Intermodulation Emissions Detected									



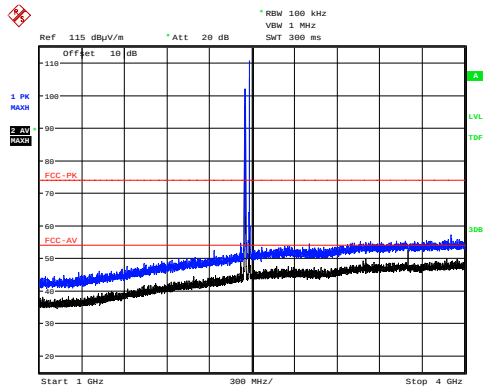
Date: 11.MAY.2016 14:47:46

30 MHz – 200 MHz



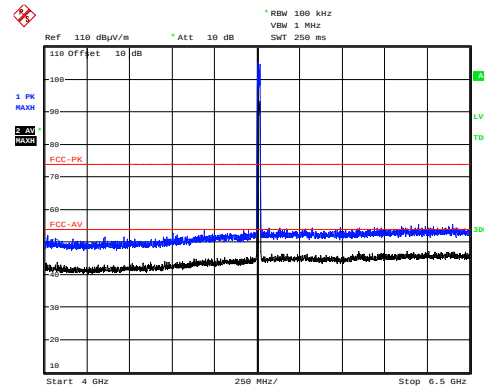
Date: 11.MAY.2016 15:14:43

200 MHz – 1 GHz



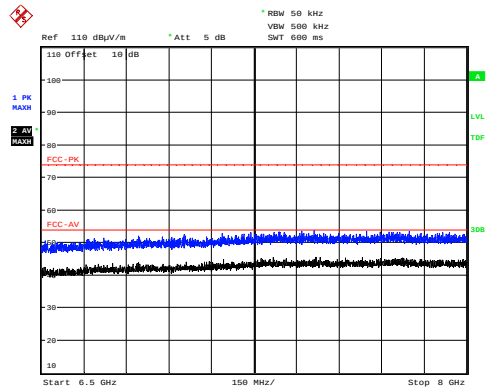
Date: 12.MAY.2016 11:23:06

1 GHz – 4 GHz



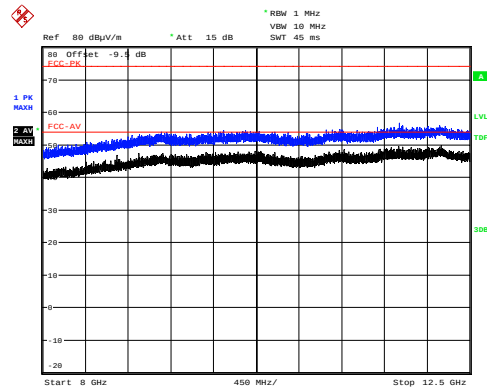
Date: 12.MAY.2016 09:58:23

4 GHz – 6.5 GHz



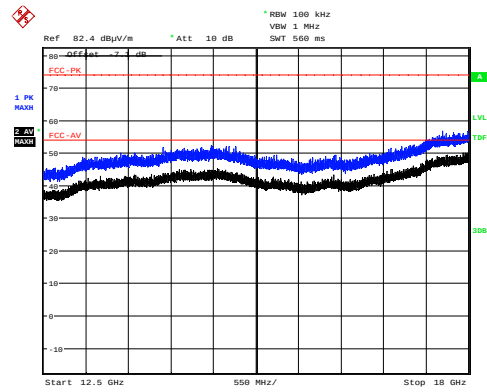
Date: 12.MAY.2016 09:55:44

6.5 GHz – 8 GHz



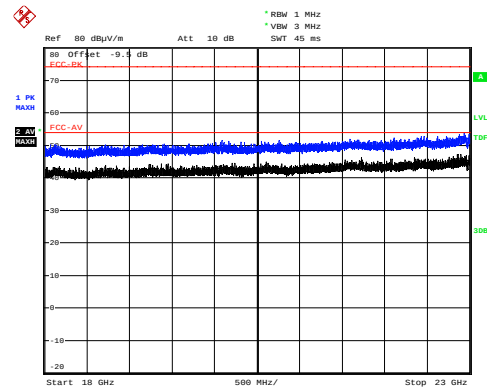
Date: 12.MAY.2016 09:36:00

8 GHz – 12.5 GHz



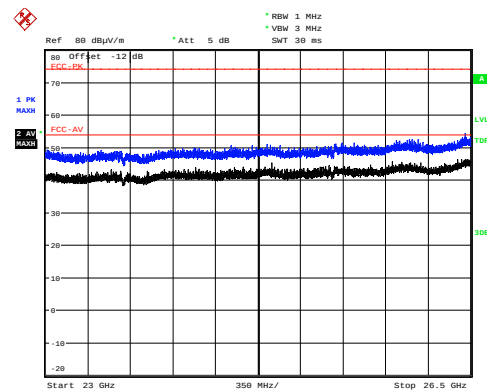
Date: 12.MAY.2016 09:32:05

12.5 GHz – 18 GHz



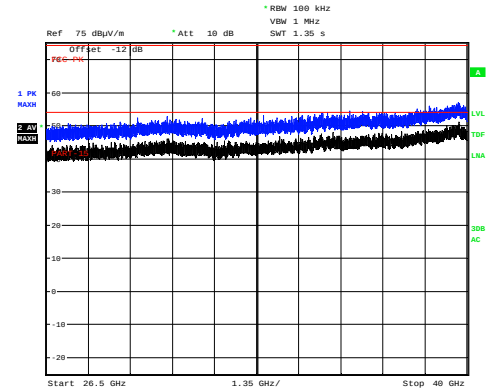
Date: 12.MAY.2016 11:56:37

18 GHz – 23 GHz



Date: 12.MAY.2016 12:21:32

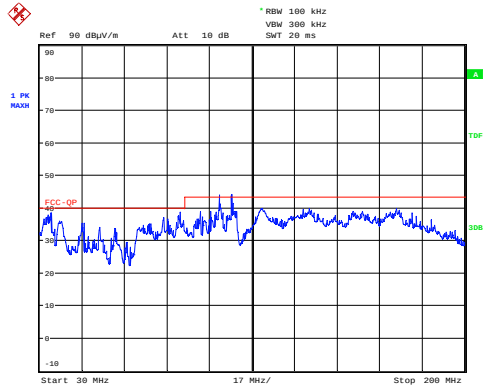
23 GHz – 26.5 GHz



Date: 26.MAY.2003 09:47:14

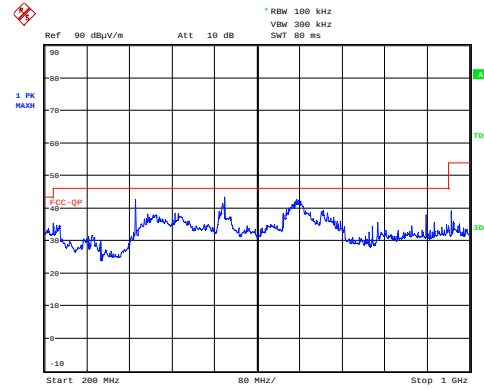
26.5 GHz – 40 GHz

Multi radio Intermodulation Emission - Frequency Set 5									
Detector	Freq. (MHz)	Meas'd Emission (dBμV)	Cable Loss (dB)	Antenna Factor (dB/m)	Pre-amp Gain (dB)	Distance Extrap'n Factor (dB)	Field Strength (dBμV/m)	Field Strength (μV/m)	Limit (μV/m)
No Multi Radio Intermodulation Emissions Detected									



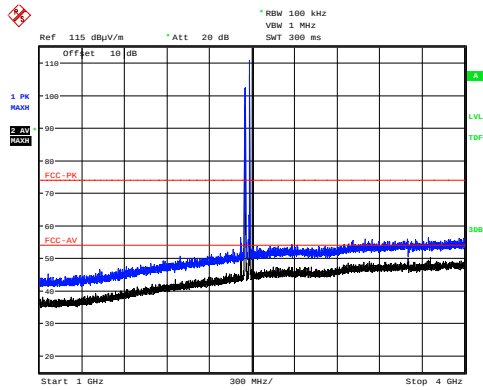
Date: 11.MAY.2016 14:50:21

30 MHz – 200 MHz



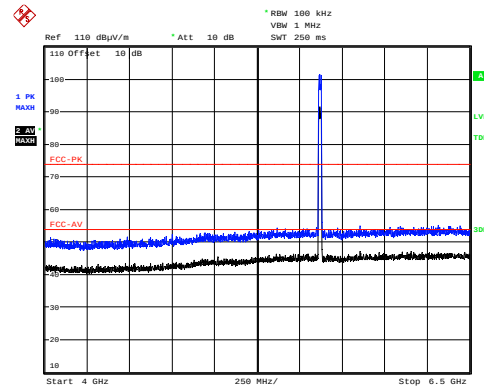
Date: 11.MAY.2016 15:12:23

200 MHz – 1 GHz



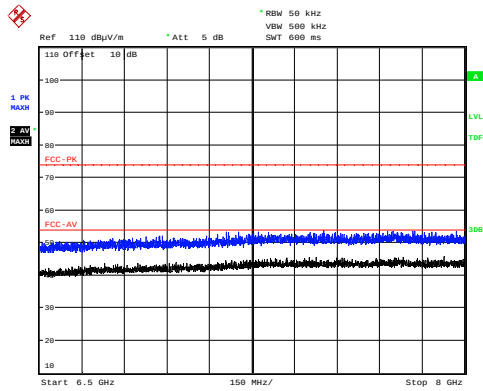
Date: 12.MAY.2016 11:21:05

1 GHz – 4 GHz



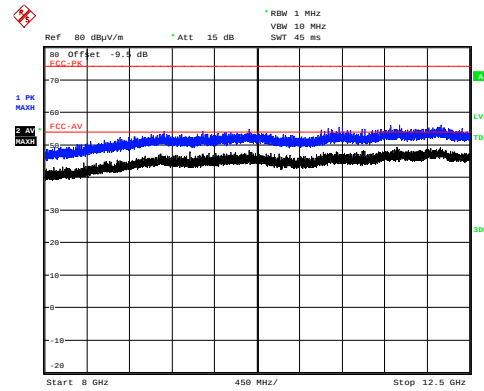
Date: 12.MAY.2016 10:00:14

4 GHz – 6.5 GHz



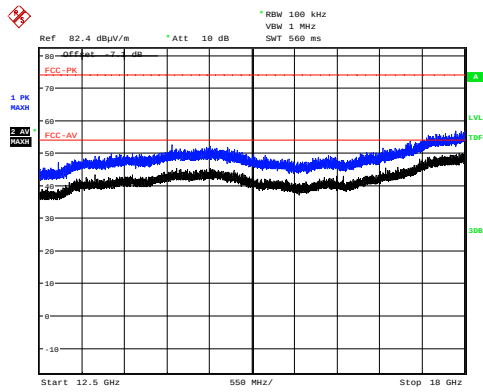
Date: 12.MAY.2016 09:54:16

6.5 GHz – 8 GHz



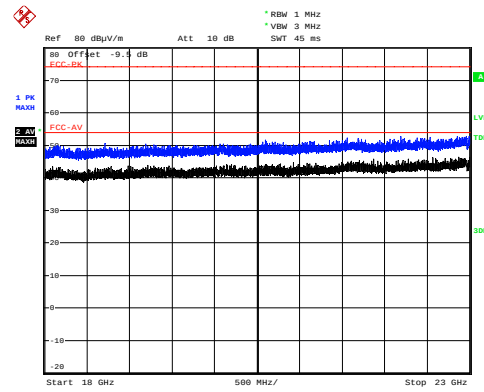
Date: 12.MAY.2016 09:37:22

8 GHz – 12.5 GHz



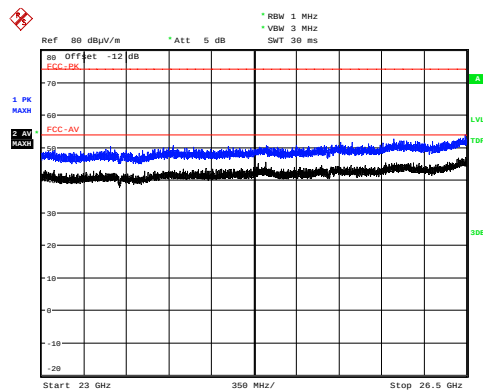
Date: 12.MAY.2016 09:30:12

12.5 GHz – 18 GHz



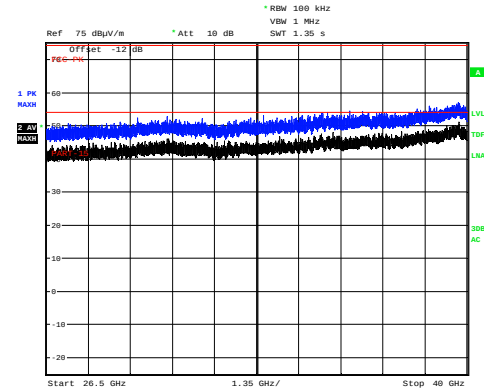
Date: 12.MAY.2016 11:53:48

18 GHz – 23 GHz



Date: 12.MAY.2016 12:19:31

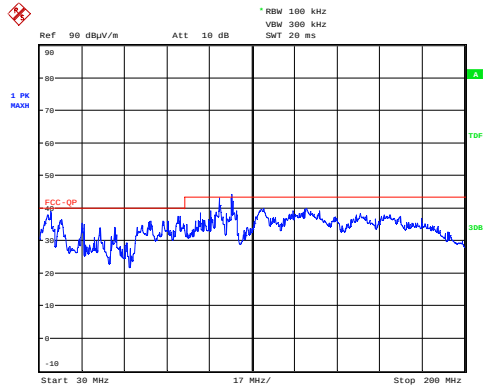
23 GHz – 26.5 GHz



Date: 26.MAY.2003 09:47:14

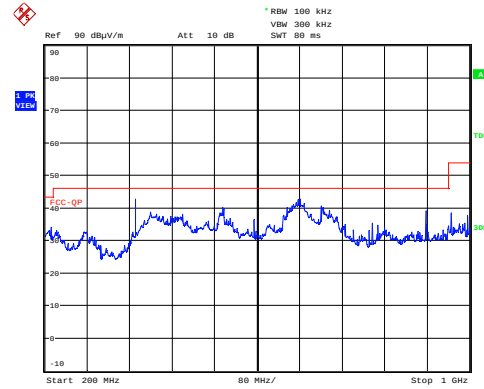
26.5 GHz – 40 GHz

Multi radio Intermodulation Emission - Frequency Set 6									
Detector	Freq. (MHz)	Meas'd Emission (dBμV)	Cable Loss (dB)	Antenna Factor (dB/m)	Pre-amp Gain (dB)	Distance Extrap'n Factor (dB)	Field Strength (dBμV/m)	Field Strength (μV/m)	Limit (μV/m)
No Multi Radio Intermodulation Emissions Detected									



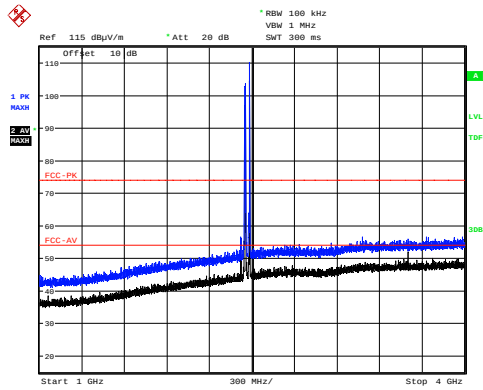
Date: 11.MAY.2016 14:52:21

30 MHz – 200 MHz



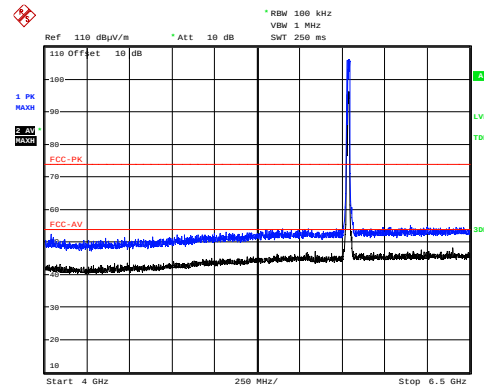
Date: 11.MAY.2016 15:06:36

200 MHz – 1 GHz



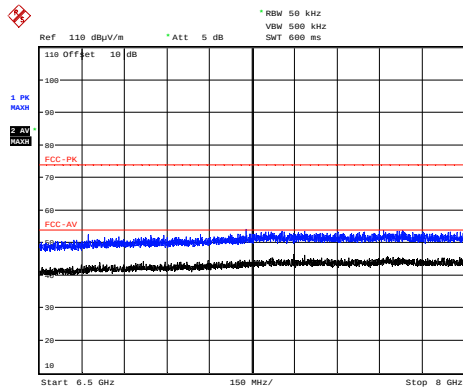
Date: 12.MAY.2016 11:18:51

1 GHz – 4 GHz



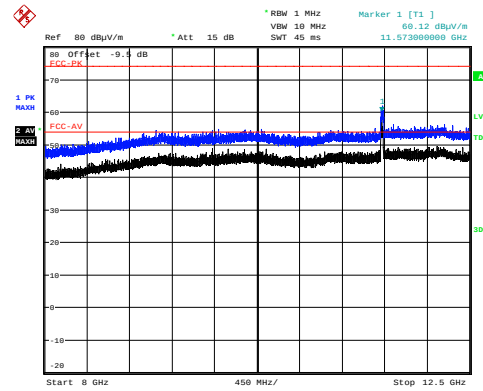
Date: 12.MAY.2016 10:02:06

4 GHz – 6.5 GHz



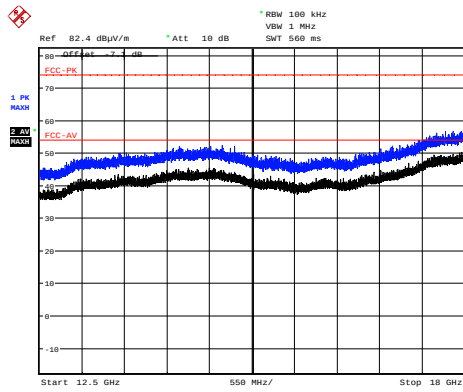
Date: 12.MAY.2016 09:52:53

6.5 GHz – 8 GHz



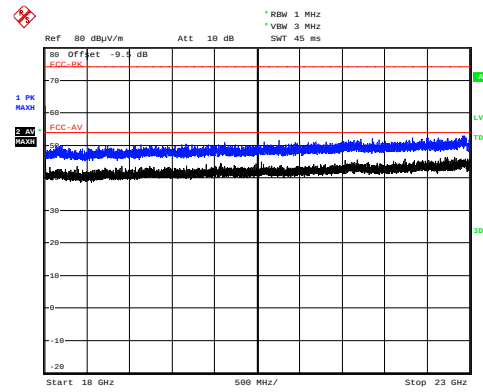
Date: 12.MAY.2016 09:40:40

8 GHz – 12.5 GHz



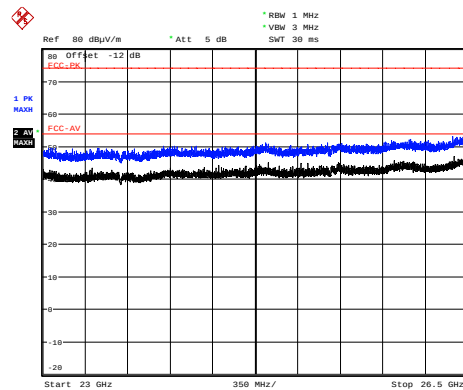
Date: 12.MAY.2016 09:28:33

12.5 GHz – 18 GHz



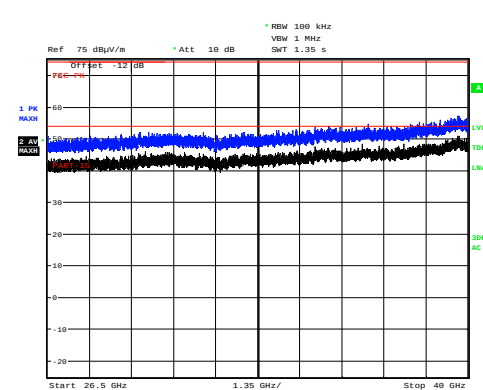
Date: 12.MAY.2016 11:52:31

18 GHz – 23 GHz



Date: 12.MAY.2016 12:17:01

23 GHz – 26.5 GHz



Date: 26.MAY.2003 09:58:43

26.5 GHz – 40 GHz

12 AC power-line conducted emissions

12.1 Definition

Line-to-ground radio-noise voltage that is conducted from all of the EUT current-carrying power input terminals that are directly (or indirectly via separate transformers or power supplies) connected to a public power network.

12.2 Test Parameters

Test Location:	Element Hull
Test Chamber:	Screen Room 1
Test Standard and Clause:	ANSI C63.10-2013, Clause 6.2
EUT Channels / Frequencies Measured:	Mid
EUT Channel Bandwidths:	Bluetooth: 1 MHz, RF4CE: 2 MHz, Wi-Fi: 20 MHz
EUT Modulation:	Bluetooth GFSK, RF4CE: OQPS, Wi-Fi 802.11n HT20
Deviations From Standard:	None
Measurement BW:	9 kHz
Measurement Detectors:	Quasi-Peak and Average, RMS

Environmental Conditions (Normal Environment)

Temperature:	23 °C	+15 °C to +35 °C (as declared)
Humidity:	35%RH	20%RH to 75%RH (as declared)
Supply:	110 Vac	110Vac +/-10% (as declared)

Test Limits

A radio apparatus that is designed to be connected to the public utility (AC) power line shall ensure that the radio frequency voltage, which is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz-30 MHz, shall not exceed the limits in Table 3.

Table 3 – AC Power Line Conducted Emission Limits

Frequency (MHz)	Conducted limit (dBµV)	
	Quasi-Peak	Average**
0.15 – 0.5	66 to 56	56 to 46
0.5 – 5.0	56	46
5.0 – 30.0	60	50

* The level decreases linearly with the logarithm of the frequency.

** A linear average detector is required.

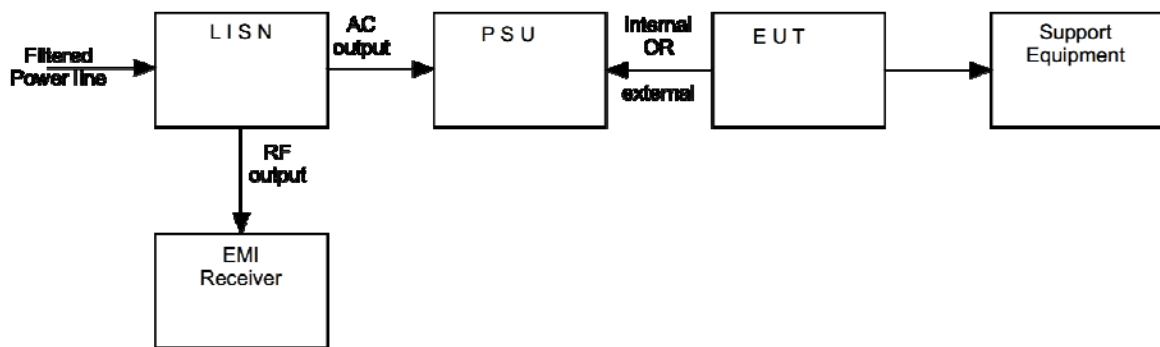
12.3 Test Method

With the EUT setup in a screened room, as per section 9 of this report and connected as per Figure ii, the power line emissions were measured on a spectrum analyzer / EMI receiver.

AC power line conducted emissions from the EUT are checked first by preview scans with peak and average detectors covering both live and neutral lines. A spectrum analyzer is used to determine if any periodic emissions are present.

Formal measurements using the correct detector(s) and bandwidth are made on frequencies identified from the preview scans. Final measurements were performed with EUT set at its maximum duty in transmit and receive modes.

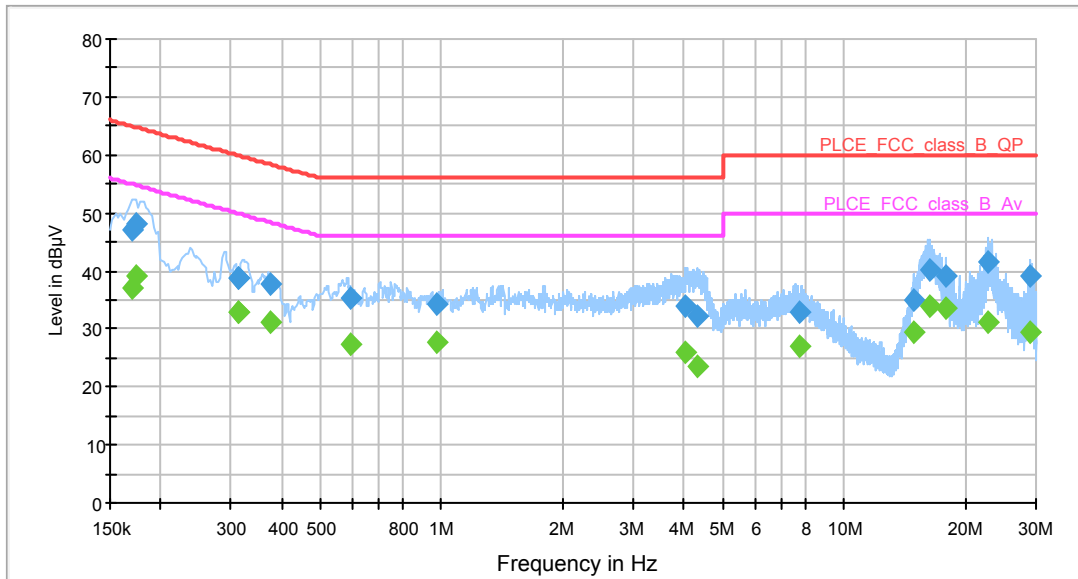
Figure ii Test Setup



12.4 Test Equipment

<i>Equipment Description</i>	<i>Manufacturer</i>	<i>Equipment Type</i>	<i>Element No</i>	<i>Last Cal Calibration</i>	<i>Calibration Period</i>	<i>Due For Calibration</i>
Pulse Limiter	R & S	ESH3-Z2	RFG680	09/06/2015	12	09/06/2016
LISN	R & S	ESH3-Z5	RFG189	08/09/2015	12	08/09/2016
Measuring Receiver	R & S	ESCI7	RFG715	06/10/2015	12	06/10/2016

12.5 Test Results



Results measured using the average detector						
Reference Number	Frequency (MHz)	Conductor	Result (dBuV)	Specification Limit (dBuV)	Margin (dB)	Result Summary
1.	0.170	L1	37.0	55.0	18.0	PASS
2.	0.175	L1	39.1	54.7	15.6	PASS
3.	0.310	L1	32.8	50.0	17.2	PASS
4.	0.311	L1	32.9	49.9	17.1	PASS
5.	0.374	L1	31.1	48.4	17.3	PASS
6.	0.591	L1	27.4	46.0	18.6	PASS
7.	0.977	L1	27.9	46.0	18.1	PASS
8.	16.390	N	33.9	50.0	16.1	PASS
9.	18.001	N	33.6	50.0	16.4	PASS
10.	22.698	N	31.2	50.0	18.8	PASS
Results measured using the quasi-peak detector						
Reference Number	Frequency (MHz)	Conductor	Result (dBuV)	Specification Limit (dBuV)	Margin (dB)	Result Summary
11.	0.170	L1	47.2	65.0	17.8	PASS
12.	0.1750	L1	48.3	64.7	16.4	PASS
13.	16.390	N	40.2	60.0	19.8	PASS
14.	22.698	N	41.5	60.0	18.5	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 (30MHz – 1GHz) = **4.6dB**,

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

[2] AC power line conducted emissions

Uncertainty in test result = **3.4dB**

[3] Occupied bandwidth

Uncertainty in test result = **15.5%**

[4] Conducted carrier power

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

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

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

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

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

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

[6] Power spectral density

Uncertainty in test result (Spectrum Analyser) = **2.48dB**