




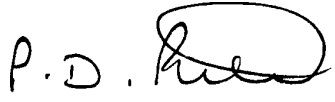


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Test Report for e7, e7D Marine Multifunction Displays

To 47 CFR Part 15 Subpart C – Spurious Emissions

Model Number	E62354, E62355		
Product Description	e7, e7D Marine Multifunction Displays		
Report Number	TP/802/1056		
Report Author Mike Thompson Paul Pitt EMC Engineers		Date	30/09/2011
			14/10/2011
Technical Check Andrew Sartin EMC Test Engineer		Date	17/10/2011
Approval Andrew Little Compliance Manager		Date	17/10/2011

Test Date Range	09/08/2011 to 10/10/2011
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Product Status	PASS
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The test data and results contained within this report relate only to the items tested.

1 47 CFR Part 15 Test Summary

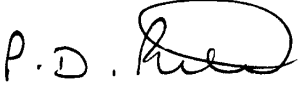

15.209(a) Radiated Emissions	Pass
15.247(d) Spurious Emissions	Pass

2 Attestations

This equipment has been tested in accordance with the standards identified in this report. To the best of *our* knowledge and belief, these tests were performed using the measurement procedures described in these reports.

All measuring instruments used to determine the status of the product's compliance to the identified standards are calibrated regularly in accordance with UKAS requirements.

A comprehensive system of traceable calibration in accordance with ISO9001 is maintained.

Name/Position	Signature	Date
Paul Pitt EMC Engineer		14/10/2011
Mike Thompson EMC Engineer		30/09/2011

I attest that the necessary measurements were made, under my supervision at:

Raymarine UK Ltd, Marine House, 5 Harbourgate, Southampton Road,
Portsmouth, PO6 4BQ.



Andy Little
Compliance Manager

Date: 10th October 2011

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3 Test Information

3.1 Test Facilities

Site 1	9m x 6m x 5.5m Semi Anechoic Chamber	FCC ID IC Certification	183727 4069B-1
Site 2	8m x 4m x 4m Fully Anechoic, Free Space Chamber		
Site 3	9m x 6m x 5.5m Semi Anechoic Chamber	FCC ID IC Certification	183727 4069B-2
Site 4	6m x 3m x 2.5m Screened Room	GND reference plane GND reference plane	1.15 x 2.5m 1 x 2.5m
Site 5	4m x 3m x 2.5m Screened Room		
Site 6	3m x 2m x 2.5m Screened Room		
Site 7	3m x 2m x 2.5m Screened Room		
Site 8	4m x 3m x 2.5 Screened Room	GND reference plane	1.25 x 2.5m
Site 9	6m x 3m x 2.5 Screened Room	GND reference plane GND reference plane	1.25 x 2.5m 1.25 x 2.5m
Site 10	6.5m x 4m x 2.7m Room	GND reference plane GND reference plane	5 x 2m 2 x 1m

3.2 Overall Test Conditions

Work Area	Relative Humidity (%)	Air Pressure (mbar)	Ambient Temperature (°C)
Site 1-5	60-65	1003-1005	18.5-19.6
Sites 6-10	59-65	1013-1015	21.2-22.0

3.3 Test Methods

The objective of the report is to perform testing according to 47 CFR Part 15 Subpart C paragraph 15.247(d) (Bluetooth and WIFI, 2.4GHz ISM band radiators) for the EUT FCC ID Certification:

Number	Standard Number	Document Title
1	47 CFR Part 15 (10-01-09 Edition)	Radio Frequency Devices

3.3.1 Deviations from Test Methods

None

4 EUT Information

4.1 Test Rationale

Tested to ensure compliance to FCC Chapter 47, part 15: 15.209(a) Radiated Emissions 15.247(d) Spurious Emissions

4.2 Description of Equipment under Test (EUT)

Date of Receipt:	1-8-11(0710004) 29/09/2011(0910030)
Client:	Steven Grant – e7 Technical team leader
Brand Name:	Raymarine
Product Range:	Multifunction Display with Sonar
Country of Manufacture:	China
Operational voltage range:	10.8V to 18.0V

Unit 1

Model Name or Number:	e7D - E62355
Unique Type Identification:	n/a
Serial Number:	0910030 – Tested to 15.209 (a)
CCT Diagram Number(s) & Issue:	Main 4802-002 Issue 8 Sonar IO 4802-007 Issue 4 GPS 1000415 Issue 1 Keyboard 4802-021 Issue 3 Chart Reader 4802-018 Issue 2
PCB Assembly Number(s) & Issue:	Main 4802-009 Issue 7 Sonar IO 4802-007 Issue 4 GPS 1000416 Issue 1 Keyboard 4802-022 Issue 3 Chart Reader 4802-019 Issue 2
Software Version:	Platform 0.25 Application 0.25
Modifications to Unit:	0910030 – None. ESO build standard

Unit 2

Model Name or Number:	e7D - E62355
Unique Type Identification:	n/a
Serial Number:	0710004 – Tested to 15.247 (d)
CCT Diagram Number(s) & Issue:	<p><u>Chartplotter Only Variant</u> CPU 4802-003 Issue 8 Sonar IO 4802-008 Issue 4 GPS 1000415 Issue 1 Keyboard 4802-021 Issue 3 Chart Reader 4802-018 Issue 2</p> <p><u>Chartplotter + Sonar Variant</u> Main 4802-002 Issue 8 Sonar IO 4802-007 Issue 4 GPS 1000415 Issue 1 Keyboard 4802-021 Issue 3 Chart Reader 4802-018 Issue 2</p>
PCB Assembly Number(s) & Issue:	<p><u>Chartplotter Only Variant</u> CPU 4802-010 Issue 7 Sonar IO 4802-005 Issue 3 GPS 1000416 Issue 1 Keyboard 4802-022 Issue 3 Chart Reader 4802-019 Issue 2</p> <p><u>Chartplotter + Sonar Variant</u> Main 4802-009 Issue 7 Sonar IO 4802-007 Issue 4 GPS 1000416 Issue 1 Keyboard 4802-022 Issue 3 Chart Reader 4802-019 Issue 2</p>
Software Version:	Platform 0.25 Application 0.25
Modifications to Unit:	0710004 – TLA2 build modified to TLA3

4.3 Additional information

<p>This test report is also applicable to E62354 e7 Multifunction Display</p>

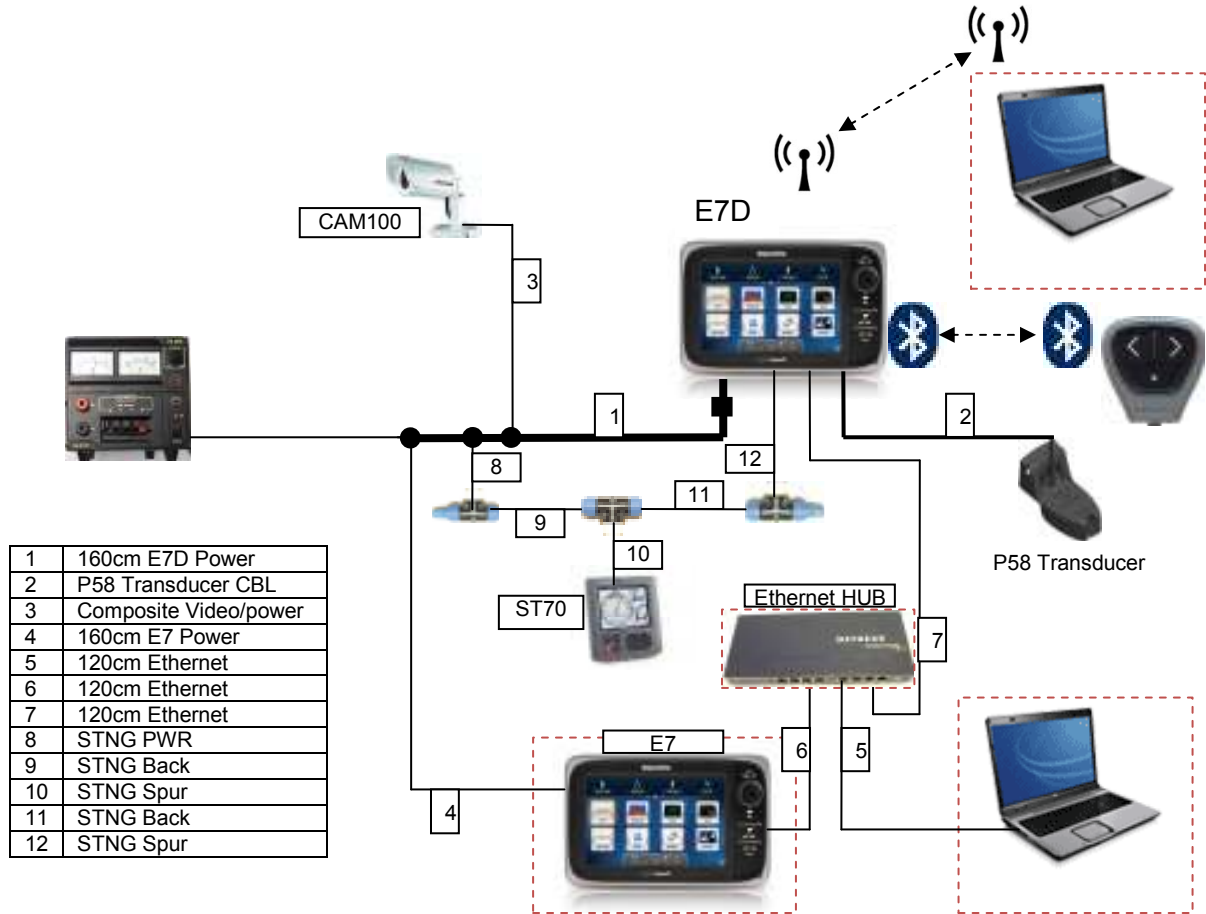
4.4 0910030 Description of Auxiliary Equipment

Product Type	Part Number	Serial Number
CAM100	E03006	EMC111004
ST70	E22105	1270965
Transducer	P58	n/a
RCU-3	E62351	EMC111004b
E7 Aux Display	E62355	0810019
Ethernet Switch	FS108	FS17144CB079343
Compaq Laptop	NC6220	RM0048
HP Compaq Laptop	6910p	CND83025V6

4.5 0710004 Description of Auxiliary Equipment

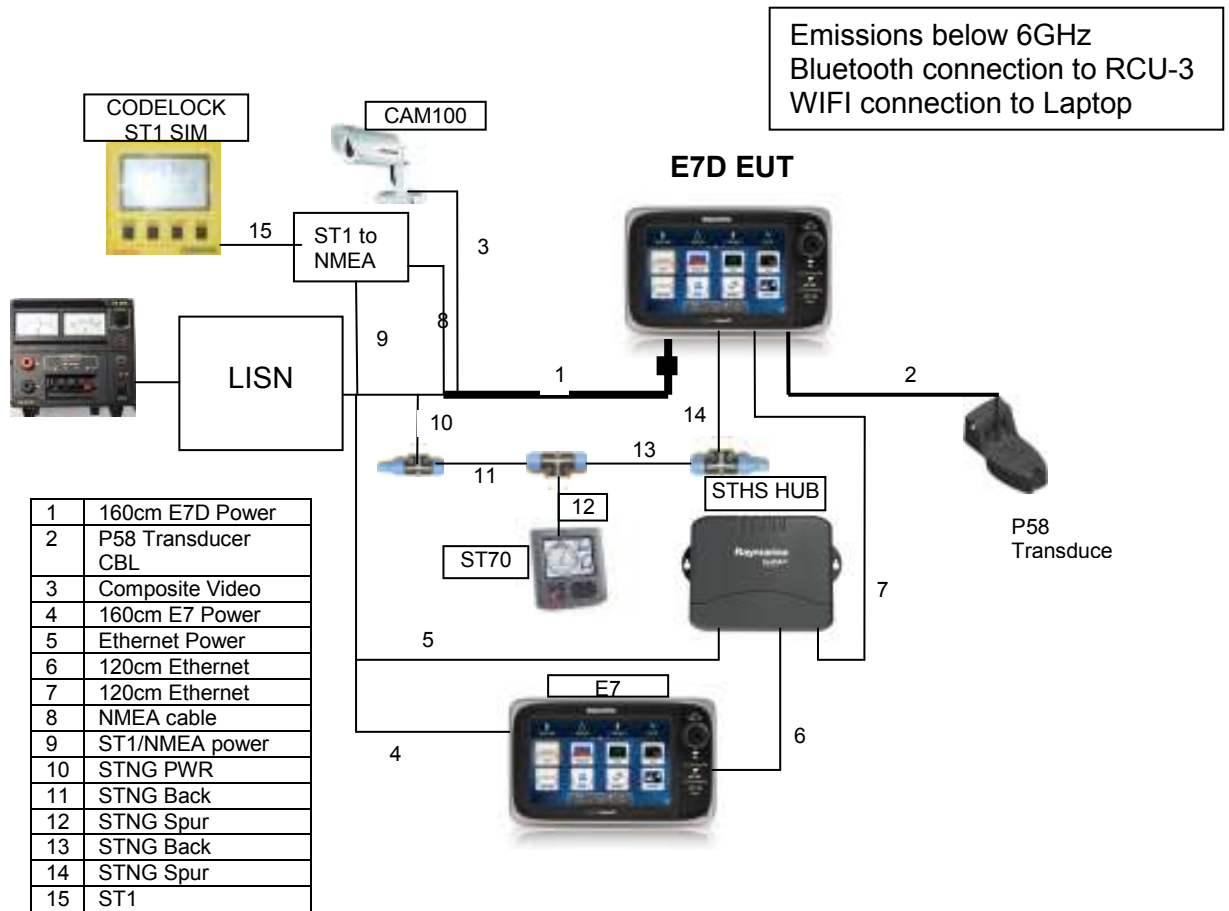
Product Type	Part Number	Serial Number
ST1 Simulator	Codelock	EMC170306d
CAM100	E03006	EMC111004
ST1 to NMEA Converter	E85001	EMC111004a
ST70	E22105	1270965
Transducer	P58	n/a
STHS Switch	E55058	0570950
Compaq Laptop	NC6220	RM0048
RCU-3	E62351	EMC111004b
E7 Aux Display	E62355	0810019

4.6 Test Configurations
0910030 – Tested to 15.209 setup



The equipment highlighted in red was placed in the chamber control room and powered separately. Connection to the Ethernet hub was made via a 20m cable. Wireless connection was realised by the use of hard-wired 2.4GHz antenna terminated through the chamber waveguide.

0710004 – Tested to 15.247



4.7 Emissions – Below 6GHz

Below 6GHz the unit was setup in a system to ensure the EUT was fully functional. The Bluetooth and WIFI were functional during testing.

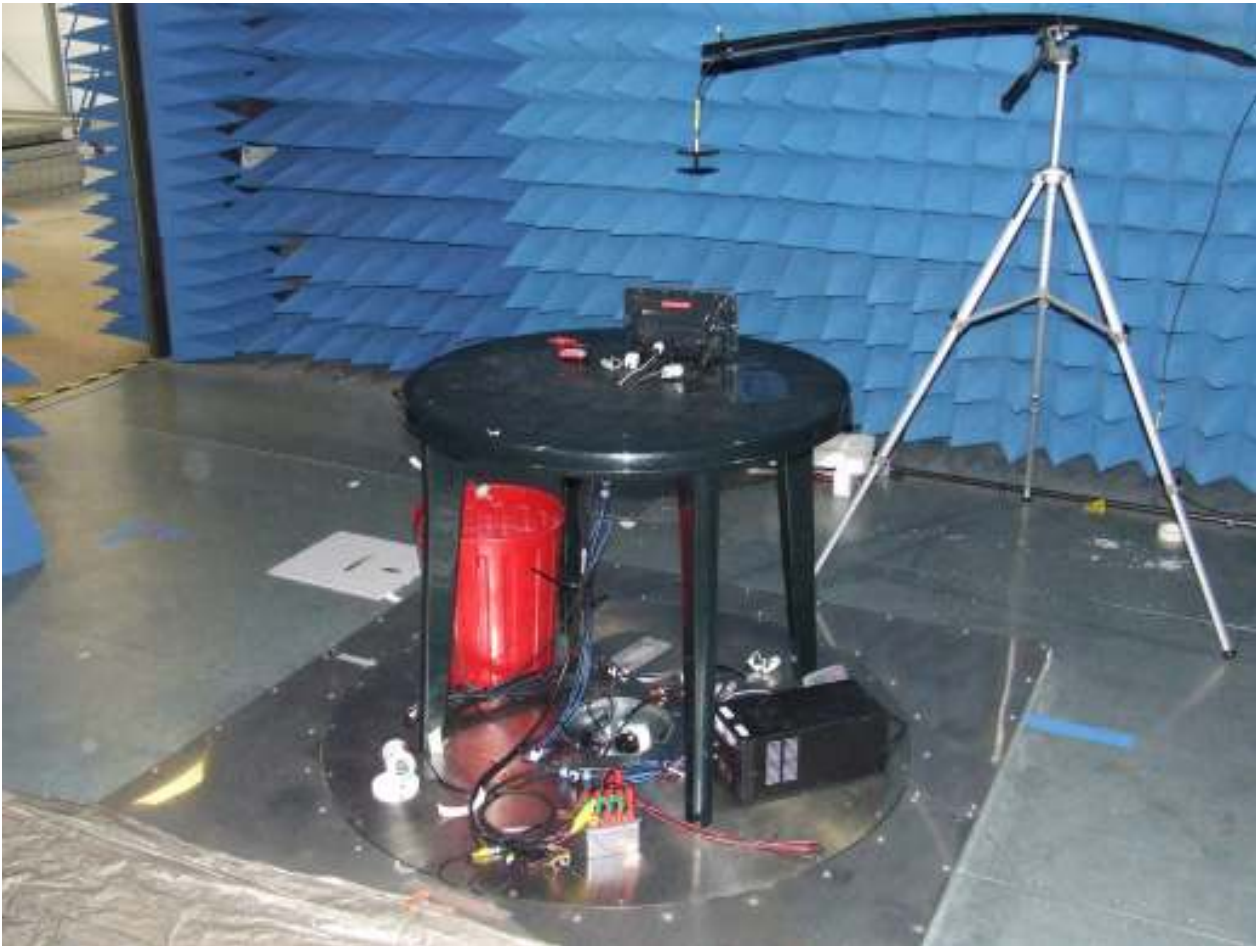
4.8 Transmitter Spurious Emissions – 1GHz to 26GHz

1GHz to 26GHz the unit was setup in a system to ensure the EUT was fully functional. Control of the WIFI and Bluetooth was controlled externally to enable the WIFI and Bluetooth Emissions to be measured separately.

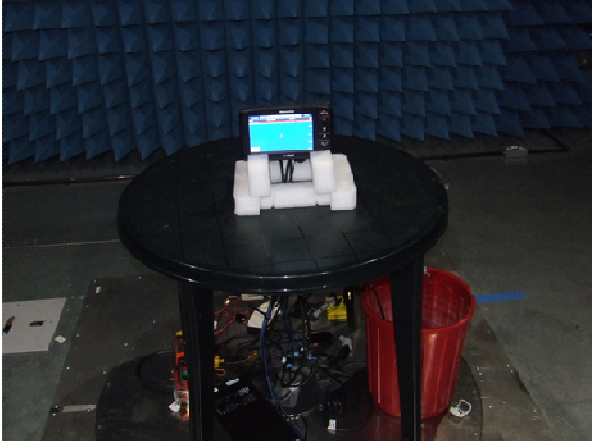
5 Photographs

5.1.1 Radiated Emissions

15.209 setup

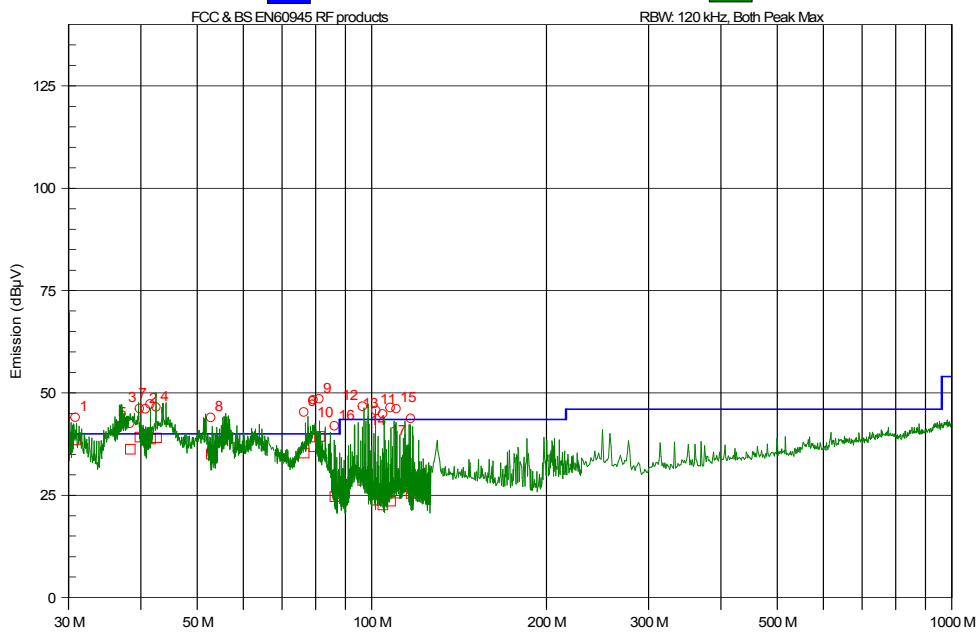


15.247 setup



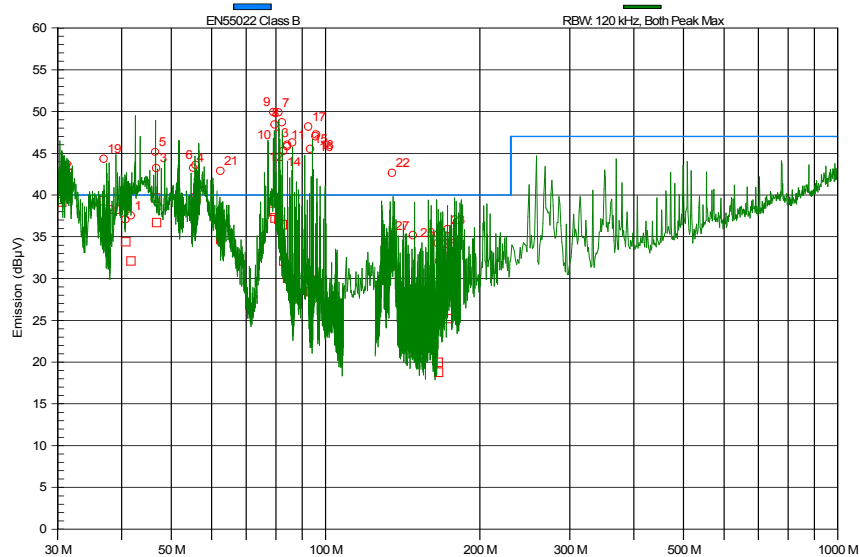
6 Emissions Results

6.1 FCC Part 15, Chapter 47_15.209 Radiated Emissions –30MHz to 1GHz EUT operating at 50kHz single Frequency



	Frequency (MHz)	PK Value (dBµV)	QP Value (dBµV)	QP Limit (dBµV)	QP Margin (dB)	QP Result	Angle (degrees)	Height (m)	H/V
1	30.858 MHz	43.91 dBµV	38.5 dBµV	40 dBµV	-1.5 dB	Pass	180 Degree	100 cm	Vertical
2	40.729 MHz	45.97 dBµV	38.56 dBµV	40 dBµV	-1.44 dB	Pass	90 Degree	100 cm	Vertical
3	39.84 MHz	46.08 dBµV	39.24 dBµV	40 dBµV	-0.76 dB	Pass	180 Degree	100 cm	Vertical
4	42.532 MHz	46.44 dBµV	39 dBµV	40 dBµV	-1 dB	Pass	180 Degree	100 cm	Vertical
5	38.333 MHz	42.51 dBµV	36.21 dBµV	40 dBµV	-3.79 dB	Pass	270 Degree	100 cm	Vertical
6	76.481 MHz	45.23 dBµV	35.27 dBµV	40 dBµV	-4.73 dB	Pass	0 Degree	100 cm	Vertical
7	41.538 MHz	47.13 dBµV	38.74 dBµV	40 dBµV	-1.26 dB	Pass	0 Degree	100 cm	Vertical
8	52.856 MHz	43.88 dBµV	35.02 dBµV	40 dBµV	-4.98 dB	Pass	180 Degree	100 cm	Vertical
9	81.181 MHz	48.45 dBµV	39.34 dBµV	40 dBµV	-0.66 dB	Pass	0 Degree	100 cm	Vertical
10	79.372 MHz	48.22 dBµV	36.9 dBµV	40 dBµV	-3.1 dB	Pass	90 Degree	100 cm	Vertical
11	101.731 MHz	45.61 dBµV	23.82 dBµV	43.5 dBµV	-19.68 dB	Pass	180 Degree	100 cm	Vertical
12	96.474 MHz	46.6 dBµV	28.65 dBµV	43.5 dBµV	-14.85 dB	Pass	180 Degree	100 cm	Vertical
13	104.535 MHz	44.76 dBµV	22.67 dBµV	43.5 dBµV	-20.83 dB	Pass	180 Degree	100 cm	Vertical
14	107.699 MHz	46.31 dBµV	23.59 dBµV	43.5 dBµV	-19.91 dB	Pass	180 Degree	100 cm	Vertical
15	110.288 MHz	46.03 dBµV	25.54 dBµV	43.5 dBµV	-17.96 dB	Pass	180 Degree	100 cm	Vertical
16	86.282 MHz	41.84 dBµV	24.66 dBµV	40 dBµV	-15.34 dB	Pass	90 Degree	100 cm	Vertical
17	116.859 MHz	43.65 dBµV	25.47 dBµV	43.5 dBµV	-18.03 dB	Pass	180 Degree	100 cm	Vertical

6.2 FCC Part 15, Chapter 47_15.209 Radiated Emissions –30MHz to 1GHz EUT operating at 200kHz single Frequency



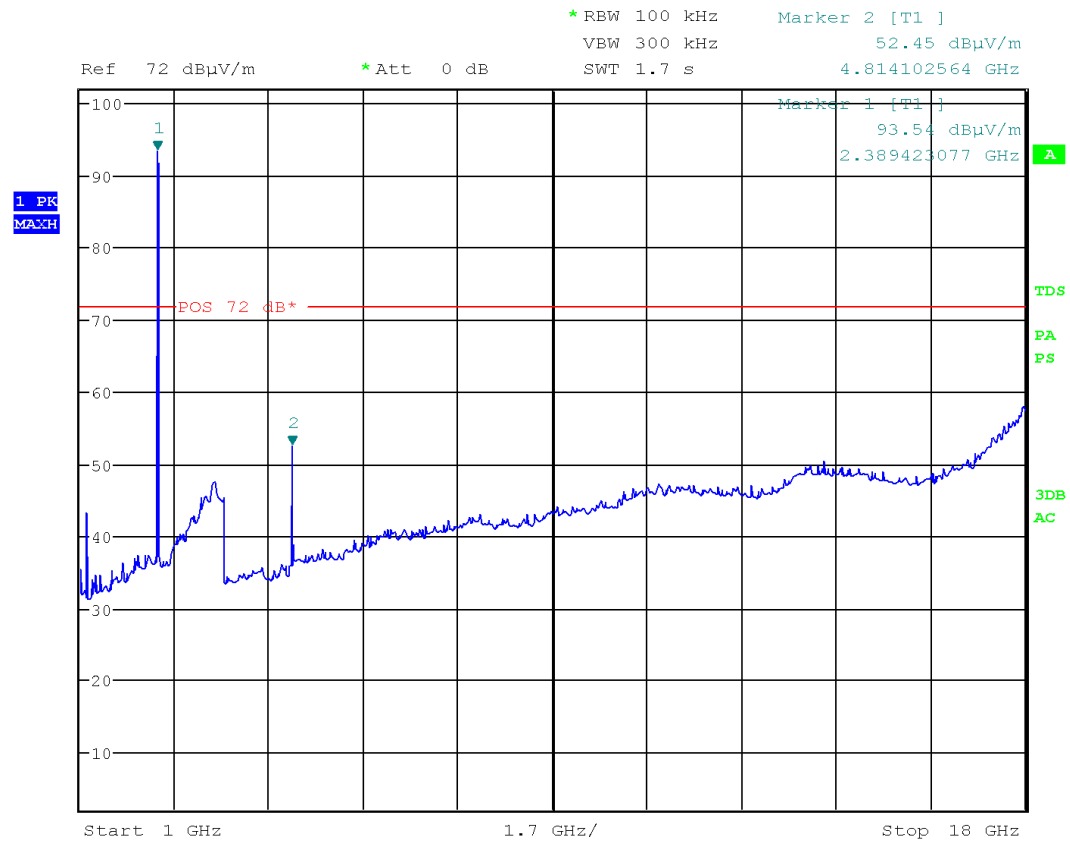
	Frequency (MHz)	PK Value (dBµV)	QP Value (dBµV)	QP Limit (dBµV)	QP Margin (dB)	QP Result	Angle (degrees)	Height (m)	H/V
1	41.751 MHz	37.5 dBµV	32.1 dBµV	40 dBµV	-7.9 dB	Pass	120 Degree	100 cm	Vertical
2	30.557 MHz	42.27 dBµV	39.18 dBµV	40 dBµV	-0.82 dB	Pass	97 Degree	100 cm	Vertical
3	46.79 MHz	43.19 dBµV	36.7 dBµV	40 dBµV	-3.3 dB	Pass	165 Degree	100 cm	Vertical
4	55.301 MHz	43.23 dBµV	39.39 dBµV	40 dBµV	-0.61 dB	Pass	15 Degree	100 cm	Vertical
5	46.571 MHz	45.12 dBµV	39.66 dBµV	40 dBµV	-0.34 dB	Pass	112 Degree	100 cm	Vertical
6	55.841 MHz	43.56 dBµV	39.65 dBµV	40 dBµV	-0.35 dB	Pass	247 Degree	100 cm	Vertical
7	81.121 MHz	49.85 dBµV	37.09 dBµV	40 dBµV	-2.91 dB	Pass	22 Degree	100 cm	Vertical
8	82.404 MHz	48.66 dBµV	36.46 dBµV	40 dBµV	-3.54 dB	Pass	75 Degree	100 cm	Vertical
9	79.289 MHz	49.9 dBµV	38.06 dBµV	40 dBµV	-1.94 dB	Pass	105 Degree	1.5 m	Vertical
10	79.726 MHz	48.41 dBµV	37.26 dBµV	40 dBµV	-2.74 dB	Pass	270 Degree	100 cm	Vertical
11	84.327 MHz	46 dBµV	30.6 dBµV	40 dBµV	-9.4 dB	Pass	67 Degree	100 cm	Vertical
12	84.263 MHz	45.77 dBµV	30.07 dBµV	40 dBµV	-9.93 dB	Pass	157 Degree	100 cm	Vertical
13	86.288 MHz	46.24 dBµV	28.99 dBµV	40 dBµV	-11.01 dB	Pass	180 Degree	1.5 m	Vertical
14	82.917 MHz	45.23 dBµV	32.1 dBµV	40 dBµV	-7.9 dB	Pass	270 Degree	100 cm	Vertical
15	93.494 MHz	45.47 dBµV	28.43 dBµV	40 dBµV	-11.57 dB	Pass	0 Degree	100 cm	Vertical
16	95.756 MHz	46.99 dBµV	29.19 dBµV	40 dBµV	-10.81 dB	Pass	180 Degree	100 cm	Vertical
17	92.724 MHz	48.15 dBµV	30.2 dBµV	40 dBµV	-9.8 dB	Pass	195 Degree	1.5 m	Vertical
18	96.026 MHz	47.22 dBµV	29.8 dBµV	40 dBµV	-10.2 dB	Pass	157 Degree	100 cm	Vertical
19	36.995 MHz	44.3 dBµV	39.3 dBµV	40 dBµV	-0.7 dB	Pass	15 Degree	100 cm	Vertical
20	40.718 MHz	37.04 dBµV	34.42 dBµV	40 dBµV	-5.58 dB	Pass	142 Degree	100 cm	Vertical
21	62.436 MHz	42.85 dBµV	34.68 dBµV	40 dBµV	-5.32 dB	Pass	22 Degree	100 cm	Vertical
22	135.128 MHz	42.61 dBµV	31.58 dBµV	40 dBµV	-8.42 dB	Pass	180 Degree	100 cm	Vertical
23	173.269 MHz	35.86 dBµV	25.21 dBµV	40 dBµV	-14.79 dB	Pass	247 Degree	100 cm	Vertical
24	166.859 MHz	32.05 dBµV	26.95 dBµV	40 dBµV	-13.05 dB	Pass	270 Degree	100 cm	Vertical
25	165.897 MHz	34.22 dBµV	19.99 dBµV	40 dBµV	-20.01 dB	Pass	165 Degree	100 cm	Vertical
26	166.218 MHz	35.29 dBµV	18.79 dBµV	40 dBµV	-21.21 dB	Pass	195 Degree	1.5 m	Vertical
27	148.269 MHz	35.15 dBµV	21.72 dBµV	40 dBµV	-18.28 dB	Pass	180 Degree	100 cm	Vertical

*The following margins and hence pass status were only achievable with the application of a Würth 74271131 ferrite or utilising the TDK ZCAT2436-1330 ferrite fitted to the e7D power cable and looping the transducer cable through once.

6.3 FCC Part 15, Chapter 47_15.247 Spurious Emissions –1GHz to 26GHz

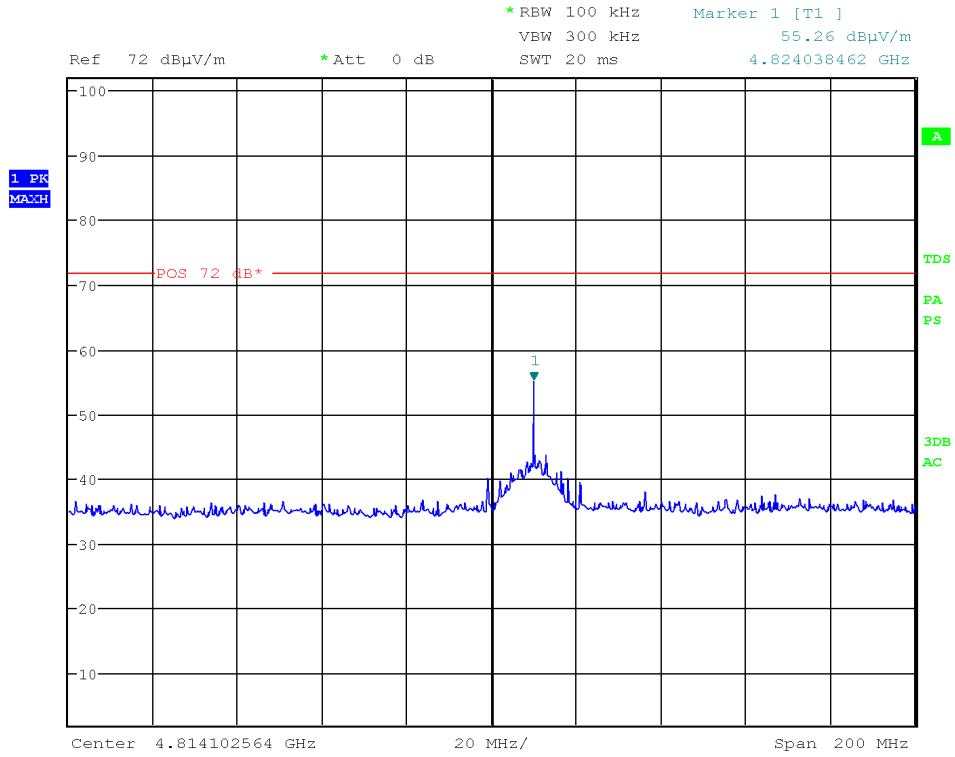
The following plots illustrate the radiated emissions of the EUT from 1GHz to 26GHz. The limits for emissions in this band is 20dBc and 500µV/m. Any emissions more than 10dB of this limit are not recorded, however all emissions were more than 10dB below this limit.

6.3.1 WIFI Emissions

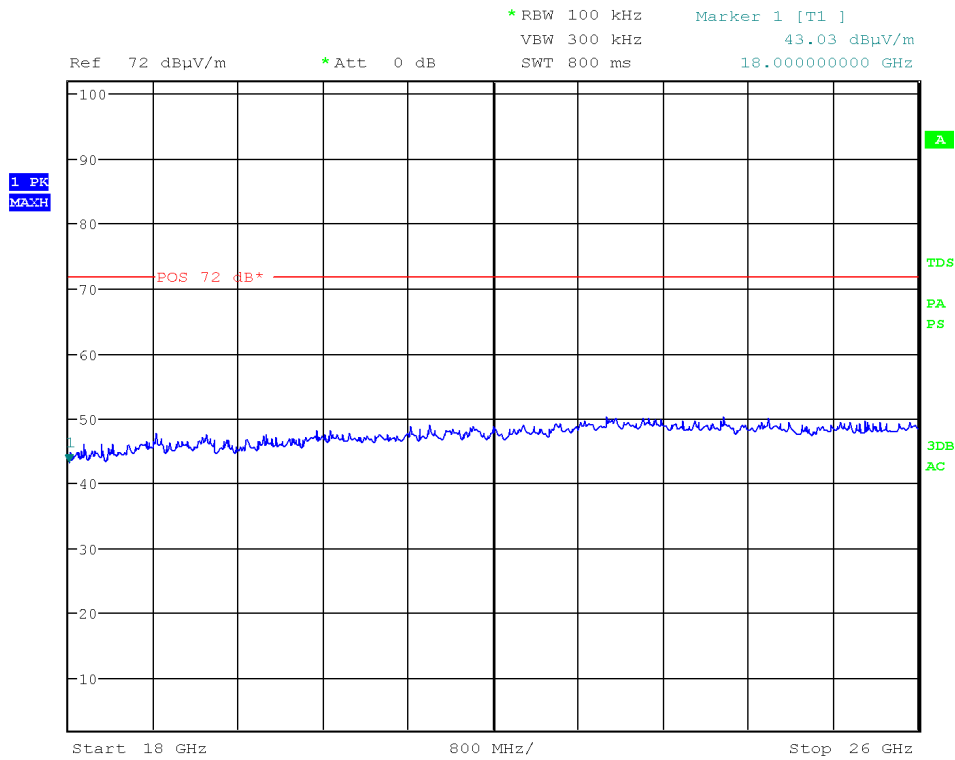


Date: 15.AUG.2011 12:11:43

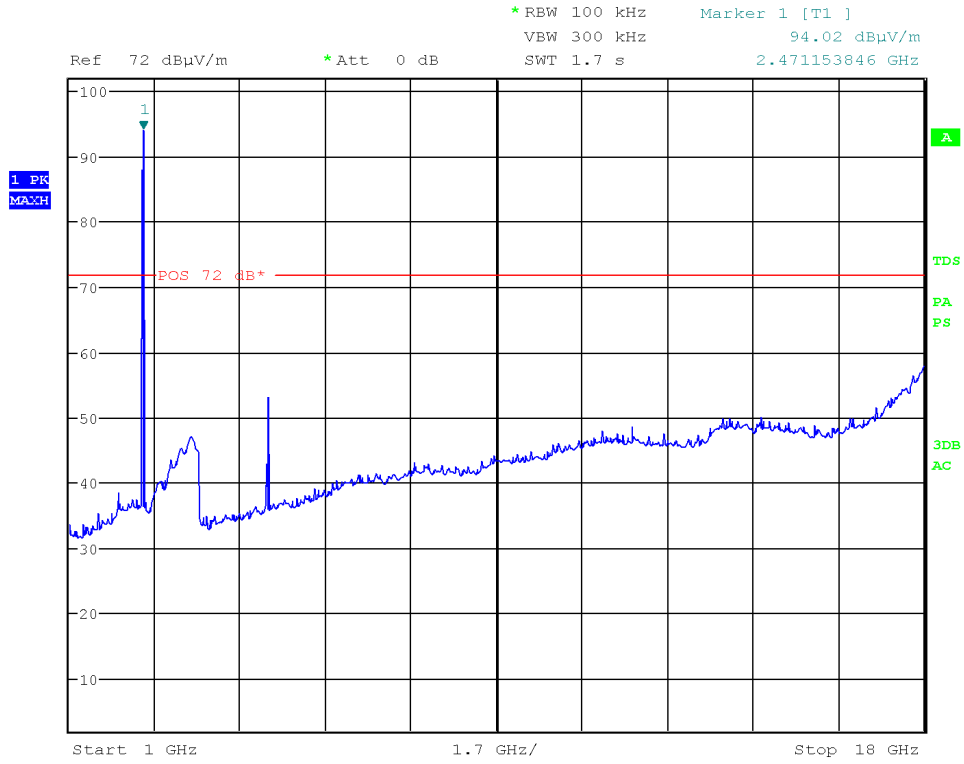
11Mbps 802.11b DSSS 20dBm nominal Channel 1 (1GHz to 18GHz)



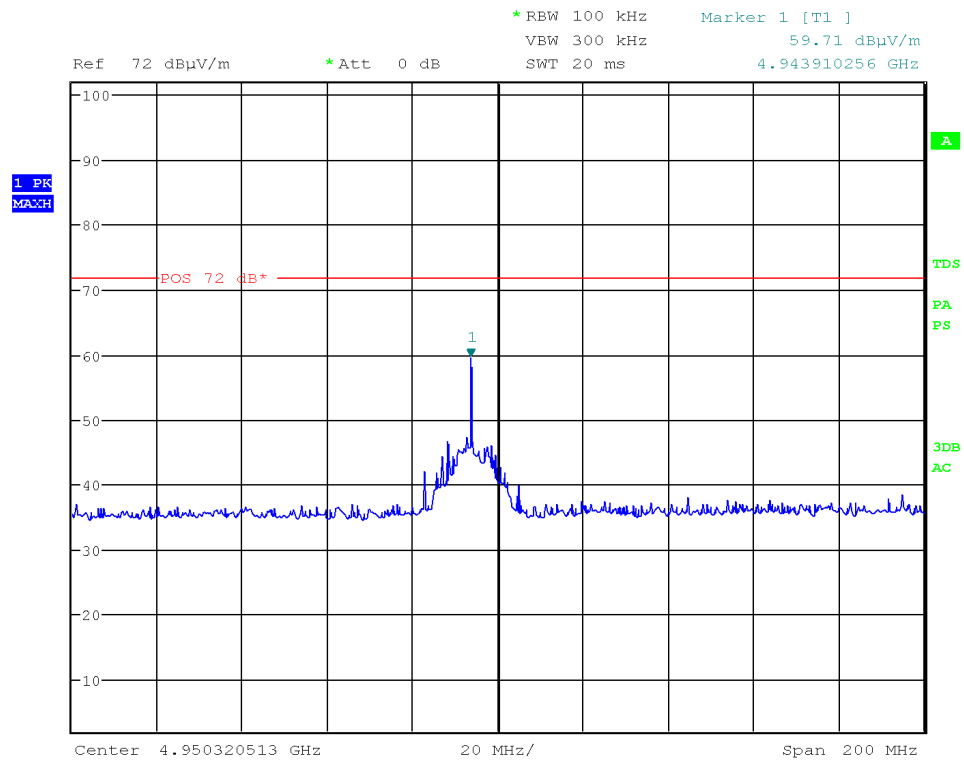
11Mbps 802.11b DSSS 20dBm nominal Channel 1 (4.8GHz span 200MHz)



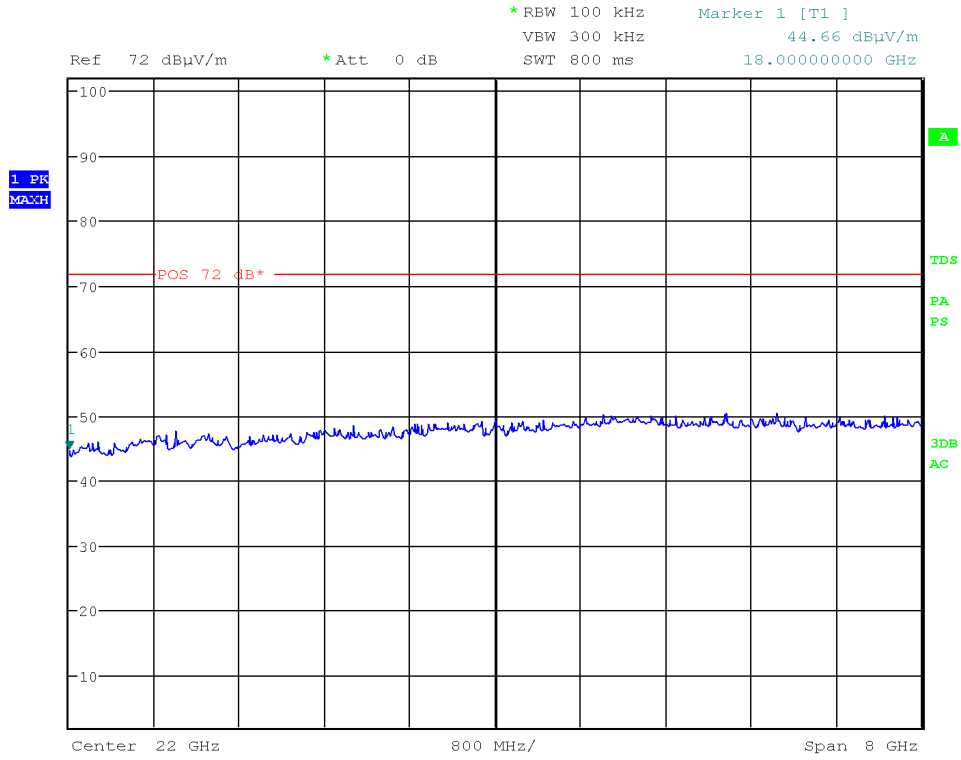
11Mbps 802.11b DSSS 20dBm nominal Channel 1 (18GHz to 26GHz)



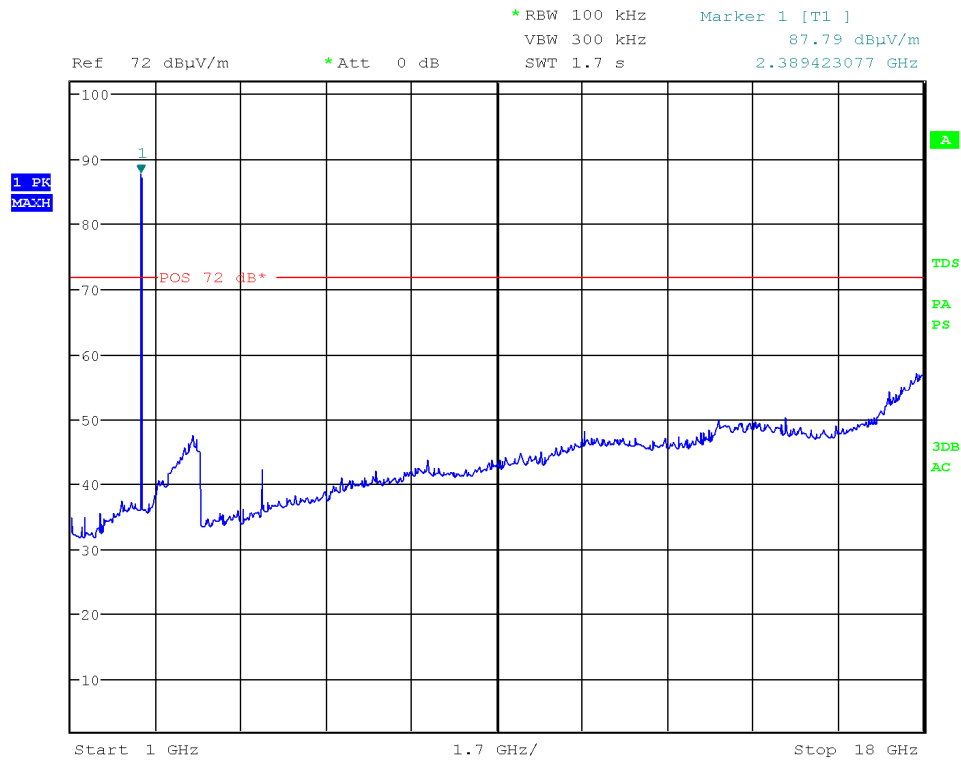
11Mbps 802.11b DSSS 20dBm nominal Channel 13 (1GHz to 18GHz)



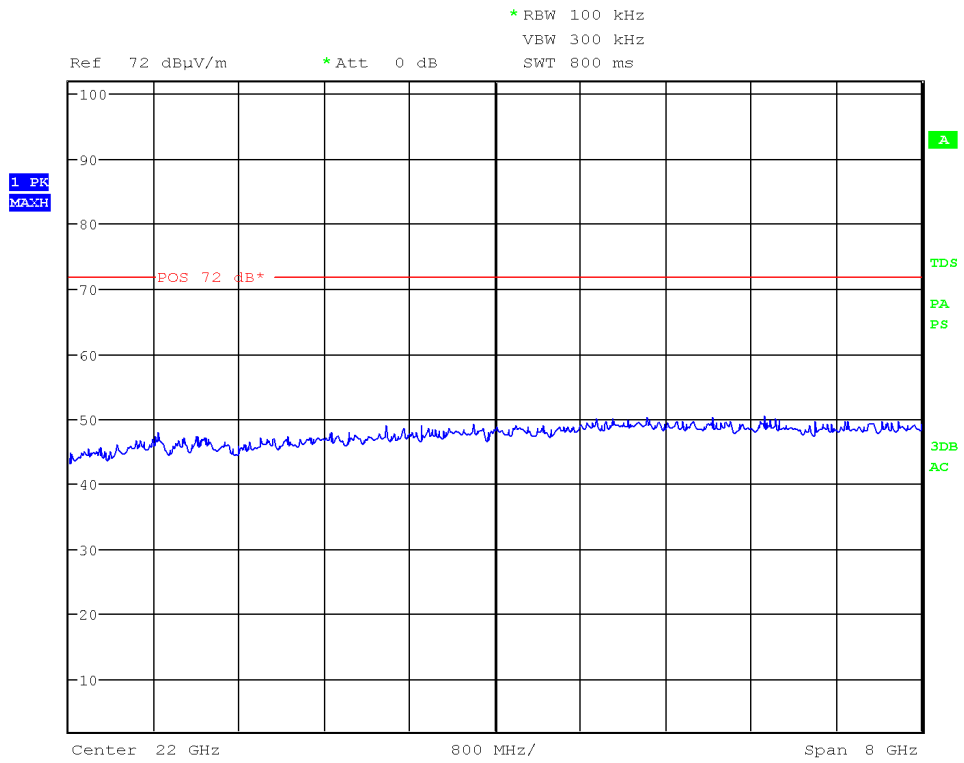
11Mbps 802.11b DSSS 20dBm nominal Channel 13 (4.9GHz span 200MHz)



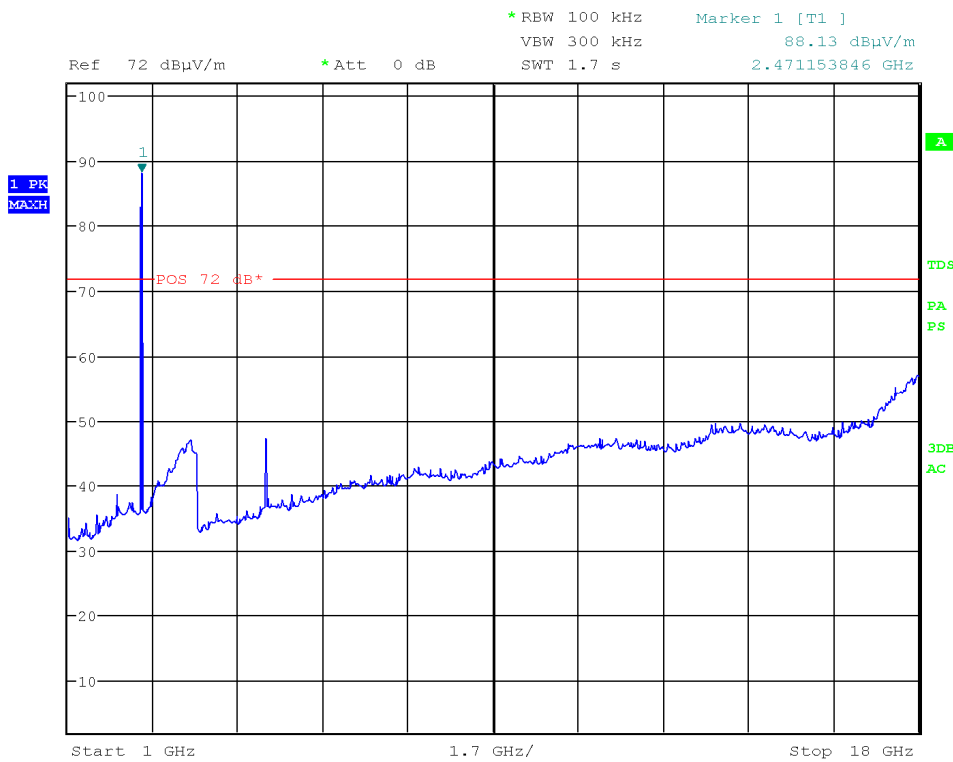
11Mbps 802.11b DSSS 20dBm nominal Channel 13 (18GHz to 26GHz)



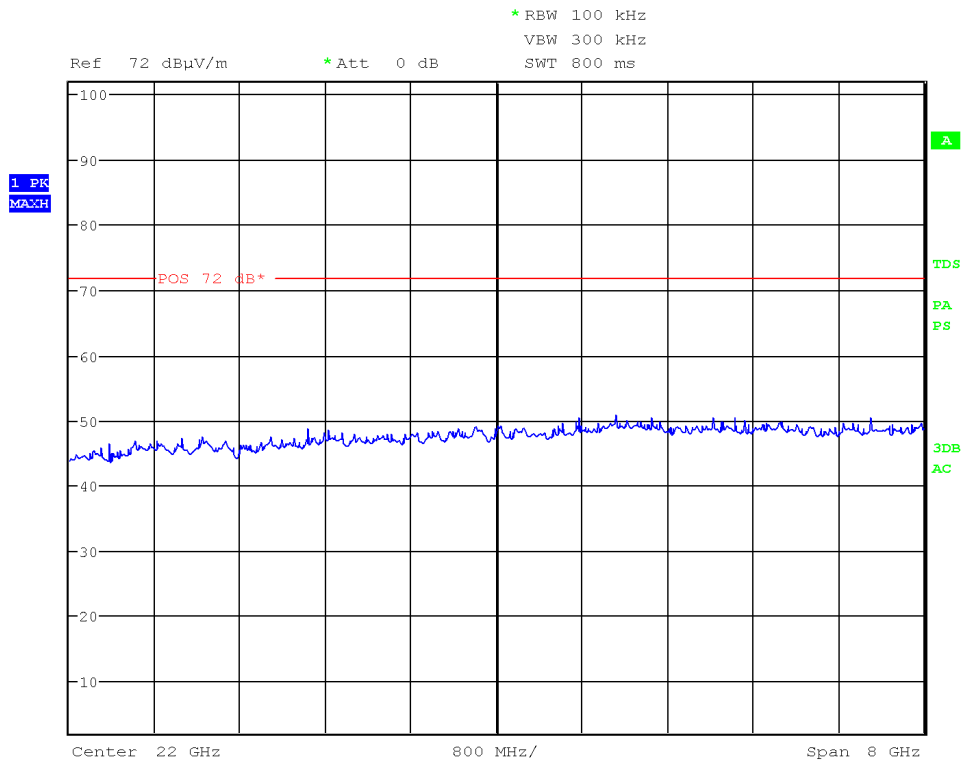
54Mbps 802.11g OFDM 14.5dBm nominal Channel 1 (1GHz to 18GHz)



54Mbps 802.11g OFDM 14.5dBm nominal Channel 1 (18GHz to 26GHz)

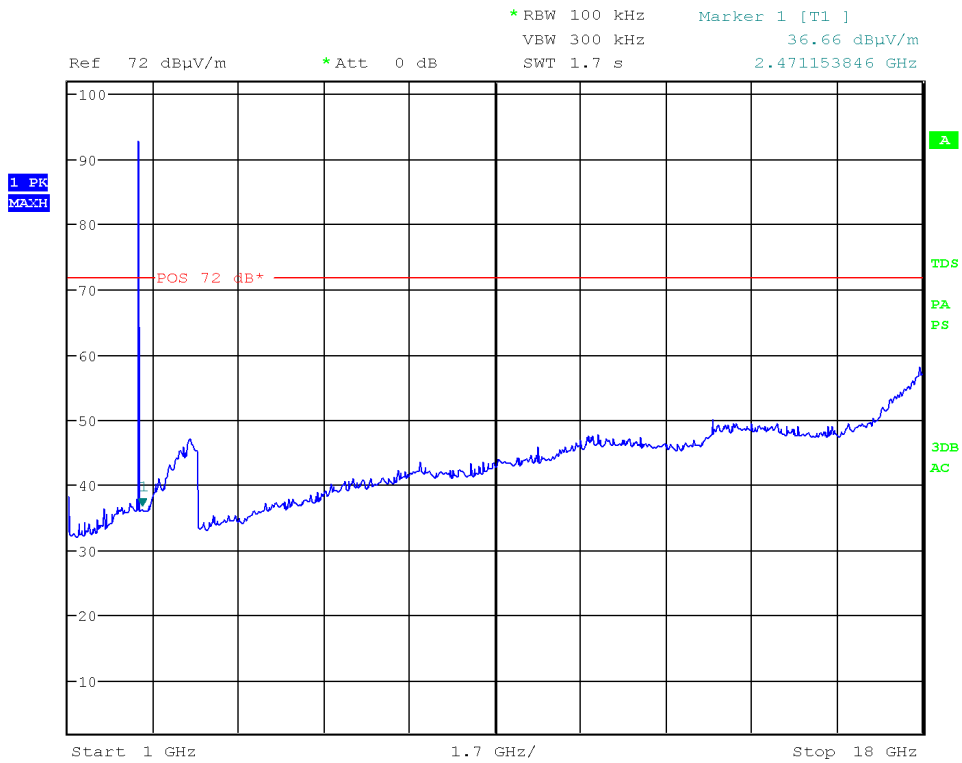


54Mbps 802.11g OFDM 14.5dBm nominal Channel 13 (1GHz to 18GHz)

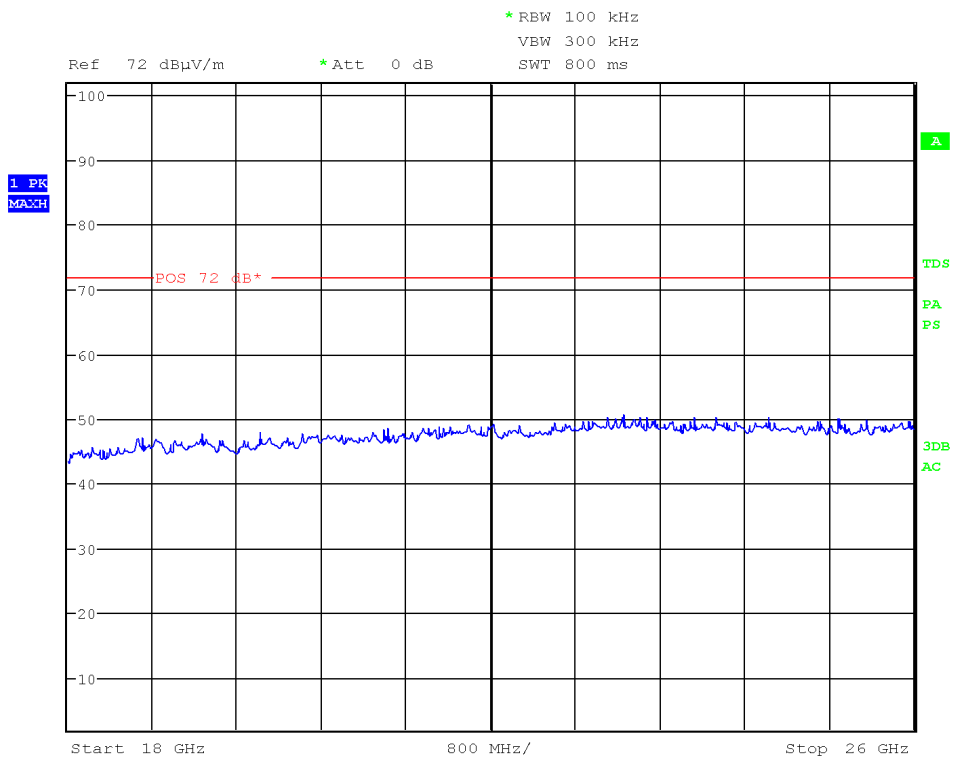


54Mbps 802.11g OFDM 14.5dBm nominal Channel 13 (18GHz to 26GHz)

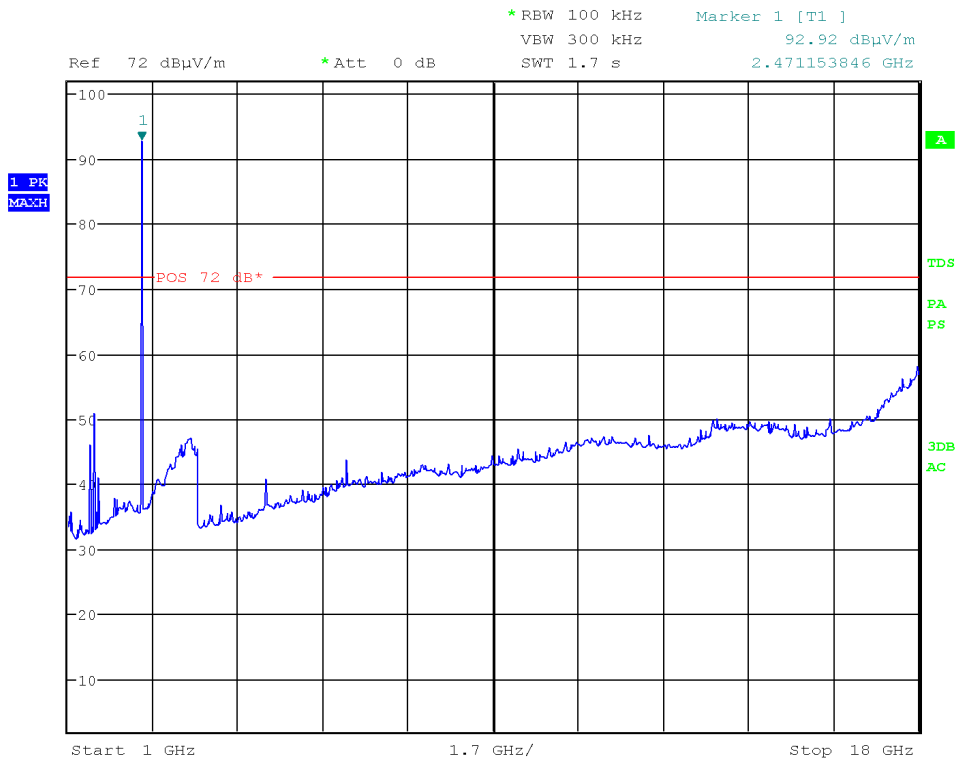
6.3.2 Bluetooth Emissions



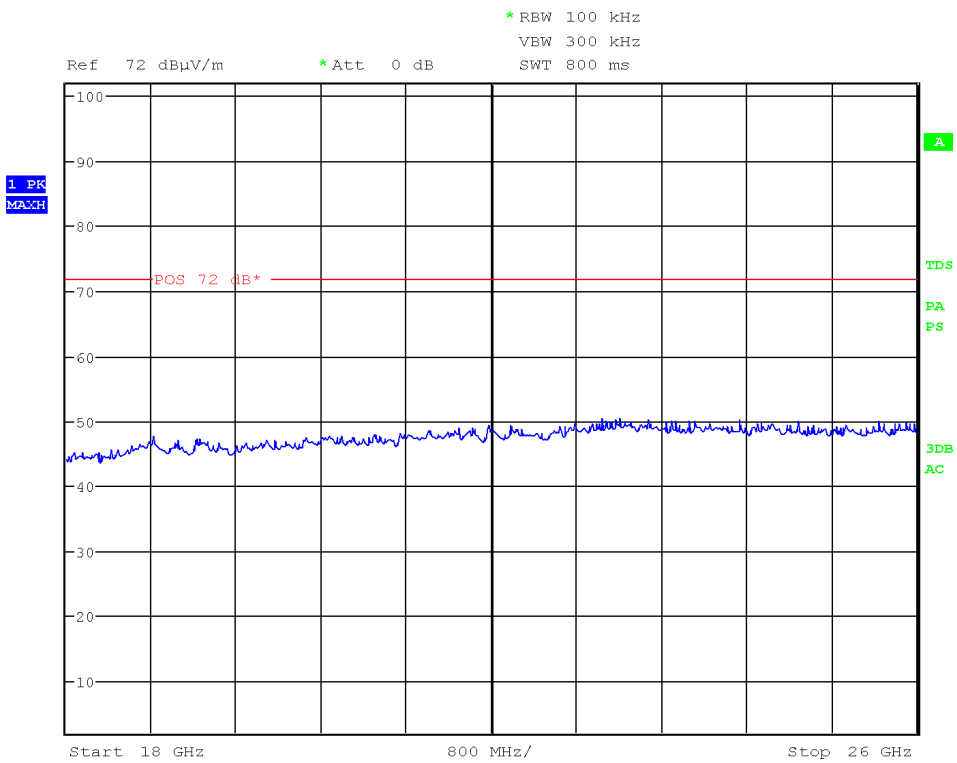
1Mbps Bluetooth GFSK 9.5dBm nominal Channel 1 (1GHz to 18GHz)



1Mbps Bluetooth GFSK 9.5dBm nominal Channel 1 (18GHz to 26GHz)



1Mbps Bluetooth GFSK 9.5dBm nominal Channel 79 (1GHz to 18GHz)



1Mbps Bluetooth GFSK 9.5dBm nominal Channel 79 (18GHz to 26GHz)

7 List of Test Equipment

Test Equipment Type	Manufacturer and Type Number	Serial Number	Cal No.	Cal Due
Power Meter	Agilent E4419B		02079	14.10.2011
Power Supply Unit	Palstar PS30M	G290775401	02020	not cal'd
Digital Multimeter	Fluke 85	65690477	00618	13.10.2011
Peak Power Analyser	HP 8991A		00318	14.10.2011
EMI Receiver 20Hz to 26.5GHz	Rohde & Schwarz ESI26	832692/006	00886	03.06.2012
Antenna Horn 1-18GHz	Chase BBHA9120D	9120D-578	01719	12.10.2011
Antenna Mast (Site 1)	Inn-co GmbH MM4000	MM4000/056/13750 806/L	02075	N/A
Turntable (Site 1)	Inn-co GmbH DS1200S	DS1200S/175/1375 0806/L	02076	N/A
Mast/Turntable Controller (Site 1)	Inn-co GmbH Co 2000	CO/2000/359/137/5 0806/L	02077	N/A
EMI Receiver 20Hz to 40GHz	Rohde & Schwarz ESU40	100017	01721	31.01.2012
Power Supply Unit	Palstar PS30M	G450673928	01935	N/A

In accordance with UKAS requirements, all measuring equipment is on a calibration cycle.