



**FCC 47CFR part 15C
Test Report
For
IEEE 802.15.4 wireless controller modules
JN5142-001-M00 & JN5142-001-M03**

Reference Standard: FCC 47CFR part 15C
Manufacturer: NXP Labs UK Ltd
For type of equipment and serial number, refer to section 3
Report Number: 12-522/4907/3A/11
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2. Summary of Test Results

The JN5142-001-M00 & JN5142-001-M03 were tested to the following standards: -

FCC 47CFR Part 15C (effective date October 1st, 2011); Class DTS Intentional Radiator

Any compliance statements are made reliant on the modes of operation as instructed to us by the Manufacturer based on their specific knowledge of the application and functionality of the equipment tested. Whilst every effort is made to assure quality of testing, type tests are not exhaustive and although no non-conformances may be found, this doesn't exclude the possibility of equipment not meeting the intentions of the standard, particularly under different conditions to those during testing.

Title	Reference	Results
1. Conducted Emissions	FCC Part 15C §15.207	NOT APPLICABLE ¹
2. Radiated Emissions	FCC Part 15C §15.205, §15.209 & §15.247(d)	PASSED
3. Modulation Bandwidth	FCC Part 15C §15.215(c), §15.247(a)(2)	PASSED
4. Intentional Radiator Field Strength	FCC Part 15C §15.247(b)(3)	PASSED
5. Power Spectral Density	FCC Part 15C §15.247(e)	PASSED
6. Band Edge Compliance	FCC Part 15C §15.205, §15.209 & §15.247	PASSED

Notes:

¹ The digital device tested is intended to be powered from 3V dc supply (battery) and intended for modular approval. Any third party device it is incorporated into with a connection to the AC power line will require demonstration of compliance with the limits. Refer to §15.207(c) "Measurements to demonstrate compliance with the conducted limits are not required for devices which only employ battery power for operation and which do not operate from the AC power lines or contain provisions for operation while connected to AC power lines".

This report relates to the equipment tested as identified by a unique serial number and at the time it was tested. It does not relate to any other similar equipment and performance of the product before or after the test cannot be guaranteed.

Date of Test: 12th to 20th December 2011

Test Engineer:

Approved By:

Customer Representative:

3. Equipment Under Test (EUT)

3.1 Equipment Specification

Applicant	NXP Laboratories UK Ltd Furnival Street Sheffield S1 4QT
Manufacturer of EUT	NXP Laboratories (UK) Ltd
Brand name of EUT	NXP Labs UK Ltd
Model Number of EUT	JN5142-001-M00 & JN5142-001-M03
Serial Number of EUT	001 & 001
Date when equipment was received by RN Electronics	12th December 2011
Date of test:	12th to 20th December 2011
Customer order number:	GB628200025079
Visual description of EUT:	A small metal canned enclosure mounted onto a PCB. The M00 variant has an integral PCB antenna, the M03 variant has a UFL RF port. For the purpose of tests the PCBs were mounted onto a battery powered motherboard.
Main function of the EUT:	an IEEE 802.15.4, 2.4GHz wireless controller module.
Height	30 mm
Width	18 mm
Depth	3 mm
Weight	0.002 g
Voltage	3V DC battery powered (2of AA batteries)
Current required from above voltage source	<100 mA

3.2 EUT Configurations for testing

Frequency range	2.405 - 2.48 GHz
Normal use position	fitted to host equipment
Normal test signals	IEEE 802.15.4 test packet
Declared Power Level	+2dBm
Declared Channel Bandwidth	1.725 MHz
Highest Frequencies generated/used	2.48 GHz

3.3 EUT Modes

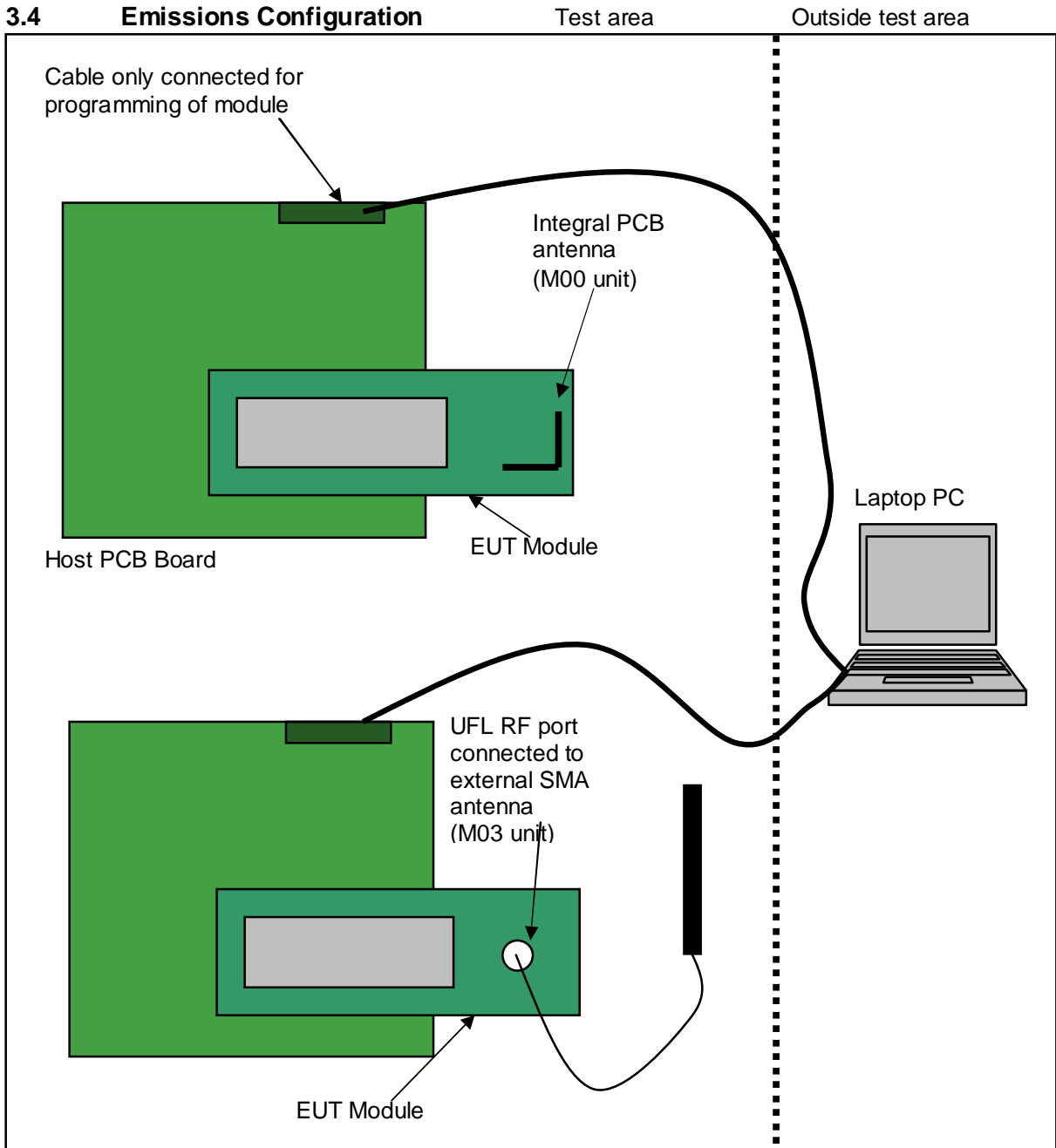
Mode	Description of mode	Used for Testing
Transmit CW 2.405GHz	Unit in constant transmit with no mod @ 2.405GHz	YES
Transmit CW 2.440GHz	Unit in constant transmit with no mod @ 2.440GHz	YES
Transmit CW 2.480GHz	Unit in constant transmit with no mod @ 2.480GHz	YES
Transmit Mod 2.405GHz	Unit in constant transmit with mod @ 2.405GHz	YES
Transmit Mod 2.440GHz	Unit in constant transmit with mod @ 2.440GHz	YES
Transmit Mod 2.480GHz	Unit in constant transmit with mod @ 2.480GHz	YES
Receive 2.405GHz	Unit in receive mode @2.405 GHz	YES
Receive 2.440GHz	Unit in receive mode @2.440 GHz	YES
Receive 2.480GHz	Unit in receive mode @2.480 GHz	YES
Transmit 1% duty cycle	Unit transmitting system modulation 1% duty cycle	YES

Description of ancillary equipment connected to the equipment under test, for the purpose of tests, can be found in Section 10.

Any modifications made to the EUT, whilst under test, can be found in Section 11.

This report was printed on: 09 February 2012

3.4 Emissions Configuration



The equipment under test was supplied by 3V DC from two new Batteries situated on the provided host PCB board. The battery levels were monitored throughout tests to ensure the levels did not drop below the +/- 10% required. To change channels and select the correct modes for test a programming lead was connected and the unit programmed. The programming lead was removed for tests. Application programming software was provided by NXP Laboratories UK Ltd. A laptop provided by RN Electronics was used to program the modules.

For radiated emissions the support equipment was situated outside the chamber and the programming lead removed after each channel/mode change.

Top, Middle & Bottom channels were checked / tested in both Transmit and Receive modes using the 32MHz clock option. All power levels were left at maximum (default setting).

Bottom channel = 2.405GHz
Middle channel = 2.440GHz
Top channel = 2.480GHz

The Two modules tested were identical except for the Antenna / RF port.

Unit JN5142-001-M00 s//n 001 had an integral pcb antenna.

Unit JN5142-001-M03 s//n 001 had a UFL RF port which was attached to a dedicated antenna supplied by NXP Labs UK Ltd.

Separate antenna details: Manufacturer: Antenova
 Model: TITANIS (2.2dBi) 2.4 GHz

Each test states which module/s were used for testing.

Description of ancillary equipment connected to the equipment under test, for the purpose of tests, can be found in Section 11.

4. Specifications

The tests were performed by RN Electronics Engineer Daniel Sims who set up the tests, the test equipment, and operated it in accordance with the **R.N. Electronics Ltd** procedures manual, ANSI C63.10-2009, FCC Part 15 and those specifications incorporated by reference into 47CFR15 (e.g. ANSI C63.4-2003).

R.N. Electronics Ltd sites M and OATS are listed with the FCC. Registration Number 293246

4.1 Deviations

ANSI C63-10-2009 deviations:

The reference standard ANSI C63.4-2003 was used, not the latest ANSI C63.4-2009
Power spectral density was measured instead per KDB558074, PSD Option 1

FCC Part 15 deviations:

None.

4.2 Tests at Extremes of Temperature & Voltage

No tests were required at temperature extremes.

Tests were performed with new batteries.

Two similar modules were presented for test, one with an on board antenna, one with an antenna connector, otherwise the units were declared to be identical by the manufacturer.

- A permanent integral antenna was used for testing.
- A test fixture was used for testing.
- A temporary RF port was created for testing.
- The equipment external RF port was used for testing.

4.3 Measurement Uncertainties

Parameter	Uncertainty
Transmitter Tests	
Conducted RF power	<± 1.0 dB
Spectral power density	<± 1.5 dB
Bandwidth	<± 1.9 %
Radiated RF Power	<± 3.5 dB
Radiated Spurious Emissions	<± 3.4 dB
H-Field Emissions	<± 2.8 dB

5. Tests, Methods and Results
5.1 Conducted Emissions

NOT APPLICABLE.

The digital device tested is intended to be powered from 3V DC supply (battery) and intended for modular approval. Any third party device it is incorporated into with a connection to the AC power line will require demonstration of compliance with the limits. Refer to §15.207(c)
"Measurements to demonstrate compliance with the conducted limits are not required for devices which only employ battery power for operation and which do not operate from the AC power lines or contain provisions for operation while connected to AC power lines"

5.2 Radiated Emissions

5.2.1 Test Methods

Test Requirements	FCC Part 15C, Reference (15.209)
Test Method:	ANSI C63.10, Reference (6.4 – 6.6.)

5.2.1.1 Configuration of EUT

The EUT was placed on a 0.8 metres high turntable. The front edge of the EUT was initially positioned facing the antenna. The EUT was measured at a distance of 3 metres. The EUT was rotated in all three orthogonal planes. Radiated Emissions testing was performed with new batteries.

5.2.1.2 Test Procedure

Tests were made in accordance with FCC Part 15 using the measuring equipment noted below.

Below 30MHz, measurements were made in a semi-anechoic chamber (pre-scan) with final measurements on an OATS without a ground plane. The antenna was placed 1m above the ground. The equipment and the antenna were rotated 360° to record the worst case emissions.

30MHz - 1GHz, measurements were made on a site listed with the FCC. The equipment was rotated 360° and the antenna scanned 1 – 4 metres in both horizontal and vertical polarisations to record the worst case emissions.

Above 1GHz, measurements were made in a semi-anechoic chamber with appropriate absorbing material for use in this range. The antenna was placed 1m above the ground in line with the EUT, which was rotated through 360° to record the worst case emissions.

At least 6 signals within 20dB and all signals within 10dB of the limit were investigated.

5.2.2 Test results

Tests were performed using Test Site M.

Test Environment: M Temperature: 18-20°C Humidity: 32-38%

Analyser plots for the Quasi-Peak / Average values as applicable and any table of signals within 20dB of the limit line can be found in Section 6.2 of this report. Band Edge Compliance plots can be found in section 6.6 of this report.

These show that the **EUT** has **PASSED** this test.

5.2.2.1 Test Equipment used

E410, E411, E412, TMS933, E268, E342, E429, TMS78, TMS79, TMS82, TMS81

See Section 10 for more details

5.3 Intentional Radiator Field Strength & Peak Conducted Power

5.3.1 Test Methods

Test Requirements FCC Part 15C, Reference (15.247)

Test Method: ANSI C63.10, Reference (6.6)
ANSI C63.10, Reference (6.10.2.1 a))

5.3.1.1 Configuration of EUT

The conducted EUT was measured on a bench using a power meter connected to the RF port.

For radiated measurements, the EUT was placed on a 0.8 metres high turntable. The front edge of the EUT was initially positioned facing the antenna. The EUT was measured at a distance of 3 metres. The antenna was scanned 1-4m in height in both Horizontal and Vertical polarisations. The EUT was rotated in all three orthogonal planes.

5.3.1.2 Test Procedure

Tests were made in accordance with FCC Part 15 using the measuring equipment noted below.

Measurements were made in a semi-anechoic chamber and on a test bench. The equipment was rotated 360° to record the maximised emission.

Radiated measurements in alternative bandwidths are presented for reference only. They are required to observe (a) the 1MHz reference levels for band edge compliance measurements above 1GHz (b) the 100kHz reference levels for spurious emission measurements per 15.247(d) and are useful as a comparison of the antenna performances.

5.3.2 Test results

Test Environment: M Temperature: 18-21°C Humidity: 31-48 %

Any Analyser plots can be found in Section 6.3 of this report.

Conducted RF port results M03 unit

Frequency (MHz)	Power (dBm) (2MHz RBW)
2405	+2.6
2440	+2.8
2480	+3.3

Limits: 1Watt (+30dBm). (Equivalent to 125.2dBuV/m @ 3m).

These results show that the EUT has **PASSED** this test.

The maximised field strength measured was:-

Integral Antenna results M00 unit

Frequency (MHz)	Power (1MHz RBW) (dBuV/m @ 3 metres)	Power (100kHz RBW) (dBuV/m @ 3 metres)
2405	92.4	89.9
2440	91.1	87.2
2480	92.6	88.3

Dedicated antenna results M03 unit

Frequency (MHz)	Power (1MHz RBW) (dBuV/m @ 3 metres)	Power (100kHz RBW) (dBuV/m @ 3 metres)
2405	97.4	94.7
2440	97.3	93.5
2480	99.6	95.4

Limits: Not applicable.

These results are for demonstration of required reference levels only.

5.3.2.1 Test Equipment used

E268, E410, E411, E412, TMS82, E342

See Section 10 for more details

5.4 Duty Cycle

Test not applicable. However, a basic duty cycle measurement was made in order to ascertain any duty cycle corrections required to be applied to the test results.

According to 15.35(b): the limit on peak radio frequency emissions is 20 dB above the maximum permitted average emission limit applicable to the equipment under test.

As peak emissions (upper restricted band edge – see page 65) were no more than 19.9dB above the average emissions measured then the condition for peak emissions is met.

The worst case average emission measured at the upper restricted band edge (see page 64) is 7.2dB above the permitted average emission limit, However, according to 15.35(c): when the radiated emission limits are expressed in terms of the average value of the emission, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds.

For purposes of test the equipment was operated with the transmitter continuously on. For a 10% duty cycle, the power measured would be reduced by $20 \log(0.10) = -20\text{dB}$. According to the declared duty cycle, therefore, the emissions observed are below the limit after averaging for pulse rate.

Duty Cycle

In normal operation the equipment employs pulsing at a variable rate, depending on the application. The manufacturer has declared a duty cycle of 1% and quotes IEEE 802.15.4: "The specifications of IEEE Std 802.15.4-2003 are tailored for applications with low power and low data rates (a maximum of 250 kb/s and down to 20 kb/s). Typical applications for IEEE 802.15.4 devices are anticipated to run with low duty cycles (under 1%). This will make IEEE 802.15.4 devices less likely to cause interference to other standards".

IEEE 802.15.4 also quotes a nominal packet length of 0.01472ms (40 data bytes) and for <10% duty cycle restrictions up to 6 packets per 100ms. A measurement of the EUT operating at the nominal 1% rate is shown in the plots section **6.4**.

5.5 Maximum Spectral Power Density

5.5.1 Test Methods

Test Requirements FCC Part 15C, Reference (15.247)

Test Method: FCC Part 15C, Reference (15.247)
KDB558074, PSD Option 1

5.5.1.1 Configuration of EUT

The Conducted EUT was tested on a bench via the RF port.

5.5.1.2 Test Procedure

Tests were made in accordance with FCC Part 15 using the measuring equipment noted below. The peak of the power envelope was found and zoomed in on; the spectrum analyser was then set to measure at a slow sweep, per KDB558074, in 3kHz bandwidth.

5.5.2 Test results

Tests were performed using Test Site A.

Temperature of test Environment: 18°C

Channel	Duty cycle	Result (dBm/3kHz)
Bottom	100%	-8.7
Middle	100%	-8.5
Top	100%	-9.0

Limits: +8dBm/3kHz.

Any Analyser plots for the Spectral density test can be found in Section 6.7 of this report.

These results show that the **EUT** has **PASSED** this test.

5.5.2.1 Test Equipment used

E434, E342

See Section 10 for more details.

5.6 6 Bandwidth

5.6.1 Test Methods

Test Requirements FCC Part 15C, Reference (15.247)

Test Method: ANSI C63.10, Reference (6.9.1)

5.6.1.1 Configuration of EUT

The Conducted EUT was tested on a bench via the RF port.

5.6.1.2 Test Procedure

Tests were made in accordance with FCC Part 15 using the measuring equipment noted below.

5.6.2 Test results

Tests were performed using Test Site **A**.

Temperature of test Environment: 18°C

Analyser plots for the 6dB bandwidth can be found in Section 6.5 of this report.

Channel	Result	Plot reference
Bottom	1.550 MHz	J4907-3, bottom channel 6dB BW (OBW)
Middle	1.558 MHz	J4907-3, middle channel 6dB BW (OBW)
Top	1.642 MHz	J4907-3, top channel 6dB BW (OBW)

Limits: > 500kHz BW.

These results show that the **EUT** has **PASSED** this test.

5.6.2.1 Test Equipment used

E342, P240

See Section 10 for more details.

5.7 Band Edge Compliance

5.7.1 Test Methods

Test Requirements FCC Part 15C, Reference (15.215 and 15.247)
Test Method: ANSI C63.10, Reference (6.9.2)

5.7.1.1 Configuration of EUT

The EUT was placed on a 0.8 metres high turntable. The front edge of the EUT was initially positioned facing the antenna. The EUT was measured at a distance of 3 metres.

5.7.1.2 Test Procedure

Tests were made in accordance with FCC Part 15 using the measuring equipment noted below.

5.7.2 Test results

Tests were performed using Test Site A.

Temperature of test Environment: 19°C

Analyser plots for the Band Edge Compliance can be found in Section 6.5 and 6.6 of this report. These show the 30dBc requirement of 15.247(d) are met at the band edges of 2400 and 2483.5 MHz.

The following tables list the field strengths observed in the adjacent restricted bands, which are required to meet the tighter 15.209 limits:

Channel	Band edge PK reading (dBuV/m)	Band edge AV reading (dBuV/m)	Plot reference
Bottom	51.2	44.2	J4907-3, Bottom channel band edge AV plot 1M RBW & J4907-3, Bottom channel band edge PK plot 1M RBW
Top	73.9	*61.9	J4907-3, Top channel band edge AV plot 1M RBW & J4907-3, Top channel band edge PK plot 1M RBW

The band edge readings were performed with a peak detector (max held plot) and with the EUT set in a constant 100% transmit state.

*The limit is 54dBuV/m for Average emissions. According to 15.35(c): when the radiated emission limits are expressed in terms of the average value of the emission, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds. For a 10% duty cycle, the power measured would be reduced by $20 \log(0.10) = 20\text{dB}$. According to the declared duty cycle, therefore, the emissions observed are below the limit after averaging for pulse rate.

Limits: AV = 54dBuV/m at band edges
PK = 74dBuV/m at band edges

These results show that the EUT has **PASSED** this test.

5.7.2.1 Test Equipment used

P240, E342, E434

See Section 10 for more details.

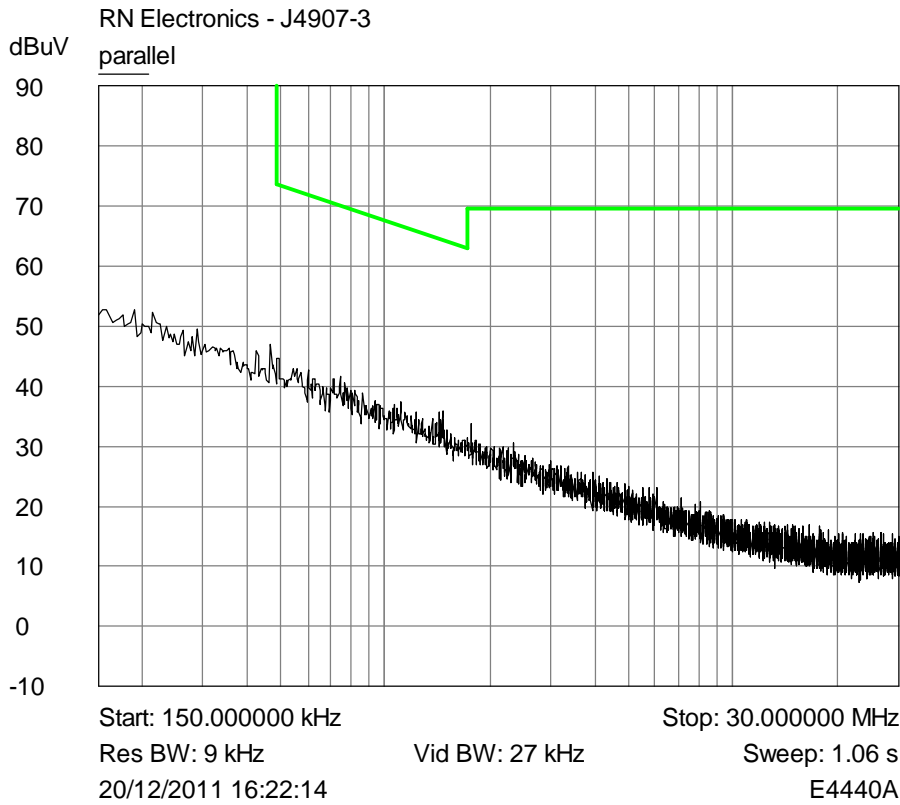
6. Plots and Results
6.1 Conducted Emissions

Test not applicable.

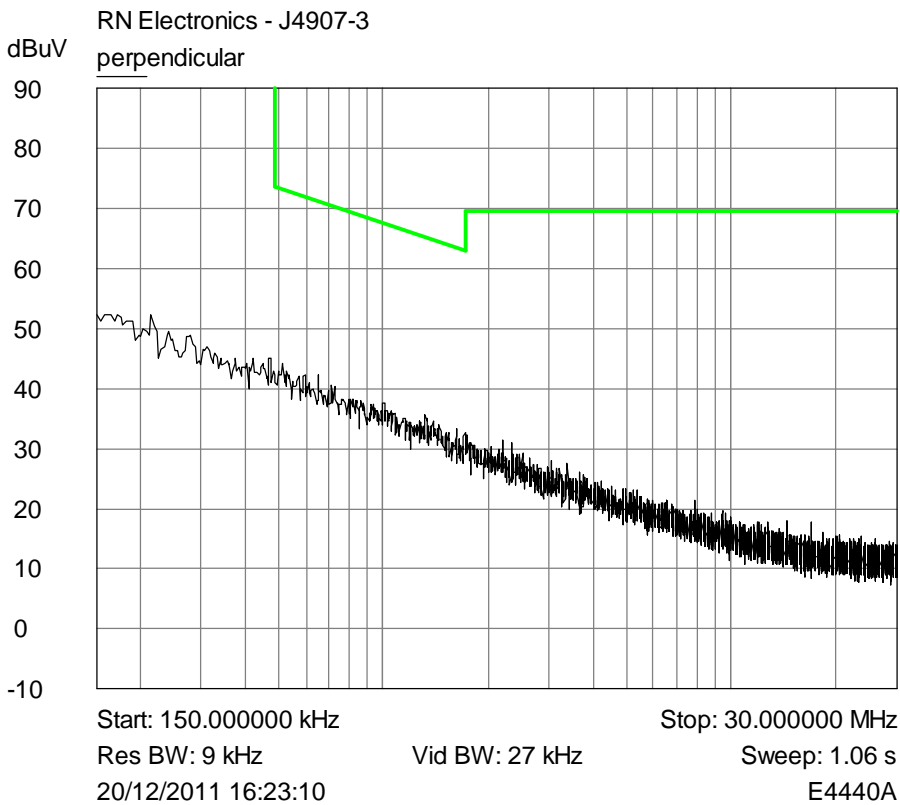
The digital device tested is intended to be powered from 3V DC supply (battery) and intended for modular approval. Any third party device it is incorporated into with a connection to the AC power line will require demonstration of compliance with the limits. Refer to §15.207(c)
"Measurements to demonstrate compliance with the conducted limits are not required for devices which only employ battery power for operation and which do not operate from the AC power lines or contain provisions for operation while connected to AC power lines"

6.2 Radiated Emissions

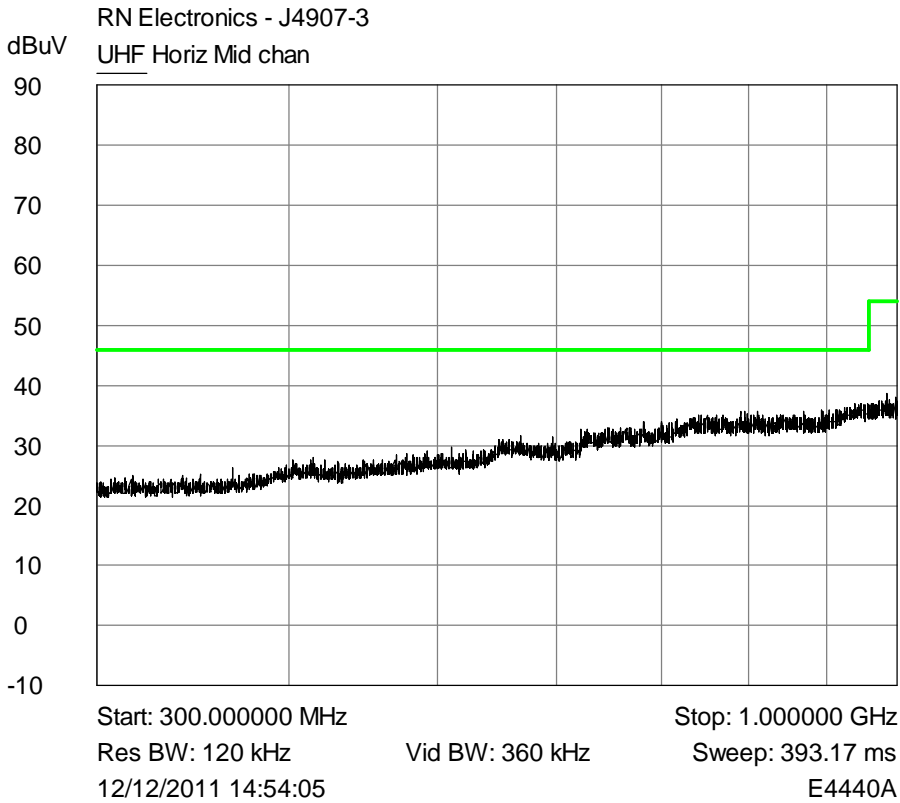
6.2.1 M00 integral antenna unit results



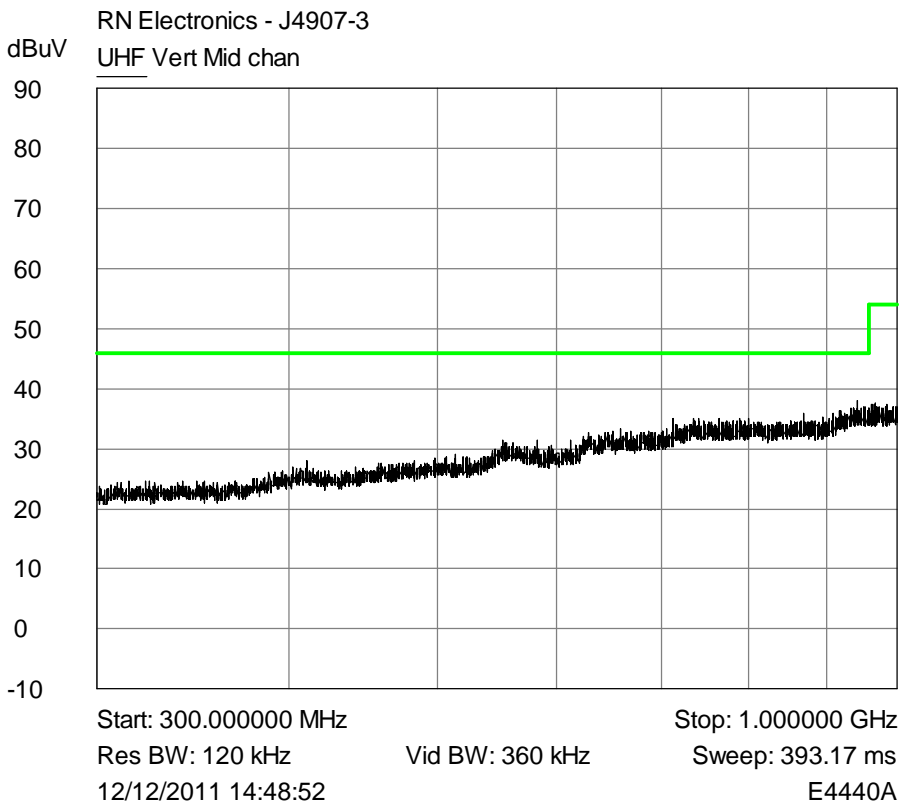
Plot of peak Parallel emissions 150kHz - 30MHz against the quasi-peak limit line.



Plot of peak Perpendicular emissions 150kHz - 30MHz against the quasi-peak limit line.



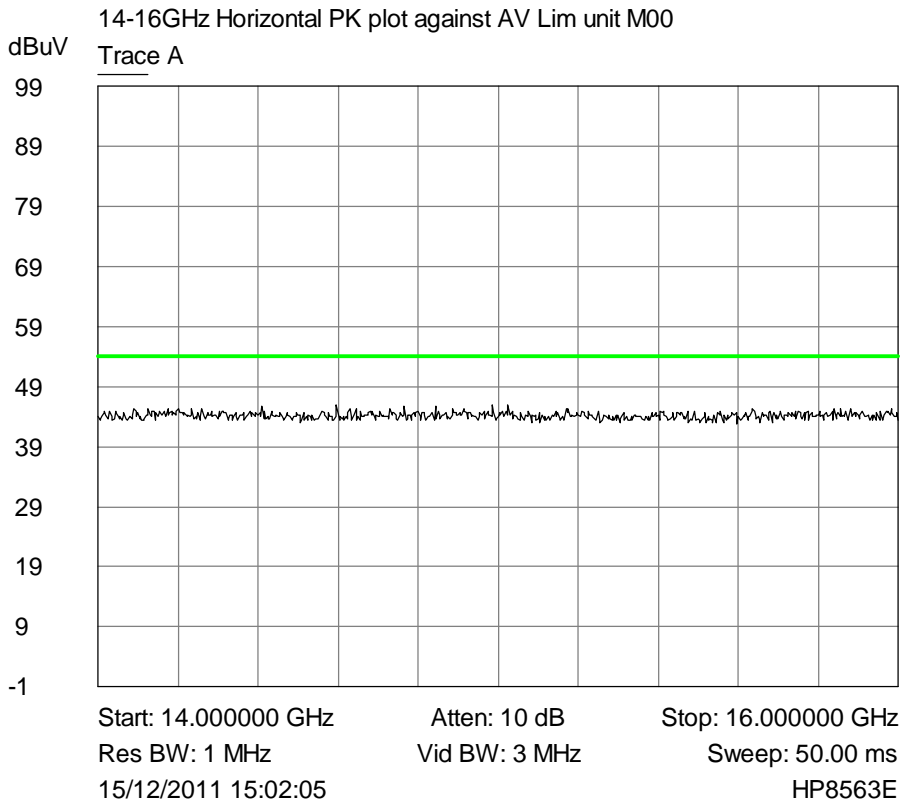
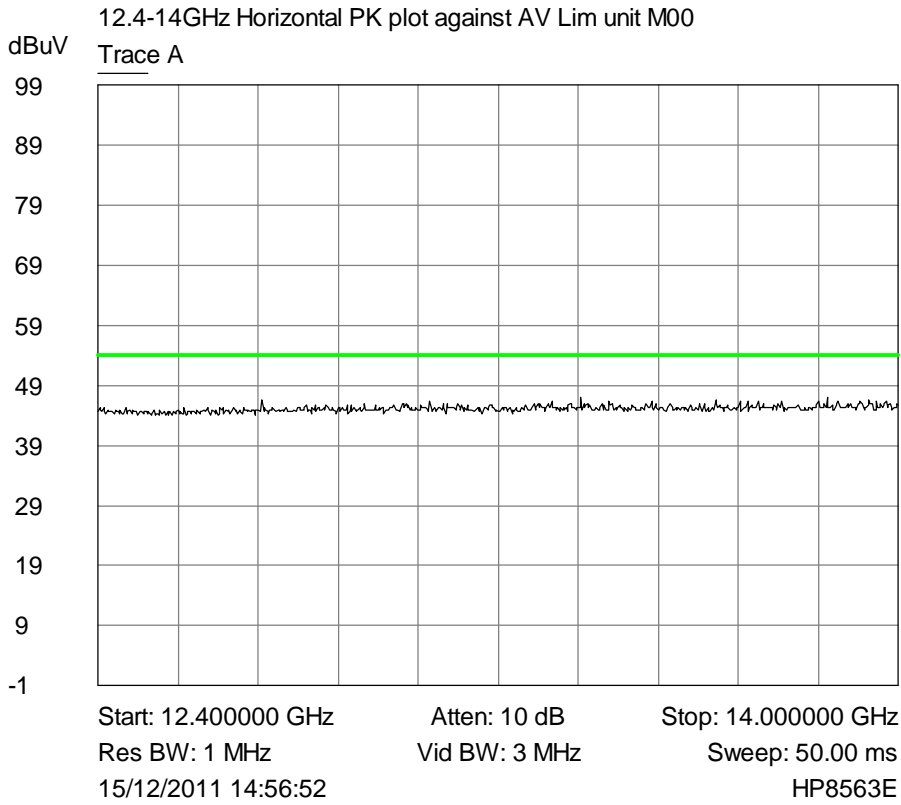
Plot of peak horizontal emissions 300MHz - 1GHz against the quasi-peak limit line.

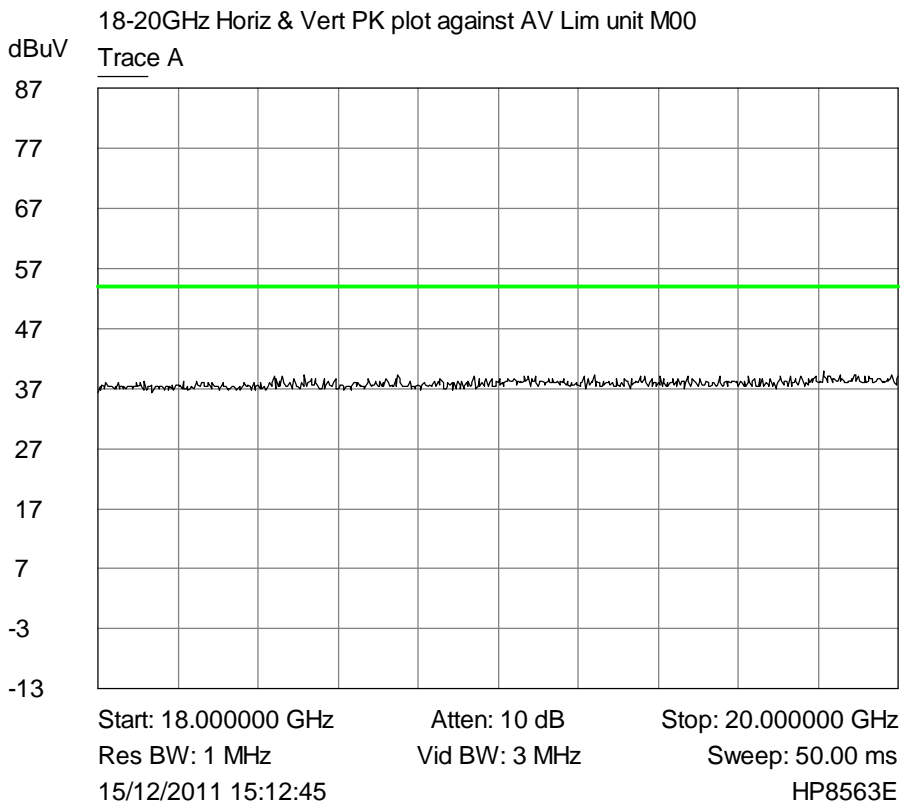
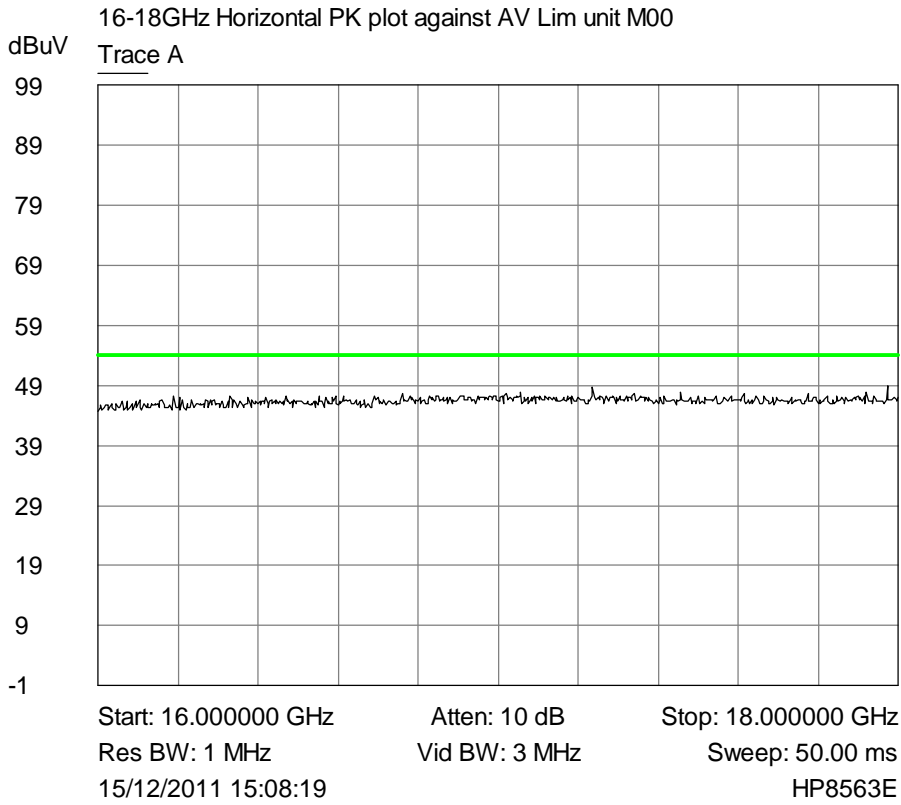


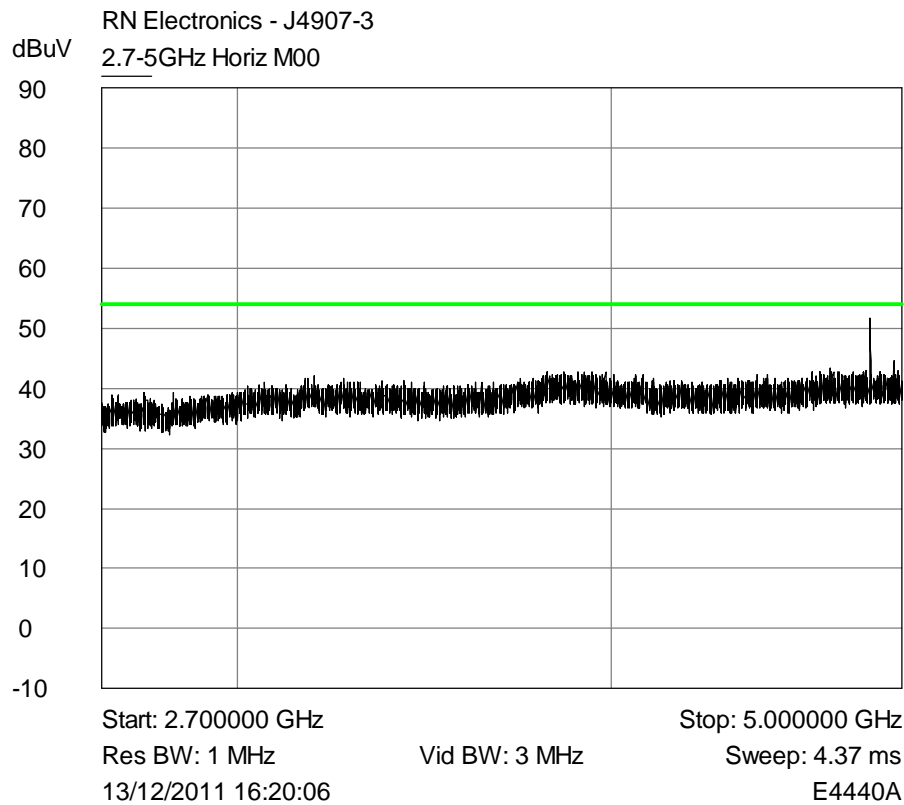
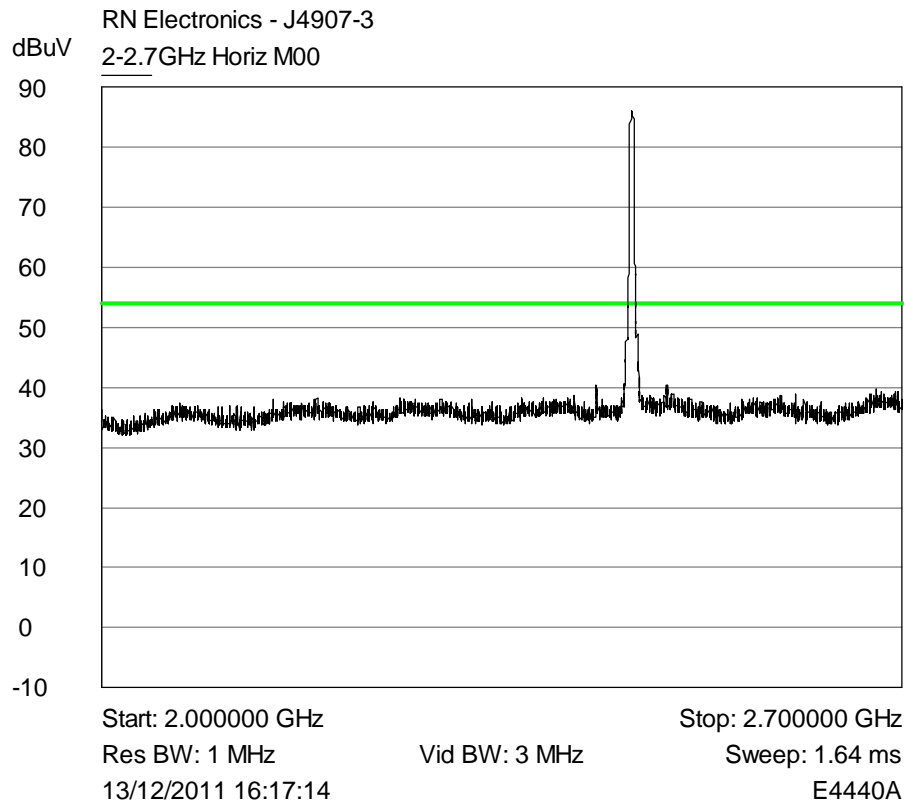
Plot of peak vertical emissions 300MHz - 1GHz against the quasi-peak limit line.

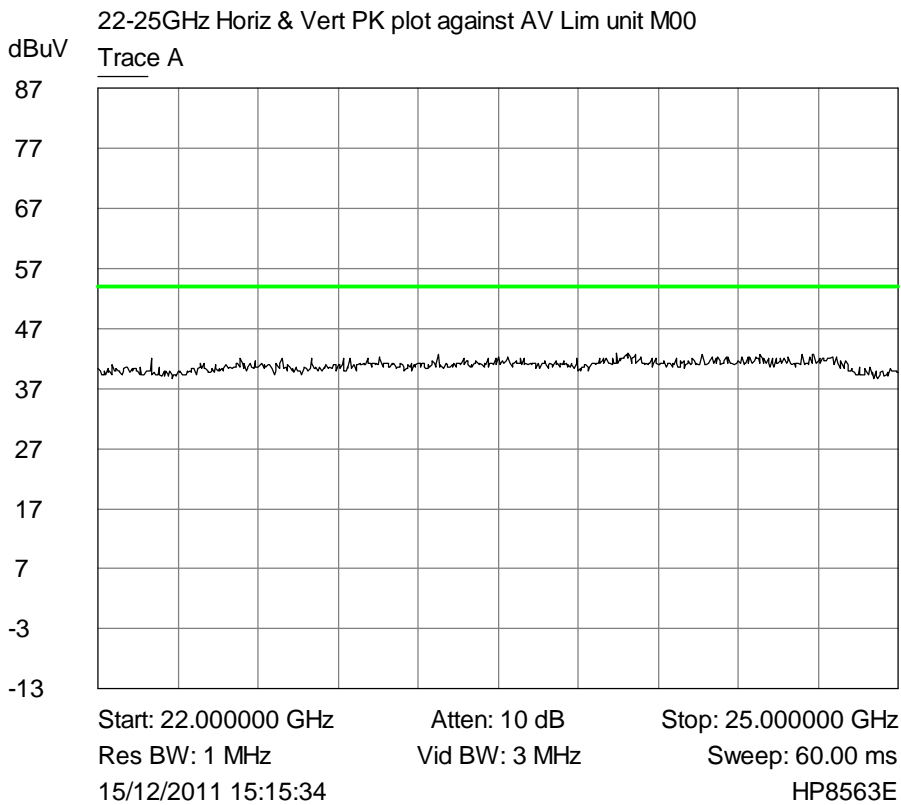
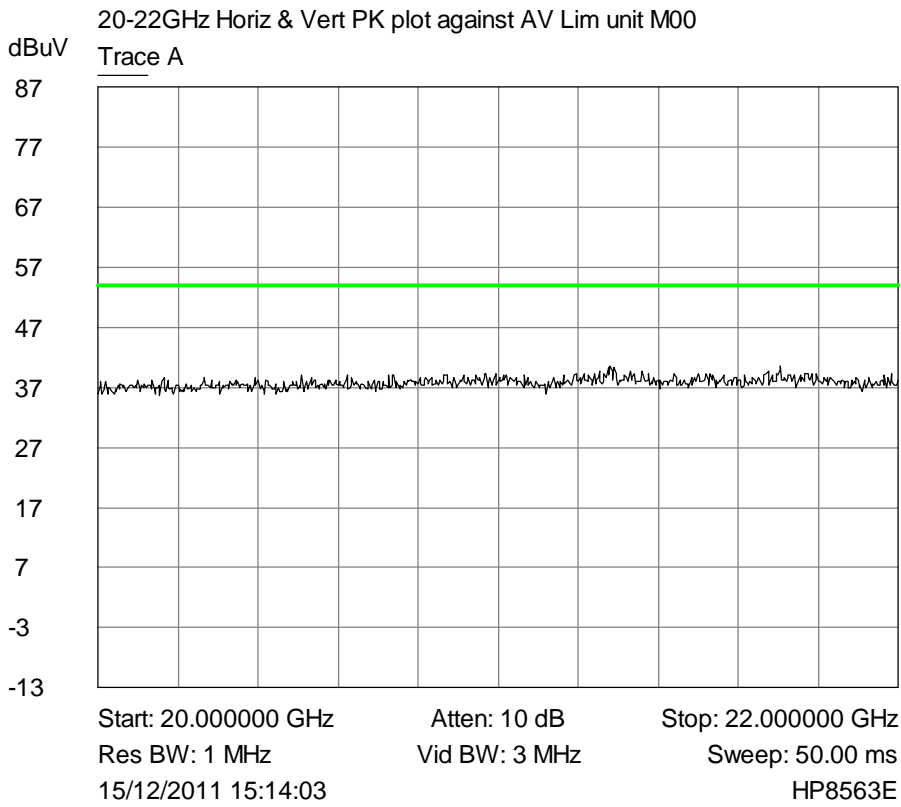
Table of signals measured below 1GHz M00 unit.

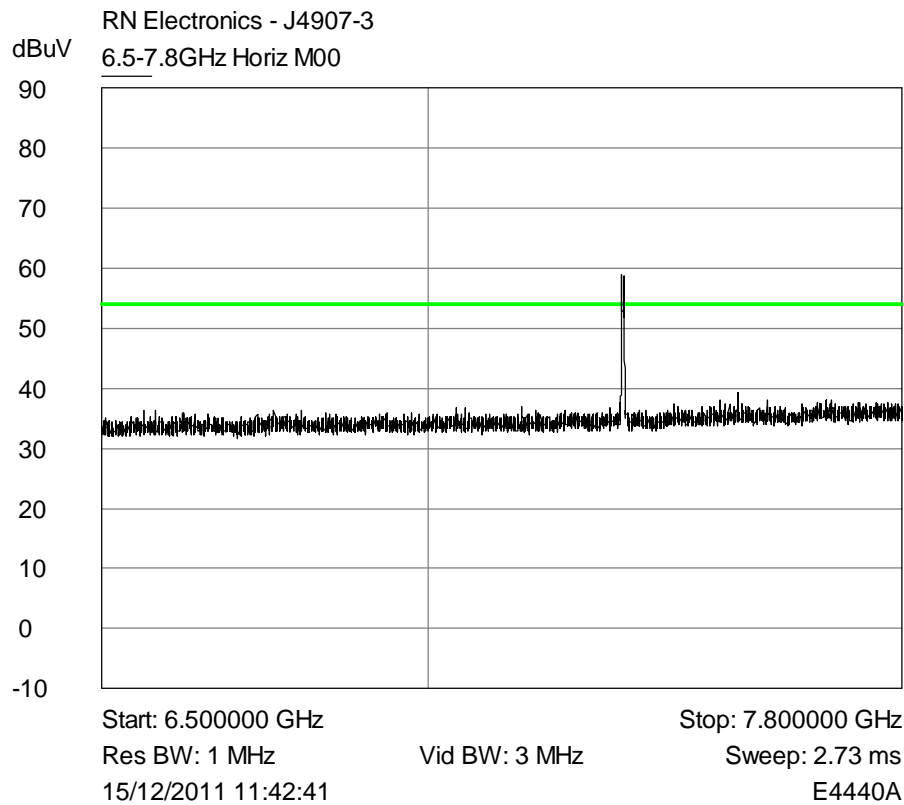
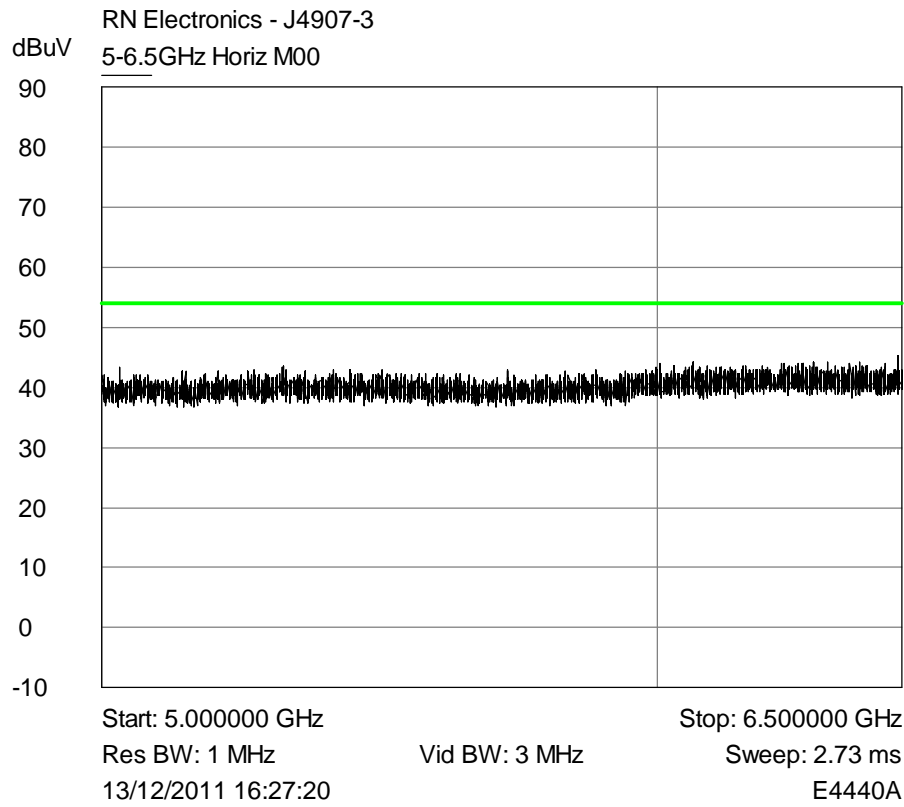
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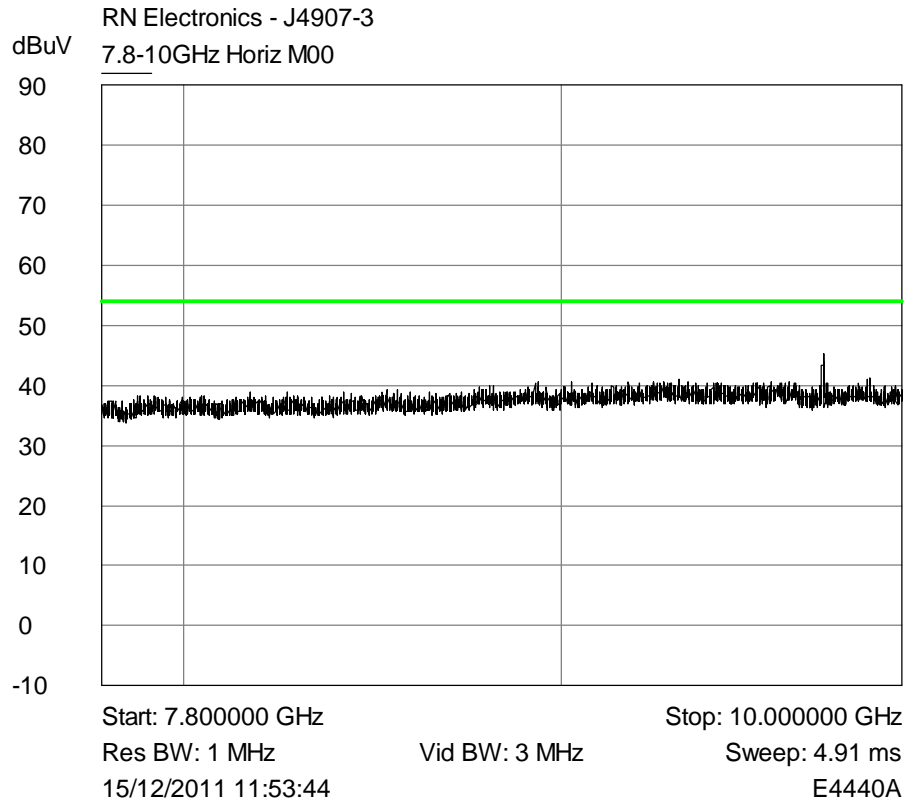




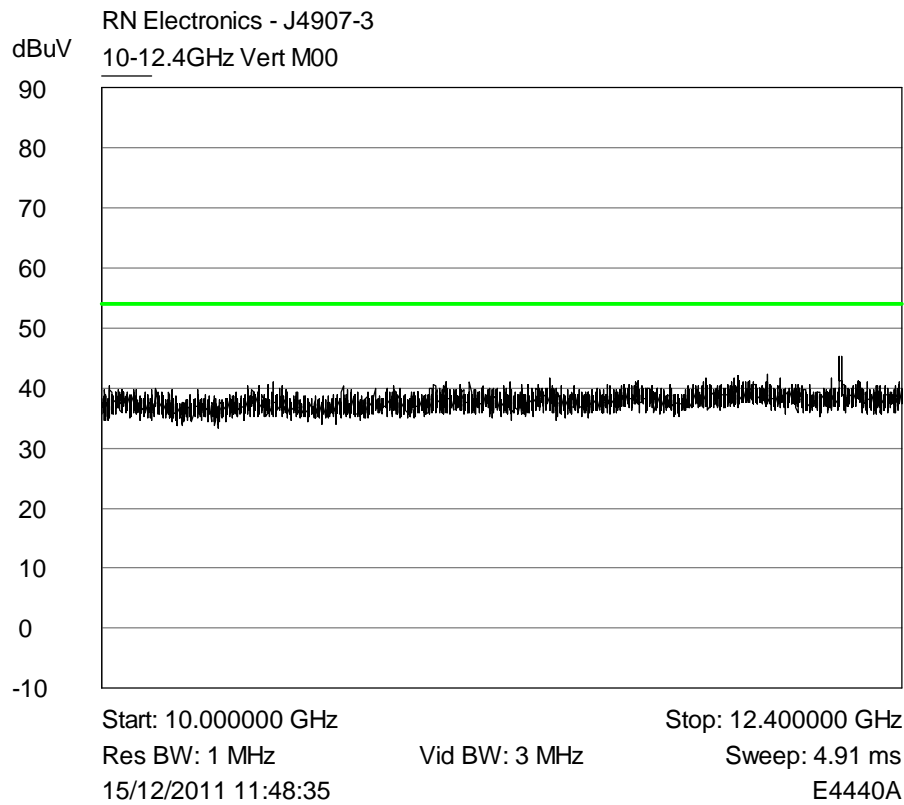
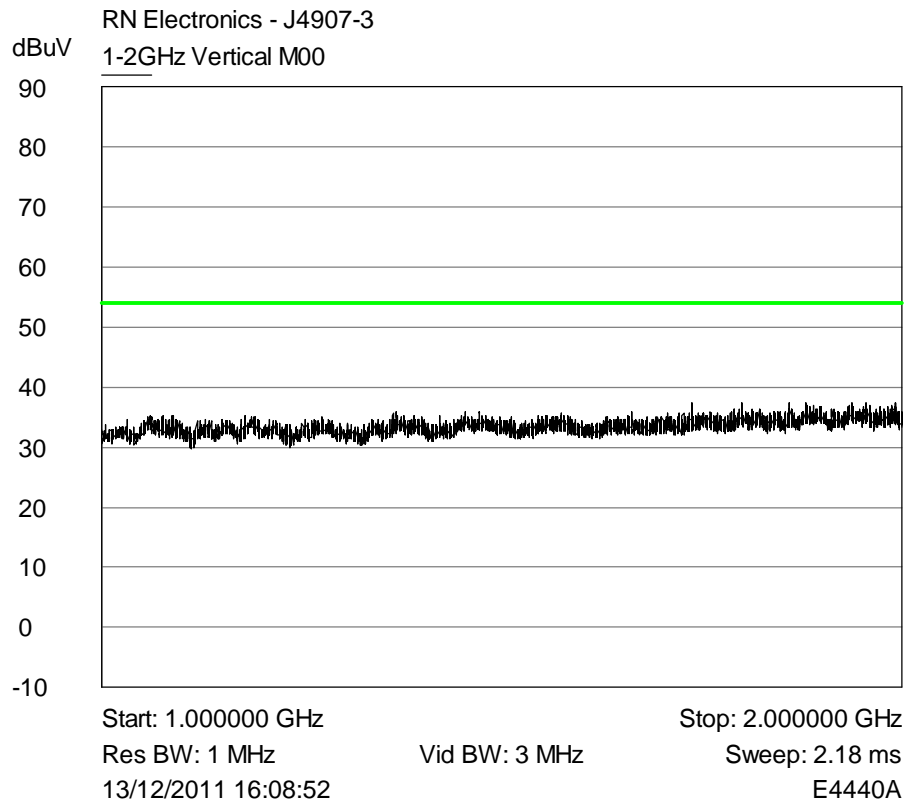


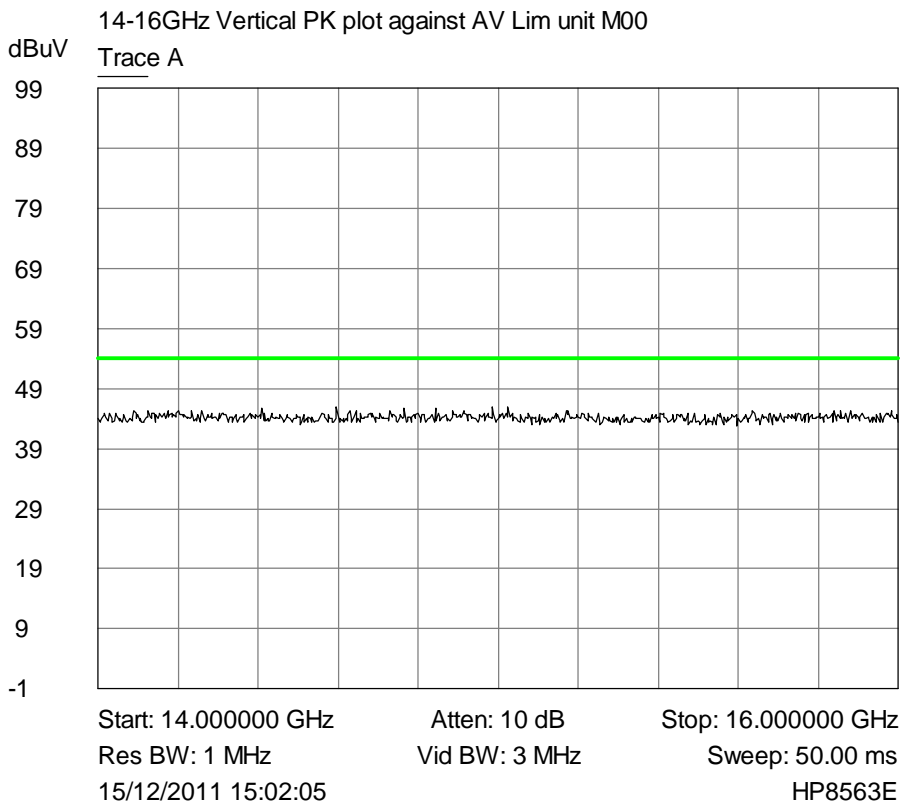
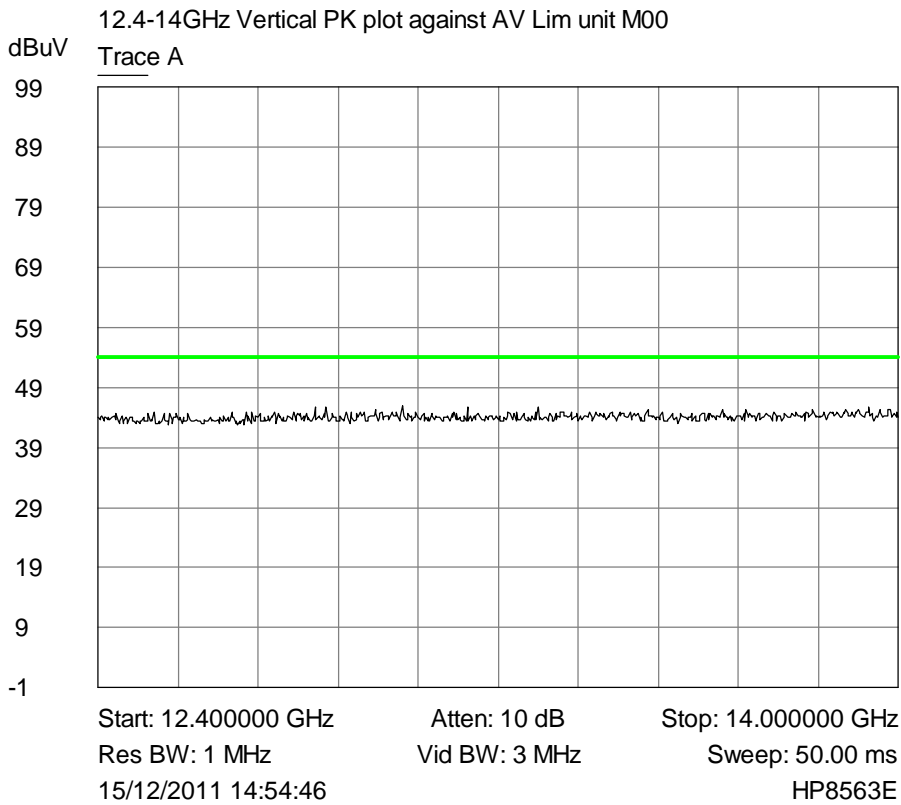


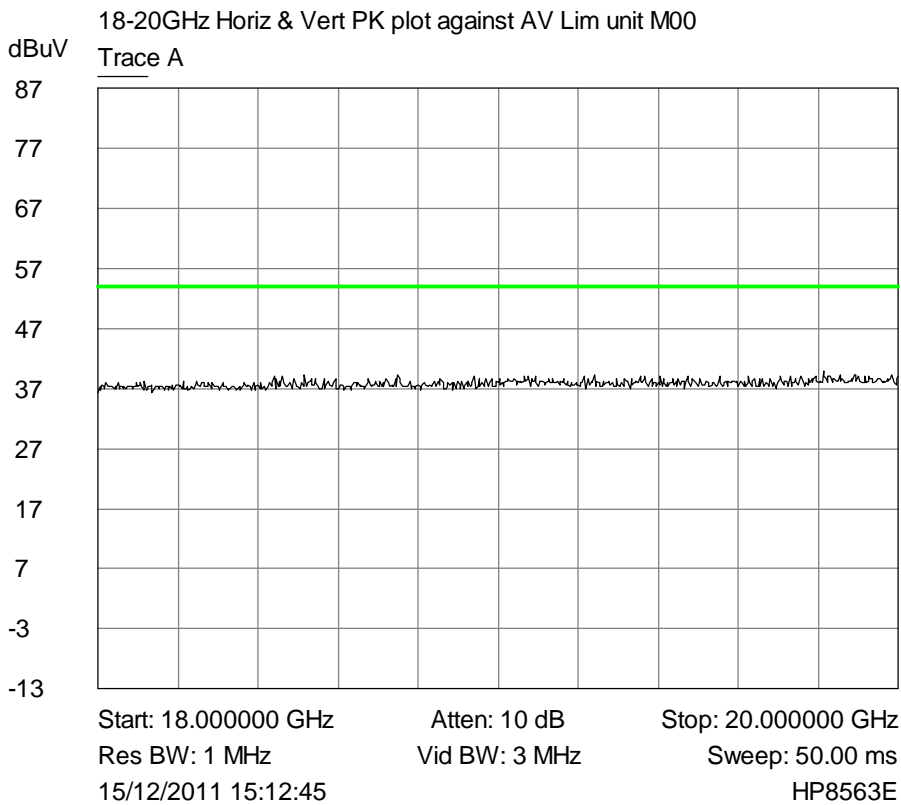
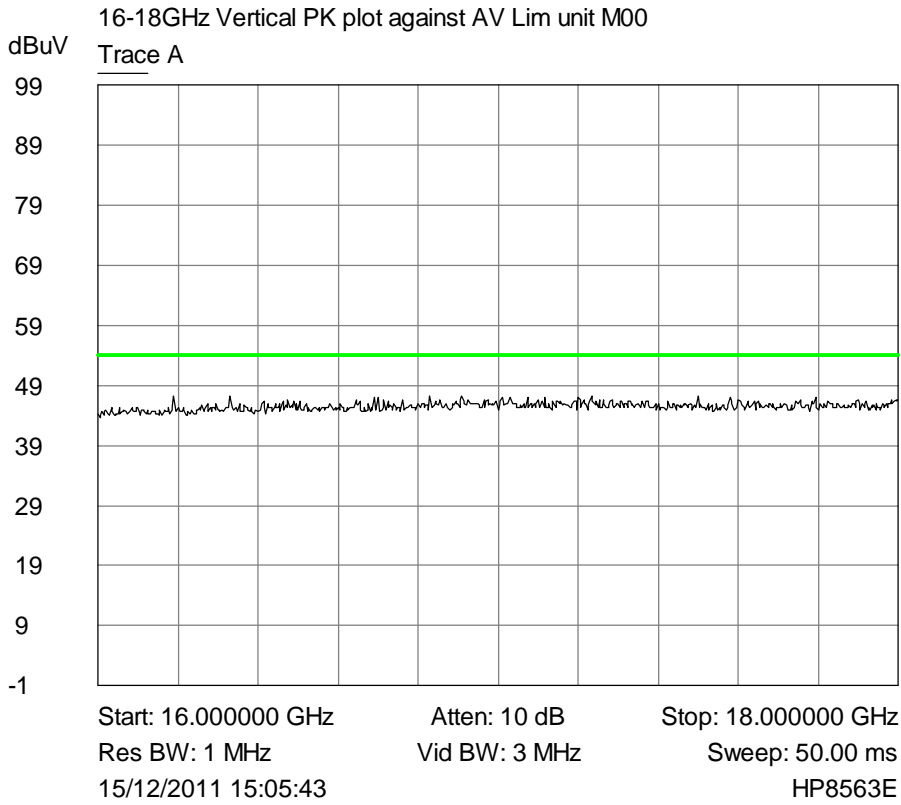


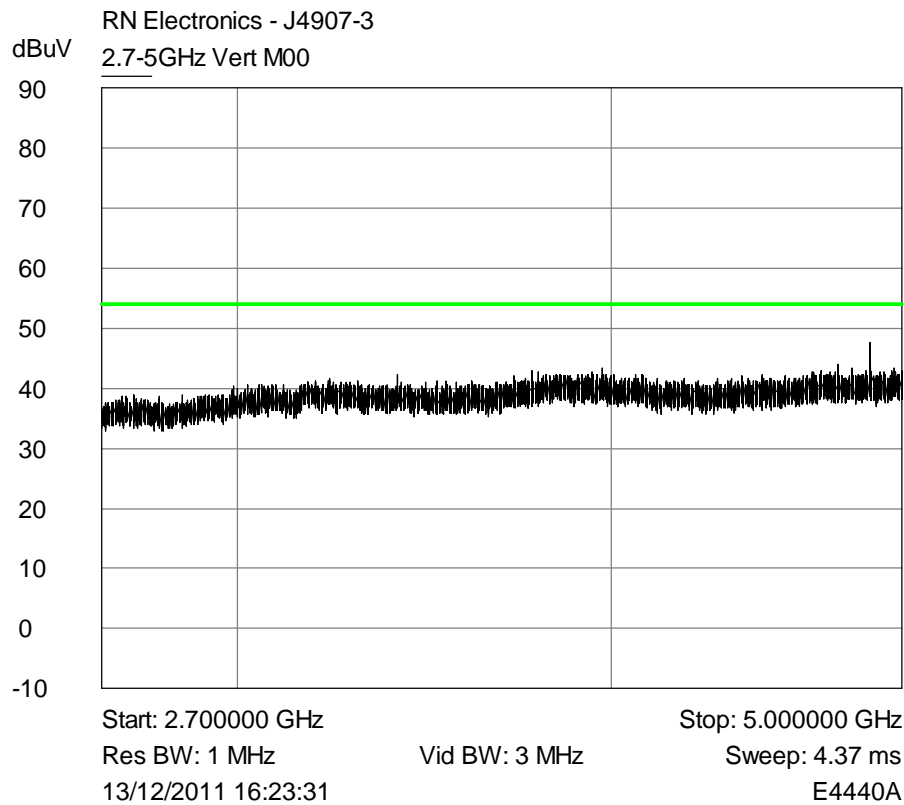
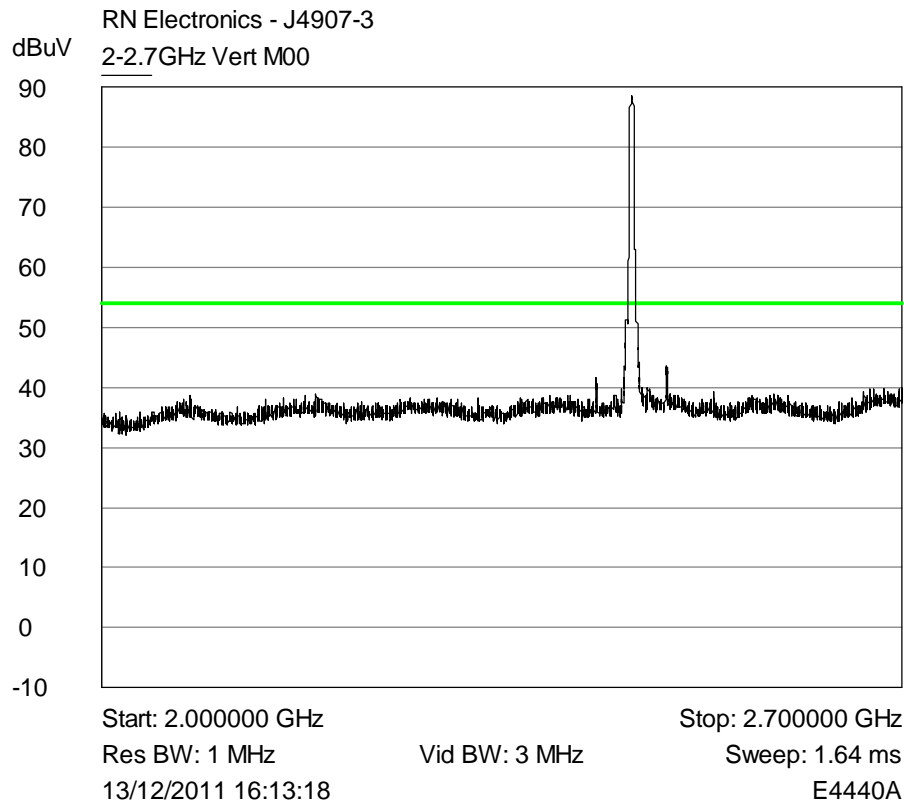


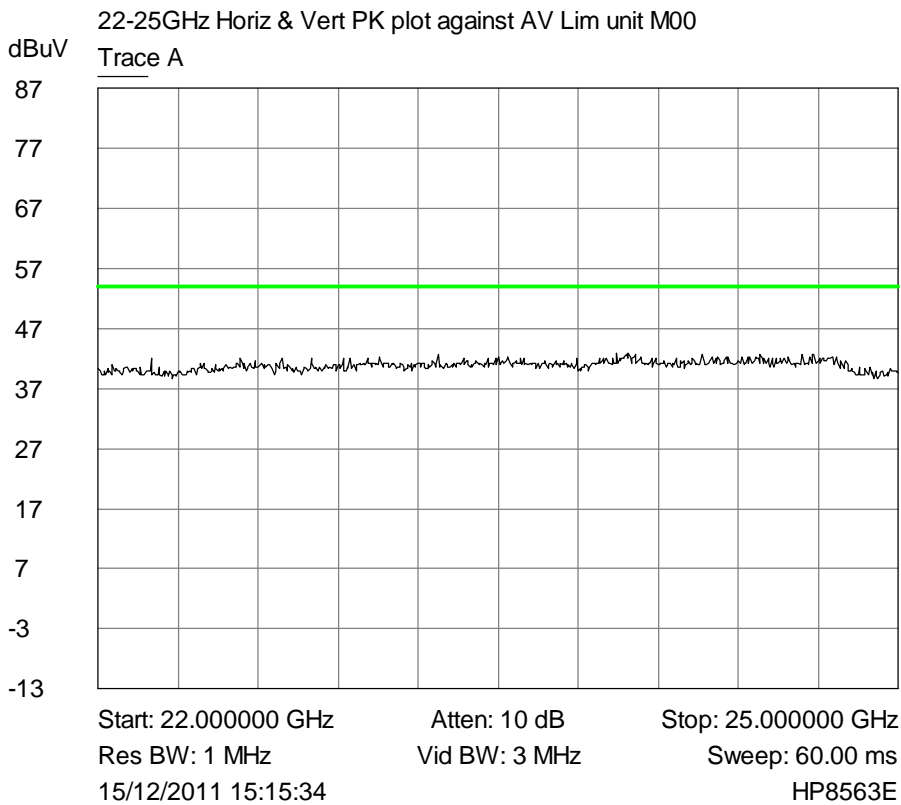
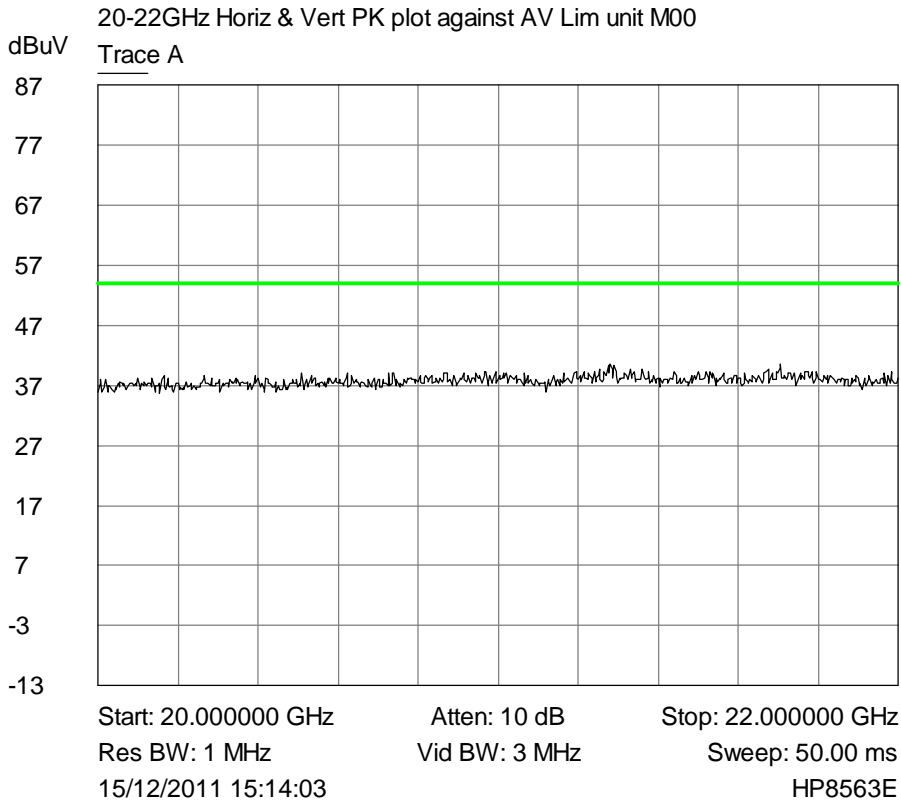
Plot of Average Vertical emissions 1GHz - 25GHz against the Average limit line.

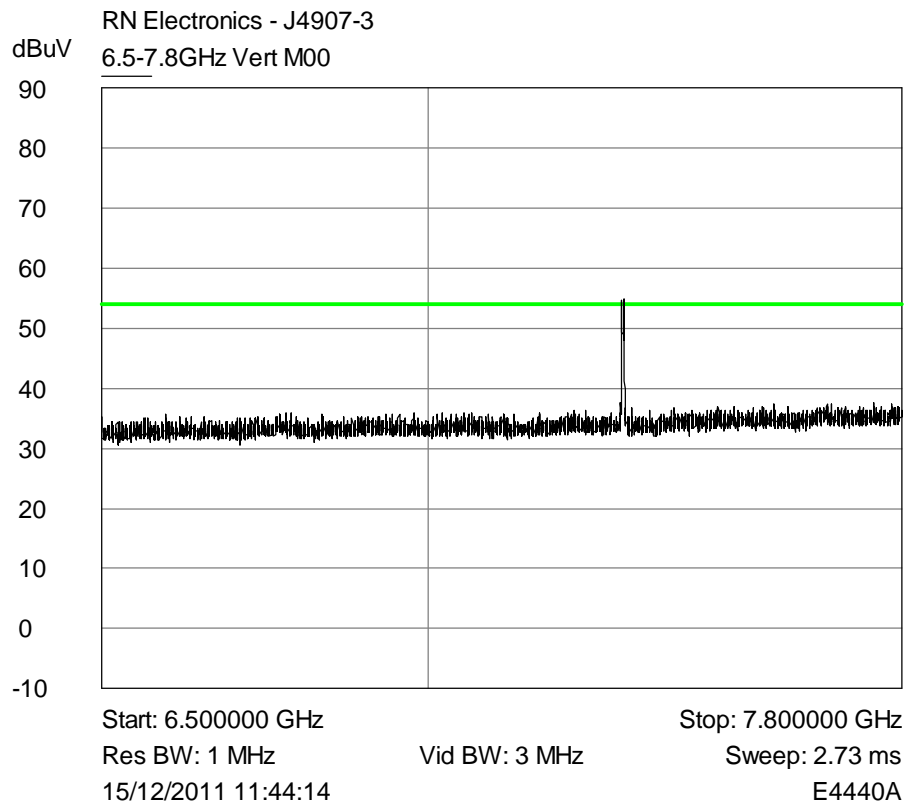
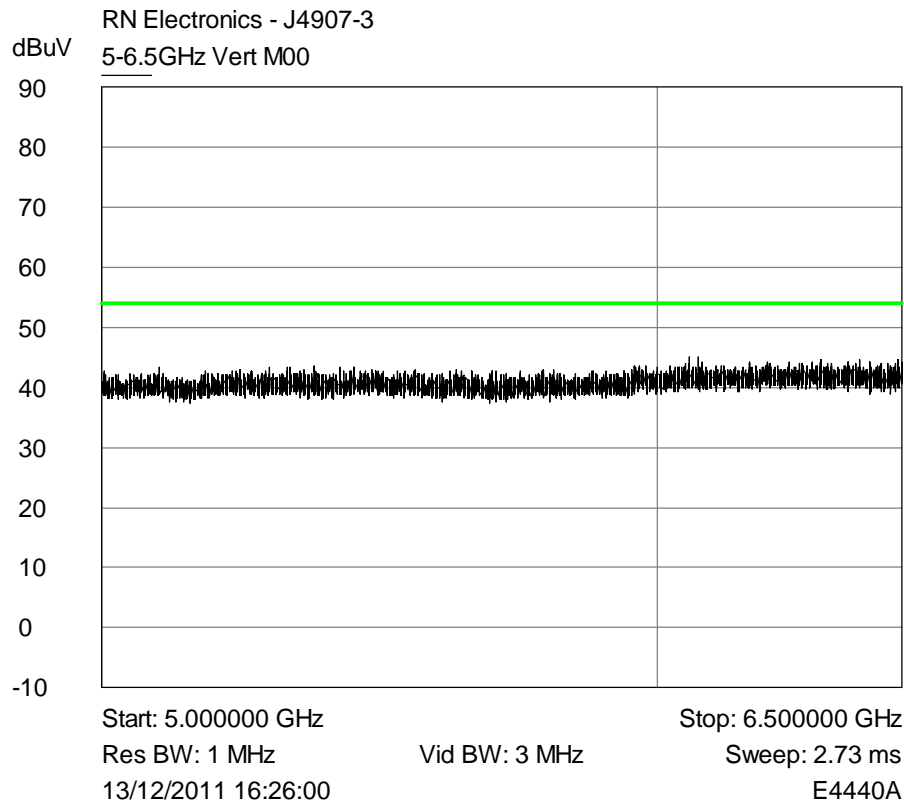












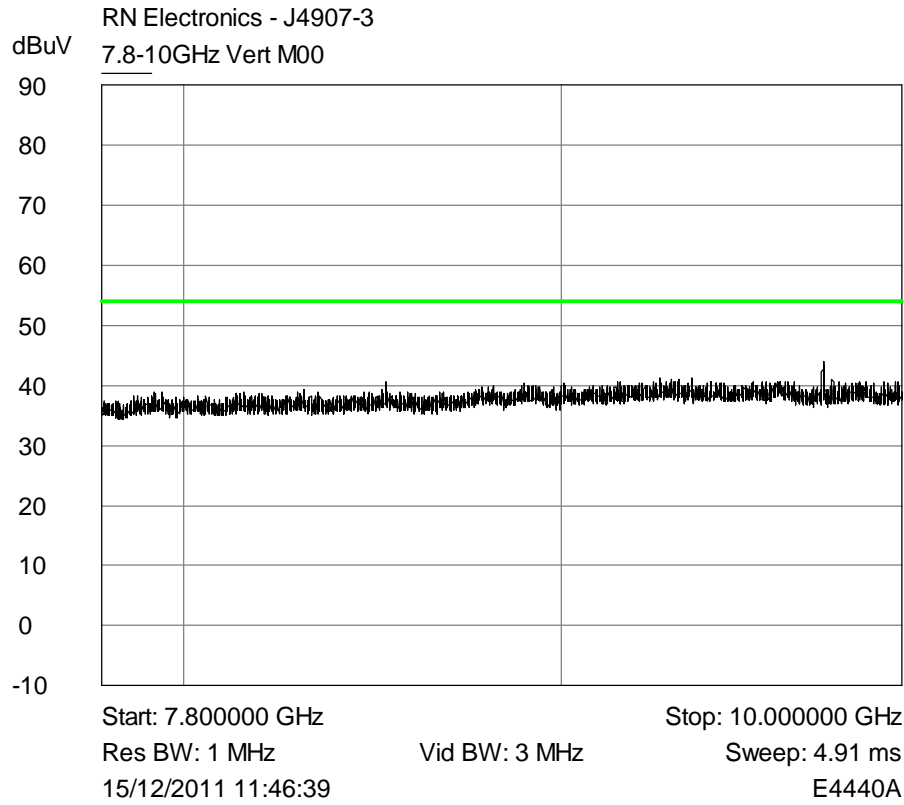


Table of signals measured above 1GHz M00 Unit.

Note: The values measured and tabulated below are with the EUT operating in continuous transmit and are directly a result of the modulated signal (harmonics). According to 15.35(c) the duty cycle should be taken into consideration when calculating the average value of the emission. Therefore these values will actually be reduced in practice. Refer to the manufacturer's statement regarding actual duty cycle.

Horizontal

Bottom Channel

Signal No.	Freq (MHz)	Peak Amp (dBuV)	AV Amp (dBuV)	AV - Lim1 (dB)
1	4810	55.7	47.9	-6.1
2	7215	58.7	51.3	-2.7
3	9620	48.9	37.9	-16.1
4	12025	51.3	41.0	-13.0

Middle Channel

Signal No.	Freq (MHz)	Peak Amp (dBuV)	AV Amp (dBuV)	AV - Lim1 (dB)
1	4880	55.4	47.2	-6.8
2	7320	64.8	58.0	4 ¹
3	9760	50.4	40.4	-13.6
4	12200	50.2	38.7	-15.3

Top Channel

Signal No.	Freq (MHz)	Peak Amp (dBuV)	AV Amp (dBuV)	AV - Lim1 (dB)
1	4960	53.7	45.4	-8.6
2	7440	63.6	56.6	2.6 ¹
3	9920	51.2	41.5	-12.5

Vertical

Bottom Channel

Signal No.	Freq (MHz)	Peak Amp (dBuV)	AV Amp (dBuV)	AV - Lim1 (dB)
1	4810	48.5	38	-16
2	7215	56.9	49.6	-4.4

Middle Channel

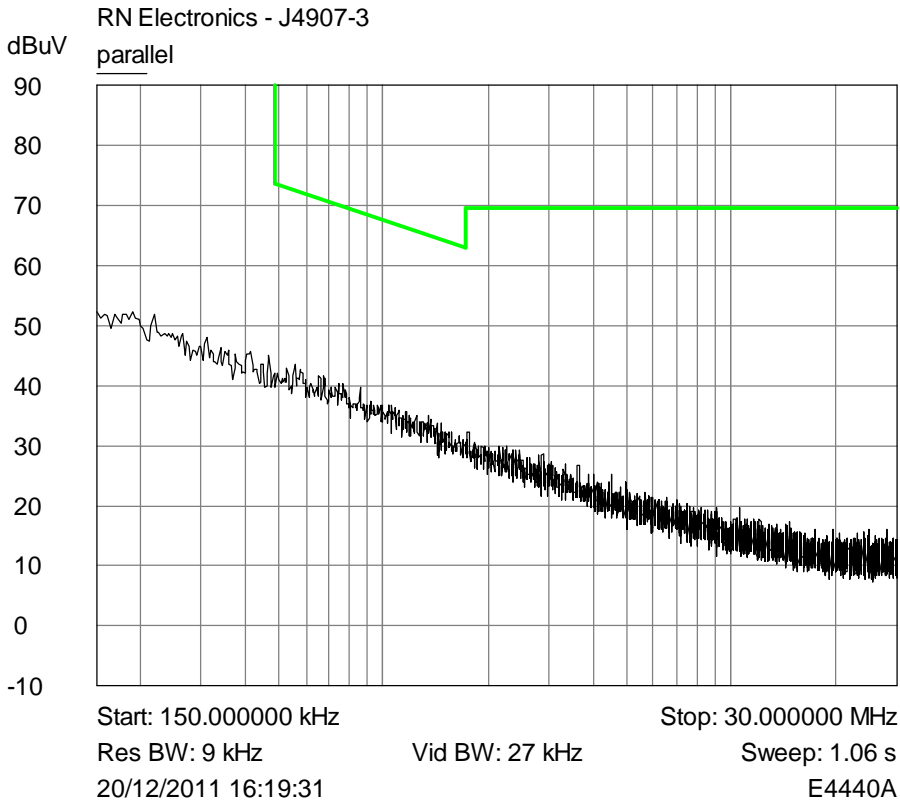
Signal No.	Freq (MHz)	Peak Amp (dBuV)	AV Amp (dBuV)	AV - Lim1 (dB)
1	4880	50.5	39.9	-14.1
2	7320	59.1	52.2	-1.8
3	9760	50.3	40.7	-13.3
4	12200	50.7	40.7	-13.3

Top Channel

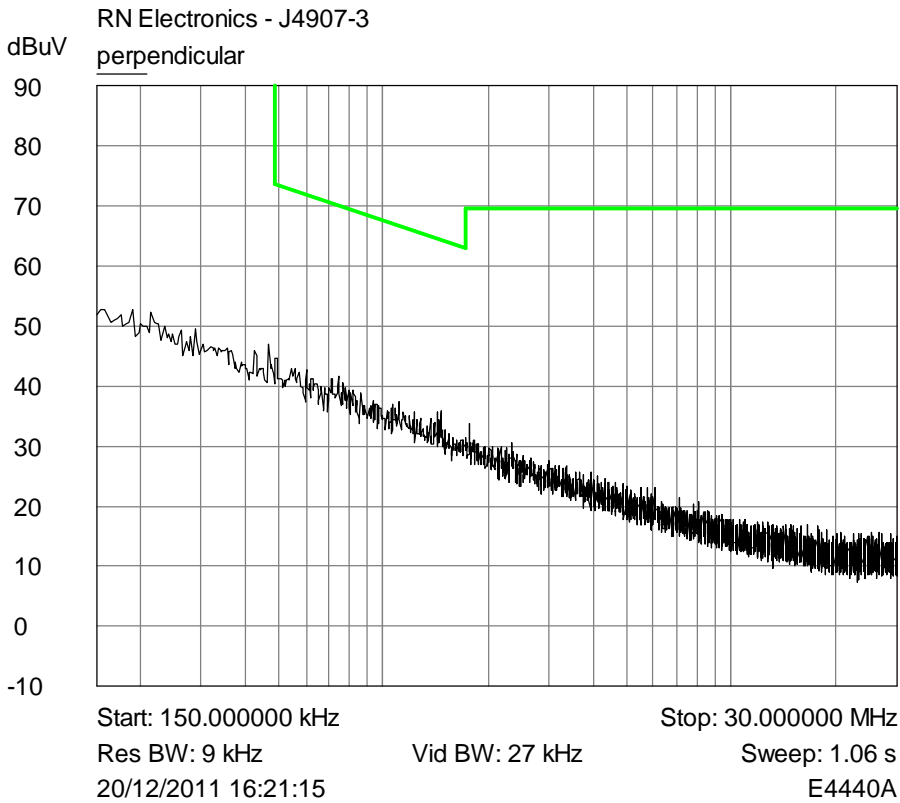
Signal No.	Freq (MHz)	Peak Amp (dBuV)	AV Amp (dBuV)	AV - Lim1 (dB)
1	4960	52.0	43.3	-10.7
2	7440	62.1	54.9	0.9 ¹
3	9920	52.2	43.0	-11
4	12400	49.3	37.3	-16.7

¹ The values in the above table are from an EUT operating at 100% duty. The manufacturer has declared the actual duty per 100ms to be typically 1% and therefore an additional correction factor of up to 20dB can be applied.

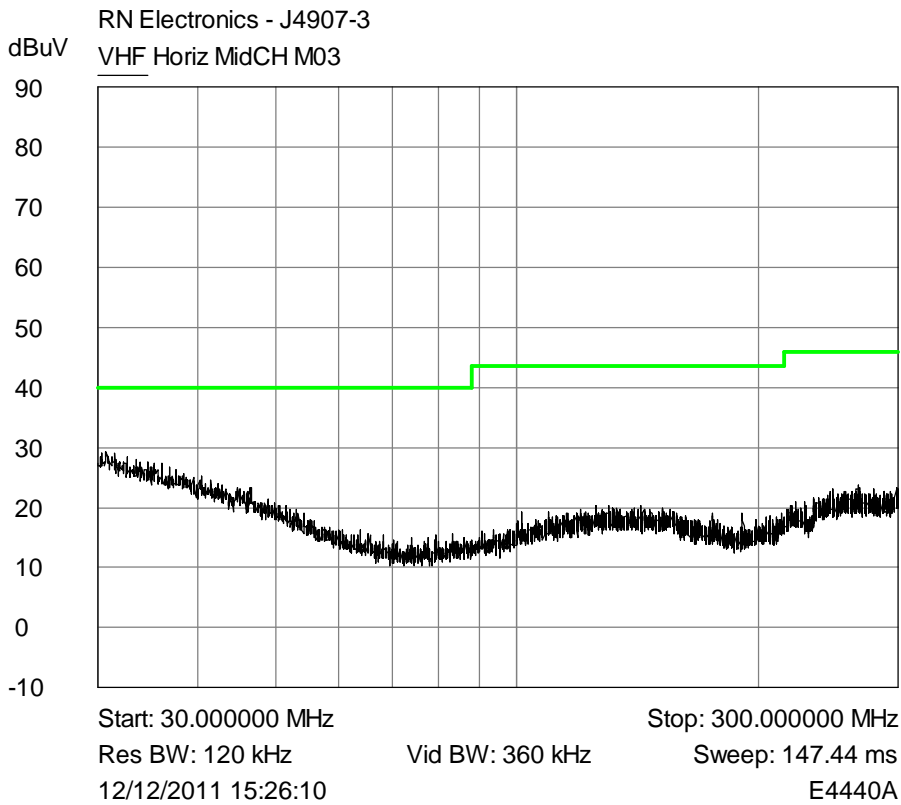
6.2.2 M03 integral antenna unit results



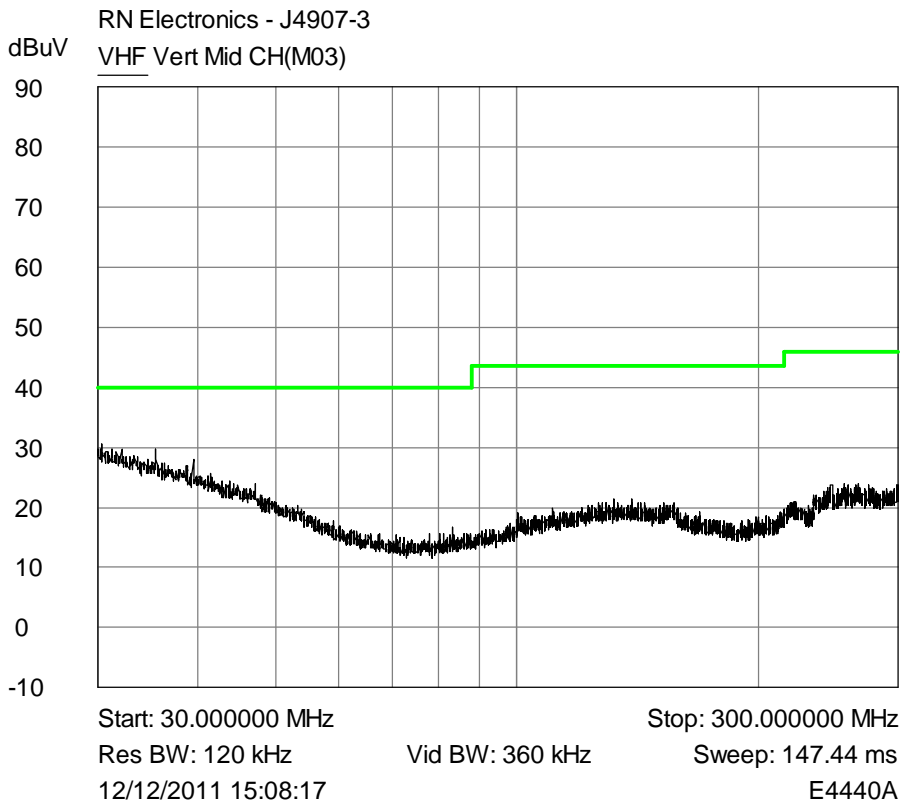
Plot of peak Parallel emissions 150kHz - 30MHz against the quasi-peak limit line.



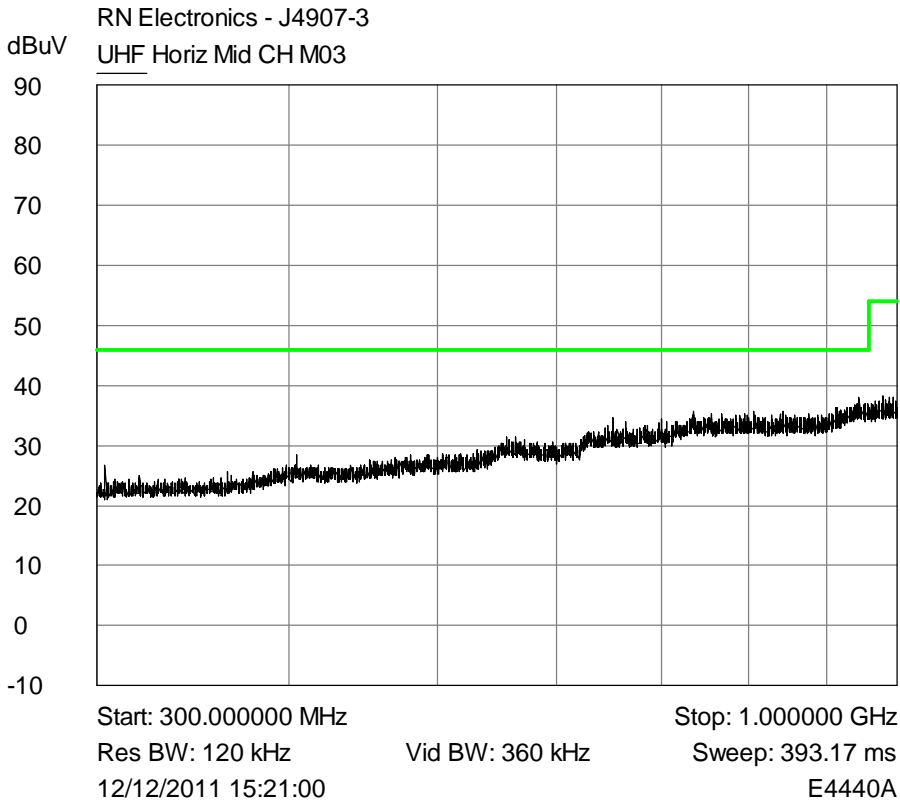
Plot of peak Perpendicular emissions 150kHz - 30MHz against the quasi-peak limit line.



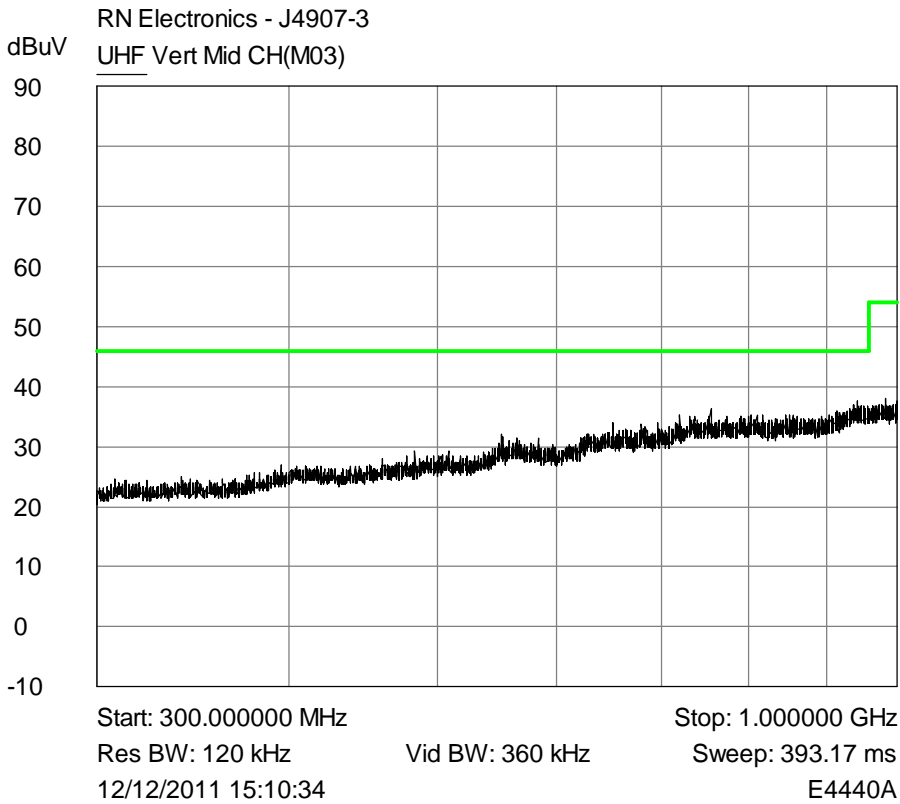
Plot of peak horizontal emissions 30MHz - 300MHz against the quasi-peak limit line.



Plot of peak vertical emissions 30MHz - 300MHz against the quasi-peak limit line.



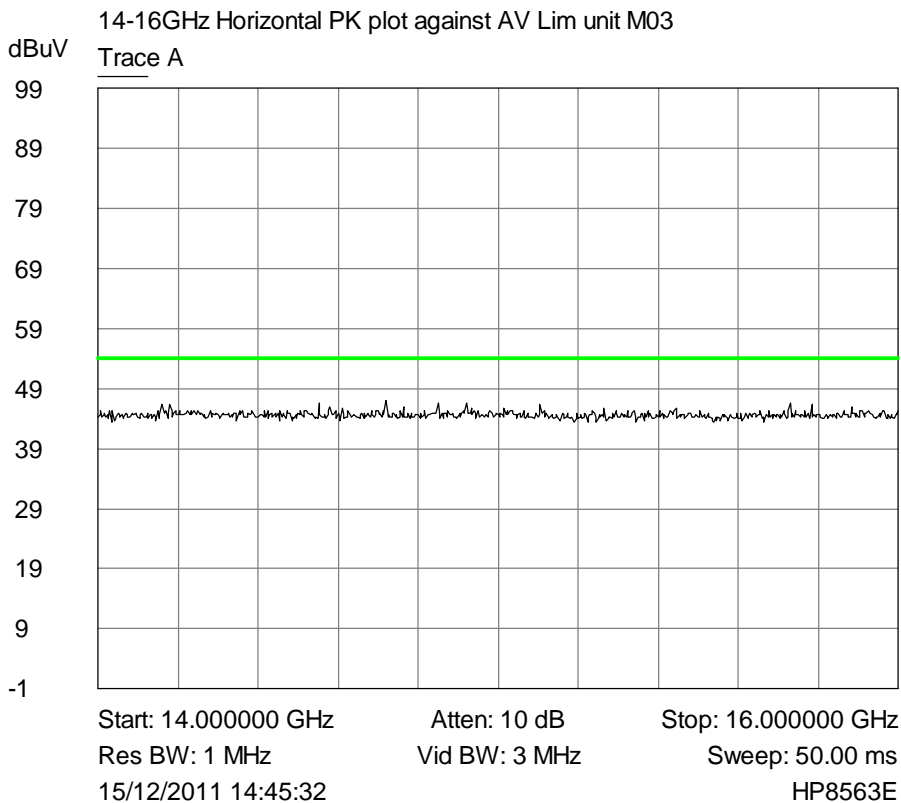
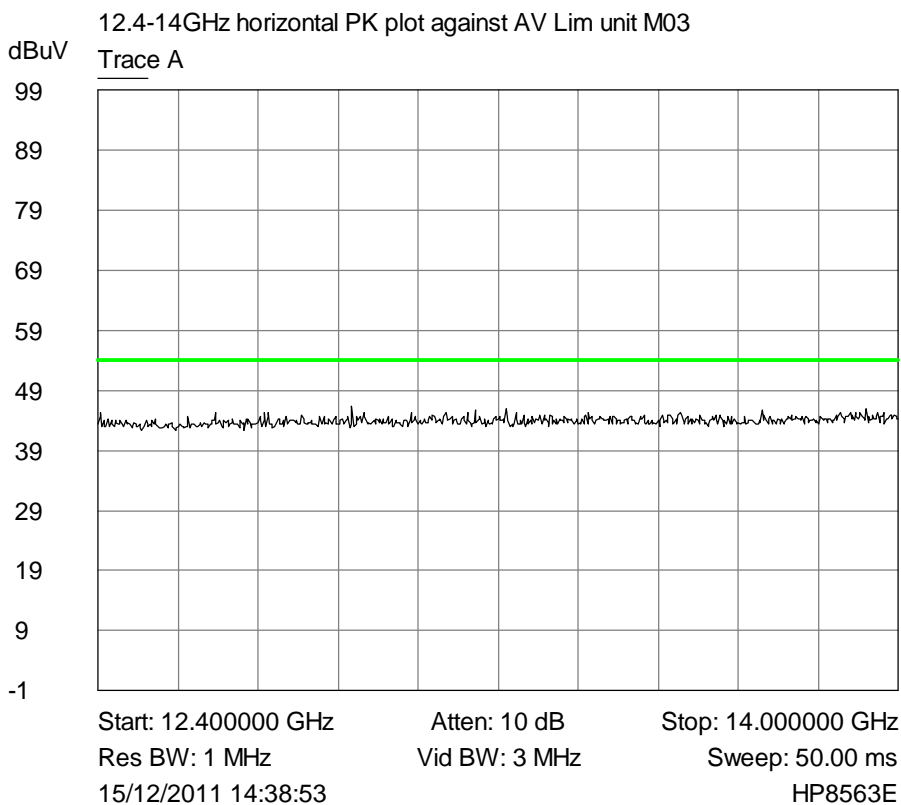
Plot of peak horizontal emissions 300MHz - 1GHz against the quasi-peak limit line.

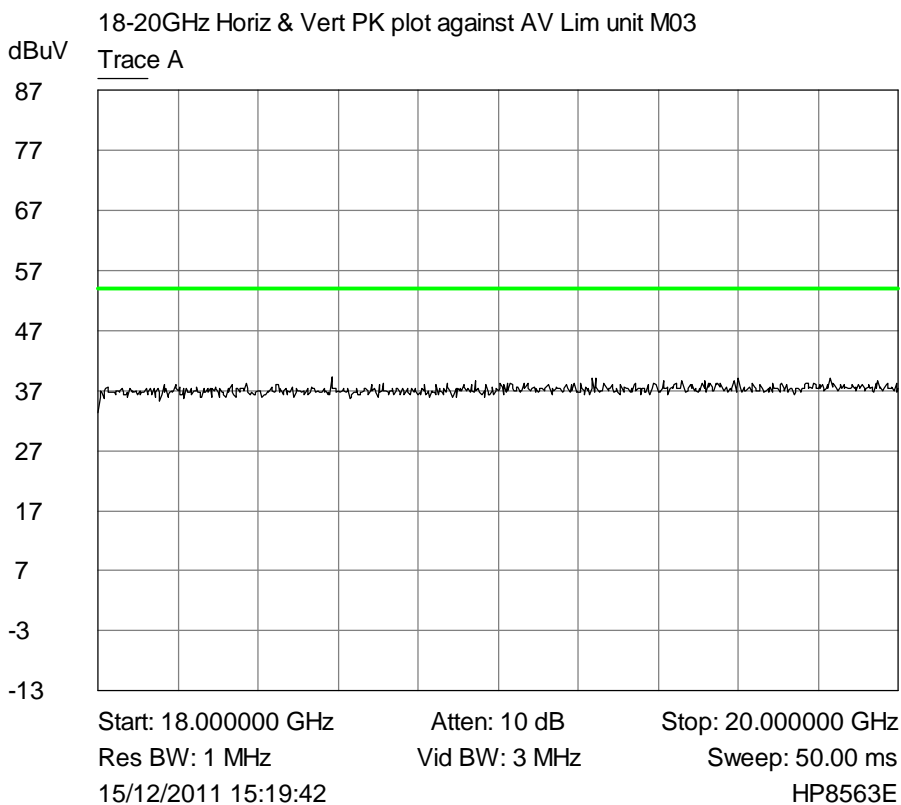
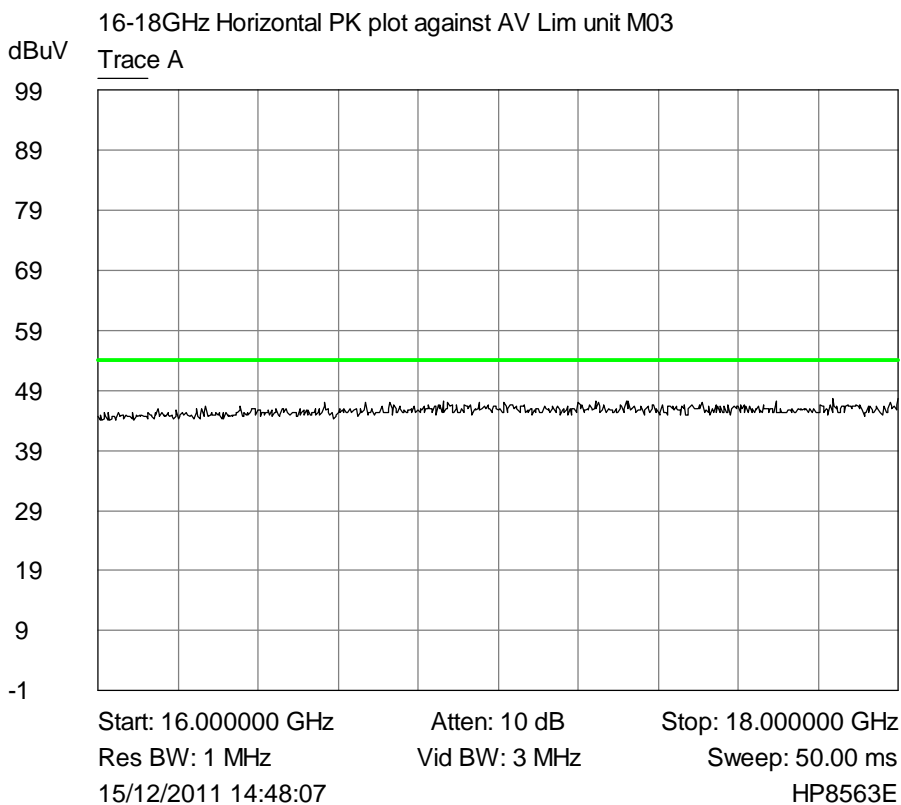


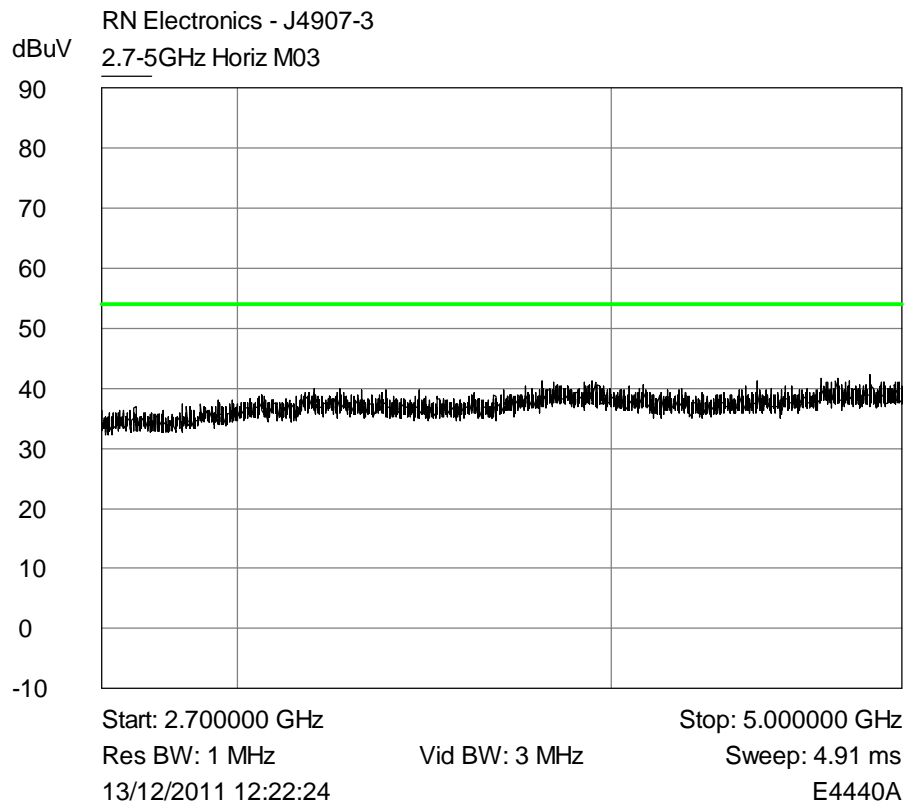
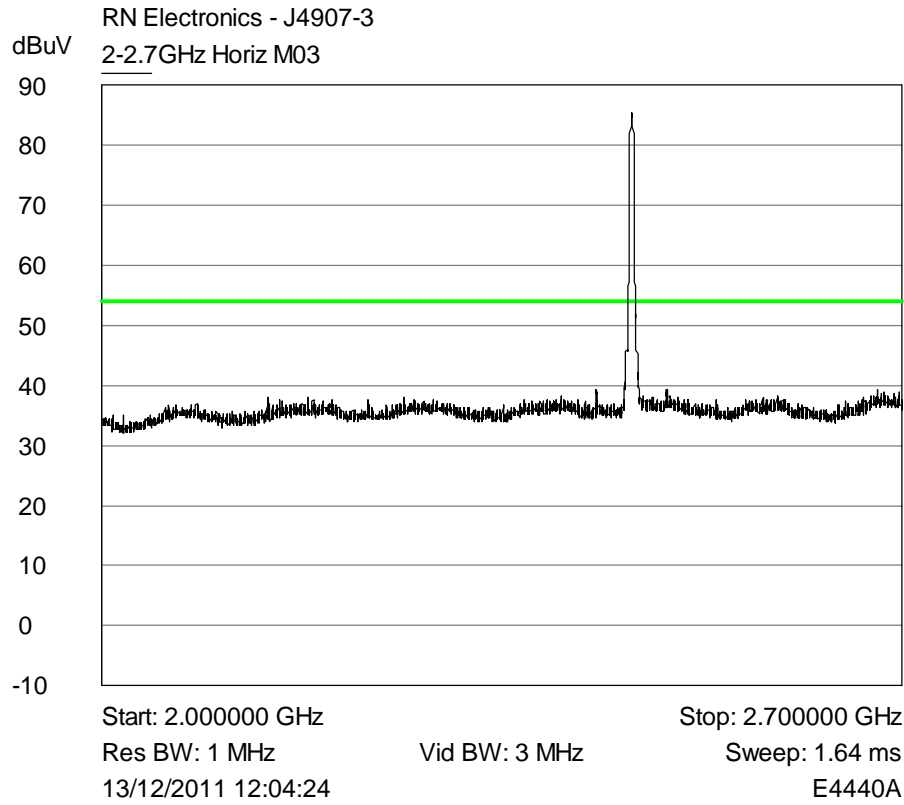
Plot of peak vertical emissions 300MHz - 1GHz against the quasi-peak limit line.

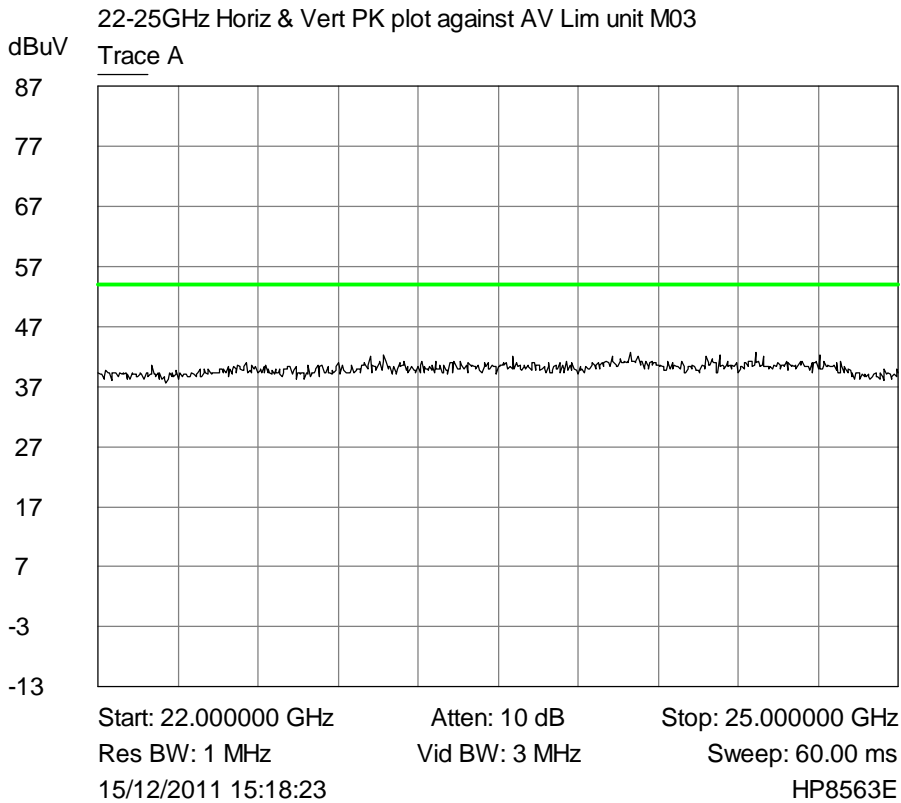
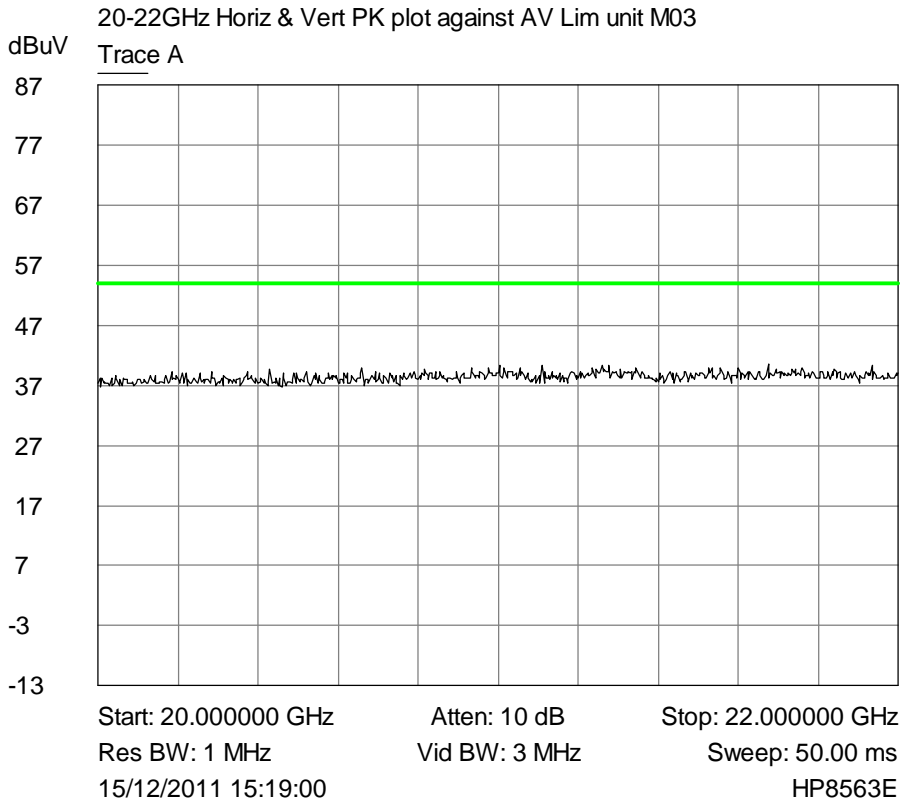
Table of signals measured below 1GHz M03 unit.

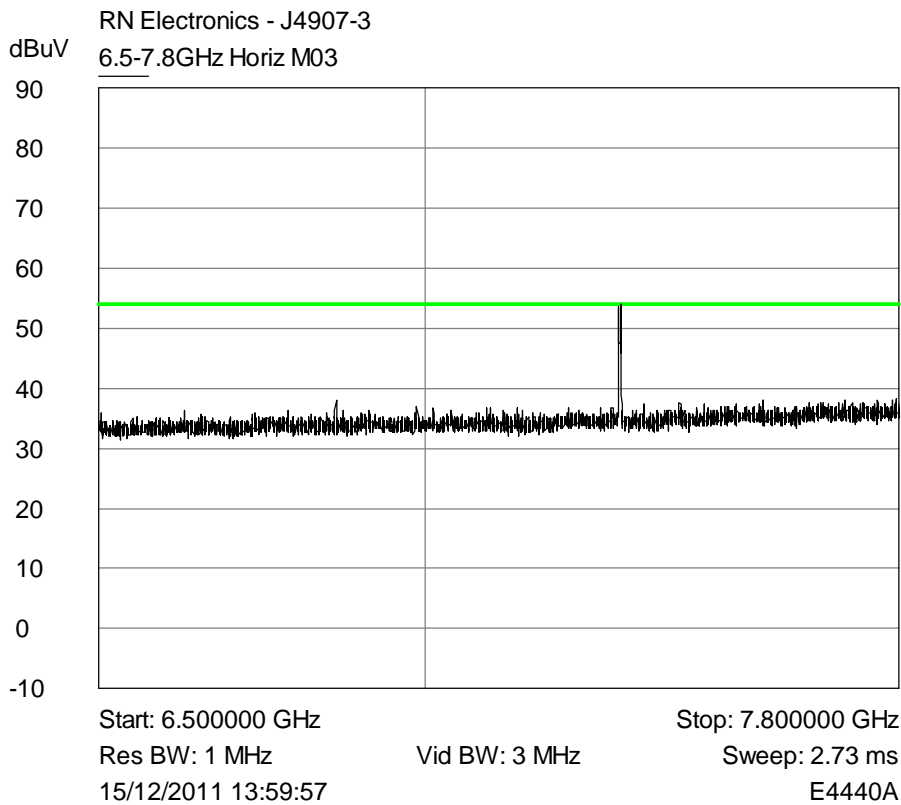
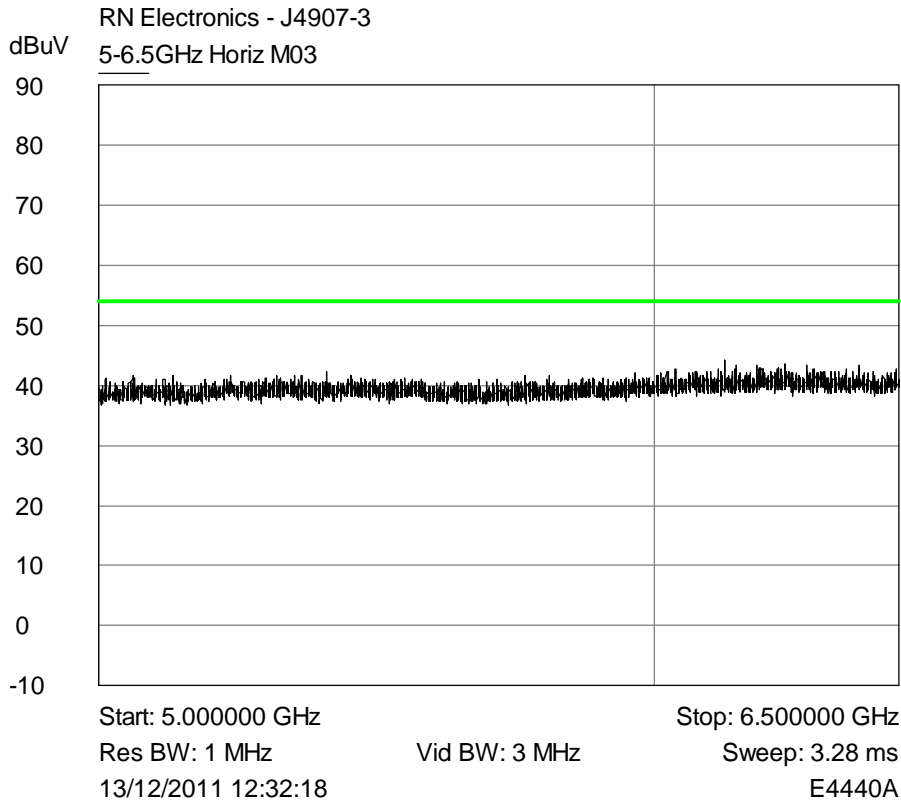
No signals found.

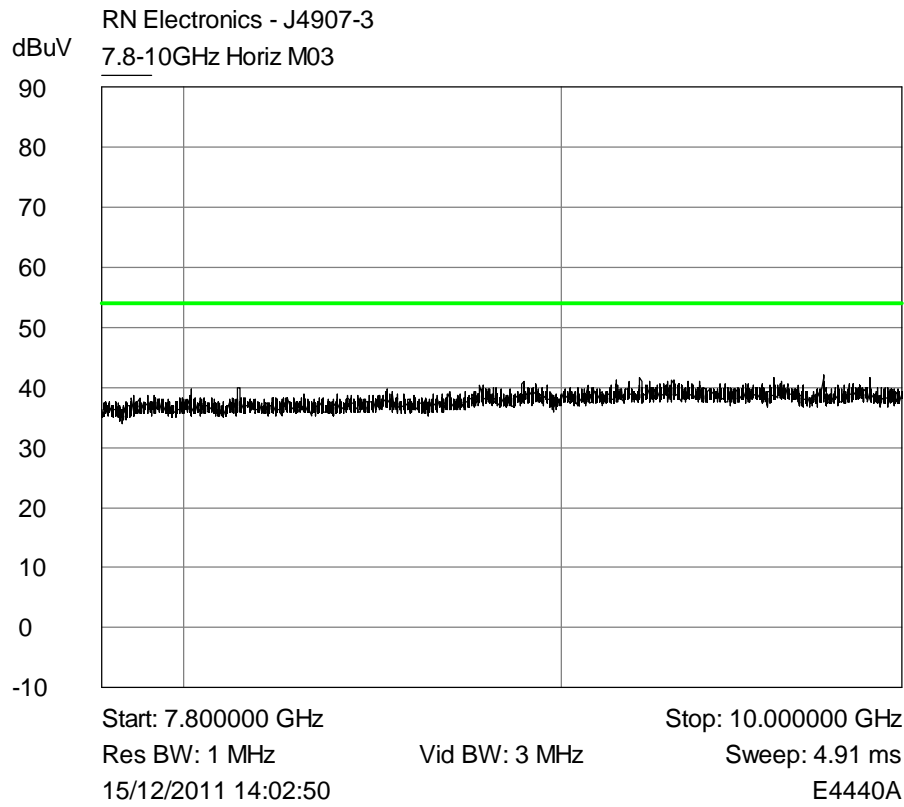




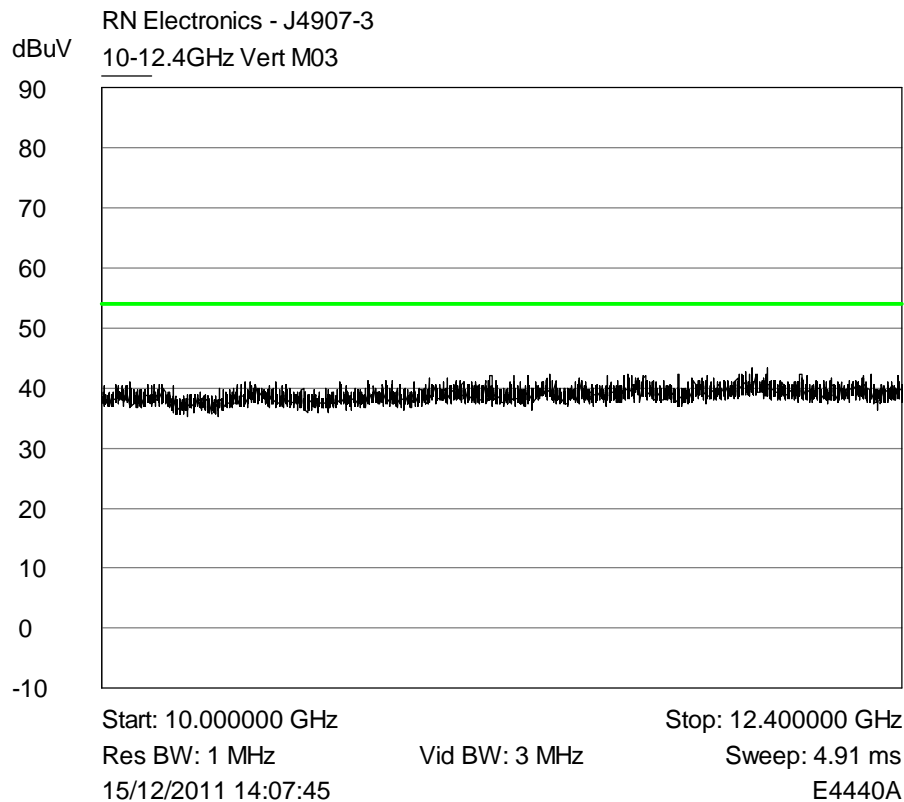
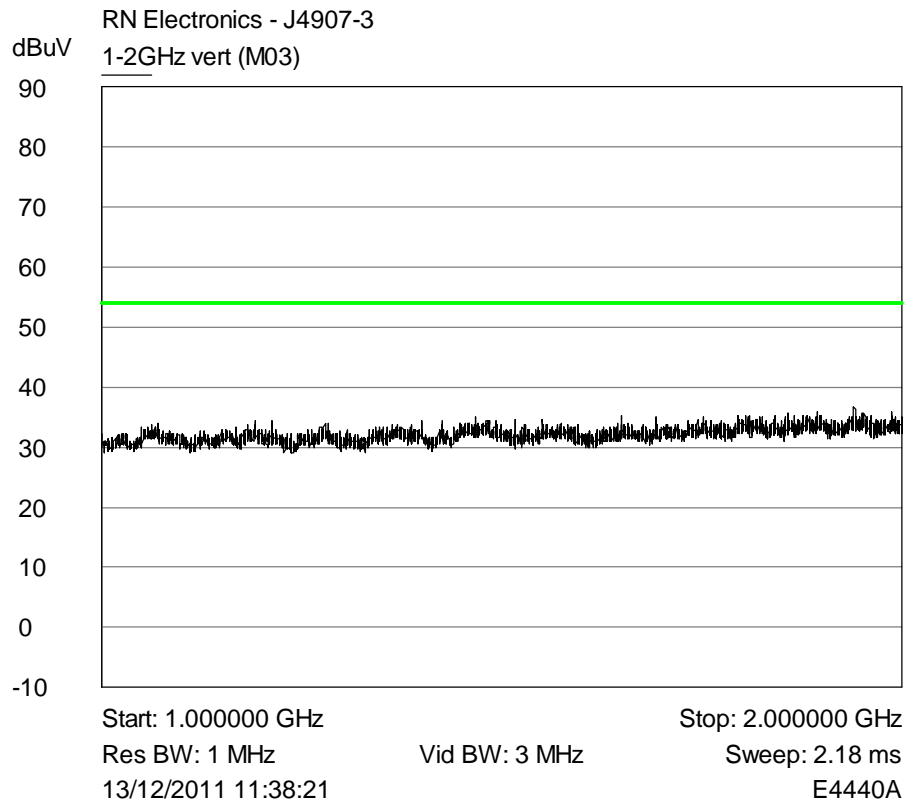


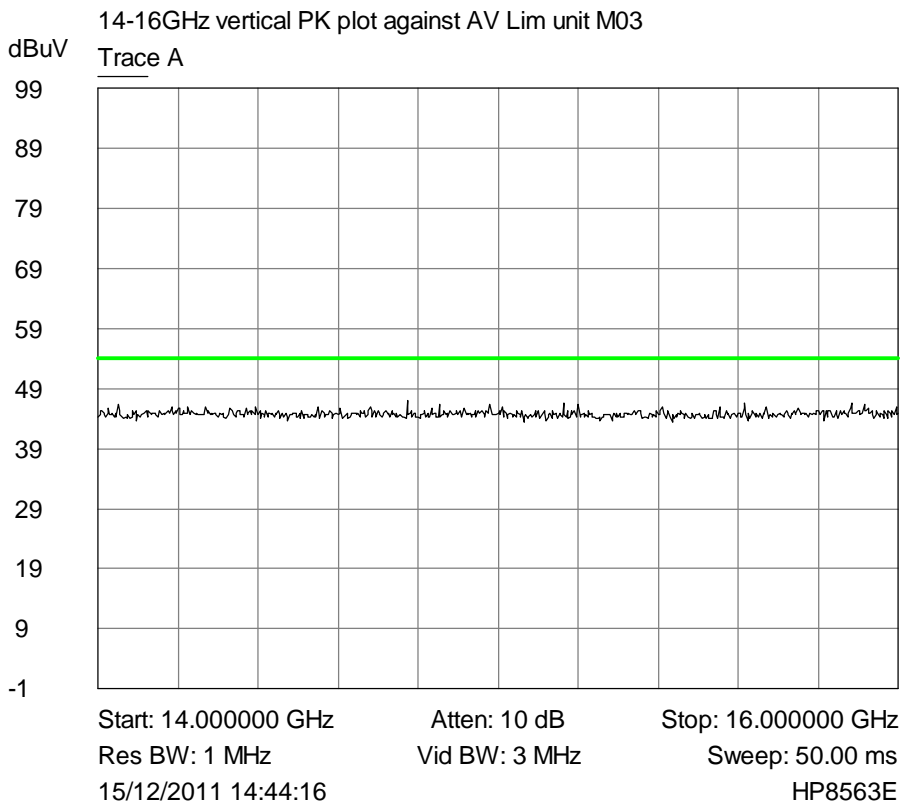
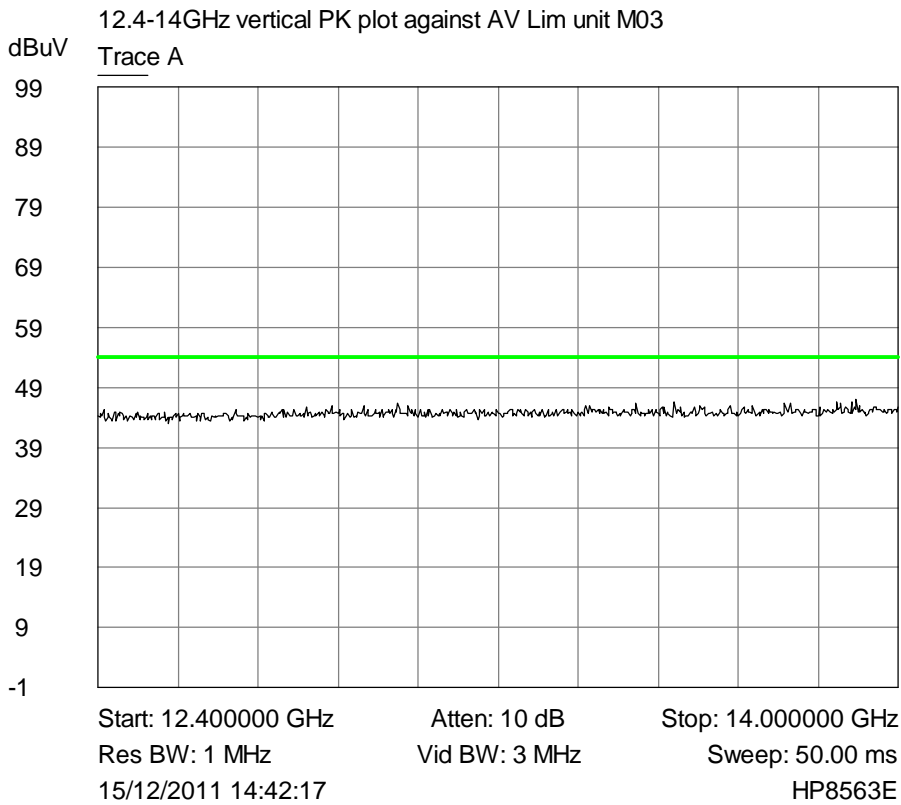


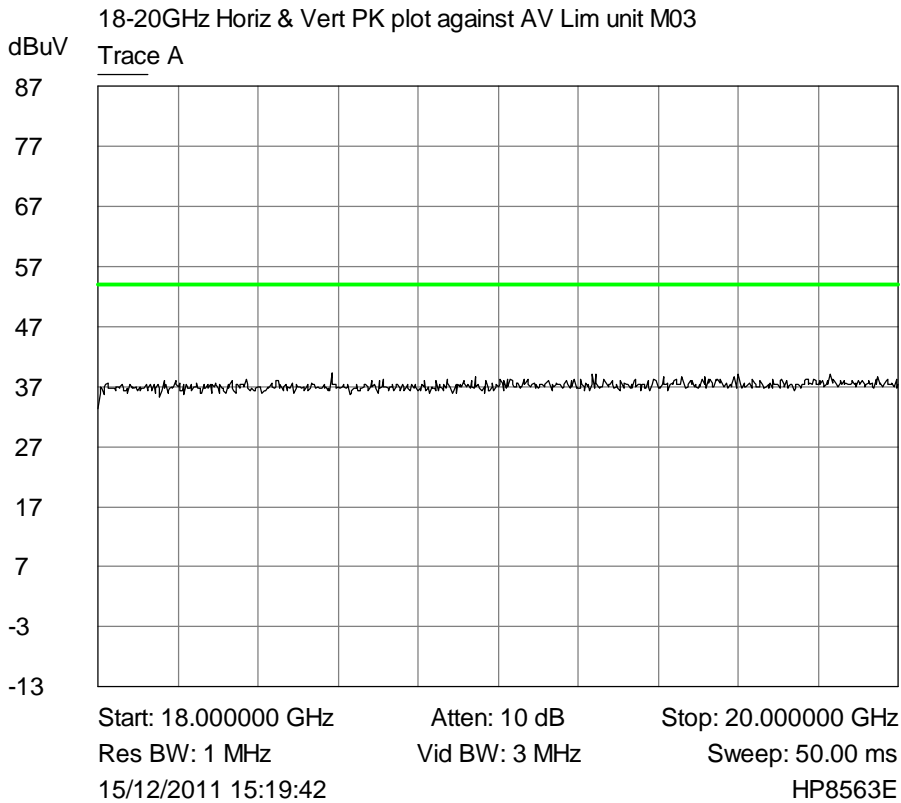
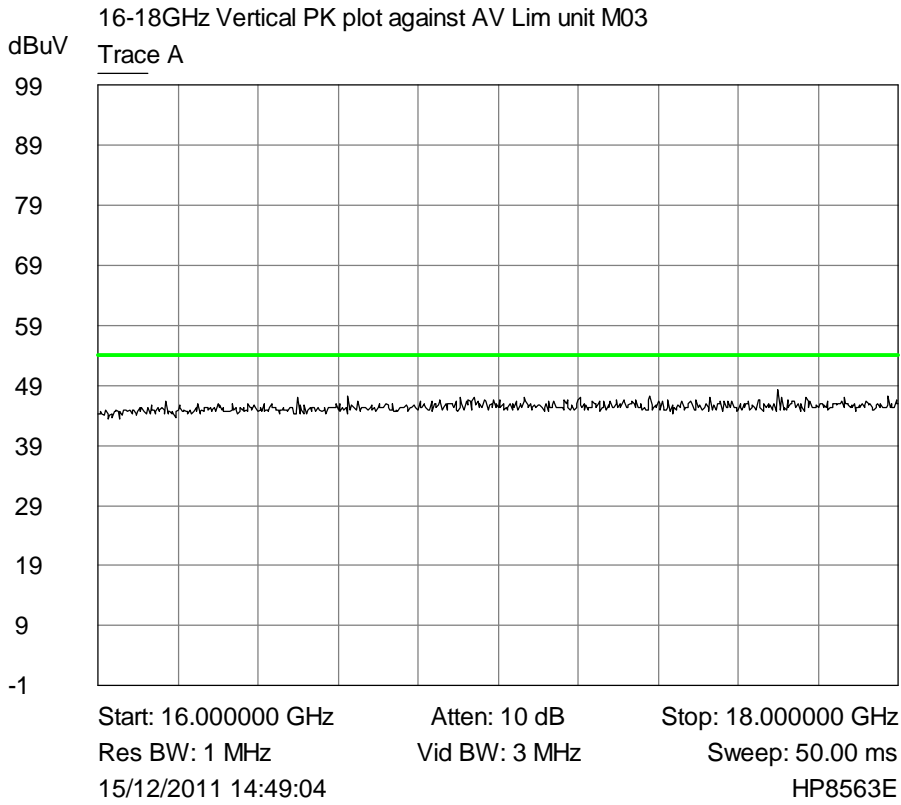


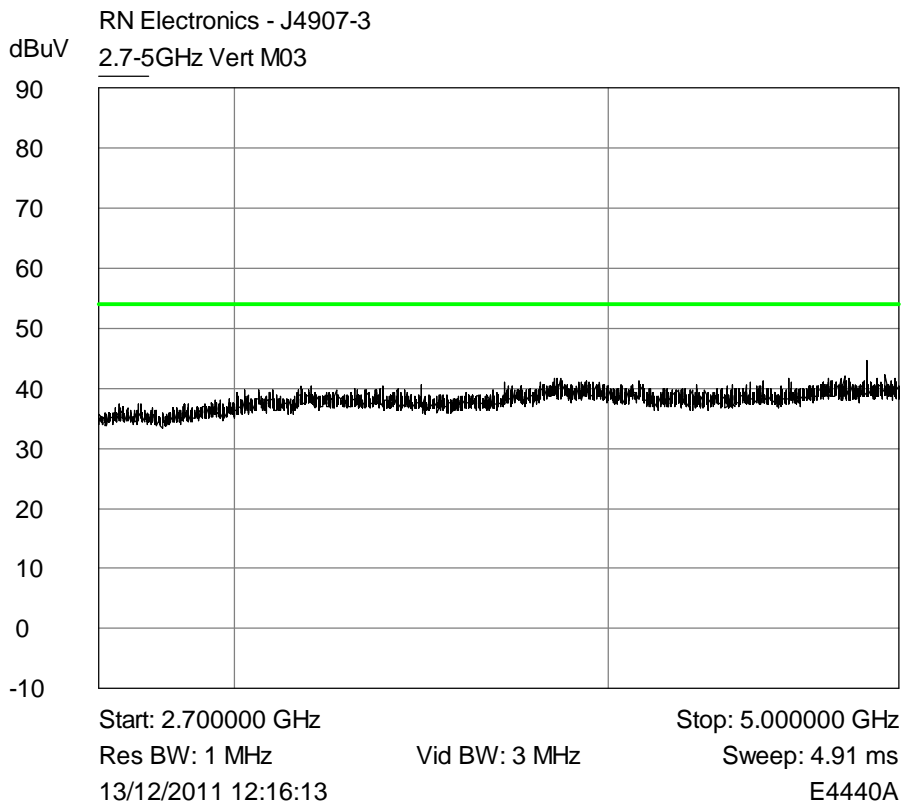
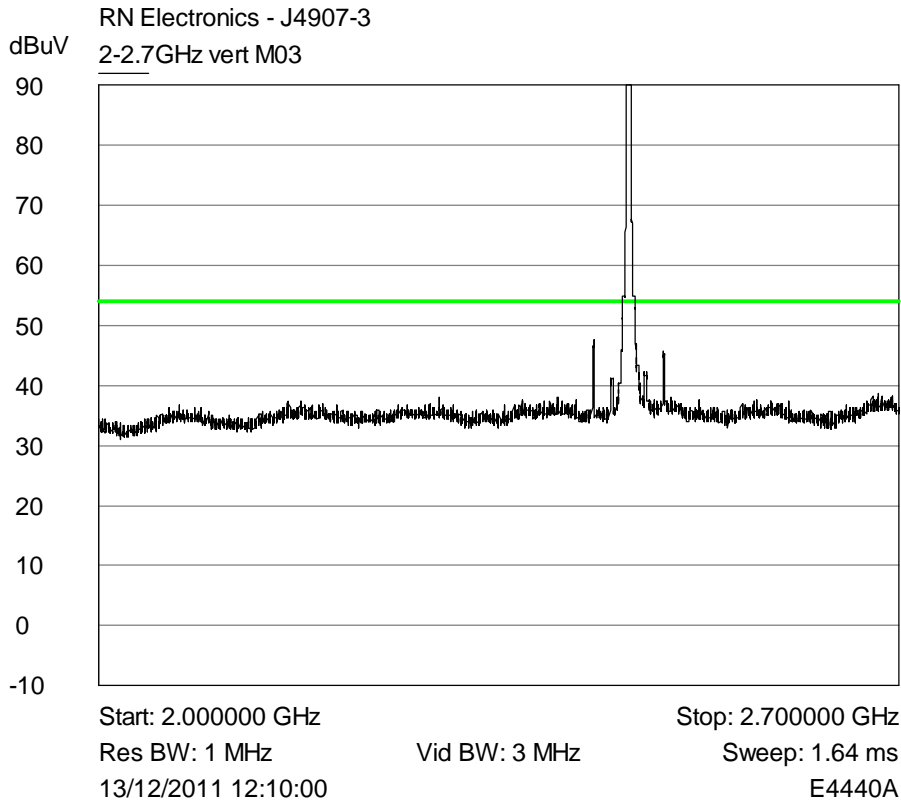


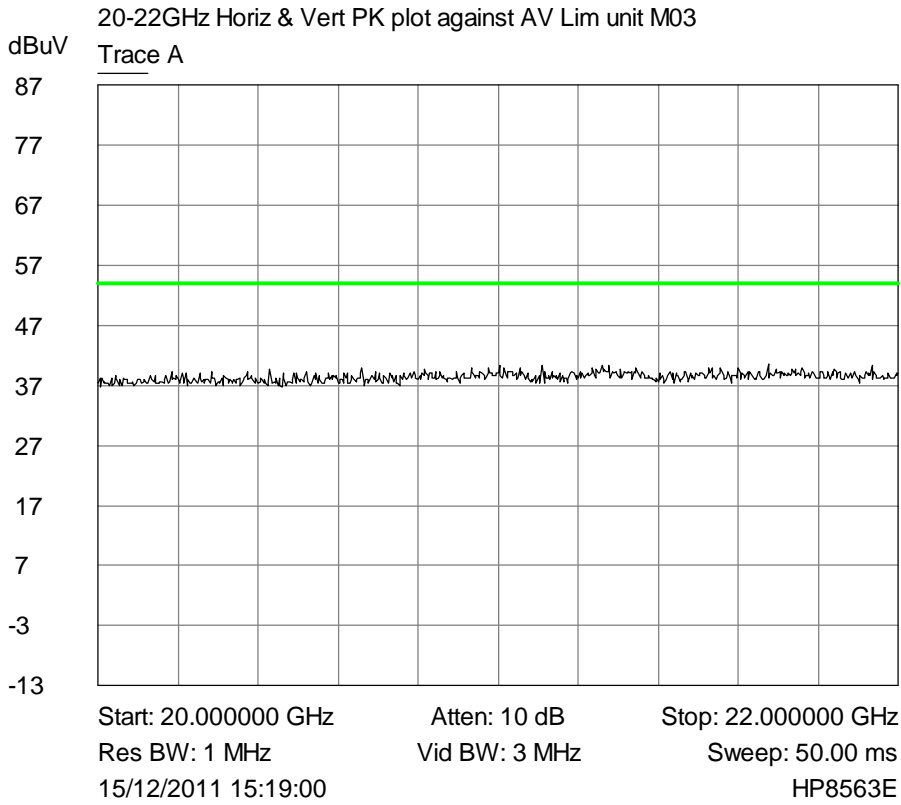
Plot of Average Vertical emissions 1GHz - 25GHz against the Average limit line.

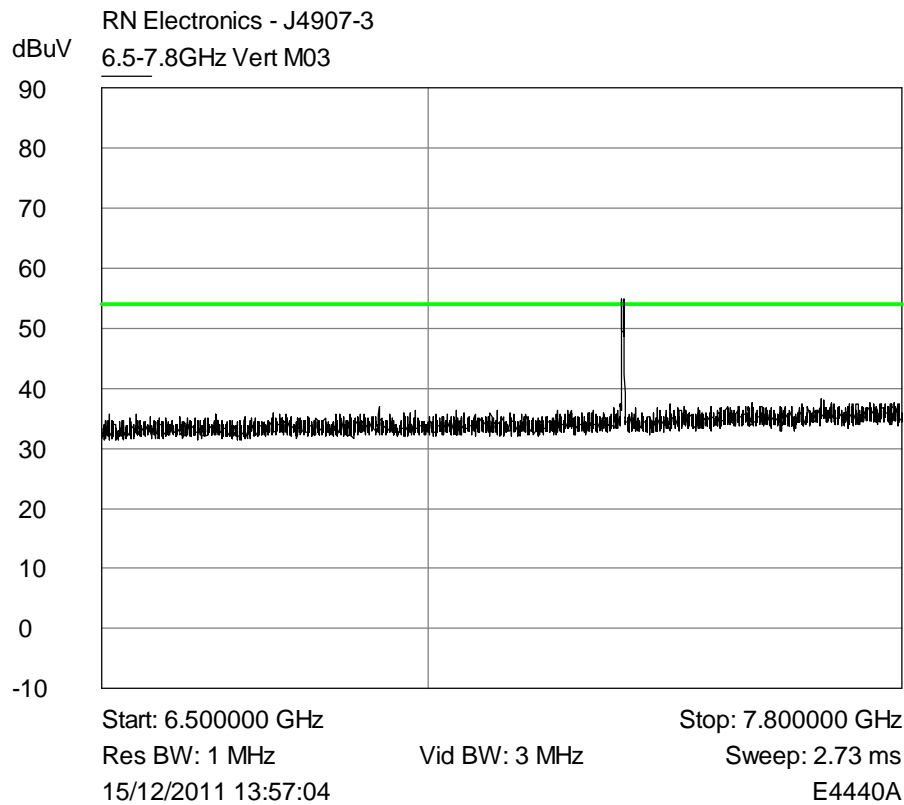
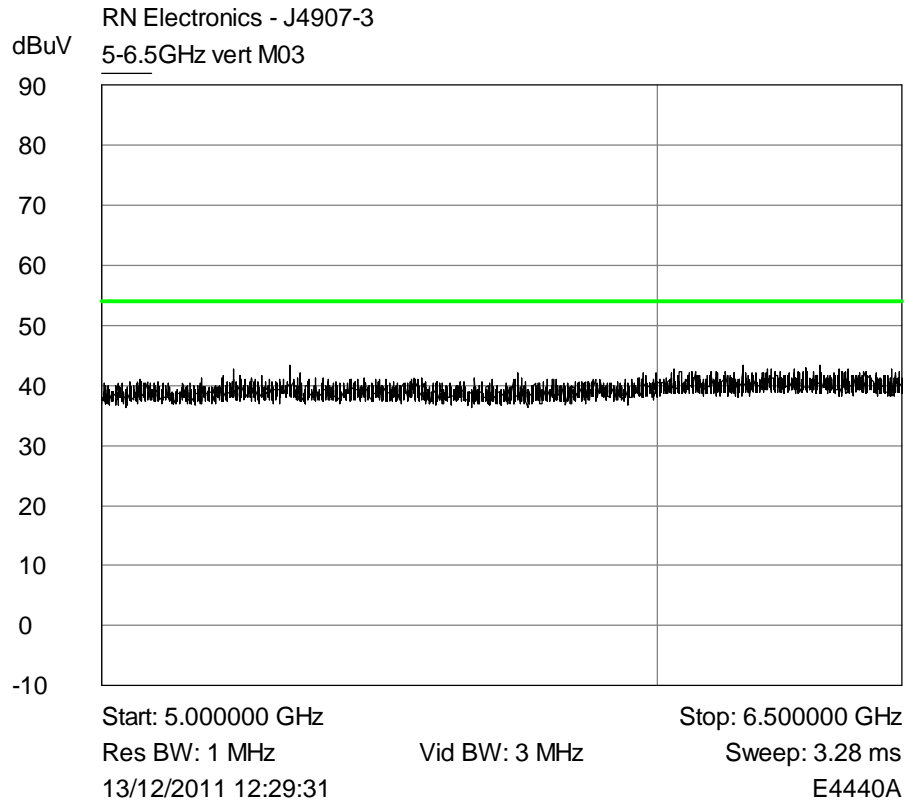












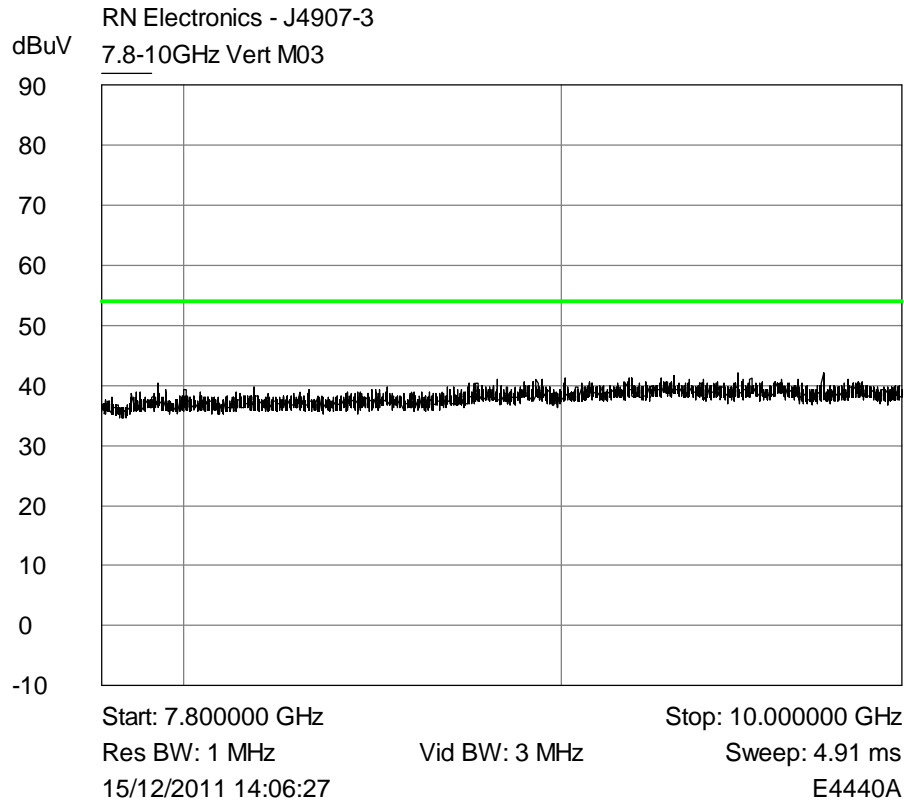


Table of signals measured above 1GHz M03 unit.

Note: The values measured and tabulated below are with the EUT operating in continuous transmit and are directly a result of the modulated signal (harmonics). According to 15.35(c) the duty cycle should be taken into consideration when calculating the average value of the emission. Therefore these values will actually be reduced in practice. Refer to the manufacturer's statement regarding actual duty cycle.

Horizontal

Bottom Channel

Signal No.	Freq (MHz)	Peak Amp (dBuV)	AV Amp (dBuV)	AV - Lim1 (dB)
1	2372.655	41.3	36.3	-17.7
2	2437.315	41.0	36.4	-17.6
3	4810	47.6	36.3	-17.7
4	7215	52.9	45.4	-8.6
5	12025	46.6	34.2	-19.8

Middle Channel

Signal No.	Freq (MHz)	Peak Amp (dBuV)	AV Amp (dBuV)	AV - Lim1 (dB)
1	2407.940	41.0	39.2	-14.8
2	2471.723	40.0	38.3	-15.7
3	4880	46.5	35.7	-18.3
4	7320	59.2	51.9	-2.1
5	9760	48.4	37.8	-16.2

Top Channel

Signal No.	Freq (MHz)	Peak Amp (dBuV)	AV Amp (dBuV)	AV - Lim1 (dB)
1	2447.623	41.1	38.9	-15.1
2	2512.557	41.7	39.2	-14.8
3	4960	45.6	33.9	-20.1
4	7440	56.7	49.0	-5.0

Vertical

Bottom Channel

Signal No.	Freq (MHz)	Peak Amp (dBuV)	AV Amp (dBuV)	AV - Lim1 (dB)
1	2373.315	49.8	47.7	-6.3
2	2436.607	47.2	45.9	-8.1
3	4810	49.2	39.1	-14.9
4	7215	54.9	47.4	-6.6
5	9620	48.2	36.7	-17.3

Middle Channel

Signal No.	Freq (MHz)	Peak Amp (dBuV)	AV Amp (dBuV)	AV - Lim1 (dB)
1	2408.396	48.0	46.0	-8.0
2	2472.302	46.8	45.2	-8.8
3	4880	50	39.9	-14.1
4	7320	58.1	50.6	-3.4
5	9760	48.4	37.8	-16.2

Top Channel

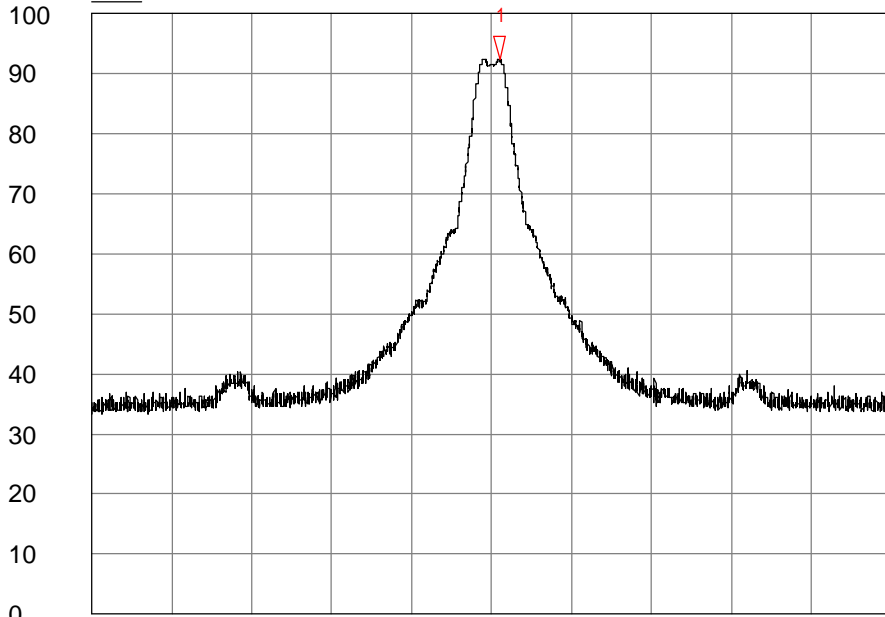
Signal No.	Freq (MHz)	Peak Amp (dBuV)	AV Amp (dBuV)	AV - Lim1 (dB)
1	2447.541	48.8	46.9	-7.1
2	2512.542	47.6	44.9	-9.1
3	4960	49.0	37.4	-16.6
4	7440	56.8	49.3	-4.7
5	9920	48.7	37.7	-16.3

6.3 Fundamental Emissions

M00 Unit.

J4907-3 vert field strength 2.405GHz chan 1MHz RBW M00

dBuV
Trace A

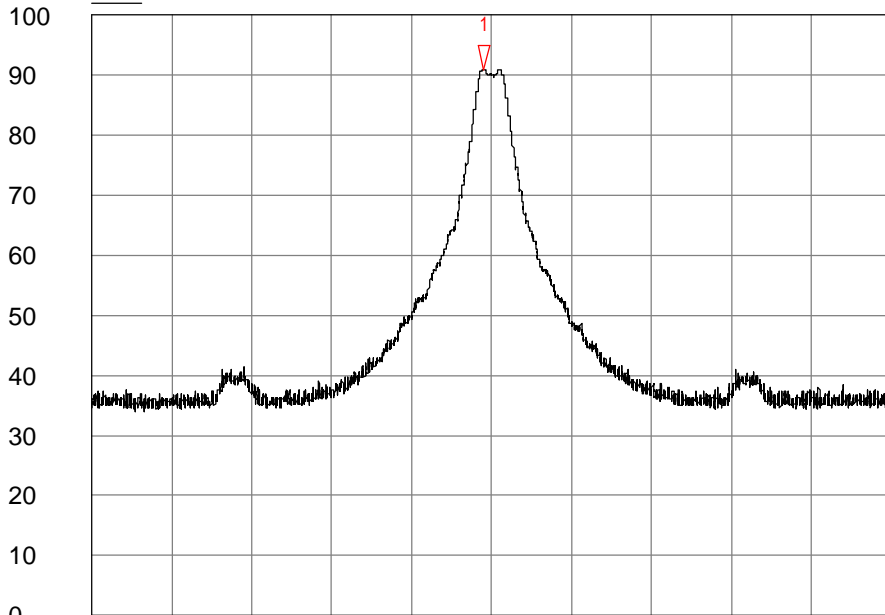


1 Trace A
2.405485 GHz
92.3947 dBuV

Start: 2.380000 GHz Stop: 2.430000 GHz
Res BW: 1 MHz Vid BW: 3 MHz Sweep: 1.09 ms
15/12/2011 16:10:38 E4440A

J4907-3 vert field strength 2.440GHz chan 1MHz RBW M00

dBuV
Trace A

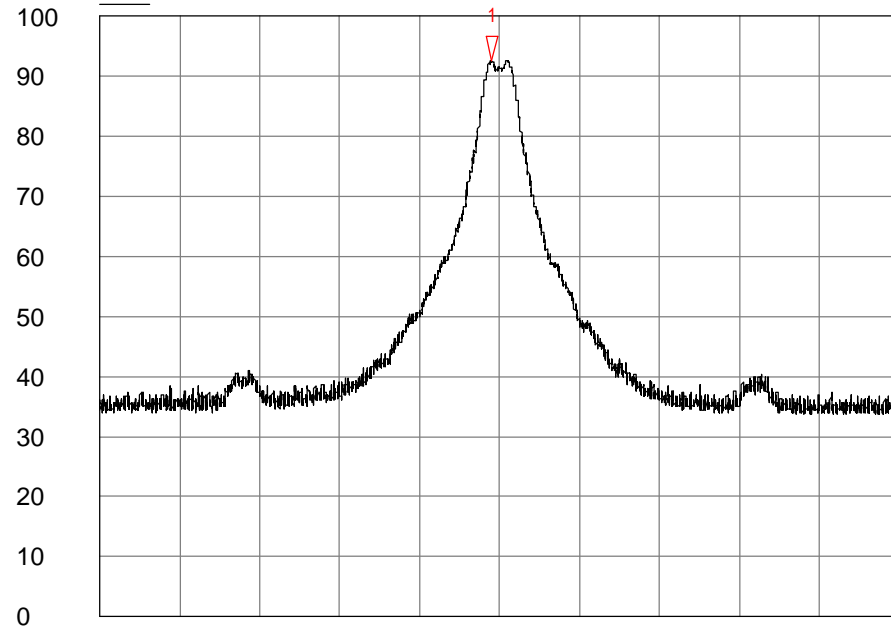


1 Trace A
2.439484 GHz
91.1077 dBuV

Start: 2.415000 GHz Stop: 2.465000 GHz
Res BW: 1 MHz Vid BW: 3 MHz Sweep: 1.09 ms
15/12/2011 16:33:21 E4440A

J4907-3 vert field strength 2.480GHz chan 1MHz RBW M00

Trace A



1 Trace A
2.479490 GHz
92.5857 dBuV

Start: 2.455000 GHz

Stop: 2.505000 GHz

Res BW: 1 MHz

Vid BW: 3 MHz

Sweep: 1.09 ms

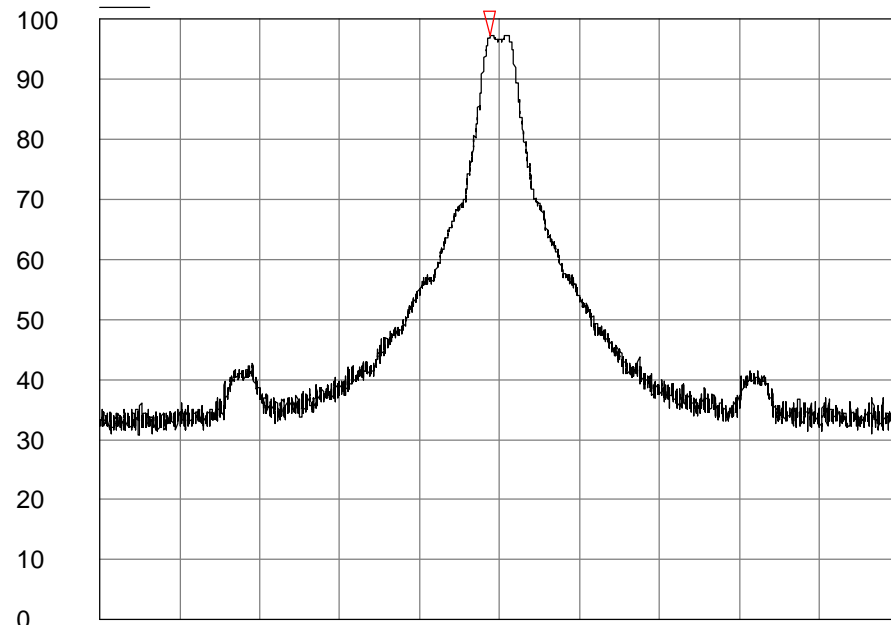
15/12/2011 16:39:18

E4440A

M03 unit.

J4907-3 vert field strength 2.405GHz chan 1MHz RBW M03

Trace A



1 Trace A
2.404423 GHz
97.4057 dBuV

Start: 2.380000 GHz

Stop: 2.430000 GHz

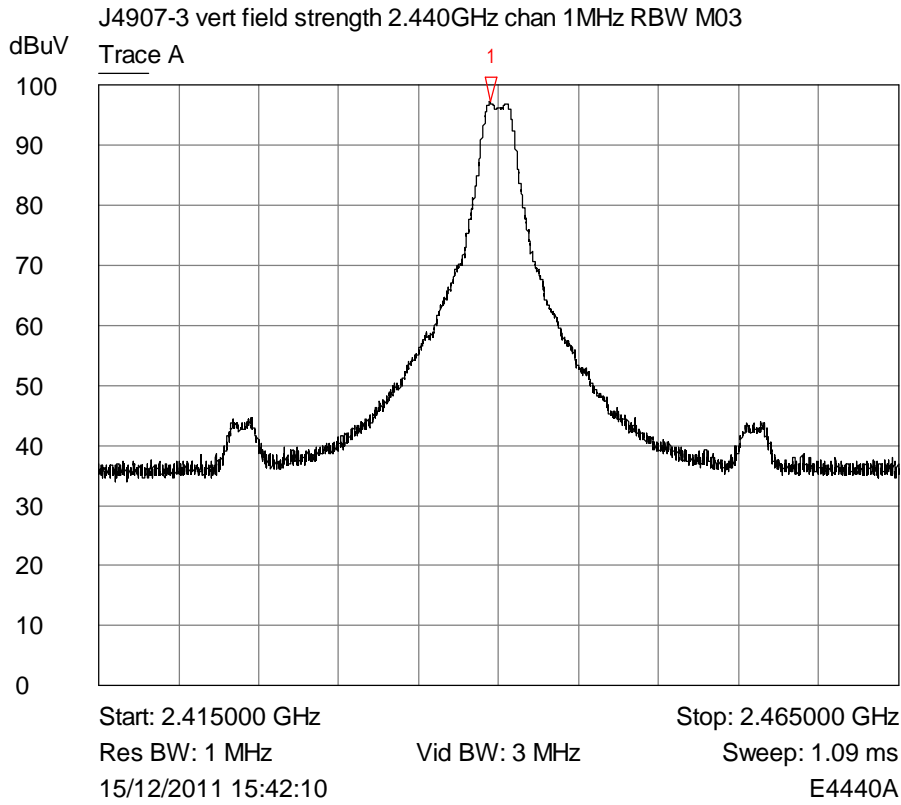
Res BW: 1 MHz

Vid BW: 3 MHz

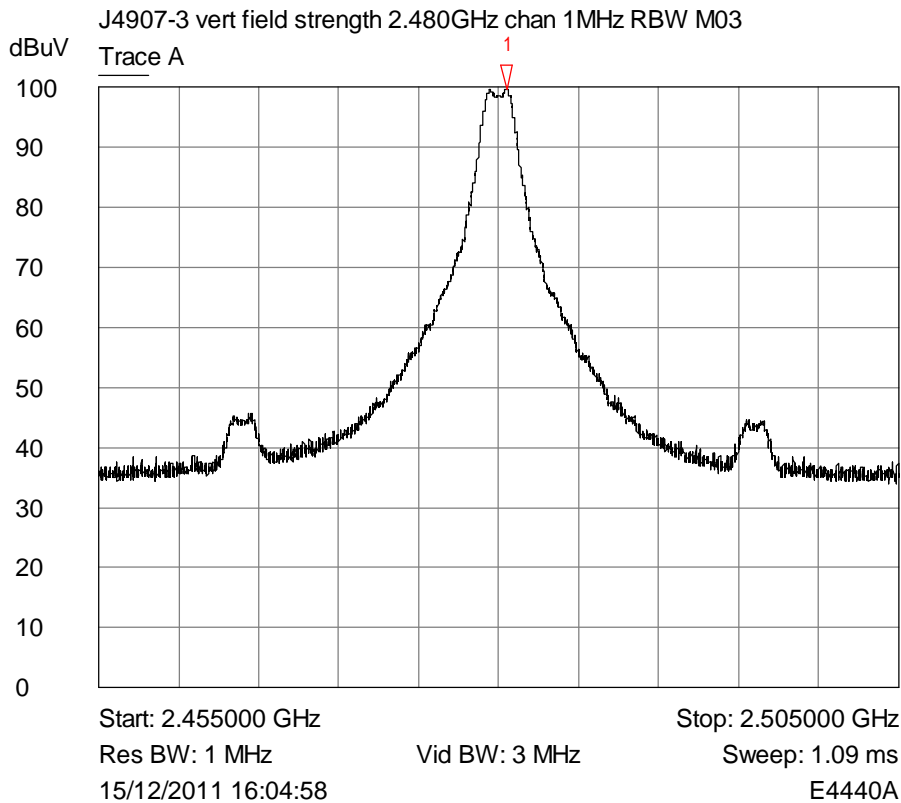
Sweep: 1.09 ms

15/12/2011 15:58:25

E4440A

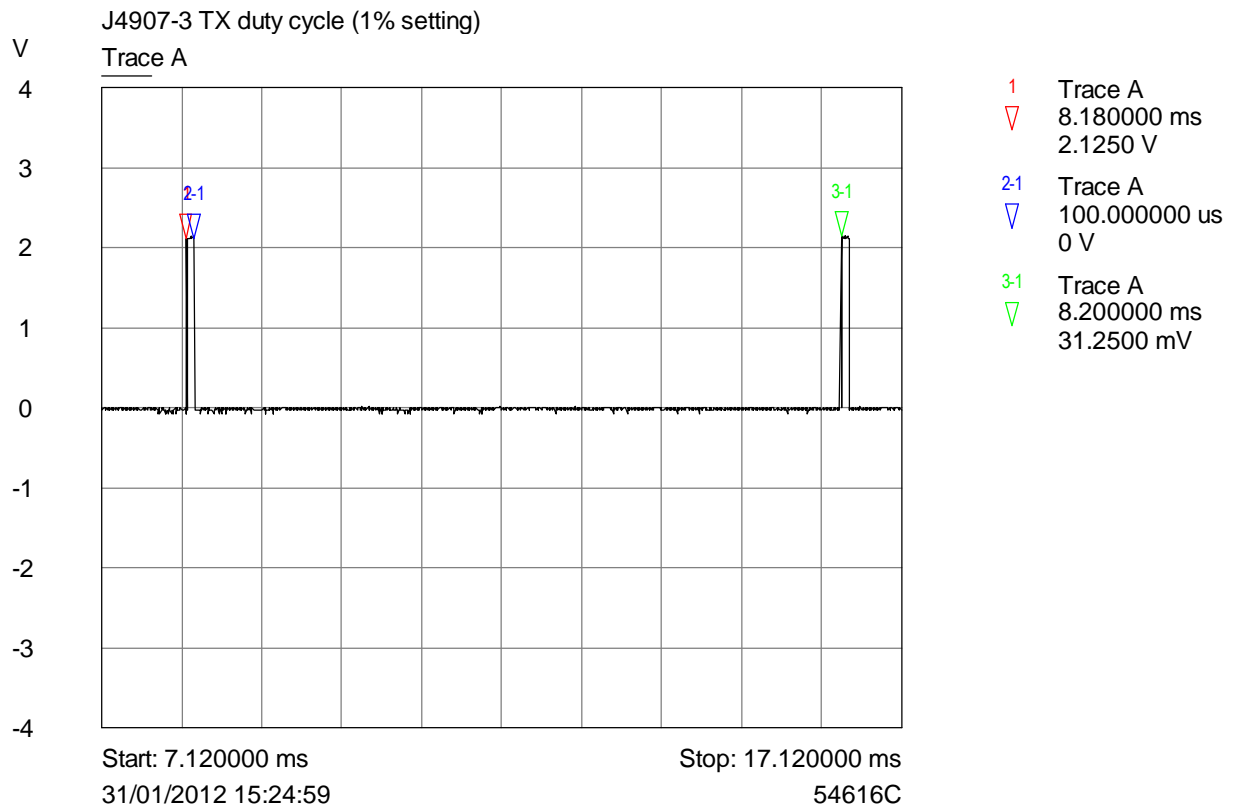


1 Trace A
2.439448 GHz
97.3177 dBuV

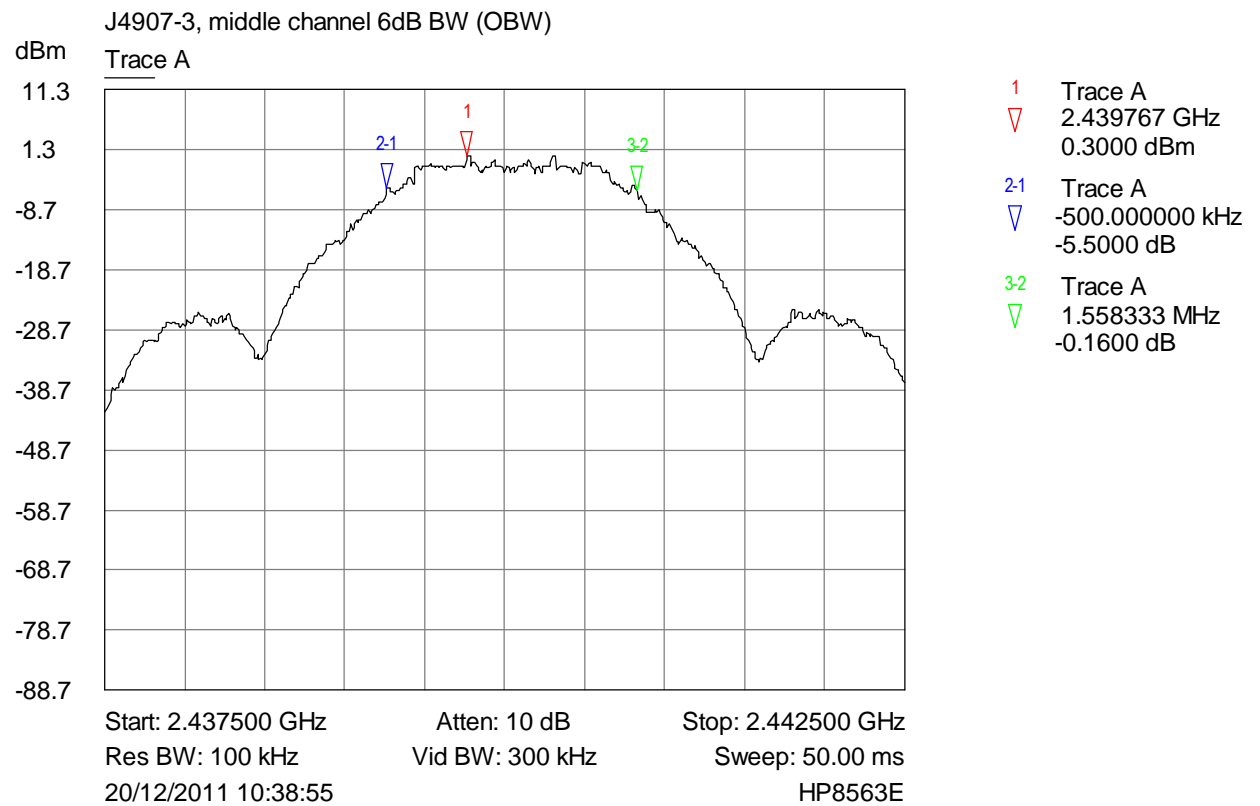
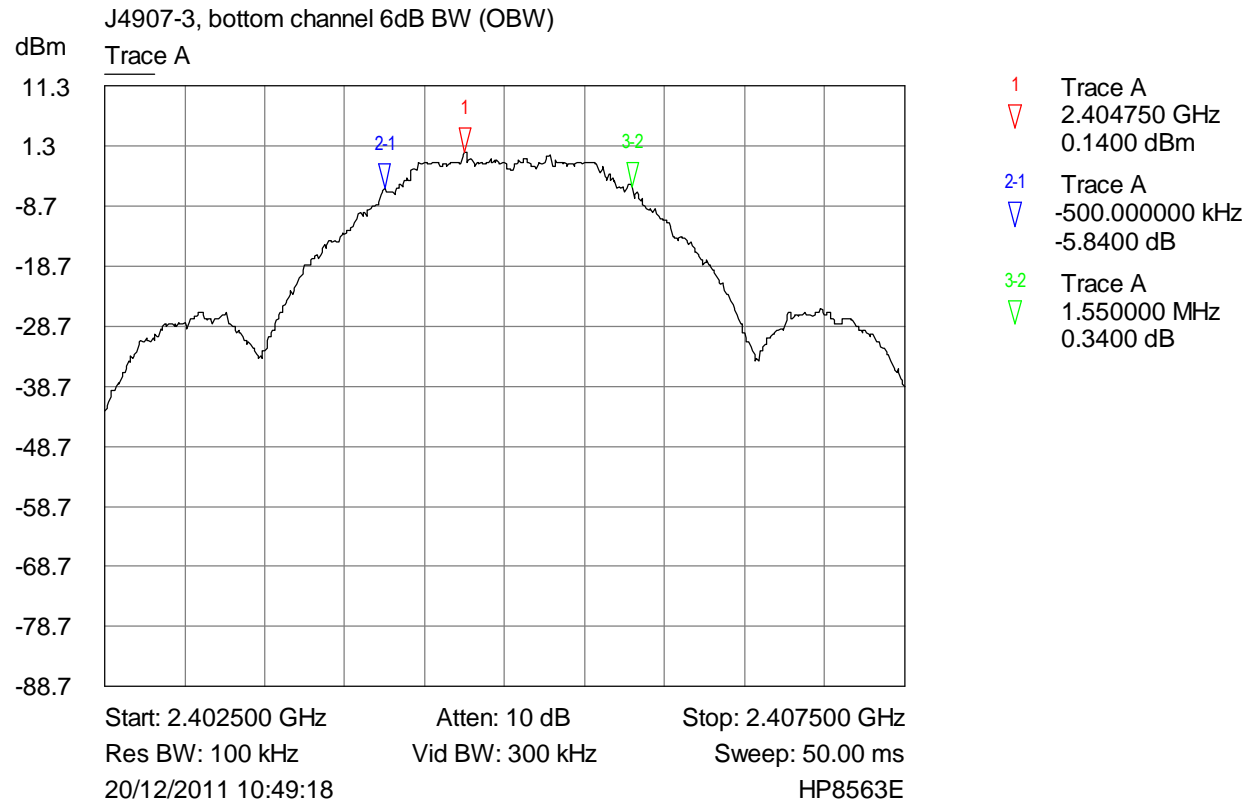


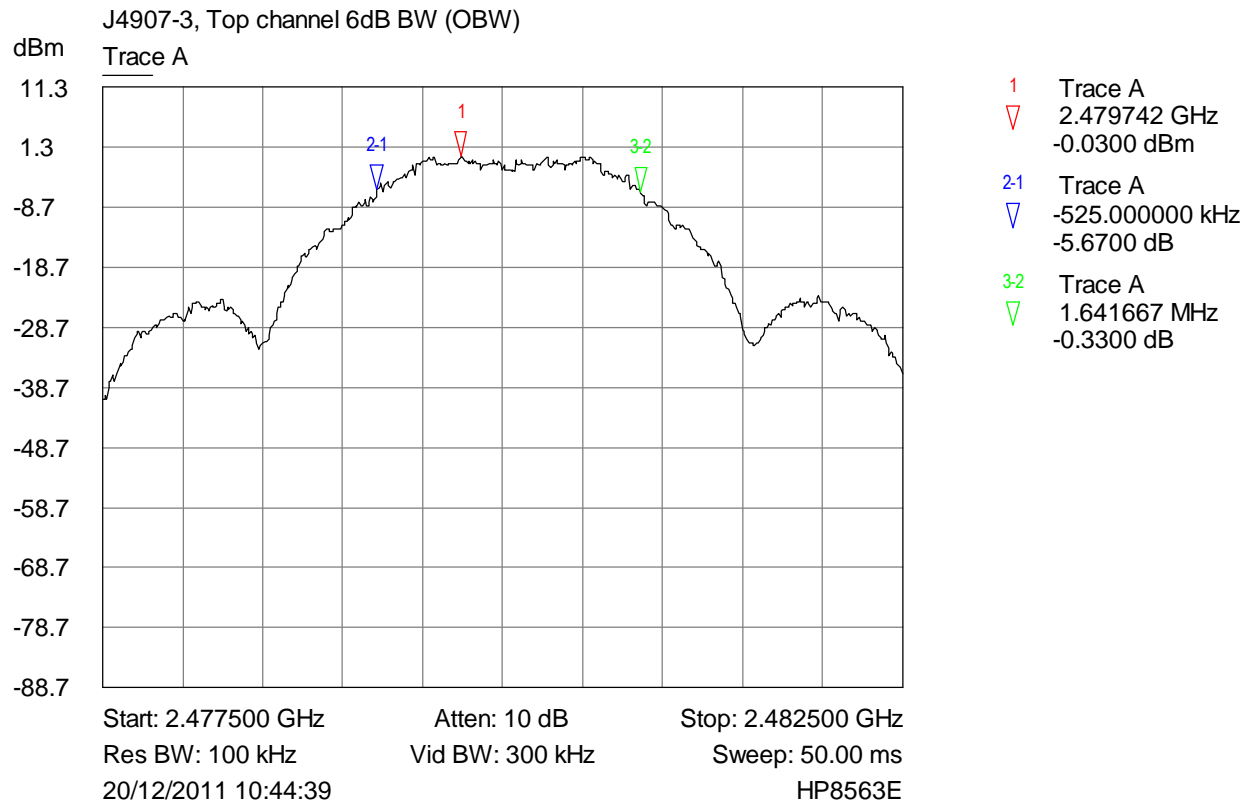
1 Trace A
2.480497 GHz
99.6457 dBuV

6.4 Duty Cycle



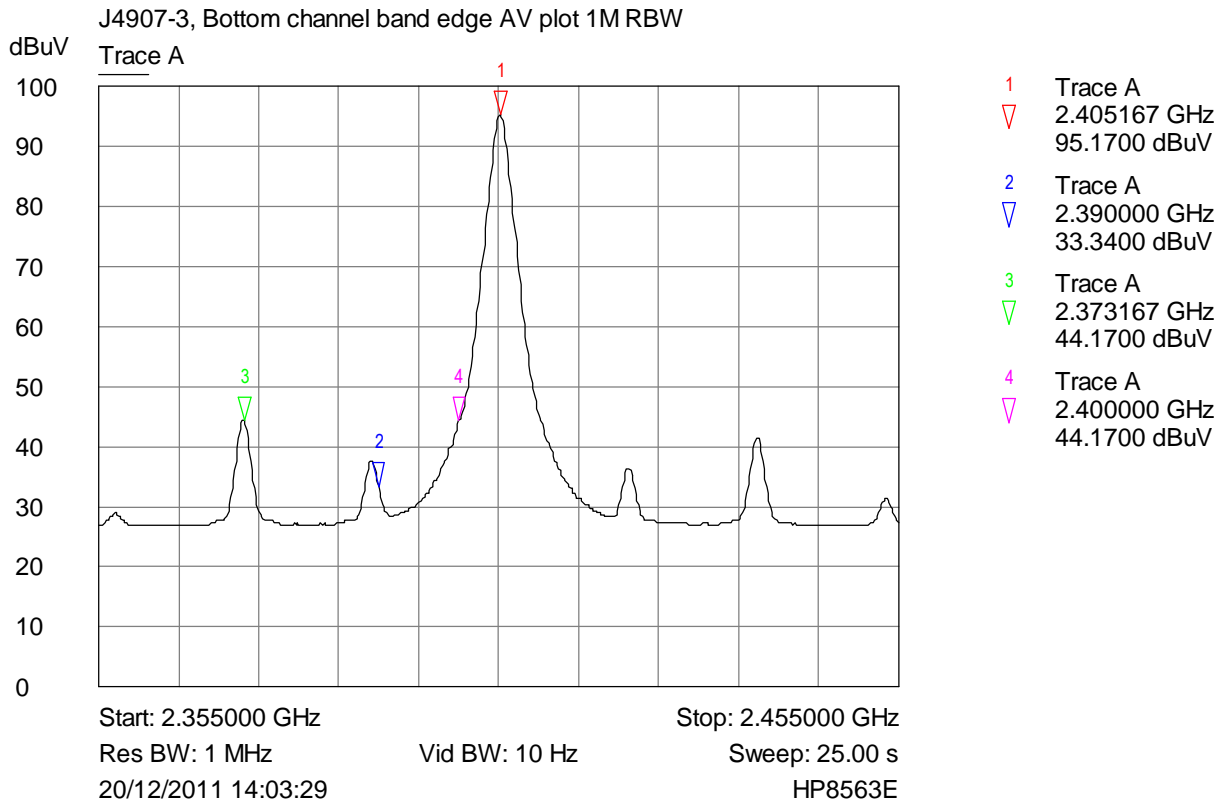
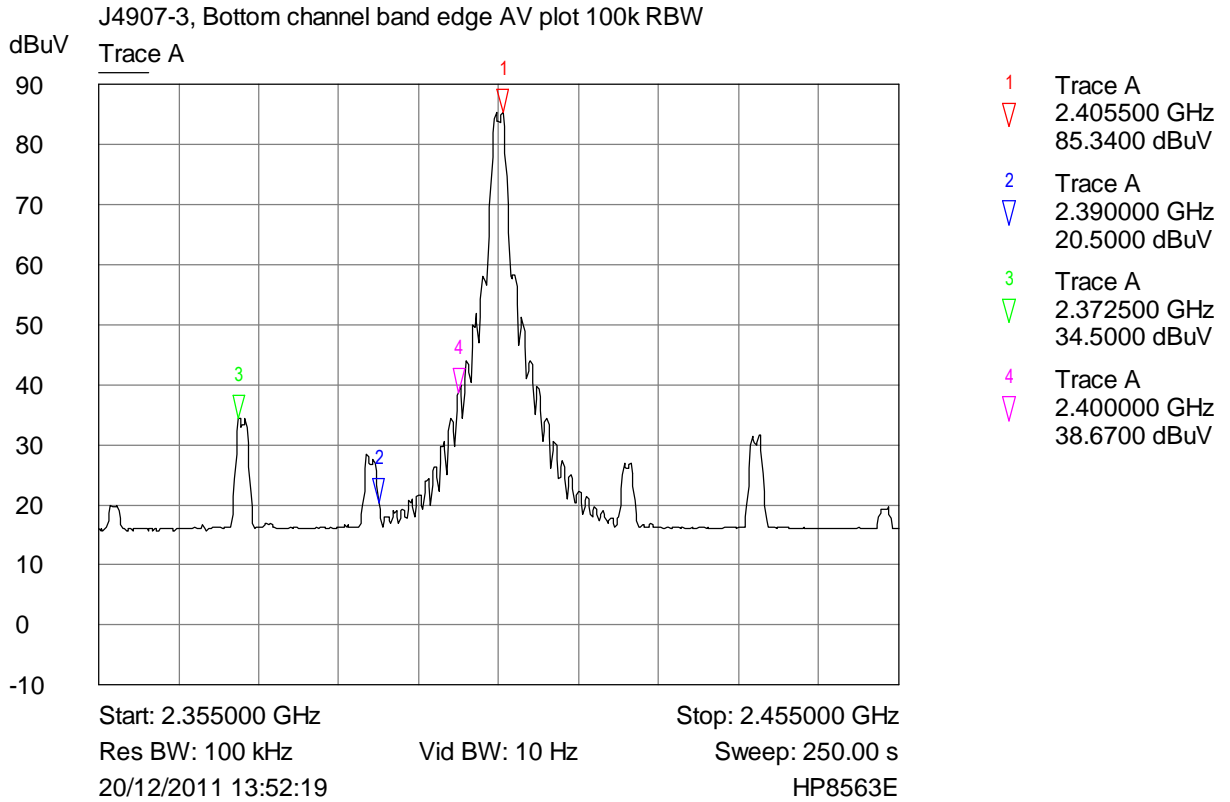
6.5 6dB Bandwidth

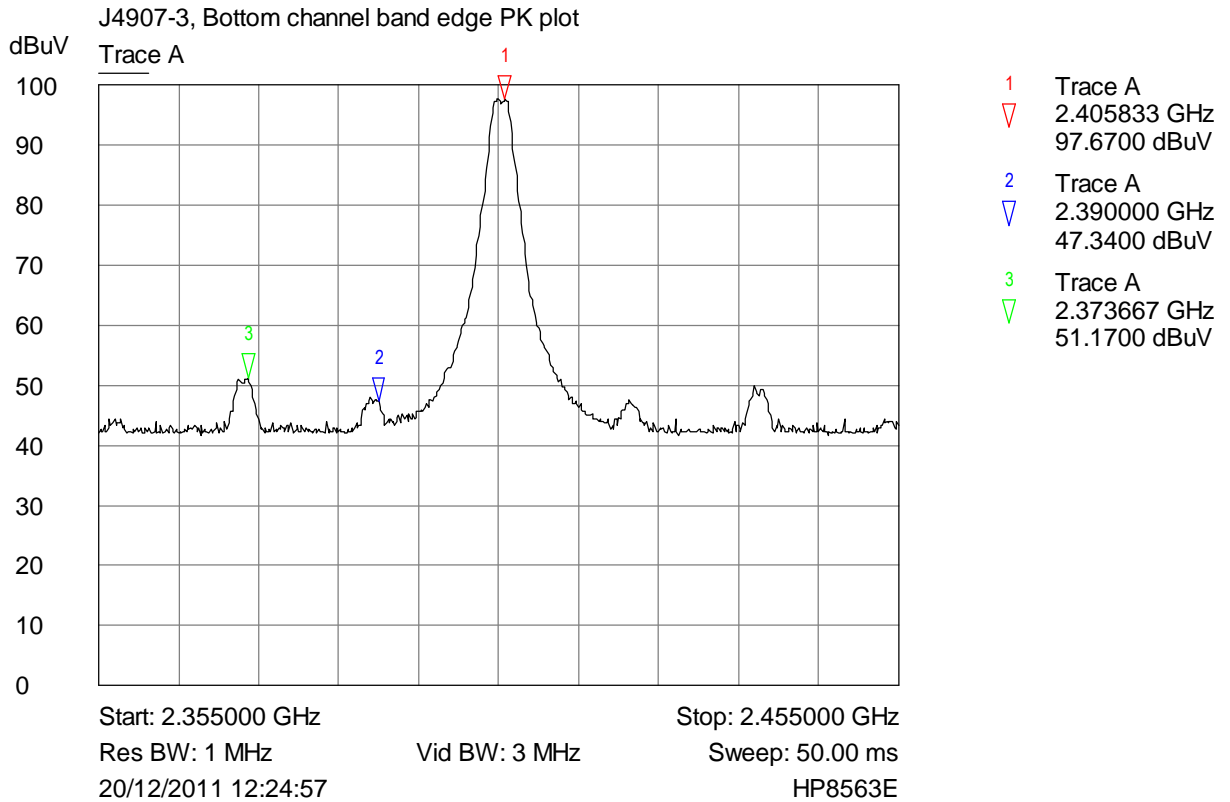
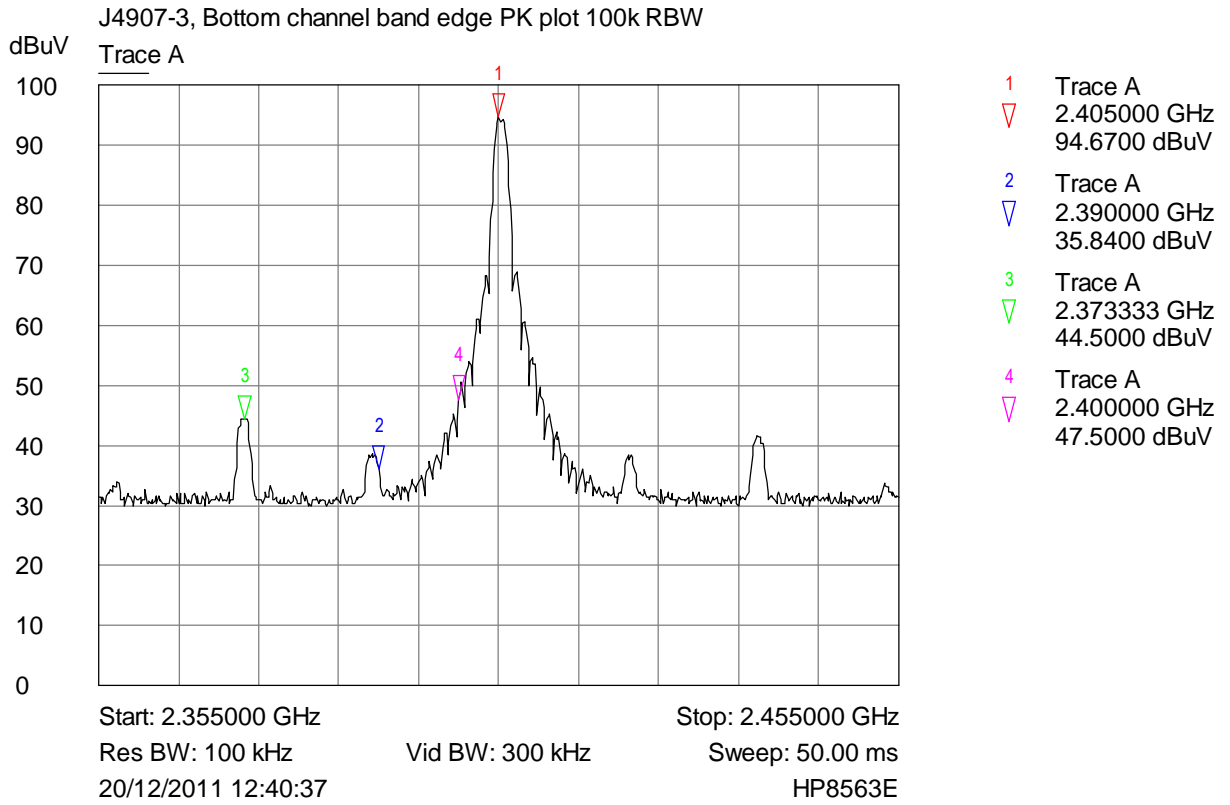


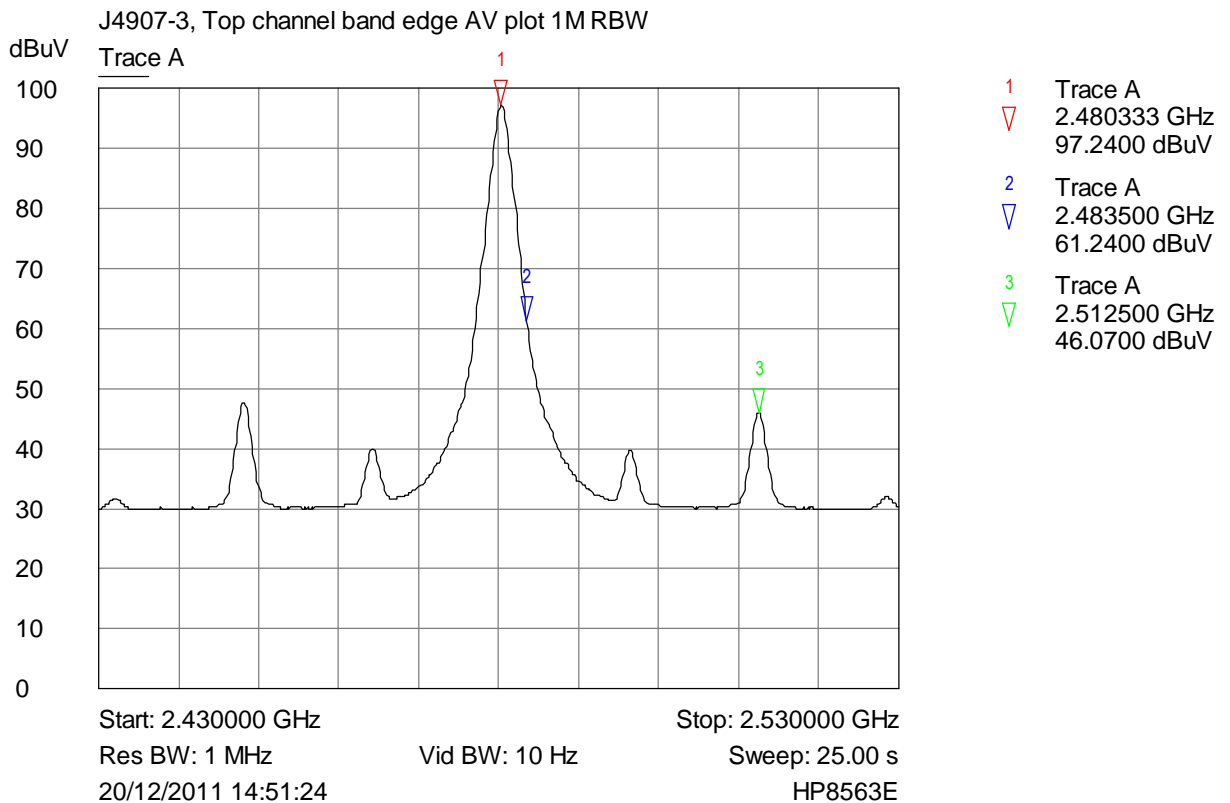
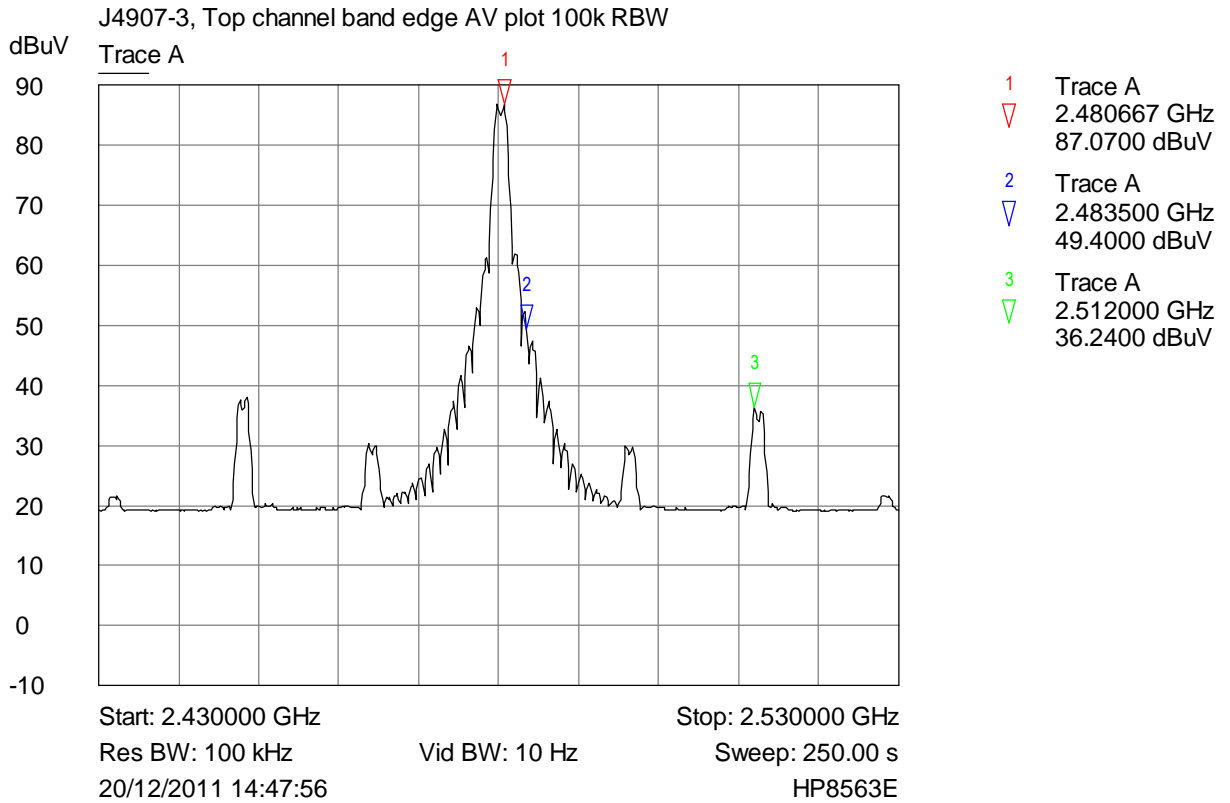


6.6 Band Edge Compliance

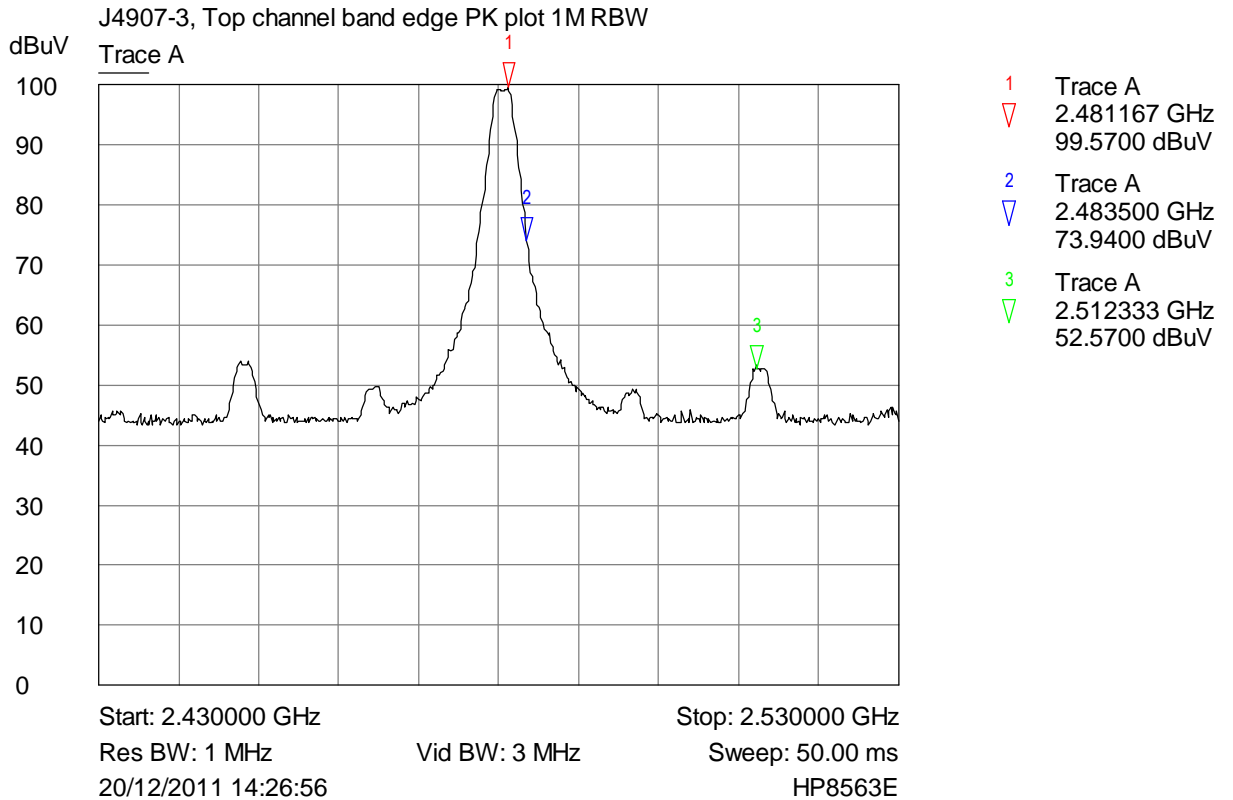
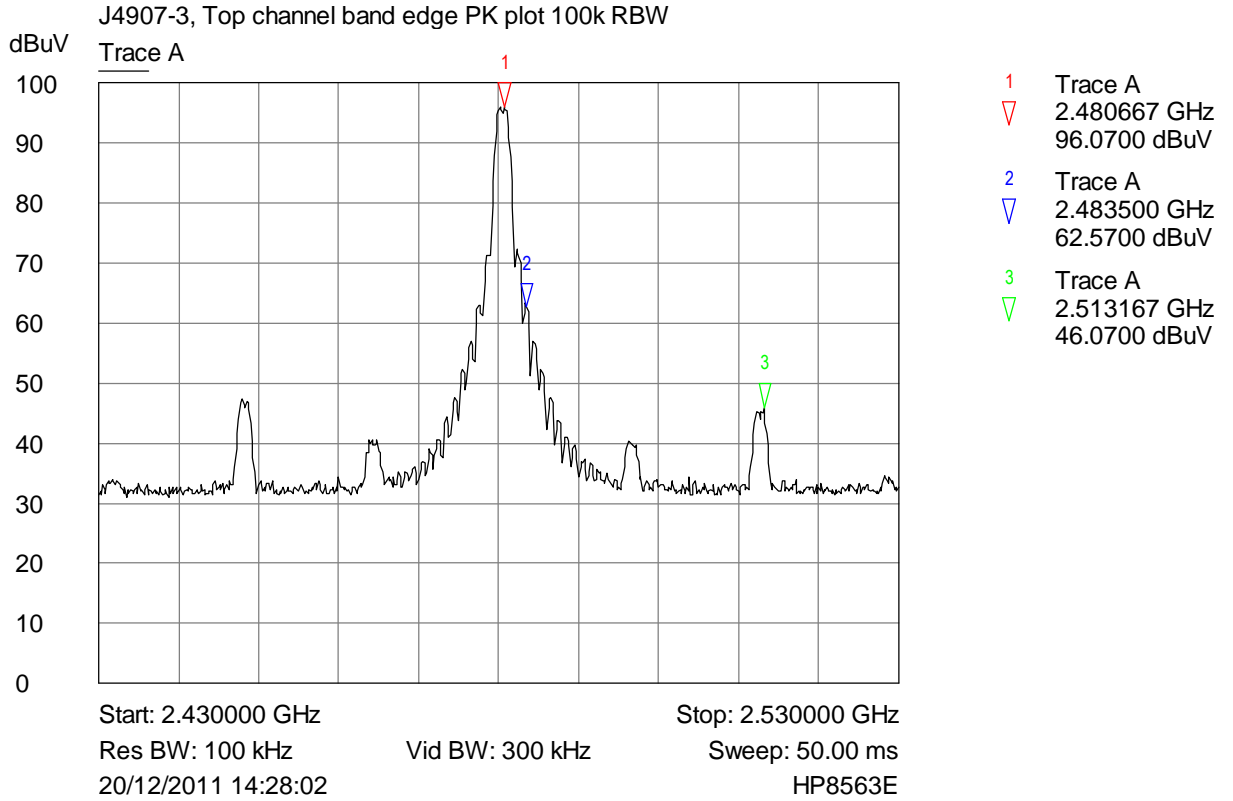
Band Edge & Restricted band edge.



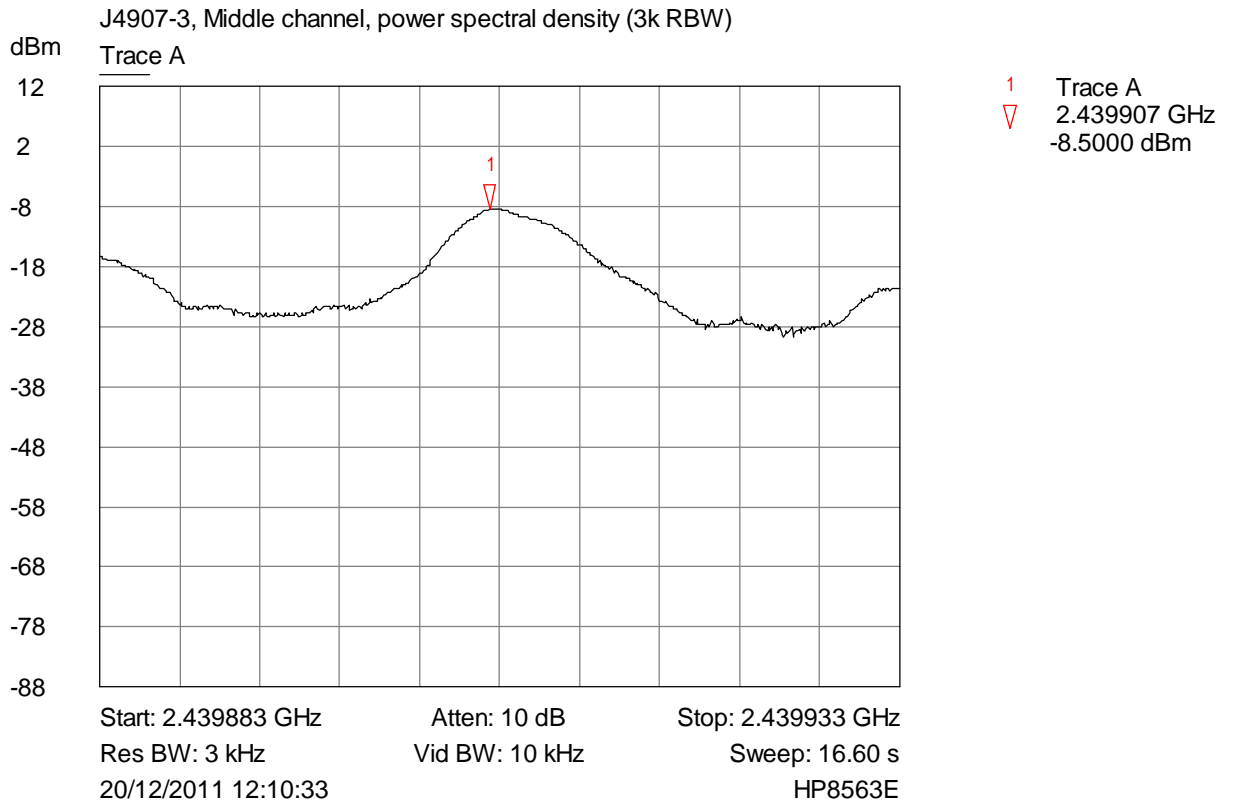
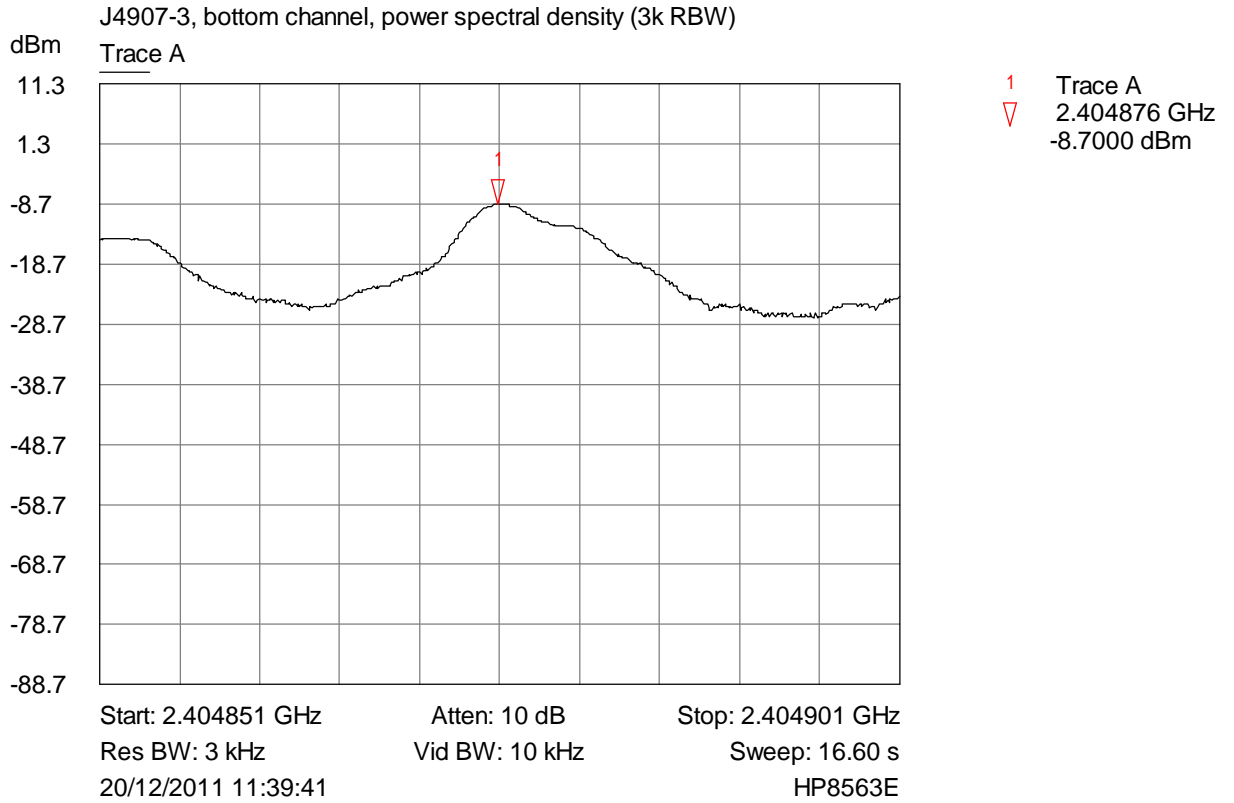


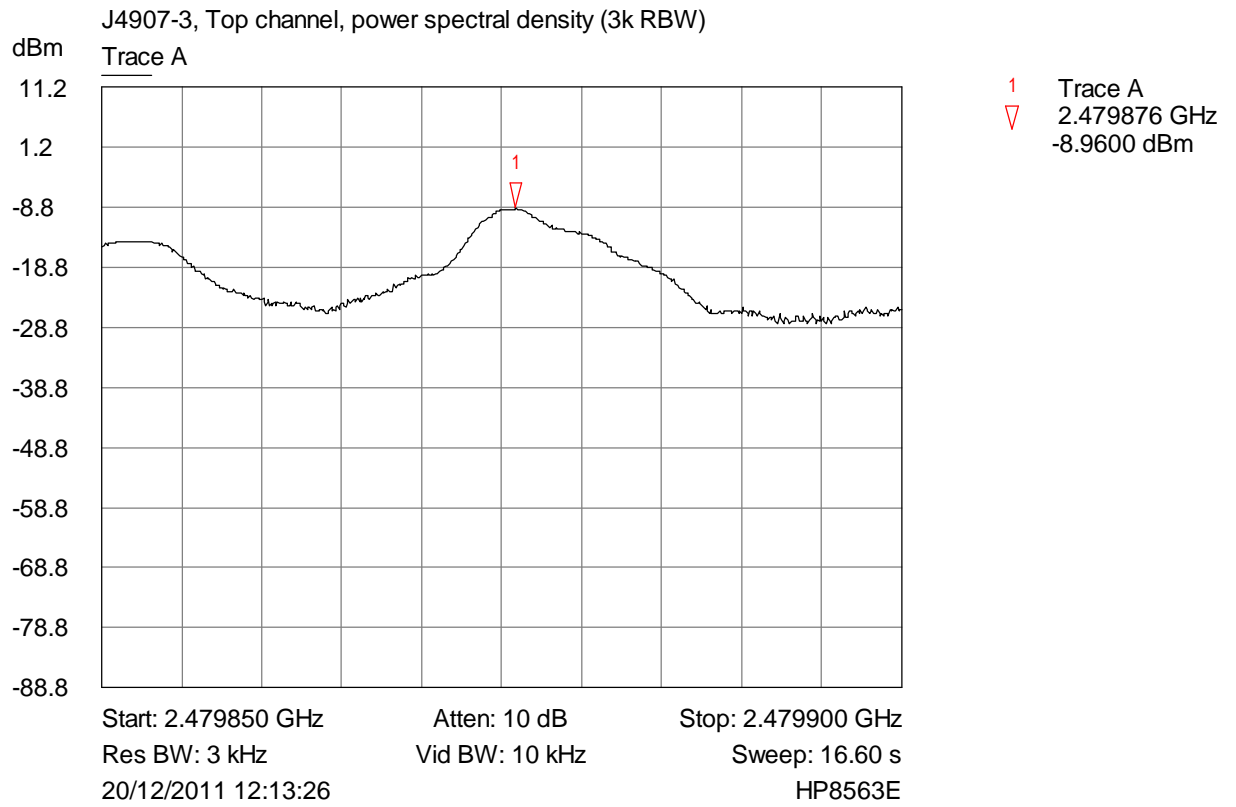


The limit is 54dBuV/m for Average emissions. According to 15.35(c): when the radiated emission limits are expressed in terms of the average value of the emission, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds. For a 10% duty cycle, the power measured would be reduced by $20 \log(0.10) = 20\text{dB}$. According to the declared duty cycle, therefore, the emissions observed are below the limit after averaging for pulse rate.



6.7 Spectral Density





7 Explanatory Notes

7.1 Explanation of FAIL LIMIT 1 Statement

The **FAIL MARGIN 1** statement(s) may appear on the graphical plots when the receiver used to measure your equipment detects a signal that exceeds the dashed line. This does not mean that the **EUT** has failed the test, only that the 10 dB calculation margin set, has been exceeded on a peak measurement.

Following the indication that the margin has been exceeded, measurements are made at the frequency (ies) of the peaks. These peaks have been calculated to either Quasi Peak or Average Peak dependant on the test. A table of results has been printed on the reverse of the page. This table looks similar to the one illustrated below: -

Signal Number	Frequency (MHz)	Peak (dB μ V)	PK Delta L 1 (dB)	Avg (dB μ V)	Av Delta L 1 (dB)
1	12345.0000	12.9	-2.5	10.2	-5.2

The First column, labelled Signal Number, is a number that the receiver has given to each signal, which has been calculated.

Column Two, labelled Frequency (MHz), is the frequency of the signal received.

Column Three, labelled Peak (dB μ V), (can also be labelled, in the case of Quasi Peak, Peak dB μ V/m) is the Level that was received at peak amount in dB above 1 μ V.

Column Four, labelled PK Delta L1 (dB), is the same level as Column three but is given in a level relative to the limit line required.

Column Five, labelled AVG (dB μ V), (can also be labelled, in the case of Quasi Peak, QP dB μ V/m) when undertaking a Quasi peak test, This is the Average or Quasi peak calculation results given in dB μ V or dB μ V/m above 1 μ V.

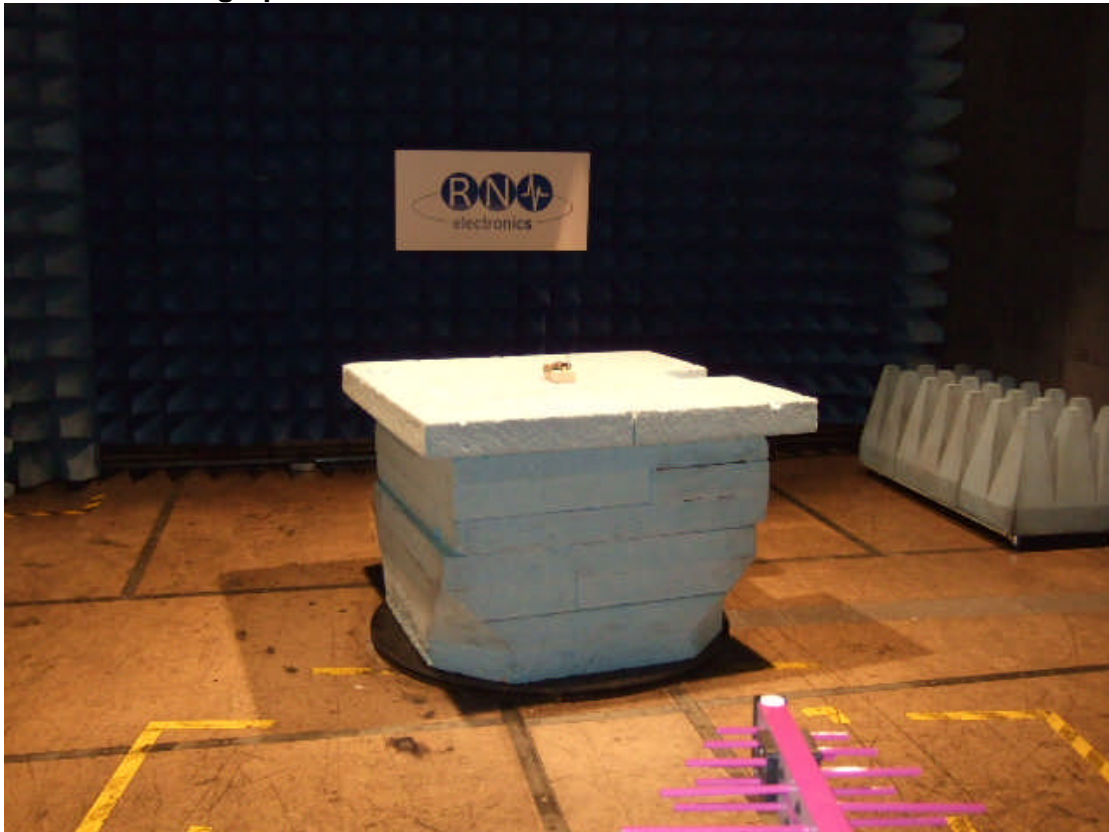
Column Six, labelled AV Delta L 1 (dB), (can also be labelled, in the case of Quasi Peak, QP Delta L 1 (dB)) is the Average or Quasi Peak calculation relevant to the limit line. The results entered in this column indicate the signal level relative to the compliance limit required. Negative numbers indicate that the product is compliant.

7.2 Explanation of limit line calculations for radiated measurements

The limits given in the test standard are normally expressed as absolute values (e.g. in μ V/m at a specified distance), whereas the measured values are expressed as peak, quasi peak or average values in dB μ V/m referenced to the measuring instrument inputs. RN Electronics calibrate the test set-up to account for any path losses, antenna gains, etc. so that the value read at the receiver relates directly to the absolute value required, except that it is expressed in dB relative to one microVolt and may need to take account of any alternative measuring distance used. Examples:

- (a) limit of 500 μ V/m equates to $20.\log(500) = 54$ dB μ V/m.
- (b) limit of 300 μ V/m at 10m equates to $20.\log(300 \cdot 10/3) = 60$ dB μ V/m at 3m
- (c) limit of 30 μ V/m at 30m, but below 30MHz, equates to $20.\log(30) + 40.\log(30/3) = 69.5$ dB μ V/m at 3m, as extrapolation factor below 30MHz is 40dB/decade per 15.31(f)(2).

8. Photographs



Photographs of the EUT's as viewed from in front of the antenna, site M.

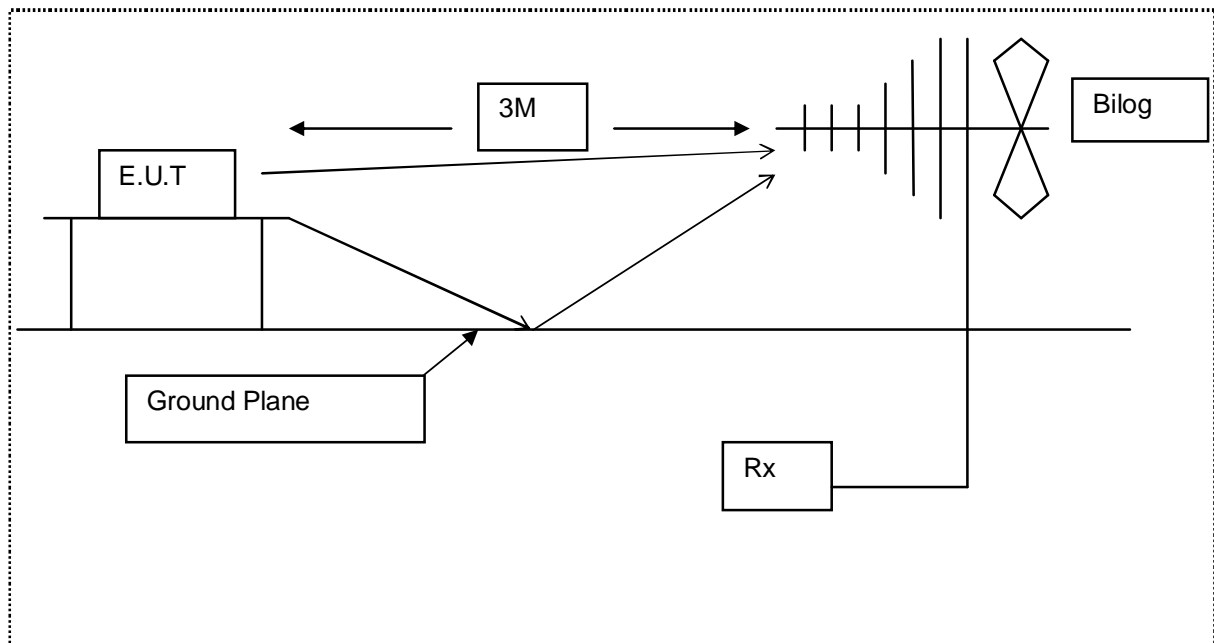
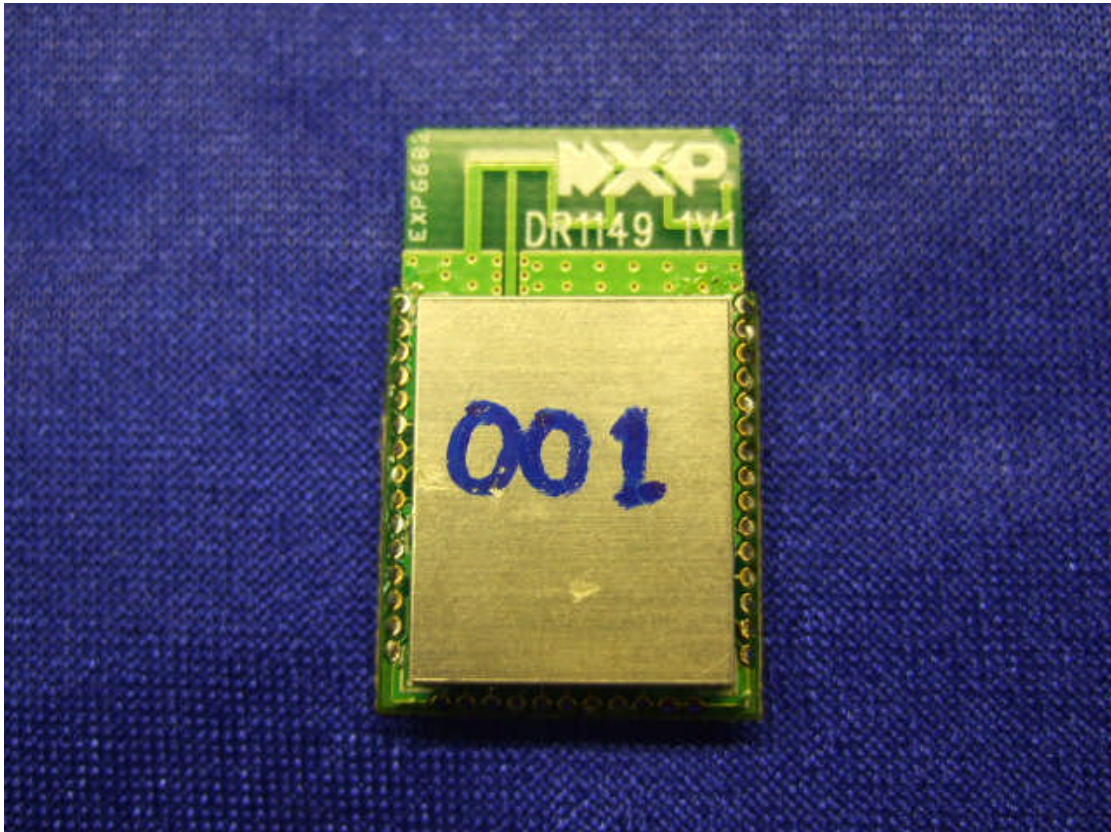
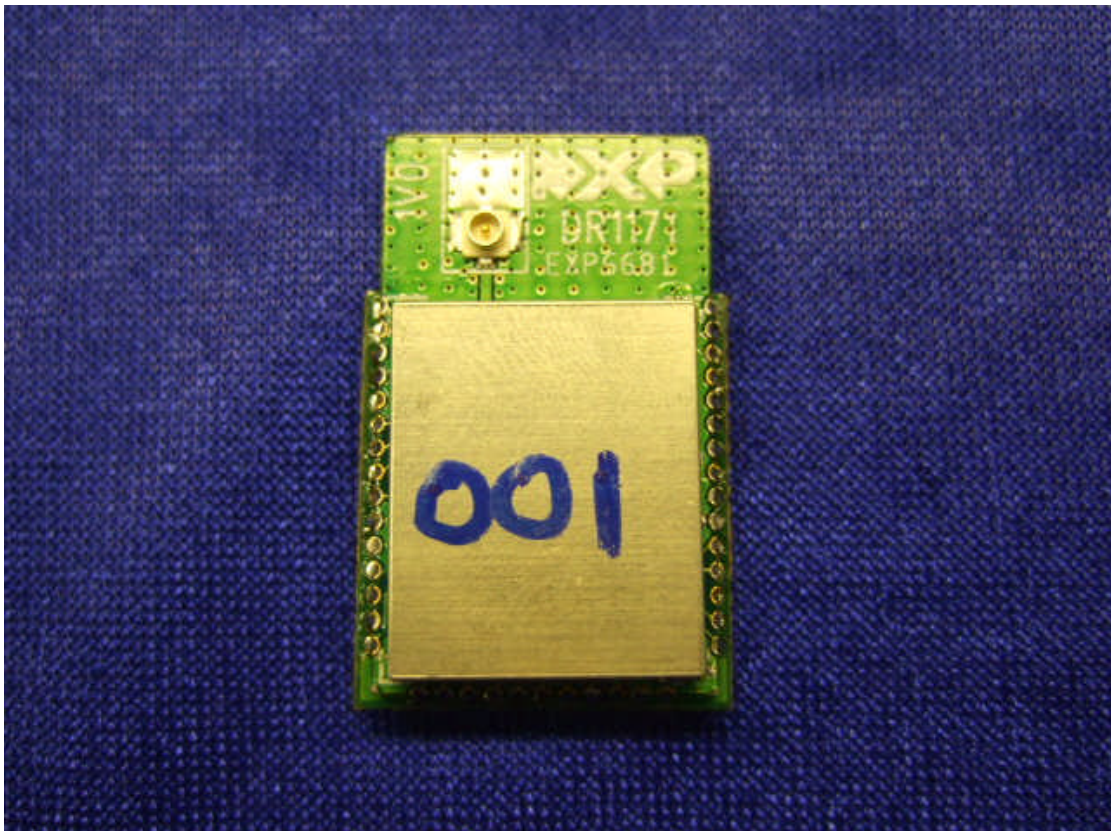


Diagram of the radiated emissions test setup.

M00 unit

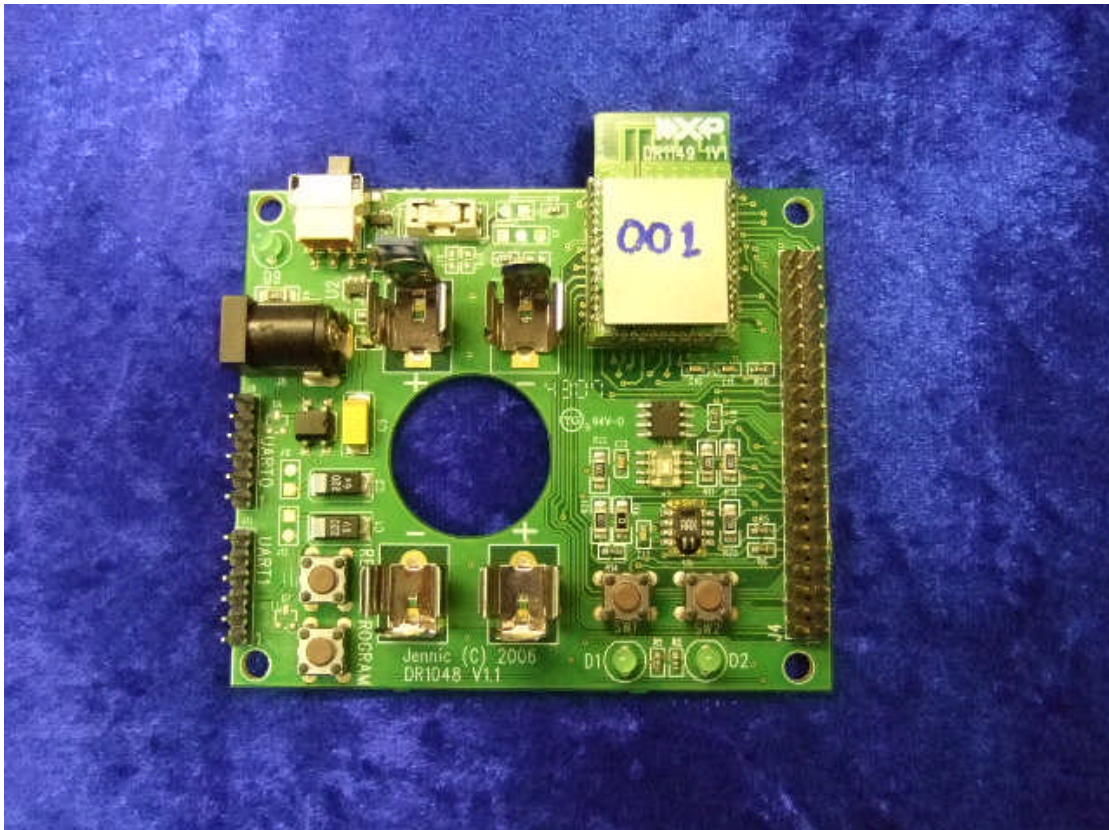


M03 unit

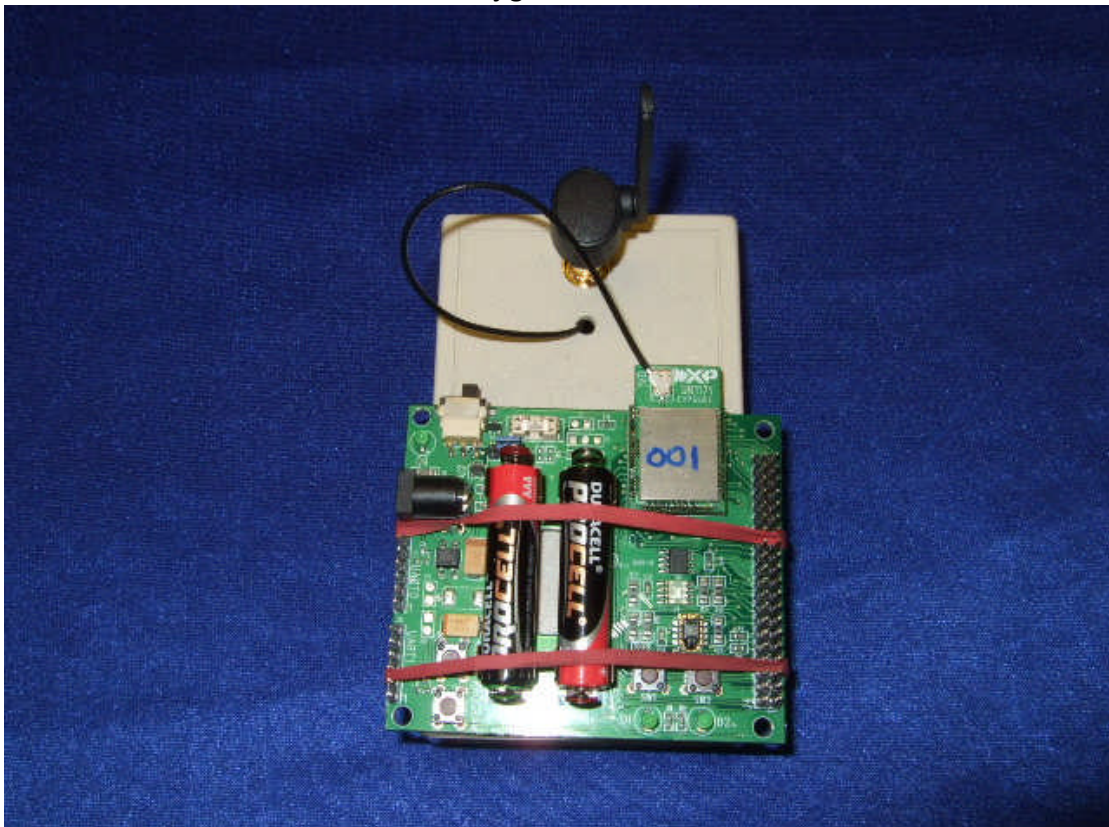


Identifying Photographs of the EUT's

M00 Unit on host motherboard.



M03 Unit on host motherboard and test jig.



Host motherboard Photographs of the EUT's

9. Signal Leads

Integral antenna unit had no ports.

Conducted unit.

Port Name	Cable Type
RF Port	Coaxial

10. Test Equipment Calibration list

The following table lists the test equipment used, last calibration date and calibration interval. All test equipment used has been maintained within the calibration requirements of **R.N. Electronics Ltd.** test facility quality system. Calibration intervals are regularly reviewed dependent on equipment manufacturer's recommendations and actual usage of the equipment.

RNNo	Model	Description	Manufacturer	Date Calibrated	Period
E268	BHA 9118	1-18 GHz Horn Antenna	Schaffner	02-Mar-09	60
E290	6914	Power Sensor	Marconi Instruments	23-Aug-11	24
E342	8563E	Spectrum Analyser 26.5 GHz	HP	29-Mar-11	24
E397	6960B	RF Power Meter	Marconi Instruments	16-Jul-11	24
E410	N5181A	3 GHz MXG Signal Generator	Agilent Technologies	26-Oct-11	12
E411	N9039A	9 kHz - 1 GHz RF Filter Section	Agilent Technologies	26-Oct-11	12
E412	E4440A	3 Hz - 26.5 GHz PSA	Agilent Technologies	26-Oct-11	12
E429	-	5 Switch Filter Box 0.91 GHz - 16.3 GHz	RN Electronics	10-Nov-11	12
E434	G3RUH	10 MHz GPS Oscillator	James Miller	N/A	N/A
P240	A110-26711-0005	6-18GHz Pre-Amp & 10dB Attn	Avantek/Midwest Microwave	N/A	N/A
TMS78	3160-08	Std Gain Horn Antenna 12.4-18 GHz	ETS Systems	03-Nov-10	24
TMS79	3160-09	Std Gain Horn Antenna 18-26.5 GHz	ETS Systems	03-Nov-10	24
TMS81	6502	Active Loop Antenna	EMCO	13-Apr-10	24
TMS82	8449B	Pre Amplifier 1 - 26 GHz	Agilent	14-Nov-11	12
TMS933	CBL6141A	Bilog Antenna 30MHz - 2GHz	York EMC	09-Sep-10	36

11. Auxiliary equipment

11.1 Auxiliary equipment supplied by NXP Laboratories UK Ltd

Auxiliary equipment used for the purpose of test supplied by the above has been listed below

Manufacturer	Description	Model Number	Serial Number
NXP Labs UK Ltd	UFL to SMA lead/test jig	-	-
NXP Labs UK Ltd	FTDI USB Lead	TTL-232R-3V3	-
NXP Labs UK Ltd	PCB Motherboard	DR1048 V1.1	-

11.2 Auxiliary equipment supplied by RN Electronics Limited

Auxiliary equipment used for the purpose of test supplied by the above has been listed below

RN Number	Manufacturer	Description	Model Number	Serial Number
I005	HP	Laptop	NX9010	CNF3512U85

12. Modifications

In order for the EUT to produce the results shown within this report the following modifications, if any, were implemented.

12.1 Modifications before test

There were no modifications made by R.N. Electronics Ltd before testing commenced.

12.2 Modifications during test

There were no modifications made by R.N. Electronics Ltd during testing.

n.b. The settings of the device - continuous transmit, power level & frequency were set by test software not normally available to the user.

13. Compliance information

Products subject to the Declaration of Conformity procedure are required to be supplied with a compliance information statement. A copy of this statement may be included here:

Not Applicable – Devices to be certified.

14 Description of Test Sites

Site A	Radio / Calibration Laboratory and anechoic chamber
Site B	Semi-anechoic chamber
Site B1	Control Room for Site B
Site C	Transient Laboratory
Site D	Screened Room (Conducted Immunity)
Site E	Screened Room (Control Room for Site D)
Site F	Screened Room (Conducted Emissions) VCCI Registration No. C-2823
Site K	Screened Room (Control Room for Site M)
Site M	3m Semi-anechoic chamber (indoor OATS) FCC Registration No. 293246
Site Q	Fully-anechoic chamber
Site OATS	3m and 10m Open Area Test Site FCC Registration No. 293246 IC Registration No. 5612A-1 VCCI Registration No. R-2580

15 Abbreviations and Units

%	Percent	mA	milliAmps
μ A/m	microAmps per metre	max	maximum
μ V	microVolts	mbar	milliBars
μ W	microWatts	Mbit/s	MegaBits per second
AC	Alternating Current	MHz	MegaHertz
ALSE	Absorber Lined Screened Enclosure	mic	Microphone
AM	Amplitude Modulation	min	minimum
Amb	Ambient	mm	milliMetres
ATPC	Automatic Transmit Power Control	ms	milliSeconds
BER	Bit Error Rate	mW	milliWatts
$^{\circ}$ C	Degrees Celsius	NA	Not Applicable
C/I	Carrier / Interferer	nom	Nominal
CEPT	European Conference of Postal and Telecommunications Administrations	nW	nanoWatt
COFDM	Coherent OFDM	OATS	Open Area Test Site
CS	Channel Spacing	OFDM	Orthogonal Frequency Division Multiplexing
CW	Continuous Wave	ppm	Parts per million
dB	decibels	PRBS	Pseudo Random Bit Sequence
dB μ A/m	decibels relative to 1 μ A/m	QAM	Quadrature Amplitude Modulation
dB μ V	decibels relative to 1 μ V	QPSK	Quadrature Phase Shift Keying
dBc	decibels relative to Carrier	R&TTE	Radio and Telecommunication Terminal Equipment
dBm	decibels relative to 1mW	Ref	Reference
DC	Direct Current	RF	Radio Frequency
DTA	Digital Transmission Analyser	RFC	Remote Frequency Control
EIRP	Equivalent Isotropic Radiated Power	RSL	Received Signal Level
ERP	Effective Radiated Power	RTP	Room Temperature and Pressure
EU	European Union	RTPC	Remote Transmit Power Control
EUT	Equipment Under Test	Rx	Receiver
FM	Frequency Modulation	s	Seconds
FSK	Frequency Shift Keying	SINAD	Signal to Noise And Distortion
g	Grams	Tx	Transmitter
GHz	GigaHertz	V	Volts
Hz	Hertz		
IF	Intermediate Frequency		
kHz	kiloHertz		
LBT	Listen Before Talk		
LO	Local Oscillator		



Certificate of Test 4907/3A

The equipment noted below has been tested by **R.N. Electronics Limited** and conforms with the relevant subpart of FCC 47CFR part 15, subject to deviations as detailed in this report.

This certificate relates to the unit, as identified by unique serial number(s) and further detailed in the referenced report, in the condition(s) at the time it was tested. It does not relate to any other similar equipment and performance of the product before or after the test cannot be guaranteed. Furthermore, this is a certificate of test only and should not be confused with an equipment authorisation.

Equipment: JN5142-001-M00 & JN5142-001-M03

Model Number(s): JN5142-001-M00 & JN5142-001-M03

Unique Serial Number(s): 001 & 001

Manufacturer: NXP Laboratories UK Ltd
Furnival Street
Sheffield
S1 4QT

Customer Purchase Order Number: GB628200025079

R.N. Electronics Limited
Report Number: 12-522/4907/3A/11

Test Standards: FCC 47CFR Part 15C:
effective date **October 1st 2011**,
Class DTS Intentional Radiator

Date: 12th to 20th December 2011

For and on behalf of
R.N. Electronics Limited

Signature:

Notes:

QMF21J – 3: FCC PART 15C: RNE ISSUE 02: - JUN 10