FCC 47CFR part 15C
Test Report
For
DR1131 JN5148-J01-U00 High Power USB Dongle

Reference Standard: FCC 47CFR part 15C
Manufacturer: NXP Laboratories UK Ltd
For type of equipment and serial number, refer to section 3
Report Number: 08-580/5117/3/12
Report Produced by: -

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Certificate of Test 5117/3

The unit noted below has been tested by **R.N. Electronics Limited** and, where appropriate, conforms to the relevant subpart of FCC 47CFR Part 15. This is a certificate of test only and should not be confused with an equipment authorisation. Other standards may also apply.

Equipment:	DR1131 JN5148-J01-U00 High Power USB Dongle
Model Number:	DR1131 JN5148-J01-U00
Proposed FCC ID:	TYOJN5148U0
Unique Serial Number:	Not stated – RN tag# 2154
Manufacturer:	NXP Laboratories UK Ltd Furnival Street Sheffield S1 4QT
Customer Purchase Order Number:	GB628200053570
Full measurement results are detailed in Report Number:	08-580/5117/3/12
Test Standards:	FCC 47CFR Part 15.247 effective date **October 1st 2011,** Class DTS Intentional Radiator

NOTE:
Certain tests were not performed based upon manufacturer's declarations. Certain other requirements are subject to manufacturer declaration only and have not been tested/verified. For details refer to section 3 of this report.

DEVIATIONS:
Deviations from the standards have been applied. For details refer to section 4.2 of this report.

This certificate relates only to the unit tested as identified by a unique serial number and in the condition 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. 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 unit not meeting the intentions of the standard or the requirements of the Directive, particularly under different conditions to those during testing. Any compliance statements are made reliant on (a) the application of the product and use of the assigned band being acceptable to one or more national authorities within the EU and (b) the modes of operation as instructed to us by the Customer based on their specific knowledge of the application and functionality of the EUT. Statements of compliance, where measurements were made, do not include the measurement uncertainty. The measurement uncertainty, where stated, is the expanded uncertainty based on a standard uncertainty multiplied by a coverage factor of k=2, providing a level of confidence of approximately 95%.

Date of Test: 21/AUG/2012 to 24/AUG/2012

Test Engineer:

Approved By:
Technical Director

Customer Representative:

File name NXP.5117-3 (FCC).DOCX
The contents of this report, apart from the referenced ANSI C63.4-2003, are beyond the scope of UKAS Testing Laboratory No. 2360 accreditation.

1 Contents

2 Summary of test results

The DR1131 JN5148-J01-U00 High Power USB Dongle was tested to the following standards: -

FCC 47CFR Part 15.247 (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	PASSED
2. Radiated emissions	FCC Part 15C §15.205, §15.209 and §15.247(d)	PASSED
3. Occupied bandwidth	FCC Part 15C §15.215(c), §15.247(a)(2)	PASSED
4. Peak conducted power	FCC Part 15C §15.247(b)	PASSED[1]
5. Frequency tolerance	FCC Part 15C §15.215(c)	Not Applicable[2]
6. Duty cycle	FCC Part 15C §15.35(c)	Not Applicable[3]
7. Power Spectral Density	FCC Part 15C §15.247(e)	PASSED
8. Band edge compliance	FCC Part 15C §15.205, §15.209 and §15.247	PASSED
9. FHSS parameters	FCC Part 15C §15.247(a)(1)	Not Applicable[4]

[1] Test was performed radiated as the EUT has an integral PCB antenna and no 50ohm connection.
[2] No limits apply, however the requirement to contain the designated bandwidth of the emission within the specified frequency band includes the frequency stability of the transmitter over expected variations in temperature and supply voltage.
[3] No limits apply, however duty cycle measurement performed to verify correction factors for average emissions.
[4] EUT does not employ FHSS technology.

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
Model Number of EUT	DR1131 JN5148-J01-U00
Proposed FCC ID	TYOJN5148U0
Serial Number of EUT	Not specified – RN tag# 2154
Date when equipment was received by RN Electronics	21st August 2012
Date of test:	21st to 24th August 2012
Customer order number:	GB628200036941
Visual description of EUT:	Small clear plastic enclosure similar to a USB memory stick. The PCB is visible through the plastic and has a USB port at one end and an on board (PCB) antenna.
Main function of the EUT:	IEEE 802.15.4 compliant 2.4GHz wireless microcontroller USB dongle
Height	70mm
Width	22mm
Depth	7mm
Weight	0.005kg
Voltage	5V via USB
Current required from above voltage source	Not stated

3.2 EUT Configurations for testing

Frequency range	2.405 – 2.480 GHz
Normal use position	Fitted to host USB port
Normal test signals	OQPSK, 250kbps, Internally generated IEEE 802.15.4 compliant packets
Declared power level	+22dBm
Declared channel bandwidth	1.725MHz (-6dB points)
Highest frequency generated / used	2.480 GHz (top RF channel)
Lowest frequency generated / used	1.3125 MHz (IF)

3.3 Functional Description

The DR1131 JN5148-J01-U00 High Power USB Dongle works over the 2.405 – 2.480 GHz frequency range and provides a complete solution for the development of IEEE 802.15.4-based wireless network systems, incorporating all the necessary hardware and software components. The JN5148 microcontroller fitted in the dongle provides the optimum hardware platform around which wireless network nodes can be designed, combining high-performance processing and radio communications.

3.4 EUT Modes

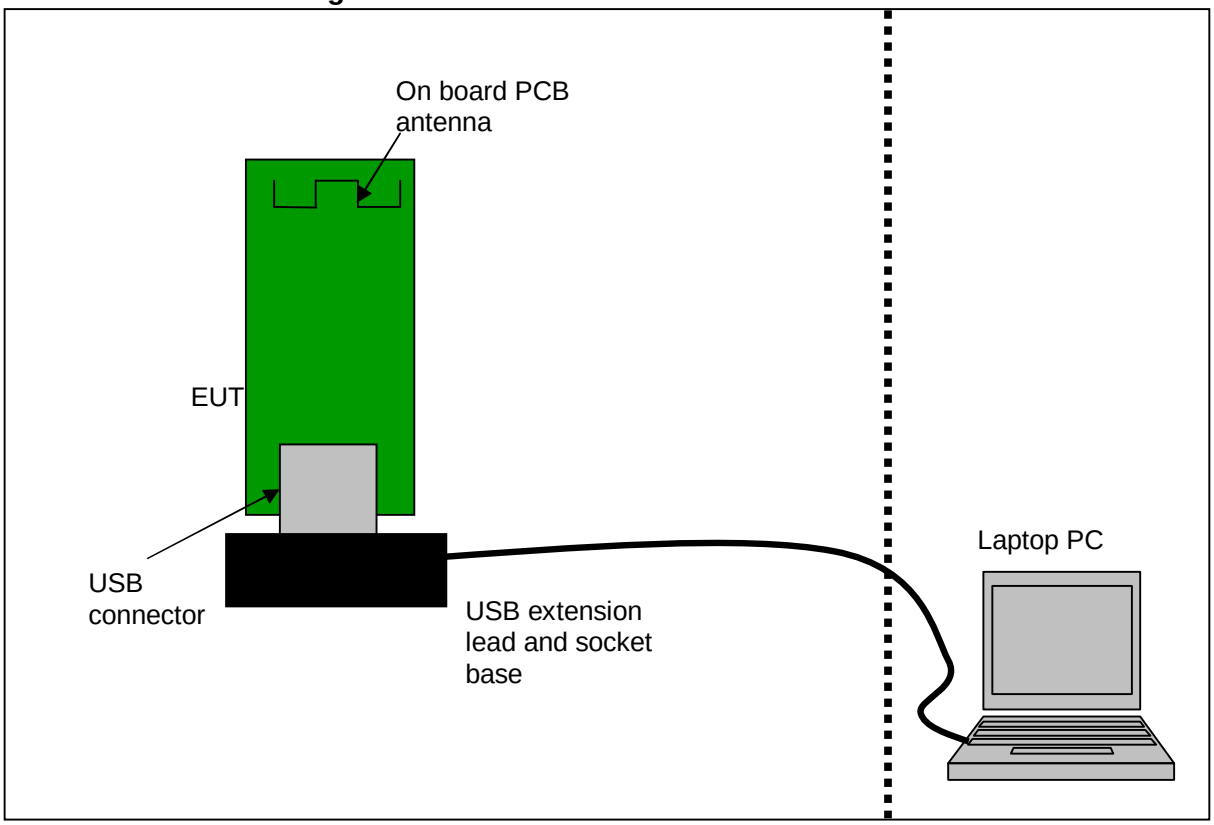
Mode	Description of mode	Used for Testing
Transmit CW 2.405GHz	Unit in constant transmit with no mod @ 2.405GHz	YES
Transmit CW 2.440GHz	Unit in constant transmit with no mod @ 2.440GHz	YES
Transmit CW 2.480GHz	Unit in constant transmit with no mod @ 2.480GHz	YES
Transmit Mod 2.405GHz	Unit in constant 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: 21 September 2012

3.4.1 Emissions Configuration



The equipment under test was supplied by 5V DC via the USB port of a laptop PC which itself was powered with 110V AC 60Hz. A 1 metre USB extension lead was provided by NXP which allowed the unit to be sat in a vertical position initially. To change channels and select the correct modes for test Hyper terminal software was used which was connected to the EUT with a baud rate of 38400 with no flow control; all other settings were left at default in the Hyper terminal software. The laptop was provided by RN Electronics Ltd.

For radiated and conducted emissions the laptop was used to prove compliance of the device with an ”off the shelf” available computer.

Top, middle & bottom channels were tested in both Transmit and Receive modes using the 16 MHz clock option. All power levels were left at the Default setting (number 3), as set by the selection of the root menu mode named “**High Power module**”.

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

4 Specifications

4.1 Relevant Standards

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

4.2 Deviations

ANSI C63-10-2009 deviations:
The reference standard ANSI C63.4-2003 was used, not the latest ANSI C63.4-2009

FCC Part 15 deviations:
None.

4.3 Tests at Extremes of Temperature & Voltage

No tests at extremes were required.

4.4 Measurement Uncertainties

Parameter	Uncertainty
Transmitter Tests	
Occupied bandwidth	± 1.9 %
Radiated RF power	± 3.5 dB
Radiated spurious emissions	30MHz - 1000MHz ±5.1dB 1000MHz - 2000MHz ±4.5dB 1 – 18 GHz ±3.5dB 18 – 26.5 GHz ±3.9dB
AC line conducted emissions	150kHz to 30MHz ±3.6dB

5 Tests, Methods and Results

5.1 Conducted emissions

5.1.1 Test Methods

Test Requirements FCC Part 15C, Reference (15.207)

Test Method: ANSI C63.10, Reference (6.2.)

5.1.1.1 Configuration of EUT

The EUT and off the shelf laptop were placed on a wooden table 0.8m above the ground plane and the laptop AC/DC adapter connected to a LISN via a 1m mains cable.

Details of the Peripheral and Ancillary Equipment connected for this test is listed in section 11.

Initial scans were made in transmit, receive and normal modes to determine any worst case mode for emissions. No discernible difference was noted. Therefore full tests were performed in mode **Transmit Mod 2.440GHz** (see section 3.4).

5.1.1.2 Test Procedure

Tests were made in accordance with FCC Part 15 using the measuring equipment noted in the 'Test Equipment' Section. Measurements were made on the live and neutral conductors using both average and quasi-peak detection.
At least 6 signals within 20dB and/or all signals within 10dB of the limit were investigated.

Tests were performed in Test Site F.

5.1.2 Test results

Temperature of test Environment: 24°C

Analyser plots for the Quasi-Peak / Average values as applicable can be found in Section 6.1 of this report.

Quasi-Peak and Average Live

Signal No.	Freq (MHz)	Peak Amp (dBuV)	QP Amp (dBuV)	QP - Lim1 (dB)	AV Amp (dBuV)	AV - Lim1 (dB)
1	0.177	53.2	50.8	-13.8	38.0	-16.6
2	0.217	46.4	43.5	-19.4	32.4	-20.5
3	0.232	44.2	41.2	-21.2	20.7	-31.7
4	0.349	48.4	46.4	-12.6	27.9	-21.1
5	0.583	40.1	35.0	-21.0	18.0	-28.0
6	0.670	43.9	39.9	-16.1	26.2	-19.8
7	0.845	37.4	34.8	-21.2	21.3	-24.7
8	0.877	40.1	36.2	-19.8	27.4	-18.6
9	3.856	39.4	34.4	-21.6	25.1	-20.9
10	4.473	38.7	35.1	-20.9	26.0	-20.0
11	4.629	43.6	37.8	-18.2	25.8	-20.2
12	4.664	41.9	33.8	-22.2	25.8	-20.2
13	4.672	42.5	37.3	-18.7	25.2	-20.8
14	4.819	43.6	38.3	-17.7	26.8	-19.2

Quasi-Peak and Average Neutral

Signal No.	Freq (MHz)	Peak Amp (dBuV)	QP Amp (dBuV)	QP - Lim1 (dB)	AV Amp (dBuV)	AV - Lim1 (dB)
1	0.151	50.6	47.0	-18.9	33.9	-22.0
2	0.174	48.4	44.9	-19.9	28.7	-26.1
3	0.196	46.7	44.4	-19.4	28.8	-25.0
4	0.308	30.9	27.0	-33.0	11.1	-38.9
5	0.382	43.0	40.3	-17.9	21.4	-26.8
6	0.561	40.2	37.0	-19.0	24.6	-21.4
7	0.743	40.7	38.2	-17.8	20.7	-25.3
8	0.919	41.8	38.3	-17.7	22.7	-23.3
9	1.522	45.6	38.8	-17.2	23.2	-22.8
10	1.898	39.5	36.4	-19.6	25.5	-20.5
11	2.162	42.9	37.1	-18.9	26.1	-19.9
12	2.856	44.7	36.4	-19.6	25.4	-20.6
13	2.942	44.5	37.0	-19.0	28.0	-18.0
14	3.532	41.2	37.3	-18.7	28.4	-17.6

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

5.1.2.1 Test Equipment used

E035, E150, E410, E411, E412, N465
See Section 10 for more details.

5.2 Peak Conducted power

5.2.1 Test Methods

Test Requirements FCC Part 15C, Reference (15.247)

Test Method: FCC Part 15C, Reference (15.247)
ANSI C63.10, Reference (6.10.2.1 a))

5.2.1.1 Configuration of EUT

The EUT was measured in a chamber using a spectrum analyser. The EUT was set to each mode/test signal in turn (see section 3.4) and highest power levels recorded once the emission had been maximised.

5.2.1.2 Test Procedure

Tests were made in accordance with FCC Part 15 using the measuring equipment noted below.
Peak stated reading is maximum power observed using a spectrum analyser and 3MHz RBW to encompass sufficiently the entire modulated signal.

5.2.2 Test results

Test Environment: Temperature: 24°C Humidity: 40 %

Channel / scheme	Peak reading @ 3m (dBuV/m)	Duty cycle adjustment (dB)	Total (dBm)	Result (mW)	Peak ANSI C63.10 (mW)
2.405GHz	116.0	N/A	N/A	119.4	119.4
2.440GHz	115.2	N/A	N/A	99.3	99.3
2.480GHz	114.0	N/A	N/A	75.4	75.4

LIMITS:
15.247(b)(3)
For systems using digital modulation in the 902-928, 2400-2483.5 or 5725-5850 MHz bands 1 Watt.

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

5.2.2.1 Test Equipment used

E268, E410, E411, E412, TMS82, E250
See Section 10 for more details

5.3 Maximum Power Spectral Density

5.3.1 Test Methods

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

5.3.1.1 Configuration of EUT

The EUT was tested in a chamber at a distance of 3metres.

5.3.1.2 Test Procedure

Tests were made in accordance with FCC Part 15 using the measuring equipment noted below. The emission from the EUT was maximised before taking any plots. PEP was recorded in the required bandwidths and the plots were taken.

5.3.2 Test results

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

Temperature of test Environment: 24°C

Table of results

Channel/ scheme	PEP (dBuV/m @3m/3kHz)	PEP (dBm/3kHz)
2.405GHz	102.0	6.8
2.440GHz	100.0	4.8
2.480GHz	99.3	4.1

Note: Highest powers recorded were with EUT in a Vertical (upright position) and with a vertical measuring antenna.

LIMITS:
15.247(e) +8dBm/3kHz.

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

5.3.2.1 Test Equipment used

E268, TMS82, E410, E411, E412

See Section 10 for more details.

5.4 Duty cycle

5.4.1 Test Methods

Test Requirements	FCC Part 15C, Reference (15.35)
Test Method:	ANSI C63.10, Reference (7.5)

5.4.1.1 Configuration of EUT

The EUT was set to a nominally 1% duty cycle.

5.4.1.2 Test Procedure

The centre frequency of the analyser was set to that of the transmitter, and the span set to zero. The sweep time was adjusted so that either the pulse width or the periodic operation could be observed.

5.4.2 Test results

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.**

LIMITS:
Not applicable. However, a basic duty cycle measurement was made in order to demonstrate any duty cycle corrections which may be applied to the test results.

The worst case average emission measured at the upper restricted band edge (see page 21) is 17.3dB 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) = -20dB. According to the declared duty cycle, therefore, the emissions observed are below the limit after averaging for pulse rate.

5.4.2.1 Test Equipment used

E412
See Section 10 for more details.

5.5 Radiated emissions

5.5.1 Test Methods

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

5.5.1.1 Configuration of EUT

The EUT and off the shelf laptop were placed on a 0.8 metres high turntable. The front edge of the EUT and laptop were initially positioned facing the antenna. The EUT and laptop were measured at a distance of 3 metres. The EUT was rotated in all three orthogonal planes.

5.5.1.2 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.

5.5.2 Test results

Tests were performed using Test Site M and B**.**

Test Environment: M & B
Temperature: 22-25°C Humidity: 42-51%

Analyser plots for the Quasi-Peak / Average values as applicable can be found in Section 6.2 and 6.3 of this report.

Table of signals measured below 1GHz.

Horizontal

The signal list below is common to Top, Middle & Bottom channels

Signal No.	Freq (MHz)	Peak Amp (dBuV)	QP Amp (dBuV)	QP - Lim1 (dB)
1	32.351	30.8	25.5	-14.5
2	48.349	26.5	18.2	-21.8
3	49.561	26.5	21.2	-18.8
4	166.121	34.6	24.5	-19.0
5	215.998	36.1	34.8	-8.7
6	287.997	44.1	43.5	-2.5
7	391.499	38.7	37.1	-8.9
8	396.307	28.7	23.7	-22.3
9	431.995	41.4	38.4	-7.6
10	664.018	36.2	29.4	-16.6
11	665.919	37.6	29.6	-16.4

Vertical

The signal list below is common to Top, Middle & Bottom channels

Signal No.	Freq (MHz)	Peak Amp (dBuV)	QP Amp (dBuV)	QP - Lim1 (dB)
1	32.206	35.1	30.2	-9.8
2	48.266	39.1	28.8	-11.2
3	48.519	40.6	29.2	-10.8
4	49.625	36.5	32.5	-7.5
5	165.828	30.7	26.4	-17.1
6	199.714	34.8	31.0	-12.5
7	391.499	45.4	43.0	-3.0
8	499.387	40.4	28.5	-17.5
9	664.310	48.3	39.3	-6.7

Table of signals measured within 20dB of limits above 1GHz.

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 in section 5.4.

Horizontal

Bottom channel TX.

Signal No.	Freq (MHz)	Peak Amp (dBuV)	PK - Lim1 (dB)	AV Amp (dBuV)	AV - Lim1 (dB)
1	2249.8	56.2	-17.8	47.9	-6.1
2	2373.5	55.4	-18.6	47.2	-6.8
3	2437.5	55.3	-18.7	46.5	-7.5
4	2469.7	45.3	-28.7	35.2	-18.8
5	2469.7	45.6	-28.4	35.3	-18.7
6	4810	57.0	-17.0	48.9	-5.1
7	7215	70.7	-3.3	64.0	10.0[1]
8	9620	60.2	-13.8	52.3	-1.7
9	12025	68.6	-5.4	61.1	7.1[1]
10	14430	55.8	-18.2	49.0	-5.0
11	16835	54.0	-20.0	62.0	8.0[1]
12	19240	58.0	-16.0	48.0	-6.0
13	21645	50.0	-24.0	41.0	-13.0
14	24050	49.2	-24.8	39.0	-15.0

Middle channel TX.

Signal No.	Freq (MHz)	Peak Amp (dBuV)	PK - Lim1 (dB)	AV Amp (dBuV)	AV - Lim1 (dB)
1	2375.0	39.9	-34.1	27.8	-26.2
2	2408.0	50.6	-23.4	46.2	-7.8
3	2472.5	52.0	-22.0	43.8	-10.2
4	2503.8	41.9	-32.1	32.6	-21.4
5	3198	51.2	-22.8	31.2	-22.8
6	4880	56.6	-17.4	48.7	-5.3
7	7320	69.1	-4.9	62.4	8.4[1]
8	9760	57.9	-16.1	49.9	-4.1
9	12200	65.9	-8.1	57.9	3.9[1]
10	14640	61.2	-12.8	51.0	-3.0
11	17080	62.0	-12.0	51.5	-2.5
12	19520	48.7	-25.3	39.5	-14.5
13	21960	57.0	-17.0	48.0	-6.0
14	24400	45.5	-28.5	34.5	-19.5

[1] The values in the above tables 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.

Top channel TX.

Signal No.	Freq (MHz)	Peak Amp (dBuV)	PK - Lim1 (dB)	AV Amp (dBuV)	AV - Lim1 (dB)
1	2384.5	41.9	-32.1	31.3	-22.7
2	2448.5	58.0	-16.0	51.2	-2.8
3	2464.4	50.2	-23.8	40.5	-13.5
4	2511.5	54.2	-19.8	47.4	-6.6
5	2527.6	39.4	-34.6	27.3	-26.7
6	3198	54.2	-19.8	30.5	-23.5
7	4960	54.3	-19.7	45.5	-8.5
8	7440	69.8	-4.2	62.9	8.9[1]
9	9920	60.9	-13.1	53.4	-0.6
10	12400	65.6	-8.4	57.7	3.7[1]
11	14880	64.5	-9.5	54.0	0.0[1]
12	17360	60.5	-13.5	52.0	-2.0
13	19840	47.0	-27.0	37.2	-16.8
14	22320	55.2	-18.8	46.0	-8.0
15	24800	47.5	-26.5	36.5	-17.5

Vertical

Bottom channel TX.

Signal No.	Freq (MHz)	Peak Amp (dBuV)	PK - Lim1 (dB)	AV Amp (dBuV)	AV - Lim1 (dB)
1	2247.7	48.8	-25.2	40.8	-13.2
2	2373.5	52.5	-21.5	44.6	-9.4
3	2429.4	43.5	-30.5	30.7	-23.3
4	2436.6	52.7	-21.3	46.4	-7.6
5	2468.8	45.2	-28.8	37.7	-16.3
6	3198	55.2	-18.8	31.2	-22.8
7	4810	56.4	-17.6	48.5	-5.5
8	7215	71.2	-2.8	64.4	10.4[1]
9	9620	57.2	-16.8	48.8	-5.2
10	12025	64.7	-9.3	56.4	2.4[1]
11	14430	51.5	-22.5	40.0	-14.0
12	16835	60.7	-13.3	51.0	-3.0
13	19240	54.3	-19.7	44.0	-10.0
14	21645	57.0	-17.0	47.7	-6.3
15	24050	46.0	-28.0	34.0	-20.0

[1] The values in the above tables 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.

Middle channel TX.

Signal No.	Freq (MHz)	Peak Amp (dBuV)	PK - Lim1 (dB)	AV Amp (dBuV)	AV - Lim1 (dB)
1	2317.7	42.0	-32.0	31.7	-22.3
2	2375.0	41.6	-32.4	30.2	-23.8
3	2408.4	54.4	-19.6	47.6	-6.4
4	2471.5	54.4	-19.6	47.5	-6.5
5	2504.1	43.5	-30.5	34.9	-19.1
6	3198	55.2	-18.8	31.2	-22.8
7	4880	59.4	-14.6	52.0	-2.0
8	7320	69.9	-4.1	63.3	9.3[1]
9	9760	55.3	-18.7	46.7	-7.3
10	12200	63.1	-10.9	54.9	0.9[1]
11	14640	56.3	-17.7	48.0	-6.0
12	17080	60.6	-13.4	51.0	-3.0
13	19520	51.0	-23.0	40.0	-14.0
14	21960	54.0	-20.0	44.8	-9.2
15	24400	48.0	-26.0	38.0	-16.0

Top channel TX.

Signal No.	Freq (MHz)	Peak Amp (dBuV)	PK - Lim1 (dB)	AV Amp (dBuV)	AV - Lim1 (dB)
1	2152.4	43.6	-30.4	32.5	-21.5
2	2157.4	42.9	-31.1	32.5	-21.5
3	2383.5	42.7	-31.3	32.9	-21.1
4	2415.4	42.8	-31.2	32.0	-22.0
5	2432.0	44.5	-29.5	33.5	-20.5
6	2447.5	60.5	-13.5	54.4	0.4[1]
7	2503.6	46.1	-27.9	33.4	-20.6
8	2511.4	56.6	-17.4	49.4	-4.6
9	2511.5	54.6	-19.4	47.9	-6.1
10	3198	55.5	-18.5	31.0	-23.0
11	4960	60.6	-13.4	53.2	-0.8
12	7440	68.0	-6.0	61.1	7.1[1]
13	9920	58.1	-15.9	50.0	-4.0
14	12400	61.9	-12.1	53.4	-0.6
15	14880	58.0	-16.0	49.0	-5.0
16	17360	60.8	-13.2	50.7	-3.3
17	19840	46.3	-27.7	34.5	-19.5
18	22320	55.5	-18.5	46.5	-7.5
19	24800	46.0	-28.0	34.0	-20.0

[1] The values in the above tables 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.

Plot references above 1GHz

Frequency range	Plot reference
1 – 2 GHz	5117-3,1-2 GHz Horiz Middle channel
2 – 2.7 GHz	5117-3, 2-2.7 GHz Horiz Middle channel
2.7 – 5 GHz	5117-3,1-2 GHz Horiz Middle channel
5 – 6.5 GHz	5117-3,1-2 GHz Horiz Middle channel
6.5 – 7.8 GHz	5117-3,1-2 GHz Horiz Middle channel
7.8 – 10 GHz	5117-3,1-2 GHz Horiz Middle channel
10 – 12.5 GHz	5117-3,1-2 GHz Horiz Middle channel
12.5 – 15 GHz	5117-3,1-2 GHz Horiz Middle channel
15 – 18 GHz	5117-3,1-2 GHz Horiz Middle channel
18 – 20 GHz	5117-3,1-2 GHz Horiz Middle channel
20 – 22 GHz	5117-3,1-2 GHz Horiz Middle channel
22 – 25 GHz	5117-3,1-2 GHz Horiz Middle channel
1 – 2 GHz	5117-3,1-2 GHz Vert Middle channel
2 – 2.7 GHz	5117-3, 2-2.7 GHz Vert Middle channel
2.7 – 5 GHz	5117-3,1-2 GHz Vert Middle channel
5 – 6.5 GHz	5117-3,1-2 GHz Vert Middle channel
6.5 – 7.8 GHz	5117-3,1-2 GHz Vert Middle channel
7.8 – 10 GHz	5117-3,1-2 GHz Vert Middle channel
10 – 12.5 GHz	5117-3,1-2 GHz Vert Middle channel
12.5 – 15 GHz	5117-3,1-2 GHz Vert Middle channel
15 – 18 GHz	5117-3,1-2 GHz Vert Middle channel
18 – 20 GHz	5117-3,1-2 GHz Vert Middle channel
20 – 22 GHz	5117-3,1-2 GHz Vert Middle channel
22 – 25 GHz	5117-3,1-2 GHz Vert Middle channel

All applicable channels were measured and signal lists for all three channels are presented above. Only middle channel (2.44GHz) plots are listed/shown.

n.b. the general limits of 15.209 are as drawn on the respective plots.

LIMITS:
15.209 limits are applicable in the restricted bands of 15.205 with the relevant detector.
15.247(d) other emissions, outside the intentional band, must be attenuated by at least 50dB from the level of the fundamental / meet the general limits of 15.209.

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

5.5.2.1 Test Equipment used

N240, E410, E411, E412, TMS933, E268, E342, E429, E492, TMS78, TMS79, TMS82, TMS81.
See Section 10 for more details

5.6 Occupied bandwidth

5.6.1 Test Methods

Test Requirements FCC Part 15C, Reference (15.215)

Test Method: ANSI C63.10, Reference (6.9)

5.6.1.1 Configuration of EUT

As per radiated emissions test. The measurement was made with the emission from the EUT maximised.

5.6.1.2 Test Procedure

Tests were made in accordance with FCC Part 15 using the measuring equipment noted below. A 120kHz RBW, 3x VBW, auto sweep time and max hold settings were used for the 6dB bandwidth.

5.6.2 Test results

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

Temperature of test Environment: 24°C

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

Channel	Result (MHz)	Plot reference
2.405GHz	1.58	J5117-3, Bottom channel 6dB BW (PK radiated Vert)
2.440GHz	1.62	J5117-3, Middle channel 6dB BW (PK radiated Vert)
2.480GHz	1.62	J5117-3, Top channel 6dB BW (PK radiated Vert)

LIMITS:

15.215(c) The 20dB bandwidth of the emission must be contained within the designated frequency band.
15.247(a)(2) The minimum 6dB bandwidth shall be at least 500kHz.

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

5.6.2.1 Test Equipment used

E268, E410, E411, E412, TMS82
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: FCC Part 15C, Reference (15.215)
ANSI C63.10-2009, Reference clause 6.9.3

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. The emission from the EUT was maximised before taking the plots. Due to the influence of high in-band signals when using the specified resolution bandwidth the Marker Delta method was employed for the restricted band edge tests.

5.7.2 Test results

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

Temperature of test Environment: 23°C

Analyser plots for the Band Edge Compliance can be found in Section 6.6 of this report. These show the 20dBc requirement of 15.247(d) are met at the band edges of 2400 and 2483.5 MHz.

Restricted band edge plots are also shown in section 6.6. The restricted band edges closest to the EUT frequency of 2400-2483.5MHz are 2390 & 2483.5MHz.

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

Channel	PK reading (dBuV/m)	AV reading (dBuV/m)	Plot reference	Limit (dBuV/m)
Bottom	59.0	-	J5117-3, Band edge bottom channel PK	91.9 (=20dBc)
Bottom	-	53.5	J5117-3, Band edge bottom channel Average	54
Top$^{\Delta}$	115.3 – 42.3 = 73.0	-	J5117-3, Band edge top chan PK 1MHz RBW	74
Top	-	71.3*	J5117-3, Band edge top chan AV 1MHz RBW	54

*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) = 20dB. According to the declared duty cycle, therefore, the emissions observed are below the limit after averaging for pulse rate.

$^{\Delta}$ Delta Marker method used due to the influence of high in band signal at band edge.

LIMITS:
15.247(d) In any 100kHz bandwidth outside the frequency band 2400-2483.5 MHz the RF power that is produced by the intentional radiator shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power.

15.209(a) Radiated emissions which fall in the restricted bands as defined in section 205(a) must also comply with the radiated emission limits specified in section 15.209(a)

Further wider span plots have been taken to show the fact that there are no spurious emissions above the restricted limits of 15.209.

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

5.7.2.1 Test Equipment used

E492, E268

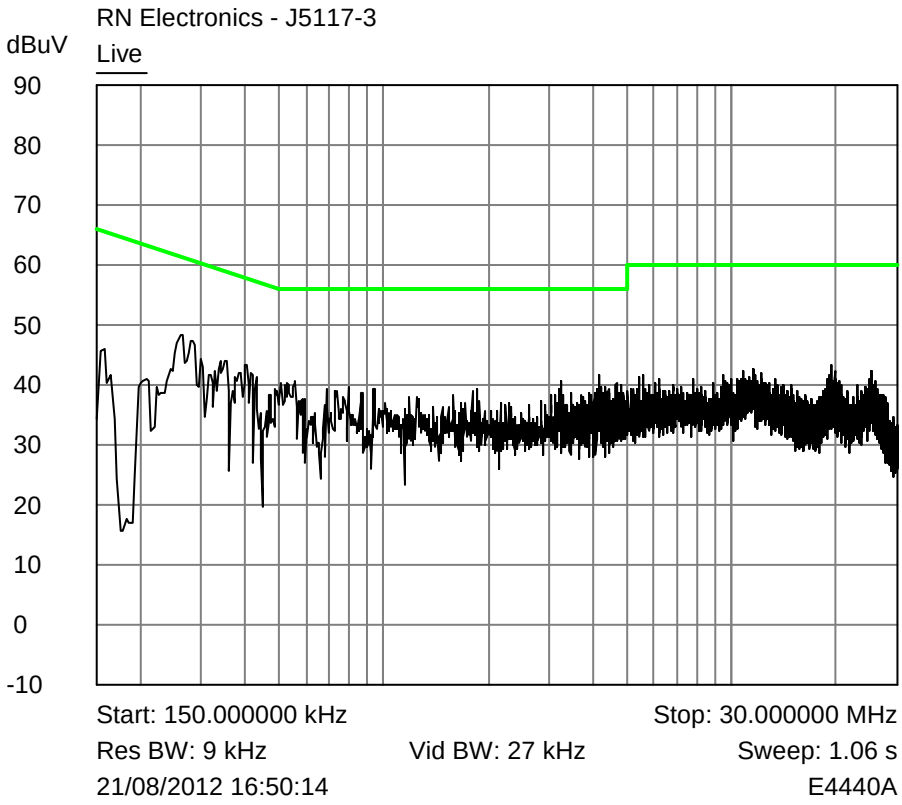
5.8 FHSS Parameters

Test following tests were not applicable as the EUT does not employ FHSS Technology.

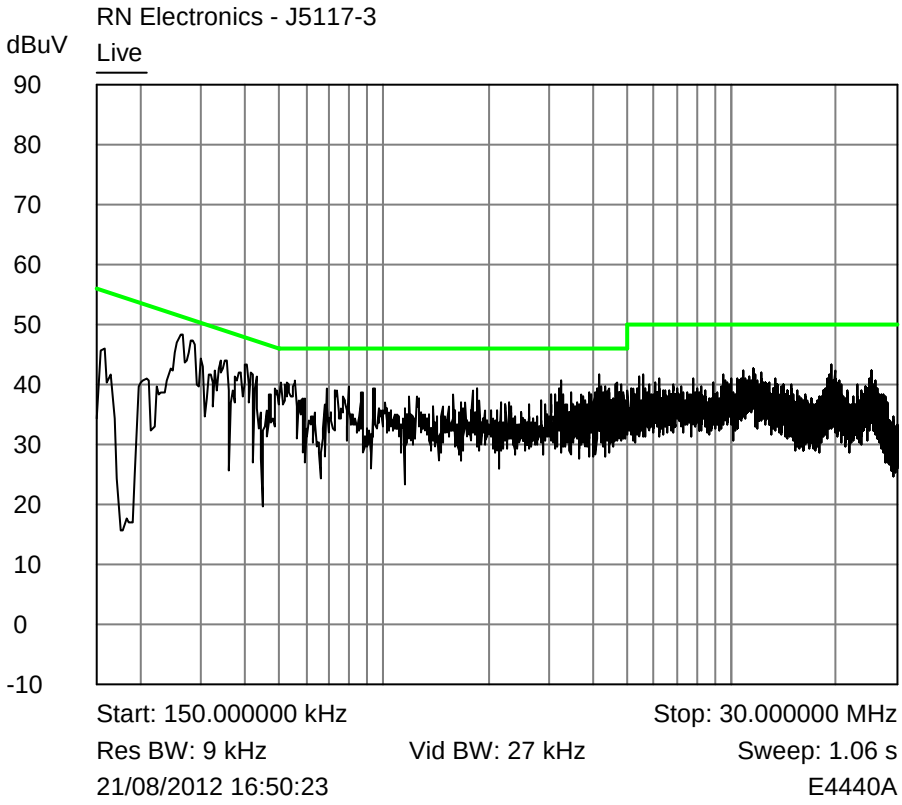
5.8.1 Frequency Separation
5.8.2 Number of hopping Channels
5.8.3 Dwell time

6 Plots and Results

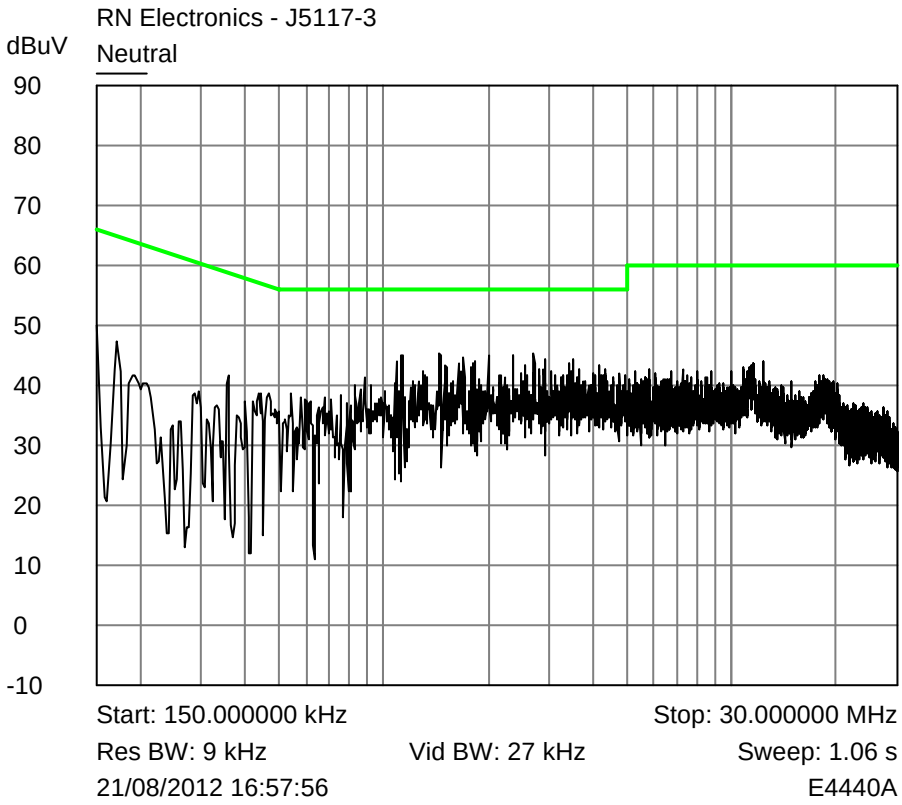
6.1 Conducted Emissions



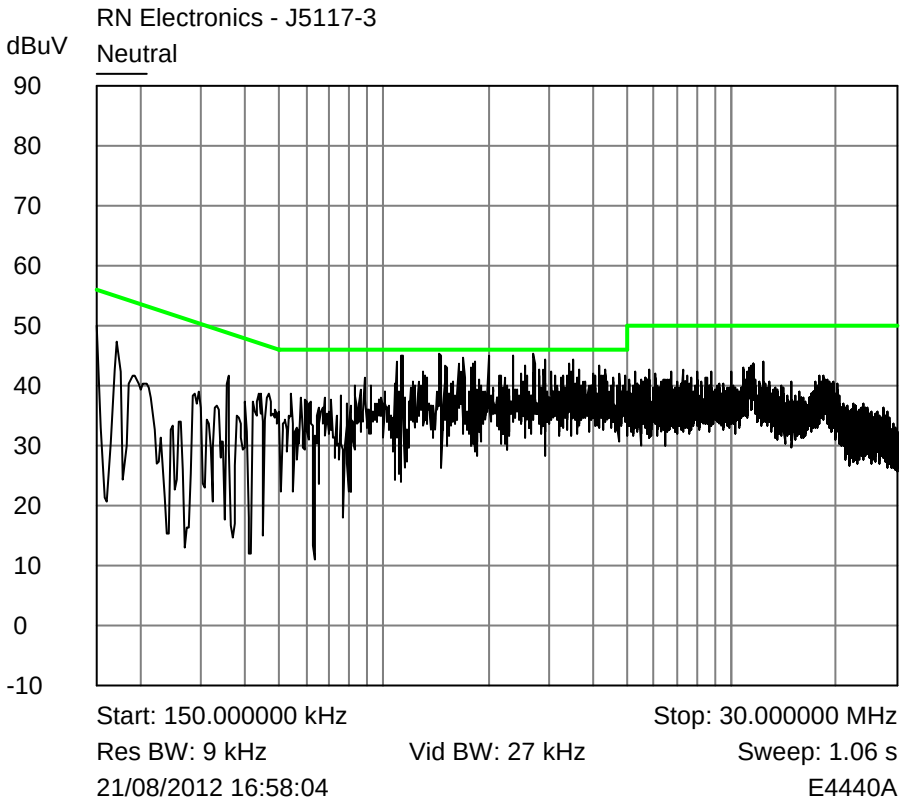
Plot of peak emissions 150kHz - 30MHz on the mains live terminal against the quasi-peak limit line.



Plot of peak emissions 150kHz - 30MHz on the mains live terminal against the average limit line.

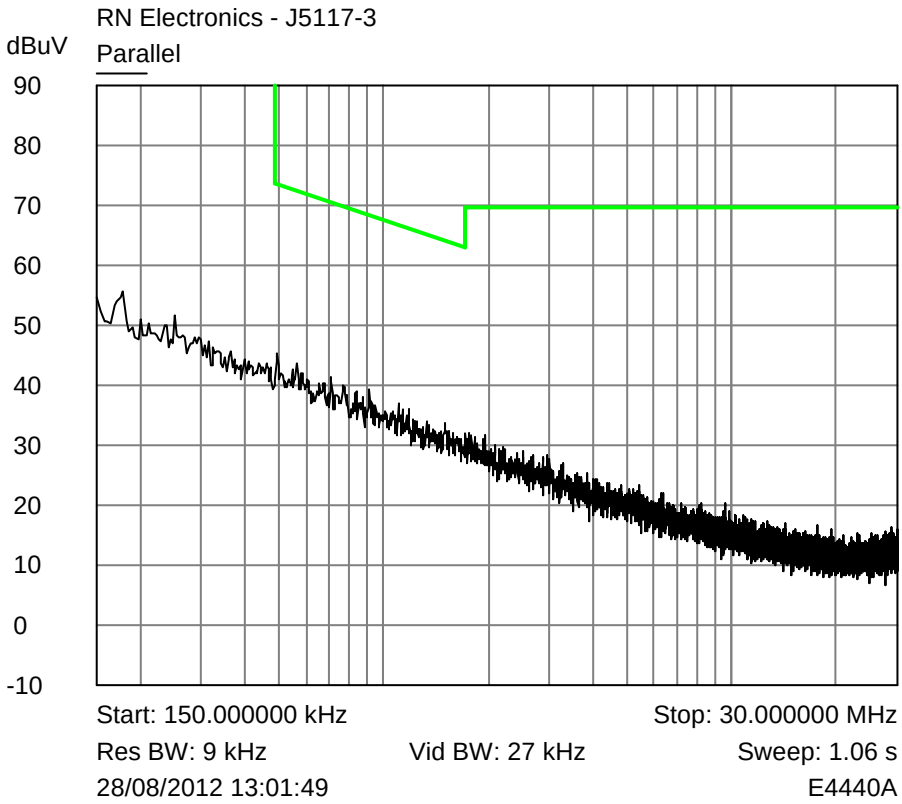


Plot of peak emissions 150kHz - 30MHz on the mains neutral terminal against the quasi-peak limit line.

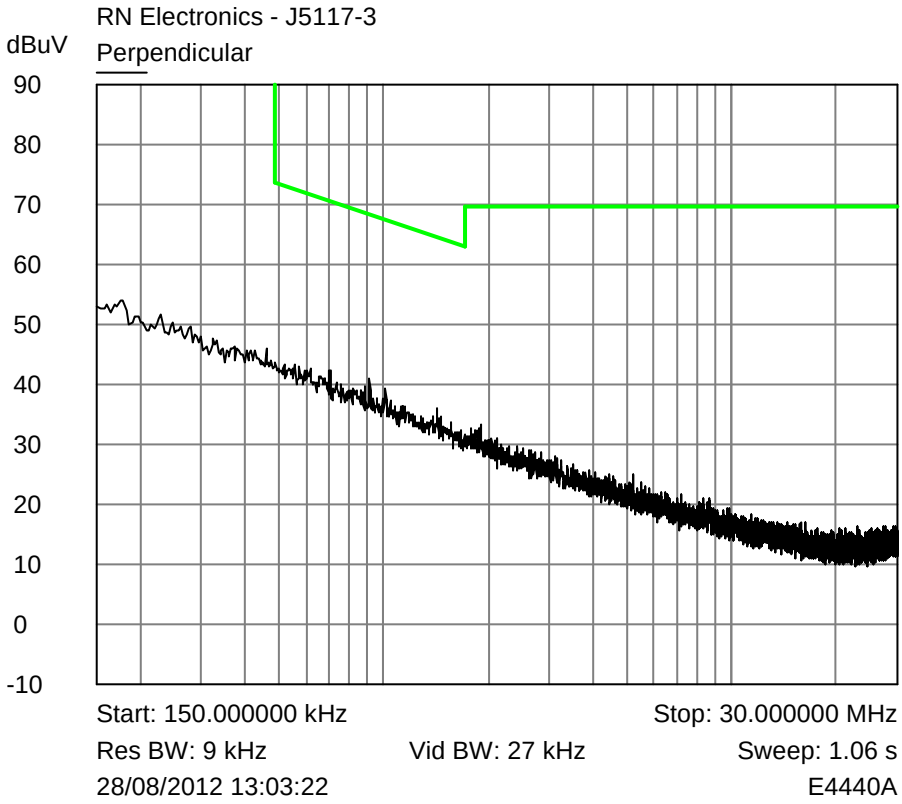


Plot of peak emissions 150kHz - 30MHz on the mains neutral terminal against the average limit line.

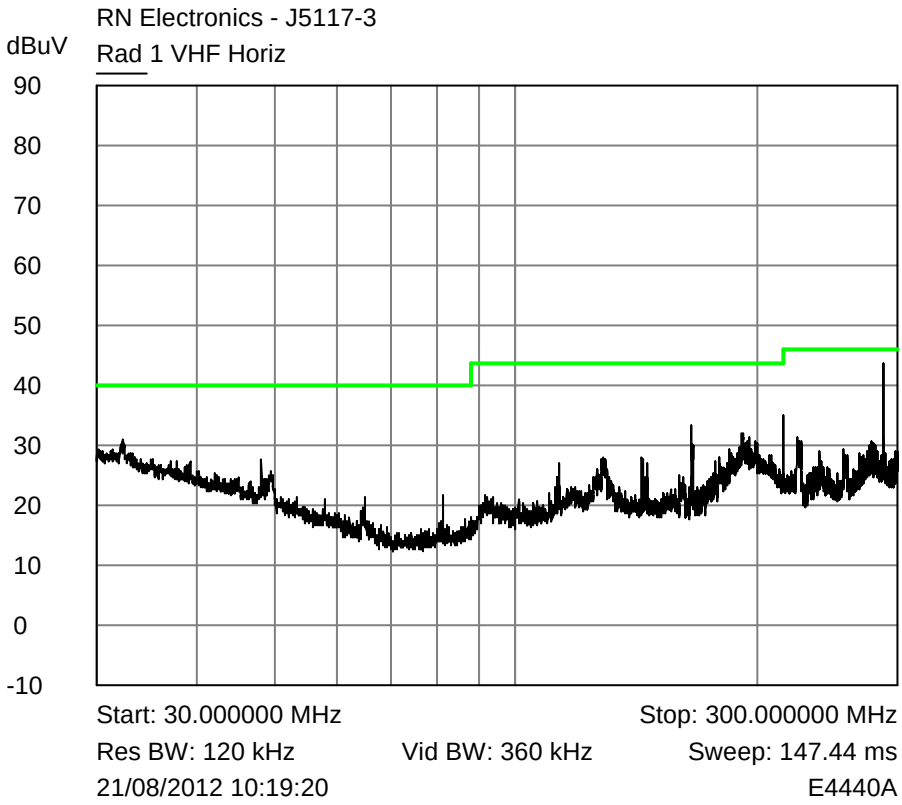
6.2 Radiated Emissions 9kHz – 1GHz



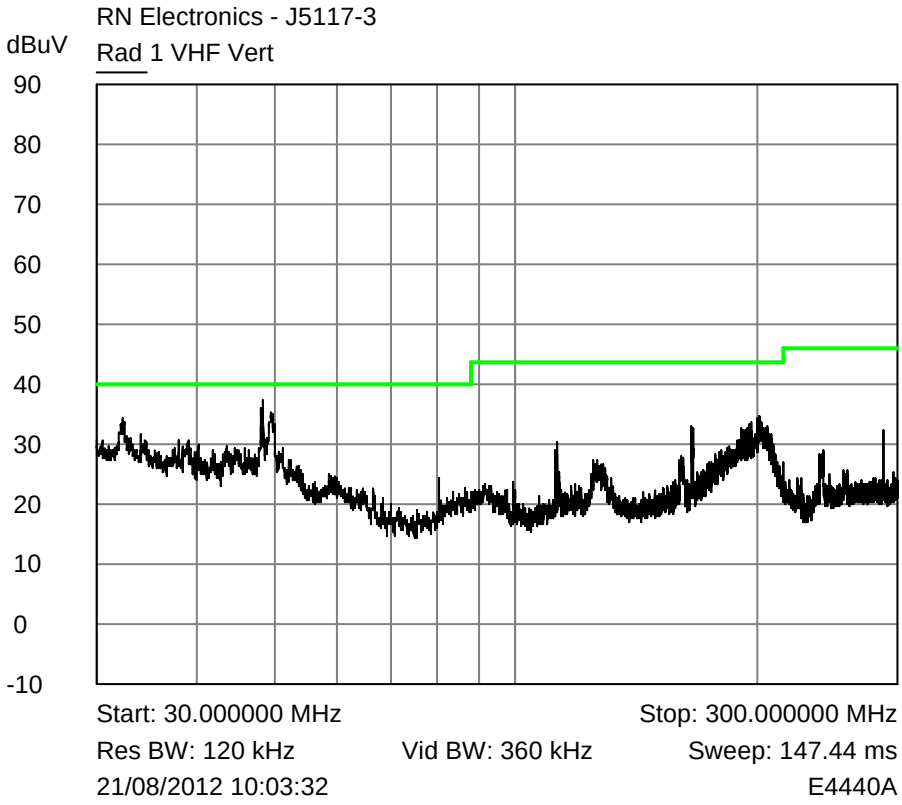
Plot of peak Parallel emissions 150kHz - 30MHz against the quasi-peak limit line.



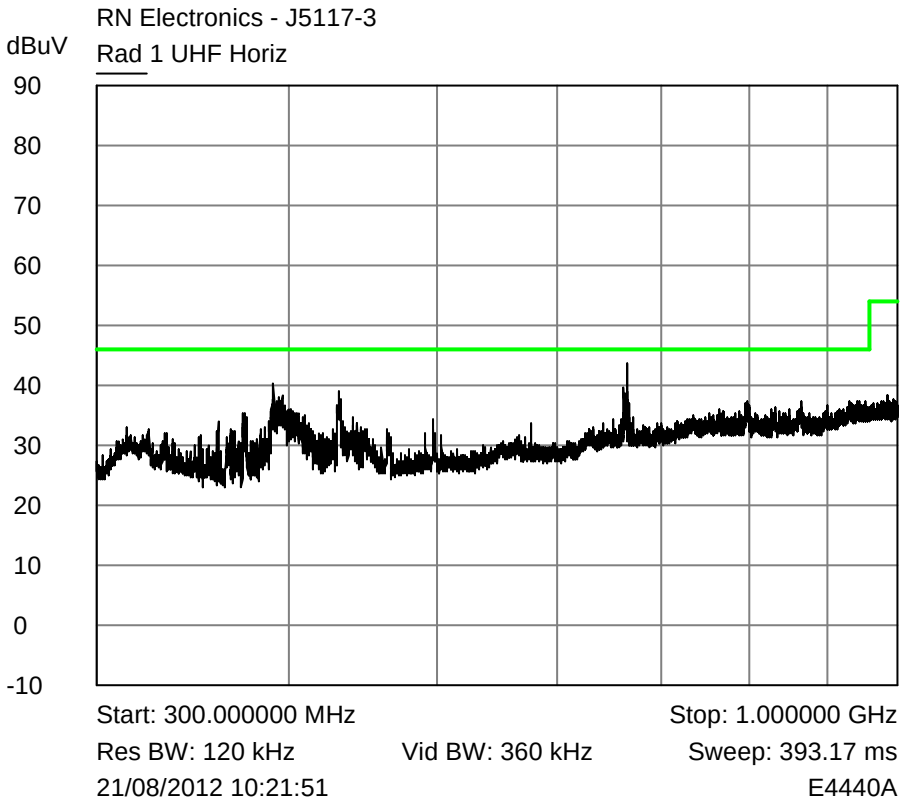
Plot of peak Perpendicular emissions 150kHz - 30MHz against the quasi-peak limit line.



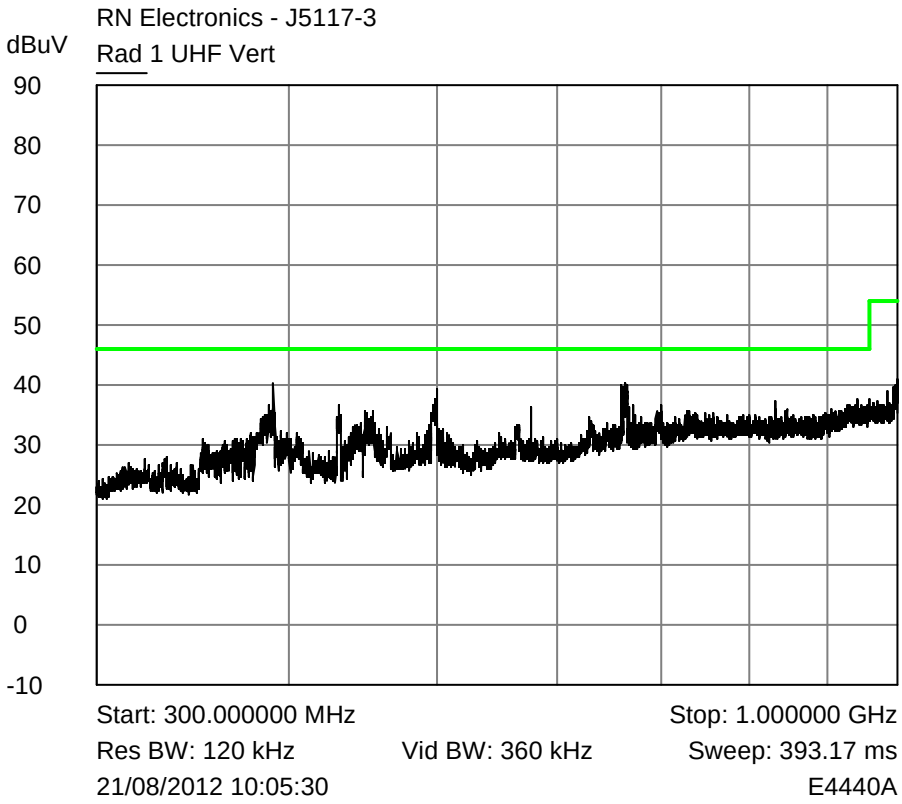
Plot of peak horizontal emissions 30MHz - 300MHz against the quasi-peak limit line.



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



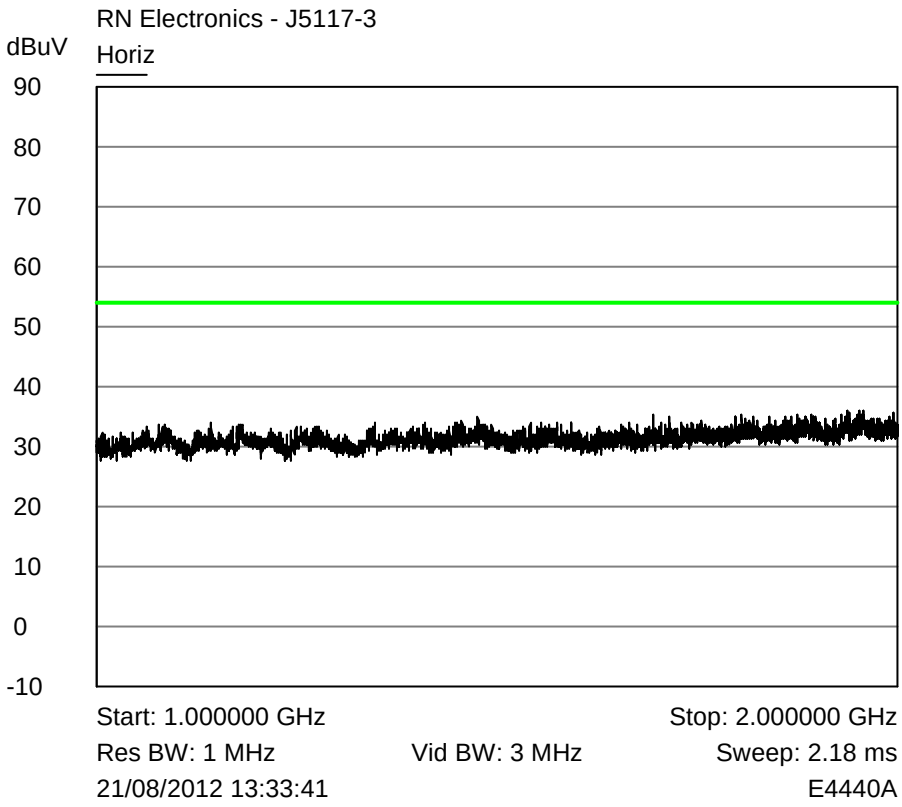
Plot of peak horizontal emissions 300MHz - 1GHz against the quasi-peak limit line.

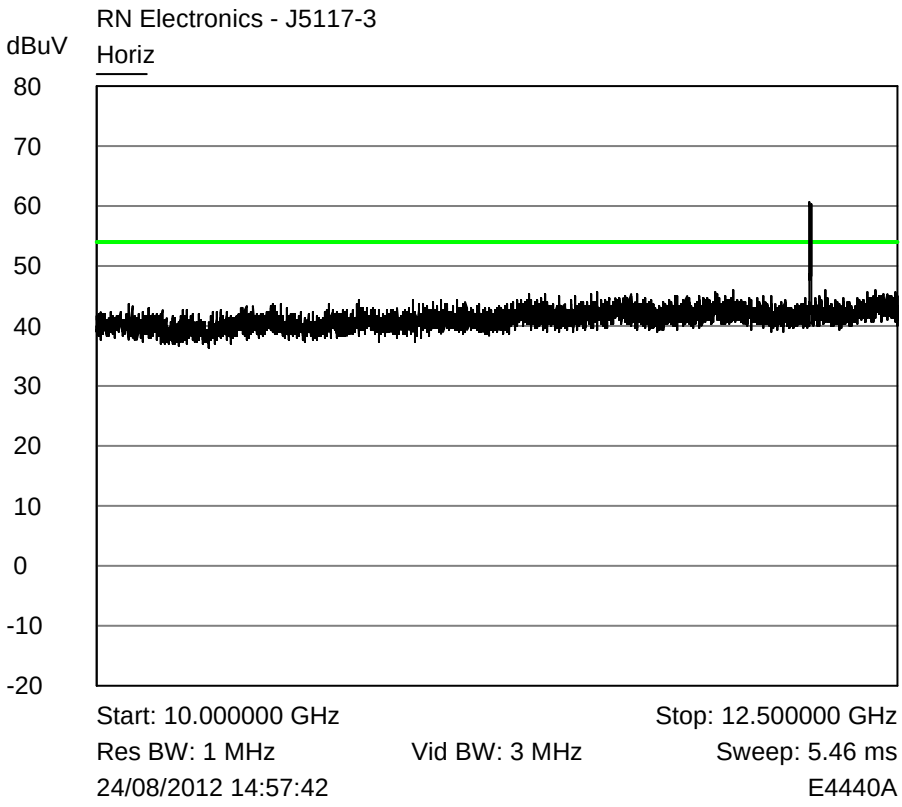


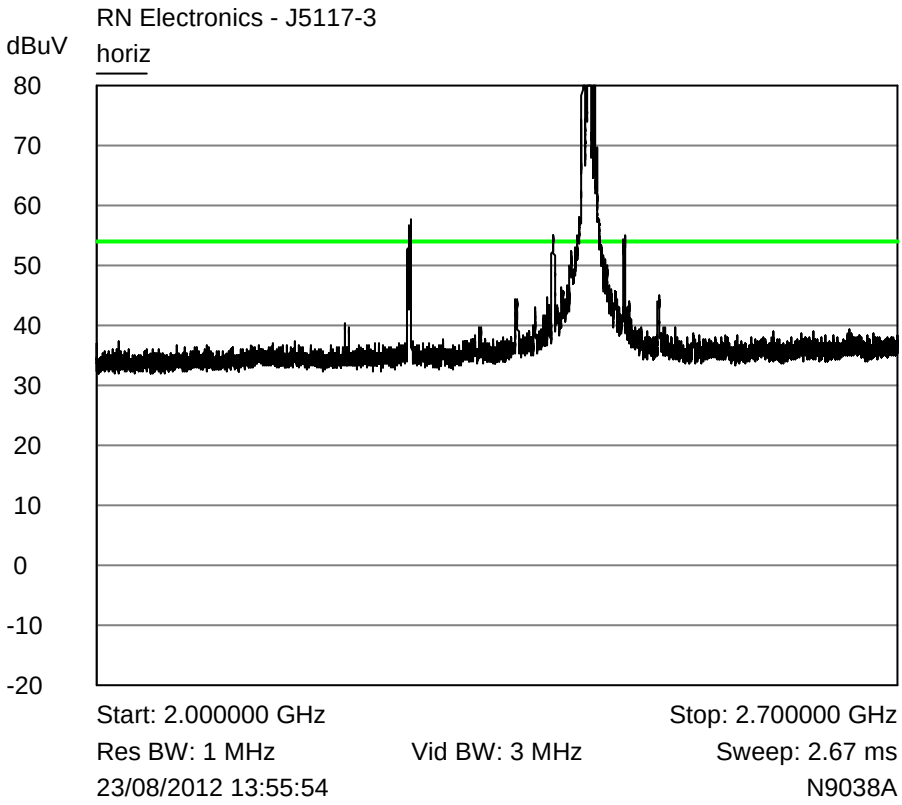
Plot of peak vertical emissions 300MHz - 1GHz against the quasi-peak limit line.

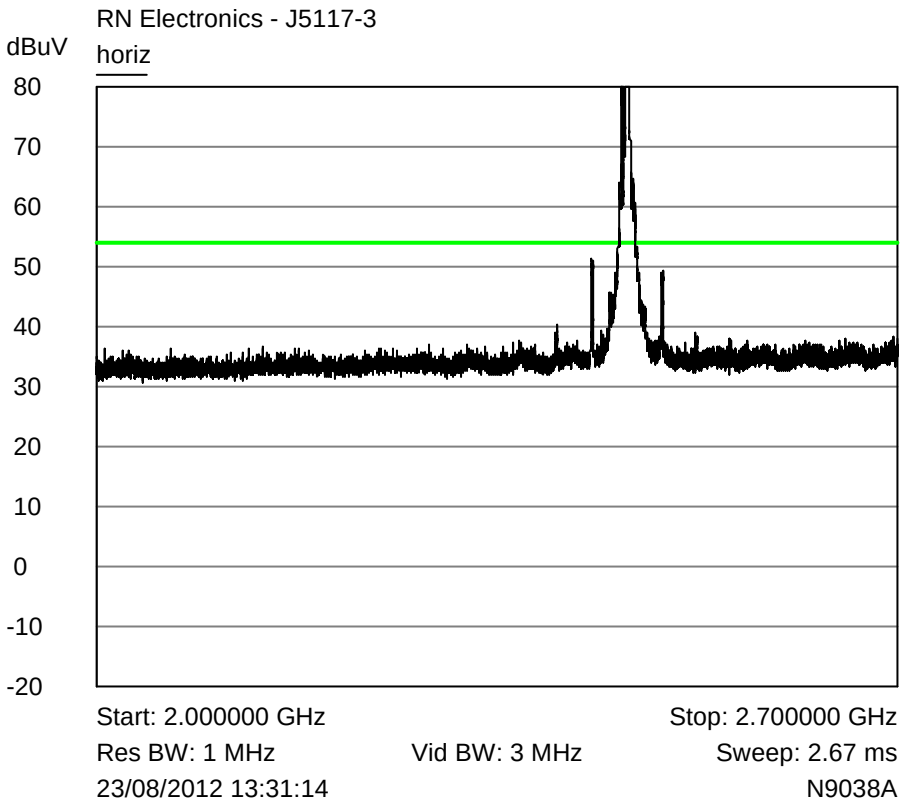
6.3 Radiated Emissions above 1GHz

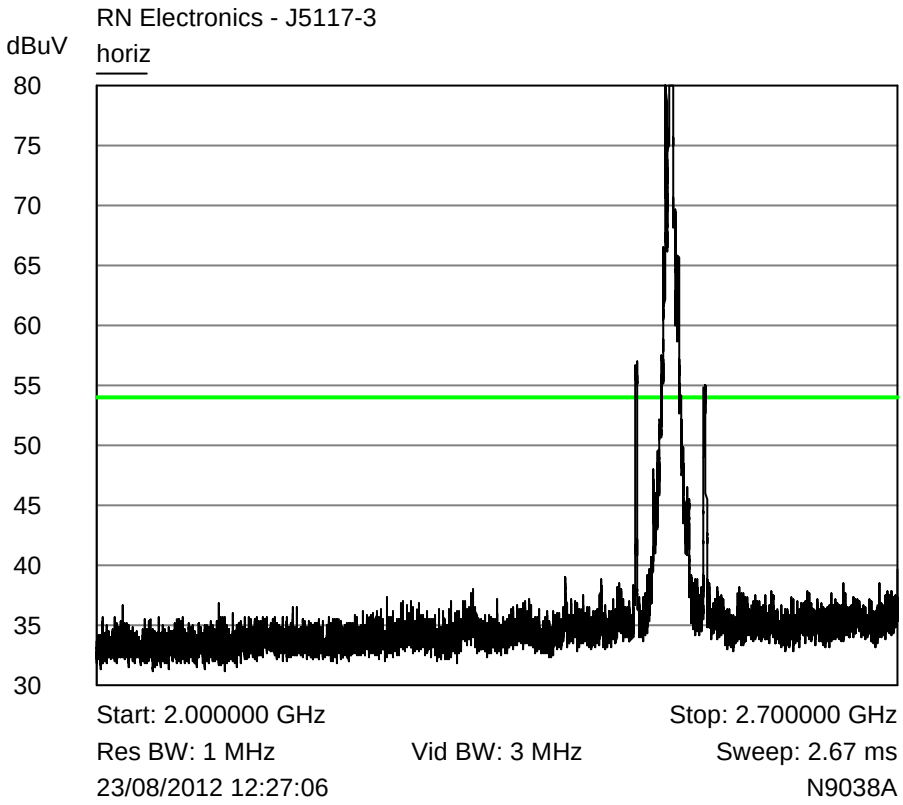
Plots of Peak horizontal emissions 1GHz - 25GHz against the Average limit line.

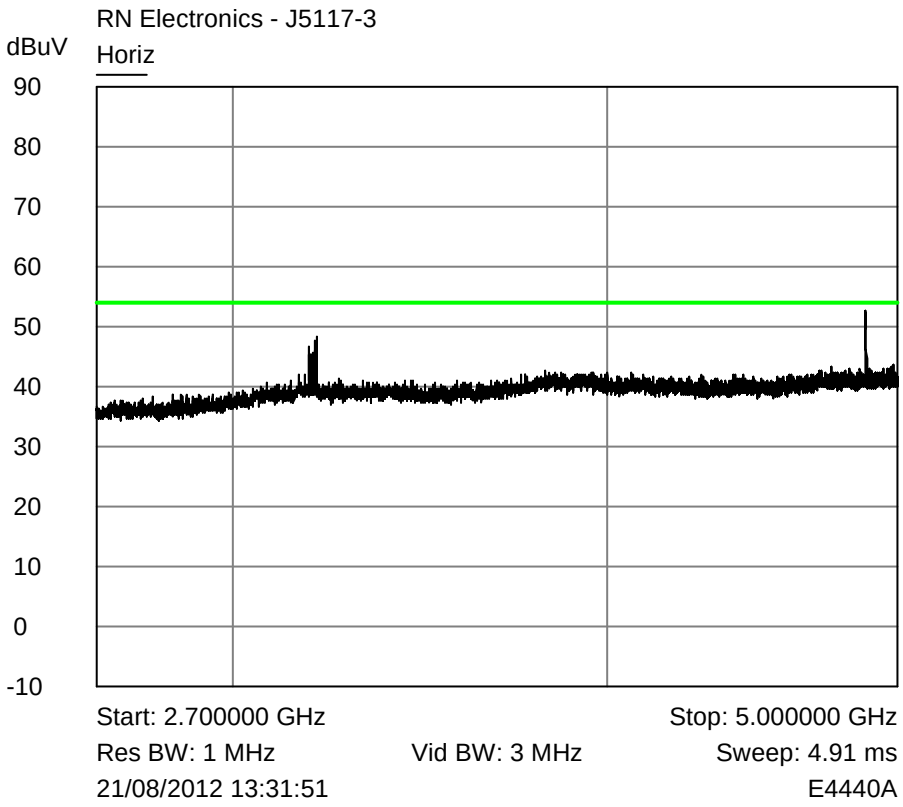


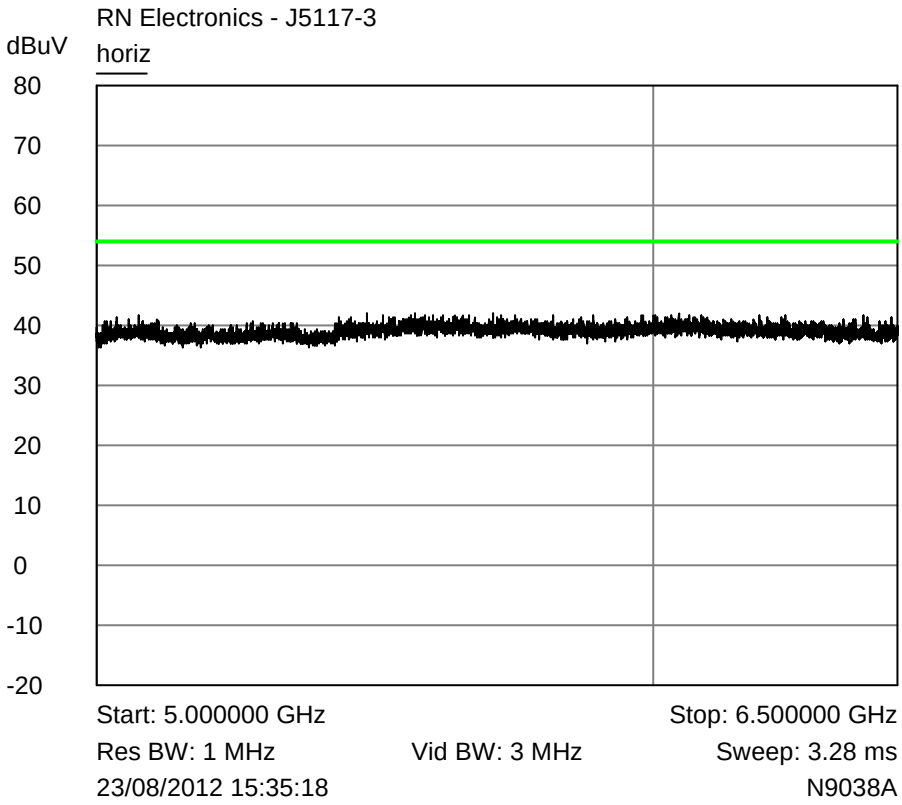


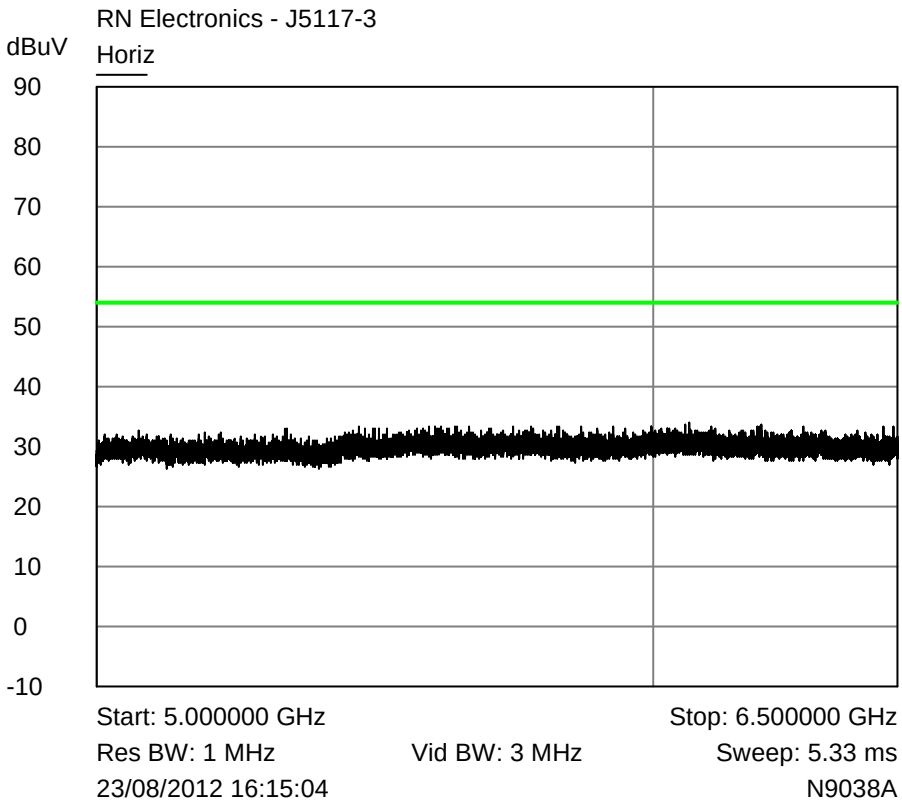

RN Electronics - J5117-3
dBuV
horiz
80
70
60
50
40
30
20
10
0
-10
-20
Start: 2.000000 GHz
Stop: 2.700000 GHz
Res BW: 1 MHz
Vid BW: 3 MHz
Sweep: 2.67 ms
23/08/2012 13:55:54
N9038A

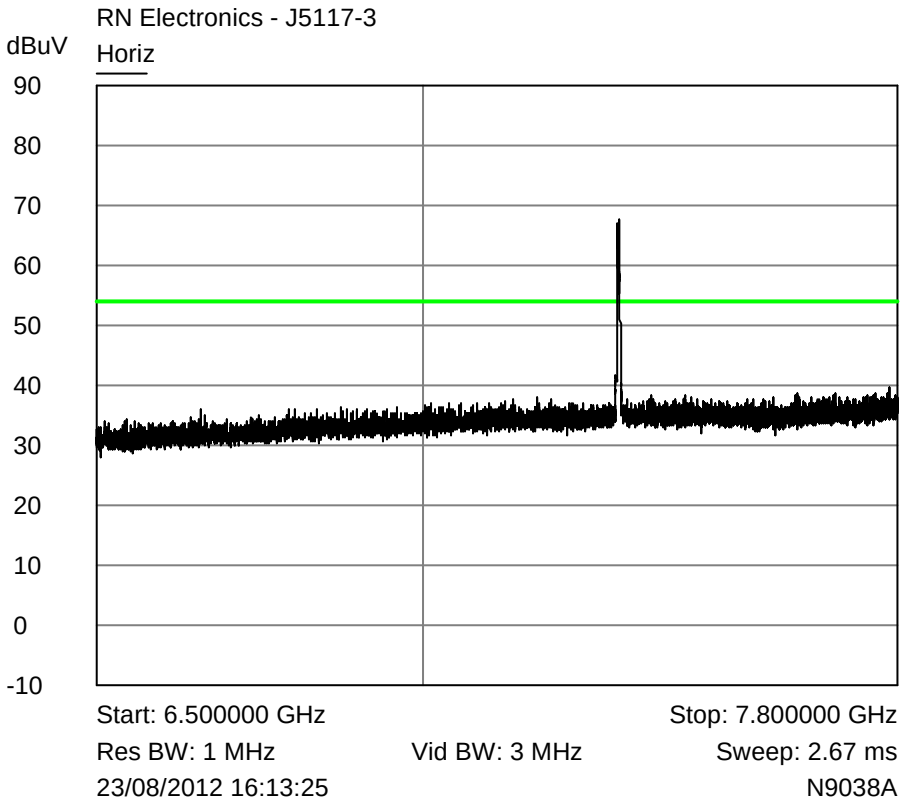

RN Electronics - J5117-3
dBuV
horiz
80
70
60
50
40
30
20
10
0
-10
-20
Start: 2.000000 GHz
Stop: 2.700000 GHz
Res BW: 1 MHz
Vid BW: 3 MHz
Sweep: 2.67 ms
23/08/2012 13:31:14
N9038A

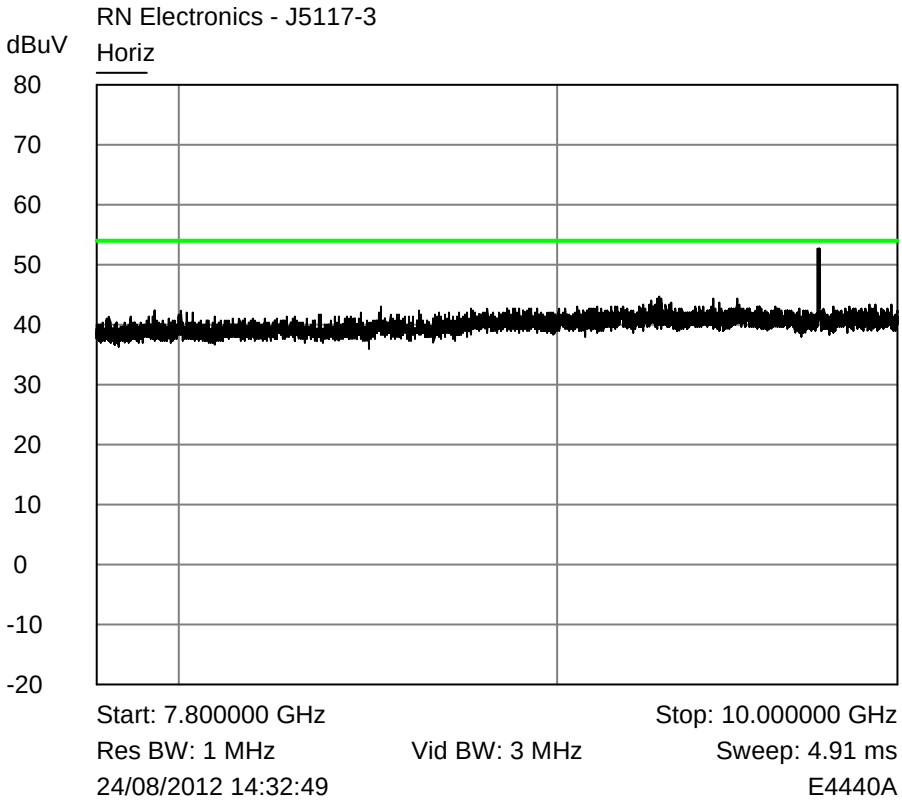

RN Electronics - J5117-3
horiz
dBuV
80
75
70
65
60
55
50
45
40
35
30
Start: 2.000000 GHz
Stop: 2.700000 GHz
Res BW: 1 MHz
Vid BW: 3 MHz
Sweep: 2.67 ms
23/08/2012 12:27:06
N9038A


RN Electronics - J5117-3
Horiz
dBuV
90
80
70
60
50
40
30
20
10
0
-10
Start: 2.700000 GHz
Stop: 5.000000 GHz
Res BW: 1 MHz
Vid BW: 3 MHz
Sweep: 4.91 ms
21/08/2012 13:31:51
E4440A

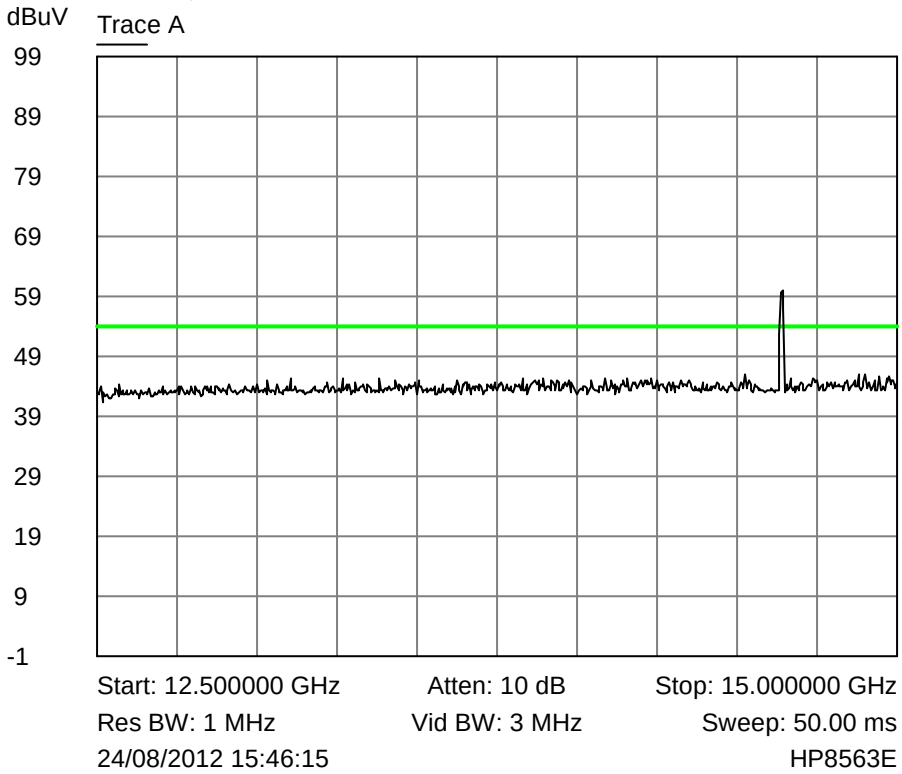

RN Electronics - J5117-3
dBuV
horiz
80
70
60
50
40
30
20
10
0
-10
-20
Start: 5.000000 GHz
Stop: 6.500000 GHz
Res BW: 1 MHz
Vid BW: 3 MHz
Sweep: 3.28 ms
23/08/2012 15:35:18
N9038A


RN Electronics - J5117-3
dBuV
Horiz
90
80
70
60
50
40
30
20
10
0
-10
Start: 5.000000 GHz
Stop: 6.500000 GHz
Res BW: 1 MHz
Vid BW: 3 MHz
Sweep: 5.33 ms
23/08/2012 16:15:04
N9038A


RN Electronics - J5117-3
dBuV
Horiz
90
80
70
60
50
40
30
20
10
0
-10
Start: 6.500000 GHz
Stop: 7.800000 GHz
Res BW: 1 MHz
Vid BW: 3 MHz
Sweep: 2.67 ms
23/08/2012 16:13:25
N9038A

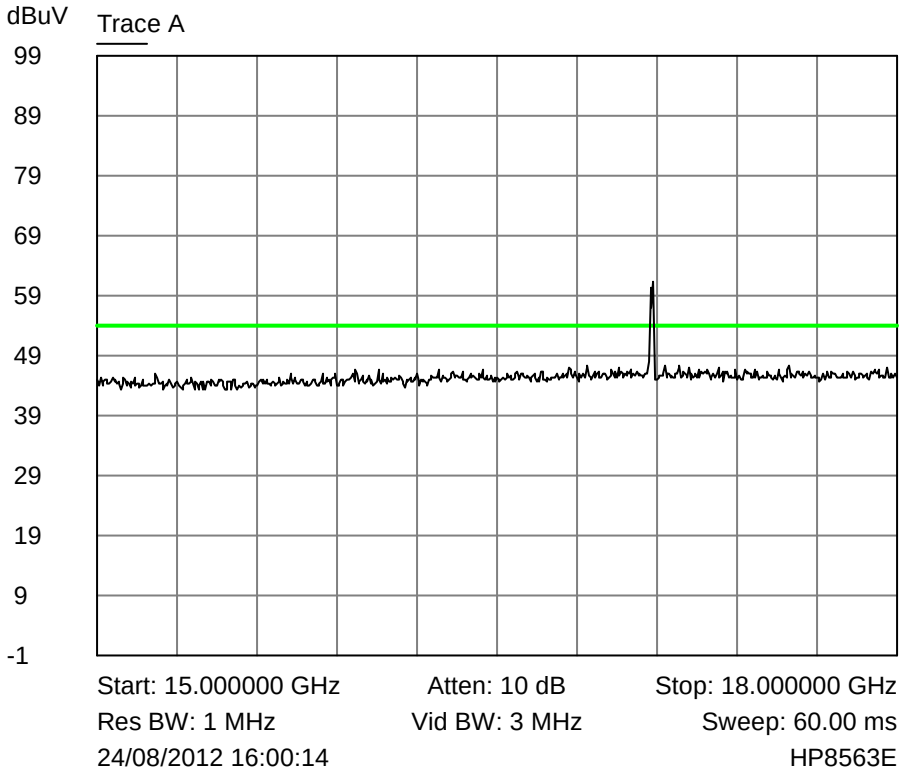

RN Electronics - J5117-3
dBuV
Horiz
80
70
60
50
40
30
20
10
0
-10
-20
Start: 7.800000 GHz
Stop: 10.000000 GHz
Res BW: 1 MHz
Vid BW: 3 MHz
Sweep: 4.91 ms
24/08/2012 14:32:49
E4440A

J5117-3, 12.5 - 15 GHz Horizontal



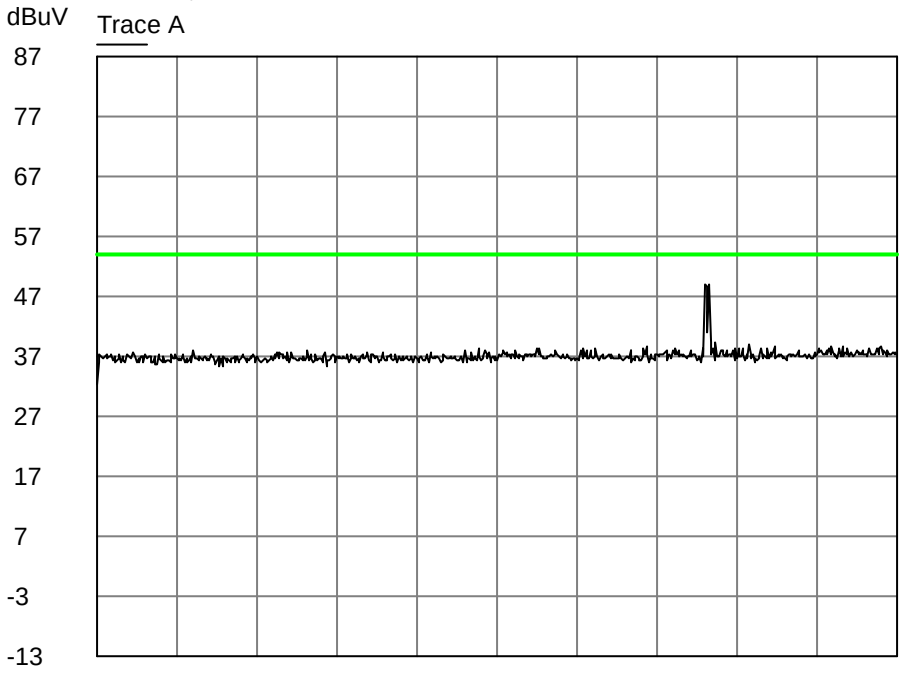
Start: 12.500000 GHz Atten: 10 dB Stop: 15.000000 GHz
Res BW: 1 MHz Vid BW: 3 MHz Sweep: 50.00 ms
24/08/2012 15:46:15 HP8563E

J5117-3, 15 - 18 GHz Horizontal Mid chan



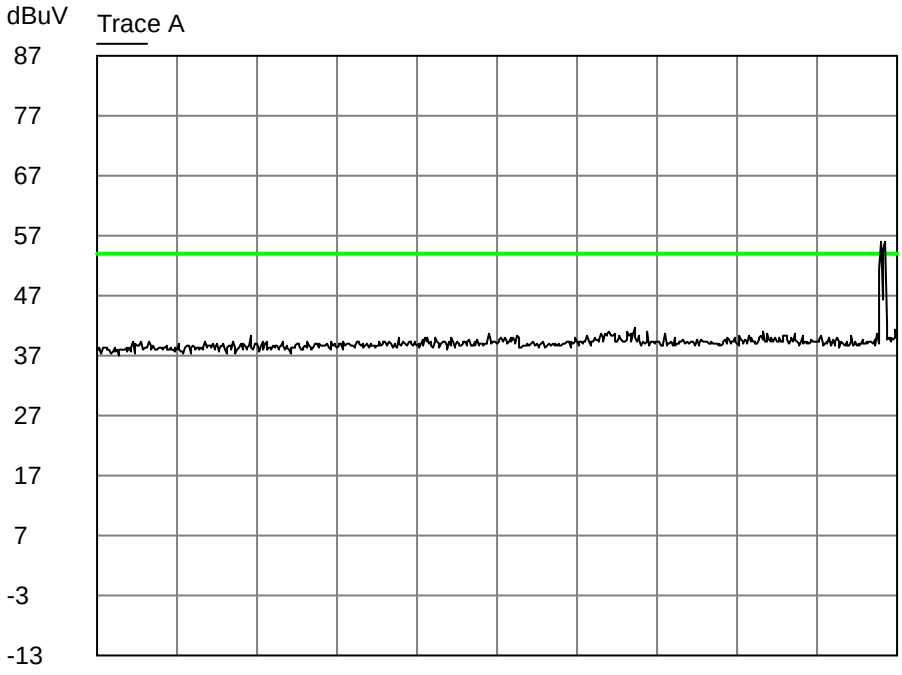
Start: 15.000000 GHz Atten: 10 dB Stop: 18.000000 GHz
Res BW: 1 MHz Vid BW: 3 MHz Sweep: 60.00 ms
24/08/2012 16:00:14 HP8563E

J5117-3, 18 - 20 GHz Horizontal Mid chan

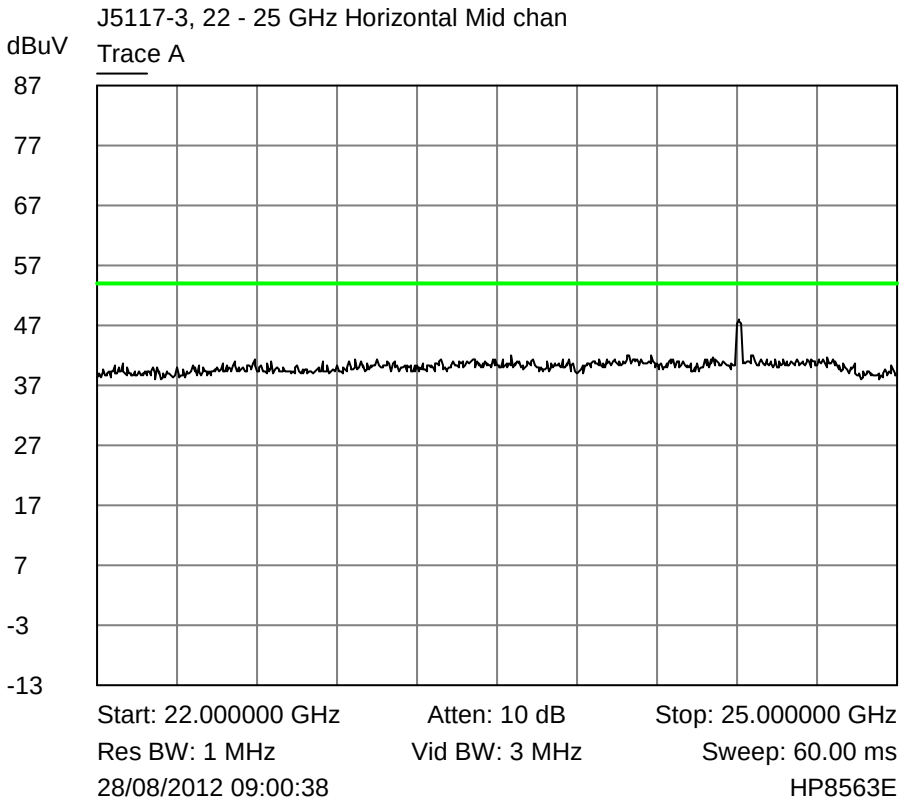


Start: 18.000000 GHz Atten: 10 dB Stop: 20.000000 GHz
Res BW: 1 MHz Vid BW: 3 MHz Sweep: 50.00 ms
28/08/2012 08:49:08 HP8563E

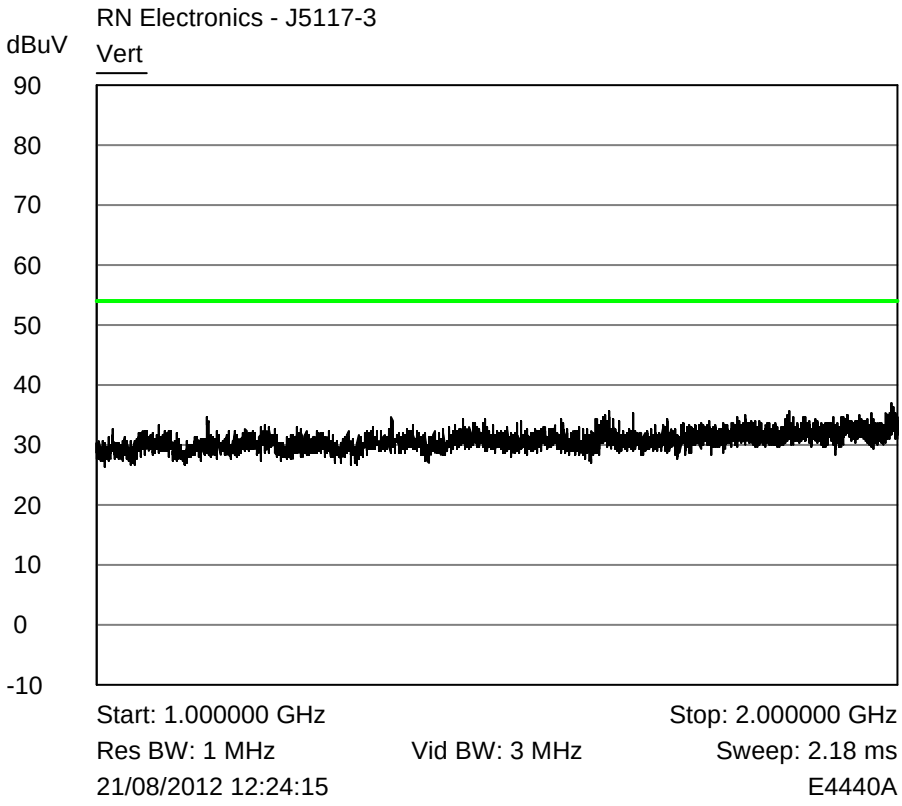
J5117-3, 20 - 22 GHz Horizontal Mid chan

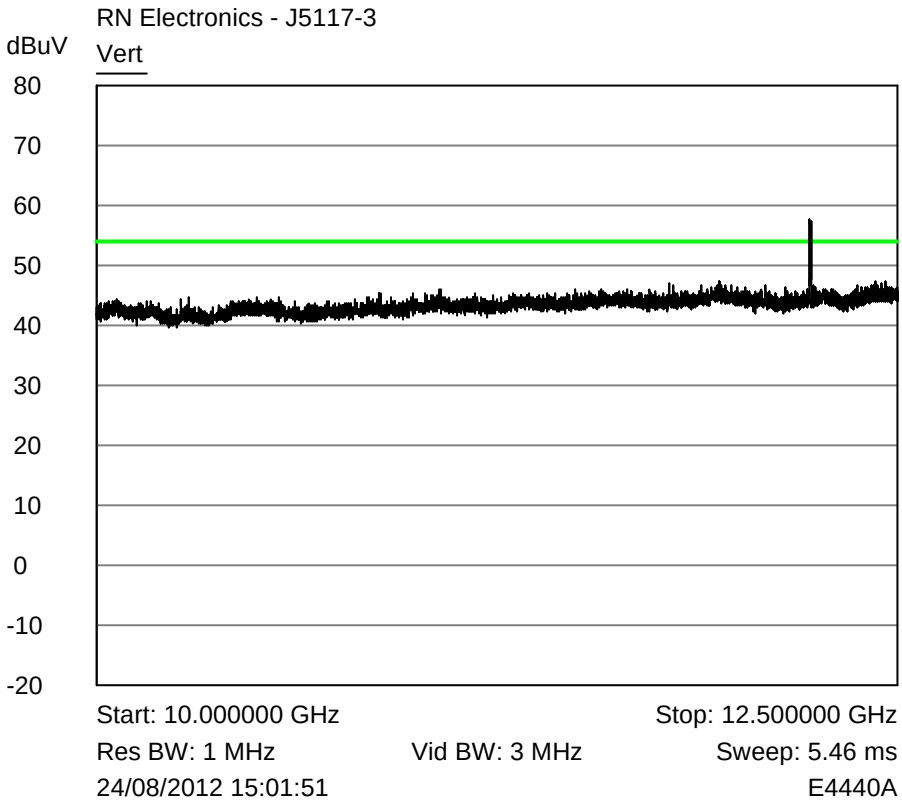


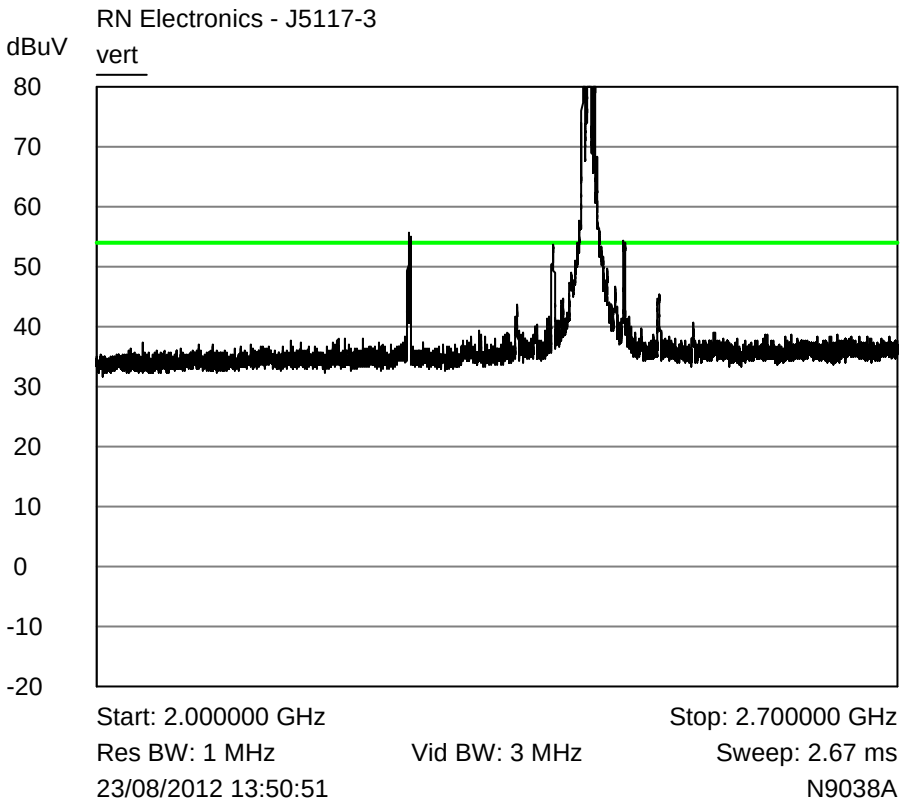
Start: 20.000000 GHz Atten: 10 dB Stop: 22.000000 GHz
Res BW: 1 MHz Vid BW: 3 MHz Sweep: 50.00 ms
28/08/2012 08:54:25 HP8563E

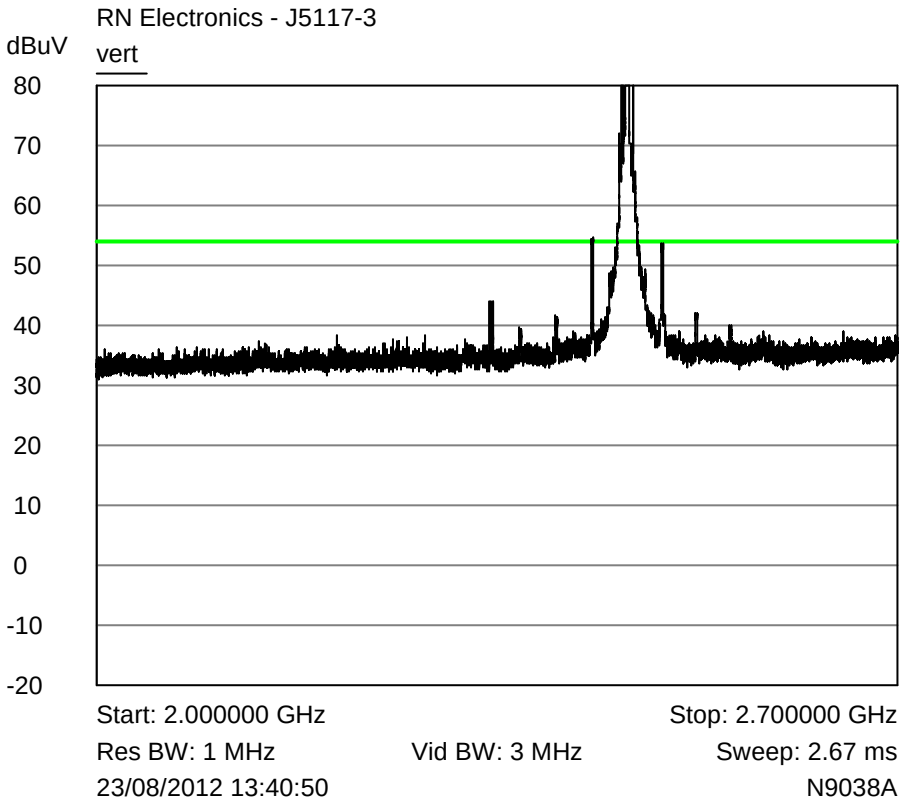


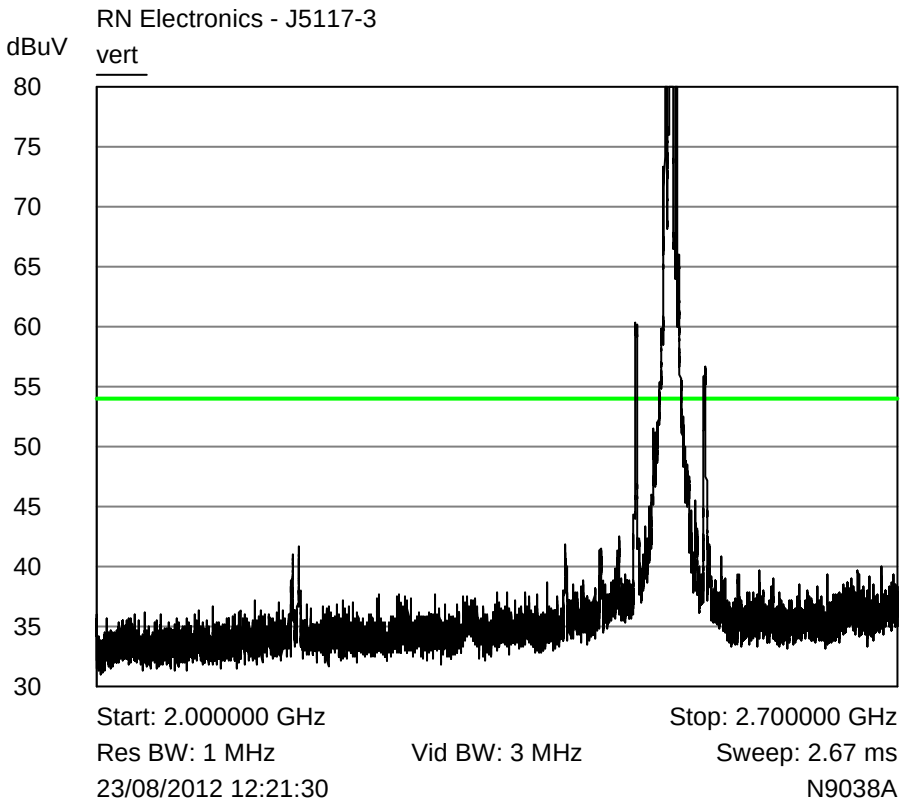
Plot of Peak Vertical emissions 1GHz - 25GHz against the Average limit line.

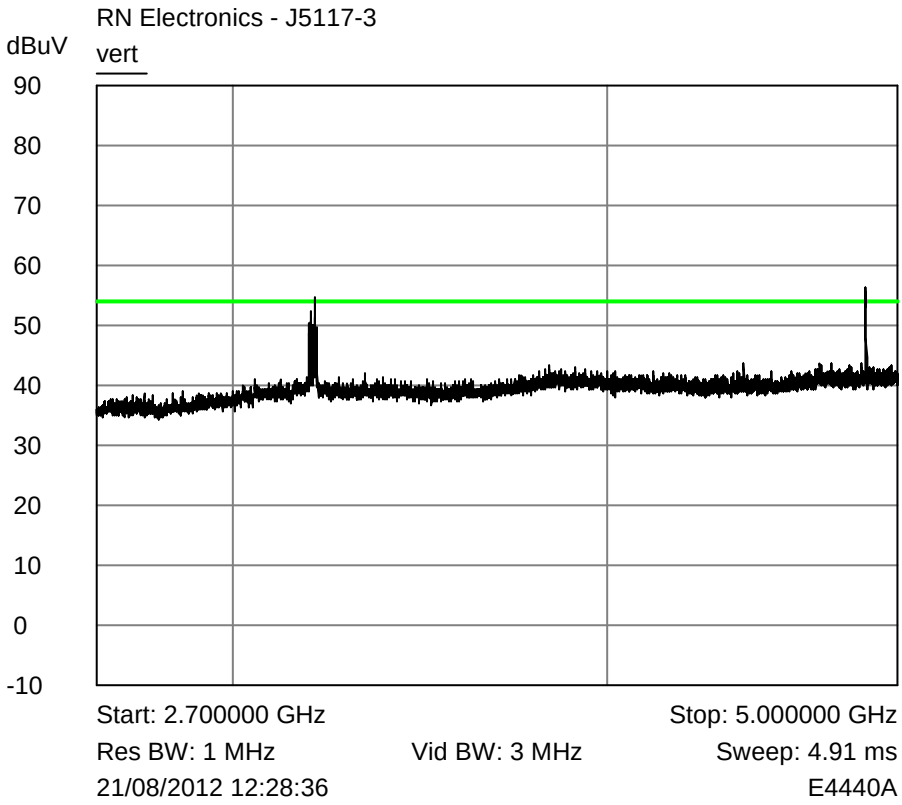


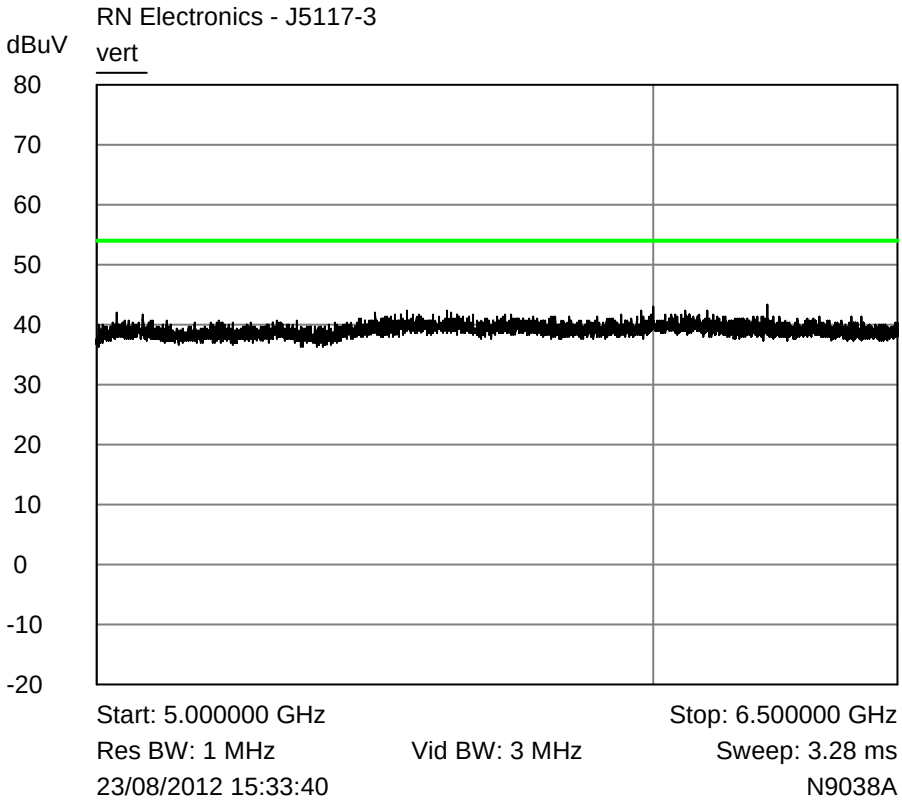

RN Electronics - J5117-3
dBuV
Vert
80
70
60
50
40
30
20
10
0
-10
-20
Start: 10.000000 GHz
Stop: 12.500000 GHz
Res BW: 1 MHz
Vid BW: 3 MHz
Sweep: 5.46 ms
24/08/2012 15:01:51
E4440A

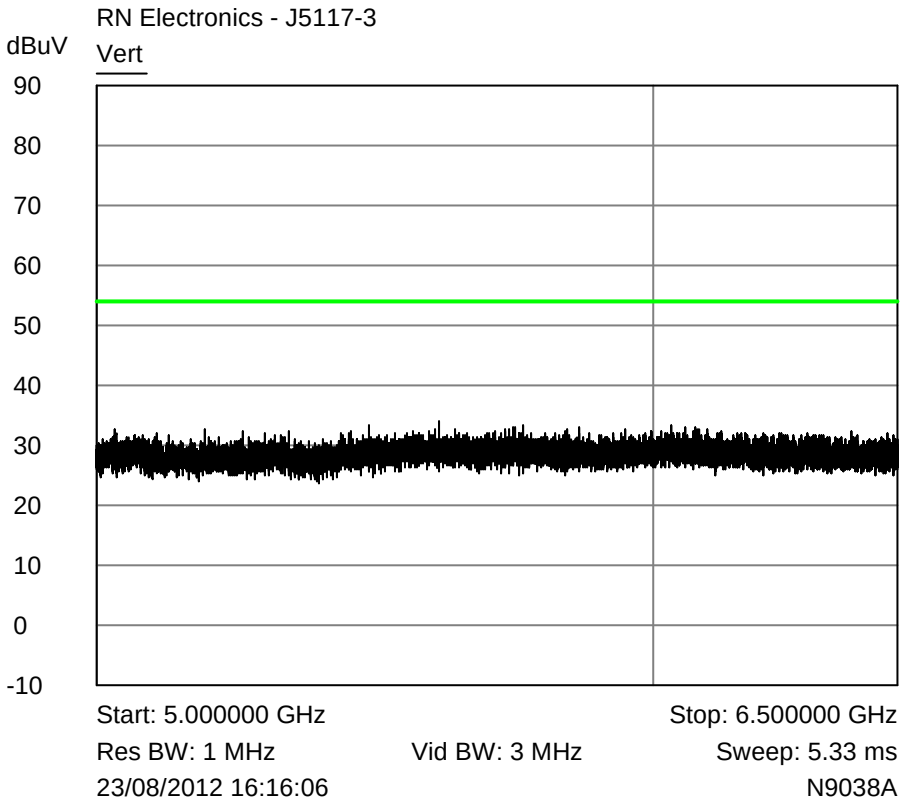

RN Electronics - J5117-3
dBuV
vert
80
70
60
50
40
30
20
10
0
-10
-20
Start: 2.000000 GHz
Stop: 2.700000 GHz
Res BW: 1 MHz
Vid BW: 3 MHz
Sweep: 2.67 ms
23/08/2012 13:50:51
N9038A

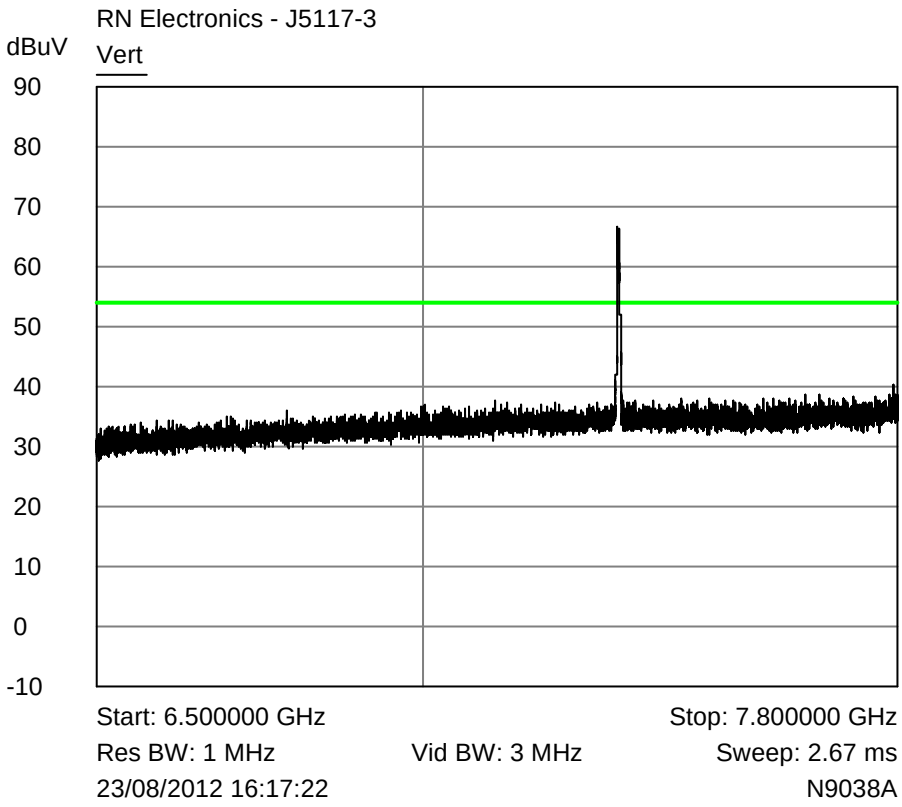

RN Electronics - J5117-3
dBuV
vert
80
70
60
50
40
30
20
10
0
-10
-20
Start: 2.000000 GHz
Stop: 2.700000 GHz
Res BW: 1 MHz
Vid BW: 3 MHz
Sweep: 2.67 ms
23/08/2012 13:40:50
N9038A

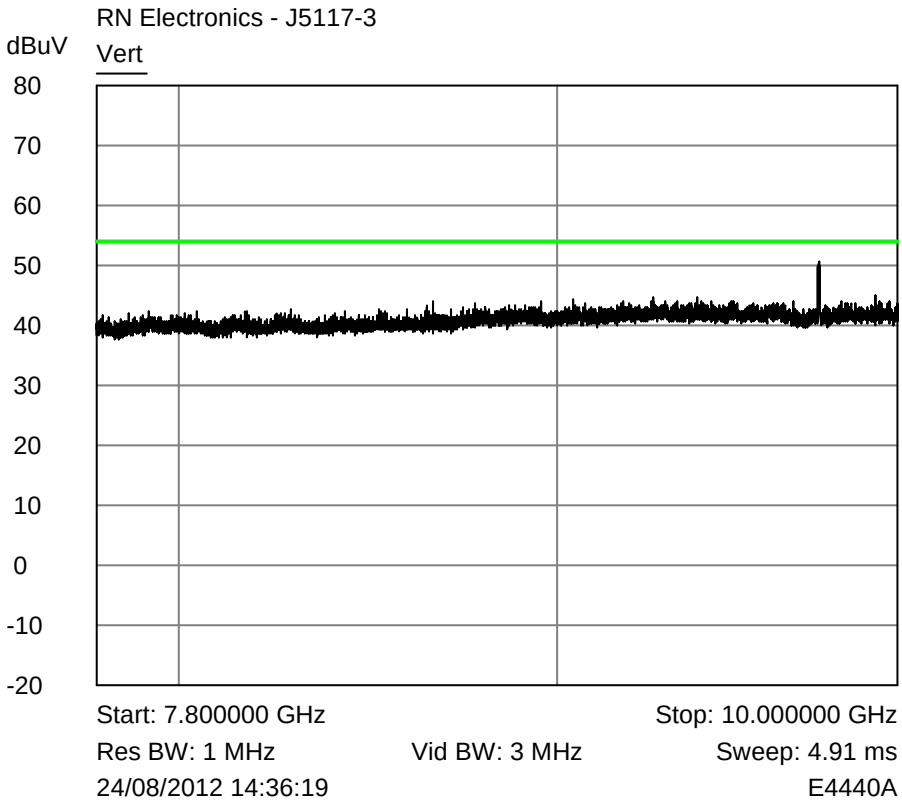

RN Electronics - J5117-3
dBuV
vert
80
75
70
65
60
55
50
45
40
35
30
Start: 2.000000 GHz
Stop: 2.700000 GHz
Res BW: 1 MHz
Vid BW: 3 MHz
Sweep: 2.67 ms
23/08/2012 12:21:30
N9038A

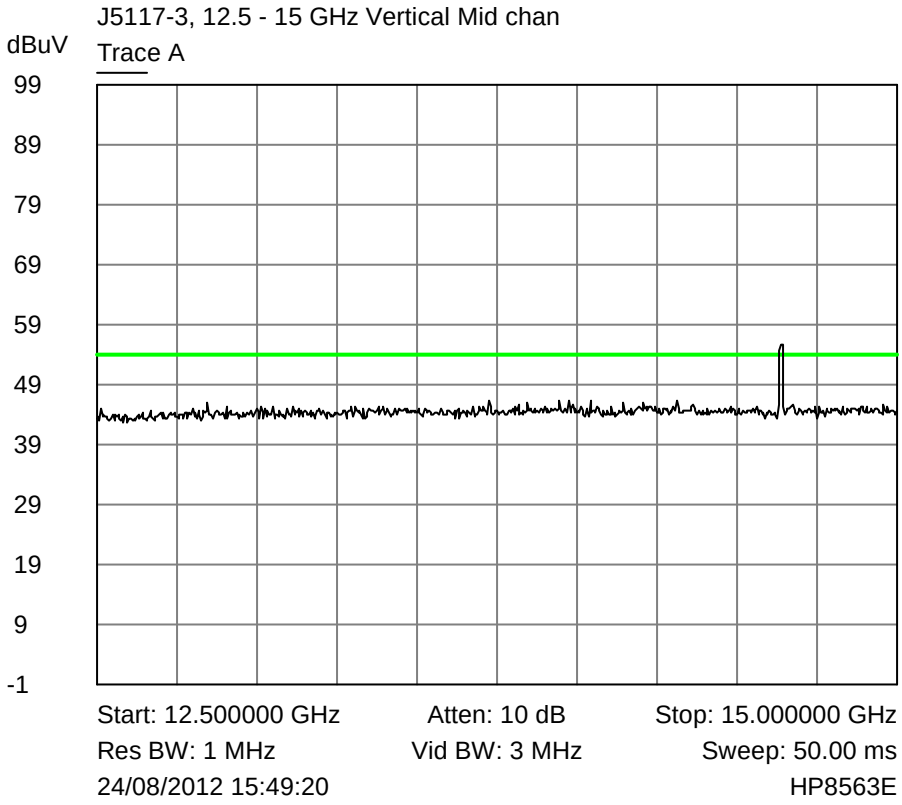

RN Electronics - J5117-3
dBuV
vert
90
80
70
60
50
40
30
20
10
0
-10
Start: 2.700000 GHz
Stop: 5.000000 GHz
Res BW: 1 MHz
Vid BW: 3 MHz
Sweep: 4.91 ms
21/08/2012 12:28:36
E4440A


RN Electronics - J5117-3
dBuV
vert
80
70
60
50
40
30
20
10
0
-10
-20
Start: 5.000000 GHz
Stop: 6.500000 GHz
Res BW: 1 MHz
Vid BW: 3 MHz
Sweep: 3.28 ms
23/08/2012 15:33:40
N9038A

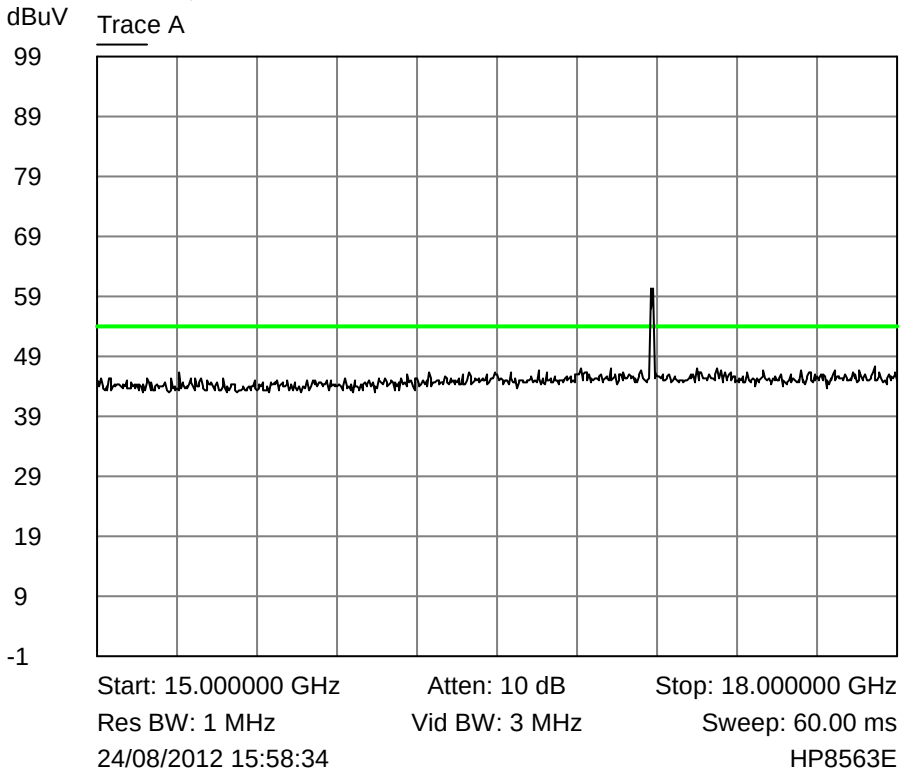

RN Electronics - J5117-3
dBuV
Vert
90
80
70
60
50
40
30
20
10
0
-10
Start: 5.000000 GHz
Stop: 6.500000 GHz
Res BW: 1 MHz
Vid BW: 3 MHz
Sweep: 5.33 ms
23/08/2012 16:16:06
N9038A


RN Electronics - J5117-3
dBuV
Vert
90
80
70
60
50
40
30
20
10
0
-10
Start: 6.500000 GHz
Stop: 7.800000 GHz
Res BW: 1 MHz
Vid BW: 3 MHz
Sweep: 2.67 ms
23/08/2012 16:17:22
N9038A


RN Electronics - J5117-3
dBuV
Vert
80
70
60
50
40
30
20
10
0
-10
-20
Start: 7.800000 GHz
Stop: 10.000000 GHz
Res BW: 1 MHz
Vid BW: 3 MHz
Sweep: 4.91 ms
24/08/2012 14:36:19
E4440A

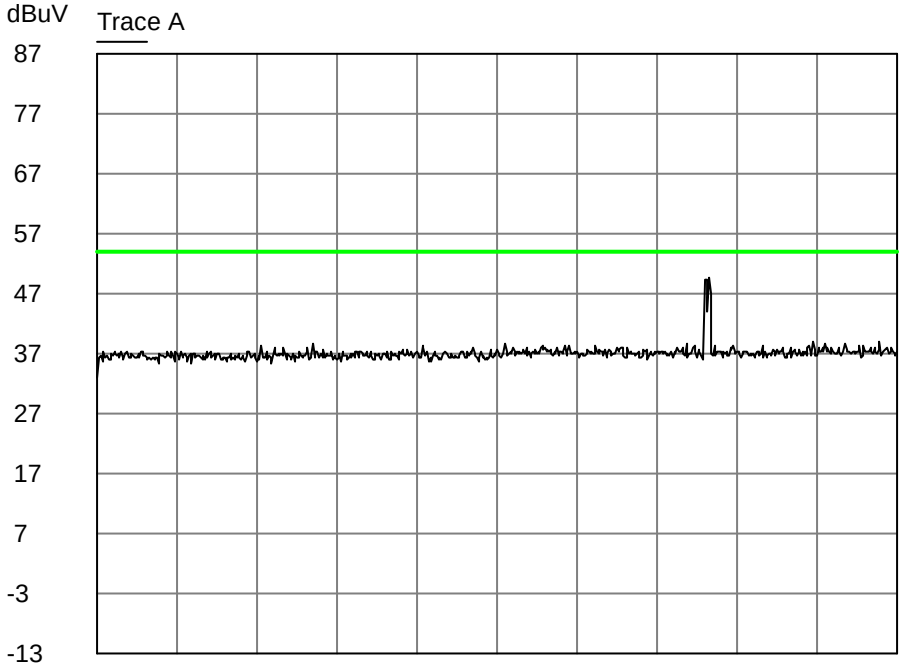

J5117-3, 12.5 - 15 GHz Vertical Mid chan
dBuV
Trace A
99
89
79
69
59
49
39
29
19
9
-1
Start: 12.500000 GHz
Atten: 10 dB
Stop: 15.000000 GHz
Res BW: 1 MHz
Vid BW: 3 MHz
Sweep: 50.00 ms
24/08/2012 15:49:20
HP8563E

J5117-3, 15 - 18 GHz Vertical Mid chan



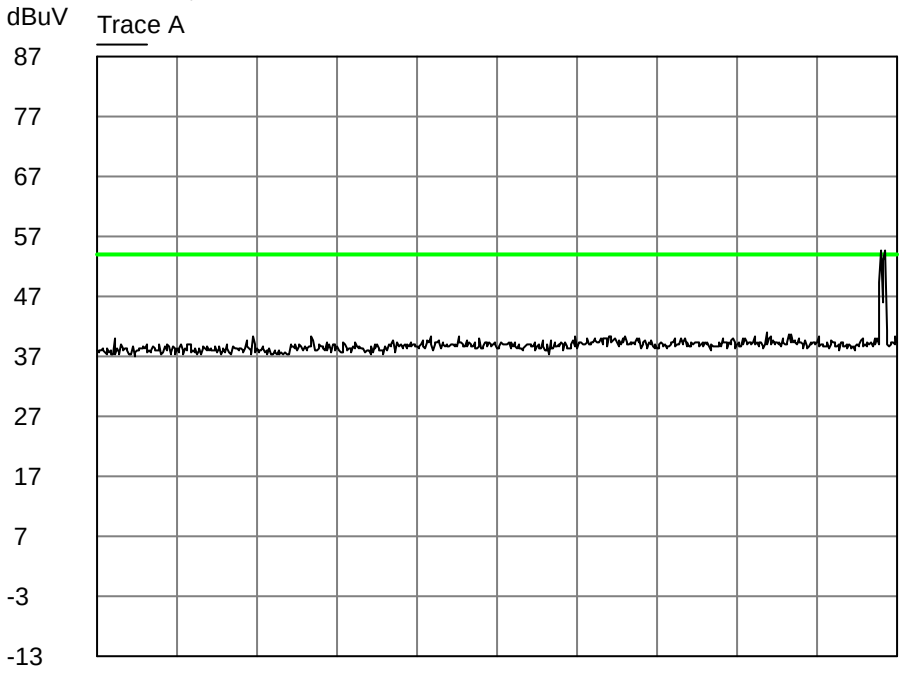
Start: 15.000000 GHz Atten: 10 dB Stop: 18.000000 GHz
Res BW: 1 MHz Vid BW: 3 MHz Sweep: 60.00 ms
24/08/2012 15:58:34 HP8563E

J5117-3, 18 - 20 GHz Vertical Mid chan



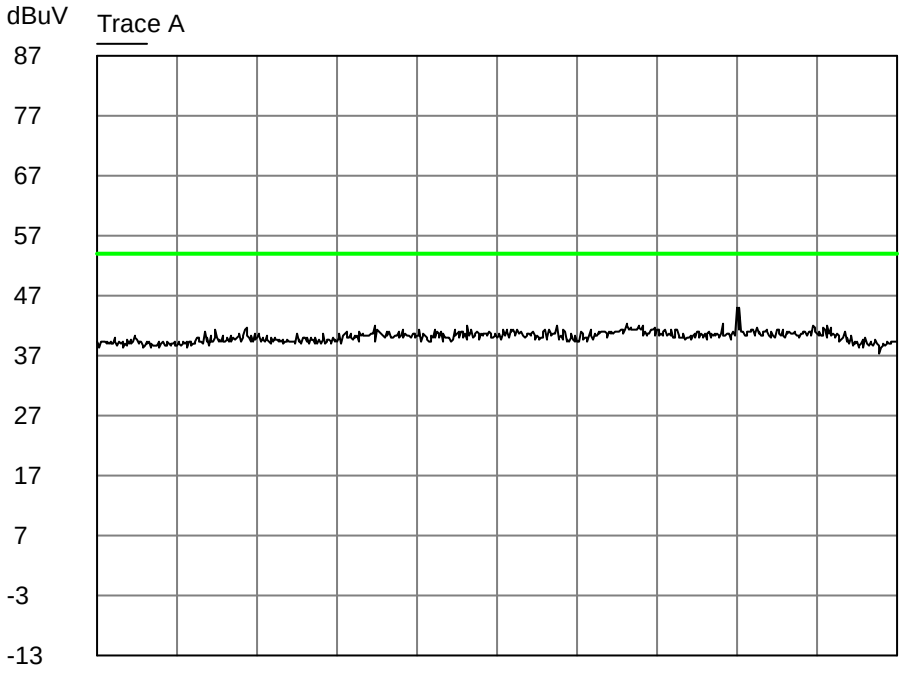
Start: 18.000000 GHz Atten: 10 dB Stop: 20.000000 GHz
Res BW: 1 MHz Vid BW: 3 MHz Sweep: 50.00 ms
28/08/2012 08:47:57 HP8563E

J5117-3, 20 - 22 GHz Vertical Mid chan



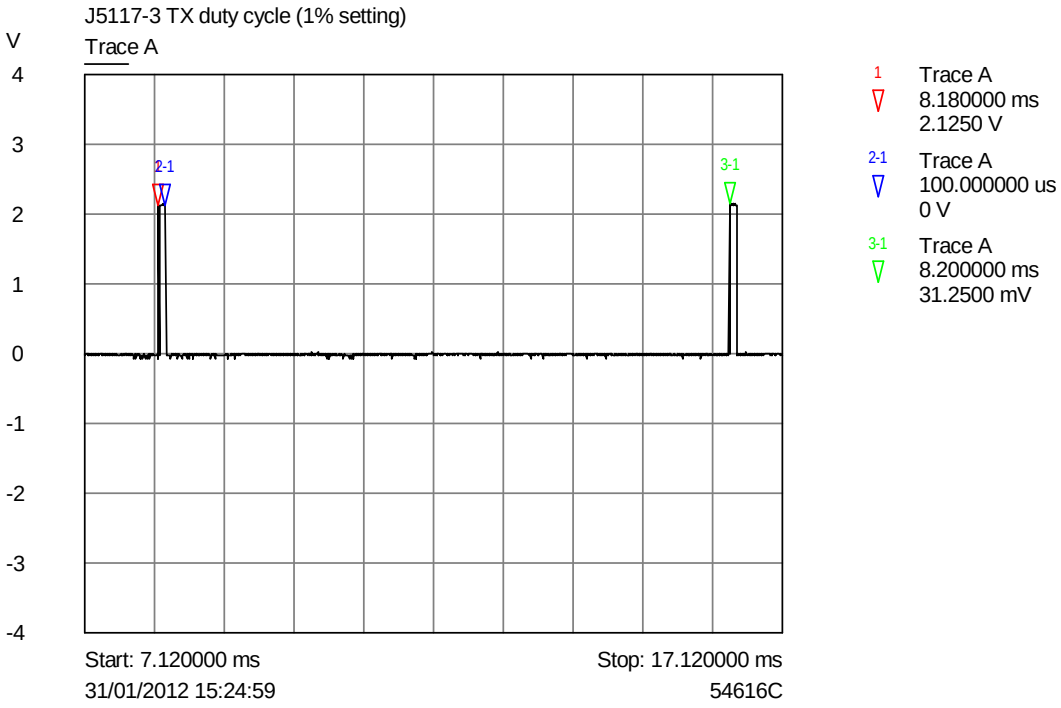
Start: 20.000000 GHz Atten: 10 dB Stop: 22.000000 GHz
Res BW: 1 MHz Vid BW: 3 MHz Sweep: 50.00 ms
28/08/2012 08:52:51 HP8563E

J5117-3, 22 - 25 GHz Vertical Mid chan

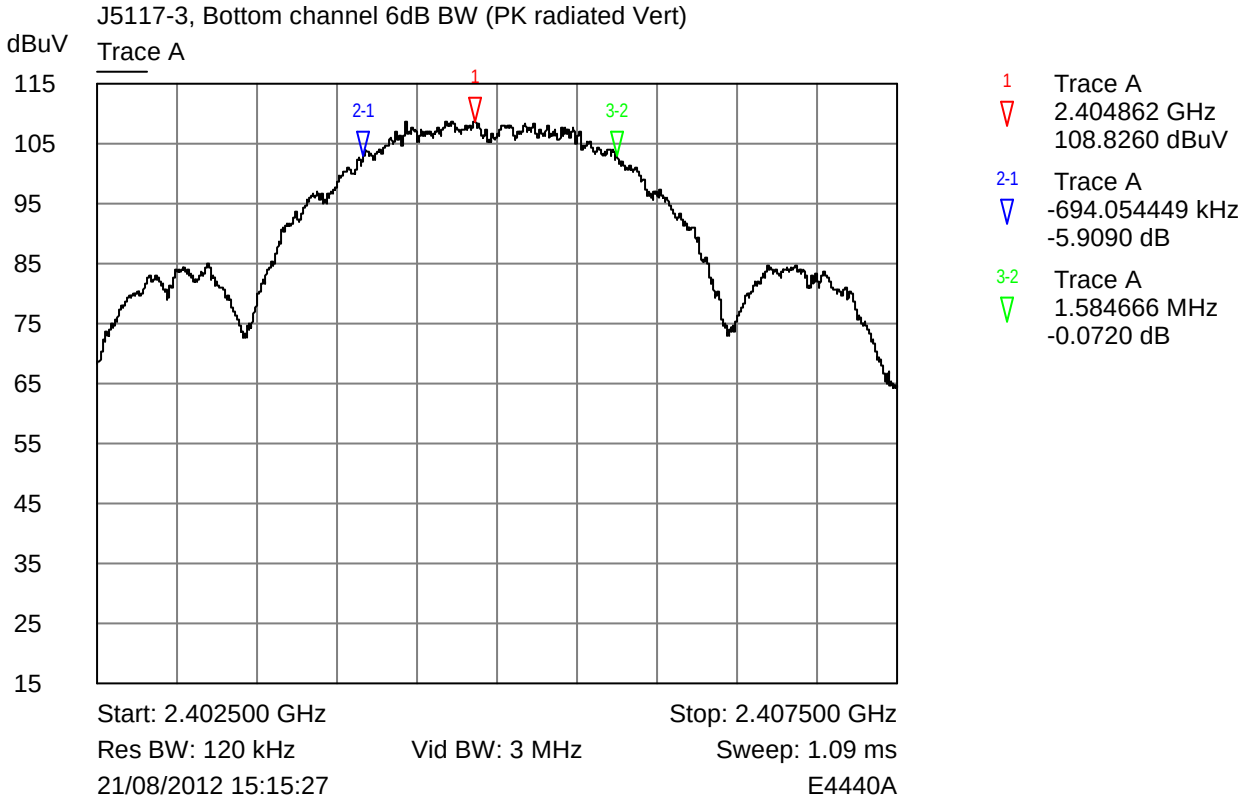


Start: 22.000000 GHz Atten: 10 dB Stop: 25.000000 GHz
Res BW: 1 MHz Vid BW: 3 MHz Sweep: 60.00 ms
28/08/2012 08:59:10 HP8563E

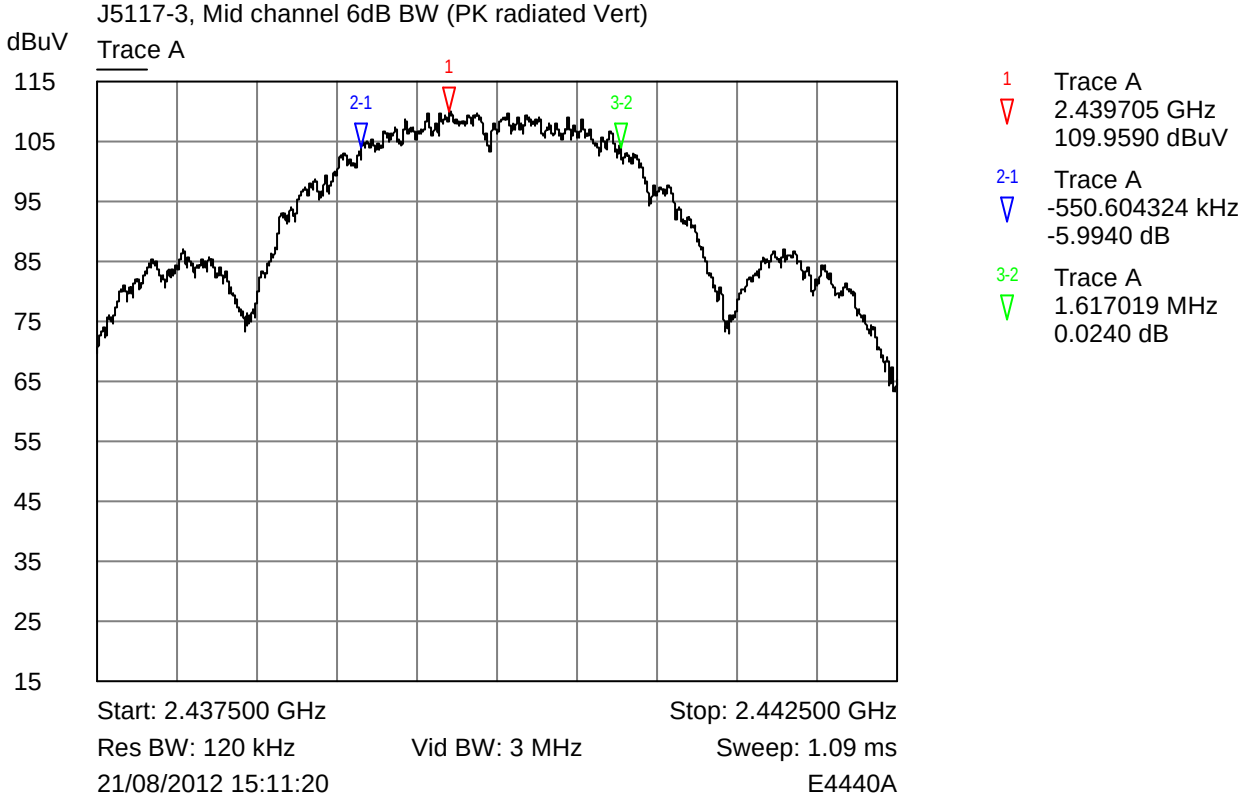
6.4 Duty Cycle



6.5 Occupied Bandwidth



J5117-3, Mid channel 6dB BW (PK radiated Vert)

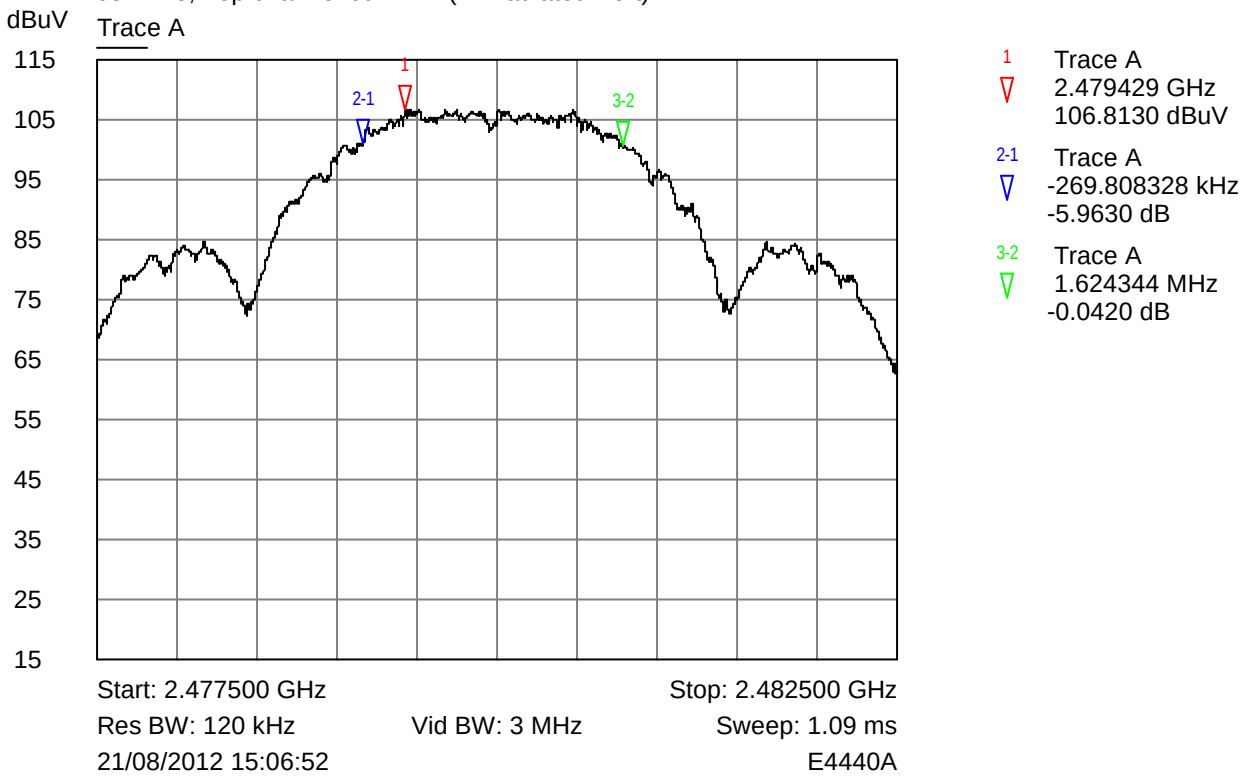


1 Trace A
2.439705 GHz
109.9590 dBuV

2-1 Trace A
-550.604324 kHz
-5.9940 dB

3-2 Trace A
1.617019 MHz
0.0240 dB

J5117-3, Top channel 6dB BW (PK radiated Vert)



1 Trace A
2.479429 GHz
106.8130 dBuV

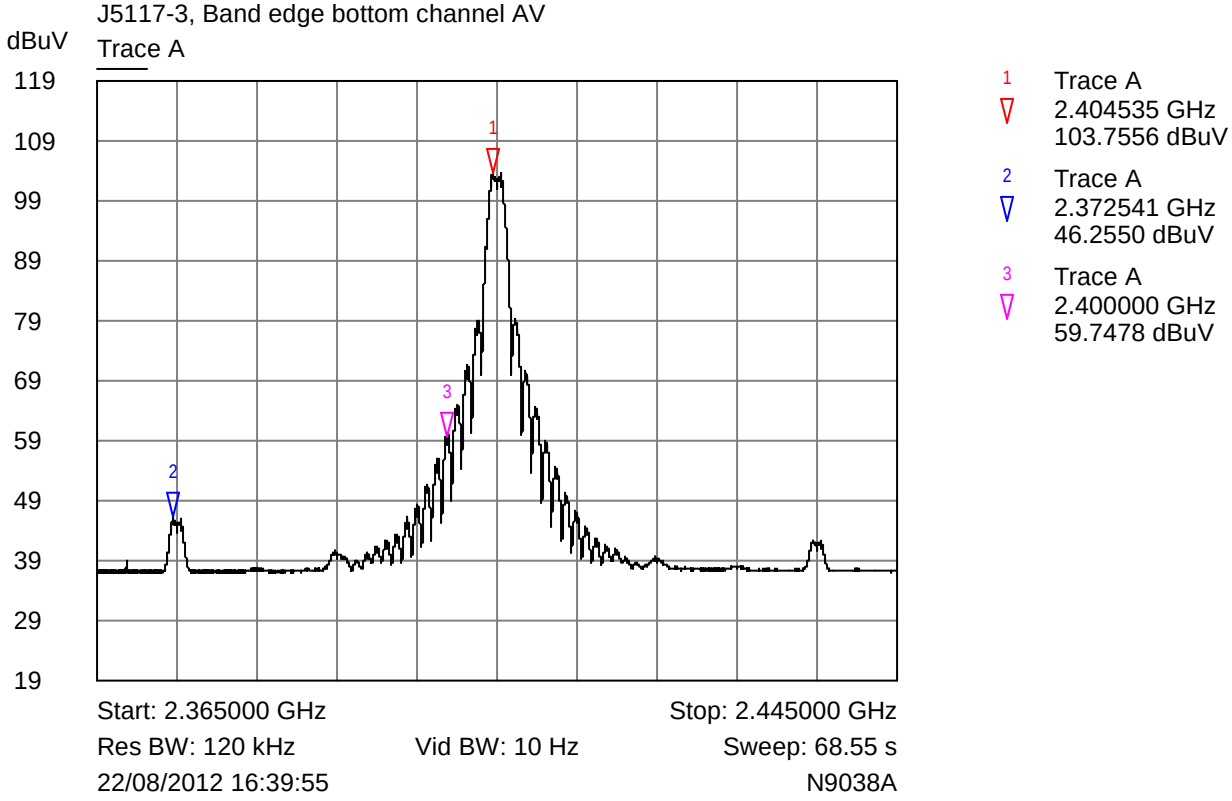
2-1 Trace A
-269.808328 kHz
-5.9630 dB

3-2 Trace A
1.624344 MHz
-0.0420 dB

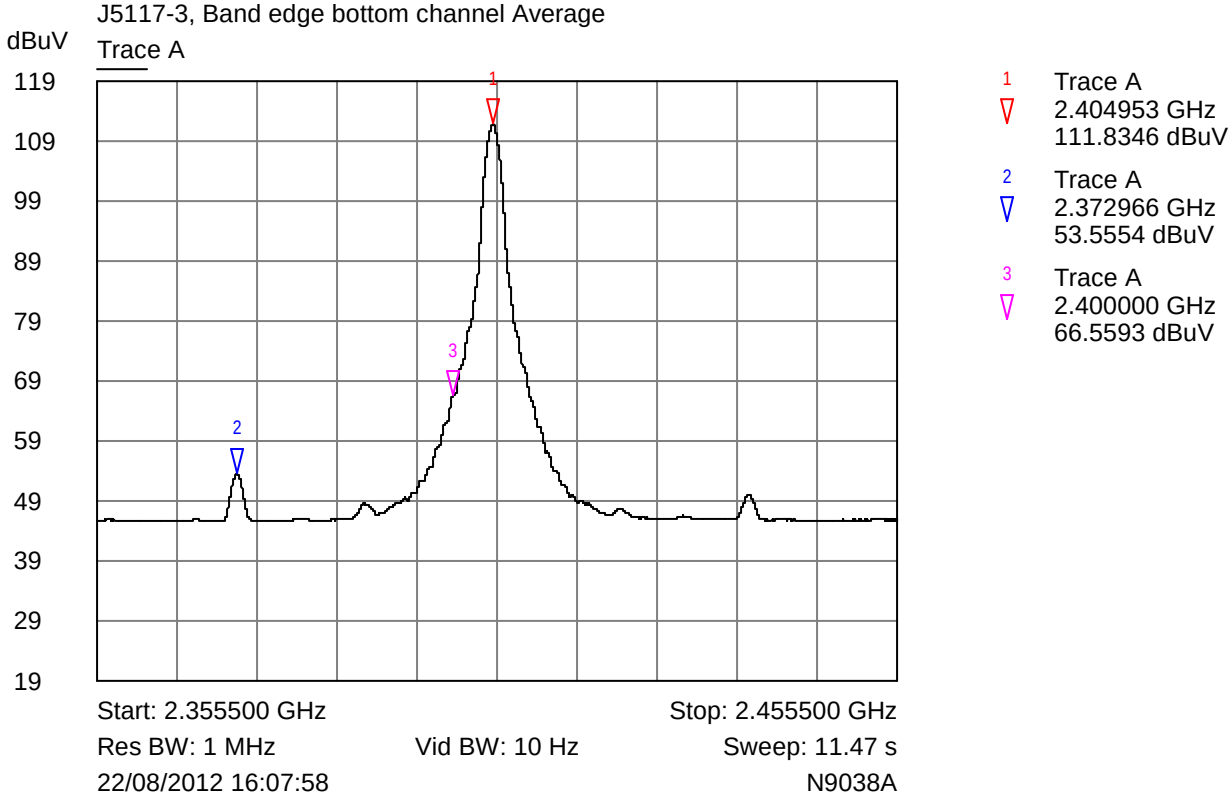
6.6 Band Edge Compliance

Band Edge & Restricted band edge plots.

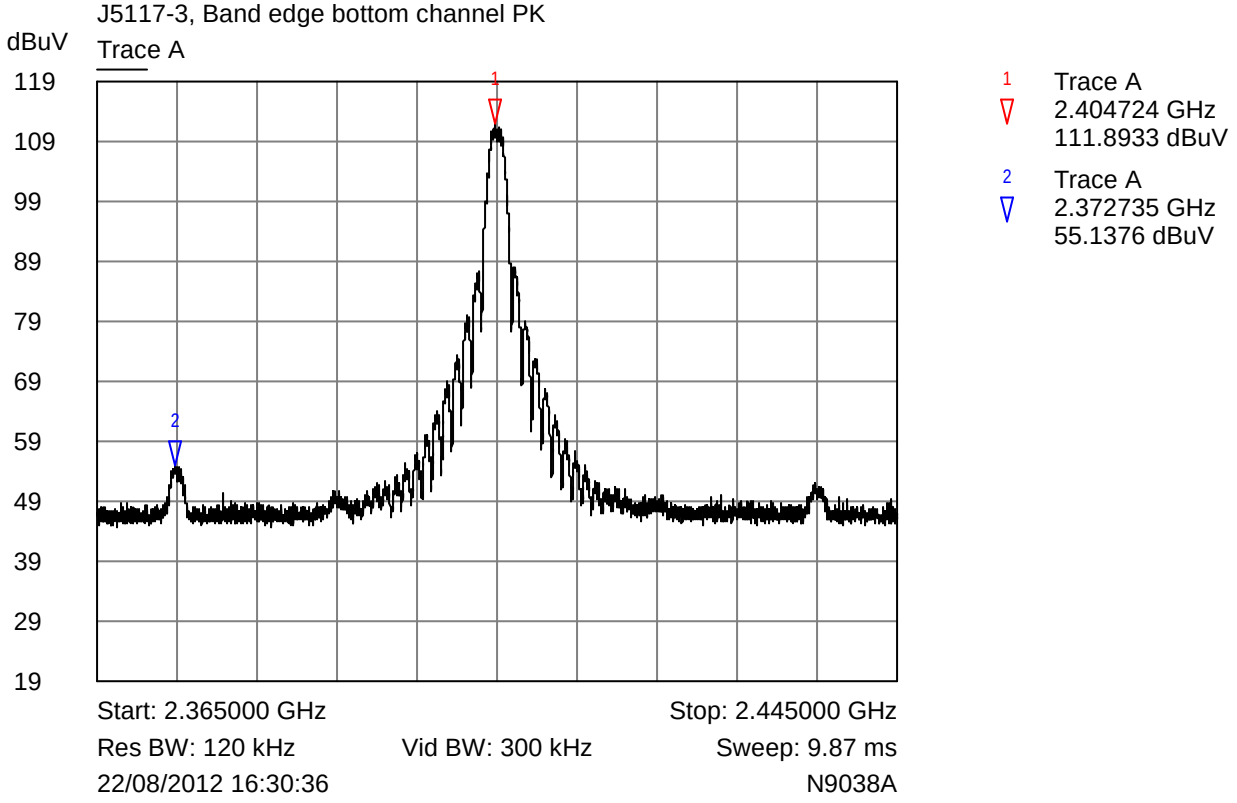
J5117-3, Band edge bottom channel AV



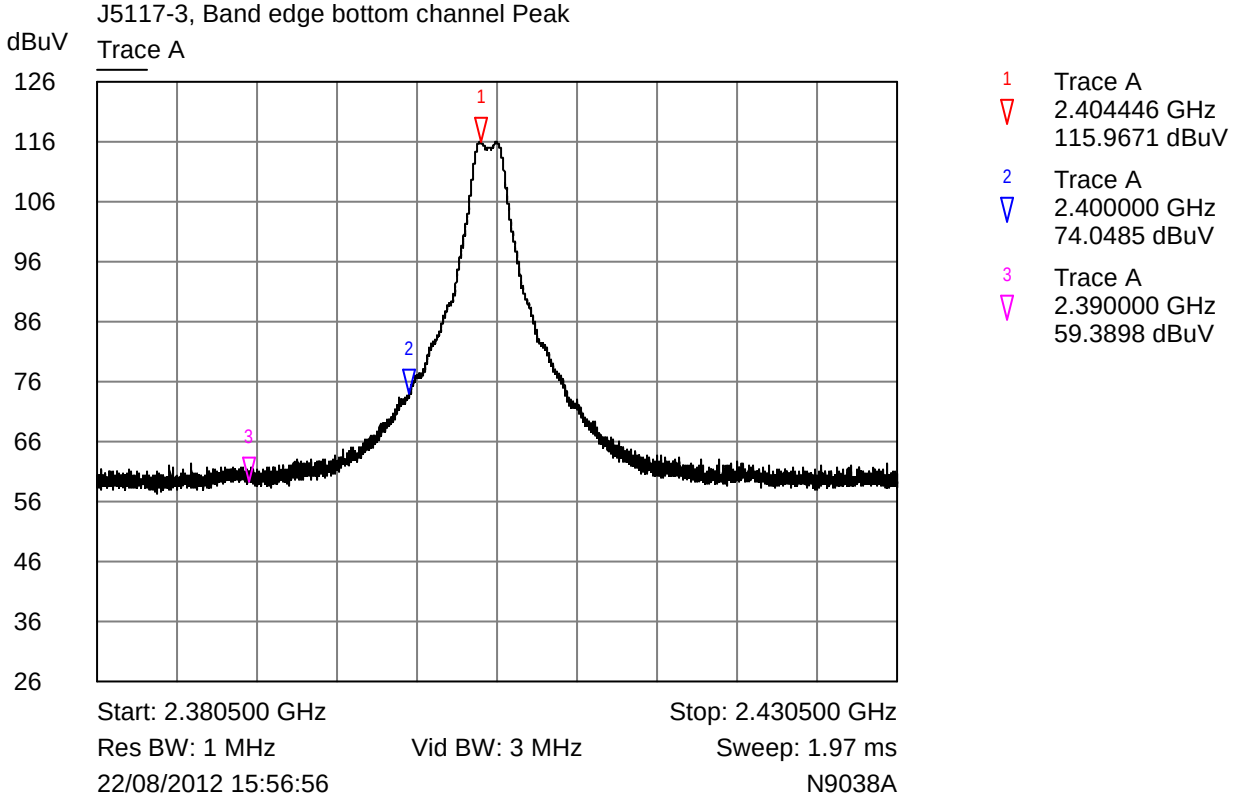
J5117-3, Band edge bottom channel Average



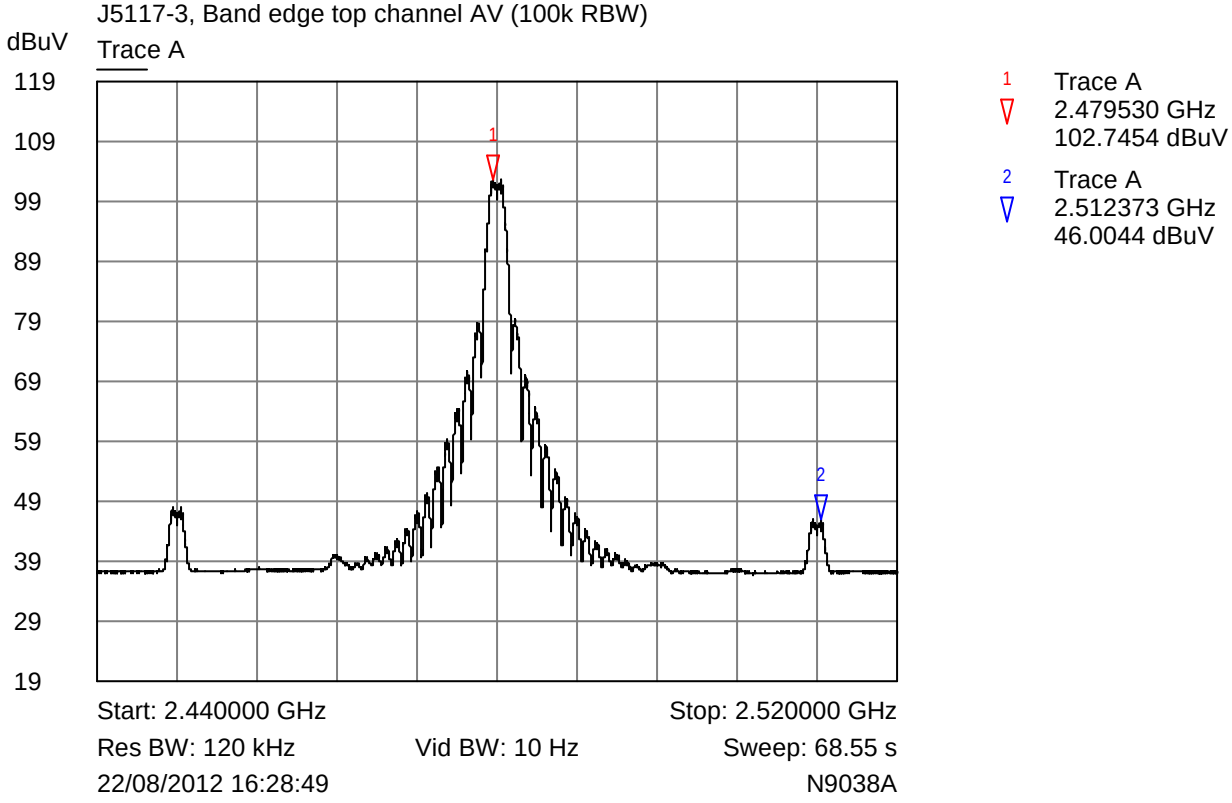
J5117-3, Band edge bottom channel PK



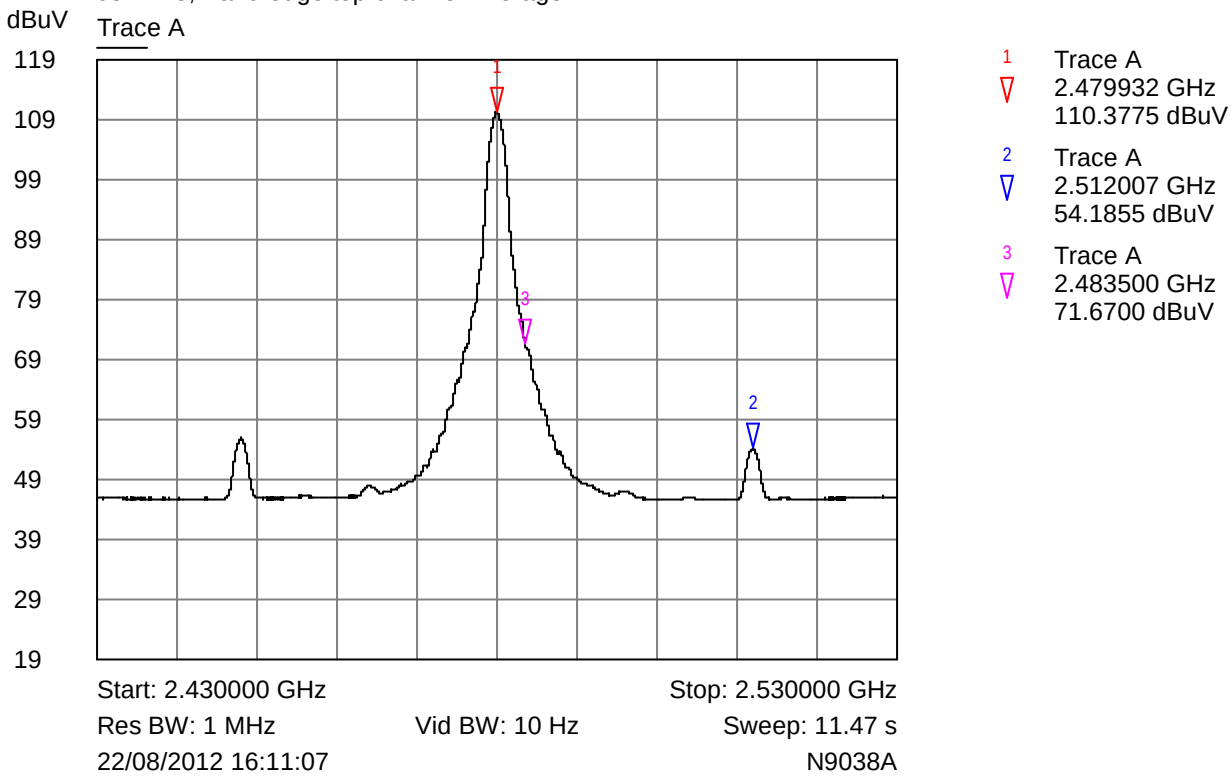
J5117-3, Band edge bottom channel Peak



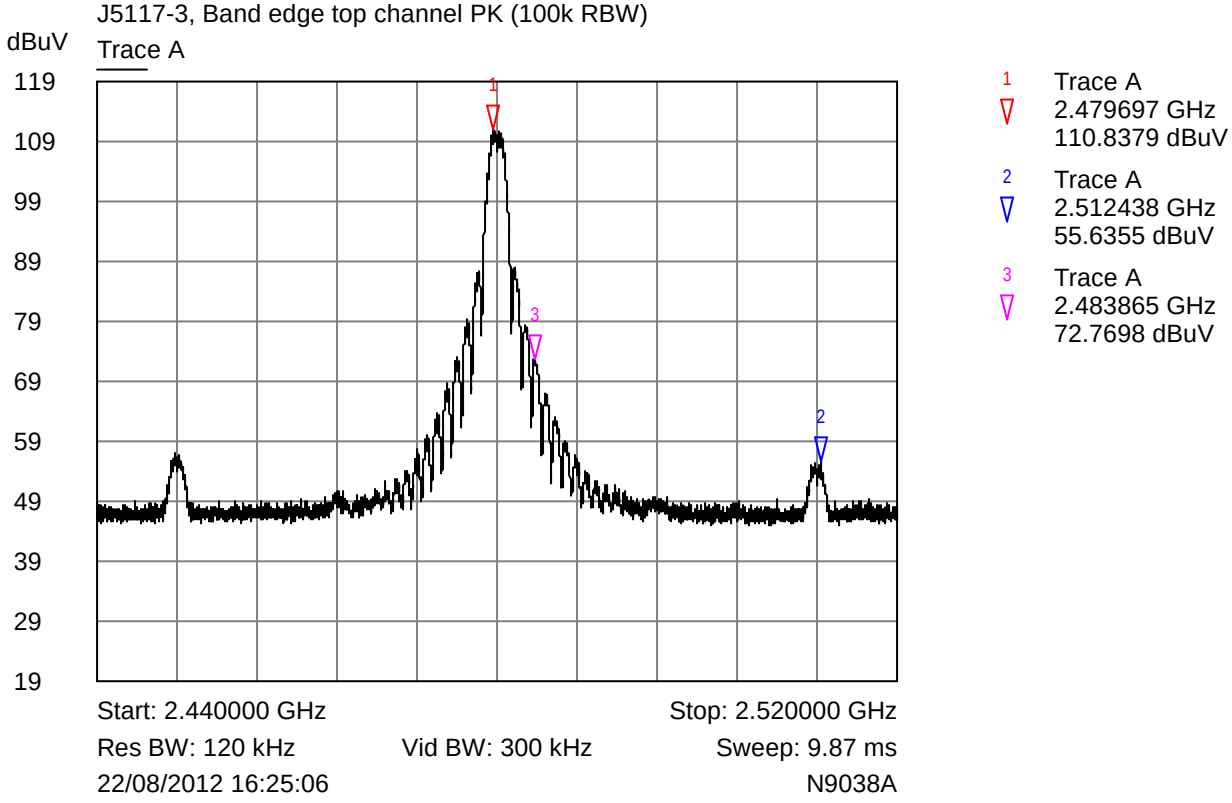
J5117-3, Band edge top channel AV (100k RBW)



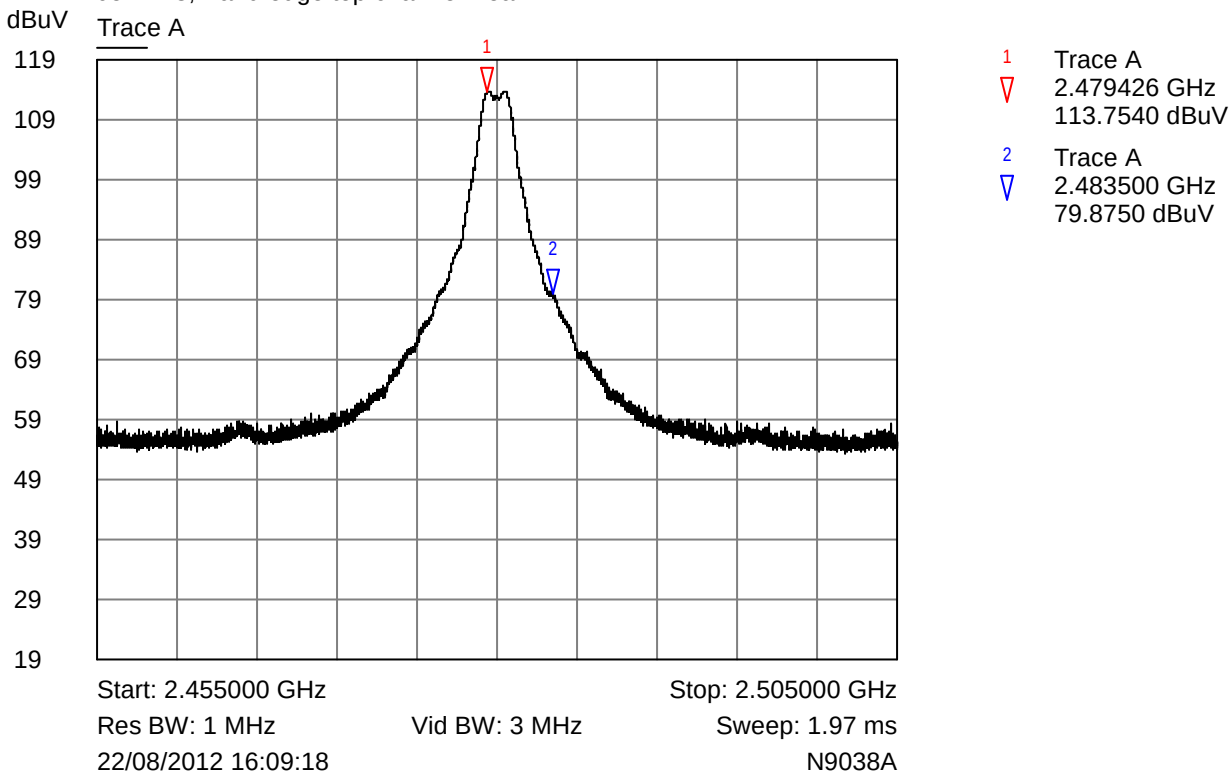
J5117-3, Band edge top channel Average



J5117-3, Band edge top channel PK (100k RBW)



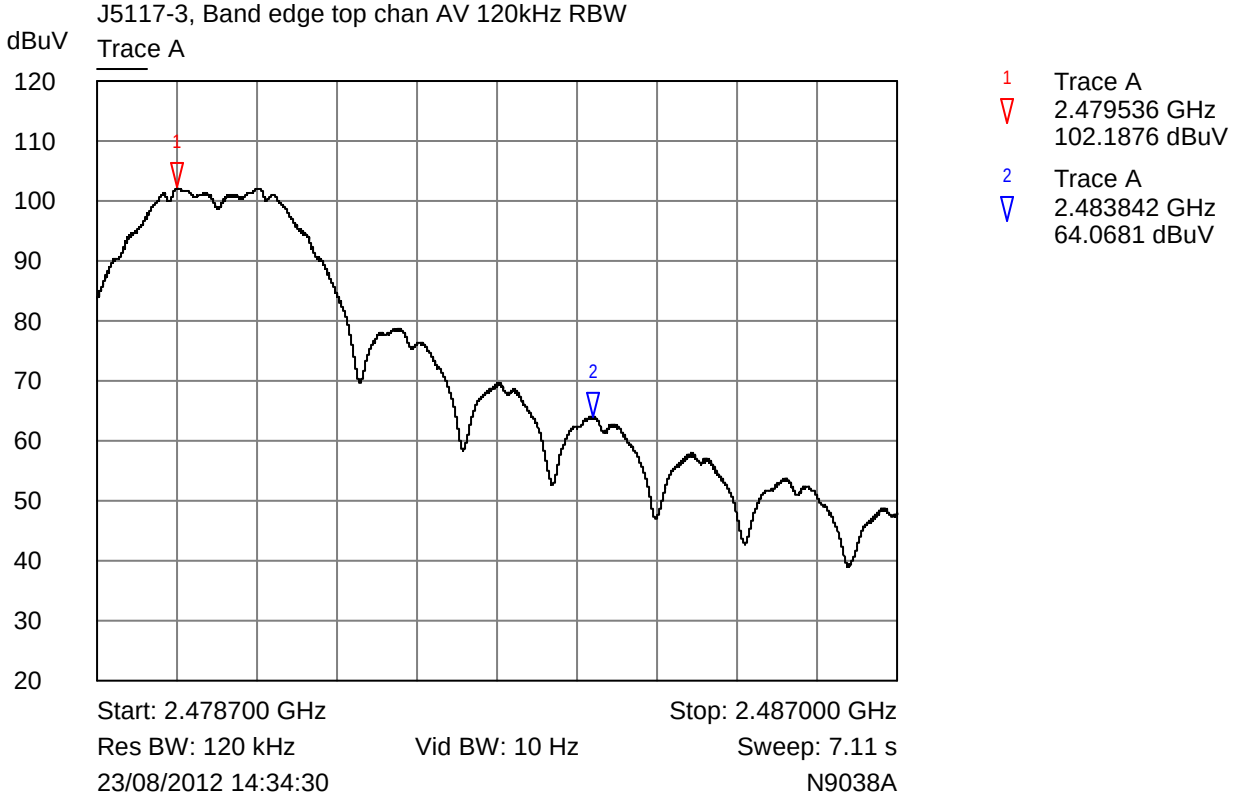
J5117-3, Band edge top channel Peak



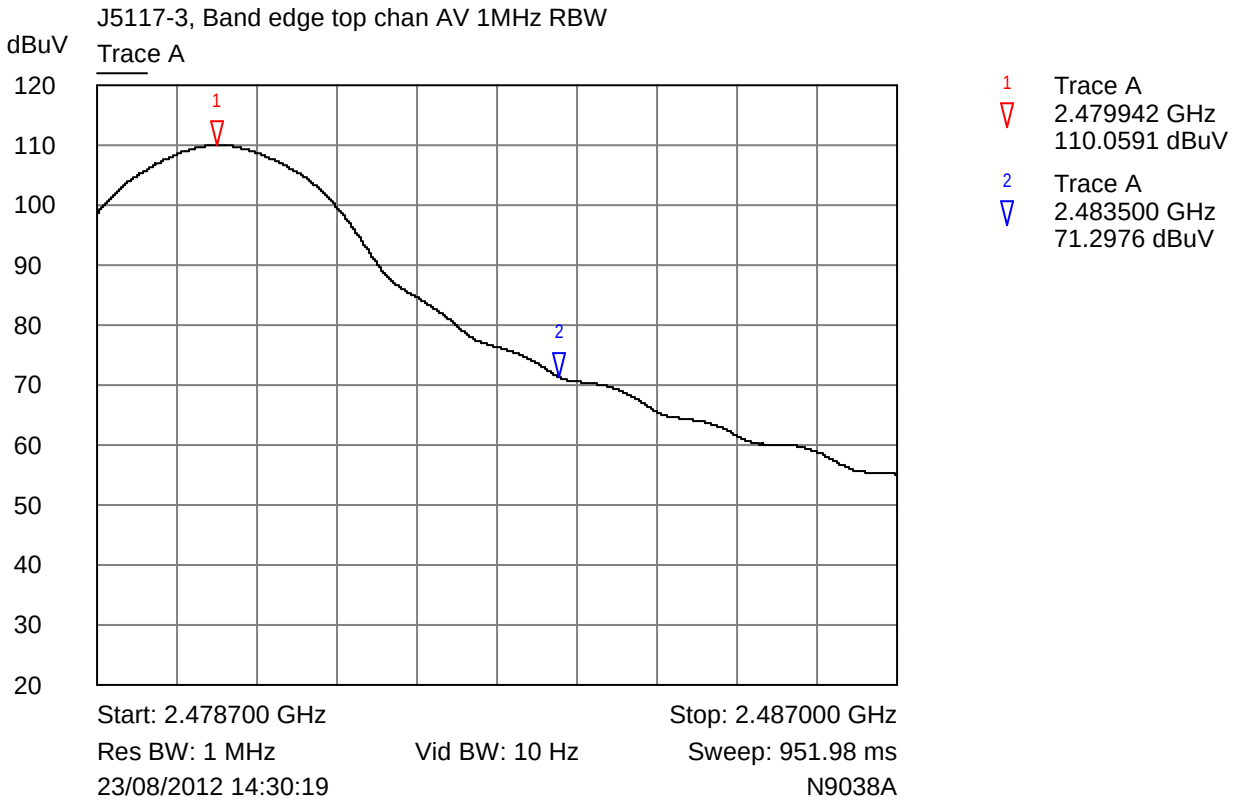
Refer to delta Marker plots for dB value to remove from measured power to determine restricted band edge compliance to the peak limit.

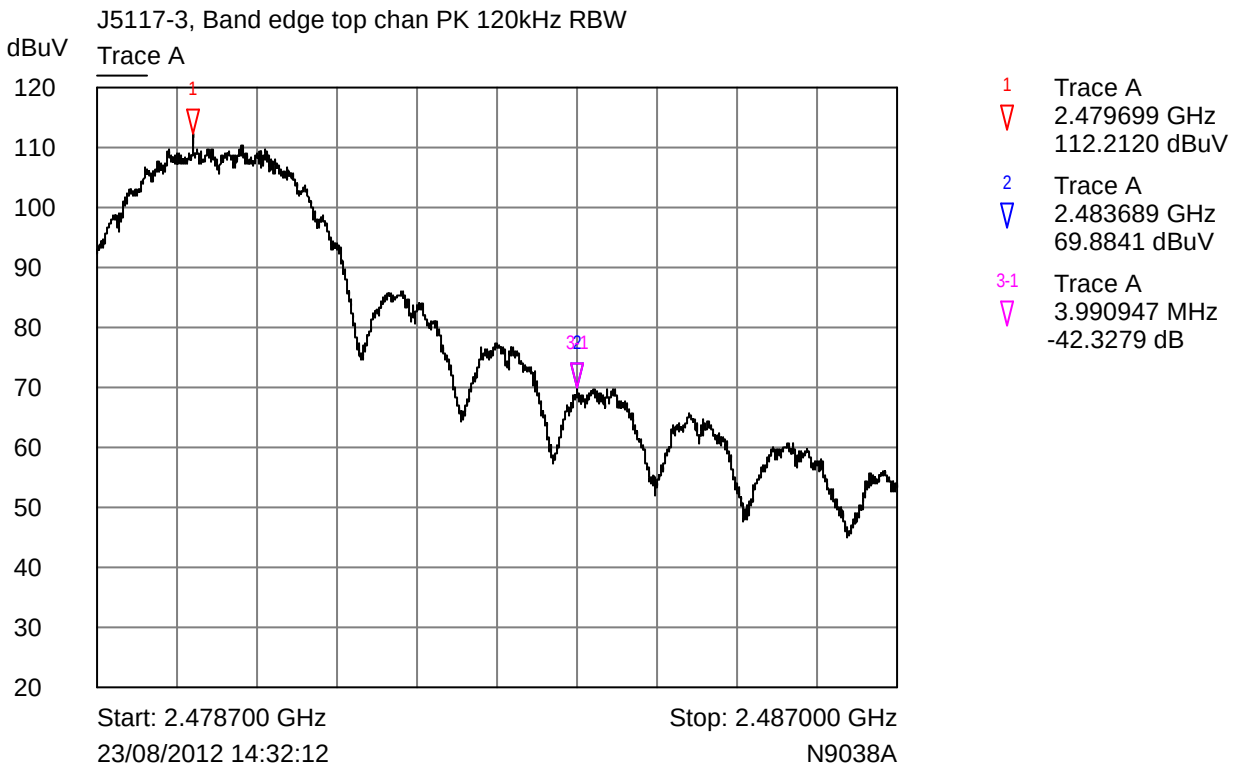
Delta Marker Plots / Average Band Edge Plots

J5117-3, Band edge top chan AV 120kHz RBW

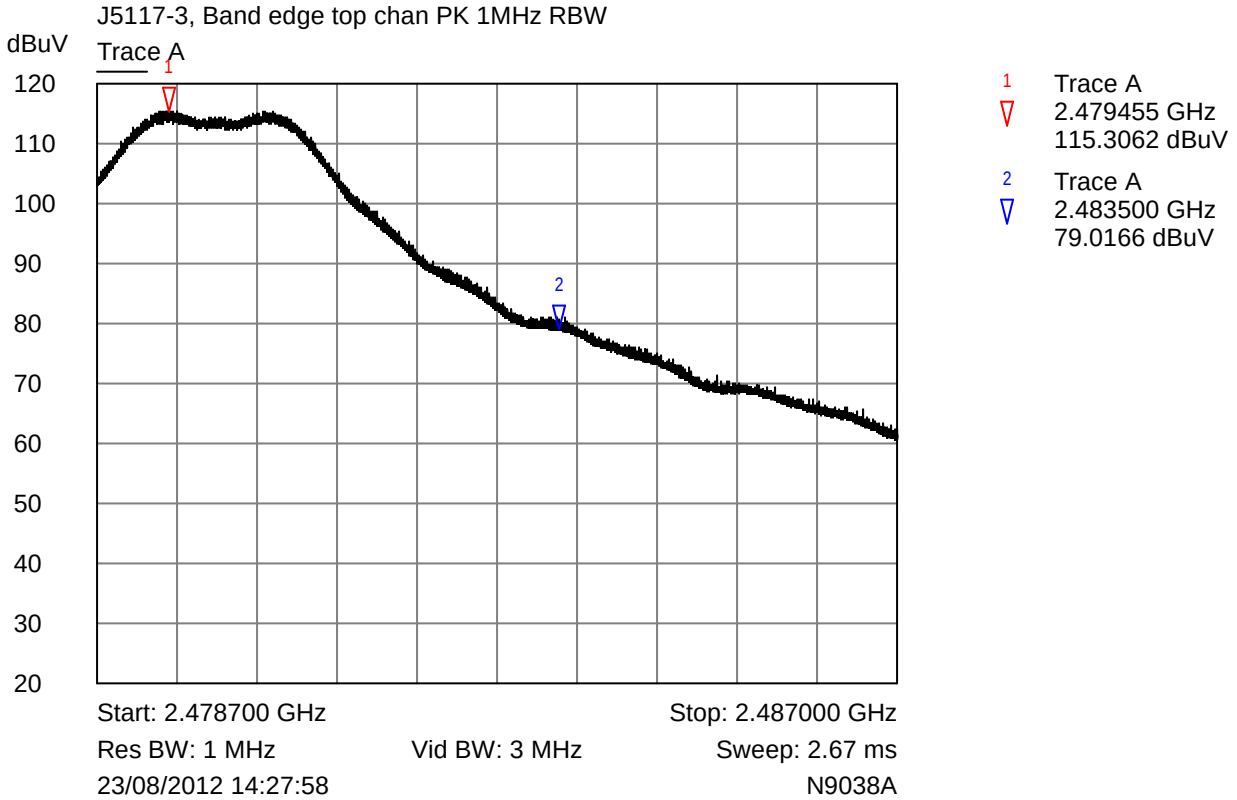


J5117-3, Band edge top chan AV 1MHz RBW





Delta marker shows 42.3dB.



Peak power in 1MHz RBW = 115.3 - 42.3 = 73 dBuV/m @3m PK at restricted band edge top channel.

7 Explanatory Notes

7.1 Explanation of Table of Signals Measured

Measurements are made as required by the standard. These measurements are made and recorded using detectors, either peak, quasi peak or average dependant on the test. A table of results has been given following the relevant plots. This table looks similar to the one illustrated below dependant on the measurements required by the test: -

Signal No.	Freq (MHz)	Peak Amp (dBuV)	Pk – Lim 1 (dB)	QP Amp (dBuV)	QP - Lim1 (dB)	Av Amp (dBuV)	Av - Lim1 (dB)
1	12345	54.9	-10.5	48.0	-12.6	37.6	-14.4

Column One - Labelled Signal No. is an incremental number that the receiver has given to each signal that has been measured.

Column Two - Labelled Freq (MHz) is the approximate frequency of the signal received.

Column Three - Labelled Peak Amp (dBμV) is the level of received signal that was measured in dB above 1μV using the peak detector.

Column Four - Labelled Pk - Lim1 (dB) is the difference in level from the peak signal given to the active limit line. If this column appears in the table the peak detector measurement is required by the standard for this test. The results entered in this column indicate the signal level relative to the compliance limit required. Negative numbers indicate that the product is compliant.

Column Five - Labelled QP Amp (dBμV) is the level of received signal that was measured in dB above 1μV using the quasi-peak detector.

Column Six - Labelled QP - Lim1 (dB) is the difference in level from the quasi-peak signal given to the active limit line. If this column appears in the table the quasi-peak detector measurement is required by the standard for this test. The results entered in this column indicate the signal level relative to the compliance limit required. Negative numbers indicate that the product is compliant.

Column Seven - Labelled Av Amp (dBμV) is the level of received signal that was measured in dB above 1μV using the average detector.

Column Eight - Labelled Av - Lim1 (dB) is the difference in level from the average signal given to the active limit line. If this column appears in the table the average detector measurement is required by the standard for this test. The results entered in this column indicate the signal level relative to the compliance limit required. Negative numbers indicate that the product is compliant.

Only signals highlighted in red are deemed to exceed the limit of the detector required.

7.2 Explanation of limit line calculations for radiated measurements

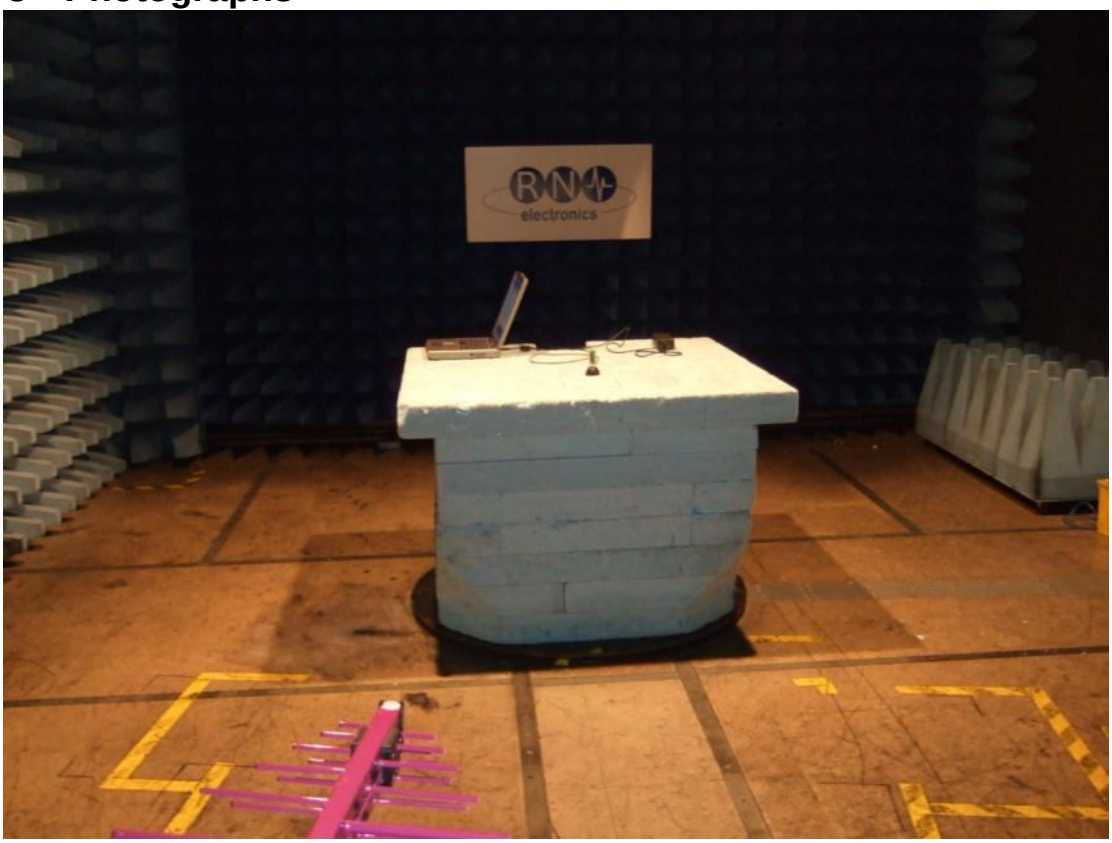
The limits given in the test standard are normally expressed as absolute values (e.g. in μV/m at a specified distance), whereas the measured values are expressed as peak, quasi peak or average values in dBμV/m referenced to the measuring instrument inputs. RN Electronics calibrate the test set-up to 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:

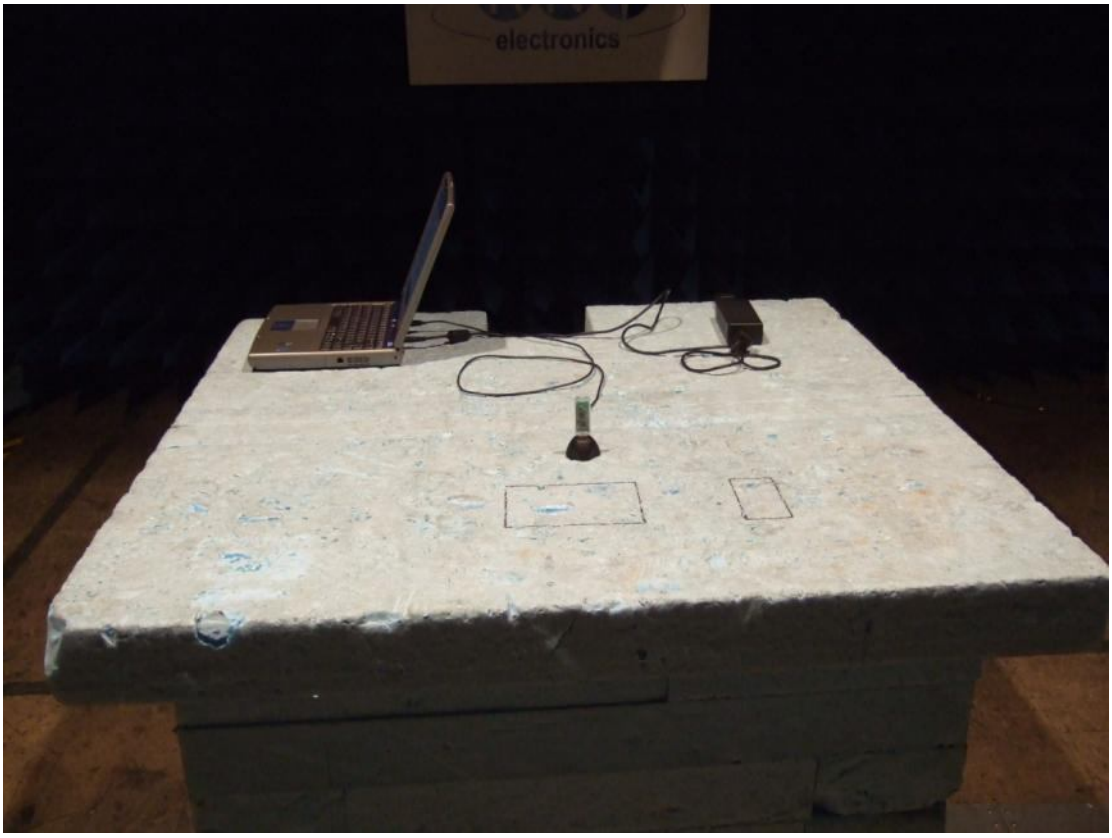
(a) limit of 500 μV/m equates to 20.log (500) = 54 dB μV/m.
(b) limit of 300 μV/m at 10m equates to 20.log (300 . 10/3) = 60 dB μV/m at 3m
(c) limit of 30 μV/m at 30m, but below 30MHz, equates to 20.log(30) + 40.log(30/3) = 69.5 dBμV/m at 3m, as extrapolation factor below 30MHz is 40dB/decade per 15.31(f)(2).

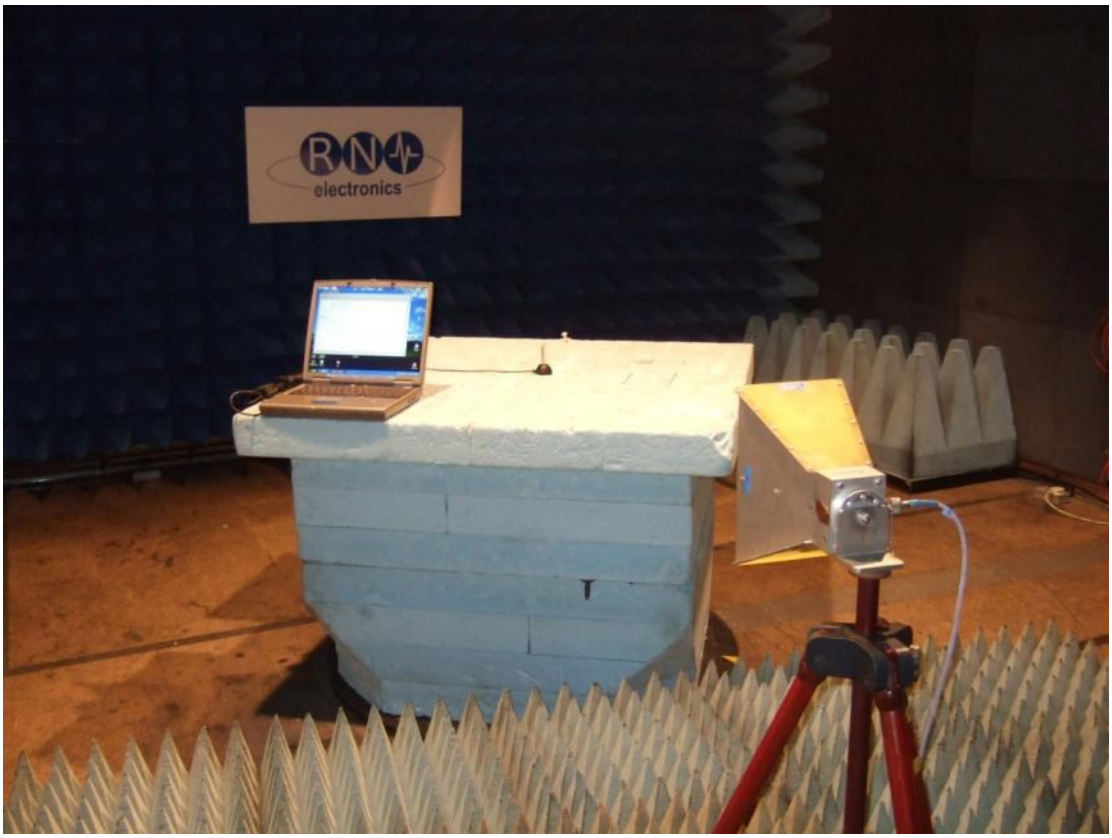
7.3 Explanation of duty cycle corrections

For purposes of test the equipment was operated with the transmitter continuously on. For a 10% duty cycle (maximum declared by the manufacturer), the average levels measured would be reduced by 20 log (0.10) = -20dB, when measured in Volts

8 Photographs






RN
electronics


RN
electronics


RN
electronics

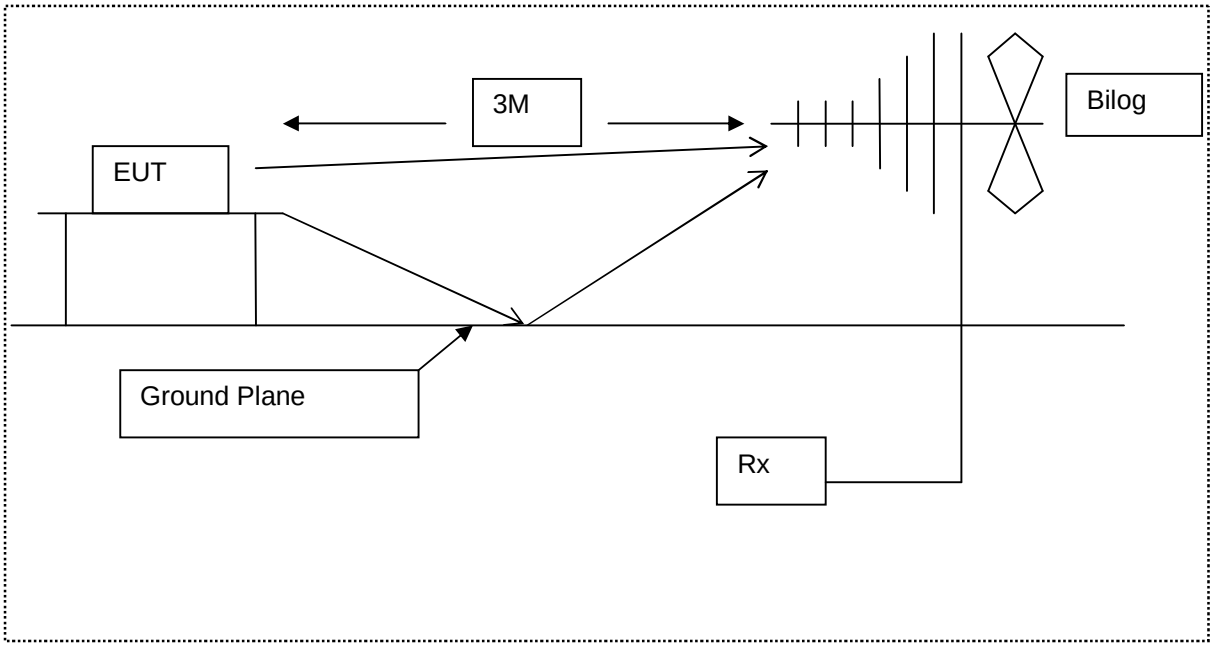
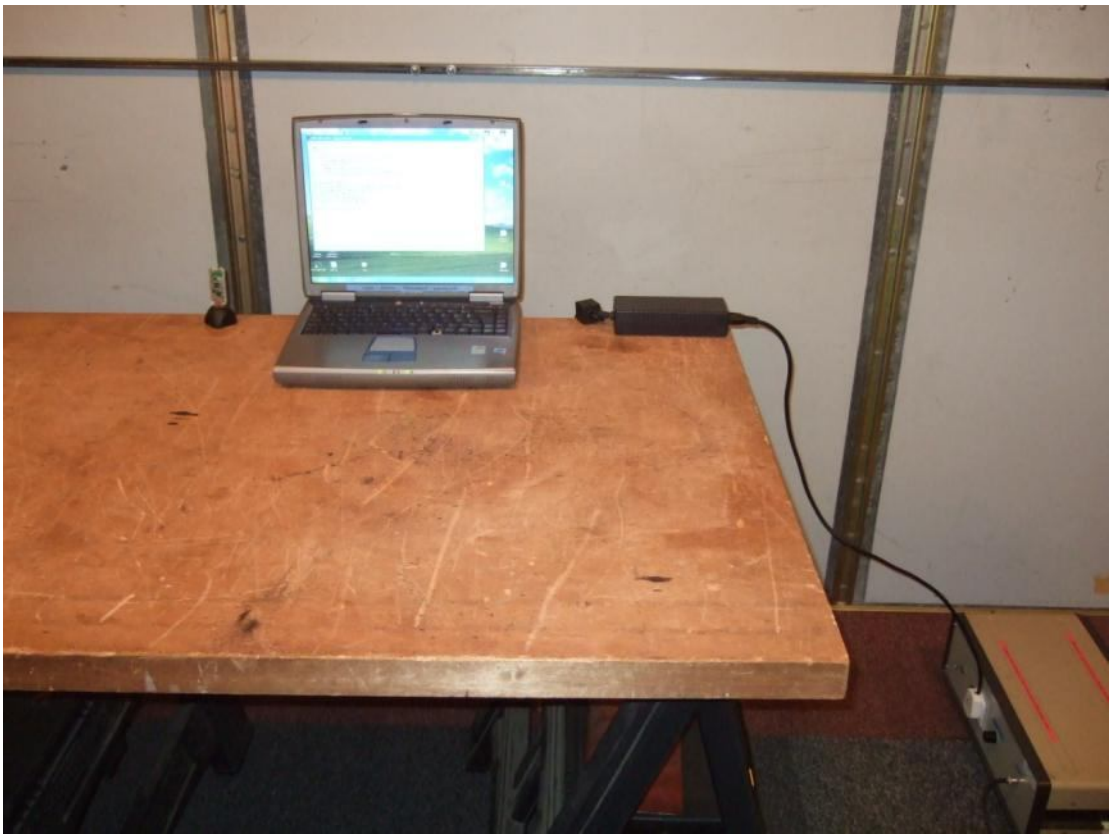


Diagram of the radiated emissions test setup.



Photograph of the EUT as viewed from screened room (conducted emissions)

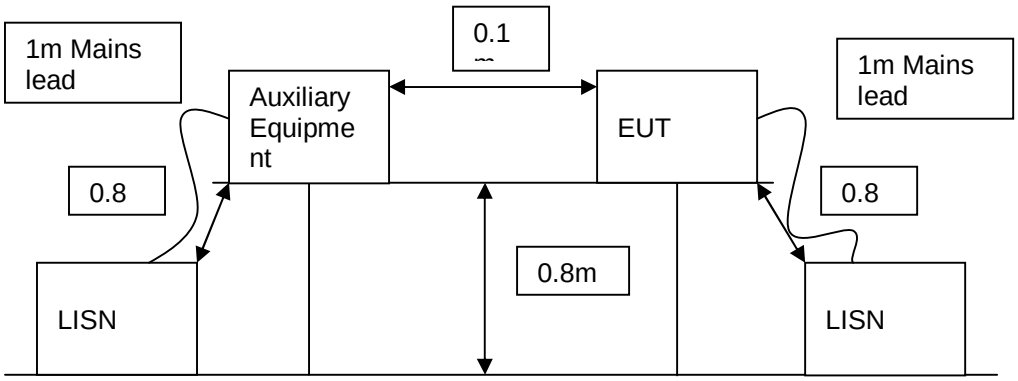


Diagram of the conducted emissions test setup.

Identifying Photograph of the EUT

9 Signal Leads

Port Name	Cable Type
USB	Standard USB screened

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
E035	HP11947A	Transient Limiter + 10dB Atten.	Hewlett Packard	08-Aug-12	6
E150	MN2050	LISN 13A	Chase	14-Oct-11	12
E250	6806.19.A	6dB Attenuator	Hewlett Packard	15-Nov-11	12
E268	BHA 9118	1-18 GHz Horn Antenna	Schaffner	14-Apr-11	60
E342	8563E	Spectrum Analyser 26.5 GHz	HP	29-Mar-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
E492	N9038A	20Hz - 8.4GHz MXE EMI Receiver	Agilent Technologies	31-May-12	12
N240	CRT700/3/2C	100v Transformer	Not specified	N/A	N/A
E465	PCR2000LA	AC power supply	Kikusui	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	30-Apr-12	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

No Auxiliary equipment was provided.

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 Numb	Manufacturer	Description	Model Number	Serial Number
I017	DELL	Laptop PC	Inspiron 5150	CN-0W0940-12961-44J-2047

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

No modifications were made before test by RN Electronics Ltd.

N.B. The settings of the device - continuous transmit, power level, frequency were set by test software not normally available to the user. The manufacturer should ensure that any OEM programming does not allow for alternative modes inconsistent with those tested.

The root menu module selected for tests was “High power module”, which had a default power setting of 3.

12.2 Modifications during test

No modifications were made during test by RN Electronics Ltd.

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:

This device is subject to the Certification authorisation procedure and as such, does not require a DoC (**D**eclaration **o**f **C**onformity) to be included here

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
Site R	Screened Room (Conducted Immunity)
Site S	Safety Laboratory
Site T	Transient Laboratory

15 Abbreviations and Units

%	Percent
µV	microVolts
µW	microWatts
AC	Alternating Current
ALSE	Absorber Lined Screened Enclosure
AM	Amplitude Modulation
Amb	Ambient
ANSI	American National Standards Institute
ºC	Degrees Celsius
CFR	Code of Federal Regulations
CS	Channel Spacing
CW	Continuous Wave
dB	deciBels
dBµV	deciBels relative to 1µV
dBc	deciBels relative to Carrier
dBm	deciBels relative to 1mW
DC	Direct Current
EIRP	Equivalent Isotropic Radiated Power
ERP	Effective Radiated Power
EUT	Equipment Under Test
FCC	Federal Communications Commission
FM	Frequency Modulation
FSK	Frequency Shift Keying
g	Grams
GHz	GigaHertz
Hz	Hertz
IF	Intermediate Frequency
kHz	kiloHertz
LO	Local Oscillator
mA	milliAmps
max	maximum
mbar	milliBars
MHz	MegaHertz
min	minimum
mm	milliMetres
ms	milliSeconds
mW	milliWatts
NA	Not Applicable
nom	Nominal
nW	nanoWatt
OATS	Open Area Test Site
OFDM	Orthogonal Frequency Division Multiplexing
ppm	Parts per million
QAM	Quadrature Amplitude Modulation
QPSK	Quadrature Phase Shift Keying
Ref	Reference
RF	Radio Frequency
RTP	Room Temperature and Pressure
s	Seconds
Tx	Transmitter
V	Volts