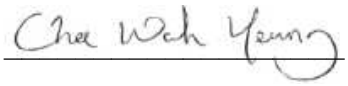
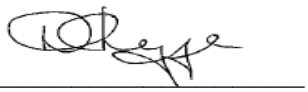
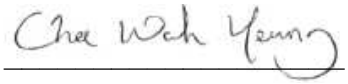
Leatherhead, Surrey
KT22 7SB, United Kingdom

Telephone: +44 1372 370900
Facsimile: +44 1372 370999
www.intertek.com

EMC TEST REPORT

COMPANY: ELTAV Wireless Monitoring Limited
PRODUCT: Westlock Valve Device (WKVD) Quarter Turn (QTR)

REPORT NO: 11056263 LHD-001 A

WRITTEN BY:	**C Yeung**	
REVIEWED BY:	**D Legge**	
TEST ENGINEER:	**C Yeung**	
ISSUE: 4	**DATE: 6th August 2013**	**TOTAL PAGES: 36**

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UKAS TESTING
029

Contents Page No.

1. JOB DESCRIPTION

Equipment:	Westlock Valve Device (WKVD)
Equipment Model Name:	Quarter Turn (QTR)
PCB Serial No.:	9211120038 (Transmitter) 9211120050 (Receive)
Phase:	Compliance
Customer:	ELTAV Wireless Monitoring Limited 15 Hatassia Street 43654 Ranana Israel
Test Plan Reference:	-
Test Standards:	CFR 47 Part 15:247 RSS 210 Issue 8 RSS-Gen Issue 3
FCC Ident:	X2VQTR000X4
IC Ident:	8876A-QTR000X4
Test Location:	Intertek Testing & Certification Ltd Unit D, Imperial Park Randalls Way Leatherhead Surrey KT22 7TS
Test Work Started:	13th February 2012
Test Work Completed:	15th July 2013

2. TEST SUMMARY

2.1. Standard: CRF 47 Part 15:247

TEST STANDARD	TEST	COMMENT
CFR47: Part 15:109	Receiver Radiated Emission	Pass
CFR47: Part 15:247 (a)(2)	-6dB Bandwidth	Pass
CFR47: Part 15:247 (b)(3)	Maximum Output Power	Pass
CFR47: Part 15:247 (d)	Frequency Band Edge	Pass
CFR47: Part 15:247 (d)	Transmitter Radiated Emission	Pass
CFR47: Part 15:247 (e)	Power Spectral Density	Pass

2.2. RSS210 Issue 8 & RSS-Gen Issue 3

TEST STANDARD	TEST	COMMENT
RSS-210: A8.2 (a)	-6dB Bandwidth	Pass
RSS-210: A8.2 (b)	Power Spectral Density	Pass
RSS-210: A8.4 (4)	Transmitter Maximum Output Power	Pass
RSS-210: A8.5	Out of Band Emissions	Pass
RSS-Gen: 4.6.1	Occupied Bandwidth	Pass

All of the above tests have been carried out to meet the requirements of ANSI C63.4:2003.

2.3. Modification

No modifications were carried out on the EUT during testing.

3. EQUIPMENT UNDER TEST (EUT)

3.1. Description of the EUT

The WKVD QTR is a wireless quarter turn valve monitoring device which monitors temperature, battery level and valve angle. It can also be used as a diagnostics tool (Valve Dynamics).

The WKVD QTR is powered using 3.6V dc which is supplied from an internal battery pack. For test purposes only, a power lead was supplied with the WKVD QTR to enable the supply voltage to be adjusted and to allow the device to operate in constant transmit mode.

The valve status is transmitted by an internal bi-directional transceiver using a standard 'Zigbee' protocol. The WKDV has the option of using either an internal or external antenna which is selectable by an internal switch, the manufacturer has stated that only the external antenna will be used. For testing purposes the external antenna (TQX-2400C) was used as this would be the antenna used in the transmission system and installed by the manufacturer.
The transmission system and antenna are professionally installed on site and tested by the manufacturer, a data sheet for the antenna has been supplied by the manufacturer.

The EUT was tested as received with no external visible signs of damage and was of production quality. Any alterations or modifications would only be installed by the manufacturers representative.

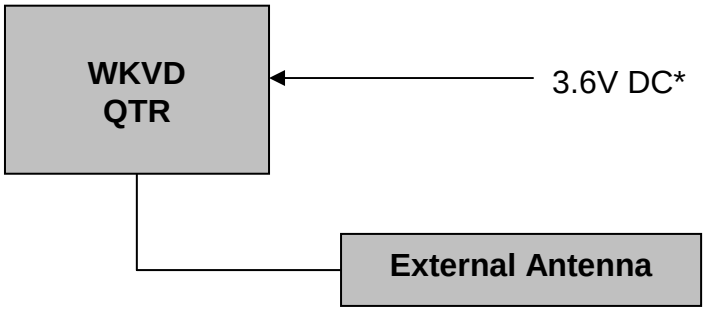
3.2. EUT Modes of Operation

1) Transmit Mode:
- Continuously transmitting in the following states

Channel	Transmission	Frequency (GHz)
11	Streaming Data	2.405
18	Streaming Data	2.440
26	Streaming Data	2.480

2) Receive Mode:
- WKVD QTR in constant receive mode

3.3. EUT Configuration Diagram



* Power cable suppied for test purposes only

3.4. EUT Support Equipment

None.

3.5. Cables Associated With the EUT

EUT PORT	CABLE TYPE	LENGTH (m)	TERMINATION/LOAD
Antenna Port	Coax cable	0.1	SMA Connector (Female)

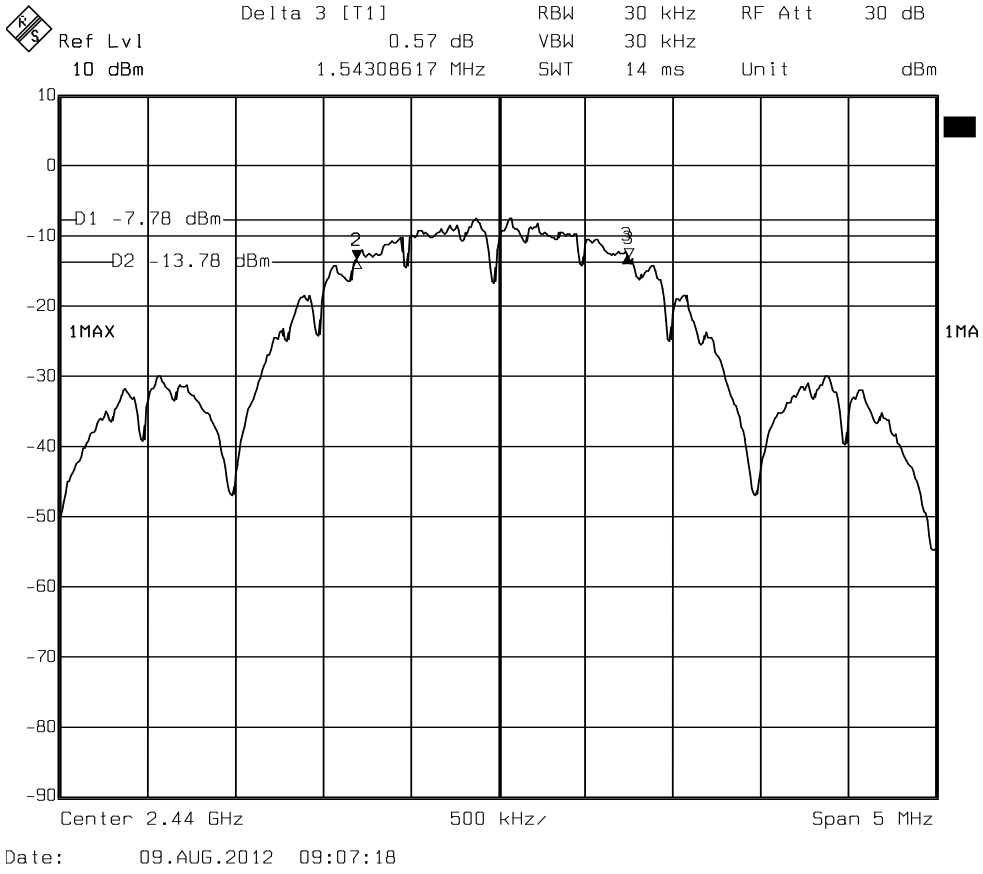
4. TESTS

4.1. - 6dB Bandwidth

Specifications: CFR47: Part 15:247 (a)(2)
RSS-210: A8.2 (a)

Temperature: 20.5 °C **Relative Humidity:** 39 %

Mode of operation: Transmit Mode Stream Data (Channel18)



Note: Worst case condition from channels 11,18,26.

Channel 18

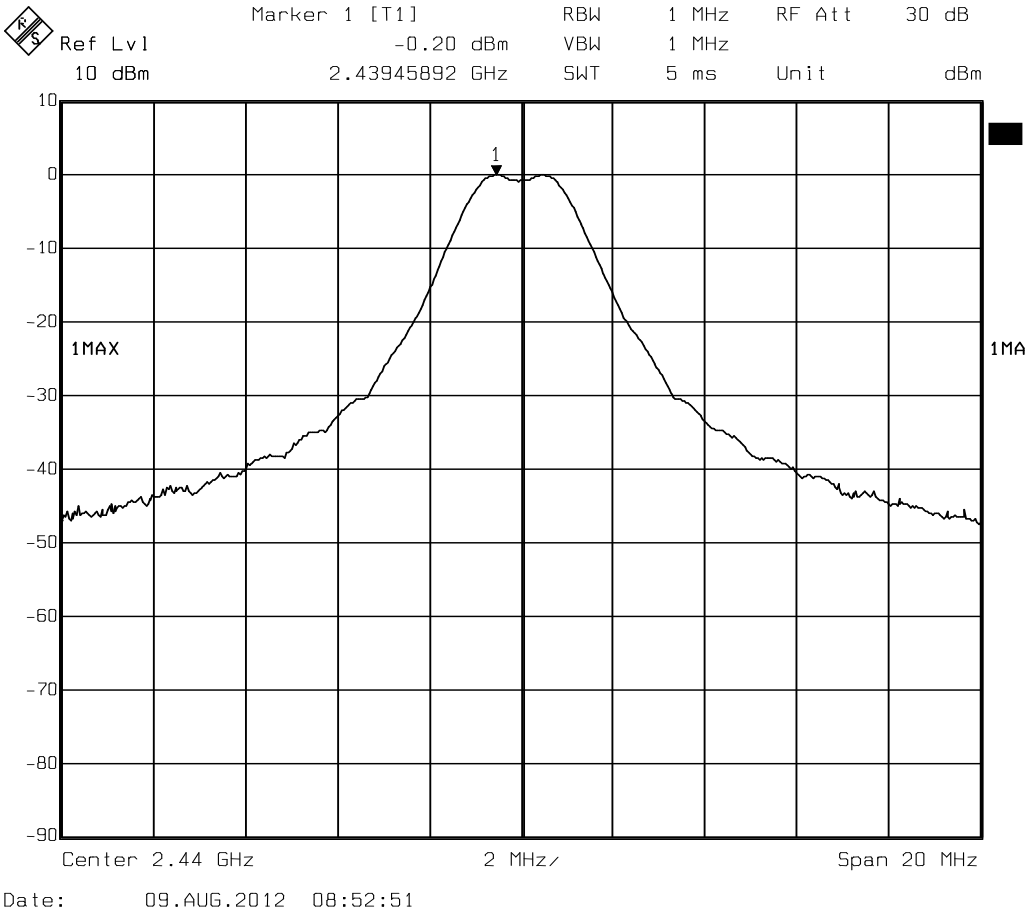
Channel	- 6dB Bandwidth (MHz)	Limit (kHz)	Comment
18	1.543	≥ 500	Pass

Transmitter Peak Output Power (Conducted):

Specifications: CFR47: Part 15:247 (b)(3)
RSS-210: A8.4 (4)

Temperature: 22 °C **Relative Humidity:** 42 %

Mode of operation: Transmit Mode Stream Data (Channel 18)



Antenna gain = 3dB.
BW Correction = 10log (1.543/1) = 1.88 - 0.2 = 1.68

Channel	Power (dBm)	Limit (dBm)	Comment
18*	1.68	30.00	Pass

Worst case out of Ch11, Ch18 & Ch26

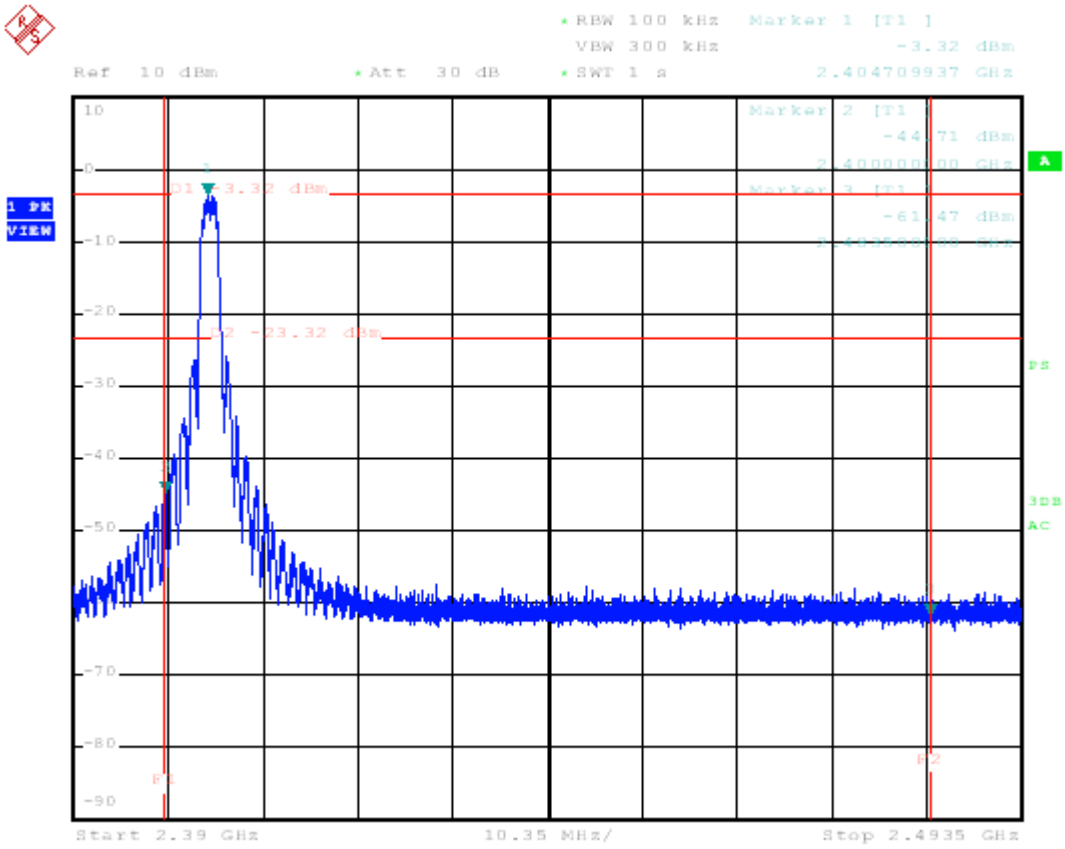
4.2. Frequency Band Edge

Specifications: CFR47: Part 15:247 (d)
RSS-210: A8.5

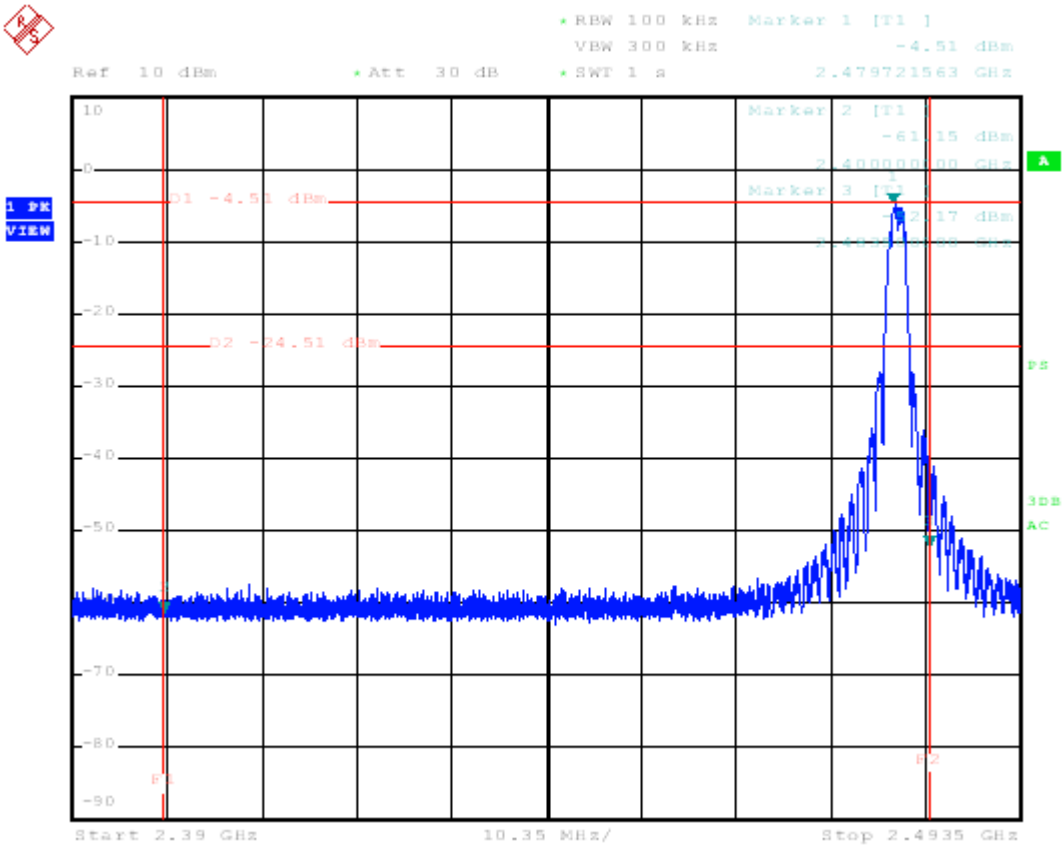
Temperature: 20.5 °C **Relative Humidity:** 39 %

Mode of operation: Transmit Mode (Channel 11 & 26)

Frequency Band: 2400 – 2483.5MHz



Channel 11: Lower Band Edge



Channel 26: Upper Band Edge

Band Edge	Level (dBm)	Limit (dBm)	Comment
Lower	-44.71	-23.32	Pass
Upper	-52.17	-24.51	Pass

Worst case out of channels 11,18,26.

4.3. Transmitter Radiated Emissions

Testing was conducted in an FCC registered semi-anechoic chamber. An emissions signature was obtained with the measuring antenna placed 3m from the product. Frequencies falling within 10dB of the limit line were investigated.

Specifications: CFR47: Part 15:247 (d)
RSS-210: A8.5

Temperature: 21.5 °C **Relative Humidity:** 43 %

Mode of operation: Transmit Mode (Channels 18)

Frequency Range: 30MHz to 25GHz

* All channels were tested the results of the worst case, out of the 3 channels, have been included in this report.

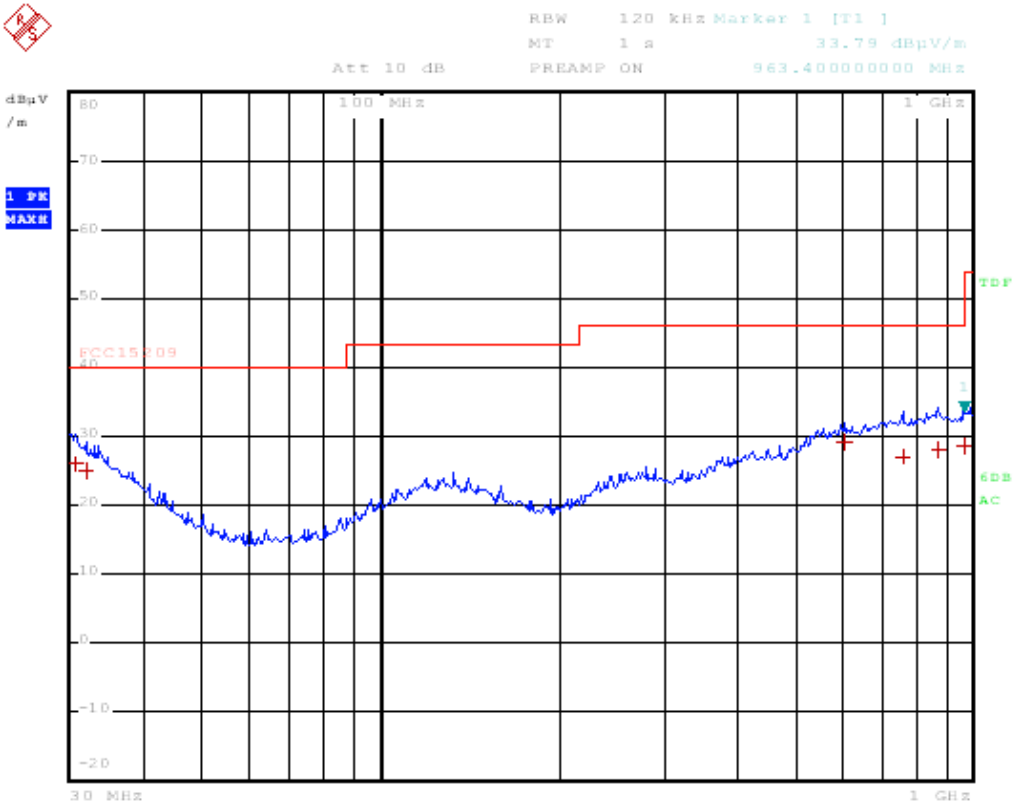
Table 1: Worst case emissions between 30MHz to 1GHz:

Frequency (MHz)	Polarity	QP Level (dBµV/m)	QP Limit (dBµV/m)	Comment
30.52	V	26.15	40.00	Pass
30.60	H	26.13	40.00	Pass

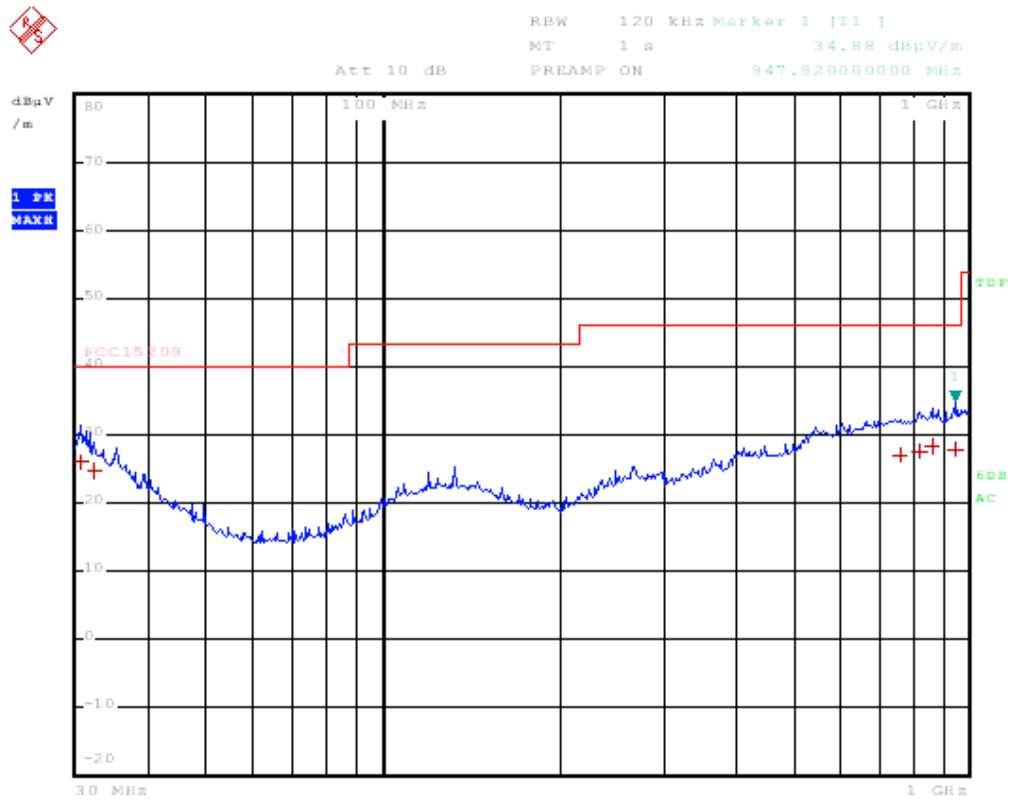
Table 2: Worst case emissions between 1GHz to 25GHz:

Frequency (GHz)	Polarity	Pk Level (dBµV/m)	Limit (dBµV/m)	Comment
1.95	V	33.52	54.00	Pass
2.14	V	44.40	54.00	Pass
4.87	V	43.58	54.00	Pass
11.80	V	49.31	54.00	Pass*
17.68	V	45.75	54.00	Pass
22.88	V	51.59	54.00	Pass*

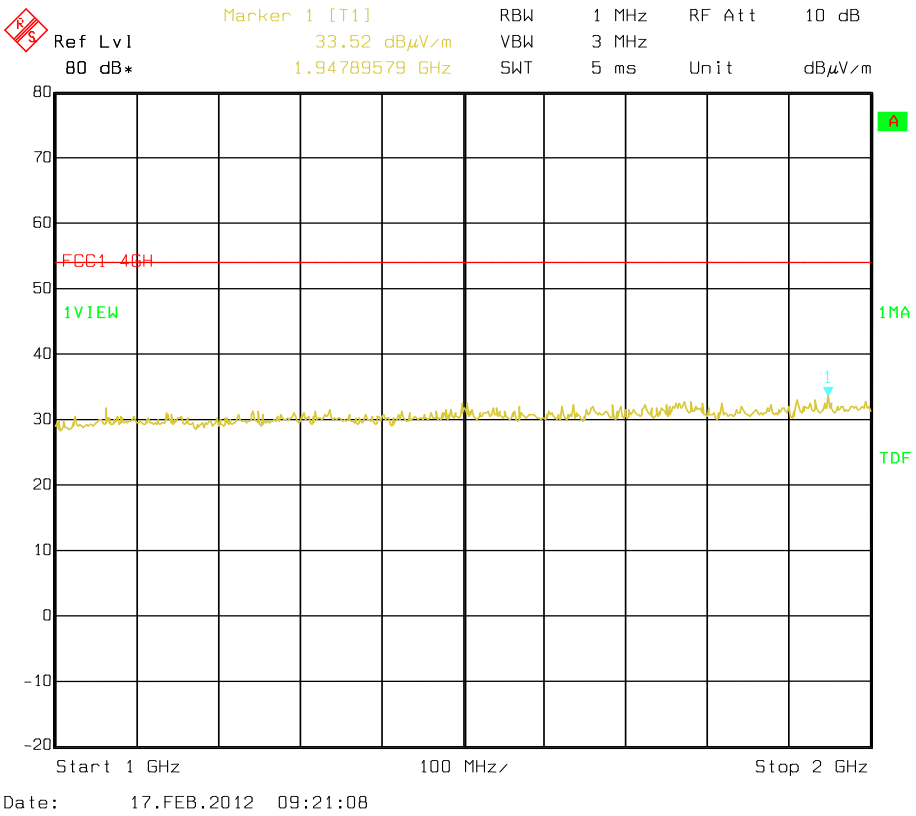
* Results are below the specification limit by a margin less than the measurement uncertainty; it is therefore not possible to state compliance based on the 95% level of confidence. However, the result indicates that compliance is more probable than non-compliance with the specification limit. After investigations these levels are consistant with the system noise levels.



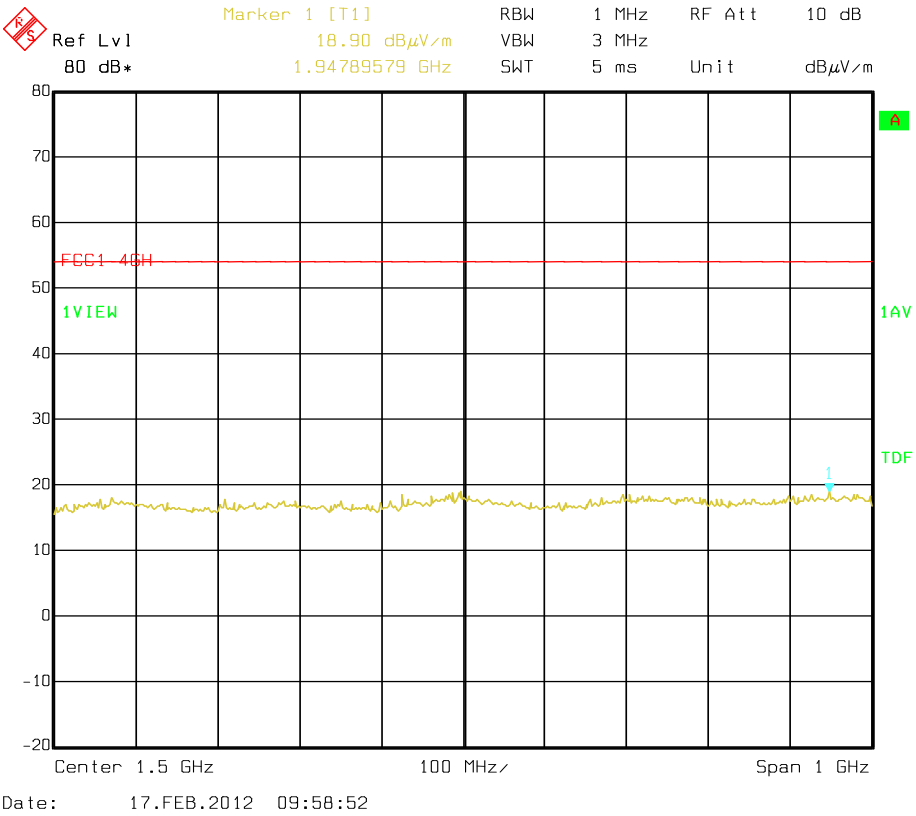
Channel 18: 30MHz - 1GHz Vertical – Quasi-Peak Detector



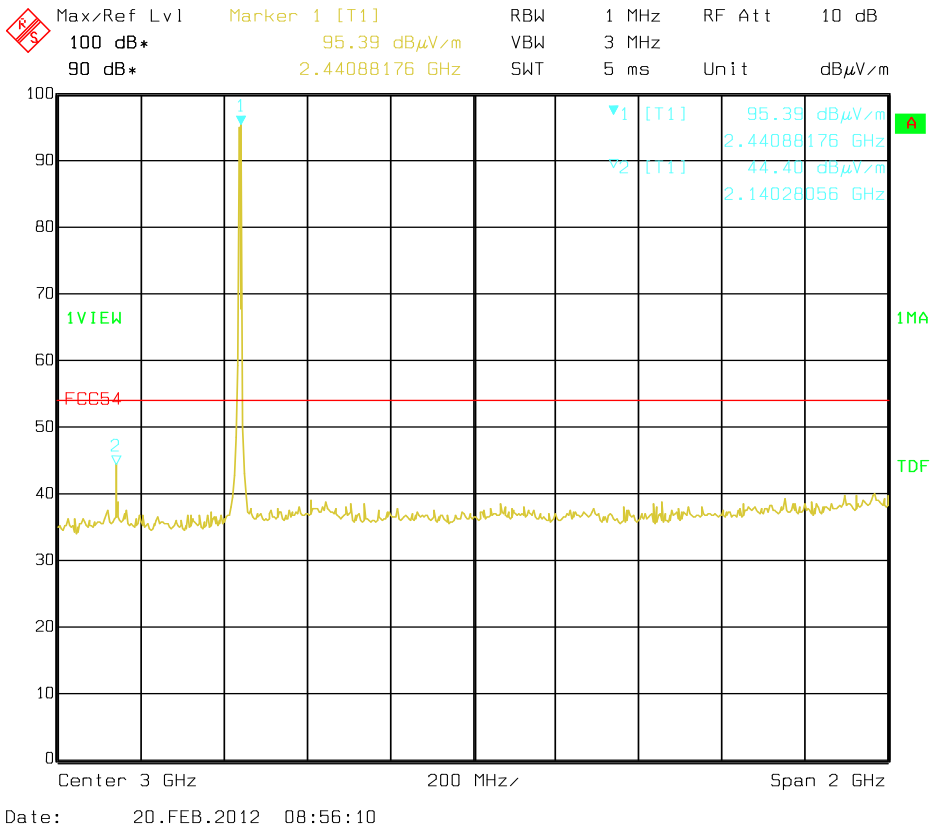
Channel 18: 30MHz - 1GHz Horizontal – Quasi-Peak Detector



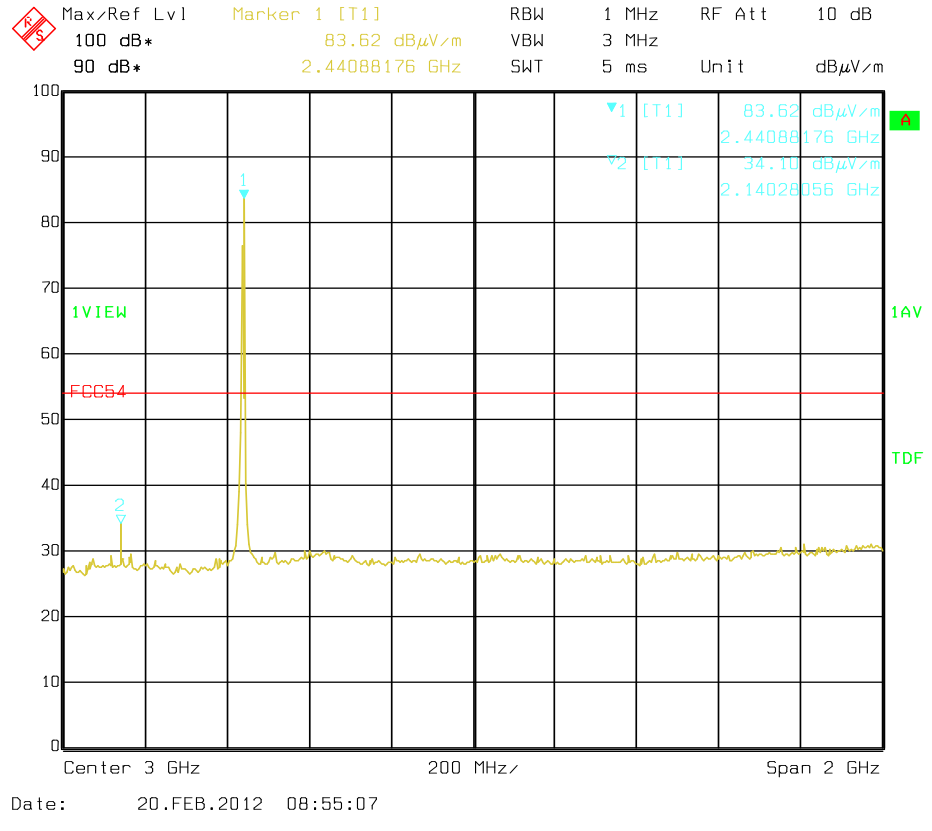
Channel 18: 1-2GHz – Peak Detector



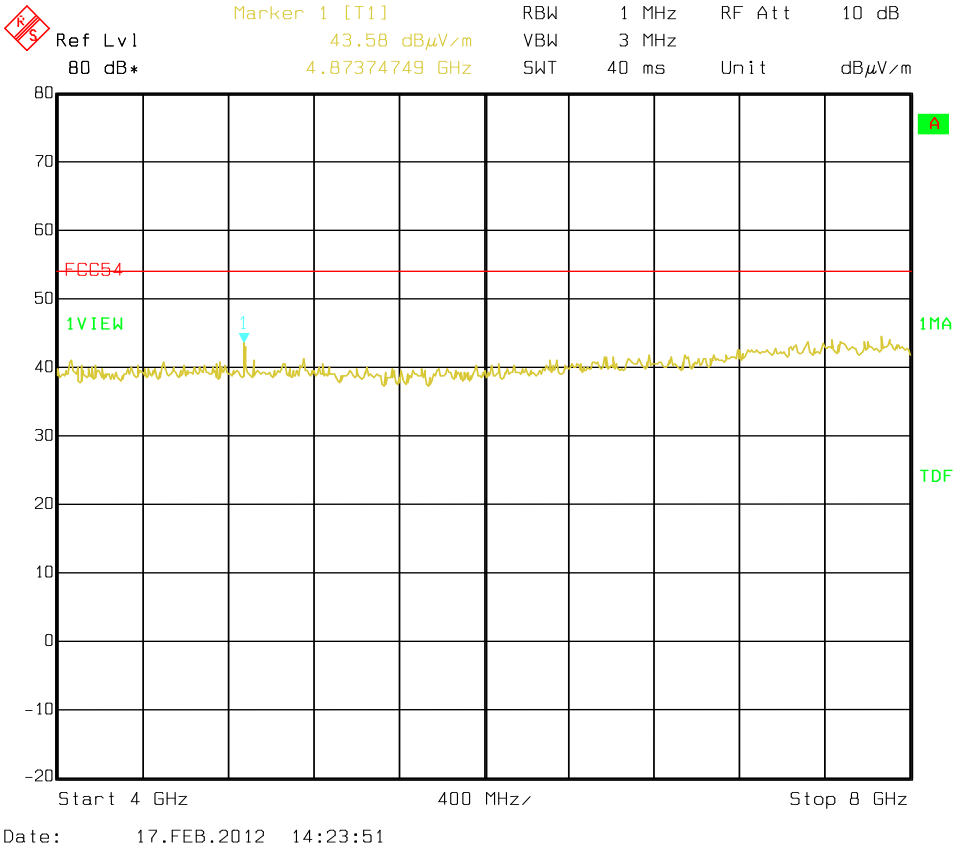
Channel 18: 1-2GHz – Average Detector



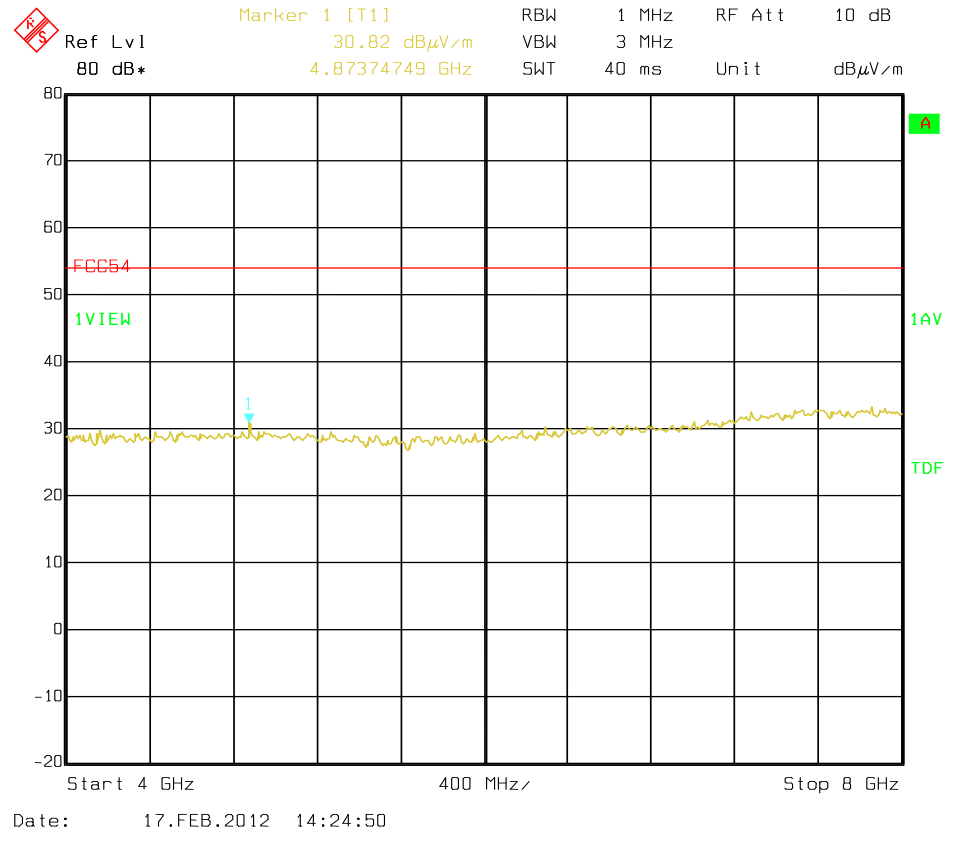
Channel 18: 2-4GHz – Peak Detector



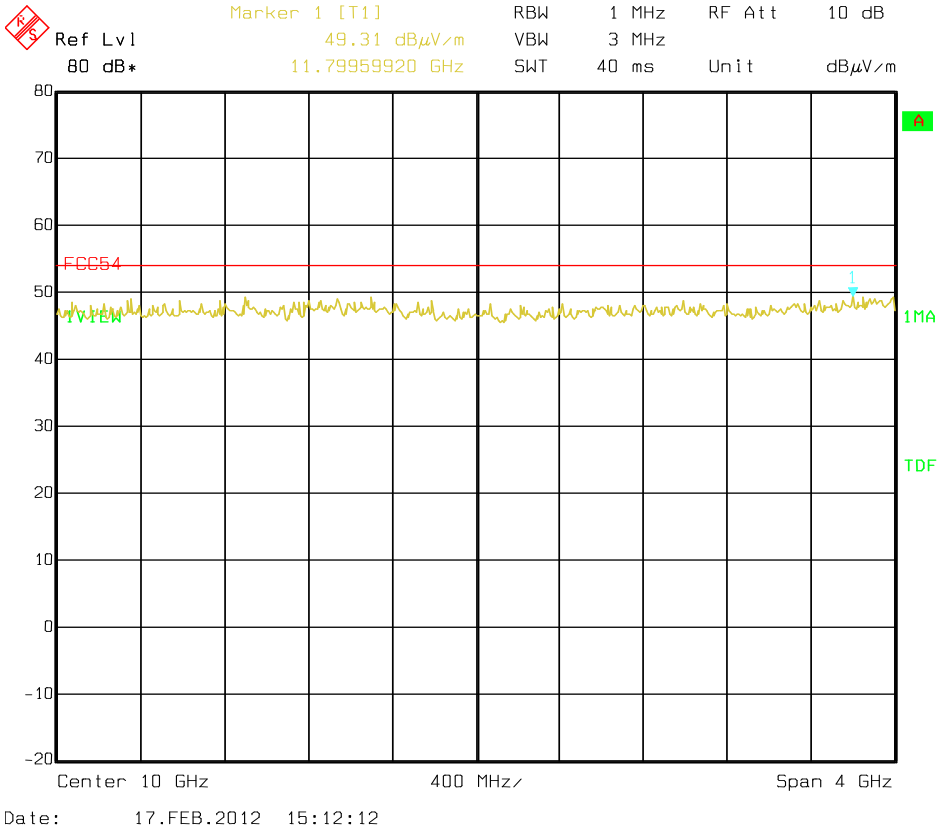
Channel 18: 2-4GHz – Average Detector



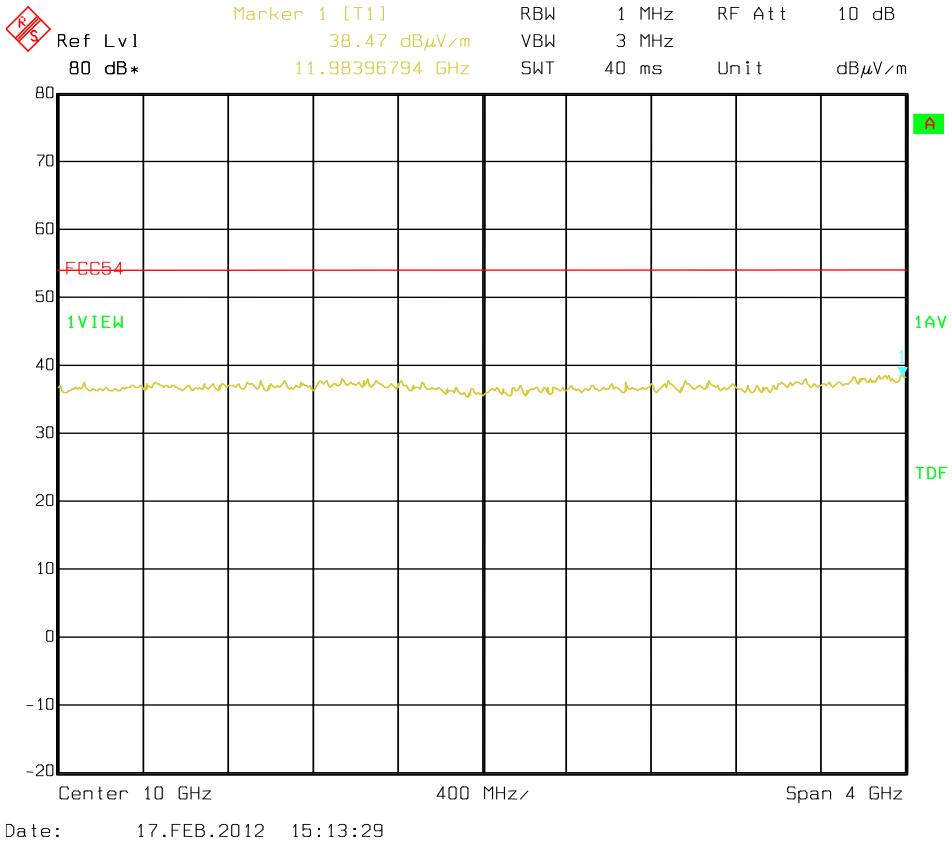
Channel 18: 4-8GHz – Peak Detector



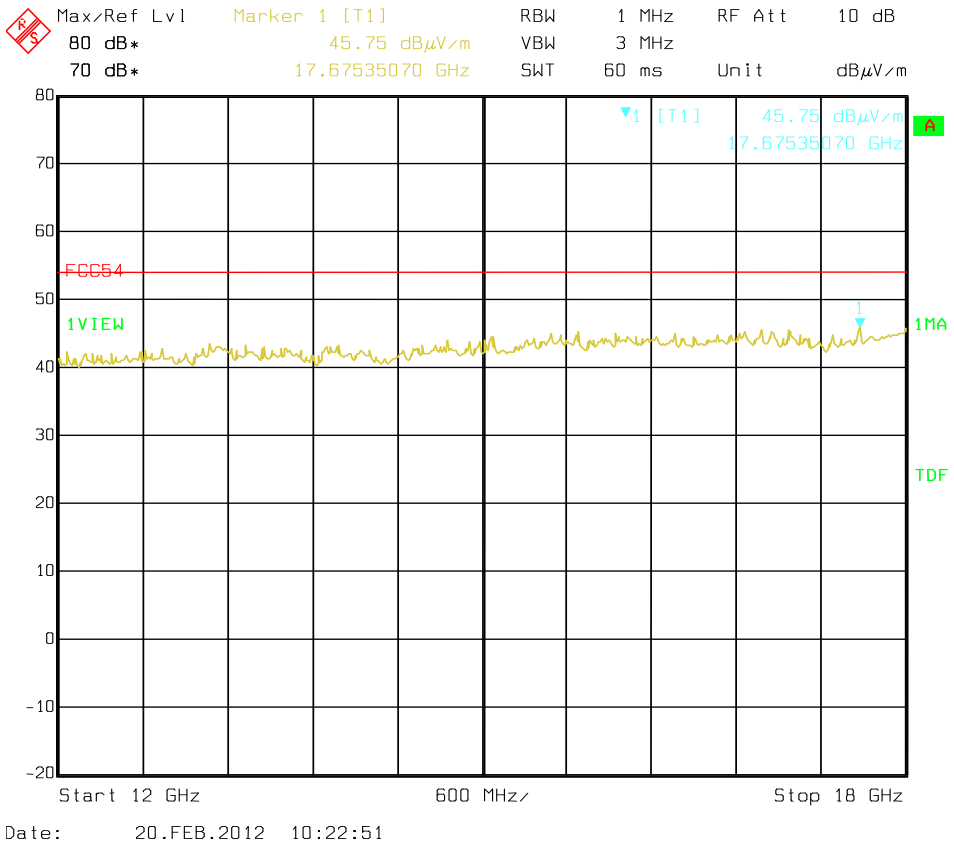
Channel 18: 4-8GHz – Average Detector



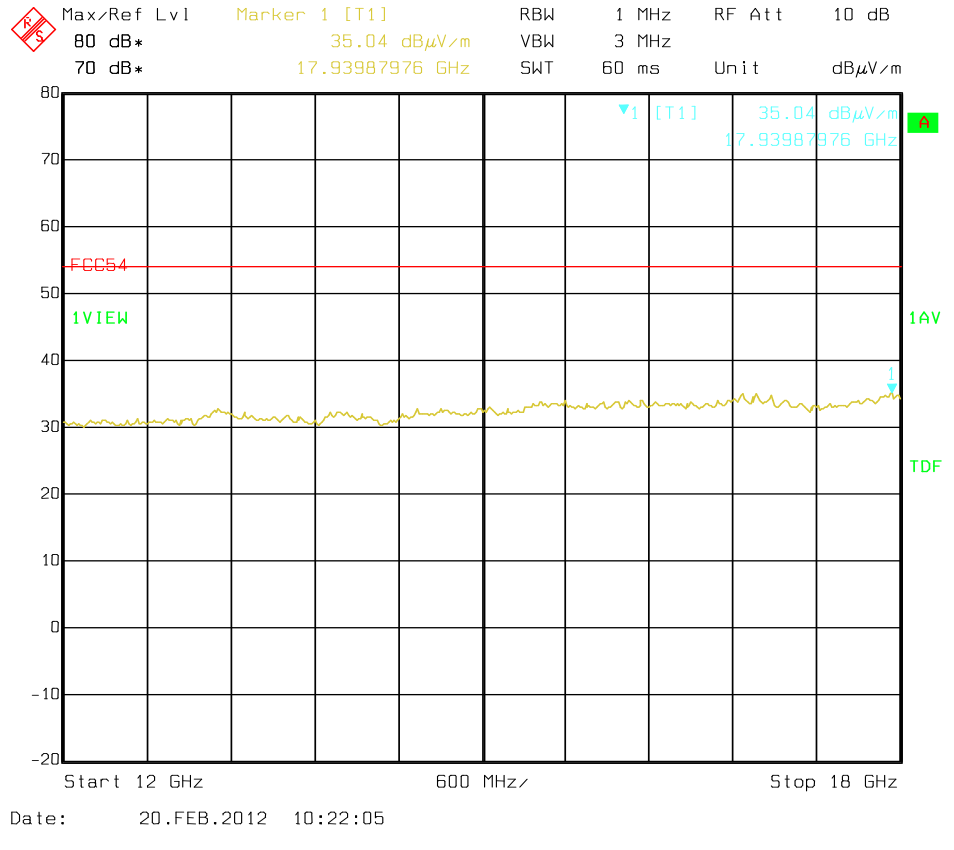
Channel 18: 8-12GHz – Peak Detector



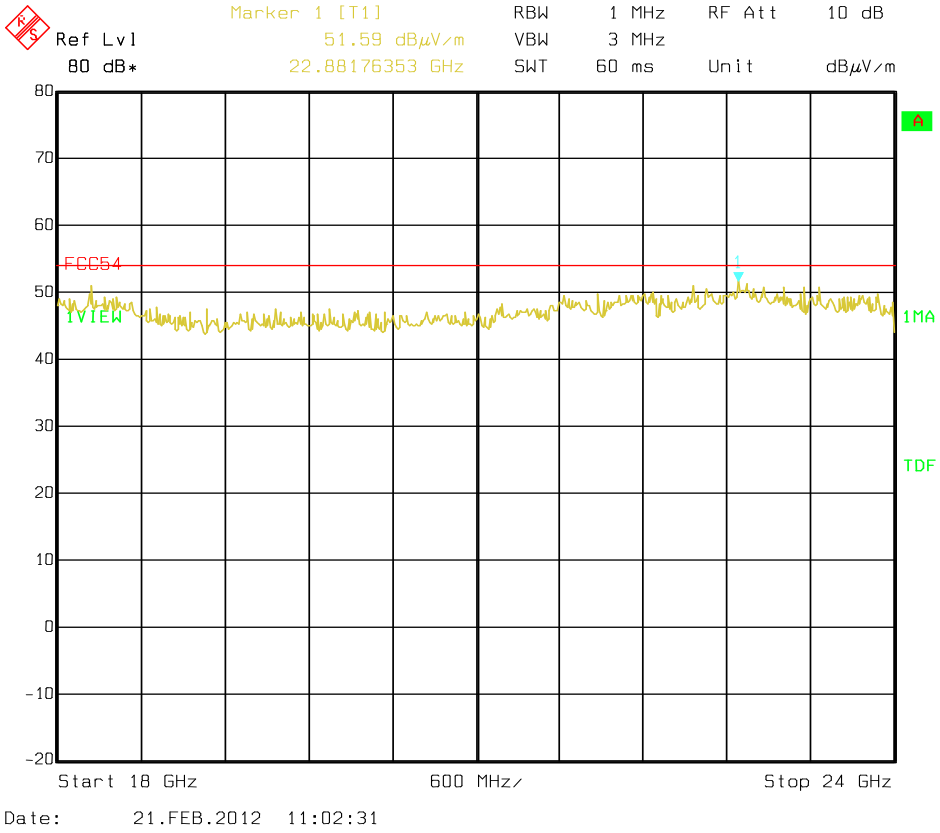
Channel 18: 8-12GHz – Average Detector



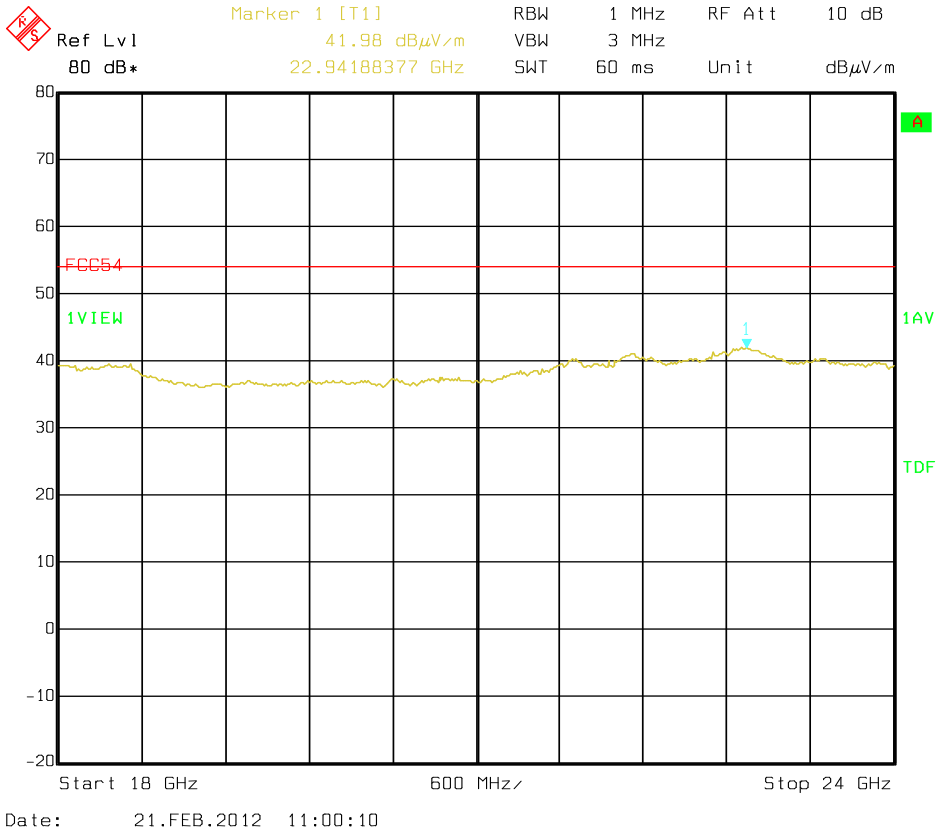
Channel 18: 12-18GHz – Peak Detector



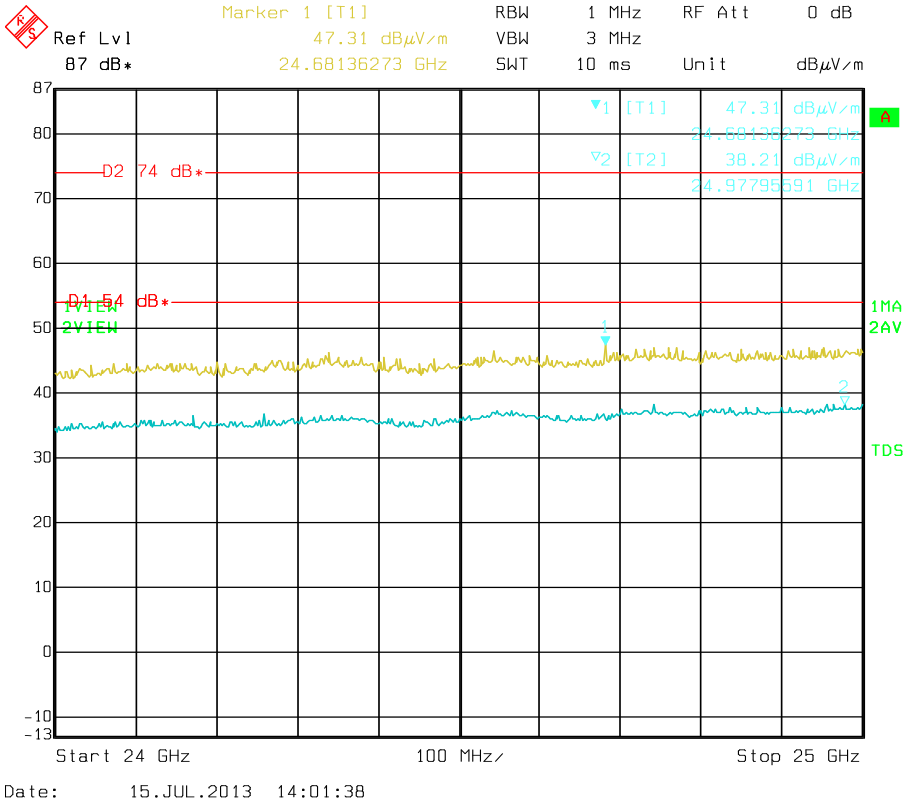
Channel 18: 12-18GHz – Average Detector



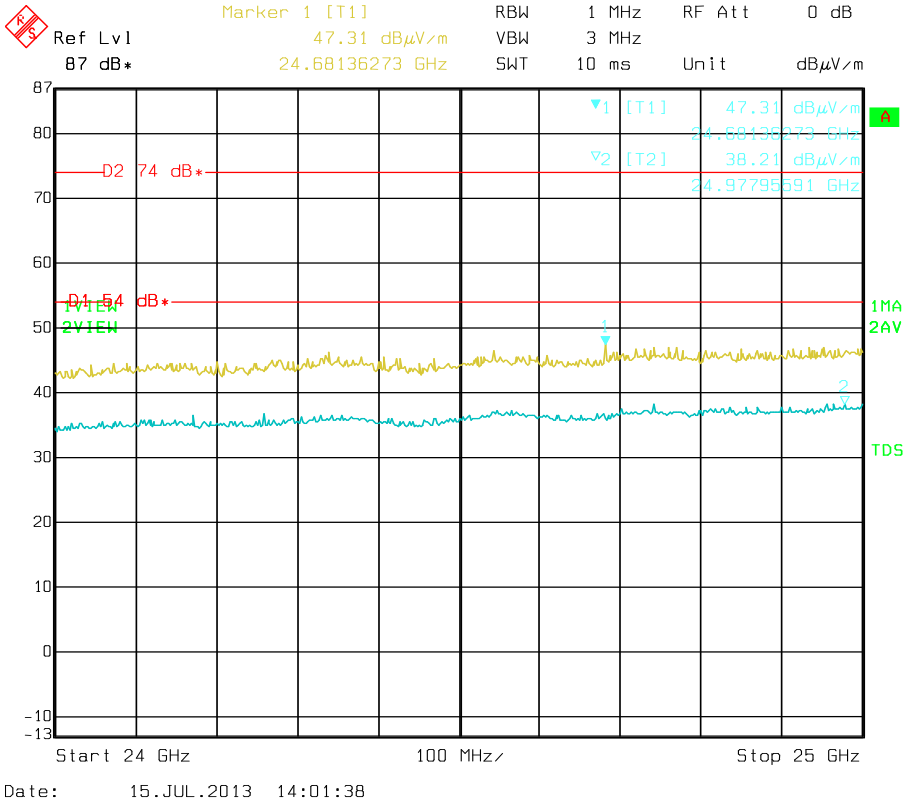
Channel 18: 18-24GHz – Peak Detector



Channel 18: 18-24GHz – Average Detector



Channel 18: 24 – 25GHz
Combined Average and Peak Detectors(Vert)



Channel 18: 24 -25GHz
Combined Average and Peak Detectors(Horz)

4.4. Receiver Radiated Emissions

Testing was conducted in an FCC registered semi-anechoic chamber. An emissions signature was obtained with the measuring antenna placed 3m from the product. Frequencies falling within 10dB of the limit line were investigated.

Specification: CFR47: Part 15:109

Temperature: 21.5 °C **Relative Humidity:** 43 %

Mode of operation: Receive Mode (Channels 18)

Frequency Range: 30MHz to 25GHz

* All channels were tested the results for Channel 18 have been included in this report.

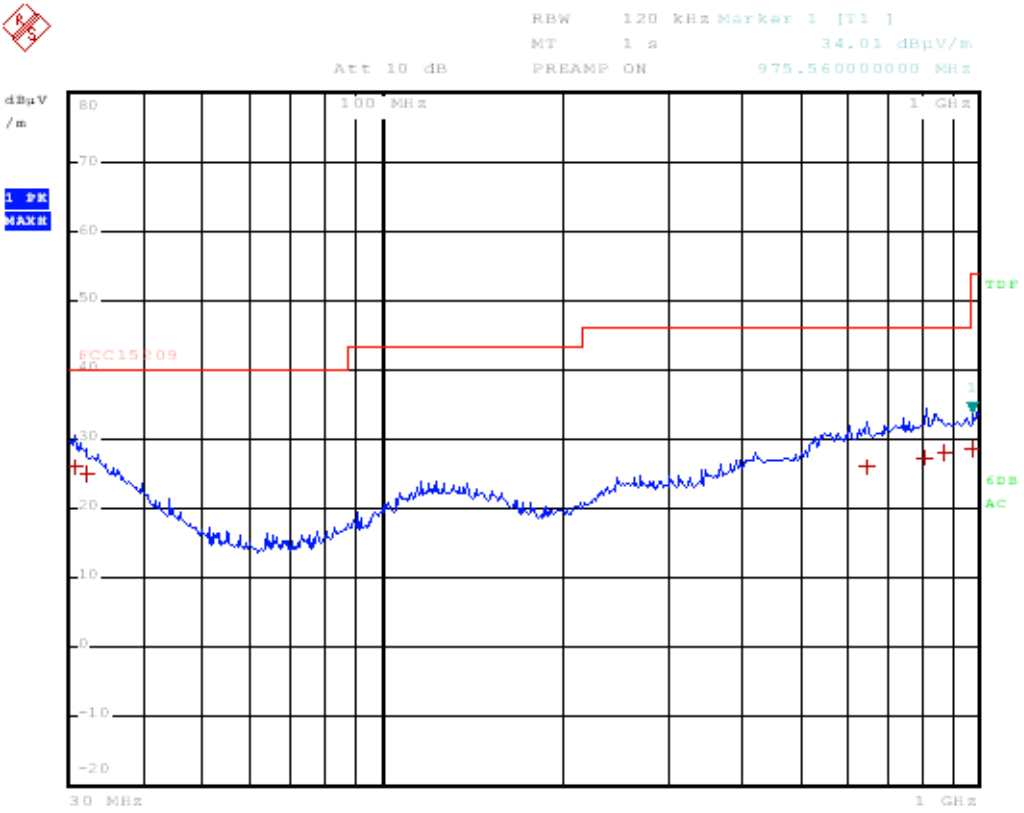
Table 1: Worst case emissions between 30MHz to 1GHz:

Frequency (MHz)	Polarity	QP Level (dBµV/m)	QP Limit (dBµV/m)	Comment
30.60	V	26.07	40.00	Pass
31.04	H	25.78	40.00	Pass

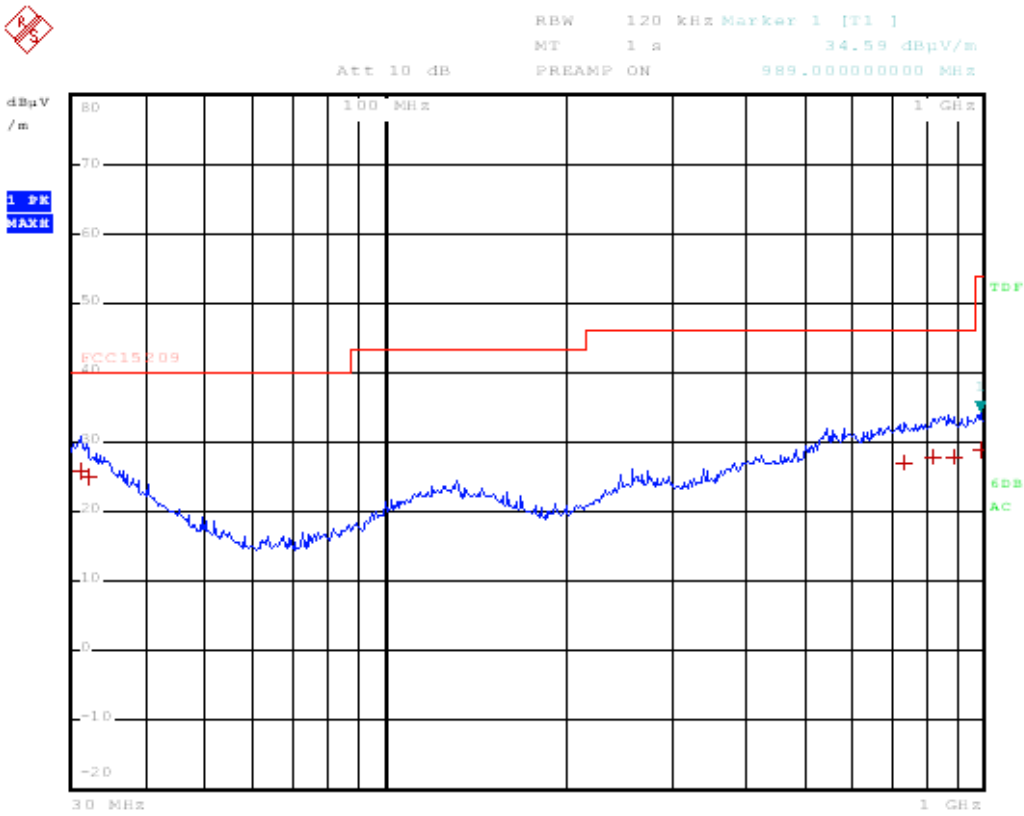
Table 2: Worst case emissions between 1GHz to 25GHz:

Frequency (GHz)	Polarity	Pk Level (dBµV/m)	Limit (dBµV/m)	Comment
1.78	V	33.75	54.00	Pass
3.98	V	40.17	54.00	Pass
4.87	V	42.68	54.00	Pass
11.91	V	49.88	54.00	Pass*
17.06	V	45.03	54.00	Pass
22.88	V	52.24	54.00	Pass*

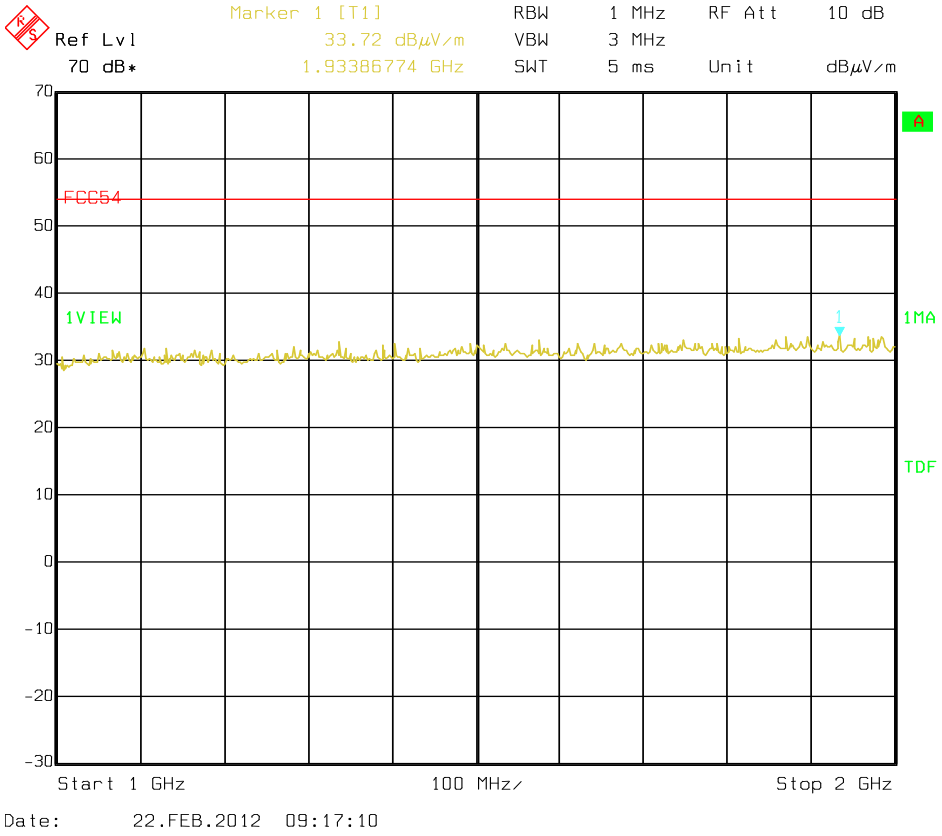
* Results are below the specification limit by a margin less than the measurement uncertainty; it is therefore not possible to state compliance based on the 95% level of confidence. However, the result indicates that compliance is more probable than non-compliance with the specification limit. After investigations these levels are consistant with the system noise levels.



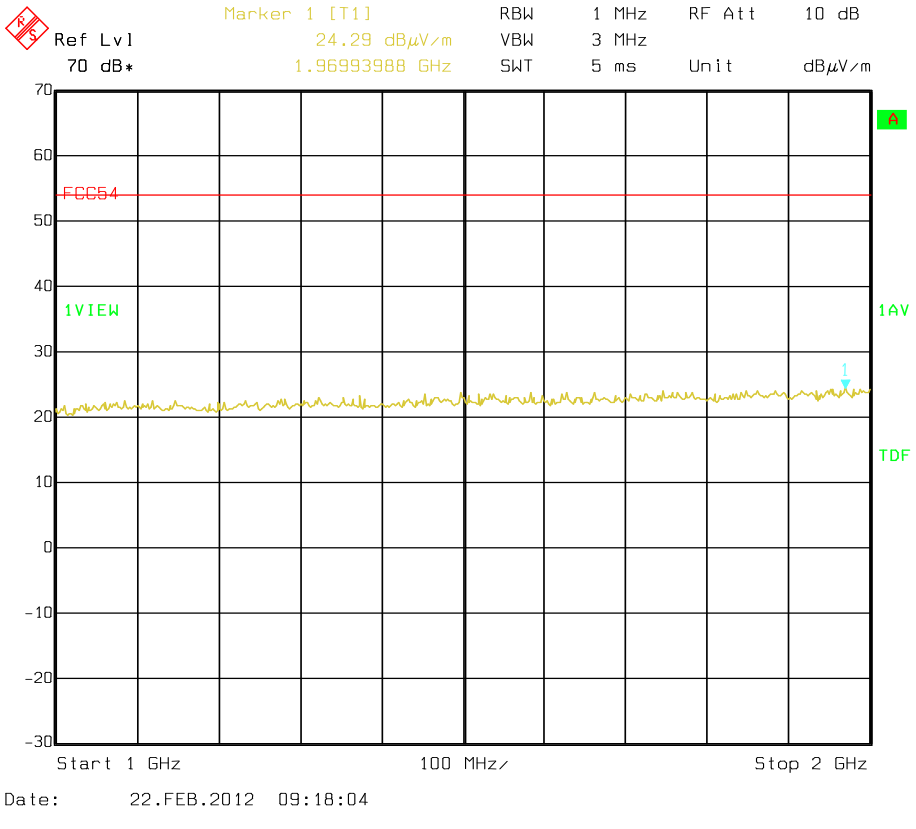
Channel 18: 30MHz - 1GHz Vertical – Quasi-Peak Detector



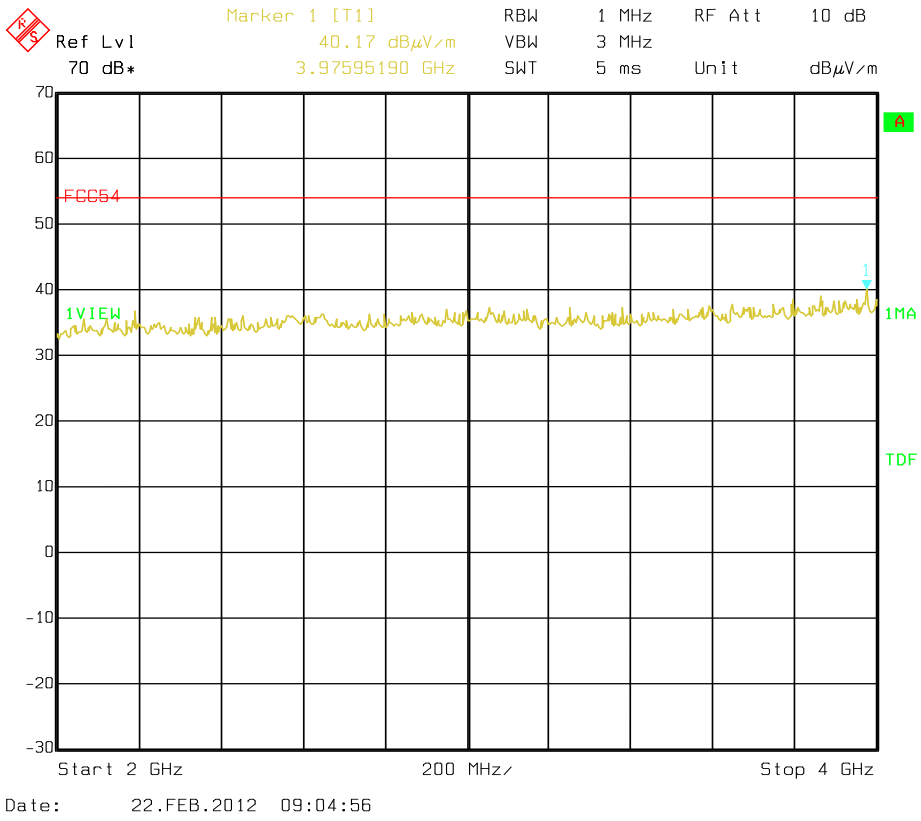
Channel 18: 30MHz - 1GHz Horizontal – Quasi-Peak Detector



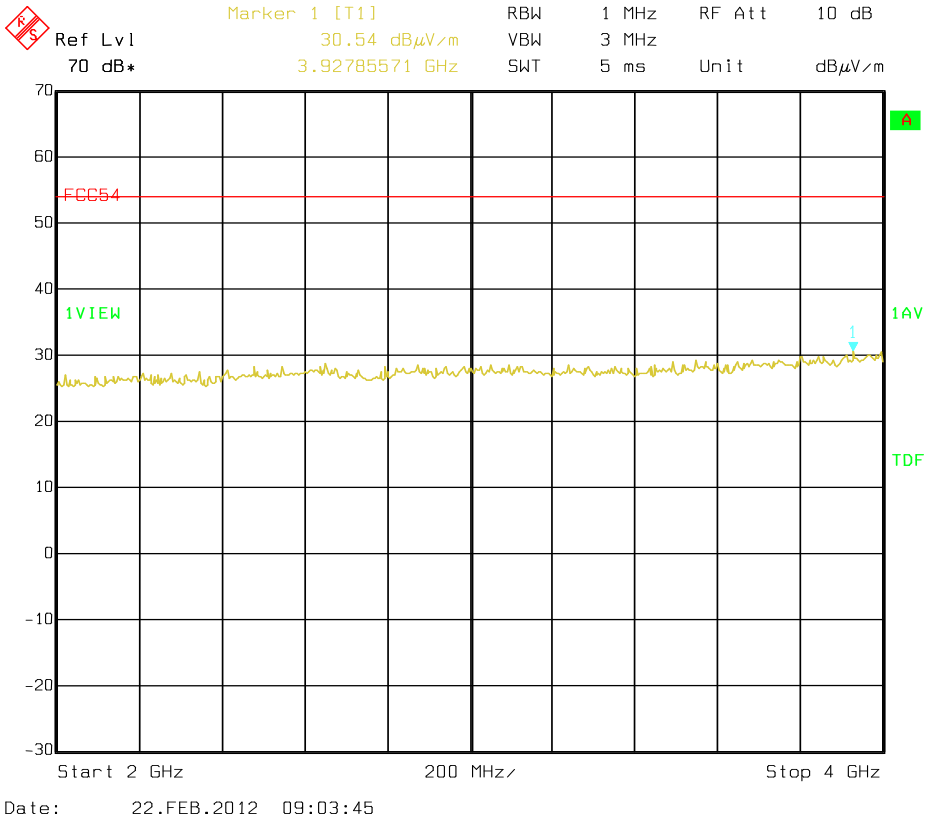
Channel 18: 1-2GHz – Peak Detector



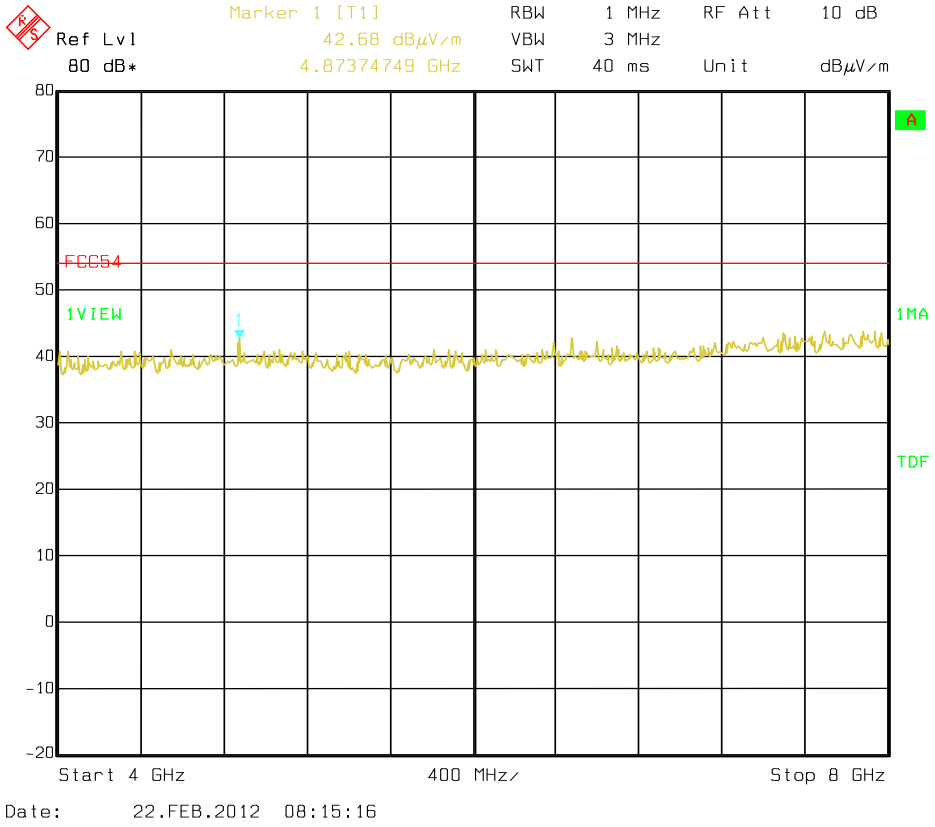
Channel 18: 1-2GHz – Average Detector



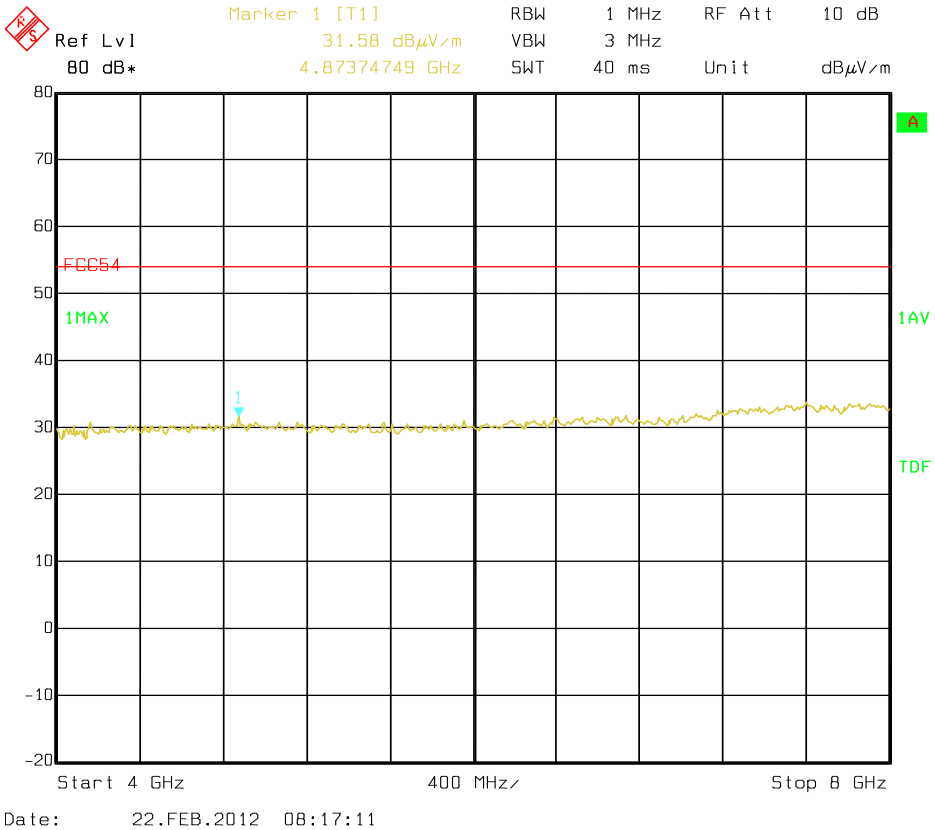
Channel 18: 2-4GHz – Peak Detector



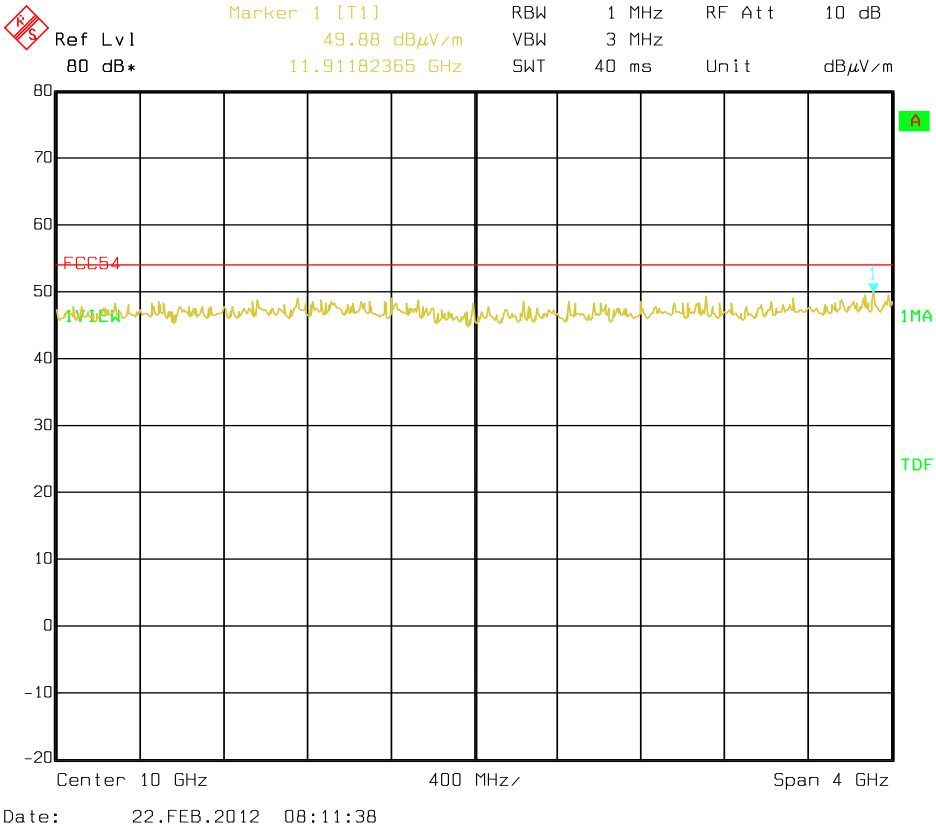
Channel 18: 2-4GHz – Average Detector



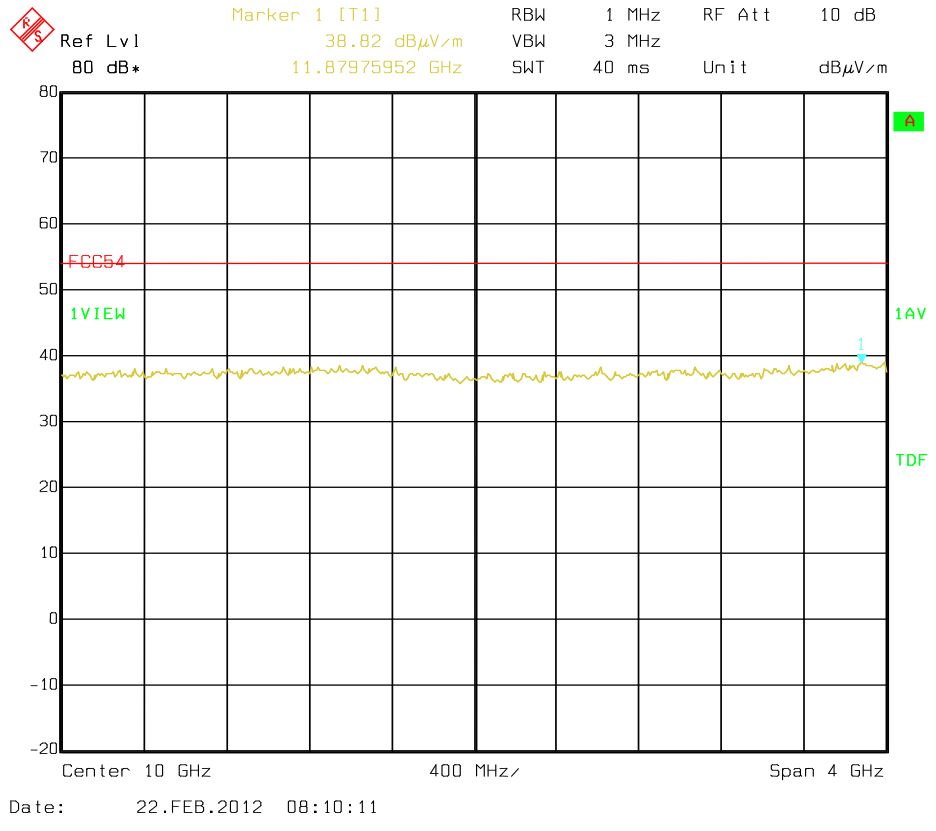
Channel 18: 4-8GHz – Peak Detector



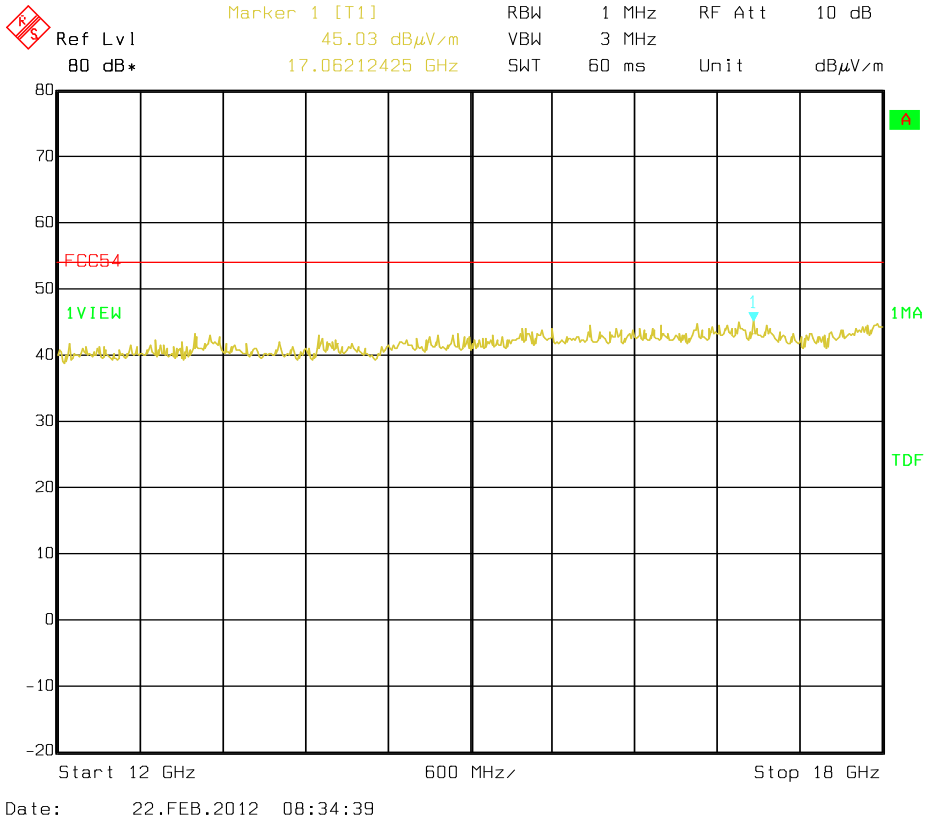
Channel 18: 4- 8GHz – Average Detector



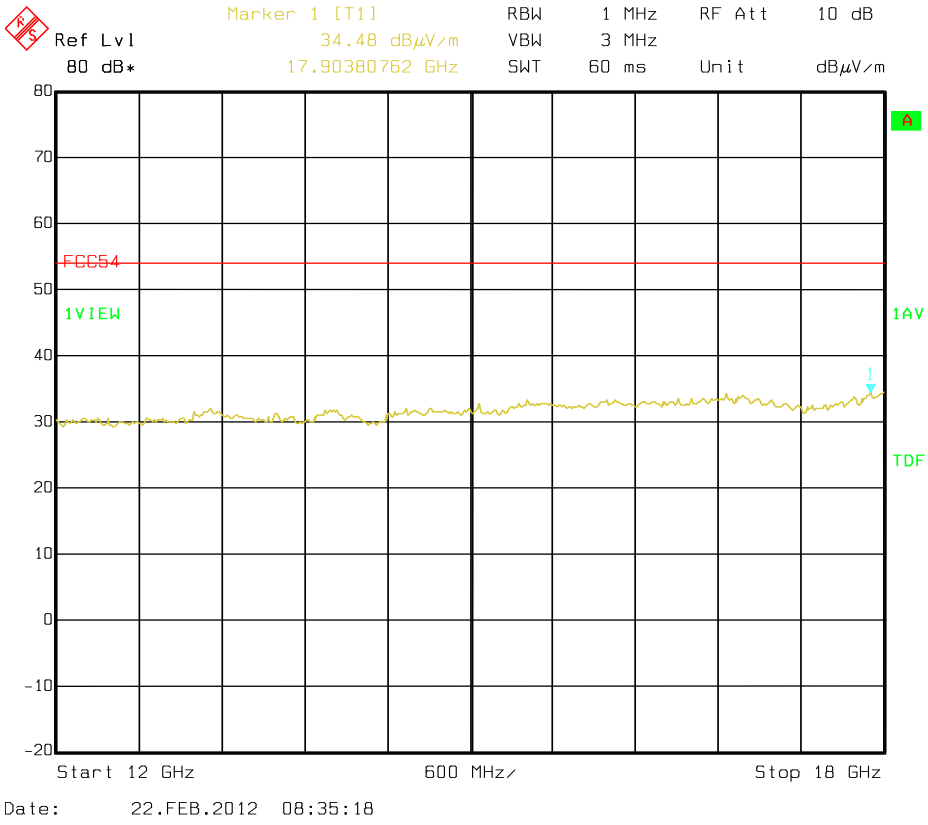
Channel 18: 8-12GHz – Peak Detector



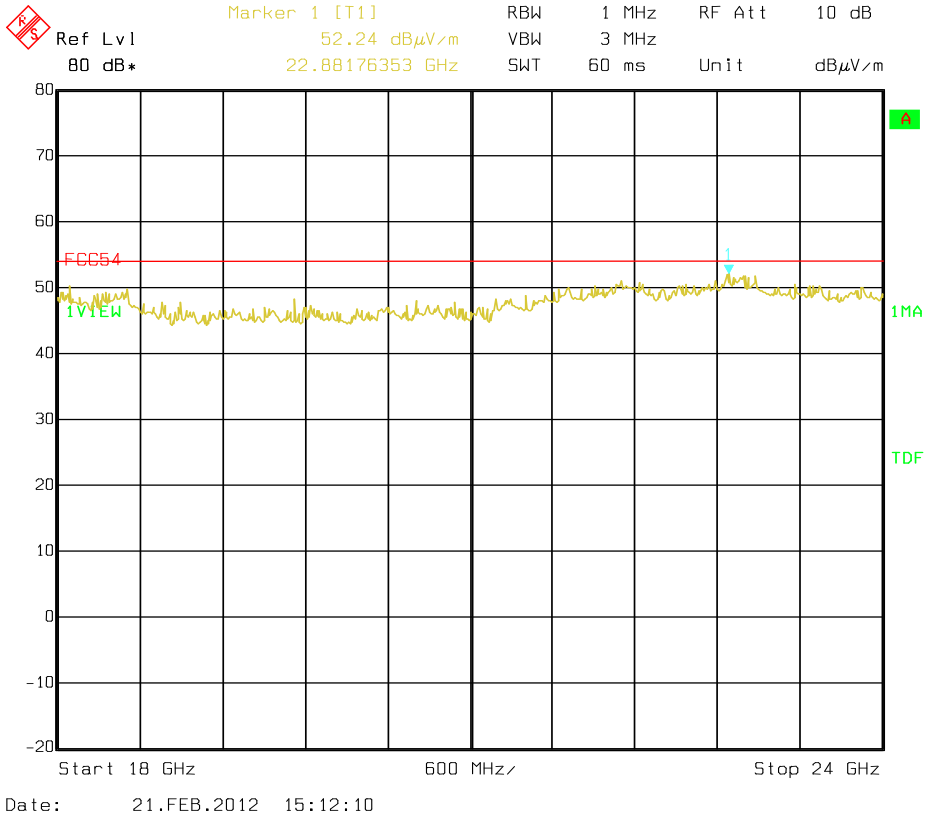
Channel 18: 8-12GHz – Average Detector



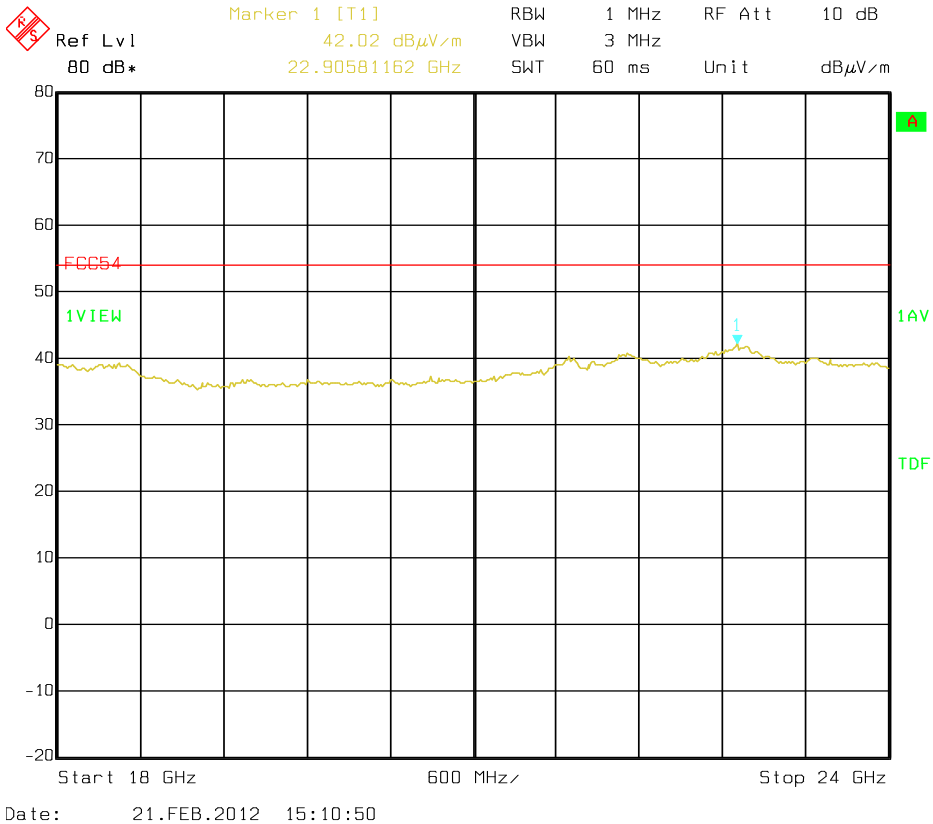
Channel 18: 12-18GHz – Peak Detector



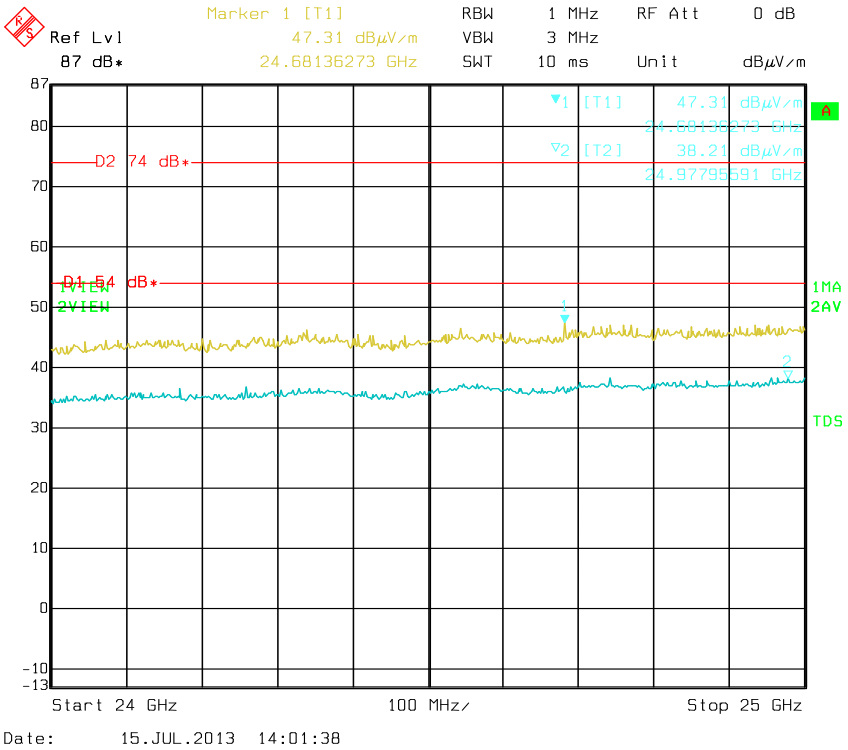
Channel 18: 12-18GHz – Average Detector



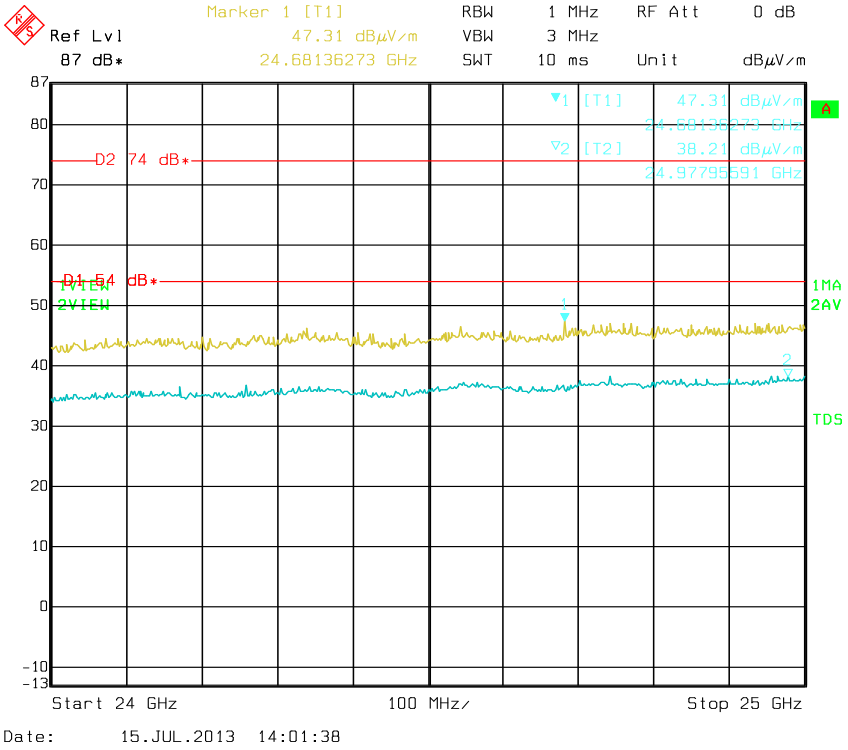
Channel 18: 18-24GHz – Peak Detector



Channel 18: 18-24GHz – Average Detector



Channel 18: 24 -25GHz
Combined Average and Peak Detectors(Vert)



Channel 18: 24-25GHz

Combined Average and Peak Detectors(Horz)

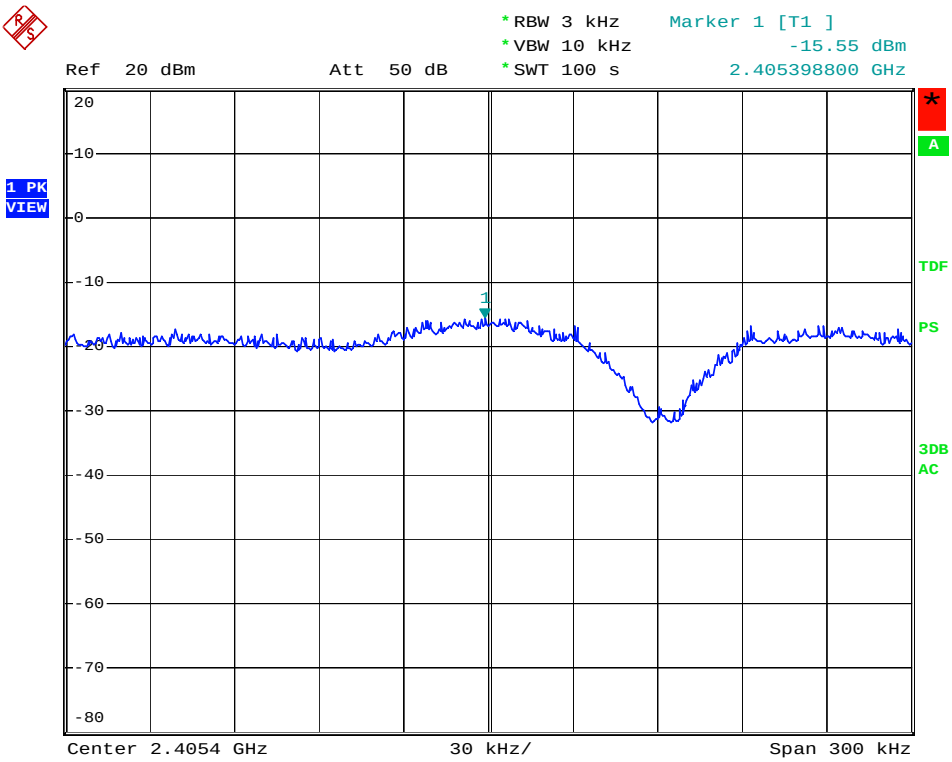
4.6 **Power Spectral Density (Conducted)**

Specifications: CFR47: Part 15:247 (e)
RSS-210: A8.2 (b)

Temperature: 20.5 °C **Relative Humidity:** 39 %

Mode of operation: Transmit Mode (Channels 11*)

* Worst case out of Ch11, Ch18 & Ch26



50C

Date: 1.MAR.2012 15:40:26

Channel	Power (dBm/3kHz)	Limit (dBm/3kHz)	Comment
11	-15.55	8.0	Pass

Maximum peak radiated power = -12.52dBm

$$Pd = \frac{Pt}{4\pi d2} = \frac{-12.52dBm}{12.566} = -1.23dBm =$$

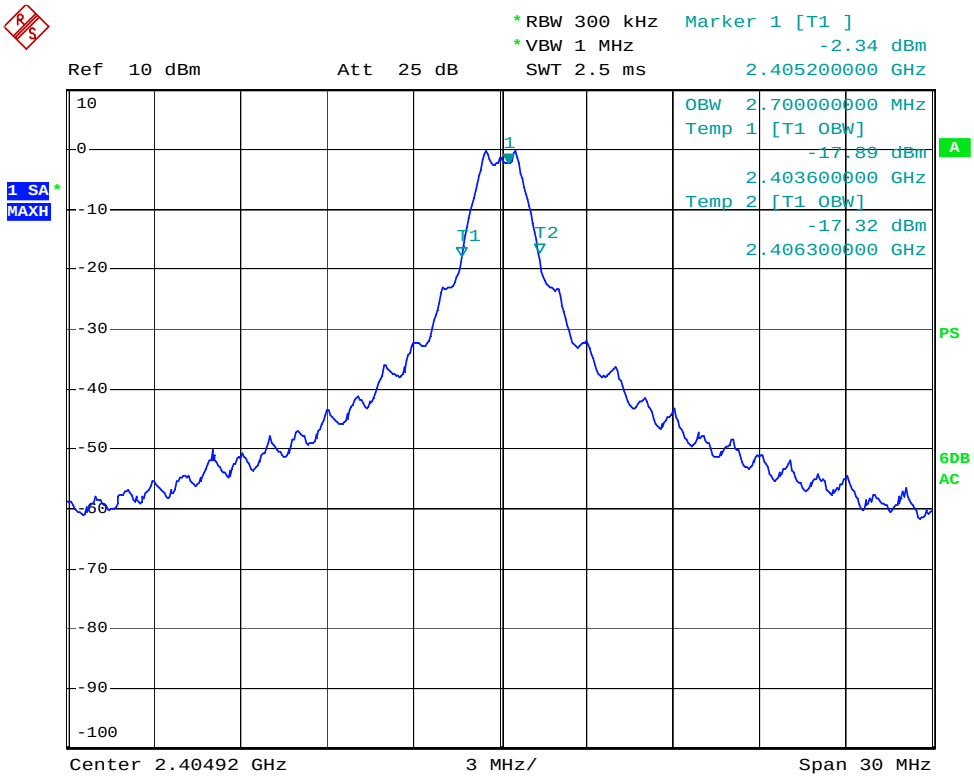
4.7 Occupied Bandwidth

Specification: RSS-Gen: 4.6.1

Temperature: 20.5 °C **Relative Humidity:** 39 %

Mode of operation: Transmit Mode (Channels 11*)

- Largest bandwidth out of Ch11, Ch18 & Ch26



50C

Date: 21.FEB.2012 09:22:32

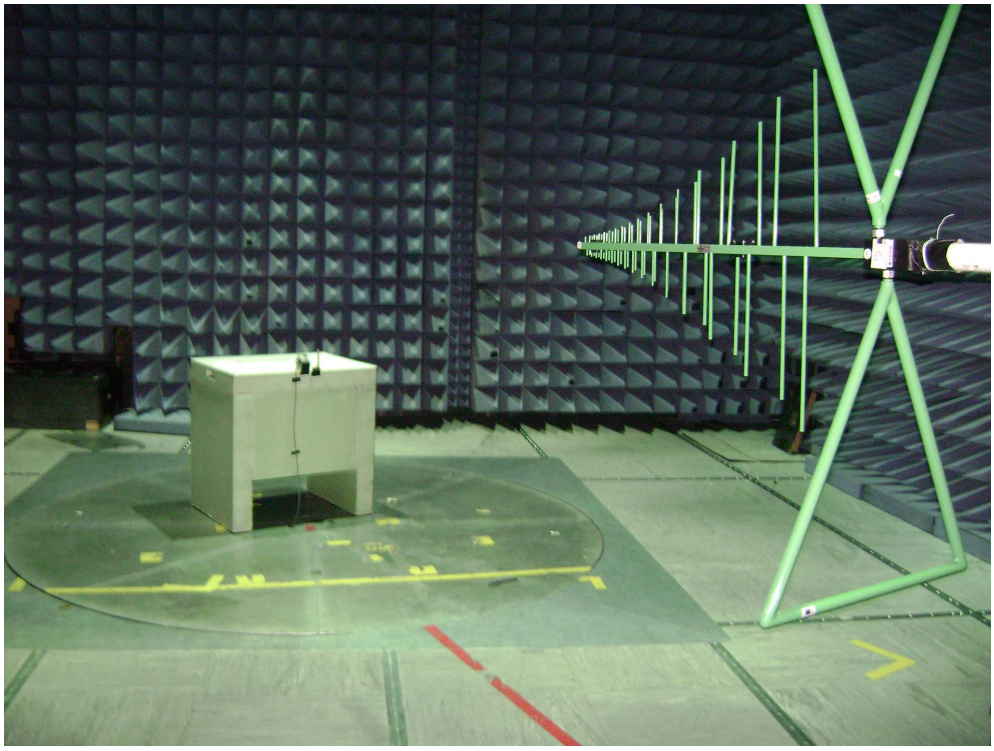
Channel 11

Channel	Occupied Bandwidth (MHz)
11	2.7

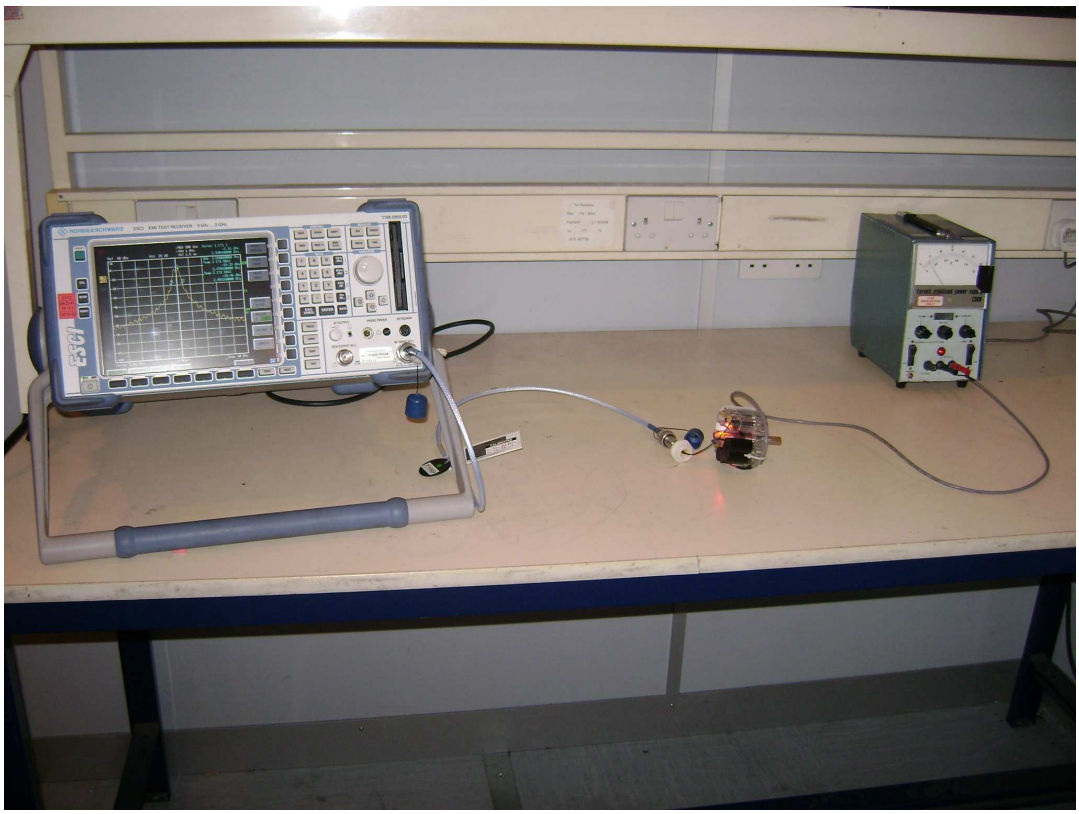
4.8 Uncertainty Budget Calculations

Symbol	Source of Uncertainty	Value	Probability distribution	Divisor	c_i	u_i(y)	$(u_i(y))^2$	v_i or v_{eff}	ui^4(y)
RI	Receiver Indication	0.05	normal 2	2.000	1	0.03	0.001	∞	0
dVsw	Receiver Sine Wave	1.60	normal 2	2.000	1	0.80	0.640	∞	0
dVpa	Receiver Pulse Amplitude	1.60	normal 2	2.000	1	0.80	0.640	∞	0
dVpr	Receiver Pulse repetition	1.60	normal 2	2.000	1	0.80	0.640	∞	0
dVnf	Noise Floor Proximity	1.60	normal 2	2.000	1	0.80	0.640	∞	0
AF	Antenna Factor Calibration	1.20	normal 2	2.000	1	0.60	0.360	∞	0
CL	Cable Loss	0.50	normal 2	2.000	1	0.25	0.063	∞	0
AD	Antenna Directivity	3.00	rectangular	1.732	1	1.73	3.000	∞	0
AH	Antenna Factor Height Dependence	1.00	rectangular	1.732	1	0.58	0.333	∞	0
AP	Antenna Phase Centre Variation	0.50	rectangular	1.732	1	0.29	0.083	∞	0
AI	Antenna Factor Frequency Interpolation	0.68	rectangular	1.732	1	0.39	0.154	∞	0
SI	Site Imperfections	4.00	triangular	2.449	1	1.63	2.667	∞	0
DV	Measurement Distance Variation	0.60	rectangular	1.732	1	0.35	0.120	∞	0
Fstep	Frequency step error	0.00	rectangular	1.732	1	0.00	0.000	∞	0
M	Mismatch	-1.99	U-shaped	1.414	1	-1.41	1.990	∞	0
	Receiver VRC 0.216		-						0
	Antenna +Cable VRC 0.95		-						0
R_S	Measurement System Repeatability	0.96	normal 1	1.000	1	0.96	0.922	13	0.0653343 51
R_{EUT}	Repeatability of EUT	0.00	normal 1	1.000	1	0.00	0.000		0
$u_c(F_S)$	Combined Standard Uncertainty		normal			3.50	12.252	2298	0.0653343 51
$U(F_S)$	**Expanded Uncertainty**		**normal k=**	**1.64**		**5.7**		2298	

5. PHOTOGRAPHS OF TEST SETUP



PHOTOGRAPHS OF RADIATED EMISSIONS TEST SET-UP



PHOTOGRAPHS OF CONDUCTED MEASUREMENTS TEST SET-UP

6. TEST EQUIPMENT

Equipment	Type	ID	Cal Due
Test Bay 1	Environment	7400	25/01/13
Rohde & Schwarz ESCI	Receiver	8357	15/02/14
Rohde & Schwarz FSEK	Analyser	7811	19/08/14
Schaffner CBL6112B	Bilog Antenna	8164	02/05/15
EMCO 3161-01 (1-2GHz)	Horn Antenna	8334	11/04/15
EMCO 3161-02 (2-4GHz)	Horn Antenna	8327	12/04/15
EMCO 3161-03 (4-8GHz)	Horn Antenna	7617	04/02/15
EMCO 3160-07 (8-12.4GHz)	Horn Antenna	7614*	04/02/15
Scientific Atlanta (12.4-18GHz)	Horn Antenna	7615	03/05/15
Scientific Atlanta (18-26.5GHz)	Horn Antenna	7513	21/05/15
ERA WBA3-4 Microwave	Pre-Amp	7534	06/12/13
Amplica inc. DKM7454 Wideband	Pre-Amp	8196	06/11/14
Narda Microwave (18-40GHz)	Pre-Amp	447**	03/07/14
N to N Type	Coaxial Cable	7602	25/04/14
N to N Type	Coaxial Cable	8183	25/04/14
N to N Type	Coaxial Cable	7569	25/04/14
N to N Type	Coaxial Cable	7287	25/02/14
MW N Type	Coaxial Cable	7176	01/07/14
MW N Type	Coaxial Cable	7177	19/10/13
MW N Type	Coaxial Cable	7169	02/07/14

* Last cal within 0.5dB of previous calibrations
** Hired from ‘EMC Hire’ includes K type cables

7. ANNEX A: REGISTRATION SITES

FEDERAL COMMUNICATIONS COMMISSION

Laboratory Division
7435 Oakland Mills Road
Columbia, MD 21046

March 27, 2009

Registration Number: 737726

Intertek
Unit D,
Imperial Park,
Leatherhead, KT22 7TS
United Kingdom

Attention: David Peasey

Re: Measurement facility located at Leatherhead, United Kingdom

Date of Listing: March 27, 2009

Dear Sir or Madam:

Your request for registration of the subject measurement facility has been reviewed and found to be in compliance with the requirements of Section 2.948 of the FCC rules. The information has, therefore, been placed on file and the name of your organization added to the list of facilities whose measurement data will be accepted in conjunction with applications for Certification under Parts 15 or 18 of the Commission's Rules. Please note that the file must be updated for any changes made to the facility and the registration must be renewed at least every three years. Please also note that this registration does not recognize the measurement facility to perform testing for products authorized under the Declaration of Conformity (DoC) process. In order to test products subject to DoC authorization process, a measurement facility must be accredited and recognized by the FCC.

Measurement facilities that have indicated that they are available to the public to perform measurement services on a fee basis may be found on the FCC website www.fcc.gov under E-Filing, OET Equipment Authorization Electronic Filing, Test Firms.

Sincerely,

Katie Hawkins

Katie Hawkins
Electronics Engineer

Industry Canada Industrie Canada

February 7, 2011

OUR FILE: 46405-2042
Submission No: 145396

Intertek Commercial & Electrical
Unit D Imperial Park Randalls Way
Leatherhead, SRY, KT22 7SB
United Kingdom

Attention: Dave Feasey

Dear Sir/Madame:

The Bureau has received your application for the renewal of a 3m alternative test site. Be advised that the information received was satisfactory to Industry Canada. The following number(s) is now associated to the site(s) for which registration / renewal was sought (**Site# 2042F-1**). Please reference the appropriate site number in the body of test reports containing measurements performed on the site. In addition, please keep for your records the following information;

- The company address code associated to the site(s) located at the above address is: **2042F**

Furthermore, to obtain or renew a unique site number, the applicant shall demonstrate that the site has been accredited to ANSI C63.4-2003 or later. A scope of accreditation indicating the accreditation by a recognized accreditation body to ANSI C63.4-2003 or later shall be accepted. Please indicate in a letter the previous assigned site number if applicable and the type of site (example: 3 metre OATS or 3 metre chamber). If the test facility is not accredited to ANSI C63.4-2003 or later, the test facility shall submit test data demonstrating full compliance with the ANSI standard. The Bureau will evaluate the filing to determine if recognition shall be granted.

The frequency for re-validation of the test site and the information that is required to be filed or retained by the testing party shall comply with the requirements established by the accrediting organization. However, in all cases, test site re-validation shall occur on an interval not to **exceed three years**. There is no fee or form associated with an OATS filing. OATS submissions are encouraged to be submitted electronically to the Bureau using the following URL;
http://strategis.ic.gc.ca/epic/internet/inceb-bhst.nsf/en/h_tt00052e.html.

If you have any questions, you may contact the Bureau by e-mail at certification.bureau@ic.gc.ca Please reference our file and submission number above for all correspondence.

Yours sincerely,

Dalwinder Gill
For: Wireless Laboratory Manager
Certification and Engineering Bureau
3701 Carling Ave., Building 94
P.O. Box 11490, Station "H"
Ottawa, Ontario K2H 8S2
Email: dalwinder.gill@ic.gc.ca
Tel. No. (613) 998-8363
Fax. No. (613) 990-4752