

TEST REPORT FROM RFI GLOBAL SERVICES LTD

Test of: Siemens SITRANS LR560, 7ML5400 TLPR HART Variant

FCC ID: NJA-LR560

To: FCC Part 15.207 and Part 15.209: 2010 Subpart B

Test Report Serial No:
RFI-RPT-RP78054JD01B V3.0

Version 3.0 supersedes all previous versions

**This Test Report Is Issued Under The Authority
Of Chris Guy, Head of Global Approvals:**



Checked By:

Ian Watch

Signature:



Date of Issue:

15 December 2010

This report is issued in Adobe Acrobat portable document format (PDF). It is only a valid copy of the report if it is being viewed in PDF format with the following security options not allowed: Changing the document, Selecting text and graphics, Adding or changing notes and form fields.

This report may not be reproduced other than in full, except with the prior written approval of RFI Global Services Ltd. The results in this report apply only to the sample(s) tested.

RFI Global Services Ltd

Pavilion A, Ashwood Park, Ashwood Way, Basingstoke, Hampshire RG23 8BG
Telephone: +44 (0)1256 312000 Facsimile: +44 (0)1256 312001
Email: info@rfi-global.com Website: www.rfi-global.com

Registered in England and Wales. Company number: 2117901

This page has been left intentionally blank.

Table of Contents

1. Customer Information	4
2. Summary of Testing	5
3. Equipment Under Test (EUT)	7
4. Operation and Monitoring of the EUT during Testing	9
5. Measurements, Examinations and Derived Results	10
6. Measurement Uncertainty	36
Appendix 1. Test Equipment Used	37

1. Customer Information

Company Name:	Siemens Milltronics Process Instrument Inc.
Address:	1954 Technology Drive P.O. Box 4225 Peterborough, ON Canada K9J 7B1

2. Summary of Testing

2.1. General Information

Specification Reference:	47CFR15.207 and 47CFR15.209 Tested in accordance with Notice of Proposed Rulemaking and Order to allow tank level probing radar devices to operate in the 77-81 GHz frequency band on an unlicensed basis under the provisions of Part 15 of the Commissions' rules, request released January 19, 2010. RM-11352 (ET Docket 10-23).
Specification Title:	Code of Federal Regulations Volume 47 (Telecommunications) 2010: Part 15 Subpart B (Radio Frequency Devices) - Sections 15.207 and 15.209
Site Registration:	FCC: 209735
Location of Testing:	RFI Global Services Ltd, Wade Road, Basingstoke, Hampshire, RG24 8AH.
Test Dates:	26 July 2010 to 29 September 2010

2.2. Summary of Test Results

FCC Reference (47CFR)	Measurement	Result
FCC Part 15.207	Transmitter AC Conducted Spurious Emissions	
FCC Part 15.209(a)	Transmitter Radiated Spurious Emissions	
FCC Part 2.1049	Transmitter 20 dB Bandwidth	
Paragraph 41 of Notice of Proposed Rule Making and Order. See Note 2.	Equivalent Isotropic Radiated Power and Fundamental / Harmonic Measurement	 Note 1
Key to Results  = Complied  = Did not comply		

Notes

1. Tested at customer's request.
2. Notice of Proposed Rulemaking and Order to allow tank level probing radar devices to operate in the 77-81 GHz frequency band on an unlicensed basis under the provisions of Part 15 of the Commissions' rules, request released January 19, 2010. RM-11352 (ET Docket 10-23).

2.3. Methods and Procedures

Reference:	ANSI C63.4 (2009)
Title:	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz

2.4. Deviations from the Test Specification

As there are no formal rules or regulations to govern the testing requirements for a tank level probing radar (TLPR) operating in the 77-81 GHz band, a notice of proposed rule making and order was released by the FCC to allow this type of product.

Testing has been performed in accordance with Notice of Proposed Rulemaking and Order to allow TLPR devices to operate in the 77-81 GHz frequency band on an unlicensed basis under the provisions of Part 15 of the Commission's rules, request released January 19, 2010. RM – 11352 (ET Docket No. 10-23).

3. Equipment Under Test (EUT)

3.1. Identification of Equipment Under Test (EUT)

Description:	Tank Level Probing Radar
Brand Name:	Siemens SITRANS LR560
Model Name or Number:	7ML5440
Variant:	HART
Serial Number:	B3-057
Hardware Version Number:	1.00.00
Software Version Number:	None Stated
FCC ID:	NJA-LR560

Description:	TPLR Tank
Dimensions:	Height: 0.78 m
	Diameter: 0.50 m

Description:	120 VAC 60 Hz AC/DC Power supply
Brand Name:	GW
Model Name or Number:	GPC-3030
Serial Number:	E835141

3.2. Description of EUT

The equipment under test was a pulsed radar system operating in the 77-81 GHz band. Its primary function is to measure the level of substances stored within a tank using low duty cycle FMCW techniques.

3.3. Modifications Incorporated in the EUT

No modifications were applied to the EUT during testing.

3.4. Additional Information Related to Testing

Category of Equipment:	TLPR	
Type of Equipment	Low Duty Cycle FMCW Radar	
Intended Operating Environment:	Industrial	
Modulation Type:	Interrupted FMCW	
Duty Cycle	< 1% typically 4 ms / 8 seconds (every 2.5 seconds for test purposes)	
Antenna Connection Type:	Integral	
Power Supply Requirement:	Nominal	24.0 VDC
	Minimum	20.4 VDC
	Maximum	27.6 VDC
Tested Temperature Range:	Minimum	-20 °C
	Maximum	+55 °C
Transmit Frequency Range:	78 GHz – 79.3 GHz	
Receive Frequency Range:	78 GHz – 79.3 GHz	

3.5. Support Equipment

No support equipment was used to exercise the EUT during testing.

4. Operation and Monitoring of the EUT during Testing

4.1. Operating Modes

The EUT was tested in the following operating mode(s):

- Transmitting and receiving a CW swept pulsed radar signal.
- Two methods were used to verify that the EUT was operating as intended for testing. Firstly an ammeter was used to check that the current consumption was as defined by the Client. Second, the EUT display screen was monitored.

4.2. Configuration and Peripherals

The EUT was tested in the following configuration(s):

- The EUT was powered from a DC power supply during the testing.
- The EUT display screen was attached to the EUT.
- For radiated spurious emissions testing, the EUT had two different test requirements:
 1. The EUT was fixed to the test tank (details of dimensions can be found in section 3.1 – Identification of Equipment Under Test) and was operating in normal mode. Emissions were performed as directed up to 250 GHz
 2. The EUT was detached from the test tank. The EUT was positioned pointing directly at the measurement antenna and radiated emissions testing performed up to 40 GHz.
- 20 dB bandwidth tests were performed with the EUT fixed at a defined distance of 0.5m from the measurement antenna. To ensure that the measurement antenna was within the bore sight of the EUT, the EUT was pointing directly at the measurement antenna with both the EUT and measurement antenna fixed in position.
- AC conducted emission tests were performed with the EUT powered at nominal DC voltage from an AC/DC bench power supply. The power supply AC input was connected to a LISN. The LISN input was connected to a 120 VAC 60 Hz supply.

5. Measurements, Examinations and Derived Results

5.1. General Comments

Measurement uncertainties are evaluated in accordance with current best practice. Our reported expanded uncertainties are based on standard uncertainties, which are multiplied by an appropriate coverage factor to provide a statistical confidence level of approximately 95%. Please refer to *Section 6. Measurement Uncertainty* for details.

5.2. Test Results

5.2.1. Transmitter AC Conducted Spurious Emissions

Test Summary:

Test Engineer:	Fara Razally	Test Date:	26 August 2010
Test Sample Serial No:	B3-057		

FCC Part:	15.207(a)
Test Method Used:	As detailed in ANSI C63.4 Section 7

Environmental Conditions:

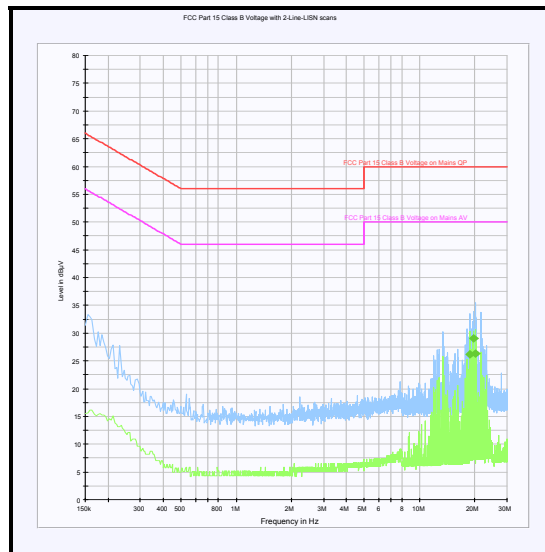
Temperature (°C):	26
Relative Humidity (%):	30

Results: Average Detector Measurements

Frequency (MHz)	Line	Level (dBμV)	Limit (dBμV)	Margin (dB)	Result
18.915	Live	26.2	50.0	23.8	Complied
19.707	Live	29.1	50.0	20.9	Complied
20.256	Live	26.3	50.0	23.7	Complied

Note(s):

- Quasi-peak measurements were not performed as the average measurements were >20 dB below the applicable limits.



Note: This plot is a pre-scan and for indication purposes only. For final measurements, see accompanying tables.

5.2.2. Transmitter 20 dB Bandwidth**Test Summary:**

Test Engineer:	Fara Razally	Test Date:	26 August 2010
Test Sample Serial No:	B3-057		

FCC Part:	2.1049
Test Method Used:	As detailed in ANSI C63.4 Section 13.7

Environmental Conditions:

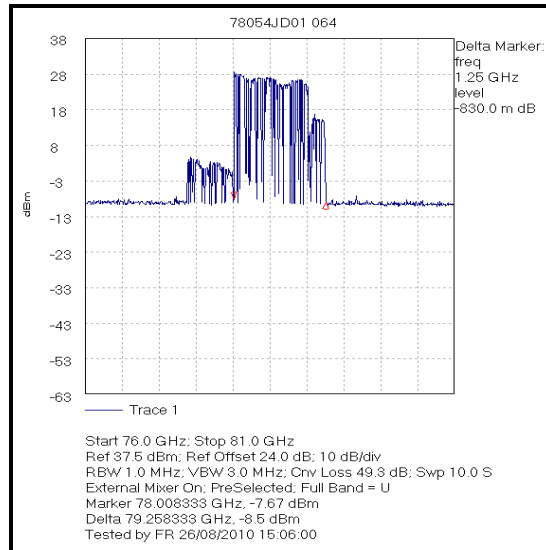
Ambient Temperature (°C):	25
Ambient Relative Humidity (%):	33

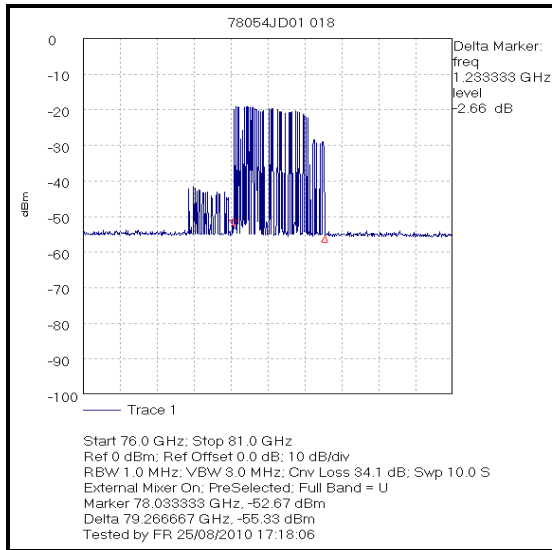
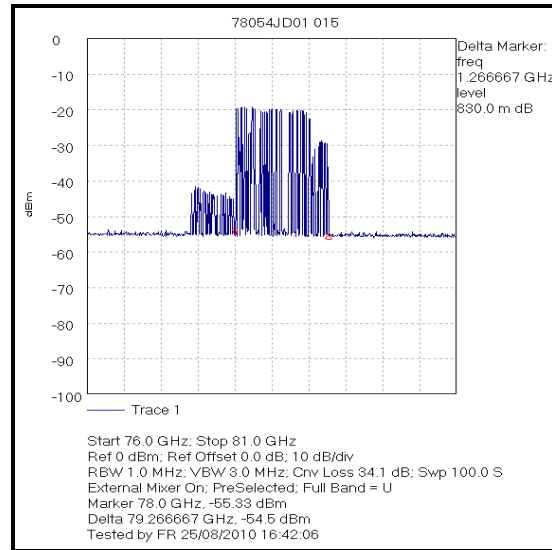
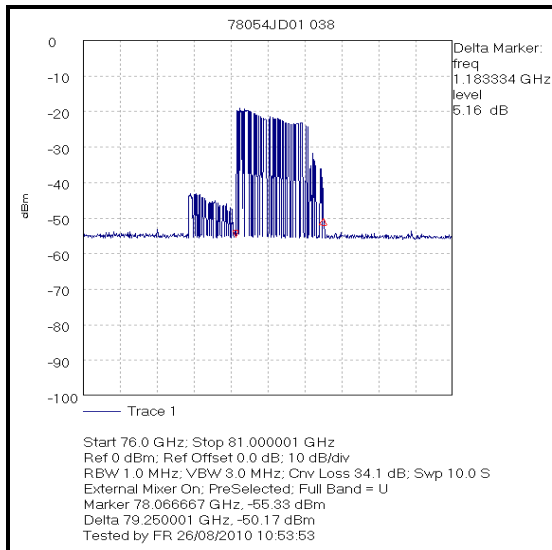
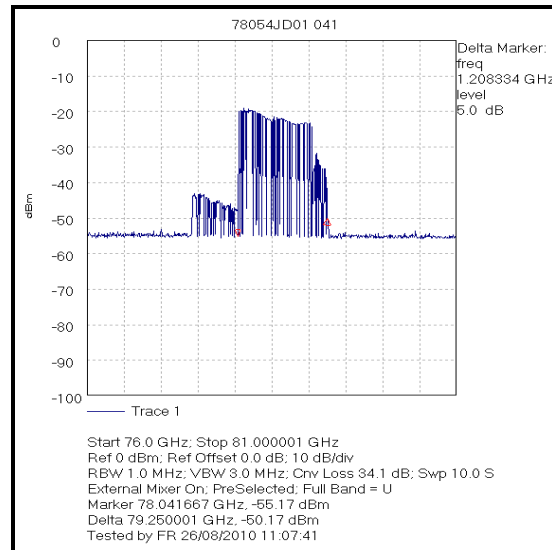
Results:

Temperature (°C)	Voltage (V)	Measured 20 dB Bandwidth (MHz)	Result
25	24.0	1250	Complied
-20	20.4	1233	Complied
	27.6	1267	Complied
+55	20.4	1183	Complied
	27.6	1208	Complied

Note(s):

1. The EUT and spectrum analyser was configured for radiated measurements. The EUT was mounted onto a measurement fixture to allow a constant and stable measurement. The measurement antenna was also mounted into a fixture at a fixed distance of 50 cm from the EUT's antenna aperture.
2. The spectrum analyser was configured with a resolution bandwidth and video bandwidth of 1 MHz & 3 MHz respectively.
3. The analyser was set for a maximum hold scan with a positive peak detector to capture the profile of the signal. The spectrum analyser was allowed to continuously sweep for a long period of time until the emission had maximised.
4. As the emission on the plot is vertical at the -20 dBc points it was not possible to place markers at exactly the -20 dBc levels. The markers were moved away from the centre of the carrier to record the upper and lower frequencies at levels in excess of -20 dBc. These frequencies are greater than the -20 dBc point frequencies and the results confirm compliance.

Transmitter 20 dB Bandwidth (continued)**Nominal**

Transmitter 20 dB Bandwidth (continued)**Low Voltage Extreme -20°C****High Voltage Extreme -20°C****Low Voltage Extreme +55°C****High Voltage Extreme +55°C**

5.2.3. Transmitter Radiated Spurious Emissions: TLPR fixed to Test Tank**Test Summary:**

Test Engineer:	Fara Razally	Test Date:	26 August 2010
Test Sample Serial No:	B3-057		
Frequency Range:	30 MHz to 1000 MHz		

FCC Part:	15.209(a)
Test Method Used:	As detailed in ANSI C63.4 Section 8 and relevant annexes

Environmental Conditions:

Ambient Temperature (°C):	26
Ambient Relative Humidity (%):	43

Results: Electric Field Strength Measurements

Frequency (MHz)	Antenna Polarity	Quasi-peak Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
50.076	Vertical	18.8	40.0	21.2	Complied
107.604	Vertical	24.1	43.0	18.9	Complied
153.292	Vertical	20.5	43.0	22.5	Complied
187.471	Horizontal	28.0	43.0	15.0	Complied
212.484	Vertical	34.0	46.0	12.0	Complied
237.482	Horizontal	37.0	46.0	9.0	Complied
328.136	Vertical	26.5	46.0	19.5	Complied

Transmitter Radiated Spurious Emissions (continued)**Note(s):**

1. Radiated emissions measurements were performed in accordance with the standard against appropriate limits for each detector function.

Initial measurements covering the frequency range of 30 MHz to 250 GHz, were performed in order to identify frequencies on which the EUT was generating interference. Pre-scans of the frequency range of 30 MHz to 4 GHz, were performed in a shielded enclosure. Scans of the frequency range of 4 GHz to 250 GHz, were performed in an anechoic chamber. In order to minimise the time taken for the swept measurements, a peak detector was used in conjunction with the appropriate detector IF measuring bandwidth (see table below). Repetitive scans were performed to allow for emissions with low repetition rates. Levels were maximised by rotating the EUT and measurement antenna. The spectrum analyser was left to repeatedly sweep on max hold for a sufficiently long period of time to capture the peak value.

Following the initial scans, graphs were produced giving an overview of the emissions from the EUT plotted against the appropriate specification limit. Any emissions within 20 dB of the limit were then measured in the test site, except in cases where the noise floor was within 20 dB of the limit, in these cases the highest point of the noise floor was measured.

All measurements were performed using broadband antennas in both vertical and horizontal polarisations.

At each frequency where a signal was to be measured, the trace was maximised by rotating the EUT through 360°. The angle at which the maximum signal was observed was locked out. For frequencies below 1000 MHz the test antenna was varied in height between 1 m and 4 m in order to further maximise the radiated emission.

For frequencies above 1000 MHz where a horn antenna was used, height searching was performed to locate the optimal height of the horn with respect to the EUT. At this point the horn was locked off and the turntable was again rotated through 360° to maximise the target signal. It should be noted that the received signal from the EUT would diminish very quickly after it exits the beam width of the horn antenna, for this reason it may not be necessary to fully height search with the horn antennas.

At this point, any signals found to be between the limit and a level 20 dB below it were further maximised by changing the configuration of the EUT, e.g. re-routing cables to peripherals and moving peripherals with respect to the EUT.

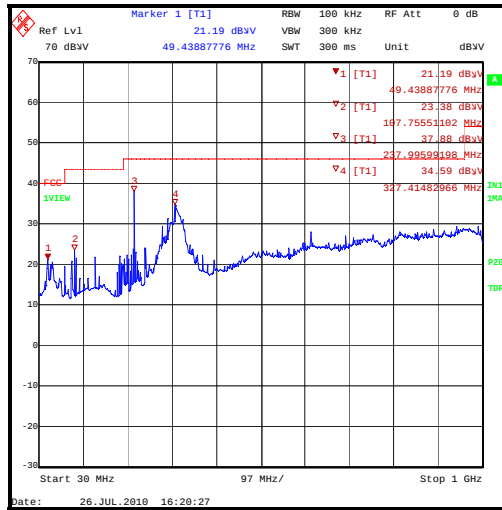
Radiated Emissions (continued)

The test equipment settings for radiated emissions measurements were as follows (unless otherwise stated below):

Receiver Function	Initial Scan	Final Measurements <1 GHz	Final Measurements ≥1 GHz
Detector Type:	Peak	Quasi-Peak (CISPR)	Average
Mode:	Max Hold	Not applicable	Max Hold
Bandwidth:	(120 kHz <1 GHz) (1 MHz ≥1 GHz)	120 kHz	1 MHz / 3 MHz
Amplitude Range:	100 dB	100 dB	100 dB
Step Size:	Continuous sweep	Not applicable	Not applicable
Sweep Time:	Coupled	Not applicable	Not applicable

The following bandwidths and measurement distances were used:

Frequency Range	Bandwidth	Measurement Distance
18 GHz to 26.5 GHz	1 MHz / 3 MHz	1 metre
26.5 GHz to 40 GHz	1 MHz / 3 MHz	0.5 metre
40 GHz to 60 GHz	100 kHz / 300 kHz	0.5 metre
60 GHz to 75 GHz	100 kHz / 300 kHz	0.5 metre
75 GHz to 110 GHz	1 MHz / 3 MHz	0.5 metre
110 GHz to 170 GHz	1 MHz / 3 MHz	0.1 metre
170 GHz to 250Hz	1 MHz / 3 MHz	0.1 metre

Transmitter Radiated Spurious Emissions (continued)

Note: This plot is a pre-scan and for indication purposes only. For final measurements, see accompanying tables.

5.2.4. Transmitter Radiated Spurious Emissions: TLPR fixed to Test Tank**Test Summary:**

Test Engineer:	Fara Razally	Test Dates:	26 July 2010 to 22 September 2010
Test Sample Serial No:	B3-057		
Frequency Range:	1 GHz to 250 GHz		

FCC Part:	15.209(a) Testing has been performed in accordance with Notice of Proposed Rulemaking and Order ET Docket No. 10-23 RM-11352.
Test Method Used:	As detailed in ANSI C63.4 Section 8 and relevant annexes

Environmental Conditions:

Ambient Temperature (°C):	22 to 26
Ambient Relative Humidity (%):	31 to 43

Results: Highest Peak Level

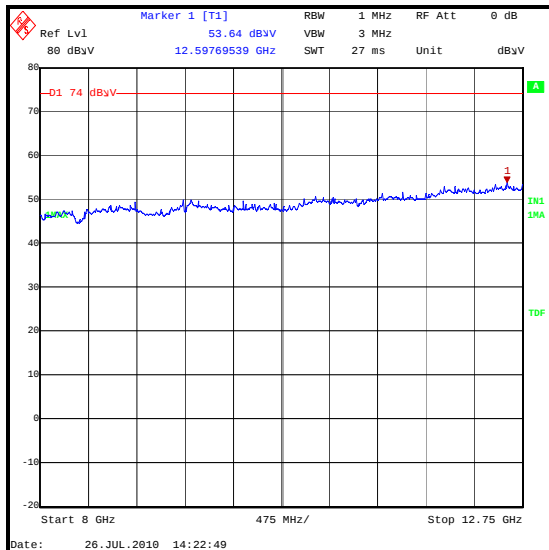
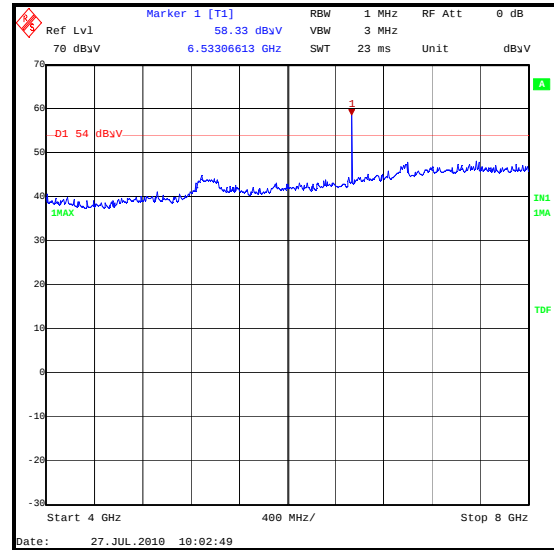
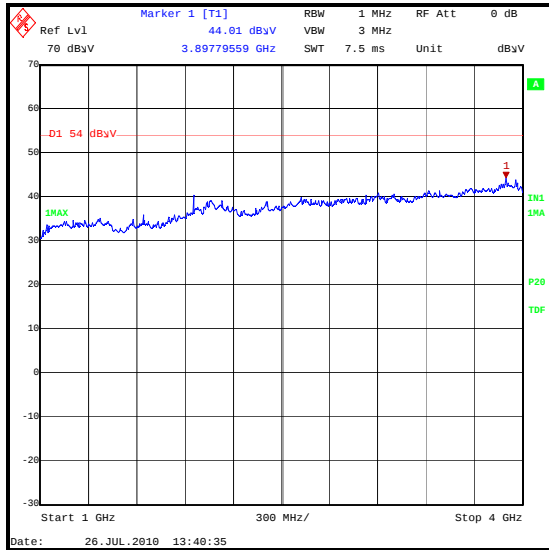
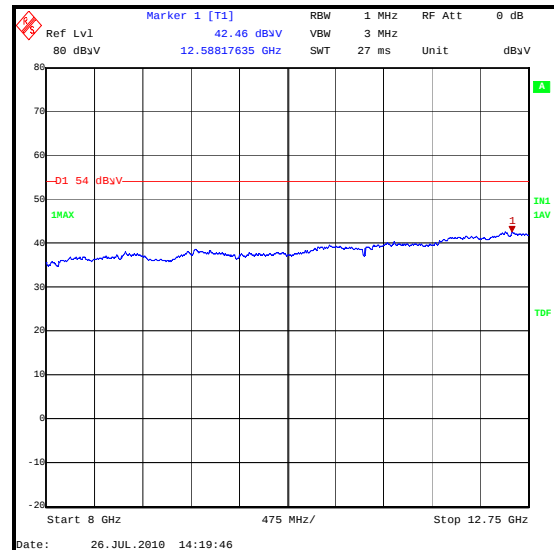
Frequency (GHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
6.500	Vertical	65.7	74.0	8.3	Complied

Results: Highest Average Level

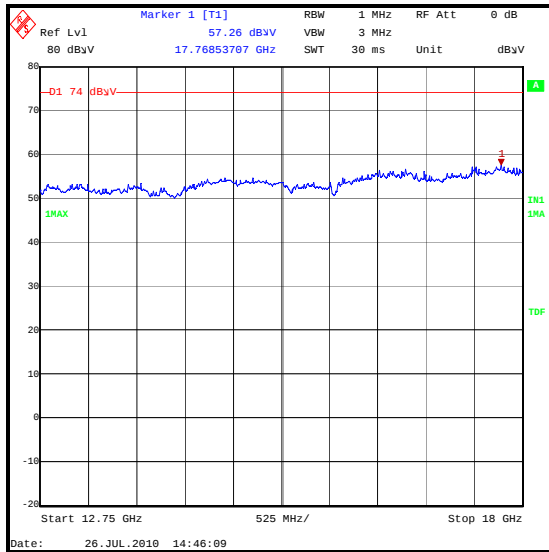
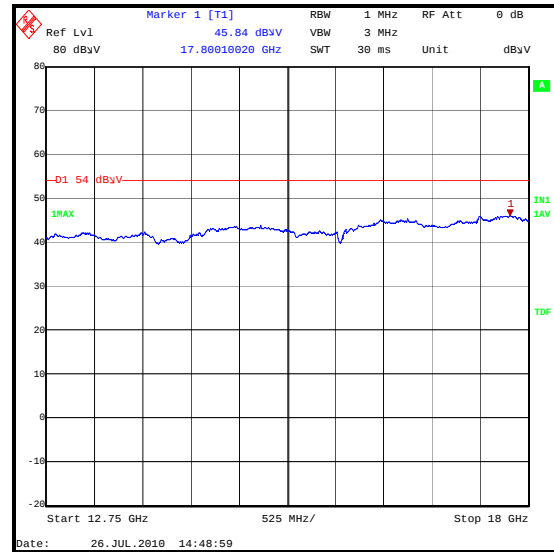
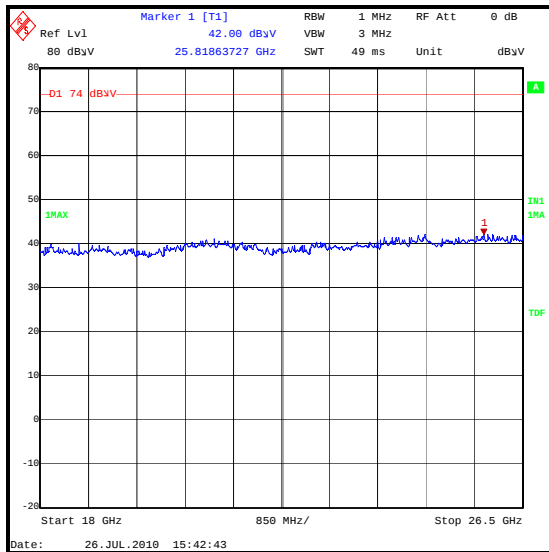
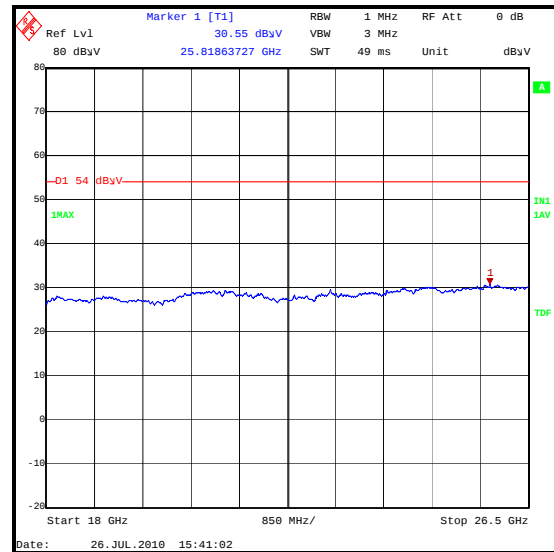
Frequency (GHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
6.500	Vertical	39.7	54.0	14.3	Complied

Note(s):

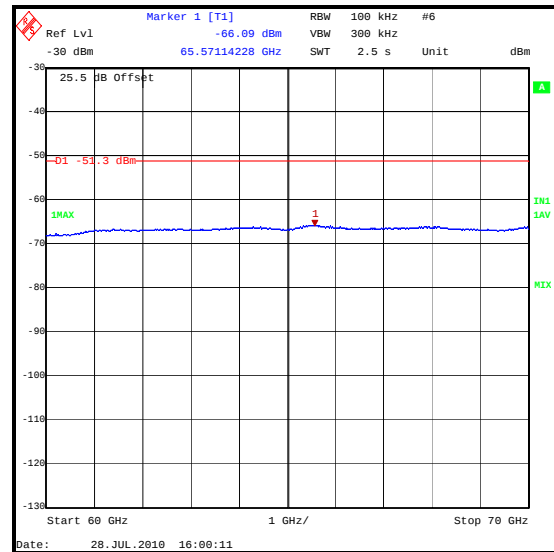
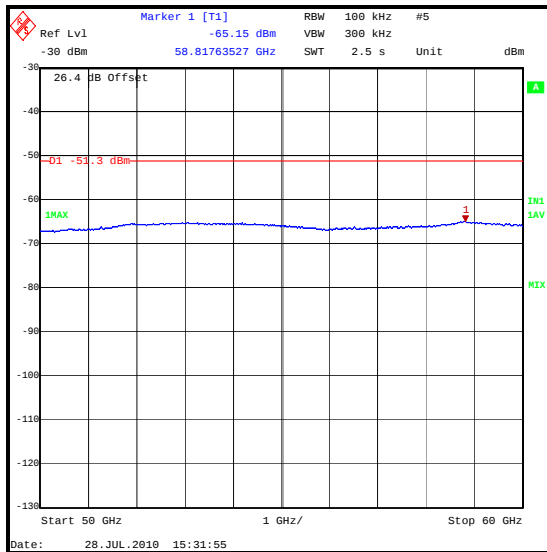
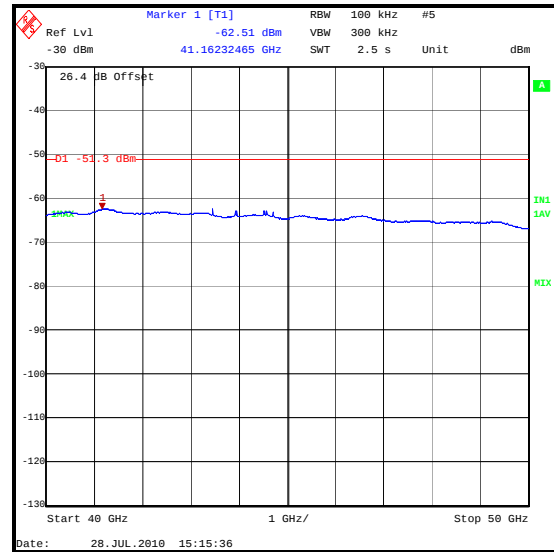
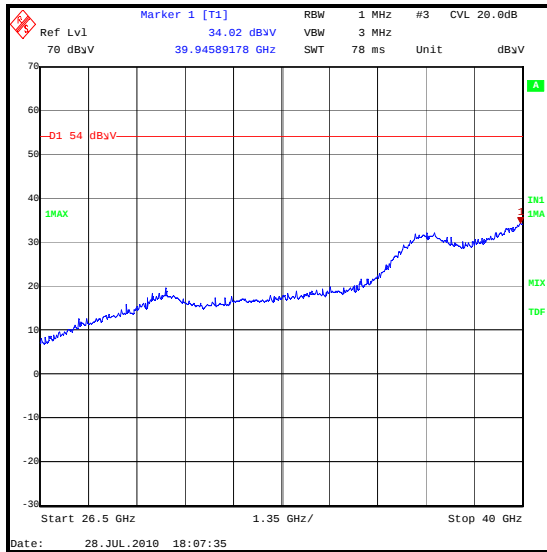
1. Pre-scans in the range 1 to 8 GHz were performed with a peak detector against average limits.
2. Pre-scans in the range of 8 to 250 GHz were performed with peak and average detectors and the applicable limit applied. This was due to the noise floor exceeding the average limit when using a peak detector.

Transmitter Radiated Spurious Emissions (continued)**Peak Detector****Average Detector**

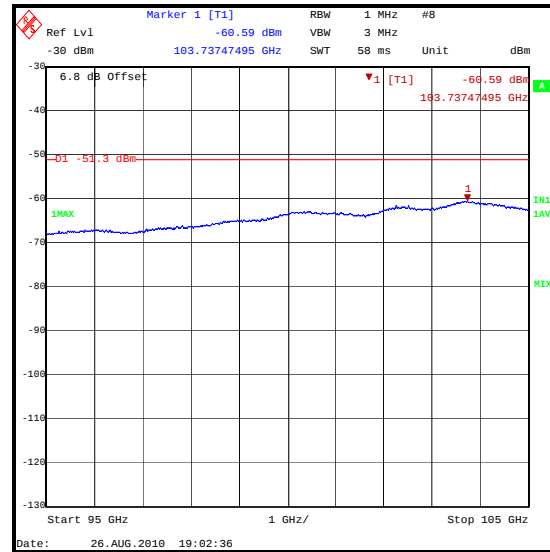
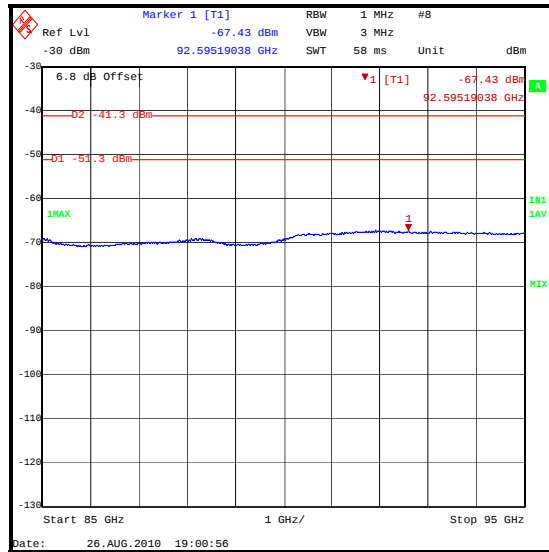
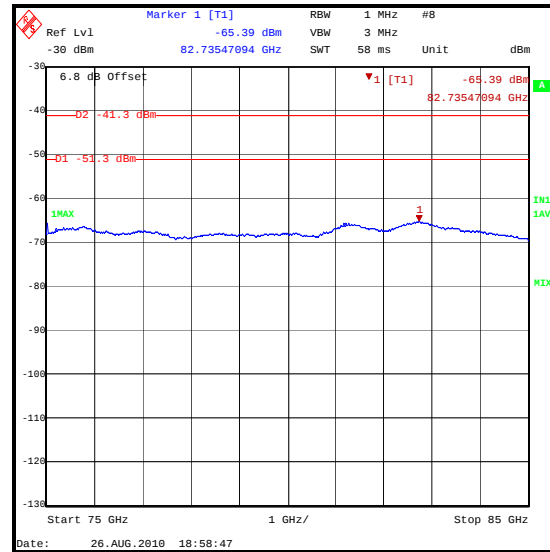
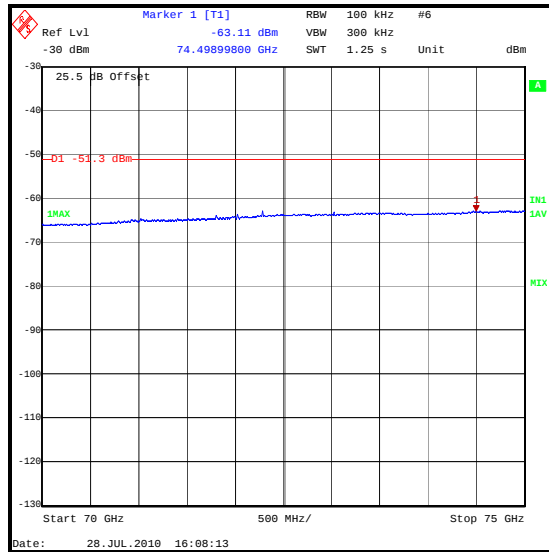
Note: These plots are pre-scans and for indication purposes only. For final measurements, see accompanying tables.

Transmitter Radiated Spurious Emissions (continued)**Peak Detector****Average Detector****Peak Detector****Average Detector**

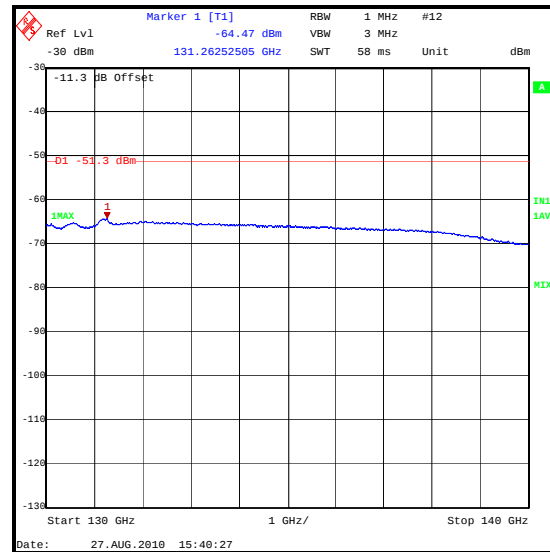
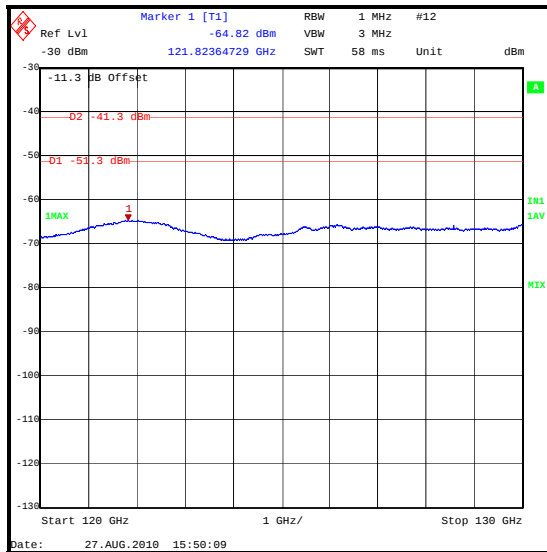
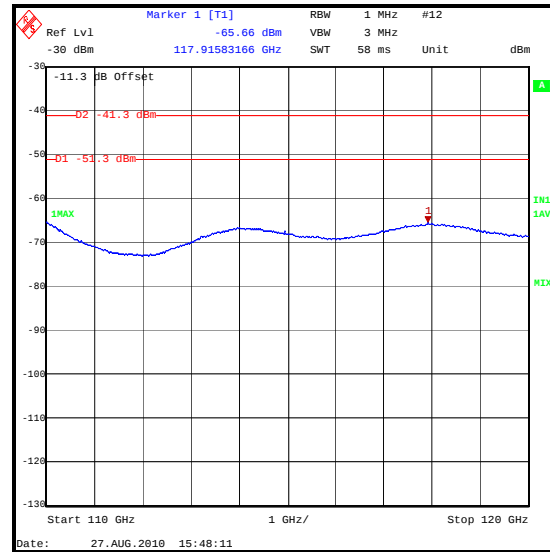
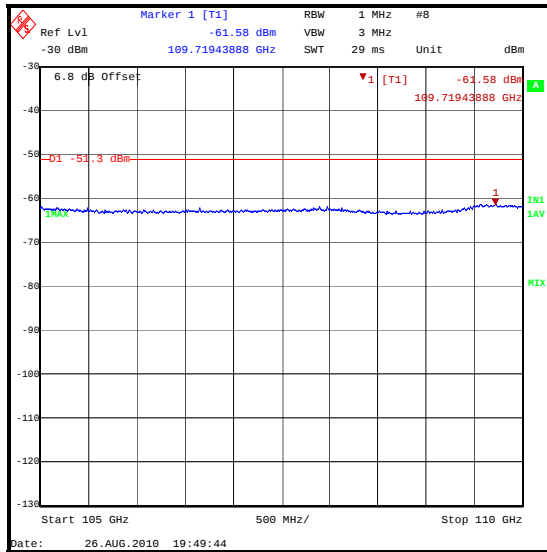
Note: These plots are pre-scans and for indication purposes only. For final measurements, see accompanying tables.

Transmitter Radiated Spurious Emissions (continued)

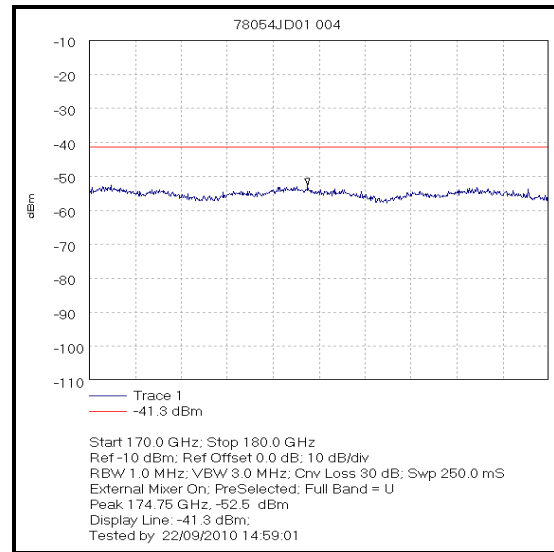
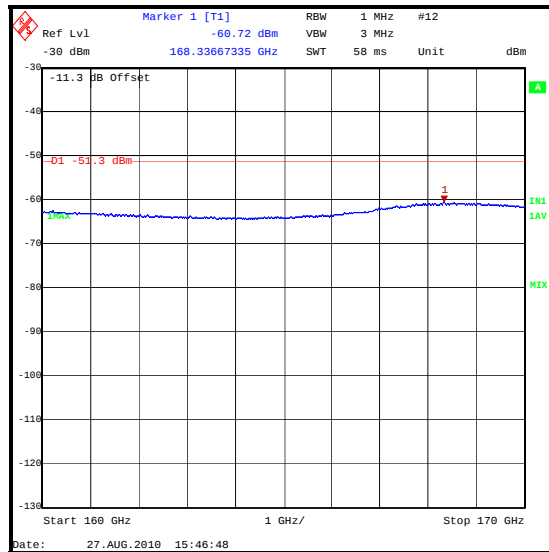
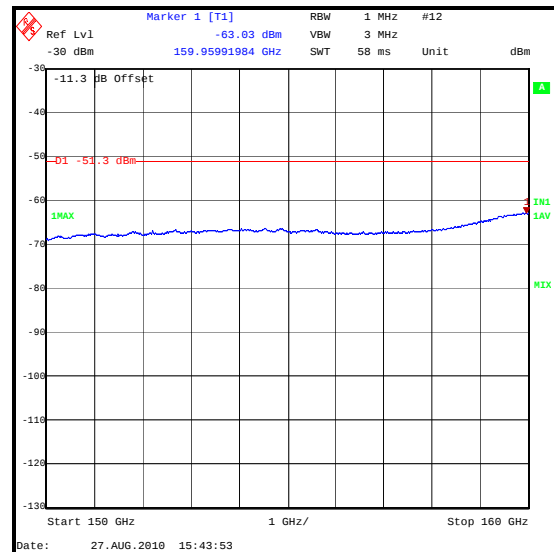
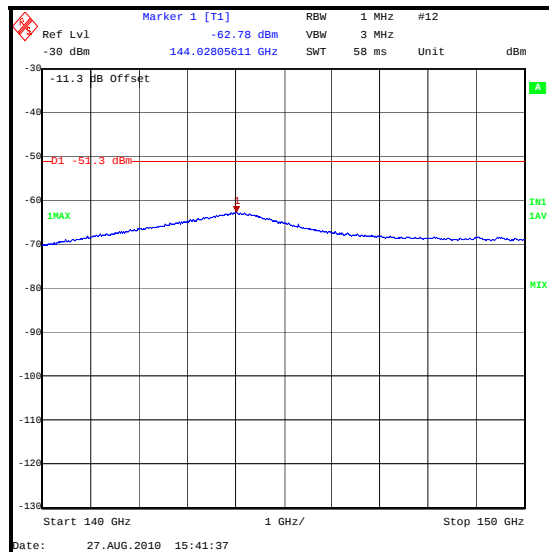
Note: These plots are pre-scans and for indication purposes only. For final measurements, see accompanying tables.

Transmitter Radiated Spurious Emissions (continued)

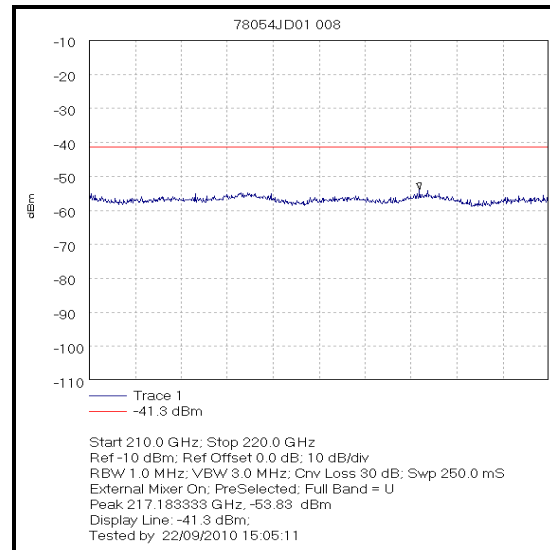
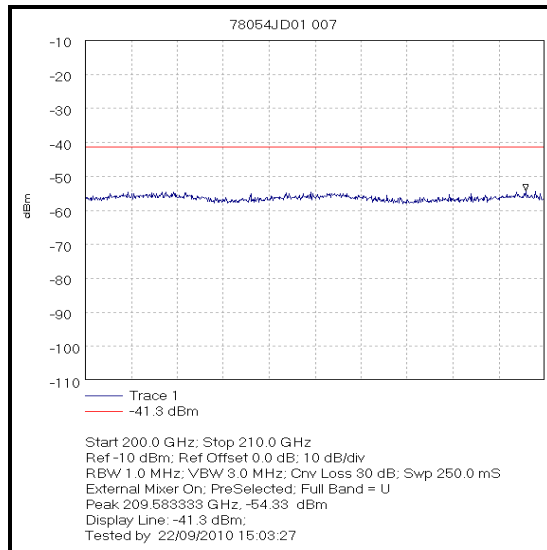
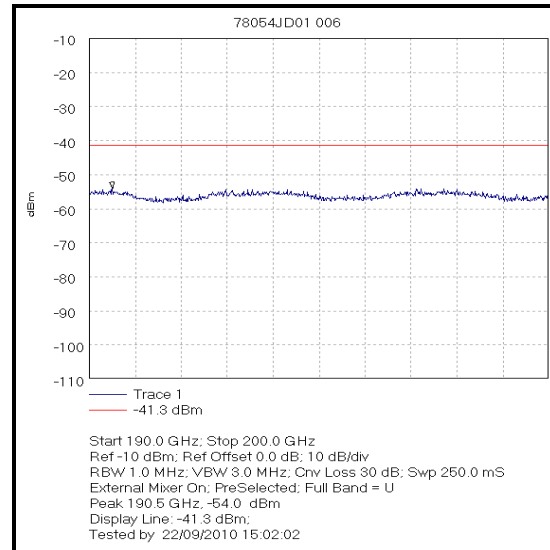
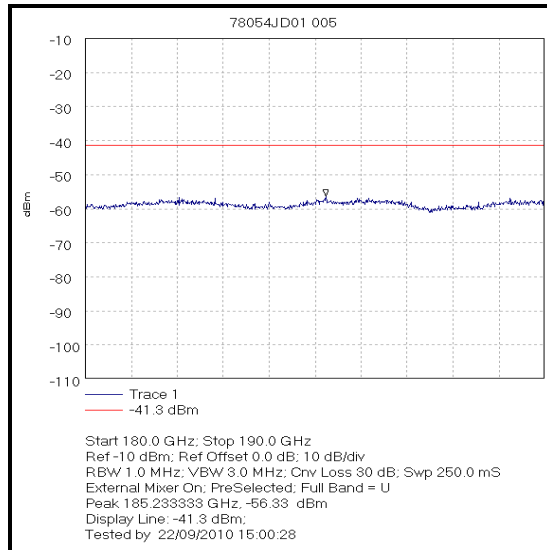
Note: These plots are pre-scans and for indication purposes only. For final measurements, see accompanying tables.

Transmitter Radiated Spurious Emissions (continued)

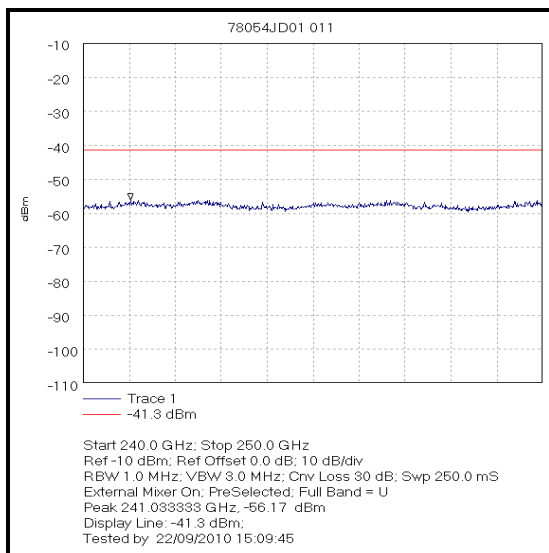
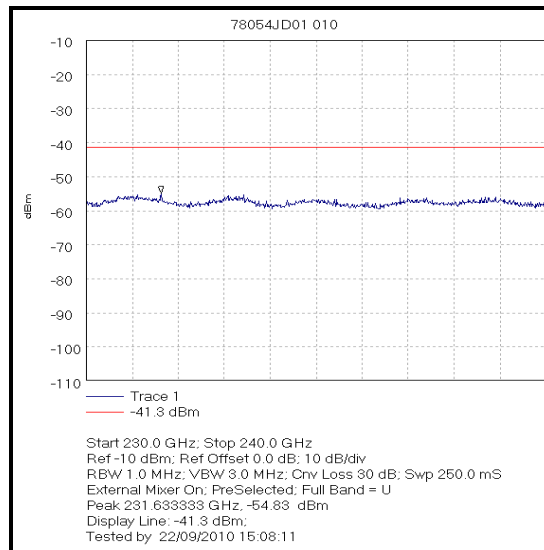
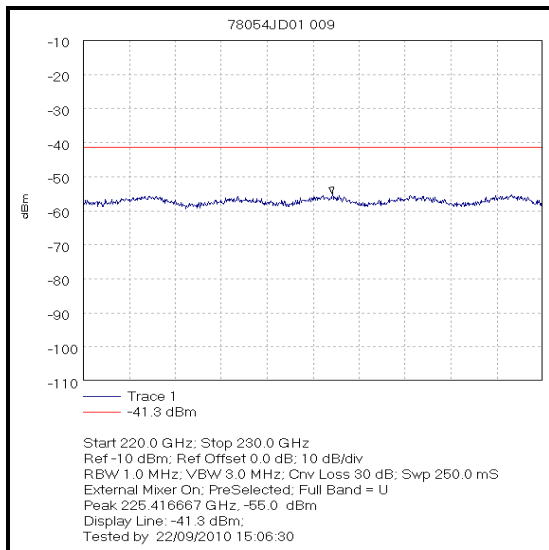
Note: These plots are pre-scans and for indication purposes only. For final measurements, see accompanying tables.

Transmitter Radiated Spurious Emissions (continued)

Note: These plots are pre-scans and for indication purposes only. For final measurements, see accompanying tables.

Transmitter Radiated Spurious Emissions (continued)

Note: These plots are pre-scans and for indication purposes only. For final measurements, see accompanying tables.

Transmitter Radiated Spurious Emissions (continued)

Note: These plots are pre-scans and for indication purposes only. For final measurements, see accompanying tables.

5.2.5. Transmitter Radiated Spurious Emissions: Antenna to Antenna (detached from Tank)**Test Summary:**

Test Engineer:	Fara Razally	Test Date:	29 July 2010
Test Sample Serial No:	B3-057		
Frequency Range:	30 MHz to 1000 MHz		

FCC Part:	15.209(a)
Test Method Used:	As detailed in ANSI C63.4 Section 8 and relevant annexes

Environmental Conditions:

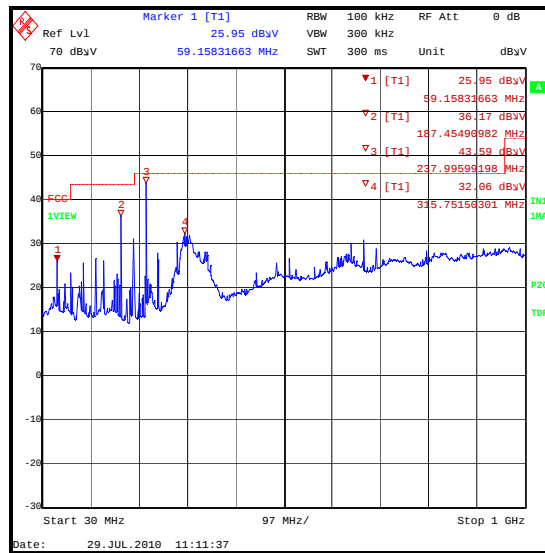
Ambient Temperature (°C):	26
Ambient Relative Humidity (%):	43

Results: Electric Field Strength Measurements

Frequency (MHz)	Antenna Polarity	Quasi-peak Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
53.124	Vertical	19.3	105.4*	86.1	Complied
107.578	Vertical	22.0	105.4*	83.4	Complied
153.305	Vertical	25.1	105.4*	80.3	Complied
162.489	Vertical	33.0	43.0	10.0	Complied
187.488	Vertical	34.0	105.4*	71.4	Complied
212.486	Vertical	35.0	105.4*	70.4	Complied
237.463	Vertical	39.0	105.4*	66.4	Complied
262.474	Vertical	36.0	46.0	10.0	Complied
299.944	Vertical	29.0	46.0	17.0	Complied
649.949	Vertical	29.0	105.4*	76.4	Complied
624.987	Vertical	30.0	105.4*	75.4	Complied
674.983	Horizontal	28.1	105.4*	77.4	Complied

Note(s):

1. *-20 dBc limit

Transmitter Radiated Spurious Emissions (continued)

Note: This plot is a pre-scan and for indication purposes only. For final measurements, see accompanying tables.

5.2.6. Transmitter Radiated Spurious Emissions: Antenna to Antenna (detached from Tank)**Test Summary:**

Test Engineer:	Fara Razally	Test Dates:	26 July 2010 to 29 July 2010
Test Sample Serial No:	B3-057		
Frequency Range:	1 GHz to 40 GHz		

FCC Part:	15.209(a) Testing has been performed in accordance with Notice of Proposed Rulemaking and Order ET Docket No. 10-23 RM-11352.
Test Method Used:	As detailed in ANSI C63.4 Section 8 and relevant annexes

Environmental Conditions:

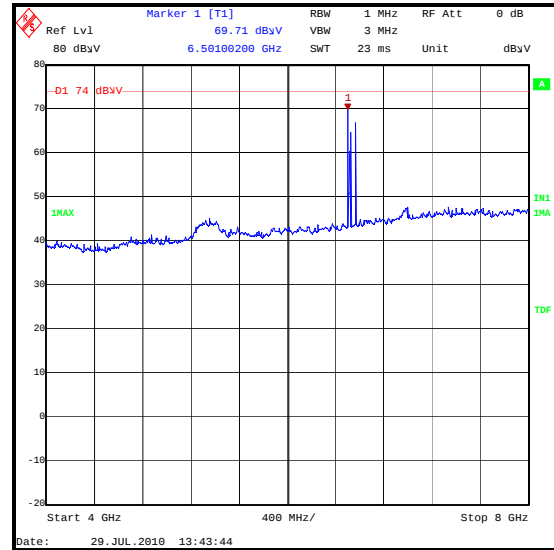
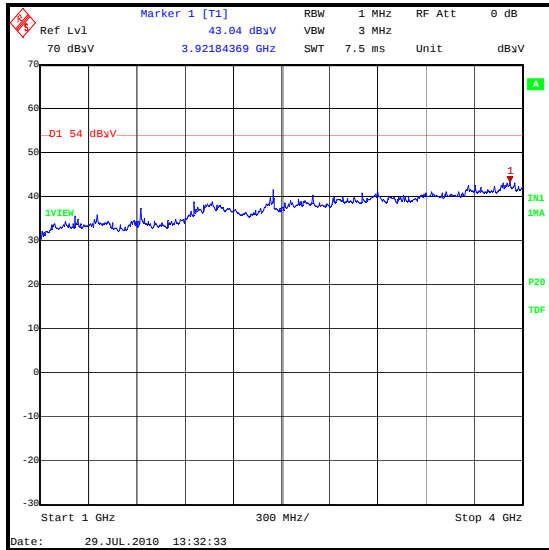
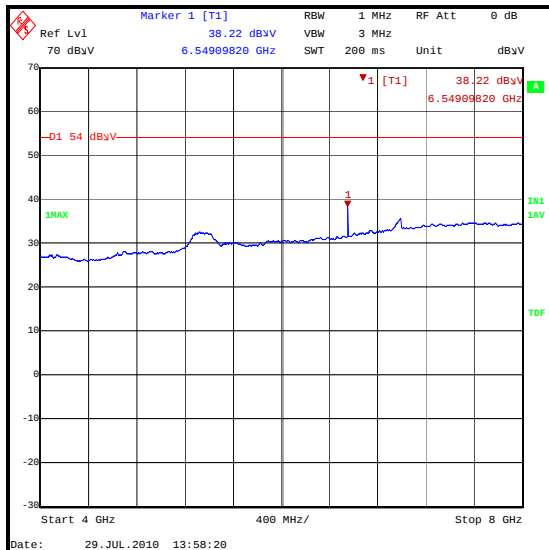
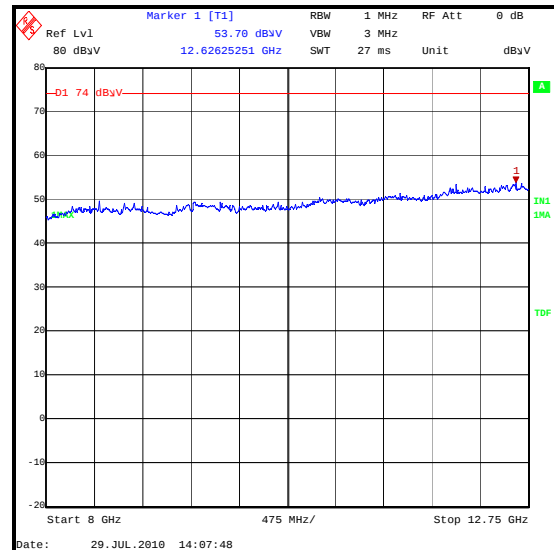
Ambient Temperature (°C):	22 to 26
Ambient Relative Humidity (%):	31 to 43

Results: Highest Peak Level

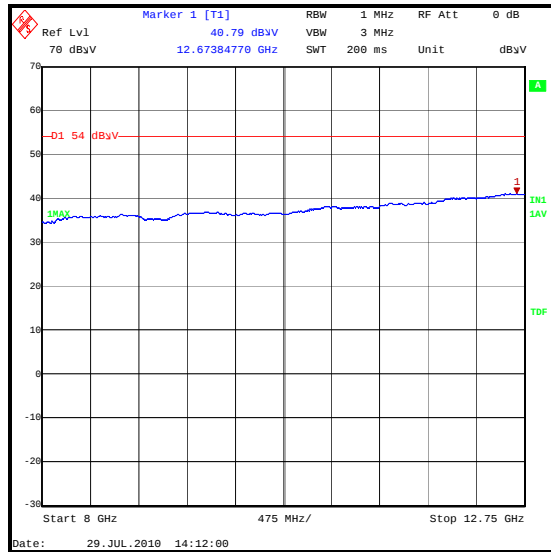
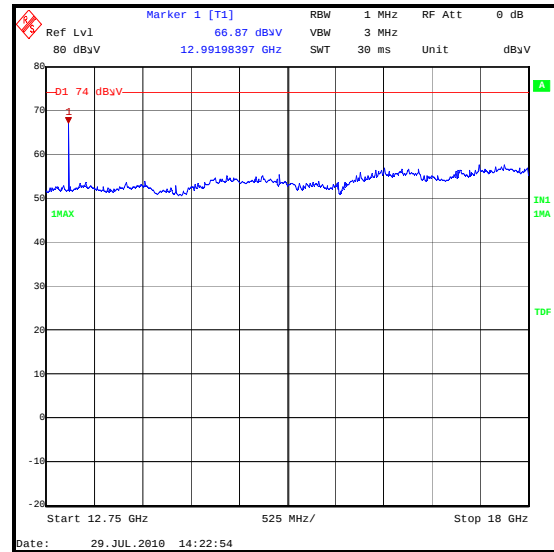
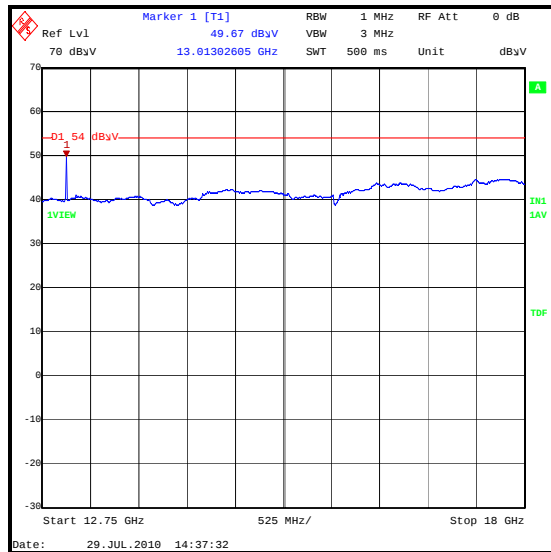
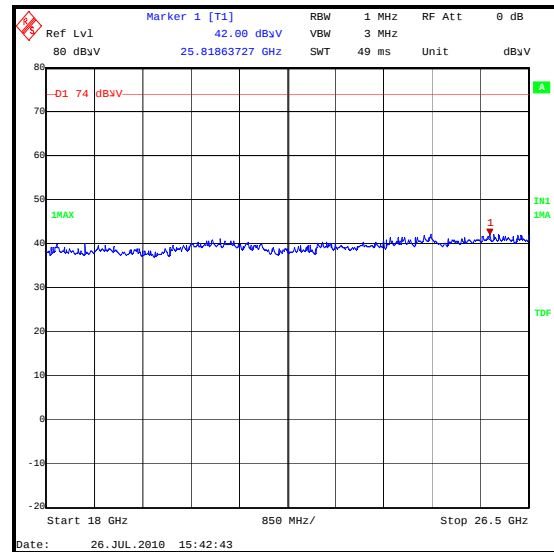
Frequency (GHz)	Antenna Polarity	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
6.548	Horizontal	67.8	105.4*	37.6	Complied
13.070	Vertical	76.2	105.4*	29.2	Complied

Note(s):

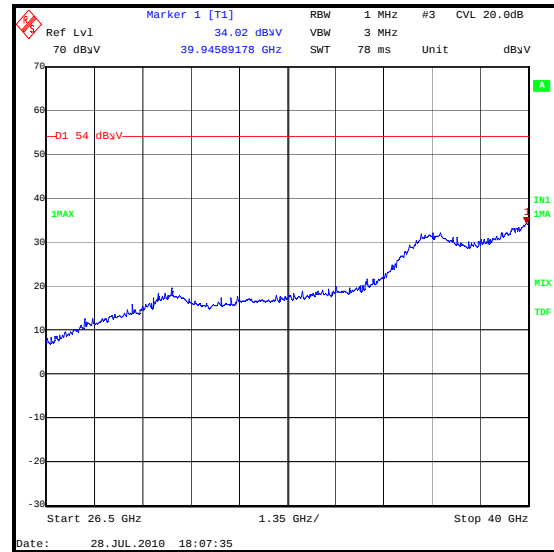
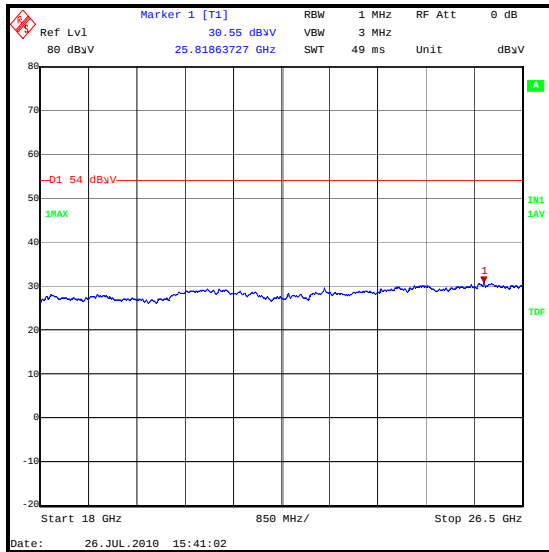
1. *-20 dBc limit
2. All pre-scans were performed with a peak detector against average limits apart from measurements made in the range of 4 to 26.5 GHz where pre-scans were performed with peak and average detectors and the applicable limit applied. This was due to the noise floor exceeding the average limit when using a peak detector.

Transmitter Radiated Spurious Emissions (continued)**Peak Detector****Average Detector****Peak Detector**

Note: These plots are pre-scans and for indication purposes only. For final measurements, see accompanying tables.

Transmitter Radiated Spurious Emissions (continued)**Average Detector****Peak Detector****Average Detector****Peak Detector**

Note: These plots are pre-scans and for indication purposes only. For final measurements, see accompanying tables.

Transmitter Radiated Spurious Emissions (continued)**Average Detector**

Note: These plots are pre-scans and for indication purposes only. For final measurements, see accompanying tables.

5.2.7. Equivalent Isotropic Radiated Power and Fundamental / Harmonic Measurements**Test Summary:**

Test Engineer:	Fara Razally	Test Dates:	26 July 2010 to 29 July 2010
Test Sample Serial No:	B3-057		
Declared EIRP:	+30.0 dBm (Peak)		
Frequency Range:	77 GHz to 235 GHz		

FCC Part:	15.209(a). Testing has been performed in accordance with Notice of Proposed Rulemaking and Order ET Docket No. 10-23 RM-11352.
Test Method Used:	As detailed in ANSI C63.4 Section 8 and relevant annexes

Environmental Conditions:

Ambient Temperature (°C):	26
Ambient Relative Humidity (%):	43

Results: Fundamental/Harmonic EIRP measured on Bench

Type	Frequency (GHz)	Measured Level (dBm)	Noise Floor (dBm)	Margin from Limit (dBm)	Result
Fundamental (Peak)	78.017	+30.2	-6.4	12.8	Complied
Fundamental (Average)	78.017	+16.2*	-6.4	6.8	Complied
2 nd Harmonic	156.034	-65.3	-65.3	24.0	Complied
3 rd Harmonic	234.051	-54.8	-54.8	13.5	Complied

* Calculated value

EIRP Limit:

Effective Isotropic Radiated Power (EIRP):	+43 dBm (Peak)
	+23 dBm (Average)

Results: Fundamental/Harmonic EIRP measured with EUT attached to the Test Tank

Type	Frequency Range (GHz)	Maximum Measured Level (dBm)	Margin from Part 15.209 limit (dB)	Result
Fundamental	78.017	-64.4	23.1	Complied
2 nd Harmonic	156.034	-65.3	24.0	Complied
3 rd Harmonic	234.051	-54.8	13.5	Complied

EIRP and Fundamental / Harmonic Measurements (continued)**Note(s):**

1. The noise floor value shown in the above table, was measured using a resolution / video bandwidth of 1 MHz / 3 MHz. No further work was performed to reduce the noise floor any further as the signal under measurement had a clearance of at least 20dB signal to noise and would not be affected by signal to noise addition.
2. Case radiation tests were performed with the EUT fitted inside the test tank. Emission levels in dBm were compared to the FCC Part 15.209 field strength limit of 54 dBµV at 3 metres. The 54 dBµV limit was converted to dBm using a factor of 95.2 dB.
3. Fundamental Peak Power shown in the table above was measured using a peak detector on a spectrum analyzer. The spectrum analyzer was allowed to sweep several times using the maximum hold function and slow sweep time until the level had maximized.
4. In accordance with the duty cycle requirements of Part 15.35(c), the measured EUT transmit pulse duration was 4 ms in 100 ms or 0.04%. The duty cycle was calculated as:
$$\text{Duty cycle (dB)} = 10 \log(\text{dwell time}/100 \text{ ms}) = 10 \log(4/100) = 14 \text{ dB}$$
5. Applying a duty cycle correction of 14 dB to the peak power measurement of 30.2 dBm gives a result of +16.2 dBm which also shows compliance with the average power limit.

6. Measurement Uncertainty

No measurement or test can ever be perfect and the imperfections give rise to error of measurement in the results. Consequently the result of a measurement is only an approximation to the value of the measurand (the specific quantity subject to measurement) and is only complete when accompanied by a statement of the uncertainty of the approximation.

The expression of uncertainty of a measurement result allows realistic comparison of results with reference values and limits given in specifications and standards.

The uncertainty of the result may need to be taken into account when interpreting the measurement results.

The reported expanded uncertainties below are based on a standard uncertainty multiplied by an appropriate coverage factor such that a confidence level of approximately 95% is maintained. For the purposes of this document "approximately" is interpreted as meaning "effectively" or "for most practical purposes".

Measurement Type	Range	Confidence Level (%)	Calculated Uncertainty
AC Conducted Spurious Emissions	0.15 MHz to 30 MHz	95%	±3.25 dB
Radiated Spurious Emissions	30 MHz to 1000 MHz	95%	±3.53 dB
Radiated Spurious Emissions	1 GHz to 26 GHz	95%	±2.94 dB
Radiated Spurious Emissions	26 GHz to 250 GHz	95%	±5.6 dB
20 dB Bandwidth	75 GHz to 81 GHz	95%	±0.92 ppm

The methods used to calculate the above uncertainties are in line with those recommended within the various measurement specifications. Where measurement specifications do not include guidelines for the evaluation of measurement uncertainty the published guidance of the appropriate accreditation body is followed.

Appendix 1. Test Equipment Used

RFI No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
A1033	Harmonic Mixer	Hewlett Packard	11970W	2521A01380	12 Jun 2011	12
A1069	Single Phase LISN	Rohde & Schwarz	ESH3-Z5	837469/012	13 Apr 2011	12
A1245	Antenna	Dorado	GH-10-25	200010	Calibrated before use	-
A1248	Antenna	Dorado	WT-EW	WT12-10	Calibrated before use	-
A1534	Pre Amplifier	Hewlett Packard	8449B	3008A00405	06 Jun 2011	12
A1818	Antenna	EMCO	3115	00075692	05 Sep 2011	12
A1916	Horn Antenna	Flann	25240-25	166399	11 May 2011	12
A1928	110 GHz to 170 GHz Horn Antenna	Flann	29240-20	166411	11 May 2011	12
A1930	170 GHz to 260 GHz Horn Antenna	Link Microtek	None	None	Calibration not required	-
A202	Antenna	Flann	24240-20	116	11 May 2013	36
A288	Antenna	Chase	CBL6111A	1589	05 Sep 2011	12
A366	Isolator	MRI	FRR-400	169	Calibration not required	-
A436	Antenna	Flann	20240-20	330	05 Sep 2011	12
G080	Preselector Power Supply	Hewlett Packard	11974-60028	0680	Calibration not required	-
G084	Microwave Amplifier	Hewlett Packard	8349B	2548A00701	Calibrated before use	-
K0002	3m RSE Chamber	Rainford EMC	N/A	N/A	05 Sep 2011	12
M1124	Spectrum Analyser	Rohde & Schwarz	ESI26	100046K	22 Apr 2011	12
M1246	Harmonic Mixer	Rohde & Schwarz	FS-Z75	100032	Calibrated before use	-
M1247	Harmonic Mixer	Rohde & Schwarz	FS-Z60	100046	Calibrated before use	-
M1248	Harmonic Mixer	Rohde & Schwarz	FS-Z110	100015	10 Aug 2011	12
M1251	Digital Multimeter	Fluke	175	89170179	15 Jul 2011	12
M1253	Spectrum Analyser	Hewlett Packard	8564E	3442A00262	26 Jan 2011	12
M1390	Harmonic Mixer	Farran Technology	WHMP 28	FTL1677B	Calibrated before use	-
M1517	170 GHz to 260 GHz Harmonic Mixer	Farran	WHM-04	FTL7153	20 Sep 2013	36
M177	Mixer	Hewlett Packard	11974V	3001A00273	Calibrated before use	-

RFI No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M181	110-170 GHz Harmonic Mixer	Farran	WHMP-06	FTL 720B	Calibrated before use	-
S0537	EL302D Dual Power Supply	TTI	EL302D	249928	Calibrated before use	-

NB In accordance with UKAS requirements all the measurement equipment is on a calibration schedule.