

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

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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:

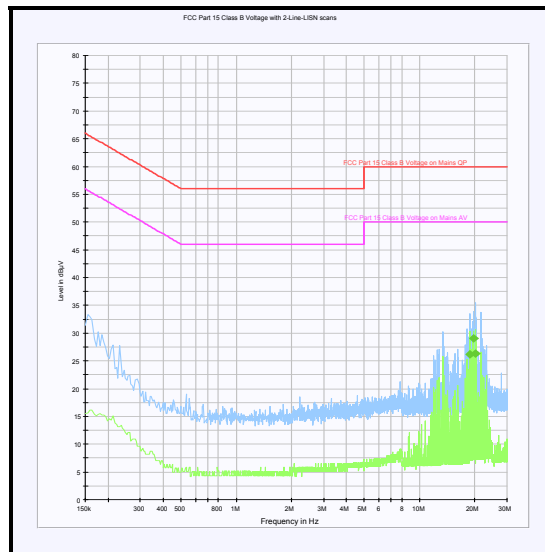
| | |
|-------------------------------|----|
| Temperature (°C): | 26 |
| Relative Humidity (%): | 30 |

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):

1. 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 |

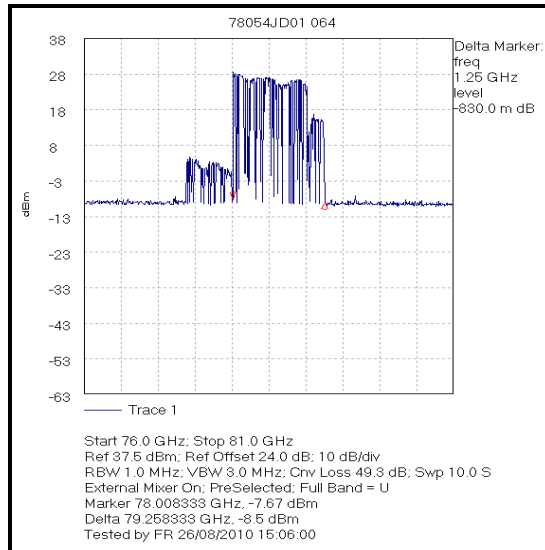
Results:

| 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):

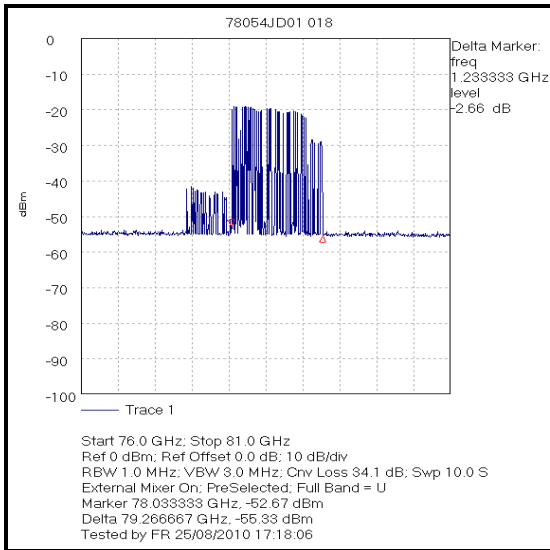
1. The EUT and spectrum analyser was configured for radiated measurements. The EUT was mounted onto a measurement fixture to allow a constant and stable measurement. The measurement antenna was also mounted into a fixture at a fixed distance of 50 cm from the EUT's antenna aperture.
2. The spectrum analyser 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)

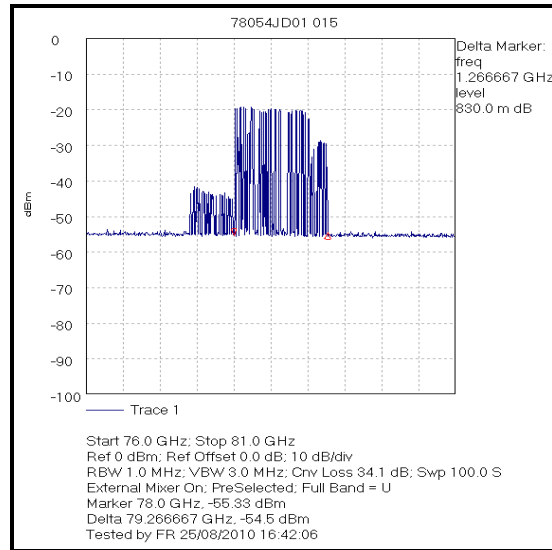


Nominal

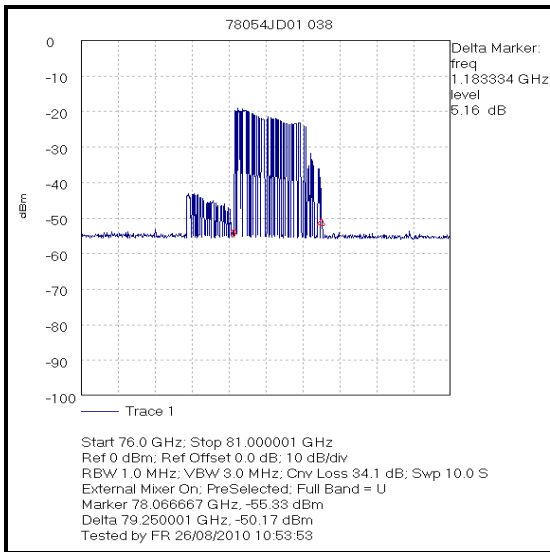
Transmitter 20 dB Bandwidth (continued)



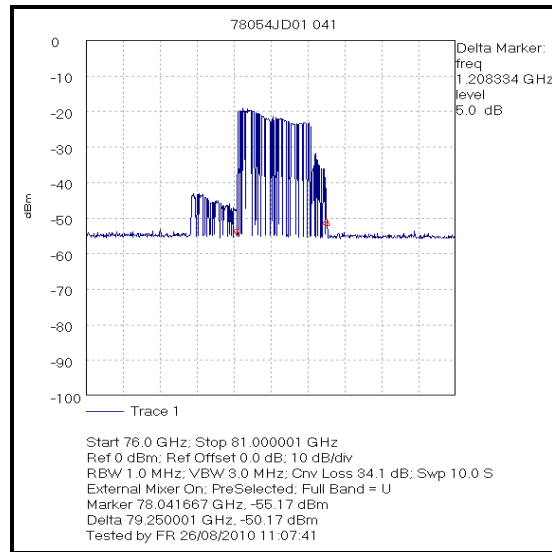
Low Voltage Extreme -20°C



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)

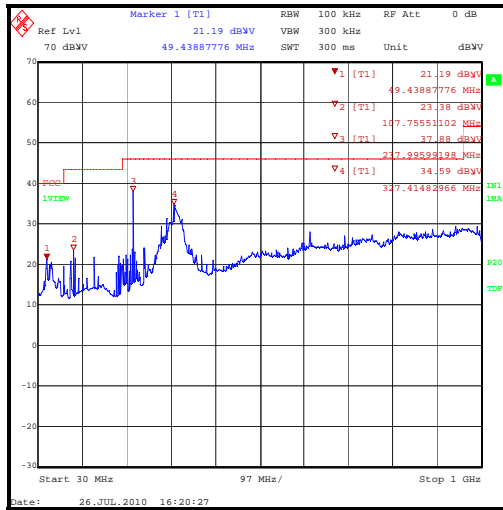
The test equipment settings for radiated emissions measurements were as follows (unless otherwise stated below):

| 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 |

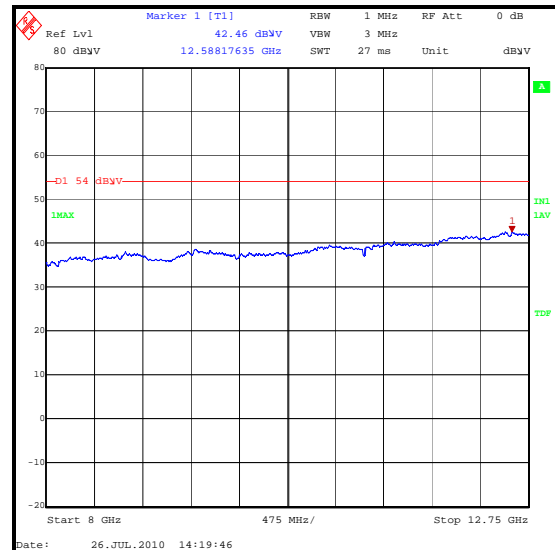
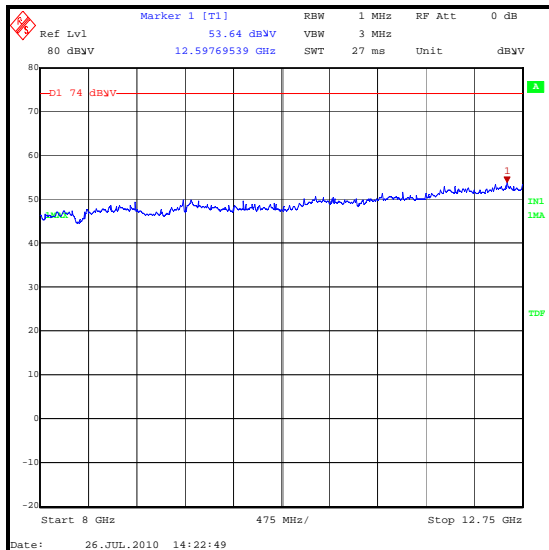
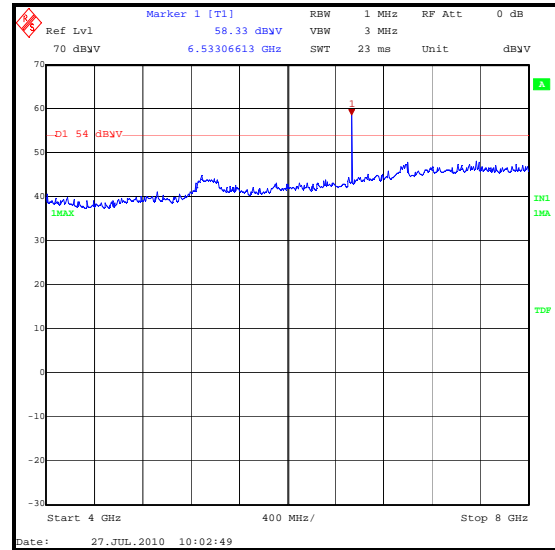
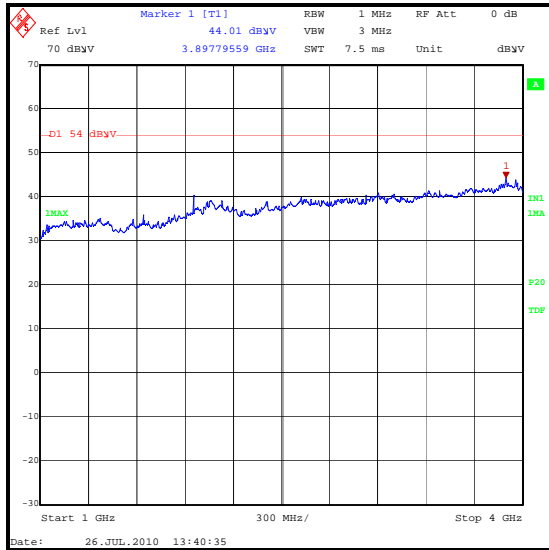
Results: Highest Average Level

| 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)

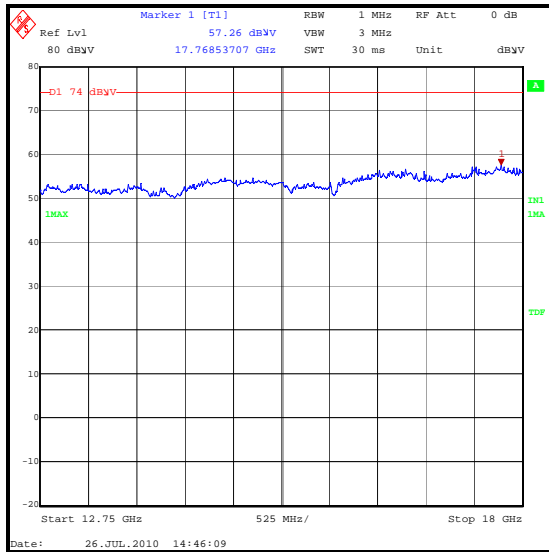


Peak Detector

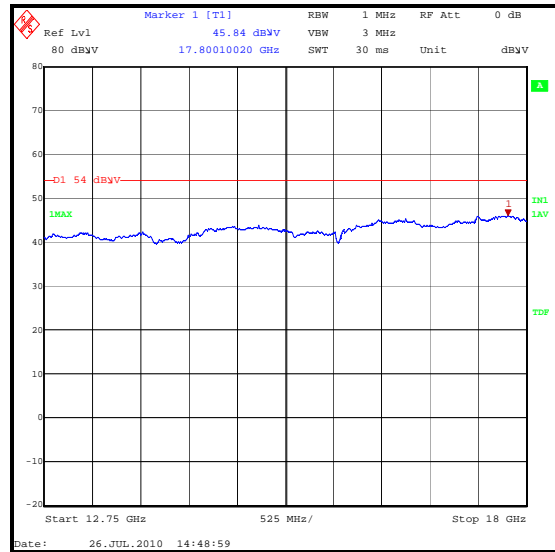
Average Detector

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

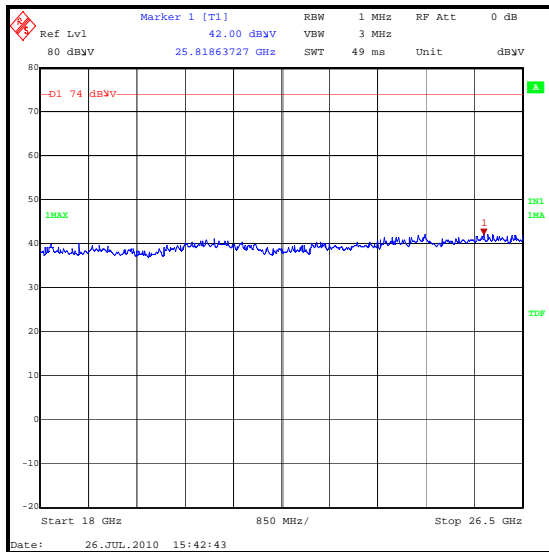
Transmitter Radiated Spurious Emissions (continued)



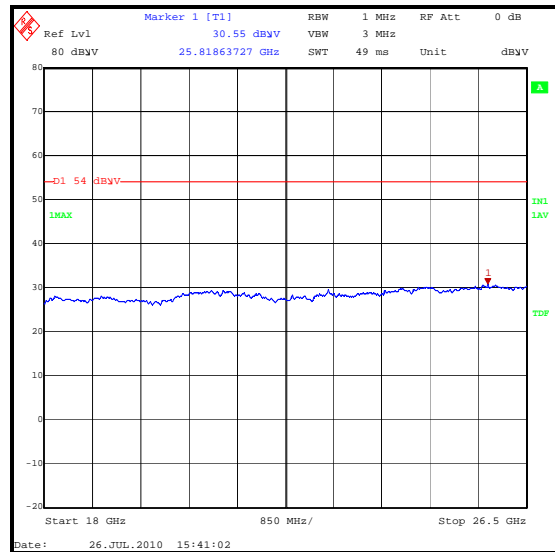
Peak Detector



Average Detector



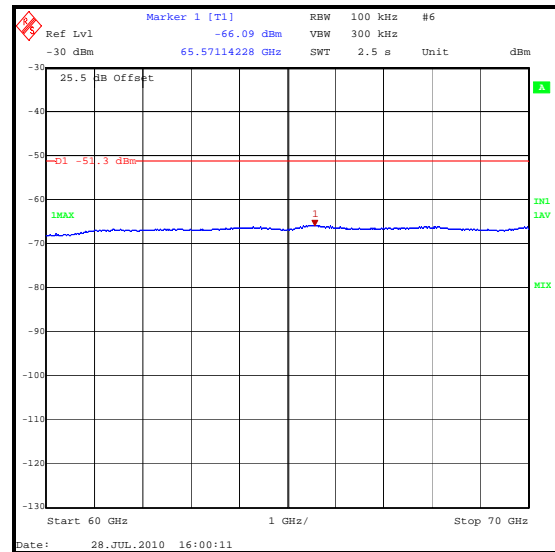
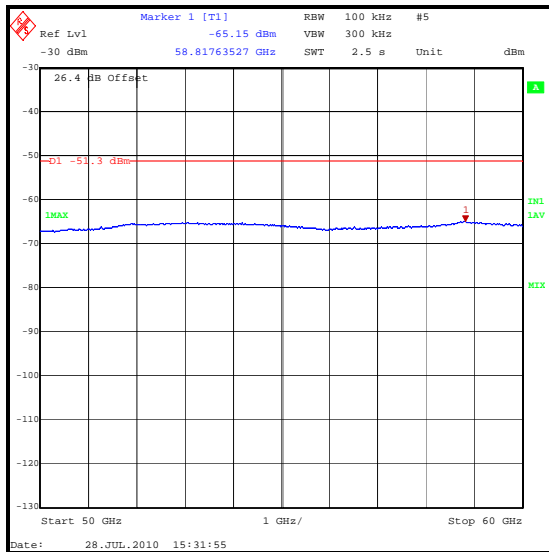
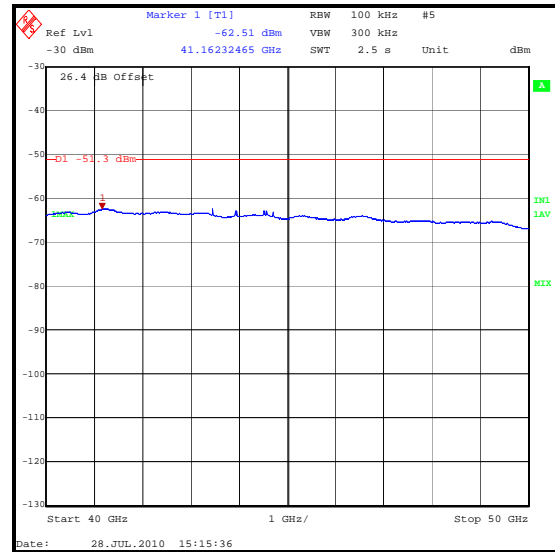
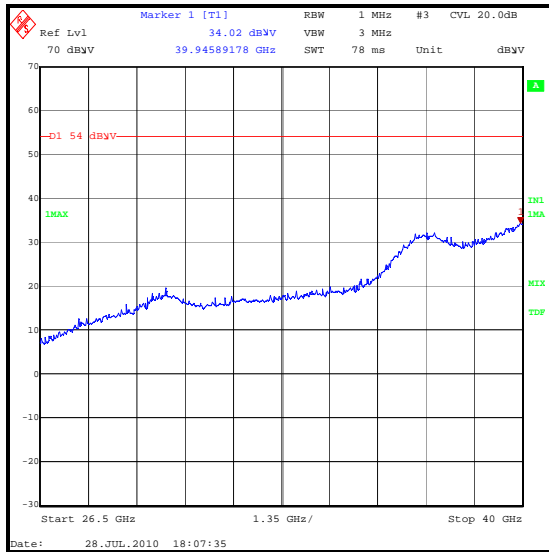
Peak Detector



Average Detector

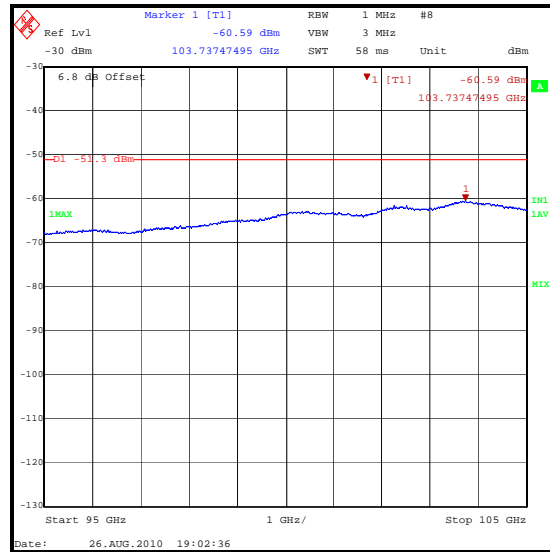
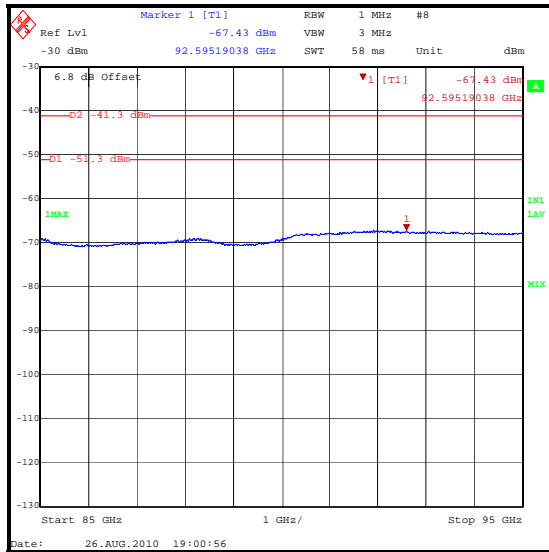
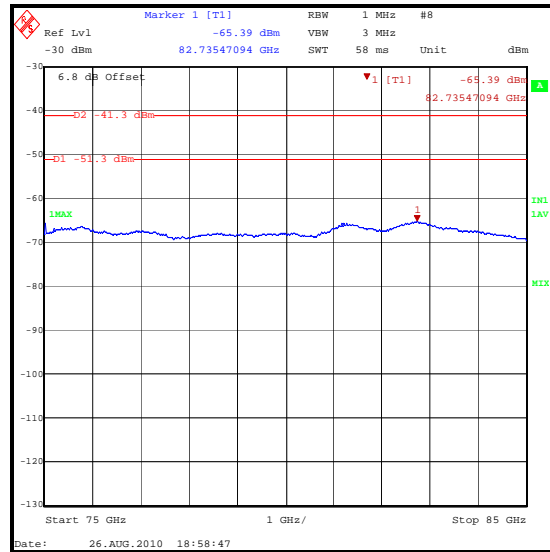
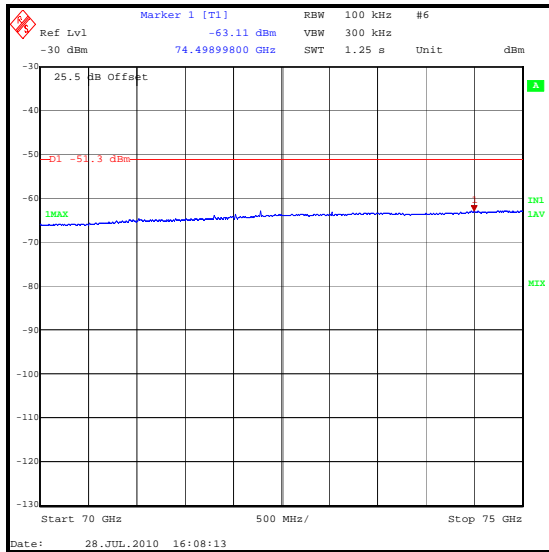
Note: These plots are pre-scans and for indication purposes only. For final measurements, see accompanying tables.

Transmitter Radiated Spurious Emissions (continued)



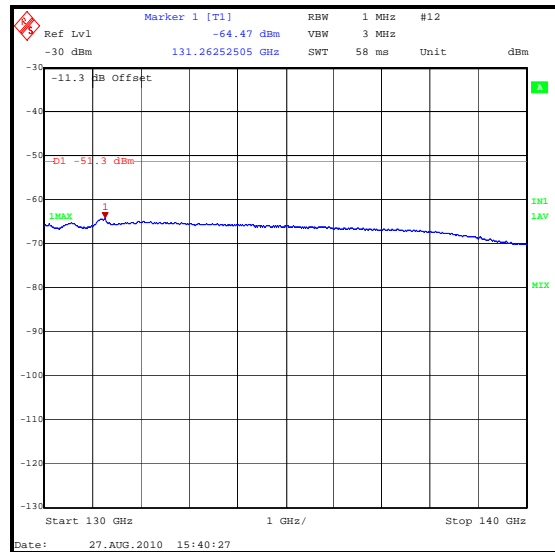
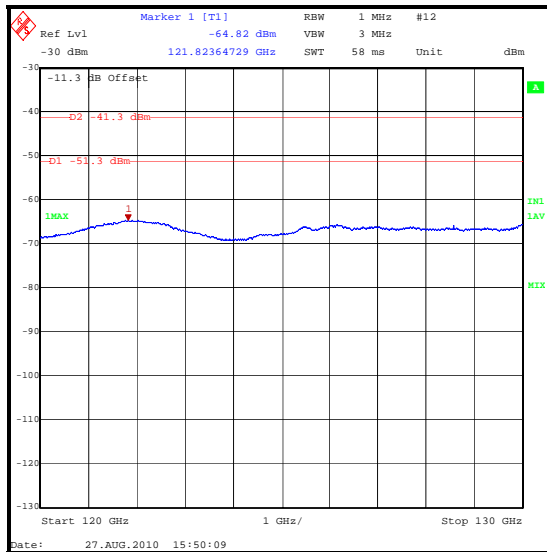
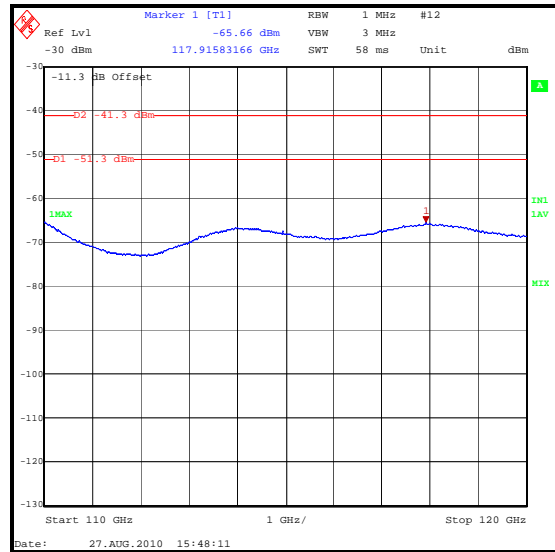
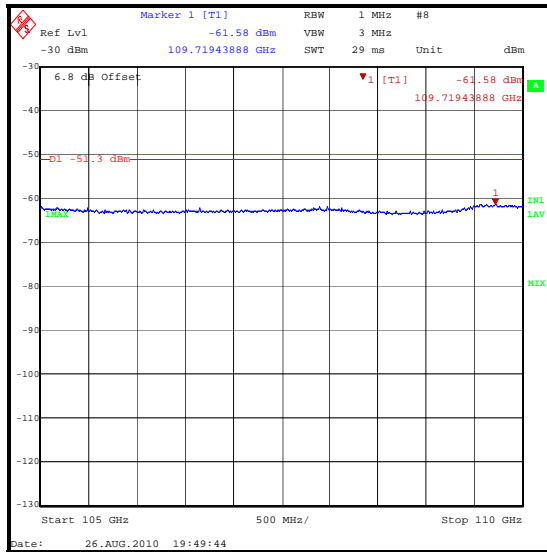
Note: These plots are pre-scans and for indication purposes only. For final measurements, see accompanying tables.

Transmitter Radiated Spurious Emissions (continued)



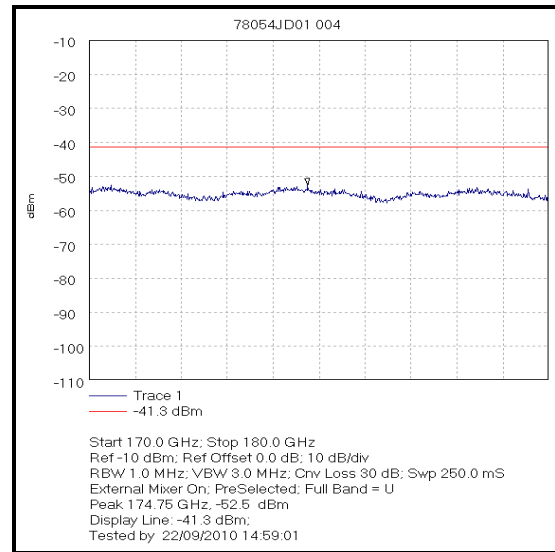
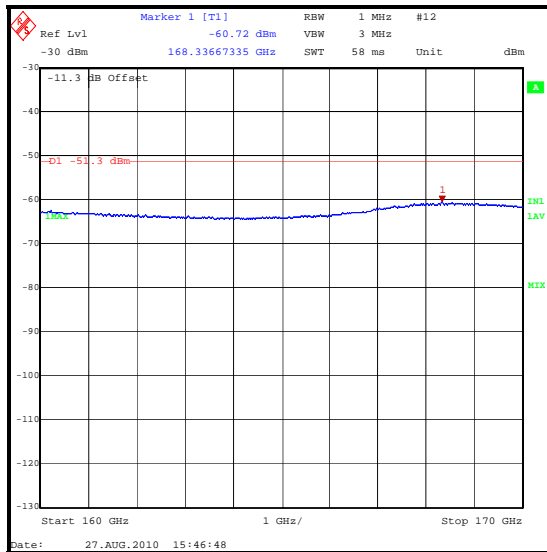
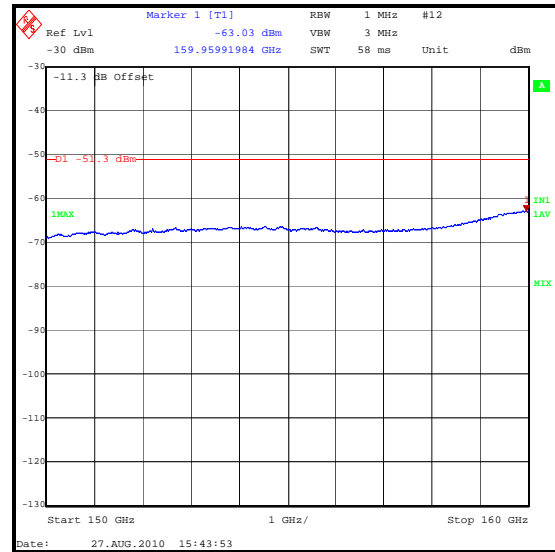
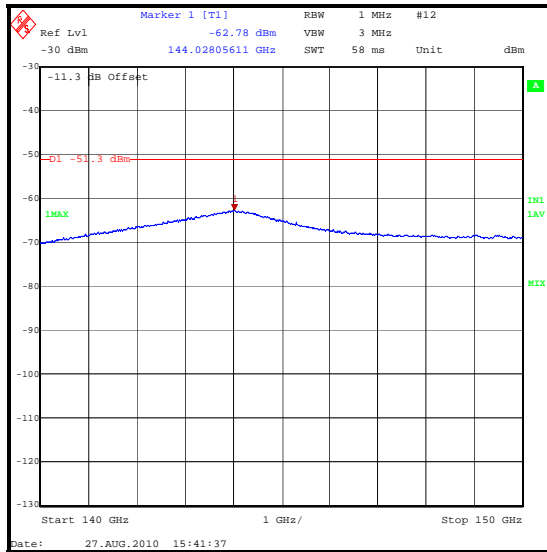
Note: These plots are pre-scans and for indication purposes only. For final measurements, see accompanying tables.

Transmitter Radiated Spurious Emissions (continued)



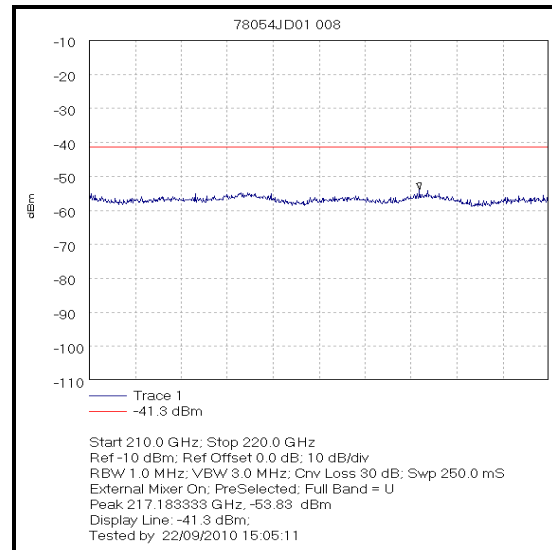
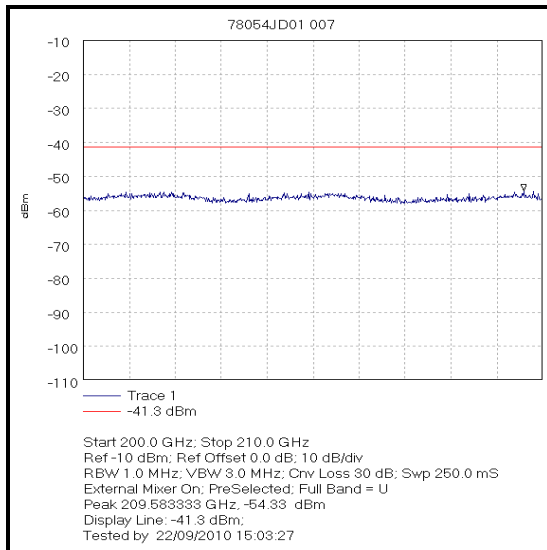
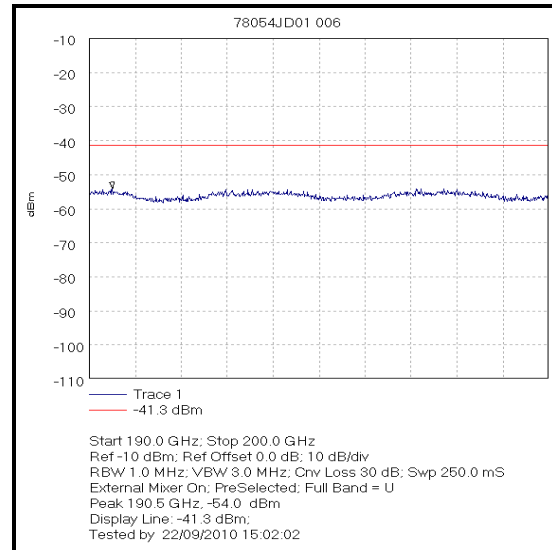
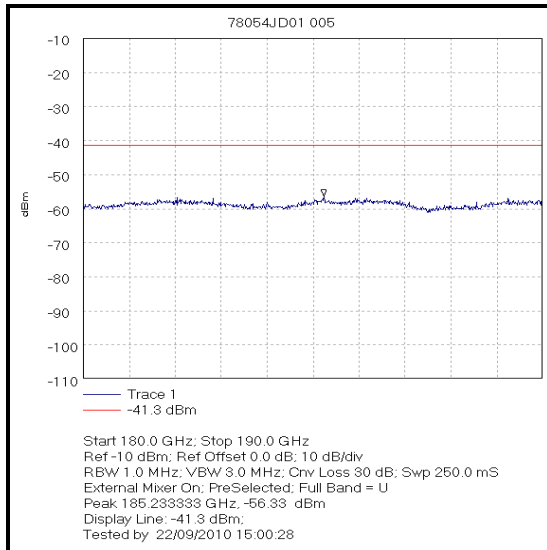
Note: These plots are pre-scans and for indication purposes only. For final measurements, see accompanying tables.

Transmitter Radiated Spurious Emissions (continued)



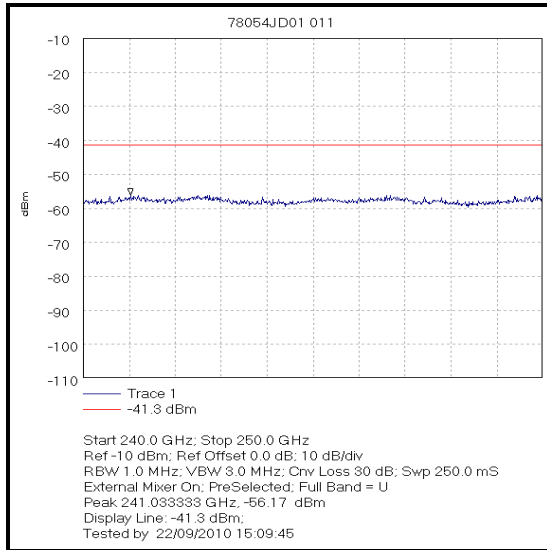
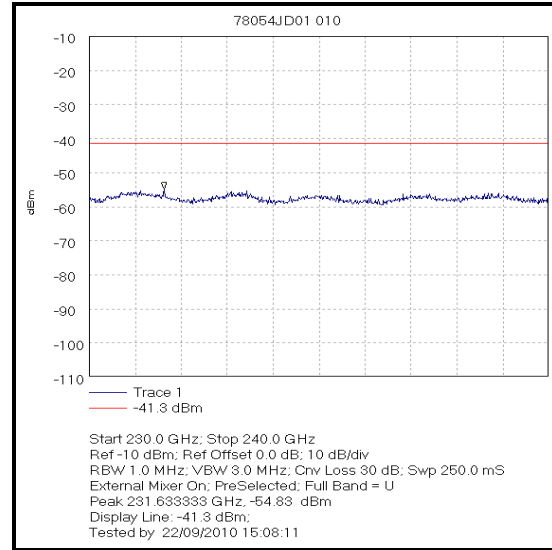
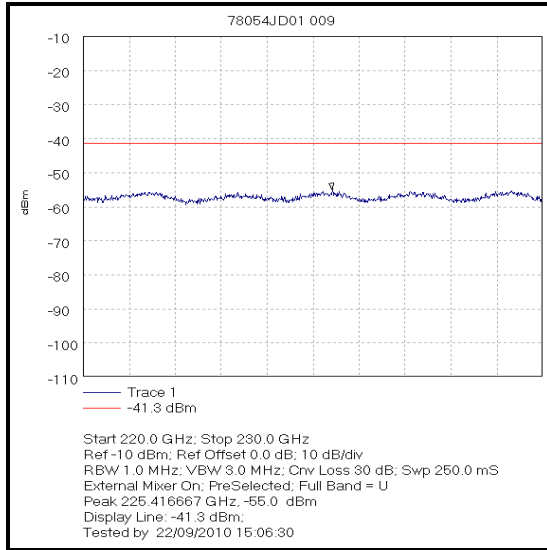
Note: These plots are pre-scans and for indication purposes only. For final measurements, see accompanying tables.

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 |

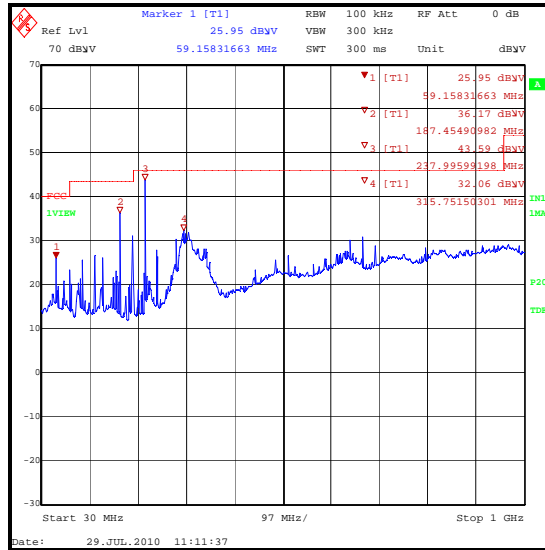
Results: Electric Field Strength Measurements

| Frequency (MHz) | Antenna Polarity | Quasi-peak Level (dB μ V/m) | Limit (dB μ V/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):

- *-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 |

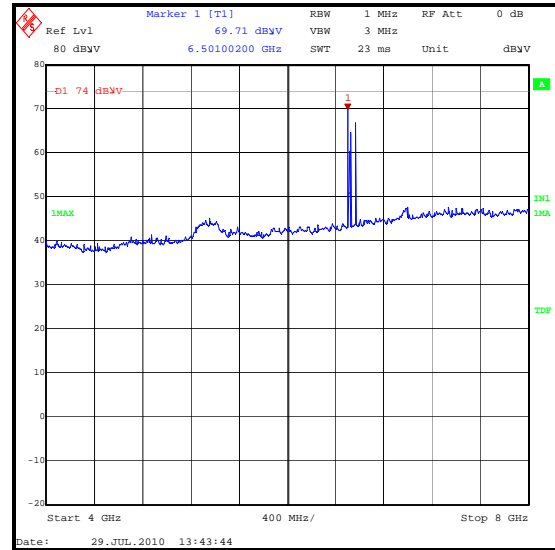
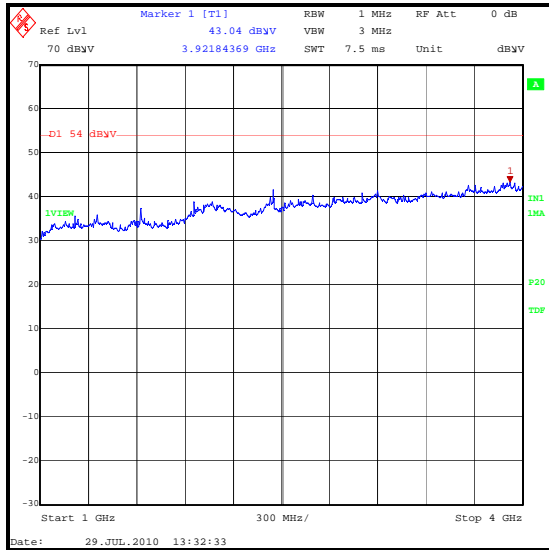
Results: Highest Peak Level

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

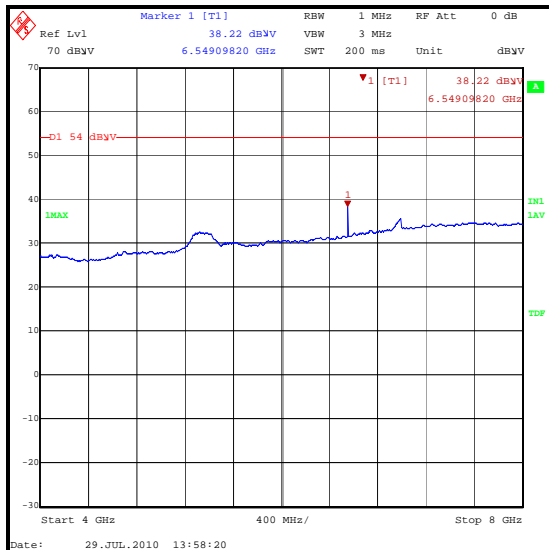
Note(s):

- *-20 dBc limit
- 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.

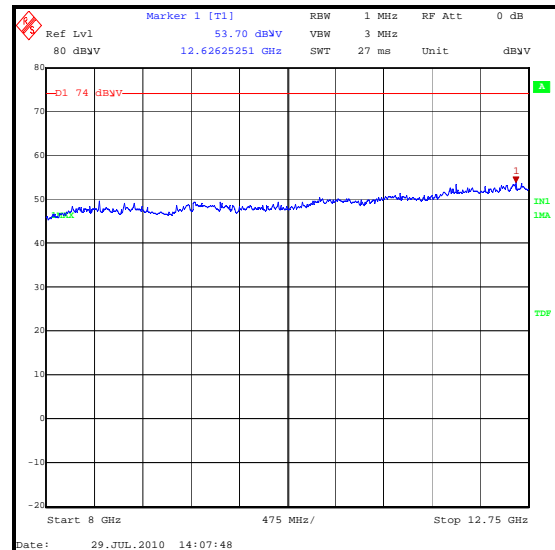
Transmitter Radiated Spurious Emissions (continued)



Peak Detector



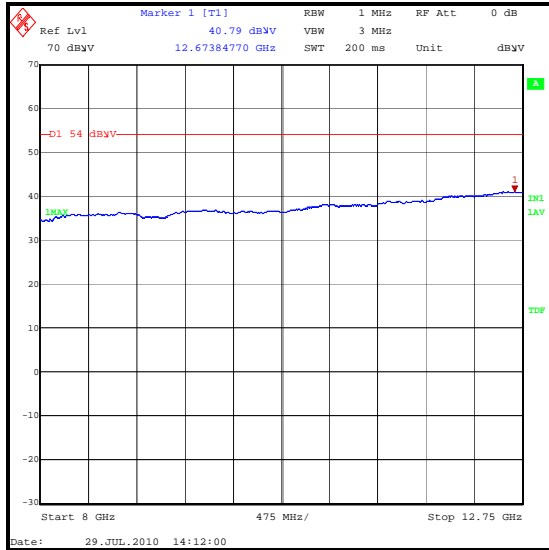
Average Detector



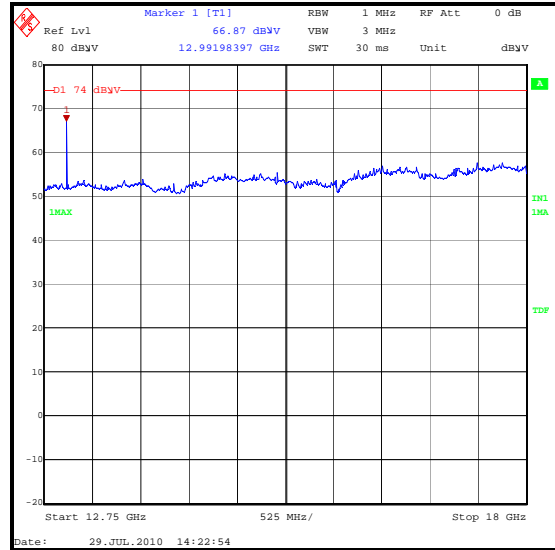
Peak Detector

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

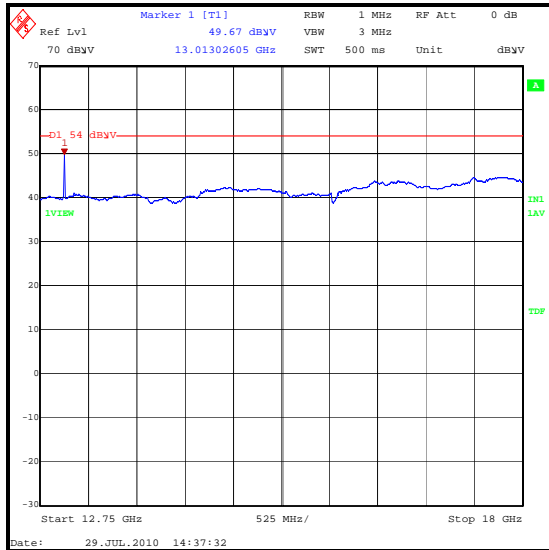
Transmitter Radiated Spurious Emissions (continued)



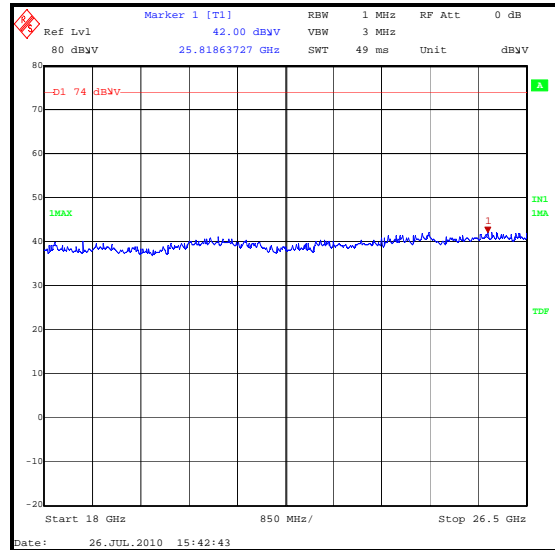
Average Detector



Peak Detector



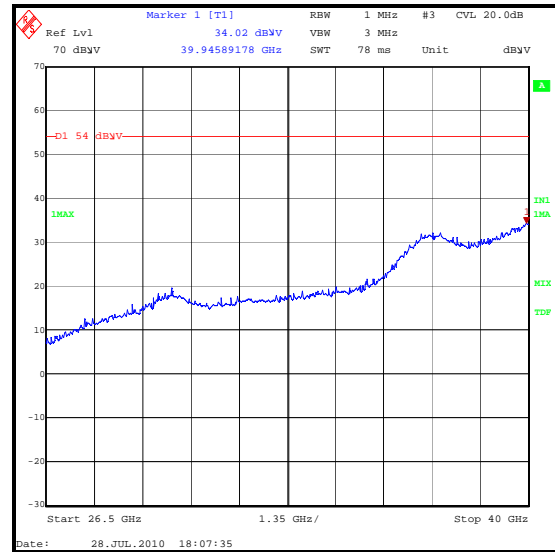
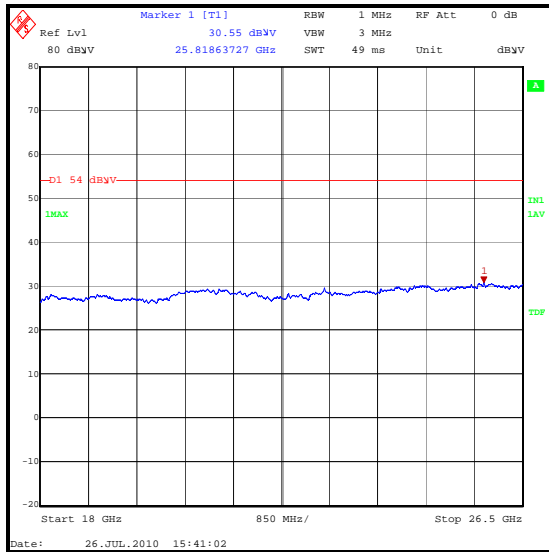
Average Detector



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 dB μ V at 3 metres. The 54 dB μ V 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.