# TRaC RADIO TEST REPORT

# FOR

# Crow Electronic Engineering Ltd

# ON

# DECT ULE based wireless detectors

# DOCUMENT NO. TRA-023838-47-00A

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| | |
|---|---|
| **TRaC Wireless Test Report** | **:** TRA-023838-47-00A |
| **Applicant** | **:** Crow Electronic Engineering Ltd. |
| **Apparatus** | **:** DECT ULE based wireless detectors |
| **Specification(s)** | **:** CFR47 Part 15D & RSS-213 |
| **Purpose of Test** | **: Certification** |
| **FCCID** | **: NFC-CRUD** |
| **Certification number** | **: 8164A-CRDU** |
| **Authorised by** | : John Charters<br>Digitally signed by John Charters<br>DN: cn=John Charters, o=TRAC Global Ltd, ou=Radio Product Manager, email=john.charters@tracglobal.com, c=GB<br>Date: 2015.09.16 11:08:52 +01'00' |
| | : Radio Product Manager |
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## Section 1: Introduction

### 1.1 General

This report contains an assessment of an apparatus against Electromagnetic Compatibility Standards based upon tests carried out on samples submitted to the Laboratory.

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### 1.2 Tests Requested By

This testing in this report was requested by :

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### 1.3 Manufacturer

As Above

### 1.4 Apparatus Assessed

The following apparatus was assessed between 14th April – 27th July 2015:

DECT ULE based wireless detectors

The above equipment was a range of wireless sensors using DECT ULE technology to send data to a central controller. For the purposes of testing the units were tested as a DECT portable part.

The devices are fixed type products

All devices were based on identical RF circuitry. Full testing was performed on one unit (CR-DU-PIR-USA) and partial testing (Radiated Emissions) on the rest of the units.

The models concerned are:

| Crow Part Number | Alternative Part Number |
|---|---|
| CR-DU-FLD-USA | - |
| CR-DU-MAG-USA | - |
| CR-DUS-PIR-USA | VC7003 |
| CR-DU-PIR-USA | - |
| CR-DU-TMP-USA | - |

## 1.5 Test Result Summary

Full details of test results are contained within Appendix A. The following table summarises the results of the assessment.

The statements relating to compliance with the standards below apply ONLY as qualified in the notes and deviations stated in sections 1.6 to 1.7 of this test report.

Full details of test results are contained within Appendix A. The table overleaf summarises the results of the assessment.

Abbreviations used in the overleaf table:

| | | | |
|---|---|---|---|
| CFR | : Code of Federal Regulations | ANSI | : American National Standards Institution |
| RSS | : Radio Standards Specification | PLCE | : Power Line Conducted Emissions |

| TEST/EXAMINATION | Part 15 | RSS-213 | Result |
|---|---|---|---|
| Cross reference to Subpart B | 15.309 (b) | N/A | - |
| Labelling Requirements | 15.19 (a)(3) | RSP-100<br>3 | - |
| Measurement Procedures | 15.313 | 3.2 | - |
| Antenna Requirement | 15.317<br>15.203 | RSS-Gen<br>6.7 | - |
| Modulation Techniques | 15.319 (b) | 5.1 | - |
| Conducted AC Powerline | 15.315<br>15.207 | 4.2 | N/A<br>Note 2 |
| Emission Bandwidth | 15.323 (a) | 5.5 | Pass |
| Peak Transmit Power | 15.319 (c) | 5.6 | Pass |
| Power Spectral Density | 15.319 (d) | 5.7 | Pass |
| Antenna Gain | 15.319 (e) | 5.6 | Pass |
| Automatic Discontinuation of Transmission | 15.319 (f) | 5.2 | Pass |
| Radio Frequency Radiation Exposure | 15.319 (i) | RSS-102 | Pass |
| Monitoring Thresholds | 15.323 (c)(2)<br>15.323 (c)(9) | 5.2 (2)<br>5.2 (9) | Pass |
| Monitoring of Intended Transmit Window and Maximum Reaction Time | 15.323 (c)(1) | 5.2 (1) | Pass |
| Monitoring Bandwidth | 15.323 (c)(7) | 5.2 (7) | Pass |
| Access Criteria Functional Test | 15.323 (c)(6) | 5.2 (6) | No<br>Note 1 & 3 |
| Duration of Transmission | 15.323 (c)(3) | 5.2 (3) | Pass |
| Connection Acknowledgement | 15.323 (c)(4) | 5.2 (4) | Pass |
| Lower threshold Selected Channel, Power Accuracy, Segment Occupancy | 15.323 (c)(5) | 5.2 (5) | Pass |
| Monitoring Antenna | 15.323 (c)(8) | 5.2 (8) | Pass |
| Duplex Connections | 15.323 (c)(10) | 5.2 (10) | Pass |
| Alternative Monitoring Interval for Co-located Devices | 15.323 (c)(11) | 5.2 (11) | N/A<br>Note 5 |
| Fair Access to Spectrum Related to (c)(10) & (c)(11) | 15.323 (c)(12) | 5.2 (12) | Pass |
| Emission Inside and Outside the Sub-band | 15.323 (d) | 5.8 | Pass |
| Frame Period | 15.323 (e) | 5.2 (13) | Pass |
| Frequency Stability | 15.323 (f) | 5.2 (13) | Pass |

Note:
1. The EUT utilises LIC and implements more than 20 channels
2. The portable part is battery powered only.
3. The EUT does not transmit control and signalling information.
4. Not utilized by this EUT as devices will not be co-located within 1m of each other.
5. The EUT does not utilise the provisions of 15.323 (c)(11)

## 1.6 Notes Relating To The Assessment

With regard to this assessment, the following points should be noted:

The results contained in this report relate only to the items tested and were obtained in the period between the date of initial receipt of samples and the date of issue of the report.

The apparatus was set up and exercised using the configurations, modes of operation and arrangements defined in this report only.

Particular operating modes, apparatus monitoring methods and performance criteria required by the standards tested to have been performed except where identified in Section 1.7 of this test report (Deviations from Test Standards).

For emissions testing, throughout this test report, “Pass” indicates that the results for the sample as tested were below the specified limit (refer also to Section 2, Measurement Uncertainty).

Where relevant, the apparatus was only assessed using the monitoring methods and susceptibility criteria defined in this report.

All testing with the exception of testing at the Open Area Test Site was performed under the following environmental conditions:

| | |
|---|---|
| Temperature | : 17 to 23 °C |
| Humidity | : 45 to 75 % |
| Barometric Pressure | : 86 to 106 kPa |

All dates used in this report are in the format dd/mm/yy.

This assessment has been performed in accordance with the requirements of ISO/IEC 17025.

## 1.7 Deviations from Test Standards

There were no deviations from the standards tested to.

## Section 2: Measurement Uncertainty

### 2.3 Measurement Uncertainty Values

For the test data recorded the following measurement uncertainty was calculated.

**Radio Testing – General Uncertainty Schedule**

*All statements of uncertainty are expanded standard uncertainty using a coverage factor of 1.96 to give a 95% confidence where no required test level exists.*

***[1] Adjacent Channel Power***

Uncertainty in test result = **1.86dB**

***[2] Carrier Power***

Uncertainty in test result (Power Meter) = **1.08dB**
Uncertainty in test result (Spectrum Analyser) = **2.48dB**

***[3] Effective Radiated Power***

Uncertainty in test result = **4.71dB**

***[4] Spurious Emissions***

Uncertainty in test result = **4.75dB**

***[5] Maximum frequency error***

Uncertainty in test result (Frequency Counter) = **0.113ppm**
Uncertainty in test result (Spectrum Analyser) = **0.265ppm**

***[6] Radiated Emissions, field strength OATS 14kHz-18GHz Electric Field***

Uncertainty in test result (14kHz – 30MHz) = **4.8dB**,
Uncertainty in test result (30MHz – 1GHz) = **4.6dB**,
Uncertainty in test result (1GHz – 18GHz) = **4.7dB**

***[7] Frequency deviation***

Uncertainty in test result = **3.2%**

***[8] Magnetic Field Emissions***

Uncertainty in test result = **2.3dB**

***[9] Conducted Spurious***

Uncertainty in test result – Up to 8.1GHz = **3.31dB**
Uncertainty in test result – 8.1GHz – 15.3GHz = **4.43dB**
Uncertainty in test result – 15.3GHz – 21GHz = **5.34dB**
Uncertainty in test result – Up to 26GHz = **3.14dB**

***[10] Channel Bandwidth***

Uncertainty in test result = **15.5%**

***[11] Amplitude and Time Measurement – Oscilloscope***

Uncertainty in overall test level = **2.1dB**,
Uncertainty in time measurement = **0.59%,**
Uncertainty in Amplitude measurement = **0.82%**

***[12] Power Line Conduction***

Uncertainty in test result = **3.4dB**

***[13] Spectrum Mask Measurements***

Uncertainty in test result = **2.59% (frequency)**
Uncertainty in test result = **1.32dB (amplitude)**

***[14] Adjacent Sub Band Selectivity***

Uncertainty in test result = **1.24dB**

***[15] Receiver Blocking – Listen Mode, Radiated***

Uncertainty in test result = **3.42dB**

***[16] Receiver Blocking – Talk Mode, Radiated***

Uncertainty in test result = **3.36dB**

***[17] Receiver Blocking – Talk Mode, Conducted***

Uncertainty in test result = **1.24dB**

***[18] Receiver Threshold***

Uncertainty in test result = **3.23dB**

***[19] Transmission Time Measurement***

Uncertainty in test result = **7.98%**

# Section 3: Modifications

## 3.1 Modifications Performed During Assessment

No modifications were performed during the assessment

**Section 4** **General Test Procedures**

## 4.1 Radiated Test Setup and Procedures

Radiated electromagnetic emissions from the EUT are checked first by preview scans. Preview scans for all spectrum and modulation characteristics are checked, using a peak detector and where applicable worst case determined for function, operation, orientation etc for both vertical and horizontal polarisations

If the EUT connects to auxiliary equipment and is table or floor standing, the configurations prescribed in ANSI C63.10 are followed. Alternatively, a layout closest to normal use (as declared by the provider) is employed, (see EUT setup photographs for more detail).

For devices with intentional emissions below 30 MHz, a shielded loop antenna is used as the test antenna. It is placed at a 1 meter receive height and appropriate low frequency magnetic field extrapolation to the regulatory limit distance is employed. The EUT is rotated through 360˚in the azimuth.

Emissions between 30 MHz and 1 GHz are measured using calibrated broadband antennas. Emissions above 1 GHz are characterized using standard gain horn antennas. Pre-amplifiers and filters are used where required. Care is taken to ensure that test receiver resolution bandwidth, video bandwidth and detector type(s) meet the regulatory requirements.

For both horizontal and vertical polarizations, the EUT is then rotated through 360˚ in azimuth until the highest emission is detected. At the previously determined azimuth the test antenna is raised and lowered from 1 to 4 m in height until a maximum emission level is detected, this maximum value is recorded.

Where regulations allow for direct measurement of field strength, power values measured on the test receiver / analyzer are converted to dBuV/m at the regulatory distance, using:

$$FS = PR + AF + CL - PA + KG + DC - CF \text{ (dBuV/m)}$$

Where:

PR is the power recorded on receiver / spectrum analyzer (dBuV),
AF is the test antenna factor in dB/m,
CL is the cable loss in dB,
PA is the pre-amplifier gain dB (when applicable),
DC is duty correction factor (when applicable) in dB, and
CF is a distance correction (employed only for measurements at alternate distance to limit) in dB.

This field strength value is then compared with the regulatory limit.

If effective radiated power (ERP) or effective isotropic radiated power (EIRP) is required, it is computed as per ANSI C63.10

$$P = \frac{(Ed)^2}{30G}$$

Where

*P* is the power, in W
*E* is the measured peak field strength, in V/m
*d* is the distance at which the measurement was made, in m
*G* is the numeric gain of the radiating element

If the gain of the radiating element is not known, then either the effective radiated power (ERP) or the effective isotropic radiated power (EIRP) may be calculated from the measured peak field strength, by using either G = 1.64 or G = 1, respectively.

## 4.2 AC Powerline Conducted Emissions Test Setup and Procedures

AC Powerline Conducted Emissions from the EUT are checked first by preview scans with Peak and average detectors covering both live and neutral lines. A spectrum analyser is used to determine if any periodic emissions are present. Preview scans are performed in standby or receive mode if the device is subject to these requirements. For transmit mode of operation the device is set to one of the following modes.

- Transmitting operating at full power (single mode device)
- Transmitting at freq / modulation that gives highest output power (multi mode device)
- Transmitter operating in normal TX mode (e.g. FHSS, TDMA etc)

Formal measurements using the correct detector(s) and bandwidth are made on frequencies identified from the preview scans.

Battery Power devices are not subject to power line conducted emissions measurements when it is powered solely by its internal battery.

## 4.3 Antenna Port Conducted Emissions

Antenna port conducted emissions can include, but are not limited to, Carrier power, Power Spectral Density, Occupied bandwidth and spurious emission.

Spurious Emissions from the EUT are checked first by preview scans. Preview scans for all spectrum and modulation characteristics are checked to identify frequencies to perform formal measurements on.

Formal measurements are made on frequencies identified from the preview scans and fundamental emission(s). Measurements are made using the correct instrumentation (inc. power meter, receiver, spectrum analyser) that operate with the required detector(s) and bandwidth.

Care is taken to ensure the measurement instrument is not overloaded by the presence of the transmitted signal by use of external attenuation and filtering where required.

Measured levels are corrected for cables, attenuators, and filters. If applicable, for the specific measurement, antenna gain is also taken into account.

## 4.4 Power Supply Variation

Tests at extreme supply voltages are made if required by the procedures specified in the test standard, and results of this testing are detailed in this report.

In the case the EUT is designed for operation from a lead-acid battery power source, the extreme test voltages are evaluated between 90% and 130% of the nominal battery voltage declared by the manufacturer.

For float charge applications using gel-cell type batteries, extreme test voltages are evaluated between 85% and 115% of the nominal battery voltage declared.

For all battery operated equipment, worst case intentional and spurious emissions are re-checked employing a new (fully charged) battery.

## 4.5 Thermal Variation

Tests at extreme temperatures are made if required by the procedures specified in the test standard, and results of this testing are detailed in this report.

Tests are performed at the upper and lower extremes as required and typically at 10˚ steps between.

Before any temperature measurements are made, the equipment is allowed to reach a thermal balance in the test chamber.

## 4.6 Time Domain Measurements

Time domain measurements are made for (but not limited to) use in duty cycle correction, to ensure compliance with time restrictions on certain types of devices.

If measurements of a transmitter's on time are required these are performed with a spectrum analyser in the time domain or with an oscilloscope and RF detector. If time on a specific frequency is required ( e.g. FHSS timing) the measurement can only be made with a spectrum analyser.

The triggering, timescale and amplitude settings are adjusted according to the signal to be measured on a case by case basis.

For devices with sharp rise/fall times measurements are made between RF reaching full power ($T_{on}$) and RF dropping to the measurement instrument noise floor ($T_{off}$). For longer rise times measurements are made for $T_{on}$ and $T_{off}$ at the RF level required by the occupied bandwidth measurement (e.g. 6 dB, 20 dB etc).

## Appendix A: Formal Emission Test Results

Abbreviations used in the tables in this appendix:

| | |
|---|---|
| Spec | : Specification |
| Mod | : Modification |
| EUT | : Equipment Under Test |
| SE | : Support Equipment |
| L | : Live Power Line |
| N | : Neutral Power Line |
| E | : Earth Power Line |
| Pk | : Peak Detector |
| QP | : Quasi-Peak Detector |
| Av | : Average Detector |
| CDN | : Coupling & decoupling network |

| | |
|---|---|
| ALSR | : Absorber Lined Screened Room |
| OATS | : Open Area Test Site |
| ATS | : Alternative Test Site |
| Ref | : Reference |
| Freq | : Frequency |
| MD | : Measurement Distance |
| SD | : Spec Distance |
| Pol | : Polarisation |
| H | : Horizontal Polarisation |
| V | : Vertical Polarisation |

## A1 Cross Reference To Subpart B

### CFR 47 Part 15.309(b)

The unit contains digital circuitry, which is not directly related to the radio transmitter. See emissions outside the sub-band for results.

## A2 Labelling Information

### CFR 47 Part 15.311 & 15.19(a)(3) & PSP-100 3

This information is contained in a separate document. See attached exhibit.

## A3 Antenna Requirements

### CFR 47 Part 15.317 & 15.203 & RSS-GEN 6.7

The unit employs an integral antenna arrangement.

## A4 Modulation Techniques

### CFR 47 Part 15.139(b) & RSS-213 – 5.1

The Crow Electronic Engineering Ltd. DECT ULE based wireless detectors is an isochronous device operating in the 1920 MHz – 1930 MHz frequency band.

The Crow Electronic Engineering Ltd. DECT ULE based wireless detectors modulation technique is based on DECT technology as described in European standards EN 300 175-2 and EN 300 175-3.

The Crow Electronic Engineering Ltd. DECT ULE based wireless detectors modulation techniques are MC/TDMA/TDD (Multi Carrier / Time Division Multiple Access / Time Division Duplex) using QPSK modulation.

## A5 Radio Frequency Radiation Exposure

### CFR 47 Part 15.319(i) & RSS102

This information is contained is a separate document

## A6 Transmitter Emission Bandwidth

| Test Details: | |
|---|---|
| Regulation | CFR 47 Part 15.323(a) & RSS-213 – 5.5 |
| Measurement standard | ANSI C63.17:2013 sub-clause 6.1.3 |
| EUT sample number | S25 |
| Modification state | 0 |
| SE in test environment | None |
| SE isolated from EUT | S21, S24 |
| EUT set up | Refer to Appendix C |

| Test Details: $f_l$ = 1921.536 MHz | | | | |
|---|---|---|---|---|
| Δ P (dBc) | fl (MHz) | fh (MHz) | Δf (MHz) | Limit |
| -26 | 1920.887923 | 1922.219654 | 1.332 | 50kHz> Δf > 2.5MHz |
| -12 | 1920.955231 | 1922.133115 | 1.178 | N/A |
| -6 | 1921.157154 | 1921.926385 | 0.769 | N/A |

| Test Details: $f_c$ = 1924.992 MHz | | | | |
|---|---|---|---|---|
| Δ P (dBc) | fl (MHz) | fh (MHz) | Δf (MHz) | Limit |
| -26 | 1924.348731 | 1925.669885 | 1.321 | 50kHz> Δf > 2.5MHz |
| -12 | 1924.411231 | 1925.588154 | 1.177 | N/A |
| -6 | 1924.617692 | 1925.381423 | 0.764 | N/A |

| Test Details: $f_h$ = 1928.448 MHz | | | | |
|---|---|---|---|---|
| Δ P (dBc) | fl (MHz) | fh (MHz) | Δf (MHz) | Limit |
| -26 | 1927.798962 | 1929.125885 | 1.327 | 50kHz> Δf > 2.5MHz |
| -12 | 1927.866269 | 1929.044154 | 1.178 | N/A |
| -6 | 1928.068192 | 1928.237423 | 0.169 | N/A |

## A7 Peak Transmit Power

| Test Details: | |
|---|---|
| Regulation | CFR 47 Part 15.319(c) & RSS-213 – 5.6 |
| Measurement standard | ANSI C63.17:2013 sub-clause 6.1.2 |
| EUT sample number | S25 |
| Modification state | 0 |
| SE in test environment | None |
| SE isolated from EUT | S21, S24 |
| EUT set up | Refer to Appendix C |

| Frequency (MHz) | Peak Transmit Power (dBm) | Limit (dBm) |
|---|---|---|
| 1921.536 | 18.39 | 19.22 |
| 1924.992 | 18.34 | 19.22 |
| 1928.448 | 18.82 | 19.22 |

Note:
1. Permanent antenna was replaced with temporary antenna connector to enable conducted measurement.
2. Peak Antenna gain of 4.4 dBi exceeds 3dBi by 1.4 dBi and so correction of the limit is required.
3. See Annex E for Peak Transmit Power Plots.

**Limit**

The limit for Peak Transmit Power (PTP) is calculated using the following formula:

$$PTP = 5 \text{ Log}_{10} \text{ EBW} – 10 \text{ dBm} – (Ga - g)$$

This limit must be corrected to take into account any gain of the antenna greater than 3dBi.
Where: EBW is the transmitter emission bandwidth in Hz as determined in the previous test.

| | | | |
|---|---|---|---|
| EBW | = | 1.33 MHz | Emission Bandwidth |
| $G_A$ | = | 4.4 dBi | Peak antenna Gain |
| g | = | 3 dBi | Maximum Allowable Gain |

$PTP = 5 \text{ Log}_{10} 1.33 – 10 \text{ dBm } (4.4 – 3)$

$PTP = 19.22 \text{ dBm}$

## A8 Power Spectral Density

| Test Details: | |
|---|---|
| Regulation | CFR 47 Part 15.319(d) & RSS-213 - 4.3.2.1 |
| Measurement standard | ANSI C63.17:2013 sub-clause 6.1.2 |
| EUT sample number | S25 |
| Modification state | 0 |
| SE in test environment | None |
| SE isolated from EUT | S21, S24 |
| EUT set up | Refer to Appendix C |

| Frequency (MHz) | Power Spectral Density (mW/3kHz) | Limit (mW/3kHz) |
|---|---|---|
| 1921.536 | 1.86 | 3 |
| 1924.992 | 2.63 | 3 |
| 1928.448 | 1.62 | 3 |

Note: 1. Permanent antenna was replaced with temporary antenna connector to enable conducted measurement.
2. See Annex E for PSD Plots.

### Limit

The power spectral density shall not exceed 3mW in any 3 kHz bandwidth as measured with a spectrum analyser having a resolution bandwidth of 3 kHz.

## A9 Antenna Gain

### CFR 47 Part 15.319(e) & RSS-213 – 5.6

Any directional gain of the antenna exceeding 3dBi has an effect on the limit applied to the measurements taken for the peak transmit power test. If the directional gain of the antenna is less than 3dBi it is not required to be taken into account.

| Equipment | Antenna Gain (dBi) |
|---|---|
| CR-DUS-PIR-XX antenna | 2.9 |
| CR-DU-PIR-XX | 2.7 |
| CR-DU-MAG, CR-DU-FLD, CR-DU-TMP | 4.4 |

| Maximum Antenna Gain | Exceeds 3dBi by |
|---|---|
| 4.4 | 1.4 |

## A10 Automatic Discontinuation of Transmissions

| Test Details: | |
|---|---|
| Regulation | CFR 47 Part 15.319(f) & RSS-213 – 5.2 |
| Measurement standard | ANSI C63.17:2013 sub-clause 6.1.2 |
| EUT sample number | S25 |
| Modification state | 0 |
| SE in test environment | None |
| SE isolated from EUT | S21, S24 |
| EUT set up | Refer to Appendix C |

Automatic discontinuation of transmission means break off of transmissions that are not control and signalling information.

The DECT ULE based wireless detectors is a Portable part and as such does not transmit control and signalling information the counterpart device is a fixed part device and does transmit control and signalling information.

| Part | Transmits Control and Signalling Information | Equipment Under Test |
|---|---|---|
| Fixed Part | X | |
| Portable Part | | X |

### Results

The following tests were performed after a connection had been established with the counterpart device

| Number | Test | Reaction of EUT | Pass / Fail |
|---|---|---|---|
| 1 | Power Removed Form EUT | C | Pass |
| 2 | Power Removed From Companion Device | A | Pass |
| 3 | Reset Button Pressed | C | Pass |

A – Connection breakdown, Cease of all transmissions.
B – Connection breakdown, EUT transmits control and signalling information.
C – Connection breakdown, Counterpart transmits control and signalling information.

## A11 Monitoring Thresholds

| Test Details: | |
|---|---|
| Regulation | CFR 47 Part 15.323(c)(2) & (c)(9) & RSS-213 – 5.2 (2) & (9) |
| Measurement standard - Calculation | ANSI C63.17:2013 sub-clause 7.2.1 |
| Calculations | As laid out in ANSI C63.17:2013 sub-clauses 4.3.3 |
| Measurement standard | ANSI C63.17:2013 sub-clause 7.3 |
| EUT sample number | S25 |
| Modification state | 0 |
| SE in test environment | None |
| SE isolated from EUT | S21, S24 |
| EUT set up | Refer to Appendix C |

Calculation of monitoring threshold limits for isochronous devices:

Lower threshold: $T_L = -174 + 10Log_{10}B + M_L + P_{MAX} - P_{EUT}$ (dBm)

Where:
B = Emission bandwidth (Hz)
$M_L$ = dBs the threshold may exceed thermal noise
$P_{MAX}$ = Output Power Limit (dBm)
$P_{EUT}$ = Transmitted power (dBm)

| Monitor Threshold | B (MHz) | $M_L$ (dB) | $P_{MAX}$ (dBm) | $P_{EUT}$ (dBm) | Threshold (dBm) |
|---|---|---|---|---|---|
| $T_L$ | 1.33 | 30 | 19.22 | 18.82 | -82.35 |

Note: 1. Threshold levels rounded up/down to nearest whole number

The threshold level was determined following the Least Interfered Channel Procedure as laid out in ANSI C63.17:2013 sub-clause 7.3.2. Operation was restricted to 2 carriers in the band designated $f_1$ and $f_2$.

### Limits

The EUT must not transmit until the interference level is less than or equal to:

Measured Threshold Level ≤ $T_U + U_M$

Where:
$T_L$ = Calculated Lower threshold level
$U_M$ = Margin of uncertainty in threshold measurements (6dB)

### Results

| clause 7.3.2 ref | Level of $f_1$ | Level of $f_2$ | EUT transmission Frequency | Pass/Fail |
|---|---|---|---|---|
| b | $T_L + U_M + 7$ | $T_L + U_M$ | $f_2$ | Pass |
| c | $T_L + U_M$ | $T_L + U_M + 7$ | $f_1$ | Pass |
| d | $T_L + U_M + 1$ | $T_L + U_M - 6$ | $f_2$ | Pass |
| e | $T_L + U_M - 6$ | $T_L + U_M + 1$ | $f_1$ | Pass |

Each test was repeated 5 times.

## A11 Monitoring of Intended Transmit Window & Maximum Reaction Time

| Test Details: | |
|---|---|
| Regulation | CFR 47 Part 15.323(c)(1) & RSS-213 – 5.2(1) |
| Measurement standard | ANSI C63.17:2013 sub-clause 7.5 |
| EUT sample number | S25 |
| Modification state | 0 |
| SE in test environment | None |
| SE isolated from EUT | S21, S24 |
| EUT set up | Refer to Appendix C |

The EUT was restricted to operation on two channels. The interference generator was fed pulses from the function generator to produce a pulsed carrier of the specified time length and the output of the interference generator was set to the required level. The pulse generator and companion device were synchronized so the position of the pulses corresponded to the time-slot pattern in the frame of the EUT. The test is performed with the unit frequency administered to operate only on middle frequency.

For each of the required tests the pulse width and interference level are as below:

Test c)

With the interference generator output set at the relevant calculated threshold level plus measurement uncertainty ($U_M$) and the width of the pulse interference exceeds the largest of 50µs and $50\sqrt{1.25/B}$ µs verify that the EUT does not establish a connection.

Test d)

With the interference generator output set at 6dB above the relevant calculated threshold level plus measurement uncertainty ($U_M$) and the width of the pulse interference exceeds the largest of 35µs and $35\sqrt{1.25/B}$ µs verify that the EUT does not establish a connection.

Where B = Emission bandwidth of the EUT in MHz

## Results

**Single Slot Configuration**

| Test Equation (µs) | Pulse Width (µs) | $f_1$ Interferer Level (dBm) | $f_2$ Interferer Level (dBm) | EUT transmission Frequency | Pass/Fail |
|---|---|---|---|---|---|
| $50\sqrt{1.25/B}$ | 50µs | $T_L + U_m$ | $T_L$ | $f_2$ | Pass |
| $35\sqrt{1.25/B}$ | 35µs | $T_L + U_m + 6$ | $T_L$ | $f_2$ | Pass |

Notes:
1. $T_L$ is the calculated Lower threshold.
2. $U_M$ is Margin of uncertainty in threshold measurements (6dB).

## A12 Monitoring Bandwidth & Antenna

### Monitoring Bandwidth – CFR 47 Part 15.323(c)(7) & RSS-213 – 5.2 (7)

The monitoring bandwidth test was carried out in accordance with ANSI C63.17:2013 sub-clause 7.4.

ANSI C63.17:2013 sub-clause 7.4 states that if the monitoring is made through the radio receiver used by the EUT for communication the intended bandwidth requirements for the monitoring system are met.

As declared by the manufacturer the EUT uses the radio receiver used for communication for monitoring therefore the intended bandwidth requirements for the monitoring system are met of ANSI C63.17:2013 sub-clause 7.4 are met.

### Monitoring Antenna – CFR 47 Part 15.323(c)(8) & RSS-213 - 5.2 (8)

The antenna of the EUT used for transmitting is the same antenna that is used for monitoring.

## A13 Power Accuracy

**CFR 47 Part 15.323(c)(5) & RSS-213 – 5.2 (5)**

The power measurement resolution for the previous comparison must be accurate to within 6dB.

The monitoring threshold test covered in Part 15.323 (c)(2) automatically proves that this requirement is met.

## A13 Segment Occupancy

**CFR 47 Part 15.323(c)(5) & RSS-213 – 5.2 (5)**

See manufacture Declaration

## A14 Duration Of Transmission

| Test Details: | |
|---|---|
| Regulation | CFR 47 Part 15.323(c)(3) & RSS-213 – 5.2 (3) |
| Measurement standard | ANSI C63.17:2013 sub-clause 8.2.2 |
| EUT sample number | S26 |
| Modification state | 1 |
| SE in test environment | None |
| SE isolated from EUT | S21, S24 |
| EUT set up | Refer to Appendix C |

The test was carried out in two parts. The first was to verify that with the companion device off the EUT does not transmit on the same time/spectrum window for more than the limit. The second was to verify that after a connection is broken the EUT terminates its transmission on the current communication channel within 30 seconds or less.

### Result

| Repetition of Access Criteria | Maximum Transmission Time | Maximum Transmission Time Limit | Pass/Fail |
|---|---|---|---|
| Period | 4.85 seconds | <8 Hours | Pass |

Note: 1. The portable part is the initiating device that repeats the access criteria

## A15 Connection Acknowledgement

| Test Details: | |
|---|---|
| Regulation | CFR 47 Part 15.323(c)(4) & RSS-213 – 5.2 (4) |
| Measurement standard | ANSI C63.17:2013 sub-clause 8.2.1 |
| EUT sample number | S26 |
| Modification state | 1 |
| SE in test environment | None |
| SE isolated from EUT | S21, S24 |
| EUT set up | Refer to Appendix C |

The test was carried out in two parts. The first was to verify that with the companion device off the EUT does not transmit on the same time/spectrum window for more than the limit. The second was to verify that after a connection is broken the EUT terminates its transmission on the current communication channel within 30 seconds or less.

### Result

| Test | Time Taken (seconds) | Limit (seconds) | Pass/Fail |
|---|---|---|---|
| Transmission on communications channel no acknowledgement received (note 1) | 0.653 | 1 | Pass |
| Established communication channel termination, acknowledgements blocked during communication (note 1) | 0.826 | 30 | Pass |

Note:
1. The companion device transmits a beacon signal when acknowledgements are blocked.
2. The EUT does not transmit a control channel.
3. Figures are worst case for manual and automatic events that trigger transmissions.
4. See Appendix B for Acknowledgement plots.

## A16 Least Interfered Channel (LIC) Procedure

| Test Details: | |
|---|---|
| Regulation | CFR 47 Part 15.323(c)(5) & RSS-213 – 5.2 (5) |
| Measurement standard | ANSI C63.17:2013 sub-clause 7.3.3 |
| EUT sample number | S25 |
| Modification state | 1 |
| SE in test environment | None |
| SE isolated from EUT | S21, S24 |
| EUT set up | Refer to Appendix C |

The EUT utilizes more than 40 channels; therefore the least interfered channel testing is applicable.

The EUT was frequency administered to operating on two frequencies only, f1 and f2.

f1 = 1923.264 MHz
f2 = 1924.992 MHz

Test b)
Interference on f1 was set at $T_L + U_M$ + 7dB and at $T_L + U_M$ on f2. Initiate communication. The EUT should transmit on f2. Repeat 5 times. If the EUT transmits on f1 the test is failed.

Test c)
Interference on f1 was set at $T_L + U_M$ and at $T_L + U_M$ + 7dB on f2. Initiate communication. The EUT should transmit on f1. Repeat 5 times. If the EUT transmits on f2 the test is failed.

Test d)
Interference on f1 was set at $T_L + U_M$ + 1dB and at $T_L + U_M$ - 6dB on f2. Initiate communication. The EUT should transmit on f2. Repeat 5 times. If the EUT transmits on f1 the test is failed.

Test e)
Interference on f1 was set at $T_L + U_M$ - 6dB and at $T_L + U_M$ + 7dB on f2. Initiate communication. The EUT should transmit on f1. Repeat 5 times. If the EUT transmits on f2 the test is failed.

**Result**

| Clause 7.3.2 ref | Level of $f_1$ | Level of $f_2$ | EUT transmission Frequency | Pass/Fail |
|---|---|---|---|---|
| b | $T_L + U_M$ +7 | $T_L + U_M$ | $f_2$ | Pass |
| c | $T_L + U_M$ | $T_L + U_M$ + 7 | $f_1$ | Pass |
| d | $T_L + U_M$ + 1 | $T_L + U_M$ - 6 | $f_2$ | Pass |
| e | $T_L + U_M$ - 6 | $T_L + U_M$ + 1 | $f_1$ | Pass |

Each test was repeated 5 times.

## A17 Selected Channel Confirmation

| Test Details: | |
|---|---|
| Regulation | CFR 47 Part 15.323(c)(1) & (c)(5) & RSS-213 – 5.2 (5) |
| Measurement standard | ANSI C63.17:2013 sub-clause 7.3.4 |
| EUT sample number | S25 |
| Modification state | 1 |
| SE in test environment | None |
| SE isolated from EUT | S21, S24 |
| EUT set up | Refer to Appendix C |

The test is to ensure the EUT monitors the time/spectrum window immediately prior to transmission.

The EUT was frequency administered to operating on two frequencies only, f1 and f2.

f1 = 1923.264 MHz
f2 = 1924.992 MHz

Test a)
Interference is applied on f1 at a level of $T_L + U_M$. Verify a connection is established on f2.

Any connection is terminated.

Test b)
Interference is applied on f2 at a level of $T_L + U_M$ and immediately removed from f1 and the EUT is immediately caused to attempt transmission. In this case the EUT should transmit on f1

The test is applied in both single and long slot configurations.

**Result**

| Test | Transmit on f1 | Transmit on f2 | Wanted Transmit Channel | Pass/Fail |
|---|---|---|---|---|
| a | No | Yes | f2 | Pass |
| b | Yes | No | f1 | Pass |

## A18 Duplex Connections

| Test Details: | |
|---|---|
| Regulation | CFR 47 Part 15.323(c)(10) & RSS-213 – 5.2 (10) |
| Measurement standard | ANSI C63.17:2013 sub-clause 8.3.2 |
| EUT sample number | S25 |
| Modification state | 1 |
| SE in test environment | None |
| SE isolated from EUT | S21, S24 |
| EUT set up | Refer to Appendix C |

Before all tests are carried out any connection is terminated.

Test b)
The system is restricted to operation on one frequency (1924.992 MHz). Verify that a connection between the EUT and its companion device can be made.

Test c) & d)
Apply interference at a level $T_L + U_M$ to all transmit time slots except one which has interference at least 10dB below $T_L$. Apply interference at a level $T_L + U_M + 7dB$ to all receive time slots except one which has interference at least 10dB below $T_L$. The interference free receive timeslot should not be the duplex mate of the interference free transmit timeslot. The EUT should establish a connection on the interference free receive slot and its duplex mate.

Test e) & f)
Apply interference at a level $T_L + U_M$ to all receive time slots except one which has interference at least 10dB below $T_L$. Apply interference at a level $T_L + U_M + 7dB$ to all transmit time slots except one which has interference at least 10dB below $T_L$. The interference free transmit timeslot should not be the duplex mate of the interference free receive timeslot. The EUT should establish a connection on the interference free transmit slot and its duplex mate.

**Result**

| Clause 7.3.2 ref | Connection Made | Time Slot Selected | Required Time Slot | Pass/Fail |
|---|---|---|---|---|
| b | Yes | 4 | Any | Pass |
| c & d | Yes | 3 | Interference Free Receive Slot and Duplex Mate | Pass |
| e & f | Yes | 11 | Interference Free Transmit Slot and Duplex Mate | Pass |

## A19 Alternative Monitoring Interval For Co-Located Devices

Manufacturer declares that the EUT does not use the provisions of 15.323(c)(11)

## A20 Fair Access To Spectrum

### CFR 47 Part 15.323(c)(12) & RSS-213 - 4.3.3(b)(12)

The provisions of (10) & (11) shall not be used to extend the range of spectrum occupied over space or time for the purposes of denying fair access to the spectrum to other devices.

The manufacturer declares that this device does not work in a mode, which denies fair access to the spectrum to others.

(10) Relates to part 15.323(c)(10) and 4.3.4(b)(10)
(11) Relates to part 15.323(c)(11) and 4.3.4(b)(11

## A21 Emissions Inside and Outside the Sub-Band - Conducted

| Test Details: | |
|---|---|
| Regulation | CFR 47 Part 15.323(d) & RSS-213 – 5.8 |
| Measurement standard | ANSI C63.17:2013 sub-clause 6.1.6. |
| EUT sample number | S25 |
| Modification state | 1 |
| SE in test environment | None |
| SE isolated from EUT | S21, S24 |
| EUT set up | Refer to Appendix C |

| Out-of-Band Emissions from UPCS bandedge | FREQ. (MHz) | MEAS. Rx. (dBm) | CABLE & ATTEN. LOSS (dB) | EMISSION LEVEL (dBm) | LIMIT (dBm) |
|---|---|---|---|---|---|
| > - 2.5MHz | 1916.95 | -76.37 | 21.1 | -55.27 | -39.5 |
| - 1.25 MHz – 2.5 MHz | 1918.73 | -69.29 | 21.1 | -48.19 | -29.5 |
| - 1.25 MHz | 1919.82 | -54.70 | 21.1 | -33.60 | -9.5 |
| + 1.25 MHz | 1931.05 | -80.97 | 21.1 | -59.87 | -9.5 |
| + 1.25 MHz – 2.5 MHz | 1931.19 | -81.10 | 21.1 | -60.00 | -29.5 |
| > + 2.5MHz | 1933.06 | -81.93 | 21.1 | -60.83 | -39.5 |

| | Out-of-Band Emissions From UPCS bandedge | Attenuation (dB) required below Reference power of 112mW |
|---|---|---|
| Limits | ± 1.25MHz | 30 |
| | ±1.25 MHz – 2.5 MHz | 50 |
| | > ±2.5MHz | 60 |
| | **In band Emissions from centre of emission bandwidth** | **Attenuation (dB) required below permitted peak power for the EUT** |
| | 1B – 2B | 30 |
| | 2B – 3B | 50 |
| | 3B – UPCS band edge | 60 |

**Notes**:
1 EUT fitted with temporary antenna connector.
2 New / Fully Charged batteries used for battery powered products.
3 See Appendix B for out of band emissions compliance plots, offsets <2.5 MHz
4 See Appendix B for in band emissions compliance plots.
5 Resolution bandwidth approximately 1% of emissions bandwidth.
6 Video bandwidth 3 x Resolution bandwidth.
7 Receiver detector = Peak detector, Max Hold Enabled.
8 Only emissions within 20 dB of the limit are recorded.
9 EUT utilises integral antenna, manufacturer declares radiated emission at offset >2.5MHz

**Test Method**:
1 The EUT was connected to a spectrum analyser via suitable attenuation or filter.
2 The Spectrum analyser was tuned to upper and lower offsets in turn.
3 Any emissions found were measured with the required analyser settings.

| Test Details: | |
|---|---|
| Regulation | CFR 47 Part 15.323(d) & RSS-213 – 5.8 |
| Measurement standard | ANSI C63.17:2013 sub-clause 6.1.6. |
| EUT sample number | S25 |
| Modification state | 1 |
| SE in test environment | None |
| SE isolated from EUT | S21, S24 |
| EUT set up | Refer to Appendix C |

| Out-of-Band Emissions from UPCS bandedge | FREQ. (MHz) | MEAS. Rx. (dBm) | CABLE & ATTEN. LOSS (dB) | EMISSION LEVEL (dBm) | LIMIT (dBm) |
|---|---|---|---|---|---|
| > - 2.5MHz | 1917.26 | -82.41 | 21.1 | -61.31 | -39.5 |
| - 1.25 MHz – 2.5 MHz | 1918.71 | -82.61 | 21.1 | -61.51 | -29.5 |
| - 1.25 MHz | 1919.91 | -81.35 | 21.1 | -60.25 | -9.5 |
| + 1.25 MHz | 1930.17 | -57.64 | 21.1 | -36.54 | -9.5 |
| + 1.25 MHz – 2.5 MHz | 1931.25 | -70.75 | 21.1 | -49.65 | -29.5 |
| > + 2.5MHz | 1932.94 | -77.30 | 21.1 | -56.20 | -39.5 |

| | | |
|---|---|---|
| Limits | **Out-of-Band Emissions From UPCS bandedge** | **Attenuation (dB) required below Reference power of 112mW** |
| | ± 1.25MHz | 30 |
| | ±1.25 MHz – 2.5 MHz | 50 |
| | > ±2.5MHz | 60 |
| | **In band Emissions from centre of emission bandwidth** | **Attenuation (dB) required below permitted peak power for the EUT** |
| | 1B – 2B | 30 |
| | 2B – 3B | 50 |
| | 3B – UPCS band edge | 60 |

## A22 Emissions Inside and Outside the Sub-Band - Radiated

| Test Details: CR-DU-PIR-USA | |
|---|---|
| Regulation | CFR 47 Part 15.323(d) & RSS-213 – 5.8 |
| Measurement standard | ANSI C63.17:2013 sub-clause 6.1.6. |
| EUT sample number | S16 |
| Modification state | 0 |
| SE in test environment | None |
| SE isolated from EUT | None |
| EUT set up | Refer to Appendix C |

| DET | FREQ. (MHz) | MEAS Rx (dBµV) | CABLE LOSS (dB) | ANT FACT. (dB/m) | PRE AMP (dB) | FIELD ST'GH (dBµV/m) | EXTRAP FACT (dB) | FIELD ST'GH (µV/m) | LIMIT (µV/m) |
|---|---|---|---|---|---|---|---|---|---|
| Bottom Channel | | | | | | | | | |
| Pk | 3842.72 | 58.81 | 3.40 | 32.30 | 35.72 | 58.79 | 0.00 | 869.96 | 5012 |
| Av | 3842.72 | 38.09 | 3.40 | 32.30 | 35.72 | 38.07 | 0.00 | 80.08 | 500 |
| Pk | 3850.67 | 59.19 | 3.40 | 32.30 | 35.71 | 59.18 | 0.00 | 909.91 | 5012 |
| Av | 3850.67 | 35.92 | 3.40 | 32.30 | 35.71 | 35.91 | 0.00 | 62.45 | 500 |
| Top Channel | | | | | | | | | |
| Pk | 3857.02 | 58.96 | 3.40 | 32.30 | 35.70 | 58.96 | 0.00 | 887.16 | 5012 |
| Av | 3857.02 | 36.85 | 3.40 | 32.30 | 35.70 | 36.85 | 0.00 | 69.58 | 500 |
| Pk | 7712.49 | 51.53 | 5.00 | 36.60 | 36.70 | 56.43 | 0.00 | 662.98 | 5012 |
| Av | 7712.49 | 34.02 | 5.00 | 36.60 | 36.70 | 38.92 | 0.00 | 88.31 | 500 |

| Test Details: CR-DUS-PIR-USA | |
|---|---|
| Regulation | CFR 47 Part 15.323(d) & RSS-213 – 5.8 |
| Measurement standard | ANSI C63.17:2013 sub-clause 6.1.6. |
| EUT sample number | S12 |
| Modification state | 0 |
| SE in test environment | None |
| SE isolated from EUT | None |
| EUT set up | Refer to Appendix C |

| DET | FREQ. (MHz) | MEAS Rx (dBµV) | CABLE LOSS (dB) | ANT FACT. (dB/m) | PRE AMP (dB) | FIELD ST'GH (dBµV/m) | EXTRAP FACT (dB) | FIELD ST'GH (µV/m) | LIMIT (µV/m) |
|---|---|---|---|---|---|---|---|---|---|
| Bottom Channel | | | | | | | | | |
| Pk | 2882.35 | 65.05 | 3.20 | 29.30 | 36.10 | 61.45 | 0.00 | 1181.68 | 5012 |
| Av | 2882.35 | 43.48 | 3.20 | 29.30 | 36.10 | 39.88 | 0.00 | 98.63 | 500 |
| Pk | 3842.72 | 54.43 | 3.40 | 32.30 | 35.72 | 54.41 | 0.00 | 525.41 | 5012 |
| Av | 3842.72 | 35.91 | 3.40 | 32.30 | 35.72 | 35.89 | 0.00 | 62.30 | 500 |
| Pk | 5763.80 | 54.17 | 5.00 | 34.00 | 36.16 | 57.01 | 0.00 | 708.76 | 5012 |
| Av | 5763.80 | 34.94 | 5.00 | 34.00 | 36.16 | 37.78 | 0.00 | 77.45 | 500 |
| Top Channel | | | | | | | | | |
| Pk | 2892.65 | 65.65 | 3.20 | 29.40 | 36.10 | 62.15 | 0.00 | 1280.86 | 5012 |
| Av | 2892.65 | 43.94 | 3.20 | 29.40 | 36.10 | 40.44 | 0.00 | 105.20 | 500 |
| Pk | 3857.02 | 54.01 | 3.40 | 32.30 | 35.70 | 54.01 | 0.00 | 501.76 | 5012 |
| Av | 3857.02 | 35.67 | 3.40 | 32.30 | 35.70 | 35.67 | 0.00 | 60.74 | 500 |
| Pk | 5785.26 | 53.69 | 4.90 | 33.90 | 36.17 | 56.32 | 0.00 | 654.64 | 5012 |
| Av | 5785.26 | 34.85 | 4.90 | 33.90 | 36.17 | 37.48 | 0.00 | 74.82 | 500 |
| Pk | 7712.49 | 53.34 | 5.00 | 36.60 | 36.70 | 58.24 | 0.00 | 816.58 | 5012 |
| Av | 7712.49 | 34.91 | 5.00 | 36.60 | 36.70 | 39.81 | 0.00 | 97.84 | 500 |

| Test Details: CR-DU-TMP-USA | |
|---|---|
| Regulation | CFR 47 Part 15.323(d) & RSS-213 – 5.8 |
| Measurement standard | ANSI C63.17:2013 sub-clause 6.1.6. |
| EUT sample number | S13 |
| Modification state | 0 |
| SE in test environment | None |
| SE isolated from EUT | None |
| EUT set up | Refer to Appendix C |

| DET | FREQ. (MHz) | MEAS Rx (dBµV) | CABLE LOSS (dB) | ANT FACT. (dB/m) | PRE AMP (dB) | FIELD ST'GH (dBµV/m) | EXTRAP FACT (dB) | FIELD ST'GH (µV/m) | LIMIT (µV/m) |
|---|---|---|---|---|---|---|---|---|---|
| Bottom Channel | | | | | | | | | |
| Pk | 3842.72 | 56.75 | 3.40 | 32.30 | 35.72 | 56.73 | 0.00 | 686.28 | 5012 |
| Av | 3842.72 | 37.51 | 3.40 | 32.30 | 35.72 | 37.49 | 0.00 | 74.90 | 500 |
| Pk | 7684.59 | 57.27 | 5.00 | 36.60 | 36.70 | 62.17 | 0.00 | 1283.81 | 5012 |
| Av | 7684.59 | 36.82 | 5.00 | 36.60 | 36.70 | 41.72 | 0.00 | 121.90 | 500 |
| Top Channel | | | | | | | | | |
| Pk | 3857.02 | 54.94 | 3.40 | 32.30 | 35.70 | 54.94 | 0.00 | 558.47 | 5012 |
| Av | 3857.02 | 36.11 | 3.40 | 32.30 | 35.70 | 36.11 | 0.00 | 63.90 | 500 |
| Pk | 7712.49 | 57.36 | 5.00 | 36.60 | 36.70 | 62.26 | 0.00 | 1297.18 | 5012 |
| Av | 7712.49 | 36.52 | 5.00 | 36.60 | 36.70 | 41.42 | 0.00 | 117.76 | 500 |

| Test Details: CR-DU-MAG-USA | |
|---|---|
| Regulation | CFR 47 Part 15.323(d) & RSS-213 – 5.8 |
| Measurement standard | ANSI C63.17:2013 sub-clause 6.1.6. |
| EUT sample number | S15 |
| Modification state | 0 |
| SE in test environment | None |
| SE isolated from EUT | None |
| EUT set up | Refer to Appendix C |

| DET | FREQ. (MHz) | MEAS Rx (dBµV) | CABLE LOSS (dB) | ANT FACT. (dB/m) | PRE AMP (dB) | FIELD ST'GH (dBµV/m) | EXTRAP FACT (dB) | FIELD ST'GH (µV/m) | LIMIT (µV/m) |
|---|---|---|---|---|---|---|---|---|---|
| Bottom Channel | | | | | | | | | |
| Pk | 3842.72 | 56.01 | 3.40 | 32.30 | 35.72 | 55.99 | 0.00 | 630.23 | 5012 |
| Av | 3842.72 | 36.36 | 3.40 | 32.30 | 35.72 | 36.34 | 0.00 | 65.61 | 500 |
| Pk | 7684.59 | 55.99 | 5.00 | 36.60 | 36.70 | 60.89 | 0.00 | 1107.90 | 5012 |
| Av | 7684.59 | 35.81 | 5.00 | 36.60 | 36.70 | 40.71 | 0.00 | 108.52 | 500 |
| Top Channel | | | | | | | | | |
| Pk | 3857.02 | 55.14 | 3.40 | 32.30 | 35.70 | 55.14 | 0.00 | 571.48 | 5012 |
| Av | 3857.02 | 36.05 | 3.40 | 32.30 | 35.70 | 36.05 | 0.00 | 63.46 | 500 |
| Pk | 7712.49 | 56.36 | 5.00 | 36.60 | 36.70 | 61.26 | 0.00 | 1156.11 | 5012 |
| Av | 7712.49 | 36.22 | 5.00 | 36.60 | 36.70 | 41.12 | 0.00 | 113.76 | 500 |

| Test Details: CR-DU-FLD-USA | |
|---|---|
| Regulation | CFR 47 Part 15.323(d) & RSS-213 – 5.8 |
| Measurement standard | ANSI C63.17:2013 sub-clause 6.1.6. |
| EUT sample number | S14 |
| Modification state | 0 |
| SE in test environment | None |
| SE isolated from EUT | None |
| EUT set up | Refer to Appendix C |

| DET | FREQ. (MHz) | MEAS Rx (dBµV) | CABLE LOSS (dB) | ANT FACT. (dB/m) | PRE AMP (dB) | FIELD ST'GH (dBµV/m) | EXTRAP FACT (dB) | FIELD ST'GH (µV/m) | LIMIT (µV/m) |
|---|---|---|---|---|---|---|---|---|---|
| Bottom Channel | | | | | | | | | |
| Pk | 3842.72 | 55.11 | 3.40 | 32.30 | 35.72 | 55.09 | 0.00 | 568.20 | 5012 |
| Av | 3842.72 | 36.44 | 3.40 | 32.30 | 35.72 | 36.42 | 0.00 | 66.22 | 500 |
| Pk | 7684.59 | 54.22 | 5.00 | 36.60 | 36.70 | 59.12 | 0.00 | 903.65 | 5012 |
| Av | 7684.59 | 35.08 | 5.00 | 36.60 | 36.70 | 39.98 | 0.00 | 99.77 | 500 |
| Top Channel | | | | | | | | | |
| Pk | 3857.02 | 54.08 | 3.40 | 32.30 | 35.70 | 54.08 | 0.00 | 505.82 | 5012 |
| Av | 3857.02 | 35.83 | 3.40 | 32.30 | 35.70 | 35.83 | 0.00 | 61.87 | 500 |
| Pk | 7712.49 | 54.25 | 5.00 | 36.60 | 36.70 | 59.15 | 0.00 | 906.78 | 5012 |
| Av | 7712.49 | 35.41 | 5.00 | 36.60 | 36.70 | 40.31 | 0.00 | 103.63 | 500 |

**Notes:**

1 Any testing performed below 30 MHz was performed using a magnetic loop antenna in accordance with ANSI C63.10: section 4.5, Table 1 For emissions below 30MHz the cable losses are assumed to be negligible.
2 In accordance with 15.35(b), above 1 GHz, emissions measured using a peak detector shall not exceed a level 20 dB above the average limit.
3 Testing was performed with the EUT orientated in three orthogonal planes and the maximum emissions level recorded. In addition, the EUT antenna was varied within its range of motion in order to maximise emissions.
4 For Frequencies below 1 GHz, RBW= 120 kHz, testing was performed with CISPR16 compliant test receiver with QP detector. Above 1 GHz tests were performed using a spectrum analyser using the following settings:

| | |
|---|---|
| Peak | RBW=VBW= 1MHz |
| Average | RBW=VBW= 1MHz |

The upper and lower frequency of the measurement range was decided according to 47 CFR 15:2008 Clause 15.33(a) and 15.33(a)(1).

Radiated emission limits 47 CFR 15: Clause 15.209 for all emissions:

| Frequency of emission (MHz) | Field strength μV/m | Measurement Distance m | Field strength dBμV/m |
|---|---|---|---|
| 0.009-0.490 | 2400/F(kHz) | 300 | 67.6/F (kHz) |
| 0.490-1.705 | 24000/F(kHz) | 30 | 87.6/F (kHz |
| 1.705-30 | 30 | 30 | 29.5 |
| 30-88 | 100 | 3 | 40.0 |
| 88-216 | 150 | 3 | 43.5 |
| 216-960 | 200 | 3 | 46.0 |
| Above 960 | 500 | 3 | 54.0 |

(a) Where results have been measured at one distance, and a signal level displayed at another, the results have been extrapolated using the following formula:

$$\text{Extrapolation}\,(\text{dB}) = 20\log_{10}\left(\frac{\text{measurement distance}}{\text{specification distance}}\right)$$

(b) The levels may have been rounded for display purposes.

(c) The following table summarises the effect of the EUT operating mode, internal configuration and arrangement of cables / samples on the measured emission levels :

| | See (i) | See (ii) | See (iii) | See (iv) |
|---|---|---|---|---|
| Effect of EUT operating mode on emission levels | ✓ | | | |
| Effect of EUT internal configuration on emission levels | ✓ | | | |
| Effect of Position of EUT cables & samples on emission levels | | | ✓ | |

(i) Parameter defined by standard and / or single possible, refer to Appendix D
(ii) Parameter defined by client and / or single possible, refer to Appendix D
(iii) Parameter had a negligible effect on emission levels, refer to Appendix D
(iv) Worst case determined by initial measurement, refer to Appendix D

## A23 Frame Repetition Stability

| Test Details: | |
|---|---|
| Regulation | CFR 47 Part 15.323(e) & RSS-213 - 4.3.4(c) |
| Measurement standard | ANSI C63.17:2013 sub-clause 6.2.2 & 6.2.3 |
| EUT sample number | S25 |
| Modification state | 1 |
| SE in test environment | None |
| SE isolated from EUT | None |
| EUT set up | Refer to Appendix C |

### Frame Repetition Stability

This is the mean value of the frame repetition rate recorded over 1000 samples. For devices that divide access in time the repetition rate shall not exceed 10ppm.

### Result

| Frame Repetition Stability (ppm) | Limit (ppm) | Pass/Fail |
|---|---|---|
| -0.01 | ±10ppm | PASS |

### Frame Period and Jitter

Jitter is the difference in time between the rising edges of consecutive pulses.

### Result

| Maximum Jitter (µs) | 3xSD Jitter (µs) | Frame period (ms) | Limit (µs) | | Pass/Fail |
|---|---|---|---|---|---|
| | | | Frame Period (ms) | Jitter (µs) | |
| 0.22 | 0.66 | 10.00066 | 2 or 10/X | 12.5 | Pass |

Notes: 1. See Annex K for frame period plot.

## A24 Frequency Stability

| Test Details: | |
|---|---|
| Regulation | CFR 47 Part 15.323(f) & RSS-213 – 6.2 |
| Measurement standard | ANSI C63.17:2013 sub-clause 6.2.1 |
| EUT sample number | S25 |
| Modification state | 1 |
| SE in test environment | None |
| SE isolated from EUT | None |
| EUT set up | Refer to Appendix C |

This testing is carried out with the following conditions over 5000 samples.

### Results

| Temperature ($^{o}$C) | Voltage (Vdc) | Fc (MHz) | offset (kHz) | offset (ppm) | Limit (ppm) |
|---|---|---|---|---|---|
| +20 | Vnom | 1924.992 | 5 | 2.60 | ±10ppm |
| -20 | Vnom | 1924.992 | 4 | 2.08 | ±10ppm |
| +55 | Vnom | 1924.992 | 6 | 3.12 | ±10ppm |

Note: 1. The EUT is battery powered therefore voltage variations are not required.

## A25 Unintentional Radiated Emissions

Preliminary scans were performed using a peak detector with the RBW = 100kHz. The radiated electric field emission test applies to all spurious emissions on directly related to the transmitter. The EUT was set to operate in a transmit standby / receive mode.

The following test site was used for final measurements as specified by the standard tested to:

3m open area test site : [ ] 3m alternative test site : [X]

| Test Details: | |
|---|---|
| Regulation | CFR 47 Part 15.323(d) & RSS-GEN Issue 4, 7.1 |
| Measurement standard | ANSI C63.17:2013 sub-clause 6.1.6. |
| EUT sample number | S12, S13, S14, S15, S16 |
| Modification state | 0 |
| SE in test environment | None |
| SE isolated from EUT | None |
| EUT set up | Refer to Appendix C |
| Temperature | 24$^{o}$C |
| Photographs | Appendix E |

The worst case radiated emission measurements for spurious emissions are listed below:

| Ref No. | FREQ. (MHz) | MEAS Rx (dBµV) | CABLE LOSS (dB) | ANT FACT. (dB/m) | PRE AMP (dB) | FIELD ST'GH (dBµV/m) | EXTRAP FACT (dB) | FIELD ST'GH (µV/m) | LIMIT (µV/m) |
|---|---|---|---|---|---|---|---|---|---|
| CR-DUS-PIR-USA | | | | | | | | | |
| No Significant Emissions Within 20 dB of The Limit | | | | | | | | | |
| CR-DUS-TMP-USA | | | | | | | | | |
| No Significant Emissions Within 20 dB of The Limit | | | | | | | | | |
| CR-DUS-MAG-USA | | | | | | | | | |
| No Significant Emissions Within 20 dB of The Limit | | | | | | | | | |
| CR-DUS-FLD-USA | | | | | | | | | |
| No Significant Emissions Within 20 dB of The Limit | | | | | | | | | |
| CR-DU-PIR-USA | | | | | | | | | |
| No Significant Emissions Within 20 dB of The Limit | | | | | | | | | |

**Notes:**

1 Any testing performed below 30 MHz was performed using a magnetic loop antenna in accordance with ANSI C63.10: section 4.5, Table 1 For emissions below 30MHz the cable losses are assumed to be negligible.
2 In accordance with 15.35(b), above 1 GHz, emissions measured using a peak detector shall not exceed a level 20 dB above the average limit.
3 Testing was performed with the EUT orientated in three orthogonal planes and the maximum emissions level recorded. In addition, the EUT antenna was varied within its range of motion in order to maximise emissions.
4 For Frequencies below 1 GHz, RBW = 120 kHz, testing was performed with CISPR16 compliant test receiver with QP detector. Above 1 GHz tests were performed using a spectrum analyser using the following settings:

| | |
|---|---|
| Peak | RBW=VBW= 1MHz |
| Average | RBW=VBW= 1MHz |

The upper and lower frequency of the measurement range was decided according to 47 CFR Part 15:2008 Clause 15.33(a) and 15.33(a)(1).

Radiated emission limits 47 CFR Part 15: Clause 15.209 for all emissions:

| Frequency of emission (MHz) | Field strength μV/m | Measurement Distance m | Field strength dBμV/m |
|---|---|---|---|
| 0.009-0.490 | 2400/F(kHz) | 300 | 67.6/F (kHz) |
| 0.490-1.705 | 24000/F(kHz) | 30 | 87.6/F (kHz |
| 1.705-30 | 30 | 30 | 29.5 |
| 30-88 | 100 | 3 | 40.0 |
| 88-216 | 150 | 3 | 43.5 |
| 216-960 | 200 | 3 | 46.0 |
| Above 960 | 500 | 3 | 54.0 |

(a) Where results have been measured at one distance, and a signal level displayed at another, the results have been extrapolated using the following formula:

$$\text{Extrapolation}\,(\text{dB}) = 20\log_{10}\left(\frac{\text{measurement distance}}{\text{specification distance}}\right)$$

(b) The levels may have been rounded for display purposes.

(c) The following table summarises the effect of the EUT operating mode, internal configuration and arrangement of cables / samples on the measured emission levels :

| | See (i) | See (ii) | See (iii) | See (iv) |
|---|---|---|---|---|
| Effect of EUT operating mode on emission levels | ✓ | | | |
| Effect of EUT internal configuration on emission levels | ✓ | | | |
| Effect of Position of EUT cables & samples on emission levels | | | ✓ | |

(i) Parameter defined by standard and / or single possible, refer to Appendix D
(ii) Parameter defined by client and / or single possible, refer to Appendix D
(iii) Parameter had a negligible effect on emission levels, refer to Appendix D
(iv) Worst case determined by initial measurement, refer to Appendix D

**Appendix B: Supporting Graphical Data**

This appendix contains graphical data obtained during testing.

Notes:

(a) The radiated electric field emissions and conducted emissions graphical data in this appendix is preview data. For details of formal results, refer to Appendix A and Appendix B.

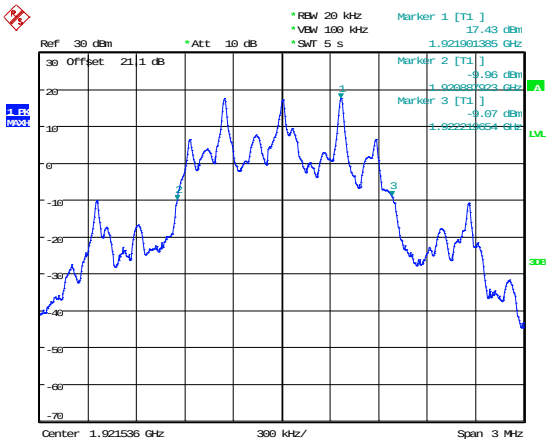
(b) The time and date on the plots do not necessarily equate to the time of the test.

(c) Where relevant, on power line conducted emission plots, the limit displayed is the average limit, which is stricter than the quasi peak limit.

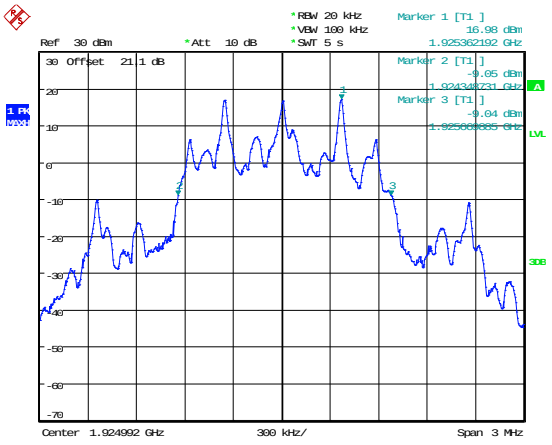
(d) Appendix C details the numbering system used to identify the sample and its modification state.

(e) The plots presented in this appendix may not be a complete record of the measurements performed, but are a representative sample, relative to the final assessment.

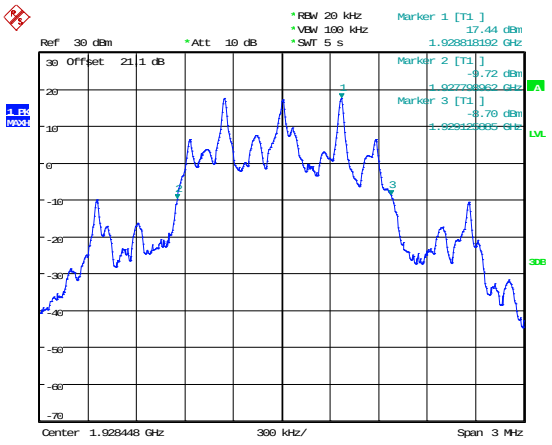
## Emission Bandwidth




$f_l$

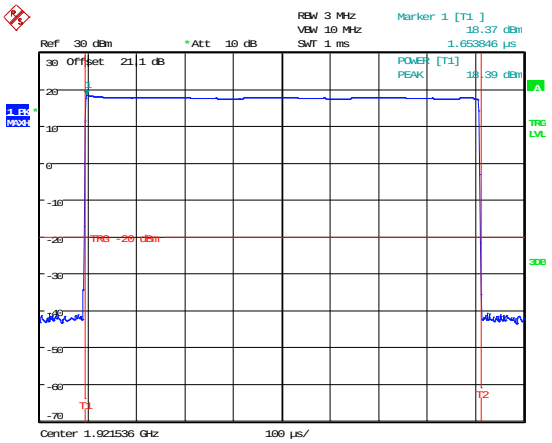



$f_c$

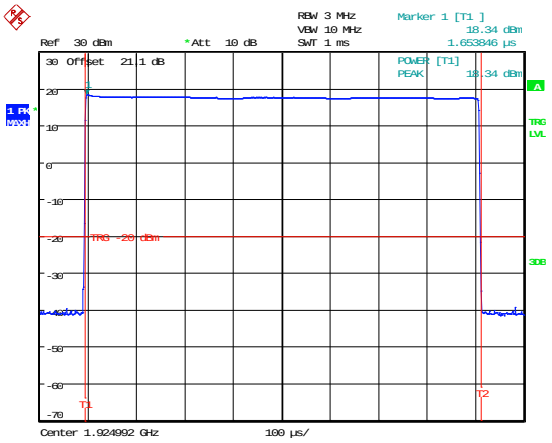



$f_h$

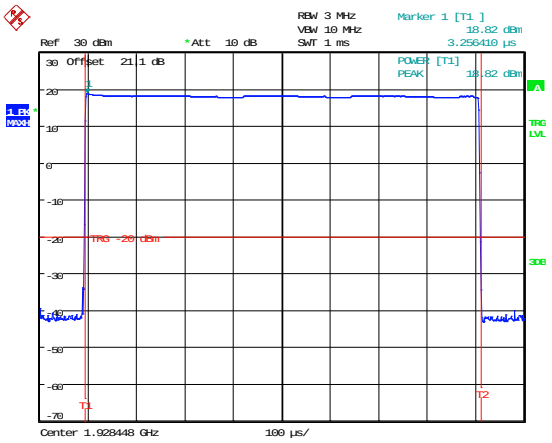
## Peak Transmit Power




$f_l$

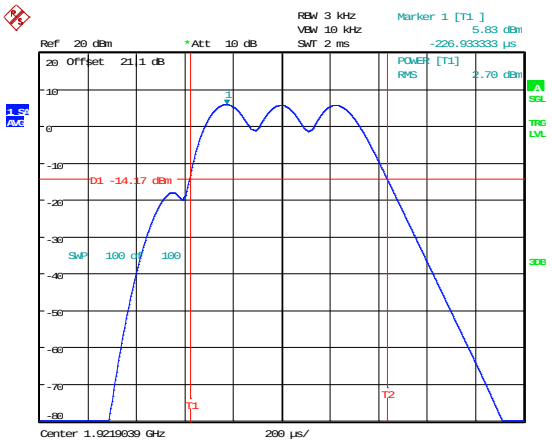



$f_c$

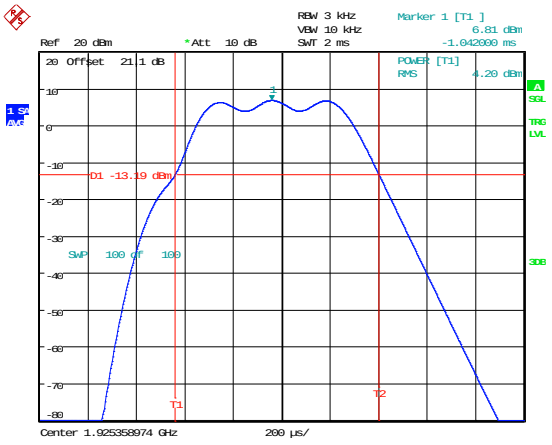



$f_h$

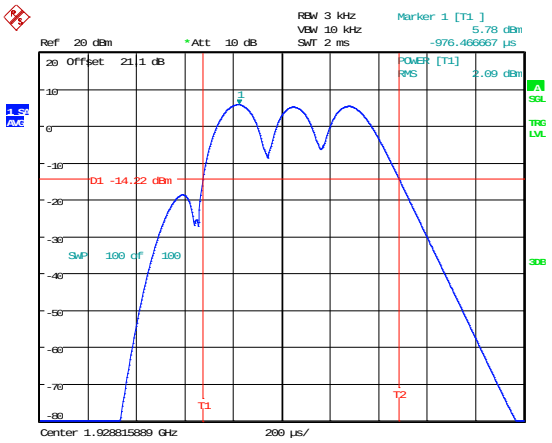
## Power Spectral Density




$f_l$

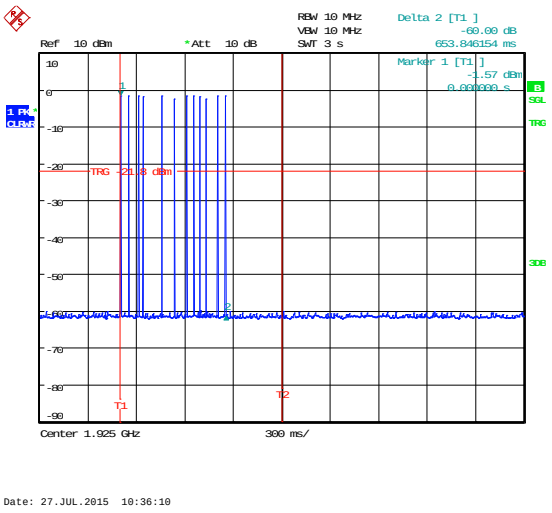



$f_c$

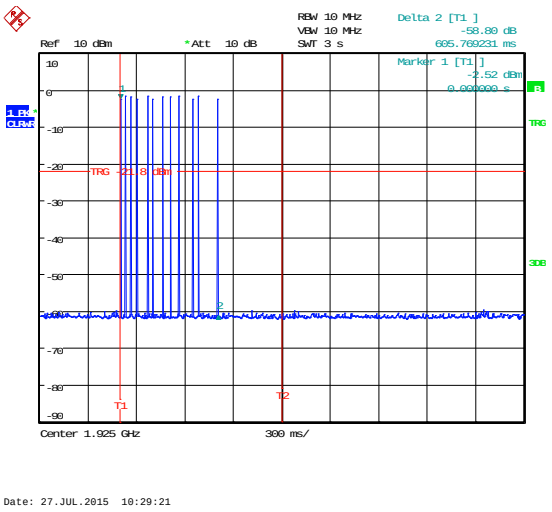



$f_h$

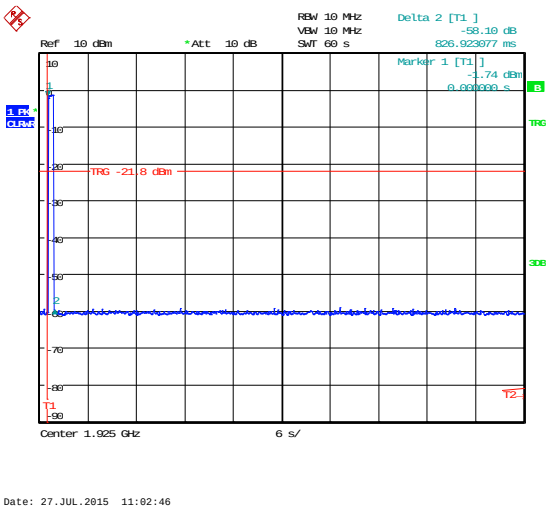
Acknowledgements



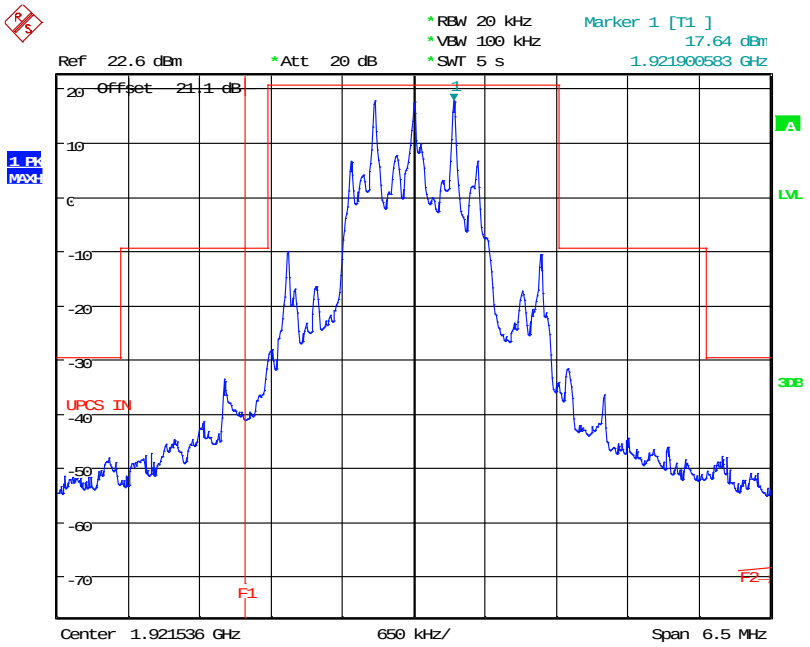

Transmissions on Communications Channel - Initial Acknowledgement Not Received – Automatic Trigger



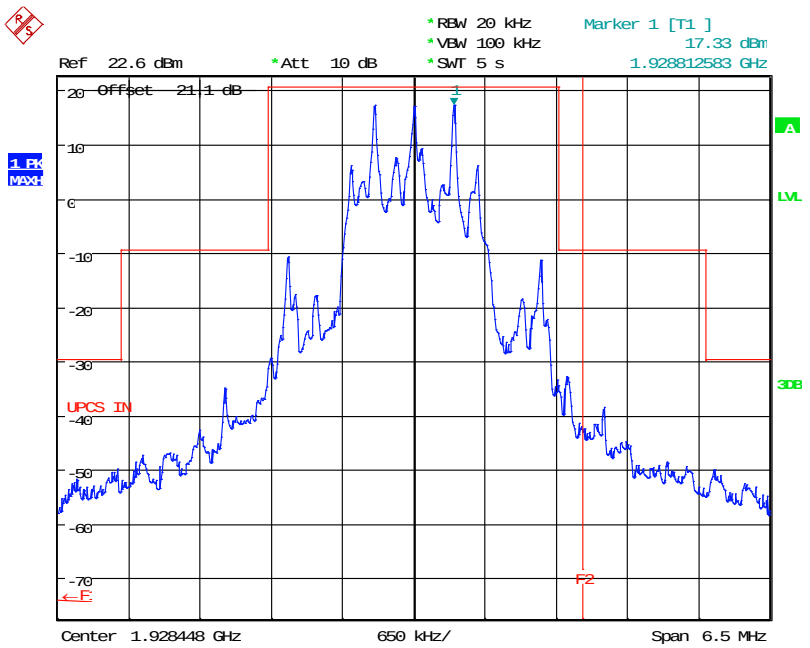

Transmissions on Communications Channel - Initial Acknowledgement Not Received – Manual Trigger




Cease Of Transmissions on Communications Channel - Acknowledgements Blocked

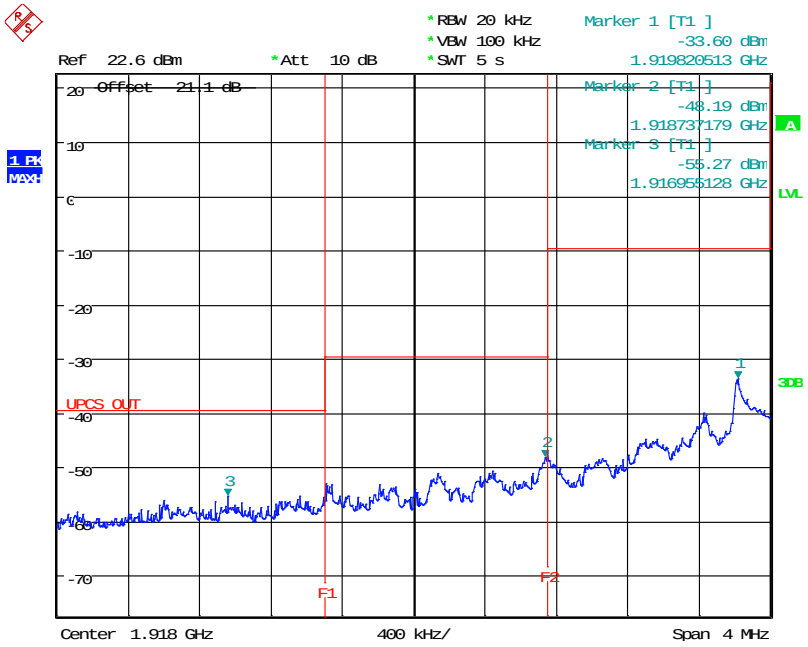



Emissions inside the Sub-Band RF carrier set to the lowest carrier defined by the EUT



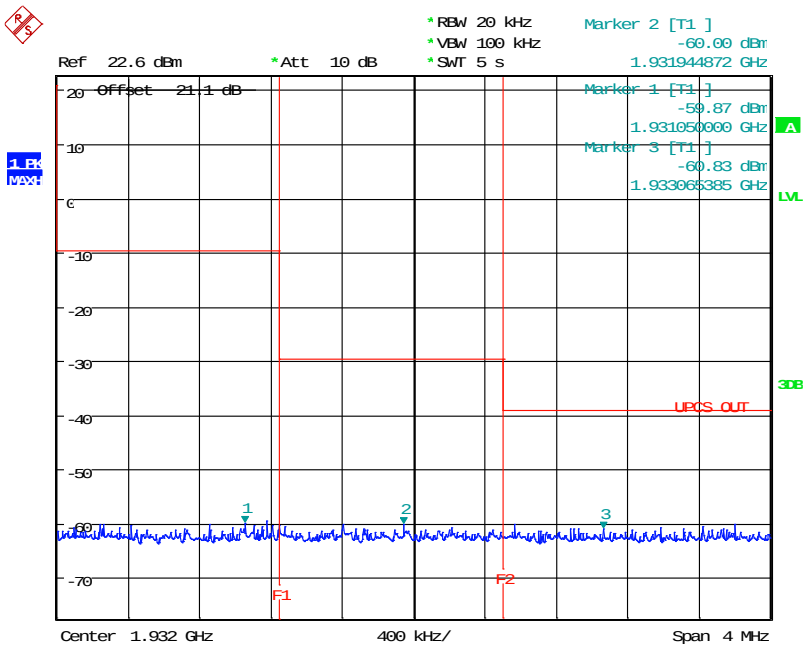

Emissions inside the Sub-Band RF carrier set to the highest carrier defined by the EUT

Conducted Emissions outside the Sub-Band RF carrier set to the lowest carrier defined by the EUT




Date: 28.MAY.2015 14:18:12

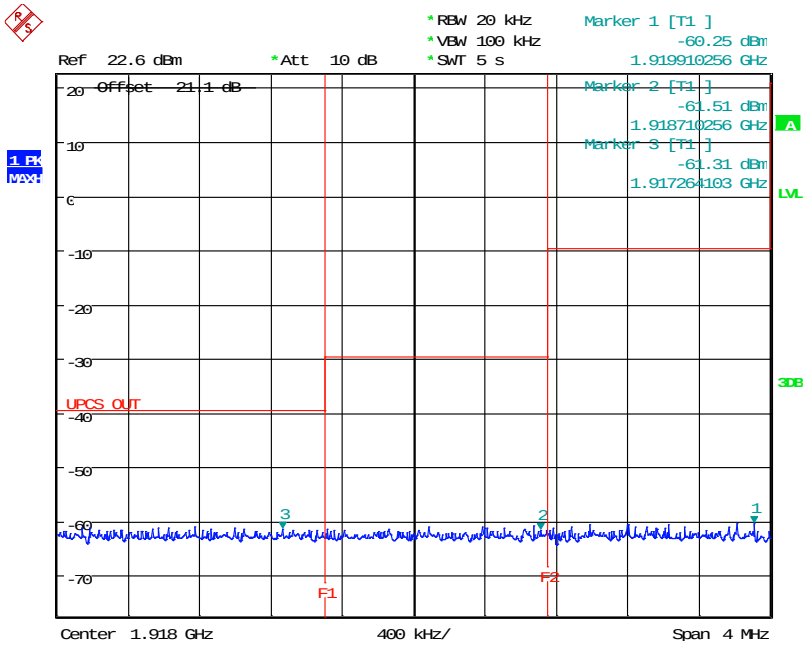
Lower Bandedge - > 2.5MHz




Date: 28.MAY.2015 14:19:20

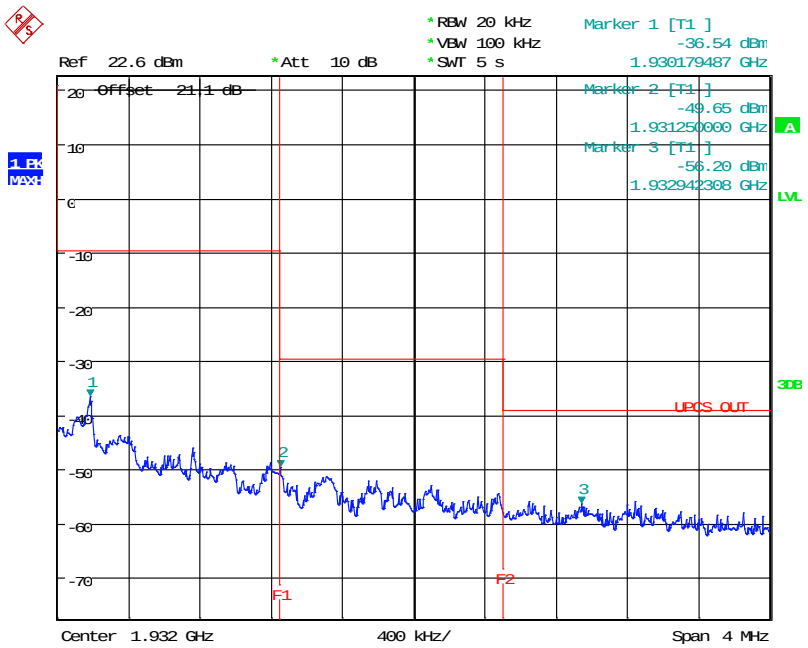
Upper Bandedge - > 2.5MHz

Conducted Emissions outside the Sub-Band RF carrier set to the highest carrier defined by the EUT




Date: 28.MAY.2015 14:24:37

Lower Bandedge - > 2.5MHz

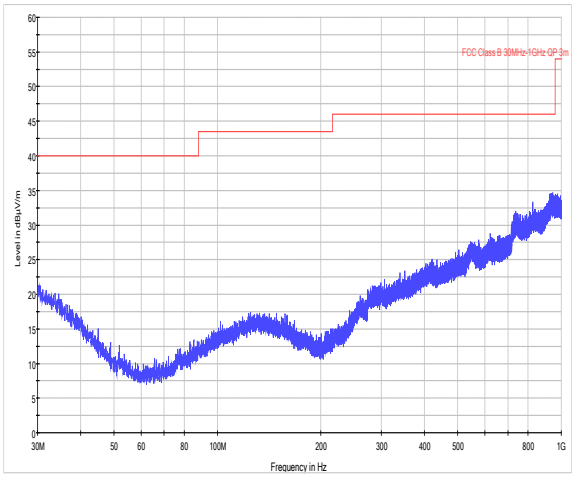



Date: 28.MAY.2015 14:23:59

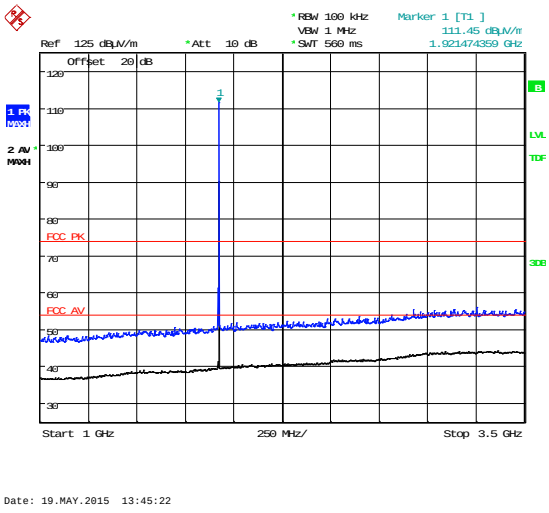
Upper Bandedge - > 2.5MHz

Radiated Emissions outside the Sub-Band RF carrier set to the lowest carrier defined by the EUT

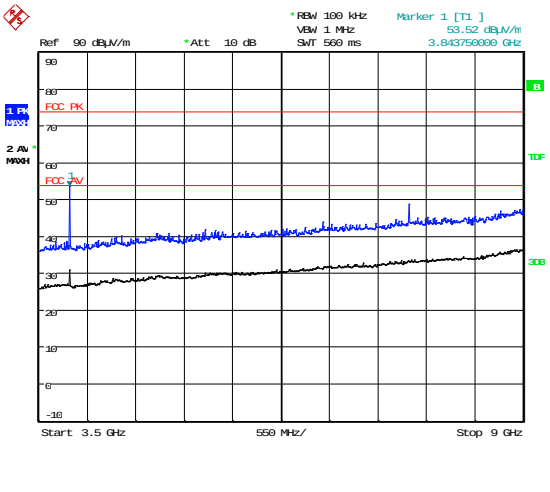
**CR-DU-PIR-USA**



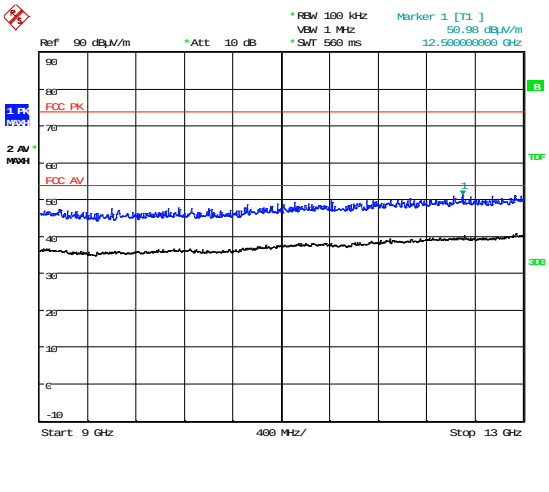

30MHz – 1GHz



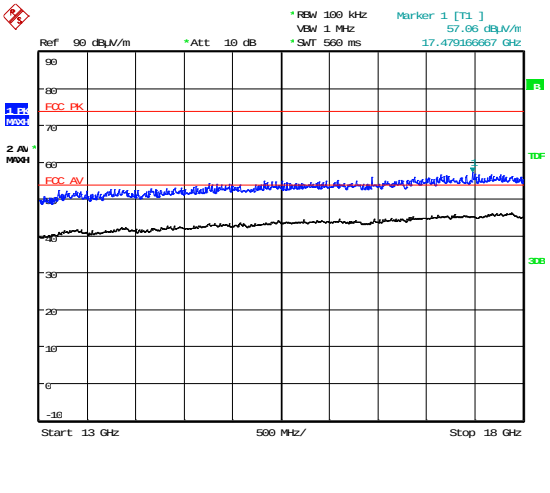

1GHz – 3.5GHz



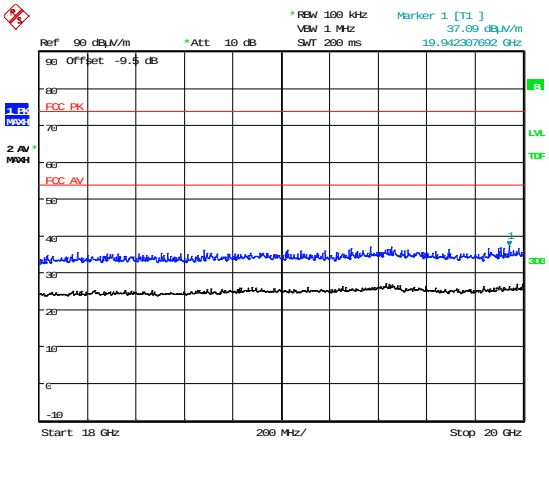

3.5GHz – 9 GHz




9GHz – 13GHz



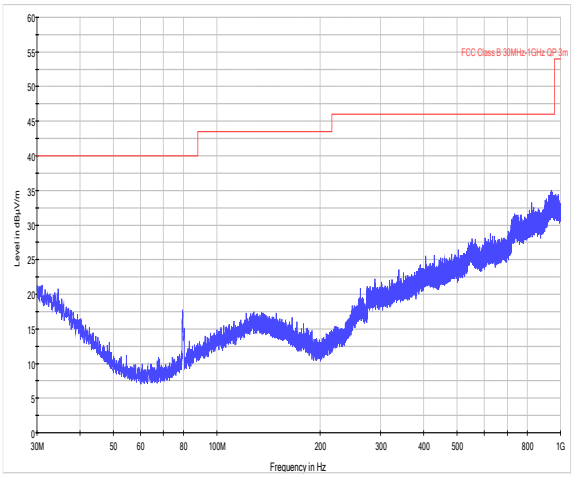

13GHz – 18GHz



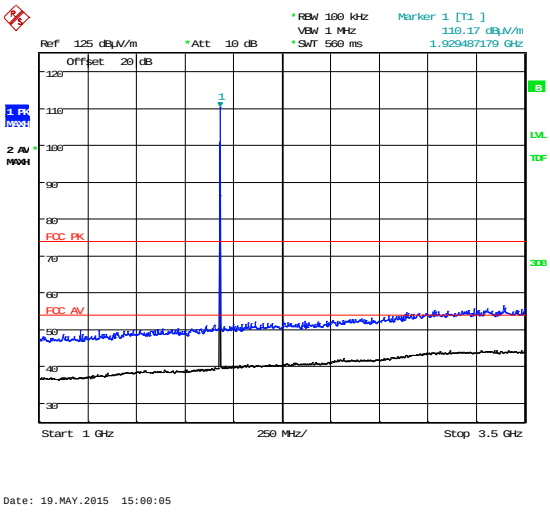

18GHz – 20GHz

Radiated Emissions outside the Sub-Band RF carrier set to the highest carrier defined by the EUT

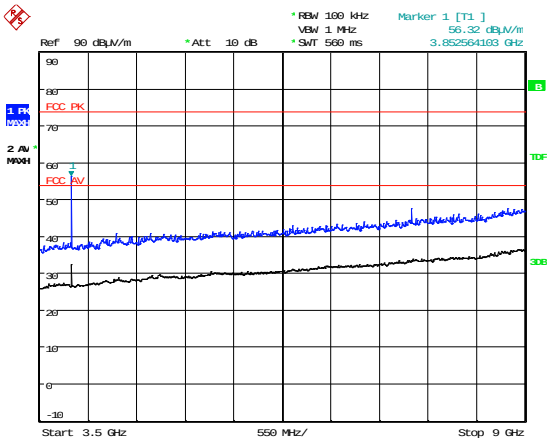
**CR-DU-PIR-USA**



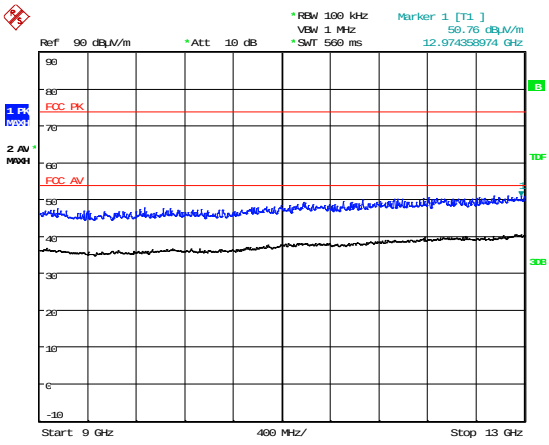

30MHz – 1GHz



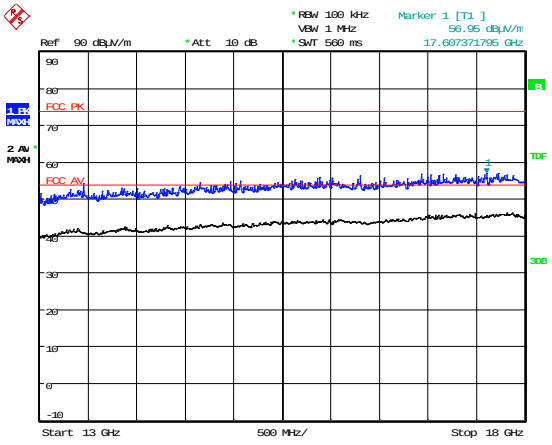

1GHz – 3.5GHz



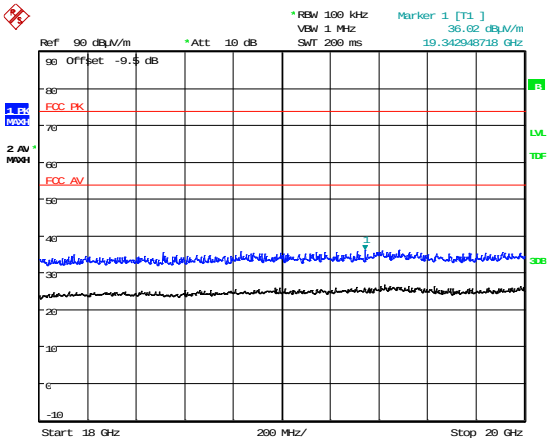

3.5GHz – 9 GHz




9GHz – 13GHz



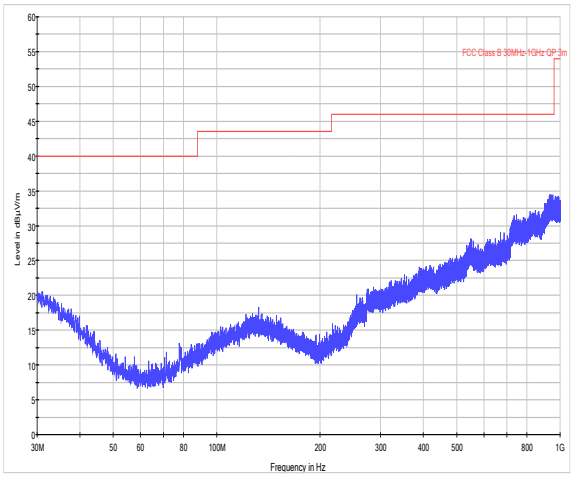

13GHz – 18GHz



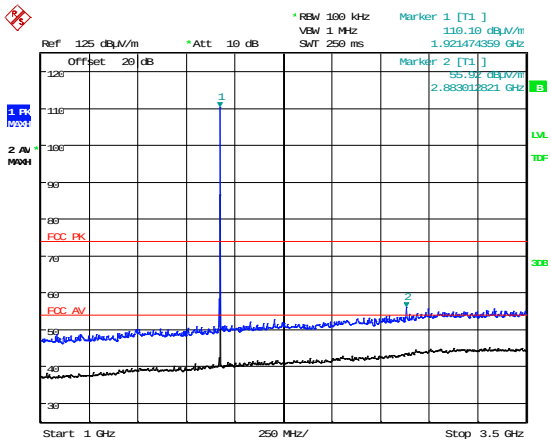

18GHz – 20GHz

Radiated Emissions outside the Sub-Band RF carrier set to the lowest carrier defined by the EUT

**CR-DUS-PIR-USA**

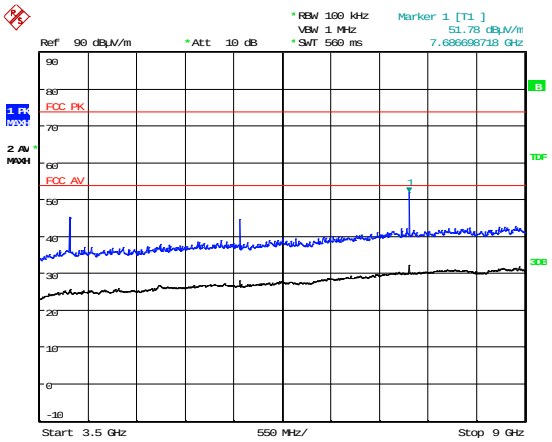



30MHz – 1GHz



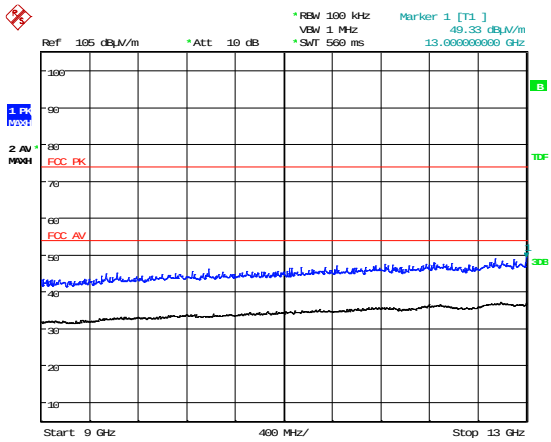

Date: 19.MAY.2015 10:43:30

1GHz – 3.5GHz



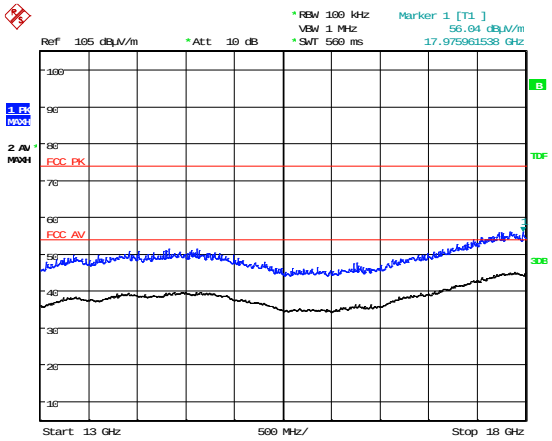

Date: 19.MAY.2015 10:56:26

3.5GHz – 9 GHz



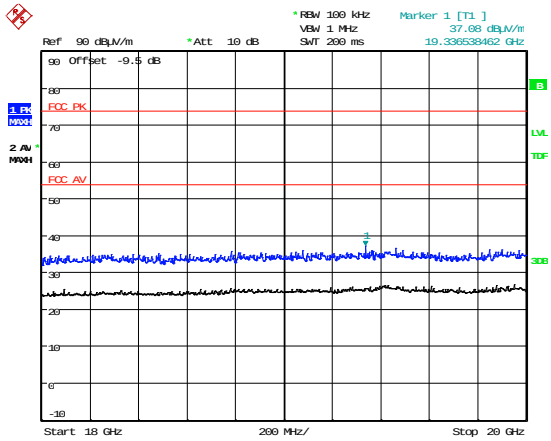

Date: 19.MAY.2015 10:49:26

9GHz – 13GHz




Date: 19.MAY.2015 10:50:04

13GHz – 18GHz

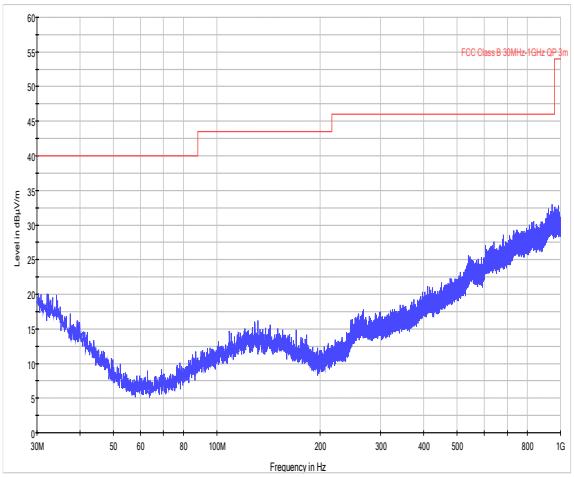



Date: 19.MAY.2015 16:30:03

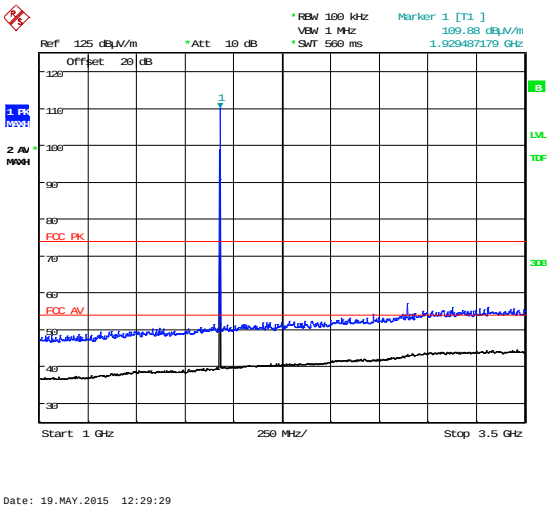
18GHz – 20GHz

Radiated Emissions outside the Sub-Band RF carrier set to the highest carrier defined by the EUT

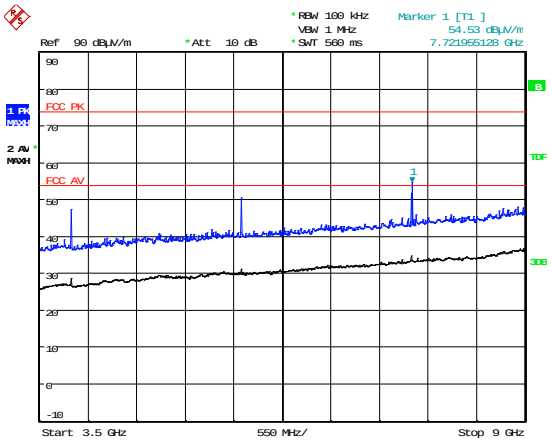
**CR-DUS-PIR-USA**



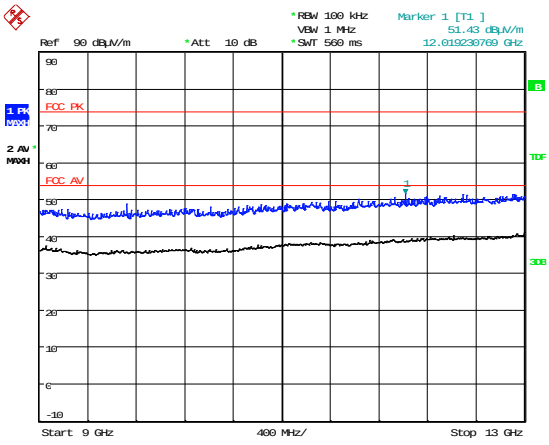

30MHz – 1GHz



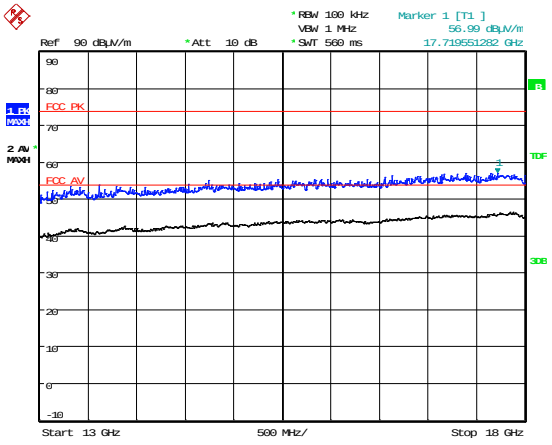

1GHz – 3.5GHz



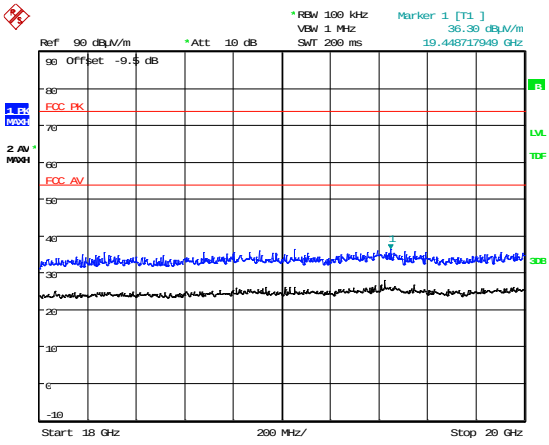

3.5GHz – 9 GHz




9GHz – 13GHz



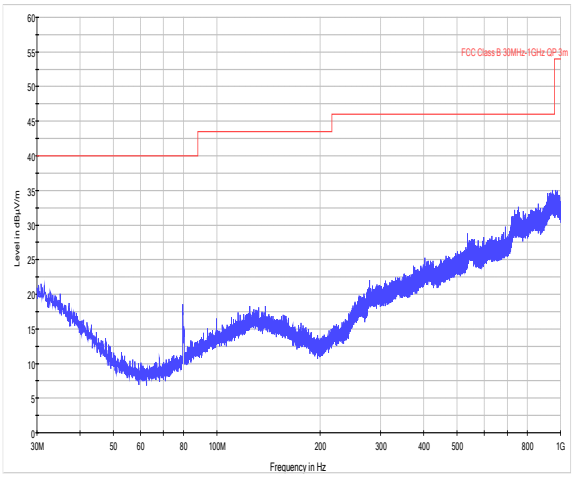

13GHz – 18GHz



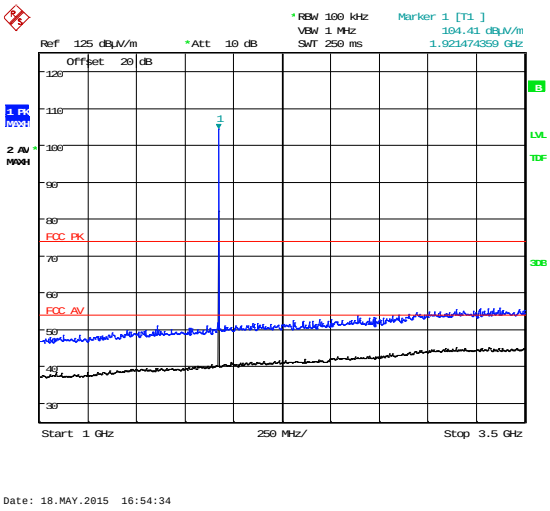

18GHz – 20GHz

Radiated Emissions outside the Sub-Band RF carrier set to the lowest carrier defined by the EUT

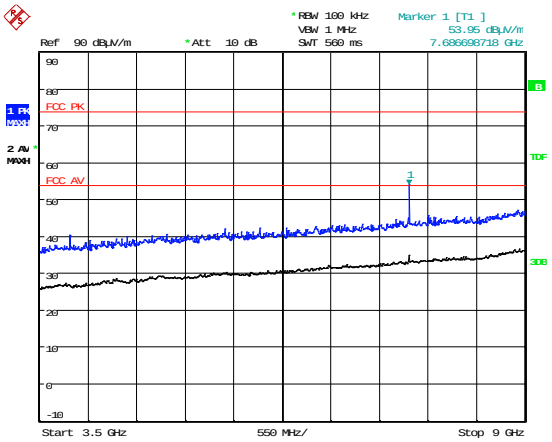
**CR-DU-TMP-USA**



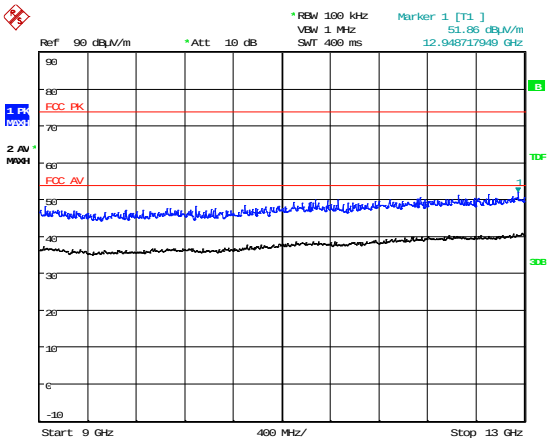

30MHz – 1GHz



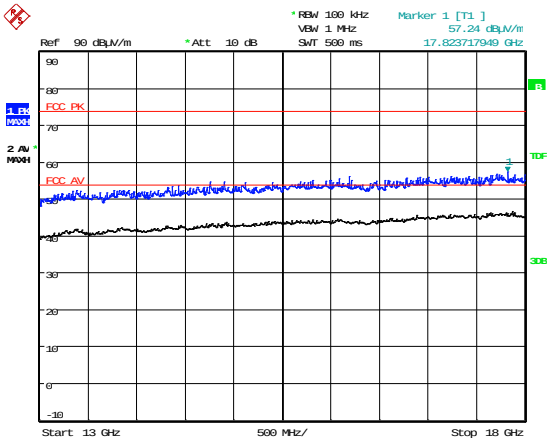

1GHz – 3.5GHz



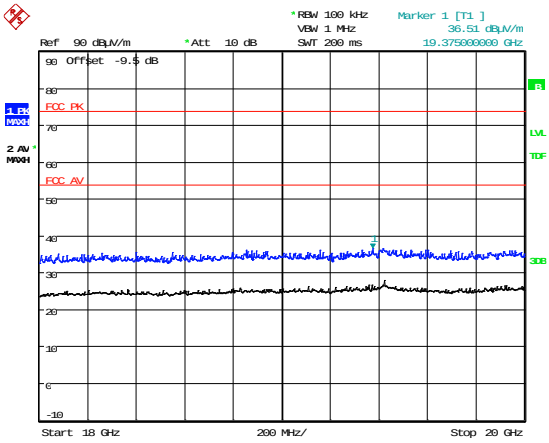

3.5GHz – 9 GHz




9GHz – 13GHz



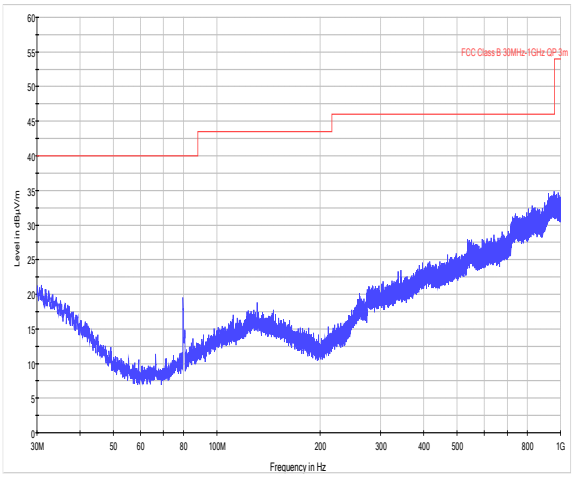

13GHz – 18GHz



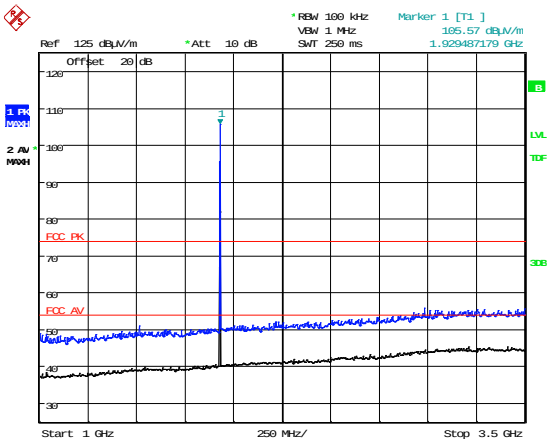

18GHz – 20GHz

Radiated Emissions outside the Sub-Band RF carrier set to the highest carrier defined by the EUT

**CR-DU-TMP-USA**

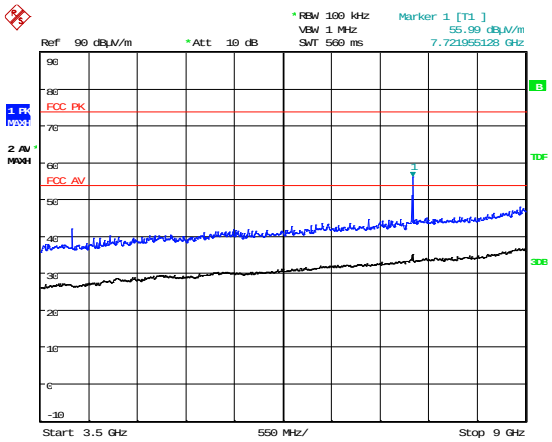



30MHz – 1GHz



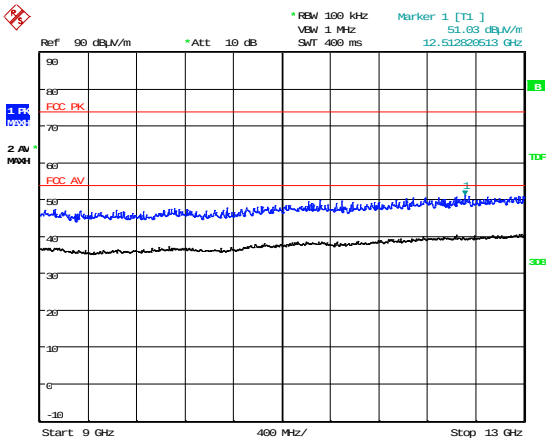

Date: 19.MAY.2015 09:26:37

1GHz – 3.5GHz



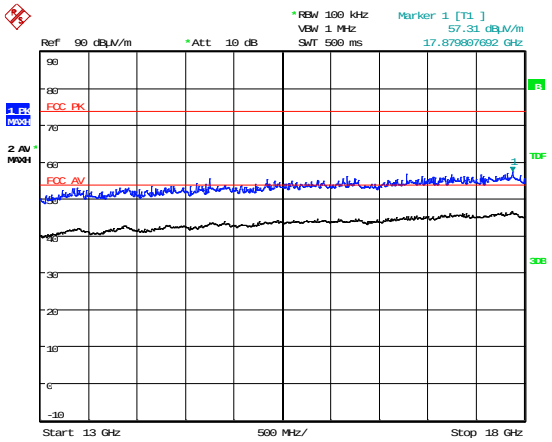

Date: 19.MAY.2015 09:33:51

3.5GHz – 9 GHz



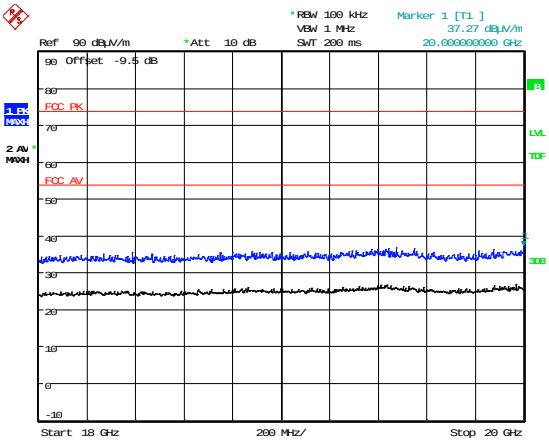

Date: 19.MAY.2015 09:34:11

9GHz – 13GHz




Date: 19.MAY.2015 09:34:33

13GHz – 18GHz

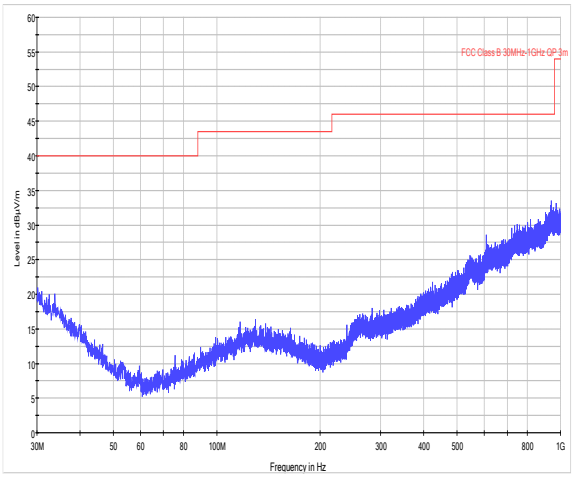



Date: 19.MAY.2015 16:59:48

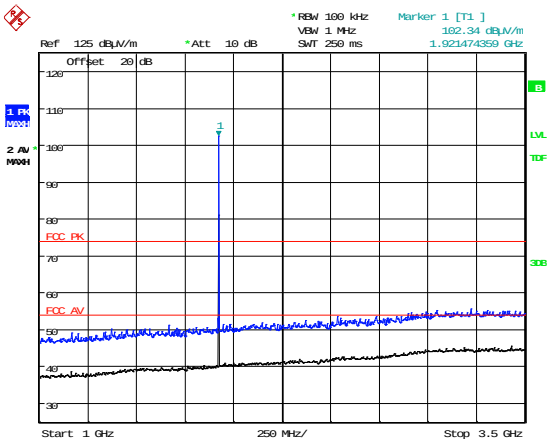
18GHz – 20GHz

Radiated Emissions outside the Sub-Band RF carrier set to the lowest carrier defined by the EUT

**CR-DU-MAG-USA**

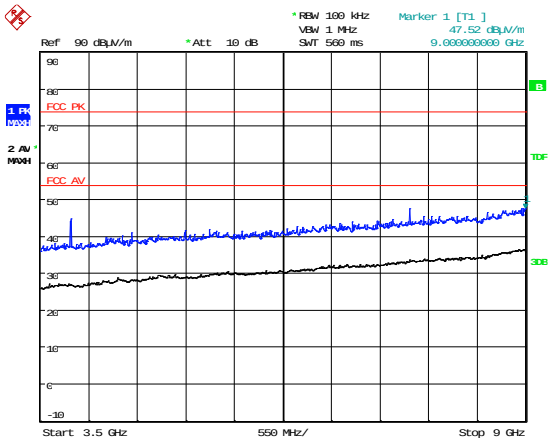



30MHz – 1GHz



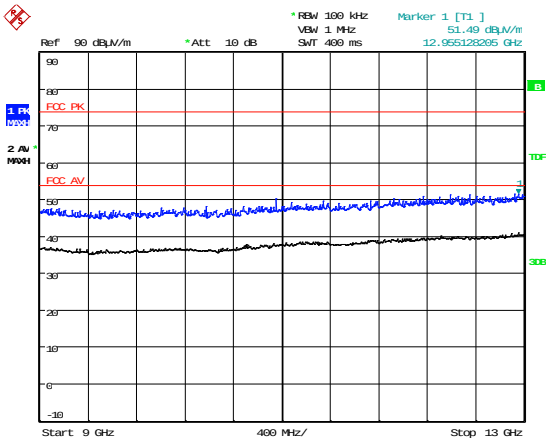

Date: 18.MAY.2015 15:28:12

1GHz – 3.5GHz



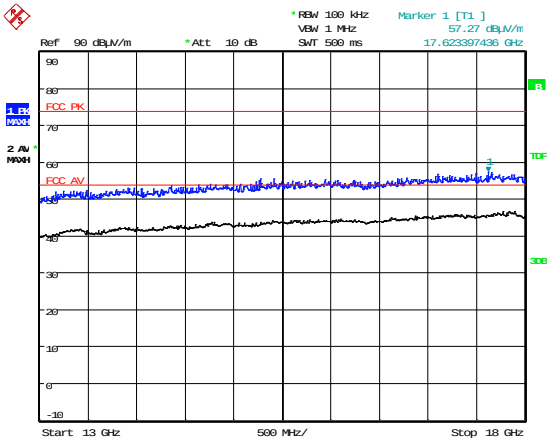

Date: 18.MAY.2015 15:20:58

3.5GHz – 9 GHz



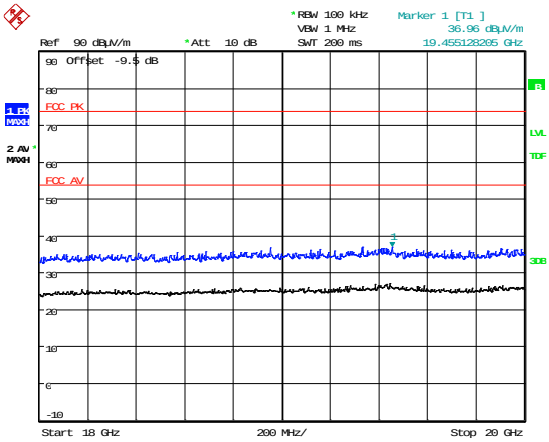

Date: 18.MAY.2015 15:21:33

9GHz – 13GHz




Date: 18.MAY.2015 15:22:08

13GHz – 18GHz

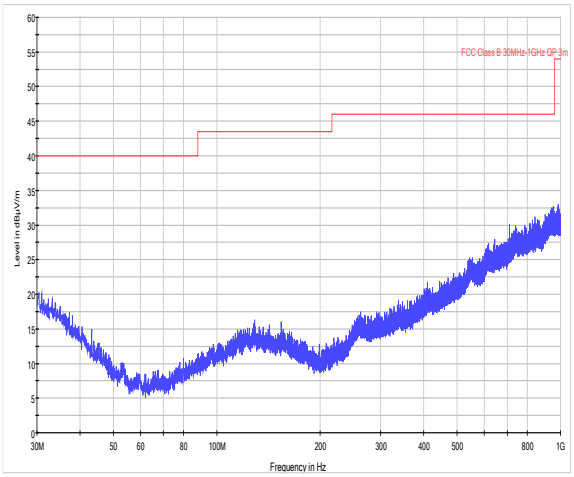



Date: 19.MAY.2015 16:56:45

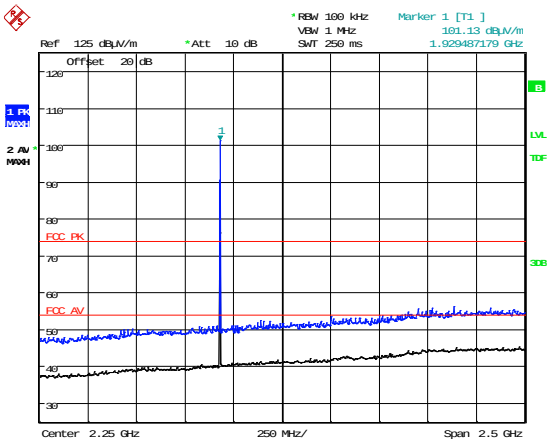
18GHz – 20GHz

Radiated Emissions outside the Sub-Band RF carrier set to the highest carrier defined by the EUT

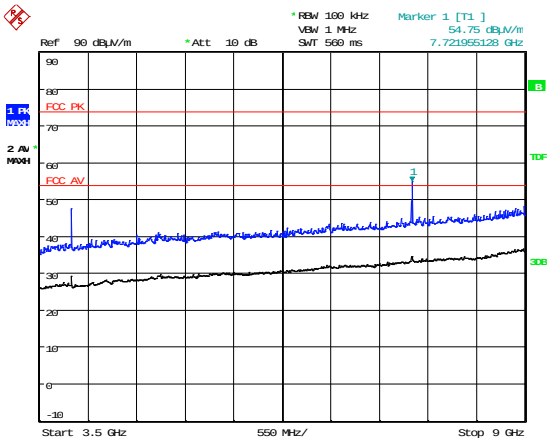
**CR-DU-MAG-USA**



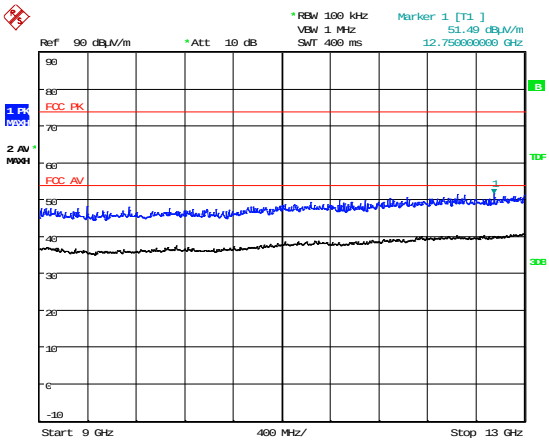

30MHz – 1GHz



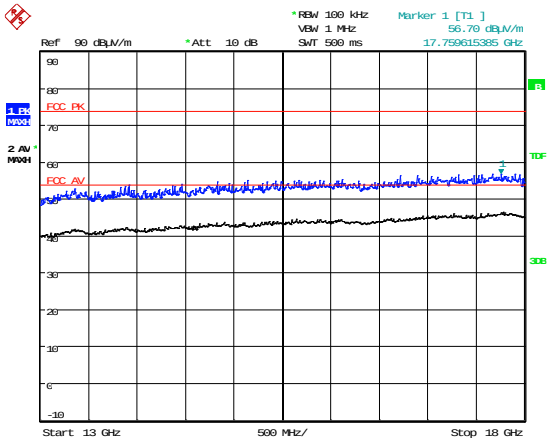

1GHz – 3.5GHz



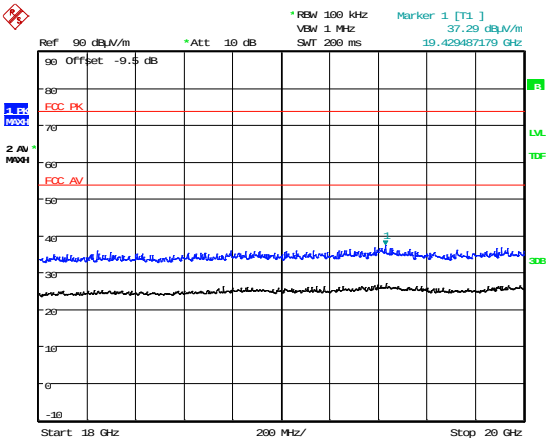

3.5GHz – 9 GHz




9GHz – 13GHz



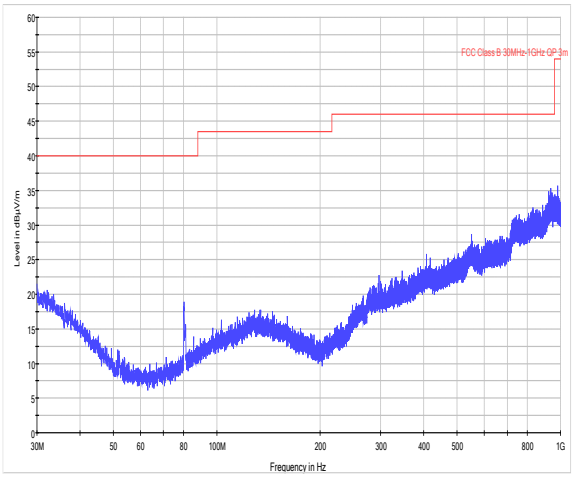

13GHz – 18GHz



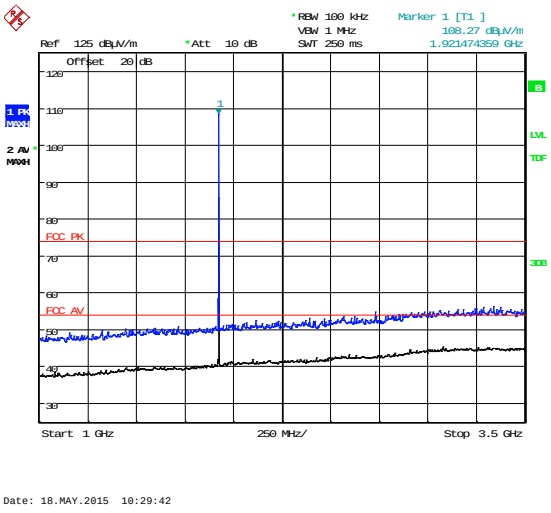

18GHz – 20GHz

Radiated Emissions outside the Sub-Band RF carrier set to the lowest carrier defined by the EUT

**CR-DU-FLD-USA**

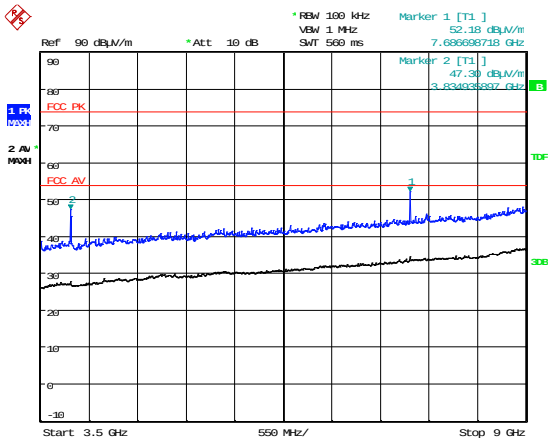



30MHz – 1GHz



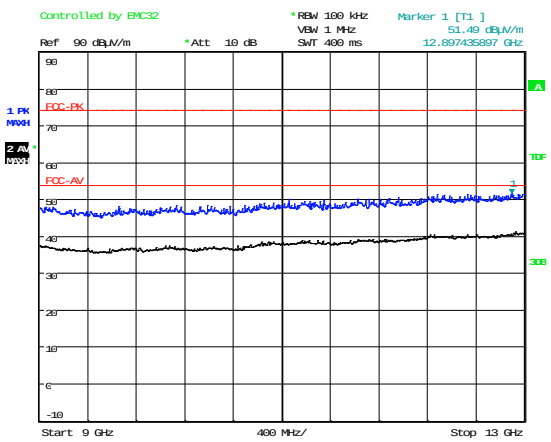

Date: 18.MAY.2015 10:29:42

1GHz – 3.5GHz



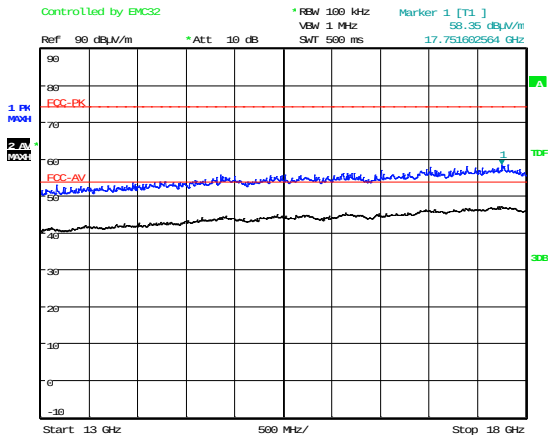

Date: 18.MAY.2015 10:52:01

3.5GHz – 9 GHz



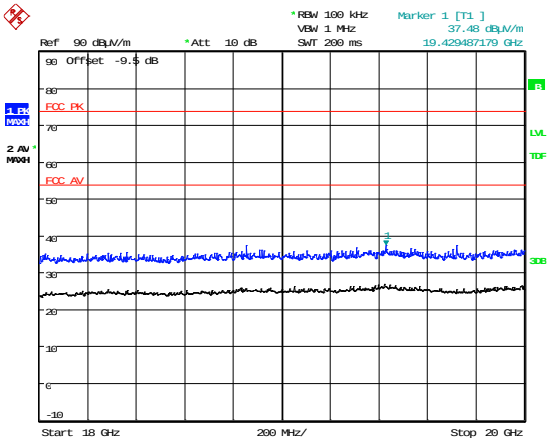

Date: 15.APR.2015 13:11:38

9GHz – 13GHz




Date: 15.APR.2015 13:12:38

13GHz – 18GHz

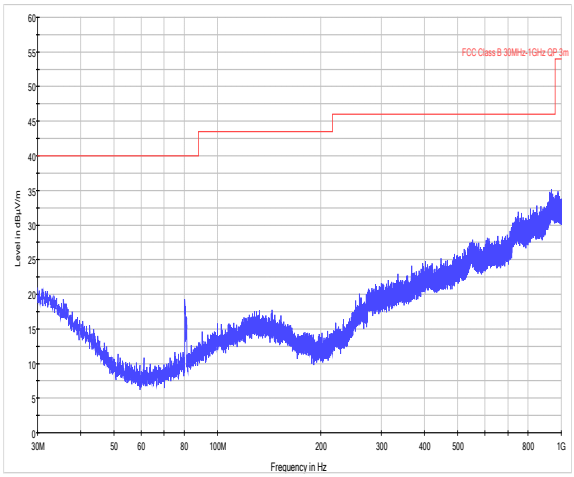



Date: 19.MAY.2015 17:09:45

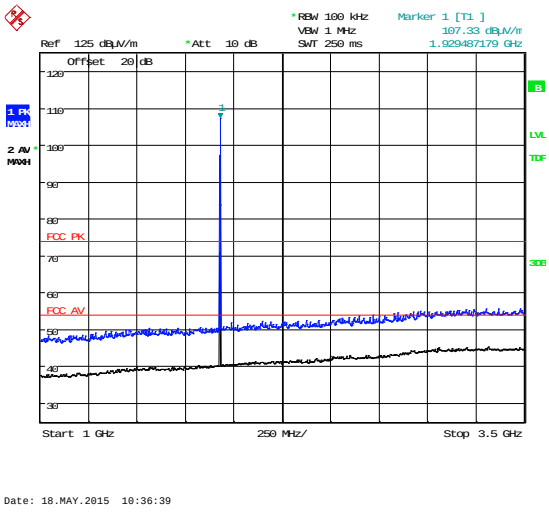
18GHz – 20GHz

Radiated Emissions outside the Sub-Band RF carrier set to the highest carrier defined by the EUT

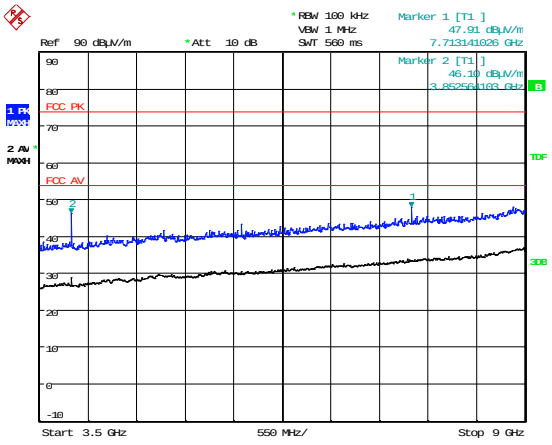
**CR-DU-FLD-USA**



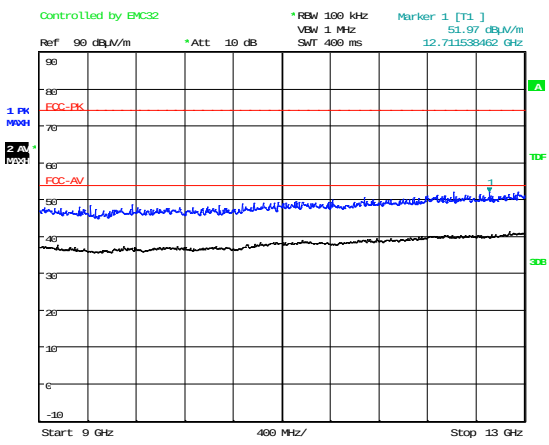

30MHz – 1GHz



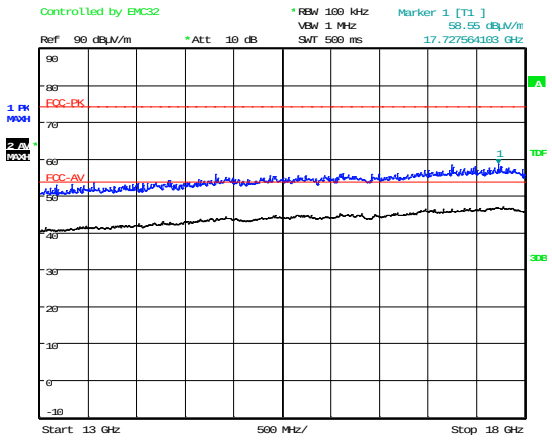

1GHz – 3.5GHz



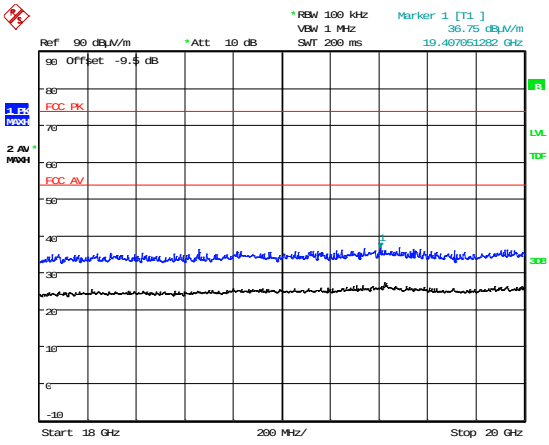

3.5GHz – 9 GHz




9GHz – 13GHz



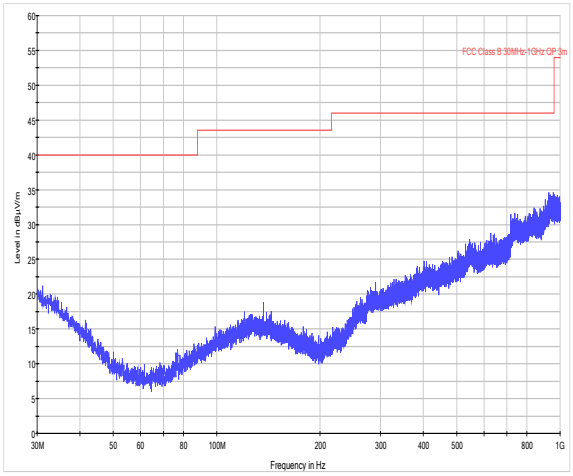

13GHz – 18GHz



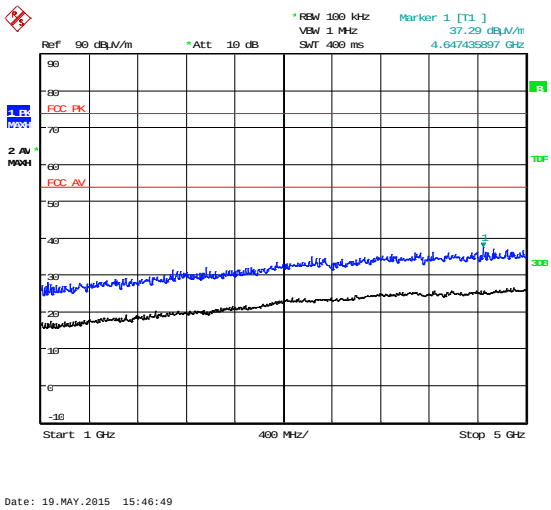

18GHz – 20GHz

Unintentional Radiated spurious emissions RF carrier set to the lowest channel defined by the EUT

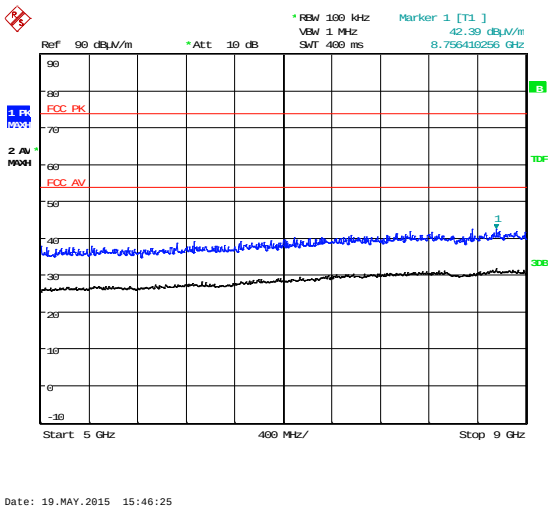
**CR-DU-PIR-USA**



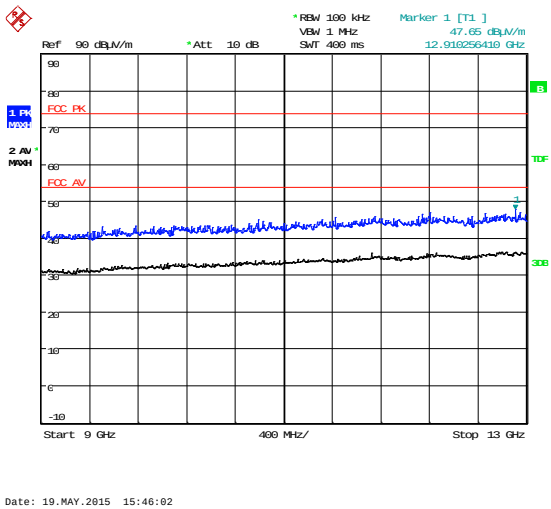

30MHz – 1GHz



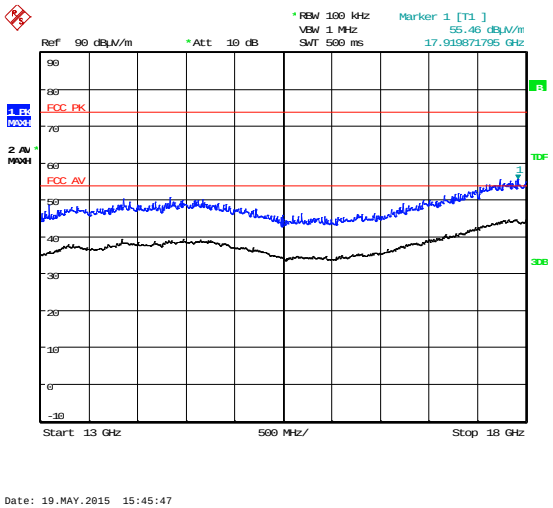

1GHz – 5GHz



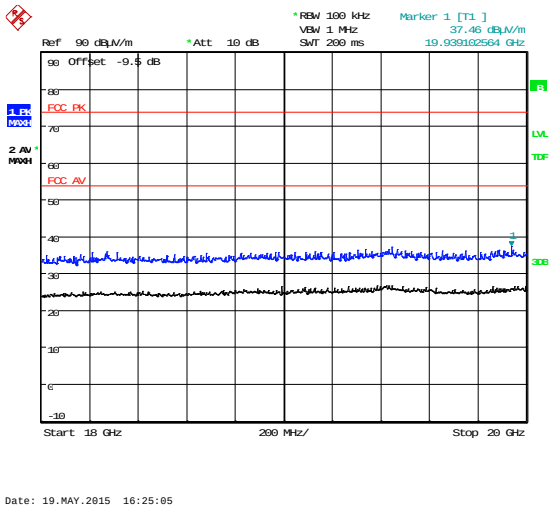

5GHz – 9 GHz




9GHz – 13GHz



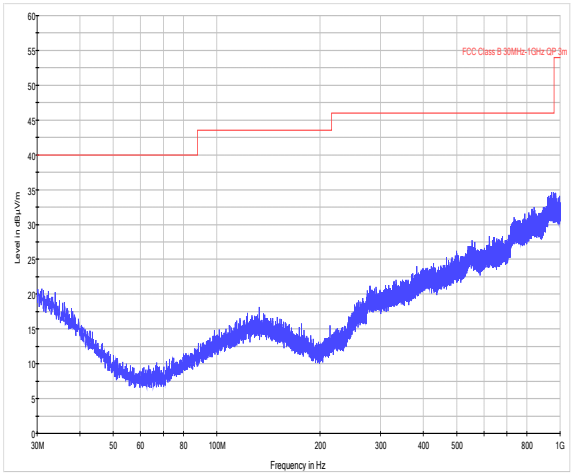

13GHz – 18GHz



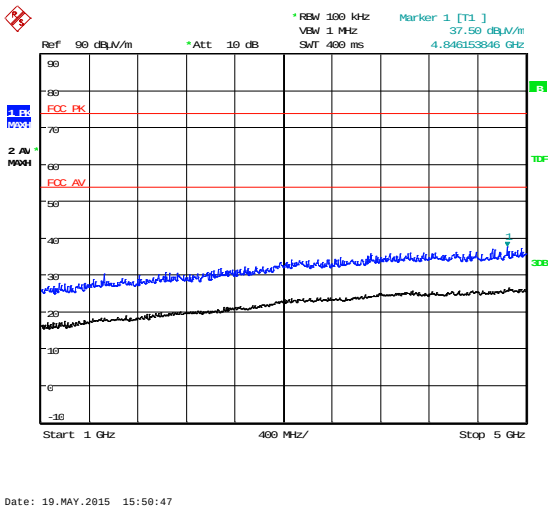

18GHz – 20GHz

Unintentional Radiated spurious emissions RF carrier set to the highest channel defined by the EUT

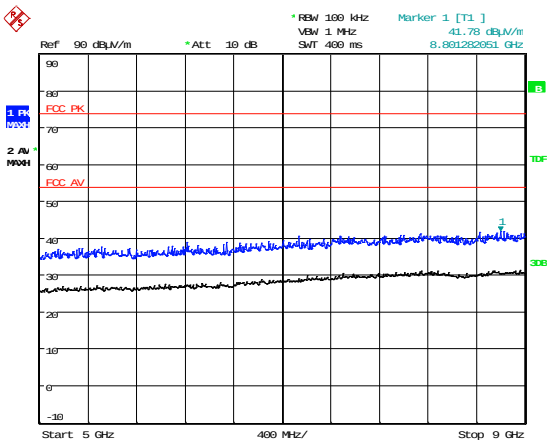
**CR-DU-PIR-USA**



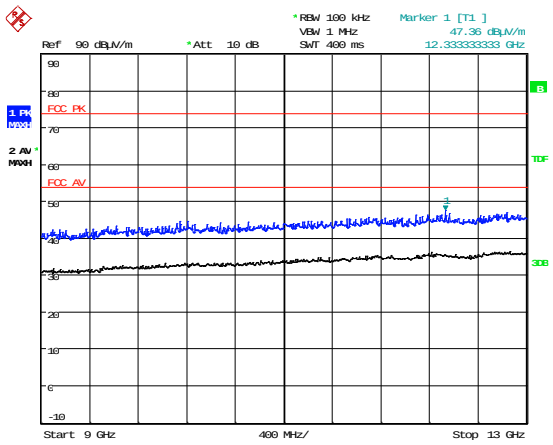

30MHz – 1GHz



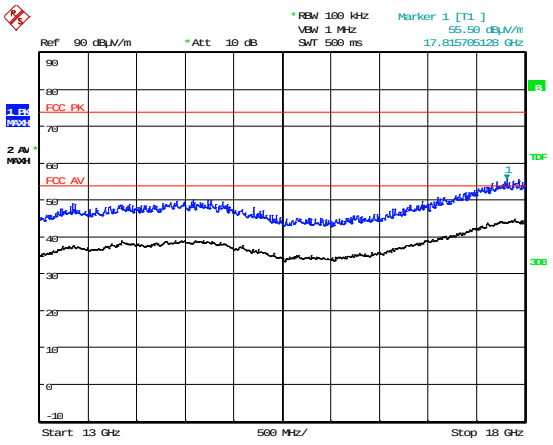

1GHz – 5GHz



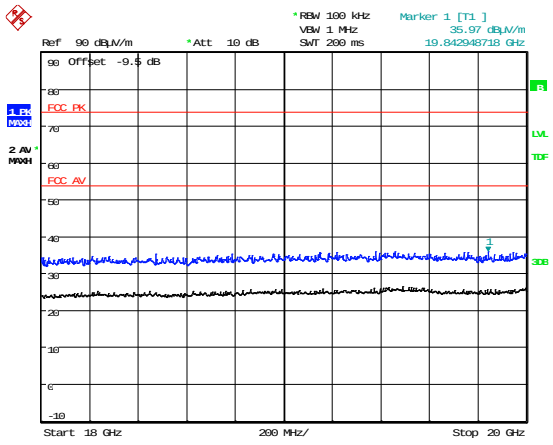

5GHz – 9 GHz




9GHz – 13GHz



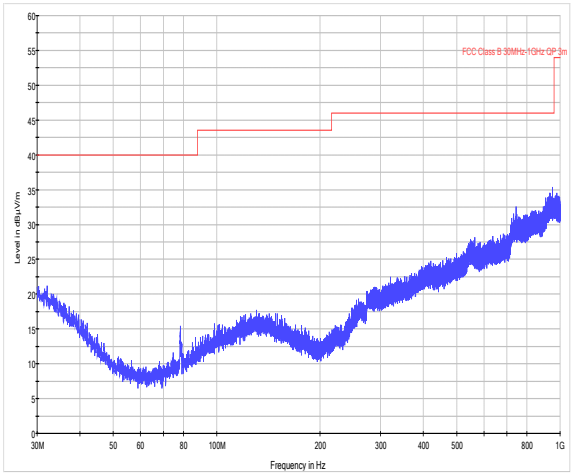

13GHz – 18GHz



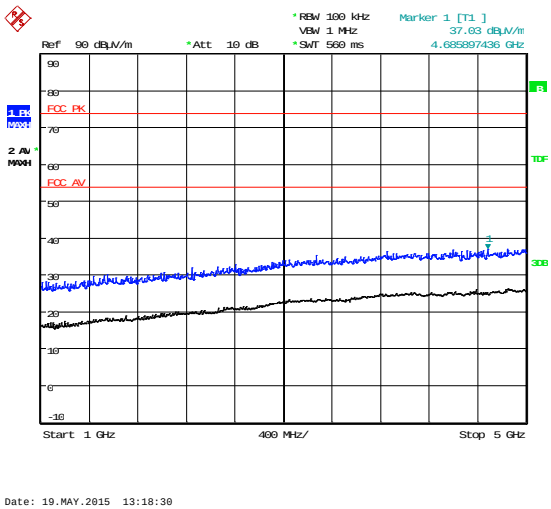

18GHz – 20GHz

Unintentional Radiated spurious emissions RF carrier set to the lowest channel defined by the EUT

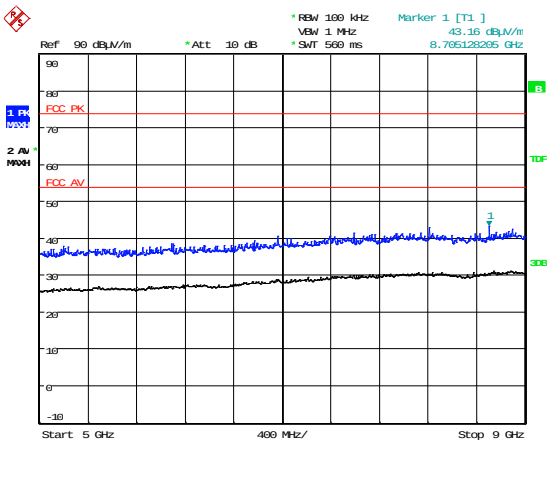
**CR-DUS-PIR-USA**



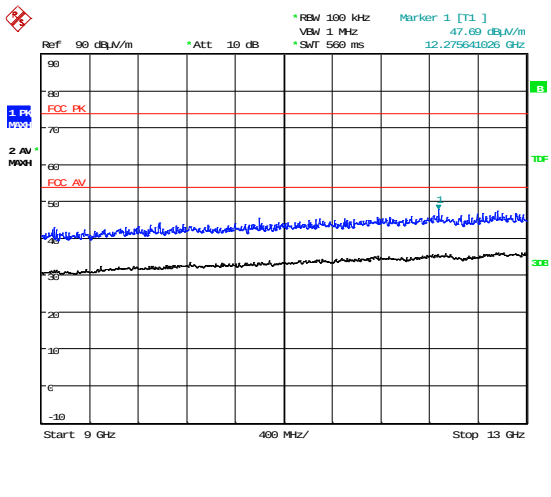

30MHz – 1GHz



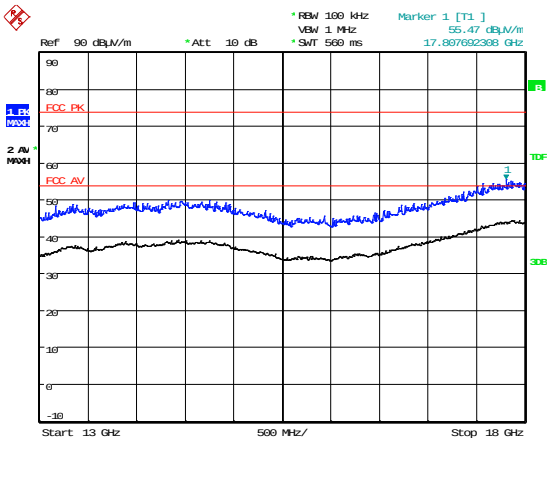

1GHz – 5GHz



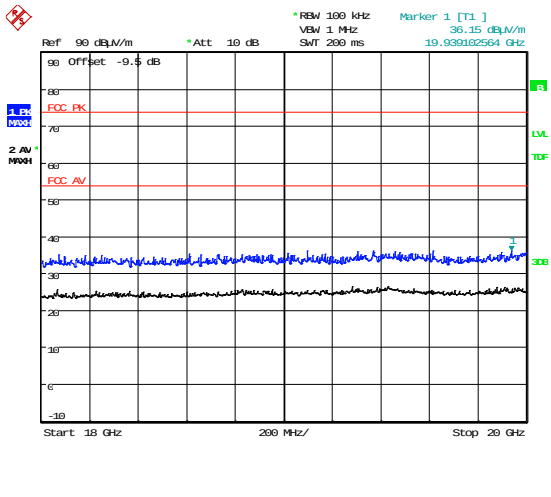

5GHz – 9 GHz




9GHz – 13GHz



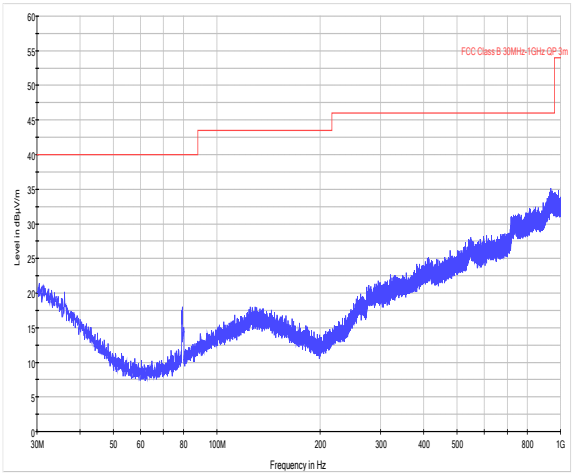

13GHz – 18GHz



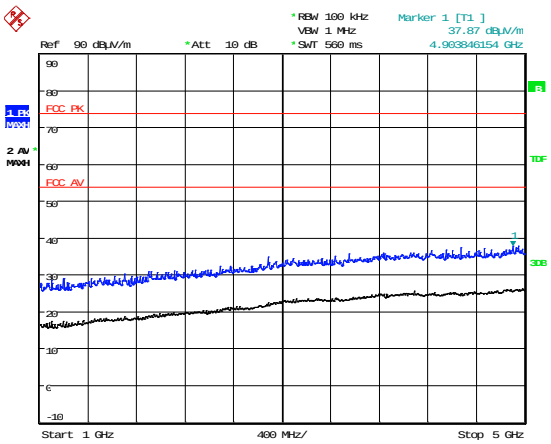

18GHz – 20GHz

Unintentional Radiated spurious emissions RF carrier set to the highest channel defined by the EUT

**CR-DUS-PIR-USA**

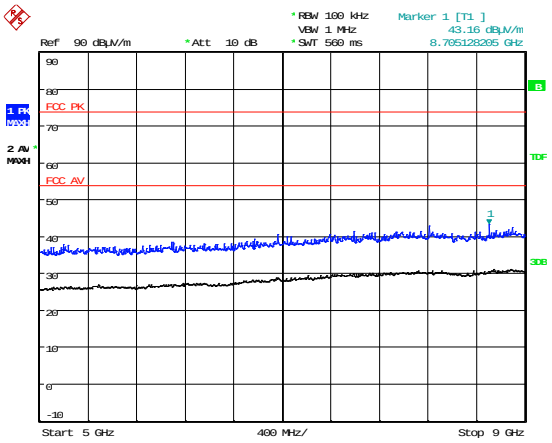



30MHz – 1GHz



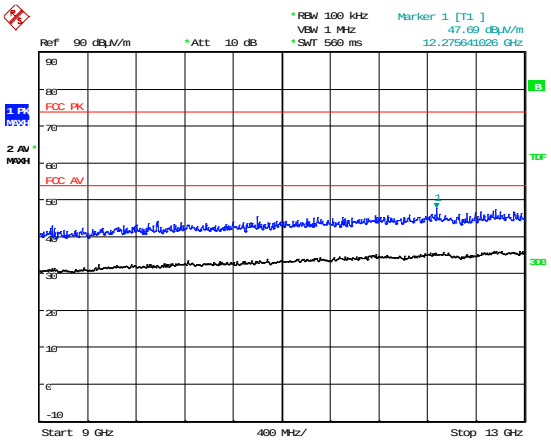

Date: 19.MAY.2015 13:05:59

1GHz – 5GHz



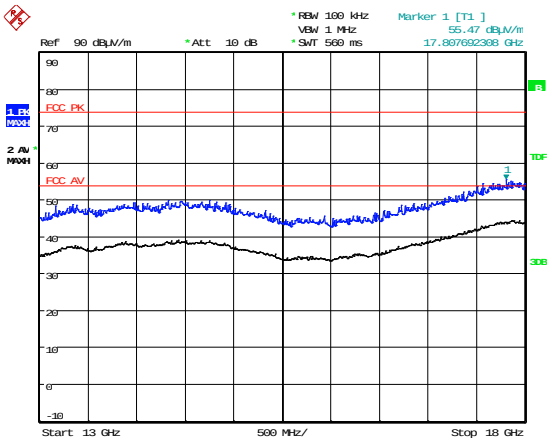

Date: 19.MAY.2015 13:18:49

5GHz – 9 GHz



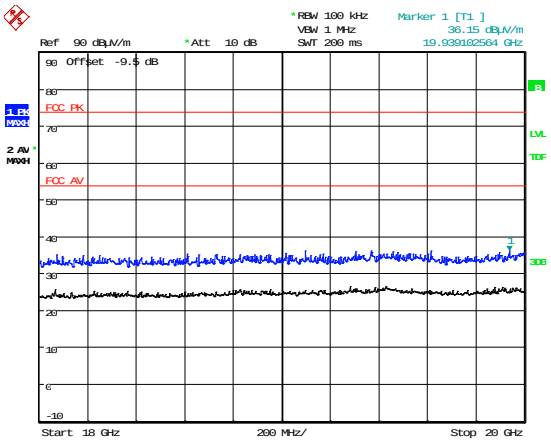

Date: 19.MAY.2015 13:19:06

9GHz – 13GHz




Date: 19.MAY.2015 13:19:26

13GHz – 18GHz

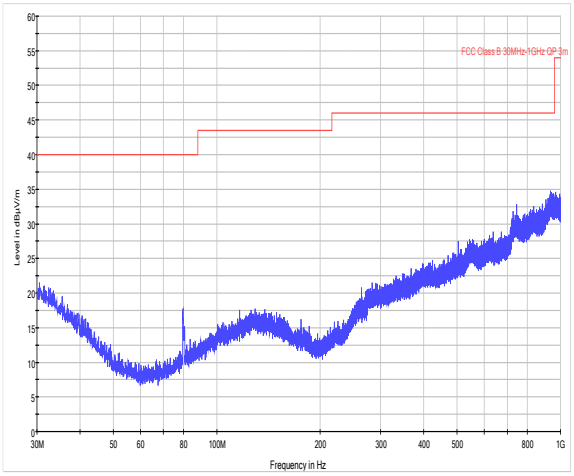



Date: 19.MAY.2015 16:31:14

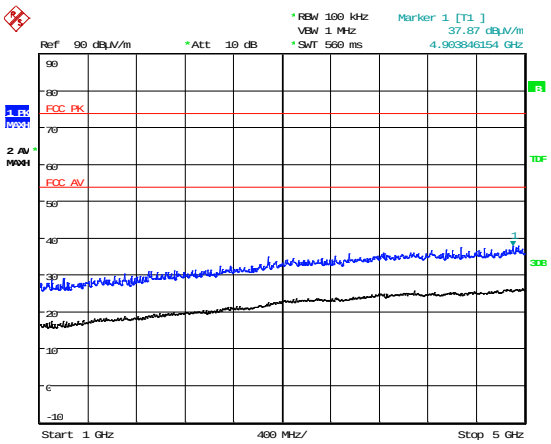
18GHz – 20GHz

Unintentional Radiated spurious emissions RF carrier set to the lowest channel defined by the EUT

**CR-DU-TMP-USA**

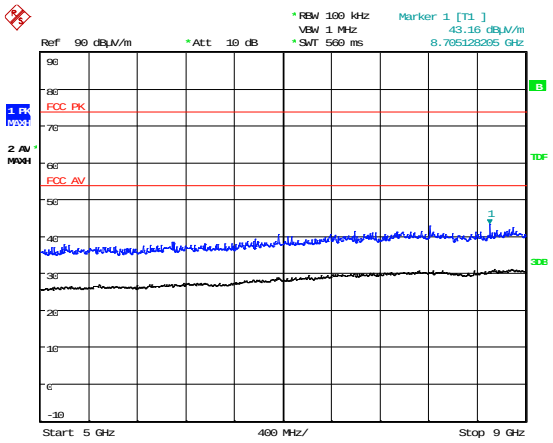



30MHz – 1GHz



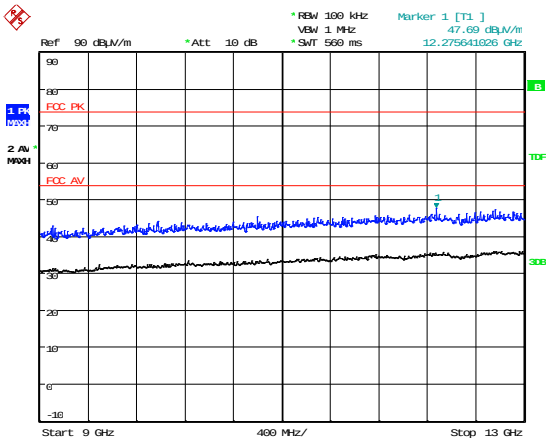

Date: 19.MAY.2015 13:05:59

1GHz – 5GHz



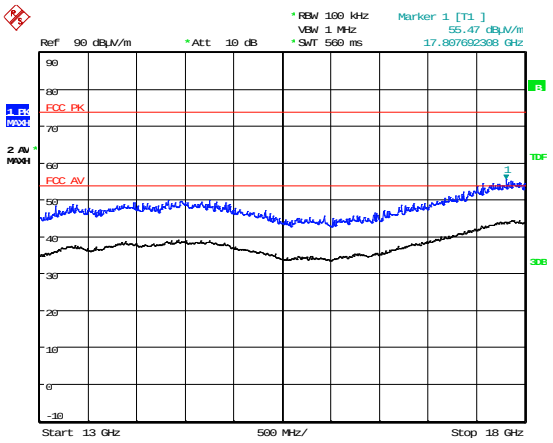

Date: 19.MAY.2015 13:18:49

5GHz – 9 GHz



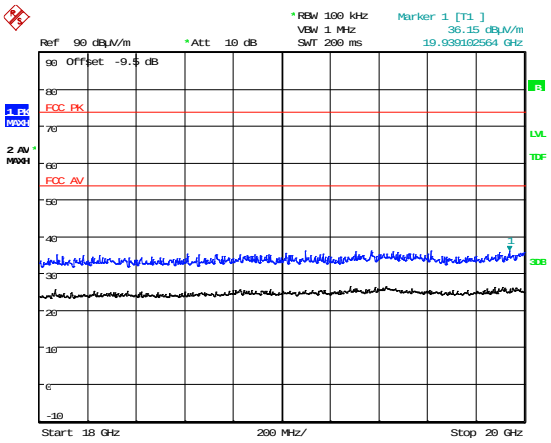

Date: 19.MAY.2015 13:19:06

9GHz – 13GHz




Date: 19.MAY.2015 13:19:26

13GHz – 18GHz

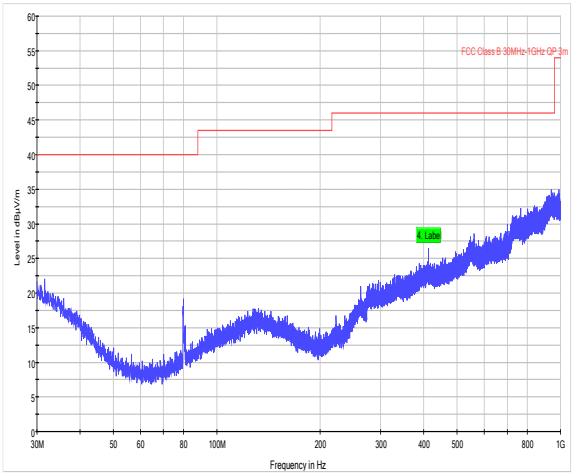



Date: 19.MAY.2015 16:31:14

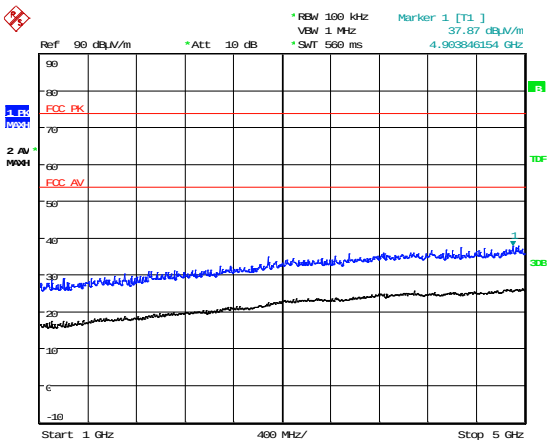
18GHz – 20GHz

Unintentional Radiated spurious emissions RF carrier set to the highest channel defined by the EUT

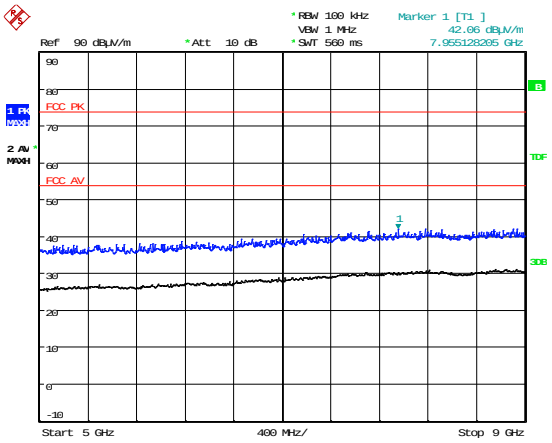
**CR-DU-TMP-USA**



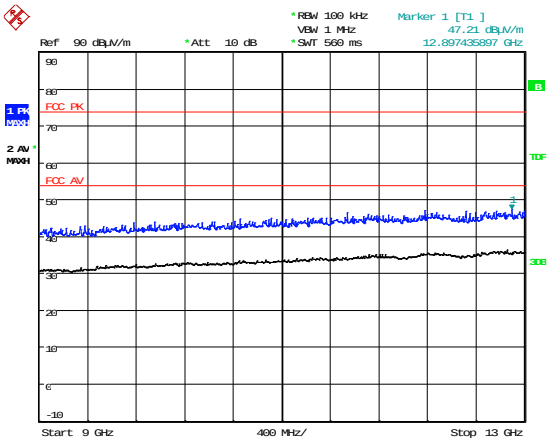

30MHz – 1GHz



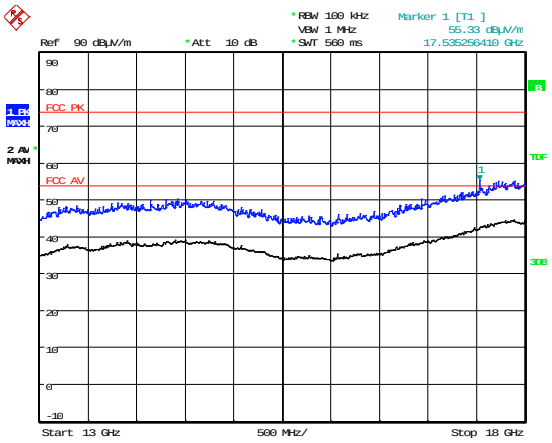

1GHz – 5GHz



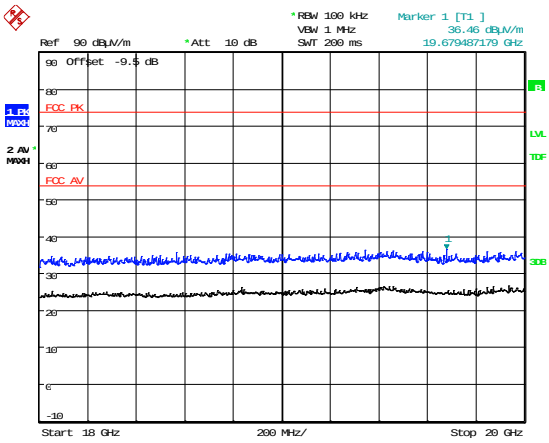

5GHz – 9 GHz




9GHz – 13GHz



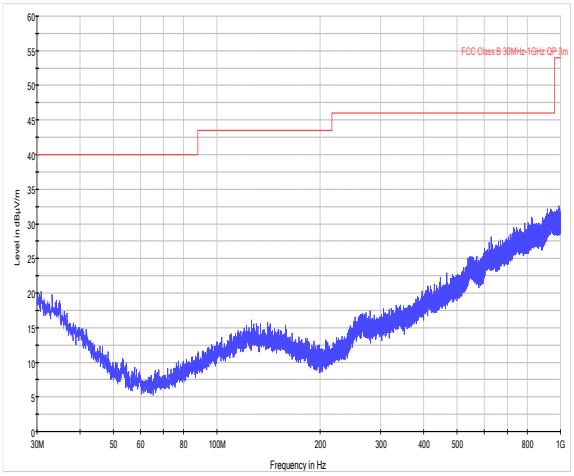

13GHz – 18GHz



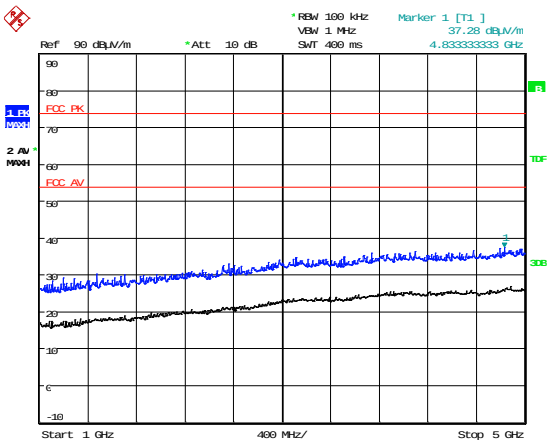

18GHz – 20GHz

Unintentional Radiated spurious emissions RF carrier set to the lowest channel defined by the EUT

**CR-DU-MAG-USA**

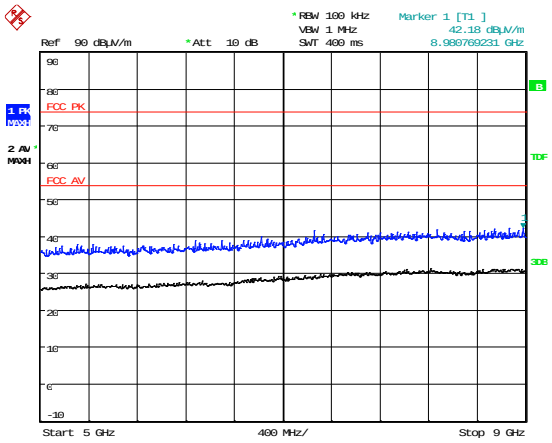



30MHz – 1GHz



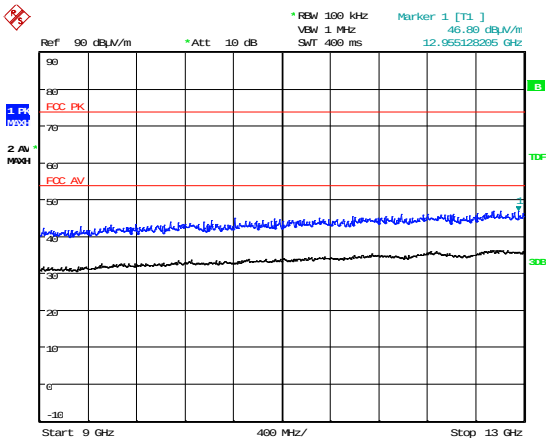

Date: 18.MAY.2015 15:30:53

1GHz – 5GHz



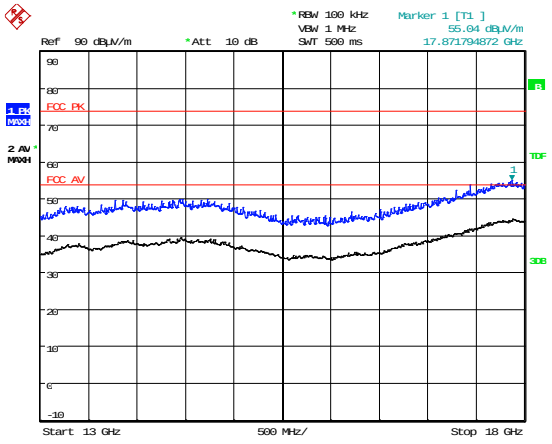

Date: 18.MAY.2015 15:31:13

5GHz – 9 GHz



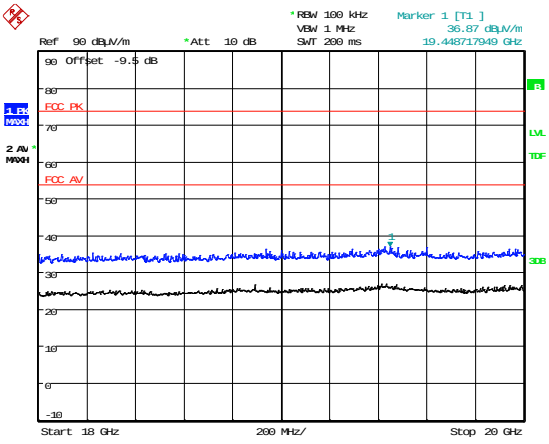

Date: 18.MAY.2015 15:31:36

9GHz – 13GHz




Date: 18.MAY.2015 15:31:56

13GHz – 18GHz

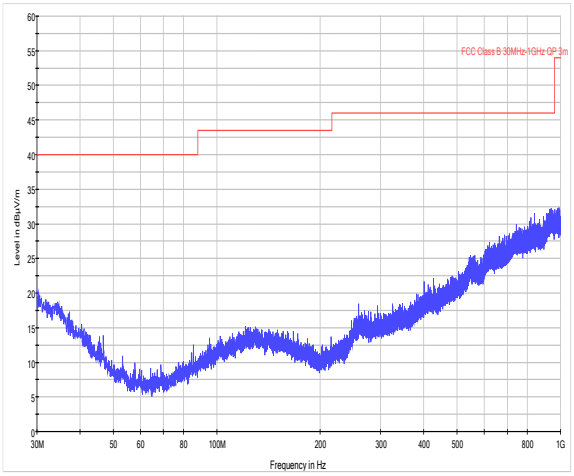



Date: 19.MAY.2015 16:57:42

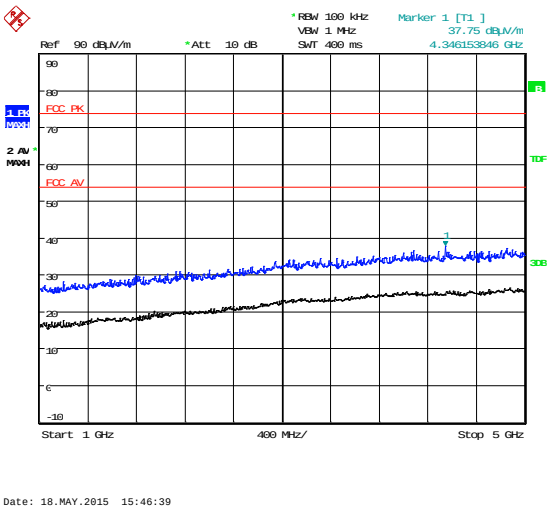
18GHz – 20GHz

Unintentional Radiated spurious emissions RF carrier set to the highest channel defined by the EUT

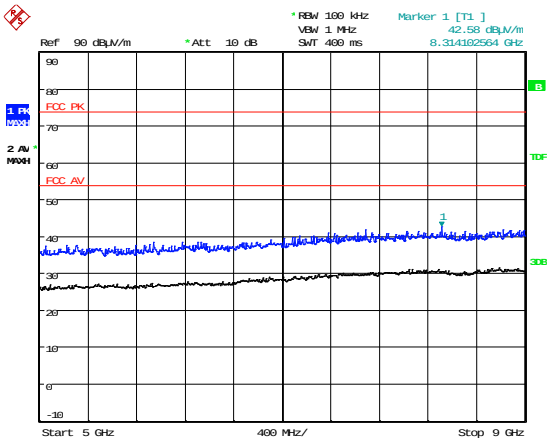
**CR-DU-MAG-USA**



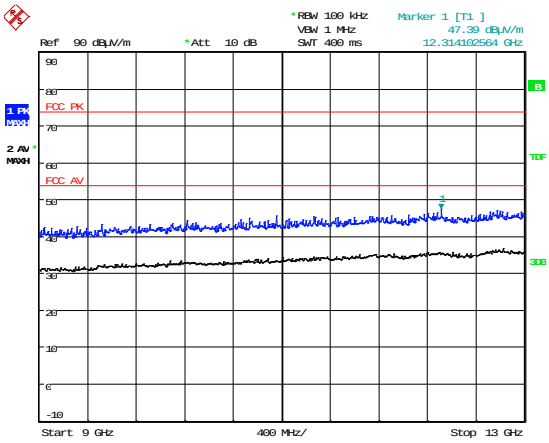

30MHz – 1GHz



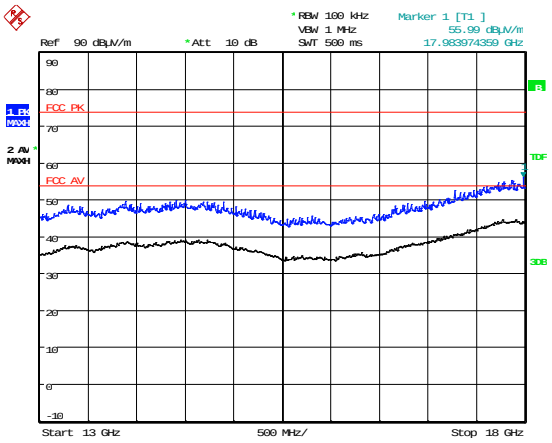

1GHz – 5GHz



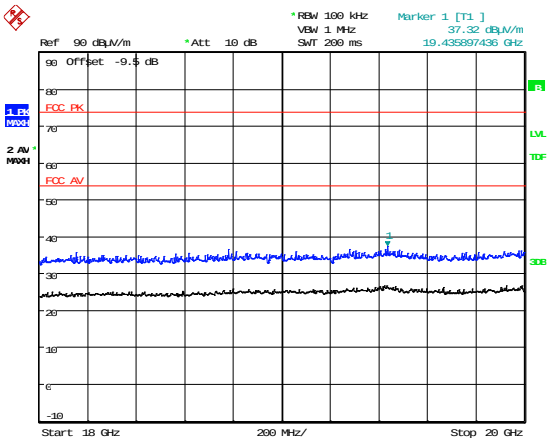

5GHz – 9 GHz




9GHz – 13GHz



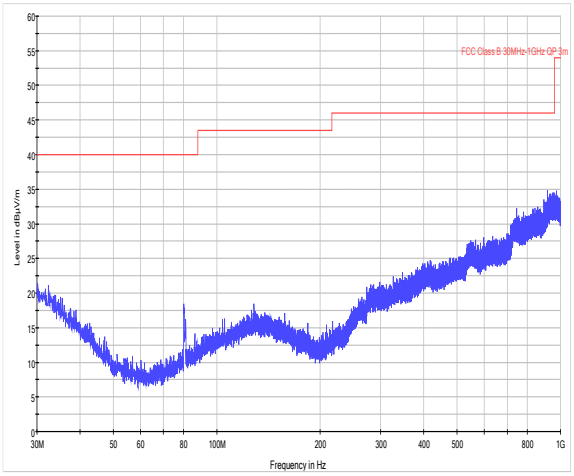

13GHz – 18GHz



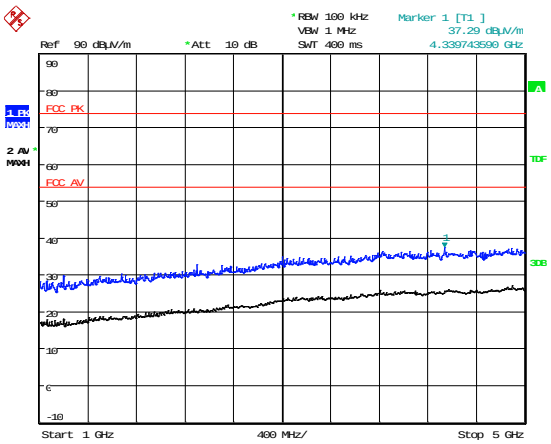

18GHz – 20GHz

Unintentional Radiated spurious emissions RF carrier set to the lowest channel defined by the EUT

**CR-DU-FLD-USA**

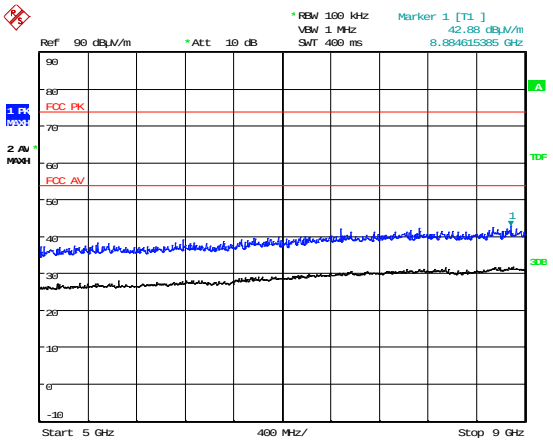



30MHz – 1GHz



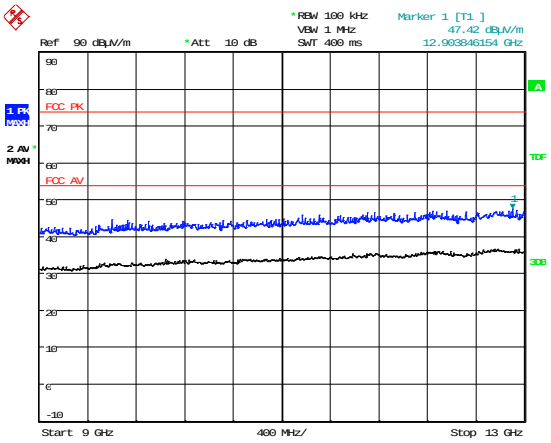

Date: 20.MAY.2015 10:27:58

1GHz – 5GHz



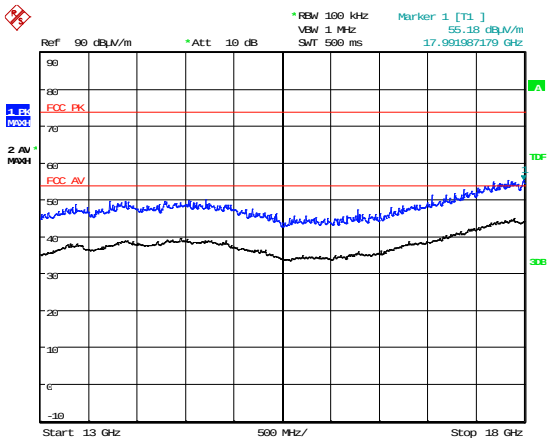

Date: 20.MAY.2015 10:26:50

5GHz – 9 GHz



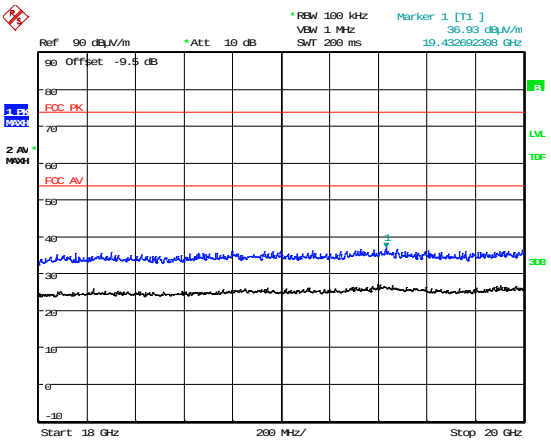

Date: 20.MAY.2015 10:26:15

9GHz – 13GHz




Date: 20.MAY.2015 10:25:16

13GHz – 18GHz

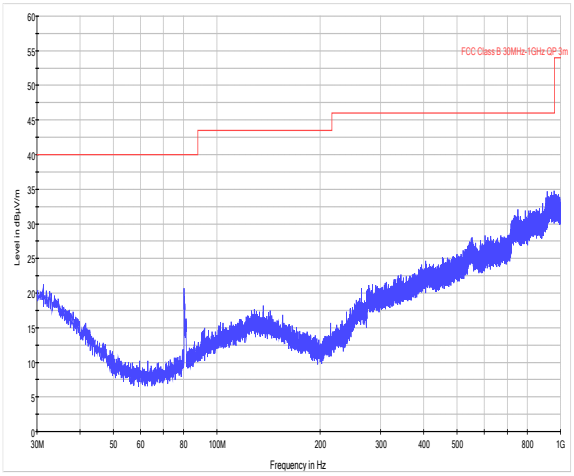



Date: 19.MAY.2015 17:12:00

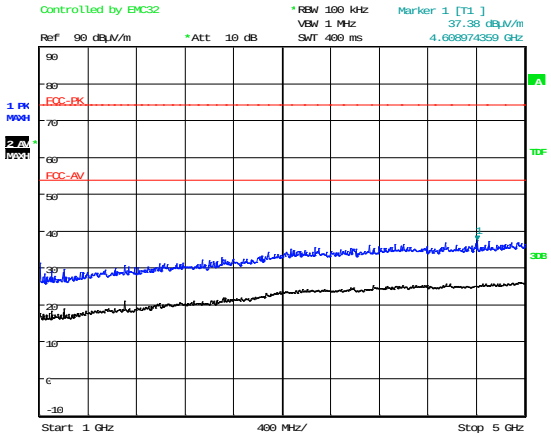
18GHz – 20GHz

Unintentional Radiated spurious emissions RF carrier set to the highest channel defined by the EUT

**CR-DU-FLD-USA**

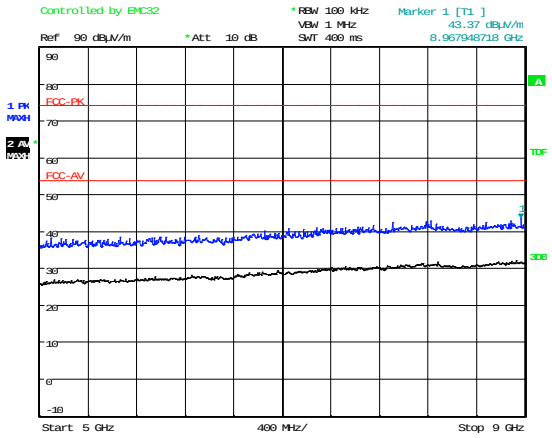



30MHz – 1GHz



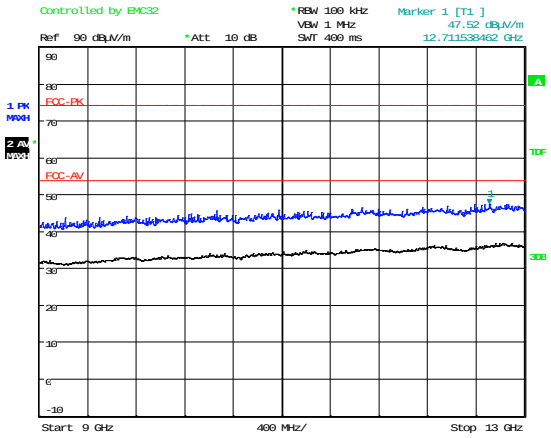

Date: 15.APR.2015 14:48:59

1GHz – 5GHz



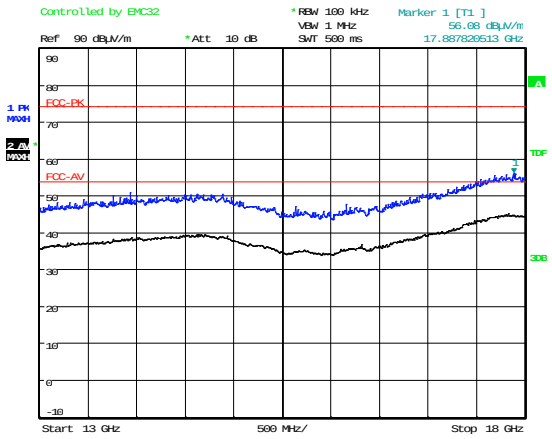

Date: 15.APR.2015 14:50:23

5GHz – 9 GHz



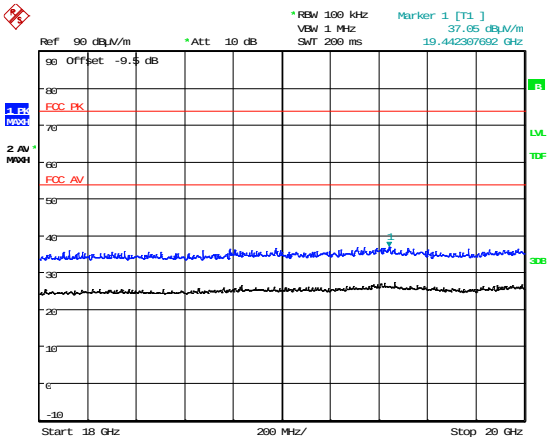

Date: 15.APR.2015 14:51:26

9GHz – 13GHz




Date: 15.APR.2015 14:52:24

13GHz – 18GHz




Date: 19.MAY.2015 17:15:49

18GHz – 20GHz

**Appendix C:** **Additional Test and Sample Details**

This appendix contains details of:

1. The samples submitted for testing.
2. Details of EUT operating mode(s)
3. Details of EUT configuration(s) (see below).
4. EUT arrangement (see below).

Throughout testing, the following numbering system is used to identify the sample and it's modification state:

**Sample No:** Sxx Mod w

where:

| | | |
|---|---|---|
| xx | = sample number | eg. S01 |
| w | = modification number | eg. Mod 2 |

The following terminology is used throughout the test report:

**Support Equipment (SE)** is any additional equipment required to exercise the EUT in the applicable operating mode. Where relevant SE is divided into two categories:

SE in test environment: The SE is positioned in the test environment and is not isolated from the EUT (e.g. on the table top during REFE testing).

SE isolated from the EUT: The SE is isolated via filtering from the EUT. (e.g. equipment placed externally to the ALSR during REFE testing).

**EUT configuration** refers to the internal set-up of the EUT. It may include for example:

Positioning of cards in a chassis.
Setting of any internal switches.
Circuit board jumper settings.
Alternative internal power supplies.

Where no change in EUT configuration is **possible**, the configuration is described as “single possible configuration”.

**EUT arrangement** refers to the termination of EUT ports / connection of support equipment, and where relevant, the relative positioning of samples (EUT and SE) in the test environment.

For further details of the test procedures and general test set ups used during testing please refer to the related document "EMC Test Methods - An Overview", which can be supplied by TRaC Global upon request.

## C1) Test samples

The following samples of the apparatus were submitted by the client for testing :

| Sample No. | Description | Identification |
|---|---|---|
| S14 | CR-DU-FLD-USA – Radiated Sample | 0067151 |
| S15 | CR-DU-MAG-USA – Radiated Sample | 0067195 |
| S12 | CR-DUS-PIR-USA – Radiated Sample | 0067194 |
| S16 | CR-DU-PIR-USA – Radiated Sample | 0067190 |
| S13 | CR-DU-TMP-USA – Radiated Sample | 0067101 |
| S25 | CR-DU-PIR-USA – Conducted Sample | N/A |
| S16 | CR-DU-PIR-USA – Conducted Sample | N/A |

The following samples of apparatus were submitted by the client as host, support or drive equipment (auxiliary equipment):

| Sample No. | Description | Identification |
|---|---|---|
| S21 | Power Supply for CMBS | ADFC0502000WEU-2 |
| S24 | CMBS – Support Equipment acting as FP companion | N/A |

The following samples of apparatus were supplied by TRaC Global as support or drive equipment (auxiliary equipment):

| Identification | Description |
|---|---|
| | None |

**C2) EUT Operating Mode During Testing**.

During testing, the EUT was exercised as described in the following tables :

| Test | Description of Operating Mode: |
|---|---|
| Carrier power,<br>Power Spectral Density<br>Emission Bandwidth<br>Emissions inside and outside of the sub band | EUT in test mode (using Fig 31 test pattern) operating at maximum power. |

| Test | Description of Operating Mode: |
|---|---|
| Frequency Stability<br>Frame Repetition Stability<br>Frame period & jitter | EUT operating TBR6 Test mode in communications with CMD60 test set |

| Test | Description of Operating Mode: |
|---|---|
| Etiquette Testing | EUT operating in normal mode with communication to a companion device |

| Test | Description of Operating Mode: |
|---|---|
| Receiver radiated spurious emissions | EUT active but non-transmitting. |

**C3) EUT Configuration Information**.

The EUT was submitted for testing in one single possible configuration.

### C4) List of EUT Ports

The tables below describe the termination of EUT ports:

Sample : S25, S26
Tests : Conducted

| Port | Description of Cable Attached | Cable length | Equipment Connected |
|---|---|---|---|
| Antenna port | Coaxial | 10cm | Measurement System |

Sample : S12, S13, S14, S15, S15
Tests : Radiated Emissions

| Port | Description of Cable Attached | Cable length | Equipment Connected |
|---|---|---|---|
| None | | | |

* Only connected during setup.

## C5 Details of Equipment Used

| Asset No | Equipment Type | Equipment Description | Manufacturer | Last Cal Calibration | Calibration Period | Due For Calibration |
|---|---|---|---|---|---|---|
| UH028 | UHALP 9108 | Log Periodic Ant | Schwarbeck | 18/06/2015 | 24 | 18/06/2017 |
| UH029 | VHBA 9123 | Bicone Antenna | Schwarbeck | 17/06/2015 | 24 | 17/06/2017 |
| UH093 | CBL6112B | Bilog | Chase | 17/06/2015 | 24 | 17/06/2017 |
| UH191 | CBL611/A | Bilog | Chase | 26/02/2015 | 24 | 26/02/2017 |
| UH281 | FSU46 | Spectrum Analyser | R&S | 24/04/2015 | 12 | 24/04/2016 |
| UH403 | ESCI 7 | Receiver | R&S | 20/08/2014 | 12 | 20/08/2015 |
| UH405 | FSU26 | Spectrum Analyser | R&S | 11/05/2015 | 12 | 11/05/2016 |
| UH420 | CBL6112 | Bilog | Chase | 25/07/2014 | 24 | 25/07/2016 |
| UH456 | ESR7 | EMI Receiver | R&S | 22/04/2015 | 12 | 22/04/2016 |
| UH457 | 8449B | Pre Amp | Agilent | 07/08/2014 | 12 | 07/08/2015 |
| UH489 | ESR26 | EMI Receiver | R&S | 21/04/2015 | 12 | 21/04/2016 |
| UH519 | VHF-1500+ | High Pass Filter | MiniCircuits | 25/02/2015 | 24 | 25/02/2017 |
| UH520 | VHF-3000+ | High Pass Filter | MiniCircuits | 25/02/2015 | 24 | 25/02/2017 |
| L138 | 3115 | 1-18GHz Horn | EMCO | 17/10/2013 | 24 | 17/10/2015 |
| L139 | 3115 | 1-18GHz Horn | EMCO | 20/09/2013 | 24 | 20/09/2015 |
| L193 | VHA 9103 balu | Bicone Antenna | Chase | 25/06/2014 | 24 | 25/06/2016 |
| L203 | UPA6108 | Log Periodic Ant | Chase | 25/06/2014 | 24 | 25/06/2016 |
| L290 | CBL611/A | Bilog | Chase | 02/12/2014 | 24 | 02/12/2016 |
| L317 | ESVS10 | Receiver | R&S | 26/02/2015 | 12 | 26/02/2016 |
| L352 | ESVS10 | Receiver | R&S | 26/03/2015 | 12 | 26/03/2016 |
| L426 | 52 Series II | Temperature Indicator | Fluke | 30/05/2015 | 12 | 30/05/2016 |
| L572 | 8449B | Pre Amp | Agilent | 10/02/2015 | 12 | 10/02/2016 |
| REF844 | E4438C | Singal Generator | Agilent | 14/04/2015 | 11 | 14/03/2016 |
| REF909 | FSU26 | Spectrum Analyser | R&S | 13/02/2015 | 12 | 13/02/2016 |
| REF916 | SMBV100A | Signal Generator | R&S | 17/02/2015 | 12 | 17/02/2016 |
| REF940 | ATS | Radio Chamber - PP | Rainford EMC | 08/09/2014 | 24 | 08/09/2016 |
| REF940 | ATS | IC Reg Radio Chamber - PP | Rainford EMC | 19/11/2014 | 36 | 19/11/2017 |
| REF976 | 34405a | Multimeter | Agilent | 03/06/2015 | 12 | 03/06/2016 |
| REF977 | SH4141 | High Pass Filter | BSC | 25/02/2015 | 24 | 25/02/2017 |
| N/A | E4433B | Signal Generator | Agilent | Cal in Use | | |

## Appendix D: Additional Information

No additional information is included within this test report.

## Appendix E: Photographs and Figures

The following photographs were taken of the test samples:

1. Radiated electric field emissions arrangement: CR-DU-PIR-USA over view.
2. Radiated electric field emissions arrangement: CR-DU-PIR-USA close up.
3. Radiated electric field emissions arrangement: CR-DUS-PIR-USA over view.
4. Radiated electric field emissions arrangement: CR-DUS-PIR-USA close up.
5. Radiated electric field emissions arrangement: CR-DU-TMP-USA over view.
6. Radiated electric field emissions arrangement: CR-DU-TMP-USA close up.
7. Radiated electric field emissions arrangement: CR-DU-MAG-USA over view.
8. Radiated electric field emissions arrangement: CR-DU-MAG-USA close up.
9. Radiated electric field emissions arrangement: CR-DU-FLD-USA over view.
10. Radiated electric field emissions arrangement: CR-DU-FLD-USA close up.

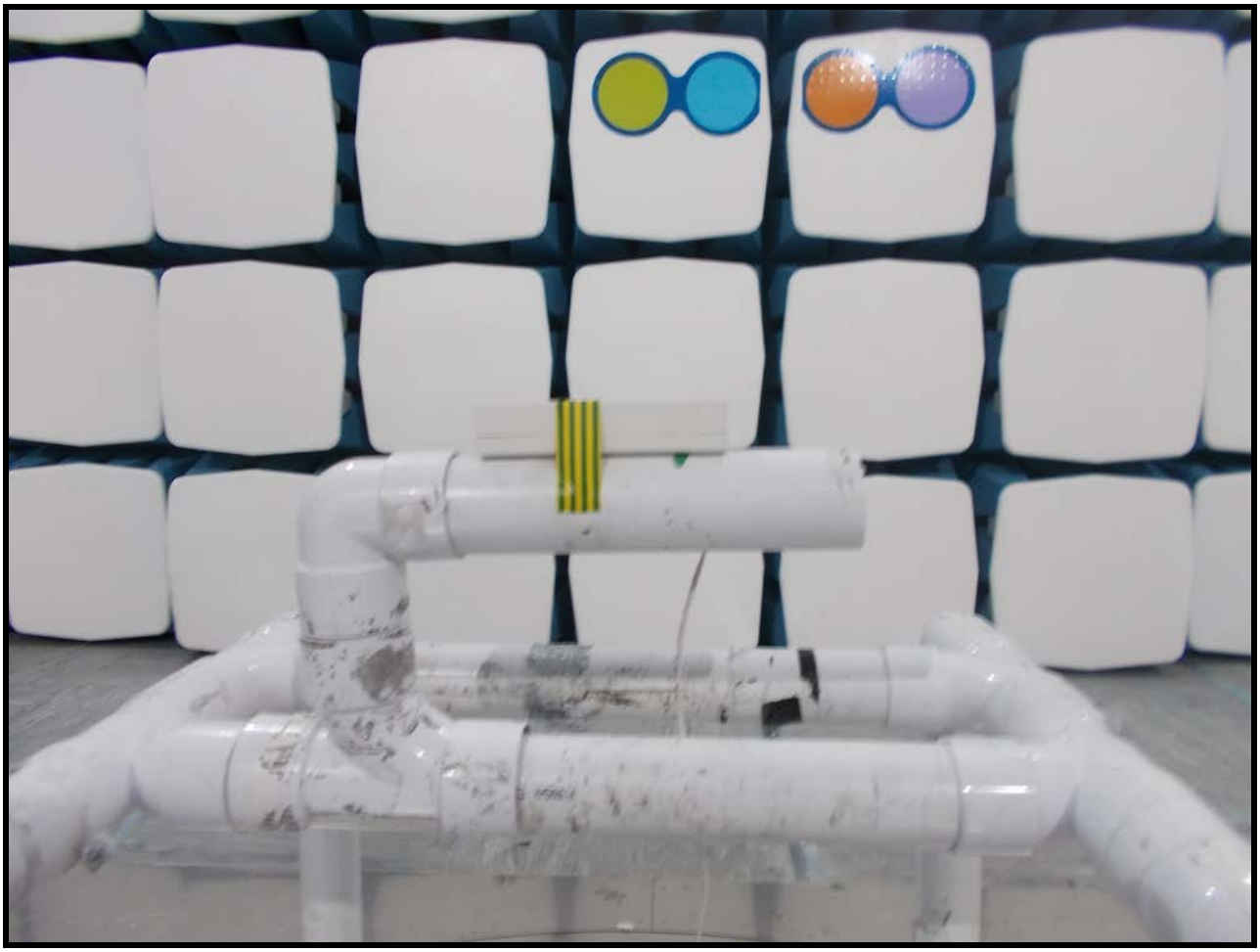

Photograph 1


Photograph 2


Photograph 3

Photograph 4


Photograph 5

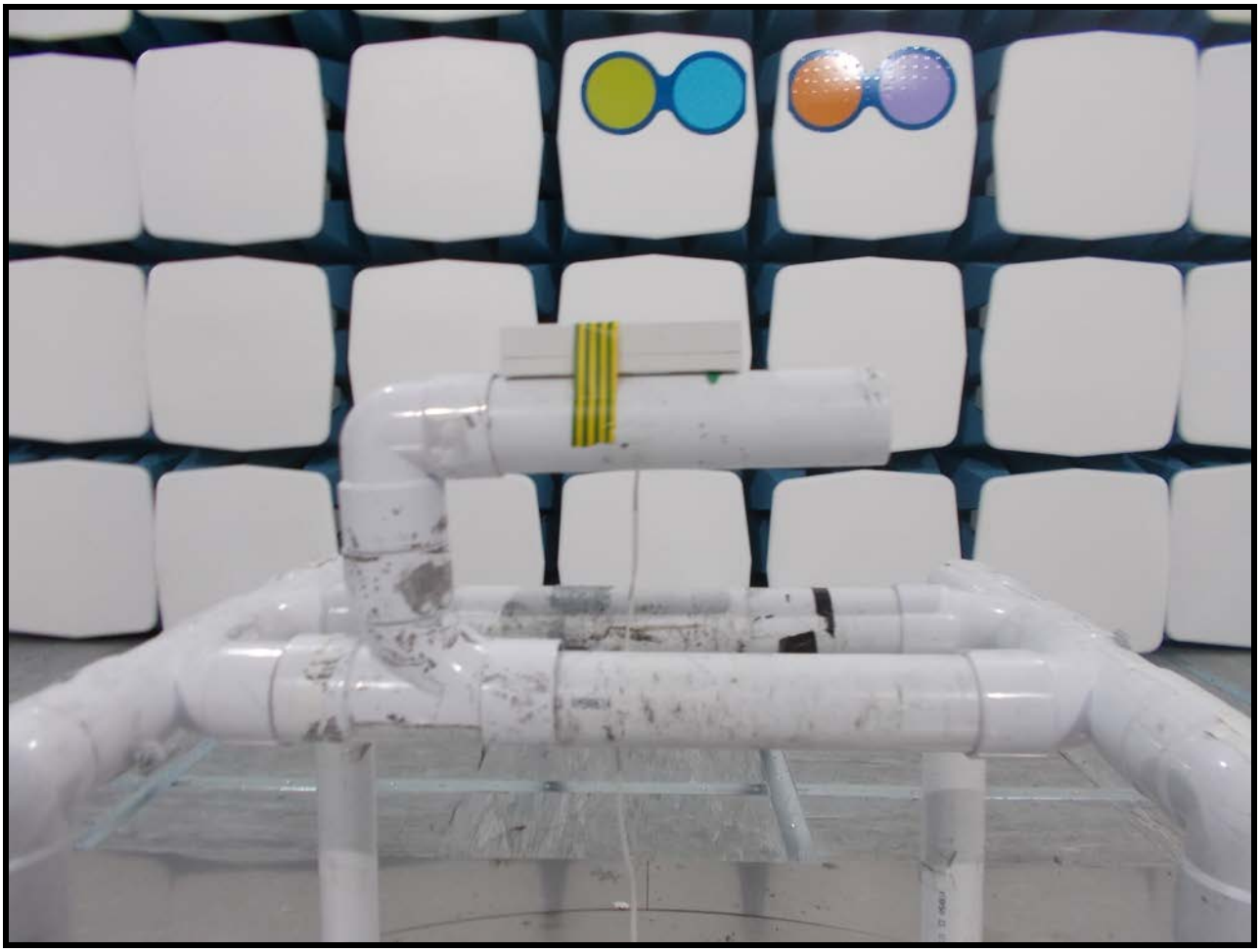


Photograph 6


Photograph 7

Photograph 8


Photograph 9



Photograph 10

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