



A RADIO TEST REPORT
FOR
AXELL WIRELESS LIMITED
ON
MBF - 4317 - 4319
DOCUMENT NO. TRA-017640-47-00-B

HULL

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TRaC Wireless Test Report : TRA-017640-47-00-B

Applicant : Axell Wireless Limited

Apparatus : MBF- 43170-4319

Specification(s) : CFR47, Part 24E, Part 27

Purpose of Test : Certification

FCCID : NEOMBF4050

Authorised by :

: Radio Product Manager

Issue Date : 21st January 2015

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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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Report author: S Hodgkinson

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1.2 Tests Requested By

This testing in this report was requested by :

Axell Wireless Limited
 Aerial House
 Asheridge Road
 Chesham
 Buckinghamshire
 HP5 1TU

1.3 Manufacturer

Axell Wireless Limited
 Aerial House
 Asheridge Road
 Chesham
 Buckinghamshire
 HP5 1TU

1.4 Apparatus Assessed

The following apparatus was assessed between 14th April and 3rd December 2014

Fibre Optic (F/O) Remote Unit

The Multi-Band Fibre Optic system is composed of two building blocks: OMU (Optical Master unit) and MBF-40 series (Fibre Distributed Antenna System) Remote Unit. This is an indoor solution for single or multi operator use.

| Technical specifications | | | |
|--------------------------|-----------------|-----------------|------------------|
| Frequency Range | Uplink | Downlink | CFR 47 Rule Part |
| 1900 MHz (PCS) | 1850 - 1910 MHz | 1930 - 1990 MHz | 24, Subpart E |
| 1700 MHz (AWS) | 1710 - 1755 MHz | 2110 - 2155 MHz | 27, Subpart A |

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 following table summarises the results of the assessment.

| Test Type | FCC Part 2 | CFR 47 Part 24 Subpart E | CFR 47 Part 27 Subpart A | Appendix in Report |
|---|----------------------|--------------------------|--------------------------|--------------------|
| RF Power Output | 2.1046 | 24.232(a) | 27.50 (a) | A1 & B1 |
| Intermodulation Spurious Emissions | 2.1051 | 24.238(a) | 27.53(c) & (g) | A2 & B2 |
| Occupied Bandwidth & Modulation | 2.1049 KDB 935210 | N/A | N/A | A3 & B3 |
| Spurious Emissions at Antenna Terminals Less than 1 MHz | 2.1051 | 24.238(a) | 27.53(c) & (g) | A4 & B4 |
| Spurious Emissions at Antenna Terminals Greater than 1MHz | 2.1051 | 24.238(a) | 27.53(c) & (g) | A5 & B5 |
| Field Strength of Spurious Emissions | 2.1053 | 24.238(a) | 27.53(c),(f) & (g) | A6 & B6 |
| Passband Gain & 20dB bandwidth | KDB 935210 | N/A | N/A | A7 & B7 |
| Frequency Stability | 2.1055 | 24.135 | 27.54 | N/A(note 1) |
| Transient behaviour | 2.1055 | N/A | N/A | N/A(note 2) |
| Audio Frequency Response (a) | TIA EIA-603.3.2.6 | N/A | N/A | N/A |
| Modulation Limiting | TIA EIA-603.3.2.6 | N/A | N/A | N/A |
| Signal Booster Labelling Requirements | 20.21(f)(1)(ii) | N/A | N/A | N/A |

Notes:

1 The EUT does not contain modulation circuitry; therefore the test was not performed.

2 The EUT is not a keyed carrier system; therefore the test was not performed.

Abbreviations used in the above table:

CFR : Code of Federal Regulations
 REFE : Radiated Electric Field Emissions
 A Uplink Results Appendix

ANSI : American National Standards Institution
 PLCE : Power Line Conducted Emissions
 B Downlink Results Appendix

1.6 Equipment Test Conditions

| | | |
|--|-------------------------------|--|
| Product class: | Uplink | Class A <input type="checkbox"/> Class B <input checked="" type="checkbox"/> |
| | Downlink | Class A <input type="checkbox"/> Class B <input checked="" type="checkbox"/> |
| | | |
| Product Use: | Cellular / PCS Signal Booster | |
| | | |
| Supply Voltages: | Vnom | 110Vac |
| Note: Vnom voltages are as stated above unless otherwise shown on the test report page | | |
| | | |
| Equipment Category: | Single channel | <input type="checkbox"/> |
| | Two channel | <input type="checkbox"/> |
| | Multi-channel | <input checked="" type="checkbox"/> |
| | | |
| Channel spacing: | Wideband | Uplink |
| | Wideband | Downlink |
| | | |
| Test Location | TRaC Global | |
| | Skelmersdale | <input checked="" type="checkbox"/> |
| | Hull | <input type="checkbox"/> |
| | Other | <input type="checkbox"/> Please Specify |

1.7 Standard References

| | |
|----------------|---|
| 47 CFR 2 | Code of Federal Regulations, Title 47, Part 2, "Frequency allocations and Radio Telemetry Matters; General Rules and Regulations" |
| 47 CFR 24 | Code of Federal Regulations, Title 47, Part 24," Personal Communications Services" |
| 47 CFR 27 | Code of Federal Regulations, Title 47, Part 27," Miscellaneous Wireless Communications Services" |
| 47 CFR 15 | Code of Federal Regulations, Title 47, Part 15,"Radio Frequency Devices" Subpart B, "Unintentional Radiators" |
| TIA EIA-603-D | Land Mobile FM or PM Communications Equipment Measurement and Performance Standards |
| KDB 935210 D01 | Booster Definitions v02 |
| KDB 935210 D02 | Certification Requirements v02r01 |
| KDB 935210 D03 | Signal Booster Measurements v02r01 |

1.8 Notes Relating To 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.

1.9 Deviations from Test Standards

There were no deviations from the standards tested to.

Section 2:**Measurement Uncertainty****2.1 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

Appendix A:**Uplink Formal Emission Test Results**

Abbreviations used in the tables in this appendix:

| | | | |
|------|---------------------------------|------|--------------------------------|
| Spec | : Specification | ALSR | : Absorber Lined Screened Room |
| Mod | : Modification | OATS | : Open Area Test Site |
| EUT | : Equipment Under Test | ATS | : Alternative Test Site |
| SE | : Support Equipment | Ref | : Reference |
| L | : Live Power Line | Freq | : Frequency |
| N | : Neutral Power Line | MD | : Measurement Distance |
| E | : Earth Power Line | SD | : Spec Distance |
| Pk | : Peak Detector | Pol | : Polarisation |
| QP | : Quasi-Peak Detector | H | : Horizontal Polarisation |
| Av | : Average Detector | V | : Vertical Polarisation |
| CDN | : Coupling & decoupling network | | |

A1 RF Gain and Output Power

| Test Details: | |
|------------------------|-----------------------------------|
| Measurement standard | Part 2.1046, 24.232(a), 27.50(a), |
| EUT sample number | S01 & S02 |
| Modification state | 0 |
| SE in test environment | None |
| SE isolated from EUT | None |
| Temperature | 22°C |
| Humidity | 47% |
| EUT set up | Refer to Appendix C |

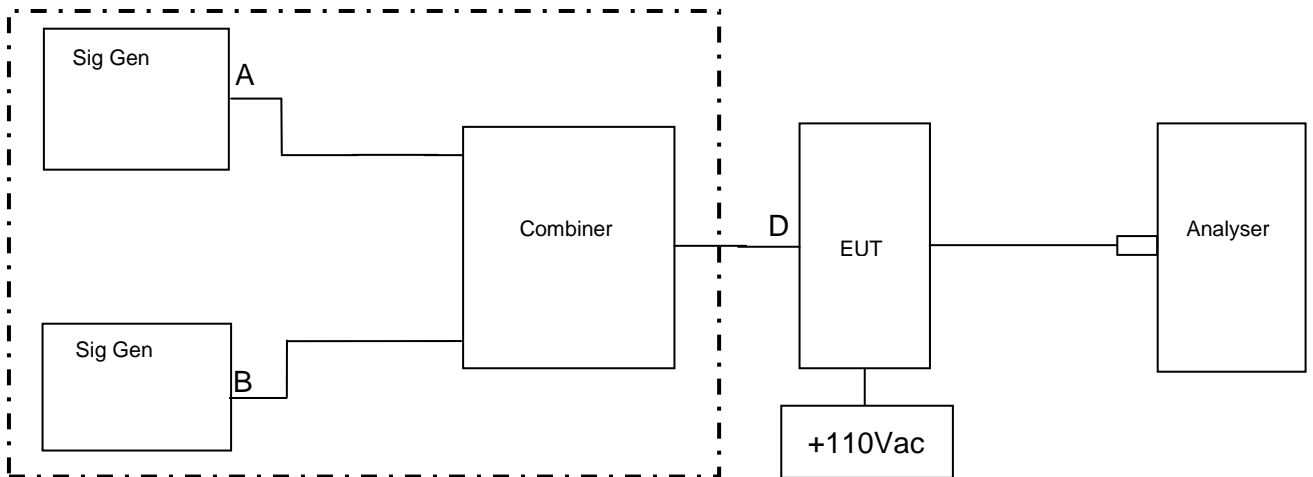
| Frequency (MHz) | Signal Generator input level (dBm) | Input Cable Loss (dB) | Input Level (dBm) | Level at Spectrum Analyser (dBm) | Output Cable & Attenuator loss (dB) | Gain (dB) | Conducted Output Power (dBm) | Gain after 10dB input level increase (dB) |
|-----------------|------------------------------------|-----------------------|-------------------|----------------------------------|-------------------------------------|-----------|------------------------------|---|
| 1700MHz | | | | | | | | |
| 1710.00 | -60.80 | 0.60 | -61.40 | -31.06 | 0.60 | 30.94 | -30.46 | 20.97 |
| 1732.50 | -63.30 | 0.60 | -63.90 | -31.29 | 0.60 | 33.21 | -30.69 | 23.25 |
| 1755.00 | -63.10 | 0.60 | -63.70 | -31.17 | 0.60 | 33.13 | -30.57 | 23.21 |
| 1800MHz | | | | | | | | |
| 1850.00 | -52.70 | 0.8 | -53.50 | -31.46 | 0.8 | 22.84 | -30.66 | 12.90 |
| 1882.50 | -53.50 | 0.80 | -54.30 | -31.36 | 0.80 | 23.74 | -30.56 | 13.82 |
| 1915.00 | -49.60 | 0.80 | -50.40 | -31.32 | 0.80 | 19.88 | -30.52 | 9.92 |

Notes:

1. The signal generator input was increased by 10dBs and the level of the output signal re measured.
2. *As per Annex .3 Policies + Procedures (k) of KDB 935210 D02 Signal Boosters Certification v02 the EUT was tested at compression and 10dB into compression to show AGC operation*

A2 Amplifier Intermodulation Spurious Emissions

| Test Details: | |
|------------------------|---|
| Measurement standard | Part 2.1053, 22.917(a), 24.238(a), 27.53(c) & (g) |
| EUT sample number | S01 & S02 |
| Modification state | 0 |
| SE in test environment | None |
| SE isolated from EUT | None |
| EUT set up | Refer to Appendix C |



| 2 Signals at | Frequency (MHz) | Level (dBm) | Limit (dBm) |
|--|-----------------|-------------|-------------|
| 1700 MHz | | | |
| No Emissions Within 10 dB of the limit | | | -13 |
| 1800 MHz | | | |
| No Emissions Within 10 dB of the limit | | | -13 |

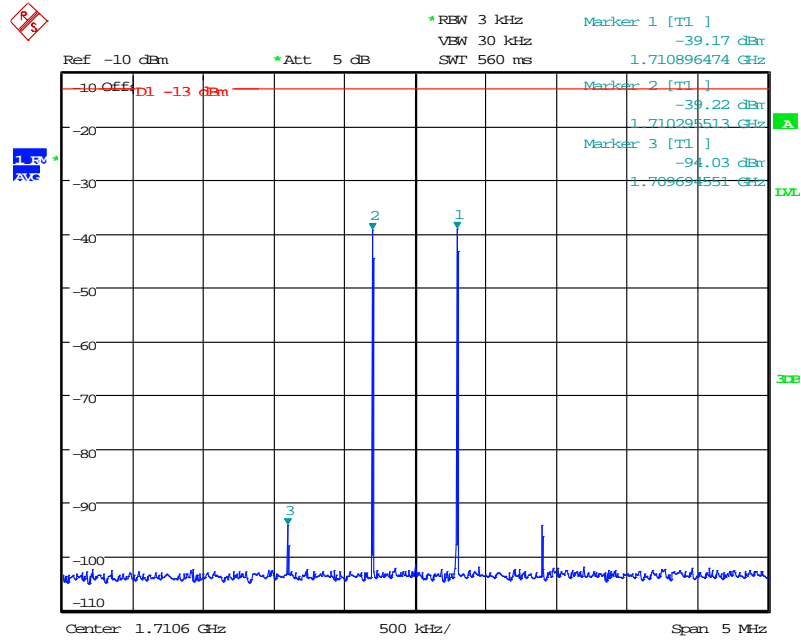
Sweep data is shown on the next page:

Results

The EUT was found to comply with the limits

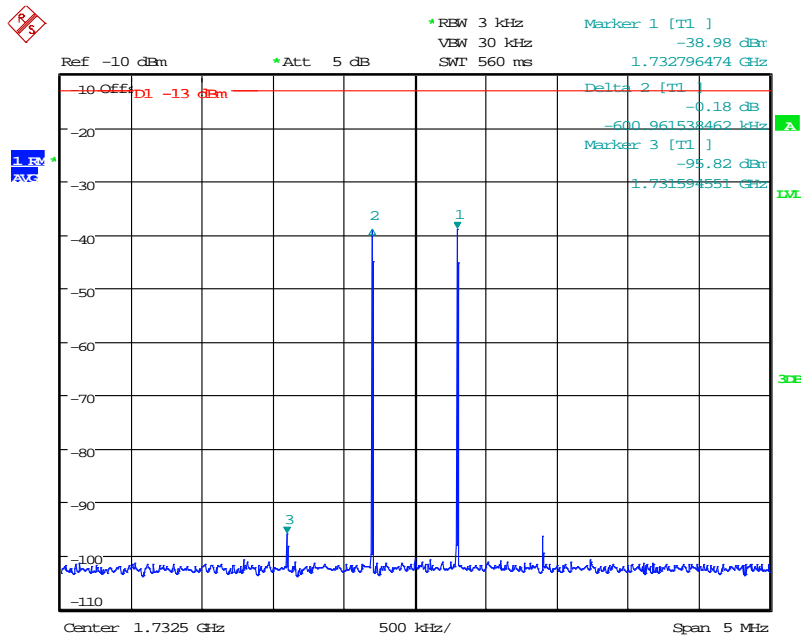
See plots below

1700 MHz Intermodulation close Views



Date: 18.SEP.2014 16:51:02

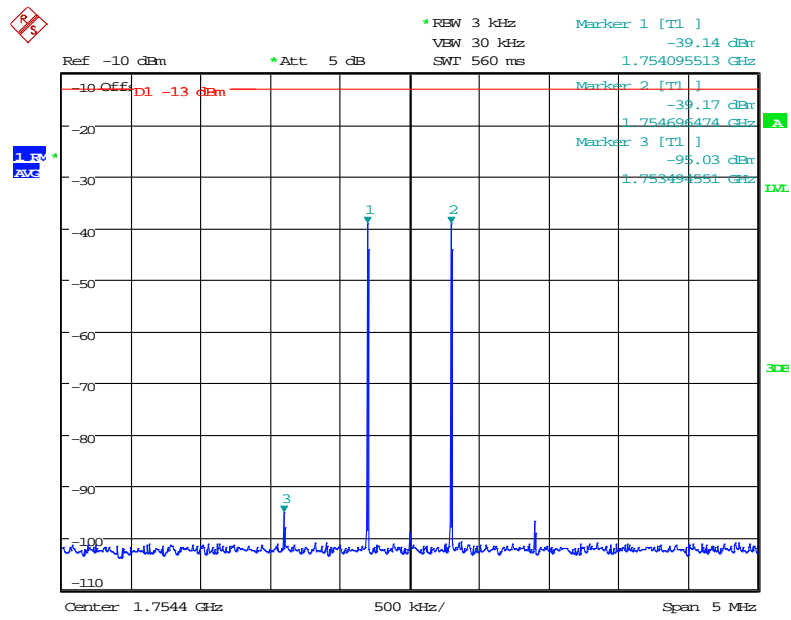
2 Signals at bottom end of band



Date: 18.SEP.2014 16:47:45

2 Signals at Middle of the band

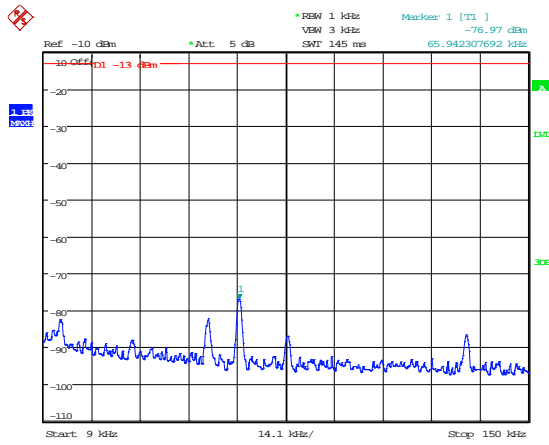
1700 MHz Intermodulation close Views



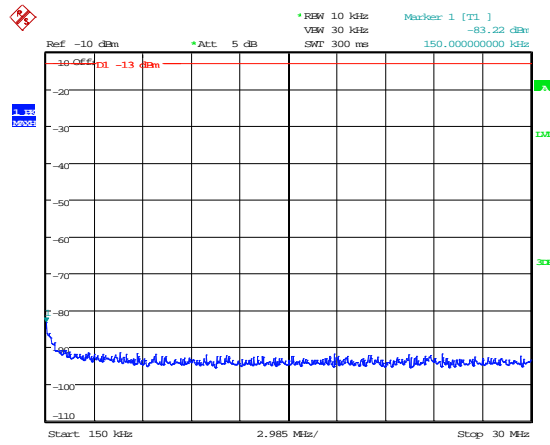
Date: 18.SEP.2014 16:53:29

2 Signals at top of the band

1700 MHz



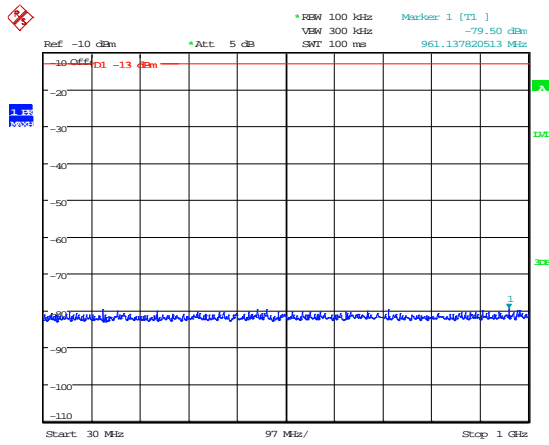
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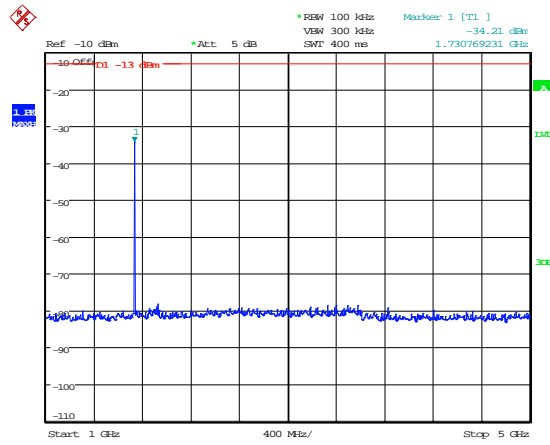
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9 – 150kHz

150kHz – 30MHz



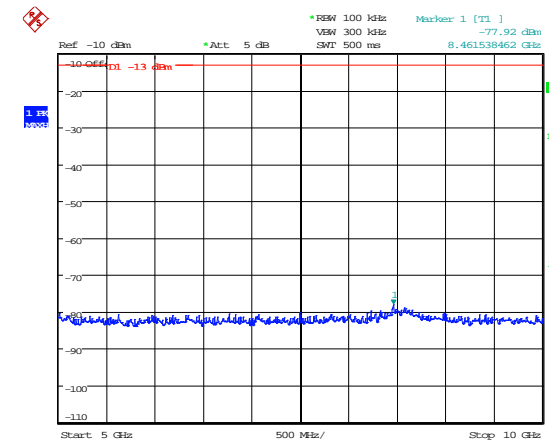
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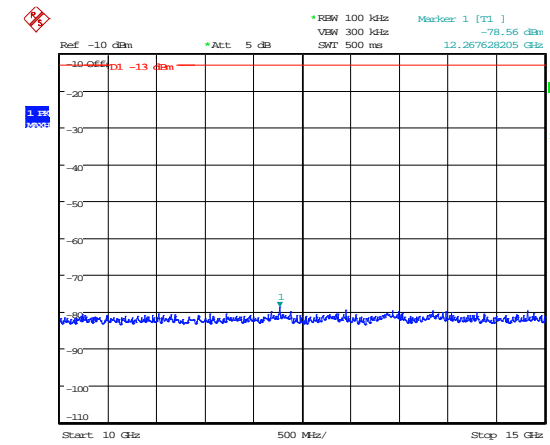
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30MHz – 1GHz

1GHz – 5GHz



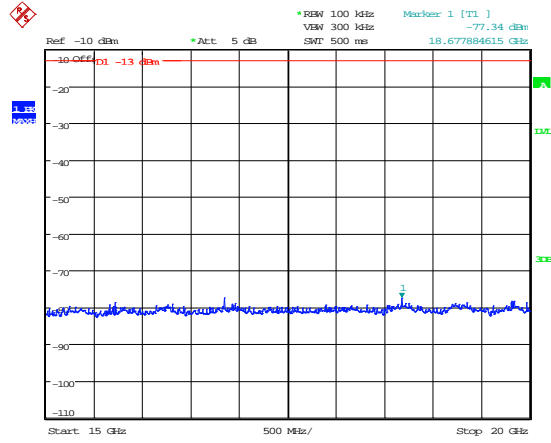
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Date: 18.SEP.2014 16:43:55

5GHz – 10GHz

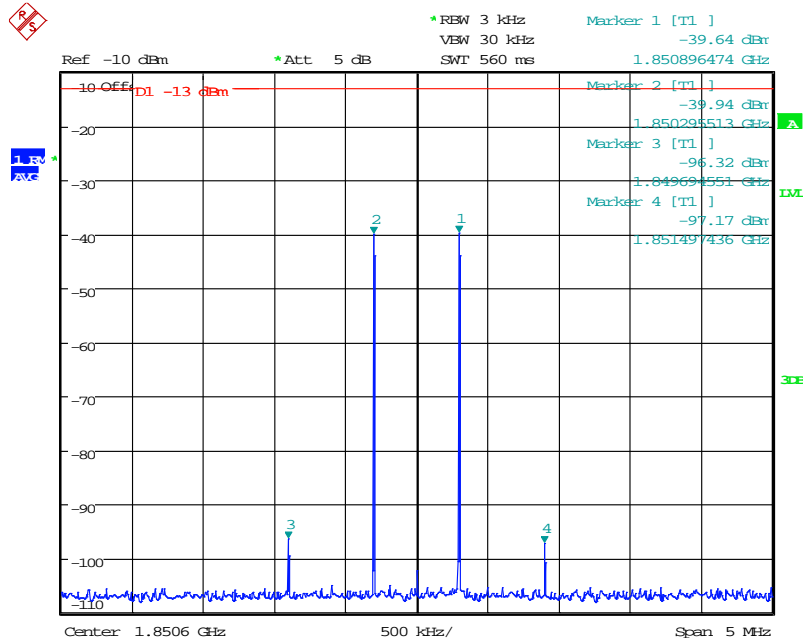
10GHz – 15GHz



Date: 18.SEP.2014 16:44:28

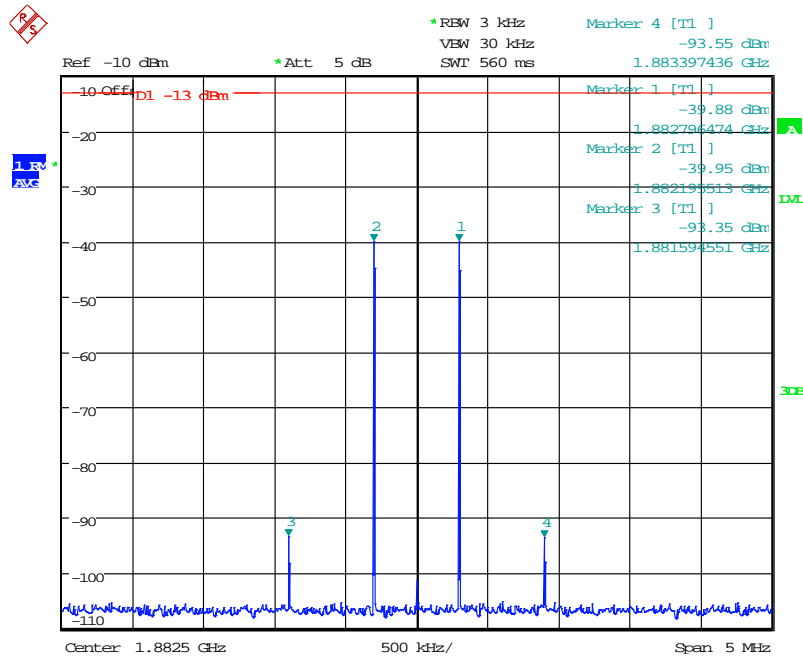
15GHz – 20GHz

1800 MHz Intermodulation close Views



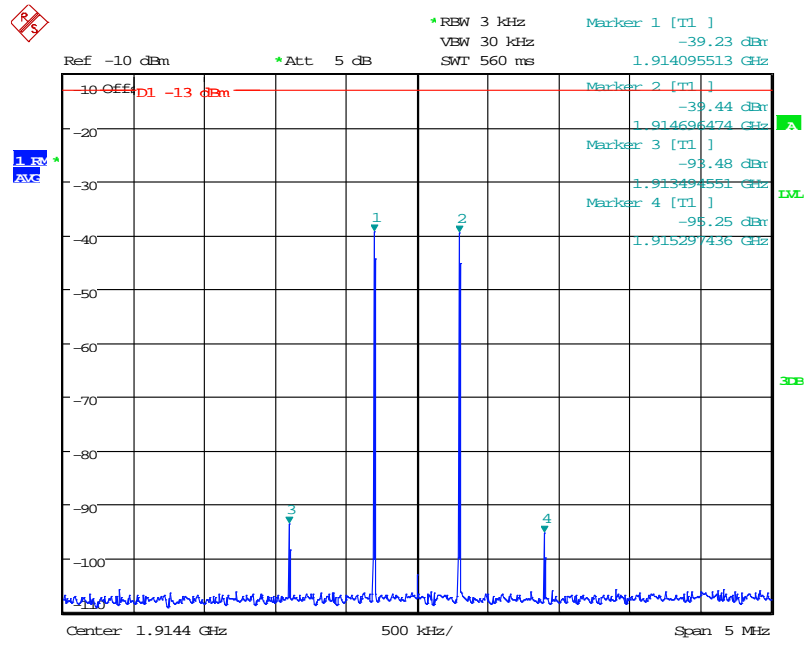
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2 Signals at bottom end of band



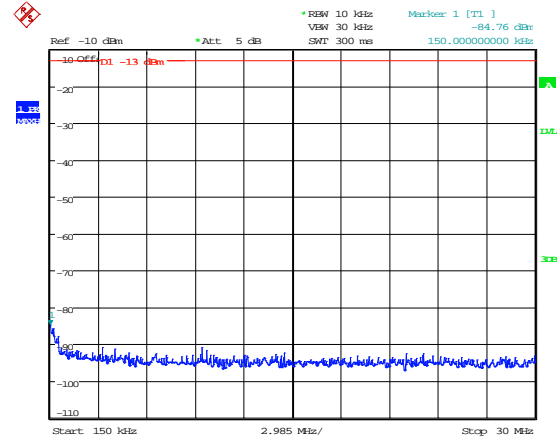
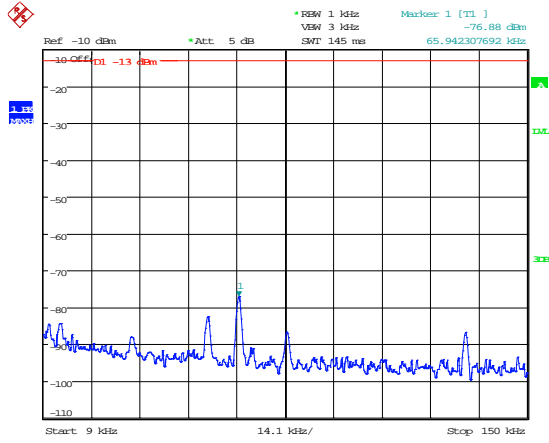
Date: 18.SEP.2014 16:26:54

2 Signals at bottom end of band



Date: 18.SEP.2014 16:30:47

2 Signals at top end of band

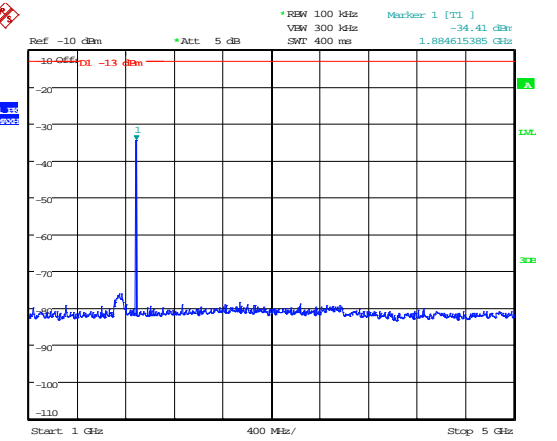
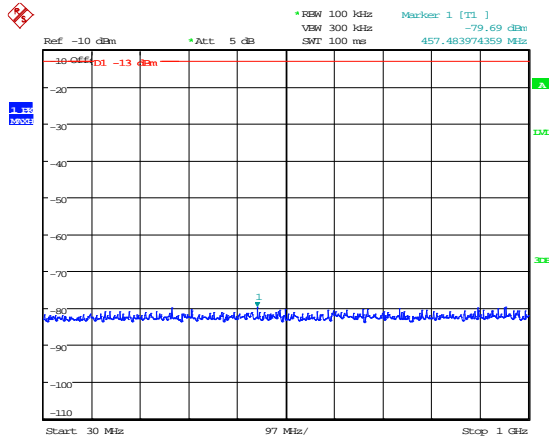


Date: 18.SEP.2014 16:41:25

Date: 18.SEP.2014 16:41:50

9 – 150kHz

150kHz – 30MHz

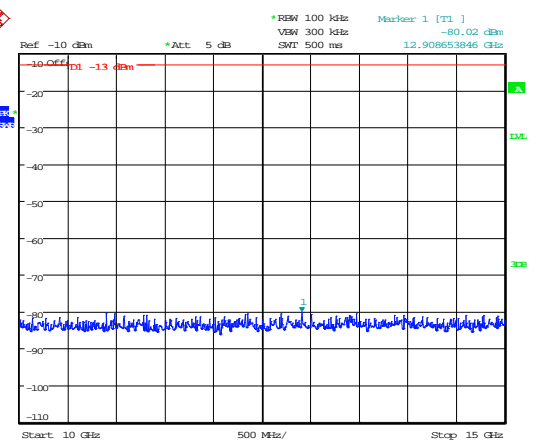
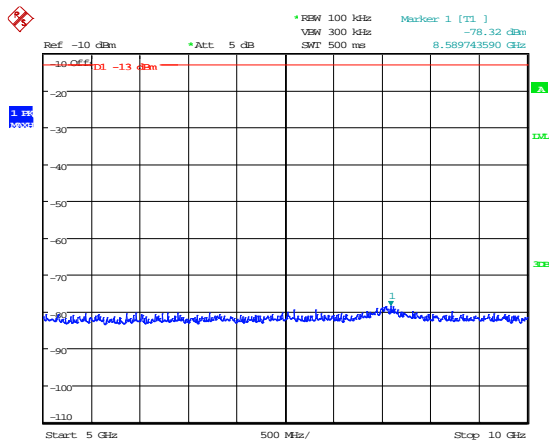


Date: 18.SEP.2014 16:42:02

Date: 18.SEP.2014 16:35:28

30MHz -1GHz

1GHz – 5GHz

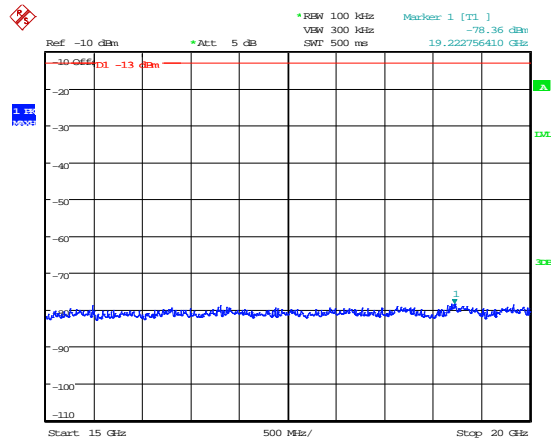


Date: 18.SEP.2014 16:35:43

Date: 18.SEP.2014 16:39:04

5GHz – 10GHz

10GHz-15GHz



Date: 18.SEP.2014 16:41:03

15GHz-20GHz

A3 Amplifier Modulated Channel Test

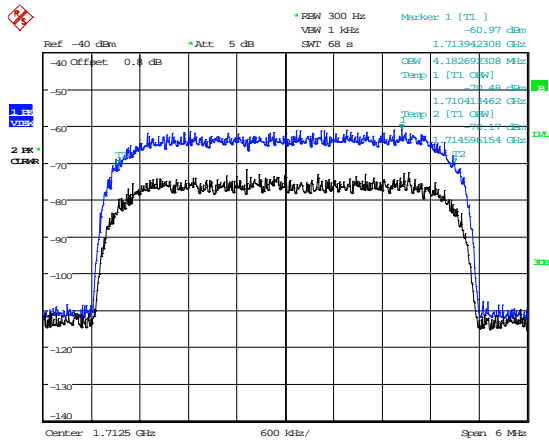
| Test Details: | |
|------------------------|---|
| Measurement standard | D.3 Policies + Procedures (j) of KDB 935210 D02 Signal Boosters Certification v02 |
| EUT sample number | S01 & S02 |
| Modification state | 0 |
| SE in test environment | None |
| SE isolated from EUT | None |
| EUT set up | Refer to Appendix C |

| Frequency Of Operation Channel | Modulation Type | | | | |
|--------------------------------|-----------------|------------|----------|-------------|--------------|
| | CDMA | GSM | WCDMA | LTE 1.4 MHz | LTE 20.0 MHz |
| 1710.0 MHz | N/A | N/A | 4.182MHz | 1.089MHz | 17.875MHz |
| 1732.5 MHz | N/A | N/A | 4.173MHz | 1.086MHz | 17.910MHz |
| 1755.0 MHz | N/A | N/A | 4.173MHz | 1.086MHz | 17.910MHz |
| 1850.0 MHz | 1.269MHz | 248.397kHz | 4.173MHz | 1.086MHz | 17.875MHz |
| 1882.5 MHz | 1.272MHz | 248.397kHz | 4.182MHz | 1.089MHz | 17.875MHz |
| 1915.0 MHz | 1.275MHz | 248.397kHz | 4.173MHz | 1.089MHz | 17.875MHz |

Waveforms applied to selected bands as requested.

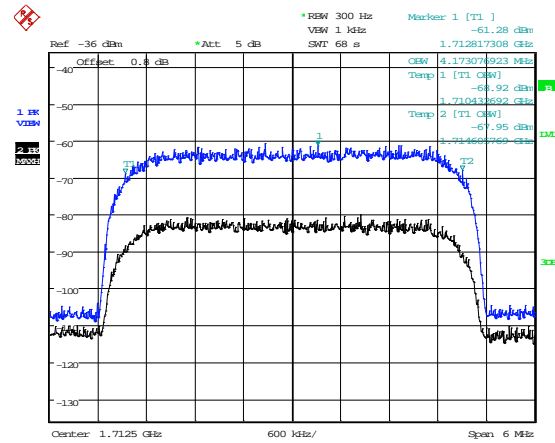
As per Annex .3 Policies + Procedures (k) of KDB 935210 D02 Signal Boosters Certification v02 the EUT was tested at compression and 10dB into compression to show AGC operation, worst case results taken.

WCDMA



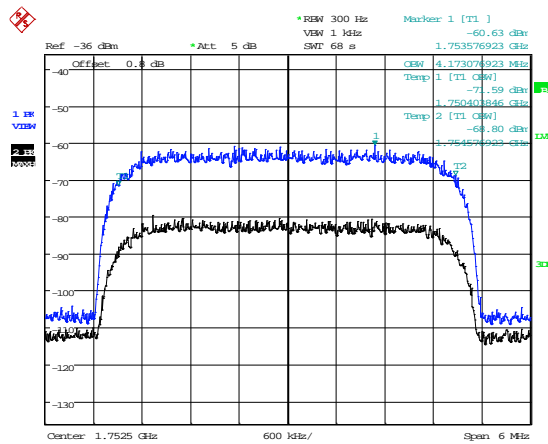
Date: 23.SEP.2014 14:22:23

1710MHz



Date: 23.SEP.2014 14:31:52

1732.5MHz

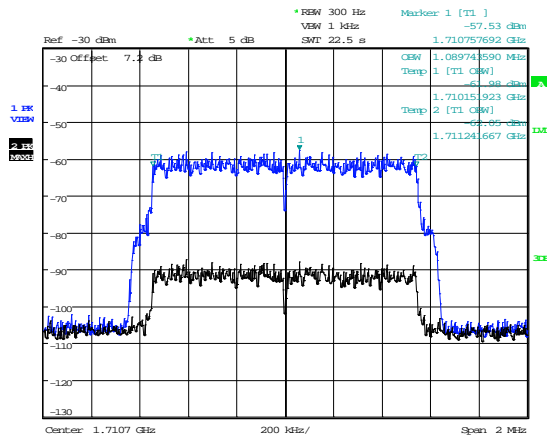


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1755MHz

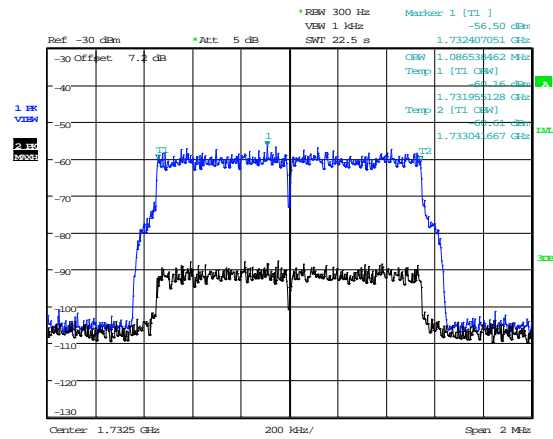
The above plots depicting the output wavsshape show no measurable distortion visible when compared to the input signal.

1.4MHz LTE Modulation



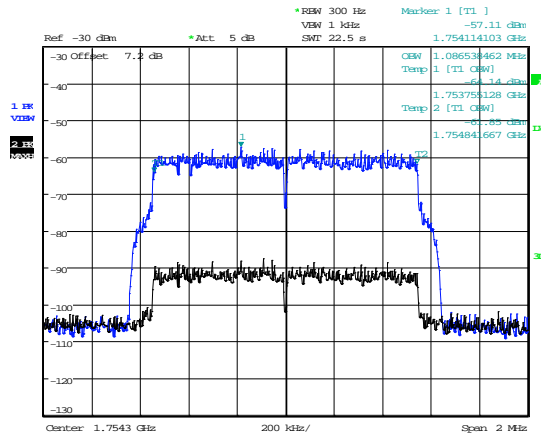
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1710MHz



Date: 3.DEC.2014 11:57:39

1732.5MHz

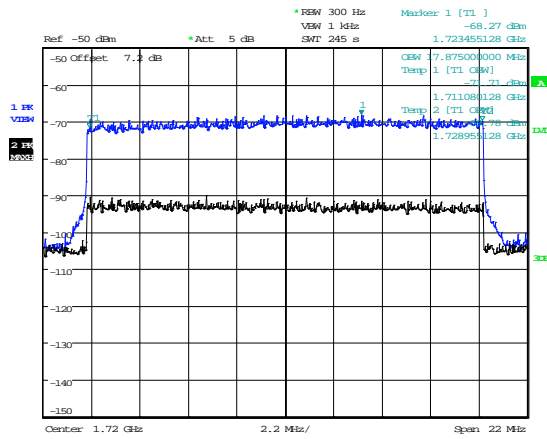


Date: 3.DEC.2014 12:01:48

1755MHz

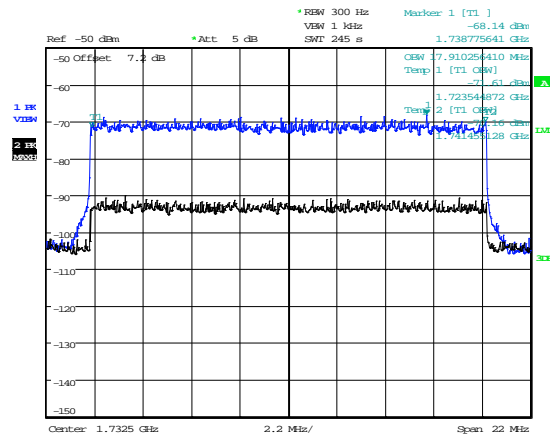
The above plots depicting the output wavelshape show no measurable distortion visible when compared to the input signal.

LTE 20MHz Modulation



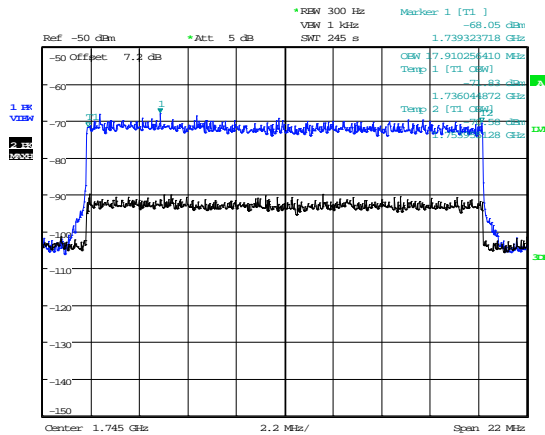
Date: 3.DEC.2014 12:44:26

1710MHz



Date: 3.DEC.2014 12:27:33

1732.5MHz

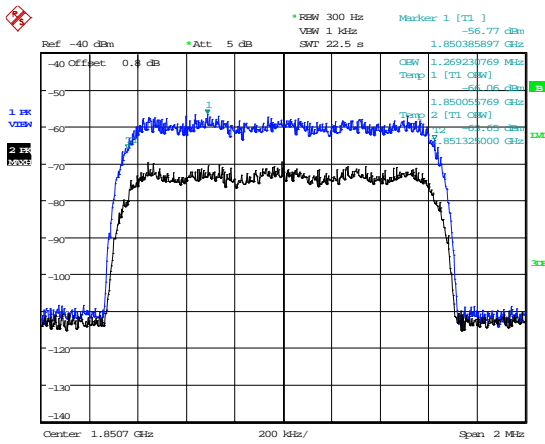


Date: 3.DEC.2014 12:17:28

1755MHz

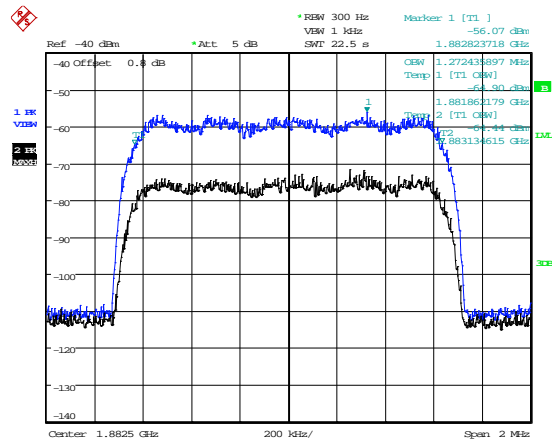
The above plots depicting the output wavelshape show no measurable distortion visible when compared to the input signal.

CDMA Modulation



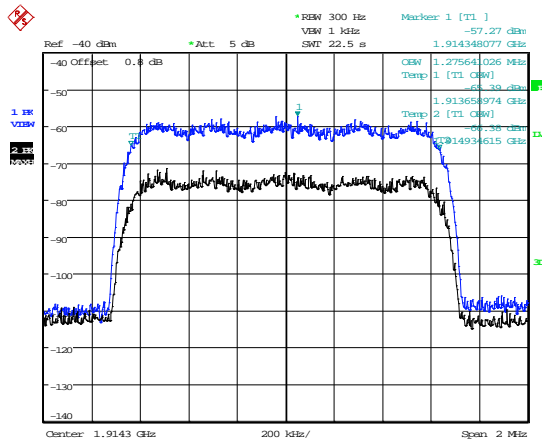
Date: 23.SEP.2014 13:08:03

1850MHz



Date: 23.SEP.2014 13:13:16

1882.5 MHz

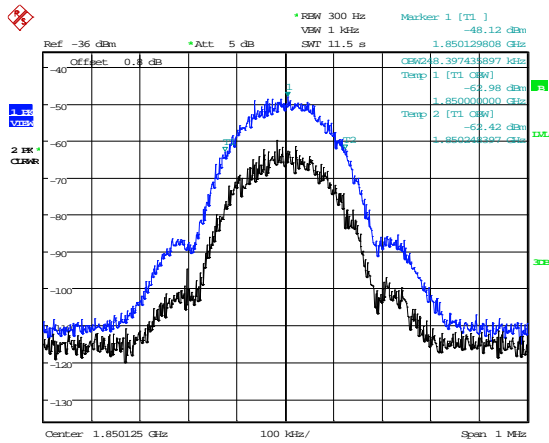


Date: 23.SEP.2014 14:07:57

1915 MHz

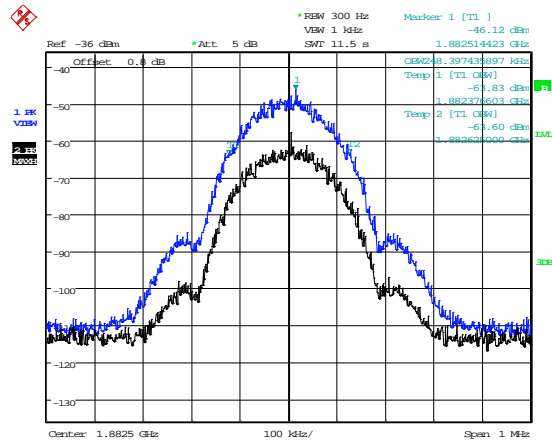
The above plots depicting the output waveshape show no measurable distortion visible when compared to the input signal.

GSM Modulation



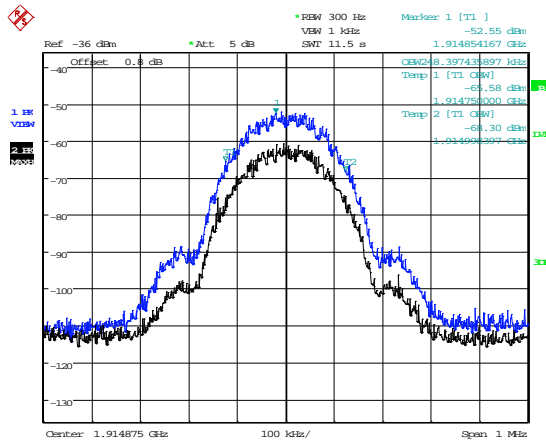
Date: 24.SEP.2014 09:59:46

1850MHz



Date: 24.SEP.2014 10:03:57

1882.5MHz

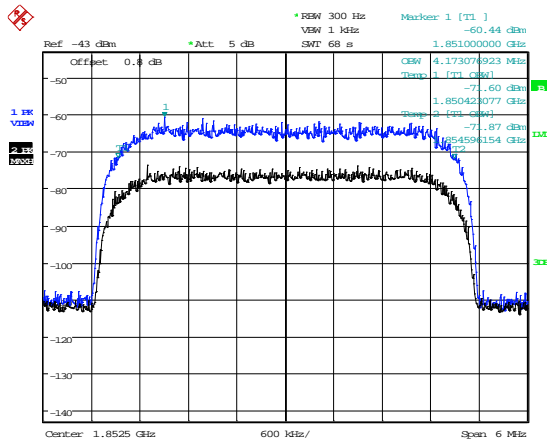


Date: 24.SEP.2014 10:07:43

1915MHz

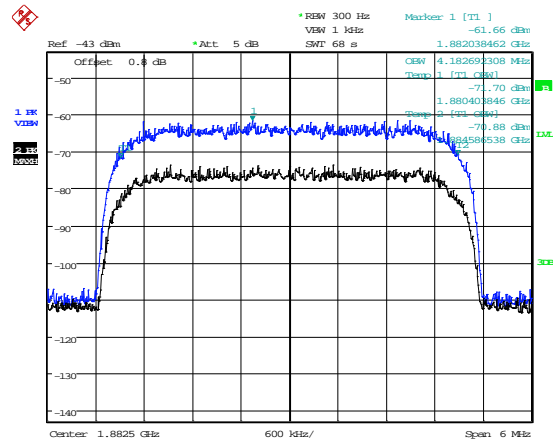
The above plots depicting the output waveshape show no measurable distortion visible when compared to the input signal.

WCDMA Modulation



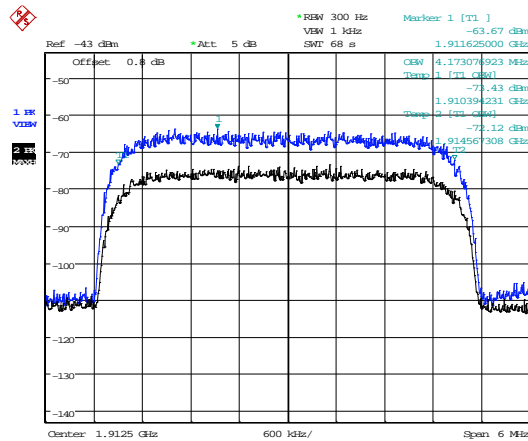
Date: 23.SEP.2014 14:59:47

1850 MHz



Date: 23.SEP.2014 15:14:41

1882.5 MHz

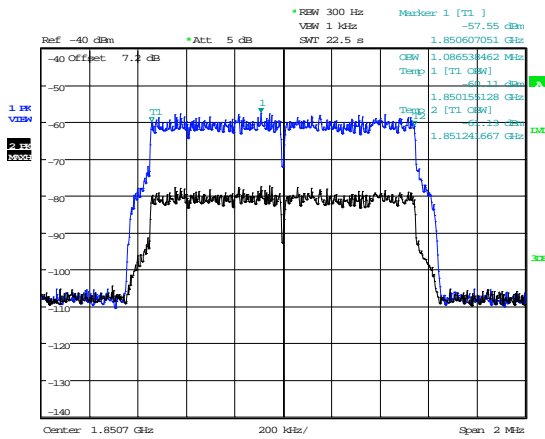


Date: 23.SEP.2014 15:25:38

1915.0 MHz

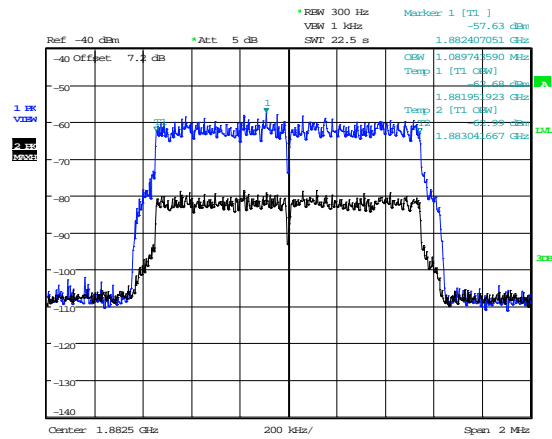
The above plots depicting the output waveshape show no measurable distortion visible when compared to the input signal.

1.4 MHz LTE Modulation



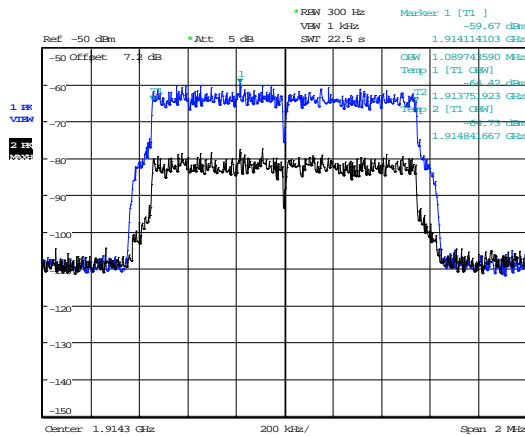
Date: 3.DEC.2014 14:42:09

1850 MHz



Date: 3.DEC.2014 14:37:09

1882.5 MHz

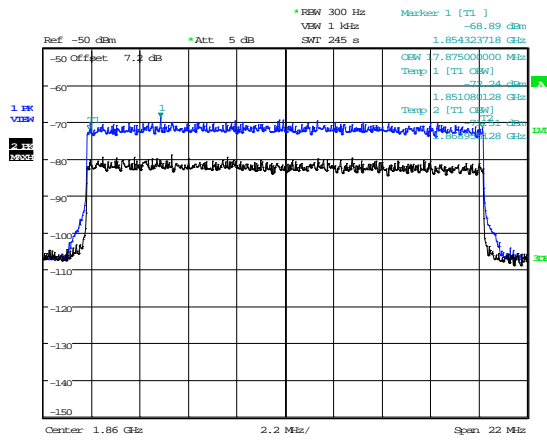


Date: 3.DEC.2014 14:30:21

1915 MHz

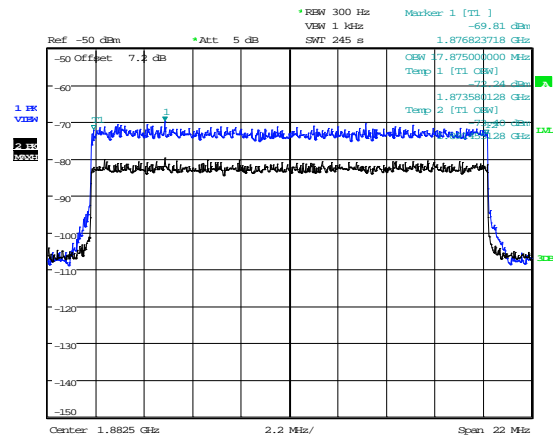
The above plots depicting the output waveshape show no measurable distortion visible when compared to the input signal.

20 MHz LTE Modulation



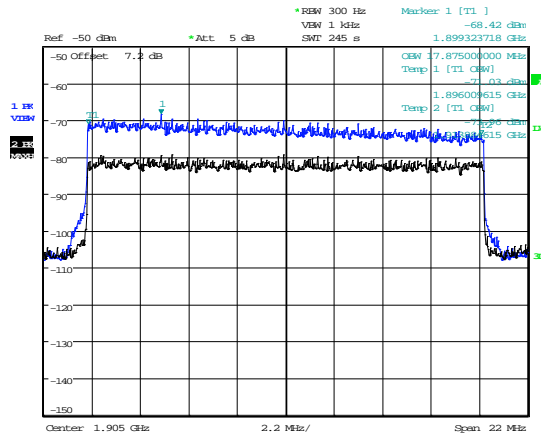
Date: 3.DEC.2014 14:12:02

1850MHz



Date: 3.DEC.2014 12:59:53

1882.5MHz



Date: 3.DEC.2014 14:22:13

1915MHz

The above plots depicting the output waveshape show no measurable distortion visible when compared to the input signal.

A4 Spurious Emissions at Antenna Terminals Less than 1MHz

| Test Details: | |
|------------------------|---|
| Measurement standard | Part 2.1053, 24.238(a), 27.53(c) & (g), |
| EUT sample number | S01 & S02 |
| Modification state | 0 |
| SE in test environment | None |
| SE isolated from EUT | None |
| EUT set up | Refer to Appendix C |

Note: The spurious emissions at the antenna terminals less than 1MHz, in the uplink direction was not performed, as the output power was below the -13dBm spurious limit (-30.46dBm).

A5 Spurious Emissions at Antenna Terminals Greater than 1 MHz

| Test Details: | |
|------------------------|---|
| Measurement standard | Part 2.1053, 24.238(a), 27.53(c) & (g), |
| EUT sample number | S01 & S02 |
| Modification state | 0 |
| SE in test environment | None |
| SE isolated from EUT | None |
| EUT set up | Refer to Appendix C |

| Frequency (MHz) | Frequency Range (MHz) | Freq. of Emission (MHz) | Measured Level (dBm) | Attenuator & Cable Losses (dB) | Spurious Emission Level (dBm) | Limit (dBm) |
|-----------------|-----------------------|-------------------------|----------------------|--------------------------------|--|-------------|
| 1700 MHz | | | | | | |
| 1710.000 | | | | | No Significant Emissions Within 20 dB of limit | -13 |
| 1732.500 | | | | | | -13 |
| 1755.000 | | | | | | -13 |
| 1800 MHz | | | | | | |
| 1850.000 | | | | | No Significant Emissions Within 20 dB of limit | -13 |
| 1882.500 | | | | | | -13 |
| 1915.000 | | | | | | -13 |

Limit is determined by the outermost step of the emissions mask and is calculated as follows:

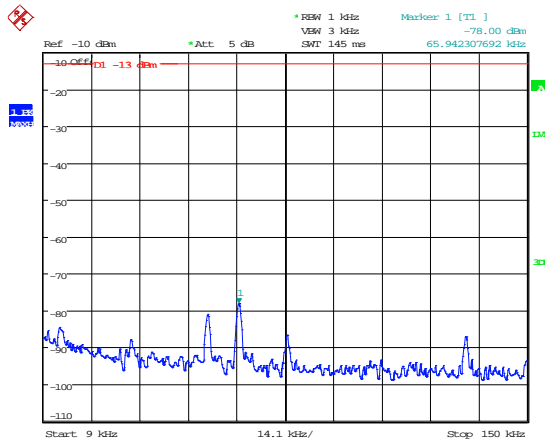
At least $43 + 10 \log P$ dB

$$(10 \log P_{\text{watts}}) - (43 + 10 \log (P_{\text{watts}} * 1000)) = \text{LIMIT} = -13 \text{ dBm}$$

Result

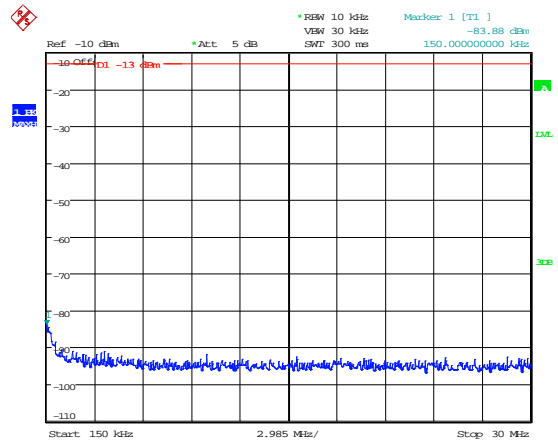
The EUT was found to comply with the limits

Conducted spurious 1710MHz



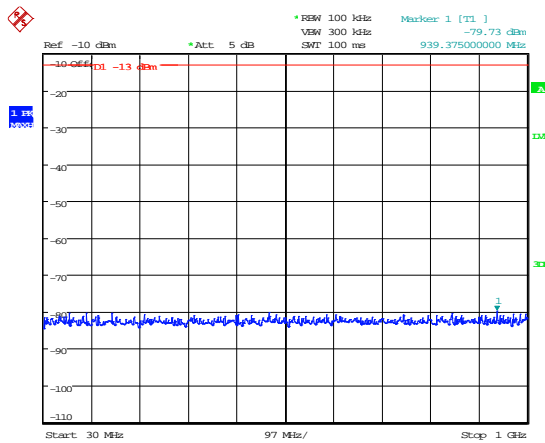
Date: 18.SEP.2014 17:21:05

9-150kHz



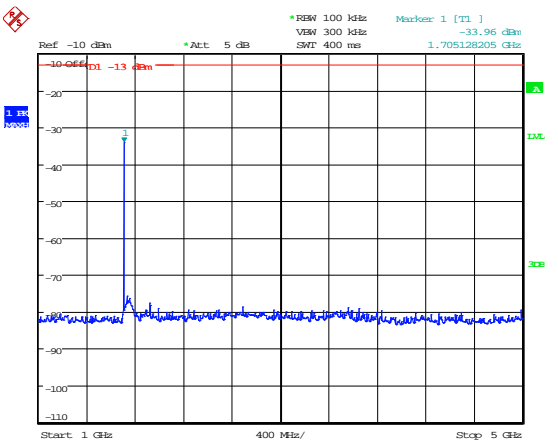
Date: 18.SEP.2014 17:21:33

150kHz – 30MHz



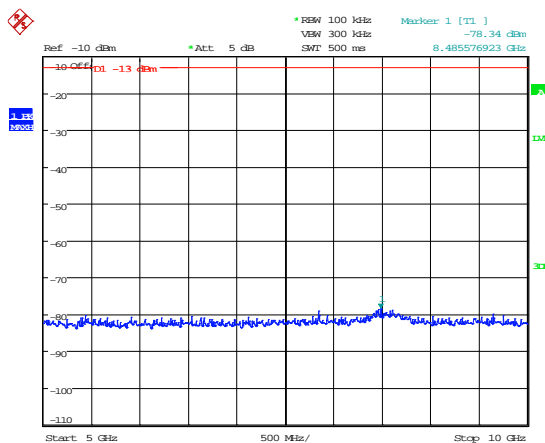
Date: 18.SEP.2014 17:21:44

30MHz – 1GHz

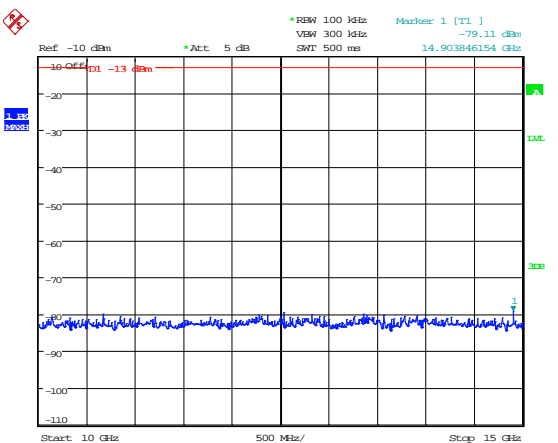


Date: 18.SEP.2014 17:21:57

1GHz – 5GHz



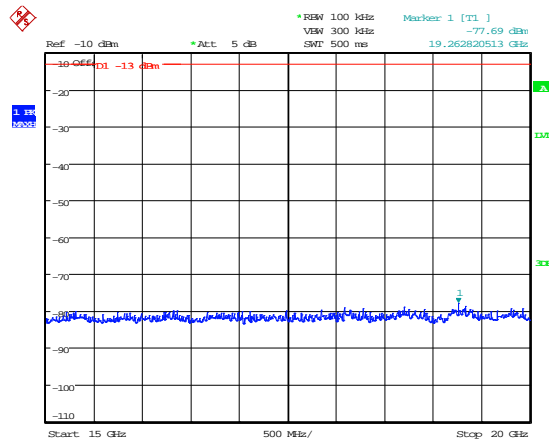
Date: 18.SEP.2014 17:22:08



Date: 18.SEP.2014 17:20:44

5GHz – 10GHz

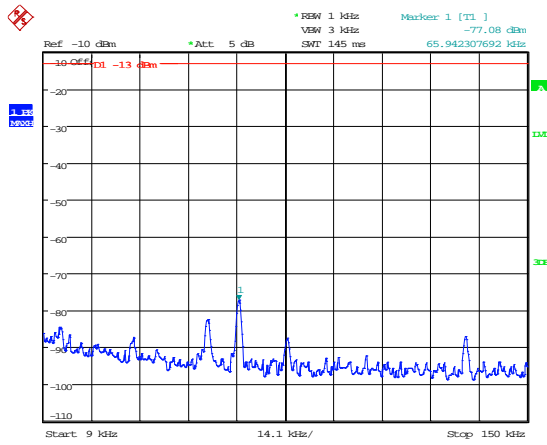
10GHz – 15GHz



Date: 18.SEP.2014 17:20:54

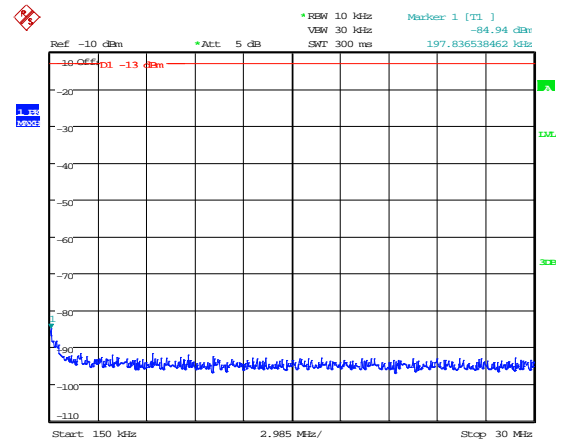
15GHz – 20GHz

Conducted spurious 1732.5MHz



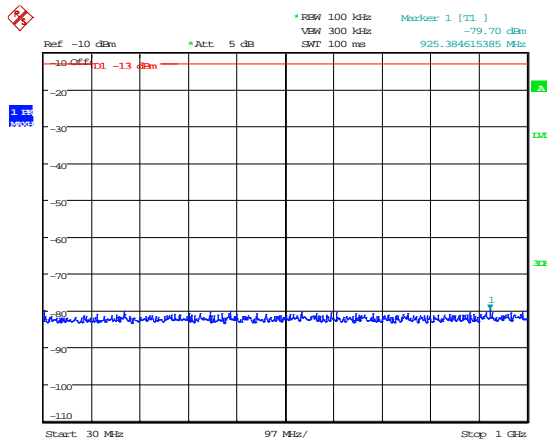
Date: 18.SEP.2014 17:18:50

9-150kHz



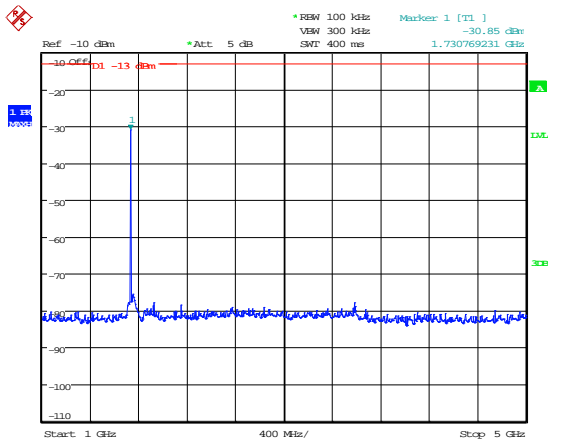
Date: 18.SEP.2014 17:19:08

150kHz- 30MHz



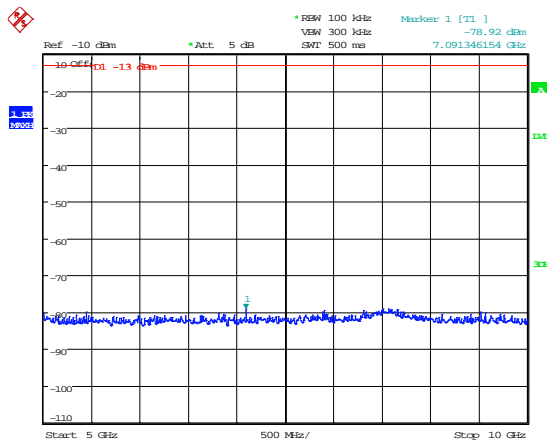
Date: 18.SEP.2014 17:19:24

30MHz – 1GHz



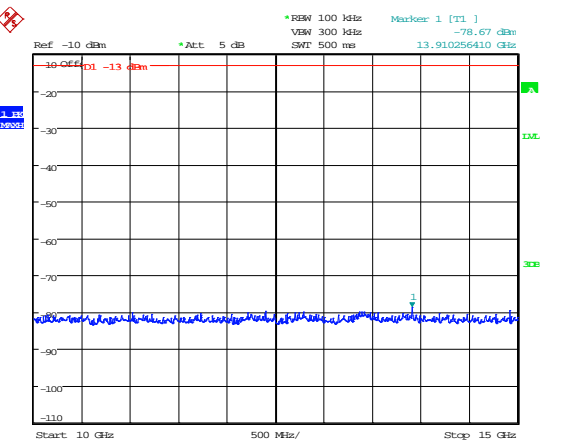
Date: 18.SEP.2014 17:19:34

1GHz – 5GHz



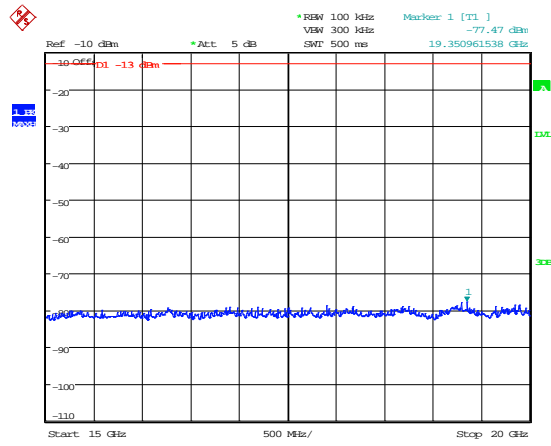
Date: 18.SEP.2014 17:19:47

5GHz – 10GHz



Date: 18.SEP.2014 17:19:58

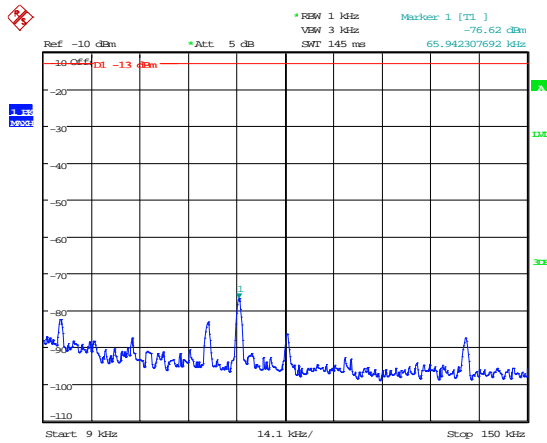
10GHz – 15GHz



Date: 18.SEP.2014 17:18:38

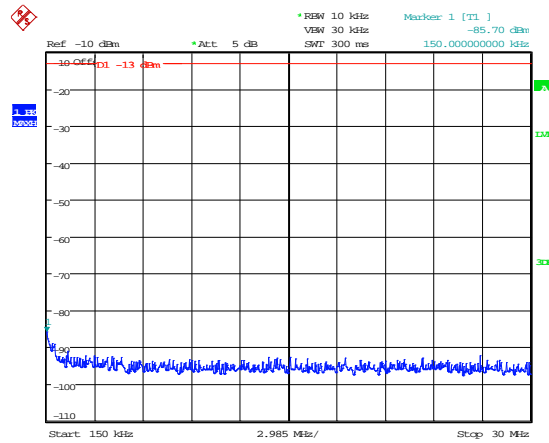
15GHz – 20GHz

Conducted spurious 1755MHz



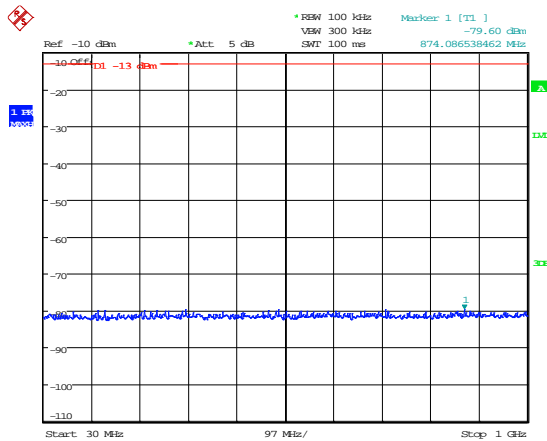
Date: 18.SEP.2014 17:12:23

9kHz – 150kHz



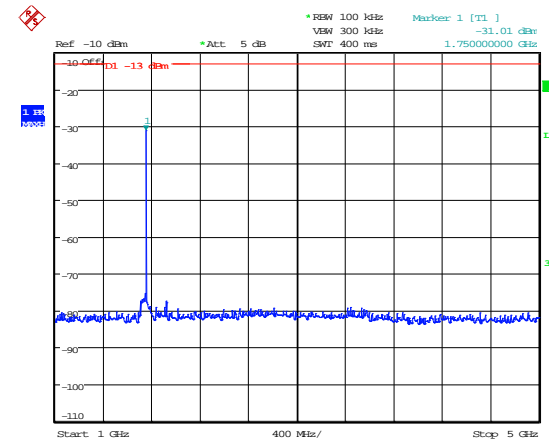
Date: 18.SEP.2014 17:12:40

150kHz – 30MHz



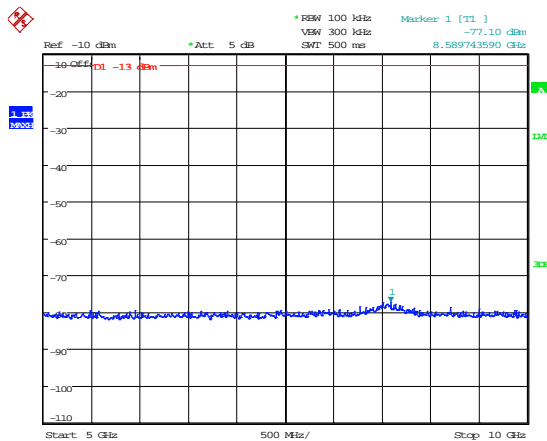
Date: 18.SEP.2014 17:12:11

30MHz – 1GHz



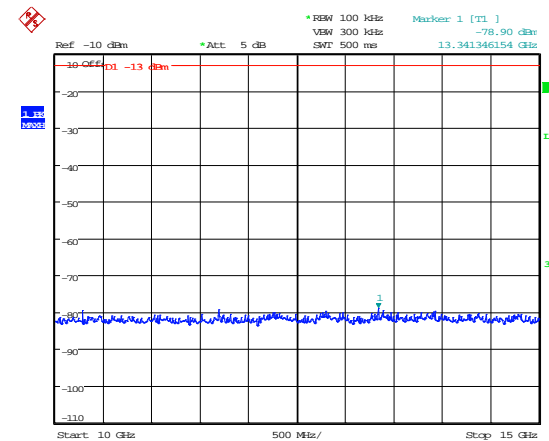
Date: 18.SEP.2014 17:12:51

1GHz – 5GHz



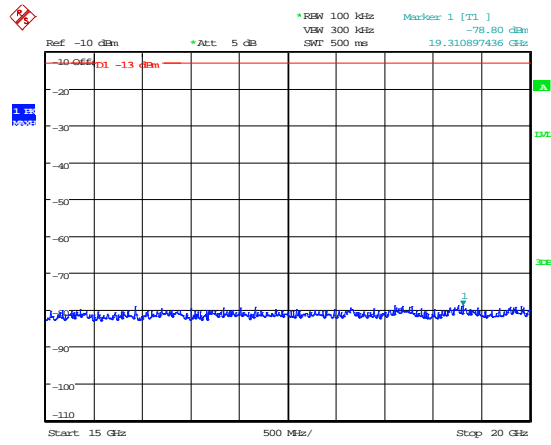
Date: 18.SEP.2014 17:15:34

5GHz-10GHz



Date: 18.SEP.2014 17:17:39

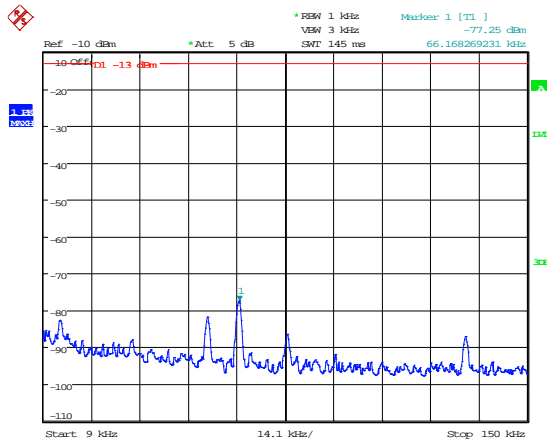
10GHz – 15GHz



Date: 18.SEP.2014 17:17:56

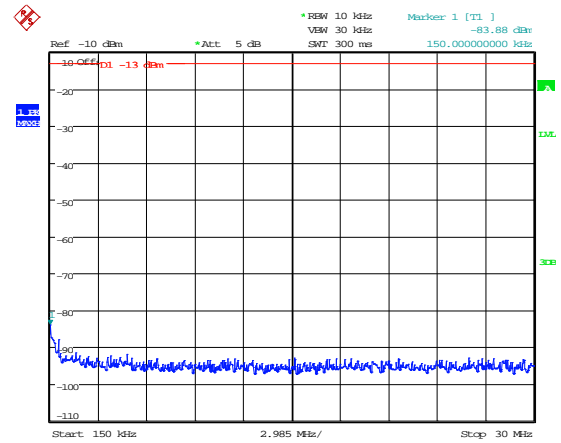
15GHz – 20GHz

Conducted spurious 1850MHz



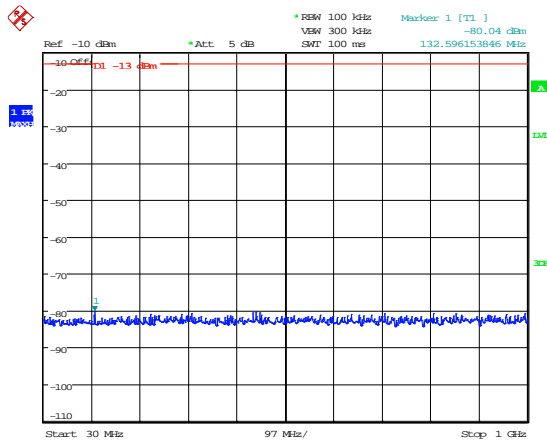
Date: 18.SEP.2014 17:28:27

9kHz – 150kHz



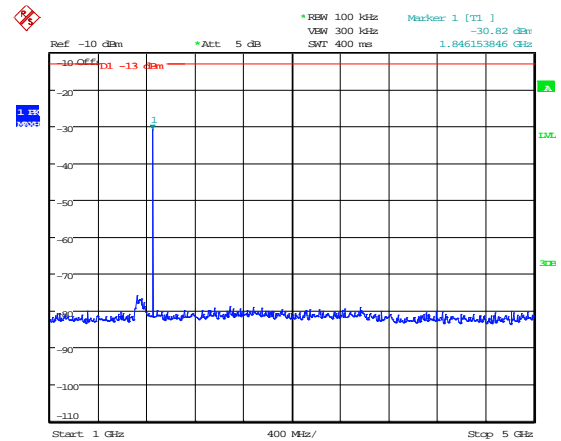
Date: 18.SEP.2014 17:28:42

150kHz – 30MHz



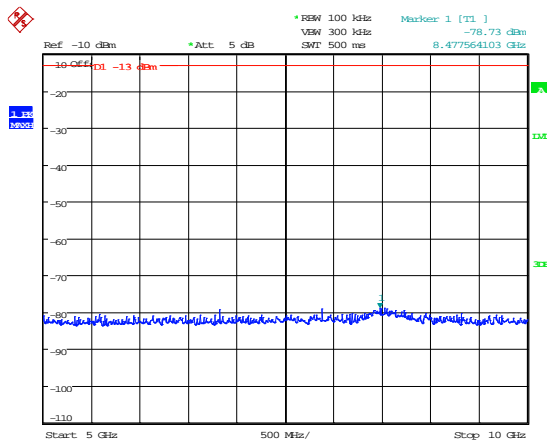
Date: 18.SEP.2014 17:27:21

30MHz – 1GHz



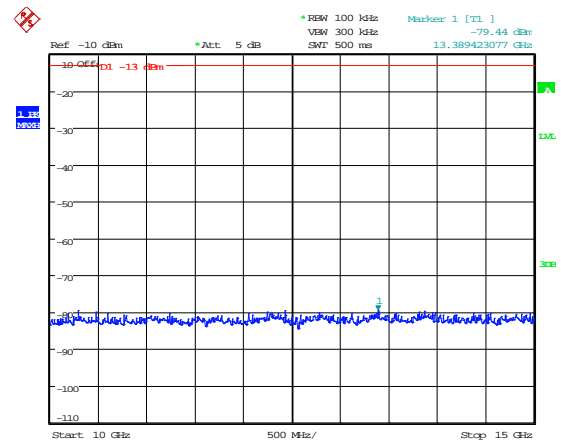
Date: 18.SEP.2014 17:27:33

1GHz – 5GHz



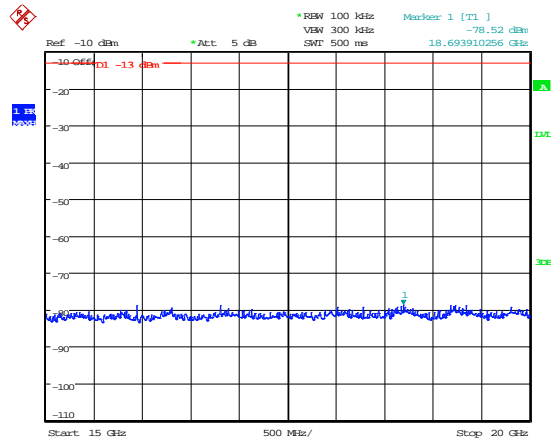
Date: 18.SEP.2014 17:27:43

5GHz – 10GHz



Date: 18.SEP.2014 17:27:57

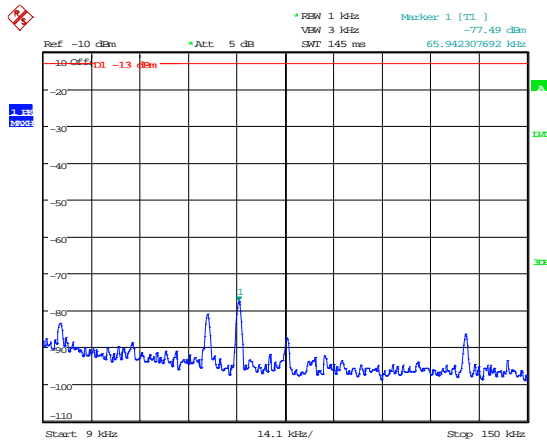
10GHz – 15GHz



Date: 18.SEP.2014 17:28:09

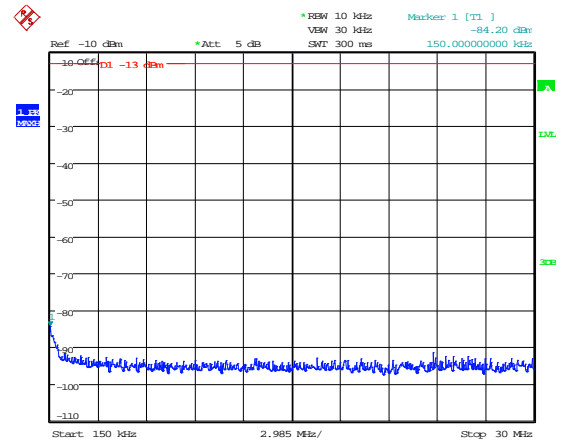
15GHz - 20GHz

Conducted spurious 1882.5MHz



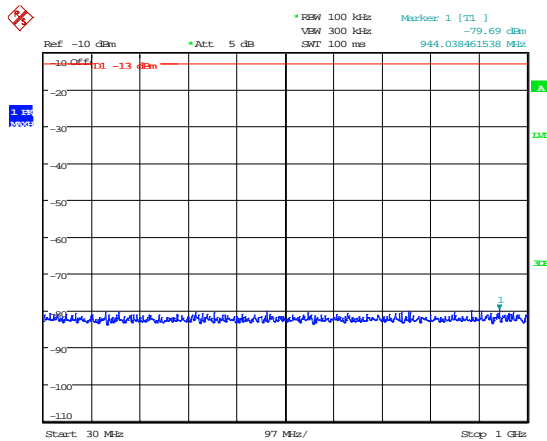
Date: 18.SEP.2014 17:26:12

9kHz – 150kHz



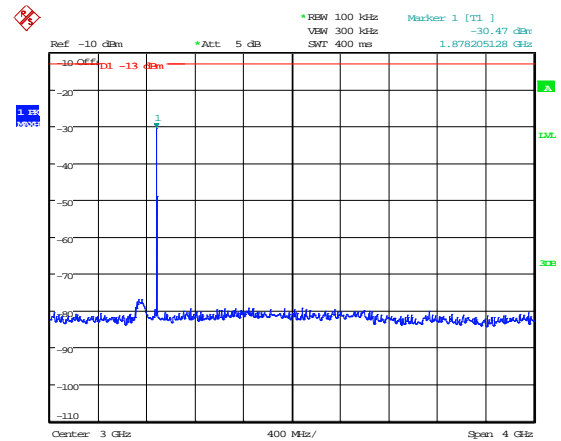
Date: 18.SEP.2014 17:26:29

150kHz – 30MHz



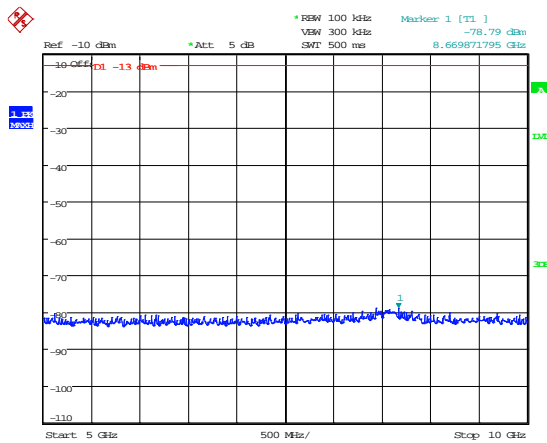
Date: 18.SEP.2014 17:26:42

30MHz – 1GHz



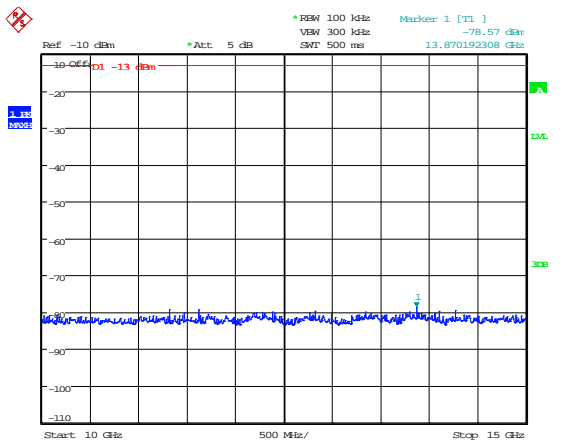
Date: 18.SEP.2014 17:25:27

1GHz – 5GHz



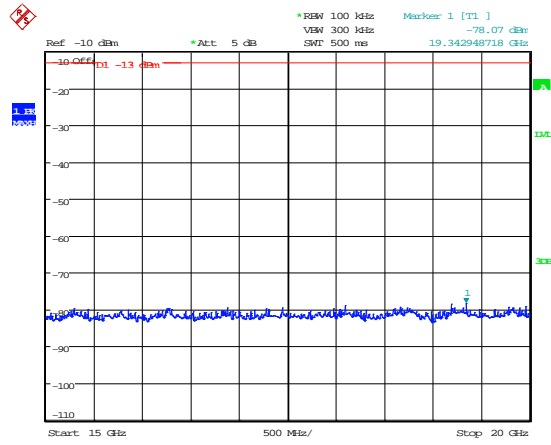
Date: 18.SEP.2014 17:25:39

5GHz - 10GHz



Date: 18.SEP.2014 17:25:50

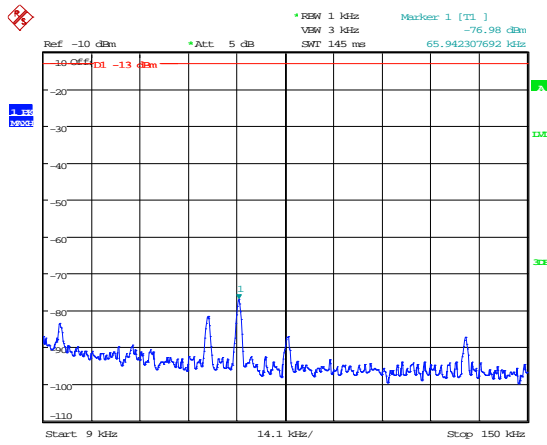
10GHz – 15GHz



Date: 18.SEP.2014 17:26:00

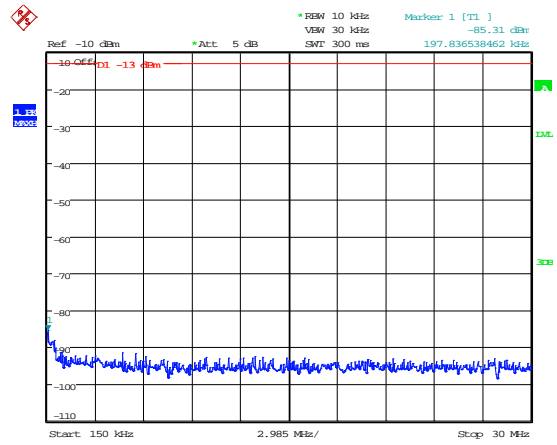
15GHz – 20GHz

Conducted spurious 1915MHz



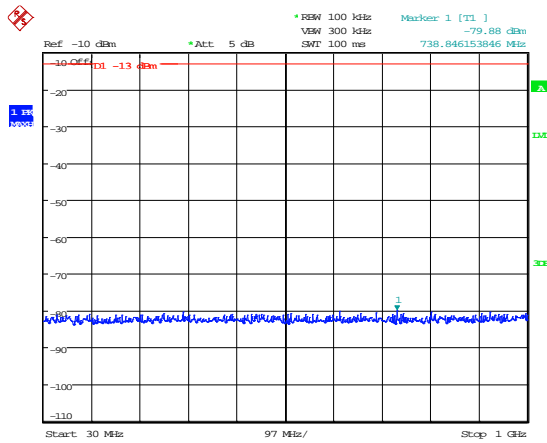
Date: 18.SEP.2014 17:23:41

9kHz – 150kHz



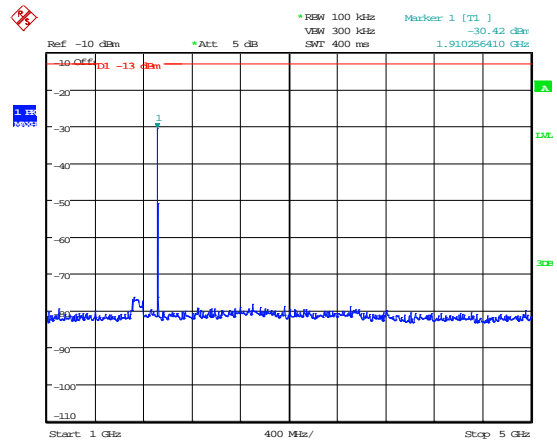
Date: 18.SEP.2014 17:23:54

150kHz – 30MHz



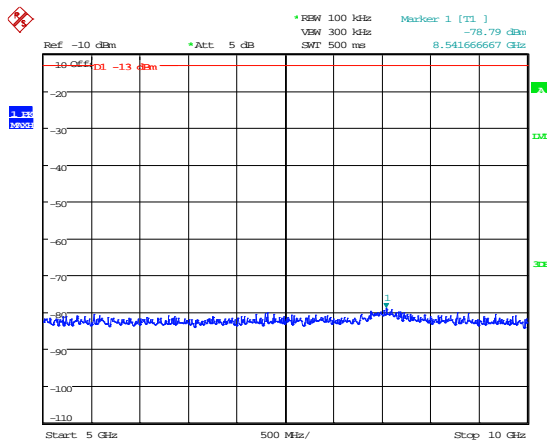
Date: 18.SEP.2014 17:24:07

30MHz – 1GHz



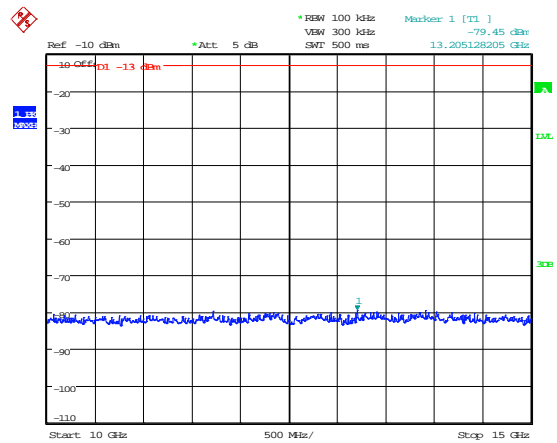
Date: 18.SEP.2014 17:24:27

1GHz – 5GHz



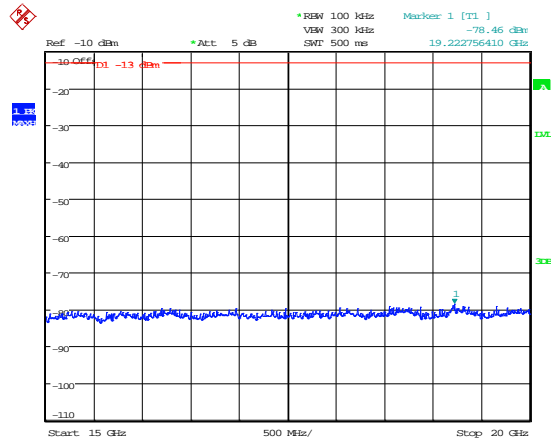
Date: 18.SEP.2014 17:23:03

5GHz – 10GHz



Date: 18.SEP.2014 17:23:15

10GHz – 15GHz



Date: 18.SEP.2014 17:23:29

15GHz – 20GHz

A6 Radiated Electric Field Emissions

Preliminary scans were performed using a peak detector with the RBW = 100kHz. The radiated electric field emission test applies to all spurious and harmonic emissions. The EUT was set to transmit as required.

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 :

The effect of the EUT set-up on the measurements is summarised in note (c) below.

| Test Details: | |
|------------------------|---|
| Measurement standard | Part 2.1053, 22.917(a), 24.238(a), 27.53(c) & (g) |
| Frequency range | 30 MHz – 22 GHz |
| EUT sample number | S01 & S02 |
| Modification state | 0 |
| SE in test environment | None |
| SE isolated from EUT | None |
| EUT set up | Refer to Appendix C |
| Photographs | Appendix F |

| Frequency (MHz) | Freq. of Emission (MHz) | ERP/EIRP (dBm) | Limit (dBm) |
|-----------------|---------------------------------|----------------|-------------|
| 1700 MHz | | | |
| 1710.000 | No Significant Emissions Within | | -13 |
| 1732.500 | | | -13 |
| 1755.000 | | | -13 |
| 1800MHz | | | |
| 1710.000 | No Significant Emissions Within | | -13 |
| 1732.500 | | | -13 |
| 1755.000 | | | -13 |

Result

The EUT was found to comply with the limits

Notes:

1. Emissions Checked up to 10 times Fc.
2. The unit was mounted on a turntable and rotated through 360⁰ and in 3 orthogonal planes to find the worst case emission.
3. 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 Detector RBW = 1MHz; VBW = ≥RBW

4. Limit is determined as the outermost step of the emissions mask and is calculated as follows.

At least 43 + 10 log P dB

$$(10\log P_{\text{watts}}) - (43+10\log (P_{\text{watts}} * 1000)) = \text{LIMIT} = -13 \text{ dBm}$$

The upper and lower frequency of the measurement range was decided according to 47 CFR Part 2.1057.

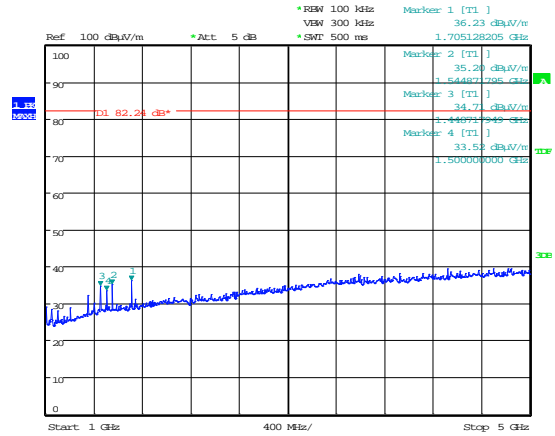
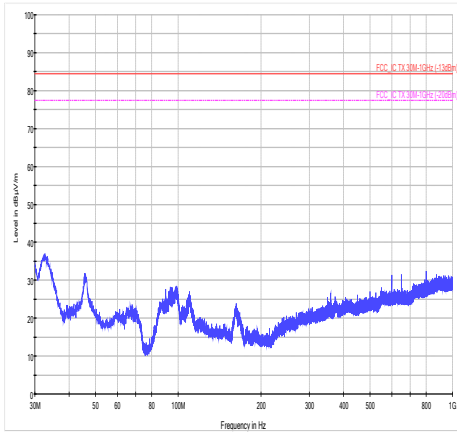
- (a) Where results have been measured at one distance, and a signal level displayed at another, the results have been extrapolated using the following formula:

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

- (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 :

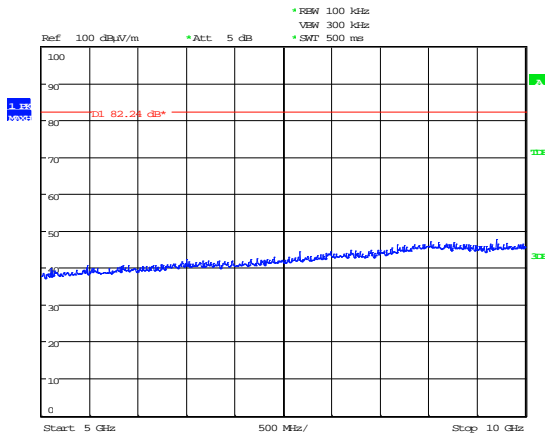
| | See (i) | See (ii) | See (iii) | See (iv) |
|---|---------|----------|-----------|----------|
| Effect of EUT operating mode on emission levels | ✓ | | | |
| Effect of EUT internal configuration on emission levels | ✓ | | | |
| Effect of Position of EUT cables & samples on emission levels | | | ✓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

1710 MHz



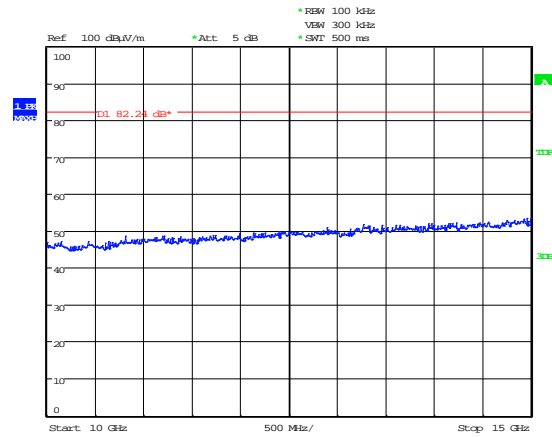
Date: 25.NOV.2014 16:17:29

30MHz – 1GHz



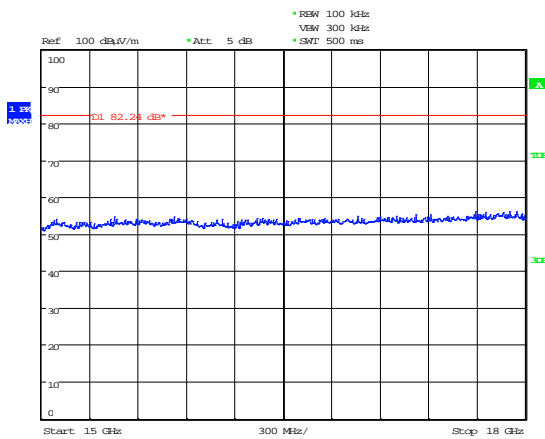
Date: 25.NOV.2014 16:06:46

1GHz – 5GHz



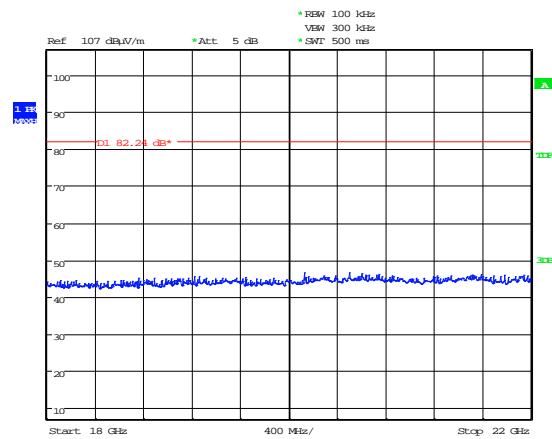
Date: 25.NOV.2014 16:13:14

5GHz – 10GHz



Date: 25.NOV.2014 16:14:48

10GHz – 15GHz

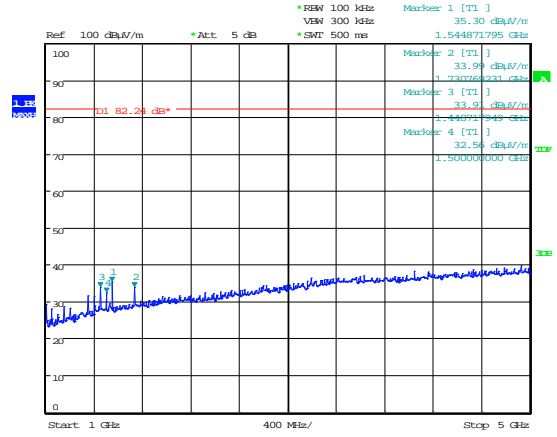
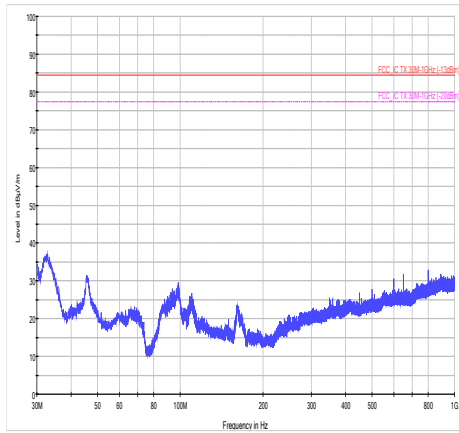


Date: 26.NOV.2014 15:38:11

15GHz – 18GHz

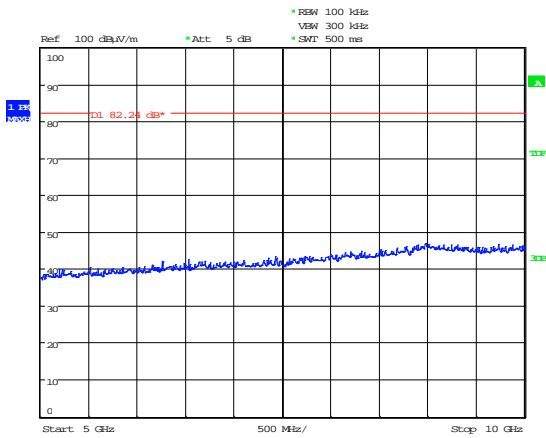
18GHz – 22GHz

1732.5 MHz



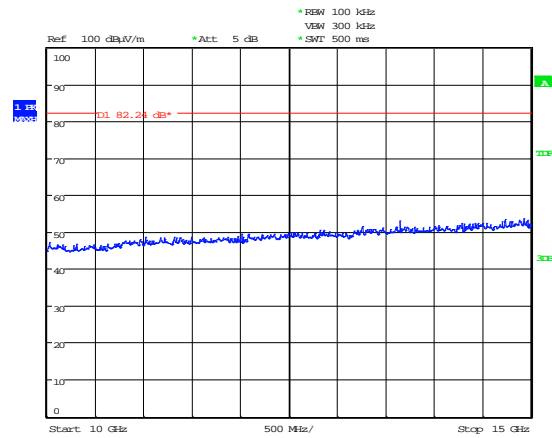
Date: 25.NOV.2014 16:40:40

30MHz – 1GHz



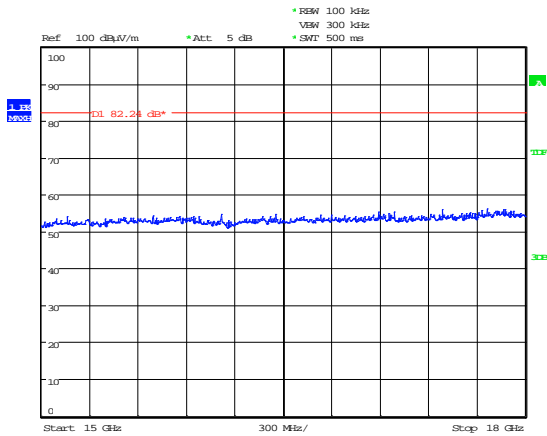
Date: 25.NOV.2014 16:34:42

1GHz – 5GHz



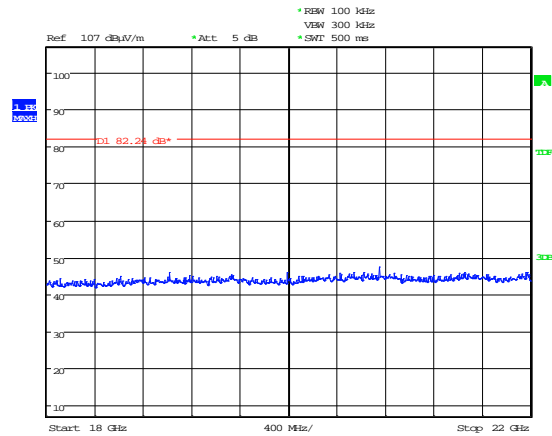
Date: 25.NOV.2014 16:36:29

5GHz – 10GHz



Date: 25.NOV.2014 16:38:40

10GHz – 15GHz

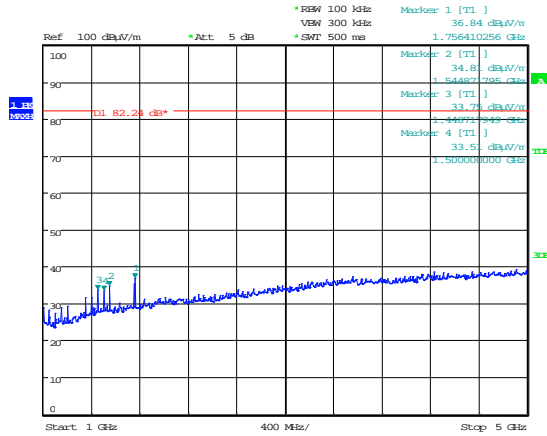
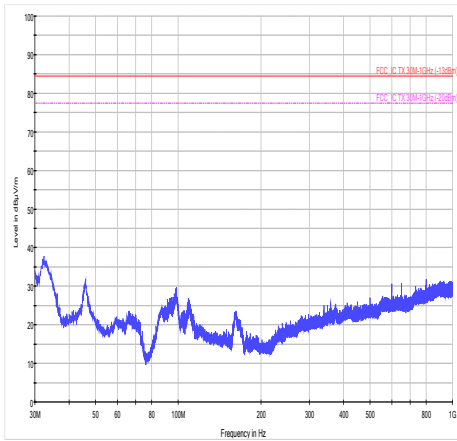


Date: 26.NOV.2014 15:40:01

15GHz – 18GHz

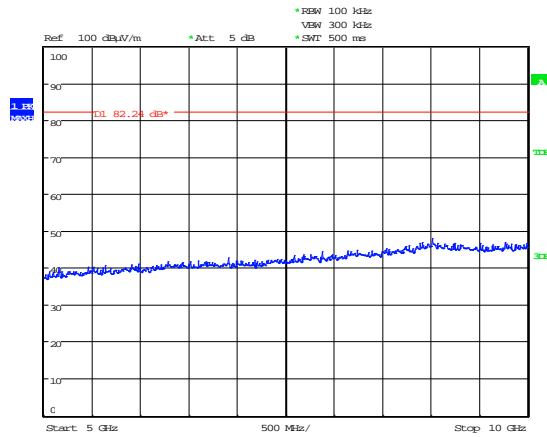
18GHz – 22GHz

1755 MHz



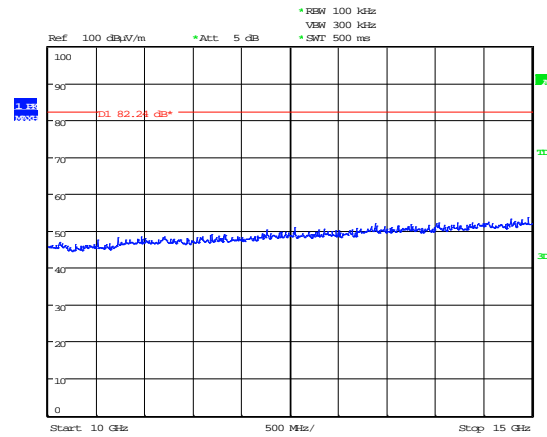
Date: 25.NOV.2014 17:12:11

30MHz – 1GHz



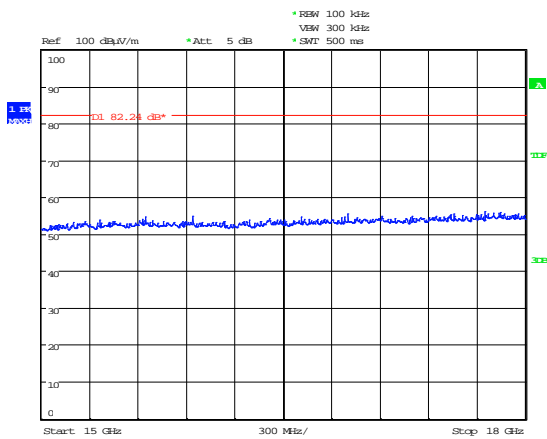
Date: 25.NOV.2014 17:06:15

1GHz – 5GHz



Date: 25.NOV.2014 17:08:01

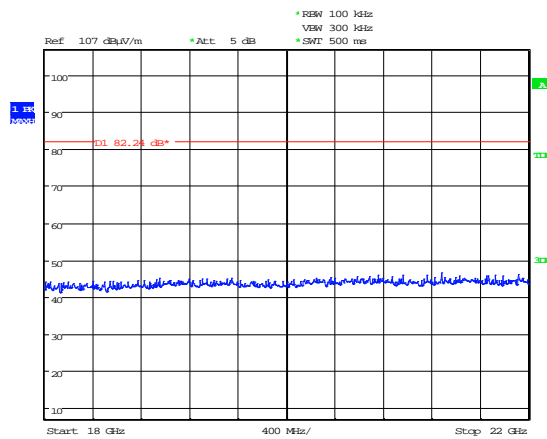
5GHz – 10GHz



Date: 25.NOV.2014 17:09:41

15GHz – 18GHz

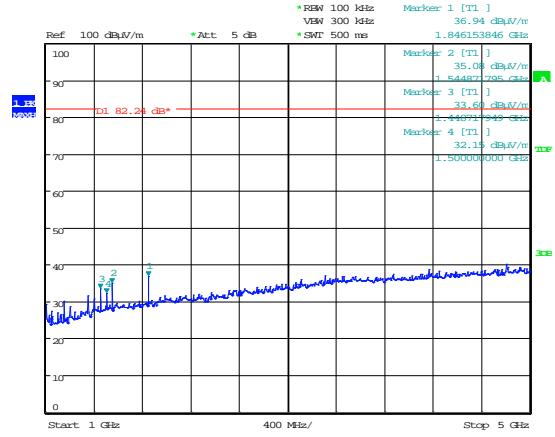
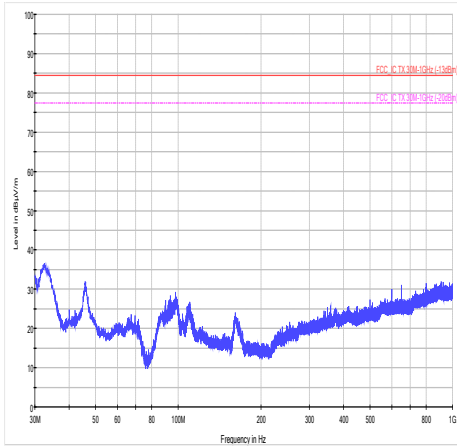
10GHz – 15GHz



Date: 26.NOV.2014 15:41:06

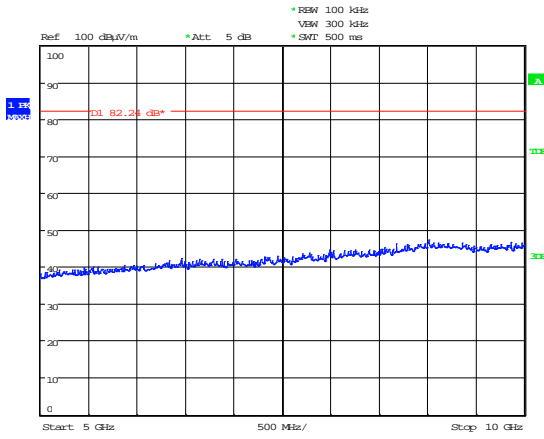
18GHz – 22GHz

1850 MHz



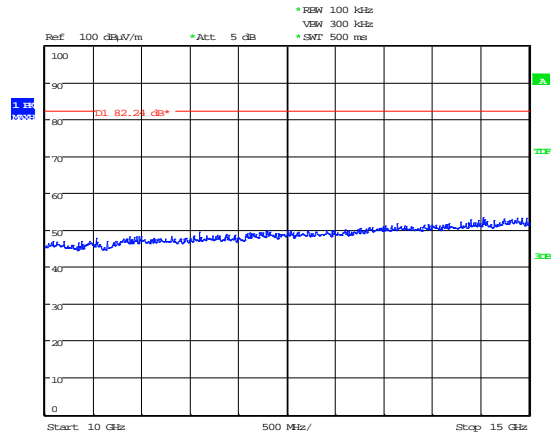
Date: 25.NOV.2014 17:35:01

30MHz – 1GHz



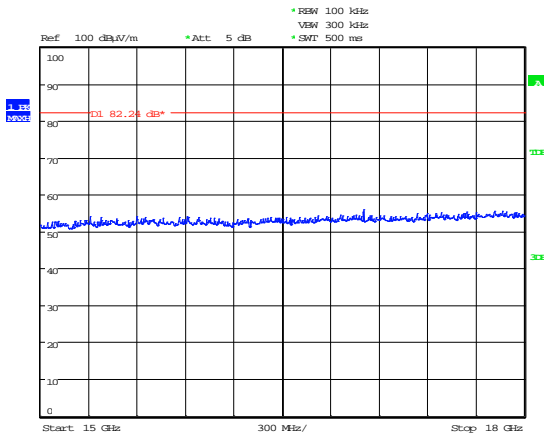
Date: 25.NOV.2014 17:29:22

1GHz – 5GHz



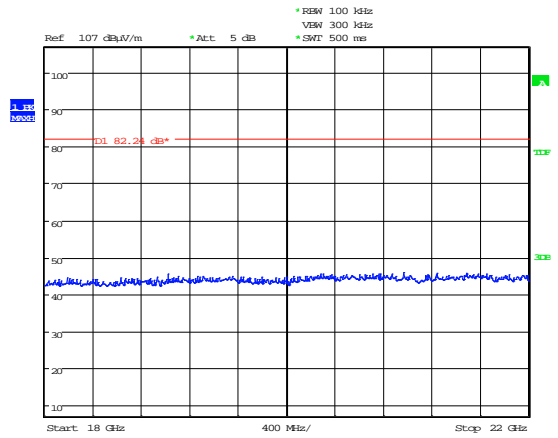
Date: 25.NOV.2014 17:31:05

5GHz – 10GHz



Date: 25.NOV.2014 17:32:17

10GHz – 15GHz

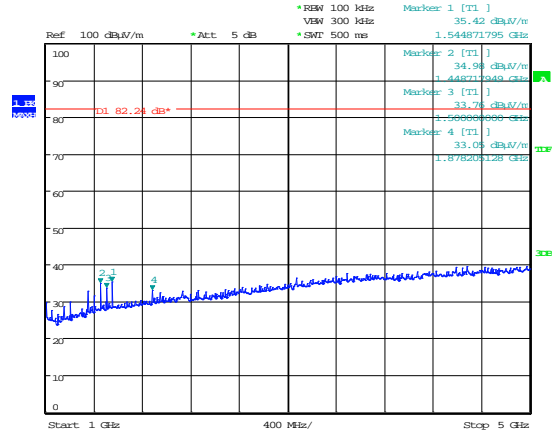
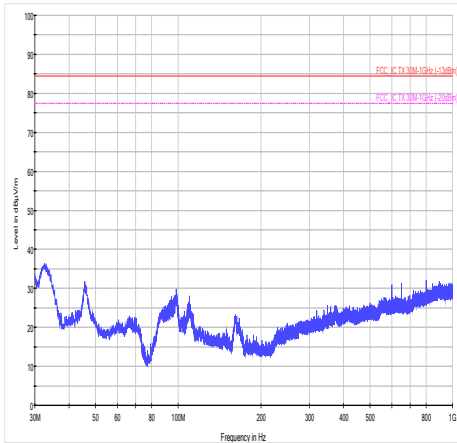


Date: 26.NOV.2014 15:43:42

15GHz – 18GHz

18GHz – 22GHz

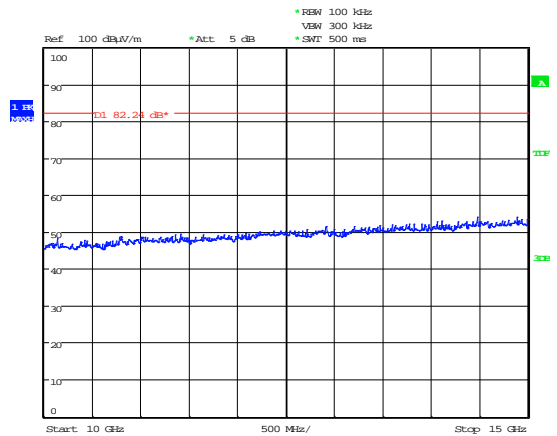
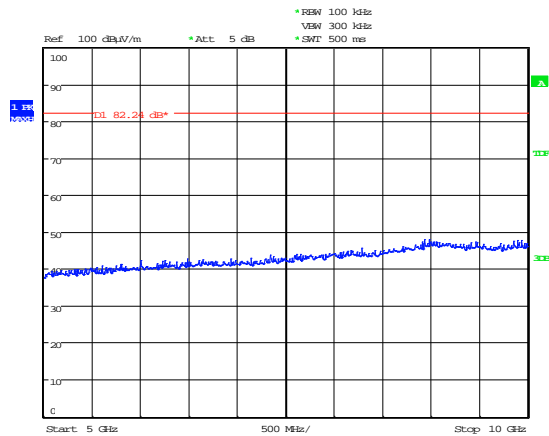
1882.5 MHz



Date: 26.NOV.2014 09:57:12

30MHz – 1GHz

1GHz – 5GHz

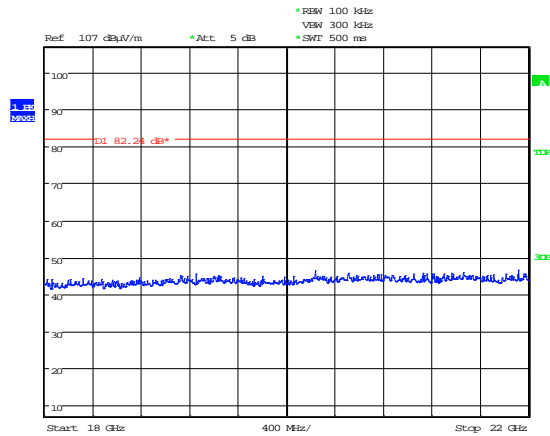
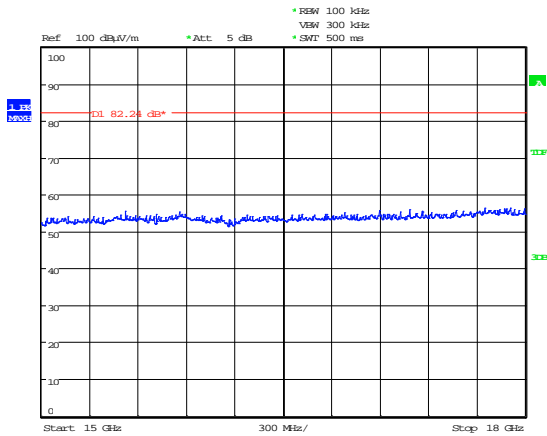


Date: 26.NOV.2014 09:51:28

Date: 26.NOV.2014 09:53:40

5GHz – 10GHz

10GHz – 15GHz



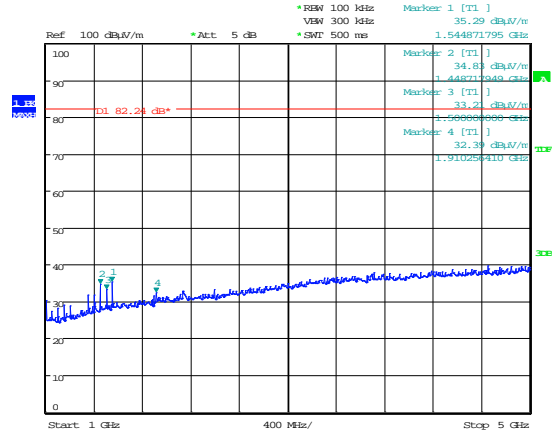
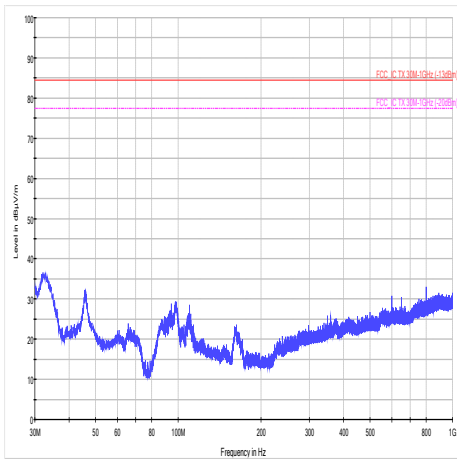
Date: 26.NOV.2014 09:54:42

Date: 26.NOV.2014 15:45:50

15GHz – 18GHz

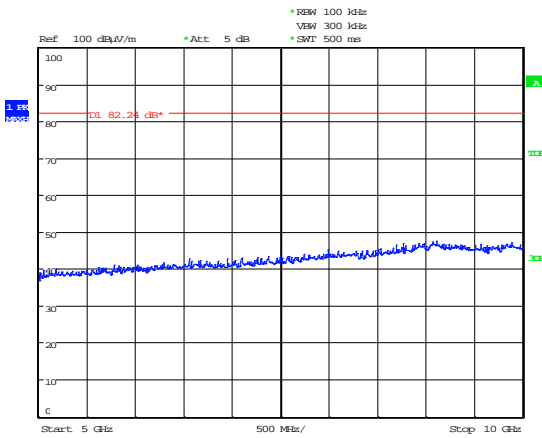
18GHz – 22GHz

1915 MHz



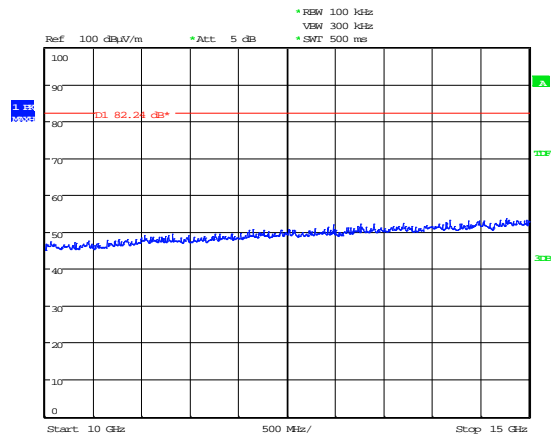
Date: 26.NOV.2014 10:31:53

30MHz – 1GHz



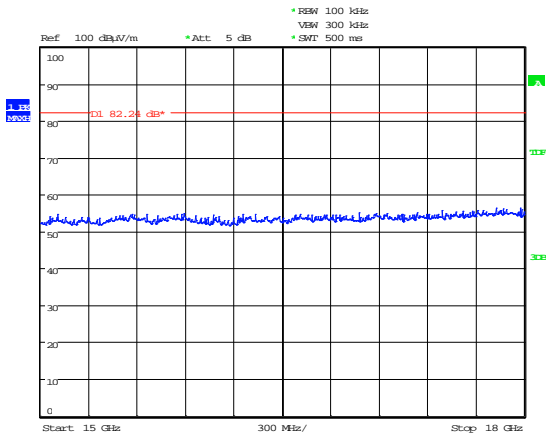
Date: 26.NOV.2014 10:26:19

1GHz – 5GHz



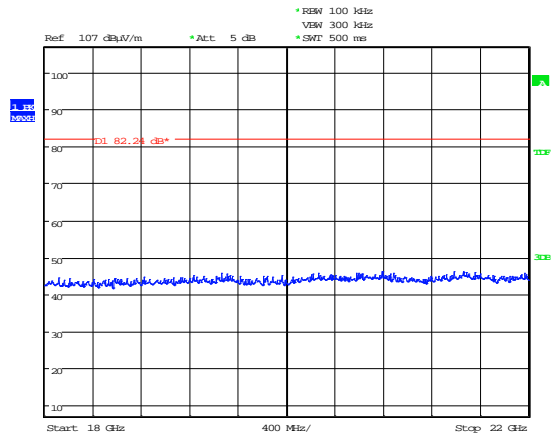
Date: 26.NOV.2014 10:27:23

5GHz – 10GHz



Date: 26.NOV.2014 10:28:31

10GHz – 15GHz



Date: 26.NOV.2014 15:46:27

15GHz – 18GHz

18GHz – 22GHz

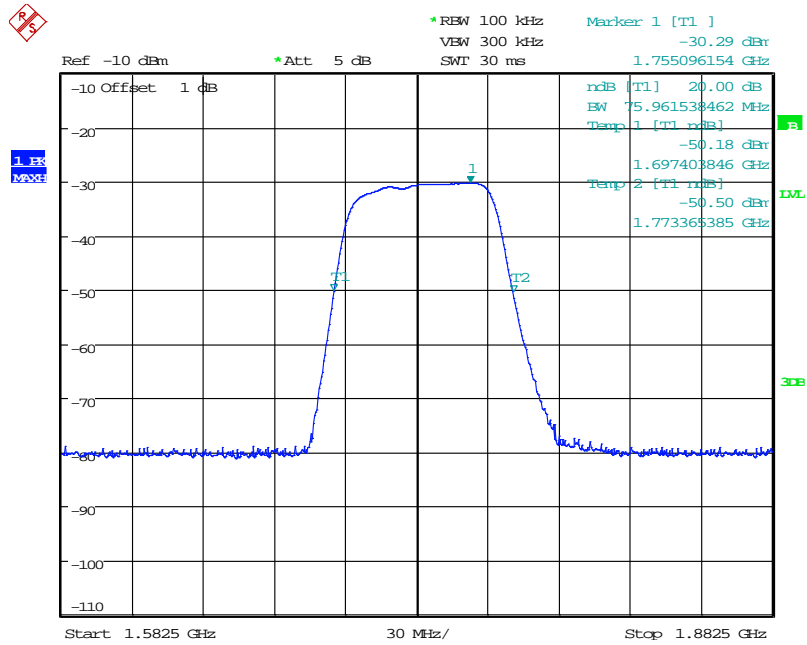
A7 Passband Gain & Bandwidth

| Test Details: | |
|------------------------|---|
| Measurement standard | D.3 Policies + Procedures (k) of KDB 935210 D02 Signal Boosters Certification v02 |
| EUT sample number | S01 & S02 |
| Modification state | 0 |
| SE in test environment | None |
| SE isolated from EUT | None |
| EUT set up | Refer to Appendix C |

| BAND | Frequency MHz | fl | fh | 20 dB Bandwidth |
|----------------|-----------------|-------------|-------------|-----------------|
| 1700 MHz (AWS) | 1710 - 1755 MHz | 1.697403MHz | 1.773365MHz | 75.961MHz |
| 1900 MHz (PCS) | 1850 – 1910 MHz | 1.837788MHz | 1.918557MHz | 80.769MHz |

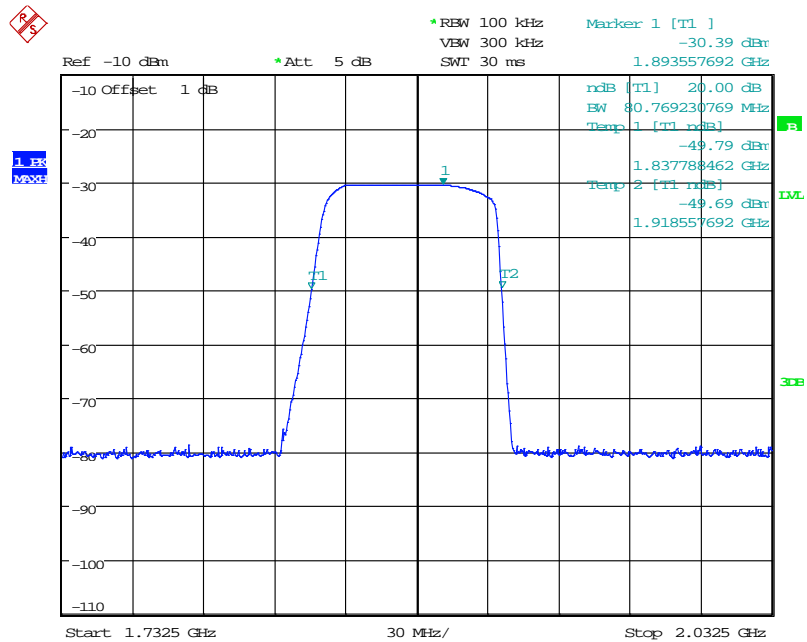
See below for plots showing passband gain & bandwidth

With the aid of a CW Swept signal generator and spectrum analyser, the bandwidth and frequency response of the open channel (i.e. at the point where the gain has fallen by 20 dB) is measured. This measurement shows the gain-versus-frequency response of the open channel from the midband frequency f_0 of the channel up to at least $f_0 + 250\%$ of the 20 dB bandwidth.



Date: 19.SEP.2014 12:02:08

1700 MHz



Date: 19.SEP.2014 11:55:20

1800MHz

Appendix B:**Downlink Formal Emission Test Results**

Abbreviations used in the tables in this appendix:

| | | | |
|------|---------------------------------|------|--------------------------------|
| Spec | : Specification | ALSR | : Absorber Lined Screened Room |
| Mod | : Modification | OATS | : Open Area Test Site |
| EUT | : Equipment Under Test | ATS | : Alternative Test Site |
| SE | : Support Equipment | Ref | : Reference |
| L | : Live Power Line | Freq | : Frequency |
| N | : Neutral Power Line | MD | : Measurement Distance |
| E | : Earth Power Line | SD | : Spec Distance |
| Pk | : Peak Detector | Pol | : Polarisation |
| QP | : Quasi-Peak Detector | H | : Horizontal Polarisation |
| Av | : Average Detector | V | : Vertical Polarisation |
| CDN | : Coupling & decoupling network | | |

B1 RF Gain and Output Power

| Test Details: | |
|------------------------|---|
| Measurement standard | Part 2.1046,22.913(a), 24.232(a), 27.50(a), |
| EUT sample number | S01 & S02 |
| Modification state | 0 |
| SE in test environment | None |
| SE isolated from EUT | None |
| Temperature | 22°C |
| Humidity | 47% |
| EUT set up | Refer to Appendix C |

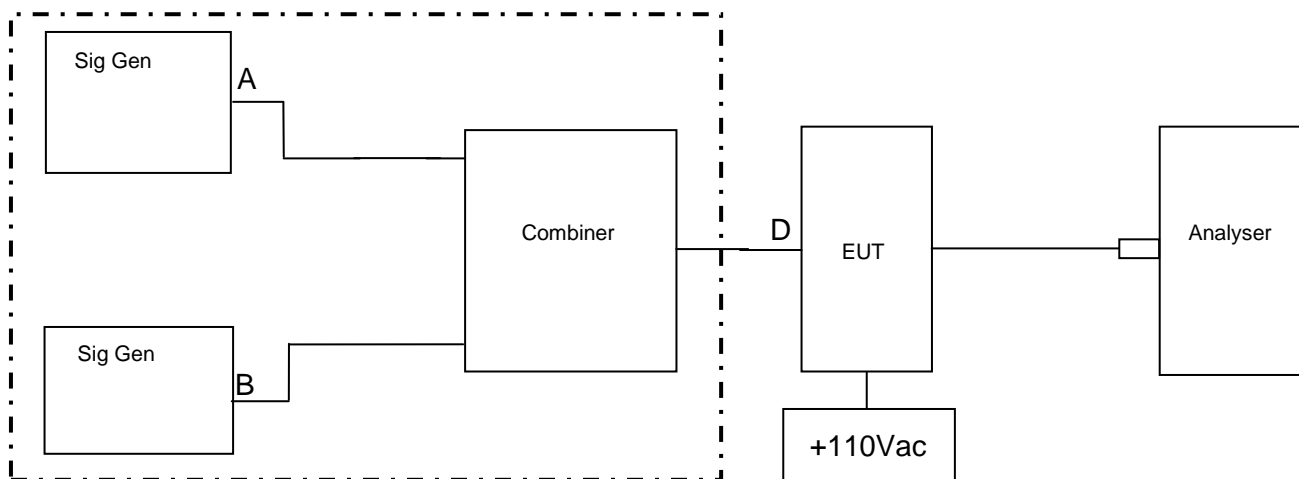
| Frequency (MHz) | Signal Generator input level (dBm) | Input Cable Loss (dB) | Input Level (dBm) | Level at Spectrum Analyser (dBm) | Output Cable & Attenuator loss (dB) | Gain (dB) | Conducted Output Power (dBm) | Gain after 10dB input level increase (dB) |
|-----------------|------------------------------------|-----------------------|-------------------|----------------------------------|-------------------------------------|-----------|------------------------------|---|
| 1900MHz | | | | | | | | |
| 1930.000000 | 10.00 | 0.58 | 9.42 | -8.83 | 50.52 | 32.27 | 41.69 | 22.27 |
| 1960.000000 | 7.08 | 0.58 | 6.50 | -8.16 | 50.67 | 36.01 | 42.51 | 26.00 |
| 1990.000000 | 8.68 | 0.59 | 8.09 | -8.43 | 50.55 | 34.03 | 42.12 | 24.03 |
| 2100 MHz | | | | | | | | |
| 2110.000000 | 8.72 | 0.57 | 8.15 | -7.99 | 50.56 | 34.42 | 42.57 | 24.43 |
| 2132.500000 | 6.36 | 0.70 | 5.66 | -8.15 | 50.59 | 36.78 | 42.44 | 26.82 |
| 2155.000000 | 7.72 | 0.61 | 7.11 | -8.54 | 50.73 | 35.08 | 42.19 | 25.09 |

Notes:

1. The signal generator input was increased by 10dBs and the level of the output signal re measured.
2. As per Annex .3 Policies + Procedures (k) of KDB 935210 D02 Signal Boosters Certification v02 the EUT was tested at compression and 10dB into compression to show AGC operation

B2 Amplifier Intermodulation Spurious Emissions

| Test Details: | |
|------------------------|---|
| Measurement standard | Part 2.1053, 22.917(a), 24.238(a), 27.53(c) & (g) |
| EUT sample number | S01 & S02 |
| Modification state | 0 |
| SE in test environment | None |
| SE isolated from EUT | None |
| EUT set up | Refer to Appendix C |



| 2 Signals at | Frequency (MHz) | Level (dBm) | Limit (dBm) |
|--------------------|-----------------|-------------|-------------|
| 1900 MHz | | | |
| Middle of the band | 1959.09 | -20.58 | -13 |
| 2100 MHz | | | |
| Top end of band | 2111.497 | -18.55 | -13 |

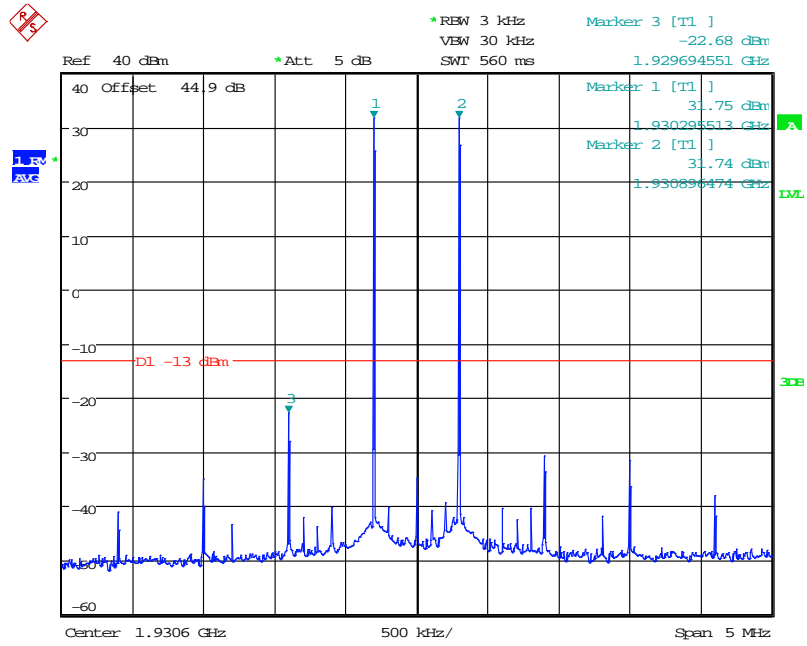
Sweep data is shown on the next page:

Results

The EUT was found to comply with the limits

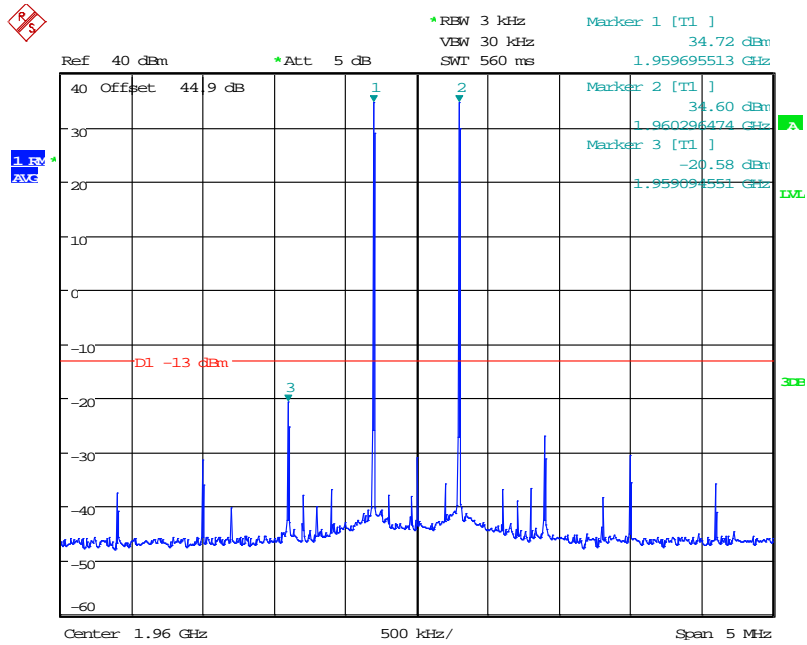
See plots below

1900 MHz Intermodulation close View



Date: 18.SEP.2014 15:27:18

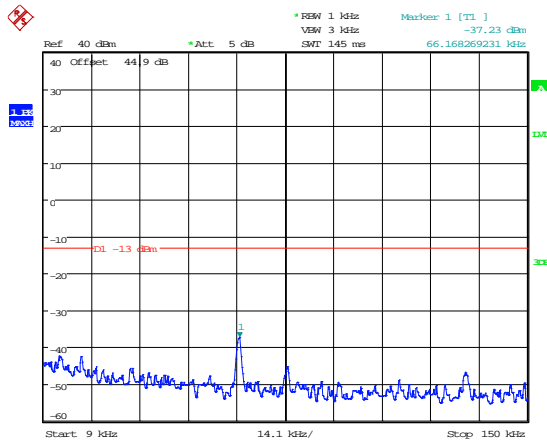
2 Signals at bottom end of band



Date: 18.SEP.2014 15:27:58

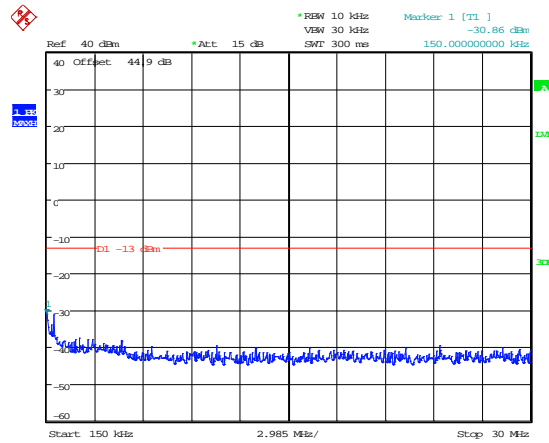
2 Signals at middle of the band

1900 MHz Intermodulation



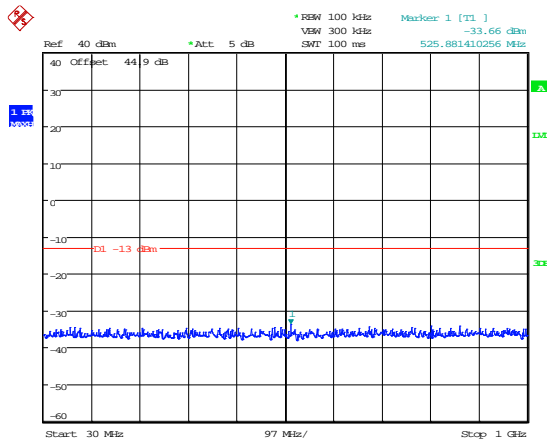
Date: 18.SEP.2014 15:47:50

9 – 150kHz



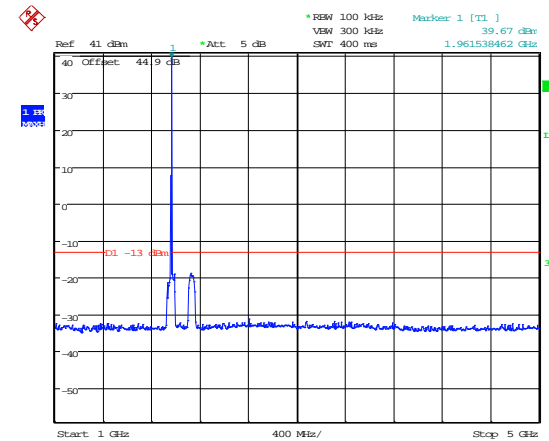
Date: 18.SEP.2014 15:48:08

150kHz – 30MHz



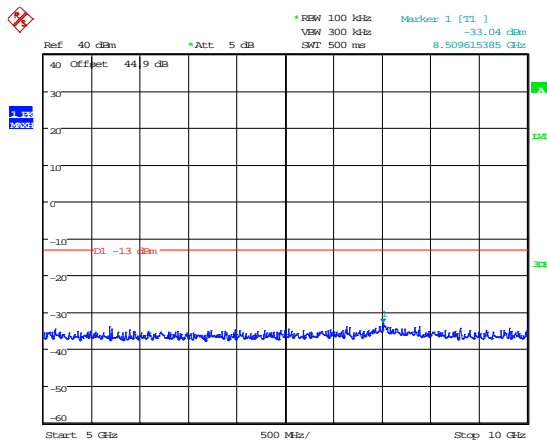
Date: 18.SEP.2014 15:48:27

30MHz – 1GHz



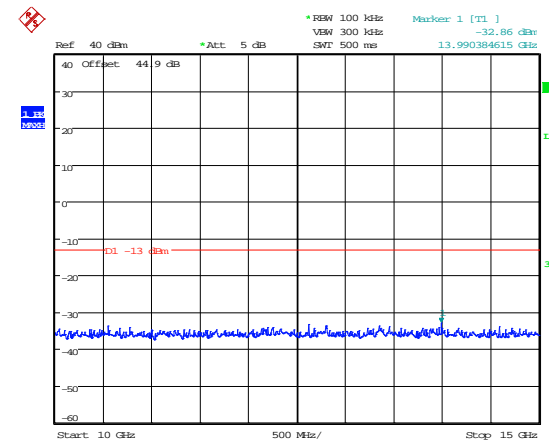
Date: 18.SEP.2014 15:46:52

1GHz – 5GHz



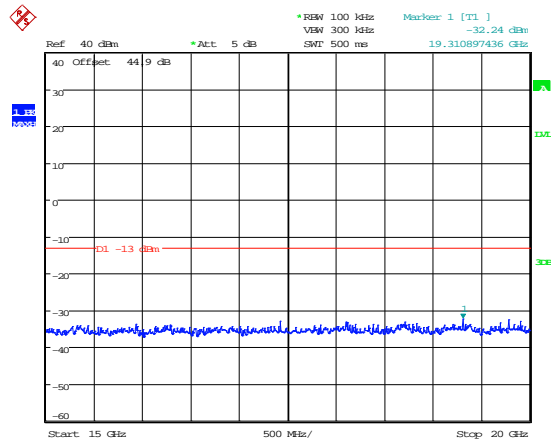
Date: 18.SEP.2014 15:47:09

5GHz – 10GHz



Date: 18.SEP.2014 15:47:22

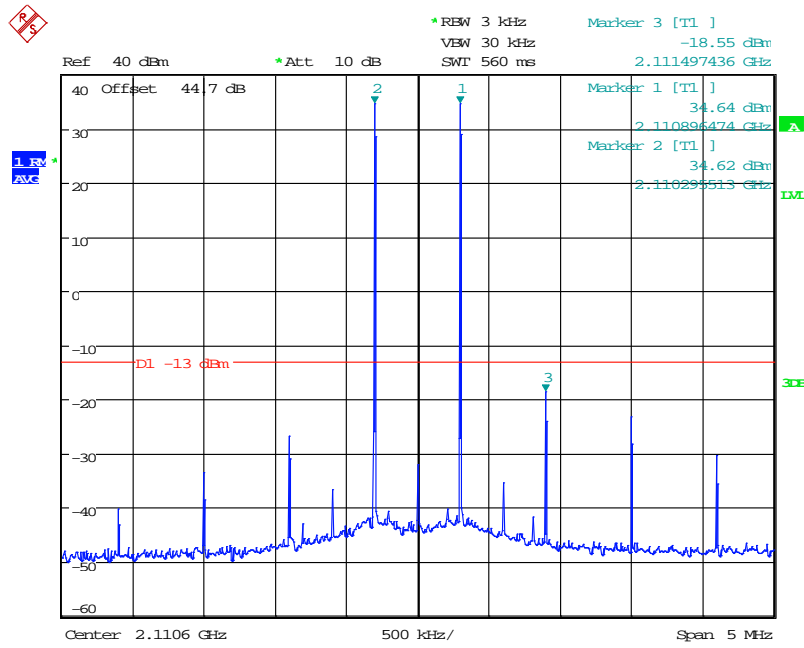
10GHz – 15GHz



Date: 18.SEP.2014 15:47:37

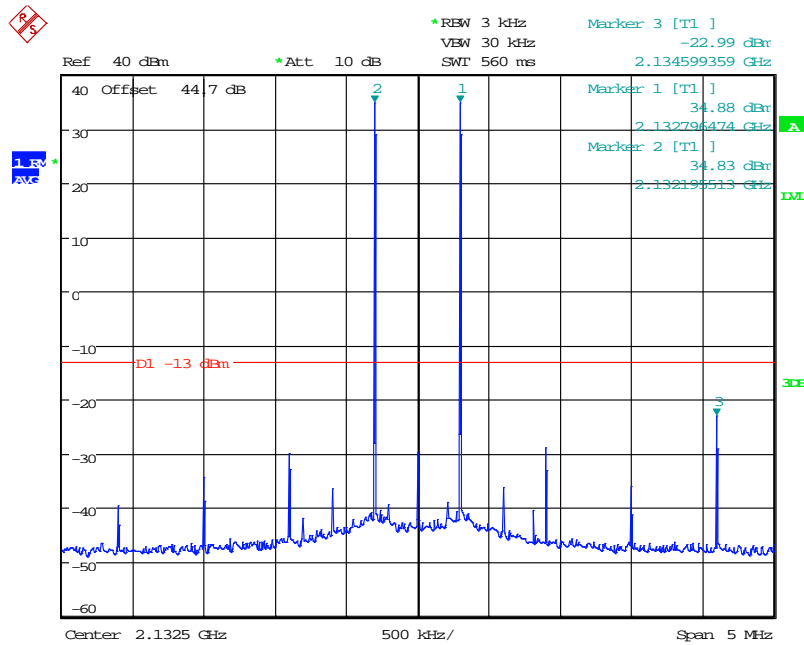
15GHz – 20GHz

2100 MHz Intermodulation close View



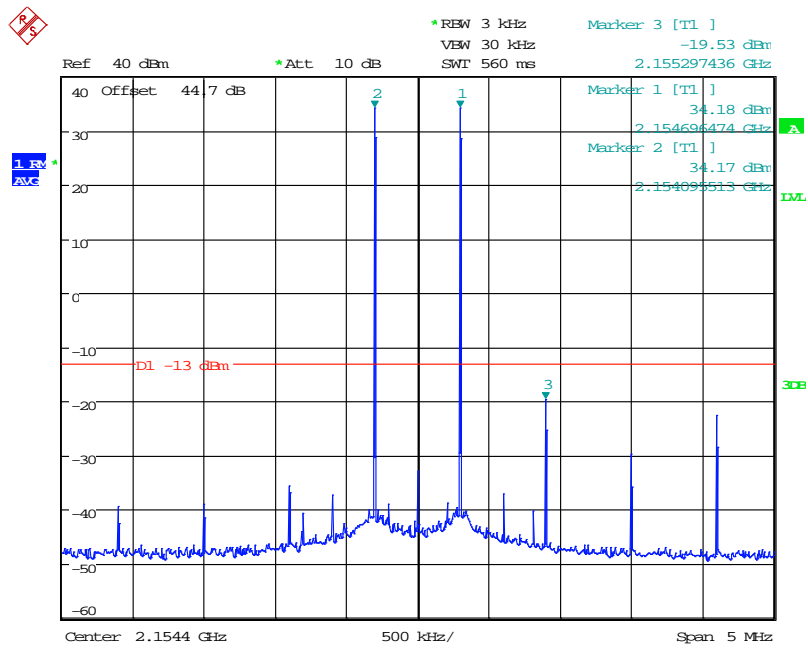
Date: 18.SEP.2014 14:52:40

2 Signals at bottom end of band



Date: 18.SEP.2014 15:12:58

2 Signals at middle end of band

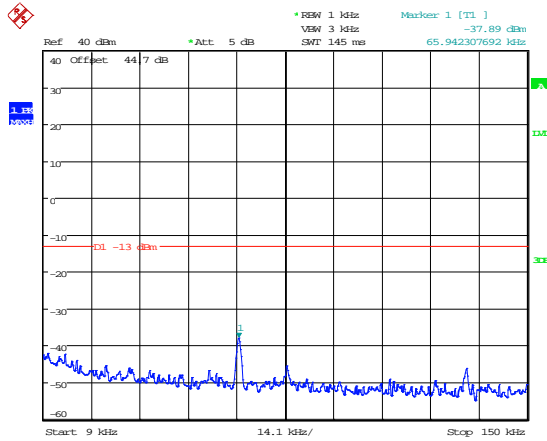


Date: 18.SEP.2014 15:10:41

2 Signals at top end of band

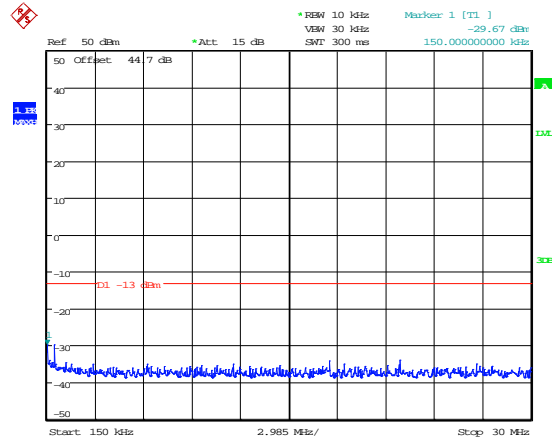
2100 MHz Intermodulation

9 – 150kHz



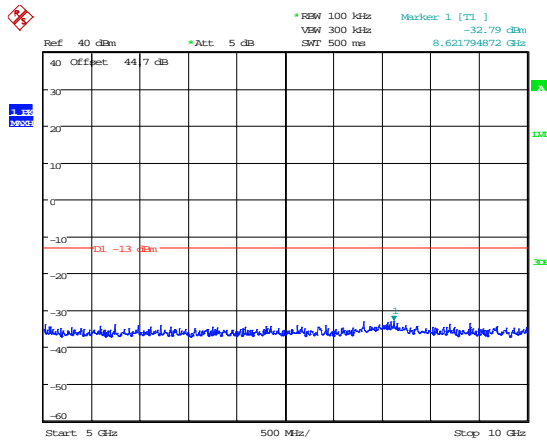
Date: 18.SEP.2014 15:16:06

150kHz – 30MHz



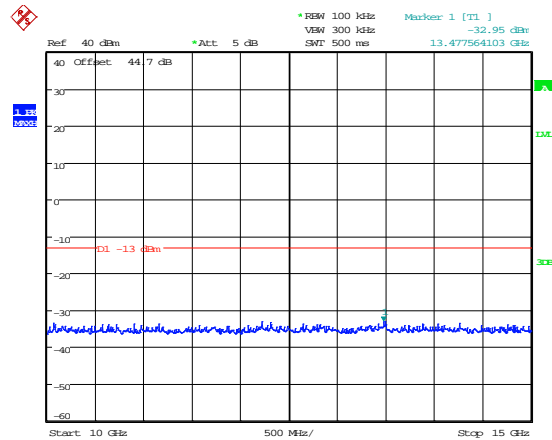
Date: 18.SEP.2014 15:17:16

30MHz – 1GHz



Date: 18.SEP.2014 15:14:50

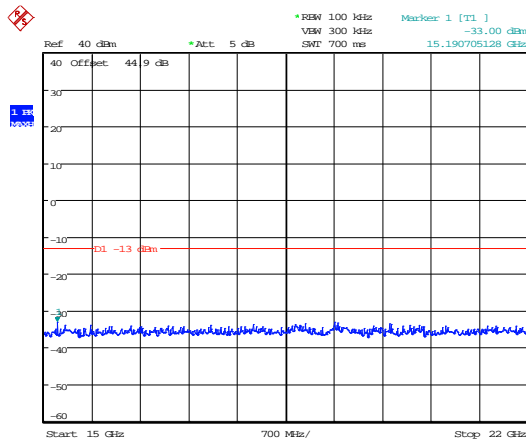
1GHz – 5GHz



Date: 18.SEP.2014 15:15:27

5GHz – 10GHz

10GHz – 15GHz



Date: 18.SEP.2014 15:49:28

15GHz - 22GHz

B3 Amplifier Modulated Channel Test

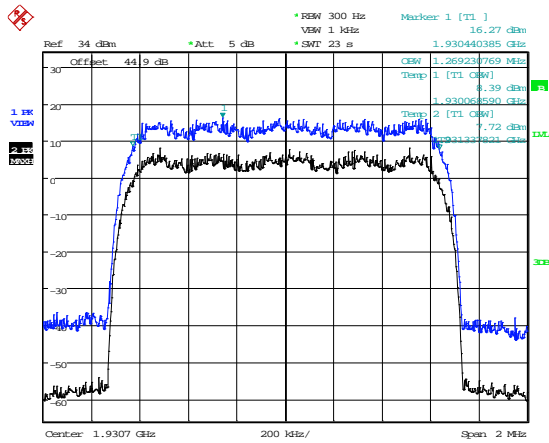
| Test Details: | |
|------------------------|---|
| Measurement standard | D.3 Policies + Procedures (j) of KDB 935210 D02 Signal Boosters Certification v02 |
| EUT sample number | S01 & S02 |
| Modification state | 0 |
| SE in test environment | None |
| SE isolated from EUT | None |
| EUT set up | Refer to Appendix C |

| Frequency Of Operation Channel | Modulation Type | | | | | |
|--------------------------------|-----------------|------------|------------|----------|-------------|--------------|
| | CDMA | GSM | GSM EDGE | WCDMA | LTE 1.4 MHz | LTE 20.0 MHz |
| 1930.000 | 1.269MHz | 246.794kHz | 245.192kHz | 4.182MHz | 1.086MHz | 17.839MHz |
| 1960.000 | 1.269MHz | 245.192kHz | 246.794kHz | 4.173MHz | 1.086MHz | 17.910MHz |
| 1990.000 | 1.272MHz | 245.192kHz | 246.794kHz | 4.163MHz | 1.086MHz | 17.875MHz |
| 2110.000 | N/A | N/A | N/A | 4.192MHz | 1.086MHz | 17.875MHz |
| 2132.500 | N/A | N/A | N/A | 4.173MHz | 1.086MHz | 17.875MHz |
| 2155.000 | N/A | N/A | N/A | 4.163MHz | 1.086MHz | 17.910MHz |

Waveforms applied to selected bands as requested.

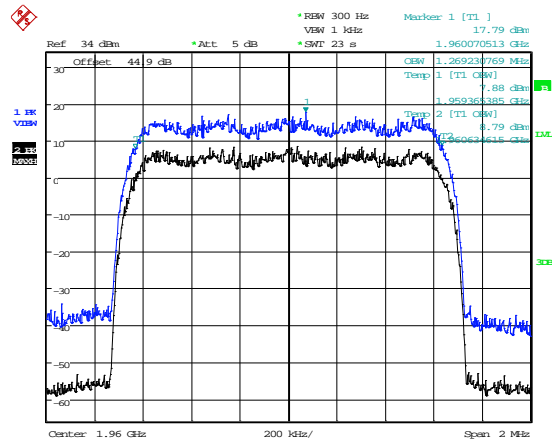
As per Annex .3 Policies + Procedures (k) of KDB 935210 D02 Signal Boosters Certification v02 the EUT was tested at compression and 10dB into compression to show AGC operation, worst case results taken.

CDMA Modulation



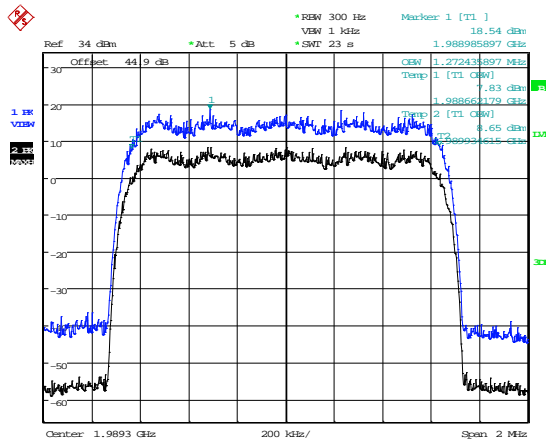
Date: 23.SEP.2014 09:37:52

1930.0 MHz



Date: 23.SEP.2014 10:22:13

1960.0 MHz

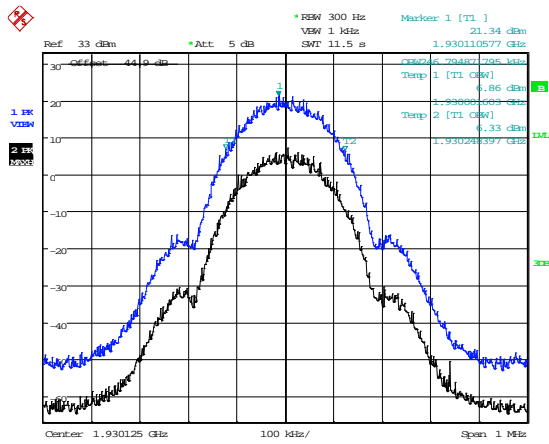


Date: 23.SEP.2014 10:34:20

1990.0 MHz

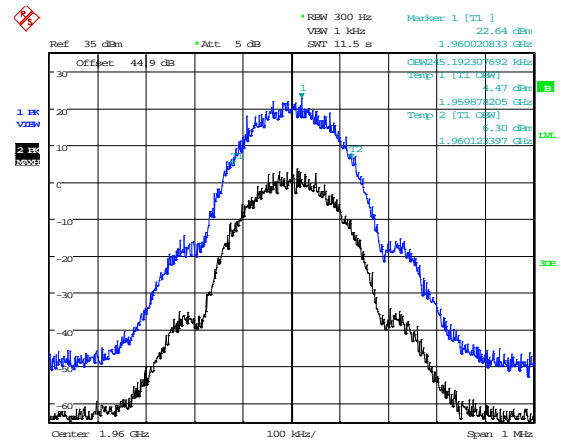
The above plots depicting the output waveshape show no measurable distortion visible when compared to the input signal.

GSM Modulation



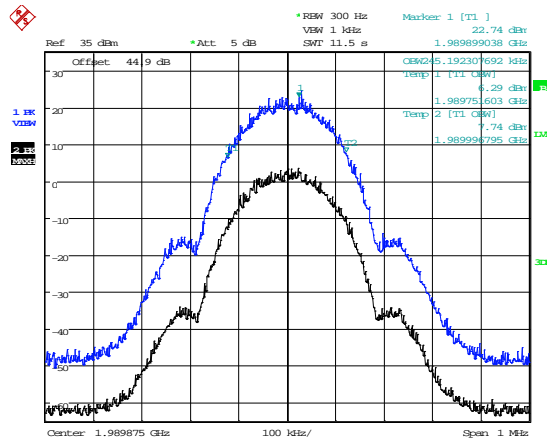
Date: 23.SEP.2014 17:04:38

1930.0 MHz



Date: 24.SEP.2014 09:35:07

1960.0MHz

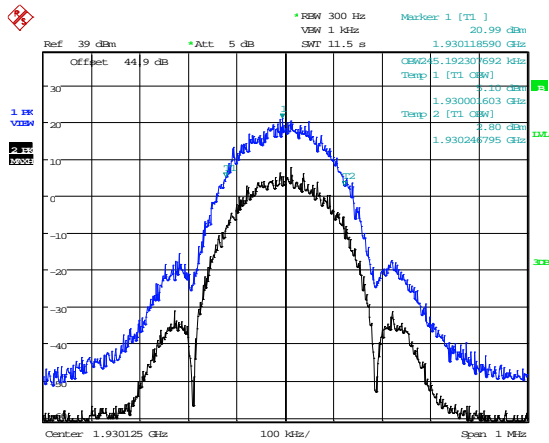


Date: 23.SEP.2014 17:29:00

1990.0 MHz

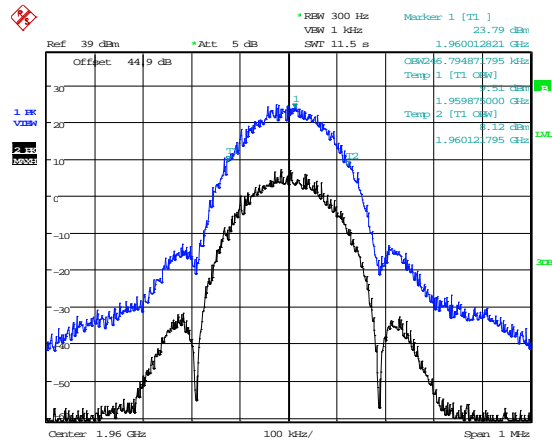
The above plots depicting the output waveshape show no measurable distortion visible when compared to the input signal.

GSM Edge Modulation



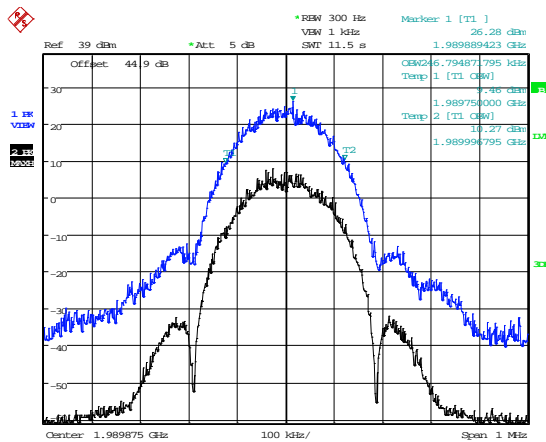
Date: 26.SEP.2014 10:10:16

1930.0 MHz



Date: 26.SEP.2014 10:02:59

1960.0 MHz

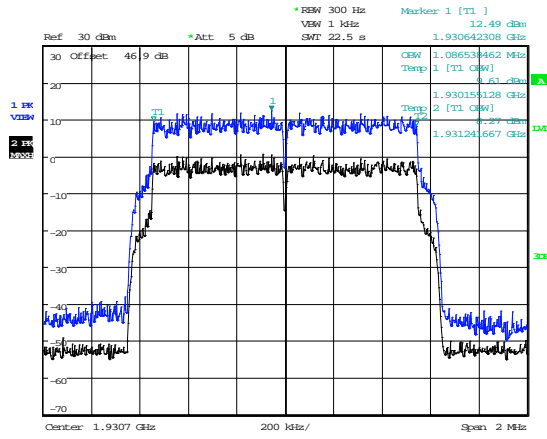


Date: 26.SEP.2014 10:14:31

1990.0 MHz

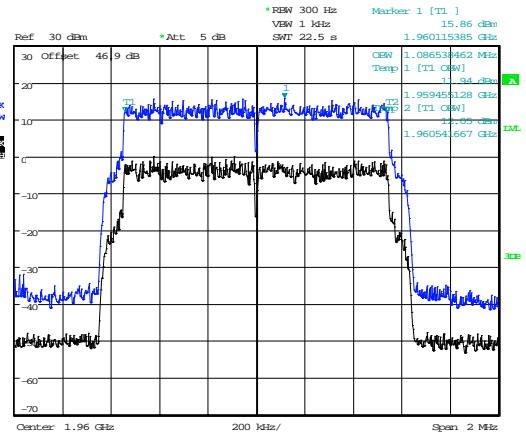
The above plots depicting the output waveshape show no measurable distortion visible when compared to the input signal.

1.4 MHz LTE Modulation



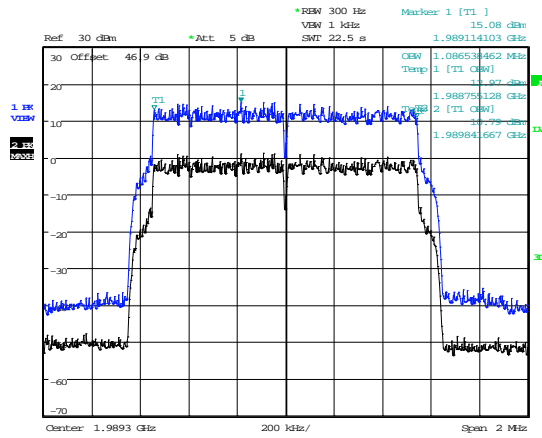
Date: 3.DEC.2014 11:47:45

1930.0 MHz



Date: 3.DEC.2014 11:44:33

1960.0 MHz

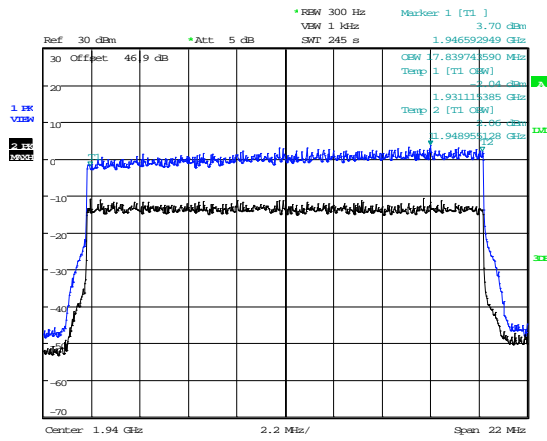


Date: 3.DEC.2014 11:41:59

1990.0 MHz

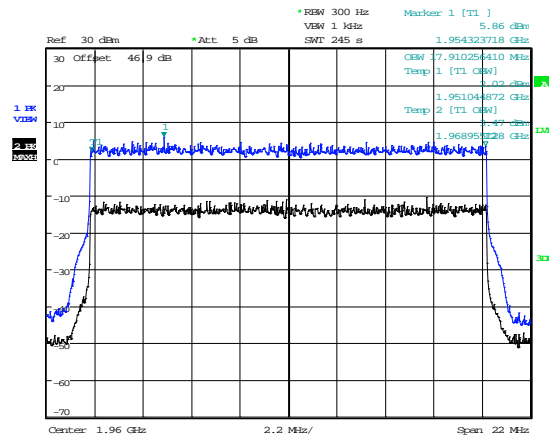
The above plots depicting the output wavelshape show no measurable distortion visible when compared to the input signal.

20.0 MHz LTE Modulation



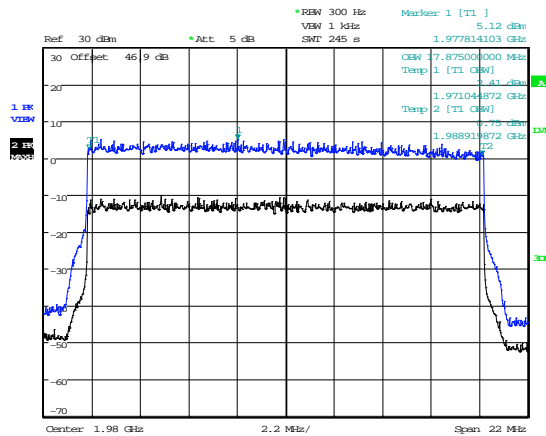
Date: 3.DEC.2014 11:11:07

1930.0 MHz



Date: 3.DEC.2014 10:54:56

1960.0 MHz

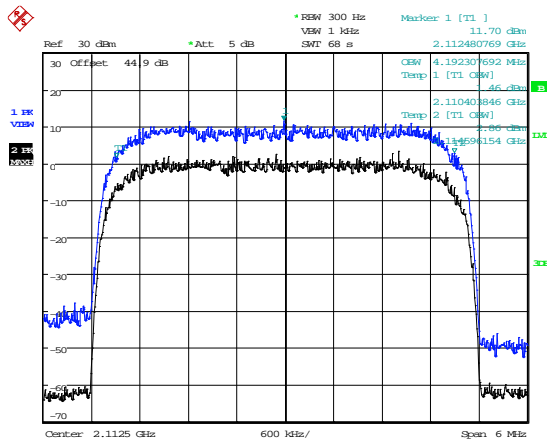


Date: 3.DEC.2014 11:29:51

1990.0 MHz

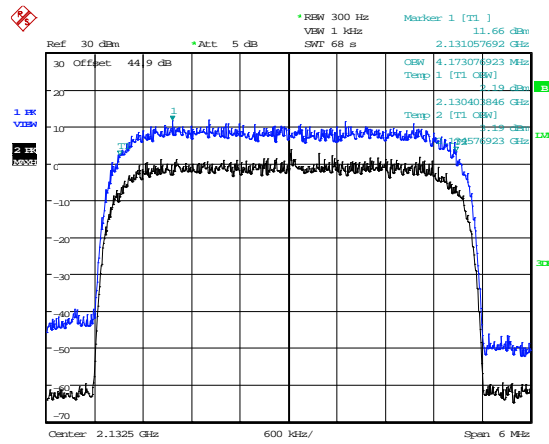
The above plots depicting the output waveshape show no measurable distortion visible when compared to the input signal.

WCDMA Modulation



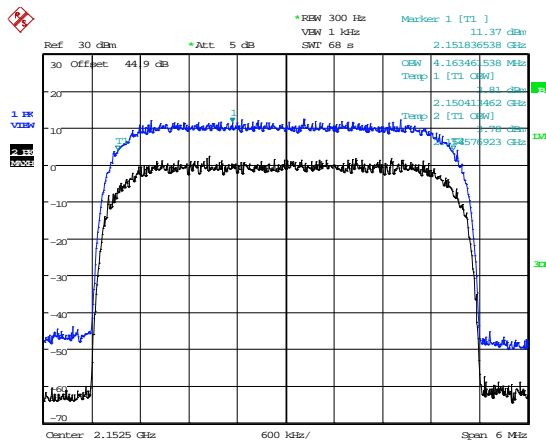
Date: 23.SEP.2014 16:18:58

2110 MHz



Date: 23.SEP.2014 16:24:52

2132.5MHz

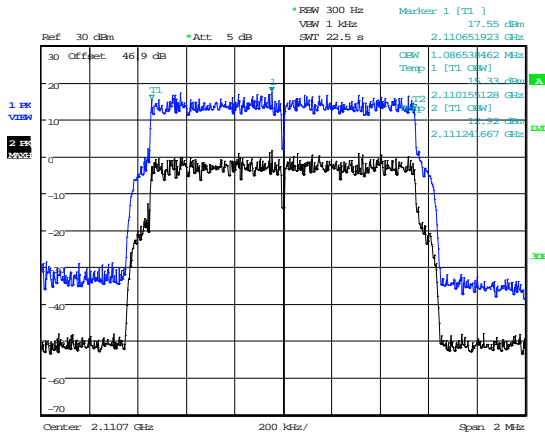


Date: 23.SEP.2014 16:48:35

2155 MHz

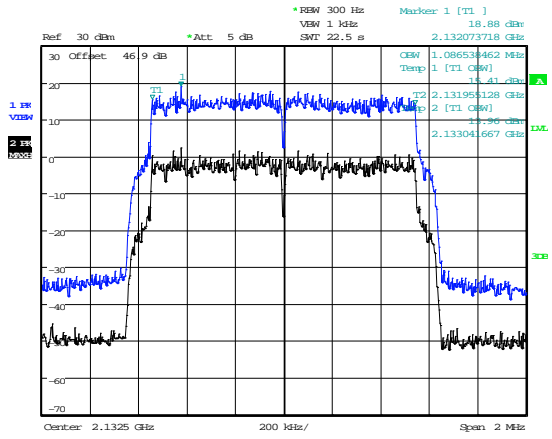
The above plots depicting the output wavelshape show no measurable distortion visible when compared to the input signal.

1.4 MHz LTE Modulation



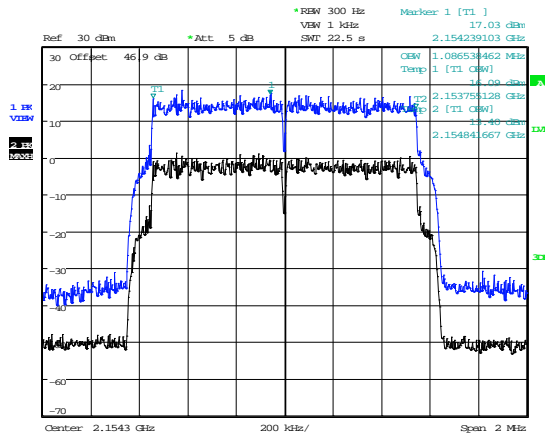
Date: 3.DEC.2014 09:45:23

2110 MHz



Date: 3.DEC.2014 09:42:16

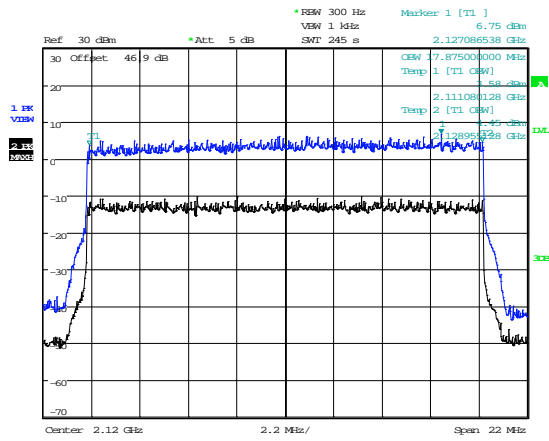
2132.5MHz



Date: 3.DEC.2014 09:39:26

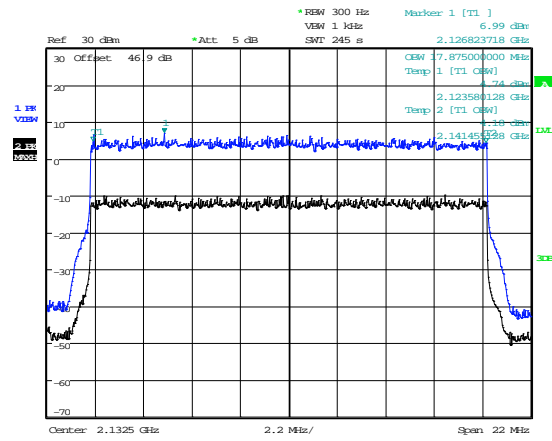
2155MHz

20 MHz LTE Modulation



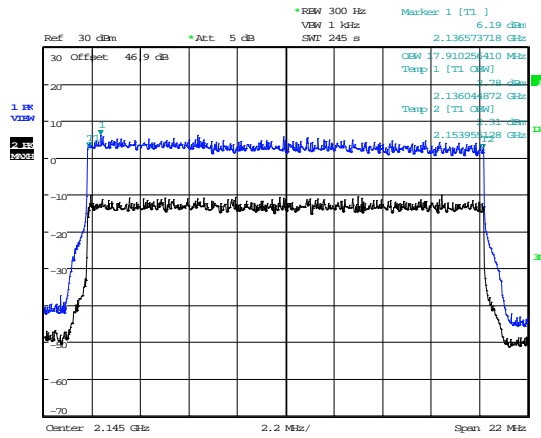
Date: 3.DEC.2014 10:05:10

2110 MHz



Date: 3.DEC.2014 10:29:44

2132.5MHz



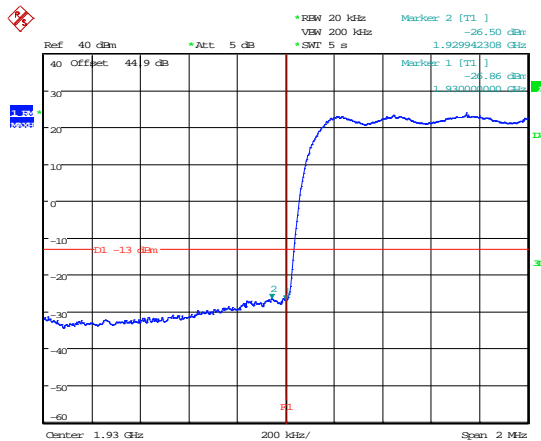
Date: 3.DEC.2014 10:39:37

2155MHz

B4 Spurious Emissions at Antenna Terminals Less than 1MHz

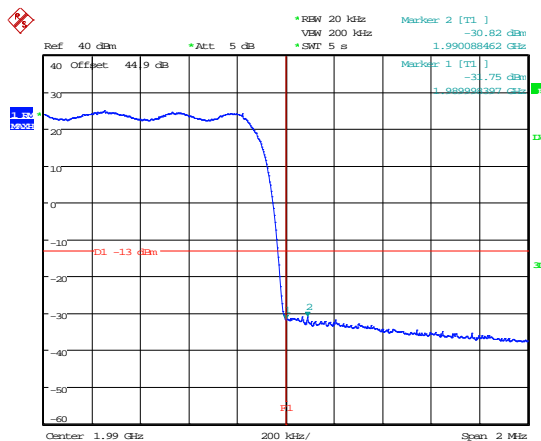
| Test Details: | |
|------------------------|---|
| Measurement standard | Part 2.1053, 24.238(a), 27.53(c) & (g), |
| EUT sample number | S01 & S02 |
| Modification state | 0 |
| SE in test environment | None |
| SE isolated from EUT | None |
| EUT set up | Refer to Appendix C |

| Modulation Type | Bandedge | Carrier Centre Frequency (MHz) | Max Level @ upto 1MHz from Bandedge (dBm) |
|-----------------|----------------|--------------------------------|---|
| CDMA | 1900 MHz Lower | 1930.75 | -26.50 |
| | 1900 MHz Upper | 1989.25 | -30.82 |



Date: 19.SEP.2014 10:18:31

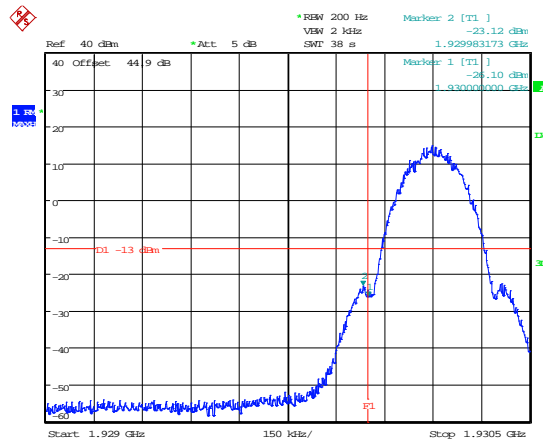
Lower bandedge



Date: 19.SEP.2014 10:20:48

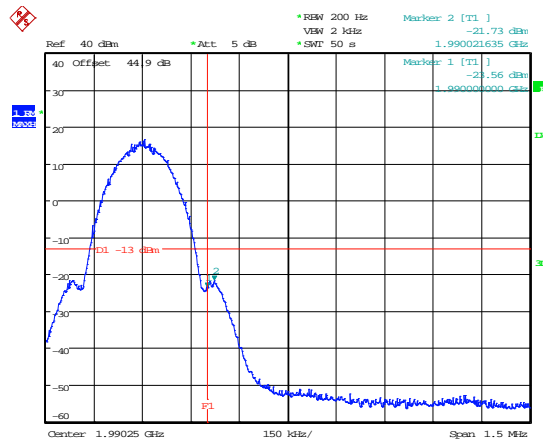
Upper Bandedge

| Modulation Type | Bandedge | Carrier Centre Frequency (MHz) | Max Level @ upto 1MHz from Bandedge (dBm) |
|-----------------|----------------|--------------------------------|---|
| GSM | 1900 MHz Lower | 1930.20 | -23.12 |
| | 1900 MHz Upper | 1989.80 | -21.73 |



Date: 19.SEP.2014 10:00:14

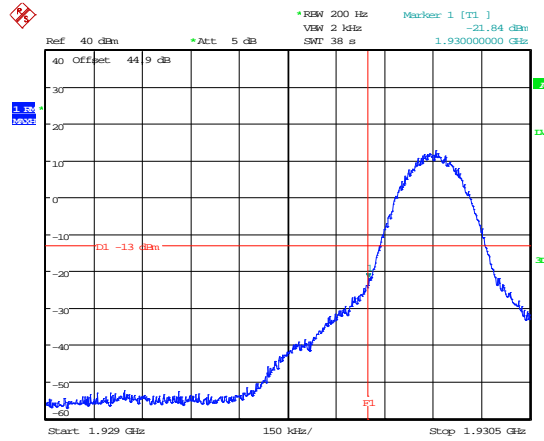
Lower Bandedge



Date: 19.SEP.2014 09:56:17

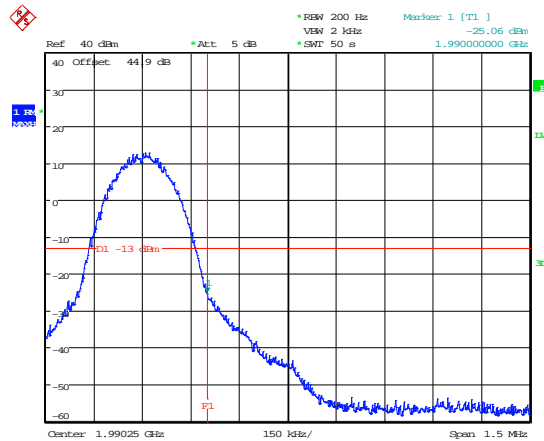
Upper Bandedge

| Modulation Type | Bandedge | Carrier Centre Frequency (MHz) | Max Level @ upto 1MHz from Bandedge (dBm) |
|-----------------|----------------|--------------------------------|---|
| GSM EDGE | 1900 MHz Lower | 1930.20 | -21.84 |
| | 1900 MHz Upper | 1989.80 | -25.06 |



Date: 19.SEP.2014 10:03:43

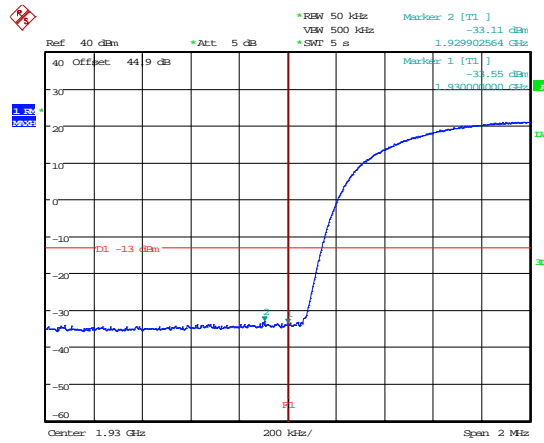
Lower Bandedge



Date: 19.SEP.2014 10:05:57

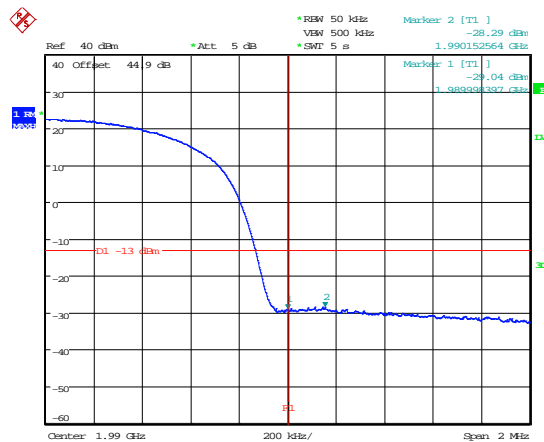
Upper Bandedge

| Modulation Type | Bandedge | Carrier Centre Frequency (MHz) | Max Level @ upto 1MHz from Bandedge (dBm) |
|-----------------|----------------|--------------------------------|---|
| WCDMA | 1900 MHz Lower | 1932.5 | -33.11 |
| | 1900 MHz Upper | 1987.5 | -28.29 |



Date: 19.SEP.2014 10:46:46

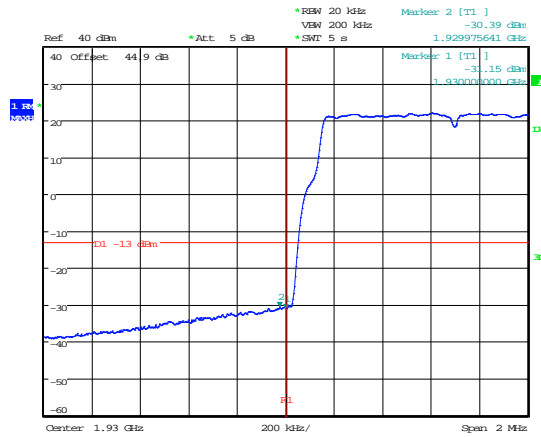
Lower Bandedge



Date: 19.SEP.2014 10:39:39

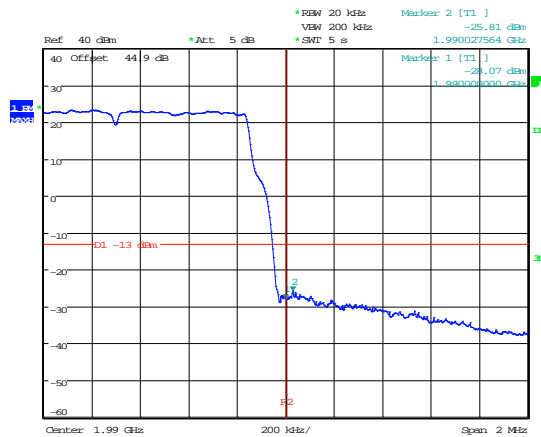
Upper Bandedge

| Modulation Type | Bandedge | Carrier Centre Frequency (MHz) | Max Level @ upto 1MHz from Bandedge (dBm) |
|-----------------|----------------|--------------------------------|---|
| LTE 1.4 MHz | 1900 MHz Lower | 1930.7 | -30.39 |
| | 1900 MHz Upper | 1989.30 | -25.81 |



Date: 2.DEC.2014 17:10:26

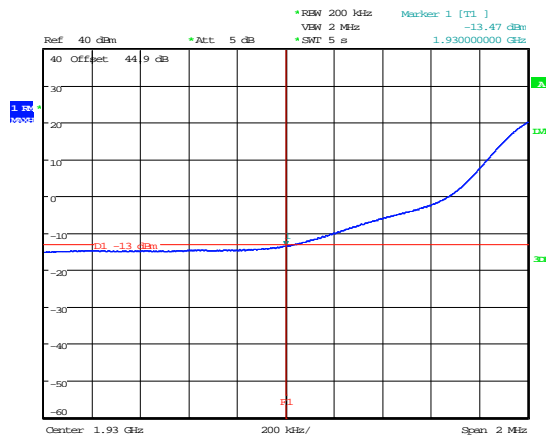
Lower Bandedge



Date: 2.DEC.2014 17:14:34

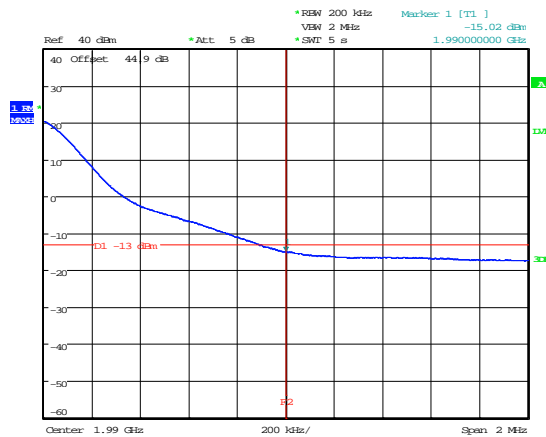
Upper bandedge

| Modulation Type | Bandedge | Carrier Centre Frequency (MHz) | Max Level @ upto 1MHz from Bandedge (dBm) |
|-----------------|----------------|--------------------------------|---|
| LTE 20.0 MHz | 1900 MHz Lower | 1940.0 | -13.47 |
| | 1900 MHz Upper | 1985.0 | -15.02 |



Date: 2.DEC.2014 17:11:39

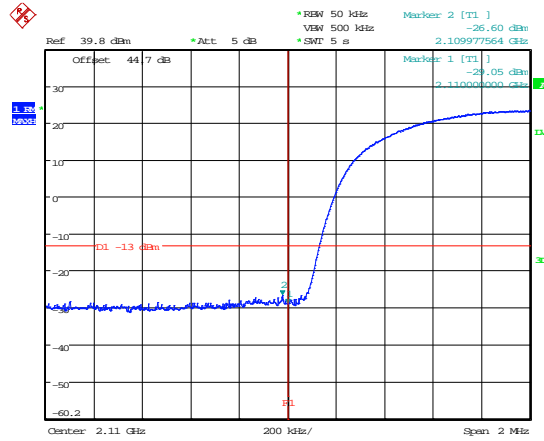
Lower Bandedge



Date: 2.DEC.2014 17:13:33

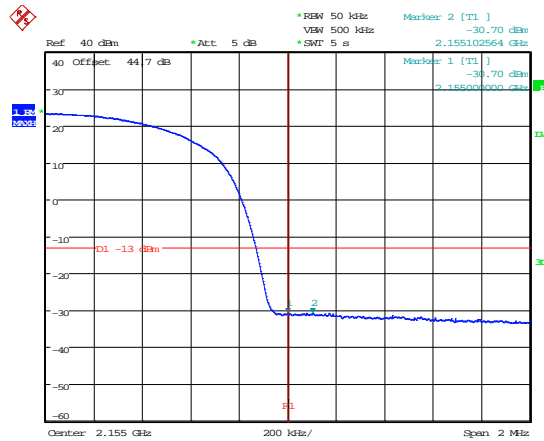
Upper Bandedge

| Modulation Type | Bandedge | Carrier Centre Frequency (MHz) | Max Level @ upto 1MHz from Bandedge (dBm) |
|-----------------|----------------|--------------------------------|---|
| WCDMA | 2100 MHz Lower | 2112.50 | -26.60 |
| | 2100 MHz Upper | 2152.50 | -30.70 |



Date: 19.SEP.2014 10:48:31

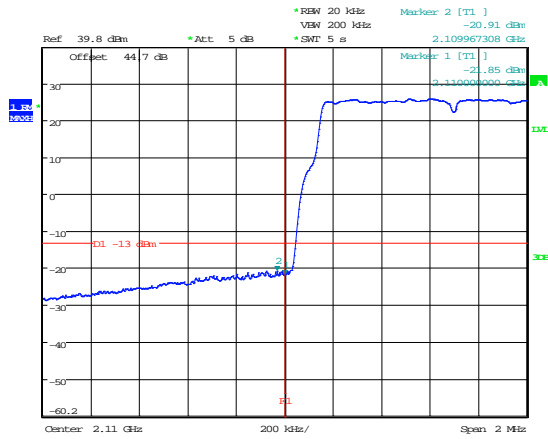
Lower Bandedge



Date: 19.SEP.2014 10:43:35

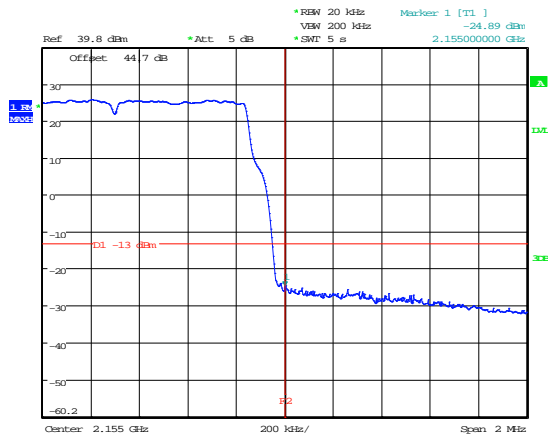
Upper Bandedge

| Modulation Type | Bandedge | Carrier Centre Frequency (MHz) | Max Level @ upto 1MHz from Bandedge (dBm) |
|-----------------|----------------|--------------------------------|---|
| 1.4MHz LTE | 2100 MHz Lower | 2110.70 | -20.91 |
| | 2100 MHz Upper | 2154.30 | -24.89 |



Date: 2.DEC.2014 17:16:54

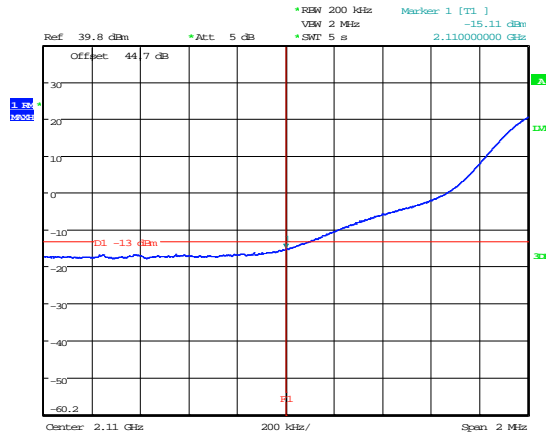
Lower Bandedge



Date: 2.DEC.2014 17:25:29

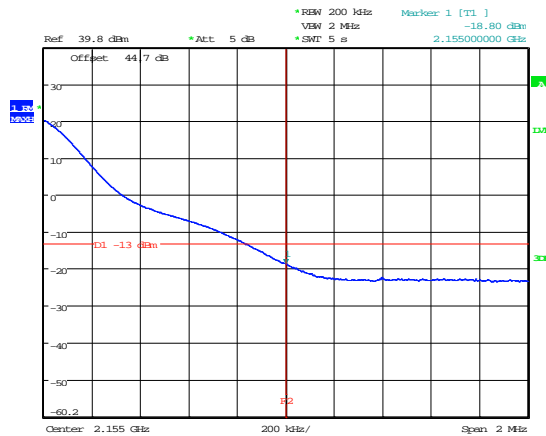
Upper Bandedge

| Modulation Type | Bandedge | Carrier Centre Frequency (MHz) | Max Level @ upto 1MHz from Bandedge (dBm) |
|-----------------|----------------|--------------------------------|---|
| 20MHz LTE | 2100 MHz Lower | 2120.00 | -15.11 |
| | 2100 MHz Upper | 2145.00 | -18.80 |



Date: 2.DEC.2014 17:18:27

Lower Bandedge



Date: 2.DEC.2014 17:19:59

Upper Bandedge

B5 Spurious Emissions at Antenna Terminals Greater than 1MHz

| Test Details: | |
|------------------------|---|
| Measurement standard | Part 2.1053, 22.917(a), 24.238(a), 27.53(c) & (g), 90.691(a)(1) & (2) |
| EUT sample number | S01 & S02 |
| Modification state | 0 |
| SE in test environment | None |
| SE isolated from EUT | None |
| EUT set up | Refer to Appendix C |

| Frequency (MHz) | Frequency Range (MHz) | Freq. of Emission (MHz) | Measured Level (dBm) | Attenuator & Cable Losses (dB) | Spurious Emission Level (dBm) | Limit (dBm) |
|-----------------|--|-------------------------|----------------------|--------------------------------|-------------------------------|-------------|
| 1900 MHz | | | | | | |
| 1930.000 | No Significant Emissions Within 20 dB of limit | | | | | -13 |
| 1960.000 | | | | | | -13 |
| 1990.000 | | | | | | -13 |
| 2100 MHz | | | | | | |
| 2110.000 | No Significant Emissions Within 20 dB of limit | | | | | -13 |
| 2132.500 | | | | | | -13 |
| 2155.000 | | | | | | -13 |

Limit is determined by the outermost step of the emissions mask and is calculated as follows:

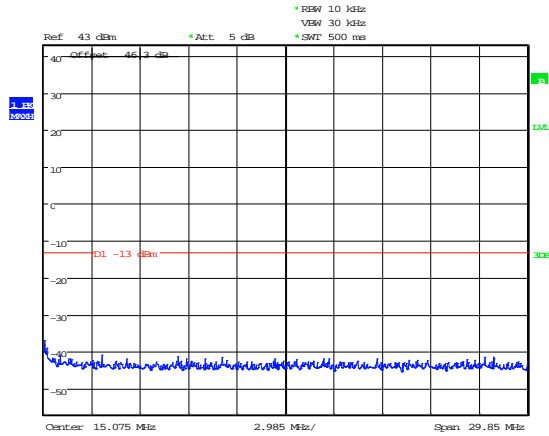
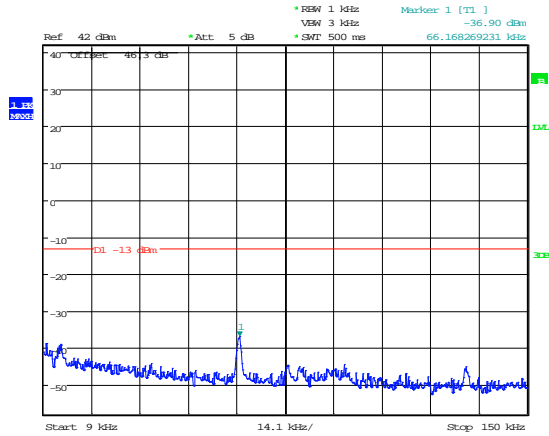
At least $43 + 10 \log P$ dB

$$(10\log P_{\text{watts}}) - (43 + 10\log (P_{\text{watts}} * 1000)) = \text{LIMIT} = -13 \text{ dBm}$$

Result

The EUT was found to comply with the limits

1930.0 MHz

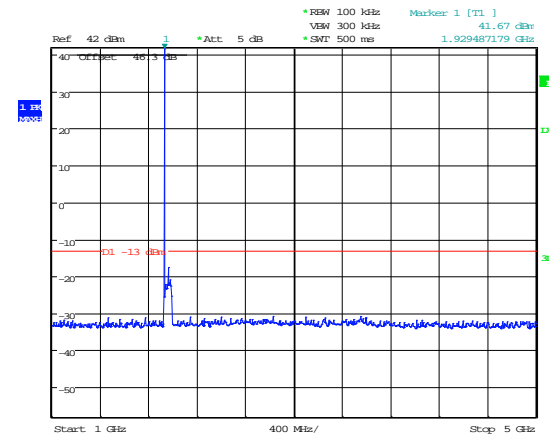
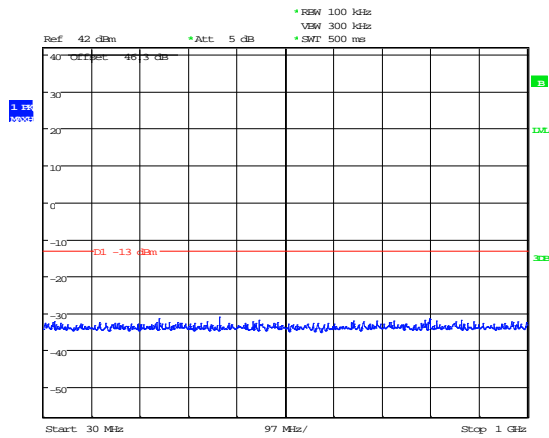


Date: 17.APR.2014 15:03:01

Date: 17.APR.2014 15:15:47

9kHz - 150kHz

150kHz - 30MHz

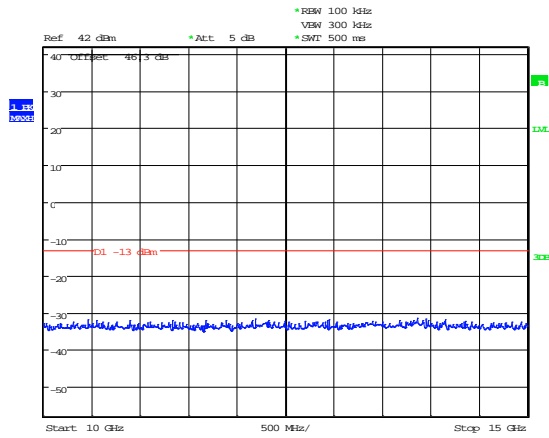
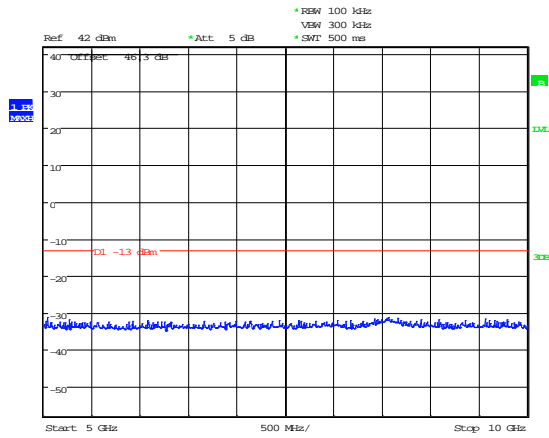


Date: 17.APR.2014 15:02:20

Date: 17.APR.2014 14:49:42

30MHz - 1GHz

1GHz - 5GHz

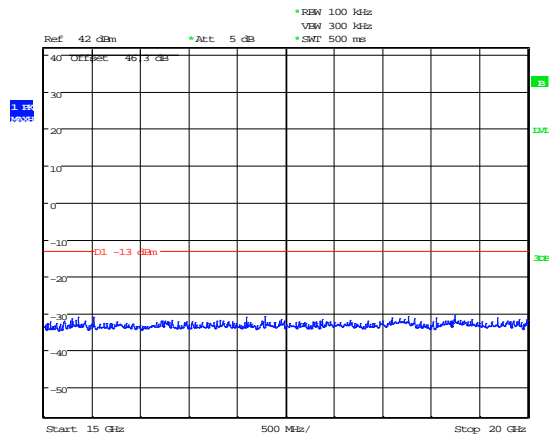


Date: 17.APR.2014 15:00:48

Date: 17.APR.2014 15:01:15

5GHz - 10GHz

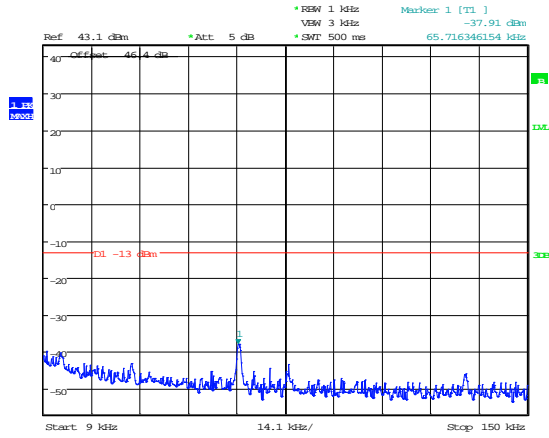
10GHz - 15GHz



Date: 17.APR.2014 15:01:44

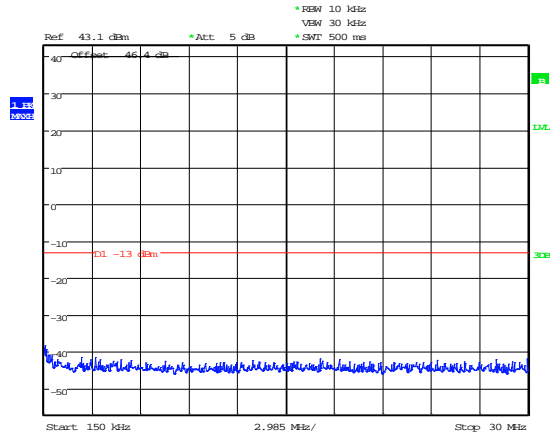
15GHz – 20GHz

1960.0 MHz



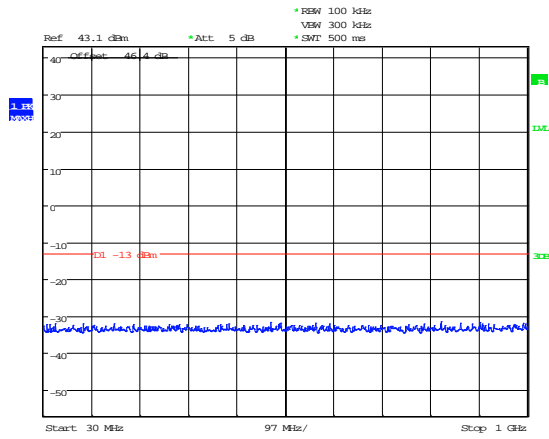
Date: 17.APR.2014 15:23:17

9kHz - 150kHz



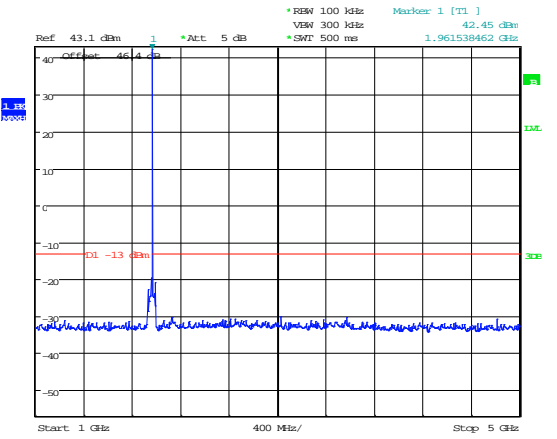
Date: 17.APR.2014 15:23:42

150kHz - 30MHz



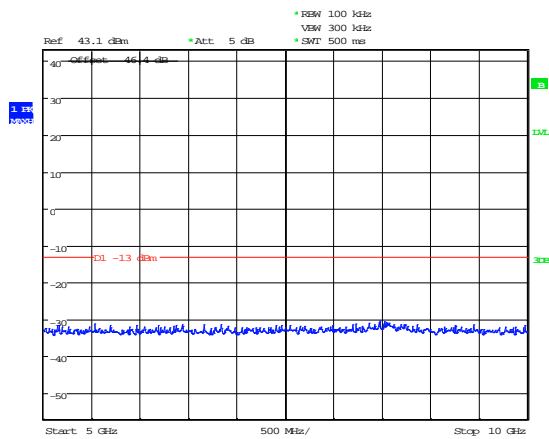
Date: 17.APR.2014 15:24:04

30MHz - 1GHz



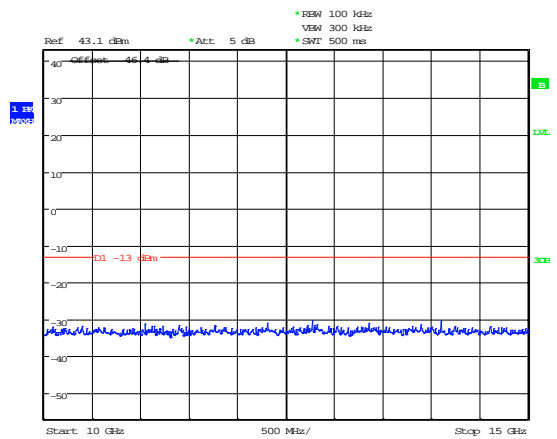
Date: 17.APR.2014 15:21:48

1GHz - 5GHz



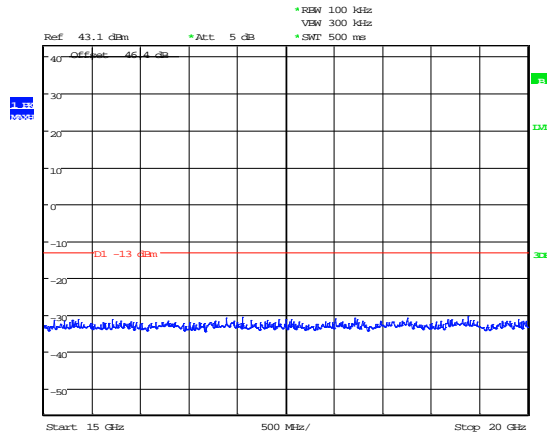
Date: 17.APR.2014 15:22:18

5GHz - 10GHz



Date: 17.APR.2014 15:22:35

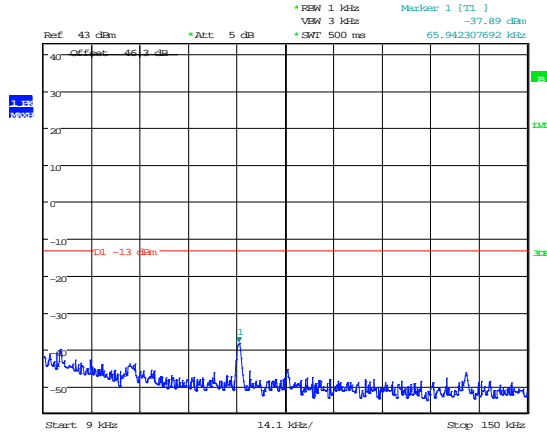
10GHz - 15GHz



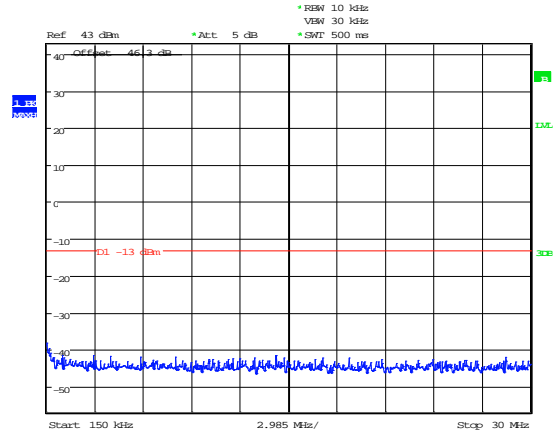
Date: 17.APR.2014 15:22:55

15GHz – 20GHz

1990 MHz



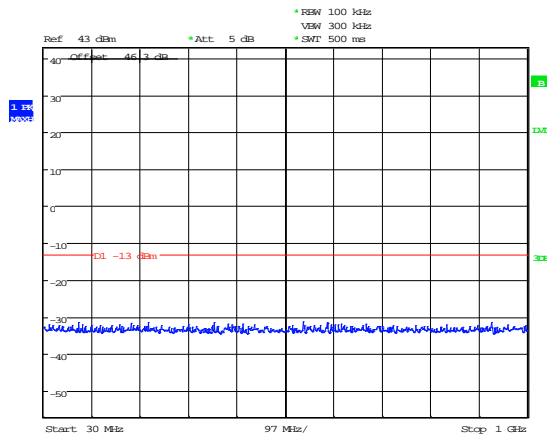
Date: 17.APR.2014 15:32:09



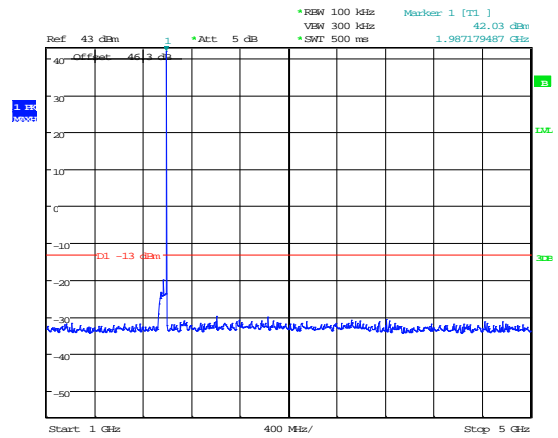
Date: 17.APR.2014 15:32:32

9kHz - 150kHz

150kHz - 30MHz



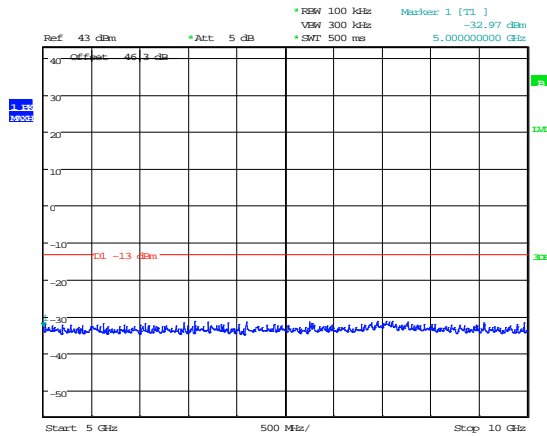
Date: 17.APR.2014 15:32:55



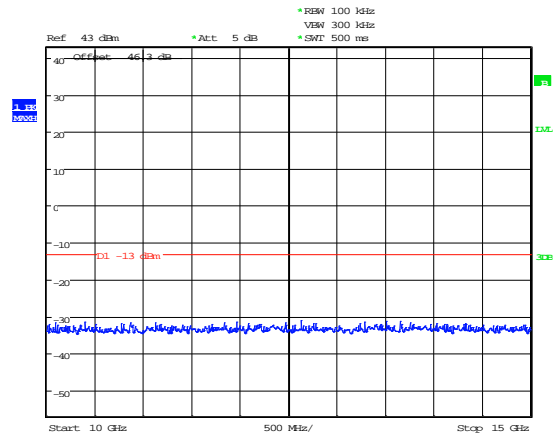
Date: 17.APR.2014 15:33:15

30MHz - 1GHz

1GHz - 5GHz



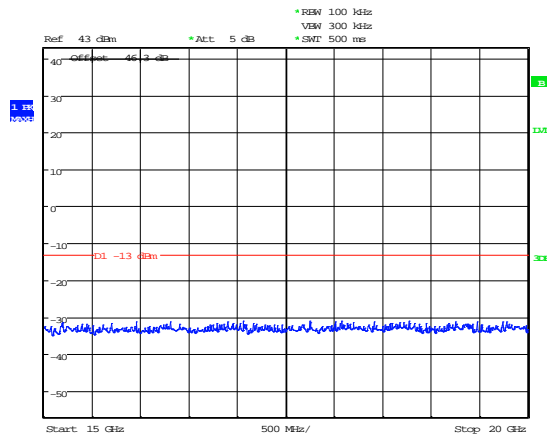
Date: 17.APR.2014 15:33:32



Date: 17.APR.2014 15:33:58

5GHz - 10GHz

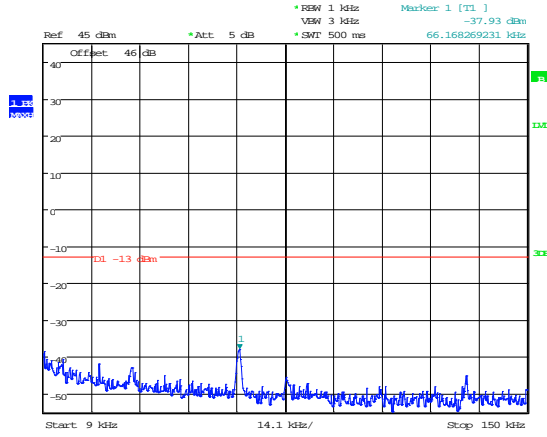
10GHz - 15GHz



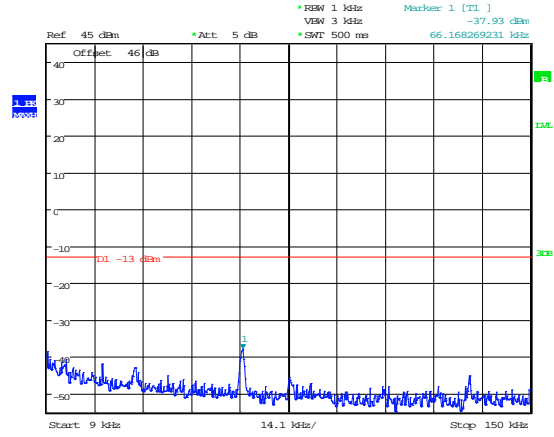
Date: 17.APR.2014 15:34:27

15GHz – 20GHz

2110 MHz



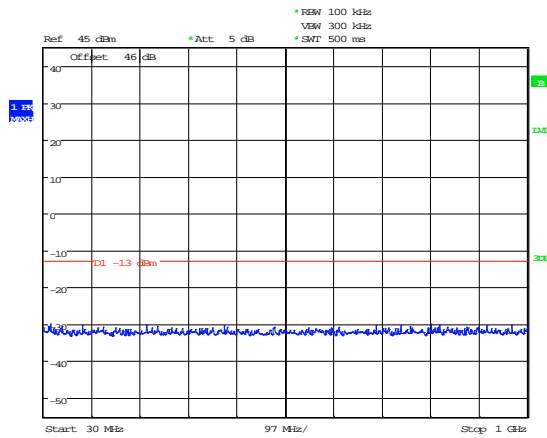
Date: 17.APR.2014 15:47:28



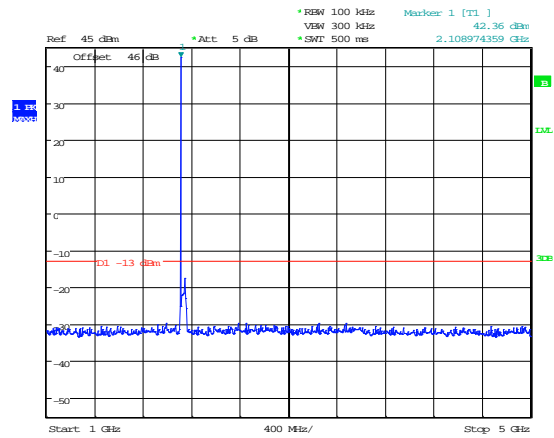
Date: 17.APR.2014 15:47:28

9kHz - 150kHz

150kHz - 30MHz



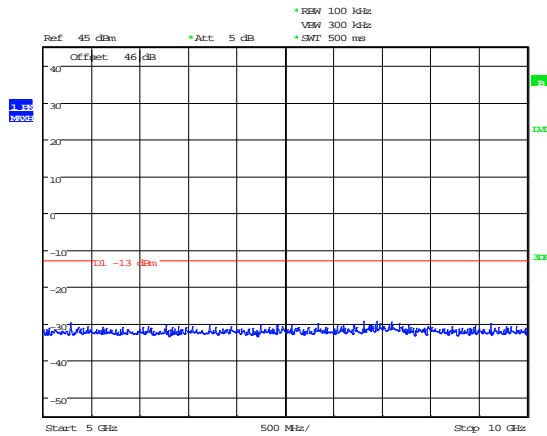
Date: 17.APR.2014 15:48:13



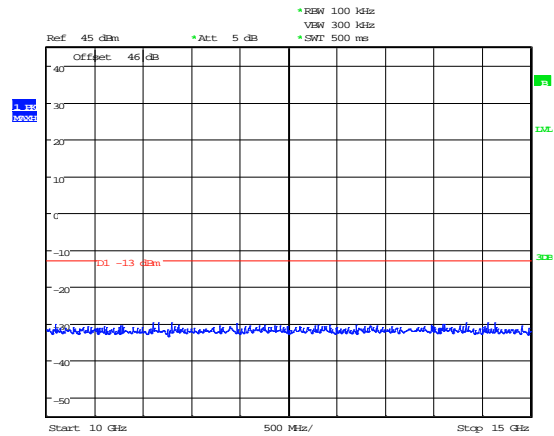
Date: 17.APR.2014 15:44:11

30MHz - 1GHz

1GHz - 5GHz



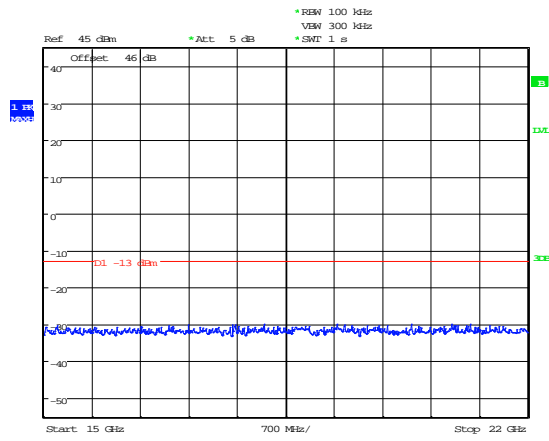
Date: 17.APR.2014 15:52:50



Date: 17.APR.2014 15:46:04

5GHz - 10GHz

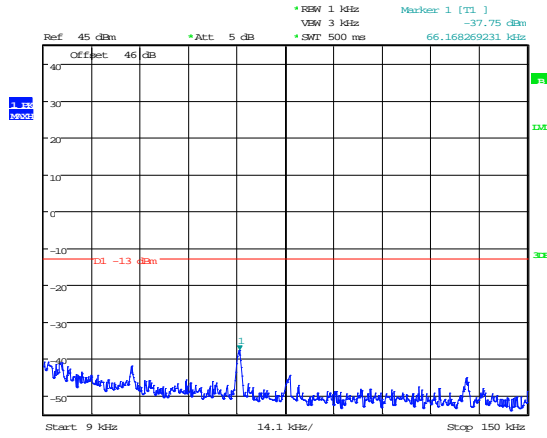
10GHz - 15GHz



Date: 17.APR.2014 15:47:02

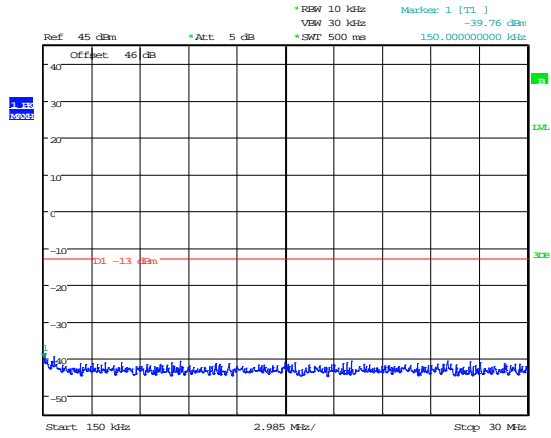
15GHz – 22GHz

2132.5 MHz



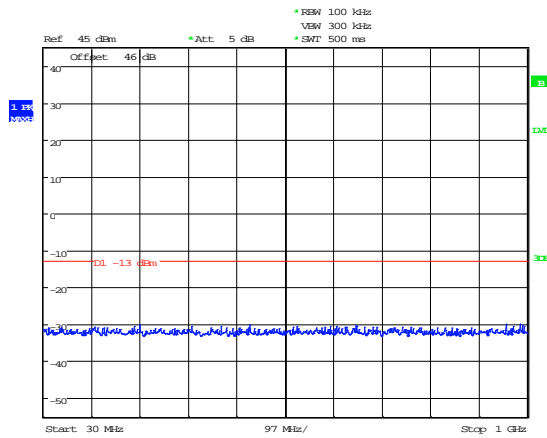
Date: 17.APR.2014 15:53:58

9kHz - 150kHz



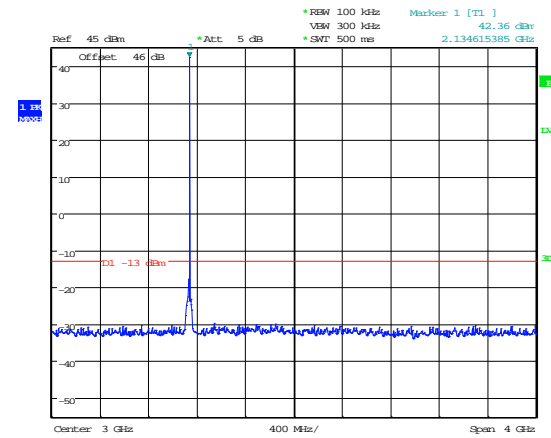
Date: 17.APR.2014 15:54:22

150kHz - 30MHz



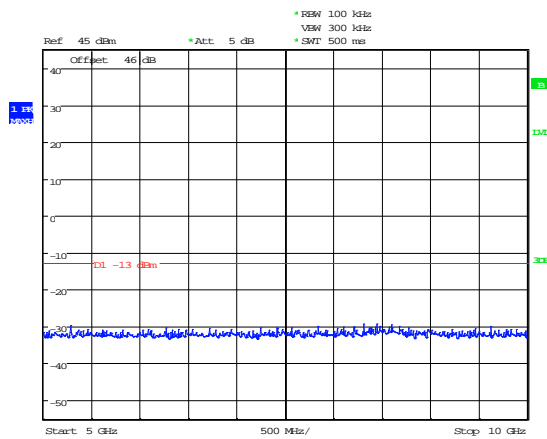
Date: 17.APR.2014 15:54:44

30MHz - 1GHz



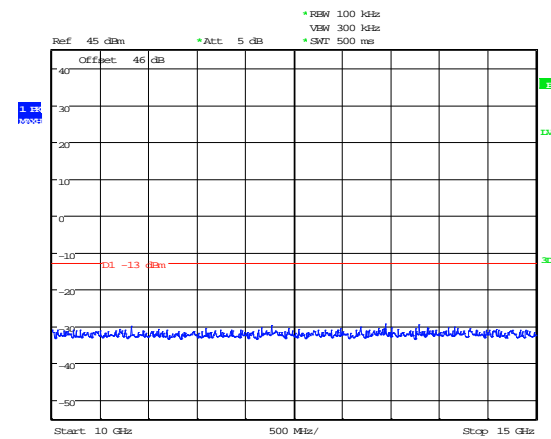
Date: 17.APR.2014 15:52:03

1GHz - 5GHz



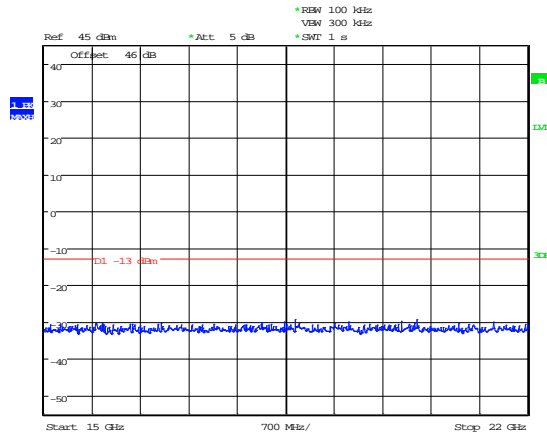
Date: 17.APR.2014 15:52:50

5GHz - 10GHz



Date: 17.APR.2014 15:53:11

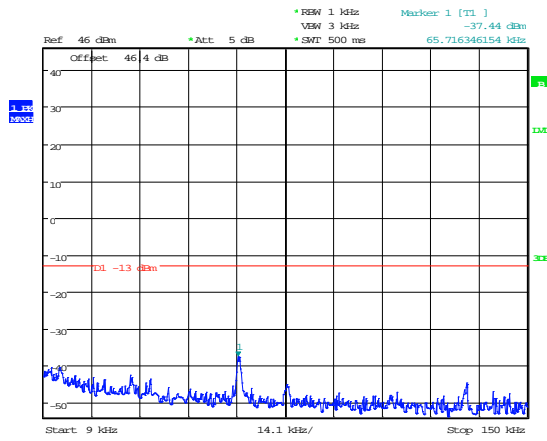
10GHz - 15GHz



Date: 17.APR.2014 15:53:30

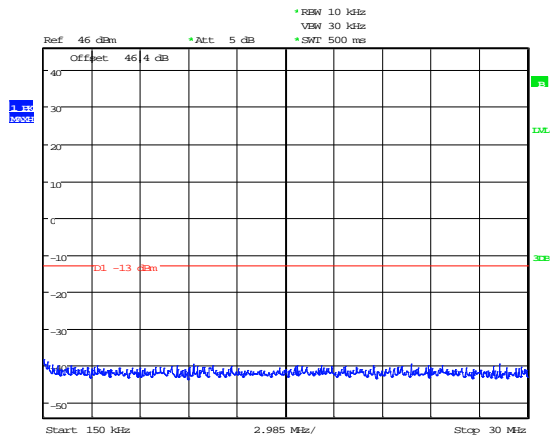
15GHz – 22GHz

2155.0 MHz



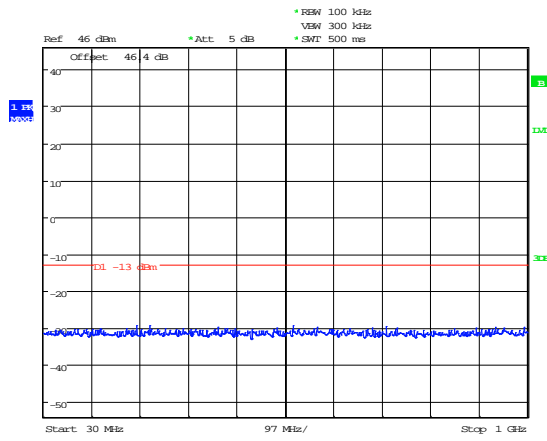
Date: 17.APR.2014 16:33:35

9kHz - 150kHz



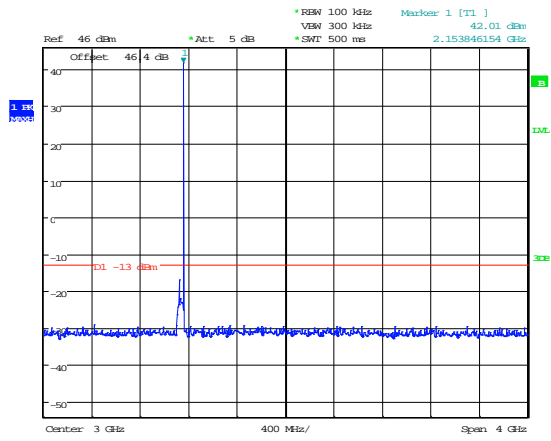
Date: 17.APR.2014 16:33:59

150kHz – 30MHz



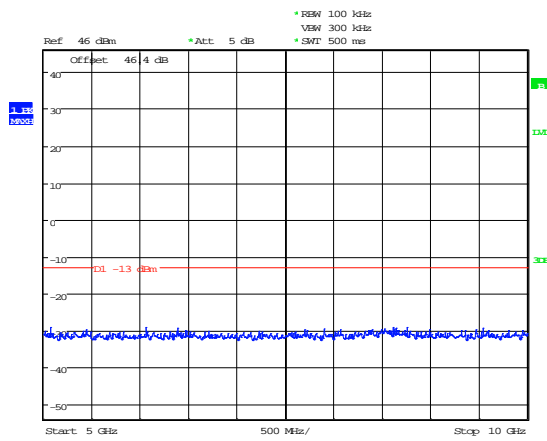
Date: 17.APR.2014 16:34:18

30MHz – 1GHz



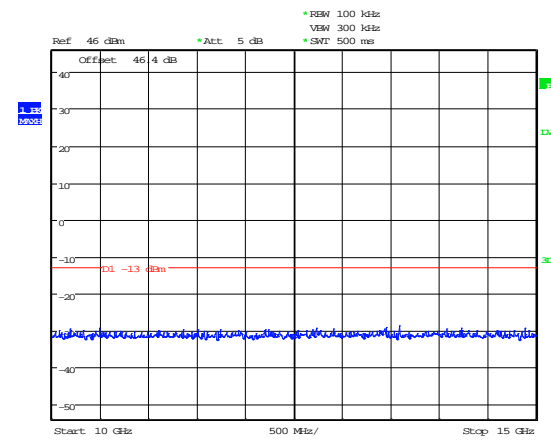
Date: 17.APR.2014 16:28:58

1GHz – 5GHz



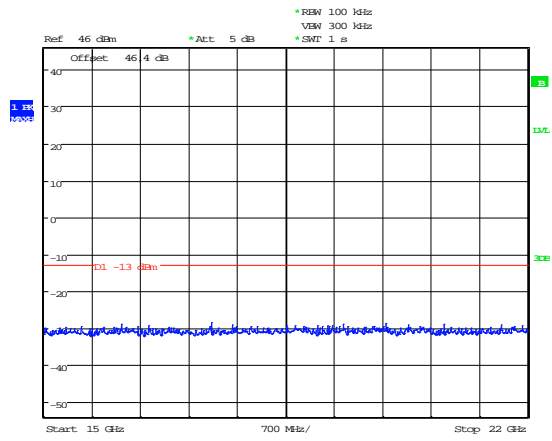
Date: 17.APR.2014 16:29:16

5GHz – 10GHz



Date: 17.APR.2014 16:29:36

10GHz – 15GHz



Date: 17.APR.2014 16:30:01

15GHz – 22GHz

B6 Radiated Electric Field Emissions

Preliminary scans were performed using a peak detector with the RBW = 100kHz. The radiated electric field emission test applies to all spurious and harmonic emissions. The EUT was set to transmit as required.

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 :

The effect of the EUT set-up on the measurements is summarised in note (c) below.

| Test Details: | |
|------------------------|---|
| Measurement standard | Part 2.1053, 22.917(a), 24.238(a), 27.53(c) & (g) |
| Frequency range | 30 MHz – 22 GHz |
| EUT sample number | S01 & S02 |
| Modification state | 0 |
| SE in test environment | None |
| SE isolated from EUT | None |
| EUT set up | Refer to Appendix C |

| Frequency (MHz) | Freq. of Emission (MHz) | ERP/EIRP (dBm) | Limit (dBm) |
|-----------------|---------------------------------|----------------|-------------|
| 1900 MHz | | | |
| 1930.000 | No Significant Emissions Within | | -13 |
| 1962.500 | | | -13 |
| 1995.000 | | | -13 |
| 2100MHz | | | |
| 2110.000 | 4219.990 | -26.5 | -13 |
| 2132.500 | 4265.000 | -30.7 | -13 |
| 2155.000 | 4310.000 | -30.3 | -13 |

Result

The EUT was found to comply with the limits

Notes:

1. Emissions Checked up to 10 times Fc.
2. The unit was mounted on a turntable and rotated through 360⁰ and in 3 orthogonal planes to find the worst case emission.
3. 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 Detector RBW = 1MHz; VBW = ≥RBW

4. Limit is determined as the outermost step of the emissions mask and is calculated as follows.

At least $43 + 10 \log P$ dB

$$(10\log P_{\text{watts}}) - (43 + 10\log (P_{\text{watts}} * 1000)) = \text{LIMIT} = -13 \text{ dBm}$$

The upper and lower frequency of the measurement range was decided according to 47 CFR Part 2.1057.

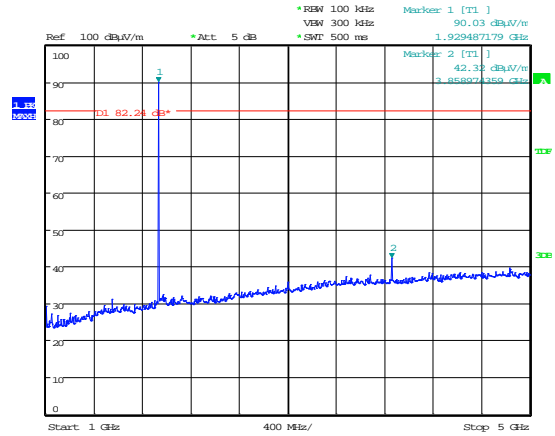
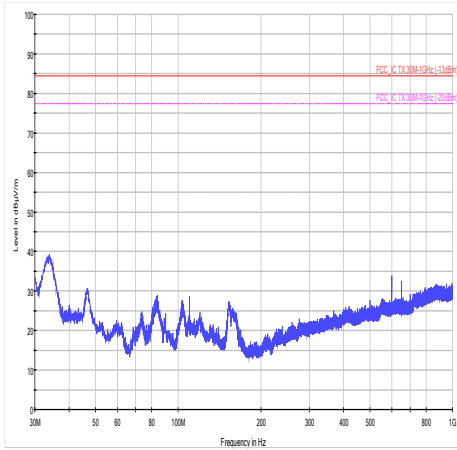
- (a) Where results have been measured at one distance, and a signal level displayed at another, the results have been extrapolated using the following formula:

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

- (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 | | | | |

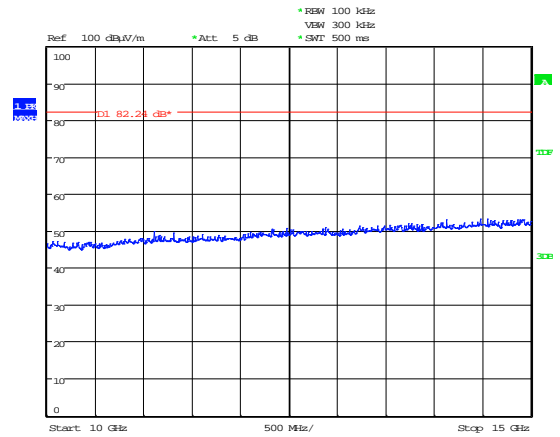
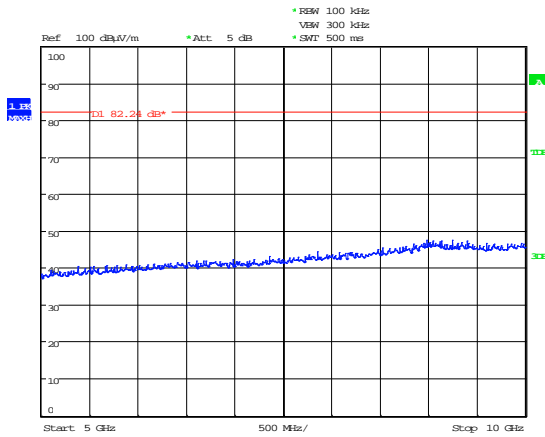
1930.0 MHz



Date: 26.NOV.2014 10:59:10

30MHz – 1GHz

1GHz – 5GHz

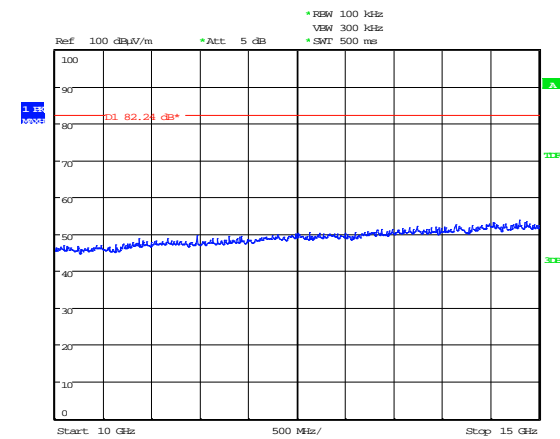
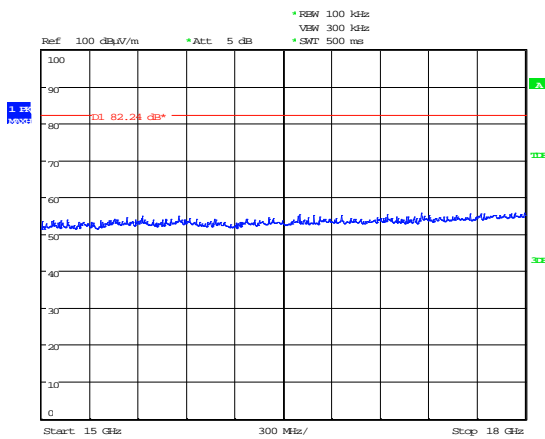


Date: 26.NOV.2014 11:00:22

Date: 26.NOV.2014 11:01:28

5GHz – 10GHz

10GHz – 15GHz



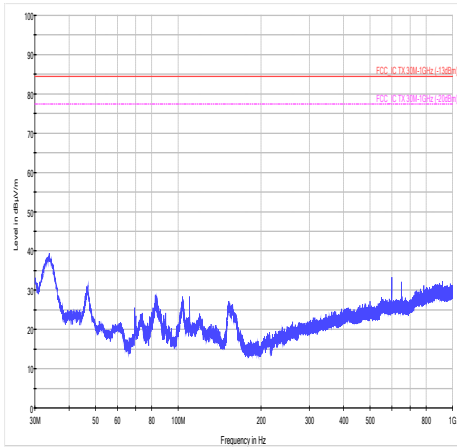
Date: 26.NOV.2014 11:02:40

Date: 26.NOV.2014 11:07:35

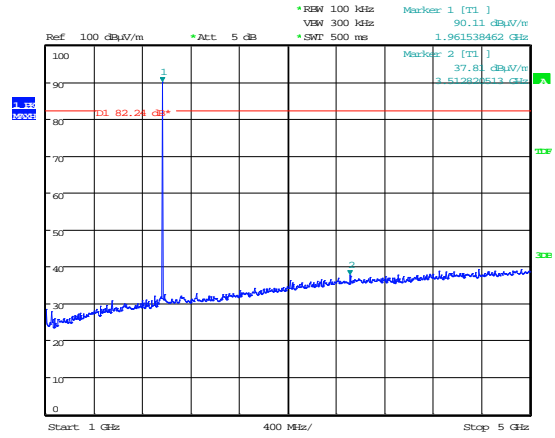
15GHz – 18GHz

18GHz – 22GHz

1960.0 MHz

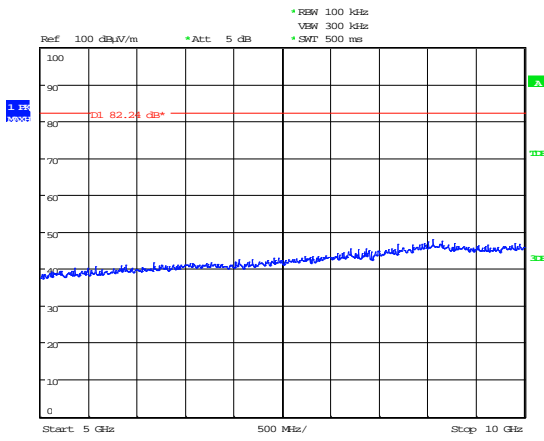


30MHz – 1GHz



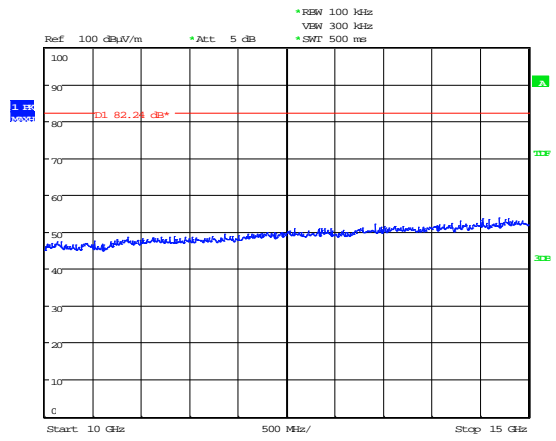
1GHz – 5GHz

Date: 26.NOV.2014 11:12:14



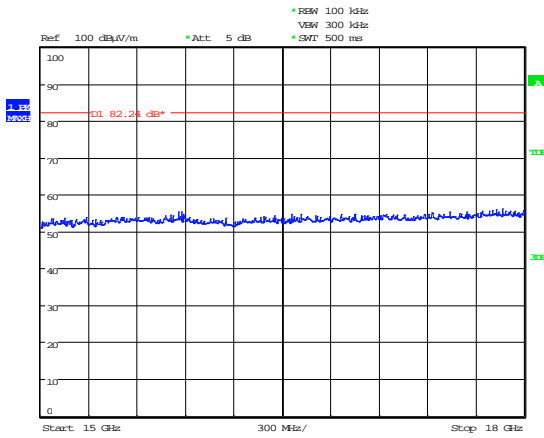
5GHz – 10GHz

Date: 26.NOV.2014 11:13:16



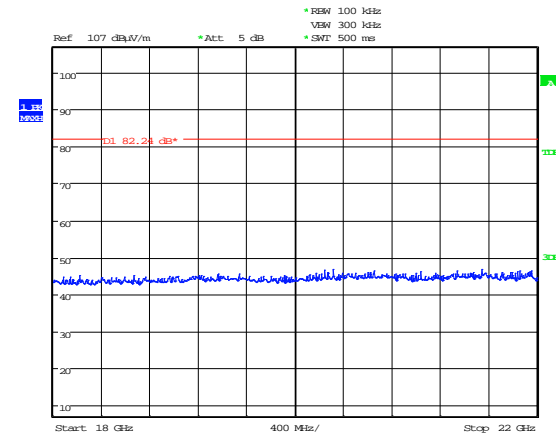
10GHz – 15GHz

Date: 26.NOV.2014 11:14:49



15GHz – 18GHz

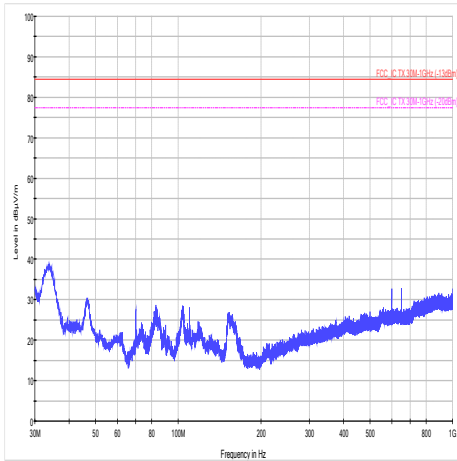
Date: 26.NOV.2014 11:15:50



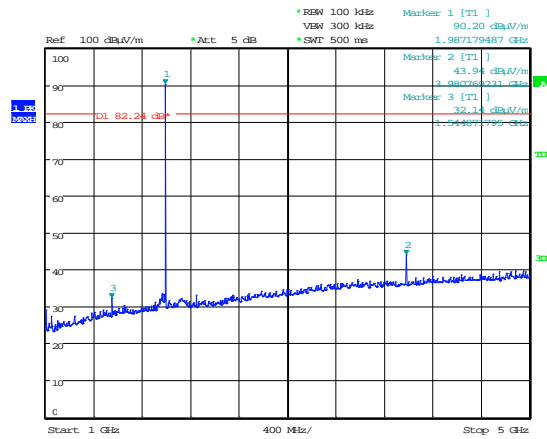
18GHz – 22GHz

Date: 26.NOV.2014 15:12:18

1995.0 MHz

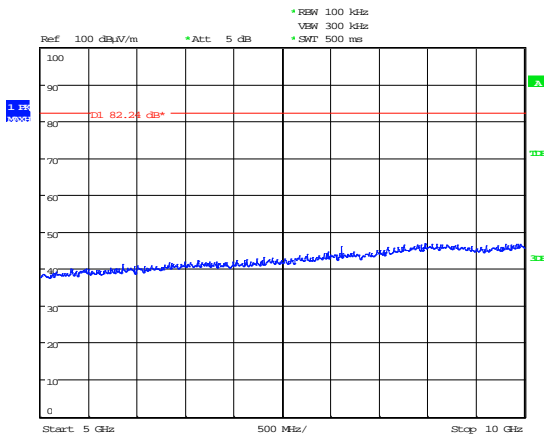


30MHz – 1GHz



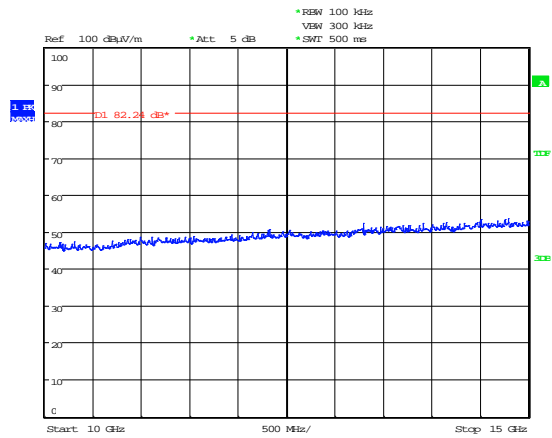
1GHz – 5GHz

Date: 26.NOV.2014 11:25:48



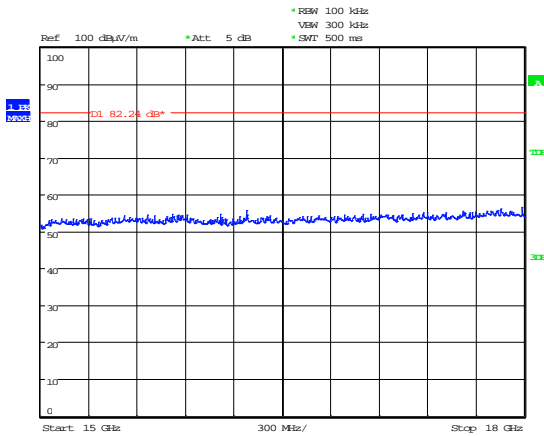
5GHz – 10GHz

Date: 26.NOV.2014 11:27:11



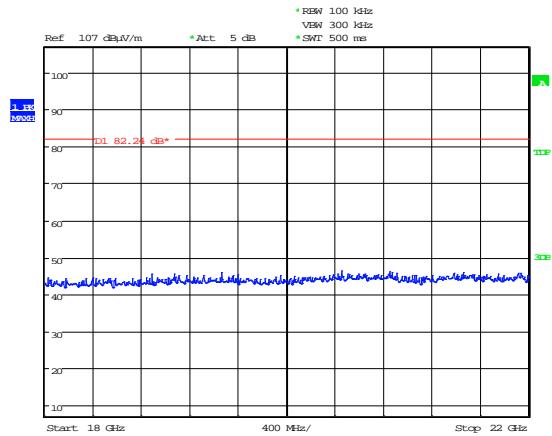
10GHz – 15GHz

Date: 26.NOV.2014 11:28:18



15GHz – 18GHz

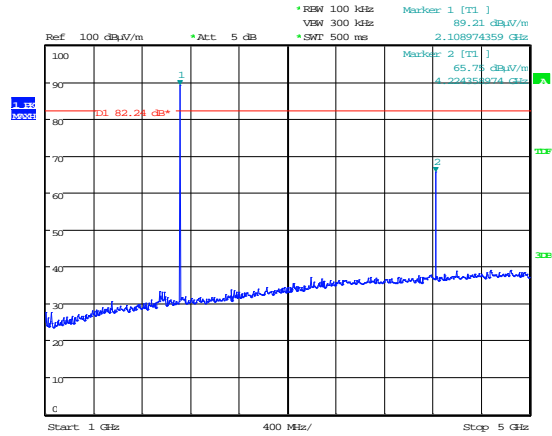
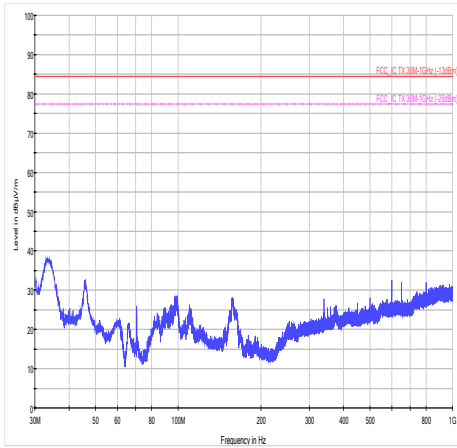
Date: 26.NOV.2014 11:30:08



18GHz – 22GHz

Date: 26.NOV.2014 15:13:01

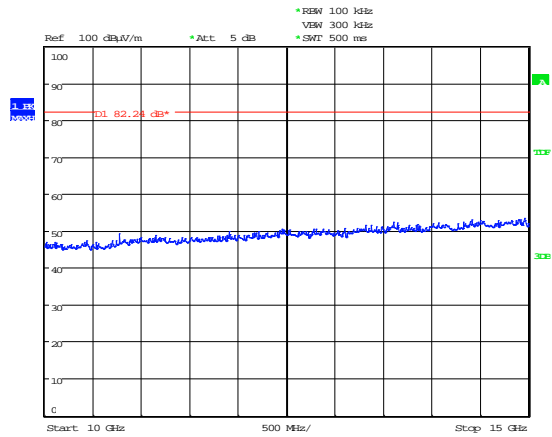
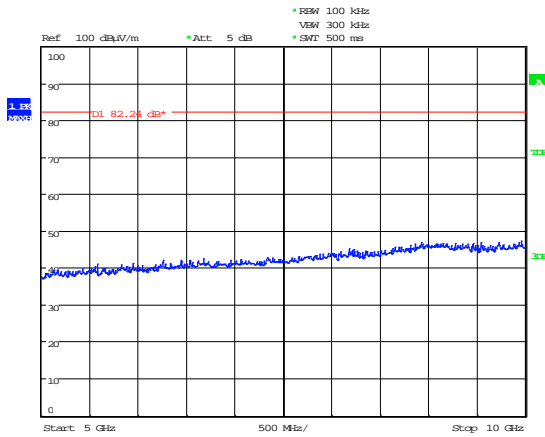
2110.0 MHz



Date: 26.NOV.2014 11:53:51

30MHz – 1GHz

1GHz – 5GHz

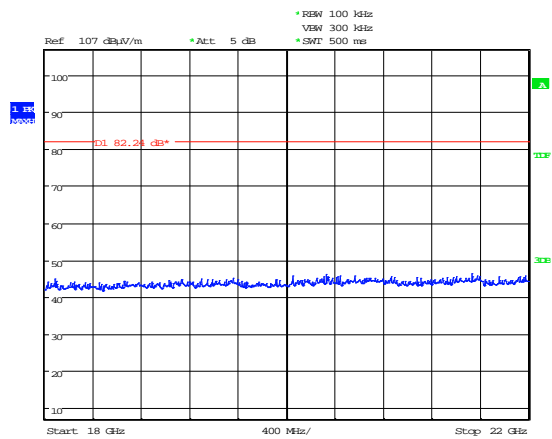
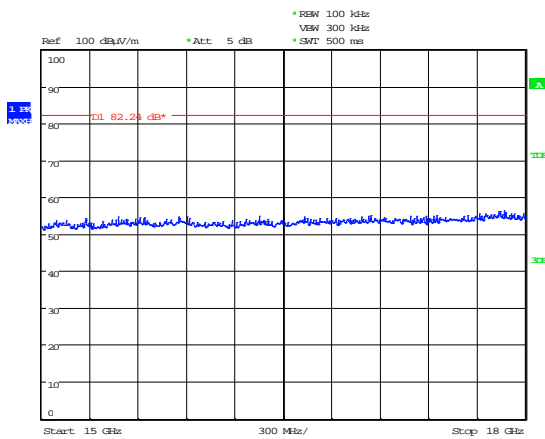


Date: 26.NOV.2014 11:54:59

Date: 26.NOV.2014 11:55:58

5GHz – 10GHz

10GHz – 15GHz



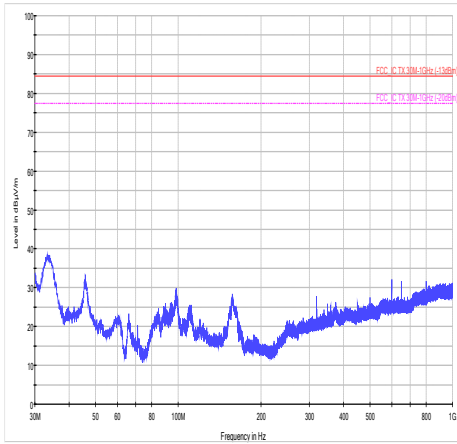
Date: 26.NOV.2014 11:56:58

Date: 26.NOV.2014 15:27:00

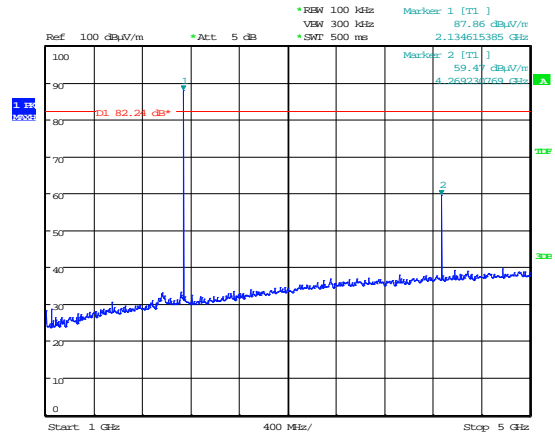
15GHz – 18GHz

18GHz – 22GHz

2132.5 MHz

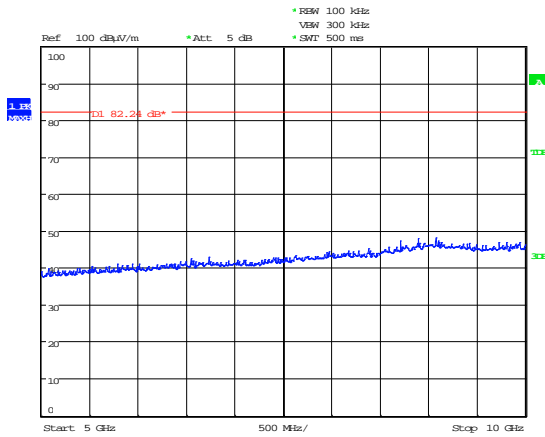


30MHz – 1GHz



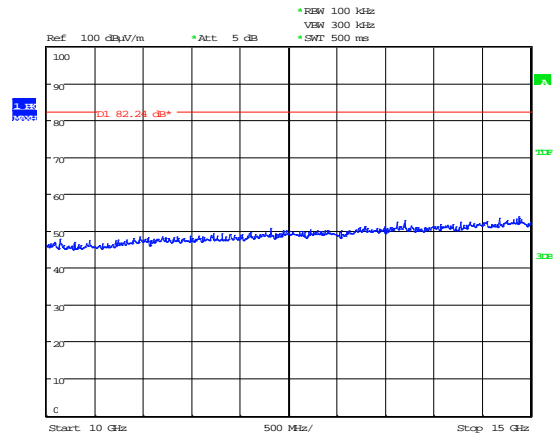
Date: 26.NOV.2014 12:04:21

1GHz – 5GHz



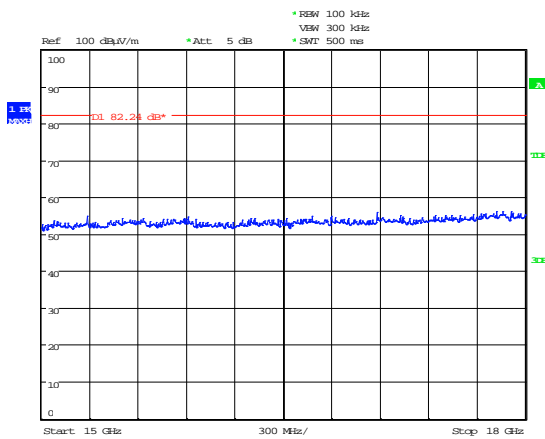
Date: 26.NOV.2014 12:10:45

5GHz – 10GHz



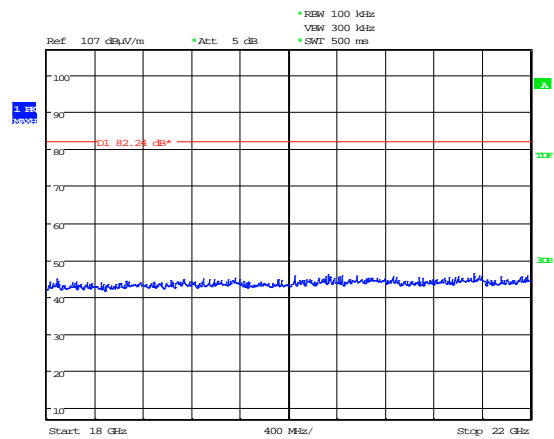
Date: 26.NOV.2014 12:06:31

10GHz – 15GHz



Date: 26.NOV.2014 12:07:41

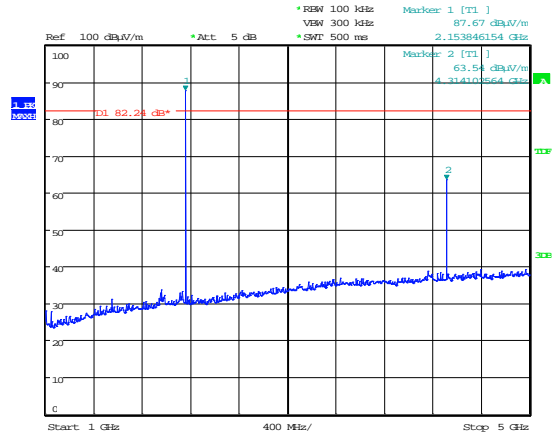
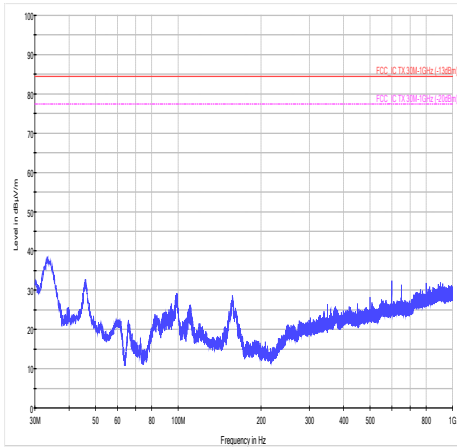
15GHz – 18GHz



Date: 26.NOV.2014 15:27:00

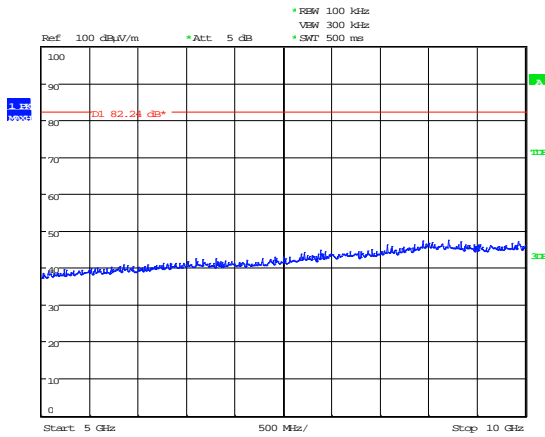
18GHz – 22GHz

2155.0 MHz



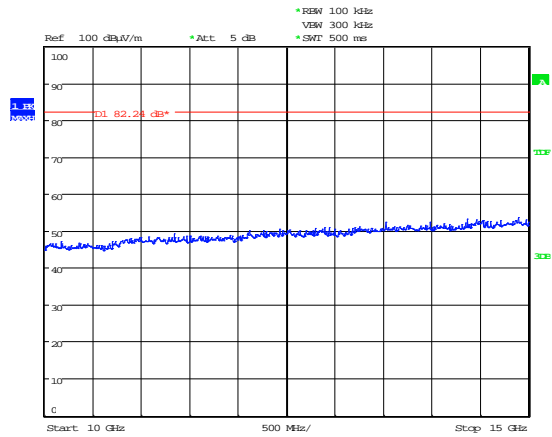
Date: 26.NOV.2014 12:19:36

30MHz – 1GHz



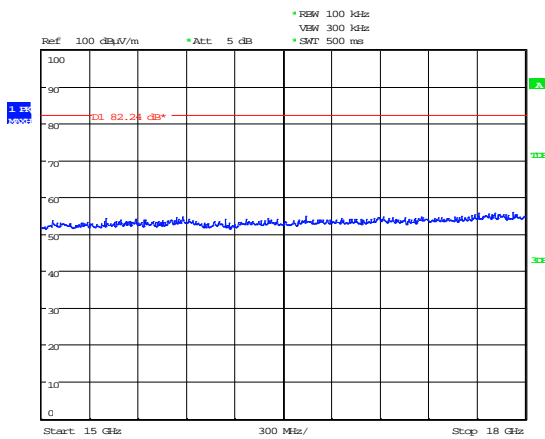
Date: 26.NOV.2014 12:20:41

1GHz – 5GHz



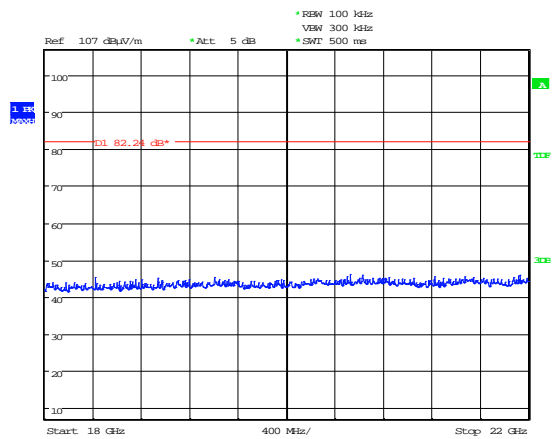
Date: 26.NOV.2014 12:21:44

5GHz – 10GHz



Date: 26.NOV.2014 12:22:56

10GHz – 15GHz



Date: 26.NOV.2014 15:29:35

15GHz – 18GHz

18GHz – 22GHz

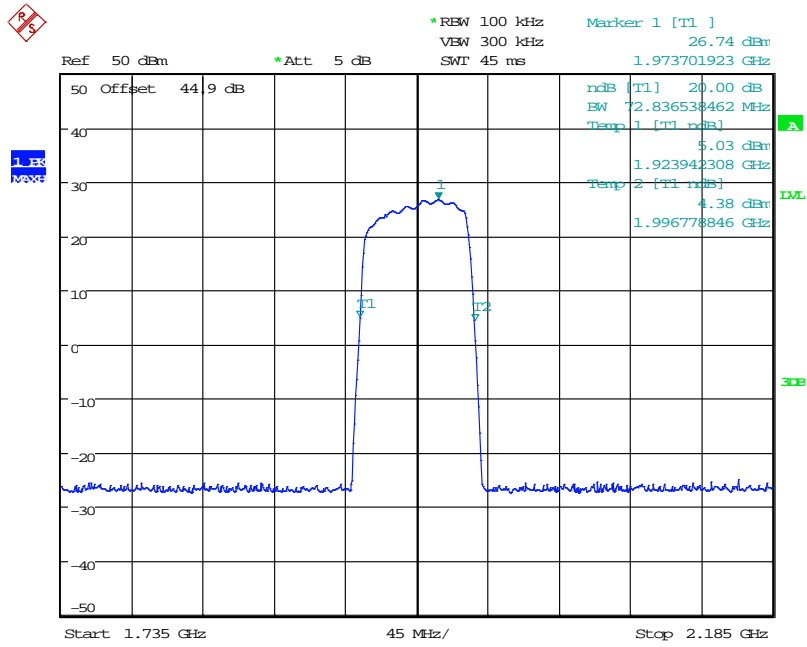
B7 Passband Gain & Bandwidth

| Test Details: | |
|------------------------|---|
| Measurement standard | D.3 Policies + Procedures (k) of KDB 935210 D02 Signal Boosters Certification v02 |
| EUT sample number | S03 |
| Modification state | 0 |
| SE in test environment | None |
| SE isolated from EUT | None |
| EUT set up | Refer to Appendix C |

| BAND | Frequency MHz | fl | fh | 20 dB Bandwidth |
|-------------------|--------------------|-------------|-------------|-----------------|
| 1900 MHz Upper | 1930 - 1990 MHz | 1.923943GHz | 1.996778GHz | 72.836MHz |
| 1700 MHz (AWS) | 2110 - 2155 MHz | 2.098605GHz | 2.167115GHz | 68.509MHz |

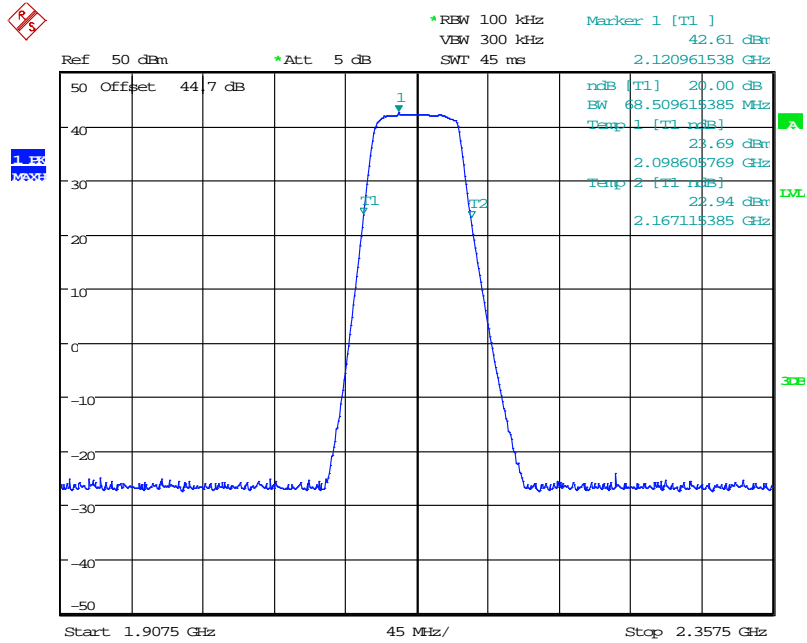
See below for plots showing passband gain & bandwidth

With the aid of a CW Swept signal generator and spectrum analyser, the bandwidth and frequency response of the open channel (i.e. at the point where the gain has fallen by 20 dB) is measured. This measurement shows the gain-versus-frequency response of the open channel from the midband frequency f_0 of the channel up to at least $f_0 + 250\%$ of the 20 dB bandwidth.



Date: 19.SEP.2014 12:35:03

1900 MHz



Date: 19.SEP.2014 11:19:19

2100MHz

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 |
|------------|---------------|
| S01 | MBF-4317-4319 |
| S02 | OMU |

C2) EUT Operating Mode During Testing.

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

| Test | Description of Operating Mode: |
|-----------------------------------|--|
| All tests detailed in this report | EUT active, operating at maximum gain and output power |

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 : S01 & S02
Tests : Conducted

| Port | Description of Cable Attached | Cable length | Equipment Connected |
|----------------|-------------------------------|--------------|---------------------|
| Server / Donor | Coaxial | 2m | Measurement System |
| Power | Multi core | 1.5m | AC Mains |

Sample : S01 & S02
Tests : Radiated Emissions

| Port | Description of Cable Attached | Cable length | Equipment Connected |
|----------------|-------------------------------|--------------|---------------------|
| Server / Donor | Coaxial | 2m | Measurement System |
| Power | Multi core | 1.5m | AC Mains |

* Only connected during setup.

C5 Details of Equipment Used

| TRaC No | Equipment Type | Equipment Description | Manufacturer | Last Cal | Cal Period | Due For Cal |
|----------|----------------|-----------------------|----------------|------------|------------|-------------|
| L352 | ESVS10 | Receiver | R&S | 21/03/2014 | 12 | 21/03/2015 |
| UH093 | CBL6112B | Bilog | Chase | 08/07/2013 | 24 | 08/07/2015 |
| UH281 | FSU46 | Spectrum Analyser | R&S | 26/03/2014 | 12 | 26/03/2015 |
| UH405 | FSU26 | Spectrum Analyser | R&S | 16/04/2014 | 12 | 16/04/2015 |
| 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 |
| L300 | 20240-20 | Horn 18-26GHz | Flann | 10/02/2014 | 24 | 10/02/2016 |
| L572 | 8449B | Pre Amp | Agilent | 11/02/2014 | 24 | 11/02/2015 |
| REF916 | SMBV100A | Signal Generator | R&S | 19/02/2014 | 12 | 19/02/2015 |
| REF940 | ATS | Radio Chamber - PP | Rainford EMC | 08/09/2014 | 12 | 08/09/2016 |
| REF976 | 34405a | Multimeter | Agilent | 19/05/2014 | 12 | 19/05/2015 |
| UH272 | N TYPE | Cable | TRaC | Cal in use | | |
| UH273 | N TYPE | Cable | TRaC | Cal in use | | |
| UH274 | N TYPE | Cable | TRaC | Cal in use | | |
| TRLUH225 | Attenuator | 100W/20dB | Spinner | Cal in use | | |
| TRL112 | Attenuator | 75W/10dB | Bird | Cal in use | | |
| N/A | Attenuator | 10W/20dB | Axell Wireless | 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

Photograph 1



