



| | | | | | |
|--|---|-------------------------|---|--|------------------|
| Test Report No.: | | 14071604.fcc01 | | Page 1 of 46 | |
| <i>Client:</i> | Sirona Dental Systems GmbH Fabrikstrasse 31 D-64625 Bensheim Germany | | | | |
| <i>Test Item:</i> | Digital Transmission System (DTS) CEREC Radio Device | | | | |
| <i>Identification:</i> | 6543891 D3492 | <i>Serial Number:</i> | 00116 (conducted tests) and 00108 (radiated tests) | | |
| <i>Project No.:</i> | 14071604 | <i>Date of Receipt:</i> | February 18, 2015 | | |
| <i>Testing Location:</i> | TÜV Rheinland Nederland B.V. Eiberkamp 10 9351VT Leek | | | | |
| <i>Test Specification:</i> | FCC 47 CFR Part 15, Subpart C, Section 15.247 (10-1-14 Edition) ANSI C63.10-2009 KDB Publication No. 558074 D01 V3.02: Measurement of Digital Transmission Systems Operating under Section 15.247 (06/05/14) | | | | |
| <i>Test Result:</i> | The test item passed the test specification(s). | | | | |
| <i>Testing Laboratory:</i> | TÜV Rheinland Nederland B.V. Eiberkamp 10 9351 VT Leek | | | | |
| <i>Tested by:</i> |  | | <i>Reviewed by</i> |  | |
| 2015-03-09 | R. van der Meer / Inspector | | 2015-03-09 | P. de Beer / Reviewer | |
| <i>Date</i> | <i>Name/Position</i> | <i>Signature</i> | <i>Date</i> | <i>Name/Position</i> | <i>Signature</i> |
| <i>Other Aspects:-.</i> | | | | | |
| <i>Abbreviations:</i> P(ass) = passed F(ail) = failed N/A = not applicable N/T = not tested | | | | | |
| This report shall not be reproduced, except in full, without the written permission of TÜV Rheinland Nederland B.V. The test results relate only to the item(s) tested. | | | | | |

*Test Report No.:***14071604.fcc01***Page 2 of 46*

TEST SUMMARY

5.1.1 CONDUCTED MEASUREMENTS AT ANTENNA PORT

RESULT: PASS

5.1.2 6dB BANDWIDTH

RESULT: PASS

5.1.3 PEAK POWER SPECTRAL DENSITY

RESULT: PASS

5.1.4 BAND EDGE CONDUCTED EMISSIONS

RESULT: Pass

5.1.5 RADIATED SPURIOUS EMISSIONS OF TRANSMITTER

RESULT: PASS

5.1.6 RADIATED SPURIOUS EMISSIONS OF TRANSMITTER IN RESTRICTED BANDS

RESULT: PASS

5.2.1 AC POWER LINE CONDUCTED EMISSION OF TRANSMITTER

RESULT: PASS

Contents

| | | |
|------------|--|-----------|
| 1. | GENERAL REMARKS | 4 |
| 1.1 | COMPLEMENTARY MATERIALS | 4 |
| 2. | TEST SITES | 4 |
| 2.1 | TEST FACILITIES | 4 |
| 2.2 | LIST OF TEST AND MEASUREMENT INSTRUMENTS TABLE 1: LIST OF TEST AND MEASUREMENT EQUIPMENT..... | 5 |
| 2.3 | MEASUREMENT UNCERTAINTY | 6 |
| 3. | GENERAL PRODUCT INFORMATION..... | 7 |
| 3.1 | PRODUCT FUNCTION AND INTENDED USE..... | 7 |
| 3.2 | SYSTEM DETAILS..... | 7 |
| 3.3 | COUNTERMEASURES TO ACHIEVE EMC COMPLIANCE | 8 |
| 4. | TEST SET-UP AND OPERATION MODES | 9 |
| 4.1 | TEST METHODOLOGY..... | 9 |
| 4.2 | OPERATION MODES | 9 |
| 4.3 | PHYSICAL CONFIGURATION FOR TESTING | 10 |
| 4.4 | TEST SOFTWARE | 12 |
| 4.5 | SPECIAL ACCESSORIES AND AUXILIARY EQUIPMENT..... | 13 |
| 5. | TEST RESULTS | 14 |
| 5.1 | CONDUCTED MEASUREMENTS AT ANTENNA PORT | 14 |
| 5.1.1 | <i>Conducted Output Power</i> | <i>14</i> |
| 5.1.2 | <i>6dB Bandwidth</i> | <i>18</i> |
| 5.1.3 | <i>Peak Power Spectral Density.....</i> | <i>25</i> |
| 5.1.4 | <i>Band Edge Conducted Emissions.....</i> | <i>29</i> |
| 5.1.5 | <i>Radiated Spurious Emissions of Transmitter</i> | <i>32</i> |
| 5.2 | AC POWER LINE CONDUCTED MEASUREMENTS | 36 |

*Test Report No.:***14071604.fcc01***Page 4 of 46*

1. General Remarks

1.1 Complementary Materials

There is no attachment to this test report.

2. Test Sites

2.1 Test Facilities

The Federal Communications Commission and Industry Canada has reviewed the technical characteristics of the test facilities at TÜV Rheinland Nederland B.V., located in Leek, 9351VT Eiberkamp 10, The Netherlands, and has found these test facilities to be in compliance with the requirements of 47 CFR Part 15, section 2.948.

The description of the test facilities has been filed at the Office of the Federal Communications Commission under registration number 90828. The facility has been added to the list of laboratories performing these test services for the public on a fee basis.

Normal test conditions:

Temperature (*) : +15°C to +35°C
Relative humidity(*) : 20 % to 75 %
Supply voltage : 120VAC/60Hz.

When it was impracticable to carry out the tests under these conditions, a note to this effect stating the ambient temperature and relative humidity during the tests are stated separately.

Test Report No.:

14071604.fcc01

Page 5 of 46

2.2 List of Test and Measurement Instruments

Table 1: List of Test and Measurement Equipment

| Kind of Equipment | Manufacturer | Model Name | Inventory number | Calibration date (mm/yyyy) | Calibration due date (mm/yyyy) |
|---|-----------------|-------------------------------------|------------------|----------------------------|--------------------------------|
| For Antenna Port Conducted Emissions | | | | | |
| Temperature-Humiditymeter | Extech | SD500 | A00446 | 03/2014 | 03/2015 |
| Spectrum Analyzer | Rohde & Schwarz | FSV | A00337 | 08/2014 | 08/2015 |
| RF Cable | H+S | Secuflex | A00347 | 04/2014 | 04/2015 |
| For Radiated Emissions | | | | | |
| Measurement Receiver | Rohde & Schwarz | ESCI | A00314 | 03/2014 | 03/2015 |
| RF Cable S-AR | Gigalink | APG0500 | A00447 | 01/2015 | 01/2016 |
| RF Cable | H+S | Sucoflex | A00339 | 04/2014 | 04/2015 |
| RF Cable | H+S | Sucoflex | A00343 | 04/2014 | 04/2015 |
| Controller | Maturo | SCU/088/8090811 | A00450 | N/A | N/A |
| Controller | EMCS | DOC202 | A00257 | N/A | N/A |
| Test facility | Comtest | FCC listed: 90828 IC: 2932G-2 | A00235 | 04/2014 | 04/2017 |
| Spectrum Analyzer | Rohde & Schwarz | FSV | A00337 | 08/2014 | 08/2015 |
| Antenna mast | EMCS | AP-4702C | A00258 | N/A | N/A |
| Temperature-Humiditymeter | Extech | SD500 | A00444 | 03/2014 | 03/2015 |
| Guidehorn 1-18 GHz | EMCO | 3115 | A00009 | 04/2014 | 04/2015 |
| Guidehorn 18-26.5 GHz | EMCO | 3160-09 | A00209 | 04/2014 | 04/2015 |
| Amplifier for Guidehorn 18-26.5 GHz | EMCS | -- | A00378 | 04/2014 | 04/2015 |
| Biconilog Testantenna | Teseq | CBL 6111D | A00466 | 06/2014 | 06/2015 |
| 2.4 GHz bandreject filter | BSC | XN-1783 | A00065 | N/A | N/A |
| Bandpass filter 4-10 GHz | Reactel | 7AS-7G-6G-511 | A00131 | N/A | N/A |
| Bandpass filter 10-26 GHz | Reactel | 9HS-10G/26.5G-S11 | A00151 | N/A | N/A |
| Preamplifier 0.5 - 18 GHz | Miteq | AMF-5D-005180-28-13p | A00247 | N/A | N/A |
| Filterbox | EMCS | RFS06S | A00255 | 08/2014 | 08/2015 |
| | | | | | |

Continues on next page.

Test Report No.:

14071604.fcc01

Page 6 of 46

| Kind of Equipment | Manufacturer | Model Name | Inventory number | Calibration date (mm/yyyy) | Calibration due date (mm/yyyy) |
|---|-----------------|------------|------------------|----------------------------|--------------------------------|
| For AC Powerline Conducted Emissions | | | | | |
| Pulse limiter | R&S | ESH3-Z2 | A00051 | 01/2015 | 01/2016 |
| Variac | RFT | LSS020 | A00171 | NA | NA |
| LISN | EMCO | 3625/2 | A00022 | 01/2014 | 01/2016 |
| Measurement Receiver | Rohde & Schwarz | ESCS30 | A00726 | 09/2014 | 09/2015 |
| Shielded room for Conducted emissions | -- | -- | A00437 | NA | NA |
| Temperature-Humiditymeter | Extech | SD500 | A00444 | 03/2014 | 03/2015 |

Conformance of the used measurement and test equipment with the requirements of ISO/IEC 17025:2005 has been confirmed before testing. NA= Not Applicable

2.3 Measurement Uncertainty

Table 2: Emission Measurement Uncertainty

| Measurement Type | Frequency | Uncertainty |
|----------------------------------|----------------|-------------|
| Antenna Port Conducted Emission | < 1GHz | ±0.5dB |
| | > 1GHz | ±0.7dB |
| Radiated Emission | 150kHz - 30MHz | ±5.0dB |
| | 30MHz - 1GHz | ±5.0dB |
| | > 1GHz | ±5.5dB |
| AC Powerline Conducted Emissions | 150kHz - 30MHz | ±3.5dB |

Test Report No.:

14071604.fcc01

Page 7 of 46

3. General Product Information

3.1 Product Function and Intended Use

The brand Sirona Dental Systems GmbH model 6543891 D3492, hereafter referred to as EUT, is a part of the Sirona CEREC system, that produces full-ceramic dental implants based on 3D imaging technology. The CEREC configuration has a 3D image capturing camera, an acquisition unit and a milling unit. The 3D camera is hard wired to the acquisition unit; processed data is wirelessly send to the milling unit for implant processing. The transmitter will support and utilizes GFSK modulation techniques.

The content of this report and measurement results have not been changed other than the way of presenting the data.

3.2 System Details

Details and an overview of the system and all of its components, as it has been tested, may be found below.

| | | |
|-----------------------|---|--|
| EUT | : | Digital Transmission System (DTS) |
| Manufacturer | : | Benchmark Electronics B.V. |
| Brand | : | Sirona Dental Systems GmbH |
| Model(s) | : | 6543891 D3492 |
| Serial Number | : | 00116 (conducted tests) and 00108 (radiated tests) |
| Voltage input rating | : | 5Vdc |
| Voltage output rating | : | -- |
| Current input rating | : | -- |
| Antenna | : | 2 external antennas (1 Tx and 1 Rx) |
| Antenna Gain | : | 2 dBi |
| Operating frequency | : | 2402 MHz-2480 MHz. |
| Modulation | : | GFSK |
| Data-rate | : | 1 Mbps |
| Remarks | : | n.a. |

Test Report No.:

14071604.fcc01

Page 8 of 46

Table 3: Interfaces present on the EUT

There are no interface ports present on the EUT.

3.3 Countermeasures to achieve EMC Compliance

No additional measures were employed to achieve compliance.

Test Report No.:

14071604.fcc01

Page 9 of 46

4. Test Set-up and Operation Modes

4.1 Test Methodology

The test methodology used is based on the requirements of 47 CFR Part 15, Sections 15.31, 15.33, 15.35, 15.205, 15.207, 15.209, 15.247.

The test methods, which have been used, are based on KDB 558074 D01 and ANSI C63.10-2009.

For details, see under each test item.

4.2 Operation Modes

Testing was performed at the lowest operating frequency (2402 MHz), at the operating frequency in the middle of the specified frequency band (2440 MHz) and at the highest operating frequency (2480 MHz). These operation modes were selected after review of the capabilities and characteristics of the EUT. The test software as mentioned in section 4.4 enabled the settings of these modes.

The EUT has been tested in the modes as described in table below

| Operation Mode | EUT Status | Frequency (MHz) | Air Data Rate | TX power |
|----------------|------------|-----------------|---------------|----------|
| Transmit (Tx) | On | 2402 | 1 Mbps | 0x7F |
| Transmit (Tx) | On | 2440 | 1 Mbps | 0x7F |
| Transmit (Tx) | On | 2480 | 1 Mbps | 0x7F |

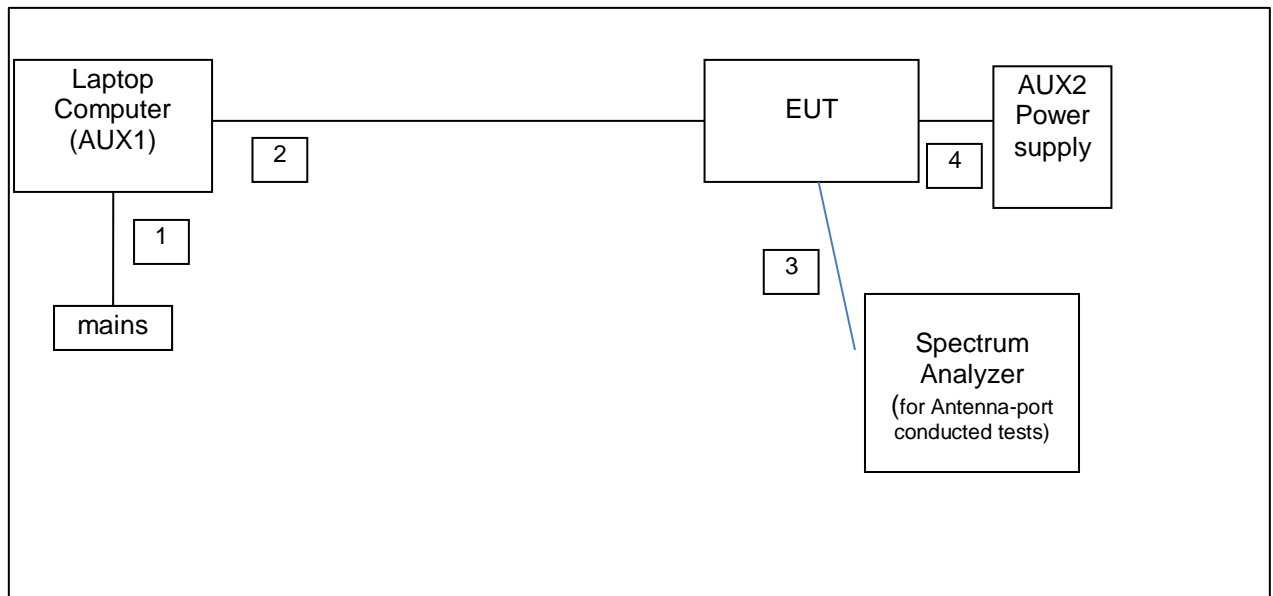
4.3 Physical Configuration for Testing

For programming purposes only the EUT was connected to the usb port of a laptop computer. The laptop computer was used to configure the EUT to continuously transmit at a specified output power and channel as specified in the testdata. See section 4.5 for Auxiliary details.

The EUT was tested on a stand-alone basis and the test system was configured in a way

The justification and manipulation of cables and equipment in order to simulate a worst-case behavior of the test setup has been carried out as prescribed in ANSI C63.10-2009 and KDB 558074 D01.

Figure 1a: Test Setup Diagram – antenna port conducted tests and programming.



| No. | Port | From | To | Remarks |
|-----|--------------|------------|-------------------|------------------------------|
| 1. | Mains | Mains | Laptop (AUX1) | Through a AC/DC power supply |
| 2. | Data com. | Laptop LAN | EUT LAN | -- |
| 3. | Antenna port | EUT | Spectrum analyzer | Conducted tests |
| 4. | Power supply | AUX2 | EUT mini usb | Vdc |

Test Report No.:

14071604.fcc01

Page 11 of 46

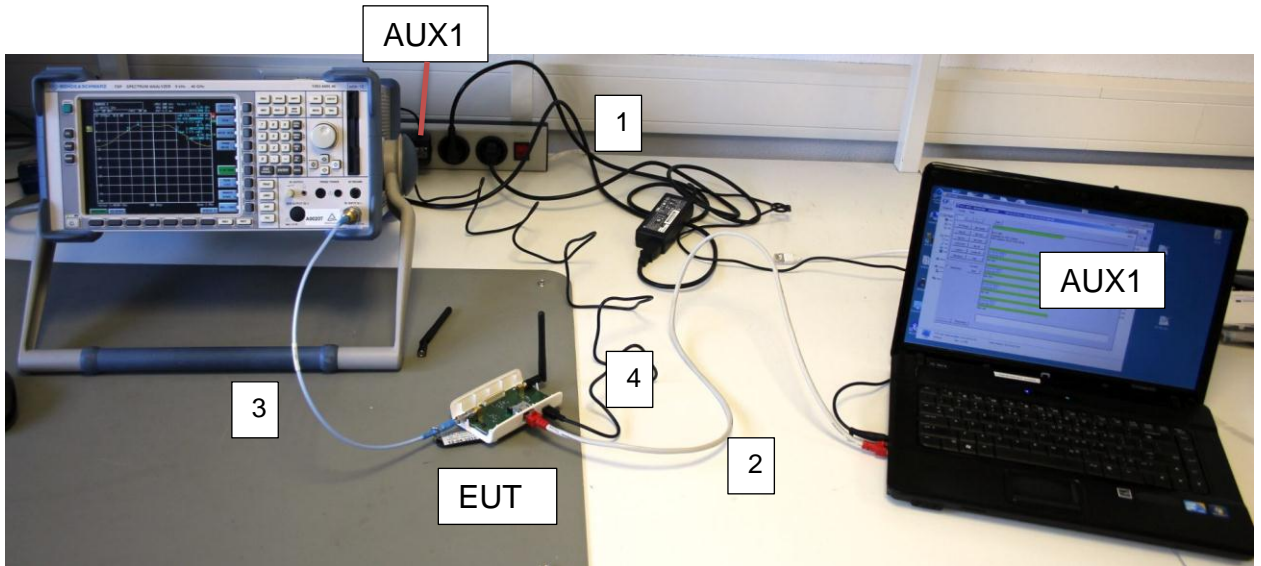


Figure 2a: Test Setup Photos – conducted tests and programming.

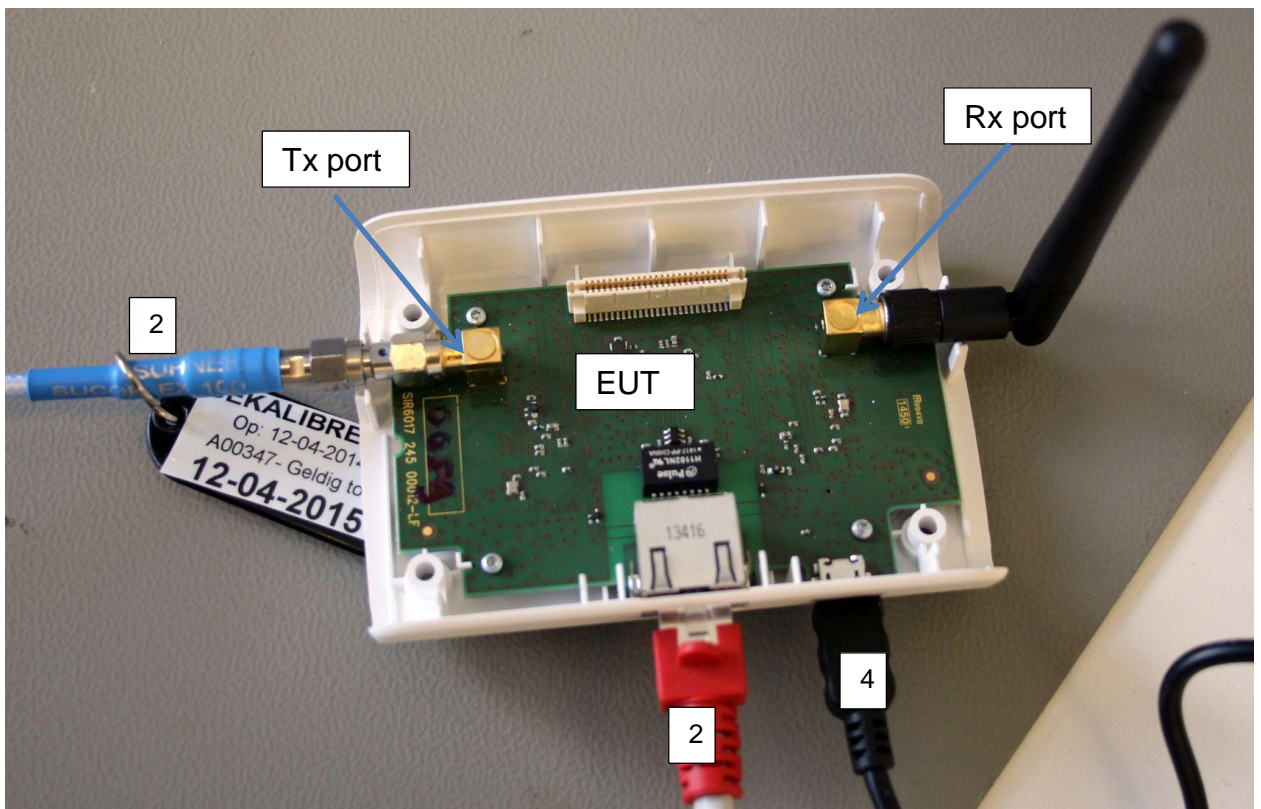


Figure 3b: Test Setup Photos – conducted tests and programming

*Test Report No.:***14071604.fcc01***Page 12 of 46*

4.4 Test Software

A continuous transmit mode could be initiated by using test software as supplied by the applicant. The test software was used to define various different operational modes of the EUT for the purpose of compliance testing. The version of the test software, as supplied by the applicant and used during all tests is:

Test software : OTC version 0.0.0.46

The depending software parameter for the representative highest output power configurations was stated as the command "Hci.par.txp" with the parameter "0x7F".

This software was running on a laptop computer (AUX1). It was used to enable the test operation modes listed in section 4.2 as appropriate.

*Test Report No.:***14071604.fcc01***Page 13 of 46*

4.5 Special Accessories and Auxiliary Equipment

The product has been tested together with the following additional accessories:

The auxiliary items were not used during testing, but instead are only used to make the required settings for testing. For setting the transmit frequency, enable hopping etc.

1. AUX1

Product: Laptop Computer
Brand: HP
Model: Compaq 610
Serial Number: CNU94710WB
Remark: host for testsoftware

2. AUX2

Product: AC/DC Adapter
Brand: --
Model: FW7662/05
Serial Number: --
Output: 5Vdc / 1.1 A
Remark: property applicant, as standard delivered with the EUT

Test Report No.:

14071604.fcc01

Page 14 of 46

5. Test Results

5.1 Conducted Measurements at Antenna Port

5.1.1 Conducted Output Power

RESULT: Pass

Date of testing: 2015-02-18

Requirements:

FCC 15.247(b)(3)

For systems using digital modulation in the 2400-2483.5 MHz band, the maximum peak output power is 1W (+30dBm).

Test procedure:

The Peak Conducted Output Power was measured using the method according to section 9.1.1 in KDB 558074 D01.

The maximum peak output power (conducted) was measured at the antenna connector with a spectrum analyzer. The final measurement takes into account the loss generated by all the involved cables.

Notes: $mW = 10^{(dBm/10)}$
 $dBm = 10 \times \log(mW)$

plots : Peak power plots,

Figures 1a, 1b and 1c show plots of the Peak Power outputs, correction factors (= 0.5dB Cableloss) included in the reading.

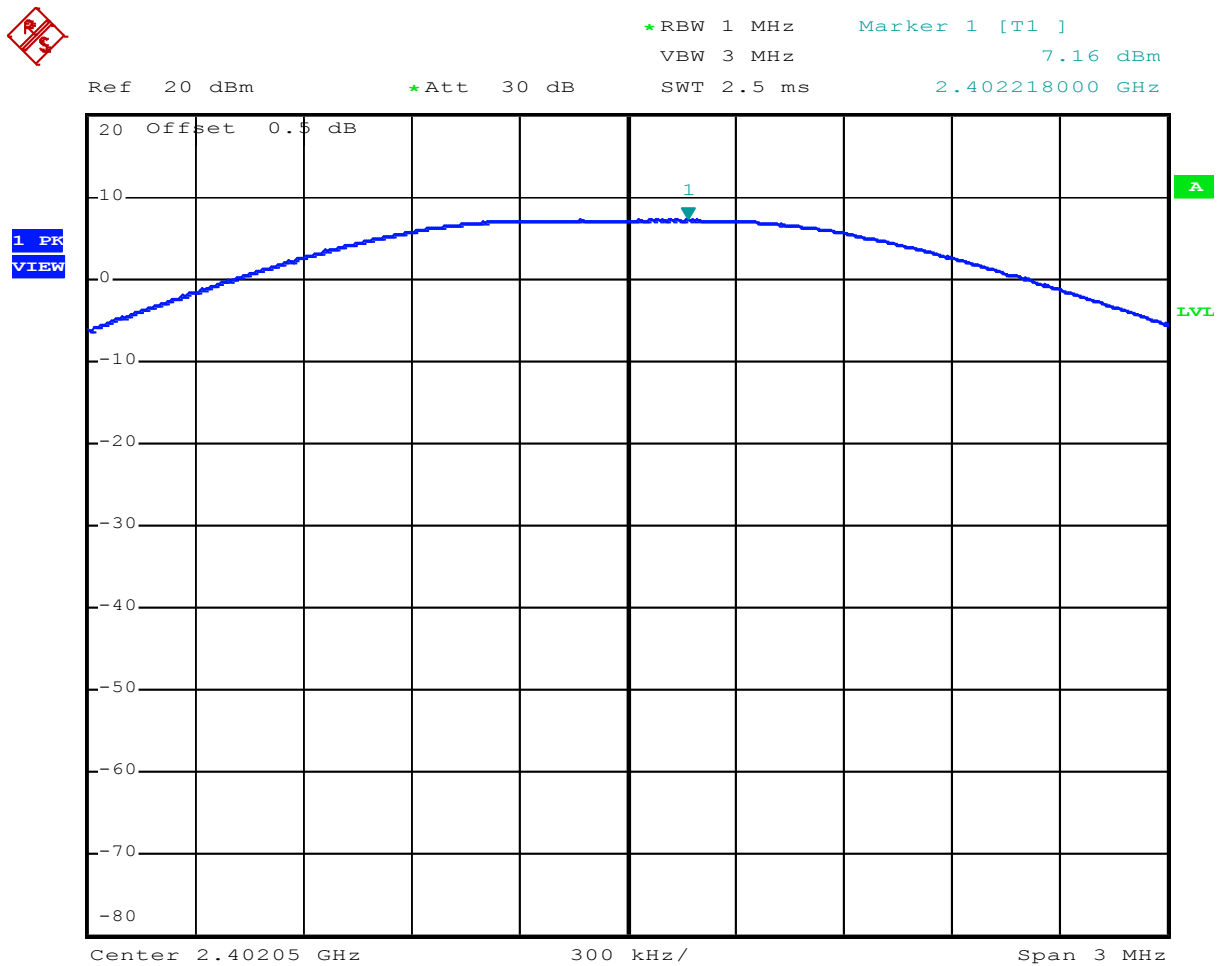
Test Report No.:

14071604.fcc01

Page 15 of 46

Conducted Output Power

| Frequency [MHz] | Output Power [dBm] | Limit [dBm] | Verdict [Pass/Fail] | Antenna Gain [dBi] | EIRP [dBm] | EIRP [mW] | Plot number |
|-----------------|--------------------|-------------|---------------------|--------------------|------------|-----------|-------------|
| 2402 | 7.16 | +30 | Pass | 2.0 | 9.16 | 8.2 | 1A |
| 2440 | 5.60 | +30 | Pass | 2.0 | 7.60 | 5.8 | 1B |
| 2480 | 4.05 | +30 | Pass | 2.0 | 6.05 | 2.5 | 1C |



Date: 18.FEB.2015 13:06:57

Plot A

Test Report No.:

14071604.fcc01

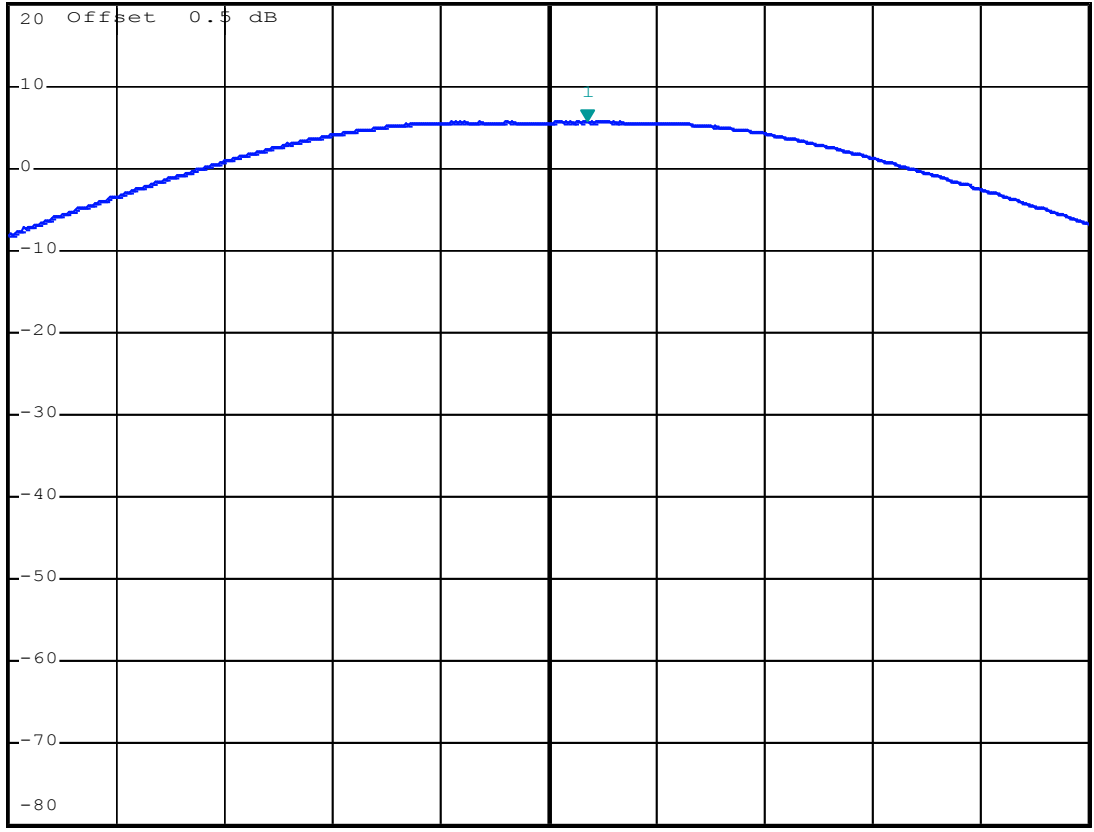
Page 16 of 46



*RBW 1 MHz Marker 1 [T1]
VBW 3 MHz 5.60 dBm
SWT 2.5 ms 2.440138000 GHz

Ref 20 dBm

*Att 30 dB



Center 2.44003 GHz 300 kHz/ Span 3 MHz

Date: 18.FEB.2015 13:08:08

Plot B

Test Report No.:

14071604.fcc01

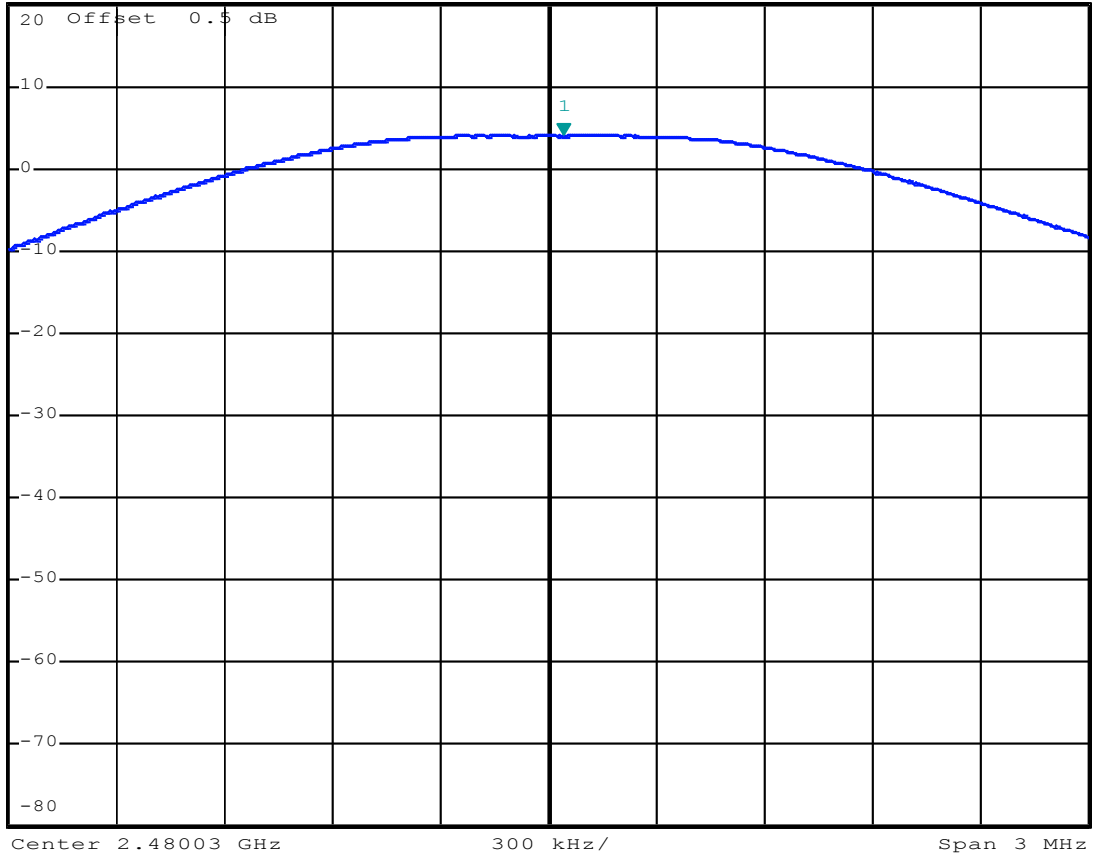
Page 17 of 46



*RBW 1 MHz Marker 1 [T1]
VBW 3 MHz 4.05 dBm
SWT 2.5 ms 2.480072000 GHz

Ref 20 dBm

*Att 30 dB



Date: 18.FEB.2015 13:09:16

Plot C

Test Report No.:

14071604.fcc01

Page 18 of 46

5.1.2 6dB and 99% Bandwidth

RESULT: PASS

Date of testing: 2015-02-18

Requirements:

FCC 15.247(a)(2)

For systems using digital modulation in the 2400-2483.5MHz band, the 6dB bandwidth shall be at least 500kHz.

For 20 dB Bandwidth: No requirement is given.

Test procedure 6dB bandwidth:

KDB 558074 D01 section 8.1 Option 1

A spectrum analyzer was connected to the antenna port of the EUT. The spectrum analyzer resolution bandwidth was set to 100kHz, video bandwidth to 300kHz and the span wide enough to capture the modulated carrier.

For 20 dB Bandwidth:

The transmitter shall be operated at its maximum carrier power measured under normal test conditions. The span of the analyzer shall be set to capture all products of the modulation process, including the emission skirts. The resolution bandwidth shall be set as close to 1% of the selected span as is possible without being below 1%. The video bandwidth shall be set to 3 times the resolution bandwidth. Video averaging is not permitted. Where practical, a sampling detector shall be used given that a peak or peak hold may produce a wider bandwidth than actual.

A spectrum analyzer was connected to the antenna port of the EUT. The spectrum analyzer resolution bandwidth was set to 1% of the selected span, Video bandwidth was set to 3 times the resolution bandwidth. The span was set to capture the whole modulation process. The Spectrum analyzers automated function for 20 dB BW was used.

Plots A1,B1 and C1 shown on the next pages are of the 6 dB bandwidth.

Plots A2,B2 and C2 shown on the next pages are of the 20 dB bandwidth

Test Report No.:

14071604.fcc01

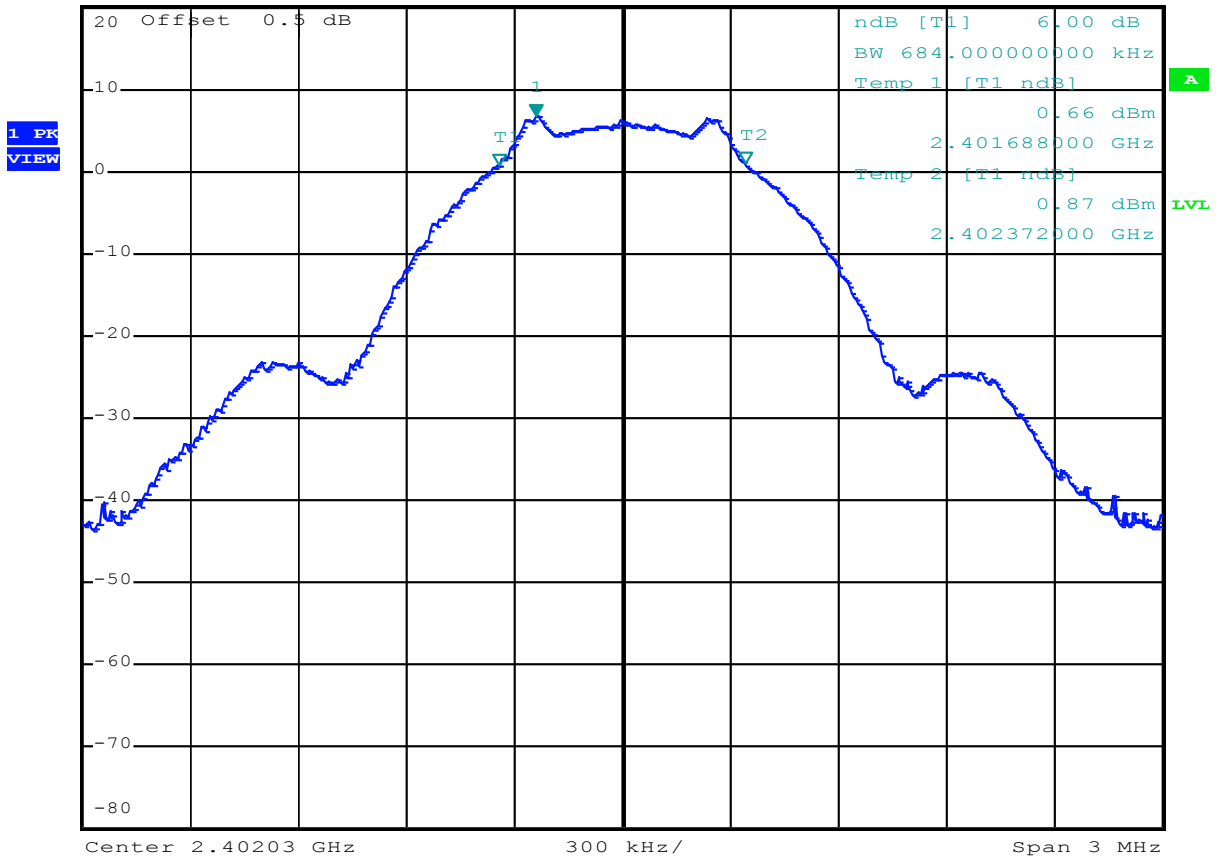
Page 19 of 46

6dB Bandwidth

| Operating Frequency [MHz] | 20 dB Bandwidth [kHz] | 6dB Bandwidth [kHz] | Limit [kHz] | Verdict [Pass/Fail] | Plot number |
|---------------------------|-----------------------|---------------------|-------------|---------------------|-------------|
| 2402 | 3920 | 684.0 | >500 | Pass | A1/A2 |
| 2440 | 3930 | 702.0 | >500 | Pass | B1/B2 |
| 2480 | 3920 | 678.0 | >500 | Pass | C1/C2 |



*RBW 100 kHz Marker 1 [T1]
 VBW 300 kHz 6.78 dBm
 Ref 20 dBm *Att 30 dB SWT 2.5 ms 2.401790000 GHz



Date: 18.FEB.2015 13:13:38

Plot A1

Test Report No.:

14071604.fcc01

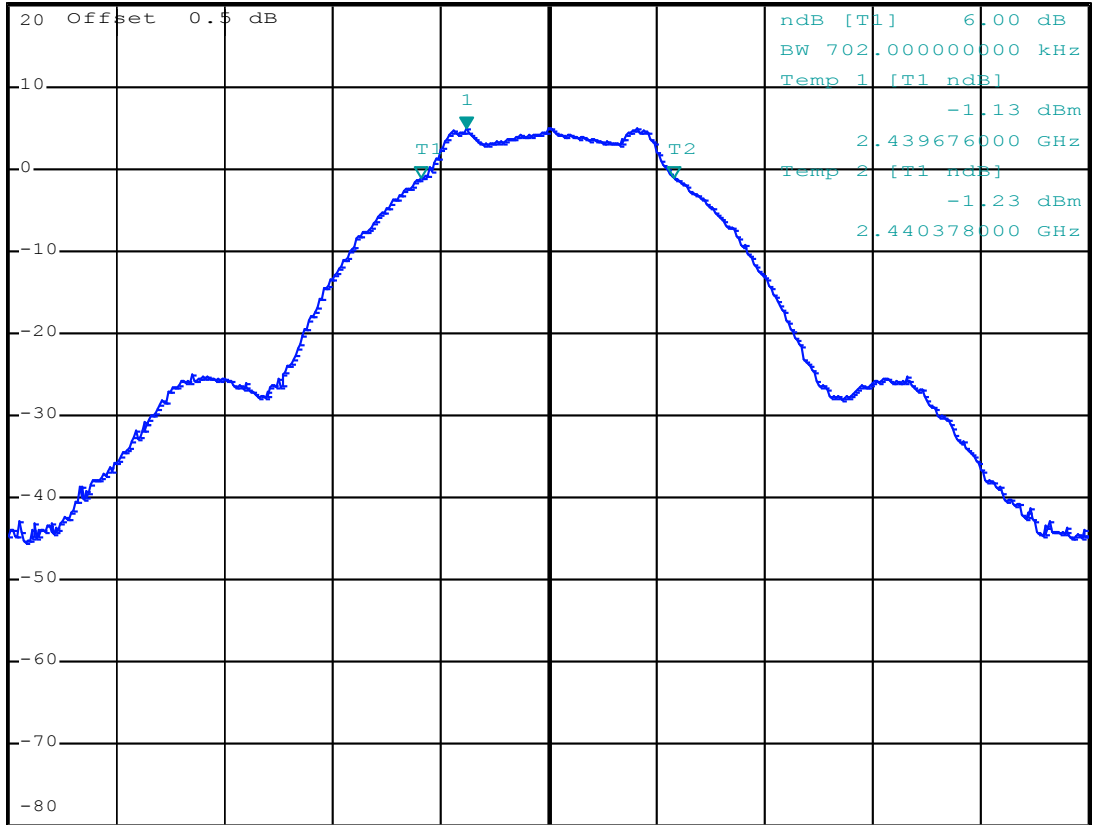
Page 20 of 46



*RBW 100 kHz Marker 1 [T1] 4.89 dBm
VBW 300 kHz
SWT 2.5 ms 2.439802000 GHz

Ref 20 dBm *Att 30 dB

1 PK
VIEW



Center 2.44003 GHz 300 kHz/ Span 3 MHz

Date: 18.FEB.2015 13:12:31

Plot B1

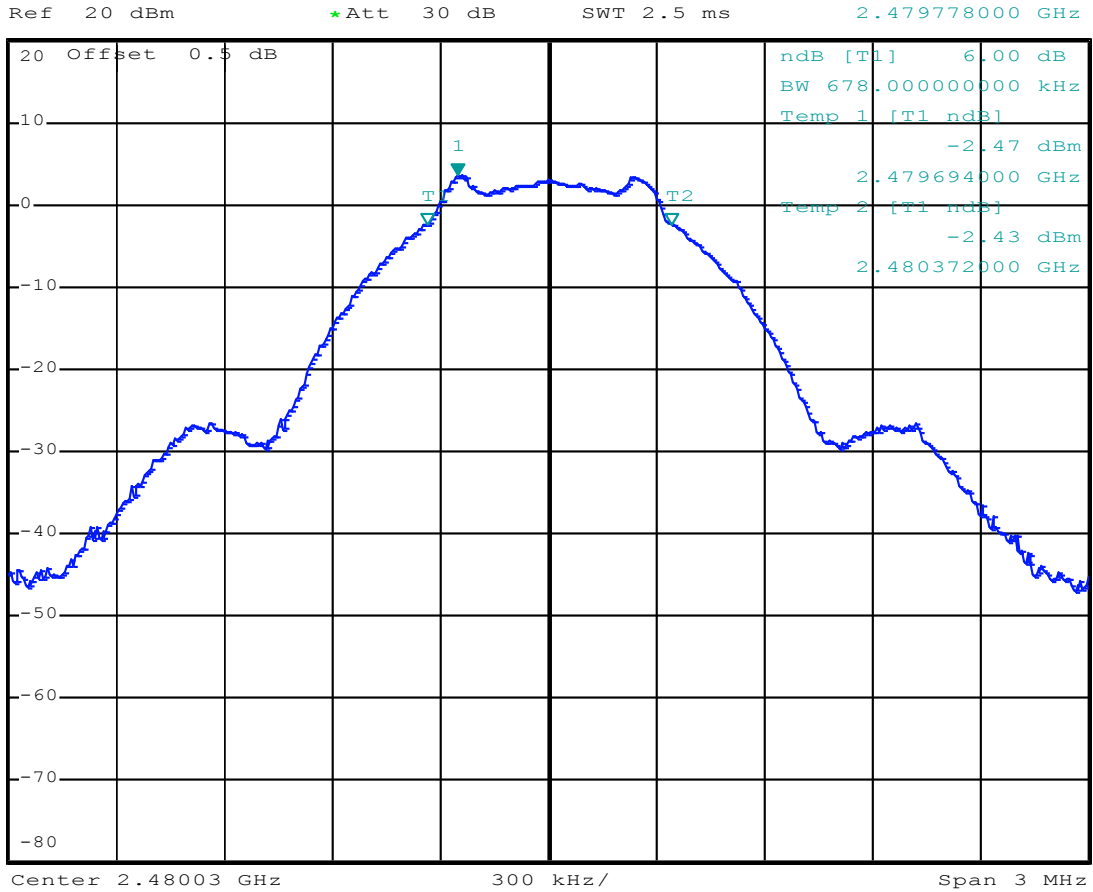
Test Report No.:

14071604.fcc01

Page 21 of 46



*RBW 100 kHz Marker 1 [T1] 3.60 dBm
VBW 300 kHz 2.479778000 GHz
*Att 30 dB SWT 2.5 ms 2.479778000 GHz



Date: 18.FEB.2015 13:11:07

Plot C1

Test Report No.:

14071604.fcc01

Page 22 of 46

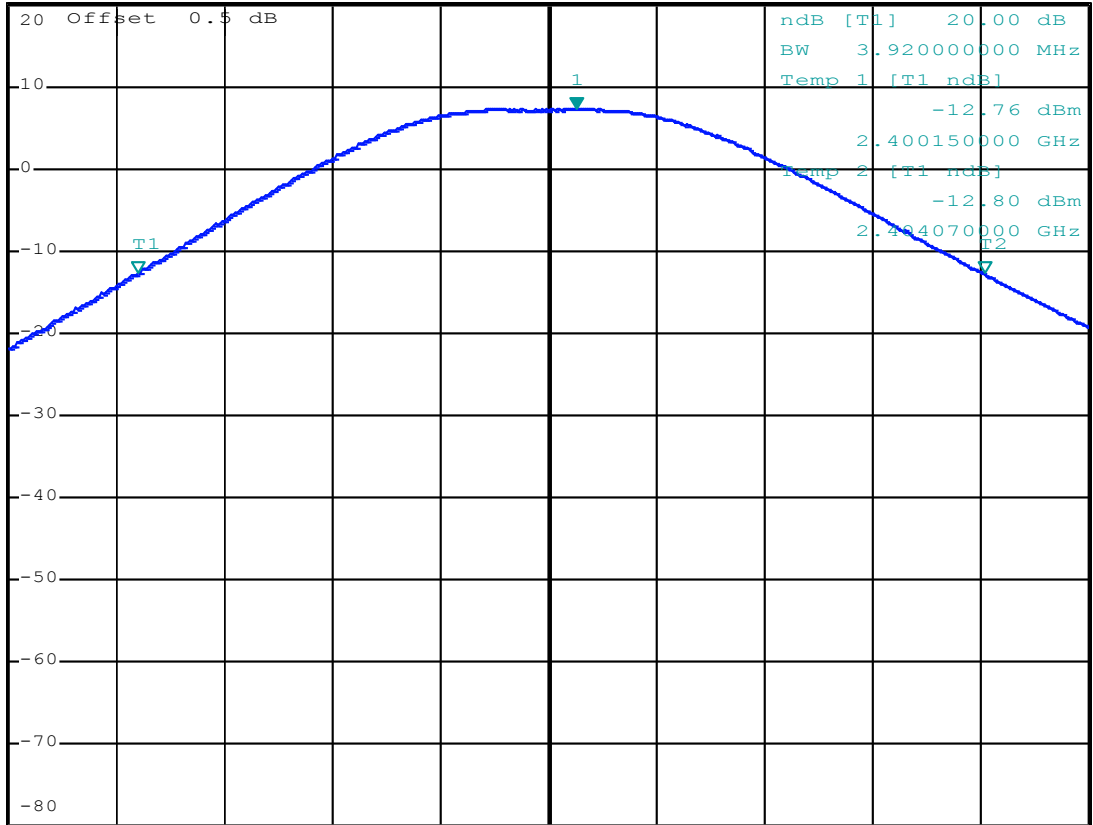


*RBW 1 MHz Marker 1 [T1] 7.19 dBm
VBW 3 MHz
SWT 2.5 ms 2.402180000 GHz

Ref 20 dBm

*Att 30 dB

1 PK
VIEW



Center 2.40205 GHz 500 kHz/ Span 5 MHz

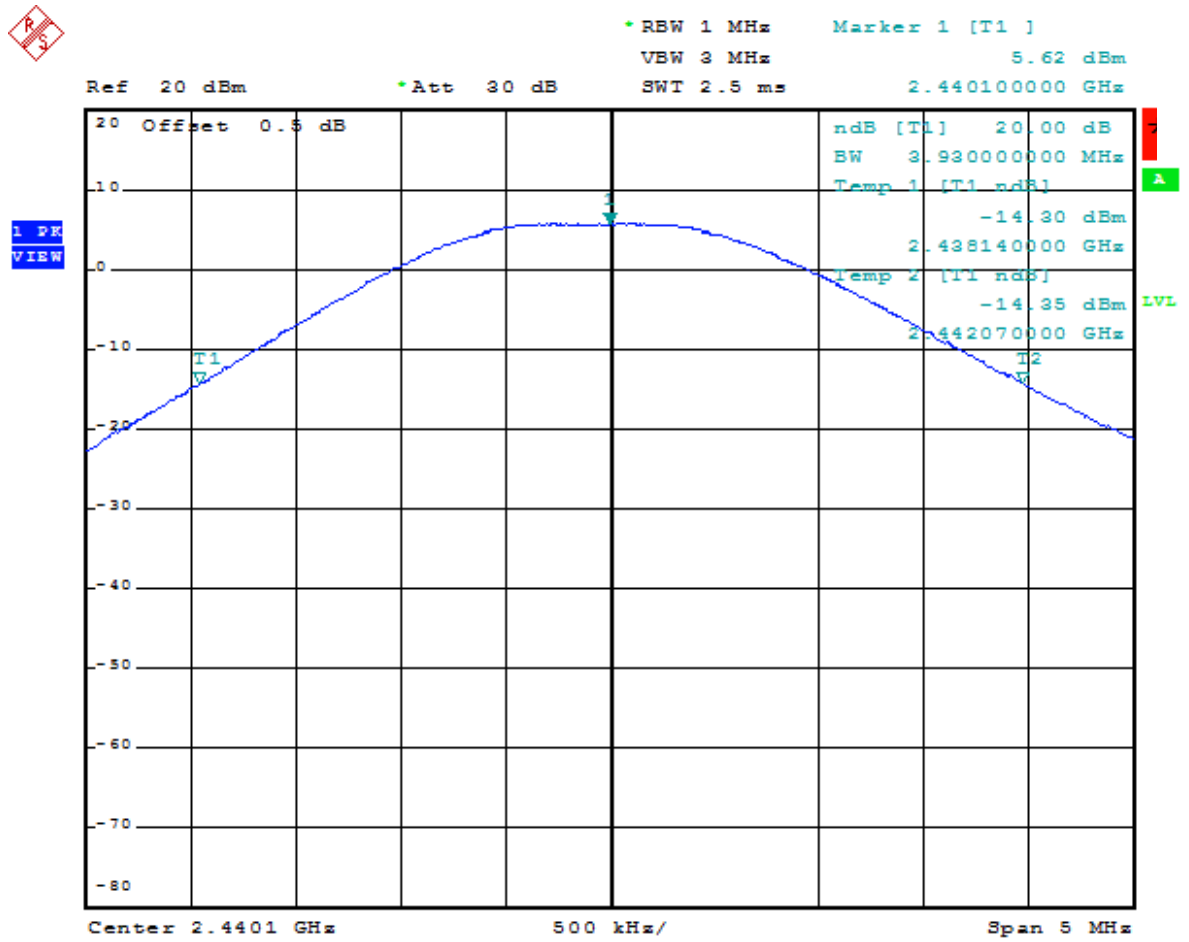
Date: 18.FEB.2015 12:48:00

Plot A2

Test Report No.:

14071604.fcc01

Page 23 of 46



Date: 18.FEB.2015 12:46:29

Plot B2

Test Report No.:

14071604.fcc01

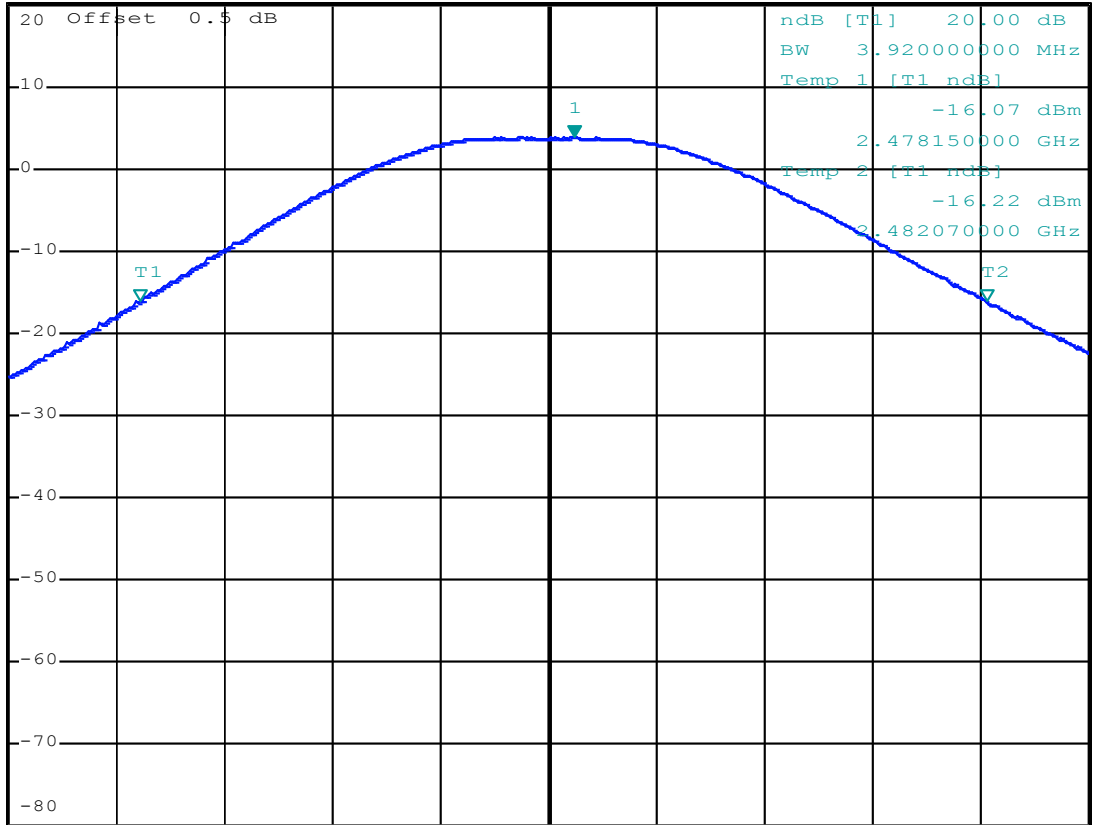
Page 24 of 46



*RBW 1 MHz Marker 1 [T1] 3.79 dBm
VBW 3 MHz
*Att 30 dB SWT 2.5 ms 2.480160000 GHz

Ref 20 dBm Offset 0.5 dB

1 PK
VIEW



Center 2.48004 GHz 500 kHz/ Span 5 MHz

Date: 18.FEB.2015 12:43:56

Plot C2

*Test Report No.:***14071604.fcc01***Page 25 of 46*

5.1.3 Peak Power Spectral Density

RESULT: PASS

Date of testing:

2015-02-18

Requirements:

FCC 15.247(e)

For digitally modulated systems, the power spectral density (PSD) conducted from the intentional radiator to the antenna shall not be greater than 8dBm in any 3kHz band during any time interval of continuous transmission.

Test procedure:

KDB 558074 D01

The section 10.2 PKPSD peak PSD procedure was used. A spectrum analyzer was connected to the antenna port of the EUT. The analyzer resolution bandwidth was set to 3kHz and the video bandwidth was set to 10kHz. The sweep time was set to auto couple and the trace was allowed to stabilize before making the final measurement. By using the Peak marker function the maximum amplitude was determined. The final measurement takes into account the loss generated by all the involved cables (0.5 dB).

Test Report No.:

14071604.fcc01

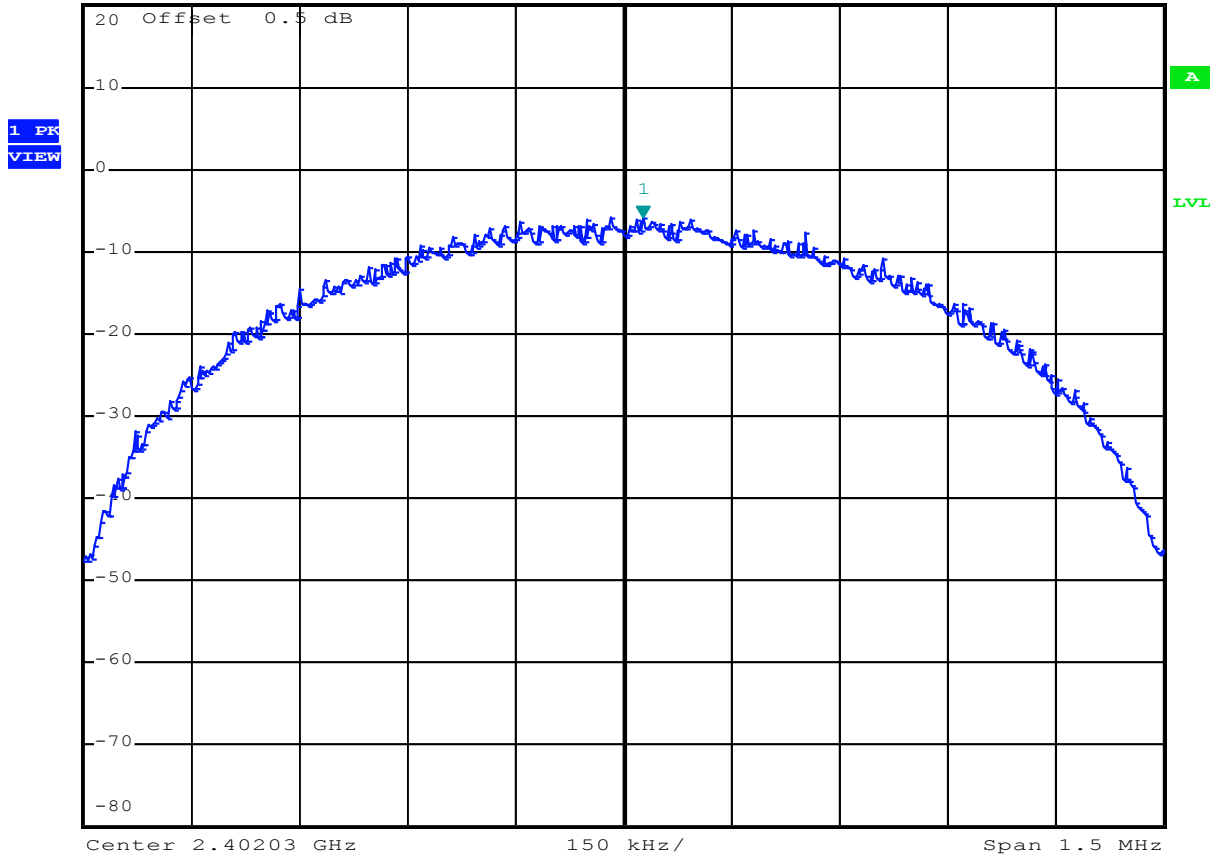
Page 26 of 46

Peak Power Spectral Density

| Operating Frequency [MHz] | Max PSD [dBm] | Limit [dBm] | Verdict [Pass/Fail] | Plot |
|---------------------------|---------------|-------------|---------------------|------|
| 2402 | -5.92 | 8 | Pass | A |
| 2440 | -7.01 | 8 | Pass | B |
| 2480 | -7.80 | 8 | Pass | C |



*RBW 3 kHz Marker 1 [T1]
 VBW 10 kHz -5.92 dBm
 Ref 20 dBm *Att 30 dB SWT 170 ms 2.402057000 GHz



Date: 18.FEB.2015 13:53:21

Plot A

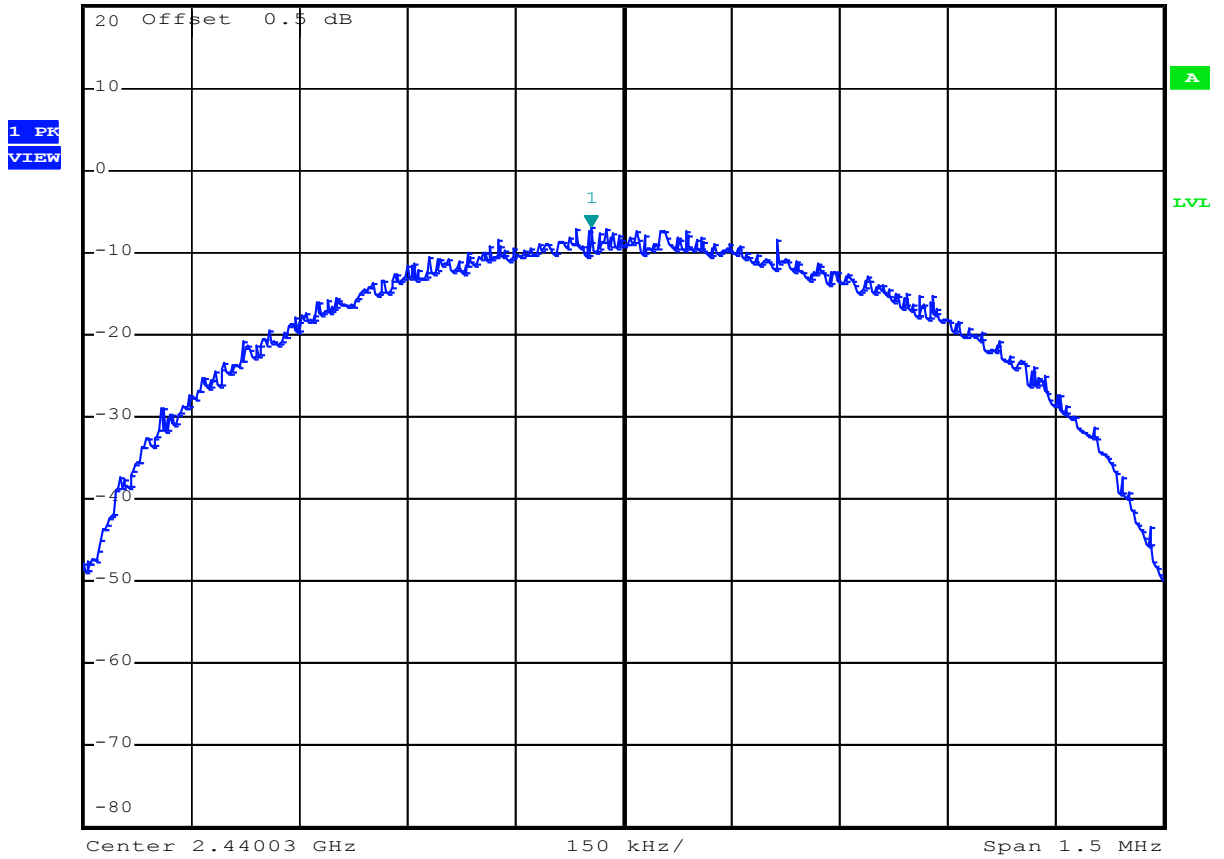
Test Report No.:

14071604.fcc01

Page 27 of 46



*RBW 3 kHz Marker 1 [T1]
VBW 10 kHz -7.01 dBm
*Att 30 dB SWT 170 ms 2.439985000 GHz



Date: 18.FEB.2015 13:51:58

Plot B

Test Report No.:

14071604.fcc01

Page 28 of 46

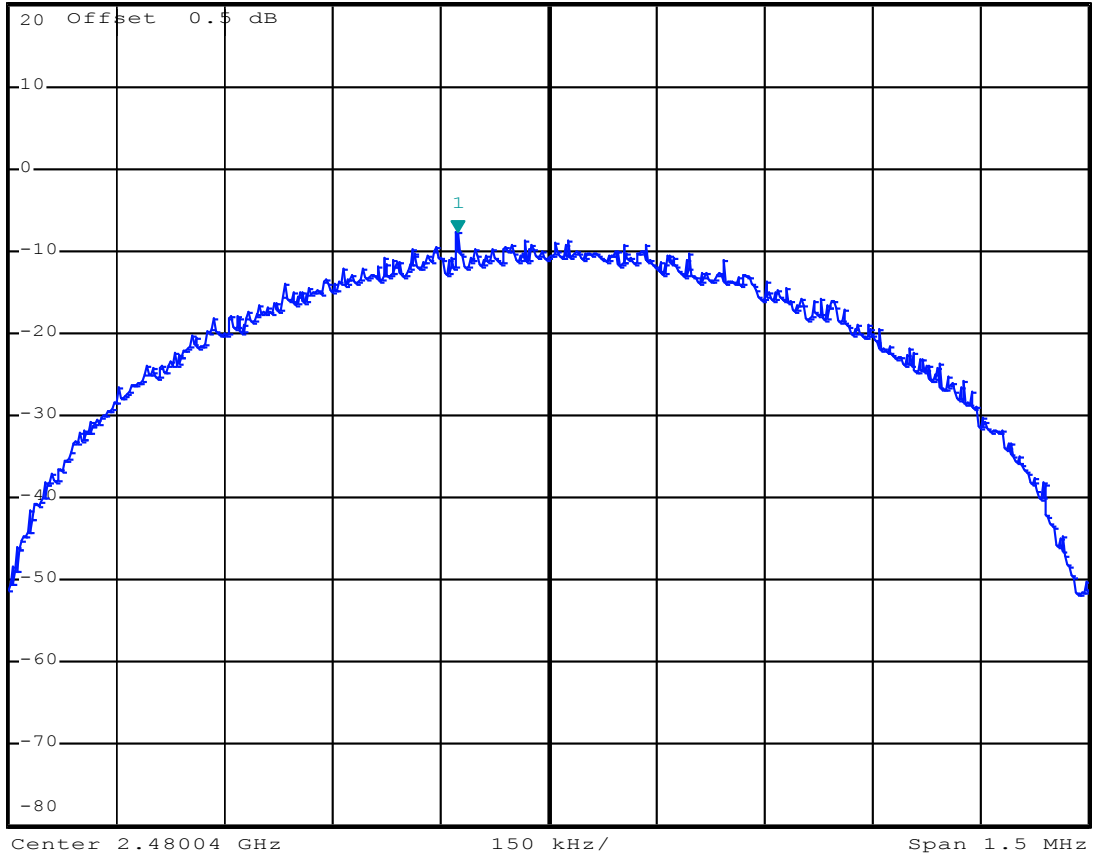


*RBW 3 kHz Marker 1 [T1]
VBW 10 kHz -7.80 dBm
SWT 170 ms 2.479914000 GHz

Ref 20 dBm

*Att 30 dB

1 PK
VIEW



Date: 18.FEB.2015 13:50:33

Plot C

*Test Report No.:***14071604.fcc01***Page 29 of 46*

5.1.4 Band Edge Conducted Emissions

RESULT: Pass

Date of testing: 2015-02-18

Requirements:

FCC 15.205, FCC 15.209, FCC 15.247(d)

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits.

Test procedure:

KDB 558074 D01 Section 13.2 and ANSI C63.10-2009

The marker-delta method, as described in ANSI C63.10 was used.

Measurements were performed using a spectrum analyzer with a suitable span to encompass the peak of the fundamental and using the following settings:
RBW = 100kHz, VBW = 300kHz.

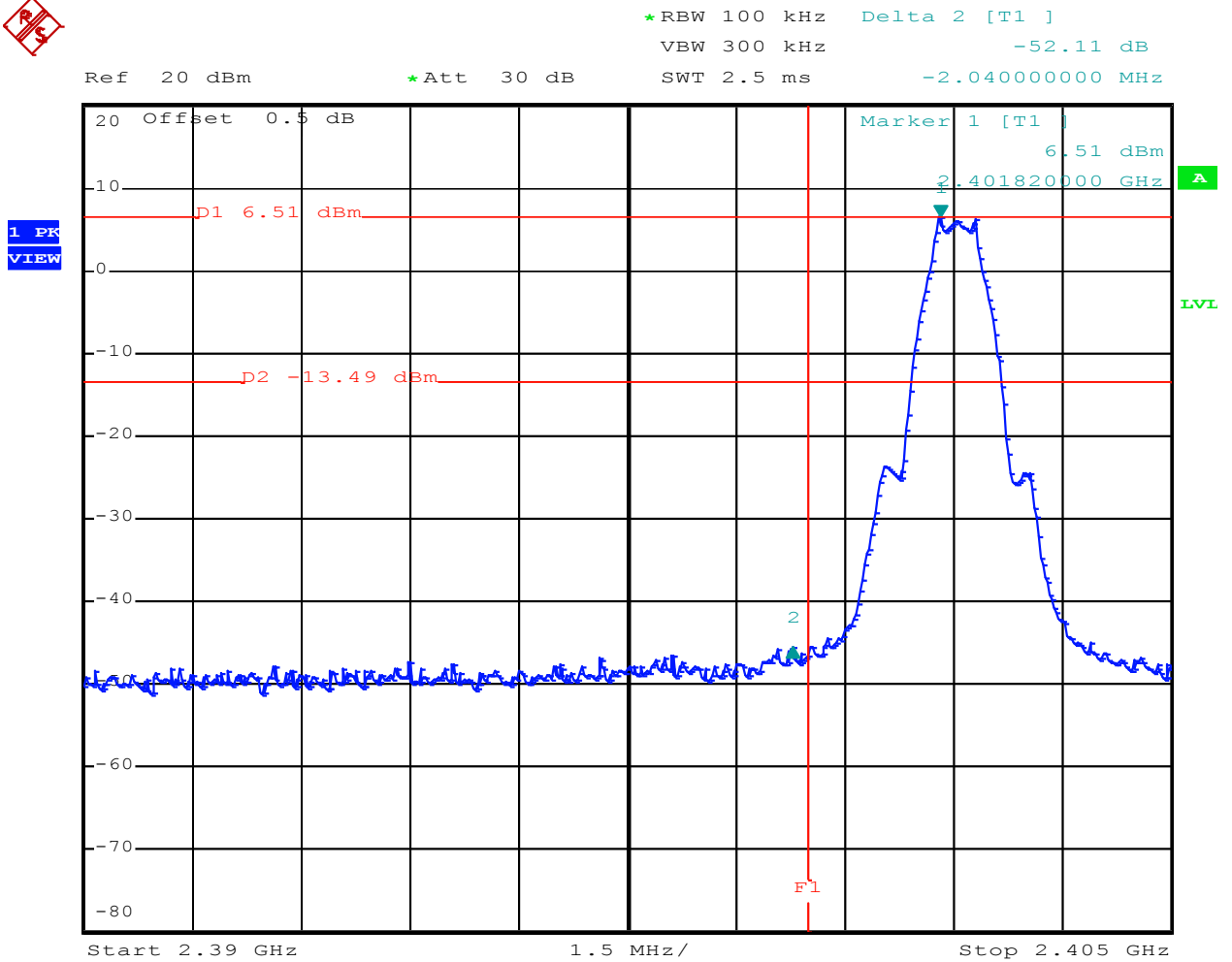
The highest emission amplitudes relative to the appropriate limit were measured and recorded in this report.

Results: All out of band spurious emissions are more than 20 dB below the fundamental. See the figures on the following pages.

Test Report No.:

14071604.fcc01

Page 30 of 46



Date: 18.FEB.2015 13:55:51

Plot: Band Edge Conducted Emission, Spectral Diagram, 2402 MHz

Plot showing more than 20 dB band edge attenuation.

F1 shows the band edge frequency of 2400 MHz.

Test Report No.:

14071604.fcc01

Page 31 of 46

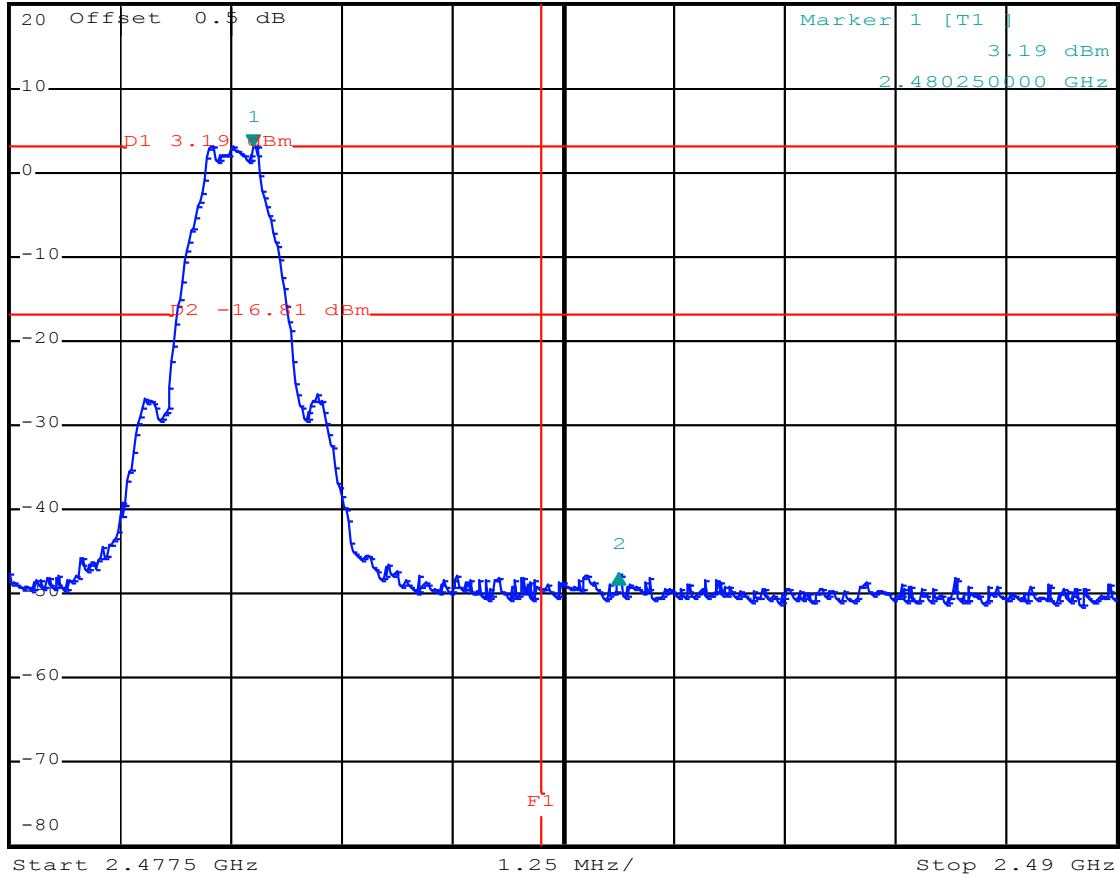


*RBW 100 kHz Delta 2 [T1]
VBW 300 kHz -50.86 dB
SWT 2.5 ms 4.12500000 MHz

Ref 20 dBm

*Att 30 dB

1 PK
VIEW



Date: 18.FEB.2015 13:58:39

Plot: Band Edge Conducted Emission, Spectral Diagram, 2480 MHz.

Plot showing more than 20 dB band edge attenuation.
F1 shows the band edge frequency of 2483,5 MHz.

Test Report No.:

14071604.fcc01

Page 32 of 46

5.1.5 Radiated Spurious Emissions of Transmitter

RESULT: Pass

Date of testing: 2015-02-24

Frequency range: 30MHz - 25GHz

Requirements:

FCC 15.209 and FCC 15.247(d)

Radiated emissions which fall outside the operation frequency band and outside restricted bands shall either meet the limit specified in FCC 15.209(a) or be attenuated at least 20dB below the power level in the 100kHz bandwidth within the band that contains the highest level of the desired power (the less severe limit applies).

Radiated emissions which fall in the restricted bands, as defined in FCC 15.205(a), must comply with the radiated emission limits specified in FCC 15.209(a).

Test procedure:

ANSI C63.10-2009

Before final measurements of radiated emissions were performed, the EUT was scanned to determine its emission spectrum profile. The physical arrangement of the test system, the associated cabling and the EUT orientation (X, Y, Z) were varied in order to ensure that maximum emission amplitudes were attained.

The spectrum was examined from 30MHz to the 10th harmonic of the highest fundamental transmitter frequency (25GHz). Final radiated emission measurements were made at 3m distance.

At each frequency where a spurious emission was found, the EUT was rotated 360° and the antenna was raised and lowered from 1 to 4m in order to determine the emission's maximum level. Measurements were taken using both horizontal and vertical antenna polarizations.

The highest emission amplitudes relative to the appropriate limit were recorded in this report. Field strength values of radiated emissions at frequencies not listed in the tables are more than 20 dB below the applicable limit. The levels are expressed in dBm which are derived from $\text{dBm} = E(\text{dB}\mu\text{V}/\text{m}) - 95.2\text{dB}$. Where Peak (Pk) values were at least 6 dB under the Average (Av) limits, Av value was not tested. Where Average values were tested, Average values were measured using a 10Hz Video Bandwidth.

Test Report No.:

14071604.fcc01

Page 33 of 46

Radiated Emissions, 30MHz - 1GHz, Horizontal and Vertical Antenna Orientations

| Frequency [MHz] | Antenna Orientation | Level QP [dB μ V/m] | Limit QP [dB μ V/m] | Verdict [Pass/Fail] |
|-----------------|---------------------|-------------------------|-------------------------|---------------------|
| 31.44 | Vertical | 30.0 | 40.0 | Pass |
| 39.50 | Vertical | 29.2 | 40.0 | Pass |
| 98.50 | Vertical | 25.4 | 43.5 | Pass |
| 181.04 | Vertical | 32.0 | 43.5 | Pass |
| 188.48 | Horizontal | 33.0 | 43.5 | Pass |
| 250.00 | Vertical | 33.2 | 46.0 | Pass |
| 375.00 | Horizontal | 41.0 | 46.0 | Pass |
| 464.00 | Horizontal | 35.0 | 46.0 | Pass |
| 466.30 | Vertical | 36.3 | 46.0 | Pass |
| 554.00 | Vertical | 37.8 | 46.0 | Pass |
| 624.00 | Horizontal | 45.5 | 46.0 | Pass |
| 625.00 | Vertical | 40.0 | 46.0 | Pass |
| 816.00 | Vertical | 31.0 | 46.0 | Pass |
| 925.00 | Vertical | 43.0 | 46.0 | Pass |
| 937.00 | Vertical | 40.0 | 46.0 | Pass |

- Note:
- Level QP = Reading QP + Factor
 - Tested in modes as described in section 4.2, the 6 highest values noted.
- Preliminary measurements indicated that the radiated emissions from EUT were not affected by the EUT's operating mode or frequency.
- Quasi Peak detector used with a bandwidth of 120 kHz.
 - The EUT was varied in 3 positions.

Test Report No.:

14071604.fcc01

Page 34 of 46

Radiated Emissions, 1 - 25GHz, Horizontal and Vertical Antenna Orientations, 2402 MHz.

| Frequency [MHz] | Antenna Orientation | Detector | Bandwidth (MHz) | Level [dBm] | Limit [dBm] | Result |
|----------------------|---------------------|----------|-----------------|-------------|--------------------------|--------|
| 1080.80 ^R | Vertical | Pk | 1 | -61.2 | -41.2 (Av) -21.2 (Pk) | Pass |
| 1440.80 ^R | Horizontal | Pk | 1 | -60.8 | -41.2 (Av) -21.2 (Pk) | Pass |
| 2341 ^R | Vertical | Pk | 1 | -52.9 | -41.2 (Av) -21.2 (Pk) | Pass |
| 4674 ^R | Vertical | Pk | 1 | -51.7 | -41.2 (Av) -21.2 (Pk) | Pass |
| 4700 ^R | Vertical | Pk | 1 | -52.6 | -41.2 (Av) -21.2 (Pk) | Pass |
| 11499 ^R | Vertical | Pk | 1 | -43.3 | -21.2 (Pk) | Pass |
| 11499 ^R | Vertical | Av | 1 | -58.0 | -41.2 (Av) | Pass |
| 17987 ^R | Vertical | Pk | 1 | -38.2 | -21.2 (Pk) | Pass |
| 17987 ^R | Vertical | Av | 1 | -51.6 | -41.2 (Av) | Pass |

Radiated Emissions, 1 - 25GHz, Horizontal and Vertical Antenna Orientations, 2440 MHz.

| Frequency [MHz] | Antenna Orientation | Detector | Bandwidth (MHz) | Level [dBm] | Limit [dBm] | Result |
|---------------------|---------------------|----------|-----------------|-------------|--------------------------|--------|
| 1088.1 ^R | Horizontal | Pk | 1 | -60.9 | -41.2 (Av) -21.2 (Pk) | Pass |
| 1440.6 ^R | Horizontal | Pk | 1 | -61.3 | -41.2 (Av) -21.2 (Pk) | Pass |
| 2335.3 ^R | Vertical | Pk | 1 | -55.0 | -41.2 (Av) -21.2 (Pk) | Pass |
| 5364 ^R | Vertical | Pk | 1 | -46.8 | -21.2 (Pk) | Pass |
| 5364 ^R | Vertical | Av | 1 | -71.5 | -41.2 (Av) | Pass |
| 11798 ^R | Vertical | Pk | 1 | -44.4 | -21.2 (Pk) | Pass |
| 11798 ^R | Vertical | Av | 1 | -64.4 | -41.2 (Av) | Pass |

Test Report No.:

14071604.fcc01

Page 35 of 46

Radiated Emissions, 1 - 25GHz, Horizontal and Vertical Antenna Orientations, 2480 MHz.

| Frequency [MHz] | Antenna Orientation | Detector | Bandwidth (MHz) | Level [dBm] | Limit [dBm] | Result |
|----------------------|---------------------|----------|-----------------|-------------|--------------------------|--------|
| 1080.0 ^R | Vertical | Pk | 1 | -60.3 | -41.2 (Av) -21.2 (Pk) | Pass |
| 1111.9 ^R | Vertical | Pk | 1 | -59.7 | -41.2 (Av) -21.2 (Pk) | Pass |
| 1439.3 ^R | Vertical | Pk | 1 | -60.3 | -41.2 (Av) -21.2 (Pk) | Pass |
| 4960.0 ^{HR} | Vertical | Pk | 1 | -57.7 | -41.2 (Av) -21.2 (Pk) | Pass |
| 11577.0 ^R | Vertical | Pk | 1 | -49.3 | -41.2 (Av) -21.2 (Pk) | Pass |
| 17335.7 | Vertical | Pk | 1 | -40.8 | -21.2 (Pk) | Pass |
| 17335.7 | Vertical | Av | 1 | -55.5 | -41.2 (Av) | Pass |
| 17943.6 ^R | Vertical | Pk | 1 | -38.4 | -21.2 (Pk) | Pass |
| 17943.6 ^R | Vertical | Av | 1 | -52.0 | -41.2 (Av) | Pass |

Radiated field strength measurements (1 - 25 GHz, E-field), EUT normal operation

| Frequency [MHz] | Antenna Orientation | Detector | Resolution Bandwidth (MHz) | Level [dBm] | Limit [dBm] | Result |
|---------------------|---------------------|----------|----------------------------|-------------|----------------------|--------|
| 1080.0 ^R | Vertical | Pk | 1 | -65.0 | -41.2 Av -21.2 Pk | Pass |
| 1110.1 ^R | Vertical | Pk | 1 | -62.0 | -41.2 Av -21.2 Pk | Pass |
| 1439.3 ^R | Vertical | Pk | 1 | -62.5 | -41.2 Av -21.2 Pk | Pass |
| 4884 ^{HR} | Vertical | Pk | 1 | -58.2 | -41.2 Av -21.2 Pk | Pass |
| 6966 | Vertical | Pk | 1 | -57.1 | -41.2 Av -21.2 Pk | Pass |
| 11490 | Vertical | Pk | 1 | -49.7 | -41.2 Av -21.2 Pk | Pass |

- Notes:
- R refers to a frequency in a restricted band,
 - H refers to a frequency which is a harmonic of the fundamental.
 - From pre-scan the worsed case situation proved to be EUT in horizontal position with its antenna's in vertical position.
 - Field strength values of radiated emissions not listed in the tables above are more than 20 dB below the applicable limit.

Test Report No.:

14071604.fcc01

Page 36 of 46

5.2 AC Power Line Conducted Measurements

RESULT: PASS.

Date of testing:

2015-02-19

Requirements: for equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 μ H/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the band edges.

| Frequency of Emission (MHz) | Conducted Limit (dB μ V) Quasi-Peak | Conducted Limit (dB μ V) Average |
|-----------------------------|---|--------------------------------------|
| 0.15 – 0.5 | 66 to 56* | 56 to 46* |
| 0.5 – 5 | 56 | 46 |
| 5 - 30 | 46 | 50 |

*Decreases with the logarithm of the frequency.

Test procedure:

ANSI C63.10-2009.

Each phase and neutral of the AC power line were measured with respect to ground. Measurements were performed using a 50 μ H / 50 Ω LISN. The frequency range from 150kHz to 30MHz was searched. The six highest EUT emissions relative to the limit were noted. The EUT was positioned at least 80cm from the LISN.

Test Report No.:

14071604.fcc01

Page 37 of 46

5.2.1 AC Power Line Conducted Emission of Transmitter

| Frequency (MHz) | Measurement results (dBµV) L1 | | Measurement results (dBµV) L2/Neutral | | Limits (dBµV) | | Verdict (Pass/Fail) |
|-----------------|-------------------------------|------|---------------------------------------|------|---------------|------|---------------------|
| | QP | AV | QP | AV | QP | AV | |
| | 0.15000 | 48.0 | 23.5 | 47.2 | 21.1 | 66.0 | |
| 0.21299 | 36.3 | 19.6 | 31.1 | 19.2 | 63.2 | 53.2 | Pass |
| 0.22342 | 30.0 | 20.0 | 33.9 | 19.2 | 62.8 | 52.8 | Pass |
| 0.29764 | 27.3 | 17.4 | 25.9 | 17.8 | 60.2 | 50.2 | Pass |
| 0.33812 | 25.0 | 20.0 | 25.8 | 18.3 | 59.2 | 49.2 | Pass |
| 0.61954 | 39.3 | 28.5 | 39.3 | 30.2 | 56.0 | 46.0 | Pass |

AC Power Line conducted emissions at 2402 MHz

| Frequency (MHz) | Measurement results (dBµV) L1 | | Measurement results (dBµV) L2/Neutral | | Limits (dBµV) | | Verdict (Pass/Fail) |
|-----------------|-------------------------------|------|---------------------------------------|------|---------------|------|---------------------|
| | QP | AV | QP | AV | QP | AV | |
| | 0.15000 | 49.1 | 23.2 | 47.4 | 22.6 | 66.0 | |
| 0.17313 | 35.0 | 25.0 | 33.2 | 14.0 | 65.0 | 55.0 | Pass |
| 0.22882 | 36.5 | 19.7 | 34.5 | 18.8 | 62.4 | 52.4 | Pass |
| 0.30728 | 28.1 | 18.2 | 25.0 | 15.0 | 60.0 | 50.0 | Pass |
| 0.62449 | 38.9 | 28.5 | 38.2 | 29.3 | 56.0 | 46.0 | Pass |
| 1.23917 | 29.9 | 20.9 | 25.7 | 18.6 | 56.0 | 46.0 | Pass |

AC Power Line conducted emissions at 2440 MHz

| Frequency (MHz) | Measurement results (dBµV) L1 | | Measurement results (dBµV) L2/Neutral | | Limits (dBµV) | | Verdict (Pass/Fail) |
|-----------------|-------------------------------|------|---------------------------------------|------|---------------|------|---------------------|
| | QP | AV | QP | AV | QP | AV | |
| | 0.15000 | 48.5 | 24.2 | 45.6 | 22.2 | 66.0 | |
| 0.17591 | 34.1 | 21.7 | 34.0 | 20.0 | 64.5 | 54.5 | Pass |
| 0.18899 | 28.8 | 17.0 | 30.0 | 17.1 | 64.0 | 54.0 | Pass |
| 0.21989 | 35.4 | 19.7 | 34.1 | 19.0 | 62.8 | 52.8 | Pass |
| 0.22342 | 35.2 | 19.8 | 35.0 | 18.0 | 62.8 | 52.8 | Pass |
| 0.61954 | 39.0 | 28.1 | 39.1 | 30.3 | 56.0 | 46.0 | Pass |

AC Power Line conducted emissions at 2480 MHz

Test Report No.:

14071604.fcc01

Page 38 of 46

| Frequency (MHz) | Measurement results (dBµV) L1 | | Measurement results (dBµV) L2/Neutral | | Limits (dBµV) | | Verdict (Pass/Fail) |
|-----------------|-------------------------------|------|---------------------------------------|------|---------------|------|---------------------|
| | QP | AV | QP | AV | QP | AV | |
| 0.15000 | 48.1 | 24.3 | 46.0 | 23.0 | 66.0 | 56.0 | Pass |
| 0.15120 | 46.8 | 23.0 | 46.8 | 23.0 | 66.0 | 56.0 | Pass |
| 0.16904 | 40.5 | 23.0 | 40.0 | 20.0 | 65.0 | 55.0 | Pass |
| 0.21130 | 30.0 | 20.0 | 30.7 | 20.4 | 63.2 | 53.2 | Pass |
| 0.21814 | 34.6 | 20.2 | 32.0 | 20.5 | 62.8 | 52.8 | Pass |
| 0.62949 | 38.0 | 27.4 | 38.2 | 30.0 | 56.0 | 46.0 | Pass |

AC Power Line conducted emissions in Normal mode

The results of the conducted emission tests, carried out in accordance with 47 CFR Part 15 section 15.207(a), at the 120 Volts/ 60 Hz AC mains connection terminals of the EUT, are depicted in the tables above.

Notes:

1. The resolution bandwidth used was 9 kHz.
2. Worst case values noted.
3. Plots are provided on the next pages.

Test Report No.:

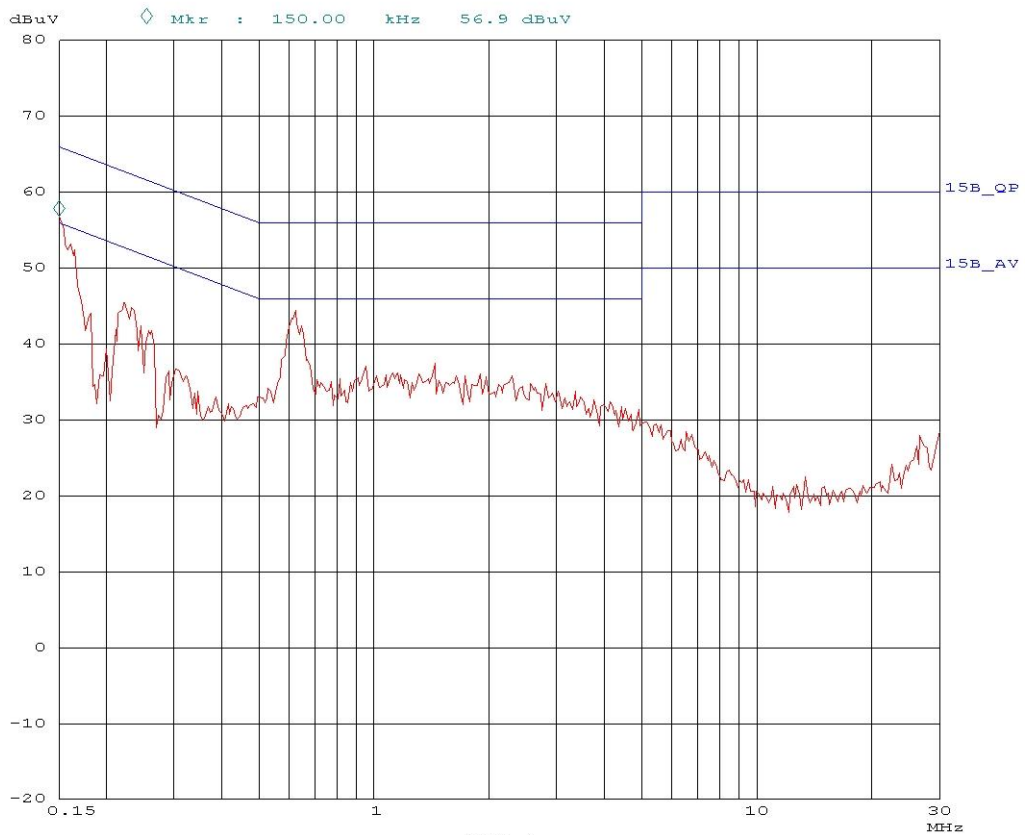
14071604.fcc01

Page 39 of 46

5.2.2 Plots of the AC Power-line Conducted Emissions

19. Feb 15 11:05

```
Scan Settings (1 Range)
|----- Frequencies -----|----- Receiver Settings -----|
| Start   Stop      Step      IF BW  Detector  M-Time  Atten  Preamp
| 150k    30M        0.8%    9k     PK        20ms   AUTO  LN   ON
Final Measurement: x QP
                   Meas Time: 1 s
                   Subranges: 25
                   Acc Margin: 6dB
```



Plot of the AC Power-line Conducted emissions on L1 at 2402 MHz.

Test Report No.:

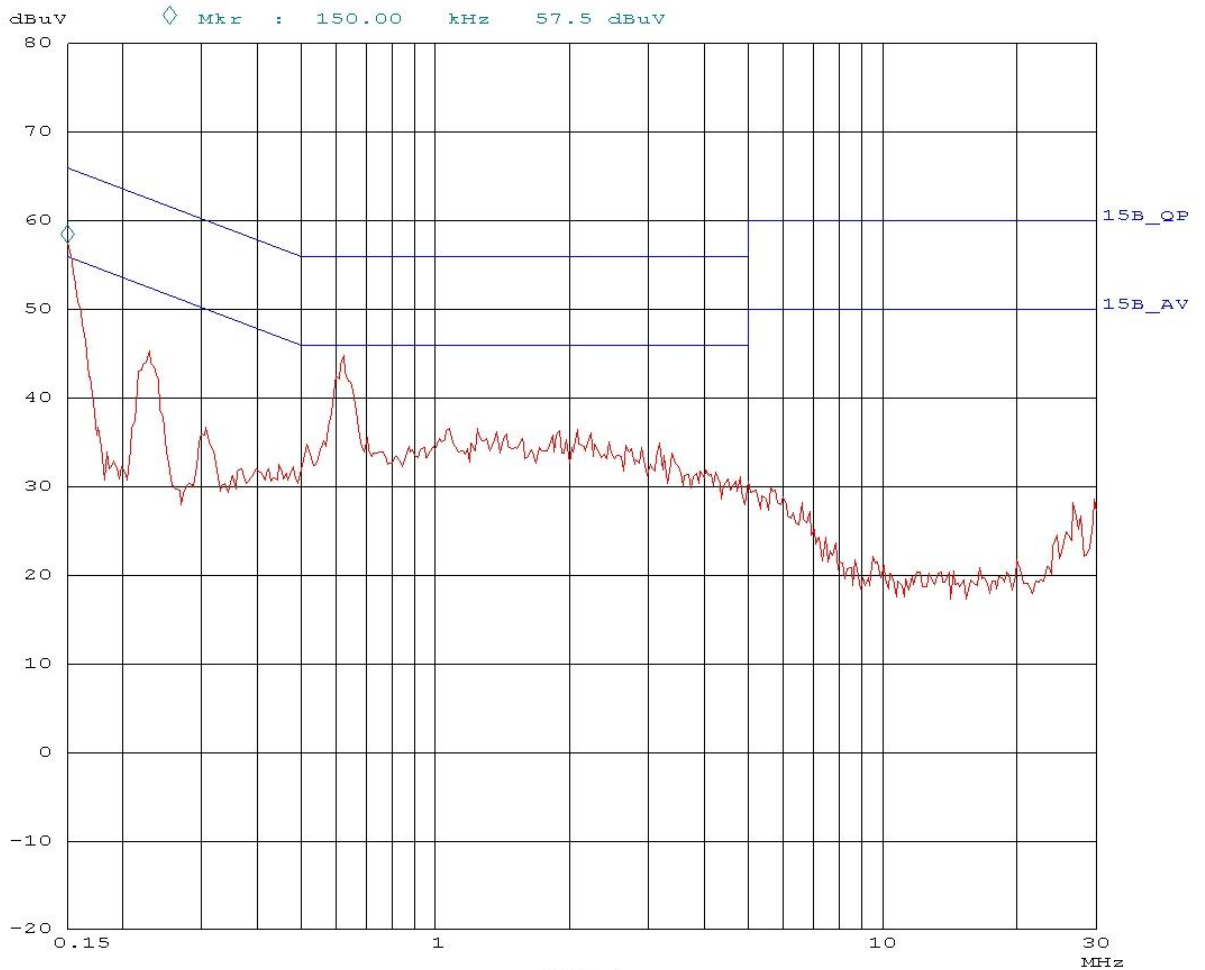
14071604.fcc01

Page 40 of 46

19. Feb 15 10:32

```
Scan Settings (1 Range)
|----- Frequencies -----| |----- Receiver Settings -----|
  Start      Stop      Step      IF BW  Detector  M-Time  Atten  Preamp
 150k        30M        0.8%      9k     PK        20ms  AUTO  LN   ON

Final Measurement: x QP
                   Meas Time: 1 s
                   Subranges: 25
                   Acc Margin: 6dB
```



PAGE 1

Plot of the AC Power-line Conducted emissions on L1 at 2440 MHz.

Test Report No.:

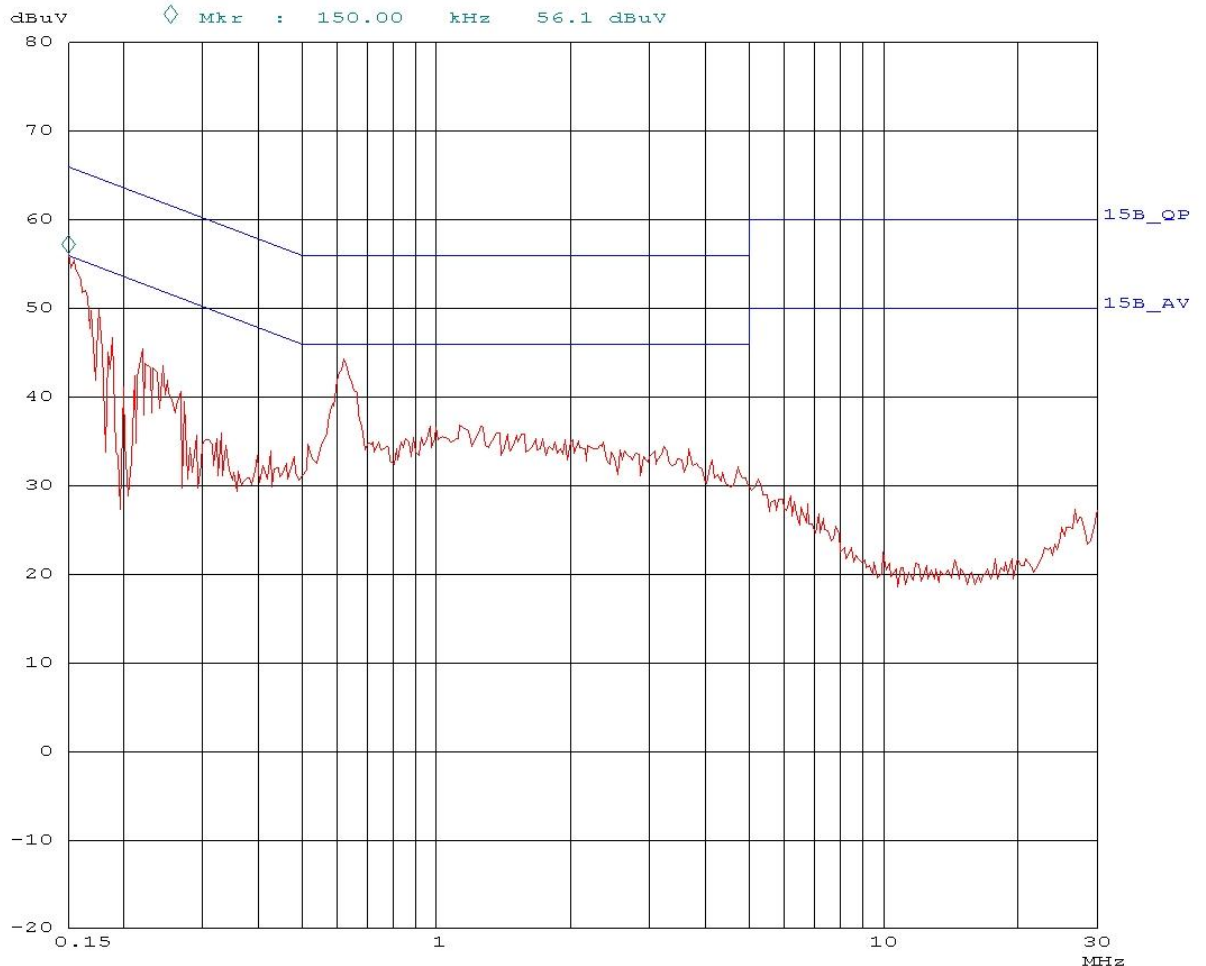
14071604.fcc01

Page 41 of 46

19. Feb 15 11:17

```
Scan Settings (1 Range)
|----- Frequencies -----| |----- Receiver Settings -----|
  Start      Stop      Step      IF BW  Detector  M-Time  Atten  Preamp
  150k       30M       0.8%     9k     PK       20ms  AUTO  LN   ON

Final Measurement:  x QP
                    Meas Time:  1 s
                    Subranges:  25
                    Acc Margin:  6dB
```



Plot of the AC Power-line Conducted emissions on L1 at 2480 MHz.

Test Report No.:

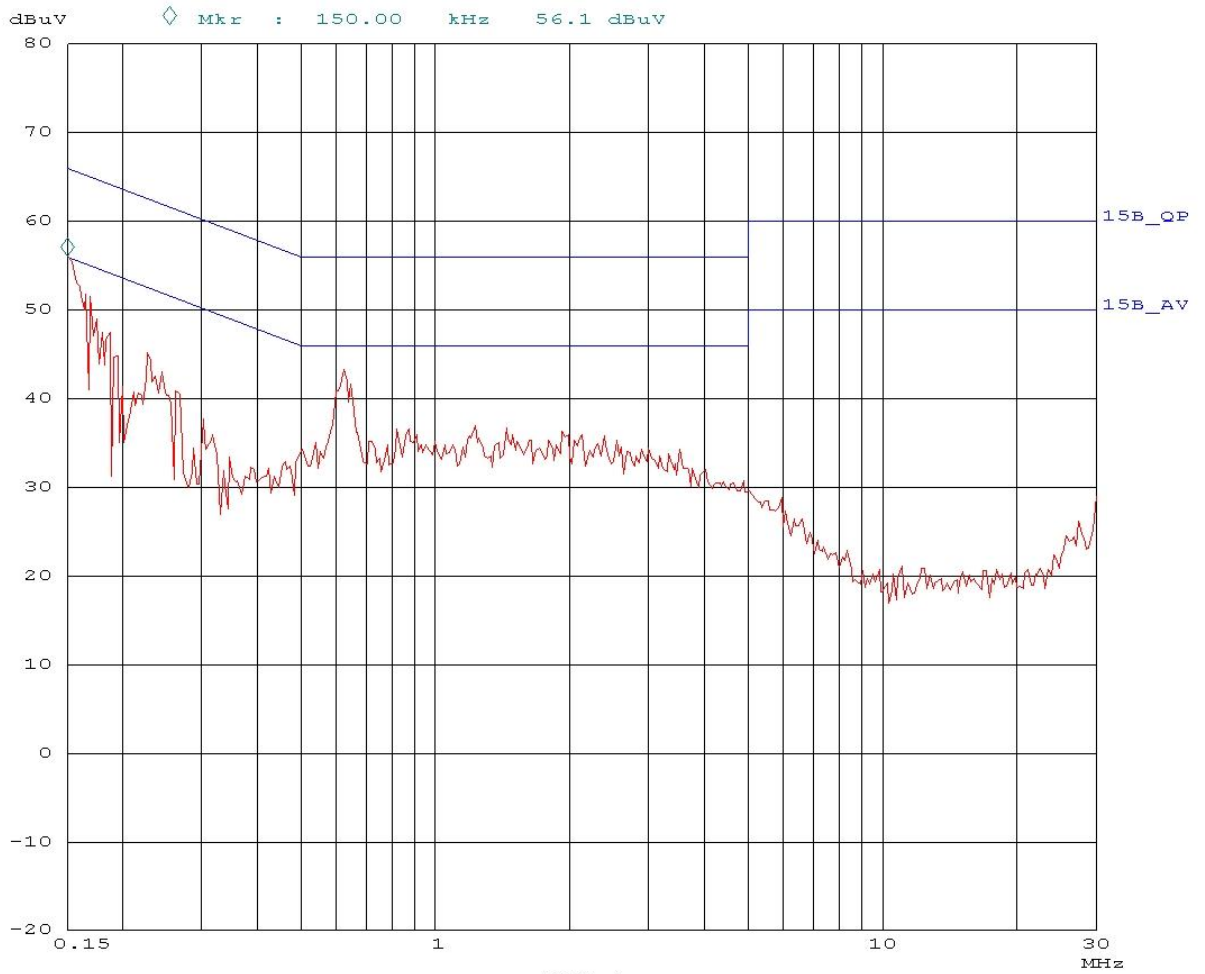
14071604.fcc01

Page 42 of 46

19. Feb 15 11:43

```
Scan Settings (1 Range)
|----- Frequencies -----| |----- Receiver Settings -----|
  Start      Stop      Step      IF BW  Detector  M-Time  Atten  Preamp
  150k       30M       0.8%    9k     PK        20ms  AUTO  LN   ON

Final Measurement: x QP
                   Meas Time: 1 s
                   Subranges: 25
                   Acc Margin: 6dB
```



Plot of the AC Power-line Conducted emissions on L1 in Normal mode.

Test Report No.:

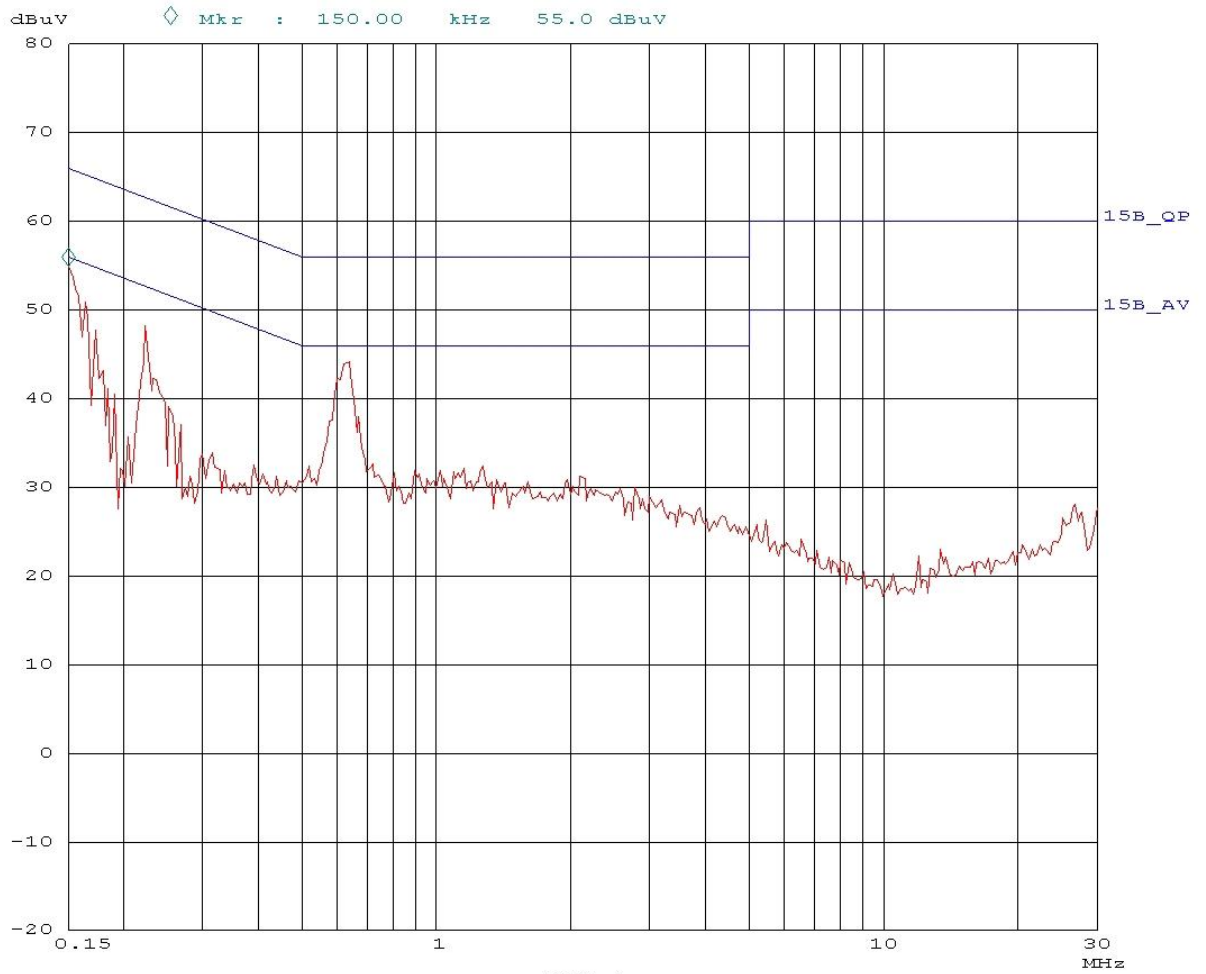
14071604.fcc01

Page 43 of 46

19. Feb 15 10:49

```
Scan Settings (1 Range)
|----- Frequencies -----| |----- Receiver Settings -----|
  Start      Stop      Step      IF BW  Detector  M-Time  Atten Preamp
  150k       30M       0.8%     9k     PK       20ms  AUTO LN  ON

Final Measurement: x QP
                   Meas Time: 1 s
                   Subranges: 25
                   Acc Margin: 6dB
```



Plot of the AC Power-line Conducted emissions on L2 at 2402 MHz

Test Report No.:

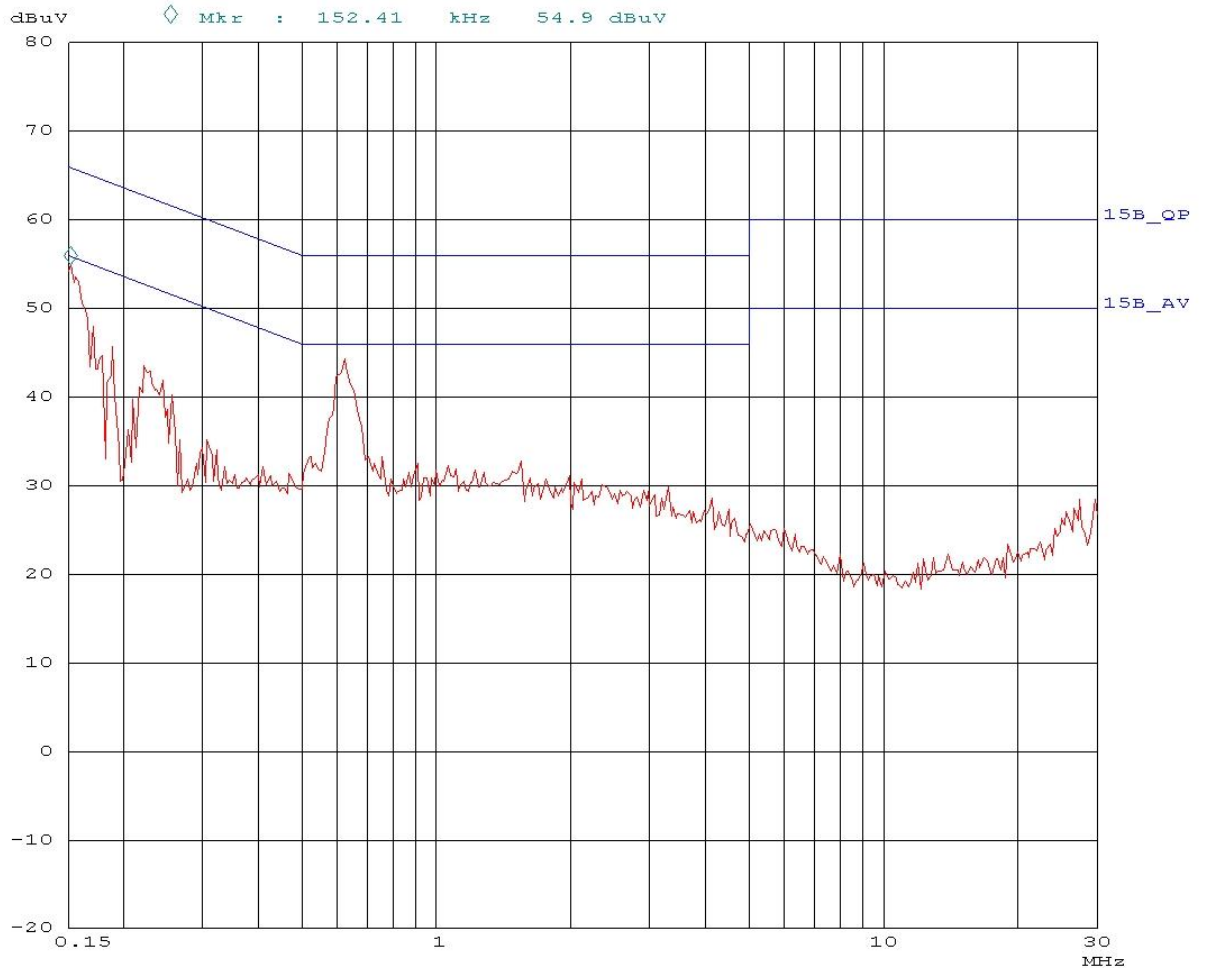
14071604.fcc01

Page 44 of 46

19. Feb 15 11:29

```
Scan Settings (1 Range)
|----- Frequencies -----| |----- Receiver Settings -----|
  Start      Stop      Step      IF BW  Detector  M-Time  Atten  Preamp
  150k       30M       0.8%     9k     PK        20ms  AUTO  LN   ON

Final Measurement:  x QP
                    Meas Time:  1 s
                    Subranges:  25
                    Acc Margin:  6dB
```



Plot of the AC Power-line Conducted emissions on L2 at 2480 MHz

Test Report No.:

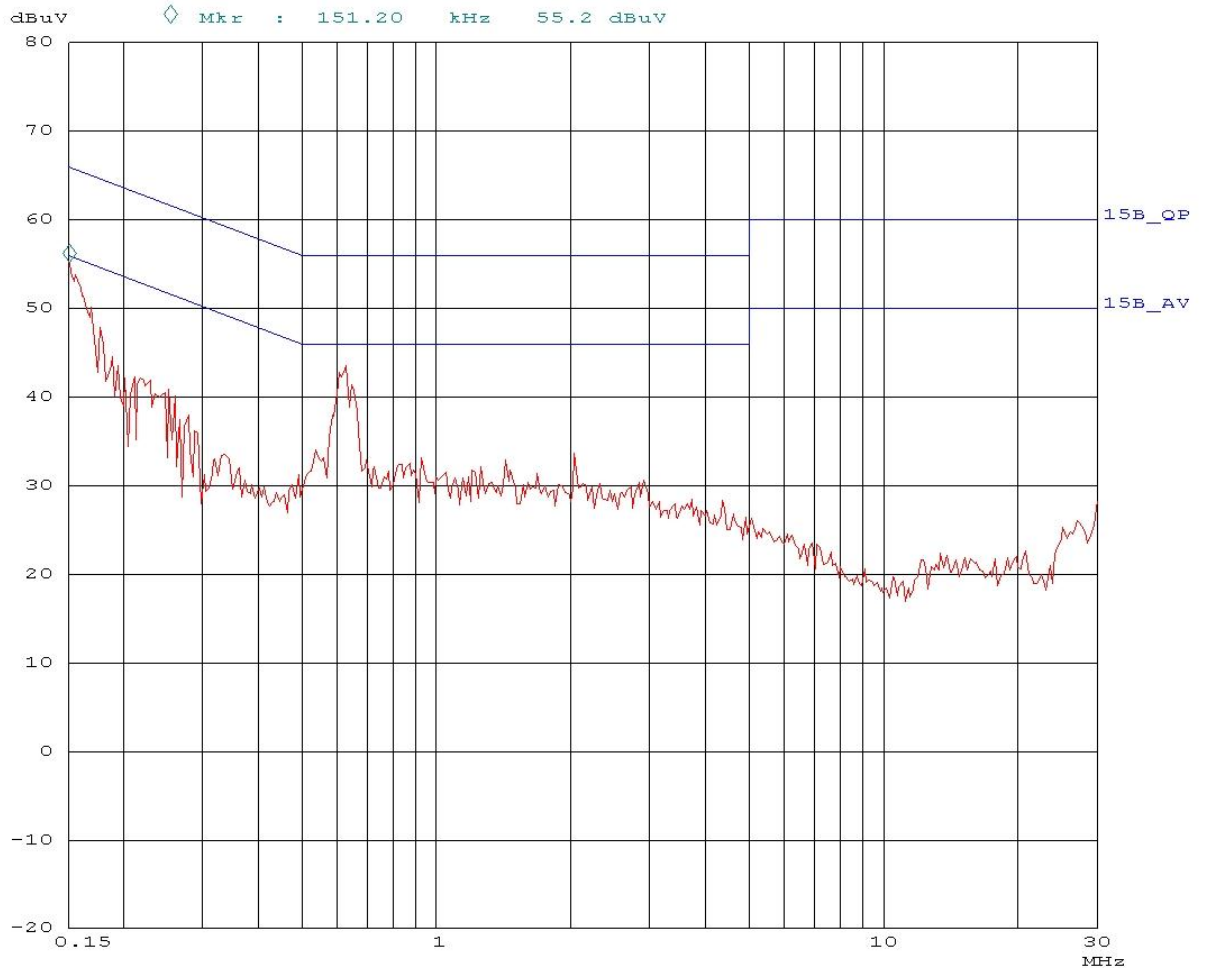
14071604.fcc01

Page 45 of 46

19. Feb 15 11:34

```
Scan Settings (1 Range)
|----- Frequencies -----| |----- Receiver Settings -----|
  Start      Stop      Step      IF BW  Detector  M-Time  Atten  Preamp
  150k       30M        0.8%     9k     PK        20ms  AUTO  LN   ON

Final Measurement:  x QP
                    Meas Time:    1 s
                    Subranges:    25
                    Acc Margin:    6dB
```



Plot of the AC Power-line Conducted emissions on L2 in Normal mode

Test Report No.:

14071604.fcc01

Page 46 of 46

End of report