

FCC and IC Test Report for Part 15.247 and RSS-247

Product name : WRDBK
Applicant : Salto Systems S.L
FCC ID : UKCWRDBK
IC ID : 10088A-WRDBK

Test report No. : 20153970301 Ver 1.00

Laboratory information

Accreditation

Telefication is designated by the FCC as an Accredited Test Firm for compliance testing of equipment subject to Certification under Parts 15 & 18. The Designation number is: NL0001

The Industry Canada registration number for the 3 meter test chamber of Telefication is: 4173A-1.

Documentation

Telefication complies with the accreditation criteria for test laboratories as laid down in ISO/IEC 17025:2005. The accreditation covers the quality system of the laboratory as well as the specific activities as described in the authorized annex bearing the accreditation number L021 and is granted on 30 November 1990 by the Dutch Council For Accreditation (RvA: Raad voor Accreditatie).

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Testing Location

Test Site	Telefication BV
Test Site location	Edisonstraat 12a 6902 PK Zevenaar The Netherlands Tel. +31316583180 Fax. +31316583189
Test Site FCC	NL0001

Revision History

Version	Date	Remarks	By
v0.50	02-05-2016	First draft	RvB
V1.00	11-05-2016	Release version	RvB

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Summary of Test results

FCC	IC	Description	Section in report	Verdict
15.247(a)	RSS-247 5.2 (1)	6dB Bandwidth	3.1	Pass
--	RSS-GEN 4.6.1	99% Bandwidth	3.2	Pass
15.247(b)	RSS-247 5.1 (2)	RF output power	3.3	Pass
15.247(e)	RSS-247 5.2 (2)	Power spectral density	3.4	Pass
15.247(d)	RSS-247 5.5	Conducted Spurious emissions	3.5	Pass
15.247(d)	RSS-247 5.5	Conducted Band edge	3.5	Pass
15.247(d)	RSS-247 5.4	Radiated Spurious emissions	3.6	Pass

1 General Description

1.1 Applicant

Client name: Salto systems, S.L.
Address C/Arkotz 9 Pol. Lanbarre, Oiartzun
Zip code: 20180
Telephone: +34 943344550
E-mail: j.gutierrez@saltosystems.com
Contact name: J. Gutierrez

1.2 Manufacturer

Manufacturer name: Salto systems, S.L.
Address: C/Arkotz 9 Pol. Lanbarre, Oiartzun
Zip code: 20180
Telephone: +34 943344550
E-mail: j.gutierrez@saltosystems.com
Contact name: J. Gutierrez

1.3 Tested Equipment Under Test (EUT)

Product name: WRDBK
Brand name: SALTO
Product type: BLE capable wall RFID card reader
FCC ID: UKCWRDBK
IC ID 10088A-WRDBK
Model(s): WRDB,WRDBK
Software version: Special firmware for testing
Hardware version: 224824 - 221298
Date of receipt 01-12-2015
Tests started: 09-12-2015
Testing ended: 06-04-2016

1.4 Product specifications of Equipment under test

Tx Frequencies:	2402 – 2480 MHz
Rx frequencies:	2402 – 2480 MHz
Maximum output power to antenna:	3.45 dBm
Antenna type	PCB PIFA Antenna
Type of modulation:	GFSK
Emission designator:	1M00F1D

1.5 Modification of the Equipment Under Test (EUT)

The tested (conducted) sample was modified to include an conducted antenna connector.

1.6 Observations and remarks

The EUT has two versions: one with a keypad (WRDBK) and one without keypad (WRDB). All the test have been performed on the worst case off the 2 the WRDBK.

1.7 Environmental conditions

Test date	17-03-2016	06-04-2016
Ambient temperature	24°C	20.7°C
Humidity	42.1%	38.1%

1.8 Measurement Standards

- FCC KDB Publication No. 558074 D01DTS Meas. Guidance V03r05
- ANSI C63.10:2013

1.9 Applicable Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- FCC Part 15 Subpart C §15.247.
- RSS-247 Issue 1, RSS-GEN Issue 4.

1.10 Conclusions

The sample of the product showed **NO NON-COMPLIANCES** to the specifications stated in paragraph 1.9 of this report.

The results of the test as stated in this report, are exclusively applicable to the product items as identified in this report. Telefication accepts no responsibility for any properties of product items in this test report, which are not supported by the tests as specified in paragraph 1.9 *"Applicable standards"*.

All tests are performed by:

Name : ing R. van Barneveld

Review of test methods and report by:

Name : ing. P.A. Suringa

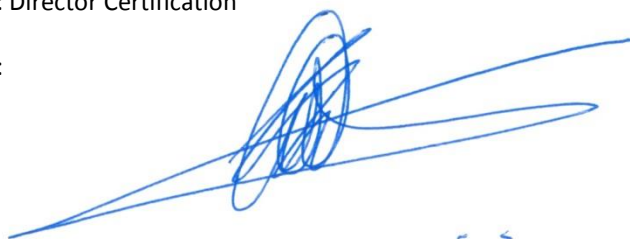
The above conclusions have been verified by the following signatory:

Date : 19-05-2016

Name : ing M.T.P.M Wouters v/d Oudenweijer

Function : Director Certification

Signature :



2 Test configuration of the Equipment Under Test

2.1 Test mode

The applicant provided test mode firmware for the EUT, in which it was possible to configure the EUT into different test channels.

2.2 Tested channels and Data rates

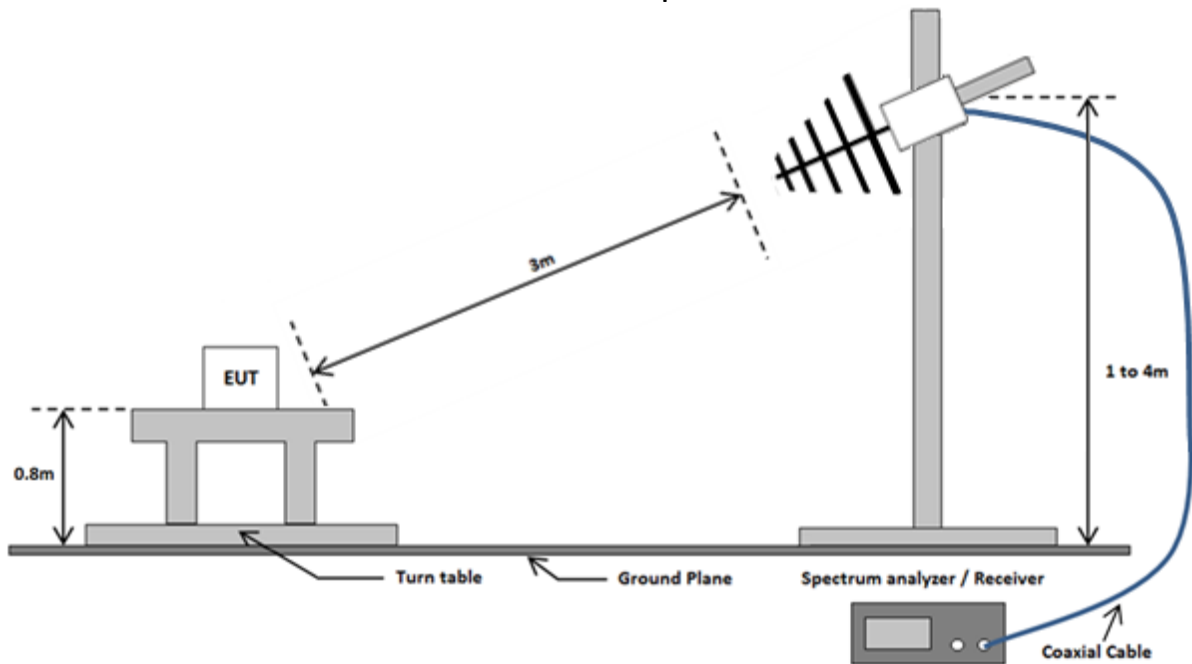
Technology	Channels	Data rate	Frequency (MHz)
Bluetooth Low Energy	0 (Low)	1 Mbps	2402
	19 (Mid)	1 Mbps	2440
	39(High)	1 Mbps	2480

2.3 Conducted Test setup

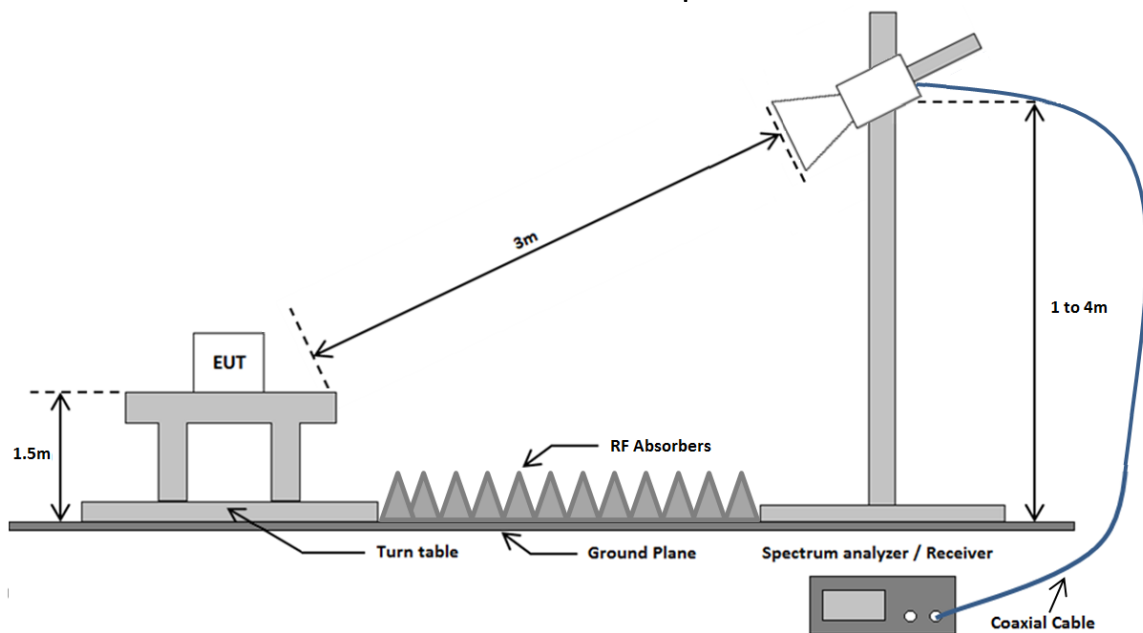


2.4 Radiated Test setup

Radiated emissions test setup 30 MHz - 1 GHz



Radiated emissions test setup above 1 GHz



2.5 Equipment used in the test configuration

Description	Manufacturer	Model	ID	Used at Par.
Signal Generator	Hewlett Packard	83650B	TE00487	3.1 to 3.5
Spectrum Analyzer	Rohde & Schwarz	FSV	TE01269	3.1 to 3.5
Spectrum Analyzer	Rohde & Schwarz	FSP40	TE11125	3.6
Spectrum Analyzer	Rohde & Schwarz	ESR7	TE01220	3.6
10 MHz distribution Amplifier	Stanford Research Systems	FS735/1	TE01278	3.1 to 3.5
USB to GPIB adapter	National Instruments	GPIB-USB-HS+	TE01283	3.1 to 3.5
Biconilog Antenna	Chase	CBL6112A	TE00967	3.6
Horn Antenna	EMCO The Electro – Mechanics Co	3115	TE00531	3.6
SAC Chamber	Comtest Engineering BV	-	TE00861	3.6

2.6 Explanation of the Measurement results for all conducted test items

The path loss between the EUT and the spectrum analyser for the frequency range of 30 MHz to 40 GHz has been measured and stored in the transducer table of the spectrum analyser. This transducer table is used for level offset of the spectrum analyser. With this level offset the spectrum analysers reading will be exactly the RF output.

2.7 Sample calculations

Field Strength Measurement example:

Frequency (GHz)	Polarization	Height(m)	Peak (dBμV/m)
7,2	Vertical	4	42.2

The following realtion applies:

$$E \text{ (dB}\mu\text{V/m)} = U \text{ (dB}\mu\text{V)} + AF \text{ (dB/m)} - G \text{ (dB)} + CL \text{ (dB)}$$

Where:

E = Electric field strength

U = Measuring reveiver voltage

AF = Antenna factor

G = Gain of the pre-amplifier

CL = Cable loss

$$(42.2 = 36.02 + 36.4 - 37.62 + 7.2)$$

3 Test results

3.1 6dB bandwidth Measurement

3.1.1 Limit

The minimum 6 dB Bandwidth shall be at least 500 kHz.

3.1.2 Measurement instruments

The measurement instruments are listed in chapter 2.5 of this report.

3.1.3 Test setup

The test setup is as shown in chapter 2.3 of this report.

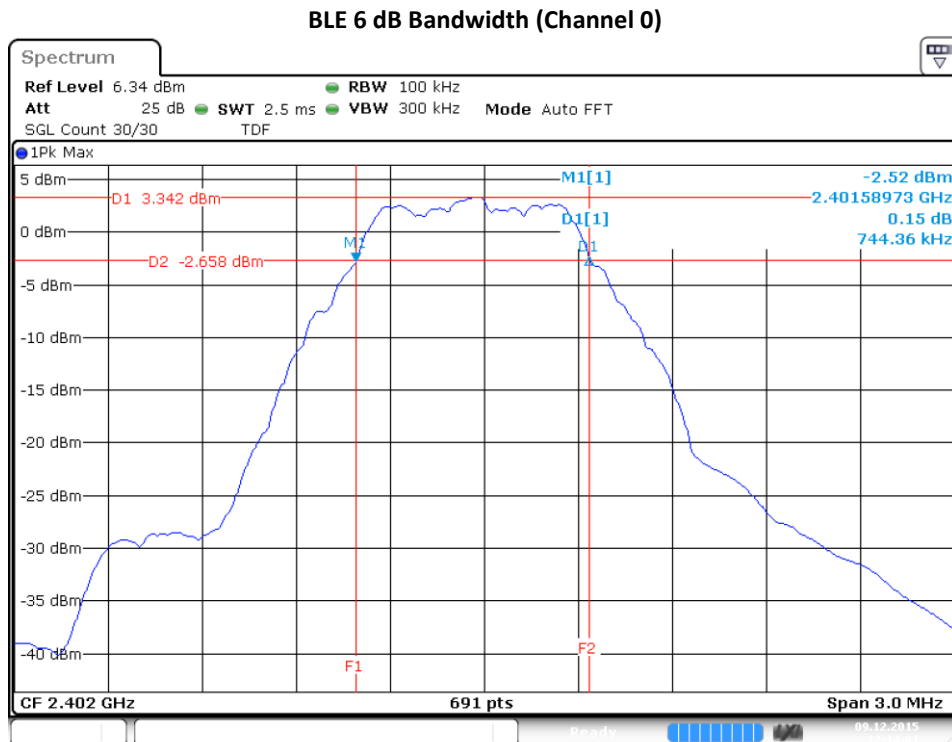
3.1.4 Test procedure

1. The testing follows FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v03r05.
2. The RF output of EUT was connected to the spectrum analyser by RF cable and attenuator.
3. The path loss was compensated to the results for each measurement. This path loss is stored within the transducer table of the Spectrum analyser.
4. The measurement results are recorded in the test report.

3.1.5 Test Results of the 6 dB bandwidth Measurement

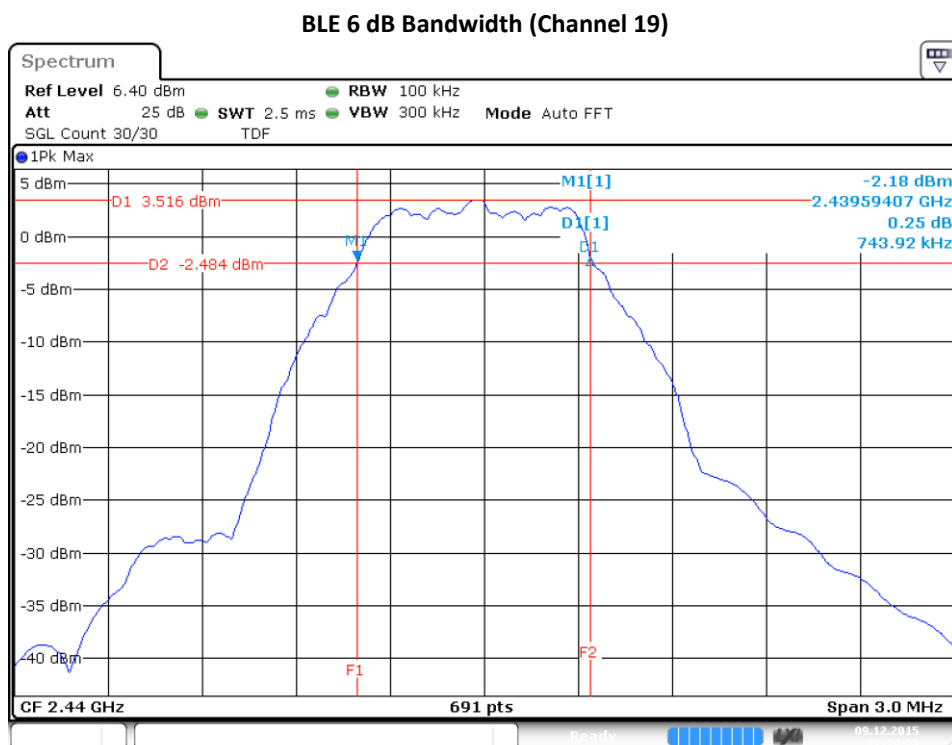
Technology Std.	Channel	Frequency (MHz)	Data rate	6dB bandwidth (kHz)
Bluetooth Low Energy	0	2402	1 Mbps	744.36
	19	2440	1 Mbps	743.92
	39	2480	1 Mbps	710.06
Uncertainty	± 707 kHz			

3.1.6 Plots of the 6 dB bandwidth Measurement



Ble, channel: 0 : 6 dB BW Measurement

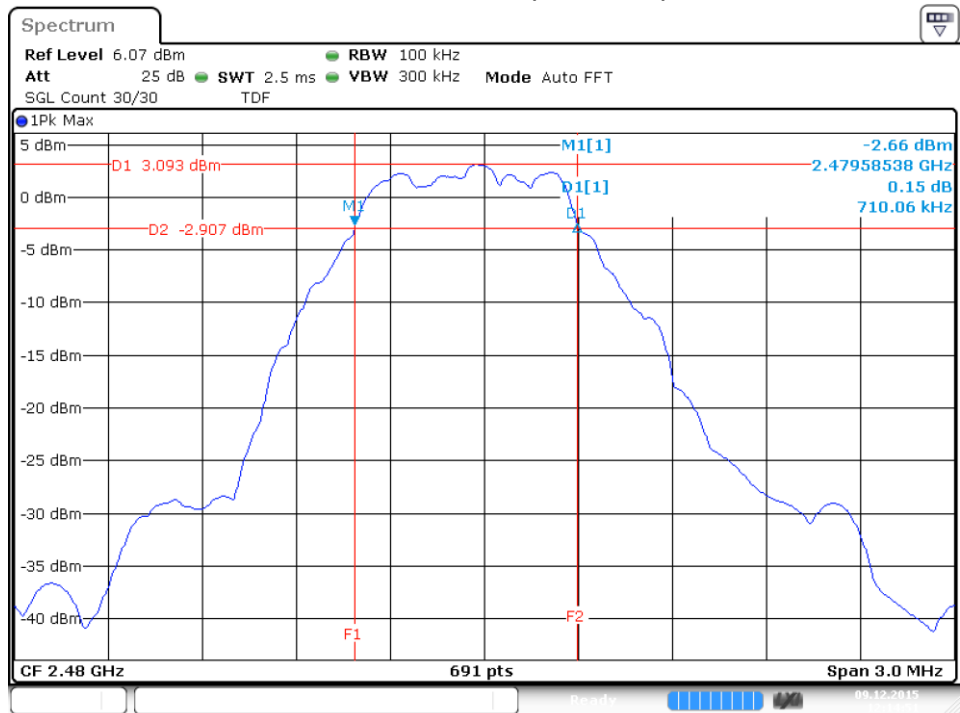
Date: 9.DEC.2015 12:14:01



Ble, channel: 19 : 6 dB BW Measurement

Date: 9.DEC.2015 12:14:25

BLE 6 dB Bandwidth (Channel 39)



Ble, channel: 39 : 6 dB BW Measurement

Date: 9.DEC.2015 12:14:51

3.2 99% Occupied Bandwidth

3.2.1 Limit

According to RSS-Gen 4.6.1.

3.2.2 Measurement instruments

The measurement instruments are listed in chapter 2.5 of this report.

3.2.3 Test setup

The test setup is as shown in chapter 2.3 of this report.

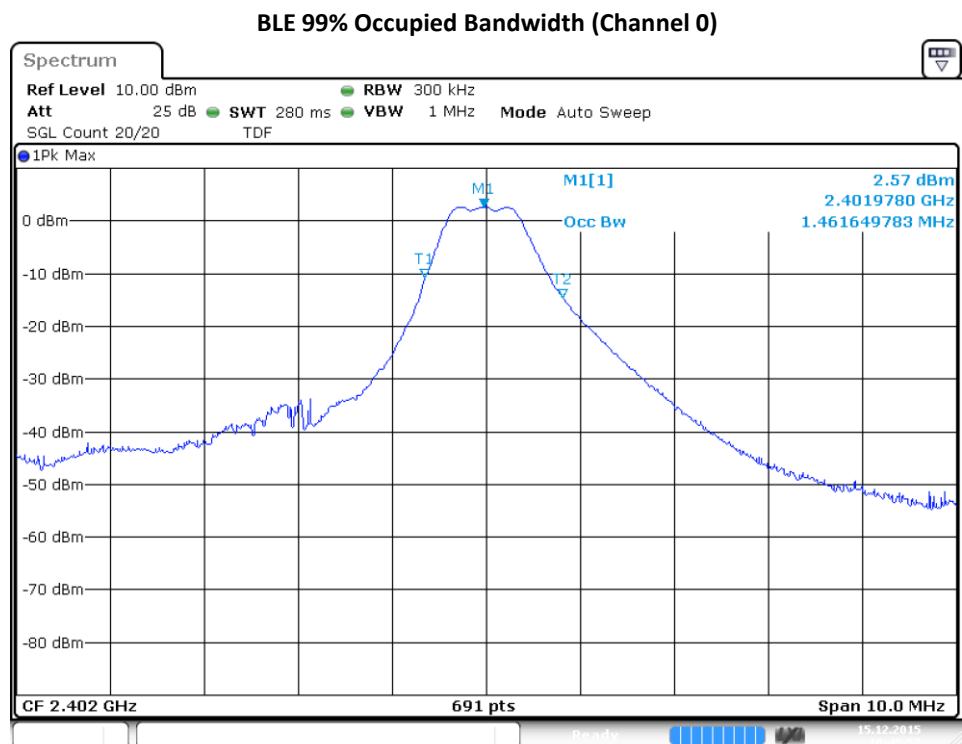
3.2.4 Test procedure

- 1 Set the centre frequency to the nominal EUT channel centre frequency.
- 2 Set span = 1.5 times to 0.5 times the Occupied Bandwidth.
- 3 Set VBW $\geq 3 \times$ RBW.
- 4 Video averaging is not permitted. Where practical detection and single sweep mode shall be used. Otherwise, peak detection and max hold mode(until the trace stabilizes) shall be used.

3.2.5 Test results of the 99% Occupied Bandwidth Measurement

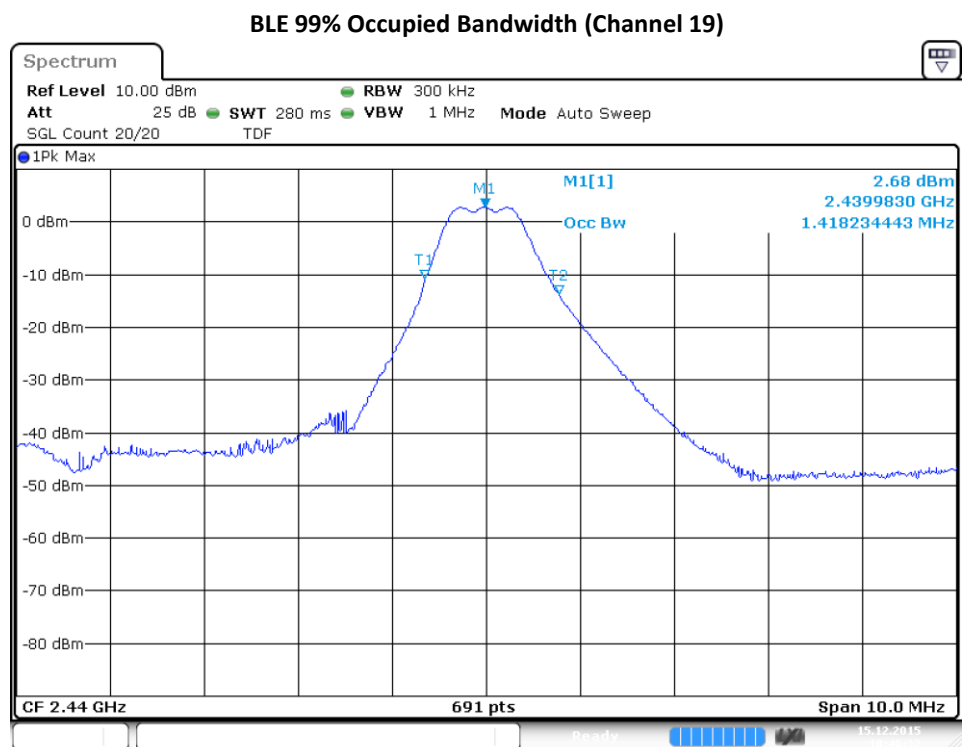
Technology Std.	Channels	Frequency (MHz)	Data rate	99% Occupied Bandwidth (MHz)
Bluetooth Low Energy	0	2402	1 Mbps	1.462
	19	2440	1 Mbps	1.418
	39	2480	1 Mbps	1.403
Uncertainty	$\pm 707\text{kHz}$			

3.2.6 Plots of the 99% Occupied Bandwidth Measurement



Ble Channel: 0 : Measure Occupied Bandwidth

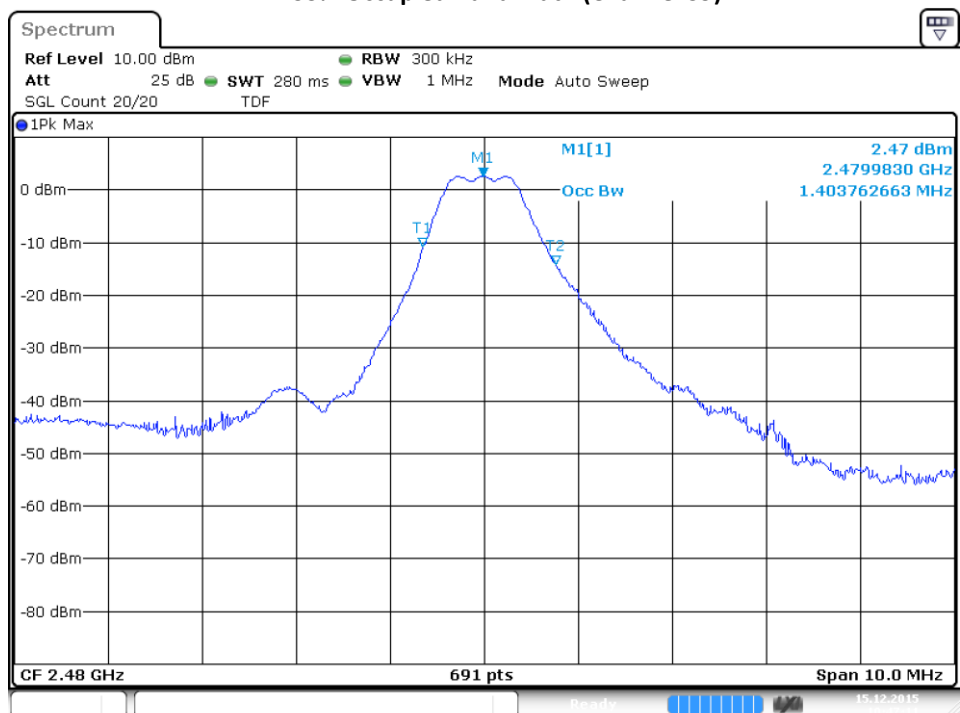
Date: 15.DEC.2015 10:45:57



Ble Channel: 19 : Measure Occupied Bandwidth

Date: 15.DEC.2015 10:46:32

BLE 99% Occupied Bandwidth (Channel 39)



Ble Channel: 39 : Measure Occupied Bandwidth

Date: 15.DEC.2015 10:47:11

3.3 Output Power Measurement

3.3.1 Limit

For systems using digital modulation in the 2400-2483.5 MHz, the limit for the peak output power is 30 dBm. If transmitting antenna of directional gain greater than 6 dBi is used, the peak output power from the intentional radiator shall be reduced below the above stated value by the amount in dB that the directional gain of the antenna exceeds 6 dBi. In case of point to point operation, the limit has to be reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.

3.3.2 Measurement instruments

The measurement instruments are listed in chapter 2.5 of this report.

3.3.3 Test setup

The test setup is as shown in chapter 2.3 of this report.

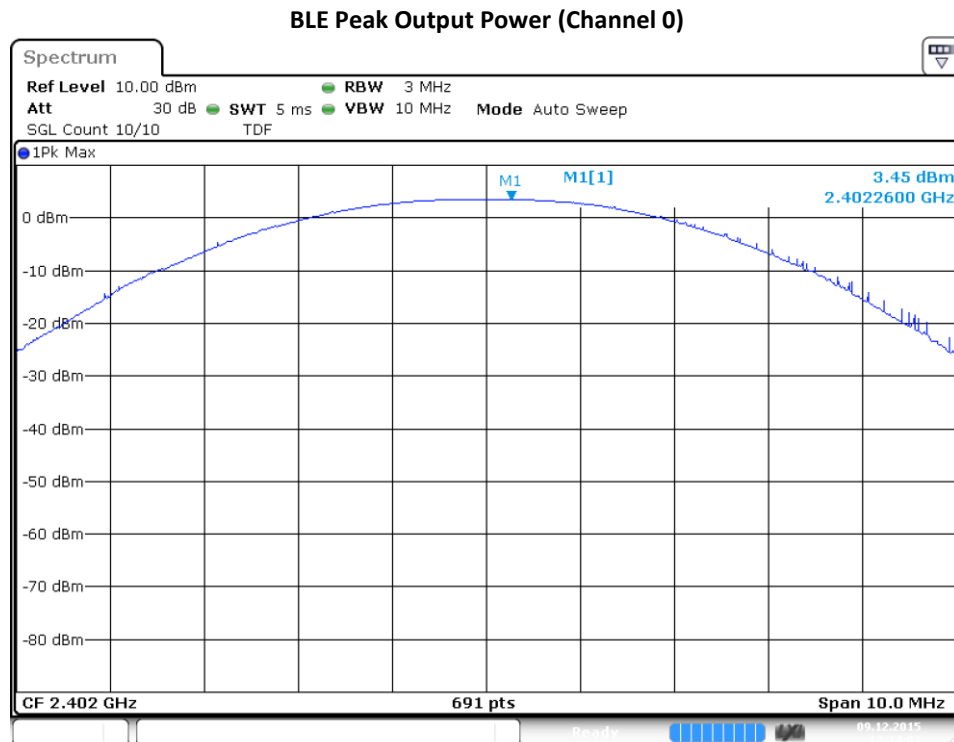
3.3.4 Test procedure

1. The testing follows FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v03r05.
2. The RF output of EUT was connected to the spectrum analyser by RF cable and attenuator.
3. The path loss was compensated to the results for each measurement. This path loss is stored within the transducer table of the Spectrum analyser.

3.3.5 Test results of Output Power Measurement

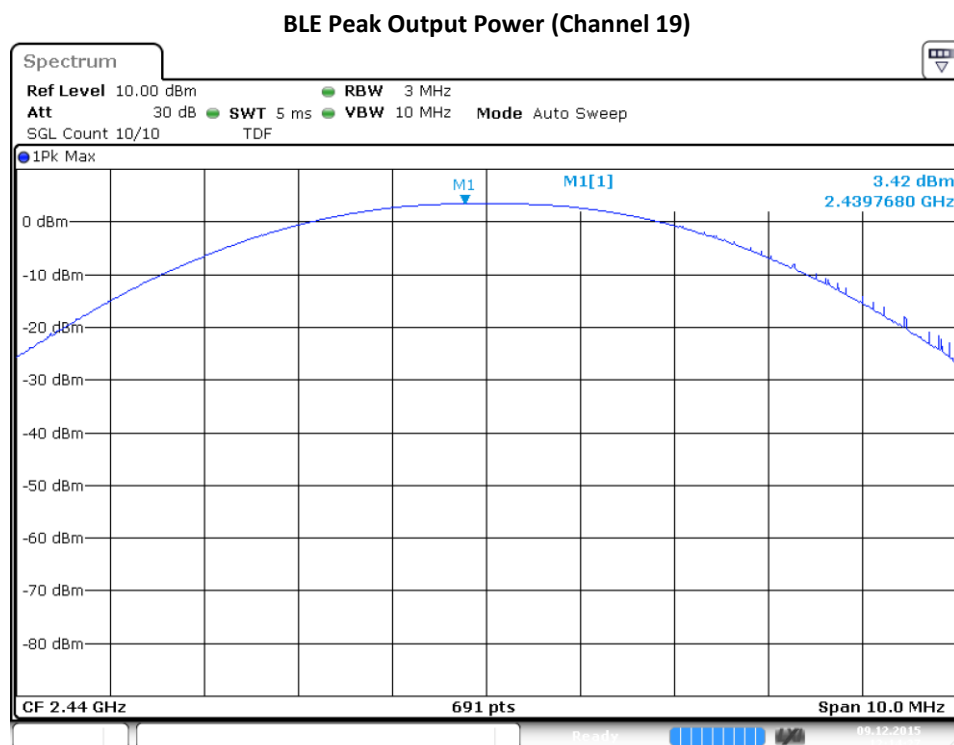
Peak method				
Technology Std.	Channels	Frequency (MHz)	Data rate	Average output power (dBm)
Bluetooth Low Energy	0	2402	1 Mbps	3.45
	19	2440	1 Mbps	3.42
	39	2480	1 Mbps	3.12
Uncertainty	±1.78 dB			

3.3.6 Plots of Peak Output Power Measurement



Ble Channel: 0 : Measure DUT output power

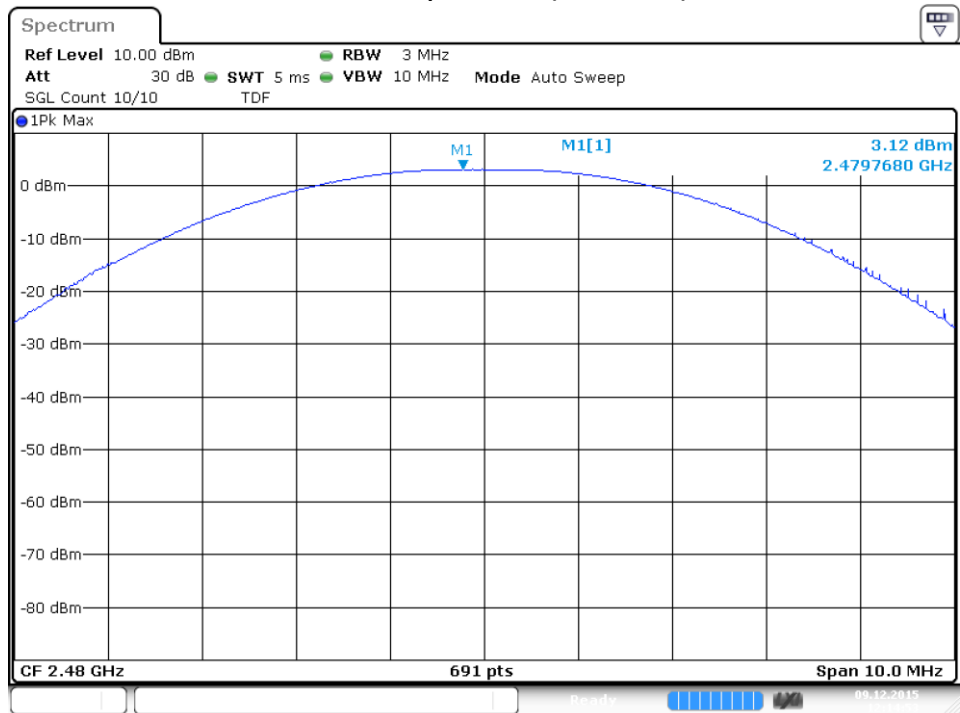
Date: 9.DEC.2015 12:14:03



Ble Channel: 19 : Measure DUT output power

Date: 9.DEC.2015 12:14:27

BLE Peak Output Power (Channel 39)



Ble Channel: 39 : Measure DUT output power

Date: 9.DEC.2015 12:14:52

3.4 Power Spectral Density

3.4.1 Limit

The peak power spectral density shall not be greater than 8 dBm in any 3 kHz band at any time interval of continuous transmission.

3.4.2 Measurement instruments

The measurement instruments are listed in chapter 2.5 of this report.

3.4.3 Test setup

The test setup is as shown in chapter 2.3 of this report.

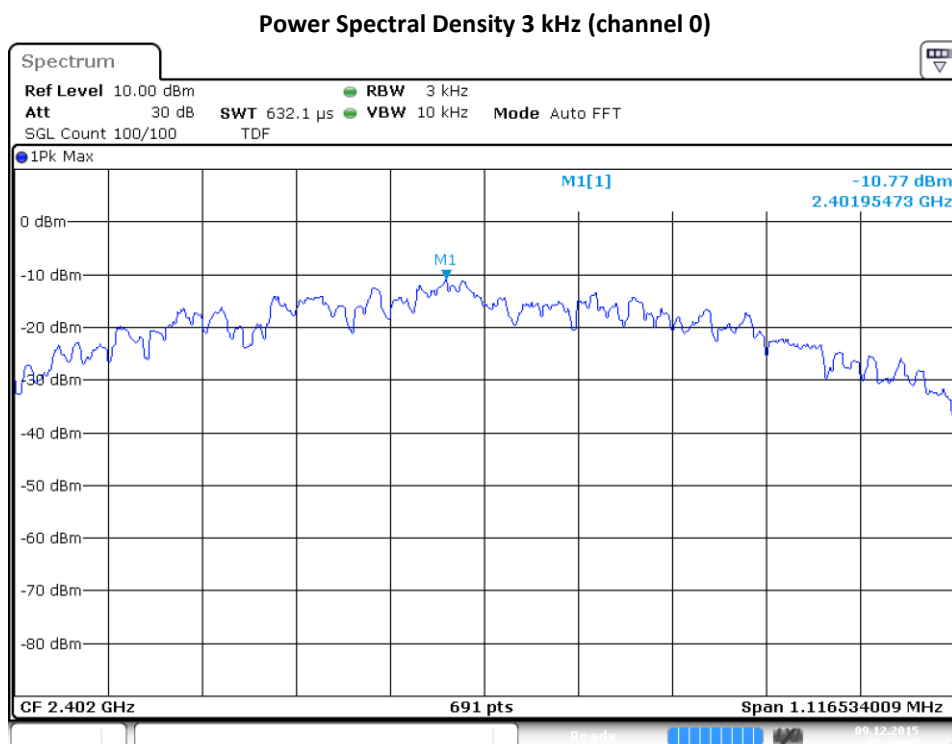
3.4.4 Test procedure

1. The testing follows FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v03r05.
2. The RF output of EUT was connected to the spectrum analyser by RF cable and attenuator.
3. The path loss was compensated to the results for each measurement. This path loss is stored within the transducer table of the Spectrum analyser.

3.4.5 Test results of Power Spectral Density Measurement

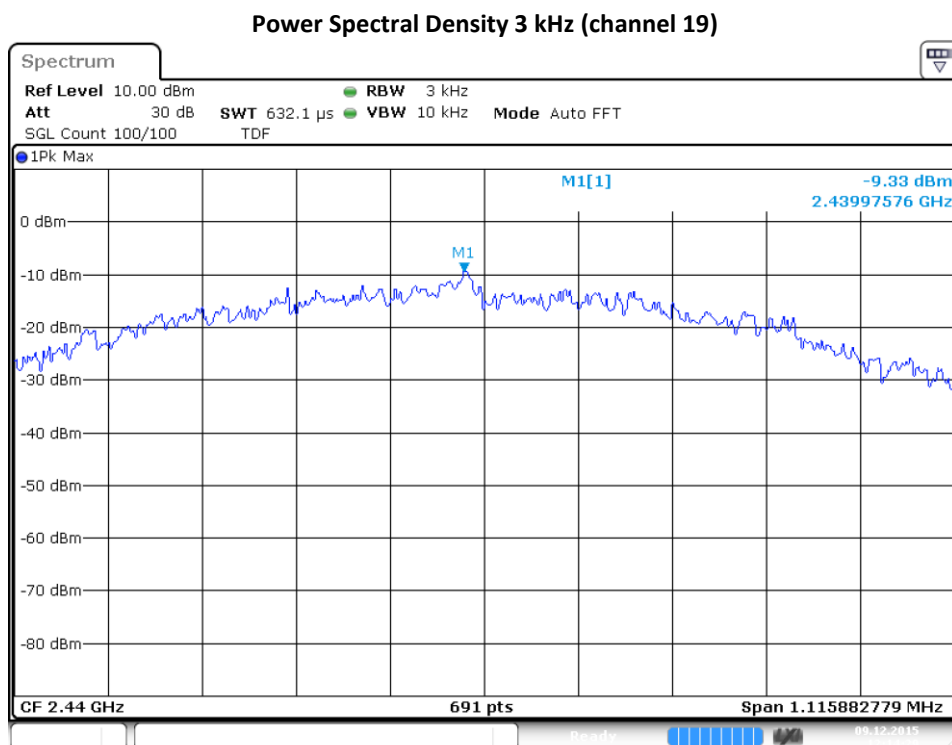
Technology Std.	Channels	Frequency (MHz)	Data rate	PSD/100 kHz (dBm)	PSD/3 kHz (dBm)
Bluetooth Low Energy	0	2402	1 Mbps	3.39	-10.77
	19	2440	1 Mbps	3.37	-9.33
	39	2480	1 Mbps	3.06	-10.07
Uncertainty	± 0.63 dB				

3.4.6 Plots of the Power Spectral Density Measurements



Ble,0 : BLE Power spectral density (3KHz)

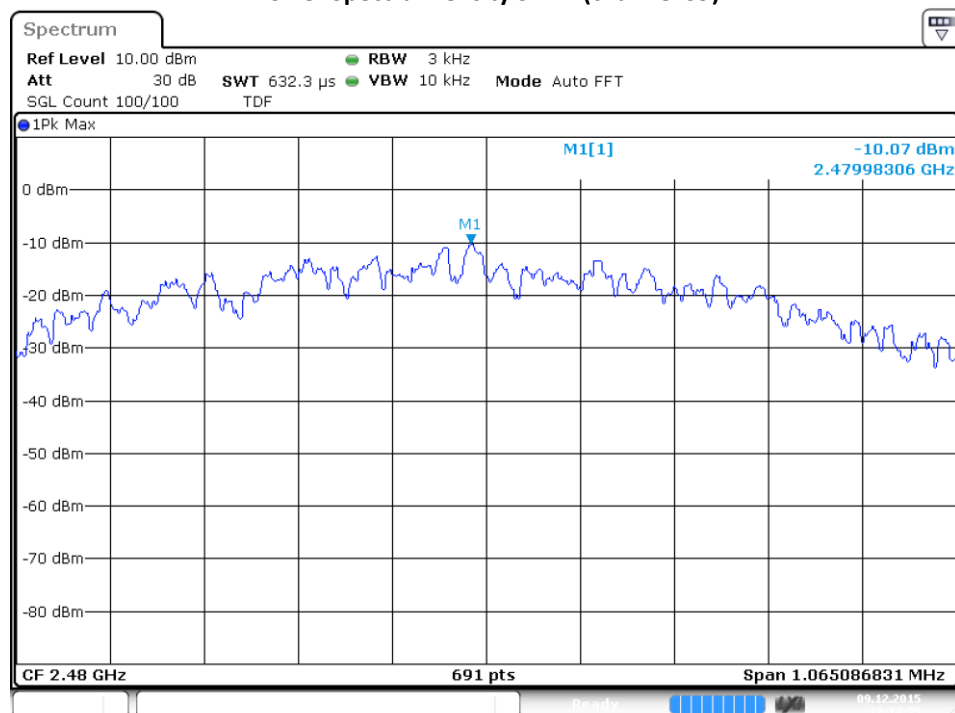
Date: 9.DEC.2015 12:14:05



Ble,19 : BLE Power spectral density (3KHz)

Date: 9.DEC.2015 12:14:29

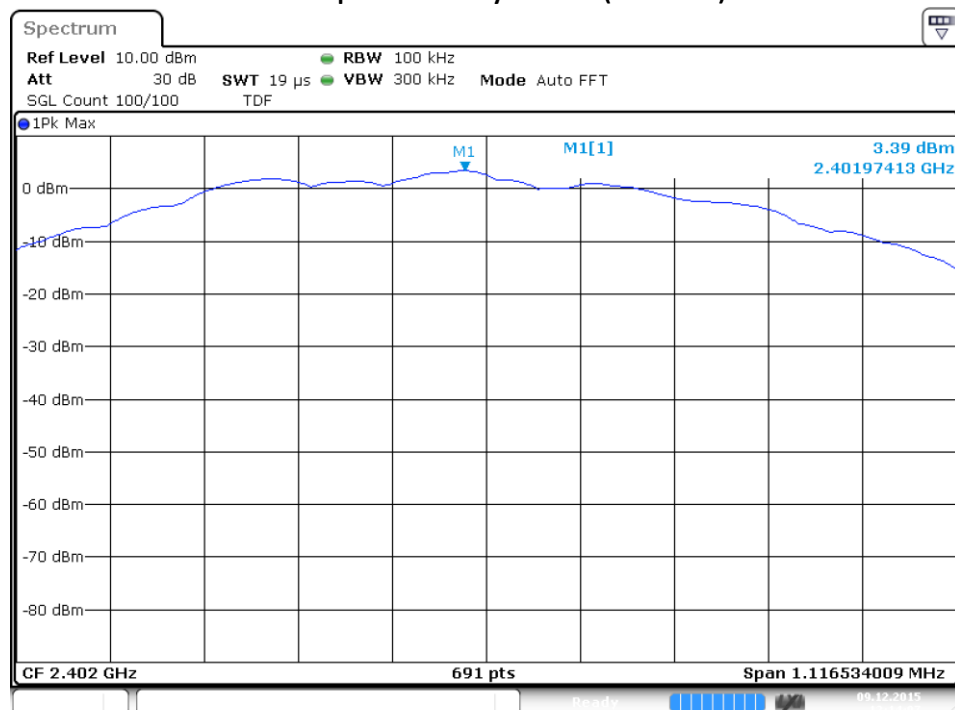
Power Spectral Density 3 kHz (channel 39)



Ble,39 : BLE Power spectral density (3KHz)

Date: 9.DEC.2015 12:14:54

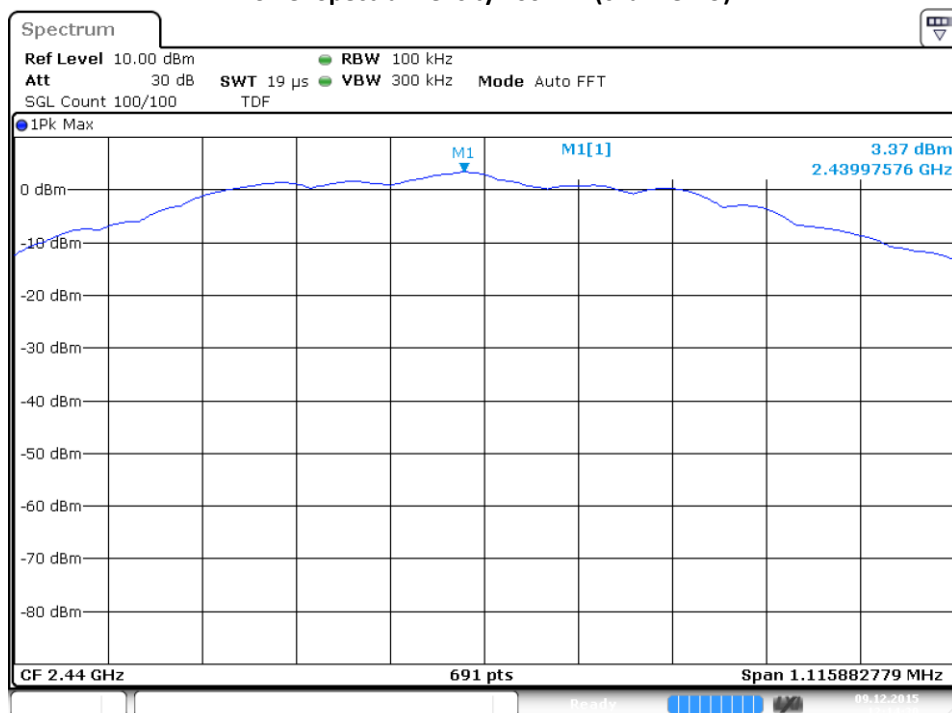
Power Spectral Density 100 kHz (channel 0)



Ble,0 : BLE Power spectral density (100KHz)

Date: 9.DEC.2015 12:14:07

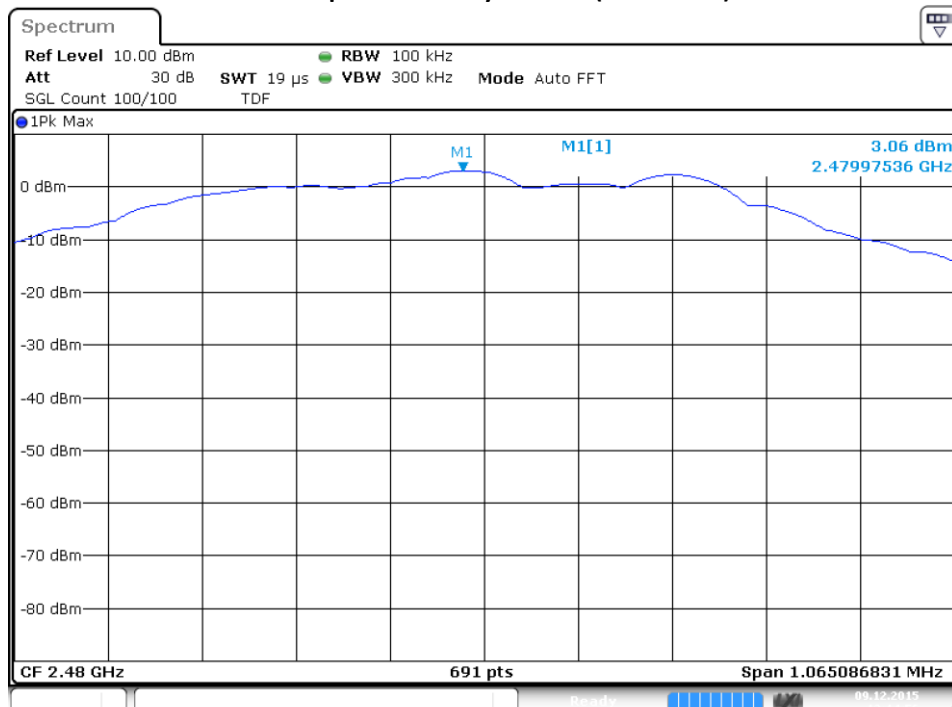
Power Spectral Density 100 kHz (channel 19)



Ble,19 : BLE Power spectral density (100KHz)

Date: 9.DEC.2015 12:14:31

Power Spectral Density 100 kHz (channel 39)



Ble,39 : BLE Power spectral density (100KHz)

Date: 9.DEC.2015 12:14:56

3.5 Conducted Band edge and Spurious Emissions Measurement

3.5.1 Limit

Spurious Emission:

In any 100 kHz bandwidth outside the operating frequency band, the RF power 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 a RF conducted or a radiated measurement.

Band edge:

At the edge of the authorized band the RF power shall be at least 20 dB down.

3.5.2 Measurement instruments

The measurement instruments are listed in chapter 2.5 of this report.

3.5.3 Test setup

The test setup is as shown in chapter 2.3 of this report.

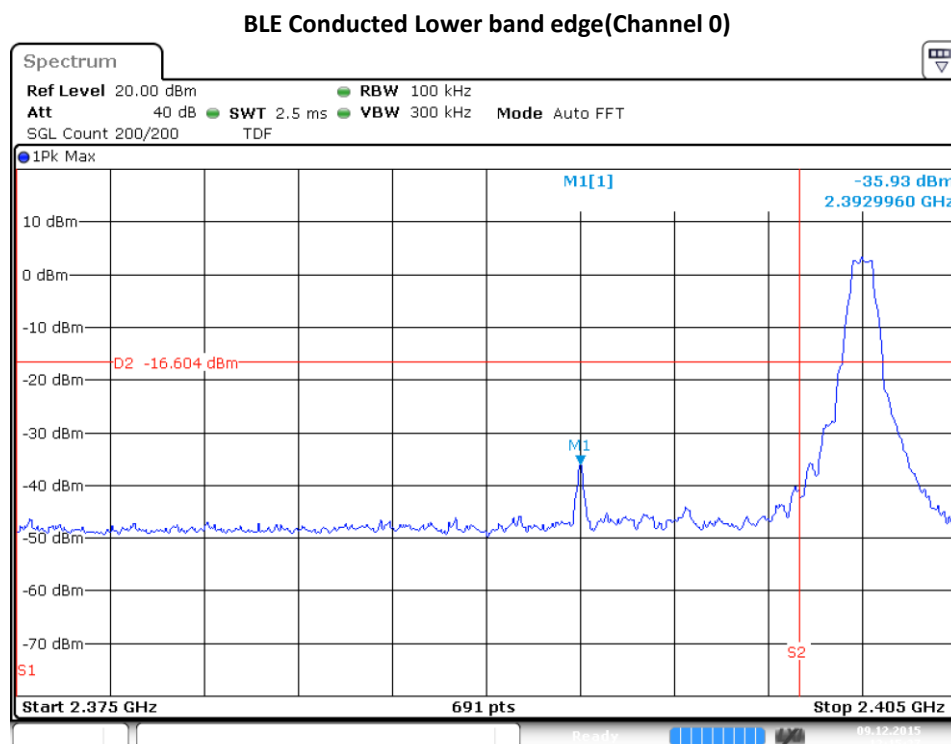
3.5.4 Test procedure

According to KDB Publication 558074 V02r05, sections 11.3 and 12.1

3.5.5 Test results of conducted Band Edges Measurements

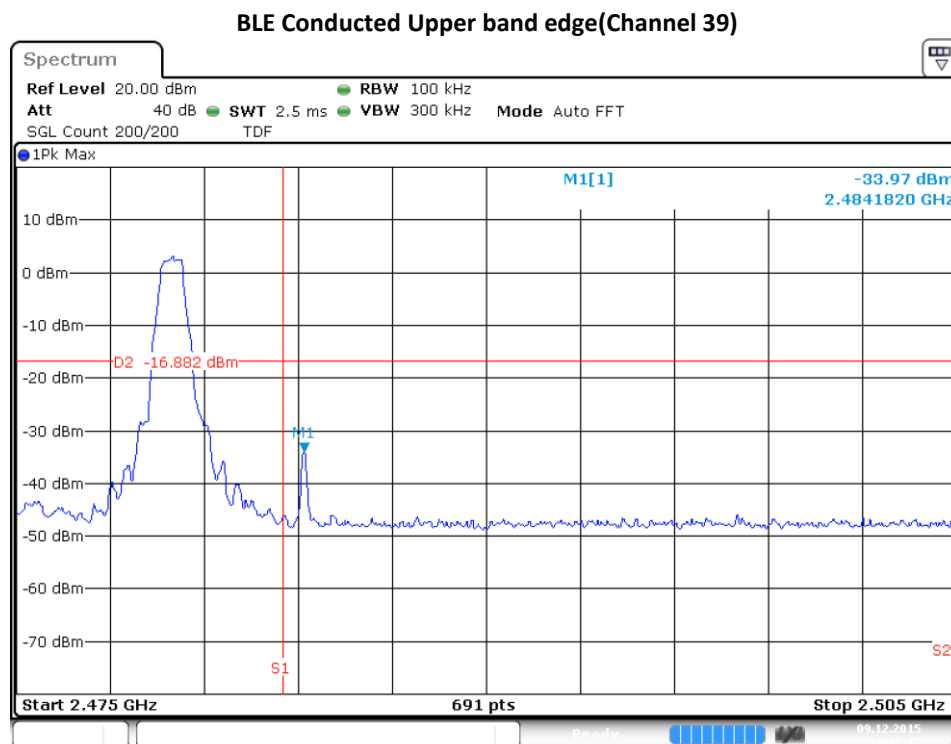
Technology Std.	Band edge				
	Channels	Frequency (MHz)	Data rate	20 dB down (dBm)	Limit (dBm)
Bluetooth Low Energy	0	2402	1 Mbps	-35.93	-16.60
	39	2480	1 Mbps	-33.97	-16.88
Uncertainty	±0.63 dB				

3.5.6 Plots of the Conducted Spurious and Band edge Measurements



Band edge

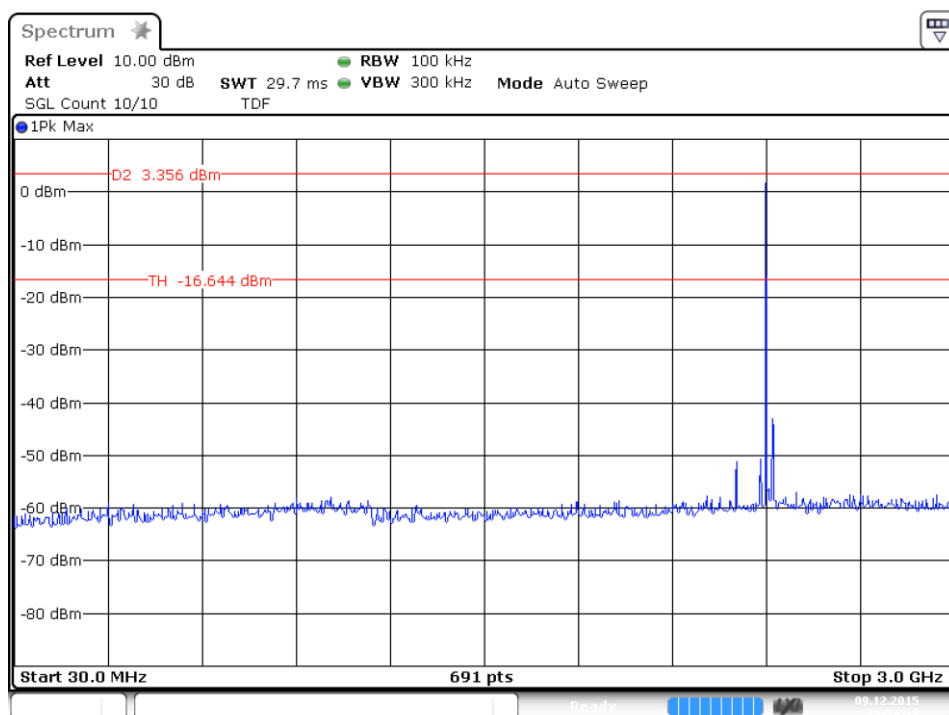
Date: 9.DEC.2015 12:15:28



Band edge

Date: 9.DEC.2015 12:15:43

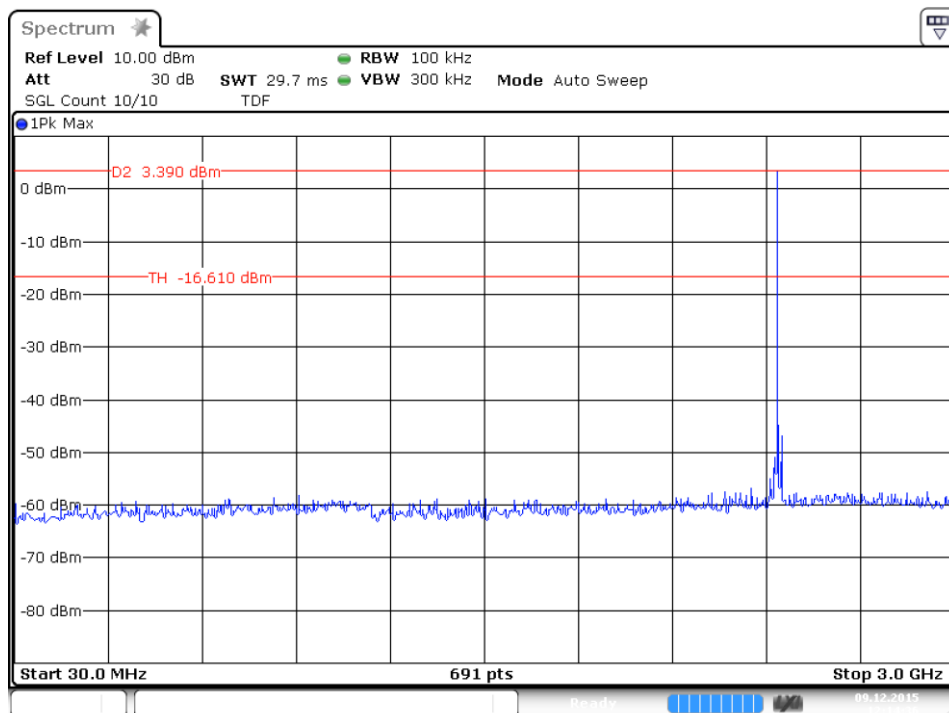
BLE Conducted Spurious Emissions 30 -3000 MHz (Channel 0)



Ble, channel: 0 : Measure Spurious Emission 30 M - 3GHz

Date: 9.DEC.2015 12:14:13

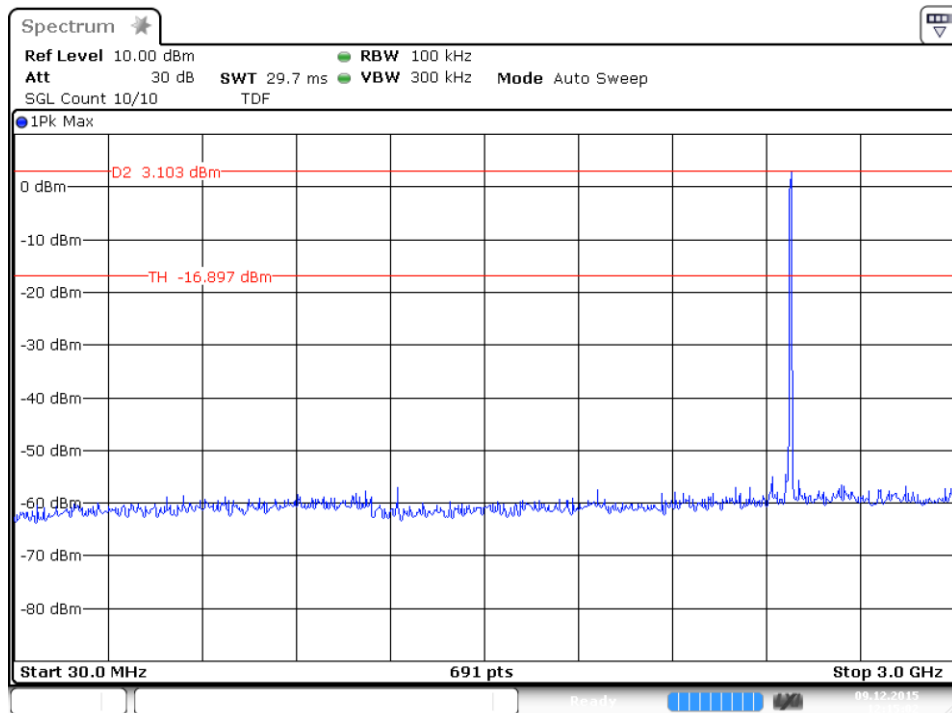
BLE Conducted Spurious Emissions 30 -3000 MHz (Channel 19)



Ble, channel: 19 : Measure Spurious Emission 30 M - 3GHz

Date: 9.DEC.2015 12:14:37

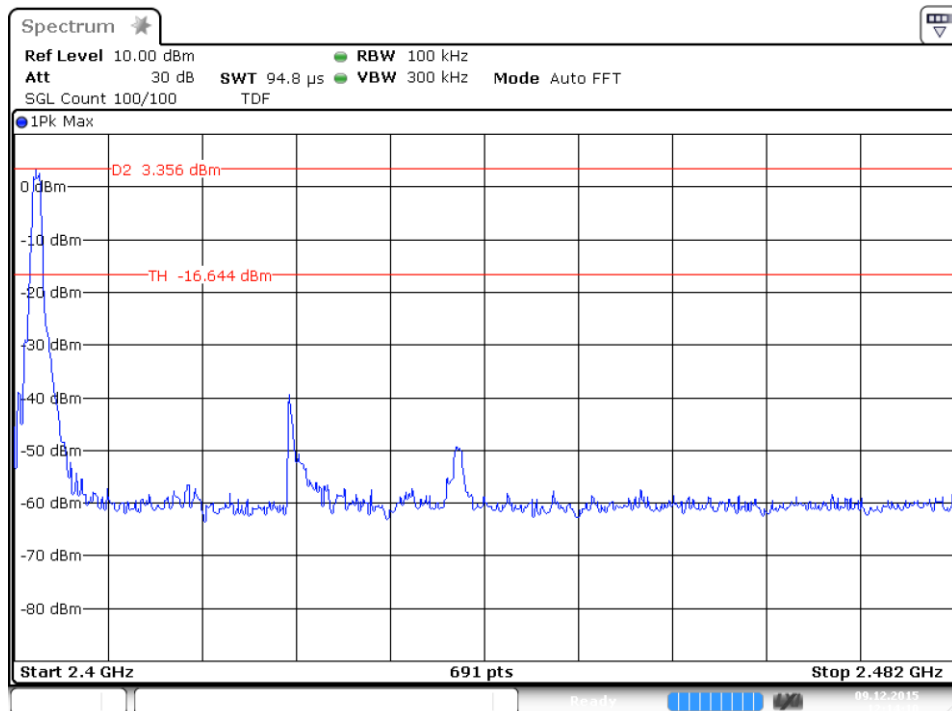
BLE Conducted Spurious Emissions 30 -3000 MHz (Channel 39)



Ble, channel: 39 : Measure Spurious Emission 30 M - 3GHz

Date: 9.DEC.2015 12:15:02

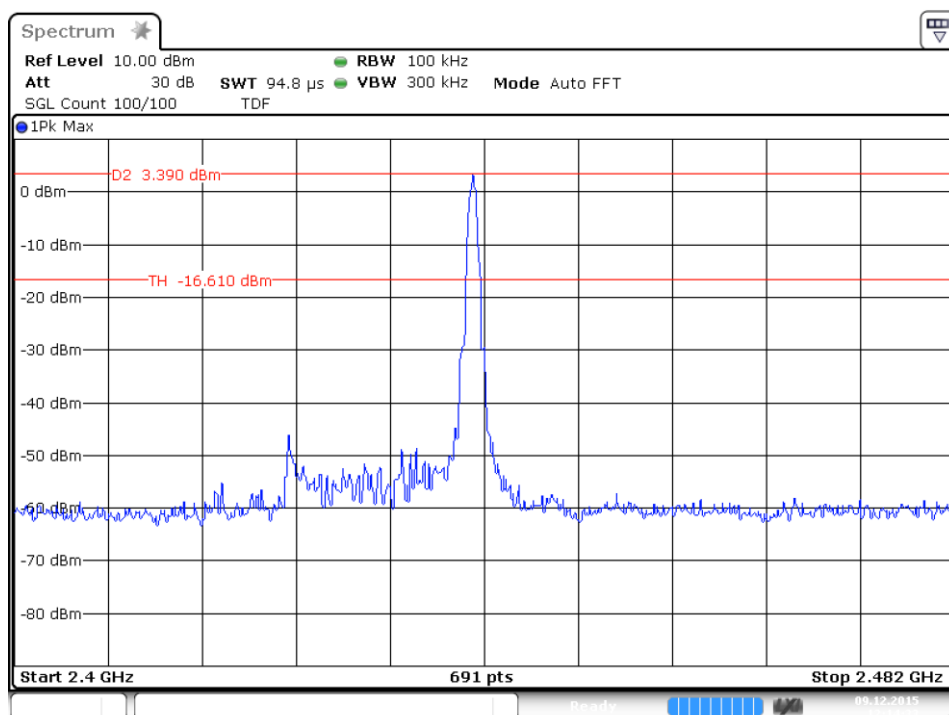
BLE Conducted Spurious Emissions 2.4 – 2.82 GHz (Channel 0)



Ble, channel: 0 : Measure Spurious Emission 2.4-2.82 GHz

Date: 9.DEC.2015 12:14:10

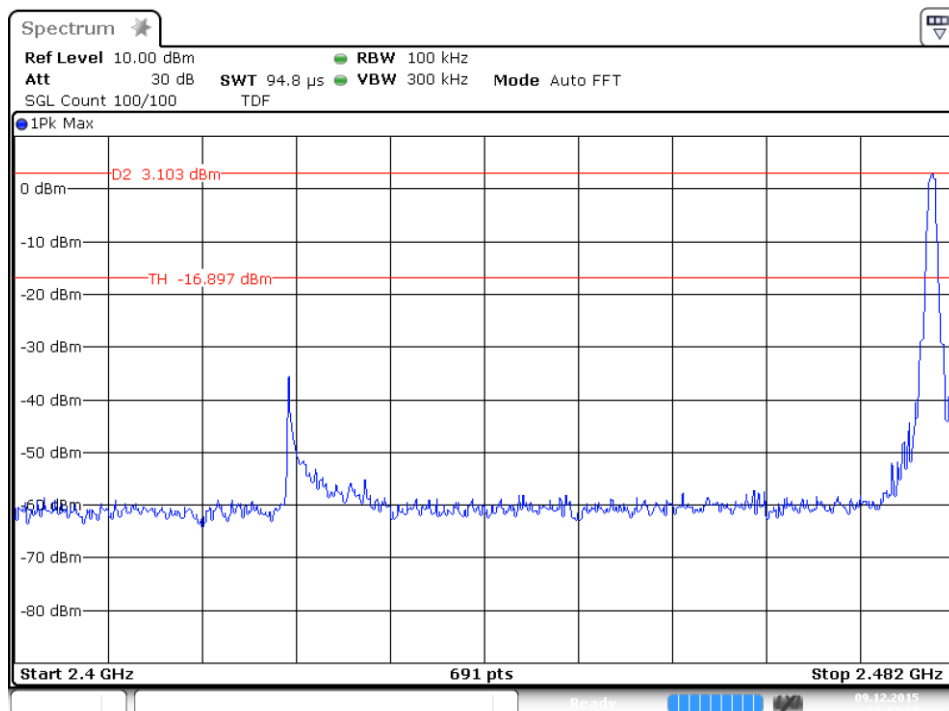
BLE Conducted Spurious Emissions 2.4 – 2.82 GHz (Channel 19)



Ble, channel: 19 : Measure Spurious Emission 2.4-2.82 GHz

Date: 9.DEC.2015 12:14:34

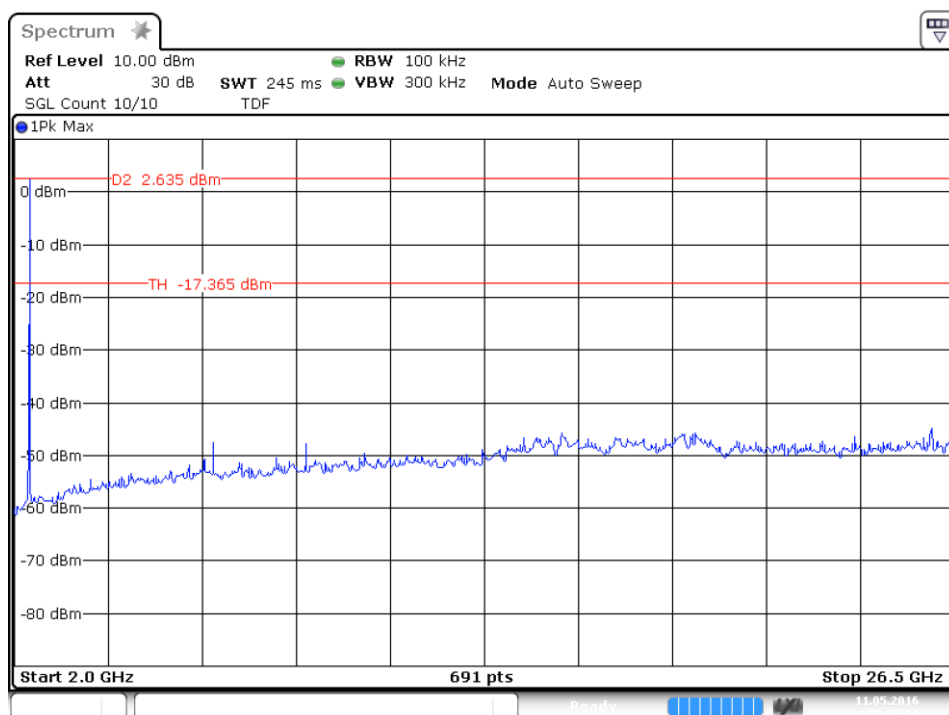
BLE Conducted Spurious Emissions 2.4 – 2.82 GHz (Channel 39)



Ble, channel: 39 : Measure Spurious Emission 2.4-2.82 GHz

Date: 9.DEC.2015 12:14:59

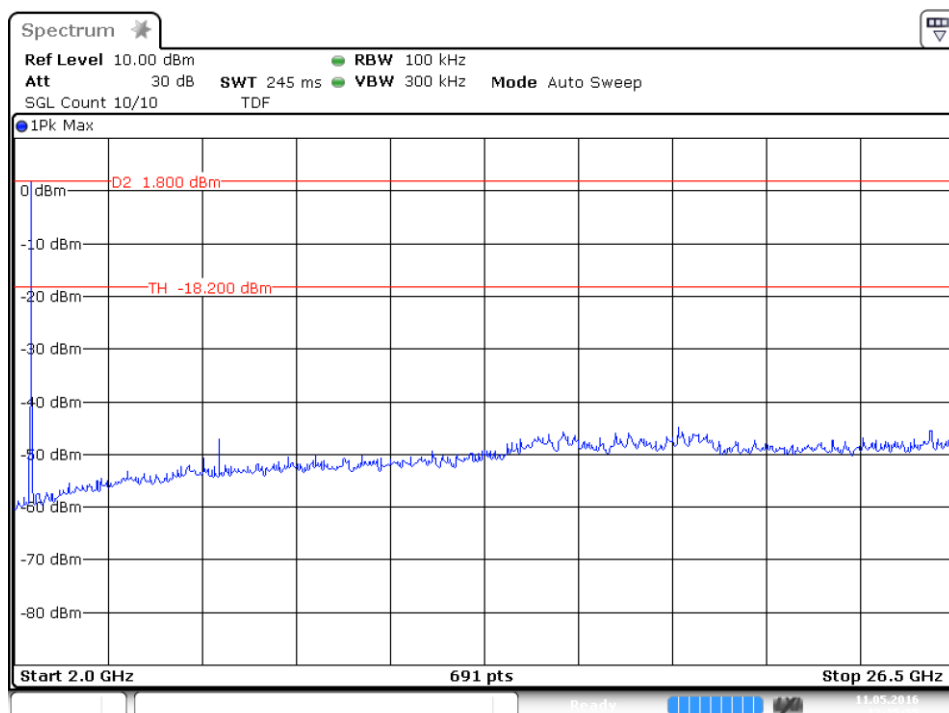
BLE Conducted Spurious Emissions 2 – 25 GHz (Channel 0)



Ble, channel: 0 : Measure Spurious Emission 2-25 GHz

Date: 11.MAY.2016 12:25:26

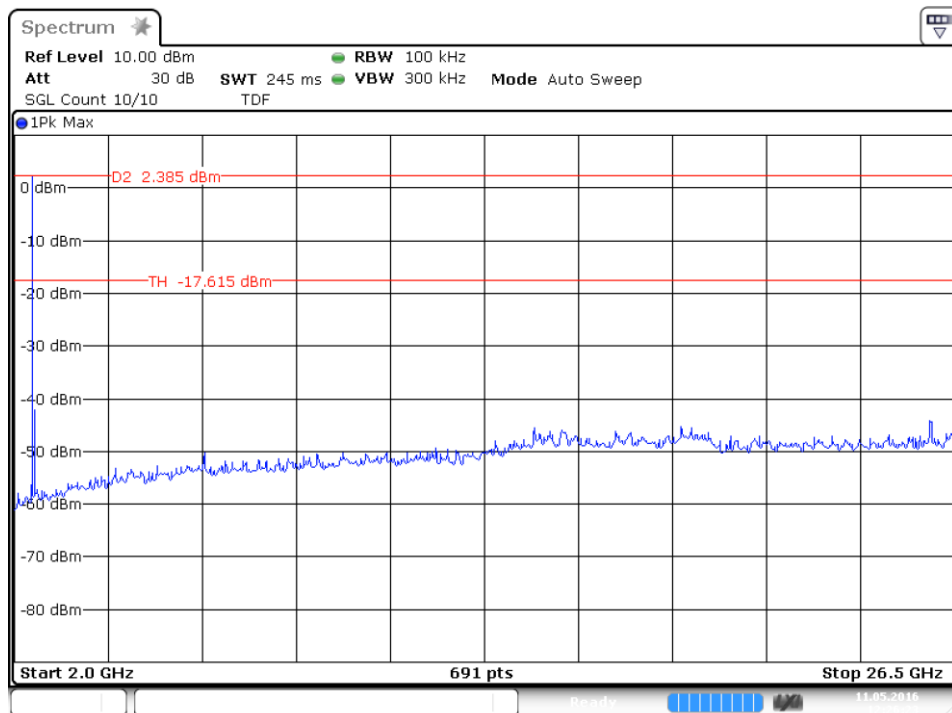
BLE Conducted Spurious Emissions 2 – 25 GHz (Channel 19)



Ble, channel: 19 : Measure Spurious Emission 2-25 GHz

Date: 11.MAY.2016 12:25:55

BLE Conducted Spurious Emissions 2 – 25 GHz (Channel 39)



Ble, channel: 39 : Measure Spurious Emission 2-25 GHz
 Date: 11.MAY.2016 12:26:24

3.6 Radiated Spurious Emissions Measurement

3.6.1 Limit

In any 100 kHz bandwidth outside the operating frequency band, the RF power 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 a RF conducted or a radiated measurement.

3.6.2 Measurement instruments

The measurement instruments are listed in chapter 2.5 of this report.

3.6.3 Test setup

The test setup is as shown in chapter 2.4 of this report.

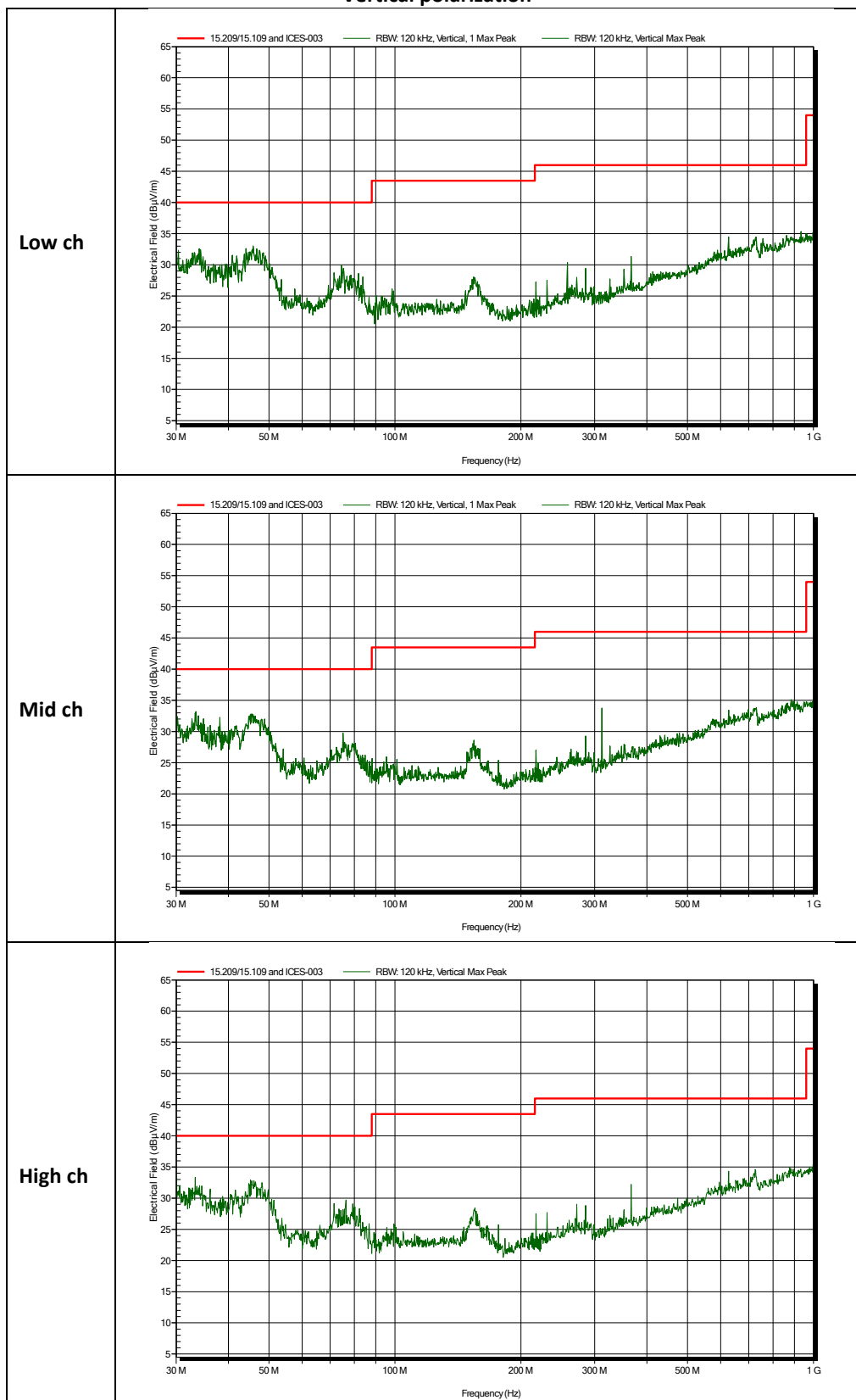
3.6.4 Test procedure

According to KDB Publication 558074 V02r05, sections 11.3 and 12.1

3.6.5 Plots of the Radiated Spurious Emissions Measurement

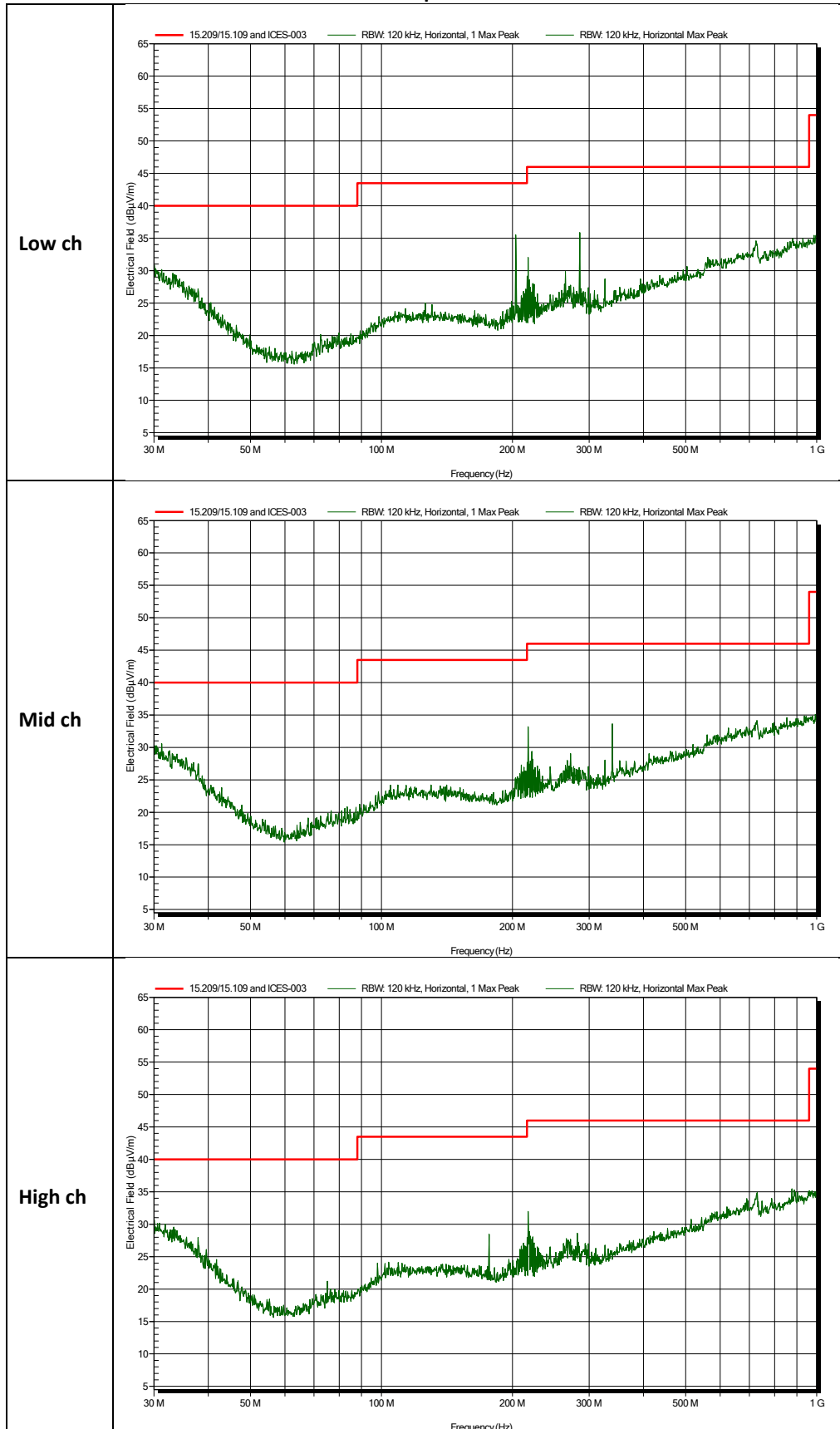
30 MHz to 1 GHz

Vertical polarization



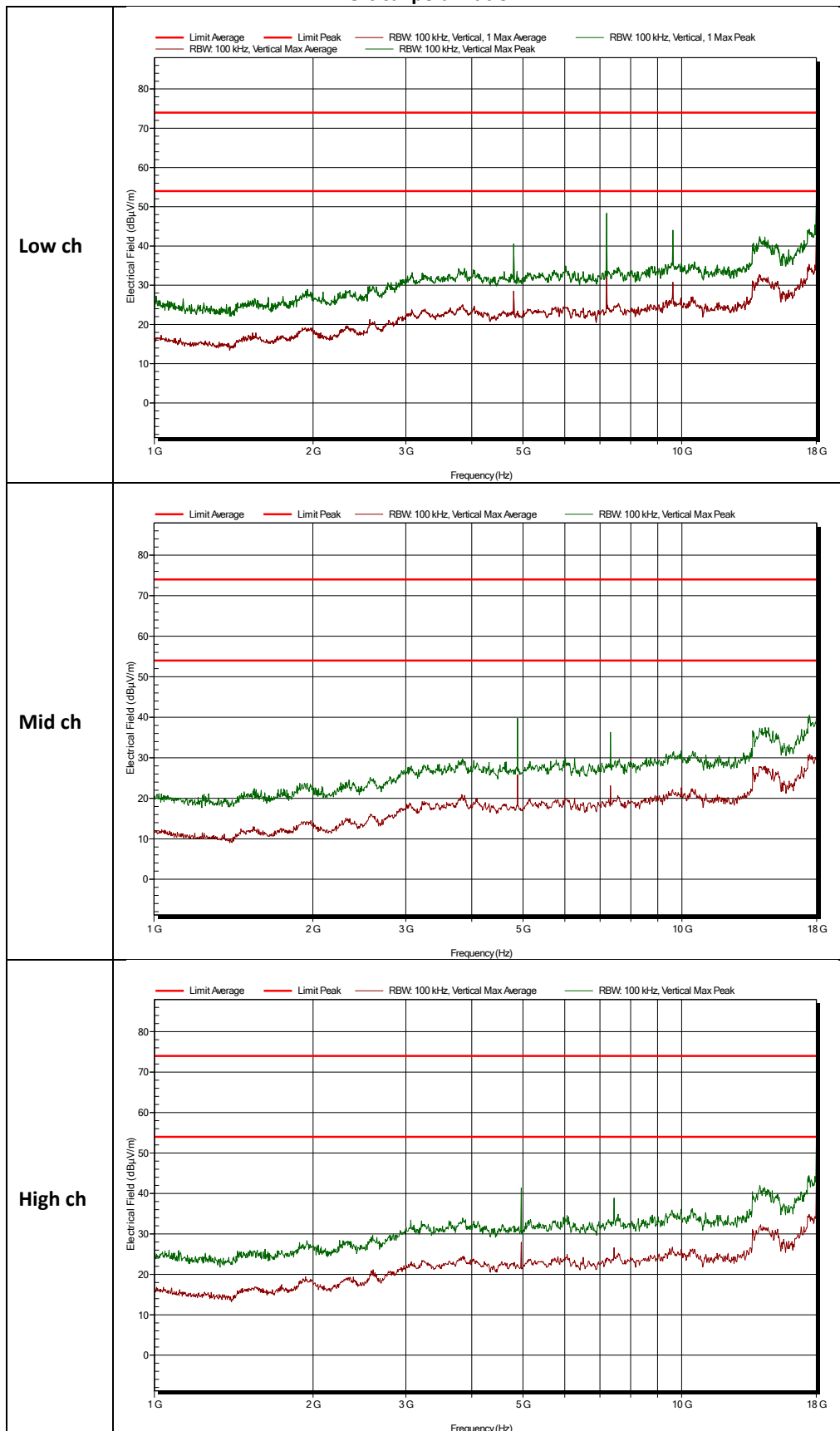
30 MHz to 1 GHz

Horizontal polarization



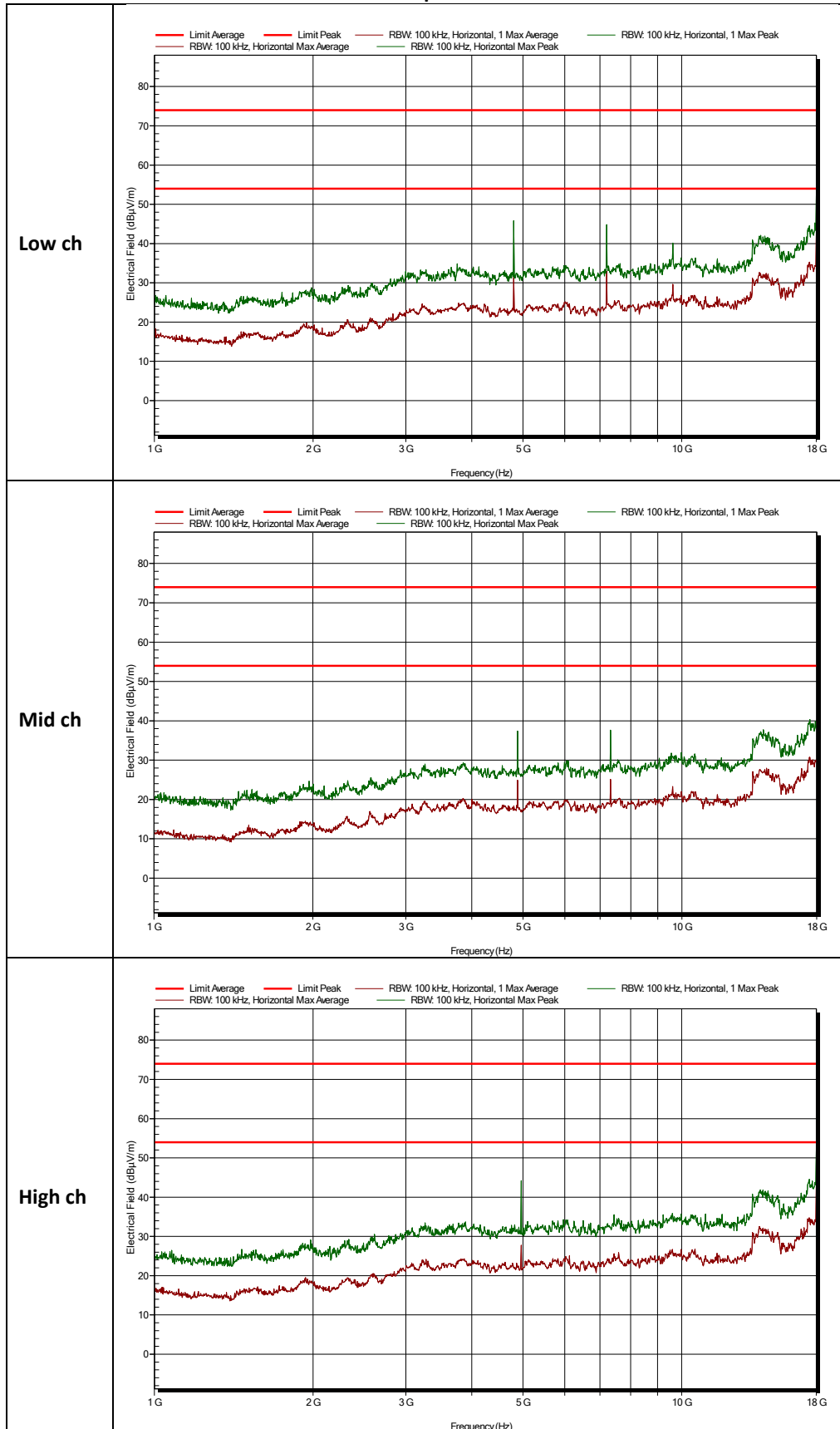
1 GHz to 18 GHz

Vertical polarization



1 GHz to 18 GHz

Horizontal polarization



18 GHz to 26 GHz

A conducted pre-scan was performed to see if any emission are found in the frequency range from 18to 26.5 GHz. See chapter 3.5.

3.6.6 Measurement Uncertainty**Measurement uncertainty Radiated emissions below 1 GHz**

Horizontal polarization	
30 – 200 MHz	4.5 dB
200 – 1000 MHz	3.6 dB
Vertical polarization	
30 – 200 MHz	5.4 dB
200 – 1000 MHz	4.6 dB

Measurement uncertainty Radiated emissions above 1 GHz

1000- 18000 MHz	+ 5.7/- 5.7dB
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