Compliance Engineering Ireland Ltd

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Project Number: 13E4897-3c

Prepared for:

Galvanic Ltd.

By

Compliance Engineering Ireland Ltd

Clonross Lane

Derrockstown

Dunshaughlin

Co. Meath

FCC Site Registration: 92592

Industry Canada Assigned Site Code: 8517A-2

FCC ID: 2ABRHPIP

IC: 11686A-PIP

Date

18th April 2014

FCC EQUIPMENT AUTHORISATION

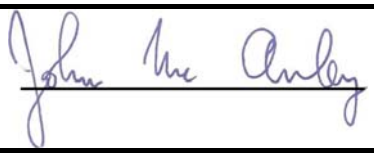
Test Report

EUT Description

Biosensor

Authorised :

John McAuley



TEST SUMMARY

The equipment complies with the requirements according to the following standards.

Bluetooth Low Energy

FCC Part Section(s)	RSS-210 Section	TEST PARAMETERS	Test Result
15.247a 2	A8.2a	6dB bandwidth of hopping Channel	Pass
15.247a	A8.4	99% bandwidth of hopping Channel	Pass
15.247e	A8.2(b)	Power Spectral Density	Pass
15.247(b)1	A8.4	Output power Conducted	Pass
15.247(d)1	A8.5	Conducted Spurious Emissions	Pass
15.209	2.6	Radiated Spurious Emissions	Pass

Exhibit A – Technical Report

Table of Contents

1.0 EUT Description

The EUT was a module using Bluetooth for biosensor feedback.

Model:	PIP
Type:	Biosensor
FCC ID:	2ABRHPIP
Company:	Galvanic Ltd
Contact	Daragh McDonnell
Address:	One Gateway , East Wall Road Dublin 3 , Ireland
Phone:	+353 87 6648363
e-mail:	daragh@galvanic.ie
Test Standards:	47 CFR, Part 15.247
Type of radio:	Stand-alone
Transmitter Type:	GFSK
Operating Frequency Range(s):	2.402 GHz- 2.48GHz
Number of Channels:	40
Antenna:	Integral
Power configuration:	3.7 v Battery.
Ports:	USB (for charging only.)
Oper. Temp Range:	5° C to +35° C
Classification:	DTS
Test Methodology:	Measurements performed according to the procedures in ANSI C63.4-2009 ANSI C63.10-2009

1.1 EUT Operation

Operating Conditions during Test:

The EUT had 2 modes of operation

a) Bluetooth Classic

i) Basic Data Rate

ii) Enhanced Data Rate (EDR) 8DPSK

iii) Enhanced Data Rate (EDR) π/4 DPSK

b) Bluetooth Low Energy

Note the Bluetooth Classic results are contained in another report.

The EUT was battery operated.

For radiated measurements the EUT had a 100k resistor connected between the sensor pads to simulate normal use case and maintain the EUT in a constant transmit state.

Environmental conditions

During the measurement the environmental conditions were within the listed ranges:

☒ Normal

Temperature:	+15 to +35 ° C
Humidity:	20-75 %

1.2 Modifications

No modifications were required in order to pass the test specifications.

1.3 Date of Test

The tests were carried out on one sample of the EUT during the months of March and April 2014 .

1.4 Electromagnetic Emissions Testing

The guidelines of CISPR 16-4 were used for all uncertainty calculations, estimates and expressions thereof for EMC testing. A copy of Compliance Engineering Ireland Ltd's policy for EMC Measurement Uncertainty is available on request.

RF Requirements: Spurious emissions in accordance with FCC CFR 15.107, 15.109 and 15.209. Tests were carried out to the requirements of CISPR 16-4 and ANSI C63.4-2009.

1.4.1 Measurement Uncertainty

The measurement uncertainty (with a 95% confidence level) for the conducted emissions test was ±3.5 dB.

The measurement uncertainty (with a 95% confidence level) for the radiated emissions test was ±5.3 dB (from 30 to 100 MHz), ±4.7 dB (from 100 to 300 MHz), ±3.9 dB (from 300 to 1000 MHz) and ±3.8 dB (from 1 GHz to 40 GHz).

2 Emissions Measurements

2.1 Conducted Emissions Measurements

The EUT chip antenna was removed and an SMA connector was connected in its place for conducted radio test.

All results were measured as conducted except radiated spurious emissions.

EUT was battery powered so conducted mains tests were not performed.

2.2 Radiated Emissions Measurements

Radiated Power measurements were made at the Compliance Engineering Ireland Ltd anechoic chamber located in Dunshaughlin, Co. Meath, Ireland to determine the radio noise radiated from the EUT. A "Description of Measurement Facilities" has been submitted to the FCC and approved pursuant to Section 2.948 of CFR 47 of the FCC rules.

The EUT was centred on a motorized turntable, which allows 360 degree rotation.

Emissions below 1GHz were measured using a bi-log antenna positioned at a distance of 3 metres from the EUT(as measured from the closest point of the EUT). The radiated emissions were maximised by configuring the EUT, by rotating the EUT, and by raising and lowering the antenna from 1 to 4 metres.. In this case the resolution bandwidth was 100kHz.

Emissions above 1GHz were measured using a horn antenna located at 3 metres distance from the EUT in a fully anechoic chamber. The radiated emissions were maximised by configuring the EUT and by rotating the EUT In this case the resolution bandwidth was 1MHz and video bandwidth was 1MHz. for peak measurements. The Video bandwidth was changed to 10Hz for Average measurements (as per ANSI 63.4-2009 Section 4.2.2 e) .

A Radiated Emission prescan was performed which covered the x, y and z orientations for low ,mid and high channels in horizontal and vertical polarizations. In each case the emission was maximised

The result of this prescan showed that the highest emission for vertical polarization was with the EUT in a vertical orientation (orientation3 O3) for low mid and high channels. The highest emission for vertical polarization was the high channel

The EUT on its side (orientation2 O2) gave the highest emissions for Low Mid and High channels for horizontal polarization. In this case the high channel gave the highest emission.

A full scan for radiated emission was performed on the high channel in orientation O3 for vertical polarization and high channel in orientation O2 for horizontal polarization.

2.3 Antenna Requirements

According to FCC 47 CFR 15.203:

"An intentional radiator antenna shall be designed to ensure that no antenna other than that furnished by the responsible party can be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section."

* The antennas of this E.U.T are permanently attached.

*The E.U.T Complies with the requirement of 15.203

4. Blue tooth Low Energy Results

4.1 Bandwidth of Hopping Channel

4.1.1 6dB bandwidth of hopping Channel

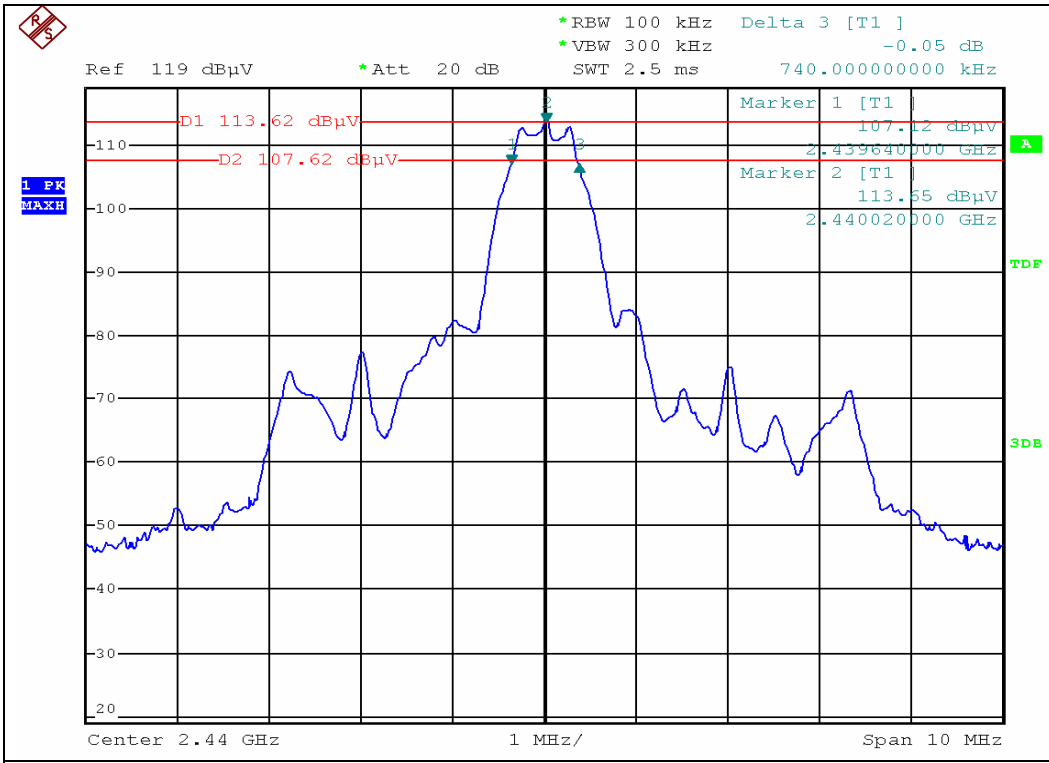


Fig 1 6dB Bandwidth

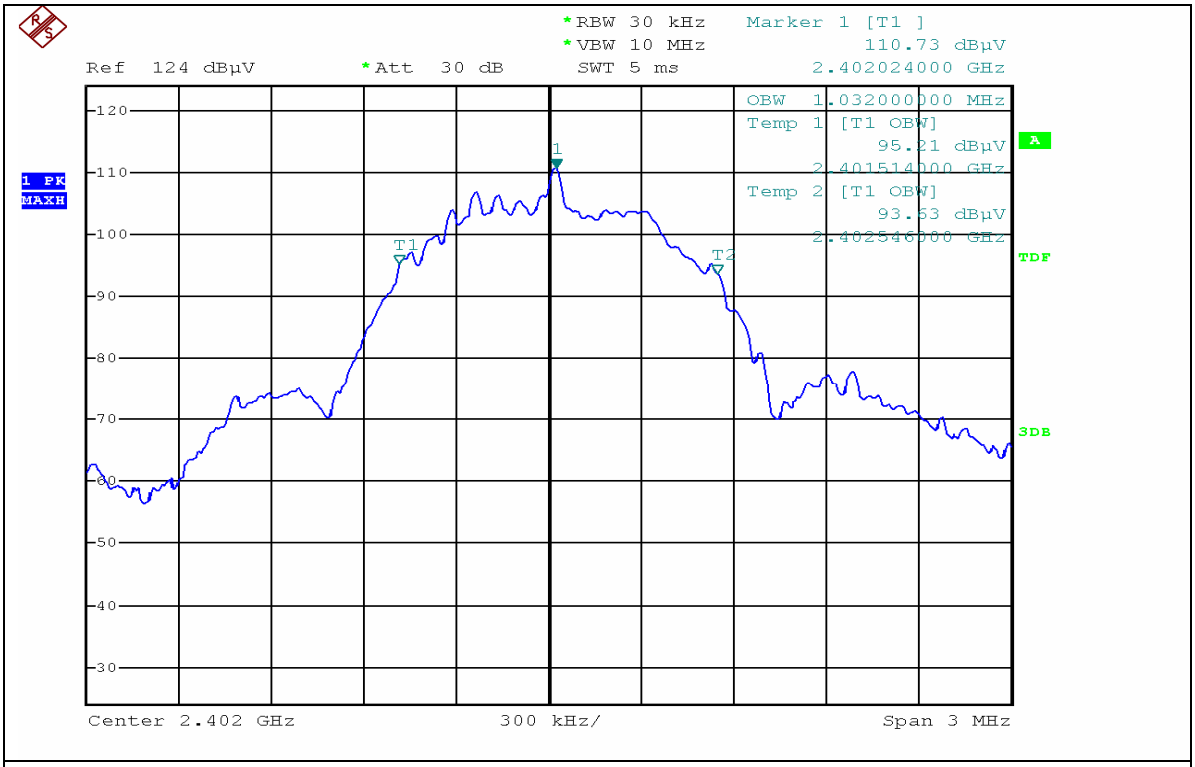


Fig 2 99% Bandwidth

Bandwidth of Hopping Channel

Channel	Operating Frequency	6dB Bandwidth	99% Bandwidth
	GHz	KHz	KHz
Low	2.402	740	1032
Mid	2.44	740	1032
High	2.48	740	1032

Limit for 6dB Bandwidth = 500KHz

Result :- Pass

4.2 Power Spectral Density

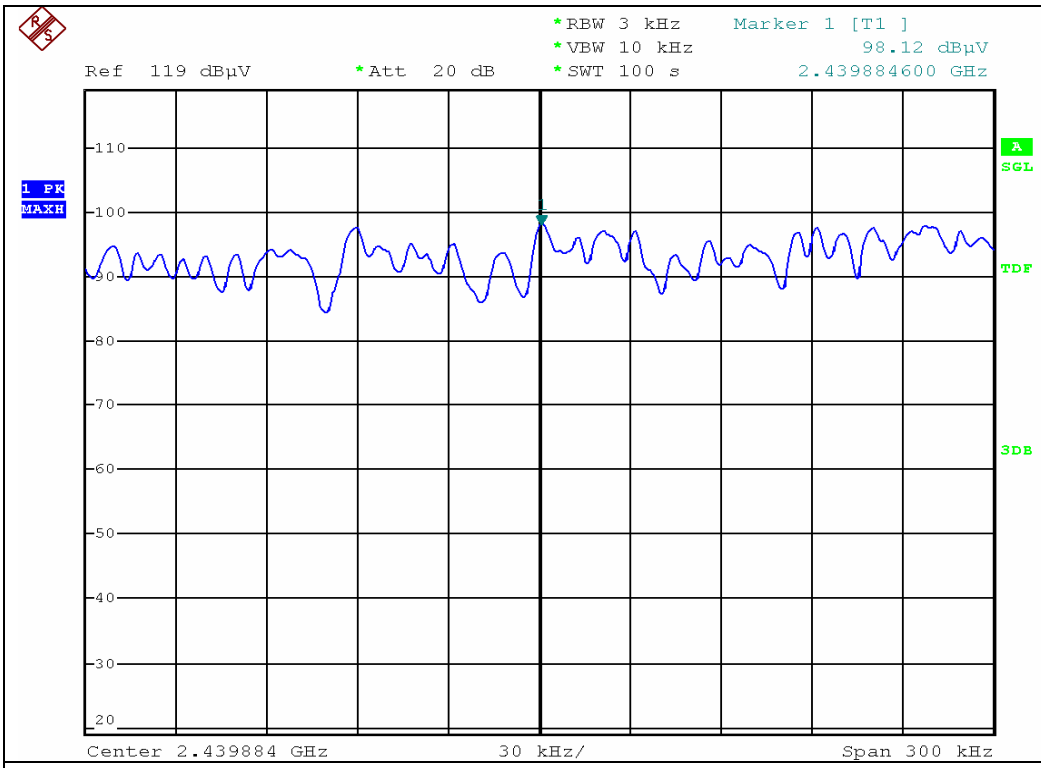


Fig 3 Power Spectral Density

Channel	Operating Frequency	Power Spectral Density	Power Spectral Density	Limit
	GHz	dBuV	dBm	dBm
Low	2.402	95.89	-11.11	8
Mid	2.44	98.12	-8.88	8
High	2.48	98.14	-8.86	8

Result :- Pass

4.3 Output power Conducted

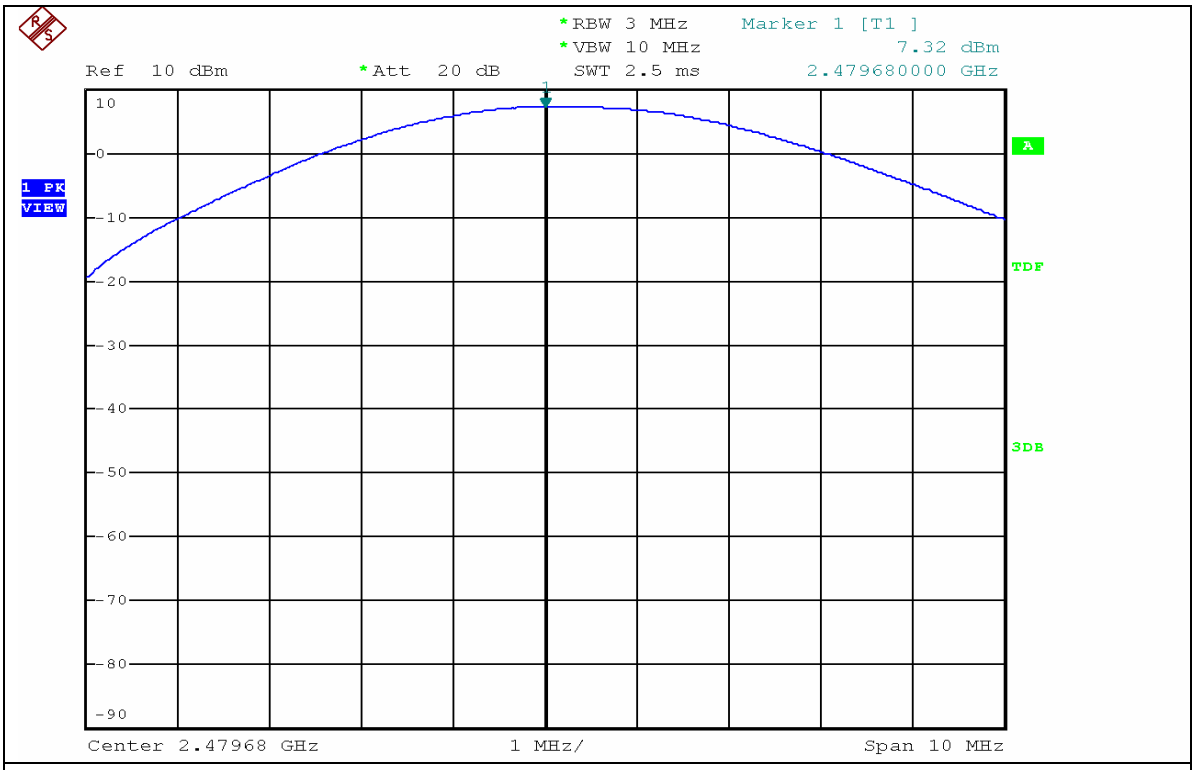


Fig 4 Output Power Conducted

Channel Frequency	Measured Level	Limit Peak Conducted Power	Margin	Result
GHz	dBm	dBm	dB	
2.402	4.84	30	25.16	Pass
2.440	7.21	30	22.79	Pass
2.48	7.32	30	22.68	Pass

4.5 Conducted Spurious Emissions

Ref scans for Bluetooth Low Energy in Appendix A

Frequency GHz	Peak Level dBuV	Cable Loss dB	Final Peak Level dBuV	Peak +20dB dBuV
0.741	53.1	0.3	53.4	73.4
4.96	48.5	1.4	49.9	69.9
0.701	51.3	0.4	51.6	71.6
4.817	46.9	1.2	48.1	68.1
7.178	48.7	1.4	50.1	70.1

Limit Peak plus 20dB is less than carrier level

Result Pass

4.6 Radiated Spurious Emissions

4.6.1 Results for Radiated emissions

Appendix B shows the results of the scans in the anechoic chamber, for Bluetooth Low Energy

Result: Pass

4.6.2 Measurements with Bilog Antenna (30MHz to 1GHz)

There were no peaks evident below 1 GHz

4.6.3 Antenna measurements (1GHz – 26 GHz)

Frequency GHz	Peak Level dBuV/m	Antenna Factor dB	Preamp Gain dB	Cable Loss	Antenna Polarity	EUT Orientation	Final Peak Level dBuV/m	Average Limit +20dB dBuV/m	Margin dB
4.804	55.8	32.3	37.1	5.2	Vertical	O3	56.2	74.0	17.8
4.804	52.0	32.3	37.1	5.2	Horizontal	O2	52.4	74.0	21.6
4.88	52.0	32.3	37.1	5.2	Vertical	O3	52.4	74.0	21.6
4.88	48.2	32.3	37.1	5.2	Horizontal	O2	48.6	74.0	25.3
4.96	51.9	34	37.3	5.2	Vertical	O3	53.8	74.0	20.2
4.96	48.9	34	37.3	5.2	Horizontal	O2	50.8	74.0	23.2

Frequency GHz	Average Level dBuV/m	Antenna Factor dB	Preamp Gain dB	Cable Loss	Antenna Polarity	EUT Orientation	Final Average Level dBuV/m	Average Limit dBuV/m	Margin dB
4.804	41.8	32.3	37.1	5.2	Vertical	O3	42.2	54.0	11.8
4.804	42.0	32.3	37.1	5.2	Horizontal	O2	42.4	54.0	11.6
4.88	40.4	32.3	37.1	5.2	Vertical	O3	40.8	54.0	13.2
4.88	39.9	32.3	37.1	5.2	Horizontal	O2	40.3	54.0	13.7
4.96	38.9	34	37.3	5.2	Vertical	O3	40.8	54.0	13.2
4.96	38.4	34	37.3	5.2	Horizontal	O2	40.3	54.0	13.7

RBW = 1MHz

VBW =10MHz for peak readings and VBW = 10Hz for Average readings as per ANSI 63.4-2009 Section 4.2.2 e.

Result: Pass

4.7 Frequency Range

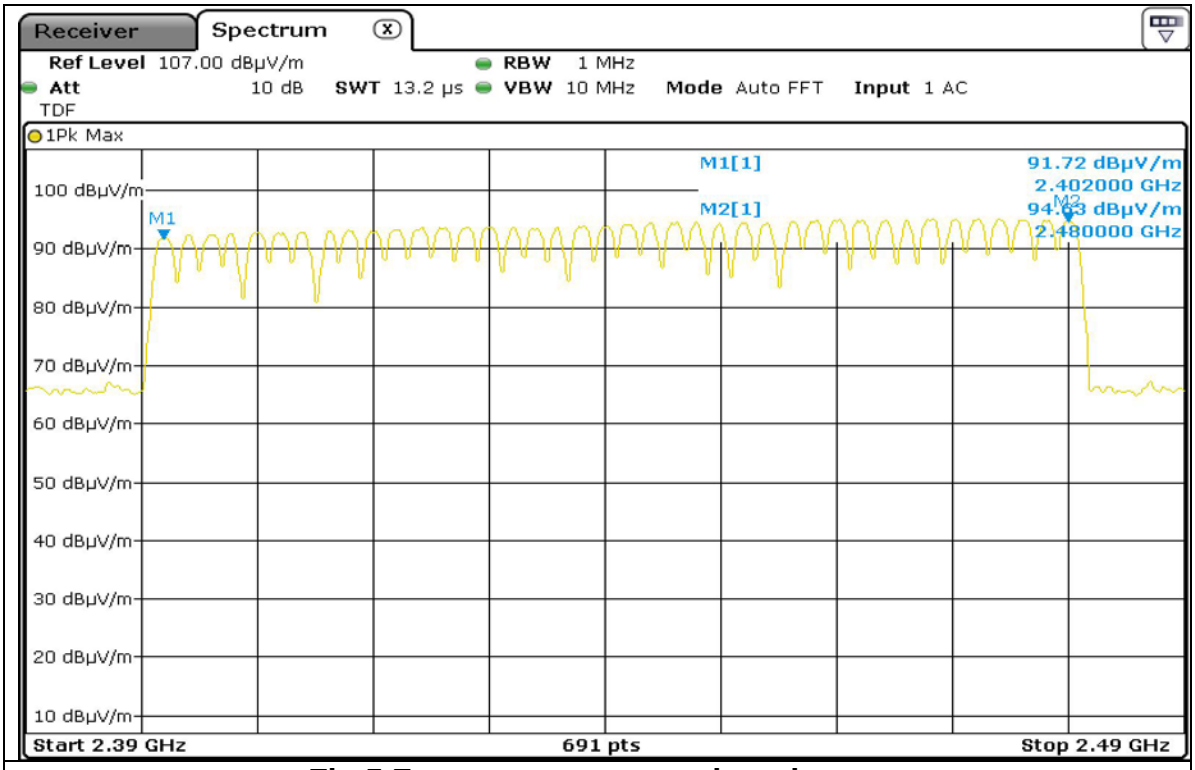


Fig 5 Frequency range hopping on

5.0 List of Test Equipment

Instrument	Mftr.	Model	CEI Ref No.	Cal Due Date
Bilog Antenna	Chase	CBL 6140	690	03/10/2015
Preamplifier	Hewlett Packard	83017A	805	10/04/2014
Horn Antenna	AH Systems	SAS 200 571	839	16/05/2016
Spectrum Analyser	Rohde & Schwarz	FSP 40	850	18/06/2014
Spectrum Analyser/Receiver	Rohde & Schwarz	ESR	869	25/05/2014
Horn Antenna	A-Inflow	LB-42-25-C-KF	877	04/09/2014
Cable low loss	Micro-Coax	Utiflex UFA147A	705	18/05/2014

Appendix A

Additional Test Results

For

Bluetooth Low Energy

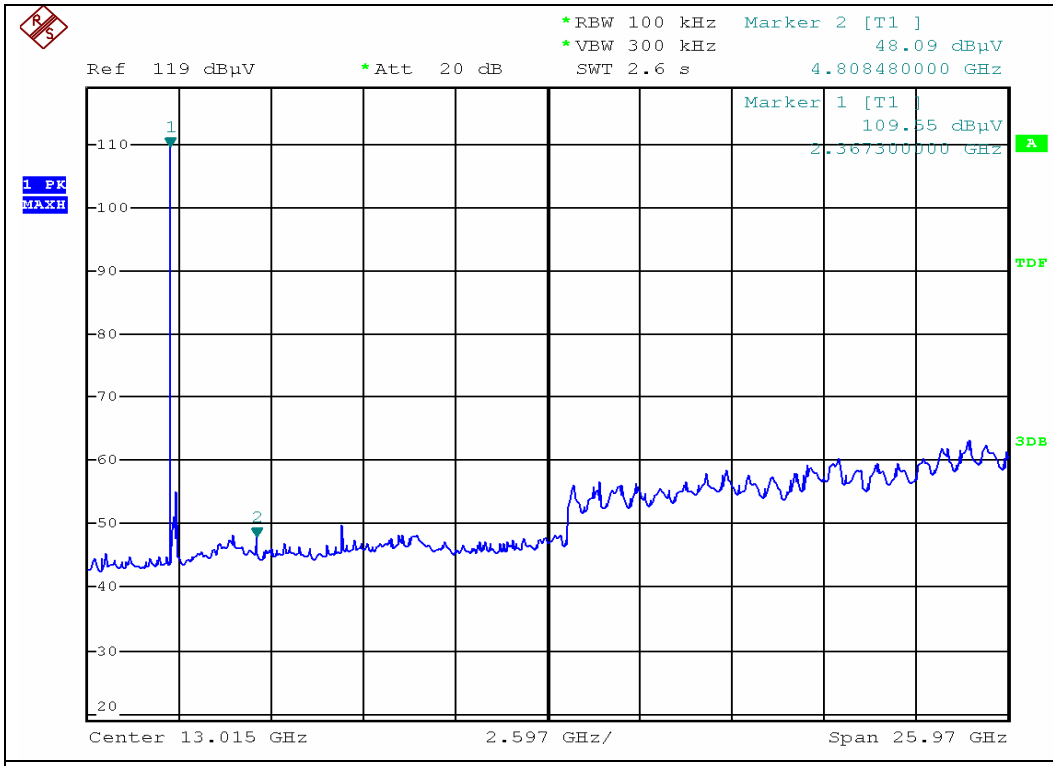


Fig A1 Low Channel Conducted Spurious Emissions 30MHz -26 GHz

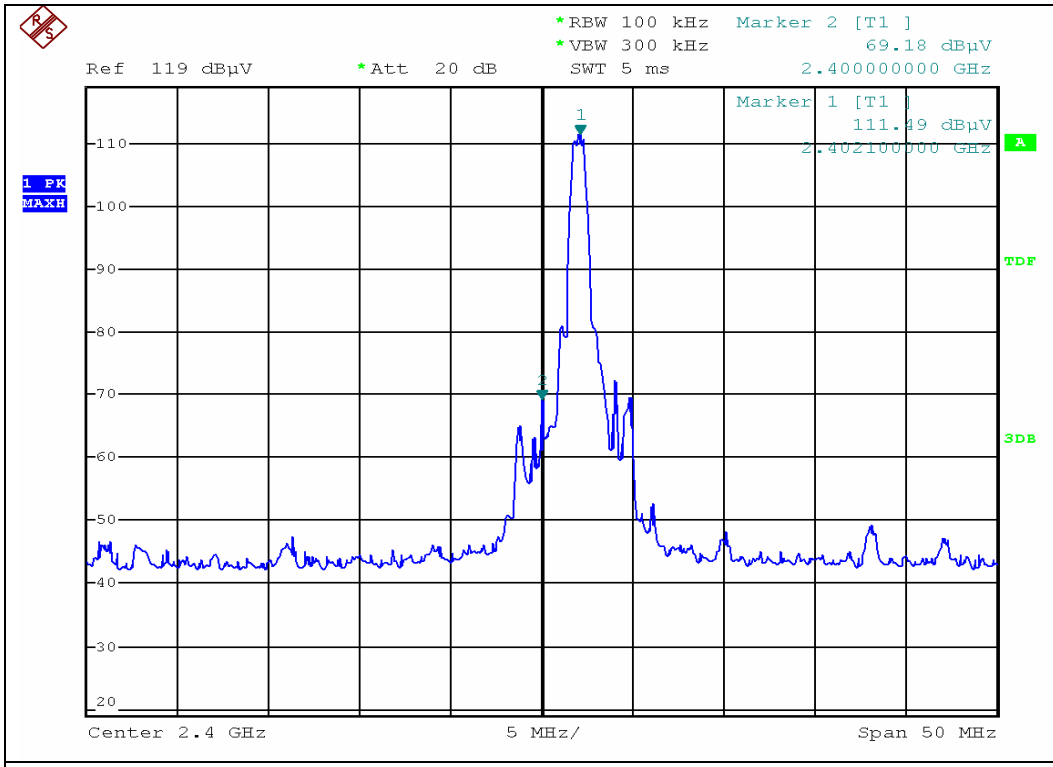


Fig A2 Low Channel Conducted Spurious Emissions Lower Band Edge

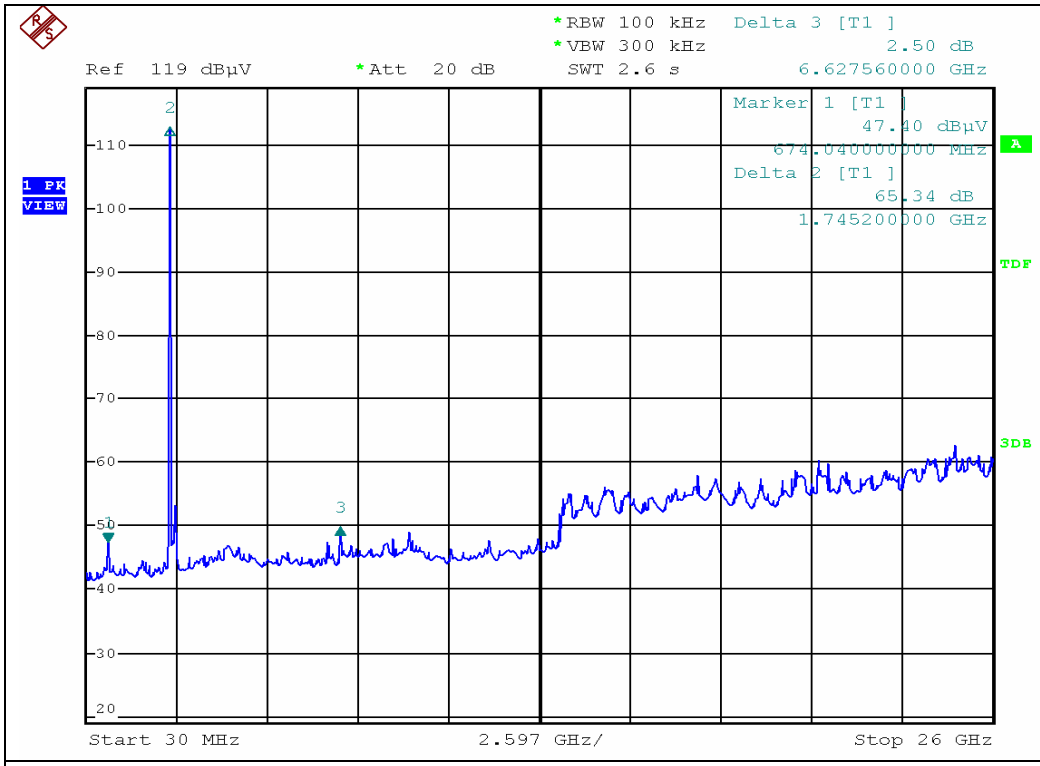


Fig A3 Mid channel Conducted Spurious Emissions 30MHz -26 GHz

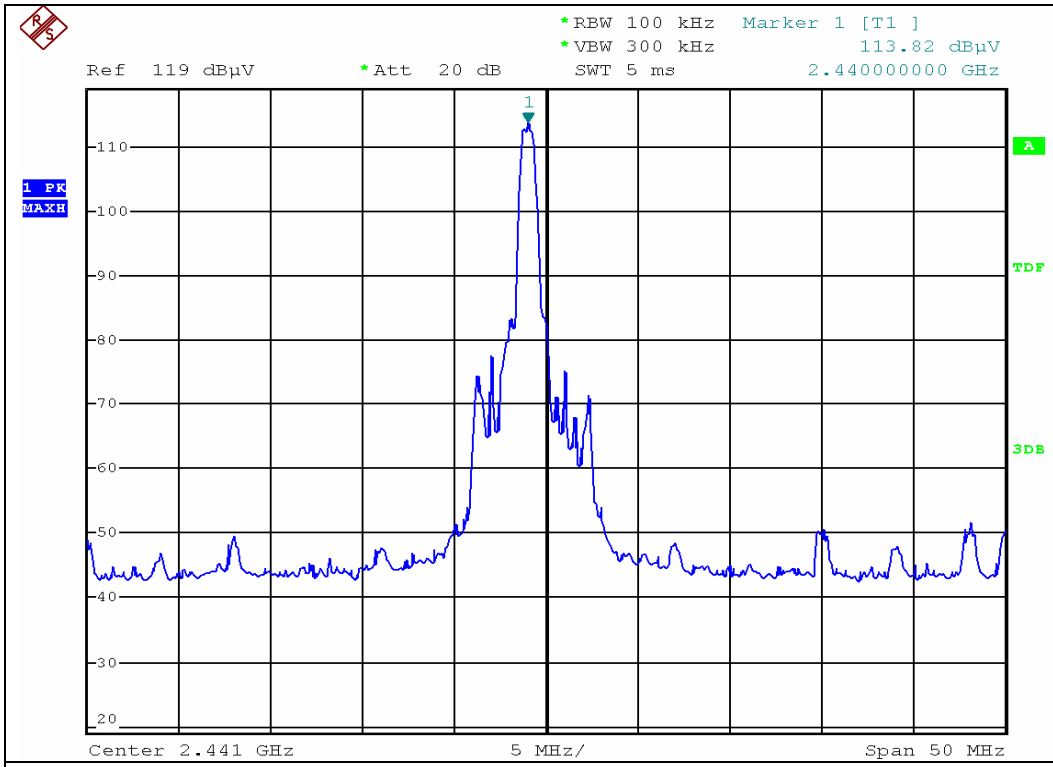


Fig A4 Mid channel Conducted Spurious Emissions

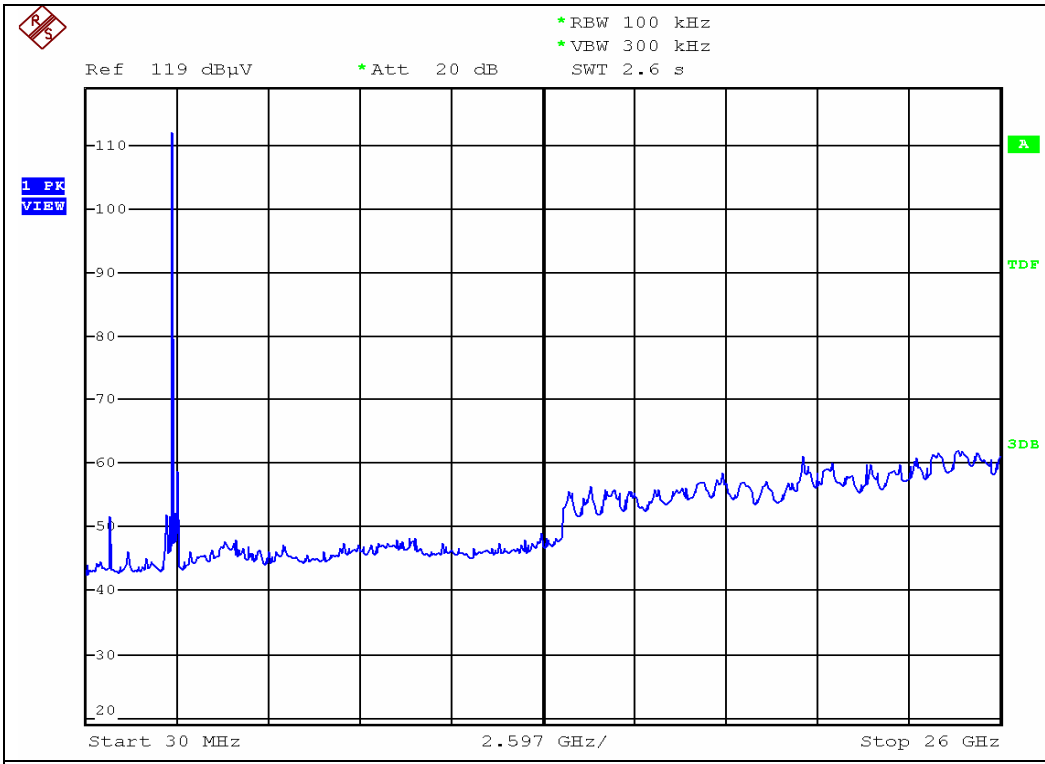


Fig A5 High channel Conducted Spurious Emissions 30MHz -26 GHz

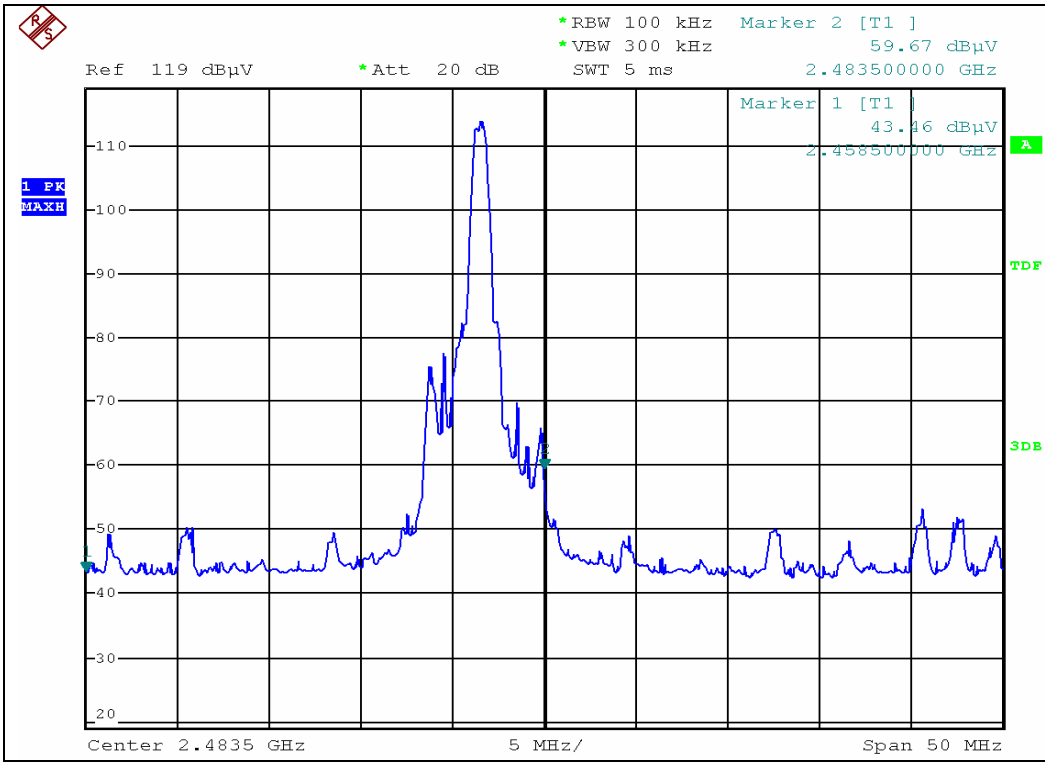


Fig A6 High channel Conducted Spurious Emissions Upper Band Edge

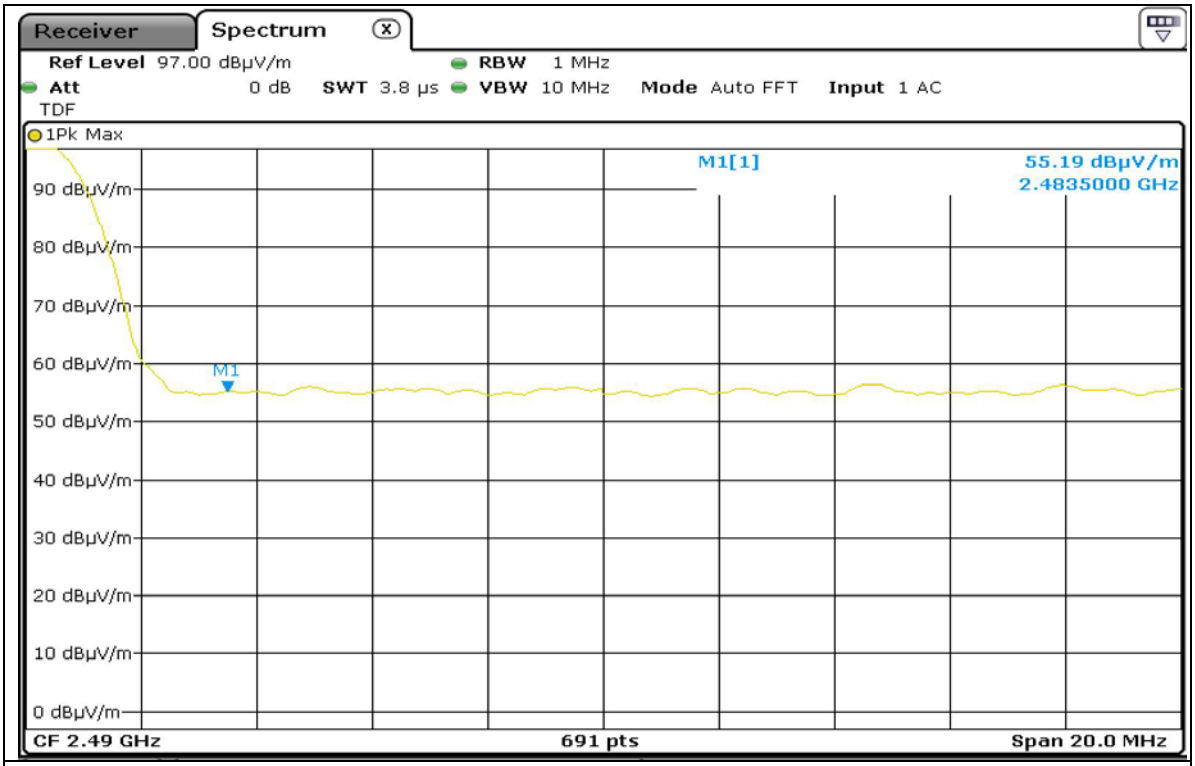


Fig A7 High Channel Restricted Band Vertical Peak at 3 metres

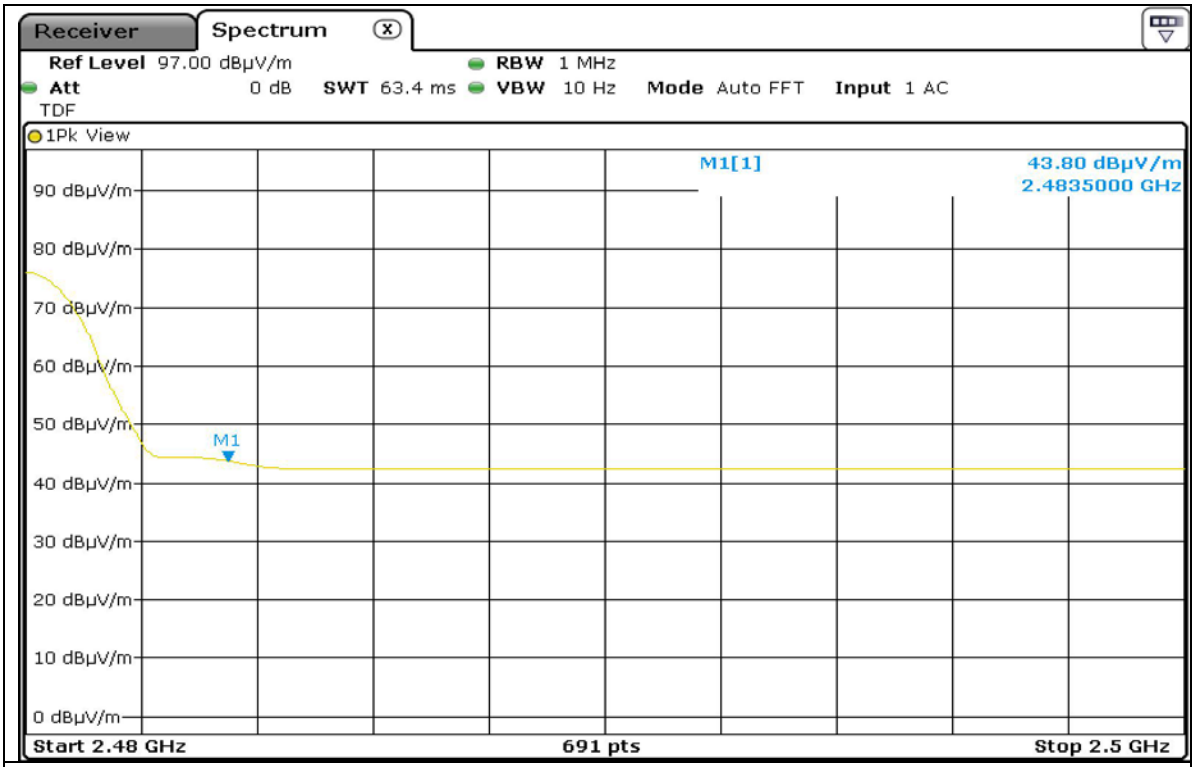


Fig A8 High Channel Restricted Band Vertical Average at 3 metres

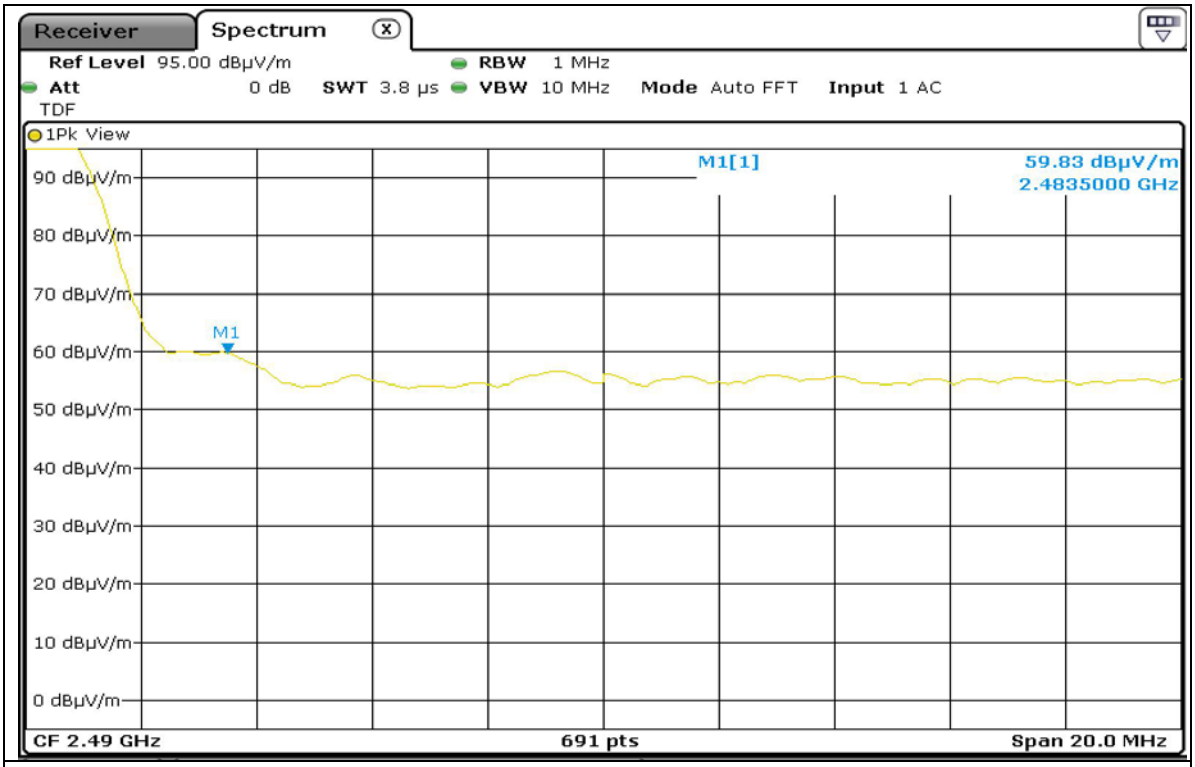


Fig A9 High Channel Restricted Band Horizontal Peak at 3 metres

Fig A10 High Channel Restricted Band Horizontal Average at 3 metres

Appendix B

Additional Test Results

For

Bluetooth Low Energy

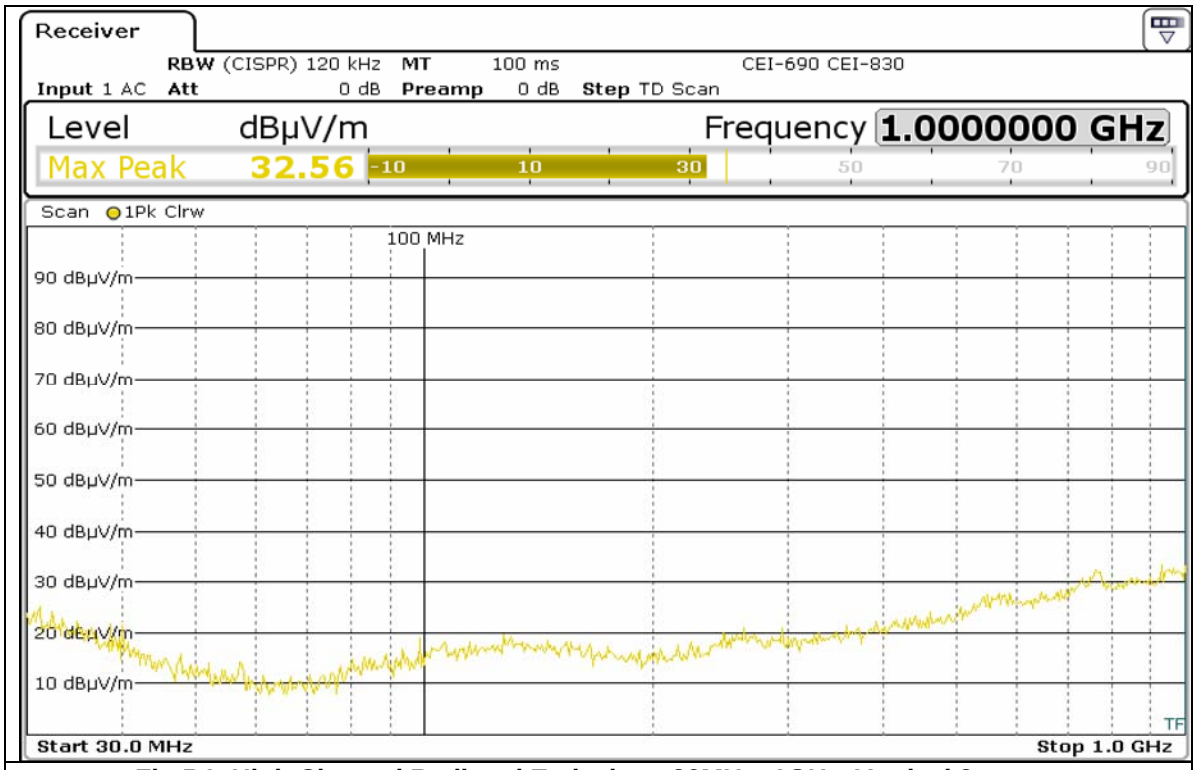


Fig B1 High Channel Radiated Emissions 30MHz -1GHz Vertical 3metres

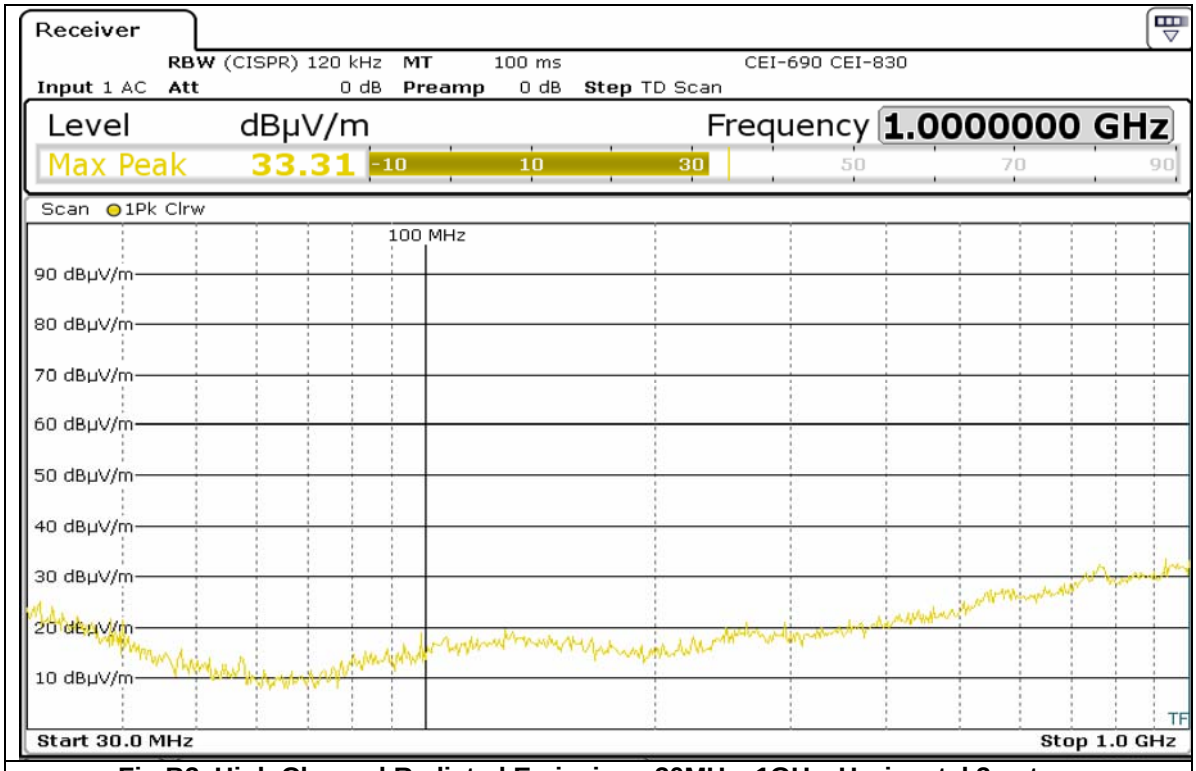


Fig B2 High Channel Radiated Emissions 30MHz -1GHz Horizontal 3metres

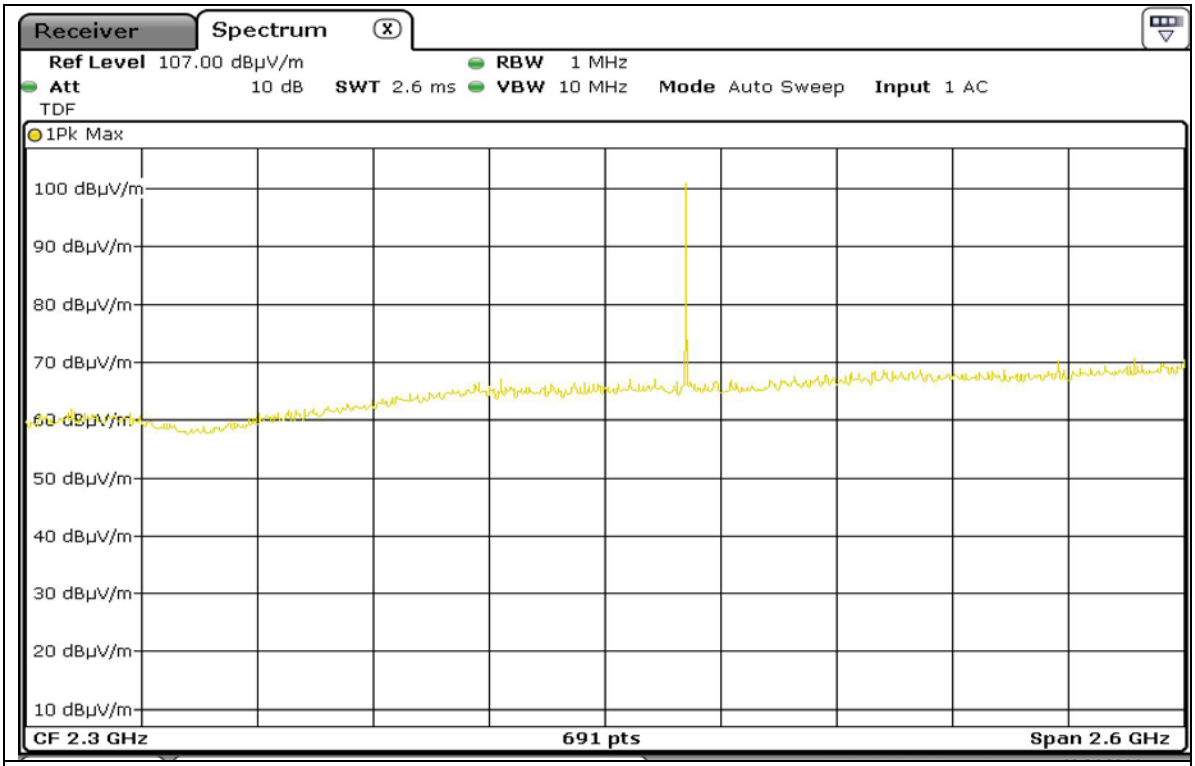


Fig B3 High Channel Radiated Emissions 1GHz -3.6GHz Vertical 3metres

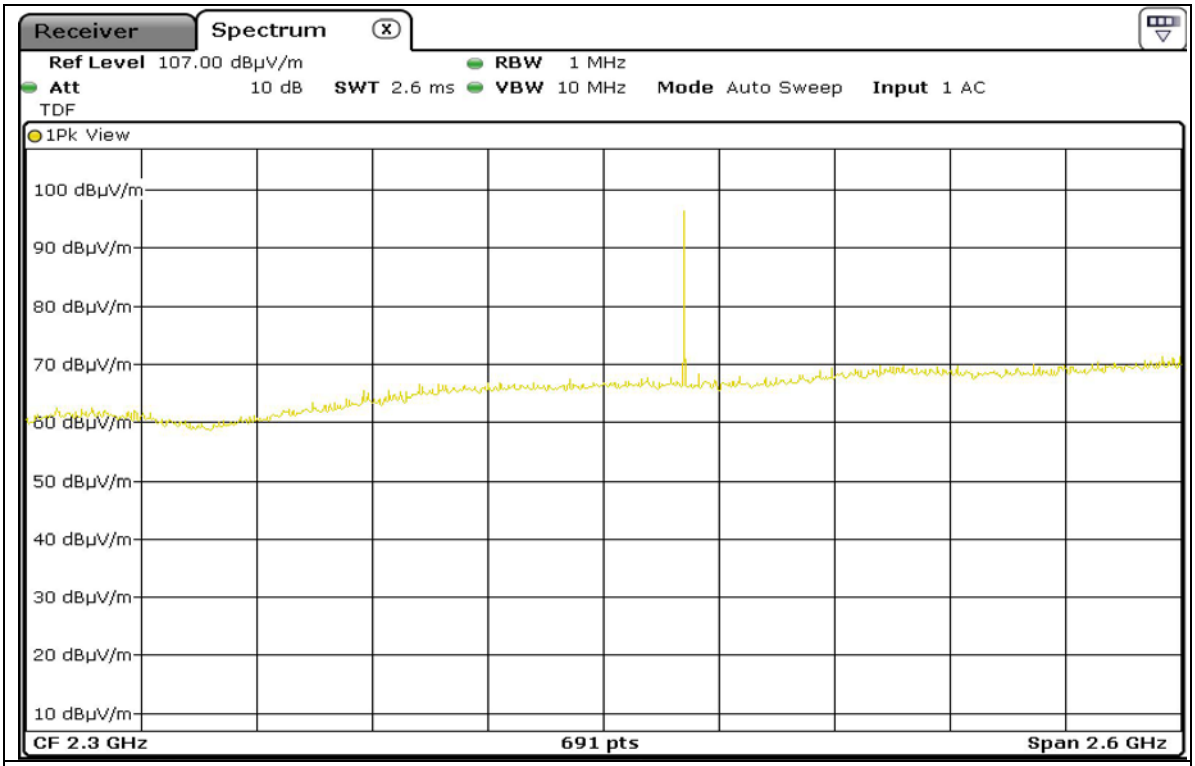


Fig B4 High Channel Radiated Emissions 1GHz -3.6GHz Horizontal 3metres

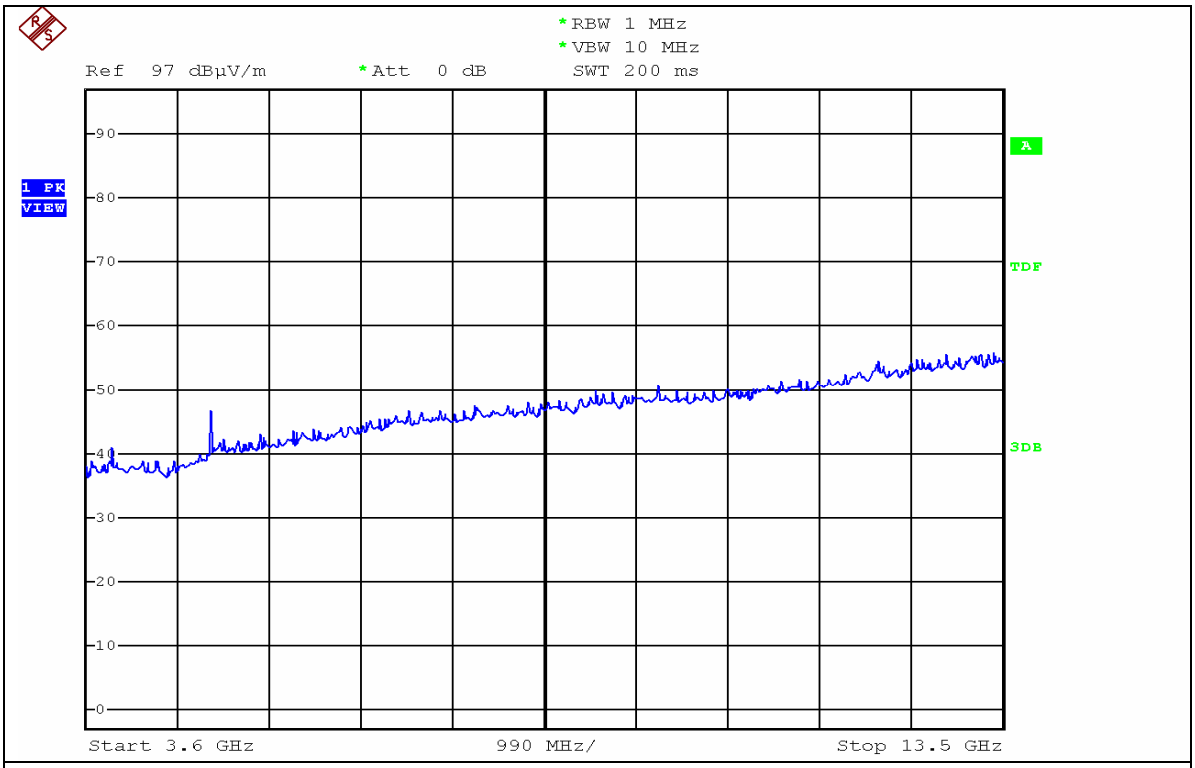


Fig B5 High Channel Radiated Emissions 3.6GHz -13.5GHz Vertical 3metres

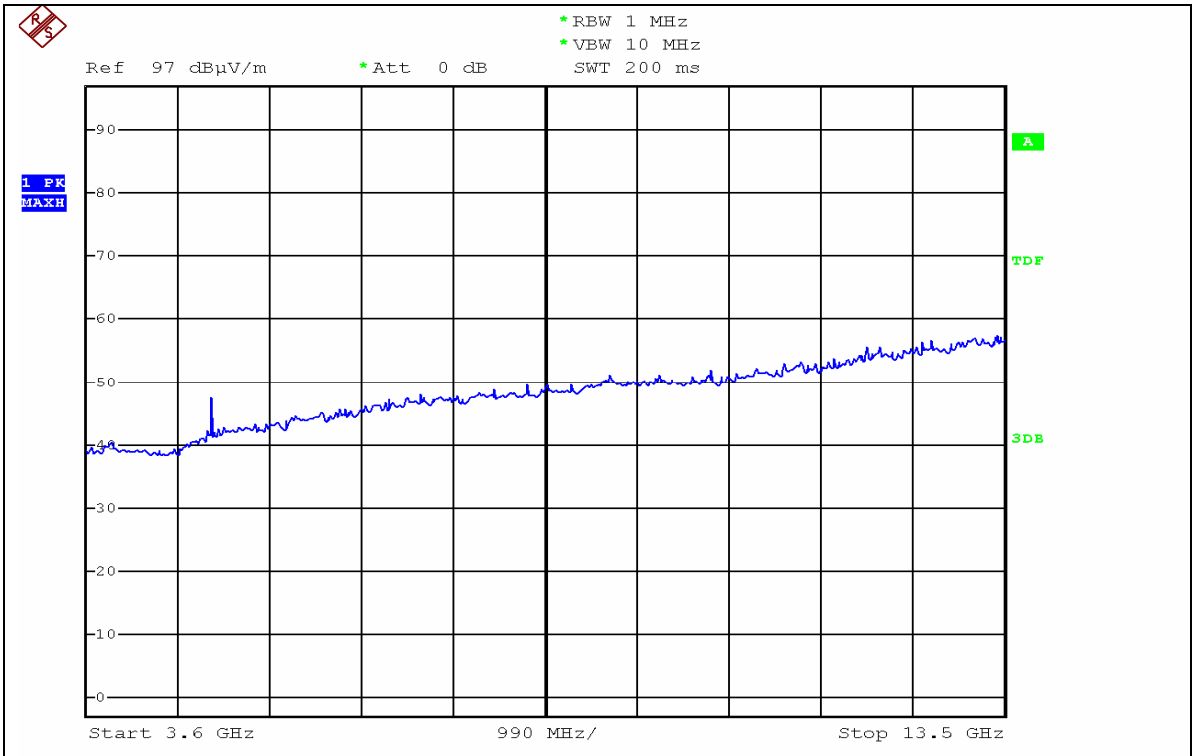


Fig B6 High Channel Radiated Emissions 3.6GHz -13.5GHz Horizontal 3metres

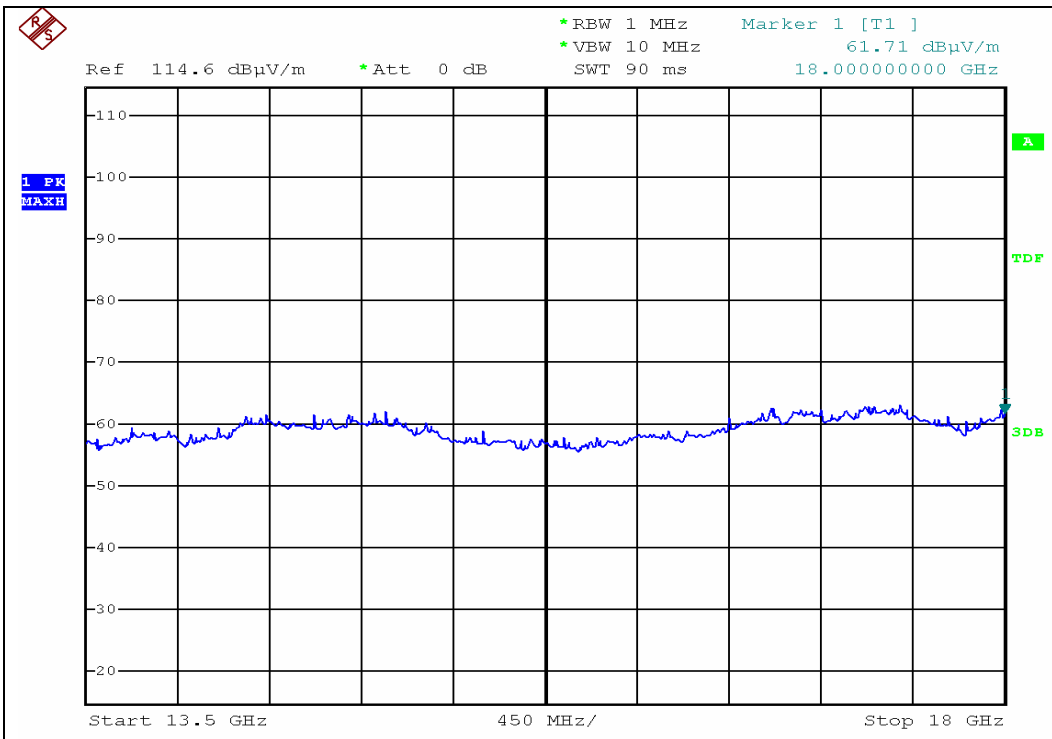


Fig B7 High Channel Radiated Emissions 13.5GHz -18GHz Vertical 3metres

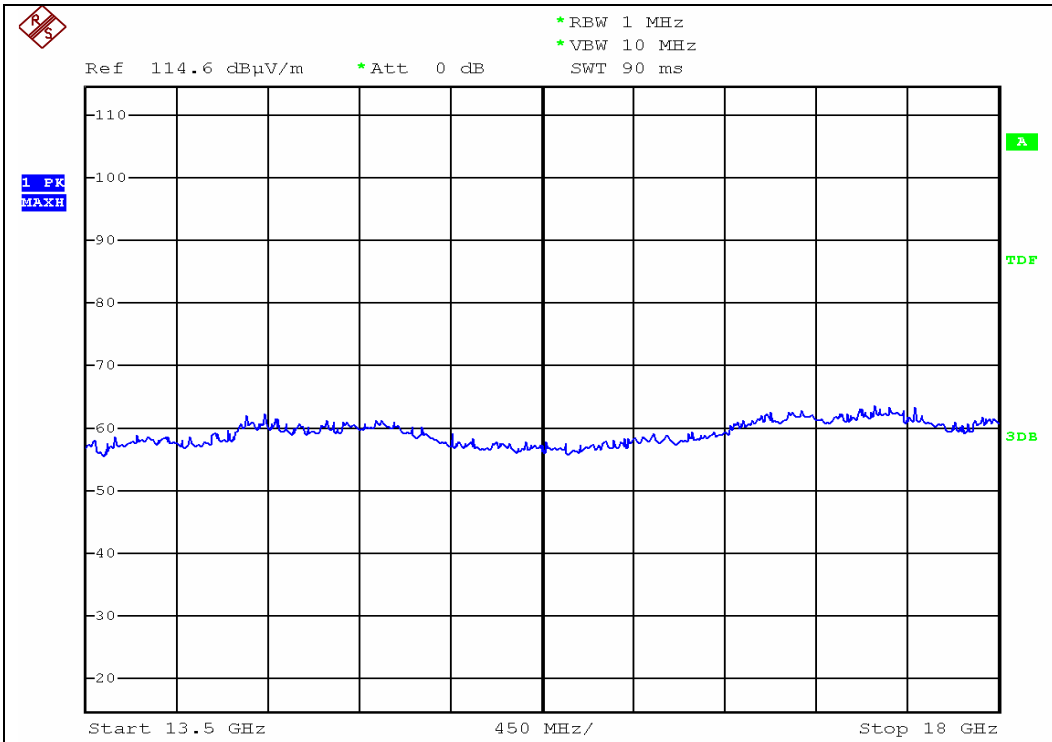


Fig B8 High Channel Radiated Emissions 13.5GHz -18GHz Horizontal 3metres

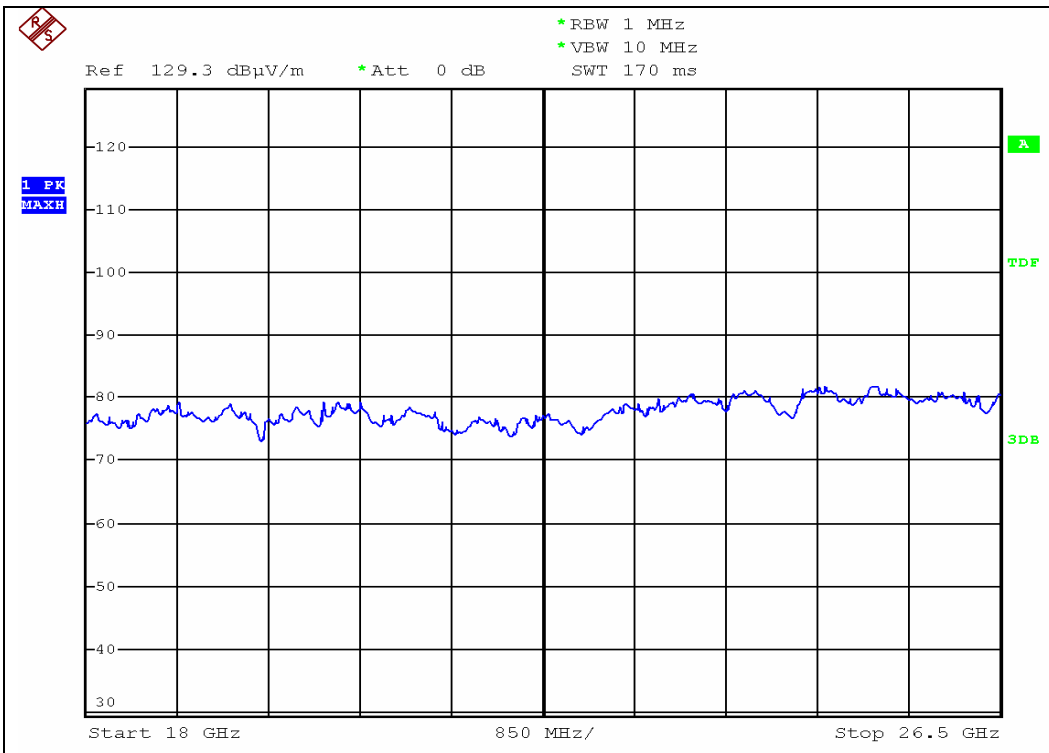


Fig B9 High Channel Radiated Emissions 18GHz -26GHz Vertical 0.1metres

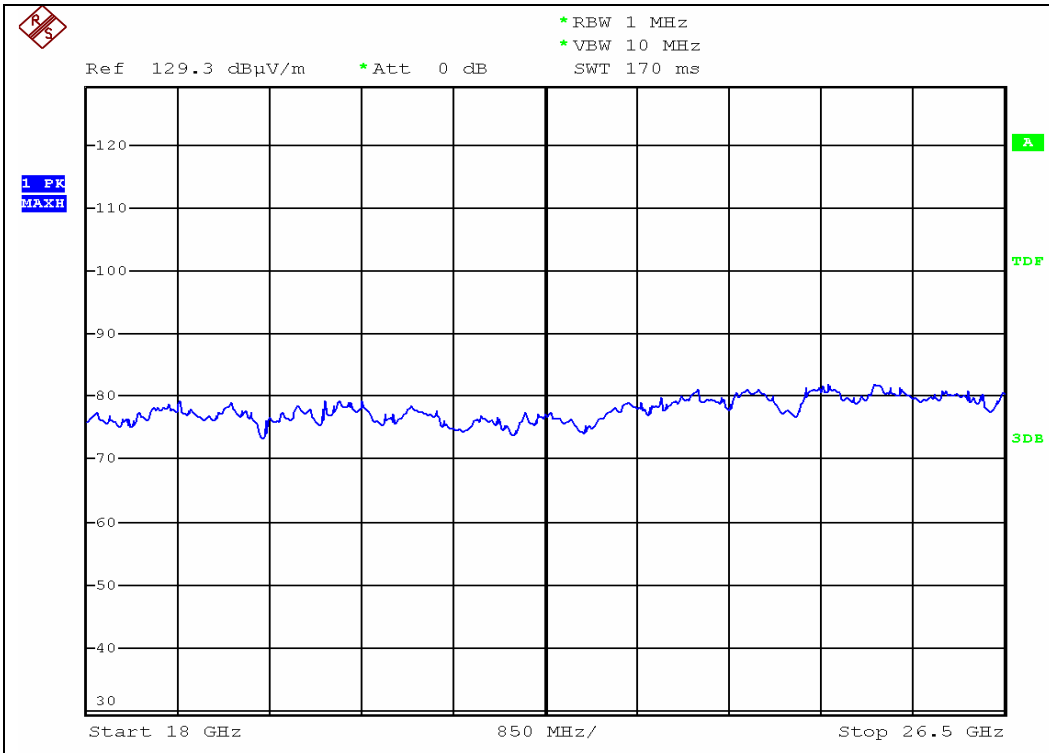


Fig B10 High Channel Radiated Emissions 18GHz -26GHz Horizontal 0.1metres