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Project Number: 13E4814-1b

Prepared for:

Itronik Interconnect Ltd.

By

Compliance Engineering Ireland Ltd

Clonross Lane

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FCC Site Registration: 92592

Industry Canada Assigned Site Code: 8517A-2

FCC ID: 2ABFL105REG

IC: 11591A-105REG

Date

25th April 2014

FCC EQUIPMENT AUTHORISATION

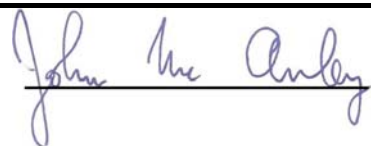
Test Report

EUT Description

Register unit (for RFID Tag)

Authorised :

John McAuley

A handwritten signature in blue ink, reading 'John McAuley', written over a horizontal line.

TEST SUMMARY

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

FCC Part Section(s)	RSS-210 Section	TEST PARAMETERS	Test Result
15.231(a)	A1.1.1(a)	MAXIMUM MODULATION PERCENTAGE (M%)	PASS
15.231(b)	A.1.1.2(1)	RADIATED EMISSIONS	PASS
15.231(c)	A1.1.3	20dB BANDWIDTH	PASS
15.207(a)	RSS Gen 7.2.4	CONDUCTED EMISSIONS ON THE MAINS	PASS

RSS Gen Issue 3 2010

RSS-210 Issue 8 2010

THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL, WITHOUT THE
WRITTEN APPROVAL OF COMPLIANCE ENGINEERING IRELAND LTD

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1.0 EUT Description

The EUT was a module using a short range 433 MHz band transceiver for RFID communication to personal TAG unit.

Model:	105REG
Type:	Register unit for Personal Tag unit
FCC ID:	2ABFL105REG
Company:	Itronik Interconnect Ltd.
Contact	Christopher Slattery
Address:	Itronik Interconnect Ltd Cloughaun, Kilchreest Loughrea, Co. Galway, Ireland
Phone:	+353921840055
e-mail:	c.slattery@higenx.com
Test Standards:	47 CFR, Part 15.231(a,e)
Type of radio:	Stand-alone
Transmitter Type:	FSK
Operating Frequency Range(s):	434.099 MHz
Number of Channels:	One
Antenna:	Integral
Transmitter power configuration:	Mains.
Oper. Temp Range:	5° C to +35° C
Classification:	DSR
Test Methodology:	Measurements performed according to the procedures in ANSI C63.4-2003 ANSI C63.10-2009

1.1 EUT Operation

Operating Conditions during Test:

The equipment under test was operated during the measurement under the following conditions:

The EUT was mains powered.

The EUT was operated in continuous modulated mode (duty cycle was 50uS on and 30uS off) for all tests except duty cycle test.

For the duty cycle test, the EUT was operated in normal operation mode, where transmission from the EUT was triggered from a unit external to the anechoic chamber..

Environmental conditions

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

☒ Normal

Temperature: +15 to +35 ° C

Humidity: 20-75 %

1.1 Modifications

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

1.2 Date of Test

The tests were carried out on one sample of the EUT during the month of November 2013.

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 C63.4-2003.

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).

2.0 Emissions Measurements

2.1 Conducted Emissions Measurements

The EUT was powered was connected to the mains through a LISN and measurements were carried out using a Receiver over the frequency range 150KHz to 30MHz.

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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. A measurement antenna was positioned at a distance of 3 metres 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.

Emissions below 1GHz were measured using a bi-log antenna. 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 this case the resolution bandwidth was 1MHz and video bandwidth was 1MHz.

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

2.4 Carrier Power

Frequency MHz	Reading Peak dBuV/m	Antenna Polarity	Antenna Factor dB	Cable loss dB	Final Field Strength Peak dBuV/m	Margin for Peak v Average Limit +20dB
434.099	54.0	Vertical	16.1	1.2	71.3	29.5
434.099	48.5	Horizontal	16.1	1.2	65.8	35.0
868.180	23.5	Vertical	22.2	1.4	47.1	33.7
868.180	22.5	Horizontal	22.2	1.4	46.1	34.7

Frequency MHz	Final Field Strength Peak dBuV/m	Antenna Polarity	Average Level dBuV/m (Peak plus - 3.8dB Duty Cycle factor)	Average Limit dBuV/m	Margin dB
434.099	71.3	Vertical	67.5	80.8	13.3
434.099	65.8	Horizontal	62	80.8	18.8
868.180	47.1	Vertical	43.3	60.8	17.5
868.180	46.1	Horizontal	42.3	60.8	18.5

2.5 Test Criteria

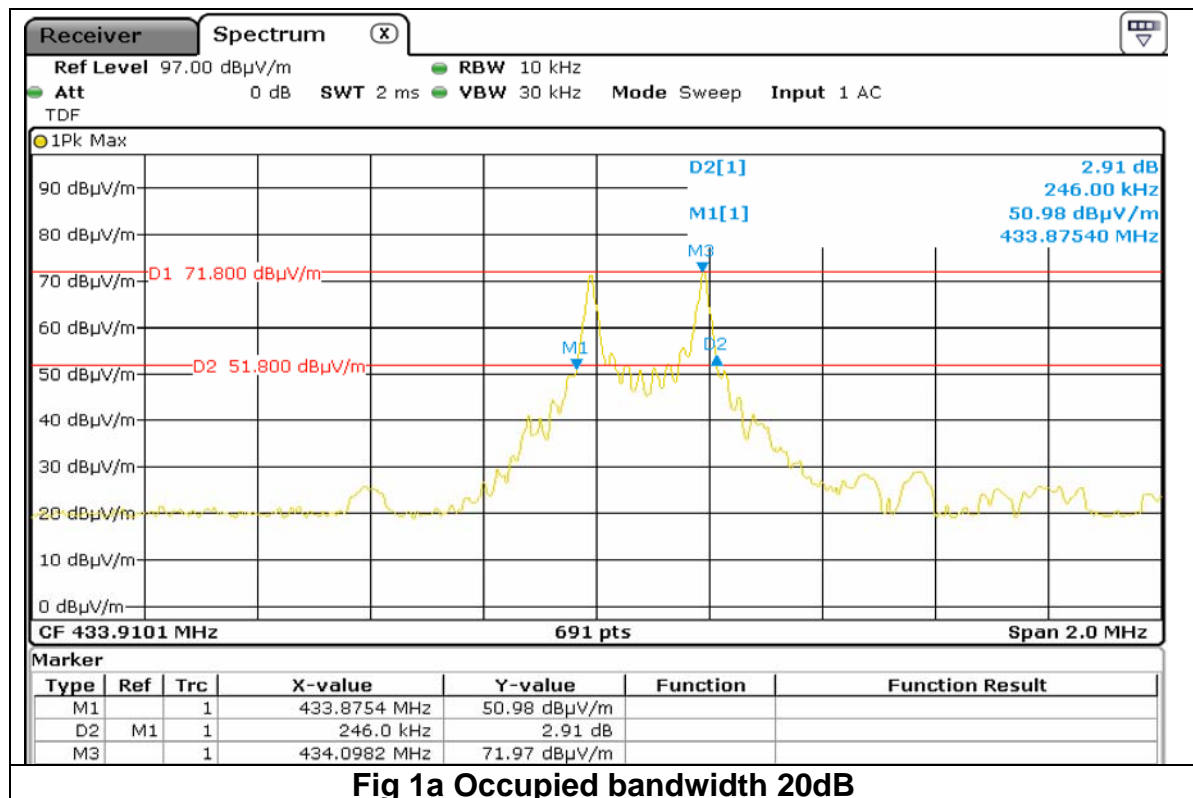
Requirement :-15.231 (c) & IC RSS-210 Issue 8 A1.1.3

The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz. For devices operating above 900 MHz, the emission shall be no wider than 0.5% of the center frequency. Bandwidth is determined at the points 20dB down from the modulated carrier.

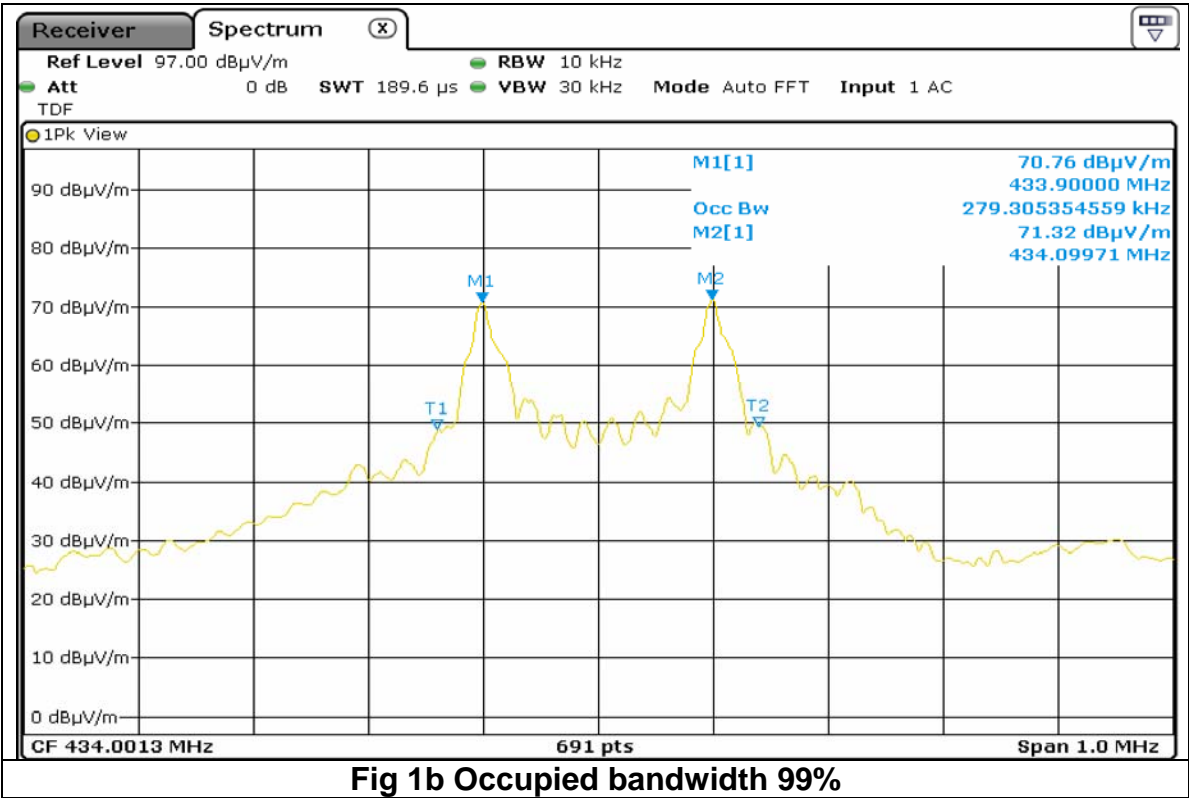
TEST PROCEDURE

The resolution bandwidth was set to 10 kHz. The video bandwidth was set to 30 kHz. Bandwidth is determined at the points 20 dB down from the modulated carrier.

RESULTS



Operating Frequency (MHz)	20dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)	Result
434.099	246	1085.2475	839.2475	Pass



Operating Frequency (MHz)	99% Occupied Bandwidth (kHz)
434.099	279.31

3.0 MAXIMUM MODULATION PERCENTAGE (M%)

LIMIT

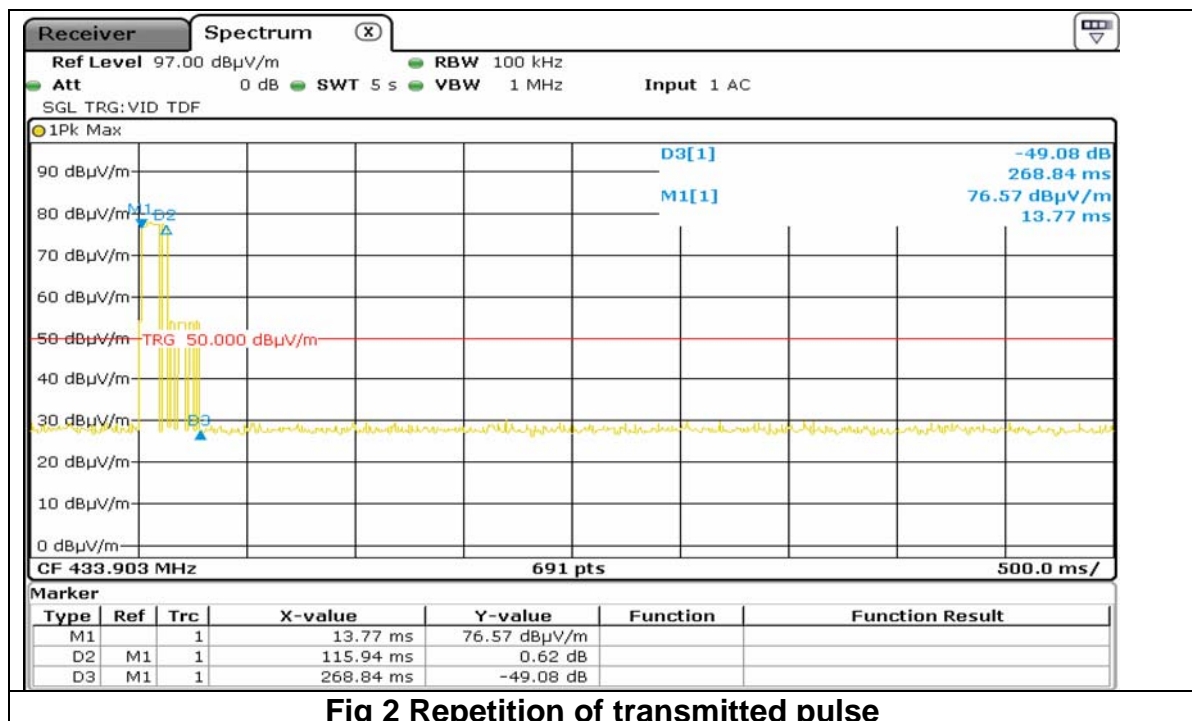
15.35 (c) & IC RSS-Gen Issue 1 4.3

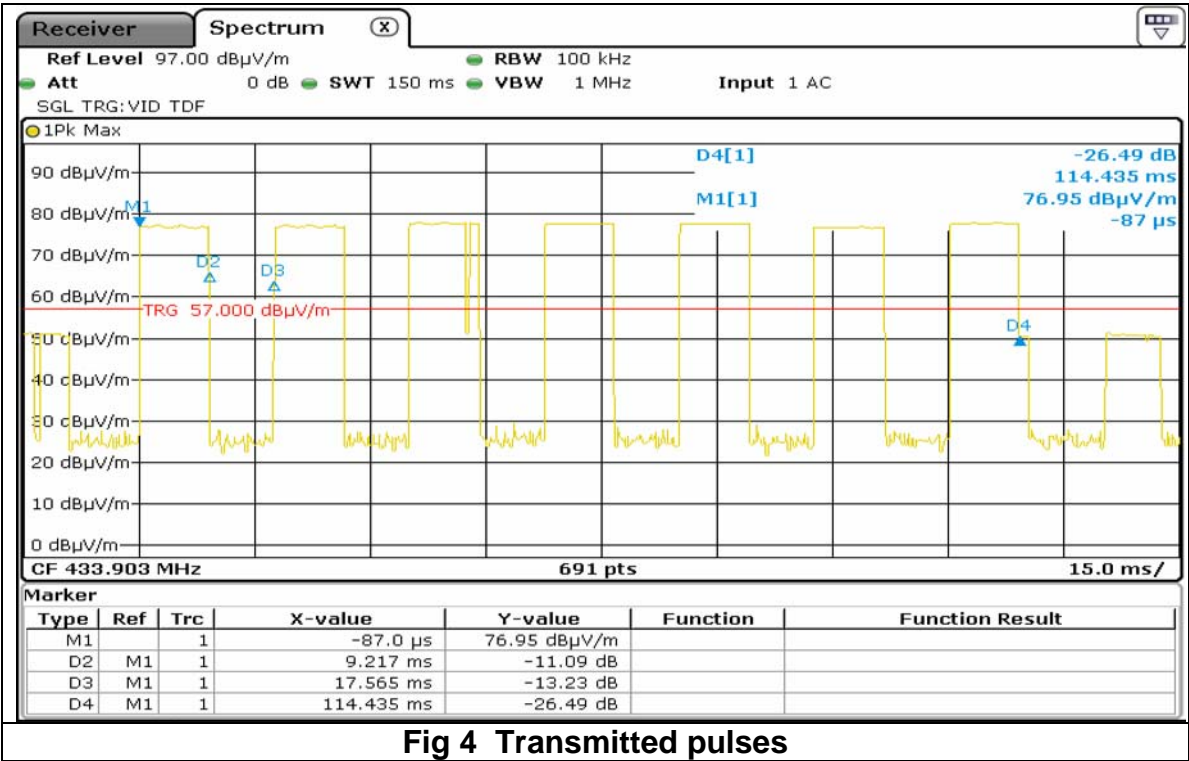
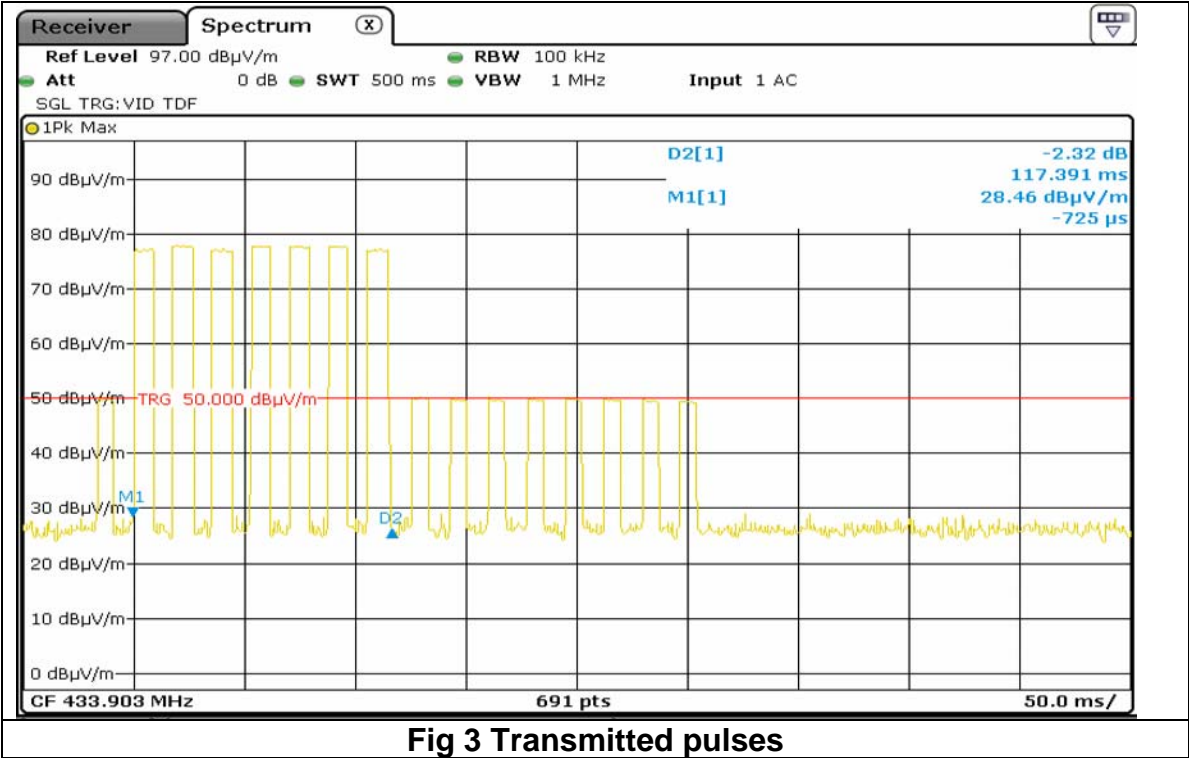
The measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds. As an alternative (provided the transmitter operates for longer than 0.1 seconds) or in cases where the pulse train exceeds 0.1 seconds, the measured field strength shall be determined from the average absolute voltage during a 0.1 seconds interval during which the field strength is at its maximum value. The exact method of calculating the average field strength shall be submitted with any application for certification or shall be retained in the measurement data file for equipment subject to notification or verification.

TEST PROCEDURE

The bilog antenna is connected to a spectrum analyzer for radiated field strength. The RBW is set to 100 kHz and the VBW is set to 1 MHz. The sweep time is coupled and the span is set to 0 Hz. The number of pulses is measured and calculated in a 100 ms scan.

RESULTS





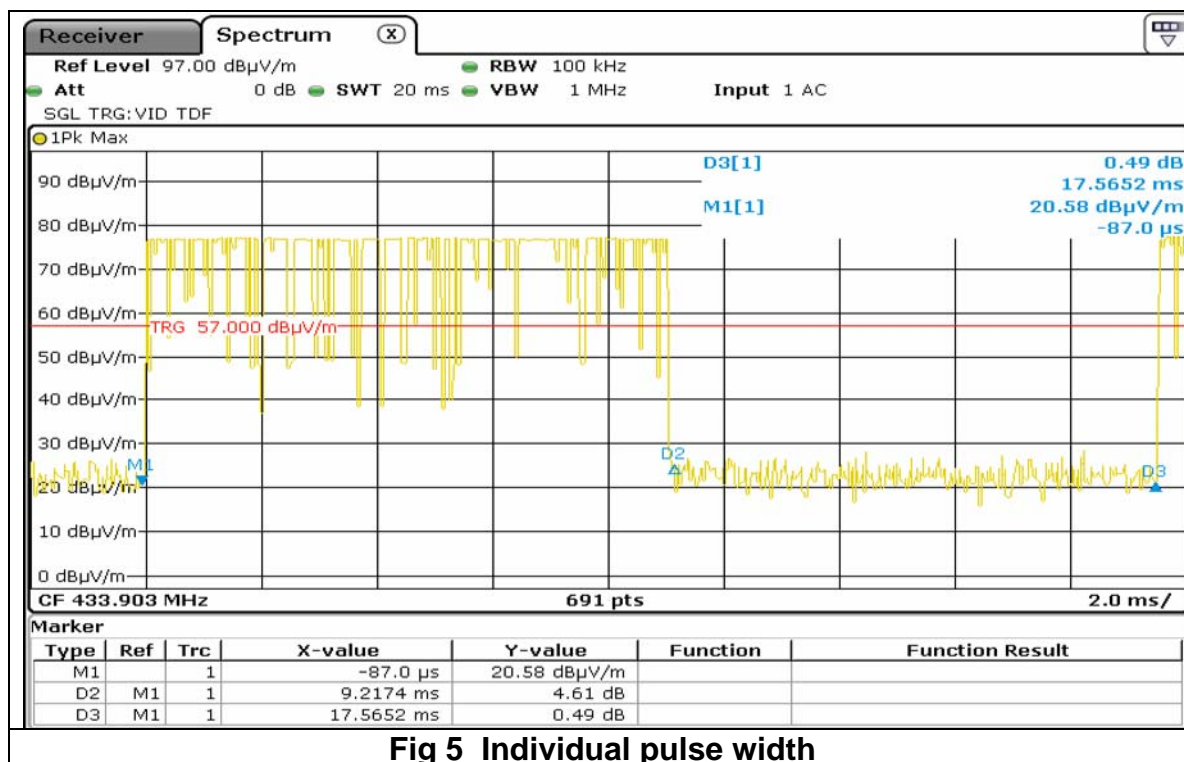


Fig 5 Individual pulse width

MAXIMUM MODULATION PERCENTAGE

One Period(mS)	Pulse Width (mS)	No of Pulses	Duty Cycle	Duty Cycle %	Test Result
100	9.22	7	0.6454	64.5	Pass

CALCULATION

Average Reading = Peak Reading dB(μV/m) + 20log (Duty Cycle),

where Duty Cycle is (No of pulses*pulse width)/100 or T

Note correction for pulse mode operation is

20 log duty cycle (dB)
-3.8

4.0 Field Strength of Spurious Radiated Emissions

Test Specification: FCC PART 15, SECTION 47 CFR 15.231(a)

Fundamental Frequency (MHz)	Field Strength of fundamental (μV/m)	Strength of Spurious Emissions (μV/m).
40.66 ~ 40.70	2250	225
70 ~ 130	1250	125
130 ~ 174	1250 to 3750 **	125 to 375 **
174 ~ 260	3750	375
260 ~ 470	3750 to 12500 **	375 to 1250 **
Above 470	12500	1250

** Linear interpolations

Interpolation Formula = $16.67 \times \text{Freq MHz} - 2833.33$

For operating frequency of 434.099 MHz the following limits apply (using interpolation formula above)

Fundamental Frequency	Field Strength of fundamental	Field Strength of fundamental	Field Strength of Spurious Emissions	Field Strength of Spurious Emissions
MHz	μV/m	dBμV/m	μV/m	dBμV/m
434.099	11005.9	80.8	1100.6	60.8

Note this is the Average limit for 3 metre measurement.

Test Specification: FCC PART 15, SECTION 47 CFR 15.209

Frequency (MHz)	Field Strength (μV/m)	Field Strength (dBμV/m)
30-88	100	40.0
88-216	150	43.5
216-960	200	46.0
Above 960	500	54.0

** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this part, e.g., Sections 15.231 and 15.241

For the spurious and harmonics measurements, the EUT was set up in an anechoic chamber. The EUT was rotated 360 degrees azimuth and the search antenna height was varied 1 to 4m in order to maximize the emissions. Significant peaks from the EUT were then recorded to determine margin to the limits. Distance of EUT to the measurement antenna was 3m.

4.1 Results for Radiated emissions

Appendix A shows the results of the scans in the anechoic chamber.

Result: Pass

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

Frequency MHz	Quasi peak Level dBuV/m	Antenna Polarity	Antenna Factor dB	Cable loss dB	Final Field Strength Quasi Peak dBuV/m
97.26	16.7	Vertical	10.3	0.2	27.2
385.77	12.7	Vertical	14.6	1.2	28.5
867.80	10.3	Vertical	22.2	1.4	33.9
385.77	14.8	Horizontal	14.6	1.2	30.6
771.54	-0.3	Horizontal	21.6	1.4	22.7

Frequency MHz	Final Field Strength Quasi Peak dBuV/m	EUT Orientation	Antenna Polarity	Average Limit dBuV/m	Margin dB
97.26	27.2	O1	Vertical	60.8	33.6
385.77	28.5	O1	Vertical	60.8	32.3
867.80	33.9	O1	Vertical	60.8	26.9
385.77	30.6	O1	Horizontal	60.8	30.2
771.54	22.7	O1	Horizontal	60.8	38.1

Result: Pass

4.1.2 Horn antenna measurements (1GHz - 6 GHz)

Frequency GHz	Peak Level dBuV/m	Antenna Factor dB	Preamp Gain dB	Cable Loss dB	Antenna Polarity	Final Peak Level dBuV/m
1.302	44.6	23.6	20	3.8	Vertical	52.0
1.7365	50.1	24.8	20	2.8	Vertical	57.7
2.17	44.1	28	20	3.2	Vertical	55.3
2.604	42.3	29.4	20	3.6	Vertical	55.3
3.039	44.1	30.6	20	3.8	Vertical	58.5
3.473	44.1	30.6	20	4.5	Vertical	59.2
1.302	40.8	23.6	20	3.8	Horizontal	48.2
1.736	48.2	24.8	20	2.8	Horizontal	55.8
2.17	45.2	28	20	3.2	Horizontal	56.4
2.604	43.8	29.4	20	3.6	Horizontal	56.8
3.039	43.8	30.6	20	3.8	Horizontal	58.2
3.473	43.2	30.6	20	4.5	Horizontal	58.3

Frequency GHz	Final Peak Level dBuV/m	Antenna Polarity	Duty Cycle Correction dB	Average Level dBuV/m	Average Limit dBuV/m	Margin dB
1.302	52.0	Vertical	-3.8	48.2	60.8	12.6
1.7365	57.7	Vertical	-3.8	53.9	60.8	7.0
2.17	55.3	Vertical	-3.8	51.5	60.8	9.3
2.604	55.3	Vertical	-3.8	51.5	60.8	9.3
3.039	58.5	Vertical	-3.8	54.7	60.8	6.1
3.473	59.2	Vertical	-3.8	55.4	60.8	5.4
1.302	48.2	Horizontal	-3.8	44.4	60.8	16.5
1.7365	55.8	Horizontal	-3.8	52.0	60.8	8.8
2.17	56.4	Horizontal	-3.8	52.6	60.8	8.2
2.604	56.8	Horizontal	-3.8	53.0	60.8	7.9
3.039	58.2	Horizontal	-3.8	54.4	60.8	6.5
3.473	58.3	Horizontal	-3.8	54.5	60.8	6.4

Spurious Emissions Harmonics

Result: Pass

4.1.3 Horn antenna measurements (1GHz - 6 GHz)

Frequency GHz	Peak Level dBuV/m	Antenna Factor dB	Preamp Gain dB	Cable Loss dB	Antenna Polarity	Final Peak Level dBuV/m	Average Limit +20dB dBuV/m	Margin dB
2.389	44.7	28	20	3.4	Vertical	56.1	60.8	24.8

Frequency GHz	Average Level dBuV/m	Antenna Factor dB	Preamp Gain dB	Cable Loss dB	Antenna Polarity	Final Average Level dBuV/m	Average Limit dBuV/m	Margin dB
2.389	32.3	28	20	3.4	Vertical	43.7	60.8	17.2

Spurious Emissions

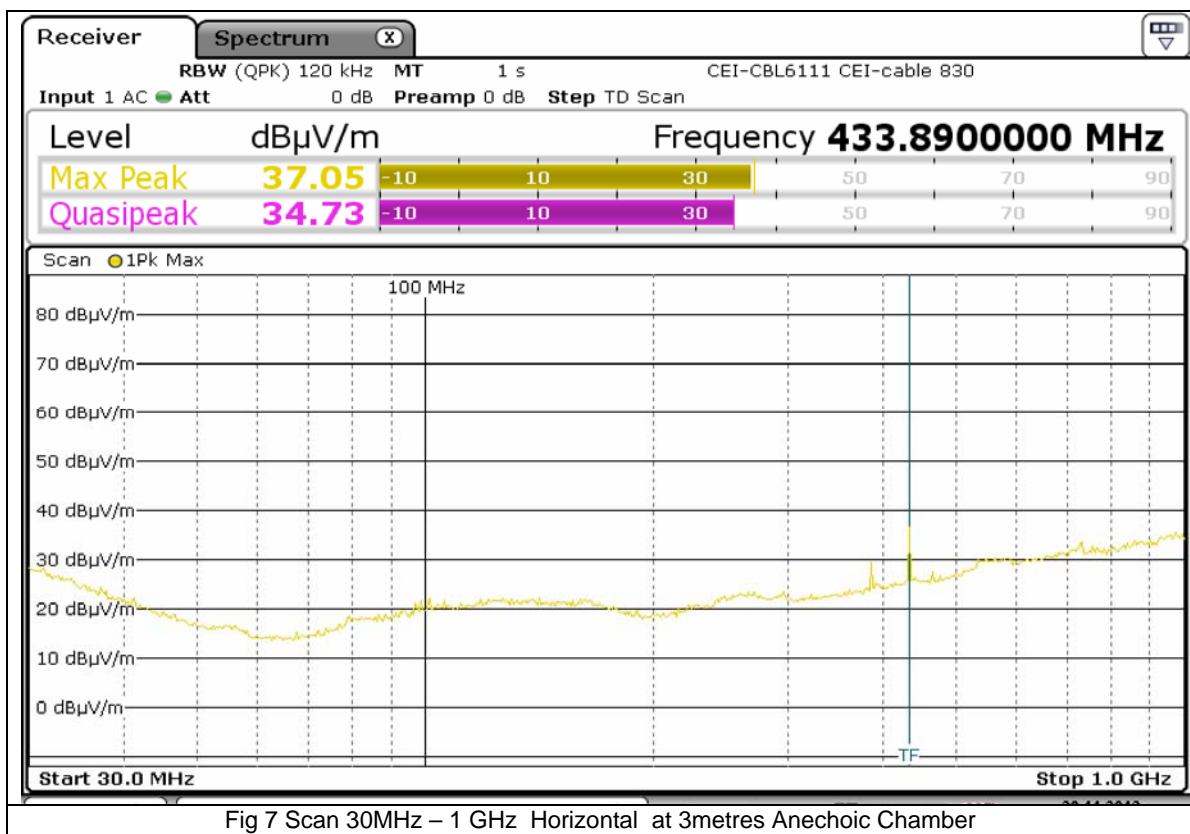
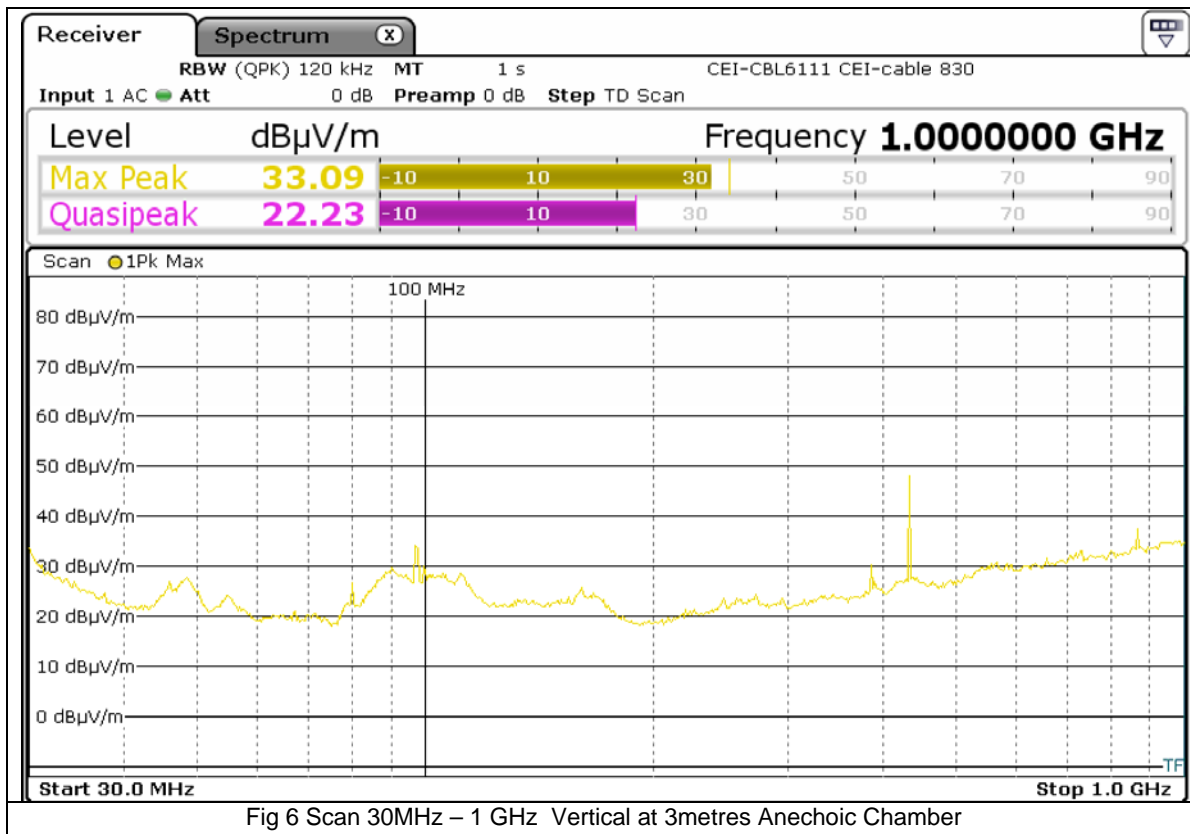
Average Readings (VBW =100Hz)

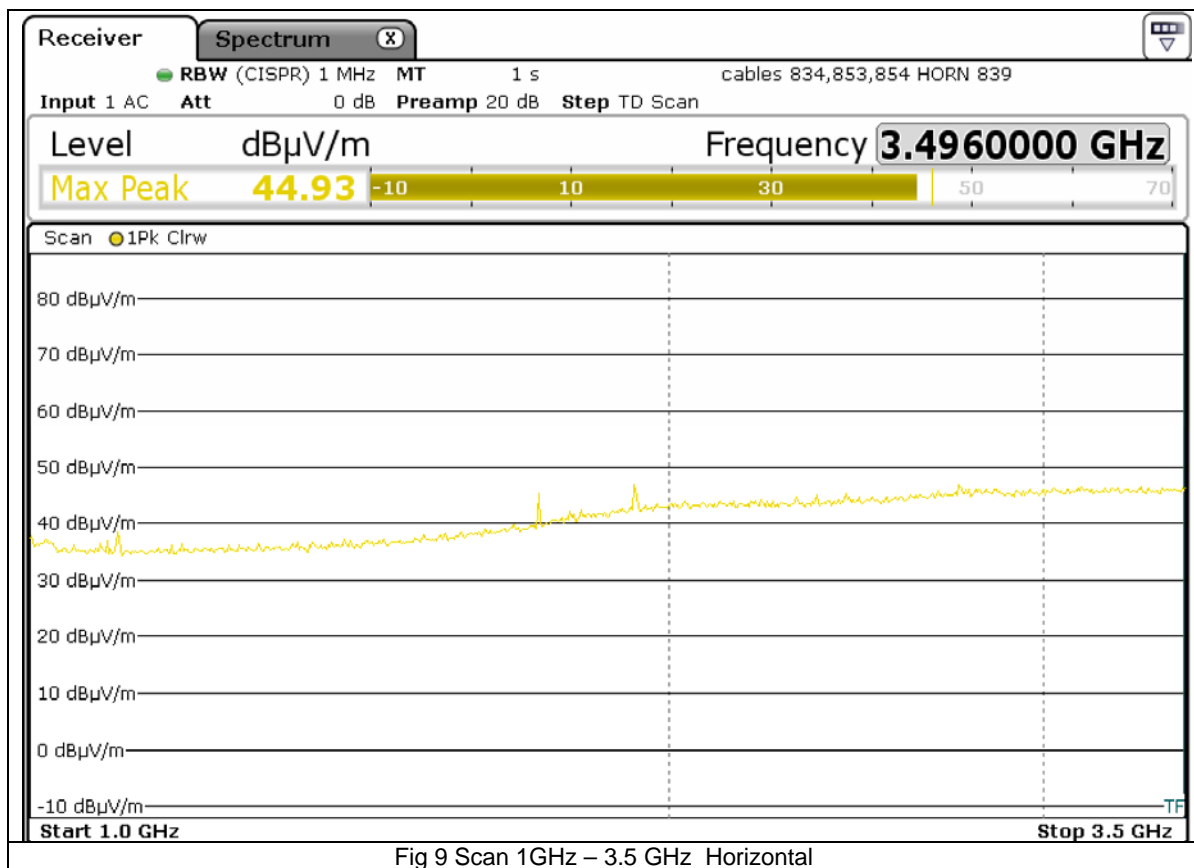
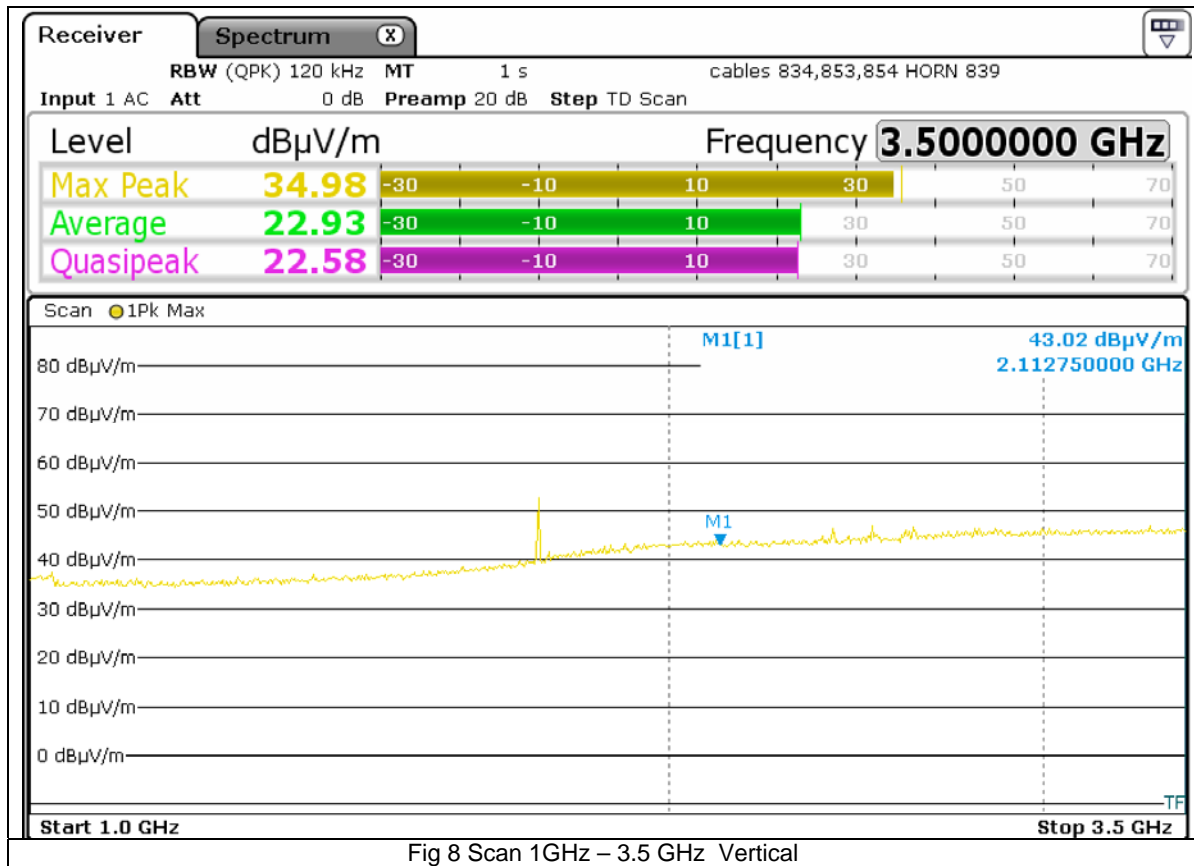
Result: Pass

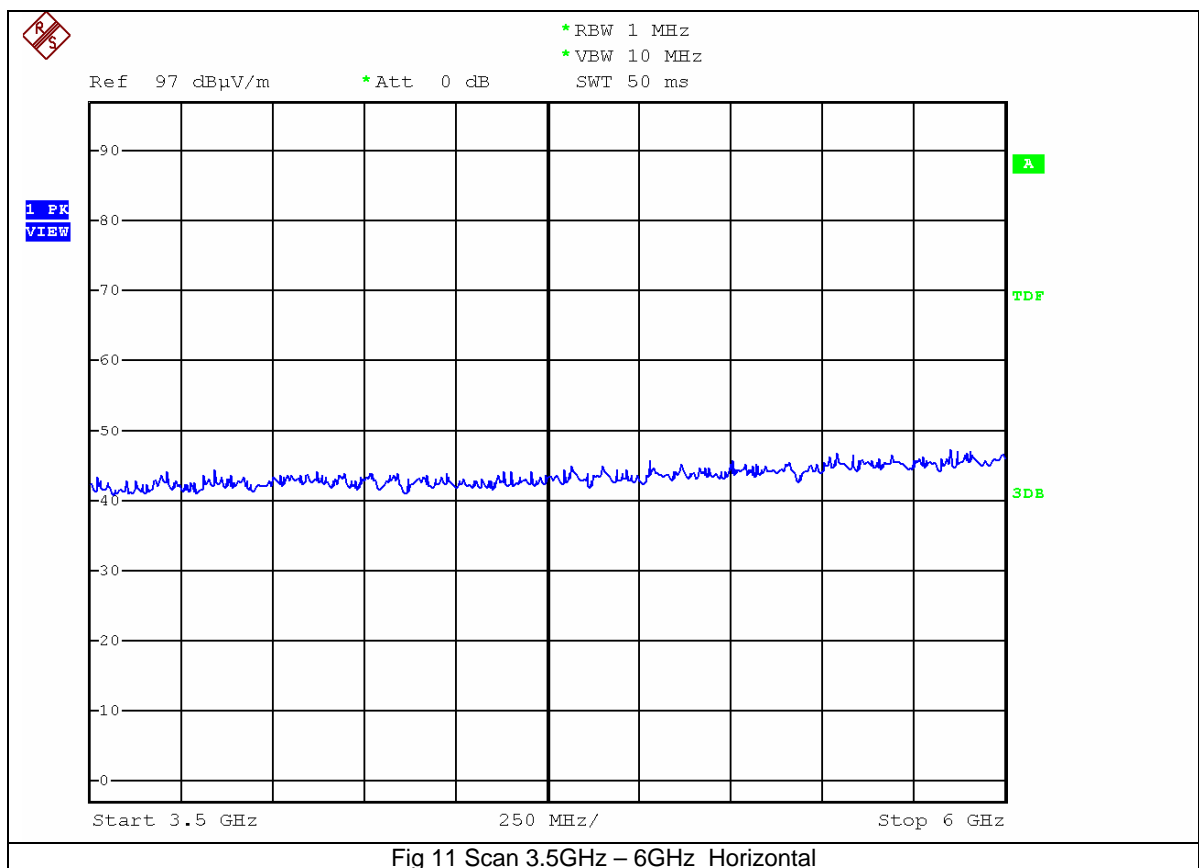
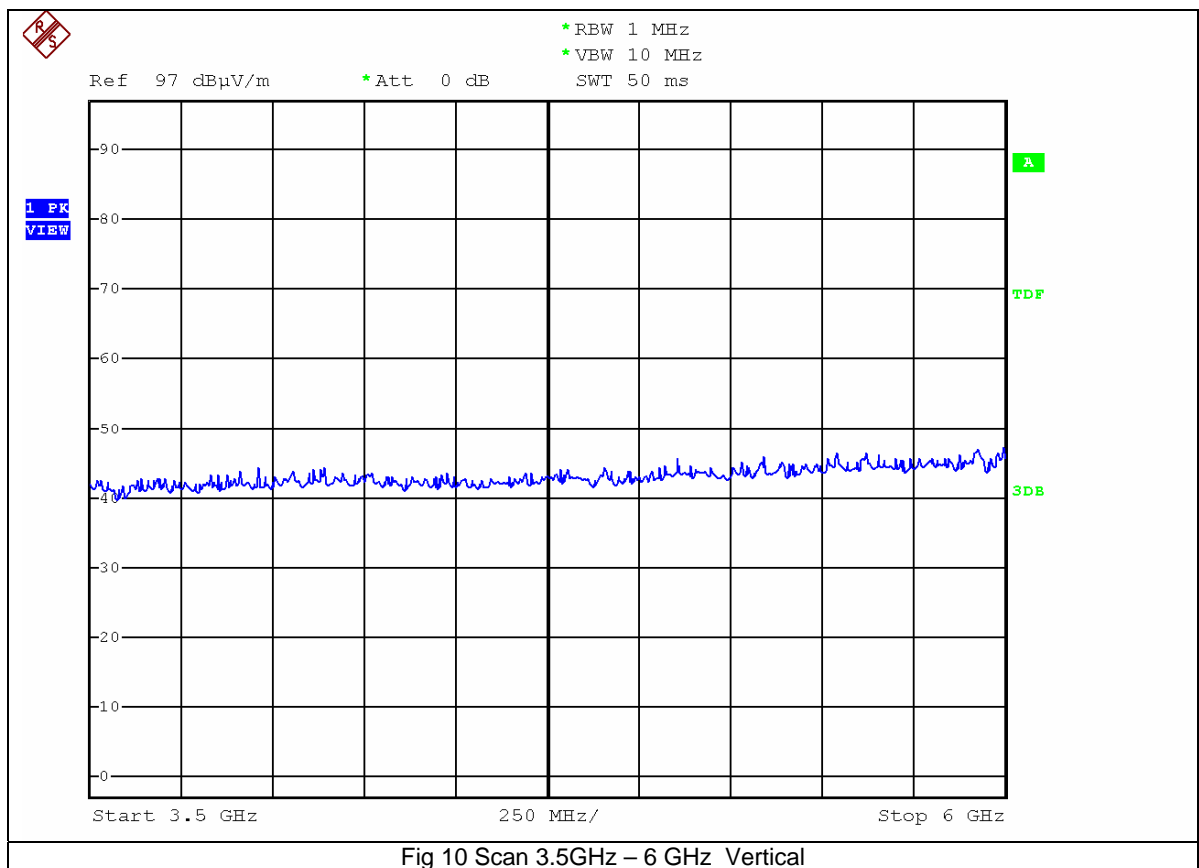
5.0 List of Test Equipment

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
LISN	Rohde & Schwarz	ESH3-Z5	604	14/12/2015

Appendix A
Additional Test Results







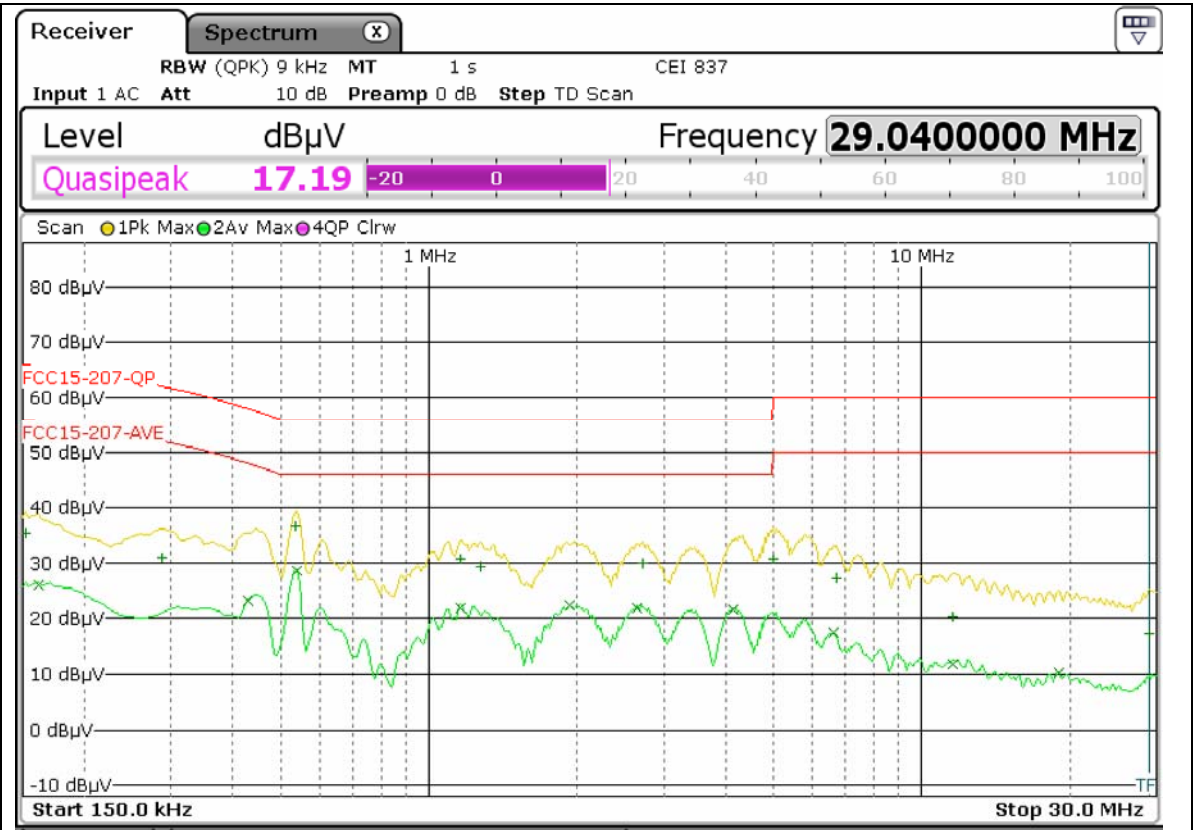


Fig 12 Conducted Emissions Mains Live

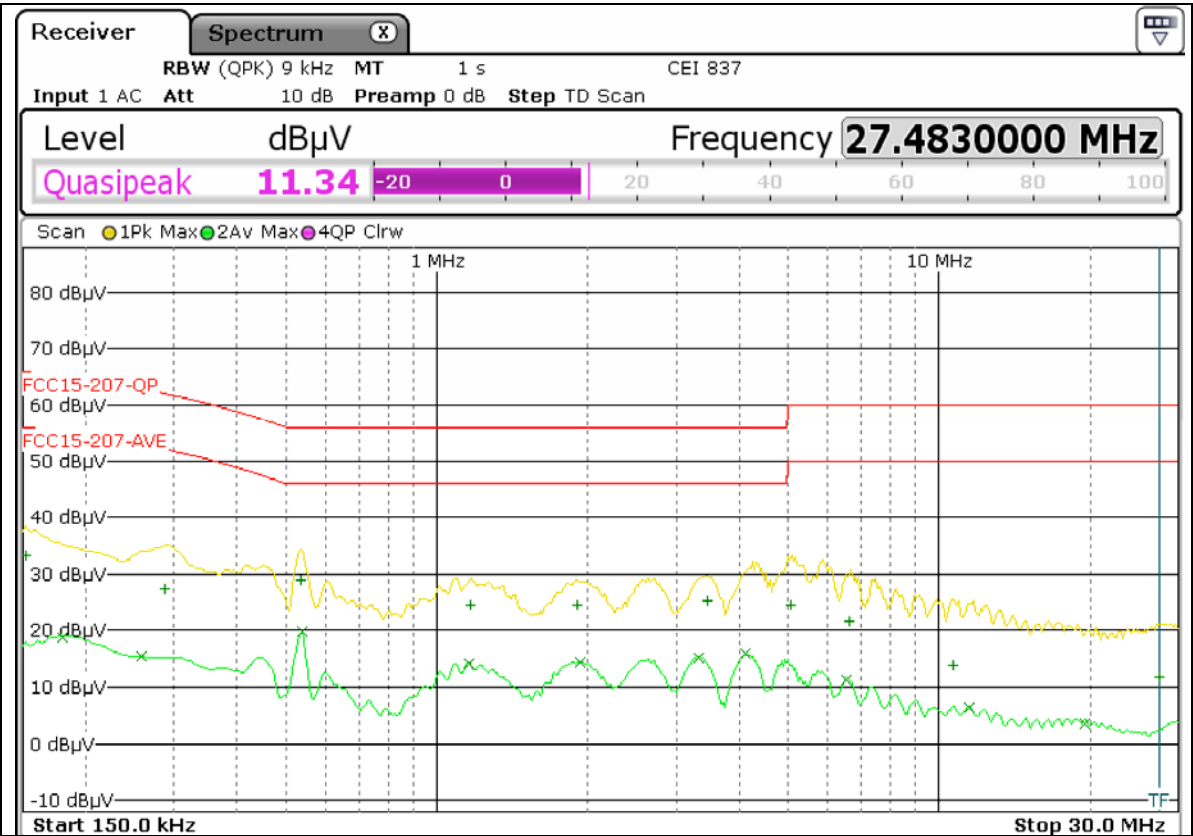


Fig 13 Conducted Emissions Mains Neutral

Detector	Frequency MHz	Reading dBuV	Margin dB	Phase
Quasi-Peak	0.152	35.34	-30.60	Live
Average	0.161	26.19	-29.49	Live
Quasi-Peak	0.287	30.98	-31.10	Live
Average	0.431	23.36	-24.60	Live
Quasi-Peak	0.537	36.58	-19.42	Live
Average	0.539	28.70	-17.30	Live
Quasi-Peak	1.163	30.76	-25.24	Live
Average	1.163	22.06	-23.94	Live
Quasi-Peak	1.275	29.46	-26.54	Live
Average	1.934	22.36	-23.64	Live
Average	2.645	22.04	-23.96	Live
Quasi-Peak	2.720	29.90	-26.10	Live
Average	4.135	21.75	-24.25	Live
Quasi-Peak	5.010	30.76	-29.24	Live
Average	6.637	17.51	-32.49	Live
Quasi-Peak	6.702	27.33	-32.67	Live
Average	11.560	11.91	-38.09	Live
Quasi-Peak	11.596	20.45	-39.55	Live
Average	18.967	10.25	-39.75	Live
Quasi-Peak	29.040	17.19	-42.81	Live

Detector	Frequency MHz	Reading dBuV	Margin dB	Phase
Quasi-Peak	0.152	33.37	-32.57	Neutral
Average	0.179	18.92	-36.24	Neutral
Average	0.258	15.48	-37.43	Neutral
Quasi-Peak	0.287	27.33	-34.75	Neutral
Quasi-Peak	0.537	29.03	-26.97	Neutral
Average	0.539	19.81	-26.19	Neutral
Average	1.158	14.11	-31.89	Neutral
Quasi-Peak	1.169	24.58	-31.42	Neutral
Quasi-Peak	1.905	24.48	-31.52	Neutral
Average	1.937	14.49	-31.51	Neutral
Average	3.325	15.16	-30.84	Neutral
Quasi-Peak	3.451	25.19	-30.81	Neutral
Average	4.128	15.88	-30.12	Neutral
Quasi-Peak	5.087	24.40	-35.60	Neutral
Average	6.565	11.26	-38.74	Neutral
Quasi-Peak	6.646	21.56	-38.44	Neutral
Quasi-Peak	10.649	13.81	-46.19	Neutral
Average	11.481	6.34	-43.66	Neutral
Average	19.572	3.64	-46.36	Neutral
Quasi-Peak	27.483	11.89	-48.11	Neutral

Results for Conducted Emissions on the mains

Test Result Pass