

COMPLIANCE ENGINEERING IRELAND LTD

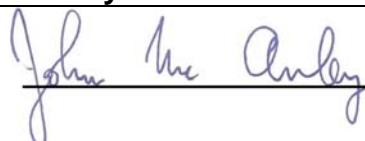


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Project Num	17E6742-1a
Quotation	Q17-0205-1b
Prepared For	Nordic ID Oy
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Tested By	Michael Kirby
Test Report By	Michael Kirby
FCC Site Registration	92592
IC Site Registration	8517-A2, 8517-A1
Date	28 th Jun 2017
IC Equipment Authorisation	Test Report
EUT Description	RFID Module
FCC ID	SCCNUR21W
IC ID	5137A-NUR21W
Authorised by	John McAuley
Authorised Signature :	

TEST SUMMARY

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

<u>FCC Spec.</u>	<u>IC Spec.</u>	<u>Test Parameters</u>	<u>Status</u>
15.247 b 2	RSS-247 5.4	Maximum Peak Conducted Output power	Pass
15.247 a 1 i	RSS-247 5.1	Carrier Freq Separation for hopping channels	Pass
15.247 a 1 i	RSS-247 5.1	Number of hopping Channels.	Pass
15.247 a 1 i	RSS-247 5.1	Average Time of Occupancy of Hopping Frequency	Pass
15.247 a 1 i	RSS-247 5.1	20 dB Bandwidth	Pass
	RSS-Gen 6.6	99% bandwidth.	Pass
15.247d	RSS-247 5.5	100KHz RBW at band edges and Conducted Spurious emissions.	Pass
15.247d 15.209a	RSS-247 5.5	Radiated Emissions within restricted bands	Pass
15.209	RSS-Gen 6.13	Unintentional Radiated Emissions	Pass
15.207a	RSS-Gen 8.8	Conducted Emissions on the mains	Pass

RSS 247-1

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

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*Note appendix F ,G,H are on a separate report, .entitled 17E6742-1a additional appendices

1.0 EUT Description

Model:	NUR2-1W
Type:	RFID Module
FCC ID:	SCCNUR21W
Company:	Nordic ID Oy
Contact	Rauno Nikkilä
Address:	Myllyojakatku 2A FI-24100 Salo Finland
Phone:	+358 (0)50 5689803
e-mail:	rauno.nikkila@nordicid.com
Test Standards:	47 CFR, Part 15.247
Type of radio:	Stand-alone
Transmitter Type:	RFID FHSS
Operating Frequency Range(s):	902-928 MHz
Number of Channels:	50
Channel Separation:	500KHz
Antenna:	External
Power configuration:	4.5V .
Ports:	None
Classification:	DSS, JBP
Test Methodology:	Measurements performed according to the procedures in ANSI C63.10-2013

The NUR2-1W is an RFID module using frequency hopping in the 902-928MHz frequency band.

The EUT has 2 alternative external antennas.

- a) Antenna #1 = Cross Dipole antenna with reflector max gain 5dBi
- b) Antenna #2 = 4 patch antenna array max gain 6dBi

1.1 EUT Operation

Operating Conditions during Test:

The EUT (RFID module) was fitted to a host pcb to allow powering and control of the module. Conducted measurements were carried out with the analyser connected to the SMA connector fitted on the host pcb.

The EUT was operated in test mode where the channel and modulation was set via USB connection from the host pcb to a laptop.

The EUT was powered from a bench PSU Type Hewlett Packard E3610A set to 4.5Vdc. for all tests

Radiated measurements (Cabinet spurious emission) were carried out on this sample with the SMA connector terminated.

Further Radiated tests were carried out on the EUT where the Antenna port was connected to the 2 alternative antennas.

Environmental conditions

	Temperature	Relative Humidity
Test	°C	%
Conducted Emissions	19	47
Radiated Emissions <1GHz	18	42
Radiated Emissions >1GHz	19	47

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 13th, 14th 23rd, 24th Jun 2017 .

1.4 Description of Test modes

Channel List

Channel	Freq MHz
Low Ch0	902.75
Mid Ch24	914.75
High Ch 49	927.25

2 Emissions Measurements

2.1 Conducted Emissions Measurements

Radio Conducted measurements were carried out on the EUT as per section 1.1 above.

All results were measured as conducted on the antenna except radiated spurious emissions.

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 in the 1GHz-3.6GHz range 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 63.10 2013 Section 4.1.4.2.3)

Emissions above 3.6GHz were measured using a horn antenna located at 1 metre 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 63.10 2013 Section 4.1.4.2.3)

3.0 Results for Conducted emissions on the mains

Conducted Emissions on the mains test was performed with the EUT connected to a LISN through PSU as per section 1.1

Detector	Frequency	Reading	Margin	Phase
QP/ Ave	MHz	dBuV	dB	L/N
Average	3.2798	36.39	-9.61	Live
Quasi-Peak	3.2955	37.78	-18.22	Live
Average	3.3630	33.16	-12.84	Live
Average	3.3990	33.14	-12.86	Live
Average	3.431	32.07	-13.93	Live
Average	3.521	35.54	-10.46	Live
Average	3.633	36.78	-9.22	Live
Quasi-Peak	3.635	39.27	-16.73	Live
Average	3.752	37.34	-8.66	Live
Average	3.984	32.26	-13.74	Live
Average	4.103	33.90	-12.1	Live
Average	4.337	32.48	-13.52	Live

Detector	Frequency	Reading	Margin	Phase
QP/ Ave	MHz	dBuV	dB	L/N
Average	3.2798	43.90	-2.1	Neutral
Quasi-Peak	3.2955	40.43	-15.57	Neutral
Average	3.3630	32.14	-13.86	Neutral
Average	3.3990	42.36	-3.64	Neutral
Average	3.4305	30.17	-15.83	Neutral
Average	3.5205	42.70	-3.3	Neutral
Average	3.6330	42.95	-3.05	Neutral
Quasi-Peak	3.6353	44.01	-11.99	Neutral
Average	3.7523	43.98	-2.02	Neutral
Average	3.9840	40.18	-5.82	Neutral
Average	4.1033	40.54	-5.46	Neutral
Average	4.3373	41.07	-4.93	Neutral

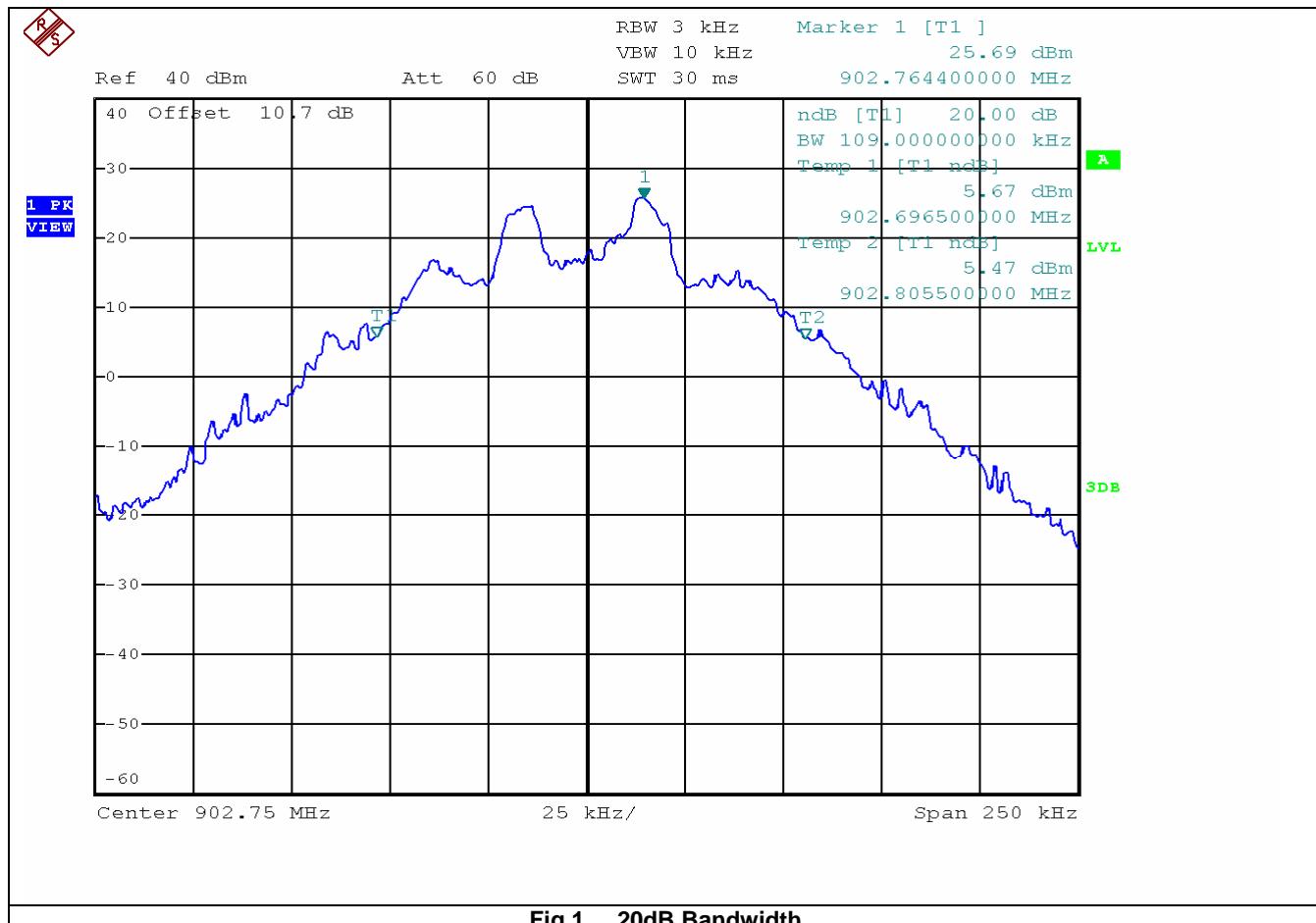
Ref Appendix G for Scans

Test Result : Pass

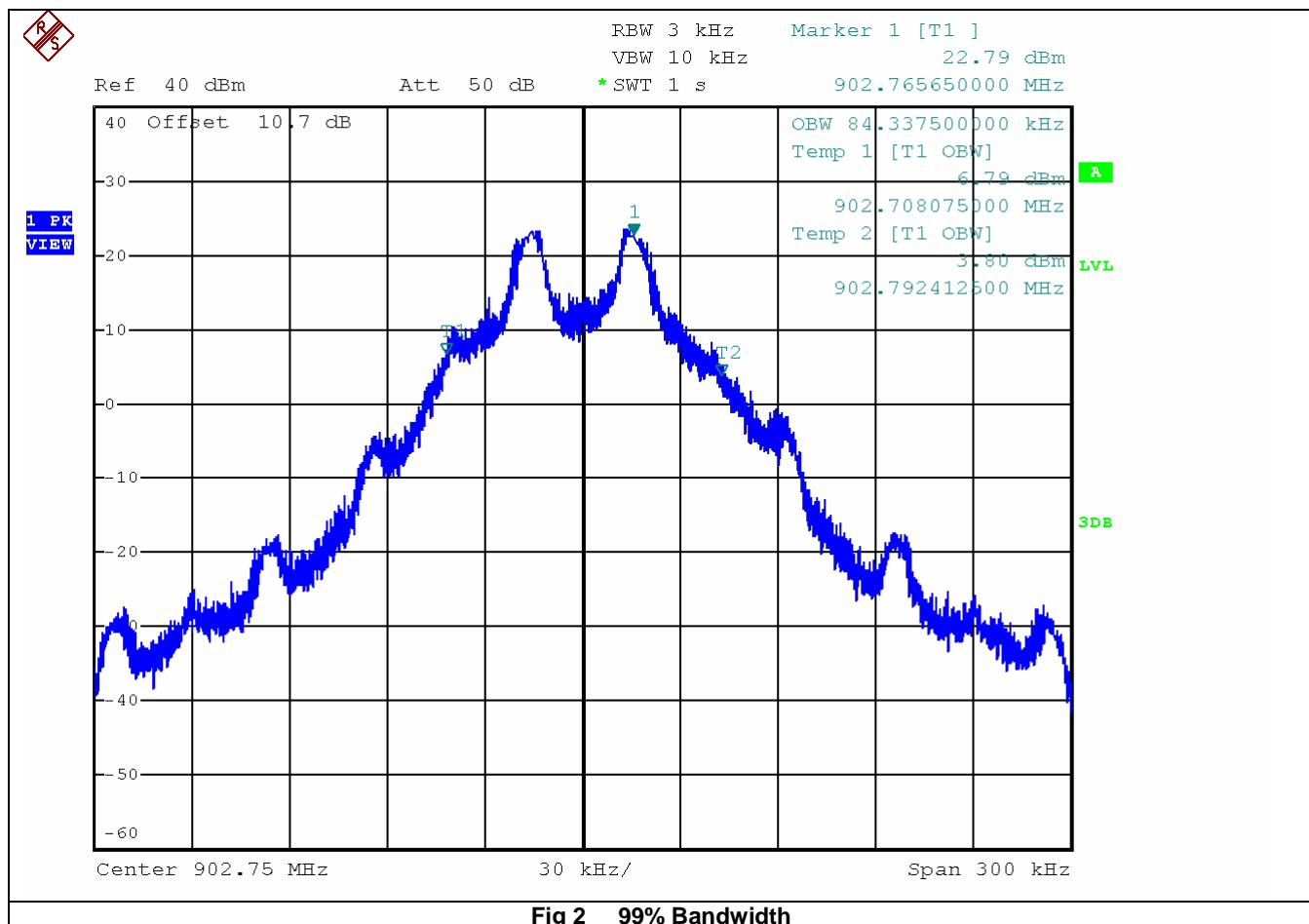
4. Conducted Measurements on the Antenna port

4.1 Bandwidth

4.1.1 20dB bandwidth



4.1.2 99% bandwidth



Bandwidth

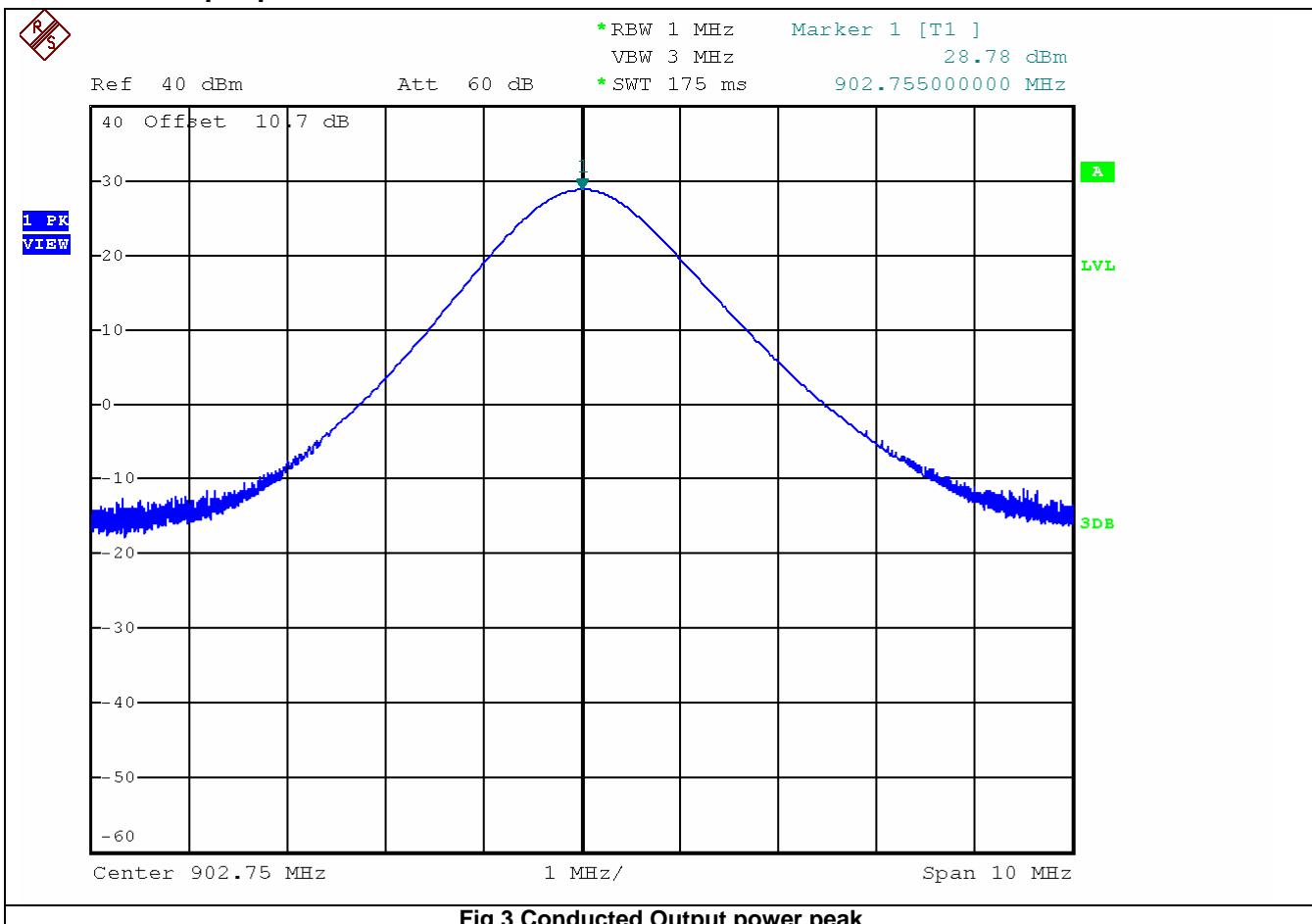
Channel	Freq	20dB Bandwidth		99% Bandwidth
		MHz	KHz	KHz
Low	902.75	109	84.337	
Mid	914.75	92.5	84.562	
High	927.25	93	85.650	

Limit

The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

Result :- Pass

4.2 Output power Conducted



Channel	Freq	Output Power Peak	Limit	Margin
	MHz	dBm	dBm	dB
Low	902.75	28.78	30	1.22
Mid	914.75	28.96	30	1.04
High	927.25	28.9	30	1.1

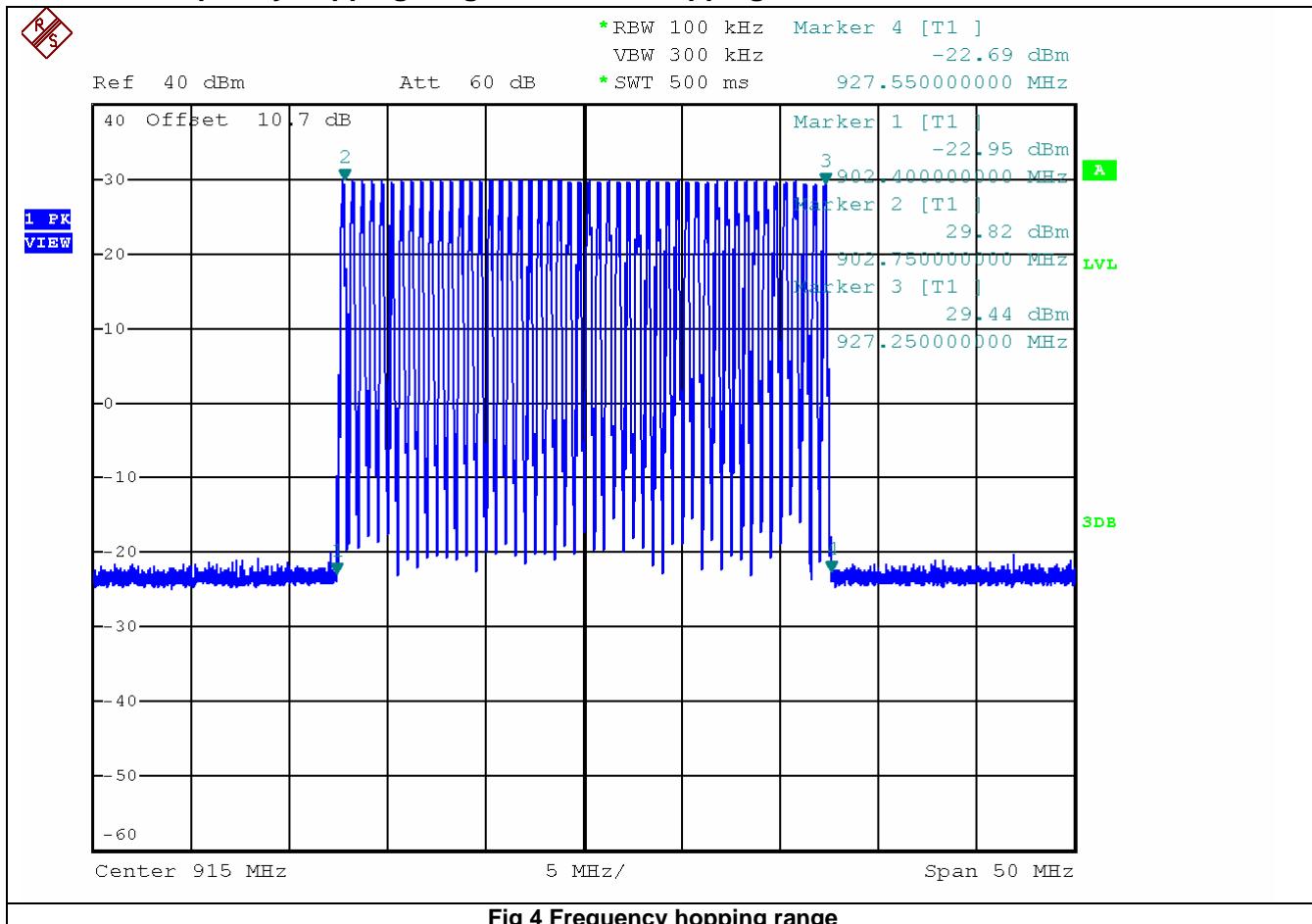
Limit

For frequency hopping systems operating in the 902-928 MHz band: 1 watt for systems employing at least 50 hopping channels

Test Result :- Pass

4.3 Frequency Hopping Characteristics

4.3.1 Frequency hopping range number of hopping Channels



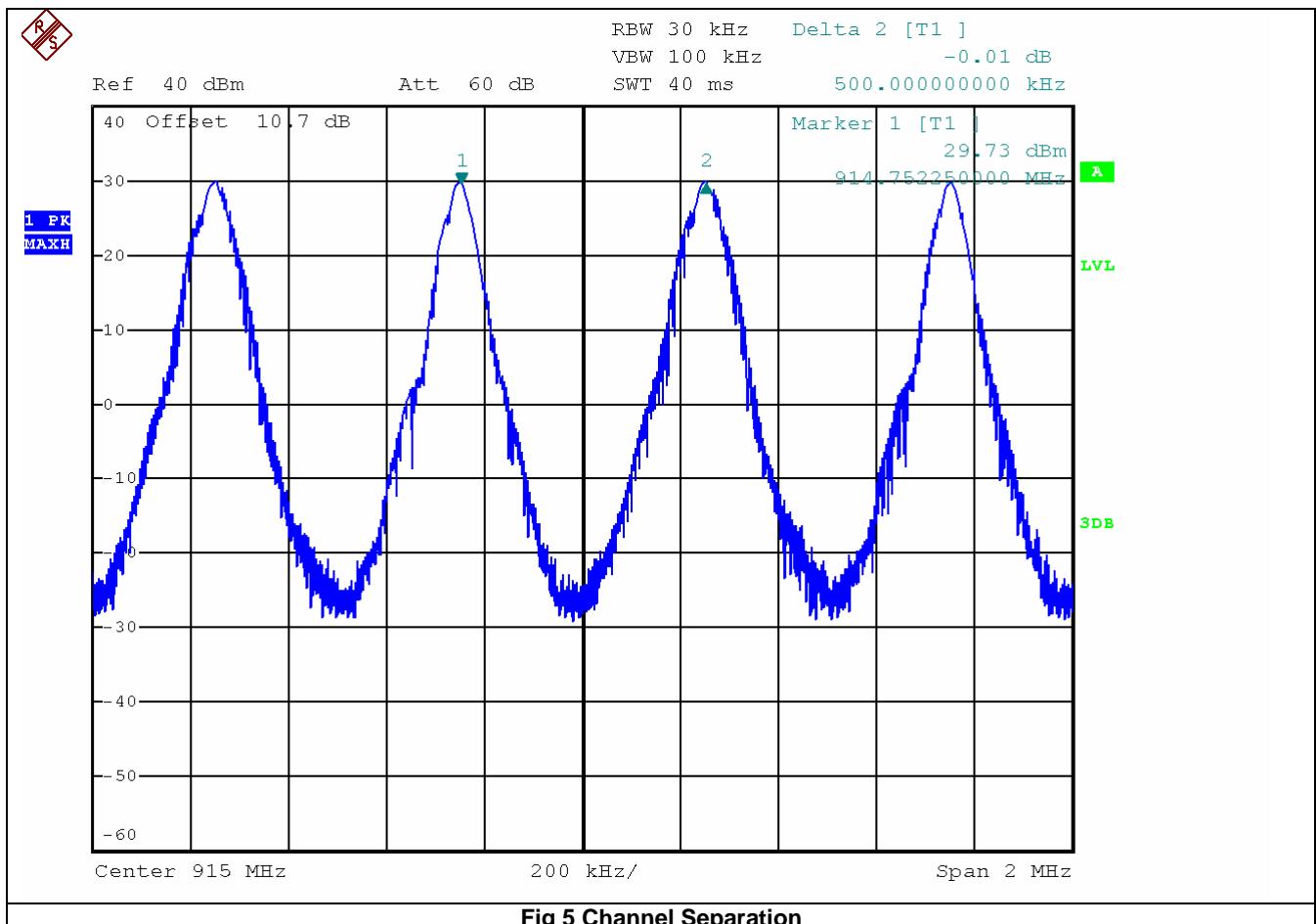
Lowest channel 902.75MHz
Highest channel 927.25MHz

Number of hopping channels =50-

Limit:- Min 50 hopping channels if the bandwidth is less than 250KHz

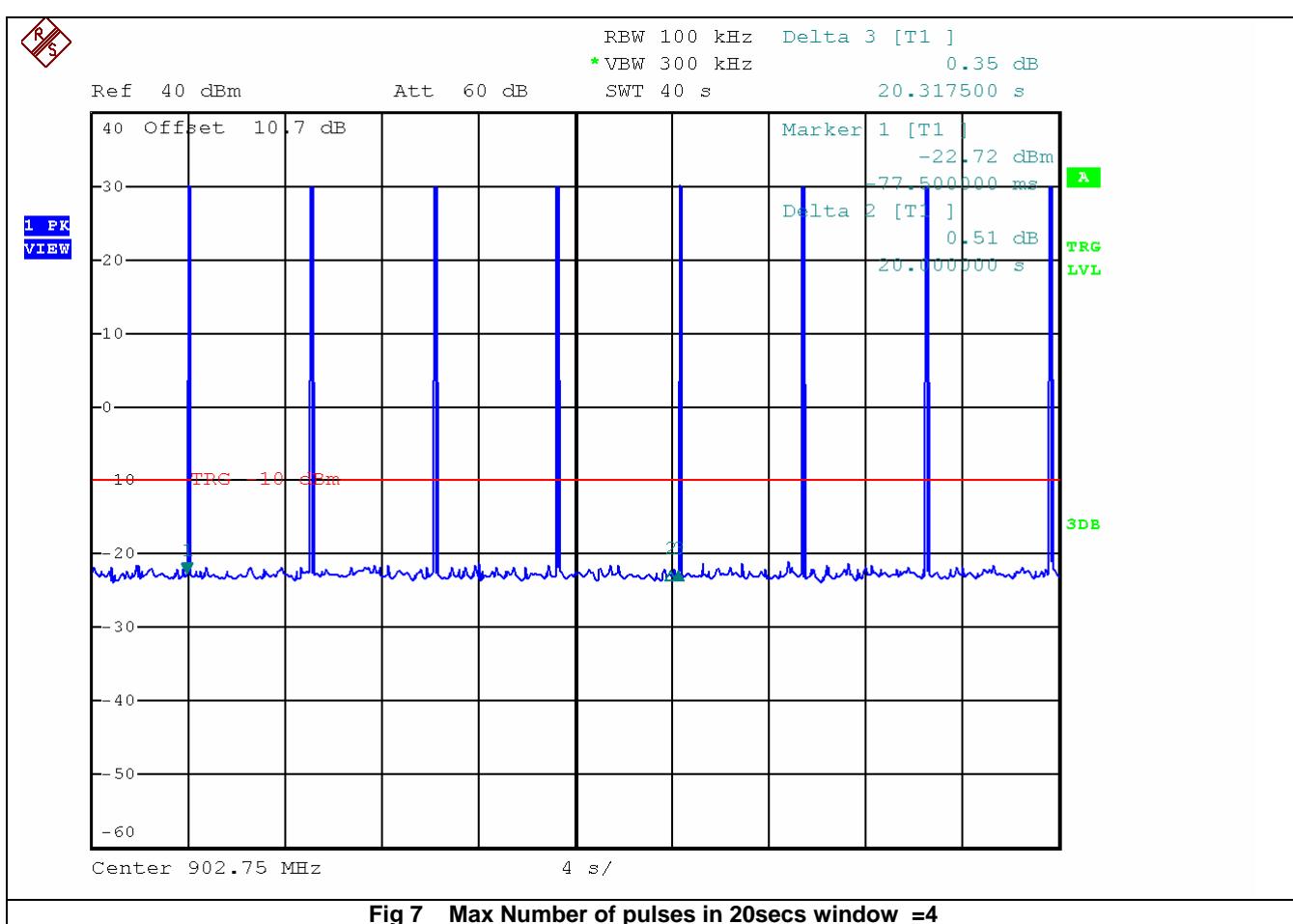
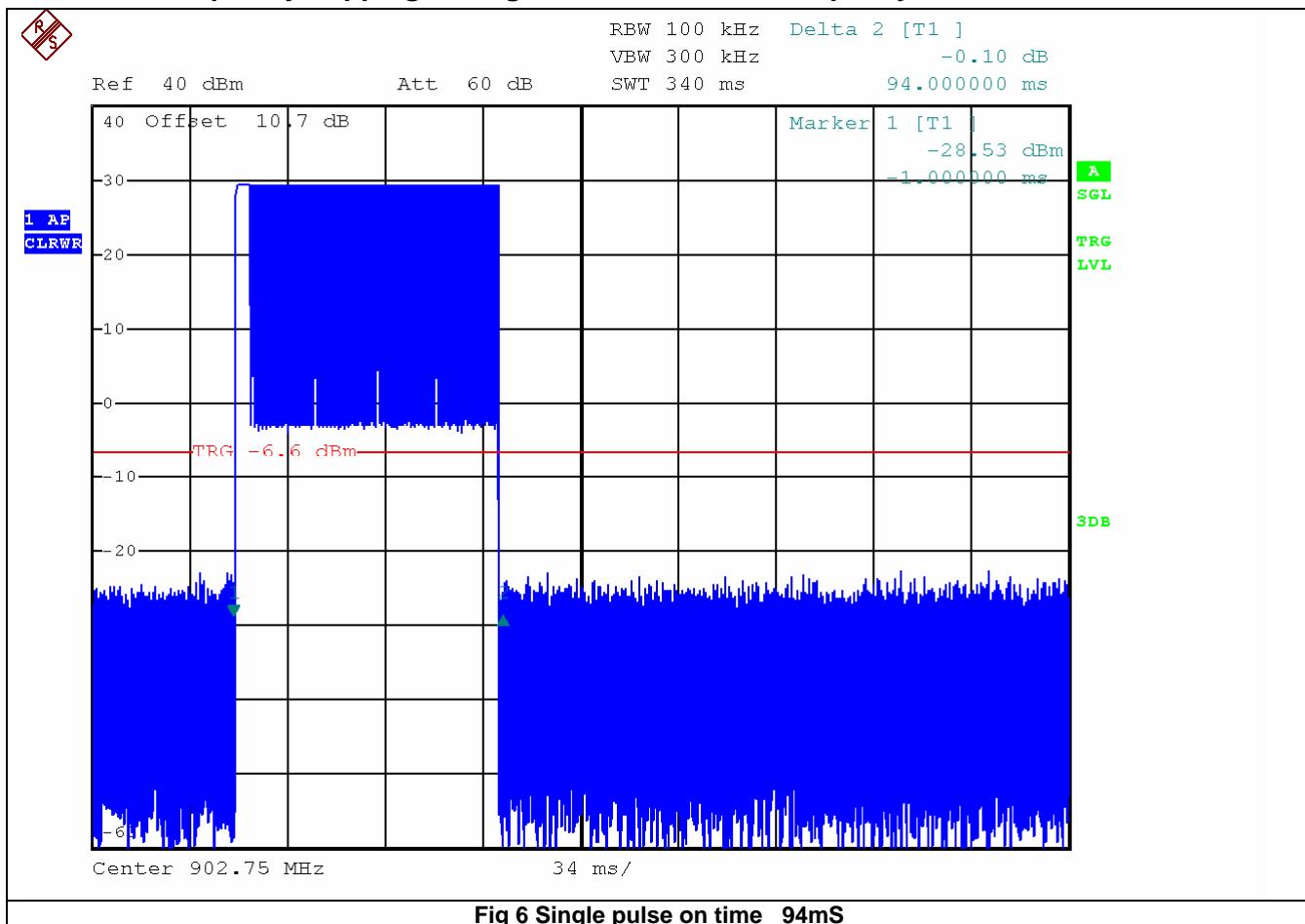
Test Result :- Pass

4.3.2 Frequency hopping channel separation



Channel separation =500KHz

4.3.3 Frequency hopping average time of channel occupancy



Limit

For frequency hopping systems operating in the 902-928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

Calculation

Single pulse on time =94mS

Max Num of pulses in 20sec window = 4

Max on time in 20secs window = $4 \times 0.094 = 0.376$ secs < 0.4 secs limit

Test result Pass

5. Spurious Emissions EUT

5.1 Conducted Spurious Emissions

5.1.1 Conducted Spurious Emissions

Note Low ,Mid and High Channels tested ...
Results similar for all three

Ref Appendix A for Scans

Test Result Pass

5.1.2 Conducted Emissions Band Edge

Ref Appendix B for Scans

Test Result Pass

5.2. Radiated Spurious Emissions

5.2.1 Radiated Spurious Emissions with Antenna port Terminated

Note Low ,Mid and High Channels tested ...

Results similar for all three

Ref Appendix C for Scans

5.2.2 Radiated Spurious Emissions Restricted Bands with Antenna #1

Frequency GHz	Peak Level dBuV/m	Antenna Factor dB	Preamp Gain dB	Cable Loss	Antenna Polarity	Final Peak Level dBuV/m	Average Limit +20dB dBuV/m	Margin dB
2.708	49.2	29.4	38.4	3.8	Vertical	44.0	74.0	30.0
2.708	34.2	29.4	38.4	3.8	Horizontal	29.0	74.0	45.0
2.744	46.4	29.4	38.4	3.8	Vertical	41.2	74.0	32.8
2.744	33.4	29.4	38.4	3.8	Horizontal	28.2	74.0	45.8
2.782	44.8	29.4	38.4	3.8	Vertical	39.6	74.0	34.4
2.782	34.1	29.4	38.4	3.8	Horizontal	28.9	74.0	45.1

Average measurements not performed as peak results were below average limit

Peak measurement performed with Resolution Bandwidth set to 1MHz as per ANSI C63.10-2013 Section 4.1.4.2.2

Ref Appendix D for Scans

Test Result Pass

5.2.3 Radiated Spurious Emissions Restricted Bands with Antenna #2

Frequency GHz	Peak Level dBuV/m	Antenna Factor dB	Preamp Gain dB	Cable Loss	Antenna Polarity	Final Peak Level dBuV/m	Average Limit +20dB dBuV/m	Margin dB
2.708	44.2	29.4	38.4	3.8	Vertical	39.0	74.0	35.0
2.708	43.2	29.4	38.4	3.8	Horizontal	38.0	74.0	36.0
2.744	43.7	29.4	38.4	3.8	Vertical	38.5	74.0	35.5
2.744	42.2	29.4	38.4	3.8	Horizontal	37.0	74.0	37.0
2.782	45.7	29.4	38.4	3.8	Vertical	40.5	74.0	33.5
2.782	44.6	29.4	38.4	3.8	Horizontal	39.4	74.0	34.6

Average measurements not performed as peak results were below average limit

Peak measurement performed with Resolution Bandwidth set to 1MHz as per ANSI C63.10-2013 Section 4.1.4.2.2

Ref Appendix E for Scans

Test Result Pass

5.2.4 Radiated Spurious Emissions Band Edge with Antenna #1

Ref Appendix F for Scans

Test Result Pass

5.2.5 Radiated Spurious Emissions Band Edge with Antenna #2

Ref Appendix G for Scans

Test Result Pass

6 List of Test Equipment

Instrument	Manufacturer	Model	Serial Num	CEI Ref	Cal Due Date	Cal Interval Months
Microwave Preamplifier	Hewlett Packard	83017A	3123A00175	805	29/09/2017	12
Spectrum Analyser 30Hz-40GHz	Rohde & Schwarz	FSP40	100053	850	09/11/2018	36
Test Receiver 3.6GHz	Rohde & Schwarz	ESR	1316.3003k03-101625-s	869	04/06/2020	36
Anechoic Chamber	CEI	SAR 10M	845	845	16/03/2019	36
Antenna Horn	EMCO	3115	9905-5809	655	03/11/2017	24
Fully Anechoic Chamber	CEI	FAR 3M	906	906	22/03/2018	36
Antenna Trilog	Schwarzbeck	VULB 9160	9160-3361	889	04/08/2018	24
LISN	Rohde & Schwarz	ESH3-Z5	825460/003	604	21/01/2019	36

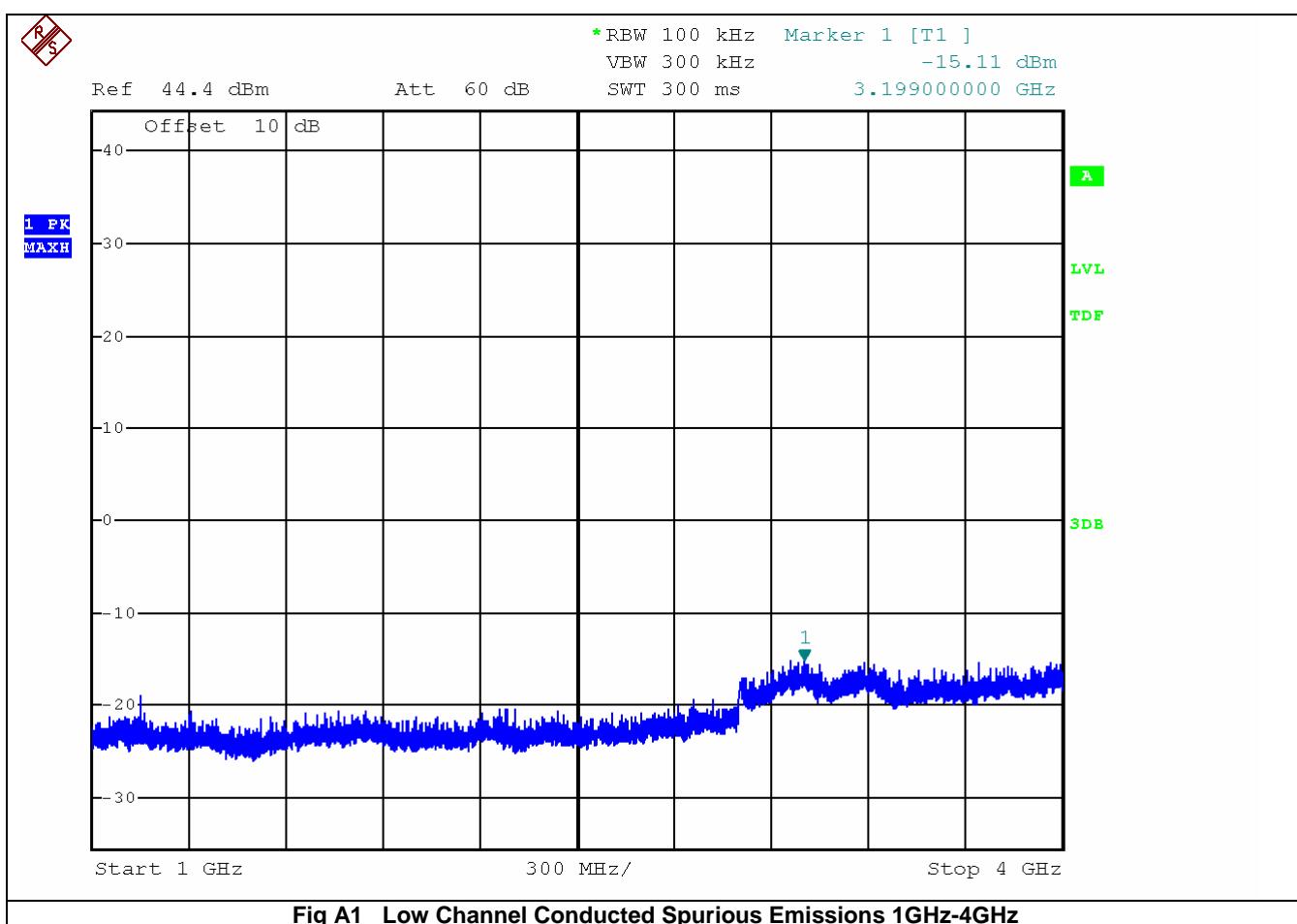
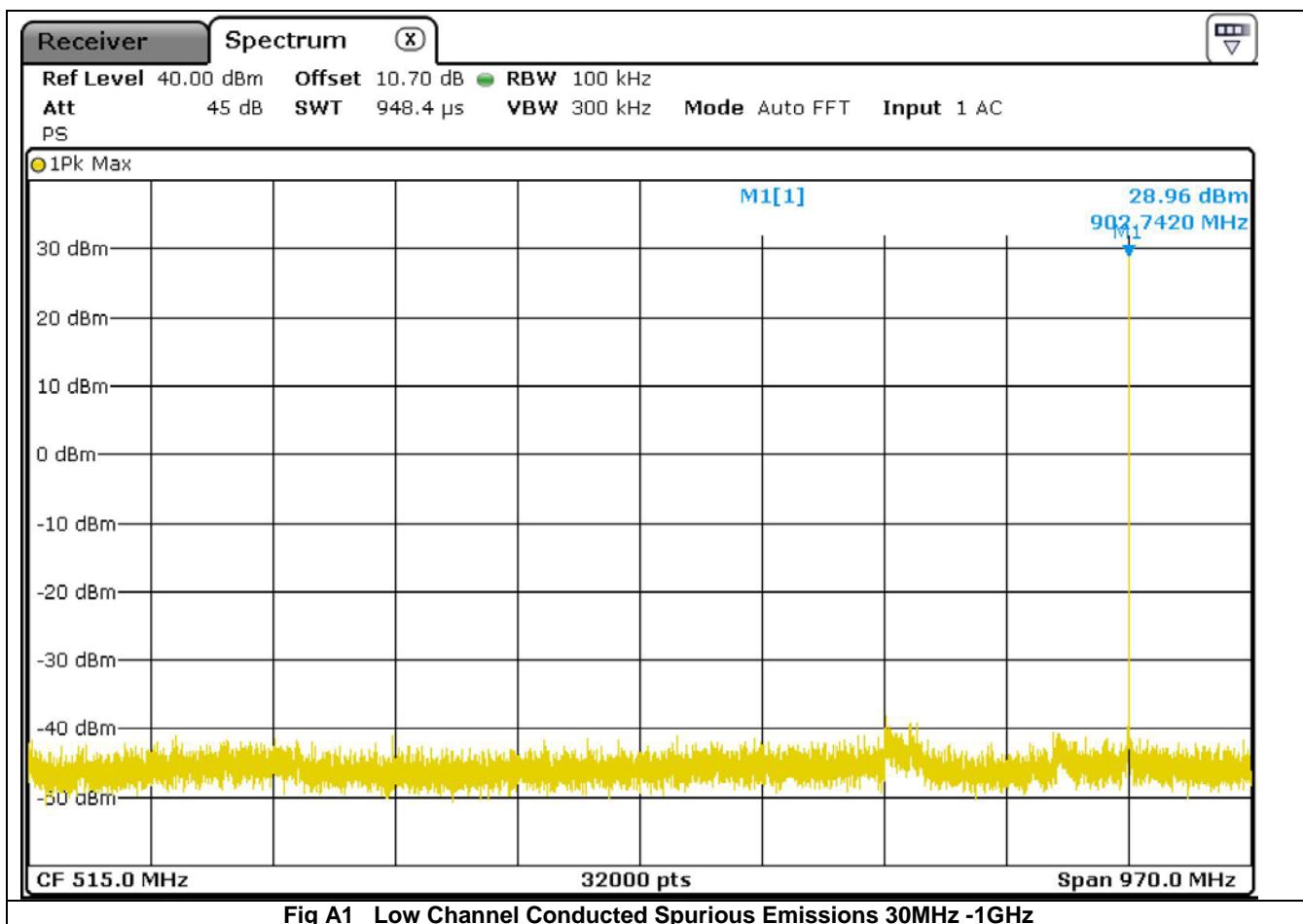
8 Measurement Uncertainties

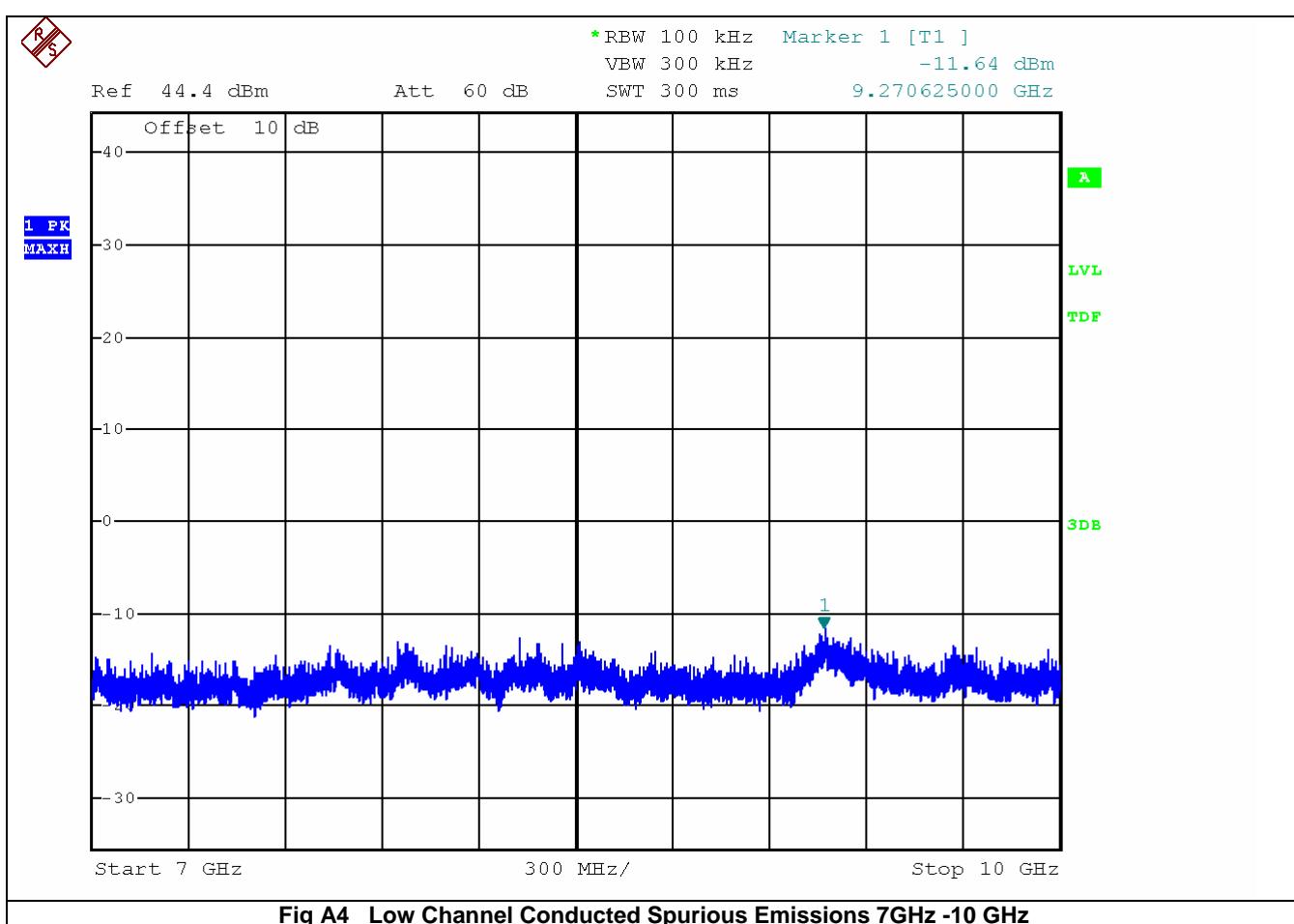
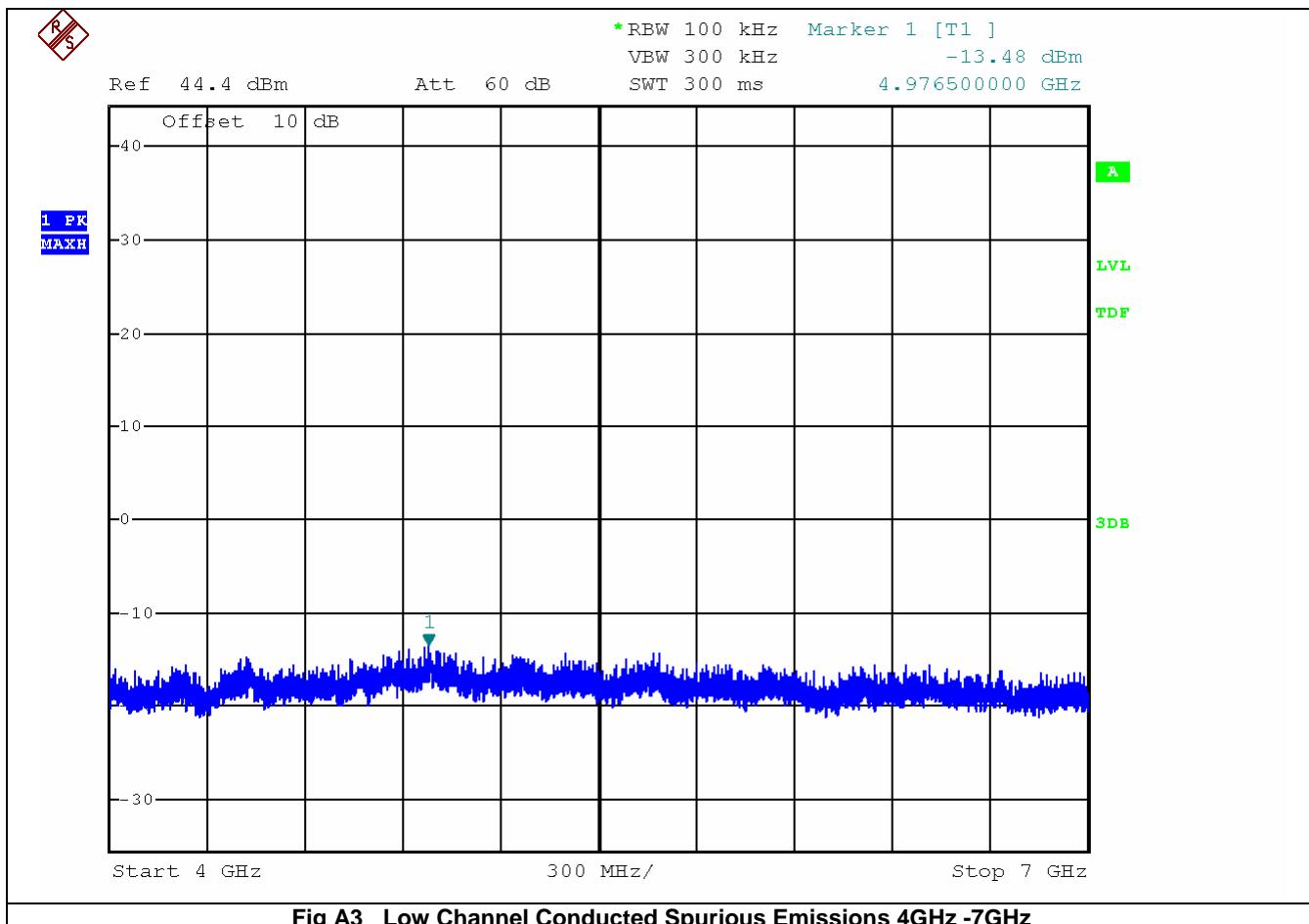
Measurement	Uncertainty
Radio Frequency	+/- 5×10^{-7}
Maximum Frequency Deviation	+/- 1.7 %
Conducted Emissions	+/- 1 dB
Radiated Emission 30MHz-100MHz	+/- 5.3 dB
Radiated Emission 100MHz-300MHz	+/- 4.7 dB
Radiated Emission 300MHz-1GHz	+/- 3.9 dB
Radiated Emission 1GHz-40GHz	+/- 3.8 dB

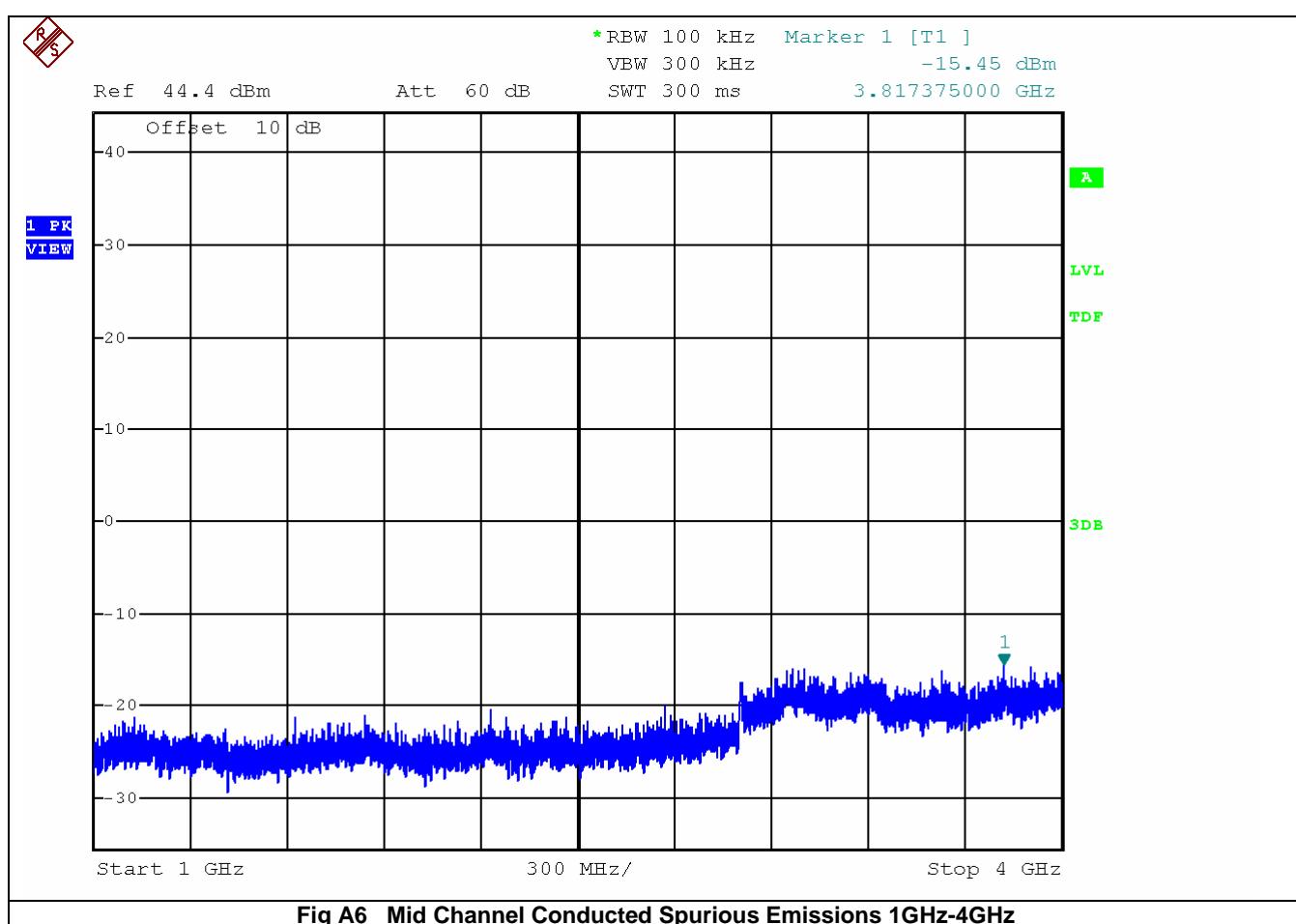
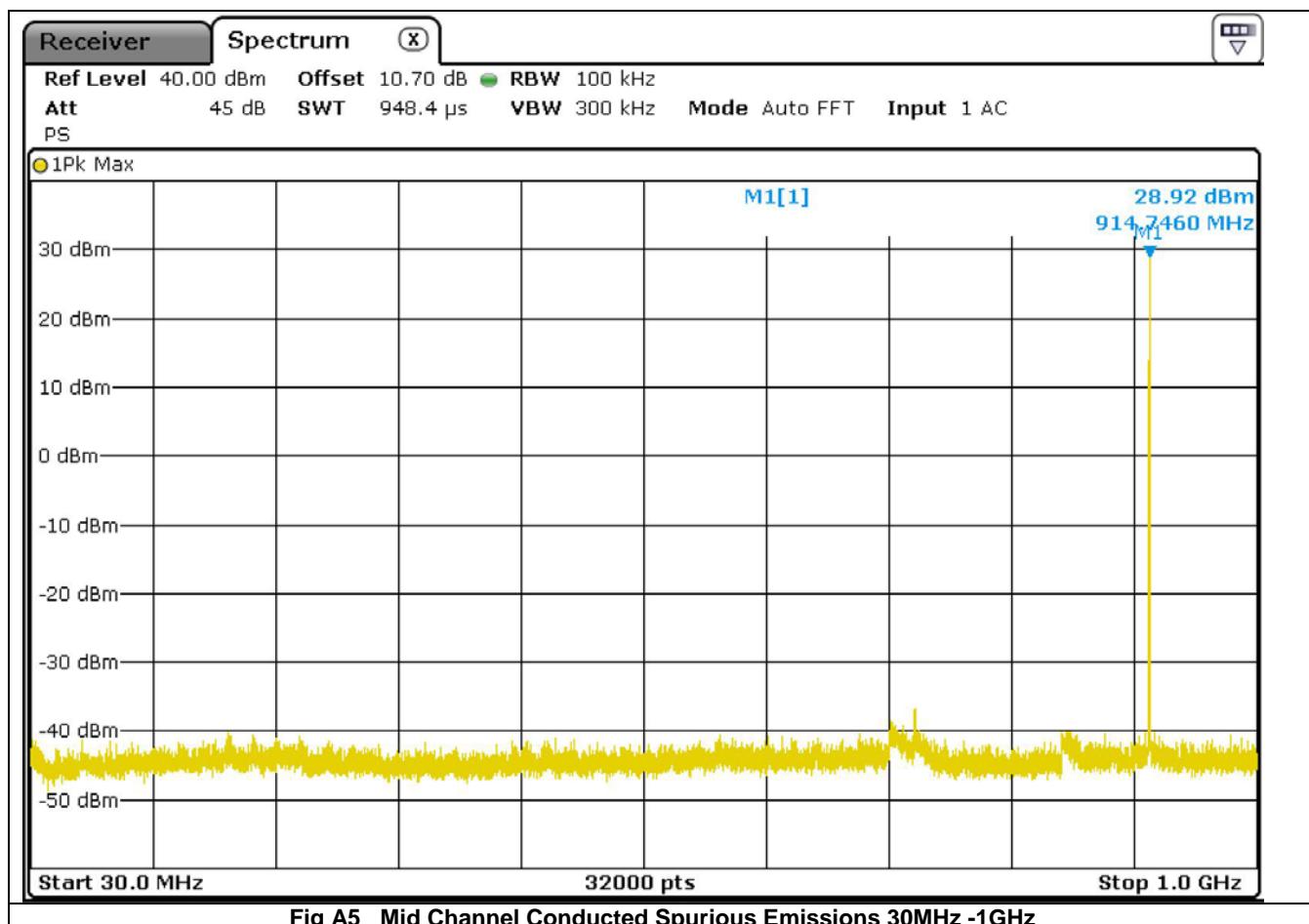
The measurement uncertainties stated were calculated with a k=2 for a confidence level of over 95% as per ETS TR100 028.

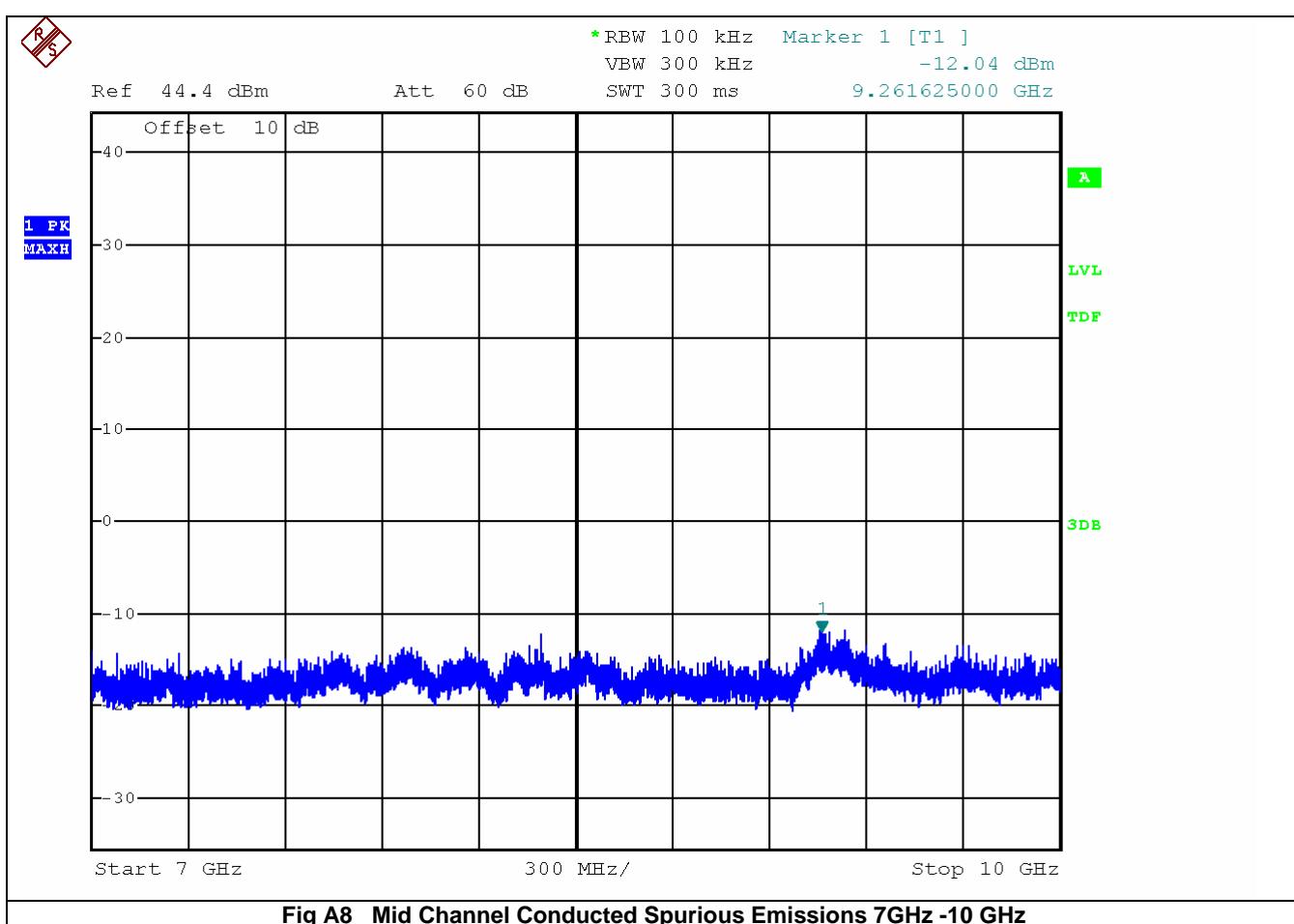
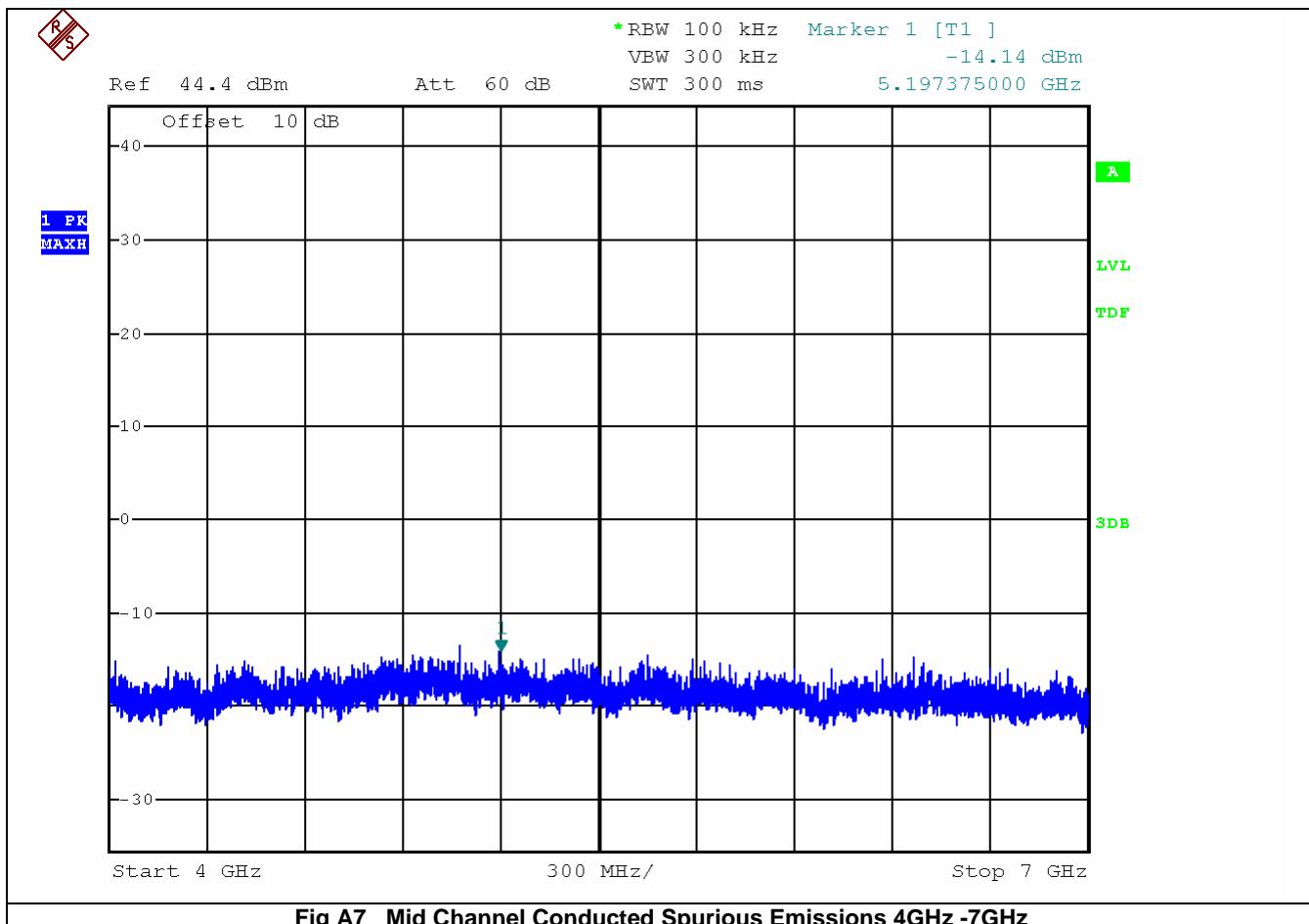
Appendix A

**Additional Test Results
For
Conducted Measurements Spurious Emissions**









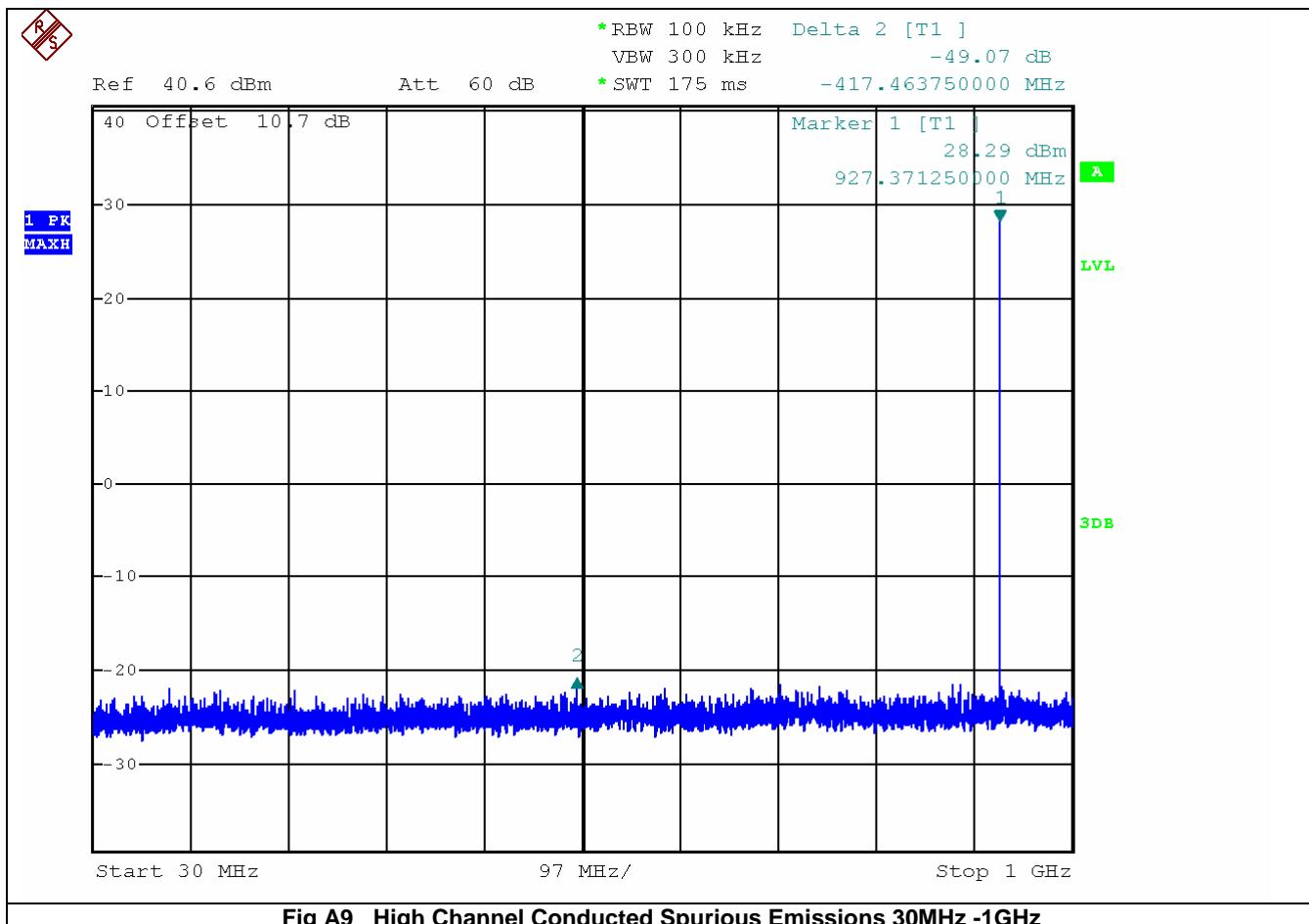


Fig A9 High Channel Conducted Spurious Emissions 30MHz -1GHz

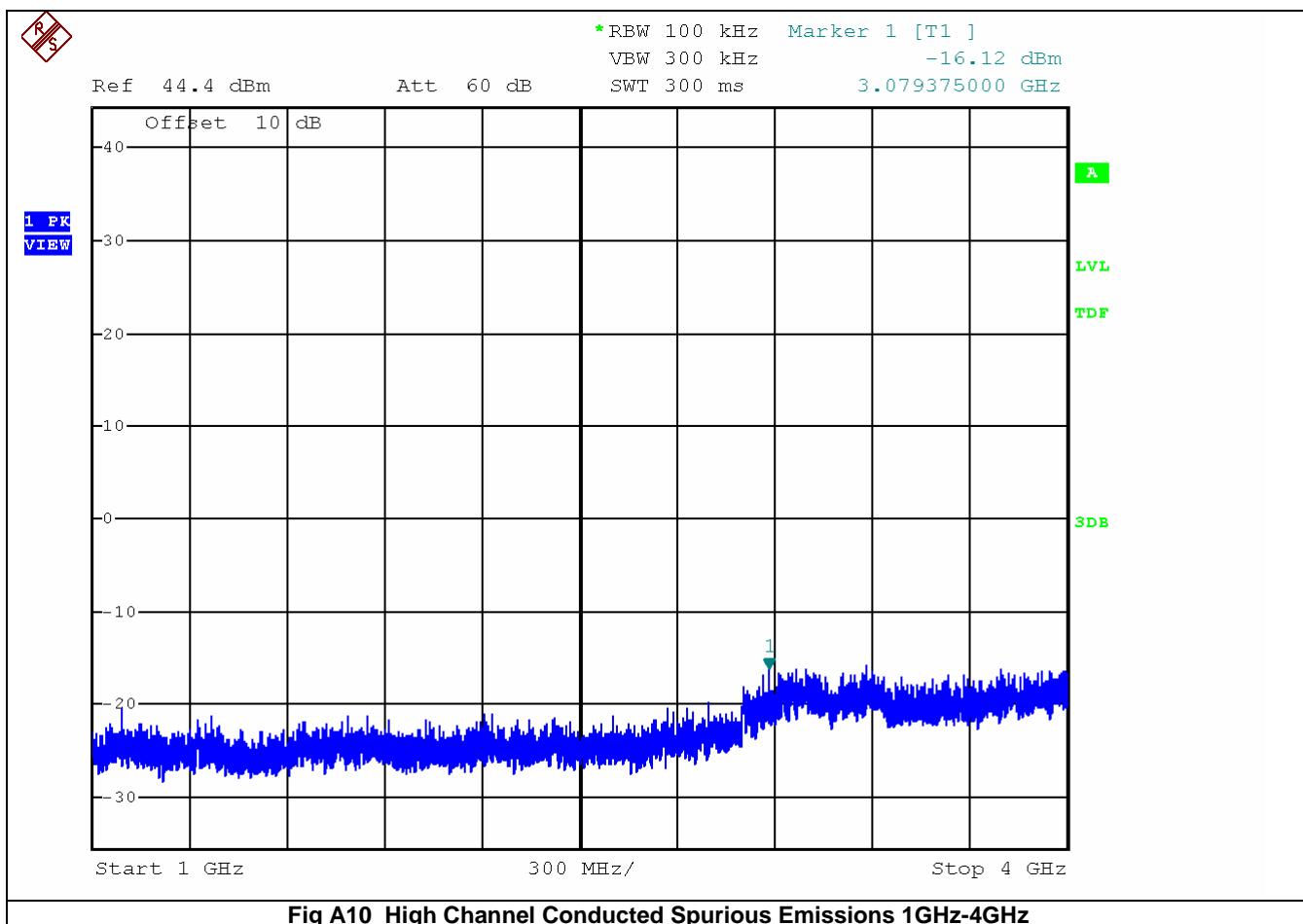
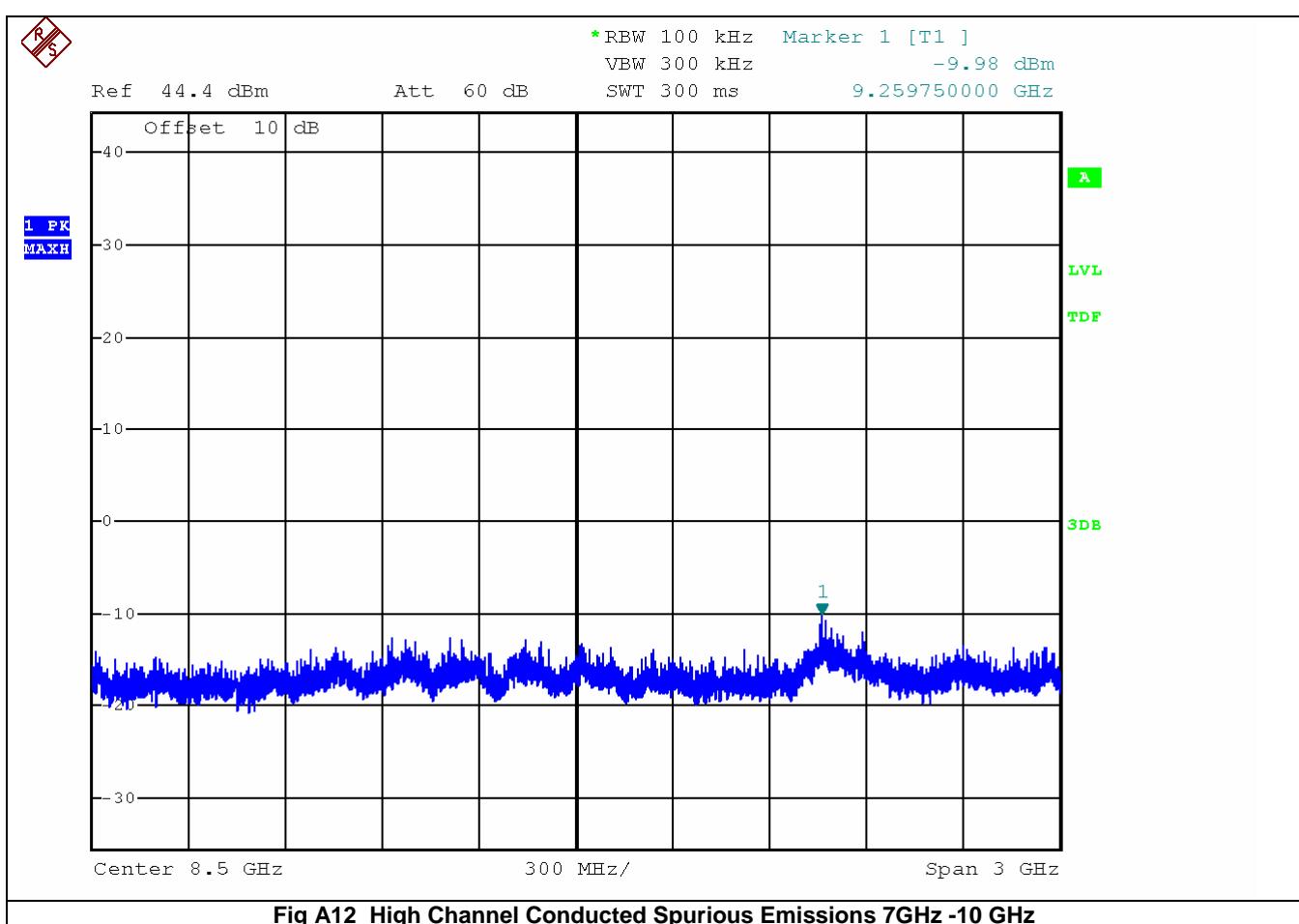
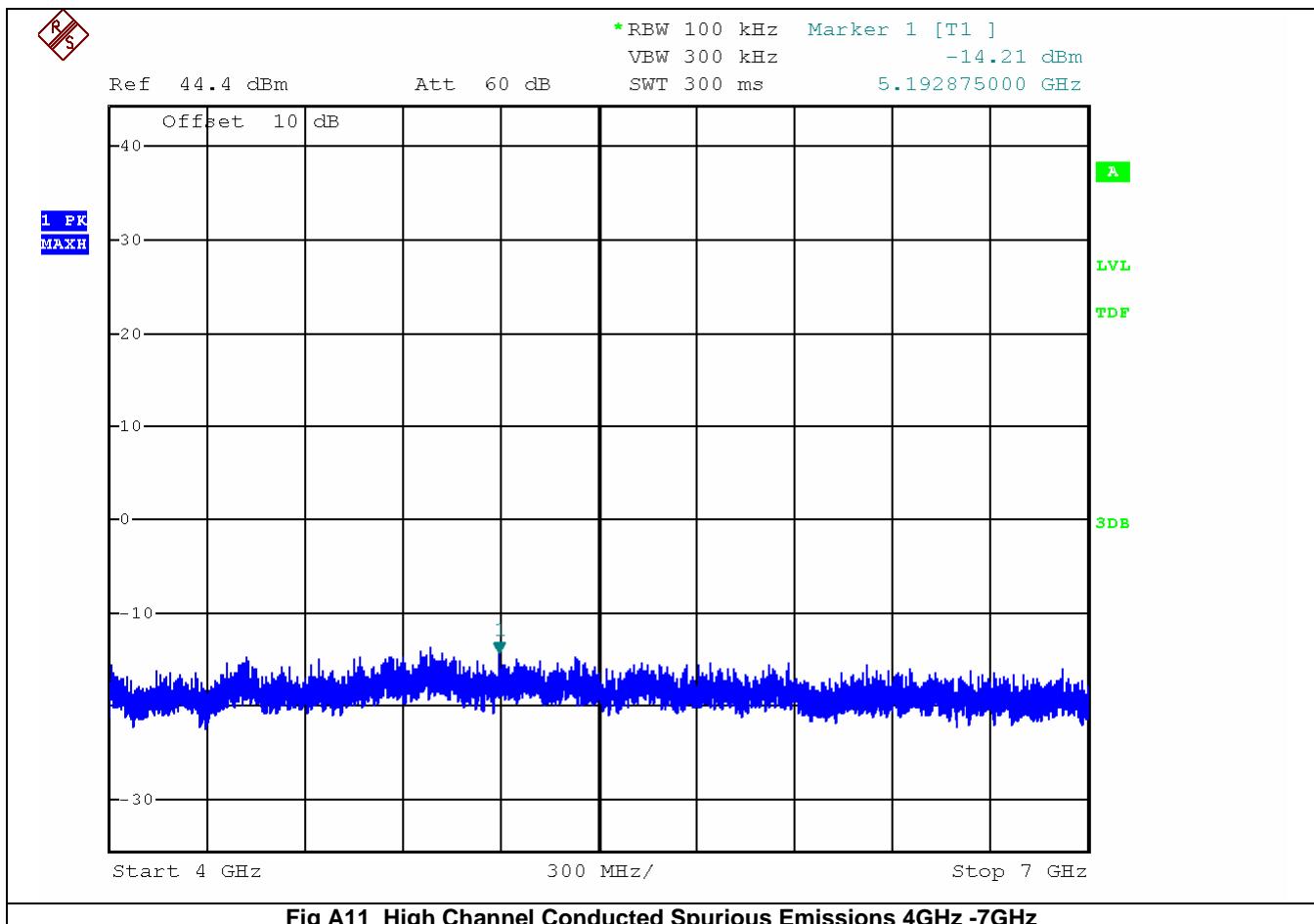


Fig A10 High Channel Conducted Spurious Emissions 1GHz-4GHz



Appendix B

Conducted Tests for Band Edges

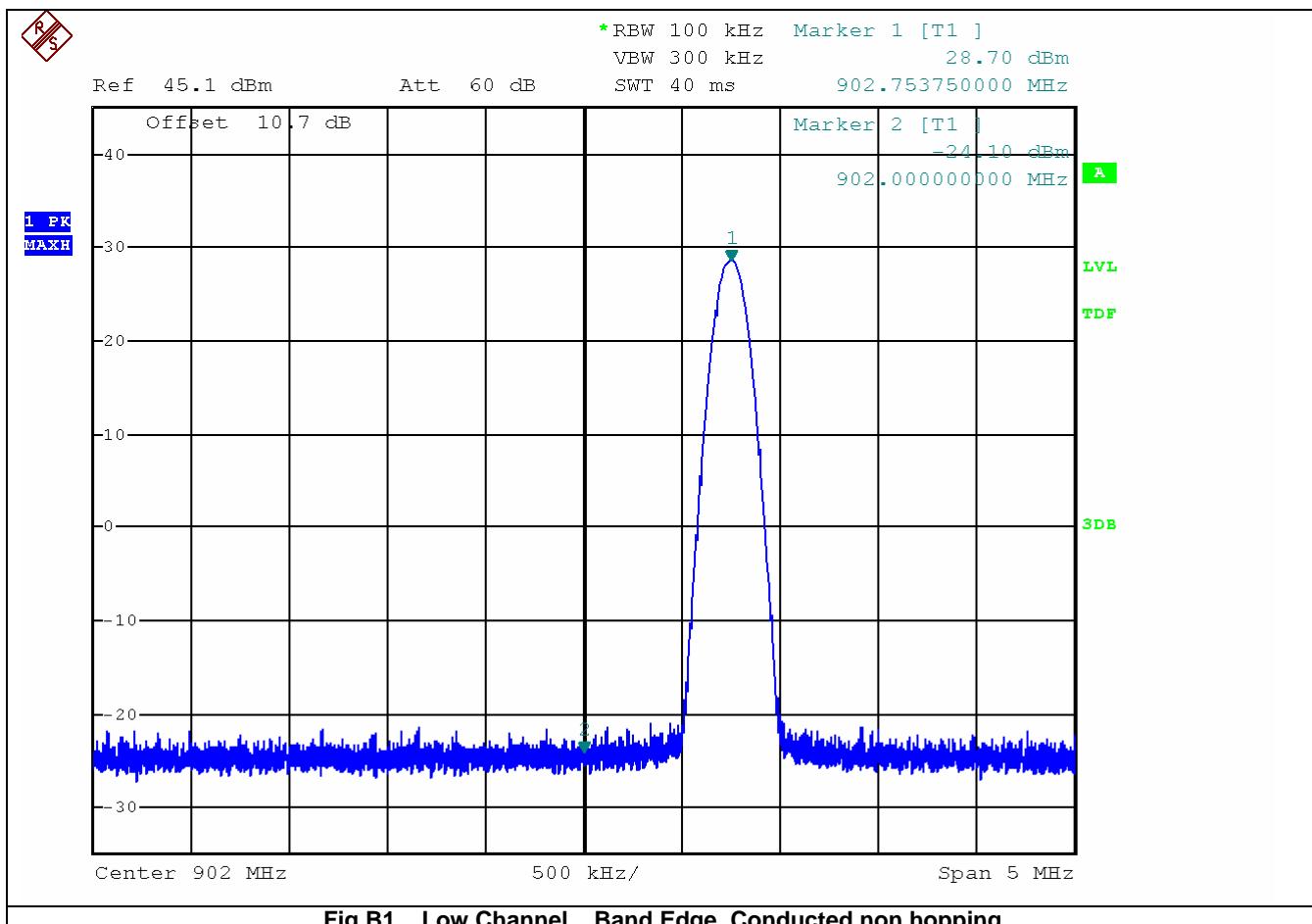


Fig B1 Low Channel Band Edge Conducted non hopping

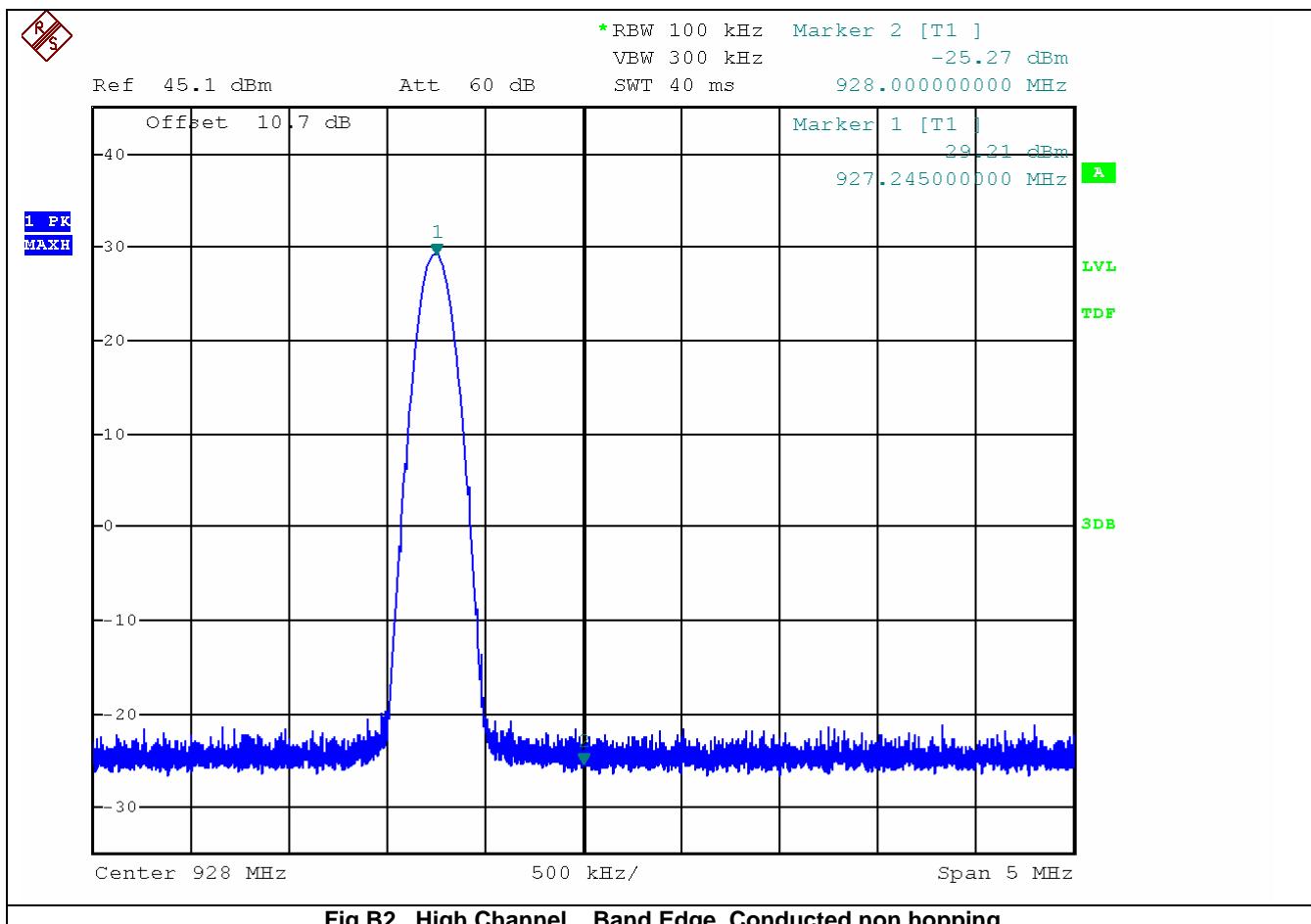


Fig B2 High Channel Band Edge Conducted non hopping

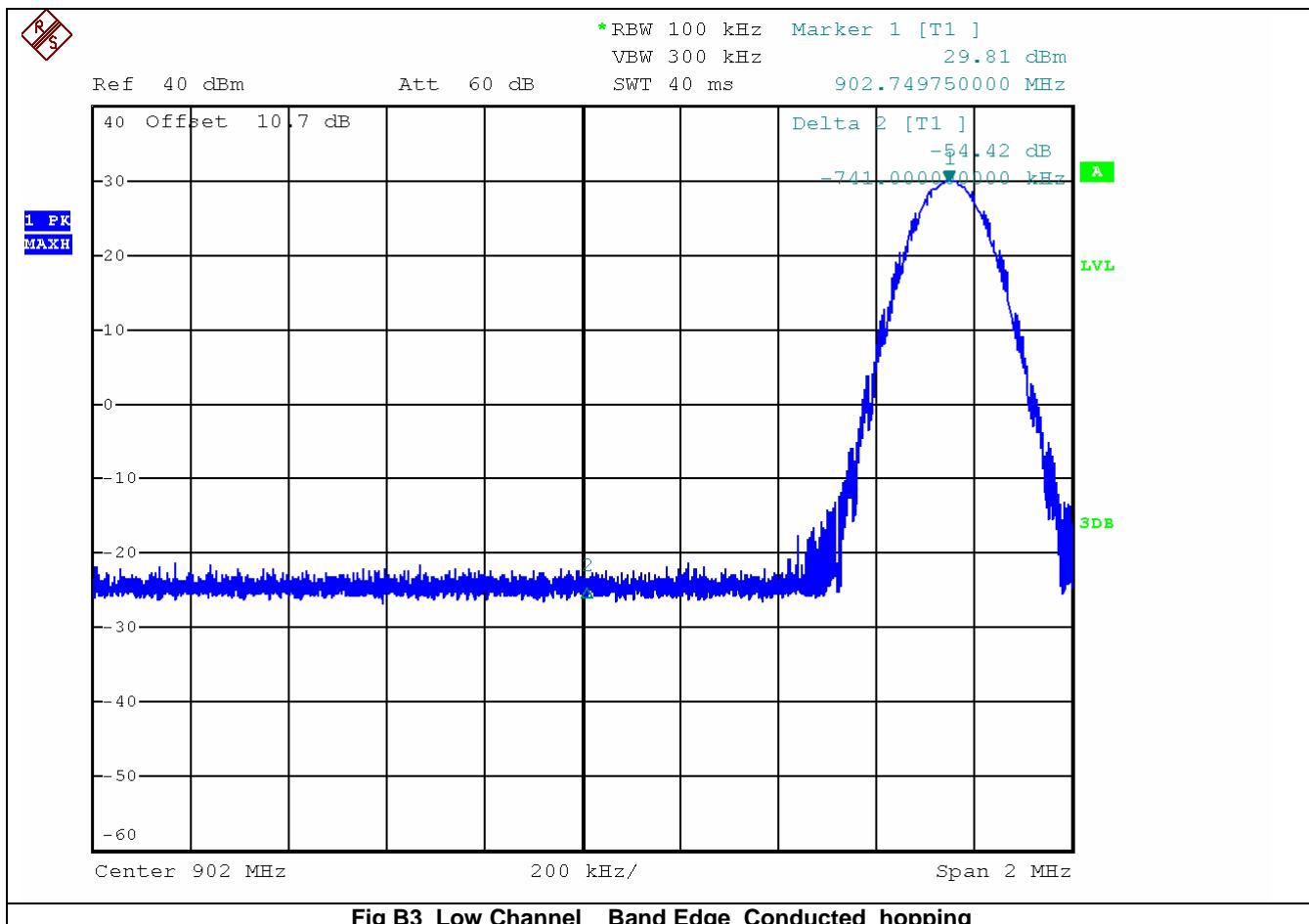


Fig B3 Low Channel Band Edge Conducted hopping

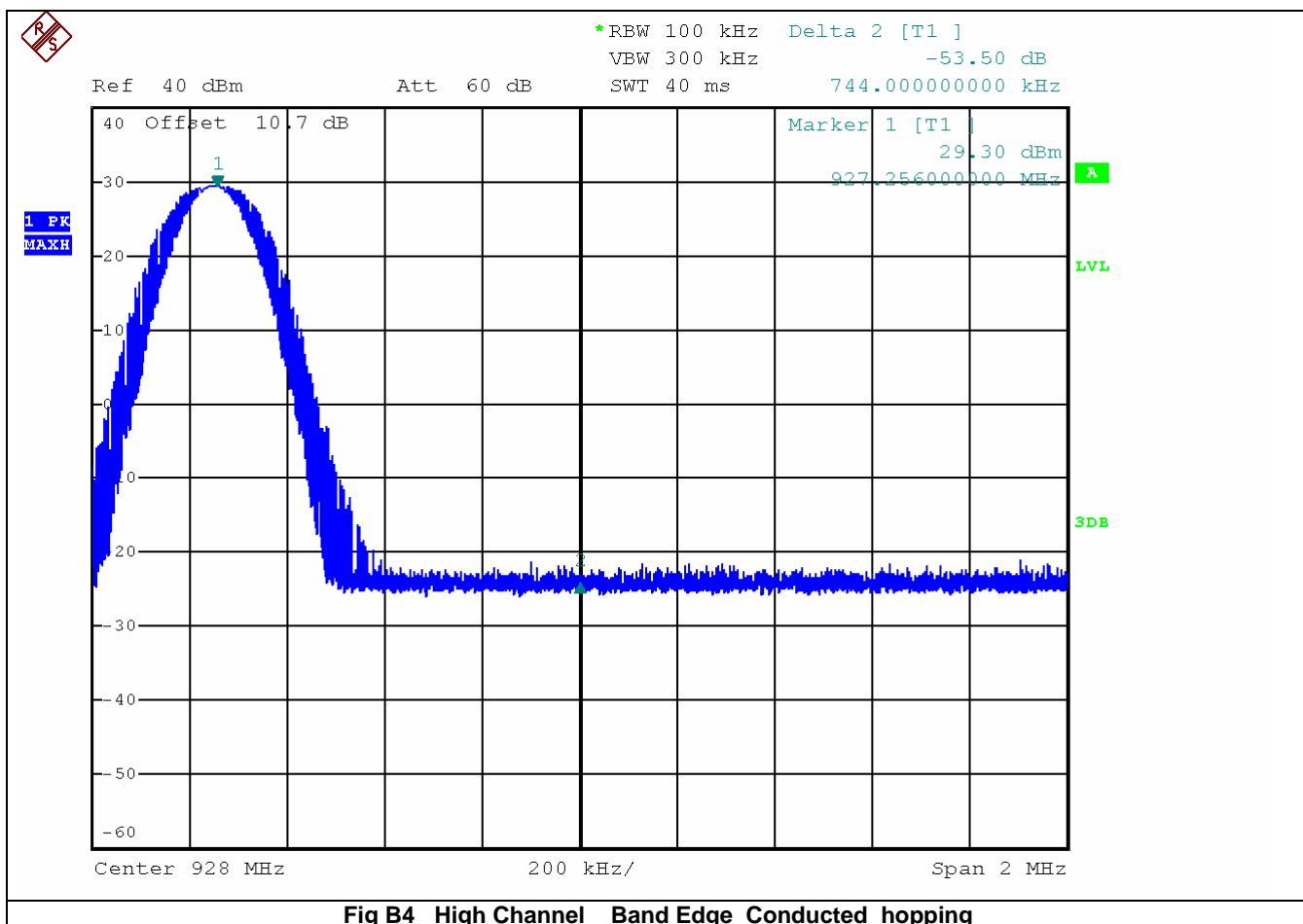
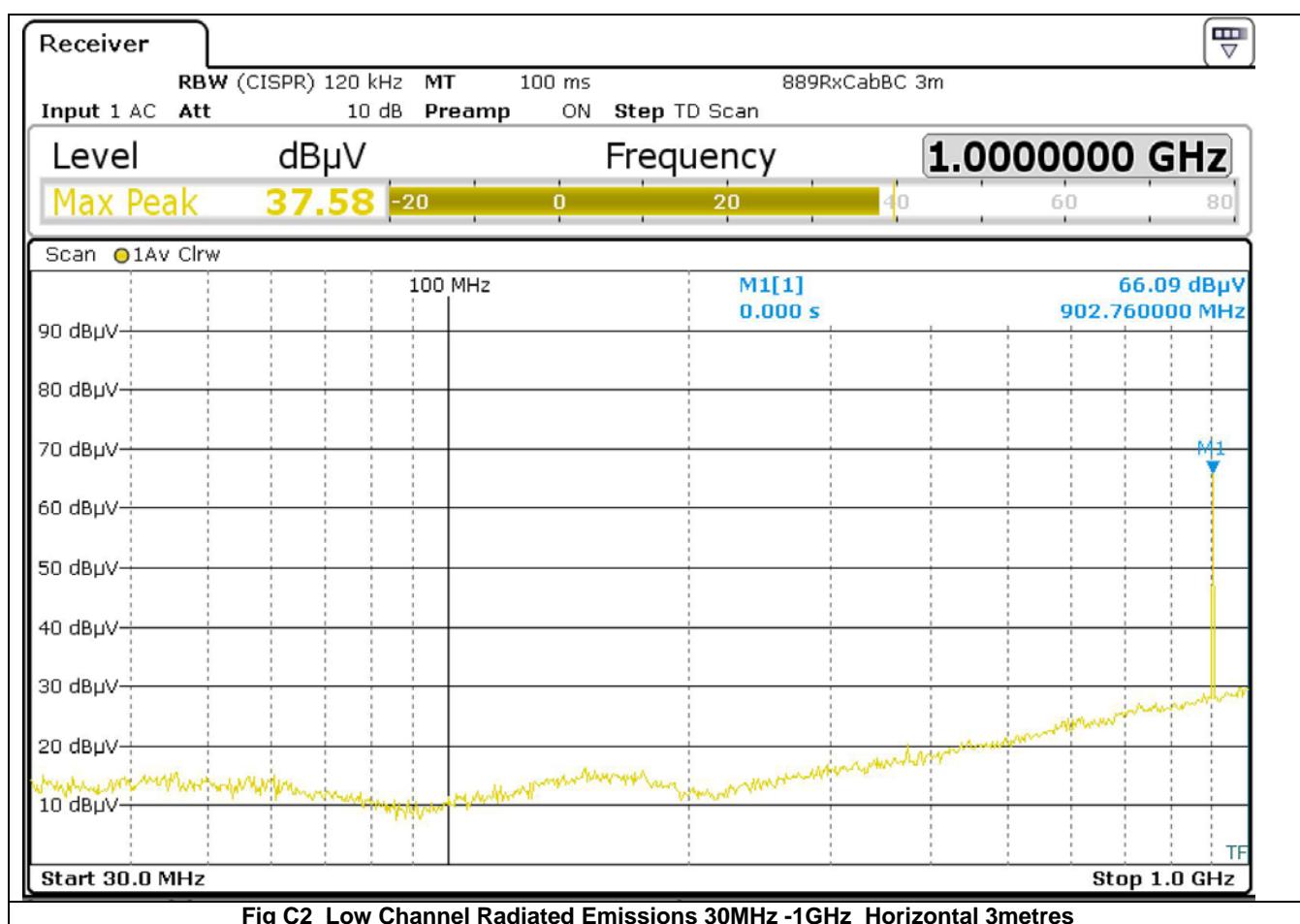
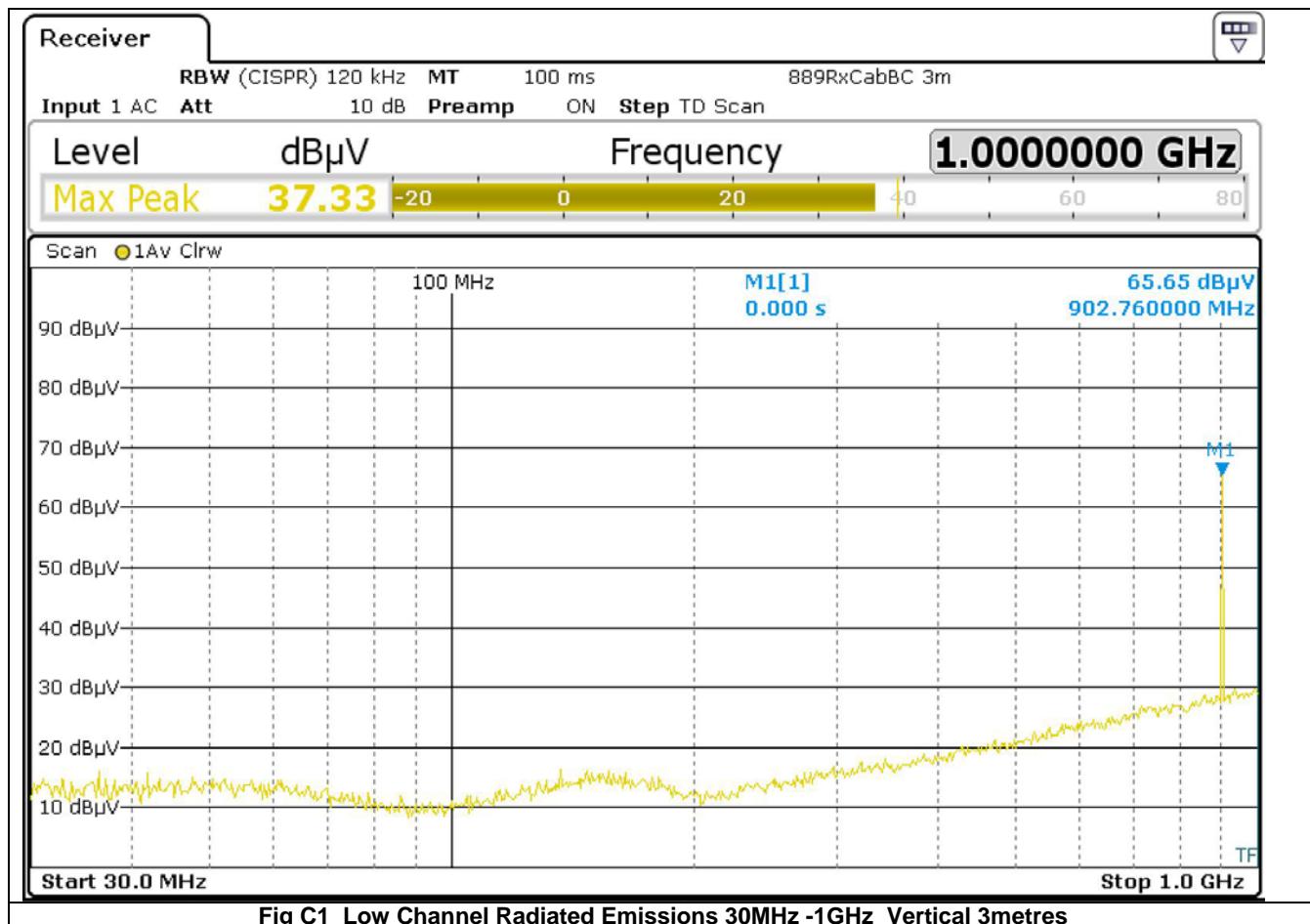
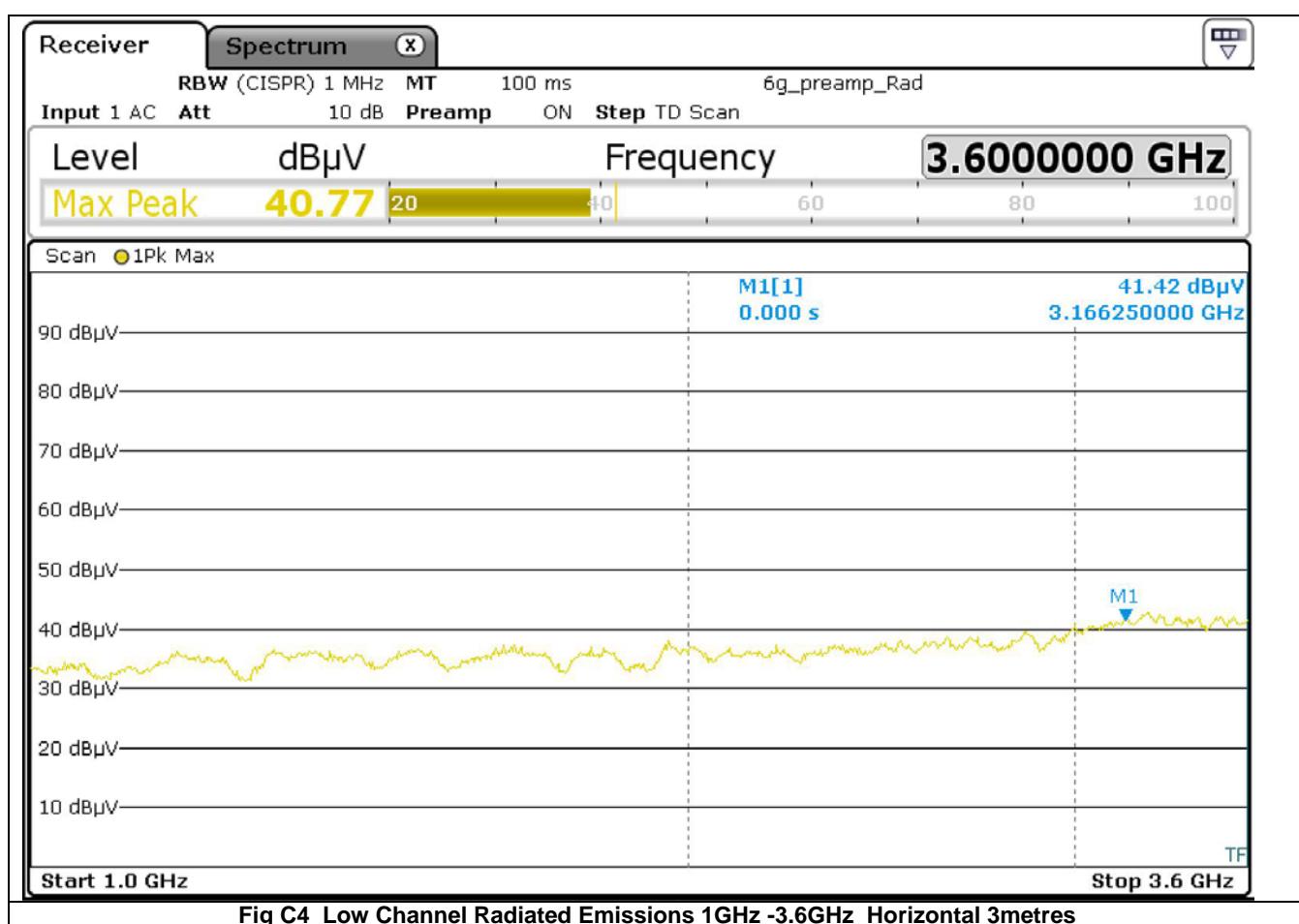
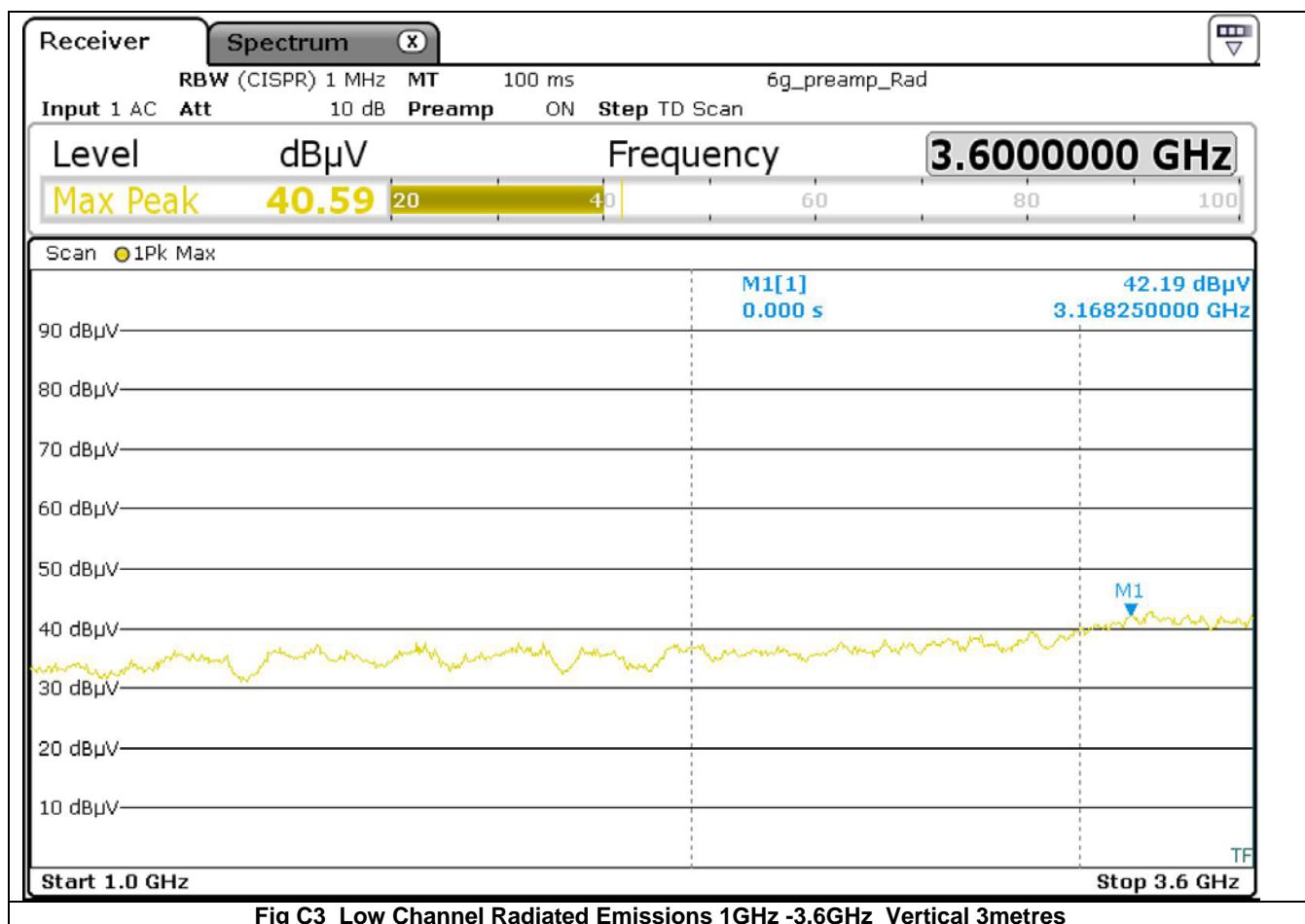


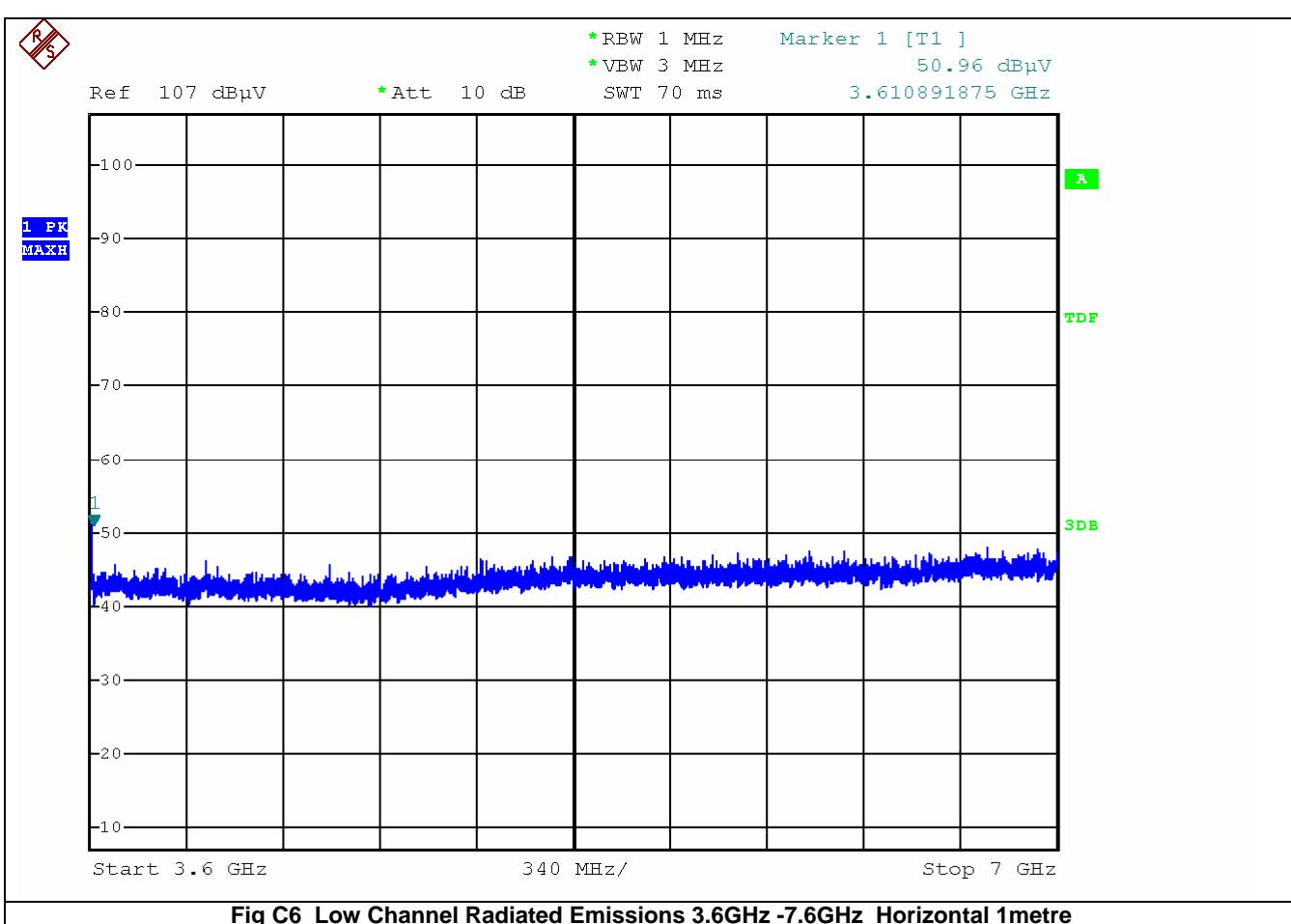
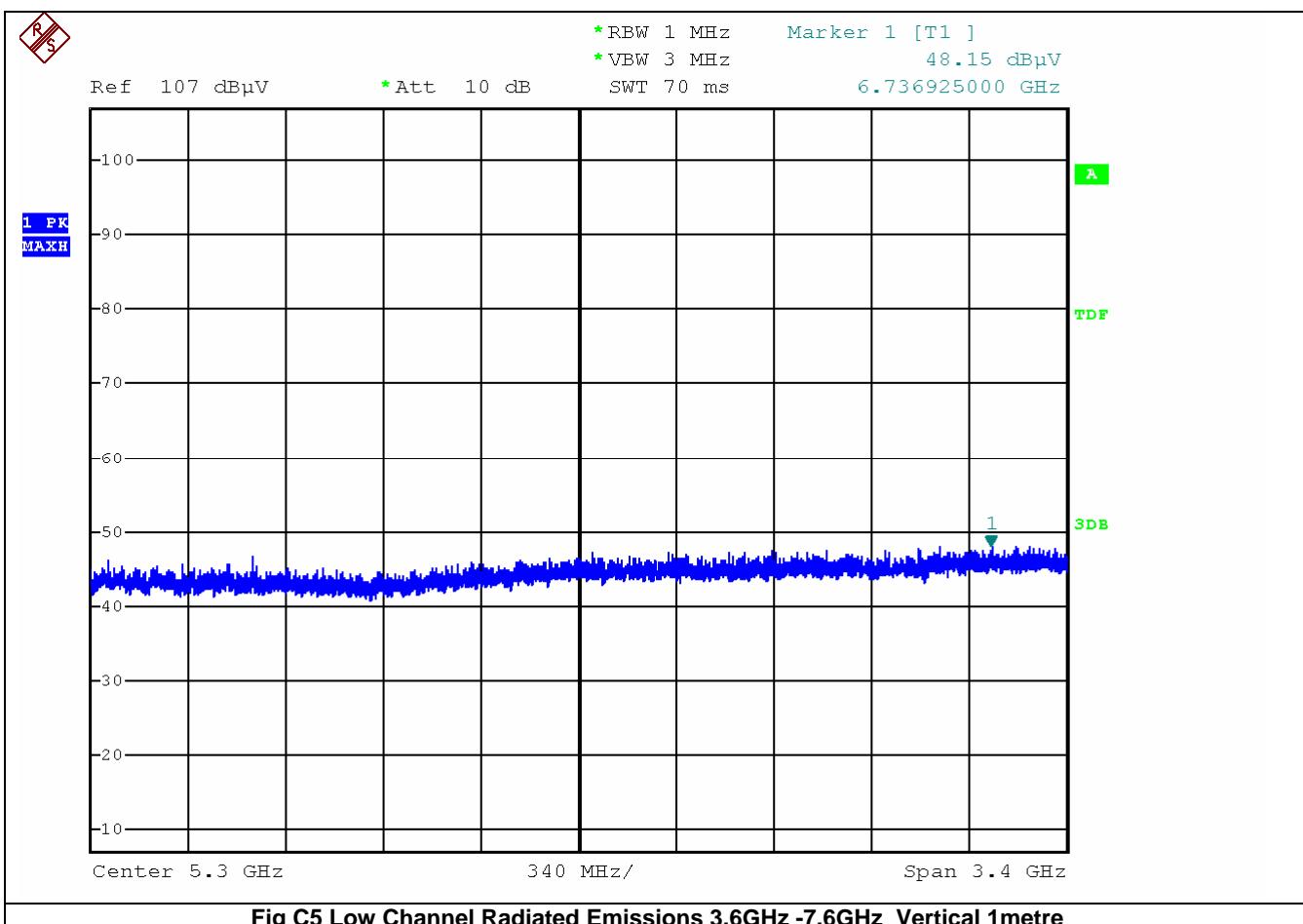
Fig B4 High Channel Band Edge Conducted hopping

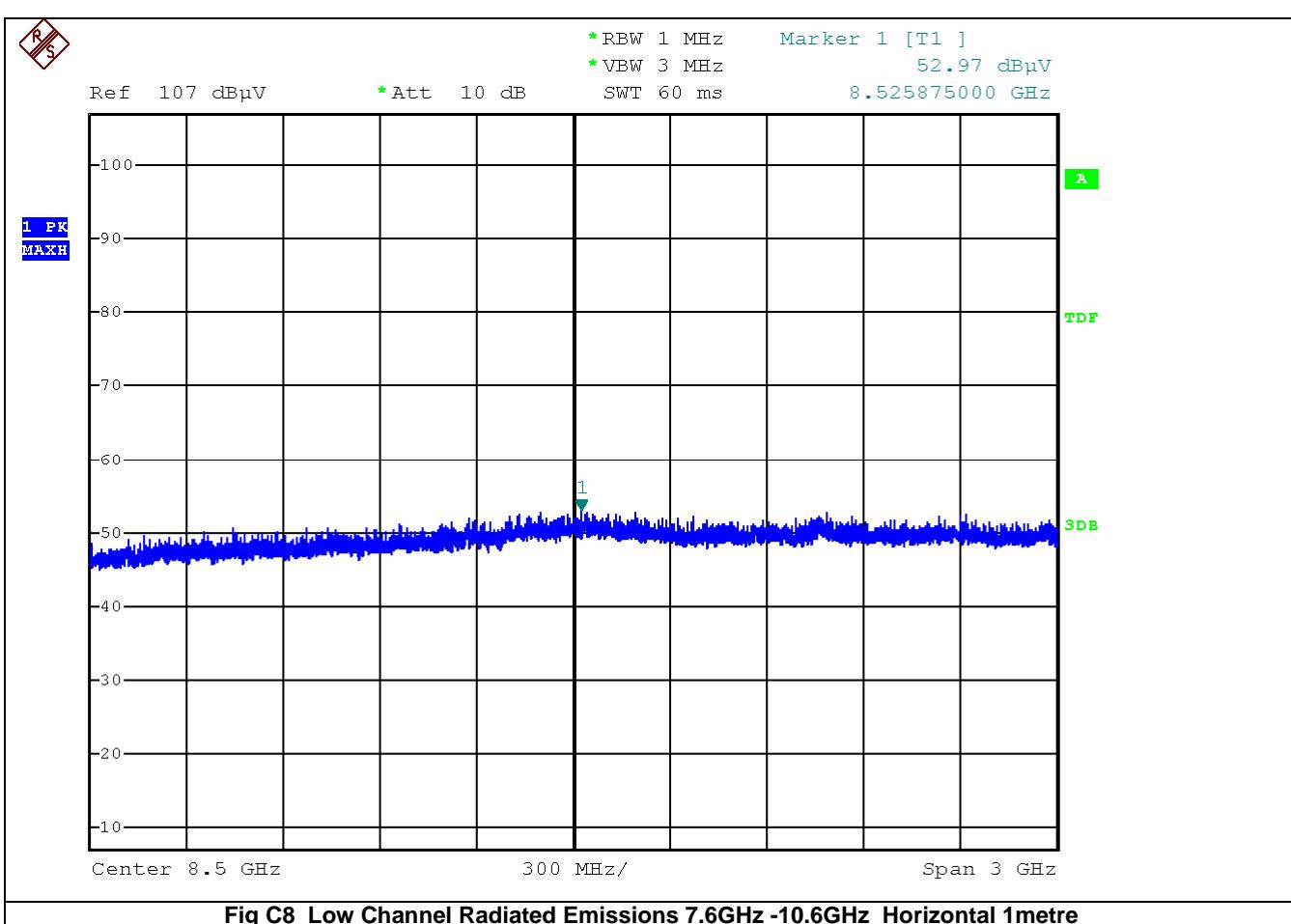
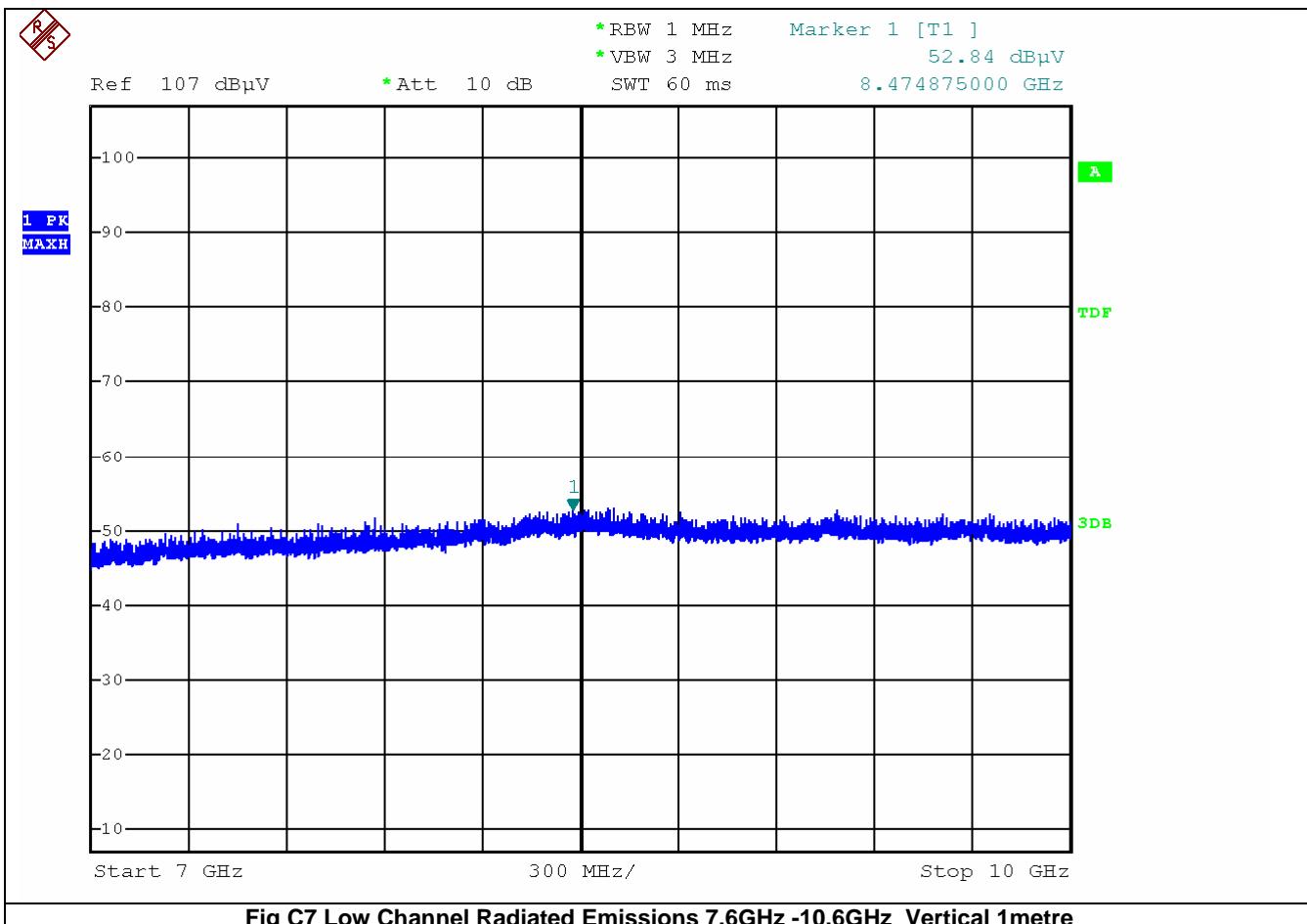
Appendix C

Radiated Spurious Emissions with antenna port terminated



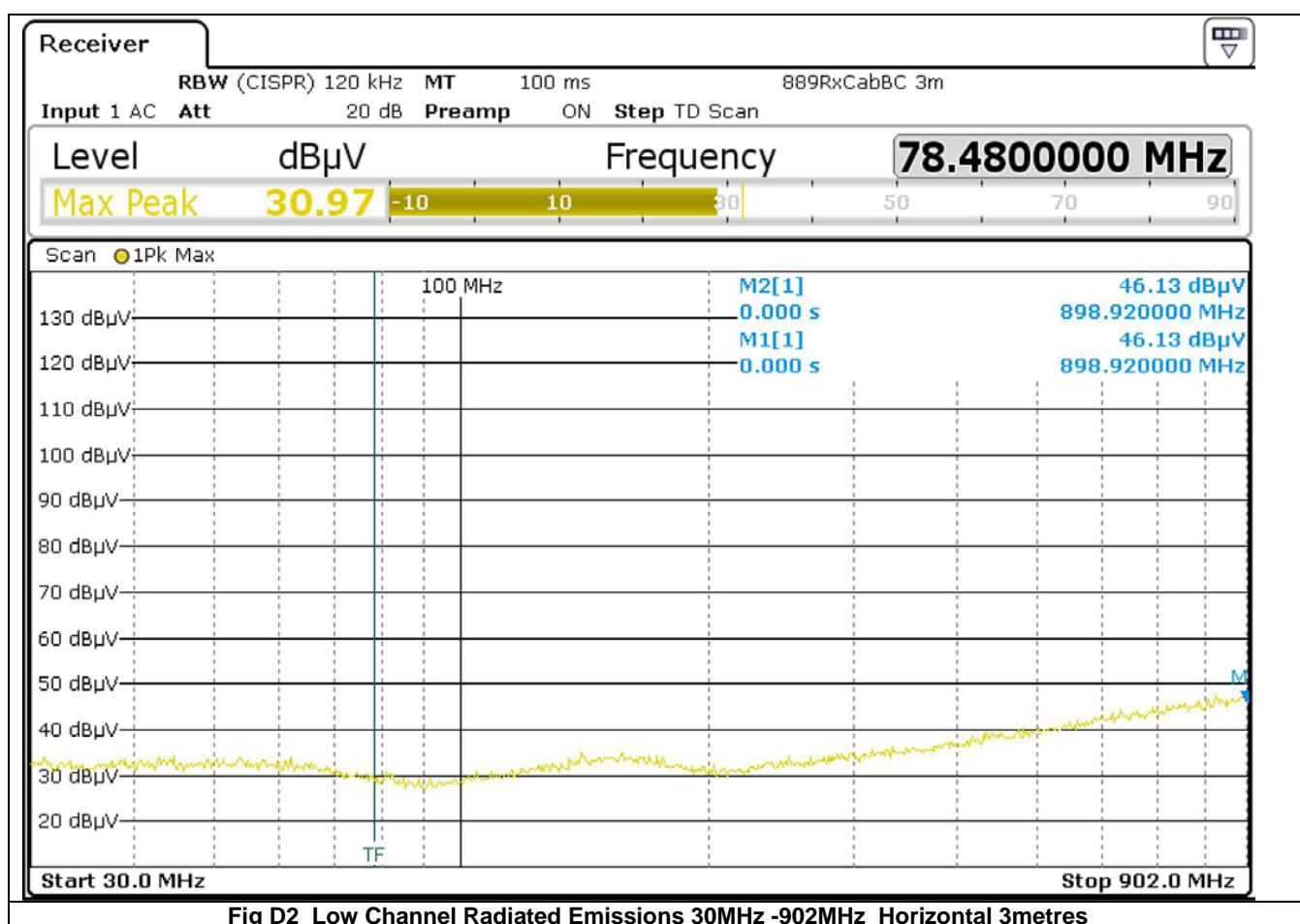
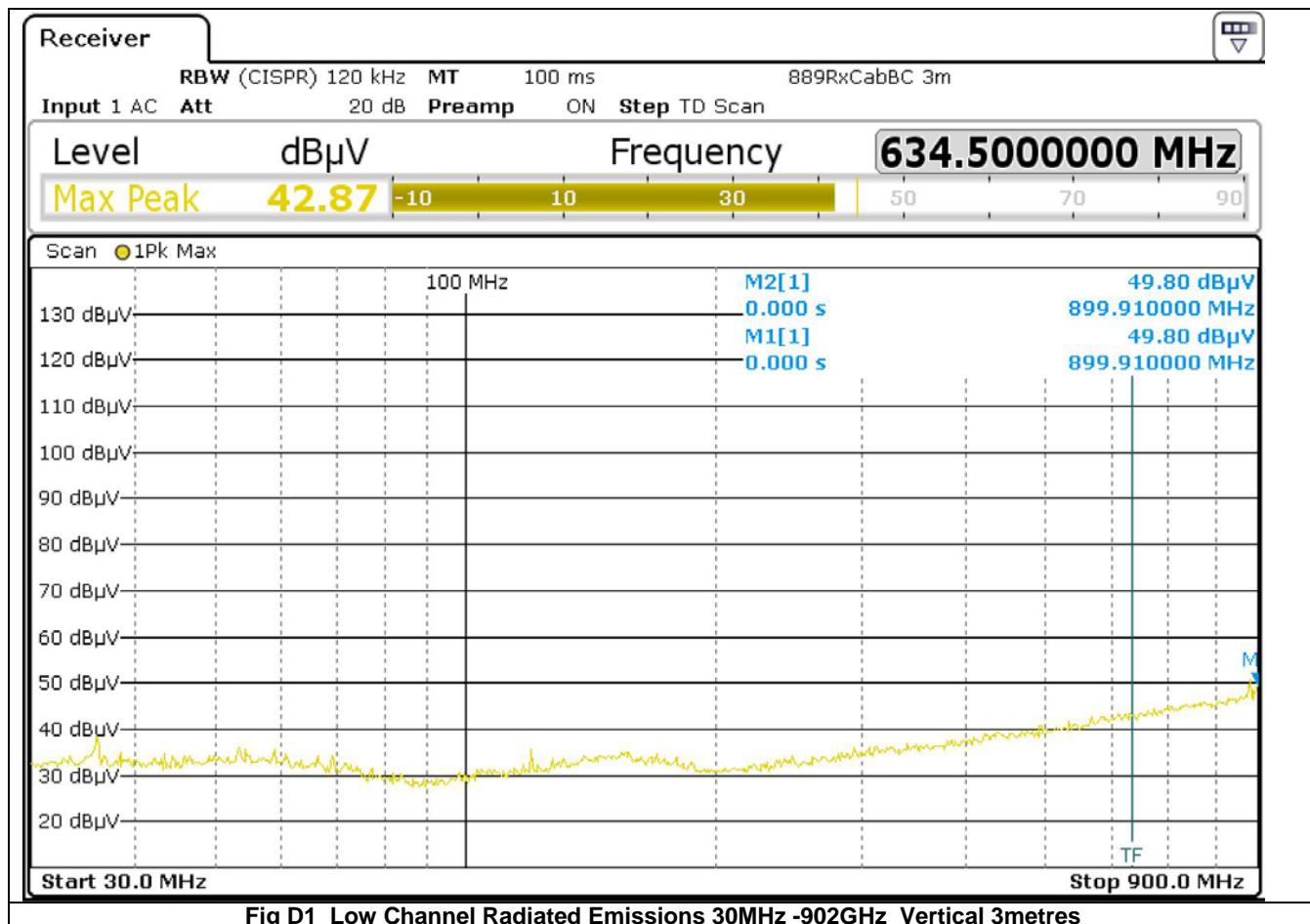


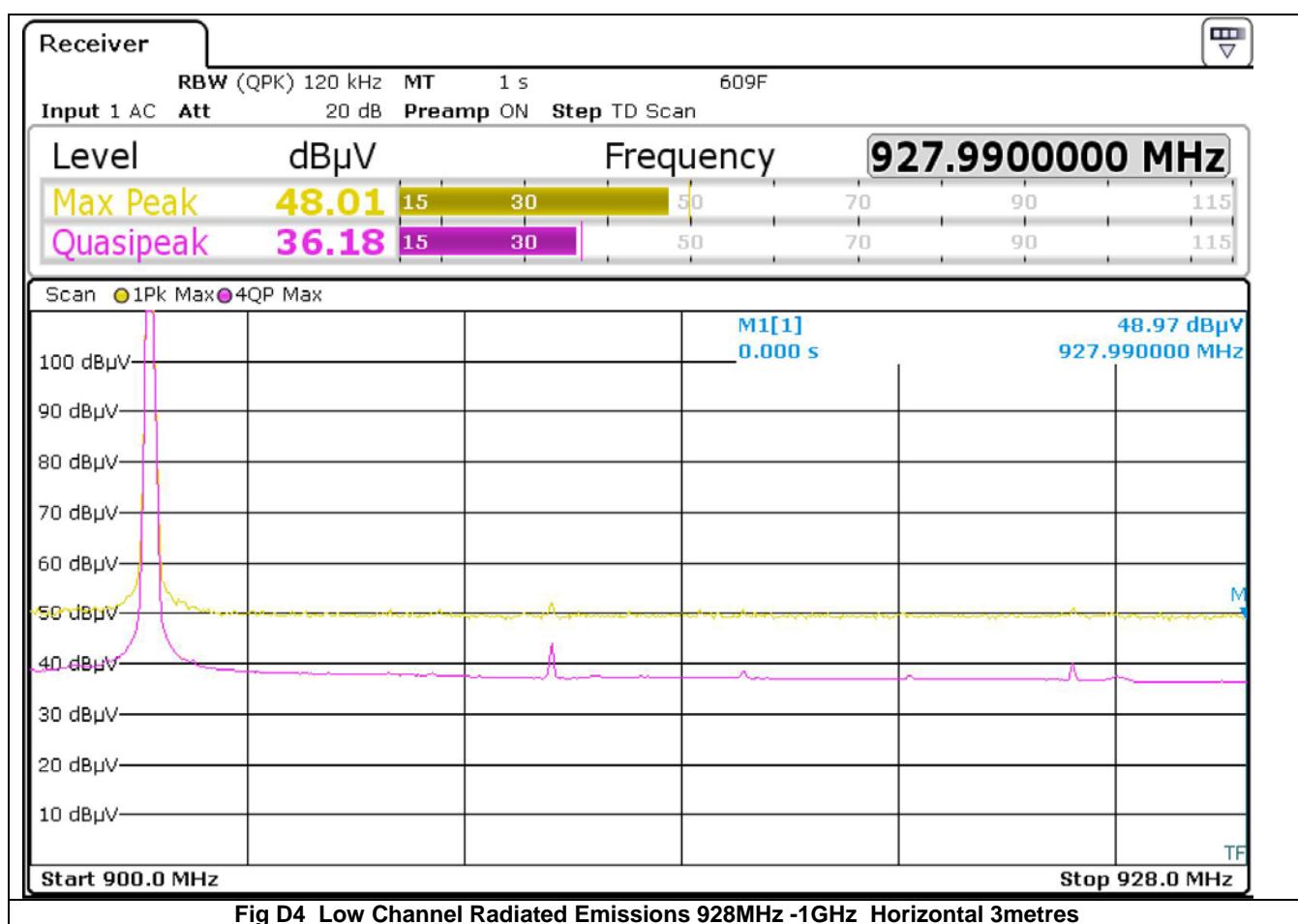
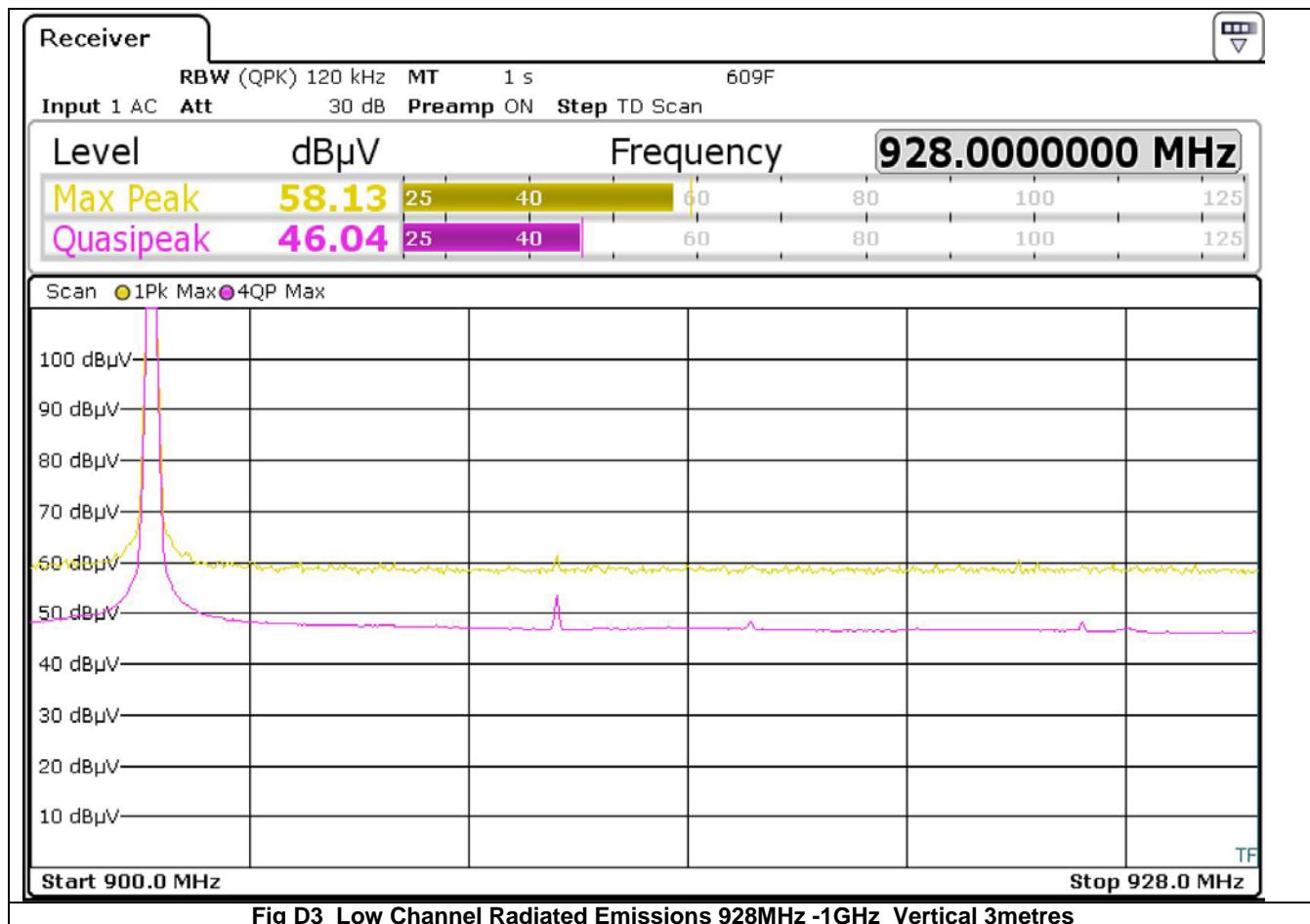




Appendix D

**Radiated Spurious Emissions Restricted Bands
with antenna #1**





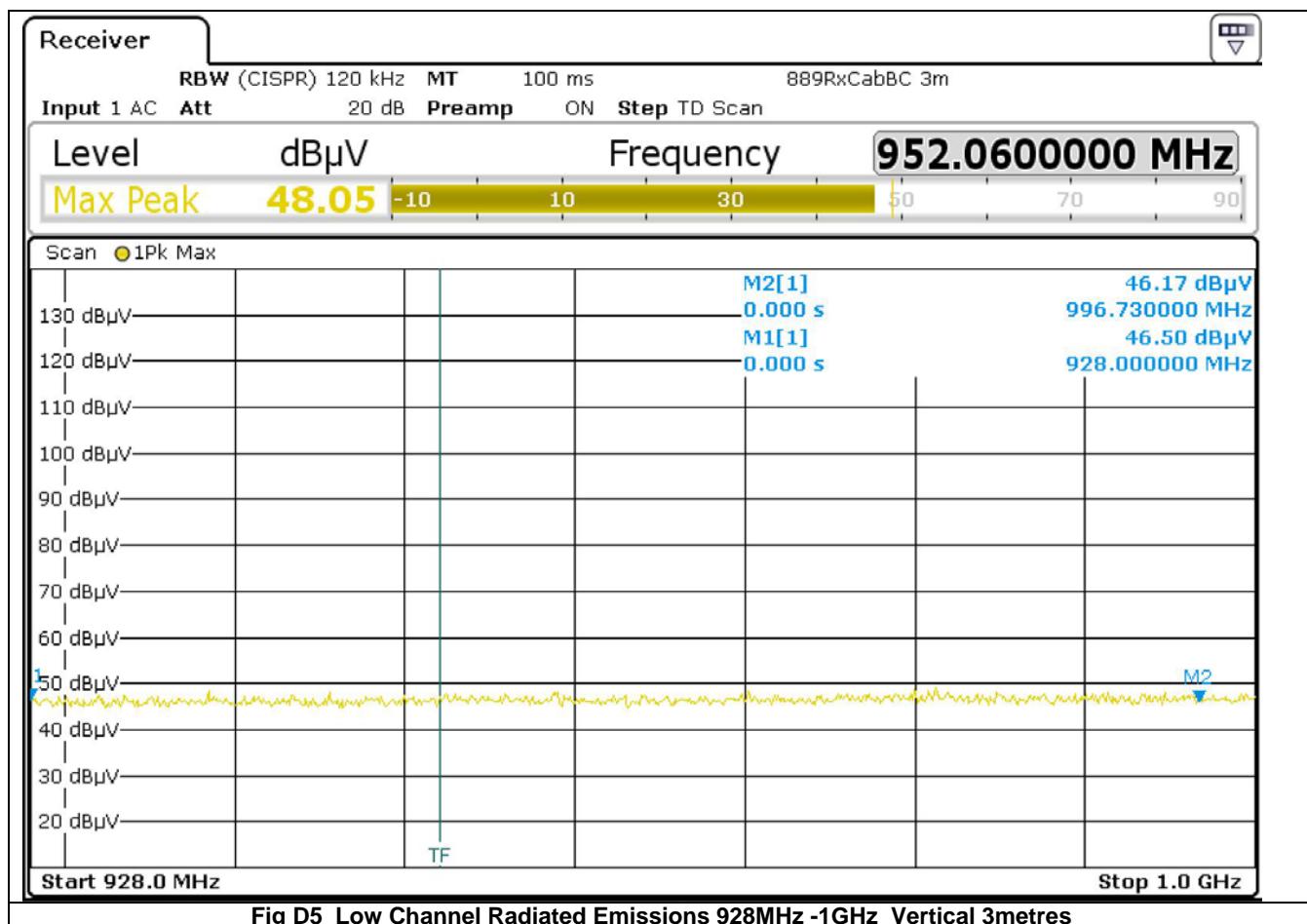


Fig D5 Low Channel Radiated Emissions 928MHz -1GHz Vertical 3metres

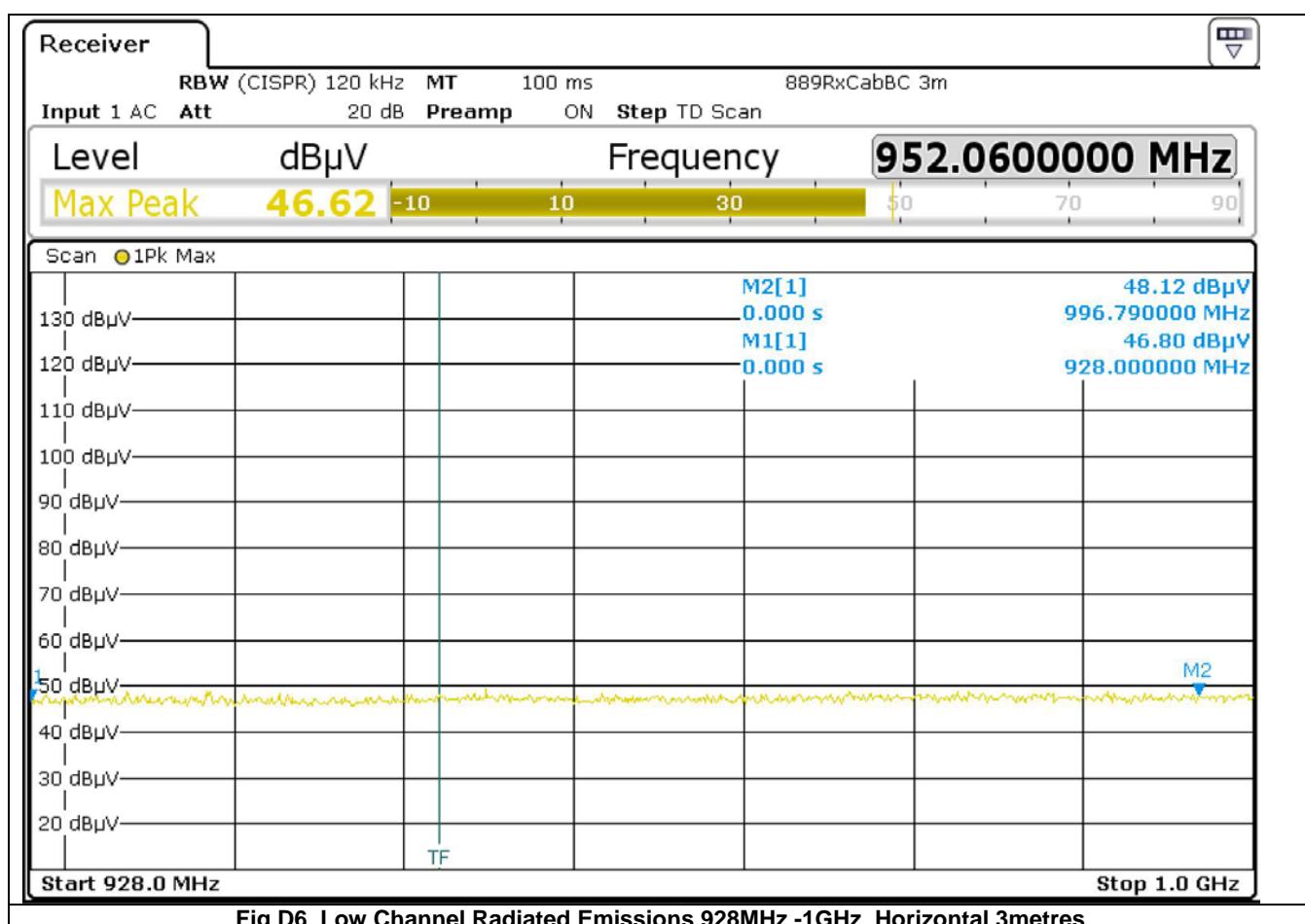
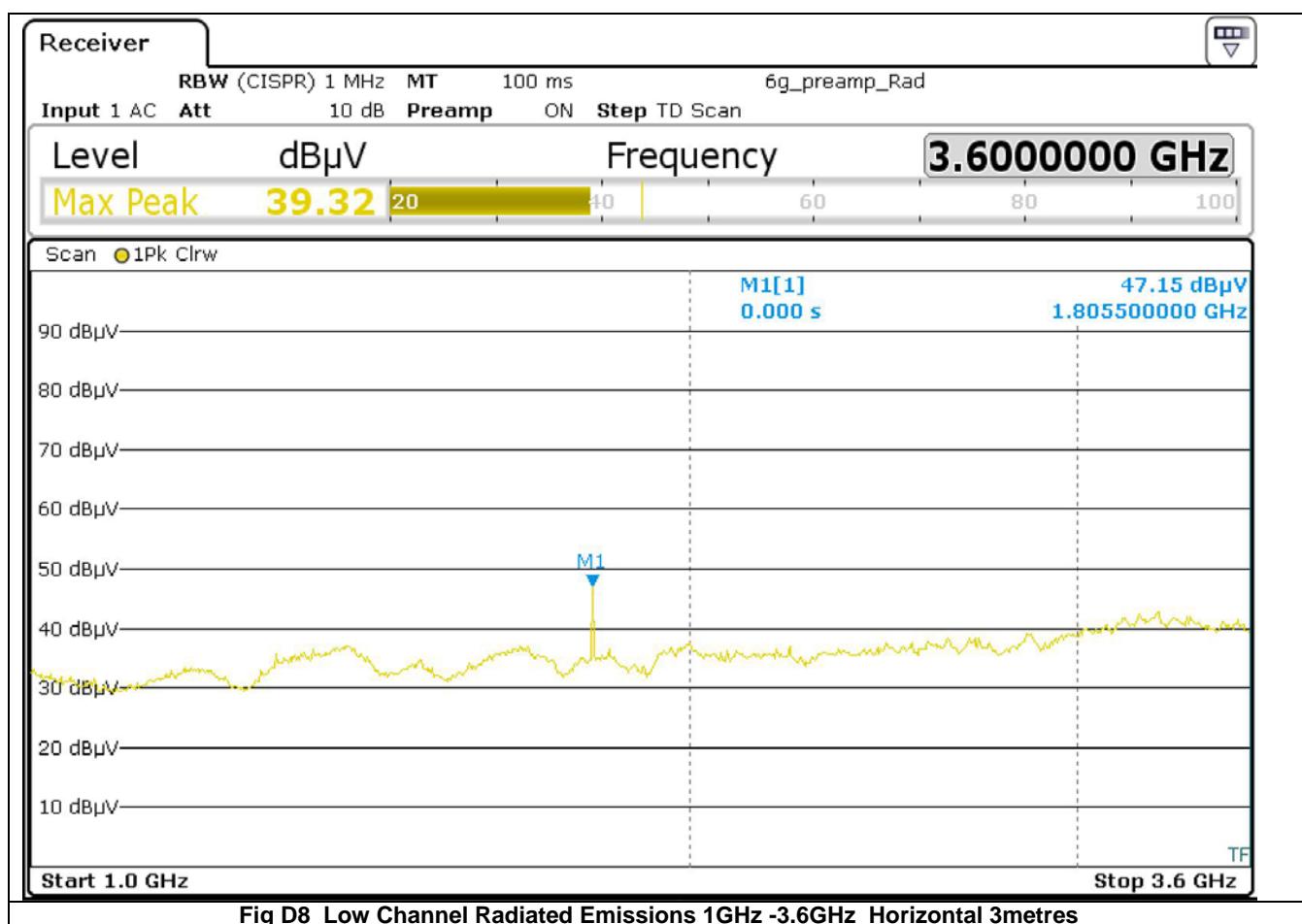
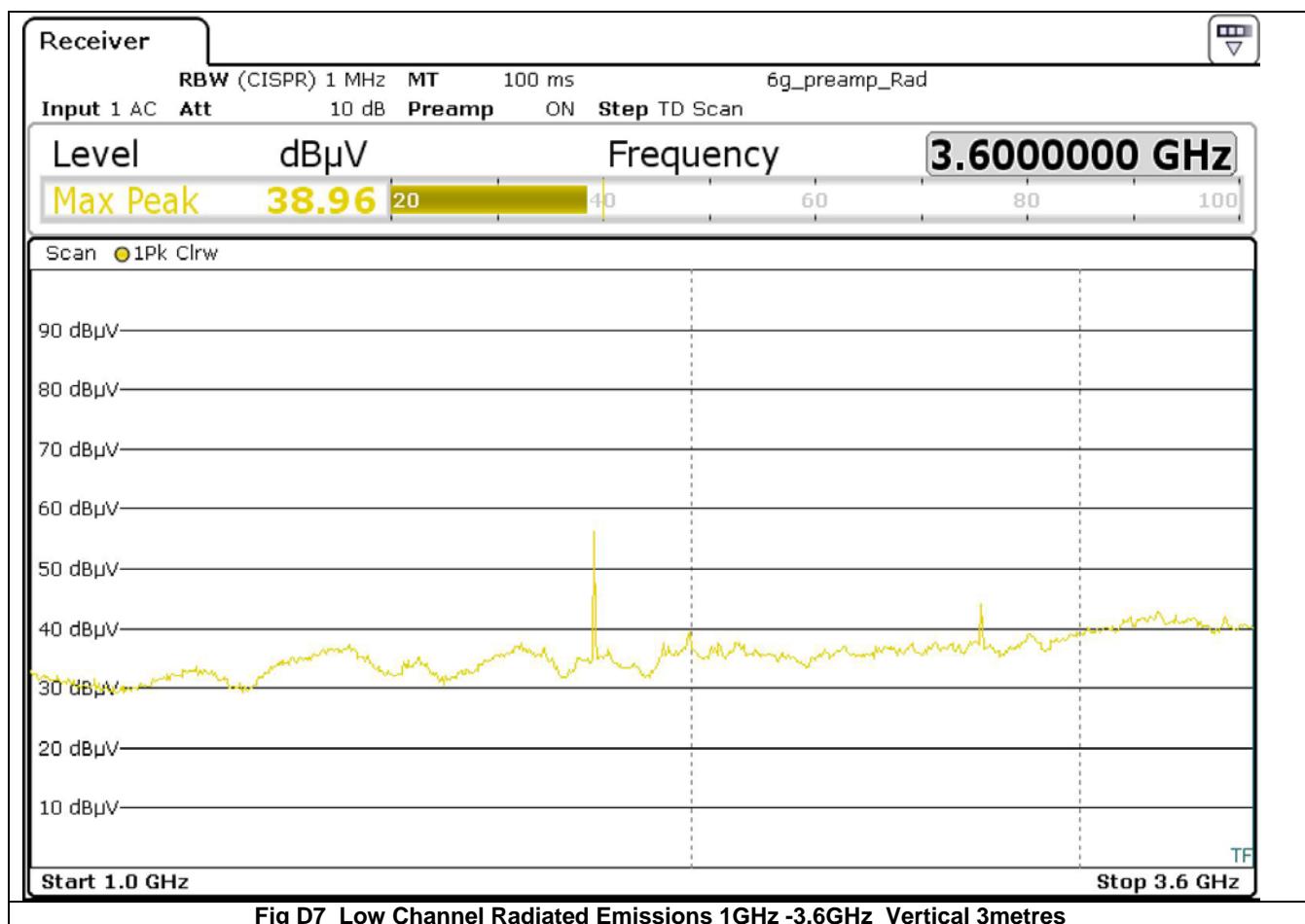
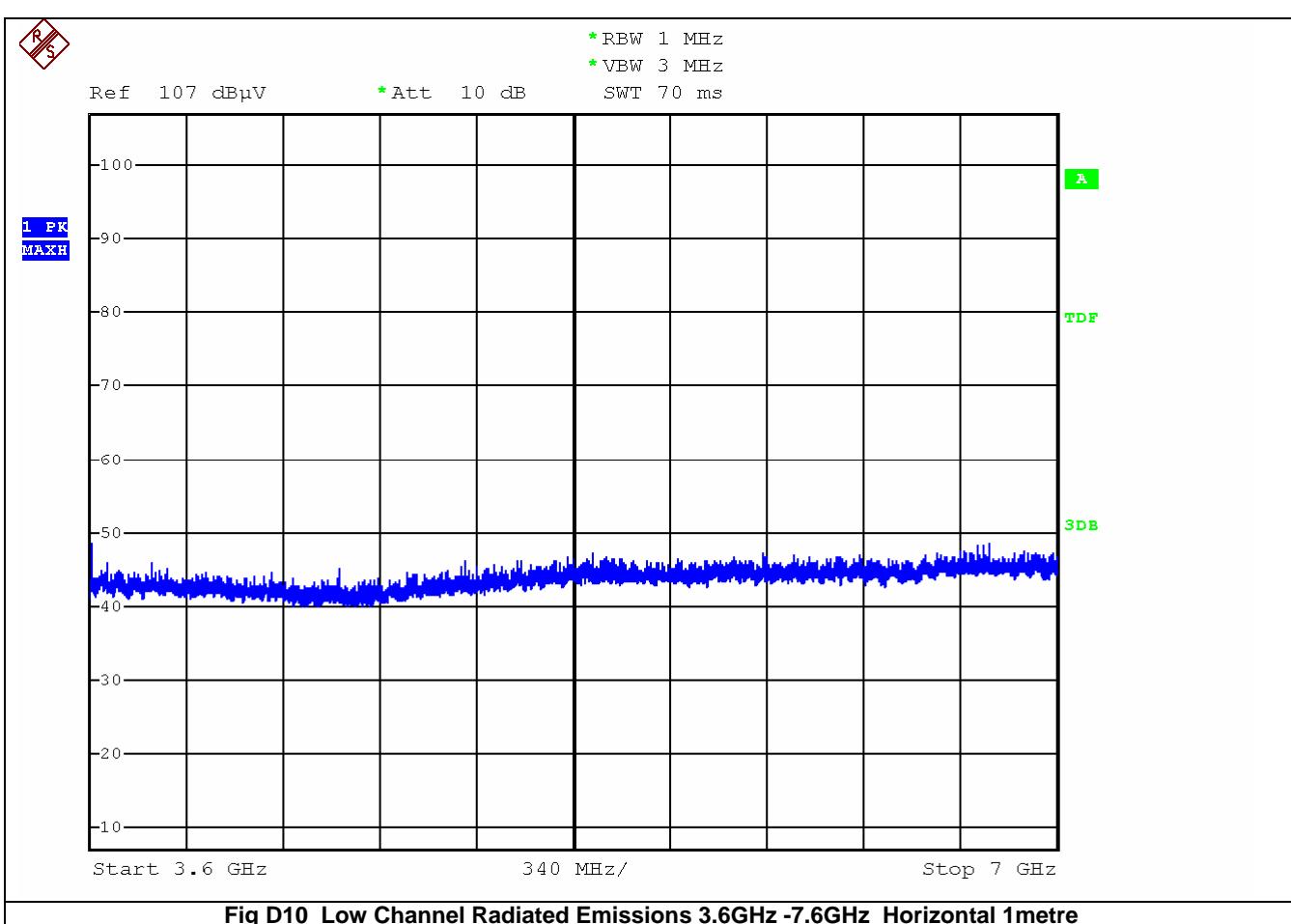
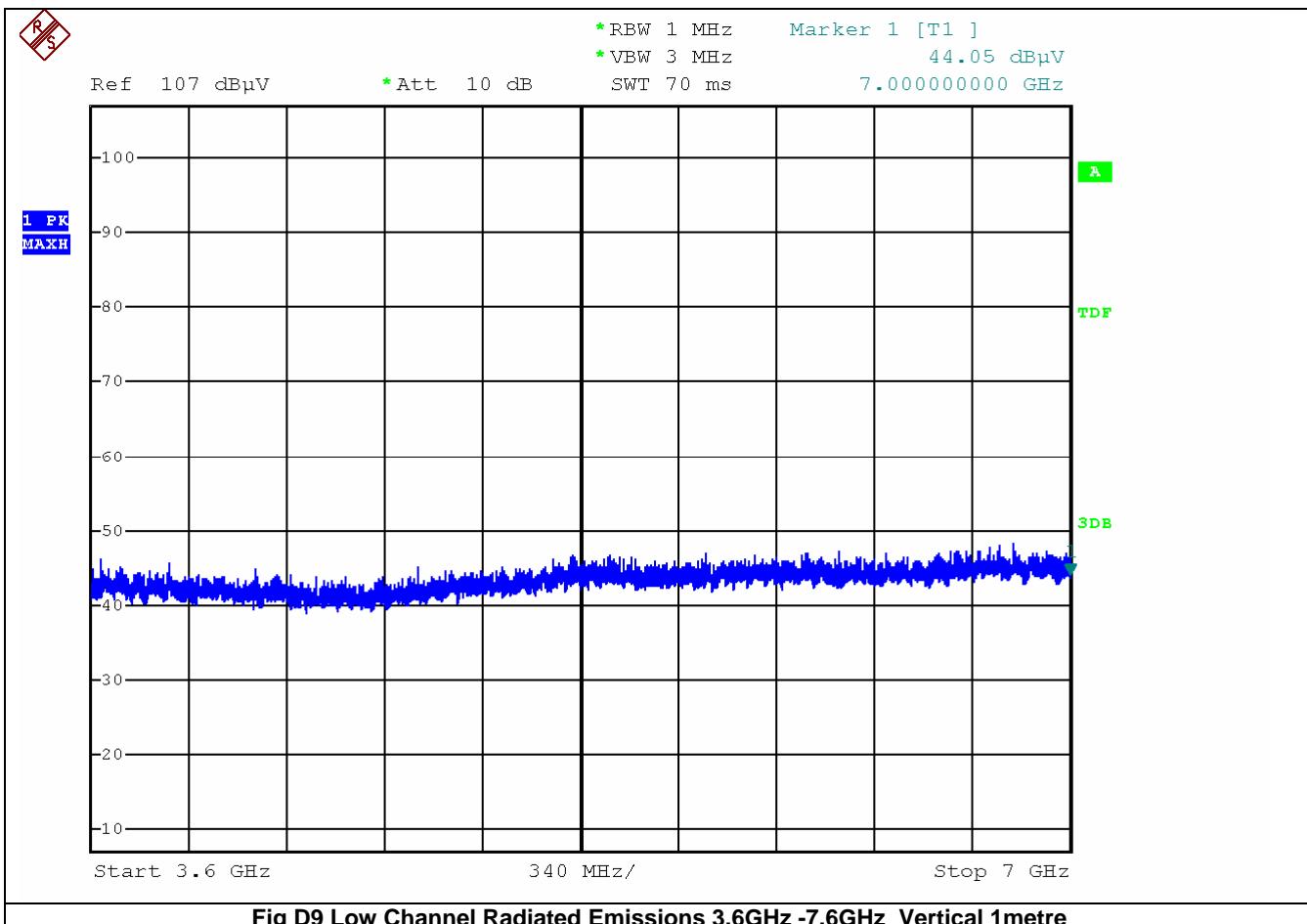
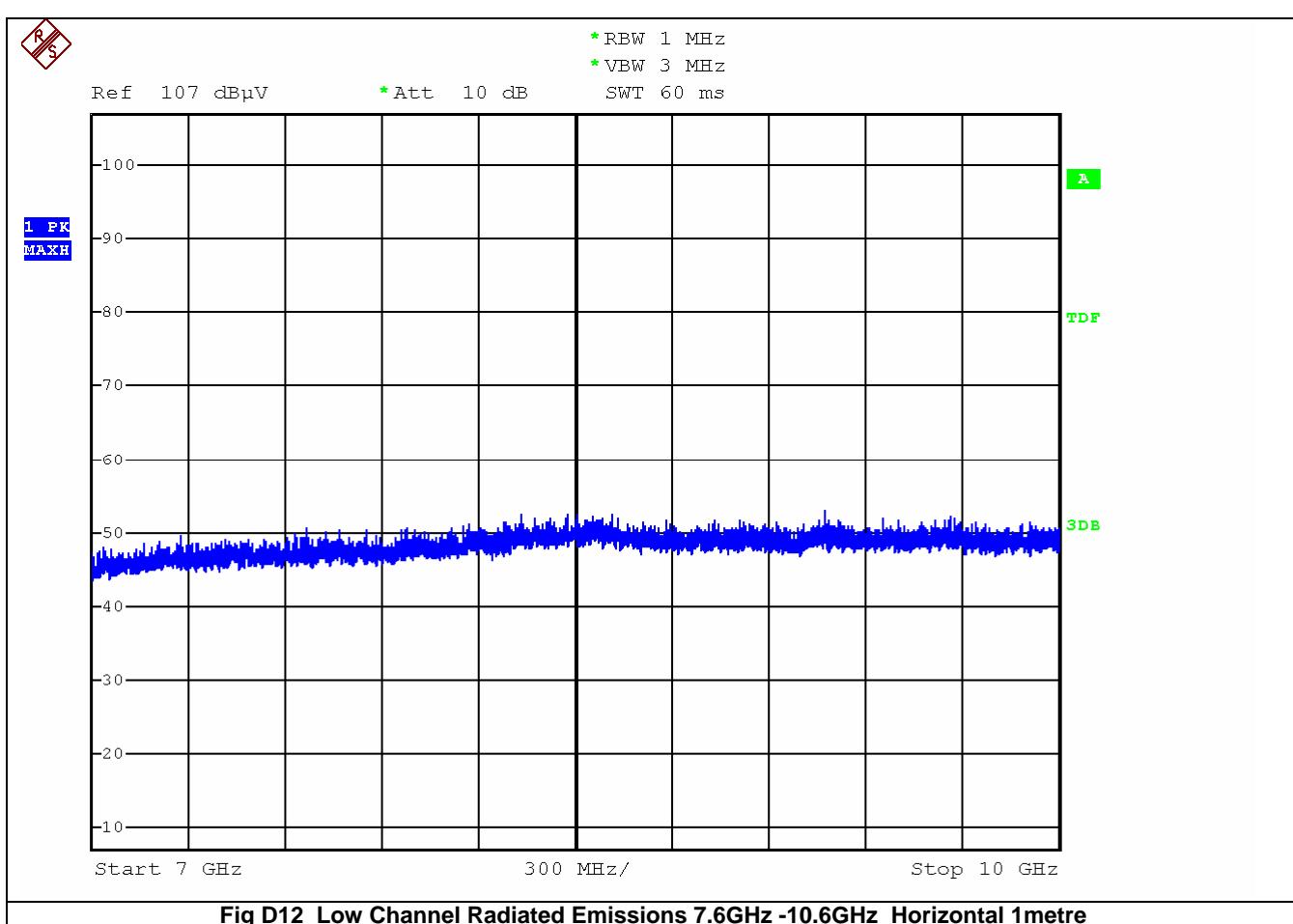
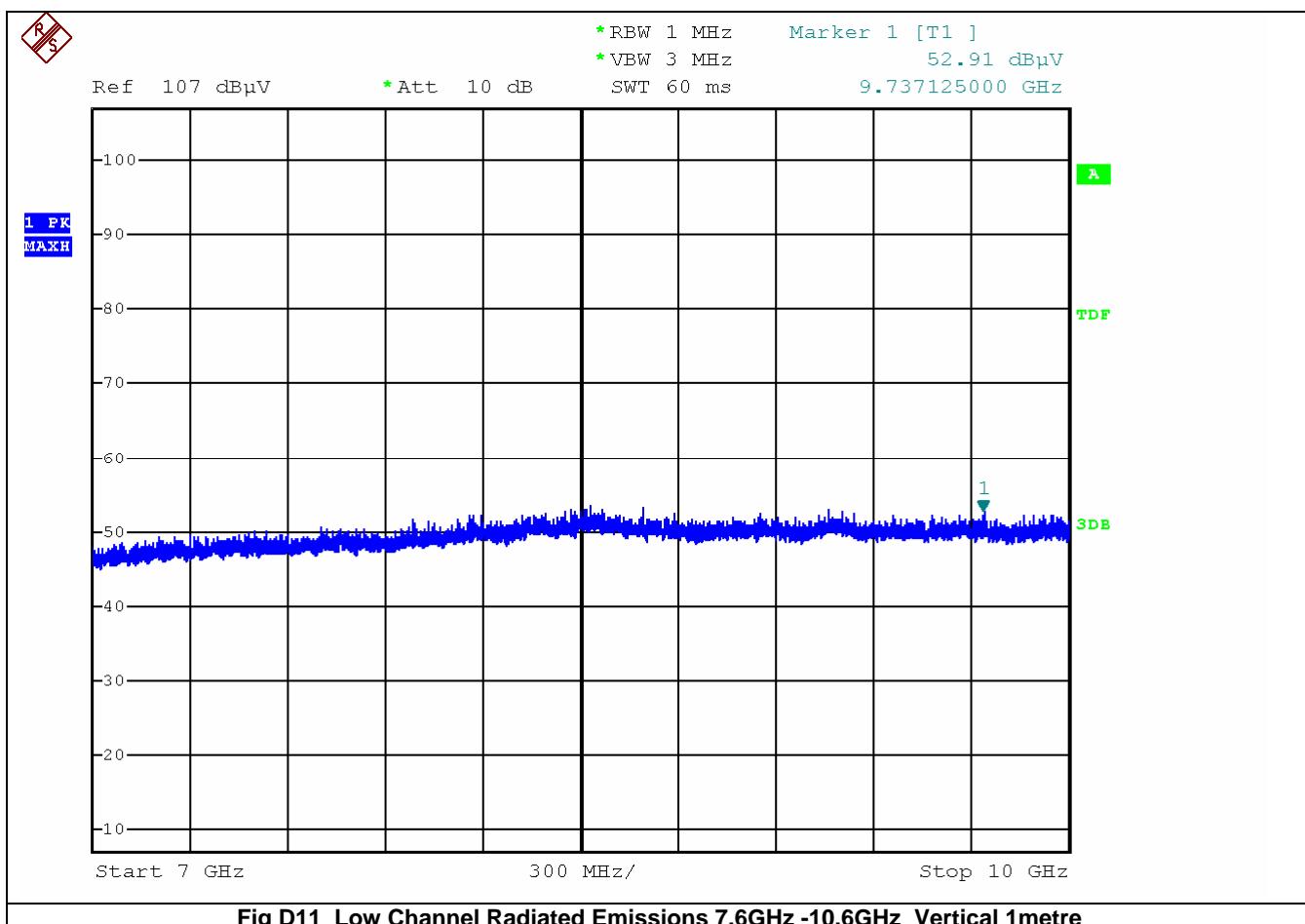


Fig D6 Low Channel Radiated Emissions 928MHz -1GHz Horizontal 3metres

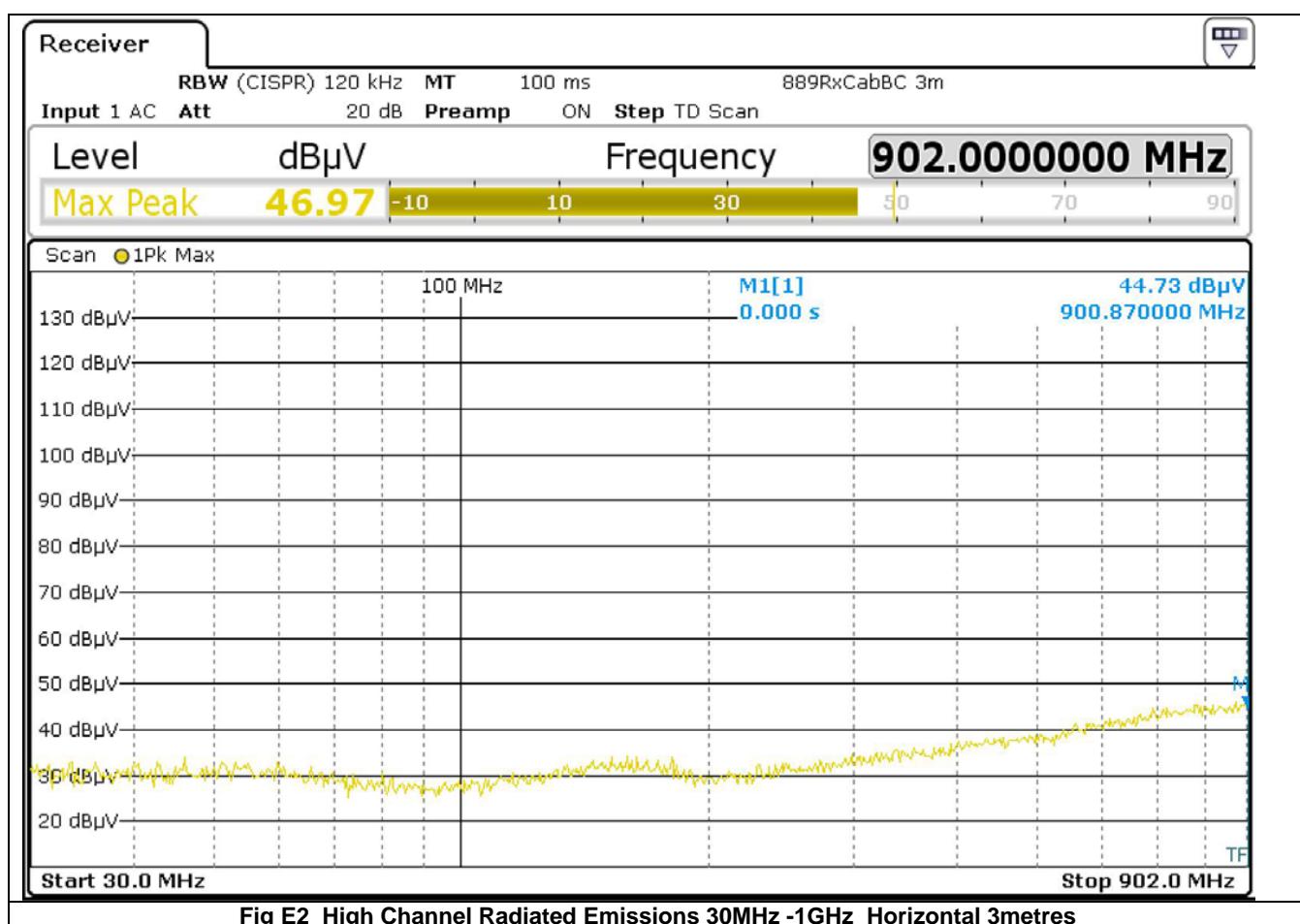
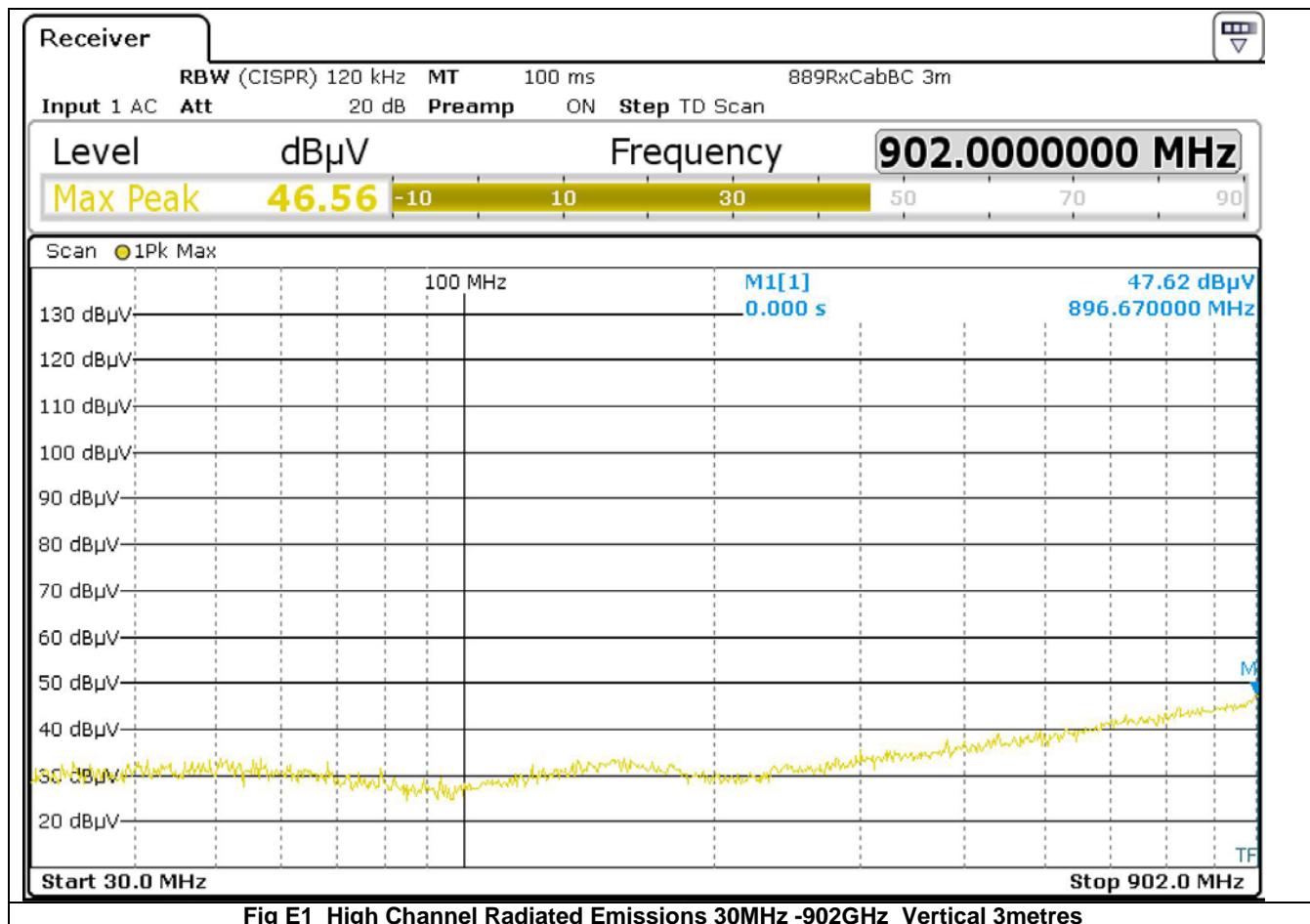


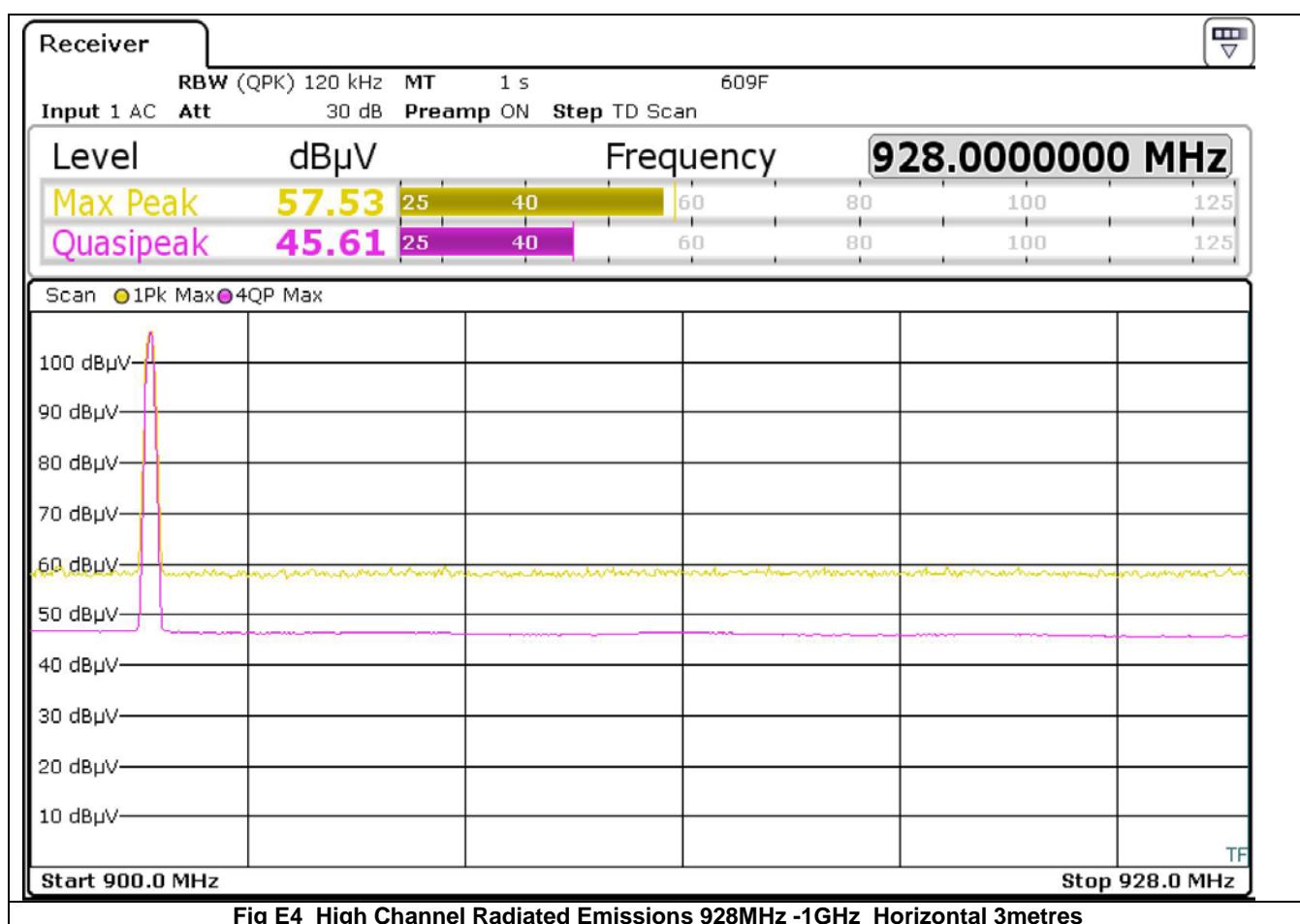
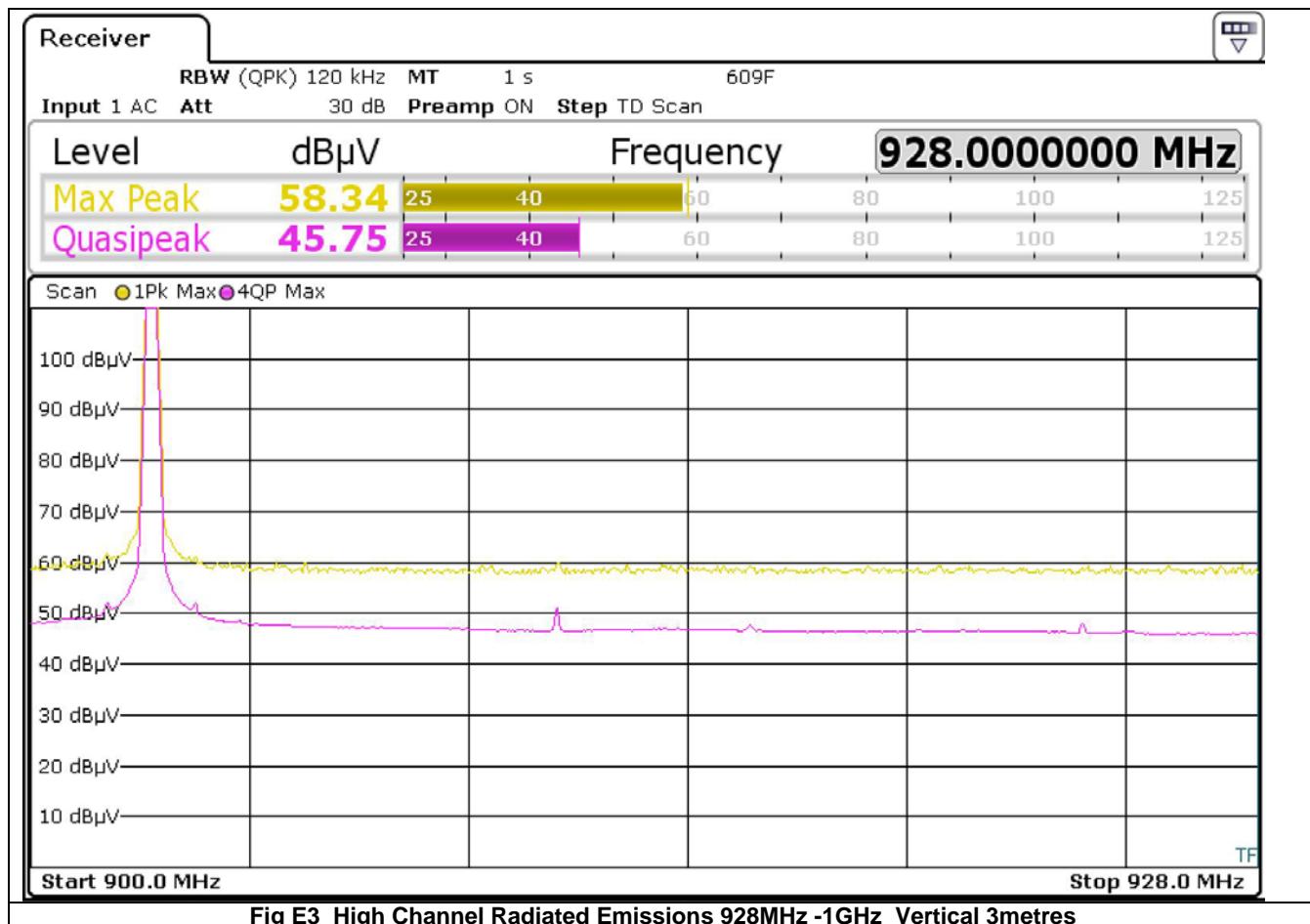




Appendix E

**Radiated Spurious Emissions Restricted Bands
with antenna #2**





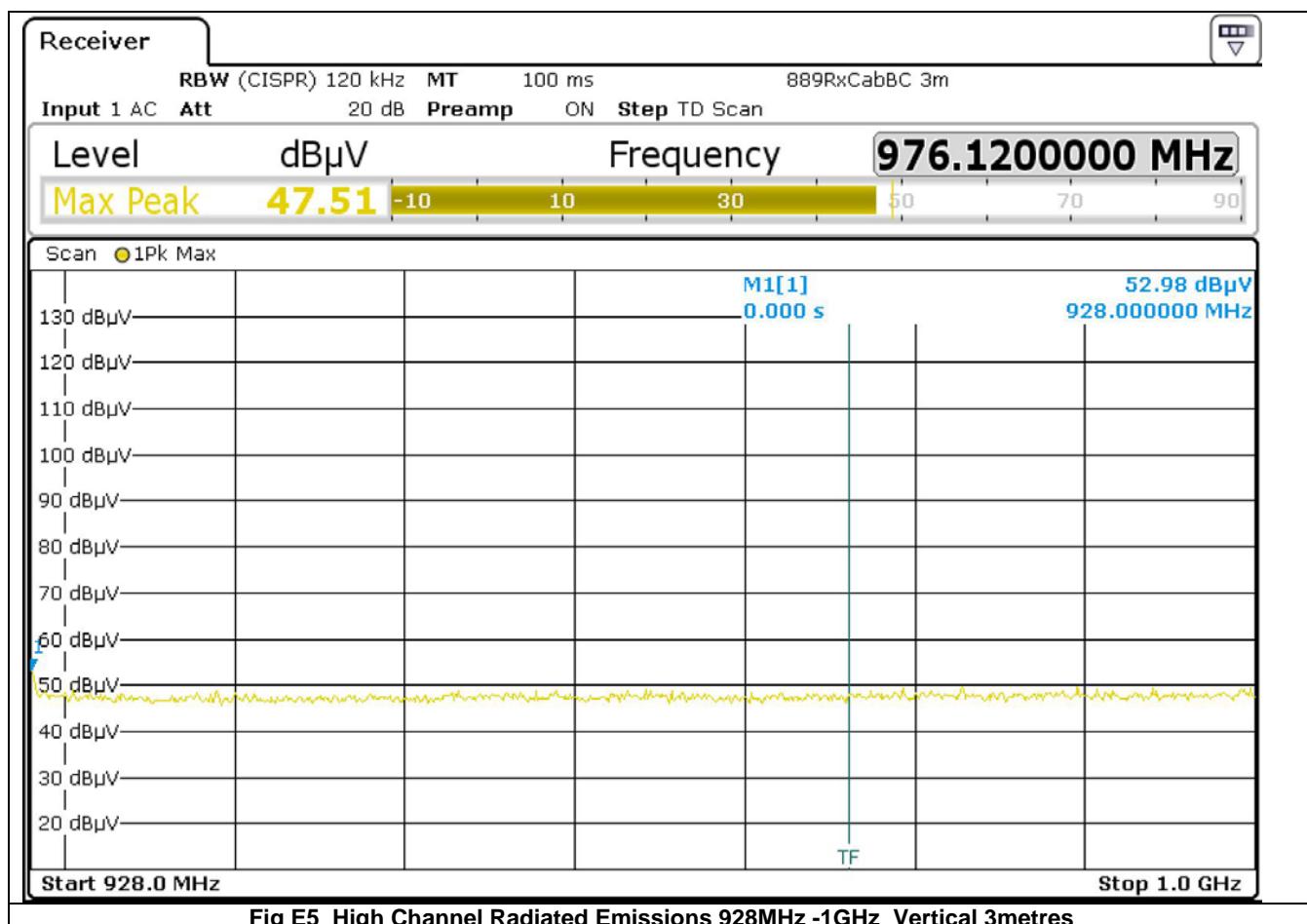


Fig E5 High Channel Radiated Emissions 928MHz -1GHz Vertical 3metres

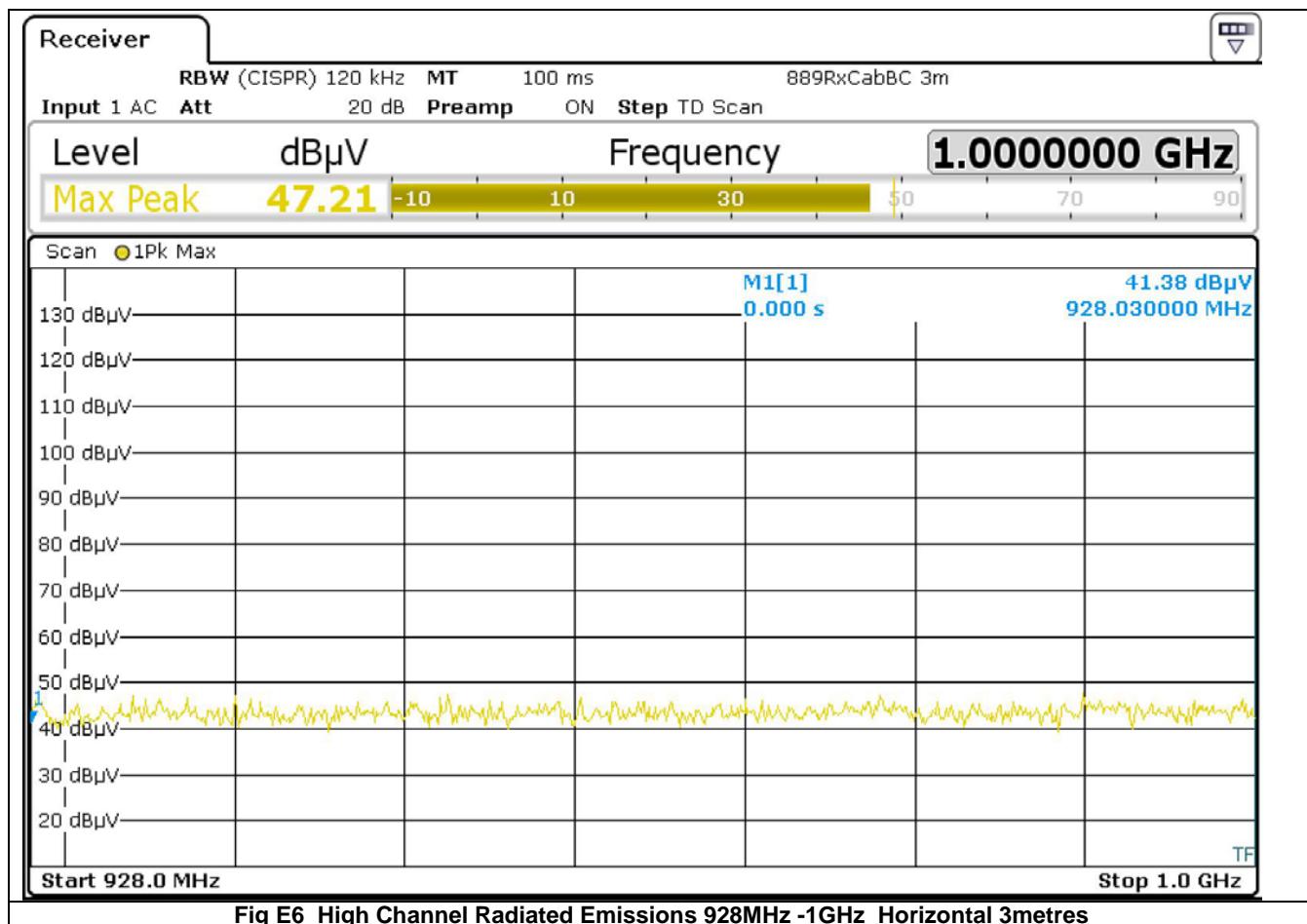
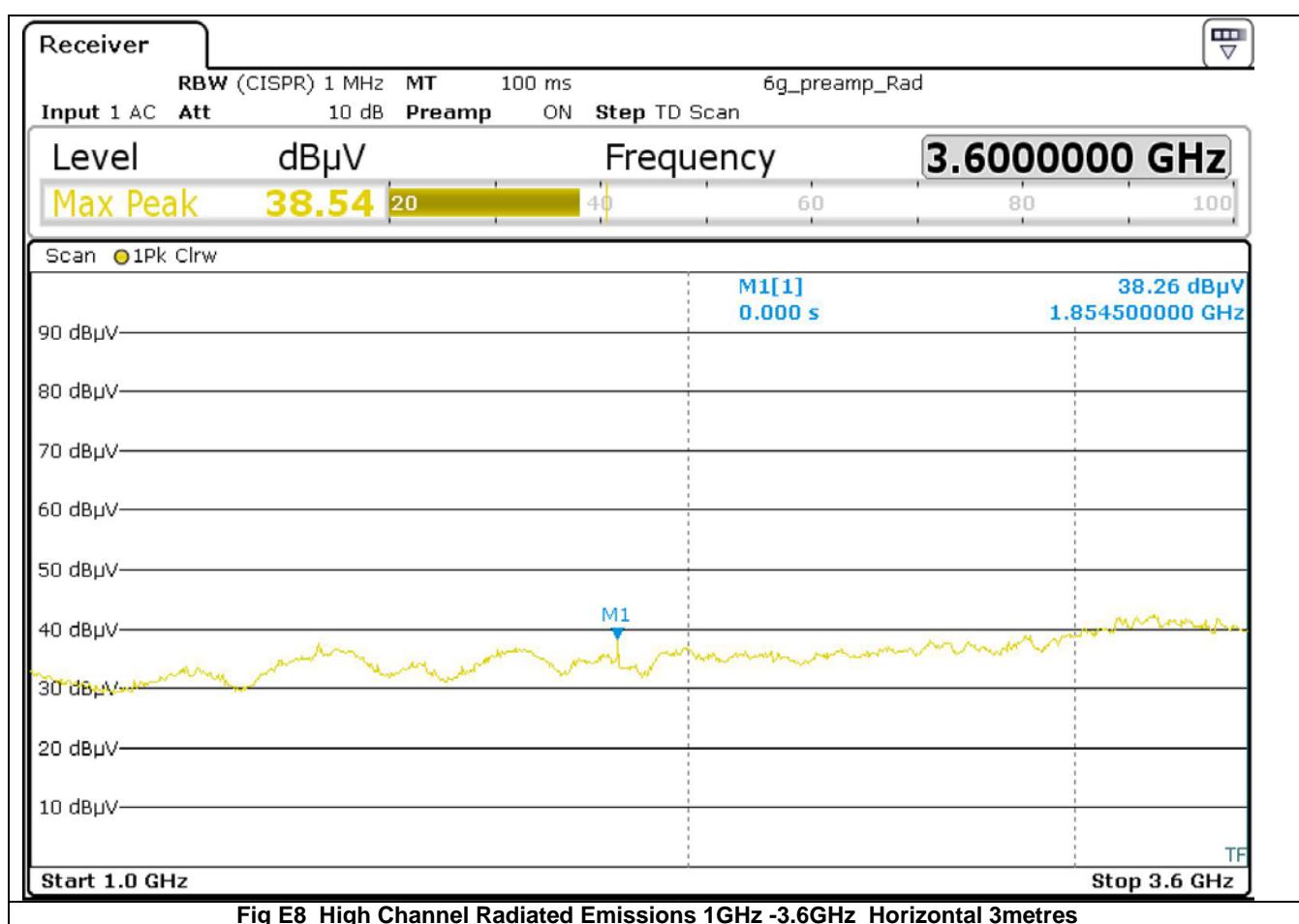
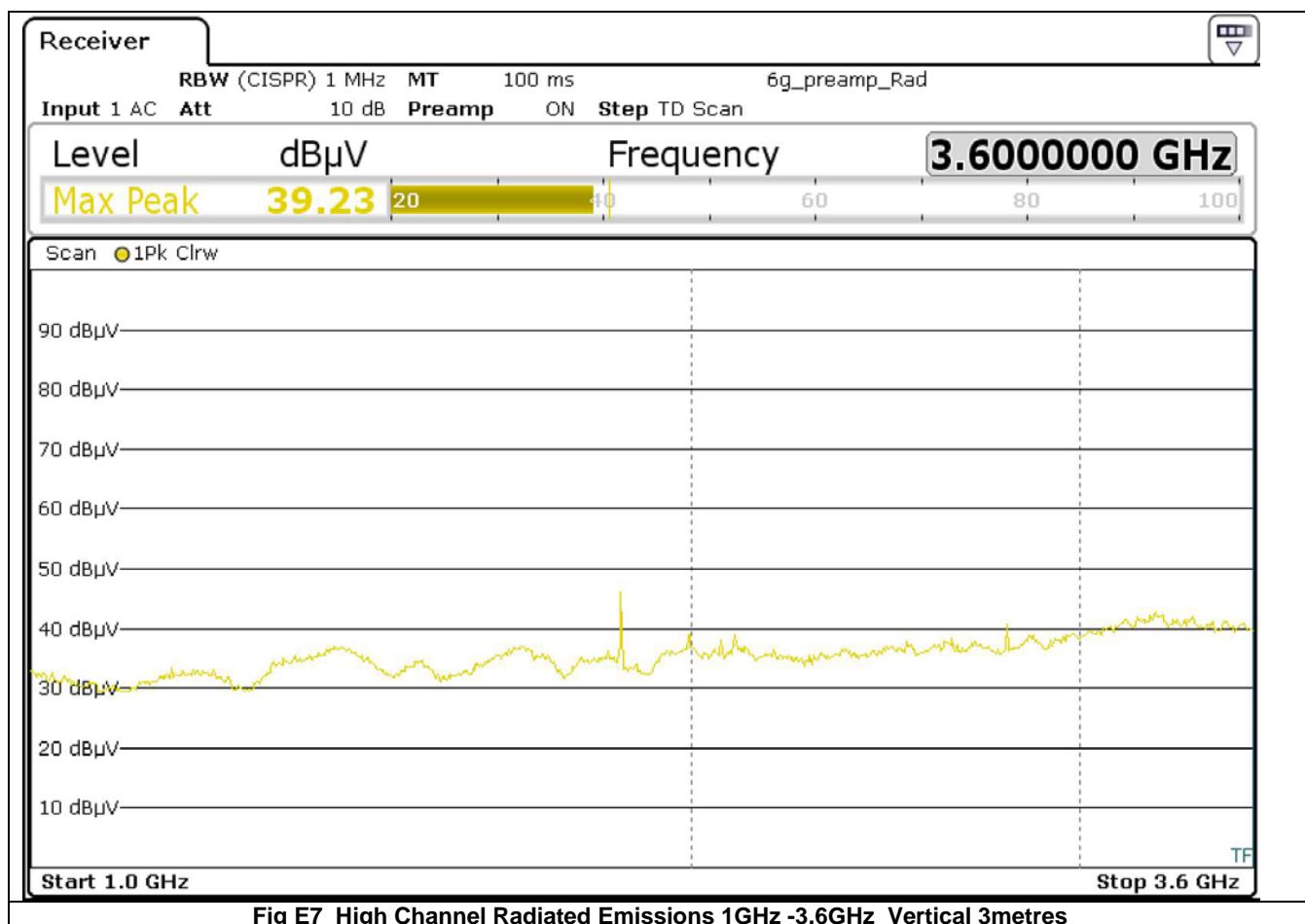
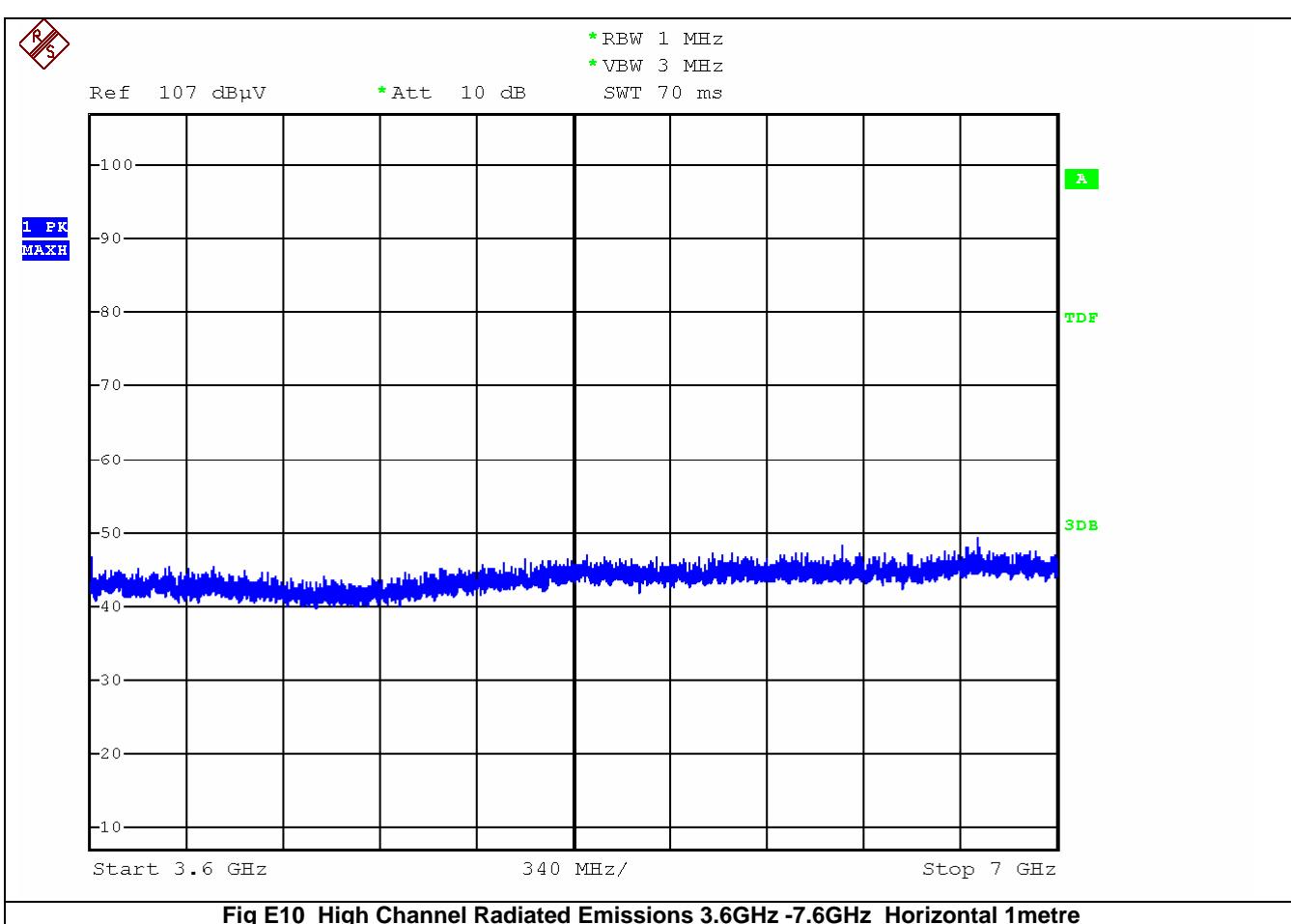
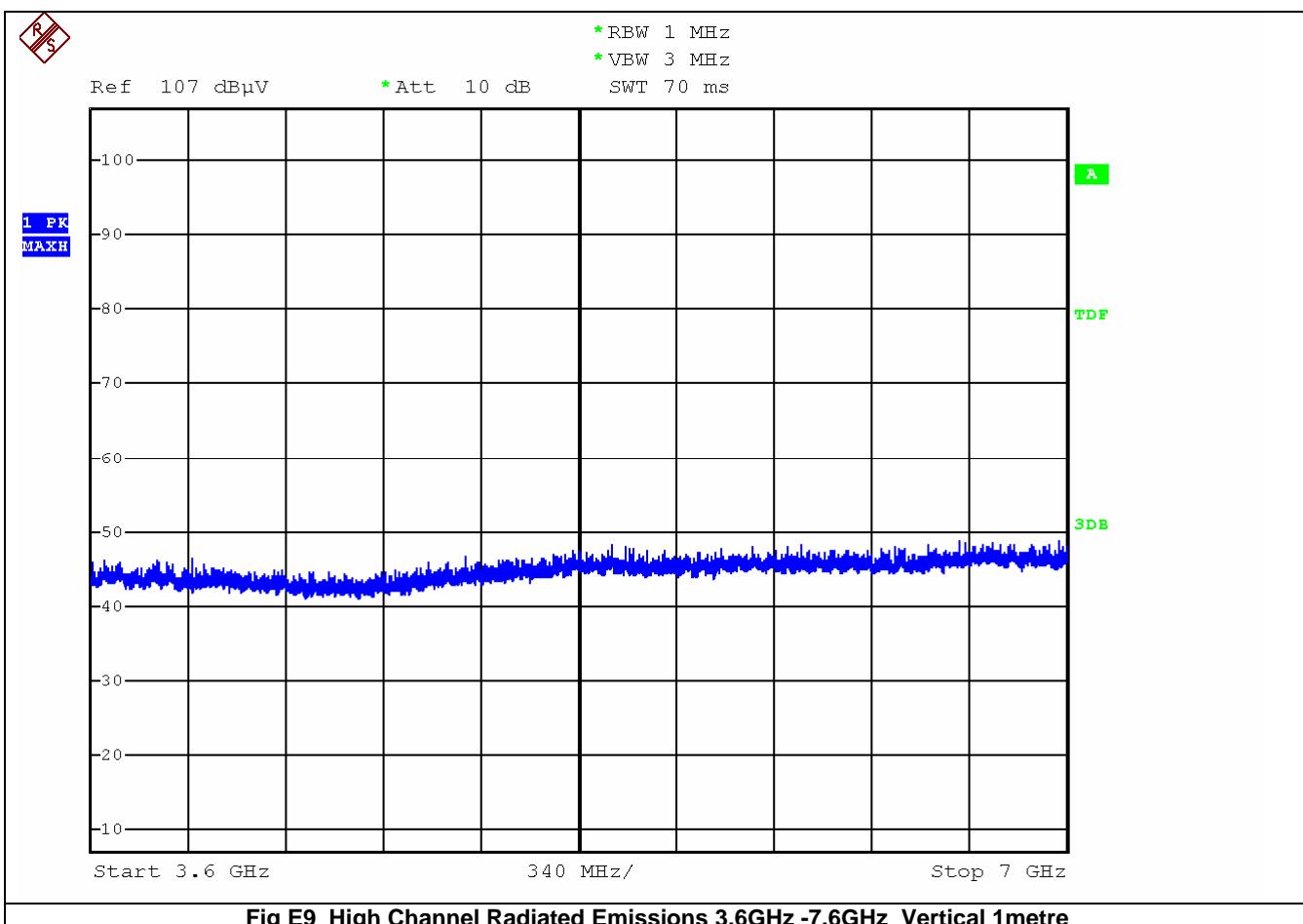


Fig E6 High Channel Radiated Emissions 928MHz -1GHz Horizontal 3metres





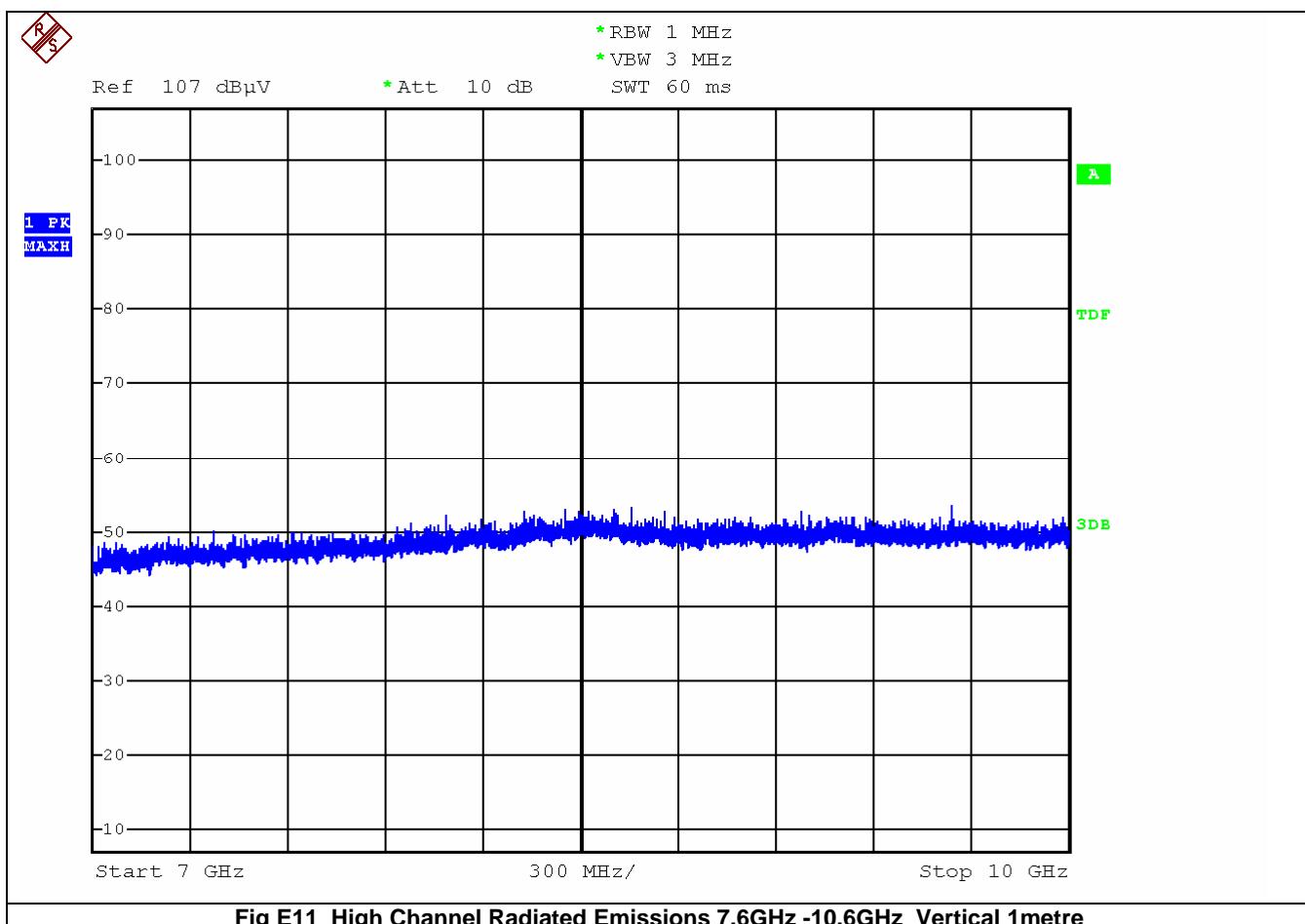


Fig E11 High Channel Radiated Emissions 7.6GHz -10.6GHz Vertical 1metre

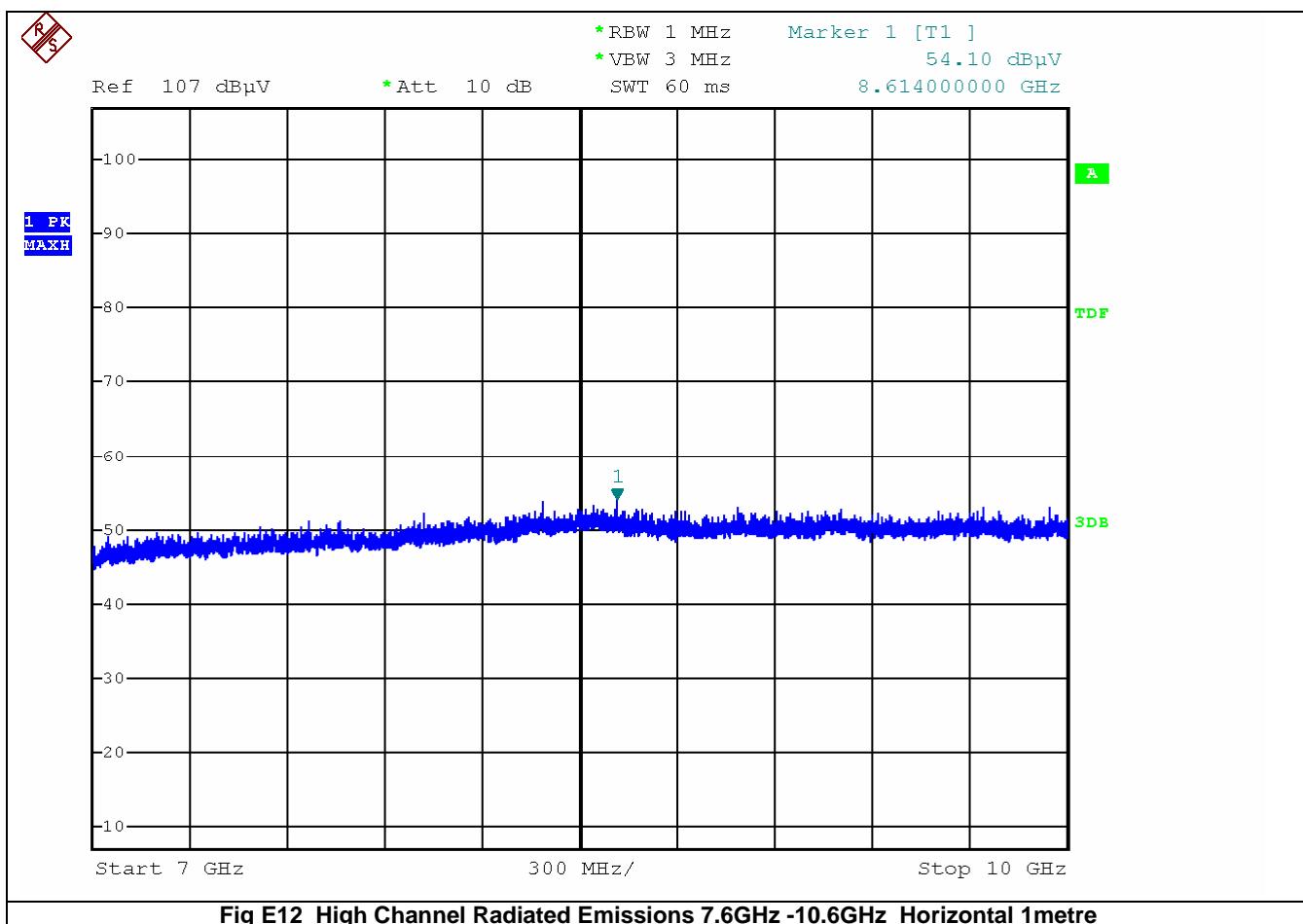


Fig E12 High Channel Radiated Emissions 7.6GHz -10.6GHz Horizontal 1metre

Note see additional report "17E6742-1a additional appendices" for the following appendices

Appendix F

**Radiated Emissions
Band Edge with antenna #1**

Appendix G

**Radiated Emissions
Band Edge with antenna #2**

Appendix H

Conducted Emissions on the mains

End of Report