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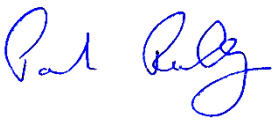
Test Report By	Michael Kirby
FCC Test Firm Registration	409640
IC Site Registration	IE0001
Date	29th Oct 2021
EUT Description	RFID Module
FCC ID	SCCNUR31W6
IC ID	5137A-NUR31W6
Authorised by	**Paul Reilly**
Authorised Signature:	

TEST SUMMARY

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

15.-247 Section	RSS-247 Section	TEST PARAMETERS	Test Result
15.247(a)	5.1(a)	20dB bandwidth of hopping Channel	Pass
15.247(a)	5.1(b)	Hopping Frequency Separation	Pass
1.247(a)	5.1(c)	Number of Hopping Channels	Pass
15.247(a)	5.1(c)	Average Time of Occupancy	Pass
15.247(b)	5.4	Output power	Pass
15.247(d)	5.5	Conducted Spurious Emissions	Pass
	RSS Gen 6.7	99% bandwidth	Pass
15.205 15.209	RSS Gen 8.9 and 8.10	Radiated Spurious Emissions for restricted bands	Pass
15.207	RSS Gen 8.8	Conducted Emissions on the mains	Pass

RSS 247 Issue 2 Mar16 2017
RSS-Gen Issue 5 Amd2 Feb 2021

Exhibit A – Technical Report

Table of Contents

1.0 EUT Description

FCC ID	SCCNUR31W6
IC ID	5137A-NUR31W6
Model:	NUR3-1W6
Type:	RFID Module
Test Standards:	47 CFR, Part 15.247
Type of radio:	Stand-alone
Transmitter Type:	RFID FHSS
Operating FrequencyRange(s):	902.75-927.25 MHz
Number of Channels:	50
Channel Separation:	500KHz
Antenna:	External
Classification:	DSS
Test Methodology:	Measurements performed according to the procedures in ANSI C63.10-2013 KDB 558074 V5 R02

The NUR-0W1 was an RFID module using frequency hopping in the 902-928MHz frequency band.

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 were set via USB connection from the host pcb to a laptop.
The host was powered from a bench PSU Type Farnell D100 set to 48Vdc. for all tests except conducted emissions on the mains.

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

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 19th, 20th, 23rd, 30th 31st Aug and 28th Oct. 2021

1.4 Description of Test modes

Channel List

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

1.5 Description of Test methods

Tests were performed manually and no special test software was used.
Preliminary tests were carried out on all ports and this report contains the worst case results.

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

The EUT was centred on a motorized turntable, which allows 360-degree rotation.
Emissions below 1GHz were measured using an 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. A bi-conical antenna was used for frequencies below 300MHz and a log periodic antenna was used for the 300MHz to 1GHz frequency range
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 and by raising and lowering the antenna from 1 to 4 metres. In this case the resolution bandwidth was 1MHz and video bandwidth was 3MHz. 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 3 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 3MHz. 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 module fitted on a host pcb.
The host pcb was powered from the LISN through an ethernet power adapter (Manufacturer PowerDsine 8001 P/N: PD-8001/AC S/N N0786060001553A00)

Detector	Frequency	Reading	Margin	Phase
QP/ Ave	MHz	dBuV	dB	L/N
Quasi-Peak	0.1905	53.79	-11.05	Live
Average	0.1905	45.60	-9.24	Live
Quasi-Peak	0.2535	50.48	-12.56	Live
Average	0.2535	44.19	-8.85	Live
Quasi-Peak	0.317	46.46	-14.78	Live
Average	0.317	40.99	-10.25	Live
Quasi-Peak	0.380	41.32	-18.12	Live
Average	0.380	37.23	-12.21	Live
Quasi-Peak	0.445	44.35	-13.23	Live
Average	0.445	41.85	-5.73	Live
Quasi-Peak	0.508	40.12	-15.88	Live
Average	0.508	39.06	-6.94	Live
Average	0.762	32.44	-13.56	Live
Average	0.888	33.09	-12.91	Live

Detector	Frequency	Reading	Margin	Phase
QP/ Ave	MHz	dBuV	dB	L/N
Quasi-Peak	0.1905	52.84	-12	Neutral
Average	0.1905	45.47	-9.37	Neutral
Quasi-Peak	0.2535	47.90	-15.14	Neutral
Average	0.2535	42.01	-11.03	Neutral
Quasi-Peak	0.3188	42.17	-19.01	Neutral
Quasi-Peak	0.3818	39.48	-19.9	Neutral
Quasi-Peak	0.5078	35.64	-20.36	Neutral
Average	0.5078	33.97	-12.03	Neutral
Average	3.0503	34.02	-11.98	Neutral
Average	4.1303	32.75	-13.25	Neutral
Average	4.1955	31.60	-14.4	Neutral
Quasi-Peak	4.7040	30.26	-25.74	Neutral
Average	4.7040	28.65	-17.35	Neutral
Quasi-Peak	4.7670	32.40	-23.6	Neutral
Average	4.7670	31.16	-14.84	Neutral
Quasi-Peak	4.8300	33.90	-22.1	Neutral

Ref Appendix D for Scans

Test Result : Pass

4. Conducted Measurements on the Antenna port

4.1 Bandwidth

4.1.1 20dB bandwidth

Requirement FCC 15.247(a) IC RSS-247 5.1a

The bandwidth of a frequency hopping channel is the 20 dB emission bandwidth, measured with the hopping stopped. The maximum 20 dB bandwidth of the hopping channel shall be 500 kHz

As per Ansi63.10 Section 7.8.7

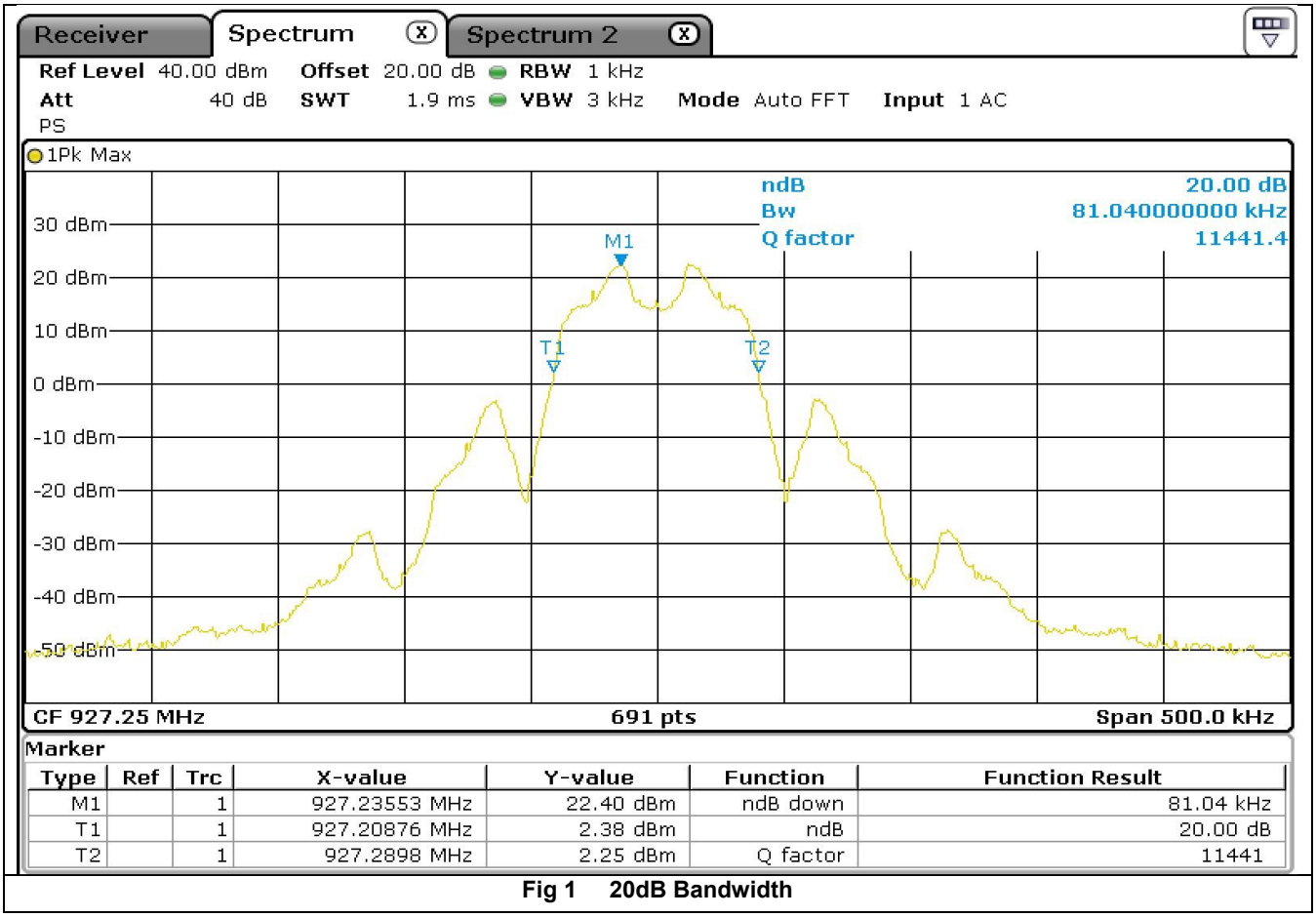


Fig 1 20dB Bandwidth

Channel	Freq	20dB Bandwidth
	MHz	**KHz**
Low	902.75	80.32
Mid	914.75	80.32
High	927.25	81.04

Limit

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

Test Result Pass

4.1.2 99% bandwidth

Test Method
As per Ansi 63.10 Section 6.9.3

Ansi63.10 Section **6.9.3 Occupied bandwidth—power bandwidth (99%) measurement procedure**
The occupied bandwidth is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers are each equal to 0.5% of the total mean power of the given emission.
The following procedure shall be used for measuring 99% power bandwidth:
a) The instrument center frequency is set to the nominal EUT channel center frequency. The frequency span for the spectrum analyzer shall be between 1.5 times and 5.0 times the OBW.
b) The nominal IF filter bandwidth (3 dB RBW) shall be in the range of 1% to 5% of the OBW, and VBW shall be approximately three times the RBW, unless otherwise specified by the applicable requirement.
c) Set the reference level of the instrument as required, keeping the signal from exceeding the maximum input mixer level for linear operation. In general, the peak of the spectral envelope shall be more than [10 log (OBW/RBW)] below the reference level. Specific guidance is given in 4.1.5.2.
d) Step a) through step c) might require iteration to adjust within the specified range.
e) Video averaging is not permitted. Where practical, a sample detection and single sweep mode shall be used. Otherwise, peak detection and max hold mode (until the trace stabilizes) shall be used.
f) Use the 99% power bandwidth function of the instrument (if available) and report the measured bandwidth.
g) If the instrument does not have a 99% power bandwidth function, then the trace data points are recovered and directly summed in linear power terms. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5% of the total is reached; that frequency is recorded as the lower frequency. The process is repeated until 99.5% of the total is reached; that frequency is recorded as the upper frequency. The 99% power bandwidth is the difference between these two frequencies.
h) The occupied bandwidth shall be reported by providing plot(s) of the measuring instrument display; the plot axes and the scale units per division shall be clearly labeled. Tabular data may be reported in addition to the plot(s).

TEST PROCEDURE
The test was performed as a conducted measurement

RESULTS

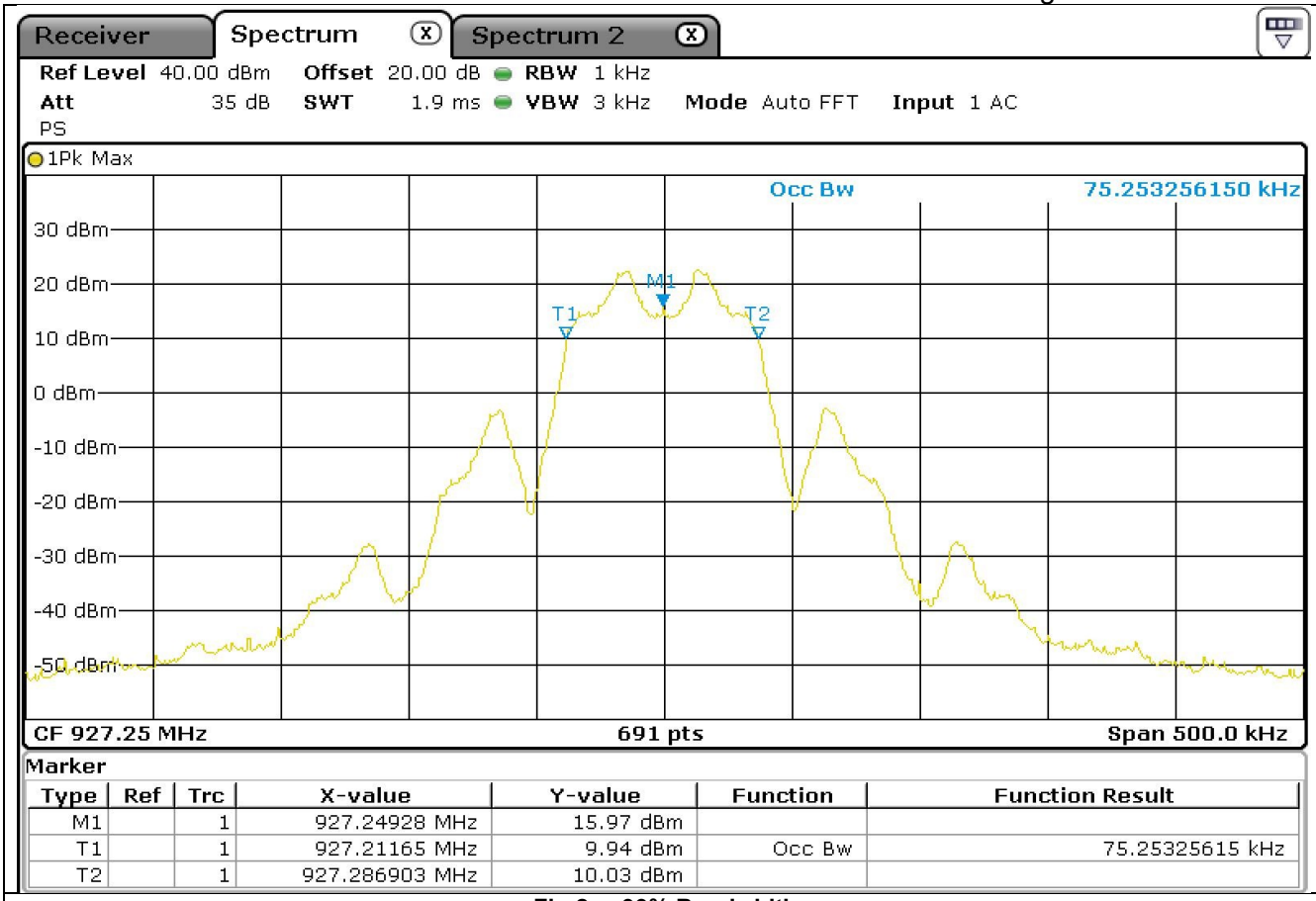


Fig 2 99% Bandwidth

Bandwidth

Frequency	99% Bandwidth
MHz	KHz
902.75	75.253
914.75	75.253
927.25	75.253

Result :- Pass

4.2 Output power Conducted

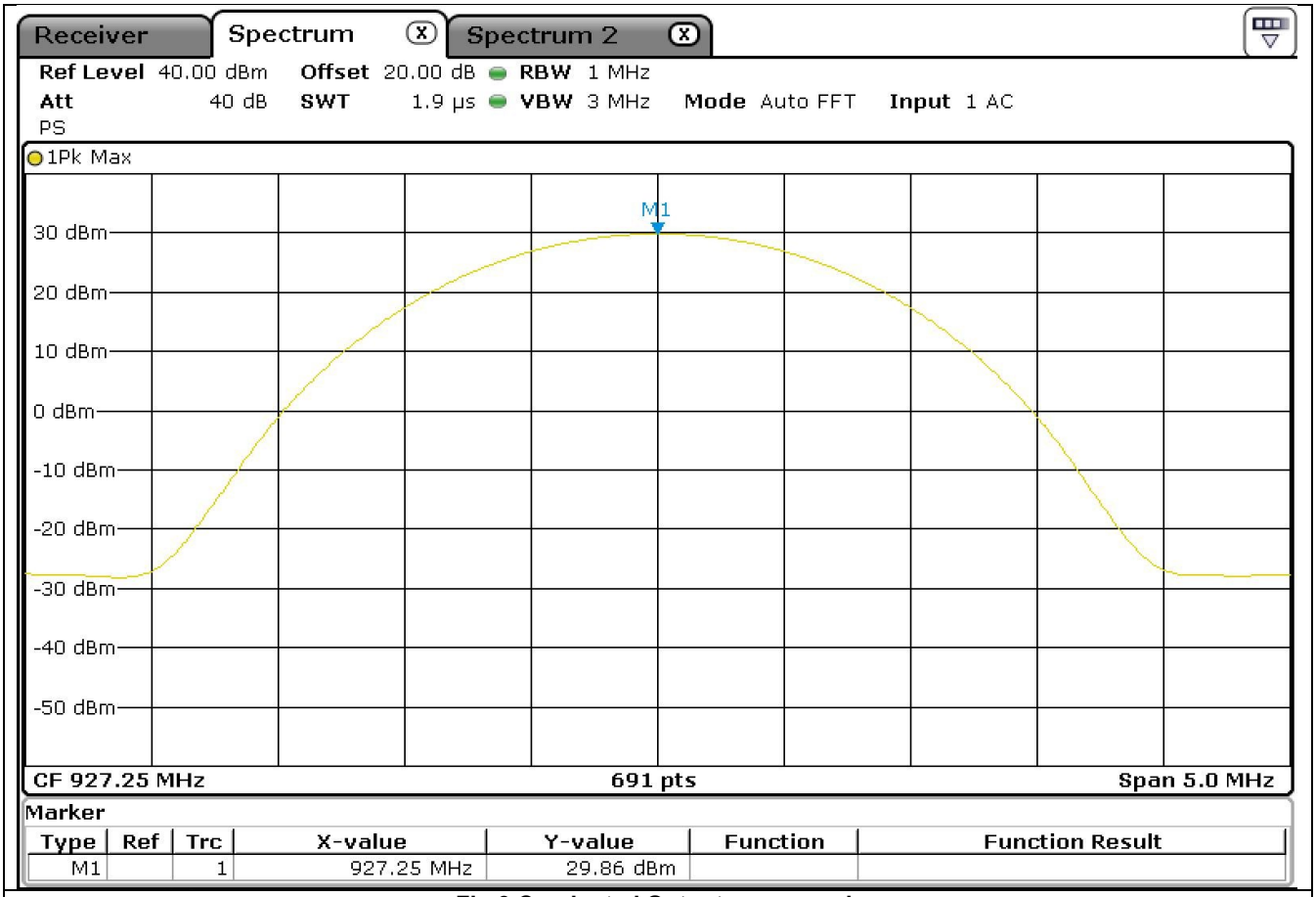


Fig 3 Conducted Output power peak

Frequency	Measurement Peak	Limit	Margin
MHz	dBm	dBm	dB
902.75	28.71	30	1.29
914.75	29.01	30	0.99
927.25	29.86	30	0.14

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

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.

4.3.1 Frequency hopping range number of hopping Channels

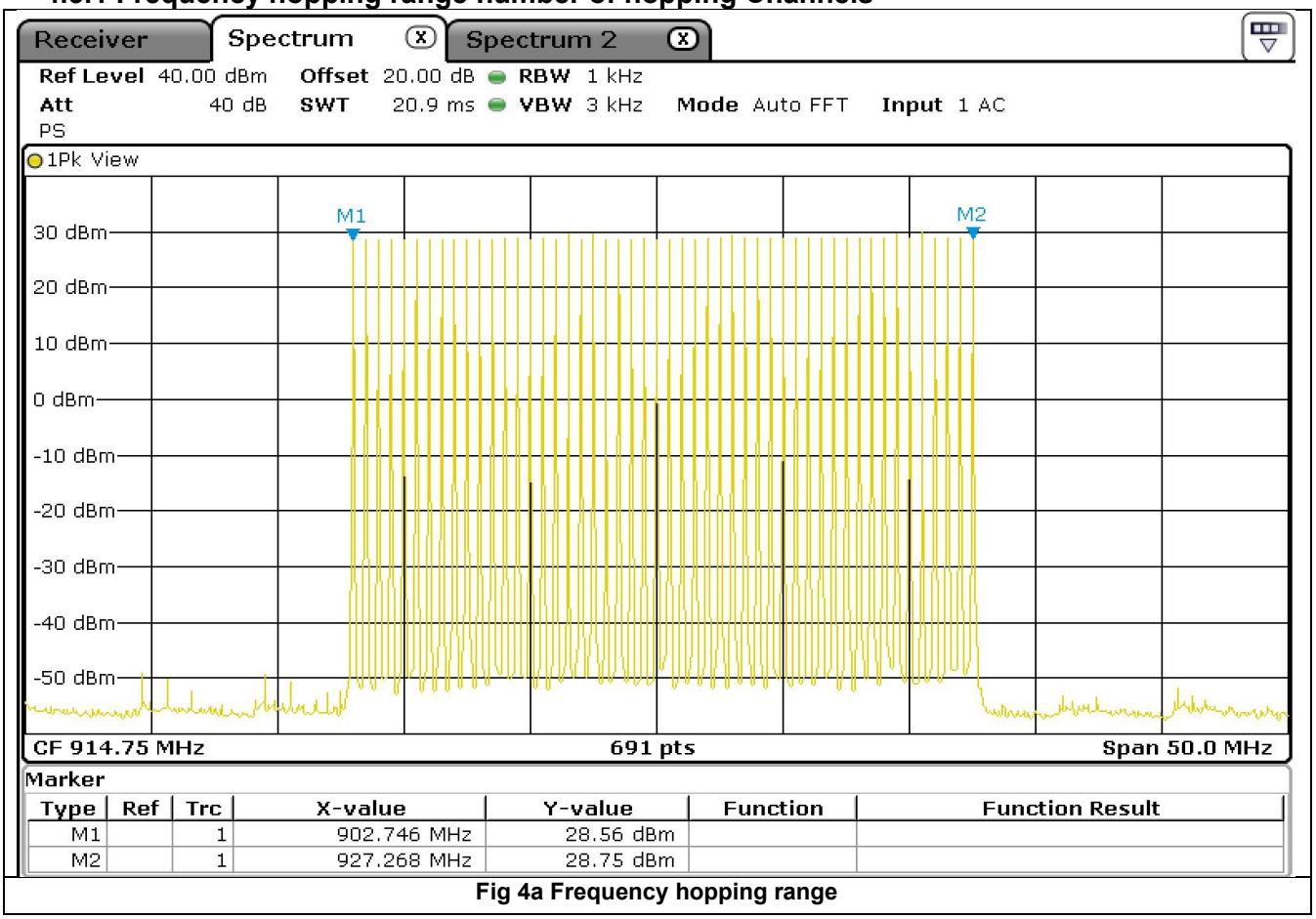


Fig 4a Frequency hopping range

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

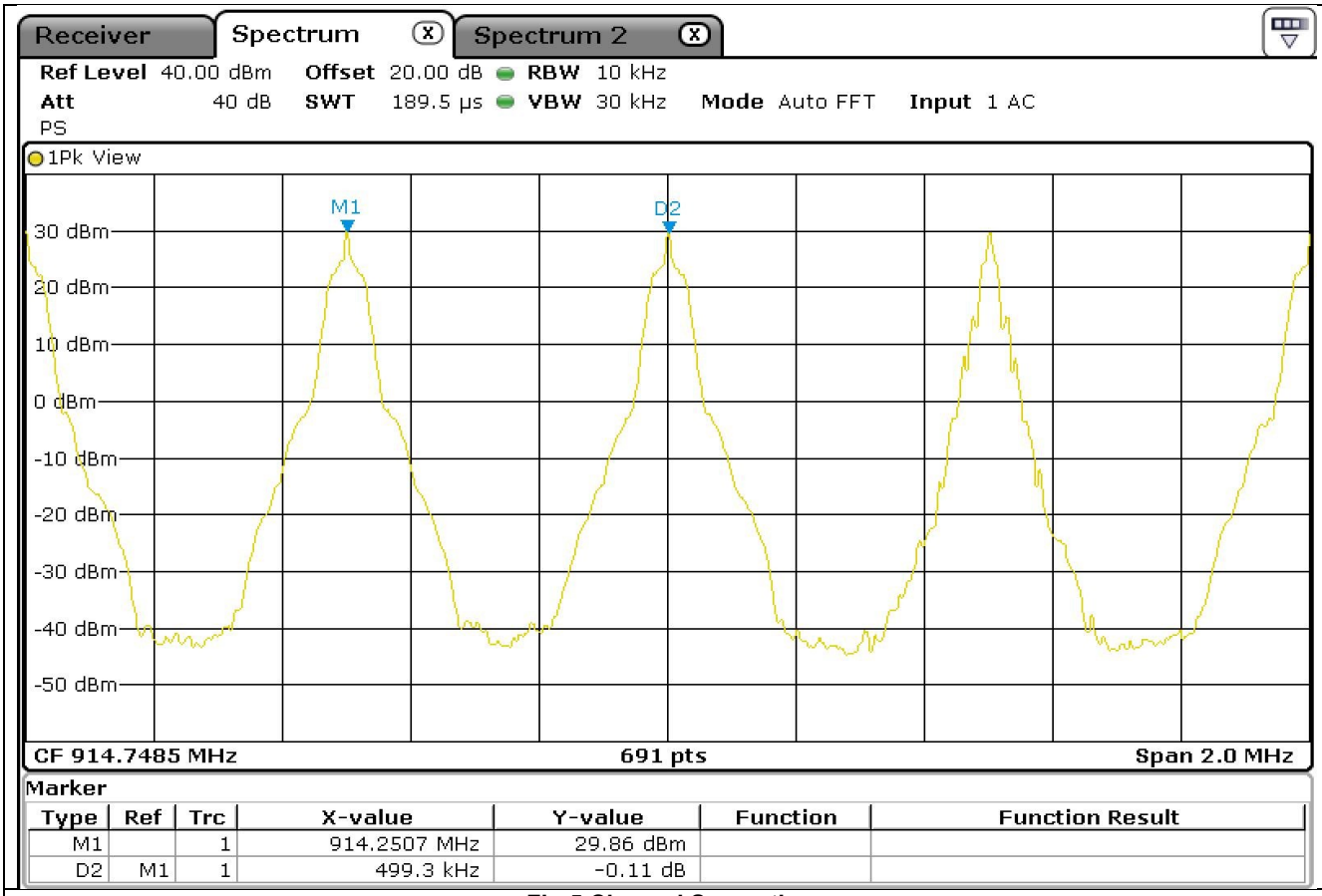


Fig 5 Channel Separation

Channel separation =499.3KHz

4.3.3 Frequency hopping average time of channel occupancy

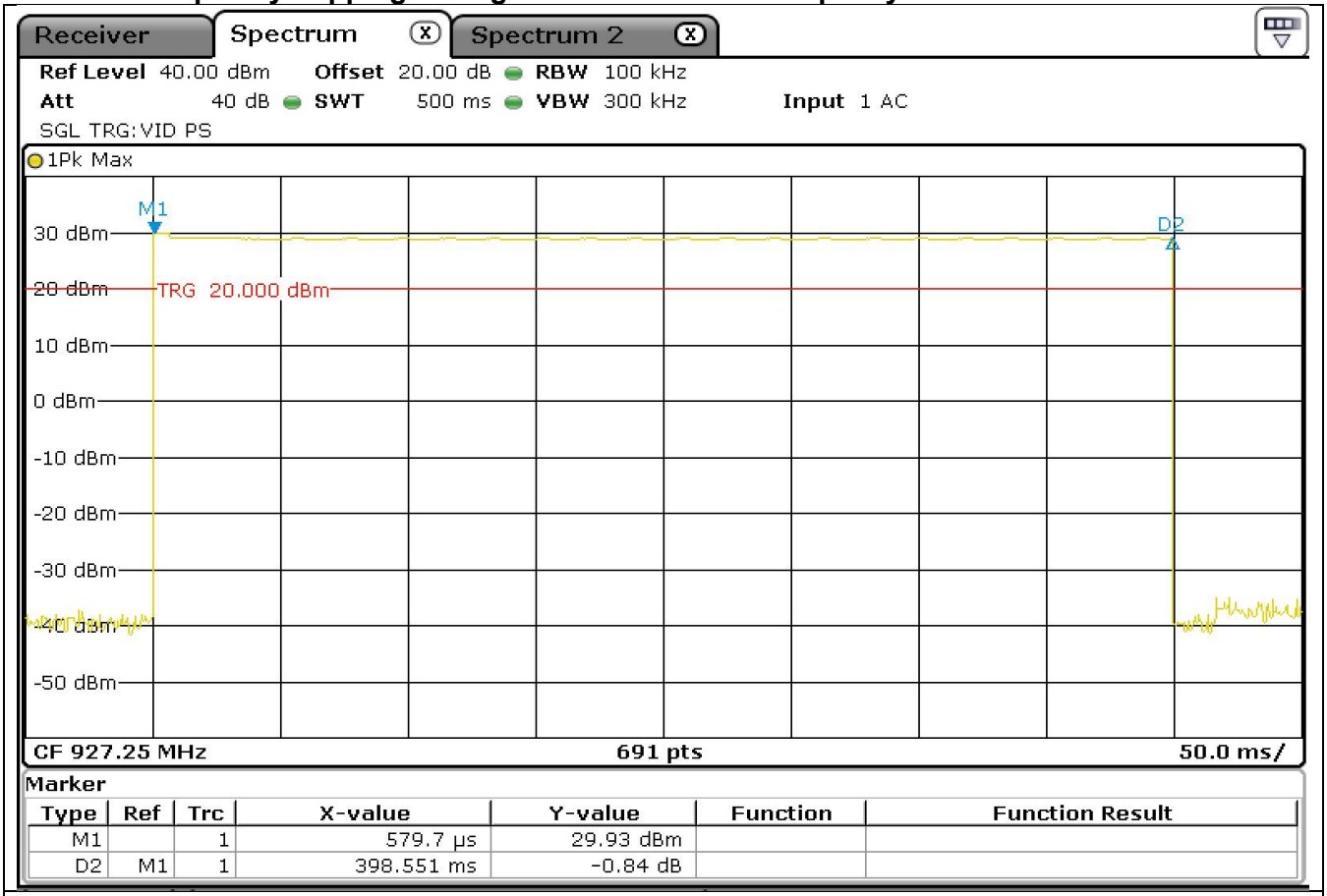


Fig 6 Single pulse on time

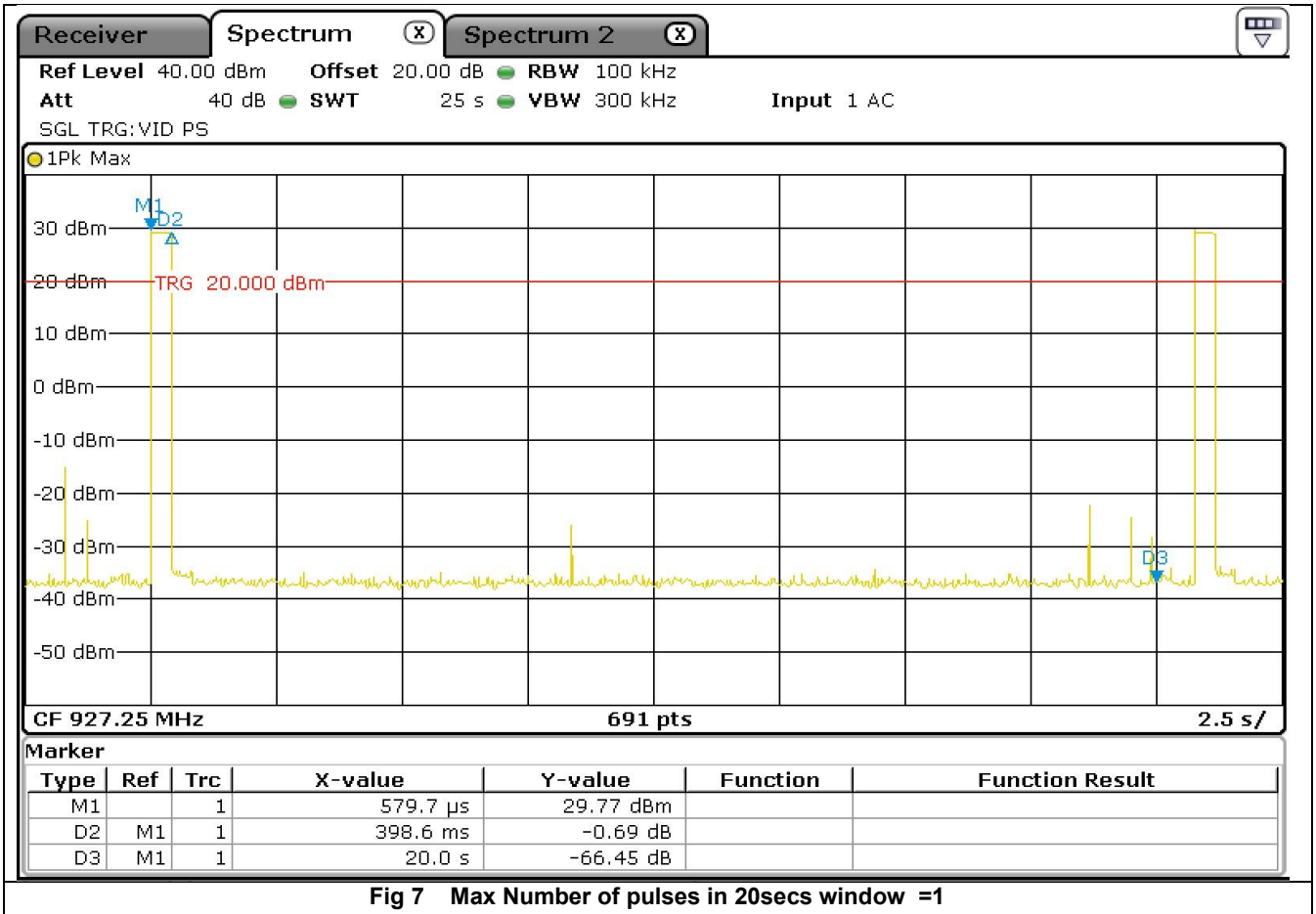


Fig 7 Max Number of pulses in 20secs window =1

Calculation

Single pulse on time =398.551mS
Max Num of pulses in 20sec window = 1
Max on time in 20secs window =0.398551 secs < 0.4 secs limit

Test result Pass

4.4. Spurious Emissions EUT

4.4.1 Conducted Spurious Emissions (100KHz bandwidth)

Frequency	Peak 100KHz RBW	Measured	Limit Min	Margin
GHz	dBm	dBc	dBc	dB
0.90275	27.48	0	20	-
1.8055	-47.1	74.58	20	54.58
2.70825	-56.4	83.88	20	63.88
3.611	-69.3	96.78	20	76.78
4.51375	-66.9	94.38	20	74.38
5.4165	-63	90.48	20	70.48

Frequency	Peak 100KHz RBW	Measured	Limit Min	Margin
GHz	dBm	dBc	dBc	dB
0.91475	28.51	0	20	-
1.8295	-48	76.51	20	56.51
2.74425	-63.14	91.65	20	71.65
3.659	-69.44	97.95	20	77.95
4.57375	-66.98	95.49	20	75.49
5.4885	-65.39	93.9	20	73.9

Frequency	Peak 100KHz RBW	Measured	Limit Min	Margin
GHz	dBm	dBc	dBc	dB
0.92725	28.46	0	20	-
1.8545	-44.45	72.91	20	52.91
2.78175	-59.24	87.7	20	67.7
3.709	-68.48	96.94	20	76.94
4.63625	-66.71	95.17	20	75.17
5.5635	-63.98	92.44	20	72.44

Ref Appendix A for Scans

Test Result Pass

4.4.2 Conducted Emissions Band Edge

Ref Appendix B for Scans

Test Result Pass

5. Radiated Spurious Emissions

5.1 Radiated Spurious Emissions with Antenna port Terminated

Frequency	Quasi Peak Level	Antenna Polarity	Antenna Factor	Cable loss	Final Field Strength Quasi Peak	Quasi Peak Limit	Margin
MHz	dBuV/m	V/H	dB	dB	dBuV/m	dBuV/m	dB
135.12	16.5	Horizontal	11.3	1.2	29	43.5	14.5
135.21	11.4	Horizontal	11.3	1.2	23.9	43.5	19.6
171	1.1	Horizontal	12.5	1.2	14.8	43.5	28.7

Frequency	Measured Peak Level	Antenna Factor	Preamp Gain	Cable Loss	Antenna Polarity	Duty Cycle Correction	Final Peak Level	Average Limit +20dB	Margin
GHz	dBuV/m	dB	dB	dB	V/H	dB	dBuV/m	dBuV/m	dB
2.708	56.3	28.7	38.4	3.8	Vertical	0.00	50.4	74	23.6
3.611	46.2	31.3	37.6	4.6	Vertical	0.00	44.5	74	29.5
4.514	44.3	32.4	37	5.0	Vertical	0.00	44.7	74	29.3
2.708	56.4	28.7	38.4	3.8	Horizontal	0.00	50.5	74	23.5
3.611	47.7	31.3	37.6	4.6	Horizontal	0.00	46.0	74	28.0
4.514	45.4	32.4	37	5.0	Horizontal	0.00	45.8	74	28.2

Frequency	Measured Average Level	Antenna Factor	Preamp Gain	Cable Loss	Antenna Polarity	Duty Cycle Correction	Final Average Level	Average Limit	Margin
GHz	dBuV/m	dB	dB	dB	V/H	dB	dBuV/m	dBuV/m	dB
2.708	49.9	28.7	38.4	3.8	Vertical	0.00	44.0	54	10.0
2.708	50.8	28.7	38.4	3.8	Horizontal	0.00	44.9	54	9.1

Frequency	Measured Peak Level	Antenna Factor	Preamp Gain	Cable Loss	Antenna Polarity	Duty Cycle Correction	Final Peak Level	Average Limit +20dB	Margin
GHz	dBuV/m	dB	dB	dB	V/H	dB	dBuV/m	dBuV/m	dB
2.744	56.8	28.7	38.4	3.8	Vertical	0.00	50.9	74	23.1
3.659	44.6	31.3	37.4	4.5	Vertical	0.00	43.0	74	31.0
4.574	44.0	32.4	37.1	5.1	Vertical	0.00	44.4	74	29.6
2.744	56.0	28.7	38.4	3.8	Horizontal	0.00	50.1	74	23.9
3.659	46.8	31.3	37.4	4.5	Horizontal	0.00	45.2	74	28.8
4.574	43.1	32.4	37.1	5.1	Horizontal	0.00	43.5	74	30.5

Frequency	Measured Average Level	Antenna Factor	Preamp Gain	Cable Loss	Antenna Polarity	Duty Cycle Correction	Final Average Level	Average Limit	Margin
GHz	dBuV/m	dB	dB	dB	V/H	dB	dBuV/m	dBuV/m	dB
2.744	48.9	28.7	38.4	3.8	Vertical	0.00	43.0	54	11.0
2.744	49.7	28.7	38.4	3.8	Horizontal	0.00	43.8	54	10.2

Frequency	Measured Peak Level	Antenna Factor	Preamp Gain	Cable Loss	Antenna Polarity	Duty Cycle Correction	Final Peak Level	Average Limit +20dB	Margin
GHz	dBuV/m	dB	dB	dB	V/H	dB	dBuV/m	dBuV/m	dB
2.782	55.9	28.7	38.4	3.8	Vertical	0.00	50.0	74	24.0
3.709	46.8	31.3	37.4	4.5	Vertical	0.00	45.2	74	28.8
4.636	42.9	32.4	37.1	5.1	Vertical	0.00	43.3	74	30.7
2.782	55.1	28.7	38.4	3.8	Horizontal	0.00	49.2	74	24.8
3.709	45.2	31.3	37.4	4.5	Horizontal	0.00	43.6	74	30.4
4.636	42.7	32.4	37.1	5.1	Horizontal	0.00	43.1	74	30.9

Frequency	Measured Average Level	Antenna Factor	Preamp Gain	Cable Loss	Antenna Polarity	Duty Cycle Correction	Final Average Level	Average Limit	Margin
GHz	dBuV/m	dB	dB	dB	V/H	dB	dBuV/m	dBuV/m	dB
2.782	48.5	28.7	38.4	3.8	Vertical	0.00	42.6	54	11.4
2.782	48.1	28.7	38.4	3.8	Horizontal	0.00	42.2	54	11.8

…Ref Appendix C for Scans

Note Margin of >6dB for all measurements

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	30-Sep-22	12
Spectrum Analyser 30Hz-40GHz	Rohde& Schwarz	FSP40	100053	850	11-Dec-21	36
Test Receiver 3.6GHz	Rohde& Schwarz	ESR	1316.3003k03-101625-s	869	28-May-23	36
Fully Anechoic Chamber	CEI	FAR 3M	906	906	23-Jul-22	36
Anechoic Chamber	CEI	SAR 10M	845	845	16-May-22	36
Antenna Biconical	Schwarzbeck	VHBB 9124	9124 667	871	06-Oct-24	36
Antenna Log Periodic	Chase	UPA6108	1072	609	09-Sep-24	36
Antenna Horn	EMCO	3115	9905-5809	655	13-Dec-21	24

7 Measurement Uncertainties

Measurement	Uncertainty
Radio Frequency	+/- $5x10^{-7}$
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
Modulation bandwidth	+/- $5x10^{-7}$
Duty Cycle	+/- 5 %
Power supply	±0.1 VDC
Temperature	±0.2 °C
Frequency	±0.01 ppm

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

The test data can be compared directly to the specification limit to determine compliance, as the calculated measurement uncertainty meets the requirements of the applicable specification.

Appendix A

Conducted Measurements Spurious Emissions

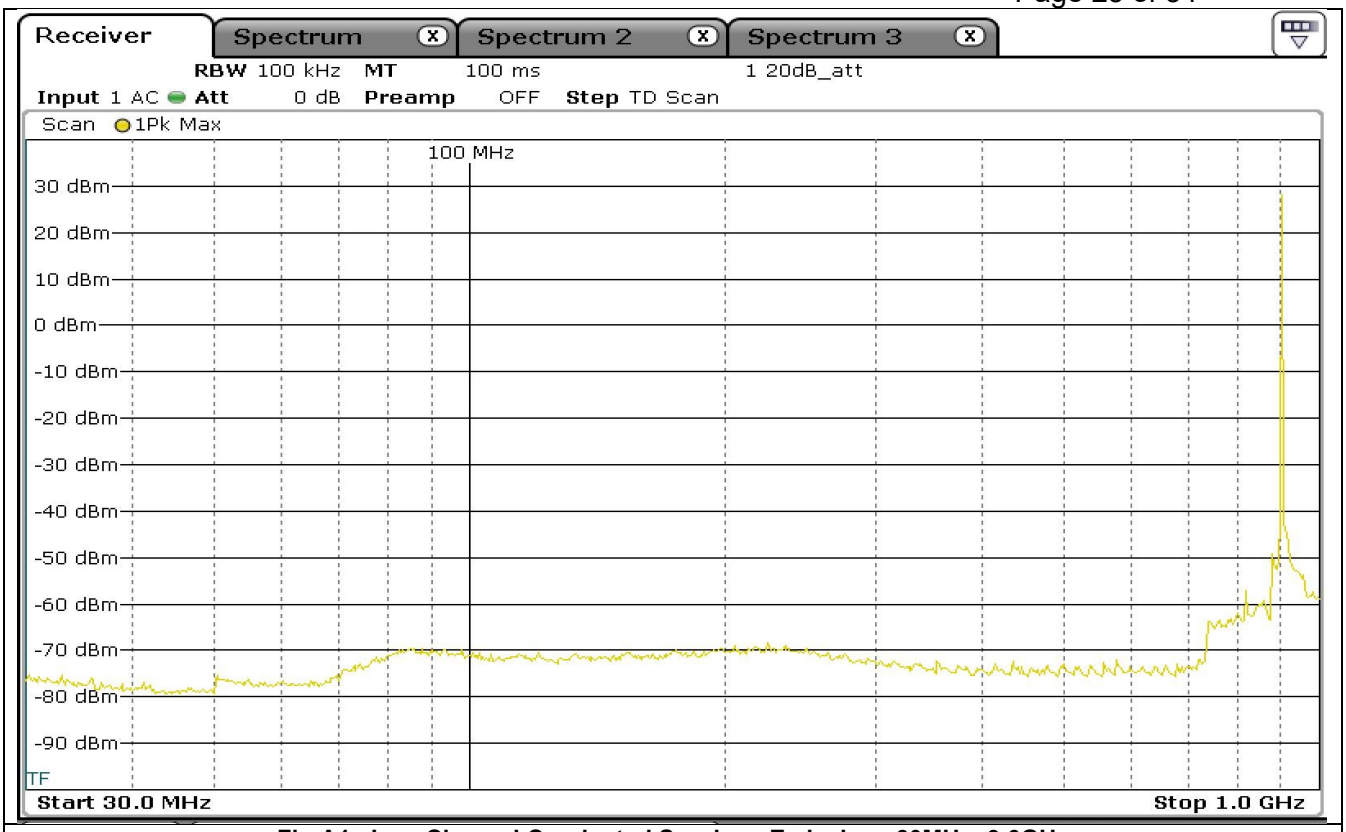


Fig A1 Low Channel Conducted Spurious Emissions 30MHz -3.6GHz

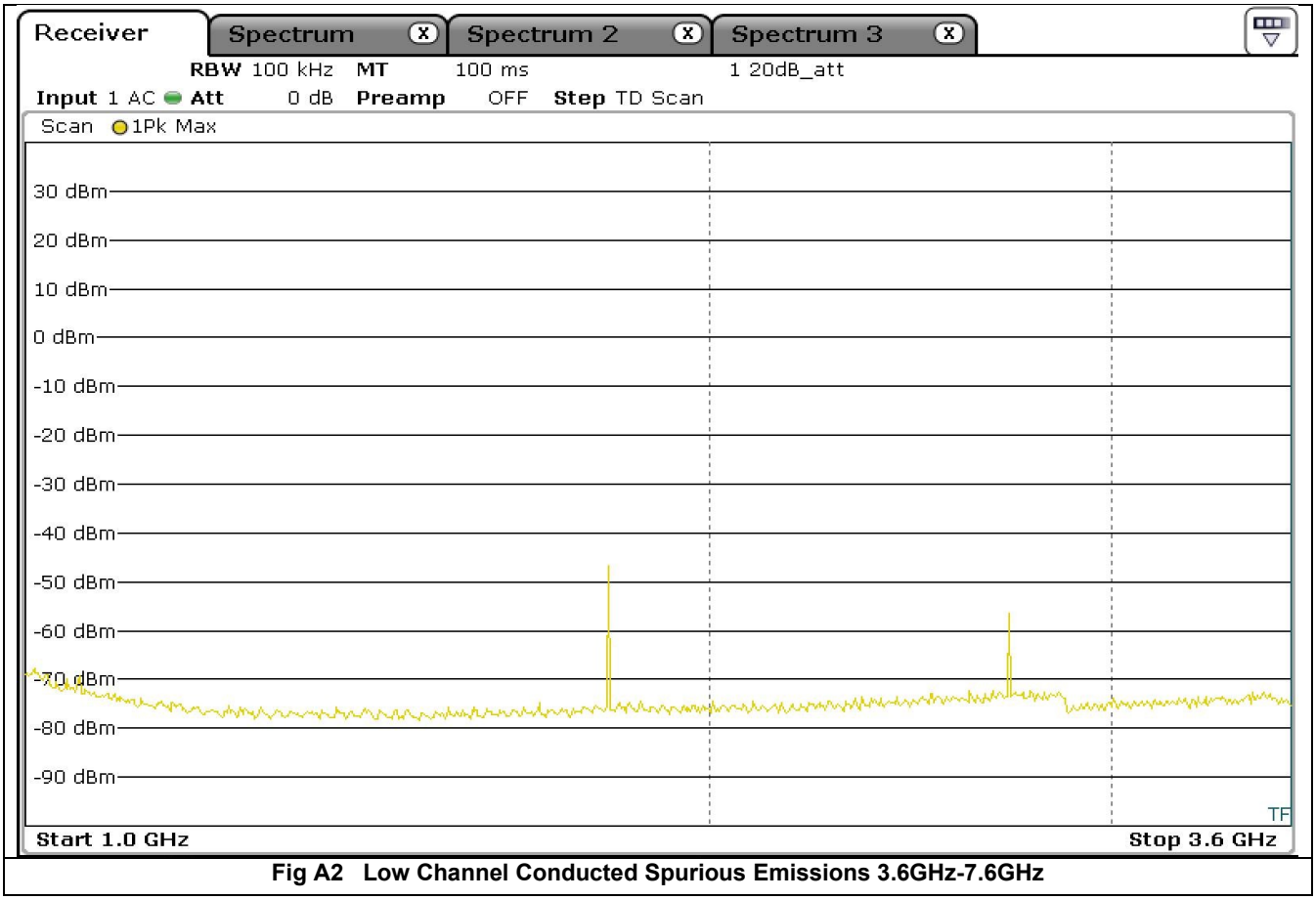


Fig A2 Low Channel Conducted Spurious Emissions 3.6GHz-7.6GHz

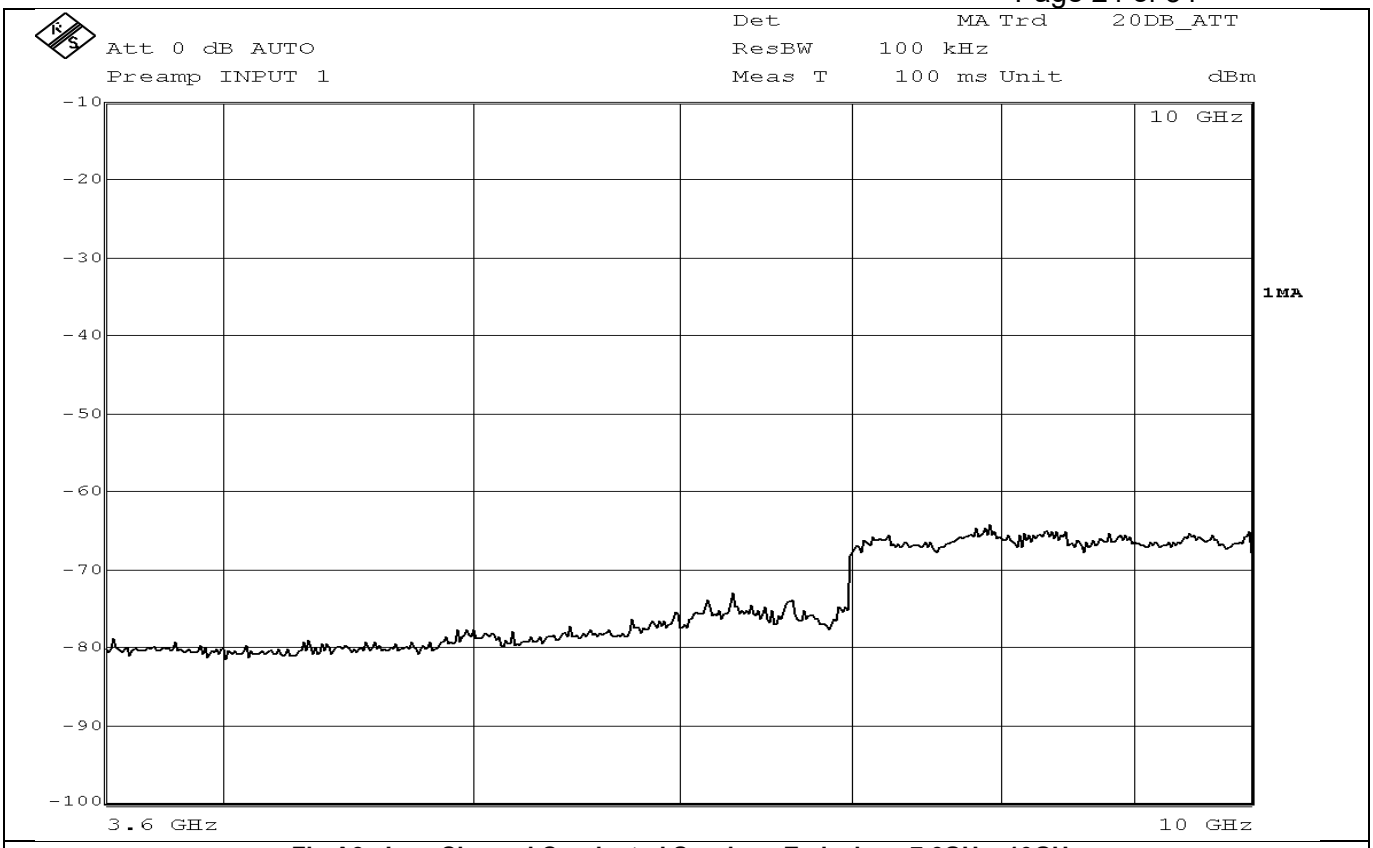


Fig A3 Low Channel Conducted Spurious Emissions 7.6GHz -10GHz

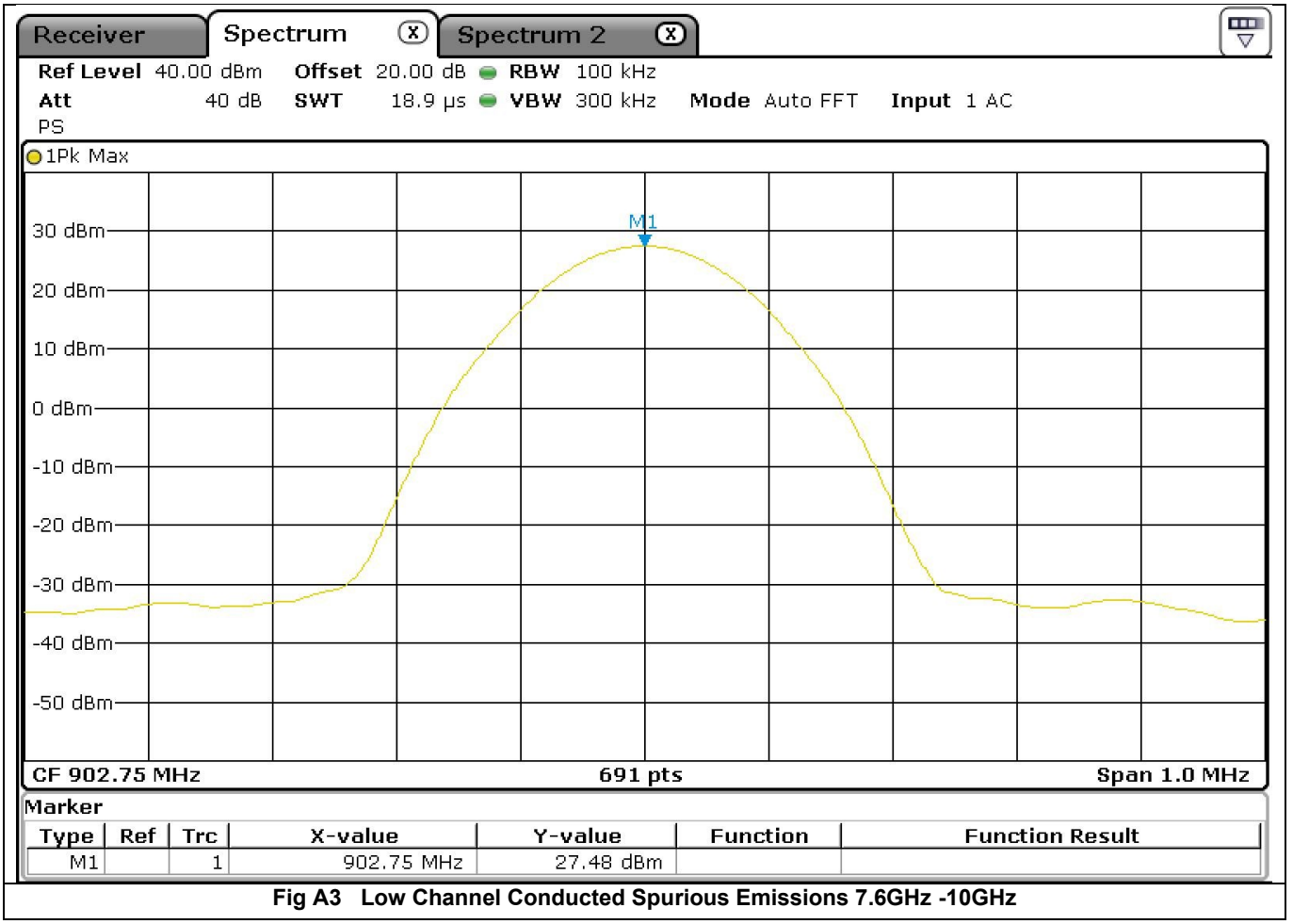


Fig A3 Low Channel Conducted Spurious Emissions 7.6GHz -10GHz

Appendix B

Conducted Tests for Band Edges

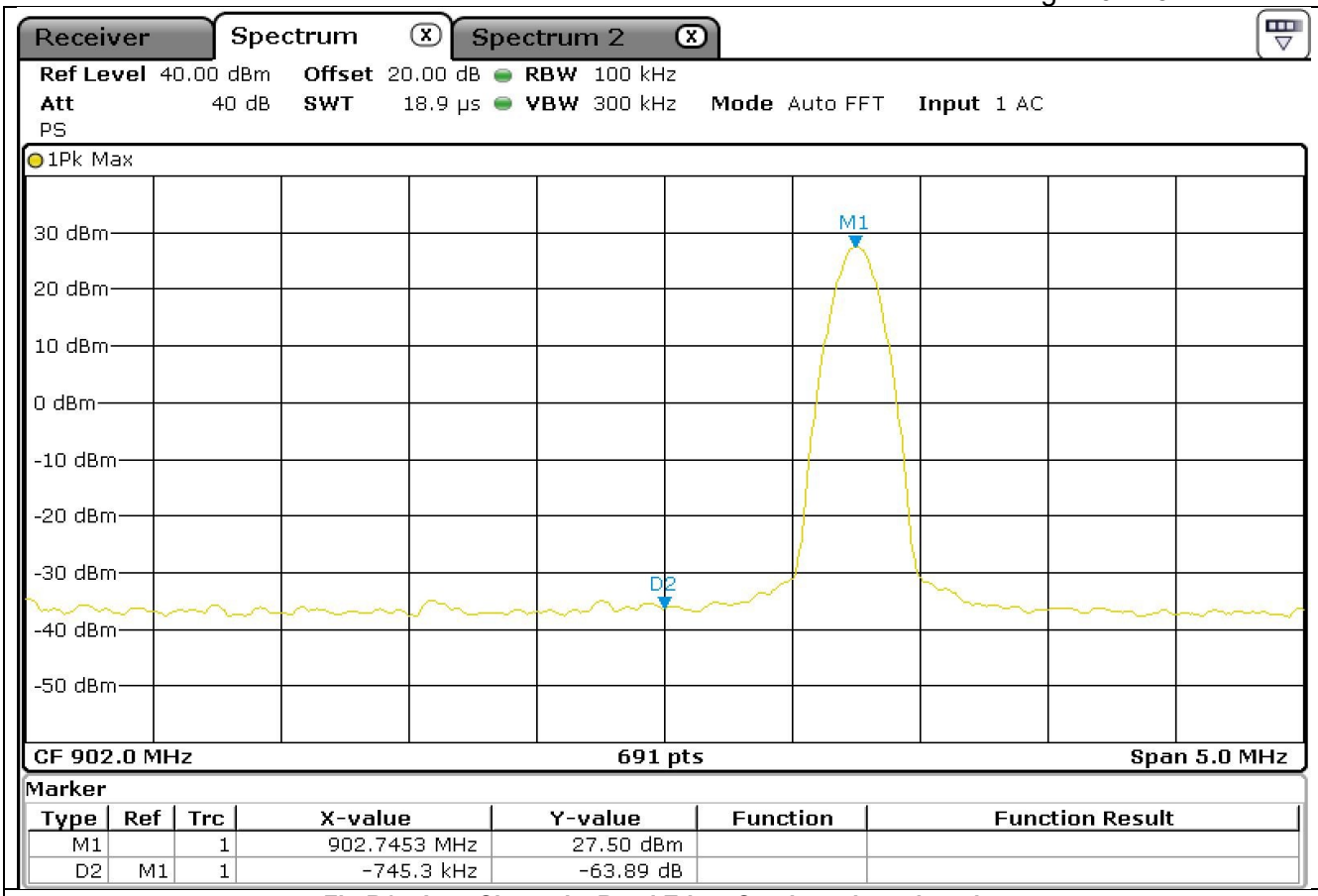


Fig B1 Low Channel Band Edge Conducted non hopping

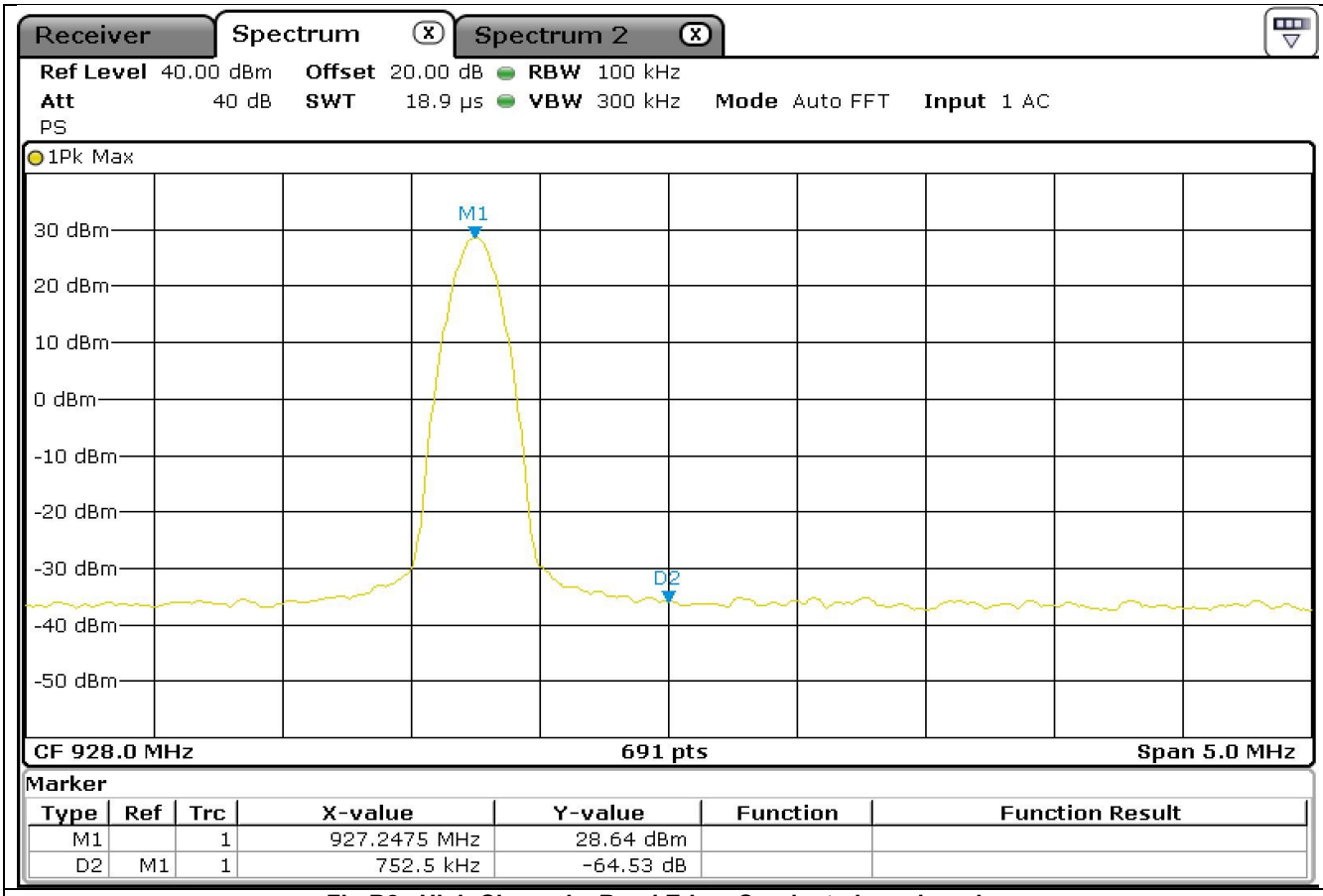


Fig B2 High Channel Band Edge Conducted non hopping

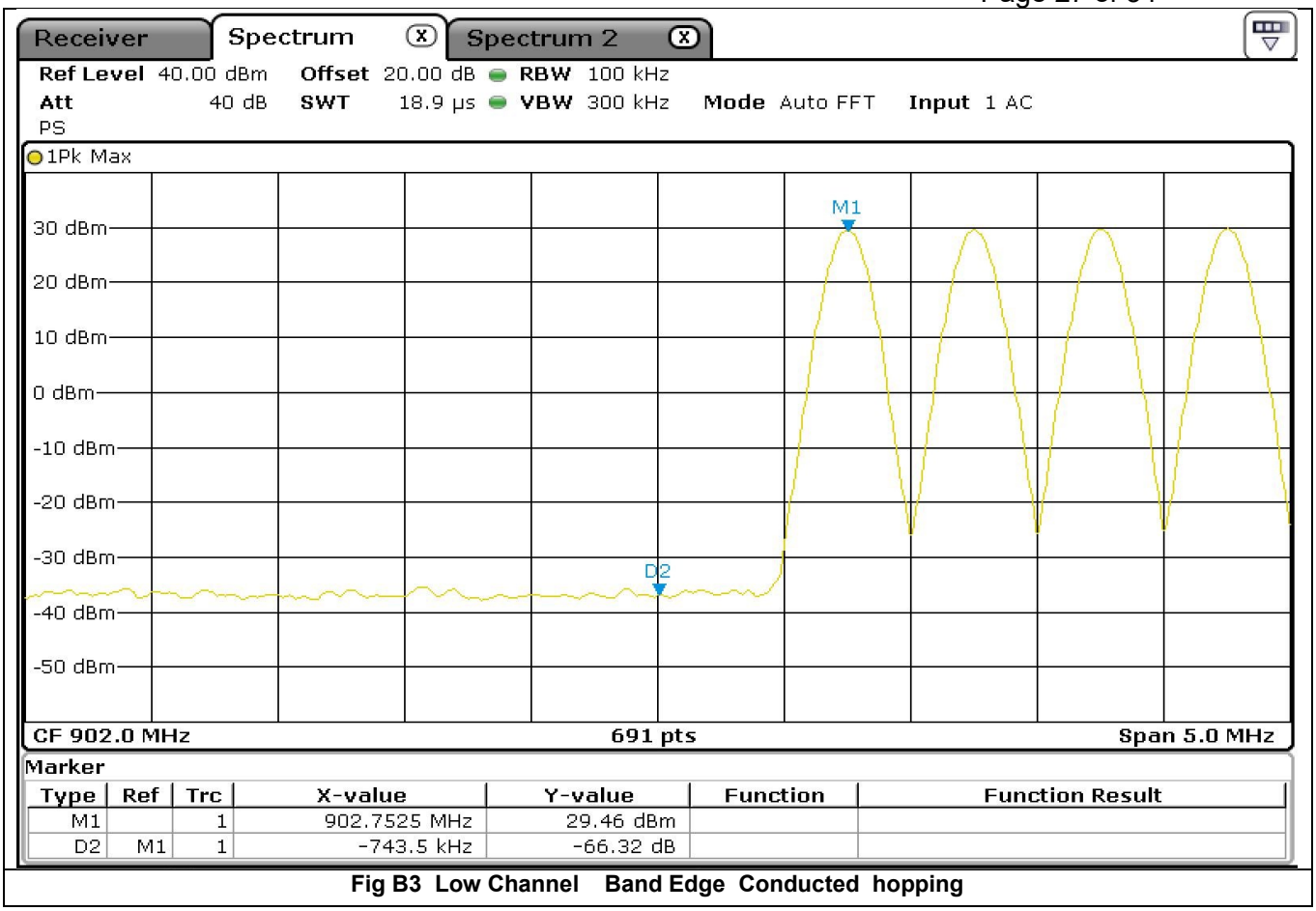


Fig B3 Low Channel Band Edge Conducted hopping

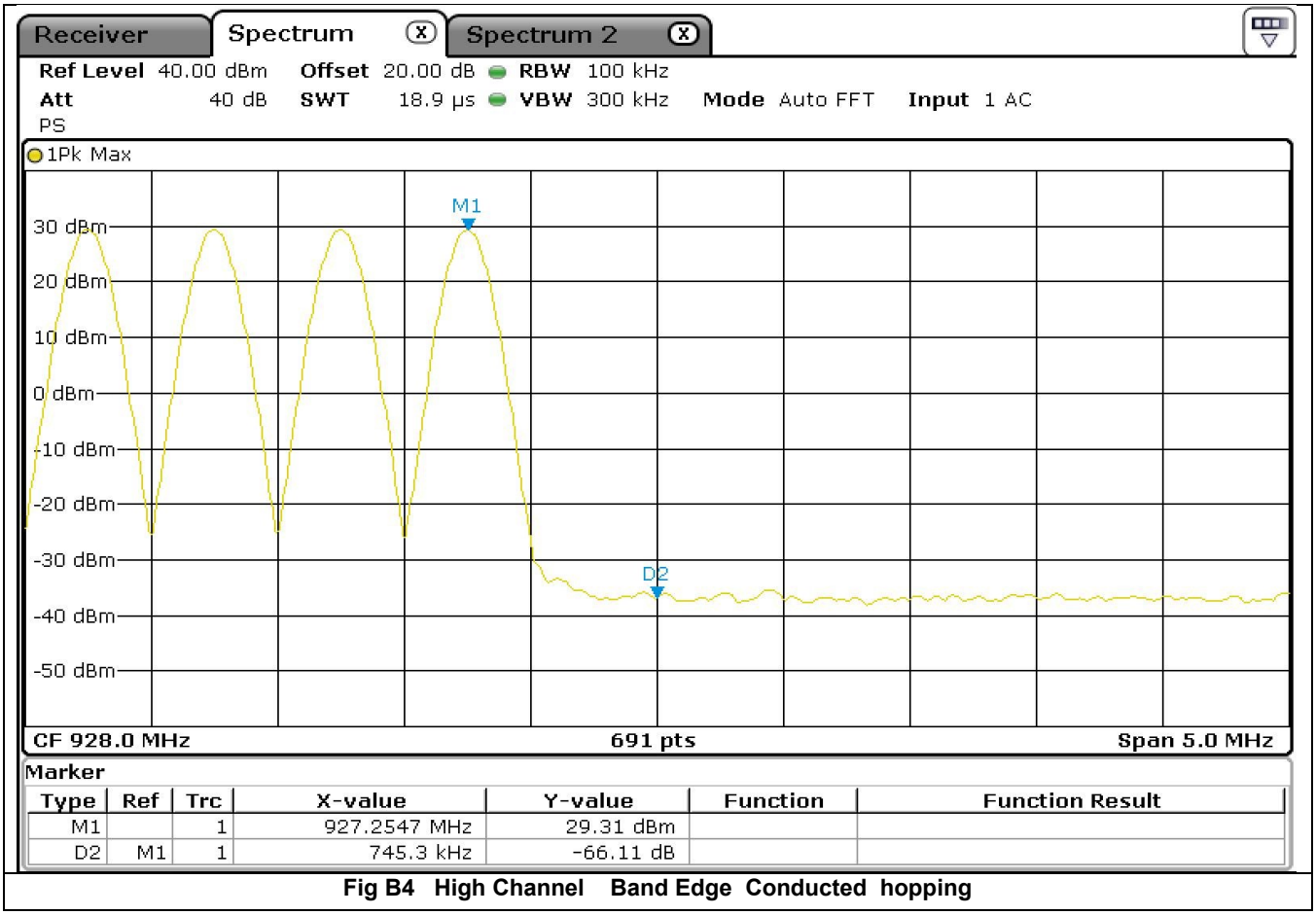


Fig B4 High Channel Band Edge Conducted hopping

Appendix C

Radiated Spurious Emissions with antenna port terminated

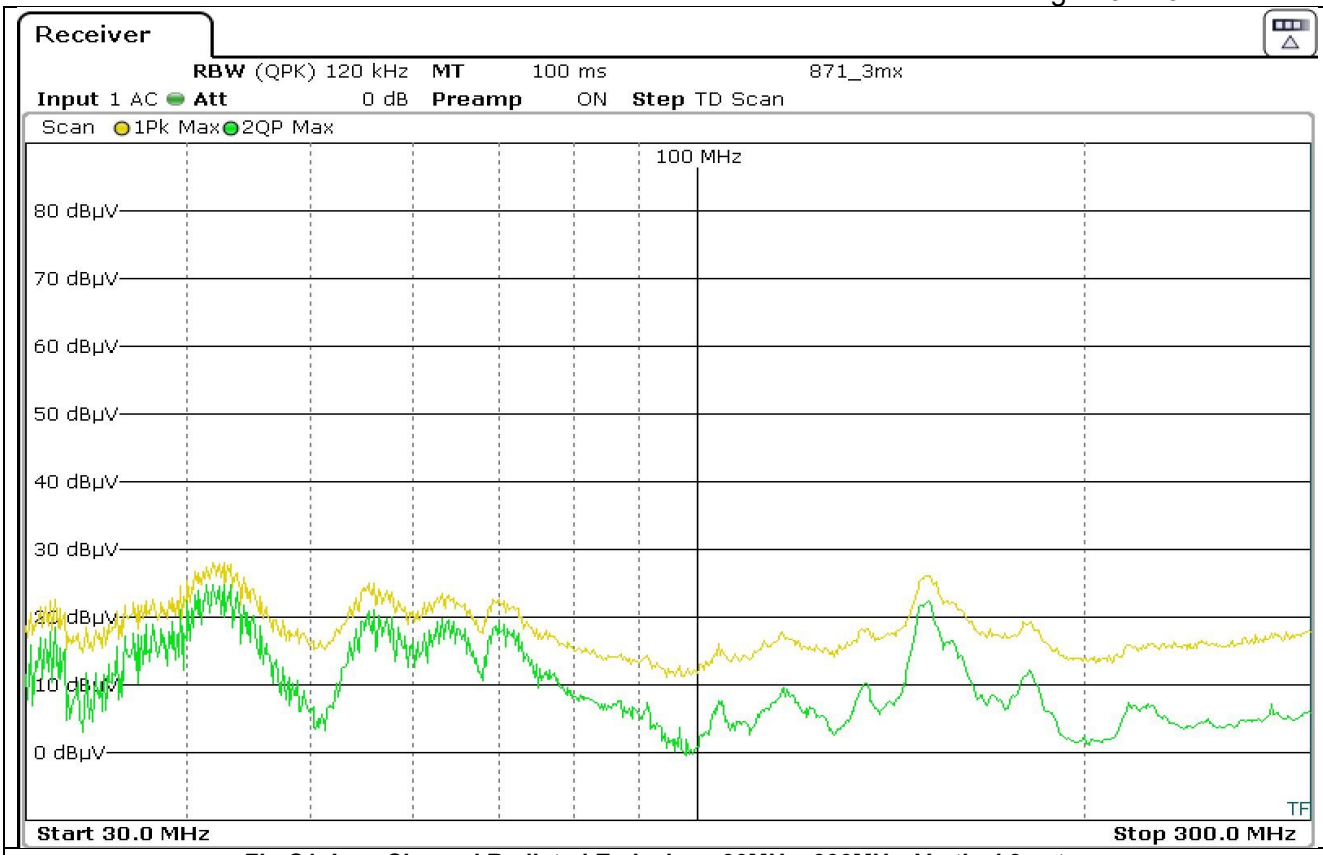


Fig C1 Low Channel Radiated Emissions 30MHz -300MHz Vertical 3metres

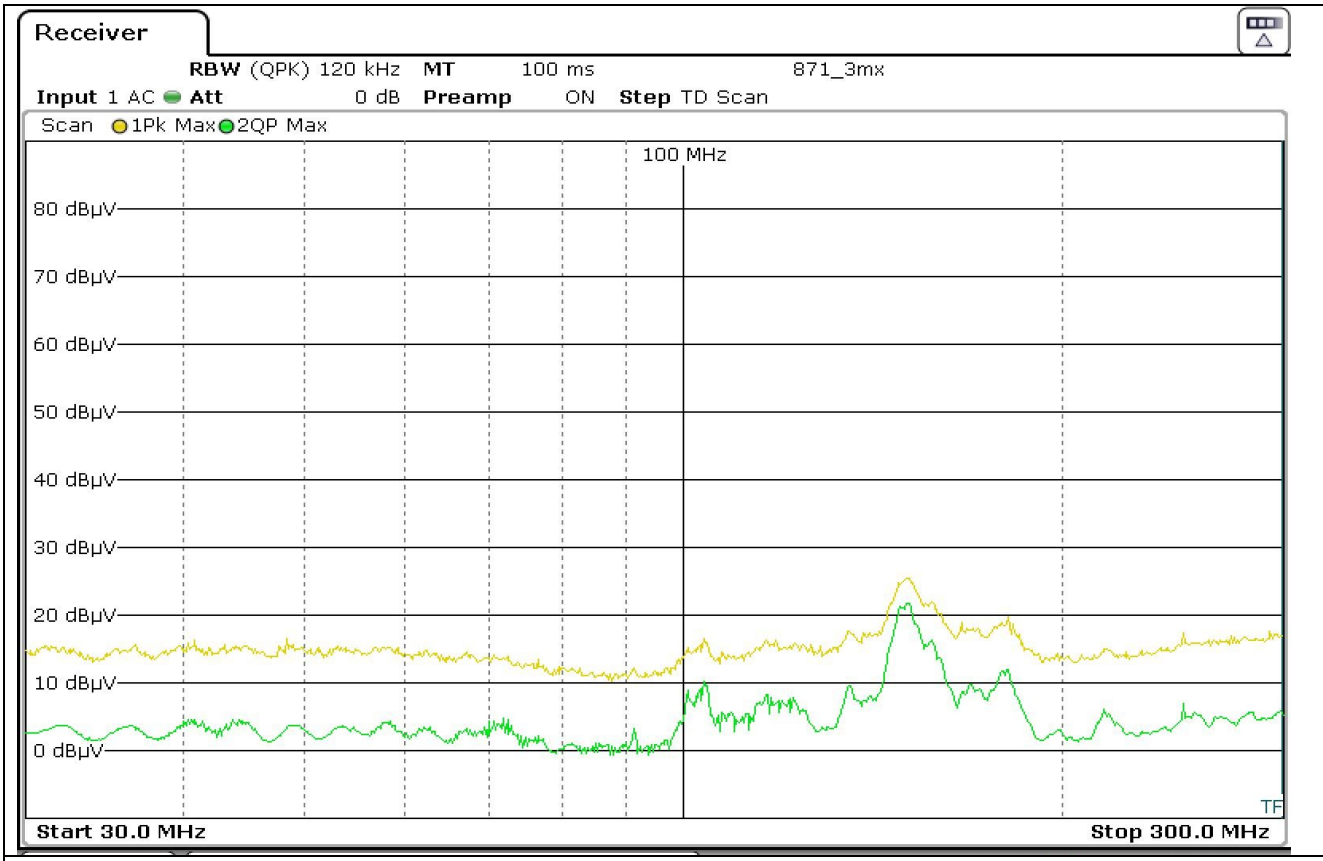


Fig C2 Low Channel Radiated Emissions 30MHz -300MHz Horizontal 3metres

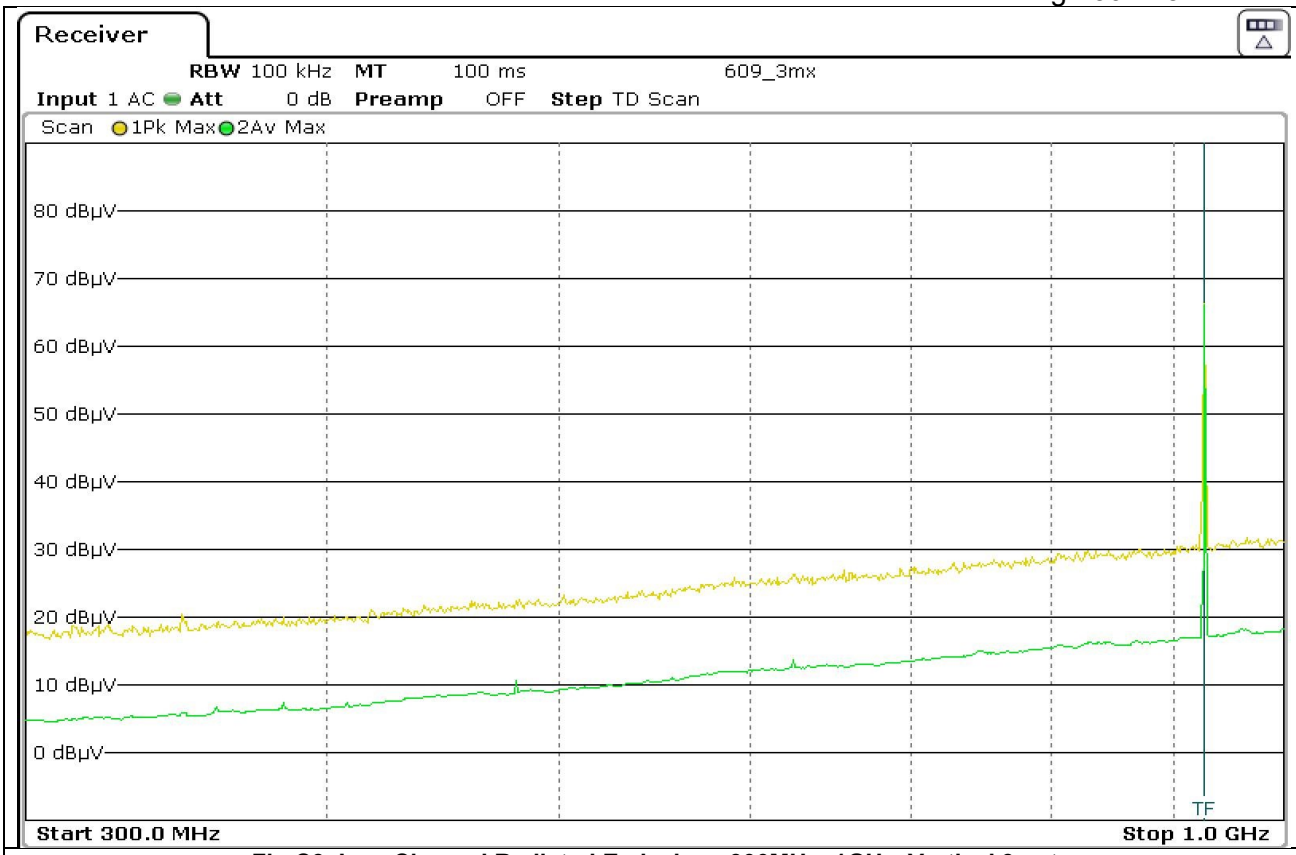


Fig C3 Low Channel Radiated Emissions 300MHz -1GHz Vertical 3metres

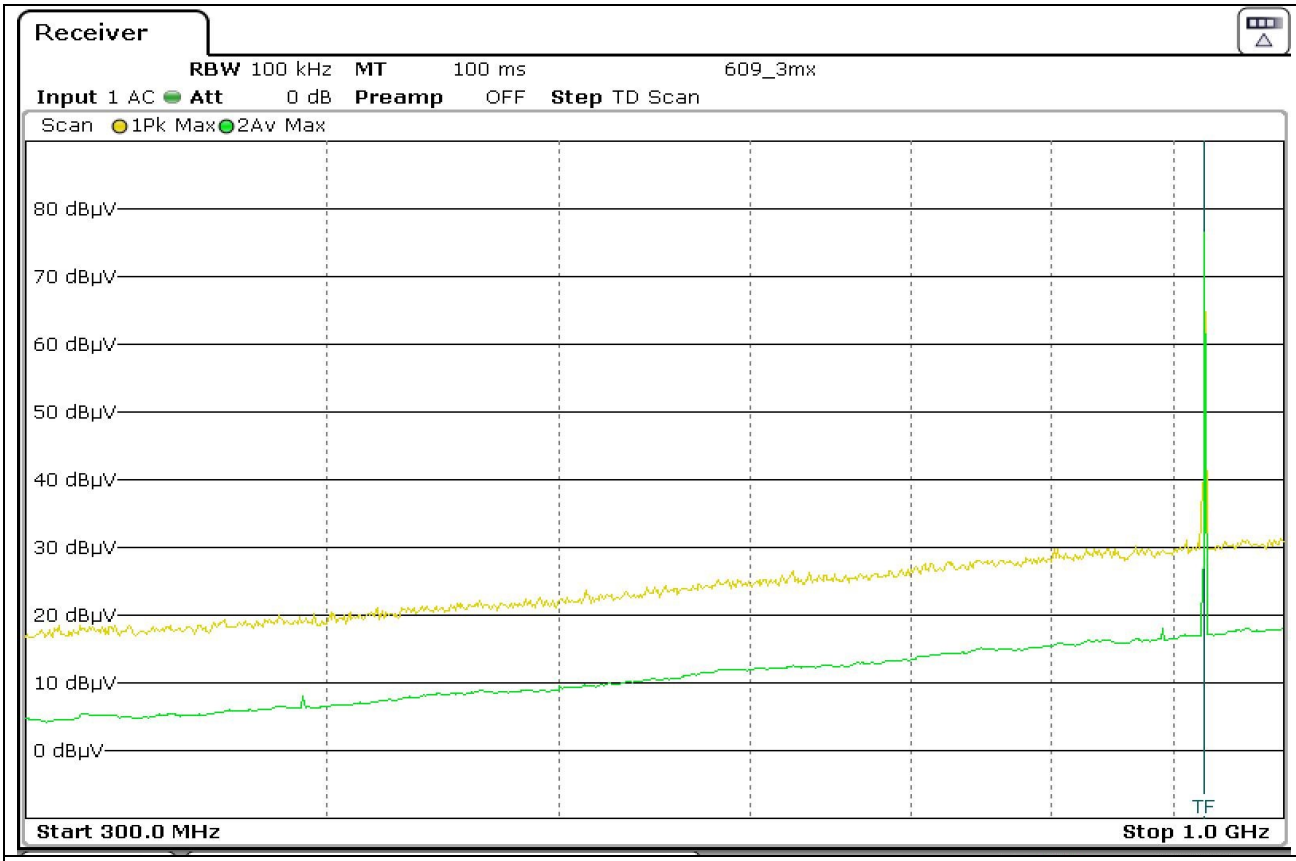


Fig C4 Low Channel Radiated Emissions 300MHz -1GHz Horizontal 3metres

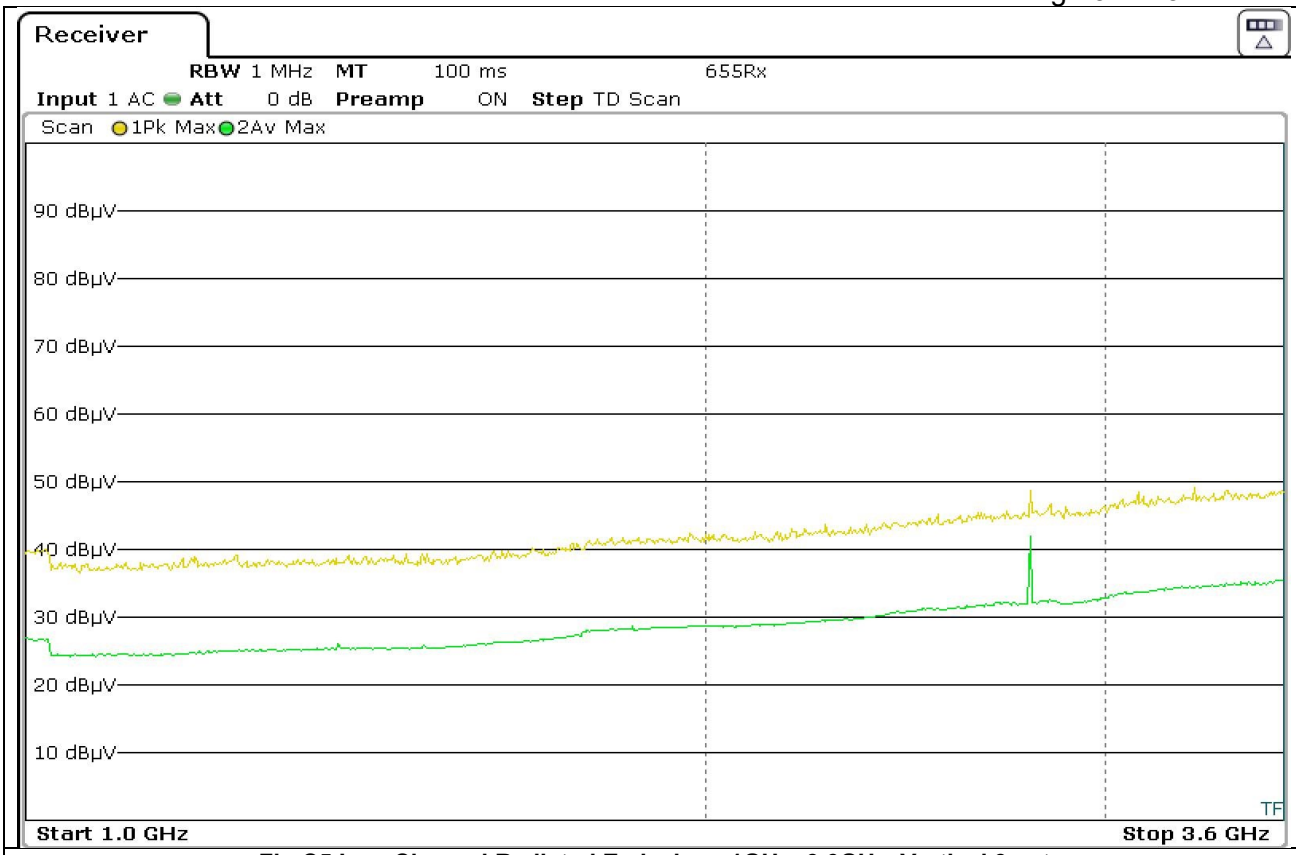


Fig C5 Low Channel Radiated Emissions 1GHz -3.6GHz Vertical 3metres

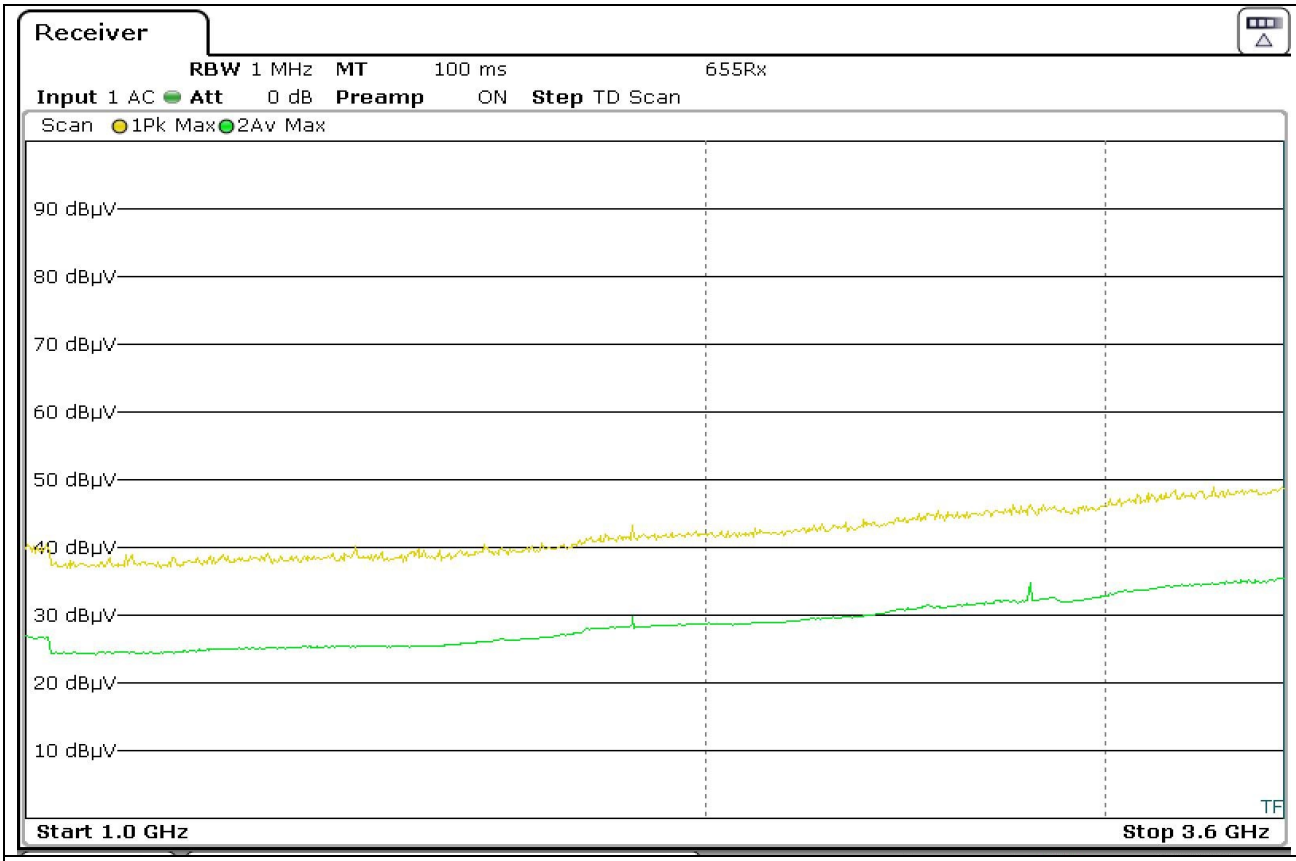


Fig C6 Low Channel Radiated Emissions 1GHz -3.6GHz Horizontal 3metres

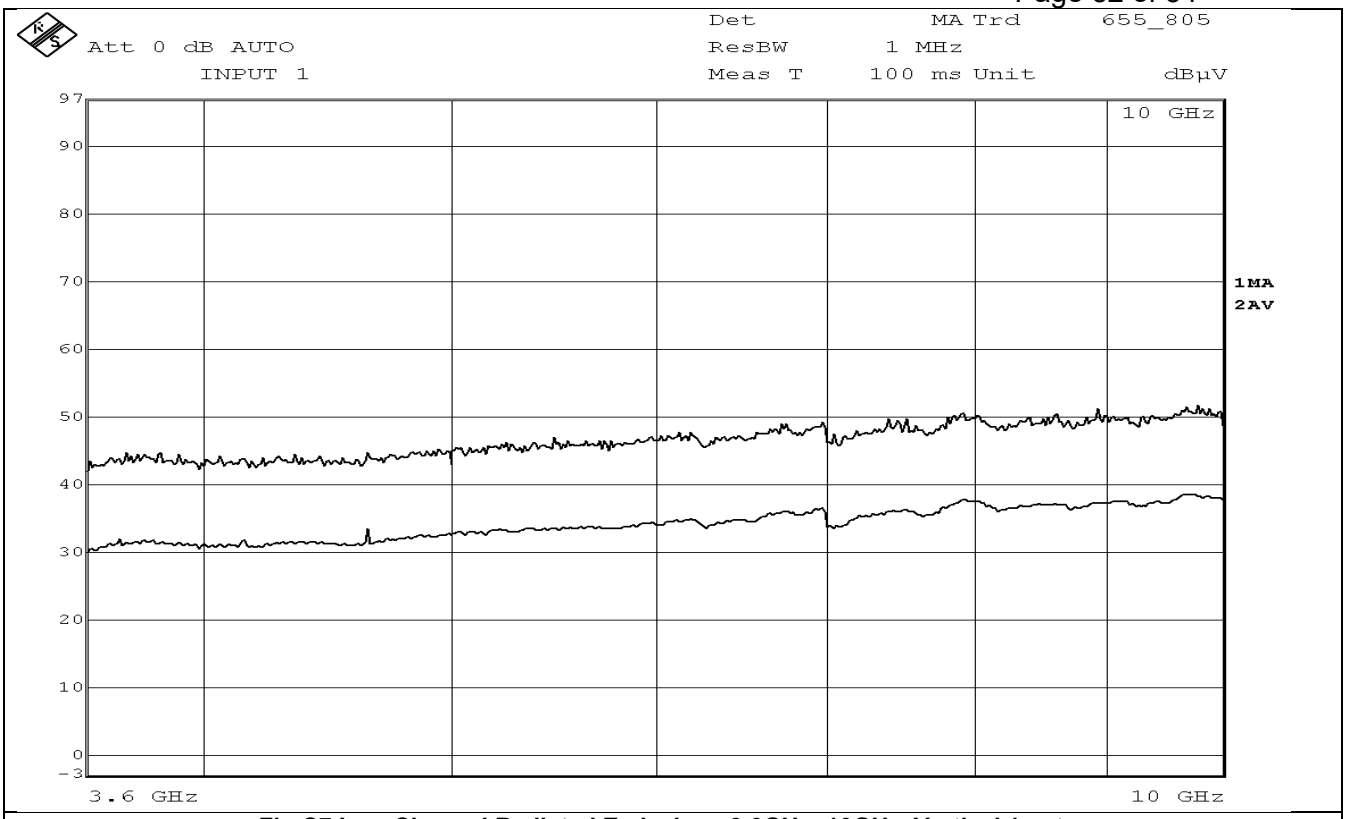


Fig C7 Low Channel Radiated Emissions 3.6GHz -10GHz Vertical 1metre

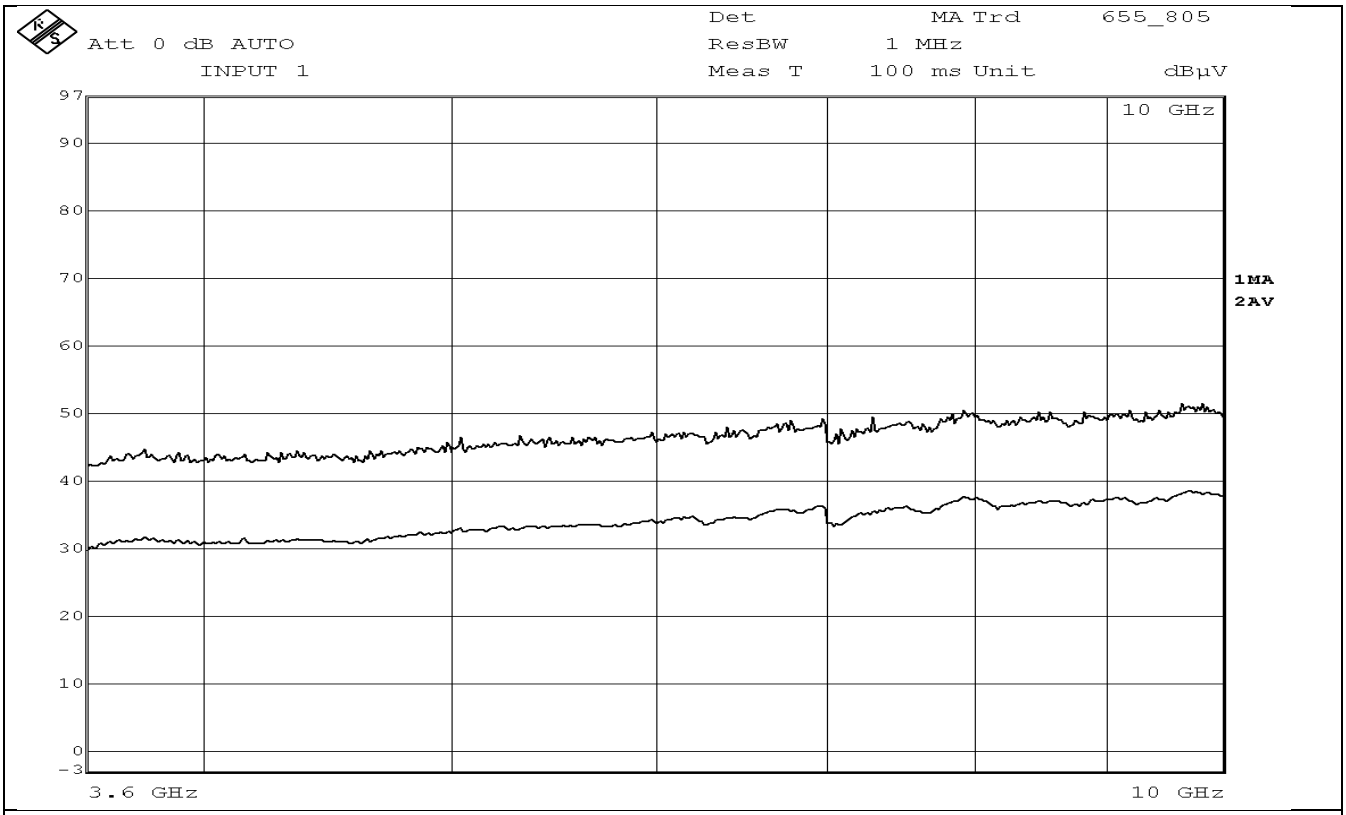


Fig C8 Low Channel Radiated Emissions 3.6GHz -10GHz Horizontal 1metre

Appendix D

Conducted Emissions on the mains

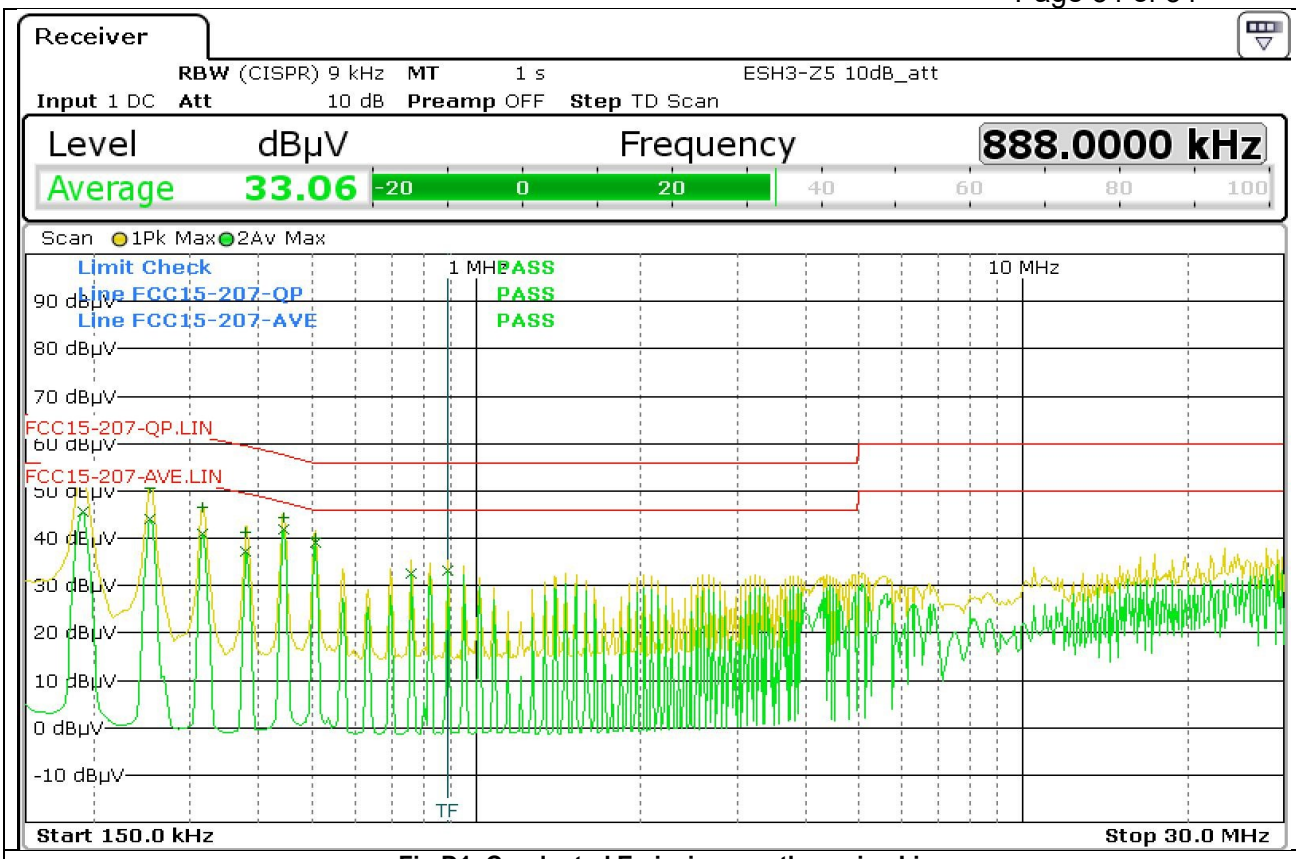


Fig D1 Conducted Emissions on the mains Live

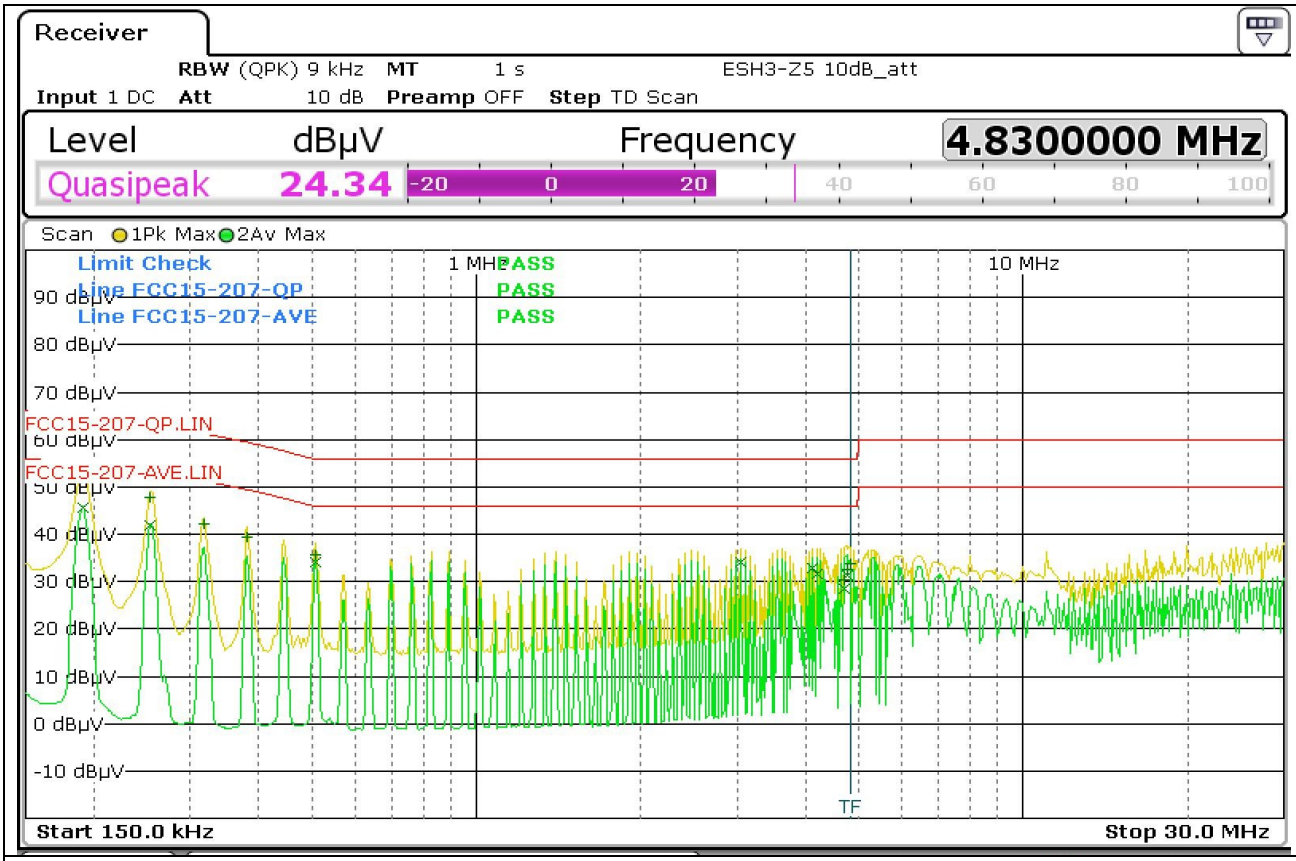


Fig D2 Conducted Emissions on the mains Neutral