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FCC Test Firm Designation	IE0002
ISED Cab Identifier	IE0001
Date	25th Jan 2024
EUT Description	Industrial RFID Reader
FCC ID	SCC10811A
IC ID	5137A-10811A
Authorised by	**Paul Reilly**
Authorised Signature:	Paul Reilly

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 Apr 2018 + Amd1 Mar 2019 + Amd2 Feb 2021

Contents

Ref doc “23E10703-1b Appendix” for the following sections

1 EUT Description

Type:	Industrial RFID reader
Type of radio:	Stand-alone
Transmitter Type:	RFID FHSS
Operating Frequency Range(s):	902.75-927.25 MHz
Number of Channels:	50
Channel Separation:	500KHz
PMN	B-IRX200-US
HVIN	1081-1A
FVIN	v17.1
Antenna:	Internal and port for external antenna
External Antenna Gain Max:	4.5dBi (7.5 dBiC)
External Antenna Impedance	50ohms
External Antenna Description	Patch Antenna
Test Standards	15.247 RSS-247
Test Methodology:	Measurements performed according to the procedures in ANSI C63.10-2013

The EUT was an Industrial RFID Reader using frequency hopping in the 902-928MHz frequency band.
The EUT contained an internal antenna with the option of fitting an external antenna.

Software used to control the EUT

Test software (NUR RD tester version 2.0.5.2) from Nordic ID, running on a standard Windows laptop (Lenovo X250) was used control the EUT during test.
This application is downloadable from Nordic ID for the purposes of testing the EUT radio interface.

1.1 EUT Operation

Operating Conditions during Test:

The EUT was powered from a dc adapter FSP 040-DAAN3 for all tests.

The same EUT sample s/n K234500061 was used for all tests.
The EUT was operated in test mode where the channel and modulation were set via USB connection to the control laptop.
The settings were 631mW for power level and continuous transmit modulated mode.

Conducted measurements were performed on the EUT with the analyser connected to the external antenna port.
Radiated measurements with the internal antenna active were performed with the connection to the external antenna port disabled.
Radiated measurements were also performed with the external antenna fitted
Nordic ID Oy , part num XA20 SN N240300002 model 1081-2A

Environmental conditions

	Temperature	Relative Humidity
Test	°C	%
Conducted Emissions on Mains	20	40
Radiated Emissions <1GHz	21	47
Radiated Emissions >1GHz	22	43
Conducted Emissions	22	42

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 10th 19th 20th 23rd 24th and 25th Jan 2024.

1.4 Description of Test modes

Channel List

Channel	Freq MHz
Low Ch 0	902.75
Mid Ch 24	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 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 port 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 Results for Conducted Emissions on the Mains

The EUT was powered from the LISN through an dc adapter FSP 040-DAAN3

Detector	Frequency	Reading	Margin	Phase
QP/ Ave	MHz	dBuV	dB	L/N
Quasi-Peak	0.1500	45.08	-20.92	Live
Average	0.3705	33.03	-16.67	Live
Quasi-Peak	0.3750	38.06	-21.51	Live
Average	0.3998	38.40	-10.46	Live
Quasi-Peak	0.404	43.10	-15.64	Live

Results for the Live Test

Detector	Frequency	Reading	Margin	Phase
QP/ Ave	MHz	dBuV	dB	L/N
Quasi-Peak	0.1500	43.15	-22.85	Neutral
Average	0.3705	32.27	-17.43	Neutral
Quasi-Peak	0.3750	37.06	-22.51	Neutral
Average	0.3998	38.03	-10.83	Neutral
Quasi-Peak	0.4043	42.90	-15.84	Neutral

Results for the Neutral Test

Ref Appendix E 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

Test Method

A reference level is established by first using a resolution bandwidth that exceeds the signal bandwidth.

The resolution bandwidth is then reduced to 1% of the estimated emission bandwidth and the video bandwidth is set to 3 times the resolution bandwidth. The markers are now moved to the -20 dB points (from the previously established reference level) on either side of centre frequency

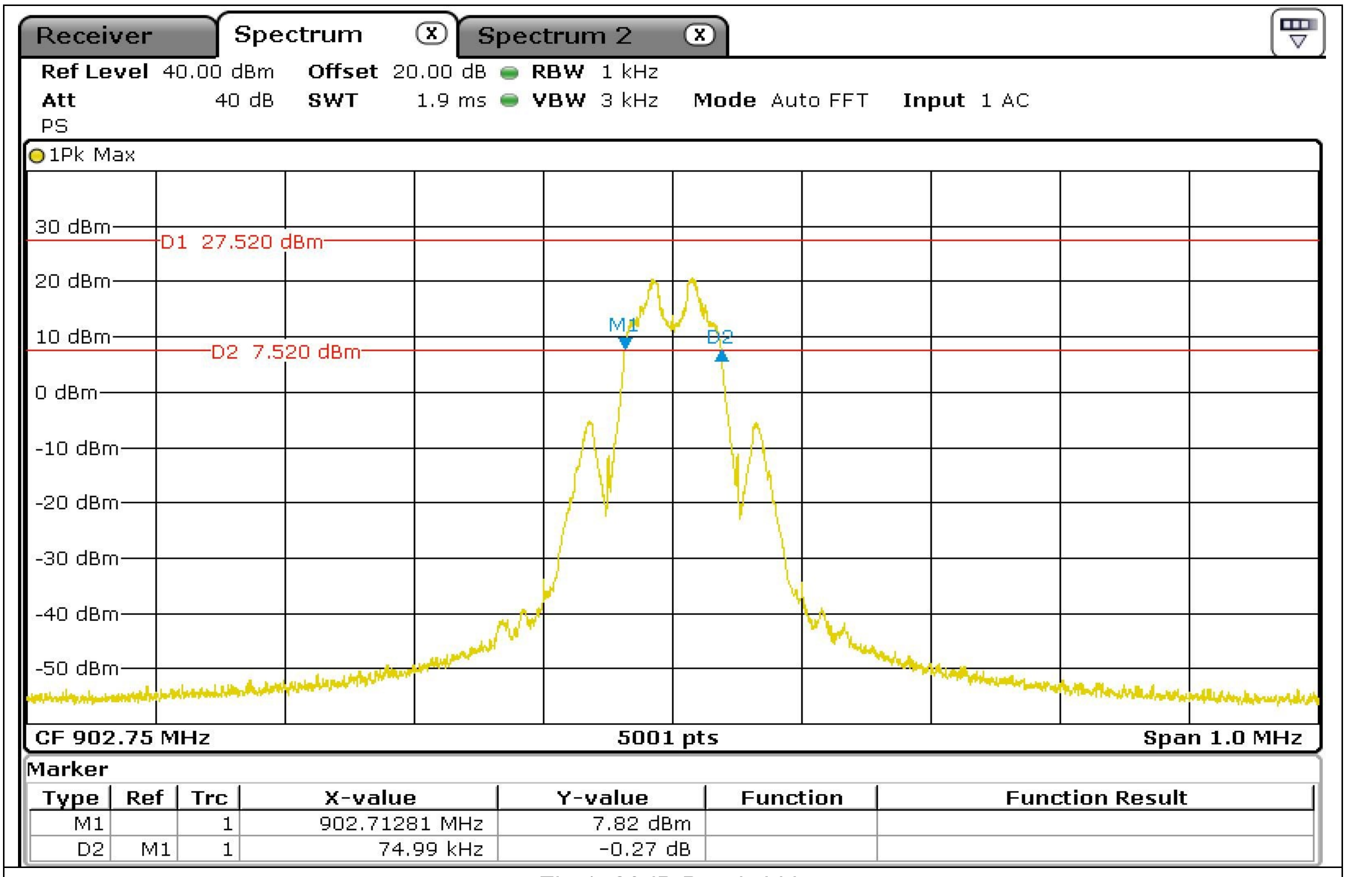

Fig 1: 20dB Bandwidth

Channel	Frequency	20dB Bandwidth	20dB Bandwidth Limit
	MHz	KHz	KHz
Low	902.75	74.99	500
Mid	914.75	75.18	500
High	927.25	75.38	500

Test Result: Pass

4.1.2 99% bandwidth

Test Method
As per Ansi 63.10 Section 6.9.3

Ansi 63.10 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.

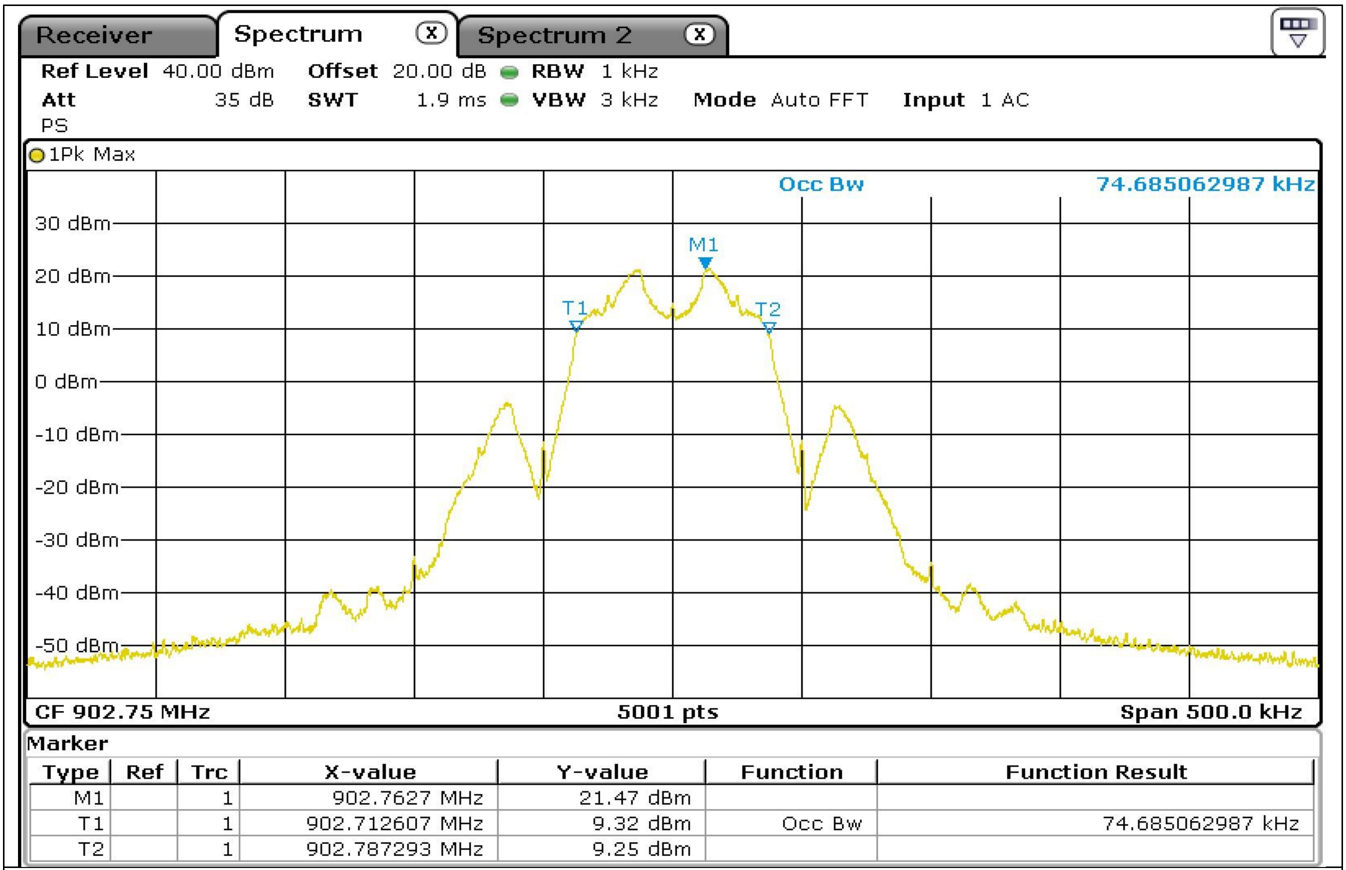

Fig 2: 99% Bandwidth

Bandwidth Result

Channel	Frequency	99% Bandwidth
	MHz	KHz
Low	902.75	74.685
Mid	914.75	74.785
High	927.25	74.585

Test Result: Pass

4.2 Output power Conducted

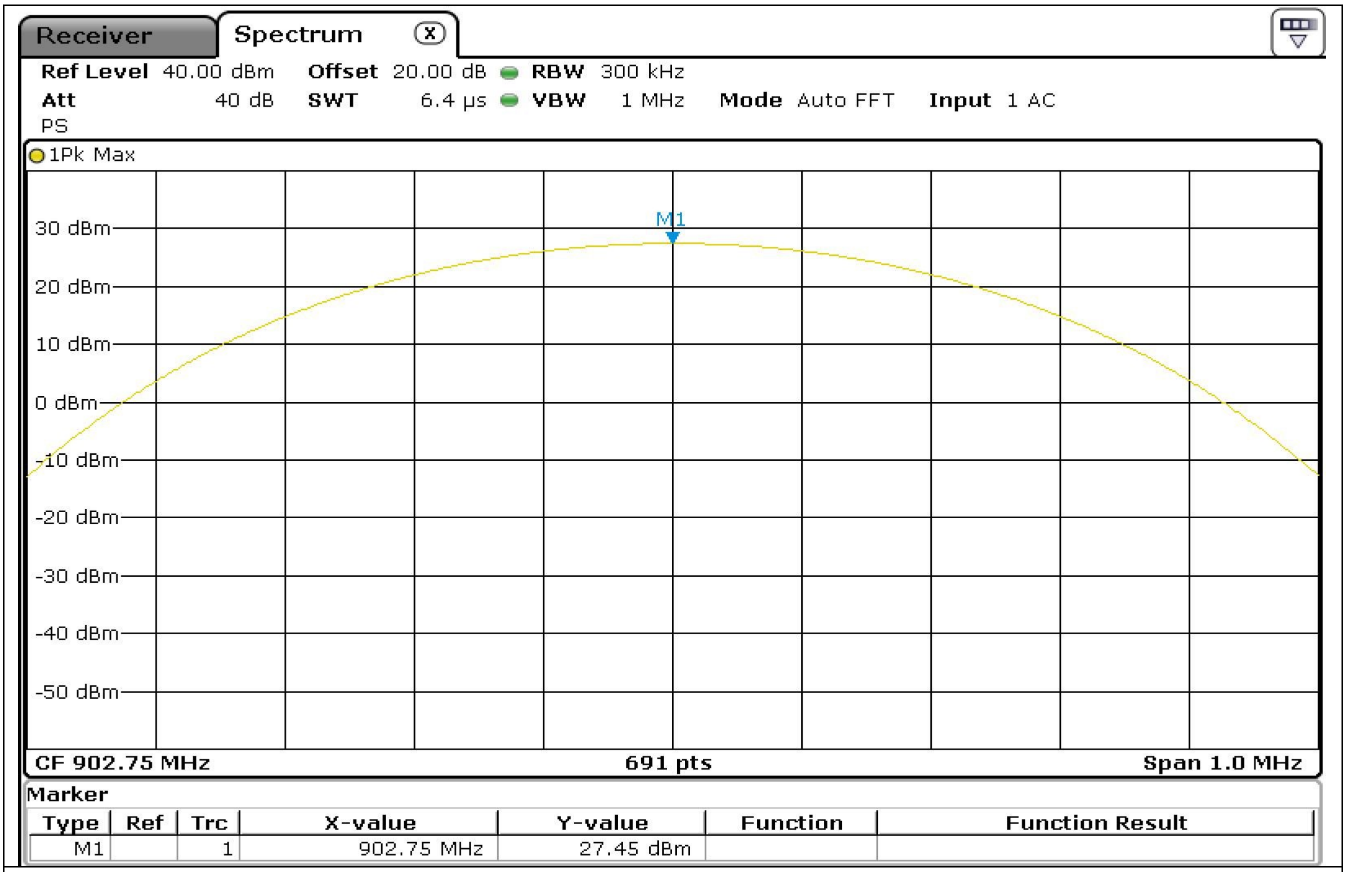

Fig 3: Conducted Output Power Peak

Frequency	Measurement	Conducted Peak	Limit	Margin
MHz	dBm	dBm	dBm	dB
902.75	27.45	27.45	30	2.55
914.75	27.87	27.87	30	2.13
927.25	27.8	27.8	30	2.2

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

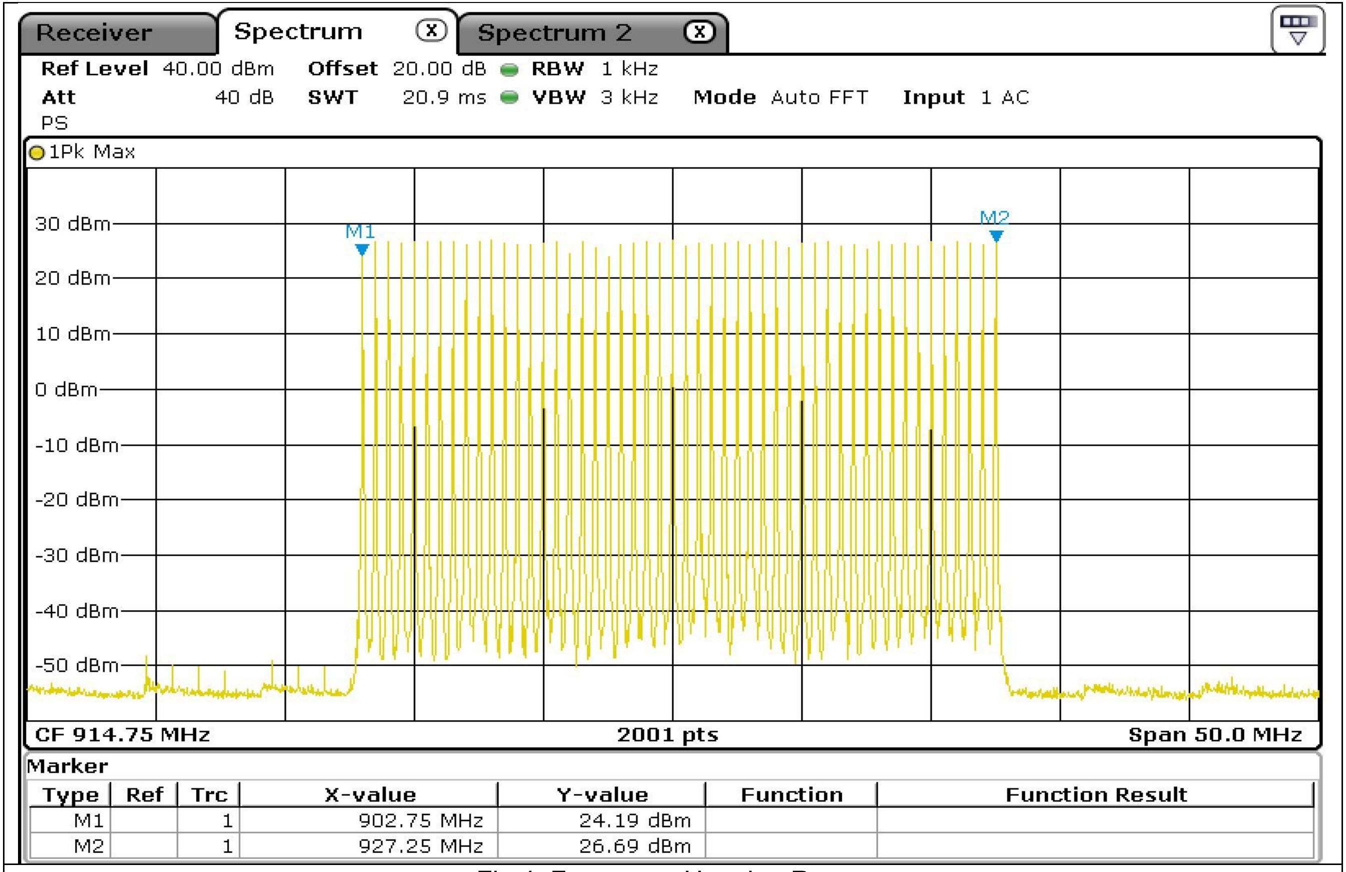

Fig 4: Frequency Hopping Range

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

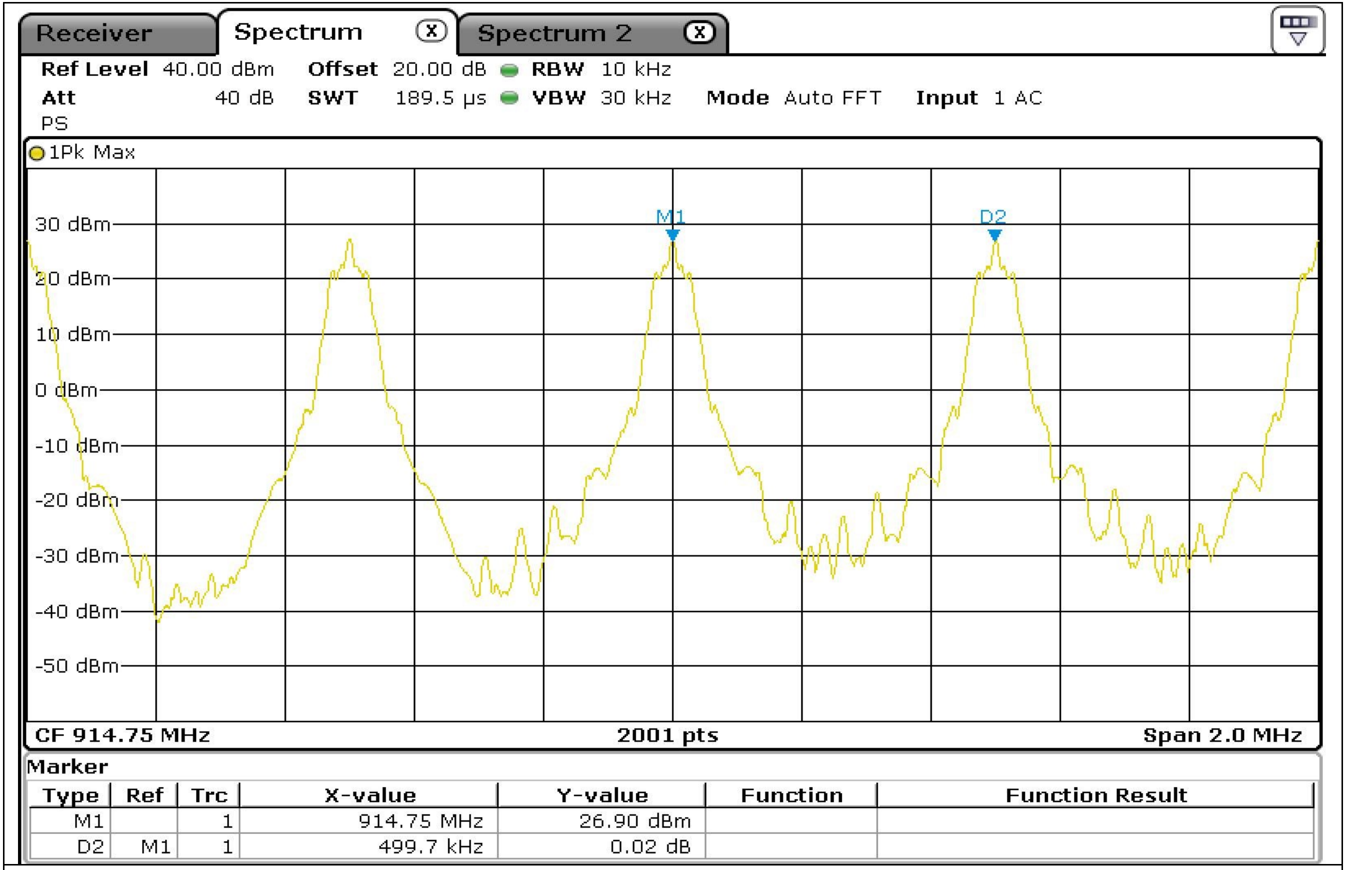

Fig 5: Channel Separation

Channel separation = 499.7KHz

4.3.3 Frequency hopping average time of channel occupancy

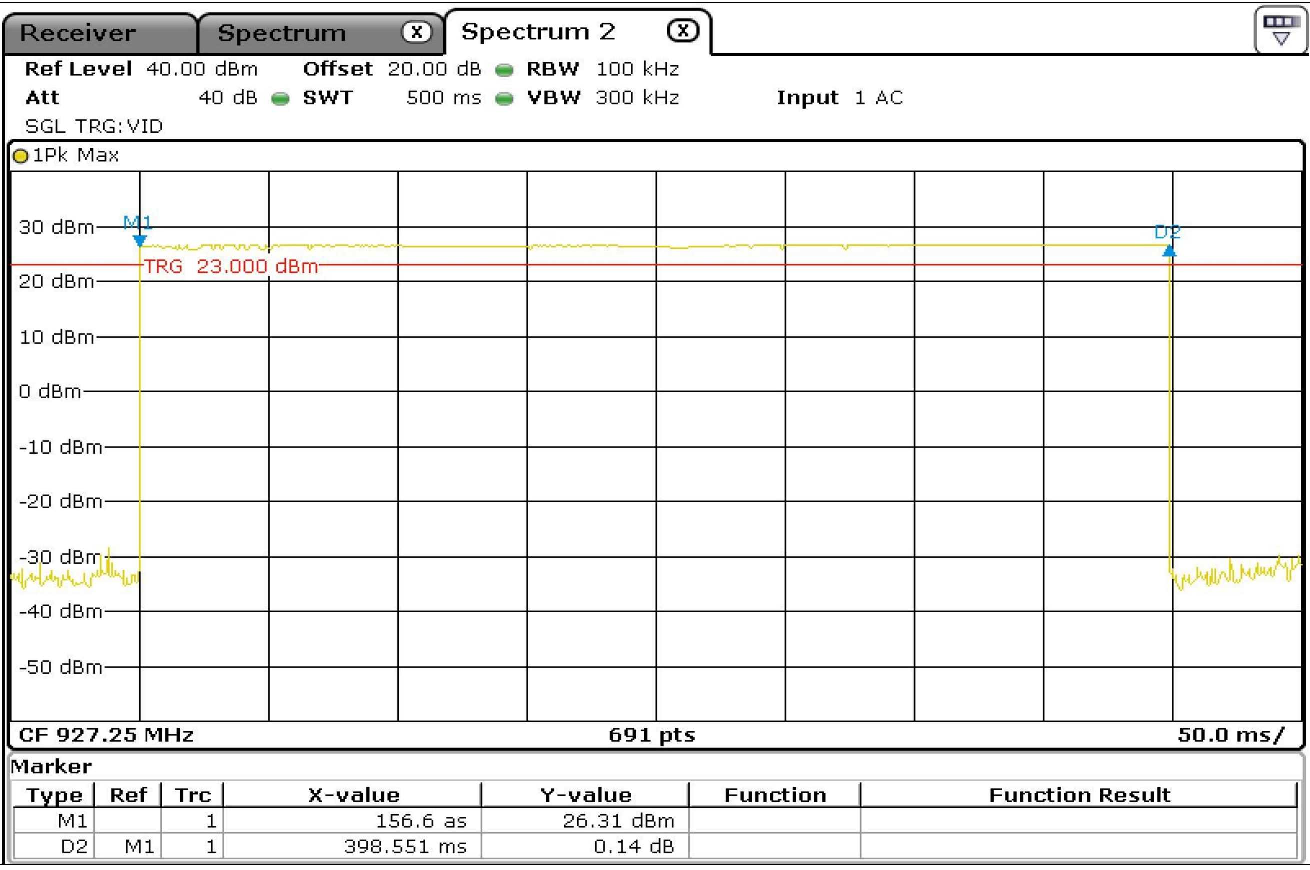

Fig 6: Single Pulse on Time

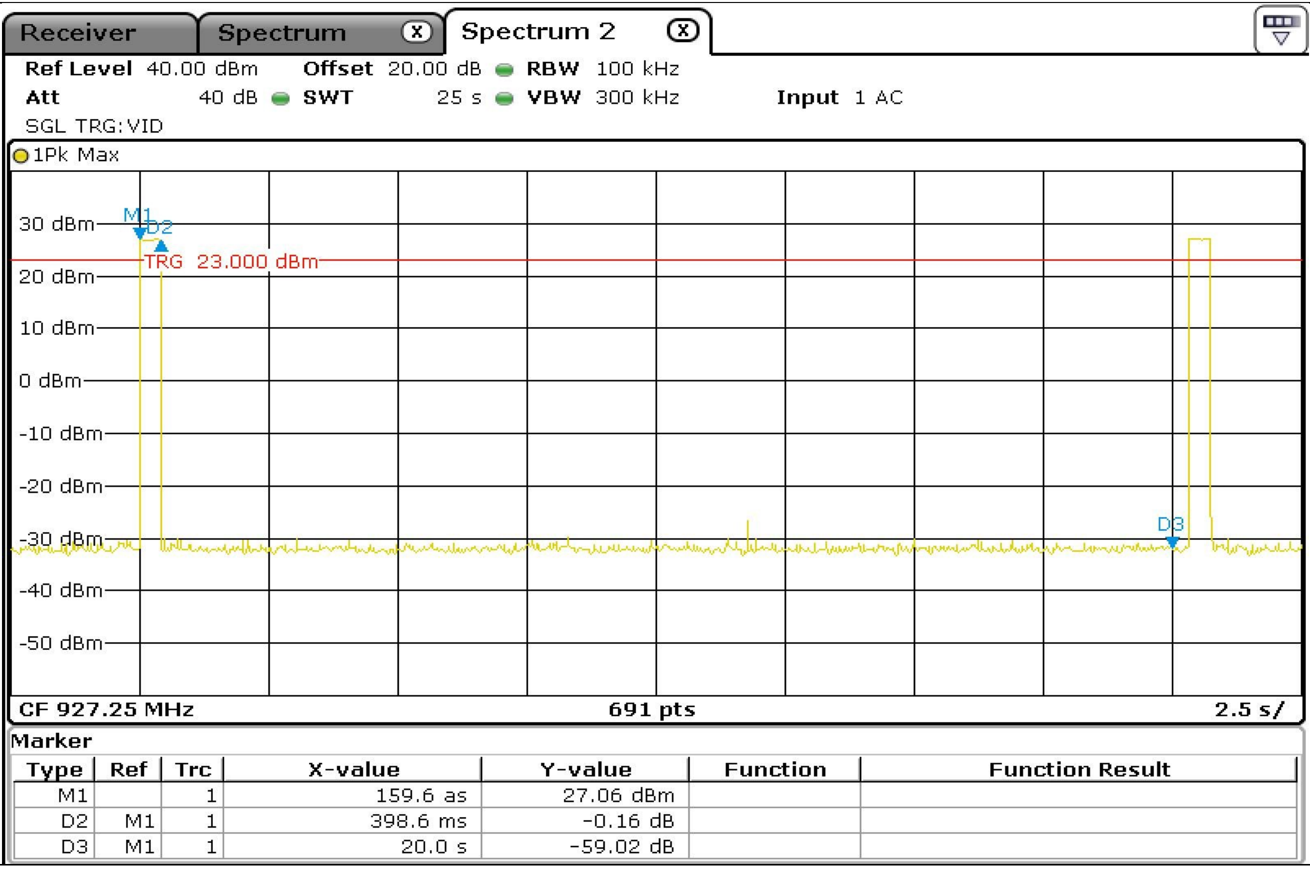

Fig 7: Max Number of Pulses in 20secs window = 1

Calculation
Single pulse on time = 398.551mS
Max Num of pulses in 20sec window = 1
Max on time in 20secs window =1* 0.39855 secs < 0.4 secs limit

Test Result: Pass

4.4 Conducted Spurious Emissions

4.4.1 Conducted Spurious Emissions (100KHz bandwidth)

Frequency	100KHz RBW	dBc Limit Min	Margin	Result
MHz	dBm	dB	dB	P/F
902.75	27.65	20	-	-
1085.5	-63.43	20	71.08	Pass
2708.2	-66.92	20	74.57	Pass

Results for Conducted Emission for Low Channel (902.75MHz)

Frequency	100KHz RBW	dBc Limit Min	Margin	Result
MHz	dBm	dB	dB	P/F
914.75	27.63	20	-	-
1829.5	-64.07	20	71.7	Pass
2744.2	-66.09	20	73.72	Pass

Results for Conducted Emission for Middle Channel (914.75MHz)

Frequency	100KHz RBW	dBc Limit Min	Margin	Result
MHz	dBm	dB	dB	P/F
927.25	27.64	20	-	-
1854.5	-59.36	20	67	Pass
2781.7	-64.24	20	71.88	Pass

Results for Conducted Emission for Middle Channel (927.25MHz)

Refer to Appendix A for Scans

Test Result: Pass

4.4.2 Conducted Emissions Band Edge

Refer to Appendix B for Scans

Test Result: Pass

5 Radiated Emissions

5.1 Radiated Spurious Emissions with Internal Antenna

5.1.1 Radiated Spurious Emission for 902.75MHz

Frequency	Quasi peak Level	EUT Orientation	Antenna Polarity	Antenna Factor	Preamp Gain	Cable loss	Final Field Strength Quasi Peak	Average Limit	Margin	Result
MHz	dBuV/m		V/H	dB	dB	dB	dBuV/m	dBuV/m	dB	P/F
119.440	-6.9	O1	Horizontal	10.1	0	1.8	5.0	43.5	38.5	Pass
250.000	4.5	O1	Horizontal	16	0	2.5	23.0	46.0	23.0	Pass

Final Field Strength Quasi Peak (dBuV/m) =Quasi peak Level (dBuV/m) + Antenna Factor (dB)- Pre-amp Gain (dB) +Cable Loss (dB)
Calculation Example **23.5 = 9.4 + 12 - 0 + 2.1**

Frequency	Reading Peak	EUT Orientation	Antenna Polarity	Antenna Factor	Preamp Gain	Cable loss	Final Field Strength Peak	Average Limit	Margin for Peak v Average Limit +20dB	Result
GHz	dBuV/m		V/H	dB	dB	dB	dBuV/m	dBuV/m	dB	P/F
2.708	14.4	O1	Vertical	29.1	0	5.1	48.6	54.0	25.4	Pass
3.611	44.1	O1	Vertical	31.7	38.2	5.8	43.4	54.0	30.6	Pass
4.514	45.1	O1	Vertical	32.6	39.1	7.5	46.1	54.0	27.9	Pass
5.417	44.5	O1	Vertical	34.3	39.2	8.2	47.8	54.0	26.2	Pass
8.125	45.7	O1	Vertical	36.7	41.1	10.9	52.2	54.0	21.8	Pass
9.028	44.4	O1	Vertical	37.8	38.9	10.2	53.5	54.0	20.5	Pass
2.708	14.8	O1	Horizontal	29.1	0	5.1	49.0	54.0	25.0	Pass
3.611	44.6	O1	Horizontal	31.7	38.2	5.8	43.9	54.0	30.1	Pass
4.514	45.7	O1	Horizontal	32.6	39.1	7.5	46.7	54.0	27.3	Pass
5.417	43.5	O1	Horizontal	34.3	39.2	8.2	46.8	54.0	27.2	Pass
8.125	46.2	O1	Horizontal	36.7	41.1	10.9	52.7	54.0	21.3	Pass
9.028	43.6	O1	Horizontal	37.8	38.9	10.2	52.7	54.0	21.3	Pass

Final Field Strength Peak (dBuV/m) =Reading Peak (dBuV/m) + Antenna Factor (dB)- Pre-amp Gain (dB) +Cable Loss (dB)
Calculation Example 44.7 = 43.4 = 44.1 + 31.7 - 38.2 + 5.8

5.1.2 Radiated Spurious Emission for 914.75MHz

Frequency	Reading Peak	EUT Orientation	Antenna Polarity	Antenna Factor	Preamp Gain	Cable loss	Final Field Strength Peak	Average Limit	Margin for Peak v Average Limit +20dB	Result
GHz	dBuV/m		V/H	dB	dB	dB	dBuV/m	dBuV/m	dB	P/F
2.744	14.2	O1	Vertical	29.1	0	5.1	48.4	54.0	25.6	Pass
3.659	45.2	O1	Vertical	31.8	38.3	6	44.7	54.0	29.3	Pass
4.574	43.8	O1	Vertical	32.7	39.7	8.1	44.9	54.0	29.1	Pass
7.318	45.2	O1	Vertical	36.4	40.6	10.1	51.1	54.0	22.9	Pass
8.233	45.6	O1	Vertical	36.8	40.9	11	52.5	54.0	21.5	Pass
9.148	44.3	O1	Vertical	37.8	38.8	10.1	53.4	54.0	20.6	Pass
2.744	14.6	O1	Horizontal	29.1	0	5.1	48.8	54.0	25.2	Pass
3.659	45.2	O1	Horizontal	31.8	38.3	6	44.7	54.0	29.3	Pass
4.574	44.4	O1	Horizontal	32.7	39.7	8.1	45.5	54.0	28.5	Pass
7.318	44.3	O1	Horizontal	36.4	40.6	10.1	50.2	54.0	23.8	Pass
8.233	45.7	O1	Horizontal	36.8	40.9	11	52.6	54.0	21.4	Pass
9.148	43.7	O1	Horizontal	37.8	38.8	10.1	52.8	54.0	21.2	Pass

Final Field Strength Peak (dBuV/m) =Reading Peak (dBuV/m) + Antenna Factor (dB)- Pre-amp Gain (dB) +Cable Loss (dB)
Calculation Example44.7 = 45.2 + 31.8 - 38.3 + 6

5.1.3 Radiated Spurious Emission for 927.25MHz

Frequency	Reading Peak	EUT Orientation	Antenna Polarity	Antenna Factor	Preamp Gain	Cable loss	Final Field Strength Peak	Average Limit	Margin for Peak v Average Limit +20dB	Result
GHz	dBuV/m		V/H	dB	dB	dB	dBuV/m	dBuV/m	dB	P/F
2.782	13.9	O1	Vertical	29.3	0	5.3	48.5	54.0	25.5	Pass
3.709	44.9	O1	Vertical	32.1	38.3	6	44.7	54.0	29.3	Pass
4.636	44.2	O1	Vertical	32.6	39.7	8.1	45.2	54.0	28.8	Pass
7.418	44.8	O1	Vertical	36.6	40.8	10.4	51.0	54.0	23.0	Pass
8.345	44.9	O1	Vertical	37.2	40.7	10.9	52.3	54.0	21.7	Pass
2.782	13.9	O1	Vertical	29.3	0	5.3	48.5	54.0	25.5	Pass
3.709	45.7	O1	Horizontal	32.1	38.3	6	45.5	54.0	28.5	Pass
4.636	44.9	O1	Horizontal	32.6	39.7	8.1	45.9	54.0	28.1	Pass
7.418	44.5	O1	Horizontal	36.6	40.8	10.4	50.7	54.0	23.3	Pass
8.345	44.7	O1	Horizontal	37.2	40.7	10.9	52.1	54.0	21.9	Pass

Final Field Strength Peak (dBuV/m) =Reading Peak (dBuV/m) + Antenna Factor (dB)- Pre-amp Gain (dB) +Cable Loss (dB)
Calculation Example **48.5 = 13.9 + 29.3 - 0 + 5.3**

Refer to Appendix C for Scans

Test Result: Pass

5.2 Radiated Spurious Emissions with External Antenna

5.2.1 Radiated Spurious Emission for 902.75MHz

Frequency	Reading Peak	EUT Orientation	Antenna Polarity	Antenna Factor	Preamp Gain	Cable loss	Final Field Strength Peak	Average Limit	Margin for Peak v Average Limit +20dB	Result
GHz	dBuV/m		V/H	dB	dB	dB	dBuV/m	dBuV/m	dB	P/F
2.708	14.5	O1	Vertical	29.1	0	5.1	48.7	54.0	25.3	Pass
3.611	45.0	O1	Vertical	31.7	38.2	5.8	44.3	54.0	29.7	Pass
4.514	45.4	O1	Vertical	32.6	39.1	7.5	46.4	54.0	27.6	Pass
5.417	45.0	O1	Vertical	34.3	39.2	8.2	48.3	54.0	25.7	Pass
8.125	46.1	O1	Vertical	36.7	41.1	10.9	52.6	54.0	21.4	Pass
9.028	44.0	O1	Vertical	37.8	38.9	10.2	53.1	54.0	20.9	Pass
2.708	13.9	O1	Horizontal	29.1	0	5.1	48.1	54.0	25.9	Pass
3.611	44.0	O1	Horizontal	31.7	38.2	5.8	43.3	54.0	30.7	Pass
4.514	45.3	O1	Horizontal	32.6	39.1	7.5	46.3	54.0	27.7	Pass
5.417	45.2	O1	Horizontal	34.3	39.2	8.2	48.5	54.0	25.5	Pass
8.125	46.0	O1	Horizontal	36.7	41.1	10.9	52.5	54.0	21.5	Pass
9.028	43.8	O1	Horizontal	37.8	38.9	10.2	52.9	54.0	21.1	Pass

Final Field Strength Peak (dBuV/m) =Reading Peak (dBuV/m) + Antenna Factor (dB)- Pre-amp Gain (dB) +Cable Loss (dB)
Calculation Example **48.7 = 14.5 + 29.1 - 0 + 5.1**

5.2.2 Radiated Spurious Emission for 914.75MHz

Frequency	Reading Peak	EUT Orientation	Antenna Polarity	Antenna Factor	Preamp Gain	Cable loss	Final Field Strength Peak	Average Limit	Margin for Peak v Average Limit +20dB	Result
GHz	dBuV/m		V/H	dB	dB	dB	dBuV/m	dBuV/m	dB	P/F
2.744	13.7	O1	Vertical	29.1	0	5.1	47.9	54.0	26.1	Pass
3.659	44.7	O1	Vertical	31.8	38.3	6	44.2	54.0	29.8	Pass
4.574	44.0	O1	Vertical	32.7	39.7	8.1	45.1	54.0	28.9	Pass
7.318	45.1	O1	Vertical	36.4	40.6	10.1	51.0	54.0	23.0	Pass
8.233	45.3	O1	Vertical	36.8	40.9	11	52.2	54.0	21.8	Pass
9.148	44.0	O1	Vertical	37.8	38.8	10.1	53.1	54.0	20.9	Pass
2.744	14.1	O1	Horizontal	29.1	0	5.1	48.3	54.0	25.7	Pass
3.659	45.4	O1	Horizontal	31.8	38.3	6	44.9	54.0	29.1	Pass
4.574	44.6	O1	Horizontal	32.7	39.7	8.1	45.7	54.0	28.3	Pass
7.318	45.0	O1	Horizontal	36.4	40.6	10.1	50.9	54.0	23.1	Pass
8.233	45.0	O1	Horizontal	36.8	40.9	11	51.9	54.0	22.1	Pass
9.148	43.7	O1	Horizontal	37.8	38.8	10.1	52.8	54.0	21.2	Pass

Final Field Strength Peak (dBuV/m) =Reading Peak (dBuV/m) + Antenna Factor (dB)- Pre-amp Gain (dB) +Cable Loss (dB)
Calculation Example **44.2 = 44.7 + 31.8 - 38.3 + 6**

5.2.3 Radiated Spurious Emission for 927.25MHz

Frequency	Reading Peak	EUT Orientation	Antenna Polarity	Antenna Factor	Preamp Gain	Cable loss	Final Field Strength Peak	Average Limit	Margin for Peak v Average Limit +20dB	Result
GHz	**dBuV/m**		**V/H**	**dB**	**dB**	**dB**	**dBuV/m**	**dBuV/m**	**dB**	**P/F**
2.782	13.7	O1	Vertical	29.3	0	5.3	48.3	54.0	25.7	Pass
3.709	45.5	O1	Vertical	32.1	38.3	6	45.3	54.0	28.7	Pass
4.636	44.2	O1	Vertical	32.6	39.7	8.1	45.2	54.0	28.8	Pass
7.418	45.4	O1	Vertical	36.6	40.8	10.4	51.6	54.0	22.4	Pass
8.345	45.8	O1	Vertical	37.2	40.7	10.9	53.2	54.0	20.8	Pass
2.782	14.3	O1	Vertical	29.3	0	5.3	48.9	54.0	25.1	Pass
3.709	44.9	O1	Horizontal	32.1	38.3	6	44.7	54.0	29.3	Pass
4.636	43.7	O1	Horizontal	32.6	39.7	8.1	44.7	54.0	29.3	Pass
7.418	44.9	O1	Horizontal	36.6	40.8	10.4	51.1	54.0	22.9	Pass
8.345	45.7	O1	Horizontal	37.2	40.7	10.9	53.1	54.0	20.9	Pass

Final Field Strength Peak (dBuV/m) =Reading Peak (dBuV/m) + Antenna Factor (dB)- Pre-amp Gain (dB) +Cable Loss (dB)
Calculation Example **48.3 = 13.7 + 29.3 - 0 + 5.3**

Average measurement not performed for frequencies where the peak measurement was below the average limit.

Refer to Appendix D for Scans

Test Result: Pass

5.3 Output Power Radiated

5.3.1 Internal Antenna

Frequency	Reading Peak	EUT Orientation	Antenna Polarity	Antenna Factor	Preamp Gain	Cable loss	Final Field Strength Peak	Transmitted Power	Limit	Margin	Result
MHz	dBuV/m		V/H	dB	dB	dB	dBuV/m	dBm	dBm	dB	P/F
902.750	100.6	O1	Vertical	23.5	0	5.3	129.4	34.2	36.0	1.8	Pass
902.750	100.7	O1	Horizontal	23.5	0	5.3	129.5	34.3	36.0	1.7	Pass
914.750	101.5	O1	Vertical	23.5	0	5.4	130.4	35.2	36.0	0.80	Pass
914.750	101.5	O1	Horizontal	23.5	0	5.4	130.4	35.2	36.0	0.80	Pass
927.250	100.3	O1	Vertical	23.7	0	5.5	129.5	34.3	36.0	1.70	Pass
927.250	100.3	O1	Horizontal	23.7	0	5.5	129.5	34.3	36.0	1.70	Pass

Final Field Strength Peak (dBuV/m) =Reading Peak (dBuV/m) + Antenna Factor (dB)- Pre-amp Gain (dB) +Cable Loss (dB)

Calculation Example 129.4 = 100.6 + 23.5 - 0 + 5.3

Transmitted power (dBm) = Final Field Strength Peak (dBuV/m) -95.2 dB
Calculation Example **34.2 = 129.4 - 95.2**

Test Result: Pass

5.3.2 External Antenna

Frequency	Reading Peak	EUT Orientation	Antenna Polarity	Antenna Factor	Preamp Gain	Cable loss	Final Field Strength Peak	Transmitted Power	Limit	Margin	Result
MHz	dBuV/m		V/H	dB	dB	dB	dBuV/m	dBm	dBm	dB	P/F
902.750	101.0	O1	Vertical	23.5	0	5.3	129.8	34.6	36.0	1.4	Pass
902.750	101.4	O1	Horizontal	23.5	0	5.3	130.2	35.0	36.0	1	Pass
914.750	101.9	O1	Vertical	23.5	0	5.4	130.8	35.6	36.0	0.40	Pass
914.750	102.1	O1	Horizontal	23.5	0	5.4	131.0	35.8	36.0	0.20	Pass
927.250	101.1	O1	Vertical	23.7	0	5.5	130.3	35.1	36.0	0.90	Pass
927.250	101.8	O1	Horizontal	23.7	0	5.5	131.0	35.8	36.0	0.20	Pass

Final Field Strength Peak (dBuV/m) =Reading Peak (dBuV/m) + Antenna Factor (dB)- Pre-amp Gain (dB) +Cable Loss (dB)

Calculation Example 129.8 = 101 + 23.5 - 0 + 5.3

Transmitted power (dBm) = Final Field Strength Peak (dBuV/m) -95.2 dB
Calculation Example **34.6 = 129.8 - 95.2**

Test Result: Pass

6 List of Test Equipment

Instrument	Manufacturer	Model	Serial Num	CEI Ref	Cal Date	Cal Interval Months
Microwave Preamplifier	Hewlett Packard	83017A	3123A00175	805	30-Sep-23	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	24-May-23	36
Receiver N9038A EMI 3Hz - 8.4 GHz	Keysight	MXE N9038A	MX60320104	1204	28-Feb-23	36
Antenna Horn	EMCO	3115	2363	1100	22-Feb-23	36
Fully Anechoic Chamber	CEI	FAR 3M	906	906	24-Jul-22	36
Anechoic Chamber	CEI	SAR 10M	845	845	22-Nov-22	36
Antenna Biconical	Schwarzbeck	VHBB 9124	9124 667	871	07-Oct-21	36
Antenna Log Periodic	Chase	UPA6108	1072	609	10-Sep-21	36
Antenna Horn Standard Gain 18-26.5GHz	A-Info	LB-42-25-C-KF	J2021091103028	877	30-Jul-23	12
Cable 20m				1213	16-May-23	12
Cable purple Ktype 1.8m				917	30-Jul-23	12
Cable HF Ktype 1.5m				705	30-Jul-23	12

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.

Appendix A: Conducted Measurements Spurious Emissions

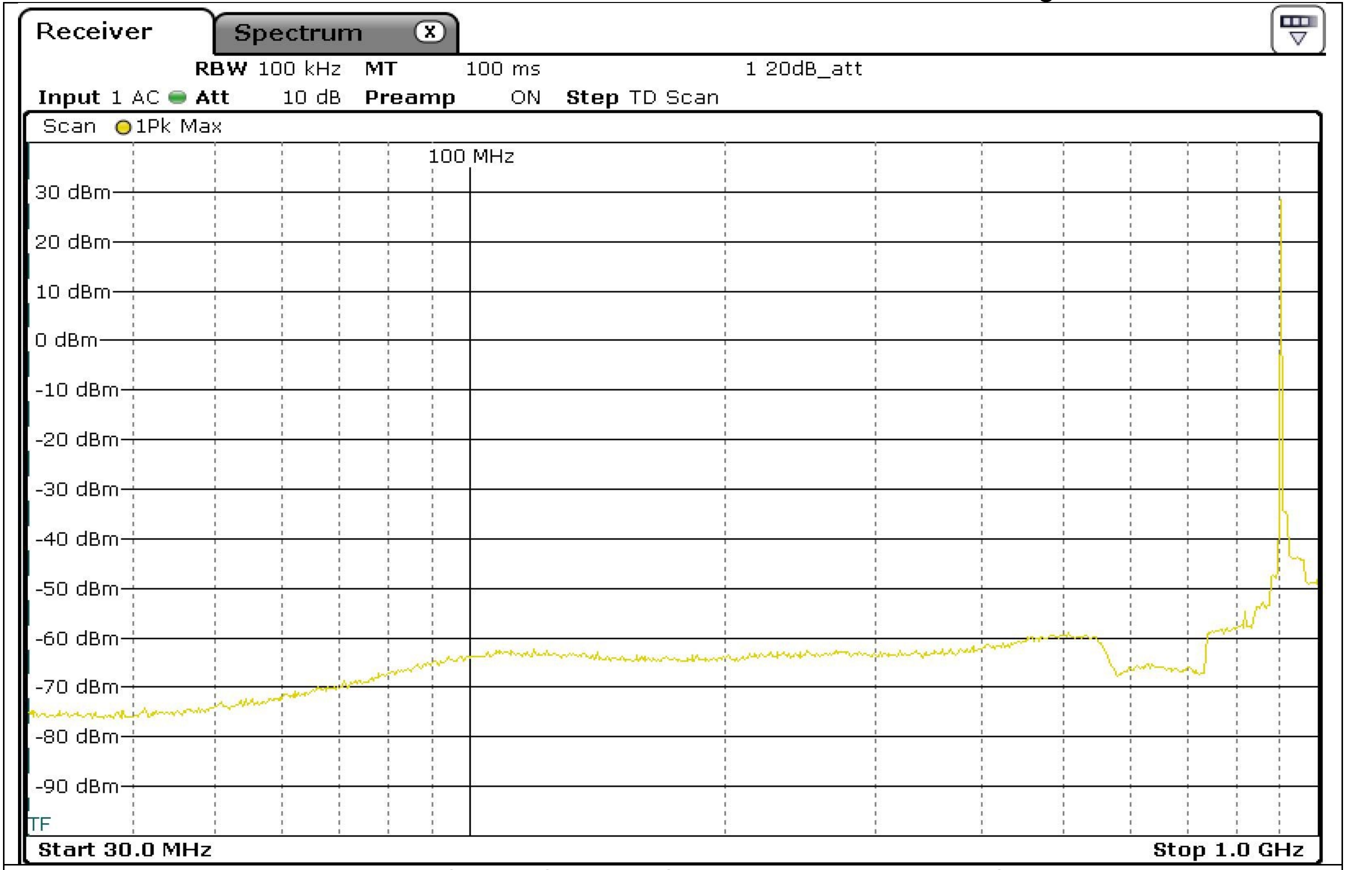

Fig A1: Low Channel Conducted Spurious Emissions 30MHz - 1GHz

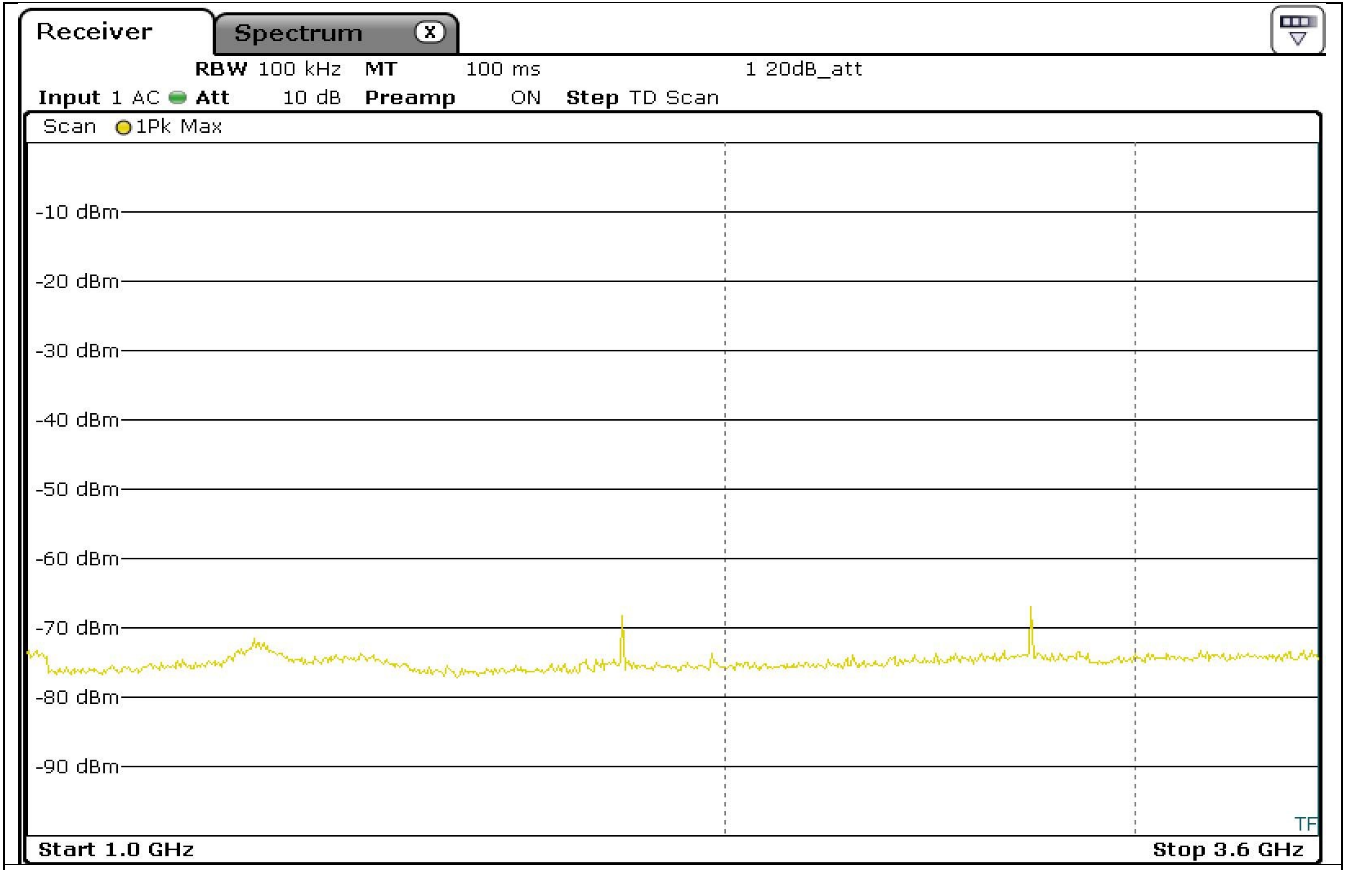

Fig A2: Low Channel Conducted Spurious Emissions 1GHz - 3.6GHz

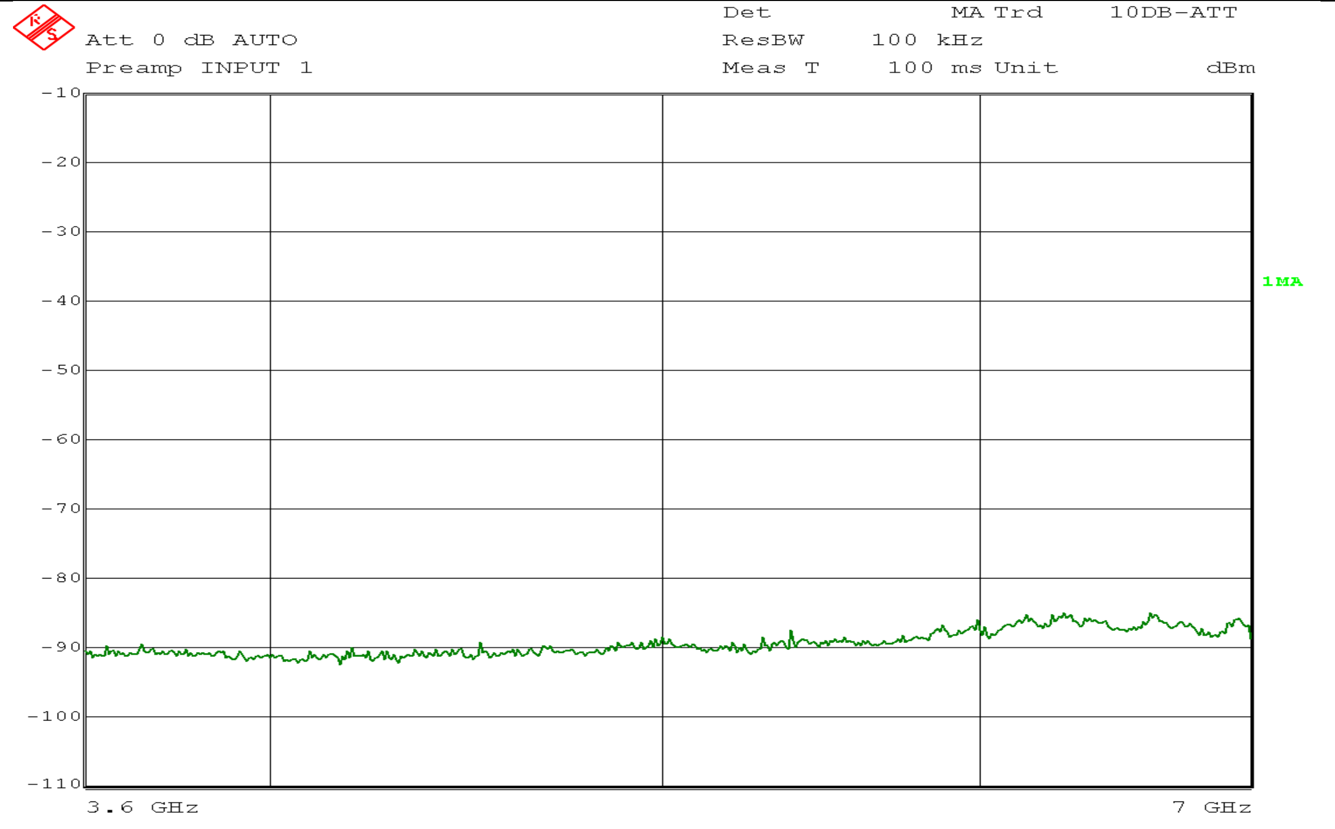

Fig A3: Low Channel Conducted Spurious Emissions 3.6GHz -7GHz

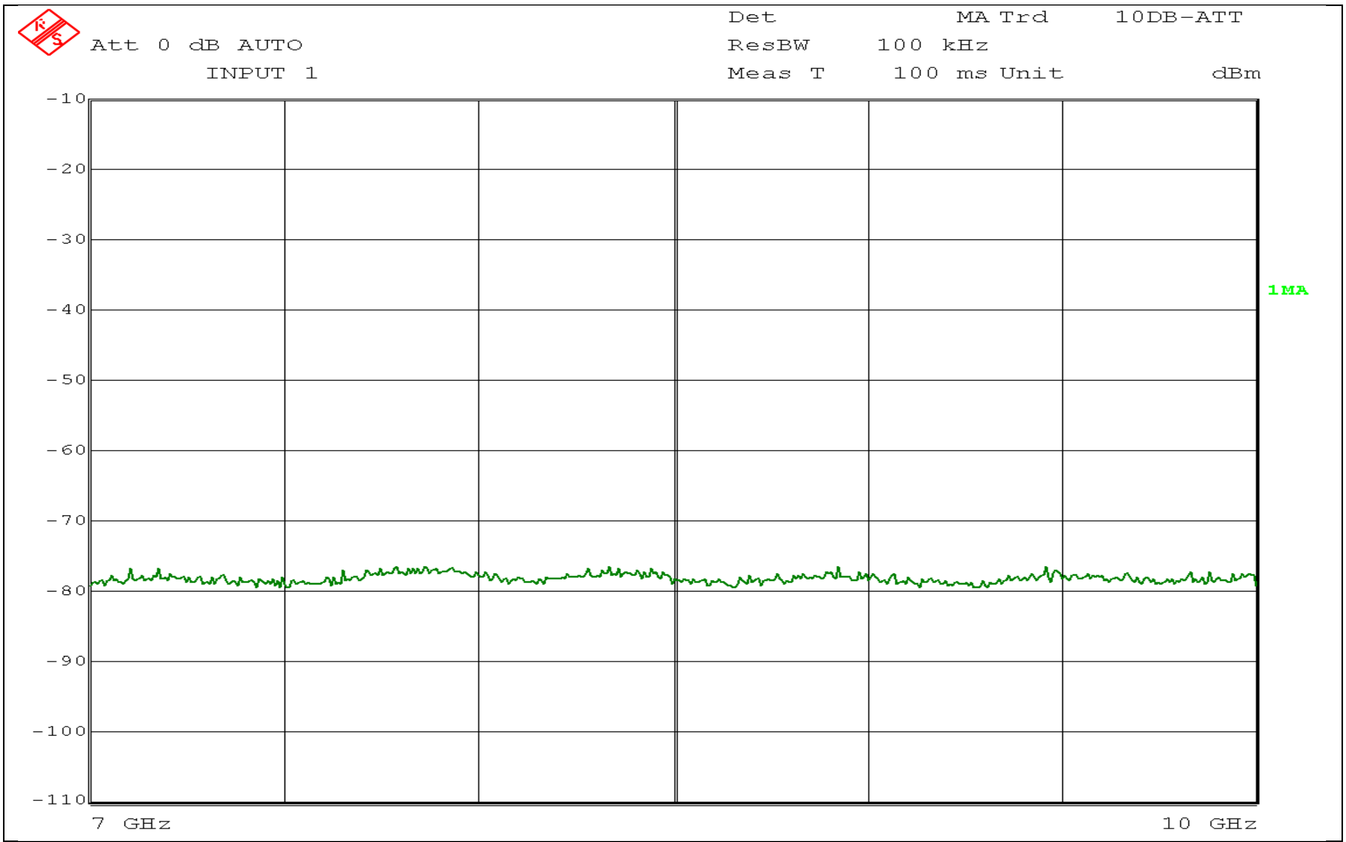

Fig A4: Low Channel Conducted Spurious Emissions 7GHz -10GHz

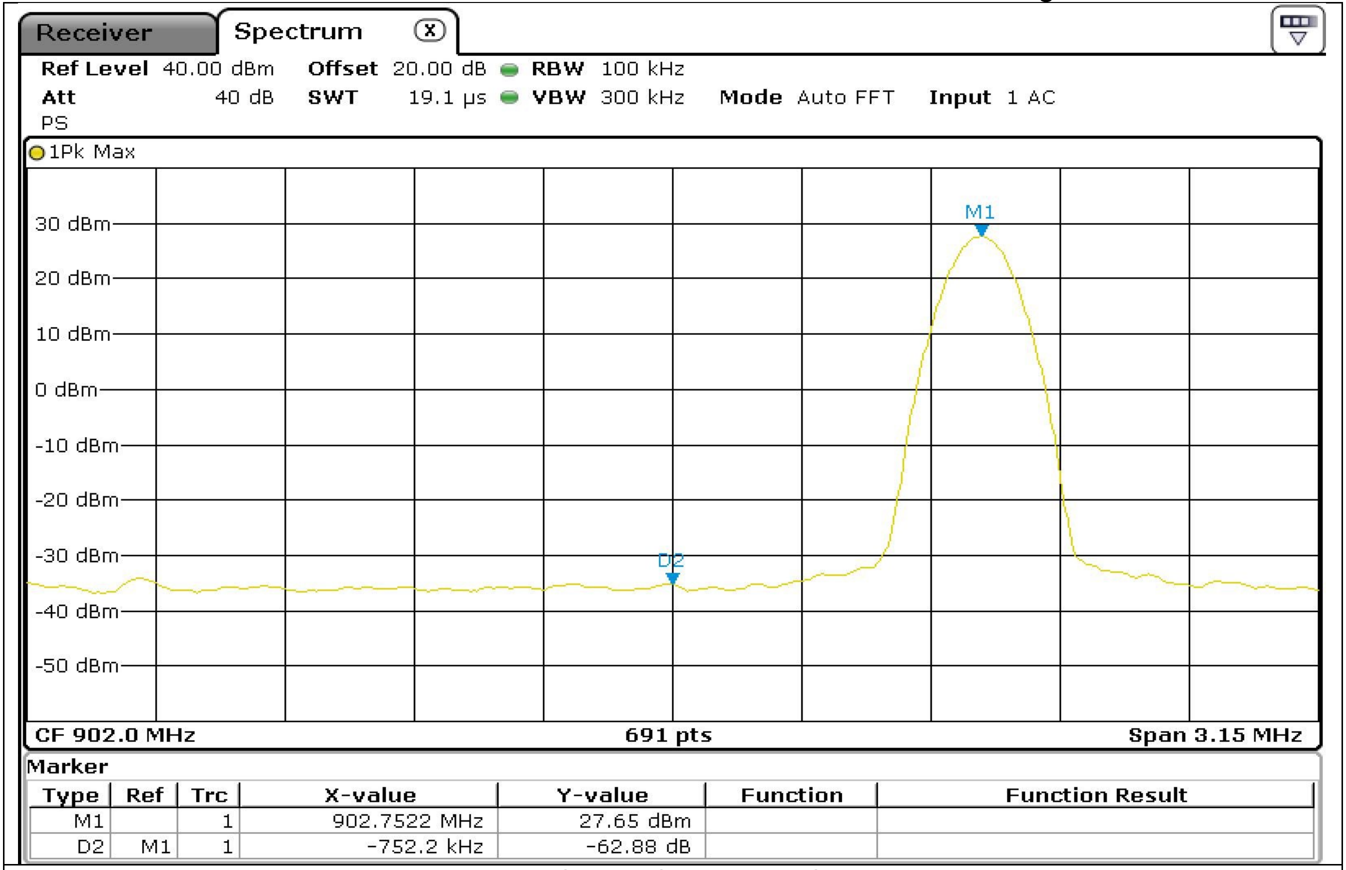

Fig A5: Low Channel Carrier Power Conducted

Appendix B: Conducted Tests for Band Edges

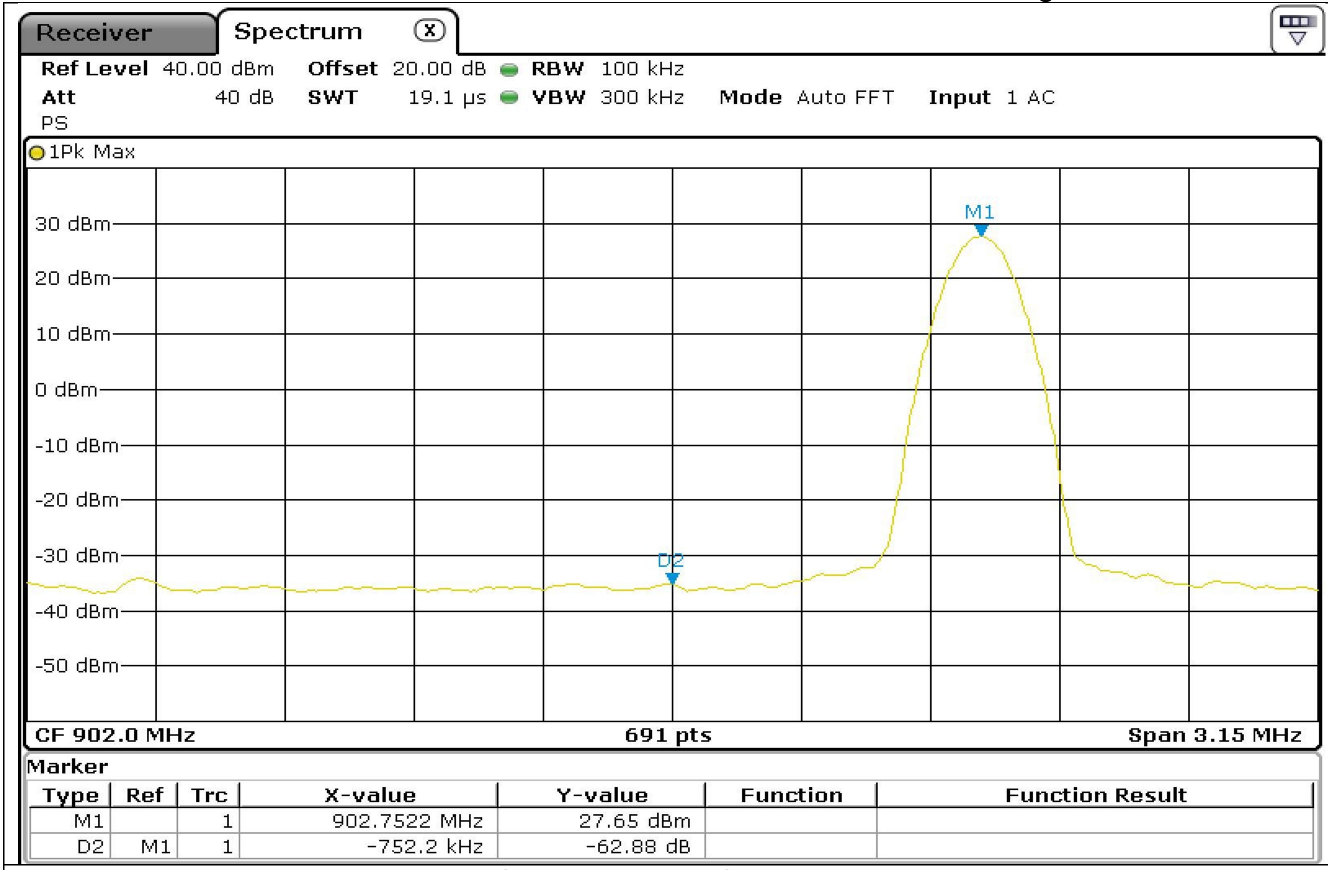

Fig B1: Low Channel Band Edge Conducted Non-Hopping

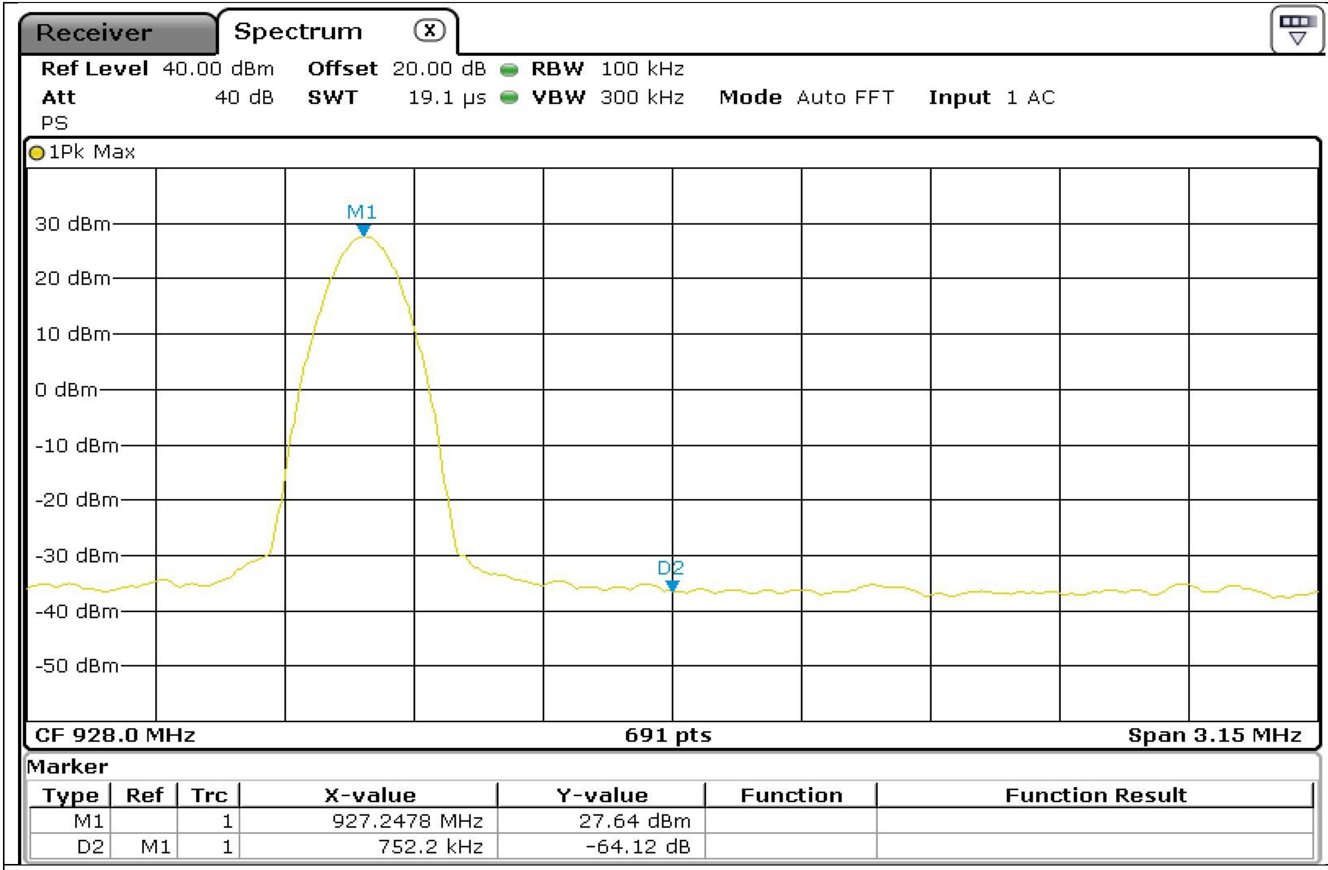

Fig B2: High Channel Band Edge Conducted Non-Hopping

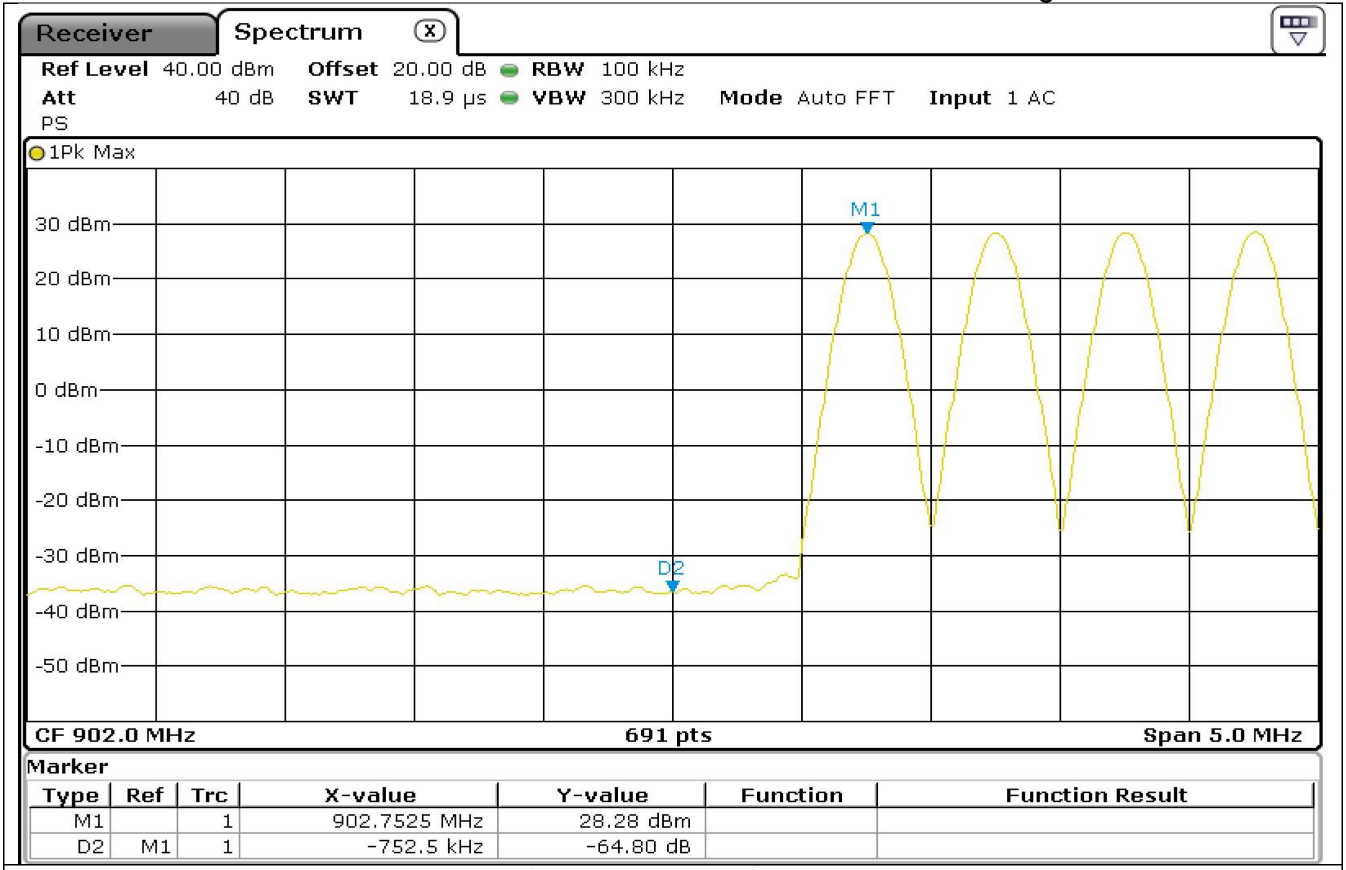

Fig B3: Low Channel Band Edge Conducted Hopping

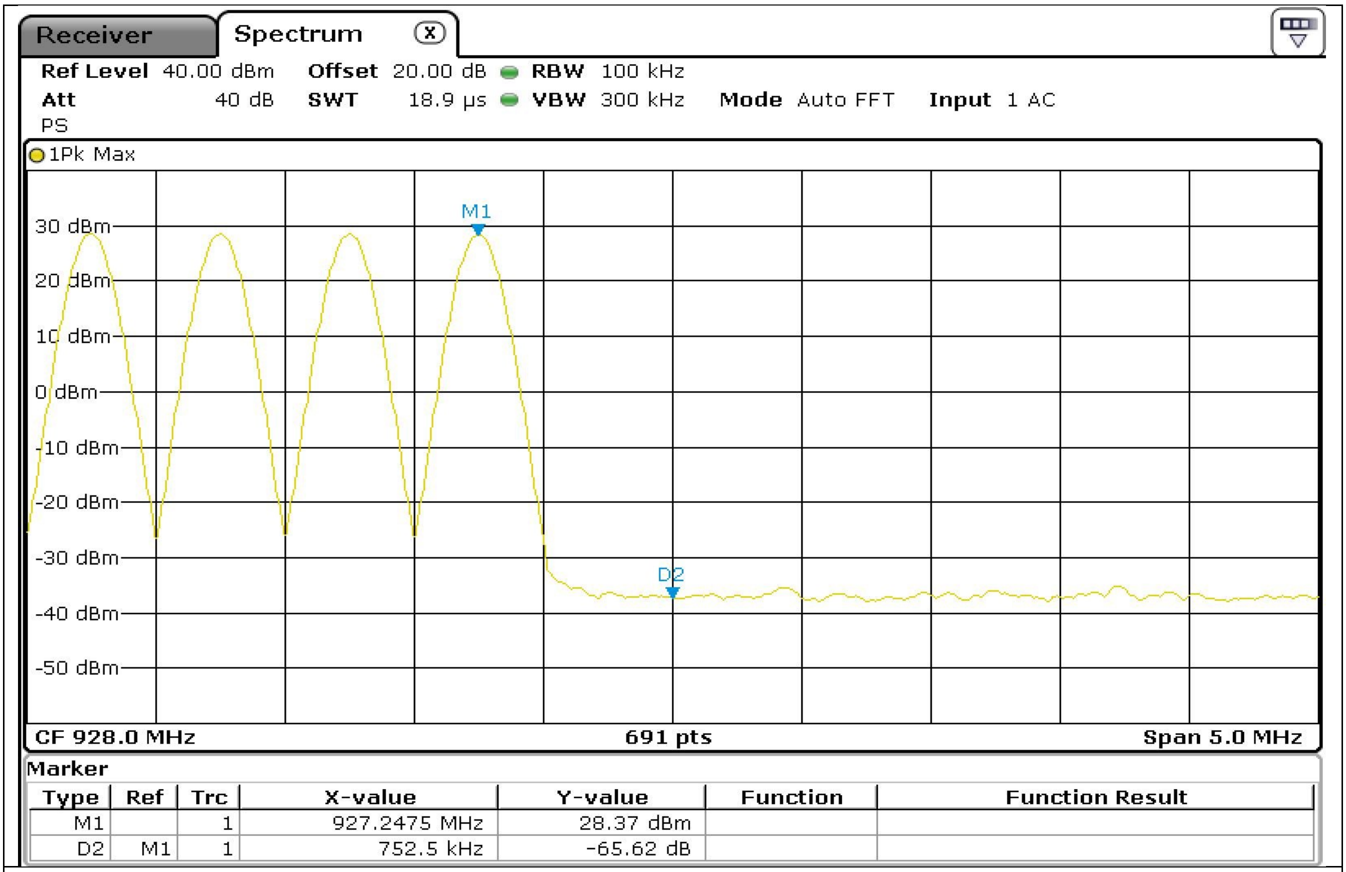

Fig B4: High Channel Band Edge Conducted Hopping

Appendix C: Radiated Spurious Emissions with Internal Antenna

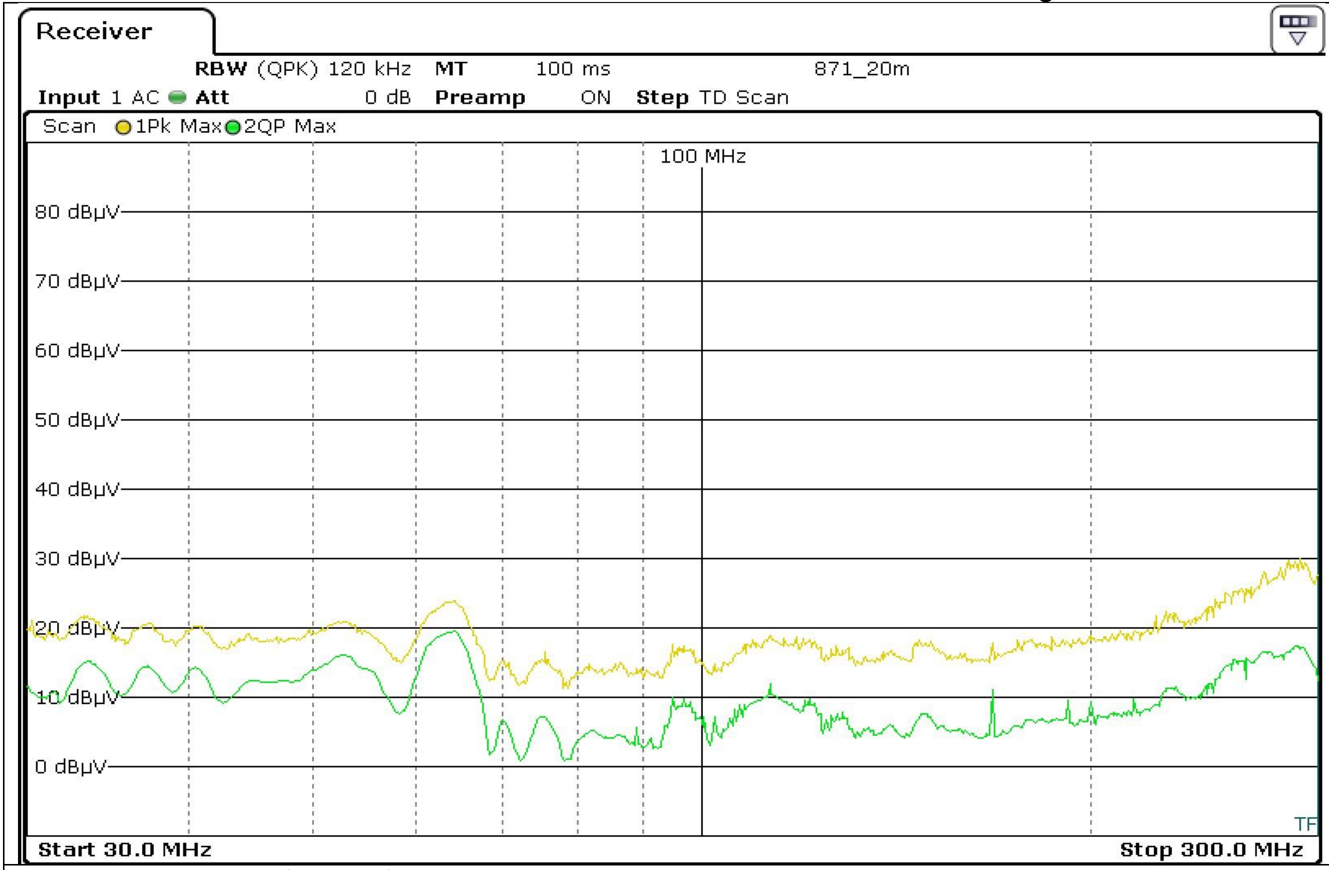

Fig C1: Low Channel Radiated Emissions 30MHz - 300MHz, Vertical, 3metres

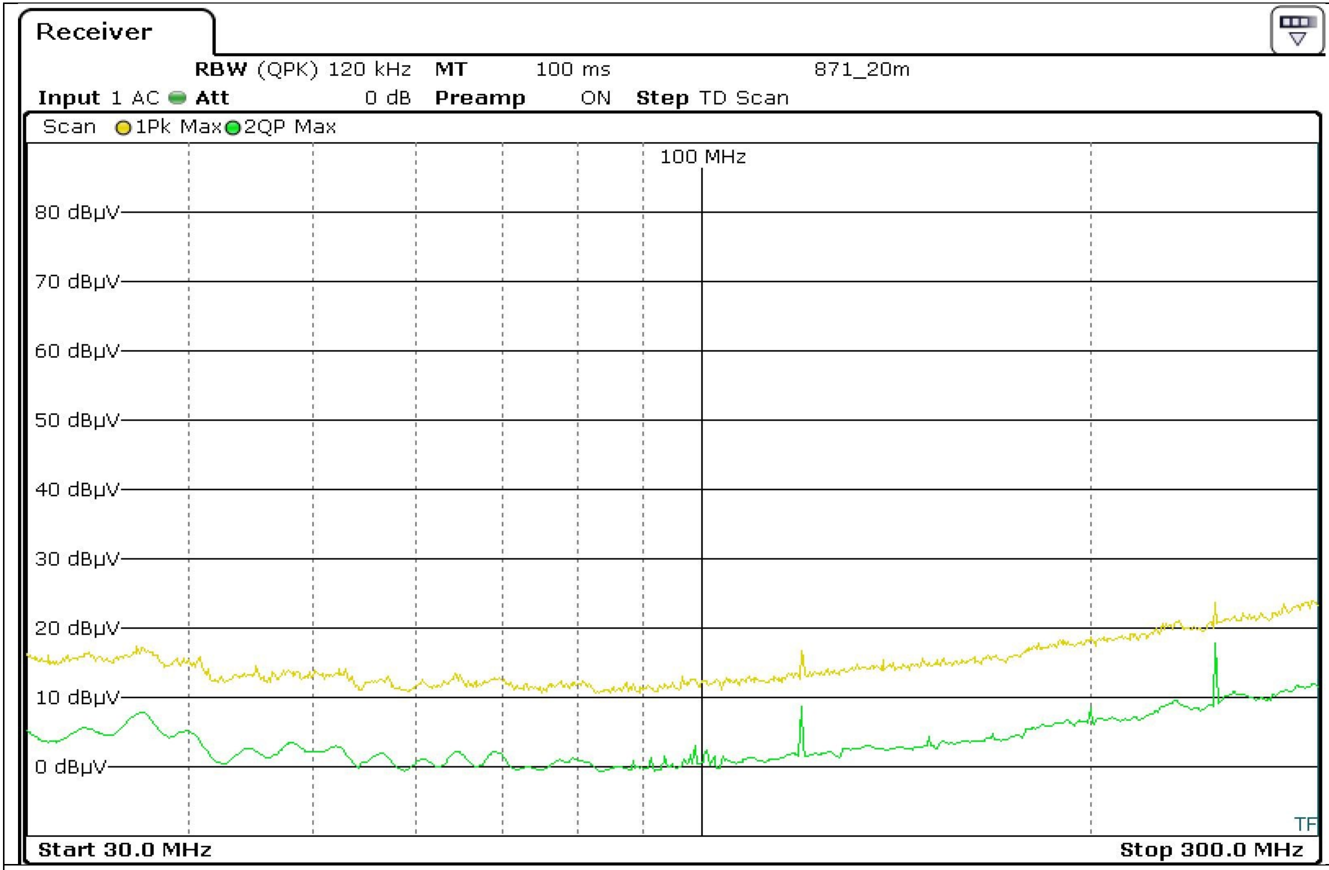

Fig C2: Low Channel Radiated Emissions 30MHz - 300MHz, Horizontal, 3metres

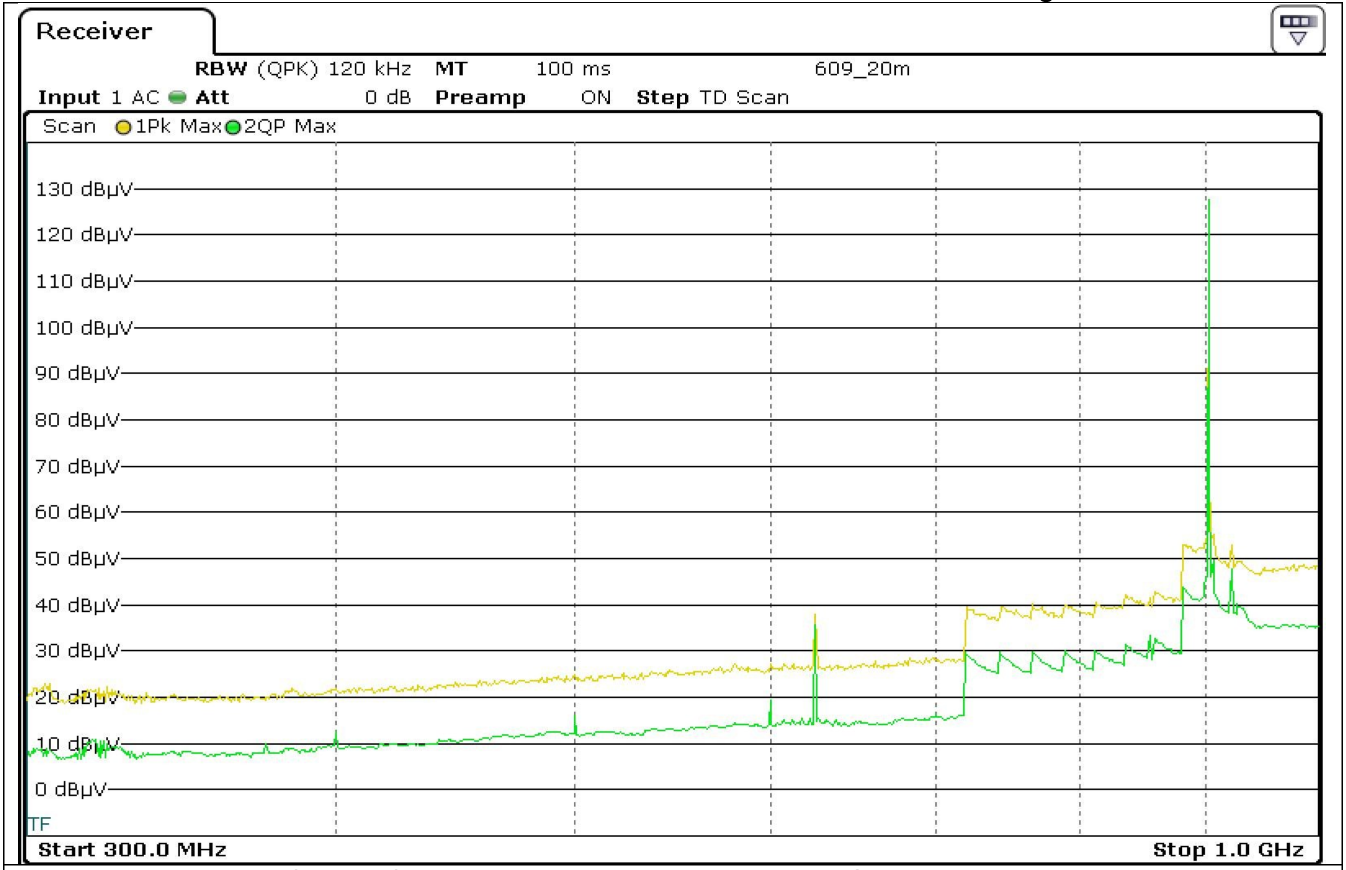

Fig C3: Low Channel Radiated Emissions 300MHz - 1GHz, Vertical, 3metres

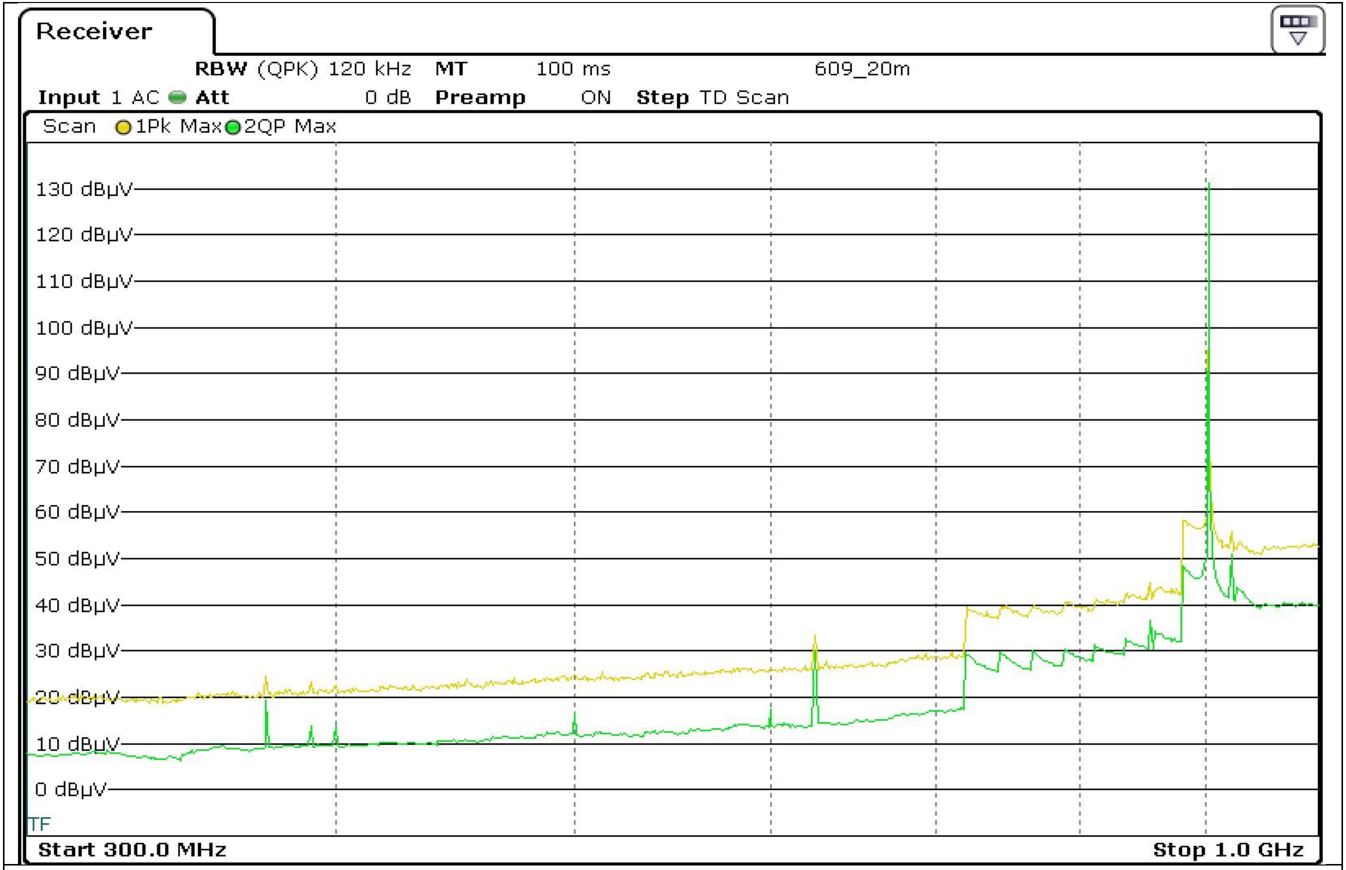

Fig C4: Low Channel Radiated Emissions 300MHz - 1GHz, Horizontal, 3metres

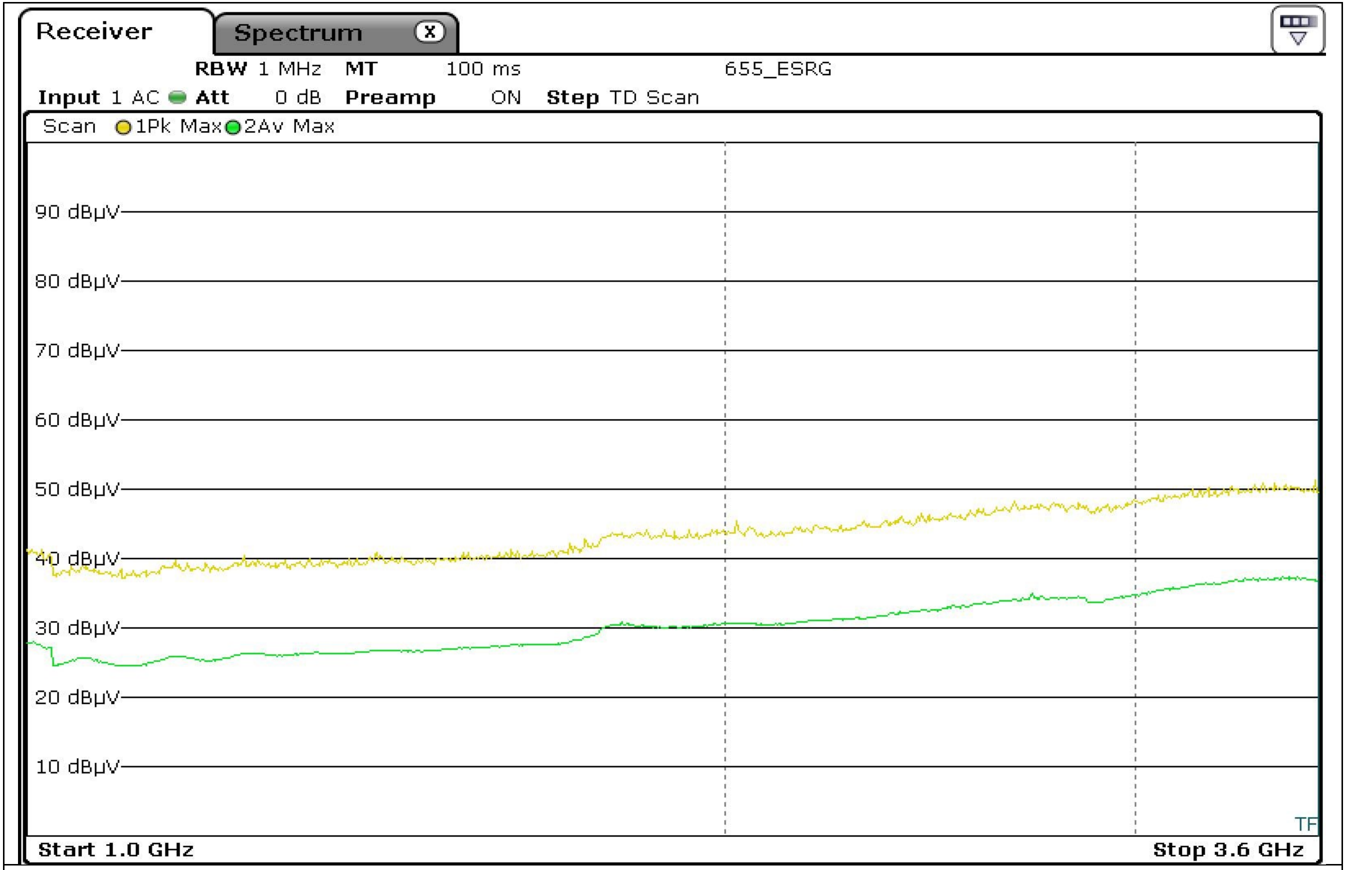

Fig C5: Low Channel Radiated Emissions 1GHz - 3.6GHz, Vertical, 3metres

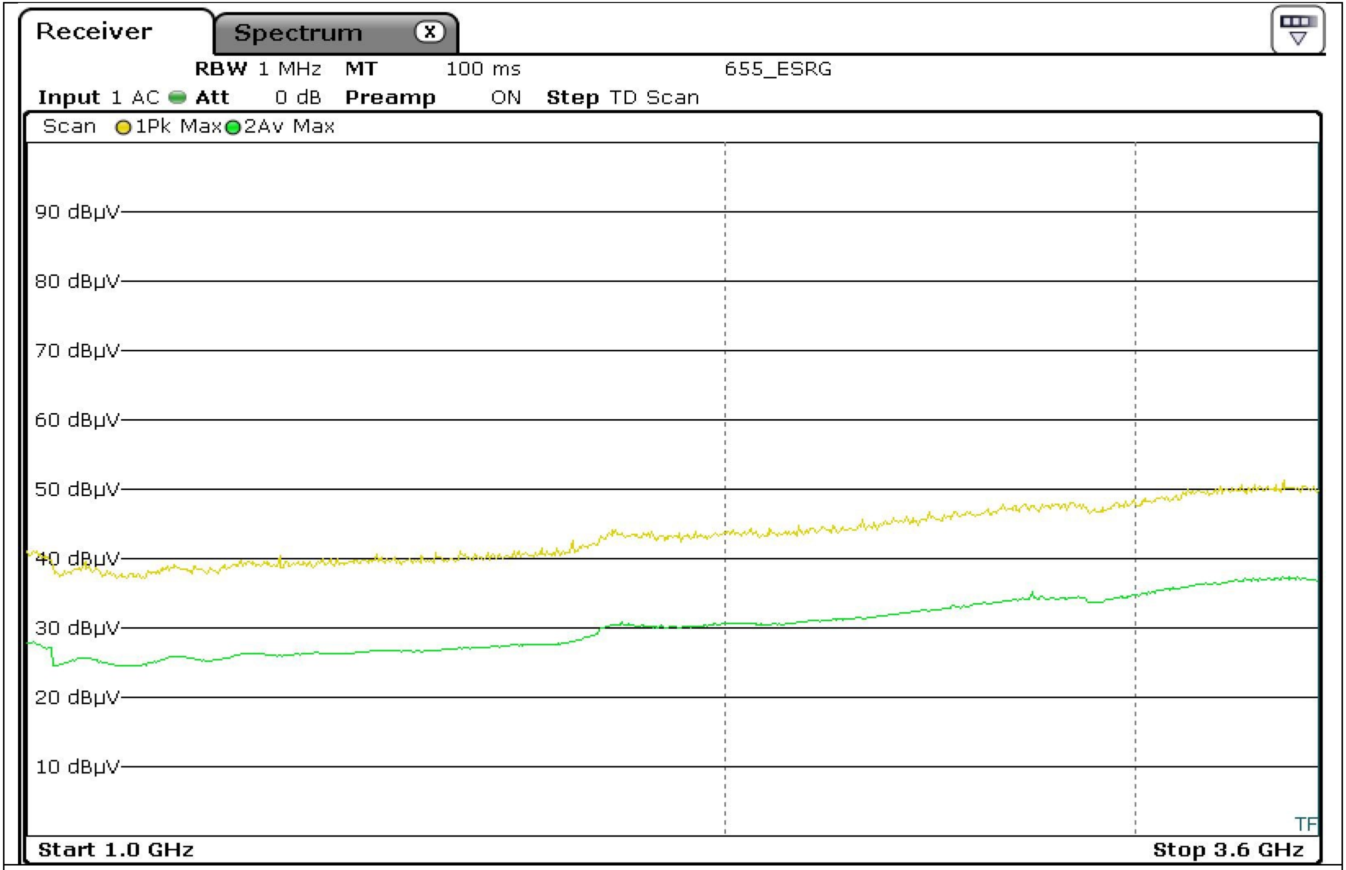

Fig C6: Low Channel Radiated Emissions 1GHz - 3.6GHz, Horizontal, 3metres

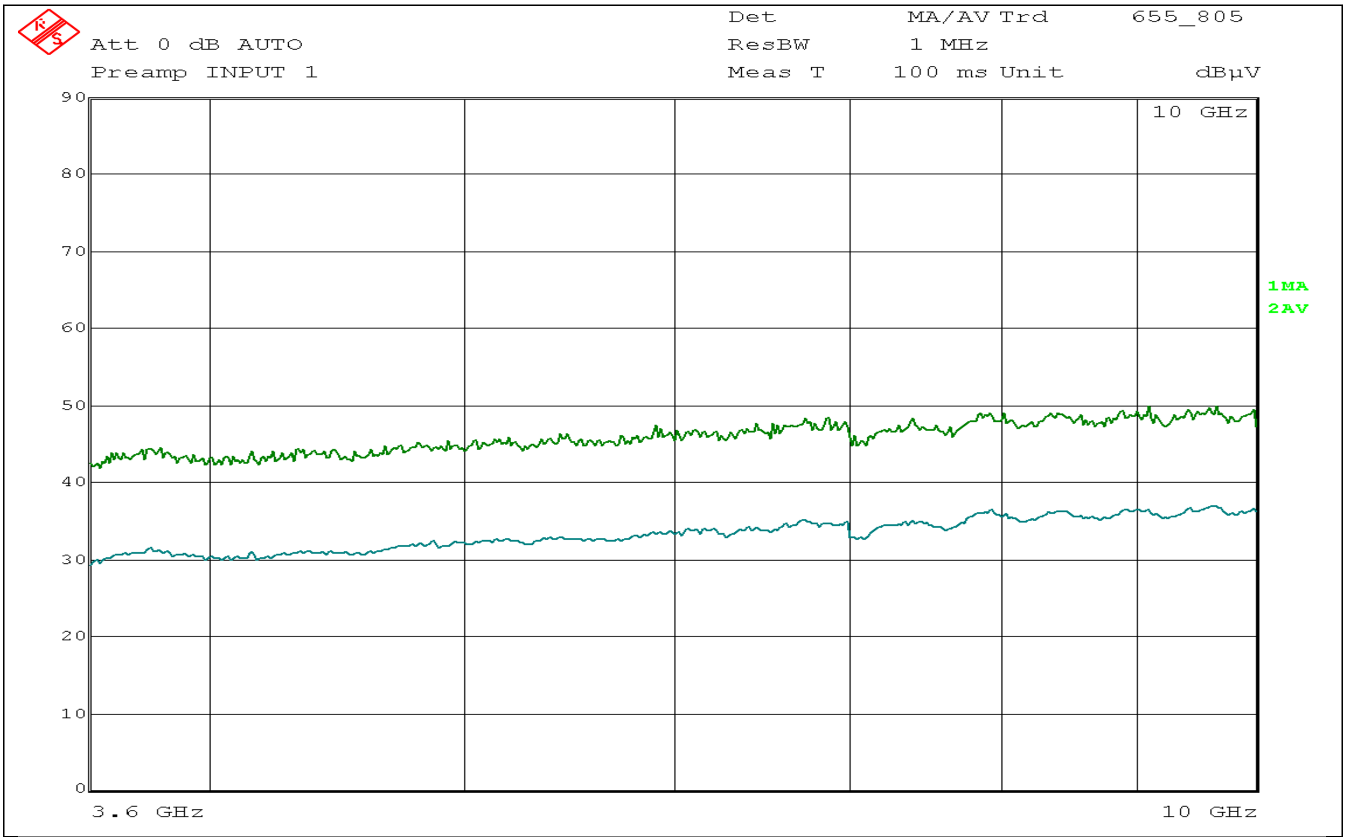

Fig C7: Low Channel Radiated Emissions 3.6GHz - 10GHz, Vertical, 3metre

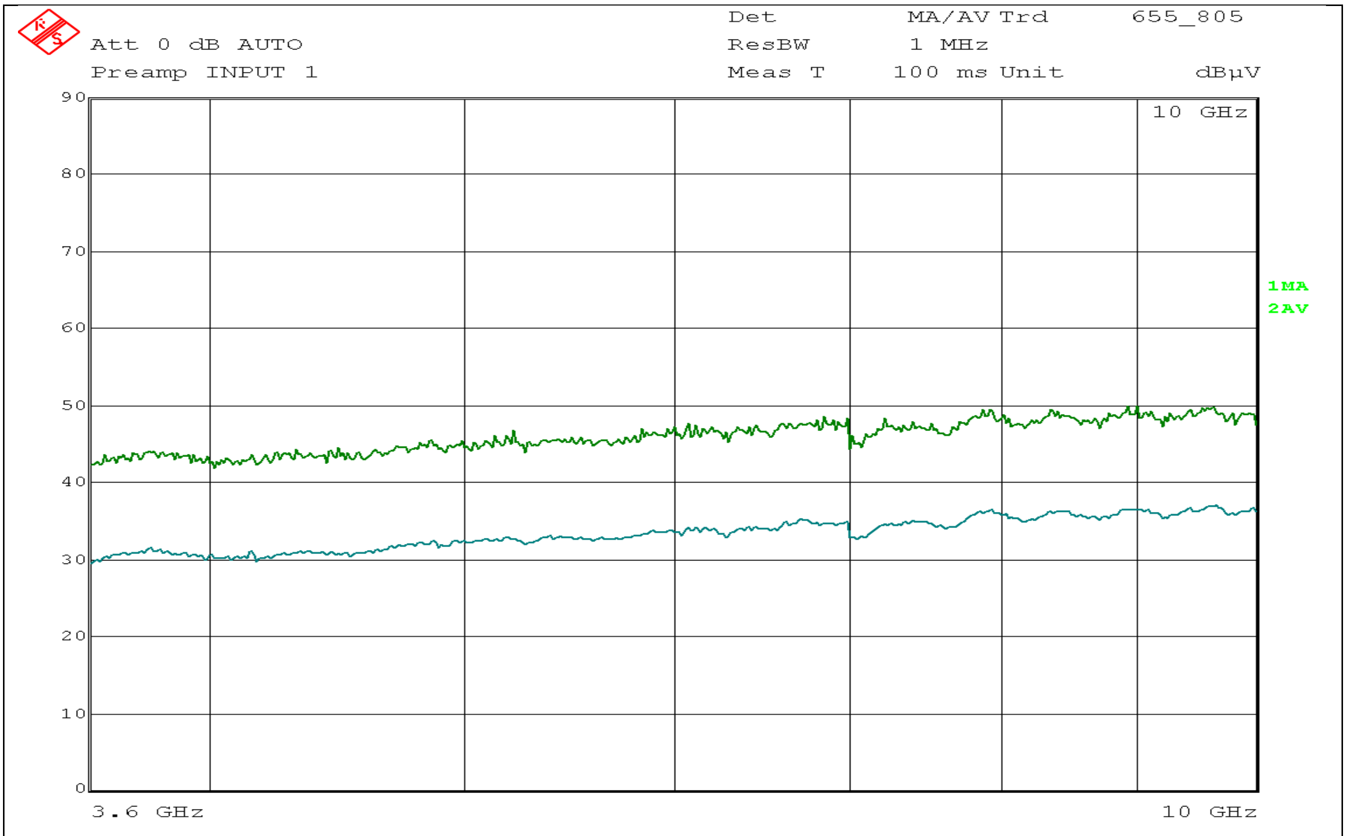

Fig C8: Low Channel Radiated Emissions 3.6GHz - 10GHz, Horizontal, 3metre