

Test Report
Testing of a T2 terminal
13.56MHz
For
Mitrefinch Ltd

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Project number: C4558



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This test report relates only to the unit(s) tested



1574

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1 Introduction

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Website	http://www.yorkemc.co.uk
UKAS Testing No.	1574

1.1 UKAS Accreditation

Opinions and interpretations expressed herein are outside the scope of UKAS Accreditation.

Please note the report is unaccredited for the scope of our UKAS accreditation.

Eurofins York latest accreditation schedule can be found at;

http://www.ukas.org/testing/lab_detail.asp?lab_id=989&location_id=&vMenuOption=3

1.2 Customer Information

Company name	Mitrefinch Ltd
Address	Mitrefinch House
	Green Lane Trading Estate,
	Clifton
	York
	North Yorkshire
	YO30 5YY
Tel:	01904 693115
Contact	Mr Chris Flynn
Email	Chris.Flynn@mitrefinch.co.uk

1 General Information

Customer supplied test plan ref.	N/A
Date of receipt of EUT	5 th November 2020
Method of receipt	Brought by customer
Date(s) of test(s)	2 nd February 2021 to 3 rd March 2021
Date(s) when EUT was out of laboratory's control	None
Method of disposal	Taken by customer
Personnel witnessing tests	N/A

Any other relevant information: The apparatus also contains a WiFi module:

This test report only covers the 13.56MHz operation of the product.

2.1 Equipment Under Test

EUT name	T2 terminal
FCC ID	2AZ53-T2
Manufacturer	DJ Assembly Ltd Atlas House, Link Business Park, Osbaldwick, York, YO10 3JB, United Kingdom BitBox Limited, 10 Whitney Road Daneshill Industrial Estate, Basingstoke, Hampshire, RG24 8NS, United Kingdom
Description	Secure Access to a Secure Facility. It is a wall mounted display with: External Mains PSU to 15 to 19VDC Input Raspberry Pie Processor Bio-metric Finger Print Sensor Ethernet Internal Camera Microphone Speaker 4 Relay banks with 12V 2 N/C and 2 N/O connections per relay. So 8 N/C and 8 N/O GPIO Digital 12 V 2 pole. 8 outputs 4 inputs. WIEGAND Serial Port with external PIN for Clock Data 5V Micro USB LED's 14", 7" and 4" Display versions Test 14" for EMC Plastic enclosure (IP66 Rated)
Operating frequency – inductive mode	13.56MHz
Modulation scheme(s)	Miller encoding
Power sources	AC mains
Type of antenna	PCB loop integral
<p>General remarks</p> <p>The test results presented in this report relate only to the item(s) tested. This report shall not be reproduced, except in full, without the written approval of the issuing test laboratory. Throughout this report a point is used as the decimal separator. The following abnormalities/departures from standard conditions were applied during the testing:</p> <p>None</p>	

1.2 Summary

FCC Rule	47 CFR Part 15 Radio Frequency Devices; Subpart C Intentional Radiators
----------	---

Requirement	Regulation	Result Summary
47 CFR Part 15C Section 15.225 Operation within the band 13.110 to 14.010MHz Test standard: ANSI C63.10	Section 15.225 (a) – field strength within the band 13.553 to 13.567MHz*.	Pass
	Section 15.225(a) - Field strength within the bands 13.410MHz-13.552MHz and 13.567MHz to 13.710MHz	Pass
	Section 15.225(b) - Field strength within the bands 13.110MHz-13.410MHz and 13.710MHz to 14.010MHz	Pass
	Section 15.225 (d) – field strength outside the band 13.553 to 13.567MHz; general radiated emission limits in Section 15.209, 9kHz to 1GHz*	Pass
	Section 15.225 (e) – Frequency tolerance of the carrier signal	Pass
47 CFR Part 15C Section 15.207 Test standard ANSI C63.10	Mains conducted emissions 150kHz to 30MHz Applicable if the apparatus connects to the AC supply directly or via other apparatus.	Pass
47 CFR 15.31(e) Test standard ANSI C63.10	Measurements of the variation of the input power or the radiated signal level of the fundamental frequency component of the emission, as appropriate, shall be performed with the supply voltage varied between 85% and 115% of the nominal rated supply voltage. For battery operated equipment, the equipment tests shall be performed using a new battery	Pass

ISED Regulation	RSS-Gen — General Requirements for Compliance of Radio Apparatus Issue 5 April 2018 RSS 210 Licence-Exempt Radio Apparatus: Category I Equipment Issue 10 December 2019
-----------------	--

Requirement	Regulation	Result Summary
Spectrum Mask – Magnetic field emissions Test standard: ANSI C63.10-2013	RSS-210 Annex B.6 (a)(i) band 13.553 to 13.567MHz*.	Pass
	RSS-210 Annex B.6 (a)(ii) bands 13.410MHz-13.552MHz and 13.567MHz to 13.710MHz	Pass
	RSS-210 Annex B.6 (a)(iii) 13.110MHz-13.410MHz and 13.710MHz to 14.010MHz	Pass
	RSS-GEN Issue 5 clause 8.9 general field strength limits for frequencies outside the band 13.110-14.010 MHz general radiated emission limits in, 9kHz to 1GHz*	Pass
	RSS GEN issue 5 Clause 8.11 Frequency tolerance of the carrier signal	Pass
Mains conducted emissions Test standard ANSI C63.10	RSS-GEN Issue 5 Clause 8.8 Mains conducted emissions 150kHz to 30MHz Applicable if the apparatus connects to the AC supply directly or via other apparatus.	Pass
99% Occupied bandwidth Test standard ANSI C63.10		Pass
Test standard ANSI C63.10	Measurements of the variation of the input power or the radiated signal level of the fundamental frequency component of the emission, as appropriate, shall be performed with the supply voltage varied between 85% and 115% of the nominal rated supply voltage. For battery operated equipment, the equipment tests shall be performed using a new battery	Pass

2 Test Results

2.1 AC Mains conducted emissions

3.1.1 Test Specification

Test standard (FCC)	Test standard (ISED)	Test description	Class/limit
CFR 47 Part 15C Section 15.225(b) and 15.225(c) & ANSI C63.10-2013	RSS-GEN Clause 8.8 & ANSI C63.10-2013	AC Mains conducted emissions	As specified in section 15.225(b) and 15.225(c)

Standard	ANSI C63.10:2013
Measurement Uncertainty	The reported uncertainty of measurement $y \pm U$, where expanded uncertainty U is based on a standard uncertainty multiplied by a coverage factor of $k=2$, providing a level of confidence of approximately 95 % is +/- 3.45dB

3.1.2 Power Line Emission Limits

Frequency (MHz)	Class A (dBµV)		Class B (dBµV)	
	Quasi Peak	Average	Quasi Peak	Average
0.15 – 0.5	79.0	66.0	66 – 56*	56 – 46*
0.5 – 5.0	73.0	60.0	56.0	46.0
5.0 - 30	73.0	60.0	60.0	50.0

Note: * The limit decreases linearly with the logarithm of the frequency in the range

3.1.3 Receiver Settings

Receiver Parameters	Setting
Detector Function	Quasi Peak and Average
Start Frequency	150kHz
Stop Frequency	30MHz
Resolution Bandwidth	10kHz
Video Bandwidth	Auto

3.1.4 Procedure and Test Software Version

Eurofins York test procedure	CEP19 Issue 5
Test software	RadiMation Version 2016.1.6

Date of Test

24th February 2021

Test Area

LAB 2

Tested By

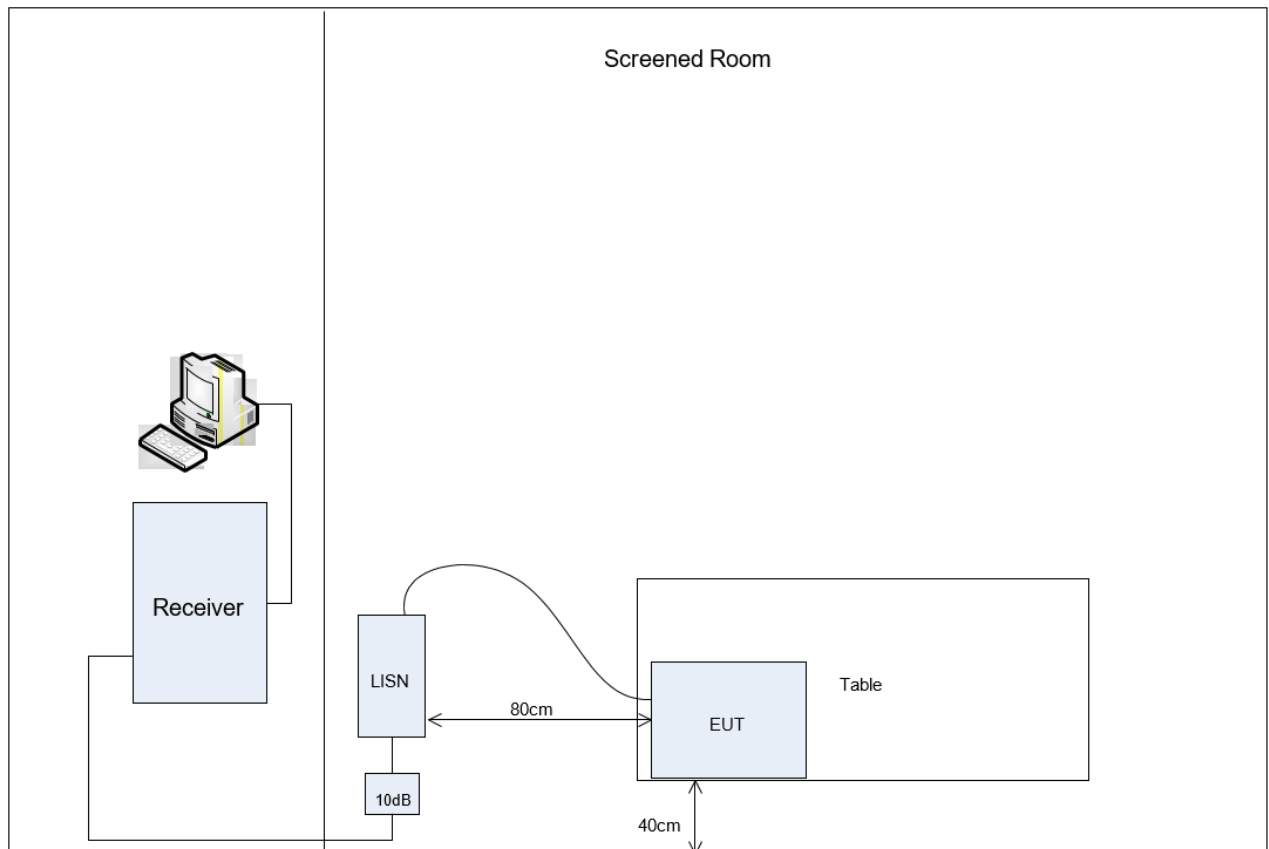
S Mohammed

Test Setup

This test was applied to the EUT's Live and Neutral lines. The EUT was configured in the screened room on an 80cm high table was positioned 40cm from the room wall.

A calibrated mains extension lead was used to ensure a known impedance was presented to the EUT

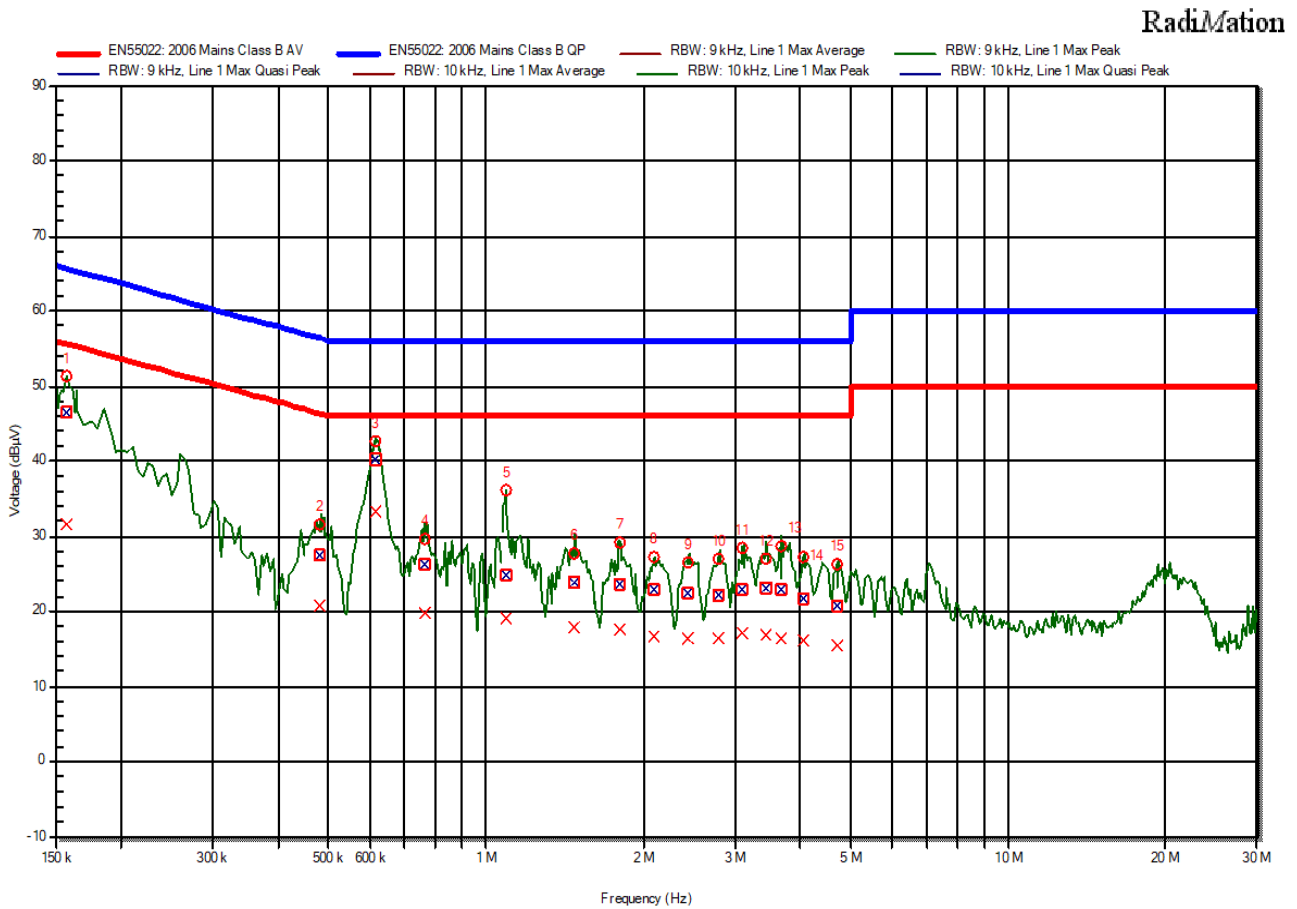
The EUT was then powered from the mains supply via a Line Impedance Stabilisation Network (LISN).



3.1.5 AC Mains Conducted Emissions Plots

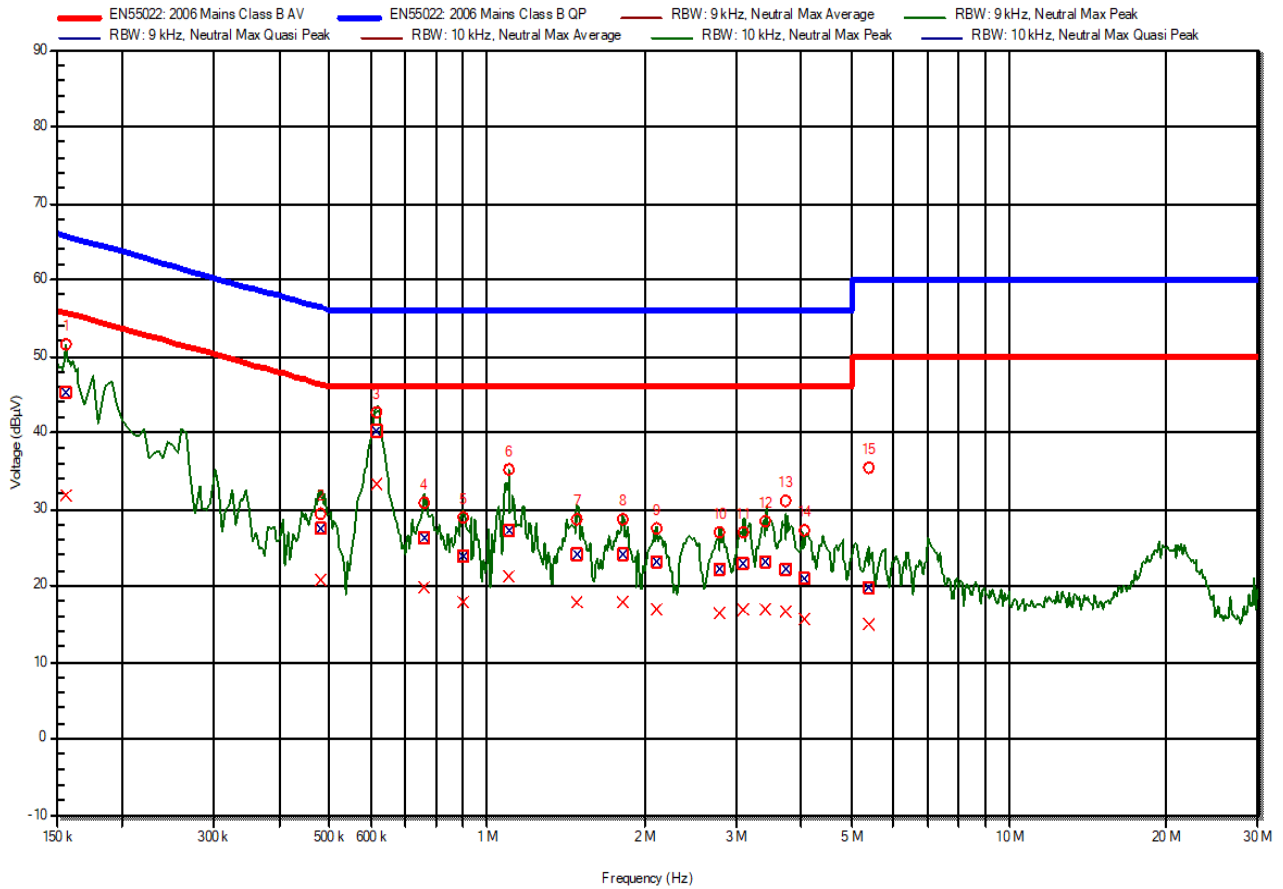
This section contains graphical and tabulated data. The following data is presented

Power supply	Channel	Conductor	Result summary
120V 60Hz	13.56 MHz	Live	Pass
120V 60Hz	13.56 MHz	Neutral	Pass



AC mains conducted emissions – Live

Frequency (MHz)	Average (dB μ V)	Average Limit (dB μ V)	Average Difference (dB)	Average Status	Quasi-Peak (dB μ V)	Quasi-Peak Limit (dB μ V)	Quasi-Peak Difference (dB)	Quasi-Peak Status
0.157	31.5	55.6	-24.1	Pass	46.4	65.6	-19.2	Pass
0.480	20.7	46.3	-25.6	Pass	27.5	56.3	-28.8	Pass
0.615	33.3	46.0	-12.7	Pass	40.1	56.0	-15.9	Pass
0.765	19.8	46.0	-26.2	Pass	26.2	56.0	-29.8	Pass
1.091	19.0	46.0	-27.0	Pass	24.9	56.0	-31.1	Pass
1.475	17.9	46.0	-28.1	Pass	24.0	56.0	-32.0	Pass
1.805	17.6	46.0	-28.4	Pass	23.7	56.0	-32.3	Pass
2.100	16.6	46.0	-29.4	Pass	22.9	56.0	-33.1	Pass
2.445	16.5	46.0	-29.5	Pass	22.3	56.0	-33.7	Pass
2.795	16.3	46.0	-29.7	Pass	22.1	56.0	-33.9	Pass
3.100	17.0	46.0	-29.0	Pass	23.0	56.0	-33.0	Pass
3.440	17.0	46.0	-29.0	Pass	23.1	56.0	-32.9	Pass
3.680	16.3	46.0	-29.7	Pass	22.8	56.0	-33.2	Pass
4.065	16.2	46.0	-29.8	Pass	21.8	56.0	-34.2	Pass
4.715	15.5	46.0	-30.5	Pass	20.8	56.0	-35.2	Pass



AC mains conducted emissions – Neutral

Frequency (MHz)	Average (dBµV)	Average Limit (dBµV)	Average Difference (dB)	Average Status	Quasi-Peak (dBµV)	Quasi-Peak Limit (dBµV)	Quasi-Peak Difference (dB)	Quasi-Peak Status
0.156	31.8	55.7	-23.9	Pass	45.4	65.7	-20.3	Pass
0.480	20.6	46.3	-25.7	Pass	27.5	56.3	-28.8	Pass
0.615	33.2	46.0	-12.8	Pass	40.3	56.0	-15.7	Pass
0.760	19.8	46.0	-26.2	Pass	26.3	56.0	-29.7	Pass
90.00	17.8	46.0	-28.2	Pass	23.7	56.0	-32.3	Pass
1.100	21.3	46.0	-24.7	Pass	27.3	56.0	-28.7	Pass
1.490	17.8	46.0	-28.2	Pass	24.1	56.0	-31.9	Pass
1.820	17.8	46.0	-28.2	Pass	24.0	56.0	-32.0	Pass
2.110	16.8	46.0	-29.2	Pass	23.1	56.0	-32.9	Pass
2.795	16.3	46.0	-29.7	Pass	22.1	56.0	-33.9	Pass
3.100	16.9	46.0	-29.1	Pass	22.9	56.0	-33.1	Pass
3.420	16.9	46.0	-29.1	Pass	23.1	56.0	-32.9	Pass
3.735	16.6	46.0	-29.4	Pass	22.3	56.0	-33.7	Pass
4.040	15.7	46.0	-30.3	Pass	20.9	56.0	-35.1	Pass
5.375	14.9	50.0	-35.1	Pass	19.8	60.	-40.2	Pass

2.2 Field strength within the band 13.553MHz-13.567MHz

Test standard (FCC)	Test Standard (ISED)	Test description	Class/limit
CFR 47 Part 15C Section 15.225(a) & ANSI C63.10-2013	RSS-210 Clause B.6(a)(i)	Radiated emissions	As specified in section 15.225(a) & RSS-210 Clause B.6(a)(i)

Mode of operation	Description
1	13.56MHz RFID device continuously transmitting.

Results	Mode	Table	Comments
	1	3.2.1	Chamber measurement 3m. Data extrapolated to 30m (parallel polarisation)
		3.2.2	Chamber measurement 3m. Data extrapolated to 30m (perpendicular polarisation)

Date of Test

8th February 2021

Test Area

LAB 5

Tested by

J Beevers

Freq (MHz)	Rx (dBμV)	CL (dB)	Antenna factor dB/m	Result at 3m (dBμV/m)	Distance correction factor (40dB/decade)	Result at 30m (dBμV/m)	Limit At 30m (dBμV/m)	Margin (dB)	Result
13.56	19.95	0.2	32.54	52.69	40	12.69	84	-71.31	Below limit

Table 3.2.1 Receiving antenna parallel position, receiving antenna at 0.8m measurement height

Freq (MHz)	Rx (dBμV)	CL (dB)	Antenna factor dB/m	Result at 3m (dBμV/m)	Distance correction factor (40dB/decade)	Result at 30m (dBμV/m)	Limit At 30m (dBμV/m)	Margin (dB)	Result
13.56	14.68	0.2	32.54	47.42	40	7.42	84	-76.58	Below limit

Table 3.2.2 Receiving antenna perpendicular polarisation, receiving antenna at 0.8m measurement height

Rx = Test receiver reading (voltage dBμV) before the addition of cable loss and antenna factor.

CL = total cable loss between antenna and test receiver (dB)

Result at 3m = Field strength (dBμV/m) at a measurement distance of 3m, calculated as follows:

$$\text{Field strength (dB}\mu\text{V/m)} = \text{Rx (dBmV)} + \text{CL(dB)} + \text{Antenna factor (dB/m)}$$

Result at 30m : Section 15.225(a) of CFR 47 Part 15(c), States the limit to be 15,848uV/m at a test distance of 30m. The above measurement was performed at a test distance of 3m and hence the result at 3m was scaled using the extrapolation factor of **40dB/decade as stated in section 15.31(f)(2)**.

$$15,485\mu\text{V/m} \equiv 84\text{dB}\mu\text{V/m,}$$

For the specified measurement distance of 30m the correction will be:

$$\text{Correction} = 40 \cdot \log(3/30) = -40\text{dB}$$

Note 3: The above measurements were taken using a Peak detector.

Modifications	Required for this test	Modification state
None	-	0

2.3 Field strength within the bands 13.410MHz to 13.553MHz, 13.567MHz to 13.710MHz, 13.110MHz to 13.410MHz and 13.710 to 14.0.0MHz

Test standard (FCC)	Test standard (ISED)	Test description	Class/limit
CFR 47 Part 15C Section 15.225(b) and 15.225(c) & ANSI C63.10-2013	RSS-201 Clause B.6.(a)(ii)	Radiated emissions	As specified in section 15.225(b), 15.225(c) & RSS-201 Clause B.6.(a)(ii)

Mode of operation	Description
1	13.56MHz RFID device continuously transmitting

Date of Test

8th February 2021

Test Area

LAB 5

Tested by

J Beavers

3.3.1 Field strength within the bands 13.110MHz-14.010MHz test results

Results	Mode	Figure	Comments
	1	3.3.1.1	Chamber measurement 3m. Data extrapolated to 30m (parallel polarisation)
		3.3.1.2	Chamber measurement 3m. Data extrapolated to 30m (perpendicular polarisation)

No emissions were detected that were within 20dB of the specification limit.

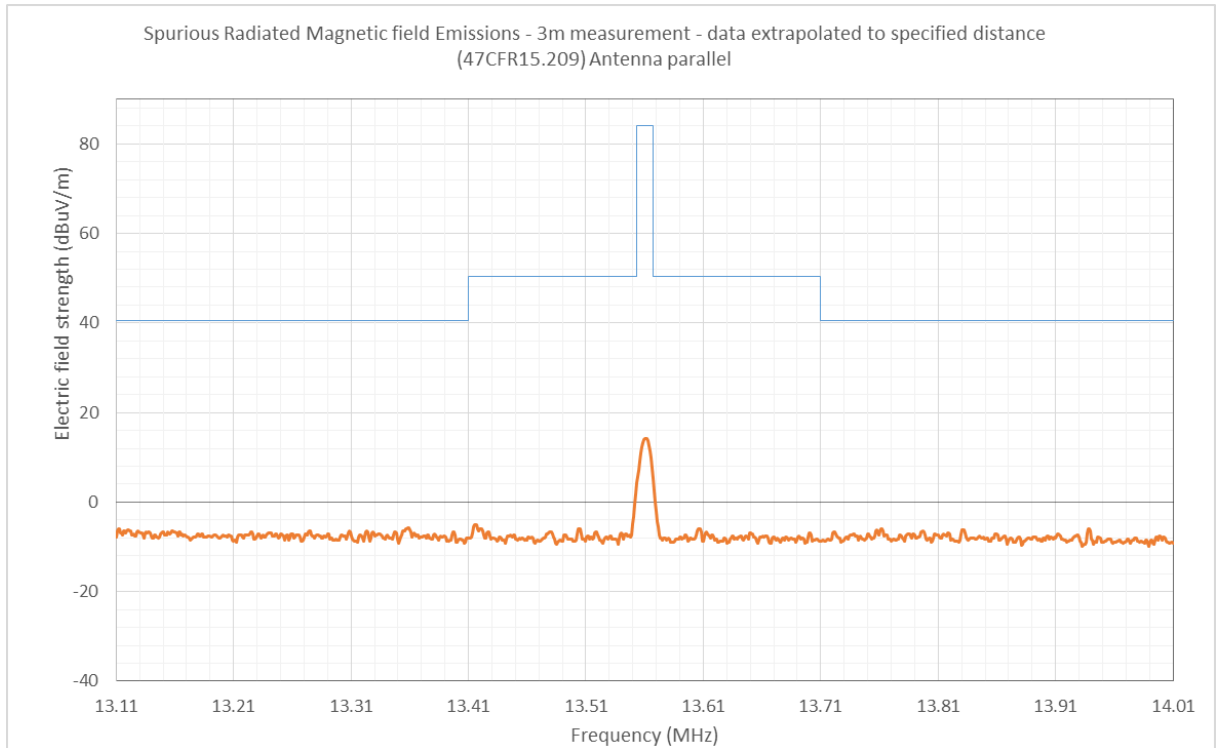


Fig 3.3.1.1 Radiated emissions result, 13.110MHz to 14.010MHz Parallel polarisation 3m measurement distance. Data extrapolated to values expected at the distances in Section 47CFR15.209 and RSS-210 B.6.

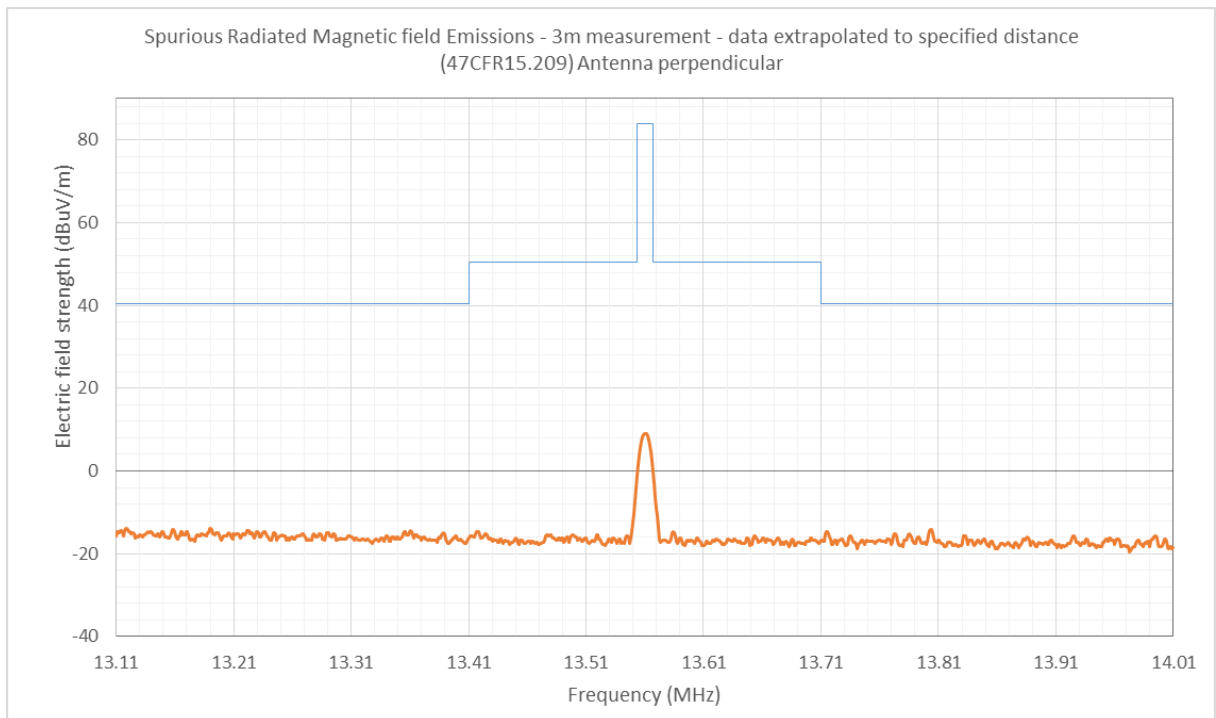


Fig 3.3.1.2 Radiated emissions result, 13.110MHz to 14.010MHz Perpendicular polarisation 3m measurement distance. Data extrapolated to values expected at the distances in Section 47CFR15.209 and RSS-210 B.6

Modifications	Required for this test	Modification state
None	None	0

2.4 Field Strength outside the band 13.110MHz-14.010MHz

Test standard (FCC)	Test standard (ISED)	Test description	Class/limit
CFR 47 Part 15C:2008 Section 15.225(d) & ANSI C63.10-2013	RSS-GEN Clause 8.9	Radiated emissions	As specified in Section 47CFR15.209

Mode of operation	Description
1	13.56MHz RFID device continuously transmitting

3.4.1 Radiated emissions between 9kHz and 30MHz

Date of Test

8th February 2021

Test Area

LAB 5 (FAC)

Tested by

J Beevers

Test Setup

Chamber measurements (scans) were performed to obtain the radiated frequency data. No ground plane was used.

3.4.1.2 Radiated emissions between 9kHz and 30MHz test results

Results	Mode	Figure	Frequency Range	Comments
	1	3.4.1.2.1	9kHz to 150kHz	Chamber measurement at 3m
		3.4.1.2.2	9kHz to 150kHz	Chamber measurement at 3m
		3.4.1.2.3	150kHz to 30MHz	Chamber measurement at 3m
		3.4.1.2.4	150kHz to 30MHz	Chamber measurement at 3m

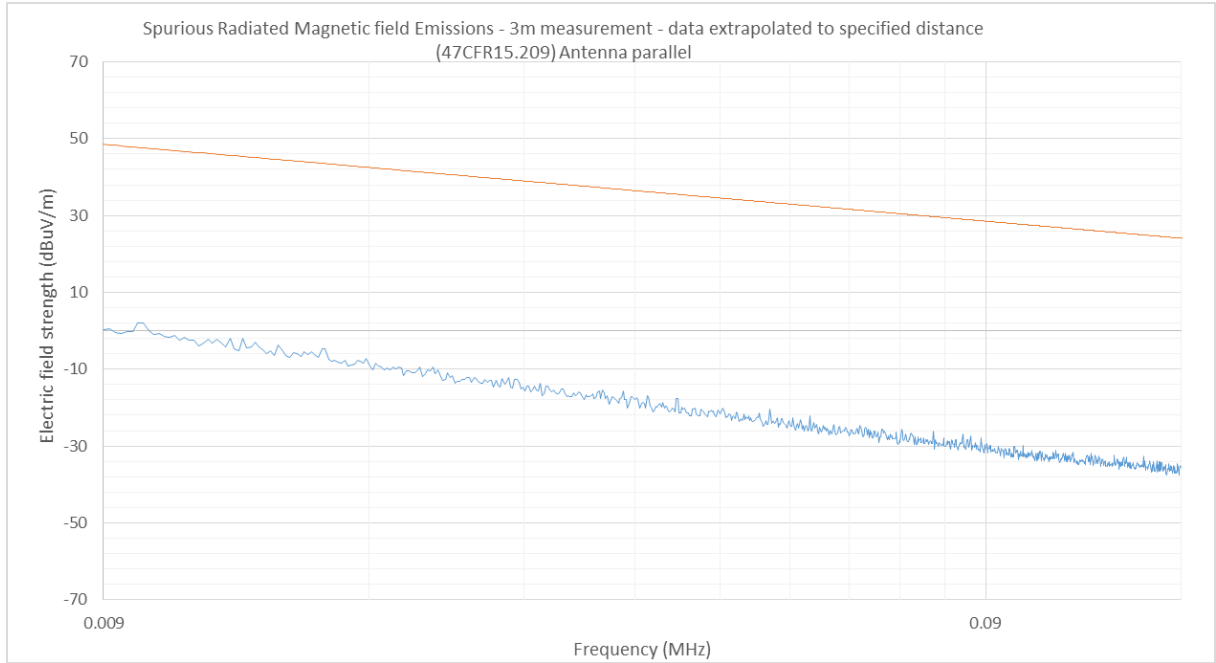


Fig 3.4.2.1.1 Radiated emissions result, 9kHz to 150kHz parallel polarisation 3m measurement distance. Data extrapolated to values expected at the distances in Section 47CFR15.209.

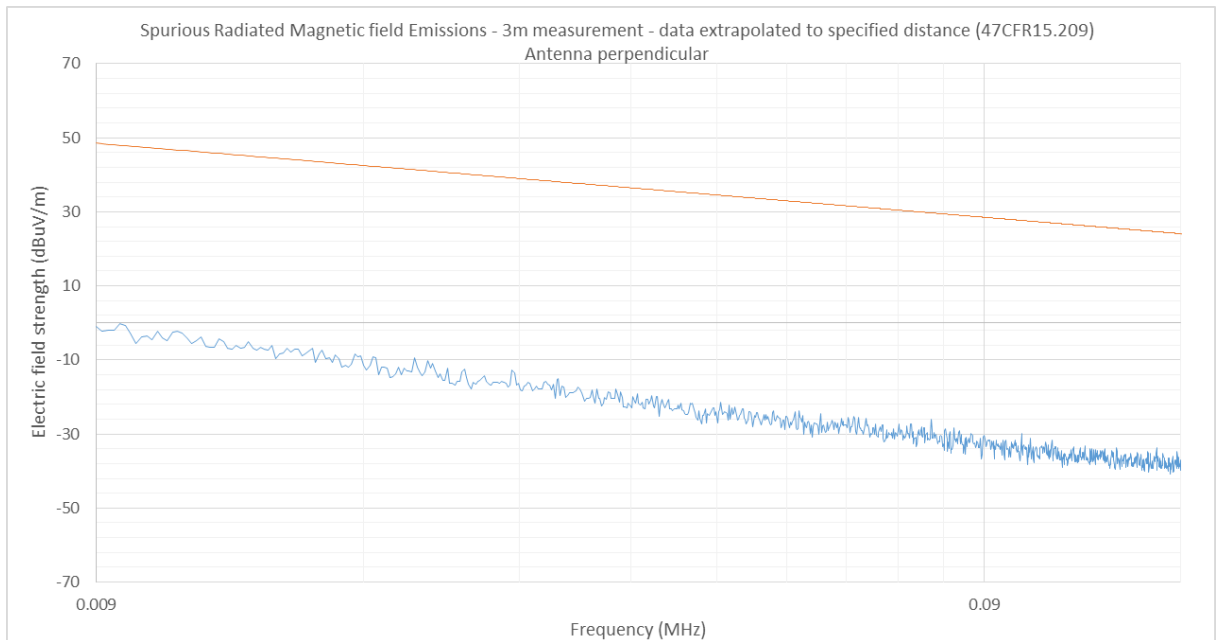


Fig 3.4.2.1.2 Radiated emissions result, 9kHz to 150kHz perpendicular polarisation 3m measurement distance. Data extrapolated to values expected at the distances in Section 47CFR15.209.

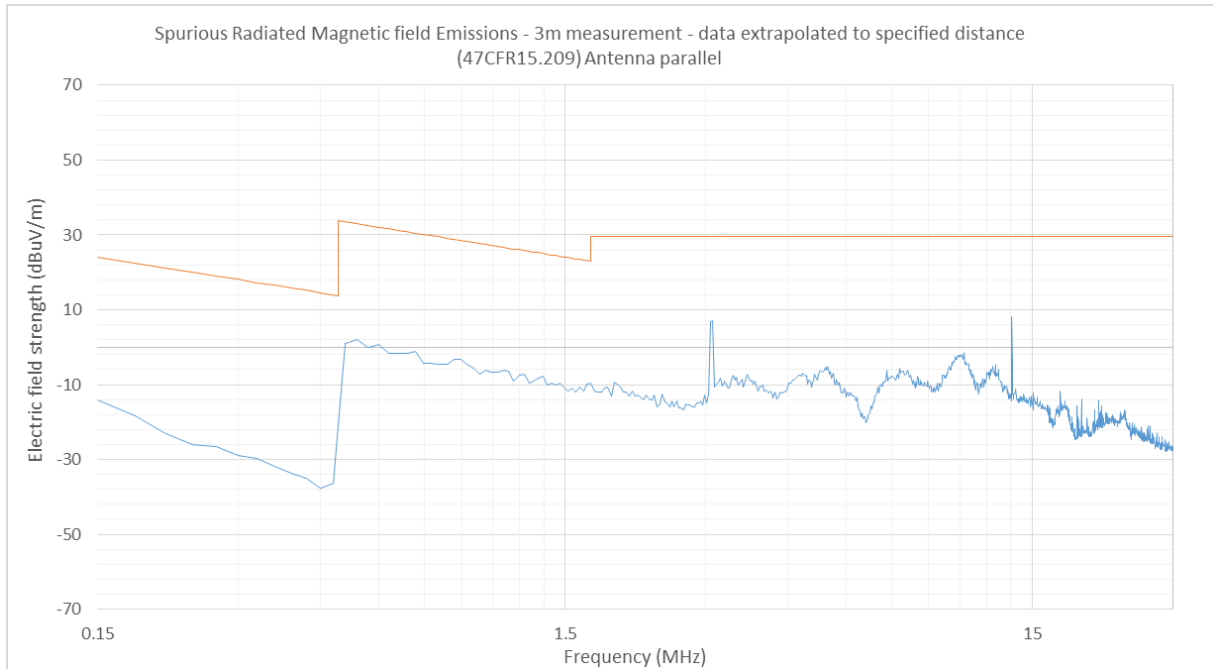


Fig 3.4.2.1.3 Radiated emissions result, 150kHz to 30MHz parallel polarisation 3m measurement distance. Data extrapolated to values expected at the distances in Section 47CFR15.209.

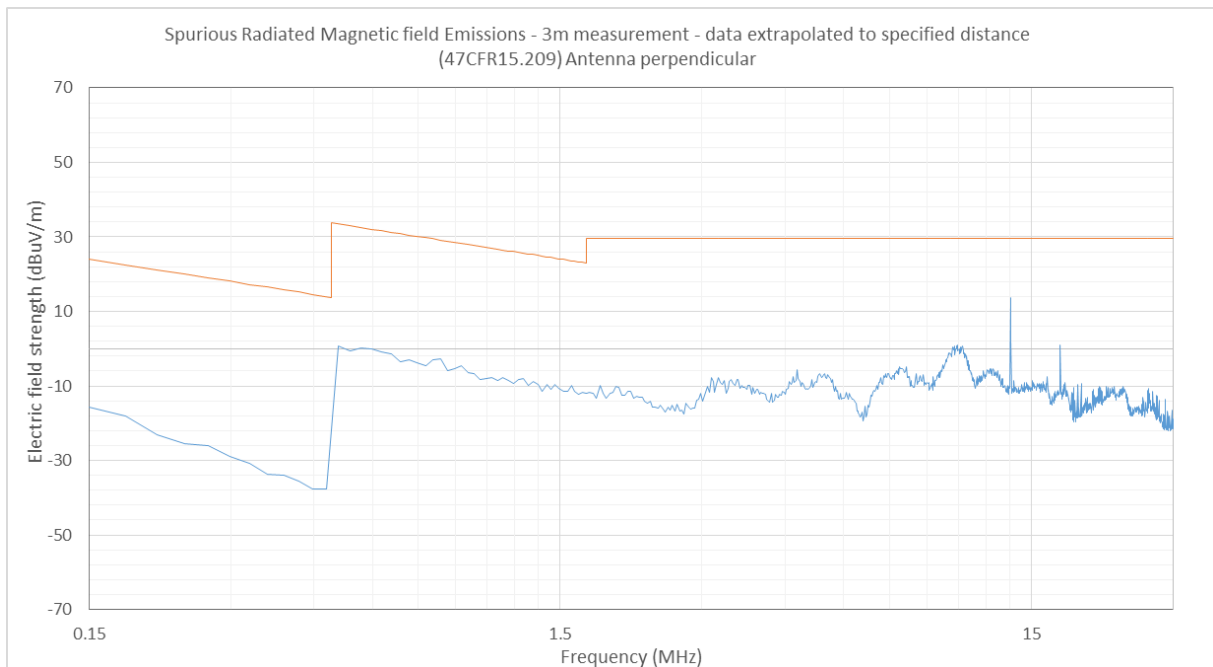


Fig 3.4.2.1.4 Radiated emissions result, 150kHz to 30MHz perpendicular polarisation 3m measurement distance. Data extrapolated to values expected at the distances in Section 47CFR15.209.

Freq (MHz)	Pol	Field strength at 3m	Specification distance (m)	Extrapolation (dB)	Field strength at Specification distance	Limit at specification distance (dBuV/m)	Result
0.009	Par.	23.8	300	-80	0.3	48.5	Below limit
20.000	Par.	14.8	30	-40	-23.8	30	Below limit
30.000	Par.	11.9	30	-40	-27.7	30	Below limit
0.009	Perp.	22.4	300	-80	-1.1	48.5	Below limit
20.000	Perp.	22.7	30	-40	-15.9	30	Below limit
30.000	Perp.	20.8	30	-40	-18.8	30	Below limit

No radiated spurious emissions were detected from the product within 10dB of the limit line. The above representative noise floor emissions were taken.

Measurements were performed in the absence of a ground plane at a 3m measurement distance.

The detector used was a peak detector.

For measurements in the band 0.009MHz to 0.490MHz the specified measurement distance is 300m. The distance correction will be:

$$\text{Correction} = 40 \cdot \log(3/300) = -80\text{dB}$$

For measurements in the band 0.490MHz to 30MHz the specified measurement distance is 30m. The distance correction will be:

$$\text{Correction} = 40 \cdot \log(3/30) = -40\text{dB}$$

The measurements were calculated as follows:

Field strength (dBuV/m) = Receiver voltage reading (dBuV) + Antenna factor (dB/m) + Preamplifier gain (dB) + extrapolation (dB)

Example:

At 20MHz

$$\begin{aligned} \text{At 30m field strength} &= \text{receiver reading (14.8dBuV)} \\ &+ \text{Antenna factor (32.1dB/m)} + \text{Preamplifier Gain}(-30.7\text{dB}) \\ &+ \text{extrapolation (-40dB)} \\ &= -23.8\text{dBuV/m} \end{aligned}$$

The limit was calculated according to 47CFR15.209 table:

Between 0.009MHz and 0.490MHz

$$\text{Limit (dBuV/m) at 300m} = 20\log_{10}(2400/F)$$

Between 0.490MHz and 30MHz

$$\text{Limit (dBuV/m) at 300m} = 20\log_{10}(24000/F)$$

Where F is frequency in kHz.

3.4.2 Radiated emissions between 30MHz and 1GHz:

Procedure and Test Software Version

Eurofins York test procedure (30MHz to 1GHz)	CEP23b Issue 8
Test software	RadiMation Version 2016.2.8

Date of Test

17th February 2021

Test Area

LAB 1 (SAC)

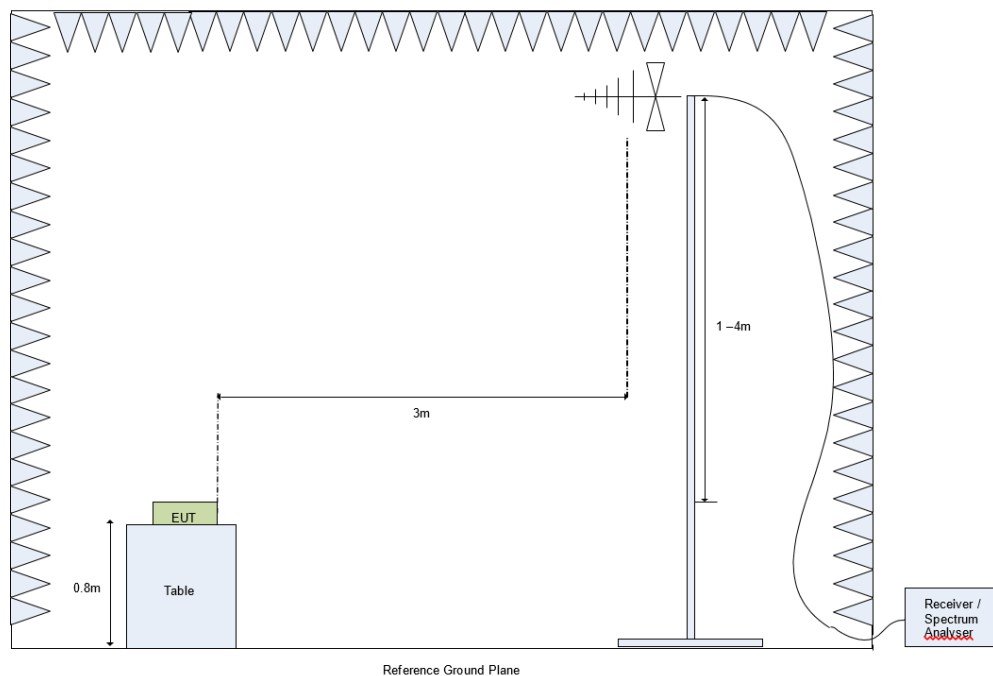
Tested by

J Beavers

Test Setup

The EUT was configured in the SAC on an 80cm high polystyrene table.

The measurement was performed with an antenna to EUT separation distance of 3m. The results were maximised in orientation 0-360 degrees and height 1-4m.



Note 1 : With the EUT de-energized the ambient radio noise and signals met the 6dB peak detection requirement of ANSI C63.10-2013.

Note 2 : There were no significant environmental temperature changes during the test duration and hence it was not considered necessary to consider any variation in cable loss.

Measurements were performed in an alternative test site as defined by ANSI C63.10-2013 clause 5.2 radiated emissions test site. Chamber measurements (scans) were first performed to obtain the radiated frequency data. The worse case frequencies were then measured at a distance of 3 meters.

3.4.2.2 Radiated emissions between 30MHz and 1GHz test results

Results	Mode	Figure	Frequency Range	Comments
	1	3.4.2.2.1	30MHz to 1GHz	Chamber measurement at 3m

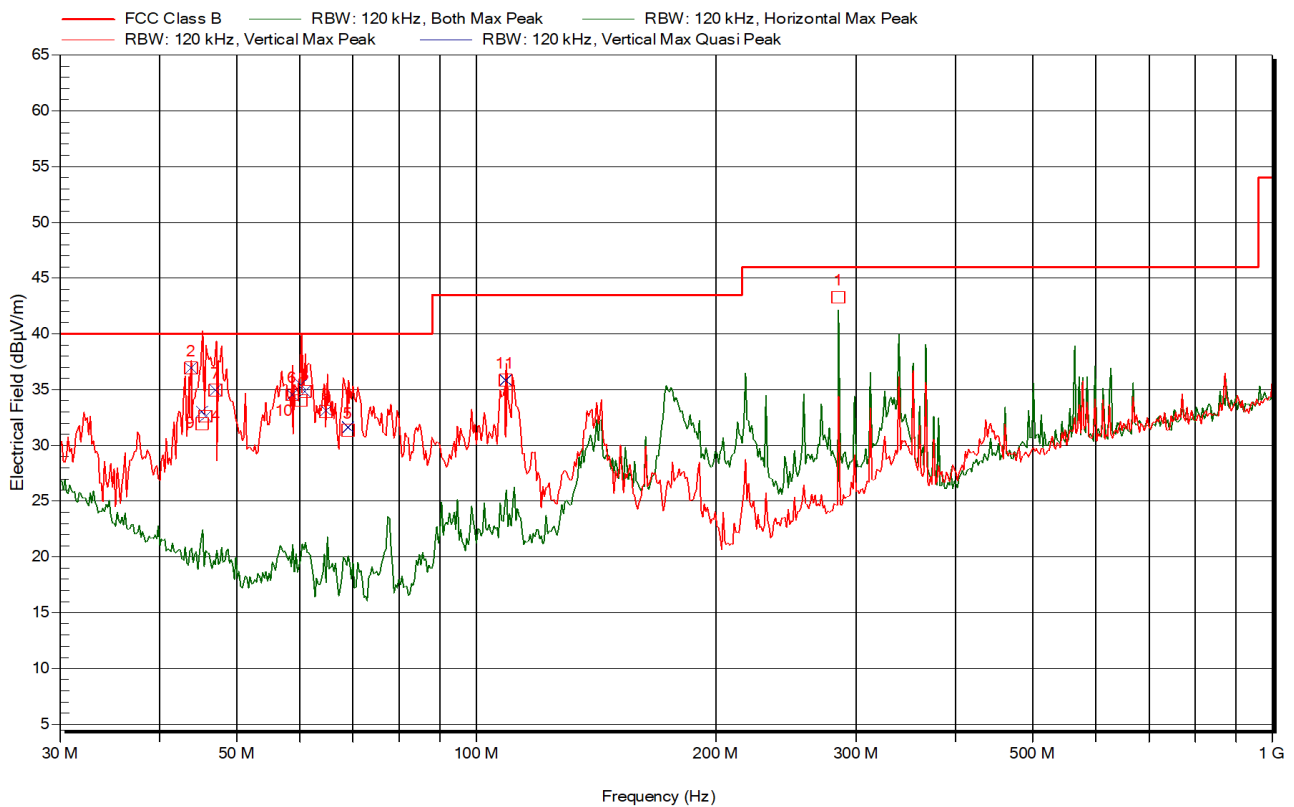


Fig 3.4.2.2.1 Radiated emissions result, 30MHz to 1GHz vertical and horizontal polarisation combined plot, 3m measurement distance

Frequency (MHz)	Polarity (H/V)	Height (m)	Angle (degrees)	Det	Meas distance (m)	E field @ spec distance (dBuV/m)	E field Limit (dBuV/m)	Margin (dB)	Result
43.782	V	1.0	235	Qp	3	37.0	40.0	-3.0	Below limit
45.234	V	1.0	25	Qp	3	32.0	40.0	-8.0	Below limit
45.660	V	1.0	100	Qp	3	32.6	40.0	-7.4	Below limit
47.004	V	1.0	0	Qp	3	35.0	40.0	-5.0	Below limit
58.728	V	1.1	75	Qp	3	34.5	40.0	-5.5	Below limit
60.216	V	1.8	360	Qp	3	34.0	40.0	-6.0	Below limit
60.840	V	1.9	220	Qp	3	34.8	40.0	-5.2	Below limit
64.770	V	1.5	90	Qp	3	33.0	40.0	-7.0	Below limit
69.000	V	1.5	140	Qp	3	31.4	40.0	-8.6	Below limit
108.810	V	1.0	315	Qp	3	35.9	43.5	-7.6	Below limit
284.766	H	1.0	345	Qp	3	43.3	46.0	-2.7	Below limit

Notes:

Det = detector, Qp = Quasi-Peak

Pol = position of receive antenna
 V = Vertical, H = horizontal

Field strength (dBuV/m) = Receiver voltage reading (dBuV)+Antenna factor (dB/m)+Cable loss (dB)

Modifications	Required for this test	Modification state
None	-	0

2.5 Frequency tolerance of the carrier signal

Test standard (FCC)	Test standard (ISED)	Test description	Class/limit
CFR 47 Part 15C:2008 Section 15.225(e) & ANSI C63.10-2013 Clause 6.8.1	RSS-210 B.6 (b)	Frequency tolerance of the carrier signal	FCC: As specified in Section 15.225(e) ISED: 100ppm (equivalent to FCC requirement)

Mode of operation	Description
1	13.56MHz RFID device

Results	Mode	Figure	Result	Comments
	1	5.3.1 to 5.3.35	Pass	The frequency tolerance as specified in section 15.225(e) is +/-0.01%, which for a frequency of 13.56MHz is (+/-1.356kHz).

Procedure:

For frequency stability with respect to supply voltage the procedures of ANSIC63.10 Section 6.8.2 were followed. The measurements were performed at ambient room temperature.

For frequency stability with respect to ambient temperature the procedure of ANSI C63.10 Section 6.8.1 was followed.

The spectrum analyser screen captures are contained within Appendix 1.

Date of Test

3rd March 2021

Test Area

LAB 5

Tested by

J Beavers

3.5.1 Frequency Tolerance Results

Supply voltage (V ac)		Frequency (MHz)	Nominal	Deviation	Limit	Result	Figure
Nom	120	13.5607	13.56	0.0052	0.01	Within limit	5.1.33
Nom+115%	138	13.5604	13.56	0.0029	0.01	Within limit	5.1.34
Nom-85%	102	13.5609	13.56	0.0066	0.01	Within limit	5.1.35

Table 3.5.1 Frequency deviation from nominal of the AC mains supply voltage.

Note: The 13.56MHz signal is significantly below the spurious emissions limit.

Temp. (°C)	Time	Frequency (MH)	Nominal (MHz)	Deviation (%)	Limit 47CFR15.225 (e) (%) (=100ppm)	Result	Screen Capture #
50	Startup	13.560524	13.56	0.00386416	0.01	Within limit	1
	2min	13.560492	13.56	0.00362819	0.01	Within limit	2
	5min	13.56047	13.56	0.00346596	0.01	Within limit	3
	10min	13.560455	13.56	0.00335534	0.01	Within limit	4
40	Startup	13.560447	13.56	0.00329635	0.01	Within limit	5
	2min	13.560441	13.56	0.00325211	0.01	Within limit	6
	5min	13.56044	13.56	0.00324473	0.01	Within limit	7
	10min	13.56044	13.56	0.00324473	0.01	Within limit	8
30	Startup	13.560454	13.56	0.00334797	0.01	Within limit	9
	2min	13.560448	13.56	0.00330373	0.01	Within limit	10
	5min	13.560449	13.56	0.0033111	0.01	Within limit	11
	10min	13.56045	13.56	0.00331847	0.01	Within limit	12
20	Startup	13.560463	13.56	0.00341434	0.01	Within limit	13
	2min	13.560464	13.56	0.00342171	0.01	Within limit	14
	5min	13.560466	13.56	0.00343646	0.01	Within limit	15
	10min	13.56047	13.56	0.00346596	0.01	Within limit	16
10	Startup	13.560499	13.56	0.00367981	0.01	Within limit	17
	2min	13.560491	13.56	0.00362081	0.01	Within limit	18
	5min	13.560494	13.56	0.00364294	0.01	Within limit	19
	10min	13.560498	13.56	0.00367243	0.01	Within limit	20
0	Startup	13.560529	13.56	0.00390103	0.01	Within limit	21
	2min	13.560522	13.56	0.00384941	0.01	Within limit	22
	5min	13.560523	13.56	0.00385678	0.01	Within limit	23
	10min	13.560525	13.56	0.00387153	0.01	Within limit	24
-10	Startup	13.560537	13.56	0.00396002	0.01	Within limit	25
	2min	13.560537	13.56	0.00396002	0.01	Within limit	26
	5min	13.560537	13.56	0.00396002	0.01	Within limit	27
	10min	13.560537	13.56	0.00396002	0.01	Within limit	28
-20	Startup	13.56054	13.56	0.00398214	0.01	Within limit	29
	2min	13.560534	13.56	0.0039379	0.01	Within limit	30
	5min	13.560537	13.56	0.00396002	0.01	Within limit	31
	10min	13.56054	13.56	0.00398214	0.01	Within limit	32

Table 3.5.2 Frequency deviation from nominal of the carrier with temperature.

Modifications	Required for this test	Modification state
None	-	0

2.6 99% Occupied Bandwidth

Test standard (FCC)	Test standard (ISED)	Test description	Class/limit
N/A	RSS-GEN Clause 6.7	The width of a frequency band such that, below the lower and above the upper frequency limits, the mean powers emitted are each equal to 0.5% of the total emitted power	Contained within frequency allocation

Mode of operation	Description
1	13.56MHz RFID device

Results	Mode	Result	Comments
	1	Pass	The emission was contained within the spurious emission limits. A measurement of the 99% occupied bandwidth was however made using an iterative method, summing the power.

Centre frequency (MHz)	Total power (mW)	99% power (mW)	Summed power (mW)	Low frequency (MHz)	High frequency (KHz)	99% OBW (MHz)
13.56	2.60×10^{-5}	2.59×10^{-5}	2.59×10^{-5}	13.5663	13.5519	0.0144

Modifications	Required for this test	Modification state
None	-	0

4 Appendices

4.1 Appendix 1 Frequency tolerance of the carrier signal

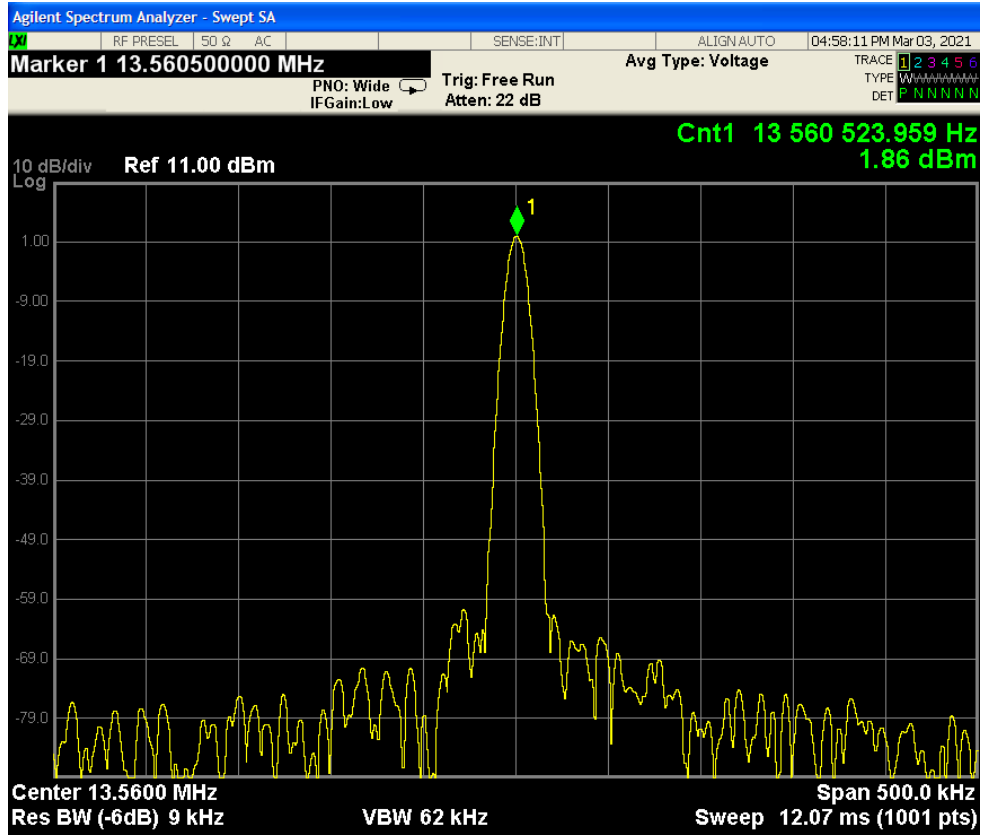


Figure 5.1.1 – Screen capture 1

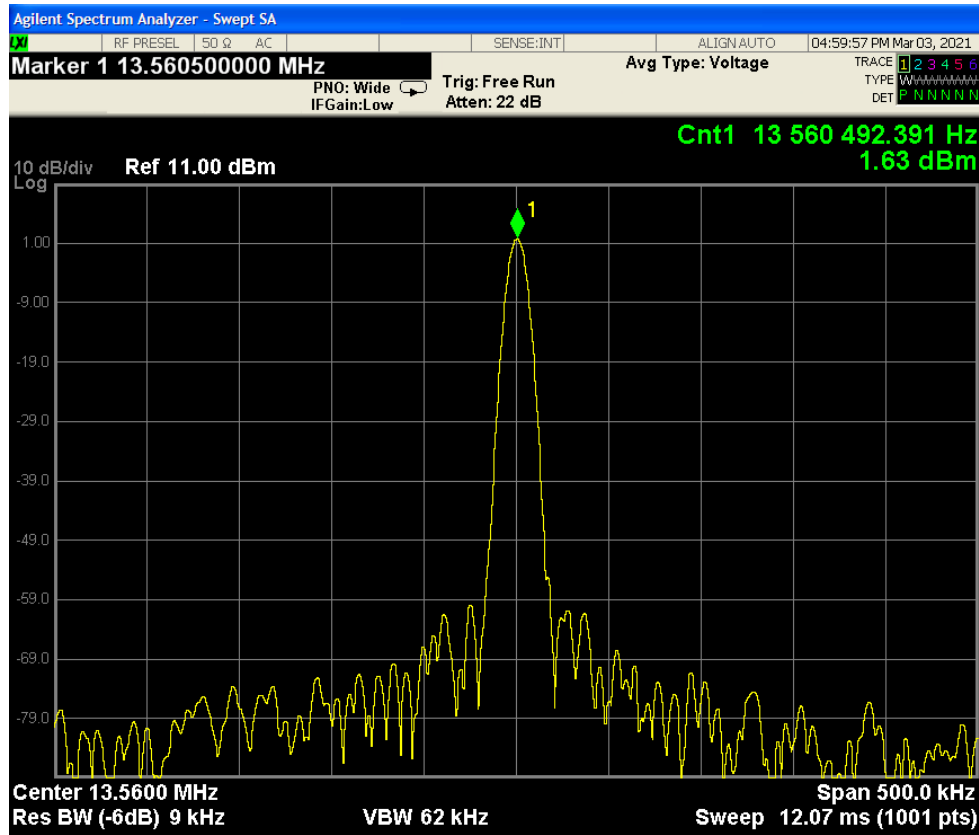


Figure 5.1.2 – Screen capture 2

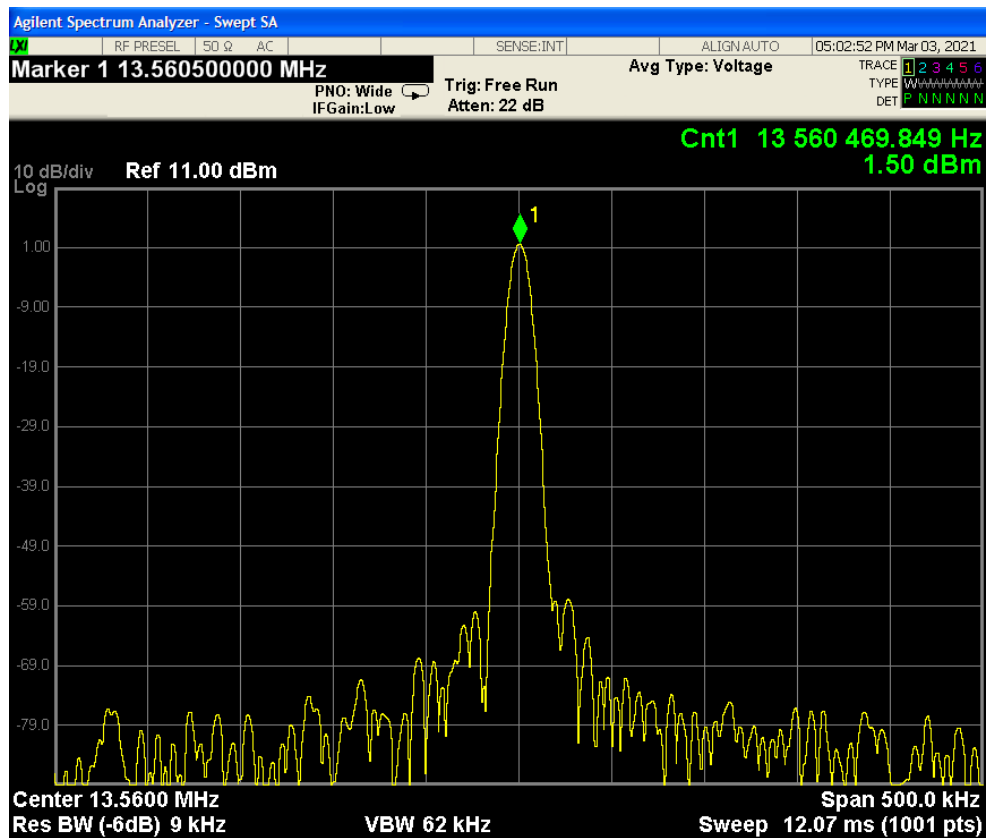


Figure 5.1.3 – Screen capture 3

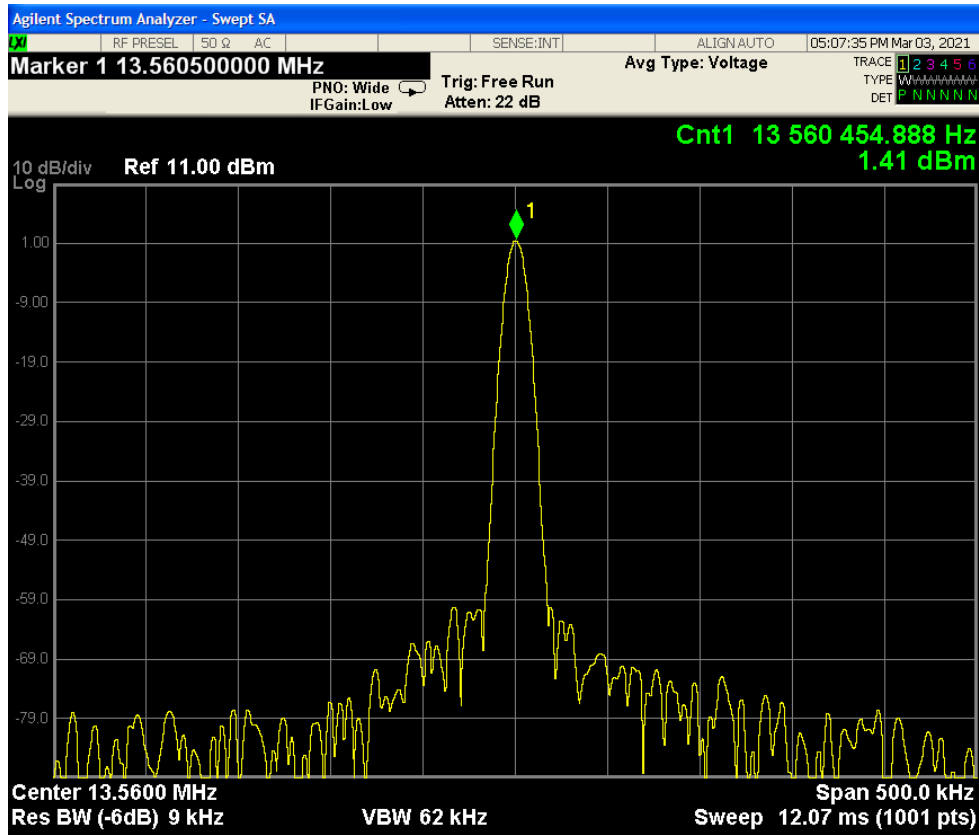


Figure 5.1.4 – Screen capture 4

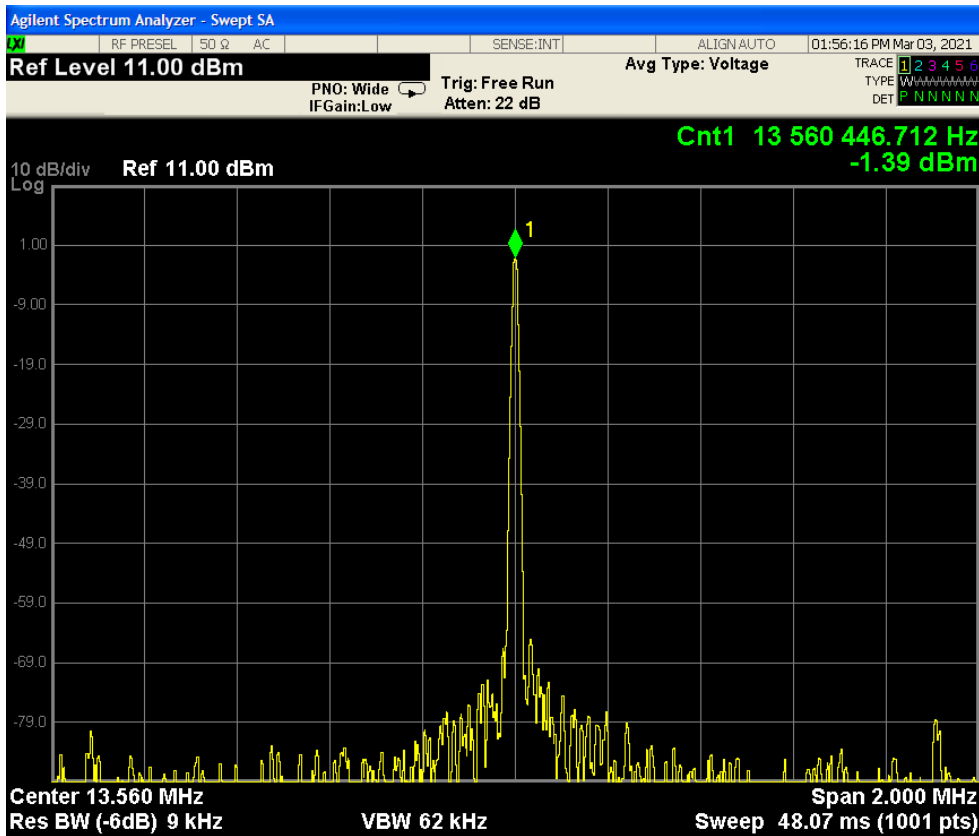


Figure 5.1.5 – Screen capture 5

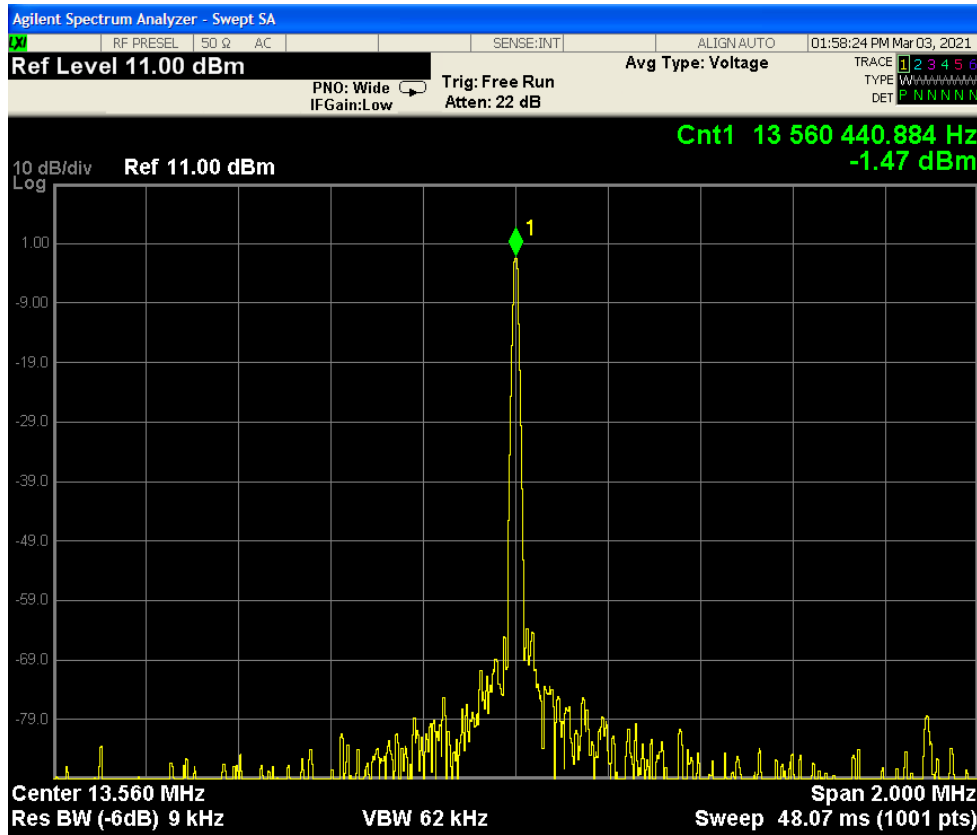


Figure 5.1.6 – Screen capture 6

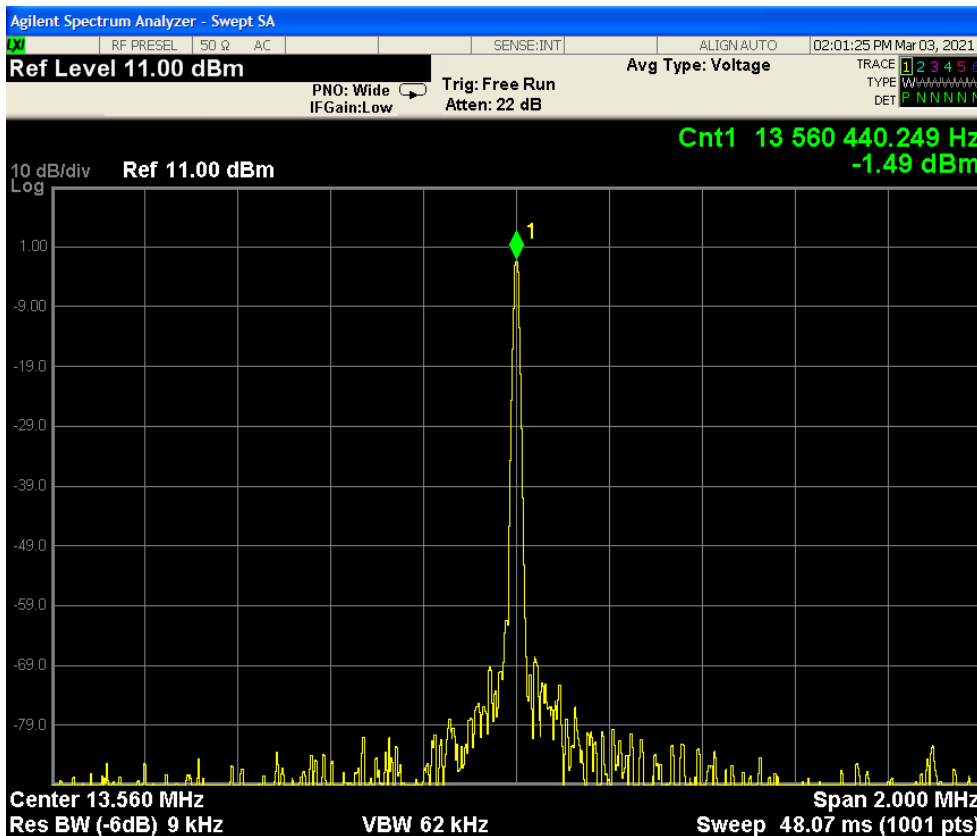


Figure 5.1.7 – Screen capture 7

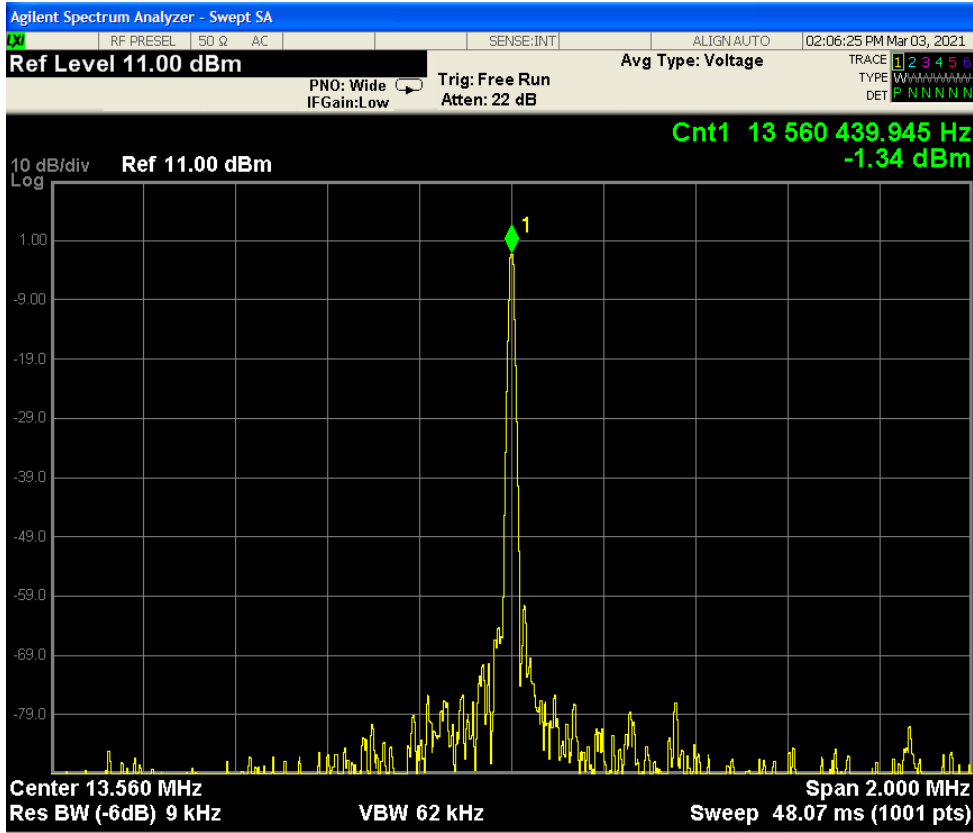


Figure 5.1.8 – Screen capture 8

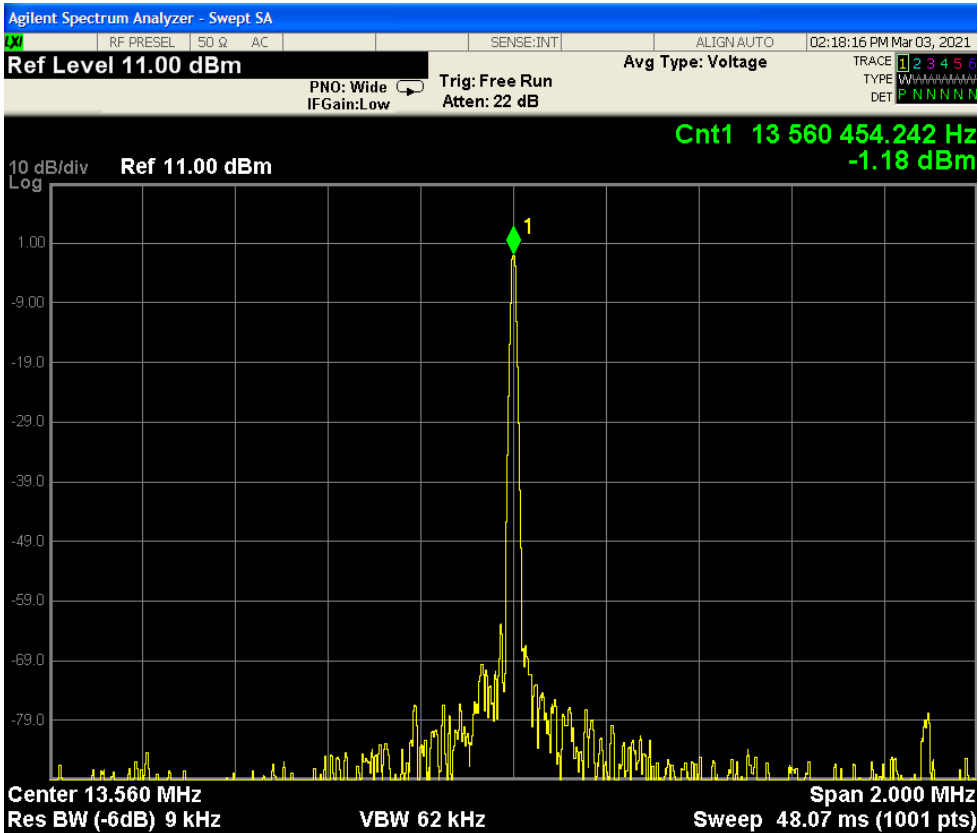


Figure 5.1.9 – Screen capture 9

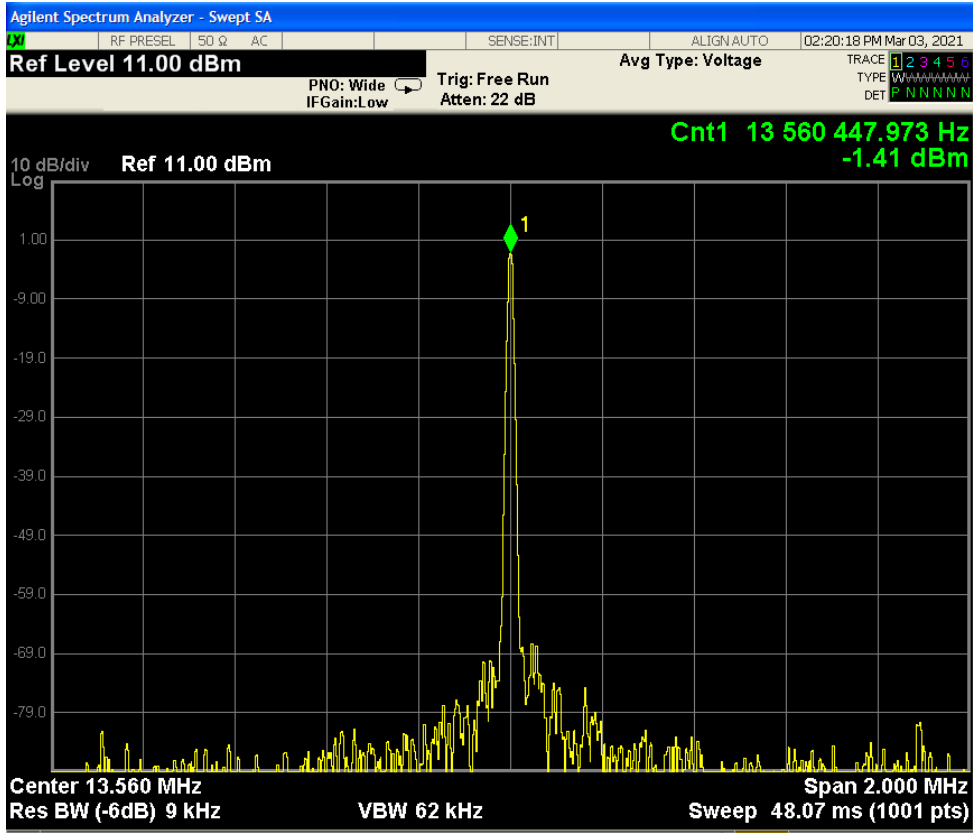


Figure 5.1.10 – Screen capture 10



Figure 5.1.11 – Screen capture 11

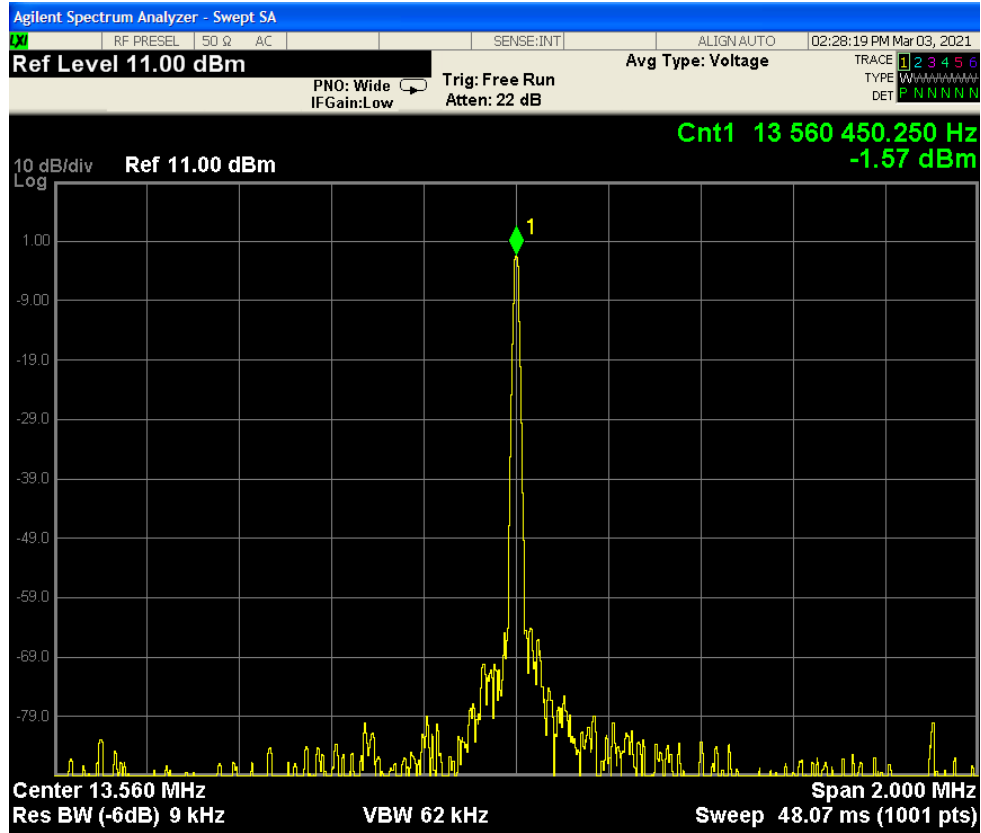


Figure 5.1.12 – Screen capture 12

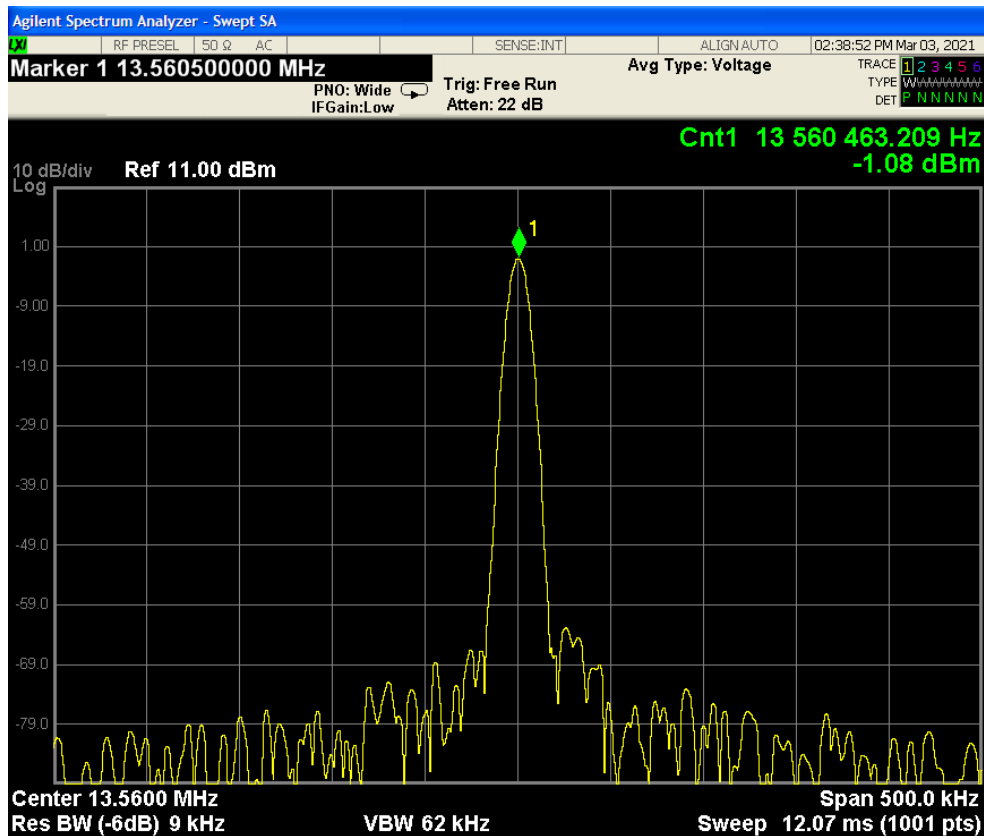


Figure 5.1.13 – Screen capture 13

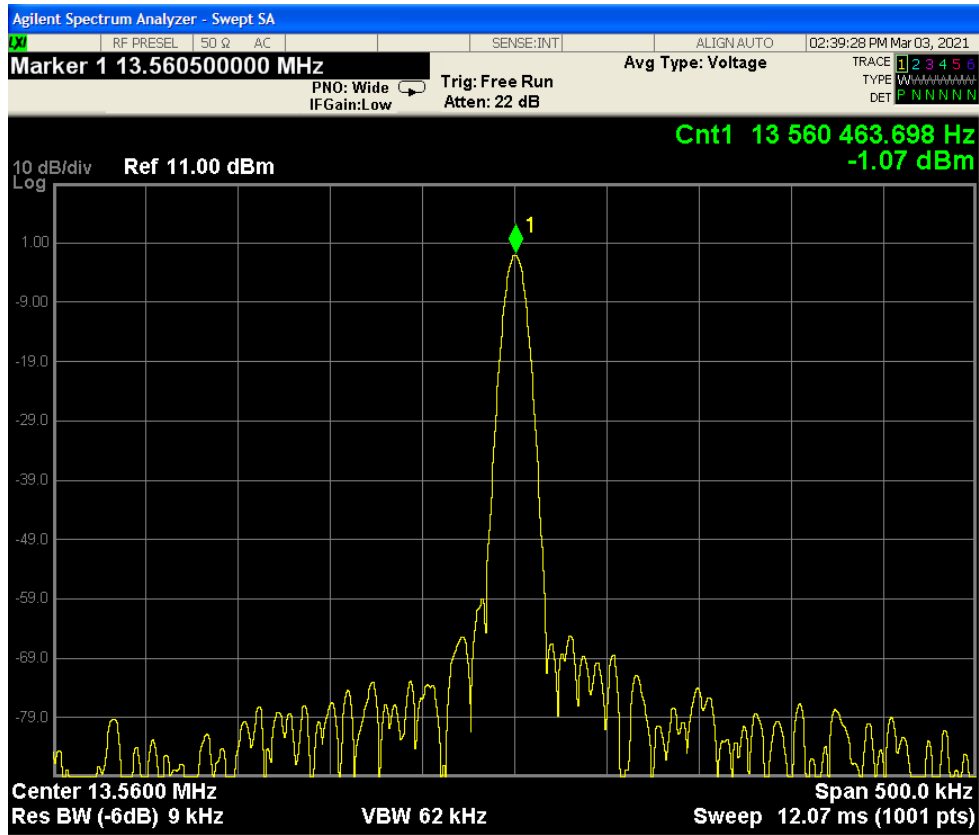


Figure 5.1.14 – Screen capture 14

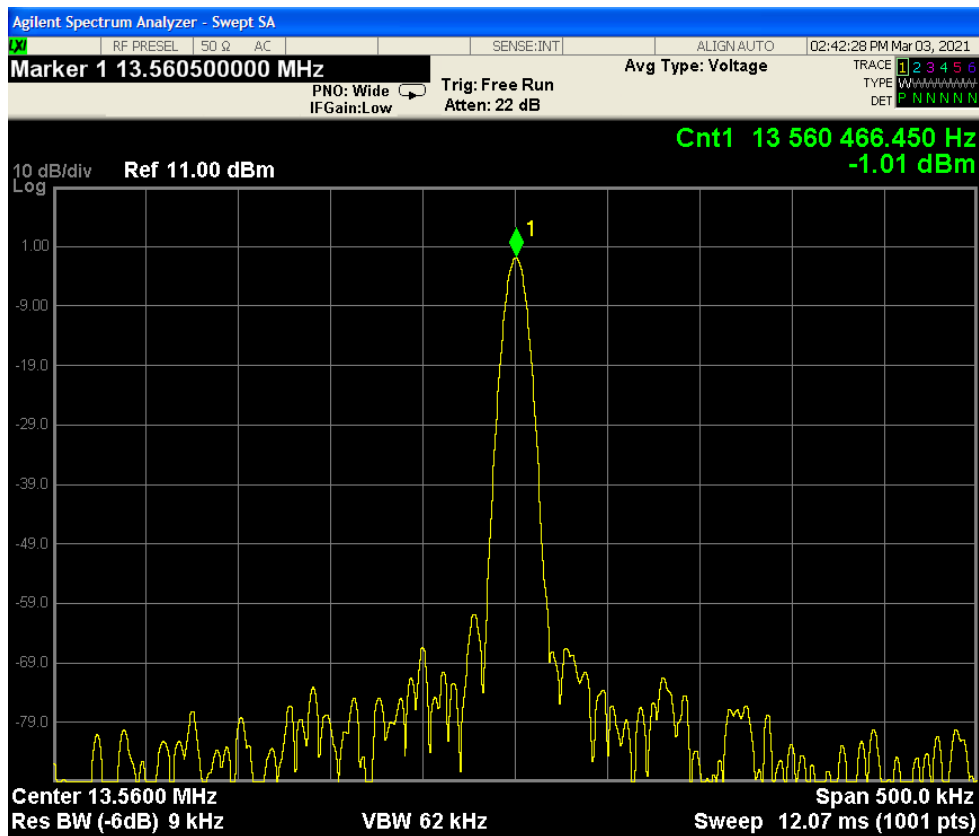


Figure 5.1.15 – Screen capture 15

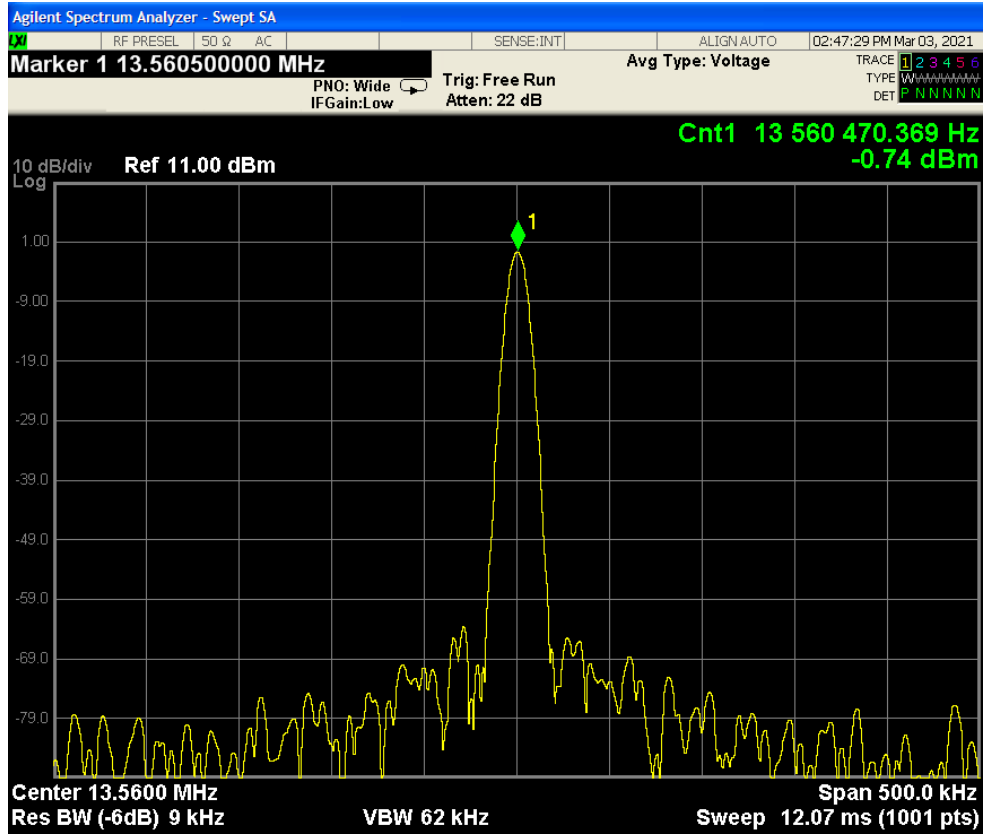


Figure 5.1.16 – Screen capture 16

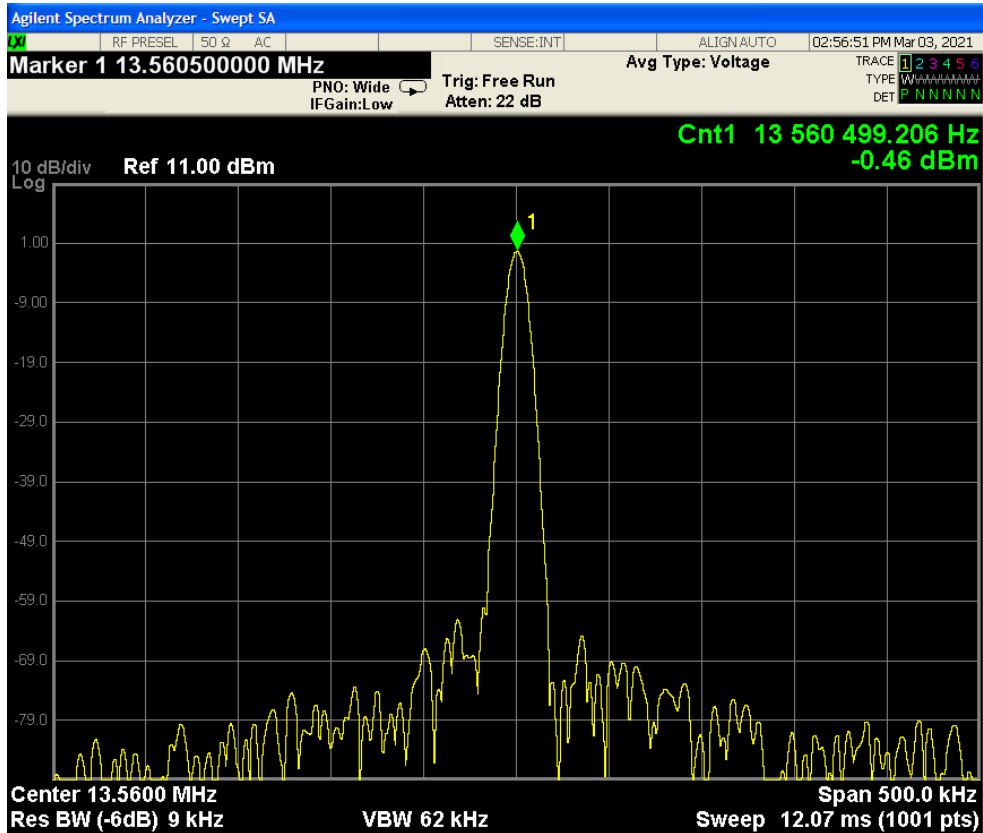


Figure 5.1.17 – Screen capture 17

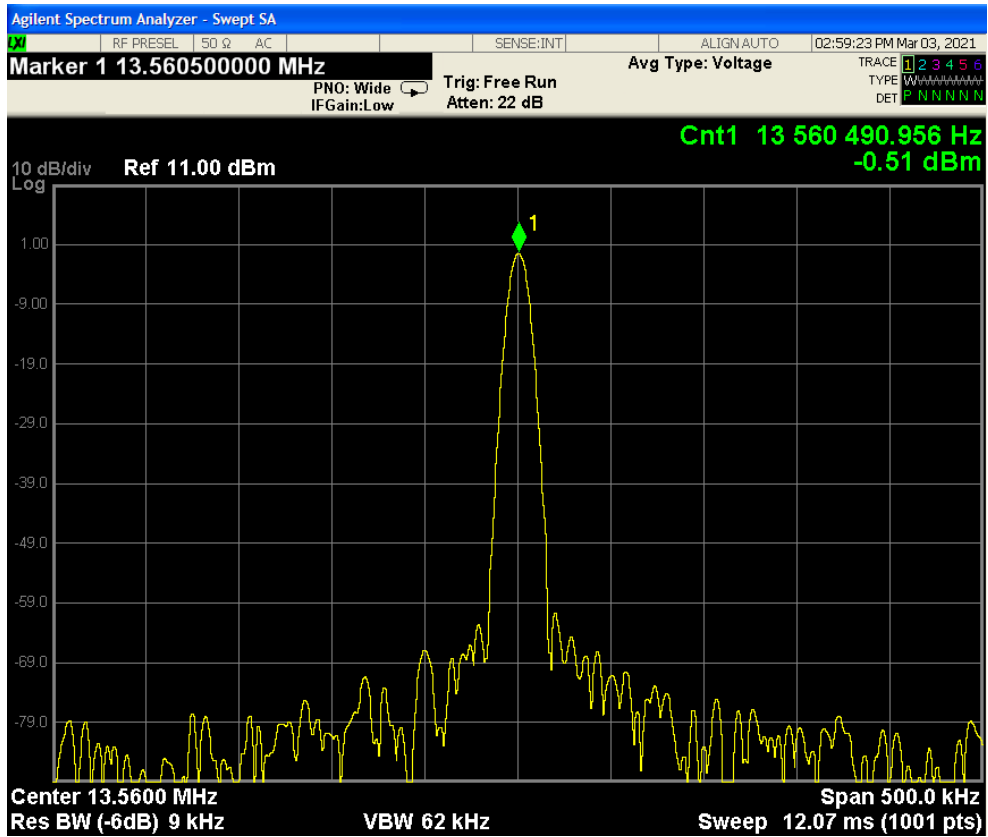


Figure 5.1.18 – Screen capture 18

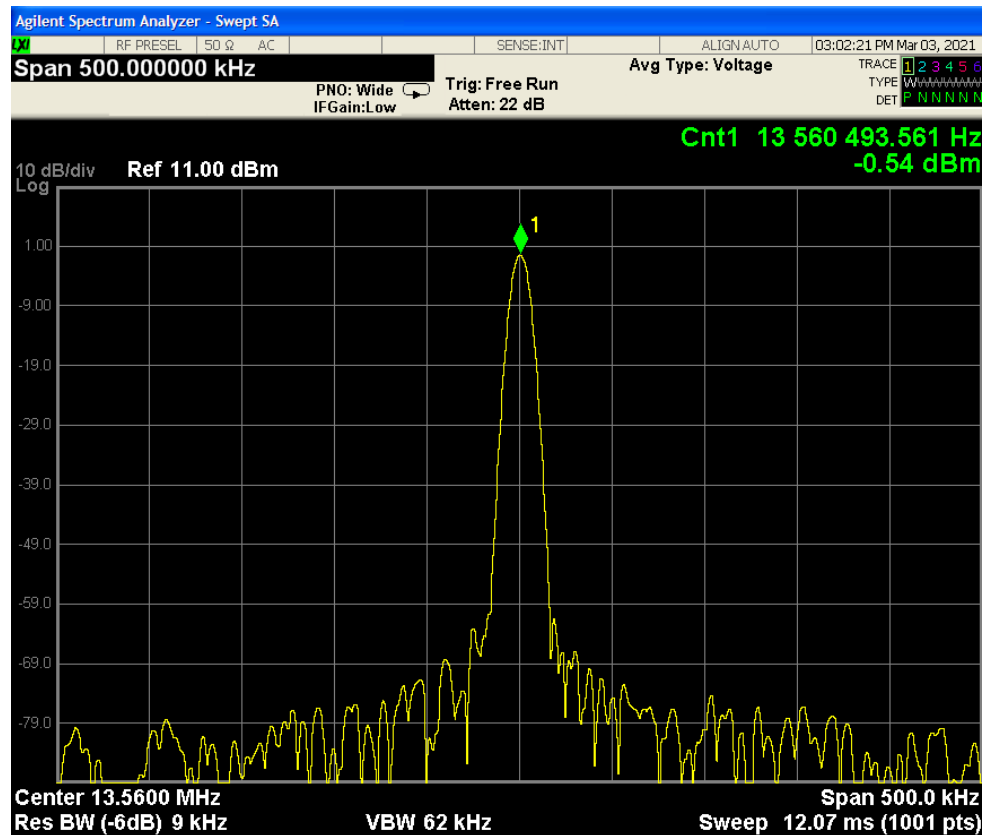


Figure 5.1.19 – Screen capture 19

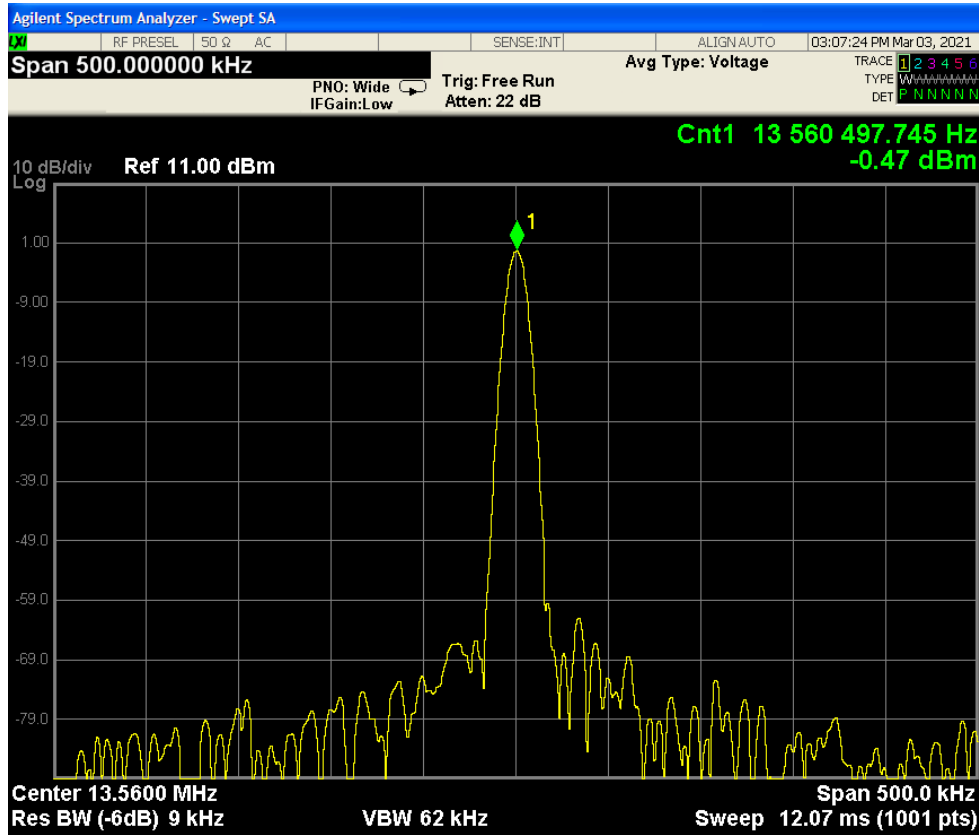


Figure 5.1.30 – Screen capture 20

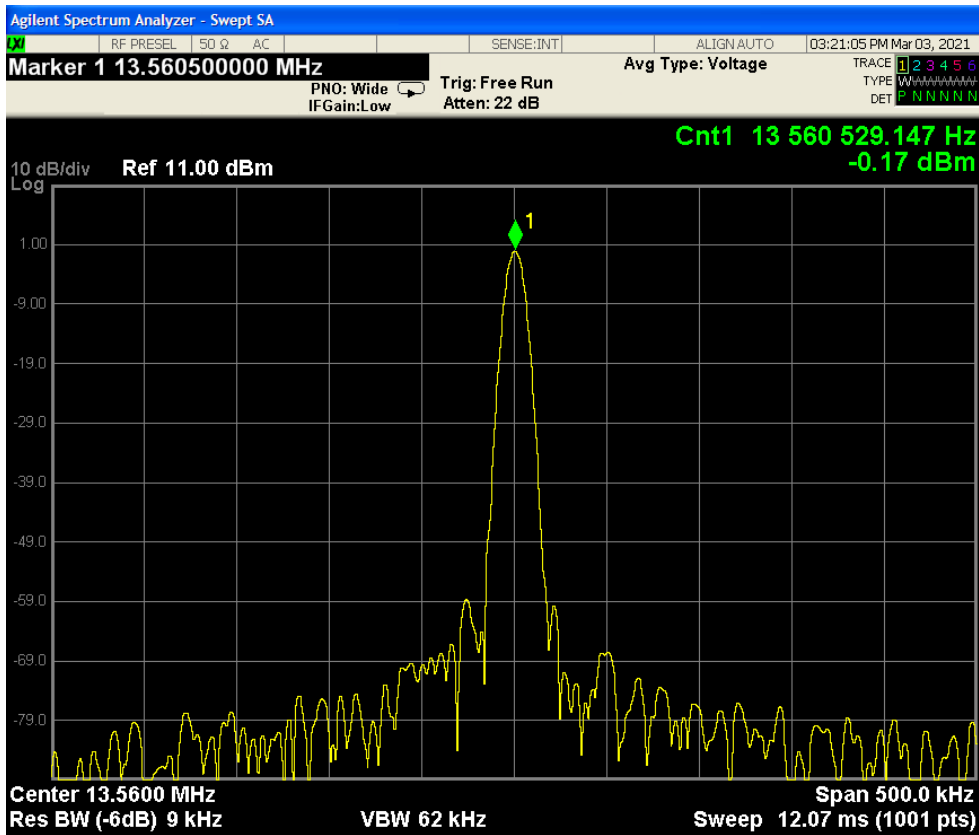


Figure 5.1.21 – Screen capture 21

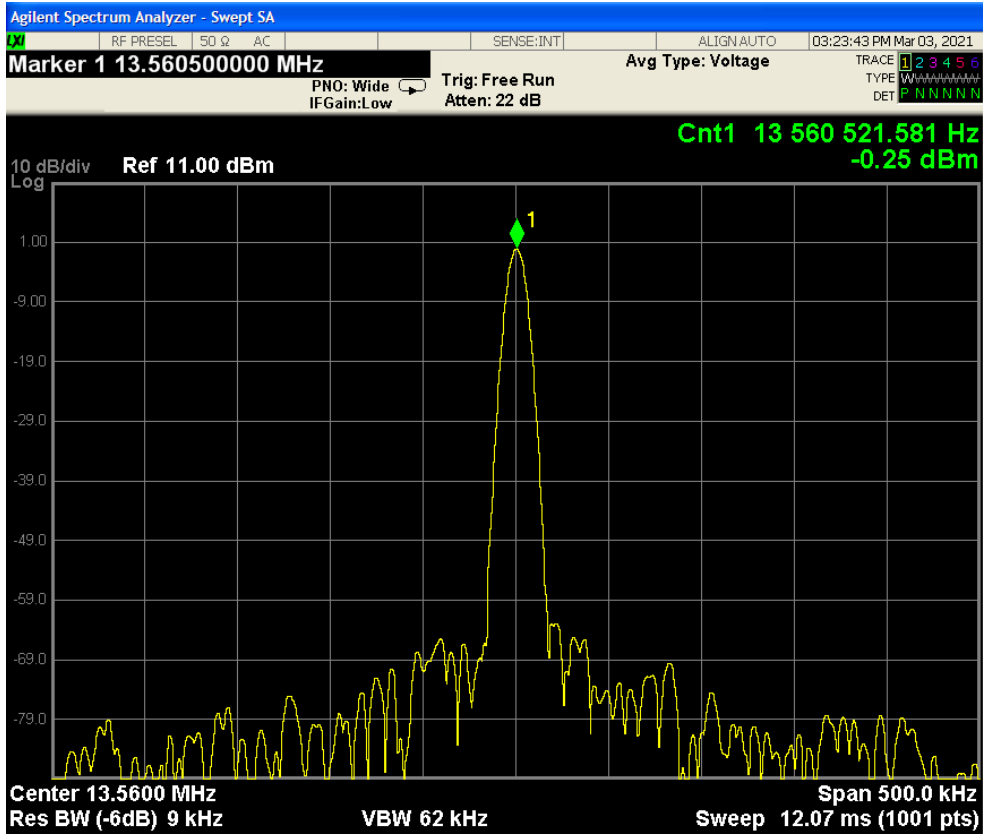


Figure 5.1.22 – Screen capture 22

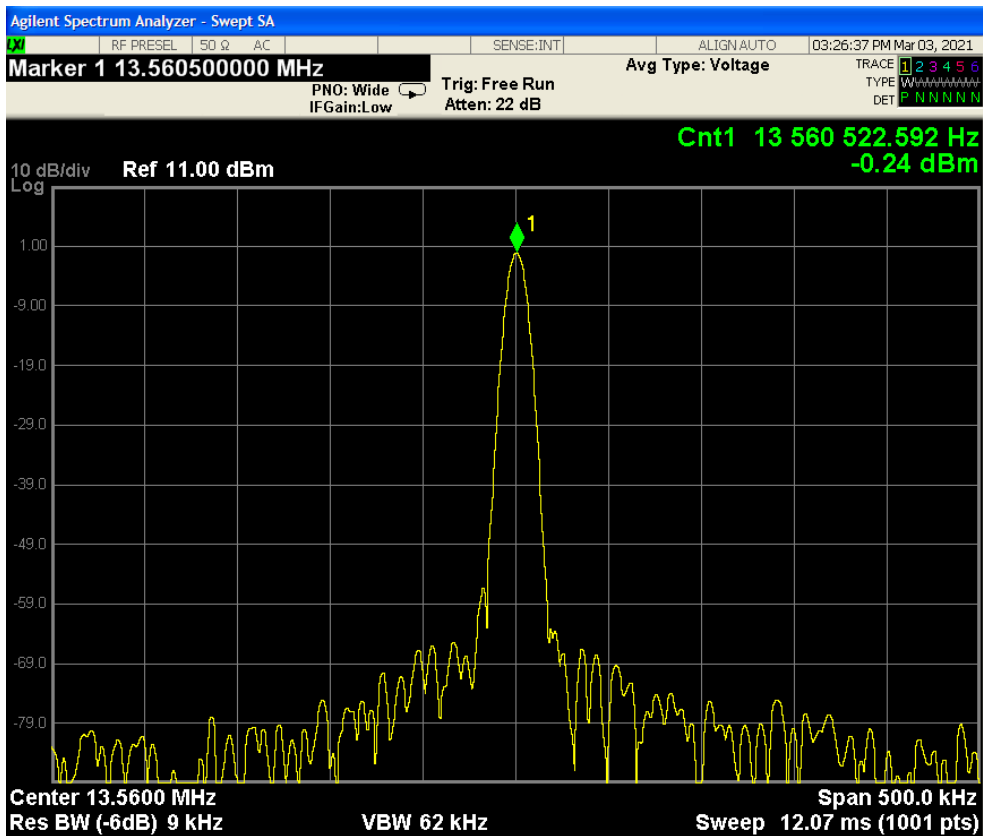


Figure 5.1.23 – Screen capture 23

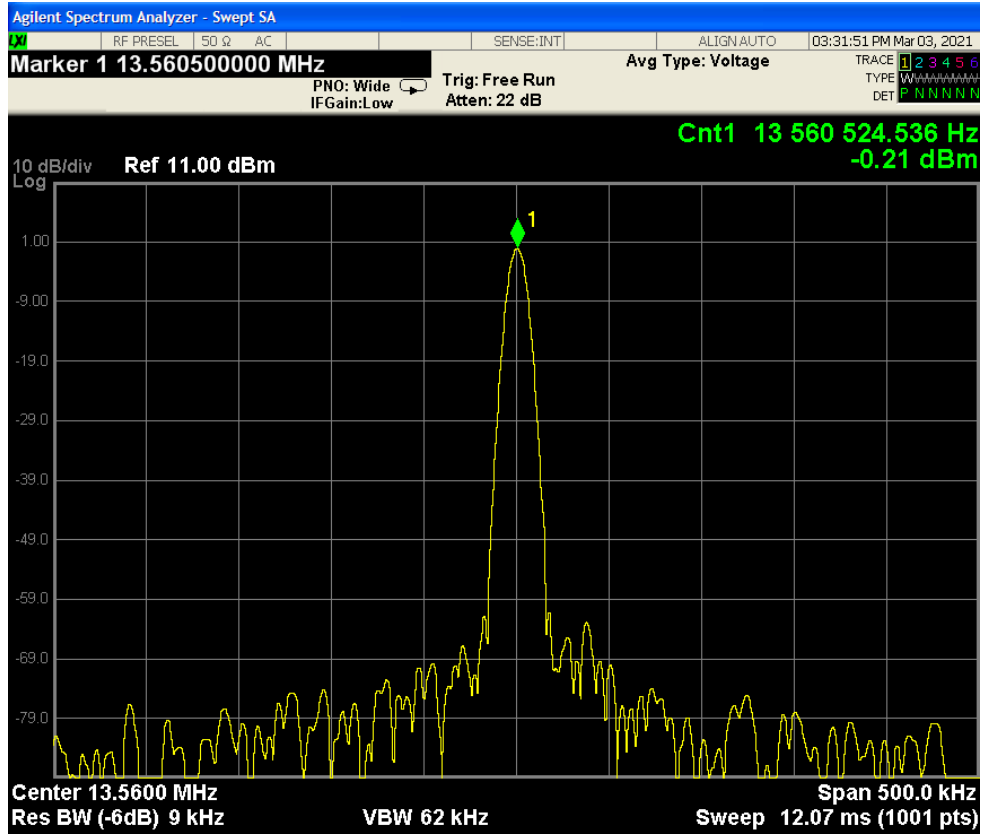


Figure 5.1.24 – Screen capture 24

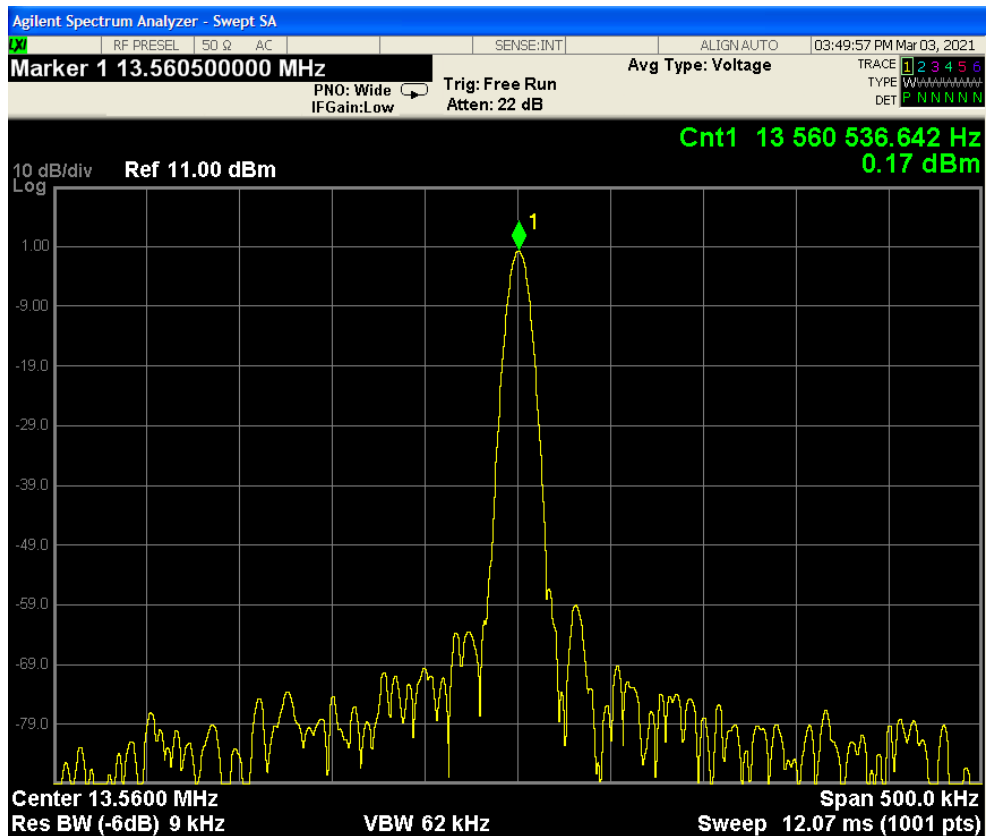


Figure 5.1.25 – Screen capture 25

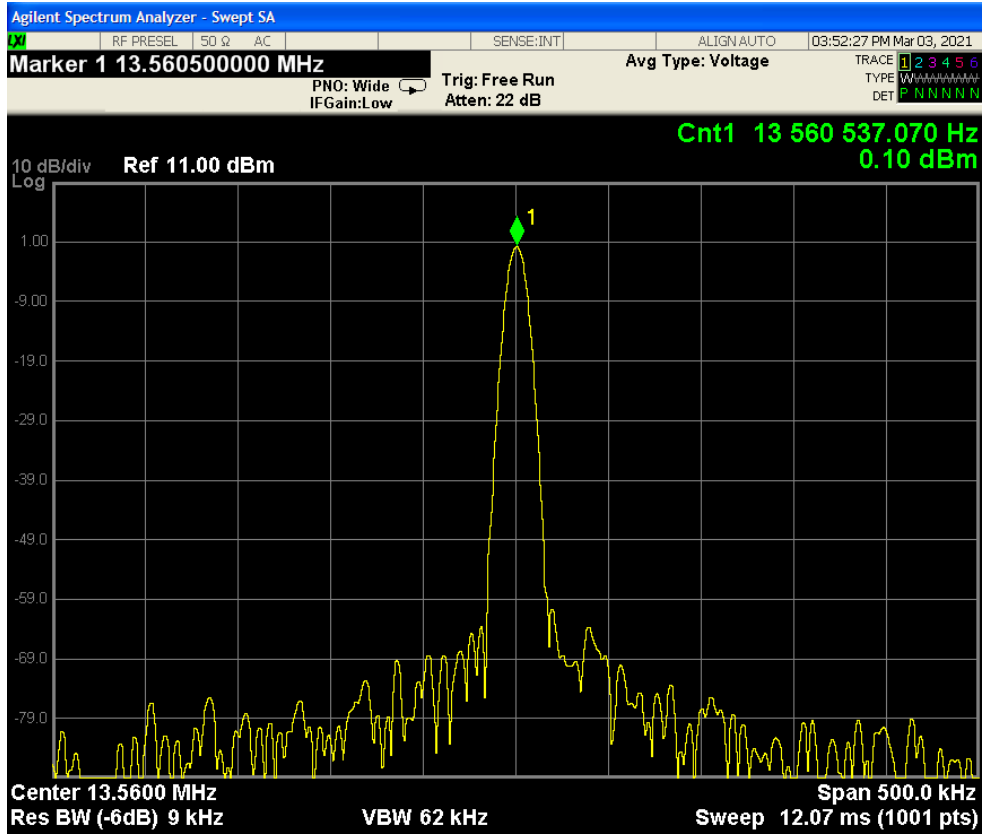


Figure 5.1.26 – Screen capture 26

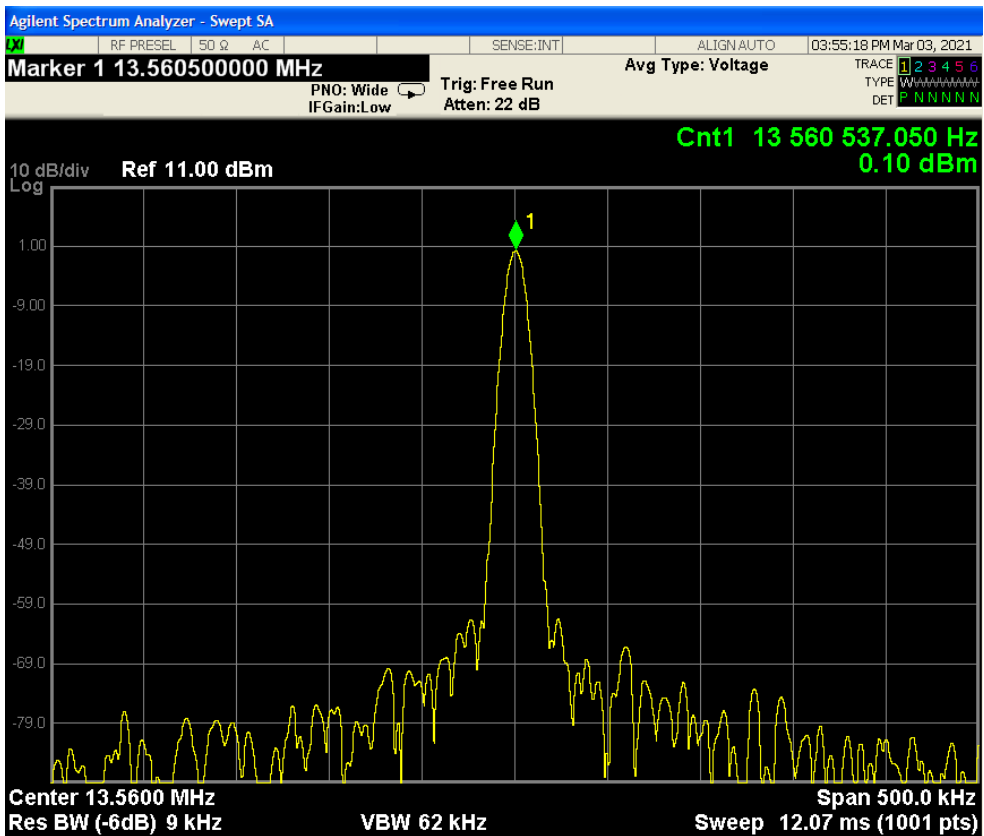


Figure 5.1.27 – Screen capture 27

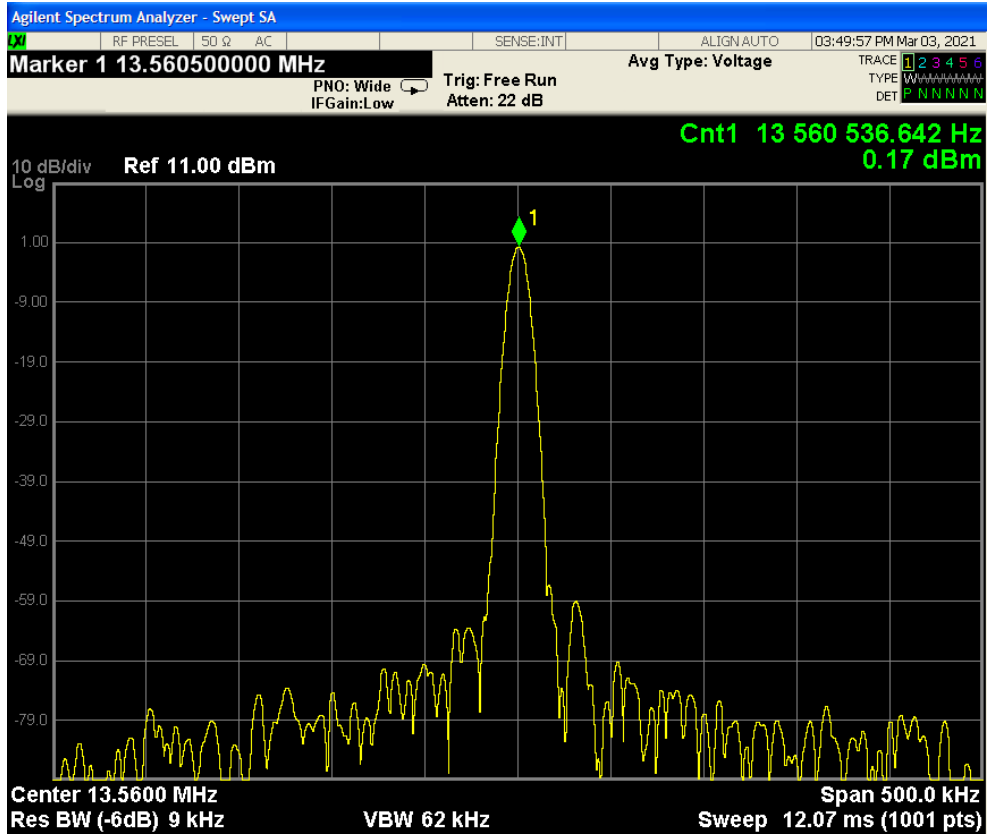


Figure 5.1.28 – Screen capture 28

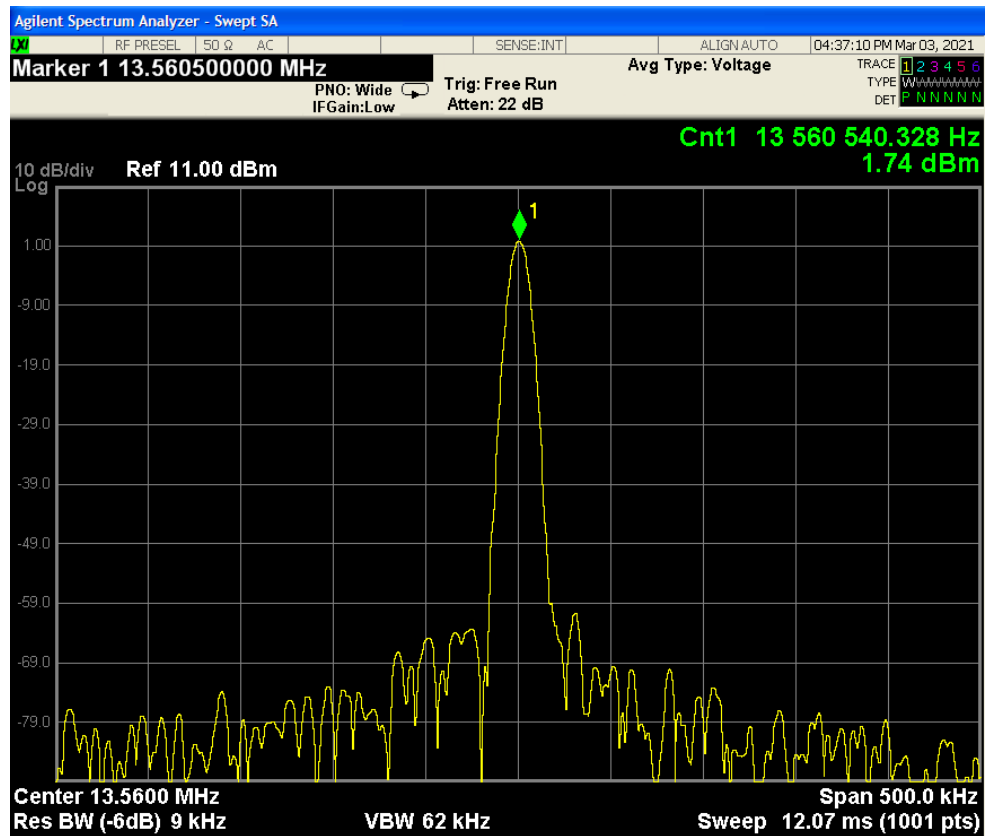


Figure 5.1.29 – Screen capture 29

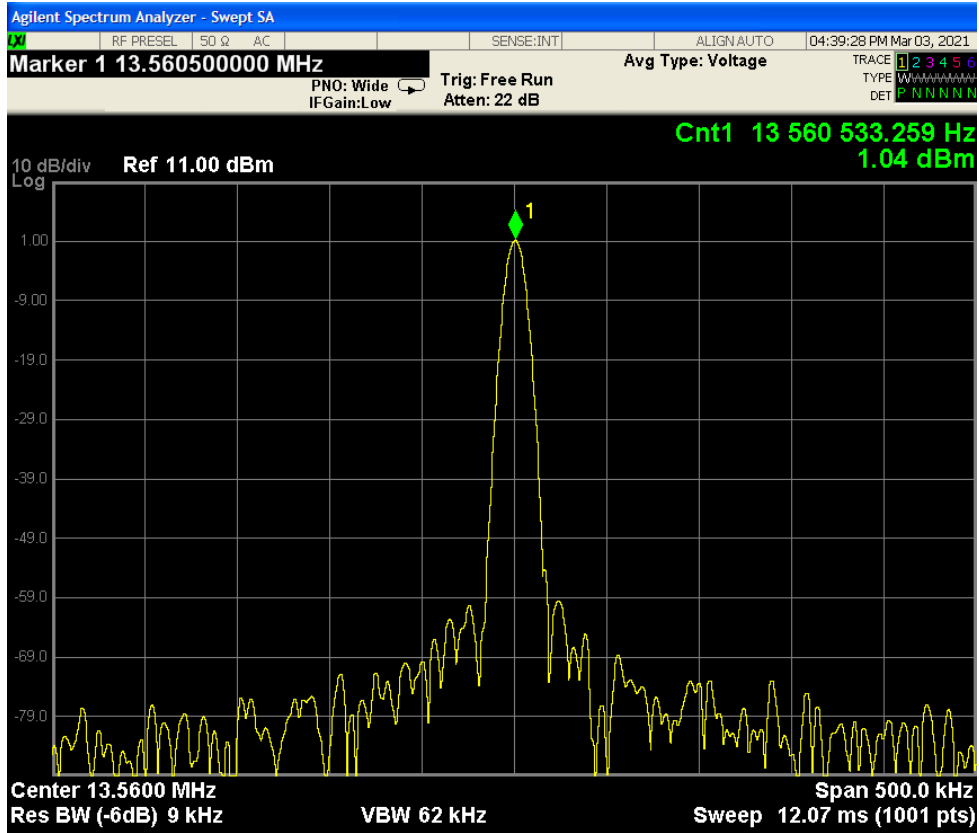


Figure 5.1.30 – Screen capture 30

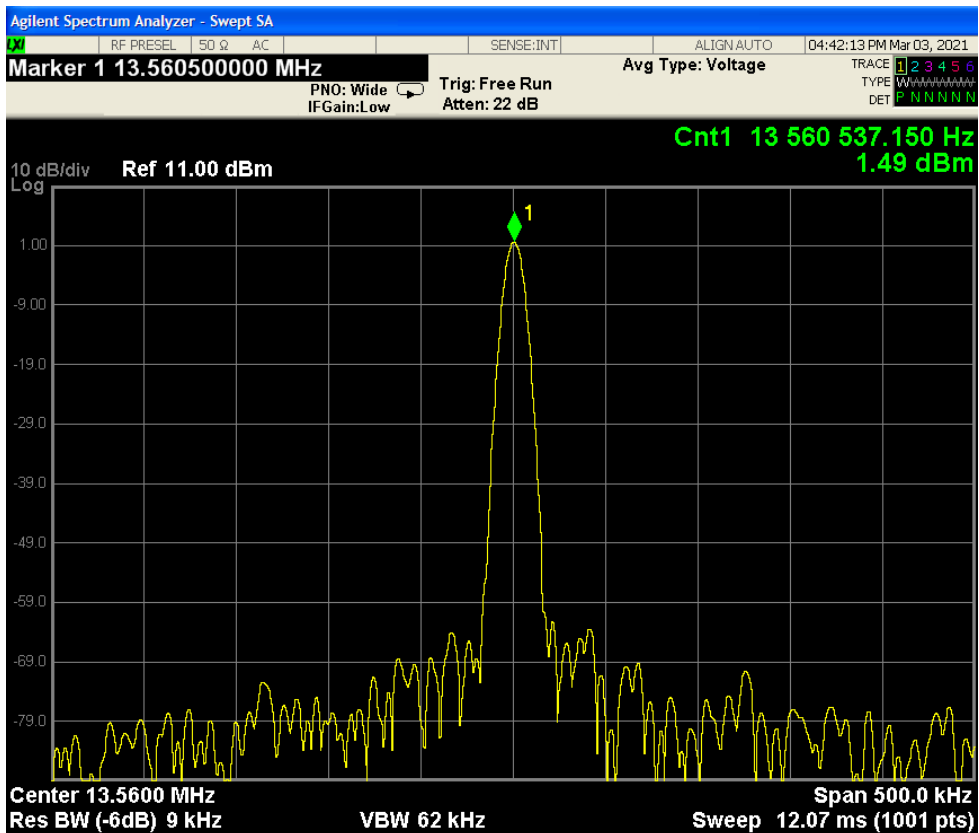


Figure 5.1.31 – Screen capture 31

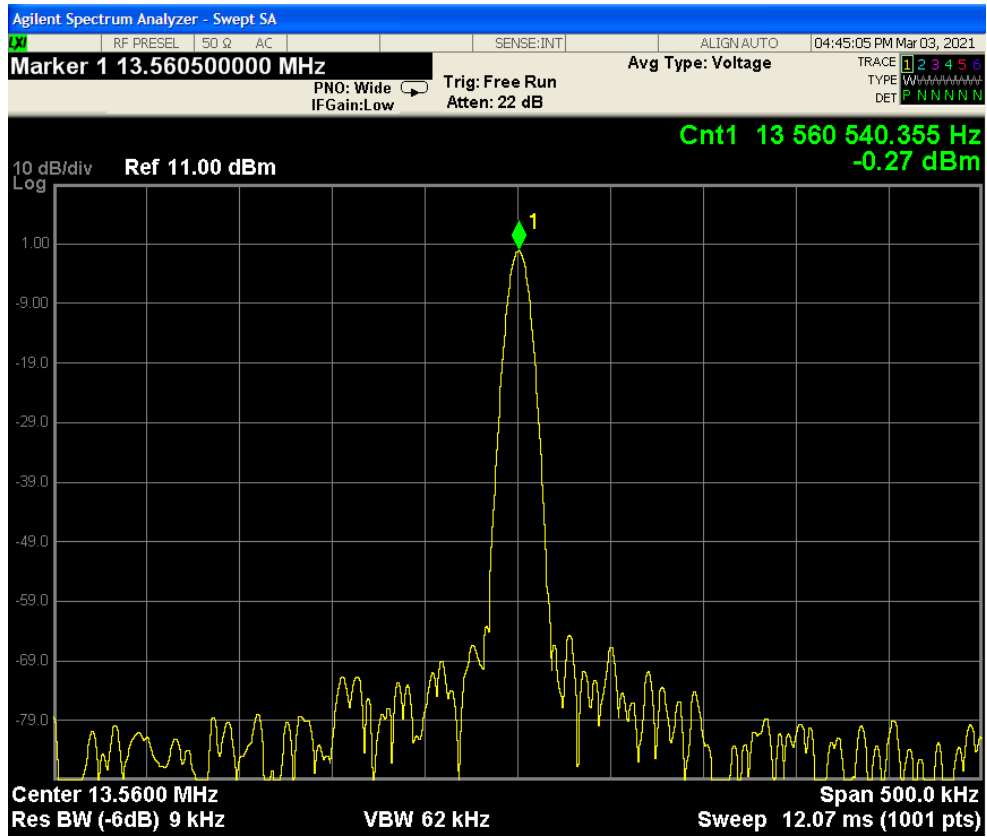


Figure 5.1.32 – Screen capture 32

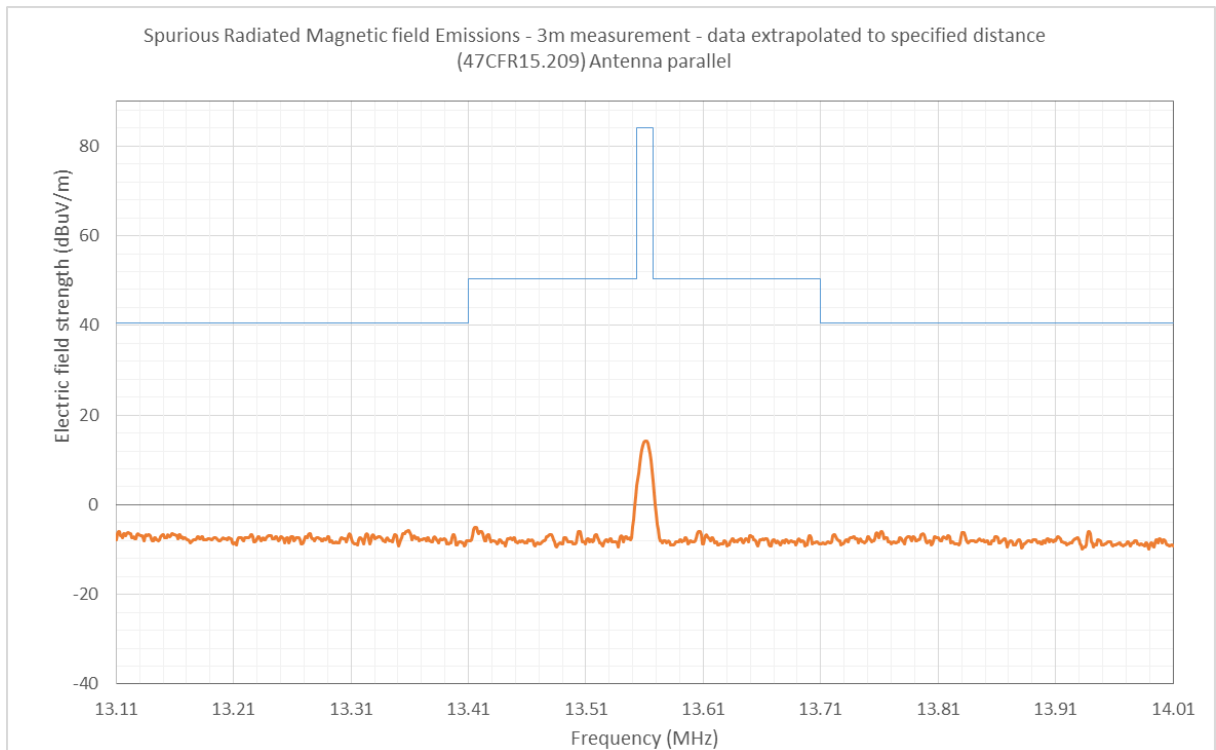


Figure 5.1.33 – Carrier signal at Nominal supply voltage

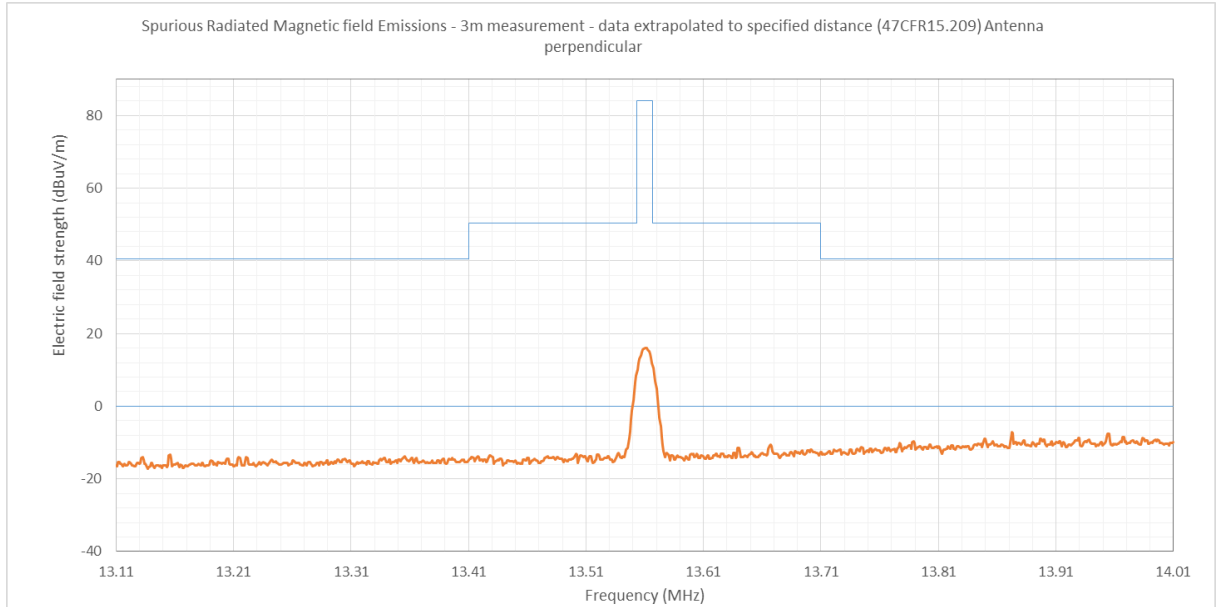


Figure 5.1.34 – Carrier signal at 115% Nominal supply voltage

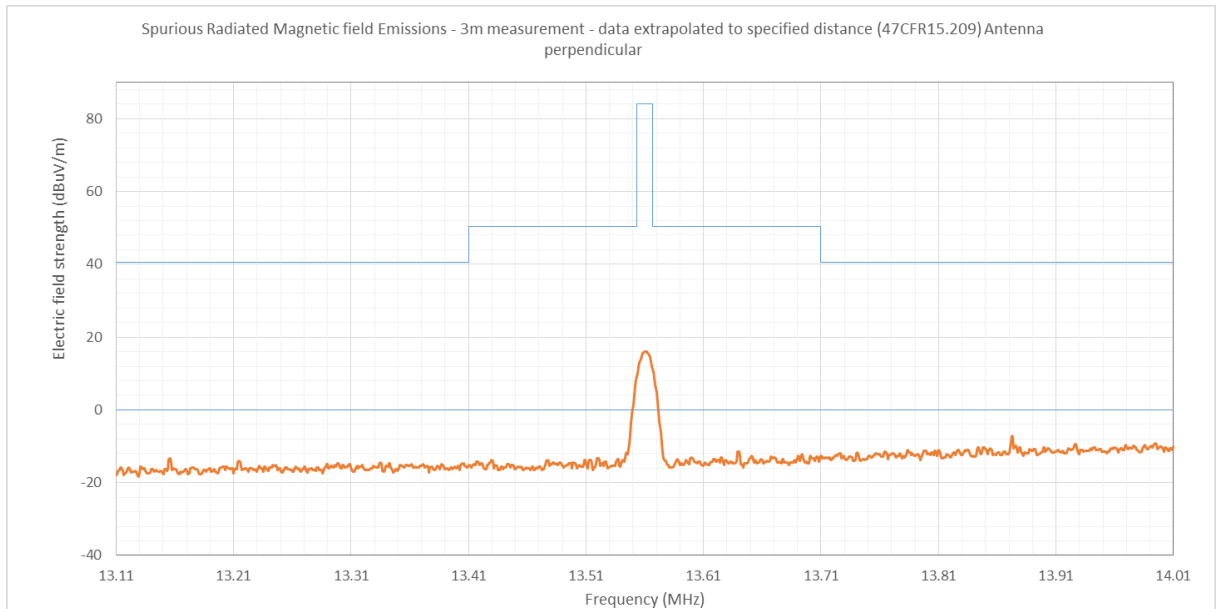


Figure 5.1.35 – Carrier signal at 85% Nominal supply voltage

4.2 Appendix 2 EUT test configurations

Test set up photographs are not included in this test report and are supplied separately.

4.3 Appendix 3 Equipment used

Radiated Emissions Equipment

Item	Serial No.	Last Calibration Date	Calibration Interval
Laboratory 1 Semi-Anechoic Chamber	Lab 1	28 th January 2020	36 Months
ETS Lindgren 2017B Mast (1 – 4m) with tilting mechanism	--	N/A	N/A
R & S ESR	-	26 th March 2020	12 Months
Chase CBL6112B Bilog Antenna, 78167	1503	13 th December 2019	36 Months
6dB Attenuator (For use with Bilog Antenna)	78708B	13 th December 2019	36 Months
RF Cables 9, 11, HF10, HF17, HF26 and HF27	-	25 th January 2021	12 Months
Schwarzbeck BBV 9745 Preamplifier	00218	8 th February 2021	12 Months
ETS Lindgren 6512 Passive Loop Antenna	00119475	21 st February 2020	24 Months
Keysight PXA EMI Receiver	MY54170531	31 st March 2020	12 Months
Thermotron Environmental chamber	26358	19 th November 2019	36 Months

Mains conducted emissions equipment

Item	Serial No.	Last Calibration Date	Calibration Interval
Rohde & Schwarz ESR7 Test receiver	-	26 th January 2021	12 Months
Cables J7, J9 and LF3	-	25 th January 2021	12 Months
Rohde & Schwarz ESH3-Z5 LISN 78119	-	25 th January 2021	12 Months
Teseq CFL 9206A transient limiter 10dB 9kHz - 30MHz	-	6 th January 2021	12 Months
Kikusui PCR2000M power supply	-	-	-

4.4 Appendix 4 Customers test equipment used

Equipment	Serial number	Cal status
None	N/A	N/A

4.5 Appendix 5 Modification States

Modification state	Modification
0	As supplied by the customer.

6.6 Appendix 6 Test Report History

Issue	Modification details
1	Original issue of the test report
2	Updated to include Canadian regulatory testing
3	Product details amended
4	FCC ID added