



Radio Test Report

Zinwave Ltd

**Zinwave UNItivity 5000 Remote Unit
305-1007**

47 CFR Part 27 Effective Date 1st October 2020

47 CFR Part 2 Effective Date 1st October 2020

Test Date: 14th February 2022 to 29th April 2022

Report Number: 03-13344-3-22 Issue 01

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Certificate of Test 13344-3

The equipment noted below has been fully tested by R.N. Electronics Limited and, where appropriate, conforms to the relevant subpart of FCC Part 27. This is a certificate of test only and should not be confused with an equipment authorisation. Other standards may also apply.

Equipment:	Zinwave UNItivity 5000 Remote Unit
Model Number:	305-1007
Unique Serial Number:	330100000001 (radiated unit) 330100000003 (conducted unit)
Applicant:	Zinwave Ltd Harston Mill, Royston Road Harston, Cambridge CB22 7GG
Proposed FCC ID	UPO3005-1007
Full measurement results are detailed in Report Number:	03-13344-3-22 Issue 01
Test Standards:	47 CFR Part 27 Effective Date 1st October 2020 47 CFR Part 2 Effective Date 1st October 2020

NOTE:

Certain tests were not performed based upon manufacturer's declarations. Certain other requirements are subject to manufacturer declaration only and have not been tested/verified. For details refer to section 3 of this report.

This report only pertains to the operation of the equipment to 47CFR part 27, for details of testing to other rule parts please see RN reports: 03-13344-1-22 (Parts 22E, 22H, 24E), 03-13344-2-22 (Part 74H), and 03-13344-4-22 (Part 90).

DEVIATIONS: No deviations have been applied.

This certificate relates only to the unit tested as identified by a unique serial number and in the condition at the time it was tested. It does not relate to any other similar equipment and performance of the product before or after the test cannot be guaranteed. Whilst every effort is made to assure quality of testing, type tests are not exhaustive and although no non-conformances may be found, this doesn't exclude the possibility of unit not meeting the intentions of the standard or the requirements of the Federal Regulations, particularly under different conditions to those during testing. Any compliance statements are made reliant on (a) the application of the product and use of the assigned band being acceptable to the FCC and (b) the modes of operation as instructed to us by the Customer based on their specific knowledge of the application and functionality of the EUT. Statements of compliance, where measurements were made, do not include the measurement uncertainty. The measurement uncertainty, where stated, is the expanded uncertainty based on a standard uncertainty multiplied by a coverage factor of $k=2$, providing a level of confidence of approximately 95%.

Date Of Test: 14th February 2022 to 28th April 2022

Test Engineer:

Approved By:
Radio Manager

Digitally signed by: Daniel Sims
DN: CN = Daniel Sims C = GB O =
RN Electronics Ltd
Date: 2022.05.11 12:14:13 Z

Customer
Representative:



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2 Equipment under test (EUT)

2.1 Equipment specification

Applicant	Zinwave Ltd Harston Mill Royston Road Harston Cambridge CB22 7GG	
Manufacturer of EUT	Zinwave Ltd	
Full Name of EUT	Zinwave UNItivity 5000 Remote Unit	
Model Number of EUT	305-1007	
Serial Number of EUT	330100000001 (radiated unit) 330100000003 (conducted unit)	
Date Received	11 th February 2022	
Date of Test:	14 th February 2022 to 28 th April 2022	
Purpose of Test	To demonstrate design compliance to the relevant rules of Chapter 47 of the Code of Federal Regulations.	
Date Report Issued	10 th May 2022	
Main Function	Distributed Antenna remote unit	
Information Specification	Height	250mm
	Width	250mm
	Depth	50mm
	Weight	2kg
	Voltage	48 V DC
	Current	< 1 A (35W)

2.2 Configurations for testing

General Parameters	
EUT Normal use position	Wall mounted
Choice of model(s) for type tests	Production unit
Antenna details	external max 8dBi
Antenna port	External: 1x TX; 1x RX (N-type ports)
Baseband Data port (yes/no)?	NO
Highest Signal generated in EUT	2690 MHz
Lowest Signal generated in EUT	Not stated
Hardware Version	1.0
Software Version	
Firmware Version	4.209
Type of Equipment	Booster, Distributed Antenna System
Technology Type	Various – wideband distributed antenna system
Geo-location (yes/no)	No
TX Parameters	
Alignment range – transmitter	150 - 2690 MHz
EUT Declared Modulation Parameters	Device supports wideband Commercial Mobile Radio Services under this rule part
EUT Declared Power level	+20dBm < 1600 MHz +24 dBm > 1600 MHz except 2345 - 2360 MHz band +16 dBm 2345 - 2360 MHz band
EUT Declared Signal Bandwidths	Device supports wideband Commercial Mobile Radio Services under this rule part
EUT Declared Channel Spacing's	Device supports wideband Commercial Mobile Radio Services under this rule part
EUT Declared Duty Cycle	up to 100%
Unmodulated carrier available?	Yes - EUT provides at its output whatever is presented to its input
Declared frequency stability	0ppm (DAS without frequency translation)
RX Parameters	
Alignment range – receiver	As per Transmitter range
EUT Declared RX Signal Bandwidth	As per Transmitter
Receiver Signal Level (RSL)	N/A
Method of Monitoring Receiver BER	N/A

2.3 Functional description

The Remote Unit is used as part of the Zinwave UNItivity 5000 system to provide cellular and private radio services within buildings, sports arenas and similar areas.

The system is wideband in nature and can support a wide range of radio services depending upon the system that is connected to the service module of the Primary Hub.

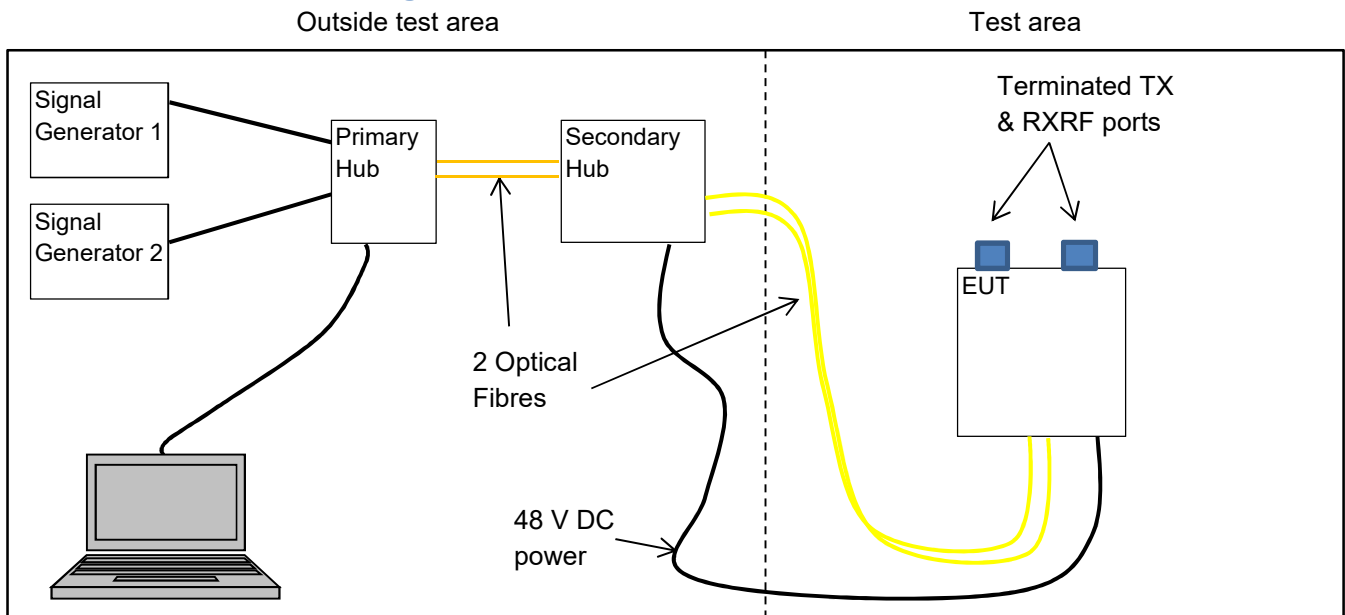
2.4 Modes of operation

Mode Reference	Description	Used for testing
Mode 1	CW Sweep from 617 – 652 MHz to determine f0	Yes
Mode 2	Single mode Channel AWGN at f0 (627.955MHz) in band 617-652 MHz	Yes
Mode 3	Single Low channel AWGN at 619.5 MHz	Yes
Mode 4	Single Mid channel AWGN at 634 MHz	Yes
Mode 5	Single High channel AWGN at 649.5 MHz	Yes
Mode 6	Dual Low channel AWGN at 619.5 MHz & 624.5 MHz	Yes
Mode 7	Dual High channel AWGN at 644.5 MHz & 649.5 MHz	Yes
Mode 8	CW Sweep from 716 – 758 MHz to determine f0	Yes
Mode 9	Single mode Channel AWGN at f0 (730.326MHz) in band 716 – 758 MHz	Yes
Mode 10	Single Low channel AWGN at 718.5 MHz	Yes
Mode 11	Single Mid channel AWGN at 740 MHz	Yes
Mode 12	Single High channel AWGN at 755.5 MHz (also used for 27.53(f))	Yes
Mode 13	Dual Low channel AWGN at 718.5 MHz & 723.5 MHz	Yes
Mode 14	Dual High channel AWGN at 750.5 MHz & 755.5 MHz	Yes
Mode 15	CW Sweep from 2110 – 2200 MHz to determine f0	Yes
Mode 16	Single mode Channel AWGN at f0 (2113.1MHz) in band 2110 – 2200 MHz	Yes
Mode 17	Single Low channel AWGN at 2112.5 MHz	Yes
Mode 18	Single Mid channel AWGN at 2155 MHz	Yes
Mode 19	Single High channel AWGN at 2197.5 MHz	Yes
Mode 20	Dual Low channel AWGN at 2112.5 MHz & 2127.5 MHz	Yes
Mode 21	Dual High channel AWGN at 2192.5 MHz & 2197.5 MHz	Yes
Mode 22	CW Sweep from 2345 – 2360 MHz to determine f0	Yes
Mode 23	Single mode Channel AWGN at f0 (2345.1MHz) in band 2345 – 2360 MHz	Yes
Mode 24	Single Low channel AWGN at 2347.5 MHz 16 dBm Power	Yes
Mode 25	Single Mid channel AWGN at 2352.5 MHz 16 dBm Power	Yes
Mode 26	Single High channel AWGN at 2357.5 MHz 16 dBm Power	Yes
Mode 27	Dual Low channel AWGN at 2347.5 MHz & 2352.5 MHz 16 dBm Power	Yes
Mode 28	Dual High channel AWGN at 2352.5 MHz & 2357.5 MHz 16 dBm Power	Yes
Mode 29	CW Sweep from 2496 – 2690 MHz to determine f0	Yes
Mode 30	Single mode Channel AWGN at f0 (2665.8MHz) in band 2496 – 2690 MHz	Yes
Mode 31	Single Low channel AWGN at 2498.5 MHz	Yes
Mode 32	Single Mid channel AWGN at 2600 MHz	Yes
Mode 33	Single High channel AWGN at 2687.5 MHz	Yes
Mode 34	Dual Low channel AWGN at 2498.5 MHz & 2503.5 MHz	Yes
Mode 35	Dual High channel AWGN at 2682.5 MHz & 2687.5 MHz	Yes
Mode 36	Single Low channel AWGN at 748.5 MHz (for 27.53(f) only)	Yes
Mode 37	Single Mid channel AWGN at 752 MHz (for 27.53(f) only)	Yes

Note: This report only pertains to the operation of the equipment to 47CFR part 27, for details of testing to other rule parts please see RN reports:

03-13344-1-22 (Parts 22E, 22H, 24E)
03-13344-2-22 (Part 74H)
03-13344-4-22 (Part 90).

2.5 Emissions configuration



The unit was powered from the secondary hub at 48V DC. The unit was configured using the supplied network management software using the settings files prepared by Zinwave Ltd, this provided 25dB gain and +20dBm EUT output power in conjunction with an input level of -5dBm. Any attenuation introduced by the Primary/secondary hub system was also accounted for in the set-up files provided by Zinwave Ltd. Test channels and required modulations were set using the signal generators connected to the primary hub. Single channel operation was provided by generator 1 and dual channel was using two signal generators. Output power of the signal generators was set to provide -5dBm at input to primary hub. The transmit mode was 100% continuous with EUT output power maintained at +20dBm (25dB gain). Test channels and combinations of used are stated in test modes section 2.4. The system supports operation with a number of wideband services, so testing was performed with AWGN modulation signal as per KDB 935210 D05.

For conducted RF tests the RF ports were connected via suitable attenuation and filtering where required and connected directly to a spectrum analyser, with losses accounted for in the measurement results.

The system is designed for operation with antennas having a maximum gain of 8.0 dBi or 5.85 dBd. This is the value used for determining EIRP or ERP where required.

2.5.1 Signal leads

Port Name	Cable Type	Connected
DC power	2 core	Yes
Fibre TX	Fibre	Yes
Fibre RX	Fibre	Yes
Transmit port	N-type coaxial	Yes
Receive port	N-type coaxial	Yes

3 Summary of test results

The Zinwave UNItivity 5000 Remote Unit, 305-1007 was tested for compliance to the following standard(s) :

47 CFR Part 27 Effective Date 1st October 2020
47 CFR Part 2 Effective Date 1st October 2020

Any compliance statements are made reliant on (a) the application of the product and use of the assigned band being acceptable to the FCC and (b) the modes of operation as instructed to us by the Customer based on their specific knowledge of the application and functionality of the EUT. Whilst every effort is made to assure quality of testing, type tests are not exhaustive and although no non-conformances may be found, this doesn't exclude the possibility of equipment not meeting the intentions of the standard or the essential requirements of the directive, particularly under different conditions to those during testing. Statements of compliance, where measurements were made, do not include the measurement uncertainty. The measurement uncertainty, where stated, is the expanded uncertainty based on a standard uncertainty multiplied by a coverage factor of k=2, providing a level of confidence of approximately 95%.

Title	References	Results
Transmitter Tests		
1. Spurious emissions at antenna terminals	FCC Part 27 Clause 27.53(a)(g)(h)(m)2 FCC Part 2 Clause 2.1051	PASSED ¹
2. RF Power Output	FCC Part 27 Clause 27.50(c)(d)(a)(h) FCC Part 2 Clause 2.1046	PASSED
3. Frequency stability	FCC Part 2 Clause 2.1055	NOT APPLICABLE ²
4. Occupied bandwidth	FCC Part 2 Clause 2.1049	PASSED
5. Field strength of spurious radiations	FCC Part 27 Clause 27.53(a)(g)(h)(m)2 FCC Part 2 Clause 2.1053	PASSED ¹
6. Band edge emissions	FCC Part 27 Clause 27.53(a)(g)(h)(m)2 FCC Part 2 Clause 2.1051	PASSED
7. Modulation characteristics	FCC Part 2 Clause 2.1047	PROVIDED ³
8. Determination of f ₀	KDB 935210 D05 Clause 3.3	PERFORMED

¹ Spectrum investigated started at a frequency of 30MHz up to a frequency of 27GHz based on 10 times the highest channel of 2687.5MHz

² EUT does not contain an oscillator and only reproduces what is provided at its input.

³ Modulation characteristics information provided in section 2.2.

4 Specifications

The tests were performed and operated in accordance with R.N. Electronics Ltd procedures and the relevant standards listed below.

4.1 Relevant standards

Ref.	Standard Number	Version	Description
4.1.1	FCC Part 27	2020	Miscellaneous Wireless Communications Services
4.1.2	47CFR part 2J	2020	Part 2 – Frequency Allocations and radio treaty matters; General rules and regulations
4.1.3	KDB 971168 D01 v03r01	2018	Federal Communications Commission Office of Engineering and Technology Laboratory Division; Measurement Guidance for Certification of Licensed Digital Transmitters
4.1.4	ANSI C63.26	2015	American National Standard for Compliance Testing of Transmitters Used in Licensed Radio Services
4.1.5	KDB 935210 D05 v01r04	2020	Federal Communications Commission Office of Engineering and Technology Laboratory Division; Measurement guidance for Industrial and Non-consumer signal booster, repeater and amplifier devices

4.2 Deviations

No deviations were applied.

5 Tests, methods and results

5.1 Spurious emissions at antenna terminals

5.1.1 Test methods

Test Requirements:	FCC Part 27 Clause 27.53 [Reference 4.1.1 of this report] FCC Part 2 Clause 2.1053 [Reference 4.1.2 of this report]
Test Method:	ANSI C63.26 2015 Clause 5.5 [Reference 4.1.4 of this report] KDB 935210 D05 Clause 3.6 / 4.7 [Reference 4.1.5 of this report]
Limits:	FCC Part 27 Clause 27.53 [Reference 4.1.1 of this report]

5.1.2 Configuration of EUT

EUT was tested on a bench. The EUT RF port under test was connected to a spectrum analyser via suitable attenuation. RX port was terminated into a 50 Ohm load. EUT was tested across Low, Middle and High channels within each applicable band in a single channel input mode and in a dual channel input mode modes are specified in section 2.4 of this report.

5.1.3 Test procedure

The EUT system was set up to maximum gain using the network management software provided. EUT signal level was raised until maximum output power was reached per channel/band setting as required. Measurements were made and plots taken in the required Resolution bandwidths, where applicable results are referenced to EIRP limits by consideration of the antenna gain used with the EUT of 8dBi (5.85dBd) and indicated. Only results within 20dB of limits are reported.

Note: some emissions >1 MHz from band edge were measured using the spectrum analyser adjacent power function that integrated power from a lower resolution bandwidth into the 1MHz required by the rule part.

Tests were performed in test site N.

5.1.4 Test equipment

F078, H071, E266, E777, E602

See Section 8 for more details

5.1.5 Test results

Temperature of test environment	17-23°C
Humidity of test environment	35-58%
Pressure of test environment	100-103kPa

For band edge results please refer to section 5.6 within this report

Setup Table

Band	617-652 MHz
Power Level	20 dBm
Channel Spacing	5 MHz
Mod Scheme	AWGN
Low channel	619.5 MHz

Spurious Frequency (MHz)	Measured Spurious Level (dBm)	Difference to Limit (dB)
616.9	-22.9	-9.9

Plots
617-652_MHz_plot1
617-652_MHz_plot2
617-652_MHz_plot3

Setup Table

File Name: Zinwave Ltd.13344-3 Issue 01

Band	617-652 MHz
Power Level	20 dBm
Channel Spacing	5 MHz
Mod Scheme	AWGN
Mid channel	634 MHz

Spurious Frequency (MHz)	Measured Spurious Level (dBm)	Difference to Limit (dB)
No Emissions observed within 20dB of limits		

Plots
617-652_MHz_plot1
617-652_MHz_plot2
617-652_MHz_plot3

Setup Table

Band	617-652 MHz
Power Level	20 dBm
Channel Spacing	5 MHz
Mod Scheme	AWGN
High channel	649.5 MHz

Spurious Frequency (MHz)	Measured Spurious Level (dBm)	Difference to Limit (dB)
No Emissions observed within 20dB of limits		

Plots
617-652_MHz_plot1
617-652_MHz_plot2
617-652_MHz_plot3

Setup Table

Band	716-758 MHz
Power Level	20 dBm
Channel Spacing	5 MHz
Mod Scheme	AWGN
Low channel	718.5 MHz

Spurious Frequency (MHz)	Measured Spurious Level (dBm)	Difference to Limit (dB)
715.9	-20.41	-7.41

Plots
716-758_MHz_plot1
716-758_MHz_plot2
716-758_MHz_plot3

Setup Table

Band	716-758 MHz
Power Level	20 dBm
Channel Spacing	5 MHz
Mod Scheme	AWGN
Mid channel	740 MHz

Spurious Frequency (MHz)	Measured Spurious Level (dBm)	Difference to Limit (dB)
No Emissions observed within 20dB of limits		

Plots
716-758_MHz_plot1
716-758_MHz_plot2
716-758_MHz_plot3

Setup Table

Band	716-758 MHz
Power Level	20 dBm
Channel Spacing	5 MHz
Mod Scheme	AWGN
High channel	755.5 MHz

Spurious Frequency (MHz)	Measured Spurious Level (dBm)	Difference to Limit (dB)
No Emissions observed within 20dB of limits		

Plots
716-758_MHz_plot1
716-758_MHz_plot2
716-758_MHz_plot3

Setup Table

Band	746-758 MHz
Power Level	20 dBm
Channel Spacing	5 MHz
Mod Scheme	AWGN
Low channel	748.5 MHz

Spurious Frequency (MHz)	Measured Spurious Level (dBm)	Difference to Limit (dB)
1597.8	-51.71	-3.71
1599.9	-71.97	-13.97

Plots
746-758_MHz_GNSS Band requirement/plots -70dBm/MHz wideband Part 27.53(f)
746-758_MHz_GNSS Band requirement/plots -80dBW discrete <700Hz Part 27.53(f)

Setup Table

Band	746-758 MHz
Power Level	20 dBm
Channel Spacing	5 MHz
Mod Scheme	AWGN
Mid channel	752 MHz

Spurious Frequency (MHz)	Measured Spurious Level (dBm)	Difference to Limit (dB)
1574.1	-51.31	-3.31
1574.0	-71.51	-13.51

Plots
746-758_MHz_GNSS Band requirement/plots -70dBm/MHz wideband Part 27.53(f)
746-758_MHz_GNSS Band requirement/plots -80dBW discrete <700Hz Part 27.53(f)

Setup Table

Band	746-758 MHz
Power Level	20 dBm
Channel Spacing	5 MHz
Mod Scheme	AWGN
High channel	755.5 MHz

Spurious Frequency (MHz)	Measured Spurious Level (dBm)	Difference to Limit (dB)
1593.0	-51.05	-3.05
1593.4	-71.23	-13.23

Plots
746-758_MHz_GNSS Band requirement/plots -70dBm/MHz wideband Part 27.53(f)
746-758_MHz_GNSS Band requirement/plots -80dBW discrete <700Hz Part 27.53(f)

Setup Table

Band	2110-2200 MHz
Power Level	20 dBm
Channel Spacing	5 MHz
Mod Scheme	AWGN
Low channel	2112.5 MHz

Spurious Frequency (MHz)	Measured Spurious Level (dBm)	Difference to Limit (dB)
2109	-22.3	-9.3
4225	-33.0	-20.0

Plots
2110-2200_MHz_plot1
2110-2200_MHz_plot2

Setup Table

Band	2110-2200 MHz
Power Level	20 dBm
Channel Spacing	5 MHz
Mod Scheme	AWGN
Mid channel	2155 MHz

Spurious Frequency (MHz)	Measured Spurious Level (dBm)	Difference to Limit (dB)
No Emissions observed within 20dB of limits		

Plots
2110-2200_MHz_plot1
2110-2200_MHz_plot2

Setup Table

Band	2110-2200 MHz
Power Level	20 dBm

Channel Spacing	5 MHz
Mod Scheme	AWGN
High channel	2197.5 MHz

Spurious Frequency (MHz)	Measured Spurious Level (dBm)	Difference to Limit (dB)
2202.5	-31.16	-18.16

Plots
2110-2200_MHz_plot1
2110-2200_MHz_plot2

Setup Table

Band	2345-2360 MHz
Power Level	16 dBm
Channel Spacing	5 MHz
Mod Scheme	AWGN
Low channel	2347.5 MHz

Spurious Frequency (MHz)	Measured Spurious Level (dBm)	Difference to Limit (dB)
1609.7	-45.16	-0.16
2782.5	-45.3	-0.3
4695.3	-55.9	-10.9

Plots
2345-2360_MHz_16dBm_plot1
2345-2360_MHz_16dBm_plot2
2345-2360_MHz_16dBm_plot3

Setup Table

Band	2345-2360 MHz
Power Level	16 dBm
Channel Spacing	5 MHz
Mod Scheme	AWGN
Mid channel	2352.5 MHz

Spurious Frequency (MHz)	Measured Spurious Level (dBm)	Difference to Limit (dB)
1605.9	-45.18	-0.18
2860.7	-45.19	-0.19
4705.2	-55.59	-10.59

Plots
2345-2360_MHz_16dBm_plot1
2345-2360_MHz_16dBm_plot2
2345-2360_MHz_16dBm_plot3

Setup Table

Band	2345-2360 MHz
Power Level	16 dBm
Channel Spacing	5 MHz
Mod Scheme	AWGN
High channel	2357.5 MHz

Spurious Frequency (MHz)	Measured Spurious Level (dBm)	Difference to Limit (dB)
1618.3	-45.06	-0.06
2817.2	-45.19	-0.19
4715.3	-55.36	-10.36

Plots
2345-2360_MHz_16dBm_plot1
2345-2360_MHz_16dBm_plot2
2345-2360_MHz_16dBm_plot3

Setup Table

Band	2496-2690 MHz
Power Level	20 dBm
Channel Spacing	5 MHz
Mod Scheme	AWGN
Low channel	2498.5 MHz

Spurious Frequency (MHz)	Measured Spurious Level (dBm)	Difference to Limit (dB)
No Emissions observed within 20dB of limits		

Plots
2496-2690_MHz_plot1
2496-2690_MHz_plot2

Setup Table

Band	2496-2690 MHz
Power Level	20 dBm
Channel Spacing	5 MHz
Mod Scheme	AWGN
Mid channel	2600 MHz

Spurious Frequency (MHz)	Measured Spurious Level (dBm)	Difference to Limit (dB)
No Emissions observed within 20dB of limits		

Plots
2496-2690_MHz_plot1
2496-2690_MHz_plot2

Setup Table

Band	2496-2690 MHz
Power Level	20 dBm
Channel Spacing	5 MHz
Mod Scheme	AWGN
High channel	2687.5 MHz

Spurious Frequency (MHz)	Measured Spurious Level (dBm)	Difference to Limit (dB)
No Emissions observed within 20dB of limits		

Plots
2496-2690_MHz_plot1
2496-2690_MHz_plot2

Results are also presented graphically in section 6.

LIMITS:

Parts 27.53(a)(1) for operation in the 2345-2360 MHz band (plotted as -45 dBm, $75 + 10 \log P$, for simplicity)

Parts 27.53 (c) and 27.53(f) for operation in the 746-758 MHz band

Parts 27.53 (g) for operation in the 698-746 MHz band

Parts 27.53 (h) for operation in the 2110-2200 MHz band

Parts 27.53 (m), for operation in the 2496 – 2690 MHz band.

In all cases, absolute limits are determined from the relative limit as per example:

Limits based on $43+10\log P$. dB attenuation below Output power in Watts: i.e. +20dBm = 0.1W therefore:

$43+10*\log 0.1 = 33\text{dB}$. +20dBm – 33 = -13dBm.

These results show that the EUT has PASSED this test.

The uncertainty gives a 95% confidence interval in the measurement. Expanded uncertainty (K=2) is as follows:

$\leq \pm 2.8 \text{ dB}$

5.2 RF Power Output

5.2.1 Test methods

Test Requirements:	FCC Part 27 Clause 27.53(a)(g)(h)(m2) [Reference 4.1.1 of this report] FCC Part 2 Clause 2.1053 [Reference 4.1.2 of this report]
Test Method:	ANSI C63.26 2015 Clause 5.2 [Reference 4.1.4 of this report] KDB 935210 D05 Clause 3.5 / 4.5 [Reference 4.1.5 of this report]
Limits:	FCC Part 27 Clause 27.53(a)(g)(h)(m2) [Reference 4.1.1 of this report]

5.2.2 Configuration of EUT

EUT was tested on a bench. The EUT RF port under test was connected to a spectrum analyser via suitable attenuation. RX port was terminated into a 50 Ohm load. EUT was tested at determined f_0 in each applicable band. Test modes used were

5.2.3 Test procedure

Tests were made in accordance with the test method noted above using the measuring equipment listed in the 'Test Equipment' Section. The EUT system was set up to maximum gain using the network management software provided. EUT signal level was raised until maximum output power was reached per channel/band setting as required and the frequency under test was set to an appropriate channel to include f_0 as determined in section 5.8. An RMS detector was set and Channel power was measured using the channel power function, in addition, the Peak to Average power ratio was also measured using the CCDF function of the analyser.

5.2.4 Test equipment

F078, H071, E266, E777, E602

See Section 8 for more details

5.2.5 Test results

Temperature of test environment	18-23°C
Humidity of test environment	35-58%
Pressure of test environment	100-103kPa

Band	617-652 MHz
Power Level	20 dBm
Channel Spacing	5 MHz
Mod Scheme	AWGN
f_0 frequency	627.995 MHz

Test conditions		Average Power (dBm)	Pk to AV Power ratio (dB)	TX power EIRP (dBm)	TX Power EIRP (W)
Temp Ambient	Volts Nominal	20.18	8.92	28.18	0.658

Note: 8dBi Antenna gain used.

Band	716-758 MHz
Power Level	20 dBm
Channel Spacing	5 MHz
Mod Scheme	AWGN
f_0 frequency	730.326 MHz

Test conditions		Average Power (dBm)	Pk to AV Power ratio (dB)	TX power EIRP (dBm)	TX Power EIRP (W)
Temp Ambient	Volts Nominal	20.3	9.61	28.3	0.676

Note: 8dBi Antenna gain used.

Band	2110-2200 MHz
Power Level	20 dBm
Channel Spacing	5 MHz
Mod Scheme	AWGN
f0 frequency	2113.1 MHz

Test conditions		Average Power (dBm)	Pk to AV Power ratio (dB)	TX power EIRP (dBm)	TX Power EIRP (W)
Temp Ambient	Volts Nominal	24.49	8.39	32.49	1.774

Note: 8dBi Antenna gain used.

Band	2345-2360 MHz
Power Level	16 dBm
Channel Spacing	5 MHz
Mod Scheme	AWGN
f0 frequency	2345.1 MHz

Test conditions		Average Power (dBm)	Pk to AV Power ratio (dB)	TX power EIRP (dBm)	TX Power EIRP (W)
Temp Ambient	Volts Nominal	15.74	10.92	23.74	0.237

Note: 8dBi Antenna gain used.

Band	2496-2690 MHz
Power Level	20 dBm
Channel Spacing	5 MHz
Mod Scheme	AWGN
f0 frequency	2665.8 MHz

Test conditions		Average Power (dBm)	Pk to AV Power ratio (dB)	TX power EIRP (dBm)	TX Power EIRP (W)
Temp Ambient	Volts Nominal	24.3	8.76	32.3	1.698

Note: 8dBi Antenna gain used.

Results are also presented graphically in section 6

LIMITS:

27.50(c), 65 W EIRP (Limit is actually W / MHz, but since bandwidth of signal is not known and the actual TX power is < 1W EIRP, the 65 W limit from table 3 covers all options for bandwidth and antenna height across the whole band)

27.50(d), 1640 W EIRP

27.50(a), 2000 W / 5 MHz EIRP

27.50(h), 2000 W EIRP

These results show that the EUT has PASSED this test.

The uncertainty gives a 95% confidence interval in the measurement. Expanded uncertainty (K=2) is as follows: < ±1 dB.

5.3 Frequency stability

NOT APPLICABLE: EUT does not contain an oscillator and only reproduces what is provided at its input.

5.4 Occupied bandwidth / Input versus output signal

5.4.1 Test methods

Test Requirements:	FCC Part 2 Clause 2.1053 [Reference 4.1.2 of this report]
Test Method:	ANSI C63.26 2015 Clause 5.4 [Reference 4.1.4 of this report]
	KDB 935210 D05 Clause 3.3 / 3.4, 4.3 / 4.4 [Reference 4.1.5 of this report]
Limits:	None

5.4.2 Configuration of EUT

EUT was tested on a bench. The EUT RF port under test was connected to a spectrum analyser via suitable attenuation. RX port was terminated into a 50 Ohm load. EUT was tested at centre frequency of each applicable band, these were modes 4, 11, 18, 25 and 32.

5.4.3 Test procedure

Tests were made in accordance with the test method noted above using the measuring equipment listed in the 'Test Equipment' Section. The EUT system was set up to maximum gain using the network management software provided. EUT signal level was raised until maximum output power was reached per channel/band setting as required and the frequency under test was set the centre channel of each band. A peak detector was set with max hold and sweeps made comparing the input and the output signals and their -26dB bandwidth points. Trace data as measured on the analyser was captured and relevant markers placed on the plots to demonstrate the bandwidths of input and Output signals.

5.4.4 Test equipment

F078, H071, E266, E777, E602

See Section 8 for more details

5.4.5 Test results

Temperature of test environment	18-24°C
Humidity of test environment	35-58%
Pressure of test environment	100-103kPa

Band	617-652 MHz
Power Level	20 dBm
Channel Spacing	5 MHz
Mod Scheme	AWGN
Centre frequency	634 MHz

	26dB BW (MHz)
Input measurement	4.66
Output measurement	4.64
Plot reference	617-652_MHz_input-output

Band	716-758 MHz
Power Level	20 dBm
Channel Spacing	5 MHz
Mod Scheme	AWGN
Centre frequency	740 MHz

	26dB BW (MHz)
Input measurement	4.64
Output measurement	4.64
Plot reference	716-758_MHz_input-output

Band	2110-2200 MHz
Power Level	20 dBm
Channel Spacing	5 MHz
Mod Scheme	AWGN
Centre frequency	2155 MHz

	26dB BW (MHz)
Input measurement	4.65
Output measurement	4.65
Plot reference	2110-2200_MHz_input-output

Band	2345-2360 MHz
Power Level	20 dBm
Channel Spacing	5 MHz
Mod Scheme	AWGN
Centre frequency	2352.5 MHz

	26dB BW (MHz)
Input measurement	4.64
Output measurement	4.64
Plot reference	2345-2360_MHz_input-output

Band	2496-2690 MHz
Power Level	20 dBm
Channel Spacing	5 MHz
Mod Scheme	AWGN
Centre frequency	2600 MHz

	26dB BW (MHz)
Input measurement	4.64
Output measurement	4.64
Plot reference	2496-2690_MHz_input-output

Results are also presented graphically in section 6

LIMITS:

Emissions to be contained within the applicable emissions mask/band edges.

These results show that the EUT has PASSED this test.

The uncertainty gives a 95% confidence interval in the measurement. Expanded uncertainty (K=2) is as follows:
< ± 1.9%

5.5 Field strength of spurious radiations

5.5.1 Test methods

Test Requirements:	FCC Part 27 Clause 27.53 [Reference 4.1.1 of this report] FCC Part 2 Clause 2.1053 [Reference 4.1.2 of this report]
Test Method:	ANSI C63.26 2015 Clause 5.5 [Reference 4.1.4 of this report] KDB 935210 D05 Clause 3.6 / 4.7 [Reference 4.1.5 of this report]
Limits:	FCC Part 27 Clause 27.53 [Reference 4.1.1 of this report]

5.5.2 Configuration of EUT

The EUT was tested in an ALSE and ambient conditions were monitored. The EUT was examined in its declared normal use position. The transmit port was terminated into a 30dB Attenuator and a 50Ohm load. RX port was terminated into a 50 Ohm load. EUT was tested across all required modes as specified in section 2.4 of this report.

5.5.3 Test procedure

Tests were made in accordance with the test method noted above using the measuring equipment listed in the 'Test Equipment' Section. The EUT system was set up to maximum gain using the network management software provided. EUT signal level was raised until maximum output power was reached. Peak field strength pre-scans using the field strength method were performed. The EUT's emissions were maximised by rotating it 360 degrees. This method was used to determine any signals for substitution. An RMS detector was used for any final measurements.

30MHz - 1GHz.

The measuring antenna was scanned 1 - 4m in both Horizontal and Vertical polarisations. Where required a Substitution method was performed using tuned dipoles / a calibrated bi-conical antenna. Measurement distance of 3metres was used.

1GHz – 27GHz.

The measuring antenna was used in both Horizontal and Vertical polarisations. Where required a Substitution method was performed using standard gain horn antennas. Measurement distances used were: 1 – 6 GHz at 3metres, 6 – 18 GHz at 1.2metres and 18 – 27 GHz at 0.3metres.

Tests were performed in test sites B & M.

5.5.4 Test equipment

E624, E411, LPE364, E743, E136, TMS82, E602, E268, Cal07, E463, E478, F031, E621, E412, E296-2, E330

See Section 8 for more details

5.5.5 Test results

Temperature of test environment	13-18°C
Humidity of test environment	51-68%
Pressure of test environment	100-102kPa

Single channel results.

Setup Table

Band	617-652 MHz
Power Level	20 dBm
Channel Spacing	5 MHz
Mod Scheme	AWGN
Low channel	619.5 MHz

Spurious Frequency (MHz)	Measured Spurious Level (dBm)	Difference to Limit (dB)	Antenna Polarisation	EUT Polarisation
No spurious emissions observed				

Setup Table

Band	617-652 MHz
Power Level	20 dBm
Channel Spacing	5 MHz
Mod Scheme	AWGN
Mid channel	634 MHz

Spurious Frequency (MHz)	Measured Spurious Level (dBm)	Difference to Limit (dB)	Antenna Polarisation	EUT Polarisation
No spurious emissions observed				

Setup Table

Band	617-652 MHz
Power Level	20 dBm
Channel Spacing	5 MHz
Mod Scheme	AWGN
High channel	649.5 MHz

Spurious Frequency (MHz)	Measured Spurious Level (dBm)	Difference to Limit (dB)	Antenna Polarisation	EUT Polarisation
No spurious emissions observed				

Setup Table

Band	716-758 MHz
Power Level	20 dBm
Channel Spacing	5 MHz
Mod Scheme	AWGN
Low channel	718.5 MHz

Spurious Frequency (MHz)	Measured Spurious Level (dBm)	Difference to Limit (dB)	Antenna Polarisation	EUT Polarisation
No spurious emissions observed				

Setup Table

Band	716-758 MHz
Power Level	20 dBm
Channel Spacing	5 MHz
Mod Scheme	AWGN

Mid channel	740 MHz
-------------	---------

Spurious Frequency (MHz)	Measured Spurious Level (dBm)	Difference to Limit (dB)	Antenna Polarisation	EUT Polarisation
No spurious emissions observed				

Setup Table

Band	716-758 MHz
Power Level	20 dBm
Channel Spacing	5 MHz
Mod Scheme	AWGN
High channel	755.5 MHz

Spurious Frequency (MHz)	Measured Spurious Level (dBm)	Difference to Limit (dB)	Antenna Polarisation	EUT Polarisation
No spurious emissions observed				

Setup Table

Band	2110-2200 MHz
Power Level	20 dBm
Channel Spacing	5 MHz
Mod Scheme	AWGN
Low channel	2112.5 MHz

Spurious Frequency (MHz)	Measured Spurious Level (dBm)	Difference to Limit (dB)	Antenna Polarisation	EUT Polarisation
No spurious emissions observed				

Setup Table

Band	2110-2200 MHz
Power Level	20 dBm
Channel Spacing	5 MHz
Mod Scheme	AWGN
Mid channel	2155 MHz

Spurious Frequency (MHz)	Measured Spurious Level (dBm)	Difference to Limit (dB)	Antenna Polarisation	EUT Polarisation
No spurious emissions observed				

Setup Table

Band	2110-2200 MHz
Power Level	20 dBm
Channel Spacing	5 MHz
Mod Scheme	AWGN
High channel	2197.5 MHz

Spurious Frequency (MHz)	Measured Spurious Level (dBm)	Difference to Limit (dB)	Antenna Polarisation	EUT Polarisation
No spurious emissions observed				

Setup Table

Band	2345-2360 MHz
Power Level	20 dBm
Channel Spacing	5 MHz
Mod Scheme	AWGN
Low channel	2347.5 MHz

Spurious Frequency (MHz)	Measured Spurious Level (dBm)	Difference to Limit (dB)	Antenna Polarisation	EUT Polarisation
4695	-54.7	-9.7	Horizontal	Normal use position
4695	-53.3	-8.3	Vertical	Normal use position

Setup Table

Band	2345-2360 MHz
Power Level	20 dBm
Channel Spacing	5 MHz
Mod Scheme	AWGN
Mid channel	2352.5 MHz

Spurious Frequency (MHz)	Measured Spurious Level (dBm)	Difference to Limit (dB)	Antenna Polarisation	EUT Polarisation
4705	-54.7	-9.7	Horizontal	Normal use position
4705	-53.6	-8.6	Vertical	Normal use position

Setup Table

Band	2345-2360 MHz
Power Level	20 dBm
Channel Spacing	5 MHz
Mod Scheme	AWGN
High channel	2357.5 MHz

Spurious Frequency (MHz)	Measured Spurious Level (dBm)	Difference to Limit (dB)	Antenna Polarisation	EUT Polarisation
4715	-54.3	-9.3	Horizontal	Normal use position
4715	-54.8	-9.8	Vertical	Normal use position

Setup Table

Band	2496-2690 MHz
Power Level	20 dBm
Channel Spacing	5 MHz
Mod Scheme	AWGN
Low channel	2498.5 MHz

Spurious Frequency (MHz)	Measured Spurious Level (dBm)	Difference to Limit (dB)	Antenna Polarisation	EUT Polarisation
No spurious emissions observed				

Setup Table

Band	2496-2690 MHz
Power Level	20 dBm
Channel Spacing	5 MHz
Mod Scheme	AWGN
Mid channel	2600 MHz

Spurious Frequency (MHz)	Measured Spurious Level (dBm)	Difference to Limit (dB)	Antenna Polarisation	EUT Polarisation
No spurious emissions observed				

Setup Table

Band	2496-2690 MHz
Power Level	20 dBm
Channel Spacing	5 MHz
Mod Scheme	AWGN
High channel	2687.5 MHz

Spurious Frequency (MHz)	Measured Spurious Level (dBm)	Difference to Limit (dB)	Antenna Polarisation	EUT Polarisation
No spurious emissions observed				

DUAL CHANNEL RESULTS.

Setup Table

Band	617-652 MHz
Power Level	20 dBm
Channel Spacing	5 MHz
Mod Scheme	AWGN
Low channels	619.5 MHz + 624.5 MHz

Spurious Frequency (MHz)	Measured Spurious Level (dBm)	Difference to Limit (dB)	Antenna Polarisation	EUT Polarisation
No spurious emissions observed				

Setup Table

Band	617-652 MHz
Power Level	20 dBm
Channel Spacing	5 MHz
Mod Scheme	AWGN
High channels	644.5 MHz + 649.5 MHz

Spurious Frequency (MHz)	Measured Spurious Level (dBm)	Difference to Limit (dB)	Antenna Polarisation	EUT Polarisation
No spurious emissions observed				

Setup Table

Band	716-758 MHz
Power Level	20 dBm
Channel Spacing	5 MHz
Mod Scheme	AWGN
Low channels	718.5 MHz + 723.5 MHz

Spurious Frequency (MHz)	Measured Spurious Level (dBm)	Difference to Limit (dB)	Antenna Polarisation	EUT Polarisation
No spurious emissions observed				

Setup Table

Band	716-758 MHz
Power Level	20 dBm
Channel Spacing	5 MHz
Mod Scheme	AWGN
High channels	750.5 MHz + 755.5 MHz

Spurious Frequency (MHz)	Measured Spurious Level (dBm)	Difference to Limit (dB)	Antenna Polarisation	EUT Polarisation
No spurious emissions observed				

Setup Table

Band	2110-2200 MHz
Power Level	20 dBm
Channel Spacing	5 MHz
Mod Scheme	AWGN
Low channels	2112.5 MHz + 2117.5 MHz

Spurious Frequency (MHz)	Measured Spurious Level (dBm)	Difference to Limit (dB)	Antenna Polarisation	EUT Polarisation
No spurious emissions observed				

Setup Table

Band	2110-2200 MHz
Power Level	20 dBm
Channel Spacing	5 MHz
Mod Scheme	AWGN
High channels	2192.5 MHz + 2197.5 MHz

Spurious Frequency (MHz)	Measured Spurious Level (dBm)	Difference to Limit (dB)	Antenna Polarisation	EUT Polarisation
No spurious emissions observed				

Band	2345-2360 MHz
Power Level	20 dBm
Channel Spacing	5 MHz
Mod Scheme	AWGN
Low channels	2347.5 MHz + 2352.5 MHz

Spurious Frequency (MHz)	Measured Spurious Level (dBm)	Difference to Limit (dB)	Antenna Polarisation	EUT Polarisation
4700	-59.4	-14.4	Horizontal	Normal Use Position
4700	-57.6	-12.6	Vertical	Normal Use Position

Setup Table

Band	2345-2360 MHz
Power Level	20 dBm
Channel Spacing	5 MHz
Mod Scheme	AWGN
High channels	2352.5 MHz + 2357.5 MHz

Spurious Frequency (MHz)	Measured Spurious Level (dBm)	Difference to Limit (dB)	Antenna Polarisation	EUT Polarisation
4710	-59.5	-14.5	Horizontal	Normal Use Position
4710	-57.0	-12.0	Vertical	Normal Use Position

Setup Table

Band	2496-2690 MHz
Power Level	20 dBm
Channel Spacing	5 MHz
Mod Scheme	AWGN
Low channels	2498.5 MHz + 2503.5 MHz

Spurious Frequency (MHz)	Measured Spurious Level (dBm)	Difference to Limit (dB)	Antenna Polarisation	EUT Polarisation
No spurious emissions observed				

Setup Table

Band	2496-2690 MHz
Power Level	20 dBm
Channel Spacing	5 MHz
Mod Scheme	AWGN
High channels	2682.5 MHz + 2687.5 MHz

Spurious Frequency (MHz)	Measured Spurious Level (dBm)	Difference to Limit (dB)	Antenna Polarisation	EUT Polarisation
No spurious emissions observed				

LIMITS:

Parts 27.53(a)(1) for operation in the 2345-2360 MHz band

Parts 27.53 (c) and 27.53(f) for operation in the 746-758 MHz band

Parts 27.53 (g) for operation in the 698-746 MHz band

Parts 27.53 (h) for operation in the 2110-2200 MHz band

Parts 27.53 (m), for operation in the 2496 – 2690 MHz band

Absolute limits are determined from the relative limit as per example:

Limits based on $43+10\log P$. dB attenuation below Output power in Watts: i.e. +20dBm = 0.1W therefore:

$43+10*\log 0.1 = 33\text{dB}$. +20dBm – 33 = -13dBm

These results show that the EUT has PASSED this test.

The uncertainty gives a 95% confidence interval in the measurement. Expanded uncertainty (K=2) is as follows:
30MHz - 1GHz ± 3.9 dB, 1 – 18 GHz $\pm 3.5\text{dB}$, 18 – 27 GHz $\pm 3.9\text{dB}$

5.6 Band edge emissions

5.6.1 Test methods

Test Requirements:	FCC Part 27 Clause 27.53 [Reference 4.1.1 of this report] FCC Part 2 Clause 2.1053 [Reference 4.1.2 of this report]
Test Method:	ANSI C63.26 2015 Clause 5.5 [Reference 4.1.4 of this report] KDB 935210 D05 Clause 3.6 / 4.7 [Reference 4.1.5 of this report]
Limits:	FCC Part 27 Clause 27.53 [Reference 4.1.1 of this report]

5.6.2 Configuration of EUT

EUT was tested on a bench. The EUT RF port under test was connected to a spectrum analyser via suitable attenuation. RX port was terminated into a 50 Ohm load. EUT was tested across all required modes as specified in section 2.4 of this report.

5.6.3 Test procedure

The EUT system was set up to maximum gain using the network management software provided. EUT signal level was raised until maximum output power was reached per channel/band setting as required. Measurements were made and plots taken in the required Resolution bandwidths, where applicable results are referenced to EIRP limits by consideration of the antenna gain used with the EUT of 8dBi (5.85dBd) and indicated.

Measurements within one measurement bandwidth of the band edge were made using a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter. Emissions just outside this bandwidth were measured by integrating the power over the required measurement bandwidth using the spectrum analyser Adjacent Channel Power measurement function.

Tests were performed in test site A.

5.6.4 Test equipment

F078, H071, E266, E777, E602

See Section 8 for more details

5.6.5 Test results

Temperature of test environment	17-23°C
Humidity of test environment	35-56%
Pressure of test environment	100-103kPa

Single channel results

Band	617-652 MHz
Power Level	20 dBm
Channel Spacing	5 MHz
Mod Scheme	AWGN
Low channel	619.5 MHz
High channel	649.5 MHz

	Lower band edge (617MHz)	Upper band edge (652MHz)
(dBm)	-35.99	-38.63
Plot reference	13344-3 617-652_MHz_low-side	13344-3 617-652_MHz_high-side

Band	716-758 MHz
Power Level	20 dBm
Channel Spacing	5 MHz

Mod Scheme	AWGN
Low channel	718.5 MHz
High channel	755.5 MHz

	Lower band edge (716MHz)	Upper band edge (758MHz)
(dBm)	-38.75	-41.8
Plot reference	13344-3 716-758_MHz_low-side	13344-3 716-758_MHz_high-side

Band	2110-2200 MHz
Power Level	20 dBm
Channel Spacing	5 MHz
Mod Scheme	AWGN
Low channel	2112.5 MHz
High channel	2197.5 MHz

	Lower band edge (2110 MHz)	Upper band edge (2200 MHz)
(dBm)	-32.7	-35.31
Plot reference	13344-3 2110-2200_MHz_low-side	13344-3 2110-2200_MHz_high-side

Band	2345-2360 MHz
Power Level	16 dBm
Channel Spacing	5 MHz
Mod Scheme	AWGN
Low channel	2347.5 MHz
High channel	2357.5 MHz

	Lower band edge (2345 MHz)	Upper band edge (2360 MHz)
(dBm)	-45.94	-46.57
Plot reference	13344-3 2345-2360_MHz_low-side_16dBm	13344-3 2345-2360_MHz_high-side_16dBm

Band	2496-2690 MHz
Power Level	20 dBm
Channel Spacing	5 MHz
Mod Scheme	AWGN
Low channel	2498.5 MHz
High channel	2687.5 MHz

	Lower band edge(2496 MHz)	Upper band edge (2690 MHz)
(dBm)	-36.7	-31.87
Plot reference	13344-3 2496-2690_MHz_low-side	13344-3 2496-2690_MHz_high-side

Dual channel results

Band	617-652 MHz
Power Level	20 dBm
Channel Spacing	5 MHz
Mod Scheme	AWGN
Low channels	619.5 + 624.5 MHz
High channels	644.5 + 649.5 MHz

	Lower band edge (617MHz)	Upper band edge (652MHz)
(dBm)	-37.94	-38.65
Plot reference	13344-3 617-652_MHz_low-side_dual	13344-3 617-652_MHz_high-side_dual

Band	716-758 MHz
Power Level	20 dBm
Channel Spacing	5 MHz
Mod Scheme	AWGN
Low channels	718.5 + 723.5 MHz
High channels	750.5 + 755.5 MHz

	Lower band edge (716MHz)	Upper band edge (758MHz)
(dBm)	-37.49	-38.98
Plot reference	13344-3 716-758_MHz_low-side_dual	13344-3 716-758_MHz_high-side_dual

Band	2110-2200 MHz
Power Level	20 dBm
Channel Spacing	5 MHz
Mod Scheme	AWGN
Low channels	2112.5 + 2117.5 MHz
High channels	2192.5 + 2197.5 MHz

	Lower band edge (2110 MHz)	Upper band edge (2200 MHz)
(dBm)	-37.82	-31.68
Plot reference	13344-3 2110-2200_MHz_low-side_dual	13344-3 2110-2200_MHz_high-side_dual

Band	2345-2360 MHz
Power Level	20 dBm
Channel Spacing	5 MHz
Mod Scheme	AWGN
Low channels	2347.5 + 2352.5 MHz
High channels	2352.5 + 2357.5 MHz

	Lower band edge (2345 MHz)	Upper band edge (2360 MHz)
(dBm)	-46.30	-52.02
Plot reference	13344-3 2345-2360_MHz_low-side_16dBm_dual	13344-3 2345-2360_MHz_high-side_16dBm_dual

Band	2496-2690 MHz
Power Level	20 dBm
Channel Spacing	5 MHz
Mod Scheme	AWGN
Low channels	2498.5 + 2503.5 MHz
High channels	2682.5 + 2687.5 MHz

	Lower band edge(2496 MHz)	Upper band edge (2690 MHz)
(dBm)	-40.08	-34.36
Plot reference	13344-3 2496-2690_MHz_low-side_dual	13344-3 2496-2690_MHz_high-side_dual

Results are also presented graphically in section 6

LIMITS:

Parts 27.53(a)(1) for operation in the 2345-2360 MHz band
 Parts 27.53 (c) and 27.53(f) for operation in the 746-758 MHz band
 Parts 27.53 (g) for operation in the 698-746 MHz band
 Parts 27.53 (h) for operation in the 2110-2200 MHz band
 Parts 27.53 (m)(2), for operation in the 2496 – 2690 MHz band

These results show that the EUT has PASSED this test.

The uncertainty gives a 95% confidence interval in the measurement. Expanded uncertainty (K=2) is as follows:
 $< \pm 2.8 \text{ dB}$

5.7 Modulation characteristics

EUT uses digital modulation techniques. Modulation schemes and information is detailed in section 2.2 of this report.

5.8 Determination of f_0

5.8.1 Test methods

Test Requirements: KDB 935210 D05 Clause 3.3 / 4.3 [Reference 4.1.5 of this report]
 Test Method: ANSI C63.26 2015 Clause 5.5 [Reference 4.1.4 of this report]
 KDB 935210 D05 Clause 3.3 / 4.3 [Reference 4.1.5 of this report]
 Limits: None.

5.8.2 Configuration of EUT

EUT was tested on a bench. The EUT RF port under test was connected to a spectrum analyser via suitable attenuation. RX port was terminated into a 50 Ohm load. EUT was swept across the 5 operational bands with a CW signal to determine the frequency of highest power in the band. Test performed in **modes 1, 8, 15, 22, and 29**.

5.8.3 Test procedure

Tests were made in accordance with the test method noted above using the measuring equipment listed in the 'Test Equipment' Section. The EUT system was set up to maximum gain using the network management software provided. EUT signal level was raised until maximum output power was reached. The EUT input signal was then swept across the applicable service band frequency and plots taken showing the frequency of highest power in the band (f_0).

5.8.4 Test equipment

F078, H071, E266, E777, E602

See Section 8 for more details

5.8.5 Test results

Temperature of test environment 17-23°C
 Humidity of test environment 35-56%
 Pressure of test environment 100-103kPa

Band	617-652 MHz
Power Level	20 dBm
Channel Spacing	5 MHz
Mod Scheme	CW

Band (MHz)	f_0 determined(MHz)
698 - 758	627.955

Note: Measurement was performed over the service band frequency range only.

Band	716-758 MHz
Power Level	20 dBm
Channel Spacing	5 MHz
Mod Scheme	CW

Band (MHz)	f_0 determined(MHz)
716 - 758	730.326

Note: Measurement was performed over the service band frequency range only.

Band	2110-2200 MHz
Power Level	20 dBm
Channel Spacing	5 MHz
Mod Scheme	CW

Band (MHz)	f ₀ determined (MHz)
2110 - 2200	2113.1

Note: Measurement was performed over the service band frequency range only.

Band	2345-2360 MHz
Power Level	20 dBm
Channel Spacing	5 MHz
Mod Scheme	CW

Band (MHz)	f ₀ determined (MHz)
2345 - 2360	2345.1

Note: Measurement was performed over the service band frequency range only.

Band	2496-2690 MHz
Power Level	20 dBm
Channel Spacing	5 MHz
Mod Scheme	CW

Band (MHz)	f ₀ determined (MHz)
2496 - 2690	2665.8

Note: Measurement was performed over the service band frequency range only.

Results are also presented graphically in section 6.

LIMITS:

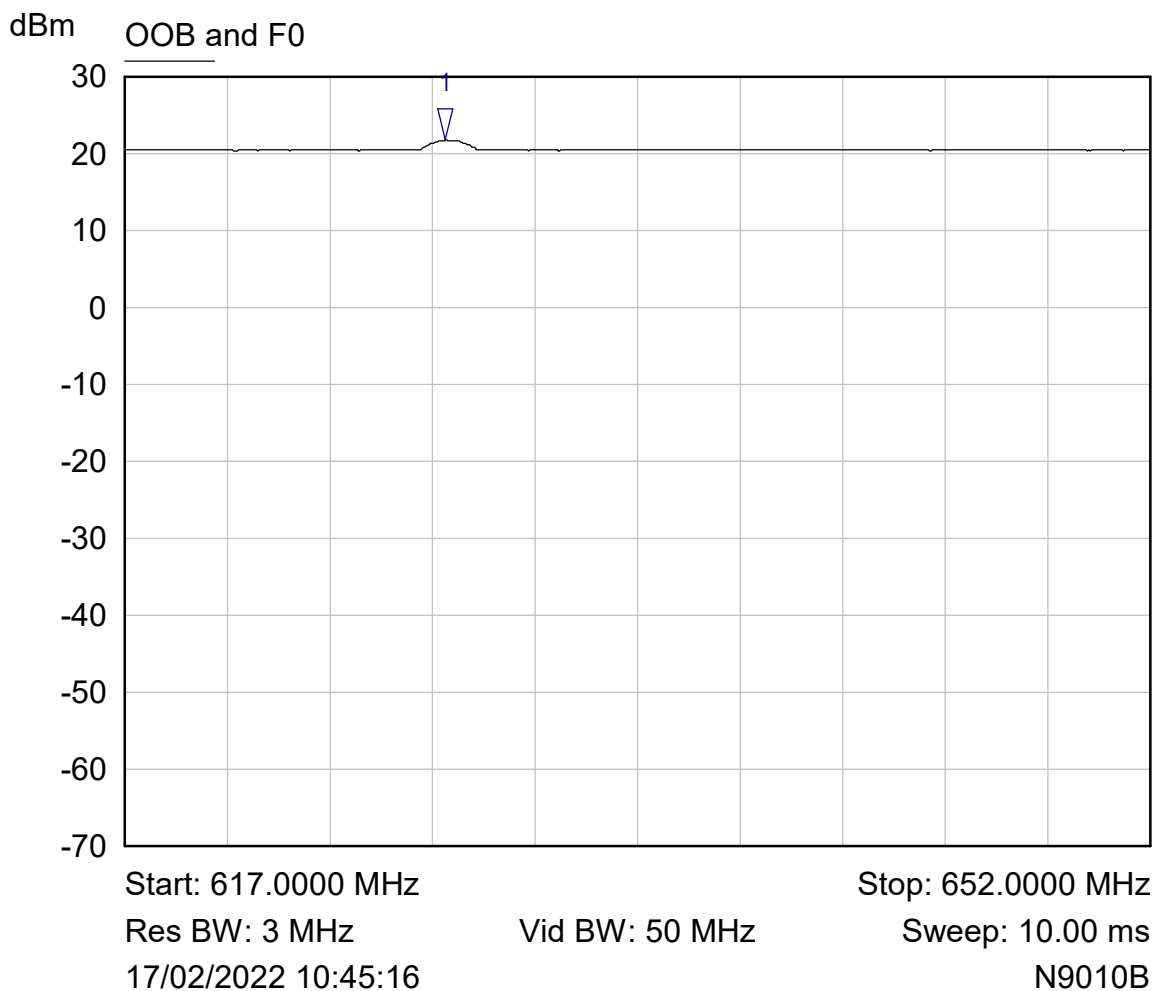
None.

The uncertainty gives a 95% confidence interval in the measurement. Expanded uncertainty (K=2) is as follows:
<± 1 dB

6 Plots/Graphical results

6.1 Determination of f_0

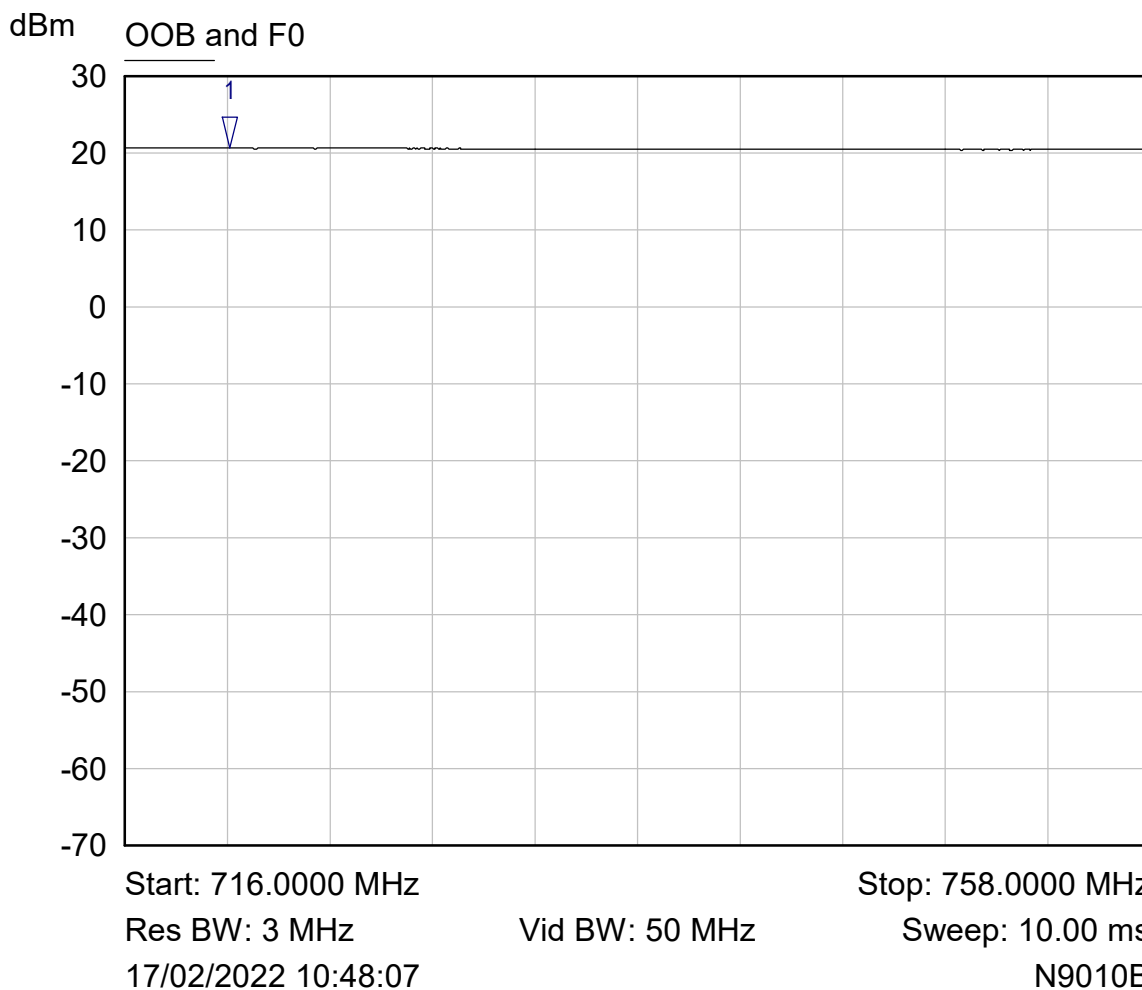
RF Parameters: Band 617-652 MHz, Power +20 dBm, Channel Spacing N/A, Modulation N/A,
Channel N/A



Mkr	Trace	X-Axis	Value	Notes
1 ▽	OOB and F0	627.9550 MHz	21.76 dBm	f_0

Plot of f_0 determined in band 617-652 MHz.

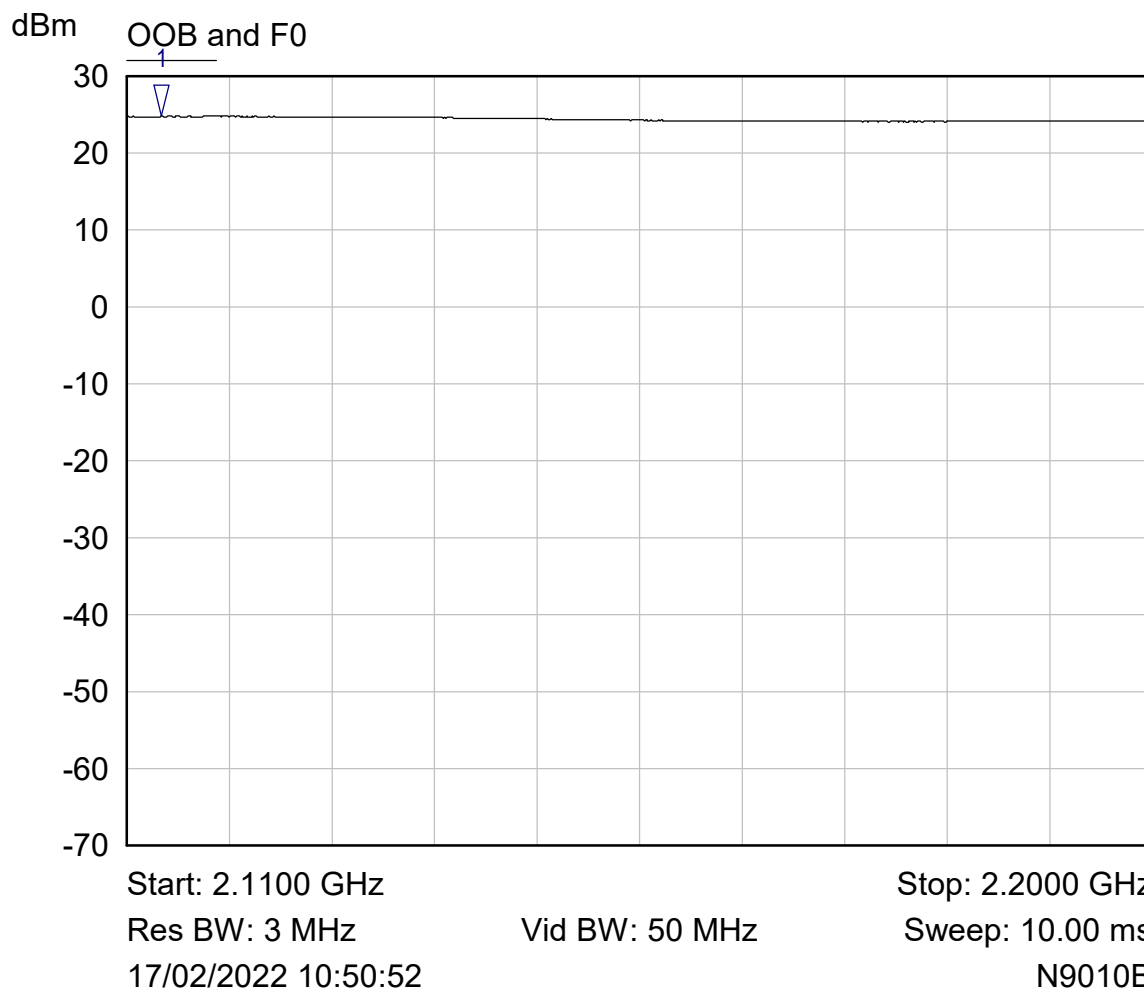
RF Parameters: Band 716-758 MHz, Power +20 dBm, Channel Spacing N/A, Modulation N/A,
Channel N/A



Mkr	Trace	X-Axis	Value	Notes
1 ▽	OOB and F0	720.3260 MHz	20.66 dBm	f0

Plot of f0 determined in band 716-758 MHz.

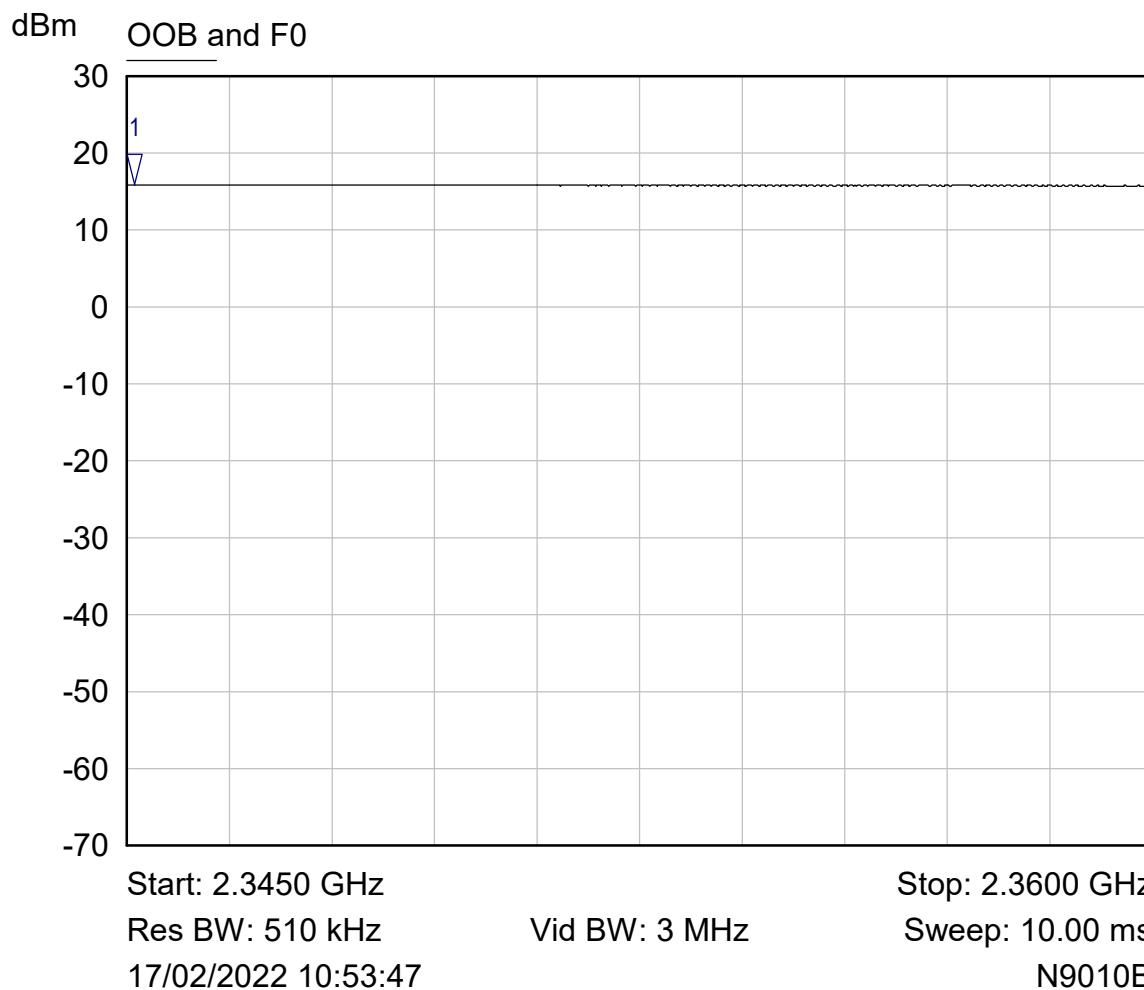
RF Parameters: Band 2110-2200 MHz, Power +20 dBm, Channel Spacing N/A, Modulation N/A,
Channel N/A



Mkr	Trace	X-Axis	Value	Notes
1 ▽	OOB and F0	2.1131 GHz	24.78 dBm	f0

Plot of f0 determined in band 2110-2200 MHz.

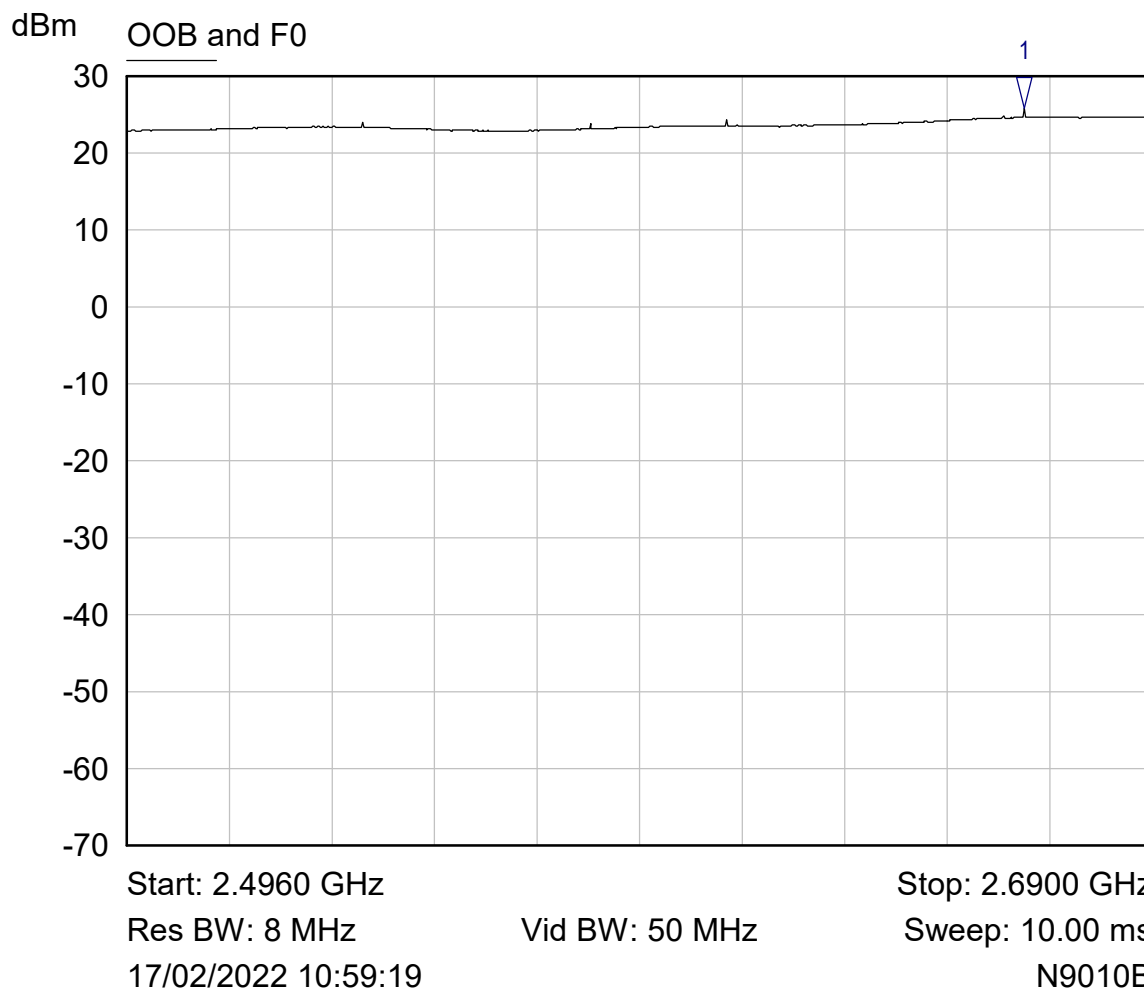
RF Parameters: Band 2345-2360 MHz, Power +20 dBm, Channel Spacing N/A, Modulation N/A,
Channel N/A



Mkr	Trace	X-Axis	Value	Notes
1 ▽	OOB and F0	2.3451 GHz	15.91 dBm	f0

Plot of f0 determined in band 2345-2360 MHz.

RF Parameters: Band 2496-2690 MHz, Power +20 dBm, Channel Spacing N/A, Modulation N/A,
Channel N/A

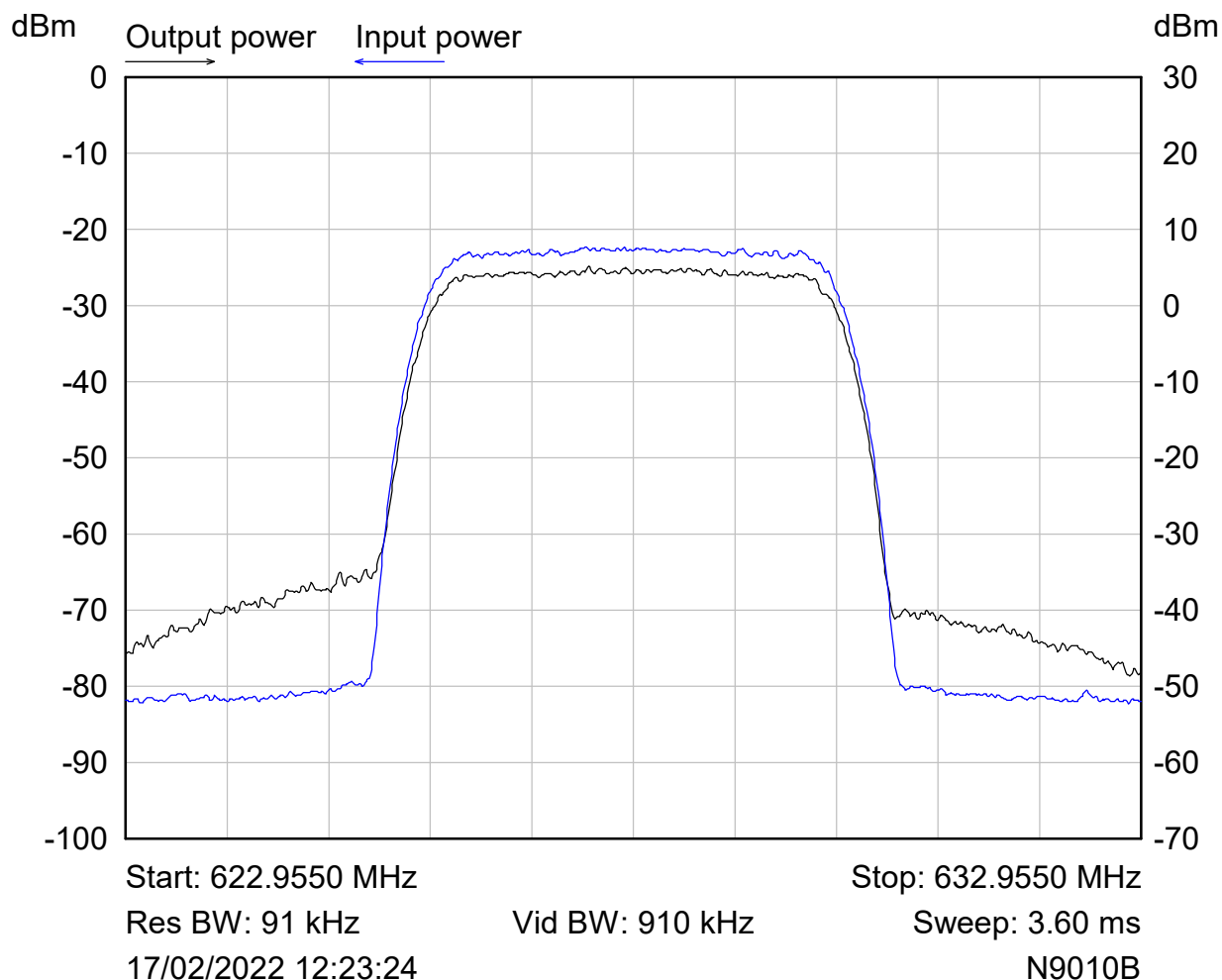


Mkr	Trace	X-Axis	Value	Notes
1 ▽	OOB and F0	2.6658 GHz	25.82 dBm	f0

Plot of f0 determined in band 2496-2690 MHz.

6.2 RF Power Output

RF Parameters: Band 617-652 MHz, Power +20 dBm, Channel Spacing 5MHz, Modulation AWGN,
Channel 627.955 MHz (determined f_0)



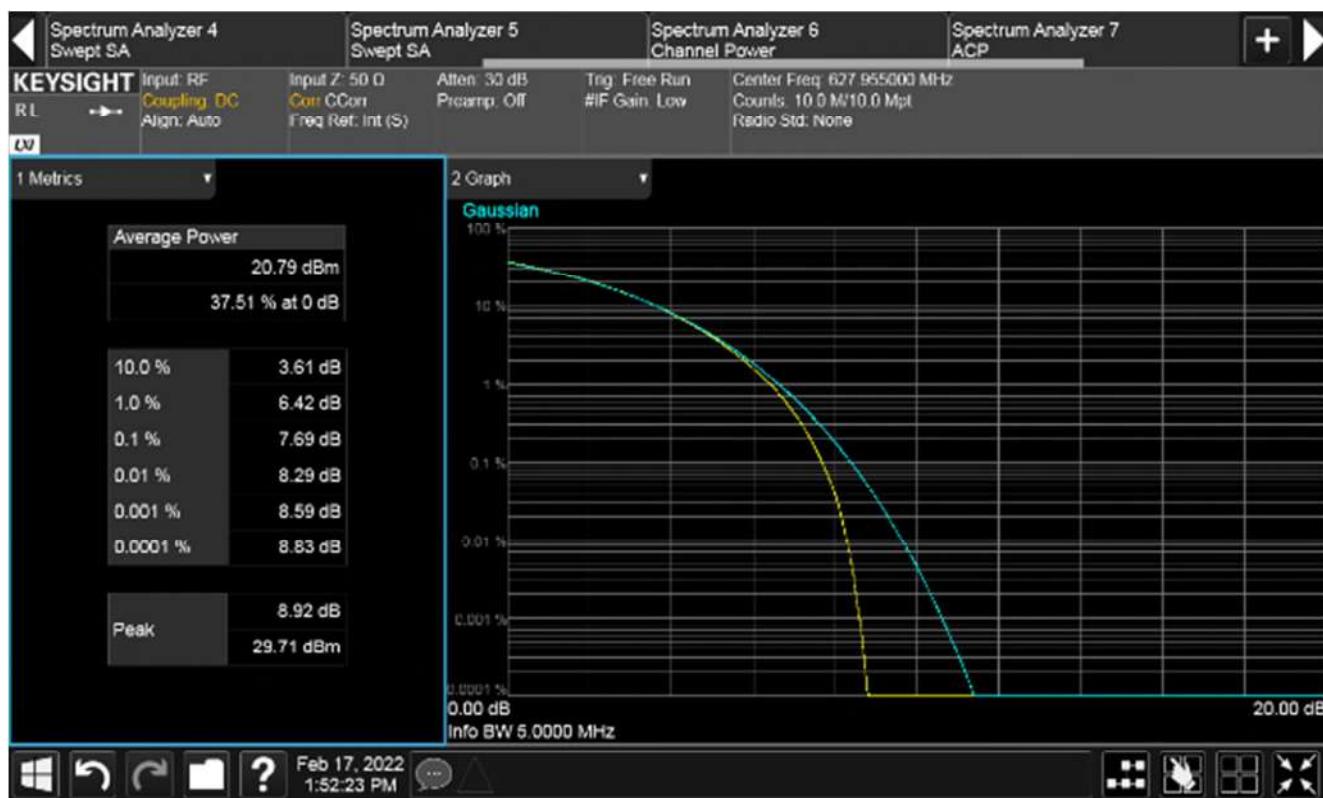
Input power

Measurement Parameter	Value
Total channel power	-7.06 dBm

Output power

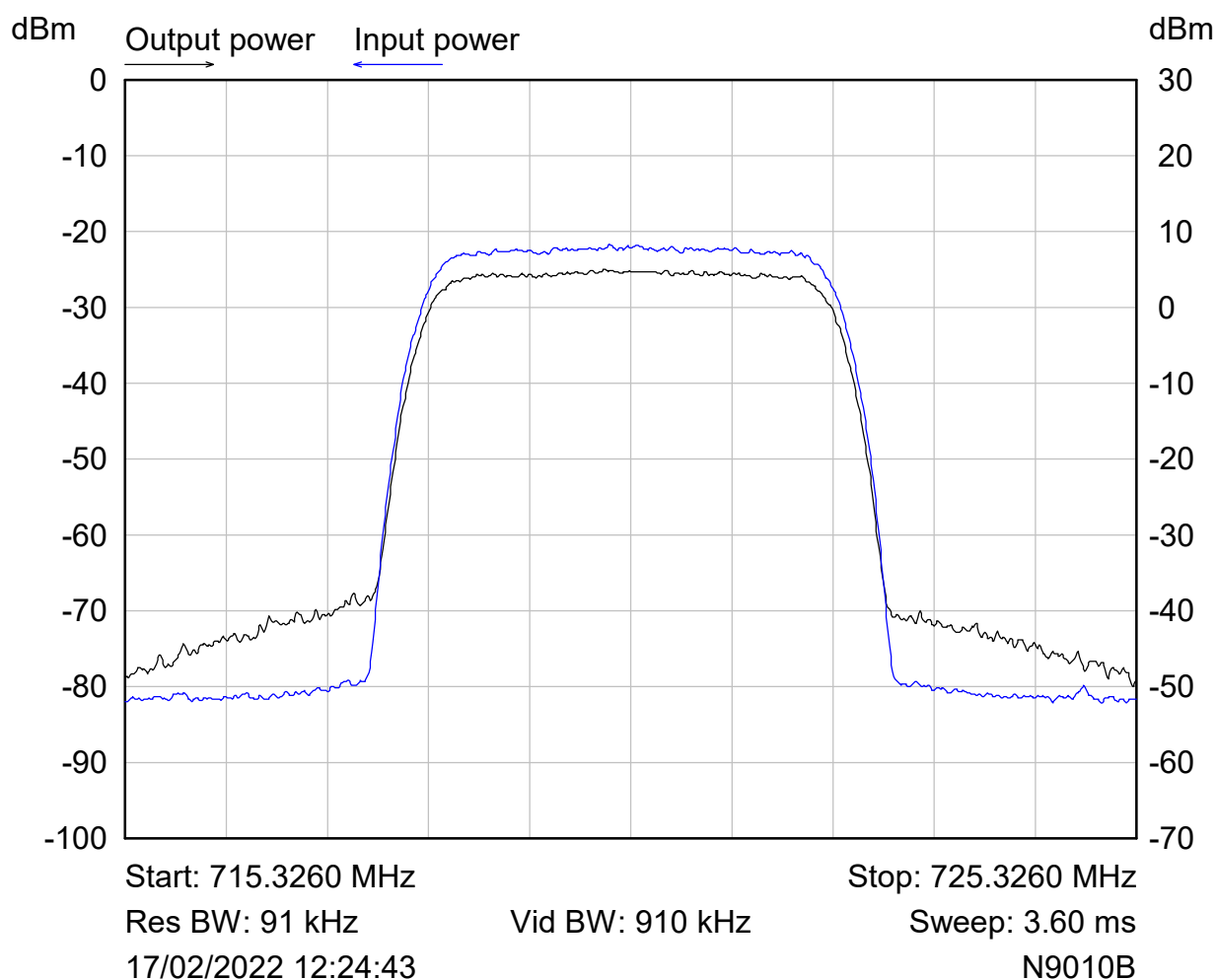
Measurement Parameter	Value
Total channel power	20.18 dBm

Plot of Channel power at determined f_0 in band 617-652 MHz



Plot of Peak to Average power ratio at determined f_0 in band 617-652 MHz

RF Parameters: Band 716-758 MHz, Power +20 dBm, Channel Spacing 5MHz, Modulation AWGN,
Channel 720.326 MHz (determined f_0)



Input power

Measurement Parameter	Value
Total channel power	-6.57 dBm

Output power

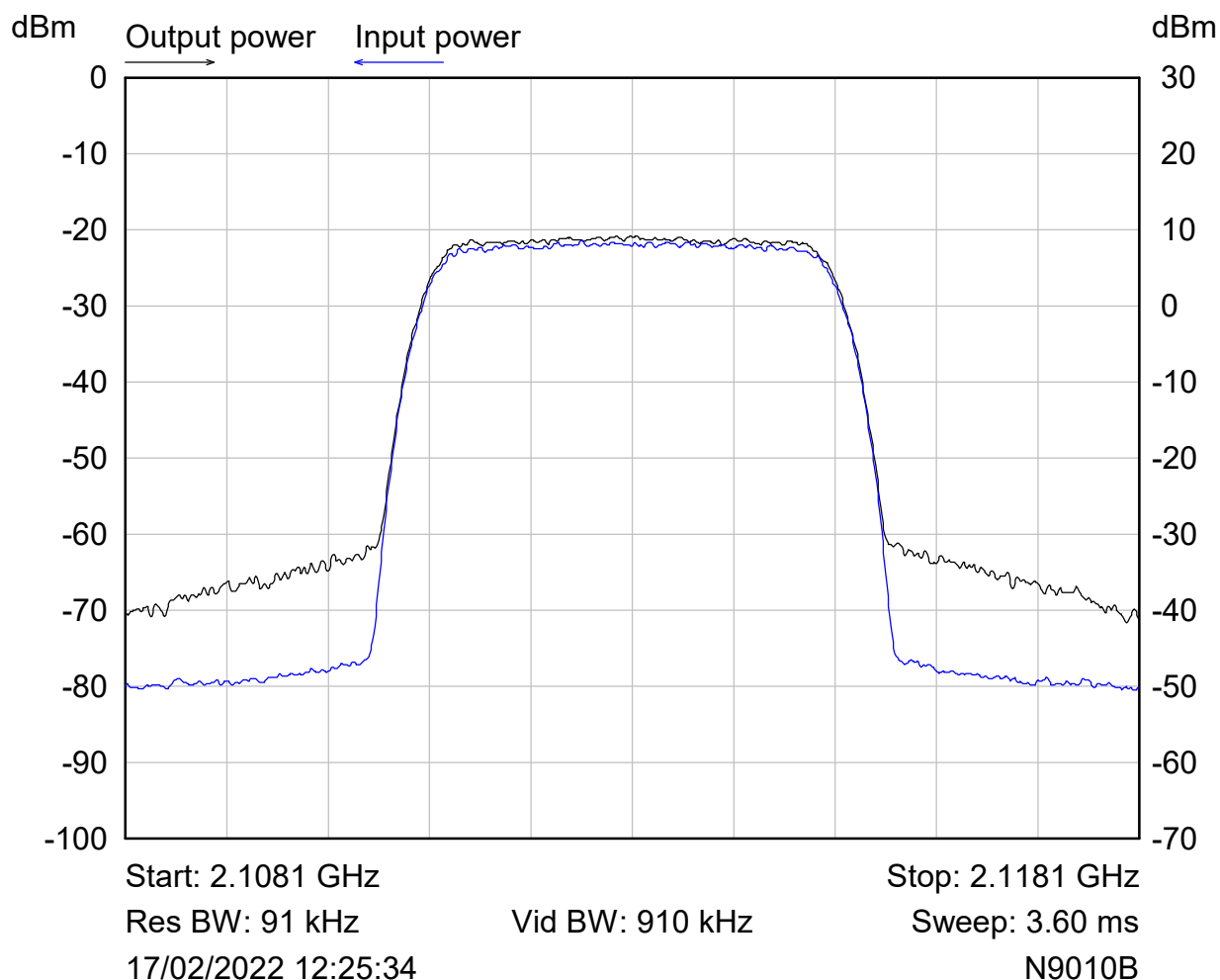
Measurement Parameter	Value
Total channel power	20.30 dBm

Plot of Channel power at determined f_0 in band 716-758 MHz



Plot of Peak to Average power ratio at determined f_0 in band 716-758 MHz

RF Parameters: Band 2110-2200 MHz, Power +20 dBm, Channel Spacing 5MHz, Modulation AWGN,
Channel 2113.1 MHz (determined f_0)



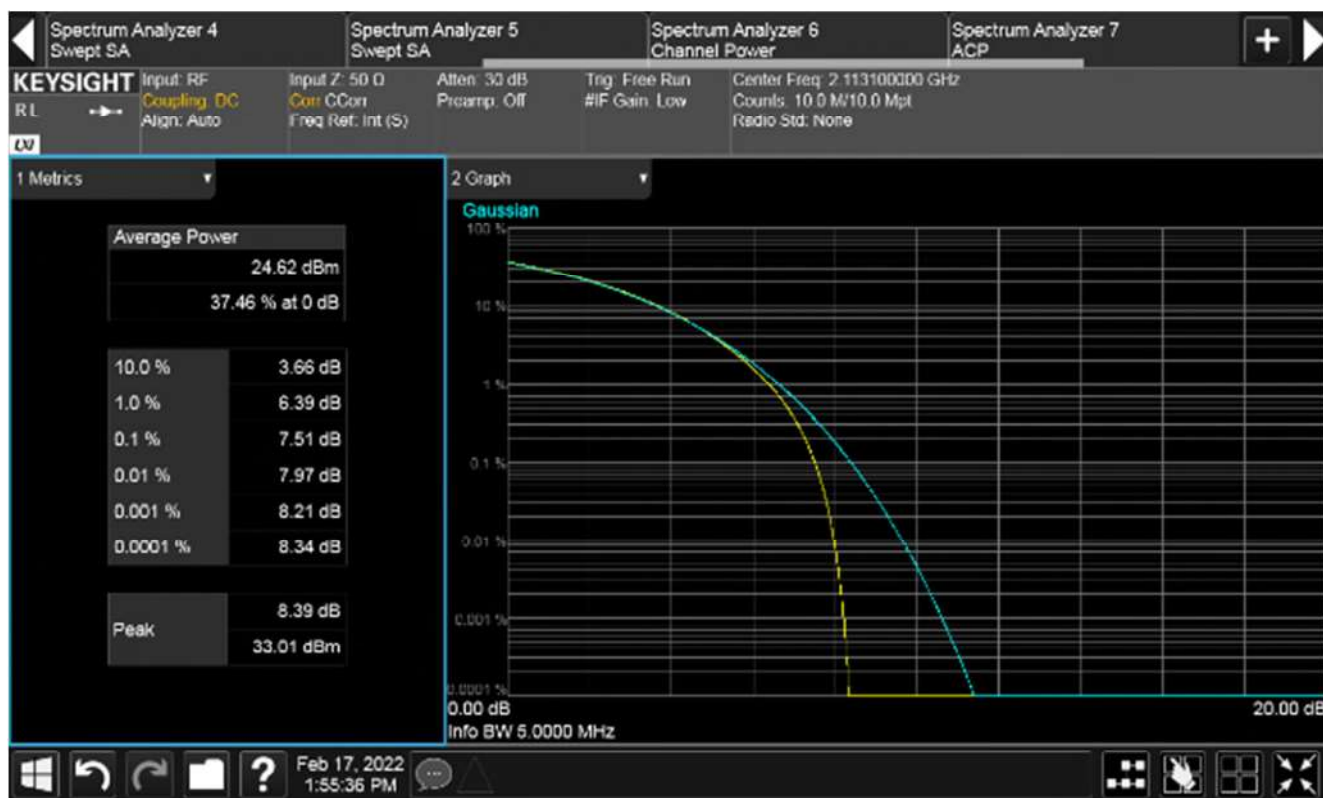
Input power

Measurement Parameter	Value
Total channel power	-6.21 dBm

Output power

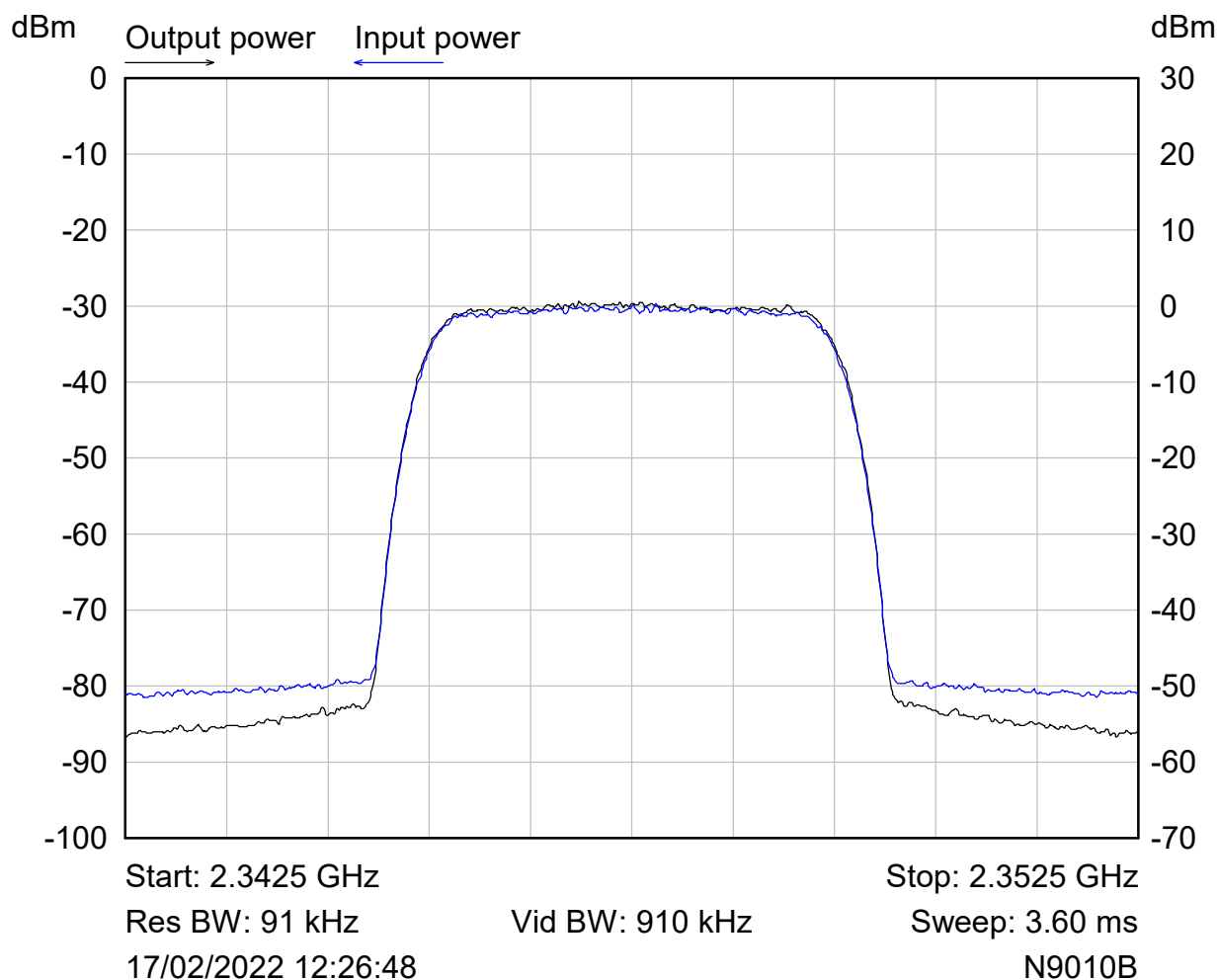
Measurement Parameter	Value
Total channel power	24.49 dBm

Plot of Channel power at determined f_0 in band 2110-2200 MHz



Plot of Peak to Average power ratio at determined f_0 in band 2110-2200 MHz

RF Parameters: Band 2345-2360 MHz, Power +20 dBm, Channel Spacing 5MHz, Modulation AWGN,
Channel 2347.5 MHz (determined f_0)



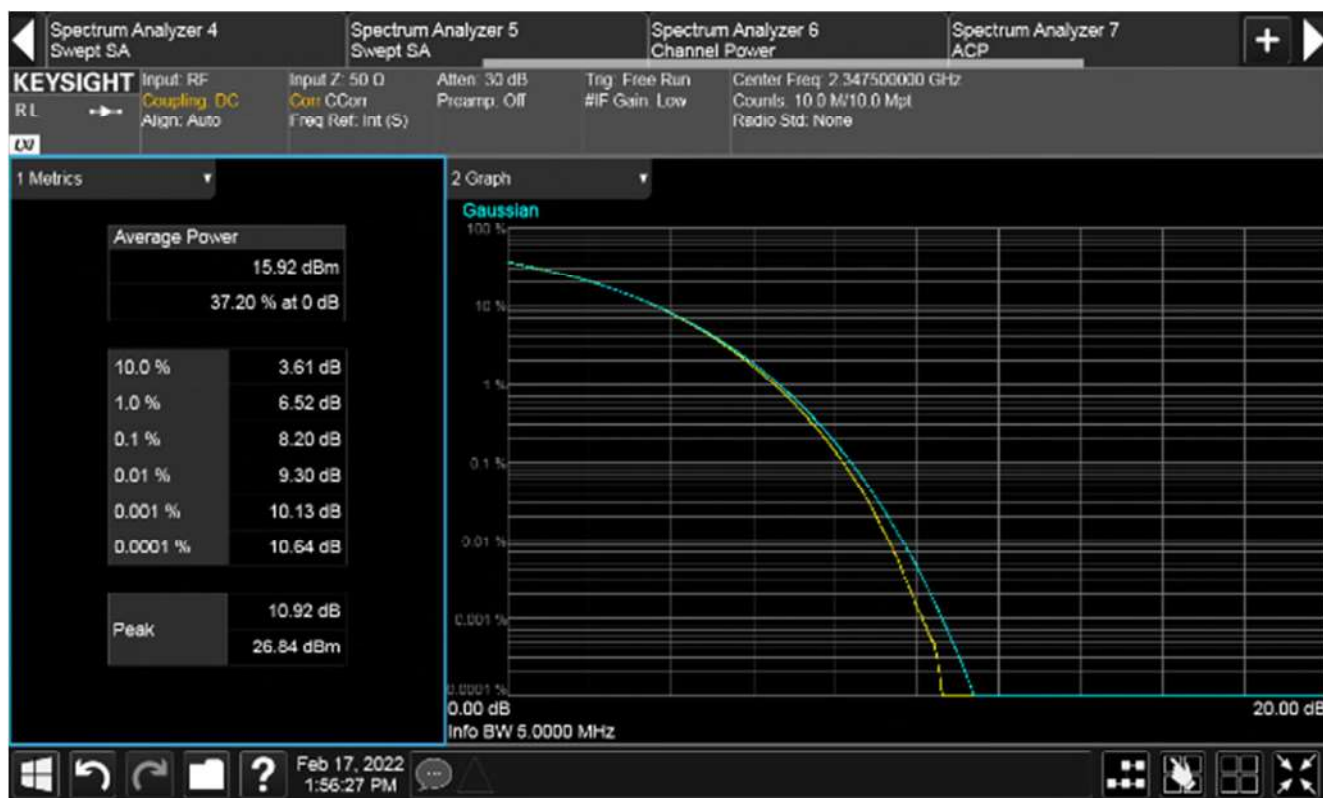
Input power

Measurement Parameter	Value
Total channel power	-14.74 dBm

Output power

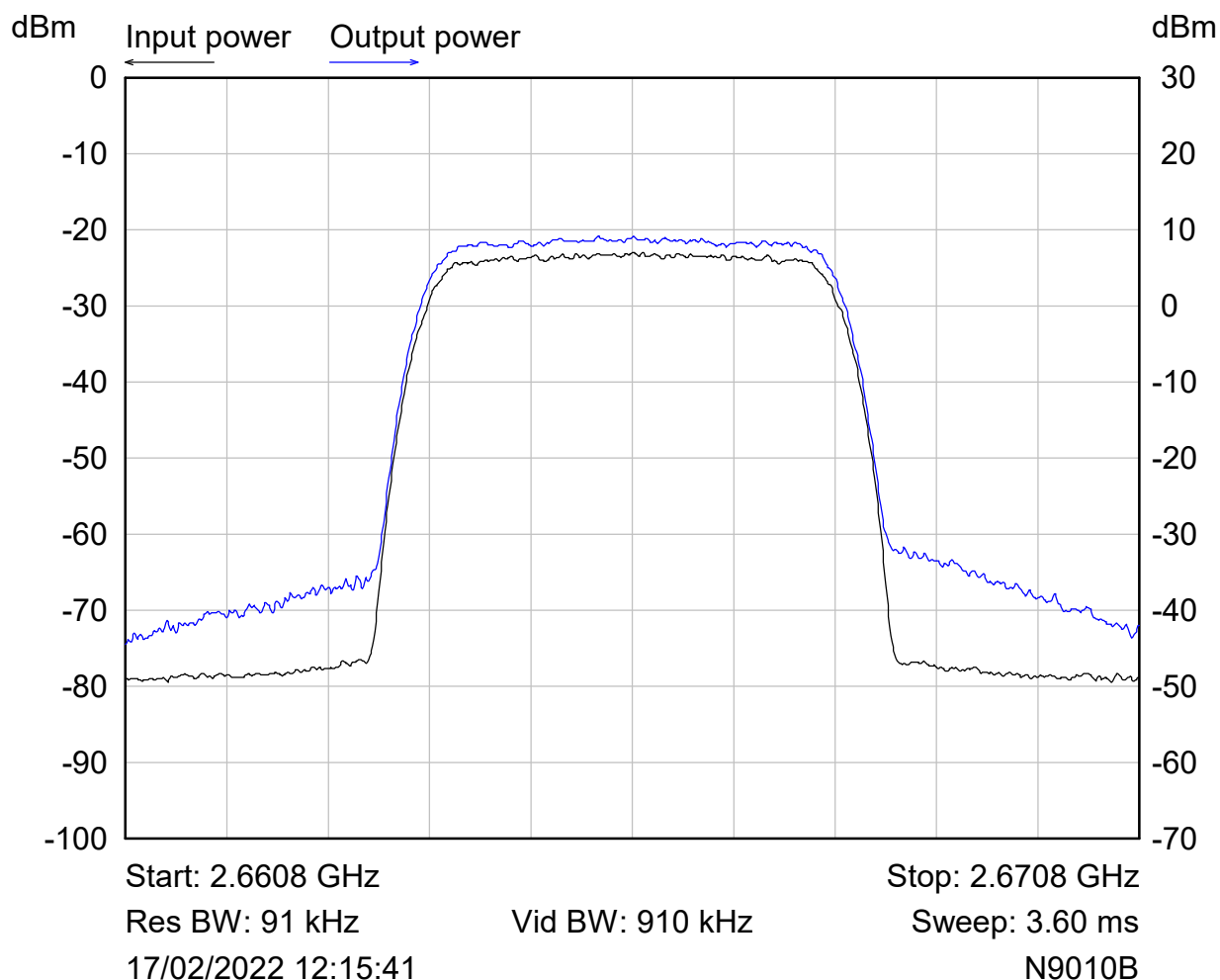
Measurement Parameter	Value
Total channel power	15.74 dBm

Plot of Channel power at determined f_0 in band 2345-2360 MHz



Plot of Peak to Average power ratio at determined f_0 in band 2345-2360 MHz

RF Parameters: Band 2496-2690 MHz, Power +20 dBm, Channel Spacing 5MHz, Modulation AWGN,
Channel 2655.8 MHz (determined f_0)



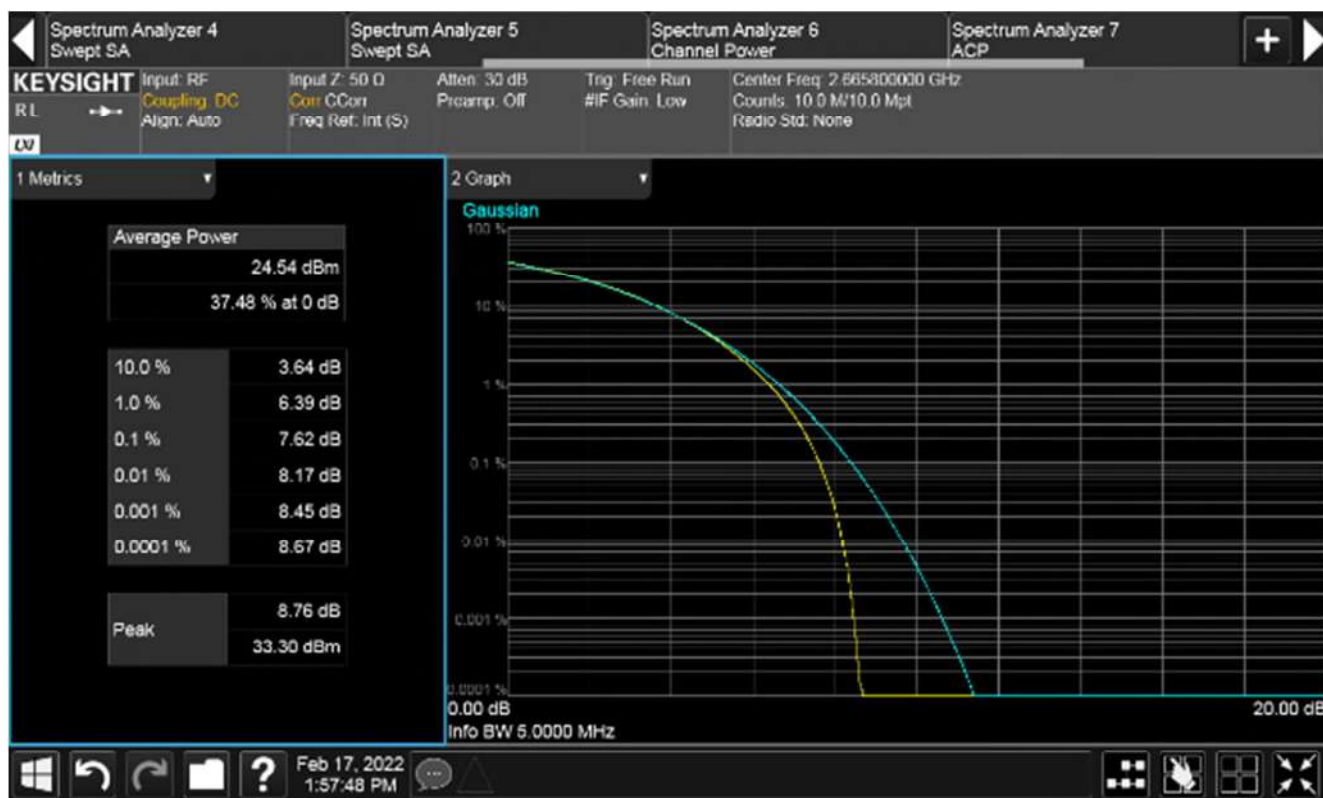
Input power

Measurement Parameter	Value
Total channel power	-7.74 dBm

Output power

Measurement Parameter	Value
Total channel power	24.30 dBm

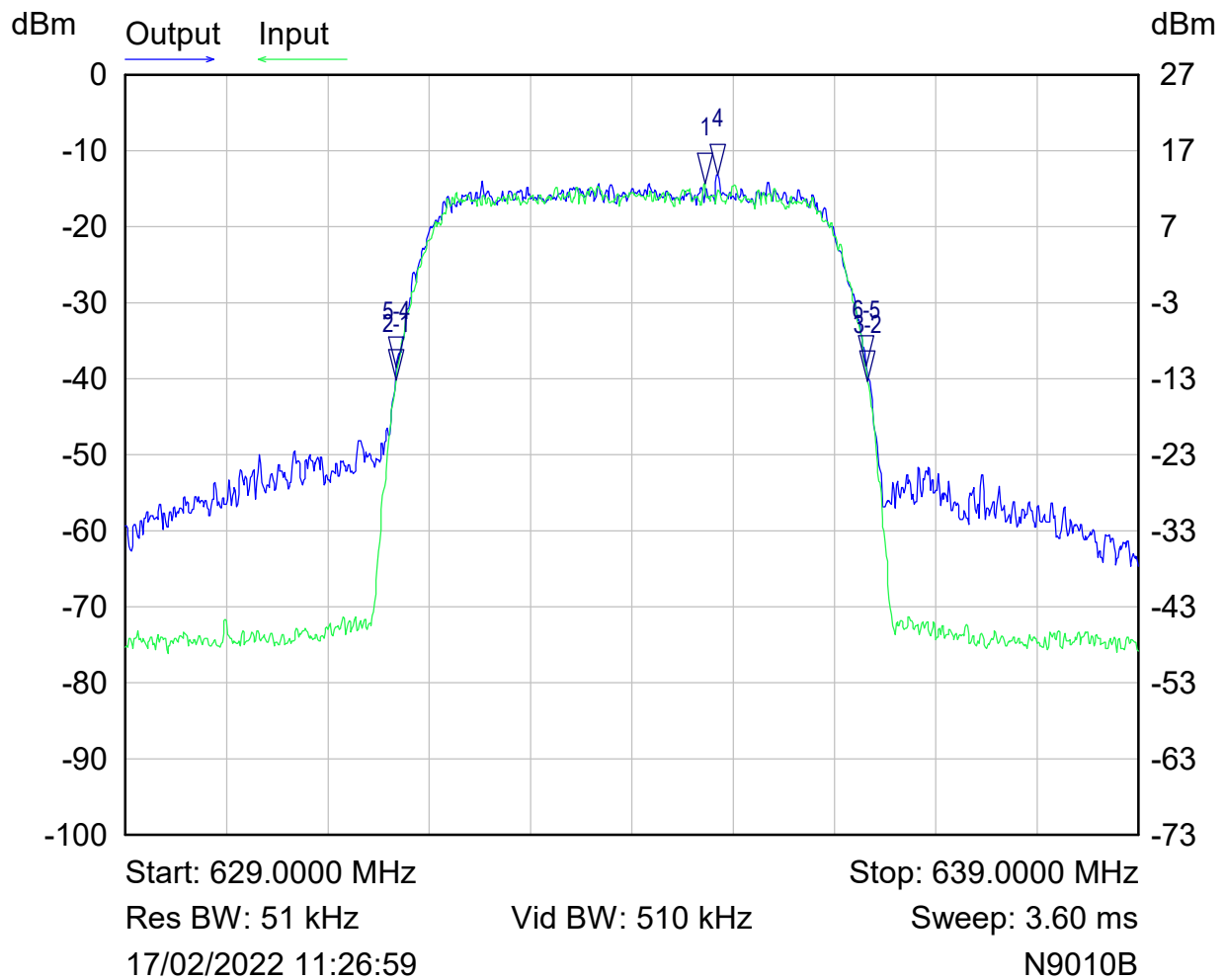
Plot of Channel power at determined f_0 in band 2496-2690 MHz



Plot of Peak to Average power ratio at determined f_0 in band 2496-2690 MHz

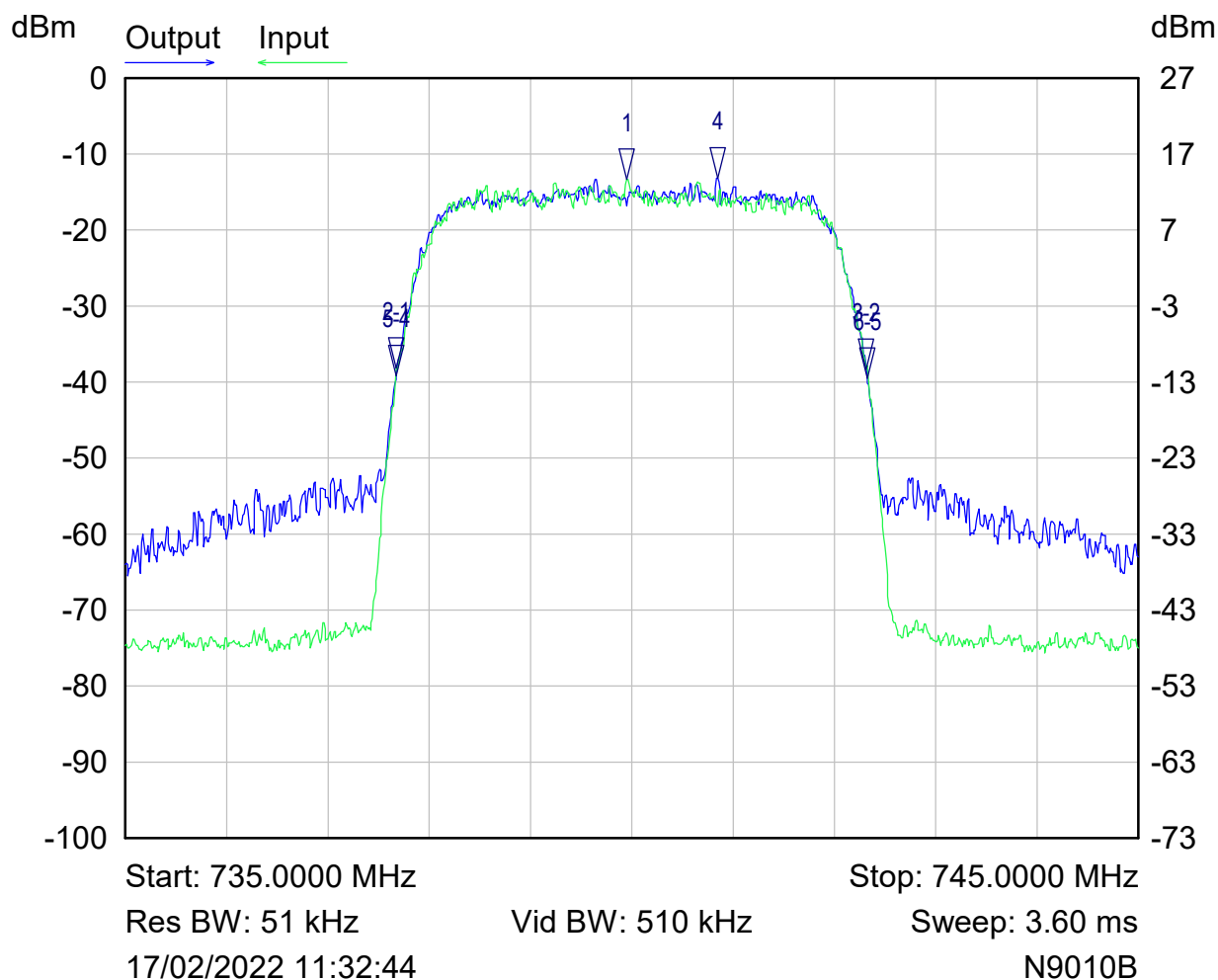
6.3 Occupied bandwidth / Input versus output signal

RF Parameters: Band 617-652 MHz, Power +20 dBm, Channel Spacing 5MHz, Modulation AWGN,
Channel 634 MHz



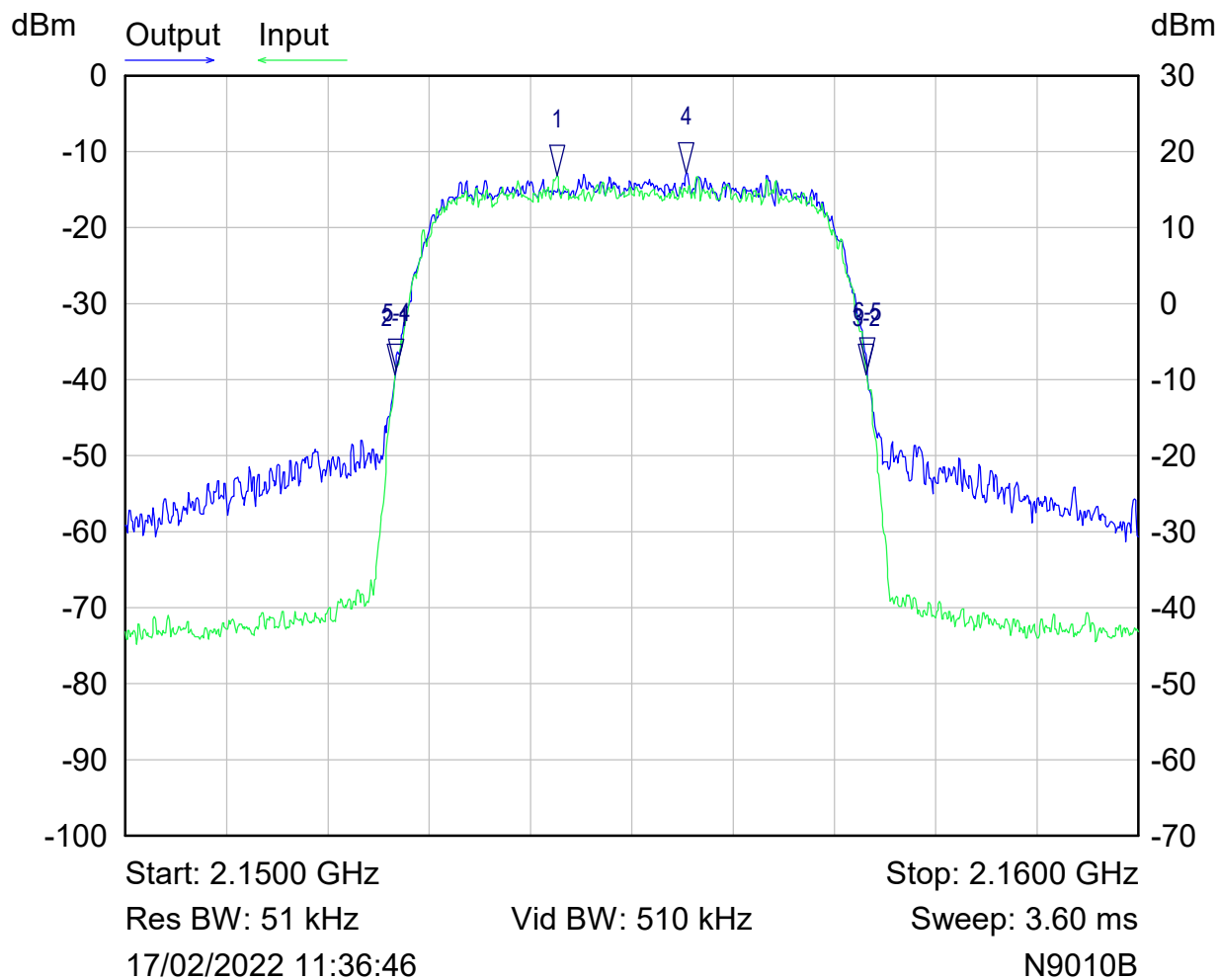
Mkr	Trace	X-Axis	Value	Notes
1 ▽	Input	634.7200 MHz	-14.33 dBm	
2-1 ▽	Input	-3.0500 MHz	-25.84 dB	-26 dB
3-2 ▽	Input	4.6600 MHz	-0.13 dB	input 26 dB BW
4 ▽	Output	634.8500 MHz	13.87 dBm	
5-4 ▽	Output	-3.1800 MHz	-25.34 dB	-26 dB
6-5 ▽	Output	4.6400 MHz	0.06 dB	output -26 dB BW

RF Parameters: Band 716-758 MHz, Power +20 dBm, Channel Spacing 5MHz, Modulation AWGN,
Channel 740 MHz



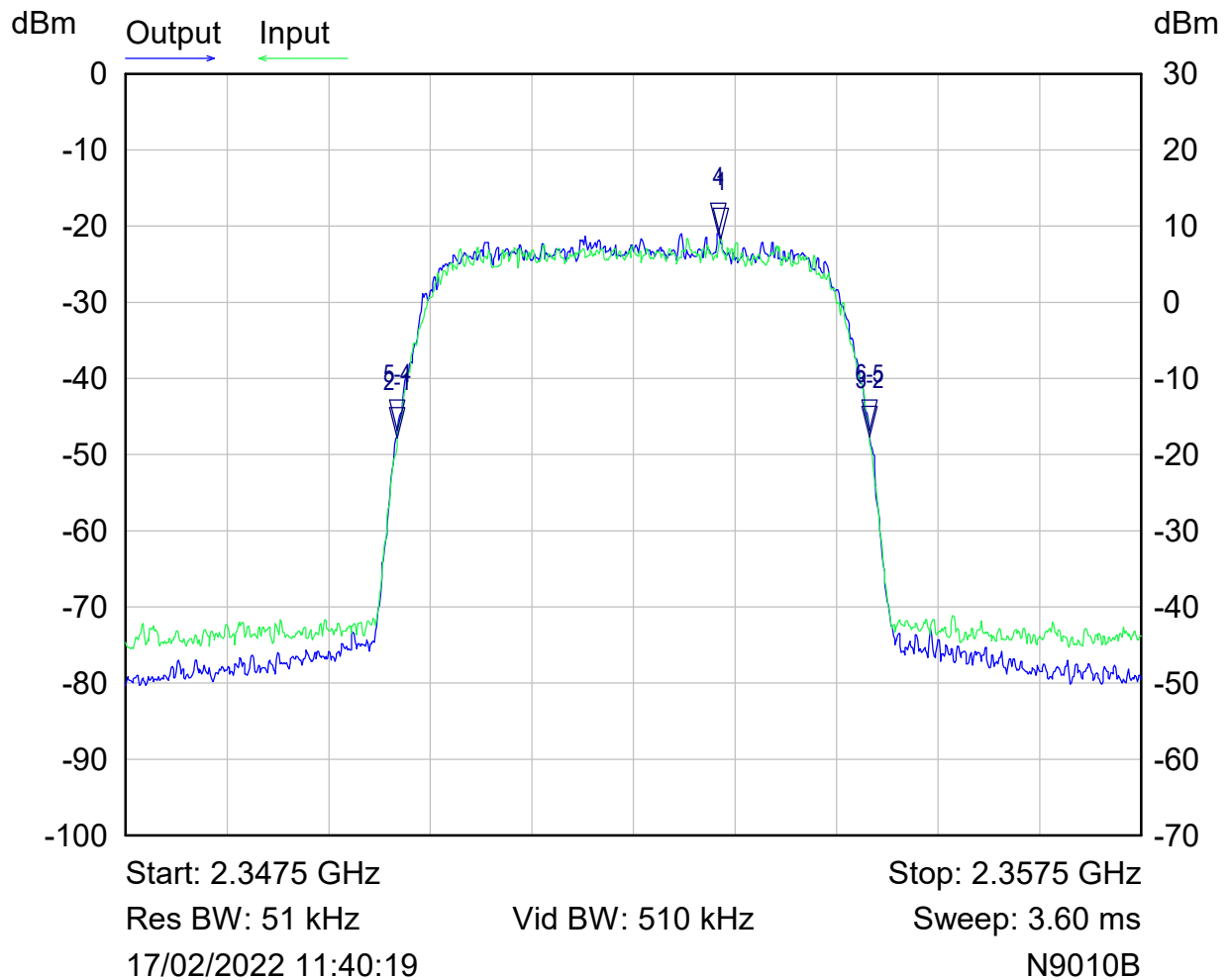
Mkr	Trace	X-Axis	Value	Notes
1 ▾	Input	739.9500 MHz	-13.35 dBm	
2-1 ▾	Input	-2.2800 MHz	-24.83 dB	-26 dB
3-2 ▾	Input	4.6400 MHz	-0.07 dB	input 26 dB BW
4 ▾	Output	740.8500 MHz	13.82 dBm	
5-4 ▾	Output	-3.1700 MHz	-25.94 dB	-26 dB
6-5 ▾	Output	4.6400 MHz	-0.46 dB	output -26 dB BW

RF Parameters: Band 2110-2200 MHz, Power +20 dBm, Channel Spacing 5MHz, Modulation AWGN,
Channel 2155 MHz



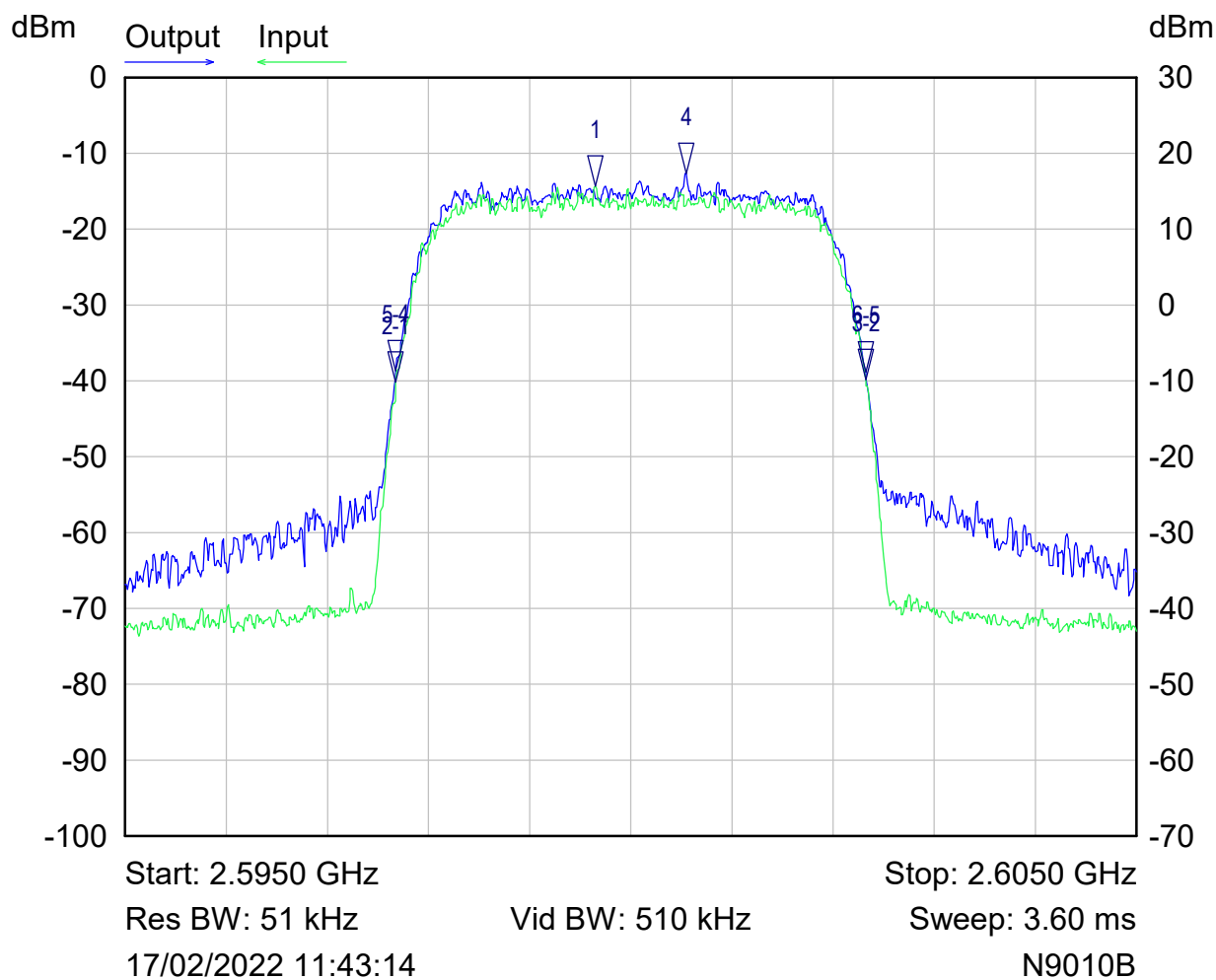
Mkr	Trace	X-Axis	Value	Notes
1 ▽	Input	2.1543 GHz	-13.12 dBm	
2-1 ▽	Input	-1.6000 MHz	-26.15 dB	-26 dB
3-2 ▽	Input	4.6500 MHz	-0.02 dB	input 26 dB BW
4 ▽	Output	2.1555 GHz	17.16 dBm	
5-4 ▽	Output	-2.8700 MHz	-25.85 dB	-26 dB
6-5 ▽	Output	4.6500 MHz	0.19 dB	output 26 dB BW

RF Parameters: Band 2345-2360 MHz, Power +20 dBm, Channel Spacing 5MHz, Modulation AWGN,
Channel 2352.5 MHz



Mkr	Trace	X-Axis	Value	Notes
1 ▾	Input	2.3534 GHz	-21.70 dBm	
2-1 ▾	Input	-3.1800 MHz	-26.12 dB	-26 dB
3-2 ▾	Input	4.6400 MHz	0.23 dB	input 26 dB BW
4 ▾	Output	2.3533 GHz	9.04 dBm	
5-4 ▾	Output	-3.1600 MHz	-25.85 dB	-26 dB
6-5 ▾	Output	4.6400 MHz	0.05 dB	output 26 dB BW

RF Parameters: Band 2496-2690 MHz, Power +20 dBm, Channel Spacing 5MHz, Modulation AWGN,
Channel 2600 MHz



Mkr	Trace	X-Axis	Value	Notes
1 ▽	Input	2.5997 GHz	-14.27 dBm	
2-1 ▽	Input	-1.9700 MHz	-25.93 dB	-26 dB
3-2 ▽	Input	4.6400 MHz	0.34 dB	input 26 dB BW
4 ▽	Output	2.6006 GHz	17.34 dBm	
5-4 ▽	Output	-2.8700 MHz	-26.09 dB	-26 dB
6-5 ▽	Output	4.6400 MHz	-0.10 dB	output 26 dB BW