



Radio Test Report

Zinwave Ltd

Zinwave UNItnity 5000 Remote Unit

305-0007

47 CFR Part 27 Effective Date 1st October 2017

47 CFR Part 2 Effective Date 1st October 2017

Test Date: 21st February 2018 to 30th May 2018

Report Number: 03-10383-2-18 Issue 03

Supersedes report: 03-10383-2-18 Issue 02

R.N. Electronics Ltd.

Arnolds Court

Arnolds Farm Lane

Mountnessing

Essex

CM13 1UT

U.K.

www.RNelectronics.com

Telephone: +44 (0) 1277 352219

Email: sales@RNelectronics.com

This report is not to be reproduced by any means except in full and in any case not without the written approval of R.N. Electronics Ltd.



Arnolds Court, Arnolds Farm Lane, Mountnessing, Brentwood Essex, CM13 1UT
Certificate of Test 10383-2

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 UNItnity 5000 Remote Unit
Model Number:	305-0007
Unique Serial Number:	660100000021
Applicant:	Zinwave Ltd Harston Mill, Royston Road Harston, Cambridge CB22 7GG
Proposed FCC ID	UPO305-0007
Full measurement results are detailed in Report Number:	03-10383-2-18 Issue 03
Test Standards:	47 CFR Part 27 Effective Date 1st October 2017 47 CFR Part 2 Effective Date 1st October 2017

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: 03-10383-1-18 (Parts 22E, 22H, 24E), 03-10383-3-18 (Part 74H), and 03-10383-4-18 (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: 21st February 2018 to 30th May 2018

Test Engineer:

A handwritten signature in black ink that reads 'Charles Blatt'.

Approved By:

Radio Approvals Manager

Customer

Representative:



1 Contents

1	Contents	3
2	Equipment under test (EUT)	4
2.1	Equipment specification	4
2.2	Configurations for testing	5
2.3	Functional description	6
2.4	Modes of operation	6
2.5	Emissions configuration	8
3	Summary of test results	9
4	Specifications	10
4.1	Relevant standards	10
4.2	Deviations	10
5	Tests, methods and results	11
5.1	Spurious emissions at antenna terminals	11
5.2	RF Power Output	17
5.3	Frequency stability	19
5.4	Occupied bandwidth / Input versus output signal	20
5.5	Field strength of spurious radiations	22
5.6	Band edge emissions	28
5.7	Modulation characteristics	32
5.8	Determination of f_0	33
6	Plots/Graphical results	35
6.1	Determination of f_0	35
6.2	RF Power Output	39
6.3	Occupied bandwidth / Input versus output signal	43
6.4	Spurious emissions at antenna terminals	47
6.5	Band edge emissions	62
7	Photographs	77
8	Test equipment calibration list	78
9	Auxiliary and peripheral equipment	79
9.1	Customer supplied equipment	79
9.2	RN Electronics supplied equipment	79
10	Condition of the equipment tested	80
10.1	Modifications before test	80
10.2	Modifications during test	80
11	Description of test sites	81
12	Abbreviations and units	82

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 UNIltivity 5000 Remote Unit
Model Number of EUT	305-0007
Serial Number of EUT	660100000021
Date Received	20 th February 2018
Date of Test:	21st February 2018 to 30th May 2018
Purpose of Test	To demonstrate design compliance to the relevant rules of Chapter 47 of the Code of Federal Regulations.
Date Report Issued	4 th June 2018
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	1.00
Software Version	4.209
Firmware Version	N/A
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
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
CW sweep Band 716-758 MHz	EUT being fed a swept CW signal across the band 716-758 MHz @ -5dBm amplitude level	Yes
CW sweep Band 2110-2200 MHz	EUT being fed a swept CW signal across the band 2110-2200 MHz @ -5dBm amplitude level	Yes
CW sweep Band 2345-2360 MHz	EUT being fed a swept CW signal across the band 2345-2360 MHz @ -5dBm amplitude level	Yes
CW sweep Band 2496-2690 MHz	EUT being fed a swept CW signal across the band 2496-2690 MHz @ -5dBm amplitude level	Yes
f_o Determined in Band 716-758 MHz	EUT Being fed a Signal at 718.9MHz @ -5dBm using AWGN modulation and 5MHz channel BW	Yes
f_o Determined in Band 2110-2200 MHz	EUT Being fed a Signal at 2173.3MHz @ -5dBm using AWGN modulation and 5MHz channel BW	Yes
f_o Determined in Band 2345-2360 MHz	EUT Being fed a Signal at 2354.0MHz @ -5dBm using AWGN modulation and 5MHz channel BW	Yes
f_o Determined in Band 2496-2690 MHz	EUT Being fed a Signal at 2496.6MHz @ -5dBm using AWGN modulation and 5MHz channel BW	Yes
Single Low channel band 716-746 MHz	EUT Being fed a Signal at 718.5MHz @ -5dBm using AWGN modulation and 5MHz channel BW	Yes
Single Mid channel band 716-746 MHz	EUT Being fed a Signal at 731MHz @ -5dBm using AWGN modulation and 5MHz channel BW	Yes
Single High channel band 716-746 MHz	EUT Being fed a Signal at 743.5MHz @ -5dBm using AWGN modulation and 5MHz channel BW	Yes
Single Low channel band 746-758 MHz	EUT Being fed a Signal at 748.5MHz @ -5dBm using AWGN modulation and 5MHz channel BW	Yes
Single Mid channel band 746-758 MHz	EUT Being fed a Signal at 752.5MHz @ -5dBm using AWGN modulation and 5MHz channel BW	Yes
Single High channel band 746-758 MHz	EUT Being fed a Signal at 755.5MHz @ -5dBm using AWGN modulation and 5MHz channel BW	Yes
Single Low channel band 716-758 MHz	EUT Being fed a Signal at 718.5MHz @ -5dBm using AWGN modulation and 5MHz channel BW (RADIATED EM TEST CHANNELS)	Yes
Single Mid channel band 716-758 MHz	EUT Being fed a Signal at 740MHz @ -5dBm using AWGN modulation and 5MHz channel BW (RADIATED EM TEST CHANNELS)	Yes
Single High channel band 698-758 MHz	EUT Being fed a Signal at 755.5MHz @ -5dBm using AWGN modulation and 5MHz channel BW (RADIATED EM TEST CHANNELS)	Yes
Single Low channel band 2110-2200 MHz	EUT Being fed a Signal at 2112.5MHz @ -5dBm using AWGN modulation and 5MHz channel BW	Yes
Single Mid channel band 2110-2200 MHz	EUT Being fed a Signal at 2142.5MHz @ -5dBm using AWGN modulation and 5MHz channel BW	Yes
Single High channel band 2110-2200 MHz	EUT Being fed a Signal at 2177.5.5MHz @ -5dBm using AWGN modulation and 5MHz channel BW	Yes

Single Low channel band 2345-2360 MHz	EUT Being fed a Signal at 2347.5MHz @ -5dBm using AWGN modulation and 5MHz channel BW	Yes
Single Mid channel band 2345-2360 MHz	EUT Being fed a Signal at 2352.5MHz @ -5dBm using AWGN modulation and 5MHz channel BW	Yes
Single High channel band 2345-2360 MHz	EUT Being fed a Signal at 2357.5MHz @ -5dBm using AWGN modulation and 5MHz channel BW	Yes
Single Low channel band 2496-2690 MHz	EUT Being fed a Signal at 2498.5MHz @ -5dBm using AWGN modulation and 5MHz channel BW	Yes
Single Mid channel band 2496-2690 MHz	EUT Being fed a Signal at 2600MHz @ -5dBm using AWGN modulation and 5MHz channel BW	Yes
Single High channel band 2496-2690 MHz	EUT Being fed a Signal at 2687.5MHz @ -5dBm using AWGN modulation and 5MHz channel BW	Yes
Dual Low channels band 716-746 MHz	EUT Being fed a Signal at 718.5MHz & 723.5MHz @ -5dBm using AWGN modulation and 5MHz channel BW per channel	Yes
Dual High channels band 746-758 MHz	EUT Being fed a Signal at 750.5MHz & 755.5MHz @ -5dBm using AWGN modulation and 5MHz channel BW per channel	Yes
Dual Low channels band 2110-2200 MHz	EUT Being fed a Signal at 2112.5MHz & 2117.5MHz @ -5dBm using AWGN modulation and 5MHz channel BW per channel	Yes
Dual High channels band 2110-2200 MHz	EUT Being fed a Signal at 2192.5MHz & 2197.5MHz @ -5dBm using AWGN modulation and 5MHz channel BW per channel	Yes
Dual Low channels band 2345-2360 MHz	EUT Being fed a Signal at 2347.5MHz & 2352.5MHz @ -5dBm using AWGN modulation and 5MHz channel BW per channel	Yes
Dual High channels band 2345-2360 MHz	EUT Being fed a Signal at 2352.5MHz & 2357.5MHz @ -5dBm using AWGN modulation and 5MHz channel BW per channel	Yes
Dual Low channels band 2496-2690 MHz	EUT Being fed a Signal at 2498.5MHz & 2503.5MHz @ -5dBm using AWGN modulation and 5MHz channel BW per channel	Yes
Dual High channels band 2496-2690 MHz	EUT Being fed a Signal at 2682.5MHz & 2687.5MHz @ -5dBm using AWGN modulation and 5MHz channel BW per channel	Yes

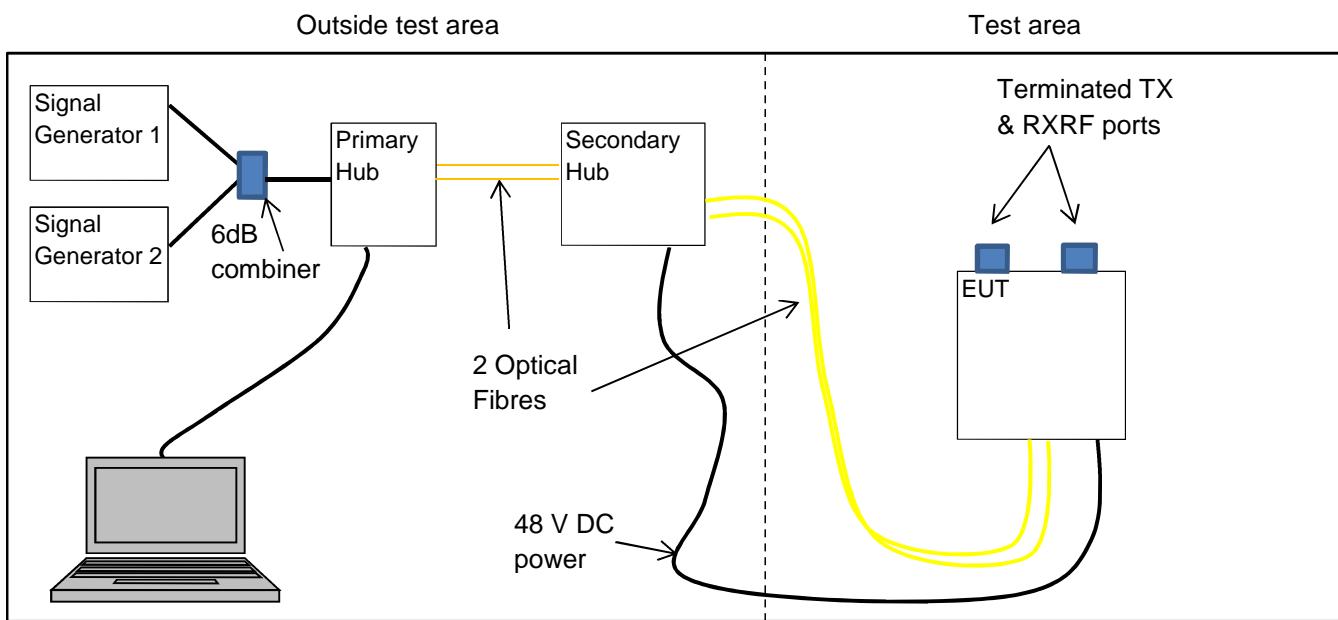
Note: This report only pertains to the operation of the equipment to 47CFR part 27, for details of testing to other rule parts please see RN reports:

03-10383-1-18 (Parts 22E, 22H, 24E)

03-10383-3-18 (Part 74H)

03-10383-4-18 (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 and a combiner. 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, 305-0007 was tested for compliance to the following standard(s) :

47 CFR Part 27 Effective Date 1st October 2017

47 CFR Part 2 Effective Date 1st October 2017

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	2017	Miscellaneous Wireless Communications Services
4.1.2	47CFR part 2J	2017	Part 2 – Frequency Allocations and radio treaty matters; General rules and regulations
4.1.3	KDB 971168 D01 v02r02	2014	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 v01r02	2017	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.

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 A.

5.1.4 Test equipment

E301, E412, E498, E642, E755

See Section 8 for more details

5.1.5 Test results

Temperature of test environment	17-22°C
Humidity of test environment	30-42%
Pressure of test environment	100-103kPa

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

Setup Table

Band	716-746 MHz
Power Level	20 dBm
Channel Spacing	5 MHz
Mod Scheme	AWGN
Low channel	700.5 MHz

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

Plots
30 – 713 MHz range
713 - 728 MHz range
746 – 5000 MHz range
5 – 8 GHz range

Setup Table

Band	716-746 MHz
Power Level	20 dBm
Channel Spacing	5 MHz
Mod Scheme	AWGN
Mid channel	731 MHz

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

Plots

Note: Whilst Low, Mid and High channels of the band have been tested and any applicable results reported, only low channel plots are shown in the plots section to minimise report size.

Setup Table

Band	716-746 MHz
Power Level	20 dBm
Channel Spacing	5 MHz
Mod Scheme	AWGN
High channel	743.5 MHz

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

Plots

Note: Whilst Low, Mid and High channels of the band have been tested and any applicable results reported, only low channel plots are shown in the plots section to minimise report size.

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)
No Emissions observed within 20dB of limits		

Plots

30 – 740.75 MHz range

740.75 – 751.25 MHz range

763 – 805 MHz (30kHz RBW)

758 – 5000 MHz range

1559 - 1610 MHz range (1MHz RBW)

1559 - 1610 MHz range (10kHz RBW)

5 – 8 GHz range

Setup Table

Band	746-758 MHz
Power Level	20 dBm

Channel Spacing	5 MHz
Mod Scheme	AWGN
Mid channel	752.5 MHz

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

Plots

Note: Whilst Low, Mid and High channels of the band have been tested and any applicable results reported, only low channel plots are shown in the plots section to minimise report size.

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)
No Emissions observed within 20dB of limits		

Plots

Note: Whilst Low, Mid and High channels of the band have been tested and any applicable results reported, only low channel plots are shown in the plots section to minimise report size.

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)
No Emissions observed within 20dB of limits		

Plots

30 – 2107 MHz range

2107 – 2118 MHz range

2203 – 22000 MHz

Setup Table

Band	2110-2200 MHz
Power Level	20 dBm
Channel Spacing	5 MHz
Mod Scheme	AWGN
Mid channel	2142.5 MHz

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

Plots

Note: Whilst Low, Mid and High channels of the band have been tested and any applicable results reported, only low channel plots are shown in the plots section to minimise report size.

Setup Table

Band	2110-2200 MHz
Power Level	20 dBm
Channel Spacing	5 MHz
Mod Scheme	AWGN
High channel	2177.5 MHz

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

Plots

Note: Whilst Low, Mid and High channels of the band have been tested and any applicable results reported, only low channel plots are shown in the plots section to minimise report size.

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)
2340	-45.6	-0.6
2389.8	-47.7	-2.7

Plots

30 – 2340 MHz range
2363 – 24000 MHz range

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)
2345	-46.4	-0.4
23740.4	-47.6	-2.6

Plots

Note: Whilst Low, Mid and High channels of the band have been tested and any applicable results reported, only low channel plots are shown in the plots section to minimise report size.

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)
1555	-47.7	-2.7
2363.9	-38.4	-13.4
2501.7	-48.0	-3.0

Plots

Note: Whilst Low, Mid and High channels of the band have been tested and any applicable results reported, only low channel plots are shown in the plots section to minimise report size.

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

10 – 2493 MHz range
2504 – 6000 MHz range
6000 – 26000 MHz range
26-27 GHz range

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

Note: Whilst Low, Mid and High channels of the band have been tested and any applicable results reported, only low channel plots are shown in the plots section to minimise report size.

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

Note: Whilst Low, Mid and High channels of the band have been tested and any applicable results reported, only low channel plots are shown in the plots section to minimise report size.

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 716-746 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. $+20\text{dBm} = 0.1\text{W}$ therefore:
 $43+10\log 0.1 = 33\text{dB}$. $+20\text{dBm} - 33 = -13\text{dBm}$

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:
 $\pm 2.8\text{ dB}$

5.2 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

E301, E498, E642, E755

See Section 8 for more details

5.2.5 Test results

Temperature of test environment	17-22°C
Humidity of test environment	30-42%
Pressure of test environment	100-103kPa

Band	716-763 MHz
Power Level	20 dBm
Channel Spacing	5 MHz
Mod Scheme	AWGN
f_0 frequency	718.9 MHz

Test conditions	Average Power (dBm)	Pk to AV Power ratio (dB)	TX power EIRP (dBm)	TX Power EIRP (W)
Temp Ambient Volts Nominal	20.06	9.62	28.06	0.640

Note: 8dBi Antenna gain used.

Band	2110-2200 MHz
Power Level	20 dBm
Channel Spacing	5 MHz
Mod Scheme	AWGN
f_0 frequency	2173.3 MHz

Test conditions	Average Power (dBm)	Pk to AV Power ratio (dB)	TX power EIRP (dBm)	TX Power EIRP (W)
Temp Ambient Volts Nominal	20.45	9.75	28.45	0.7

Note: 8dBi Antenna gain used.

Band	2345-2360 MHz
Power Level	20 dBm
Channel Spacing	5 MHz
Mod Scheme	AWGN
f0 frequency	2354.0 MHz

Test conditions	Average Power (dBm)	Pk to AV Power ratio (dB)	TX power EIRP (dBm)	TX Power EIRP (W)
Temp Ambient Volts Nominal	20.82	9.43	28.82	0.762

Note: 8dBi Antenna gain used.

Band	2496-2690 MHz
Power Level	20 dBm
Channel Spacing	5 MHz
Mod Scheme	AWGN
f0 frequency	2496.6 MHz

Test conditions	Average Power (dBm)	Pk to AV Power ratio (dB)	TX power EIRP (dBm)	TX Power EIRP (W)
Temp Ambient Volts Nominal	20.47	10.11	28.47	0.703

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]
Limits:	KDB 935210 D05 Clause 3.3 / 3.4, 4.3 / 4.4 [Reference 4.1.5 of this report]

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 determined f_0 for each applicable band.

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 to an appropriate channel to include f_0 as determined in section 5.8. A peak detector was set with max hold and sweeps made comparing the input and the output signals and their -26dB bandwidth measured using the inbuilt function on the analyser.

5.4.4 Test equipment

E301, E498, E642, E755

See Section 8 for more details

5.4.5 Test results

Temperature of test environment	17-22°C
Humidity of test environment	30-44%
Pressure of test environment	100-103kPa

Band	716-763 MHz
Power Level	20 dBm
Channel Spacing	5 MHz
Mod Scheme	AWGN
f0 frequency	718.9 MHz

	26dB BW (MHz)	Occupied BW (MHz)
Input measurement	4.64	Not captured
Output measurement	4.65	Not captured
Plot reference	Occupied BW 718.9MHz channel	

Band	2110-2200 MHz
Power Level	20 dBm
Channel Spacing	5 MHz
Mod Scheme	AWGN
f0 frequency	2173.3 MHz

	26dB BW (MHz)	Occupied BW (MHz)
Input measurement	4.68	4.14
Output measurement	4.66	4.13

Plot reference

Occupied BW 2173.3MHz channel

Band	2345-2360 MHz
Power Level	20 dBm
Channel Spacing	5 MHz
Mod Scheme	AWGN
f0 frequency	2354.0 MHz

	26dB BW (MHz)	Occupied BW (MHz)
Input measurement	4.67	4.14
Output measurement	4.68	4.12
Plot reference	Occupied BW 2354MHz channel	

Band	2496-2690 MHz
Power Level	20 dBm
Channel Spacing	5 MHz
Mod Scheme	AWGN
f0 frequency	2496.6 MHz

	26dB BW (MHz)	Occupied BW (MHz)
Input measurement	4.72	4.15
Output measurement	4.66	4.13
Plot reference	Occupied BW 2496.6MHz channel	

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:
 $< \pm 1.9\%$

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

LPE364, E743, E624, E411, E412, E755, TMS82, E268, E428, TMS78, TMS79, E602, E433, E452, E453, E454

See Section 8 for more details

5.5.5 Test results

Temperature of test environment	15-20°C
Humidity of test environment	30-42%
Pressure of test environment	102kPa

Single channel results.

Setup Table

Band	698-758 MHz
Power Level	20 dBm
Channel Spacing	5 MHz
Mod Scheme	AWGN
Low channel	700.5 MHz

Spurious Frequency (MHz)	Measured Spurious Level (dBm)	Difference to Limit (dB)	Antenna Polarisation	EUT Polarisation

No spurious emissions observed				
--------------------------------	--	--	--	--

Setup Table

Band	698-758 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	698-758 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	2142.5 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 channel	2177.5 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
No spurious emissions observed				

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
No spurious emissions observed				

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
No spurious emissions observed				

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	698-758 MHz
Power Level	20 dBm
Channel Spacing	5 MHz
Mod Scheme	AWGN
Low channels	700.5 MHz + 705.5 MHz

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

Setup Table

Band	698-758 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				

Setup Table

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
No spurious emissions observed				

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
No spurious emissions observed				

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. $+20\text{dBm} = 0.1\text{W}$ therefore:

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

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 $\pm 3.9\text{ dB}$, 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.

Tests were performed in test site A.

5.6.4 Test equipment

E301, E498, E642, E755

See Section 8 for more details

5.6.5 Test results

Temperature of test environment	17-22°C
Humidity of test environment	30-42%
Pressure of test environment	100-103kPa

Single channel results

Band	716-746 MHz
Power Level	20 dBm
Channel	
Spacing	5 MHz
Mod Scheme	AWGN
Low channel	718.5 MHz
High channel	743.5 MHz

	Lower band edge (716MHz)	Upper band edge (746MHz)
Plot reference	lower band edge for Low channel (718.5MHz)	upper band edge for High channel (743.5MHz)

Band	746-758 MHz
Power Level	20 dBm
Channel Spacing	5 MHz
Mod Scheme	AWGN
Low channel	748.5 MHz
High channel	755.5 MHz

	Lower band edge (746MHz)	Upper band edge (758MHz)
Plot reference	lower band edge for Low channel (746MHz)	upper band edge for High channel (755.5MHz)

Band	2110-2200 MHz
Power Level	20 dBm
Channel Spacing	5 MHz
Mod Scheme	AWGN
Low channel	2112.5 MHz
High channel	2177.5 MHz

	Lower band edge (2110 MHz)	Upper band edge (2200 MHz)
Plot reference	lower band edge for Low channel 1MHz RBW (2112.5MHz)	upper band edge for High channel 1MHz RBW (2197.5MHz)
Plot reference	lower band edge for Low channel 100kHz RBW (2112.5MHz)	upper band edge for High channel 100kHz RBW (2197.5MHz)

Band	2345-2360 MHz
Power Level	20 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 (2355 MHz)
Plot reference	lower/upper band edge for Low channel 1MHz RBW (2347.5 MHz)	lower/upper band edge for High channel 1MHz RBW (2352.5MHz)
	Lower band edge (2350 MHz)	Upper band edge (2360 MHz)
Plot reference	lower/upper band edge for High channel 1MHz RBW (2357.5MHz)	

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 (2501 MHz)
Plot reference	lower/upper band edge for Low channel 1MHz RBW (2498.5MHz)	
	lower/upper band edge for Low channel 100kHz RBW (2498.5MHz)	
	Lower band edge(2685 MHz)	Upper band edge (2690 MHz)

Plot reference	lower/upper band edge for Low channel 1MHz RBW (2687.5MHz)
	lower/upper band edge for Low channel 100kHz RBW (2687.5MHz)

Dual channel results

Band	716-746 MHz
Power Level	20 dBm
Channel Spacing	5 MHz
Mod Scheme	AWGN
	718.5 + 723.5
Low channels	MHz
	738.5 + 743.5
High channels	MHz

Plot reference	Lower band edge (698MHz) lower band edge for Low channels (700.5 & 705.5MHz)	Upper band edge (746MHz) upper band edge for High channels (738.5 & 743.5MHz)
----------------	---	--

Band	746-758 MHz
Power Level	20 dBm
Channel Spacing	5 MHz
Mod Scheme	AWGN
	748.5 + 753.5
Low channels	MHz
	750.5 + 755.5
High channels	MHz

Plot reference	Lower band edge (746MHz) lower band edge for Low channels (748.5 & 753.5MHz)	Upper band edge (758MHz) upper band edge for High channels (750.5 & 755.5MHz)
----------------	---	--

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

Plot reference	Lower band edge (2110 MHz) lower band edge for Low channels 100kHz RBW (2112.5 & 2117.5MHz)	Upper band edge (2200 MHz) upper band edge for High channels 100kHz RBW (2192.5 & 2197.5MHz)
----------------	--	---

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 (2355 MHz)
Plot reference	lower/upper band edge for Low channels 51kHz RBW (2347.5 & 2352.5MHz)	
	Lower band edge (2350 MHz)	Upper band edge (2360 MHz)
Plot reference	lower/upper band edge for Low channels 51kHz RBW (2352.5 & 2357.5MHz)	

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)
Plot reference	lower band edge for Low channels 100kHz RBW (2498.5 & 2503.5MHz)	upper band edge for High channels 100kHz RBW (2682.5 & 2687.5MHz)

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 716-746 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

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 4 operational bands with a CW signal to determine the frequency of highest power in the band. Test performed in **CW sweep Band 716-758 MHz, CW sweep Band 2110-2200 MHz, CW sweep Band 2345-2360 MHz and CW sweep Band 2496-2690 MHz** modes.

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

E498, E642, E755

See Section 8 for more details

5.8.5 Test results

Temperature of test environment	17-22°C
Humidity of test environment	30-44%
Pressure of test environment	100-103kPa

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

Band (MHz)	f_0 determined(MHz)
716 - 758	718.9

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	2173.3

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	2354.0

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	2496.6

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

Results are also presented graphically in section 6.

LIMITS:

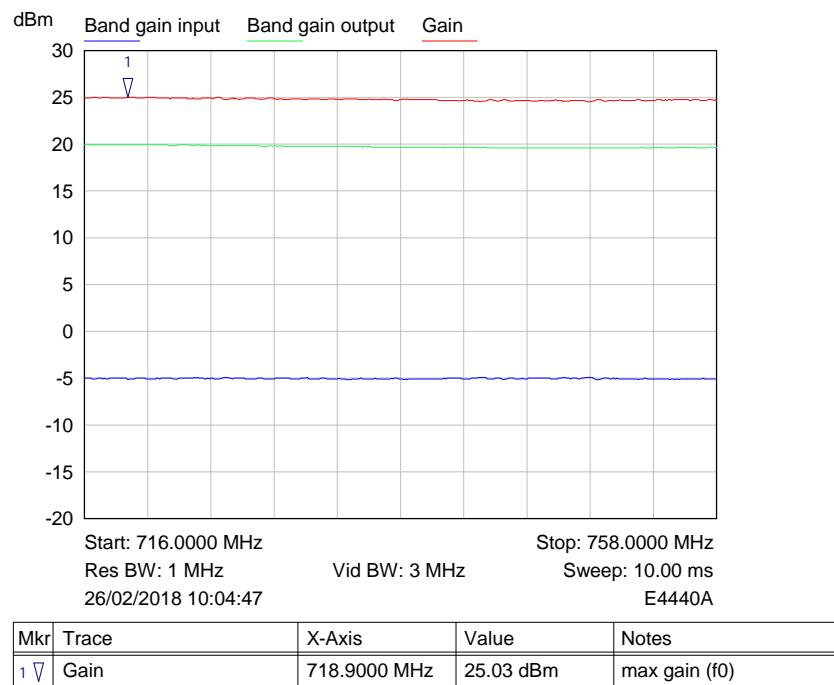
None.

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

6 Plots/Graphical results

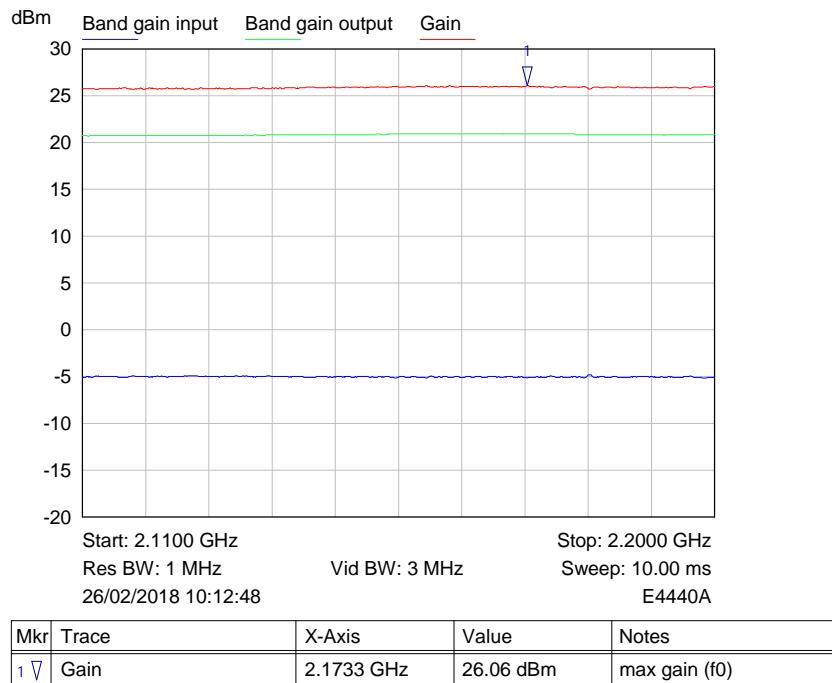
6.1 Determination of f_0

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



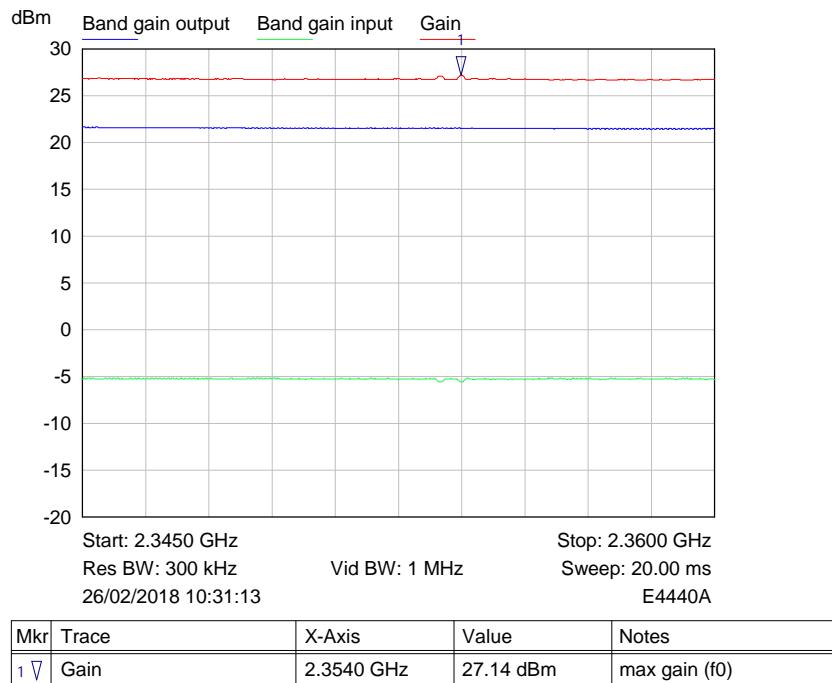
Plot of f_0 determined in band 716-758 MHz.

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



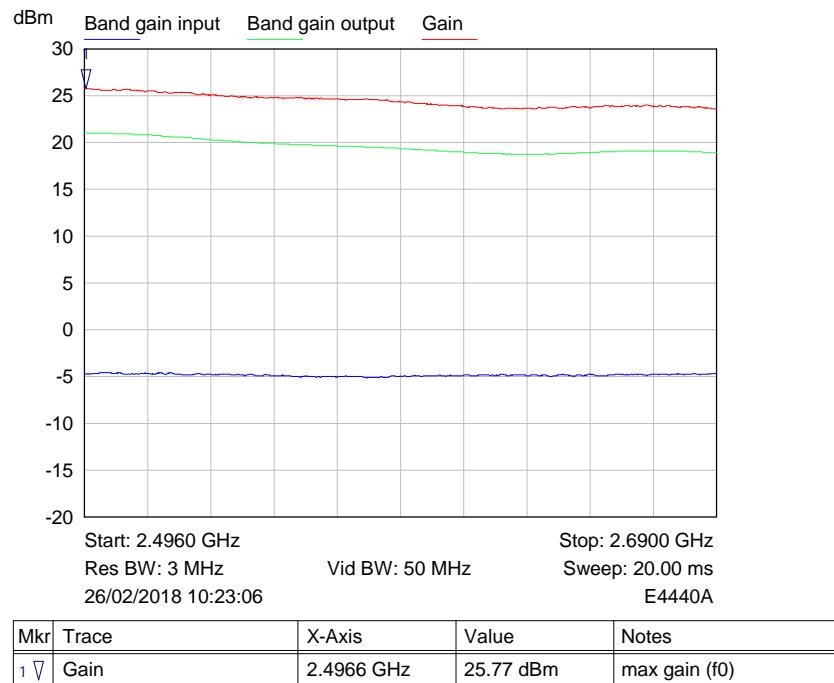
Plot of f0 determined in band 2110-2200 MHz.

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



Plot of f0 determined in band 2345-2360 MHz.

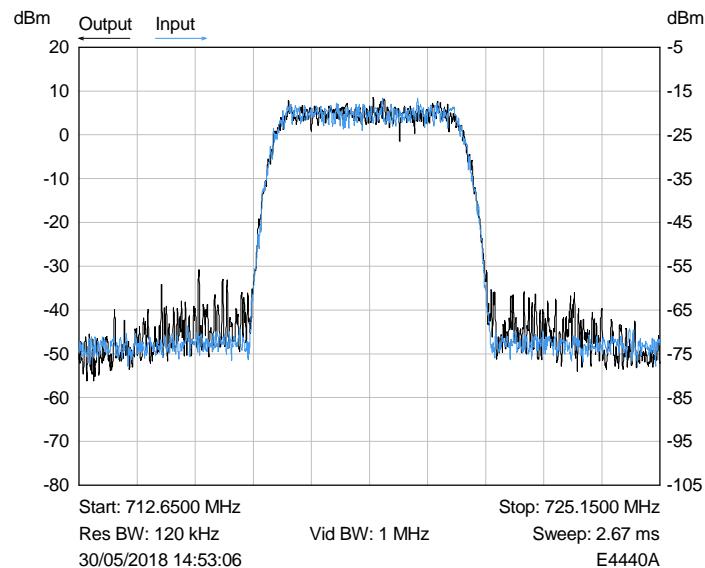
RF Parameters: Band 2496-2690 MHz, Power +20 dBm, Channel Spacing N/A, Modulation N/A, Channel N/A



Plot of f0 determined in band 2496-2690 MHz.

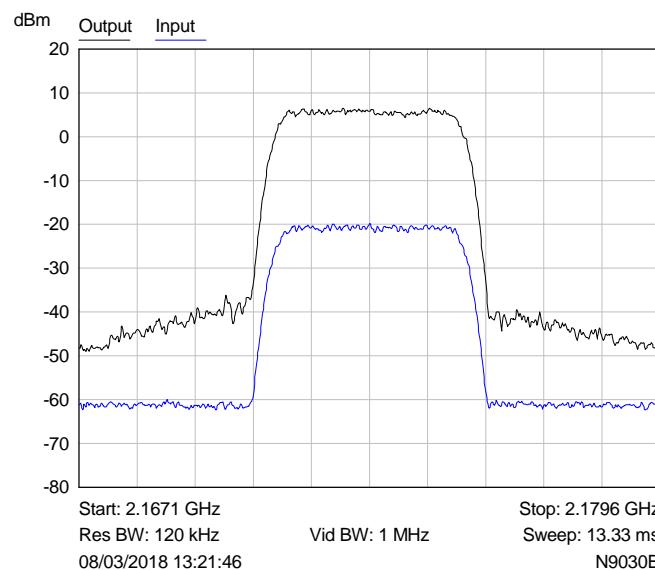
6.2 RF Power Output

RF Parameters: Band 716-758 MHz, Power +20 dBm, Channel Spacing 5MHz, Modulation AWGN, Channel 718.9 MHz (determined f_0)



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 2173.3 MHz (determined f_0)



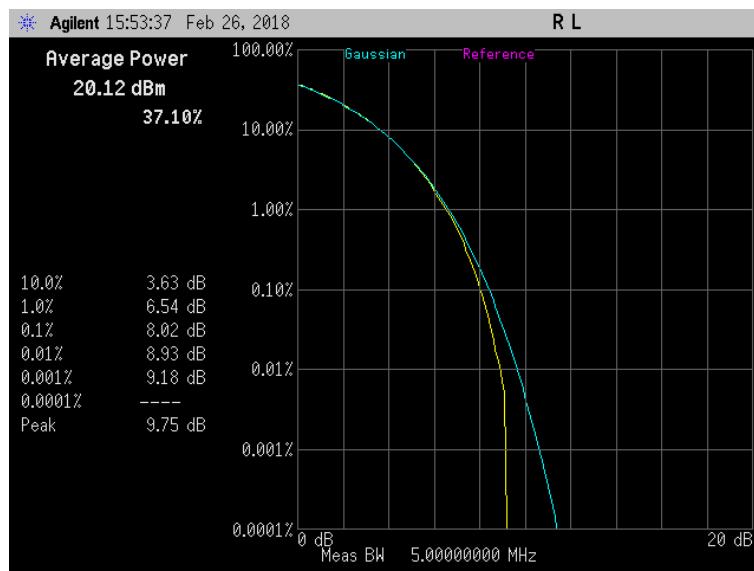
Input

Measurement Parameter	Value
Total channel power	-5.93 dBm
Power Spectral Density	-72.92 dBm/Hz

Output

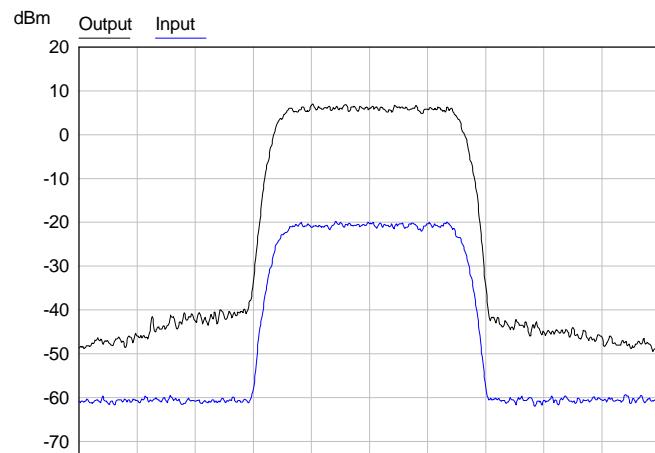
Measurement Parameter	Value
Total channel power	20.45 dBm
Power Spectral Density	-46.54 dBm/Hz

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 2354 MHz (determined f_0)



Input	
Measurement Parameter	Value
Total channel power	-5.84 dBm
Power Spectral Density	-72.83 dBm/Hz

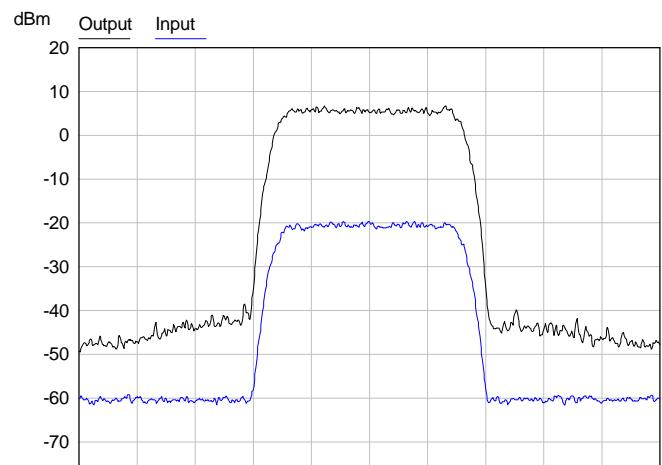
Output	
Measurement Parameter	Value
Total channel power	20.82 dBm
Power Spectral Density	-46.17 dBm/Hz

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 2496.6 MHz (determined f_0)



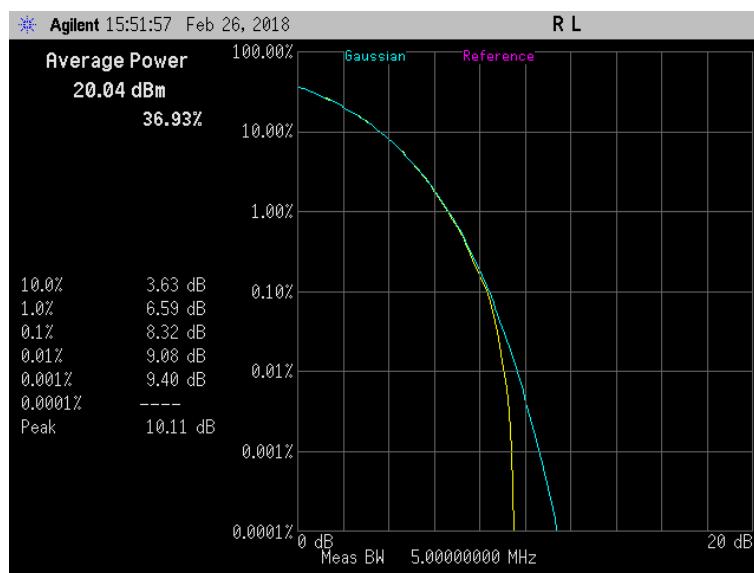
Input

Measurement Parameter	Value
Total channel power	-5.72 dBm
Power Spectral Density	-72.71 dBm/Hz

Output

Measurement Parameter	Value
Total channel power	20.47 dBm
Power Spectral Density	-46.52 dBm/Hz

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

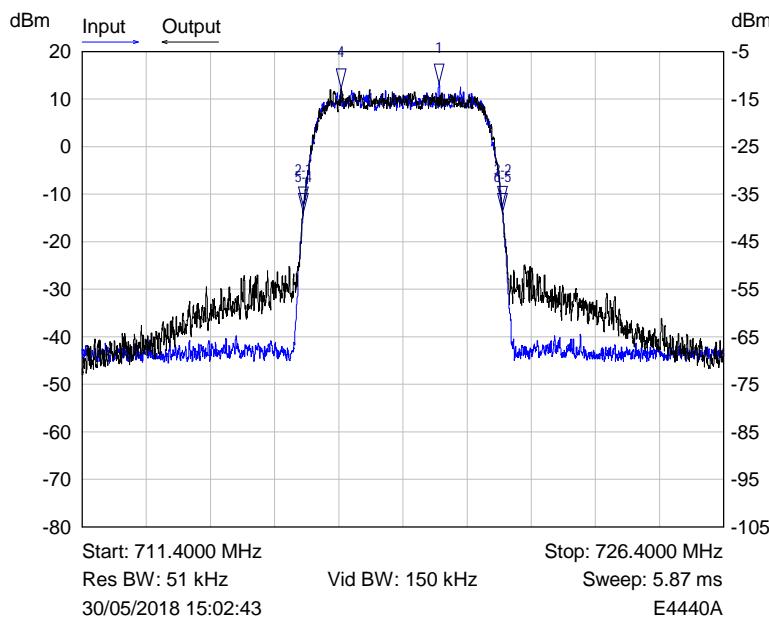


Plot of Peak to Average power ratio at determined f_0 in band 2496-2690 MHz

6.3 Occupied bandwidth / Input versus output signal

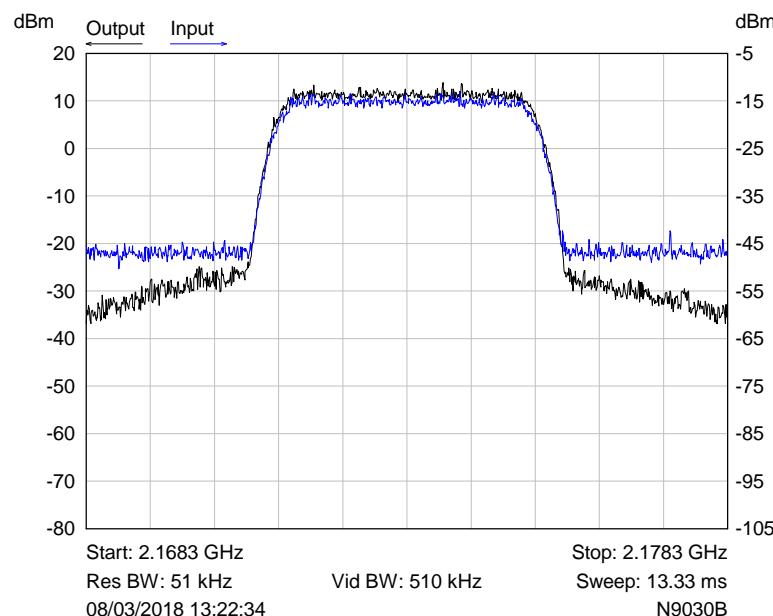
Note: Power in occupied Bandwidth is included by default in data capture from PXA instrument and is not referenced and not applicable to relative bandwidth measurements here.

RF Parameters: Band 716-758 MHz, Power +20 dBm, Channel Spacing 5MHz, Modulation AWGN,
Channel 718.9 MHz (determined f_0)



Mkr	Trace	X-Axis	Value	Notes
1	Input	719.7456 MHz	-11.59 dBm	Max input
2-1	Input	-3.1688 MHz	-37.55 dBm	Input -26 dB left
3-2	Input	4.6444 MHz	0.19 dB	Input -26 dB bandwidth
4	Output	717.4581 MHz	12.26 dBm	Max output
5-4	Output	-886.8750 kHz	-13.80 dBm	Output -26 dB left
6-5	Output	4.6519 MHz	-0.01 dB	Output -26 dB bandwidth

RF Parameters: Band 2110-2200 MHz, Power +20 dBm, Channel Spacing 5MHz, Modulation AWGN,
Channel 2173.3 MHz (determined f_0)



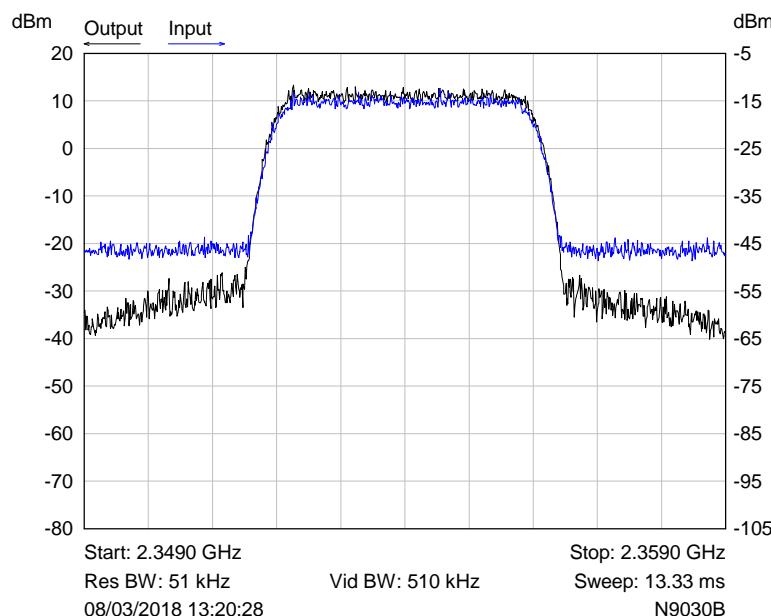
Input

Measurement Parameter	Value
Occupied Bandwidth	4.14 MHz
Power in Occupied Bandwidth	3.46 dBm
Transmit Freq Error	-333.96 Hz
-26.00 dB Bandwidth	4.68 MHz

Output

Measurement Parameter	Value
Occupied Bandwidth	4.13 MHz
Power in Occupied Bandwidth	29.89 dBm
Transmit Freq Error	-5.77 kHz
-26.00 dB Bandwidth	4.66 MHz

RF Parameters: Band 2345-2360 MHz, Power +20 dBm, Channel Spacing 5MHz, Modulation AWGN,
Channel 2354 MHz (determined f_0)



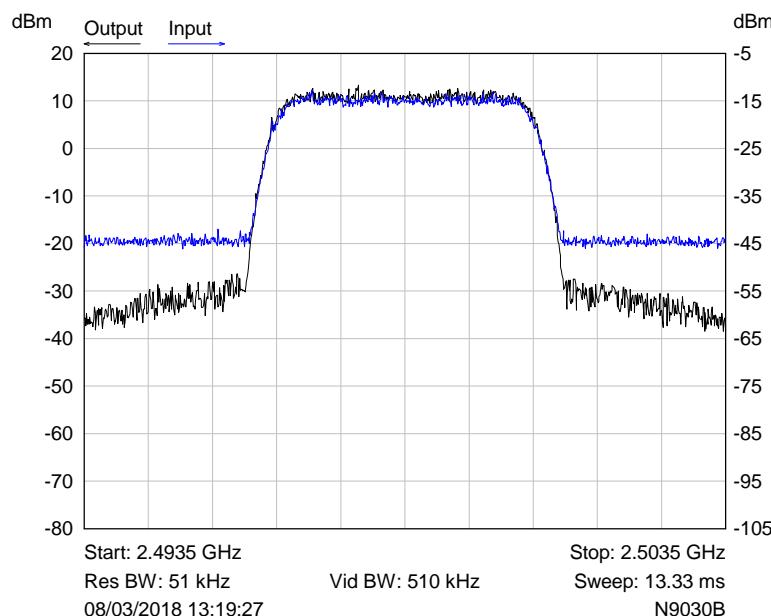
Input

Measurement Parameter	Value
Occupied Bandwidth	4.14 MHz
Power in Occupied Bandwidth	3.41 dBm
Transmit Freq Error	-1.69 kHz
-26.00 dB Bandwidth	4.67 MHz

Output

Measurement Parameter	Value
Occupied Bandwidth	4.12 MHz
Power in Occupied Bandwidth	29.72 dBm
Transmit Freq Error	2.09 kHz
-26.00 dB Bandwidth	4.68 MHz

RF Parameters: Band 2496-2690 MHz, Power +20 dBm, Channel Spacing 5MHz, Modulation AWGN,
Channel 2496.6 MHz (determined f_0)



Input

Measurement Parameter	Value
Occupied Bandwidth	4.15 MHz
Power in Occupied Bandwidth	3.69 dBm
Transmit Freq Error	-2.82 kHz
-26.00 dB Bandwidth	4.72 MHz

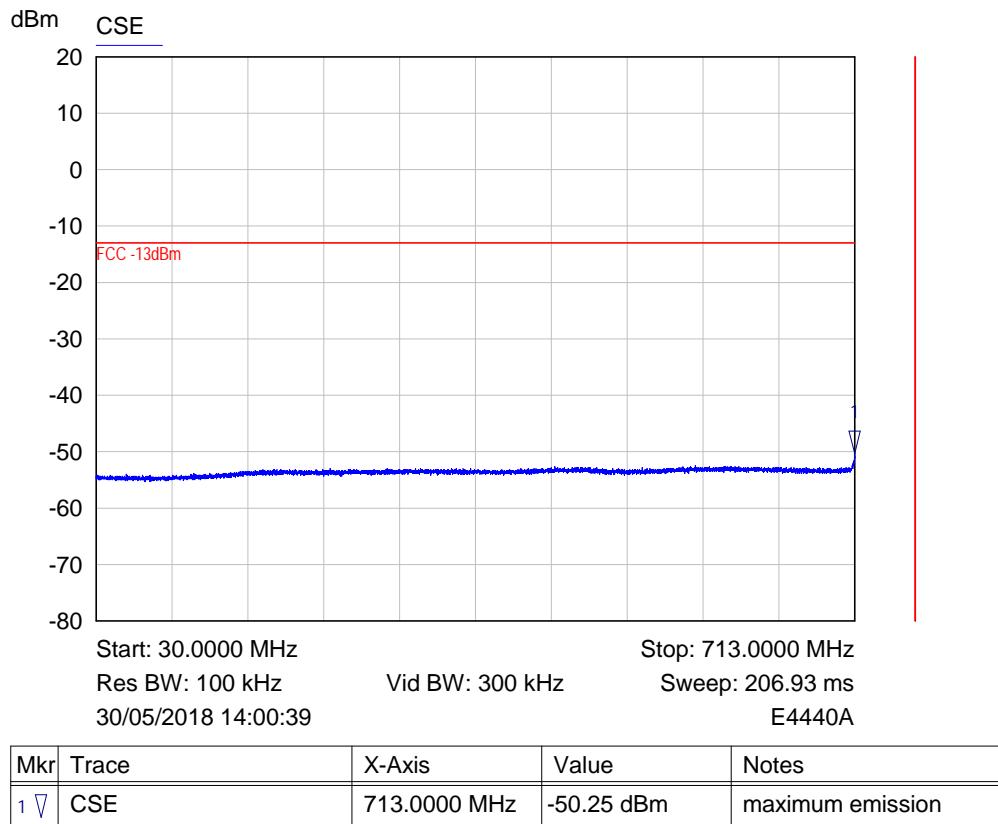
Output

Measurement Parameter	Value
Occupied Bandwidth	4.13 MHz
Power in Occupied Bandwidth	29.46 dBm
Transmit Freq Error	-8.36 kHz
-26.00 dB Bandwidth	4.66 MHz

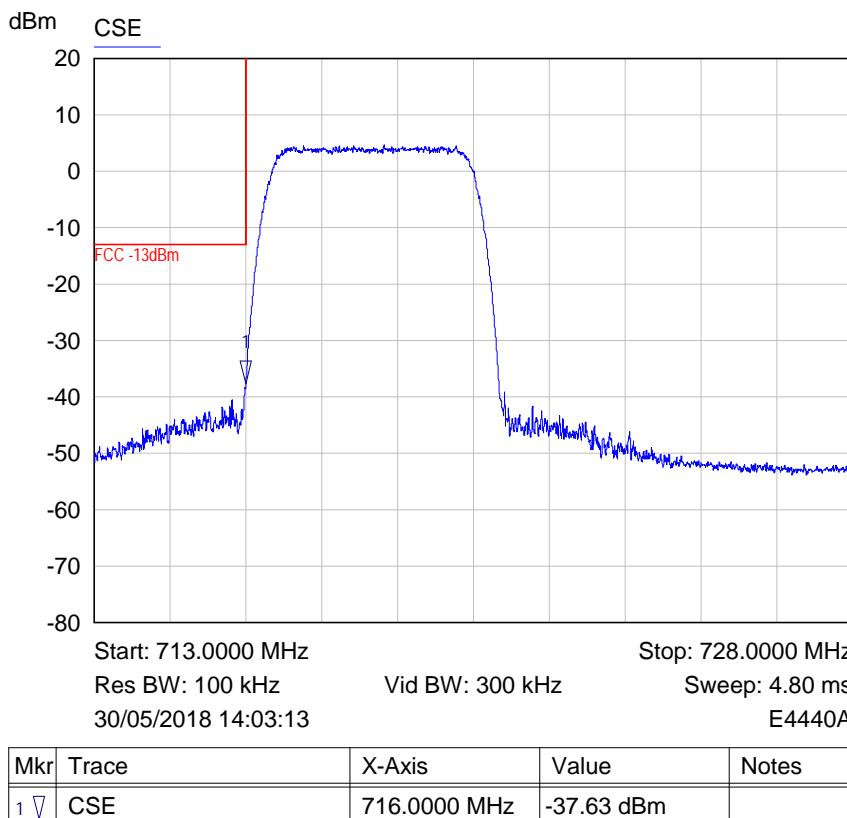
6.4 Spurious emissions at antenna terminals

Note: Whilst Low, Mid and high channels in both Single channel and dual channel modes have been tested, only Low channel plots are included in report for each band of operation to minimise report size.

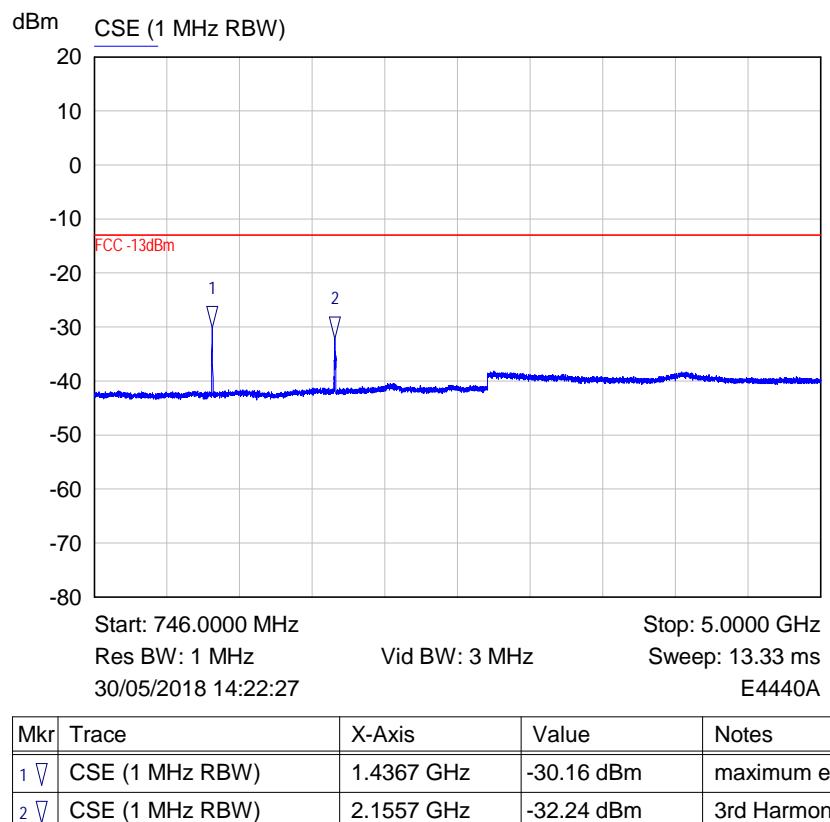
RF Parameters: Band 716-746 MHz, Power +20 dBm, Channel Spacing 5MHz, Modulation AWGN,
Channel 718.5 MHz, Single channel mode



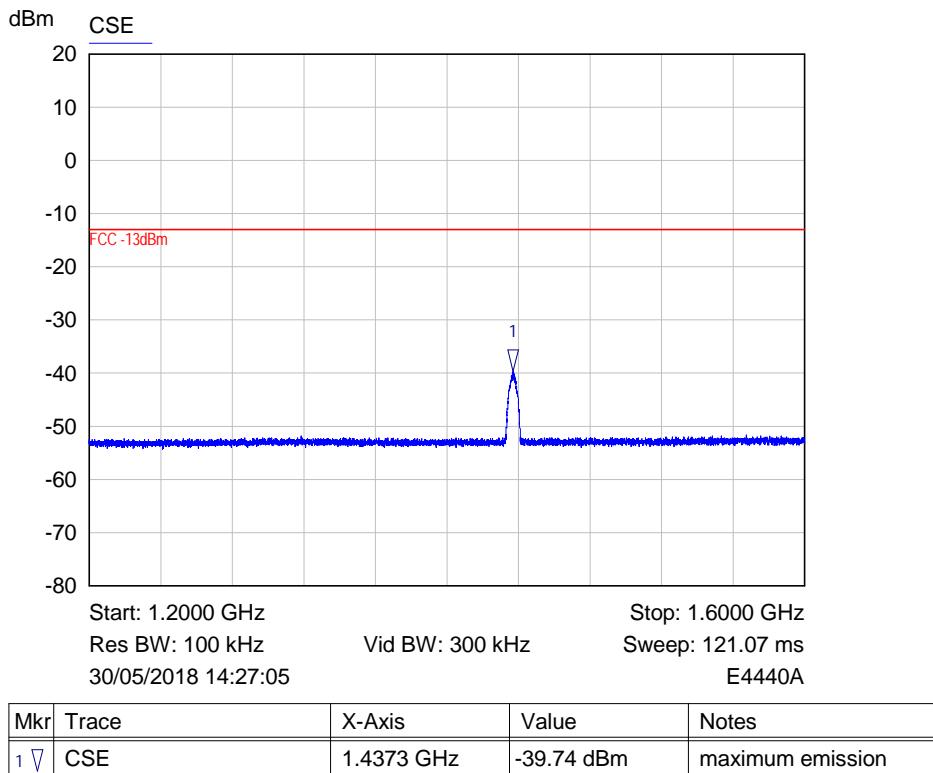
Plot of conducted emissions single Low channel (718.5MHz) 30 – 713 MHz range



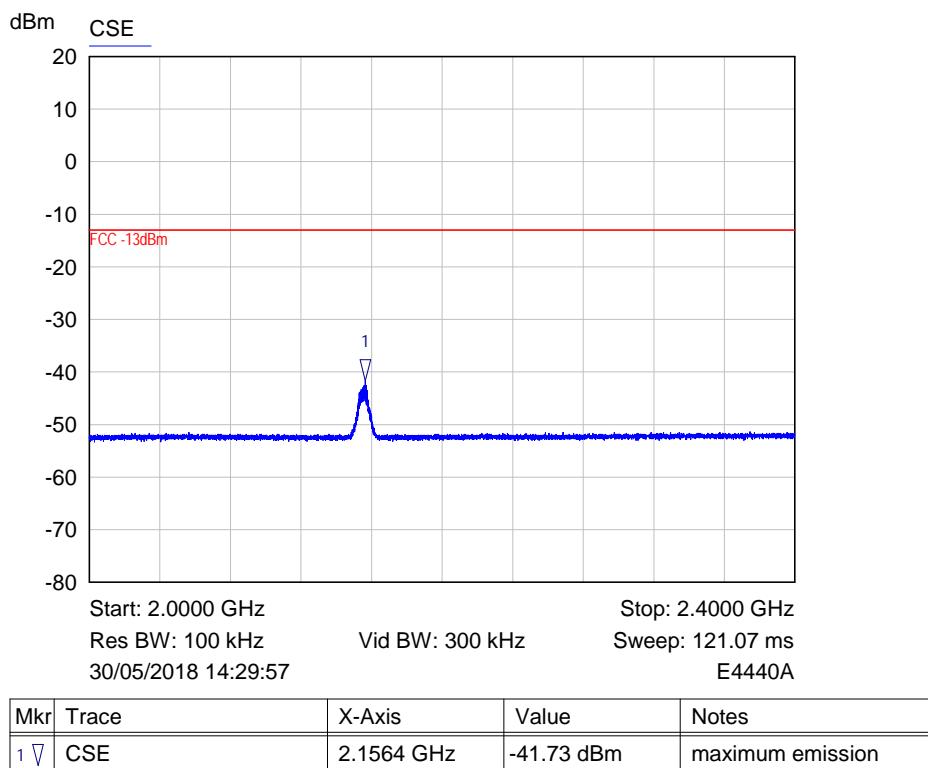
Plot of conducted emissions single Low channel (718.5MHz) 713 - 728 MHz range



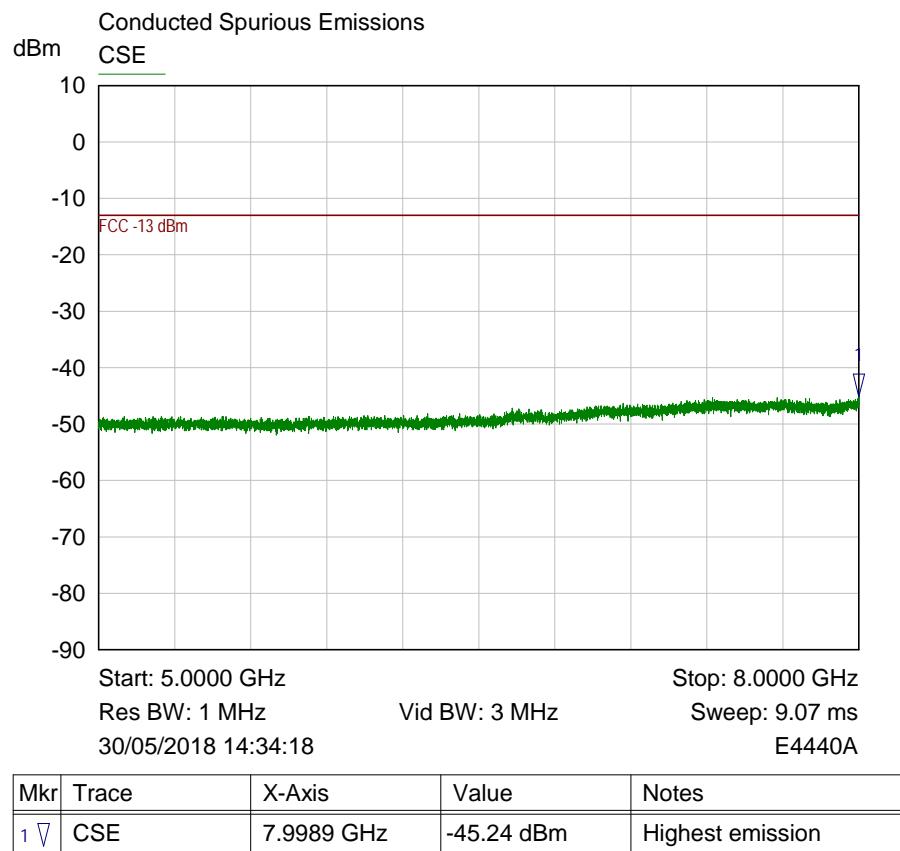
Plot of conducted emissions single Low channel (718.5MHz) 746 – 5000 MHz range (Note: performed with 1 MHz RBW due to reduced number of measurement points on PSA)



Plot of conducted emissions single Low channel (718.5MHz) 1200 - 1600 MHz range with 100 kHz RBW (2nd Harmonic)

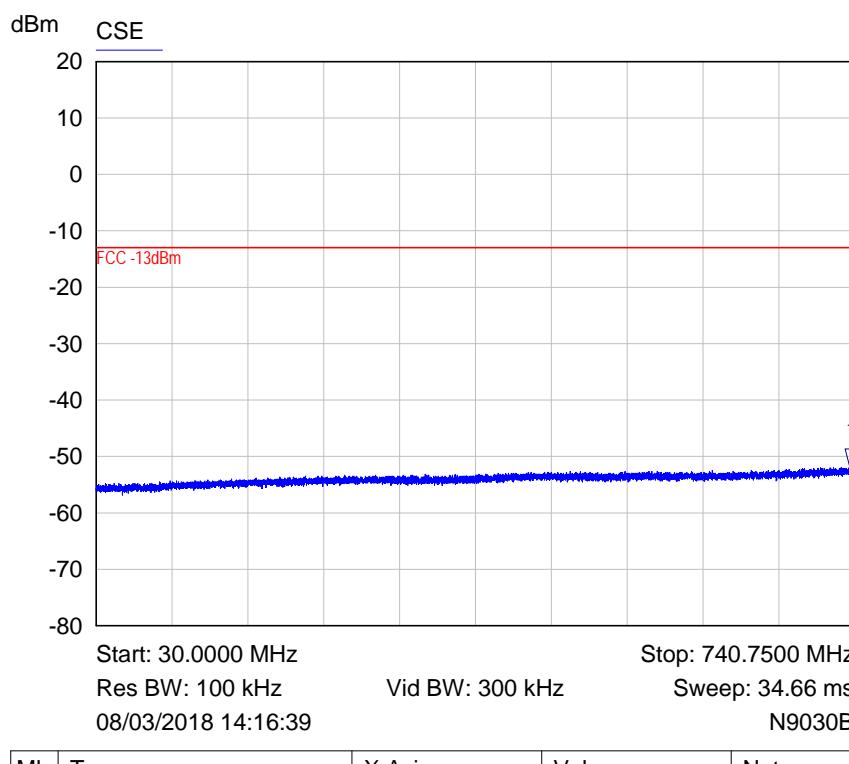


Plot of conducted emissions single Low channel (718.5MHz) 2000-2400 MHz range with 100 kHz RBW (3rd Harmonic)

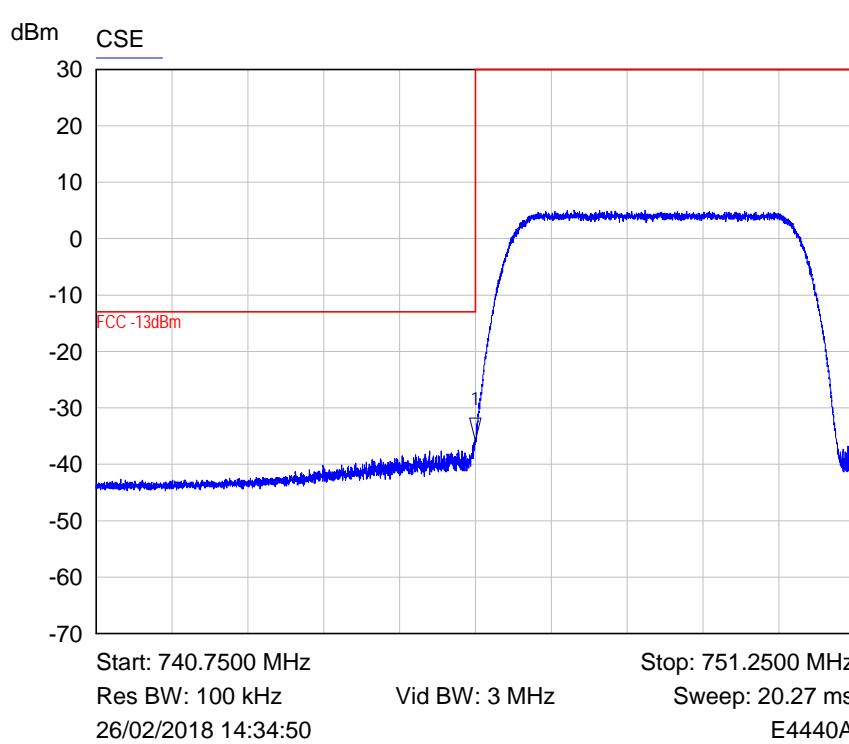


Plot of conducted emissions single Low channel (718.5MHz) 5 – 8 GHz range

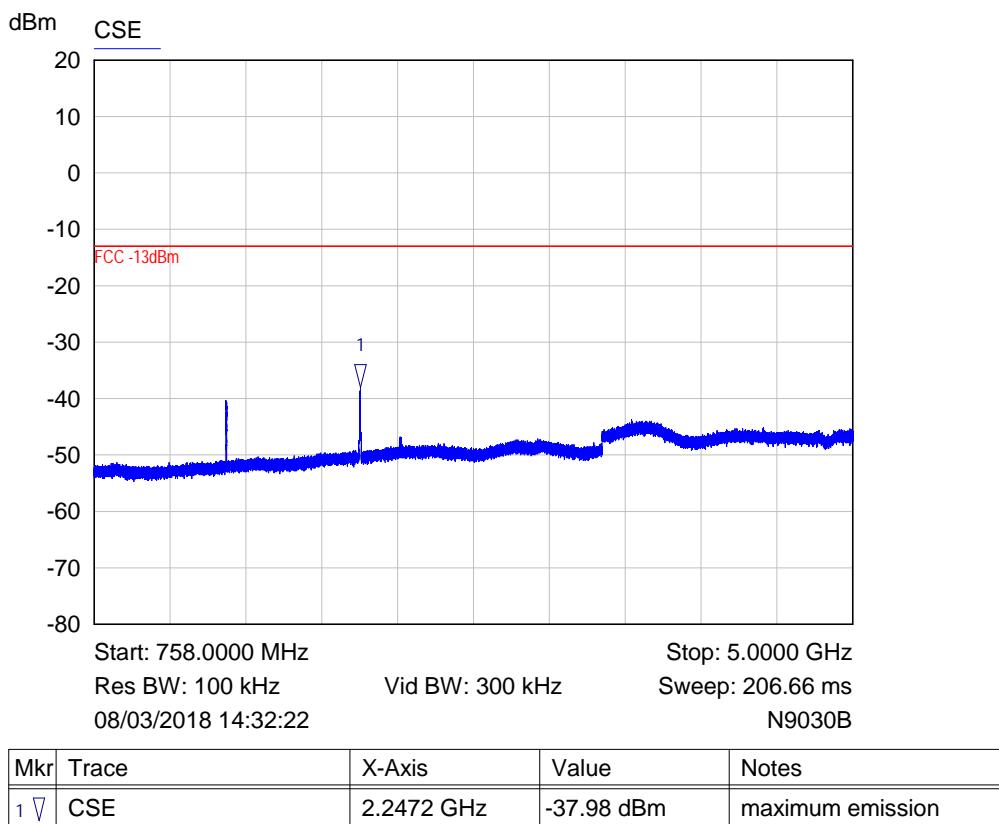
RF Parameters: Band 746-758 MHz, Power +20 dBm, Channel Spacing 5MHz, Modulation AWGN,
Channel 748.5 MHz, Single channel mode



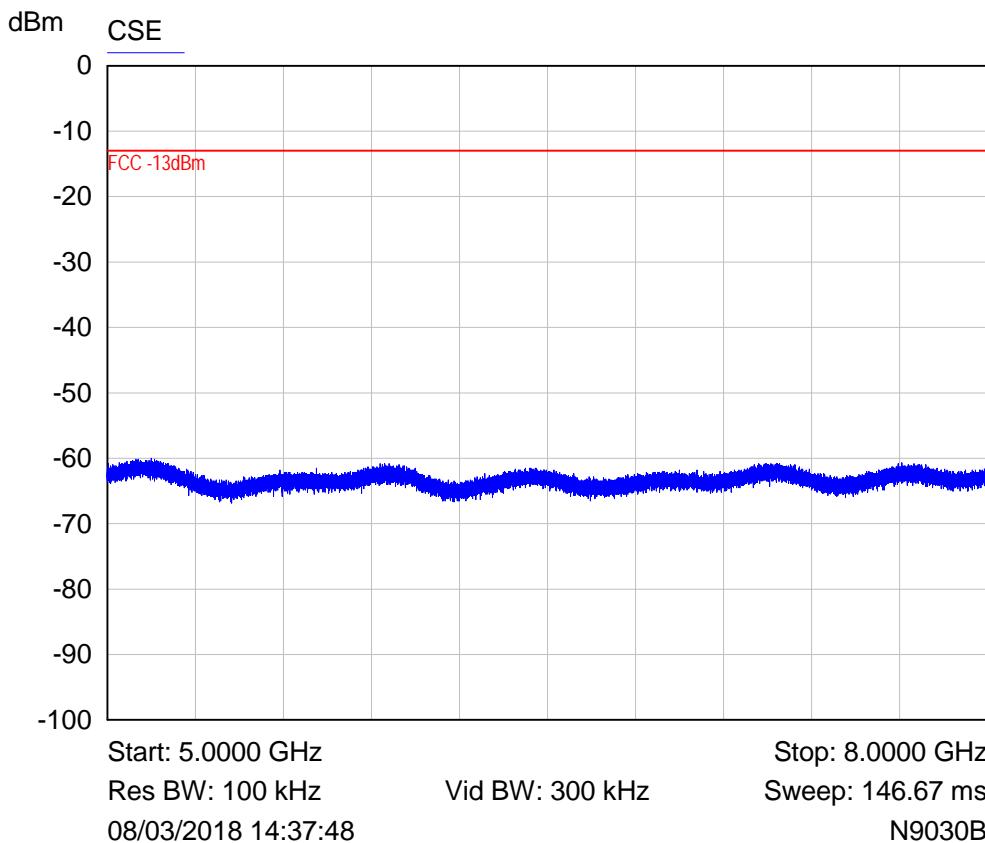
Plot of conducted emissions single Low channel (748.5MHz) 30 – 740.75 MHz range



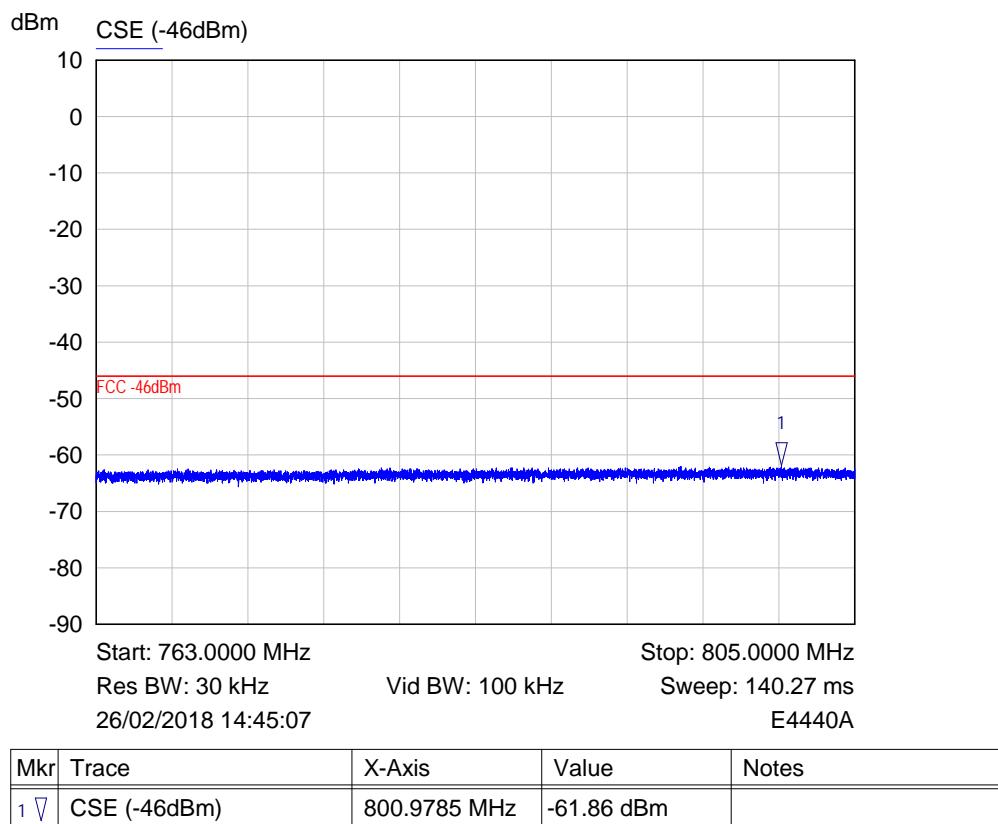
Plot of conducted emissions single Low channel (748.5MHz) 740.75 – 751.25 MHz range



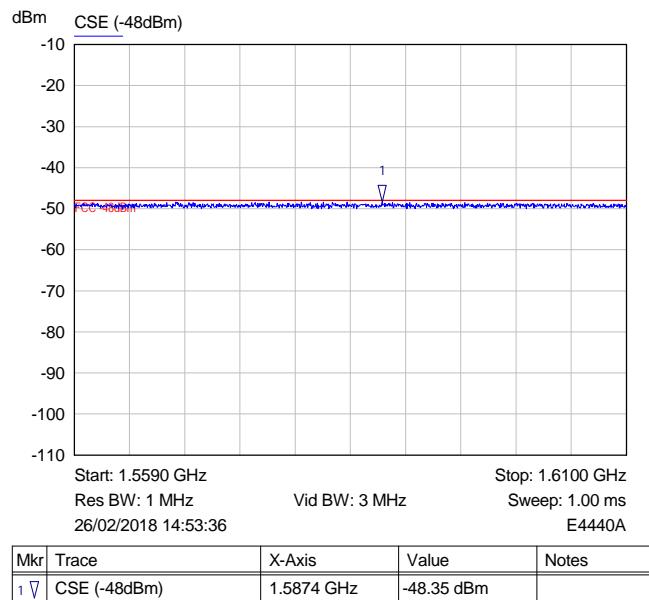
Plot of conducted emissions single Low channel (748.5MHz) 758 – 5000 MHz range



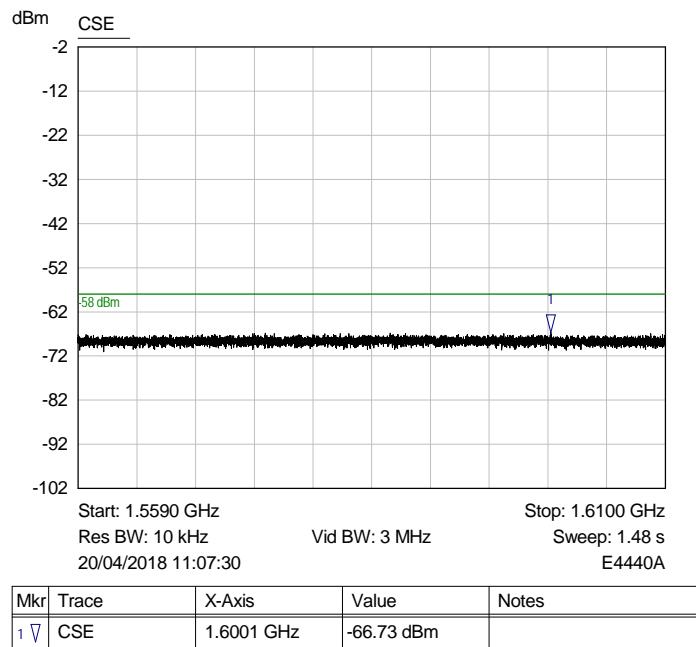
Plot of conducted emissions single Low channel (748.5MHz) 5 – 8 GHz range



Plot of conducted emissions single Low channel (748.5MHz) 763 – 805 MHz range
Note: 6.25kHz Narrowband emissions measured with a 30kHz RBW which was sufficient for showing compliance.



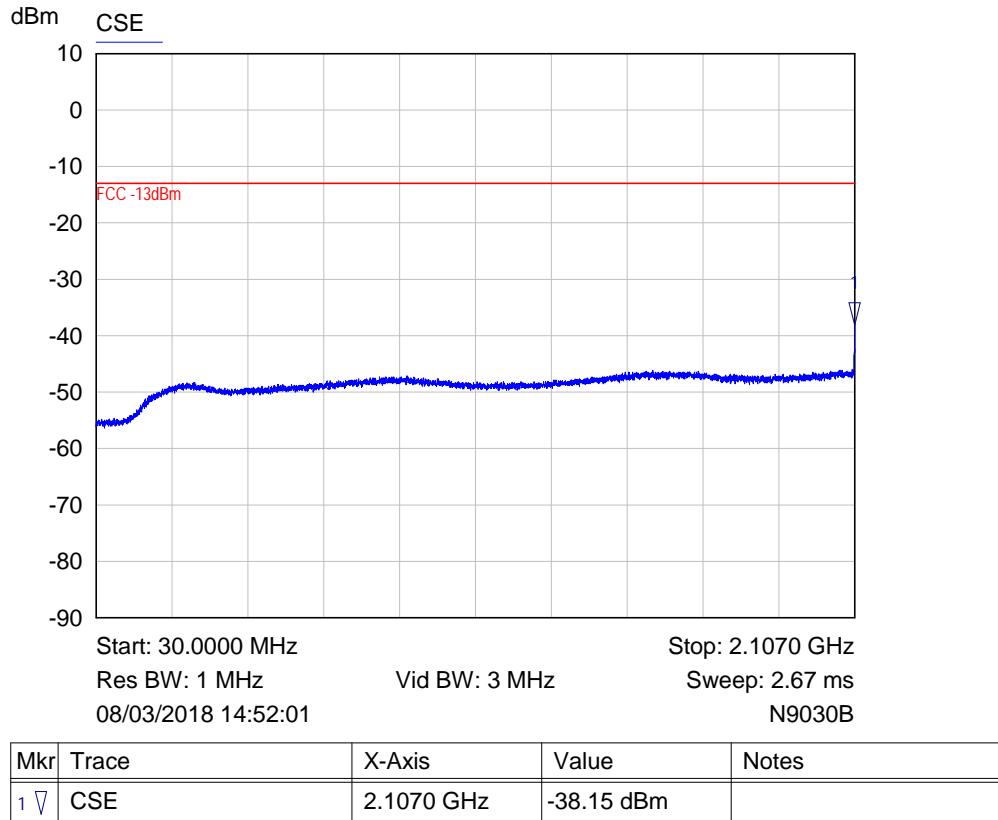
Plot of conducted emissions single Low channel (748.5MHz) 1559 – 1610 MHz range
Note: -70dBW EIRP equates to a limit of -78 dBW conducted for 8dBi antenna, which is -48dBm for wideband emissions.



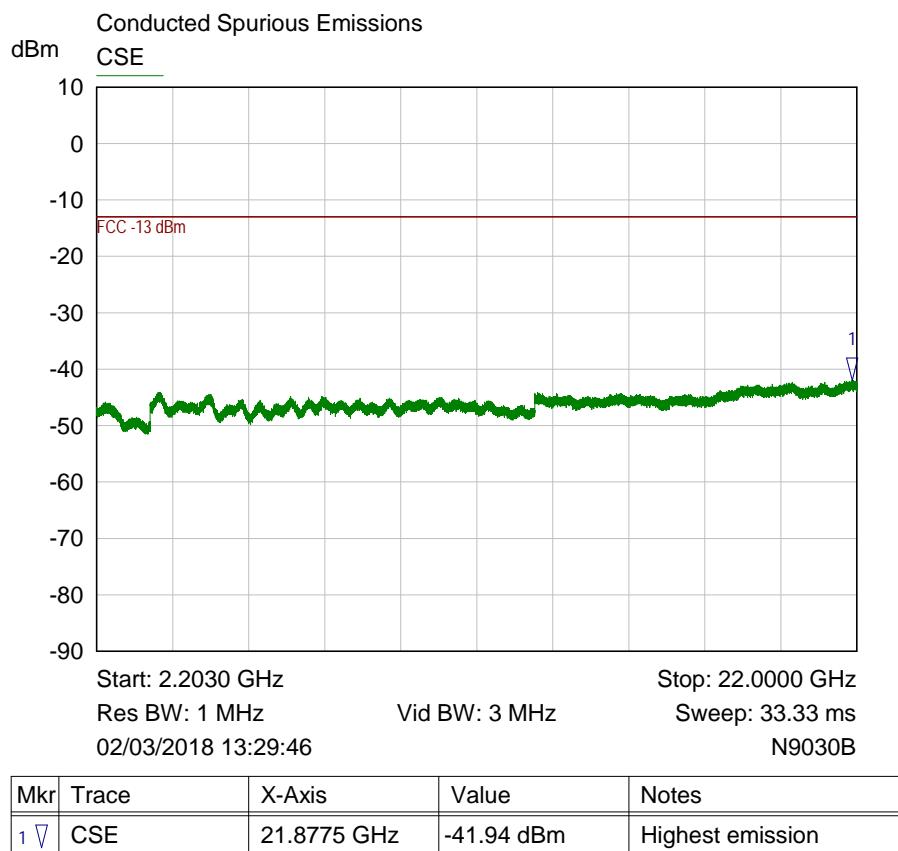
Plot of conducted emissions single Low channel 10k RBW (748.5MHz) 1559 – 1610 MHz range
Note: -80dBW EIRP equates to a limit of -88 dBW conducted for 8dBi antenna, which is -58dBm for narrowband emissions (discrete signals <700Hz bandwidth)

Note: Whilst Low, Mid and high channels have been tested, only Low channel plots are included in report for each band of operation to minimise report size.

RF Parameters: Band 2110-2200 MHz, Power +20 dBm, Channel Spacing 5MHz, Modulation AWGN,
Channel 2112.5 MHz, Single channel mode



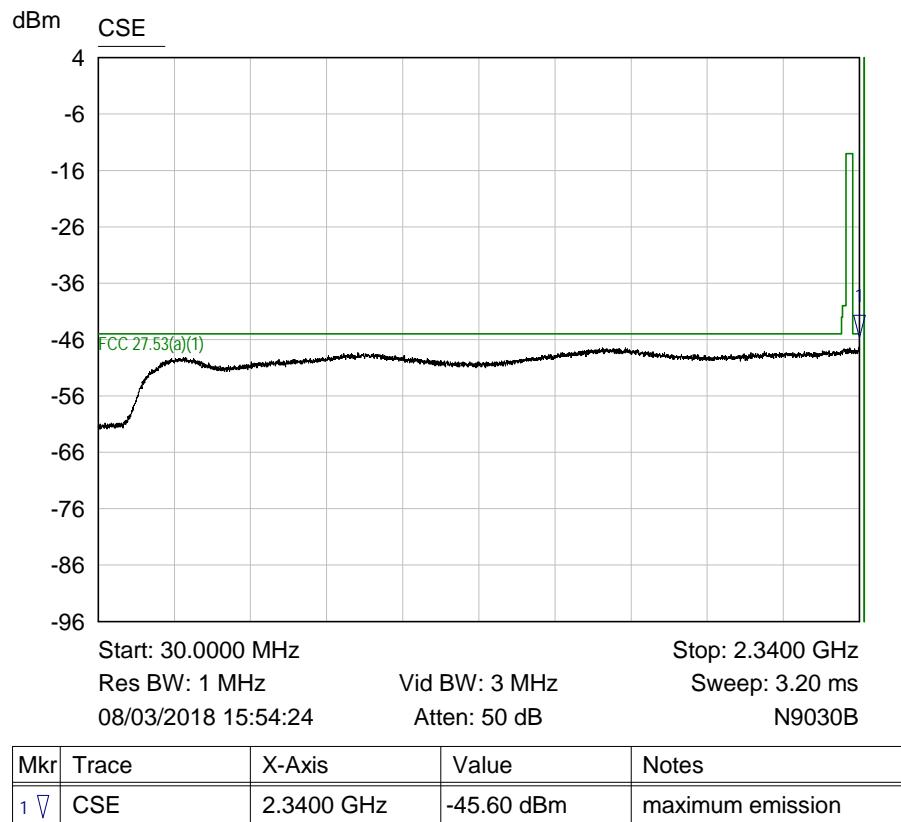
Plot of conducted emissions single Low channel (2112.5MHz) 30 – 2107 MHz range



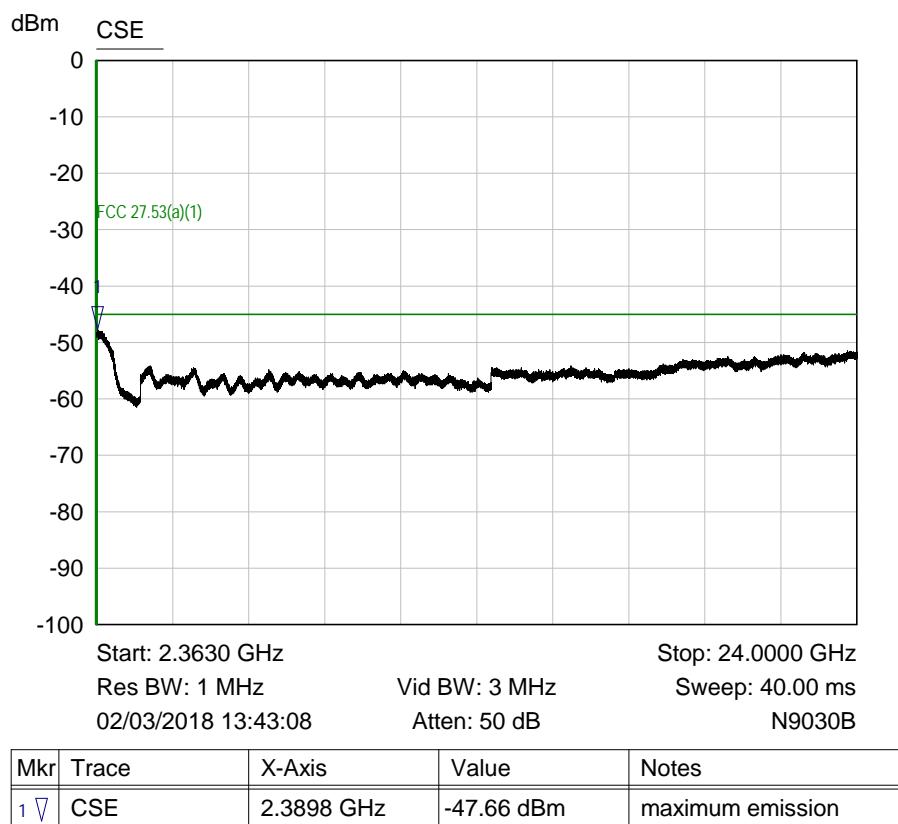
Plot of conducted emissions single Low channel (2112.5MHz) 2.203 – 22 GHz range

Note: Whilst Low, Mid and high channels have been tested, only Low channel plots are included in report for each band of operation to minimise report size.

RF Parameters: Band 2345-2360 MHz, Power +20 dBm, Channel Spacing 5MHz, Modulation AWGN,
Channel 2347.5 MHz, Single channel mode



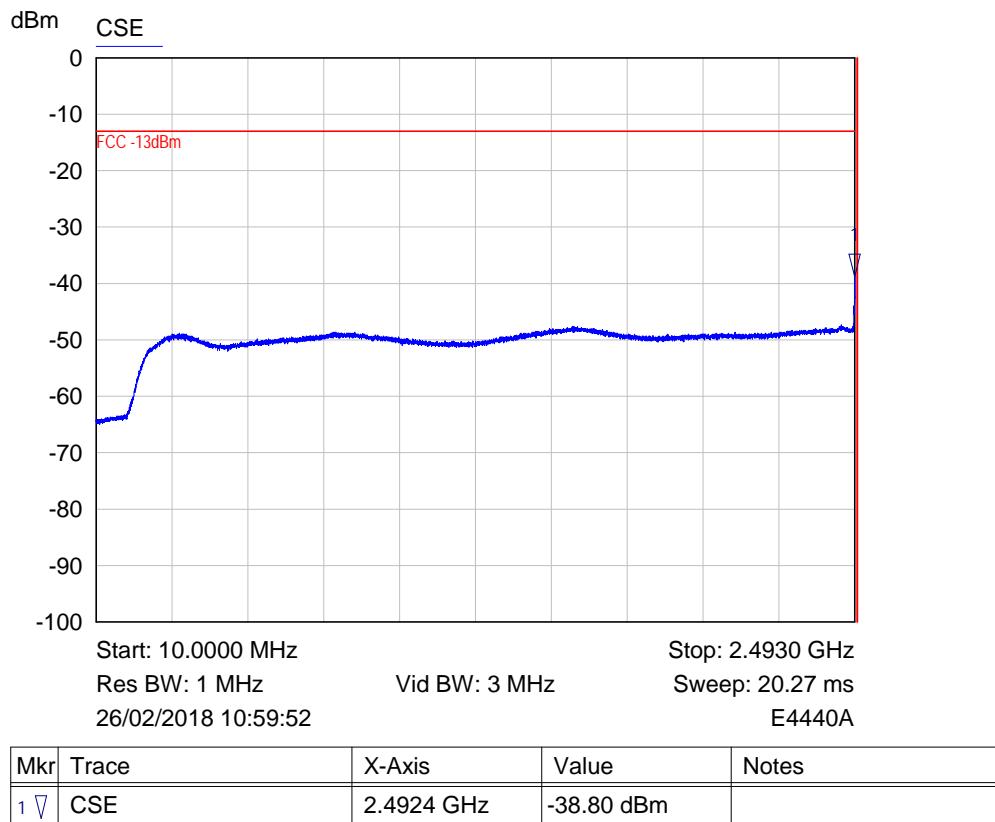
Plot of conducted emissions single Low channel (2347.5 MHz) 30 – 2340 MHz range



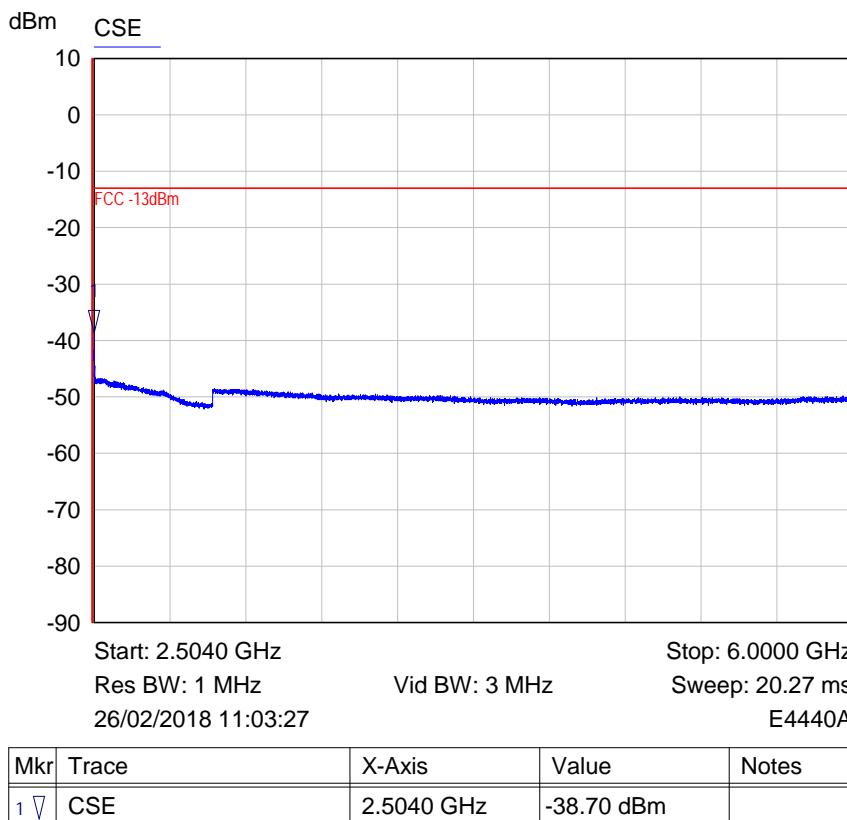
Plot of conducted emissions single Low channel (2347.5MHz) 2.363 – 24 GHz range

Note: Whilst Low, Mid and high channels have been tested, only Low channel plots are included in report for each band of operation to minimise report size.

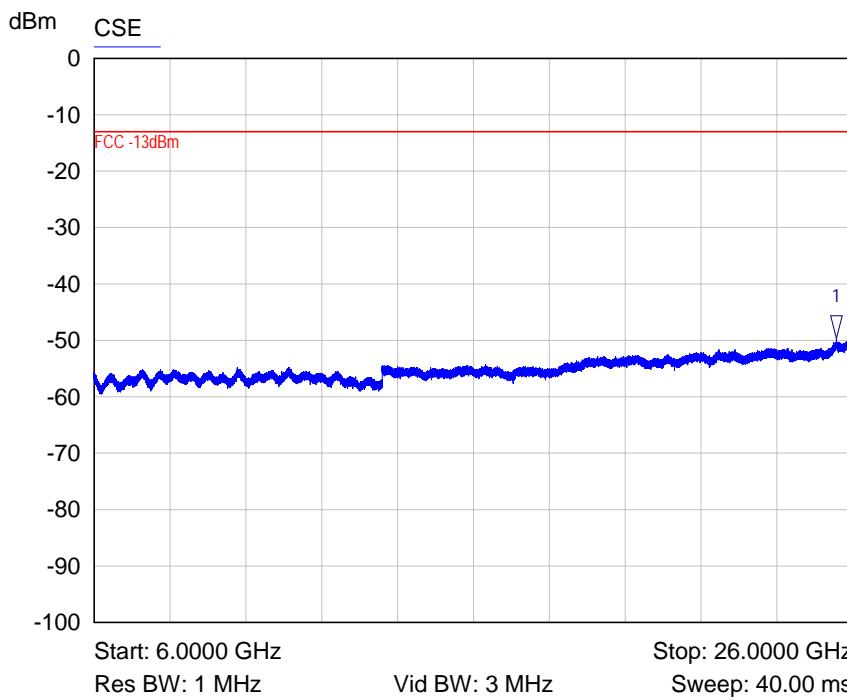
RF Parameters: Band 2496-2690 MHz, Power +20 dBm, Channel Spacing 5MHz, Modulation AWGN,
Channel 2498.5 MHz, Single channel mode



Plot of conducted emissions single Low channel (2498.5 MHz) 10 – 2493 MHz range

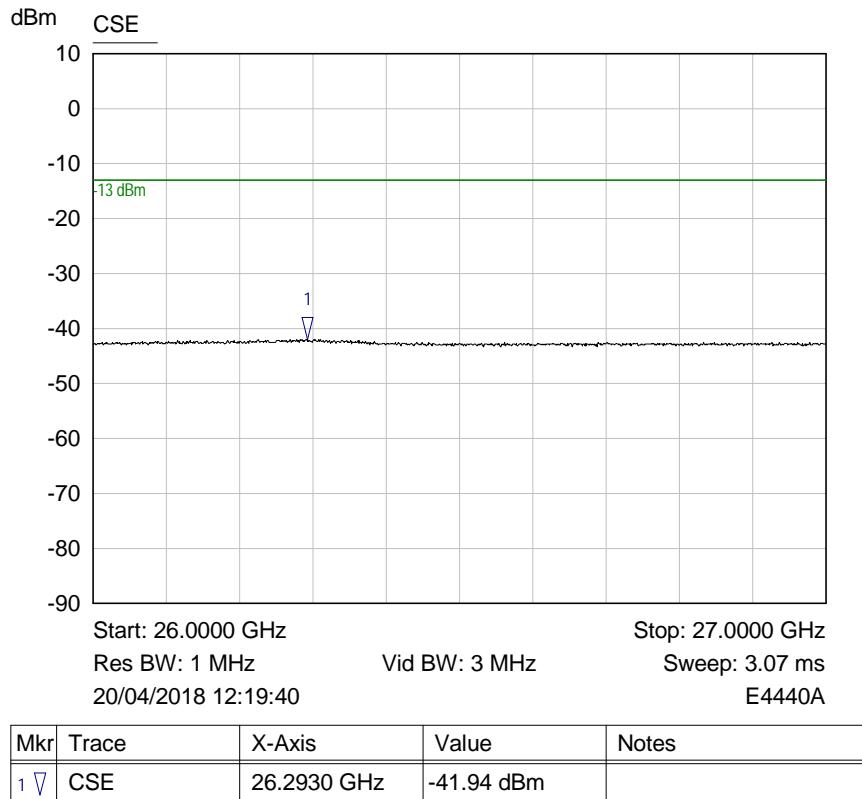


Plot of conducted emissions single Low channel (2498.5 MHz) 2.504 – 6 GHz range



Mkr	Trace	X-Axis	Value	Notes
1	CSE	25.5750 GHz	-49.73 dBm	

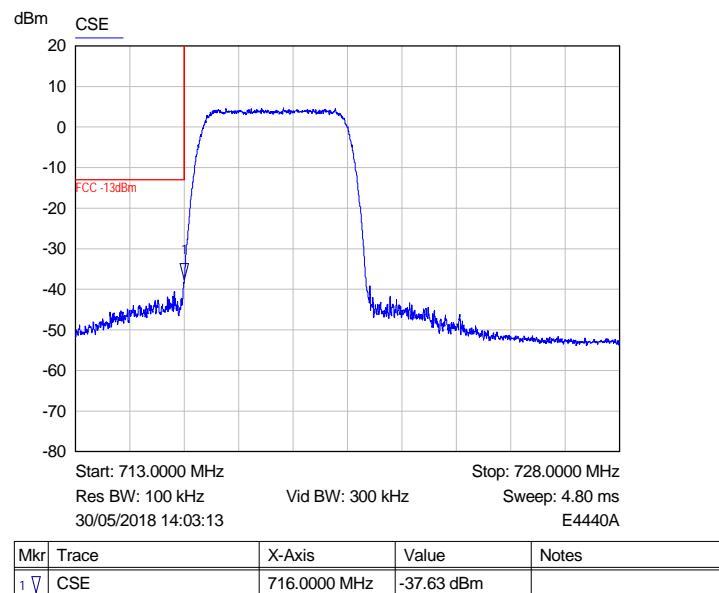
Plot of conducted emissions single Low channel (2498.5 MHz) 6 – 26 GHz range



Plot of conducted emissions single Low channel (2498.5 MHz) 26 – 27 GHz range

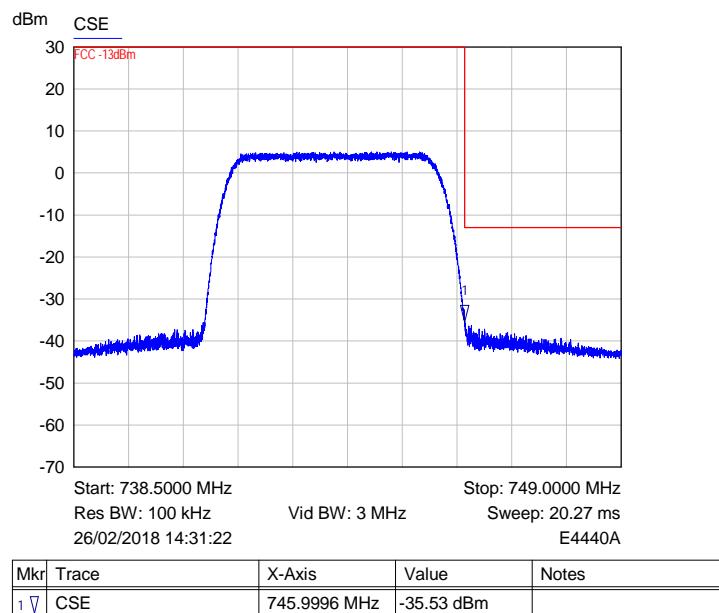
6.5 Band edge emissions

RF Parameters: Band 716-746 MHz, Power +20 dBm, Channel Spacing 5MHz, Modulation AWGN,
Channel 718.5 MHz, Single channel mode



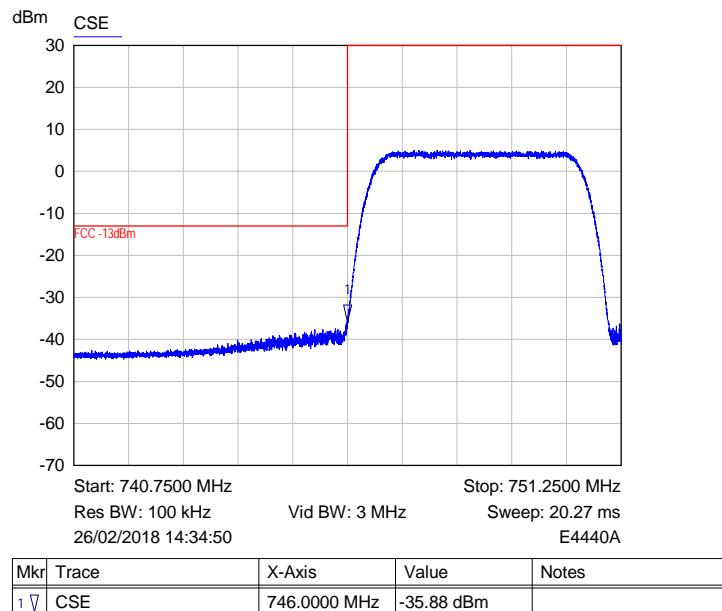
Plot of lower band edge for Low channel (718.5MHz)

RF Parameters: Band 716-746 MHz, Power +20 dBm, Channel Spacing 5MHz, Modulation AWGN,
Channel 743.5 MHz, Single channel mode



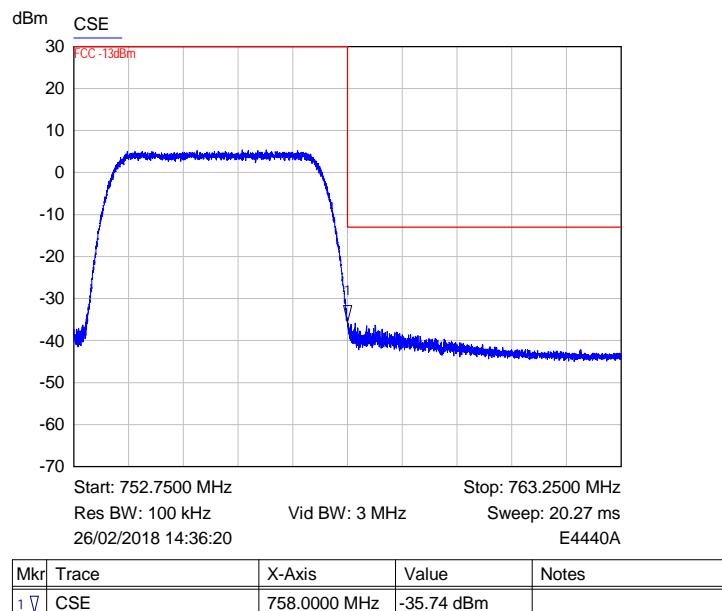
Plot of upper band edge for High channel (743.5MHz)

RF Parameters: Band 746-758 MHz, Power +20 dBm, Channel Spacing 5MHz, Modulation AWGN,
Channel 748.5 MHz, Single channel mode



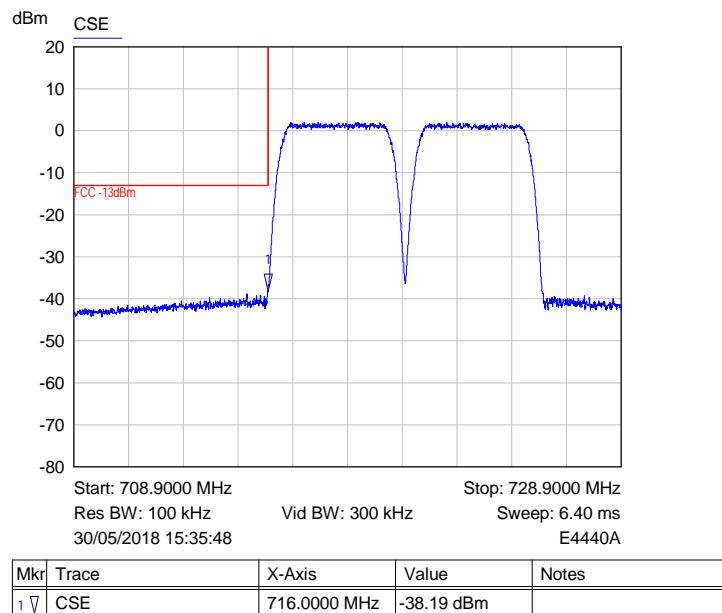
Plot of lower band edge for Low channel (748.5MHz)

RF Parameters: Band 746-758 MHz, Power +20 dBm, Channel Spacing 5MHz, Modulation AWGN,
Channel 755.5 MHz, Single channel mode



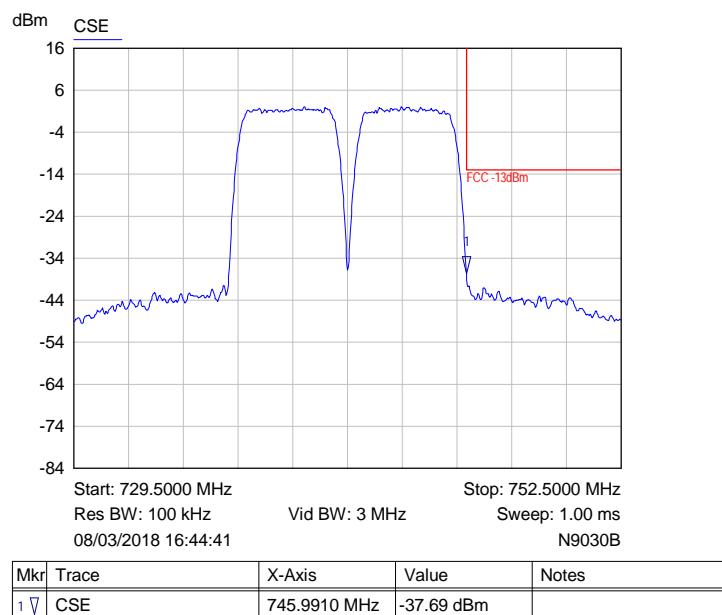
Plot of upper band edge for High channel (755.5MHz)

RF Parameters: Band 716-746 MHz, Power +20 dBm, Channel Spacing 5MHz, Modulation AWGN,
Channel 718.5 & 723.5 MHz, Dual channel mode



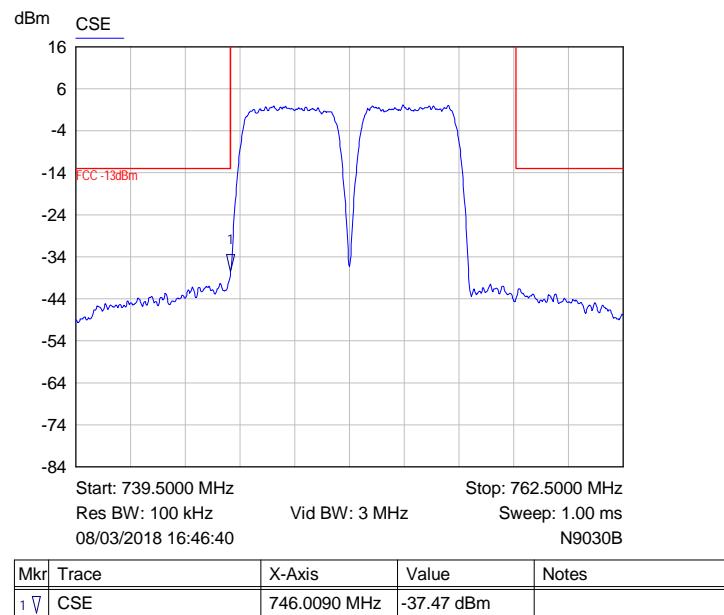
Plot of lower band edge for Low channels (700.5 & 705.5MHz)

RF Parameters: Band 716-746 MHz, Power +20 dBm, Channel Spacing 5MHz, Modulation AWGN,
Channel 738.5 & 743.5 MHz, Dual channel mode



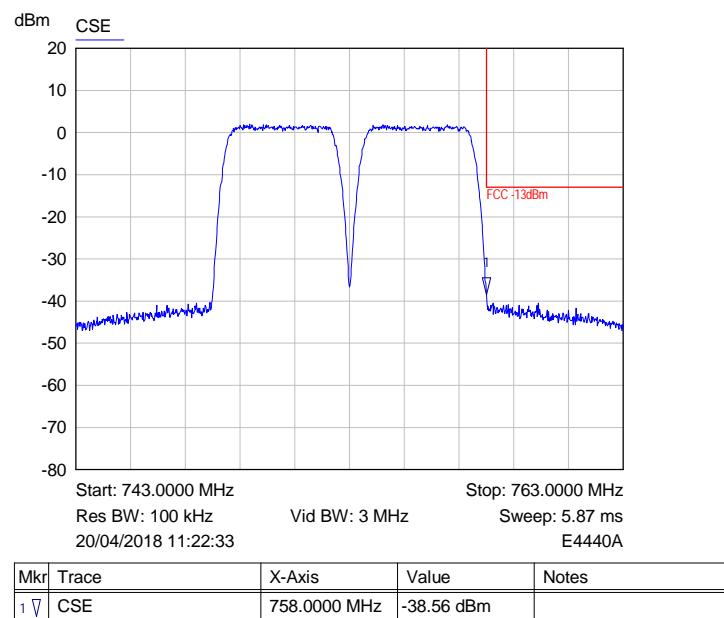
Plot of upper band edge for High channels (738.5 & 743.5MHz)

RF Parameters: Band 746-758 MHz, Power +20 dBm, Channel Spacing 5MHz, Modulation AWGN,
Channel 748.5 & 753.5 MHz, Dual channel mode



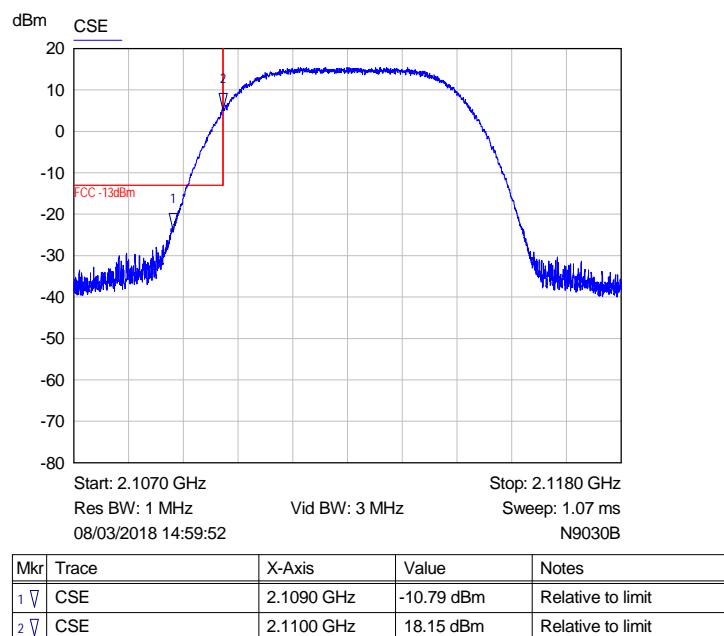
Plot of lower band edge for Low channels (748.5 & 753.5MHz)

RF Parameters: Band 746-758 MHz, Power +20 dBm, Channel Spacing 5MHz, Modulation AWGN,
Channel 750.5 & 755.5 MHz, Dual channel mode

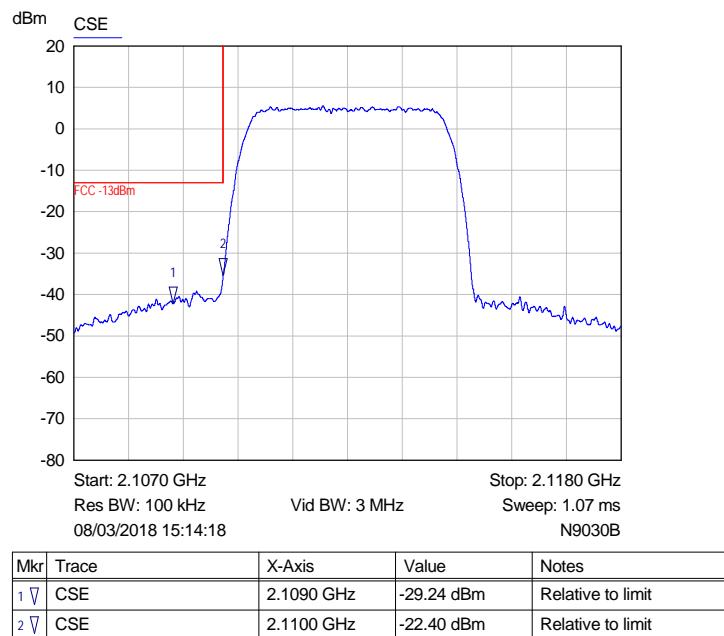


Plot of upper band edge for High channels (750.5 & 755.5MHz)

RF Parameters: Band 2110-2200 MHz, Power +20 dBm, Channel Spacing 5MHz, Modulation AWGN,
Channel 2112.5 MHz, Single channel mode



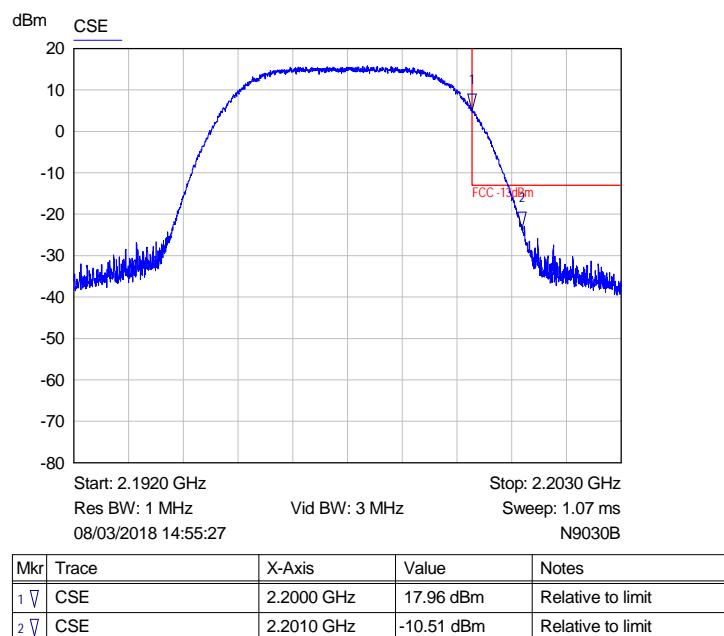
Plot of lower band edge for Low channel 1MHz RBW (2112.5MHz)



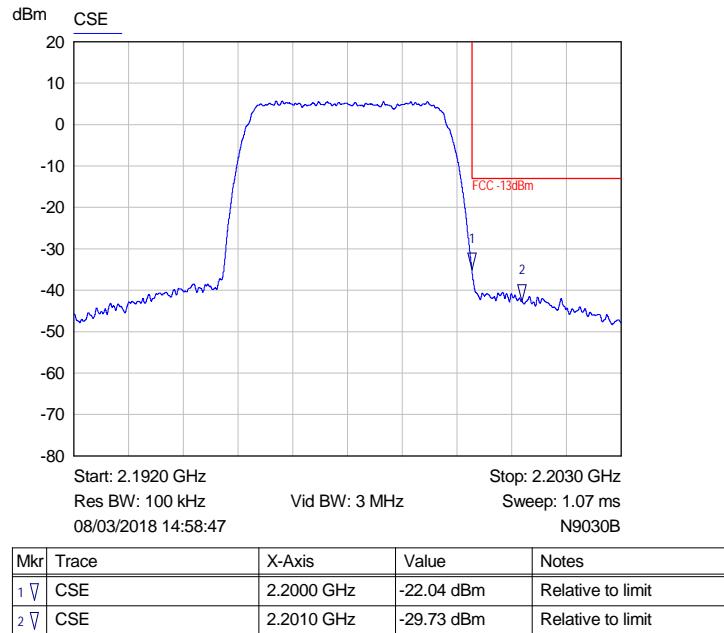
Plot of lower band edge for Low channel 100kHz RBW (2112.5MHz)

Note: Marker 1 shows band edge compliance 1 MHz from band edge with 1 MHz RBW, and second measurement made with lower RBW (100kHz) for band edge compliance as per 27.53(h)(3).

RF Parameters: Band 2110-2200 MHz, Power +20 dBm, Channel Spacing 5MHz, Modulation AWGN,
Channel 2197.5 MHz, Single channel mode



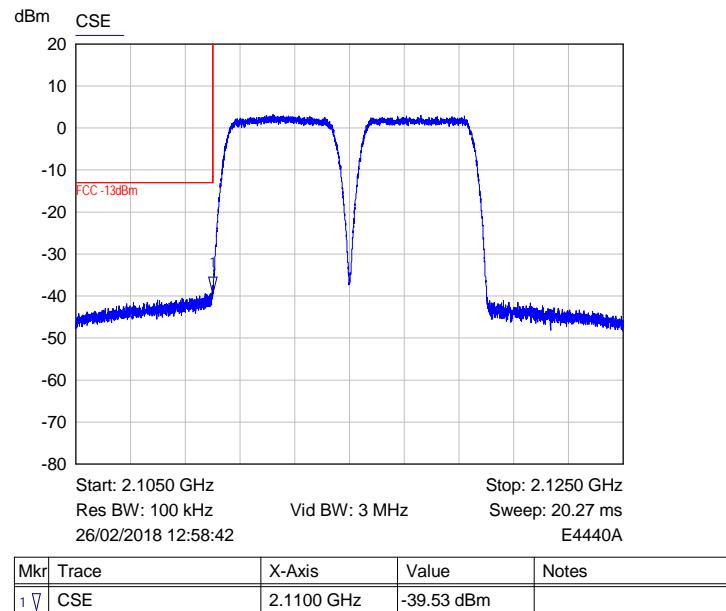
Plot of upper band edge for High channel 1MHz RBW (2197.5MHz)



Plot of upper band edge for High channel 100kHz RBW (2197.5MHz)

Note: Marker 2 shows band edge compliance 1 MHz from band edge with 1 MHz RBW, and second measurement made with lower RBW (100kHz) for band edge compliance as per 27.53(h)(3).

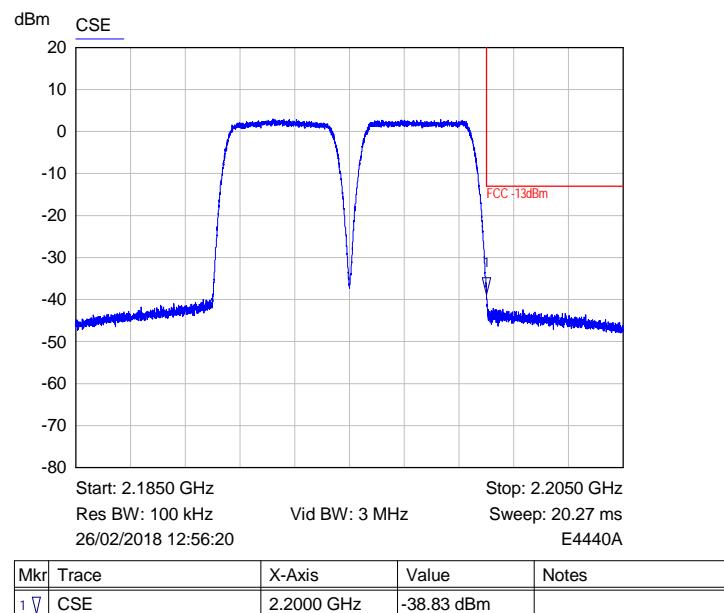
RF Parameters: Band 2110-2200 MHz, Power +20 dBm, Channel Spacing 5MHz, Modulation AWGN,
Channels 2112.5 & 2117.5MHz, Dual channel mode



Plot of lower band edge for Low channels 100kHz RBW (2112.5 & 2117.5MHz)

Note: Integrating power back to 1MHz RBW would add 10dB to signals measured in 100kHz RBW and
therefore Markers show compliance to limits

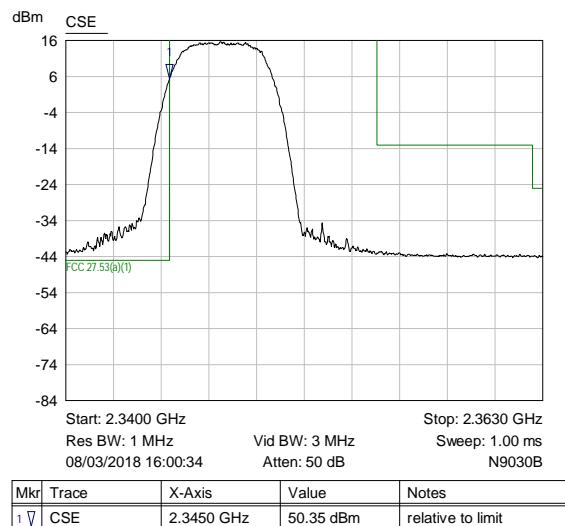
RF Parameters: Band 2110-2200 MHz, Power +20 dBm, Channel Spacing 5MHz, Modulation AWGN,
Channels 2192.5 & 2197.5MHz, Dual channel mode



Plot of upper band edge for High channels 100kHz RBW (2192.5 & 2197.5MHz)

Note: Integrating power back to 1MHz RBW would add 10dB to signals measured in 100kHz RBW and
therefore Markers show compliance to limits

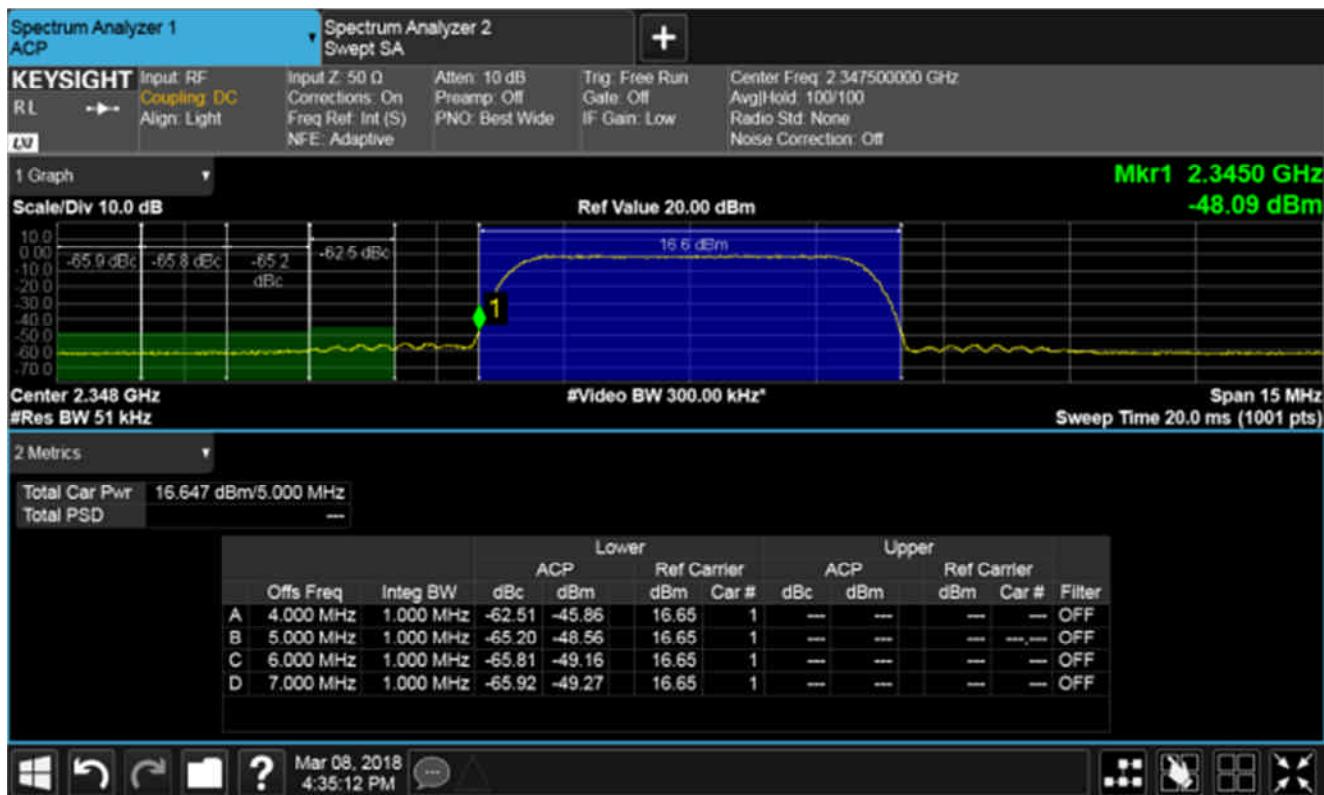
RF Parameters: Band 2345-2360 MHz, Power +20 dBm, Channel Spacing 5MHz, Modulation AWGN,
Channel 2347.5 MHz, Single channel mode



Plot of lower/upper band edge for Low channel 1MHz RBW (2347.5 MHz)

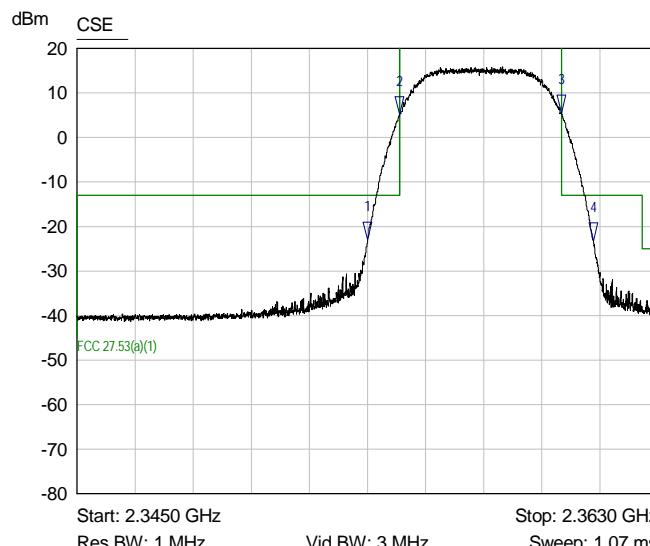
Lower band edge – see screen capture that was taken with TX power reduced by reducing input by 4 dB.

TX power measurement re-made. All other CSE measurements done with 20dBm output power are valid.



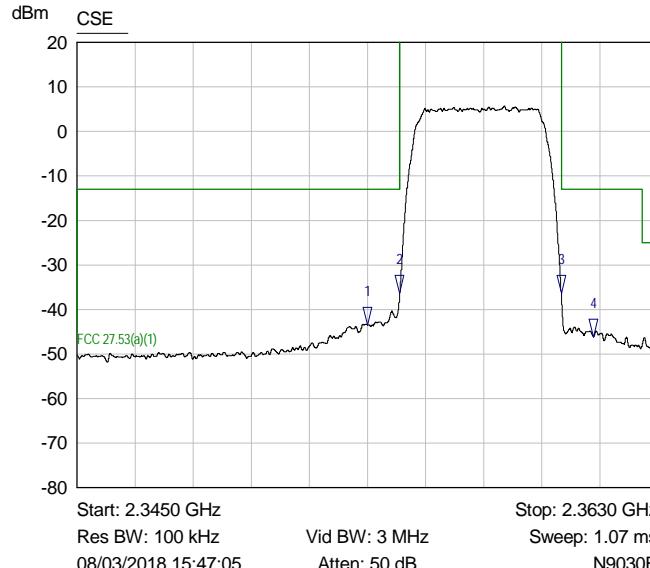
EUT is not compliant unless the power output is reduced to a maximum of 16dBm as shown. All other tests in this report were performed with a power of +20dBm which show compliance, and as such have not been repeated with the lower power setting of +16dBm

RF Parameters: Band 2345-2360 MHz, Power +20 dBm, Channel Spacing 5MHz, Modulation AWGN,
Channel 2357.5 MHz, Single channel mode



Mkr	Trace	X-Axis	Value	Notes
1	CSE	2.3540 GHz	-10.04 dBm	Relative to limit
2	CSE	2.3550 GHz	18.25 dBm	relative to limit
3	CSE	2.3600 GHz	5.57 dBm	relative to limit
4	CSE	2.3610 GHz	-23.25 dBm	relative to limit

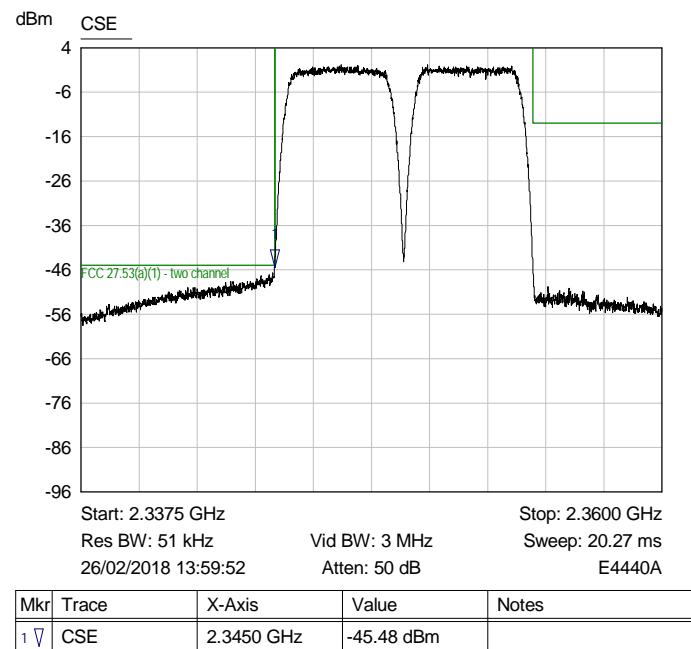
Plot of lower/upper band edge for High channel 1MHz RBW (2357.5MHz)



Mkr	Trace	X-Axis	Value	Notes
1	CSE	2.3540 GHz	-30.50 dBm	Relative to limit
2	CSE	2.3550 GHz	-23.26 dBm	relative to limit
3	CSE	2.3600 GHz	-36.29 dBm	relative to limit
4	CSE	2.3610 GHz	-46.13 dBm	relative to limit

Plot of lower/upper band edge for High channel 1MHz RBW (2357.5MHz)
Note: Lower RBW (100kHz) used for immediate 1 MHz band edge as per 27.53(a)(5)

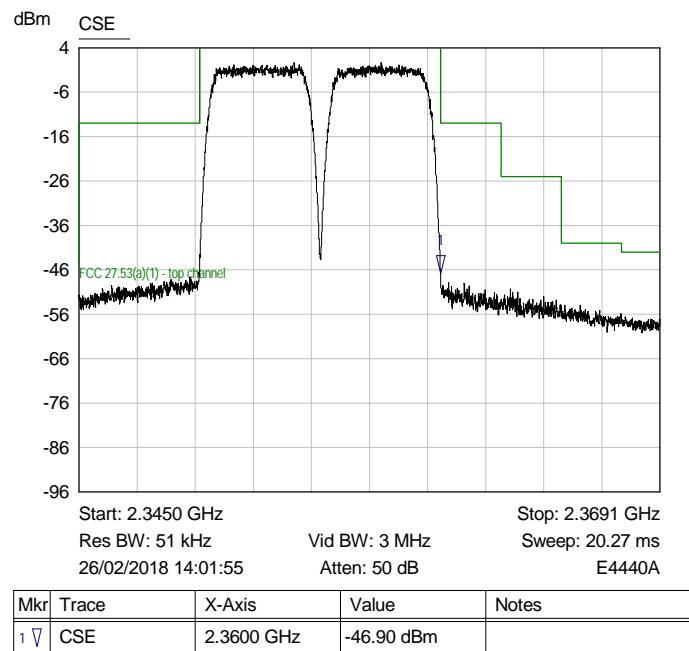
RF Parameters: Band 2345-2360 MHz, Power +20 dBm, Channel Spacing 5MHz, Modulation AWGN,
Channels 2347.5 & 2352.5MHz, Dual channel mode



Plot of lower/upper band edge for Low channels 51kHz RBW (2347.5 & 2352.5MHz)

Note: Lower RBW used for immediate 1 MHz band edge as per 27.53(a)(5)

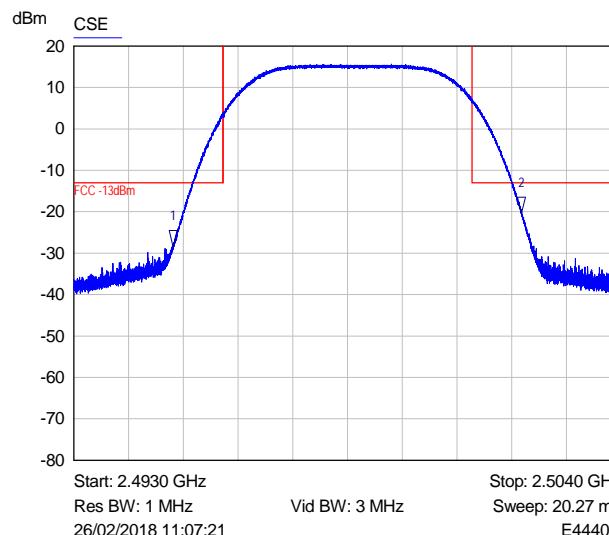
RF Parameters: Band 2345-2360 MHz, Power +20 dBm, Channel Spacing 5MHz, Modulation AWGN,
Channels 2352.5 & 2357.5MHz, Dual channel mode



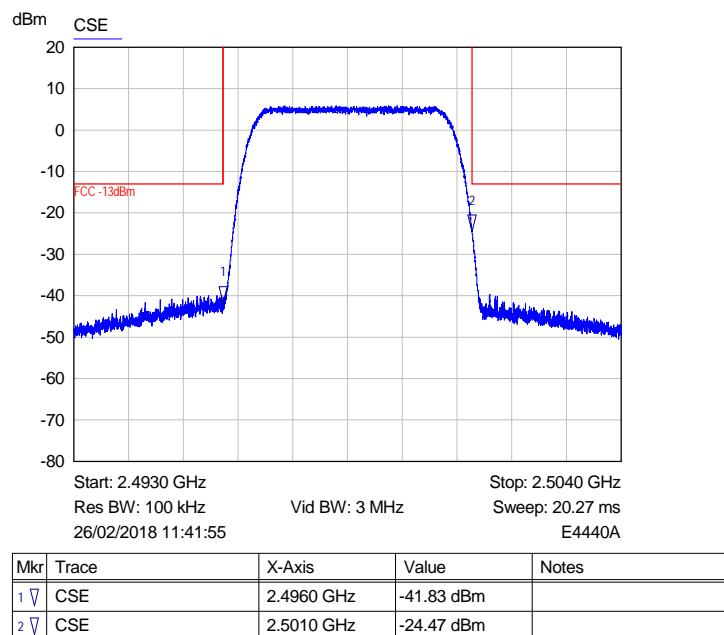
Plot of lower/upper band edge for Low channels 51kHz RBW (2352.5 & 2357.5MHz)

Note: Lower RBW used for immediate 1 MHz band edge as per 27.53(a)(5)

RF Parameters: Band 2496-2690 MHz, Power +20 dBm, Channel Spacing 5MHz, Modulation AWGN,
Channel 2498.5 MHz, Single channel mode



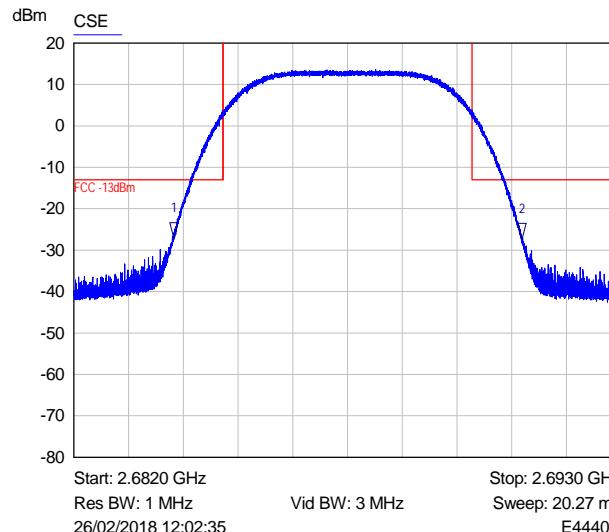
Plot of lower/upper band edge for Low channel 1MHz RBW (2498.5MHz)



Plot of lower/upper band edge for Low channel 100kHz RBW (2498.5MHz)

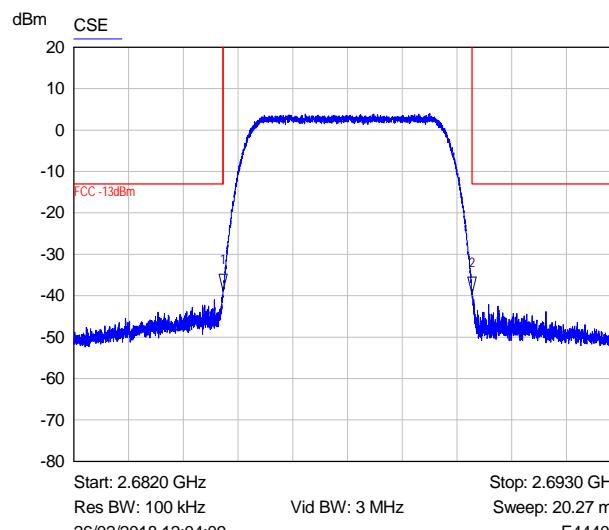
Note: Re-measured with lower RBW

RF Parameters: Band 2496-2690 MHz, Power +20 dBm, Channel Spacing 5MHz, Modulation AWGN,
Channel 2687.5 MHz, Single channel mode



Mkr	Trace	X-Axis	Value	Notes
1	CSE	2.6840 GHz	-27.40 dBm	
2	CSE	2.6910 GHz	-27.50 dBm	

Plot of lower/upper band edge for Low channel 100kHz RBW (2687.5MHz)

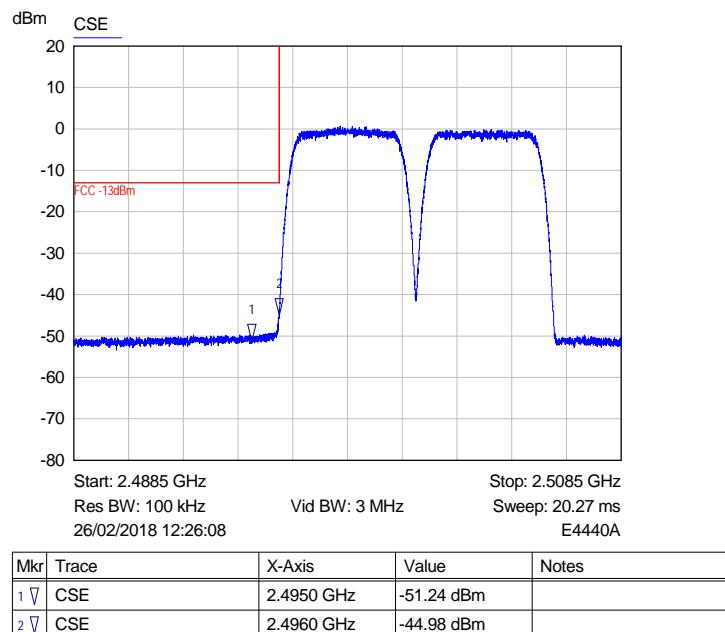


Mkr	Trace	X-Axis	Value	Notes
1	CSE	2.6850 GHz	-38.84 dBm	
2	CSE	2.6900 GHz	-39.46 dBm	

Plot of lower/upper band edge for Low channel 1MHz RBW (2687.5MHz)

Note: Re-measured with lower RBW

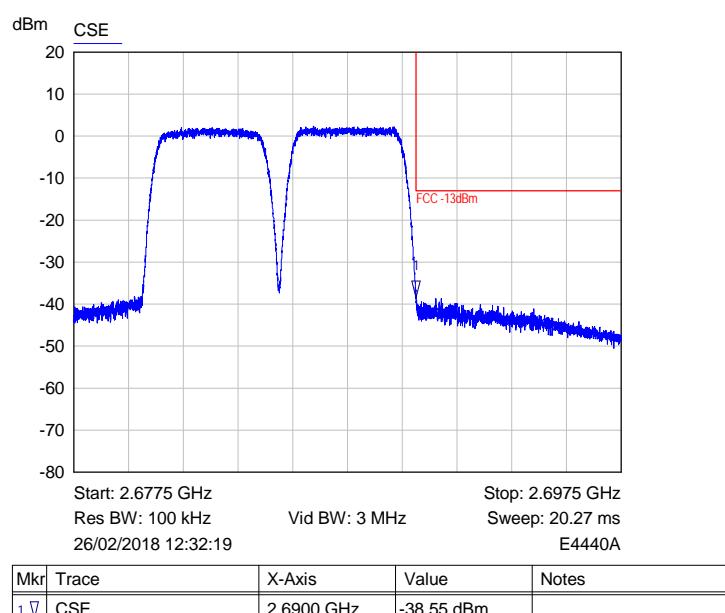
RF Parameters: Band 2496-2690 MHz, Power +20 dBm, Channel Spacing 5MHz, Modulation AWGN,
Channels 2498.5 & 2503.5MHz, Dual channel mode



Plot of lower band edge for Low channels 100kHz RBW (2498.5 & 2503.5MHz)

Note: Integrating power back to 1MHz RBW would add 10dB to signals measured in 100kHz RBW and
therefore Markers show compliance to limits

RF Parameters: Band 2496-2690 MHz, Power +20 dBm, Channel Spacing 5MHz, Modulation AWGN,
Channels 2682.5 & 2687.5MHz, Dual channel mode



Plot of upper band edge for High channels 100kHz RBW (2682.5 & 2687.5MHz)

Note: Integrating power back to 1MHz RBW would add 10dB to signals measured in 100kHz RBW and
therefore Markers show compliance to limits

7 Photographs

For confidentiality purposes, photographs are not included at client's request.

8 Test equipment calibration list

The following is a list of the test equipment used by R.N. Electronics Ltd to test the unit detailed within this report. In line with our procedures, the equipment was within calibration for the period during which testing was carried out.

RN No.	Model No.	Description	Manufacturer	Calibration date	Cal period
E268	BHA 9118	Horn Antenna 1-18 GHz	Schaffner	03-Apr-2017	12 months
E301	8493C	Attenuator 20dB 26.5GHz	Hewlett Packard	19-May-2017	12 months
E411	N9039A	9 kHz - 1 GHz RF Filter Section	Agilent Technologies	11-Jul-2017	12 months
E412	E4440A	PSA 3 Hz - 26.5 GHz	Agilent Technologies	10-Jul-2017	24 months
E428	HF906	Horn Antenna 1-18 GHz	Rohde & Schwarz	03-Apr-2017	12 months
E433	MG3693A	Signal Generator 30GHz	Anritsu	23-Jun-2016	24 months
E452	22240-20	Std Gain Horn Antenna 26.4 - 40.1 GHz	FMI Ltd	02-May-2017	12 months
E453	20240-20-AA	Std Gain Horn Antenna 17.6 - 26.7 GHz	FMI Ltd	02-May-2017	12 months
E454	18240-20	Std Gain Horn Antenna 11.9 - 18.0 GHz	FMI Ltd	25-Jul-2017	12 months
E498	4768-20	Attenuator 20dB 40GHz	Narda	24-May-2017	12 months
E602	MG3692A	Signal Generator 10MHz - 20GHz	Anritsu	30-Jan-2017	24 months
E624	E4440A	PSA 3 Hz - 26.5 GHz	Agilent Technologies	09-Jan-2018	24 months
E642	E4440A	PSA 3 Hz - 26.5 GHz	Keysight	29-Nov-2017	24 months
E743	RR2017 4/2dB	Attenuator 4/2dB 30-1000MHz	RN Electronics	12-Feb-2018	12 months
E755	N9030B	3Hz to 50GHz PXA	Keysight	08-May-2017	12 months
LPE364	CBL6112A	Antenna Bilog 30MHz - 2GHz	Chase Electronics Ltd	15-Jan-2018	24 months
TMS78	3160-08	Std Gain Horn Antenna 12.4-18 GHz	ETS Systems	25-Jul-2017	12 months
TMS79	3160-09	Std Gain Horn Antenna 18-26.5 GHz	ETS Systems	25-Jul-2017	12 months
TMS82	8449B	Pre Amplifier 1 - 26 GHz	Agilent Technologies	19-Dec-2017	12 months

9 Auxiliary and peripheral equipment

9.1 Customer supplied equipment

Item No.	Model No.	Description	Manufacturer	Serial No.
1	N5172B	EXG signal generator	Agilent	MY53050810
2	N5172B	EXG signal generator	Keysight	MY53050728
3	15542	30 dB attenuator	Mini-Circuits	VUU78901032
4		TX 50 Ohm load		
5		RX 50 Ohm load		
6	305-0001	UNItnity 5000 Primary Hub	Zinwave Ltd	650100000002
7	305-0004	Zinwave Secondary Hub	Zinwave Ltd	620100000018
8	E4432B	signal generator	HP	Zinwave 000001
9	SMJ100A	signal generator	R&S	Zinwave 000094
10	SLP-550+	520MHz LPF	Mini circuits	R0029901116
11	SLP-630+	630MHz LPF	Mini circuits	3 0719
12	SLP-1200+	1000MHz LPF	Mini circuits	R8169700721
13	305-0001	UNItnity 5000 primary hub	Zinwave Ltd	00-17-68-00-13-DE
14	305-0004	Zinwave Secondary Hub	Zinwave Ltd	620100000004

9.2 RN Electronics supplied equipment

RN No.	Model No.	Description	Manufacturer	Serial No
E401	1506A	Splitter 18 GHz 6dB	Weinschel	LT261
I224	E442-142H16	Laptop 15.6"	emachines	LXNBF02002038164171601

10 Condition of the equipment tested

In order for the EUT to produce the results shown within this report the following modifications, if any, were implemented.

10.1 Modifications before test

No modifications were made before test by RN Electronics Ltd.

10.2 Modifications during test

No modifications were made during test by RN Electronics Ltd.

11 Description of test sites

- Site A Radio / Calibration Laboratory and anechoic chamber
- Site B Semi-anechoic chamber
FCC Registration No. 293246
IC Registration No. 5612A-4
- Site B1 Control Room for Site B
- Site C Transient Laboratory
- Site D Screened Room (Conducted Immunity)
- Site E Screened Room (Control Room for Site D)
- Site F Screened Room (Conducted Emissions)
- Site G Screened Room (Control Room for Site H)
- Site H 3m Semi-anechoic chamber (indoor OATS)
FCC Registration No. 293246
IC Registration No. 5612A-2
- Site J Screened Room
- Site K Screened Room (Control Room for Site M)
- Site M 3m Semi-anechoic chamber (indoor OATS)
FCC Registration No. 293246
IC Registration No. 5612A-3
- Site Q Fully-anechoic chamber
- Site OATS 3m and 10m Open Area Test Site
FCC Registration No. 293246
IC Registration No. 5612A-1
- Site R Screened Room (Conducted Immunity)
- Site S Safety Laboratory
- Site T Transient Laboratory

12 Abbreviations and units

%	Percent	LBT	Listen Before Talk
$\mu\text{A}/\text{m}$	microAmps per metre	LO	Local Oscillator
μV	microVolts	mA	milliAmps
μW	microWatts	max	maximum
AC	Alternating Current	kPa	Kilopascal
ALSE	Absorber Lined Screened Enclosure	Mbit/s	MegaBits per second
AM	Amplitude Modulation	MHz	MegaHertz
Amb	Ambient	mic	Microphone
ATPC	Automatic Transmit Power Control	min	minimum
BER	Bit Error Rate	mm	milliMetres
$^{\circ}\text{C}$	Degrees Celsius	ms	milliSeconds
C/I	Carrier / Interferer	mW	milliWatts
CEPT	European Conference of Postal and Telecommunications Administrations	NA	Not Applicable
COFDM	Coherent OFDM	nom	Nominal
CS	Channel Spacing	nW	nanoWatt
CW	Continuous Wave	OATS	Open Area Test Site
dB	deciBels	OFDM	Orthogonal Frequency Division Multiplexing
$\text{dB}\mu\text{A}/\text{m}$	deciBels relative to $1\mu\text{A}/\text{m}$	ppm	Parts per million
$\text{dB}\mu\text{V}$	deciBels relative to $1\mu\text{V}$	PRBS	Pseudo Random Bit Sequence
dBc	deciBels relative to Carrier	QAM	Quadrature Amplitude Modulation
dBm	deciBels relative to 1mW	QPSK	Quadrature Phase Shift Keying
DC	Direct Current	R&TTE	Radio and Telecommunication Terminal Equipment
DTA	Digital Transmission Analyser	Ref	Reference
EIRP	Equivalent Isotropic Radiated Power	RF	Radio Frequency
ERP	Effective Radiated Power	RFC	Remote Frequency Control
EU	European Union	RSL	Received Signal Level
EUT	Equipment Under Test	RTP	Room Temperature and Pressure
FM	Frequency Modulation	RTPC	Remote Transmit Power Control
FSK	Frequency Shift Keying	Rx	Receiver
g	Grams	s	Seconds
GHz	GigaHertz	SINAD	Signal to Noise And Distortion
Hz	Hertz	Tx	Transmitter
IF	Intermediate Frequency	V	Volts
kHz	kiloHertz		