



Radio Test Report

Altiostar Networks UK Ltd

Aldebaran B5

iRM22490500-1

47 CFR Part 22H Effective Date 1st October 2017

↳ 47CFR part 2J Effective Date 1st October 2017

Class: TNB, Licensed Non-Broadcast Station Transmitter

Test Date: 19th March 2018 to 21st March 2018

Report Number: 03-10471-1-18 Issue 02

Supersedes report: 03-10471-1-18 Issue 01

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Arnolds Court, Arnolds Farm Lane, Mountnessing, Brentwood Essex, CM13 1UT
Certificate of Test 10471-1

The equipment noted below has been fully tested by R.N. Electronics Limited and, where appropriate, conforms to the relevant subpart of 47 CFR Part 22H. This is a certificate of test only and should not be confused with an equipment authorisation. Other standards may also apply.

Equipment:	Aldebaran B5
Model Number:	iRM22490500-1
Unique Serial Number:	TEW08170001, TEW34160006 (Frequency error only)
Applicant:	Altistar Networks UK Ltd No 1 The Heights, Brooklands Weybridge, UK KT13 0NY
Full measurement results are detailed in Report Number:	03-10471-1-18 Issue 02
Test Standards:	47 CFR Part 22H Effective Date 1st October 2017 ↳ 47CFR part 2J Effective Date 1st October 2017 Class: TNB, Licensed Non-Broadcast Station Transmitter

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.

DEVIATIONS:

Field strength of spurious emission: measurements performed with EUT at a height of 1.2 m above chamber floor.

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: 19th March 2018 to 21st March 2018

Test Engineer:

A handwritten signature in black ink that reads "Charlie Black".

Approved By:
Radio Approvals Manager

A blank rectangular box intended for a handwritten signature.

Customer
Representative:

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2 Equipment under test (EUT)

2.1 Equipment specification

Applicant	Altiostar Networks UK Ltd No 1 The Heights Brooklands Weybridge UK KT13 0NY
Manufacturer of EUT	Altiostar Inc.
Full Name of EUT	Aldebaran B5
Model Number of EUT	iRM22490500-1
Serial Number of EUT	TEW08170001, TEW34160006 (Frequency error only)
Date Received	19th March 2018
Date of Test:	19th March 2018 to 21st March 2018
Purpose of Test	To demonstrate design compliance to the relevant rules of Chapter 47 of the Code of Federal Regulations.
Date Report Issued	18th April 2018
Main Function	Band 5 LTE Remote Radio Head (base station)
Information Specification	Height 392 mm
	Width 485 mm
	Depth 182 mm
	Weight 28 kg
	Voltage 40.5-55.2 V dc
	Current 10 A

2.2 Configurations for testing

General Parameters	
EUT Normal use position	Pole mounted
Choice of model(s) for type tests	Production sample
Antenna details	Not declared
Antenna port	2 x 7/16 conn (female)
Baseband Data port (yes/no)?	No
Highest Signal generated in EUT	894 MHz
Lowest Signal generated in EUT	Not declared
Hardware Version	Rev 6
Software Version	A1055
Firmware Version	OrionFulv20_ph4_main/389
Type of Equipment	LTE base station
Technology Type	LTE
Geo-location (yes/no)	No
TX Parameters	
Alignment range – transmitter	869-894 MHz
EUT Declared Modulation Parameters	QPSK, 16QAM, 64QAM, 256QAM
EUT Declared Power level	+46 dBm per port (QPSK, 16QAM, 64QAM) +45.5 dBm per port (256QAM)
EUT Declared Signal Bandwidths	5, 10, 15 and 20 MHz
EUT Declared Channel Spacing's	5, 10, 15 and 20 MHz
EUT Declared Duty Cycle	100%
Unmodulated carrier available?	Yes
Declared frequency stability	< 1 ppm

2.3 Functional description

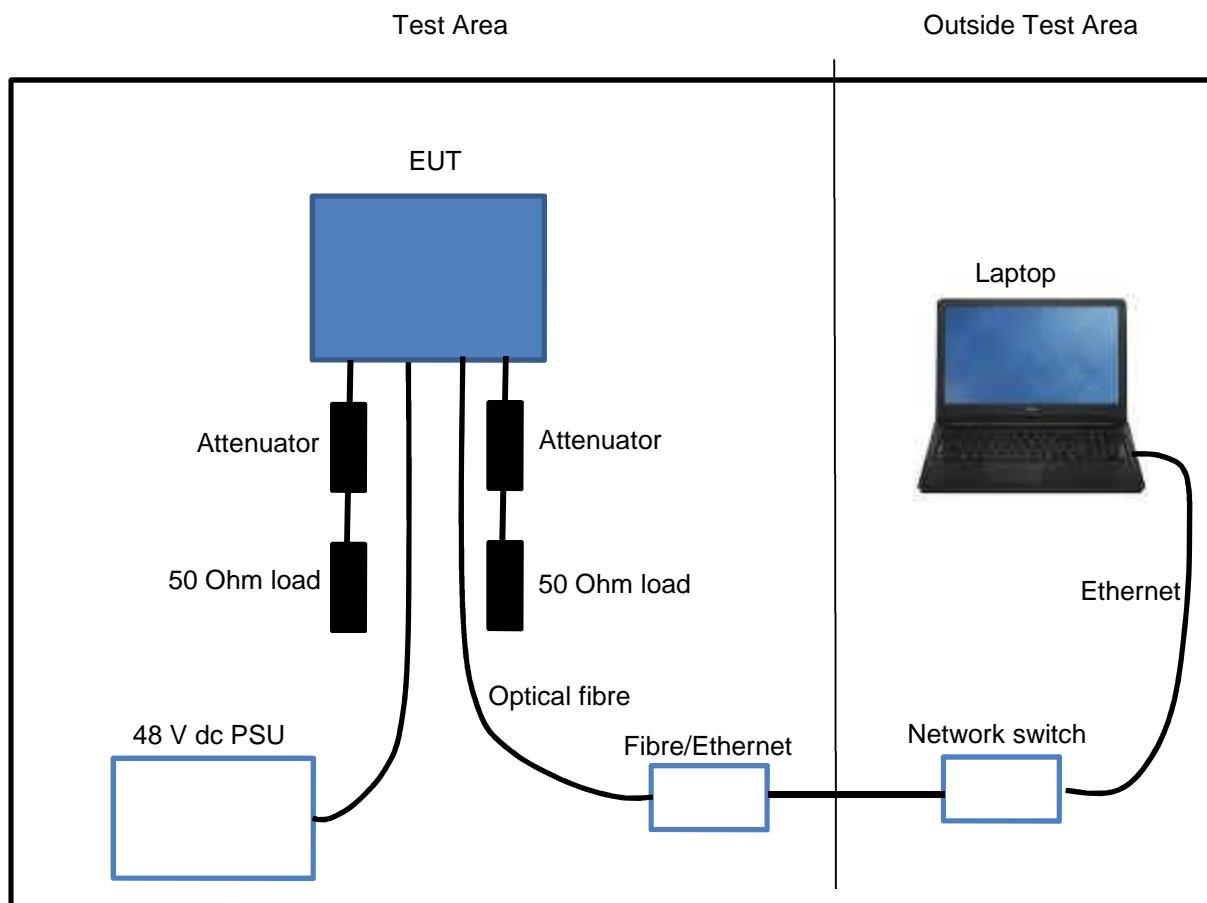
2 port, pole mount, LTE base station (Band 5), DC powered with fiber-optic data interface.

2.4 Modes of operation

Mode Reference	Description	Used for testing
TX1	Low 5 MHz BW QPSK	Yes
TX2	Low 5 MHz BW 16QAM	Yes
TX3	Low 5 MHz BW 64QAM	Yes
TX4	Low 5 MHz BW 256QAM	Yes
TX5	Low 10 MHz BW QPSK	Yes
TX6	Low 10 MHz BW 16QAM	Yes
TX7	Low 10 MHz BW 64QAM	Yes
TX8	Low 10 MHz BW 256QAM	Yes
TX9	Low 15 MHz BW QPSK	Yes
TX10	Low 15 MHz BW 16QAM	Yes
TX11	Low 15 MHz BW 64QAM	Yes
TX12	Low 15 MHz BW 256QAM	Yes
TX13	Low 20 MHz BW QPSK	Yes
TX14	Low 20 MHz BW 16QAM	Yes
TX15	Low 20 MHz BW 64QAM	Yes
TX16	Low 20 MHz BW 256QAM	Yes
TX17	Mid 5 MHz BW QPSK	Yes
TX18	Mid 5 MHz BW 16QAM	Yes
TX19	Mid 5 MHz BW 64QAM	Yes
TX20	Mid 5 MHz BW 256QAM	Yes
TX21	Mid 10 MHz BW QPSK	Yes
TX22	Mid 10 MHz BW 16QAM	Yes
TX23	Mid 10 MHz BW 64QAM	Yes
TX24	Mid 10 MHz BW 256QAM	Yes
TX25	Mid 15 MHz BW QPSK	Yes
TX26	Mid 15 MHz BW 16QAM	Yes
TX27	Mid 15 MHz BW 64QAM	Yes
TX28	Mid 15 MHz BW 256QAM	Yes
TX29	Mid 20 MHz BW QPSK	Yes
TX30	Mid 20 MHz BW 16QAM	Yes
TX31	Mid 20 MHz BW 64QAM	Yes
TX32	Mid 20 MHz BW 256QAM	Yes
TX33	High 5 MHz BW QPSK	Yes
TX34	High 5 MHz BW 16QAM	Yes
TX35	High 5 MHz BW 64QAM	Yes
TX36	High 5 MHz BW 256QAM	Yes
TX37	High 10 MHz BW QPSK	Yes
TX38	High 10 MHz BW 16QAM	Yes
TX39	High 10 MHz BW 64QAM	Yes
TX40	High 10 MHz BW 256QAM	Yes
TX41	High 15 MHz BW QPSK	Yes
TX42	High 15 MHz BW 16QAM	Yes
TX43	High 15 MHz BW 64QAM	Yes
TX44	High 15 MHz BW 256QAM	Yes
TX45	High 20 MHz BW QPSK	Yes
TX46	High 20 MHz BW 16QAM	Yes
TX47	High 20 MHz BW 64QAM	Yes

TX48	High 20 MHz BW 256QAM	Yes
TX49	Mid CW breakthrough	Yes

2.5 Emissions configuration



The unit was powered from 48 V dc via a mains powered ac/dc power supply. Each RF port was terminated with high power attenuators and 50 Ohm loads. The unit was controlled via a fibre optic cable from a laptop located outside the chamber. The unit was configured with engineering menus in software to allow permanent transmit modes of device on the top, middle and bottom channels as stated within section 2.4 of this report. The transmit mode was 100% continuous with modulation and the power settings for each channel were as stated below:-

QPSK, 16QAM and 64QAM = +46 dBm per port.

256QAM = +45.5 dBm per port.

Bandwidth (MHz)	Low channel (MHz)	Middle channel (MHz)	High channel (MHz)
5	871.5	881.5	891.5
10	874.0	881.5	889.0
15	876.5	881.5	886.5
20	879.0	881.5	884.0

2.5.1 Signal leads

Port Name	Cable Type	Connected
ANT1	Coax	Yes
ANT2	Coax	Yes
-48 V DC	-	Yes
ALARMS	-	No
RET	-	No
GPS	-	No
FH1	Optical fibre	No
FH2	Optical fibre	Yes

3 Summary of test results

The Aldebaran B5, iRM22490500-1 was tested for compliance to the following standard(s) :

47 CFR Part 22H Effective Date 1st October 2017
↳ 47CFR part 2J 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. RF Power Output (ERP / EIRP)	47CFR part 2J Clause 2.1046, 47 CFR Part 22H Clause 22.913	PASSED
2. Occupied bandwidth	47CFR part 2J Clause 2.1049, 47 CFR Part 22H Clause 22.917	PASSED
3. Frequency stability	47CFR part 2J Clause 2.1055, 47 CFR Part 22H Clause 22.355	PASSED
4. Spurious emissions at antenna terminals	47CFR part 2J Clause 2.1051, 47 CFR Part 22H Clause 22.917	PASSED
5. Band edge compliance	47CFR part 2J Clause 2.1051, 47 CFR Part 22H Clause 22.917	PASSED
6. Field strength of spurious emissions	47CFR part 2J Clause 2.1053, 47 CFR Part 22H Clause 22.917	PASSED
7. Modulation characteristics	47CFR part 2J Clause 2.1051	PASSED

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	47 CFR Part 22H	2017	Part 22 Subpart H - Cellular Radiotelephone Service
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 v03	2017	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 662911 D01 v02r01	2013	Emissions Testing of Transmitters with Multiple Outputs in the Same Band

4.2 Deviations

Field strength of spurious emission: measurements performed with EUT at a height of 1.2 m above chamber floor.

4.3 Tests at extremes of temperature & voltage

The following test conditions were used to simulate testing at nominal or extremes.

Temperature Test Conditions		Voltage Test Conditions	
T nominal	20 °C	V nominal	48V DC
T minimum	-30 °C	V minimum	40.5V DC
T maximum	50 °C	V maximum	55.2V DC

Extremes of voltage are based upon manufacturer's declaration.

Extremes of temperature are based upon FCC rules requirements.

The ambient test conditions of humidity and pressure in the laboratory were as specified in each specific test section within this report

5 Tests, methods and results

5.1 RF Power Output (ERP / EIRP)

5.1.1 Test methods

Test Requirements: 47CFR part 2J Clause 2.1046 [Reference 4.1.2 of this report],
47 CFR Part 22H Clause 22.913 [Reference 4.1.1 of this report]

Test Method: ANSI C63.26 Clause 5.2 [Reference 4.1.4 of this report]

Limits: 47 CFR Part 22H Clause 22.913 [Reference 4.1.1 of this report]

5.1.2 Configuration of EUT

The EUT was measured on a bench using a spectrum analyser connected to the external RF port. The EUT was operated in TX17-TX32 modes for this test. The EUT was set to each mode and test signal in turn (see section 2.4) and highest power levels recorded.

5.1.3 Test procedure

Tests were made in accordance with the Test Method noted above using the measuring equipment listed in the 'Test Equipment' Section. Channel power function of the analyser was used with an RMS detector.

In accordance with ANSI C63.26 clause 5.1.2.2 "Measurement of all modes and all channels is not always necessary to demonstrate compliance", therefore Initial testing on 5 MHz channels showed that highest power was on middle channel, so all measurements were made whilst transmitting on centre channel.

Testing on 5 and 10 MHz channels was performed for all modulation types and testing for 15 and 20 MHz channels was performed for QPSK modulation and highest and lower QAM modulation types. As the EUT had a 2nd RF port, the total power was summed in accordance with KDB662911D01 and ANSI C63.26 clause 6.4.3.2.4, and the result compared against the limit. Specifically, the power was measured at Antenna port 1 and then 10log2 dB, or 3 dB, was added to show total power from both ports. Peak to Average Power ratio and PSD in 1MHz RBW were also measured using built in measurement functions of the instrument.

Measurements were made on a test bench in site A.

5.1.4 Test equipment

E256, E602, E642

See Section 8 for more details

5.1.5 Test results

Temperature of test environment 18-21°C

Humidity of test environment 42-55%

Pressure of test environment 101kPa

Band	(ant 1) 869-894 MHz
Power Level	46 dBm
Channel Spacing	5 MHz
Mod Scheme	QPSK
Mid Channel	881.5 MHz

Test conditions	TX Power port1	Summed TX power	Summed TX power
	(dBm)	Port1 and 2 (dBm)	Port1 and 2 (W)
Maximum TX Power observed	45.95	48.95	78.5
	TX PSD/MHz port1 (dBm)	Summed PSD/MHz Port1 and 2 (dBm)	Summed PSD (W/MHz)
Maximum PSD/MHz observed	38.96	41.96	15.7

Band	(ant 1) 869-894 MHz
Power Level	46 dBm
Channel Spacing	10 MHz
Mod Scheme	QPSK
Mid Channel	881.5 MHz

Test conditions	TX Power port1	Summed TX power	Summed TX power
	(dBm)	Port1 and 2 (dBm)	Port1 and 2 (W)
Maximum TX Power observed	45.99	48.99	79.3
	TX PSD/MHz port1	Summed PSD/MHz	Summed PSD
	(dBm)	Port1 and 2 (dBm)	(W/MHz)
Maximum PSD/MHz observed	35.99	38.99	7.9

Band	(ant 1) 869-894 MHz
Power Level	46 dBm
Channel Spacing	15 MHz
Mod Scheme	QPSK
Mid Channel	881.5 MHz

Test conditions	TX Power port1	Summed TX power	Summed TX power
	(dBm)	Port1 and 2 (dBm)	Port1 and 2 (W)
Maximum TX Power observed	45.84	48.84	76.6
	TX PSD/MHz port1	Summed PSD/MHz	Summed PSD
	(dBm)	Port1 and 2 (dBm)	(W/MHz)
Maximum PSD/MHz observed	34.08	37.08	5.1

Band	(ant 1) 869-894 MHz
Power Level	46 dBm
Channel Spacing	20 MHz
Mod Scheme	QPSK
Mid Channel	881.5 MHz

Test conditions	TX Power port1	Summed TX power	Summed TX power
	(dBm)	Port1 and 2 (dBm)	Port1 and 2 (W)
Maximum TX Power observed	46.04	49.04	80.2
	TX PSD/MHz port1	Summed PSD/MHz	Summed PSD
	(dBm)	Port1 and 2 (dBm)	(W/MHz)
Maximum PSD/MHz observed	33.03	36.03	4.0

Band	(ant 1) 869-894 MHz
Power Level	46 dBm
Channel Spacing	5 MHz
Mod Scheme	16QAM
Mid Channel	881.5 MHz

Test conditions	TX Power port1	Summed TX power	Summed TX power
	(dBm)	Port1 and 2 (dBm)	Port1 and 2 (W)
Maximum TX Power observed	45.71	48.71	74.3
	TX PSD/MHz port1	Summed PSD/MHz	Summed PSD
	(dBm)	Port1 and 2 (dBm)	(W/MHz)

Maximum PSD/MHz observed	38.72	41.72	14.9
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Band	(ant 1) 869-894 MHz
Power Level	46 dBm
Channel Spacing	10 MHz
Mod Scheme	16QAM
Mid Channel	881.5 MHz

Test conditions	TX Power port1	Summed TX power	Summed TX power
	(dBm)	Port1 and 2 (dBm)	Port1 and 2 (W)
Maximum TX Power observed	45.92	48.92	78.0
	TX PSD/MHz port1 (dBm)	Summed PSD/MHz Port1 and 2 (dBm)	Summed PSD (W/MHz)
Maximum PSD/MHz observed	35.92	38.92	7.8

Band	(ant 1) 869-894 MHz
Power Level	46 dBm
Channel Spacing	15 MHz
Mod Scheme	16QAM
Mid Channel	881.5 MHz

Test conditions	TX Power port1	Summed TX power	Summed TX power
	(dBm)	Port1 and 2 (dBm)	Port1 and 2 (W)
Maximum TX Power observed	45.79	48.79	75.7
	TX PSD/MHz port1 (dBm)	Summed PSD/MHz Port1 and 2 (dBm)	Summed PSD (W/MHz)
Maximum PSD/MHz observed	34.02	37.02	5.0

Band	(ant 1) 869-894 MHz
Power Level	46 dBm
Channel Spacing	20 MHz
Mod Scheme	16QAM
Mid Channel	881.5 MHz

Test conditions	TX Power port1	Summed TX power	Summed TX power
	(dBm)	Port1 and 2 (dBm)	Port1 and 2 (W)
Maximum TX Power observed	46.10	49.10	81.3
	TX PSD/MHz port1 (dBm)	Summed PSD/MHz Port1 and 2 (dBm)	Summed PSD (W/MHz)
Maximum PSD/MHz observed	33.09	36.09	4.1

Band	(ant 1) 869-894 MHz
Power Level	46 dBm
Channel Spacing	5 MHz
Mod Scheme	64QAM
Mid Channel	881.5 MHz

Test conditions	TX Power port1	Summed TX power	Summed TX power
	(dBm)	Port1 and 2 (dBm)	Port1 and 2 (W)
Maximum TX Power observed	45.91	48.91	77.8
	TX PSD/MHz port1 (dBm)	Summed PSD/MHz Port1 and 2 (dBm)	Summed PSD (W/MHz)
Maximum PSD/MHz observed	38.92	41.92	15.6

Band	(ant 1) 869-894 MHz
Power Level	46 dBm
Channel Spacing	10 MHz
Mod Scheme	64QAM
Mid Channel	881.5 MHz

Test conditions	TX Power port1	Summed TX power	Summed TX power
	(dBm)	Port1 and 2 (dBm)	Port1 and 2 (W)
Maximum TX Power observed	45.86	48.86	76.9
	TX PSD/MHz port1 (dBm)	Summed PSD/MHz Port1 and 2 (dBm)	Summed PSD (W/MHz)
Maximum PSD/MHz observed	35.86	38.86	7.7

Note: 64QAM tests performed using 5 & 10 MHz BW settings only per 5.1.3 test procedure above.

Band	(ant 1) 869-894 MHz
Power Level	46 dBm
Channel Spacing	5 MHz
Mod Scheme	256QAM
Mid Channel	881.5 MHz

Test conditions	TX Power port1	Summed TX power	Summed TX power
	(dBm)	Port1 and 2 (dBm)	Port1 and 2 (W)
Maximum TX Power observed	45.45	48.45	70.0
	TX PSD/MHz port1 (dBm)	Summed PSD/MHz Port1 and 2 (dBm)	Summed PSD (W/MHz)
Maximum PSD/MHz observed	38.46	41.46	14.0

Band	(ant 1) 869-894 MHz
Power Level	46 dBm
Channel Spacing	10 MHz
Mod Scheme	256QAM
Mid Channel	881.5 MHz

Test conditions	TX Power port1	Summed TX power	Summed TX power
	(dBm)	Port1 and 2 (dBm)	Port1 and 2 (W)
Maximum TX Power observed	45.69	48.69	74.0
	TX PSD/MHz port1 (dBm)	Summed PSD/MHz Port1 and 2 (dBm)	Summed PSD (W/MHz)
Maximum PSD/MHz observed	35.69	38.69	7.4

Band	(ant 1) 869-894 MHz
Power Level	46 dBm
Channel Spacing	15 MHz
Mod Scheme	256QAM
Mid Channel	881.5 MHz

Test conditions	TX Power port1	Summed TX power	Summed TX power
	(dBm)	Port1 and 2 (dBm)	Port1 and 2 (W)
Maximum TX Power observed	45.49	48.49	70.6
	TX PSD/MHz port1 (dBm)	Summed PSD/MHz Port1 and 2 (dBm)	Summed PSD (W/MHz)
Maximum PSD/MHz observed	33.73	36.73	4.7

Band	(ant 1) 869-894 MHz
Power Level	46 dBm
Channel Spacing	20 MHz
Mod Scheme	256QAM
Mid Channel	881.5 MHz

Test conditions	TX Power port1	Summed TX power	Summed TX power
	(dBm)	Port1 and 2 (dBm)	Port1 and 2 (W)
Maximum TX Power observed	45.84	48.84	76.6
	TX PSD/MHz port1 (dBm)	Summed PSD/MHz Port1 and 2 (dBm)	Summed PSD (W/MHz)
Maximum PSD/MHz observed	32.83	35.83	3.8

Peak to Average Ratio tests

Note: Peak to average ratio is dependent on modulation type and not on channel bandwidth, so results are presented for a single 5 MHz channel bandwidth only.

Band	(ant 1) 869-894 MHz
Power Level	46 dBm
Channel Spacing	5 MHz
Mod Scheme	QPSK
Mid Channel	881.5 MHz

Test conditions	Peak to Average ratio
	(dBm)
QPSK	6.98
Plot Reference	

Band	(ant 1) 869-894 MHz
Power Level	46 dBm
Channel Spacing	5 MHz
Mod Scheme	16QAM
Mid Channel	881.5 MHz

Test conditions	Peak to Average ratio (dBm)
QPSK	6.92
Plot Reference	

Band	(ant 1) 869-894 MHz
Power Level	46 dBm
Channel Spacing	5 MHz
Mod Scheme	64QAM
Mid Channel	881.5 MHz

Test conditions	Peak to Average ratio (dBm)
QPSK	7.03
Plot Reference	

Band	(ant 1) 869-894 MHz
Power Level	46 dBm
Channel Spacing	5 MHz
Mod Scheme	256QAM
Mid Channel	881.5 MHz

Test conditions	Peak to Average ratio (dBm)
QPSK	7.84
Plot Reference	

LIMITS:

Part 22.913, Tightest limit for ERP of base stations and repeaters must not exceed—
(a)(1)(i) 500 watts per emission; or
(a)(1)(ii) 400 watts/MHz (PSD) per sector.

Other limits may also apply dependant on geographical location and are confirmed/applied by FCC at time of licensing.

22.913(a)(5)(d) The Peak to Average ratio (PAR) of the transmission must not exceed 13dB.

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:
 ± 1.0 dB

5.2 Occupied bandwidth

5.2.1 Test methods

Test Requirements: 47CFR part 2J Clause 2.1049 [Reference 4.1.2 of this report],
47 CFR Part 22H Clause 22.917 [Reference 4.1.1 of this report]
Test Method: ANSI C63.26 Clause 5.4 [Reference 4.1.4 of this report]
Limits: 47 CFR Part 22H Clause 22.917 [Reference 4.1.1 of this report]

5.2.2 Configuration of EUT

The EUT was operated on a test bench. Measurements were made at the 50 ohm coaxial transmit / receive port. The EUT was operated in TX17 to TX32 modes. No discernible difference was noted between antenna ports, therefore results are for Antenna port 1 only.

5.2.3 Test procedure

Tests were performed using Test Site A. Tests were made in accordance with the Test Method noted above using the measuring equipment listed in the 'Test Equipment' Section. A RBW of 1-5% of expected OBW, 3x VBW, auto sweep time and max hold settings were used for the 26 dB / 99% bandwidth. In accordance with ANSI C63.26 clause 5.1.2.2 "Measurement of all modes and all channels is not always necessary to demonstrate compliance", therefore Initial testing on 5 MHz channels showed that highest power was on middle channel, so all measurements were made whilst transmitting on centre channel. Testing on 5 and 10 MHz channels was performed for all modulation types and testing for 15 and 20 MHz channels was performed for QPSK modulation and highest and lower QAM modulation types. The EUT was set to these Bandwidths and modulation schemes in turn and 26 dB bandwidth / 99% bandwidth recorded.

5.2.4 Test equipment

E256, E602, E642

See Section 8 for more details

5.2.5 Test results

Temperature of test environment	18-21°C
Humidity of test environment	42-55%
Pressure of test environment	101kPa

Band	869-894 MHz
Power Level	46 dBm
Channel Spacing	5 MHz
Mod Scheme	QPSK
Single channel	881.5 MHz

Middle channel	
99 % Bandwidth (MHz) Nominal Temp & Volts	4.501
Plot for 99 % Bandwidth (MHz) Nominal Temp & Volts	10471-2 5mhz_qpsk

Band	869-894 MHz
Power Level	46 dBm
Channel Spacing	10 MHz
Mod Scheme	QPSK
Single channel	881.5 MHz

Middle channel	
99 % Bandwidth (MHz) Nominal Temp & Volts	8.9626
Plot for 99 % Bandwidth (MHz) Nominal Temp & Volts	10471-2 10mhz_qpsk

Band	869-894 MHz
Power Level	46 dBm
Channel Spacing	15 MHz
Mod Scheme	QPSK
Single channel	881.5 MHz

Middle channel	
99 % Bandwidth (MHz) Nominal Temp & Volts	13.4504
Plot for 99 % Bandwidth (MHz) Nominal Temp & Volts	10471-2 15mhz_qpsk

Band	869-894 MHz
Power Level	46 dBm
Channel Spacing	20 MHz
Mod Scheme	QPSK
Single channel	881.5 MHz

Middle channel	
99 % Bandwidth (MHz) Nominal Temp & Volts	17.8945
Plot for 99 % Bandwidth (MHz) Nominal Temp & Volts	10471-2 20mhz_qpsk

Band	869-894 MHz
Power Level	46 dBm
Channel Spacing	5 MHz
Mod Scheme	16QAM
Single channel	881.5 MHz

Middle channel	
99 % Bandwidth (MHz) Nominal Temp & Volts	4.4813
Plot for 99 % Bandwidth (MHz) Nominal Temp & Volts	10471-2 5MHz_16QAM

Band	869-894 MHz
Power Level	46 dBm
Channel Spacing	10 MHz
Mod Scheme	16QAM
Single channel	881.5 MHz

Middle channel	
99 % Bandwidth (MHz) Nominal Temp & Volts	8.9815
Plot for 99 % Bandwidth (MHz) Nominal Temp & Volts	10471-2 10MHz_16QAM

Band	869-894 MHz
Power Level	46 dBm
Channel Spacing	15 MHz
Mod Scheme	16QAM
Single channel	881.5 MHz

Middle channel	
99 % Bandwidth (MHz) Nominal Temp & Volts	13.4013
Plot for 99 % Bandwidth (MHz) Nominal Temp & Volts	10471-2 15mhz_16QAM

Band	869-894 MHz
Power Level	46 dBm
Channel Spacing	20 MHz
Mod Scheme	16QAM
Single channel	881.5 MHz

Middle channel	
99 % Bandwidth (MHz) Nominal Temp & Volts	17.8854
Plot for 99 % Bandwidth (MHz) Nominal Temp & Volts	10471-2 20mhz_16QAM

Band	869-894 MHz
Power Level	46 dBm
Channel Spacing	10 MHz
Mod Scheme	64QAM
Single channel	881.5 MHz

Middle channel	
99 % Bandwidth (MHz) Nominal Temp & Volts	8.9653
Plot for 99 % Bandwidth (MHz) Nominal Temp & Volts	10471-2 10MHz_64QAM

Note: 64QAM tests performed using 5 & 10 MHz BW settings only per 5.2.3 test procedure above.

Band	869-894 MHz
Power Level	46 dBm
Channel Spacing	5 MHz
Mod Scheme	256QAM
Single channel	881.5 MHz

Middle channel	
99 % Bandwidth (MHz) Nominal Temp & Volts	4.501
Plot for 99 % Bandwidth (MHz) Nominal Temp & Volts	10471-2 5mhz_256QAM

Band	869-894 MHz
Power Level	46 dBm
Channel Spacing	10 MHz
Mod Scheme	256QAM
Single channel	881.5 MHz

Middle channel	
99 % Bandwidth (MHz) Nominal Temp & Volts	8.9633
Plot for 99 % Bandwidth (MHz) Nominal Temp & Volts	10471-2 10mhz_256QAM

Band	869-894 MHz
Power Level	46 dBm
Channel Spacing	15 MHz
Mod Scheme	256QAM
Single channel	881.5 MHz

		Middle channel
99 % Bandwidth (MHz) Nominal Temp & Volts		13.4529
Plot for 99 % Bandwidth (MHz) Nominal Temp & Volts		10471-2 15mhz_256QAM

Band	869-894 MHz
Power Level	46 dBm
Channel Spacing	20 MHz
Mod Scheme	256QAM
Single channel	881.5 MHz

		Middle channel
99 % Bandwidth (MHz) Nominal Temp & Volts		17.8634
Plot for 99 % Bandwidth (MHz) Nominal Temp & Volts		10471-2 20mhz_256QAM

Analyser plots for the 99% that also show 26dB bandwidth can be found in Section 6 of this report.

LIMITS:

There is no pass/fail criterion so measurement results are reported without reference to a limit.

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 %

5.3 Frequency stability

5.3.1 Test methods

Test Requirements: 47CFR part 2J Clause 2.1055 [Reference 4.1.2 of this report],
47 CFR Part 22H Clause 22.355 [Reference 4.1.1 of this report]
Test Method: ANSI C63.26 Clause 5.6 [Reference 4.1.4 of this report]
Limits: 47 CFR Part 22H Clause 22.355 [Reference 4.1.1 of this report]

5.3.2 Configuration of EUT

The EUT was placed in a temperature controlled chamber and thermal balance was achieved before tests began. Measurements were made at the EUT 50 ohm port. The EUT was operated in TX49 mode for this test.

5.3.3 Test procedure

Tests were made in accordance with the Test Method noted above, using the measuring equipment listed in the 'Test Equipment' Section. Temperature stability was achieved at each test level before taking measurements. The measurement was performed on a CW signal. In accordance with ANSI C63.26 clause 5.1.2.2 "Measurement of all modes and all channels is not always necessary to demonstrate compliance", No discernible difference was noted between channels, and therefore all measurements were made whilst transmitting on centre channel.

Tests were performed using Test Site A.

5.3.4 Test equipment

E256, E612, E642

See Section 8 for more details

5.3.5 Test results

Temperature of test environment	18-21°C
Humidity of test environment	42-55%
Pressure of test environment	101kPa

Band	869-894 MHz
Power Level	46 dBm
Channel Spacing	5 MHz
Mod Scheme	CW breakthrough
Single channel	881.5 MHz

Test conditions	Frequency Error (MHz) Single channel
-30°C	881.500000
-20°C	881.500000
-10°C	881.500000
0°C	881.500000
10°C	881.500000
20°C	881.500000
	881.500000
	881.500000
30°C	881.500000
40°C	881.500000
50°C	881.500000
Max Frequency Error per chan (Hz)	+0 / 0
Max Frequency Error observed (MHz)	0.000000

Maximum variation observed was 0 ppm.

LIMITS:

22.355 Base station/fixed 821-896 MHz band Less than 1.5 ppm.

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:
 $<\pm 0.7$ ppm

5.4 Spurious emissions at antenna terminals

5.4.1 Test methods

Test Requirements:	47CFR part 2J Clause 2.1051 [Reference 4.1.2 of this report], 47 CFR Part 22H Clause 22.917(a)(b) [Reference 4.1.1 of this report]
Test Method:	ANSI C63.26 Clause 5.7 [Reference 4.1.4 of this report] KDB 662911 section 3(a)(iii) [Reference 4.1.5 of this report]
Limits:	47 CFR Part 22H Clause 22.917(a)(b) [Reference 4.1.1 of this report]

5.4.2 Configuration of EUT

The EUT was operated on a test bench. Measurements were made at the 50 ohm coaxial transmit / receive port. All test modes specified in section 2.4 were initially checked. No discernible difference was noted in emissions between Low, Middle and high channels in combination with Bandwidths and modulation scheme settings.

5.4.3 Test procedure

Tests were made in accordance with the Test Method noted above using the measuring equipment noted in the 'Test Equipment' Section at Site A. A complete scan of emissions from the lowest frequency generated/used within the equipment up to 10 times the highest frequency generated/used was made to identify any signals within 20dB of the limits. Any identified spurious signals were measured in the required bandwidths. For frequencies \leq 3 MHz from the band edge please refer to results in section 5.5 "Band edge" of this report.

5.4.4 Test equipment

E256, E478, E602, E642

See Section 8 for more details

5.4.5 Test results

Temperature of test environment	21°C
Humidity of test environment	45%
Pressure of test environment	101kPa

Note: Whilst all Bandwidths and modulation schemes were assessed in conjunction with Low, Mid and High channels, only middle channel 5MHz BW QPSK plots are shown within this report to minimise report size.

Setup Table

Band	869-894 MHz
Power Level	20 dBm
Channel Spacing	5 MHz
Mod Scheme	QPSK
Low channel	871.5 MHz

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

Setup Table

Band	869-894 MHz
Power Level	20 dBm
Channel Spacing	5 MHz
Mod Scheme	QPSK
Mid channel	881.5 MHz

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

Plots
10471-1 5 MHz QPSK 10-400 MHz
10471-1 5 MHz QPSK 400-800 MHz
10471-1 5 MHz QPSK 800-1000 MHz
10471-1 5 MHz QPSK 1-4 GHz
10471-1 5 MHz QPSK 4-8 GHz
10471-1 5 MHz QPSK 8-10 GHz

Setup Table

Band	869-894 MHz
Power Level	20 dBm
Channel Spacing	5 MHz
Mod Scheme	QPSK
High channel	891.5 MHz

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

Setup Table

Band	869-894 MHz
Power Level	20 dBm
Channel Spacing	10 MHz
Mod Scheme	QPSK
Low channel	874MHz

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

Setup Table

Band	869-894 MHz
Power Level	20 dBm
Channel Spacing	10 MHz
Mod Scheme	QPSK
Mid channel	881.5 MHz

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

Setup Table

Band	869-894 MHz
Power Level	20 dBm
Channel Spacing	10 MHz
Mod Scheme	QPSK
High channel	889 MHz

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

No Spurious emissions observed within 20dB of limits		
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Setup Table

Band	869-894 MHz
Power Level	20 dBm
Channel Spacing	15 MHz
Mod Scheme	QPSK
Low channel	876.5 MHz

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

Band	869-894 MHz
Power Level	20 dBm
Channel Spacing	15 MHz
Mod Scheme	QPSK
Mid channel	881.5 MHz

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

Band	869-894 MHz
Power Level	20 dBm
Channel Spacing	15 MHz
Mod Scheme	QPSK
High channel	886.5 MHz

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

Band	869-894 MHz
Power Level	20 dBm
Channel Spacing	20 MHz
Mod Scheme	QPSK
Low channel	879 MHz

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

No Spurious emissions observed within 20dB of limits		
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Setup Table

Band	869-894 MHz
Power Level	20 dBm
Channel Spacing	20 MHz
Mod Scheme	QPSK
Mid channel	881.5 MHz

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

Setup Table

Band	869-894 MHz
Power Level	20 dBm
Channel Spacing	20 MHz
Mod Scheme	QPSK
High channel	884 MHz

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

Setup Table

Band	869-894 MHz
Power Level	20 dBm
Channel Spacing	5 MHz
Mod Scheme	16QAM
Low channel	871.5 MHz

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

Setup Table

Band	869-894 MHz
Power Level	20 dBm
Channel Spacing	5 MHz
Mod Scheme	16QAM
Mid channel	881.5 MHz

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

Setup Table

Band	869-894 MHz
Power Level	20 dBm
Channel Spacing	5 MHz
Mod Scheme	16QAM
High channel	891.5 MHz

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

Setup Table

Band	869-894 MHz
Power Level	20 dBm
Channel Spacing	10 MHz
Mod Scheme	16QAM
Low channel	874 MHz

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

Setup Table

Band	869-894 MHz
Power Level	20 dBm
Channel Spacing	10 MHz
Mod Scheme	16QAM
Mid channel	881.5 MHz

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

Setup Table

Band	869-894 MHz
Power Level	20 dBm
Channel Spacing	10 MHz
Mod Scheme	16QAM
High channel	889 MHz

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

Setup Table

Band	869-894 MHz
Power Level	20 dBm
Channel Spacing	15 MHz
Mod Scheme	16QAM
Low channel	876.5 MHz

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

Setup Table

Band	869-894 MHz
Power Level	20 dBm
Channel Spacing	15 MHz
Mod Scheme	16QAM
Mid channel	881.5 MHz

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

Setup Table

Band	869-894 MHz
Power Level	20 dBm
Channel Spacing	15 MHz
Mod Scheme	16QAM
High channel	886.5 MHz

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

Setup Table

Band	869-894 MHz
Power Level	20 dBm
Channel Spacing	20 MHz
Mod Scheme	16QAM
Low channel	879 MHz

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

Setup Table

Band	869-894 MHz
Power Level	20 dBm
Channel Spacing	20 MHz
Mod Scheme	16QAM
Mid channel	881.5 MHz

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

Setup Table

Band	869-894 MHz
Power Level	20 dBm
Channel Spacing	20 MHz
Mod Scheme	16QAM
High channel	884 MHz

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

Setup Table

Band	869-894 MHz
Power Level	20 dBm
Channel Spacing	5 MHz

Mod Scheme	64QAM
Low channel	871.5 MHz

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

Setup Table

Band	869-894 MHz
Power Level	20 dBm
Channel Spacing	5 MHz
Mod Scheme	64QAM
Mid channel	881.5 MHz

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

Setup Table

Band	869-894 MHz
Power Level	20 dBm
Channel Spacing	5 MHz
Mod Scheme	64QAM
High channel	891.5 MHz

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

Setup Table

Band	869-894 MHz
Power Level	20 dBm
Channel Spacing	10 MHz
Mod Scheme	64QAM
Low channel	874 MHz

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

Setup Table

Band	869-894 MHz
Power Level	20 dBm
Channel Spacing	10 MHz
Mod Scheme	64QAM
Mid channel	881.5 MHz

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

Setup Table

Band	869-894 MHz
Power Level	20 dBm
Channel Spacing	10 MHz
Mod Scheme	64QAM
High channel	889 MHz

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

Setup Table

Band	869-894 MHz
Power Level	20 dBm
Channel Spacing	15 MHz
Mod Scheme	64QAM
Low channel	876.5 MHz

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

Setup Table

Band	869-894 MHz
Power Level	20 dBm
Channel Spacing	15 MHz
Mod Scheme	64QAM
Mid channel	881.5 MHz

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

Setup Table

Band	869-894 MHz
Power Level	20 dBm
Channel Spacing	15 MHz
Mod Scheme	64QAM
High channel	886.5 MHz

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

Setup Table

Band	869-894 MHz
Power Level	20 dBm
Channel Spacing	20 MHz
Mod Scheme	64QAM
Low channel	879 MHz

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

Setup Table

Band	869-894 MHz
Power Level	20 dBm
Channel Spacing	20 MHz
Mod Scheme	64QAM
Mid channel	881.5 MHz

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

Setup Table

Band	869-894 MHz
Power Level	20 dBm
Channel Spacing	20 MHz
Mod Scheme	64QAM
High channel	884 MHz

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

Setup Table

Band	869-894 MHz
Power Level	20 dBm
Channel Spacing	5 MHz
Mod Scheme	256QAM
Low channel	871.5 MHz

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

Setup Table

Band	869-894 MHz
Power Level	20 dBm
Channel Spacing	5 MHz
Mod Scheme	256QAM
Mid channel	881.5 MHz

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

Setup Table

Band	869-894 MHz
Power Level	20 dBm
Channel Spacing	5 MHz
Mod Scheme	256QAM

High channel	891.5 MHz
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Spurious Frequency (MHz)	Measured Spurious Level (dBm)	Difference to Limit (dB)
No Spurious emissions observed within 20dB of limits		

Setup Table

Band	869-894 MHz
Power Level	20 dBm
Channel Spacing	10 MHz
Mod Scheme	256QAM
Low channel	874 MHz

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

Setup Table

Band	869-894 MHz
Power Level	20 dBm
Channel Spacing	10 MHz
Mod Scheme	256QAM
Mid channel	881.5 MHz

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

Setup Table

Band	869-894 MHz
Power Level	20 dBm
Channel Spacing	10 MHz
Mod Scheme	256QAM
High channel	889 MHz

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

Setup Table

Band	869-894 MHz
Power Level	20 dBm
Channel Spacing	15 MHz
Mod Scheme	256QAM
Low channel	876.5 MHz

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

Setup Table

Band	869-894 MHz
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Power Level	20 dBm
Channel Spacing	15 MHz
Mod Scheme	256QAM
Mid channel	881.5 MHz

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

Setup Table

Band	869-894 MHz
Power Level	20 dBm
Channel Spacing	15 MHz
Mod Scheme	256QAM
High channel	886.5 MHz

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

Setup Table

Band	869-894 MHz
Power Level	20 dBm
Channel Spacing	20 MHz
Mod Scheme	256QAM
Low channel	879 MHz

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

Setup Table

Band	869-894 MHz
Power Level	20 dBm
Channel Spacing	20 MHz
Mod Scheme	256QAM
Mid channel	881.5 MHz

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

Setup Table

Band	869-894 MHz
Power Level	20 dBm
Channel Spacing	20 MHz
Mod Scheme	256QAM
High channel	884 MHz

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

The plots referred to in the above table may be found in section 6.

Note: For additional emissions limitations at the band edge/spectrum mask, plots for all combinations of modulation schemes, channel bandwidths and Low and high channel frequencies have been shown in band edge section. Whilst Low, Middle and high channels have been fully tested, only middle channel plots for 5MHz bandwidth and QPSK modulation scheme across the entire spectrum are shown within this report to minimise report size. Any spurious emissions found within 20dB are included in tables above.

LIMITS:

Part 22.917, -13 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:
± 2.8 dB up to 10 GHz.

5.5 Band edge compliance

5.5.1 Test methods

Test Requirements: 47CFR part 2J Clause 2.1051 [Reference 4.1.2 of this report],
47 CFR Part 22H Clause 22.917 [Reference 4.1.1 of this report]
Test Method: ANSI C63.26 Clause 5.7 [Reference 4.1.4 of this report]
Limits: 47 CFR Part 22H Clause 22.917 [Reference 4.1.1 of this report]

5.5.2 Configuration of EUT

The EUT was operated on a test bench. Measurements were made at the 50 ohm coaxial transmit / receive port. EUT was operated on low and High channels using modulation schemes in combination with channel Bandwidths listed below.

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. Band edge emissions were performed on Low and High channels using RBW $\geq 1\%$ EBW using an RMS detector and trace averaging. In accordance with ANSI C63.26 clause 5.1.2.2 "Measurement of all modes and all channels is not always necessary to demonstrate compliance", therefore Initial testing on 5 MHz channels showed that highest power was on middle channel, so all measurements were made whilst transmitting on centre channel. Testing on 5 and 10 MHz channels was performed for all modulation types and testing for 15 and 20 MHz channels was performed for QPSK modulation and highest and lower QAM modulation types. As the EUT had a 2nd RF port, the band edge power was summed in accordance with KDB662911D01 and ANSI C63.26 clause 6.4.3.2.4, and the result compared against the limit. Specifically, the lower and upper band edge power was measured at Antenna port 1 and then 10log2 dB, or 3 dB, was added to show total power from both ports at band edges.

The EUT was tested in Site A.

5.5.4 Test equipment

E256, E602, E642

See Section 8 for more details

5.5.5 Test results

Temperature of test environment	18-21°C
Humidity of test environment	42-55%
Pressure of test environment	101kPa

Band	869-894 MHz
Power Level	46 dBm
Channel Spacing	5 MHz
Mod Scheme	QPSK
Low channel	871.5 MHz
High channel	891.5 MHz

	Lower band edge	Upper band edge
Measured level dBm	-23.0	-21.2
Nominal plot reference	5 MHz Channel, QPSK, Low (1%RBW)	5 MHz Channel, QPSK, high (1%RBW)
RF port 1 & 2 Summed (dBm)	-20.0	-18.2

Band	869-894 MHz
Power Level	46 dBm

Channel Spacing	10 MHz
Mod Scheme	QPSK
Low channel	874.0 MHz
High channel	889.0 MHz

	Lower Band Edge	Upper Band Edge
Measured level dBm	-23.8	-23.3
Nominal plot reference	Lower 10 MHz QPSK (100 kHz RBW)	Upper 10 MHz QPSK (100 kHz RBW)
RF port 1 & 2 Summed (dBm)	-20.8	-20.3

Band	869-894 MHz
Power Level	46 dBm
Channel Spacing	15 MHz
Mod Scheme	QPSK
Low channel	876.5 MHz
High channel	886.5 MHz

	Lower Band Edge	Upper band edge
Measured level dBm	-27.2	-26.1
Nominal plot reference	Lower 15 MHz QPSK (100 kHz RBW)	Upper 15 MHz QPSK (100 kHz RBW)
RF port 1 & 2 Summed (dBm)	-24.2	-23.1

Band	869-894 MHz
Power Level	46 dBm
Channel Spacing	20 MHz
Mod Scheme	QPSK
Low channel	879.0 MHz
High channel	884.0 MHz

	Lower Band Edge	Upper band edge
Measured level dBm	-28.8	-29.6
Nominal plot reference	Lower 20 MHz QPSK (100 kHz RBW)	Upper 20 MHz QPSK (100 kHz RBW)
RF port 1 & 2 Summed (dBm)	-25.8	-26.6

Band	869-894 MHz
Power Level	46 dBm
Channel Spacing	5 MHz
Mod Scheme	16QAM
Low channel	871.5 MHz

High channel 891.5 MHz

	Lower Band Edge	Upper band edge
Measured level dBm	-23.0	-22.4
Nominal plot reference	Lower 5 MHz 16QAM (100 kHz RBW)	Upper 5 MHz 16QAM (100 kHz RBW)
RF port 1 & 2 Summed (dBm)	-20.0	-19.4

Band	869-894 MHz
Power Level	46 dBm
Channel Spacing	10 MHz
Mod Scheme	16QAM
Low channel	874.0 MHz
High channel	889.0 MHz

	Lower Band Edge	Upper band edge
Measured level dBm	-29.8	-30.9
Nominal plot reference	Lower 10 MHz 16QAM (100 kHz RBW)	Upper 10 MHz 16QAM (100 kHz RBW)
RF port 1 & 2 Summed (dBm)	-26.8	-27.9

Band	869-894 MHz
Power Level	46 dBm
Channel Spacing	15 MHz
Mod Scheme	16QAM
Low channel	876.5 MHz
High channel	886.5 MHz

	Lower Band Edge	Upper band edge
Measured level dBm	-31.4	-32.2
Nominal plot reference	Lower 15 MHz 16QAM (100 kHz RBW)	Upper 15 MHz 16QAM (100 kHz RBW)
RF port 1 & 2 Summed (dBm)	-28.4	-29.2

Band	869-894 MHz
Power Level	46 dBm
Channel Spacing	20 MHz
Mod Scheme	16QAM
Low channel	879.0 MHz
High channel	884.0 MHz

	Lower Band Edge	Upper band edge
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Measured level dBm	-31.1	-30.7
Nominal plot reference	Lower 20 MHz 16QAM (100 kHz RBW)	Upper 20 MHz 16QAM (100 kHz RBW)
RF port 1 & 2 Summed (dBm)	-28.1	-27.7

Band	869-894 MHz
Power Level	46 dBm
Channel Spacing	5 MHz
Mod Scheme	64QAM
Low channel	871.5 MHz
High channel	891.5 MHz

	Lower Band Edge	Upper band edge
Measured level dBm	-22.6	-21.9
Nominal plot reference	Lower 5 MHz 64QAM (100 kHz RBW)	Upper 5 MHz 64QAM (100 kHz RBW)
RF port 1 & 2 Summed (dBm)	-19.6	-18.9

Band	869-894 MHz
Power Level	46 dBm
Channel Spacing	10 MHz
Mod Scheme	64QAM
Low channel	874.0 MHz
High channel	889.0 MHz

	Lower Band Edge	Upper band edge
Measured level dBm	-30.8	-28.9
Nominal plot reference	Lower 10 MHz 64QAM (100 kHz RBW)	Upper 10 MHz 64QAM (100 kHz RBW)
RF port 1 & 2 Summed (dBm)	-27.8	-25.9

Band	869-894 MHz
Power Level	46 dBm
Channel Spacing	15 MHz
Mod Scheme	64QAM
Low channel	876.5 MHz
High channel	886.5 MHz

	Lower Band Edge	Upper band edge
Measured level dBm	0	0
Nominal plot reference	0	0
RF port 1 & 2 Summed (dBm)		

Note: 64QAM tests performed using 5 & 10 MHz BW settings only per 5.5.3 test procedure above.

Band	869-894 MHz
Power Level	46 dBm
Channel Spacing	20 MHz
Mod Scheme	64QAM
Low channel	879.0 MHz
High channel	884.0 MHz

	Lower Band Edge	Upper band edge
Measured level dBm	0	0
Nominal plot reference	0	0
RF port 1 & 2 Summed (dBm)		

Note: 64QAM tests performed using 5 & 10 MHz BW settings only per 5.5.3 test procedure above.

Band	869-894 MHz
Power Level	46 dBm
Channel Spacing	5 MHz
Mod Scheme	256QAM
Low channel	871.5 MHz
High channel	891.5 MHz

	Lower Band Edge	Upper band edge
Measured level dBm	-22.9	-21.6
Nominal plot reference	Lower 5 MHz 256QAM (100 kHz RBW)	Upper 5 MHz 256QAM (100 kHz RBW)
RF port 1 & 2 Summed (dBm)	-19.9	-18.6

Band	869-894 MHz
Power Level	46 dBm
Channel Spacing	10 MHz
Mod Scheme	256QAM
Low channel	874.0 MHz
High channel	889.0 MHz

	Lower Band Edge	High channel
Measured level dBm	-31.7	-31.3
Nominal plot reference	Lower 10 MHz 256QAM (100 kHz RBW)	Upper 10 MHz 256QAM (100 kHz RBW)
RF port 1 & 2 Summed (dBm)	-28.7	-28.3

Band	869-894 MHz
Power Level	46 dBm
Channel Spacing	15 MHz

Mod Scheme	256QAM
Low channel	876.5 MHz
High channel	886.5 MHz

	Lower Band Edge	Upper band edge
Measured level dBm	-30.2	-29.2
Nominal plot reference	Lower 15 MHz 256QAM (100 kHz RBW)	Upper 15 MHz 256QAM (100 kHz RBW)
RF port 1 & 2 Summed (dBm)	-27.2	-26.2

Band	869-894 MHz
Power Level	46 dBm
Channel Spacing	20 MHz
Mod Scheme	256QAM
Low channel	879 MHz
High channel	884 MHz

	Lower Band Edge	Upper band edge
Measured level dBm	-29.8	-29.7
Nominal plot reference	Lower 20 MHz 256QAM (100 kHz RBW)	Upper 20 MHz 256QAM (100 kHz RBW)
RF port 1 & 2 Summed (dBm)	-26.8	-26.7

The plots referred to in the above table may be found in section 6.

LIMITS:

-13dBm at 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:
± 2.8 dB up to 10 GHz.

5.6 Field strength of spurious emissions

5.6.1 Test methods

Test Requirements: 47CFR part 2J Clause 2.1053 [Reference 4.1.2 of this report],
47 CFR Part 22H Clause 22.917 [Reference 4.1.1 of this report]
Test Method: ANSI C63.26 Clause 5.5 [Reference 4.1.4 of this report]
Limits: 47 CFR Part 22H Clause 22.917 [Reference 4.1.1 of this report]

5.6.2 Configuration of EUT

EUT was set-up on the provided stand located on a turntable. Two 50 ohm power loads were attached to the RF ports via RF cables. All modulation schemes and channel bandwidths were tested in combination with low, mid and high channels.

5.6.3 Test procedure

Tests were made in accordance with the Test Method noted above using the measuring equipment noted in the 'Test Equipment' Section at Site M. Peak field strength from the EUT was maximised by rotating it 360 degrees. Pre-scans were performed using PK field strength methods to determine any signal within 20dB of the limits. Any signals found were measured using substitution method and an RMS detector was used for final measurements.

25MHz - 1GHz.

The measuring antenna was scanned 1 - 4m in both Horizontal and Vertical polarisations. Substitution method was performed using tuned dipoles / a calibrated bi-conical antenna.

1GHz – 10GHz.

The measuring antenna was used in both Horizontal and Vertical polarisations. Substitution method was performed using standard gain horn antennas.

5.6.4 Test equipment

E136, E268, E411, E433, E624, E745, TMS82, TMS933

See Section 8 for more details

5.6.5 Test results

Temperature of test environment	13°C
Humidity of test environment	49%
Pressure of test environment	102kPa

Setup Table

Band	869-894 MHz
Power Level	46 dBm
Channel Spacing	5 MHz
Mod Scheme	QPSK
Low channel	871.5 MHz

Spurious Frequency (MHz)	Measured Spurious Level (dBm)	Difference to Limit (dB)	Antenna Polarisation	EUT Polarisation
No signals observed within 20 dB of limit				

Setup Table

Band	869-894 MHz
Power Level	46 dBm
Channel Spacing	5 MHz
Mod Scheme	QPSK
Mid channel	881.5 MHz

Spurious Frequency (MHz)	Measured Spurious Level (dBm)	Difference to Limit (dB)	Antenna Polarisation	EUT Polarisation
No signals observed within 20 dB of limit				

Setup Table

Band	869-894 MHz
Power Level	46 dBm
Channel Spacing	5 MHz
Mod Scheme	QPSK
High channel	891.5 MHz

Spurious Frequency (MHz)	Measured Spurious Level (dBm)	Difference to Limit (dB)	Antenna Polarisation	EUT Polarisation
No signals observed within 20 dB of limit				

Setup Table

Band	869-894 MHz
Power Level	46 dBm
Channel Spacing	10 MHz
Mod Scheme	QPSK
Low channel	874 MHz

Spurious Frequency (MHz)	Measured Spurious Level (dBm)	Difference to Limit (dB)	Antenna Polarisation	EUT Polarisation
No signals observed within 20 dB of limit				

Setup Table

Band	869-894 MHz
Power Level	46 dBm
Channel Spacing	10 MHz
Mod Scheme	QPSK
Mid channel	881.5 MHz

Spurious Frequency (MHz)	Measured Spurious Level (dBm)	Difference to Limit (dB)	Antenna Polarisation	EUT Polarisation
No signals observed within 20 dB of limit				

Setup Table

Band	869-894 MHz
Power Level	46 dBm
Channel Spacing	10 MHz
Mod Scheme	QPSK
High channel	889 MHz

Spurious Frequency (MHz)	Measured Spurious Level (dBm)	Difference to Limit (dB)	Antenna Polarisation	EUT Polarisation
No signals observed within 20 dB of limit				

Setup Table

Band	869-894 MHz
Power Level	46 dBm
Channel Spacing	15 MHz
Mod Scheme	QPSK
Low channel	876.5 MHz

Spurious Frequency (MHz)	Measured Spurious Level (dBm)	Difference to Limit (dB)	Antenna Polarisation	EUT Polarisation
No signals observed within 20 dB of limit				

Setup Table

Band	869-894 MHz
Power Level	46 dBm
Channel Spacing	15 MHz
Mod Scheme	QPSK
Mid channel	881.5 MHz

Spurious Frequency (MHz)	Measured Spurious Level (dBm)	Difference to Limit (dB)	Antenna Polarisation	EUT Polarisation
No signals observed within 20 dB of limit				

Setup Table

Band	869-894 MHz
Power Level	46 dBm
Channel Spacing	15 MHz
Mod Scheme	QPSK
High channel	886.5 MHz

Spurious Frequency (MHz)	Measured Spurious Level (dBm)	Difference to Limit (dB)	Antenna Polarisation	EUT Polarisation
No signals observed within 20 dB of limit				

Setup Table

Band	869-894 MHz
Power Level	46 dBm
Channel Spacing	20 MHz
Mod Scheme	QPSK
Low channel	879 MHz

Spurious Frequency (MHz)	Measured Spurious Level (dBm)	Difference to Limit (dB)	Antenna Polarisation	EUT Polarisation
No signals observed within 20 dB of limit				

Setup Table

Band	869-894 MHz
Power Level	46 dBm
Channel Spacing	20 MHz
Mod Scheme	QPSK
Mid channel	881.5 MHz

Spurious Frequency (MHz)	Measured Spurious Level (dBm)	Difference to Limit (dB)	Antenna Polarisation	EUT Polarisation
No signals observed within 20 dB of limit				

Setup Table

Band	869-894 MHz
Power Level	46 dBm
Channel Spacing	20 MHz
Mod Scheme	QPSK
High channel	884 MHz

Spurious Frequency (MHz)	Measured Spurious Level (dBm)	Difference to Limit (dB)	Antenna Polarisation	EUT Polarisation
No signals observed within 20 dB of limit				

Setup Table

Band	869-894 MHz
Power Level	46 dBm
Channel Spacing	5 MHz
Mod Scheme	16QAM
Low channel	871.5 MHz

Spurious Frequency (MHz)	Measured Spurious Level (dBm)	Difference to Limit (dB)	Antenna Polarisation	EUT Polarisation
No signals observed within 20 dB of limit				

Setup Table

Band	869-894 MHz
Power Level	46 dBm
Channel Spacing	5 MHz
Mod Scheme	16QAM
Mid channel	881.5 MHz

Spurious Frequency (MHz)	Measured Spurious Level (dBm)	Difference to Limit (dB)	Antenna Polarisation	EUT Polarisation
No signals observed within 20 dB of limit				

Setup Table

Band	869-894 MHz
Power Level	46 dBm
Channel Spacing	5 MHz
Mod Scheme	16QAM
High channel	891.5 MHz

Spurious Frequency (MHz)	Measured Spurious Level (dBm)	Difference to Limit (dB)	Antenna Polarisation	EUT Polarisation
No signals observed within 20 dB of limit				

Setup Table

Band	869-894 MHz
Power Level	46 dBm
Channel Spacing	10 MHz
Mod Scheme	16QAM
Low channel	874 MHz

Spurious Frequency (MHz)	Measured Spurious Level (dBm)	Difference to Limit (dB)	Antenna Polarisation	EUT Polarisation
No signals observed within 20 dB of limit				

Setup Table

Band	869-894 MHz
Power Level	46 dBm
Channel Spacing	10 MHz
Mod Scheme	16QAM
Mid channel	881.5 MHz

Spurious Frequency (MHz)	Measured Spurious Level (dBm)	Difference to Limit (dB)	Antenna Polarisation	EUT Polarisation
No signals observed within 20 dB of limit				

Setup Table

Band	869-894 MHz
Power Level	46 dBm
Channel Spacing	10 MHz
Mod Scheme	16QAM
High channel	889 MHz

Spurious Frequency (MHz)	Measured Spurious Level (dBm)	Difference to Limit (dB)	Antenna Polarisation	EUT Polarisation
No signals observed within 20 dB of limit				

Setup Table

Band	869-894 MHz
Power Level	46 dBm
Channel Spacing	15 MHz
Mod Scheme	16QAM
Low channel	876.5 MHz

Spurious Frequency (MHz)	Measured Spurious Level (dBm)	Difference to Limit (dB)	Antenna Polarisation	EUT Polarisation
No signals observed within 20 dB of limit				

Setup Table

Band	869-894 MHz
Power Level	46 dBm
Channel Spacing	15 MHz
Mod Scheme	16QAM
Mid channel	881.5 MHz

Spurious Frequency (MHz)	Measured Spurious Level (dBm)	Difference to Limit (dB)	Antenna Polarisation	EUT Polarisation
No signals observed within 20 dB of limit				

Setup Table

Band	869-894 MHz
Power Level	46 dBm
Channel Spacing	15 MHz
Mod Scheme	16QAM
High channel	886.5 MHz

Spurious Frequency (MHz)	Measured Spurious Level (dBm)	Difference to Limit (dB)	Antenna Polarisation	EUT Polarisation
No signals observed within 20 dB of limit				

Setup Table

Band	869-894 MHz
Power Level	46 dBm
Channel Spacing	20 MHz
Mod Scheme	16QAM
Low channel	879 MHz

Spurious Frequency (MHz)	Measured Spurious Level (dBm)	Difference to Limit (dB)	Antenna Polarisation	EUT Polarisation
No signals observed within 20 dB of limit				

Setup Table

Band	869-894 MHz
Power Level	46 dBm
Channel Spacing	20 MHz
Mod Scheme	16QAM
Mid channel	881.5 MHz

Spurious Frequency (MHz)	Measured Spurious Level (dBm)	Difference to Limit (dB)	Antenna Polarisation	EUT Polarisation
No signals observed within 20 dB of limit				

Setup Table

Band	869-894 MHz
Power Level	46 dBm
Channel Spacing	20 MHz
Mod Scheme	16QAM
High channel	884 MHz

Spurious Frequency (MHz)	Measured Spurious Level (dBm)	Difference to Limit (dB)	Antenna Polarisation	EUT Polarisation
No signals observed within 20 dB of limit				

Setup Table

Band	869-894 MHz
Power Level	46 dBm
Channel Spacing	5 MHz
Mod Scheme	64QAM
Low channel	871.5 MHz

Spurious Frequency (MHz)	Measured Spurious Level (dBm)	Difference to Limit (dB)	Antenna Polarisation	EUT Polarisation
No signals observed within 20 dB of limit				

Setup Table

Band	869-894 MHz
Power Level	46 dBm
Channel Spacing	5 MHz
Mod Scheme	64QAM
Mid channel	881.5 MHz

Spurious Frequency (MHz)	Measured Spurious Level (dBm)	Difference to Limit (dB)	Antenna Polarisation	EUT Polarisation
No signals observed within 20 dB of limit				

Setup Table

Band	869-894 MHz
Power Level	46 dBm
Channel Spacing	5 MHz
Mod Scheme	64QAM
High channel	891.5 MHz

Spurious Frequency (MHz)	Measured Spurious Level (dBm)	Difference to Limit (dB)	Antenna Polarisation	EUT Polarisation
No signals observed within 20 dB of limit				

Setup Table

Band	869-894 MHz
Power Level	46 dBm
Channel Spacing	10 MHz
Mod Scheme	64QAM
Low channel	874 MHz

Spurious Frequency (MHz)	Measured Spurious Level (dBm)	Difference to Limit (dB)	Antenna Polarisation	EUT Polarisation
No signals observed within 20 dB of limit				

Setup Table

Band	869-894 MHz
Power Level	46 dBm
Channel Spacing	10 MHz
Mod Scheme	64QAM
Mid channel	881.5 MHz

Spurious Frequency (MHz)	Measured Spurious Level (dBm)	Difference to Limit (dB)	Antenna Polarisation	EUT Polarisation
No signals observed within 20 dB of limit				

Setup Table

Band	869-894 MHz
Power Level	46 dBm
Channel Spacing	10 MHz
Mod Scheme	64QAM
High channel	889 MHz

Spurious Frequency (MHz)	Measured Spurious Level (dBm)	Difference to Limit (dB)	Antenna Polarisation	EUT Polarisation
No signals observed within 20 dB of limit				

Setup Table

Band	869-894 MHz
Power Level	46 dBm
Channel Spacing	15 MHz
Mod Scheme	64QAM
Low channel	876.5 MHz

Spurious Frequency (MHz)	Measured Spurious Level (dBm)	Difference to Limit (dB)	Antenna Polarisation	EUT Polarisation
No signals observed within 20 dB of limit				

Setup Table

Band	869-894 MHz
Power Level	46 dBm
Channel Spacing	15 MHz
Mod Scheme	64QAM
Mid channel	881.5 MHz

Spurious Frequency (MHz)	Measured Spurious Level (dBm)	Difference to Limit (dB)	Antenna Polarisation	EUT Polarisation
No signals observed within 20 dB of limit				

Setup Table

Band	869-894 MHz
Power Level	46 dBm
Channel Spacing	15 MHz
Mod Scheme	64QAM
High channel	886.5 MHz

Spurious Frequency (MHz)	Measured Spurious Level (dBm)	Difference to Limit (dB)	Antenna Polarisation	EUT Polarisation
No signals observed within 20 dB of limit				

Setup Table

Band	869-894 MHz
Power Level	46 dBm
Channel Spacing	20 MHz
Mod Scheme	64QAM
Low channel	879 MHz

Spurious Frequency (MHz)	Measured Spurious Level (dBm)	Difference to Limit (dB)	Antenna Polarisation	EUT Polarisation
No signals observed within 20 dB of limit				

Setup Table

Band	869-894 MHz
Power Level	46 dBm
Channel Spacing	20 MHz
Mod Scheme	64QAM
Mid channel	881.5 MHz

Spurious Frequency (MHz)	Measured Spurious Level (dBm)	Difference to Limit (dB)	Antenna Polarisation	EUT Polarisation
No signals observed within 20 dB of limit				

Setup Table

Band	869-894 MHz
Power Level	46 dBm
Channel Spacing	20 MHz
Mod Scheme	64QAM
High channel	884 MHz

Spurious Frequency (MHz)	Measured Spurious Level (dBm)	Difference to Limit (dB)	Antenna Polarisation	EUT Polarisation
No signals observed within 20 dB of limit				

Setup Table

Band	869-894 MHz
Power Level	46 dBm
Channel Spacing	5 MHz
Mod Scheme	256QAM
Low channel	871.5 MHz

Spurious Frequency (MHz)	Measured Spurious Level (dBm)	Difference to Limit (dB)	Antenna Polarisation	EUT Polarisation
No signals observed within 20 dB of limit				

Setup Table

Band	869-894 MHz
Power Level	46 dBm
Channel Spacing	5 MHz
Mod Scheme	256QAM
Mid channel	881.5 MHz

Spurious Frequency (MHz)	Measured Spurious Level (dBm)	Difference to Limit (dB)	Antenna Polarisation	EUT Polarisation
No signals observed within 20 dB of limit				

Setup Table

Band	869-894 MHz
Power Level	46 dBm
Channel Spacing	5 MHz
Mod Scheme	256QAM
High channel	891.5 MHz

Spurious Frequency (MHz)	Measured Spurious Level (dBm)	Difference to Limit (dB)	Antenna Polarisation	EUT Polarisation
No signals observed within 20 dB of limit				

Setup Table

Band	869-894 MHz
Power Level	46 dBm
Channel Spacing	10 MHz
Mod Scheme	256QAM
Low channel	874 MHz

Spurious Frequency (MHz)	Measured Spurious Level (dBm)	Difference to Limit (dB)	Antenna Polarisation	EUT Polarisation
No signals observed within 20 dB of limit				

Setup Table

Band	869-894 MHz
Power Level	46 dBm
Channel Spacing	10 MHz
Mod Scheme	256QAM
Mid channel	881.5 MHz

Spurious Frequency (MHz)	Measured Spurious Level (dBm)	Difference to Limit (dB)	Antenna Polarisation	EUT Polarisation
No signals observed within 20 dB of limit				

Setup Table

Band	869-894 MHz
Power Level	46 dBm
Channel Spacing	10 MHz
Mod Scheme	256QAM
High channel	889 MHz

Spurious Frequency (MHz)	Measured Spurious Level (dBm)	Difference to Limit (dB)	Antenna Polarisation	EUT Polarisation
No signals observed within 20 dB of limit				

Setup Table

Band	869-894 MHz
Power Level	46 dBm
Channel Spacing	15 MHz
Mod Scheme	256QAM
Low channel	876.5 MHz

Spurious Frequency (MHz)	Measured Spurious Level (dBm)	Difference to Limit (dB)	Antenna Polarisation	EUT Polarisation
No signals observed within 20 dB of limit				

Setup Table

Band	869-894 MHz
Power Level	46 dBm
Channel Spacing	15 MHz
Mod Scheme	256QAM
Mid channel	881.5 MHz

Spurious Frequency (MHz)	Measured Spurious Level (dBm)	Difference to Limit (dB)	Antenna Polarisation	EUT Polarisation
No signals observed within 20 dB of limit				

Setup Table

Band	869-894 MHz
Power Level	46 dBm
Channel Spacing	15 MHz
Mod Scheme	256QAM
High channel	886.5 MHz

Spurious Frequency (MHz)	Measured Spurious Level (dBm)	Difference to Limit (dB)	Antenna Polarisation	EUT Polarisation
No signals observed within 20 dB of limit				

Setup Table

Band	869-894 MHz
Power Level	46 dBm
Channel Spacing	20 MHz
Mod Scheme	256QAM
Low channel	879 MHz

Spurious Frequency (MHz)	Measured Spurious Level (dBm)	Difference to Limit (dB)	Antenna Polarisation	EUT Polarisation
No signals observed within 20 dB of limit				

Setup Table

Band	869-894 MHz
Power Level	46 dBm
Channel Spacing	20 MHz
Mod Scheme	256QAM
Mid channel	881.5 MHz

Spurious Frequency (MHz)	Measured Spurious Level (dBm)	Difference to Limit (dB)	Antenna Polarisation	EUT Polarisation
No signals observed within 20 dB of limit				

Setup Table

Band	869-894 MHz
Power Level	46 dBm
Channel Spacing	20 MHz
Mod Scheme	256QAM
High channel	884 MHz

Spurious Frequency (MHz)	Measured Spurious Level (dBm)	Difference to Limit (dB)	Antenna Polarisation	EUT Polarisation
No signals observed within 20 dB of limit				

LIMITS:

Part 22.917, -13 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 dB, 1 – 10 GHz \pm 3.5dB.

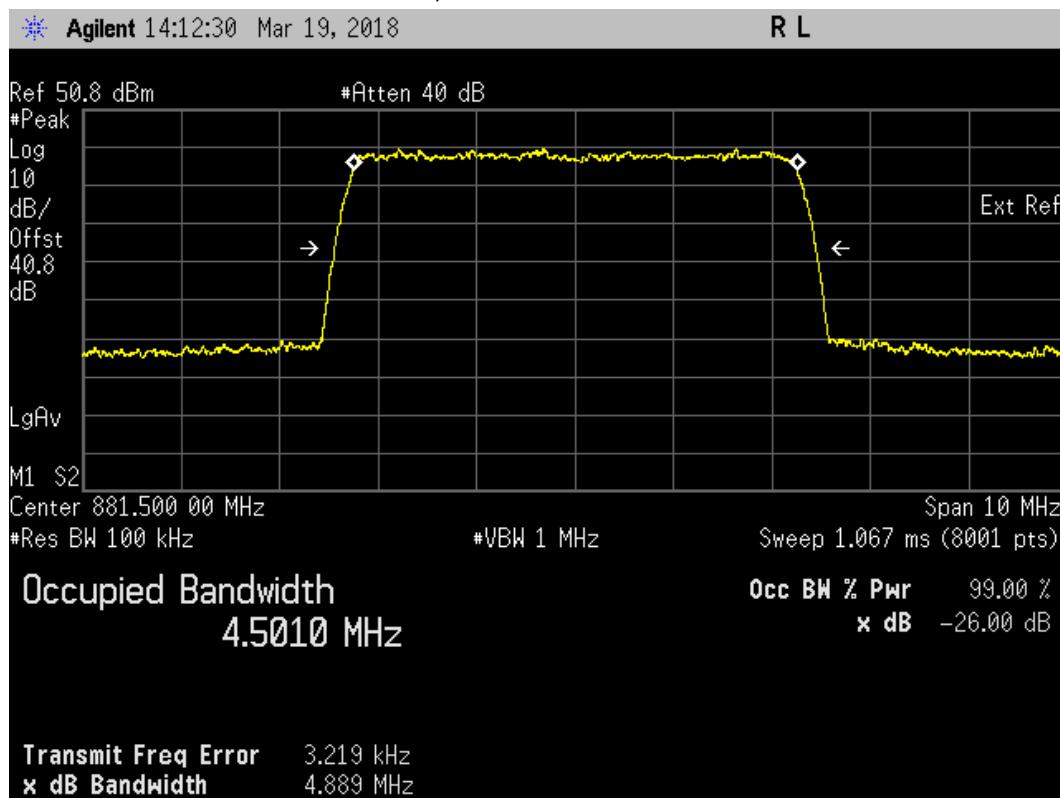
5.7 Modulation characteristics

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

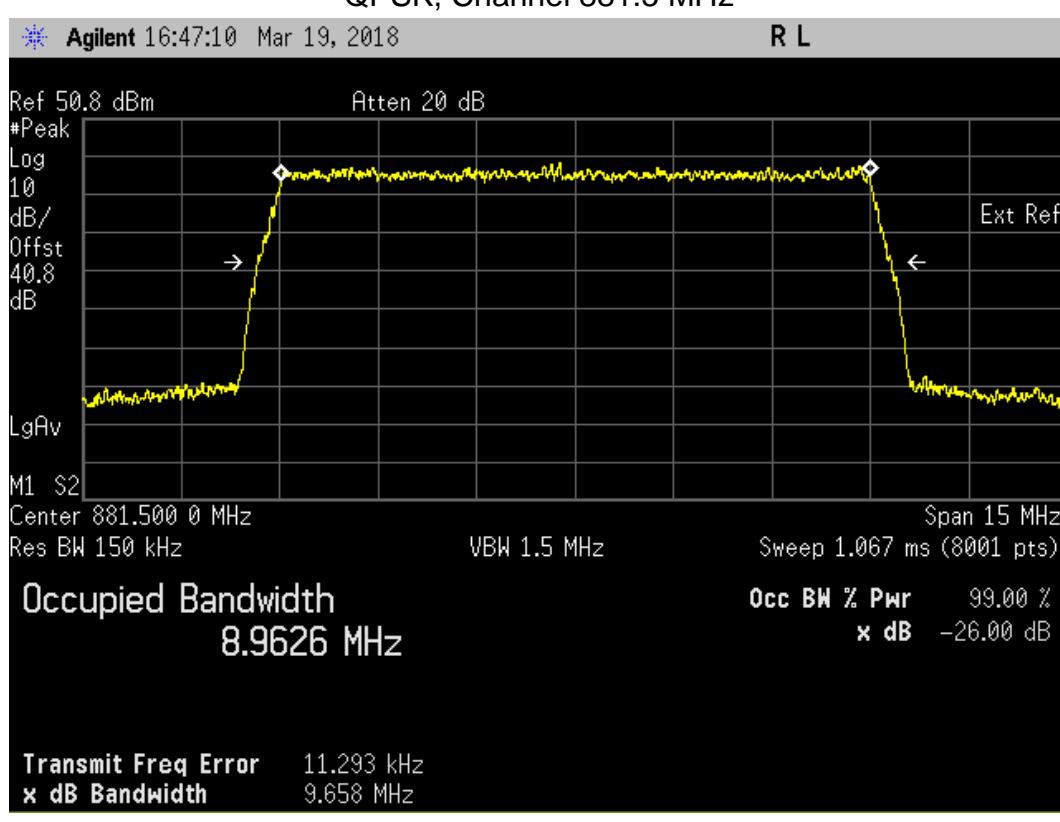
6 Plots/Graphical results

6.1 Occupied bandwidth

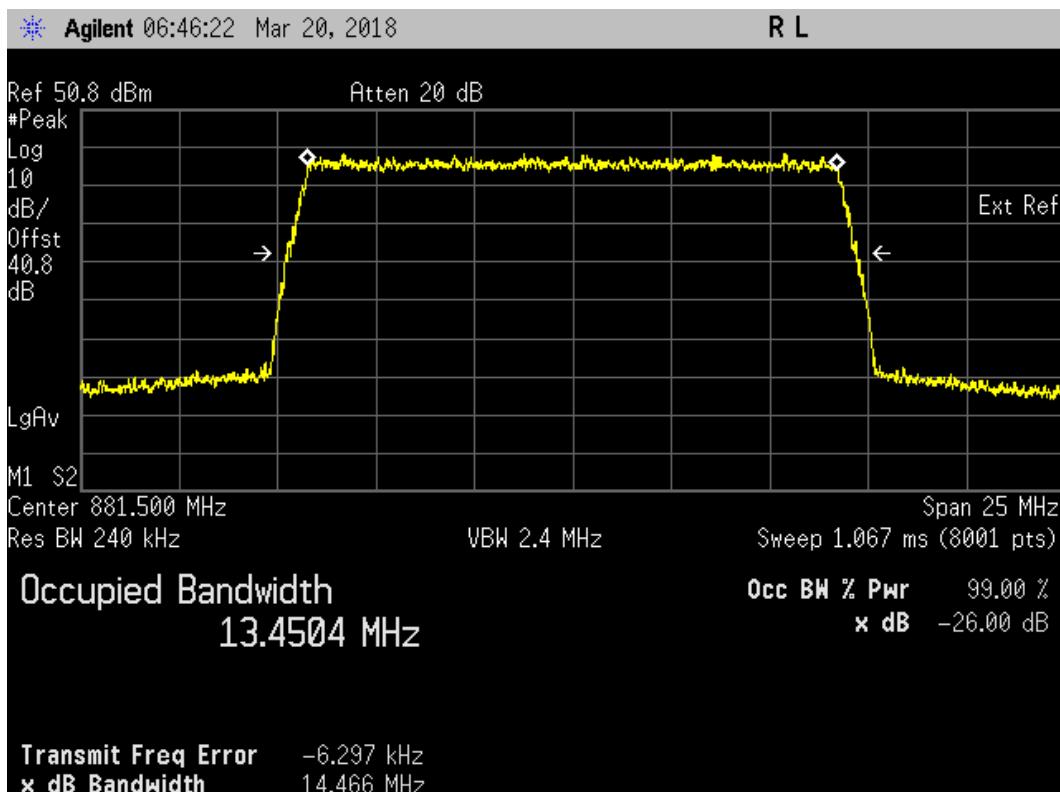
RF Parameters: Band 869-894 MHz, Power 46 dBm, Channel Spacing 5 MHz, Modulation QPSK, Channel 881.5 MHz



RF Parameters: Band 869-894 MHz, Power 46 dBm, Channel Spacing 10 MHz, Modulation QPSK, Channel 881.5 MHz

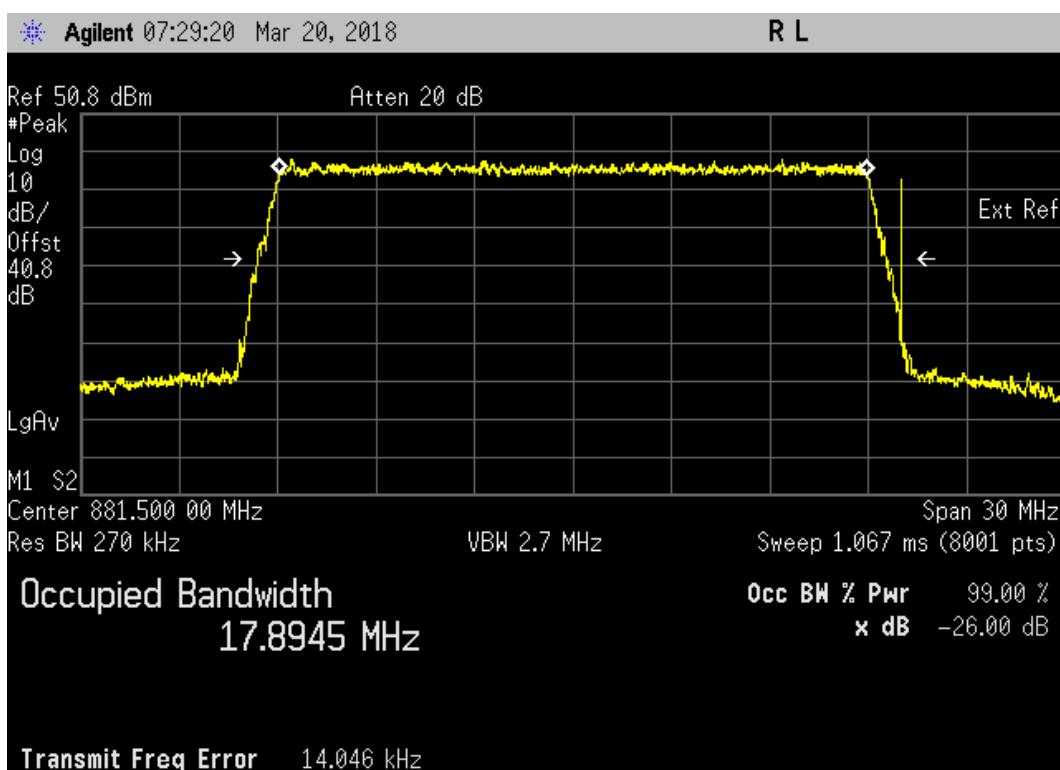


RF Parameters: Band 869-894 MHz, Power 46 dBm, Channel Spacing 15 MHz, Modulation QPSK, Channel 881.5 MHz



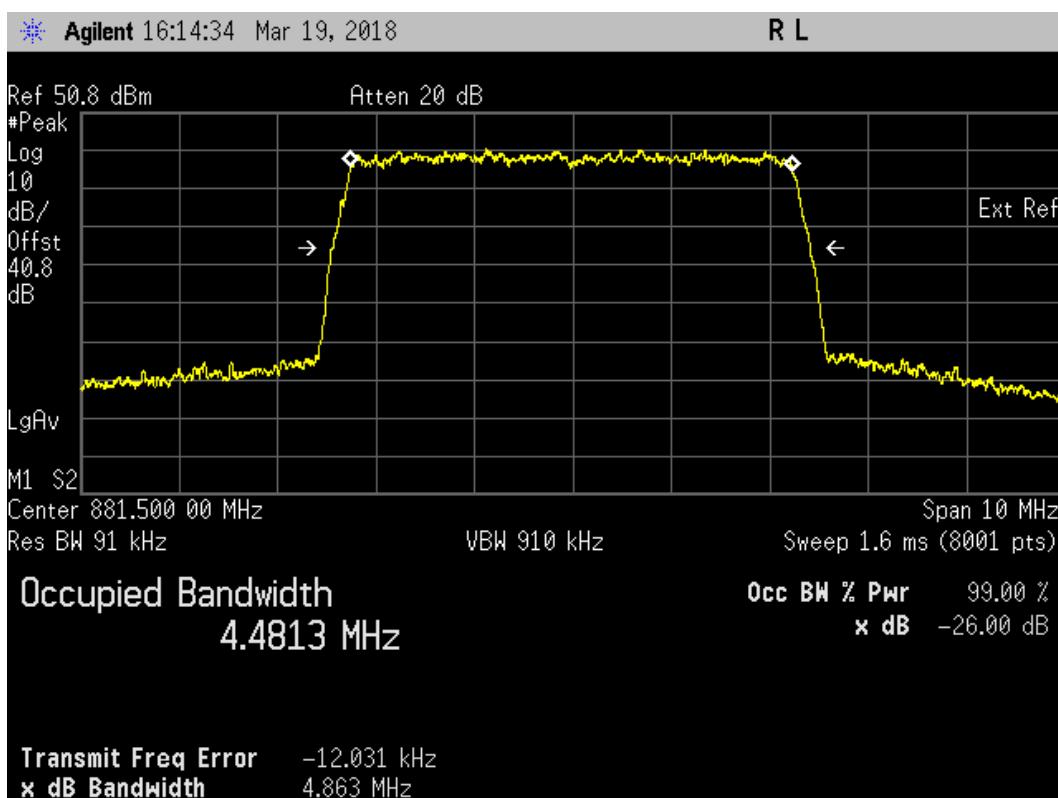
Plot for 99 % Bandwidth (MHz) Nominal Temp & Volts

RF Parameters: Band 869-894 MHz, Power 46 dBm, Channel Spacing 20 MHz, Modulation QPSK, Channel 881.5 MHz



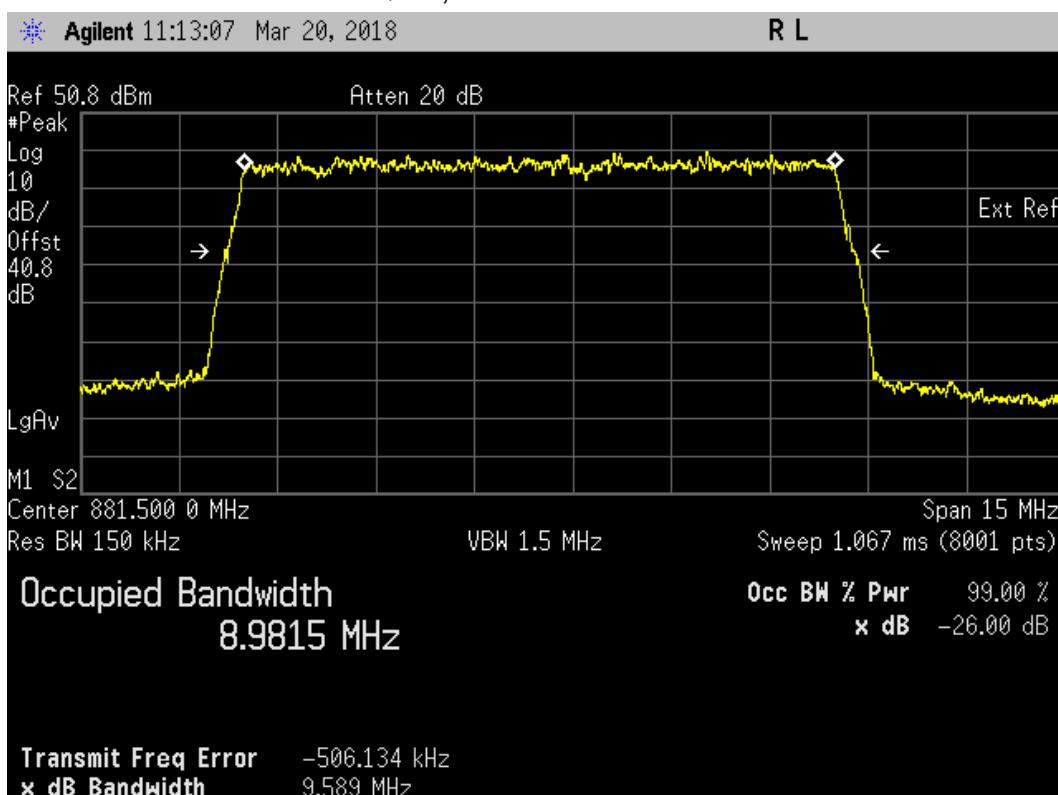
Plot for 99 % Bandwidth (MHz) Nominal Temp & Volts

RF Parameters: Band 869-894 MHz, Power 46 dBm, Channel Spacing 5 MHz, Modulation 16QAM, Channel 881.5 MHz



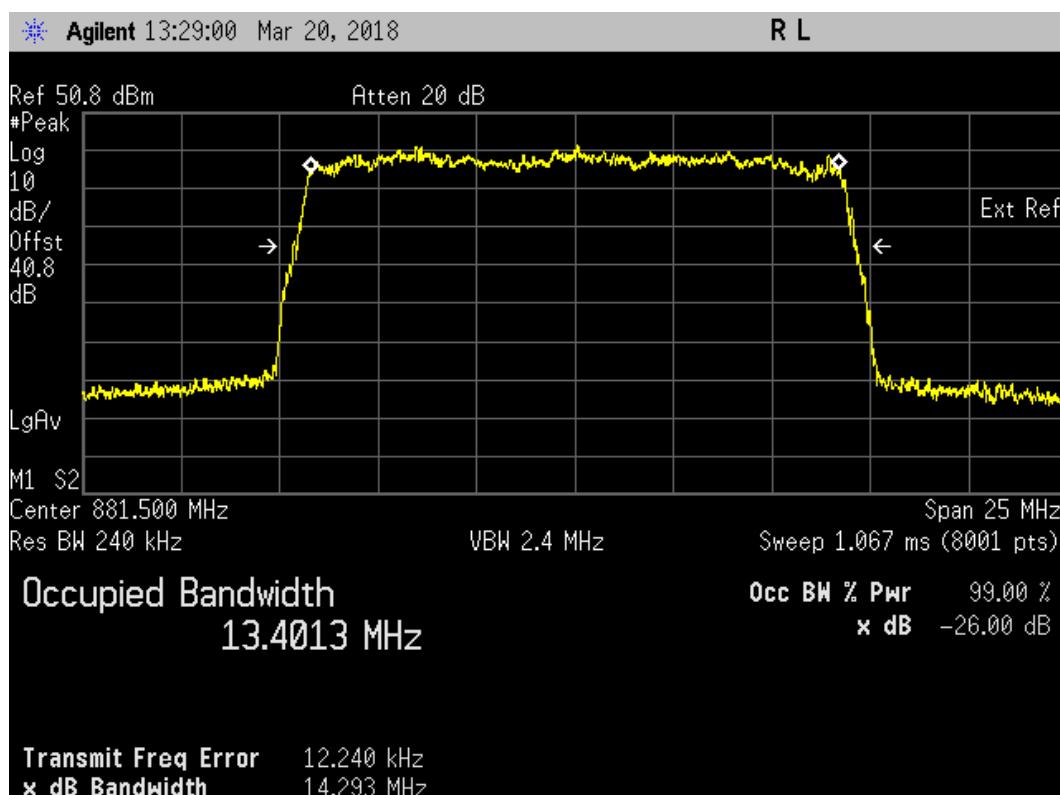
Plot for 99 % Bandwidth (MHz) Nominal Temp & Volts

RF Parameters: Band 869-894 MHz, Power 46 dBm, Channel Spacing 10 MHz, Modulation 16QAM, Channel 881.5 MHz



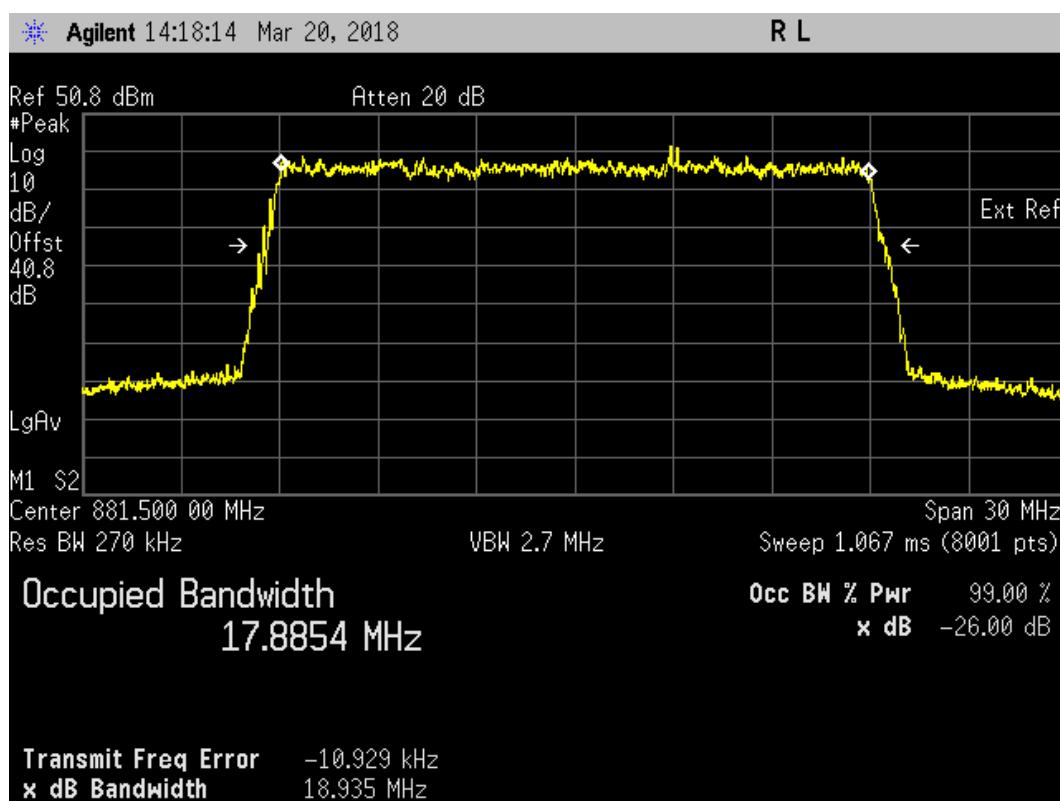
Plot for 99 % Bandwidth (MHz) Nominal Temp & Volts

RF Parameters: Band 869-894 MHz, Power 46 dBm, Channel Spacing 15 MHz, Modulation 16QAM, Channel 881.5 MHz



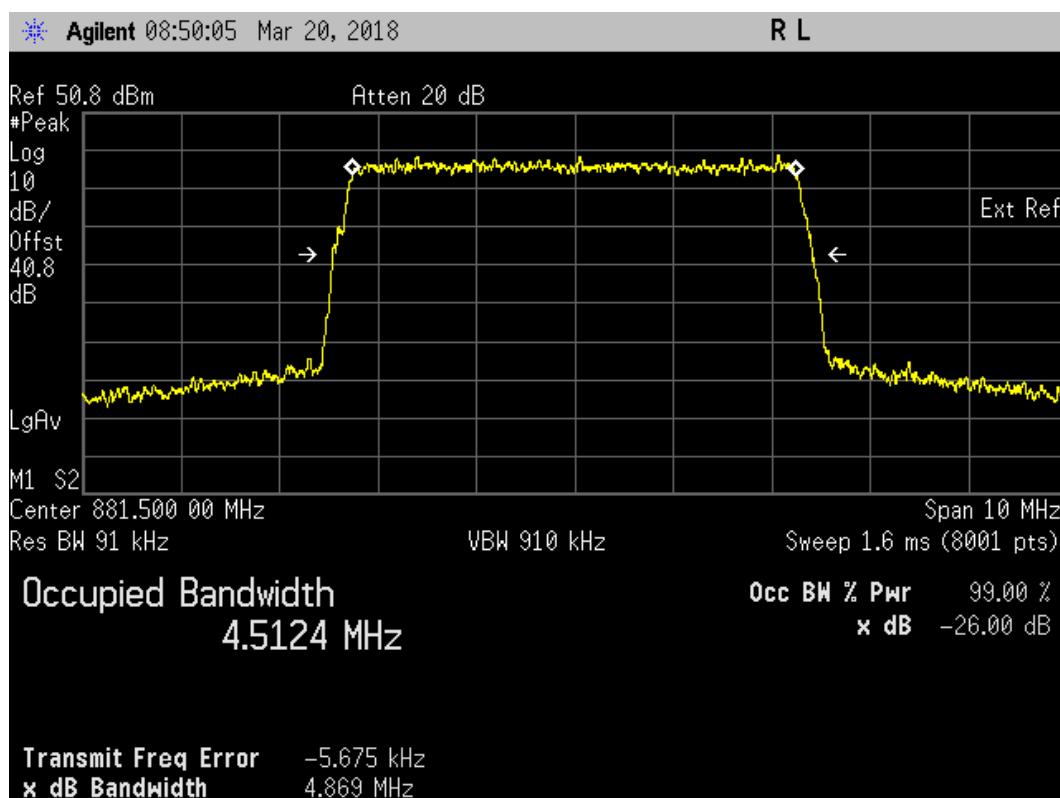
Plot for 99 % Bandwidth (MHz) Nominal Temp & Volts

RF Parameters: Band 869-894 MHz, Power 46 dBm, Channel Spacing 20 MHz, Modulation 16QAM, Channel 881.5 MHz



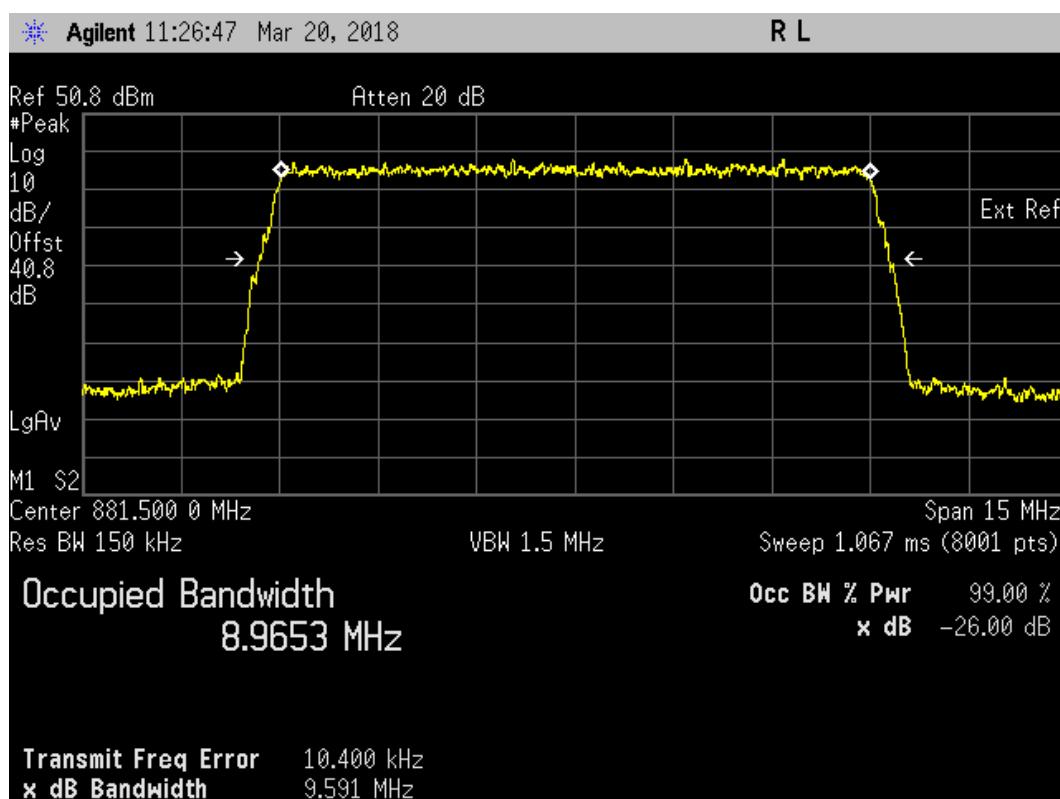
Plot for 99 % Bandwidth (MHz) Nominal Temp & Volts

RF Parameters: Band 869-894 MHz, Power 46 dBm, Channel Spacing 5 MHz, Modulation 64QAM, Channel 881.5 MHz



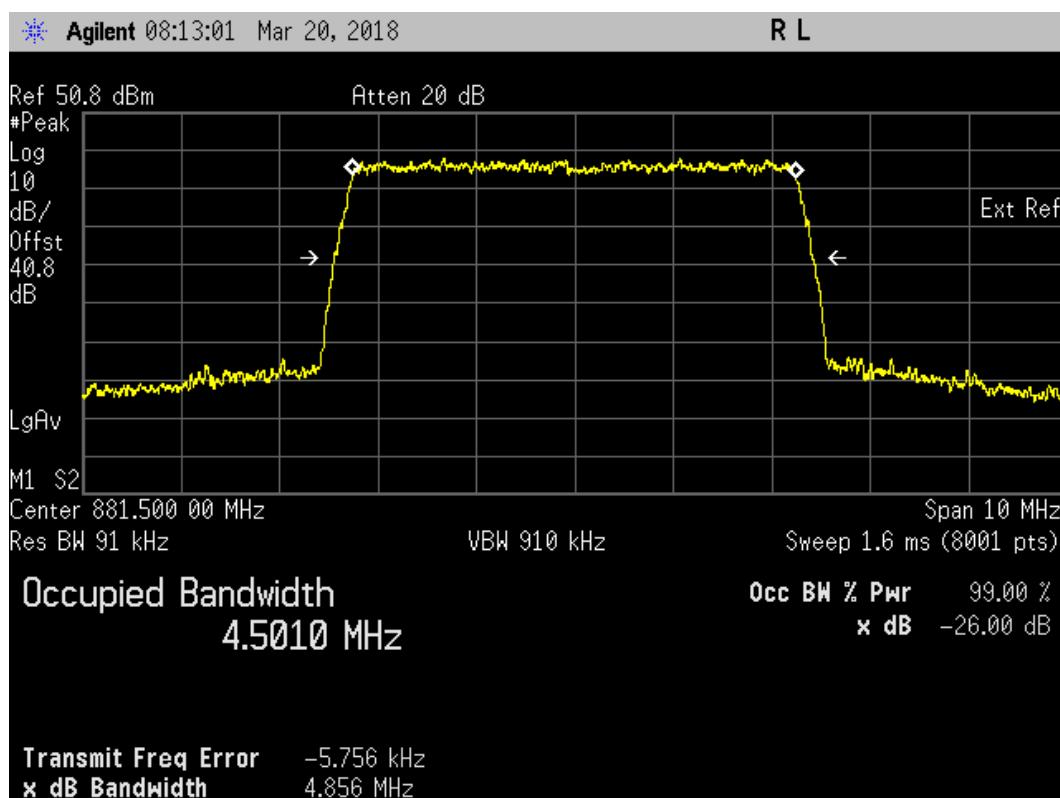
Plot for 99 % Bandwidth (MHz) Nominal Temp & Volts

RF Parameters: Band 869-894 MHz, Power 46 dBm, Channel Spacing 10 MHz, Modulation 64QAM, Channel 881.5 MHz



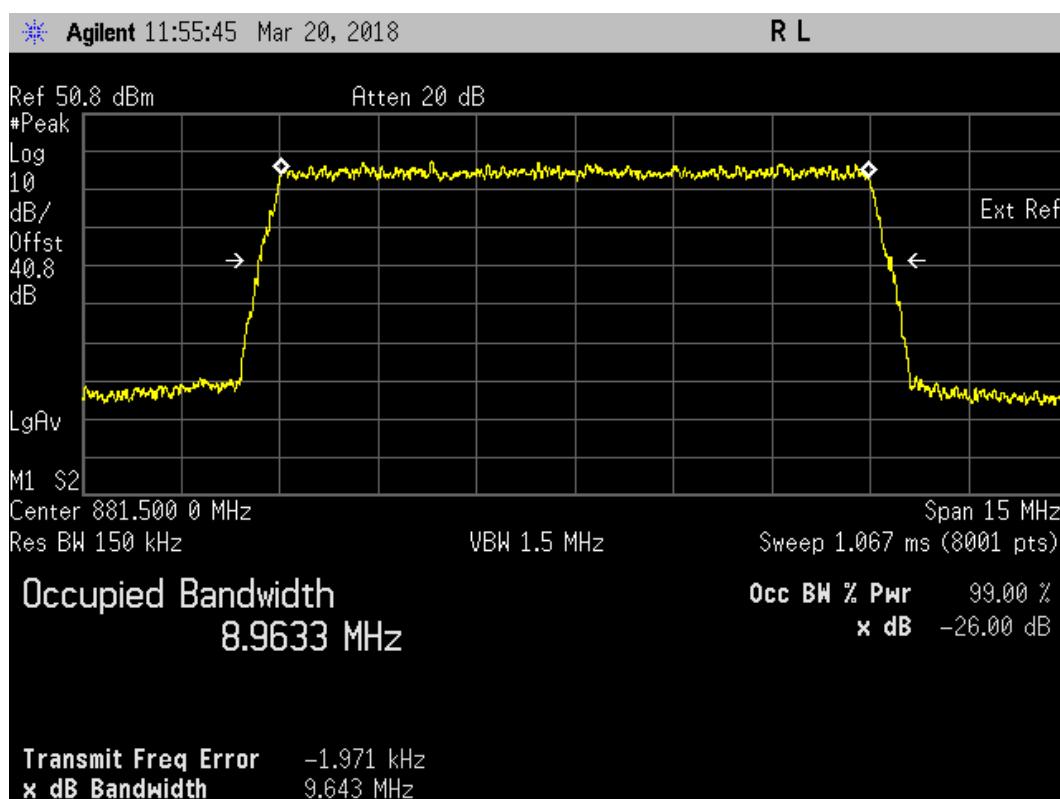
Plot for 99 % Bandwidth (MHz) Nominal Temp & Volts

RF Parameters: Band 869-894 MHz, Power 45.5 dBm, Channel Spacing 5 MHz, Modulation 256QAM, Channel 881.5 MHz



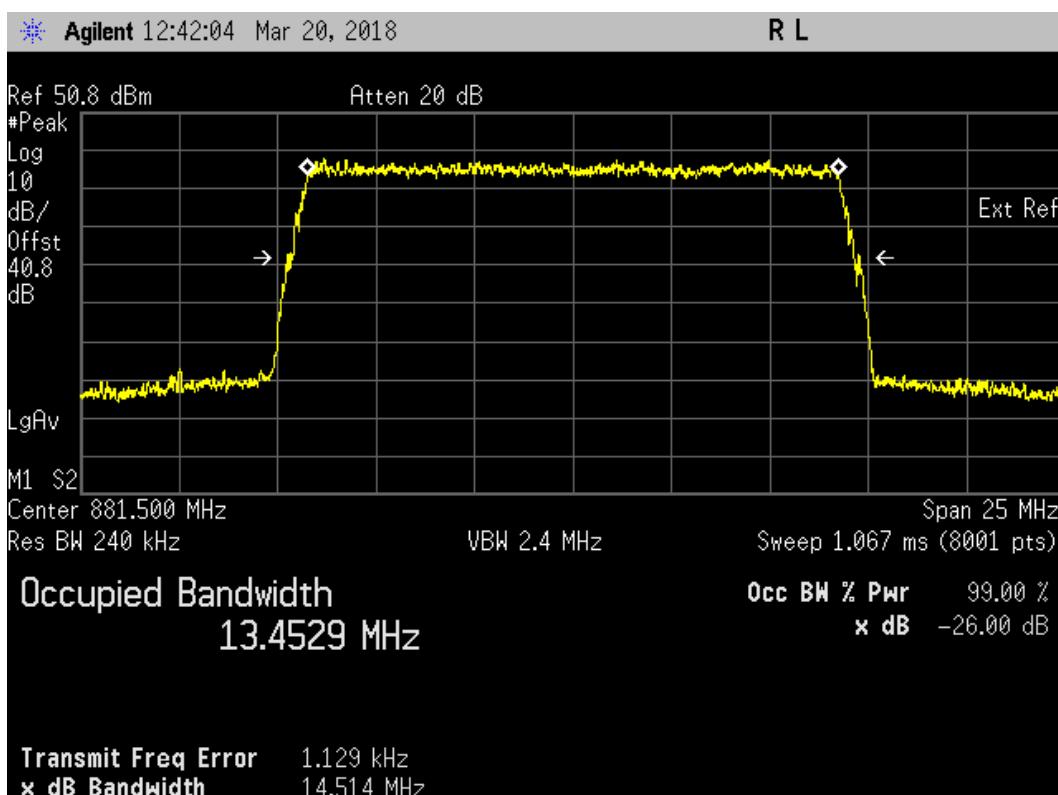
Plot for 99 % Bandwidth (MHz) Nominal Temp & Volts

RF Parameters: Band 869-894 MHz, Power 45.5 dBm, Channel Spacing 10 MHz, Modulation 256QAM, Channel 881.5 MHz



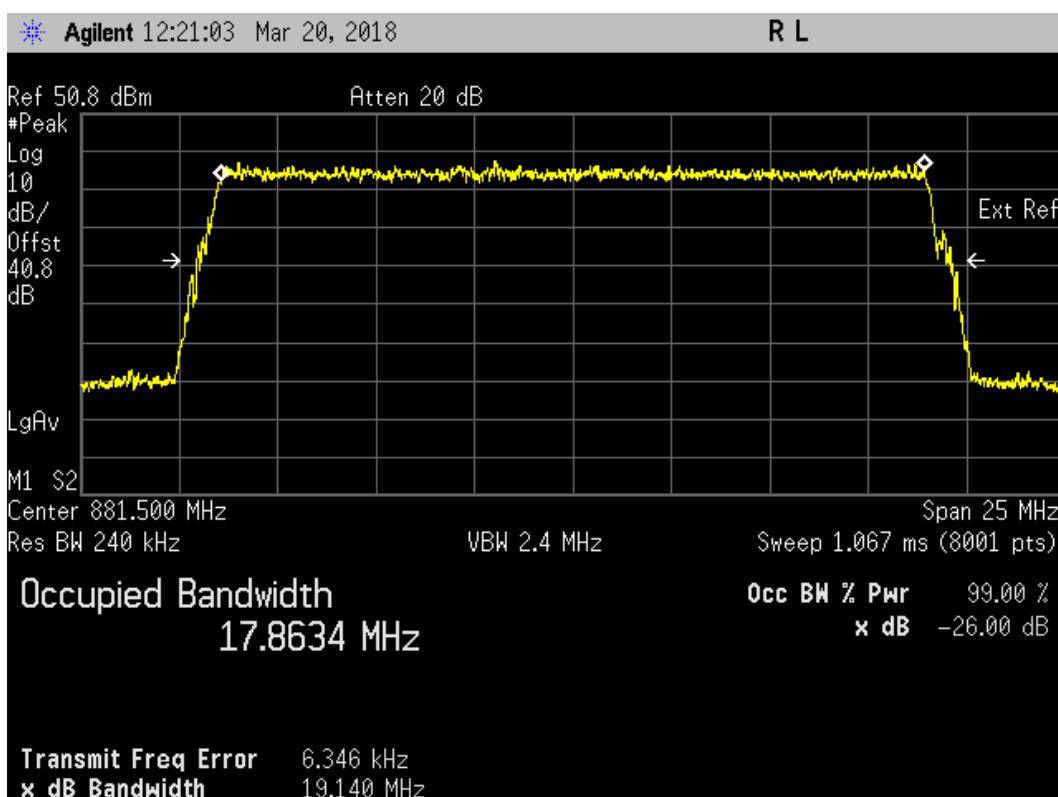
Plot for 99 % Bandwidth (MHz) Nominal Temp & Volts

RF Parameters: Band 869-894 MHz, Power 45.5 dBm, Channel Spacing 15 MHz, Modulation 256QAM, Channel 881.5 MHz



Plot for 99 % Bandwidth (MHz) Nominal Temp & Volts

RF Parameters: Band 869-894 MHz, Power 45.5 dBm, Channel Spacing 20 MHz, Modulation 256QAM, Channel 881.5 MHz

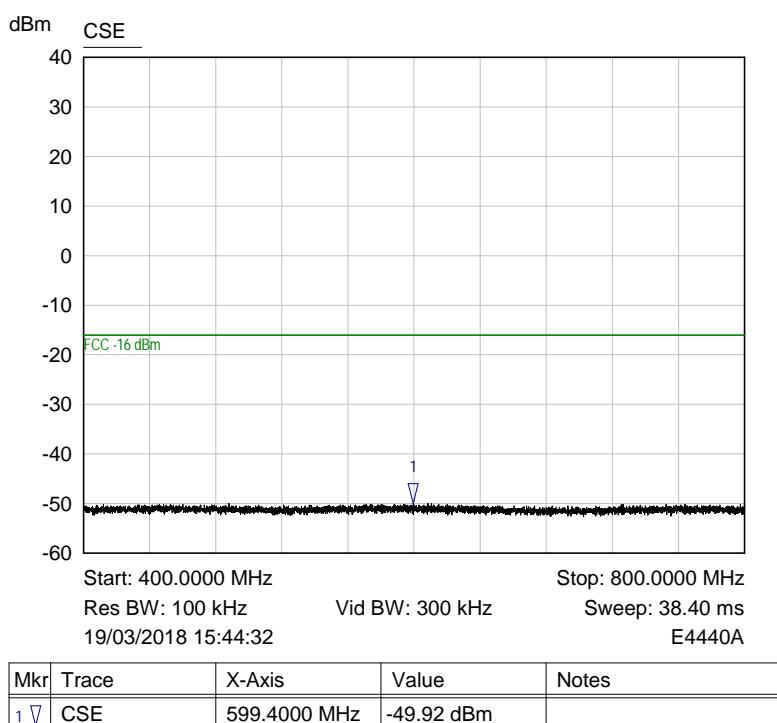
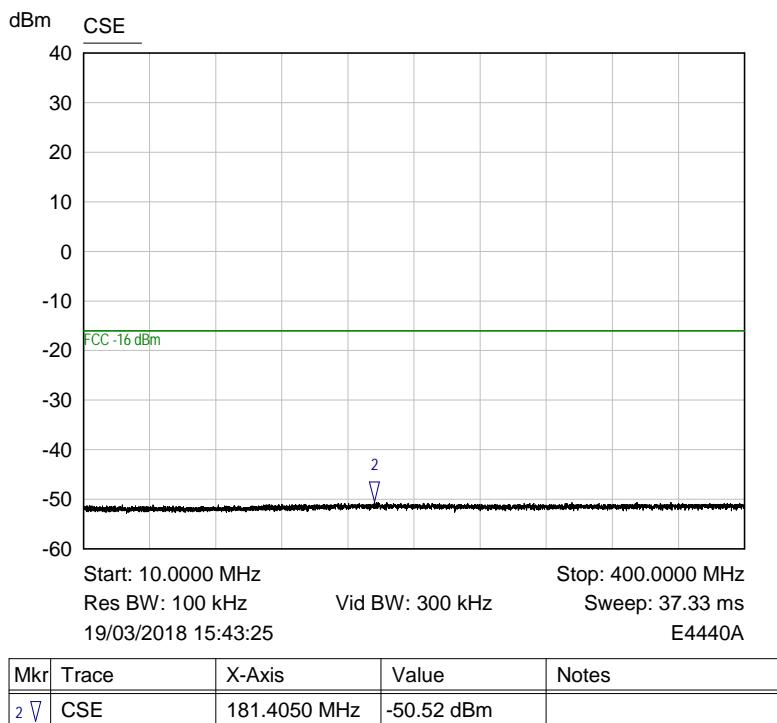


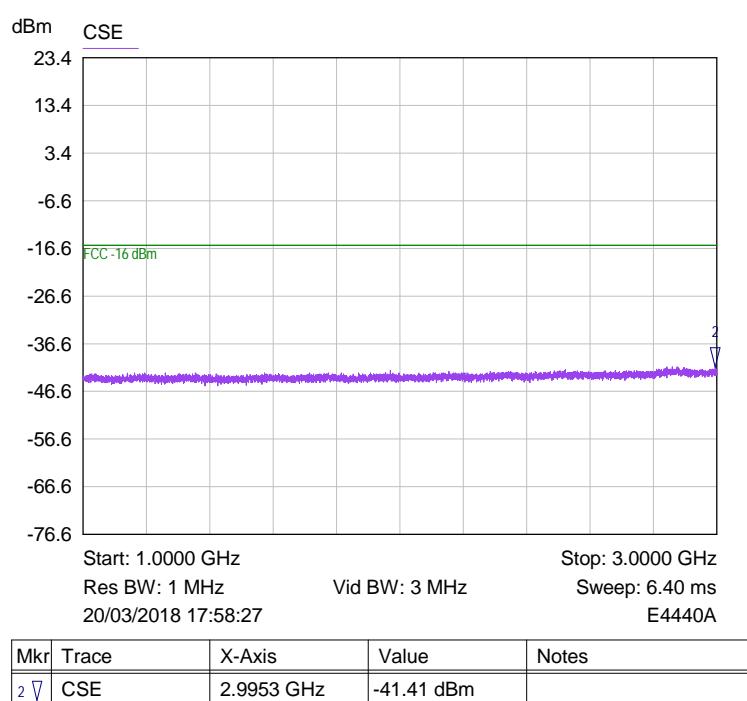
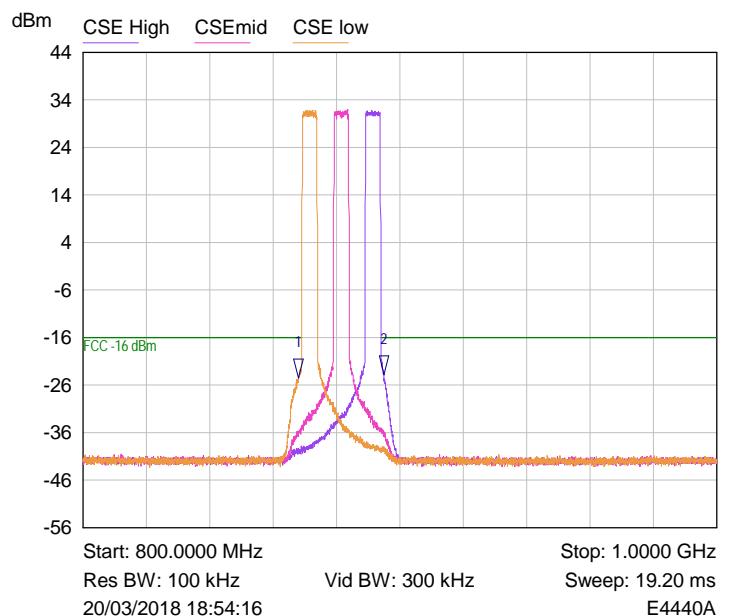
Plot for 99 % Bandwidth (MHz) Nominal Temp & Volts

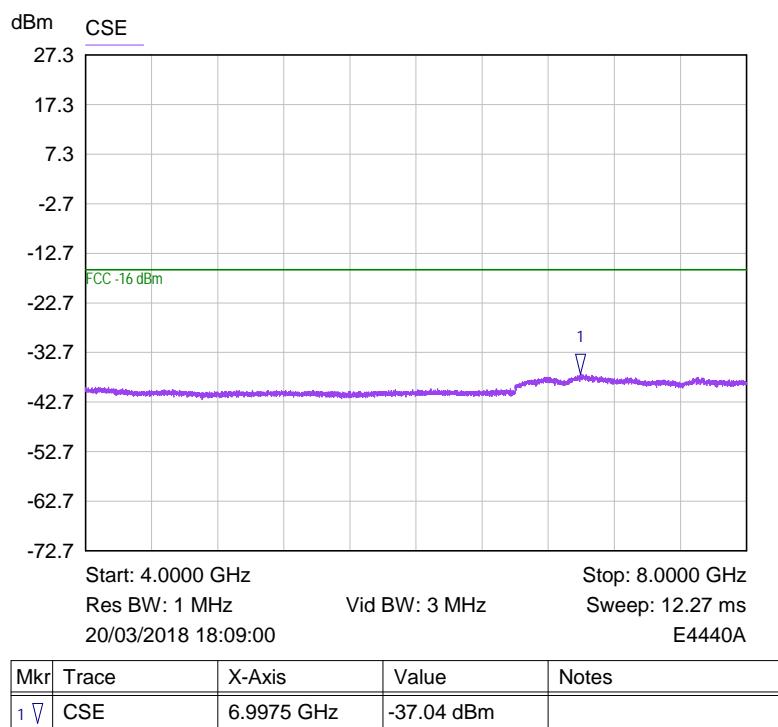
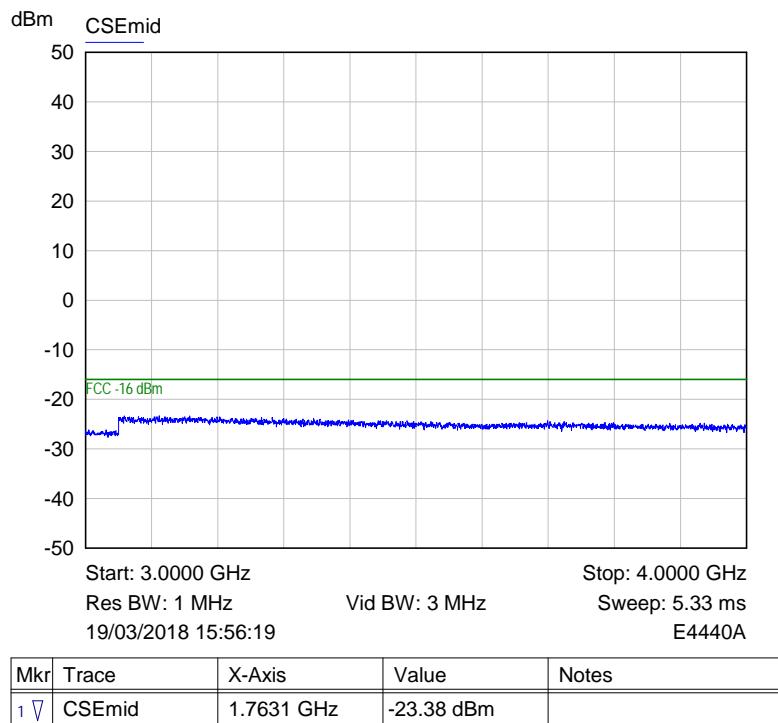
6.2 Spurious emissions at antenna terminals

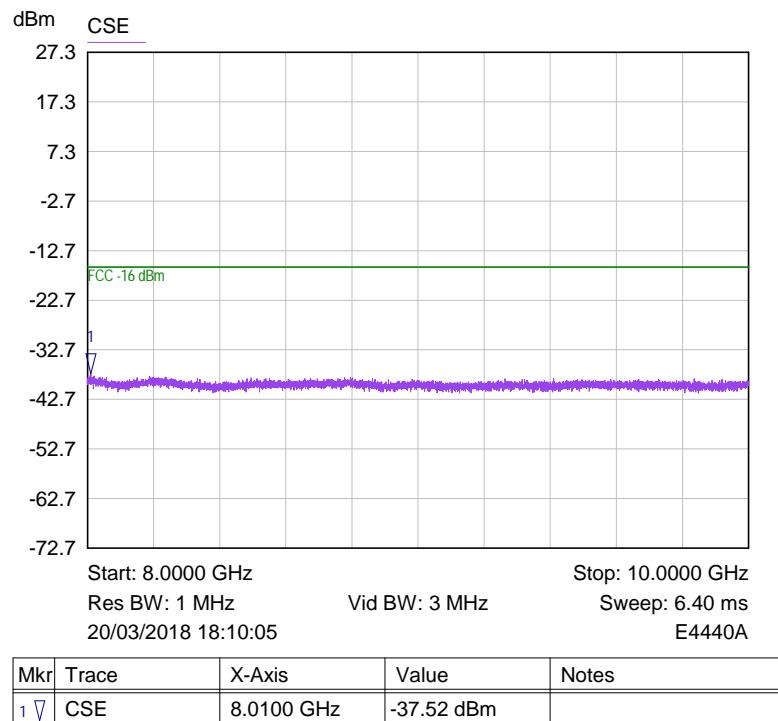
Note: Limit is -13 dBm from summed power outputs. As a visual aid limits shown on plots are referenced to -16dBm (3dB tighter than the limit to account for the 2nd RF port and additional 3dB from summing. Whilst Low, Mid and High channels have been tested in conjunction with Modulation schemes and bandwidths, and any signals reported, only middle channel plots for 5MHz spacing and QPSK modulation are shown in this report to minimise report size.

RF Parameters: Band 869-894 MHz, Power 46 dBm, Channel Spacing 5 MHz, Modulation QPSK, Channel 881.5 MHz



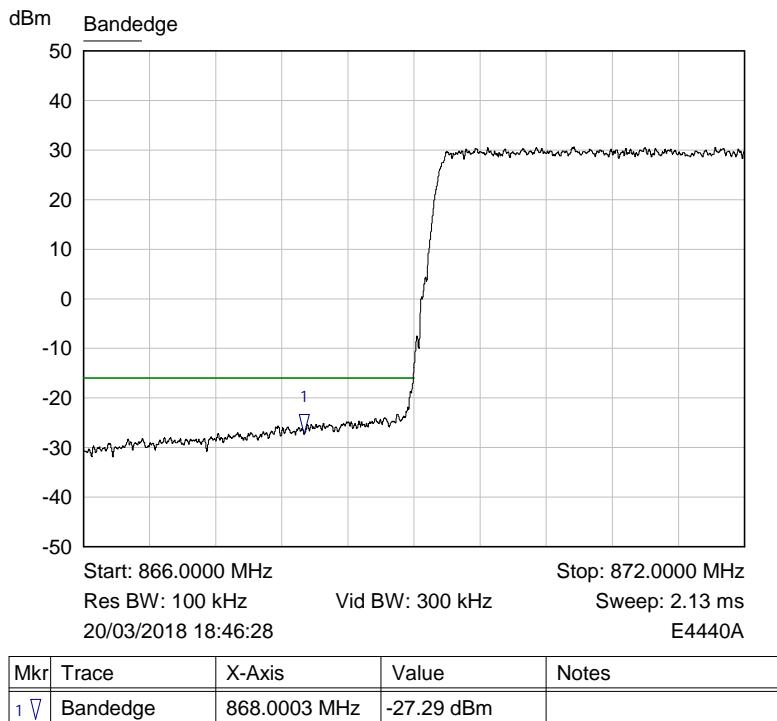




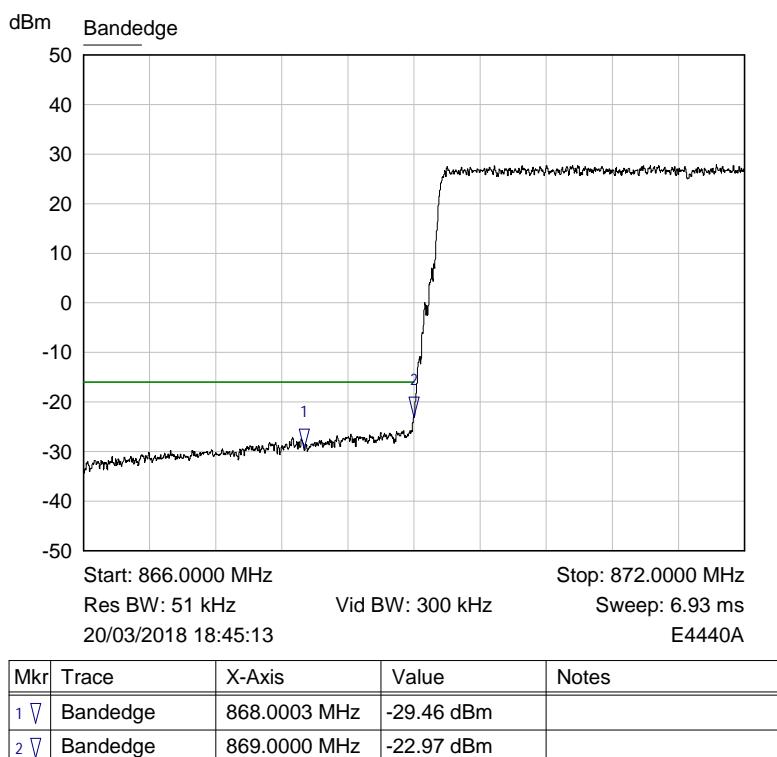


6.3 Band edge compliance

RF Parameters: Band 869-894 MHz, Power 46 dBm, Channel Spacing 5 MHz, Modulation QPSK, Channel 871.5 MHz

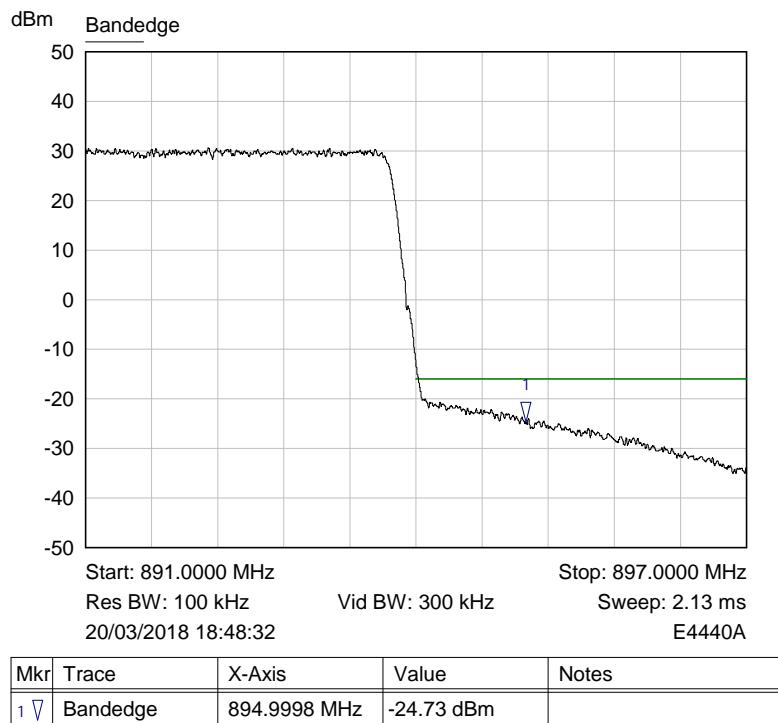


100kHz RBW plot

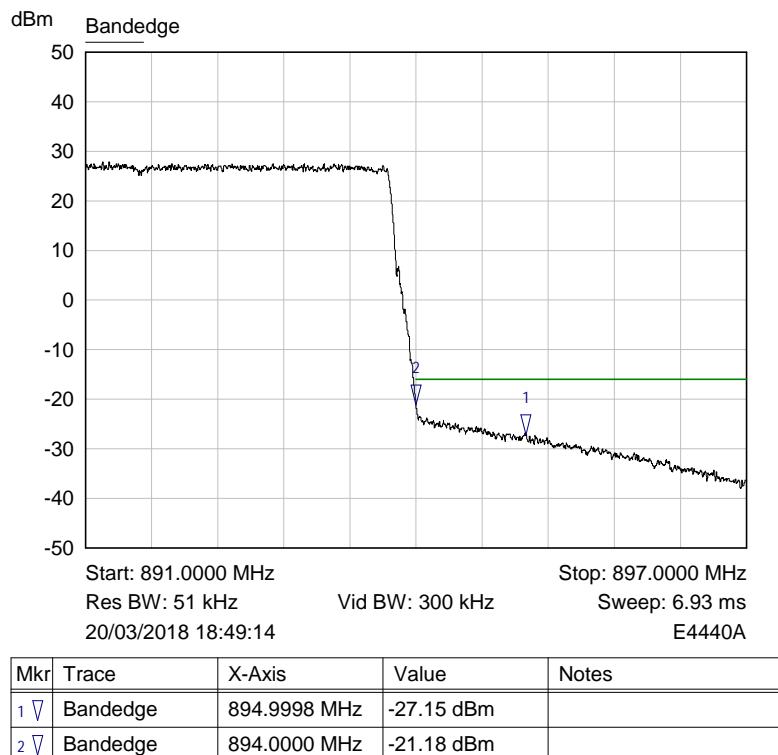


51kHz RBW plot

RF Parameters: Band 869-894 MHz, Power 46 dBm, Channel Spacing 5 MHz, Modulation QPSK, Channel 891.5 MHz

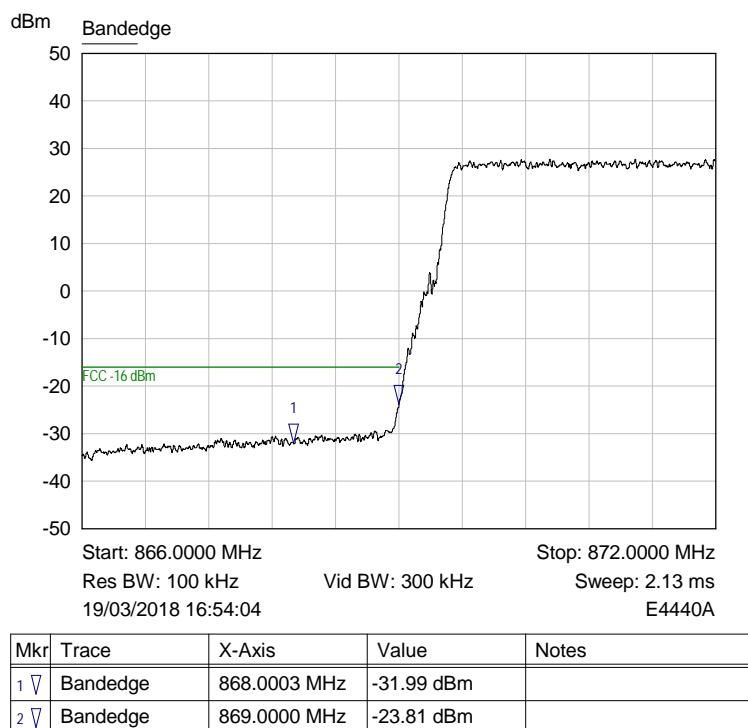


100kHz RBW plot



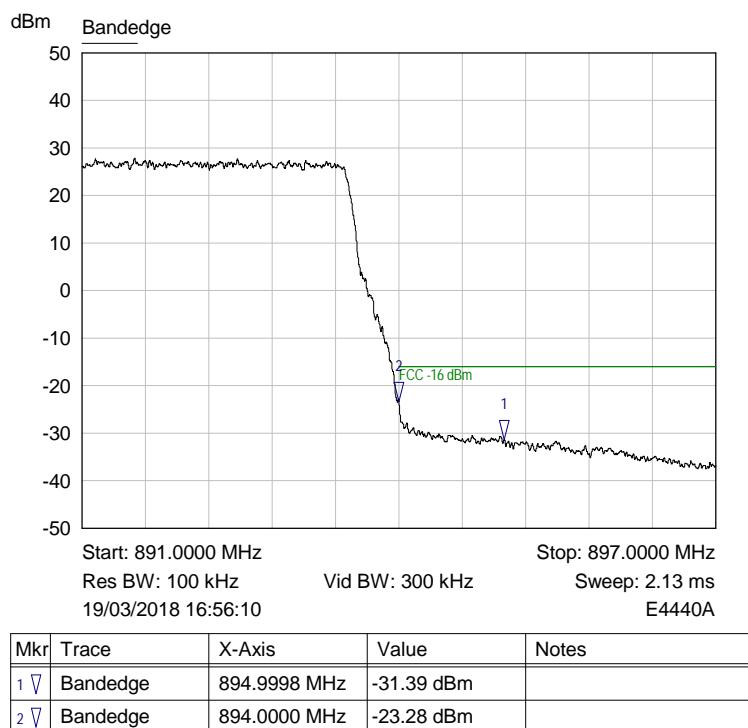
51kHz RBW plot

RF Parameters: Band 869-894 MHz, Power 46 dBm, Channel Spacing 10 MHz, Modulation QPSK, Channel 874.0 MHz



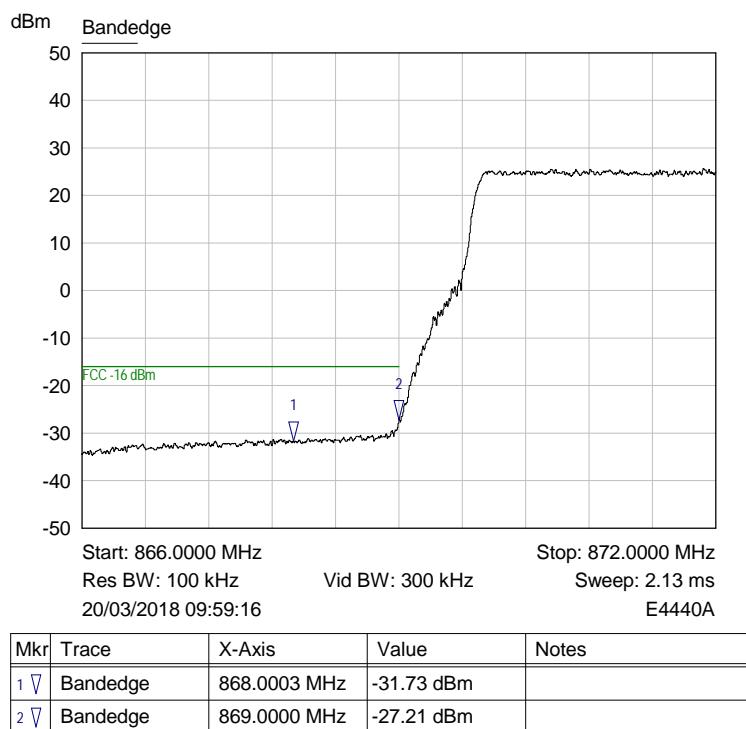
100kHz RBW plot

RF Parameters: Band 869-894 MHz, Power 46 dBm, Channel Spacing 10 MHz, Modulation QPSK, Channel 889.0 MHz



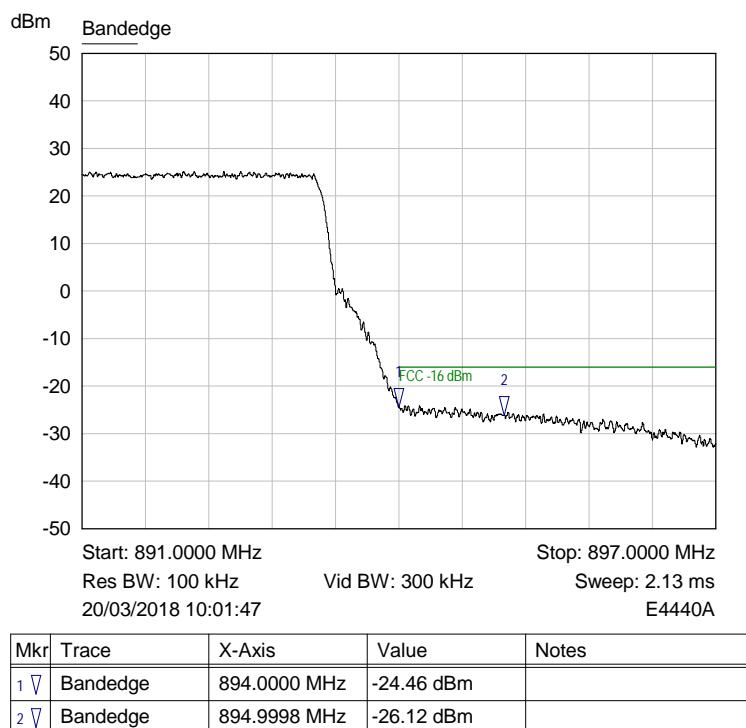
100kHz RBW plot

RF Parameters: Band 869-894 MHz, Power 46 dBm, Channel Spacing 15 MHz, Modulation QPSK, Channel 876.5 MHz



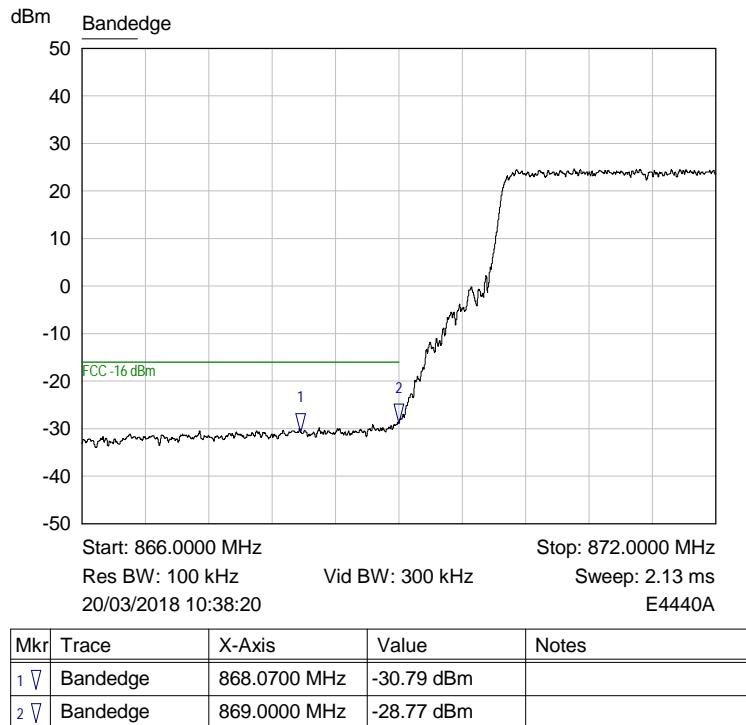
100kHz RBW plot

RF Parameters: Band 869-894 MHz, Power 46 dBm, Channel Spacing 15 MHz, Modulation QPSK, Channel 886.5 MHz



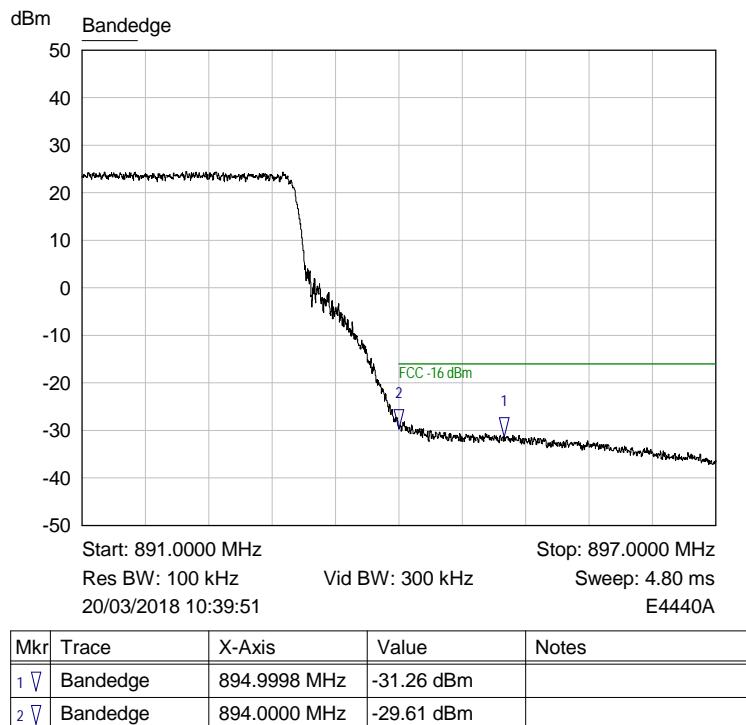
100kHz RBW plot

RF Parameters: Band 869-894 MHz, Power 46 dBm, Channel Spacing 20 MHz, Modulation QPSK, Channel 879.0 MHz



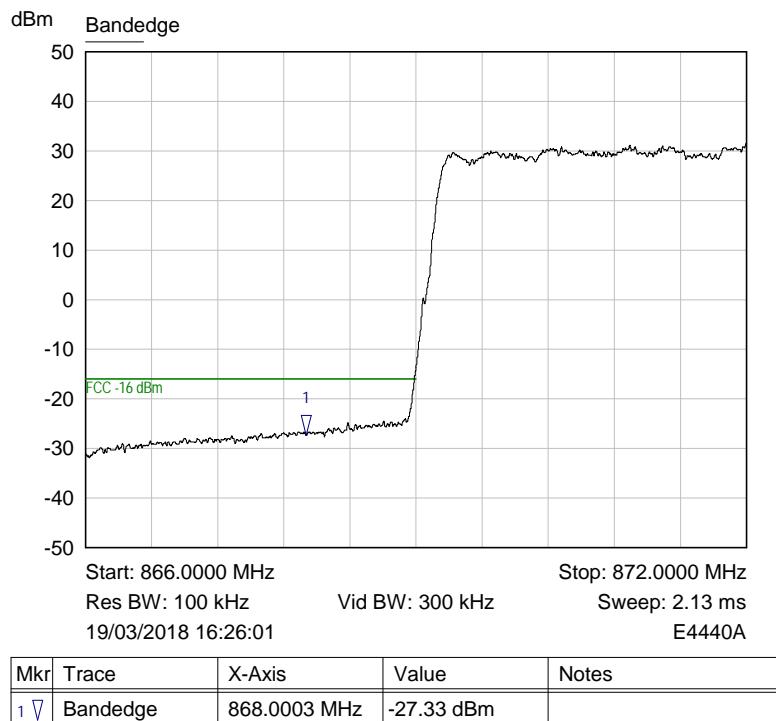
100kHz RBW plot

RF Parameters: Band 869-894 MHz, Power 46 dBm, Channel Spacing 20 MHz, Modulation QPSK, Channel 884.0 MHz

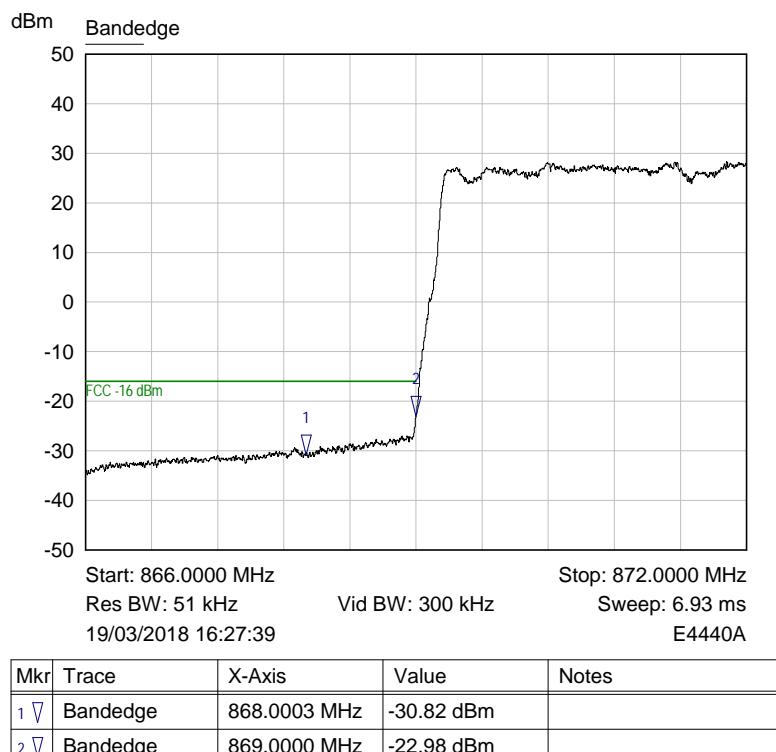


100kHz RBW plot

RF Parameters: Band 869-894 MHz, Power 46 dBm, Channel Spacing 5 MHz, Modulation 16QAM, Channel 871.5 MHz

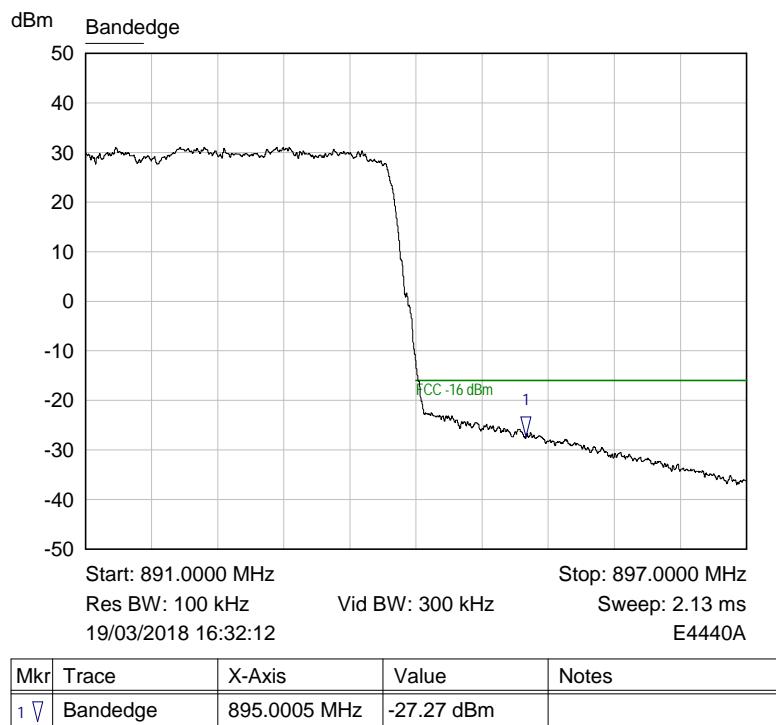


100kHz RBW plot

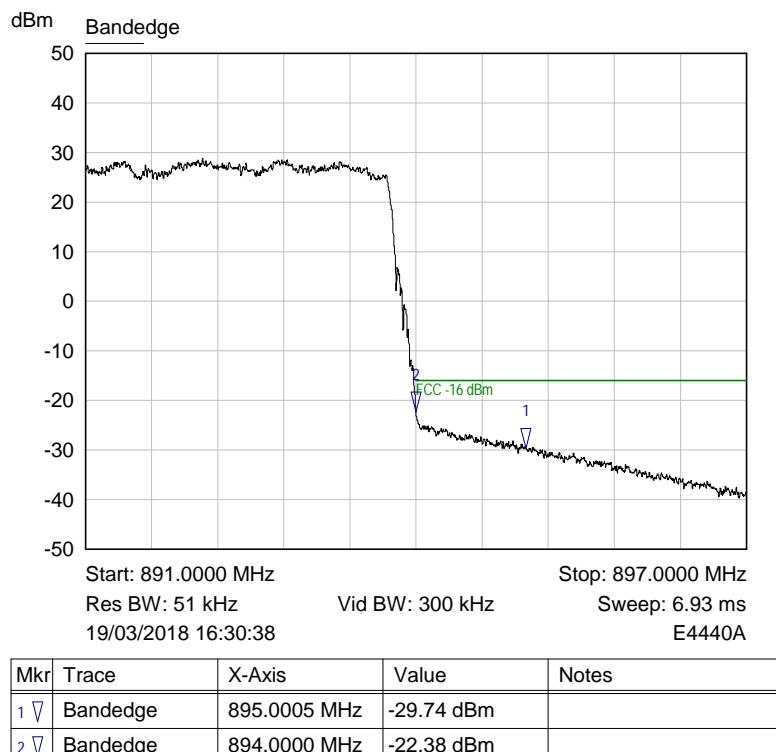


51kHz RBW plot

RF Parameters: Band 869-894 MHz, Power 46 dBm, Channel Spacing 5 MHz, Modulation 16QAM, Channel 891.5 MHz

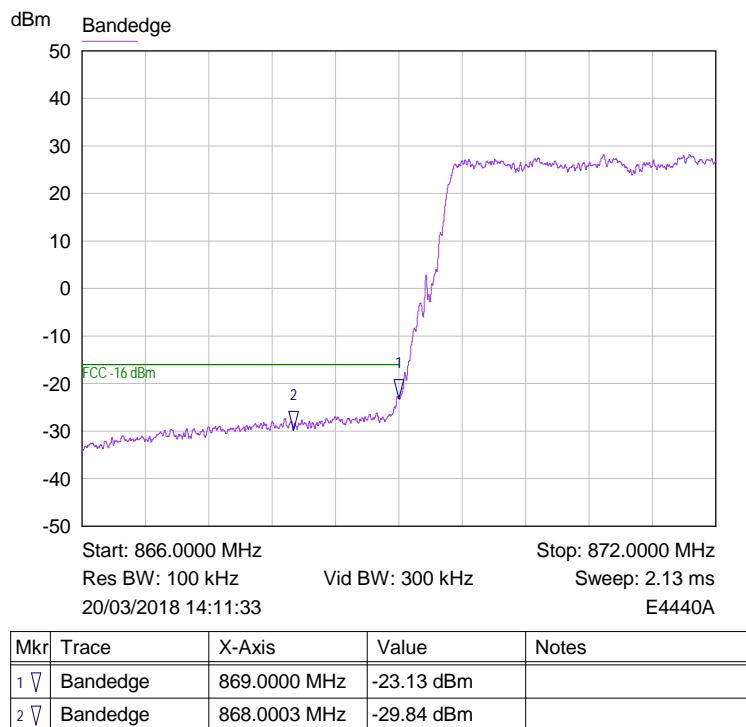


100kHz RBW plot



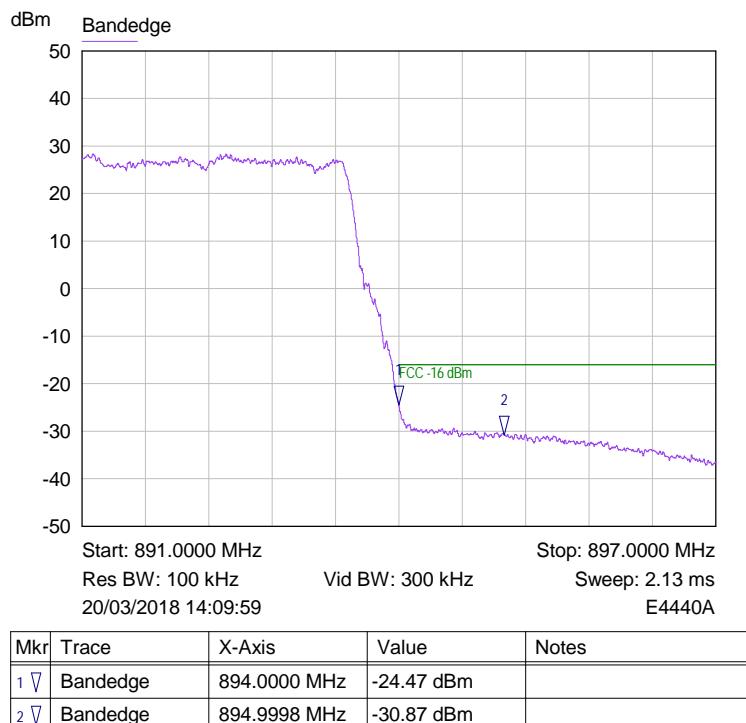
51kHz RBW plot

RF Parameters: Band 869-894 MHz, Power 46 dBm, Channel Spacing 10 MHz, Modulation 16QAM, Channel 874.0 MHz



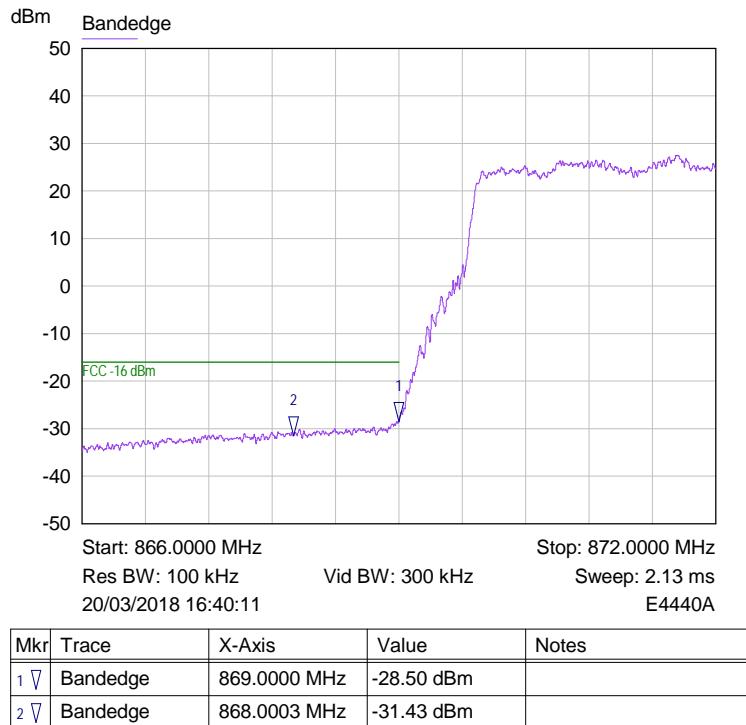
100kHz RBW plot

RF Parameters: Band 869-894 MHz, Power 46 dBm, Channel Spacing 10 MHz, Modulation 16QAM, Channel 889.0 MHz



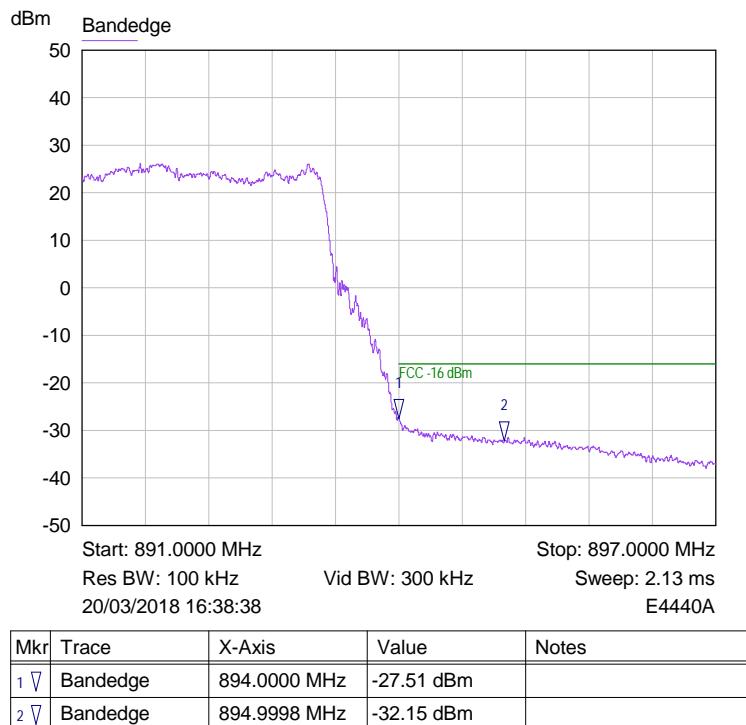
100kHz RBW plot

RF Parameters: Band 869-894 MHz, Power 46 dBm, Channel Spacing 15 MHz, Modulation 16QAM, Channel 876.5 MHz



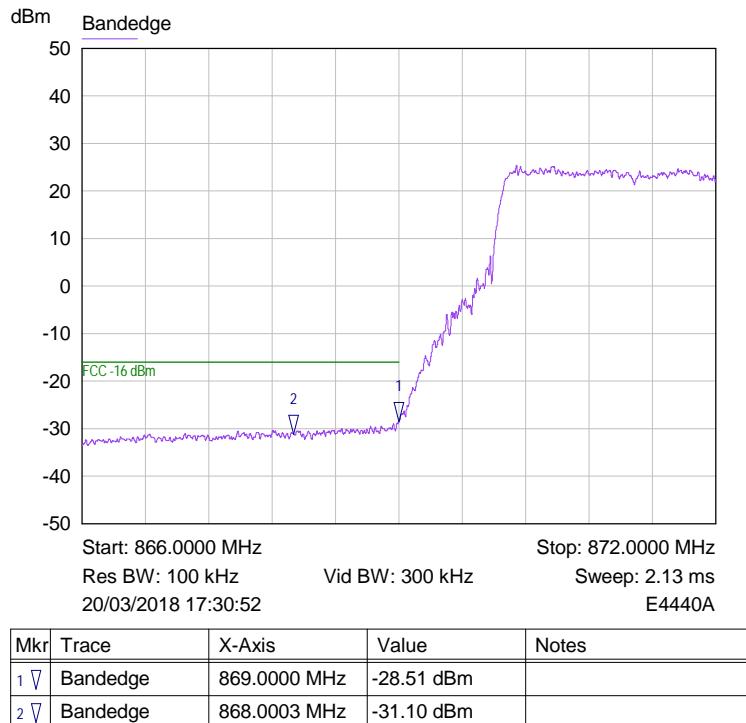
100kHz RBW plot

RF Parameters: Band 869-894 MHz, Power 46 dBm, Channel Spacing 15 MHz, Modulation 16QAM, Channel 886.5 MHz



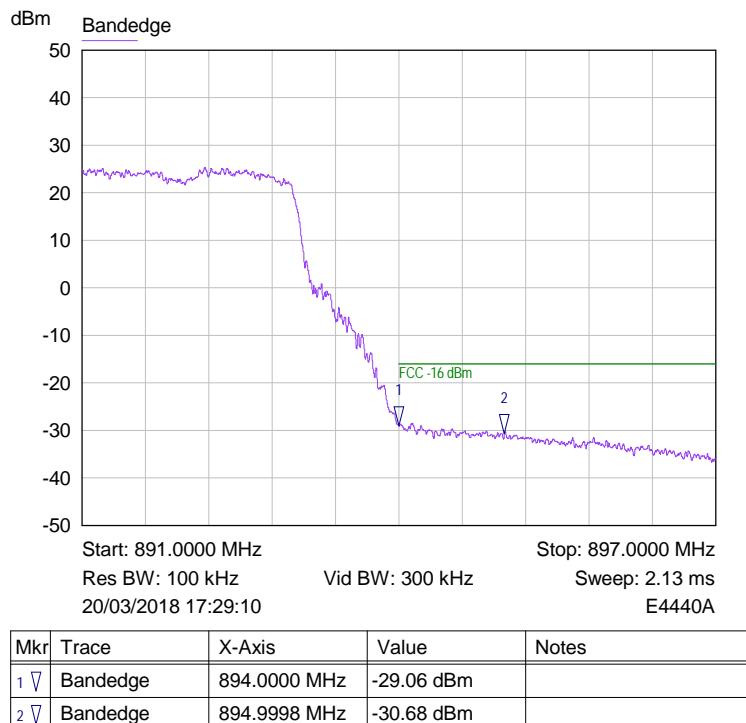
100kHz RBW plot

RF Parameters: Band 869-894 MHz, Power 46 dBm, Channel Spacing 20 MHz, Modulation 16QAM, Channel 879.0 MHz



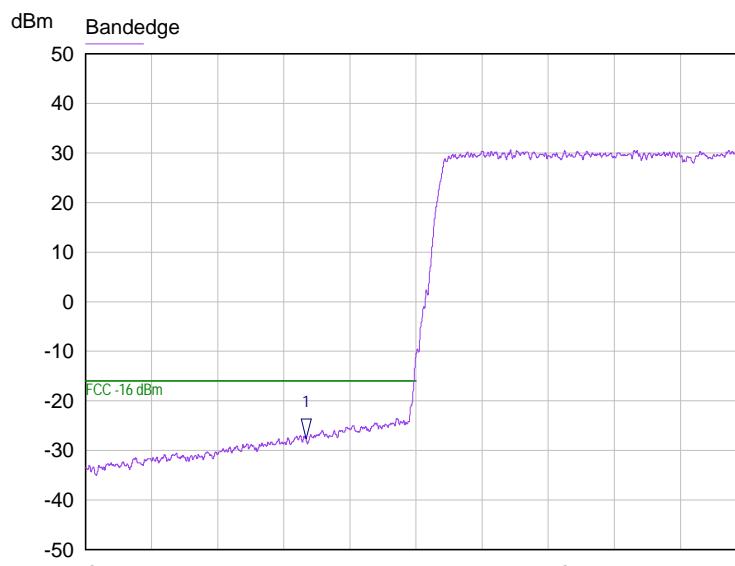
100kHz RBW plot

RF Parameters: Band 869-894 MHz, Power 46 dBm, Channel Spacing 20 MHz, Modulation 16QAM, Channel 884.0 MHz



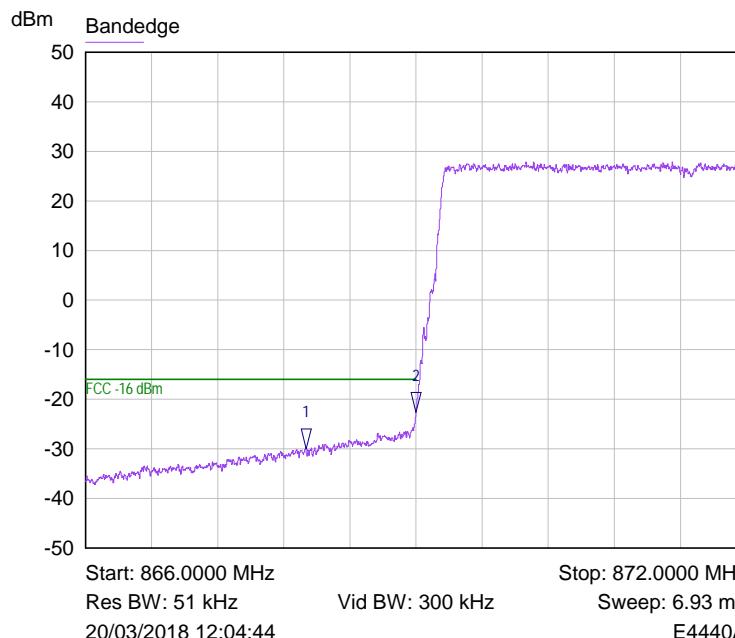
100kHz RBW plot

RF Parameters: Band 869-894 MHz, Power 46 dBm, Channel Spacing 5 MHz, Modulation 64QAM, Channel 871.5 MHz



Mkr	Trace	X-Axis	Value	Notes
1 ▽	Bandedge	868.0003 MHz	-27.63 dBm	

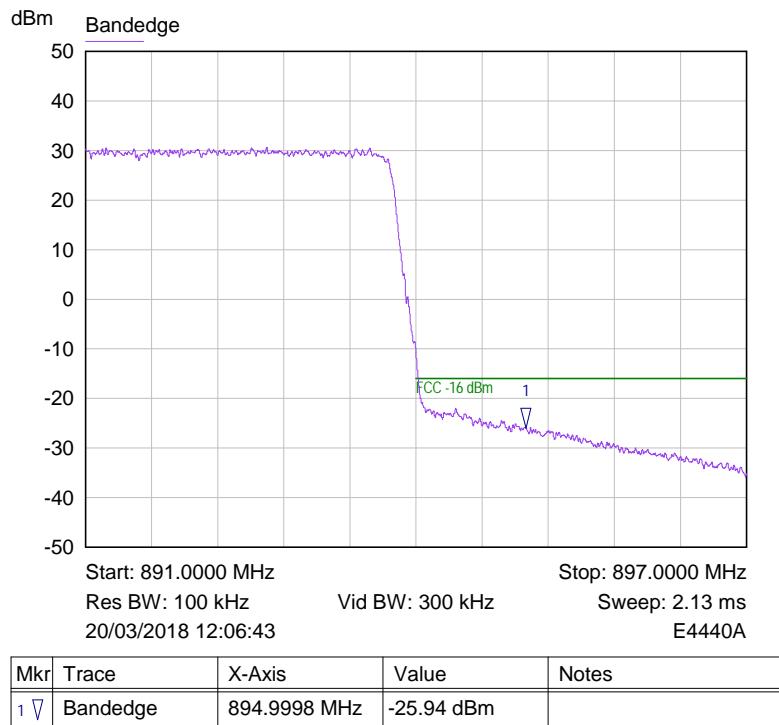
100kHz RBW plot



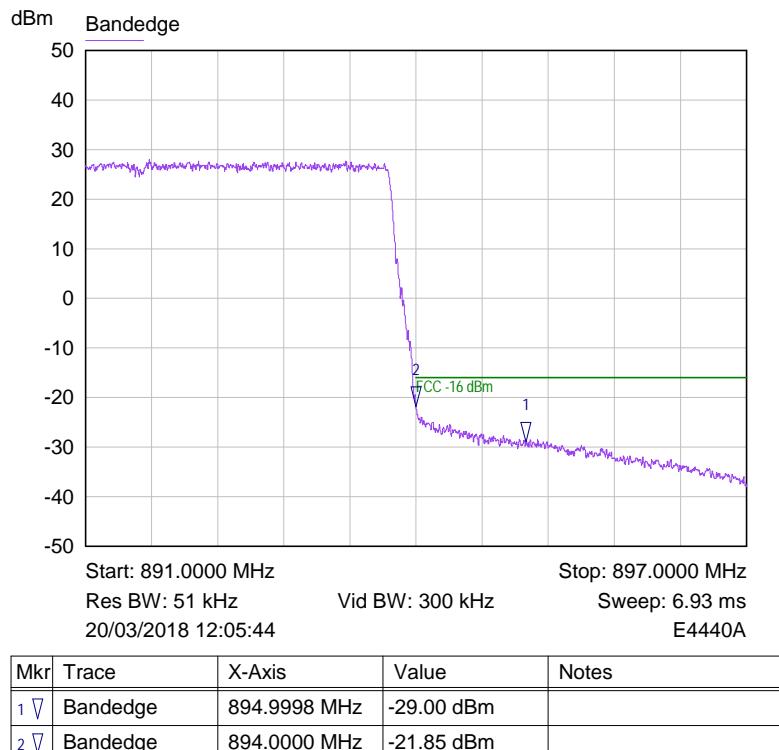
Mkr	Trace	X-Axis	Value	Notes
1 ▽	Bandedge	868.0003 MHz	-29.99 dBm	
2 ▽	Bandedge	869.0000 MHz	-22.63 dBm	

51kHz RBW plot

RF Parameters: Band 869-894 MHz, Power 46 dBm, Channel Spacing 5 MHz, Modulation 64QAM, Channel 891.5 MHz

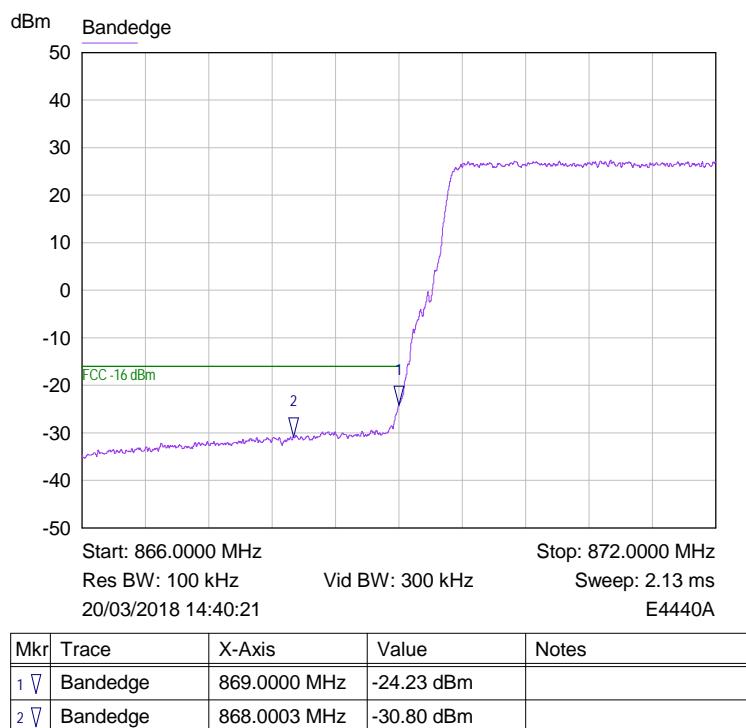


100kHz RBW plot



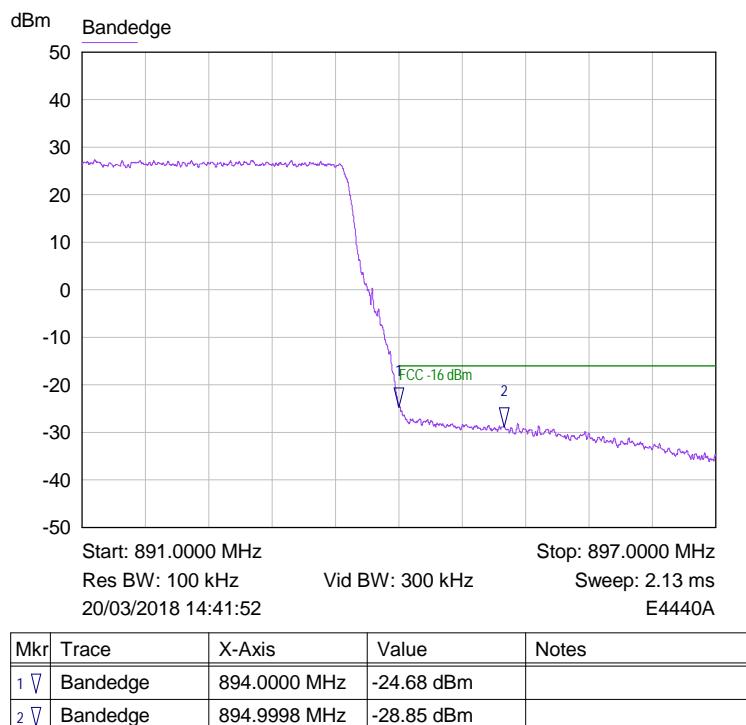
51kHz RBW plot

RF Parameters: Band 869-894 MHz, Power 46 dBm, Channel Spacing 10 MHz, Modulation 64QAM, Channel 874.0 MHz



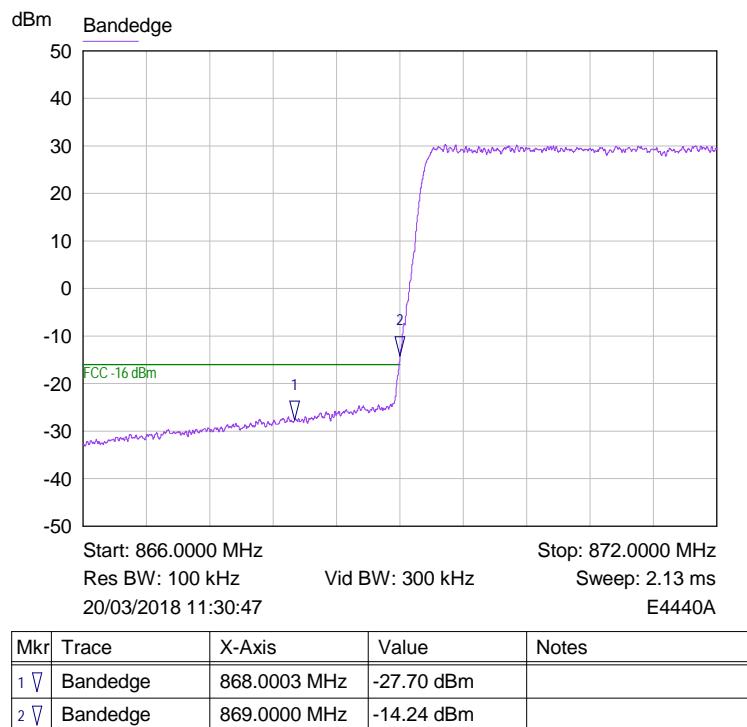
100kHz RBW plot

RF Parameters: Band 869-894 MHz, Power 46 dBm, Channel Spacing 10 MHz, Modulation 64QAM, Channel 889.0 MHz

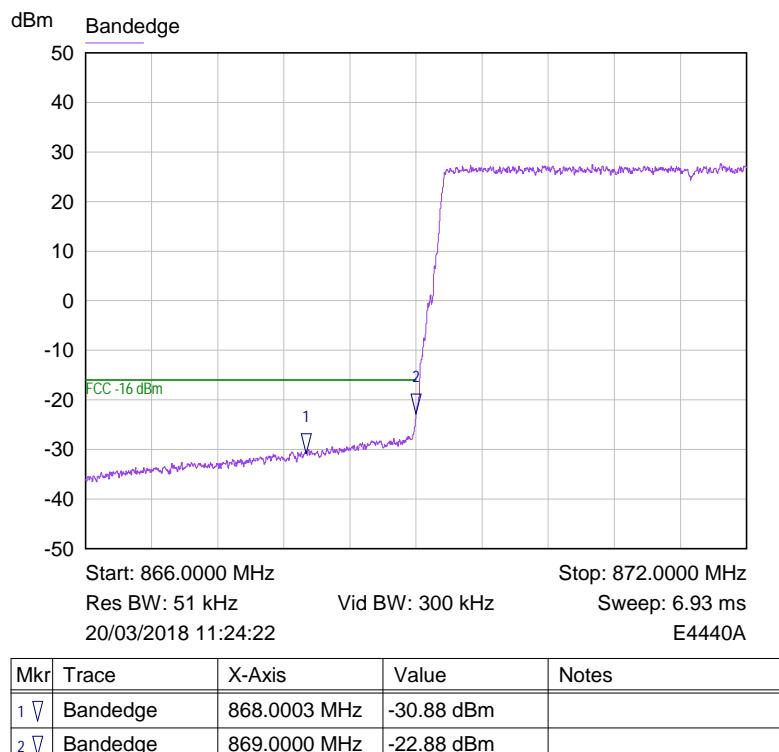


100kHz RBW plot

RF Parameters: Band 869-894 MHz, Power 45.5 dBm, Channel Spacing 5 MHz, Modulation 256QAM, Channel 871.5 MHz

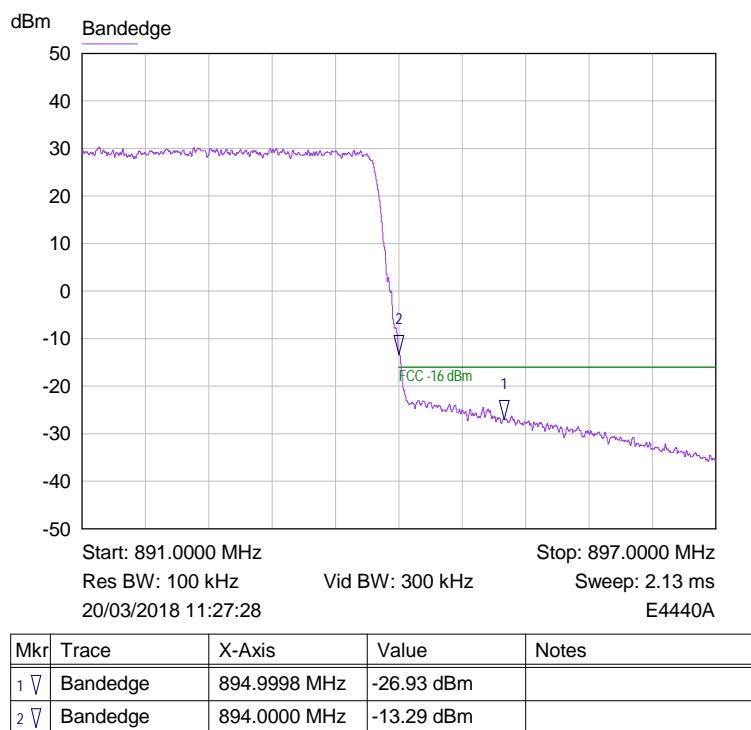


100kHz RBW plot

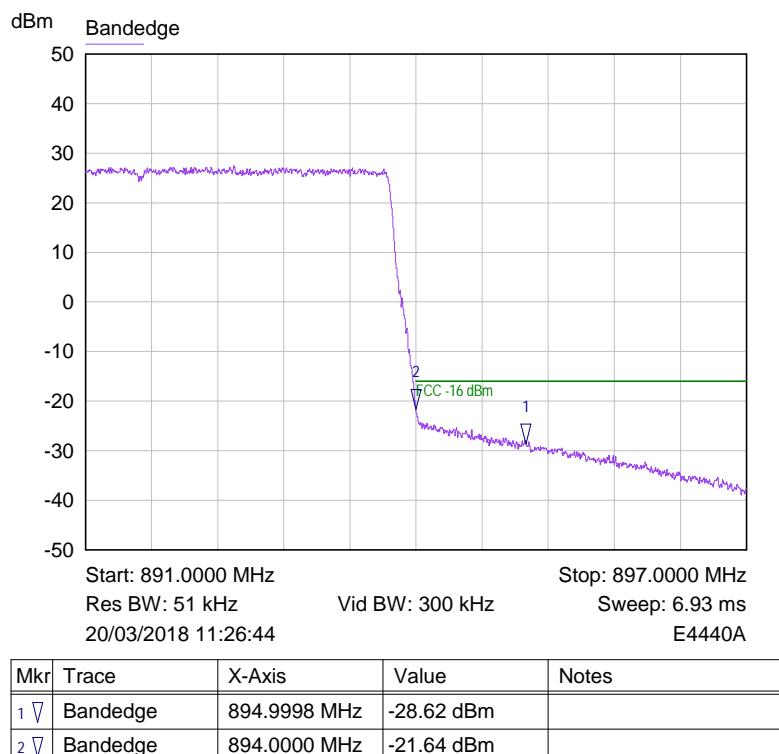


51kHz RBW plot

RF Parameters: Band 869-894 MHz, Power 45.5 dBm, Channel Spacing 5 MHz, Modulation 256QAM, Channel 891.5 MHz

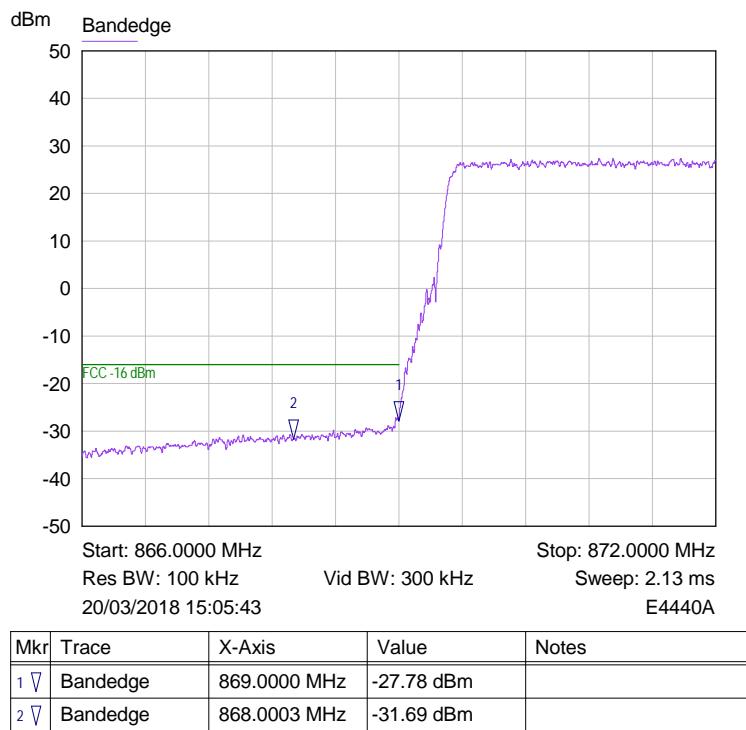


100kHz RBW plot



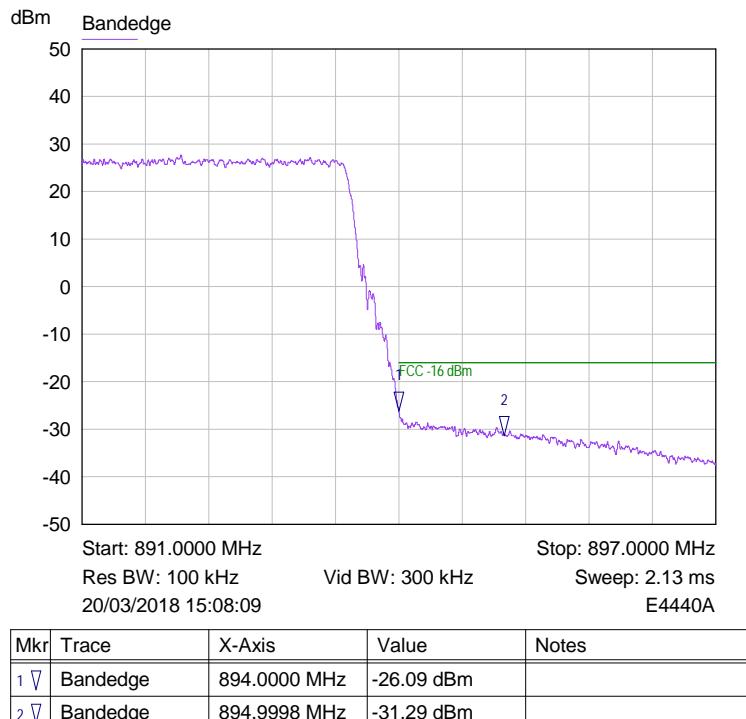
51kHz RBW plot

RF Parameters: Band 869-894 MHz, Power 45.5 dBm, Channel Spacing 10 MHz, Modulation 256QAM, Channel 874.0 MHz



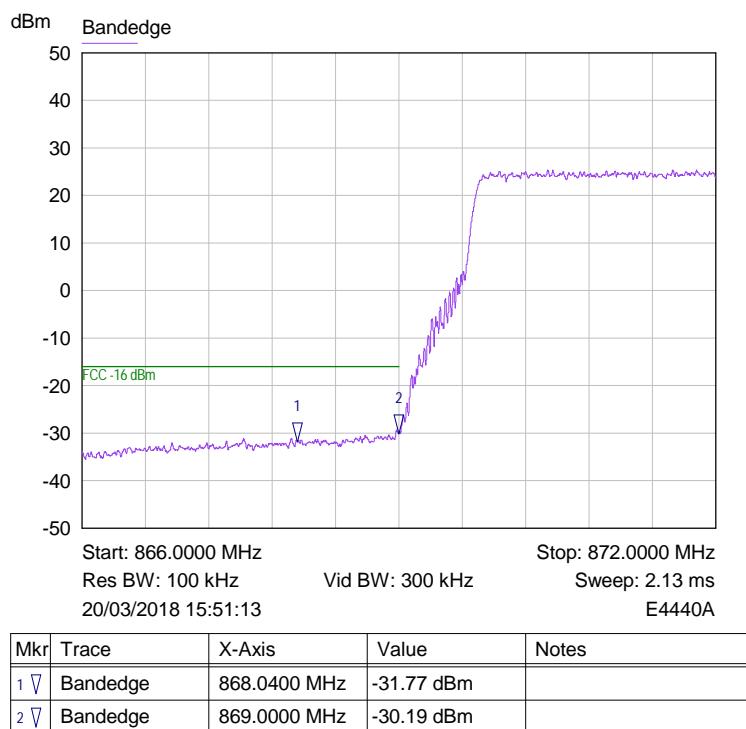
100kHz RBW plot

RF Parameters: Band 869-894 MHz, Power 45.5 dBm, Channel Spacing 10 MHz, Modulation 256QAM, Channel 889.0 MHz



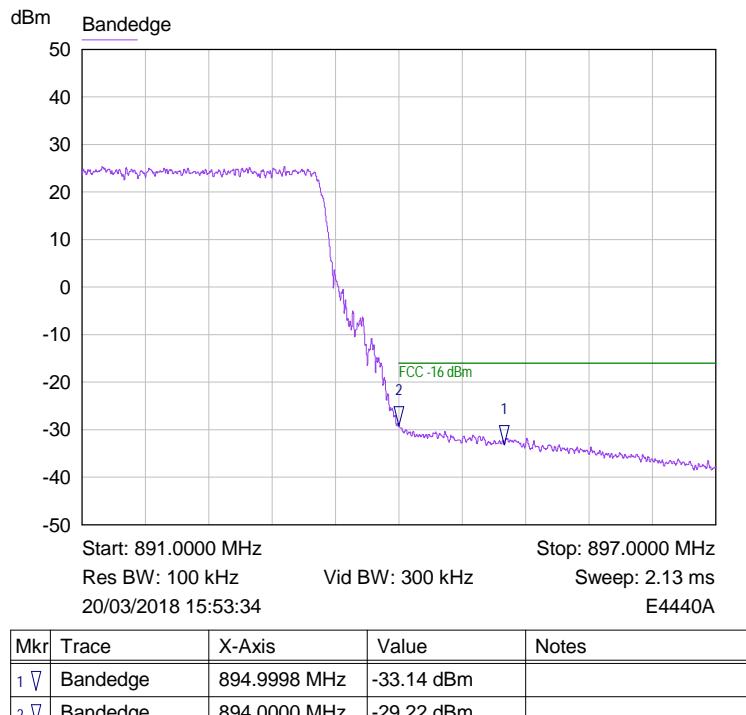
100kHz RBW plot

RF Parameters: Band 869-894 MHz, Power 45.5 dBm, Channel Spacing 15 MHz, Modulation 256QAM, Channel 876.5 MHz



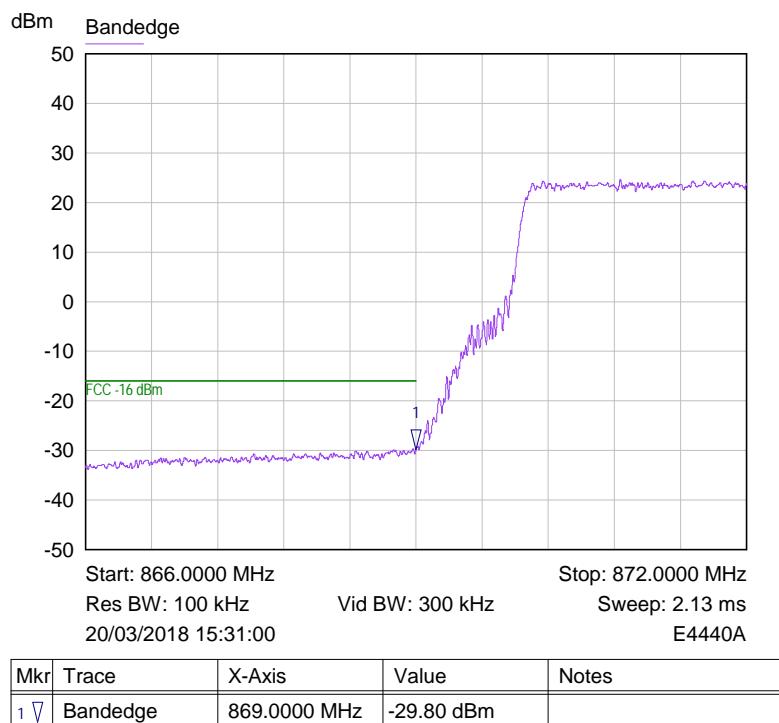
100kHz RBW plot

RF Parameters: Band 869-894 MHz, Power 45.5 dBm, Channel Spacing 15 MHz, Modulation 256QAM, Channel 886.5 MHz



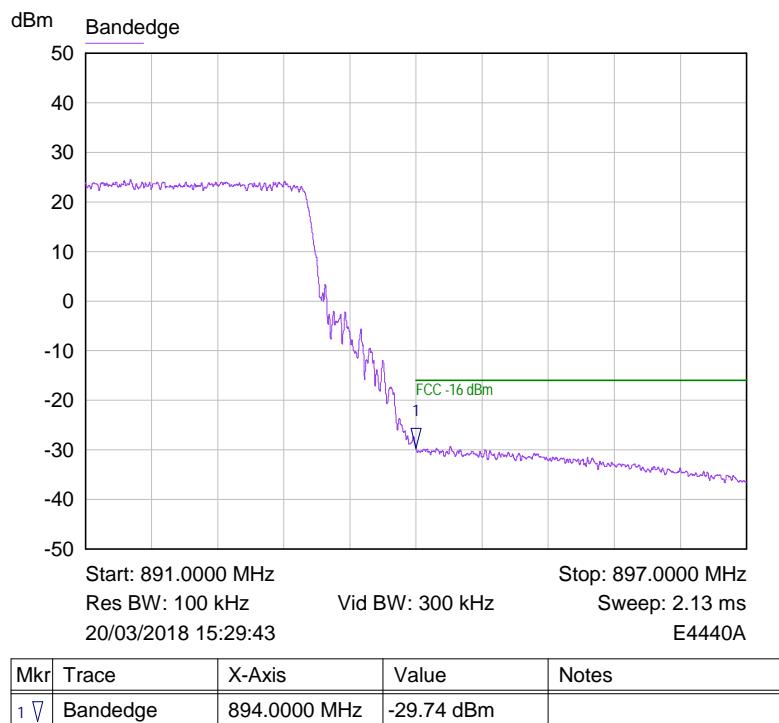
100kHz RBW plot

RF Parameters: Band 869-894 MHz, Power 45.5 dBm, Channel Spacing 20 MHz, Modulation 256QAM, Channel 879.0 MHz



100kHz RBW plot

RF Parameters: Band 869-894 MHz, Power 45.5 dBm, Channel Spacing 20 MHz, Modulation 256QAM, Channel 884.0 MHz



100kHz RBW plot

7 Photographs

7.1 EUT Front View



7.2 EUT Reverse Angle



7.3 EUT Left side View



7.4 EUT Right side View



7.5 EUT Antenna Port



7.6 EUT Display & Controls



7.7 EUT Internal photos

Internal photos removed at request of applicant.

7.8 EUT ID Label

EUT supplied for test not provided with labels on.

7.9 30-1000MHz Spurious emissions test set-up





7.10 Above 1GHz Spurious emissions test set-up



7.11 Radiated emission diagram

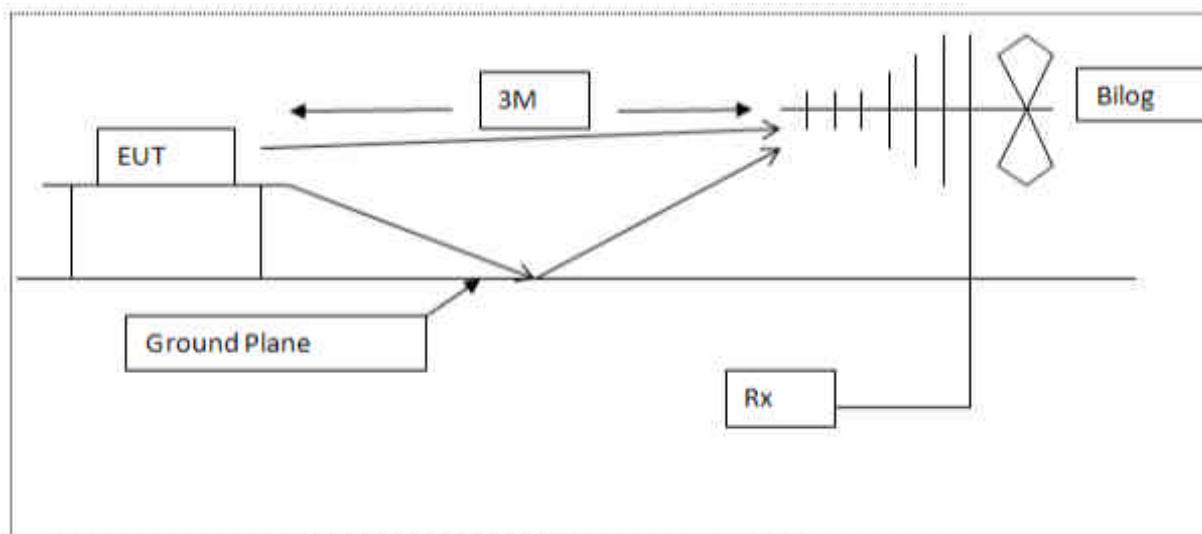


Diagram of the radiated emissions test setup 30 - 1000 MHz

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
E136	3105	Horn Antenna 12.5GHz	EMCO	03-Apr-2017	12 months
E256	44	Attenuator 10dB 18GHz	Weinschel Engineering	06-Feb-2018	12 months
E268	BHA 9118	Horn Antenna 1-18 GHz	Schaffner	03-Apr-2017	12 months
E411	N9039A	9 kHz - 1 GHz RF Filter Section	Agilent Technologies	11-Jul-2017	12 months
E433	MG3693A	Signal Generator 30GHz	Anritsu	23-Jun-2016	24 months
E478	LQ2992/H	Filter - Band pass 1-3GHz	RACAL-MESL	#29-Mar-2018	12 months
E602	MG3692A	Signal Generator 10MHz - 20GHz	Anritsu	30-Jan-2017	24 months
E612	GPS-QBW-20N	GPS Antenna	Andrew	N/A	N/A
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
E745	RR2017 4/2dB	Attenuator 4/2dB 30-1000MHz	RN Electronics	12-Feb-2018	12 months
TMS82	8449B	Pre Amplifier 1 - 26 GHz	Agilent Technologies	19-Dec-2017	12 months
TMS933	CBL6141A	Antenna Bilog 30MHz - 1GHz	Schaffner Chase EMC	16-Feb-2017	24 months

Equipment was within calibration dates for tests and has been re-calibrated since date of tests.

9 Auxiliary and peripheral equipment

9.1 Customer supplied equipment

Item No.	Model No.	Description	Manufacturer	Serial No.
1	N8737A	60V/55A DC psu	Agilent	AN00086
2	MC220L	Gigabit media converter	TP-Link	2.15819E+12
3	GS205	Gigabit switch	Netgear	38813AWH0010D
4	HP 250	Laptop and psu	HP	-
5	SA3N1007-40	40 dB/100 W attenuator	Fairview microwave	150914092
6	48-30-43	30 dB/100W attenuator	MCE	BN2799

9.2 RN Electronics supplied equipment

RN No.	Model No.	Description	Manufacturer	Serial No
TMS11	8343-100	Attenuator 10dB 1GHz 100W	Tenuline	633

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		