element

Report on the Radio Testing

For

Cambium Networks Ltd

on

PMP/PTP 450i

Report no. TRA-038845-47-00B

25 May 2018

RF930

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Report Number: TRA-038845-47-00B
Issue: B

REPORT ON THE RADIO TESTING OF A
Cambium Networks Ltd
PMP/PTP 450i
WITH RESPECT TO SPECIFICATION
FCC 47CFR Subpart E

TEST DATE: 2018-01-31 to 2018-03-07

Written by: Daniel Moncayola
                                          Radio Test Engineer

Approved by: John Charters
                                          Department Manager-Radio
        Date: 2018-05-25

1 Revision Record

Issue Number	Issue Date	Revision History
A	2018-04-18	Original
B	2018-05-25	Updates request TCB

2   Summary

TEST REPORT NUMBER:	TRA-038845-47-00B
WORKS ORDER NUMBER	TRA-039285-00
PURPOSE OF TEST:	Testing of radio frequency equipment per the relevant authorization procedure of chapter 47 of CFR (code of federal regulations) Part 2, subpart J.
TEST SPECIFICATION:	47CFR15 Subpart E
EQUIPMENT UNDER TEST (EUT):	PMP/PTP 450i
FCC IDENTIFIER:	QWP-50450I
EUT SERIAL NUMBER:	not applicable
MANUFACTURER/AGENT:	Cambium Networks Ltd
ADDRESS:	Unit B2 Linhay Business Park Eastern Road Ashburton Devon TQ13 7UP United Kingdom
CLIENT CONTACT:	Don Reid ☎ 01364 655667 ✉ Don.Reid@Cambiumnetworks.com
ORDER NUMBER:	#NP82693728
TEST DATE:	2018-01-31 to 2018-03-07
TESTED BY:	Daniel Moncayola Steve Garwell Element

2.1 Test Summary

Test Method and Description		Requirement Clause 47CFR15	Applicable to this equipment	Result / Note
Radiated spurious emissions (restricted bands of operation and cabinet radiation)		15.205	☒	*Pass*
AC power line conducted emissions		15.207	☒	*Pass*
Occupied bandwidth		15.407(e)	☒	*Pass*
Output power	Conducted	15.407(a)	☒	*Pass*
	PSD		☒	
	RPE		☐	
Conducted / radiated RF power out-of-band		15.407(b)	☒	*Pass*
TPC and DFS		15.407(h)	☐	*Note 1*
U-NII detection bandwidth		15.407(h)(2)	☐	*Note 1*
CAC		15.407(h)(2)(ii)	☐	*Note 1*
In-service monitoring		15.407(h)(2)(iii) & 15.407(h)(2)(iv)	☐	*Note 1*

Notes:

Note 1: Not Applicable, unit transmitting only in U-NII-3.

The results contained in this report relate only to the items tested, in the condition at time of test, and were obtained in the period between the date of initial receipt of samples and the date of issue of the report.

The apparatus was set-up and exercised using the configurations, modes of operation and arrangements defined in this report only. Any modifications made are identified in Section 8 of this report.

Particular operating modes, apparatus monitoring methods and performance criteria required by the standards tested to have been performed except where identified in Section 5.2 of this test report (Deviations from Test Standards).

3   Contents

4   Introduction

This report TRA-038845-47-00B presents the results of the Radio testing on a Cambium Networks Ltd, PMP/PTP 450i to specification 47CFR15 Radio Frequency Devices.

The testing was carried out for Cambium Networks Ltd by Element, at the address detailed below.

☐   Element Hull   ☒   Element Skelmersdale
      Unit E   Unit 1
      South Orbital Trading Park   Pendle Place
      Hedon Road   Skelmersdale
      Hull   West Lancashire
      HU9 1NJ   WN8 9PN
      UK   UK

This report details the configuration of the equipment, the test methods used and any relevant modifications where appropriate.

FCC Site Listing:
The test laboratory is accredited for the above sites under the US-EU MRA, Designation number UK0009.

ISED Registration Number(s):
Element Skelmersdale   3930B
Element Hull   3483A

The test site requirements of ANSI C63.4-2014 are met up to 1GHz.
The test site SVSWR requirements of CISPR 16-1-4:2010 are met over the frequency range 1 GHz to 18 GHz.

5 Test Specifications

5.1 Normative References

- FCC 47 CFR Ch. I – Part 15 – Radio Frequency Devices.
- FCC KDB Publication 789033 D02 v02r01 – Guidelines For Compliance Testing Of Unlicensed National Information Infrastructure (U-NII) Devices Part 15, Subpart E
- ANSI C63.10-2013 – American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices.
- ANSI C63.4-2014 – American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.

5.2 Deviations from Test Standards

There were no deviations from the test standard.

6 Glossary of Terms

§	denotes a section reference from the standard, not this document
AC	Alternating Current
ANSI	American National Standards Institute
BW	bandwidth
C	Celsius
CAC	Channel Availability Check
CFR	Code of Federal Regulations
CW	Continuous Wave
dB	decibel
dBm	dB relative to 1 milliwatt
DC	Direct Current
DFS	Dynamic Frequency Selection
DSSS	Direct Sequence Spread Spectrum
EIRP	Equivalent Isotropically Radiated Power
ERP	Effective Radiated Power
EUT	Equipment Under Test
FCC	Federal Communications Commission
FHSS	Frequency Hopping Spread Spectrum
Hz	hertz
IC	Industry Canada (now ISED)
ISED	Innovation, Science and Economic Development Canada
ITU	International Telecommunication Union
LBT	Listen Before Talk
LE-LAN	Licence-Exempt Local Area Network
m	metre
max	maximum
MIMO	Multiple Input and Multiple Output
min	minimum
MRA	Mutual Recognition Agreement
N/A	Not Applicable
PCB	Printed Circuit Board
PDF	Portable Document Format
Pt-mpt	Point-to-multipoint
Pt-pt	Point-to-point
PSD	Power Spectral Density
RF	Radio Frequency
RH	Relative Humidity
RMS	Root Mean Square
Rx	receiver
s	second
SVSWR	Site Voltage Standing Wave Ratio
TPC	Transmitter Power Control
Tx	transmitter
UKAS	United Kingdom Accreditation Service
U-NII	Unlicensed-National Information Infrastructure
V	volt
W	watt
Ω	ohm

7   Equipment Under Test

7.1   EUT Identification

- Name: PMP/PTP 450i
- Serial Number: not applicable
- Model Number: 450i
- Software Revision: Test software
- Build Level / Revision Number: R6

7.2   System Equipment

Equipment listed below forms part of the overall test setup and is required for equipment functionality and/or monitoring during testing. The compliance levels achieved in this report relate only to the EUT and not items given in the following list.

- Name: Cambium Networks Power Injector AC + DC
- Serial Number: 1611000125
- Model Number: E100109B G
- Build Level / Revision Number: 02

- Name: Dell Latitude Laptop PC
- Serial Number: 2CE00223BK
- Model Number: E6440

7.3   EUT Mode of Operation

The mode of operation for tests was as follows:

The equipment under test is a transceiver operating in the 5725 MHz to 5850 MHz band. The test has been performed with four different antenna configurations listed in section 7.4.2.

Maximum Power GUI settings:

GUI Power setting 5 MHz bandwidth channels				
Mod modes Freq. (MHz)	QPSK	16 QAM	64 QAM	256 QAM
5727.5	28	26	25	24
5788	28	26	25	24
5847.5	28	26	25	24

GUI Power setting 10 MHz bandwidth channels				
Mod modes Freq. (MHz)	QPSK	16 QAM	64 QAM	256 QAM
5730	28	26	25	24
5788	28	26	25	24
5845	28	26	25	24

GUI Power setting 15 MHz bandwidth channels				
Mod modes Freq. (MHz)	QPSK	16 QAM	64 QAM	256 QAM
5732.5	28	26	25	24
5788	28	26	25	24
5842.5	28	26	25	24

GUI Power setting 20 MHz bandwidth channels				
Mod modes Freq. (MHz)	QPSK	16 QAM	64 QAM	256 QAM
5735	28	26	25	24
5788	28	26	25	24
5840	28	26	25	24

GUI Power setting 30 MHz bandwidth channels				
Mod modes Freq. (MHz)	QPSK	16 QAM	64 QAM	256 QAM
5740	28	26	25	24
5788	28	26	25	24
5835	28	26	25	24

GUI Power setting 40 MHz bandwidth channels				
Mod modes Freq. (MHz)	QPSK	16 QAM	64 QAM	256 QAM
5745	28	26	25	24
5788	28	26	25	24
5830	28	26	25	24

7.4   EUT Radio Frequency Parameters

7.4.1   General

Band of operation:	5725 MHz to 5850 MHz
Modulation type(s):	QPSK, 16 QAM, 64 QAM and 256 QAM
Occupied channel bandwidth(s):	5, 10, 15, 20, 30 and 40 MHz
Channel spacing:	5, 10, 15, 20, 30 and 40 MHz
Declared output power(s):	28, 26, 25 and 24 dBm
Warning against use of alternative antennas in user manual (yes/no):	Not Applicable
Nominal Supply Voltage:	-48 Vdc (POE)
Location of notice for license exempt use:	User manual
Method of prevention of use on non-US frequencies:	Digitally signed software / licence key

7.4.2   Antennas

Type:	90 degree sector antenna
Frequency range:	4900 MHz to 5925 MHz
Impedance:	50 Ohm
Gain:	17 dBi ± 1 dBi integrated 90° sector or external
Polarisation:	Sector 90 °
Connector type:	50 Ohm, Standard N-Type, Female
Dimensions:	59.5 x 15.7 x 15.5 cm (23.4" x 6.2" x 6.1")
Weight:	Approx. 6.8 kg (15 lbs)
Environmental limits:	IP67, IP66

Type:	4-foot Dual-Pol Parabolic, PX4F-52
Frequency range:	5250 – 5850 MHz
Impedance:	50 Ohm
Polarisation:	Dual
Gain:	35.3 dBi
Connector type:	50 Ohm, Standard N-Type, Female
Dimensions:	Diameter 1.2 m/ 4ft
Weight:	Net Weight 54 kg	119 lb

Type:	6-foot Single-Pol Parabolic (Extrapolation only)
Frequency range:	5250 – 5850 MHz
Impedance:	50 Ohm
Polarisation:	Single
Gain:	38.4 dBi
Connector type:	50 Ohm, Standard N-Type, Female
Dimensions:	Diameter 1.8 m/ 6ft
Weight:	Net Weight 42.8 kg	95 lb

Type:	MA-WA56-DP23G7CM Flat Plate
Frequency range:	4900 – 6100 MHz
Impedance:	50 Ohm
Gain:	23 dBi
Polarisation:	Dual
Connector type:	Integrated
Dimensions:	305 x 305 x 15 mm (12" x 12" x 1.6")
Weight:	900 gr

Type:	KPPA-5.7-DPOMA Omnidirectional
Frequency range:	5150-5900 MHz
Impedance:	50 Ohm
Gain:	13 dBi
Polarisation:	Dual
Connector type:	50 Ohm, Standard N-Type, Female
Dimensions:	584 x 127 x 152 mm (23" x 5" x 6")
Weight:	1.8 kg/ 4 lb

7.5 EUT Description

The equipment under test is a transceiver operating in the 5725 MHz to 5850 MHz band. The test has been performed with four different antenna configurations listed in section 7.4.2.

8   Modifications

No modifications were performed during this assessment.

9   EUT Test Setup

9.1   Block Diagram

The following diagram shows basic EUT interconnections with cable type and cable lengths identified:
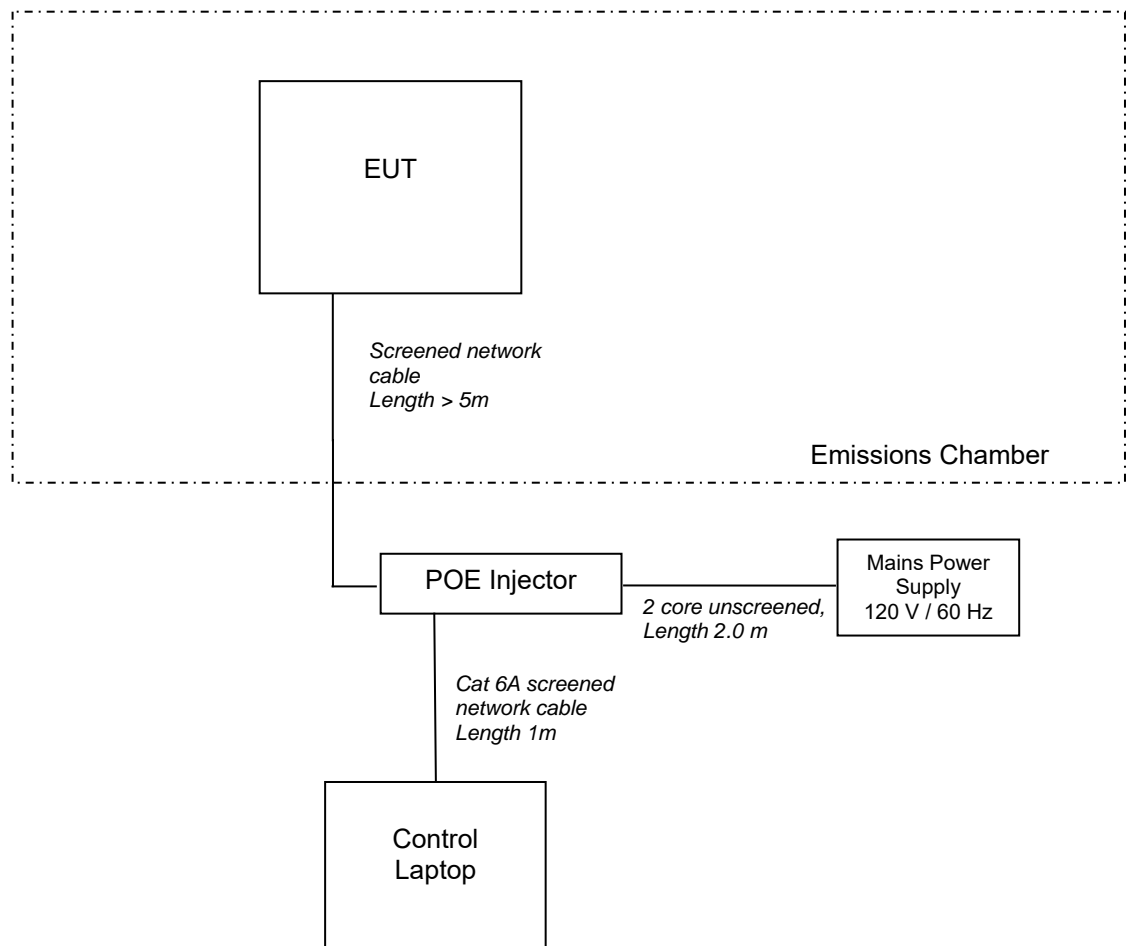
9.2   General Set-up Photograph

The following photograph shows basic EUT set-up:

Omnidirectional antenna
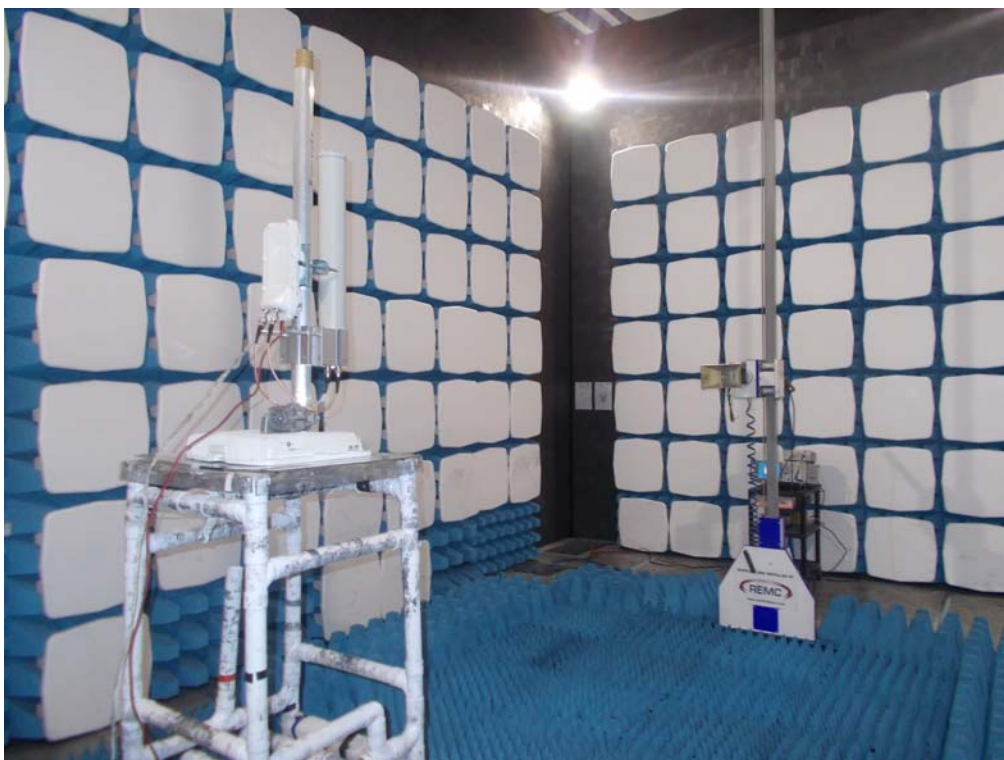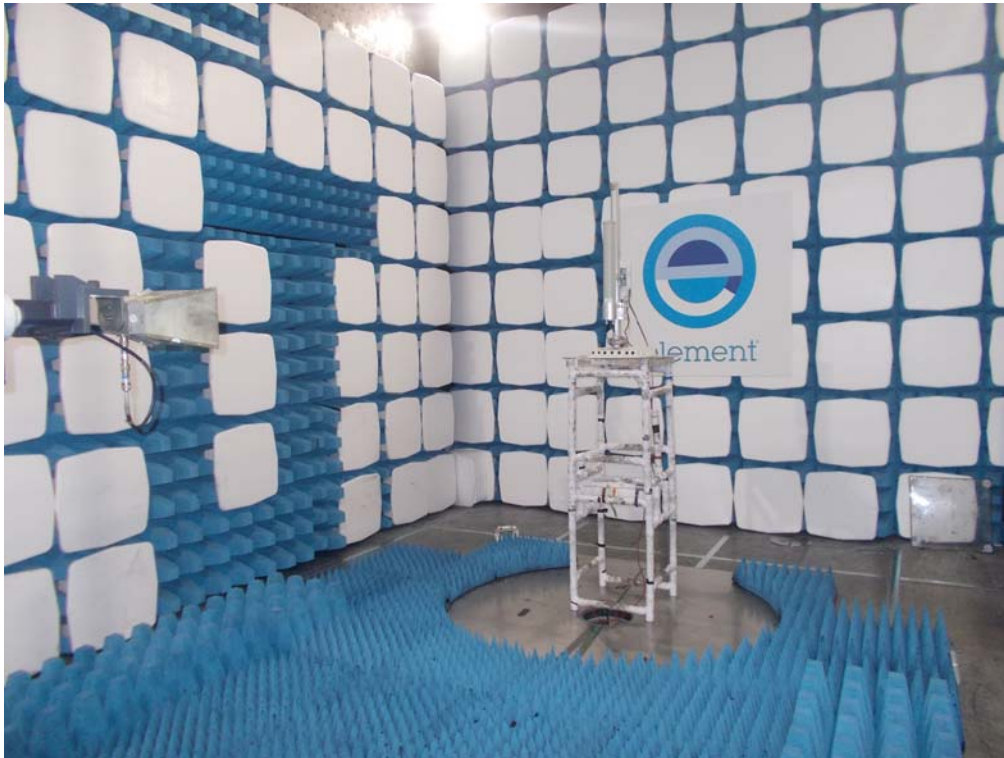
Sector antenna (connectorized)
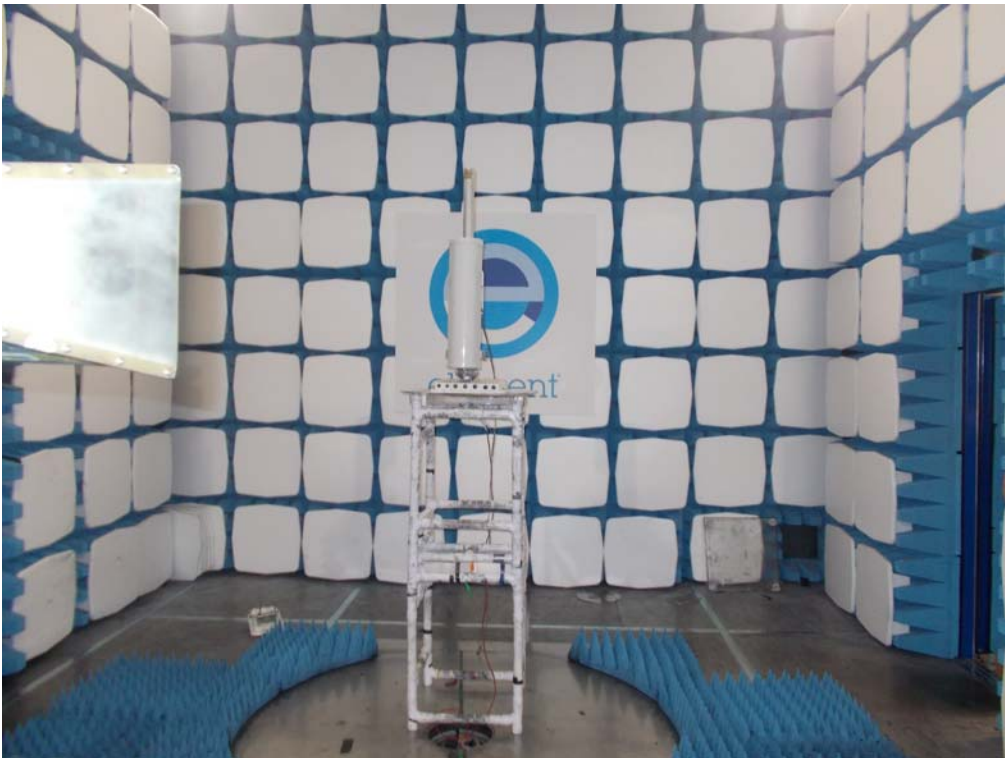
High Gain Flat plate Antenna

4' Parabolic Antenna

10   General Technical Parameters

10.1   Normal Conditions

The E U T was tested under the normal environmental conditions of the test laboratory, except where otherwise stated. The normal power source applied was -48V dc from a power over Ethernet adaptor.

10.2   Varying Test Conditions

Variation of supply voltage is required to ensure stability of the declared output power and frequency. During carrier power testing the following variations were made:

	Category	*Nominal*	*Variation*
☐	Mains	110 V ac	85% and 115%
☒	Adaptor	-48 Vdc	N/A

11 Radiated emissions

11.1 Definitions

Spurious emissions
Emissions on a frequency or frequencies, which are outside the necessary bandwidth and the level of which may be reduced without affecting the corresponding transmission of information. Spurious emissions include harmonic emissions, parasitic emissions, intermodulation products and frequency conversion products, but exclude out-of-band emissions.

Restricted bands
A frequency band in which intentional radiators are permitted to radiate only spurious emissions but not fundamental signals.

11.2 Test Parameters

Test Location:	Element Skelmersdale
Test Chamber:	Radio Chamber
Test Standard and Clause:	ANSI C63.10-2013, Clause 6.5 and 6.6
EUT Frequencies Measured:	5727.5 MHz / 5788 MHz / 5847.5 MHz
EUT Channel Bandwidths:	5 MHz
Deviations From Standard:	None (Only worst case was reported QPSK, 5 MHz)
Measurement BW:	30 MHz to 1 GHz: 120 kHz Above 1 GHz: 1 MHz
Measurement Detector:	Up to 1 GHz: quasi-peak Above 1 GHz: RMS average and Peak

Environmental Conditions (Normal Environment)

Temperature: 25 °C	+15 ºC to +35 ºC (as declared)
Humidity: 32 %RH	20%RH to 75%RH (as declared)
Supply: -48 Vdc	-48 Vdc (as declared)

Test Limits
Unwanted emissions that fall within the restricted frequency bands shall comply with the limits specified:

General Field Strength Limits for License-Exempt Transmitters at Frequencies Above 30 MHz

Frequency (MHz)	Field Strength (µV/m at 3m)
30-88	100
88-216	150
216-960	200
Above 960	500

11.3 Test Method

With the EUT setup as per section 9 of this report and connected as per Figure i, the emissions from the EUT were measured on a spectrum analyzer / EMI receiver.

Radiated electromagnetic emissions from the EUT are checked first by preview scans. Preview scans for all spectrum and modulation characteristics are checked, using a peak detector and where applicable worst-case determined for function, operation, orientation, etc. for both vertical and horizontal polarisations. Pre-scan plots are shown with a peak detector and 100kHz RBW.

If the EUT connects to auxiliary equipment and is table or floor standing, the configurations prescribed in ANSI C63.10 are followed. Alternatively, a layout closest to normal use (as declared by the provider) is employed, (see EUT setup photographs for more detail).

Emissions between 30 MHz and 1 GHz are measured using calibrated broadband antennas. Emissions above 1 GHz are characterized using standard gain horn antennas. Pre-amplifiers and filters are used where required. Care is taken to ensure that test receiver resolution bandwidth, video bandwidth and detector type(s) meet the regulatory requirements.

For both horizontal and vertical polarizations, the EUT is then rotated through 360 degrees in azimuth until the highest emission is detected. At the previously determined azimuth the test antenna is raised and lowered from 1 to 4 m in height until a maximum emission level is detected, this maximum value is recorded.

Power values measured on the test receiver / analyzer are converted to field strength, FS, in dBµV/m at the regulatory distance, using:

$$FS = PR + CL + AF - PA + DC - CF$$

Where,
   PR is the power recorded on the receiver / spectrum analyzer in dBµV;
   CL is the cable loss in dB;
   AF is the test antenna factor in dB/m;
   PA is the pre-amplifier gain in dB (where used);
   DC is the duty correction factor in dB (where used, e.g. where average detector on pulsed harmonic understates the power);
   CF is the distance factor in dB (where measurement distance different to limit distance);

This field strength value is then compared with the regulatory limit.

Figure i Test Setup
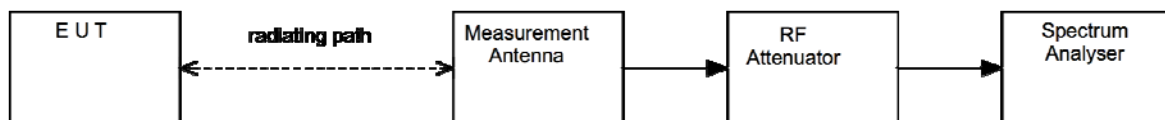
Test Setup Photograph(s)

High Gain Flat Plate

Omnidirectional Antenna

4' Parabolic Antenna

Sector Antenna Connectorized

11.4 Test Equipment

Equipment Description	Manufacturer	Equipment Type	Element No	Last Cal Calibration	Calibration Period	Due For Calibration
Bilog	Chase	CBL611/A	U191	2017-02-23	24	2019-02-23
Receiver	R&S	ESVS10	L352	2017-07-28	12	2018-07-28
Spectrum Analyser	R&S	FSU46	U281	2017-06-19	12	2018-06-19
1-18GHz Horn	EMCO	3115	L139	2017-09-25	24	2019-09-25
Pre Amp	Agilent	8449B	L572	2017-09-28	12	2018-09-28
Horn 18-26GHz (&U330)	Flann	20240-20	L300	2016-04-07	24	2018-04-07
Standard Gain Horn 26-40	Flann	22240-20	L301	2017-07-25	12	2018-07-25
6 dB Attenuator	Bird	8304-060-N	U376	Calibrate in Use		
10 dB Attenuator	Bird	8304-100-N	L222	Calibrate in Use		
High Pass Filter	Atlantic Microwave Ltd	AFH-0700	U558	Calibrate in Use		

11.5   Test Results

Flat plate High gain antenna
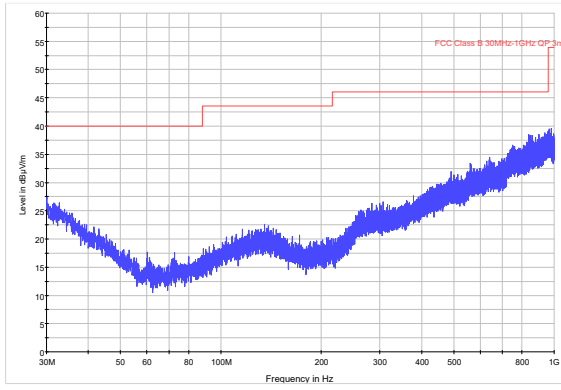

30 MHz to 1 GHz.
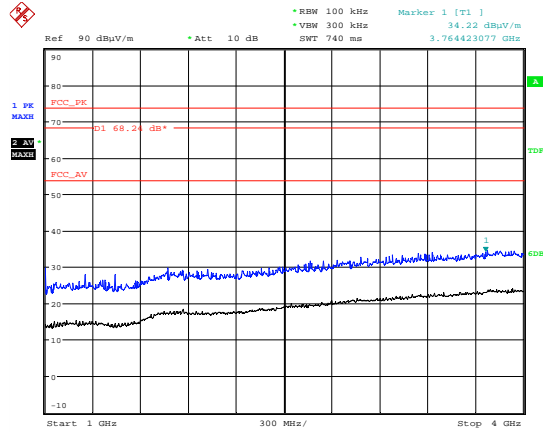
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1 GHz to 4 GHz.
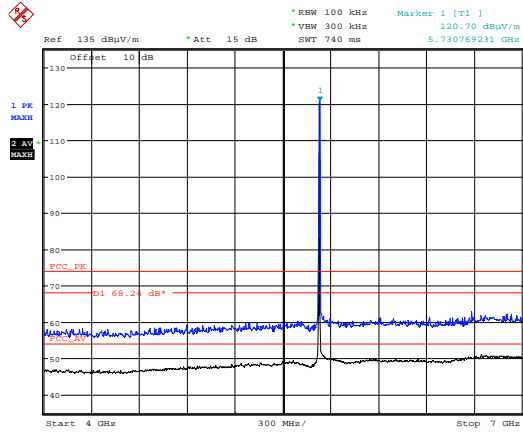
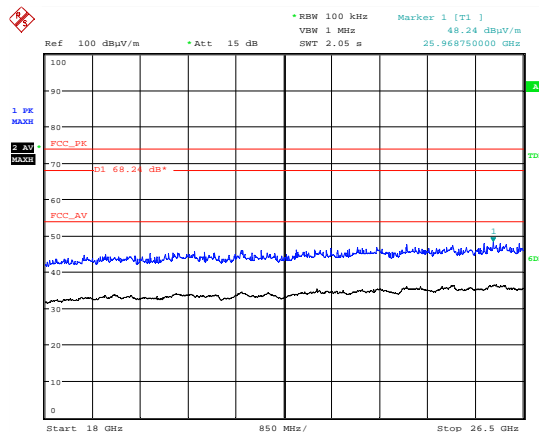Date: 16.FEB.2018 10:23:33

4 GHz to 7 GHz.
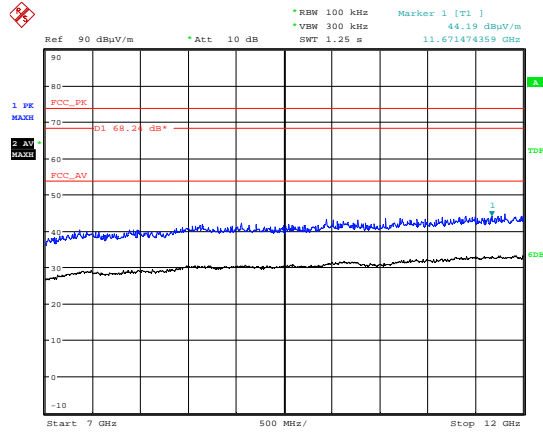
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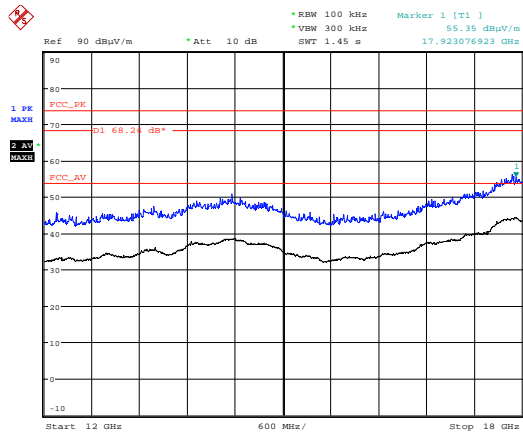
7 GHz to 12 GHz.

Date: 15.FEB.2018 15:22:42
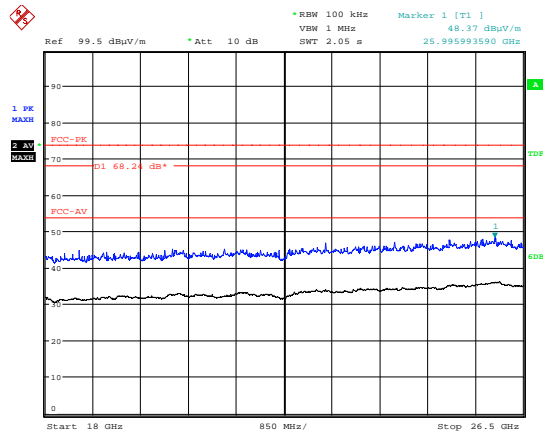
12 GHz to 18 GHz.

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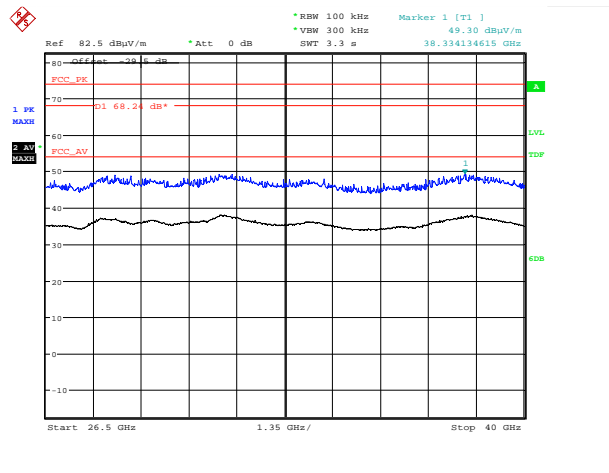
18 GHz to 26.5 GHz.
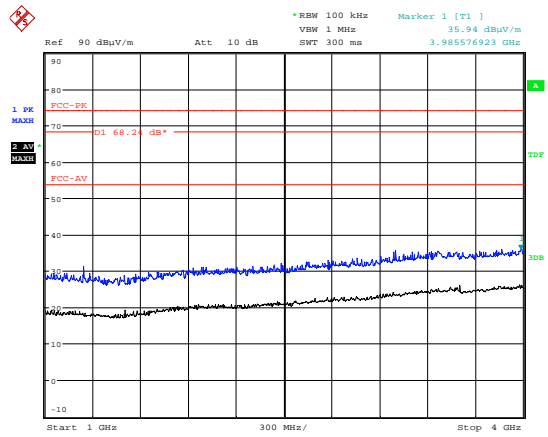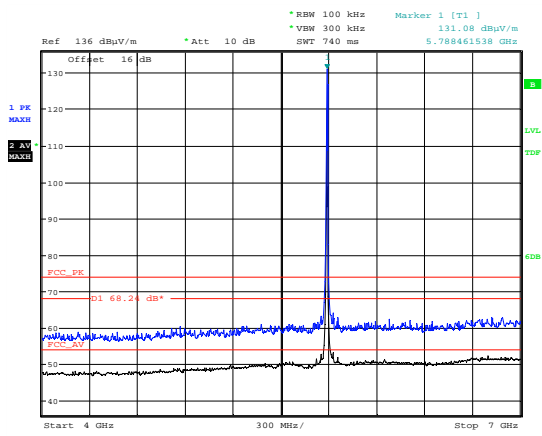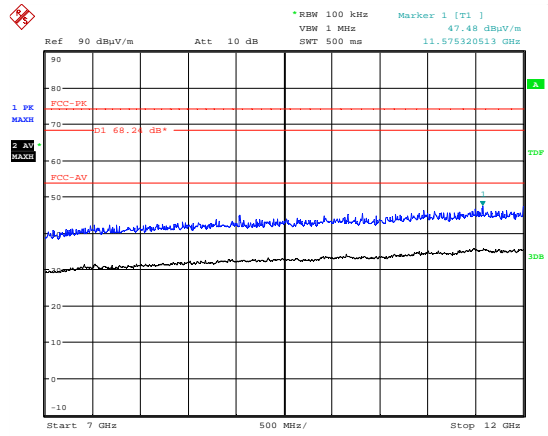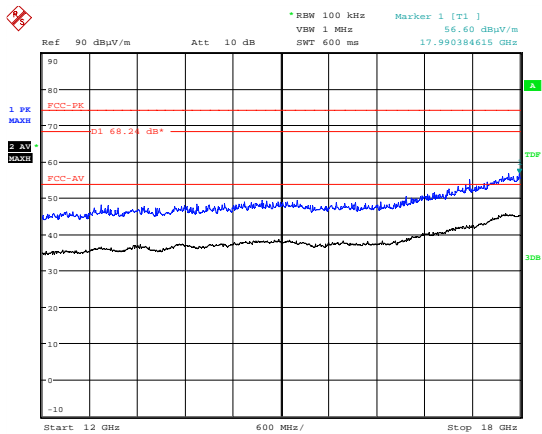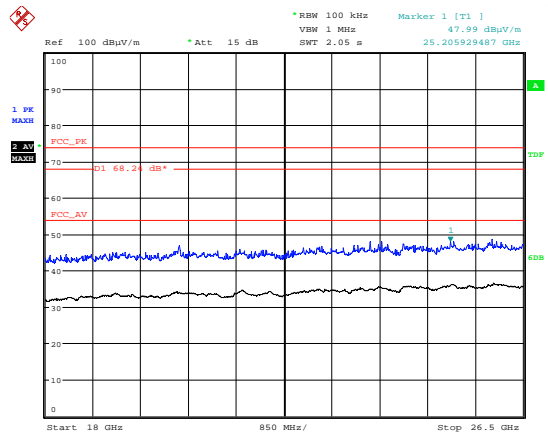
```
                              *RBW 100 kHz    Marker 1 [T1 ]
                              *VBW 300 kHz           49.30 dBµV/m
      Ref  82.5 dBµV/m    *Att  0 dB     SWT 3.3 s       38.334134615 GHz
```

26.5 GHz to 40 GHz.

High Power: 28 dBm; Bandwidth: 5 MHz; Mod mode: QPSK; Channel: 5727.5 MHz; Flat plate High gain antenna										
Detector	Freq. (MHz)	Meas'd Emission (dBµV)	Cable Loss (dB)	Antenna Factor (dB/m)	Pre-amp Gain (dB)	Duty Cycle Corr'n (dB)	Field Strength (dBµV/m)	Distance Extrap'n Factor (dB)	Field Strength (µV/m)	Limit (µV/m)
No Emission within 20 dB to the limit										

30 MHz to 1 GHz.

Date: 15.FEB.2018 15:28:58

1 GHz to 4 GHz.

Date: 16.FEB.2018 10:24:47

4 GHz to 7 GHz.

Date: 15.FEB.2018 15:28:37

7 GHz to 12 GHz.

Date: 15.FEB.2018 15:28:11

12 GHz to 18 GHz.
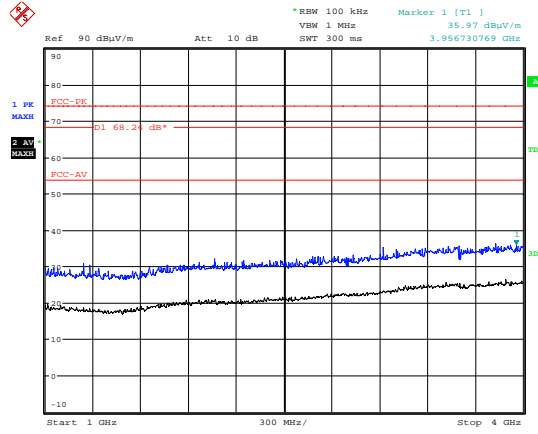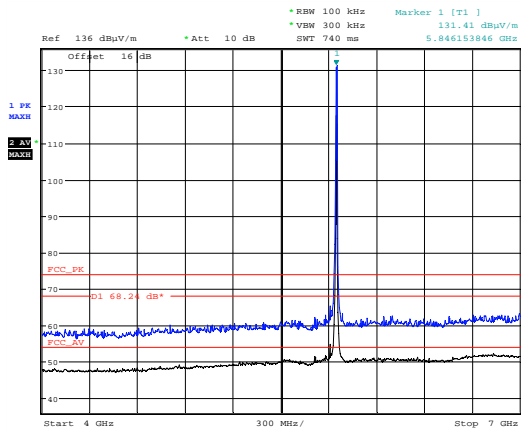

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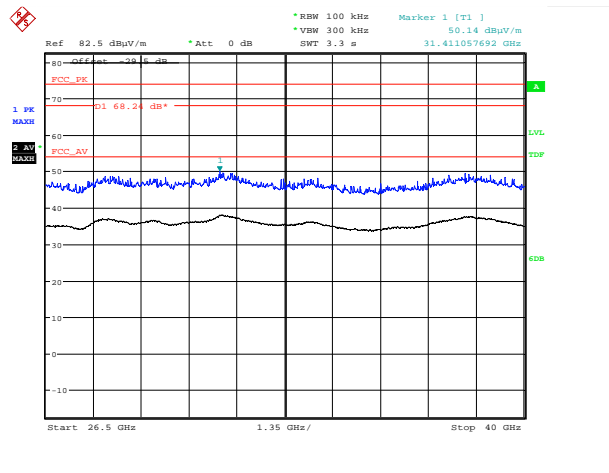
18 GHz to 26.5 GHz.

26.5 GHz to 40 GHz.

Detector	Freq. (MHz)	Meas'd Emission (dBµV)	Cable Loss (dB)	Antenna Factor (dB/m)	Pre-amp Gain (dB)	Duty Cycle Corr'n (dB)	Field Strength (dBµV/m)	Distance Extrap'n Factor (dB)	Field Strength (µV/m)	Limit (µV/m)
High Power: 28 dBm; Bandwidth: 5 MHz; Mod mode: QPSK; Channel: 5788 MHz; Flat plate High gain antenna										
No Emission within 20 dB to the limit										

30 MHz to 1 GHz.

Date: 15.FEB.2018 15:30:26

1 GHz to 4 GHz.
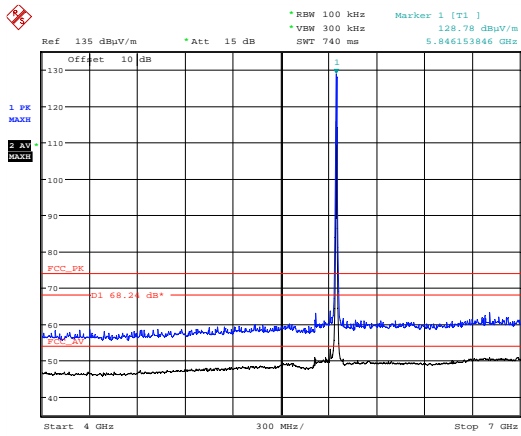
Date: 16.FEB.2018 10:28:10

4 GHz to 7 GHz.
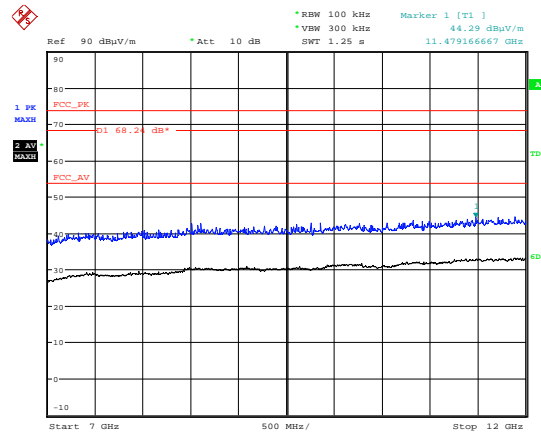
Date: 15.FEB.2018 15:31:04

7 GHz to 12 GHz.
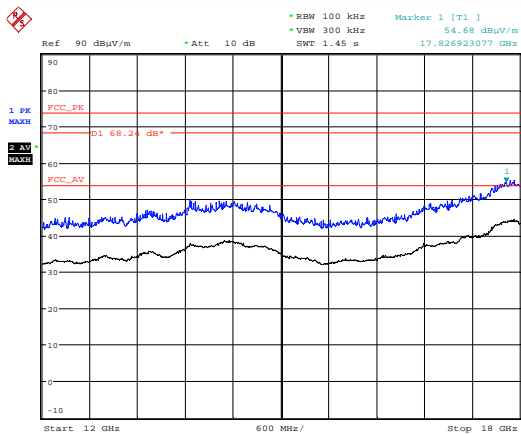
Date: 15.FEB.2018 15:31:32

12 GHz to 18 GHz.
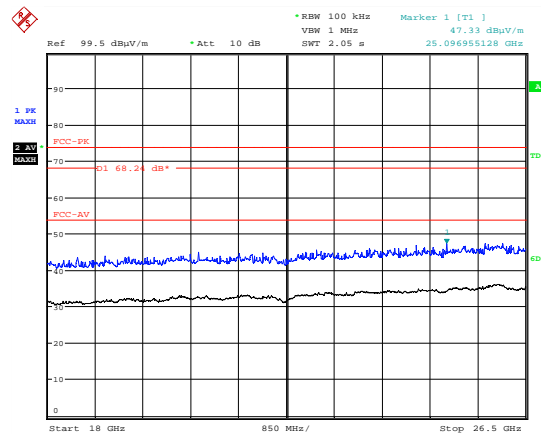
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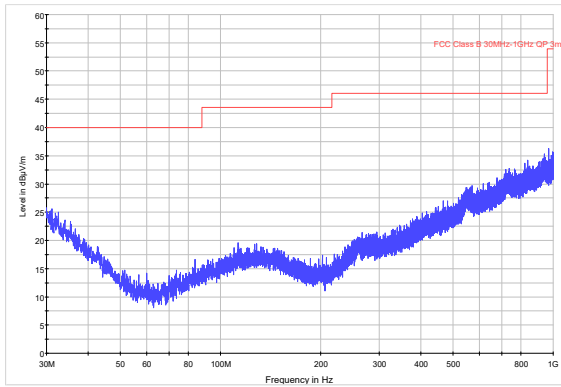
18 GHz to 26.5 GHz.
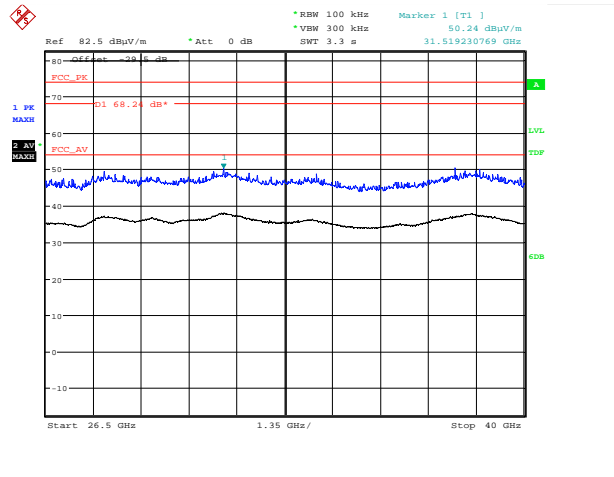
26.5 GHz to 40 GHz.

Date: 15.FEB.2018 11:15:13

Detector	Freq. (MHz)	Meas'd Emission (dBµV)	Cable Loss (dB)	Antenna Factor (dB/m)	Pre-amp Gain (dB)	Duty Cycle Corr'n (dB)	Field Strength (dBµV/m)	Distance Extrap'n Factor (dB)	Field Strength (µV/m)	Limit (µV/m)

High Power: 28 dBm; Bandwidth: 5 MHz; Mod mode: QPSK; Channel: 5847.5 MHz; Flat plate High gain antenna

No Emission within 20 dB to the limit

Omnidirectional antenna
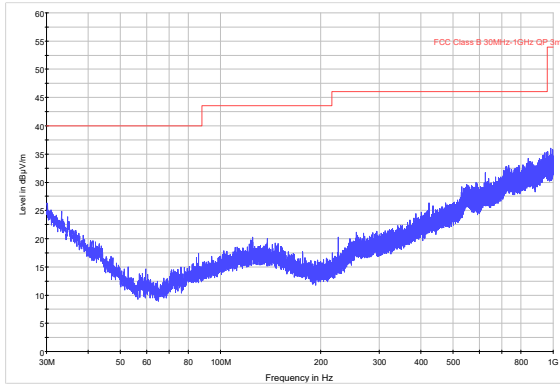
30 MHz to 1 GHz.
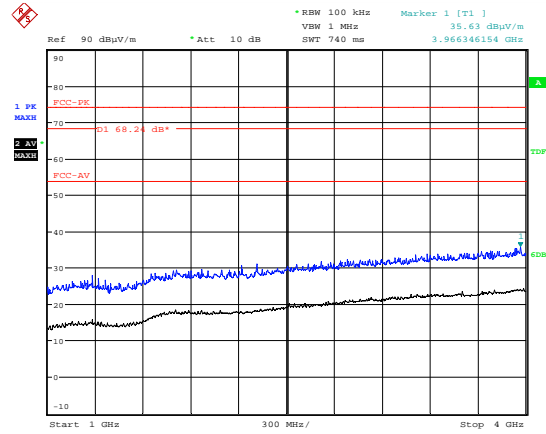
Date: 13.FEB.2018 07:39:54

1 GHz to 4 GHz.
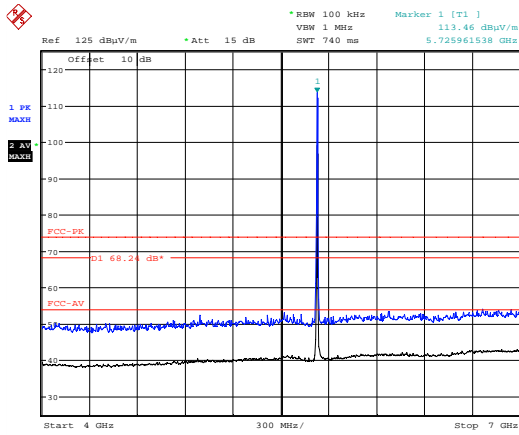

Date: 13.FEB.2018 06:42:43

4 GHz to 7 GHz.
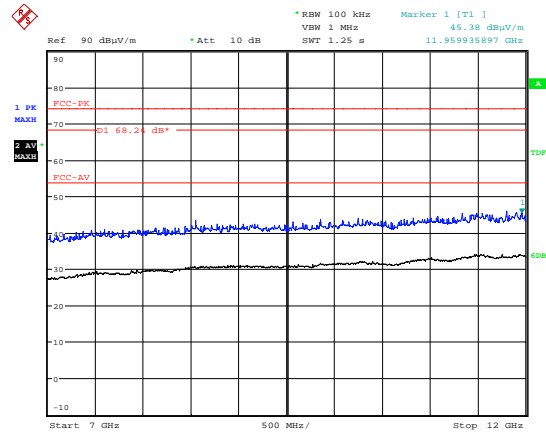
Date: 13.FEB.2018 07:41:19
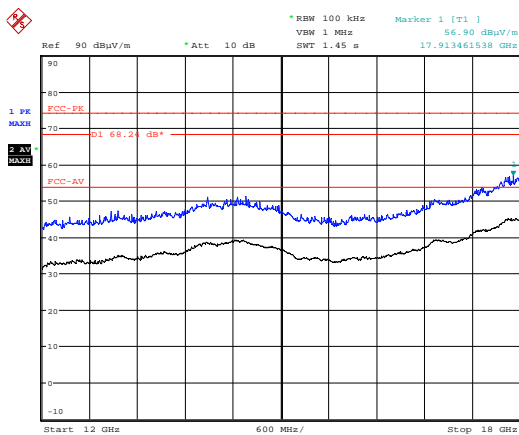
7 GHz to 12 GHz.

Date: 13.FEB.2018 07:44:34

12 GHz to 18 GHz.
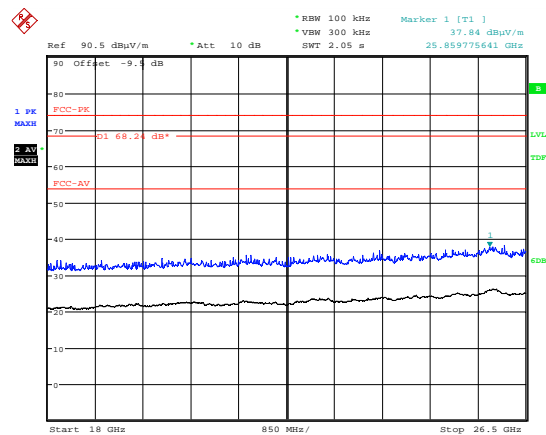
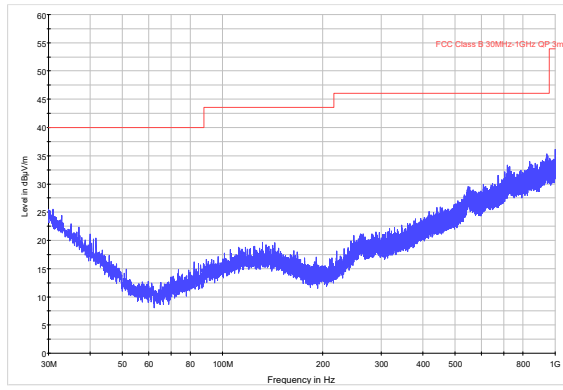Date: 14.FEB.2018 12:08:51
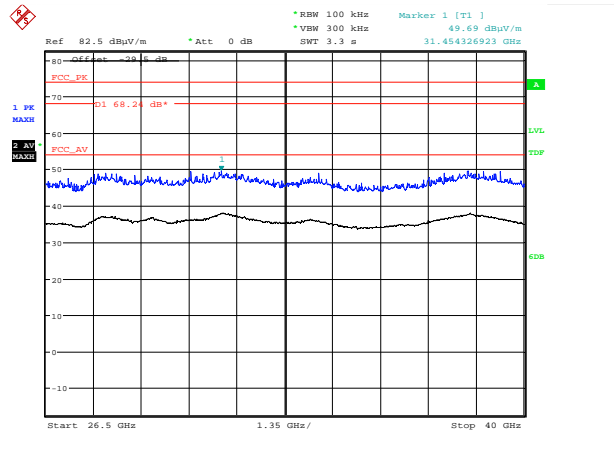
18 GHz to 26.5 GHz.

26.5 GHz to 40 GHz.

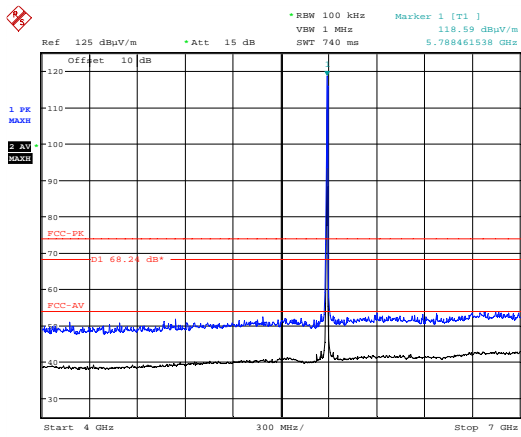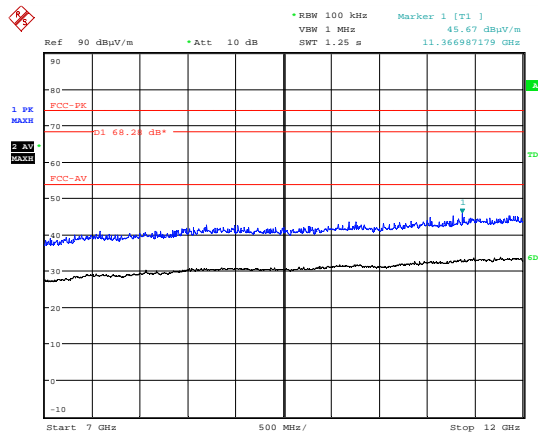|	High Power: 28 dBm; Bandwidth: 5 MHz; Mod mode: QPSK; Channel: 5727.5 MHz; Omnidirectional Antenna									
Detector	Freq. (MHz)	Meas'd Emission (dBµV)	Cable Loss (dB)	Antenna Factor (dB/m)	Pre-amp Gain (dB)	Duty Cycle Corr'n (dB)	Field Strength (dBµV/m)	Distance Extrap'n Factor (dB)	Field Strength (µV/m)	Limit (µV/m)
No Emission within 20 dB to the limit										

30 MHz to 1 GHz.

Date: 13.FEB.2018 07:53:37

1 GHz to 4 GHz.

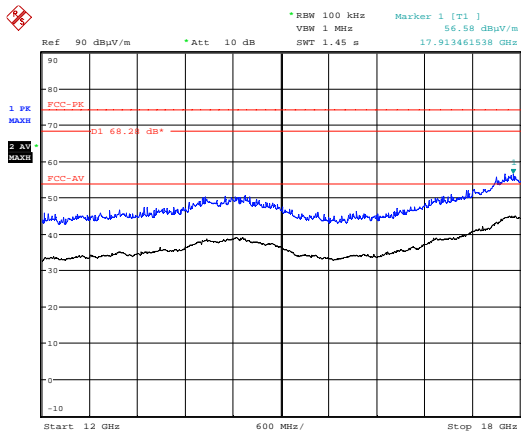Date: 13.FEB.2018 06:44:33

4 GHz to 7 GHz.

Date: 13.FEB.2018 07:52:15

7 GHz to 12 GHz.

Date: 13.FEB.2018 07:47:36

12 GHz to 18 GHz.
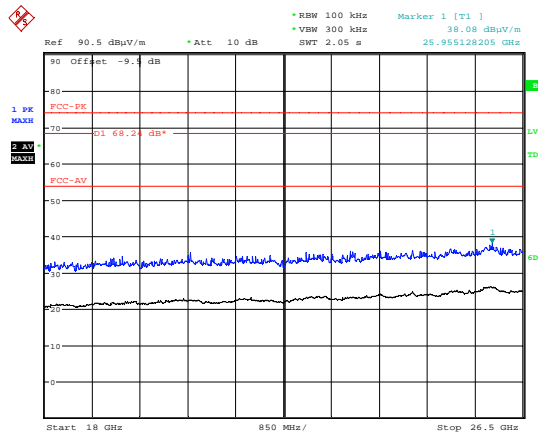
Date: 14.FEB.2018 12:11:59

18 GHz to 26.5 GHz.
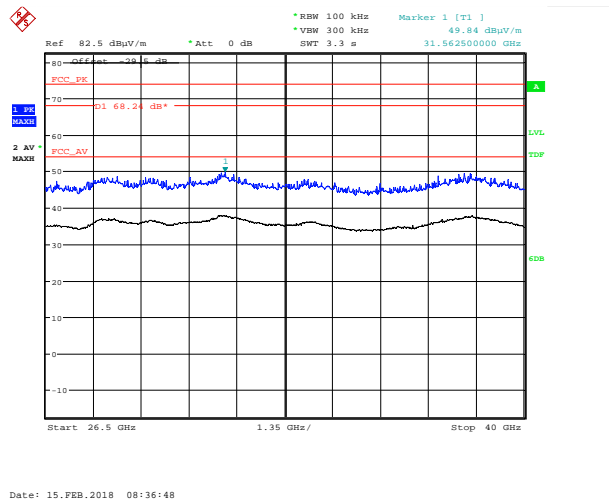
26.5 GHz to 40 GHz.

	High Power: 28 dBm; Bandwidth: 5 MHz; Mod mode: QPSK; Channel: 5788 MHz; Omnidirectional Antenna									
Detector	Freq. (MHz)	Meas'd Emission (dBµV)	Cable Loss (dB)	Antenna Factor (dB/m)	Pre-amp Gain (dB)	Duty Cycle Corr'n (dB)	Field Strength (dBµV/m)	Distance Extrap'n Factor (dB)	Field Strength (µV/m)	Limit (µV/m)
No Emission within 20 dB to the limit										

30 MHz to 1 GHz.

Date: 13.FEB.2018 07:58:01

1 GHz to 4 GHz.
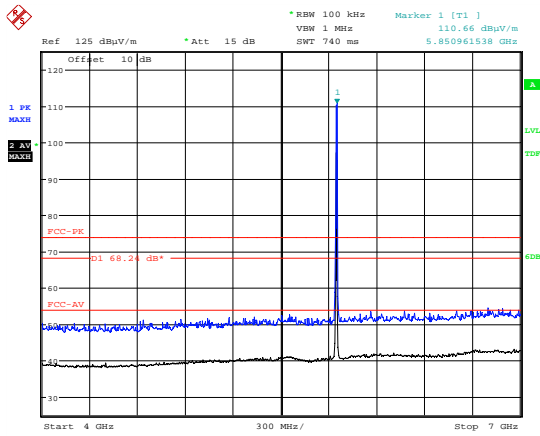
Date: 13.FEB.2018 06:48:20

4 GHz to 7 GHz.
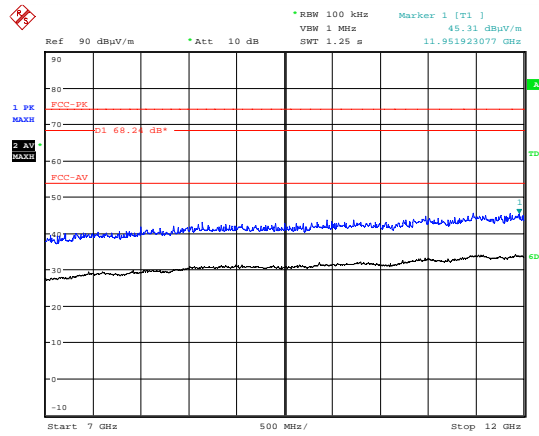
Date: 13.FEB.2018 07:59:15

7 GHz to 12 GHz.
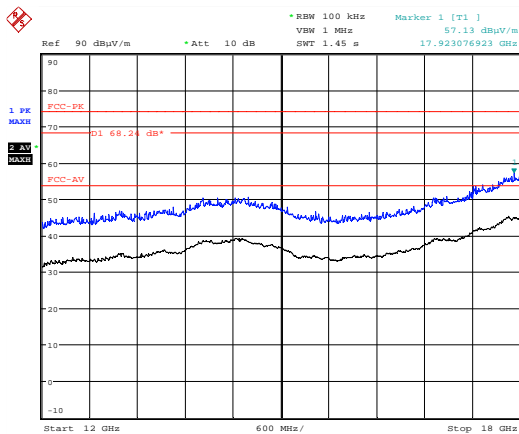
Date: 13.FEB.2018 08:02:22

12 GHz to 18 GHz.
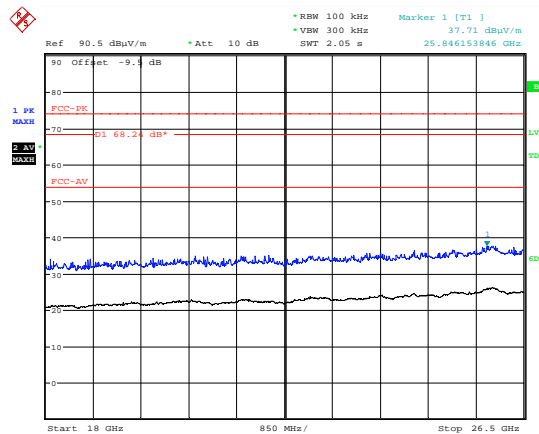
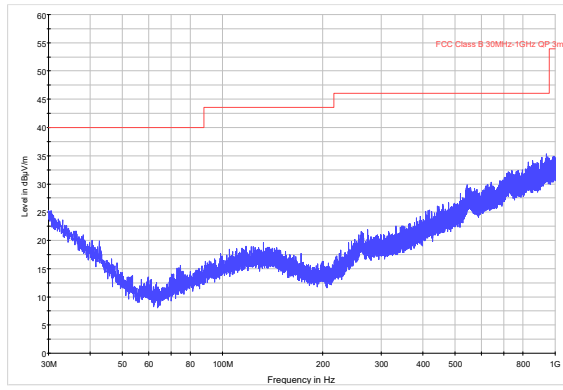Date: 14.FEB.2018 12:13:39

18 GHz to 26.5 GHz.
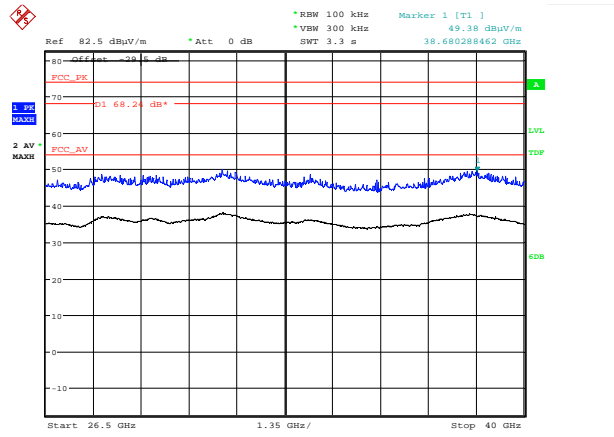
Date: 15.FEB.2018 08:37:23

26.5 GHz to 40 GHz.

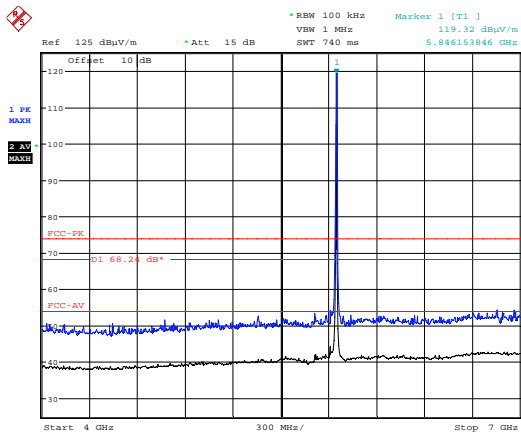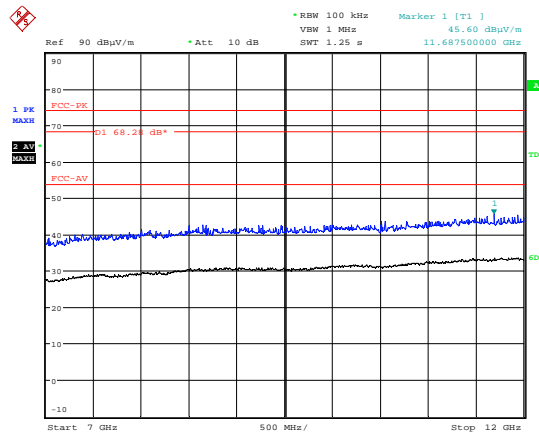| High Power: 28 dBm; Bandwidth: 5 MHz; Mod mode: QPSK; Channel: 5847.5 MHz; Omnidirectional Antenna										
Detector	Freq. (MHz)	Meas'd Emission (dBµV)	Cable Loss (dB)	Antenna Factor (dB/m)	Pre-amp Gain (dB)	Duty Cycle Corr'n (dB)	Field Strength (dBµV/m)	Distance Extrap'n Factor (dB)	Field Strength (µV/m)	Limit (µV/m)
No Emission within 20 dB to the limit										

4' Parabolic antenna
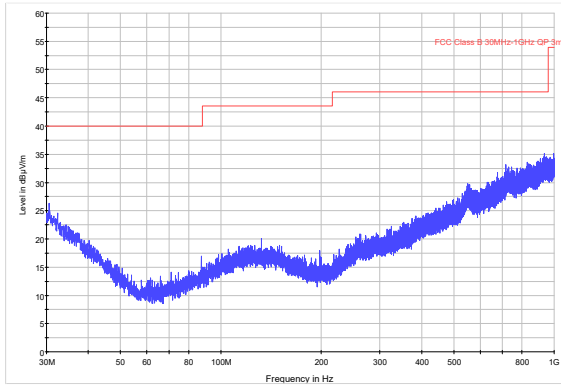
30 MHz to 1 GHz.
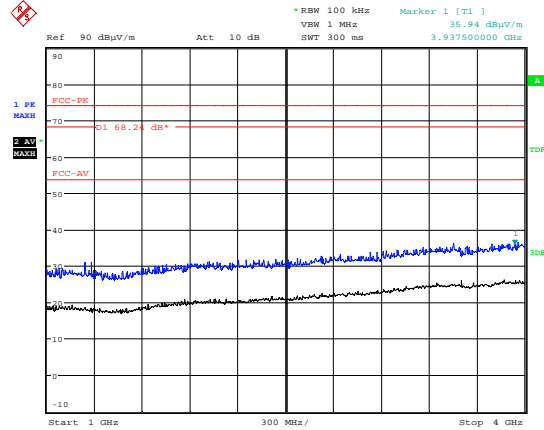
Date: 13.FEB.2018 14:31:39

1 GHz to 4 GHz.
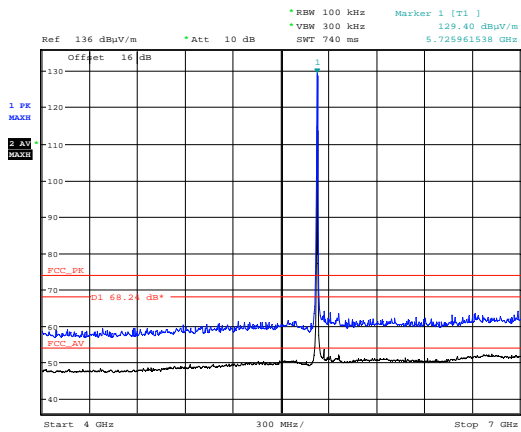
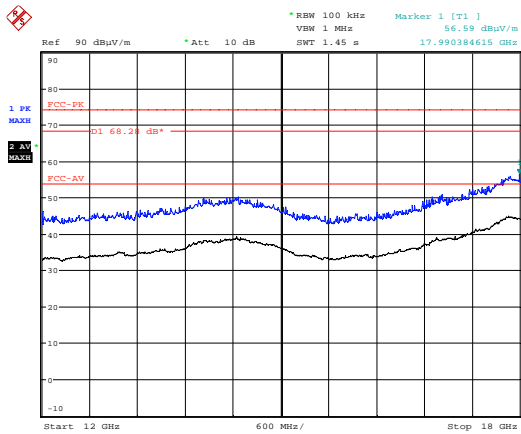Date: 6.MAR.2018 14:58:00

4 GHz to 7 GHz.
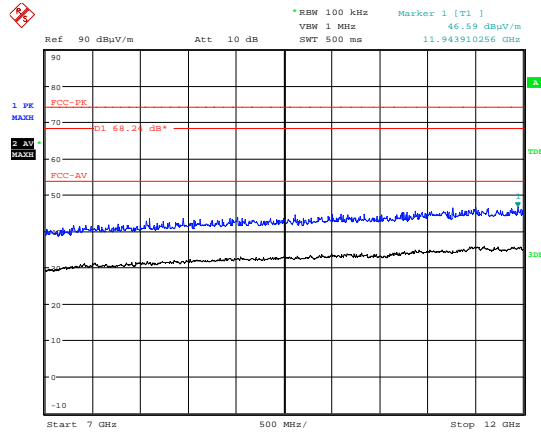
Date: 13.FEB.2018 14:32:08

7 GHz to 12 GHz.
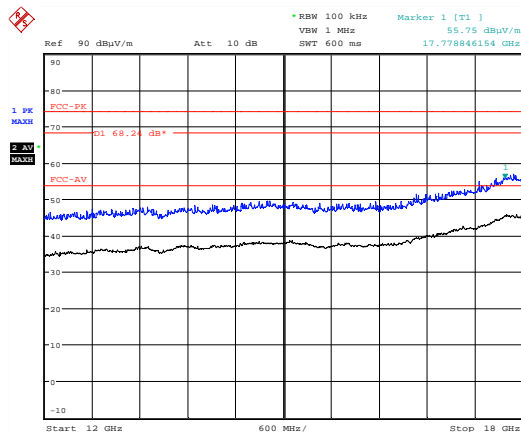
Date: 13.FEB.2018 14:33:36

12 GHz to 18 GHz.

Date: 15.FEB.2018 18:56:43

18 GHz to 26.5 GHz.

```
                                          *RBW 100 kHz     Marker 1 [T1 ]
                                           VBW 1 MHz                  49.94 dBµV/m
          Ref  82.5 dBµV/m      *Att  0 dB  SWT 3.3 s              38.420673077 GHz
```

26.5 GHz to 40 GHz.

Date: 15.FEB.2018 20:53:15
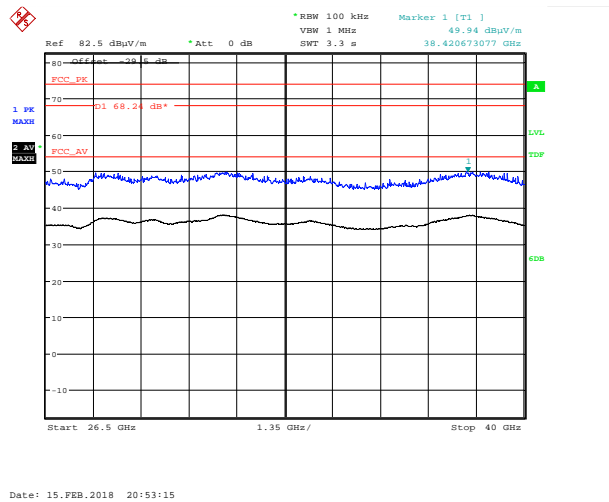
	High Power: 28 dBm; Bandwidth: 5 MHz; Mod mode: QPSK; Channel: 5727.5 MHz; Parabolic Antenna									
Detector	Freq. (MHz)	Meas'd Emission (dBµV)	Cable Loss (dB)	Antenna Factor (dB/m)	Pre-amp Gain (dB)	Duty Cycle Corr'n (dB)	Field Strength (dBµV/m)	Distance Extrap'n Factor (dB)	Field Strength (µV/m)	Limit (µV/m)
No Emission within 20 dB to the limit										

30 MHz to 1 GHz.

1 GHz to 4 GHz.

4 GHz to 7 GHz.

7 GHz to 12 GHz.

12 GHz to 18 GHz.

18 GHz to 26.5 GHz.

Date: 15.FEB.2018 20:54:29

26.5 GHz to 40 GHz.

High Power: 28 dBm; Bandwidth: 5 MHz; Mod mode: QPSK; Channel: 5788 MHz; Parabolic Antenna										
Detector	Freq. (MHz)	Meas'd Emission (dBµV)	Cable Loss (dB)	Antenna Factor (dB/m)	Pre-amp Gain (dB)	Duty Cycle Corr'n (dB)	Field Strength (dBµV/m)	Distance Extrap'n Factor (dB)	Field Strength (µV/m)	Limit (µV/m)
No Emission within 20 dB to the limit										

30 MHz to 1 GHz.

Date: 13.FEB.2018 14:39:35

1 GHz to 4 GHz.

Date: 6.MAR.2018 15:00:16

4 GHz to 7 GHz.
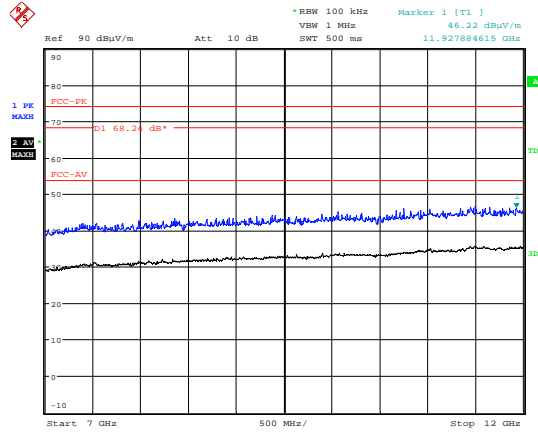
Date: 13.FEB.2018 14:40:01
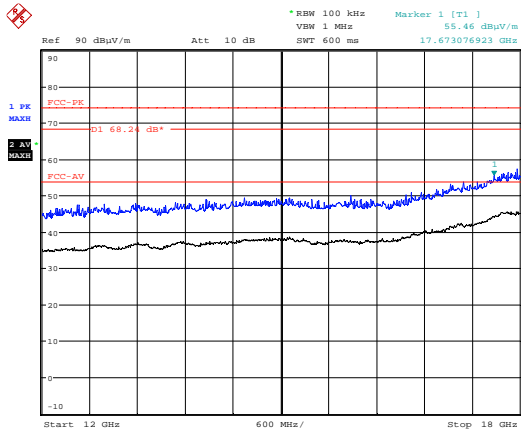
7 GHz to 12 GHz.

Date: 13.FEB.2018 14:41:25
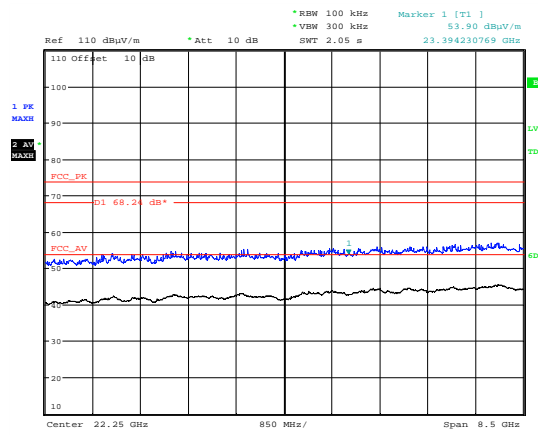
12 GHz to 18 GHz.

Date: 6.MAR.2018 17:05:33

18 GHz to 26.5 GHz.
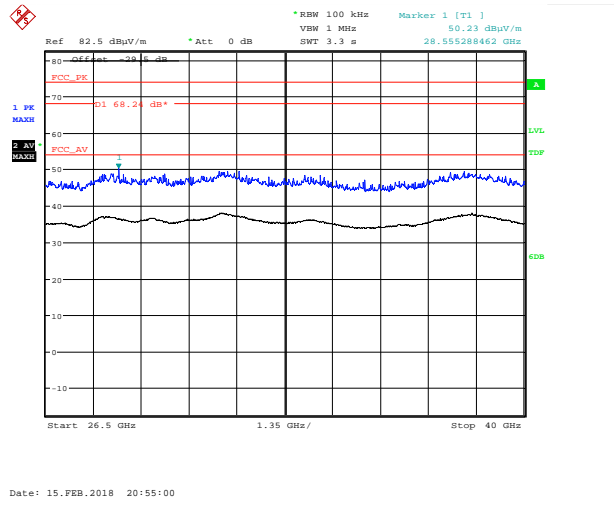
26.5 GHz to 40 GHz.

	High Power: 28 dBm; Bandwidth: 5 MHz; Mod mode: QPSK; Channel: 5847.5 MHz; Parabolic Antenna									
Detector	Freq. (MHz)	Meas'd Emission (dBµV)	Cable Loss (dB)	Antenna Factor (dB/m)	Pre-amp Gain (dB)	Duty Cycle Corr'n (dB)	Field Strength (dBµV/m)	Distance Extrap'n Factor (dB)	Field Strength (µV/m)	Limit (µV/m)
No Emission within 20 dB to the limit										

Sector antenna

30 MHz to 1 GHz.
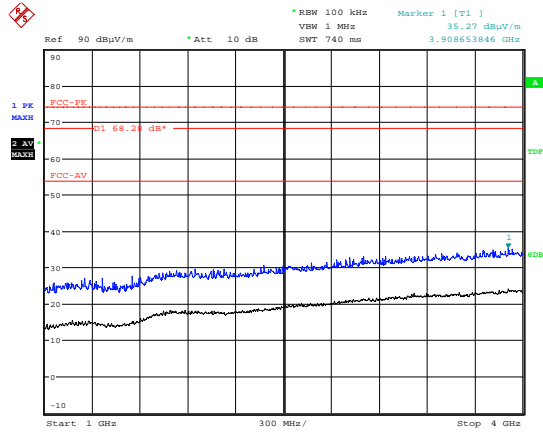
Date: 12.FEB.2018 20:21:24

1 GHz to 4 GHz.
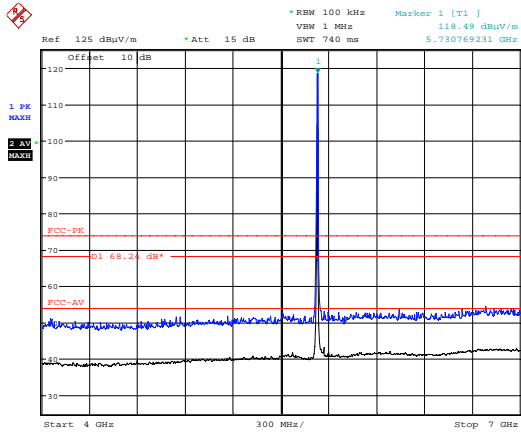
Date: 12.FEB.2018 22:08:41

4 GHz to 7 GHz.
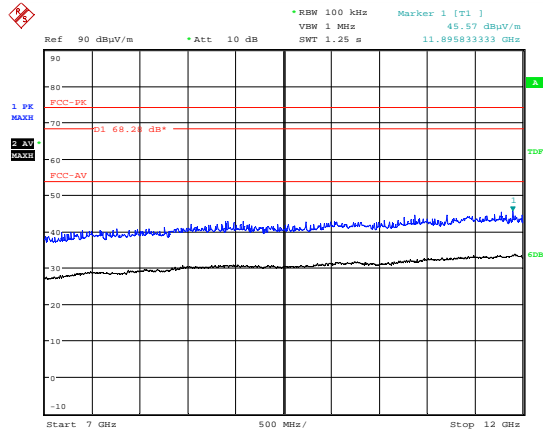
Date: 12.FEB.2018 20:20:23
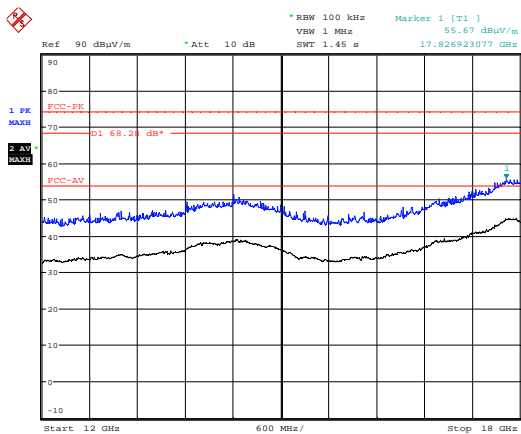
7 GHz to 12 GHz.

Date: 12.FEB.2018 20:19:38

12 GHz to 18 GHz.
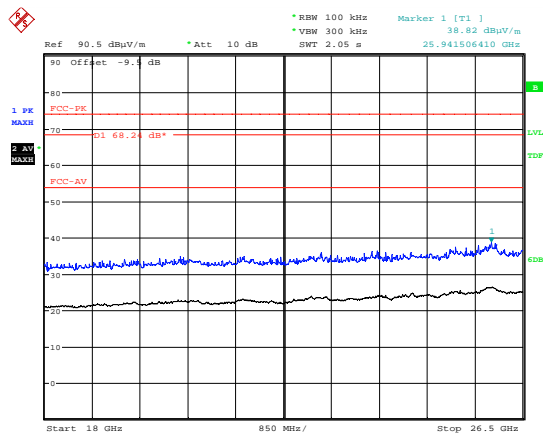
Date: 14.FEB.2018 11:25:55

18 GHz to 26.5 GHz.
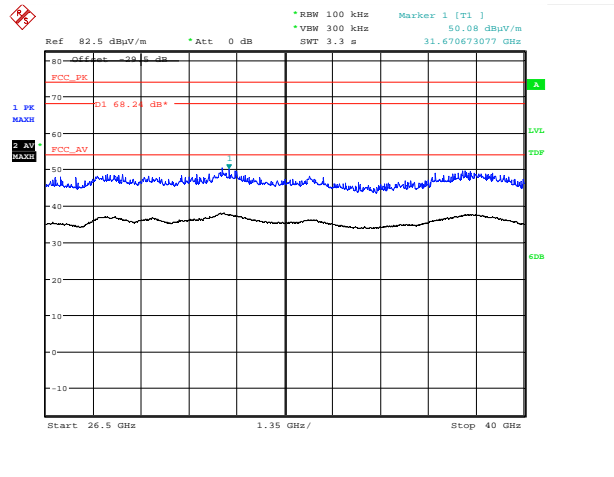
Date: 15.FEB.2018 10:20:52

26.5 GHz to 40 GHz.

High Power: 28 dBm; Bandwidth: 5 MHz; Mod mode: QPSK; Channel: 5727.5 MHz; Sector Antenna										
Detector	Freq. (MHz)	Meas'd Emission (dBµV)	Cable Loss (dB)	Antenna Factor (dB/m)	Pre-amp Gain (dB)	Duty Cycle Corr'n (dB)	Field Strength (dBµV/m)	Distance Extrap'n Factor (dB)	Field Strength (µV/m)	Limit (µV/m)
No Emission within 20 dB to the limit										

30 MHz to 1 GHz.

Date: 12.FEB.2018 20:22:20

1 GHz to 4 GHz.

Date: 12.FEB.2018 22:09:46

4 GHz to 7 GHz.

Date: 12.FEB.2018 20:23:18

7 GHz to 12 GHz.

Date: 12.FEB.2018 20:24:17
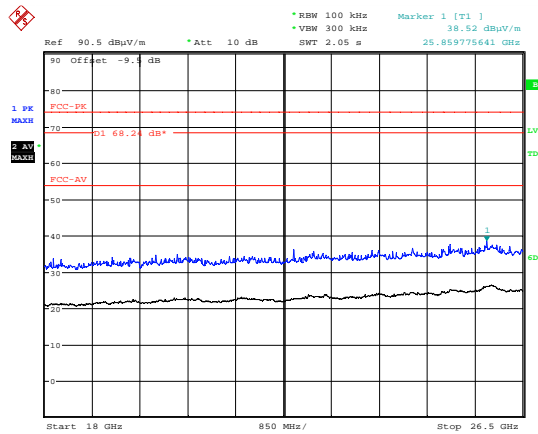
12 GHz to 18 GHz.

Date: 14.FEB.2018 11:30:07
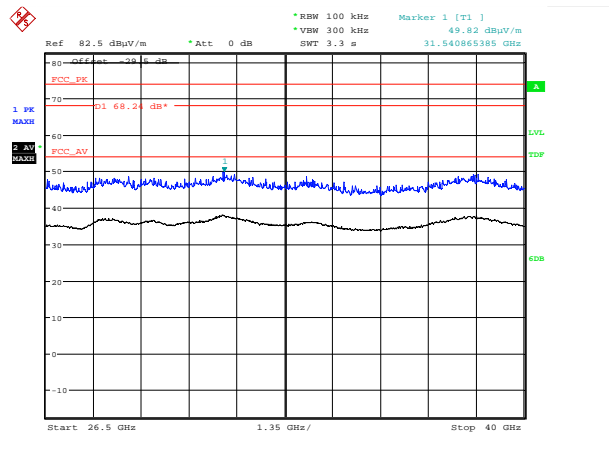
18 GHz to 26.5 GHz.

26.5 GHz to 40 GHz.

Detector	Freq. (MHz)	Meas'd Emission (dBµV)	Cable Loss (dB)	Antenna Factor (dB/m)	Pre-amp Gain (dB)	Duty Cycle Corr'n (dB)	Field Strength (dBµV/m)	Distance Extrap'n Factor (dB)	Field Strength (µV/m)	Limit (µV/m)
High Power: 28 dBm; Bandwidth: 5 MHz; Mod mode: QPSK; Channel: 5788 MHz; Sector Antenna										
No Emission within 20 dB to the limit										

30 MHz to 1 GHz.

Date: 12.FEB.2018 20:32:55

1 GHz to 4 GHz.

Date: 12.FEB.2018 22:32:12

4 GHz to 7 GHz.

Date: 12.FEB.2018 20:32:12

7 GHz to 12 GHz.

Date: 12.FEB.2018 20:31:22

12 GHz to 18 GHz.
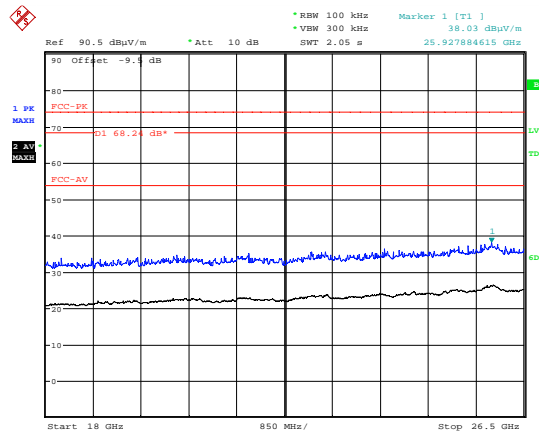
Date: 14.FEB.2018 11:31:33

18 GHz to 26.5 GHz.
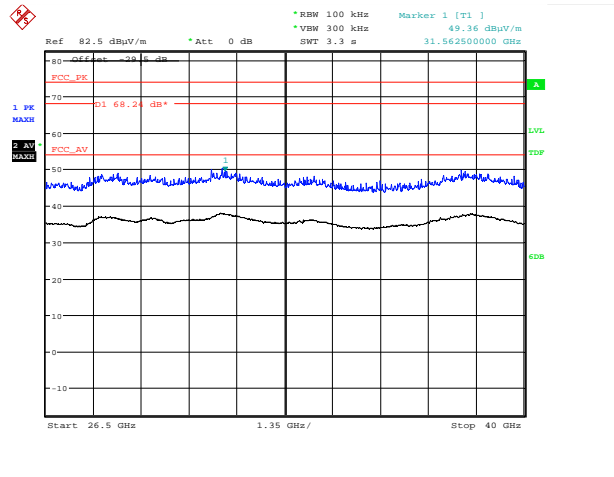
26.5 GHz to 40 GHz.

Date: 15.FEB.2018 10:22:36

High Power: 28 dBm; Bandwidth: 5 MHz; Mod mode: QPSK; Channel: 5847.5 MHz; Sector Antenna										
Detector	Freq. (MHz)	Meas'd Emission (dBµV)	Cable Loss (dB)	Antenna Factor (dB/m)	Pre-amp Gain (dB)	Duty Cycle Corr'n (dB)	Field Strength (dBµV/m)	Distance Extrap'n Factor (dB)	Field Strength (µV/m)	Limit (µV/m)
No Emission within 20 dB to the limit										

12 AC power-line conducted emissions

12.1 Definition

Line-to-ground radio-noise voltage that is conducted from all of the EUT current-carrying power input terminals that are directly (or indirectly via separate transformers or power supplies) connected to a public power network.

12.2 Test Parameters

Test Location:	Element Skelmersdale
Test Chamber:	LF Laboratory
Test Standard and Clause:	ANSI C63.10-2013, Clause 6.2
EUT Frequency of operation:	5788 MHz
EUT Channel Bandwidths:	5 MHz
EUT Modulation:	QPSK
Deviations From Standard:	None
Measurement BW:	10 kHz
Measurement Detectors:	Quasi-Peak and Average, RMS

Environmental Conditions (Normal Environment)

Temperature: 24 °C	+15 ºC to +35 ºC (as declared)
Humidity: 30 %RH	20%RH to 75%RH (as declared)
Supply: -48 V dc	-48 V dc (as declared)

Test Limits

A radio apparatus that is designed to be connected to the public utility (AC) power line shall ensure that the radio frequency voltage, which is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz-30 MHz, shall not exceed the limits in Table 3.

Table 3 – AC Power Line Conducted Emission Limits

Frequency (MHz)	Conducted limit (dBµV)	
	Quasi-Peak	Average**
0.15 – 0.5	66 to 56*	56 to 46*
0.5 – 5.0	56	46
5.0 – 30.0	60	50

* The level decreases linearly with the logarithm of the frequency.
** A linear average detector is required.

12.3 Test Method

With the EUT setup in a screened room, as per section 9 of this report and connected as per Figure ii, the power line emissions were measured on a spectrum analyzer / EMI receiver.

AC power line conducted emissions from the EUT are checked first by preview scans with peak and average detectors covering both live and neutral lines. A spectrum analyzer is used to determine if any periodic emissions are present.

Formal measurements using the correct detector(s) and bandwidth are made on frequencies identified from the preview scans. Final measurements were performed with EUT set at its maximum duty in transmit and receive modes.

Figure ii Test Setup
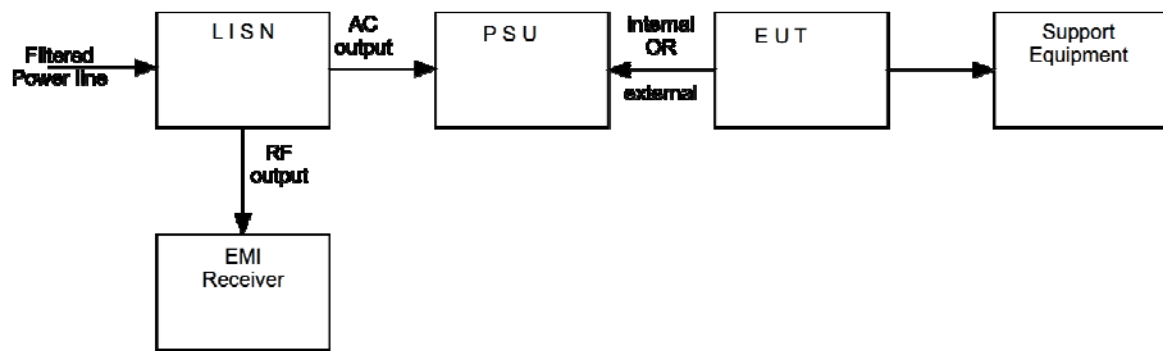
Test Setup Photograph(s)
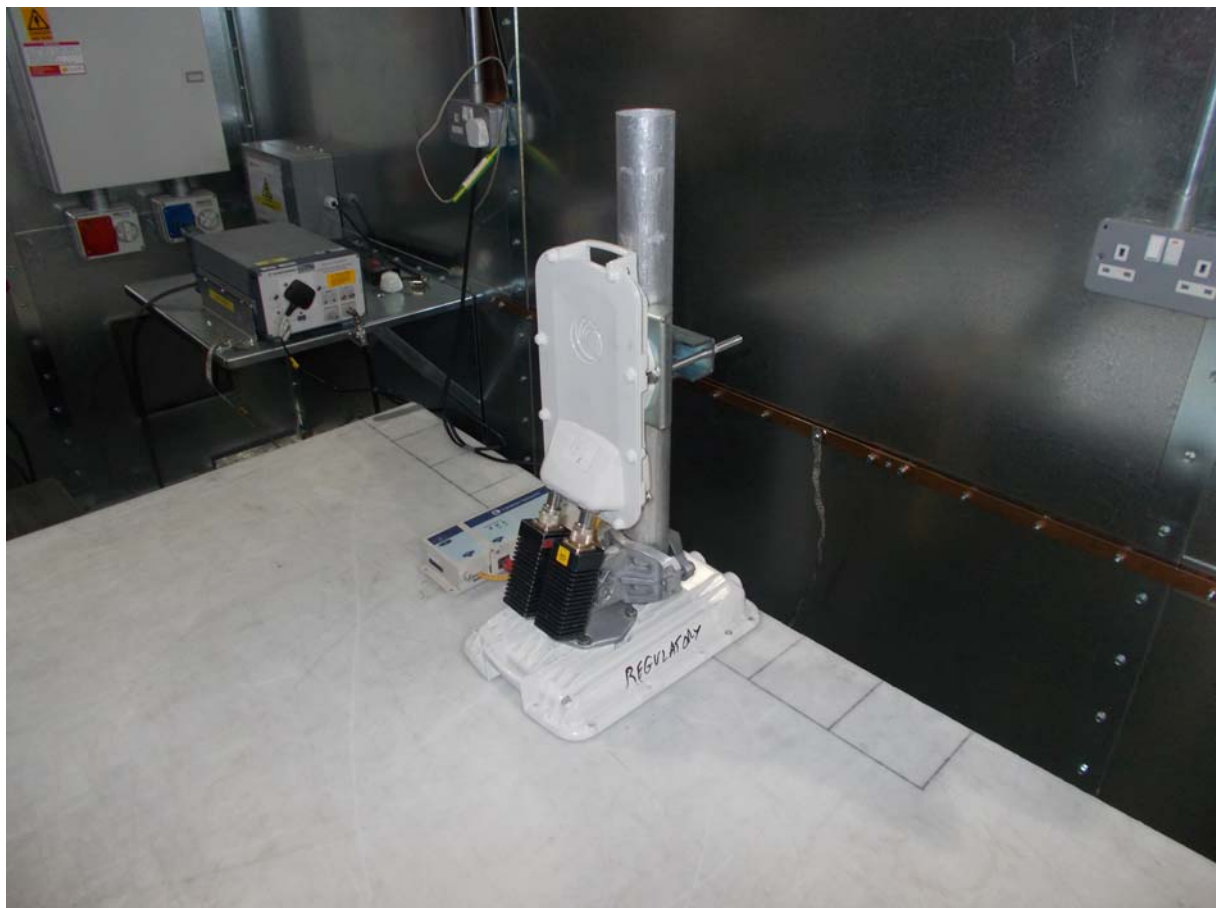
12.4   Test Equipment

Equipment Description	Manufacturer	Equipment Type	Element No	Last Cal Calibration	Calibration Period	Due For Calibration
Lisn	R&S	ESH3-Z5.831.5	U195	2017-08-16	12	2018-08-16
Receiver	R&S	ESHS10	U187	2017-11-08	12	2018-11-08

12.5   Test Results
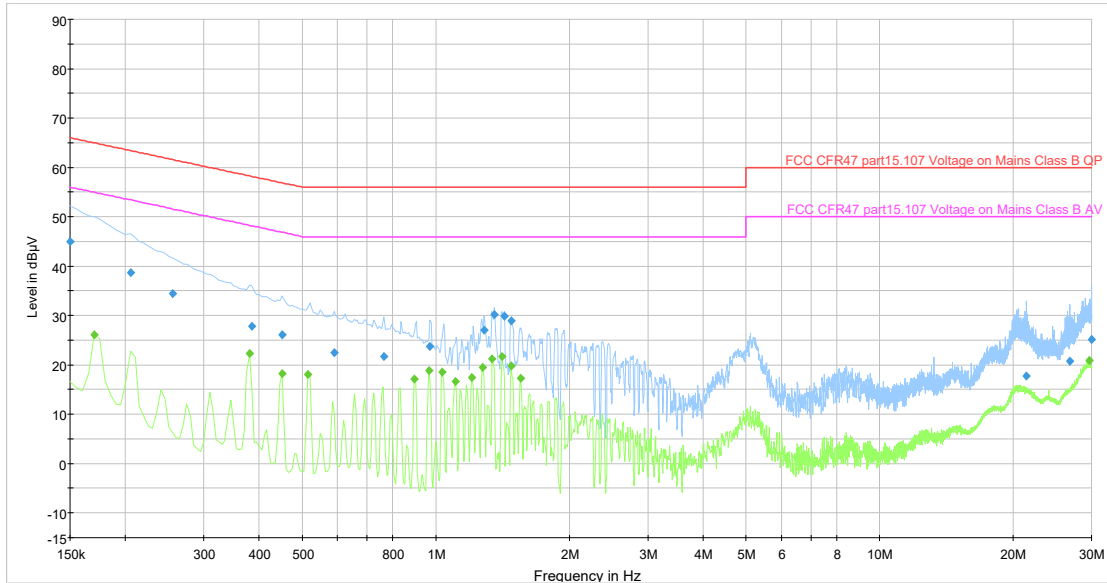
AC power-line conducted emissions, Transmit mode						
Results measured using the average detector						
Reference Number	Frequency (MHz)	Conductor	Result (dBuV)	Specification Limit (dBuV)	Margin (dB)	Result Summary
No Emission within 20 dB to the limit						PASS
Results measured using the quasi-peak detector						
Reference Number	Frequency (MHz)	Conductor	Result (dBuV)	Specification Limit (dBuV)	Margin (dB)	Result Summary
No Emission within 20 dB to the limit						PASS

13 Occupied Bandwidth

13.1   Definition

The emission bandwidth (x dB) is defined as the frequency range between two points, one above and one below the carrier frequency, at which the spectral density of the emission is attenuated x dB below the maximum in-band spectral density of the modulated signal.

13.2   Test Parameters

Test Location:	Element Skelmersdale
Test Chamber:	Radio Laboratory
Test Standard and Clause:	ANSI C63.10-2013, Clause 6.9
EUT Channels Measured:	Top, middle and bottom
EUT Channel Bandwidths:	5, 10, 15, 20, 30 and 40 MHz
EUT Test Modulations:	QPSK, 16 QAM, 64 QAM and 256 QAM
Deviations From Standard:	None
Measurement BW: (FCC requirement: 100 kHz)	100 kHz
Spectrum Analyzer Video BW: (requirement at least 3x RBW)	300 kHz
Measurement Span: (requirement 2 to 5 times OBW)	10, 20, 30, 40, 60, 80 and 90 MHz
Measurement Detector:	Peak

Environmental Conditions (Normal Environment)

Temperature: 24 °C	+15 ºC to +35 ºC (as declared)
Humidity: 32 %RH	20%RH to 75%RH (as declared)
Supply: -48 Vdc	-48 Vdc (as declared)

Test Limits
Within the 5.725–5.85 GHz band, the minimum 6 dB bandwidth of U–NII devices shall be at least 500 kHz.

13.3   Test Method

With the EUT setup as per section 9 of this report and connected as per Figure iii, the bandwidth of the EUT was measured on a spectrum analyser.
The measurements were performed with EUT set at its maximum duty. All modulation schemes, data rates and power settings were used to observe the worst-case configuration in each bandwidth.

Figure iii Test Setup
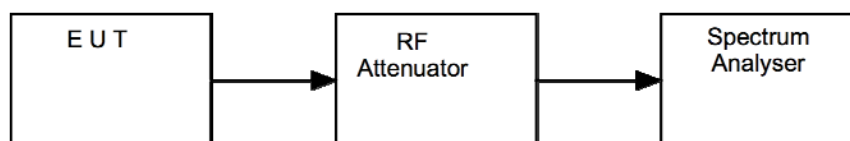
13.4 Test Equipment

Equipment Description	Manufacturer	Equipment Type	Element No	Last Cal Calibration	Calibration Period	Due For Calibration
Spectrum Analyser	R&S	FSU46	U281	2017/06/19	12	2018/06/19

13.5 Test Results

5 MHz Bandwidths
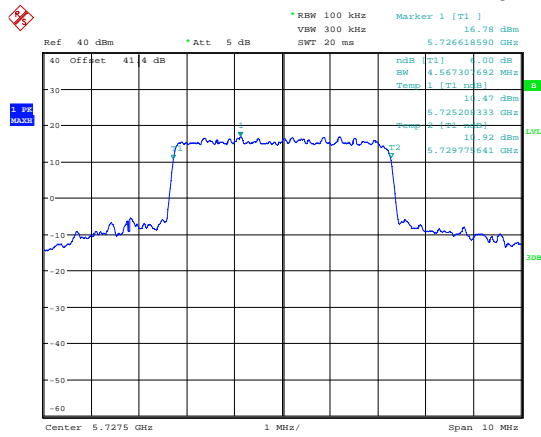
Date: 8.FEB.2018 16:46:08

6 dB Bandwidth QPSK; 5727.5 MHz.
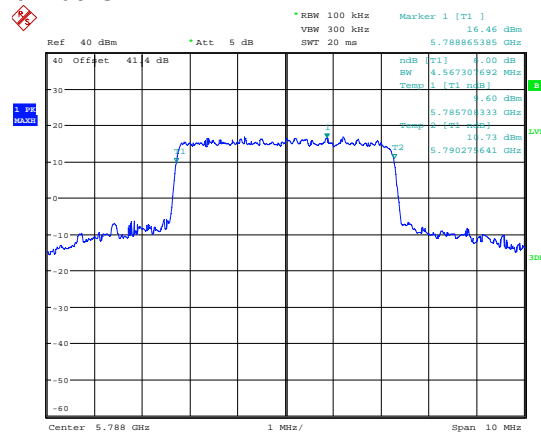
Date: 8.FEB.2018 16:52:16
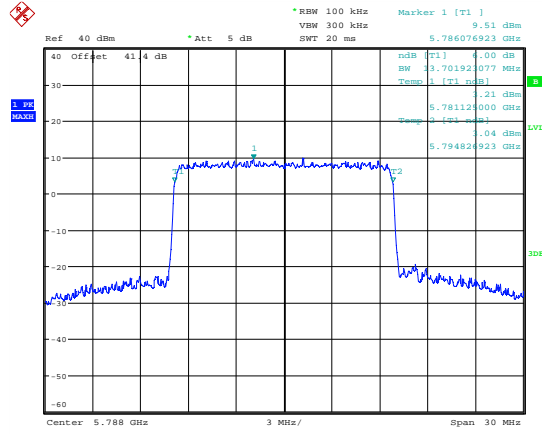
6 dB Bandwidth QPSK; 5788 MHz.
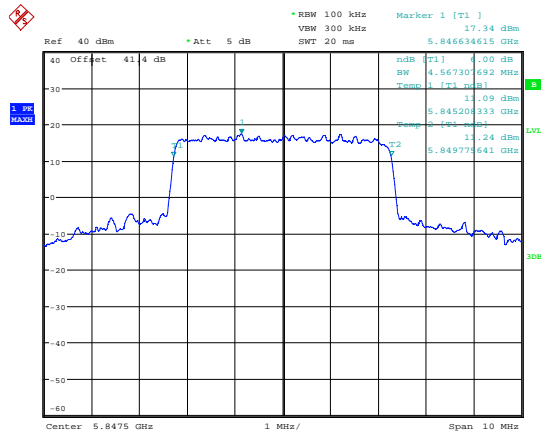
Date: 8.FEB.2018 17:11:36

6 dB Bandwidth QPSK; 5847.5 MHz.

Modulation Mode: QPSK; 5 MHz				
Frequency (MHz)	FL (MHz)	FH (MHz)	6dB Bandwidth (kHz)	Result
5727.5	5725.208	5729.776	4568	PASS
5788	5785.708	5790.276	4568	PASS
5847.5	5845.208	5849.776	4568	PASS
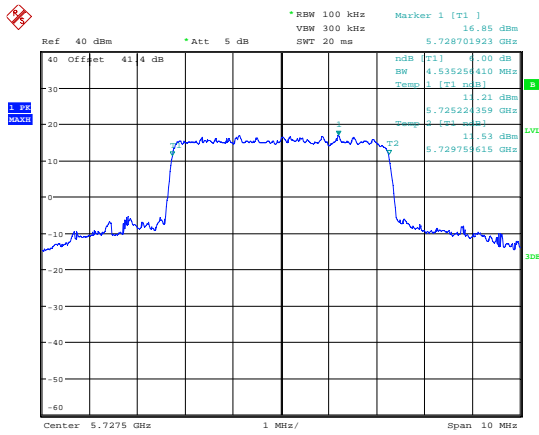
Date: 8.FEB.2018 16:46:40

6 dB Bandwidth 16 QAM; 5727.5 MHz.
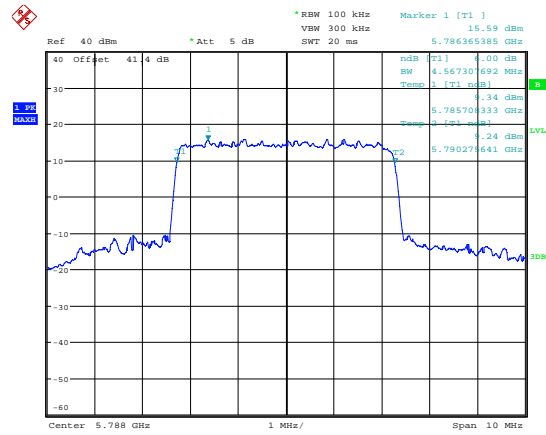
Date: 8.FEB.2018 16:55:48

6 dB Bandwidth 16 QAM; 5788 MHz.
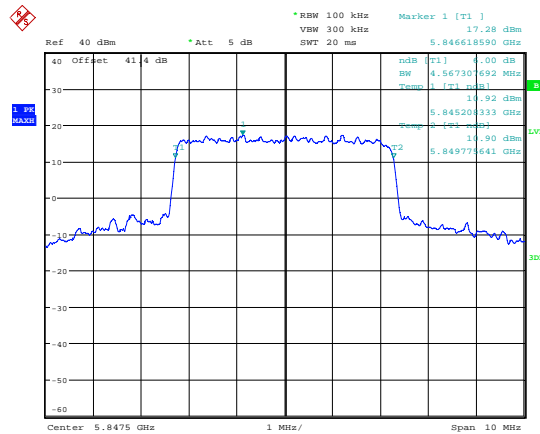
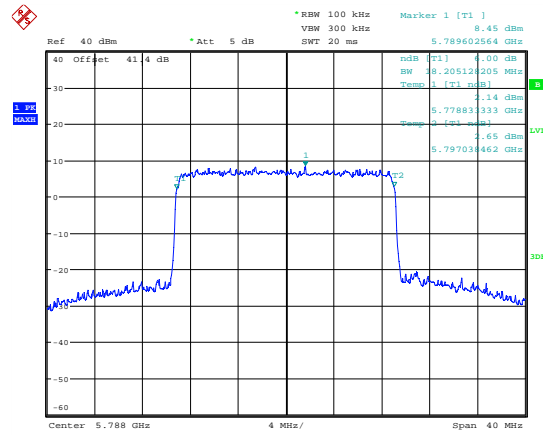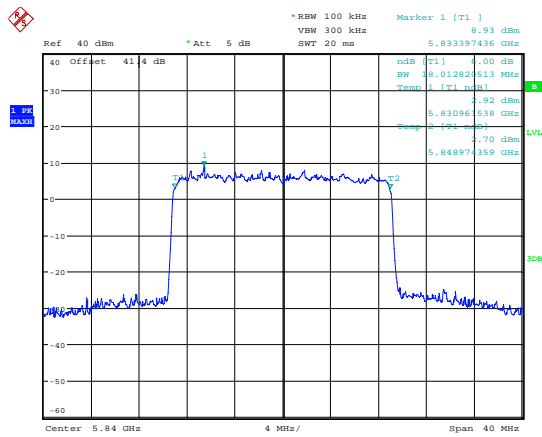Date: 8.FEB.2018 17:13:49

6 dB Bandwidth 16 QAM; 5847.5 MHz.

Modulation Mode: 16 QAM; 5 MHz				
Frequency (MHz)	FL (MHz)	FH (MHz)	6dB Bandwidth (kHz)	Result
5727.5	5725.224	5729.76	4536	PASS
5788	5785.708	5790.276	4568	PASS
5847.5	5845.208	5849.776	4568	PASS
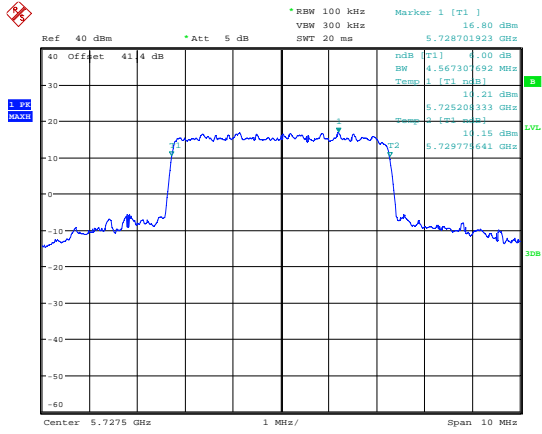
6 dB Bandwidth 64 QAM; 5727.5 MHz.
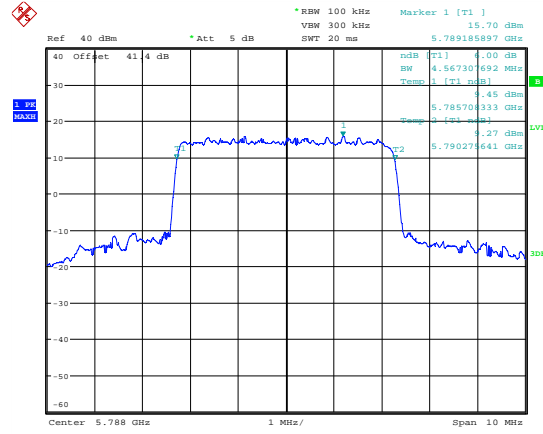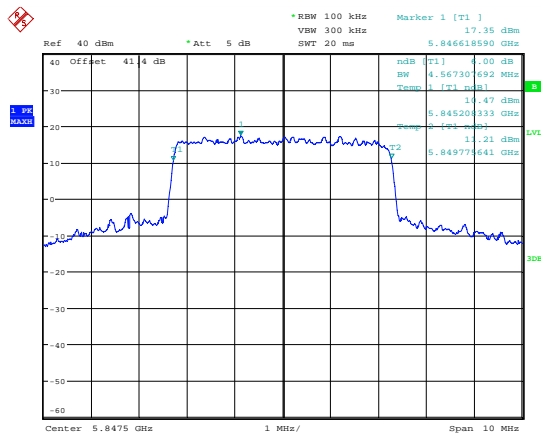
6 dB Bandwidth 64 QAM; 5788 MHz.

6 dB Bandwidth 64 QAM; 5847.5 MHz.

Modulation Mode: 64 QAM; 5 MHz				
Frequency (MHz)	FL (MHz)	FH (MHz)	6dB Bandwidth (kHz)	Result
5727.5	5725.208	5729.776	4568	PASS
5788	5785.708	5790.276	4568	PASS
5847.5	5845.208	5849.776	4568	PASS
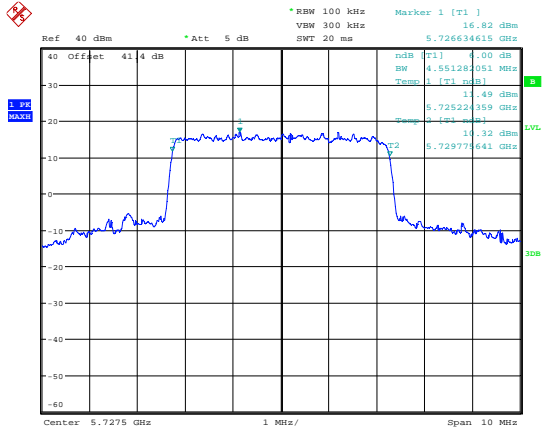
6 dB Bandwidth 256 QAM; 5727.5 MHz.
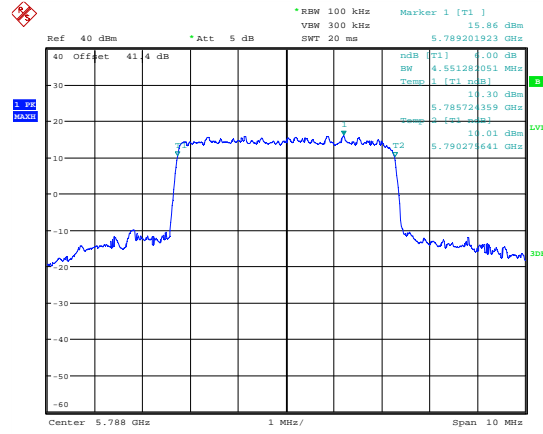
6 dB Bandwidth 256 QAM; 5788 MHz.

6 dB Bandwidth 256 QAM; 5847.5 MHz.

Modulation Mode: 256 QAM; 5 MHz				
Frequency (MHz)	FL (MHz)	FH (MHz)	6dB Bandwidth (kHz)	Result
5727.5	5725.224	5729.776	4552	PASS
5788	5785.724	5790.276	4552	PASS
5847.5	5845.224	5849.76	4536	PASS

10 MHz Bandwidths

6 dB Bandwidth QPSK; 5730 MHz.
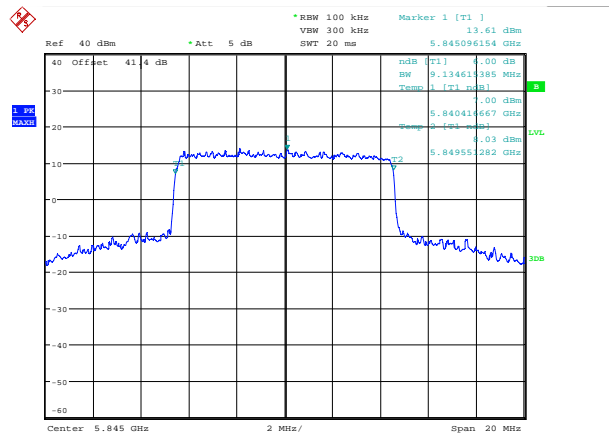
6 dB Bandwidth QPSK; 5788 MHz.

6 dB Bandwidth QPSK; 5845 MHz.

Modulation Mode: QPSK; 10 MHz				
Frequency (MHz)	FL (MHz)	FH (MHz)	6dB Bandwidth (kHz)	Result
5730	5725.448	5734.551	9103	PASS
5788	5783.448	5792.551	9103	PASS
5845	5840.416	5849.551	9135	PASS
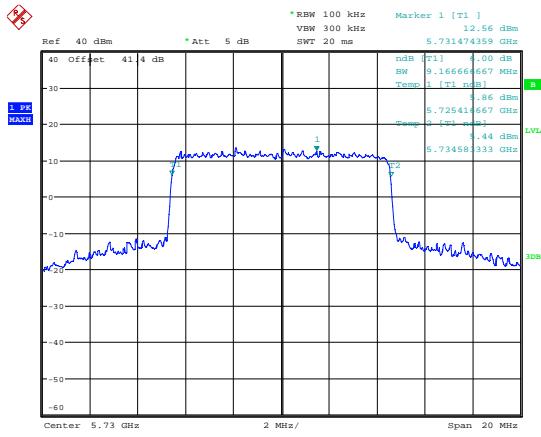
Date: 8.FEB.2018 17:21:37

6 dB Bandwidth 16 QAM; 5730 MHz.
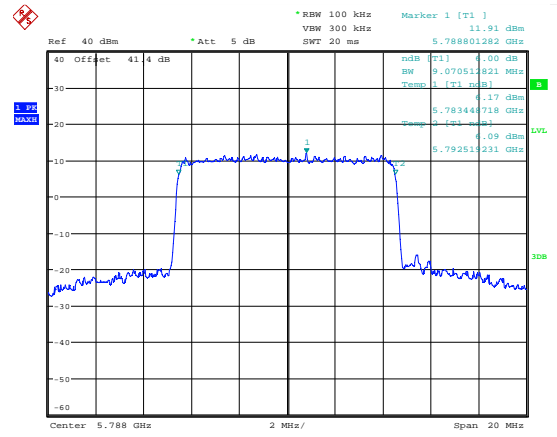
Date: 8.FEB.2018 17:29:28

6 dB Bandwidth 16 QAM; 5788 MHz.
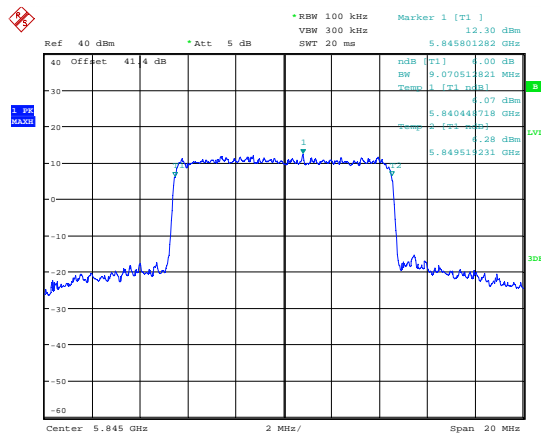
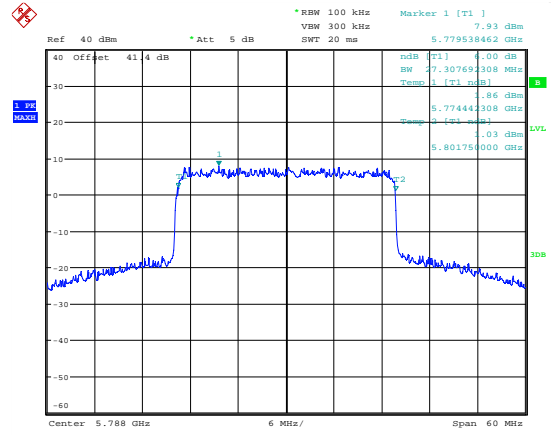Date: 8.FEB.2018 17:34:08

6 dB Bandwidth 16 QAM; 5845 MHz.

Modulation Mode: 16 QAM; 10 MHz				
Frequency (MHz)	FL (MHz)	FH (MHz)	6dB Bandwidth (kHz)	Result
5730	5725.416	5734.583	9167	PASS
5788	5783.448	5792.519	9071	PASS
5845	5840.448	5849.519	9071	PASS
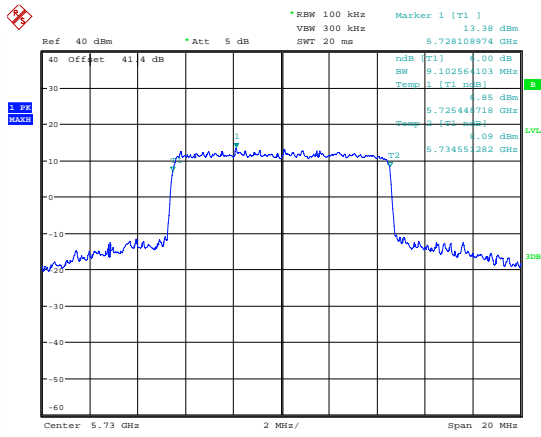
Date: 8.FEB.2018 17:22:08

6 dB Bandwidth 64 QAM; 5730 MHz.
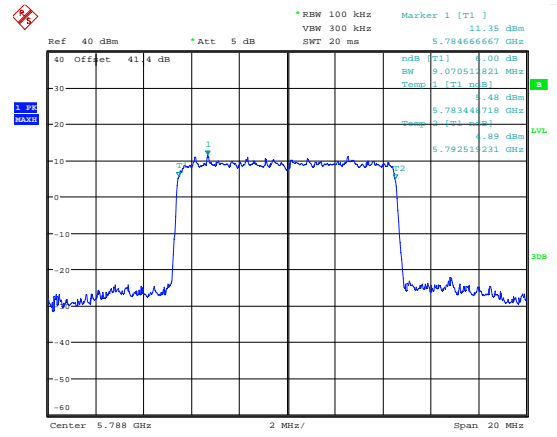
Date: 8.FEB.2018 17:28:47

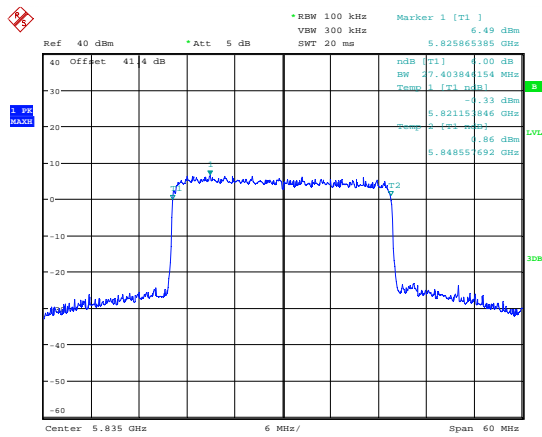6 dB Bandwidth 64 QAM; 5788 MHz.
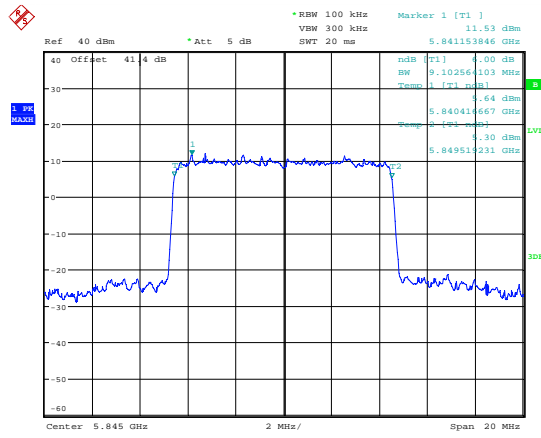
Date: 8.FEB.2018 17:35:20

6 dB Bandwidth 64 QAM; 5845 MHz.

Modulation Mode: 64 QAM; 10 MHz				
Frequency (MHz)	FL (MHz)	FH (MHz)	6dB Bandwidth (kHz)	Result
5730	5725.448	5734.551	9103	PASS
5788	5783.448	5792.519	9071	PASS
5845	5840.416	5849.519	9103	PASS
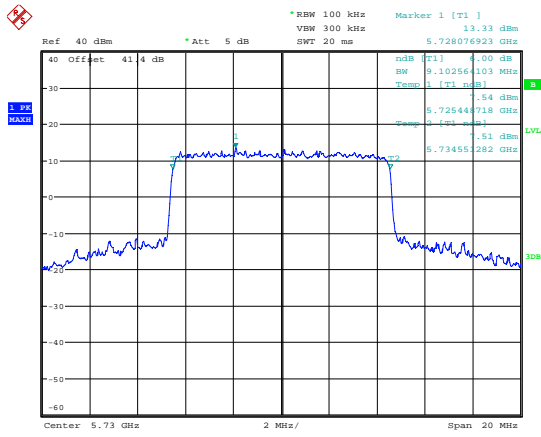
Date: 8.FEB.2018 17:23:25

6 dB Bandwidth 256 QAM; 5730 MHz.
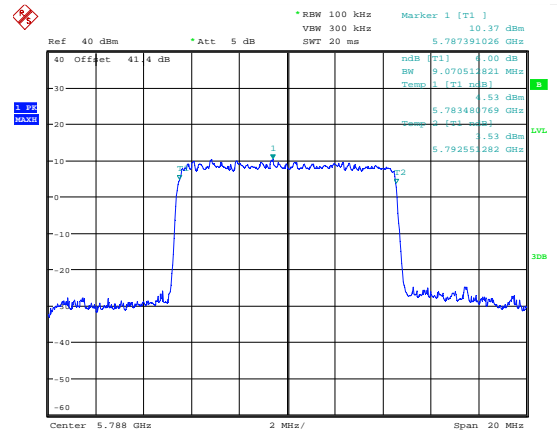
Date: 8.FEB.2018 17:27:23
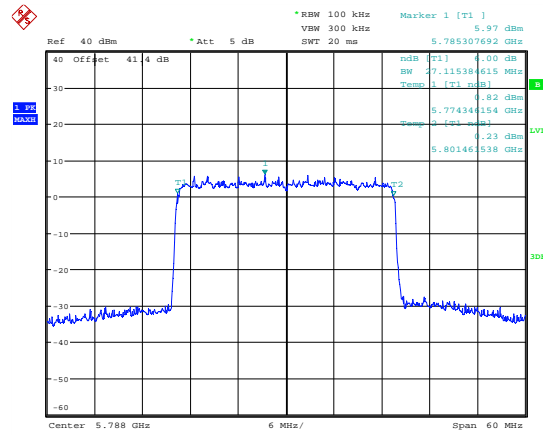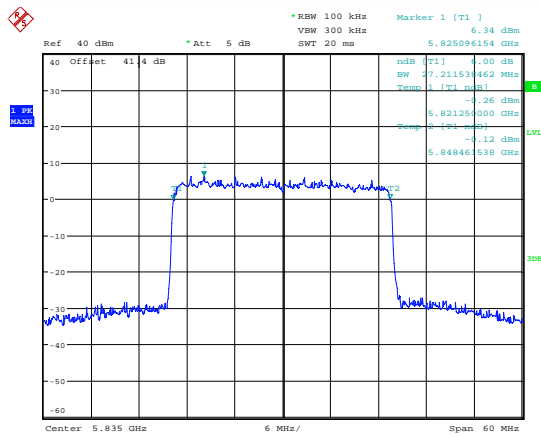
6 dB Bandwidth 256 QAM; 5788 MHz.
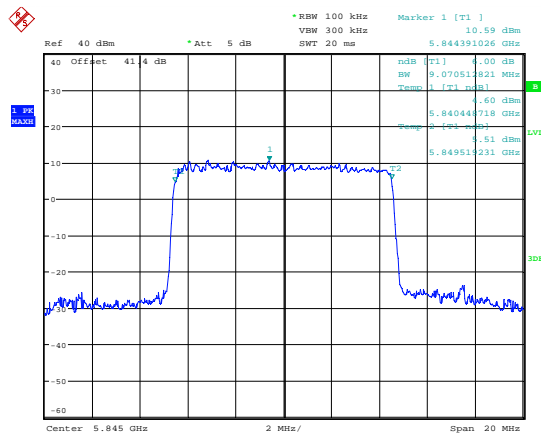
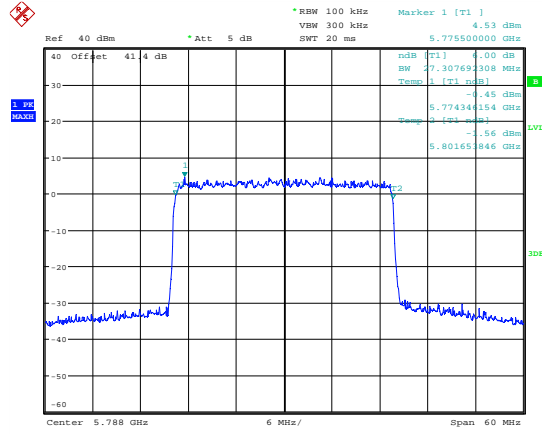Date: 8.FEB.2018 17:37:05

6 dB Bandwidth 256 QAM; 5845 MHz.

Modulation Mode: 256 QAM; 10 MHz				
Frequency (MHz)	FL (MHz)	FH (MHz)	6dB Bandwidth (kHz)	Result
5730	5725.448	5734.551	9.103	PASS
5788	5783.48	5792.551	9.071	PASS
5845	5840.448	5849.519	9.071	PASS

15 MHz Bandwidths
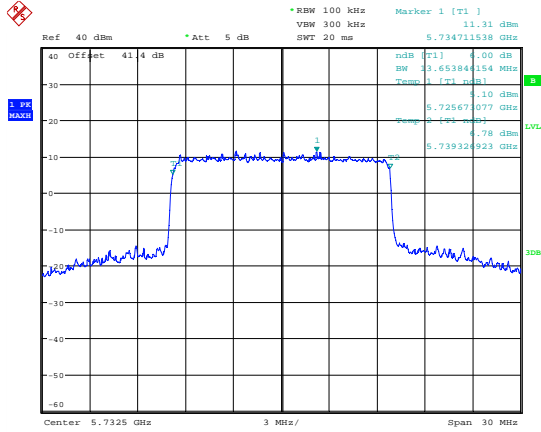
6 dB Bandwidth QPSK; 5732.5 MHz.
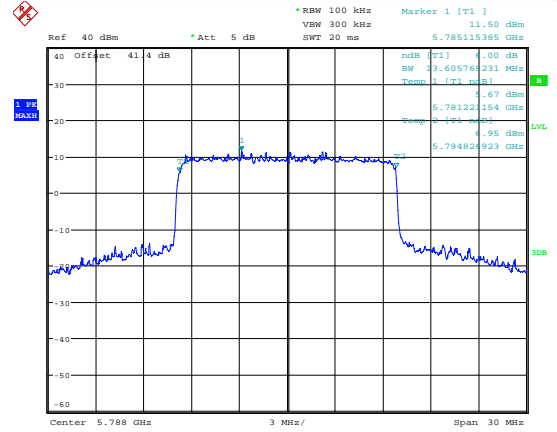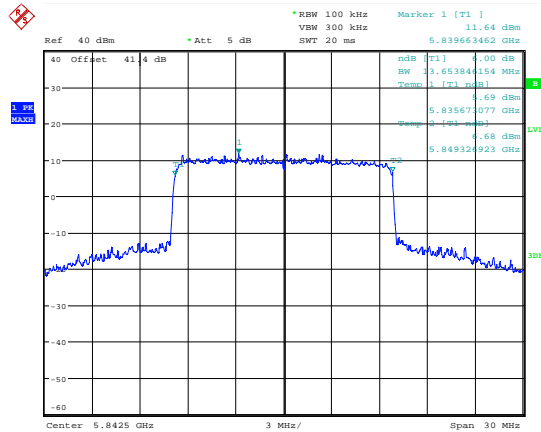
6 dB Bandwidth QPSK; 5788 MHz.

6 dB Bandwidth QPSK; 5842.5 MHz.

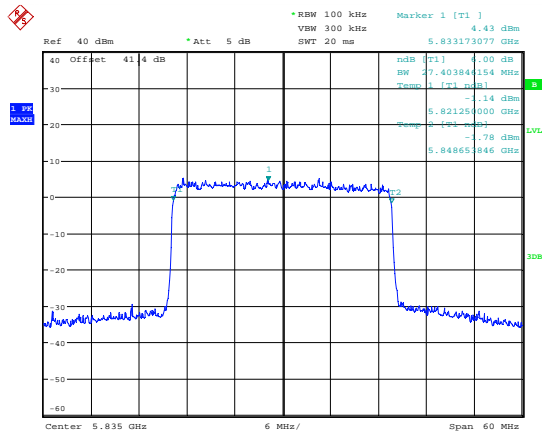| Modulation Mode: QPSK; 15 MHz				
Frequency (MHz)	FL (MHz)	FH (MHz)	6dB Bandwidth (kHz)	Result
5732.5	5725.673	5739.327	13654	PASS
5788	5781.221	5794.827	13606	PASS
5842.5	5835.673	5849.327	13654	PASS
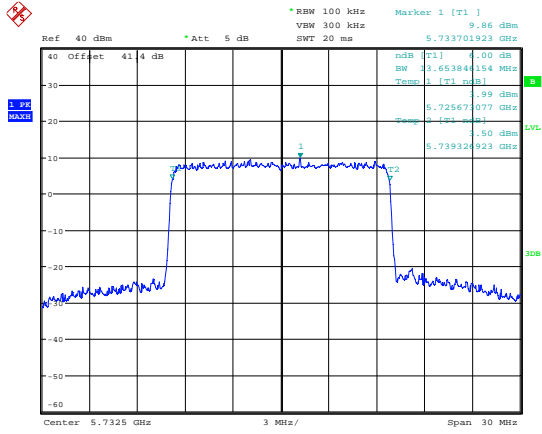
Date: 9.FEB.2018 10:26:19

6 dB Bandwidth 16 QAM; 5732.5 MHz.

Date: 9.FEB.2018 10:39:44

6 dB Bandwidth 16 QAM; 5788 MHz.
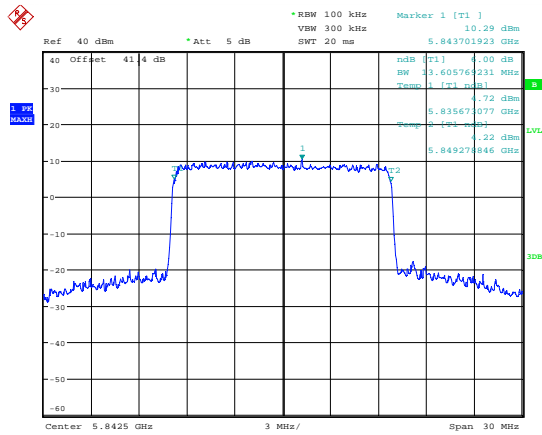
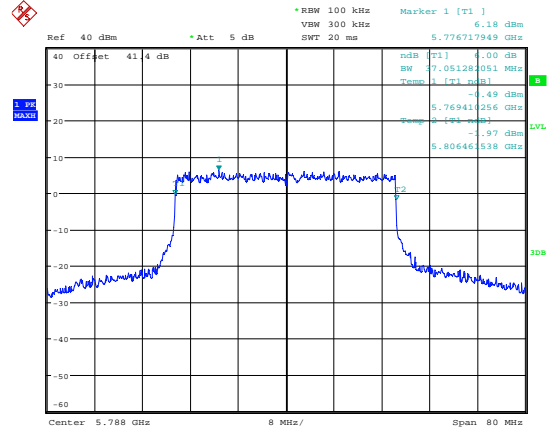Date: 9.FEB.2018 10:43:14

6 dB Bandwidth 16 QAM; 5842.5 MHz.

Modulation Mode: 16 QAM; 15 MHz				
Frequency (MHz)	FL (MHz)	FH (MHz)	6dB Bandwidth (kHz)	Result
5732.5	5725.673	5739.327	13654	PASS
5788	5781.125	5794.827	13702	PASS
5842.5	5835.673	5849.279	13606	PASS
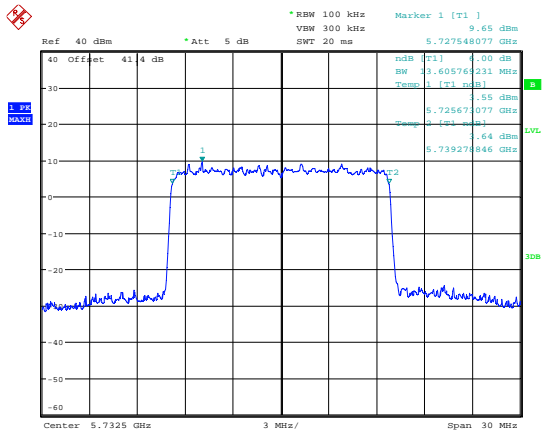
Date: 9.FEB.2018 10:29:58

6 dB Bandwidth 64 QAM; 5732.5 MHz.
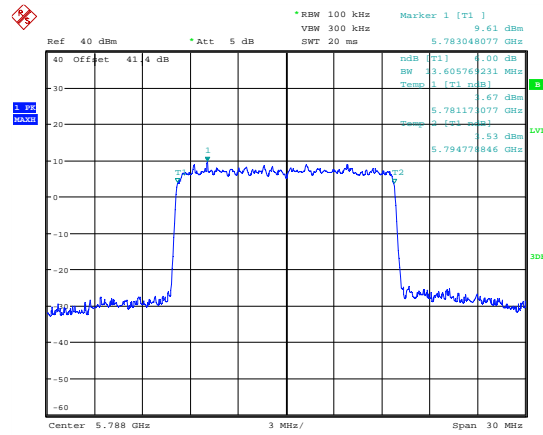
Date: 9.FEB.2018 10:37:49

6 dB Bandwidth 64 QAM; 5788 MHz.
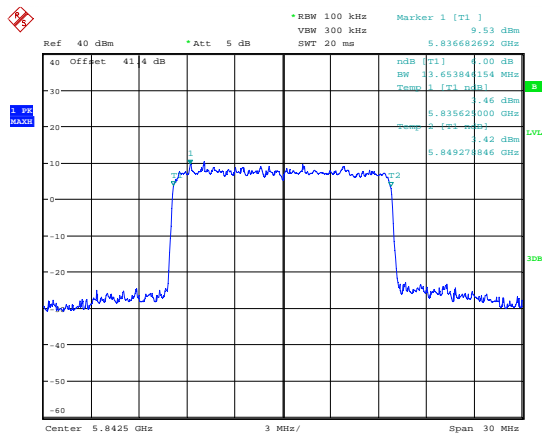
Date: 9.FEB.2018 10:44:46

6 dB Bandwidth 64 QAM; 5842.5 MHz.

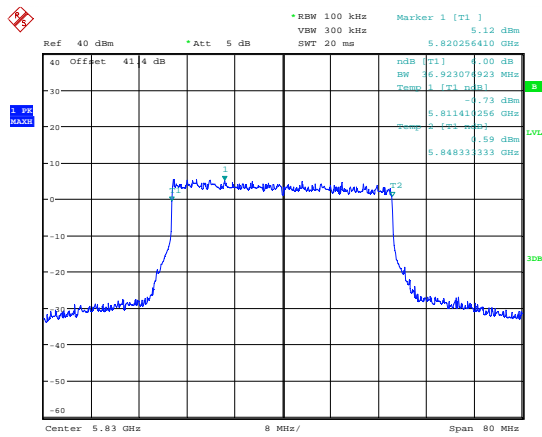| Modulation Mode: 64 QAM; 15 MHz				
Frequency (MHz)	FL (MHz)	FH (MHz)	6dB Bandwidth (kHz)	Result
5732.5	5725.673	5739.279	13606	PASS
5788	5781.173	5794.779	13606	PASS
5842.5	5835.625	5849.279	13654	PASS
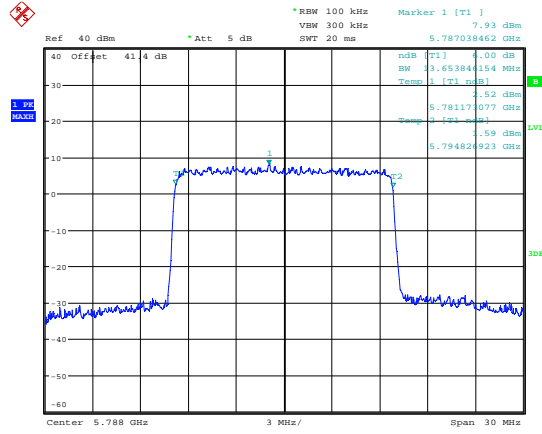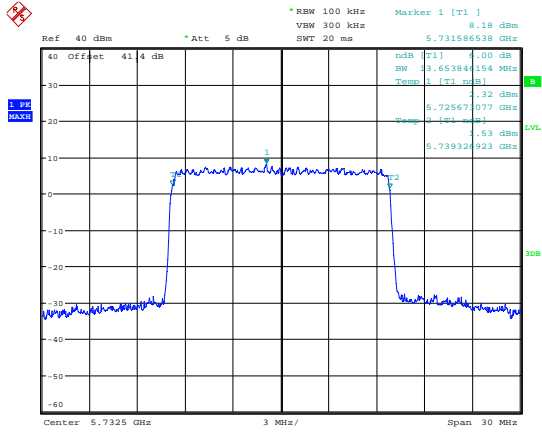
Date: 9.FEB.2018 10:30:55

6 dB Bandwidth 256 QAM; 5732.5 MHz.

Date: 9.FEB.2018 10:36:59

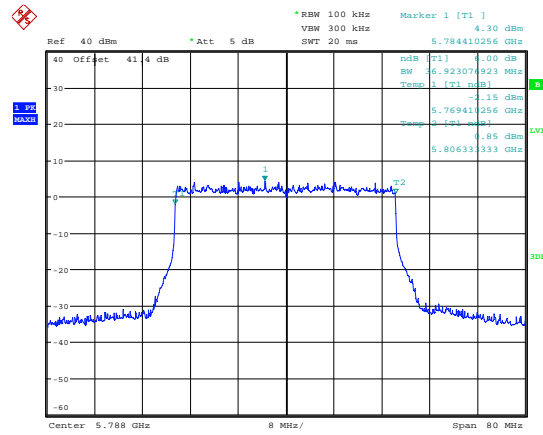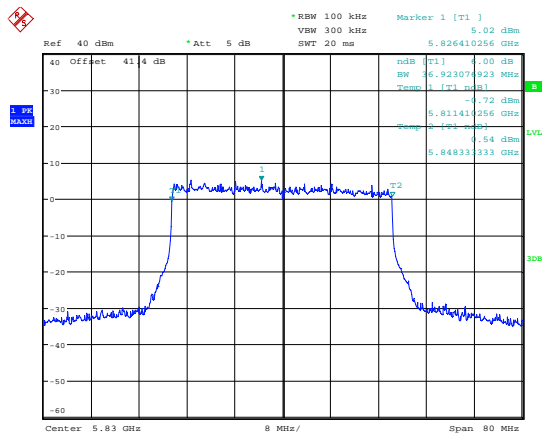6 dB Bandwidth 256 QAM; 5788 MHz.
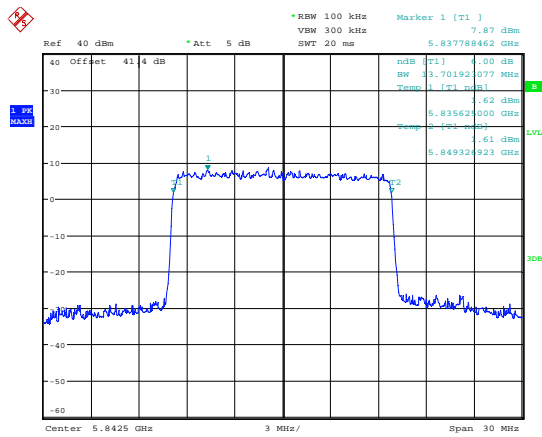
Date: 9.FEB.2018 10:46:09

6 dB Bandwidth 256 QAM; 5842.5 MHz.

Modulation Mode: 256 QAM; 15 MHz				
Frequency (MHz)	FL (MHz)	FH (MHz)	6dB Bandwidth (kHz)	Result
5732.5	5725.673	5739.327	13654	PASS
5788	5781.173	5794.827	13654	PASS
5842.5	5835.625	5849.327	13702	PASS

20 MHz Bandwidths
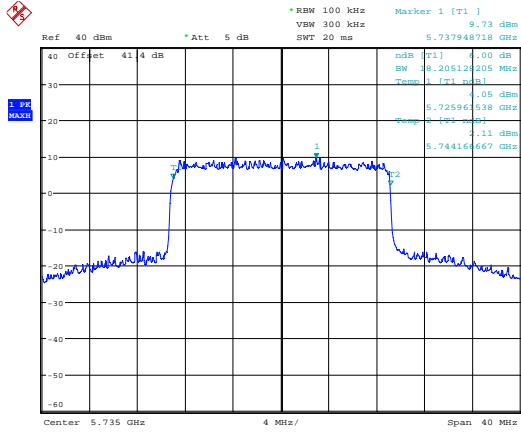
6 dB Bandwidth QPSK; 5735 MHz.
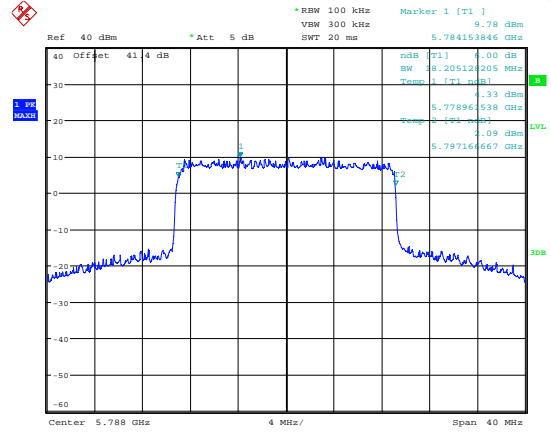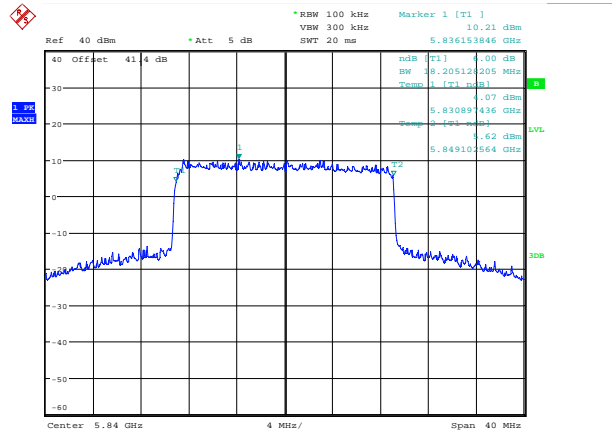
6 dB Bandwidth QPSK; 5788 MHz.

6 dB Bandwidth QPSK; 5840 MHz.

Modulation Mode: QPSK; 20 MHz				
Frequency (MHz)	FL (MHz)	FH (MHz)	6dB Bandwidth (kHz)	Result
5735	5725.961	5744.166	18205	PASS
5788	5778.961	5797.166	18205	PASS
5840	5830.897	5849.102	18205	PASS
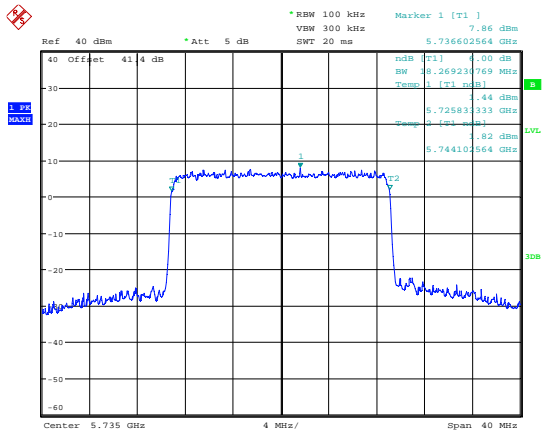
6 dB Bandwidth 16 QAM; 5735 MHz.

6 dB Bandwidth 16 QAM; 5788 MHz.

6 dB Bandwidth 16 QAM; 5840 MHz.

Modulation Mode: 16 QAM; 20 MHz				
Frequency (MHz)	FL (MHz)	FH (MHz)	6dB Bandwidth (kHz)	Result
5735	5725.833	5744.102	18269	PASS
5788	5778.833	5797.038	18205	PASS
5840	5830.961	5848.974	18013	PASS
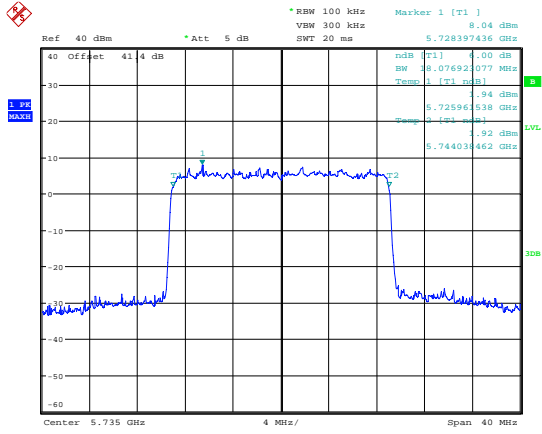
6 dB Bandwidth 64 QAM; 5735 MHz.
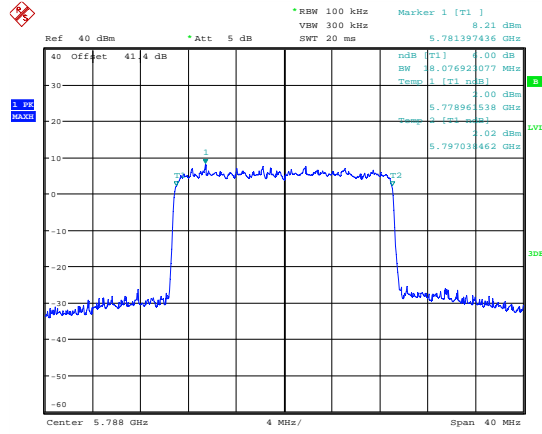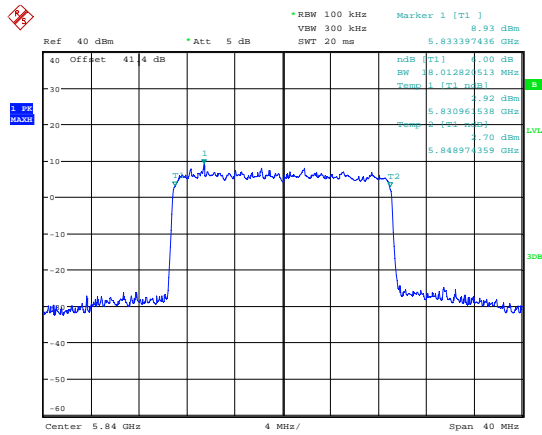
6 dB Bandwidth 64 QAM; 5788 MHz.

6 dB Bandwidth 64 QAM; 5840 MHz.

Modulation Mode: 64 QAM; 20 MHz				
Frequency (MHz)	FL (MHz)	FH (MHz)	6dB Bandwidth (kHz)	Result
5735	5725.961	5744.038	18077	PASS
5788	5778.961	5797.038	18077	PASS
5840	5830.961	5848.974	18013	PASS
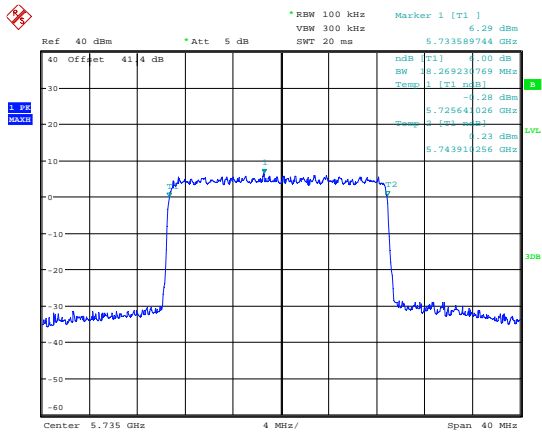
6 dB Bandwidth 256 QAM; 5735 MHz.
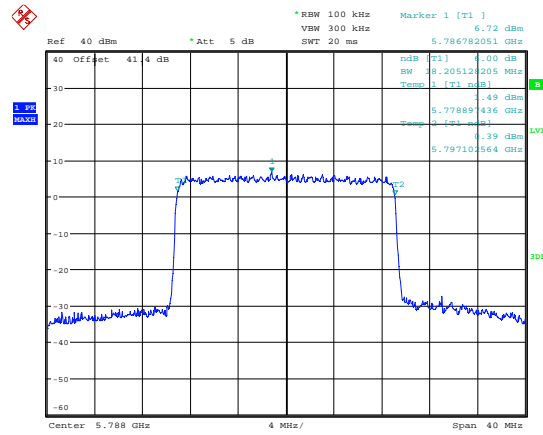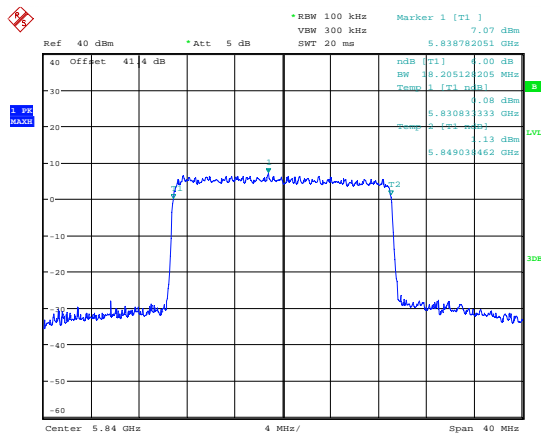
6 dB Bandwidth 256 QAM; 5788 MHz.

6 dB Bandwidth 256 QAM; 5840 MHz.

Modulation Mode: 256 QAM; 20 MHz				
Frequency (MHz)	FL (MHz)	FH (MHz)	6dB Bandwidth (kHz)	Result
5735	5725.641	5743.91	18269	PASS
5788	5778.897	5797.102	18205	PASS
5840	5830.833	5849.038	18205	PASS

30 MHz Bandwidths
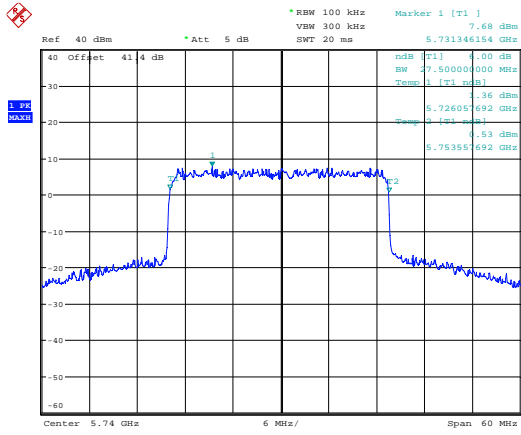
6 dB Bandwidth QPSK; 5740 MHz.
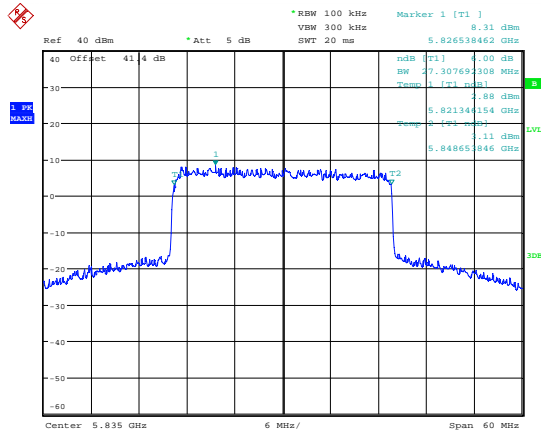
6 dB Bandwidth QPSK; 5788 MHz.

6 dB Bandwidth QPSK; 5835 MHz.

Modulation Mode: QPSK; 30 MHz				
Frequency (MHz)	FL (MHz)	FH (MHz)	6dB Bandwidth (kHz)	Result
5740	5726.058	5753.558	27500	PASS
5788	5774.442	5801.75	27308	PASS
5835	5821.346	5848.654	27308	PASS
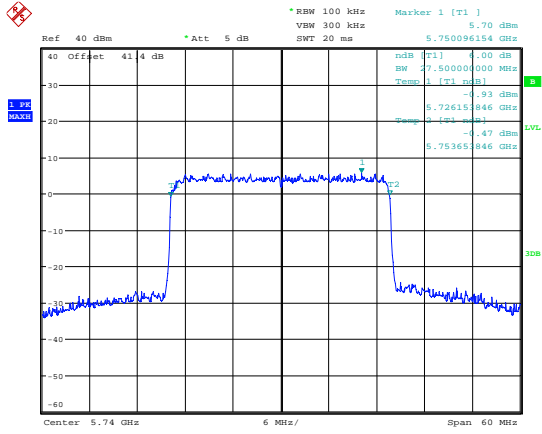
6 dB Bandwidth 16 QAM; 5740 MHz.
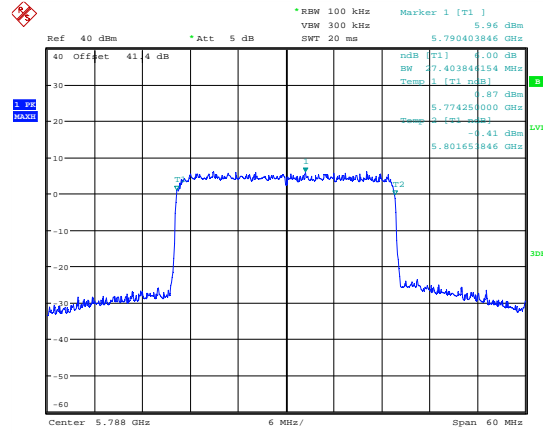
6 dB Bandwidth 16 QAM; 5788 MHz.

6 dB Bandwidth 16 QAM; 5835 MHz.

Modulation Mode: 16 QAM; 30 MHz				
Frequency (MHz)	FL (MHz)	FH (MHz)	6dB Bandwidth (kHz)	Result
5740	5726.154	5753.654	27500	PASS
5788	5774.25	5801.654	27404	PASS
5835	5821.154	5848.558	27404	PASS
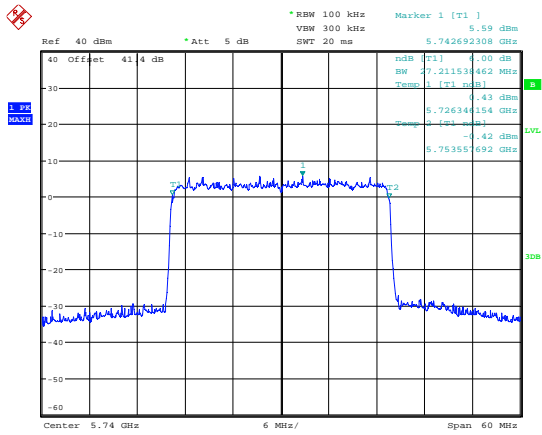
6 dB Bandwidth 64 QAM; 5740 MHz.

6 dB Bandwidth 64 QAM; 5788 MHz.

6 dB Bandwidth 64 QAM; 5835 MHz.

Modulation Mode: 64 QAM; 30 MHz				
Frequency (MHz)	FL (MHz)	FH (MHz)	6dB Bandwidth (kHz)	Result
5740	5726.346	5753.558	27212	PASS
5788	5774.346	5801.461	27115	PASS
5835	5821.25	5848.461	27212	PASS
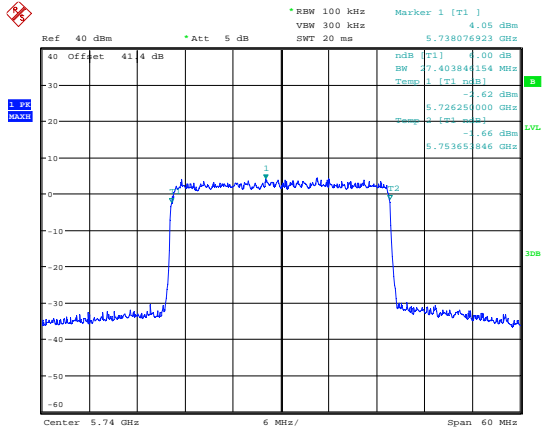
6 dB Bandwidth 256 QAM; 5740 MHz.

6 dB Bandwidth 256 QAM; 5788 MHz.

6 dB Bandwidth 256 QAM; 5835 MHz.

Modulation Mode: 256 QAM; 30 MHz				
Frequency (MHz)	FL (MHz)	FH (MHz)	6dB Bandwidth (kHz)	Result
5740	5726.25	5753.654	27404	PASS
5788	5774.346	5801.654	27308	PASS
5835	5821.25	5848.654	27404	PASS

40 MHz Bandwidths
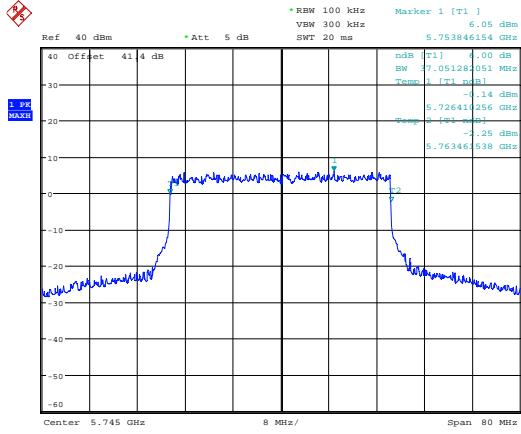
6 dB Bandwidth QPSK; 5745 MHz.
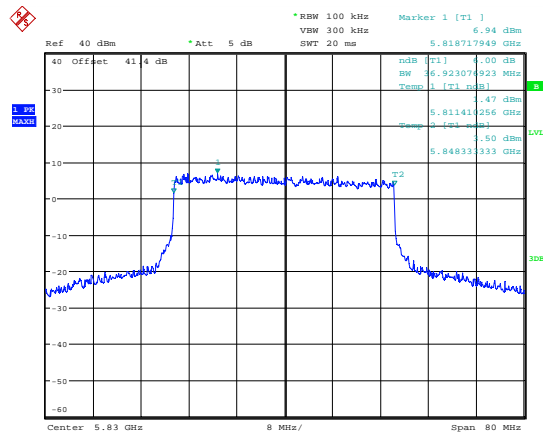
6 dB Bandwidth QPSK; 5788 MHz.

6 dB Bandwidth QPSK; 5830 MHz.

Modulation Mode: QPSK; 40 MHz				
Frequency (MHz)	FL (MHz)	FH (MHz)	6dB Bandwidth (kHz)	Result
5745	5726.41	5763.461	37051	PASS
5788	5769.41	5806.461	37051	PASS
5830	5811.41	5848.333	36923	PASS

6 dB Bandwidth 16 QAM; 5745 MHz.
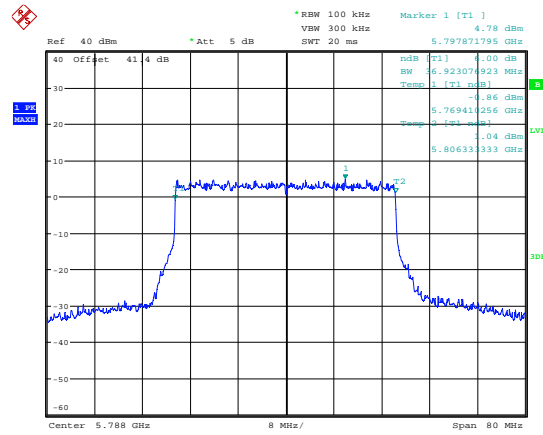
6 dB Bandwidth 16 QAM; 5788 MHz.

6 dB Bandwidth 16 QAM; 5830 MHz.

Modulation Mode: 16 QAM; 40 MHz				
Frequency (MHz)	FL (MHz)	FH (MHz)	6dB Bandwidth (kHz)	Result
5745	5726.41	5763.461	37051	PASS
5788	5769.41	5806.333	36923	PASS
5830	5811.41	5848.333	36923	PASS
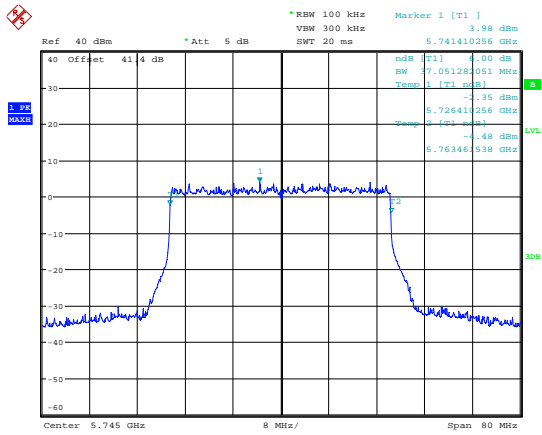
Date: 9.FEB.2018 11:57:56

6 dB Bandwidth 64 QAM; 5745 MHz.

Date: 9.FEB.2018 11:59:05

6 dB Bandwidth 64 QAM; 5788 MHz.

Date: 9.FEB.2018 12:06:48

6 dB Bandwidth 64 QAM; 5830 MHz.

Modulation Mode: 64 QAM; 40 MHz				
Frequency (MHz)	FL (MHz)	FH (MHz)	6dB Bandwidth (kHz)	Result
5745	5726.41	5763.461	37051	PASS
5788	5769.41	5806.333	36923	PASS
5830	5811.41	5848.333	36923	PASS

6 dB Bandwidth 256 QAM; 5745 MHz.
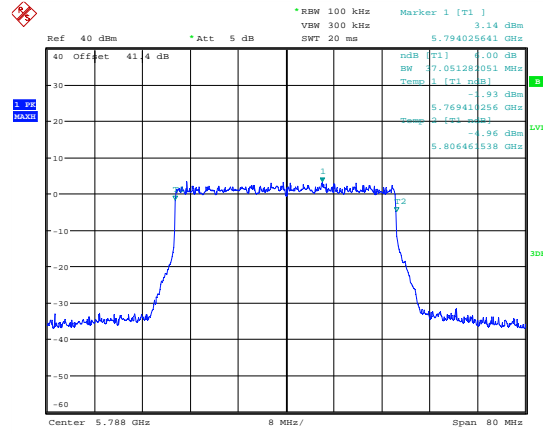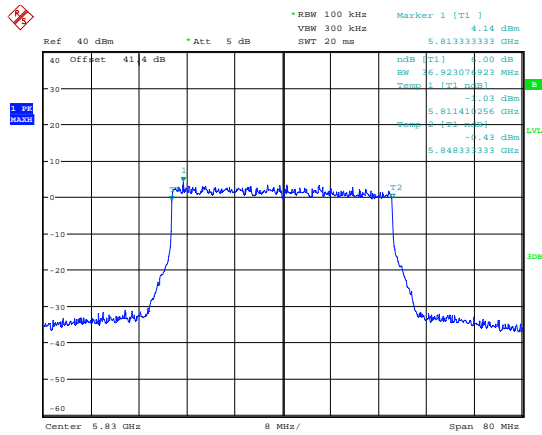
6 dB Bandwidth 256 QAM; 5788 MHz.

6 dB Bandwidth 256 QAM; 5830 MHz.

Modulation Mode: 256 QAM; 40 MHz				
Frequency (MHz)	FL (MHz)	FH (MHz)	6dB Bandwidth (kHz)	Result
5745	5726.154	5763.205	37051	PASS
5788	5769.41	5806.461	37051	PASS
5830	5811.41	5848.333	36923	PASS

14 Maximum conducted output power

14.1   Definition

The maximum conducted output power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level.

14.2   Test Parameters

Test Location:	Element Skelmersdale
Test Chamber:	Radio Laboratory
Test Standard and Clause:	ANSI C63.10-2013, Clause 12.3
EUT Channels Measured:	Bottom, Middle and Top
EUT Occupied Bandwidths:	5, 10, 15, 20, 30 and 40 MHz
EUT Duty Cycle:	100 %
Deviations From Standard:	None
Measurement Detector:	RMS
Voltage Extreme Environment Test Range:	-48 Vdc (as declared)

Environmental Conditions (Normal Environment)

Temperature: 24 °C	+15 ºC to +35 ºC (as declared)
Humidity: 32 %RH	20%RH to 75%RH (as declared)

Test Limits

For an access point operating in the band 5.15–5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W.

For mobile and portable client devices in the 5.15–5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW.

For the 5.25–5.35 GHz and 5.47–5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, where B is the 26 dB emission bandwidth in megahertz.

For the band 5.725–5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W.

If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Fixed point-to-point U–NII devices operating in the band 5.725-5.85 GHz may employ antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power.

Fixed point-to-point U-NII devices operating in other bands may employ antennas with directional gain up to 23dBi without any corresponding reduction in the maximum conducted output power or maximum power spectral density. For fixed point-to-point transmitters that employ a directional antenna gain greater than 23 dBi, a 1 dB reduction in maximum conducted output power and maximum power spectral density is required for each 1 dB of antenna gain in excess of 23 dBi.

14.3 Test Method

The EUT was setup as per section 9 of this report and, as per Figure iv, the analyser was used to measure each antenna output in turn, having taken account of all path losses. The resolution bandwidth of the spectrum analyser was set between 1 and 5 % of the EUT occupied bandwidth and the analyser band power function used to calculate the average power. The results were summed as in the tables below.

The measurements were performed with EUT set at its maximum duty. All modulation schemes, data rates and power settings were used to observe the worst case configuration in each bandwidth.

Figure iv Test Setup
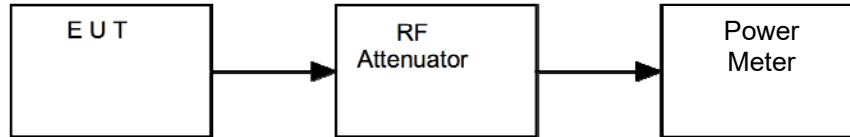
Note: The test was performed with two wide band power meter working simultaneously giving the end result of the as combined output power.

14.4 Test Equipment

Equipment Description	Manufacturer	Equipment Type	Element No	Last Cal Calibration	Calibration Period	Due For Calibration
Power Meter	Dare	RPR3006W	REF2223	2017-09-24	12	2018-09-24
Power Meter	Dare	RPR3006W	REF2083	2017-11-17	12	2018-11-17

14.5   Test Results

Maximum allowed output power into the antenna connector (dBm)				
Mod modes / Antennas	QPSK	16 QAM	64 QAM	256 QAM
sector antenna	19	19	19	19
4-foot Parabolic	28	26	25	24
6-foot Parabolic (Extrapolation only)	24.9	22.9	21.9	20.9
Flat Plate	28	26	25	24
Omnidirectional	23	23	23	23

Note 1: This device is professionally installed.
Note 2: Only the highest output power was measured.
Note 3: Different antenna systems can be installed therefore the output power must be adjusted accordingly in order to meet requirement of the different operation modes (i.e. point to point, point to multipoint…) also the power may be reduce in order to comply with other requirements on this report.

5 MHz Bandwidth; Highest output power settings					
Power Setting	Frequency (MHz)	Modulation	Total Combined Power (dBm)	Limit (dBm)	Result
28	5727.5	QPSK	27.3	30	PASS
26	5727.5	16 QAM	25.6	30	PASS
25	5727.5	64 QAM	24.5	30	PASS
24	5727.5	256 QAM	23.6	30	PASS

5 MHz Bandwidth; Highest output power settings					
Power Setting	Frequency (MHz)	Modulation	Total Combined Power (dBm)	Limit (dBm)	Result
28	5788	QPSK	27.1	30	PASS
26	5788	16 QAM	25.2	30	PASS
25	5788	64 QAM	24.2	30	PASS
24	5788	256 QAM	23.4	30	PASS

5 MHz Bandwidth; Highest output power settings					
Power Setting(dBm)	Frequency (MHz)	Modulation	Total Combined Power (dBm)	Limit (dBm)	Result
28	5847.5	QPSK	27.2	30	PASS
26	5847.5	16 QAM	25.3	30	PASS
25	5847.5	64 QAM	24.3	30	PASS
24	5847.5	256 QAM	23.4	30	PASS

10 MHz Bandwidth; Highest output power settings					
Power Setting	Frequency (MHz)	Modulation	Total Combined Power (dBm)	Limit (dBm)	Result
28	5730	QPSK	27.2	30	PASS
26	5730	16 QAM	25.4	30	PASS
25	5730	64 QAM	24.5	30	PASS
24	5730	256 QAM	23.5	30	PASS

10 MHz Bandwidth; Highest output power settings					
Power Setting	Frequency (MHz)	Modulation	Total Combined Power (dBm)	Limit (dBm)	Result
28	5788	QPSK	27.0	30	PASS
26	5788	16 QAM	25.2	30	PASS
25	5788	64 QAM	24.2	30	PASS
24	5788	256 QAM	23.3	30	PASS

10 MHz Bandwidth; Highest output power settings					
Power Setting(dBm)	Frequency (MHz)	Modulation	Total Combined Power (dBm)	Limit (dBm)	Result
28	5845	QPSK	27.1	30	PASS
26	5845	16 QAM	25.2	30	PASS
25	5845	64 QAM	24.2	30	PASS
24	5845	256 QAM	23.3	30	PASS

15 MHz Bandwidth; Highest output power settings					
Power Setting	Frequency (MHz)	Modulation	Total Combined Power (dBm)	Limit (dBm)	Result
28	5732.5	QPSK	27.1	30	PASS
26	5732.5	16 QAM	25.3	30	PASS
25	5732.5	64 QAM	24.4	30	PASS
24	5732.5	256 QAM	23.4	30	PASS

15 MHz Bandwidth; Highest output power settings					
Power Setting	Frequency (MHz)	Modulation	Total Combined Power (dBm)	Limit (dBm)	Result
28	5788	QPSK	27.0	30	PASS
26	5788	16 QAM	25.1	30	PASS
25	5788	64 QAM	24.1	30	PASS
24	5788	256 QAM	23.2	30	PASS

15 MHz Bandwidth; Highest output power settings					
Power Setting(dBm)	Frequency (MHz)	Modulation	Total Combined Power (dBm)	Limit (dBm)	Result
28	5842.5	QPSK	27.0	30	PASS
26	5842.5	16 QAM	25.3	30	PASS
25	5842.5	64 QAM	24.3	30	PASS
24	5842.5	256 QAM	23.3	30	PASS

20 MHz Bandwidth; Highest output power settings					
Power Setting	Frequency (MHz)	Modulation	Total Combined Power (dBm)	Limit (dBm)	Result
28	5735	QPSK	27.0	30	PASS
26	5735	16 QAM	25.1	30	PASS
25	5735	64 QAM	24.2	30	PASS
24	5735	256 QAM	23.3	30	PASS

20 MHz Bandwidth; Highest output power settings					
Power Setting	Frequency (MHz)	Modulation	Total Combined Power (dBm)	Limit (dBm)	Result
28	5788	QPSK	26.9	30	PASS
26	5788	16 QAM	25.1	30	PASS
25	5788	64 QAM	24.2	30	PASS
24	5788	256 QAM	23.2	30	PASS

20 MHz Bandwidth; Highest output power settings					
Power Setting(dBm)	Frequency (MHz)	Modulation	Total Combined Power (dBm)	Limit (dBm)	Result
28	5840	QPSK	26.9	30	PASS
26	5840	16 QAM	25.0	30	PASS
25	5840	64 QAM	24.2	30	PASS
24	5840	256 QAM	23.3	30	PASS

30 MHz Bandwidth; Highest output power settings					
Power Setting	Frequency (MHz)	Modulation	Total Combined Power (dBm)	Limit (dBm)	Result
28	5740	QPSK	26.9	30	PASS
26	5740	16 QAM	25.1	30	PASS
25	5740	64 QAM	24.2	30	PASS
24	5740	256 QAM	23.3	30	PASS

30 MHz Bandwidth; Highest output power settings					
Power Setting	Frequency (MHz)	Modulation	Total Combined Power (dBm)	Limit (dBm)	Result
28	5788	QPSK	27.0	30	PASS
26	5788	16 QAM	25.0	30	PASS
25	5788	64 QAM	24.0	30	PASS
24	5788	256 QAM	23.1	30	PASS

30 MHz Bandwidth; Highest output power settings					
Power Setting(dBm)	Frequency (MHz)	Modulation	Total Combined Power (dBm)	Limit (dBm)	Result
28	5835	QPSK	27.0	30	PASS
26	5835	16 QAM	25.0	30	PASS
25	5835	64 QAM	24.3	30	PASS
24	5835	256 QAM	23.2	30	PASS

40 MHz Bandwidth; Highest output power settings					
Power Setting	Frequency (MHz)	Modulation	Total Combined Power (dBm)	Limit (dBm)	Result
28	5745	QPSK	26.9	30	PASS
26	5745	16 QAM	25.0	30	PASS
25	5745	64 QAM	24.2	30	PASS
24	5745	256 QAM	23.2	30	PASS

40 MHz Bandwidth; Highest output power settings					
Power Setting	Frequency (MHz)	Modulation	Total Combined Power (dBm)	Limit (dBm)	Result
28	5788	QPSK	26.8	30	PASS
26	5788	16 QAM	25.0	30	PASS
25	5788	64 QAM	24.1	30	PASS
24	5788	256 QAM	23.1	30	PASS

40 MHz Bandwidth; Highest output power settings					
Power Setting(dBm)	Frequency (MHz)	Modulation	Total Combined Power (dBm)	Limit (dBm)	Result
28	5830	QPSK	26.9	30	PASS
26	5830	16 QAM	25.0	30	PASS
25	5830	64 QAM	24.1	30	PASS
24	5830	256 QAM	23.1	30	PASS

15 Power spectral density

15.1 Definition

The power spectral density is the total energy output per unit bandwidth from a pulse or sequence of pulses for which the transmit power is at its maximum level, divided by the total duration of the pulses.

15.2 Test Parameters

Test Location:	Element Skelmersdale
Test Chamber:	Radio Laboratory
Test Standard and Clause:	ANSI C63.10-2013, Clause 12.5
EUT Frequencies Measured:	5727.5 MHz / 5788 MHz / 5847.5 MHz
EUT Channel Bandwidths:	5 MHz
Deviations From Standard:	None
Measurement BW:	500 kHz
Spectrum Analyzer Video BW: (requirement at least 3x RBW)	5 MHz
Measurement Span: (requirement 1.5 times Channel BW)	10 MHz
Measurement Detector:	RMS

Environmental Conditions (Normal Environment)

Temperature: 24 °C	+15 ºC to +35 ºC (as declared)
Humidity: 32 %RH	20%RH to 75%RH (as declared)
Supply: -48 Vdc	-48Vdc (as declared)

Test Limits
For an access point operating in the band 5.15–5.25 GHz the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band.
For mobile and portable client devices in the 5.15–5.25 GHz band, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band.
For the 5.25-5.35 GHz and 5.47-5.725 GHz bands, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band.
For the band 5.725–5.85 GHz, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz band.

If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Fixed point- to-point U–NII-1 devices may employ antennas with directional gain up to 23dBi without any corresponding reduction in the maximum conducted output power or maximum power spectral density. For fixed point-to-point transmitters that employ a directional antenna gain greater than 23 dBi, a 1 dB reduction in maximum conducted output power and maximum power spectral density is required for each 1 dB of antenna gain in excess of 23 dBi.

15.3 Test Method

With the EUT setup as per section 9 of this report and connected as per Figure v, the peak emission of the EUT was measured on a spectrum analyser, with path losses taken into account.
The measurements were performed with EUT set at its maximum duty. All modulation schemes, data rates and power settings were used to observe the worst case configuration in each bandwidth.

Figure v Test Setup
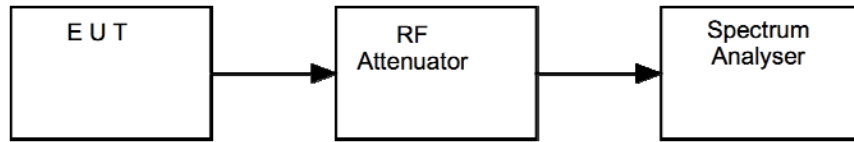
15.4 Test Equipment

Equipment Description	Manufacturer	Equipment Type	Element No	Last Cal Calibration	Calibration Period	Due For Calibration
Spectrum Analyser	R&S	FSU46	U281	2017-06-19	12	2018-06-19

15.5   Test Results

Note: This test was performed only at the highest output power settings.
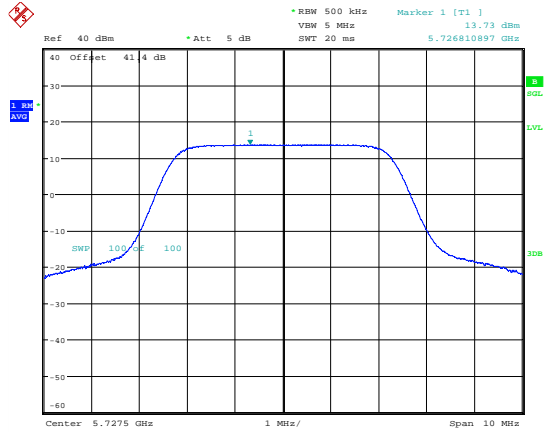
PSD QPSK; 5727.5 MHz; H Port.
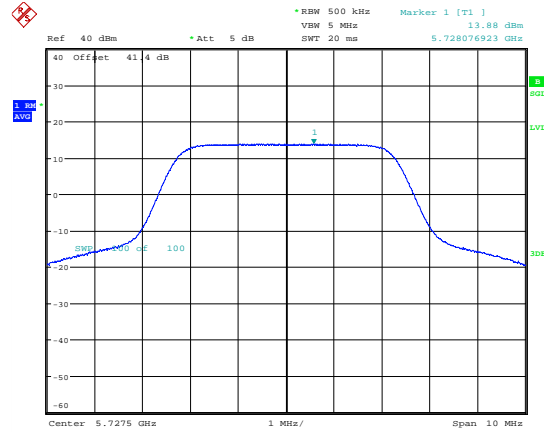
PSD QPSK; 5727.5 MHz; V Port.
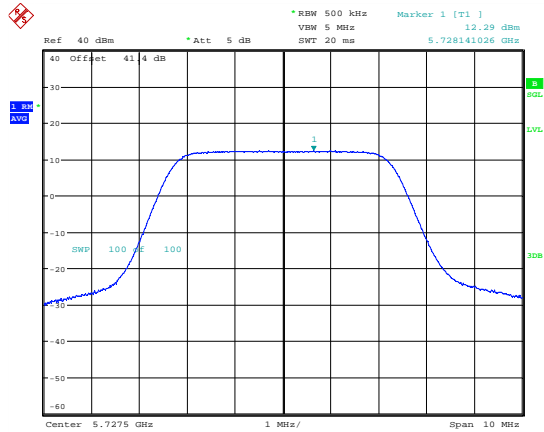
PSD 16 QAM; 5727.5 MHz; H Port.
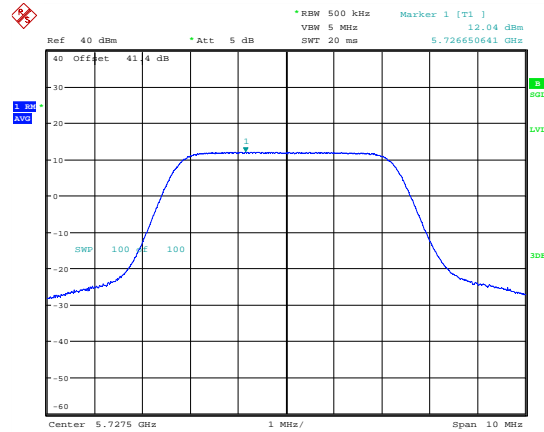
PSD 16 QAM; 5727.5 MHz; V Port.
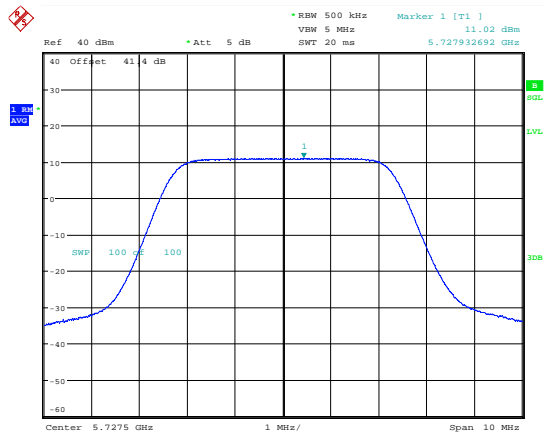
PSD 64 QAM; 5727.5 MHz; H Port.
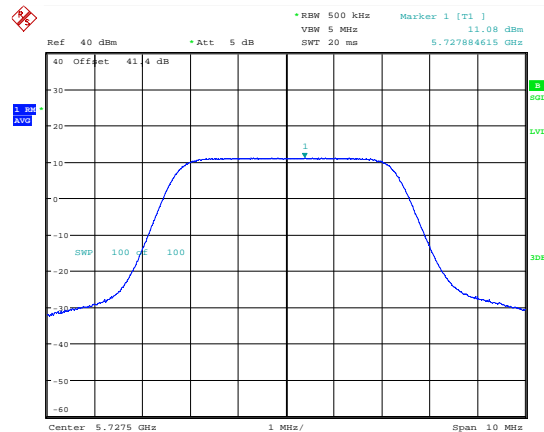
PSD 64 QAM; 5727.5 MHz; V Port.
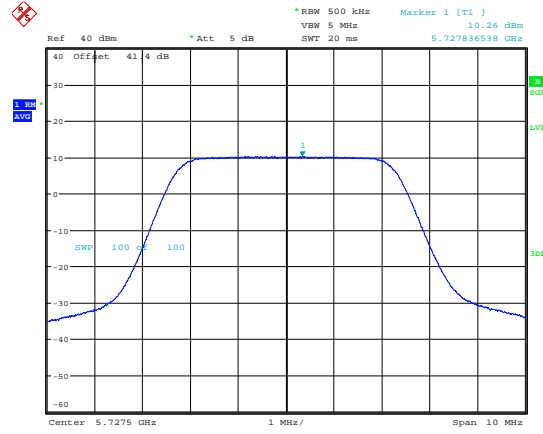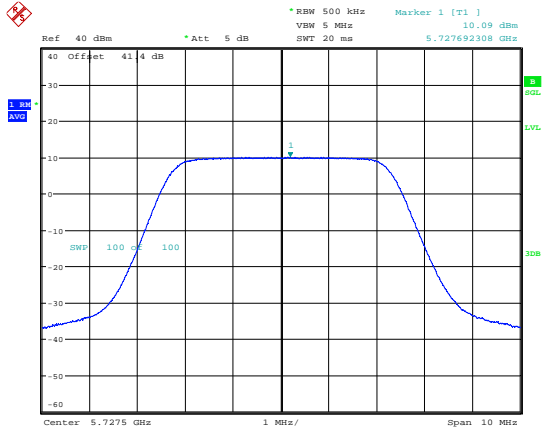
PSD 256 QAM; 5727.5 MHz; H Port.

PSD 256 QAM; 5727.5 MHz; V Port.

Frequency (MHz)	Power Setting (dBm)	Modulation	Port H Power (dBm)	Port V Power (dBm)	Combined Power (dBm)	Limit (dBm)	Result
5727.5	28	QPSK	13.73	13.88	16.82	30	PASS
5727.5	26	16 QAM	12.29	12.04	15.18	30	PASS
5727.5	25	64 QAM	11.02	11.08	14.06	30	PASS
5727.5	24	256 QAM	10.09	10.26	13.19	30	PASS
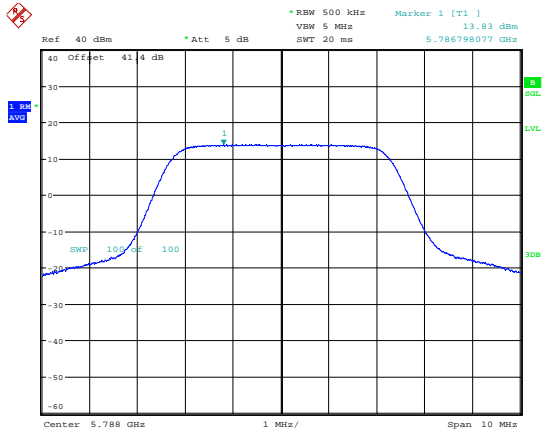
Date: 9.FEB.2018 12:43:03

PSD QPSK; 5788 MHz; H Port.
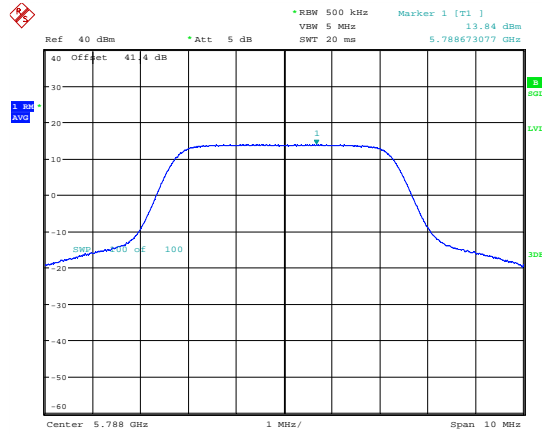
Date: 9.FEB.2018 12:31:54

PSD QPSK; 5788 MHz; V Port.
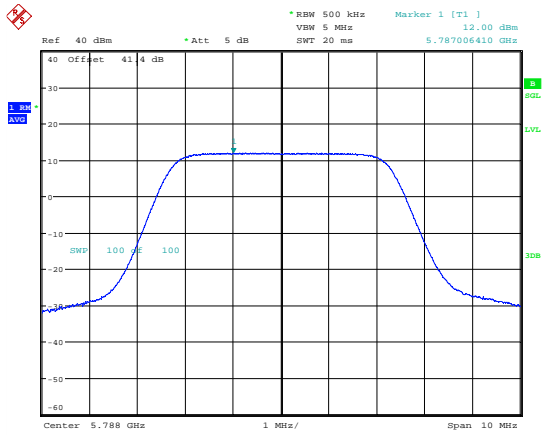
Date: 9.FEB.2018 12:44:05

PSD 16 QAM; 5788 MHz; H Port.
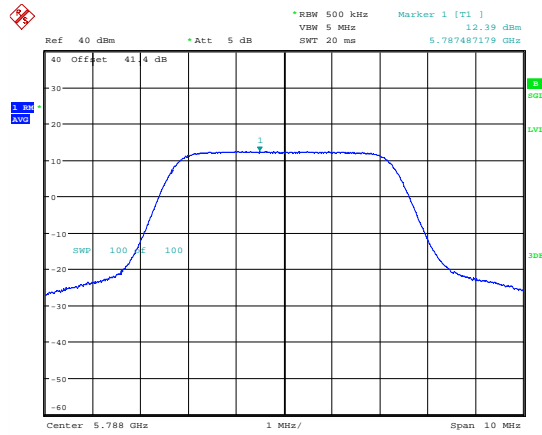
Date: 9.FEB.2018 12:30:38

PSD 16 QAM; 5788 MHz; V Port.
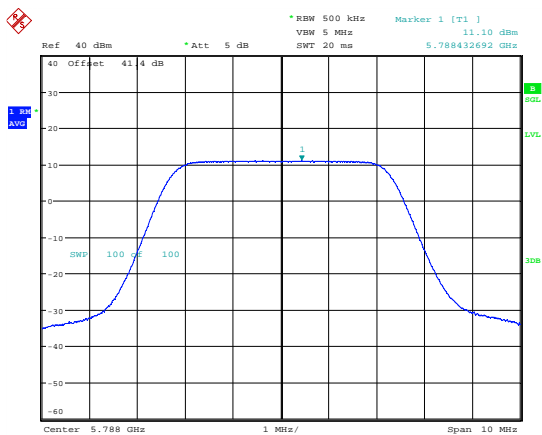
Date: 9.FEB.2018 12:45:00

PSD 64 QAM; 5788 MHz; H Port.
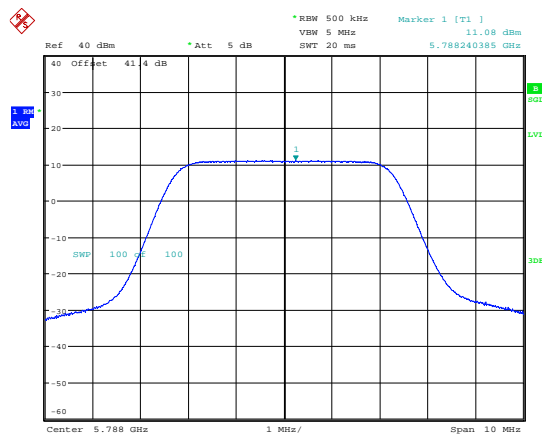
Date: 9.FEB.2018 12:29:41

PSD 64 QAM; 5788 MHz; V Port.
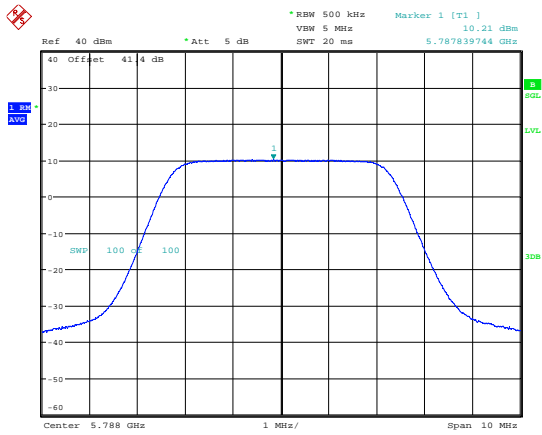
PSD 256 QAM; 5788 MHz; H Port.
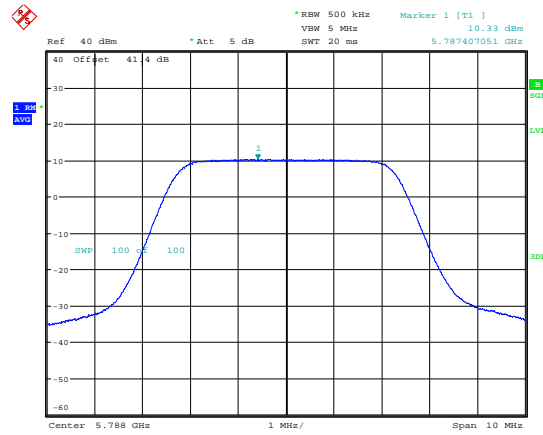
PSD 256 QAM; 5788 MHz; V Port.

Frequency (MHz)	Power Setting (dBm)	Modulation	Port H Power (dBm)	Port V Power (dBm)	Combined Power (dBm)	Limit (dBm)	Result
5788	28	QPSK	13.83	13.84	16.85	30	PASS
5788	26	16 QAM	12.00	12.39	15.21	30	PASS
5788	25	64 QAM	11.10	11.08	14.10	30	PASS
5788	24	256 QAM	10.21	10.33	13.28	30	PASS
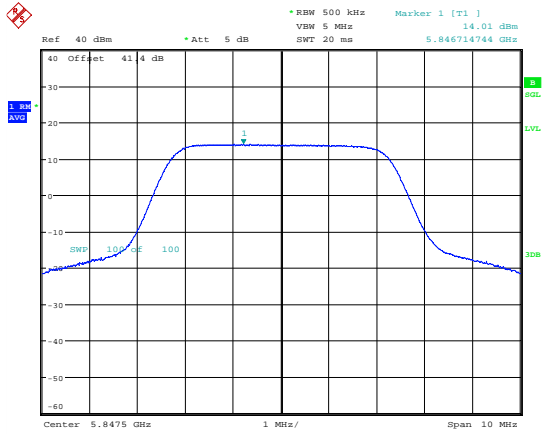
PSD QPSK; 5847.5 MHz; H Port.
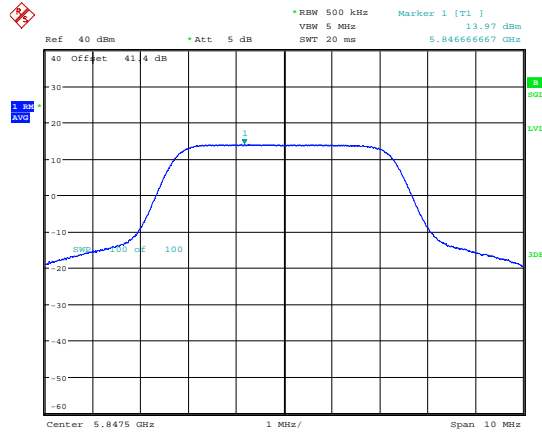
PSD QPSK; 5847.5 MHz; V Port.
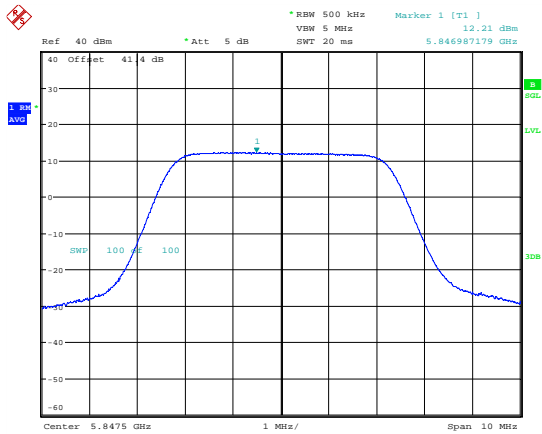
PSD 16 QAM; 5847.5 MHz; H Port.
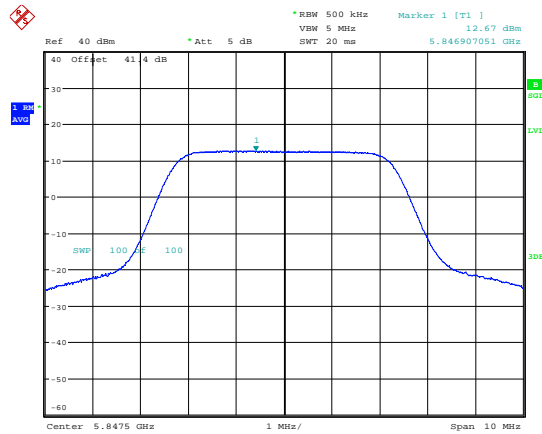
PSD 16 QAM; 5847.5 MHz; V Port.
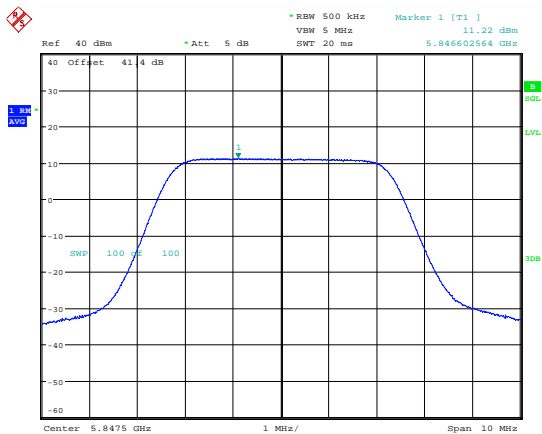
PSD 64 QAM; 5847.5 MHz; H Port.
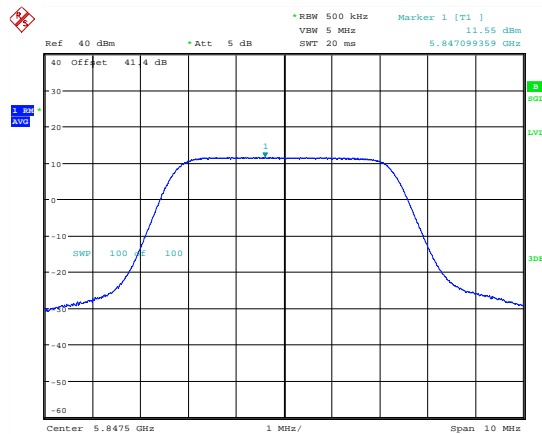
PSD 64 QAM; 5847.5 MHz; V Port.
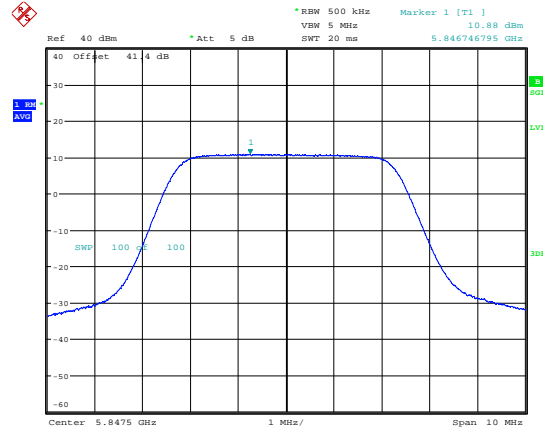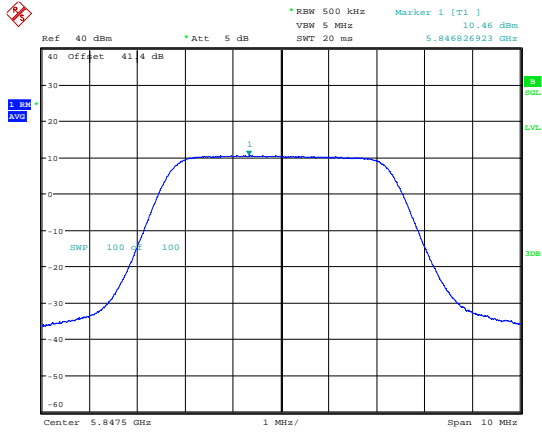
PSD 256 QAM; 5847.5 MHz; H Port.

PSD 256 QAM; 5847.5 MHz; V Port.

Frequency (MHz)	Power Setting (dBm)	Modulation	Port H Power (dBm)	Port V Power (dBm)	Combined Power (dBm)	Limit (dBm)	Result
5847.5	28	QPSK	14.01	13.97	17.00	30	PASS
5847.5	26	16 QAM	12.21	12.67	15.46	30	PASS
5847.5	25	64 QAM	11.22	11.55	14.40	30	PASS
5847.5	24	256 QAM	10.46	10.88	13.69	30	PASS

16 Out-of-band spurious emissions

16.1   Definition

Out-of-band emission.
Emission on a frequency or frequencies immediately outside the necessary bandwidth that results from the modulation process but excluding spurious emissions.

Spurious emission.
Emission on a frequency or frequencies that are outside the necessary bandwidth and the level of which may be reduced without affecting the corresponding transmission of information. Spurious emissions include harmonic emissions, parasitic emissions, intermodulation products, and frequency conversion products, but exclude out-of-band emissions.

16.2   Test Parameters

Test Location:	Element Skelmersdale
Test Chamber:	Radio Chamber
Test Standard and Clause:	ANSI C63.10-2013, Clause 12.7.3
EUT Channel Measured: (requirement as close to upper and lower frequency band edges as the design of the equipment permits).	Bottom and Top
EUT Channel Bandwidths:	5, 10, 15, 20, 30 and 40 MHz
Deviations From Standard:	None
Measurement BW:	1 MHz
Spectrum Analyzer Video BW: (requirement at least 3x RBW)	3 MHz
Measurement Detector:	Peak
Measurement Range:	1 GHz to 40 GHz

Environmental Conditions (Normal Environment)

Temperature: 24 °C	+15 ºC to +35 ºC (as declared)
Humidity: 30 %RH	20%RH to 75%RH (as declared)
Supply: -48 Vdc	-48 dc (as declared)

Test Limits
15.407(b):
(1) For transmitters operating in the 5.15–5.25 GHz band: All emissions outside of the 5.15–5.35 GHz band shall not exceed an e.i.r.p. of -27 dBm/MHz.
(2) For transmitters operating in the 5.25–5.35 GHz band: All emissions outside of the 5.15–5.35 GHz band shall not exceed an e.i.r.p. of -27 dBm/MHz.
(3) For transmitters operating in the 5.47–5.725 GHz band: All emissions outside of the 5.47–5.725 GHz band shall not exceed an e.i.r.p. of -27 dBm/MHz.
(4) All emissions shall be limited to a level of −27 dBm/MHz at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.

16.3   Test Method

With the EUT setup as per section 9 of this report and connected as per Figure vii, the emissions from the EUT were measured on a spectrum analyser.

The measurements were performed with EUT set at its maximum duty. All modulation schemes, data rates and power settings were used to observe the worst case configuration in each bandwidth.

Figure vii Test Setup

16.4   Test Equipment

Equipment Description	Manufacturer	Equipment Type	Element No	Last Cal Calibration	Calibration Period	Due For Calibration
Spectrum Analyser	R&S	FSU46	U281	2017-06-19	12	2018-06-19
1-18GHz Horn	EMCO	3115	L139	2017-09-25	24	2019-09-25
Pre Amp	Agilent	8449B	L572	2017-09-28	12	2018-09-28
6 dB Attenuator	Bird	8304-060-N	U376	Calibrate in Use		
10 dB Attenuator	Bird	8304-100-N	L222	Calibrate in Use		
3 dB Attenuator	Bird	8304-060-N	REF903	Calibrate in Use		

16.5 Test Results

5 MHz bandwidth Band Edge compliance (High Gain Flat plate antenna)
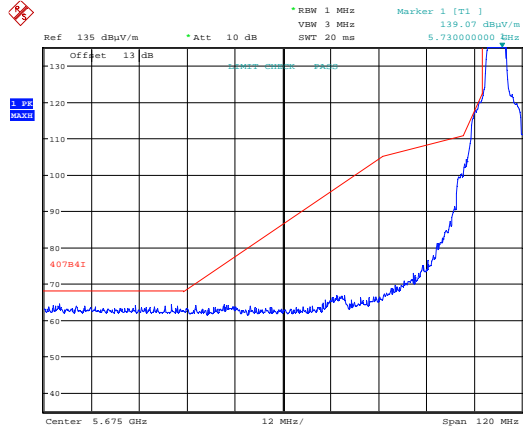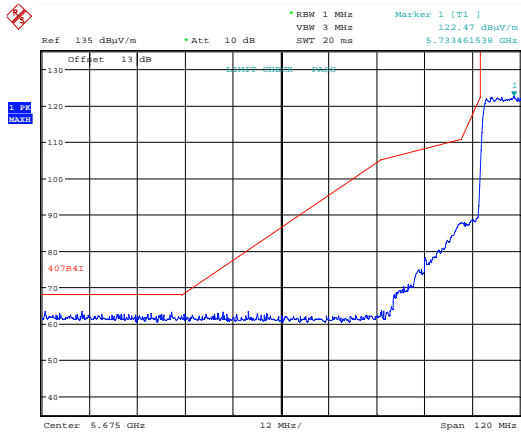

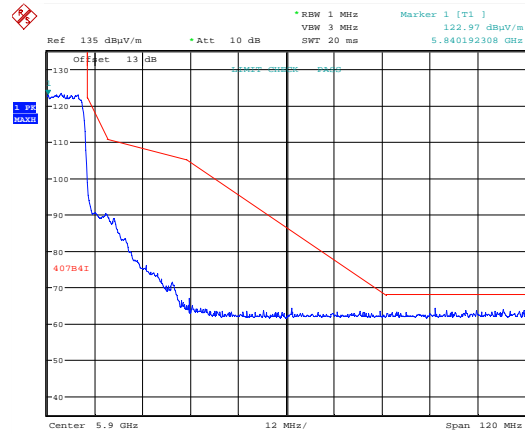Date: 29.JAN.2018 17:44:23

Band Edge QPSK; 5728.5 MHz; 27 dBm.
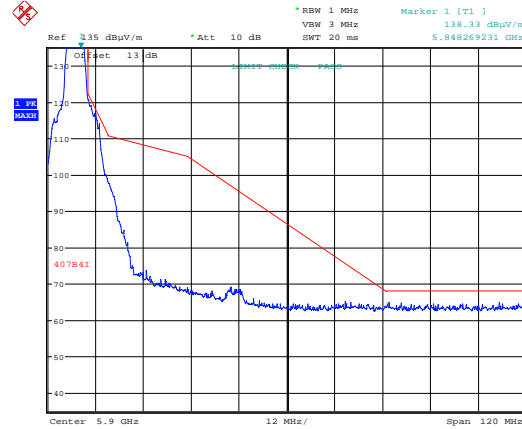
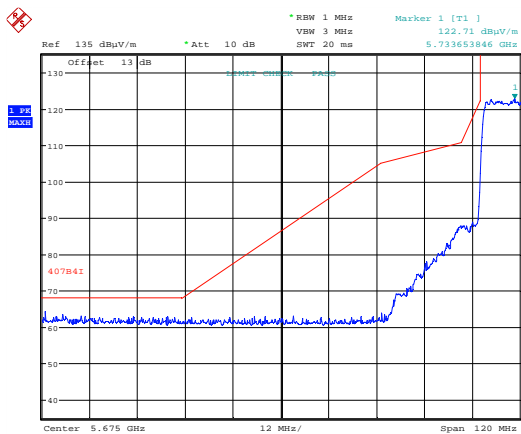Date: 29.JAN.2018 18:15:17

Band Edge QPSK; 5847 MHz; 28 dBm.
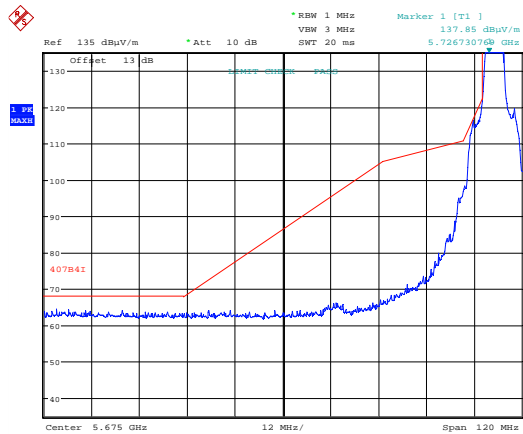
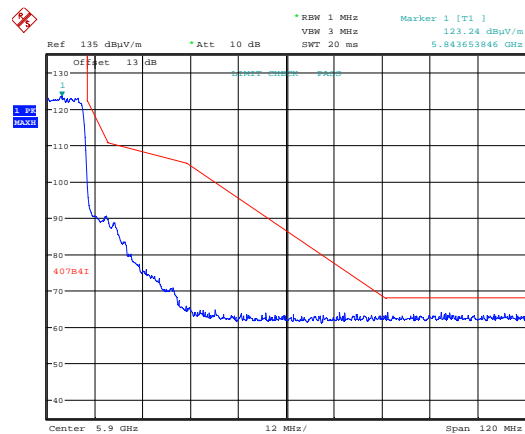Date: 29.JAN.2018 18:04:58

Band Edge 16 QAM; 5728 MHz; 26 dBm.
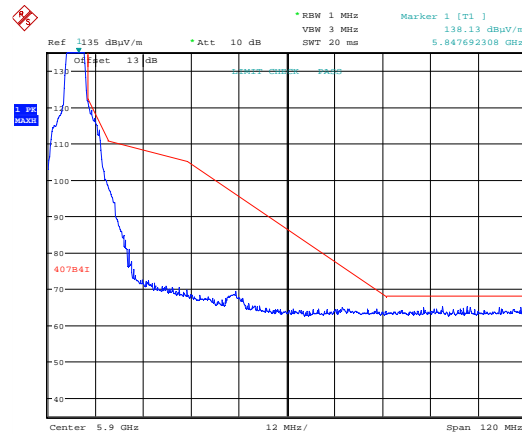
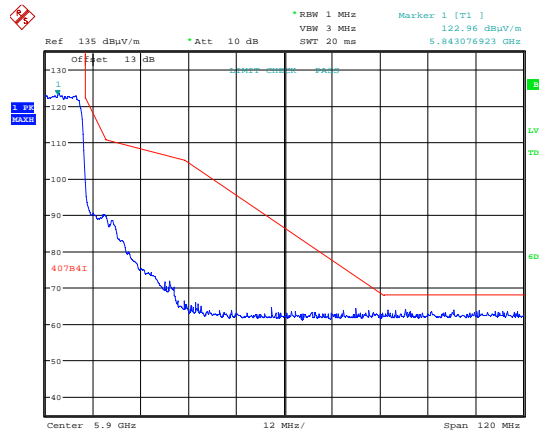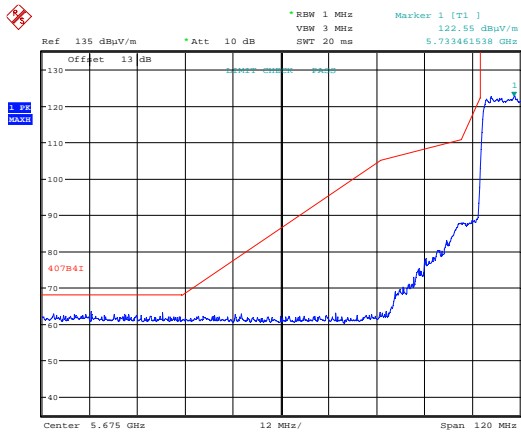Date: 29.JAN.2018 18:16:18

Band Edge 16 QAM; 5847 MHz; 26 dBm.
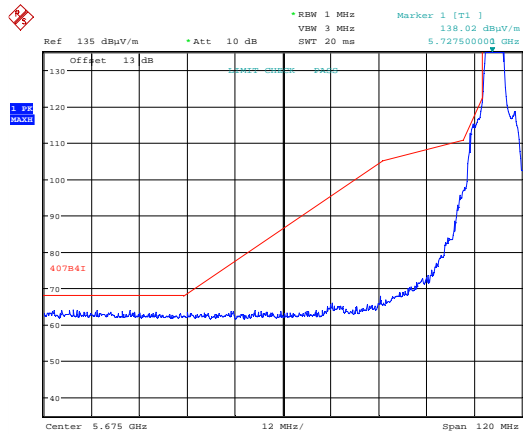
Date: 29.JAN.2018 18:07:56

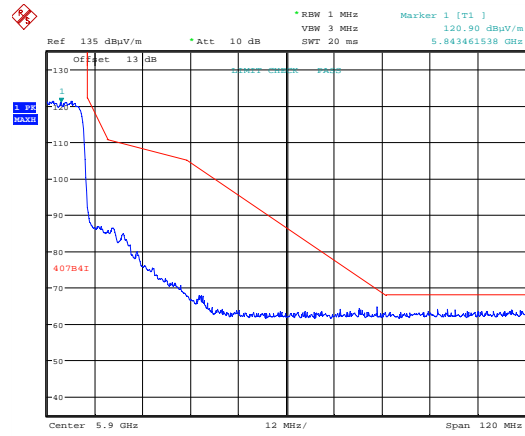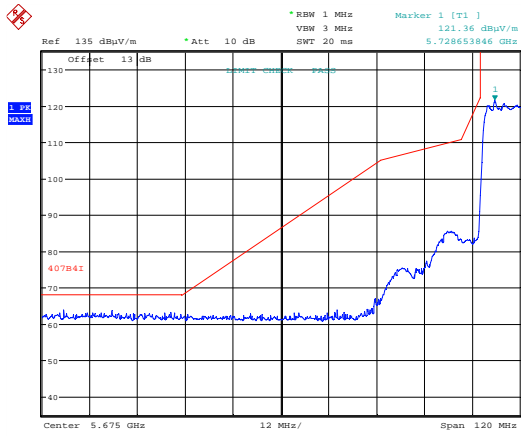Band Edge 64 QAM; 5728 MHz; 25 dBm.
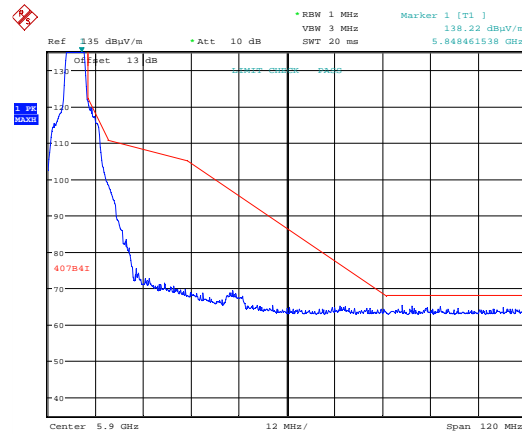
Date: 29.JAN.2018 18:17:07

Band Edge 64 QAM; 5847 MHz; 25 dBm.
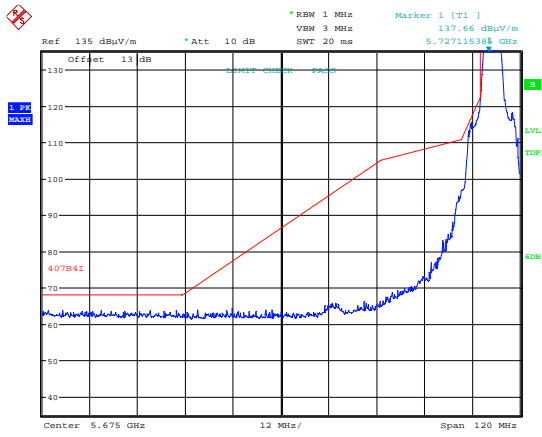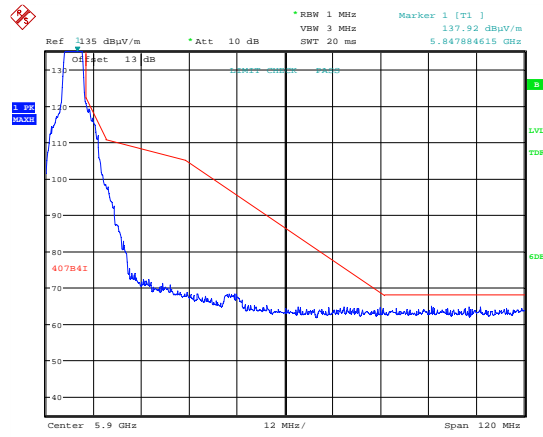
Band Edge 256 QAM; 5728 MHz; 24 dBm.

Band Edge 256 QAM; 5847 MHz; 24 dBm.

Frequencies and Power setting to comply		
Mod Mode	Frequency (MHz)	Power (dBm)
QPSK	5728.5	27
QPSK	5847	28
16 QAM	5728	26
16 QAM	5847	26
64 QAM	5728	25
64 QAM	5847	25
256 QAM	5728	24
256 QAM	5847	24

10 MHz Bandwidth
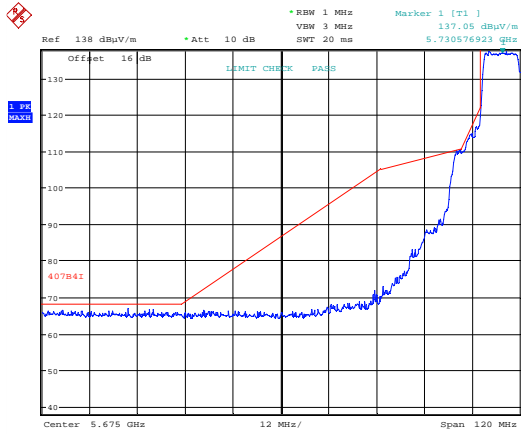
Date: 30.JAN.2018 14:29:42

Band Edge QPSK; 5730.25 MHz; 26 dBm.
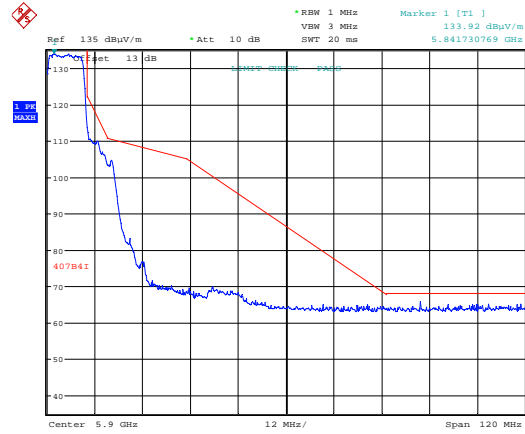
Date: 30.JAN.2018 12:20:23

Band Edge QPSK; 5845 MHz; 28 dBm.
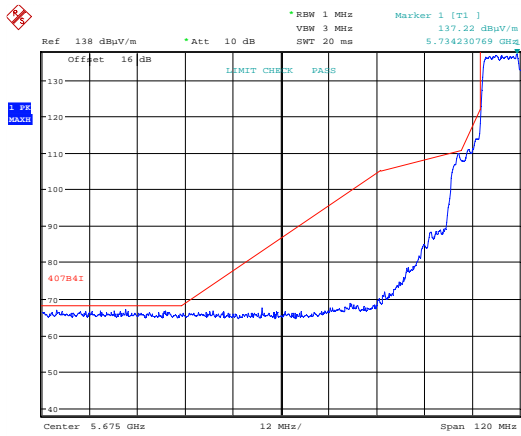
Date: 30.JAN.2018 14:22:46

Band Edge 16 QAM; 5730 MHz; 26 dBm.
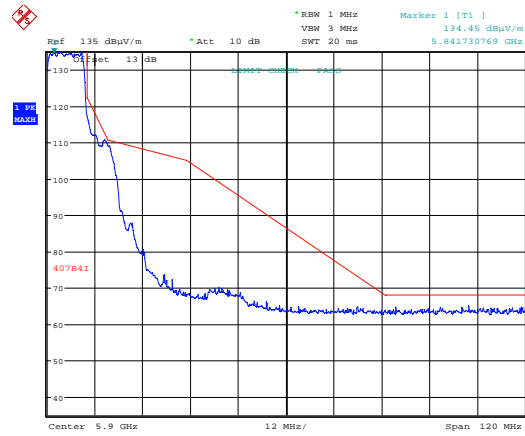
Date: 30.JAN.2018 12:24:52

Band Edge 16 QAM; 5845 MHz; 26 dBm.
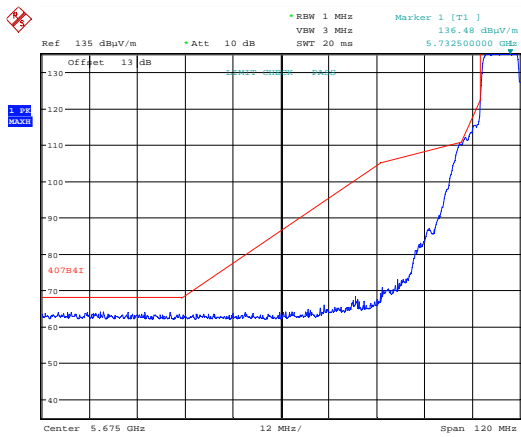

Date: 30.JAN.2018 12:32:55

Band Edge 64 QAM; 5730 MHz; 25 dBm.
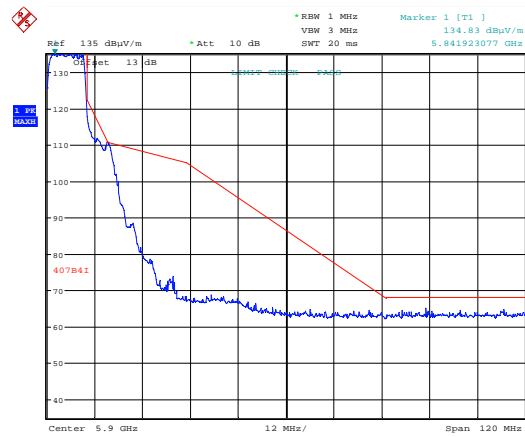
Date: 30.JAN.2018 12:34:57

Band Edge 64 QAM; 5845 MHz; 25 dBm.
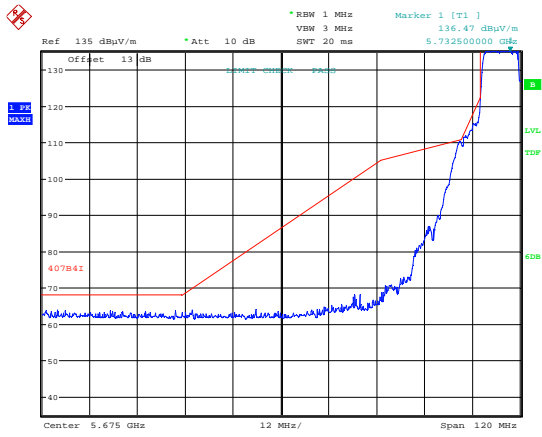
Date: 30.JAN.2018 12:33:34

Band Edge 256 QAM; 5730 MHz; 24 dBm.
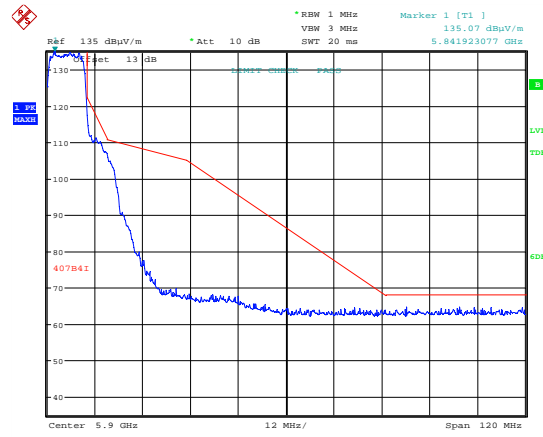
Date: 30.JAN.2018 12:34:22

Band Edge 256 QAM; 5845 MHz; 24 dBm.

Frequencies and Power setting to comply		
Mod Mode	Frequency (MHz)	Power (dBm)
QPSK	5730.25	26
QPSK	5845	28
16 QAM	5730	26
16 QAM	5845	26
64 QAM	5730	25
64 QAM	5845	25
256 QAM	5730	24
256 QAM	5845	24

15 MHz Bandwidth
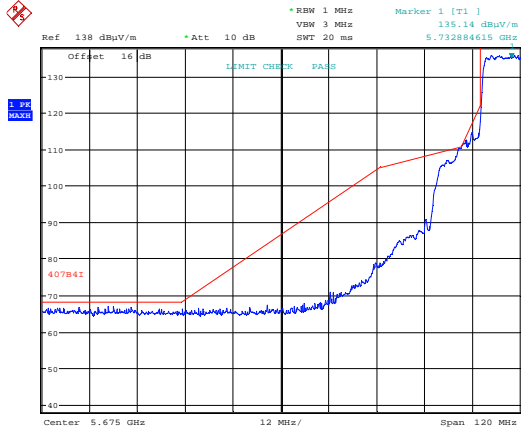
Date: 30.JAN.2018 14:41:19

Band Edge QPSK; 5732.5 MHz; 26 dBm.
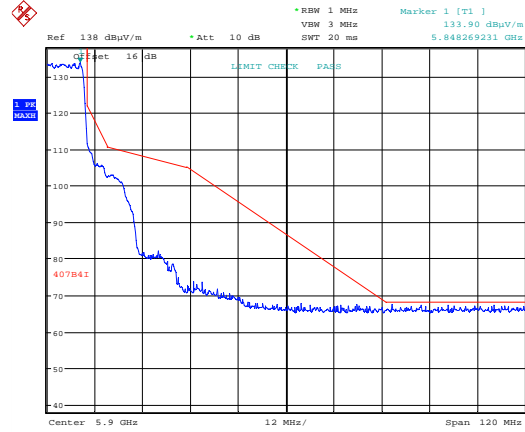
Date: 30.JAN.2018 14:44:18

Band Edge QPSK; 5842.5 MHz; 26 dBm.
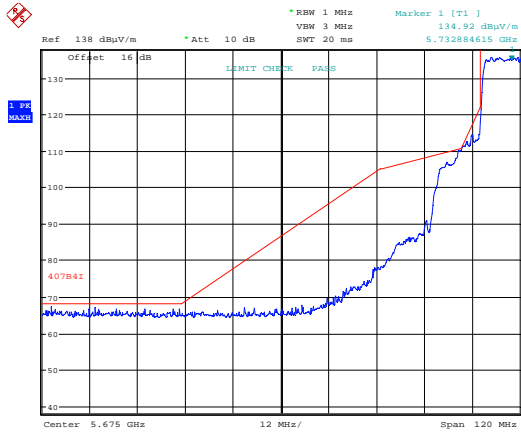
Date: 30.JAN.2018 14:42:09

Band Edge 16 QAM; 5732.5 MHz; 26 dBm.
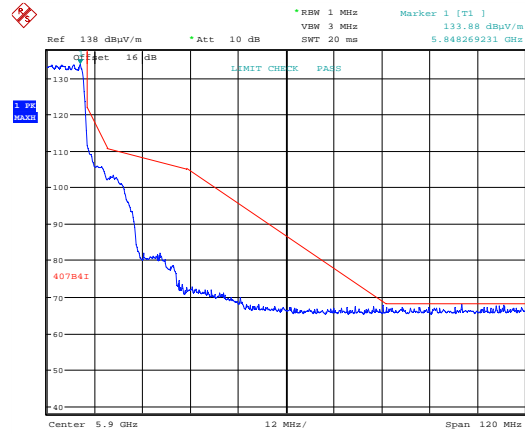
Date: 30.JAN.2018 14:43:39

Band Edge 16 QAM; 5842.5 MHz; 26 dBm.
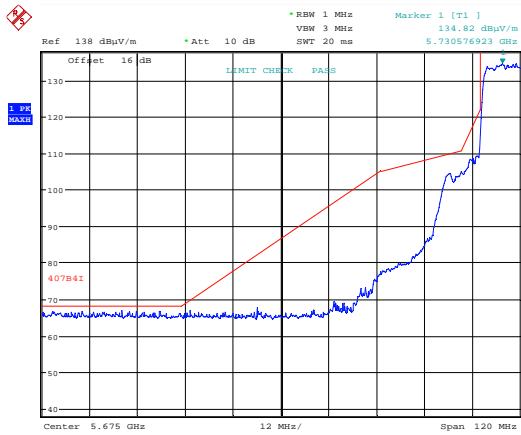
Date: 30.JAN.2018 14:38:35

Band Edge 64 QAM; 5732.5 MHz; 25 dBm.
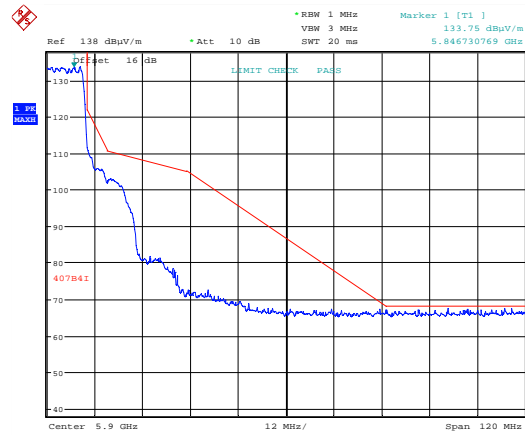
Date: 30.JAN.2018 14:44:59

Band Edge 64 QAM; 5842.5 MHz; 25 dBm.
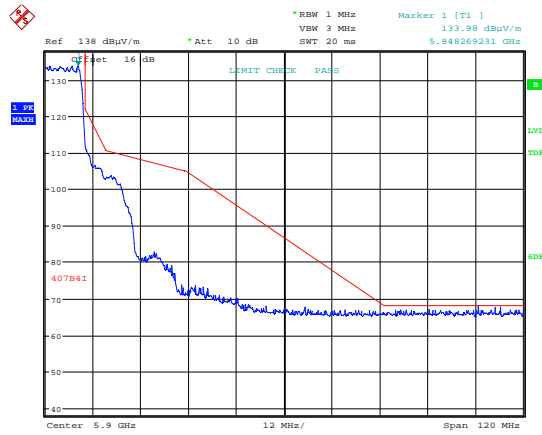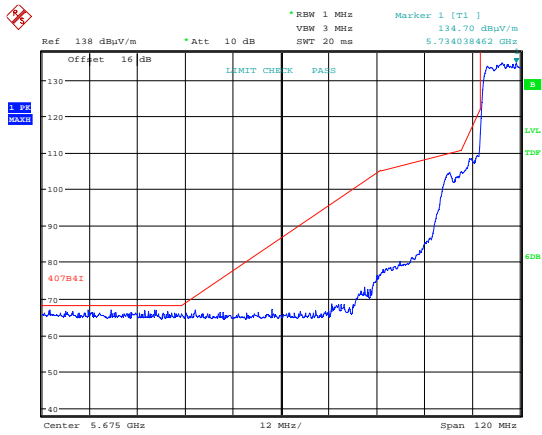
Date: 30.JAN.2018 14:39:30

Band Edge 256 QAM; 5732.5 MHz; 24 dBm.

Date: 30.JAN.2018 14:45:36

Band Edge 256 QAM; 5842.5 MHz; 24 dBm.

Frequencies and Power setting to comply		
Mod Mode	Frequency (MHz)	Power (dBm)
QPSK	5732.5	26
QPSK	5842.5	26
16 QAM	5732.5	26
16 QAM	5842.5	26
64 QAM	5732.5	25
64 QAM	5842.5	25
256 QAM	5732.5	24
256 QAM	5842.5	24

20 MHz Bandwidth
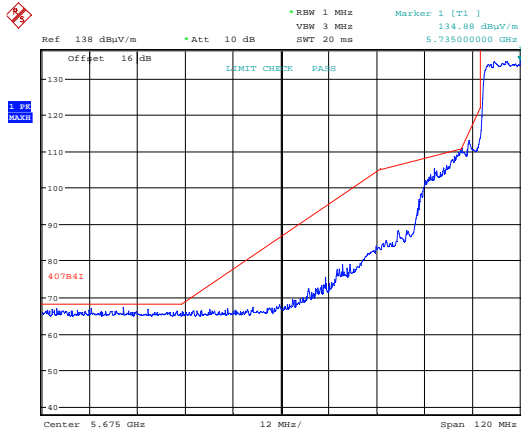
Band Edge QPSK; 5735 MHz; 26 dBm.
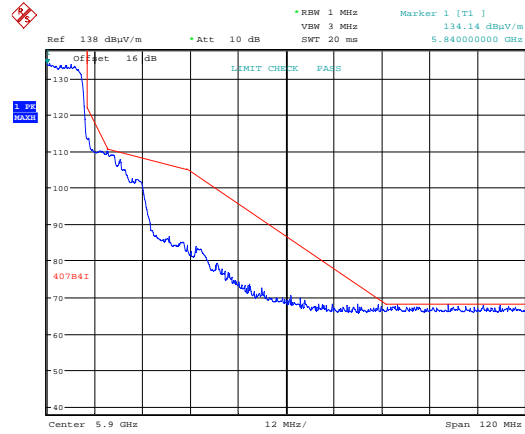
Band Edge QPSK; 5840 MHz; 28 dBm.
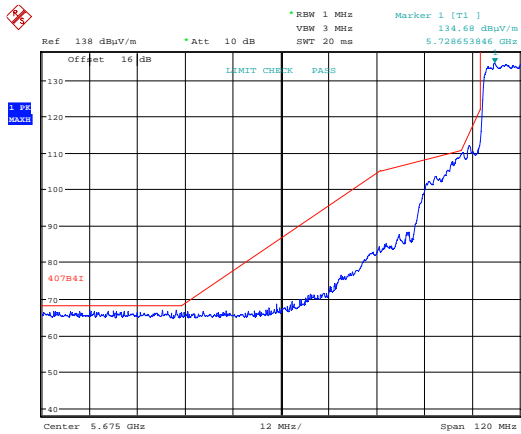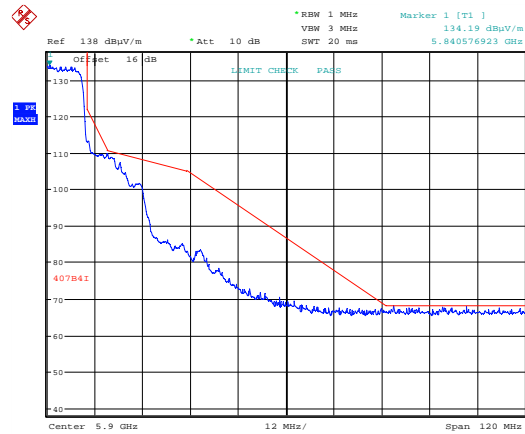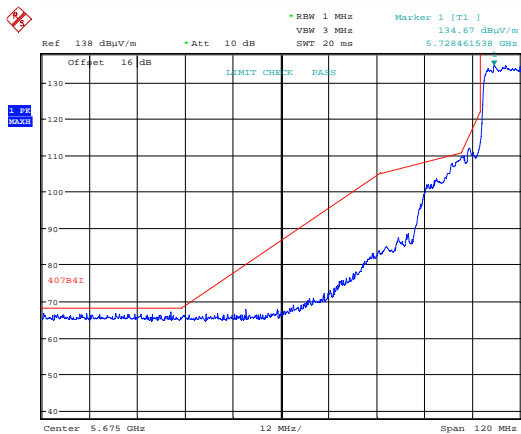
Band Edge 16 QAM; 5735 MHz; 26 dBm.

Band Edge 16 QAM; 5840 MHz; 26 dBm.

Band Edge 64 QAM; 5735 MHz; 25 dBm.

Band Edge 64 QAM; 5840 MHz; 25 dBm.

Date: 30.JAN.2018 14:58:53

Band Edge 256 QAM; 5735 MHz; 24 dBm.

Date: 30.JAN.2018 15:05:41

Band Edge 256 QAM; 5840 MHz; 24 dBm.

Frequencies and Power setting to comply		
Mod Mode	Frequency (MHz)	Power (dBm)
QPSK	5735	26
QPSK	5840	28
16 QAM	5735	26
16 QAM	5840	26
64 QAM	5735	25
64 QAM	5840	25
256 QAM	5735	24
256 QAM	5840	24

30 MHz Bandwidth
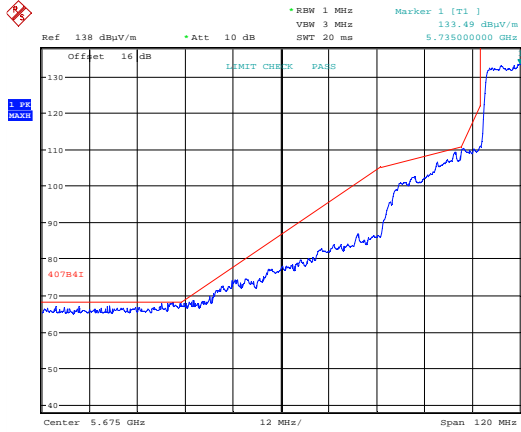
Date: 30.JAN.2018 15:06:59

Band Edge QPSK; 5740 MHz; 28 dBm.
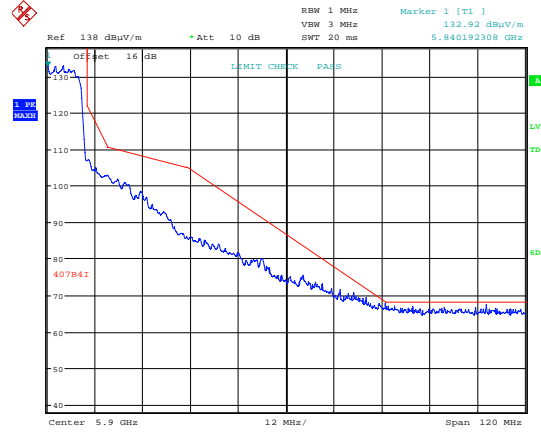
Date: 13.APR.2018 12:04:56

Band Edge QPSK; 5835 MHz; 28 dBm.
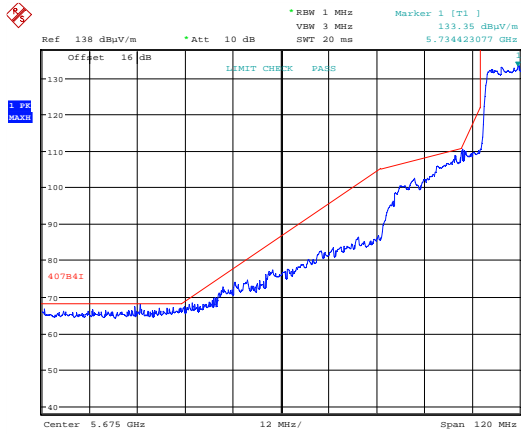
Date: 30.JAN.2018 15:09:50

Band Edge 16 QAM; 5740 MHz; 26 dBm.
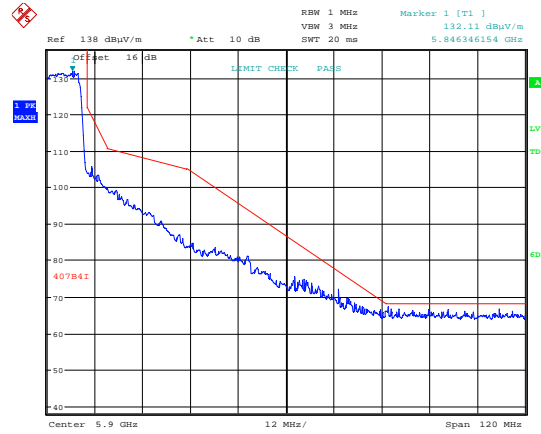
Date: 13.APR.2018 12:12:34

Band Edge 16 QAM; 5835 MHz; 26 dBm.
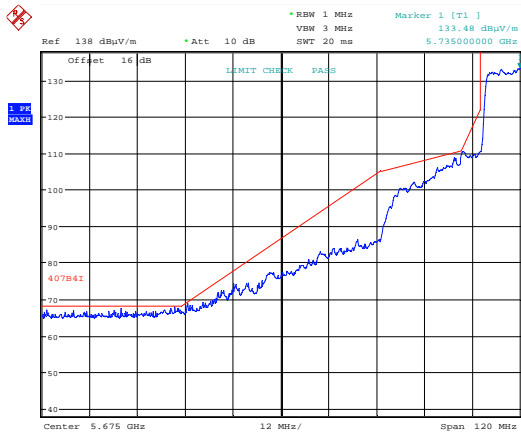
Date: 30.JAN.2018 15:10:59

Band Edge 64 QAM; 5740 MHz; 25 dBm.
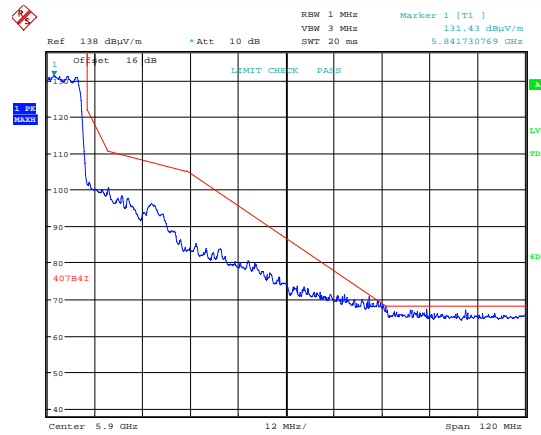
Date: 13.APR.2018 12:28:51

Band Edge 64 QAM; 5835 MHz; 25 dBm.
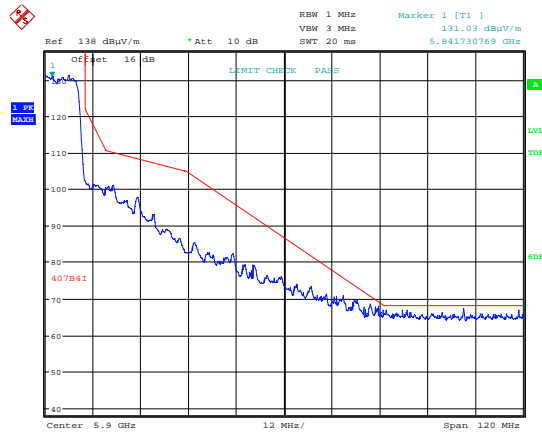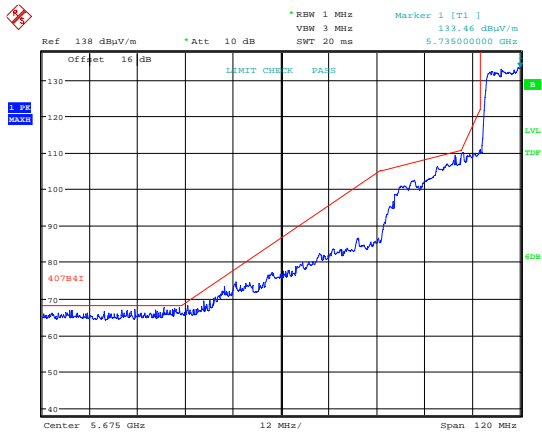
Date: 30.JAN.2018 15:12:02

Band Edge 256 QAM; 5740 MHz; 24 dBm.

Date: 13.APR.2018 12:26:24

Band Edge 256 QAM; 5835 MHz; 24 dBm.

Frequencies and Power setting to comply		
Mod Mode	Frequency (MHz)	Power (dBm)
QPSK	5740	28
QPSK	5835	28
16 QAM	5740	26
16 QAM	5835	26
64 QAM	5740	25
64 QAM	5835	25
256 QAM	5740	24
256 QAM	5835	24

40 MHz Bandwidth

Band Edge QPSK; 5745 MHz; 26 dBm.

Band Edge QPSK; 5830 MHz; 26 dBm.
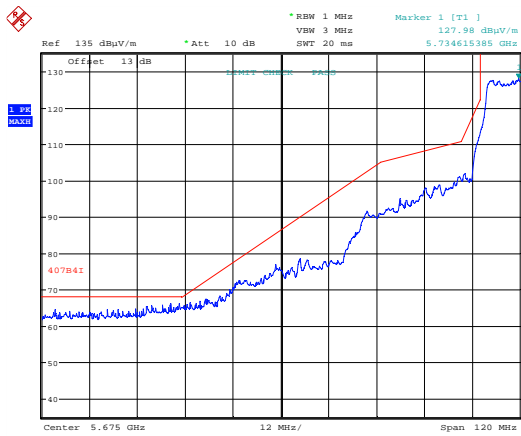
Band Edge 16 QAM; 5745 MHz; 26 dBm.
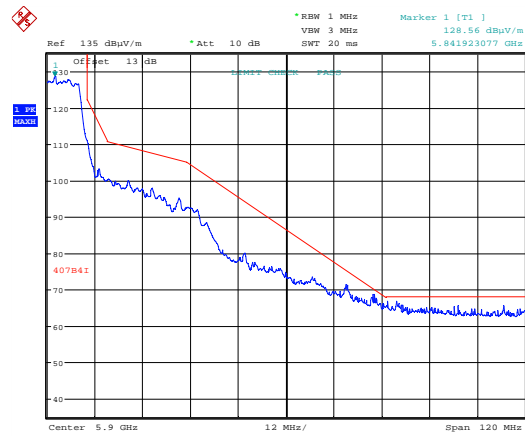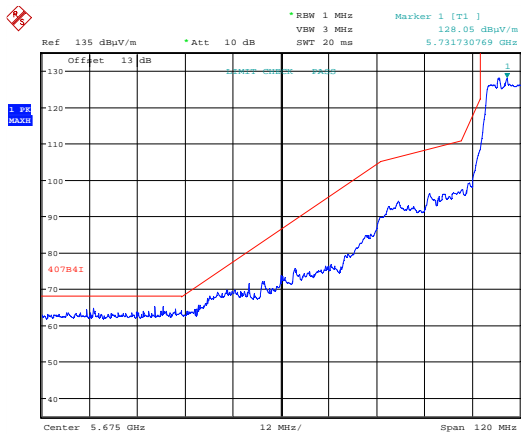
Band Edge 16 QAM; 5830 MHz; 26 dBm.

Band Edge 64 QAM; 5745 MHz; 25 dBm.

Band Edge 64 QAM; 5830 MHz; 25 dBm.

Date: 29.JAN.2018 18:38:02

Band Edge 256 QAM; 5745 MHz; 24 dBm.

Date: 29.JAN.2018 18:49:55

Band Edge 256 QAM; 5830 MHz; 24 dBm.

Frequencies and Power setting to comply		
Mod Mode	Frequency (MHz)	Power (dBm)
QPSK	5745	26
QPSK	5830	26
16 QAM	5745	26
16 QAM	5830	26
64 QAM	5745	25
64 QAM	5830	25
256 QAM	5745	24
256 QAM	5830	24

5 MHz bandwidth Band Edge compliance (Omnidirectional antenna)
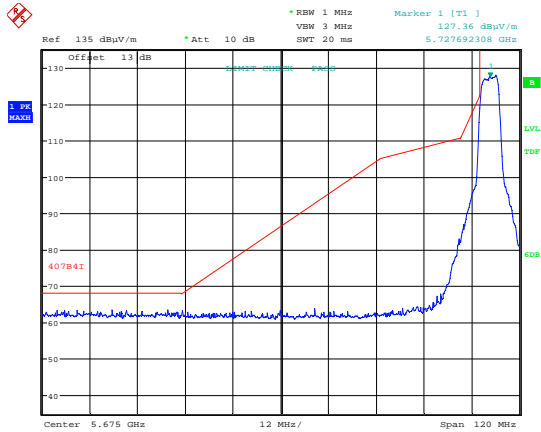
Date: 29.JAN.2018 19:03:12

Band Edge QPSK; 5727.5 MHz; 23.75 dBm.
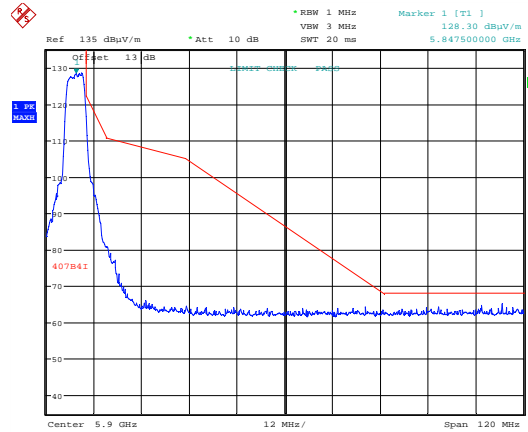
Date: 29.JAN.2018 19:05:37

Band Edge QPSK; 5847.5 MHz; 23.75 dBm.
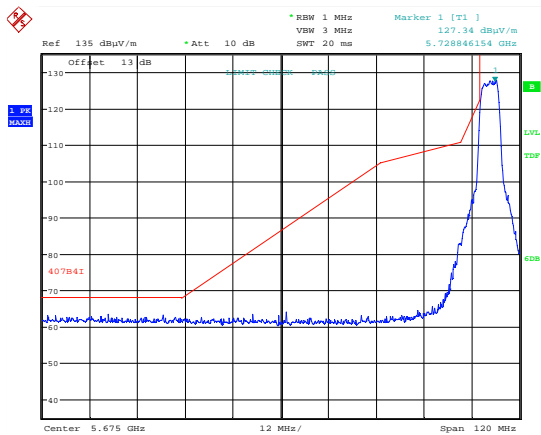
Date: 29.JAN.2018 19:03:42

Band Edge 16 QAM; 5727.5 MHz; 23.75 dBm.
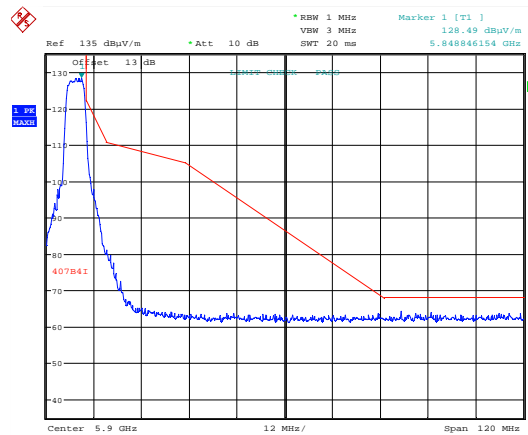
Date: 29.JAN.2018 19:06:01

Band Edge 16 QAM; 5847.5 MHz; 23.75 dBm.
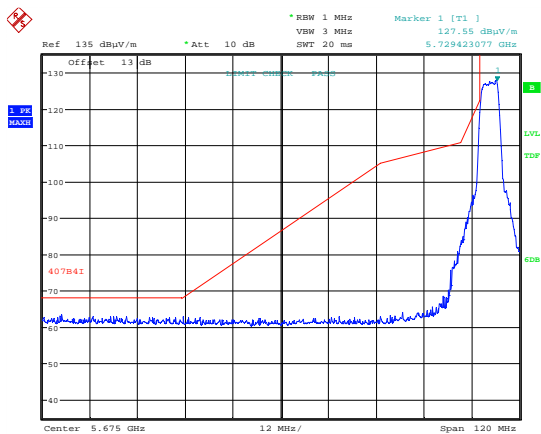
Date: 29.JAN.2018 19:04:09

Band Edge 64 QAM; 5727.5 MHz; 23.75 dBm.
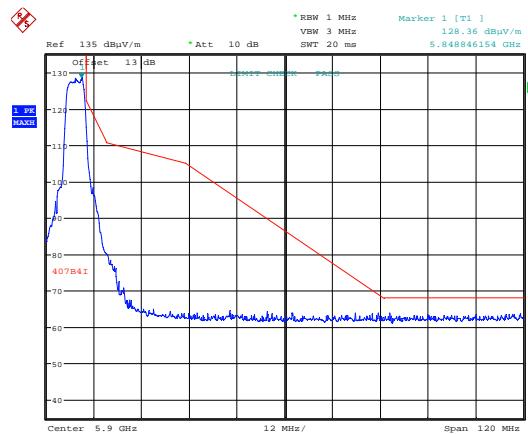
Date: 29.JAN.2018 19:06:27

Band Edge 64 QAM; 5847.5 MHz; 23.75 dBm.
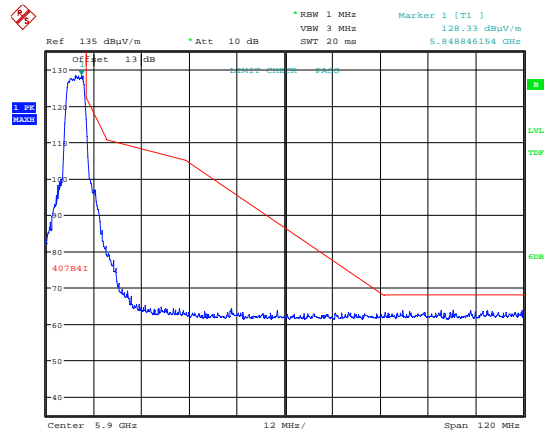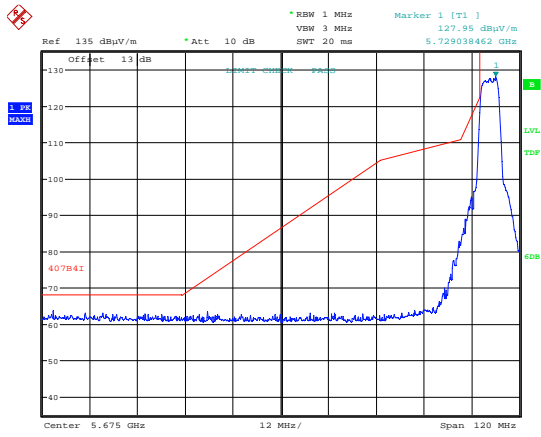
Band Edge 256 QAM; 5727.5 MHz; 23.75 dBm.

Band Edge 256 QAM; 5847.5 MHz; 23.75 dBm.

Frequencies and Power setting to comply		
Mod Mode	Frequency (MHz)	Power (dBm)
QPSK	5727.5	23.75
QPSK	5847.5	23.75
16 QAM	5727.5	23.75
16 QAM	5847.5	23.75
64 QAM	5727.5	23.75
64 QAM	5847.5	23.75
256 QAM	5727.5	23.75
256 QAM	5847.5	23.75

10 MHz Bandwidth
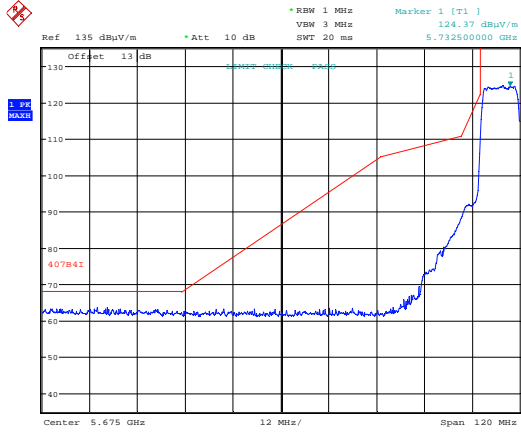
Band Edge QPSK; 5730 MHz; 23.75 dBm.
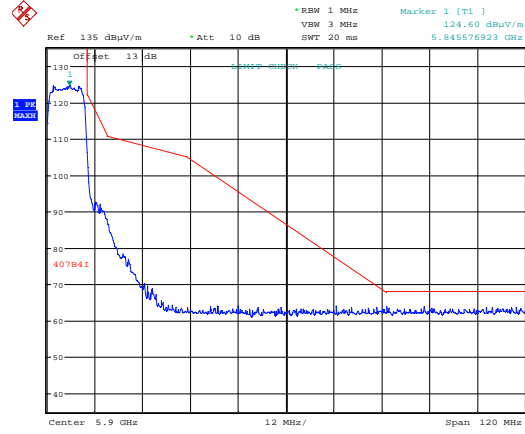
Band Edge QPSK; 5845 MHz; 23.75 dBm.
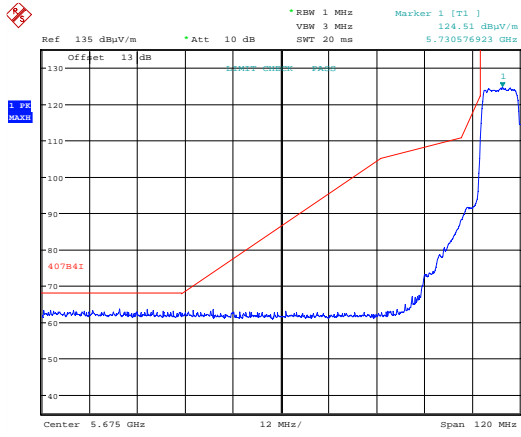
Band Edge 16 QAM; 5730 MHz; 23.75 dBm.
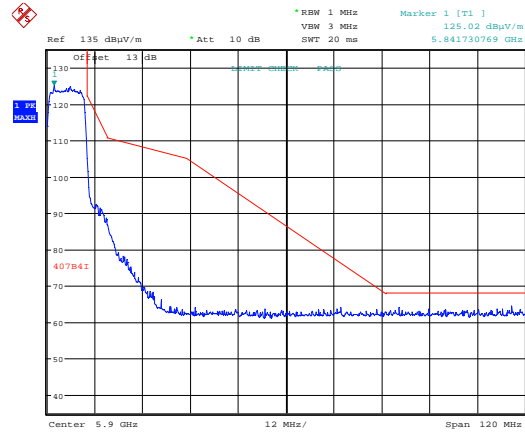
Band Edge 16 QAM; 5845 MHz; 23.75 dBm.
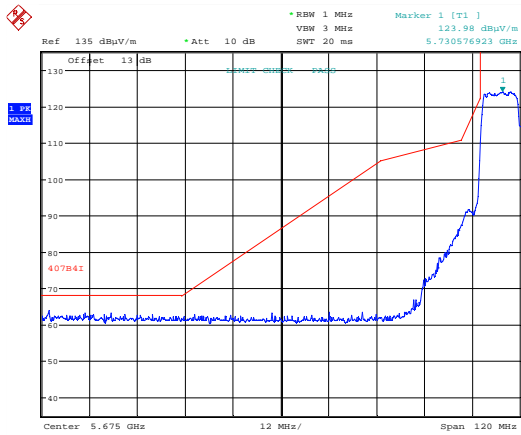
Band Edge 64 QAM; 5730 MHz; 23.75 dBm.
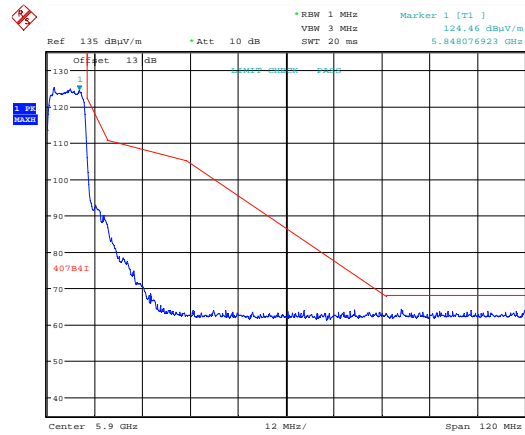
Band Edge 64 QAM; 5845 MHz; 23.75 dBm.
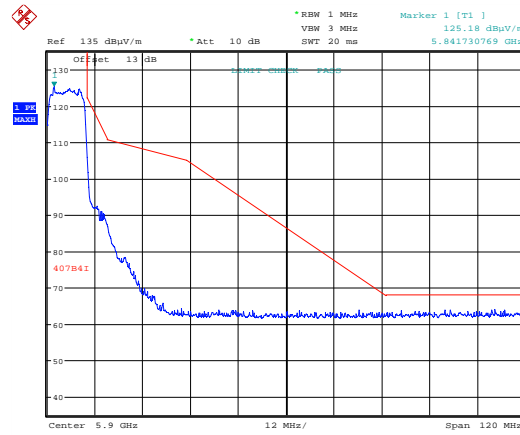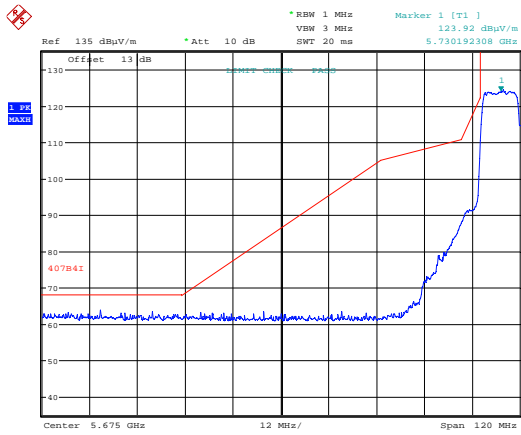
Band Edge 256 QAM; 5730 MHz; 23.75 dBm.

Band Edge 256 QAM; 5845 MHz; 23.75 dBm.

Frequencies and Power setting to comply		
Mod Mode	Frequency (MHz)	Power (dBm)
QPSK	5730	23.75
QPSK	5845	23.75
16 QAM	5730	23.75
16 QAM	5845	23.75
64 QAM	5730	23.75
64 QAM	5845	23.75
256 QAM	5730	23.75
256 QAM	5845	23.75

15 MHz Bandwidth
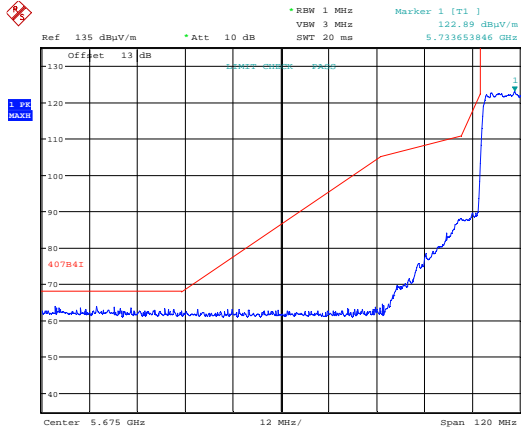
Date: 29.JAN.2018 21:00:27

Band Edge QPSK; 5732.5 MHz; 23.75 dBm.
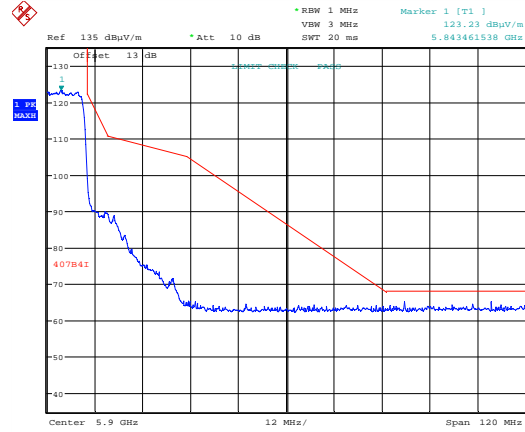
Date: 29.JAN.2018 21:04:44

Band Edge QPSK; 5842.5 MHz; 23.75 dBm.

Date: 29.JAN.2018 21:00:52

Band Edge 16 QAM; 5732.5 MHz; 23.75 dBm.

Date: 29.JAN.2018 21:05:10

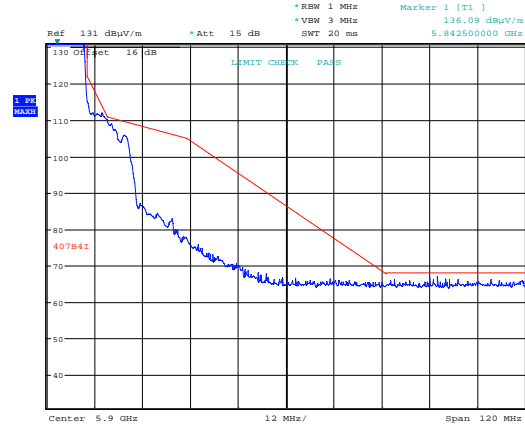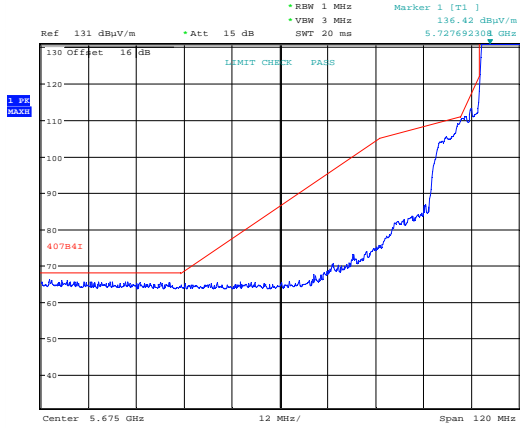Band Edge 16 QAM; 5842.5 MHz; 23.75 dBm.

Date: 29.JAN.2018 21:01:20

Band Edge 64 QAM; 5732.5 MHz; 23.75 dBm.

Date: 29.JAN.2018 21:05:40

Band Edge 64 QAM; 5842.5 MHz; 23.75 dBm.

Band Edge 256 QAM; 5732.5 MHz; 23.75 dBm.

Band Edge 256 QAM; 5842.5 MHz; 23.75 dBm.

Frequencies and Power setting to comply		
Mod Mode	Frequency (MHz)	Power (dBm)
QPSK	5732.5	23.75
QPSK	5842.5	23.75
16 QAM	5732.5	23.75
16 QAM	5842.5	23.75
64 QAM	5732.5	23.75
64 QAM	5842.5	23.75
256 QAM	5732.5	23.75
256 QAM	5842.5	23.75

20 MHz Bandwidth
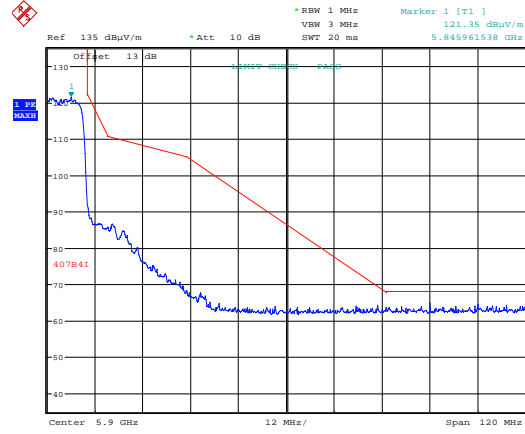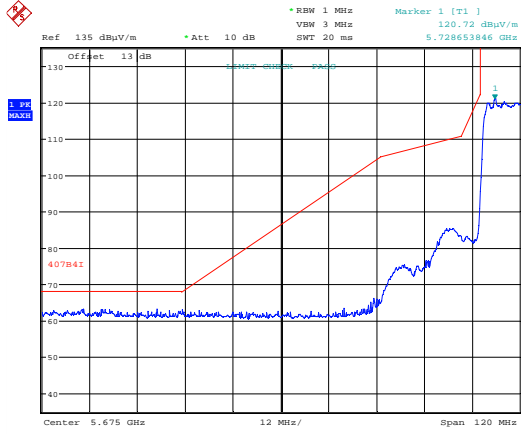
Band Edge QPSK; 5735 MHz; 23.75 dBm.

Band Edge QPSK; 5840 MHz; 23.75 dBm.

Band Edge 16 QAM; 5735 MHz; 23.75 dBm.

Band Edge 16 QAM; 5840 MHz; 23.75 dBm.
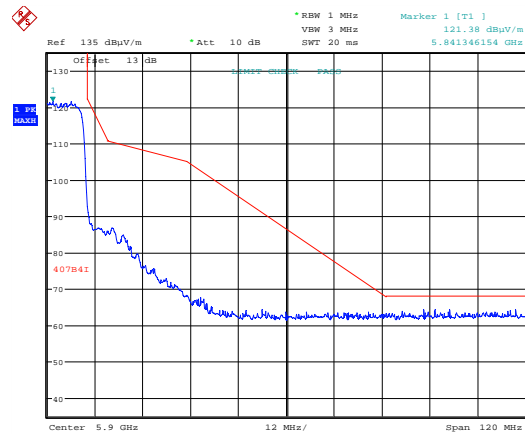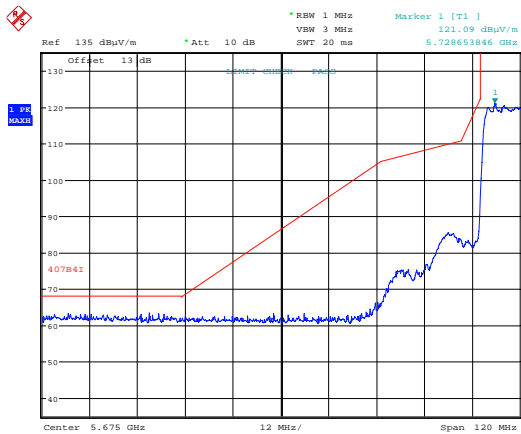
Band Edge 64 QAM; 5735 MHz; 23.75 dBm.

Band Edge 64 QAM; 5840 MHz; 23.75 dBm.
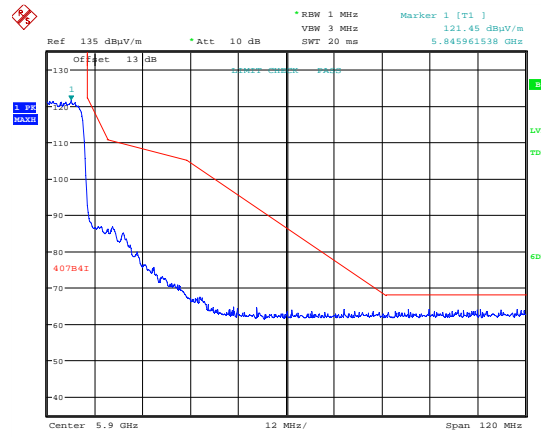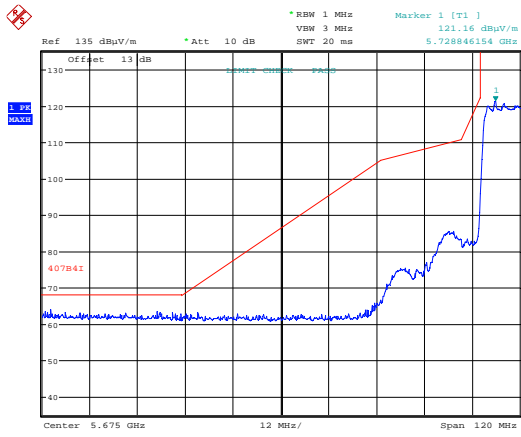
Date: 29.JAN.2018 21:08:33

Band Edge 256 QAM; 5735 MHz; 23.75 dBm.

Date: 29.JAN.2018 21:13:17

Band Edge 256 QAM; 5840 MHz; 23.75 dBm.

Frequencies and Power setting to comply		
Mod Mode	Frequency (MHz)	Power (dBm)
QPSK	5735	23.75
QPSK	5840	23.75
16 QAM	5735	23.75
16 QAM	5840	23.75
64 QAM	5735	23.75
64 QAM	5840	23.75
256 QAM	5735	23.75
256 QAM	5840	23.75

30 MHz Bandwidth
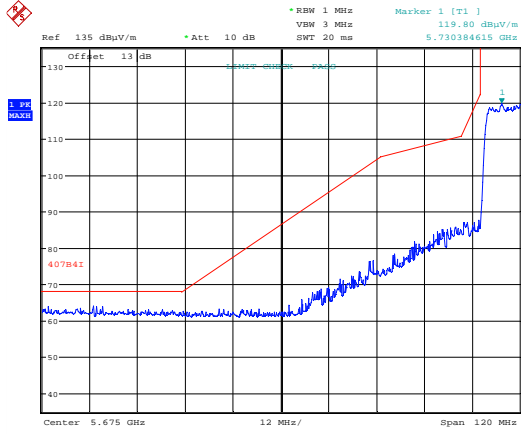
Band Edge QPSK; 5740 MHz; 23.75 dBm.
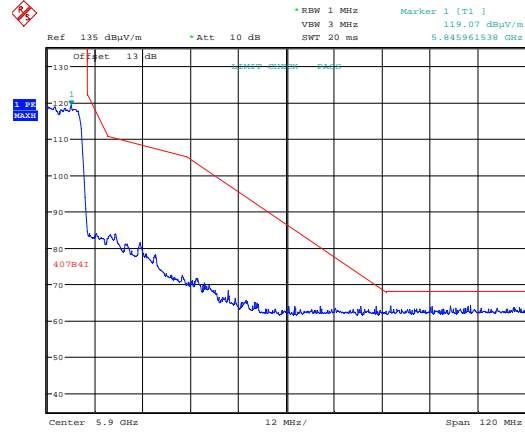
Band Edge QPSK; 5835 MHz; 23.75 dBm.
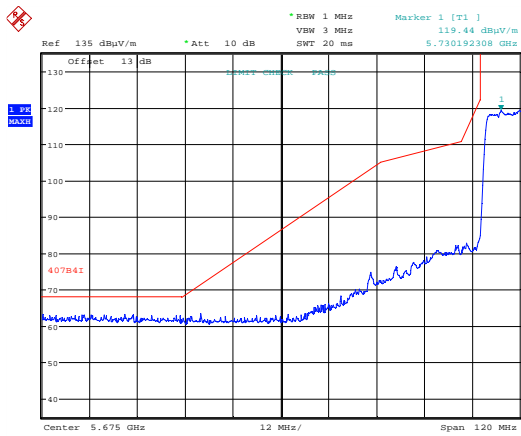
Band Edge 16 QAM; 5740 MHz; 23.75 dBm.
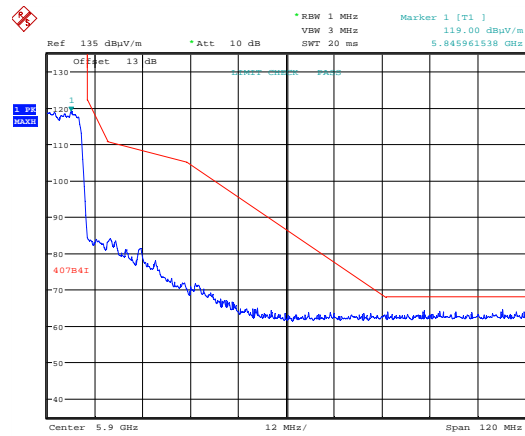
Band Edge 16 QAM; 5835 MHz; 23.75 dBm.
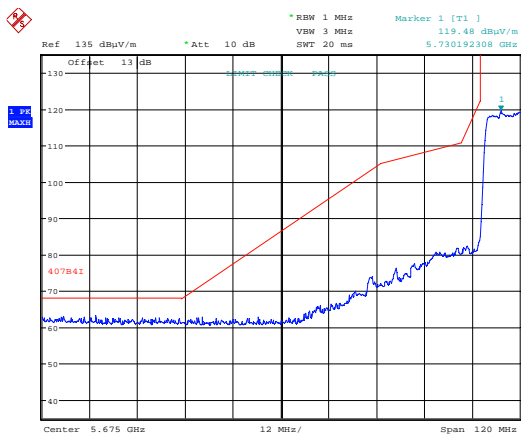
Band Edge 64 QAM; 5740 MHz; 23.75 dBm.
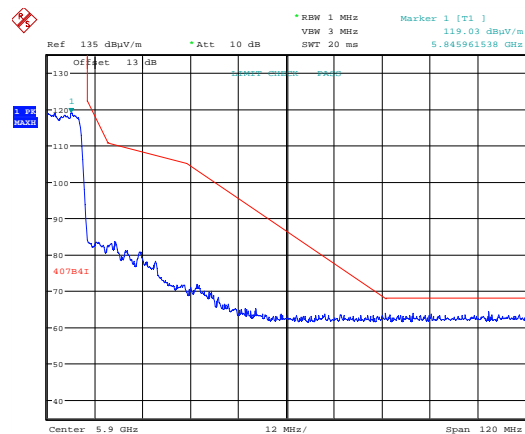
Band Edge 64 QAM; 5835 MHz; 23.75 dBm.
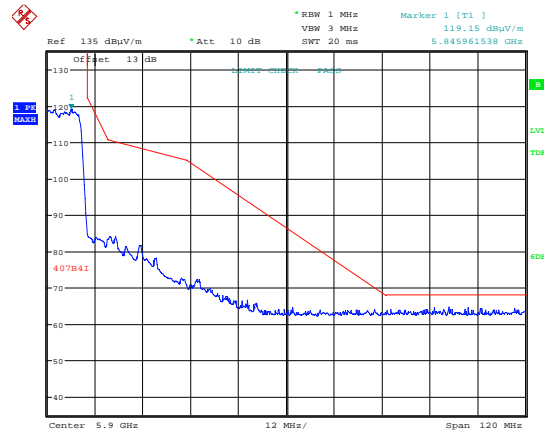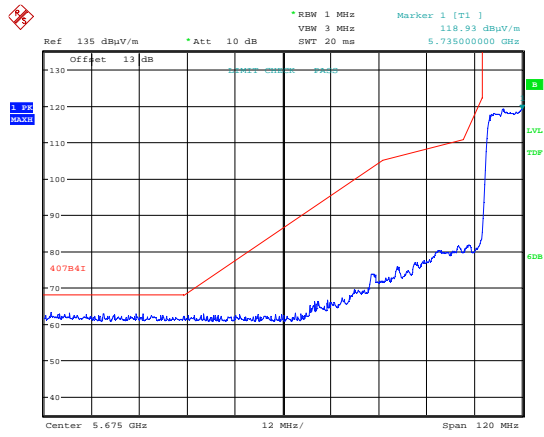
Date: 29.JAN.2018 21:20:04

Band Edge 256 QAM; 5740 MHz; 23.75 dBm.

Date: 29.JAN.2018 21:15:37

Band Edge 256 QAM; 5835 MHz; 23.75 dBm.

Frequencies and Power setting to comply		
Mod Mode	Frequency (MHz)	Power (dBm)
QPSK	5740	23.75
QPSK	5835	23.75
16 QAM	5740	23.75
16 QAM	5835	23.75
64 QAM	5740	23.75
64 QAM	5835	23.75
256 QAM	5740	23.75
256 QAM	5835	23.75

40 MHz Bandwidth
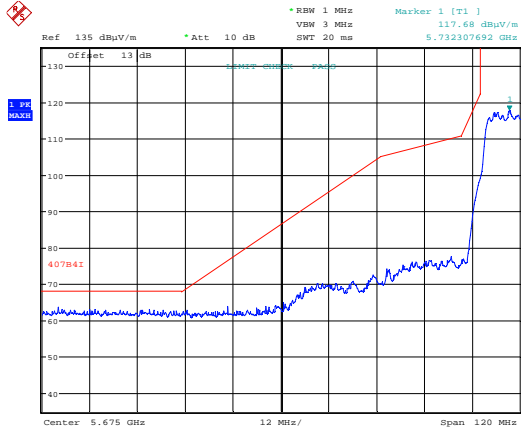
Date: 29.JAN.2018 19:11:45

Band Edge QPSK; 5745 MHz; 23.75 dBm.
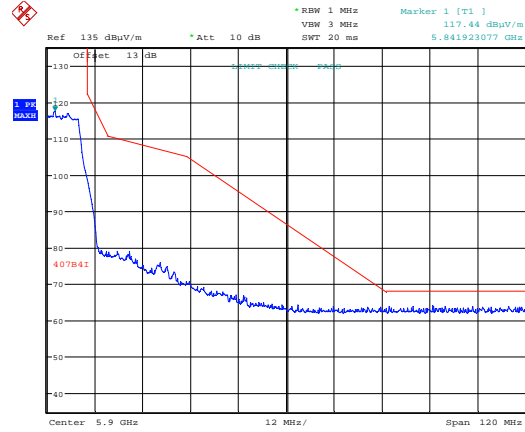
Date: 29.JAN.2018 19:09:10

Band Edge QPSK; 5830 MHz; 23.75 dBm.
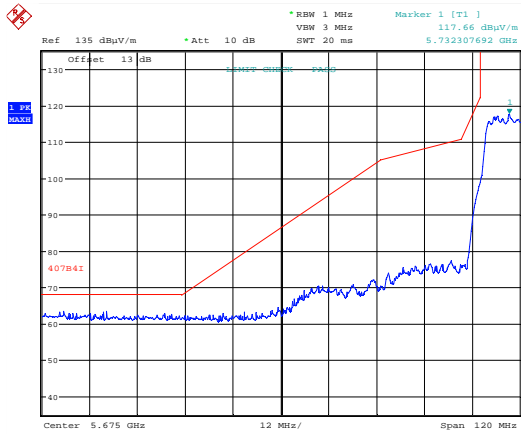
Date: 29.JAN.2018 19:12:18

Band Edge 16 QAM; 5745 MHz; 23.75 dBm.
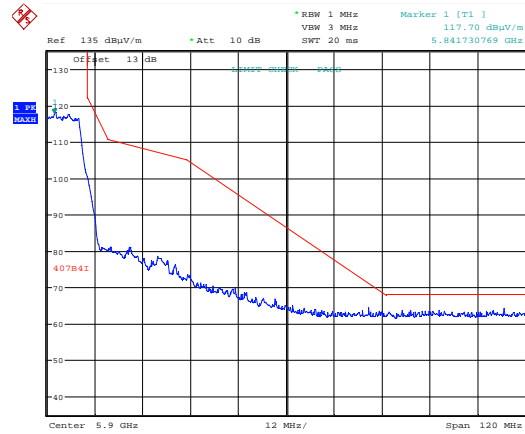
Date: 29.JAN.2018 19:09:42

Band Edge 16 QAM; 5830 MHz; 23.75 dBm.
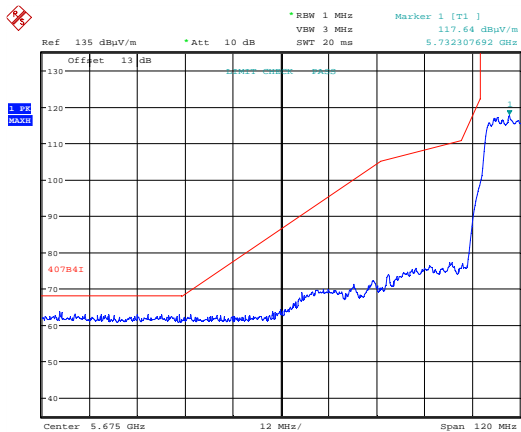
Date: 29.JAN.2018 19:12:48

Band Edge 64 QAM; 5745 MHz; 23.75 dBm.
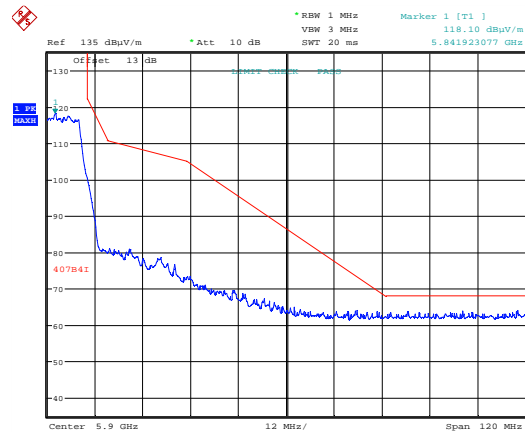
Date: 29.JAN.2018 19:10:06

Band Edge 64 QAM; 5830 MHz; 23.75 dBm.
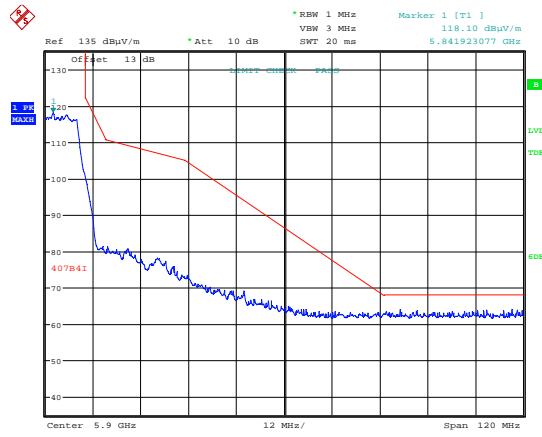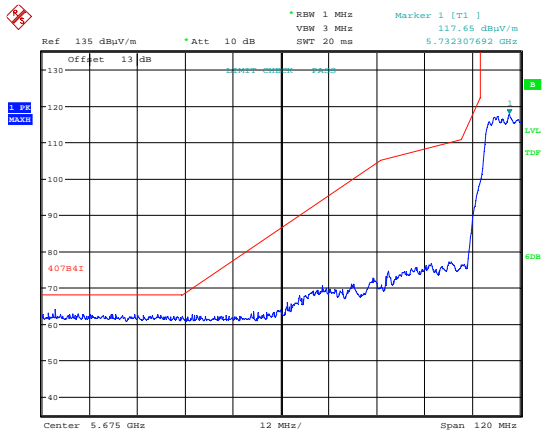
Date: 29.JAN.2018 19:13:26

Band Edge 256 QAM; 5745 MHz; 23.75 dBm.

Date: 29.JAN.2018 19:10:34

Band Edge 256 QAM; 5830 MHz; 23.75 dBm.

Frequencies and Power setting to comply		
Mod Mode	Frequency (MHz)	Power (dBm)
QPSK	5745	23.75
QPSK	5830	23.75
16 QAM	5745	23.75
16 QAM	5830	23.75
64 QAM	5745	23.75
64 QAM	5830	23.75
256 QAM	5745	23.75
256 QAM	5830	23.75

5 MHz bandwidth Band Edge compliance (Parabolic antenna)
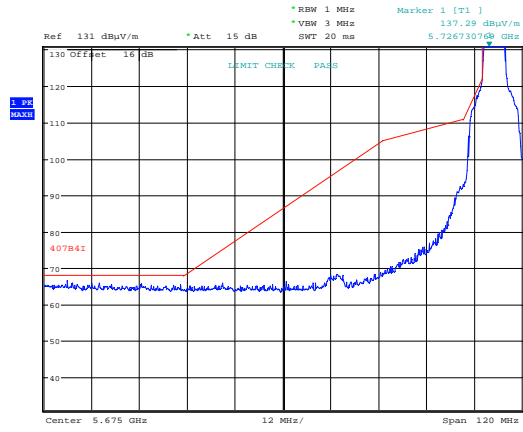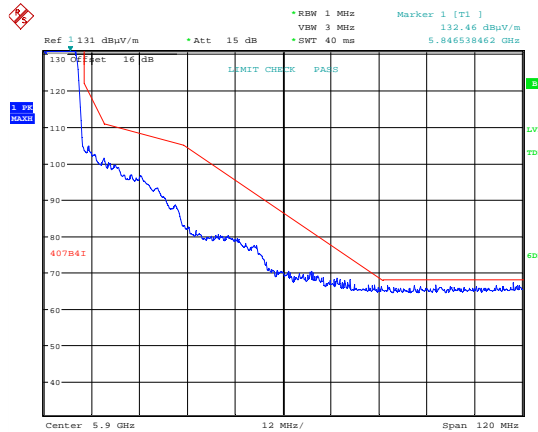

Date: 6.MAR.2018 16:42:25

Band Edge QPSK; 5728 MHz; 25 dBm.
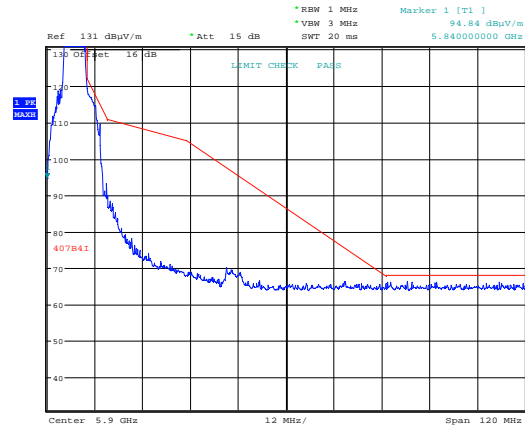
Date: 6.MAR.2018 16:44:42

Band Edge QPSK; 5847 MHz; 23 dBm.
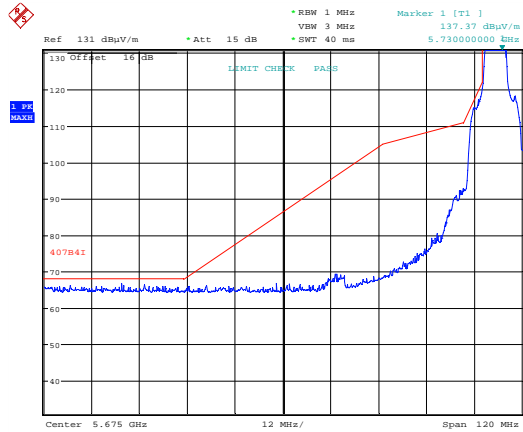
Date: 31.JAN.2018 14:21:36

Band Edge 16 QAM; 5728.25 MHz; 26 dBm.
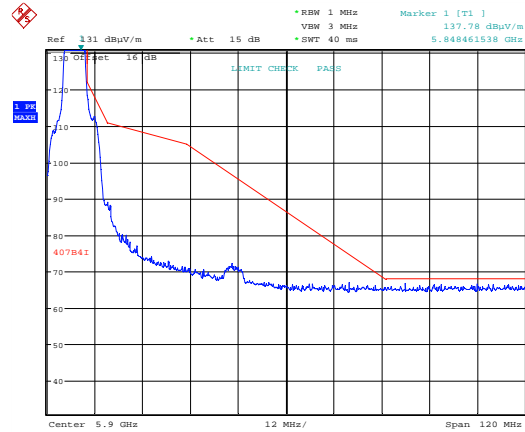
Date: 31.JAN.2018 14:35:26

Band Edge 16 QAM; 5847 MHz; 26 dBm.
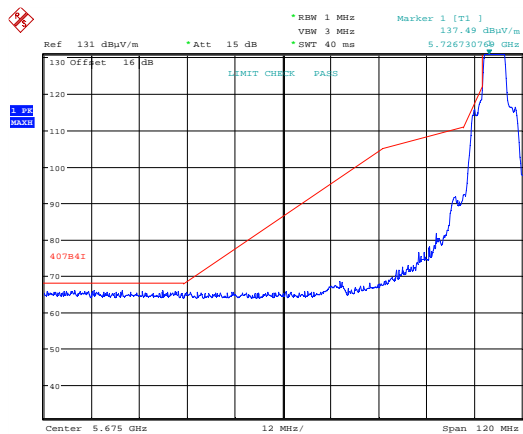
Date: 31.JAN.2018 14:24:11

Band Edge 64 QAM; 5728 MHz; 25 dBm.
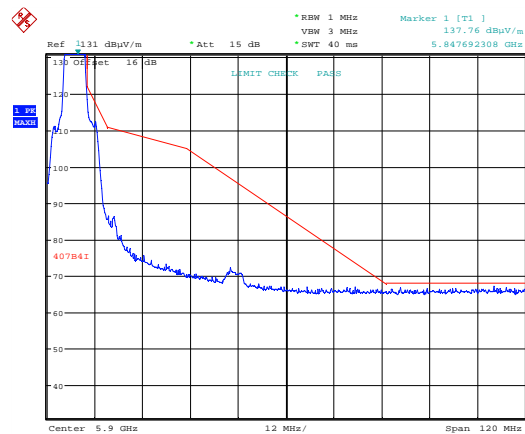
Date: 31.JAN.2018 14:38:03

Band Edge 64 QAM; 5847 MHz; 25 dBm.
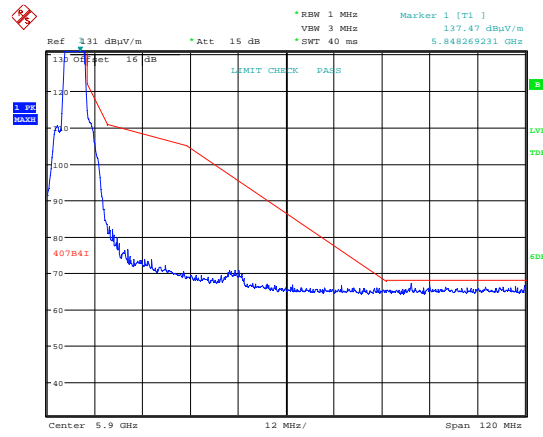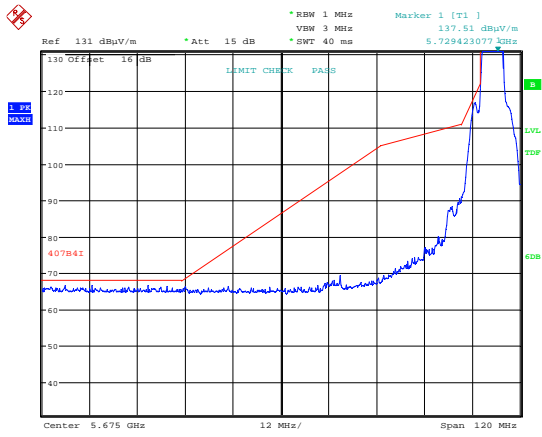
Date: 31.JAN.2018 14:27:01
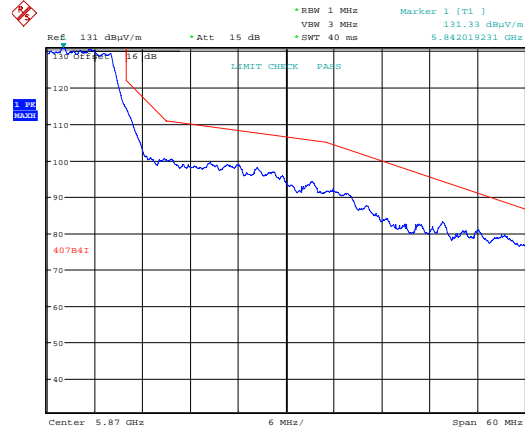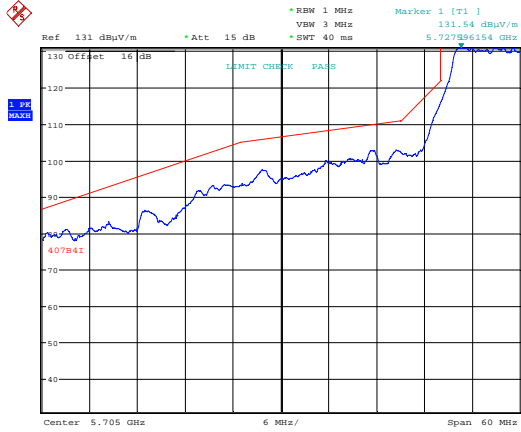
Band Edge 256 QAM; 5728 MHz; 24 dBm.

Date: 31.JAN.2018 14:39:25

Band Edge 256 QAM; 5847 MHz; 24 dBm.

Frequencies and Power setting to comply		
Mod Mode	Frequency (MHz)	Power (dBm)
QPSK	5728	25
QPSK	5847	23
16 QAM	5728.25	26
16 QAM	5847	26
64 QAM	5728	25
64 QAM	5847	25
256 QAM	5728	24
256 QAM	5847	24

10 MHz Bandwidth
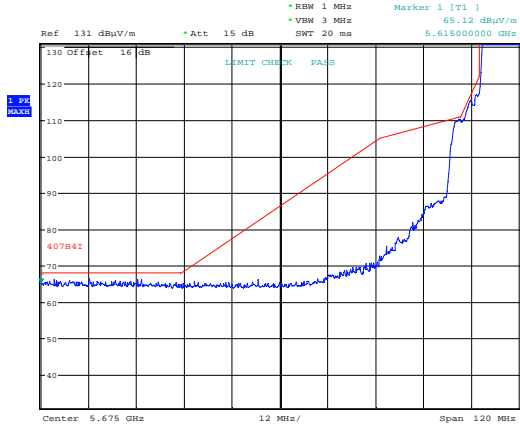
Date: 6.MAR.2018 15:16:09

Band Edge QPSK; 5730.5 MHz; 25.25 dBm.
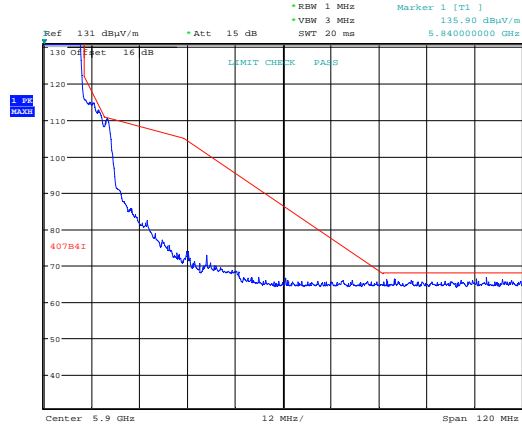
Date: 6.MAR.2018 15:20:48

Band Edge QPSK; 5844.5 MHz; 24.5 dBm.
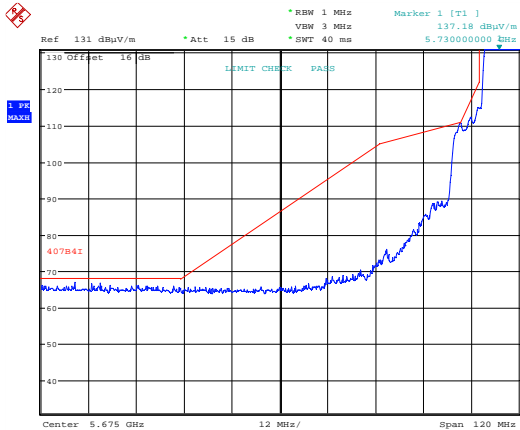
Date: 31.JAN.2018 14:48:41

Band Edge 16 QAM; 5731 MHz; 26 dBm.
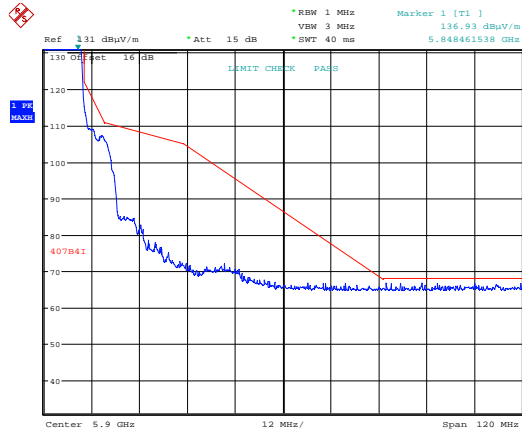
Date: 31.JAN.2018 15:04:35

Band Edge 16 QAM; 5844.75 MHz; 26 dBm.
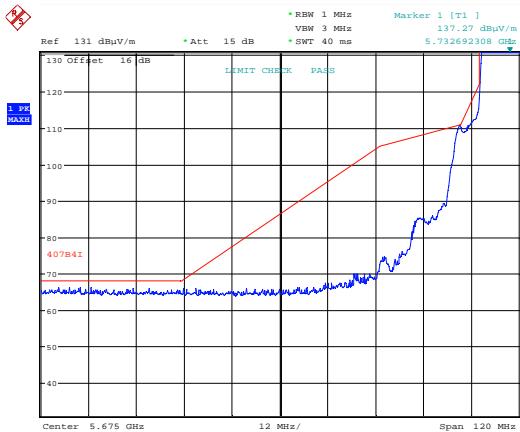
Date: 31.JAN.2018 14:55:40

Band Edge 64 QAM; 5730.25 MHz; 25 dBm.
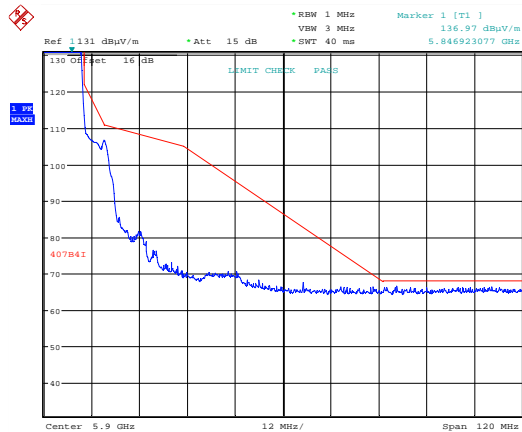
Date: 31.JAN.2018 15:05:50

Band Edge 64 QAM; 5844.75 MHz; 25 dBm.
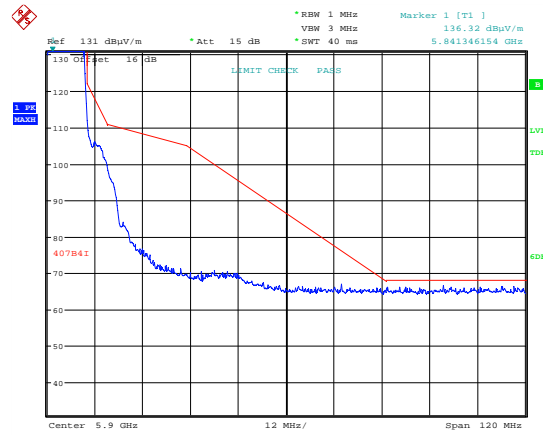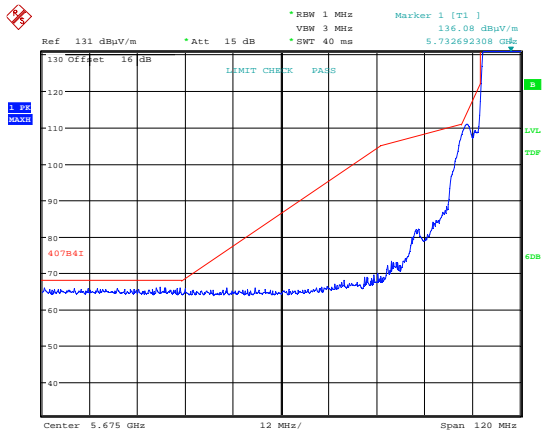
Band Edge 256 QAM; 5730.25 MHz; 24 dBm.

Band Edge 256 QAM; 5844.75 MHz; 24 dBm.

Frequencies and Power setting to comply		
Mod Mode	Frequency (MHz)	Power (dBm)
QPSK	5730.5	25.25
QPSK	5844.5	24.5
16 QAM	5731	26
16 QAM	5844.75	26
64 QAM	5730.25	25
64 QAM	5844.75	25
256 QAM	5730.25	24
256 QAM	5844.75	24

15 MHz Bandwidth

Date: 6.MAR.2018 15:22:42

Band Edge QPSK; 5732.5 MHz; 24.75 dBm.

Date: 6.MAR.2018 15:49:32

Band Edge QPSK; 5842.5 MHz; 24.5 dBm.
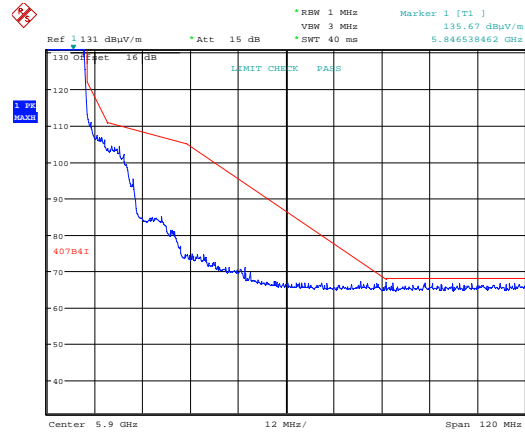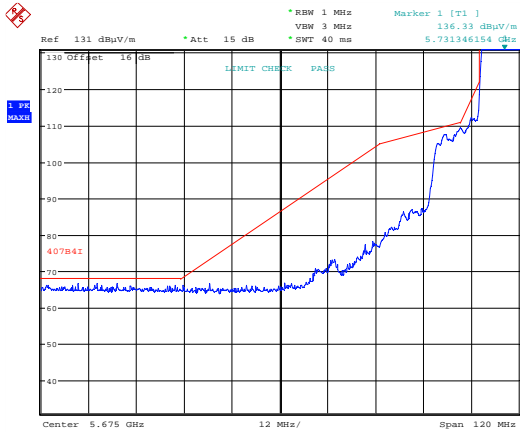
Date: 31.JAN.2018 15:15:47

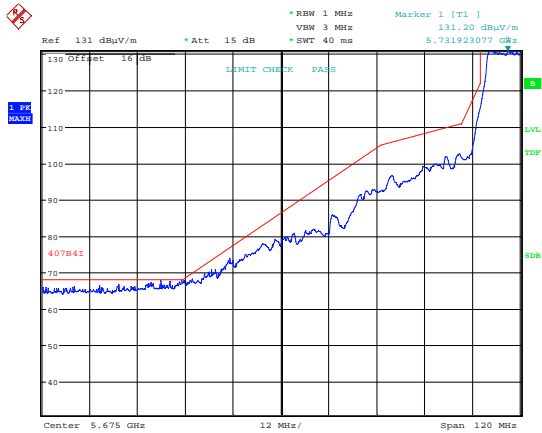Band Edge 16 QAM; 5732.5 MHz; 26 dBm.
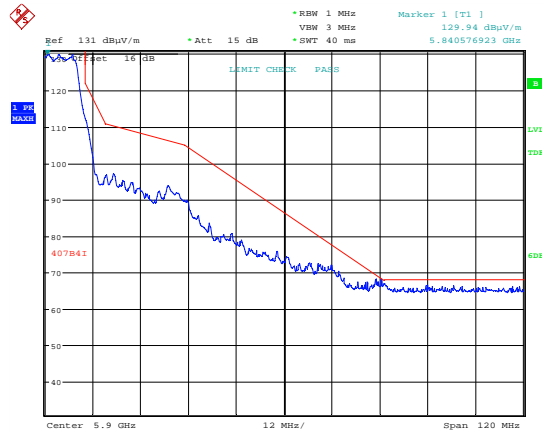

Date: 31.JAN.2018 15:25:36
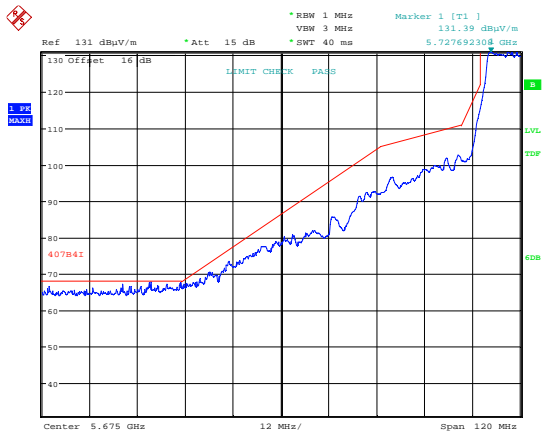
Band Edge 16 QAM; 5842.5 MHz; 26 dBm.
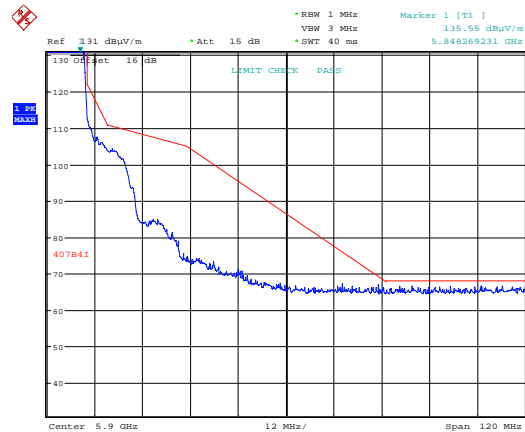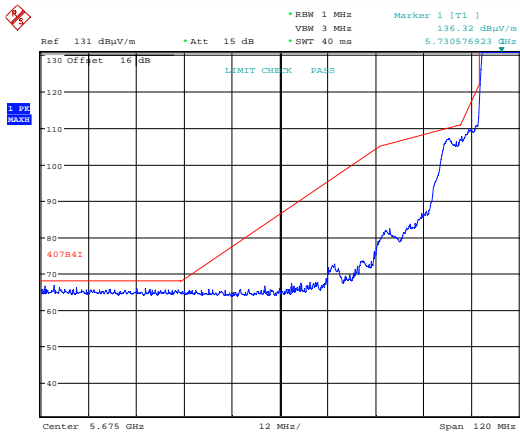
Date: 31.JAN.2018 15:16:58

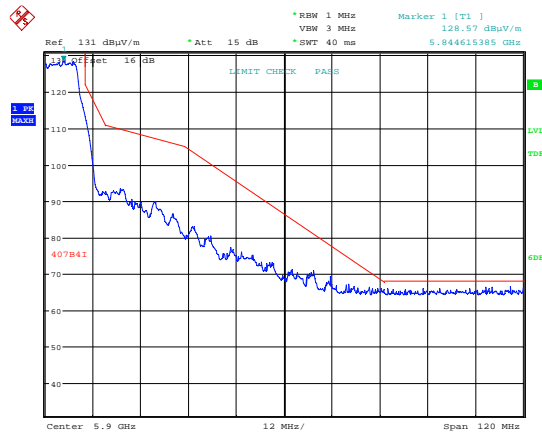Band Edge 64 QAM; 5732.5 MHz; 25 dBm.

Date: 31.JAN.2018 15:26:41

Band Edge 64 QAM; 5842.5 MHz; 25 dBm.
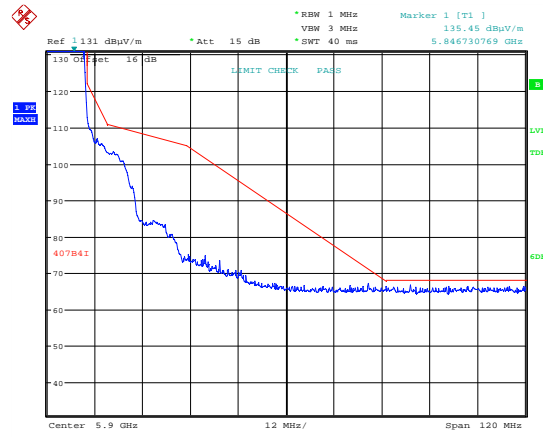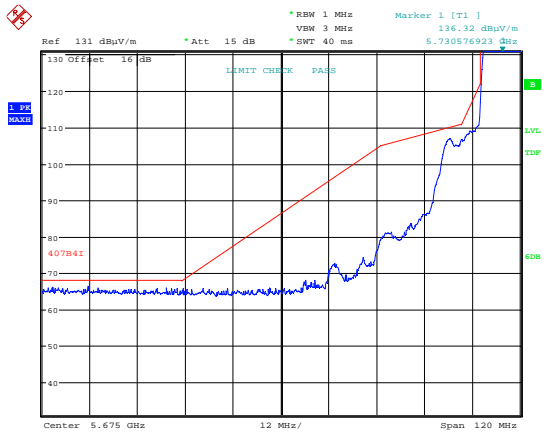
Date: 31.JAN.2018 15:17:50

Band Edge 256 QAM; 5732.5 MHz; 24 dBm.

Date: 31.JAN.2018 15:27:53

Band Edge 256 QAM; 5842.5 MHz; 24 dBm.

Frequencies and Power setting to comply		
Mod Mode	Frequency (MHz)	Power (dBm)
QPSK	5732.5	24.75
QPSK	5842.5	24.5
16 QAM	5732.5	26
16 QAM	5842.5	26
64 QAM	5732.5	25
64 QAM	5842.5	25
256 QAM	5732.5	24
256 QAM	5842.5	24

20 MHz Bandwidth
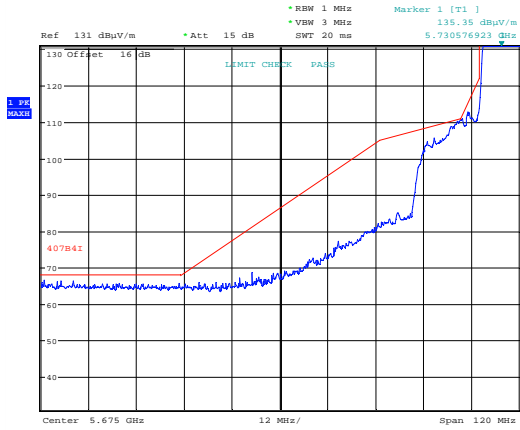
Band Edge QPSK; 5735 MHz; 25.5 dBm.
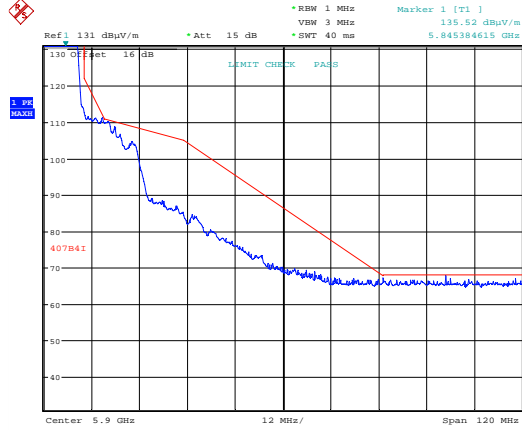
Band Edge QPSK; 5839.5 MHz; 28 dBm.
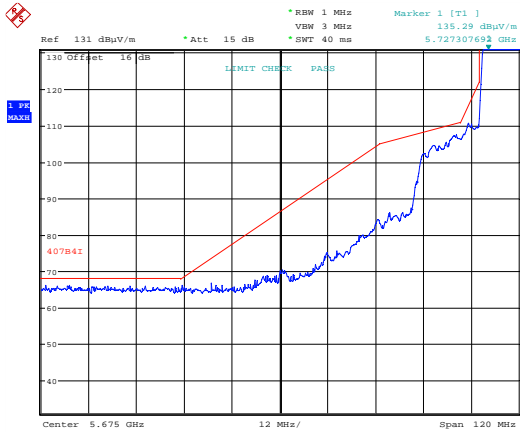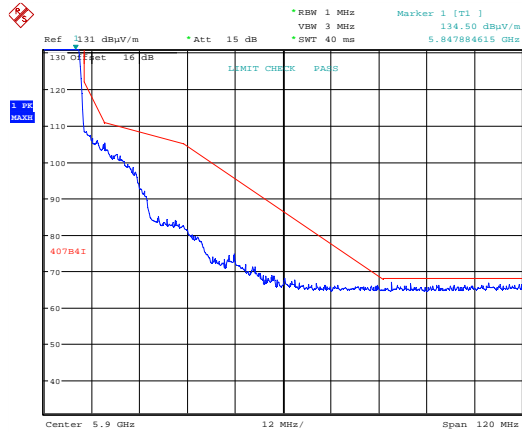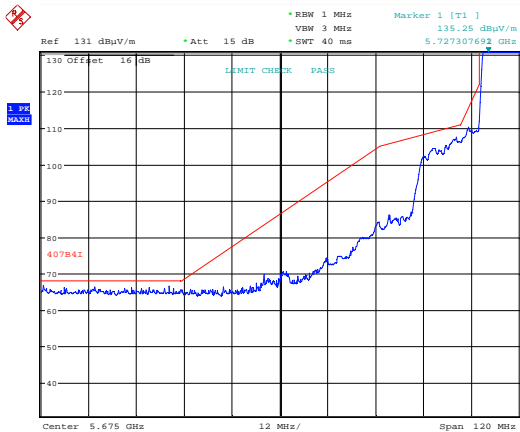
Band Edge 16 QAM; 5735 MHz; 26 dBm.

Band Edge 16 QAM; 5840 MHz; 26 dBm.

Band Edge 64 QAM; 5735 MHz; 25 dBm.

Band Edge 64 QAM; 5840 MHz; 25 dBm.
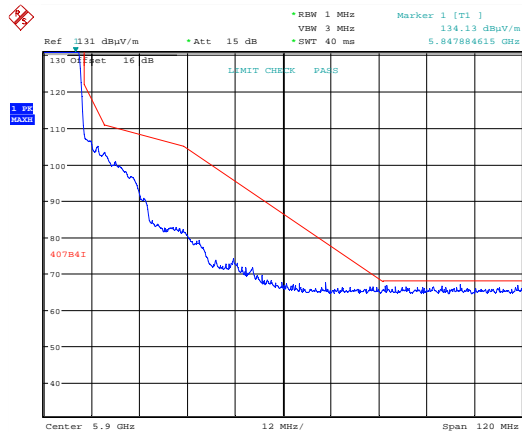
Date: 31.JAN.2018 15:37:39

Band Edge 256 QAM; 5735 MHz; 24 dBm.

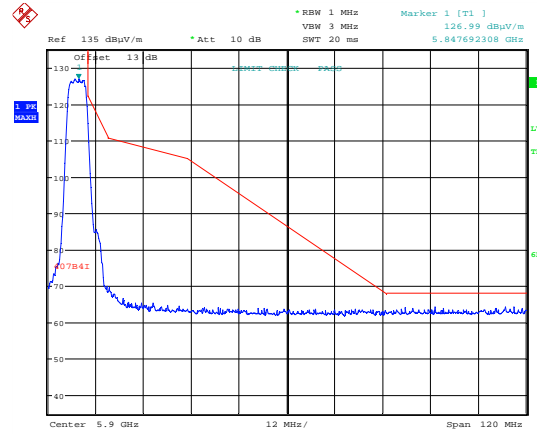Date: 31.JAN.2018 15:42:56

Band Edge 256 QAM; 5840 MHz; 24 dBm.

Frequencies and Power setting to comply		
Mod Mode	Frequency (MHz)	Power (dBm)
QPSK	5735	25.5
QPSK	5839.5	28
16 QAM	5735	26
16 QAM	5840	26
64 QAM	5735	25
64 QAM	5840	25
256 QAM	5735	24
256 QAM	5840	24

30 MHz Bandwidth
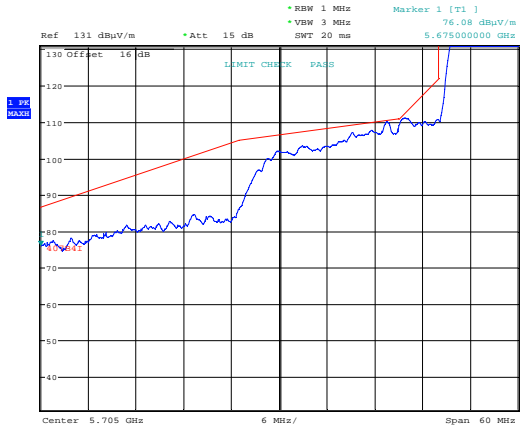
Date: 6.MAR.2018 16:02:41

Band Edge QPSK; 5740 MHz; 26 dBm.
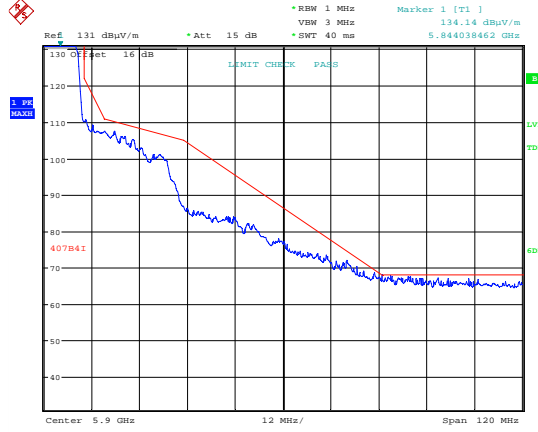
Date: 31.JAN.2018 16:23:20

Band Edge QPSK; 5835 MHz; 28 dBm.
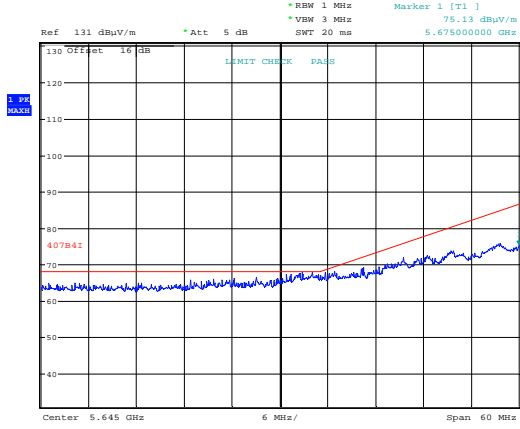
Date: 6.MAR.2018 16:01:59

Band Edge QPSK; 5740 MHz; 26 dBm.
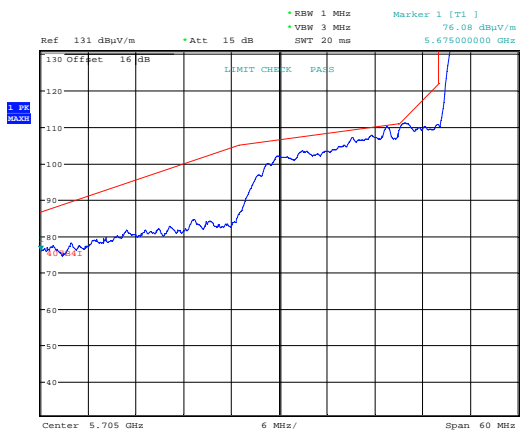
Date: 6.MAR.2018 16:02:41

Band Edge 16 QAM; 5740 MHz; 26 dBm.

Date: 31.JAN.2018 16:22:05

Band Edge 16 QAM; 5835 MHz; 26 dBm.
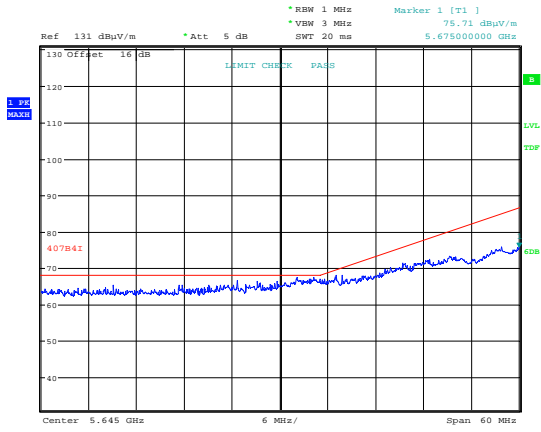
Date: 6.MAR.2018 16:04:55

Band Edge 16 QAM; 5740 MHz; 26 dBm.
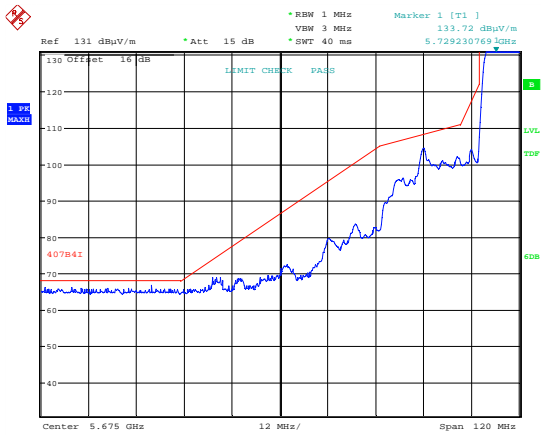
Date: 31.JAN.2018 16:19:03

Band Edge 64 QAM; 5740 MHz; 25 dBm.
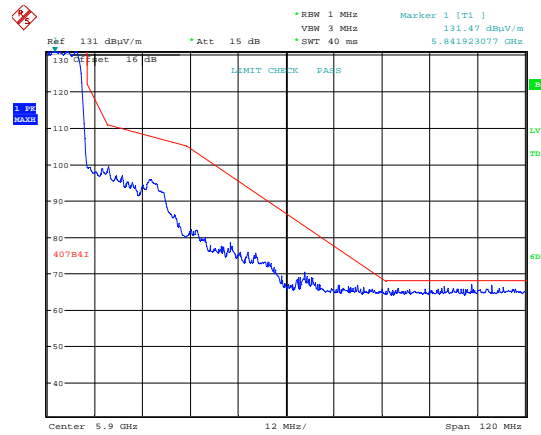
Date: 31.JAN.2018 16:21:10

Band Edge 64 QAM; 5835 MHz; 25 dBm.
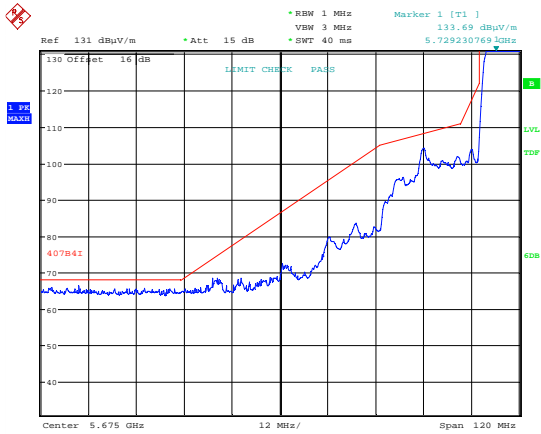
Date: 31.JAN.2018 16:19:43

Band Edge 256 QAM; 5740 MHz; 24 dBm.
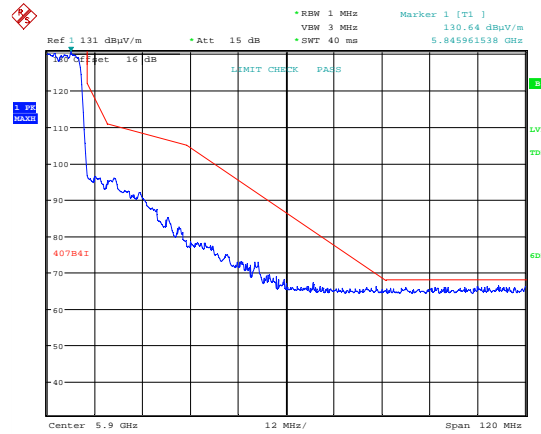
Date: 31.JAN.2018 16:20:30

Band Edge 256 QAM; 5835 MHz; 24 dBm.

Frequencies and Power setting to comply		
Mod Mode	Frequency (MHz)	Power (dBm)
QPSK	5740	26
QPSK	5835	28
16 QAM	5740	26
16 QAM	5835	26
64 QAM	5740	25
64 QAM	5835	25
256 QAM	5740	24
256 QAM	5835	24

40 MHz Bandwidth

Band Edge QPSK; 5745 MHz; 25 dBm.

Band Edge QPSK; 5830 MHz; 25.5 dBm.

Band Edge QPSk; 5745 MHz; 25 dBm.

Band Edge 16 QAM; 5745 MHz; 25 dBm.

Band Edge QPSK; 5830 MHz; 25.5 dBm.

Band Edge 16 QAM; 5830 MHz; 26 dBm.

Band Edge 16 QAM; 5745 MHz; 25 dBm.

Band Edge 16 QAM; 5830 MHz; 26 dBm.

Band Edge 64 QAM; 5745 MHz; 25 dBm.

Band Edge 64 QAM; 5830 MHz; 25 dBm.

Band Edge 256 QAM; 5745 MHz; 24 dBm.

Band Edge 256 QAM; 5830 MHz; 24 dBm.

Frequencies and Power setting to comply		
Mod Mode	Frequency (MHz)	Power (dBm)
QPSK	5745	25
QPSK	5830	25.5
16 QAM	5745	25
16 QAM	5830	26
64 QAM	5745	25
64 QAM	5830	25
256 QAM	5745	24
256 QAM	5830	24

5 MHz bandwidth Band Edge compliance (Sector antenna)
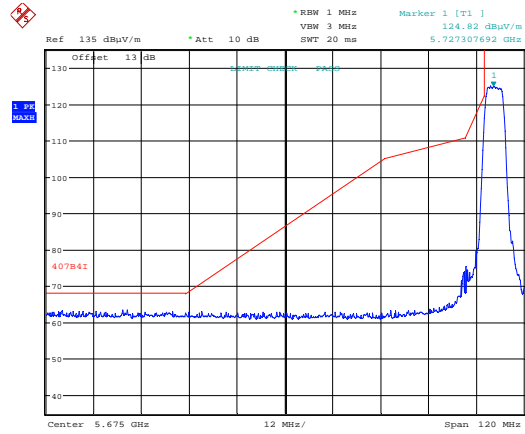
Band Edge QPSK; 5727.5 MHz; 19.5 dBm.

Band Edge QPSK; 5847.5 MHz; 19.5 dBm.
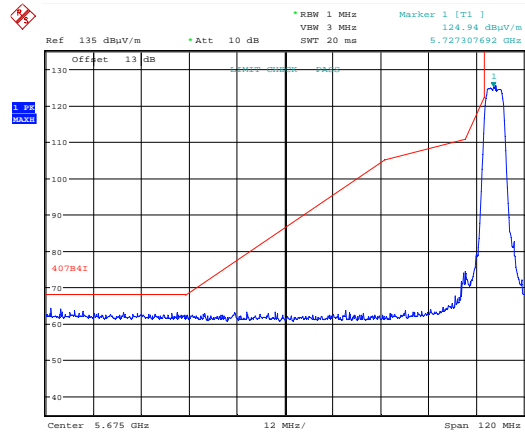
Band Edge 16 QAM; 5727.5 MHz; 19.5 dBm.
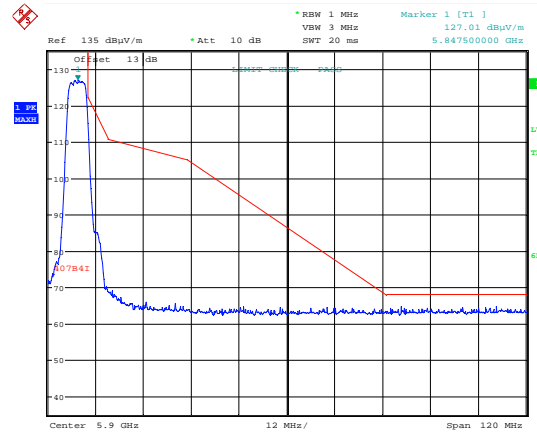
Band Edge 16 QAM; 5847.5 MHz; 19.5 dBm.
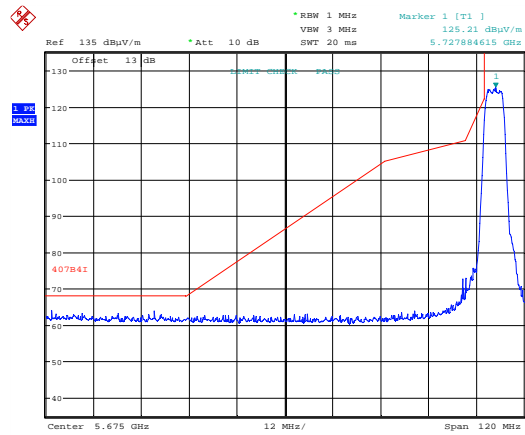
Band Edge 64 QAM; 5727.5 MHz; 19.5 dBm.
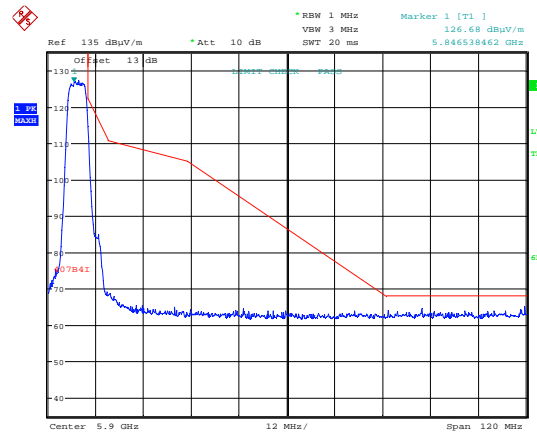
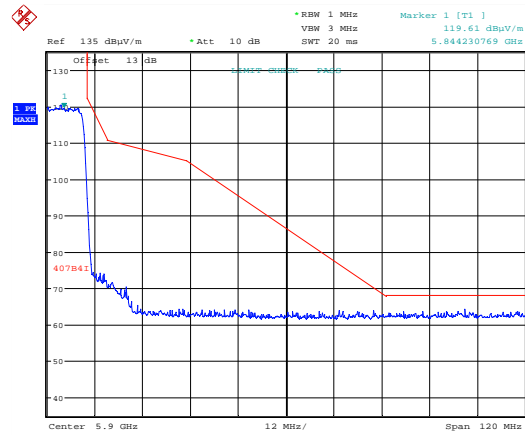Band Edge 64 QAM; 5847.5 MHz; 19.5 dBm.
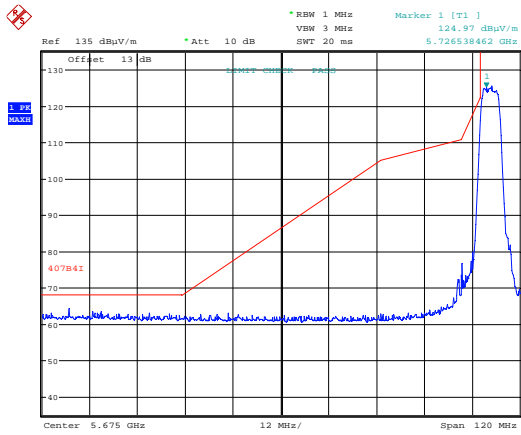
Date: 29.JAN.2018 13:02:34

Date: 29.JAN.2018 12:56:04

Band Edge 256 QAM; 5727.5 MHz; 19.5 dBm.   Band Edge 256 QAM; 5847.5 MHz; 19.5 dBm.

Frequencies and Power setting to comply		
Mod Mode	Frequency (MHz)	Power (dBm)
QPSK	5727.5	19.5
QPSK	5847.5	19.5
16 QAM	5727.5	19.5
16 QAM	5847.5	19.5
64 QAM	5727.5	19.5
64 QAM	5847.5	19.5
256 QAM	5727.5	19.5
256 QAM	5847.5	19.5

10 MHz Bandwidth
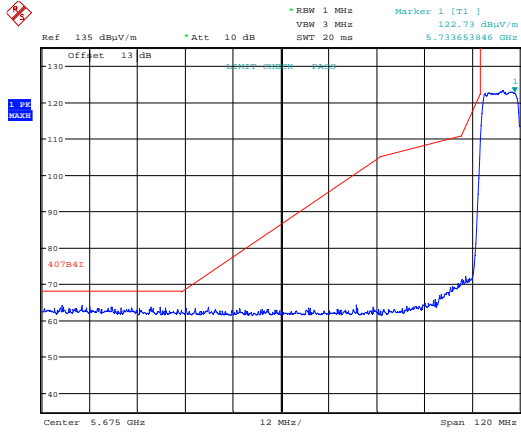
Date: 30.JAN.2018 07:41:07

Band Edge QPSK; 5730 MHz; 19.5 dBm.
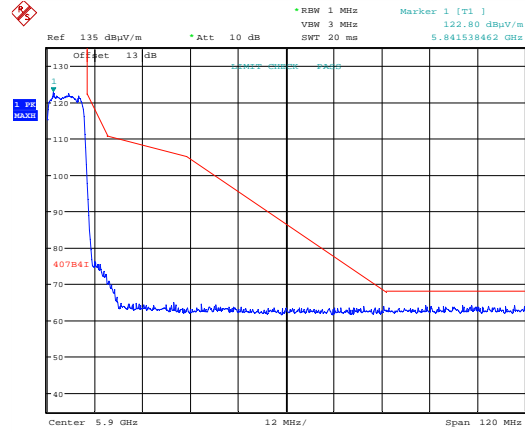
Date: 30.JAN.2018 08:19:21

Band Edge QPSK; 5845 MHz; 19.5 dBm.
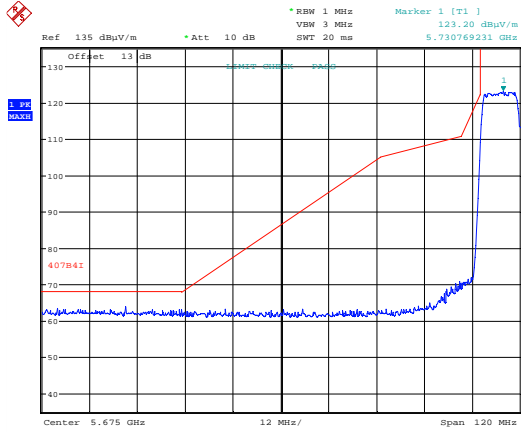
Date: 30.JAN.2018 07:41:52

Band Edge 16 QAM; 5730 MHz; 19.5 dBm.
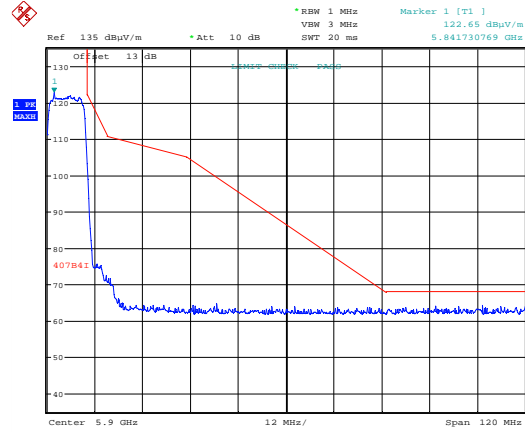
Date: 30.JAN.2018 08:20:23

Band Edge 16 QAM; 5845 MHz; 19.5 dBm.
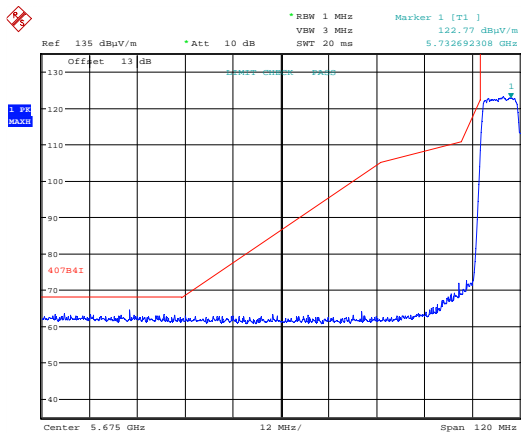
Date: 30.JAN.2018 07:42:25

Band Edge 64 QAM; 5730 MHz; 19.5 dBm.
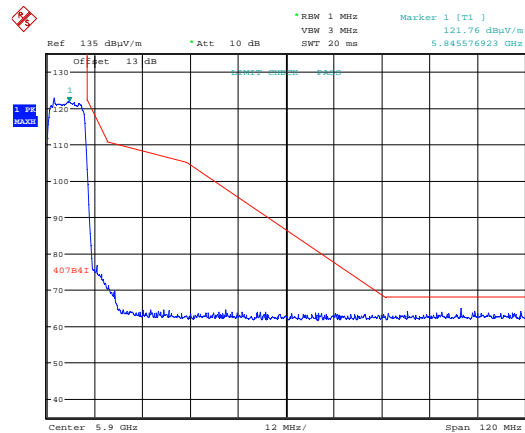
Date: 30.JAN.2018 08:20:58

Band Edge 64 QAM; 5845 MHz; 19.5 dBm.
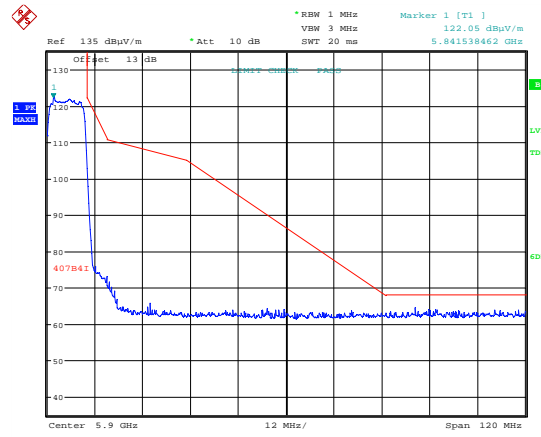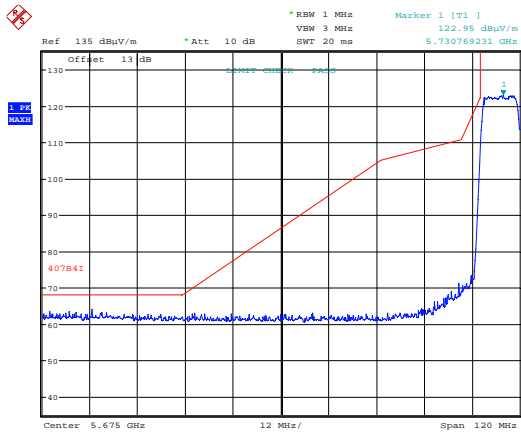
Date: 30.JAN.2018 07:42:51

Band Edge 256 QAM; 5730 MHz; 19.5 dBm.

Date: 30.JAN.2018 08:19:46

Band Edge 256 QAM; 5845 MHz; 19.5 dBm.

| Frequencies and Power setting to comply		
Mod Mode	Frequency (MHz)	Power (dBm)
QPSK	5730	19.5
QPSK	5845	19.5
16 QAM	5730	19.5
16 QAM	5845	19.5
64 QAM	5730	19.5
64 QAM	5845	19.5
256 QAM	5730	19.5
256 QAM	5845	19.5

15 MHz Bandwidth
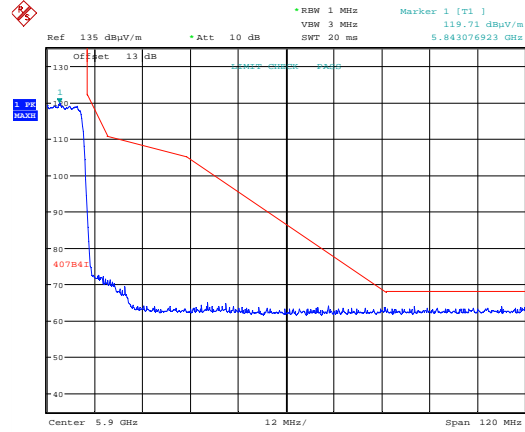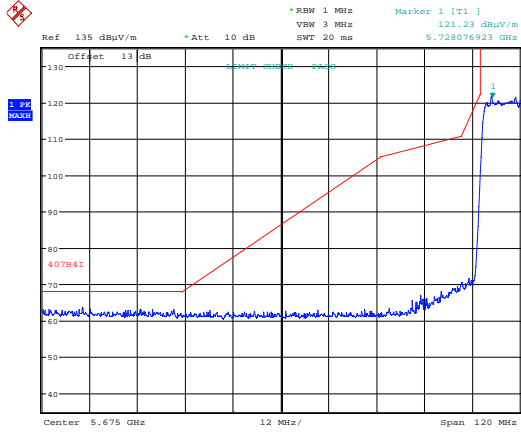
Date: 30.JAN.2018 07:52:33

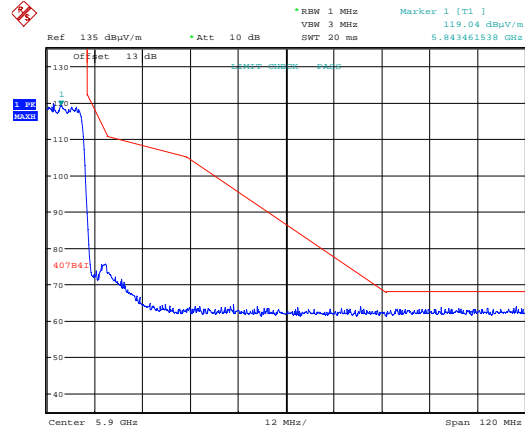Band Edge QPSK; 5732.5 MHz; 19.5 dBm.

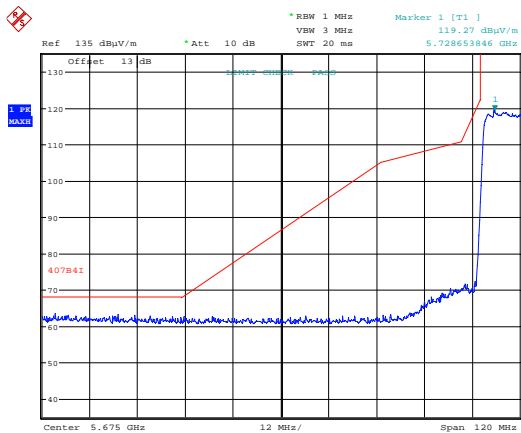Date: 30.JAN.2018 08:15:32

Band Edge QPSK; 5842.5 MHz; 19.5 dBm.
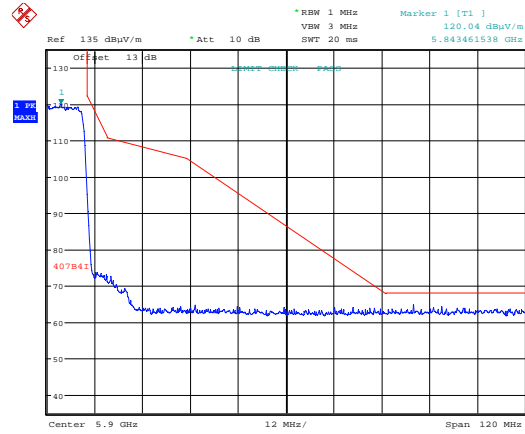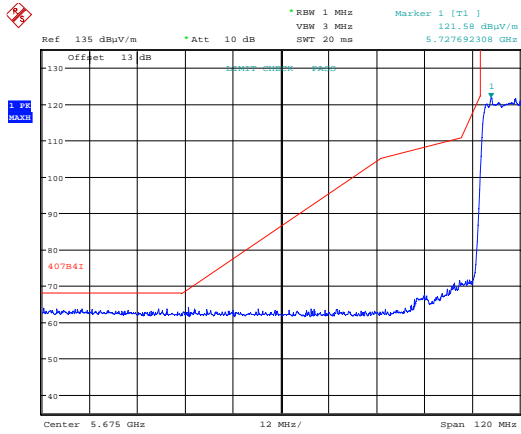
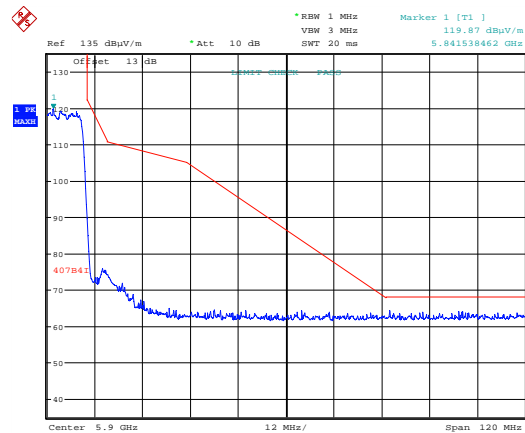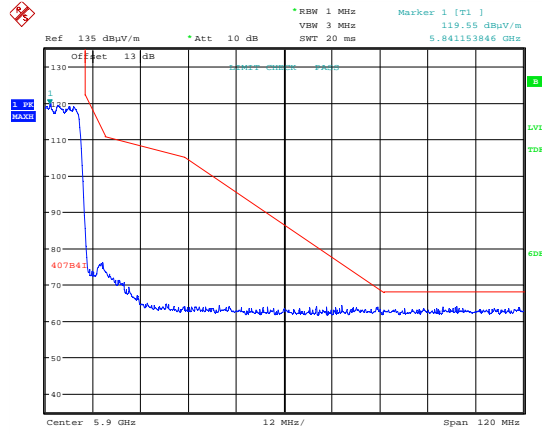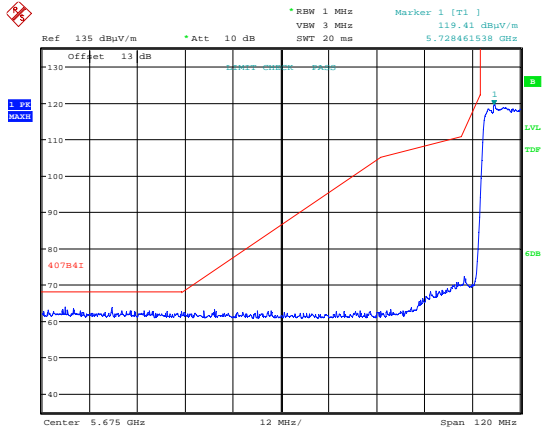Date: 30.JAN.2018 07:52:03

Band Edge 16 QAM; 5732.5 MHz; 19.5 dBm.

Date: 30.JAN.2018 08:16:19

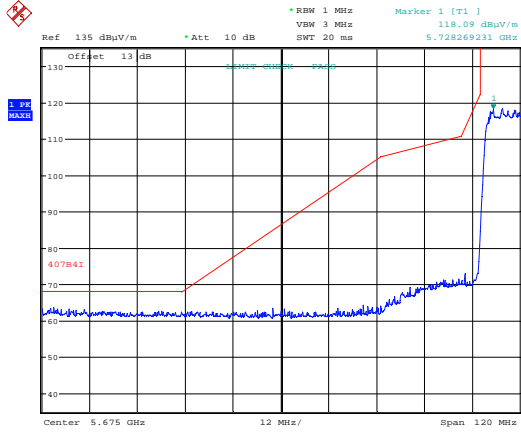Band Edge 16 QAM; 5842.5 MHz; 19.5 dBm.
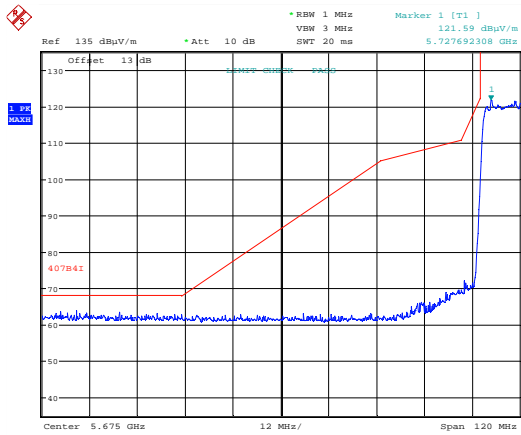
Date: 30.JAN.2018 07:49:24

Band Edge 64 QAM; 5732.5 MHz; 19.5 dBm.

Date: 30.JAN.2018 08:16:48

Band Edge 64 QAM; 5842.5 MHz; 19.5 dBm.
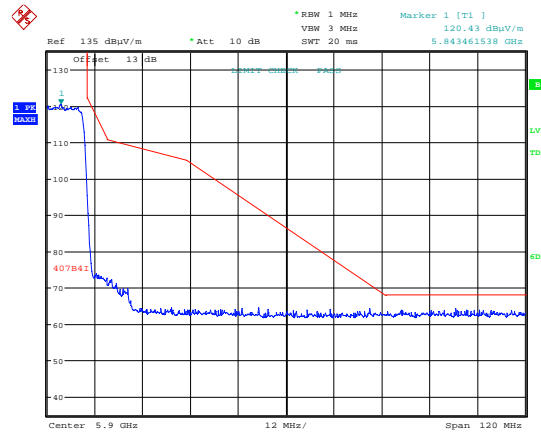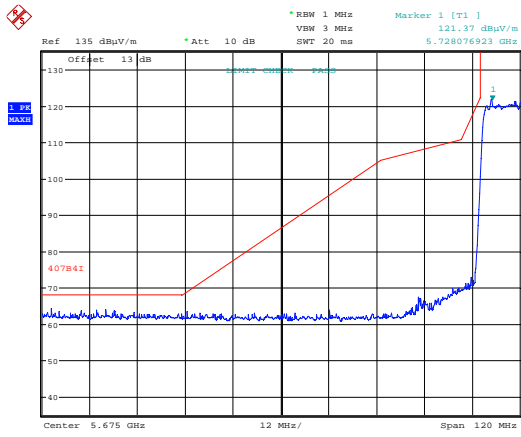
Date: 30.JAN.2018 07:48:52

Band Edge 256 QAM; 5732.5 MHz; 19.5 dBm.

Date: 30.JAN.2018 08:17:30

Band Edge 256 QAM; 5842.5 MHz; 19.5 dBm.

Frequencies and Power setting to comply		
Mod Mode	Frequency (MHz)	Power (dBm)
QPSK	5732.5	19.5
QPSK	5842.5	19.5
16 QAM	5732.5	19.5
16 QAM	5842.5	19.5
64 QAM	5732.5	19.5
64 QAM	5842.5	19.5
256 QAM	5732.5	19.5
256 QAM	5842.5	19.5

20 MHz Bandwidth
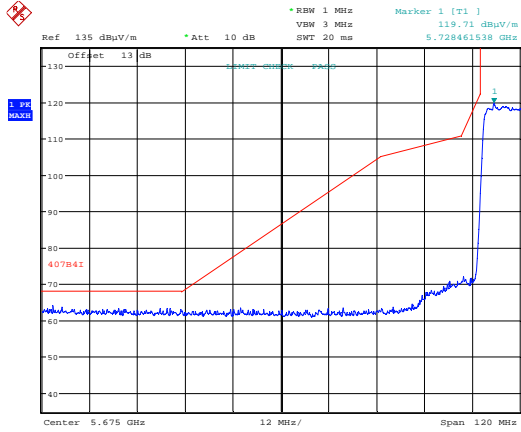
Band Edge QPSK; 5735 MHz; 19.5 dBm.
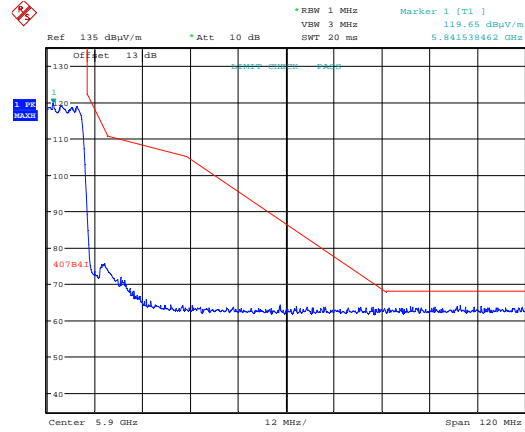
Band Edge QPSK; 5840 MHz; 19.5 dBm.
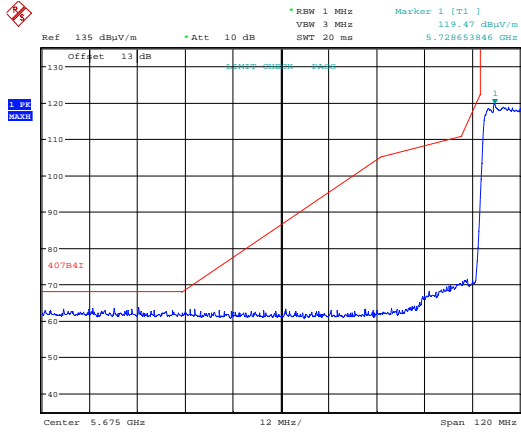
Band Edge 16 QAM; 5735 MHz; 19.5 dBm.

Band Edge 16 QAM; 5840 MHz; 19.5 dBm.

Band Edge 64 QAM; 5735 MHz; 19.5 dBm.

Band Edge 64 QAM; 5840 MHz; 19.5 dBm.

Date: 30.JAN.2018 07:56:30

Band Edge 256 QAM; 5735 MHz; 19.5 dBm.

Date: 30.JAN.2018 08:12:28

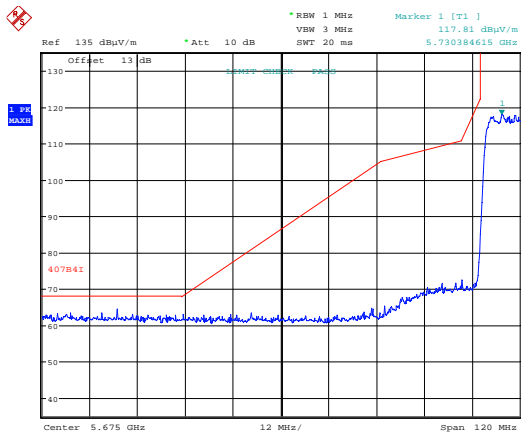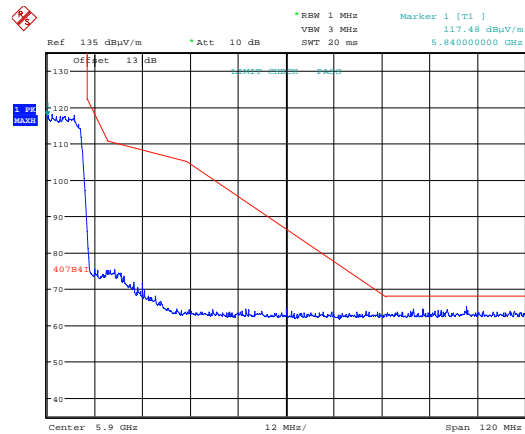Band Edge 256 QAM; 5840 MHz; 19.5 dBm.

Frequencies and Power setting to comply		
Mod Mode	Frequency (MHz)	Power (dBm)
QPSK	5735	19.5
QPSK	5840	19.5
16 QAM	5735	19.5
16 QAM	5840	19.5
64 QAM	5735	19.5
64 QAM	5840	19.5
256 QAM	5735	19.5
256 QAM	5840	19.5

30 MHz Bandwidth

Band Edge QPSK; 5740 MHz; 19.5 dBm.
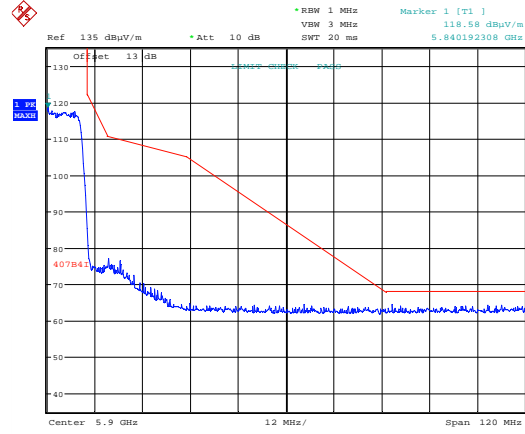
Band Edge QPSK; 5835 MHz; 19.5 dBm.
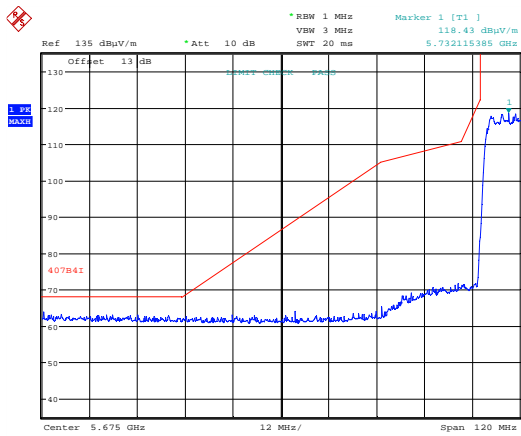
Band Edge 16 QAM; 5740 MHz; 19.5 dBm.
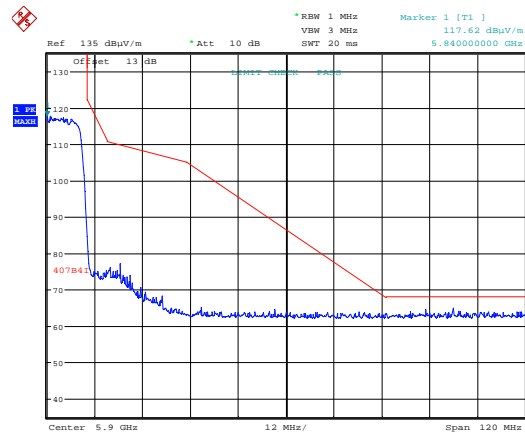
Band Edge 16 QAM; 5835 MHz; 19.5 dBm.

Band Edge 64 QAM; 5740 MHz; 19.5 dBm.

Band Edge 64 QAM; 5835 MHz; 19.5 dBm.
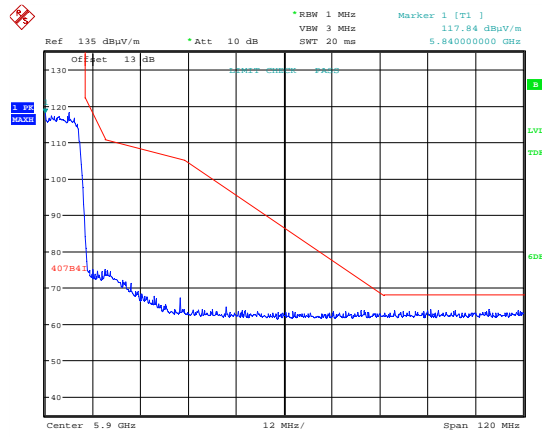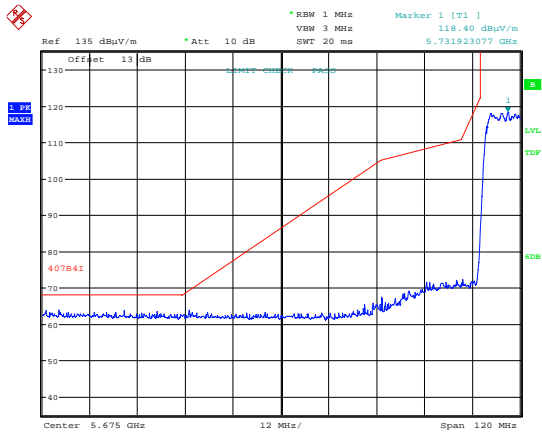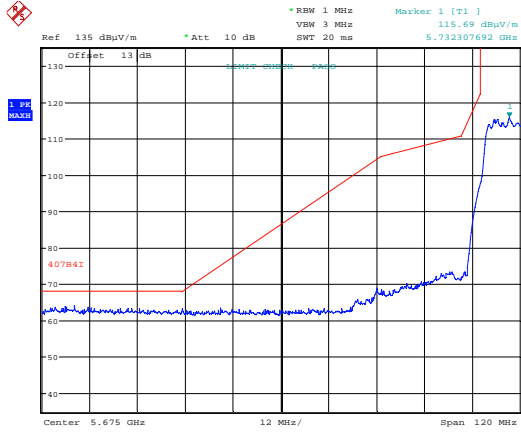
Band Edge 256 QAM; 5740 MHz; 19.5 dBm.

Band Edge 256 QAM; 5835 MHz; 19.5 dBm.

Frequencies and Power setting to comply		
Mod Mode	Frequency (MHz)	Power (dBm)
QPSK	5740	19.5
QPSK	5835	19.5
16 QAM	5740	19.5
16 QAM	5835	19.5
64 QAM	5740	19.5
64 QAM	5835	19.5
256 QAM	5740	19.5
256 QAM	5835	19.5

40 MHz Bandwidth

Band Edge QPSK; 5745 MHz; 19.5 dBm.
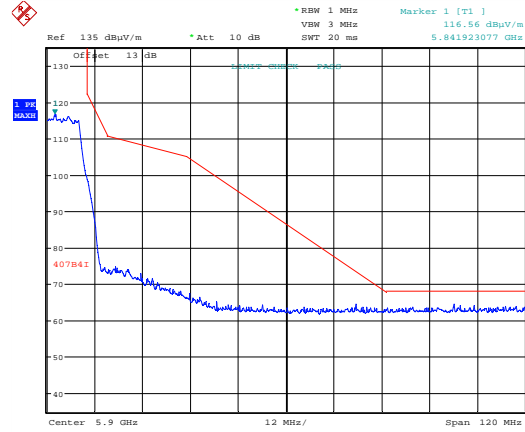
Band Edge QPSK; 5830 MHz; 19.5 dBm.

Band Edge 16 QAM; 5745 MHz; 19.5 dBm.

Band Edge 16 QAM; 5830 MHz; 19.5 dBm.

Band Edge 64 QAM; 5745 MHz; 19.5 dBm.

Band Edge 64 QAM; 5830 MHz; 19.5 dBm.
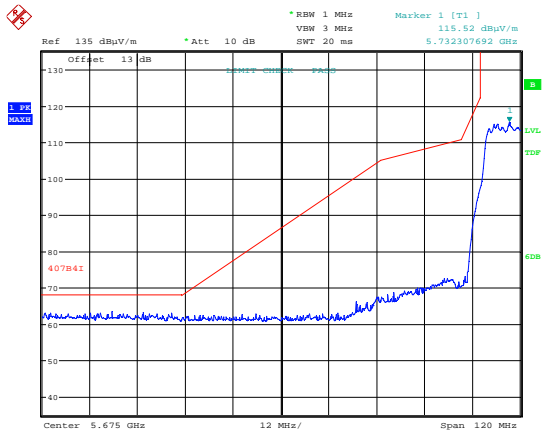
Date: 29.JAN.2018 12:35:56

Band Edge 256 QAM; 5745 MHz; 19.5 dBm.

Date: 29.JAN.2018 12:45:50
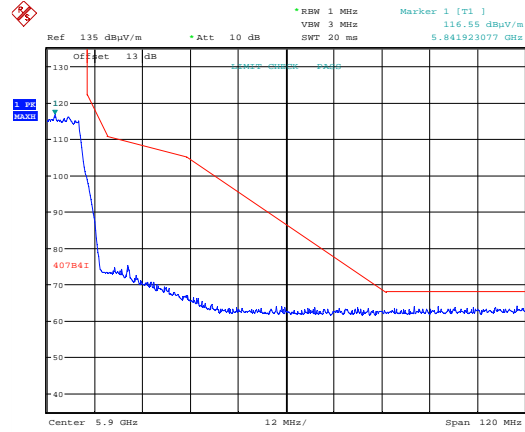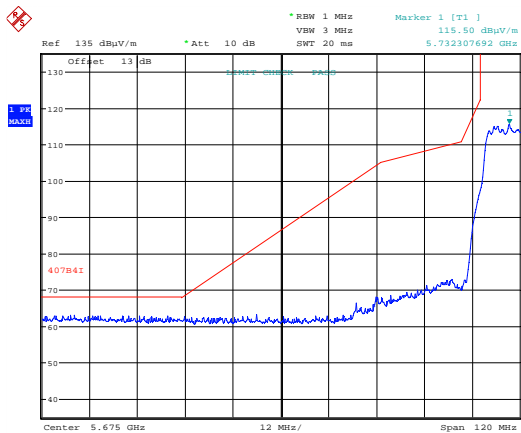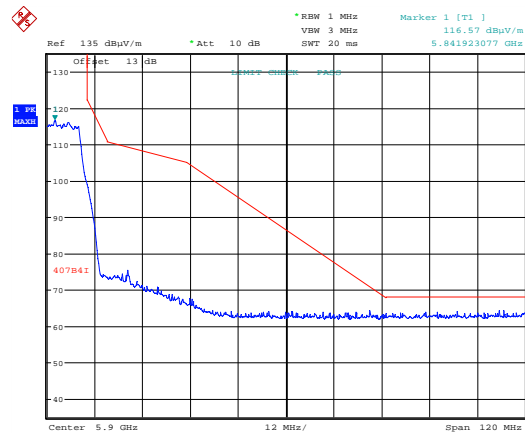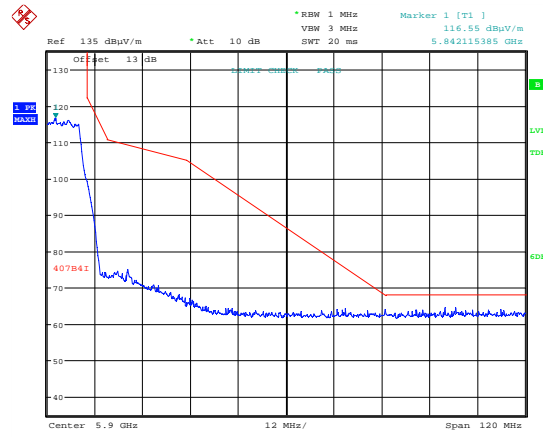
Band Edge 256 QAM; 5830 MHz; 19.5 dBm.

Frequencies and Power setting to comply		
Mod Mode	Frequency (MHz)	Power (dBm)
QPSK	5745	19.5
QPSK	5830	19.5
16 QAM	5745	19.5
16 QAM	5830	19.5
64 QAM	5745	19.5
64 QAM	5830	19.5
256 QAM	5745	19.5
256 QAM	5830	19.5

17 Measurement Uncertainty

Calculated Measurement Uncertainties
All statements of uncertainty are expanded standard uncertainty using a coverage factor of 1.96 to give a 95% confidence:

[1] Radiated spurious emissions

Uncertainty in test result (30MHz – 1GHz) = **4.6dB**,
Uncertainty in test result (1GHz – 18GHz) = **4.7dB**

[2] AC power line conducted emissions

Uncertainty in test result = **3.4dB**

[3] Occupied bandwidth

Uncertainty in test result = **15.5%**

[4] Conducted carrier power

Uncertainty in test result (Power Meter) = **1.08dB**

[5] Conducted / radiated RF power out-of-band

Uncertainty in test result – Up to 8.1GHz = **3.31dB**
Uncertainty in test result – 8.1GHz – 15.3GHz = **4.43dB**
Uncertainty in test result (30MHz – 1GHz) = **4.6dB**,
Uncertainty in test result (1GHz – 18GHz) = **4.7dB**

[6] Power spectral density

Uncertainty in test result (Spectrum Analyser) = **2.48dB**