DEKRA Testing and Certification, S.A.U.
Parque Tecnológico de Andalucía,
c/ Severo Ochoa nº 2 · 29590 Campanillas · Málaga · España
C.I.F. A29 507 456

Test report No:
NIE: 65531RRF.003

Partial Test report
REFERENCE STANDARD:
USA FCC Part 27
CANADA RSS-130, RSS-139, RSS-199

(*) Identification of item tested	Vaisala Beacon Edge Gateway EGW501
(*) Trademark	VAISALA
(*) Model and /or type reference	EGW501
Other identification of the product	SW version: V0708_01.002.01.002 HW version: B FCC ID: 2AO39-EGW501 IC: 23830-EGW501
(*) Features	GSM, WCDMA, LTE
Applicant	Vaisala Oyj Vanha Nurmijärventie 21, 01670 Vantaa FINLAND
Test method requested, standard	USA FCC Part 27 (10-1-19 Edition). CANADA RSS-130 Issue 2, Feb. 2019. CANADA RSS-139 Issue 3, Jul. 2015. CANADA RSS-199 Issue 3, Dec. 2016. ANSI C63.26-2015. KDB 971168 D01 Power Meas License Digital Systems v03r01, April. 2018.
Approved by (name / position & signature)	Rafael López Martín EMC Consumer & RF Lab. Manager RAFAEL LÓPEZ MARTÍN 2021.01.14 12:27:39 +01'00'
Date of issue	2021-01-13
Report template No	FDT08_23 (*) "Data provided by the client"

Index

Competences and guarantees 3
General conditions 3
Uncertainty 3
Data provided by the client 3
Usage of samples 4
Test sample description 6
Identification of the client 7
Testing period and place 7
Document history 7
Environmental conditions 7
Remarks and comments 8
Testing verdicts 9
Summary 9
Appendix A: Test results for FCC PART 27 / RSS-130, RSS-139, RSS-199 10

Competences and guarantees

DEKRA Testing and Certification is a testing laboratory accredited by the National Accreditation Body (ENAC - Entidad Nacional de Acreditación), to perform the tests indicated in the Certificate No. 51/LE 147.

DEKRA Testing and Certification is a FCC-recognized accredited testing laboratory with appropriate scope of accreditation that include testing performed in this test report.

DEKRA Testing and Certification is an ISED-recognized accredited testing laboratory with appropriate scope of accreditation that include testing performed in this test report.

In order to assure the traceability to other national and international laboratories, DEKRA Testing and Certification has a calibration and maintenance program for its measurement equipment.

DEKRA Testing and Certification guarantees the reliability of the data presented in this report, which is the result of the measurements and the tests performed to the item under test on the date and under the conditions stated on the report and, it is based on the knowledge and technical facilities available at DEKRA Testing and Certification at the time of performance of the test.

DEKRA Testing and Certification is liable to the client for the maintenance of the confidentiality of all information related to the item under test and the results of the test.

The results presented in this Test Report apply only to the particular item under test established in this document.

General conditions

1. This report is only referred to the item that has undergone the test.
2. This report does not constitute or imply on its own an approval of the product by the Certification Bodies or competent Authorities.
3. This document is only valid if complete; no partial reproduction can be made without previous written permission of DEKRA Testing and Certification.
4. This test report cannot be used partially or in full for publicity and/or promotional purposes without previous written permission of DEKRA Testing and Certification and the Accreditation Bodies.

Uncertainty

Uncertainty (factor k=2) was calculated according to the DEKRA Testing and Certification internal document PODT000.

Data provided by the client

The following data has been provided by the client:

1. Information relating to the description of the sample ("Identification of the item tested", "Trademark", "Model and/or type reference tested").

2. The sample of the model EGW501 is a compact weather station for environmental monitoring. The complete solution provides measurements, data collection, and data visualization in one package. Vaisala Beacon Station includes Vaisala Beacon Edge Gateway EGW501, a multi parameter Vaisala Weather Transmitter WXT536,powering equipment, and mounting accessories. To maximize ease-of-use, the station comes with a data plan and a variety of service packages to choose from.

DEKRA Testing and Certification S.A.U. declines any responsibility with respect to the information provided by the client and that may affect the validity of results.

Usage of samples

Samples undergoing test have been selected by: The client.

- Sample S/01 is composed of the following elements:

Control Nº	Description	Model	Serial Nº	Date of reception
65531/003	Vaisala Beacon Station BWS500	EGW501	S3240004	2020/10/01
65531/038	Power Supply Unit	PSU501	S3926080	2020/10/14

Auxiliary elements used with the Sample S/01:

Control Nº	Description	Model	Serial Nº	Date of reception
65531/013	Load	--	--	2020/10/01
65531/017	DC out cable	--	--	2020/10/01
65531/021	DC in cable	--	--	2020/10/01
65531/039	Power Cable	--	--	2020/10/14

Sample S/01 has undergone the following test(s): All conducted tests indicated in Appendix A.

- Sample S/02 is composed of the following elements:

Control Nº	Description	Model	Serial Nº	Date of reception
65531/003	Vaisala Beacon Station BWS500	EGW501	S3240004	2020/10/01
65531/006	Weather Transmitter	WXT536	S3240235	2020/10/01
65531/038	Power Supply Unit	PSU501	S3926080	2020/10/14

Auxiliary elements used with the Sample S/02:

Control Nº	Description	Model	Serial Nº	Date of reception
65531/013	Load	--	--	2020/10/01
65531/015	WXT cable	--	--	2020/10/01
65531/017	DC out cable	--	--	2020/10/01
65531/021	DC in cable	--	--	2020/10/01
65531/039	Power Cable	--	--	2020/10/14

Sample S/02 has undergone the following test(s): All radiated tests indicated in Appendix A except for LTE band 41.

- Sample S/03 is composed of the following elements:

Control Nº	Description	Model	Serial Nº	Date of reception
65531/042	Vaisala Beacon Station BWS500	EGW501	S324008	2020/11/23
65531/006	Weather Transmitter	WXT536	S3240235	2020/10/01
65531/038	Power Supply Unit	PSU501	S3926080	2020/10/14

Auxiliary elements used with the Sample S/03:

Control Nº	Description	Model	Serial Nº	Date of reception
65531/014	Load	--	--	2020/10/01
65531/015	WXT cable	--	--	2020/10/01
65531/017	DC out cable	--	--	2020/10/01
65531/021	DC in cable	--	--	2020/10/01
65531/039	Power Cable	--	--	2020/10/14

Sample S/03 has undergone the following test(s): The radiated tests for LTE band 41 indicated in Appendix A.

Test sample description

Ports…… :	Port name and description		Cable				
			Specified length [m]	Attached during test	Shielded		
	PSU501		2	☒	☐		
	PSU502		2	☒	☐		
	WXT		10	☒	☒		
Supplementary information to the ports…… :	Connecting power cable to gateway turns station automatically on if power is available from battery or other power source. Other ports reserved future use.						
Rated power supply .....:	Voltage and Frequency		Reference poles				
			L1	L2	L3	N	PE
	☒	AC: 100 – 240 V	☒	☒	☐	☐	☒
	☒	DC: 9 – 32 V					
Rated Power .....:	--						
Clock frequencies.....:	max. 2GHz						
Other parameters .....:	--						
Software version .....:	V0708_01.002.01.002						
Hardware version .....:	B						
Dimensions in cm (L x W x D).....:	306 x 184 x 156						
Mounting position .....:	☐	Table top equipment					
	☒	Wall/Ceiling mounted equipment					
	☐	Floor standing equipment					
	☐	Hand-held equipment					
	☐	Other:					
Modules/parts.....:	Module/parts of test item		Type	Manufacturer			
	--						
Accessories (not part of the test item) .....:	Description		Type	Manufacturer			
	PSU501, AC power supply		PSU501	Vaisala Oyj			
	PSU502, DC solar power supply		PSU502	Vaisala Oyj			
	WXT536,Weather transmitter		WXT536	Vaisala Oyj			
Documents as provided by the applicant.....:	Description		File name	Issue date			
	--						

Identification of the client

Vaisala Oyj
Vanha Nurmijärventie 21, 01670 Vantaa FINLAND

Testing period and place

Test Location	DEKRA Testing and Certification S.A.U.
Date (start)	2020-10-28
Date (finish)	2020-12-02

Document history

Report number	Date	Description
65531RRF.003	2021-01-13	First release

Environmental conditions

In the control chamber, the following limits were not exceeded during the test:

Temperature	Min. = 15 ºC Max. = 35 ºC
Relative humidity	Min. = 20 % Max. = 75 %

In the semianechoic chamber, the following limits were not exceeded during the test.

Temperature	Min. = 15 ºC Max. = 35 ºC
Relative humidity	Min. = 20 % Max. = 75 %

In the chamber for conducted measurements, the following limits were not exceeded during the test:

Temperature	Min. = 15 ºC Max. = 35 ºC
Relative humidity	Min. = 20 % Max. = 75 %

Remarks and comments

The tests have been performed by the technical personnel: José Manuel Jimenez, Pablo Redondo, Verónica García and Nicolás Salguero.

Used instrumentation:

Conducted Measurements

		Last Calibration	Due Calibration
1.	Shielded Room ETS LINDGREN S101	N.A.	N.A.
2.	Wideband Radio Communication tester ROHDE AND SCHWARZ CMW500	2020/07	2021/07
3.	Digital Multimeter FLUKE 179	2020/10	2021/10

Radiated Measurements

		Last Cal. date	Cal. due date
1.	Semianechoic Absorber Lined Chamber ETS LINDGREN FACT 3 200 STP	N.A.	N.A.
2.	Shielded Room ETS LINDGREN S101	N.A.	N.A.
3.	Biconical/Log Antenna ETS LINDGREN 3142E	2020/04	2023/04
4.	EMI Test Receiver 7 GHz ROHDE AND SCHWARZ ESR7	2019/10	2021/10
5.	Broadband Horn antenna 1-18 GHz SCHWARZBECK MESS-ELEKTRONIK BBHA 9120 D	2019/11	2022/11
6.	RF Pre-amplifier 1-18 GHz BONN ELEKTRONIK BLMA 0118-1M	2020/05	2021/05
7.	Signal and Spectrum Analyzer ROHDE AND SCHWARZ FSW 50	2020/07	2022/07
8.	HORN ANTENNA 18-40GHz SCHWARZBECK BBHA 9170	2020/05	2023/05
9.	PRE-AMPLIFIER G>30dB 18-40GHz BONN ELEKTRONIK BLMA 1840-1M	2019/02	2021/02
10.	Digital Multimeter FLUKE 175	2020/11	2021/11

Testing verdicts

Not applicable:	N/A
Pass:	P
Fail:	F
Not measured:	N/M

Summary

FCC PART 27/IC RSS-130 / RSS-139, RSS-199 PARAGRAPH		
Requirement – Test case	**Verdict**	**Remark**
Clause 27.50 / RSS-139 Clause 6.5. / RSS-130 Clause 4.6 / RSS-199 Clause 4.4: RF output power	P	(2)
Clause 2.1047 / RSS-139 Clause 6.2. / RSS-130 Clause 4.2 / /RSS-199 Clause 4.1: Modulation characteristics	N/M	(1)
Clause 27.54 / RSS-139 Clause 6.4. / RSS-130 Clause 4.5. / RSS-199 Clause 4.3: Frequency stability	N/M	(1)
Clause 2.1049: Occupied Bandwidth	N/M	(1)
Clause 27.53 / RSS-139 Clause 6.6. / RSS-130 Clause 4.7. / RSS-199 Clause 4.5: Spurious emissions at antenna terminals	N/M	(1)
Clause 27.53 / RSS-139 Clause 6.6. / RSS-130 Clause 4.7. / RSS-199 Clause 4.5: Radiated emissions	P	(2)
Supplementary information and remarks: (1) Test not requested. (2) RF Output Power and Radiated emissions tests were tested in the worst case		

Appendix A: Test results for FCC PART 27 / RSS-130, RSS-139, RSS-199

INDEX

TEST CONDITIONS.....12
RF Output Power 14
Radiated emissions 19

TEST CONDITIONS

POWER SUPPLY (V):

Vnominal = 110 Vac

Type of power supply = AC voltage

ANTENNA:

Type of antenna = Integral antenna.

Declared Gain for antenna.

LOW Bands	
LTE Band 12	0.40 dBi
LTE Band 13	0.40 dBi

MIDDLE Band	
LTE Band 4	3.5 dBi

HIGH Band	
LTE Band 41	2.1 dBi

TEST FREQUENCIES:

LTE Band 4. QPSK AND 16QAM MODULATION:

	Channel (Frequency. MHz)					
	BW = 1.4 MHz	BW = 3 MHz	BW = 5 MHz	BW = 10 MHz	BW = 15 MHz	BW = 20 MHz
Lowest	19957 (1710.7)	19965 (1711.5)	19975 (1712.5)	20000 (1715.0)	20025 (1717.5)	20050 (1720.0)
Middle	20175 (1732.5)	20175 (1732.5)	20175 (1732.5)	20175 (1732.5)	20175 (1732.5)	20175 (1732.5)
Highest	20393 (1754.3)	20385 (1753.5)	20375 (1752.5)	20350 (1750.0)	20325 (1747.5)	20300 (1745.0)

LTE Band 12. QPSK AND 16QAM MODULATION:

	Channel (Frequency. MHz)			
	BW = 1.4 MHz	BW = 3 MHz	BW = 5 MHz	BW = 10 MHz
Lowest	23017 (699.7)	23025 (700.5)	23035 (701.5)	23060 (704.0)
Middle	23095 (707.5)	23095 (707.5)	23095 (707.5)	23095 (707.5)
Highest	23173 (715.3)	23165 (714.5)	23155 (713.5)	23130 (711.0)

LTE Band 13. QPSK AND 16QAM MODULATION:

	Channel (Frequency, MHz)	
	BW = 5 MHz	BW = 10 MHz
Lowest	23205 (779.5)	N/A
Middle	23230 (782.0)	23230 (782.0)
Highest	23255 (784.5)	N/A

LTE Band 41. QPSK AND 16QAM MODULATION:

	Channel (Frequency. MHz)			
	BW = 5 MHz	BW = 10 MHz	BW = 15 MHz	BW = 20 MHz
Lowest	39675 (2498.5)	39700 (2501.0)	39725 (2503.5)	39750 (2506.0)
Middle	40620 (2593.0)	40620 (2593.0)	40620 (2593.0)	40620 (2593.0)
Highest	41565 (2687.5)	41540 (2685.0)	41515 (2682.5)	41490 (2680.0)

Results show below were performed in the worst case of modulation, and combination between bandwidth and Resource Blocks through a preliminary scan.

RF Output Power

SPECIFICATION:

FCC §27.50 (d) (4):

(4) Fixed, mobile, and portable (hand-held) stations operating in the 1710-1755 MHz band and mobile and portable stations operating in the 1695-1710 MHz and 1755-1780 MHz bands are limited to 1 watt EIRP. Fixed stations operating in the 1710-1755 MHz band are limited to a maximum antenna height of 10 meters above ground. Mobile and portable stations operating in these bands must employ a means for limiting power to the minimum necessary for successful communications.

FCC §27.50 (h) (2):

(2) Mobile and other user stations. Mobile stations are limited to 2.0 watts EIRP. All user stations are limited to 2.0 watts transmitter output power

FCC §27.50 (c) (10):

(10) Portable stations (hand-held devices) in the 600 MHz uplink band and the 698-746 MHz band, and fixed and mobile stations in the 600 MHz uplink band are limited to 3 watts ERP.

FCC §27.50 (b) (10):

(10) Portable stations (hand-held devices) transmitting in the 746-757 MHz, 776-788 MHz, and 805-806 MHz bands are limited to 3 watts ERP.

RSS-139 Clause 6.5:

The equivalent isotropically radiated power (e.i.r.p.) for mobile and portable transmitters shall not exceed one watt. The e.i.r.p. for fixed and base stations in the band 1710-1780 MHz shall not exceed one watt.

RSS-199 Clause 4.4:

The transmitter output power shall be measured in terms of average value.

For base station equipment, refer to SRSP-517 for the maximum permissible e.i.r.p.

For mobile subscriber equipment, the e.i.r.p. shall not exceed 2 W. For fixed subscriber equipment, the transmitter output power shall not exceed 2 W and the e.i.r.p. shall be limited to 40 W.

For equipment with multiple antennas, the transmitter output power and e.i.r.p shall be measured according to ANSI C63.26‑2015.

RSS-130 Clause 4.6:

4.6.3 Frequency bands 698-756 MHz and 777-787 MHz
The e.r.p. shall not exceed 30 watts for mobile equipment and outdoor fixed subscriber equipment. The e.r.p. shall not exceed 3 watts for portable equipment and indoor fixed subscriber equipment.

For base and fixed equipment other than fixed subscriber equipment, refer to SRSP-518 for the e.i.r.p. limits.

METHOD:

The conducted RF output power measurements were made at the RF output terminals of the EUT using the power meter of the Universal Radio Communication tester R&S CMW500, selecting maximum transmission power of the EUT and different modes of modulation.

The maximum equivalent isotropically radiated power (e.i.r.p.) is calculated by adding the declared maximum antenna gain (dBi).

The maximum effective radiated power e.r.p. is calculated from the maximum equivalent isotropically radiated power (e.i.r.p.) by subtracting 2.15 dB:

E.R.P. = E.I.R.P. – 2.15 dB

The EUT was controlled via the Universal Radio Communication tester R&S CMW500 selecting maximum transmission power of the EUT and different modes of modulation.

TEST SETUP:

CONDUCTED AVERAGE POWER:

RESULTS:

CONDUCTED AVERAGE POWER:

LTE Band 4:

LTE Band 4. QPSK MODULATION. Bandwidth = 15 MHz.

A preliminary scan determined the QPSK modulation, BW=15 MHz, RB=1, Offset=38 as the worst case. The following tables show the results for the worst case modulation.

Channel	Lowest	Middle	Highest
Maximum declared antenna gain (dBi)	3.50	3.50	3.50
Measured maximum average power (dBm) at antenna port	22.37	23.89	22.79
Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm)	25.87	27.39	26.29
Measurement uncertainty (dB)	<±0.941		

LTE Band 4. 16QAM MODULATION. Bandwidth = 1.4 MHz.

A preliminary scan determined the 16QAM modulation, BW=1.4 MHz, RB=3, Offset=1 as the worst case. The following tables show the results for the worst case modulation.

Channel	Lowest	Middle	Highest
Maximum declared antenna gain (dBi)	3.50	3.50	3.50
Measured maximum average power (dBm) at antenna port	22.23	22.80	22.88
Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm)	25.73	26.30	26.38
Measurement uncertainty (dB)	<±0.941		

LTE Band 12:

LTE Band 12. QPSK MODULATION. Bandwidth = 10 MHz.

A preliminary scan determined the QPSK modulation, BW=10 MHz, RB=1, Offset=24 as the worst case. The following tables show the results for the worst case modulation.

Channel	Lowest	Middle	Highest
Maximum declared antenna gain (dBi)	0.40	0.40	0.40
Measured maximum average power (dBm) at antenna port	23.28	23.57	23.75
Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm)	23.68	23.97	24.15
Maximum effective radiated power E.R.P. (dBm)	21.53	21.82	22.00
Measurement uncertainty (dB)	<±0.941		

LTE Band 12. 16QAM MODULATION. Bandwidth = 1.4 MHz.

A preliminary scan determined the 16QAM modulation, BW=1.4 MHz, RB=3, Offset=0 as the worst case. The following tables show the results for the worst case modulation.

Channel	Lowest	Middle	Highest
Maximum declared antenna gain (dBi)	0.40	0.40	0.40
Measured maximum average power (dBm) at antenna port	22.33	22.90	22.32
Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm)	22.73	23.30	22.72
Maximum effective radiated power E.R.P. (dBm)	20.58	21.15	20.57
Measurement uncertainty (dB)	<±0.941		

LTE Band 13:

LTE Band 13. QPSK MODULATION. Bandwidth = 5 MHz.

A preliminary scan determined the QPSK modulation, BW=5 MHz, RB=1, Offset=12 as the worst case. The following tables show the results for the worst case modulation.

Channel	Lowest	Middle	Highest
Maximum declared antenna gain (dBi)	0.40	0.40	0.40
Measured maximum average power (dBm) at antenna port	22.33	22.53	22.64
Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm)	22.73	22.93	23.04
Maximum effective radiated power E.R.P. (dBm)	20.58	20.78	20.89
Measurement uncertainty (dB)	<±0.941		

LTE Band 13. 16QAM MODULATION. Bandwidth = 5 MHz.

A preliminary scan determined the 16QAM modulation, BW=5 MHz, RB=1, Offset=12 as the worst case. The following tables show the results for the worst case modulation.

Channel	Lowest	Middle	Highest
Maximum declared antenna gain (dBi)	0.40	0.40	0.40
Measured maximum average power (dBm) at antenna port	21.14	21.23	21.43
Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm)	21.54	21.63	21.83
Maximum effective radiated power E.R.P. (dBm)	19.38	19.48	19.68
Measurement uncertainty (dB)	<±0.941		

LTE Band 41:

LTE Band 41. QPSK MODULATION. Bandwidth = 5 MHz.

A preliminary scan determined the QPSK modulation, BW=5 MHz, RB=1, Offset=12 as the worst case. The following tables show the results for the worst case modulation.

Channel	Lowest	Middle	Highest
Maximum declared antenna gain (dBi)	2.10	2.10	2.10
Measured maximum average power (dBm) at antenna port	22.33	22.53	22.30
Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm)	24.13	24.63	24.40
Measurement uncertainty (dB)	<±0.941		

LTE Band 41. 16QAM MODULATION. Bandwidth = 5 MHz.

A preliminary scan determined the 16QAM modulation, BW=5 MHz, RB=1, Offset=12 as the worst case. The following tables show the results for the worst case modulation.

Channel	Lowest	Middle	Highest
Maximum declared antenna gain (dBi)	2.10	2.10	2.10
Measured maximum average power (dBm) at antenna port	22.15	22.41	21.72
Maximum equivalent isotropic ally radiated power (E.I.R.P.) (dBm)	24.25	24.51	23.82
Measurement uncertainty (dB)	<±0.941		

Verdict: PASS

Radiated emissions

SPECIFICATION:

1. LTE Band 4. FCC §2.1053 & §27.53 (h) / RSS-139 Issue 3 Clause 6.6.

FCC §27.53 (h):

> (h) Except as otherwise specified below, for operations in the 1695-1710 MHz, 1710-1755 MHz, 1755-1780 MHz, 1915-1920 MHz, 1995-2000 MHz, 2000-2020 MHz, 2110-2155 MHz, 2155-2180 MHz, and 2180-2200 bands, the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) in watts by at least 43 + 10 log10 (P) dB.

RSS-139 Clause 6.6:

> i. In the first 1.0 MHz bands immediately outside and adjacent to the equipment's smallest operating frequency block, which can contain the equipment's occupied bandwidth, the emission power per any 1% of the emission bandwidth shall be attenuated below the transmitter output power P (in dBW) by at least 43 + 10 log10 p (watts) dB.
>
> ii. After the first 1.0 MHz outside the equipment's smallest operating frequency block, which can contain the equipment's occupied bandwidth, the emission power in any 1 MHz bandwidth shall be attenuated below the transmitter output power P (in dBW) by at least 43 + 10 log10 P (watts) dB.

LTE Band 4 MEASUREMENT LIMIT:

At Po transmitting power, the specified minimum attenuation becomes 43+10 log (Po), and the level in dBm relative Po becomes:

Po (dBm) – [43 + 10 log (Po in mwatts) - 30] = -13 dBm

2. LTE Band 12. FCC §2.1053 & §27.53 (g) / RSS-130 Issue 2 Clause 4.7.1.

FCC §27.53 (g):

> (g) For operations in the 600 MHz band and the 698-746 MHz band, the power of any emission outside a licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, by at least 43 + 10 log (P) dB. Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kilohertz or greater. However, in the 100 kilohertz bands immediately outside and adjacent to a licensee's frequency block, a resolution bandwidth of at least 30 kHz may be employed.

RSS-130 Issue 2 Clause 4.7.1:

> 4.7.1. The power of any unwanted emissions in any 100 kHz bandwidth on any frequency outside the frequency range(s) within which the equipment is designed to operate shall be attenuated below the transmitter power, P (dBW), by at least 43 + 10 log10 p (watts), dB. However, in the 100 kHz band immediately outside the equipment's operating frequency range, a resolution bandwidth of 30 kHz may be employed.

LTE Band 12 MEASUREMENT LIMIT:

At Po transmitting power, the specified minimum attenuation becomes 43+10 log (Po), and the level in dBm relative Po becomes:

Po (dBm) – [43 + 10 log (Po in mwatts) - 30] = -13 dBm

3. LTE Band 13. FCC §2.1053 & §27.53 (c) (2) (4) & (f) / RSS-130 Issue 2 Clause 4.7.1.

FCC §27.53 (c) (2) (4) & (f):

(c) (2) On any frequency outside the 776-788 MHz band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least 43 + 10 log (P) dB.

(c) (4) On all frequencies between 763-775 MHz and 793-805 MHz, by a factor not less than 65 + 10 log (P) dB in a 6.25 kHz band segment, for mobile and portable stations.

(f) For operations in the 746-758 MHz, 775-788 MHz, and 805-806 MHz bands, emissions in the band 1559-1610 MHz shall be limited to −70 dBW (-40 dBm)/MHz equivalent isotropically radiated power (EIRP) for wideband signals, and −80 dBW (-50 dBm) EIRP for discrete emissions of less than 700 Hz bandwidth. For the purpose of equipment authorization, a transmitter shall be tested with an antenna that is representative of the type that will be used with the equipment in normal operation.

RSS-130 Issue 2 Clause 4.7.1:

4.7.1. The power of any unwanted emissions in any 100 kHz bandwidth on any frequency outside the frequency range(s) within which the equipment is designed to operate shall be attenuated below the transmitter power, P (dBW), by at least 43 + 10 log10 p (watts), dB. However, in the 100 kHz band immediately outside the equipment's operating frequency range, a resolution bandwidth of 30 kHz may be employed.

LTE Band 13 MEASUREMENT LIMIT:

At Po transmitting power, the specified minimum attenuation becomes 43+10 log (Po), and the level in dBm relative Po becomes:

Po (dBm) – [43 + 10 log (Po in mwatts) - 30] = -13 dBm

4. LTE Band 41. FCC §2.1053 & §27.53 (m) (4) / RSS-199 Issue 3 Clause 4.5 (a).

FCC §27.53 (m) (4)

(m) For BRS and EBS stations, the power of any emissions outside the licensee's frequency bands of operation shall be attenuated below the transmitter power (P) measured in watts in accordance with the standards below. If a licensee has multiple contiguous channels, out-of-band emissions shall be measured from the upper and lower edges of the contiguous channels.

(4) For mobile digital stations, the attenuation factor shall be not less than 40 + 10 log (P) dB on all frequencies between the channel edge and 5 megahertz from the channel edge, 43 + 10 log (P) dB on all frequencies between 5 megahertz and X megahertz from the channel edge, and 55 + 10 log (P) dB on all frequencies more than X megahertz from the channel edge, where X is the greater of 6 megahertz or the actual emission bandwidth as defined in paragraph (m)(6) of this section. In addition, the attenuation factor shall not be less that 43 + 10 log (P) dB on all frequencies between 2490.5 MHz and 2496 MHz and 55 + 10 log (P) dB at or below 2490.5 MHz. Mobile Satellite Service licensees operating on frequencies below 2495 MHz may also submit a documented interference complaint against BRS licensees operating on channel BRS Channel 1 on the same terms and conditions as adjacent channel BRS or EBS licensees.

RSS-199 Clause 4.5 (a)

(a) for base station and fixed subscriber equipment, the power of any unwanted emissions measured as above shall be attenuated (in dB) below the transmitter power, P (dBW), by at least 43 + 10 log10 p (watts)

LTE Band 41 MEASUREMENT LIMIT:

At Po transmitting power, the specified minimum attenuation becomes 43+10 log (Po), and the level in dBm relative Po becomes:

Po (dBm) – [43 + 10 log (Po in mwatts) - 30] = -13 dBm

METHOD:

The measurement was performed with the EUT inside an anechoic chamber. The spectrum was scanned from 30 MHz to at least the 10th harmonic of the highest frequency generated within the equipment.

The EUT was placed on a non-conductive stand at a 3 meter distance from the measuring antenna for measurements from 30 MHz up to 18 GHz and at 1 m distance for measurements above 18 GHz.

Detected emissions were maximized at each frequency by rotating the EUT and adjusting the measuring antenna height and polarization. The maximum meter reading was recorded.

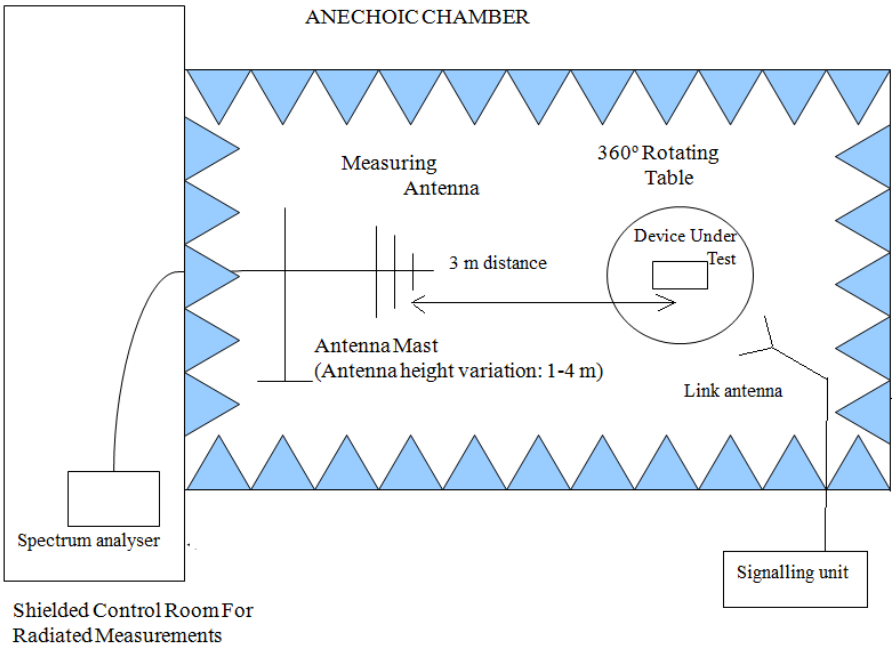
Measurement Limit:

According to specification. the power of emissions shall be attenuated below the transmitter power (P) by a factor of at least 43 + 10 log (P) dB. P in watts.
At Po transmitting power. the specified minimum attenuation becomes 43+10log (Po) and the level in dBm relative Po becomes:

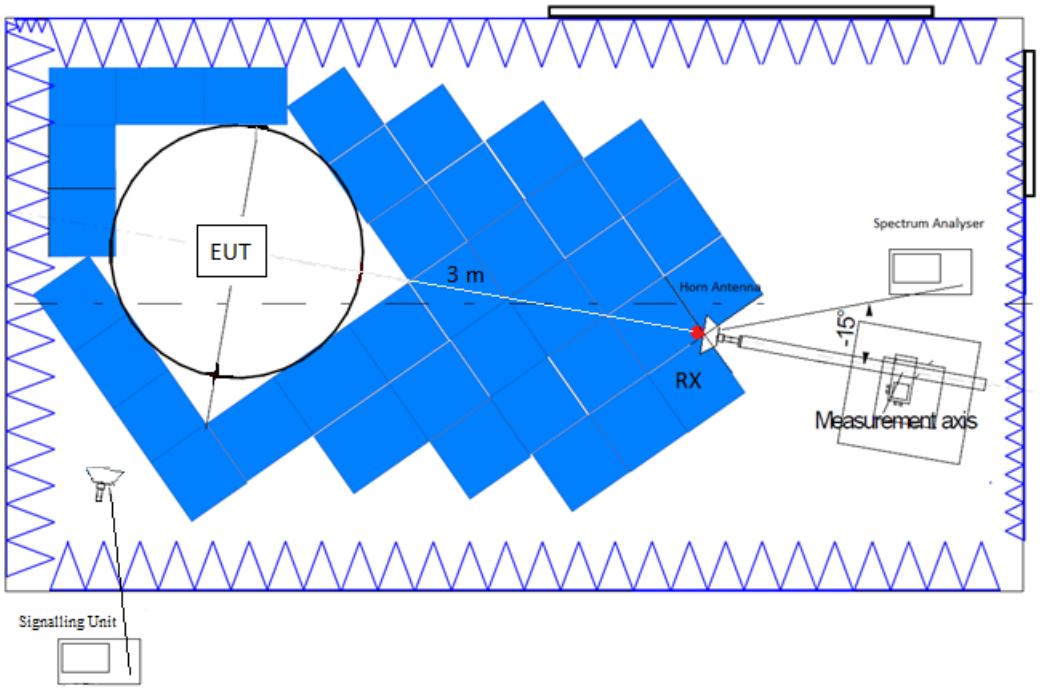
$$Po\ (dBm) – [43 + 10 \log (Po \text{ in mwatts}) - 30] = - 13\ dBm$$

TEST SETUP:

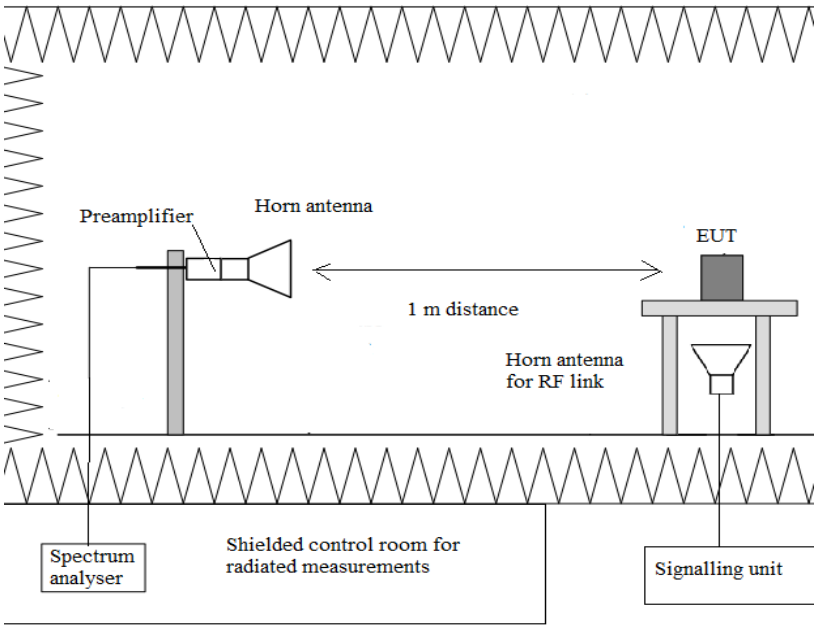
Radiated measurements below 1 GHz.



Radiated measurements between 1 GHz and 18 GHz.



Radiated measurements above 18 GHz.



RESULTS:

LTE Band 4:

QPSK:
A preliminary scan determined BW=15 MHz, RB Size=1, RB Offset=38 as the worst case. The following tables and plots show the results for the worst case modulation.

- Lowest Channel:

Frequency range 30 MHz - 1 GHz

Spurious frequencies detected at less than 20 dB below the limit:

Spurious frequency (MHz)	Detector	E.I.R.P (dBm)	Polarization
38.197	Peak	-29.66	H
868.907	Peak	-31.78	H

Frequency range 1 - 18 GHz

Spurious frequencies detected at less than 20 dB below the limit:

Spurious frequency (MHz)	Detector	E.I.R.P (dBm)	Polarization
1705.033	Peak	-28.8	H
2111.433	Peak	-32.92	H

- Middle Channel:

Frequency range 30 MHz - 1 GHz

Spurious frequencies detected at less than 20 dB below the limit:

Spurious frequency (MHz)	Detector	E.I.R.P (dBm)	Polarization
31.374	Peak	-23.63	V
33.929	Peak	-31.05	V
65.098	Peak	-29.31	V
79.648	Peak	-27.81	V
116.573	Peak	-32.12	H
137.395	Peak	-32.56	H
260.779	Peak	-20.80	V
268.475	Peak	-24.40	V

Frequency range 1 - 18 GHz

No spurious frequencies at less than 20 dB below the limit.

- Highest Channel:

Frequency range 30 MHz - 1 GHz

No spurious frequencies at less than 20 dB below the limit.

Frequency range 1 - 18 GHz

Spurious frequencies detected at less than 20 dB below the limit:

Spurious frequency (MHz)	Detector	E.I.R.P (dBm)	Polarization
1766.367	Peak	-30.82	H

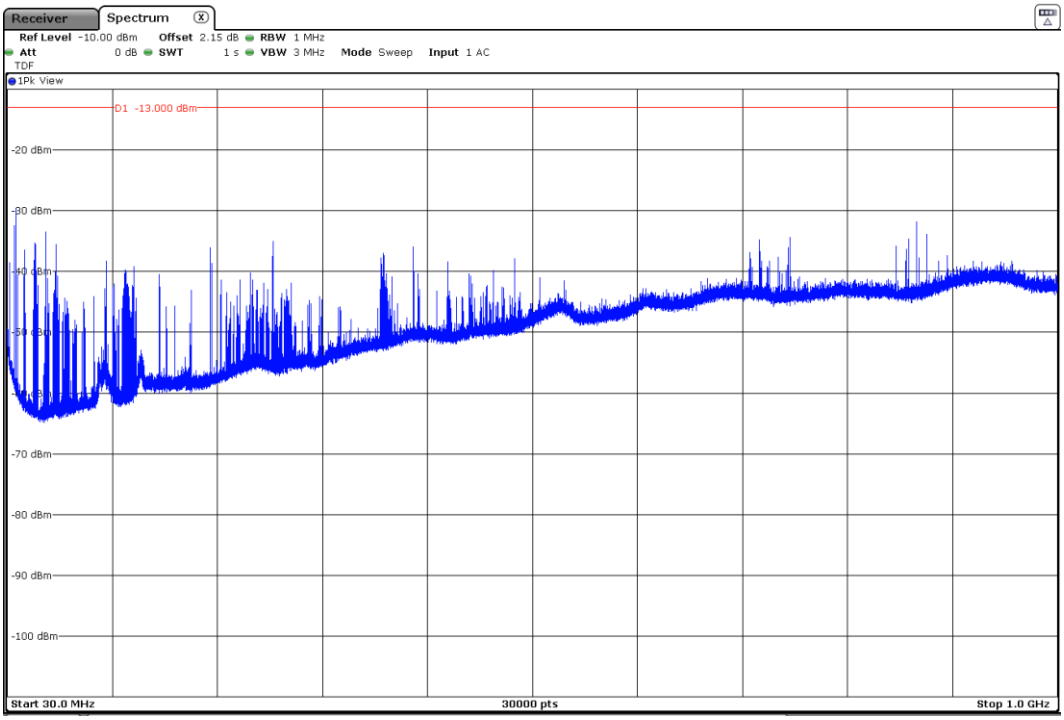
Measurement Uncertainty (dB): <± 4.68 for f ≥ 30 MHz up to 1 GHz
<± 4.00 for f ≥ 1 GHz up to 3 GHz
<± 4.99 for f ≥ 3 GHz up to 18 GHz

Verdict: PASS

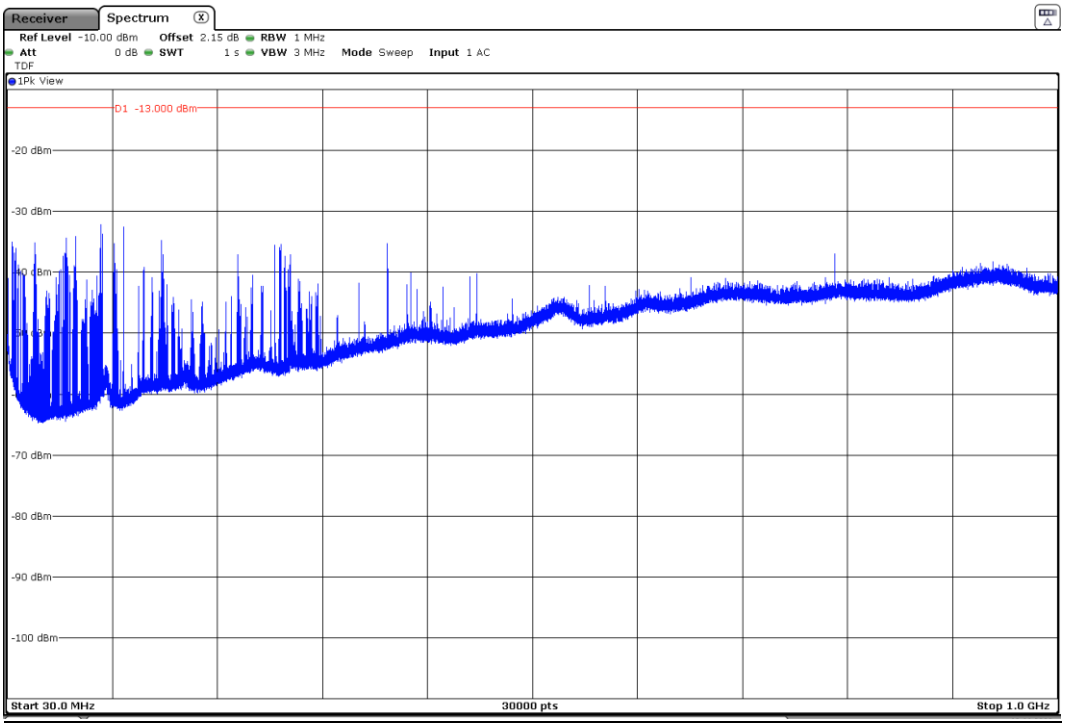
FREQUENCY RANGE 30 MHz - 1 GHz

QPSK MODULATION

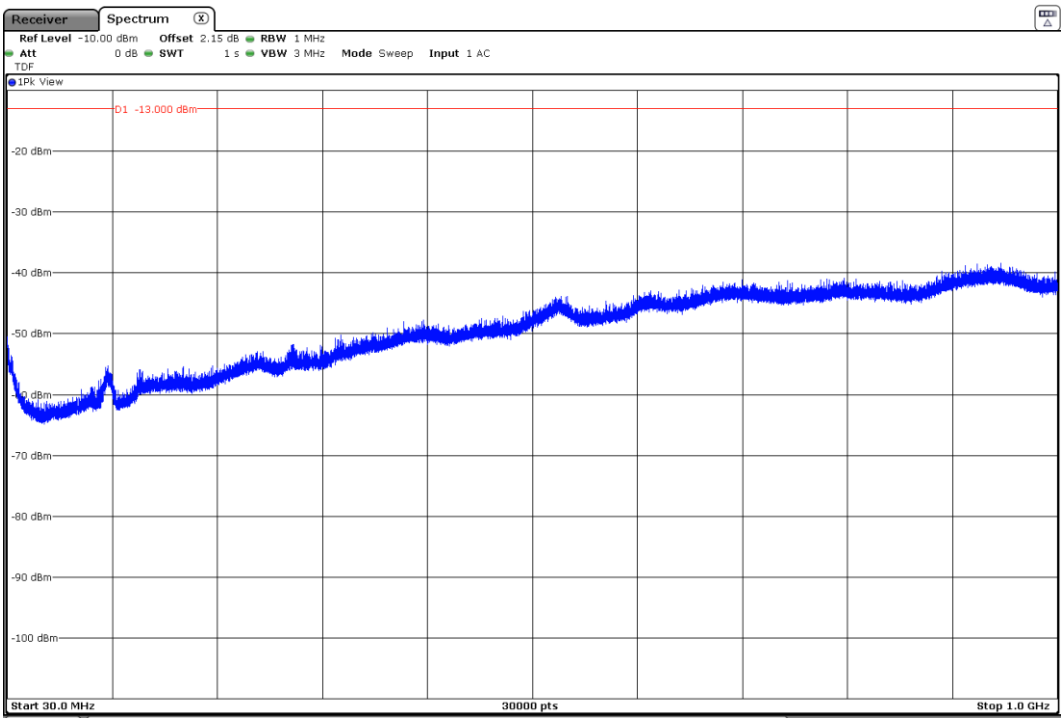
- Lowest Channel:



- Middle Channel:



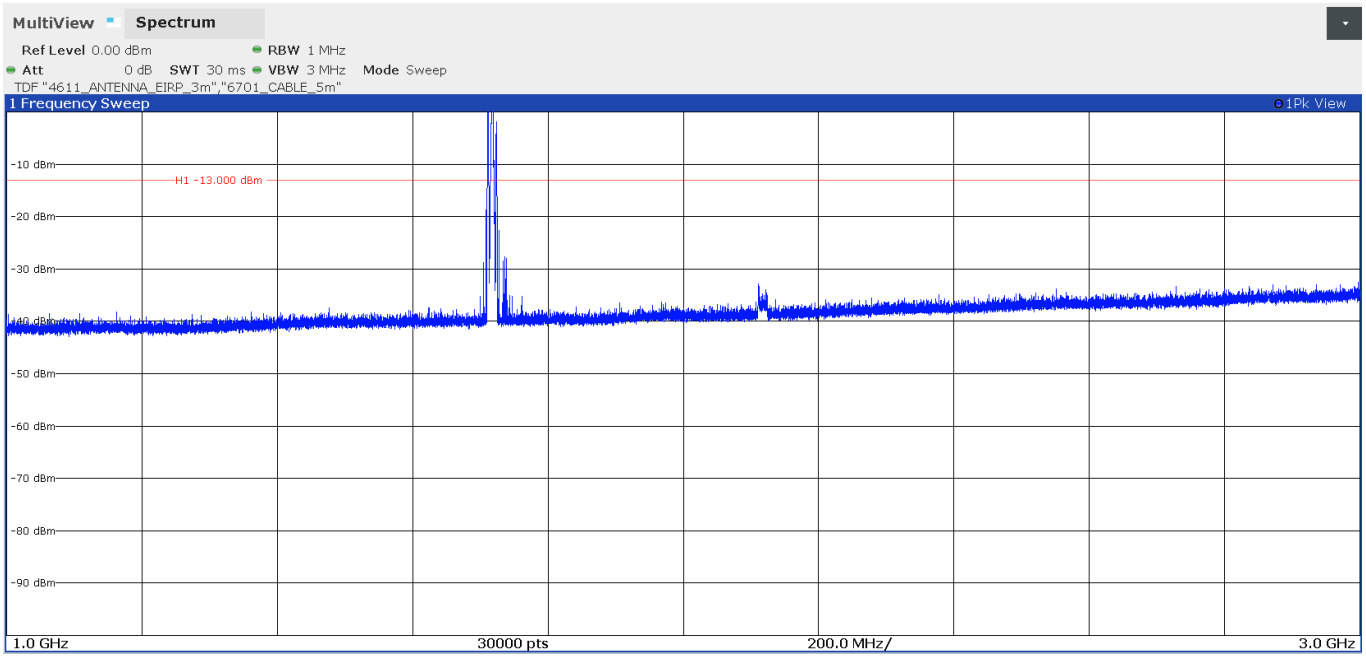
- Highest Channel:



FREQUENCY RANGE 1 - 3 GHz

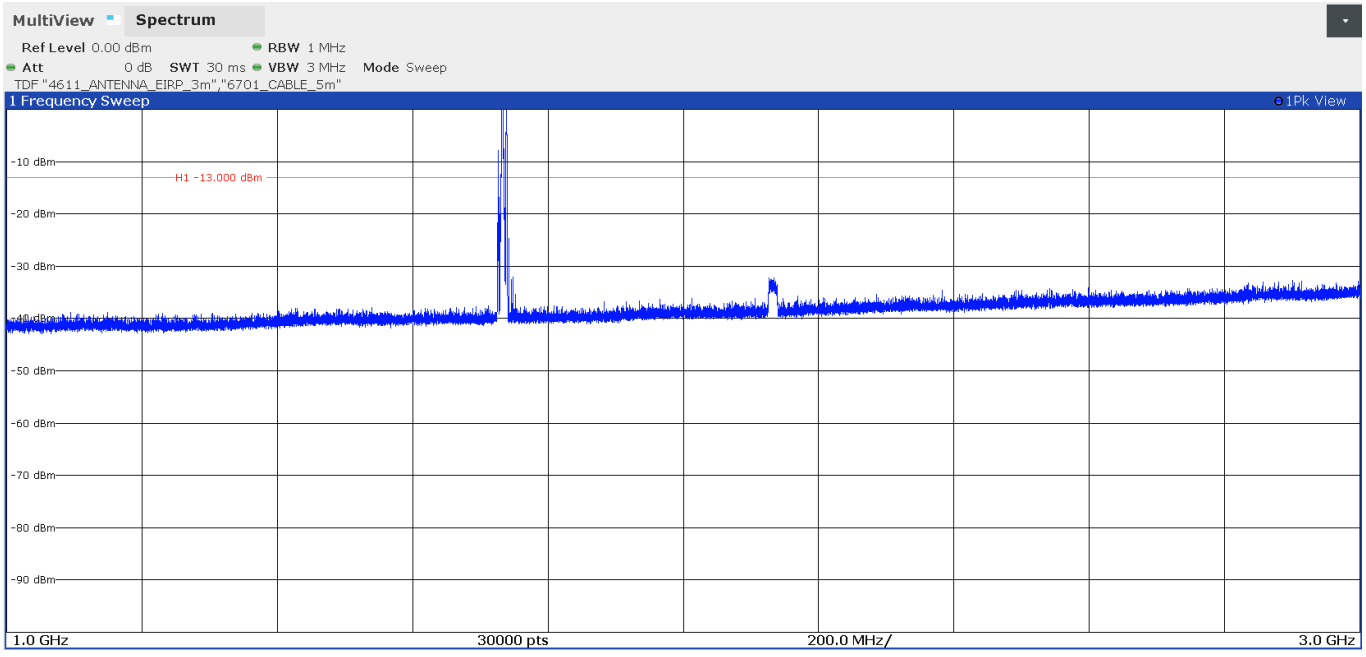
QPSK MODULATION

- Lowest Channel:



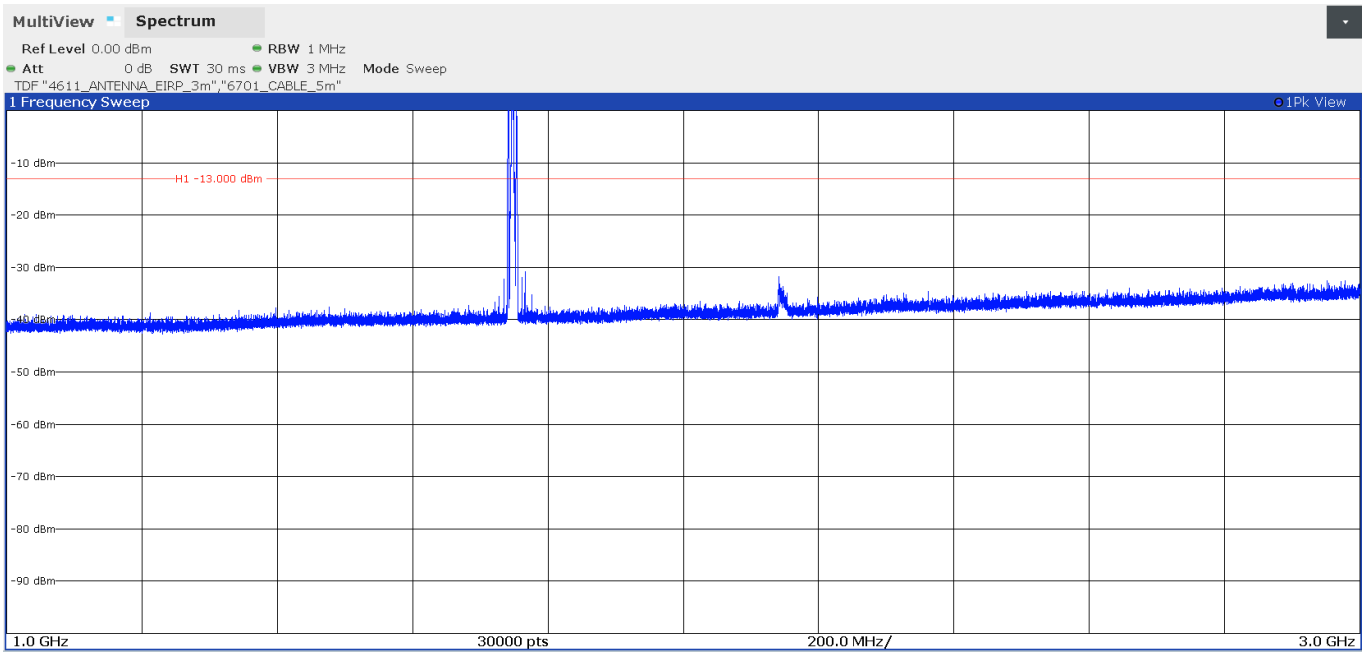
The peak above the limit is the carrier frequency:

- Middle Channel:



The peak above the limit is the carrier frequency:

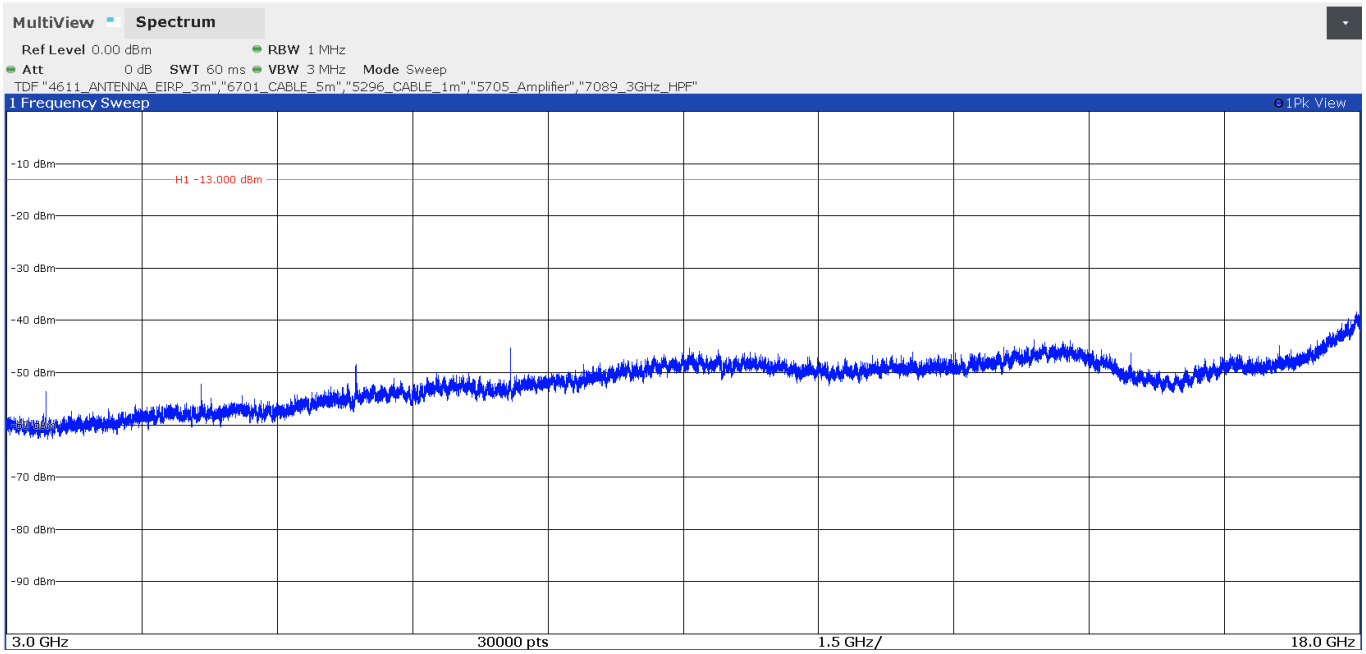
- Highest Channel:



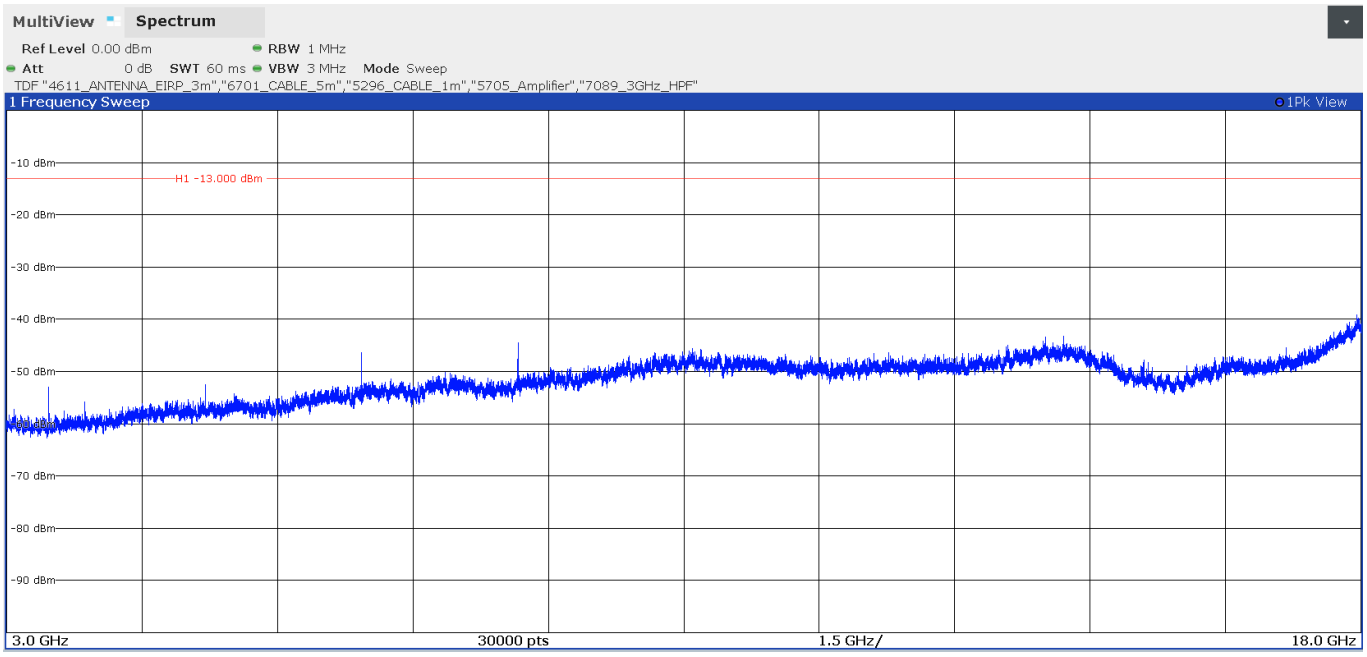
The peak above the limit is the carrier frequency:

FREQUENCY RANGE 3 – 18 GHz

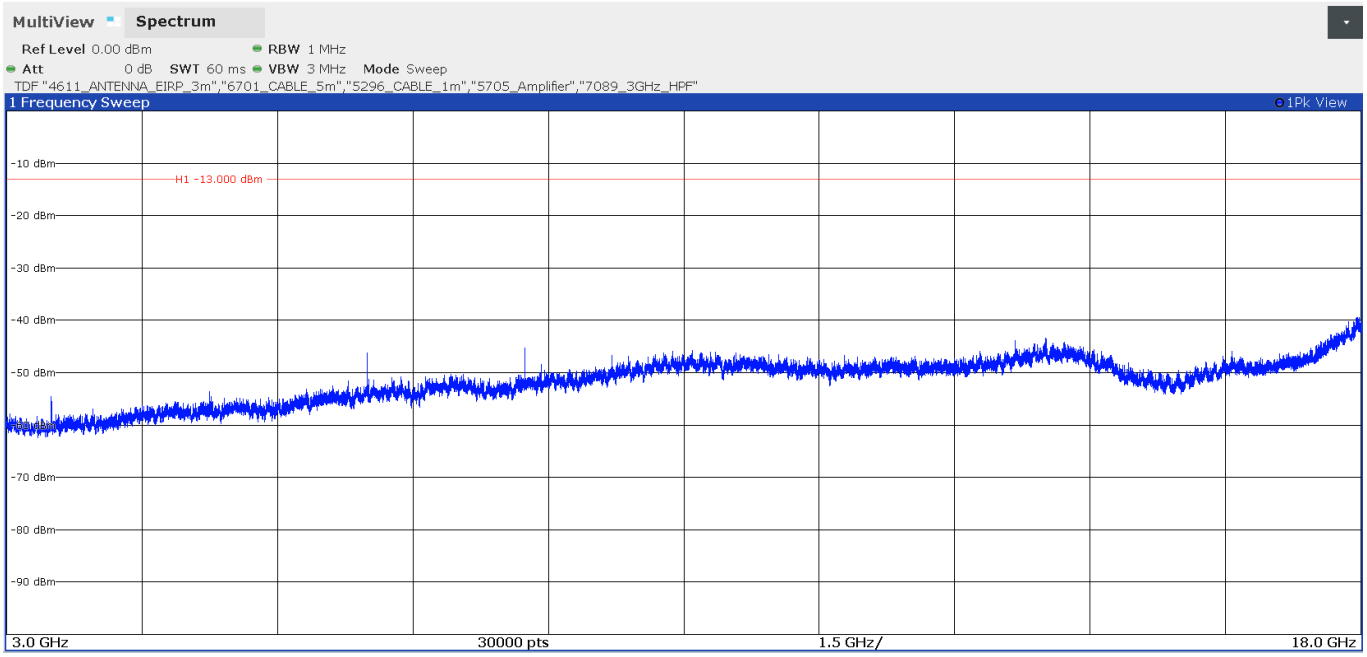
- Lowest Channel:



- Middle Channel:



- Highest Channel:



16QAM:
A preliminary scan determined BW=1.4 MHz, RB Size=3, RB Offset=1 as the worst case. The following tables and plots show the results for the worst case modulation.

- Lowest Channel:

Frequency range 30 MHz - 1 GHz

Spurious frequencies detected at less than 20 dB below the limit:

Spurious frequency (MHz)	Detector	E.I.R.P (dBm)	Polarization
30.275	Peak	-32.76	V
37.906	Peak	-30.03	V
45.633	Peak	-27.70	V
58.146	Peak	-28.35	V
61.703	Peak	-32.72	V
734.721	Peak	-29.38	H
751.632	Peak	-25.62	V
758.713	Peak	-22.94	V
779.406	Peak	-23.62	V

Frequency range 1 - 18 GHz

No spurious frequencies at less than 20 dB below the limit.

- Middle Channel:

Frequency range 30 MHz - 1 GHz

Spurious frequencies detected at less than 20 dB below the limit:

Spurious frequency (MHz)	Detector	E.I.R.P (dBm)	Polarization
30.275	Peak	-31.18	V
34.349	Peak	-32.17	V
55.301	Peak	-29.16	H
74.087	Peak	-24.40	H
83.593	Peak	-22.31	H
293.468	Peak	-28.44	V
398.293	Peak	-30.16	V
407.767	Peak	-19.11	V
500.208	Peak	-19.56	H
689.616	Peak	-27.3	H

Frequency range 1 - 18 GHz

No spurious frequencies at less than 20 dB below the limit.

- Highest Channel:

Frequency range 30 MHz - 1 GHz

Spurious frequencies detected at less than 20 dB below the limit:

Spurious frequency (MHz)	Detector	E.I.R.P (dBm)	Polarization
137.751	Peak	-29.35	V
546.024	Peak	-21.51	V
751.050	Peak	-32.20	H
779.632	Peak	-30.46	H
867.967	Peak	-29.58	V
907.471	Peak	-30.22	V

Frequency range 1 - 18 GHz

Spurious frequencies detected at less than 20 dB below the limit:

Spurious frequency (MHz)	Detector	E.I.R.P (dBm)	Polarization
1757.967	Peak	-18.76	H

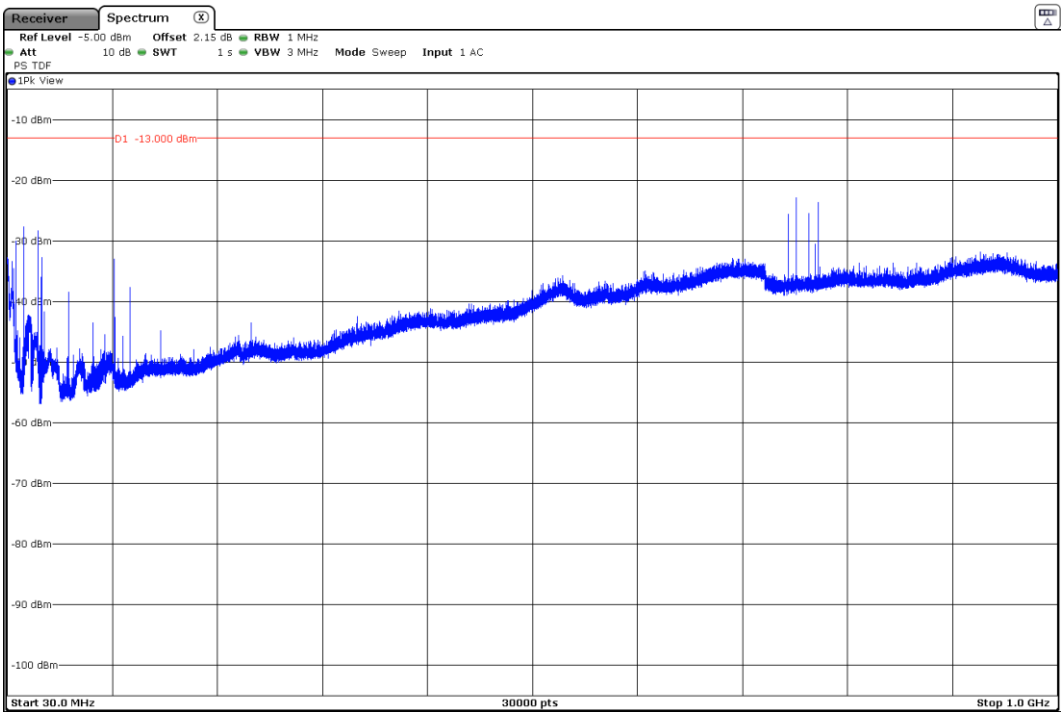
Measurement Uncertainty (dB): <± 4.68 for f ≥ 30 MHz up to 1 GHz
<± 4.00 for f ≥ 1 GHz up to 3 GHz
<± 4.99 for f ≥ 3 GHz up to 18 GHz

Verdict: PASS

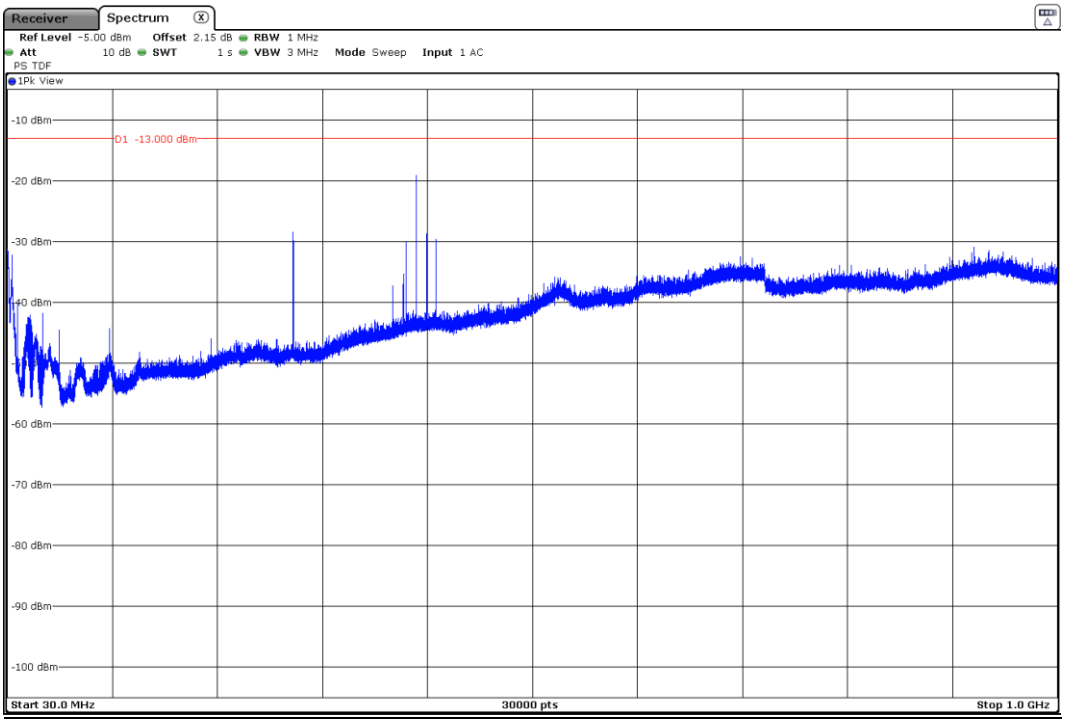
FREQUENCY RANGE 30 MHz - 1 GHz

16QAM MODULATION

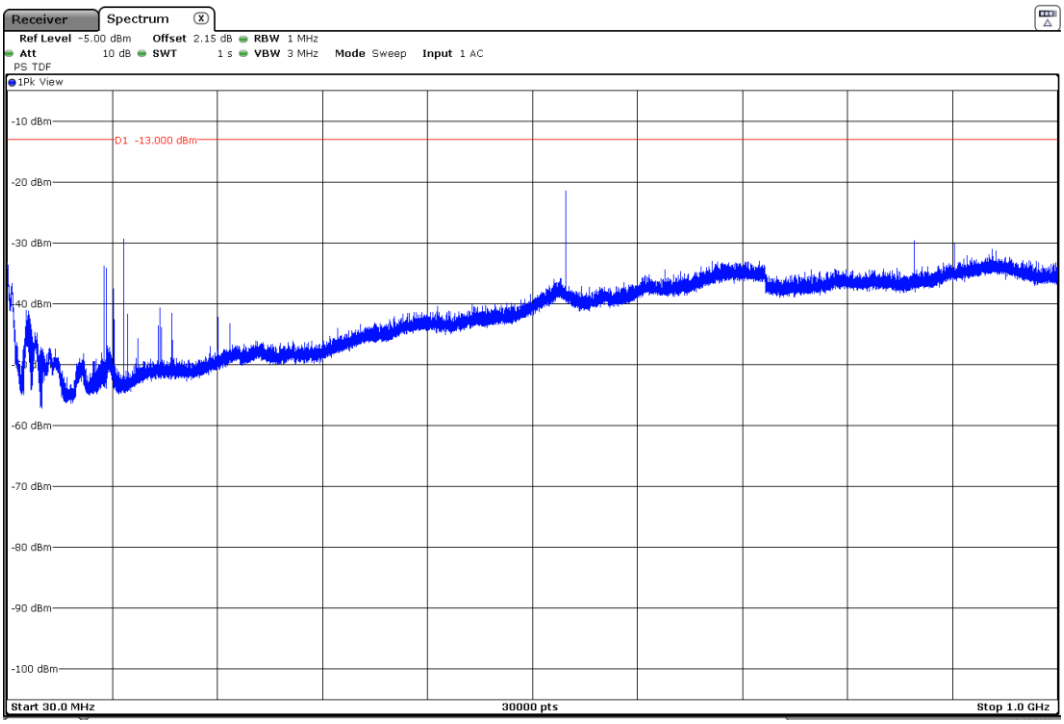
- Lowest Channel:



- Middle Channel:



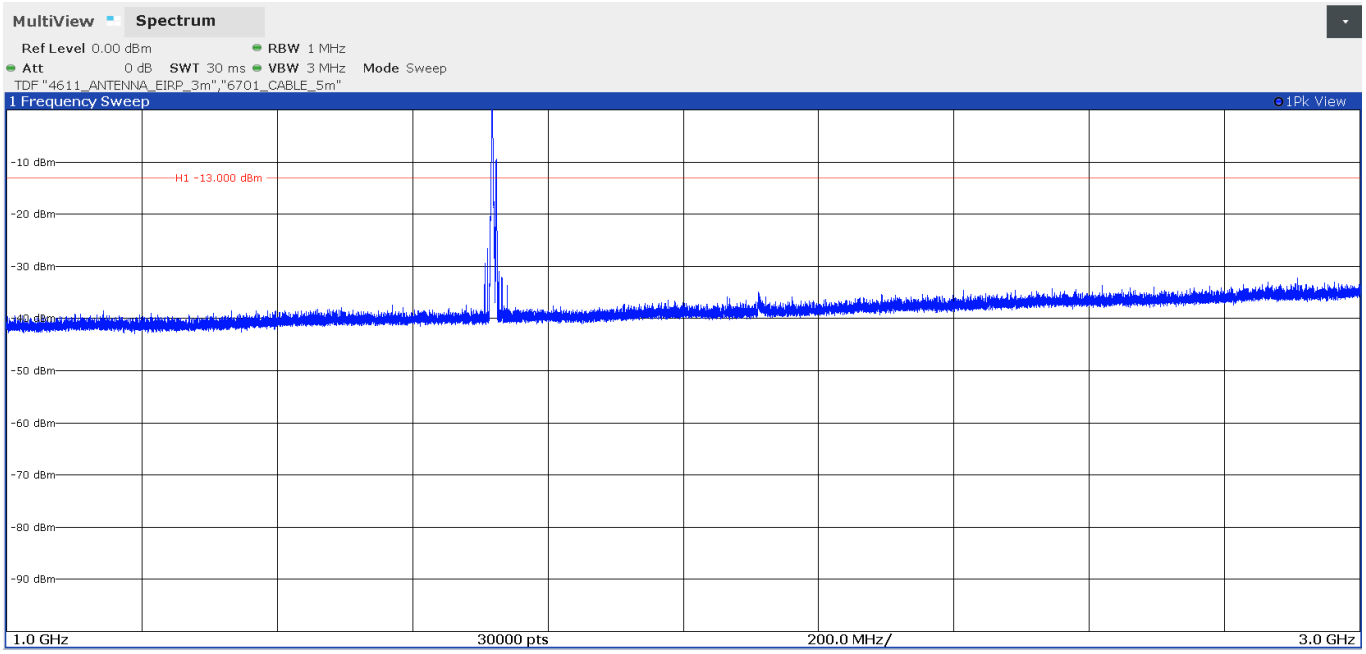
- Highest Channel:



FREQUENCY RANGE 1 - 3 GHz

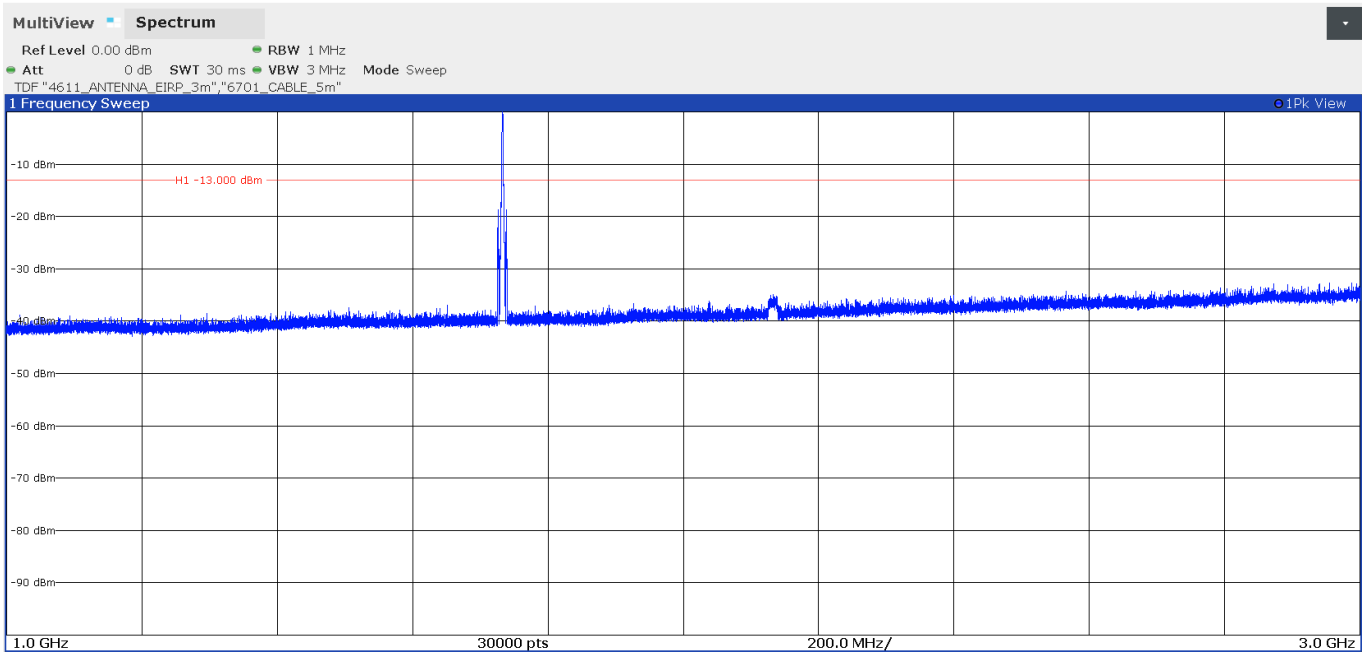
16QAM MODULATION

- Lowest Channel:



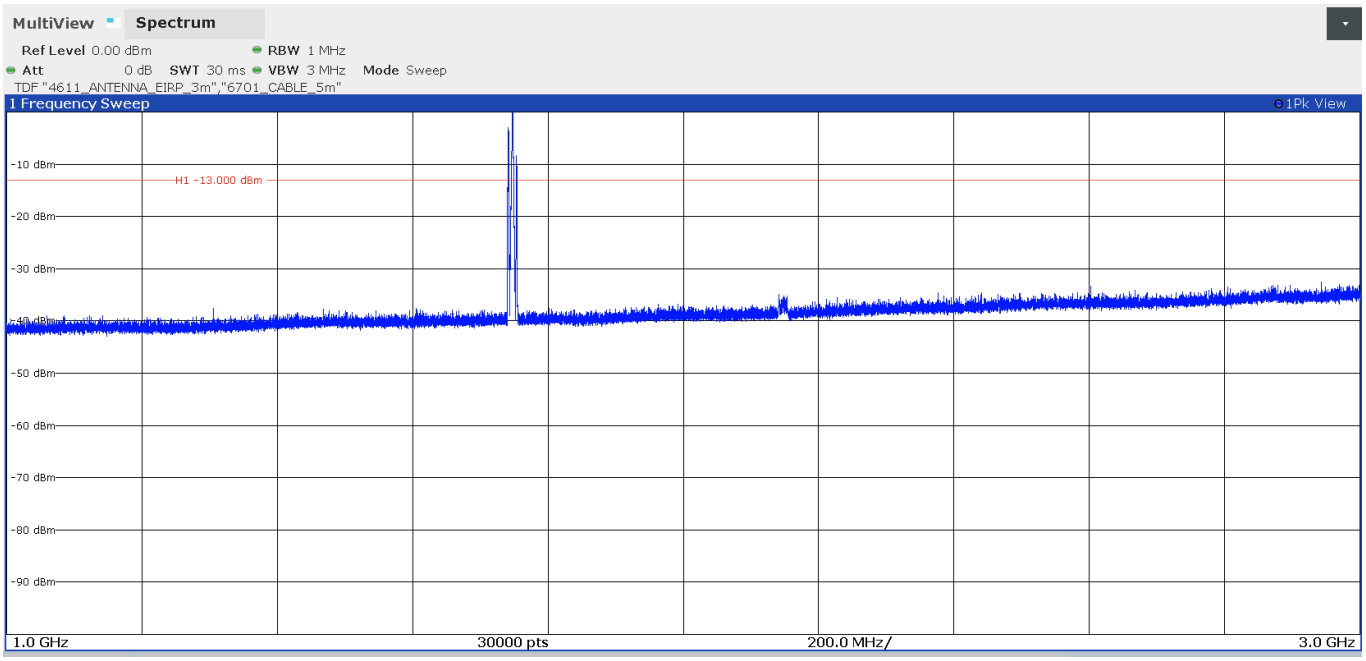
The peak above the limit is the carrier frequency:

- Middle Channel:



The peak above the limit is the carrier frequency:

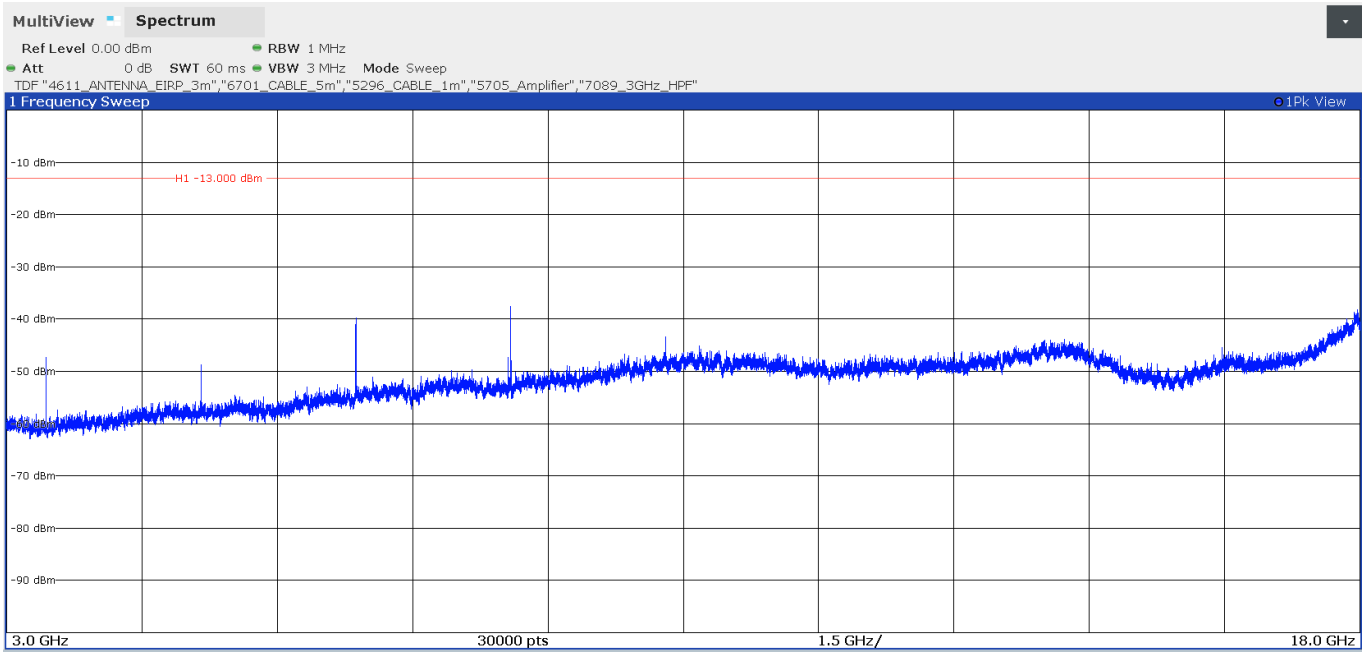
- Highest Channel:



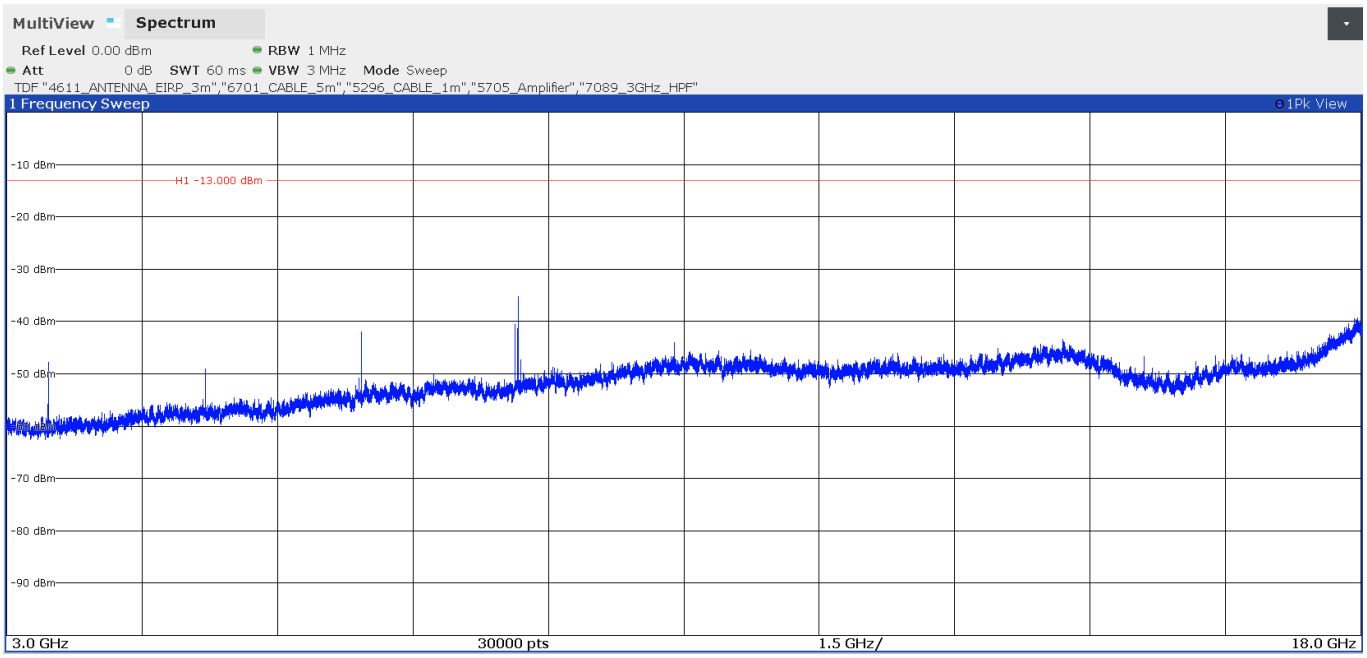
The peak above the limit is the carrier frequency:

FREQUENCY RANGE 3 – 18 GHz

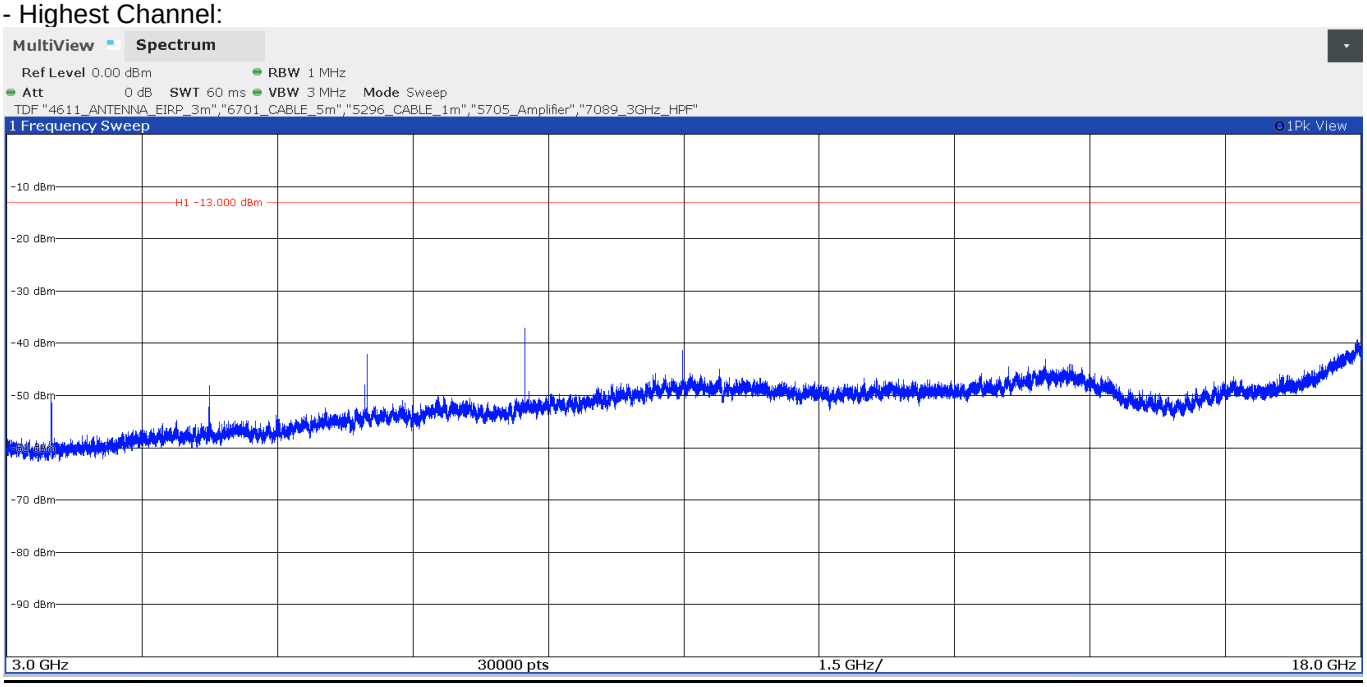
- Lowest Channel:



- Middle Channel:



- Highest Channel:



LTE Band 12:

QPSK:
A preliminary scan determined BW=10 MHz, RB Size=1, RB Offset=24 as the worst case. The following tables and plots show the results for the worst case modulation

- Lowest Channel:

Frequency range 30 MHz - 1 GHz

No spurious frequencies at less than 20 dB below the limit.

Frequency range 1 - 8 GHz

Spurious frequencies detected at less than 20 dB below the limit:

Spurious frequency (MHz)	Detector	E.I.R.P (dBm)	Polarization
1432.48	Peak	32.20	H

- Middle Channel:

Frequency range 30 MHz - 1 GHz

Spurious frequencies detected at less than 20 dB below the limit:

Spurious frequency (MHz)	Detector	E.I.R.P (dBm)	Polarization
34.769	Peak	-31.72	V
74.345	Peak	-32.24	V
698.152	Peak	-27.70	V
717.811	Peak	-27.88	H

Frequency range 1 - 8 GHz

No spurious frequencies at less than 20 dB below the limit.

- Highest Channel:

Frequency range 30 MHz - 1 GHz

Spurious frequencies detected at less than 20 dB below the limit:

Spurious frequency (MHz)	Detector	E.I.R.P (dBm)	Polarization
56.174	Peak	-32.08	V

Frequency range 1 - 8 GHz

No spurious frequencies at less than 20 dB below the limit.

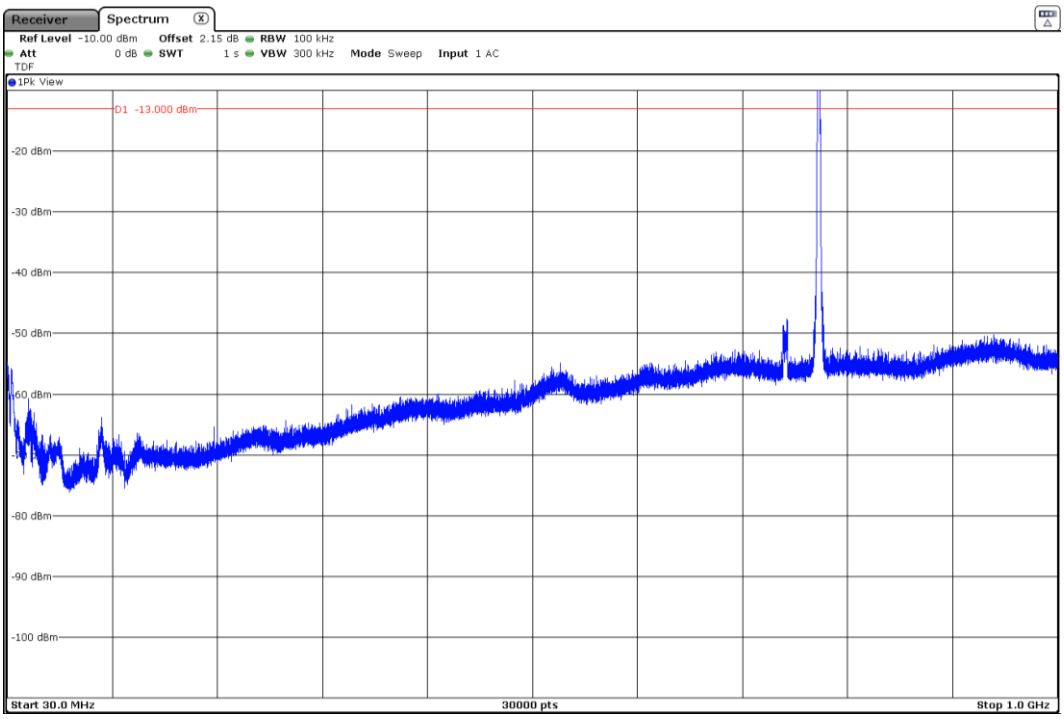
Measurement Uncertainty (dB): <± 4.68 for f ≥ 30 MHz up to 1 GHz
<± 4.99 for f ≥ 1 GHz up to 8 GHz

Verdict: PASS

FREQUENCY RANGE 30 MHz - 1 GHz

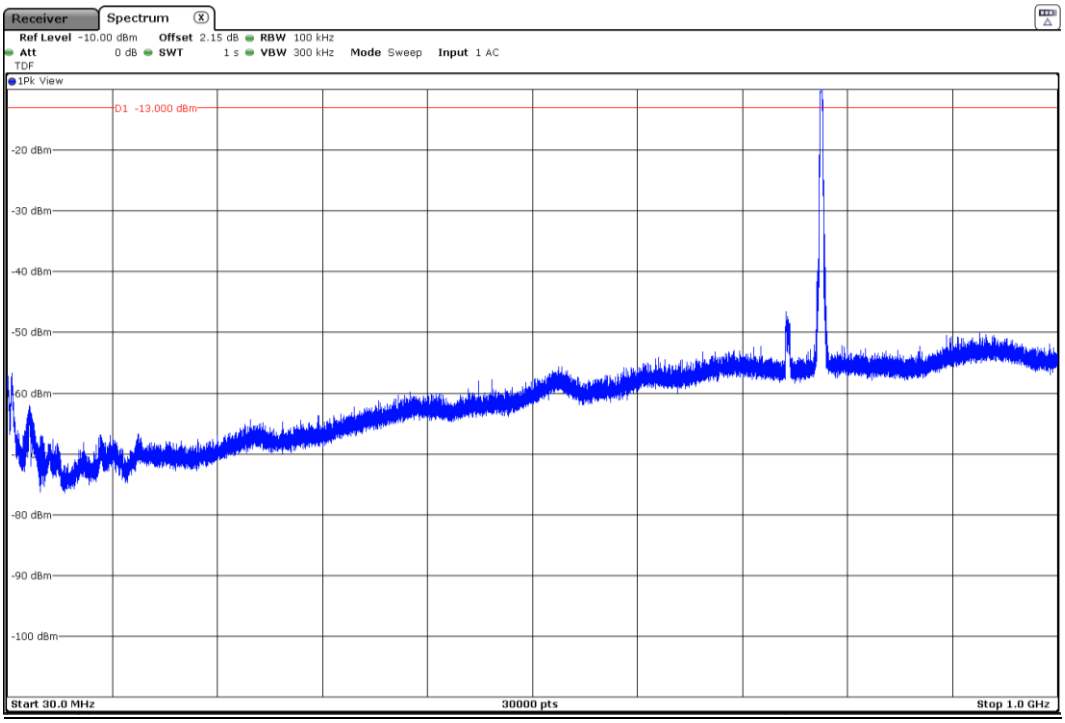
QPSK MODULATION

- Lowest Channel:



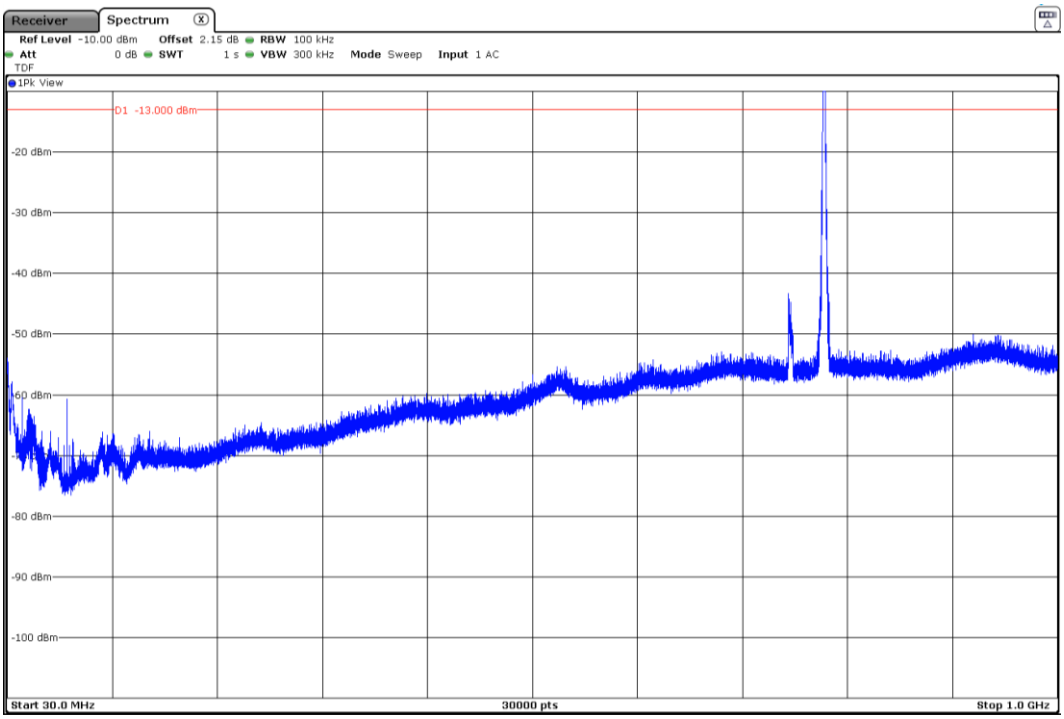
The peak above the limit is the carrier frequency:

- Middle Channel:



The peak above the limit is the carrier frequency:

- Highest Channel:

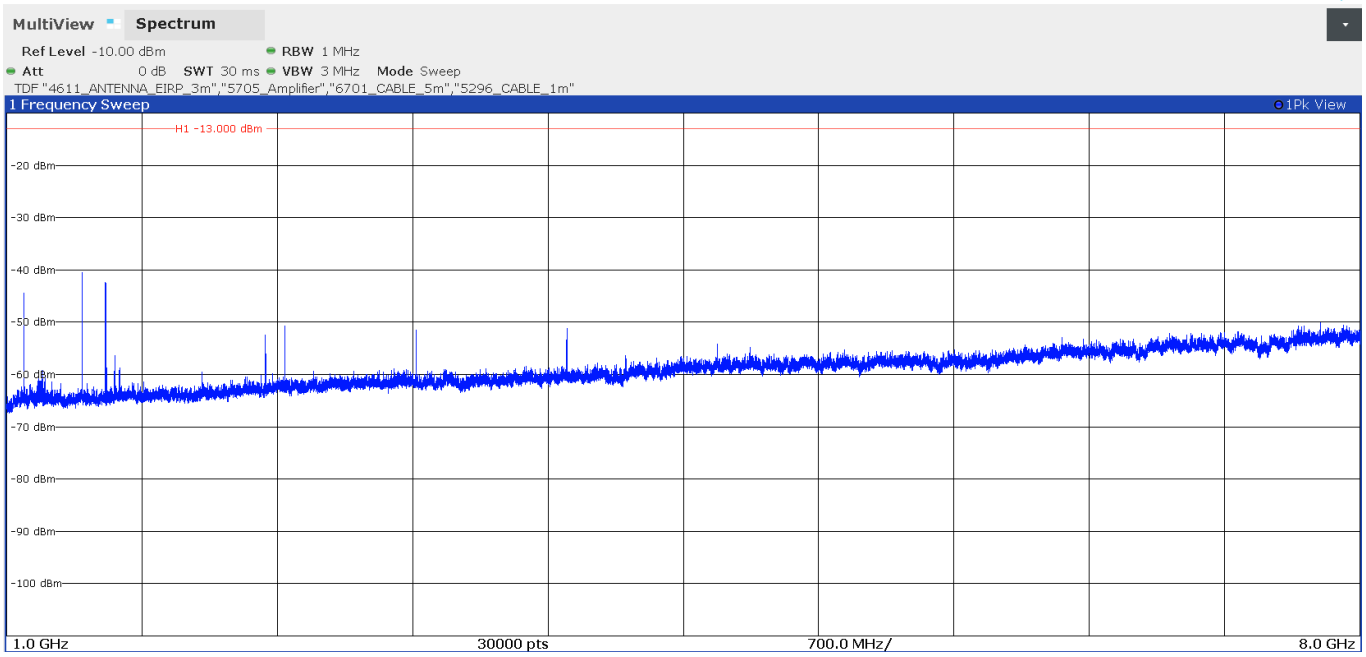


The peak above the limit is the carrier frequency:

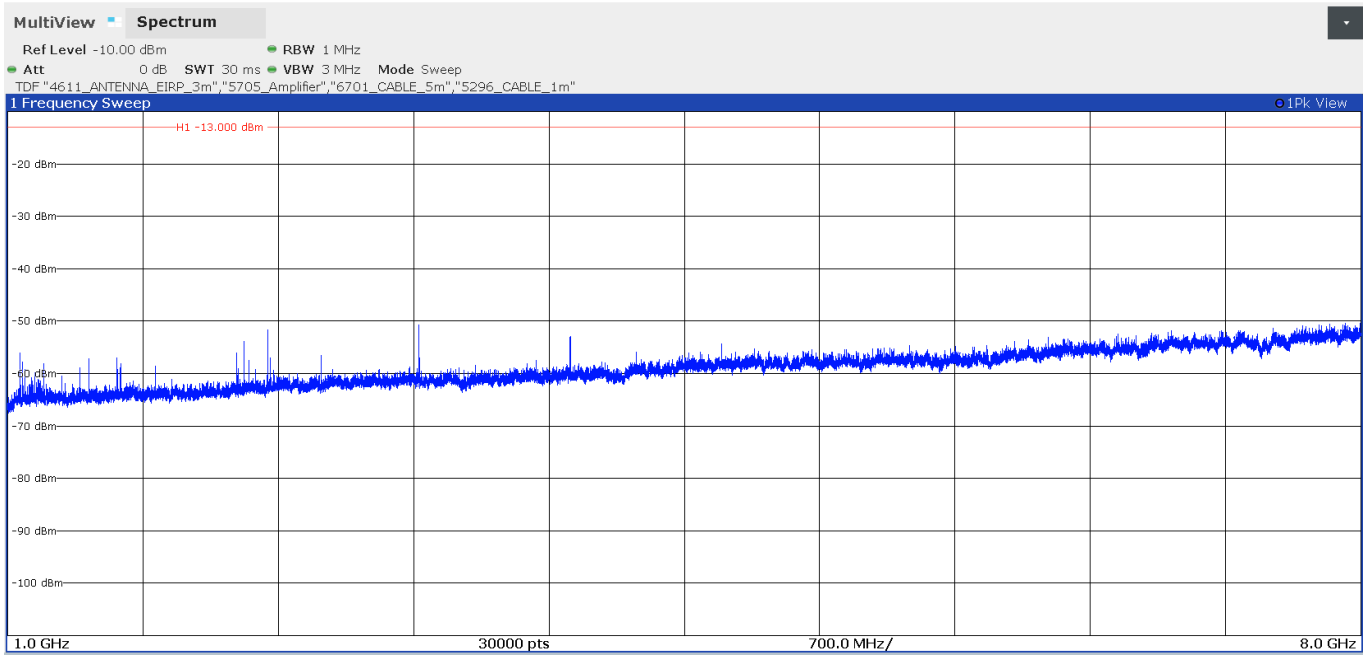
FREQUENCY RANGE 1 - 8 GHz

QPSK MODULATION

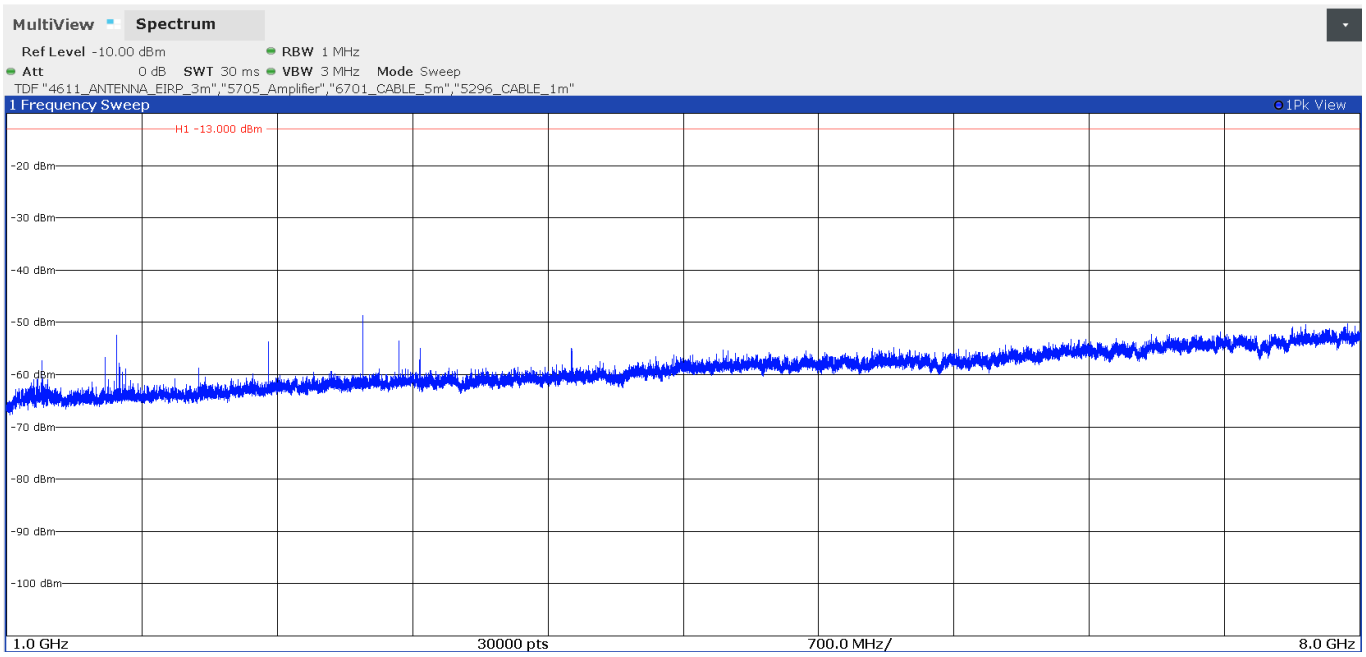
- Lowest Channel:



- Middle Channel:



- Highest Channel:



16QAM:
A preliminary scan determined BW=1.4 MHz, RB Size=3, RB Offset=0 as the worst case. The following tables and plots show the results for the worst case modulation

- Lowest Channel:

Frequency range 30 MHz - 1 GHz

Spurious frequencies detected at less than 20 dB below the limit:

Spurious frequency (MHz)	Detector	E.I.R.P (dBm)	Polarization
698.702	Peak	-17.07	V

Frequency range 1 - 8 GHz

No spurious frequencies at less than 20 dB below the limit.

- Middle Channel:

Frequency range 30 MHz - 1 GHz

Spurious frequencies detected at less than 20 dB below the limit:

Spurious frequency (MHz)	Detector	E.I.R.P (dBm)	Polarization
716.485	Peak	-27.19	H

Frequency range 1 - 8 GHz

No spurious frequencies at less than 20 dB below the limit.

- Highest Channel:

Frequency range 30 MHz - 1 GHz

Spurious frequencies detected at less than 20 dB below the limit:

Spurious frequency (MHz)	Detector	E.I.R.P (dBm)	Polarization
716.162	Peak	-17.3	H

Frequency range 1 - 8 GHz

No spurious frequencies at less than 20 dB below the limit.

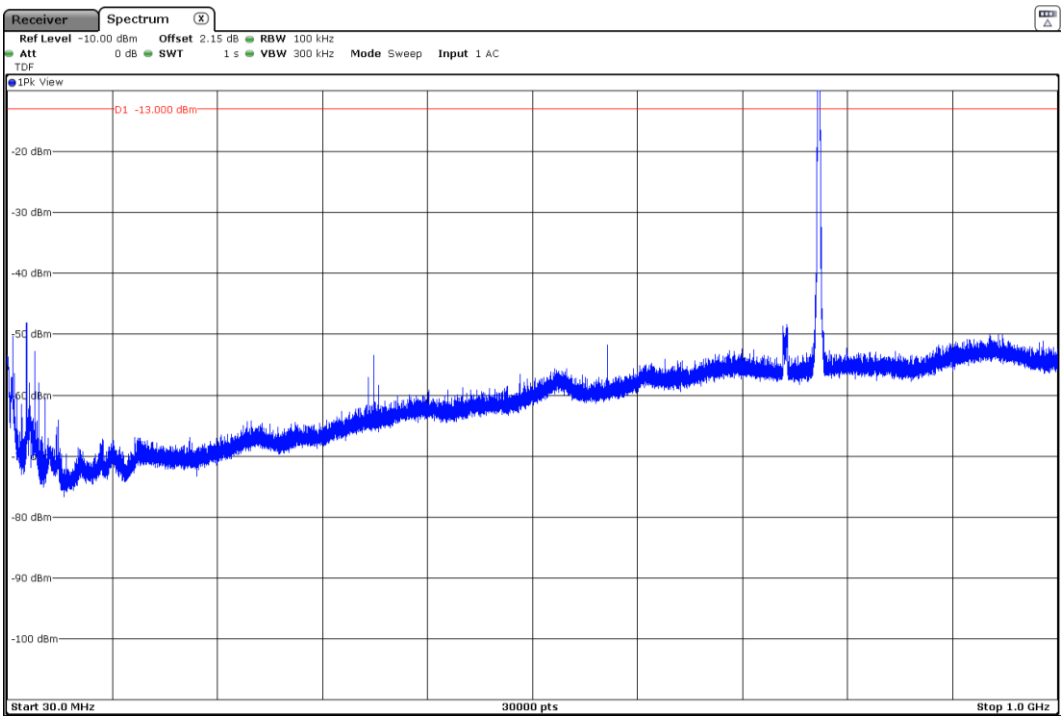
Measurement Uncertainty (dB): <± 4.68 for f ≥ 30 MHz up to 1 GHz
<± 4.99 for f ≥ 1 GHz up to 8 GHz

Verdict: PASS

FREQUENCY RANGE 30 MHz - 1 GHz

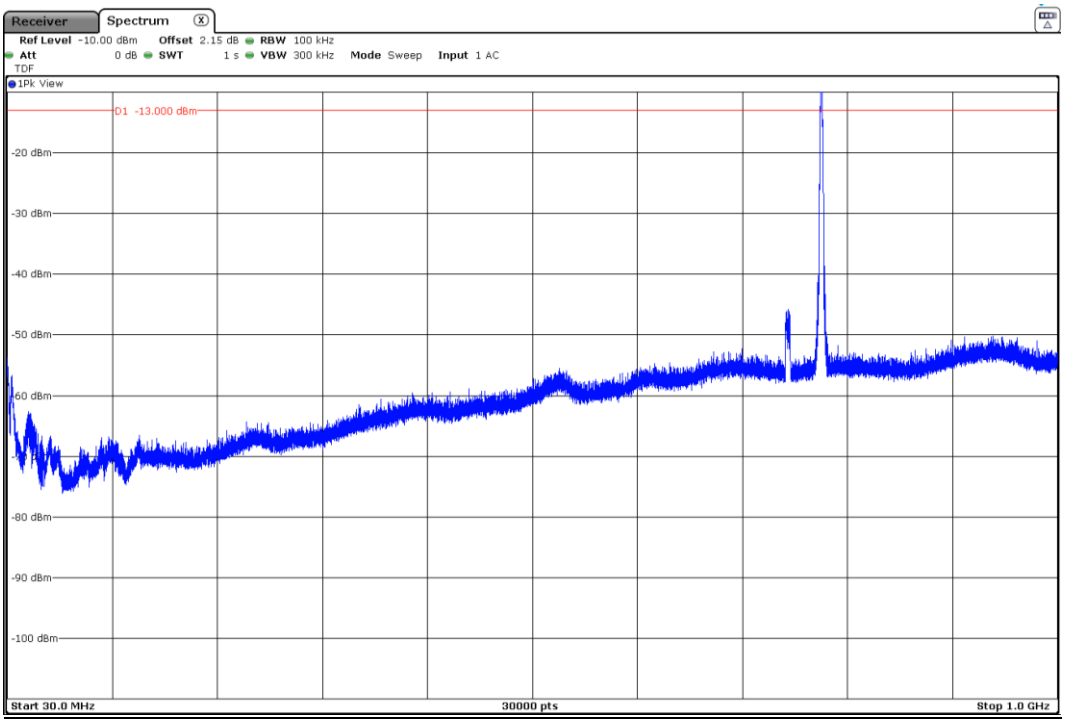
16QAM MODULATION

- Lowest Channel:



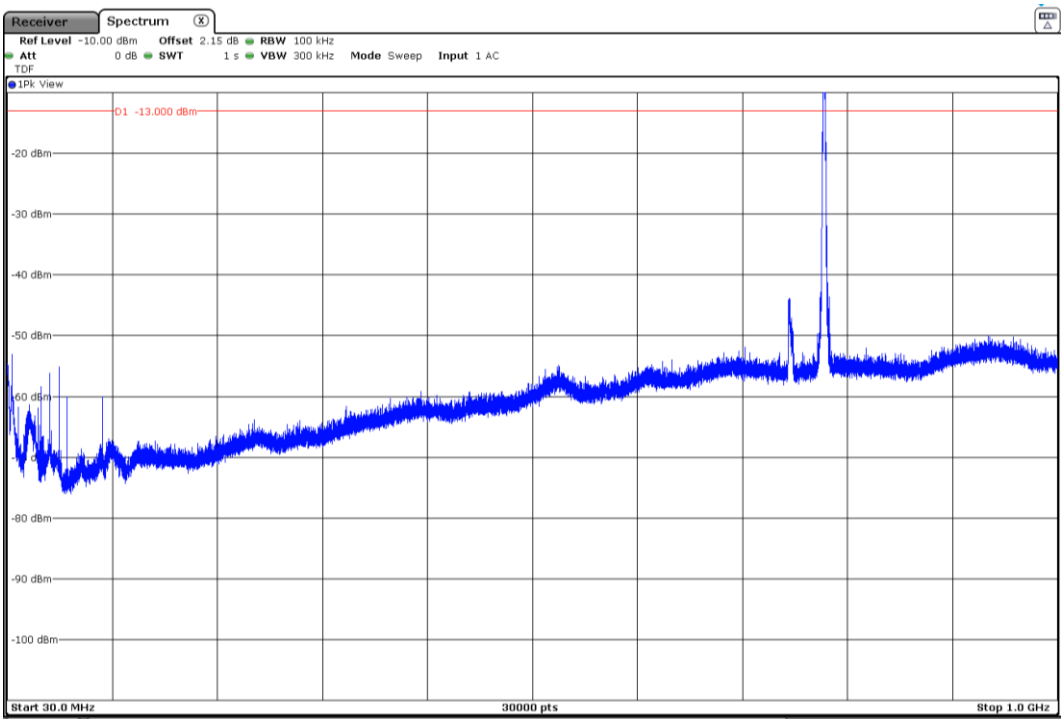
The peak above the limit is the carrier frequency:

- Middle Channel:



The peak above the limit is the carrier frequency:

- Highest Channel:

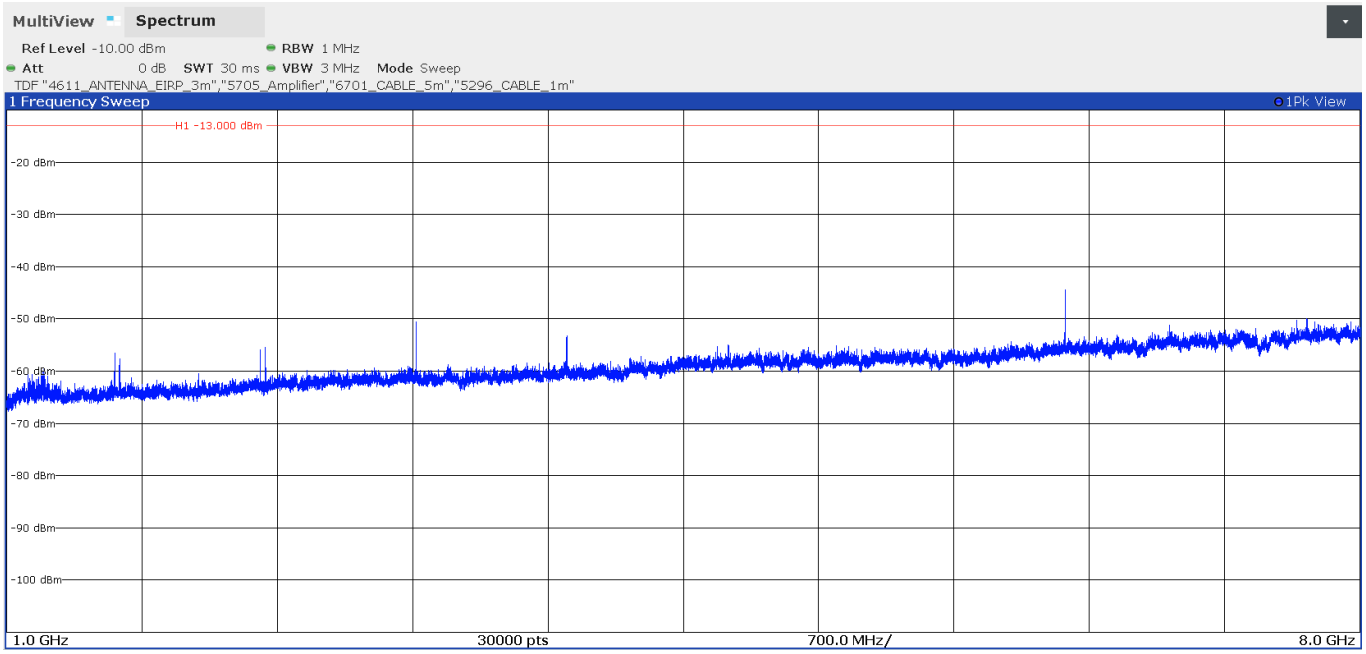


The peak above the limit is the carrier frequency:

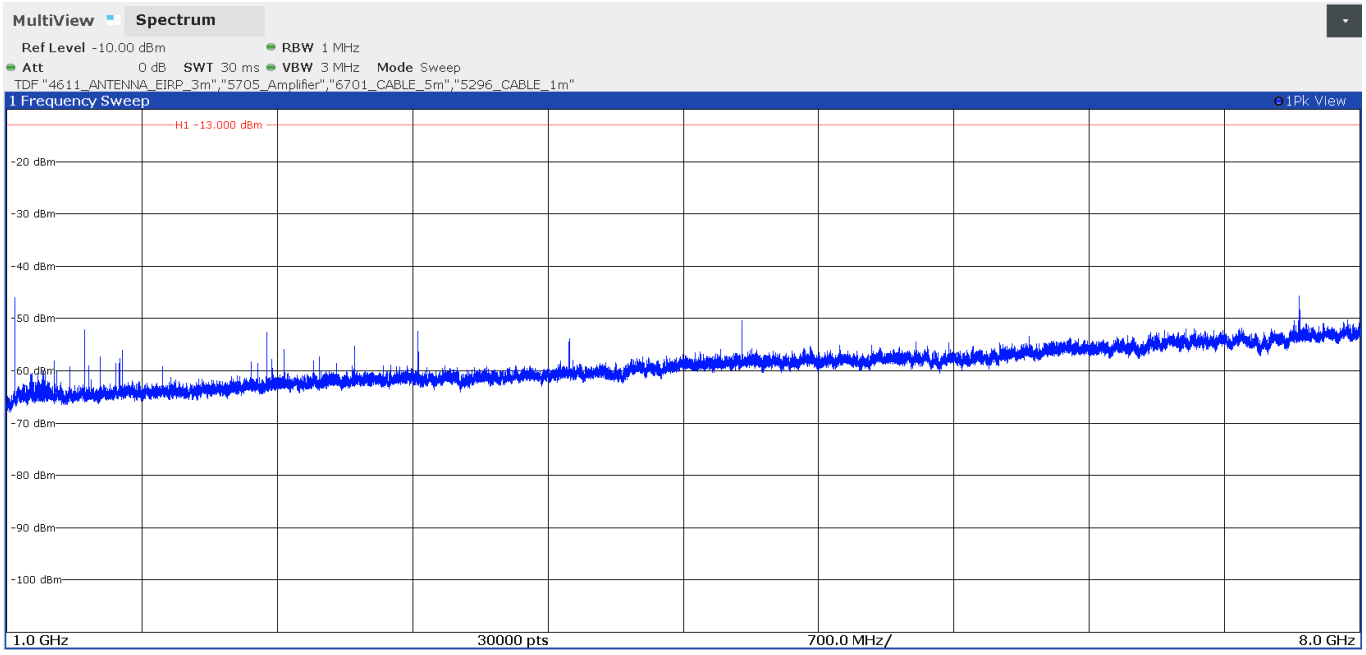
FREQUENCY RANGE 1 - 8 GHz

16QAM MODULATION

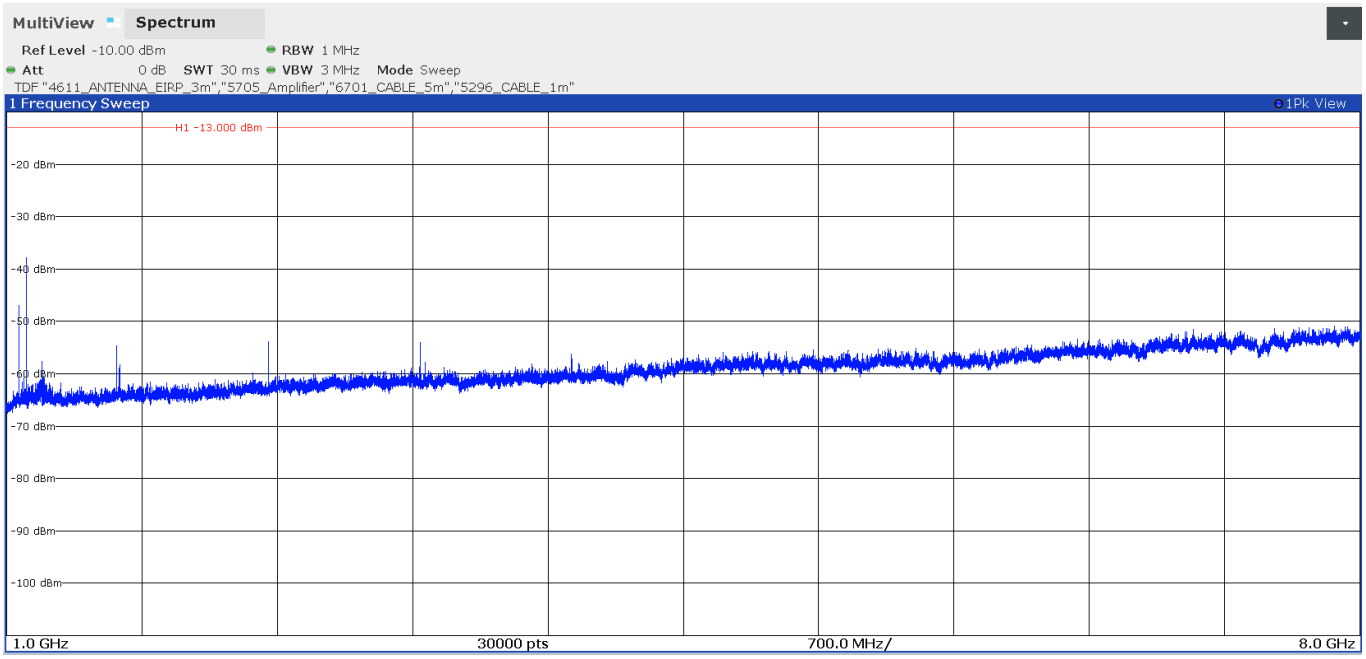
- Lowest Channel:



- Middle Channel:



- Highest Channel:



LTE Band 13:

QPSK:
A preliminary scan determined BW=5 MHz, RB Size=1, RB Offset=12 as the worst case. The following tables and plots show the results for the worst case modulation

- Lowest Channel:

Frequency range 30 MHz - 1 GHz

No spurious frequencies at less than 20 dB below the limit.

Frequency range 1 - 8 GHz

No spurious frequencies at less than 20 dB below the limit.

- Middle Channel:

Frequency range 30 MHz - 1 GHz

No spurious frequencies at less than 20 dB below the limit.

Frequency range 1 - 8 GHz

No spurious frequencies at less than 20 dB below the limit.

- Highest Channel:

Frequency range 30 MHz - 1 GHz

No spurious frequencies at less than 20 dB below the limit.

Frequency range 1 - 8 GHz

No spurious frequencies at less than 20 dB below the limit.

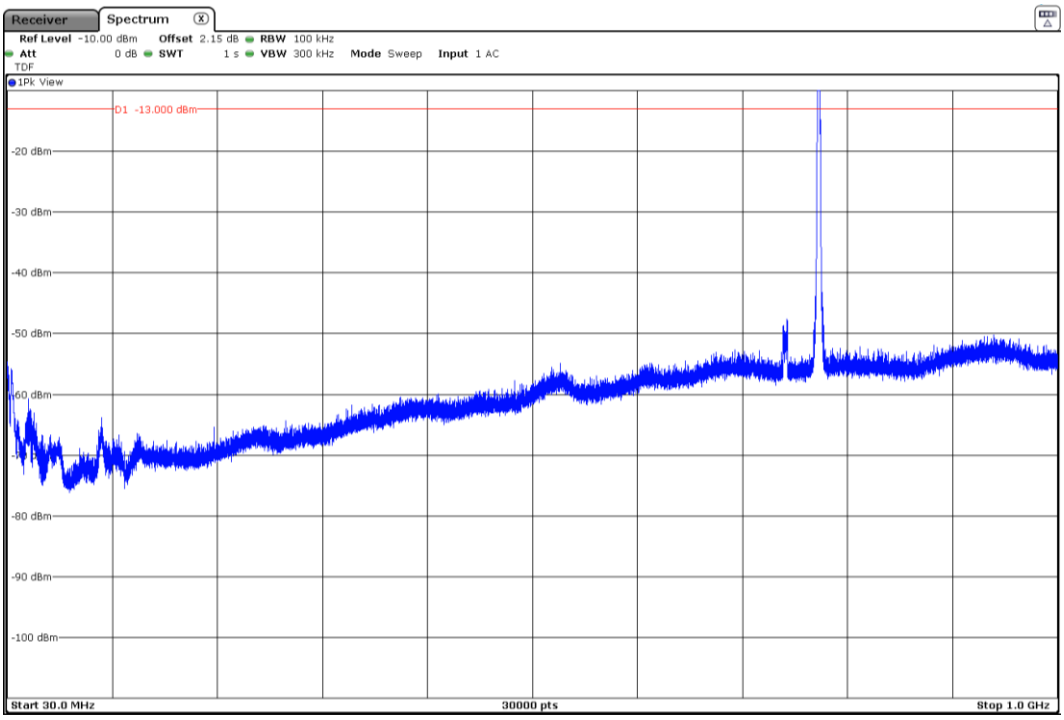
Measurement Uncertainty (dB): <± 4.68 for f ≥ 30 MHz up to 1 GHz
<± 4.99 for f ≥ 1 GHz up to 8 GHz

Verdict: PASS

FREQUENCY RANGE 30 MHz - 1 GHz

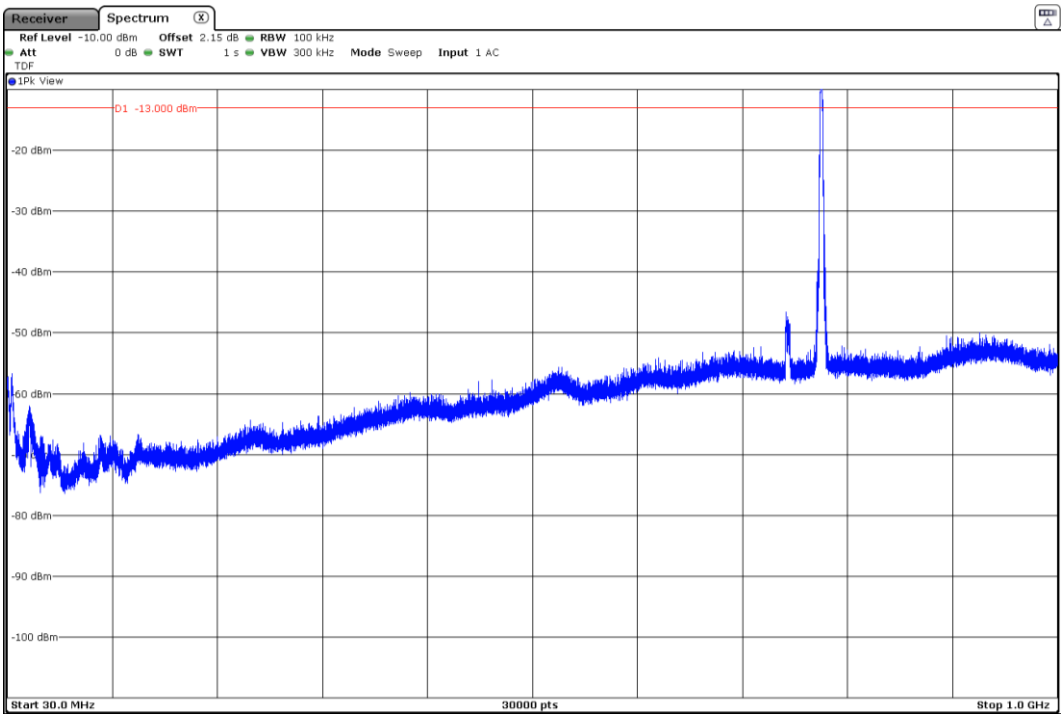
QPSK MODULATION

- Lowest Channel:



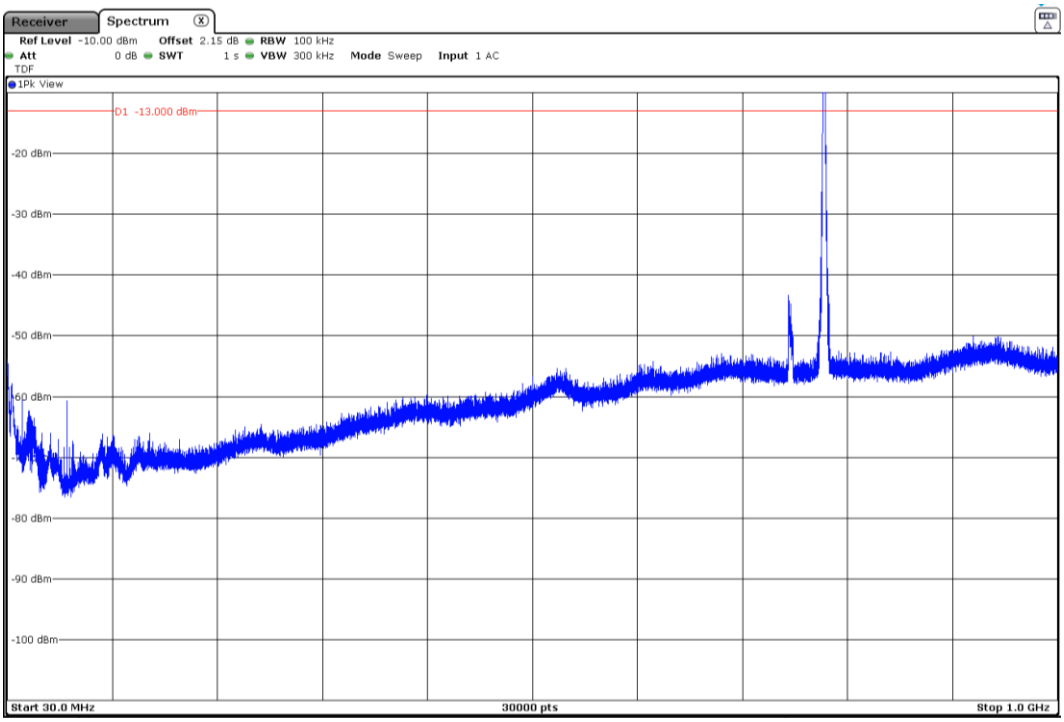
The peak above the limit is the carrier frequency:

- Middle Channel:



The peak above the limit is the carrier frequency:

- Highest Channel:

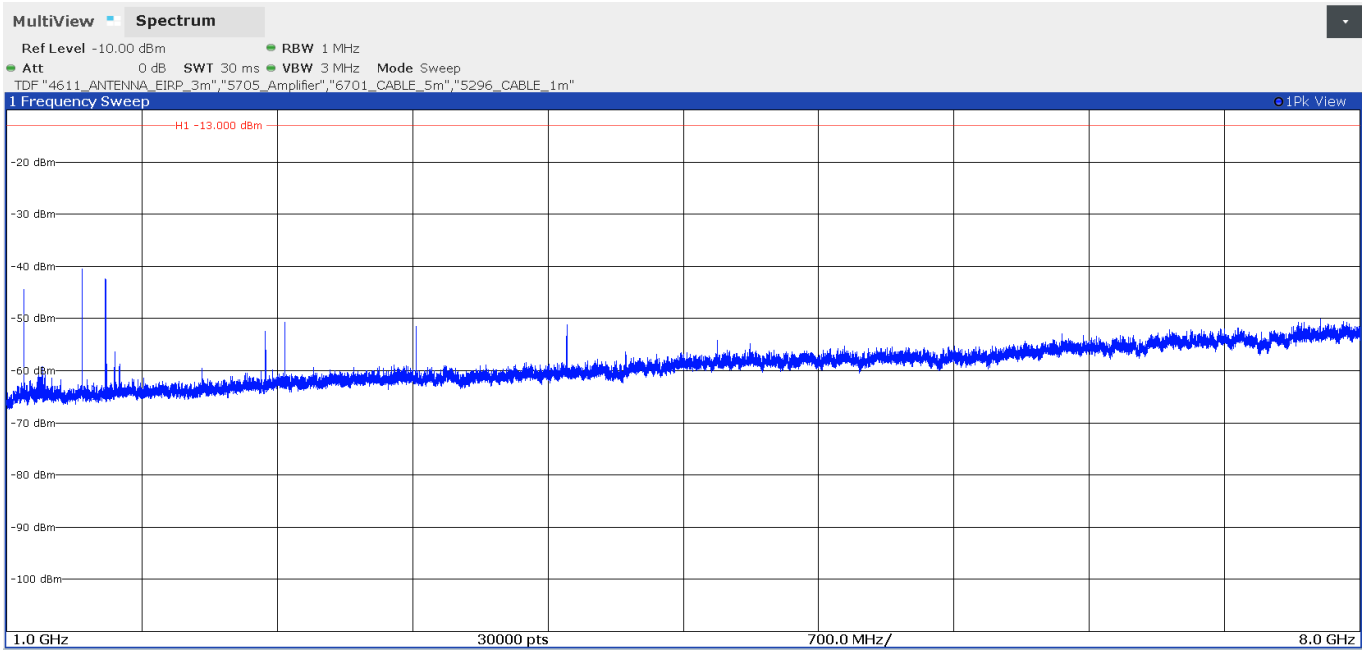


The peak above the limit is the carrier frequency:

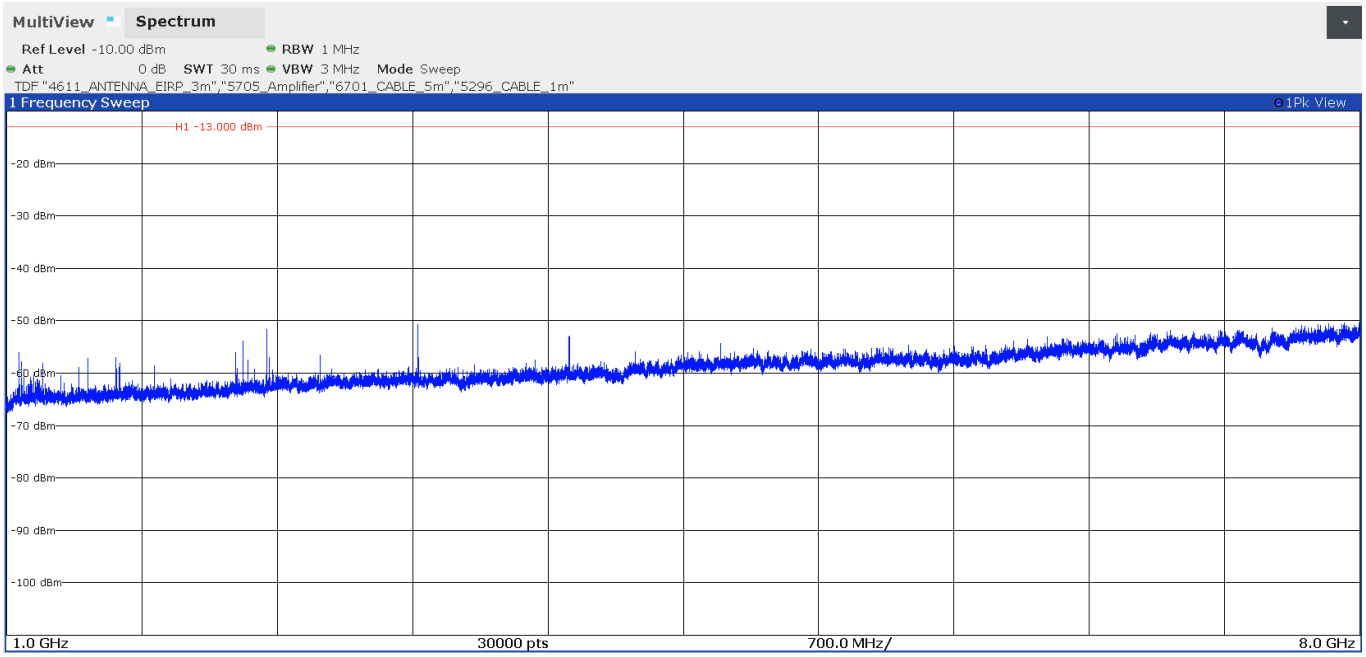
FREQUENCY RANGE 1 - 8 GHz

QPSK MODULATION

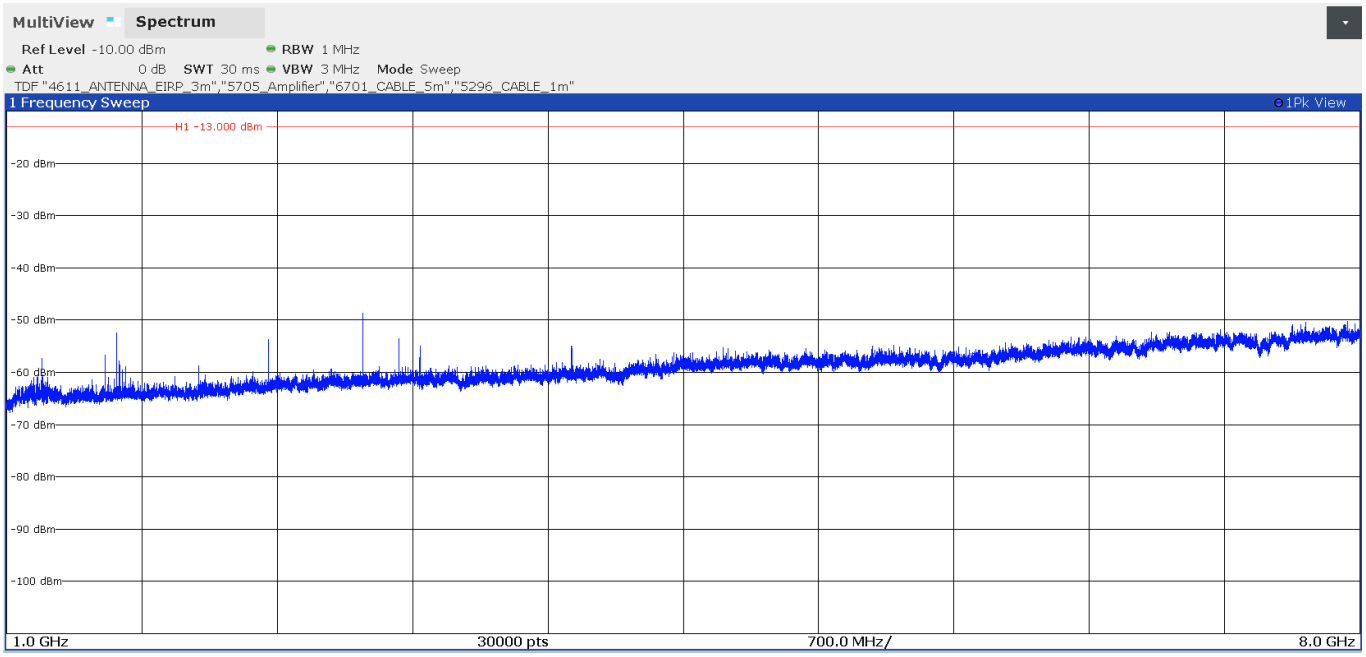
- Lowest Channel:



- Middle Channel:



- Highest Channel:



16QAM:
A preliminary scan determined BW=5 MHz, RB Size=1, RB Offset=12 as the worst case. The following tables and plots show the results for the worst case modulation

- Lowest Channel:

Frequency range 30 MHz - 1 GHz

No spurious frequencies at less than 20 dB below the limit.

Frequency range 1 - 8 GHz

No spurious frequencies at less than 20 dB below the limit.

- Middle Channel:

Frequency range 30 MHz - 1 GHz

No spurious frequencies at less than 20 dB below the limit.

Frequency range 1 - 8 GHz

No spurious frequencies at less than 20 dB below the limit.

- Highest Channel:

Frequency range 30 MHz - 1 GHz

No spurious frequencies at less than 20 dB below the limit.

Frequency range 1 - 8 GHz

No spurious frequencies at less than 20 dB below the limit.

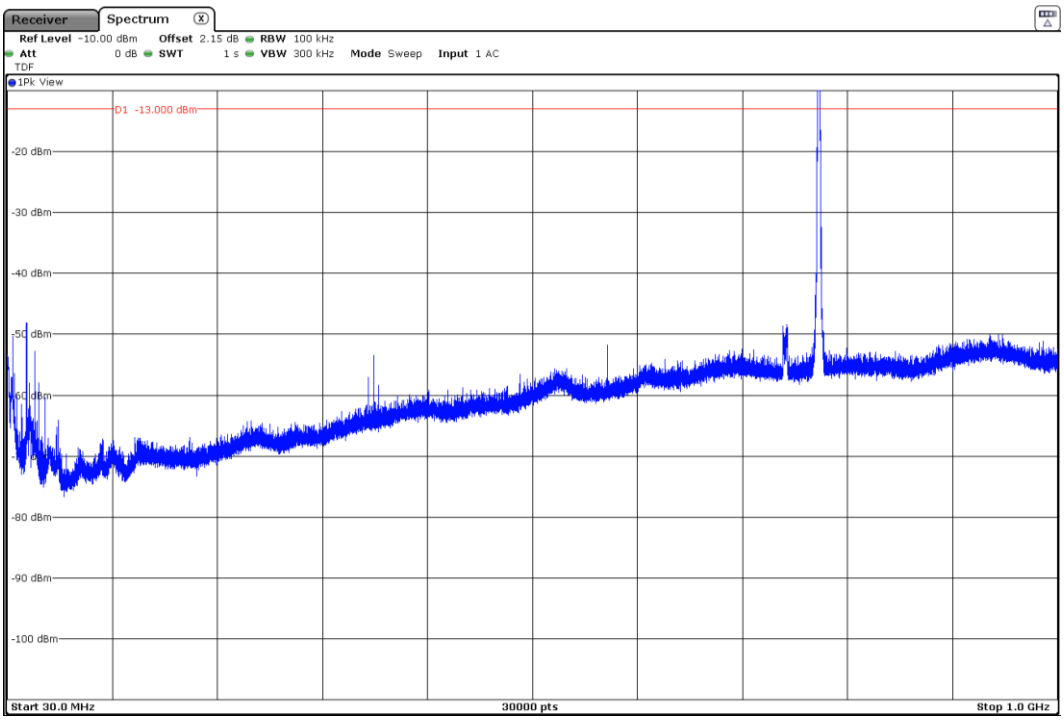
Measurement Uncertainty (dB): <± 4.68 for f ≥ 30 MHz up to 1 GHz
<± 4.99 for f ≥ 1 GHz up to 8 GHz

Verdict: PASS

FREQUENCY RANGE 30 MHz - 1 GHz

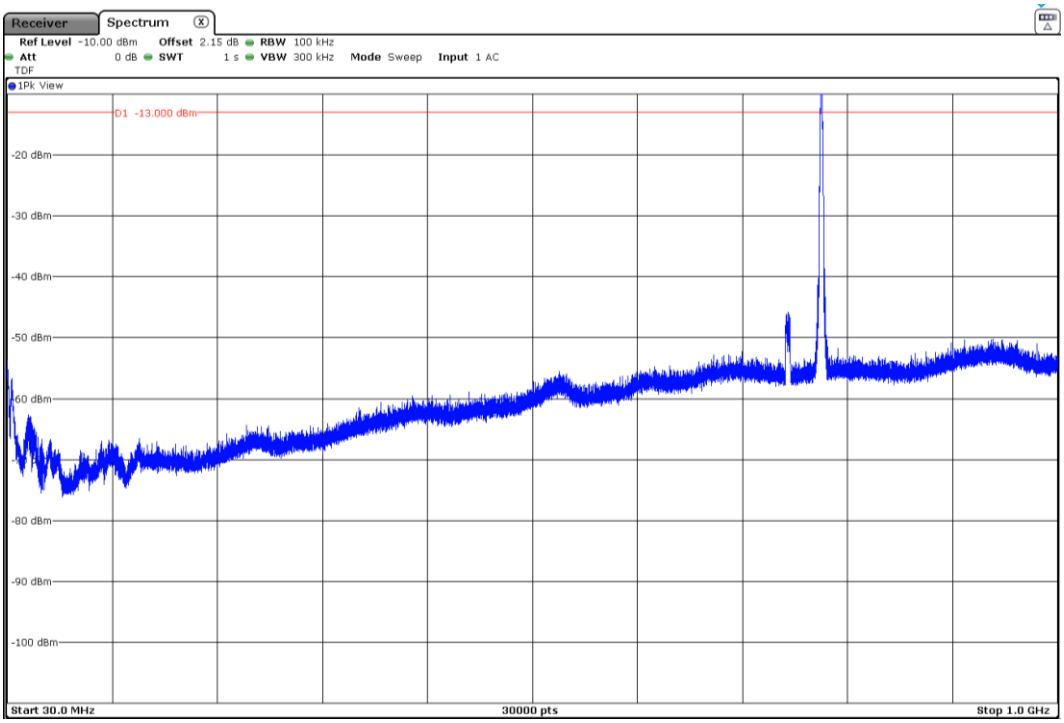
16QAM MODULATION

- Lowest Channel:



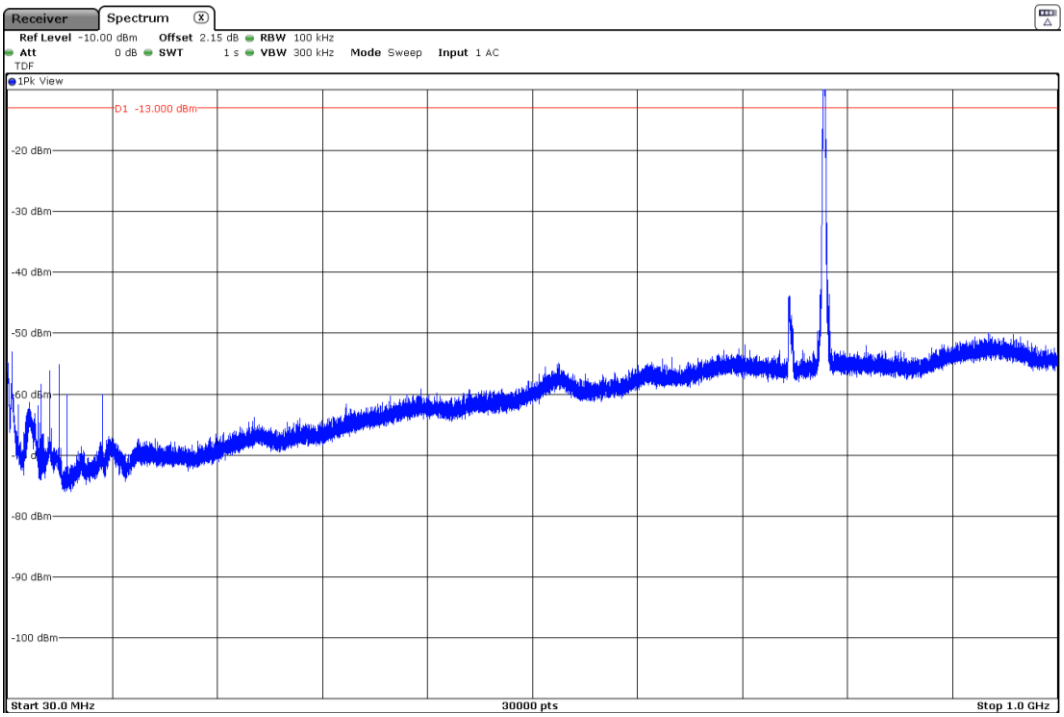
The peak above the limit is the carrier frequency:

- Middle Channel:



The peak above the limit is the carrier frequency:

- Highest Channel:

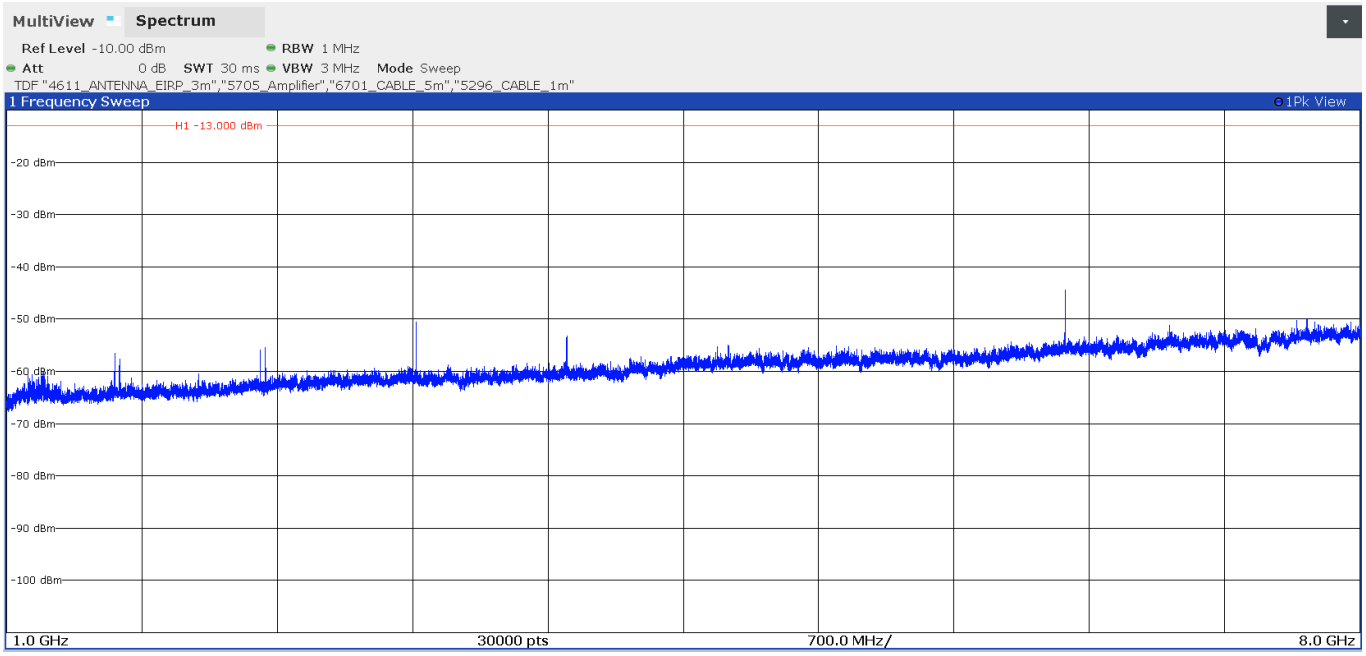


The peak above the limit is the carrier frequency:

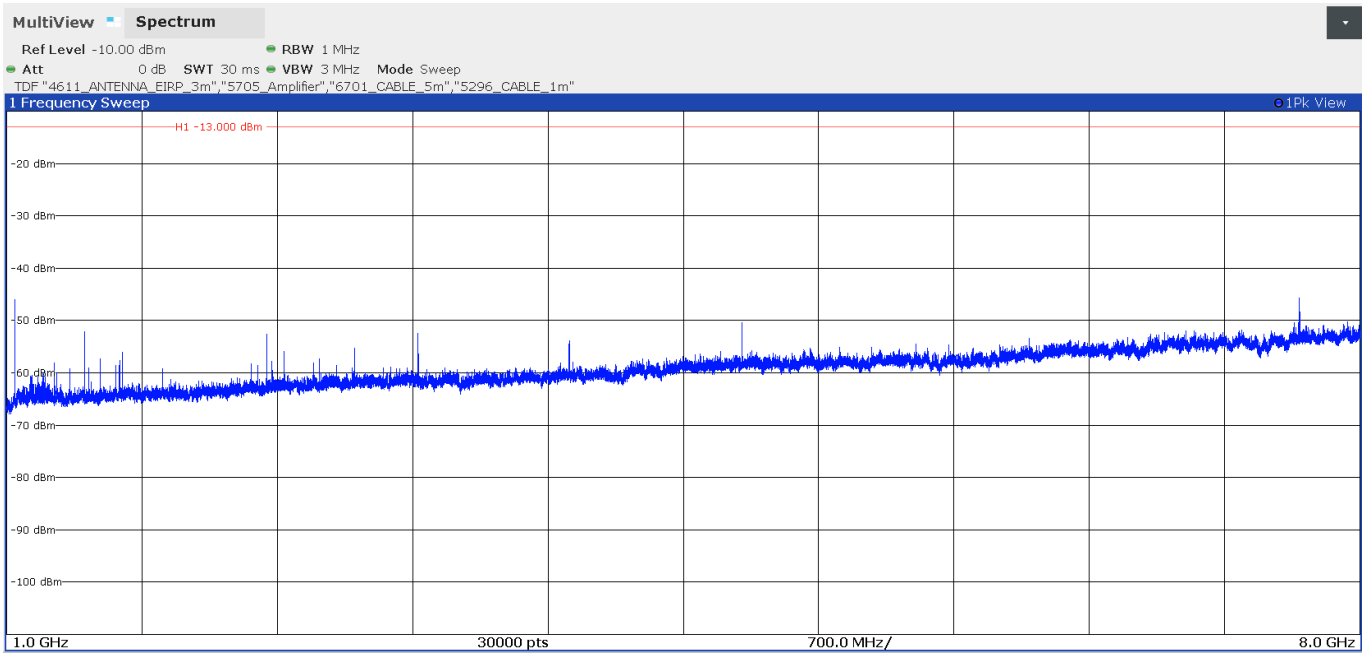
FREQUENCY RANGE 1 - 8 GHz

16QAM MODULATION

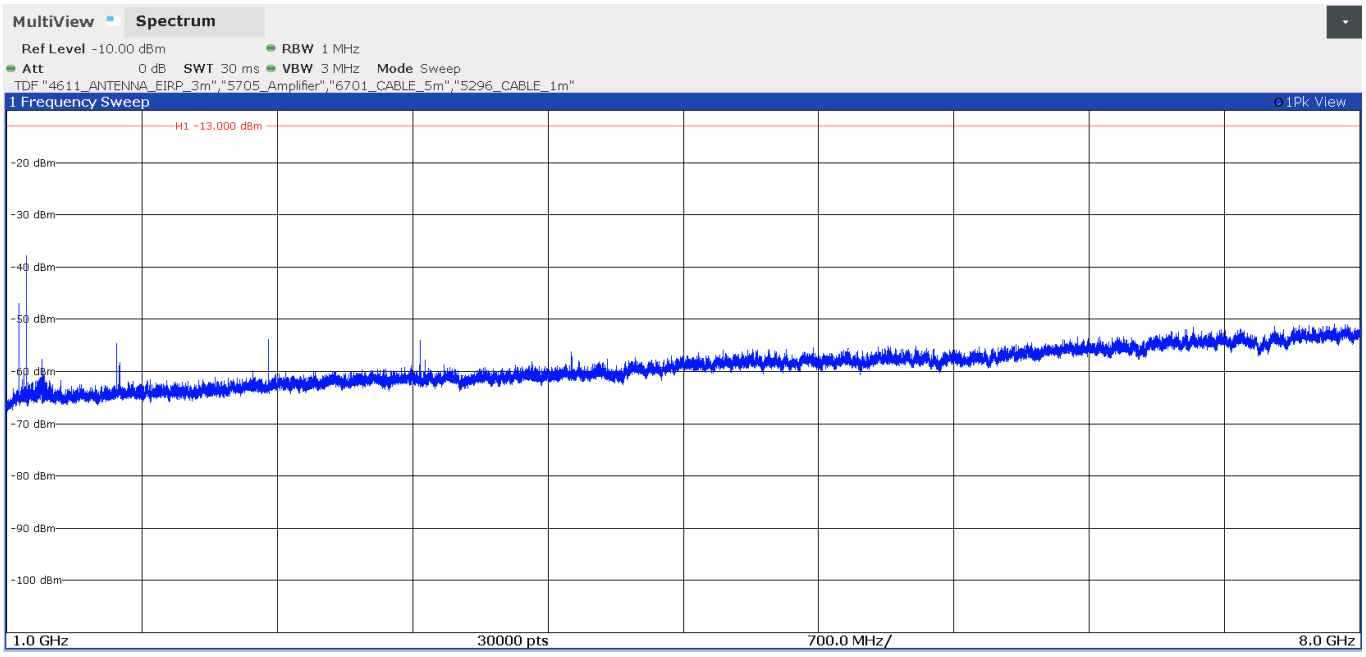
- Lowest Channel:



- Middle Channel:



- Highest Channel:



LTE Band 41:

QPSK:
A preliminary scan determined BW=5 MHz, RB Size=1, RB Offset=12 as the worst case. The following tables and plots show the results for the worst case modulation

- Lowest Channel:

Frequency range 30 MHz - 1 GHz

No spurious frequencies at less than 20 dB below the limit.

Frequency range 1 - 26 GHz

Spurious frequencies detected at less than 20 dB below the limit:

Spurious frequency (MHz)	Detector	E.I.R.P (dBm)	Polarization
4997.25	RMS	-54.75	V
7495.75	RMS	-49.4	V
9994.25	RMS	-36.62	V

Frequency range 2490.5 - 2496 MHz

No spurious frequencies at less than 20 dB below the limit.

- Middle Channel:

Frequency range 30 MHz - 1 GHz

No spurious frequencies at less than 20 dB below the limit.

Frequency range 1 - 26 GHz

Spurious frequencies detected at less than 20 dB below the limit:

Spurious frequency (MHz)	Detector	E.I.R.P (dBm)	Polarization
5186.25	RMS	-51.57	V
7778.75	RMS	-45.67	V
10371.75	RMS	-32.23	V

Frequency range 2490.5 - 2496 MHz

No spurious frequencies at less than 20 dB below the limit.

- Highest Channel:

Frequency range 30 MHz - 1 GHz

No spurious frequencies at less than 20 dB below the limit.

Frequency range 1 - 26 GHz

Spurious frequencies detected at less than 20 dB below the limit:

Spurious frequency (MHz)	Detector	E.I.R.P (dBm)	Polarization
5374.75	RMS	-49.53	V
8062.25	RMS	-47.80	V
10749.75	RMS	-26.94	V

Frequency range 2490.5 - 2496 MHz

No spurious frequencies at less than 20 dB below the limit.

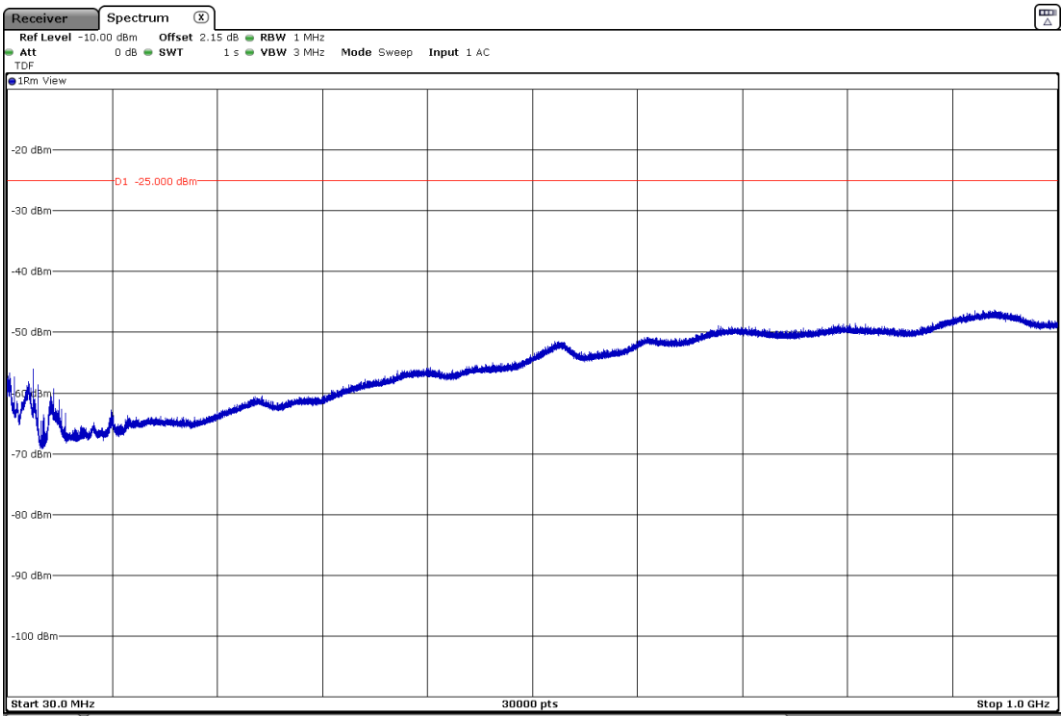
Measurement Uncertainty (dB): <± 4.68 for f ≥ 30 MHz up to 1 GHz
<± 4.00 for f ≥ 1 GHz up to 3 GHz
<± 4.99 for f ≥ 3 GHz up to 18 GHz
<± 5.08 for f ≥ 18 GHz up to 27 GHz

Verdict: PASS

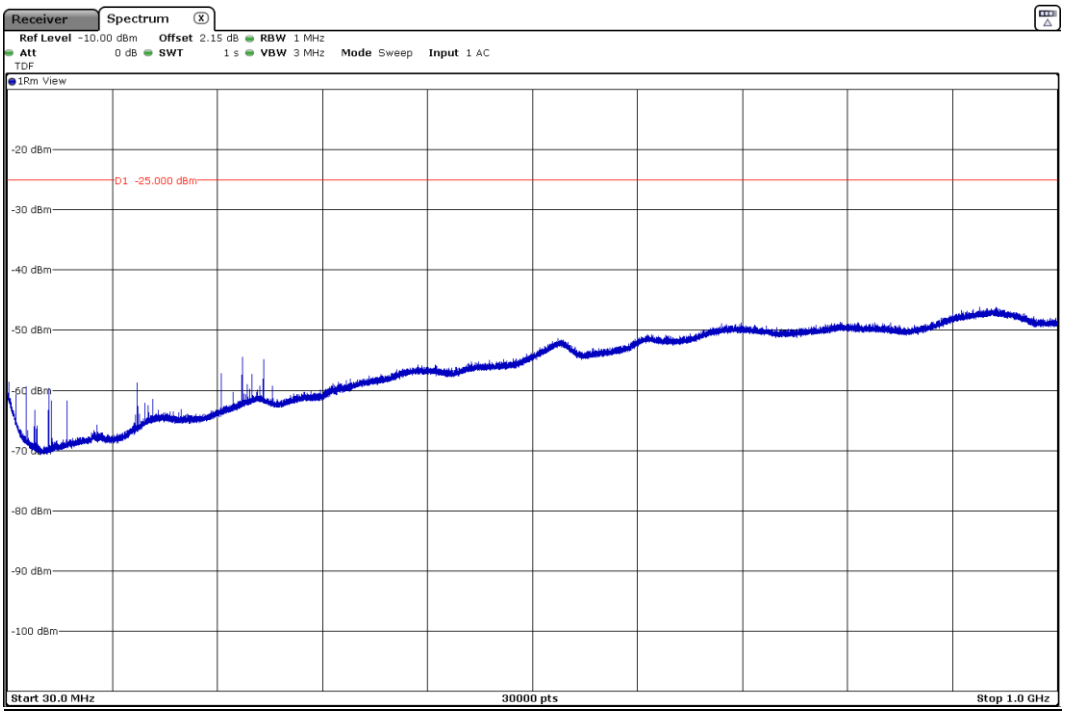
FREQUENCY RANGE 30 MHz - 1 GHz

QPSK MODULATION

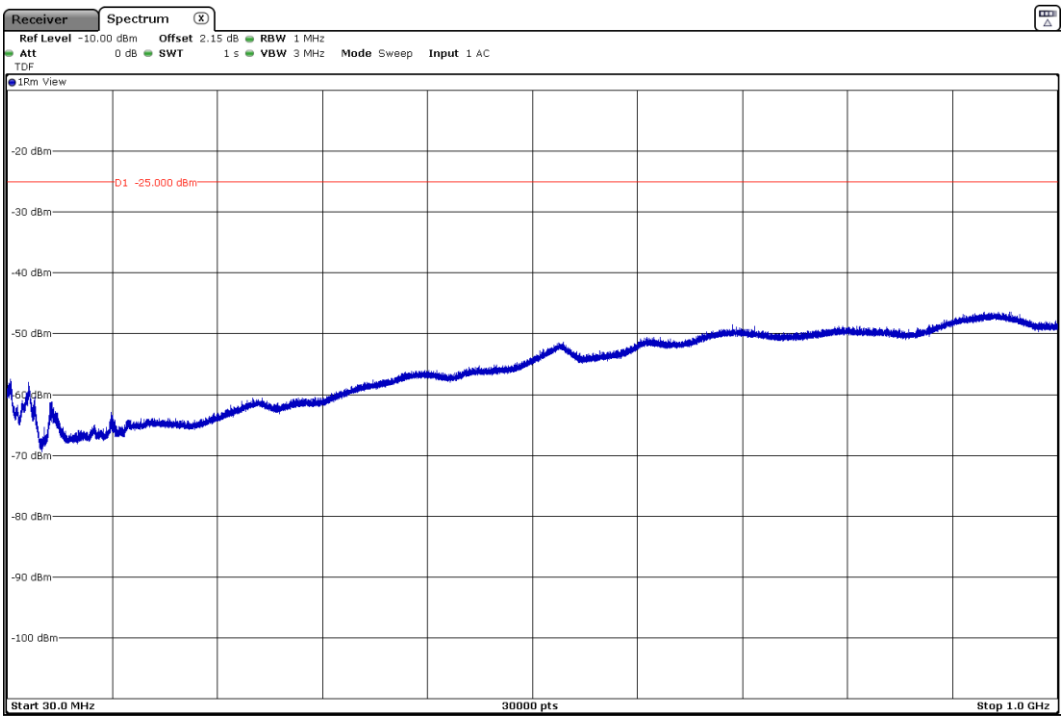
- Lowest Channel:



- Middle Channel:



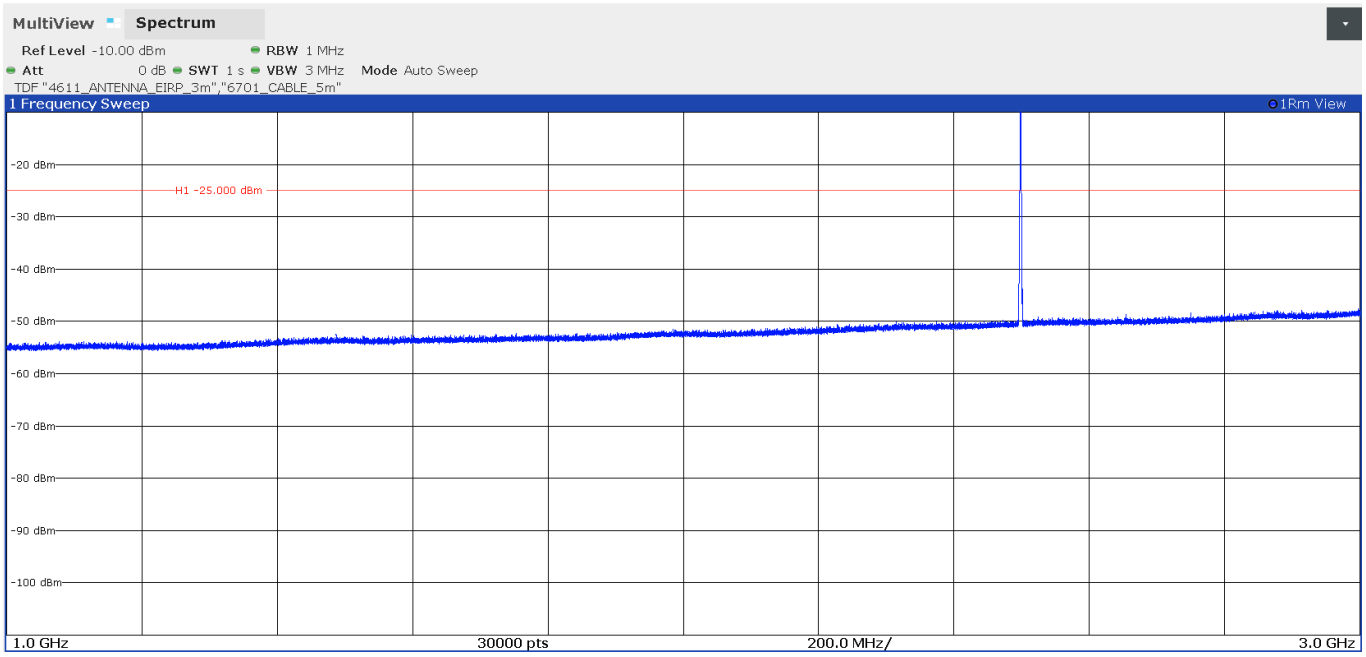
- Highest Channel:



FREQUENCY RANGE 1 - 3 GHz

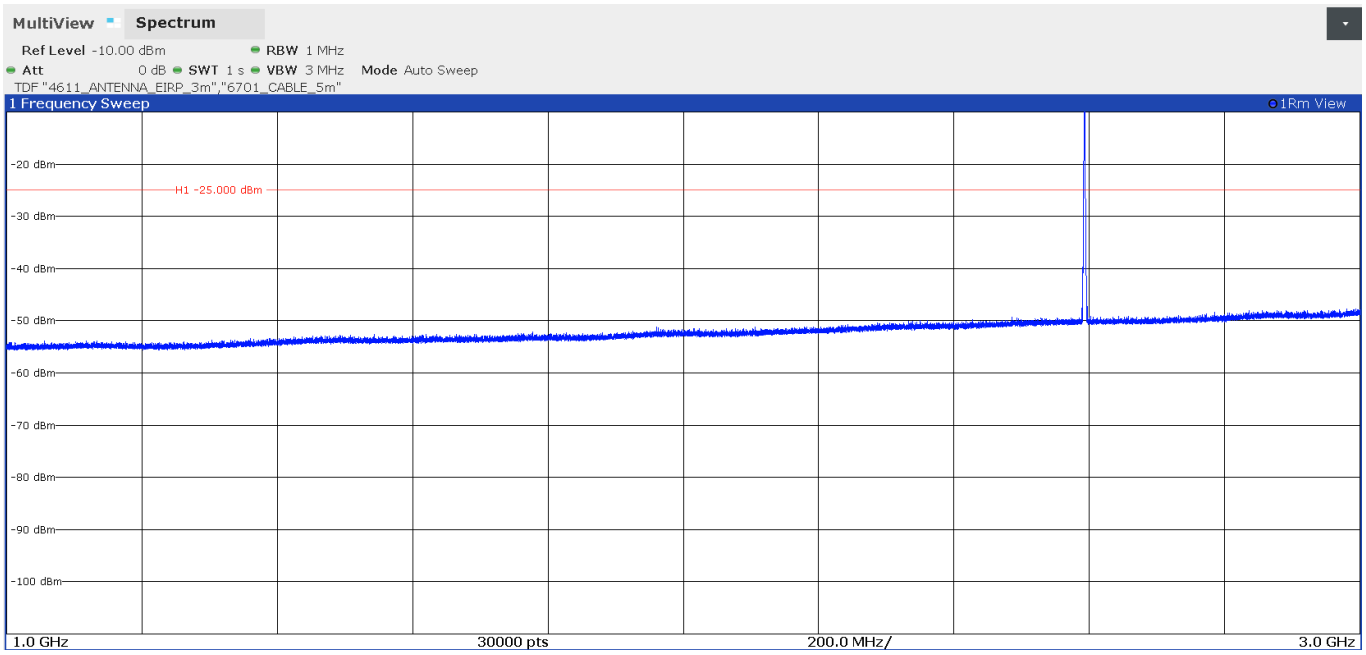
QPSK MODULATION

- Lowest Channel:



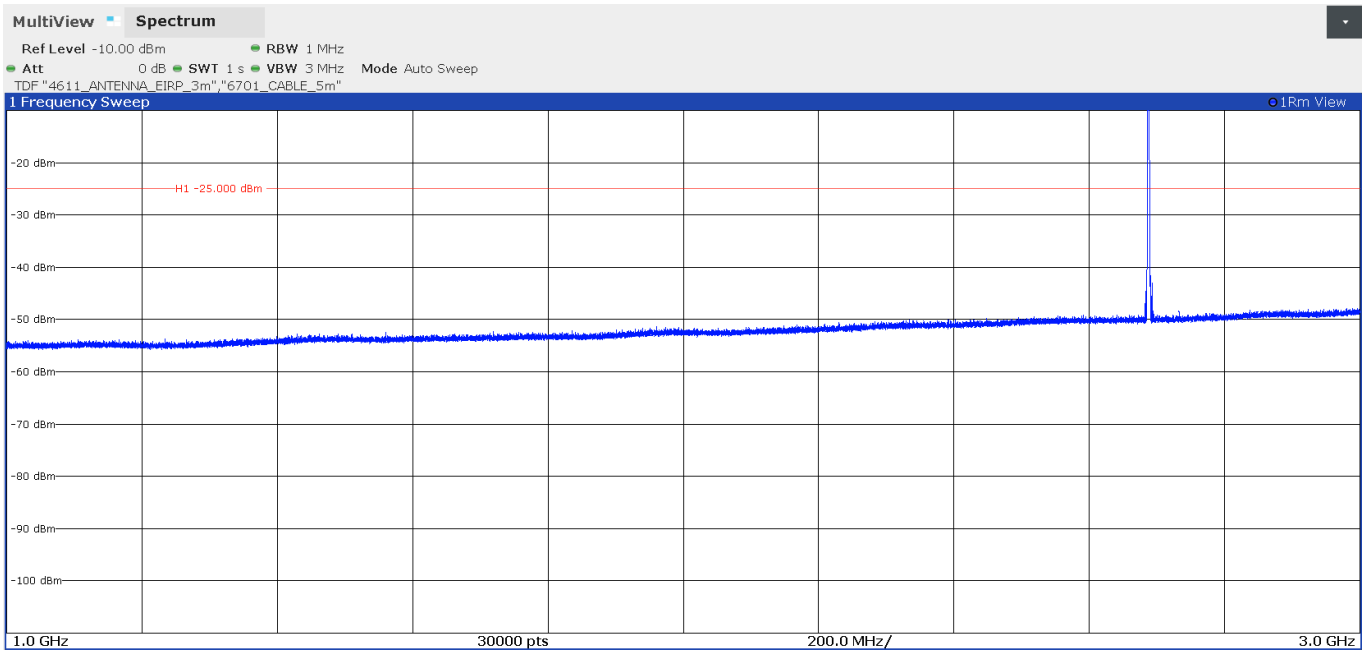
The peak above the limit is the carrier frequency:

- Middle Channel:



The peak above the limit is the carrier frequency:

- Highest Channel:

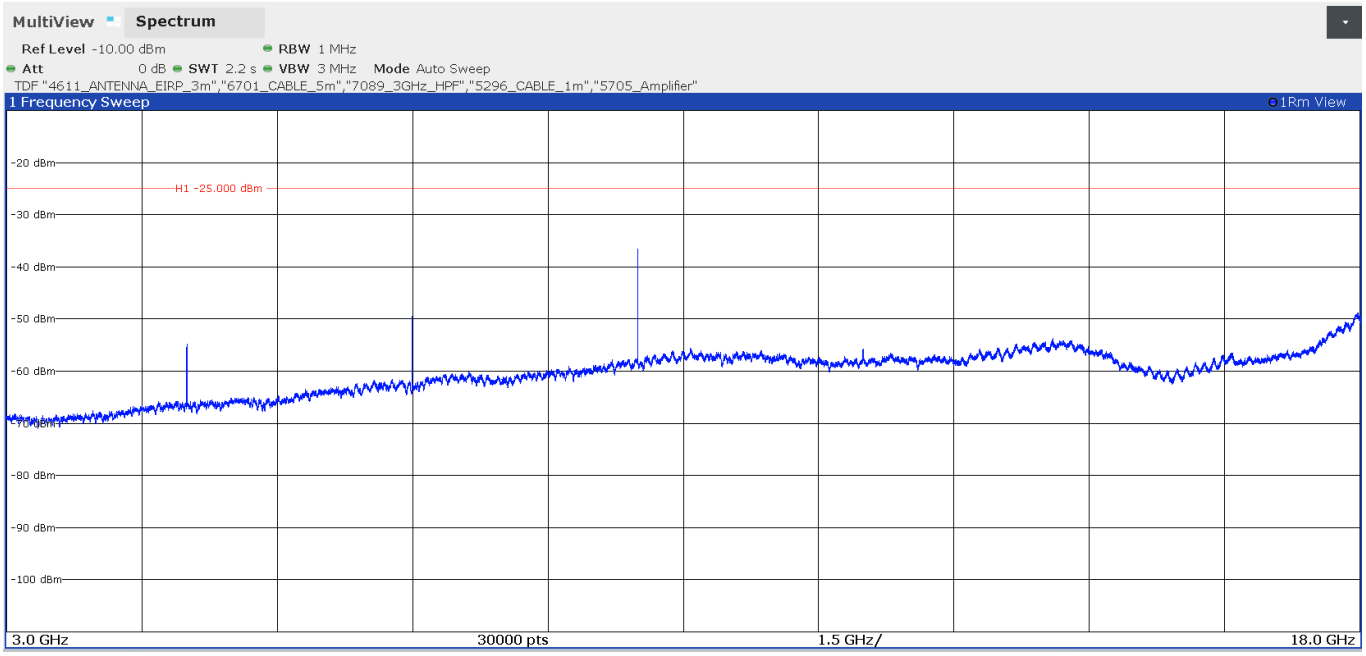


The peak above the limit is the carrier frequency:

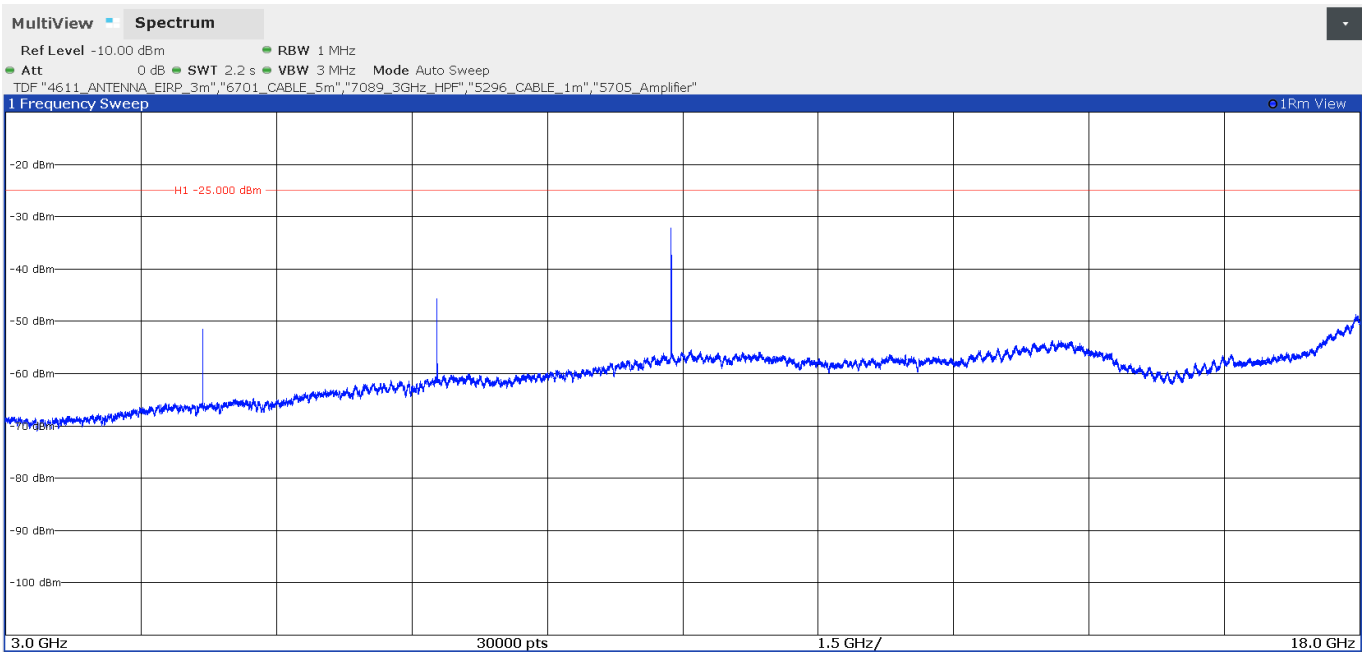
FREQUENCY RANGE 3 – 18 GHz

QPSK MODULATION

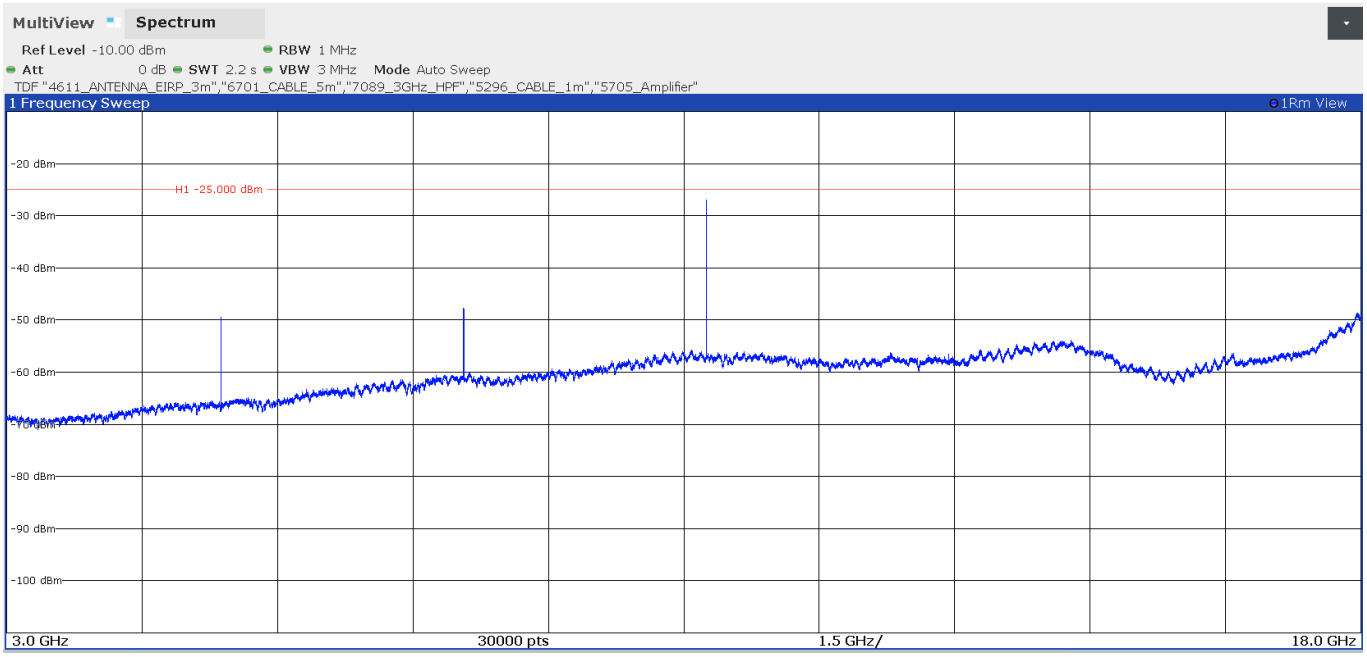
- Lowest Channel:



- Middle Channel:



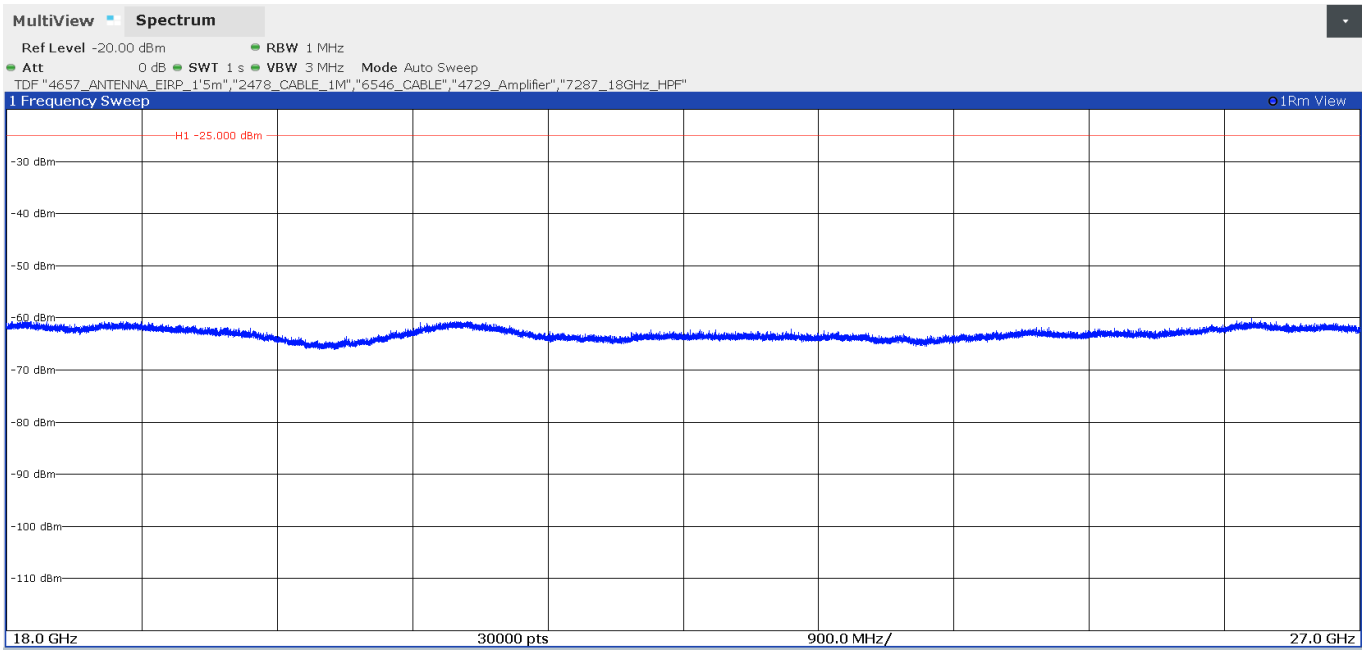
- Highest Channel:



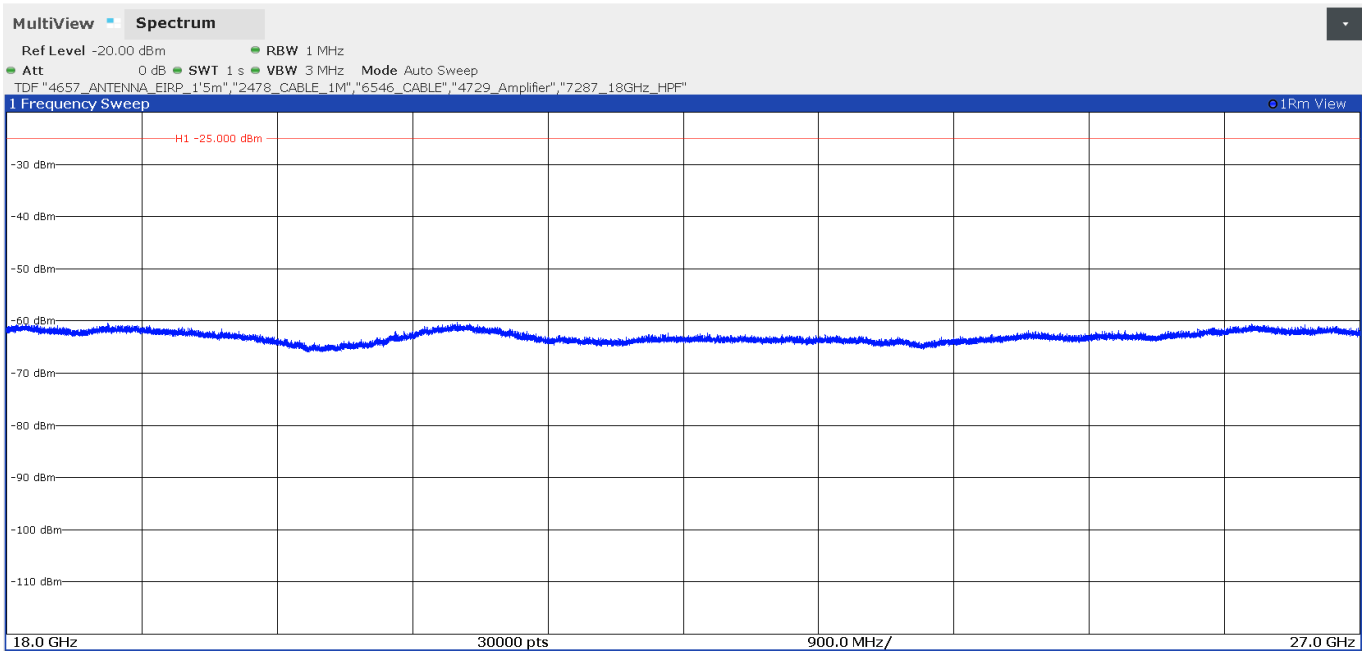
FREQUENCY RANGE 18 - 27 GHz

QPSK MODULATION

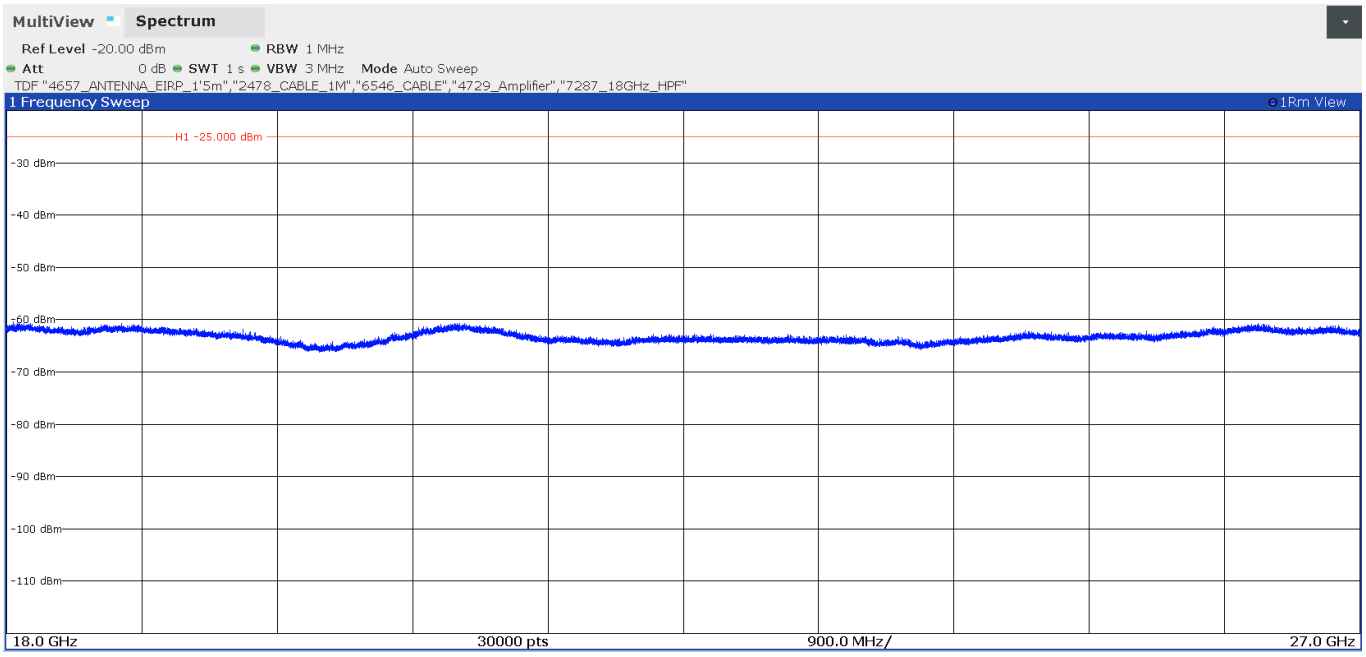
- Lowest Channel:



- Middle Channel:



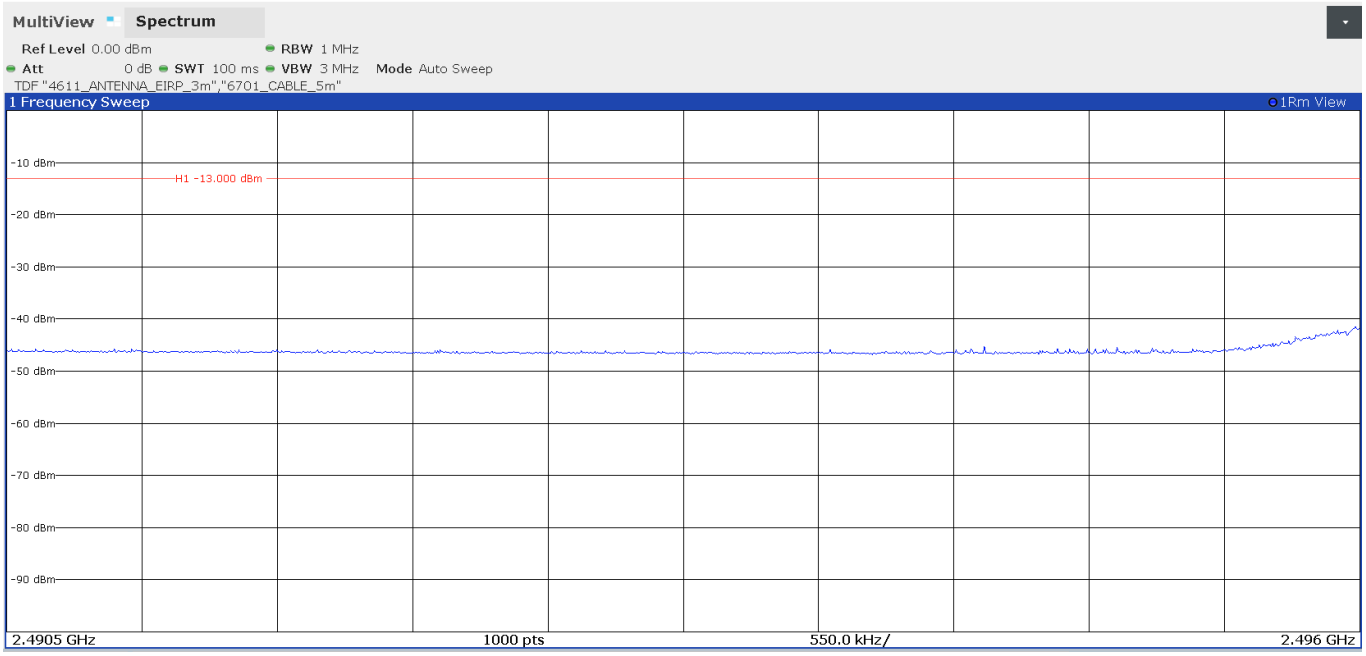
- Highest Channel:



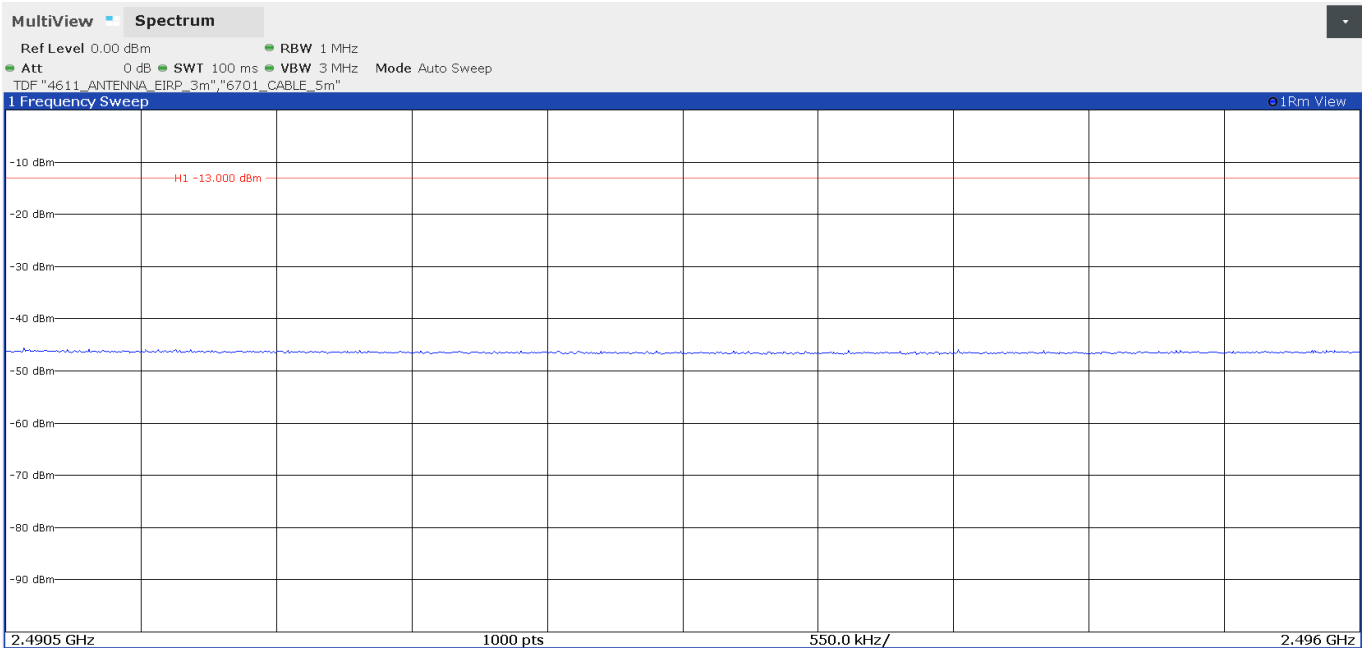
FREQUENCY RANGE 2490.5 - 2496 MHz

QPSK MODULATION

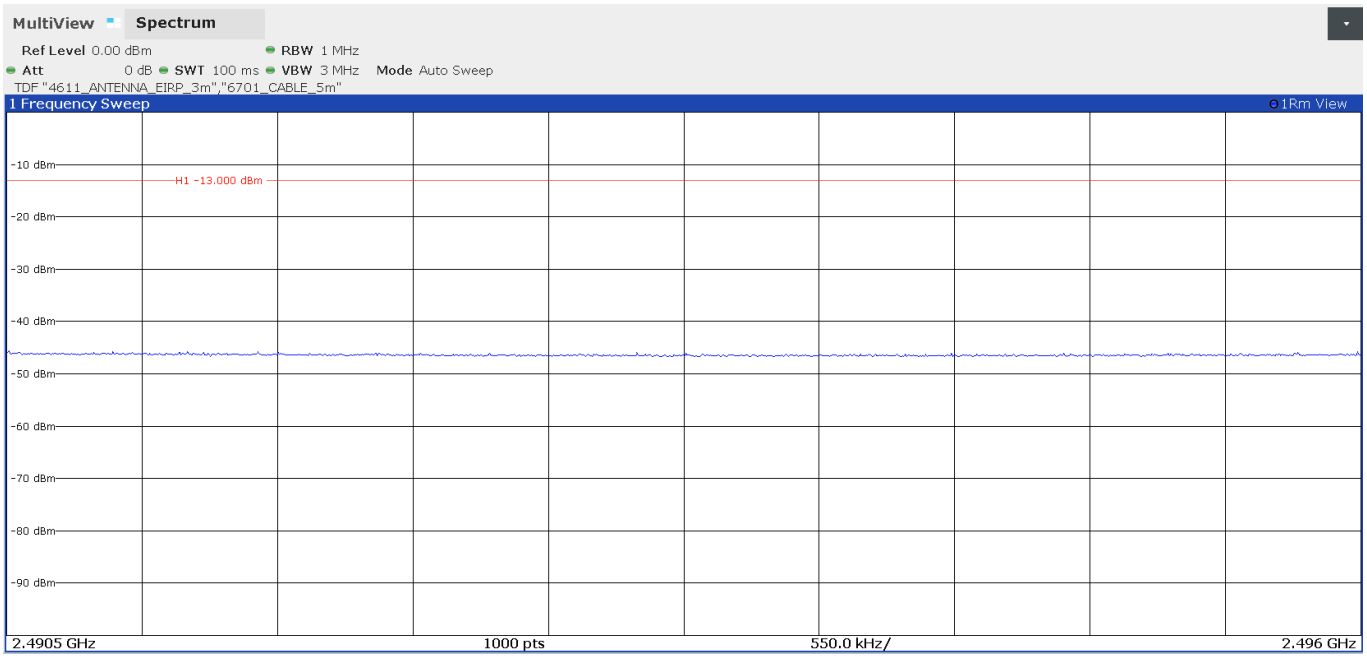
- Lowest Channel:



- Middle Channel:



- Highest Channel:



16QAM:
A preliminary scan determined BW=5 MHz, RB Size=1, RB Offset=12 as the worst case. The following tables and plots show the results for the worst case modulation

- Lowest Channel:

Frequency range 30 MHz - 1 GHz

No spurious frequencies at less than 20 dB below the limit.

Frequency range 1 - 26 GHz

Spurious frequencies detected at less than 20 dB below the limit:

Spurious frequency (MHz)	Detector	E.I.R.P (dBm)	Polarization
4996.75	RMS	-54.65	V
7495.75	RMS	-49.17	V
9993.75	RMS	-37.29	V

Frequency range 2490.5 - 2496 MHz

No spurious frequencies at less than 20 dB below the limit.

- Middle Channel:

Frequency range 30 MHz - 1 GHz

No spurious frequencies at less than 20 dB below the limit.

Frequency range 1 - 26 GHz

Spurious frequencies detected at less than 20 dB below the limit:

Spurious frequency (MHz)	Detector	E.I.R.P (dBm)	Polarization
5186.25	RMS	-52.06	V
7779.25	RMS	-47.78	V
10372.25	RMS	-32.85	V

Frequency range 2490.5 - 2496 MHz

No spurious frequencies at less than 20 dB below the limit.

- Highest Channel:

Frequency range 30 MHz - 1 GHz

No spurious frequencies at less than 20 dB below the limit.

Frequency range 1 - 26 GHz

Spurious frequencies detected at less than 20 dB below the limit:

Spurious frequency (MHz)	Detector	E.I.R.P (dBm)	Polarization
5375.5	RMS	-50.69	V
8062.25	RMS	-49.05	V
10750.25	RMS	-28.13	V

Frequency range 2490.5 - 2496 MHz

No spurious frequencies at less than 20 dB below the limit.

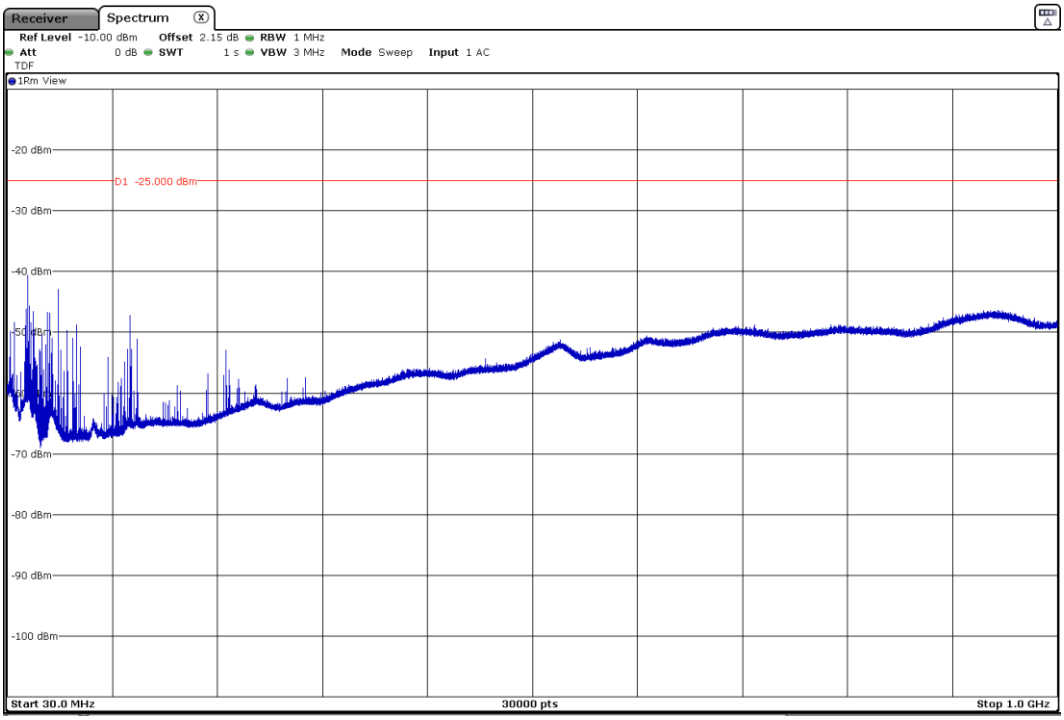
Measurement Uncertainty (dB): <± 4.68 for f ≥ 30 MHz up to 1 GHz
<± 4.00 for f ≥ 1 GHz up to 3 GHz
<± 4.99 for f ≥ 3 GHz up to 18 GHz
<± 5.08 for f ≥ 18 GHz up to 27 GHz

Verdict: PASS

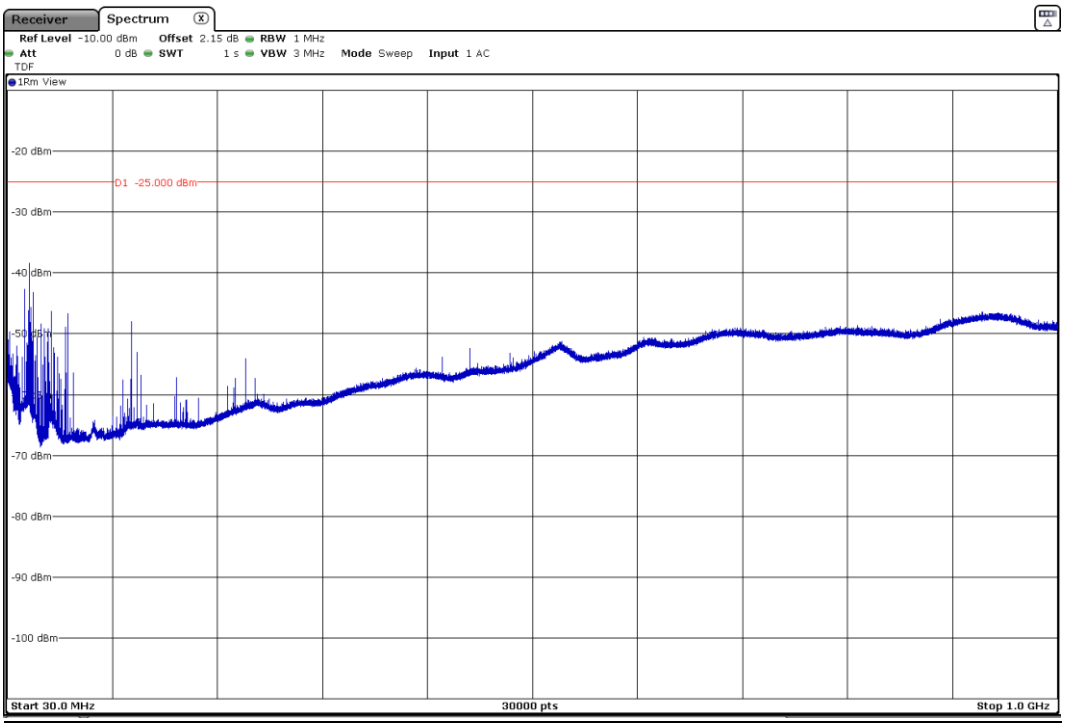
FREQUENCY RANGE 30 MHz - 1 GHz

16QAM MODULATION

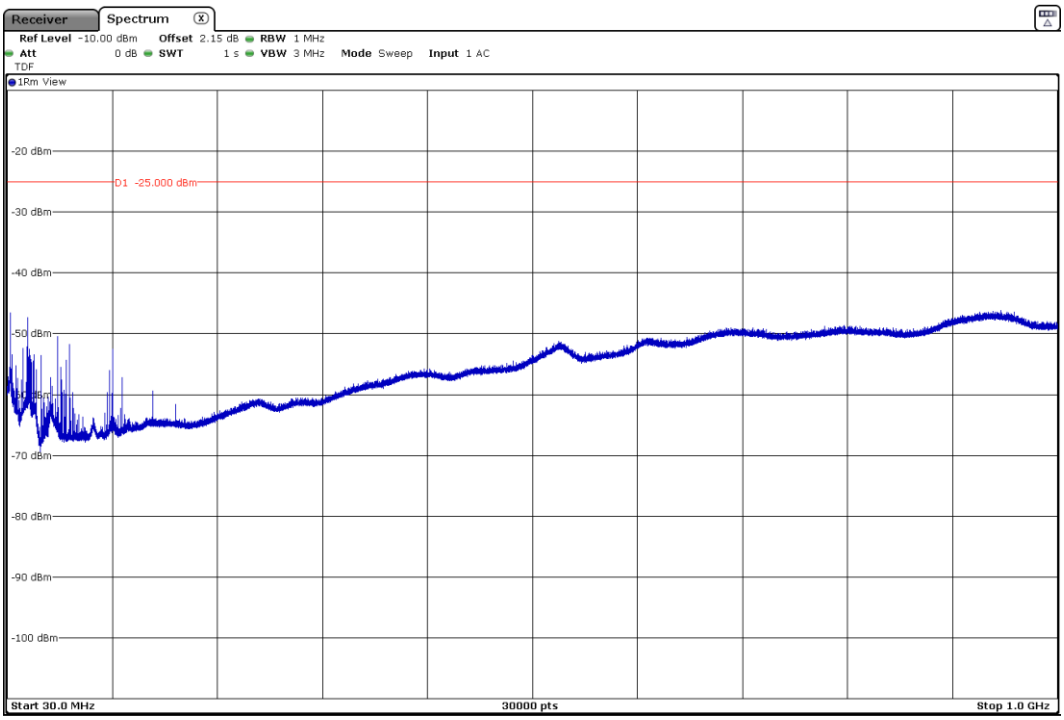
- Lowest Channel:



- Middle Channel:



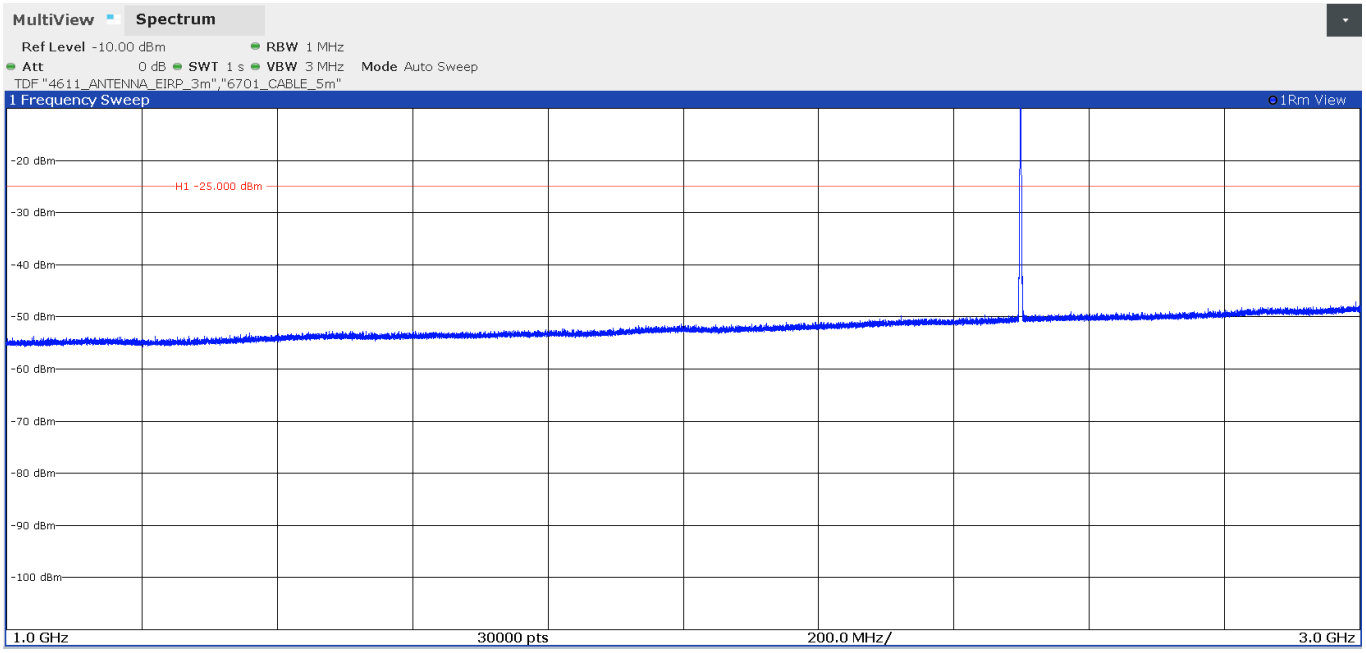
- Highest Channel:



FREQUENCY RANGE 1 - 3 GHz

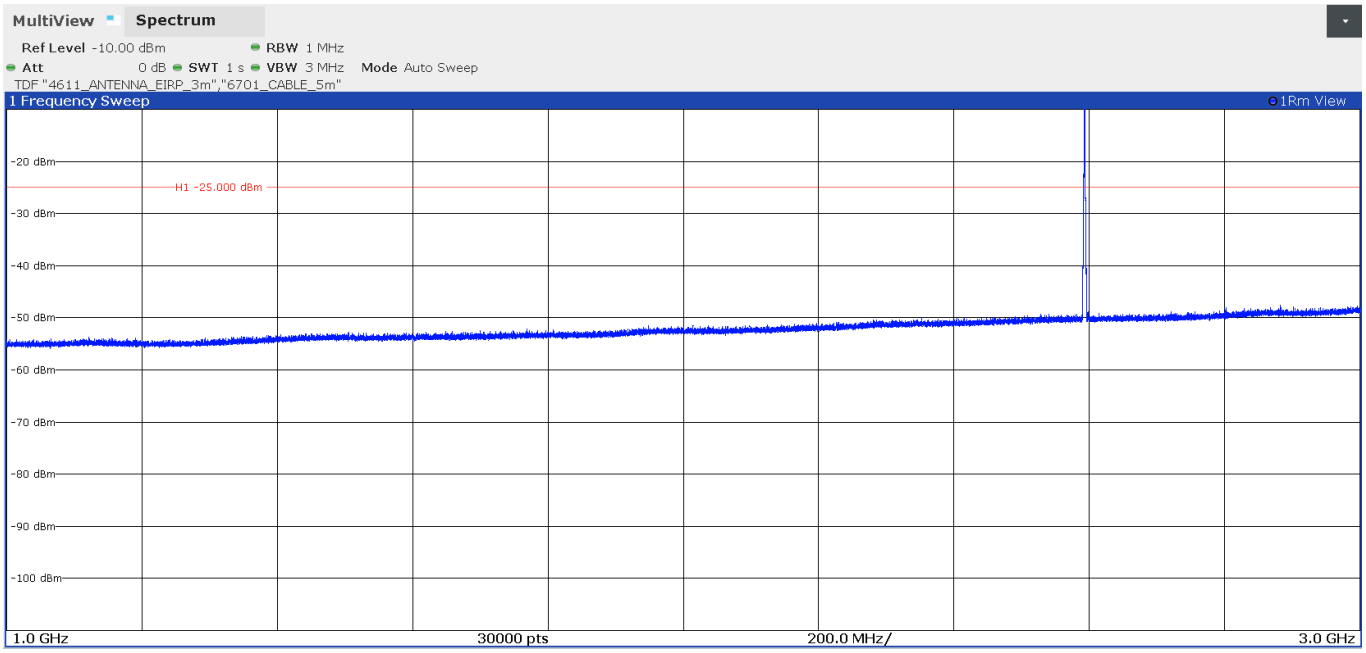
16QAM MODULATION

- Lowest Channel:



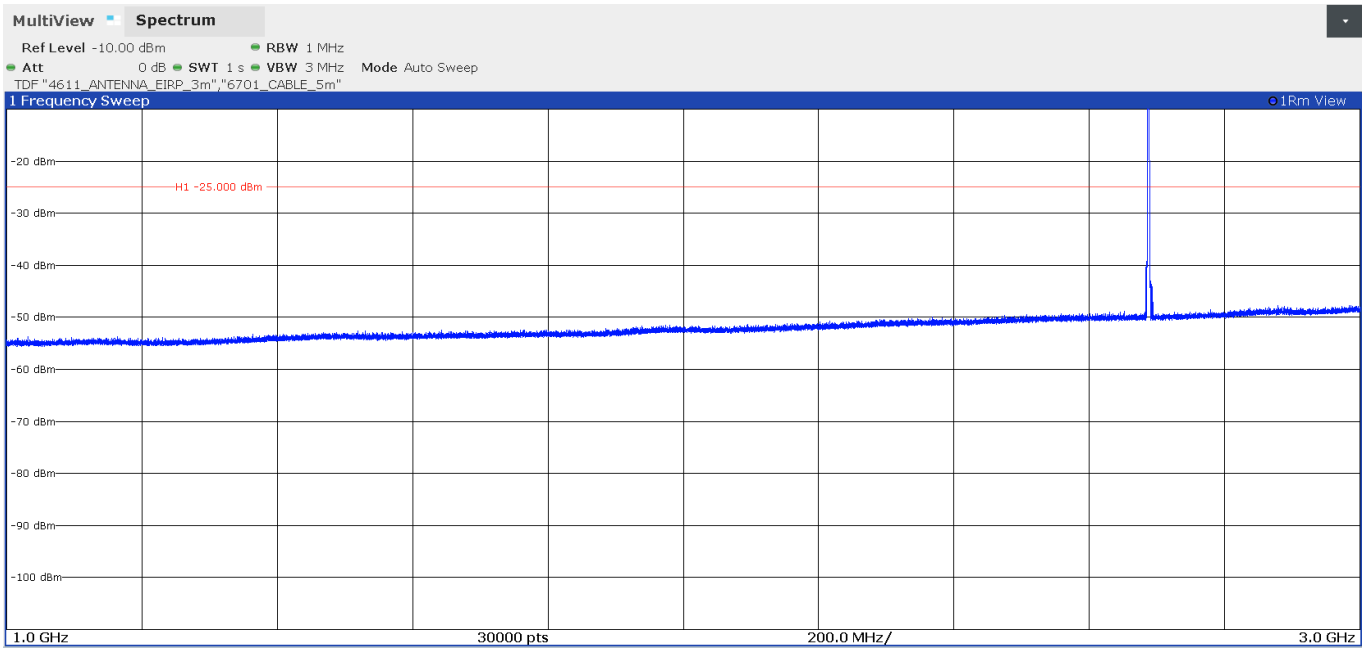
The peak above the limit is the carrier frequency:

- Middle Channel:



The peak above the limit is the carrier frequency:

- Highest Channel:

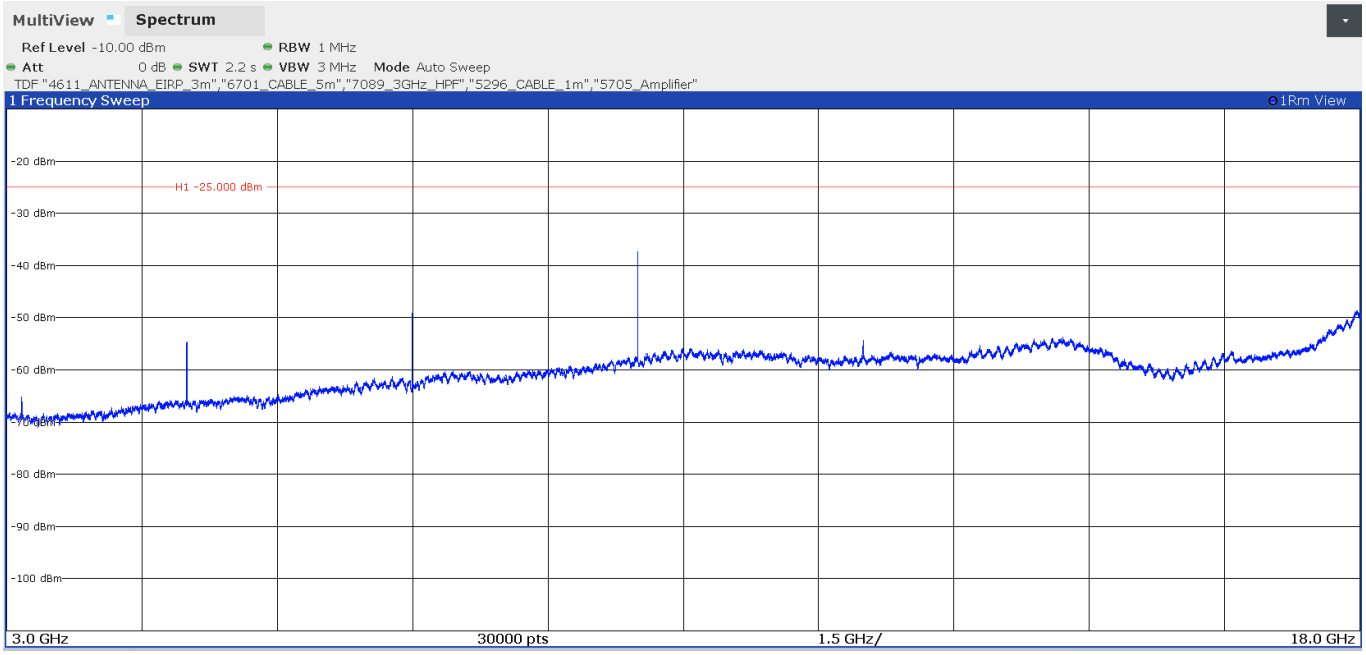


The peak above the limit is the carrier frequency:

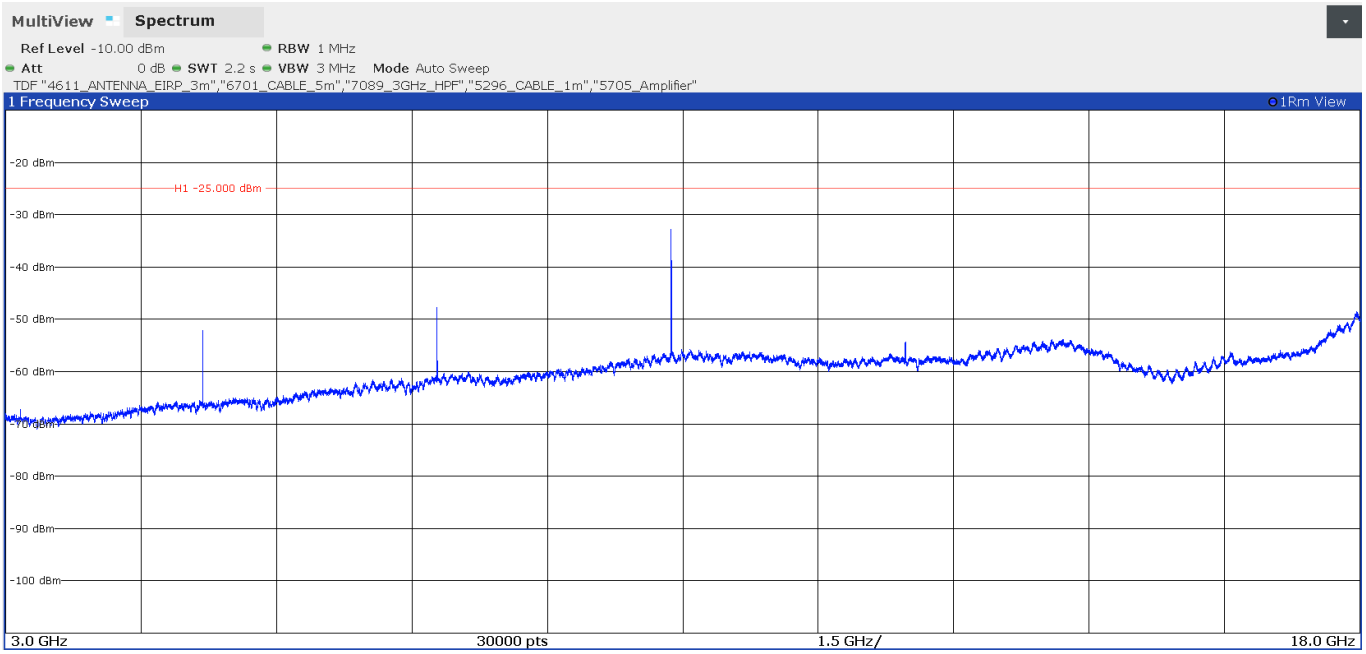
FREQUENCY RANGE 3 – 18 GHz

16QAM MODULATION

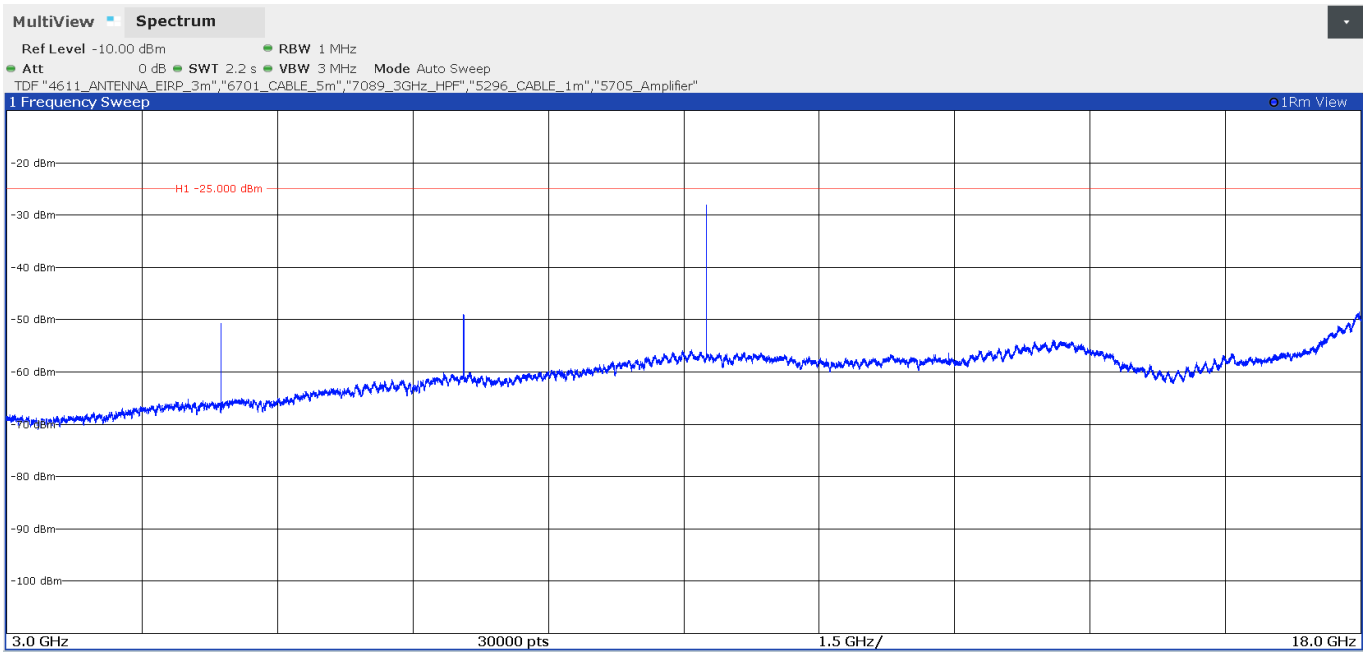
- Lowest Channel:



- Middle Channel:



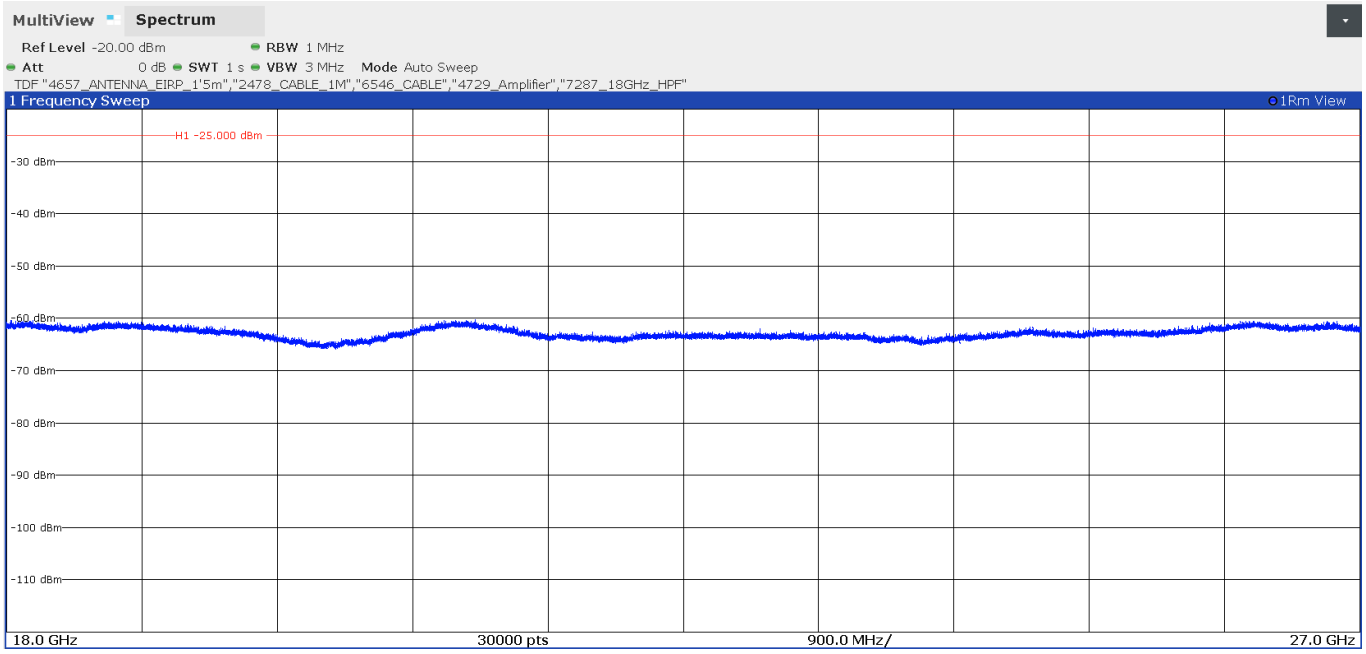
- Highest Channel:



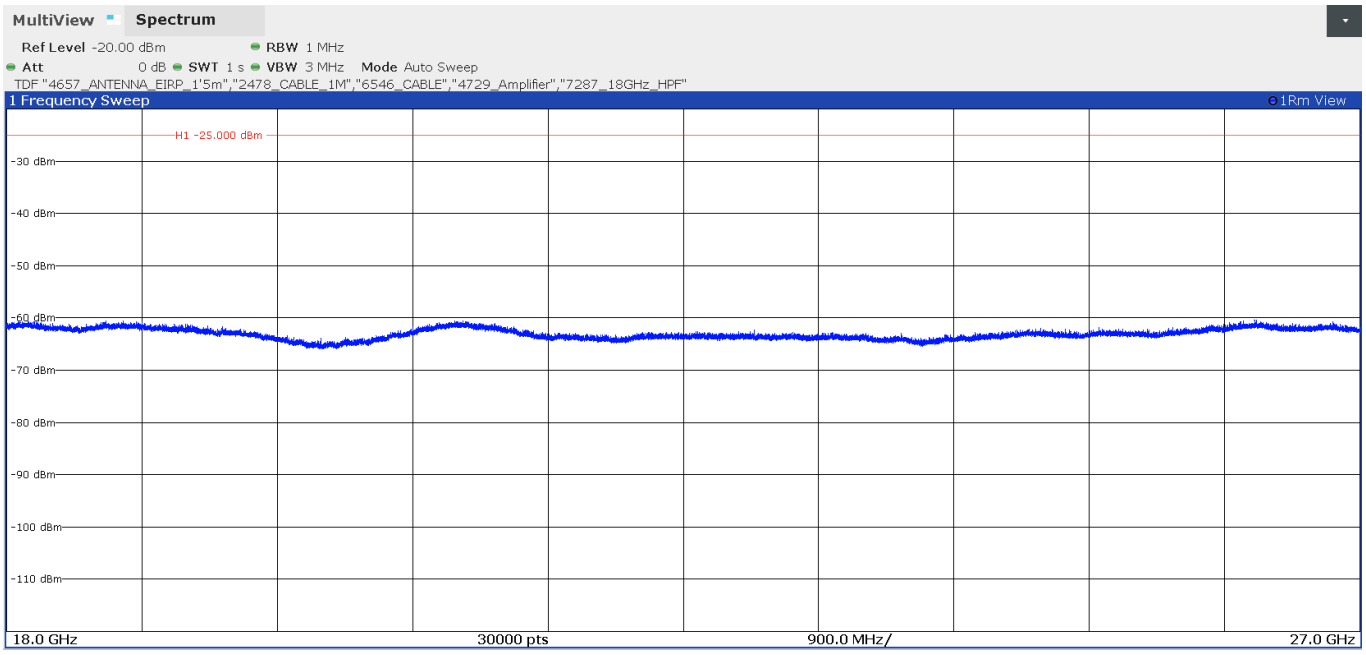
FREQUENCY RANGE 18 - 27 GHz

16QAM MODULATION

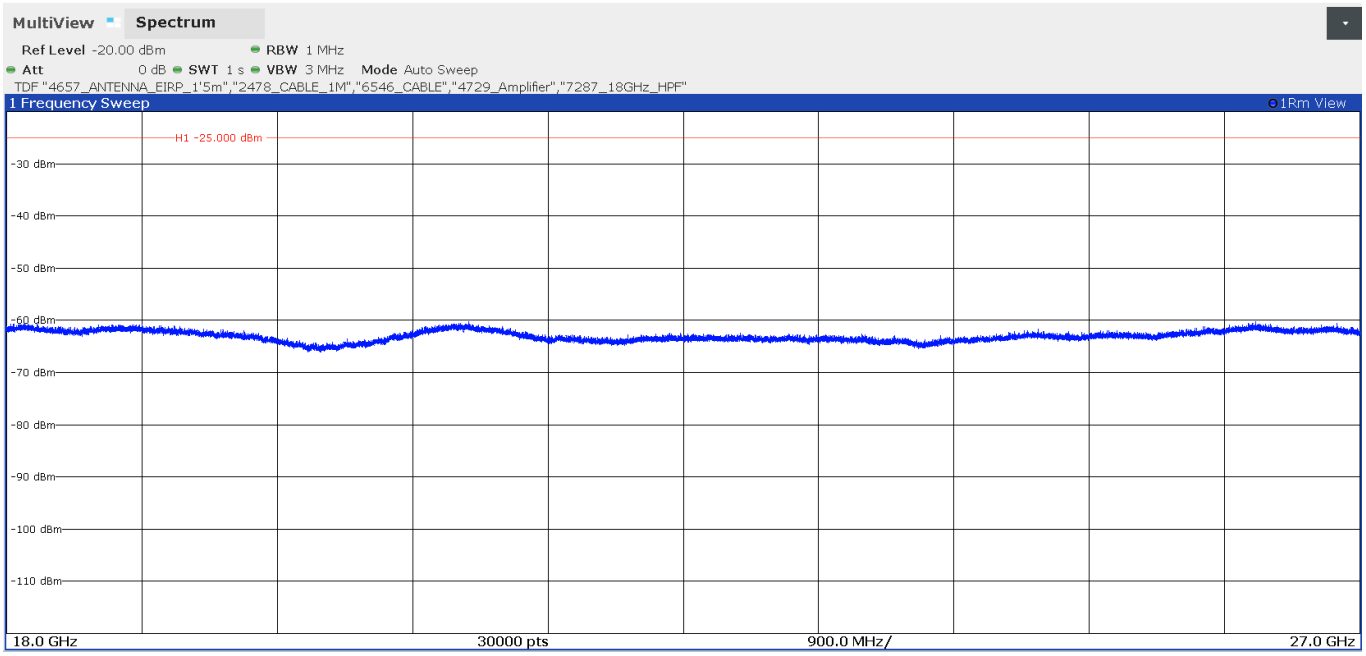
- Lowest Channel:



- Middle Channel:



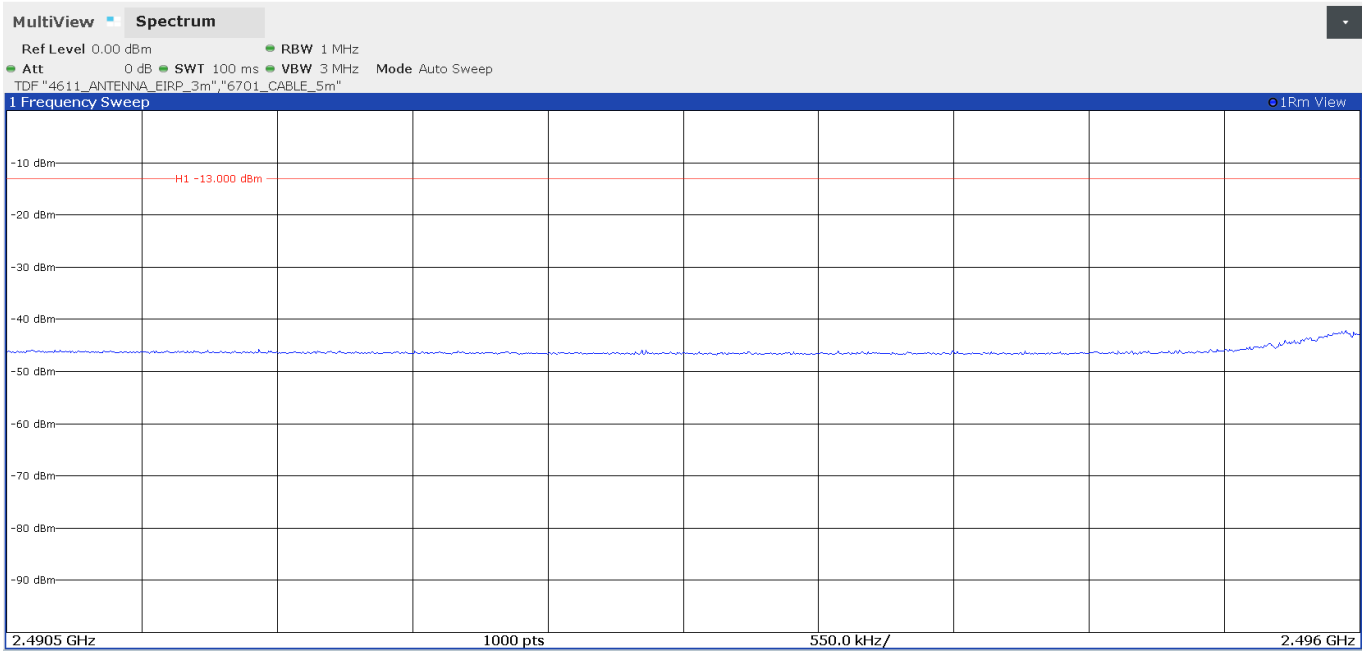
- Highest Channel:



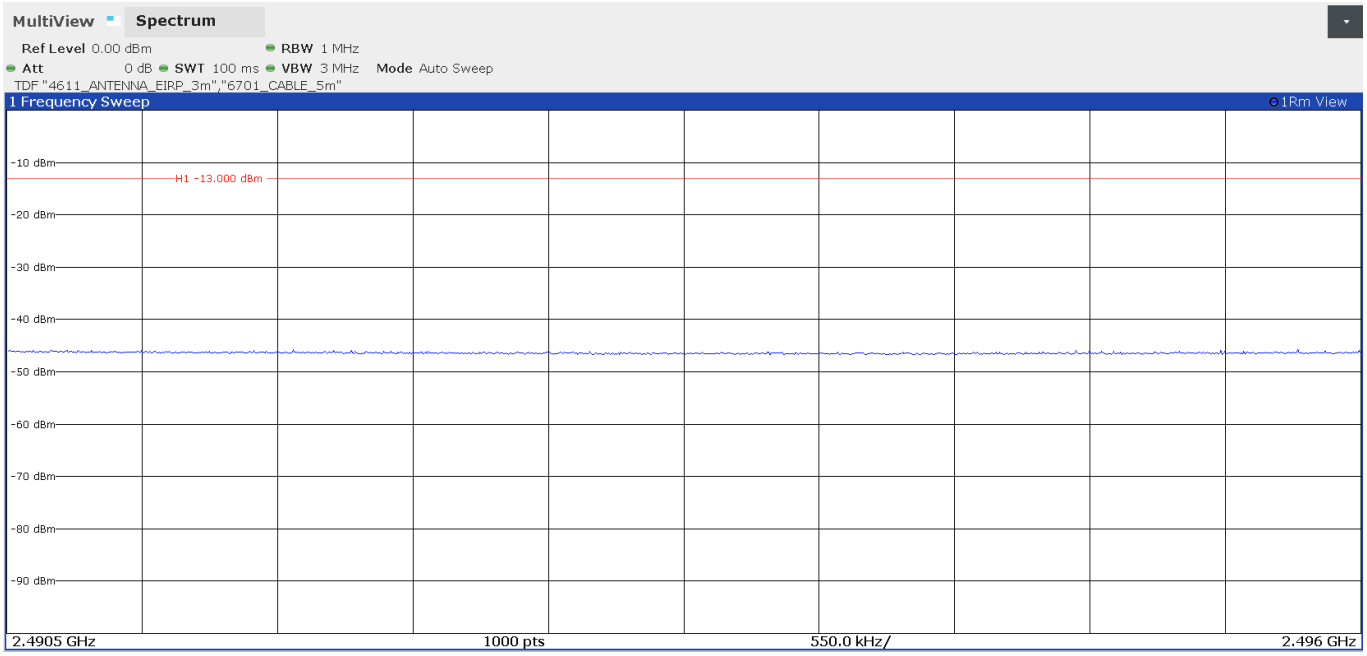
FREQUENCY RANGE 2490.5 - 2496 MHz

16QAM MODULATION

- Lowest Channel:



- Middle Channel:



- Highest Channel: