



FCC LISTED, REGISTRATION
NUMBER: 2764.01

Test report No:

ISED LISTED REGISTRATION
NUMBER: 23595-1

2209ERM.001A5

Test report
USA FCC Part 96
CITIZENS BROADBAND RADIO SERVICE DEVICES OPERATING WITHIN THE BAND
3550-3700 MHZ

Identification of item tested.....:	CPE8100
Trademark	Not provided
Model and /or type reference	CPE8100-PRO-1D-3.X
Other identification of the product	TBD
Final HW version	NA
Final SW version	01.01.02.133.10
Features	CBSD, Domain Proxy, LTE-TDD 48
Manufacturer	Telrad Networks Ltd. 1 Bat Sheva Street, P.O.B. 6118, Lod 711600, Israel
Test method requested, standard.....:	USA FCC Part 96 CITIZENS BROADBAND RADIO SERVICE DEVICES OPERATING WITHIN THE BAND 3550-3700 MHZ FCC KDB 940660 D01 Part 96 CBSD v01: Certification and Test Procedures for Citizens Broadband Radio Service Devices Authorized Under Part 96 of the Rules ANSI C63.26-2015: American National Standard for Compliance Testing of Transmitters Used in Licensed Radio Services
Summary	IN COMPLIANCE
Approved by (name / position & signature)	Domingo Galvez EMC & RF Lab. Manager
Date of issue.....:	02/04/2019
Report template No.....:	FDT08_20

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Competences and guarantees

DEKRA Certification Inc. is a testing laboratory accredited by A2LA (The American Association for Laboratory Accreditation), to perform the tests indicated in the Certificate 2764.01.

DEKRA Certification Inc. is a laboratory with a measurement facility in compliance with the requirements of Section 2.948 of the FCC rules and has been added to the list of facilities whose measurements data will be accepted in conjunction with applications for Certification under Parts 15 or 18 of the Commission's Rules. Registration Number: 2764.01.

DEKRA Certification Inc. is a laboratory with a measurement site in compliance with the requirements of RSS 212, Issue 1 (Provisional) and has been added to the list of filed sites of the Canadian Certification and Engineering Bureau. Reference File Number: 23595-1.

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

DEKRA Certification Inc. 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 Certification Inc. at the time of performance of the test.

DEKRA Certification Inc. 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.

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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.
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4. This test report cannot be used partially or in full for publicity and/or promotional purposes without previous written permission of DEKRA Certification Inc. and the Accreditation Bodies.

Uncertainty

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

Usage of samples

Samples undergoing test have been selected by: **the client**

Sample S/01 is composed of the following elements:

Control N°	Description	Model	Serial N°	Date of reception
02209.001	CPE8100	CPE8100-PRO-1D-3.X	TLR41DFE970D	05/11/2018

Auxiliary elements used with the sample S/01:

Control N°	Description	Model	Serial N°	Date of reception
02209.005	POE AC adapter	NA	NA	05/11/2018

1. Sample S/01 has undergone following test(s): All Conducted and radiated tests indicated in appendix A.

Test sample description

3.5GHz CBSD indoor/outdoor unit with supporting LTE band 48.

Product specification	Description	Yes/No
Base Station Class	Wide area Base Station (Macro Cell)	Yes
	Medium Range Base Stations (Micro Cell)	No
	Local area Base Station (Picocell)	No
	Home Base Station (Femtocell)	No
Category of CBSD	Category A	No
	Category B	Yes
Type of Installation	Professional Installation	Yes
Power supply voltage	48 V DC	
RF Test Tool Software of CBS	SQN Debug tool	
TX Frequency	10MHz: 3555 MHz — 3695 MHz	
	20MHz: 3560 MHz — 3690 MHz	
RX Frequency	10MHz: 3555 MHz — 3695 MHz	
	20MHz: 3560 MHz — 3690 MHz	
Maximum Output Power to Antenna	10 MHz BW: 26 dBm (3555-3695 MHz)	
	20 MHz BW: 24 dBm (3560/3690 MHz)	
	25 dBm (3560-3690 MHz)	
Maximum 99% Occupied Bandwidth (MHz)	20 MHz	
Type of Modulation	QPSK	Yes
	16QAM	Yes
	64QAM	Yes
	256QAM	No
Antenna Information	Model: Gain: 15dBi	
MIMO Information	# of output port: 1 # of input port: 2 # of output ports transmitting in same polarization: 0 (The unit transmit on 1 port and receive in 2 cross-polarized ports)	

Identification of the client

Telrad Networks Ltd.

1 Bat Sheva Street, P.O.B. 6118, Lod 711600, Israel

Testing period

The performed test started on 05/14/2018 and finished on 10/29/2018.

The tests have been performed at DEKRA Certification, Inc.

Environmental conditions

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

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

In the semi-anechoic chamber, the following limits were not exceeded during the test.

Temperature	Min. = 15 °C Max. = 35 °C
Relative humidity	Min. = 20 % Max. = 75 %
Air pressure	Min. = 860 mbar Max. = 1060 mbar

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

Temperature	Min. = 15 °C Max. = 35 °C
Relative humidity	Min. = 20 % Max. = 75 %
Air pressure	Min. = 860 mbar Max. = 1060 mbar

Modifications to the reference test report

It was introduced the following modifications in respect to the test report number 2209ERM.001A4 related with the same samples, in the next clauses and sub-clauses:

Clauses / Sub-clauses	Modification	Justification
Test sample description Section 96.41 Subclause (b) Maximum Power Spectral Density (PSD)	The way of displaying unit of Maximum Output Power to Antenna (dBm) was changed by moving dBm from 1 st column to 2 nd column	Per FCC request
	Yes or No for Type of modulation supporting were added	To add the data show the supported modulations
TEST CONDITIONS	A statement for the result of worst case mode identification was added	To clarify the worst case mode reported in this test report

This modification test report cancels and replaces the test report 2209ERM.001A4.

Remarks and comments

1; The tests have been performed by the technical personnel: Koji Nishimoto and Sravani Gollamudi.

2: Used instrumentation:

Conducted Measurements

No.	Description	Last Cal. Date	Cal. Due date
1.	EMI Test Receiver Rohde & Schwarz ESR7	2017/03	2019/03
2.	Spectrum analyzer Rohde & Schwarz FSV40	2017/03	2019/03

Radiated Measurements

No.	Description	Last Cal. date	Cal. due date
1.	Semi anechoic Absorber Lined Chamber Frankonia SAC 3 plus "L"	N/A	N/A
2.	BiconicalLog antenna ETS LINDGREN 3142E	2017/03	2020/03
3.	Double-ridge Waveguide Horn antenna 750 MHz-18 GHz	2017/03	2019/03
4.	Spectrum analyzer Rohde & Schwarz FSV40	2017/03	2019/03
5.	Double Ridge Horn Antenna 18 – 40 GHz	2016/12	2018/12
6.	RF pre-amplifier 30 MHz-6 GHz Bonn Elektronik BLMA 0360-01N	2017/05	2019/05
7.	RF pre-amplifier 1-18 GHz Bonn Elektronik BLMA 0118-2A	2017/05	2019/05
8.	RF Pre-amplifier 18-40 GHz Bonn Elektronik BLMA1840-1M	2017/05	2019/05
9.	Rohde & Schwarz EMC32 software	N/A	N/A

Testing verdicts

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

1. CBSD

FCC PART 96 PARAGRAPH		VERDICT
Section 96.41 Subclause (b)	Maximum effective isotropic radiated power (EIRP)	P
Section 2.1046	Conducted output power	P
Section 2.1049	99% OBW and -26 dB Bandwidth	P
Section 96.41 Subclause (b)	Maximum Power Spectral Density (PSD)	P
Section 96.41 Subclause (g)	Peak-to-Average Power Ratio (PAPR)	P
Section 2.1051 and 96.41 Subclause(e)	3.5 GHz Emissions and Interference Limits	P
Section 2.1051 and 96.41 Subclause (e)	Spurious Emissions at Antenna Terminals	P
Section 2.1053	Radiated Spurious Emission	P
Section 2.1055	Frequency Stability	P

Appendix A – Test result (CBSD as per FCC Part 96)

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TEST CONDITIONS

Power supply (V):

$$V_{\text{nominal}} = 48 \text{ Vdc}$$

Type of power supply = DC voltage from power on Ethernet (POE).

Type of antenna = External antenna

Declared Gain for antenna (maximum) = +15 dBi

TEST FREQUENCIES:

10 MHz BW (50 RB):

Lowest Channel (3555 MHz) / Middle Channel (3625 MHz) / Highest Channel (3695 MHz)

20 MHz BW (100 RB):

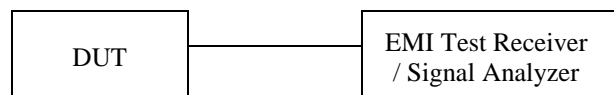
Lowest Channel (3560 MHz) / Middle Channel (3625 MHz) / Highest Channel (3690 MHz)

We have tested with minimum, half, and maximum number of RBs for both 10 MHz and 20 MHz BWs and identified that the worst case is using full RBs. All the tests were performed by using the full RBs.

CONDUCTED MEASUREMENTS

The equipment under test was set up in a shielded room.

The results and plots below show the worst results obtained for the different modulations. After preliminary tests of both QPSK and QAM modulations, it has determined QPSK was a worst case mode and this mode has been reported in the test report.



RADIATED MEASUREMENTS

All radiated tests were performed in a semi-anechoic chamber. The measurement antenna is situated at a distance of 3 m for the frequency range 30-1000 MHz (Bilog antenna) and at a distance of 1m for the frequency range 1-40 GHz (1 GHz-18 GHz and 18 GHz-40 GHz Double ridge horn antennas).

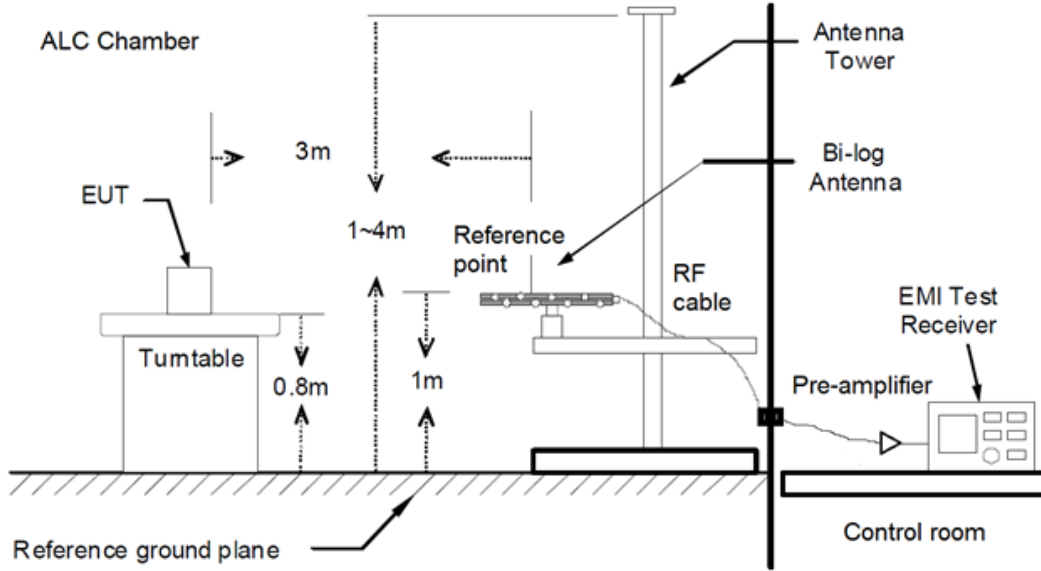
For radiated emissions in the range 1-40 GHz that is performed at a distance closer than the specified distance, an inverse proportionality factor of 20 dB per decade is used to normalize the measured data for determining compliance.

The equipment under test was set up on a non-conductive platform above the ground plane and the situation and orientation was varied to find the maximum radiated emission. It was also rotated 360° and the antenna height was varied from 1 to 4 meters to find the maximum radiated emission.

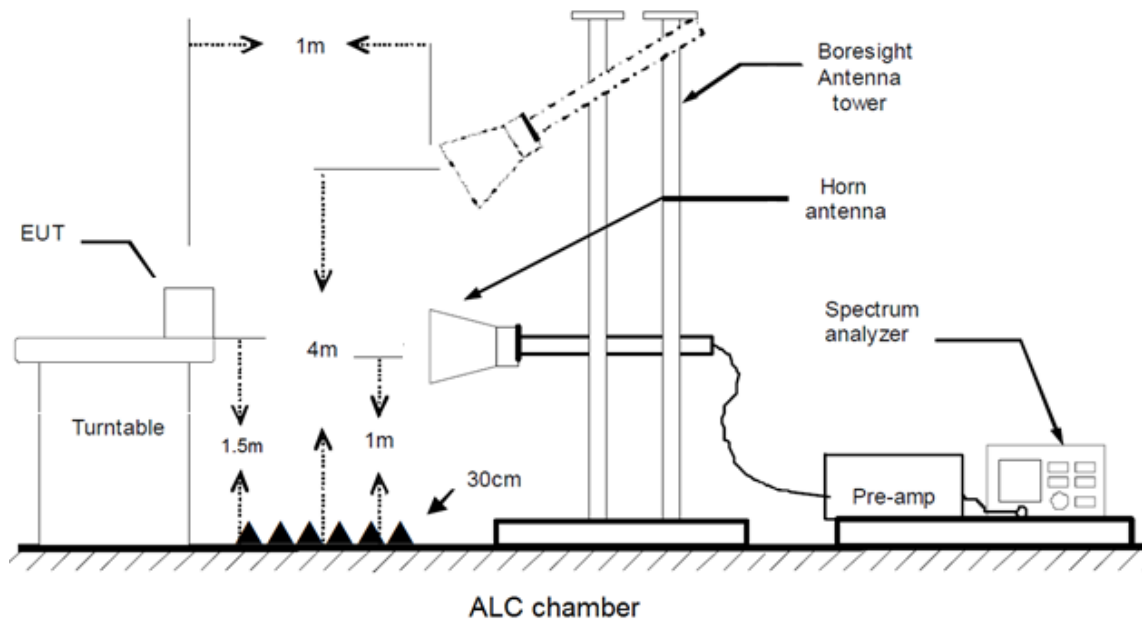
Measurements were made in both horizontal and vertical planes of polarization.

The results and plots below show the worst results obtained for the different modulations. After preliminary tests of both QPSK and QAM modulations, it has determined QPSK was a worst case mode and this mode has been reported in the test report.

Radiated measurements setup $f < 1$ GHz



Radiated measurements setup $f > 1$ GHz



Section 96.41 Subclause (b). Maximum effective isotropic radiated power (EIRP)

Section 2.1046. Conducted Output Power

The procedure in Section 5.2 of ANSI C63.26-2015 is acceptable for performing power measurements. Measurements can be made using either a peak or average (RMS) detector, if the appropriate procedure is followed. The RMS detector was used for the measurement at each frequency with following the procedure stated in the Section 5.2.4.4.2 of ANSI C63.26-2015.

The maximum effective isotropic radiated power (EIRP) and maximum Power Spectral Density (PSD) of any CBSD and End User Device must comply with the limits shown in the following table.

Device	Maximum EIRP (dBm/10 MHz)	Maximum PSD (dBm/MHz)
End User Device	23	n/a
Category A CBSD	30	20
Category B CBSD	47	37

The maximum equivalent isotropically radiated power (e.i.r.p.) is calculated by adding the declared maximum antenna gain (dBi) and 10 log (1/duty cycle) was added in RF level offset to get the accurate measured power level in the average power measurement.

The duty cycle correction = $10 \log (1/0.2) = 6.99 \text{ (dB)}$

RESULTS

10MHz BW

	Lowest frequency 3555 MHz	Middle frequency 3625 MHz	Highest frequency 3695 MHz
Conducted Output Power (dBm/10 MHz)	25.92	25.98	25.78
Maximum declared antenna gain (dBi)	15.00	15.00	15.00
Maximum EIRP (dBm/10 MHz)	40.92	40.98	40.78
Measurement uncertainty (dB)	<±0.95		

20MHz BW

	Lowest frequency 3560 MHz	Middle frequency 3625 MHz	Highest frequency 3690 MHz
Conducted Output Power (dBm/10 MHz)	20.40	21.84	21.00
Maximum declared antenna gain (dBi)	15.00	15.00	15.00
Maximum EIRP (dBm/10 MHz)	35.40	36.84	36.00
Measurement uncertainty (dB)	<±0.95		

Reference table with 20 MHz integration

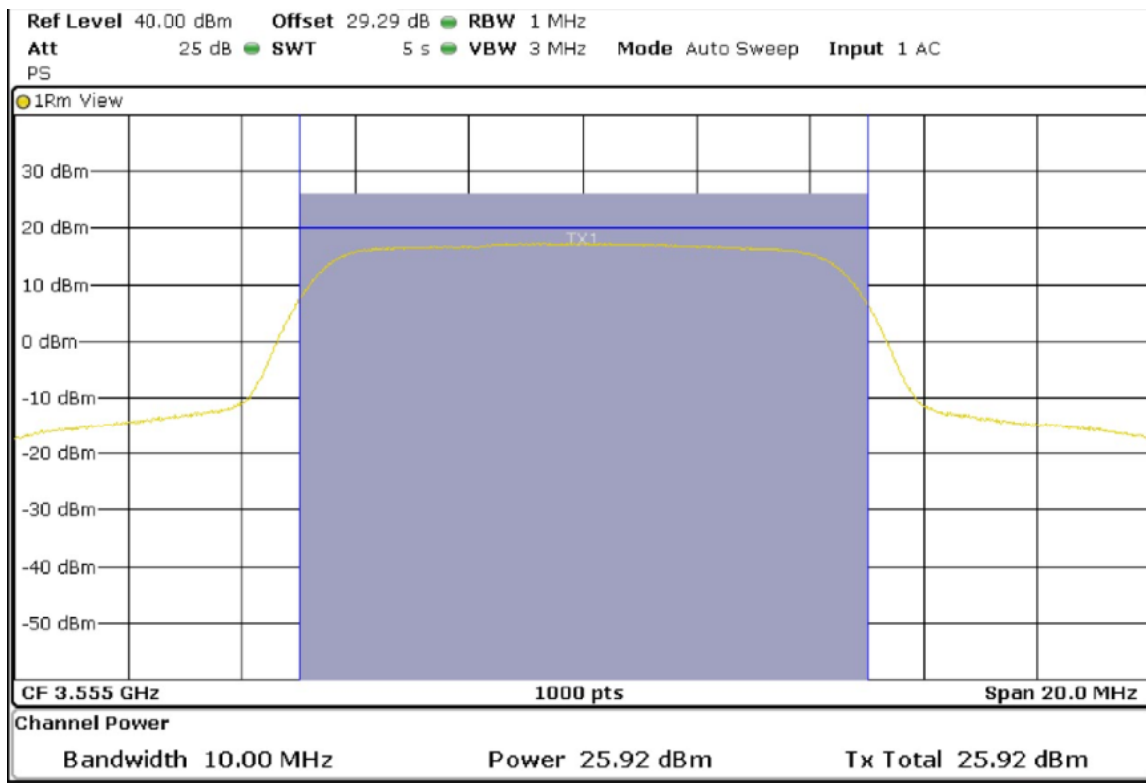
	Lowest frequency 3560 MHz	Middle frequency 3625 MHz	Highest frequency 3690 MHz
Conducted Output Power (dBm/20 MHz)	23.42	24.57	23.73
Maximum declared antenna gain (dBi)	15.00	15.00	15.00
Maximum EIRP (dBm/20 MHz)	38.42	39.57	38.73
Measurement uncertainty (dB)	<±0.95		

VERDICT: PASS

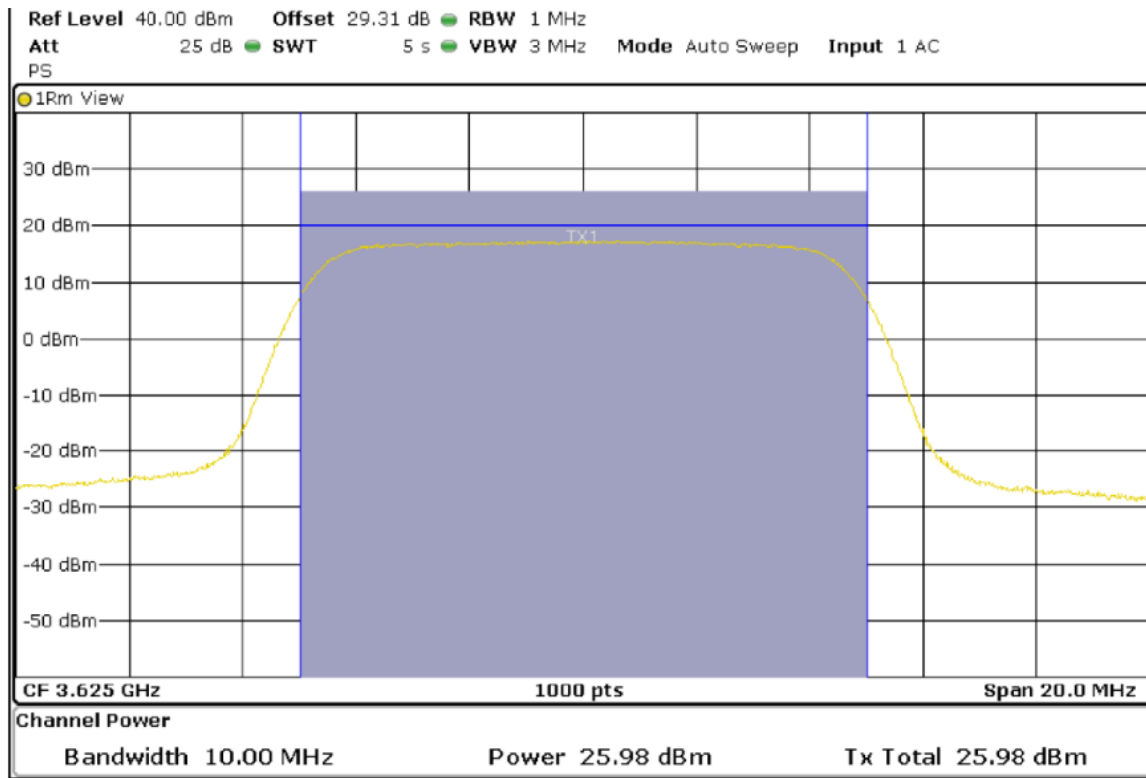
(See next plots)

10MHz BW

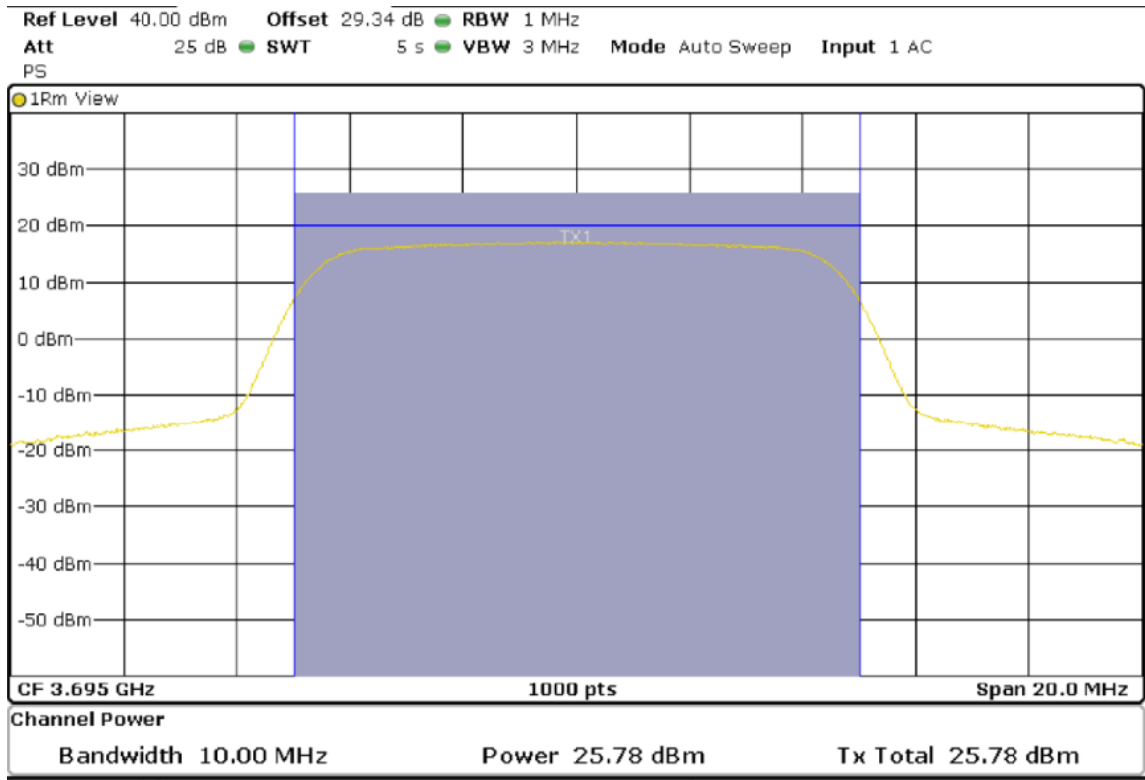
Lowest Channel (3555 MHz)



Middle Channel (3625 MHz)

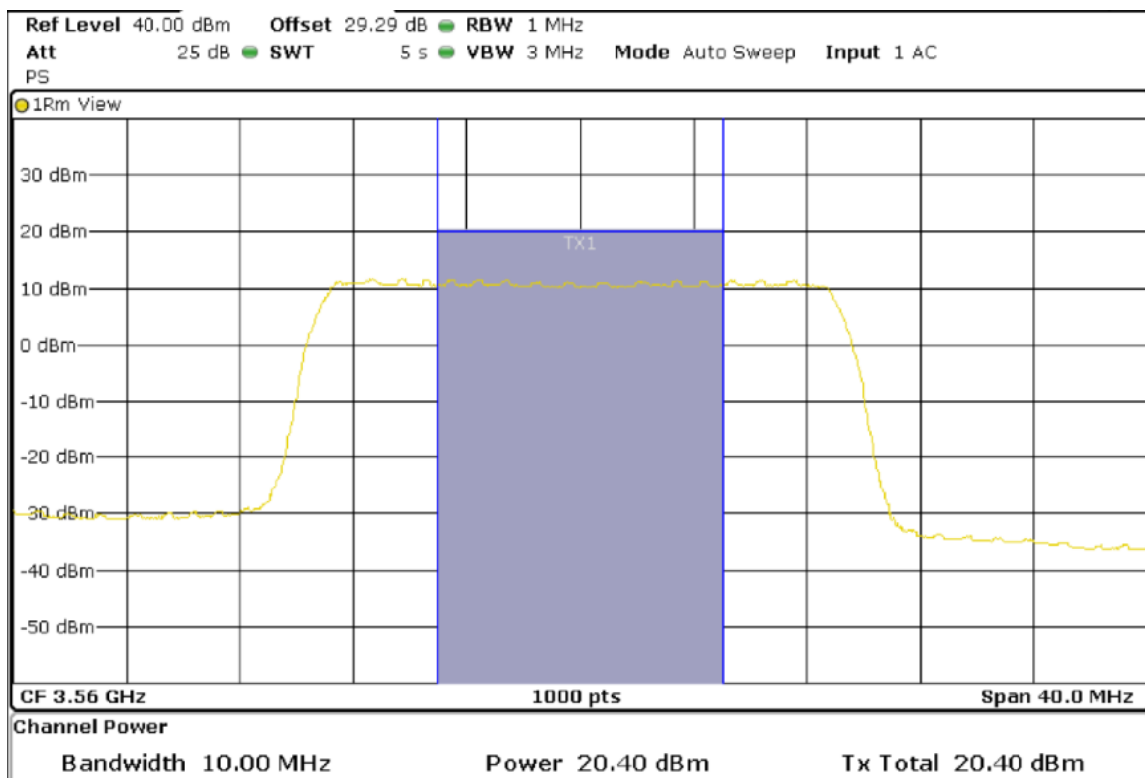


Highest Channel (3695 MHz)

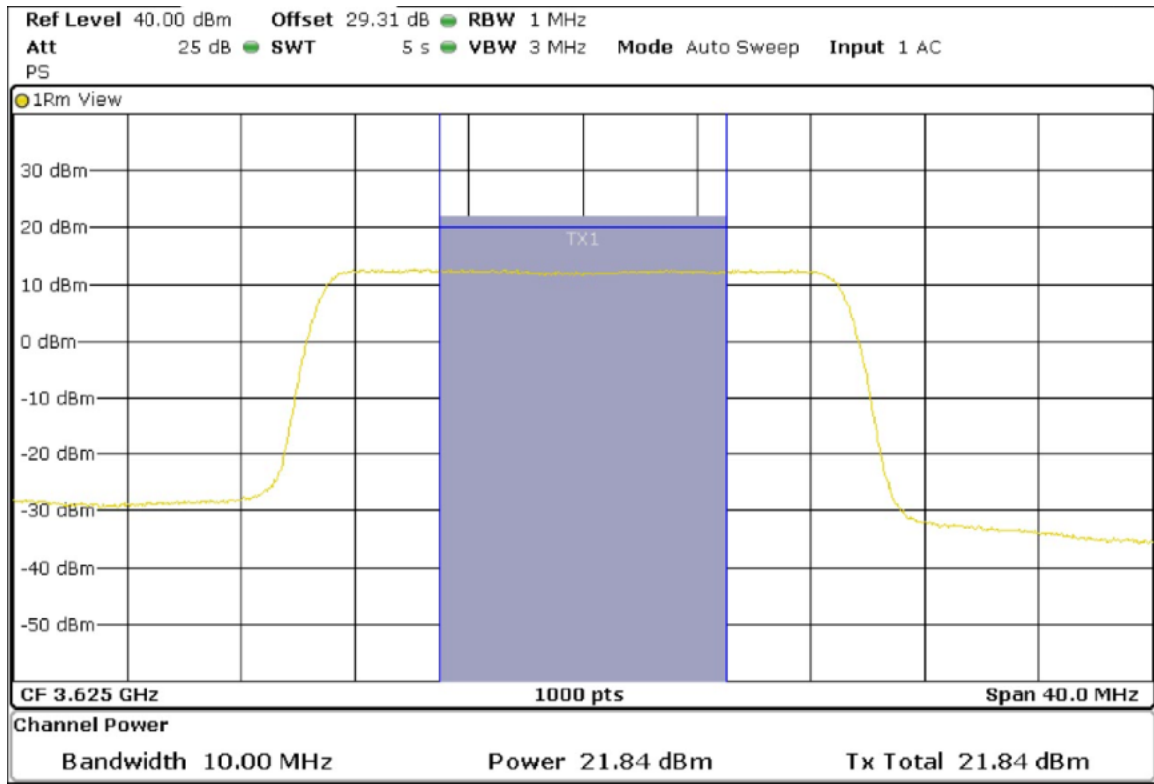


20MHz BW

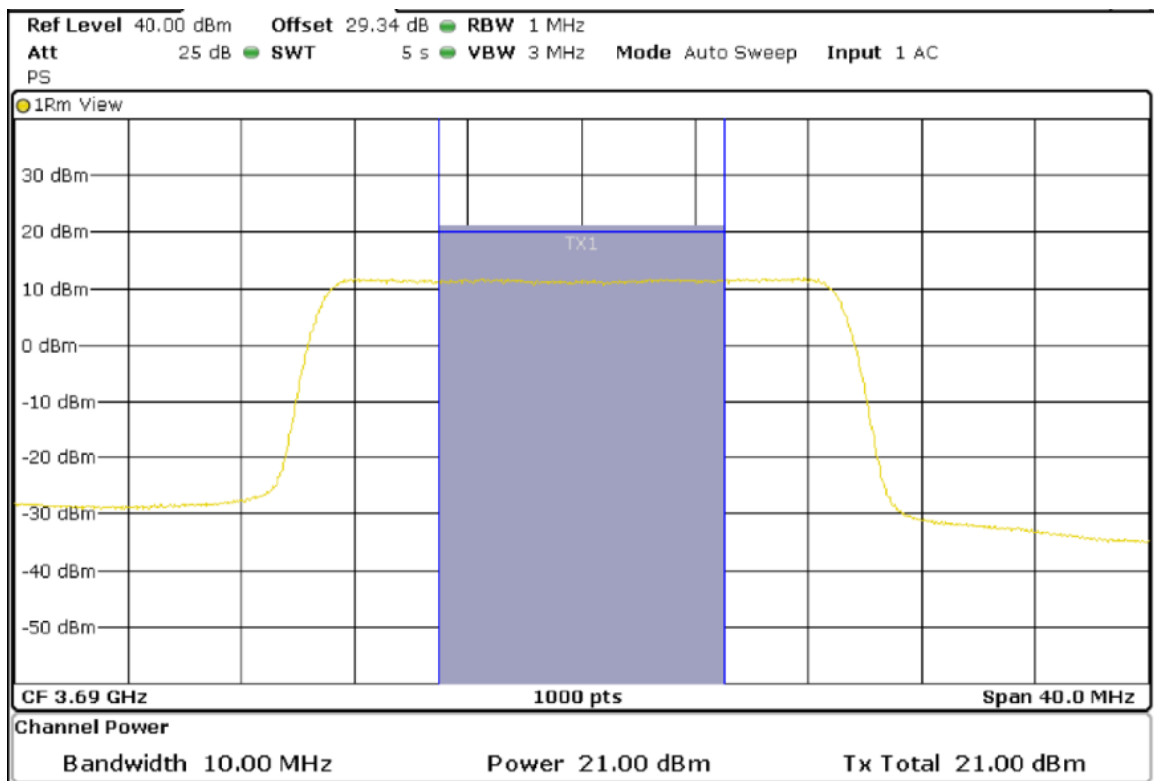
Lowest Channel (3560 MHz)



Middle Channel (3625 MHz)

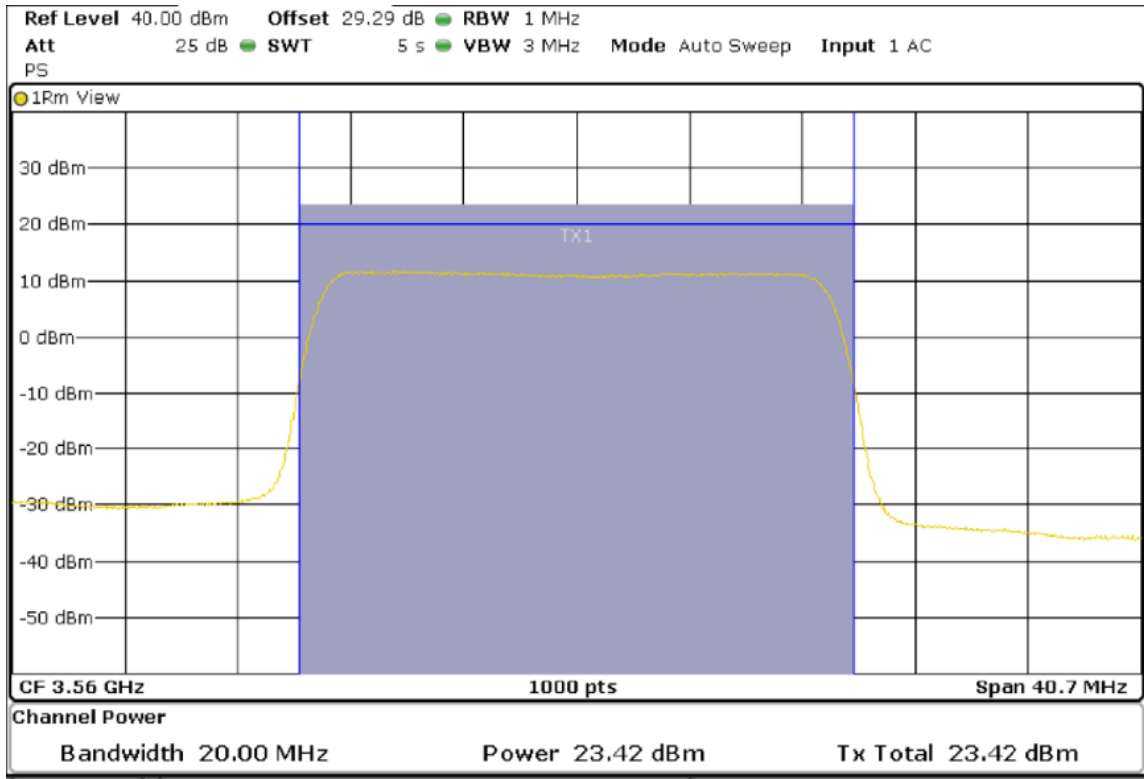


Highest Channel (3690 MHz)

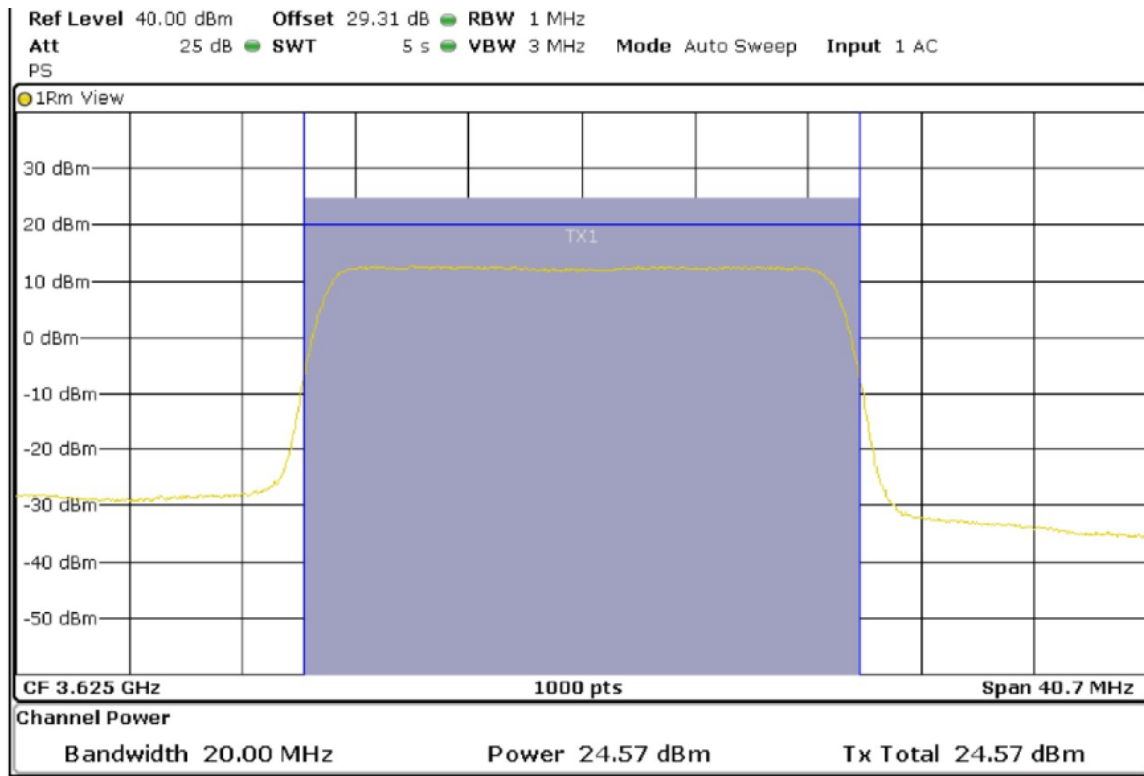


20MHz BW (Reference only)

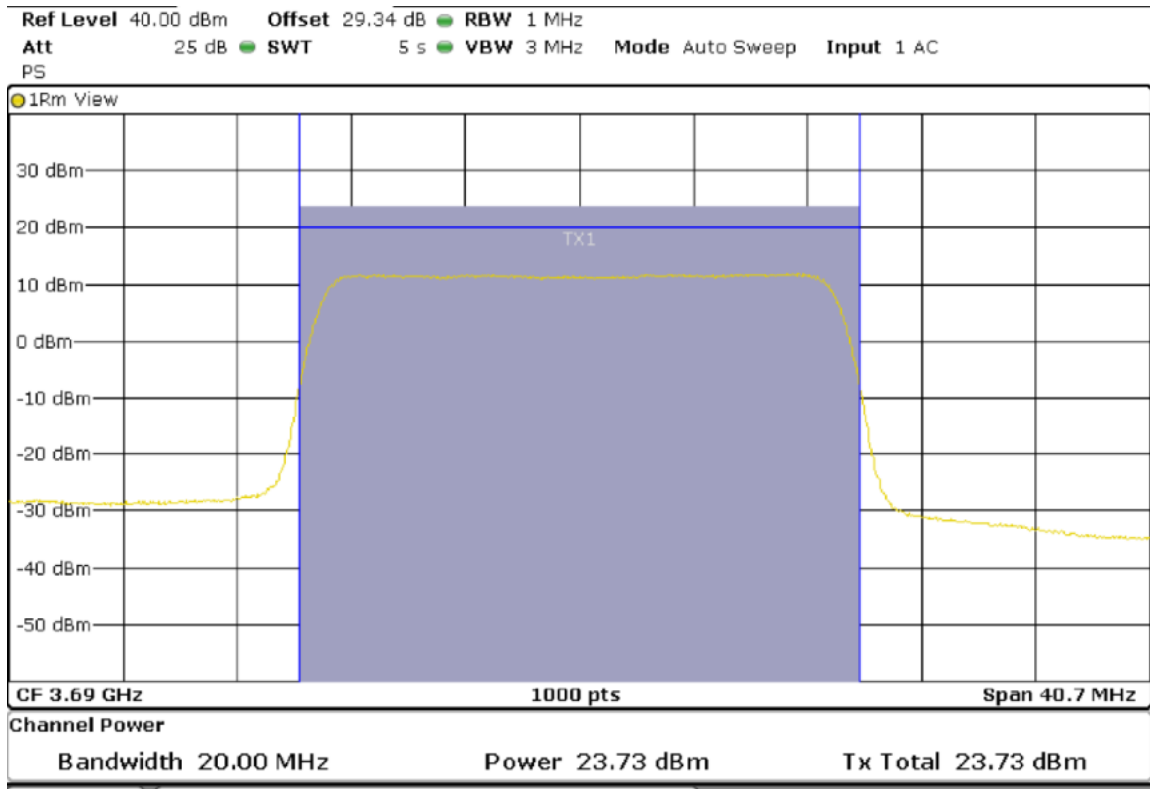
Lowest Channel (3560 MHz)



Middle Channel (3625 MHz)



Highest Channel (3690 MHz)



Section 2.1049. 99% OBW and -26 dB Bandwidth

The 99% occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission shall be measured.

The -26 dB Bandwidth is the bandwidth of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB from the peak of the carrier.

The 99% occupied bandwidth and the -26 dB bandwidth were measured directly using the built-in bandwidth measuring option of signal analyzer with following the procedure stated in the Section 5.4.4 of ANSI C63.26-2015.

RESULTS

10MHz BW

	Lowest frequency 3555 MHz	Middle frequency 3625 MHz	Highest frequency 3695 MHz
99% OBW (MHz)	9.16	9.12	9.12
-26 dB Bandwidth (MHz)	11.52	11.52	11.46
Measurement uncertainty (kHz)	<± 8.33		

20MHz BW

	Lowest frequency 3560 MHz	Middle frequency 3625 MHz	Highest frequency 3690 MHz
99% OBW (MHz)	18.00	18.00	18.00
-26 dB Bandwidth (MHz)	20.49	20.55	20.60
Measurement uncertainty (kHz)	<± 8.33		

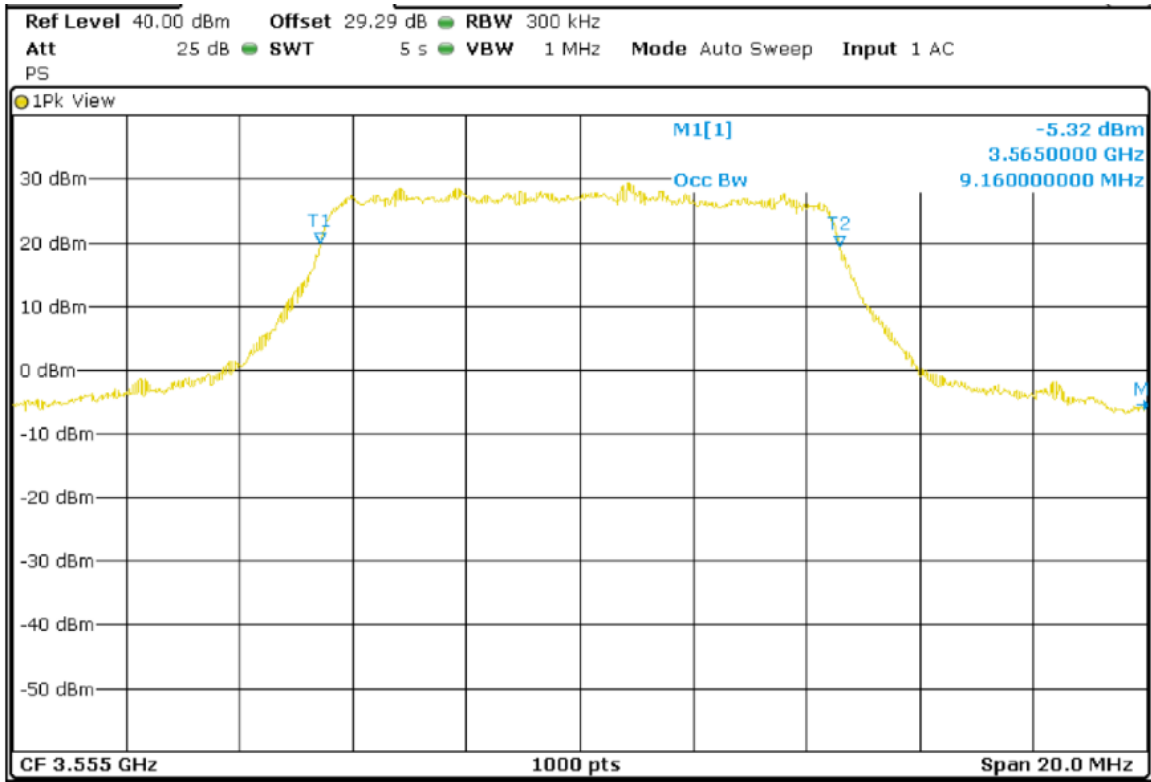
VERDICT: PASS

(See next plots)

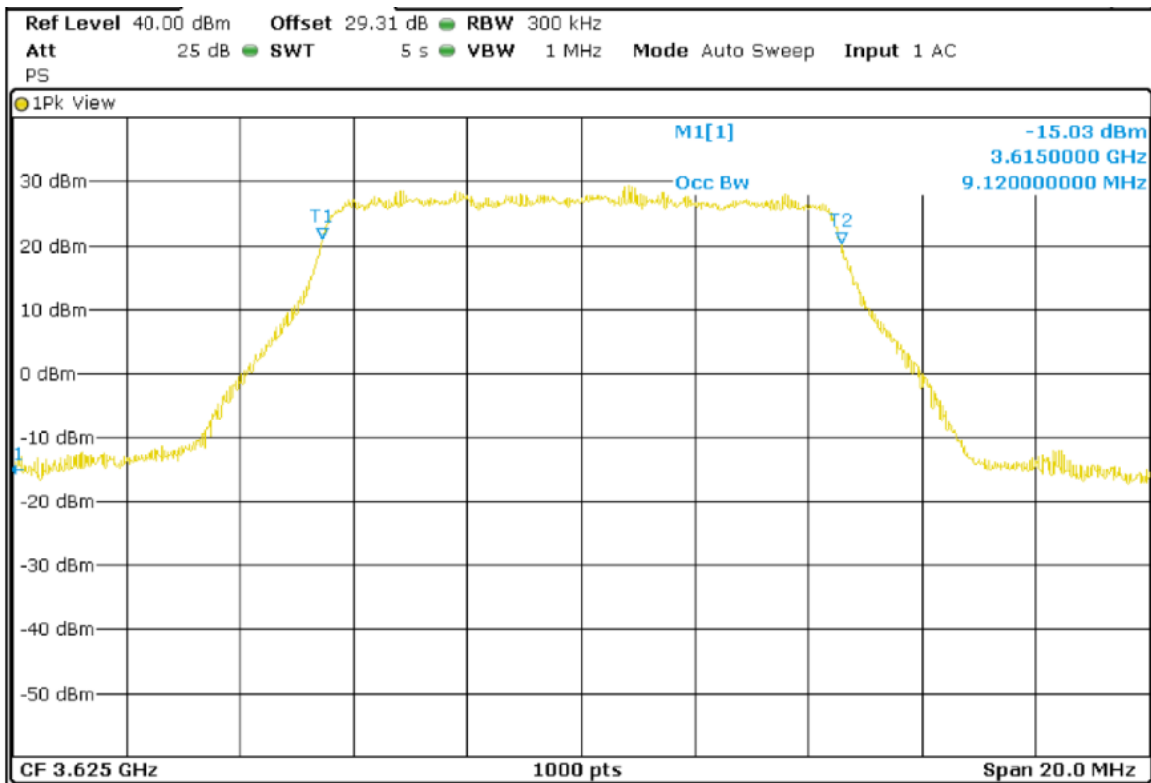
10MHz BW

OBW

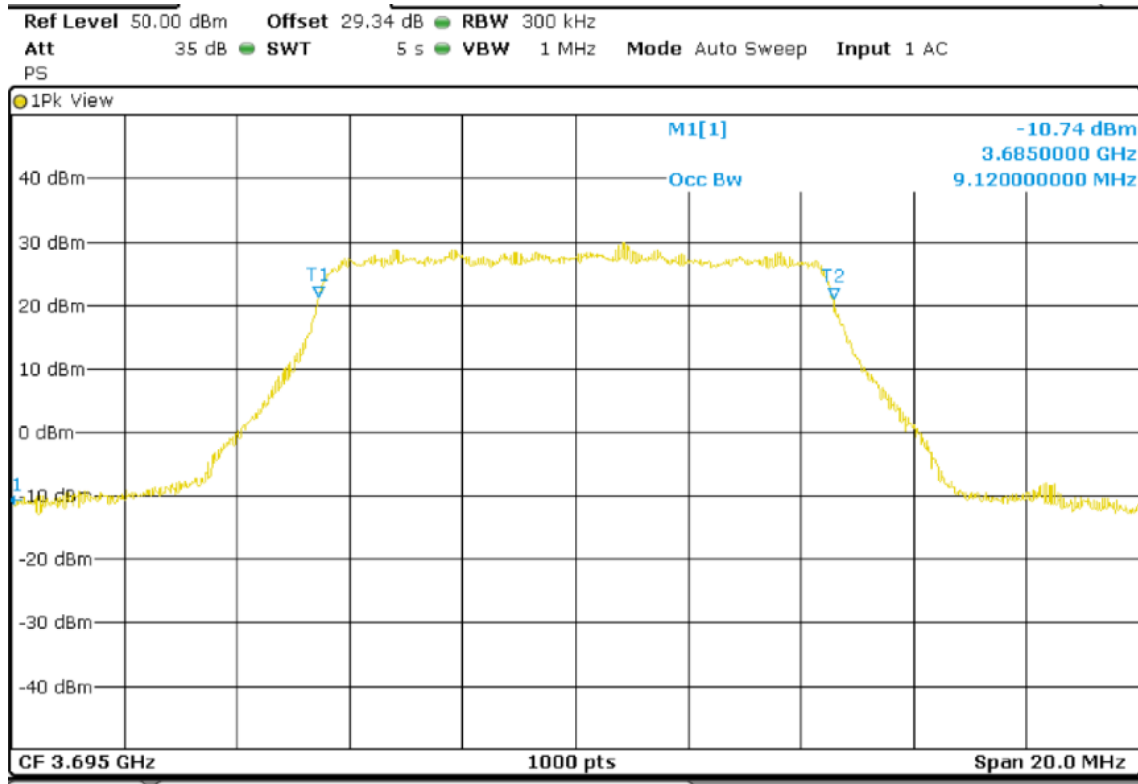
Lowest Channel (3555 MHz)



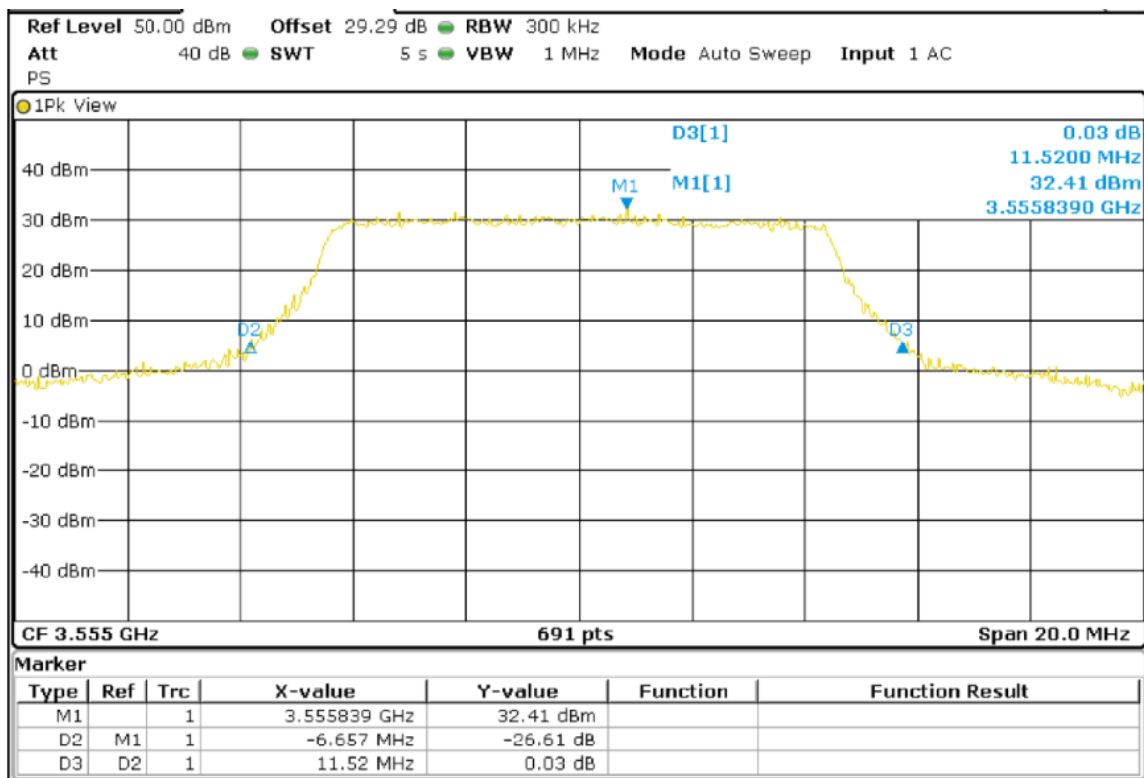
Middle Channel (3625 MHz)



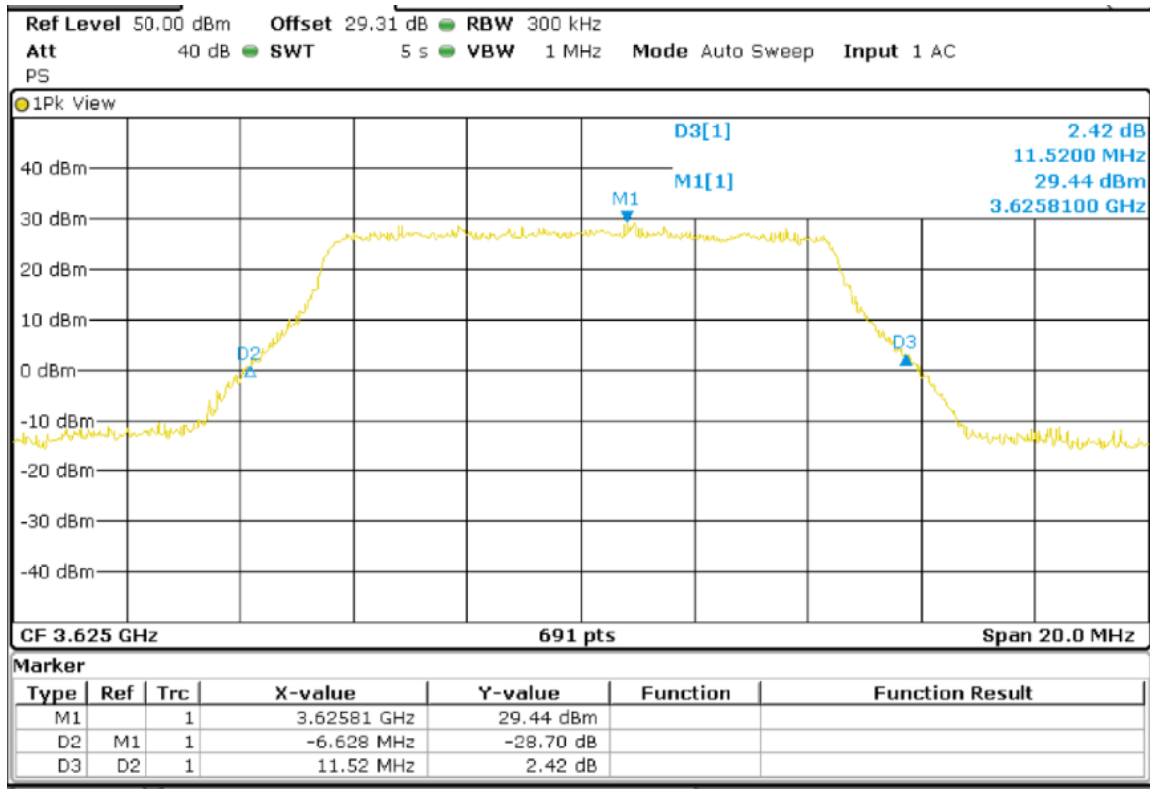
Highest Channel (3695 MHz)



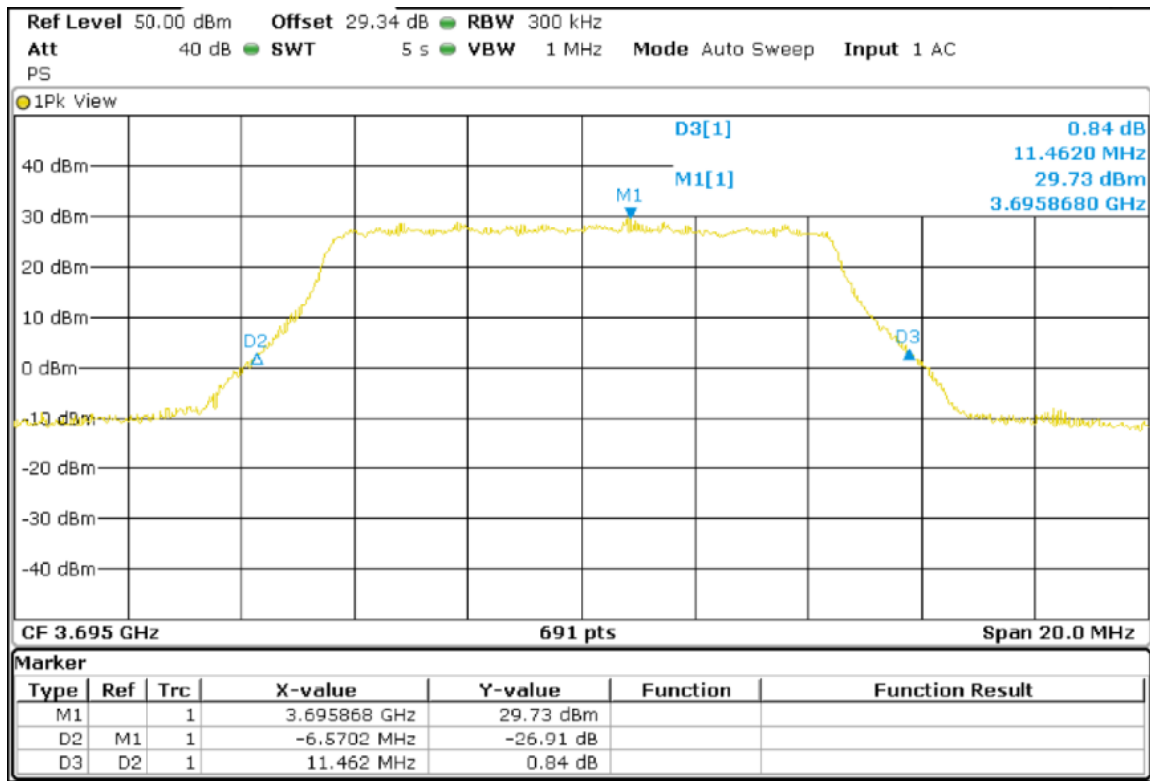
-26 dB BW Lowest Channel (3555 MHz)



Middle Channel (3625 MHz)



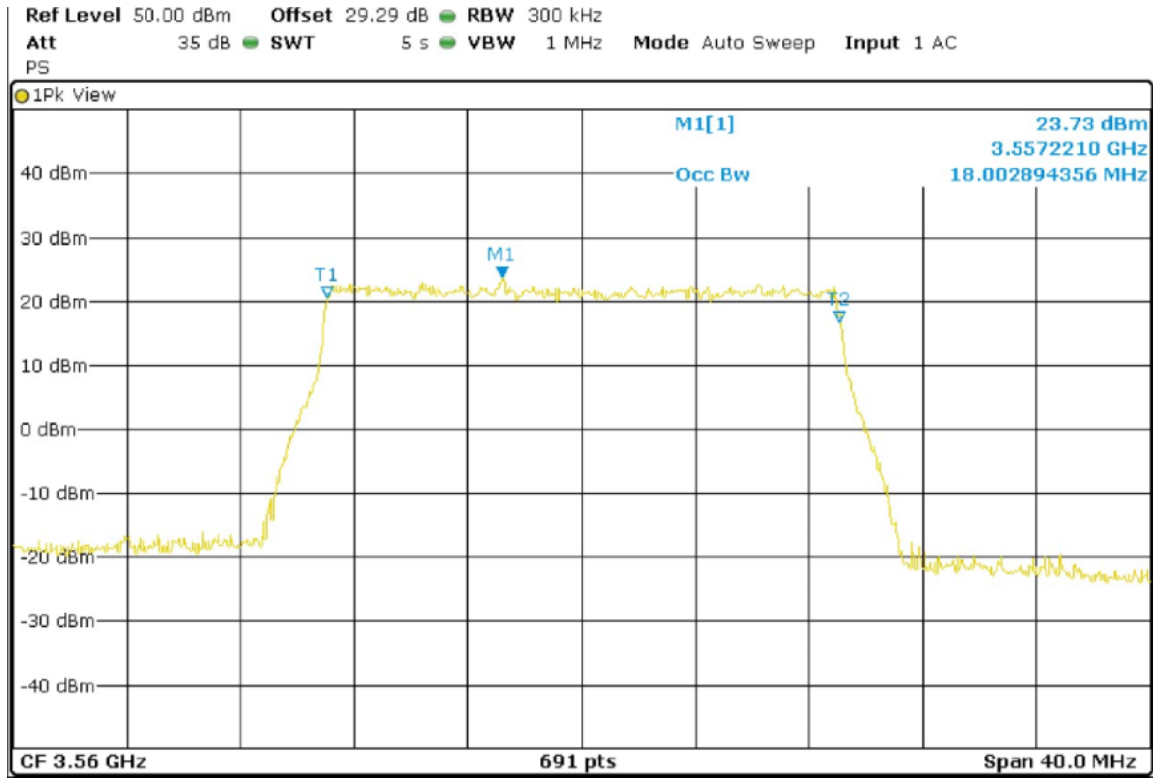
Highest Channel (3695 MHz)



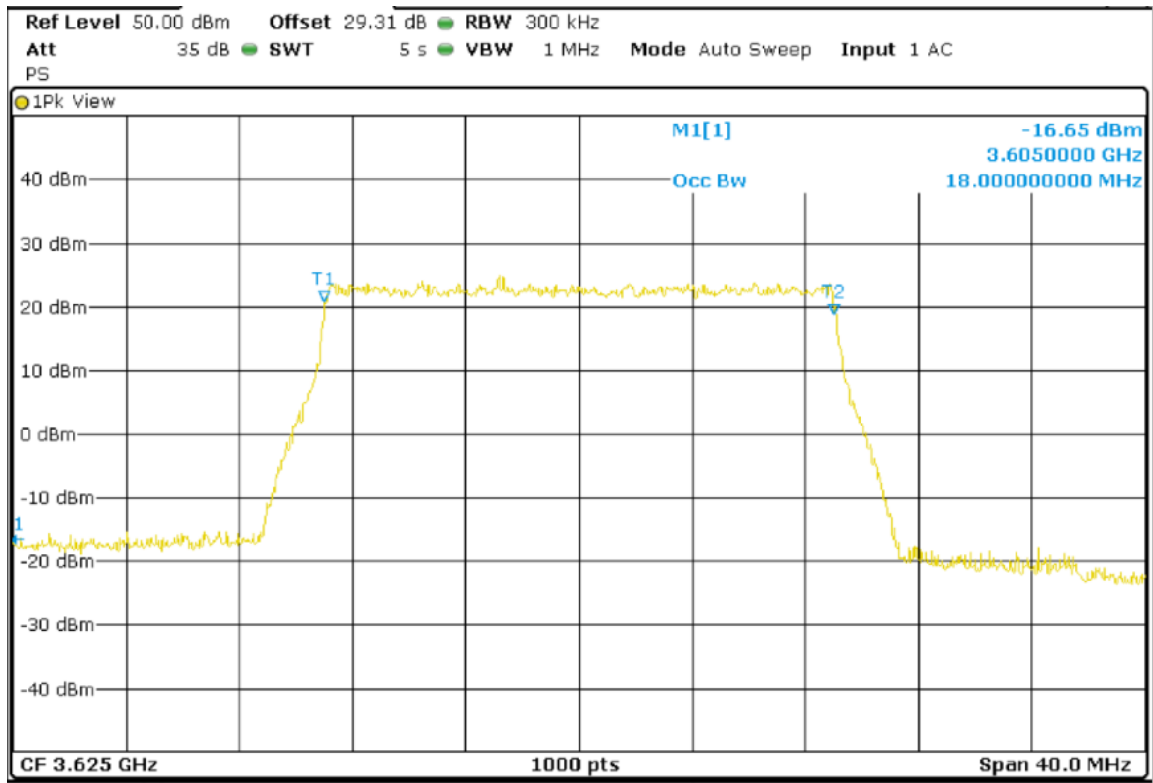
20MHz BW

OBW

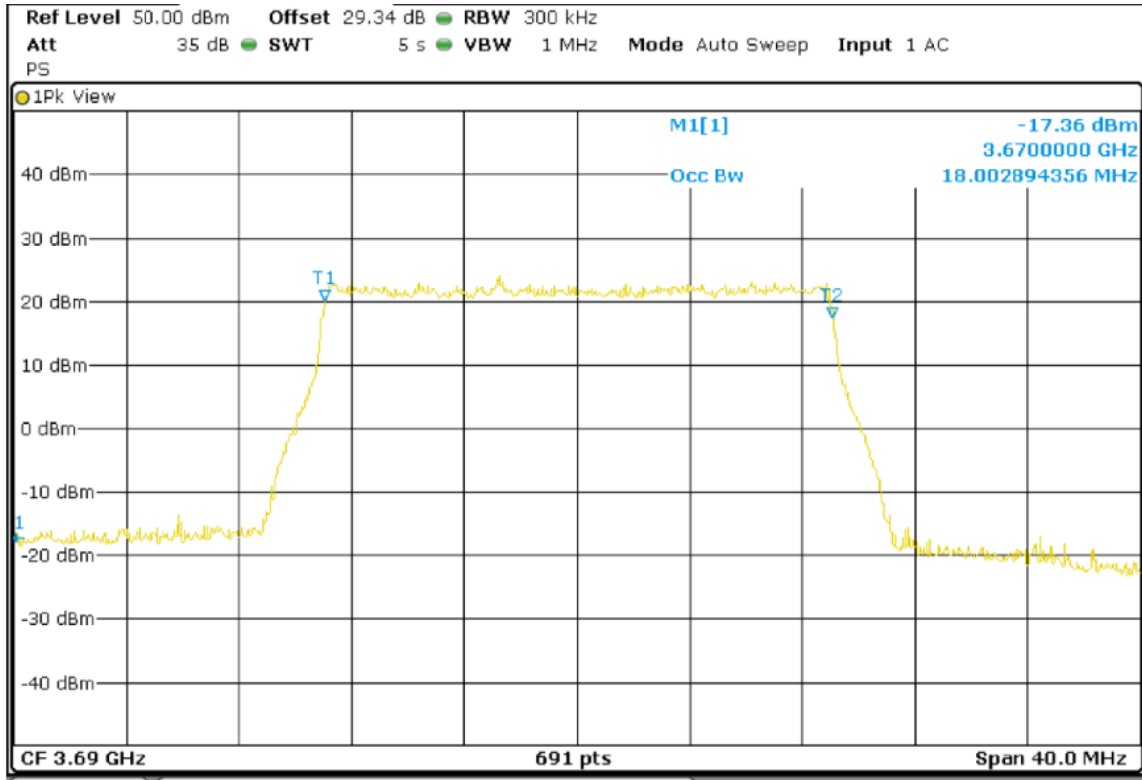
Lowest Channel (3560 MHz)



Middle Channel (3625 MHz)

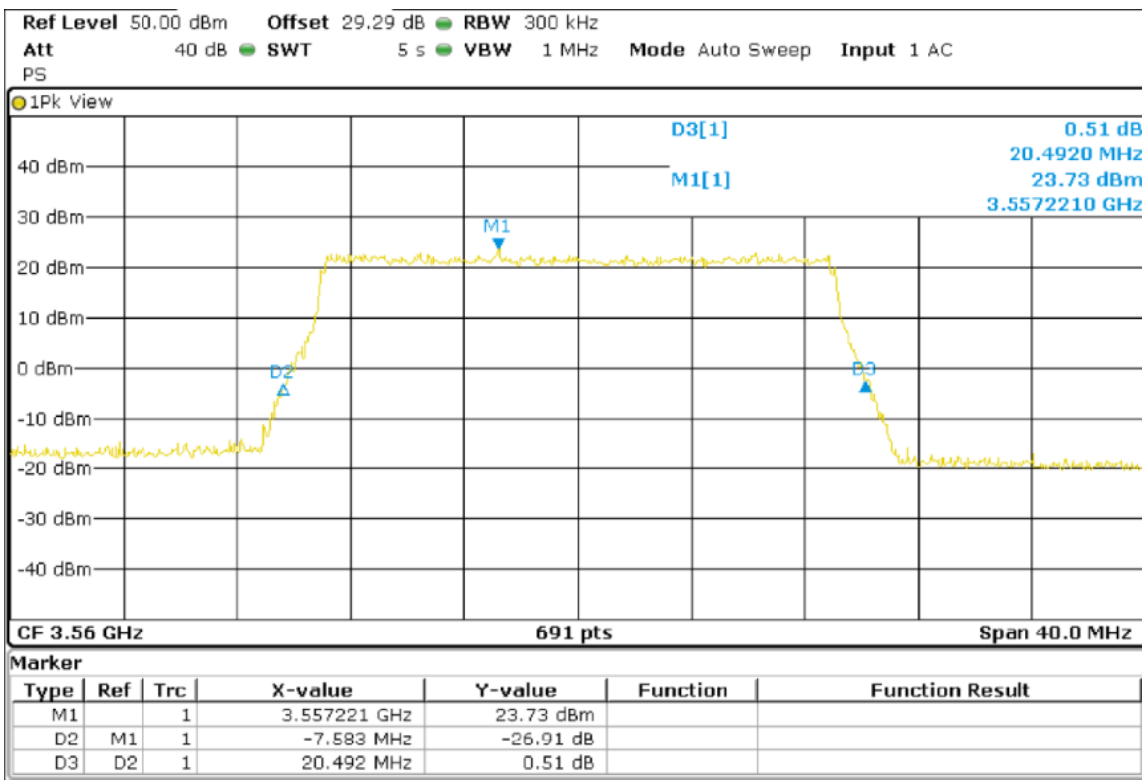


Highest Channel (3690 MHz)

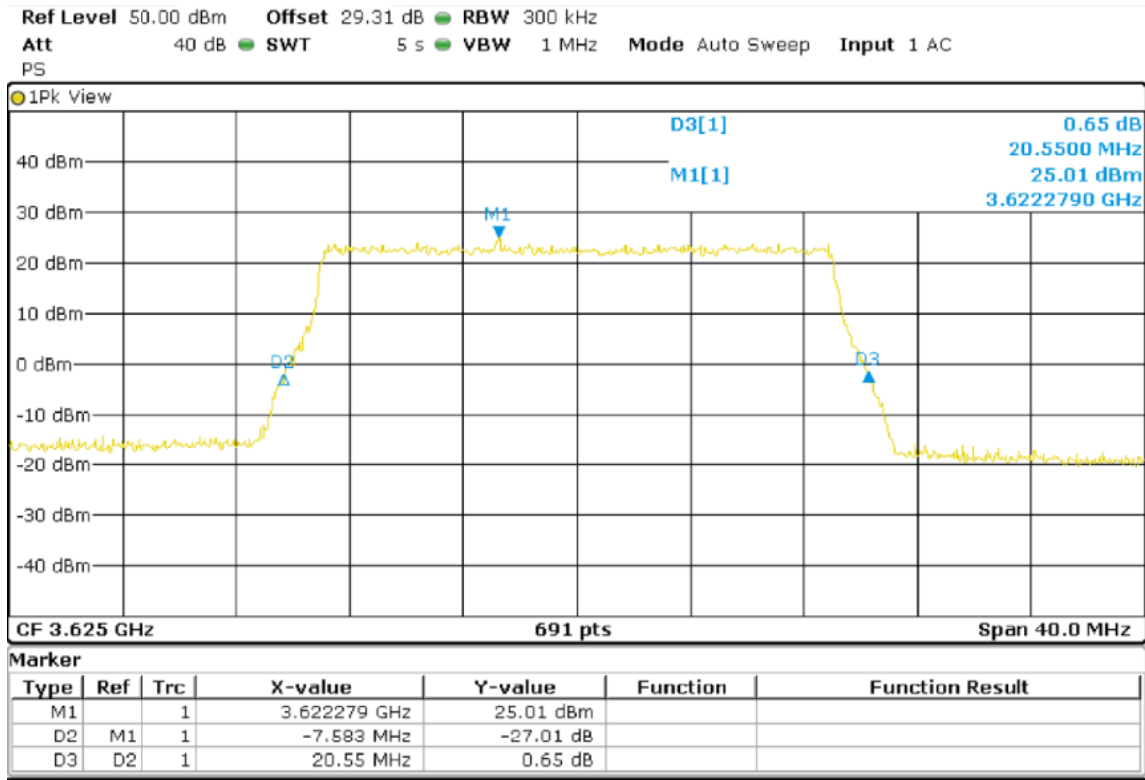


-26 dB BW

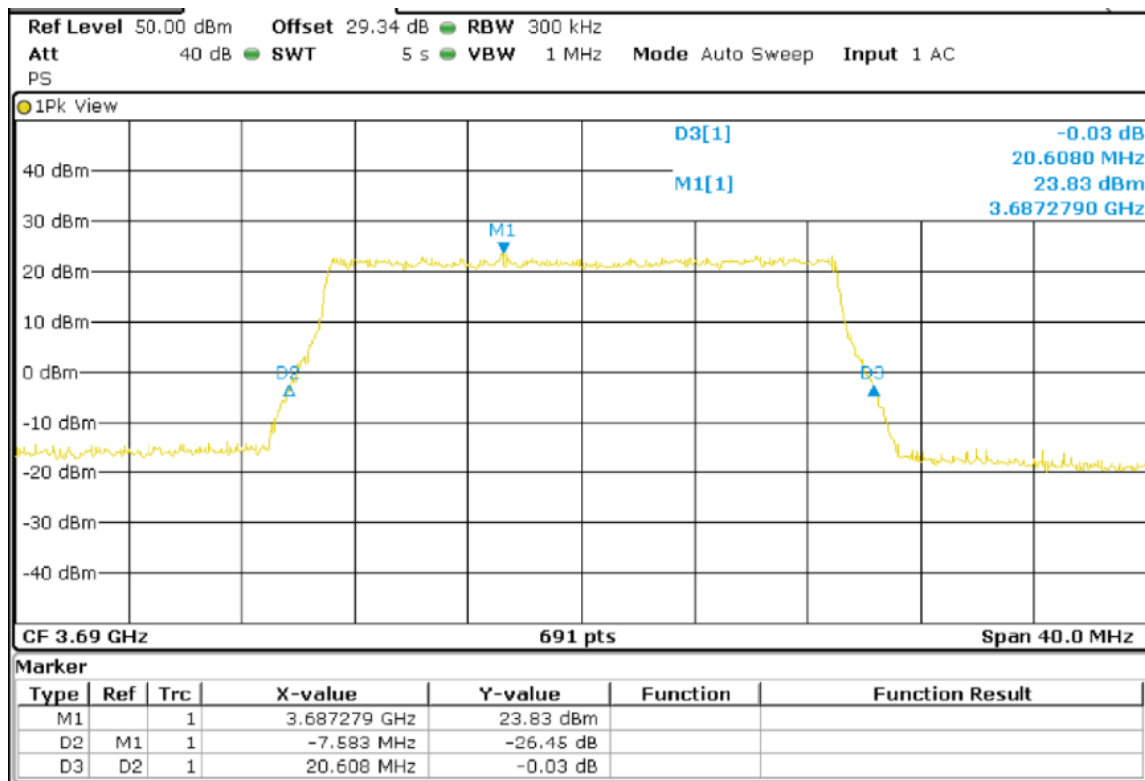
Lowest Channel (3560 MHz)



Middle Channel (3625 MHz)



Highest Channel (3690 MHz)



Section 96.41 Subclause (b). Maximum Power Spectral Density (PSD)

The rules require “maximum power spectral density” measurements, where the intent is to measure the maximum value of the time average of the power spectral density measured during a period of continuous transmission. To perform this measurement, the DUT must be configured to transmit continuously at full power. The procedure in Section 5.2 of ANSI C63.26-2015 is acceptable. The RMS detector was used for the measurement at each frequency with following the procedure stated in the Section 5.2.4.5 of ANSI C63.26-2015.

The maximum effective isotropic radiated power (EIRP) and maximum Power Spectral Density (PSD) of any CBSD and End User Device must comply with the limits shown in the following table.

Device	Maximum EIRP (dBm/10 MHz)	Maximum PSD (dBm/MHz)
End User Device	23	n/a
Category A CBSD	30	20
Category B CBSD	47	37

The maximum equivalent isotropically radiated power (e.i.r.p.) is calculated by adding the declared maximum antenna gain (dBi) and 10 log (1/duty cycle) was added in RF level offset to get the accurate measured power level in the average power measurement.

The duty cycle correction = 10 log (1/0.2) = 6.99 (dB)

RESULTS

10MHz BW

	Lowest frequency 3555 MHz	Middle frequency 3625 MHz	Highest frequency 3695 MHz
Measured power density (dBm/MHz)	17.28	17.33	17.75
Maximum declared antenna gain (dBi)	15.00	15.00	15.00
Maximum Power Spectral Density (dBm/MHz)	32.28	32.33	32.75
Measurement uncertainty (dB)	<±0.95		

20MHz BW

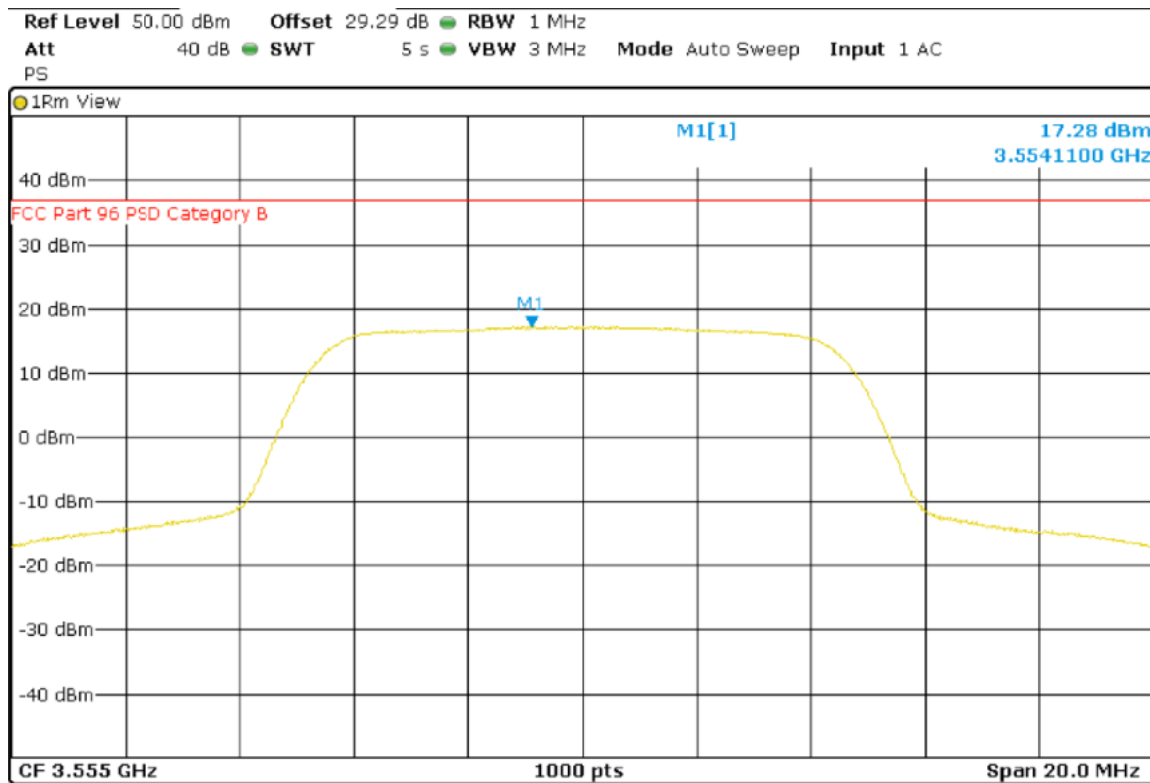
	Lowest frequency 3560 MHz	Middle frequency 3625 MHz	Highest frequency 3690 MHz
Measured power density (dBm/MHz)	11.73	12.59	11.81
Maximum declared antenna gain (dBi)	15.00	15.00	15.00
Maximum Power Spectral Density (dBm/MHz)	26.73	27.59	26.81
Measurement uncertainty (dB)	<±0.95		

VERDICT: PASS

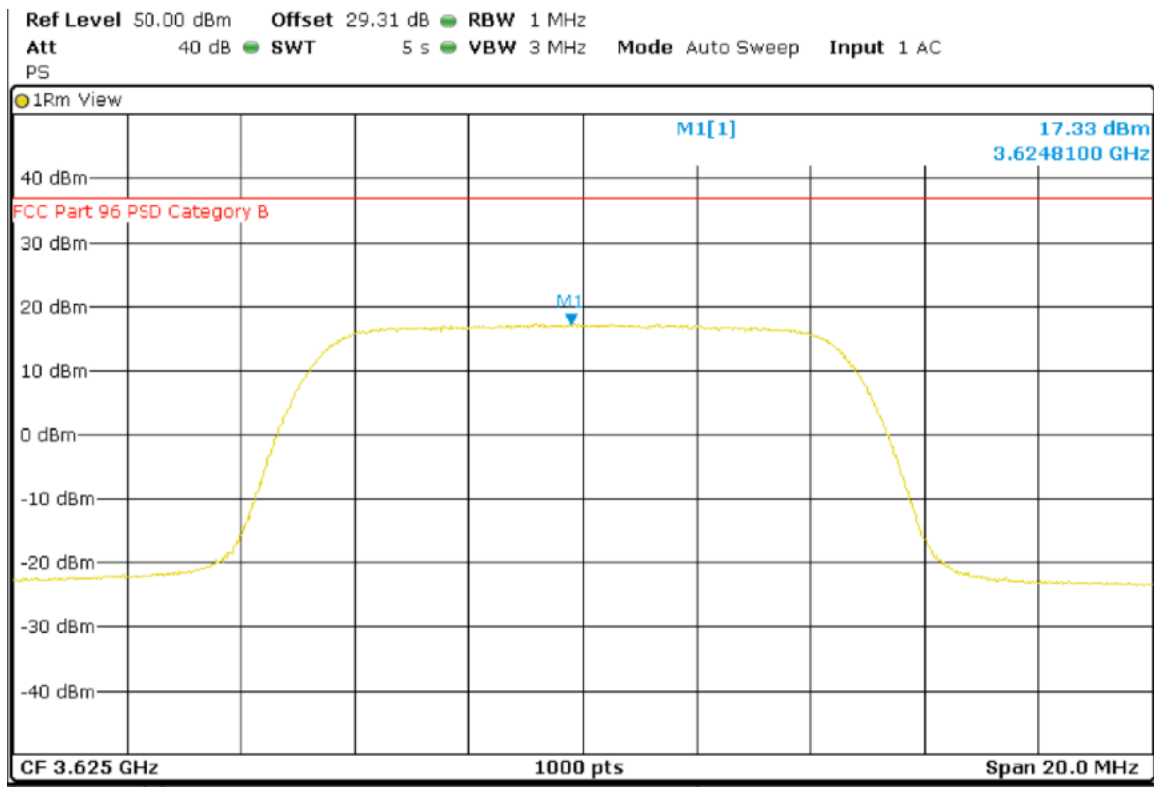
(See next plots)

10MHz BW

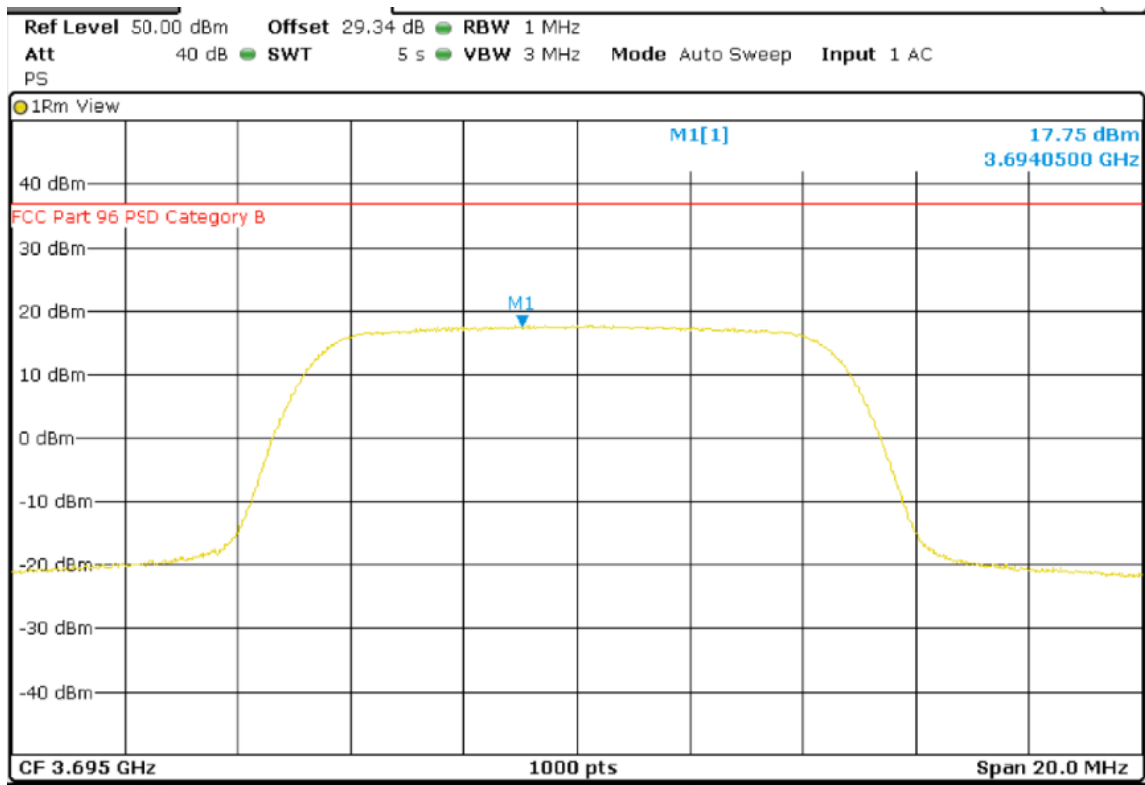
Lowest Channel (3555 MHz)



Middle Channel (3625 MHz)

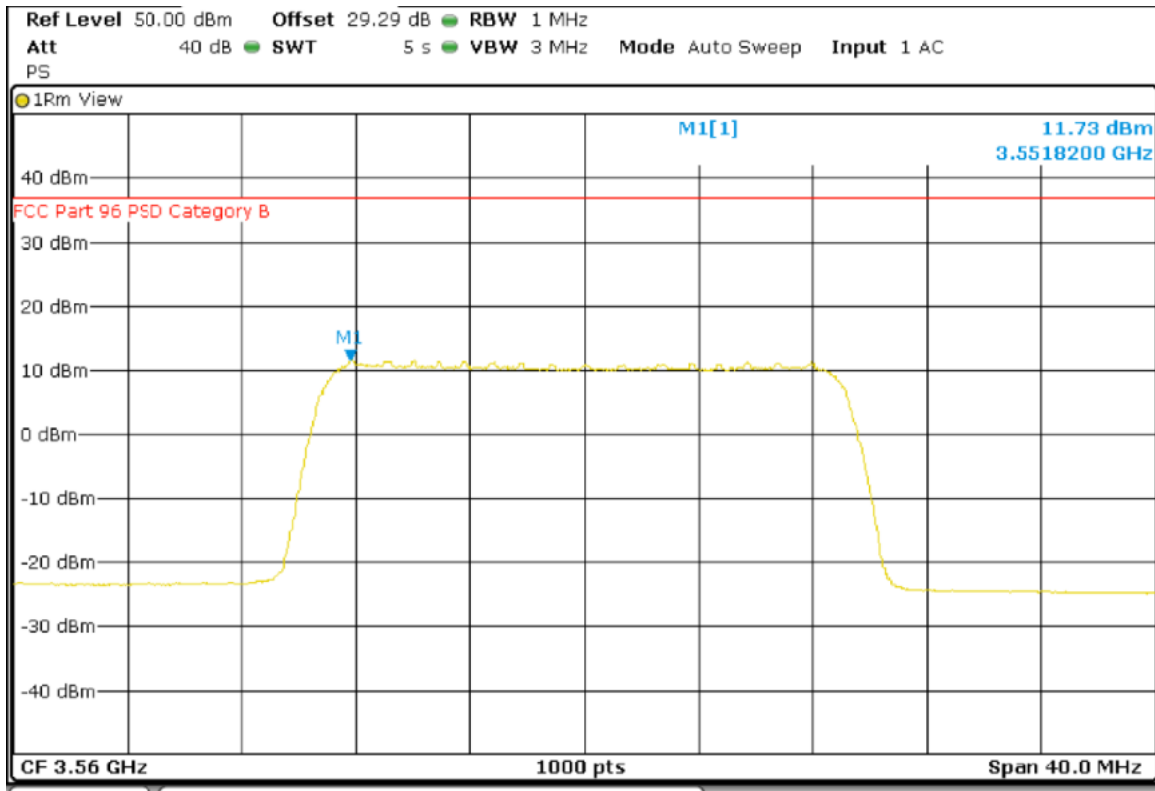


Highest Channel (3695 MHz)

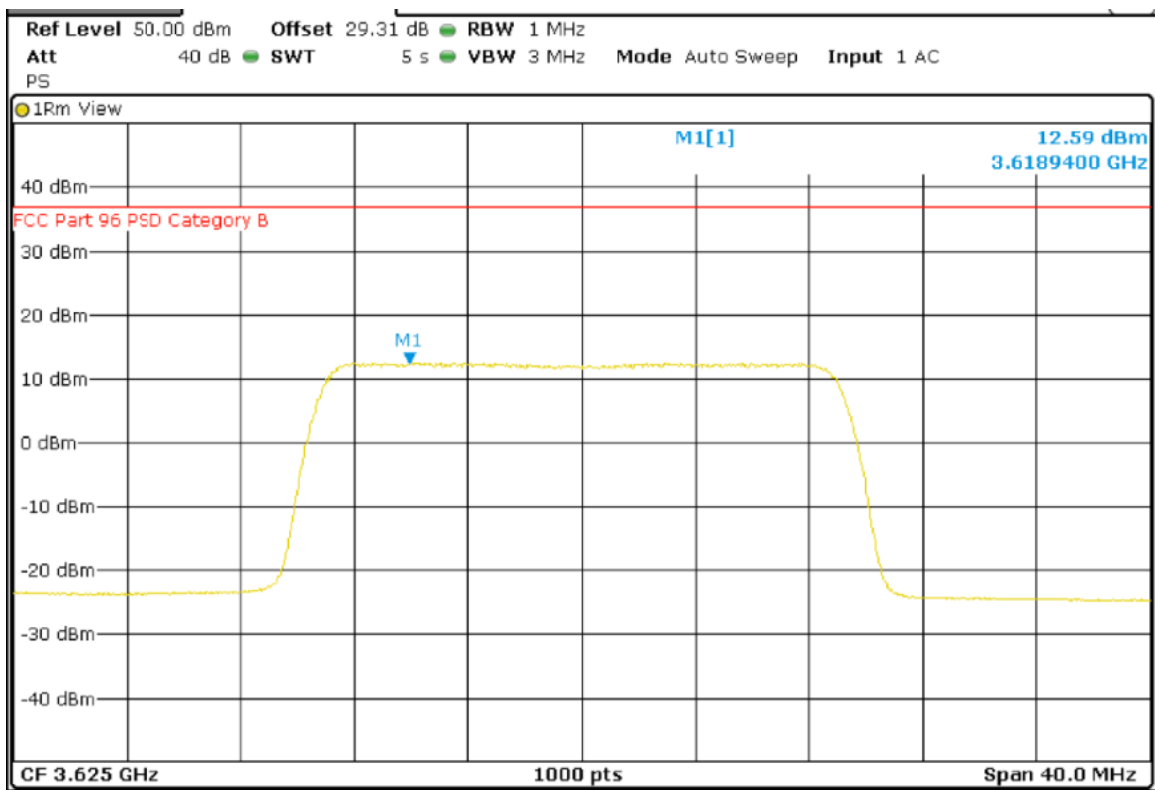


20MHz BW

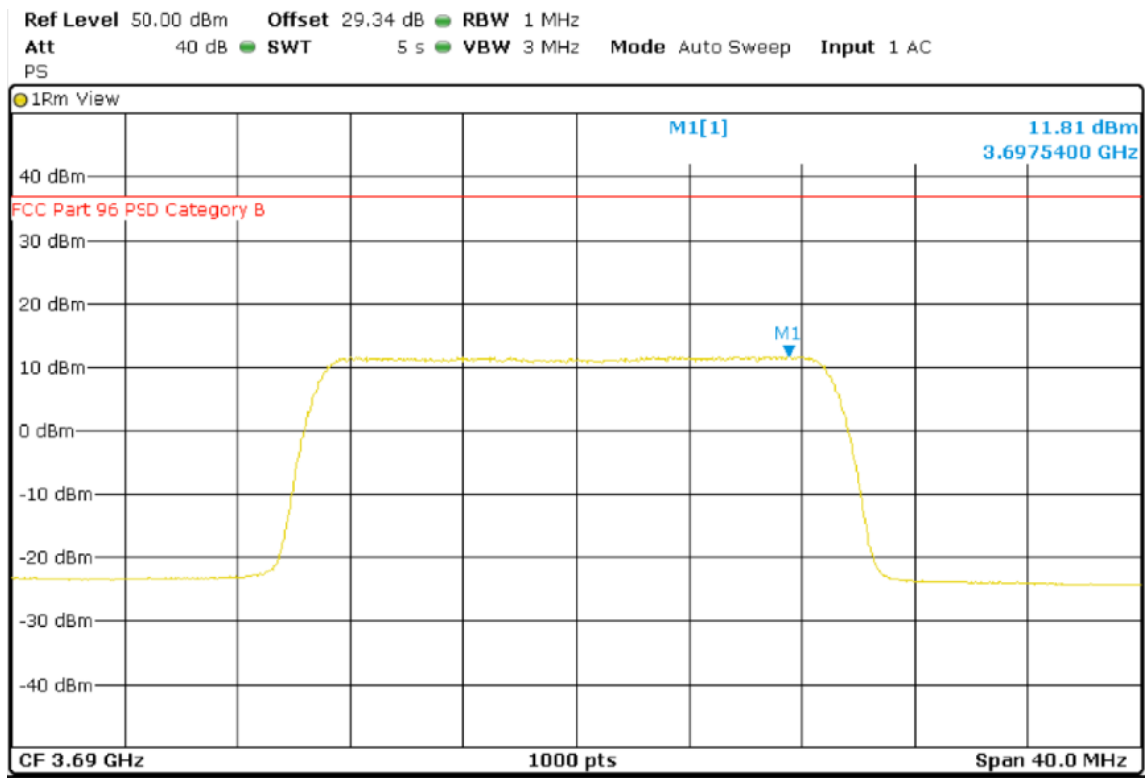
Lowest Channel (3560 MHz)



Middle Channel (3625 MHz)



Highest Channel (3690 MHz)



Section 96.41 Subclause (g). Peak-to-Average Power Ratio (PAPR)

In addition to the power limits in Section 96.41, CBSDs need to meet a PAPR limit. For this measurement, the procedure in Section 5.2.6 of ANSI C63.26-2015 is acceptable. CCDF (Complementary Cumulative Distribution Function) measurement was utilized in the spectrum analyzer and the maximum PAPR level with 0.1 % probability values were recorded.

The peak-to-average power ratio (PAPR) of any CBSD transmitter output power must not exceed 13 dB.

RESULTS

10MHz BW

	Lowest frequency 3555 MHz	Middle frequency 3625 MHz	Highest frequency 3695 MHz
Peak (dBm)	34.33	32.27	31.67
Mean (dBm)	21.37	18.26	18.78
PAPR at 0.1% probability (dB)	11.86	11.91	11.80
Measurement uncertainty (dB)	<±1.11		

20MHz BW

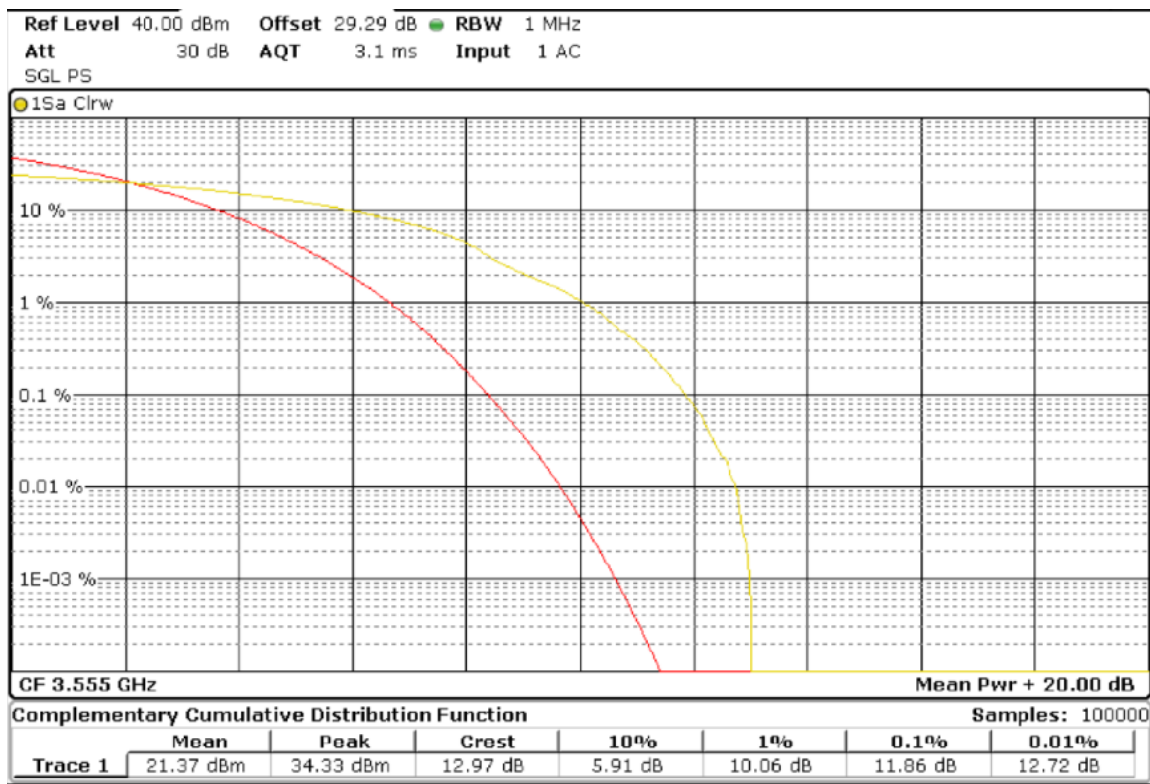
	Lowest frequency 3560 MHz	Middle frequency 3625 MHz	Highest frequency 3690 MHz
Peak (dBm)	25.85	27.46	26.22
Mean (dBm)	12.48	13.42	12.80
PAPR at 0.1% probability (dB)	12.09	12.35	12.12
Measurement uncertainty (dB)	<±1.11		

Verdict: PASS

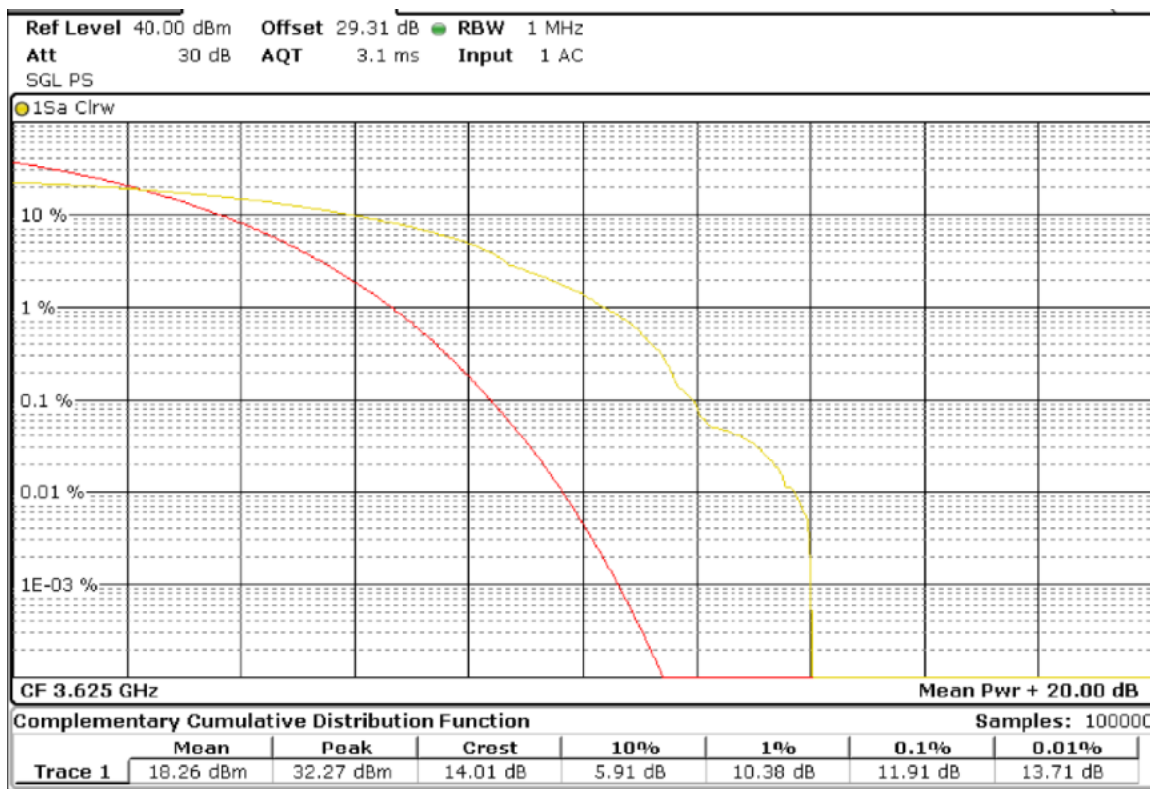
(See Next Plots)

10MHz BW

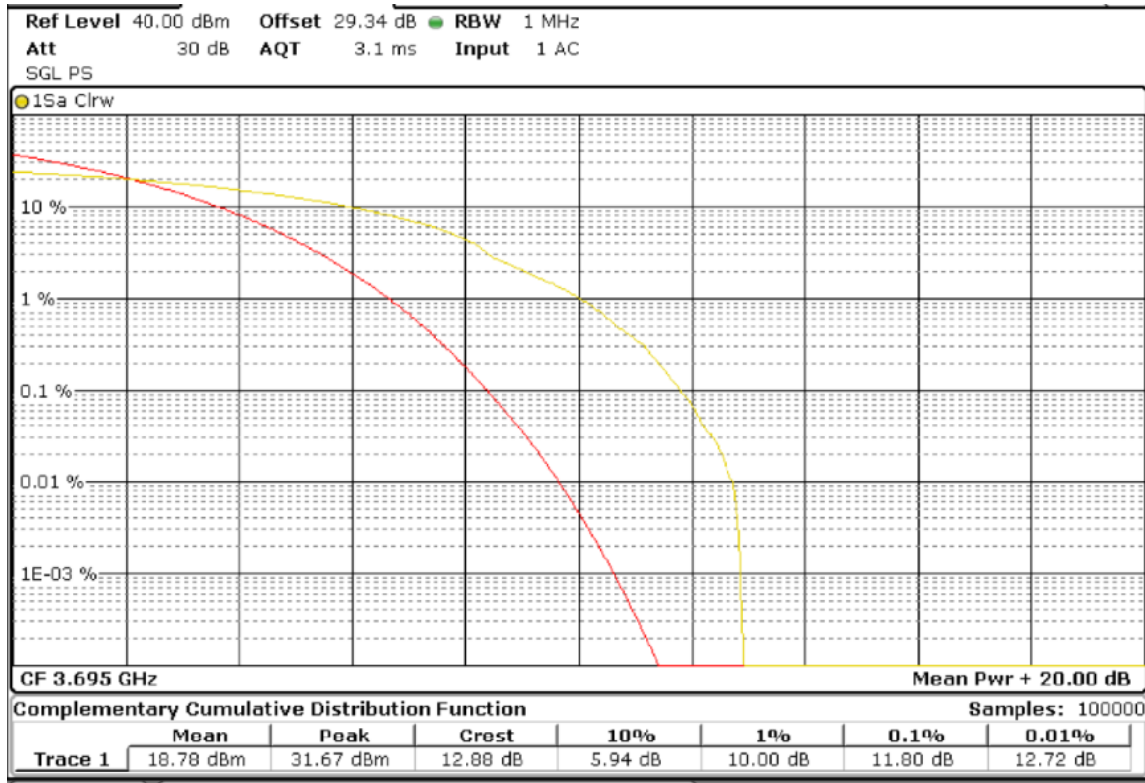
Lowest Channel (3555 MHz)



Middle Channel (3625 MHz)

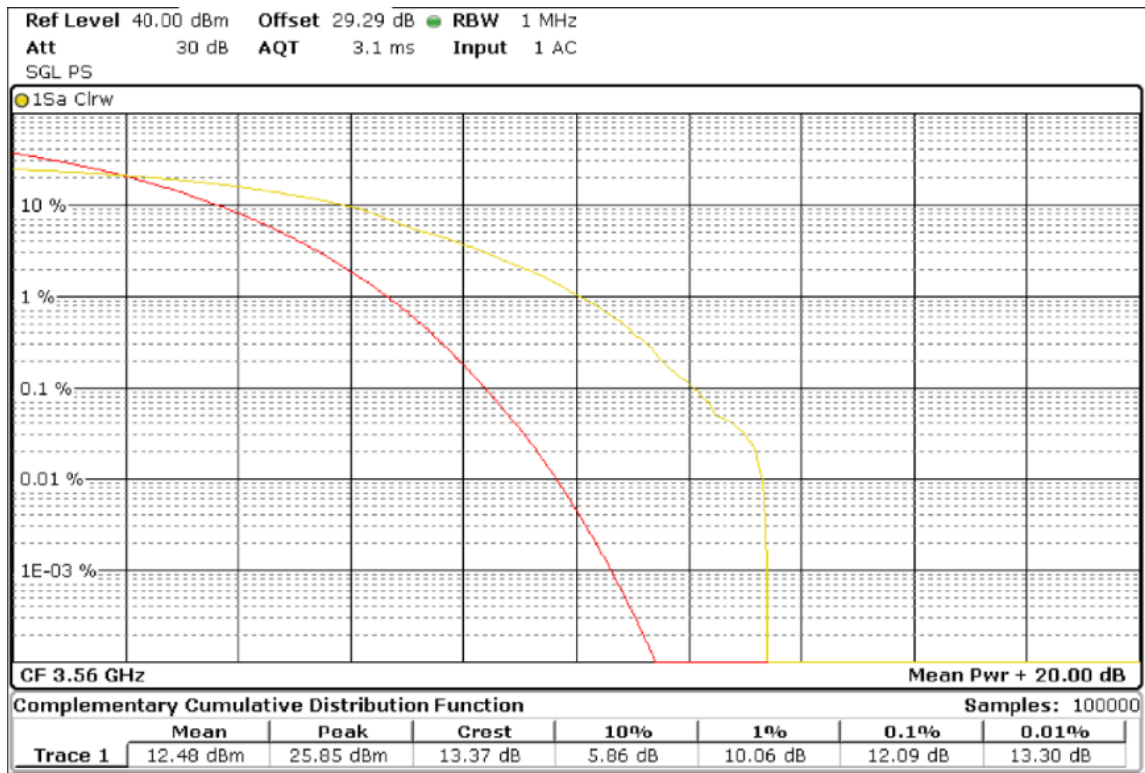


Highest Channel (3695 MHz)

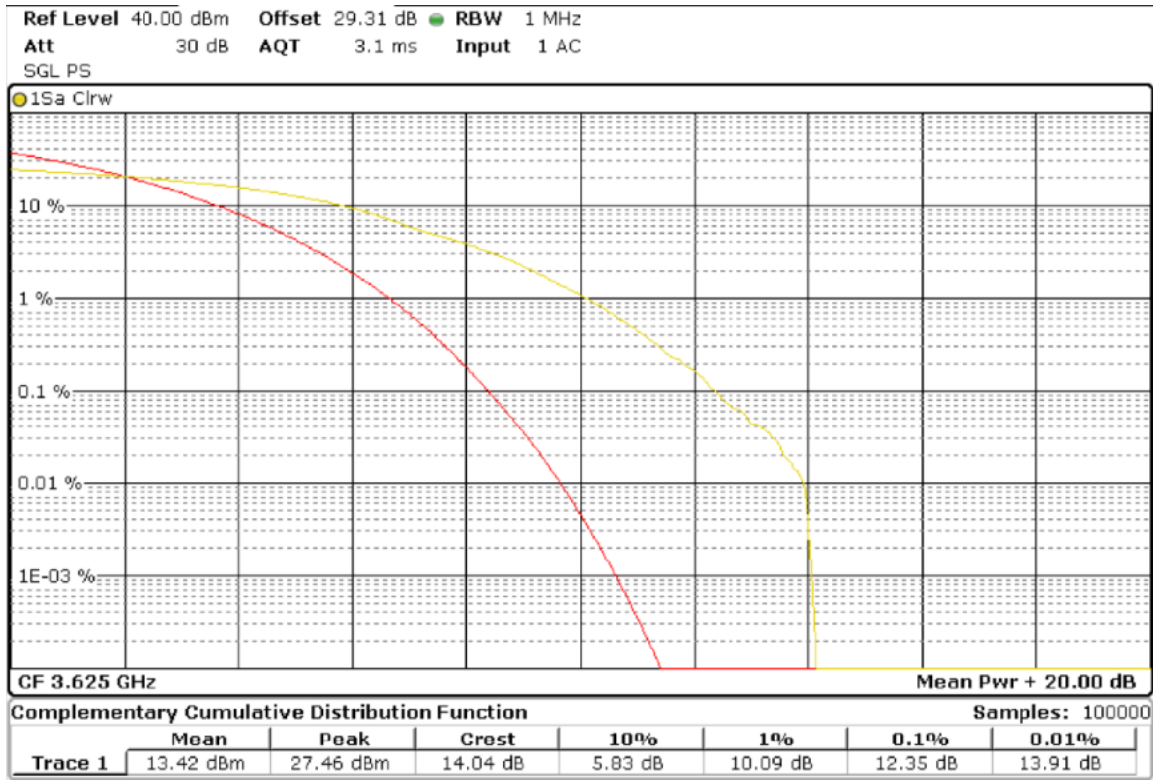


20MHz BW

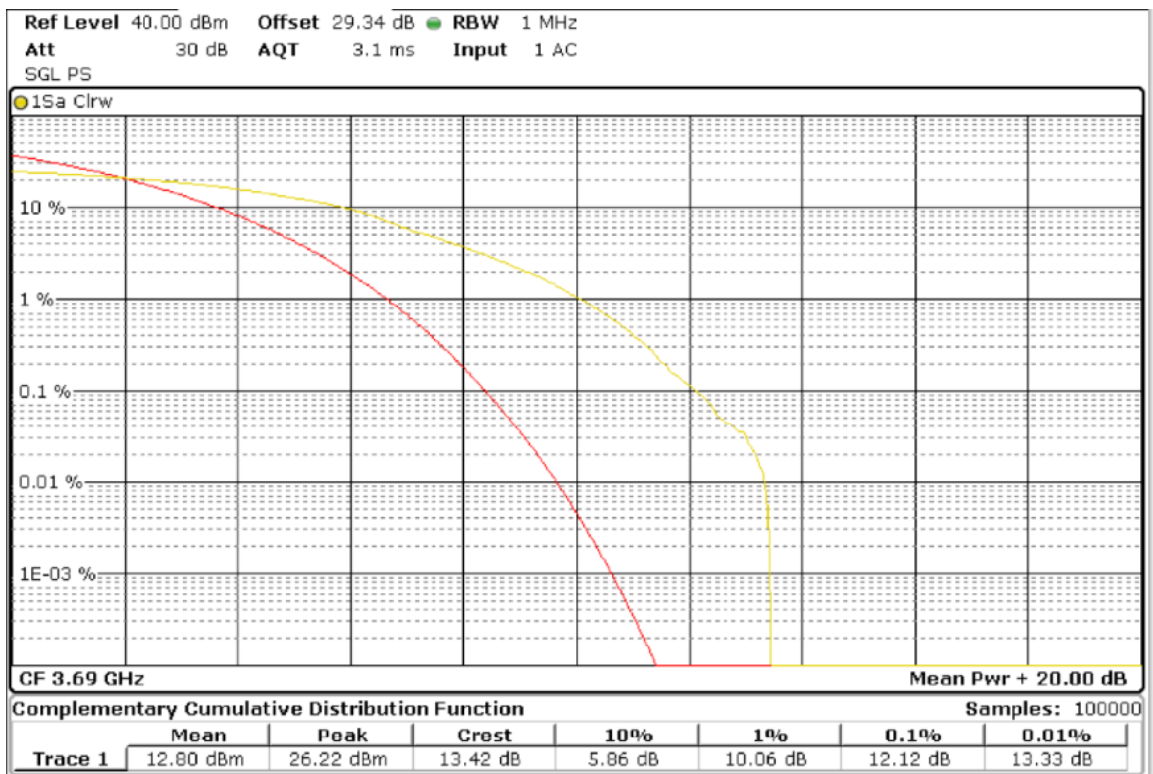
Lowest Channel (3560 MHz)



Middle Channel (3625 MHz)



Highest Channel (3690 MHz)



Section 2.1051 and 96.41 Subclause (e). 3.5 GHz Emissions and Interference Limits

The radio frequency voltage or powers generated within the equipment and appearing on a spurious frequency shall be checked at the equipment output terminals when properly loaded with a suitable artificial antenna. Curves or equivalent data shall show the magnitude of each harmonic and other spurious emission that can be detected when the equipment is operated under the conditions specified in § 2.1049 as appropriate. The magnitude of spurious emissions which are attenuated more than 20 dB below the permissible value need not be specified.

Confirm that the device satisfies the emission limits specified in Section 96.41(e) for all declared channel sizes, at the lowest and highest edges of the band, and in the middle of the band. The RMS detector was used for the measurement at each frequency with 400 MHz span.

The limits for emission outside the fundamental are stated below.

- within 0-10 MHz above and below the assigned channel ≤ -13 dBm/MHz
- greater than 10 MHz above and below the assigned channel ≤ -25 dBm/MHz
- any emission below 3530 MHz and above 3720 MHz ≤ -40 dBm/MHz

The following 10 log (1/duty cycle) was added in RF level offset to get the accurate measured power level in the average power measurement.

The duty cycle correction = 10 log (1/0.2) = 6.99 (dB)

RESULTS

10MHz BW

Lowest 3555 MHz		Middle 3625 MHz		Highest 3695 MHz	
Spurious frequency (MHz)	Emission Level (dBm/MHz)	Spurious frequency (MHz)	Emission Level (dBm/MHz)	Spurious frequency (MHz)	Emission Level (dBm/MHz)
3440.88	-46.09	3440.42	-46.50	3839.78	-47.57
		3509.38	-47.38		
Measurement uncertainty (dB)					$\leq \pm 2.03$

20MHz BW

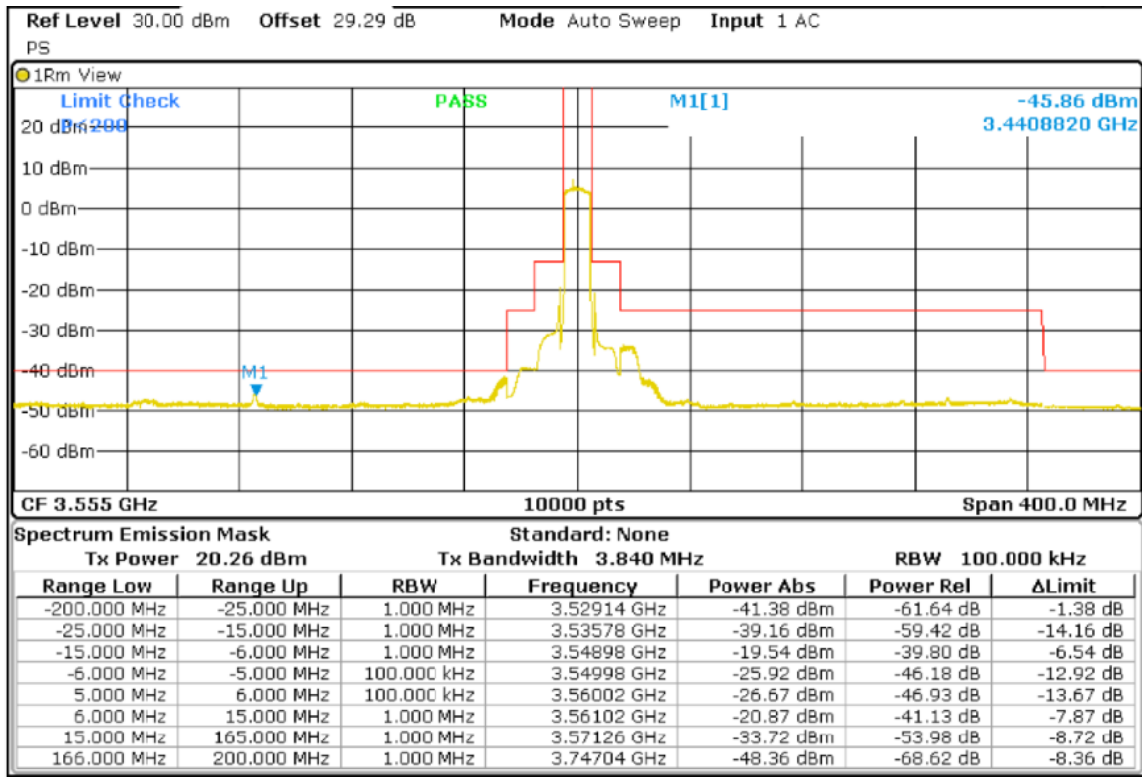
Lowest 3560 MHz		Middle 3625 MHz		Highest 3690 MHz	
Spurious frequency (MHz)	Emission Level (dBm/MHz)	Spurious frequency (MHz)	Emission Level (dBm/MHz)	Spurious frequency (MHz)	Emission Level (dBm/MHz)
3440.86	-46.92	3440.98	-47.18	3839.90	-47.81
		3778.58	-48.00		
Measurement uncertainty (dB)					$\leq \pm 2.03$

Verdict: PASS

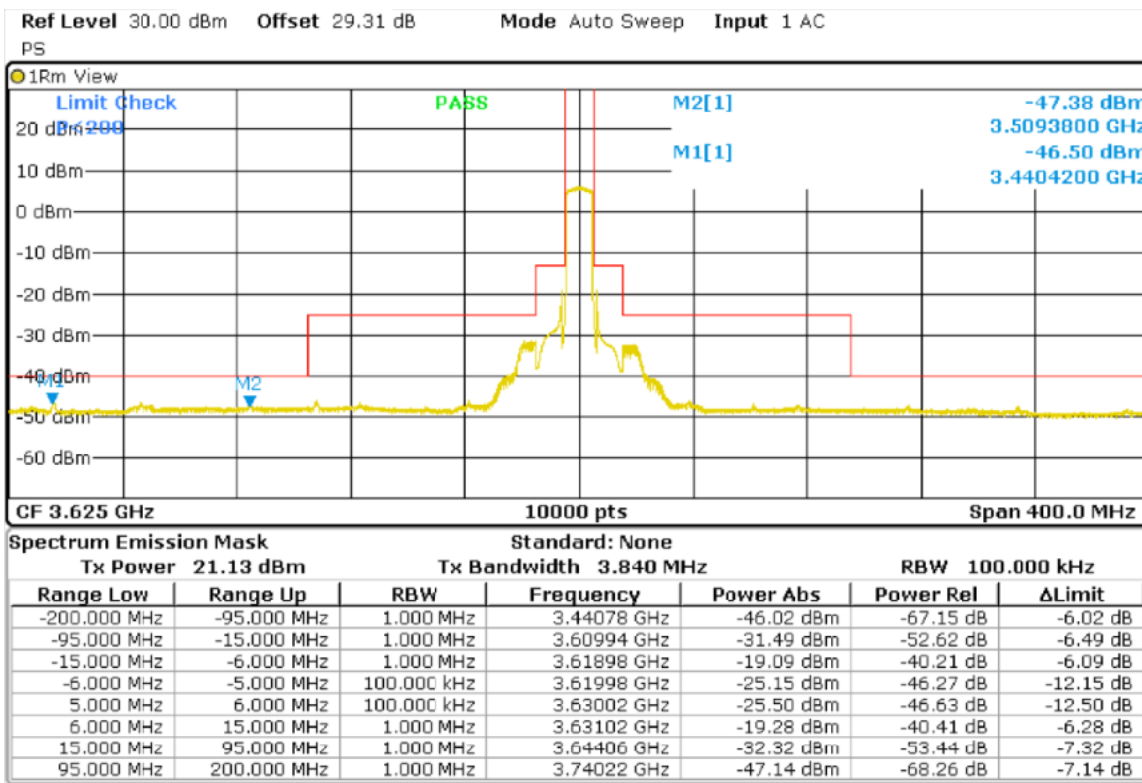
(See next plots)

10MHz BW

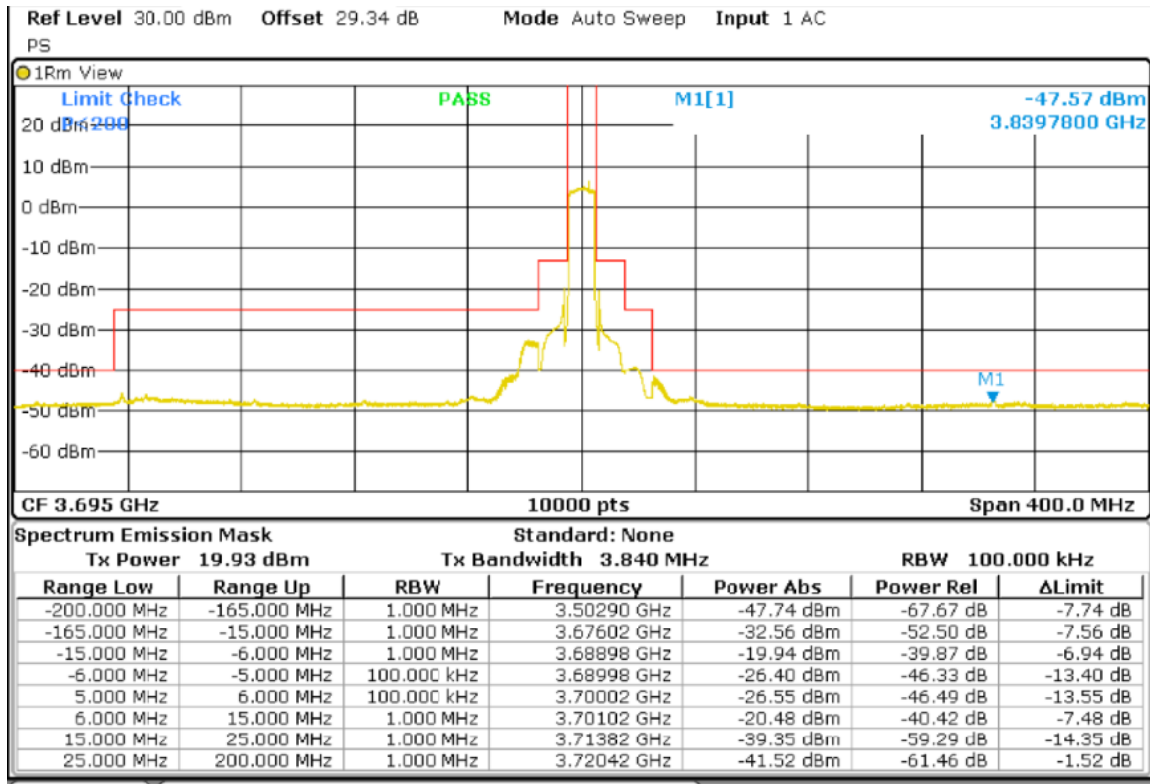
Lowest Channel (3555 MHz)



Middle Channel (3625 MHz)

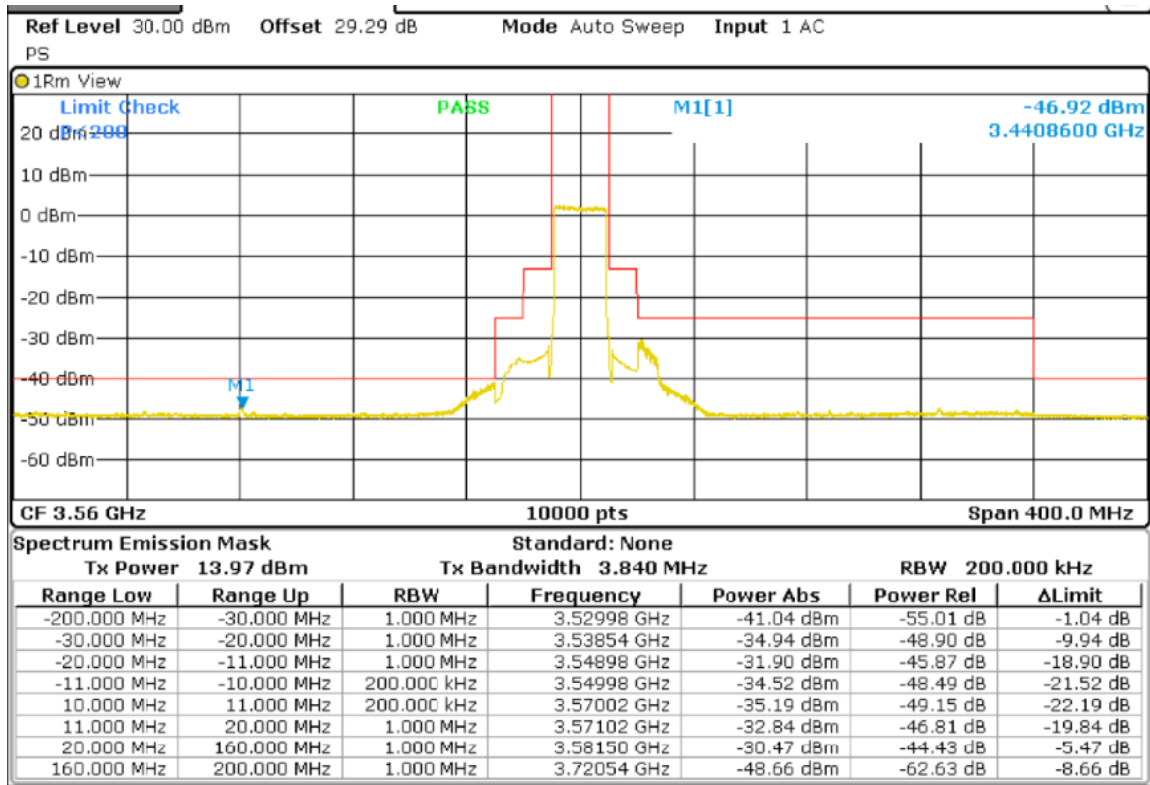


Highest Channel (3695 MHz)

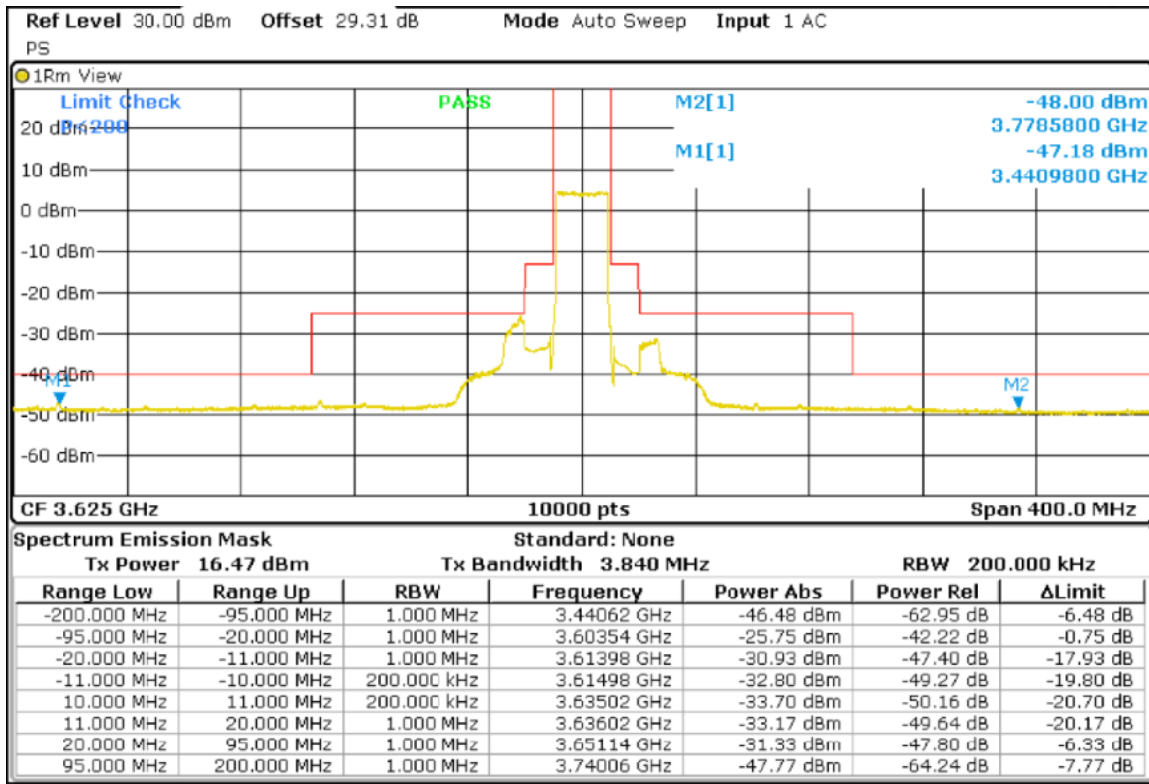


20MHz BW

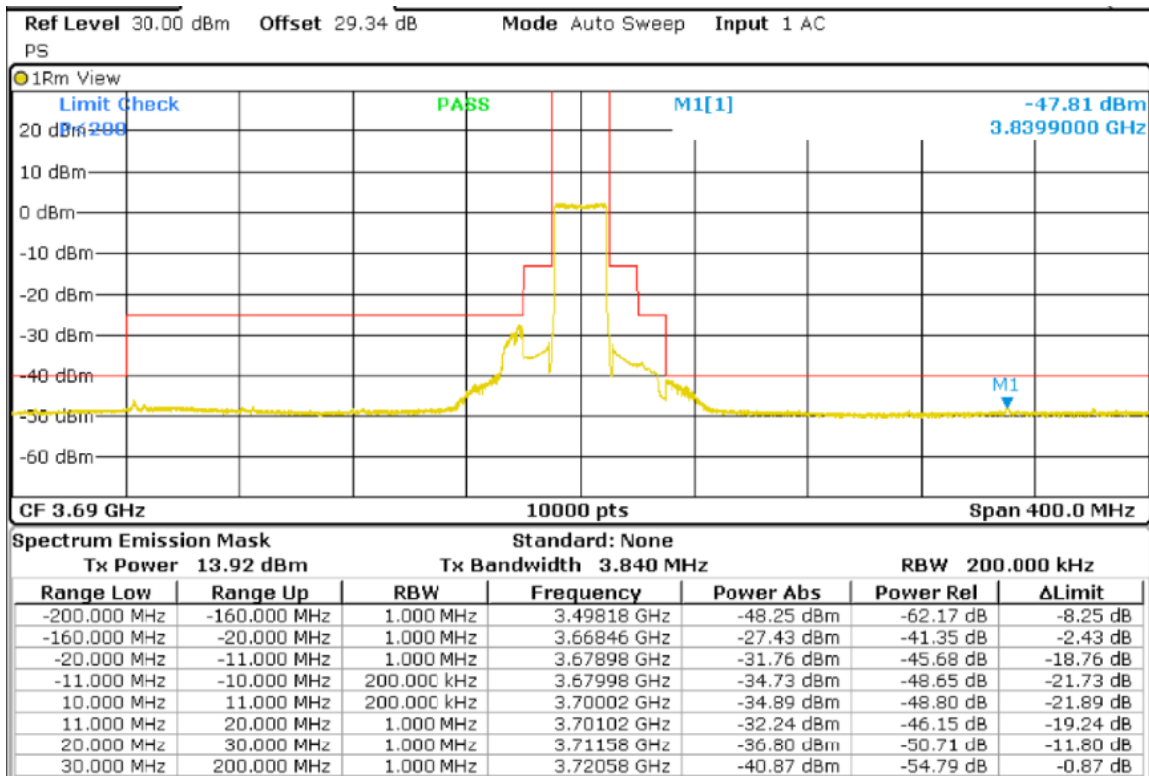
Lowest Channel (3560 MHz)



Middle Channel (3625 MHz)



Highest Channel (3690 MHz)



Section 2.1051 and 96.41 Subclause (e). Spurious Emissions at Antenna Terminals

The radio frequency voltage or powers generated within the equipment and appearing on a spurious frequency shall be checked at the equipment output terminals when properly loaded with a suitable artificial antenna. Curves or equivalent data shall show the magnitude of each harmonic and other spurious emission that can be detected when the equipment is operated under the conditions specified in § 2.1049 as appropriate. The magnitude of spurious emissions which are attenuated more than 20 dB below the permissible value need not be specified.

The limits for emission outside the fundamental for any emission below 3530 MHz and above 3720 MHz are -40 dBm/MHz.

The following 10 log (1/duty cycle) was added in RF level offset to get the accurate measured power level in the average power measurement.

The duty cycle correction = 10 log (1/0.2) = 6.99 (dB)

RESULTS

10MHz BW

Lowest 3555 MHz		Middle 3625 MHz		Highest 3695 MHz	
Spurious frequency (MHz)	Emission Level (dBm/MHz)	Spurious frequency (MHz)	Emission Level (dBm/MHz)	Spurious frequency (MHz)	Emission Level (dBm/MHz)
3225.69	-44.57	3225.54	-43.65	3225.54	-44.23
3440.76	-44.89	3440.61	-44.15	3440.61	-44.87
7109.68	-47.37	7250.18	-47.99	7389.68	-44.03
1066.45	-45.54	1987.40	-46.09	1108.70	-43.04
Measurement uncertainty (dB)					<± 2.03

20MHz BW

Lowest 3560 MHz		Middle 3625 MHz		Highest 3690 MHz	
Spurious frequency (MHz)	Emission Level (dBm/MHz)	Spurious frequency (MHz)	Emission Level (dBm/MHz)	Spurious frequency (MHz)	Emission Level (dBm/MHz)
3225.85	-45.97	3225.54	-44.57	3226.01	-45.09
3440.61	-45.96	3440.45	-45.34	3440.61	-46.22
1068.03	-52.93	7251.18	-46.95	1106.80	-53.69
		1087.55	-48.42		
Measurement uncertainty (dB)					<± 2.03

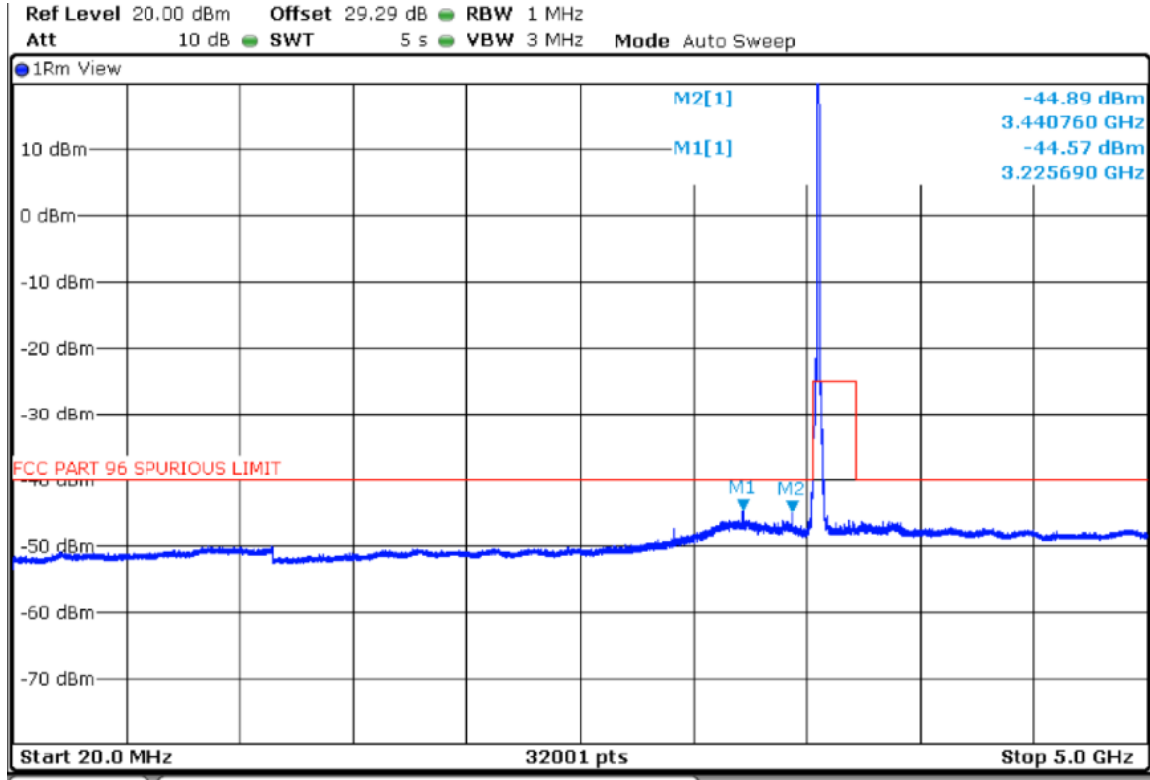
Verdict: PASS

(See the next plots)

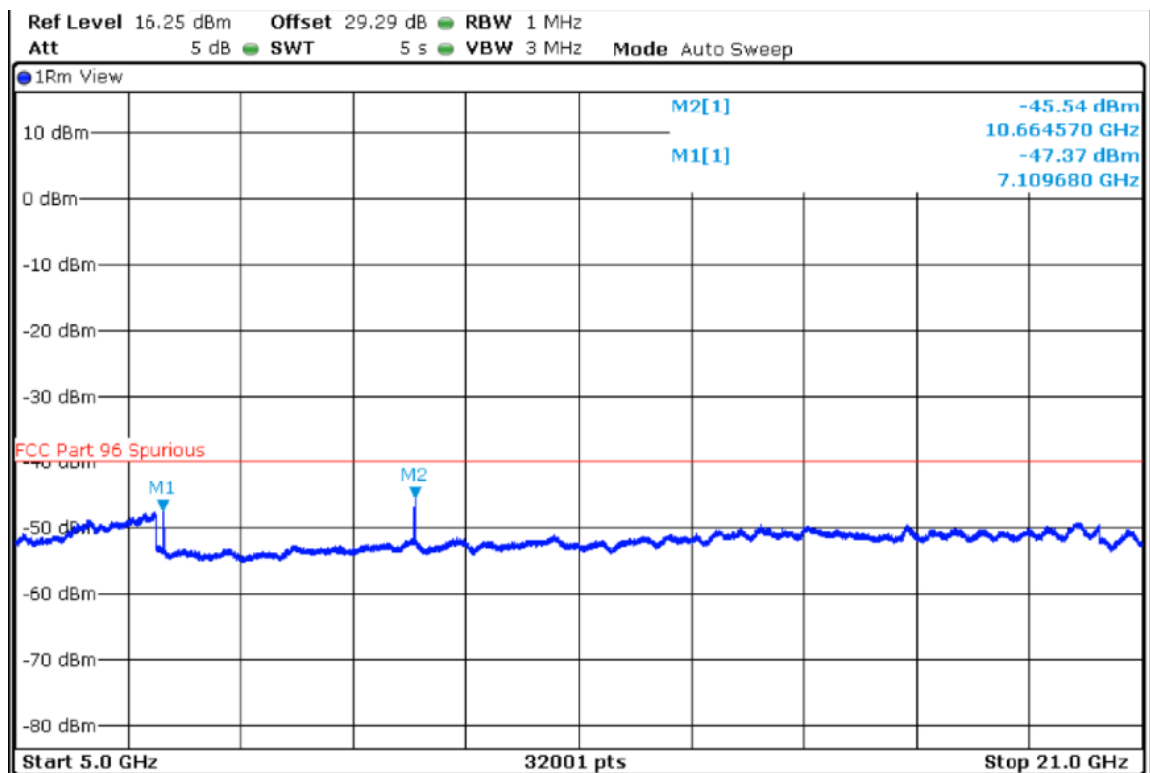
10MHz BW

Lowest Channel (3555 MHz)

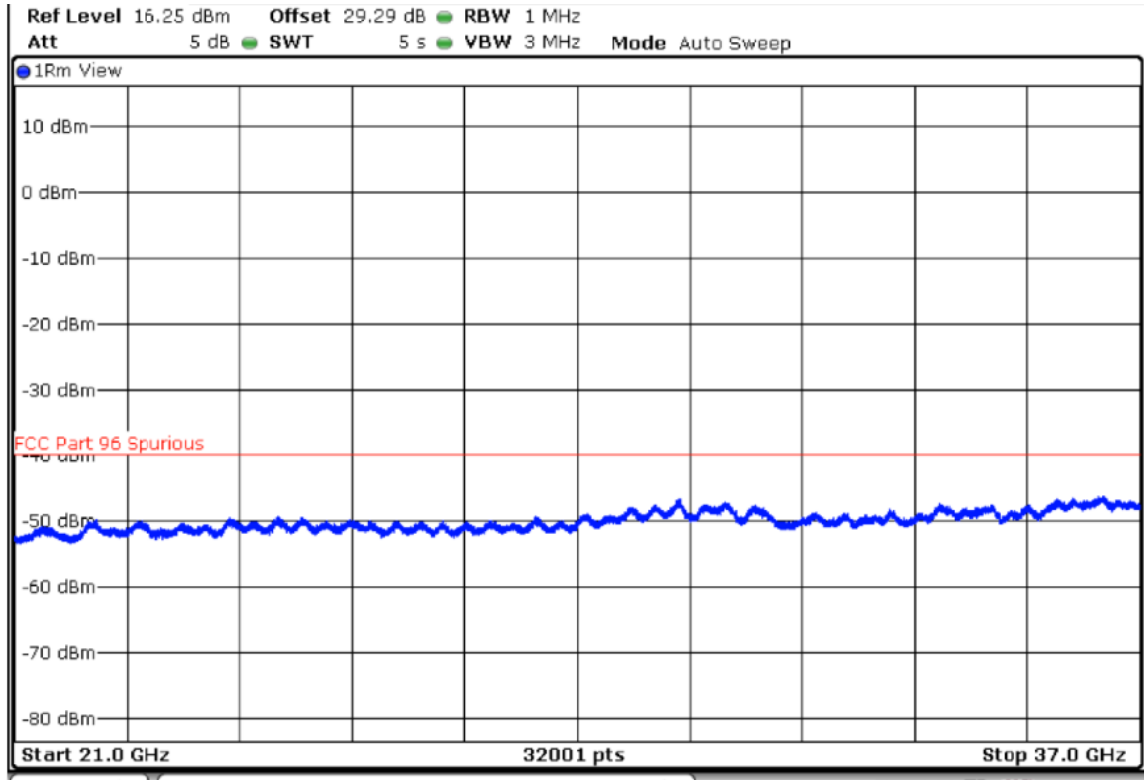
FREQUENCY RANGE 20 MHz-5 GHz



FREQUENCY RANGE 5-21 GHz

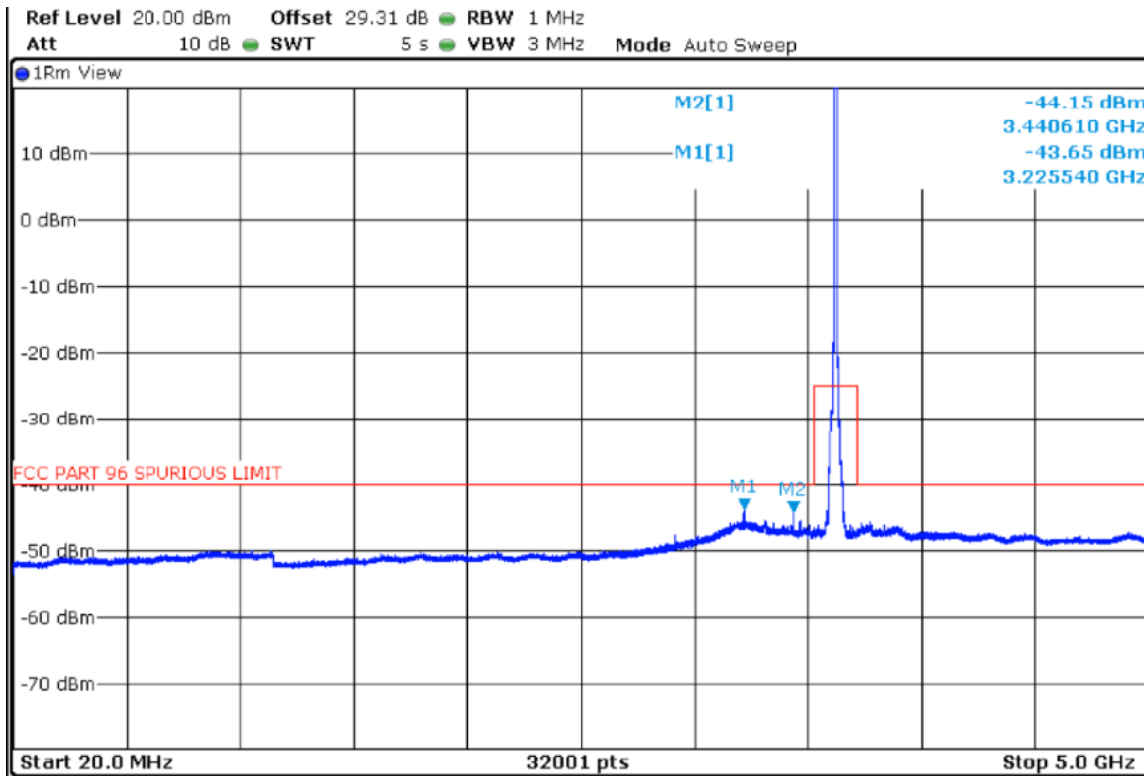


FREQUENCY RANGE 21-37 GHz

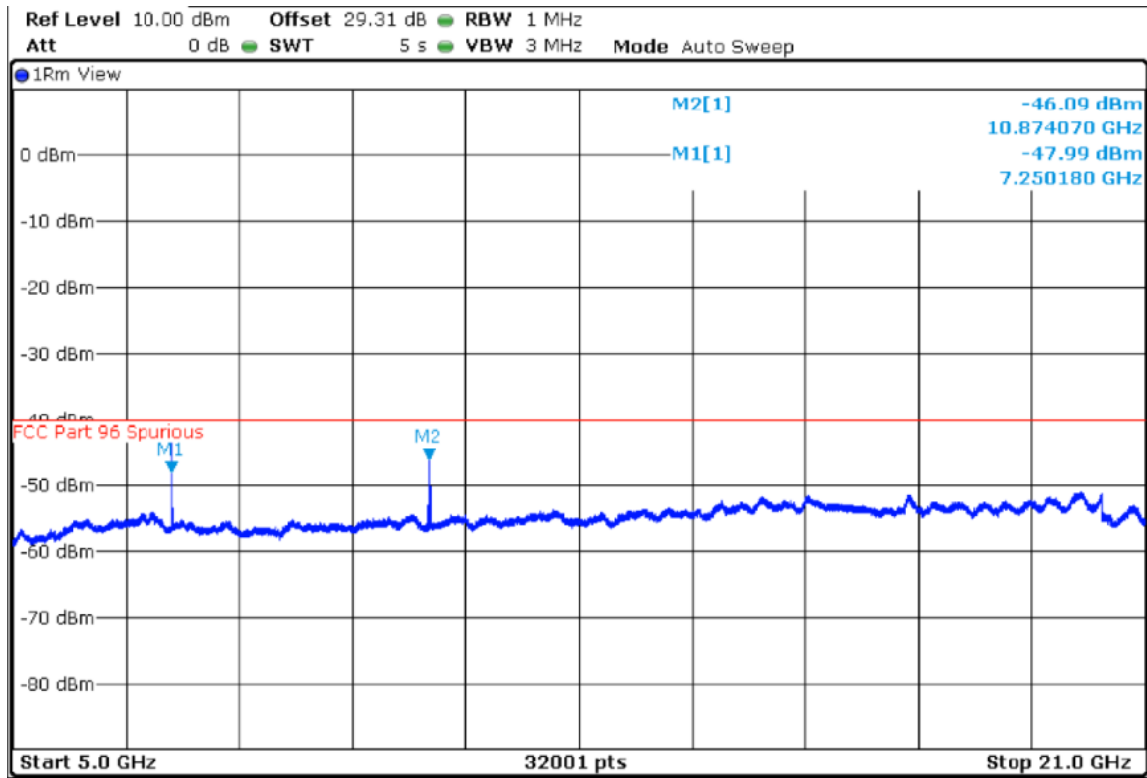


Middle Channel (3625 MHz)

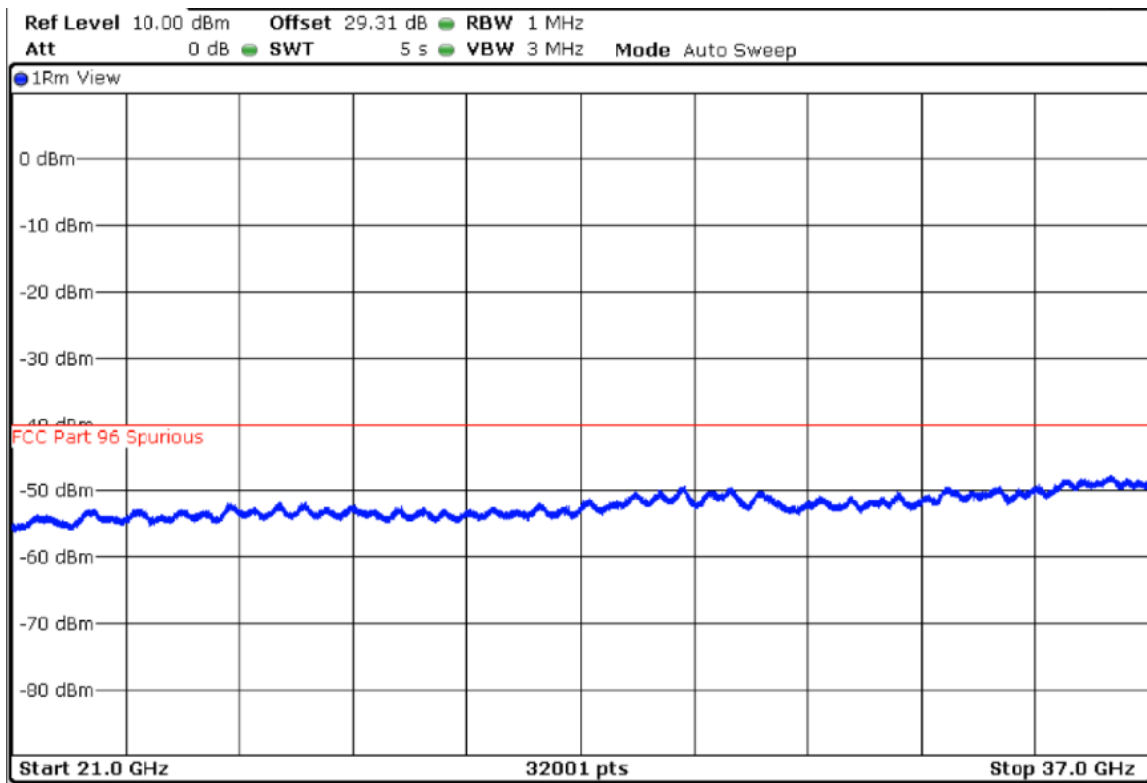
FREQUENCY RANGE 20 MHz-5 GHz



FREQUENCY RANGE 5-21 GHz

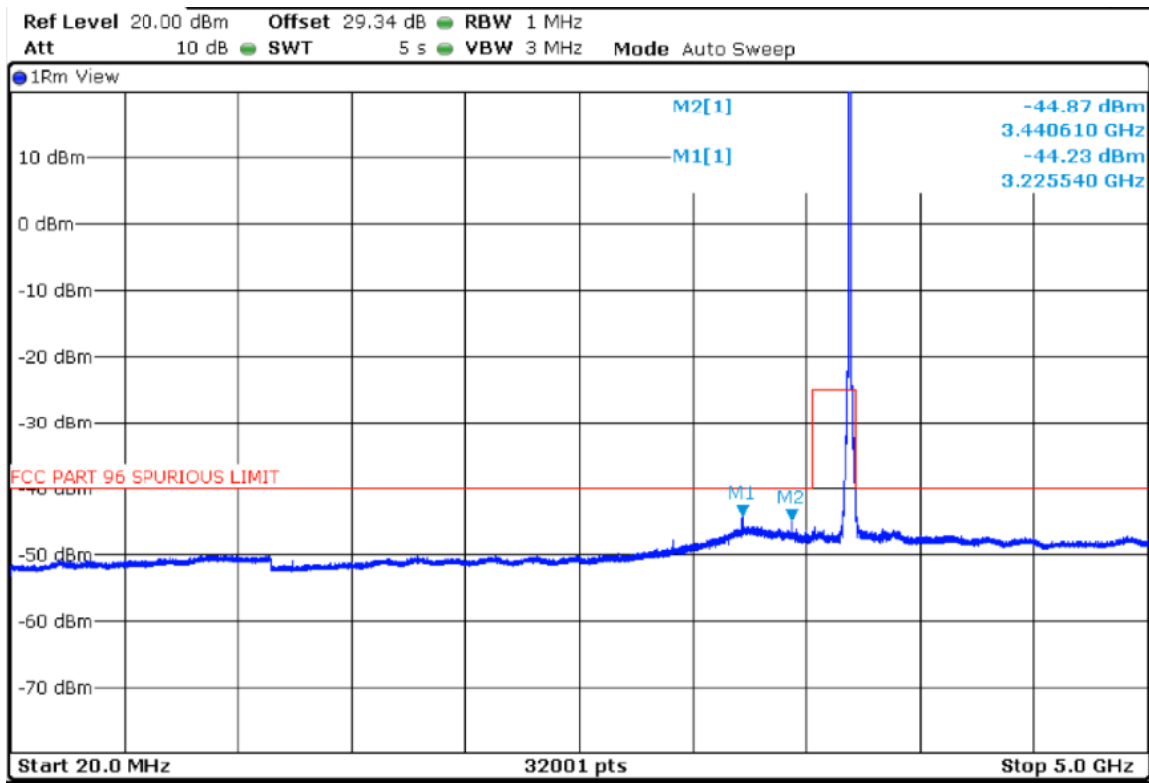


FREQUENCY RANGE 21-37 GHz

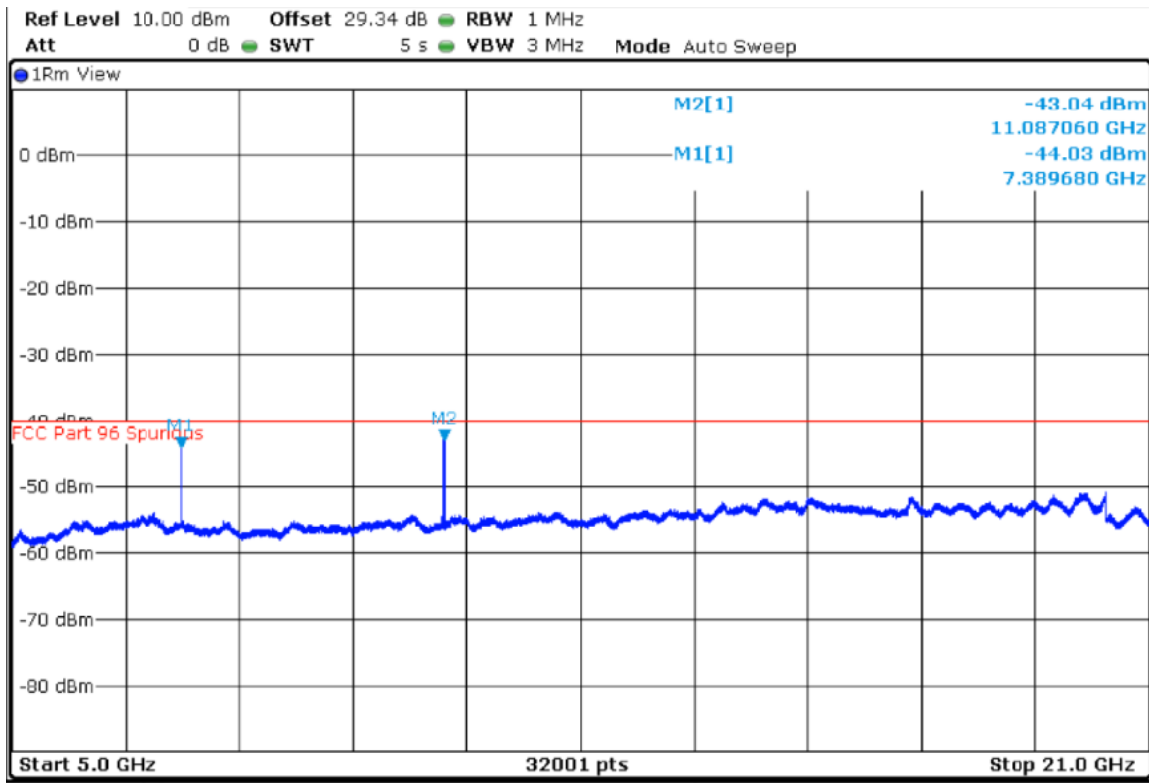


Highest Channel (3695 MHz)

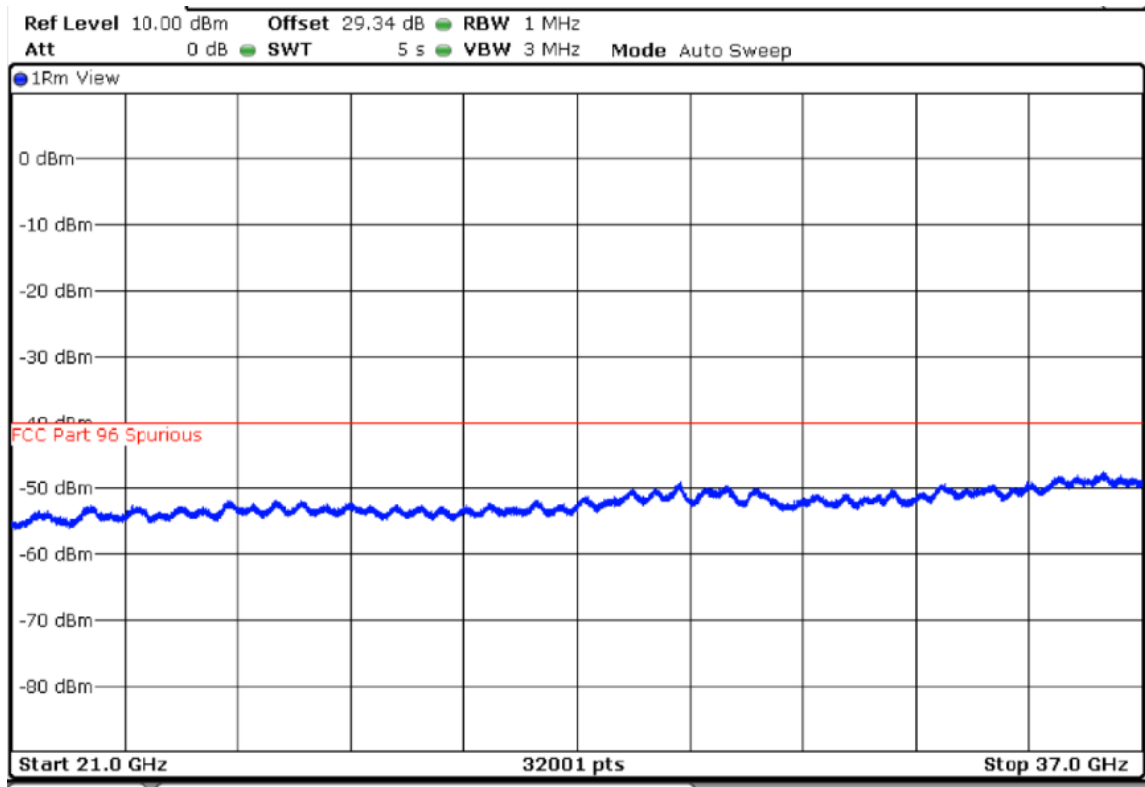
FREQUENCY RANGE 20 MHz-5 GHz



FREQUENCY RANGE 5-21 GHz



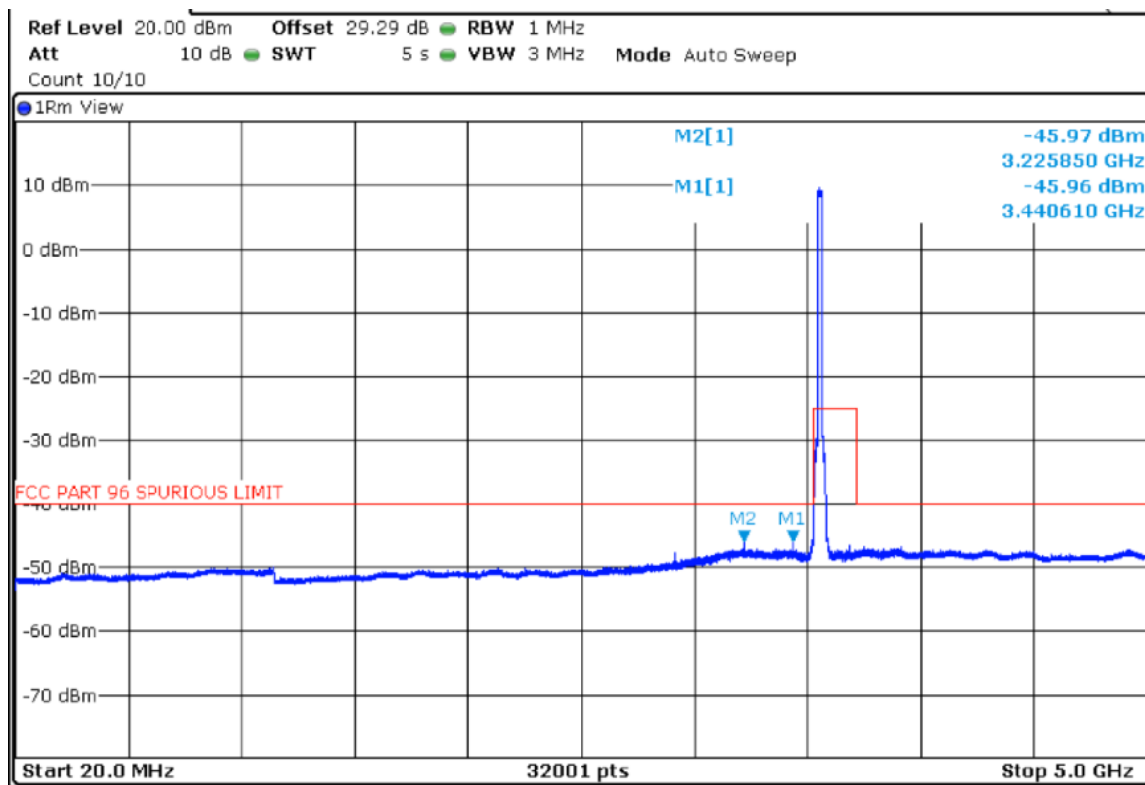
FREQUENCY RANGE 21-37 GHz



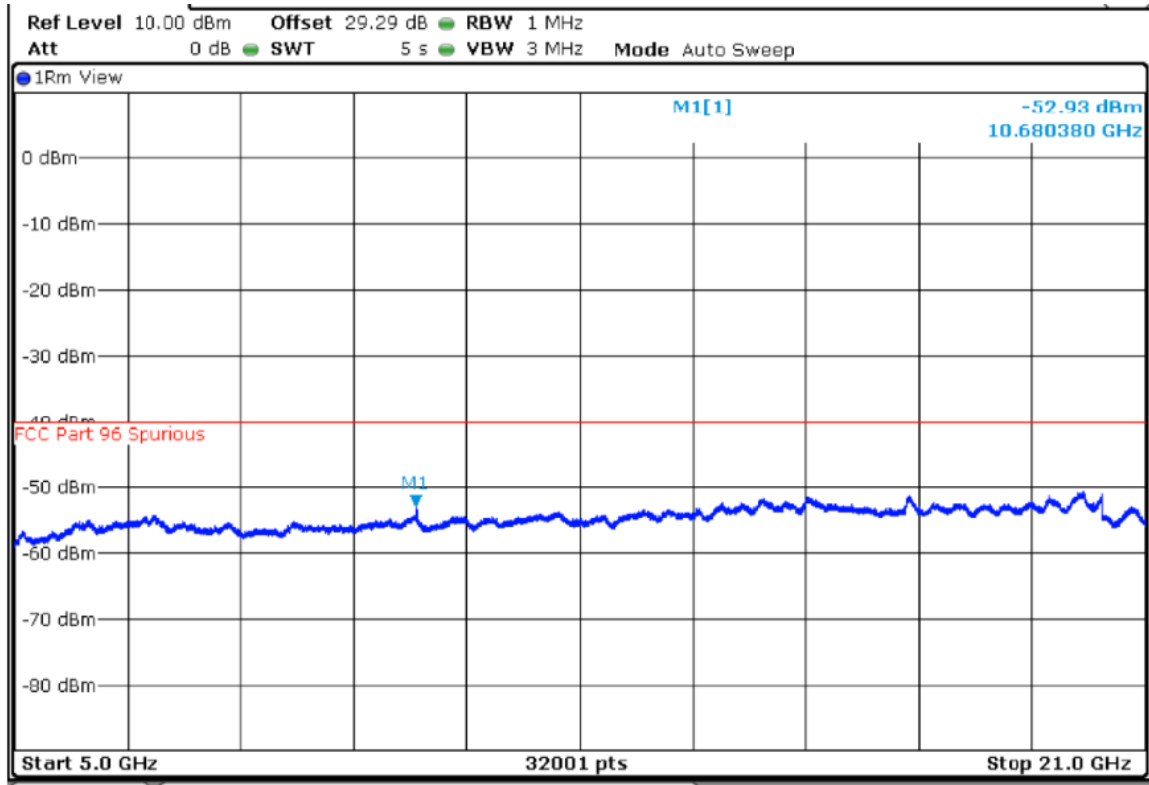
20MHz BW

Lowest Channel (3560 MHz)

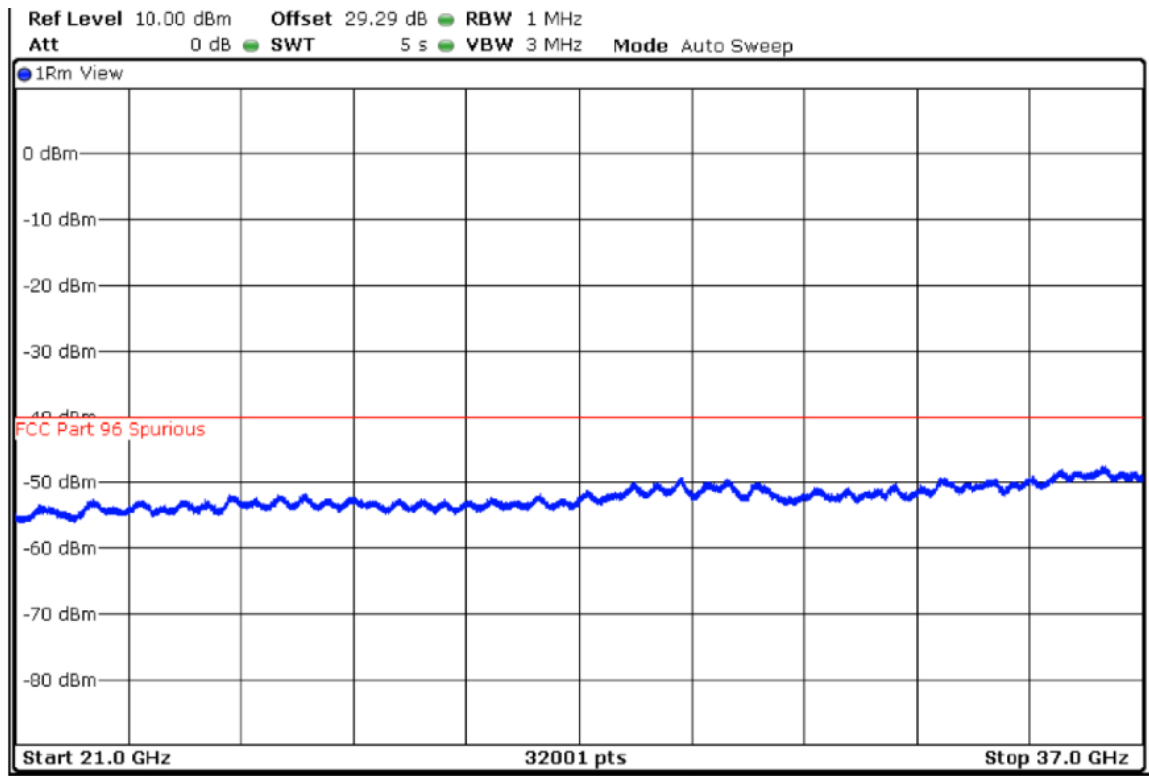
FREQUENCY RANGE 20 MHz-5 GHz



FREQUENCY RANGE 5-21 GHz

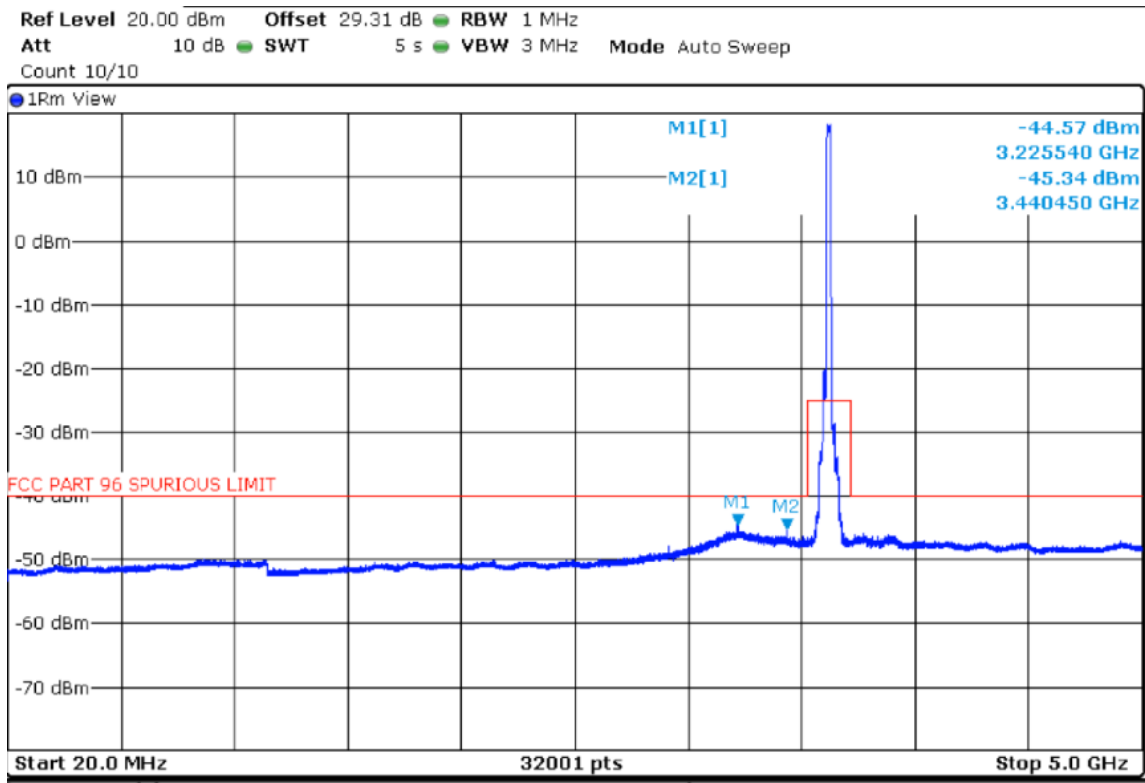


FREQUENCY RANGE 21-37 GHz

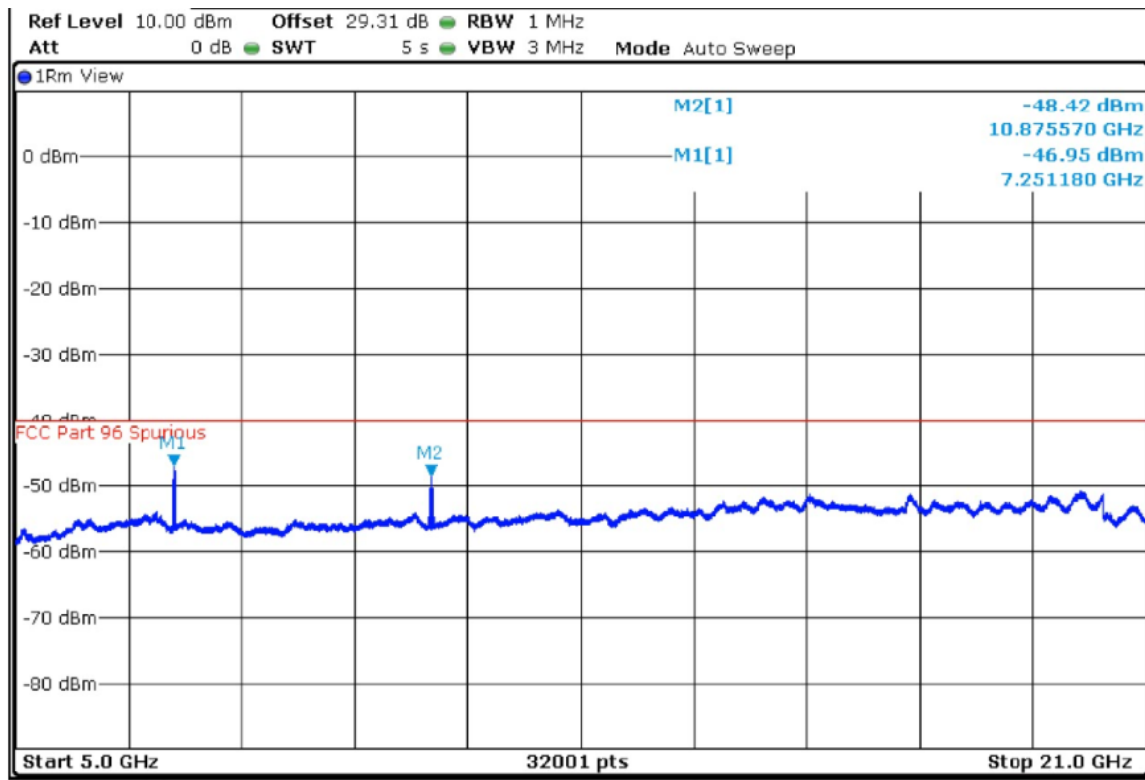


Middle Channel (3625 MHz)

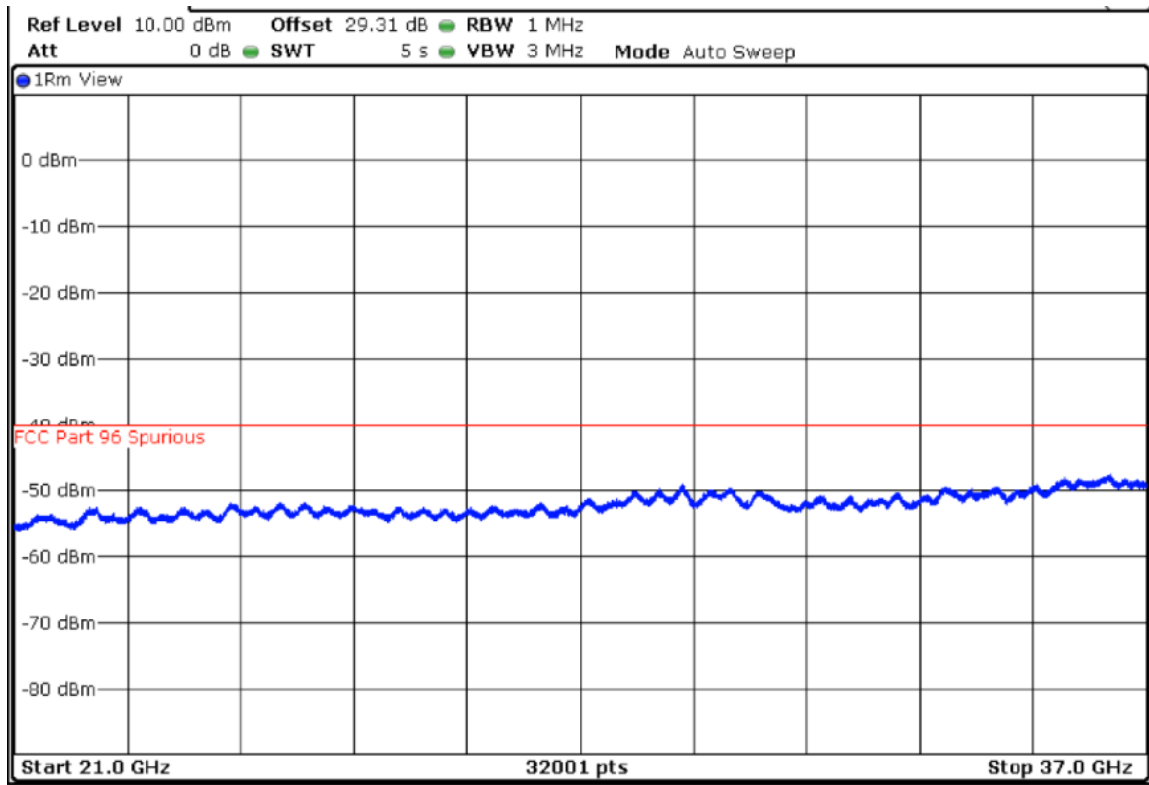
FREQUENCY RANGE 20 MHz-5 GHz



FREQUENCY RANGE 5-21 GHz

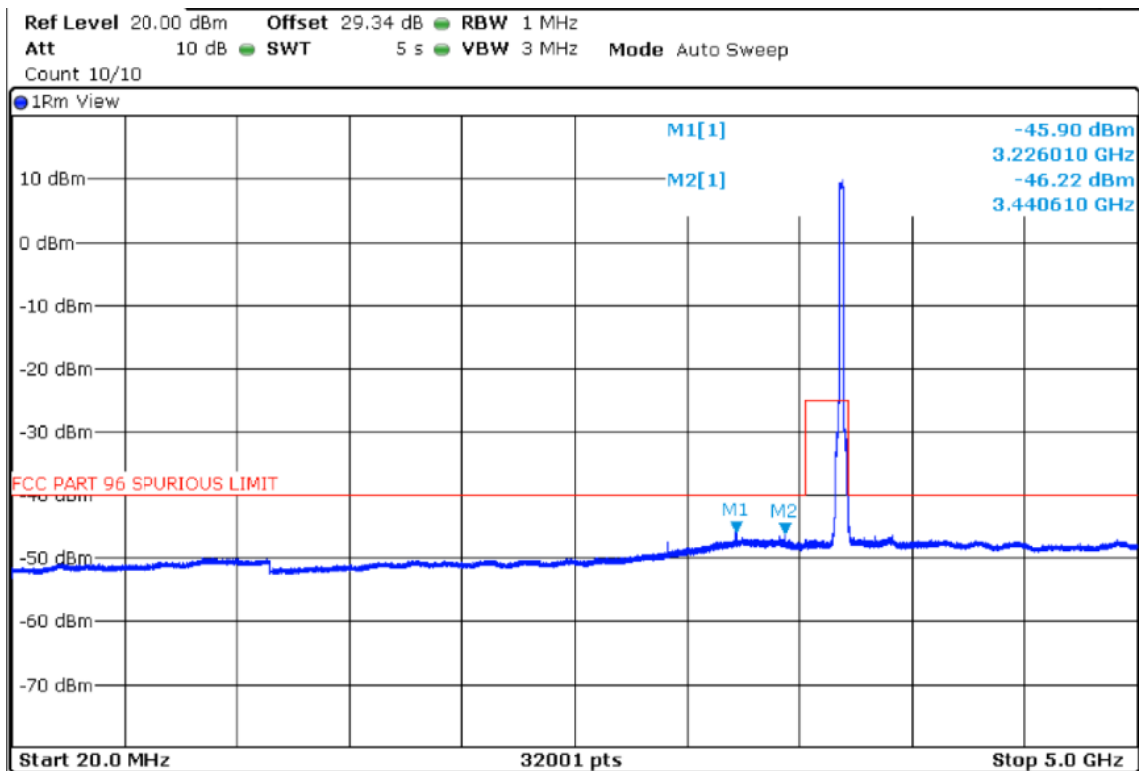


FREQUENCY RANGE 21-37 GHz

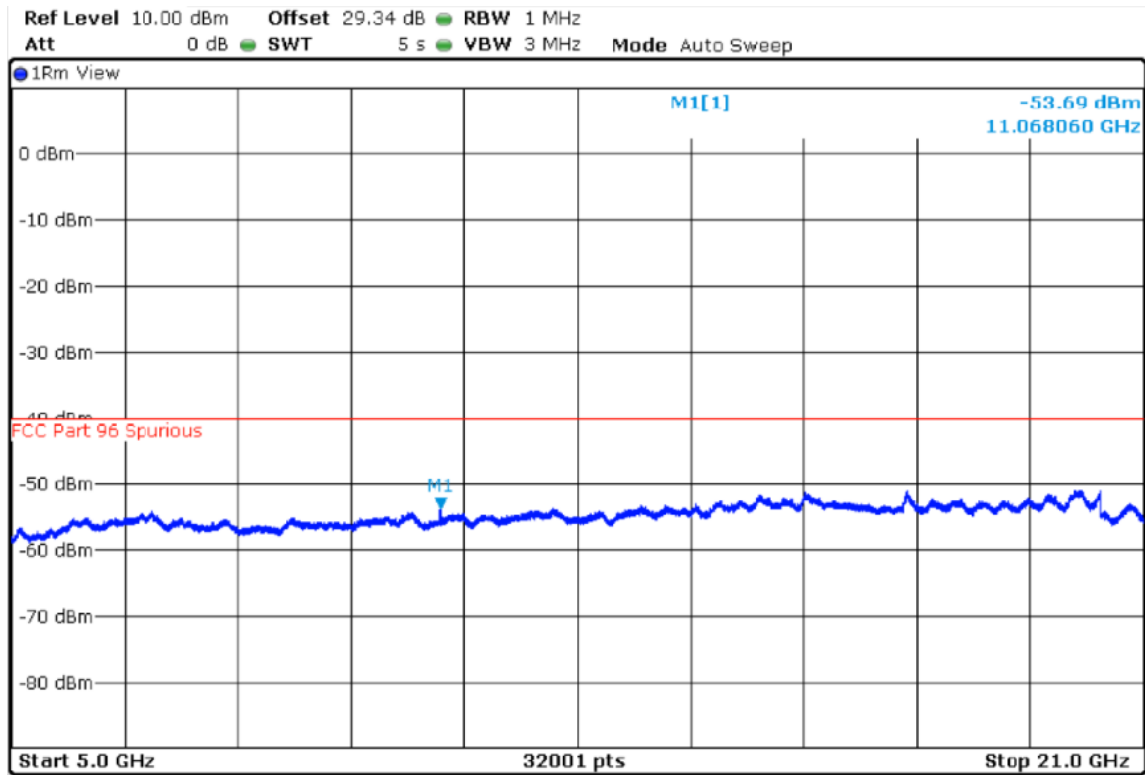


Highest Channel (3690 MHz)

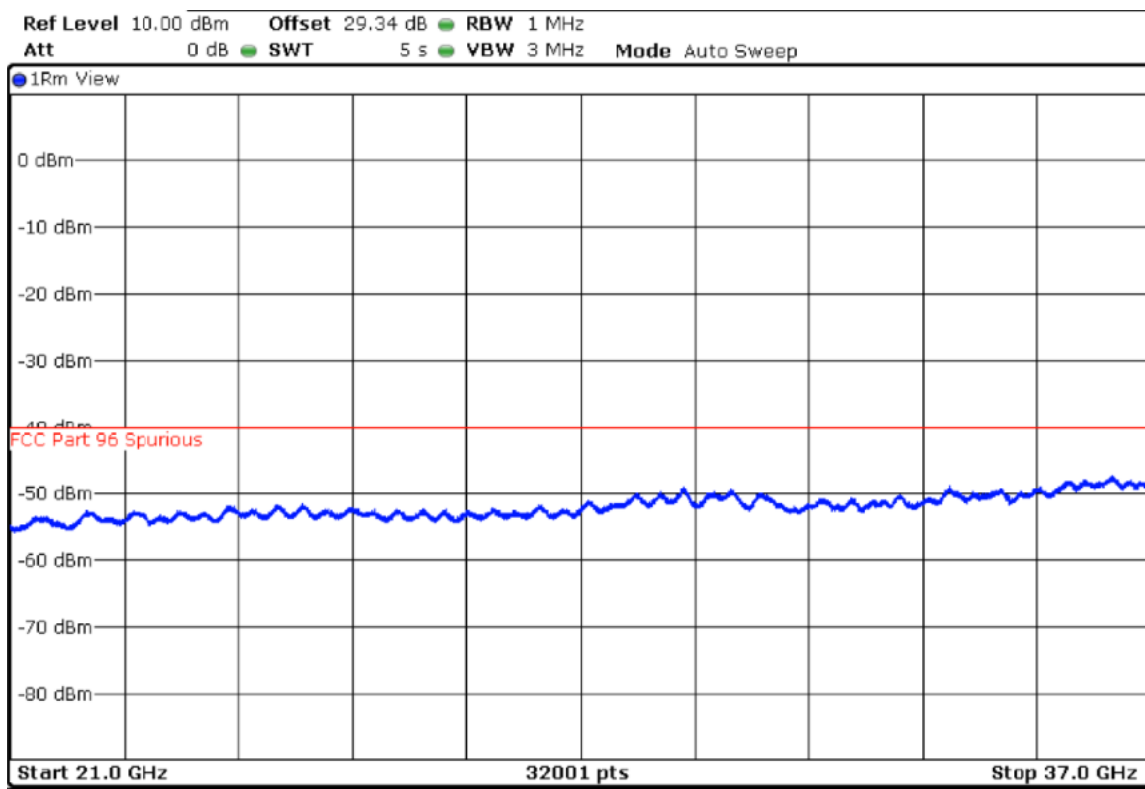
FREQUENCY RANGE 20 MHz-5 GHz



FREQUENCY RANGE 5-21 GHz



FREQUENCY RANGE 21-37 GHz



Section 2.1053. Radiated Spurious Emission

Measurements shall be made to detect spurious emissions that may be radiated directly from the cabinet, control circuits, power leads, or intermediate circuit elements under normal conditions of installation and operation.

Curves or equivalent data shall be supplied showing the magnitude of each harmonic and other spurious emission. For this test, single sideband, independent sideband, and controlled carrier transmitters shall be modulated under the conditions specified in paragraph (c) of § 2.1049, as appropriate.

The limits for radiated emissions are stated below.

- greater than 10 MHz above and below the assigned channel $\leq 70.2 \text{ dB}\mu\text{V/m}$ (-25 dBm/MHz: conducted limit)
- any emission below 3530 MHz and above 3720 MHz $\leq 55.2 \text{ dB}\mu\text{V/m}$ (-40 dBm/MHz: conducted limit)

The following measurements were performed at 3-meter distance.

The maximum equivalent isotropically radiated power (e.i.r.p.) is calculated by adding the declared maximum antenna gain (dBi) and 10 log (1/duty cycle) was added in RF level offset to get the accurate measured power level in the average power measurement.

The duty cycle correction = $10 \log (1/0.2) = 6.99 \text{ (dB)}$

RESULTS

10MHz BW

FREQUENCY RANGE 30 MHz-1000 MHz

Lowest Channel (3555 MHz)

Spurious frequency (MHz)	Polarization	Detector	Emission Level (dB μ V/m)	Measurement Uncertainty (dB)
187.237000	V	RMS	40.89	± 4.87
198.392000	V	RMS	40.14	
208.771000	V	RMS	37.39	
225.067000	H	RMS	43.18	
345.735000	V	RMS	34.70	

Middle Channel (3625 MHz)

Spurious frequency (MHz)	Polarization	Detector	Emission Level (dB μ V/m)	Measurement Uncertainty (dB)
98.482000	V	RMS	34.61	± 4.87
179.477000	V	RMS	35.25	
189.565000	H	RMS	36.31	
225.067000	V	RMS	41.44	

Highest Channel (3695 MHz)

Spurious frequency (MHz)	Polarization	Detector	Emission Level (dB μ V/m)	Measurement Uncertainty (dB)
98.288000	V	RMS	34.08	± 4.87
170.068000	H	RMS	36.35	± 4.87
187.431000	V	RMS	37.60	± 4.87
224.970000	H	RMS	43.69	± 4.87
836.167000	H	RMS	38.05	± 4.87

FREQUENCY RANGE 1-18 GHz

Lowest Channel (3555 MHz)

Spurious frequency (MHz)	Polarization	Detector	Emission Level (dB μ V/m)	Measurement Uncertainty (dB)
7109.906250	H	RMS	50.80	± 4.87
10671.406250	H	RMS	51.78	
14220.156250	V	RMS	46.21	
17774.750000	H	RMS	43.05	

Middle Channel (3625 MHz)

Spurious frequency (MHz)	Polarization	Detector	Emission Level (dB μ V/m)	Measurement Uncertainty (dB)
7250.156250	V	RMS	50.78	± 4.87
10879.656250	H	RMS	51.03	
14500.125000	V	RMS	53.87	

Highest Channel (3695 MHz)

Spurious frequency (MHz)	Polarization	Detector	Emission Level (dB μ V/m)	Measurement Uncertainty (dB)
7389.875000	H	RMS	51.83	± 4.87
11088.968750	H	RMS	47.69	
14780.093750	V	RMS	47.98	

FREQUENCY RANGE 18-40 GHz

Lowest Channel (3555 MHz)

Spurious frequency (MHz)	Polarization	Detector	Emission Level (dB μ V/m)	Measurement Uncertainty (dB)
21329.562500	H	RMS	41.96	± 4.87

Middle Channel (3625 MHz)

Spurious frequency (MHz)	Polarization	Detector	Emission Level (dB μ V/m)	Measurement Uncertainty (dB)
21749.625000	V	RMS	44.49	± 4.87
29000.000000	V	RMS	37.56	

Highest Channel (3695 MHz)

Spurious frequency (MHz)	Polarization	Detector	Emission Level (dB μ V/m)	Measurement Uncertainty (dB)
18475.750000	V	RMS	38.37	± 4.87
22169.687500	V	RMS	44.14	
29560.312500	H	RMS	37.91	

20MHz BW

FREQUENCY RANGE 30 MHz-1000 MHz

Lowest Channel (3560 MHz)

Spurious frequency (MHz)	Polarization	Detector	Emission Level (dB μ V/m)	Measurement Uncertainty (dB)
97.609000	V	RMS	34.68	± 4.87
177.731000	V	RMS	37.00	
182.290000	H	RMS	36.22	
225.067000	H	RMS	44.68	
953.537000	V	RMS	39.65	

Middle Channel (3625 MHz)

Spurious frequency (MHz)	Polarization	Detector	Emission Level (dB μ V/m)	Measurement Uncertainty (dB)
183.648000	H	RMS	38.87	± 4.87
187.431000	H	RMS	39.00	
225.067000	H	RMS	42.96	
699.591000	H	RMS	38.15	
945.001000	H	RMS	39.71	

Highest Channel (3690 MHz)

Spurious frequency (MHz)	Polarization	Detector	Emission Level (dB μ V/m)	Measurement Uncertainty (dB)
177.052000	V	RMS	37.01	± 4.87
182.484000	H	RMS	38.27	
224.970000	H	RMS	43.07	
831.123000	V	RMS	37.91	

FREQUENCY RANGE 1-18 GHz

Lowest Channel (3560 MHz)

Spurious frequency (MHz)	Polarization	Detector	Emission Level (dB μ V/m)	Measurement Uncertainty (dB)
7120.000000	H	RMS	52.17	± 4.87
10679.375000	H	RMS	47.55	
14240.343750	V	RMS	46.76	

Middle Channel (3625 MHz)

Spurious frequency (MHz)	Polarization	Detector	Emission Level (dB μ V/m)	Measurement Uncertainty (dB)
7250.156250	H	RMS	42.81	± 4.87
10865.312500	H	RMS	48.12	
14500.125000	V	RMS	46.53	

Highest Channel (3690 MHz)

Spurious frequency (MHz)	Polarization	Detector	Emission Level (dB μ V/m)	Measurement Uncertainty (dB)
7379.781250	H	RMS	44.55	± 4.87
11070.906250	H	RMS	41.57	
14759.906250	H	RMS	44.24	

FREQUENCY RANGE 18-40 GHz

Lowest Channel (3560 MHz)

Spurious frequency (MHz)	Polarization	Detector	Emission Level (dB μ V/m)	Measurement Uncertainty (dB)
21359.812500	V	RMS	43.03	± 4.87
28480.250000	V	RMS	37.77	
35593.125000	H	RMS	40.65	

Middle Channel (3625 MHz)

Spurious frequency (MHz)	Polarization	Detector	Emission Level (dB μ V/m)	Measurement Uncertainty (dB)
21749.625000	H	RMS	43.97	± 4.87
29000.000000	H	RMS	38.07	

Highest Channel (3690 MHz)

Spurious frequency (MHz)	Polarization	Detector	Emission Level (dB μ V/m)	Measurement Uncertainty (dB)
22140.125000	V	RMS	43.06	± 4.87
29519.750000	V	RMS	38.82	

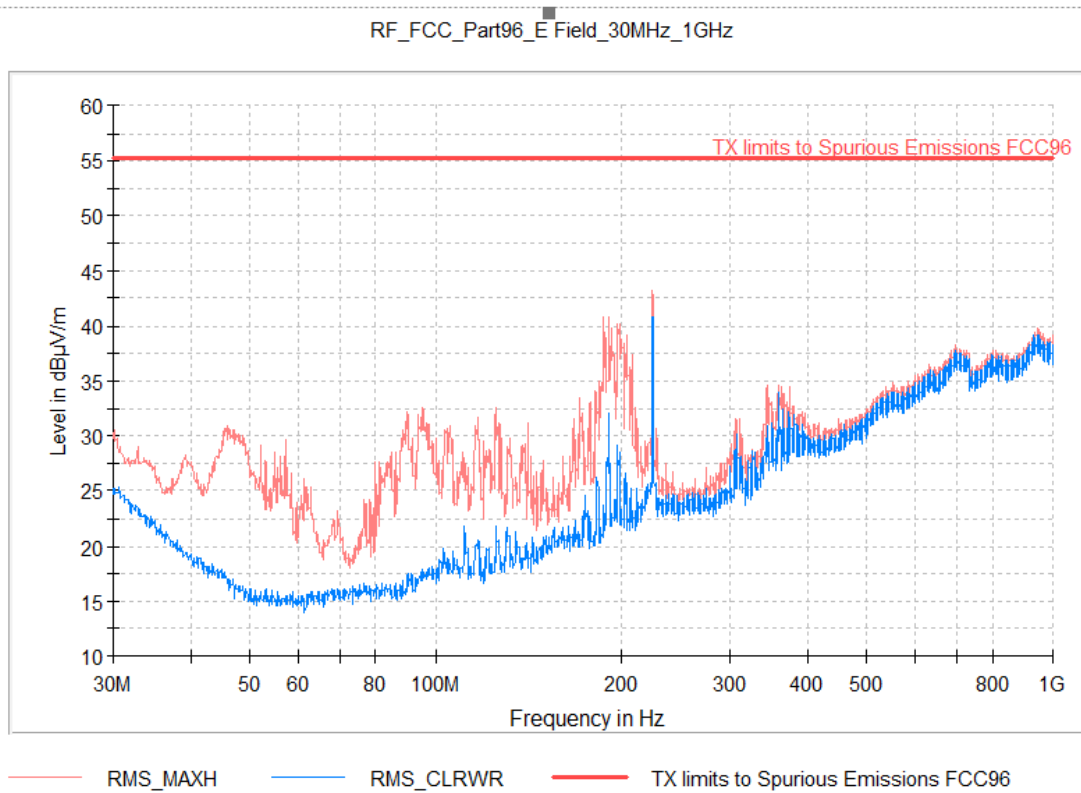
Verdict: PASS

(See the next plots)

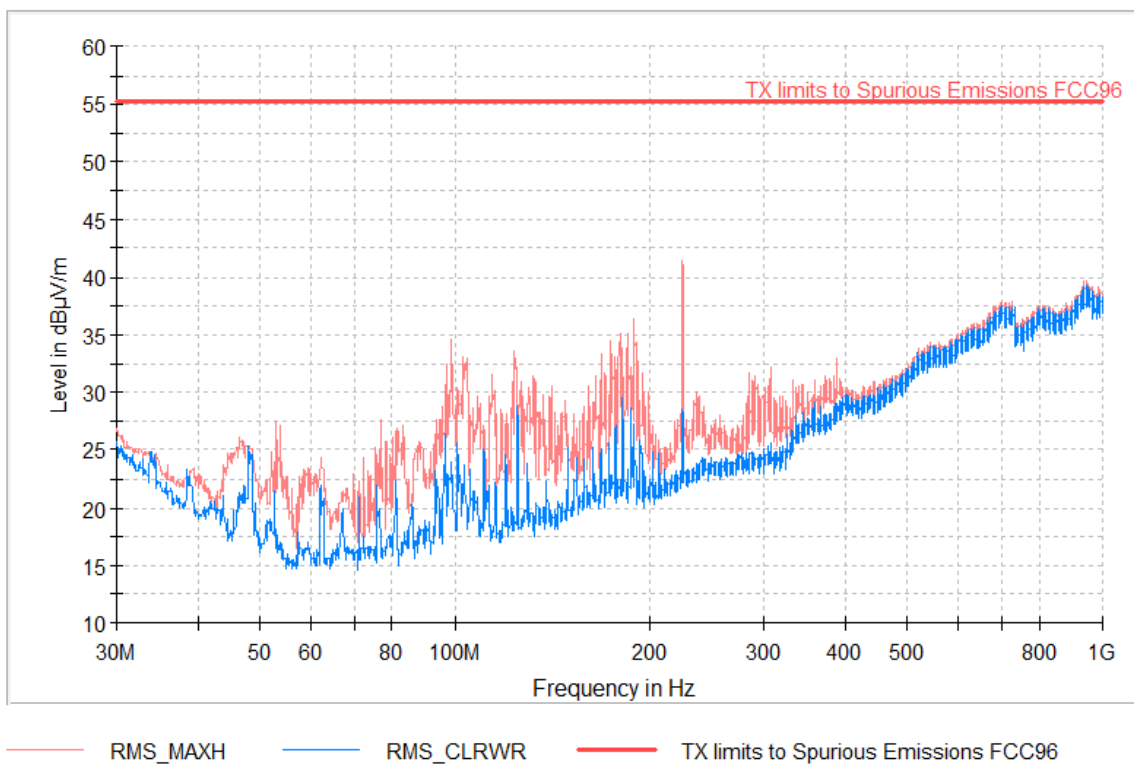
10MHz BW

FREQUENCY RANGE 30 MHz-1000 MHz

Lowest Channel (3555 MHz)

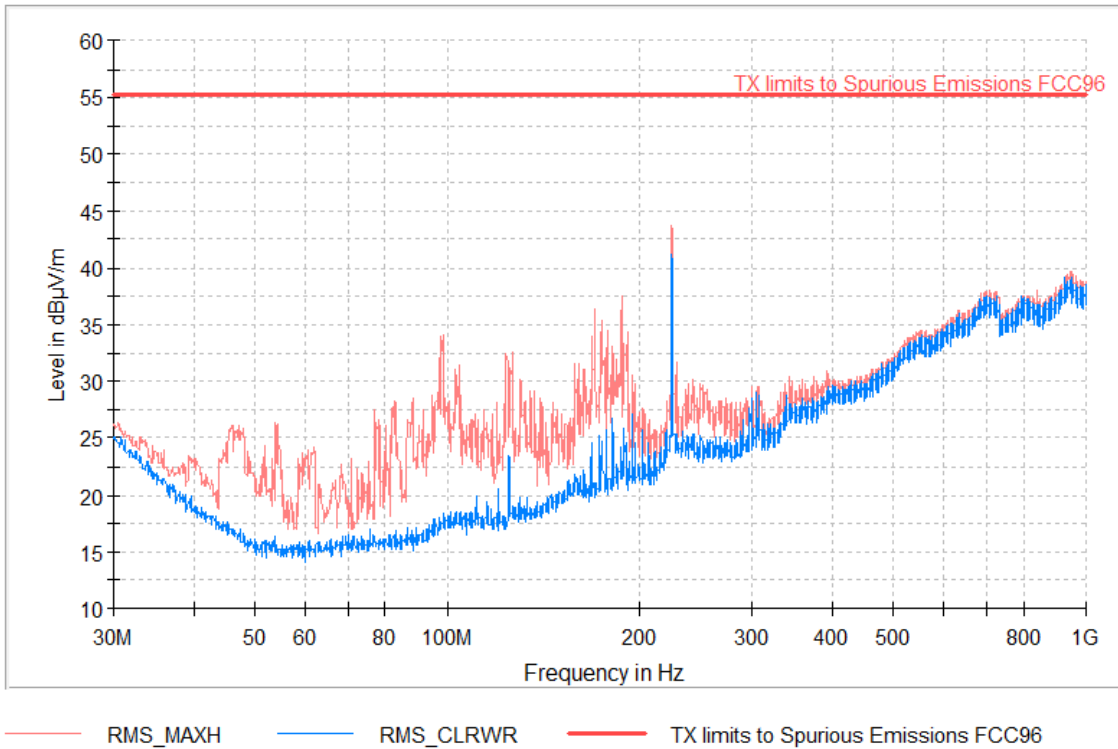


Middle Channel (3625 MHz)



Highest Channel (3695 MHz)

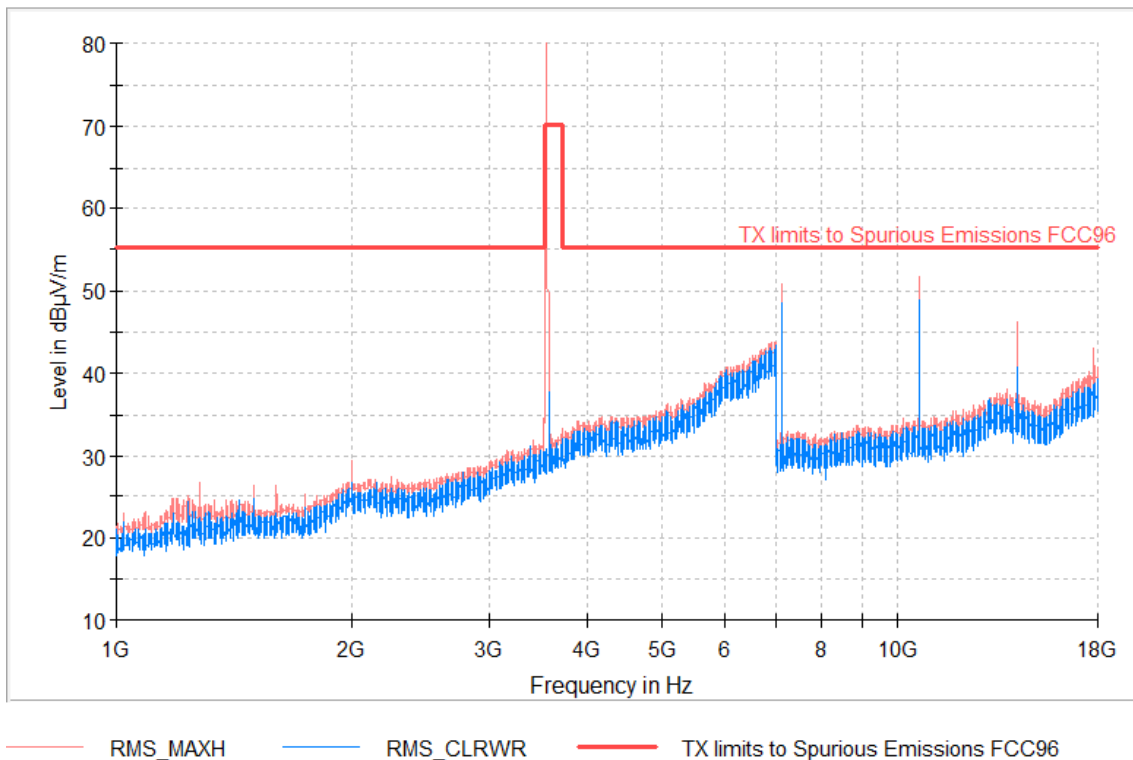
RF_FCC_Part96_E Field_30MHz_1GHz



FREQUENCY RANGE 1-18 GHz

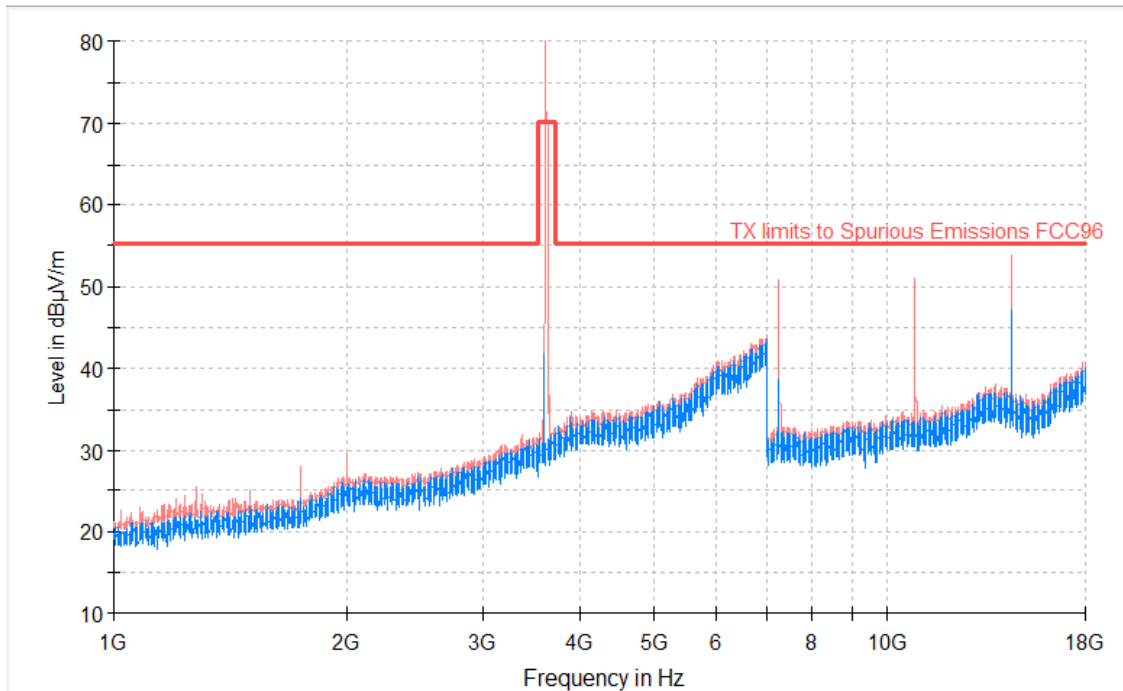
Lowest Channel (3555 MHz)

RF_FCC_Part96_E Field_1GHz_18GHz



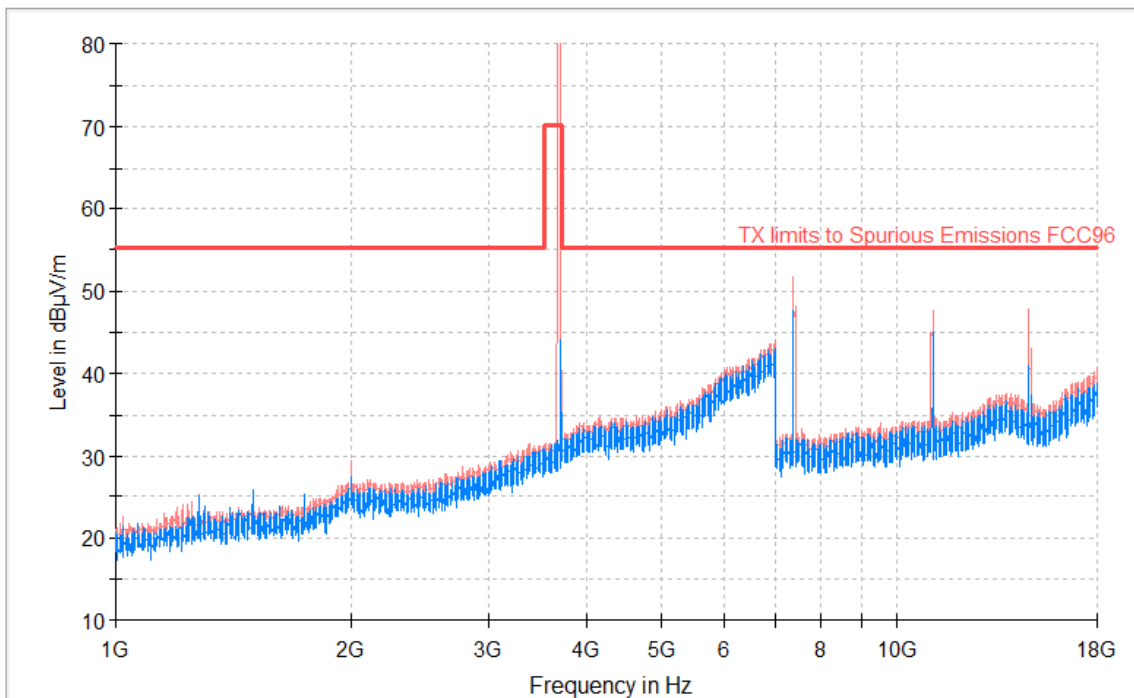
Middle Channel (3625 MHz)

RF_FCC_Part96_E Field_1GHz_18GHz



Highest Channel (3695 MHz)

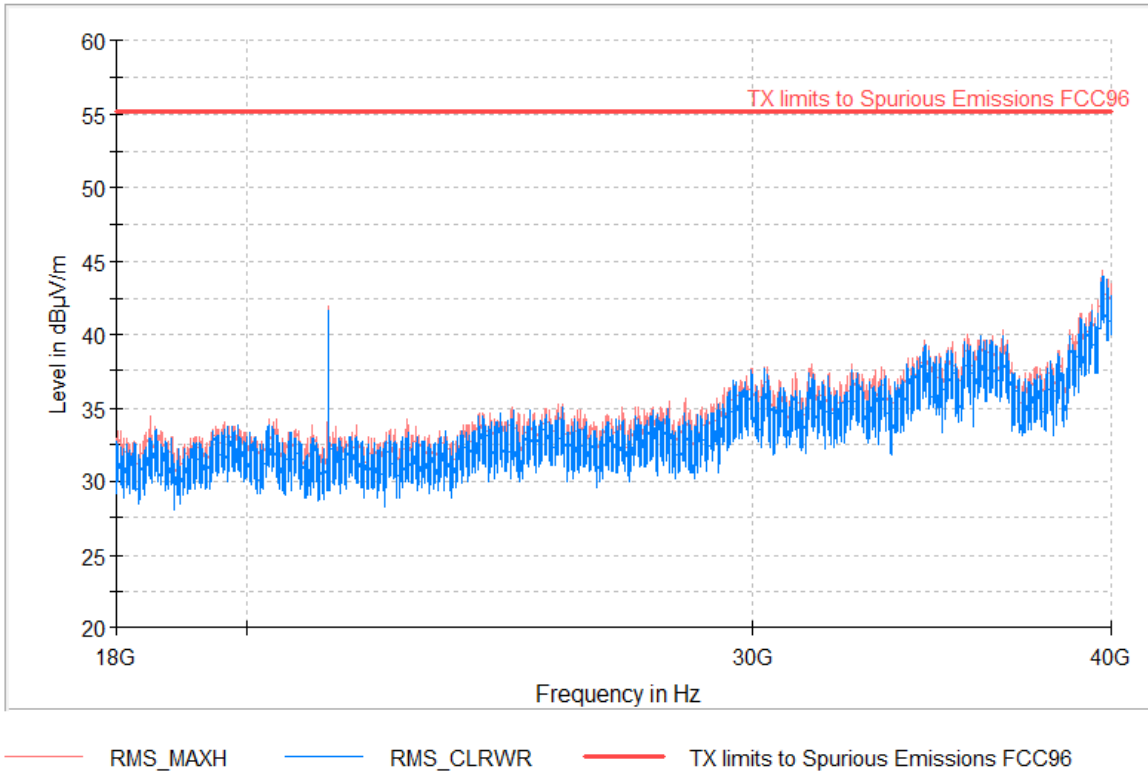
RF_FCC_Part96_E Field_1GHz_18GHz



FREQUENCY RANGE 18-40 GHz

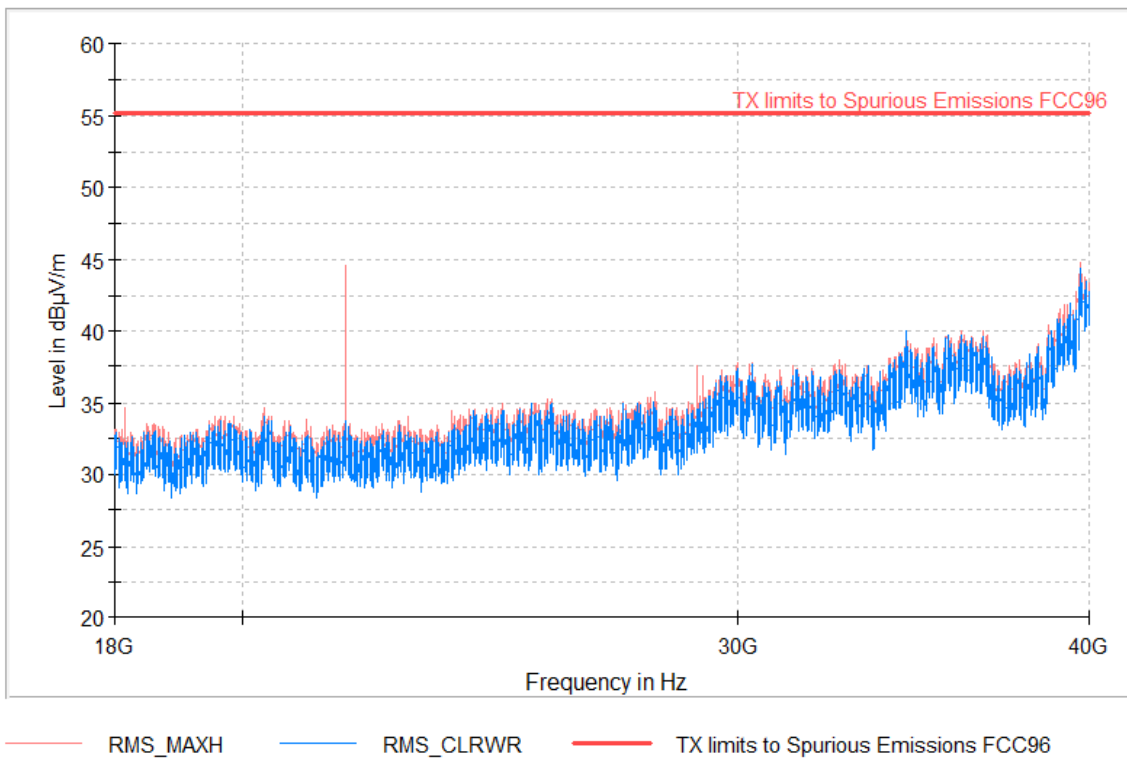
Lowest channel: 3555MHz

RF_FCC_Part96_E Field_18GHz_40GHz



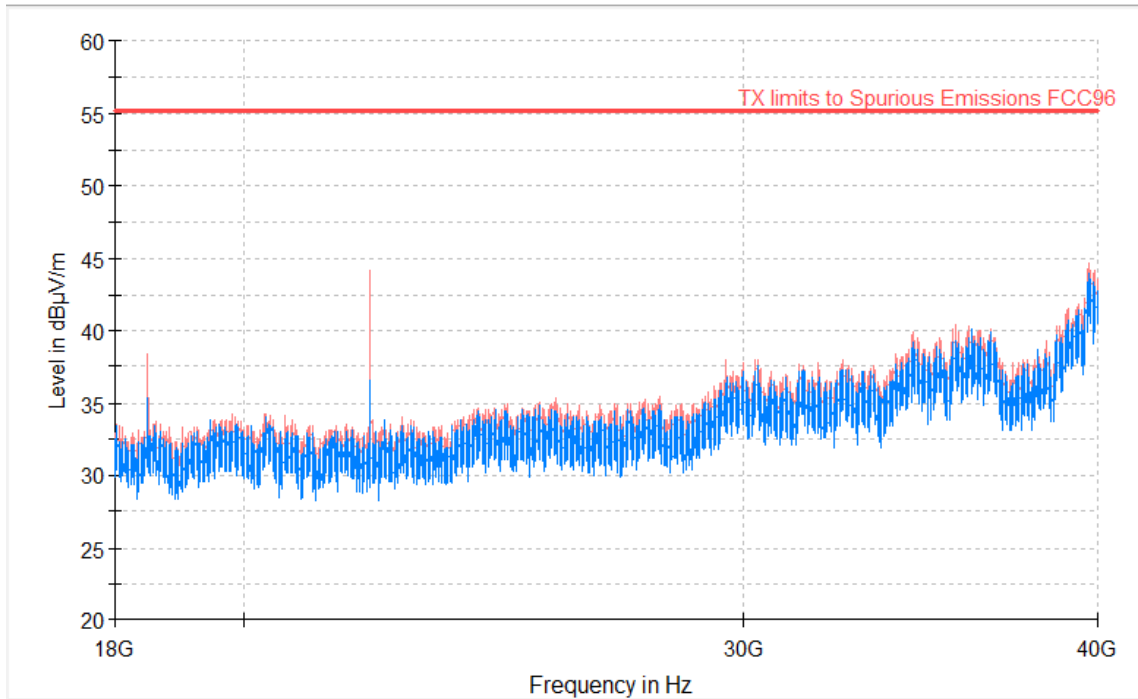
Middle Channel (3625 MHz)

RF_FCC_Part96_E Field_18GHz_40GHz



Highest Channel (3695 MHz)

RF_FCC_Part96_E Field_18GHz_40GHz

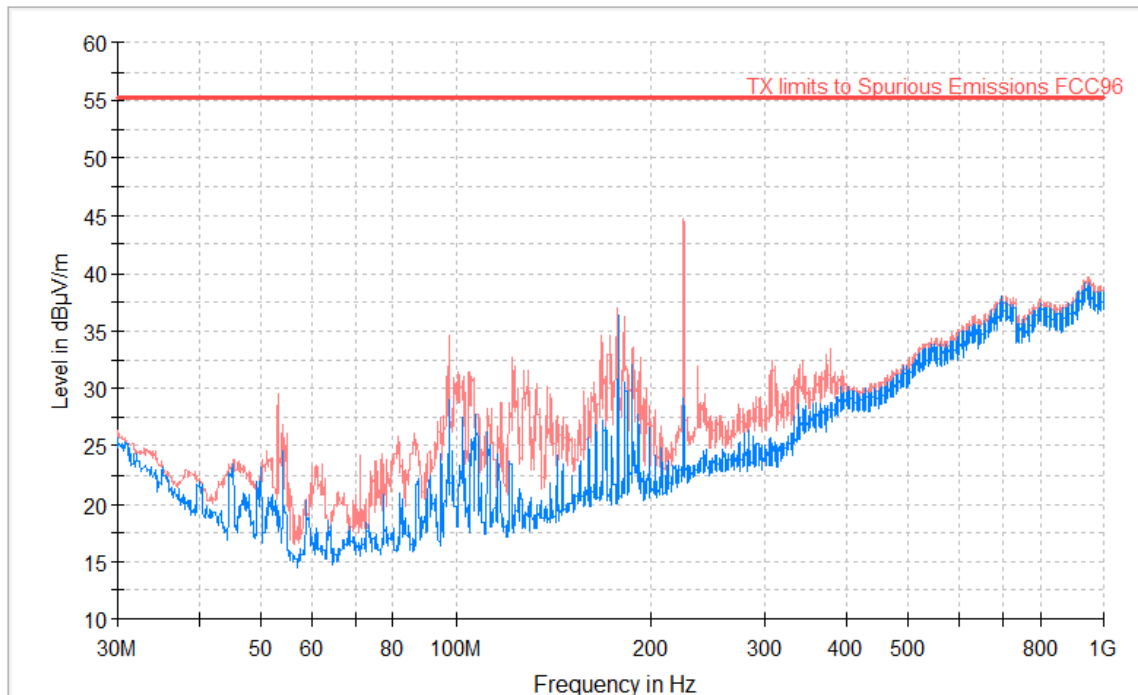


— RMS_MAXH — RMS_CLRWR — TX limits to Spurious Emissions FCC96

20MHz BW

FREQUENCY RANGE 30 MHz-1 GHz
Lowest Channel (3560 MHz)

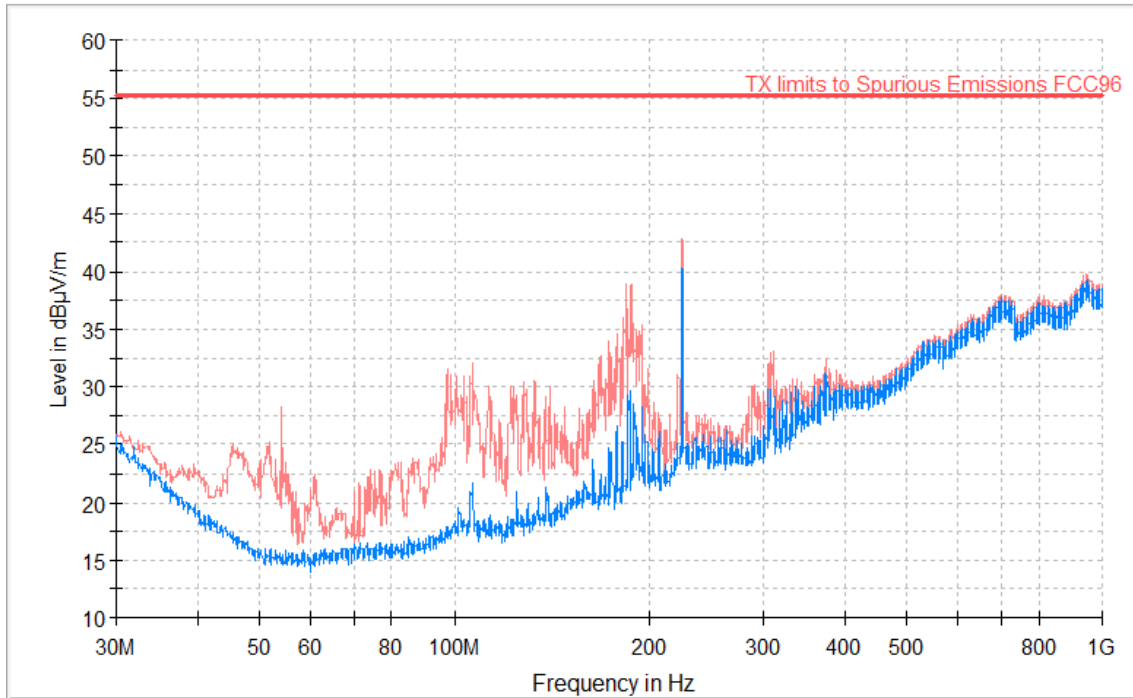
RF_FCC_Part96_E Field_30MHz_1GHz



— RMS_MAXH — RMS_CLRWR — TX limits to Spurious Emissions FCC96

Middle Channel (3625 MHz)

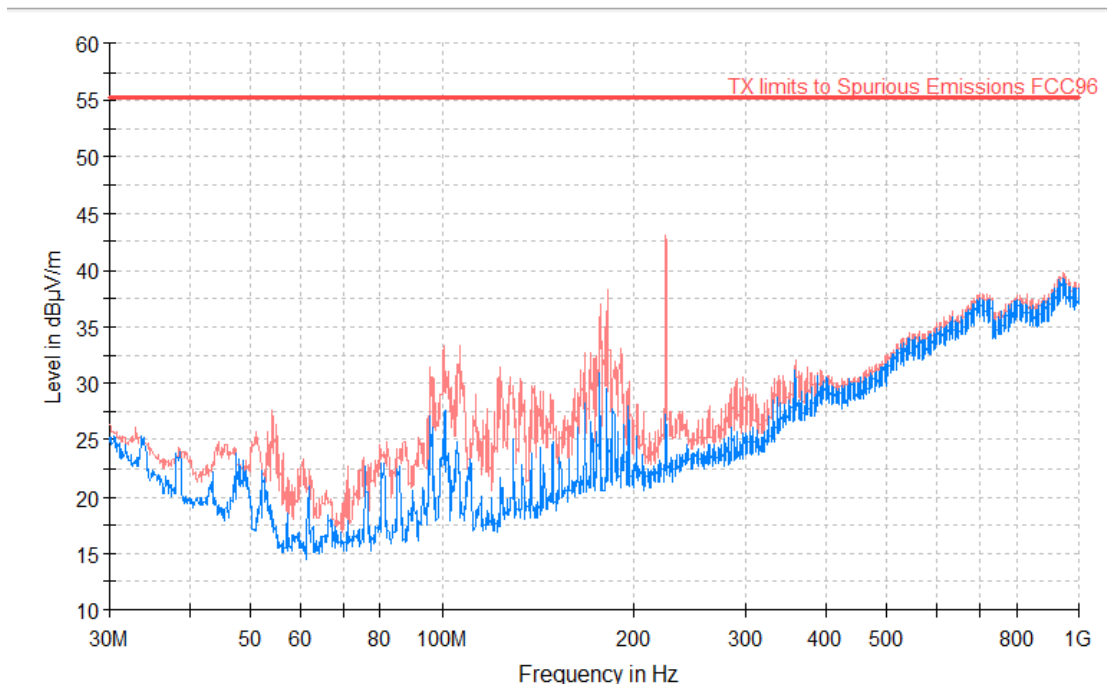
RF_FCC_Part96_E Field_30MHz_1GHz



— RMS_MAXH — RMS_CLRWR — TX limits to Spurious Emissions FCC96

Highest Channel (3690 MHz)

RF_FCC_Part96_E Field_30MHz_1GHz

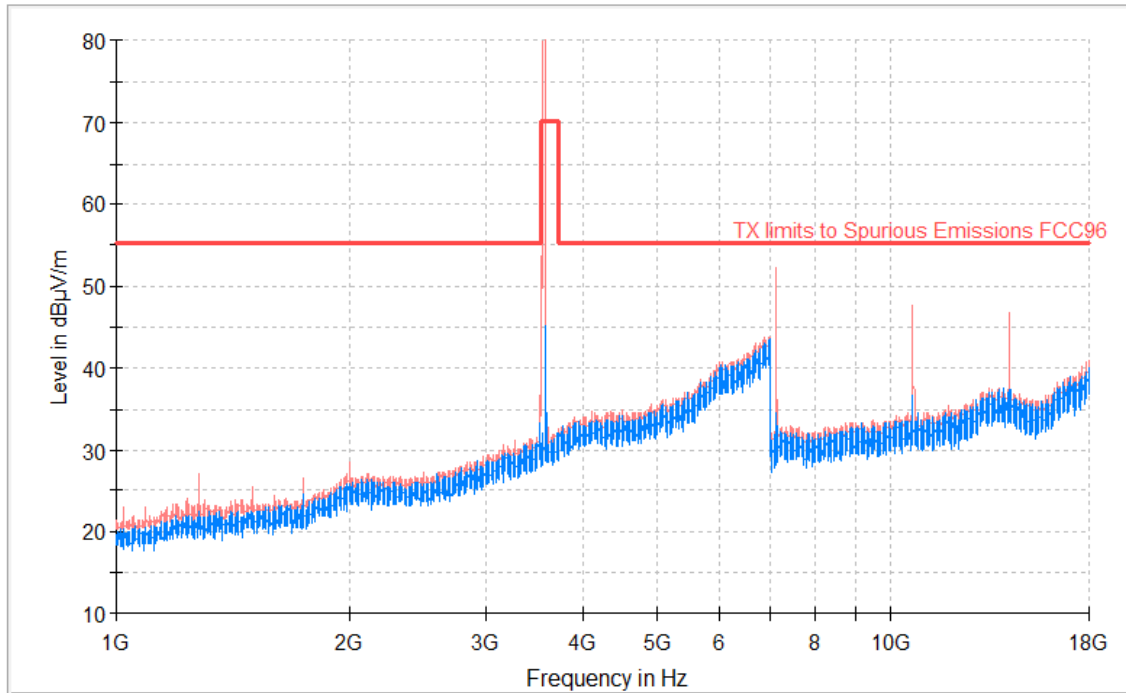


— RMS_MAXH — RMS_CLRWR — TX limits to Spurious Emissions FCC96

FREQUENCY RANGE 1-18 GHz

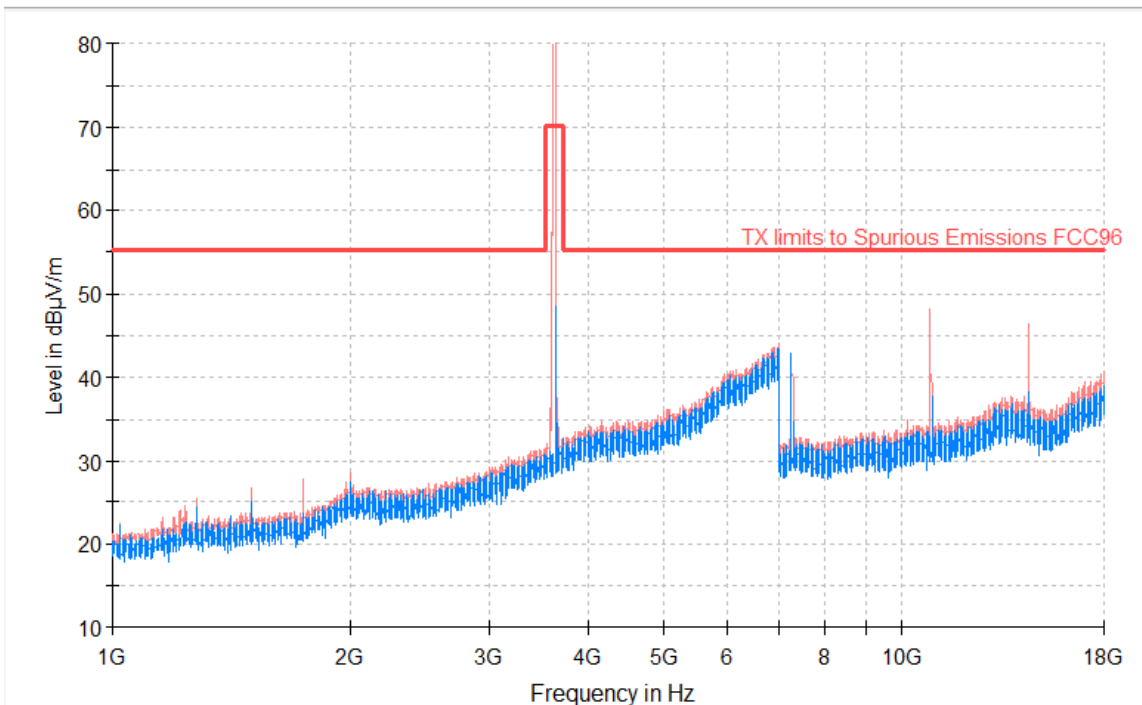
Lowest Channel (3560 MHz)

RF_FCC_Part96_E Field_1GHz_18GHz



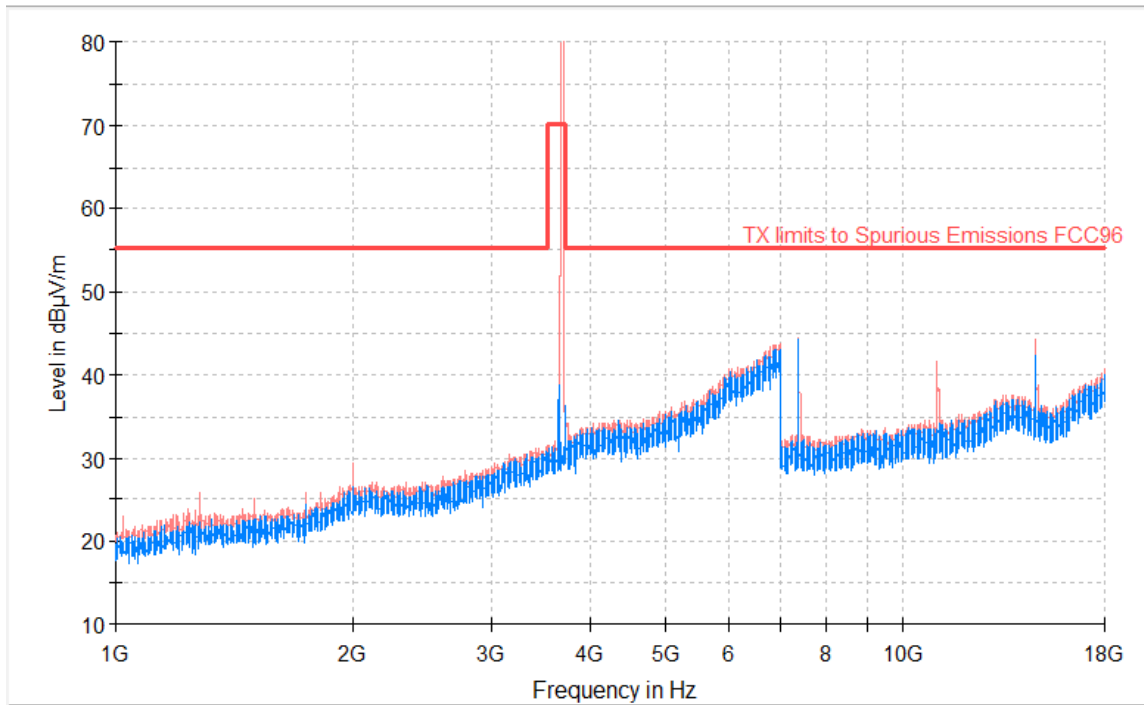
Middle Channel (3625 MHz)

RF_FCC_Part96_E Field_1GHz_18GHz



Highest Channel (3690 MHz)

RF_FCC_Part96_E Field_1GHz_18GHz

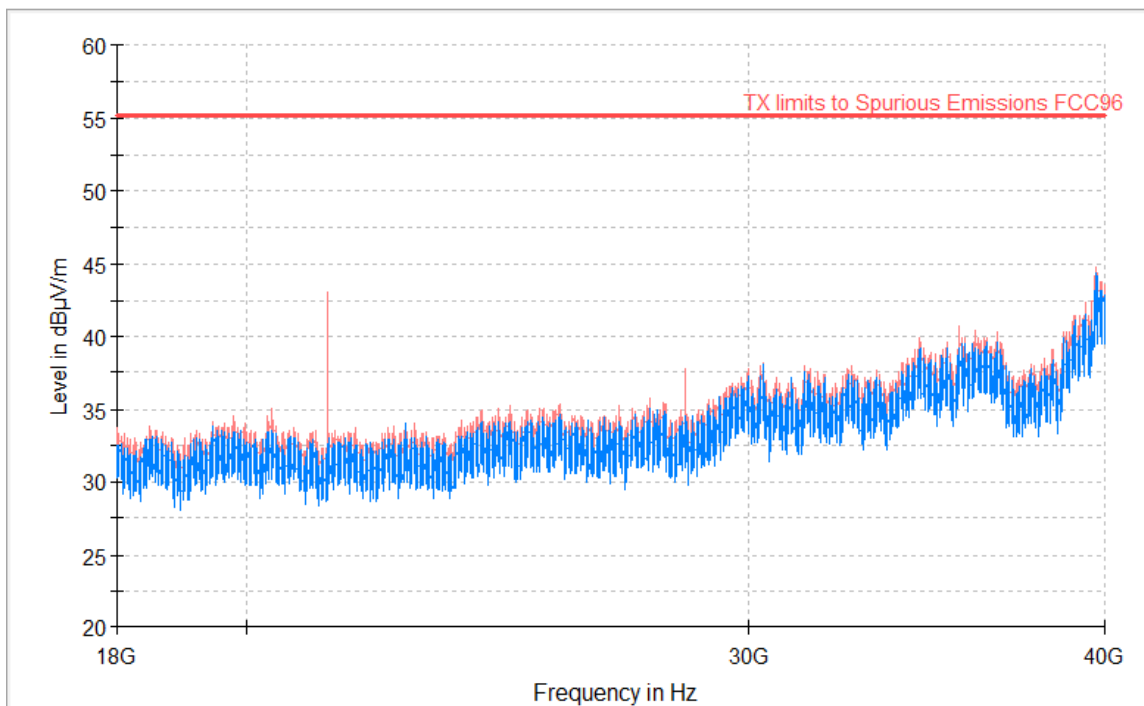


— RMS_MAXH — RMS_CLRWR — TX limits to Spurious Emissions FCC96

FREQUENCY RANGE 18-40 GHz

Lowest Channel (3560 MHz)

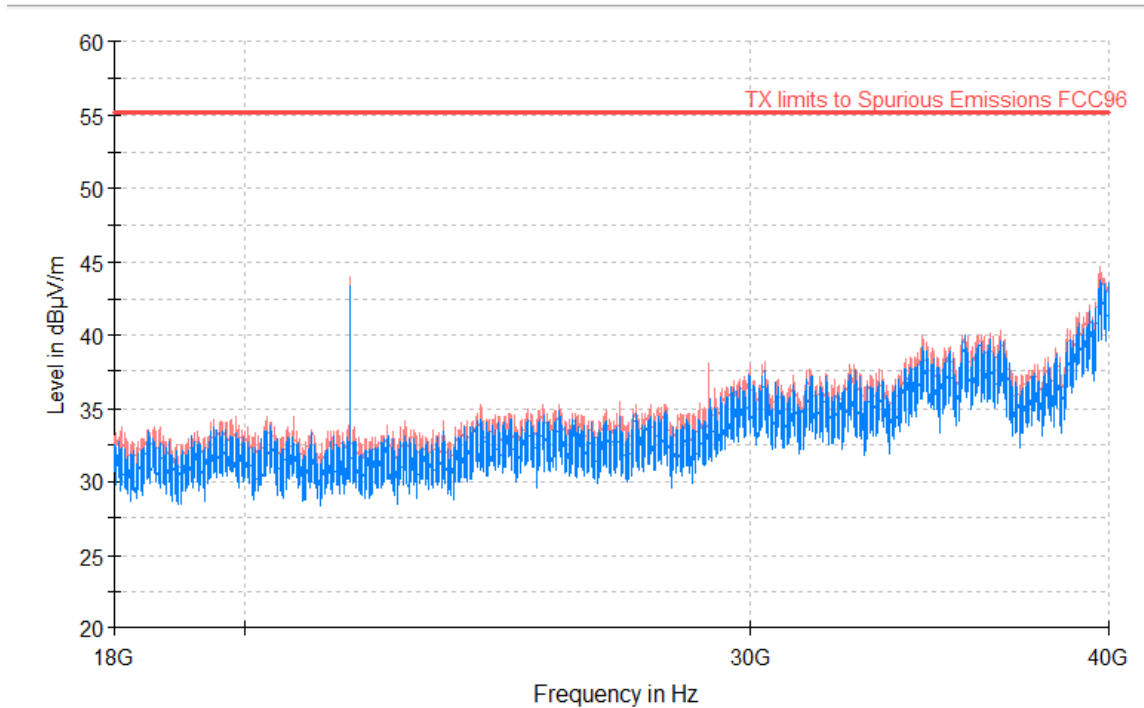
RF_FCC_Part96_E Field_18GHz_40GHz



— RMS_MAXH — RMS_CLRWR — TX limits to Spurious Emissions FCC96

Middle Channel (3625 MHz)

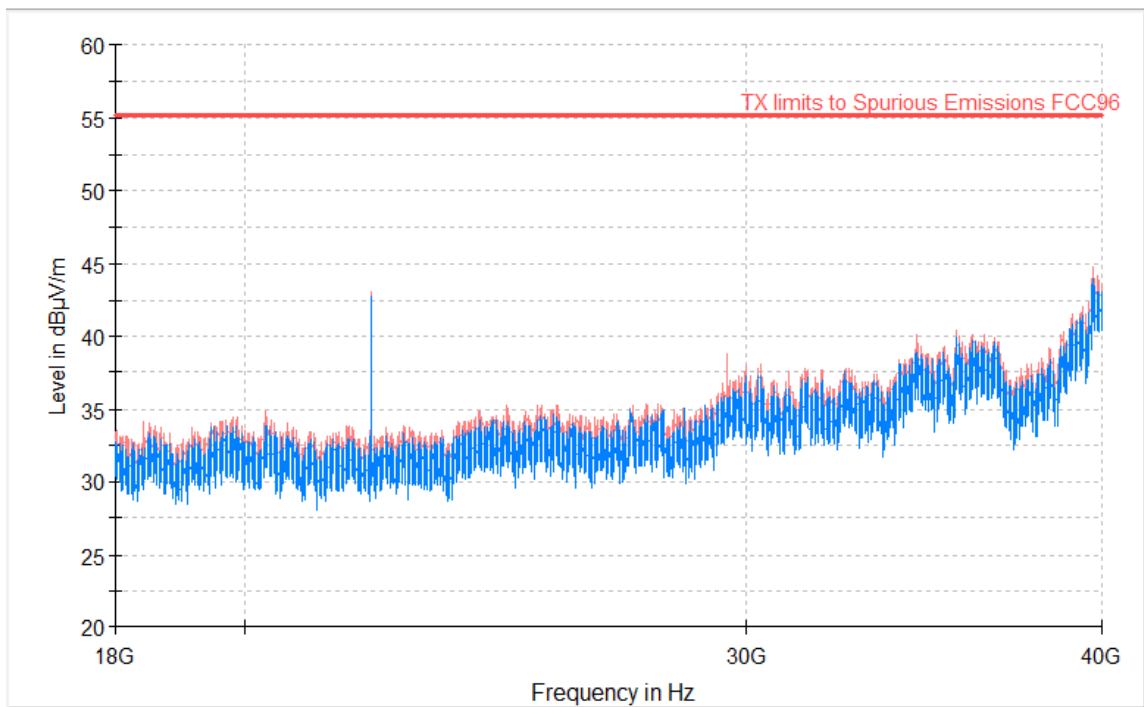
RF_FCC_Part96_E Field_18GHz_40GHz



— RMS_MAXH — RMS_CLRWR — TX limits to Spurious Emissions FCC96

Highest Channel (3690 MHz)

RF_FCC_Part96_E Field_18GHz_40GHz



— RMS_MAXH — RMS_CLRWR — TX limits to Spurious Emissions FCC96

Section 2.1055 Frequency Stability

The frequency stability shall be measured with variation of ambient temperature from -30° to +50° centigrade for all equipment except that specified in paragraphs (a) (2) and (3) of this section.

The frequency stability was measured under the following conditions:

- a) At 10°C intervals of temperatures between -30°C and +50°C at the manufacturer’s rated supply voltage, and
- b) At +20°C temperature and ±15% supply voltage variations. If a product is specified to operate over a range of input voltage then the -15% variation is applied to the lowermost voltage and the +15% is applied to the uppermost voltage.

RESULTS

Temp. (°C)	Input Voltage (V)	Frequency Low				Frequency High			
		Frequency (MHz)	Delta to Tnom-Vnom (%)	Frequency (MHz)	Delta to Tnom-Vnom (%)	Frequency Low (MHz)	Delta to Tnom-Vnom (%)	Frequency High (MHz)	Delta to Tnom-Vnom (%)
50	48	3550.521	0.000563	3559.462	0.000562	3690.532	-0.000542	3699.439	0.000541
40	48	3550.561	0.001690	3559.382	-0.001686	3690.512	-0.001084	3699.459	0.001081
30	48	3550.581	0.002253	3559.342	-0.002809	3690.572	0.000542	3699.399	-0.000541
20	48	3550.501	0.000000	3559.442	0.000000	3690.552	0.000000	3699.419	0.000000
20	40.8	3550.481	-0.000563	3559.262	-0.005057	3690.532	-0.000542	3699.329	-0.002433
20	55.2	3550.681	0.005070	3559.322	-0.003371	3690.612	0.001626	3699.359	-0.001622
10	48	3550.541	0.001127	3559.402	-0.001124	3690.632	0.002168	3699.319	-0.002703
0	48	3550.561	0.001690	3559.362	-0.002248	3690.572	0.000542	3699.399	-0.000541
-10	48	3550.621	0.003380	3559.422	-0.000562	3690.532	-0.000542	3699.439	0.000541
-20	48	3550.601	0.002817	3559.362	-0.002248	3690.552	0.000000	3699.419	0.000000
-30	48	3550.581	0.002253	3559.390	-0.001461	3690.592	0.001084	3699.399	-0.000541

Verdict: PASS