DEKRA Certification, Inc.
405, Glenn Drive Suite 12
Sterling, Virginia, USA.

ACCREDITED
Test Lab
Cert 2764.01

FCC LISTED, REGISTRATION NUMBER: 2764.01

ISED LISTED REGISTRATION NUMBER: 23595-1

Test report No:

2209ERM.002A5

Test report

USA FCC Part 96

CITIZENS BROADBAND RADIO SERVICE DEVICES OPERATING WITHIN THE BAND 3550-3700 MHZ

Identification of item tested :	CPE9000-PRO-1D-3.x
Trademark :	Not provided
Model and /or type reference :	WLTMS-110
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 Digitally signed by Domingo Galvez DN: cn=Domingo Galvez, o=DEKRA Certification Inc., ou=Regulatory Lab, email=dgalvez@dekra.com, c=US Date: 2018.12.04 19:10:41 -05'00'
Date of issue :	12/04/2018
Report template No. :	FDT08_20

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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 Nº	Description	Model	Serial Nº	Date of reception
02209.002	CPE9000-PRO-1D-3.x	WLTMS-110_B48	GMK171204000024	05/11/2018

Auxiliary elements used with the sample S/01:

Control Nº	Description	Model	Serial Nº	Date of reception
02209.004	POE AC adapter	NA	NA	05/11/2018

1. Sample S/01 has undergone following test(s).

   All Conducted tests indicated in appendix A and all 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	56 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 (dBm)	23dBm	
Maximum 99% Occupied Bandwidth (MHz)	20 MHz	
Type of Modulation	QPSK	Yes
	16QAM	Yes
	64QAM	Yes
	256QAM	no
Antenna Information	Gain: 15 dBi	
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 ºC Max. = 35 ºC
Relative humidity	Min. = 20 % Max. = 75 %

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

Temperature	Min. = 15 ºC Max. = 35 ºC
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 ºC Max. = 35 ºC
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.002A4 related with the same samples, in the next clauses and sub-clauses:

Clauses / Sub-clauses	Modification	Justification
Section 96.41 Subclause (b) Maximum effective isotropic radiated power (EIRP)	The measurement unit in the result tables was changed according to the requirements.	As per FCC requirement, the unit of the output signal level must be in dBm/10 MHz
Section 96.41 Subclause (b). Maximum Power Spectral Density (PSD)	The measurement unit in the result tables was changed according to the requirements.	As per FCC requirement, the unit of the output signal level must be in dBm/MHz
Section 96.41 Subclause (e). Spurious Emissions at Antenna Terminals	The measurement unit in the result tables was changed according to the requirements.	As per FCC requirement, the unit of the output signal level must be in dBm/MHz

This modification test report cancels and replaces the test report 2209ERM.002A4.

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):

$V_{nominal}$ = 56 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):

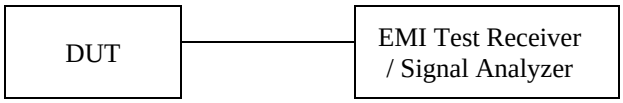
Lowest Channel (3560 MHz) / Middle Channel (3625 MHz) / Highest Channel (3690 MHz)

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.



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).

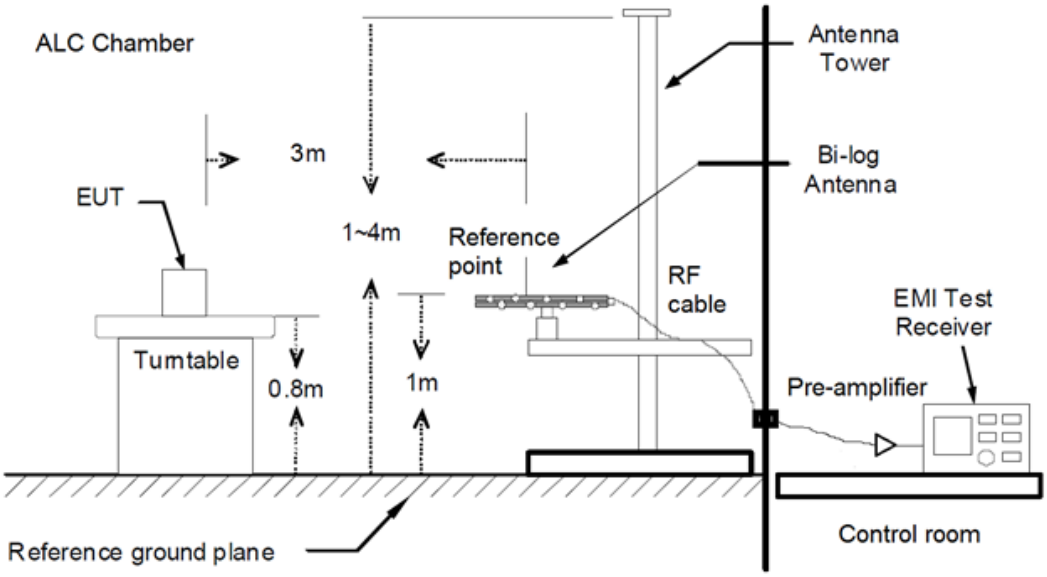
For radiated emissions in the range 1-40 GHz that is performed at a distance closer than the specified distance, an inverse proportionality factor of 20 dB per decade is used to normalize the measured data for determining compliance.

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 360º and the antenna height was varied from 1 to 4 meters to find the maximum radiated emission.

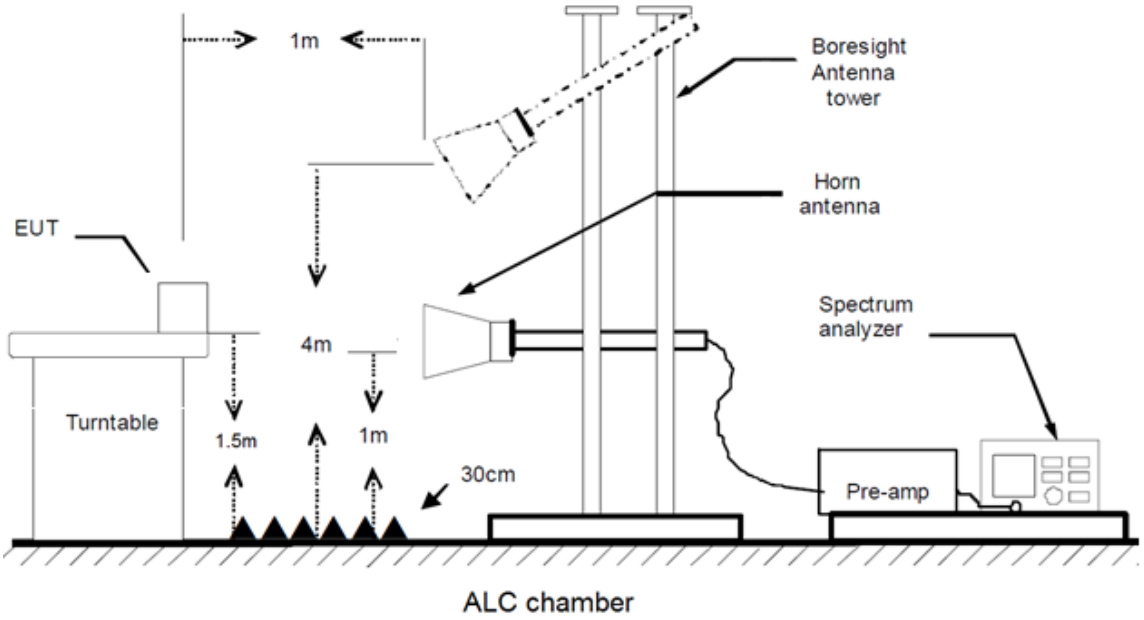
Measurements were made in both horizontal and vertical planes of polarization.

The results and plots below show the worst results obtained for the different modulations.

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, as long as 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 modification to the method is using maxhold with waiting for the sufficient time in the conservative way instead of averaging in 100 traces.

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 (1/0.4) = 3.98 (dB)

RESULTS

10MHz BW

	Lowest frequency 3555 MHz	Middle frequency 3625 MHz	Highest frequency 3695 MHz
Conducted Output Power (dBm/MHz)	22.97	22.75	22.92
Maximum declared antenna gain (dBi)	15.00	15.00	15.00
Maximum EIRP (dBm /10 MHz)	37.97	37.75	37.92
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)	20.26	20.30	20.02
Maximum declared antenna gain (dBi)	15.00	15.00	15.00
Maximum EIRP (dBm/10 MHz)	35.26	35.30	35.02
Measurement uncertainty (dB)	<±0.95		

Reference table with 20 MHz integration

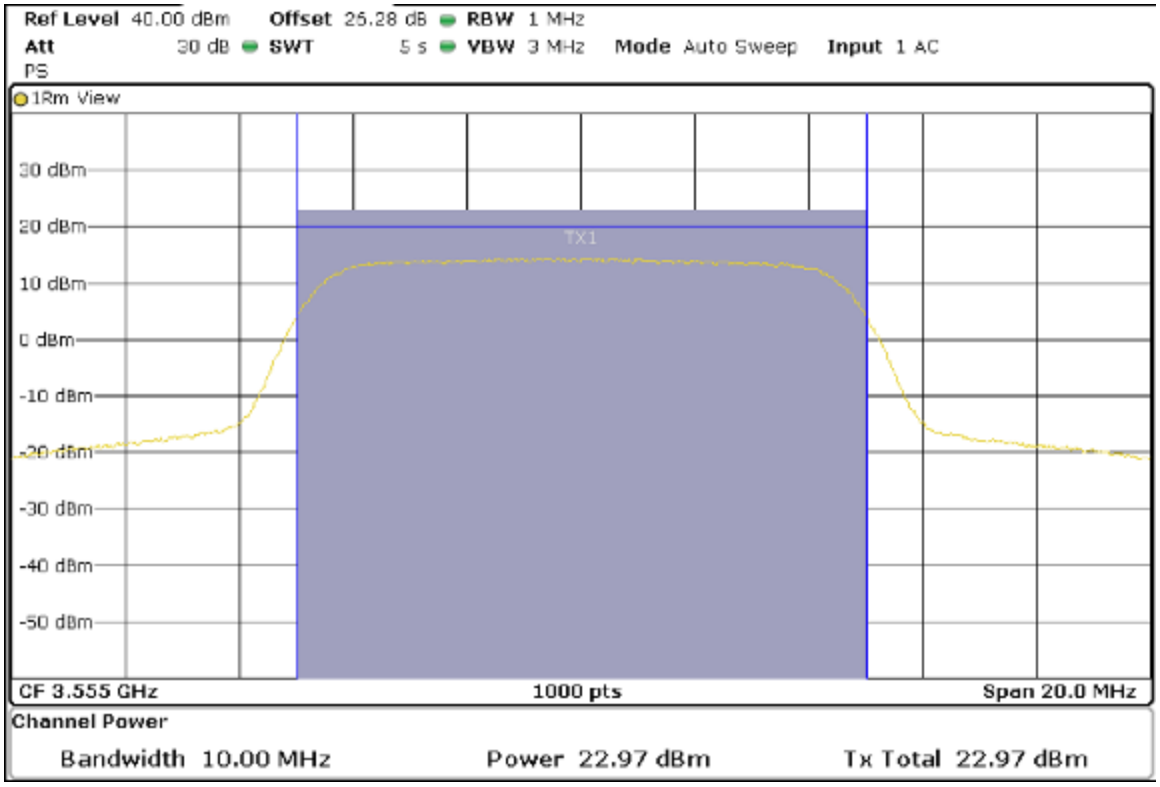
	Lowest frequency 3560 MHz	Middle frequency 3625 MHz	Highest frequency 3690 MHz
Conducted Output Power (dBm/20 MHz)	22.97	22.84	22.63
Maximum declared antenna gain (dBi)	15.00	15.00	15.00
Maximum EIRP (dBm/20 MHz)	37.97	37.84	37.63
Measurement uncertainty (dB)	<±0.95		

VERDICT: PASS

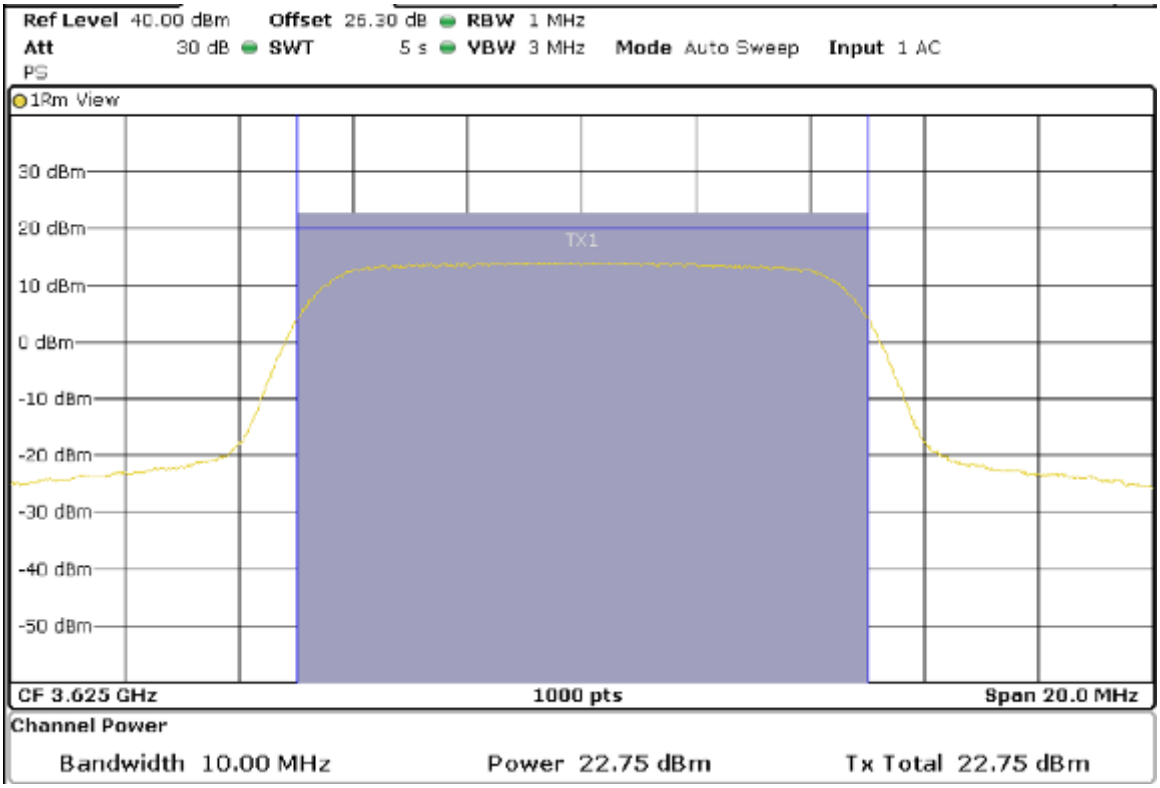
(See next plots)

10MHz BW

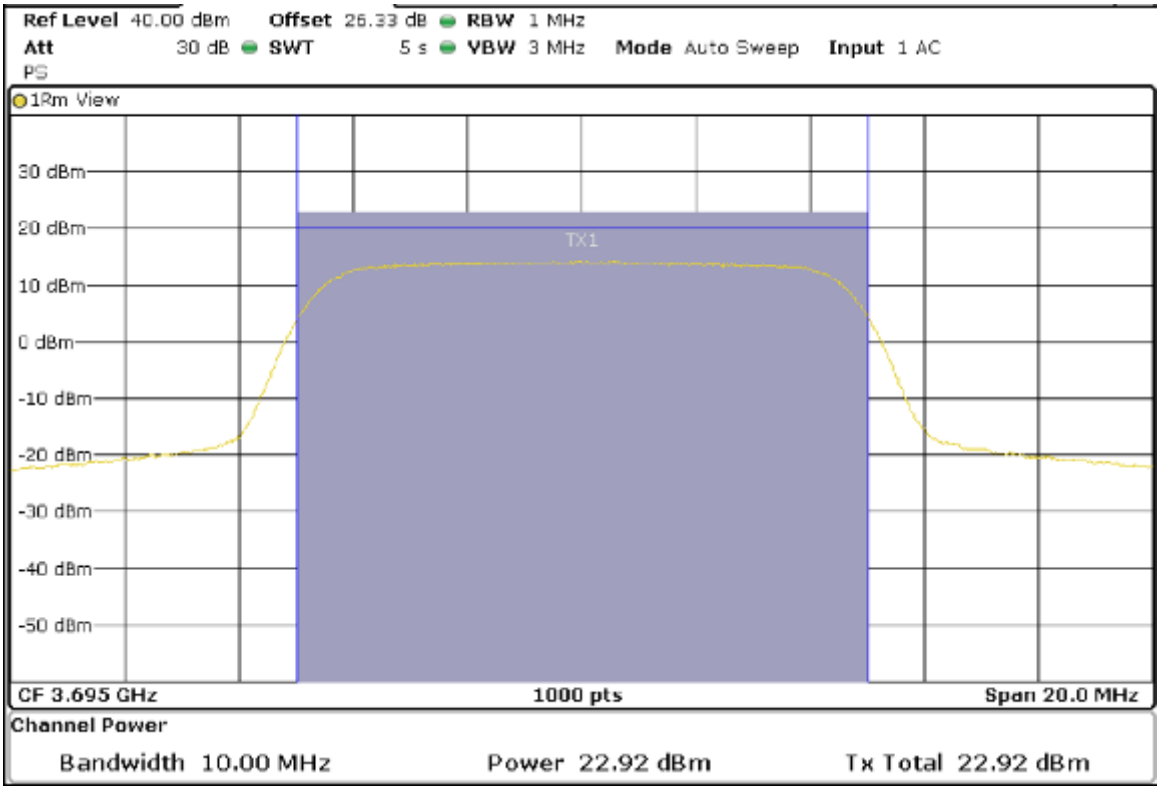
Lowest Channel (3555 MHZ)



Middle Channel (3625 MHz)

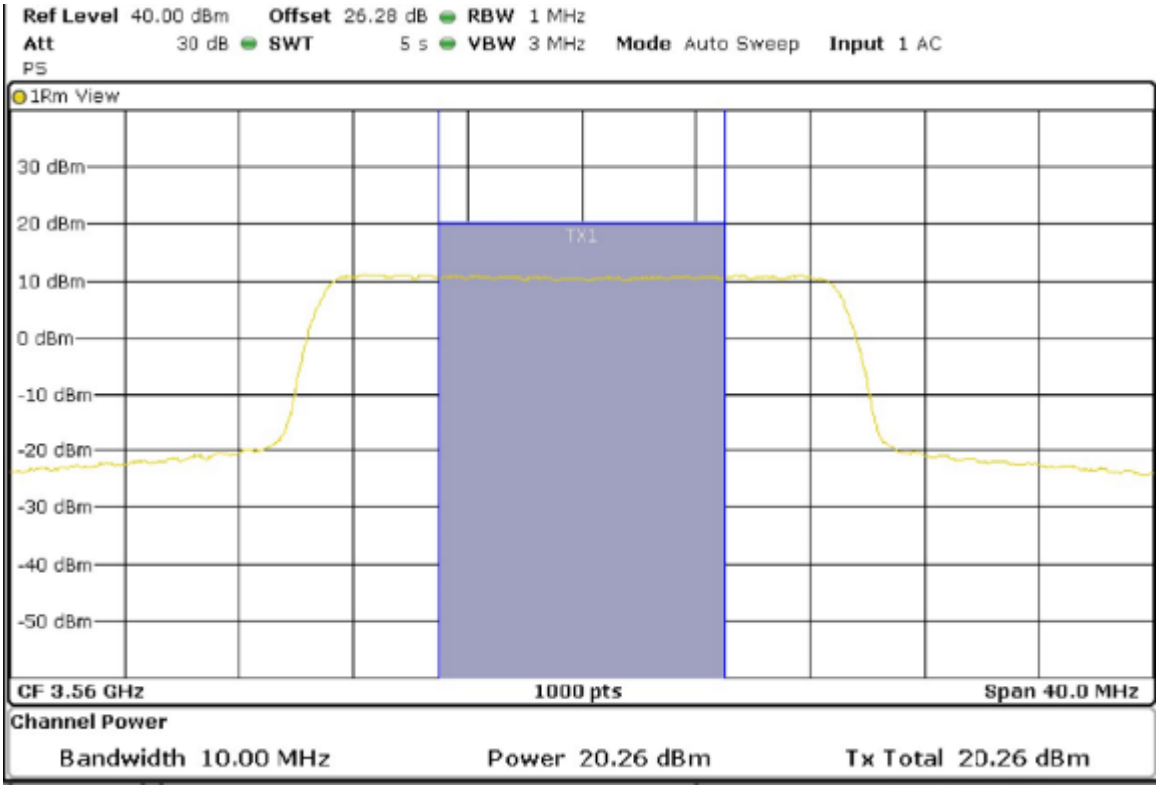


Highest Channel (3695 MHz)

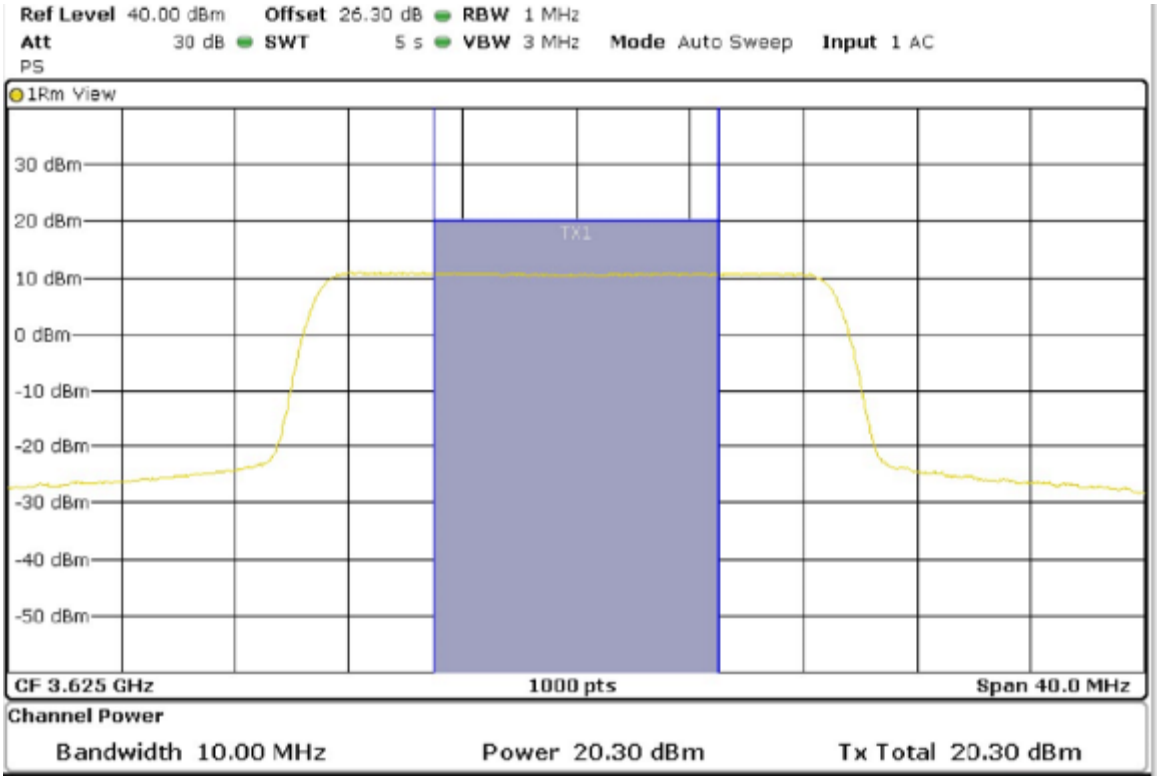


20MHz BW

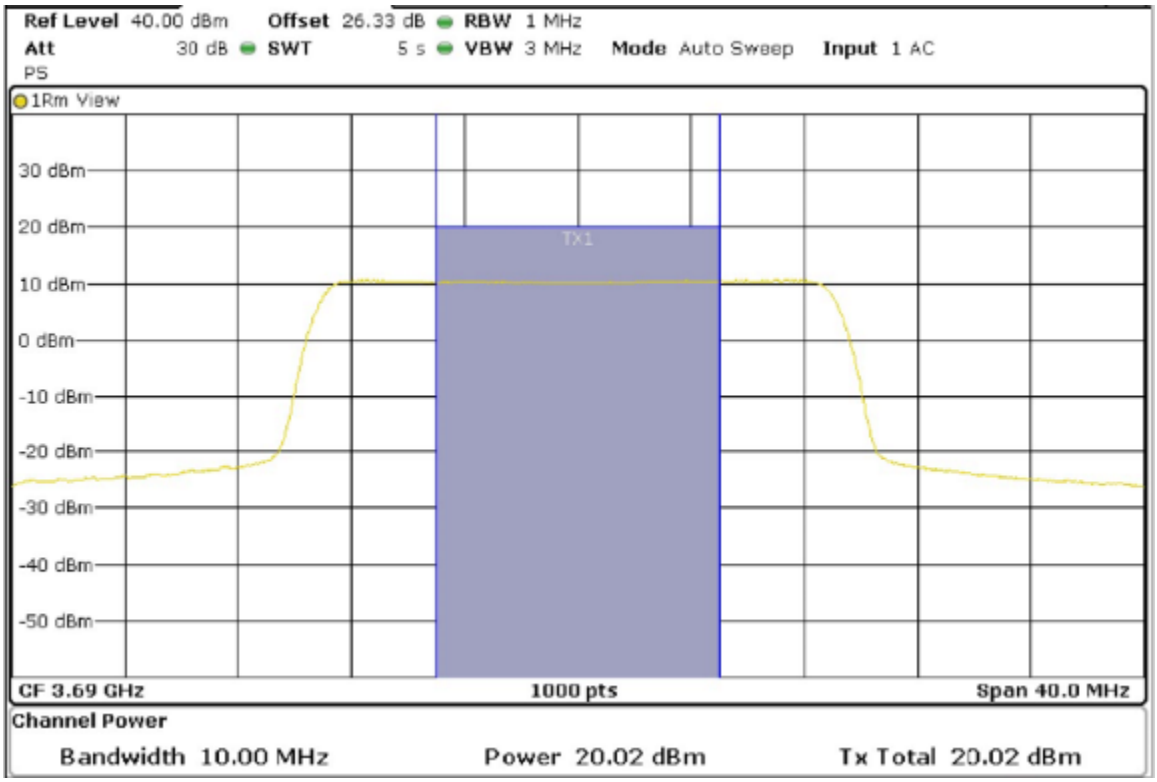
Lowest Channel (3560 MHz)



Middle Channel (3625 MHz)

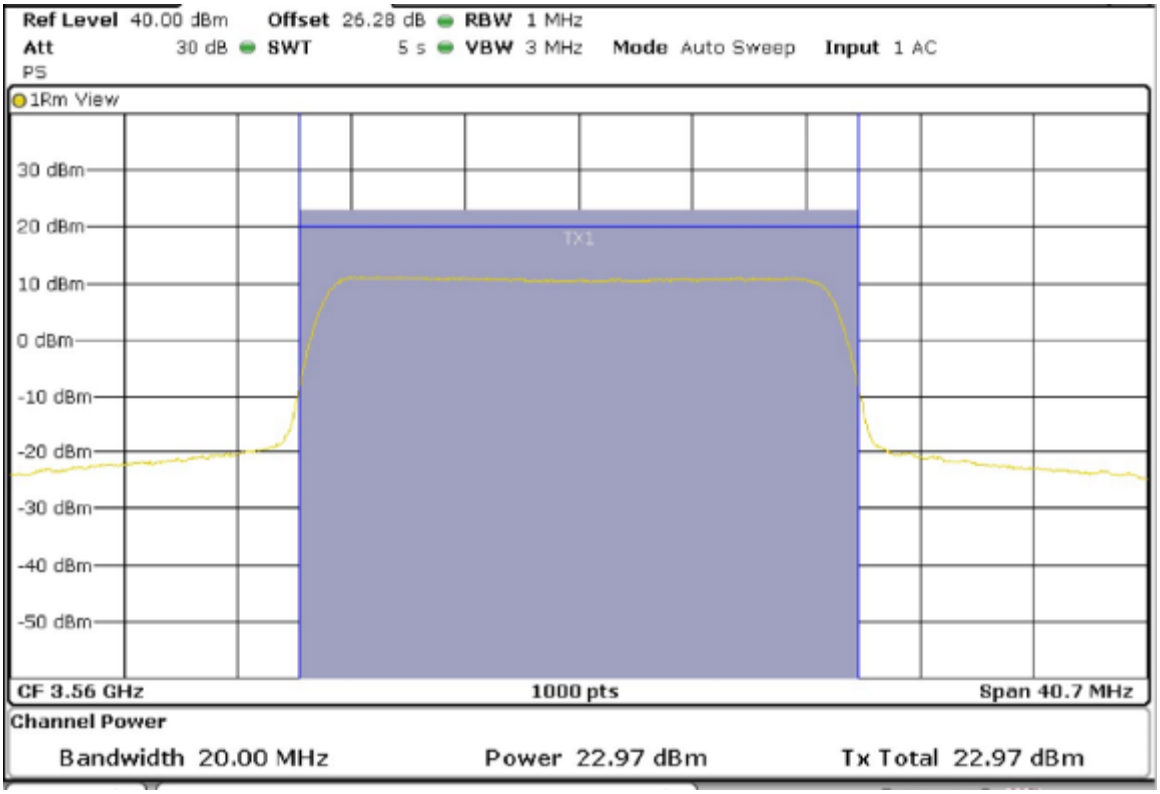


Highest Channel (3690 MHz)

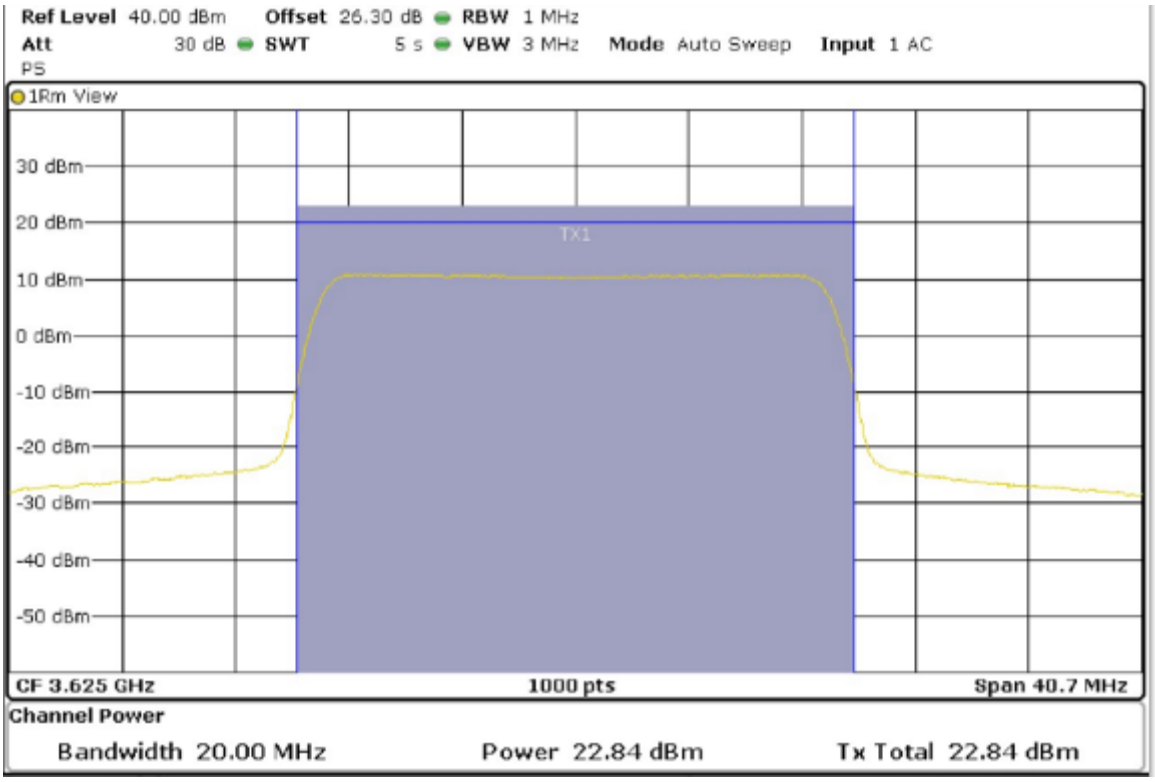


20MHz BW (Reference only)

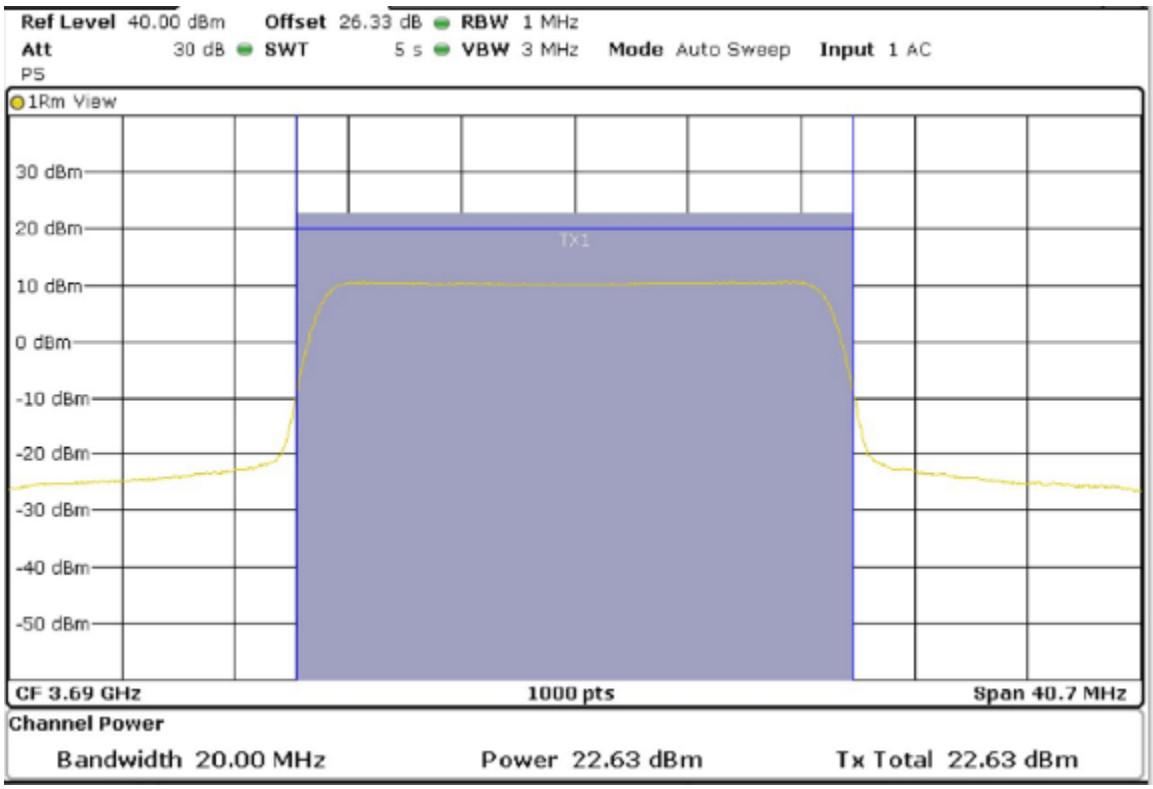
Lowest Channel (3560 MHz)



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)	9.38	9.22	9.28
-26 dB Bandwidth (MHz)	12.07	11.52	11.52
Measurement uncertainty (kHz)	<± 8.33		

20MHz BW

	Lowest frequency 3560 MHz	Middle frequency 3625 MHz	Highest frequency 3690 MHz
99% OBW (MHz)	18.35	18.00	18.12
-26 dB Bandwidth (MHz)	20.72	20.78	20.78
Measurement uncertainty (kHz)	<± 8.33		

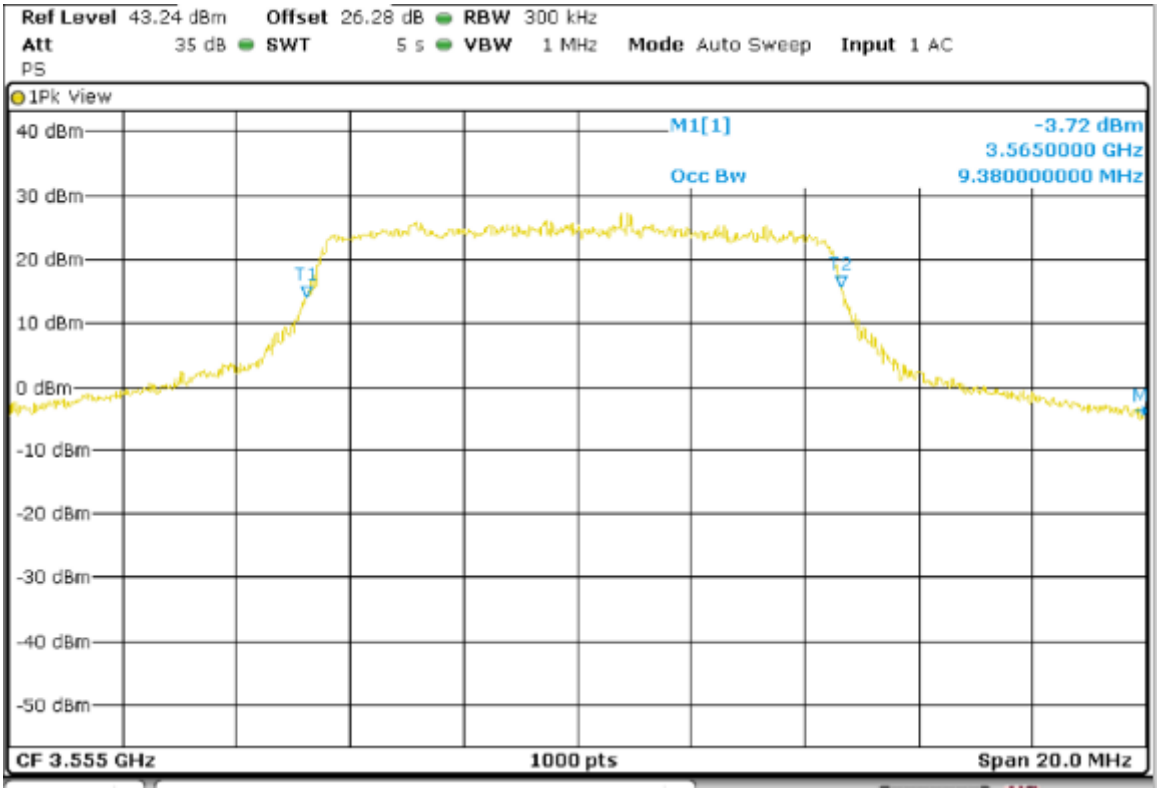
VERDICT: PASS

(See next plots)

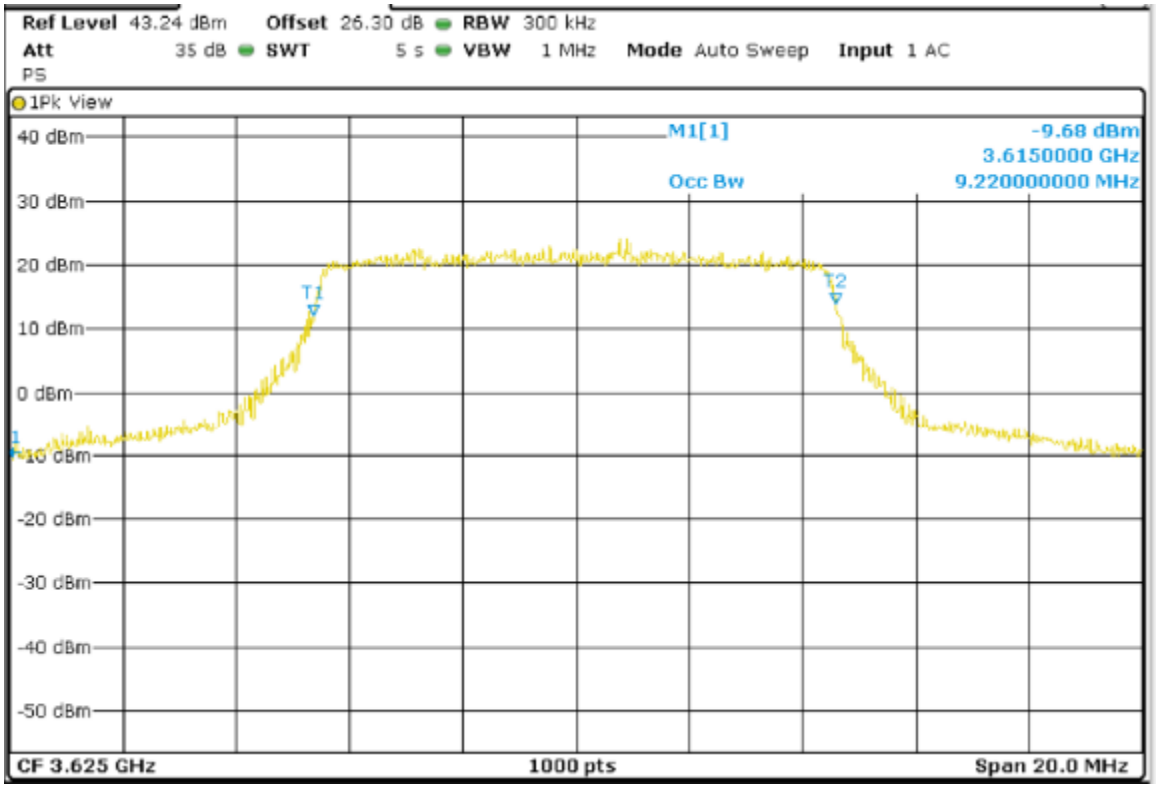
10MHz BW

OBW

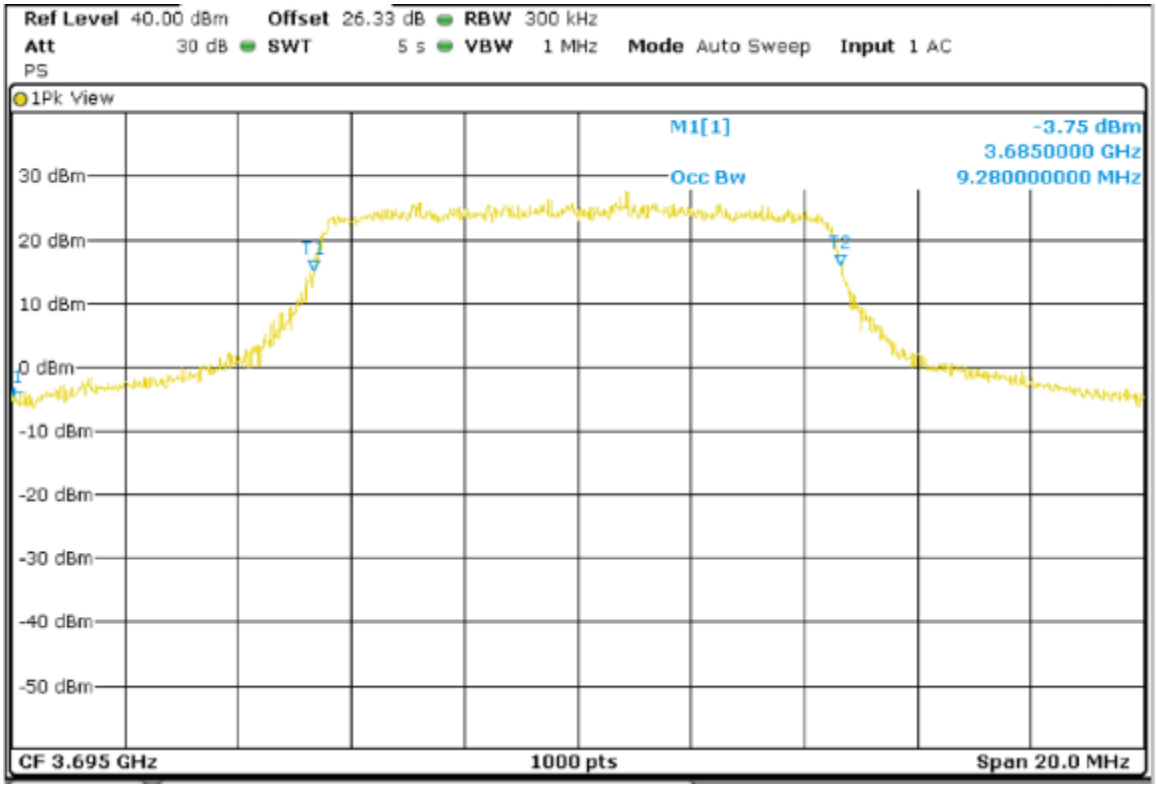
Lowest Channel (3555 MHz)



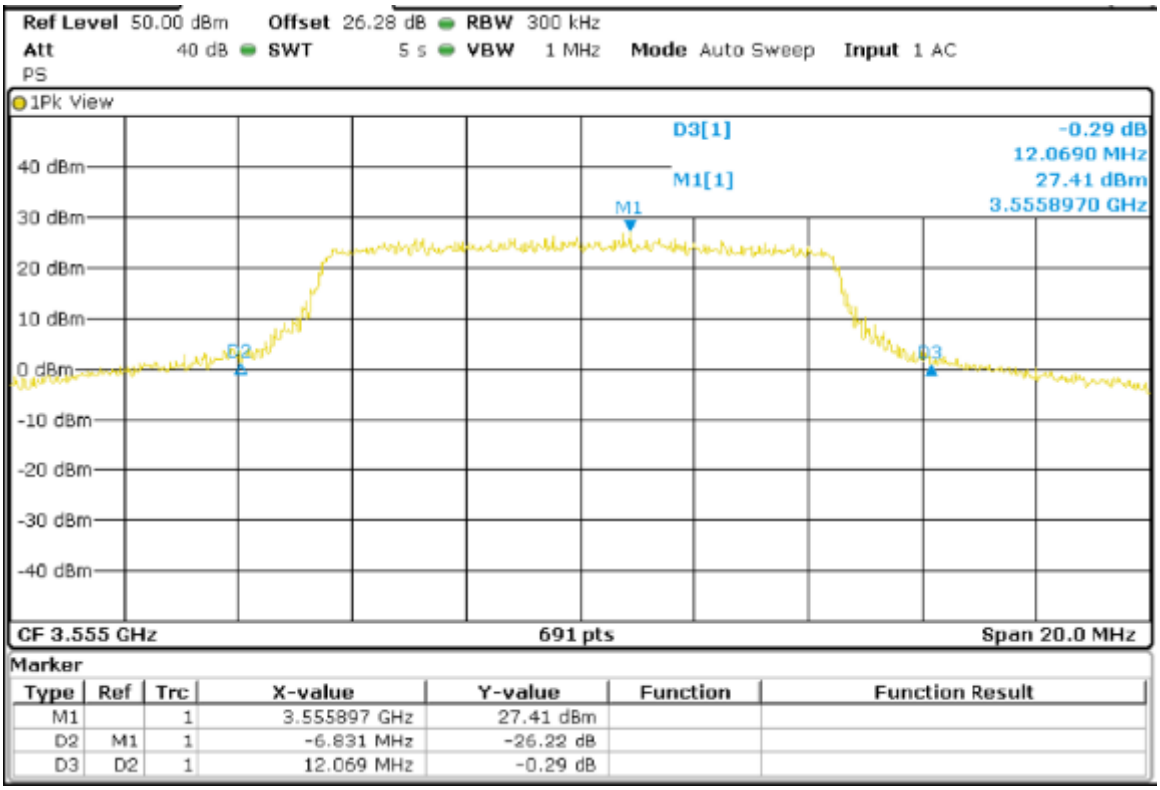
Middle Channel (3625 MHz)



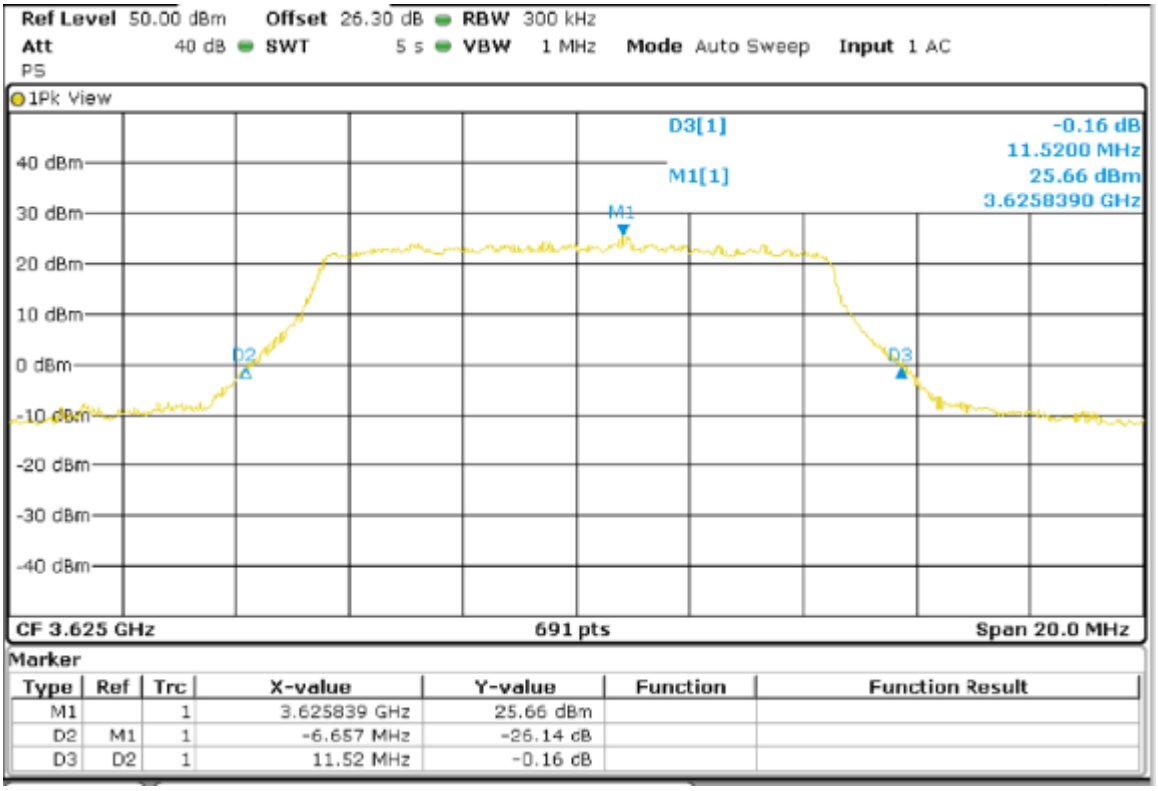
Highest Channel (3695 MHz)



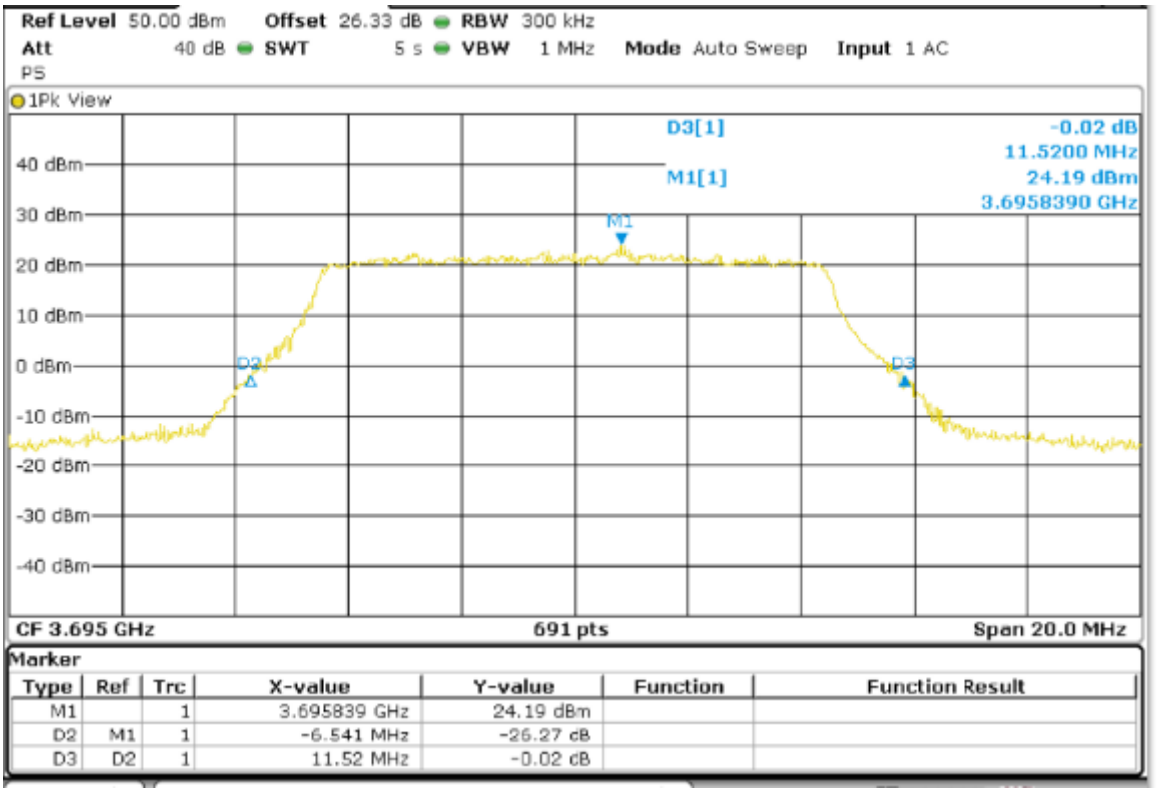
-26 dB BW
Lowest Channel (3555 MHz)



Middle Channel (3625 MHz)



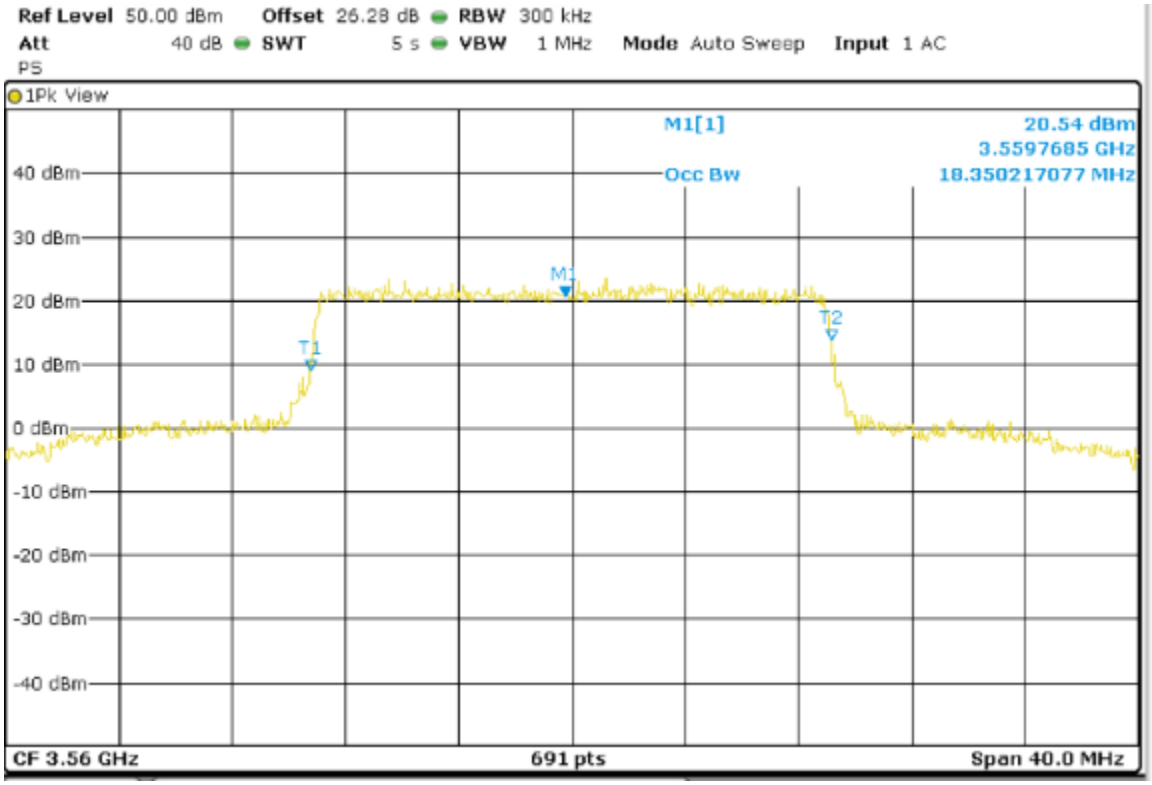
Highest Channel (3695 MHz)



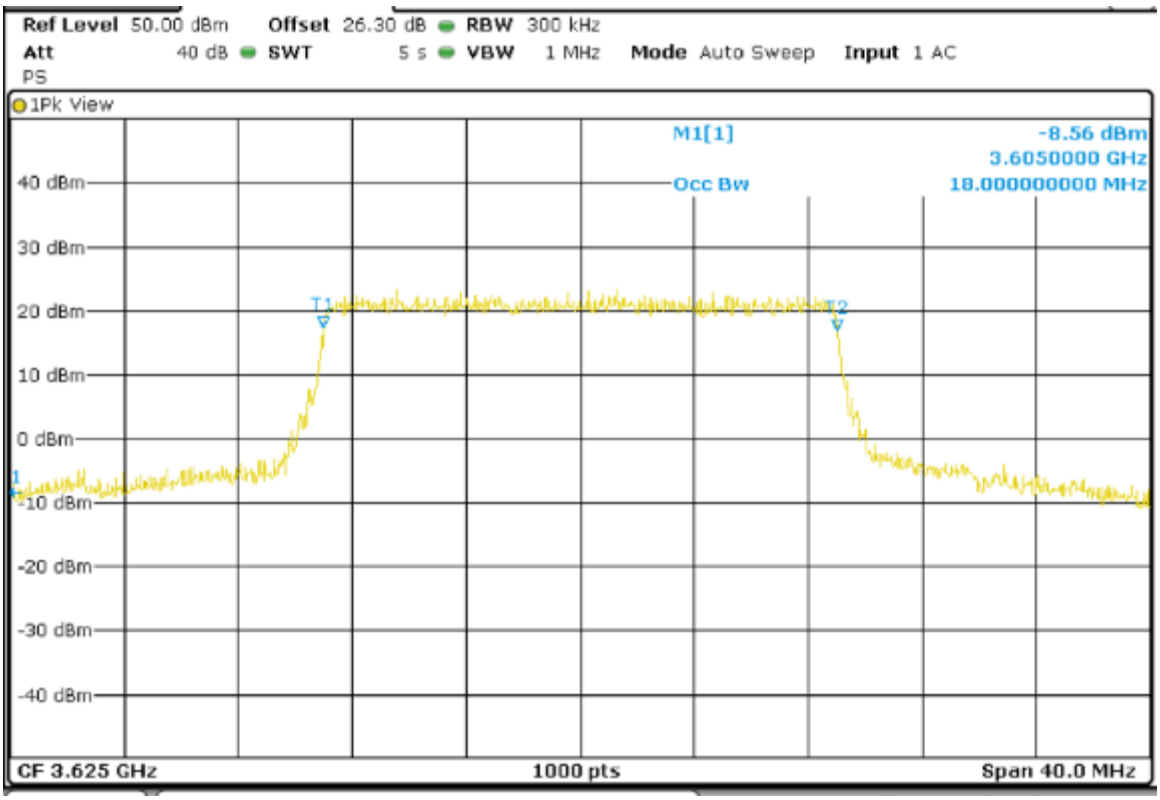
20MHz BW

OBW

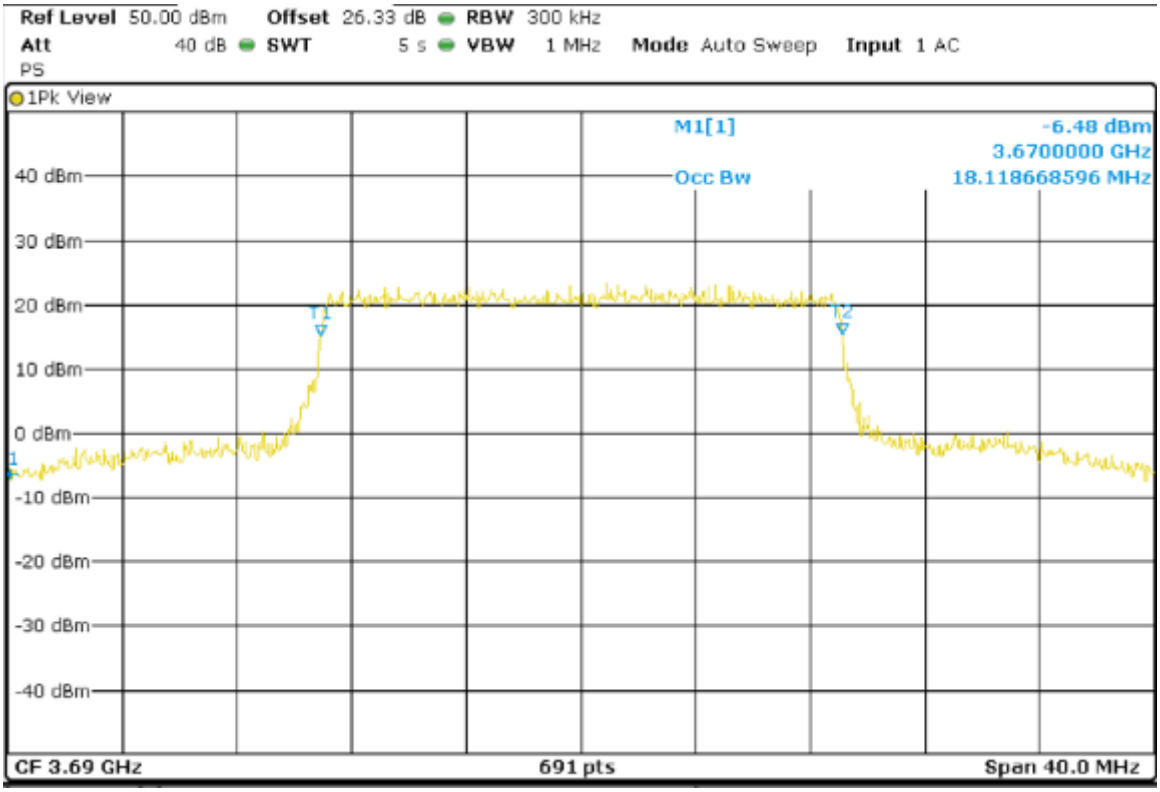
Lowest Channel (3560 MHz)



Middle Channel (3625 MHz)

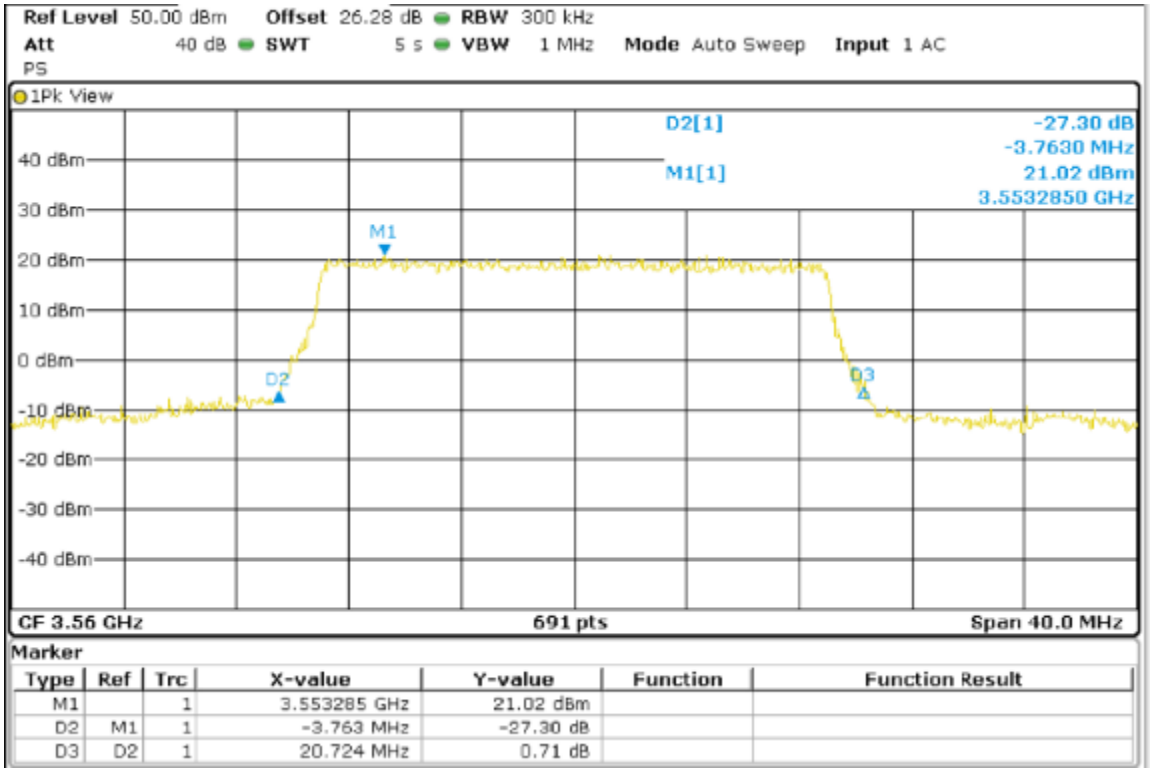


Highest Channel (3690 MHz)

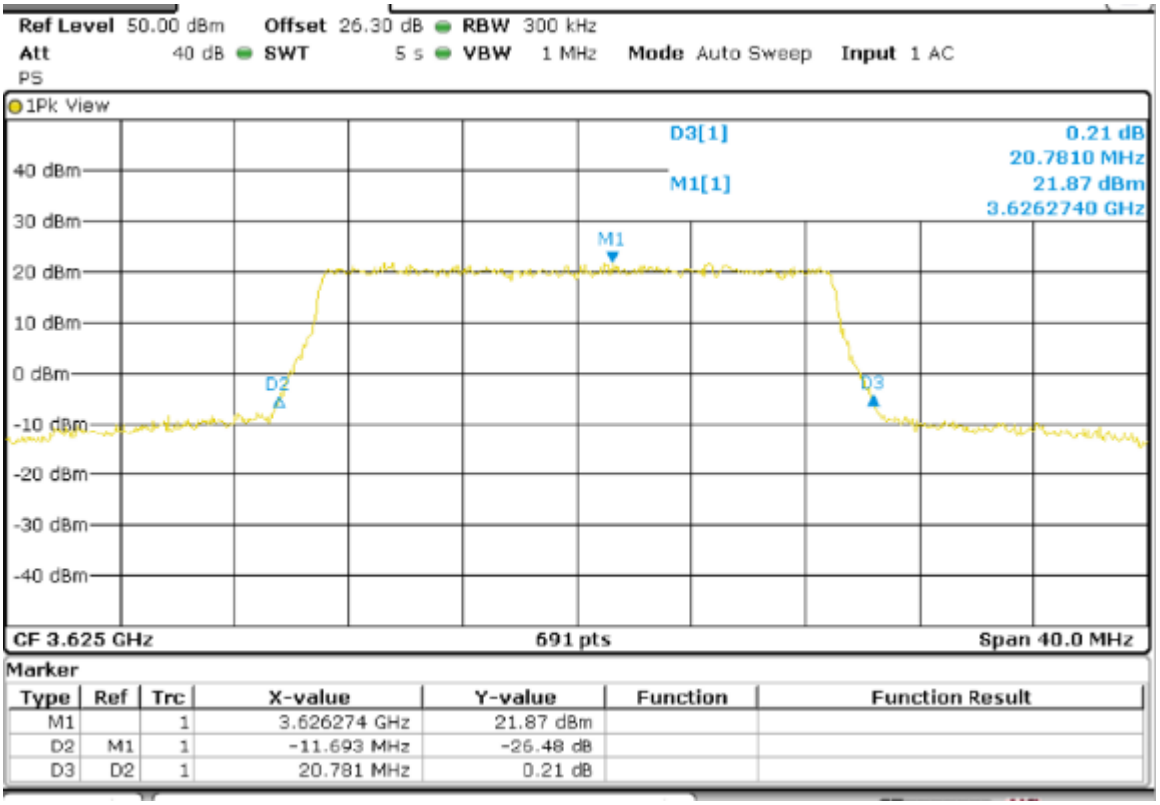


-26 dB BW

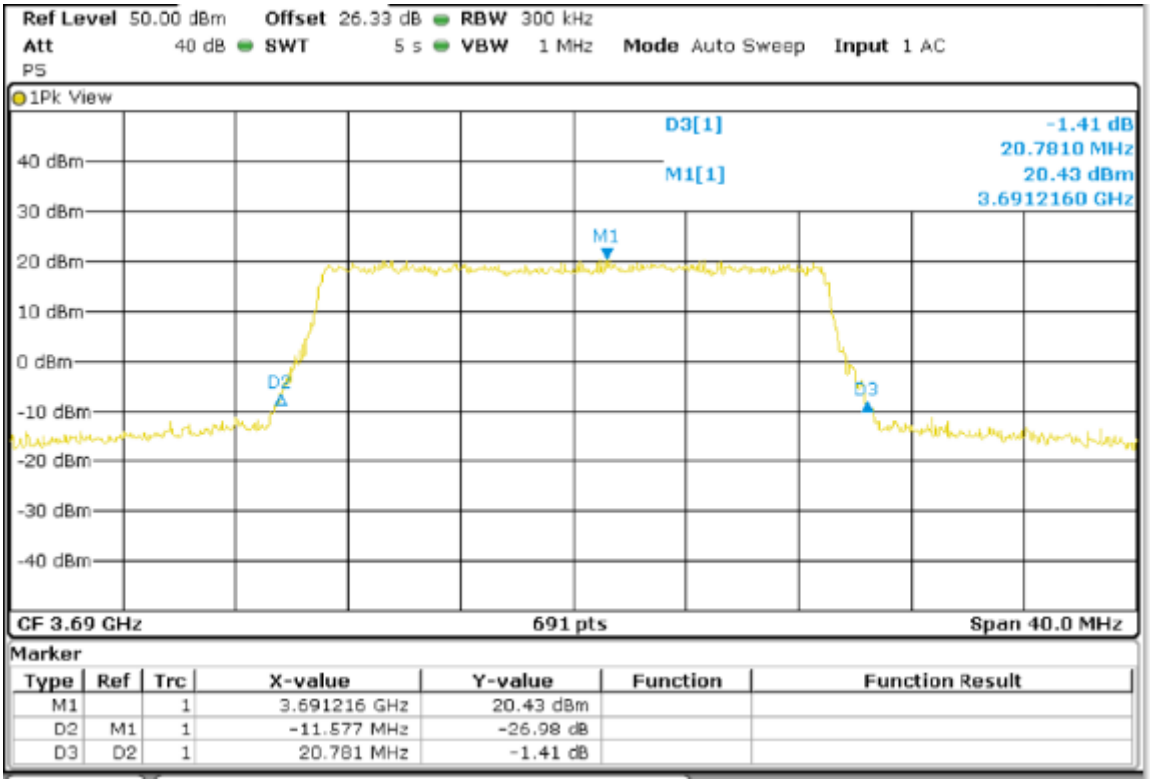
Lowest Channel (3560 MHz)



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 modification to the method is using maxhold with waiting for the sufficient time in the conservative way instead of averaging in 100 traces.

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 isotopically 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 (1/0.4) = 3.98 (dB)

RESULTS

10MHz BW

	Lowest frequency 3555 MHz	Middle frequency 3625 MHz	Highest frequency 3695 MHz
Measured power density (dBm/MHz)	14.24	14.12	14.19
Maximum declared antenna gain (dBi)	15.00	15.00	15.00
Maximum Power Spectral Density (dBm/MHz)	29.24	29.12	29.19
Measurement uncertainty (dB)	<±0.95		

20MHz BW

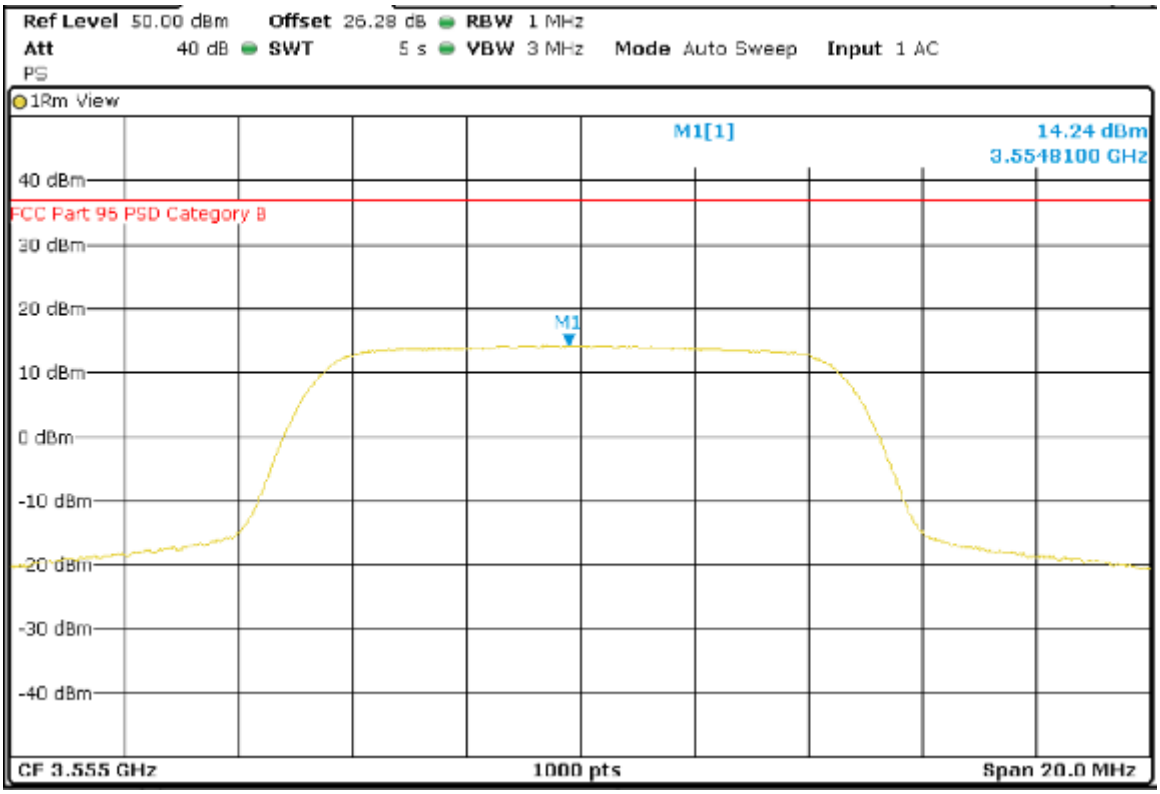
	Lowest frequency 3560 MHz	Middle frequency 3625 MHz	Highest frequency 3690 MHz
Measured power density (dBm/MHz)	11.24	11.16	10.80
Maximum declared antenna gain (dBi)	15.00	15.00	15.00
Maximum Power Spectral Density (dBm/MHz)	26.24	26.16	25.80
Measurement uncertainty (dB)	<±0.95		

VERDICT: PASS

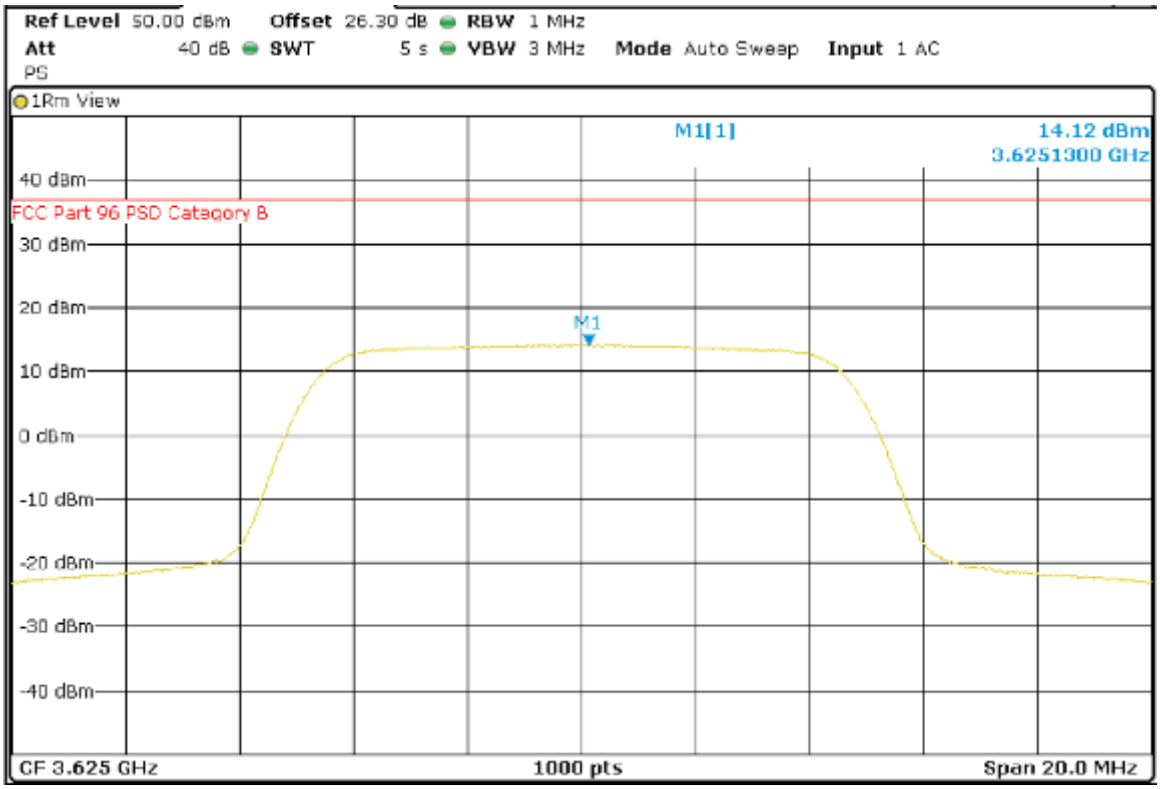
(See next plots)

10MHz BW

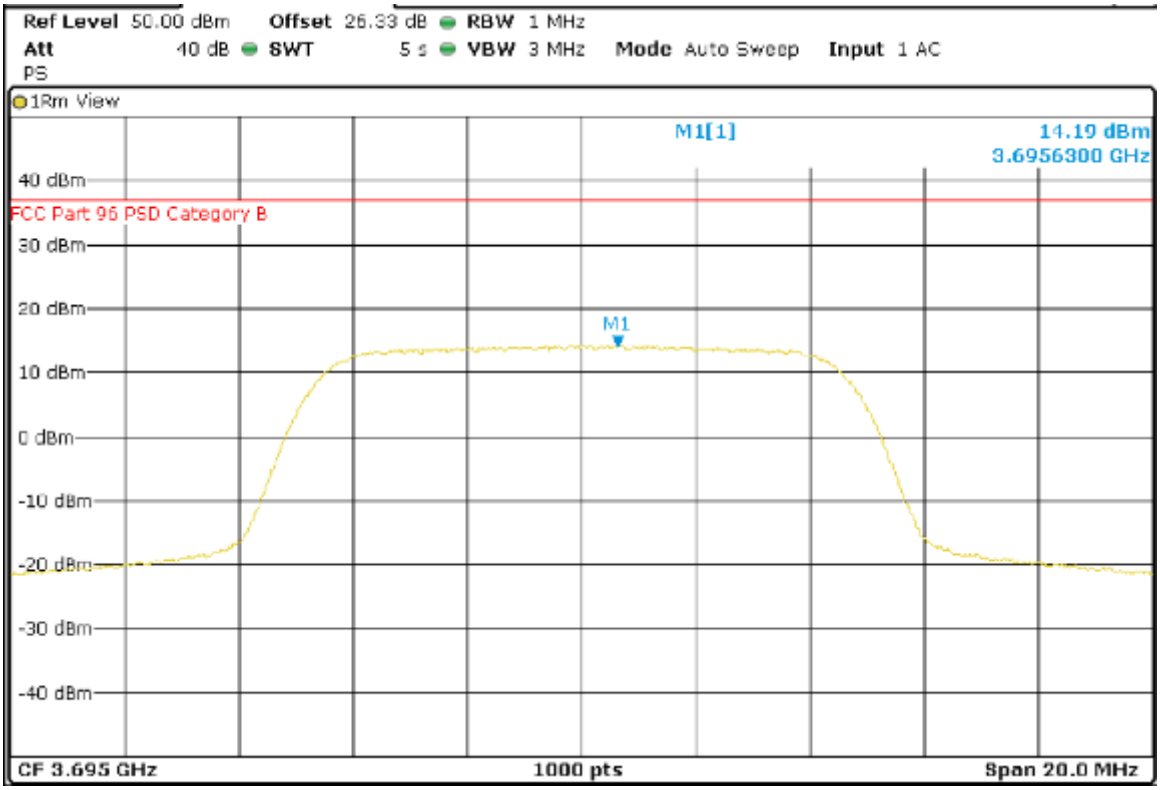
Lowest Channel (3555 MHZ)



Middle Channel (3625 MHz)

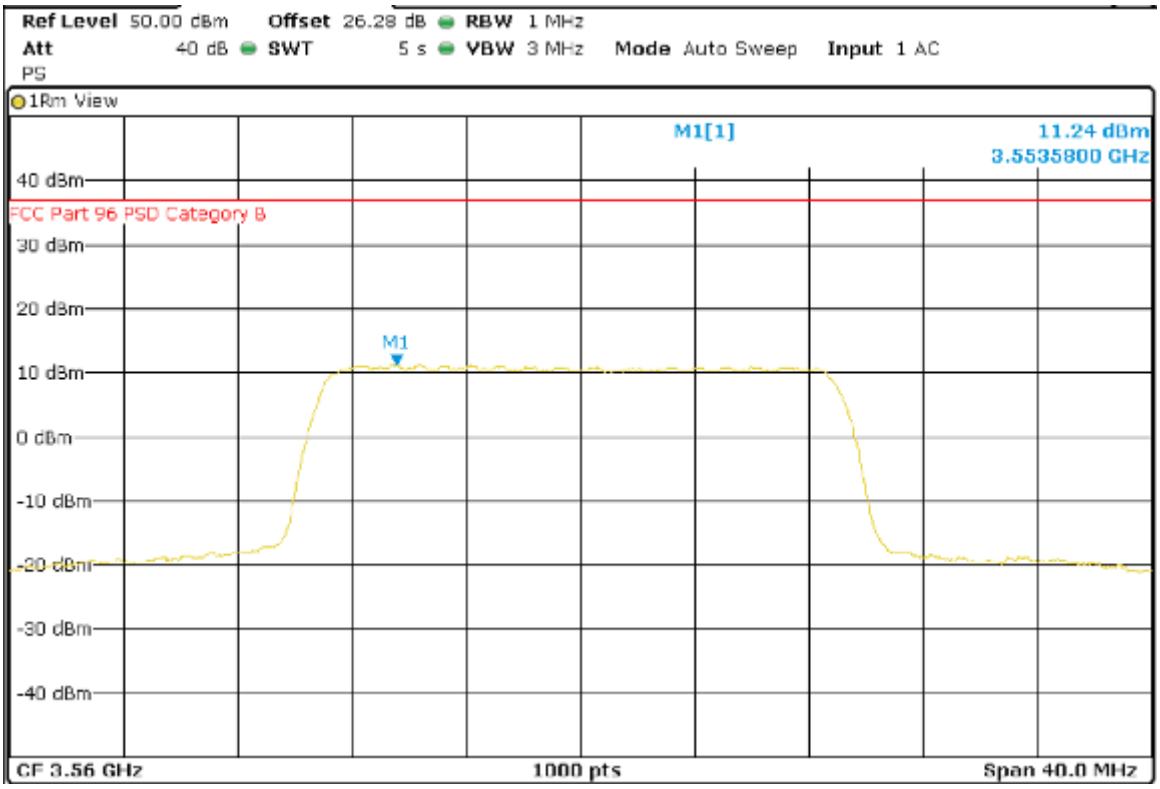


Highest Channel (3695 MHz)

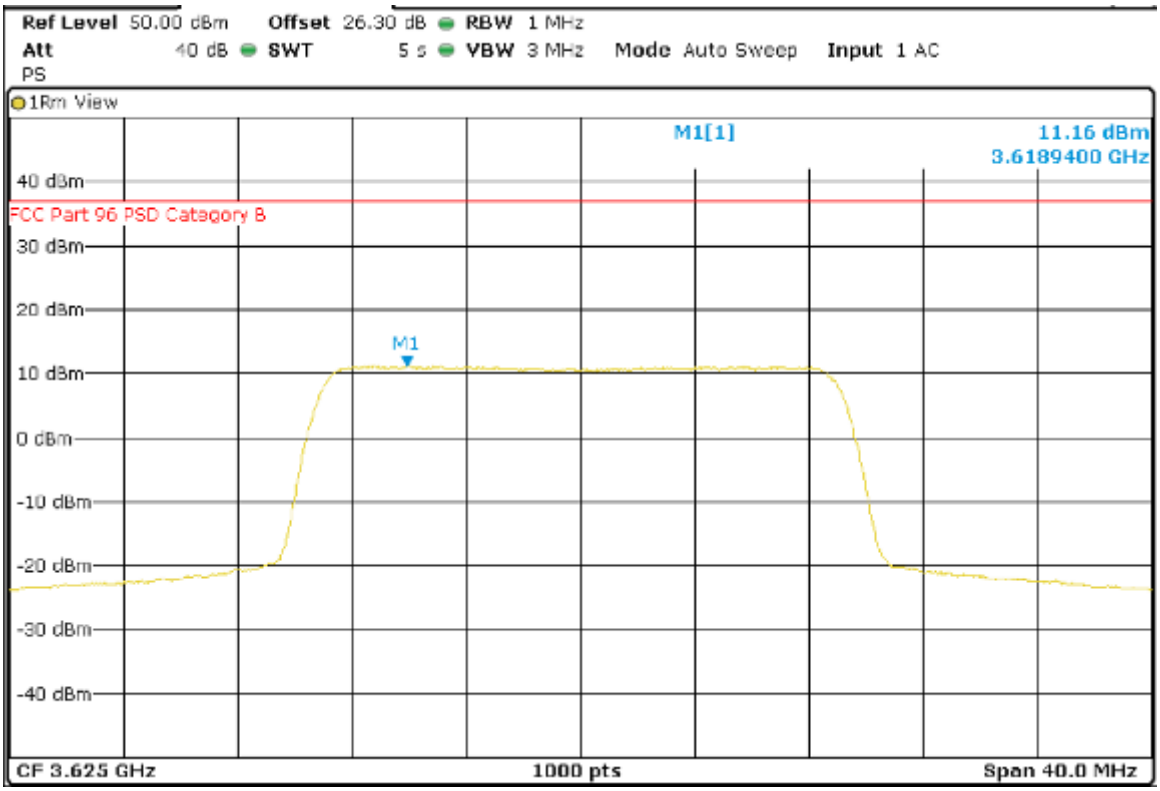


20MHz BW

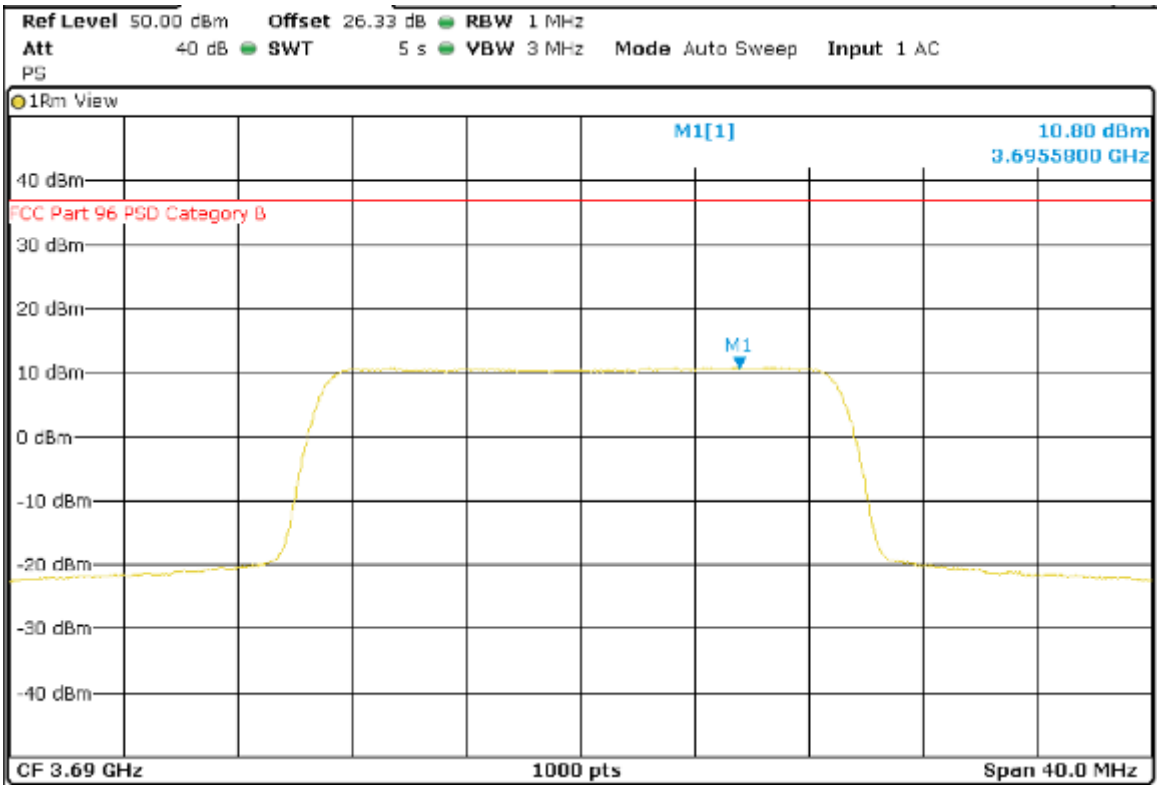
Lowest Channel (3560 MHZ)



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)	26.30	25.02	24.58
Mean (dBm)	13.10	13.29	11.52
PAPR at 0.1% probability (dB)	11.39	10.78	11.94
Measurement uncertainty (dB)	<±1.11		

20MHz BW

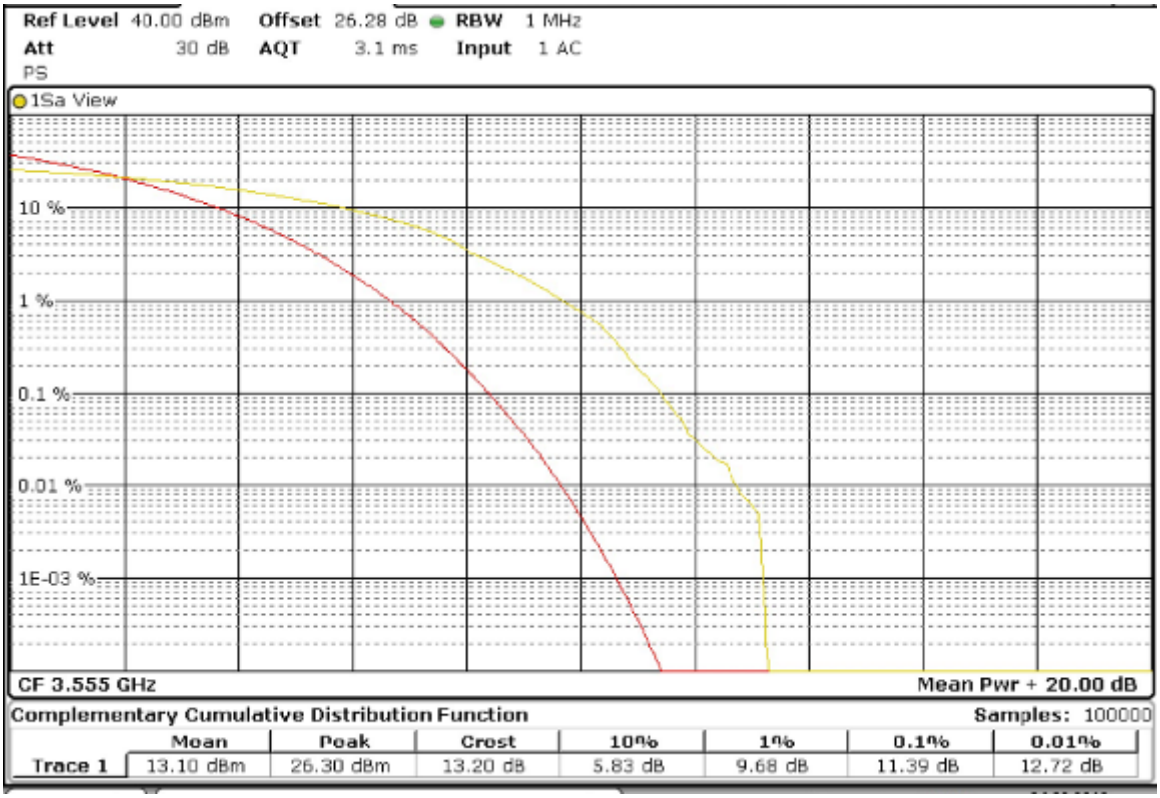
	Lowest frequency 3560 MHz	Middle frequency 3625 MHz	Highest frequency 3690 MHz
Peak (dBm)	24.36	22.94	22.57
Mean (dBm)	11.76	11.26	9.83
PAPR at 0.1% probability (dB)	10.06	10.58	11.10
Measurement uncertainty (dB)	<±1.11		

Verdict: PASS

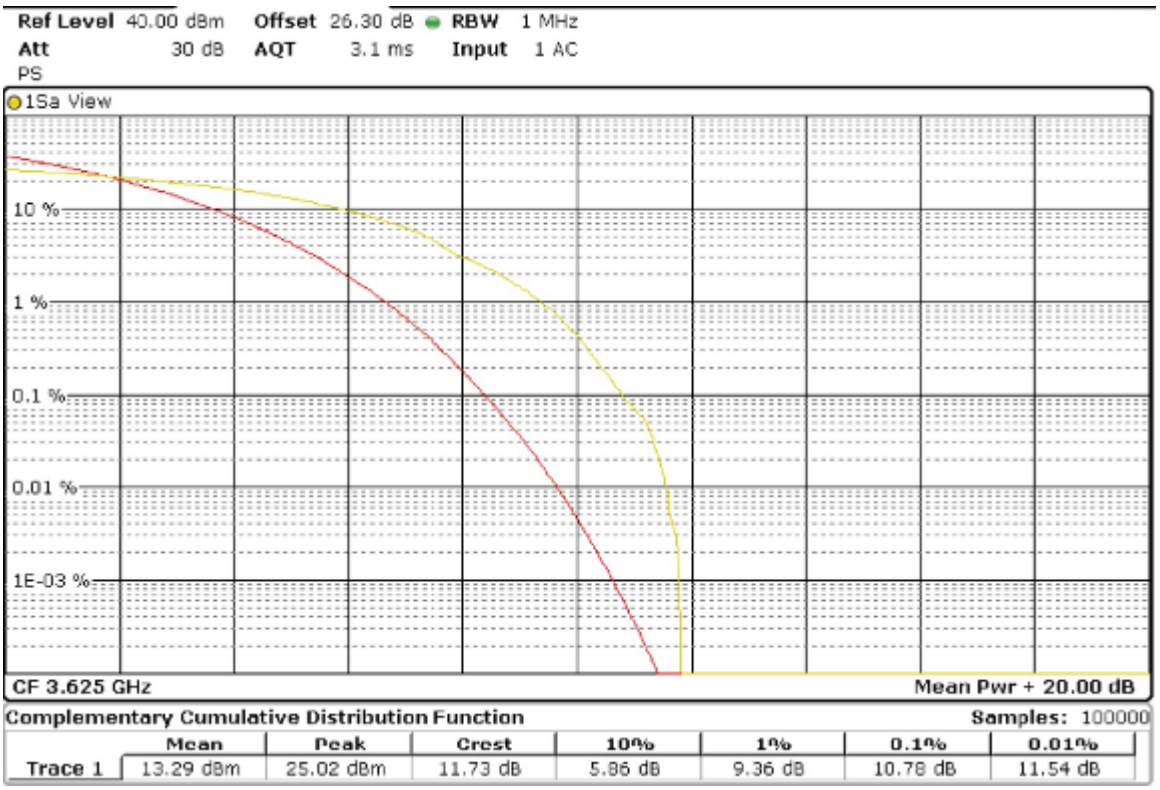
(See Next Plots)

10MHz BW

Lowest Channel (3555 MHZ)



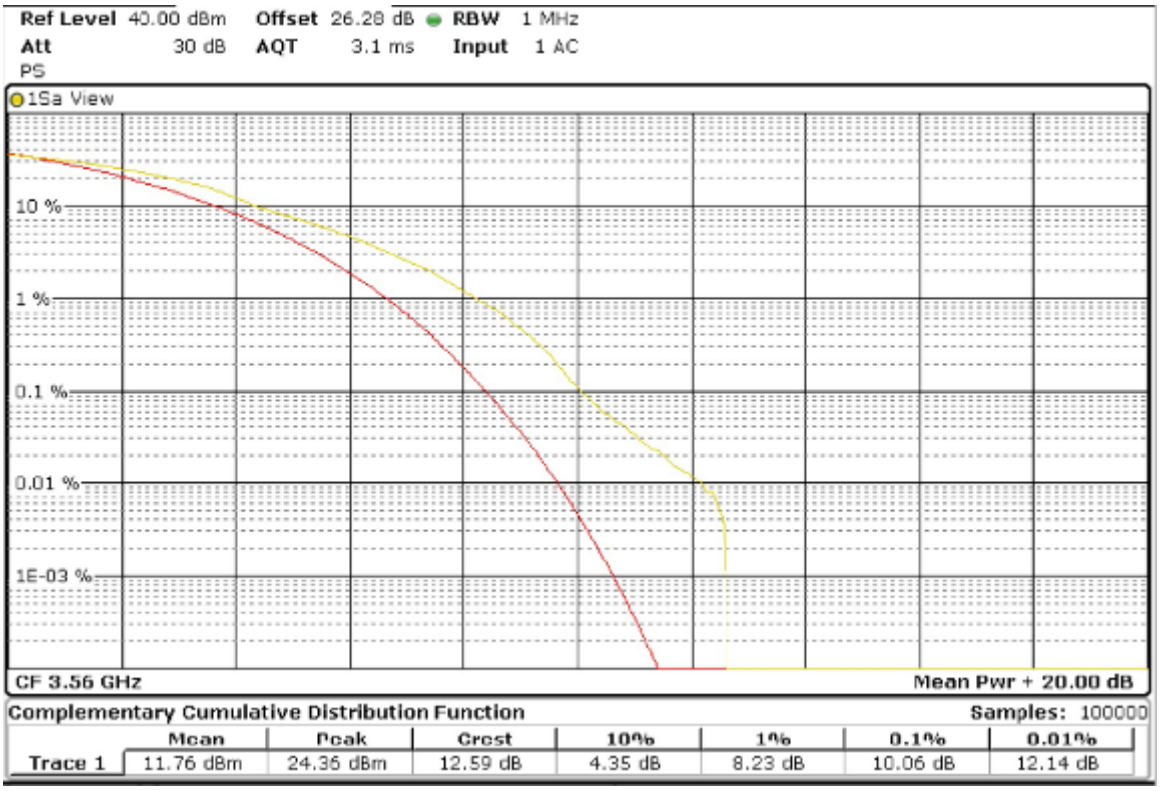
Middle Channel (3625 MHz)



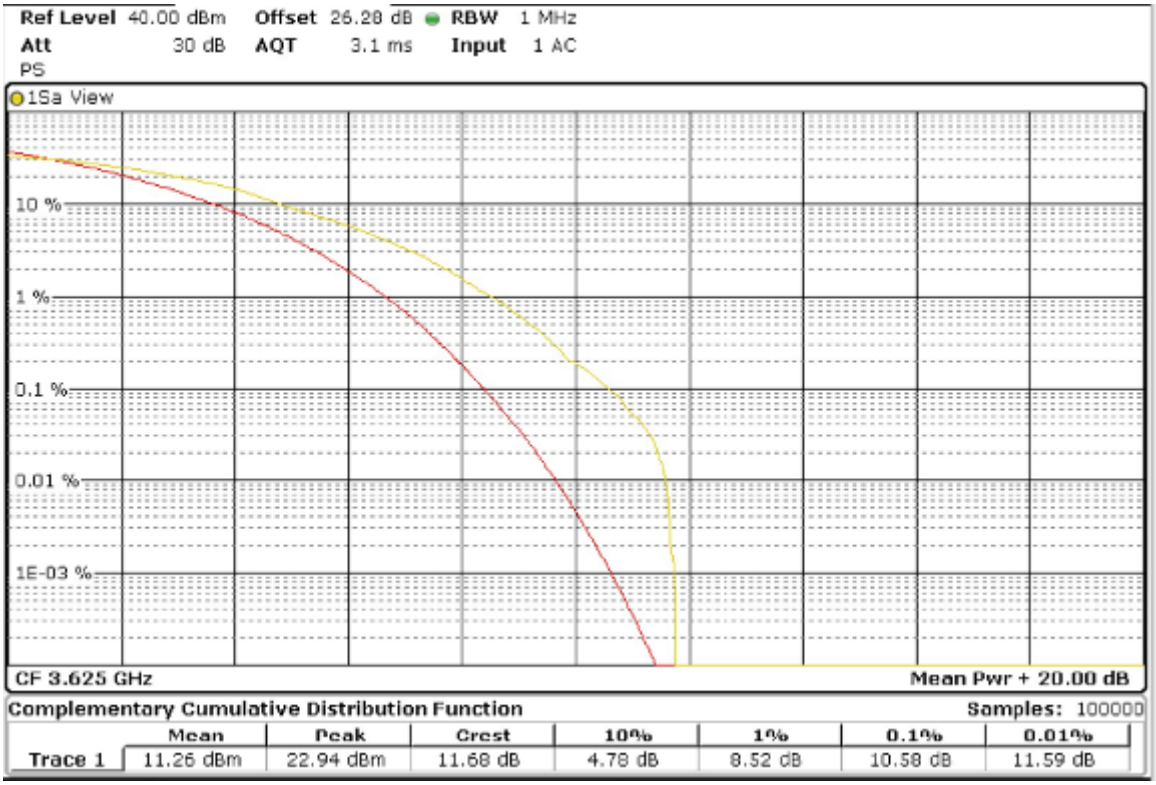
Highest Channel (3695 MHz)

20MHz BW

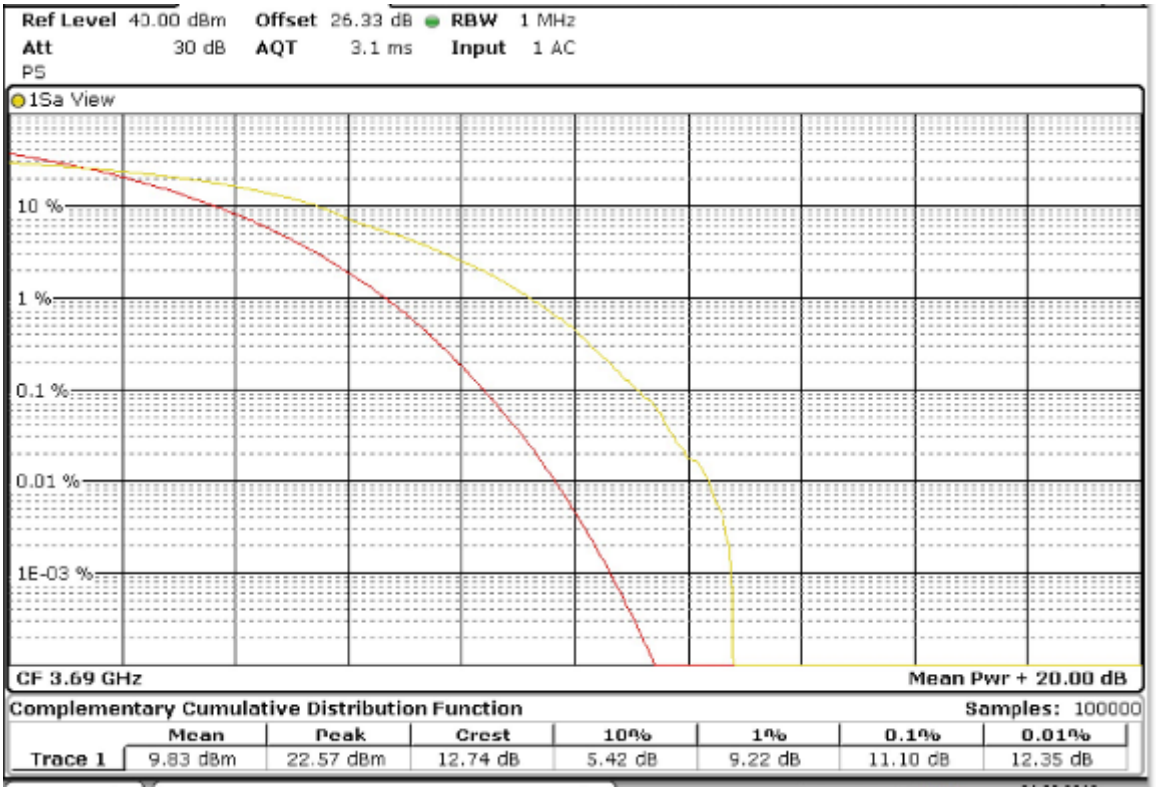
Lowest Channel (3560 MHZ)



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 (1/0.4) = 3.98 (dB)

RESULTS

10MHz BW

No conducted spurious emission was detected at or over the limit for the lowest, middle and highest channels.

20MHz BW

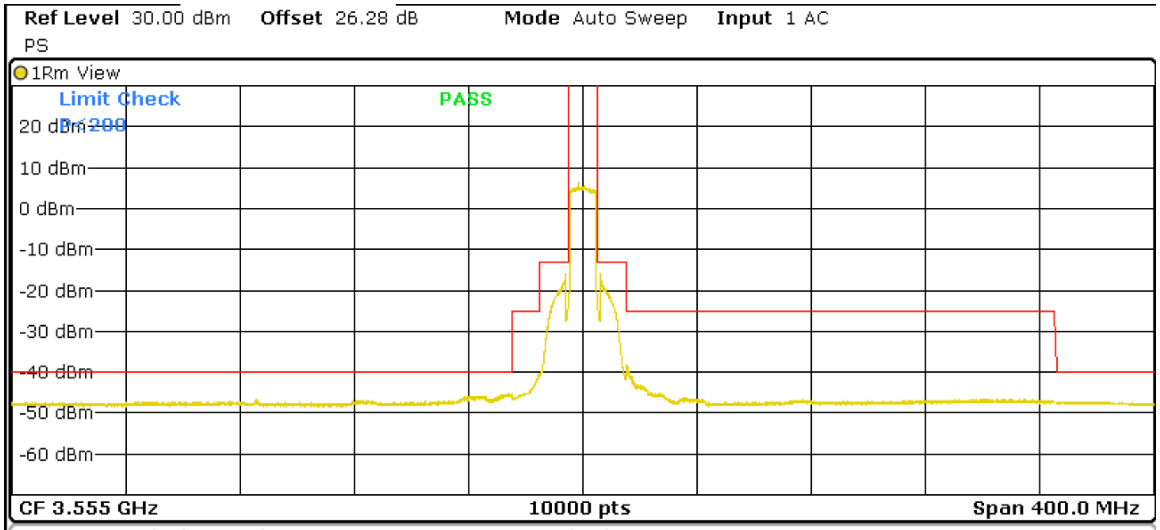
No conducted spurious emission was detected at or over the limit for the lowest, middle and highest channels.

Verdict: PASS

(See next plots)

10MHz BW

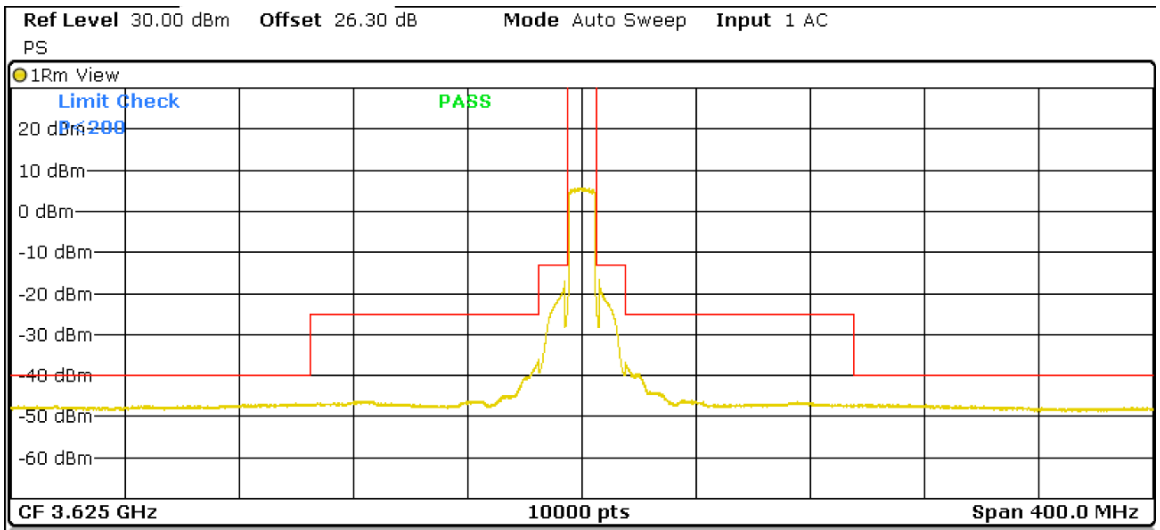
Lowest Channel (3555 MHz)



Spectrum Emission Mask — Standard: None
Tx Power 20.37 dBm — Tx Bandwidth 3.840 MHz — RBW 100.000 kHz

Range Low	Range Up	RBW	Frequency	Power Abs	Power Rel	ΔLimit
-200.000 MHz	-25.000 MHz	1.000 MHz	3.52922 GHz	-45.13 dBm	-65.50 dB	-5.13 dB
-25.000 MHz	-15.000 MHz	1.000 MHz	3.53982 GHz	-40.43 dBm	-60.80 dB	-15.43 dB
-15.000 MHz	-6.000 MHz	1.000 MHz	3.54898 GHz	-16.07 dBm	-36.43 dB	-3.07 dB
-6.000 MHz	-5.000 MHz	100.000 kHz	3.54998 GHz	-23.29 dBm	-43.65 dB	-10.29 dB
5.000 MHz	6.000 MHz	100.000 kHz	3.56002 GHz	-23.46 dBm	-43.82 dB	-10.46 dB
6.000 MHz	15.000 MHz	1.000 MHz	3.56102 GHz	-15.94 dBm	-36.31 dB	-2.94 dB
15.000 MHz	165.000 MHz	1.000 MHz	3.57006 GHz	-38.30 dBm	-58.67 dB	-13.30 dB
166.000 MHz	200.000 MHz	1.000 MHz	3.72493 GHz	-47.23 dBm	-67.59 dB	-7.23 dB

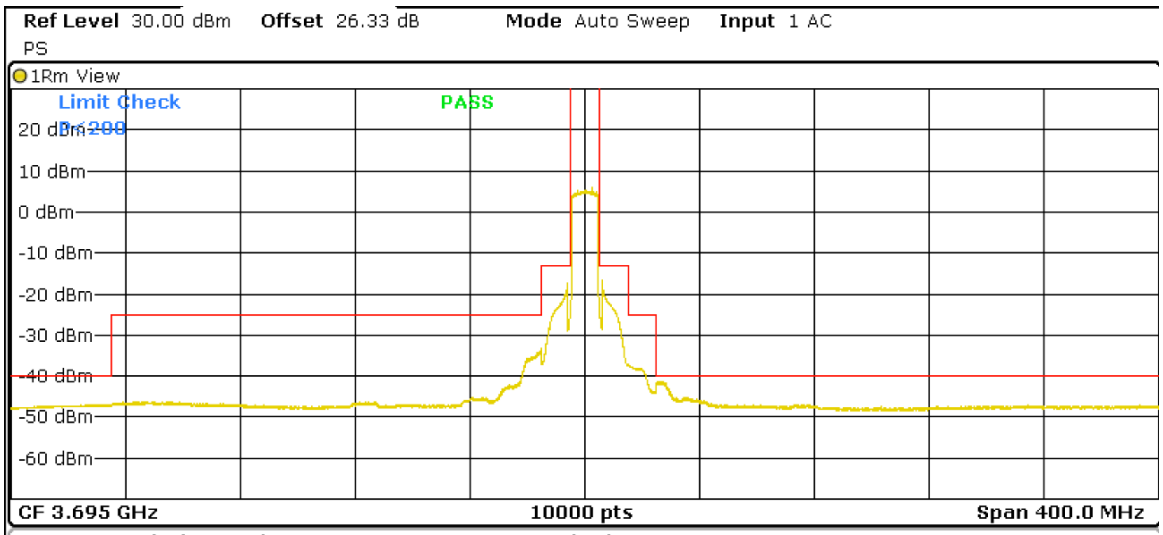
Middle Channel (3625 MHz)



Spectrum Emission Mask — Standard: None
Tx Power 20.87 dBm — Tx Bandwidth 3.840 MHz — RBW 100.000 kHz

Range Low	Range Up	RBW	Frequency	Power Abs	Power Rel	ΔLimit
-200.000 MHz	-95.000 MHz	1.000 MHz	3.52490 GHz	-46.84 dBm	-67.71 dB	-6.84 dB
-95.000 MHz	-15.000 MHz	1.000 MHz	3.60986 GHz	-36.07 dBm	-56.94 dB	-11.07 dB
-15.000 MHz	-6.000 MHz	1.000 MHz	3.61898 GHz	-16.98 dBm	-37.84 dB	-3.98 dB
-6.000 MHz	-5.000 MHz	100.000 kHz	3.61998 GHz	-23.74 dBm	-44.61 dB	-10.74 dB
5.000 MHz	6.000 MHz	100.000 kHz	3.63002 GHz	-23.60 dBm	-44.47 dB	-10.60 dB
6.000 MHz	15.000 MHz	1.000 MHz	3.63102 GHz	-16.55 dBm	-37.42 dB	-3.55 dB
15.000 MHz	95.000 MHz	1.000 MHz	3.64010 GHz	-36.70 dBm	-57.57 dB	-11.70 dB
95.000 MHz	200.000 MHz	1.000 MHz	3.73606 GHz	-46.97 dBm	-67.84 dB	-6.97 dB

Highest Channel (3695 MHz)

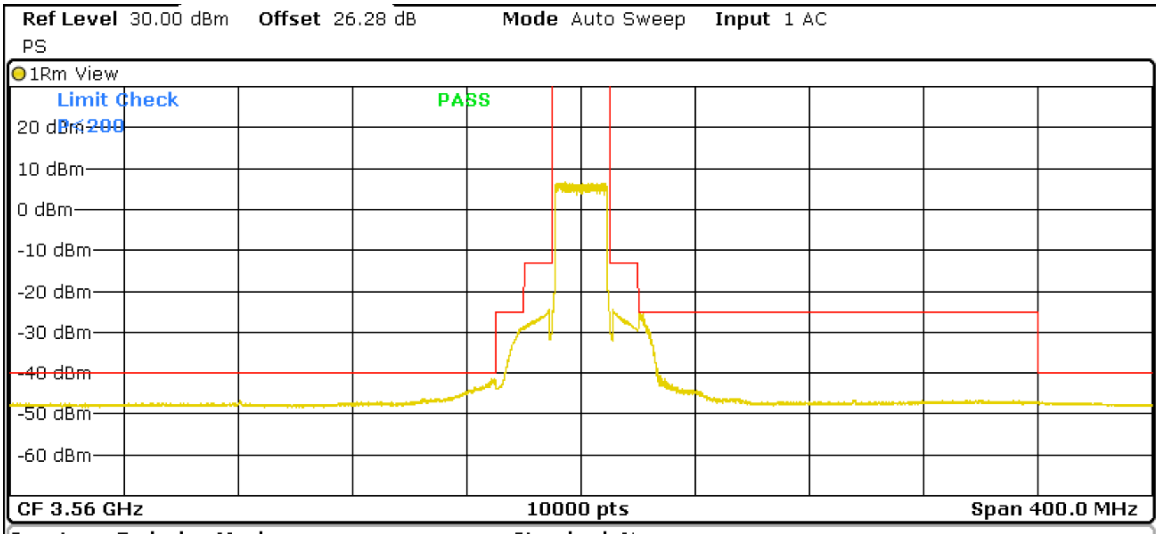


Spectrum Emission Mask Standard: None
Tx Power 20.32 dBm Tx Bandwidth 3.840 MHz RBW 100.000 kHz

Range Low	Range Up	RBW	Frequency	Power Abs	Power Rel	ΔLimit
-200.000 MHz	-165.000 MHz	1.000 MHz	3.52590 GHz	-47.01 dBm	-67.34 dB	-7.01 dB
-165.000 MHz	-15.000 MHz	1.000 MHz	3.67978 GHz	-33.30 dBm	-53.63 dB	-8.30 dB
-15.000 MHz	-6.000 MHz	1.000 MHz	3.68898 GHz	-17.40 dBm	-37.72 dB	-4.40 dB
-6.000 MHz	-5.000 MHz	100.000 kHz	3.68998 GHz	-24.53 dBm	-44.86 dB	-11.53 dB
5.000 MHz	6.000 MHz	100.000 kHz	3.70002 GHz	-24.01 dBm	-44.33 dB	-11.01 dB
6.000 MHz	15.000 MHz	1.000 MHz	3.70102 GHz	-16.71 dBm	-37.03 dB	-3.71 dB
15.000 MHz	25.000 MHz	1.000 MHz	3.71002 GHz	-37.21 dBm	-57.54 dB	-12.21 dB
25.000 MHz	200.000 MHz	1.000 MHz	3.72010 GHz	-41.28 dBm	-61.60 dB	-1.28 dB

20MHz BW

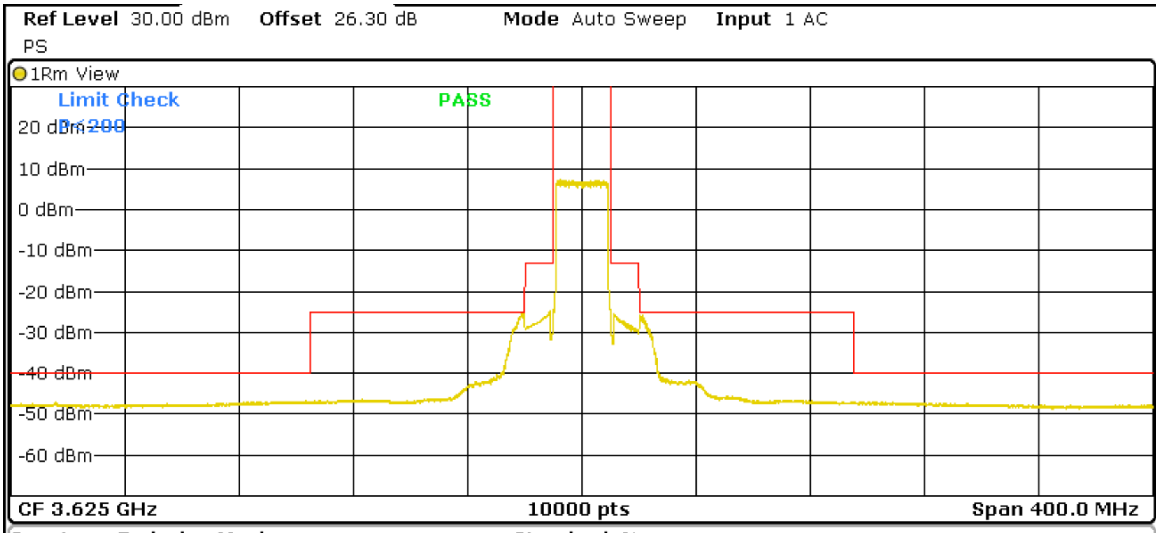
Lowest Channel (3560 MHz)



Spectrum Emission Mask Standard: None
Tx Power 17.88 dBm Tx Bandwidth 3.840 MHz RBW 200.000 kHz

Range Low	Range Up	RBW	Frequency	Power Abs	Power Rel	ΔLimit
-200.000 MHz	-30.000 MHz	1.000 MHz	3.52986 GHz	-41.37 dBm	-59.24 dB	-1.37 dB
-30.000 MHz	-20.000 MHz	1.000 MHz	3.53982 GHz	-28.56 dBm	-46.43 dB	-3.56 dB
-20.000 MHz	-11.000 MHz	1.000 MHz	3.54894 GHz	-24.42 dBm	-42.30 dB	-11.42 dB
-11.000 MHz	-10.000 MHz	200.000 kHz	3.54998 GHz	-28.49 dBm	-46.37 dB	-15.49 dB
10.000 MHz	11.000 MHz	200.000 kHz	3.57002 GHz	-28.63 dBm	-46.50 dB	-15.63 dB
11.000 MHz	20.000 MHz	1.000 MHz	3.57102 GHz	-24.43 dBm	-42.31 dB	-11.43 dB
20.000 MHz	160.000 MHz	1.000 MHz	3.58154 GHz	-25.40 dBm	-43.28 dB	-0.40 dB
160.000 MHz	200.000 MHz	1.000 MHz	3.72062 GHz	-47.04 dBm	-64.91 dB	-7.04 dB

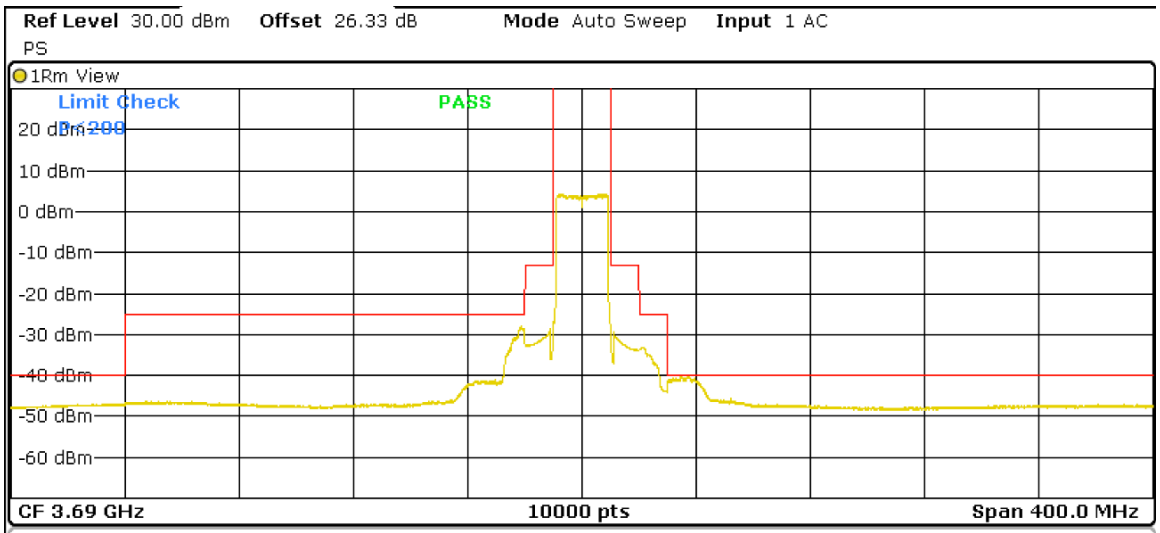
Middle Channel (3625 MHz)



Spectrum Emission Mask Standard: None
Tx Power 18.88 dBm Tx Bandwidth 3.840 MHz RBW 200.000 kHz

Range Low	Range Up	RBW	Frequency	Power Abs	Power Rel	ΔLimit
-200.000 MHz	-95.000 MHz	1.000 MHz	3.52822 GHz	-46.82 dBm	-65.70 dB	-6.82 dB
-95.000 MHz	-20.000 MHz	1.000 MHz	3.60394 GHz	-25.50 dBm	-44.38 dB	-0.50 dB
-20.000 MHz	-11.000 MHz	1.000 MHz	3.61394 GHz	-24.60 dBm	-43.47 dB	-11.60 dB
-11.000 MHz	-10.000 MHz	200.000 kHz	3.61498 GHz	-28.24 dBm	-47.12 dB	-15.24 dB
10.000 MHz	11.000 MHz	200.000 kHz	3.63502 GHz	-28.69 dBm	-47.57 dB	-15.69 dB
11.000 MHz	20.000 MHz	1.000 MHz	3.63602 GHz	-25.30 dBm	-44.18 dB	-12.30 dB
20.000 MHz	95.000 MHz	1.000 MHz	3.64522 GHz	-25.75 dBm	-44.63 dB	-0.75 dB
95.000 MHz	200.000 MHz	1.000 MHz	3.72290 GHz	-46.89 dBm	-65.77 dB	-6.89 dB

Highest Channel (3690 MHz)



Spectrum Emission Mask Standard: None
Tx Power 16.04 dBm Tx Bandwidth 3.840 MHz RBW 200.000 kHz

Range Low	Range Up	RBW	Frequency	Power Abs	Power Rel	ΔLimit
-200.000 MHz	-160.000 MHz	1.000 MHz	3.52946 GHz	-46.98 dBm	-63.02 dB	-6.98 dB
-160.000 MHz	-20.000 MHz	1.000 MHz	3.66854 GHz	-28.03 dBm	-44.07 dB	-3.03 dB
-20.000 MHz	-11.000 MHz	1.000 MHz	3.67898 GHz	-28.65 dBm	-44.69 dB	-15.65 dB
-11.000 MHz	-10.000 MHz	200.000 kHz	3.67998 GHz	-31.99 dBm	-48.02 dB	-18.99 dB
10.000 MHz	11.000 MHz	200.000 kHz	3.70002 GHz	-32.06 dBm	-48.10 dB	-19.06 dB
11.000 MHz	20.000 MHz	1.000 MHz	3.70102 GHz	-29.43 dBm	-45.46 dB	-16.43 dB
20.000 MHz	30.000 MHz	1.000 MHz	3.71126 GHz	-33.23 dBm	-49.27 dB	-8.23 dB
30.000 MHz	200.000 MHz	1.000 MHz	3.72714 GHz	-40.14 dBm	-56.17 dB	-0.14 dB

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 (1/0.4) = 3.98 (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)
3122.52	-47.28	3196.60	-45.84	3225.54	-49.33
3225.69	-46.34	3378.52	-49.86	3268.03	-47.96
3336.65	-46.61	4054.37	-47.74	3448.08	-49.80
7109.68	-54.71	7250.18	-45.71	7389.68	-47.79
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)
3125.01	-48.85	3189.75	-48.32	3226.01	-45.91
3225.54	-46.28	3225.70	-45.21	3475.16	-50.45
3348.64	-48.14	7246.18	-49.08	7372.18	-56.45
7121.50	-56.77				
Measurement uncertainty (dB)				<± 2.03	

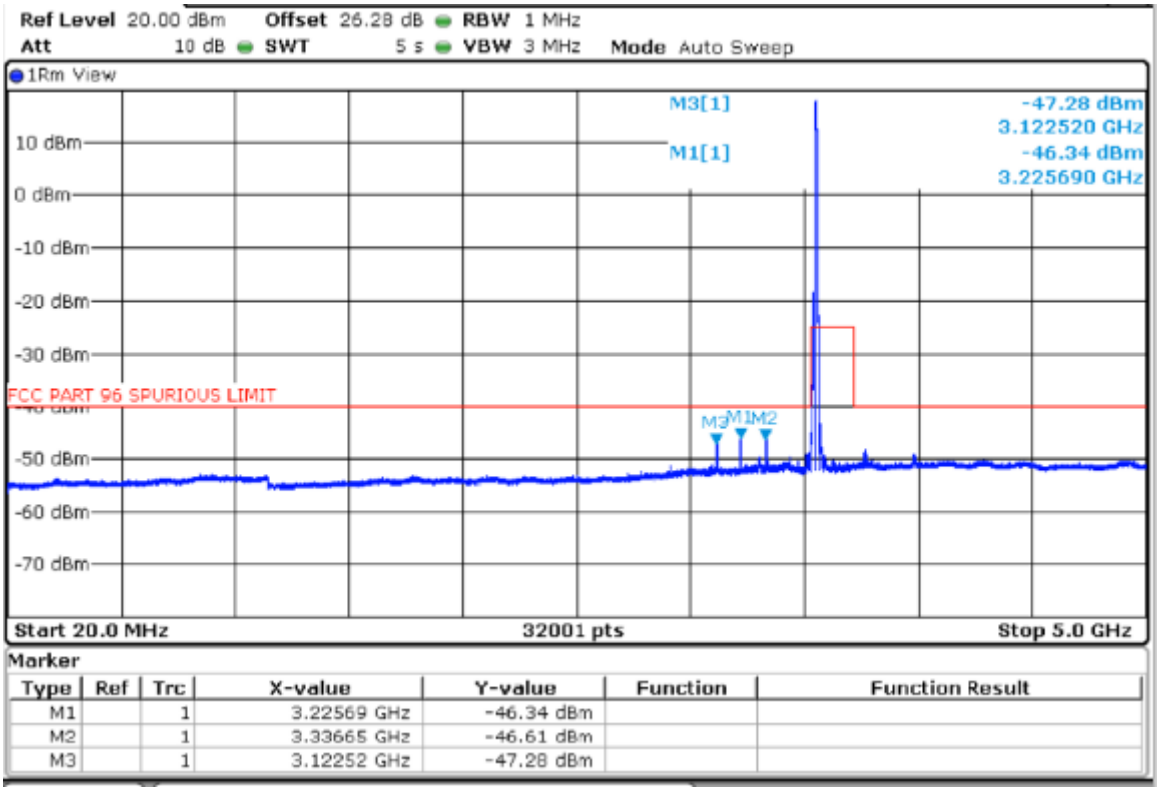
Verdict: PASS

(See the next plots)

10MHz BW

Lowest Channel (3555 MHz)

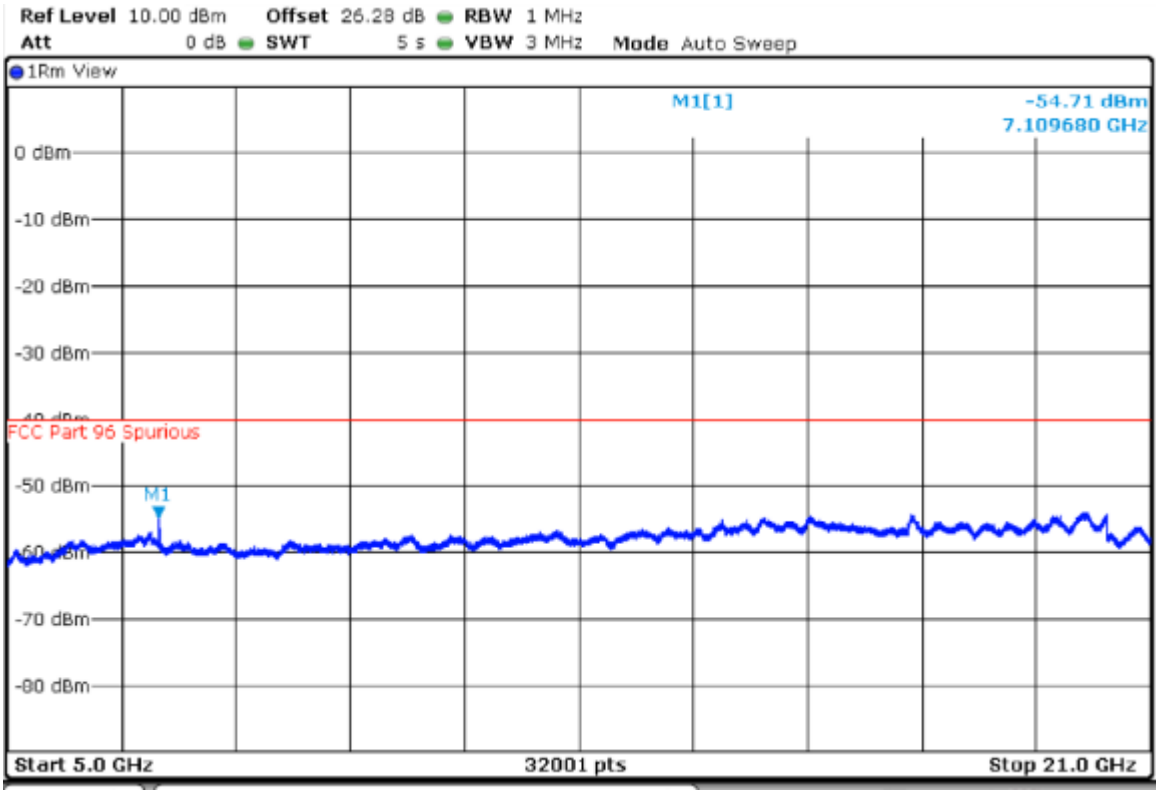
FREQUENCY RANGE 20 MHz-5 GHz



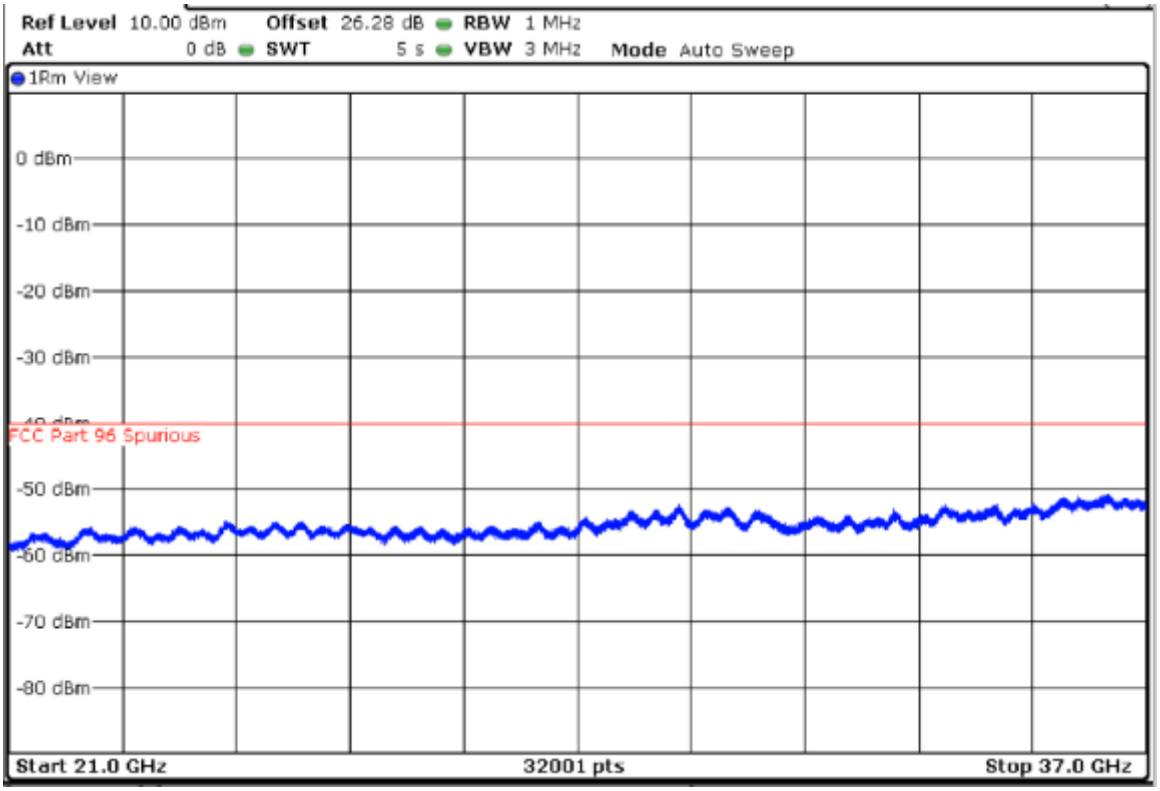
Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	3.22569 GHz	-46.34 dBm		
M2		1	3.33665 GHz	-46.61 dBm		
M3		1	3.12252 GHz	-47.28 dBm		

FREQUENCY RANGE 5-21 GHz

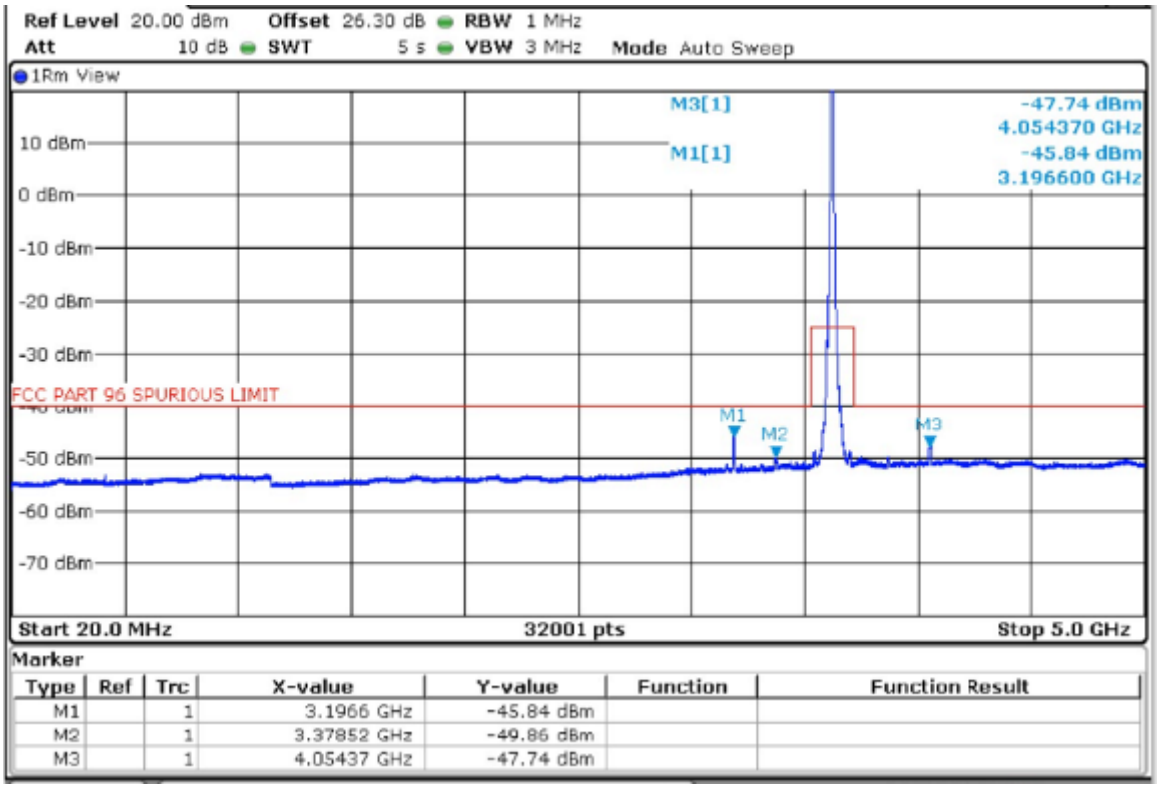


FREQUENCY RANGE 21-37 GHz

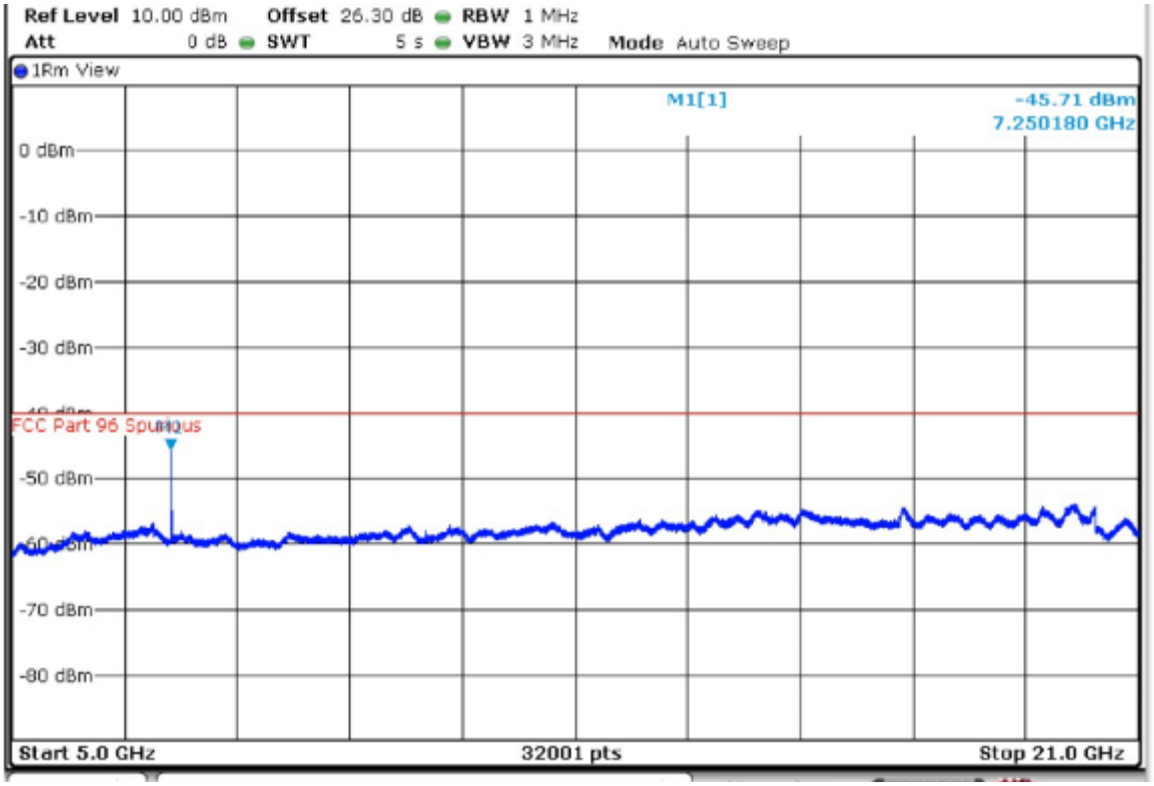


Middle Channel (3625 MHz)

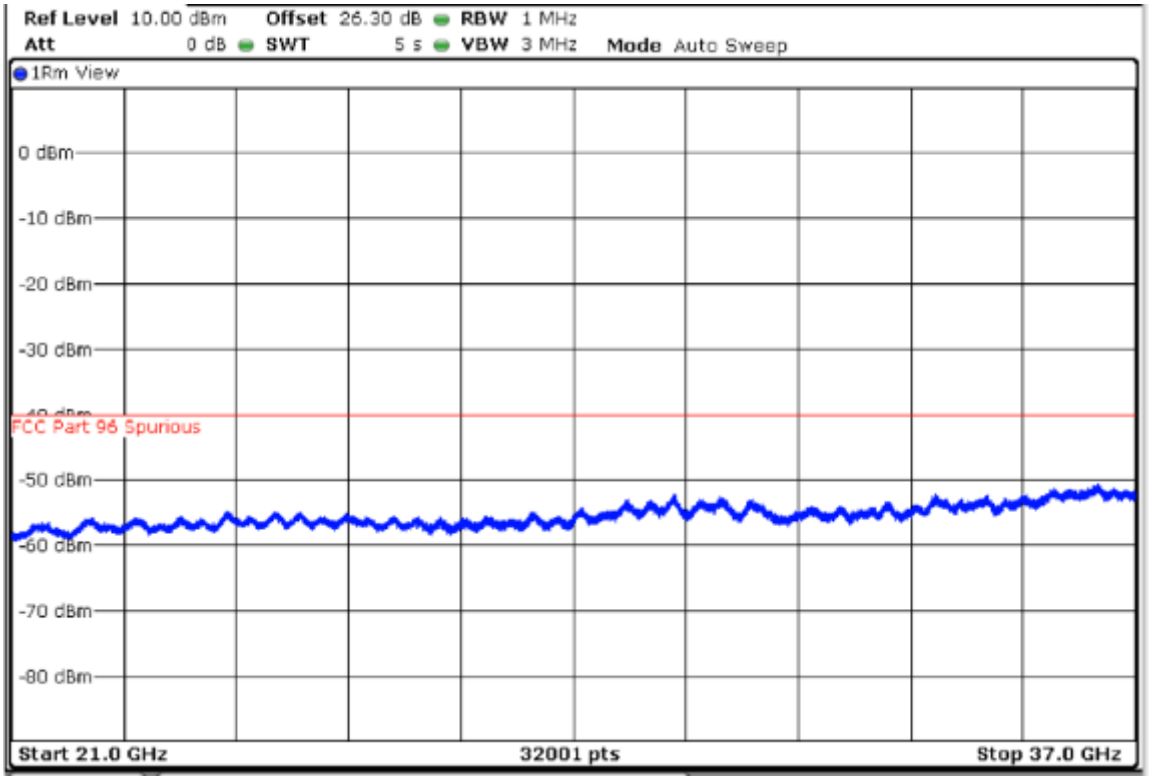
FREQUENCY RANGE 20 MHz-5 GHz



FREQUENCY RANGE 5-21 GHz

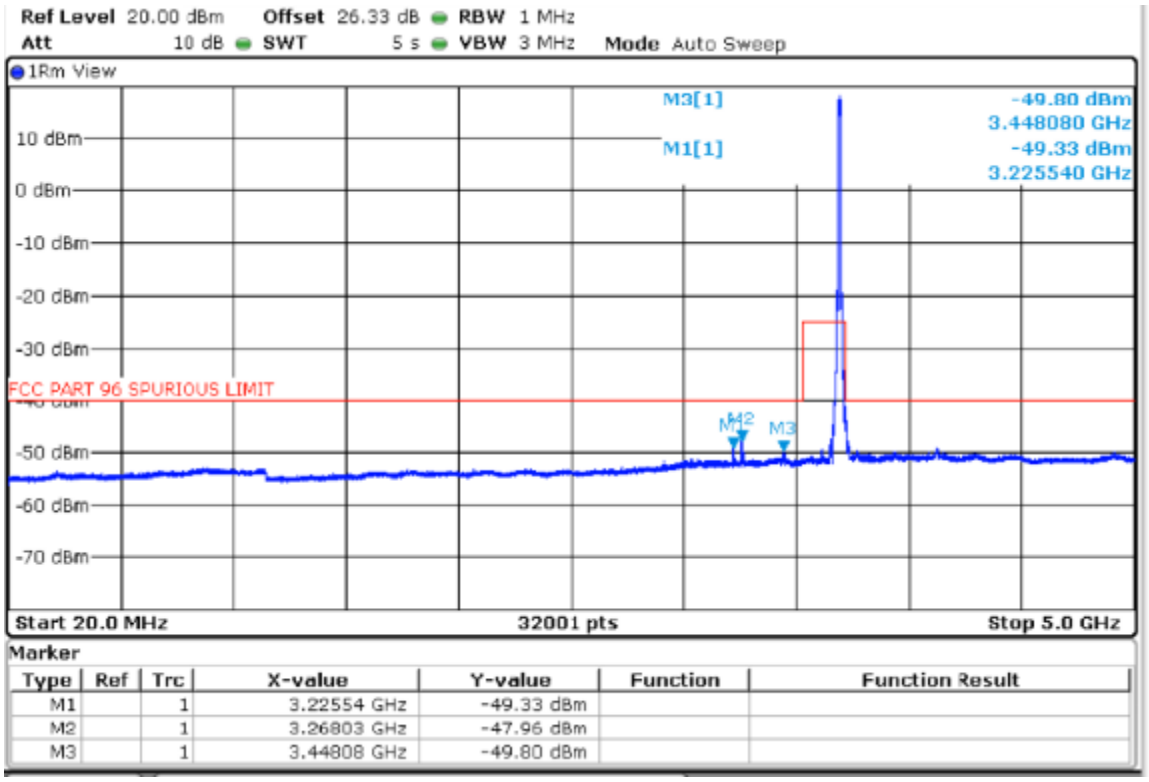


FREQUENCY RANGE 21-37 GHz



Highest Channel (3695 MHz)

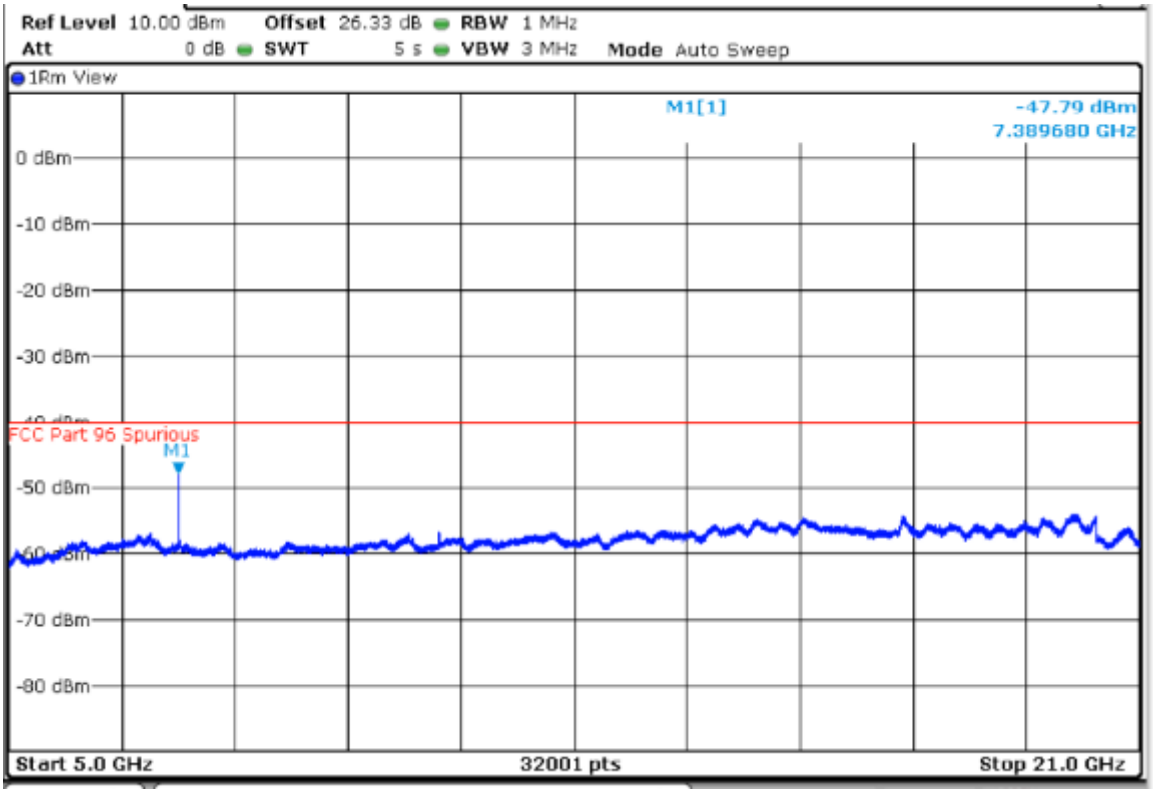
FREQUENCY RANGE 20 MHz-5 GHz



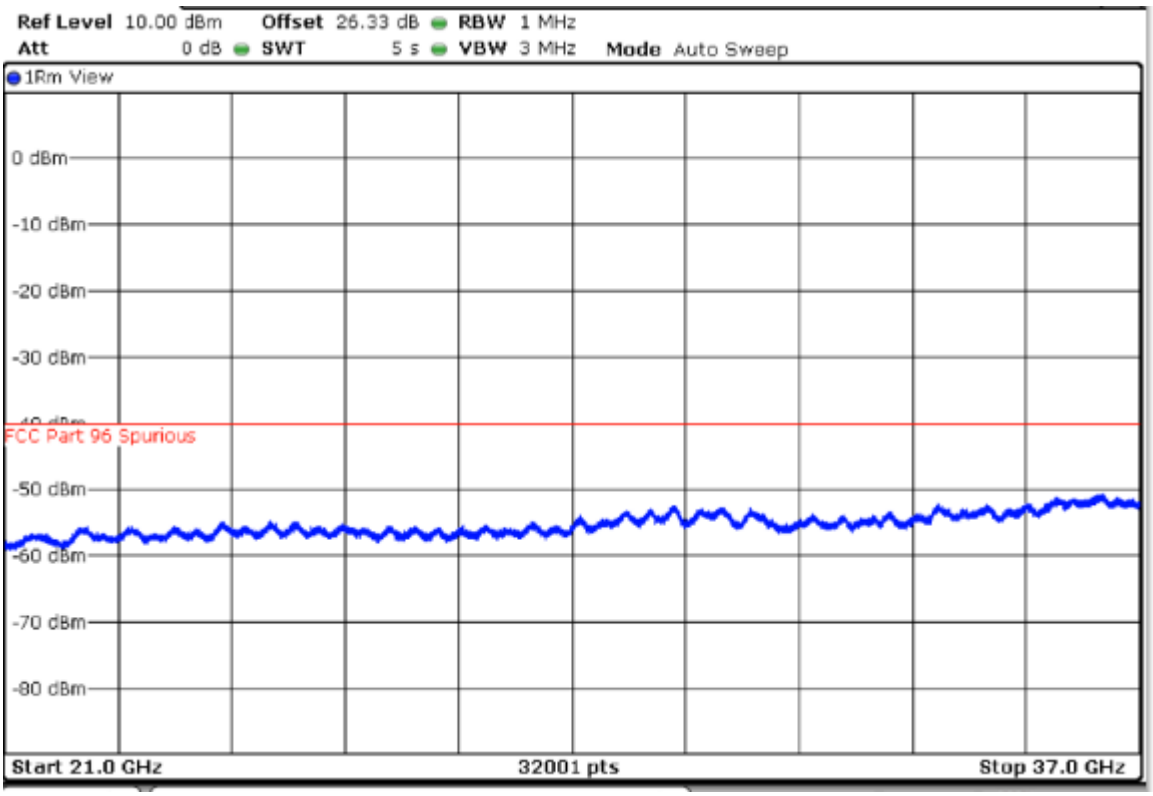
Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	3.22554 GHz	-49.33 dBm		
M2		1	3.26803 GHz	-47.96 dBm		
M3		1	3.44808 GHz	-49.80 dBm		

FREQUENCY RANGE 5-21 GHz



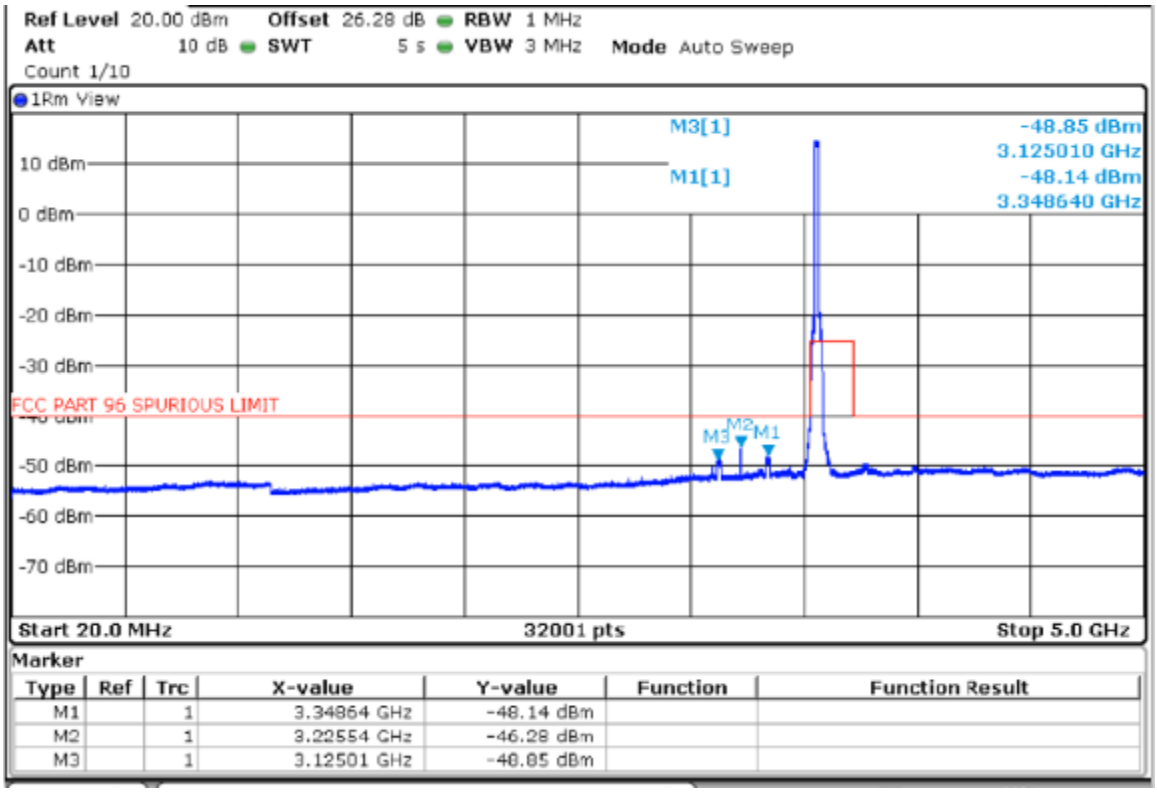
FREQUENCY RANGE 21-37 GHz



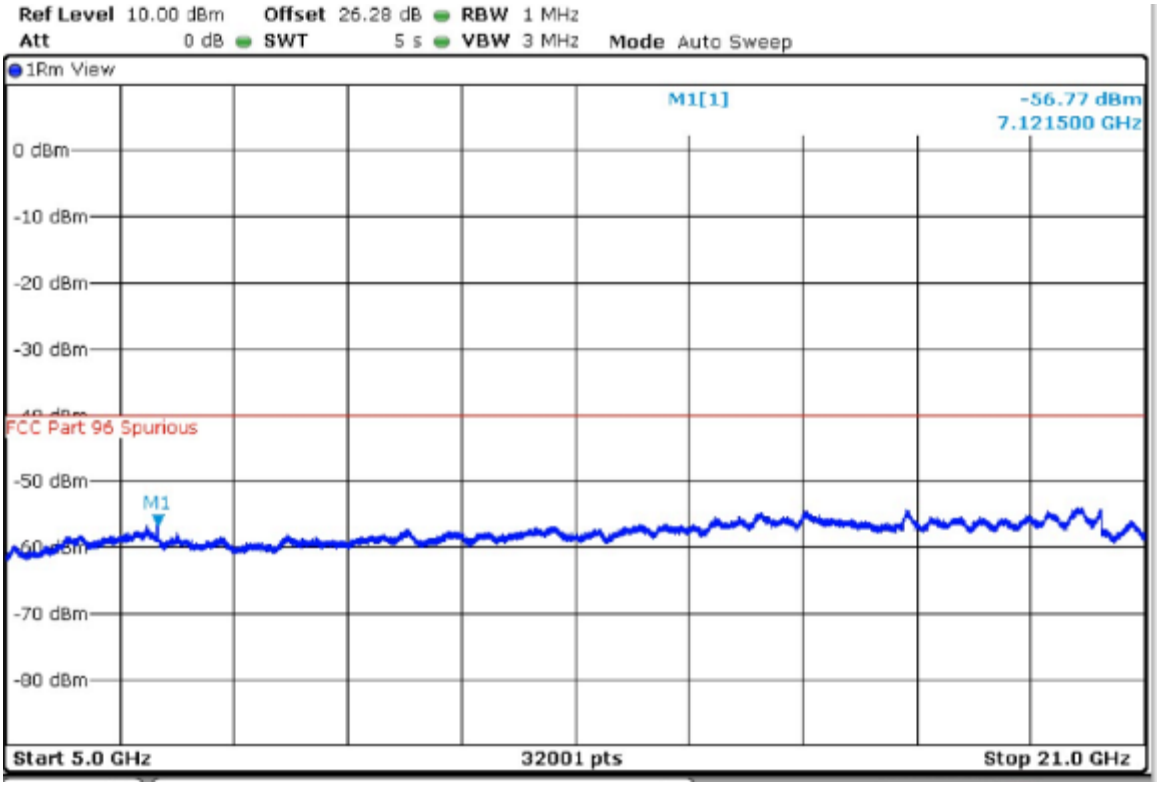
20MHz BW

Lowest Channel (3560 MHz)

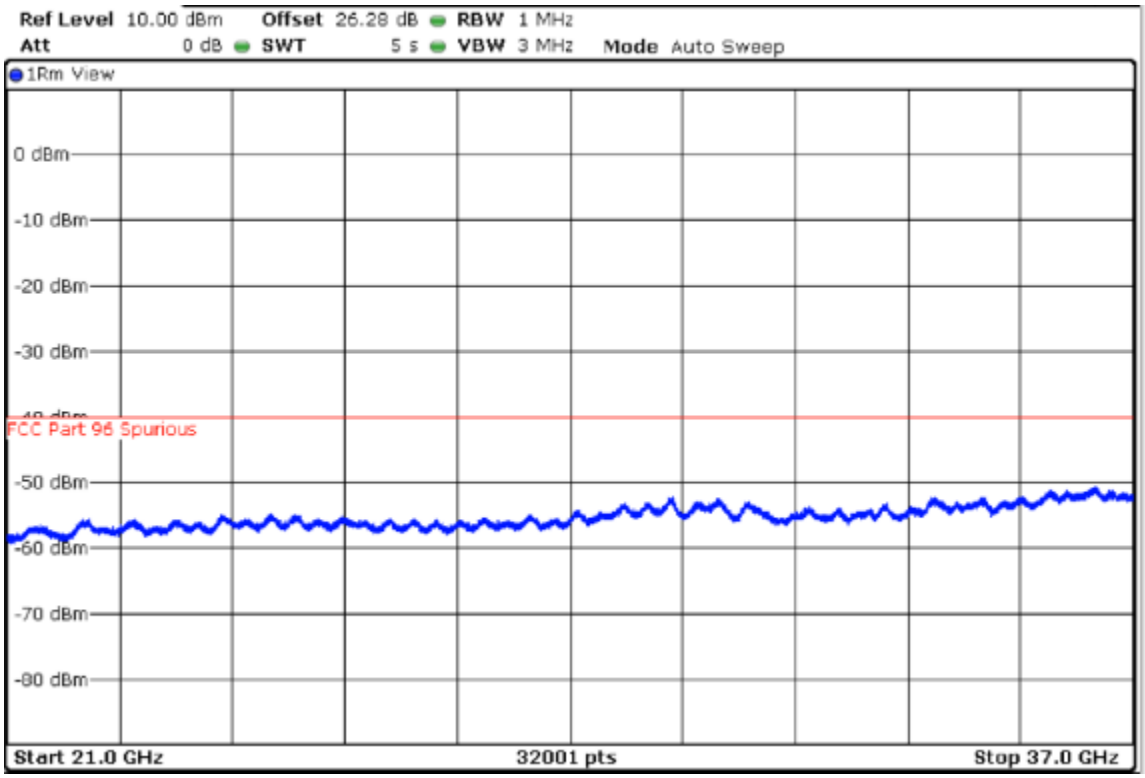
FREQUENCY RANGE 20 MHz-5 GHz



FREQUENCY RANGE 5-21 GHz

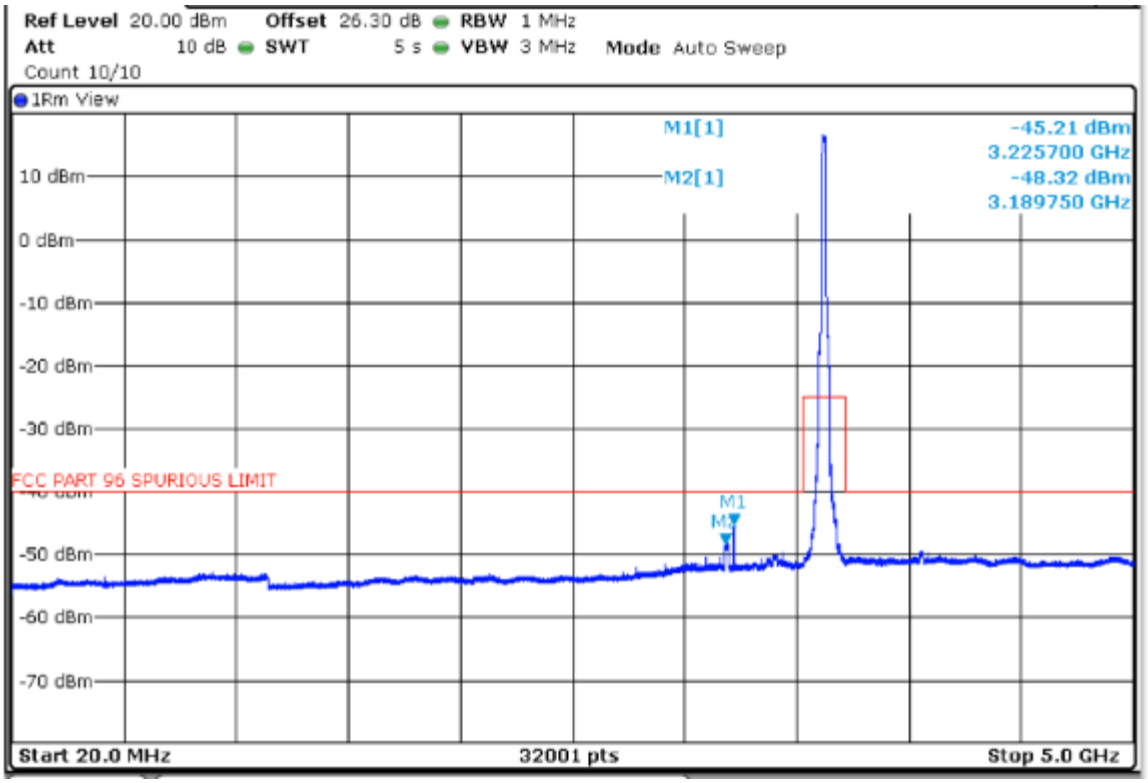


FREQUENCY RANGE 21-37 GHz

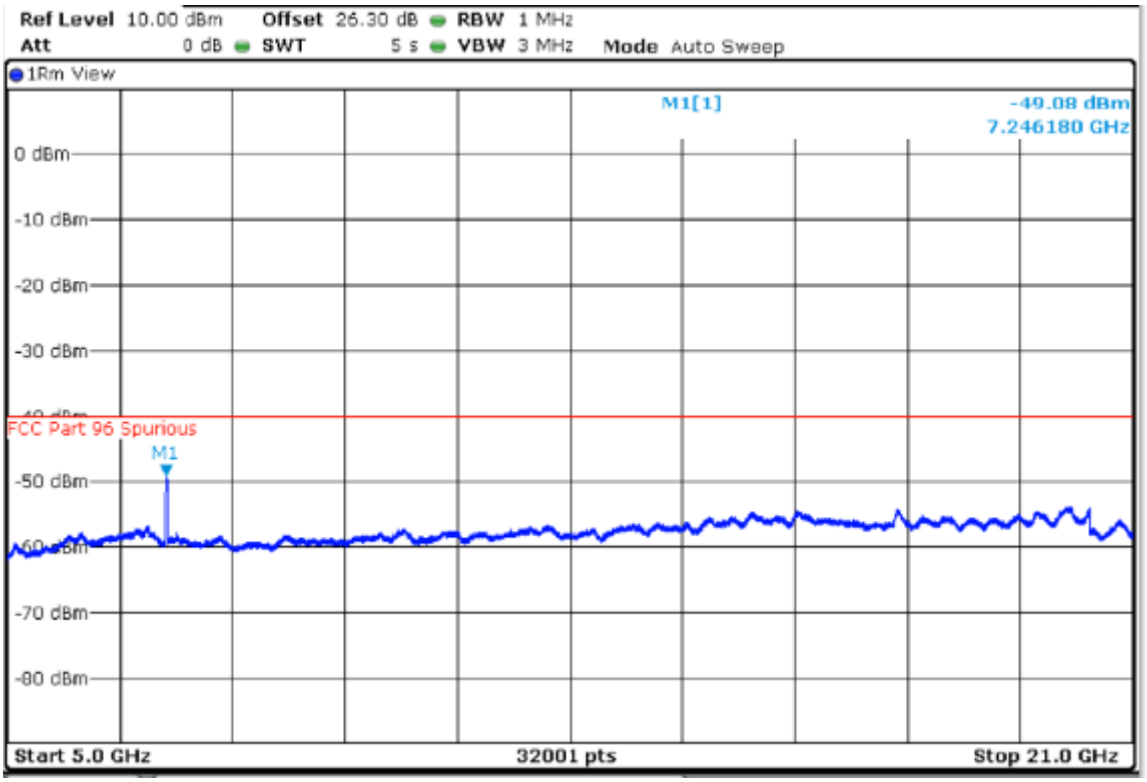


Middle Channel (3625 MHz)

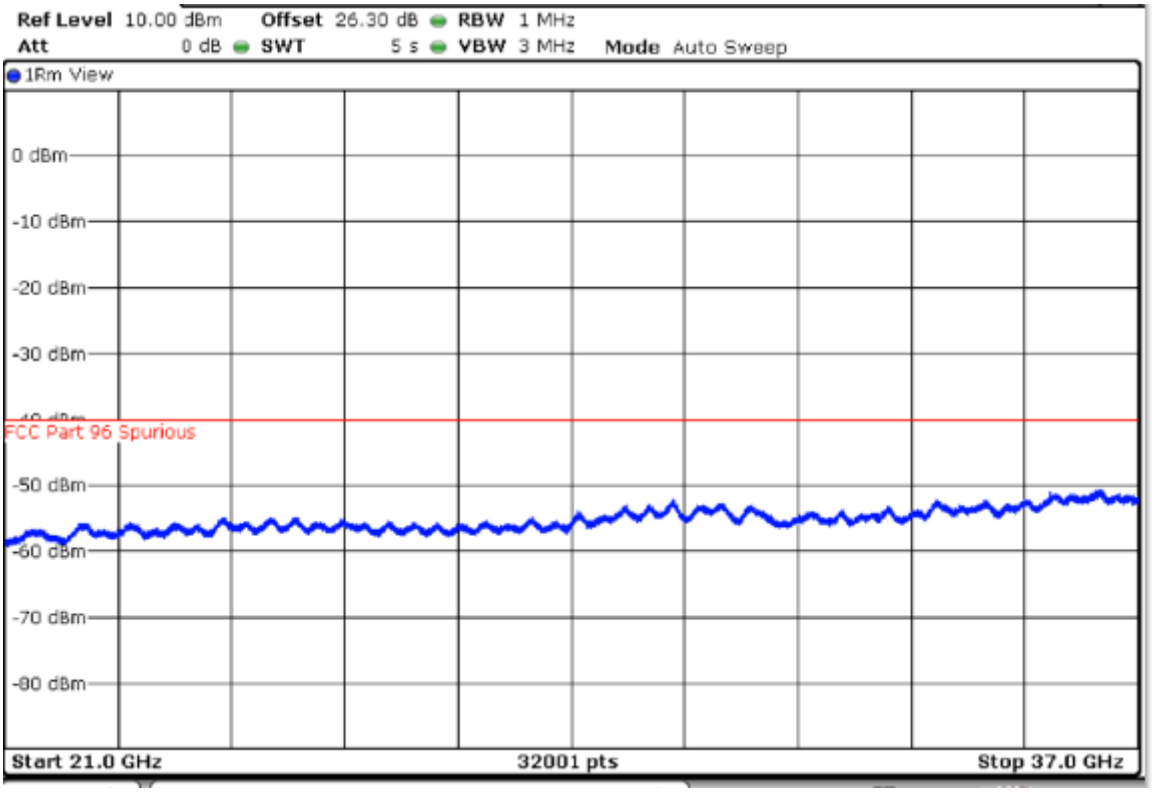
FREQUENCY RANGE 20 MHz-5 GHz



FREQUENCY RANGE 5-21 GHz

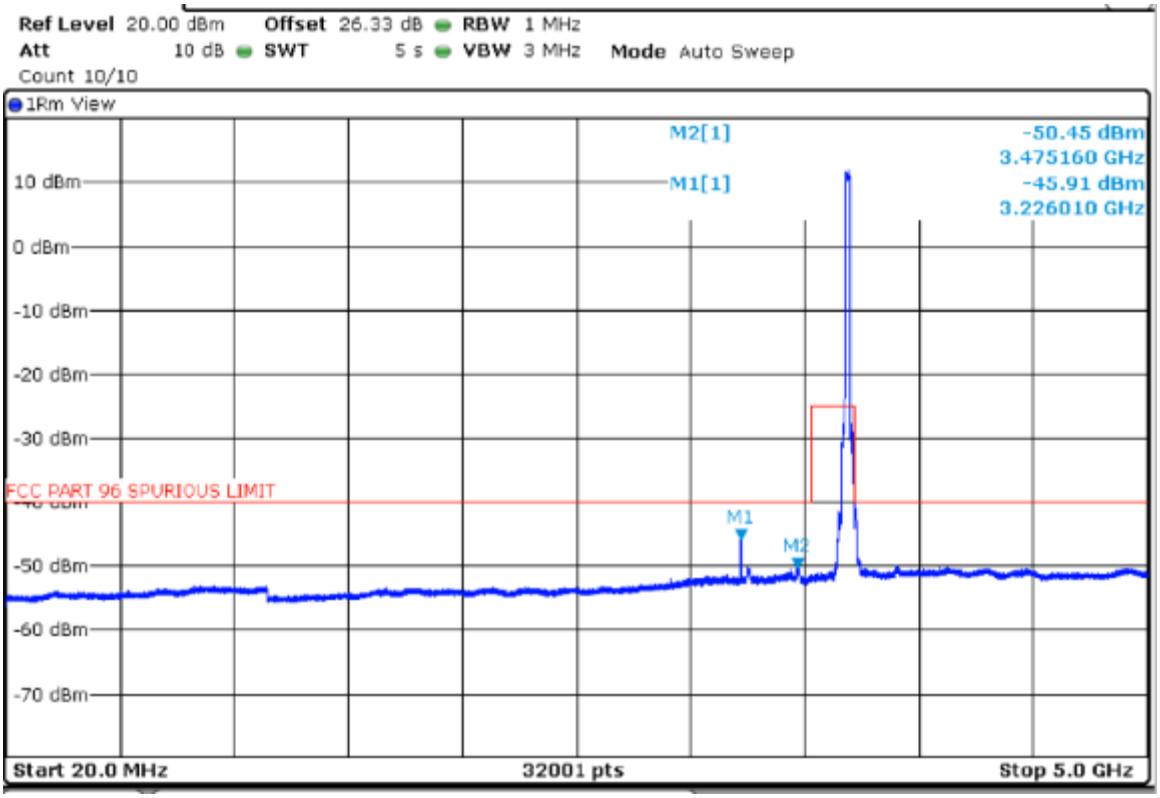


FREQUENCY RANGE 21-37 GHz

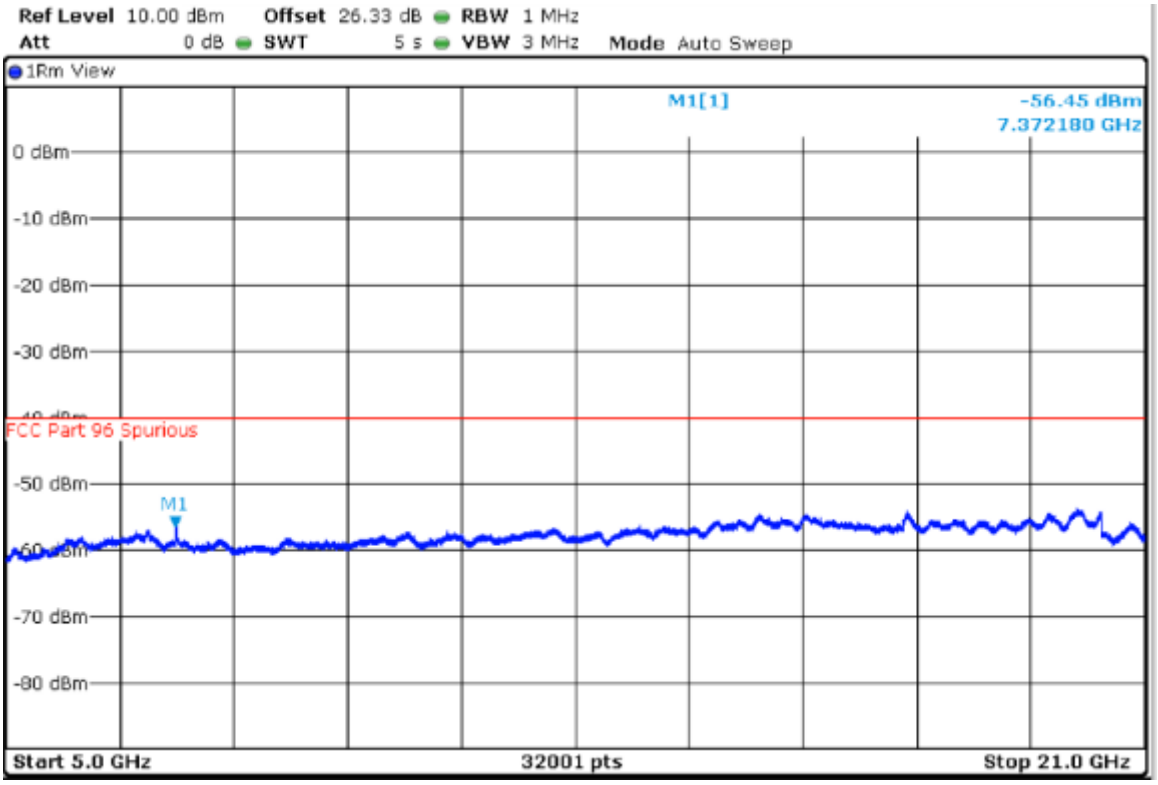


Highest Channel (3690 MHz)

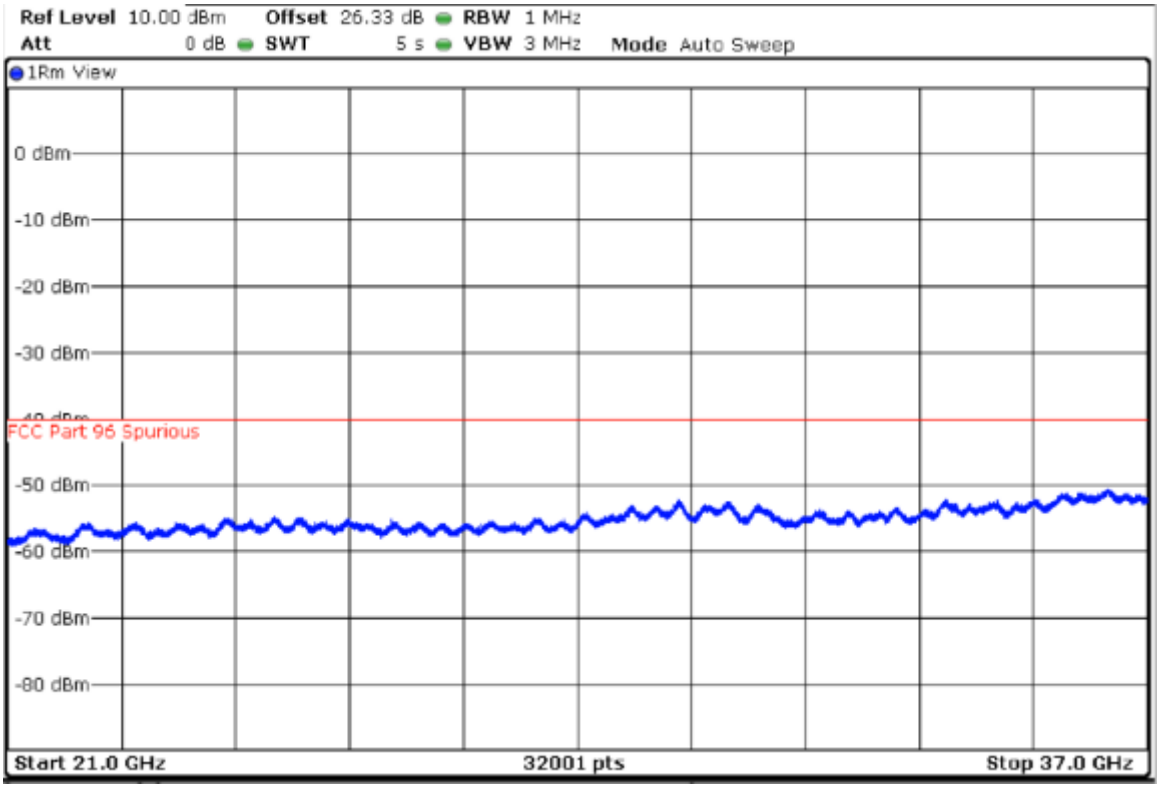
FREQUENCY RANGE 20 MHz-5 GHz



FREQUENCY RANGE 5-21 GHz



FREQUENCY RANGE 21-37 GHz



Section 2.1053. Subclause (e). 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 ≤ 70.2 dBµV/m (-25 dBm/MHz: conducted limit)
- any emission below 3530 MHz and above 3720 MHz ≤ 55.2 dBµV/m (-40 dBm/MHz: conducted limit)

The following measurements were performed at 3-meter distance.

The maximum equivalent isotopically 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 (1/0.4) = 3.98 (dB)

RESULTS

10MHz BW

FREQUENCY RANGE 30 MHz-1000 MHz

Lowest Channel (3555 MHz)

Spurious frequency (MHz)	Polarization	Detector	Emission Level (dBµV/m)	Measurement Uncertainty (dB)
39.506000	V	RMS	46.10	± 4.87
119.143000	V	RMS	39.70	
269.590000	H	RMS	47.35	
525.573000	V	RMS	46.96	
799.986000	H	RMS	39.59	
921.818000	H	RMS	40.27	

Middle Channel (3625 MHz)

Spurious frequency (MHz)	Polarization	Detector	Emission Level (dBµV/m)	Measurement Uncertainty (dB)
39.797000	V	RMS	42.70	± 4.87
119.822000	V	RMS	40.77	
269.687000	H	RMS	46.99	
303.734000	H	RMS	40.07	
525.670000	V	RMS	48.18	
907.947000	H	RMS	40.44	

Highest Channel (3695 MHz)

Spurious frequency (MHz)	Polarization	Detector	Emission Level (dBµV/m)	Measurement Uncertainty (dB)
39.700000	V	RMS	43.61	± 4.87
114.196000	V	RMS	44.03	
269.687000	H	RMS	47.12	
505.203000	V	RMS	47.79	
532.557000	V	RMS	47.98	
887.383000	V	RMS	39.89	

FREQUENCY RANGE 1-18 GHz

Lowest Channel (3555 MHz)

Spurious frequency (MHz)	Polarization	Detector	Emission Level (dBµV/m)	Measurement Uncertainty (dB)
2799.875000	V	RMS	43.09	± 4.87
7110.968750	V	RMS	46.16	
10671.937500	V	RMS	42.95	
14220.156250	V	RMS	38.28	

Middle Channel (3625 MHz)

Spurious frequency (MHz)	Polarization	Detector	Emission Level (dBµV/m)	Measurement Uncertainty (dB)
2399.843750	H	RMS	39.51	± 4.87
2799.875000	H	RMS	43.24	
7250.156250	H	RMS	49.61	
10876.468750	H	RMS	38.90	
14500.125000	H	RMS	39.88	

Highest Channel (3695 MHz)

Spurious frequency (MHz)	Polarization	Detector	Emission Level (dBµV/m)	Measurement Uncertainty (dB)
2399.843750	H	RMS	40.38	± 4.87
2799.875000	H	RMS	40.21	
7391.468750	H	RMS	44.34	
11090.562500	H	RMS	42.55	

FREQUENCY RANGE 18-40 GHz

Lowest Channel (3555 MHz)

Spurious frequency (MHz)	Polarization	Detector	Emission Level (dBµV/m)	Measurement Uncertainty (dB)
21329.562500	V	RMS	39.52	± 4.87

Middle Channel (3625 MHz)

Spurious frequency (MHz)	Polarization	Detector	Emission Level (dBµV/m)	Measurement Uncertainty (dB)
21749.625000	H	RMS	42.51	± 4.87

Highest Channel (3695 MHz)

Spurious frequency (MHz)	Polarization	Detector	Emission Level (dBµV/m)	Measurement Uncertainty (dB)
22169.687500	V	RMS	39.07	± 4.87

20MHz BW

FREQUENCY RANGE 30 MHz-1000 MHz

Lowest Channel (3560 MHz)

Spurious frequency (MHz)	Polarization	Detector	Emission Level (dBµV/m)	Measurement Uncertainty (dB)
39.797000	V	RMS	44.48	± 4.87
113.808000	V	RMS	43.09	
269.590000	H	RMS	47.10	
505.106000	V	RMS	45.52	
539.347000	V	RMS	47.12	
949.172000	H	RMS	40.28	

Middle Channel (3625 MHz)

Spurious frequency (MHz)	Polarization	Detector	Emission Level (dBµV/m)	Measurement Uncertainty (dB)
39.506000	V	RMS	47.10	± 4.87
114.487000	V	RMS	45.75	
269.590000	H	RMS	47.30	
505.203000	V	RMS	48.26	
532.460000	V	RMS	48.36	
948.784000	H	RMS	40.09	

Highest Channel (3690 MHz)

Spurious frequency (MHz)	Polarization	Detector	Emission Level (dBµV/m)	Measurement Uncertainty (dB)
39.118000	V	RMS	43.19	± 4.87
114.196000	V	RMS	44.18	
269.590000	H	RMS	46.94	
498.316000	V	RMS	47.91	
532.557000	V	RMS	47.78	
907.947000	H	RMS	40.24	

FREQUENCY RANGE 1-18 GHz

Lowest Channel (3560 MHz)

Spurious frequency (MHz)	Polarization	Detector	Emission Level (dBµV/m)	Measurement Uncertainty (dB)
2399.843750	H	RMS	40.31	± 4.87
2799.875000	V	RMS	43.05	
7124.781250	H	RMS	41.61	
10690.000000	H	RMS	36.29	
10957.218750	H	RMS	36.21	

Middle Channel (3625 MHz)

Spurious frequency (MHz)	Polarization	Detector	Emission Level (dBµV/m)	Measurement Uncertainty (dB)
2399.843750	H	RMS	40.83	± 4.87
2799.875000	V	RMS	43.19	
7251.218750	H	RMS	47.30	
10884.968750	H	RMS	37.68	
14500.125000	H	RMS	38.11	

Highest Channel (3690 MHz)

Spurious frequency (MHz)	Polarization	Detector	Emission Level (dBµV/m)	Measurement Uncertainty (dB)
2399.843750	H	RMS	40.18	± 4.87
2799.875000	V	RMS	41.36	
7376.062500	H	RMS	39.47	
11095.343750	H	RMS	38.71	
13463.125000	V	RMS	36.27	

FREQUENCY RANGE 18-40 GHz

Lowest Channel (3560 MHz)

Spurious frequency (MHz)	Polarization	Detector	Emission Level (dBµV/m)	Measurement Uncertainty (dB)
21359.812500	V	RMS	39.18	± 4.87

Middle Channel (3625 MHz)

Spurious frequency (MHz)	Polarization	Detector	Emission Level (dBµV/m)	Measurement Uncertainty (dB)
21749.625000	H	RMS	42.51	± 4.87

Highest Channel (3690 MHz)

Spurious frequency (MHz)	Polarization	Detector	Emission Level (dBµV/m)	Measurement Uncertainty (dB)
22169.687500	V	RMS	41.55	± 4.87

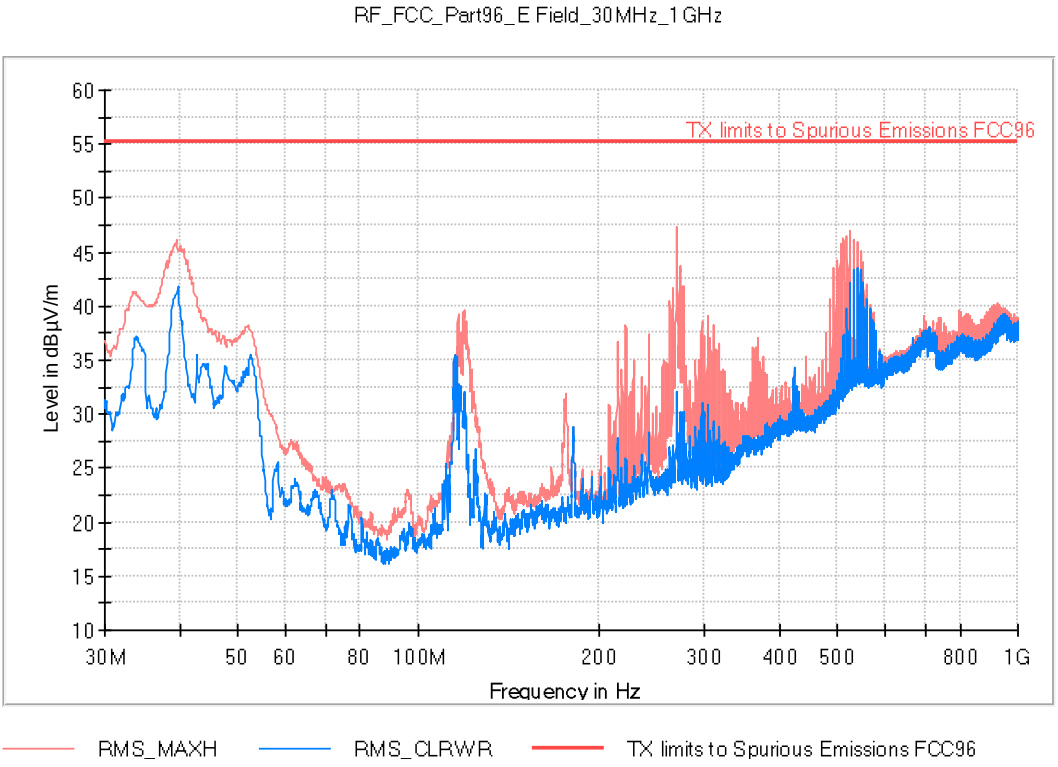
Verdict: PASS

(See the next plots)

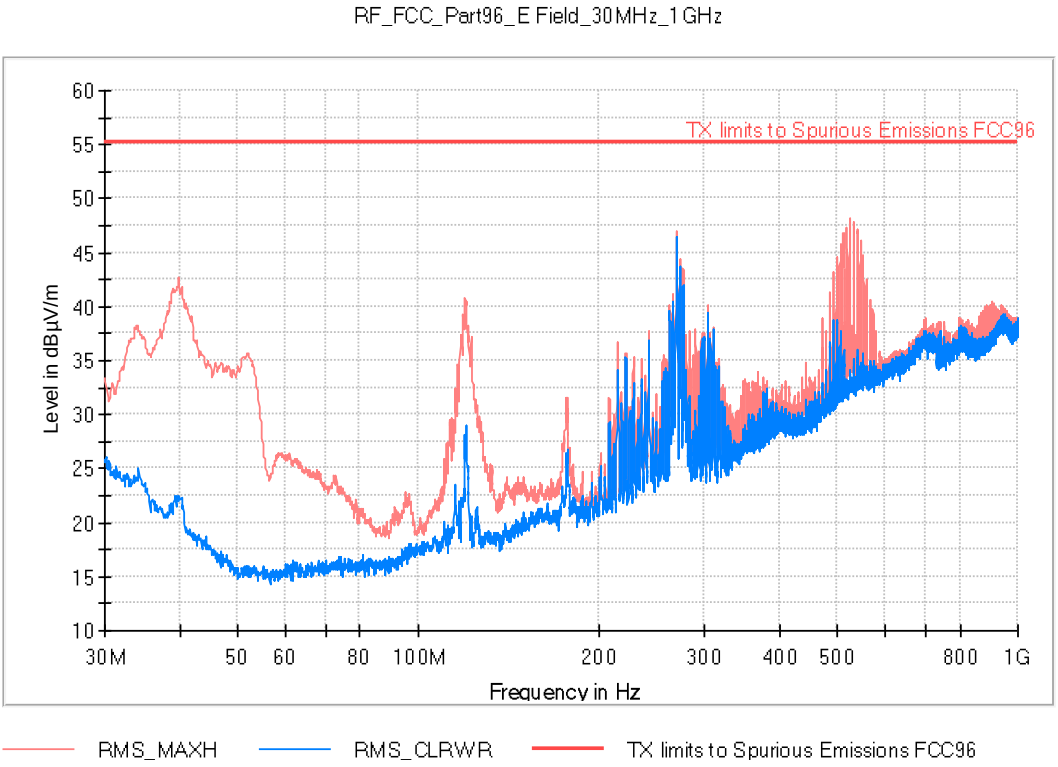
10MHz BW

FREQUENCY RANGE 30 MHz-1000 MHz

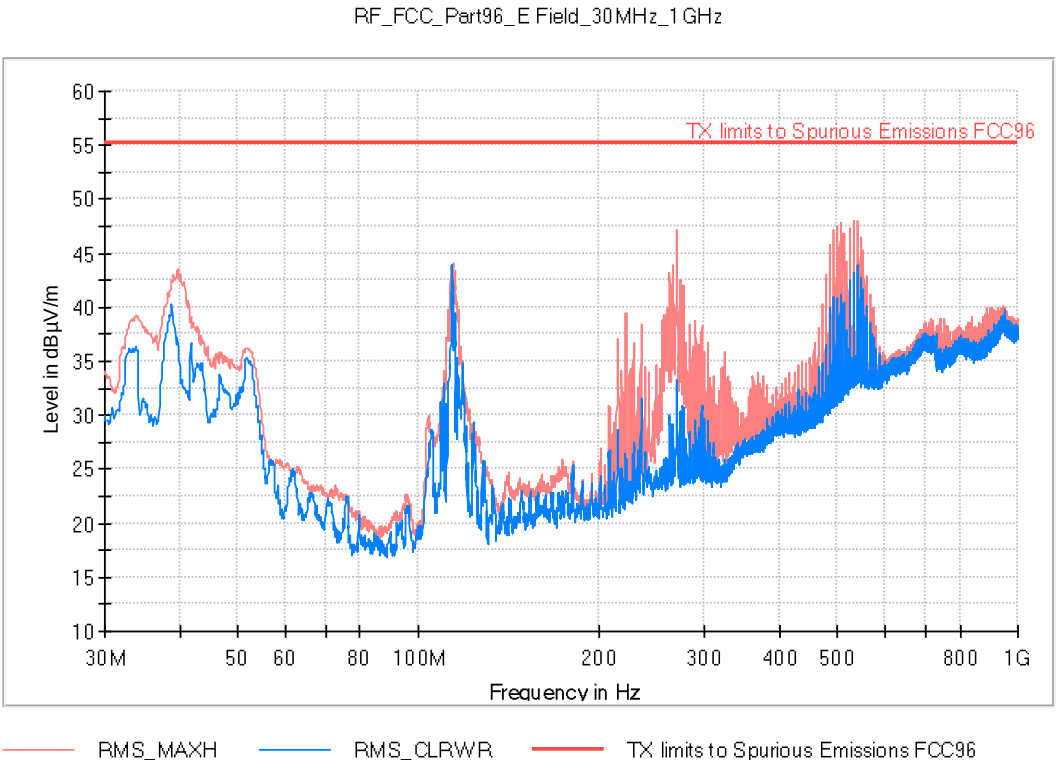
Lowest Channel (3555 MHz)



Middle Channel (3625 MHz)

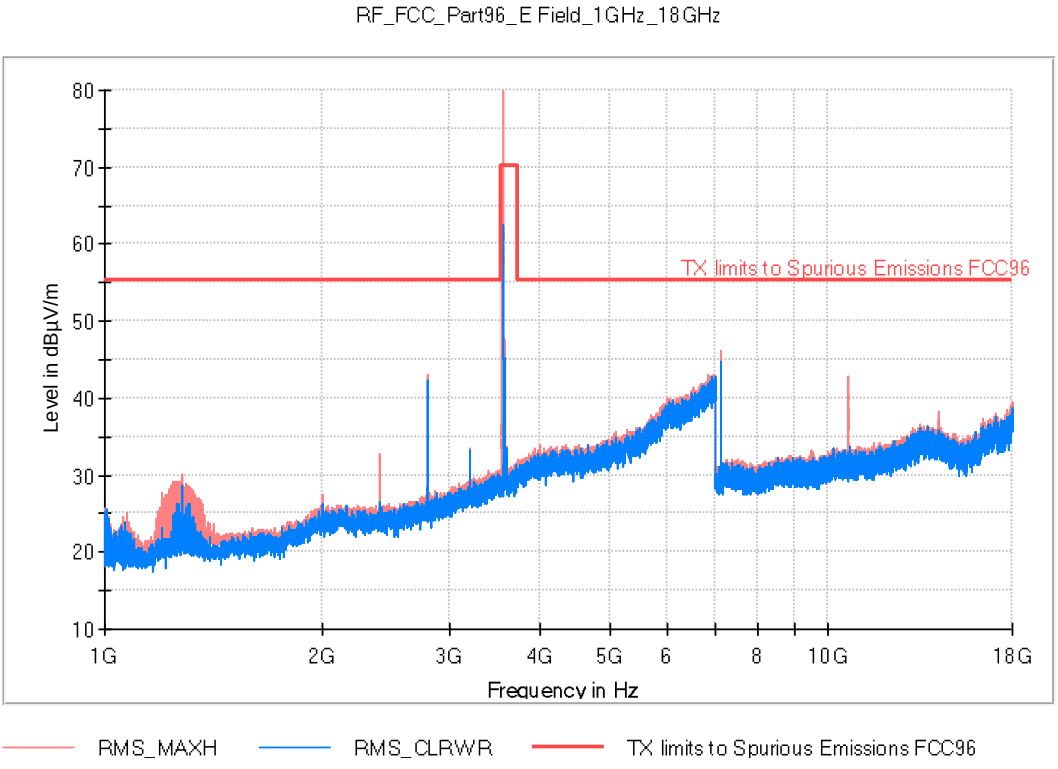


Highest Channel (3695 MHz)

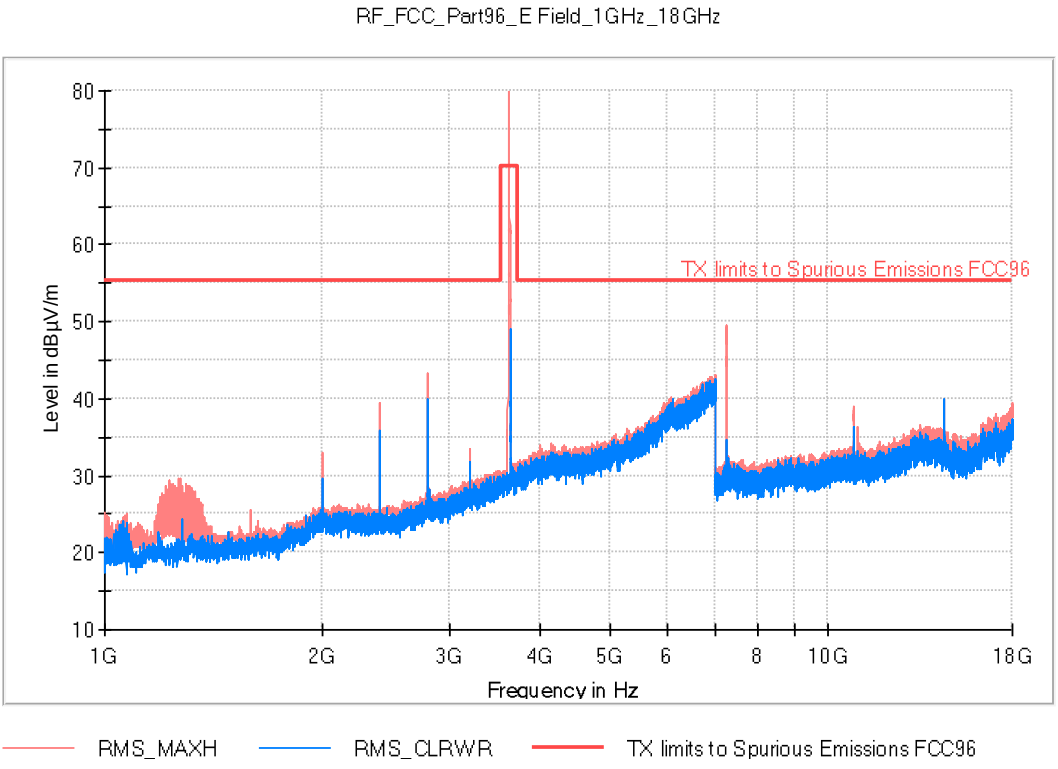


FREQUENCY RANGE 1-18 GHz

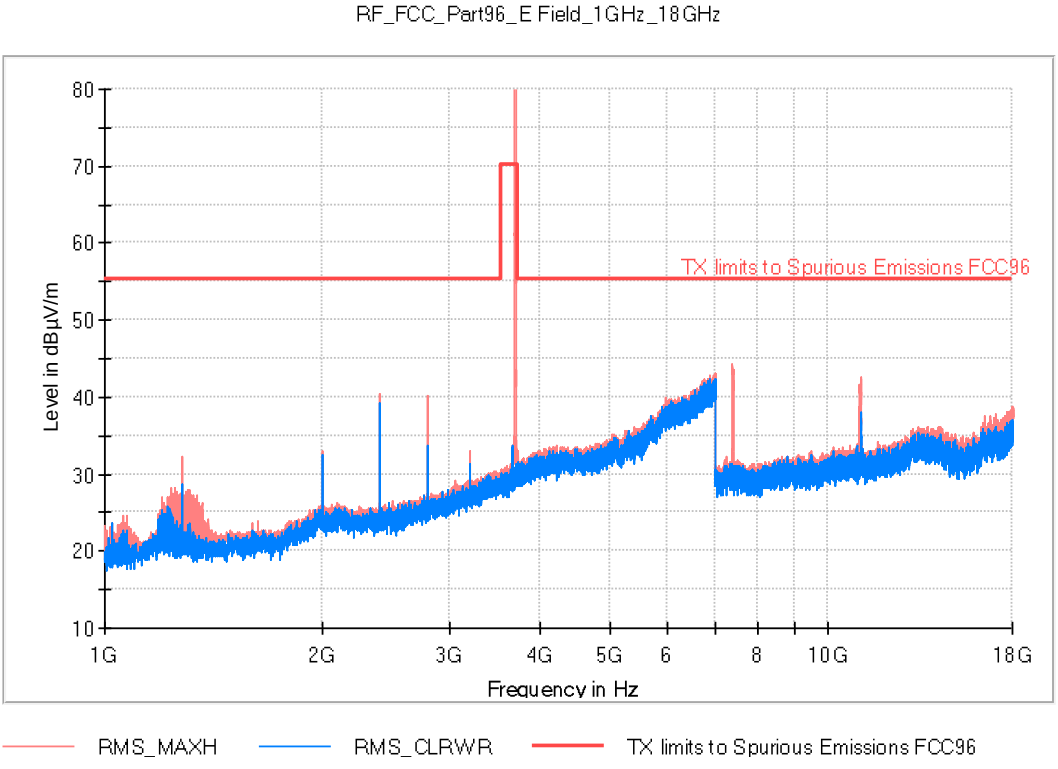
Lowest Channel (3555 MHz)



Middle Channel (3625 MHz)

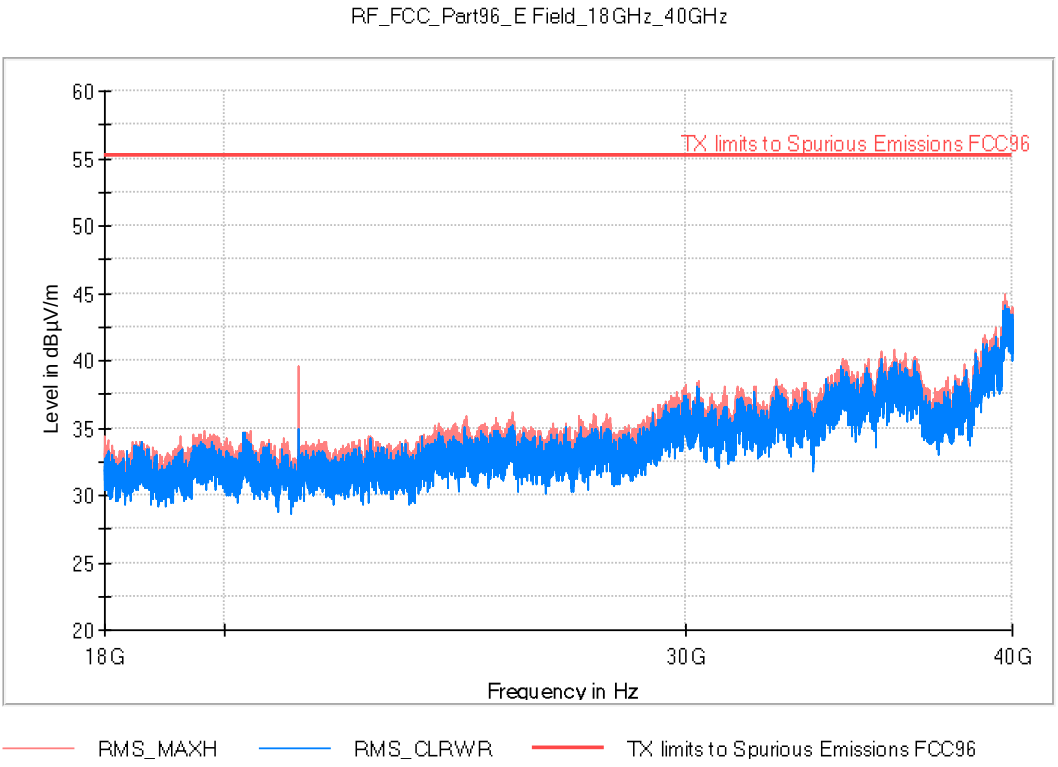


Highest Channel (3695 MHz)

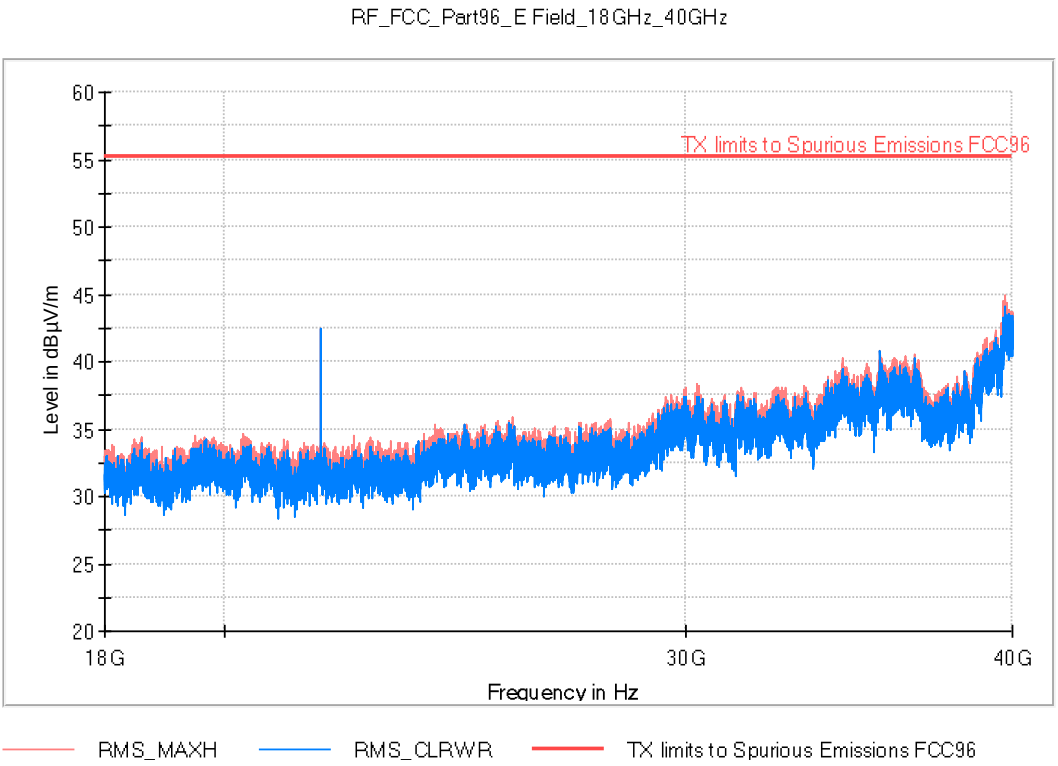


FREQUENCY RANGE 18-40 GHz

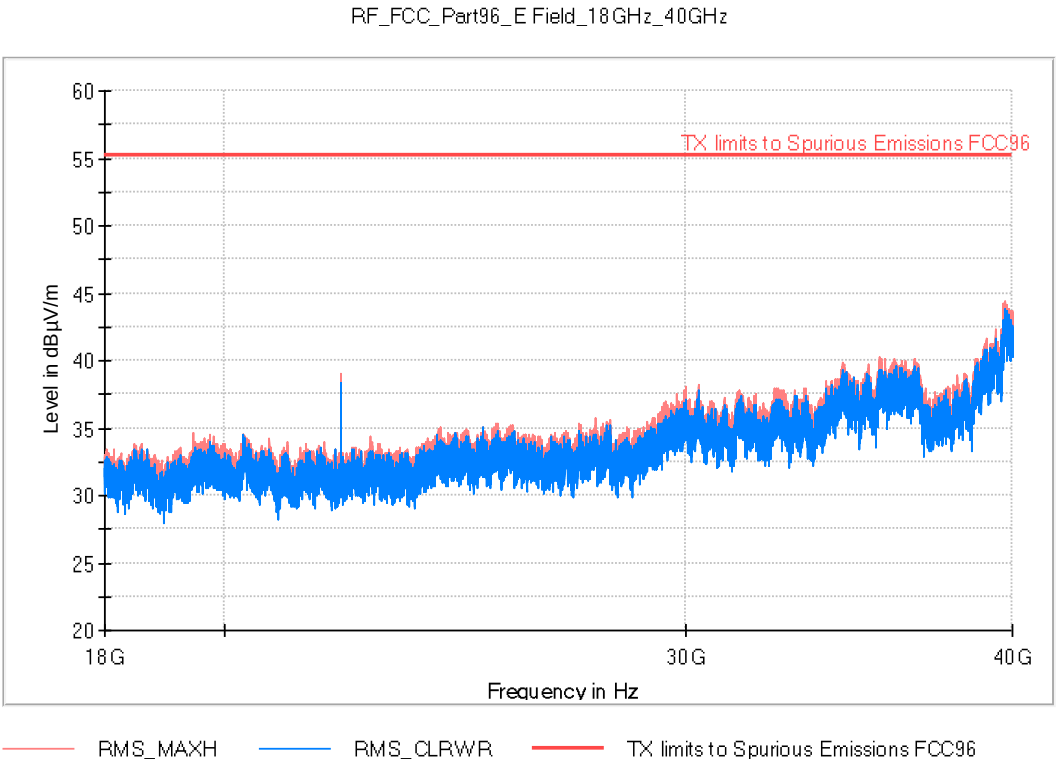
Lowest channel: 3555MHz



Middle Channel (3625 MHz)



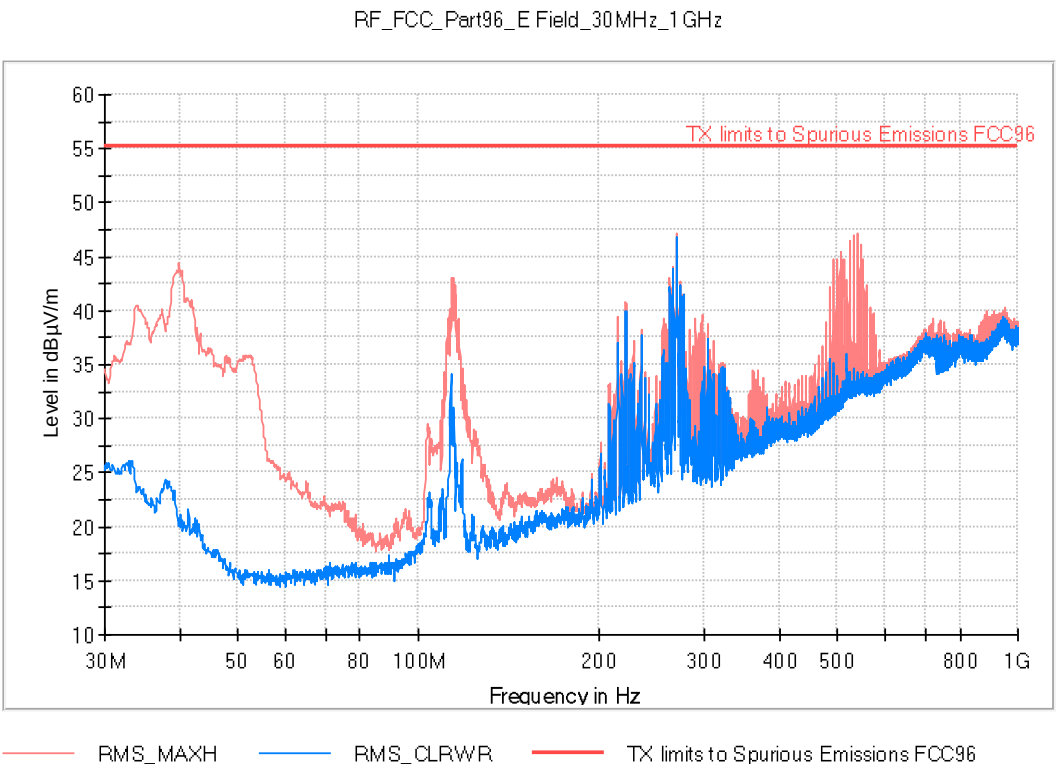
Highest Channel (3695 MHz)



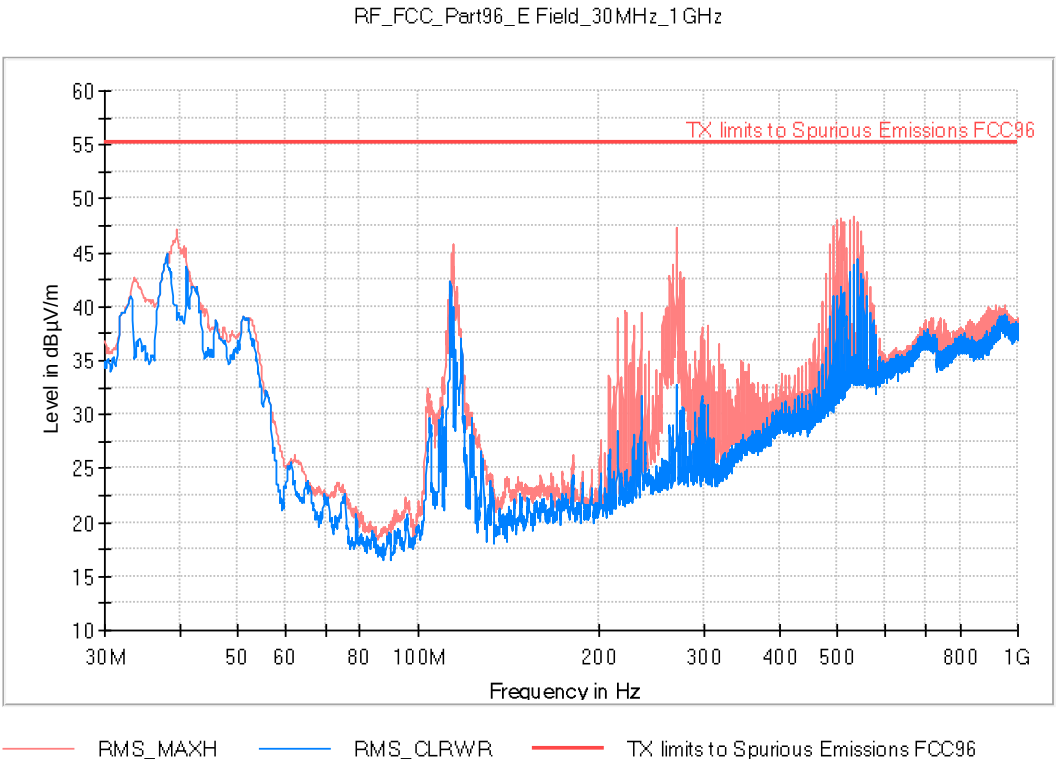
20MHz BW

FREQUENCY RANGE 30 MHz-1 GHz

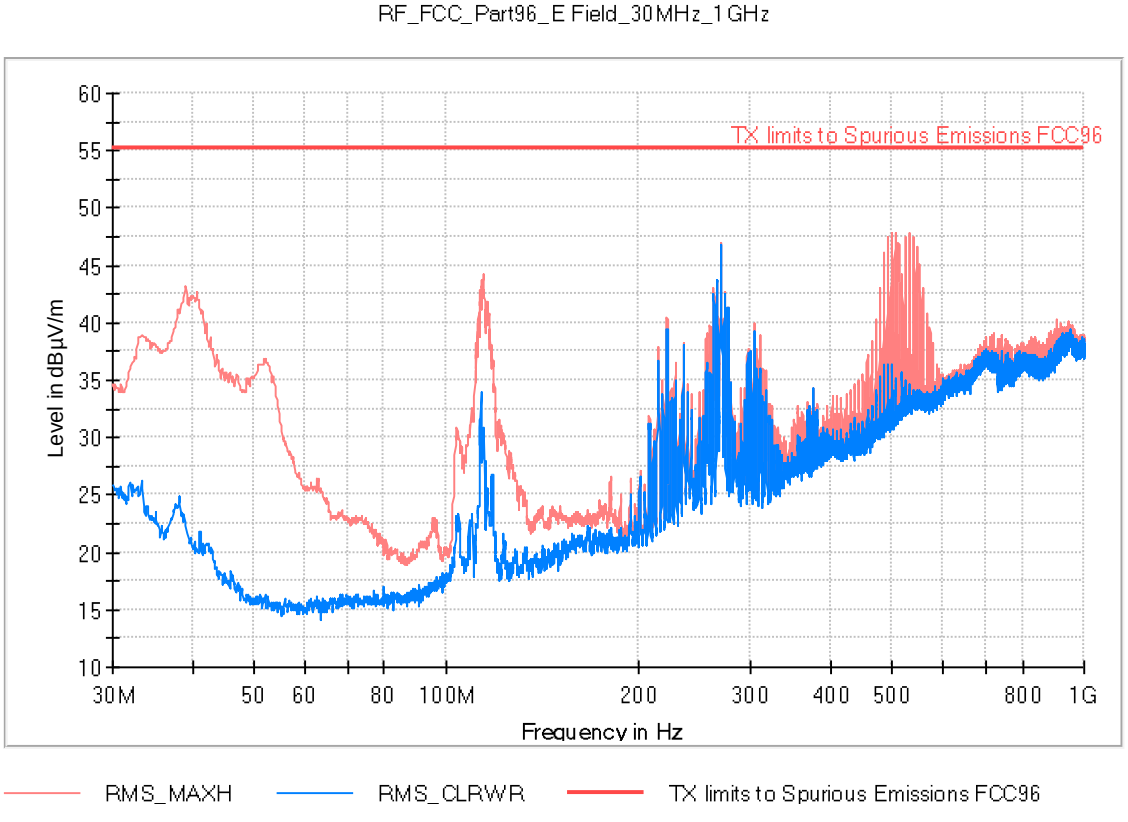
Lowest Channel (3560 MHz)



Middle Channel (3625 MHz)

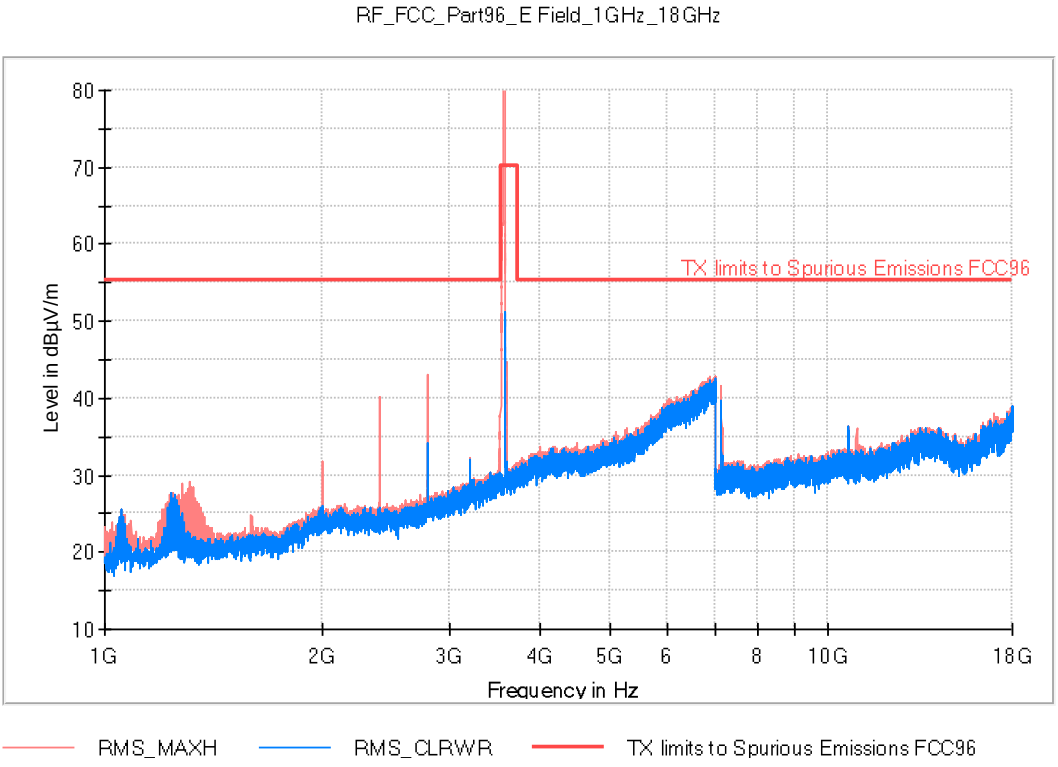


Highest Channel (3690 MHz)

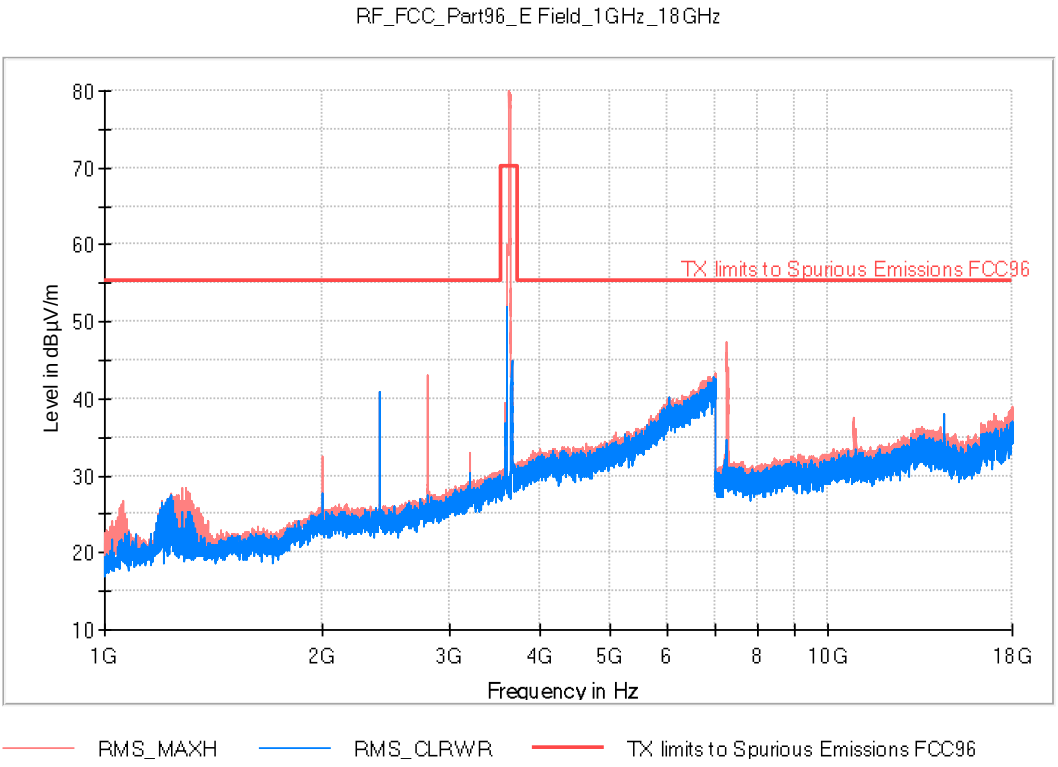


FREQUENCY RANGE 1-18 GHz

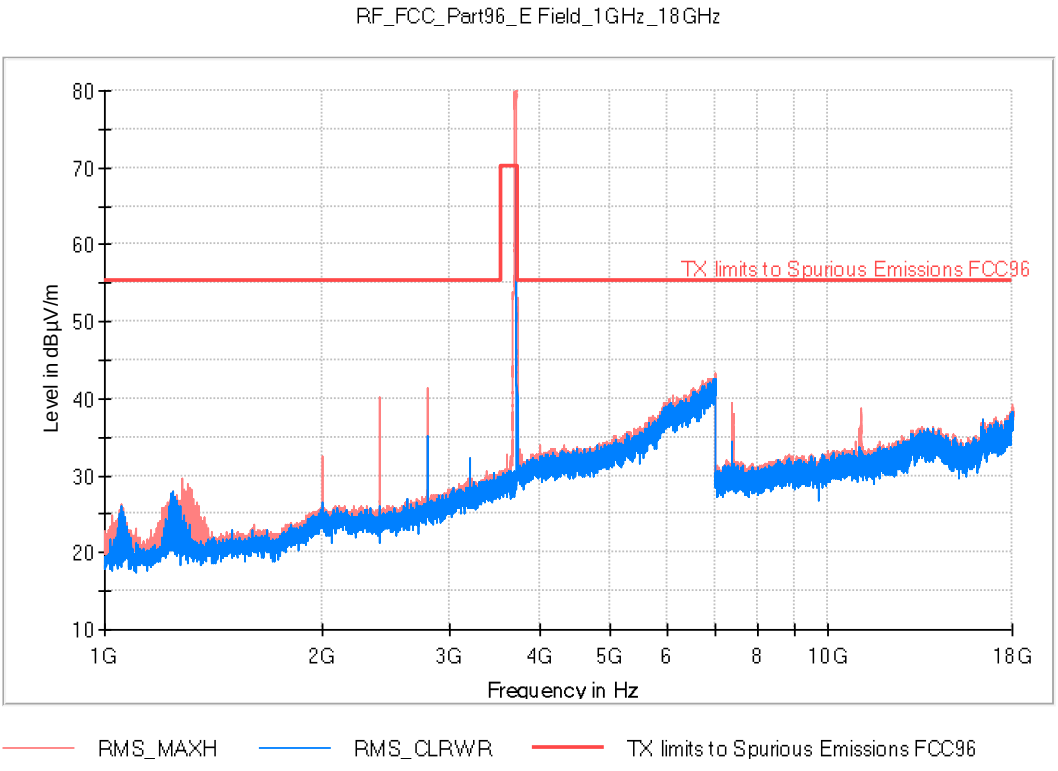
Lowest Channel (3560 MHz)



Middle Channel (3625 MHz)

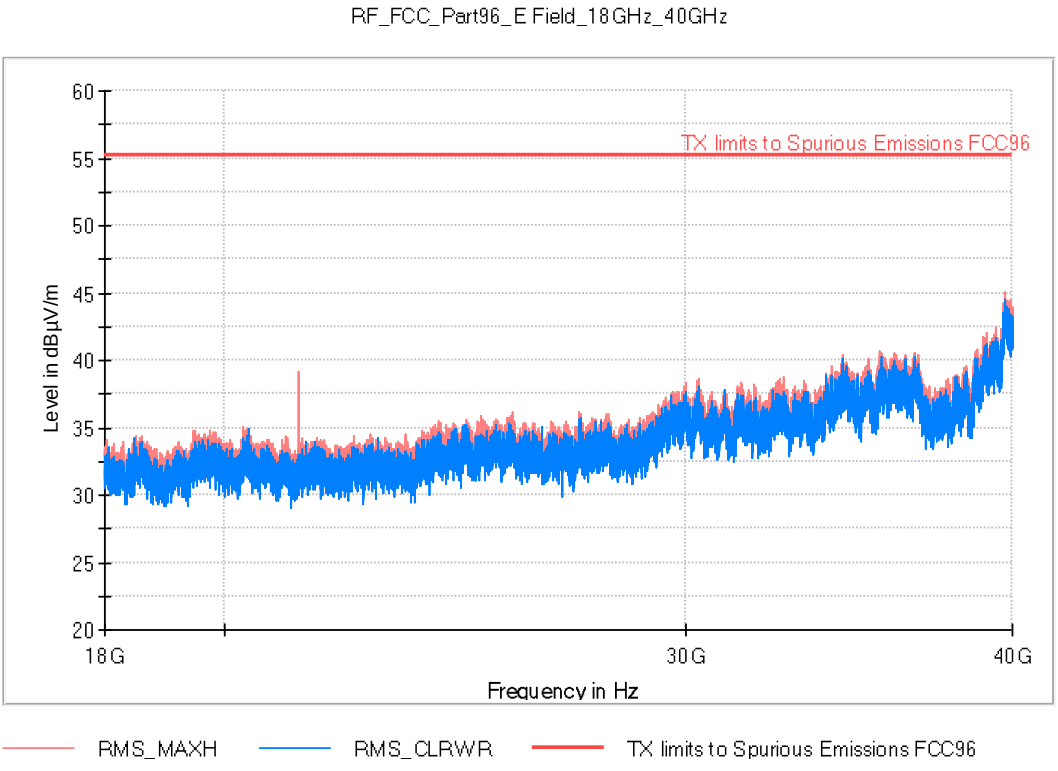


Highest Channel (3690 MHz)

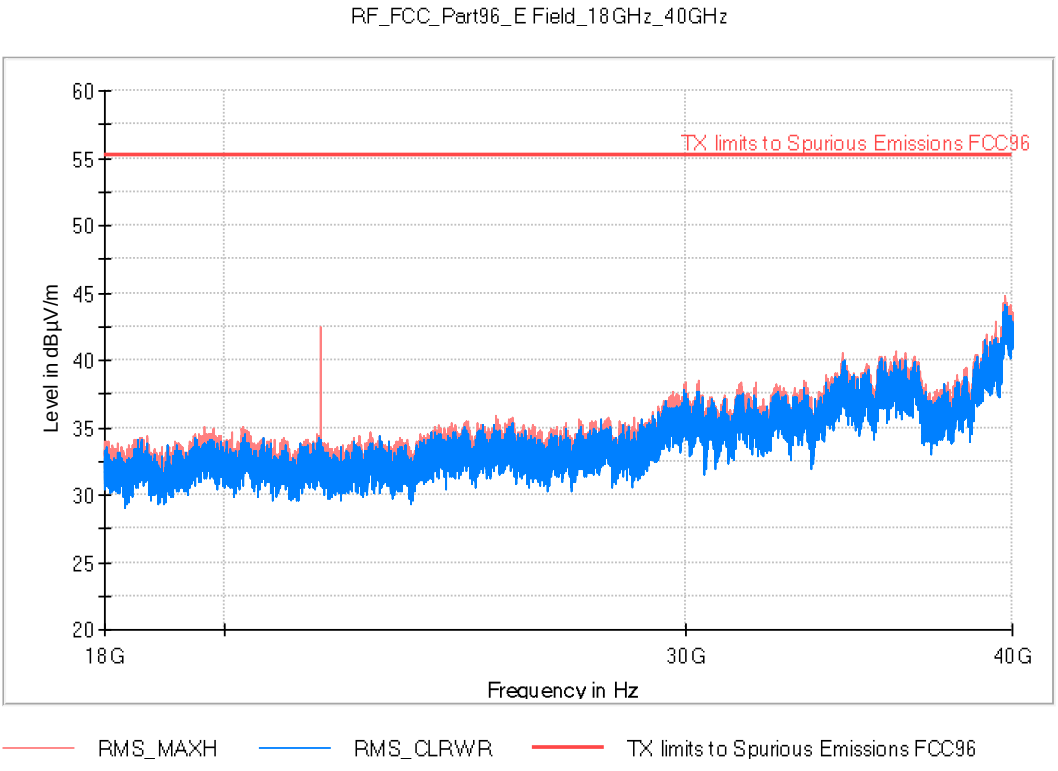


FREQUENCY RANGE 18-40 GHz

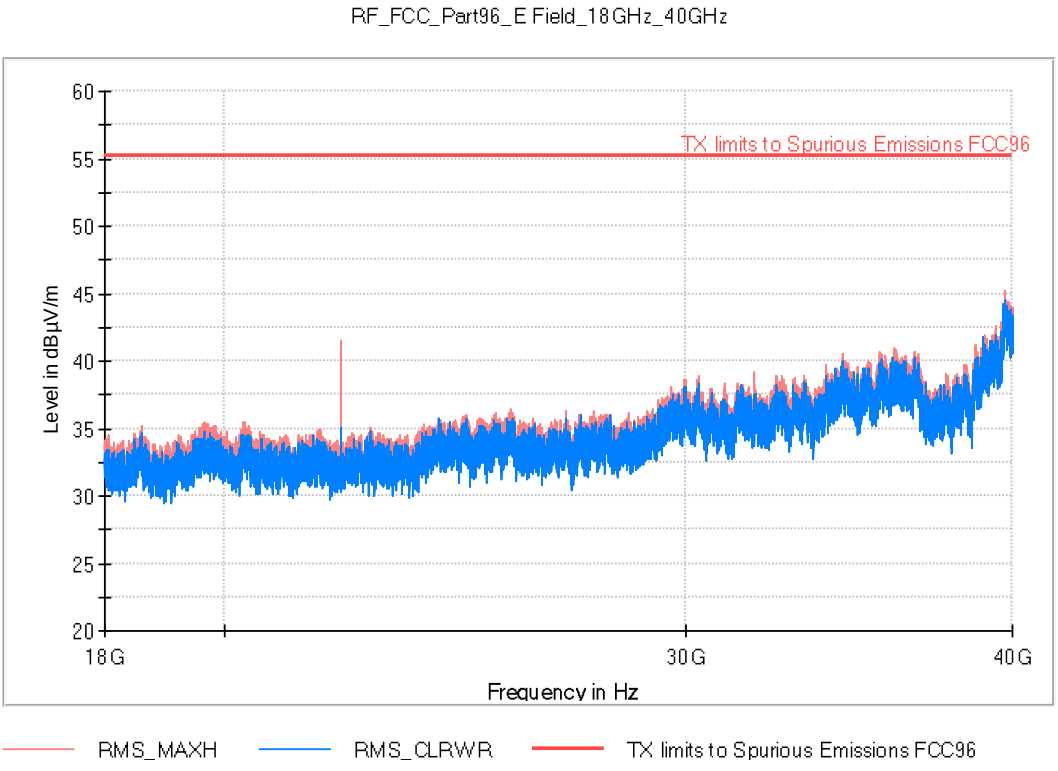
Lowest Channel (3560 MHz)



Middle Channel (3625 MHz)



Highest Channel (3690 MHz)



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	56	3550.580	-0.000591	3559.340	-0.000618	3690.571	-0.000027	3699.399	-0.001622
40	56	3550.581	-0.000563	3559.341	-0.000590	3690.570	-0.000054	3699.390	-0.001865
30	56	3550.581	-0.000563	3559.340	-0.000618	3690.571	-0.000027	3699.399	-0.001622
20	56	3550.601	0.000000	3559.362	0.000000	3690.572	0.000000	3699.459	0.000000
20	47.6	3550.561	-0.001127	3559.442	0.002248	3690.500	-0.001951	3699.330	-0.003487
20	64.4	3550.661	0.001690	3559.402	0.001124	3690.552	-0.000542	3699.700	0.006514
10	56	3550.621	0.000563	3559.442	0.002248	3690.572	0.000000	3699.399	-0.001622
0	56	3550.521	-0.002253	3559.402	0.001124	3690.592	0.000542	3699.419	-0.001081
-10	56	3550.561	-0.001127	3559.382	0.000562	3690.572	0.000000	3699.399	-0.001622
-20	56	3550.581	-0.000563	3559.422	0.001686	3690.492	-0.002168	3699.439	-0.000541
-30	56	3550.561	-0.001127	3559.382	0.000562	3690.572	0.000000	3699.399	-0.001622

Verdict: PASS