TIMCO ENGINEERING, Inc.

An IIA Company

Test Report - FCC Part 87
Applicant: Rockwell Collins Inc.

Approved for Release By:

Signature: Bruno Clavier

Name & Title: Bruno Clavier, General Manager

Date of Signature 1/18/2023

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CUSTOMER INFORMATION

Applicant: Rockwell Collins Inc.
Address: 870 Winter Street,
Waltham, Massachusetts, 02451, United States

1.1 Part 87 Test Result Summary

The following test procedure and guidance were used for measuring FCC PART 87; ANSI C63.26-2015. Full test results are available in this report.

Applicable Clauses from Part 2		
FCC Clauses	Description of the requirements	Result: (Pass, Fail, N/A)
2.1033(c)(4)	Modulation Characteristics	N/A
2.1033(c)(8)	DC Voltages & Current at Final Amplifier	Pass
2.1046(a)	RF Output Power	Pass
2.1047(b)	Modulation Characteristics	N/A
2.1049	Occupied Bandwidth	Pass
2.1051	Spurious Emissions at Antenna Terminals	Pass
2.1053	Field Strength of Spurious Radiation	Pass
2.1055	Frequency Stability	Pass

Applicable Clauses from Part 90		
FCC Clauses	Description of the requirements	Result: (Pass, Fail, N/A)
87.141	Modulation Requirements- Modulation Characteristics	N/A
87.131	Power and Emissions- RF Output Power	Pass
87.135	Occupied Bandwidth	Pass
87.139(a)	Emission Limitations- Field Strength of Spurious Emissions	Pass
87.139(d)	Emission Limitations- Spurious Emissions at Antenna Terminals	Pass
87.133	Frequency Stability	Pass

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2. Location of Testing

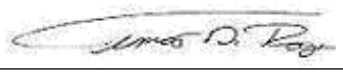
2.1 Test Laboratory

Timco Engineering Inc. is a subsidiary of Industrial Inspection & Analysis, Inc. ("IIA").
Testing was performed at Timco's permanent laboratory located at 849 NW State Road 45, Newberry, Florida 32669

FCC test firm # 578780
FCC Designation # US1070
FCC site registration is under A2LA certificate # 0955.01
ISED Canada test site registration # 2056A
EU Notified Body # 1177
For all designations see A2LA scope # 0955.01

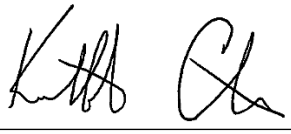
2.1 Testing was performed, reviewed by

Dates of Testing: 8/26/2022 – 9/20/2022

Signature:  Sr. EMC Engineer EMC-003838-NE

Name & Title: Tim Royer, EMC Engineer

Date of Signature 1/18/2023

Signature: 

Name & Title: Kristoffer Costa, EMC Technician

Date of Signature 1/18/2023

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3. Test Sample(s) (EUT/DUT)

The test sample was received: 8/25/2022

3.1 Description of the EUT

A description as well as unambiguous identification of the EUT(s) tested. Where more than one sample is required for technical reasons (such as the use of connected units for the purpose of conducted output power testing where the product units will have integral antennas), each specific test shall identify which unit was tested.

Identification	
FCC ID:	AJK8223586
Brief Description	IRT-4400 SATCOM System
Model(s) #	IRT-4400
Firmware version	072-4895-001C
Software version	810-0687-001M
Serial Number	78Y0L

Technical Characteristics	
Technology	SATCOM System
Frequency Range	1617.775 MHz- 1626.5 MHz
Rated RF O/P Power (Max.)	48.2 dBm Average
Modulation	QPSK, 16-APSK
Bandwidth & Emission Class	G1D, G1E, G1W
Class of station	Aircraft Earth
Number of Channels	196
Duty Cycle	Between 9.2% and 36.9%
Antenna Connector	TNC
Voltage Rating (AC or Batt.)	28 VDC

Antenna Characteristics			
Antenna	Frequency Range	Mode / BW	Antenna Gain
1	n/a	n/a	6 dBic

- Note: Information such as antenna gain, firmware/software numbers are provided by manufacturer and cannot be validated by the test lab.

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3.2 Configuration of EUT

Test Modes		
Mode (#)	Channel	Test Frequencies (MHz)
B1	44	1617.8125
	81	1619.354167
	160	1622.645833
	240	1625.979167
C1	44	1617.8125
	81	1619.354167
	160	1622.645833
	240	1625.979167
C2	45	1617.875
	81	1619.375
	160	1622.625
	240	1625.958333
C8Q	49	1618.1666667
	81	1619.50
	160	1622.50
	240	1625.833333
2C8Q	49	1618.333333
	81	1619.666667
	161	1623.00
	232	1625.666667

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Operating conditions during Testing:

The device was operated without the provided antenna(s).

No other modifications of the device under test (including firmware, specific software settings, and input/output signal levels to the EUT) were made.

Peripherals used during Testing:

A laptop provided by the manufacturer was used to program the EUT.

3.3 Test Setup of EUT

Equipment, antenna, and cable arrangement. The setup of the equipment and cable or wire placement on the test site that produces the highest radiated and the highest ac power line conducted emissions shall be shown clearly and described. Information on the orientation of portable equipment during testing shall be included. Drawings or photographs may be used for this purpose.

Test Setups are included in the test report.

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4. Test methods & Applicable Regulatory Limits

4.1 Test methods/Standards/Guidance:

Test procedures and guidance for measuring Licensed Part 87 Licensed device:

1) ANSI C63.26-2015

4.2 Applied Limits and Regulatory Limits:

1) FCC CFR 47 Part 87

5. Measurement Uncertainty

Parameter	Uncertainty (dB)
Conducted Emissions	± 3.14 dB
Radiated Emissions (9kHz – 30 MHz)	± 3.08 dB
Radiated Emissions (30 – 200 MHz)	± 2.16 dB
Radiated Emissions (200 – 1000 MHz)	± 2.15 dB
Radiated Emissions (1 GHz – 18 GHz)	± 2.14 dB
Radiated Emissions (18 GHz – 40 GHz)	± 2.31 dB
Note: The uncertainties provided in this table represent an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of K=2.	

6. Environmental Conditions

6.1 Temperature & Humidity

Measurements performed at the test site did not exceed the following:

Parameter	Measurement
Temperature	23 C +/- 5%
Humidity	55% +/- 5%
Barometric Pressure	30.05 in Hg
Note: Specific environmental conditions that are applicable to a specific test are available in the test result section.	

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7. List of Test Equipment and Test Facility

The test equipment used identified by type, manufacturer, serial number, or other identification and the date on which the next calibration or service check is due.

Description of the firmware or software used to operate EUT for testing purposes.

A complete list of all test equipment used shall be included with the test report. The manufacturer's model and serial numbers, and date of last calibration, and calibration interval shall be included. Measurement cable loss, measuring instrument bandwidth and detector function, video bandwidth, if appropriate, and antenna factors shall also be included where applicable.

7.1 List of Test Equipment

Test Equipment						
Type	Device	Manufacturer	Model	SN#	Current Cal	Cal Due
Antenna	Double-Ridged Horn/ETS Horn 1	ETS-Lindgren	3117	00035923	2/25/20	2/24/2023
CHAMBER	CHAMBER	Panashield	3M	N/A	3/12/19	12/21/2023
Pre-amp	Pre-amp	RF-LAMBDA	RLNA00M45GA	NA	2/27/19	7/26/2025
Receiver	EMI Test Receiver R&S ESU 40	Rohde & Schwarz	ESU 40	100320	5/27/21	5/26/2024
Receiver	EMI Test Receiver R&S ESW44	Rohde & Schwarz	ESW44	103049	10/13/21	10/12/2024
Function Generator	Function Generator	Standford	DS340	25200	1/13/21	1/13/2024
Signal Generator	Signal Generator HP 8648C	HP	8648C	35537A01679	3/29/19	8/03/2025
Thermometer	Type K J Thermometer	Martel	303	080504494	1/18/20	1/17/2023

Software			
Software	Author	Version	Validation on
ESU Firmware	Rohde & Schwarz	4.43 SP3; BIOS v5.1-24-3	2018
RSCommander	Rohde & Schwarz	1.6.4	2014
ScopeExplorer	LeCroy	v2.25.0.0	2009
Field Strength	Timco	v4.10.7.0	2016

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8. Test Results

The results of the test are usually indicated in the form of tables, spectrum analyzer plots, charts, sample calculations, as appropriate for each test procedure.

A description and/or a block diagram of the test setup is usually provided.

The measurement results, along with the appropriate limits for comparison, may be presented in tabular or graphical form. In addition, any variation in the measurement environment may be reported if applicable (e.g., a significant change of temperature that could affect the cable loss and amplifier response).

Unless noted otherwise in the referenced standard, the measurements of **ac power-line conducted emissions and conducted power output** will be reported in units of dBµV. Unless noted otherwise in the referenced standard, the measurements of **radiated emissions** will be reported in units of decibels, referenced to one microvolt per meter (dBµV/m) for electric fields, or to one ampere per meter (dBA/m) for magnetic fields, at the distance specified in the appropriate standards or requirements. The measurements of antenna-conducted power for receivers may be reported in units of dBµV if the impedance of the measuring instrument is also reported. Otherwise, antenna-conducted power will be reported in units of decibels referenced to one milliwatt (dBm). All formulas for data conversions and conversion factors, if used, will be included in this measurement report.

Example:

Freq (MHz)	Meter Reading	+ ACF	+CL	= FS
33	20 dBµV	+ 10.36 dB/m	+0.40 dB	=30.36 dBµV/m @ 3m

EIRP = Pcond (dBm) + dBi

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8.1 Power at the Final Amplifier

Limits from FCC Part 2.1033 (c)(8). No method of measurement is specified.

Test Results		
EUT Operating Voltage (V)	EUT Current (A)	Power at the Final Amplifier (W)
28	1.48	41.44

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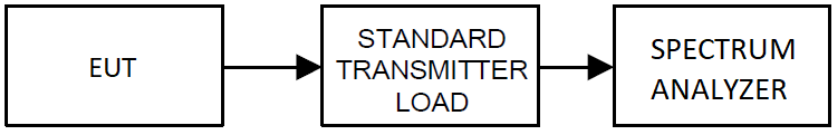
8.2 RF Output Power

Limits from FCC Parts 2.1046(a), and 87.131; and test procedure from ANSI C63.26-2015.

Test Setup


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8.2.1 RF Power Output Table

	Test Modes				
Mode (#)	Channel	Tuned Frequency (MHz)	Average Power Output (dBm)	Duty Cycle	Peak Power Output (W)
B1	44	1617.8125	37.15	36%	14.42
	81	1619.354167	37.33	36%	15.03
	160	1622.645833	37.44	36%	15.42
	240	1625.979167	37.82	36%	16.83
C1	44	1617.8125	38.75	36%	20.84
	81	1619.354167	38.85	36%	21.33
	160	1622.645833	38.83	36%	21.23
	240	1625.979167	39.02	36%	22.18
C2	45	1617.875	37.71	36%	16.41
	81	1619.375	38.01	36%	17.58
	160	1622.625	38.08	36%	17.86
	240	1625.958333	38.21	36%	18.41
C8Q	49	1618.166667	43.59	36%	63.53
	81	1619.50	43.79	36%	66.53
	160	1622.50	44.05	36%	70.63
	240	1625.833333	44.08	36%	71.12
2C8Q	49	1618.333333	47.59	36%	159.59
	81	1619.666667	47.73	36%	164.82
	161	1623.00	47.69	36%	163.31
	232	1625.666667	47.74	36%	165.20

*Power output (W) adjusted using Duty cycle correction

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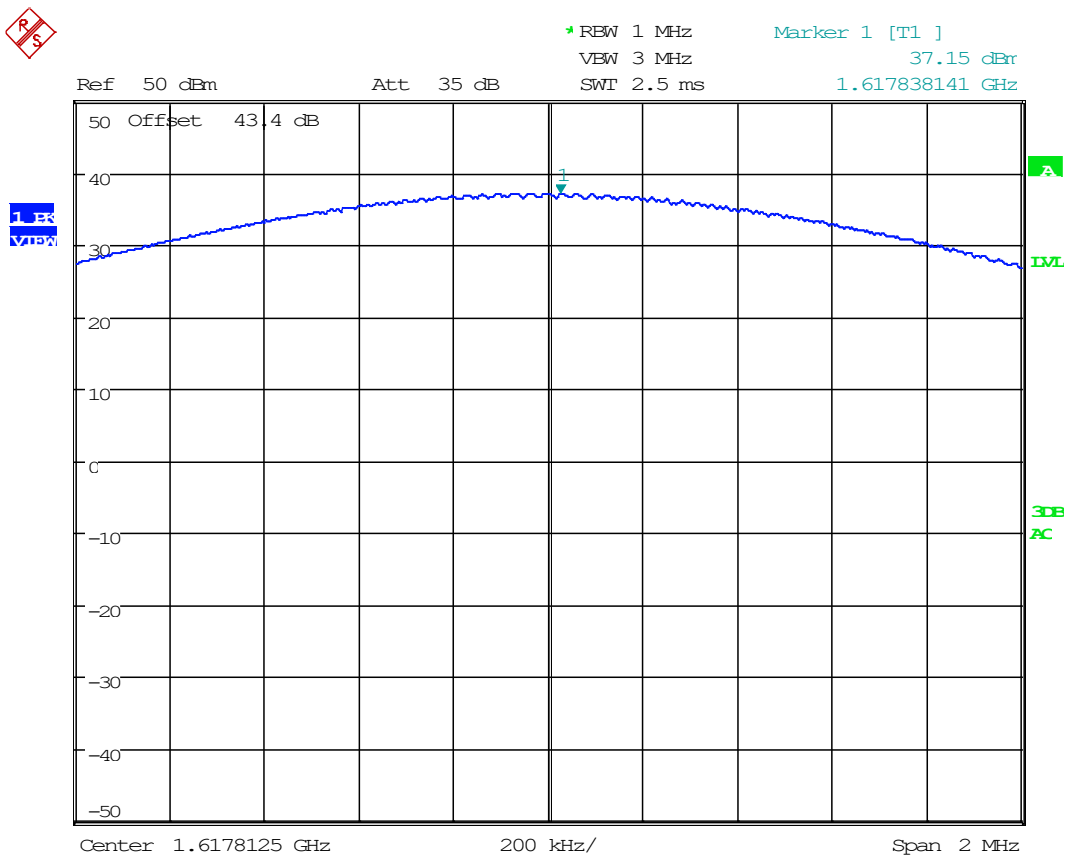
8.2.2 B1, Ch 44, RF Power Output Plot, 1617.8125 MHz



Date: 19.SEP.2022 15:43:05

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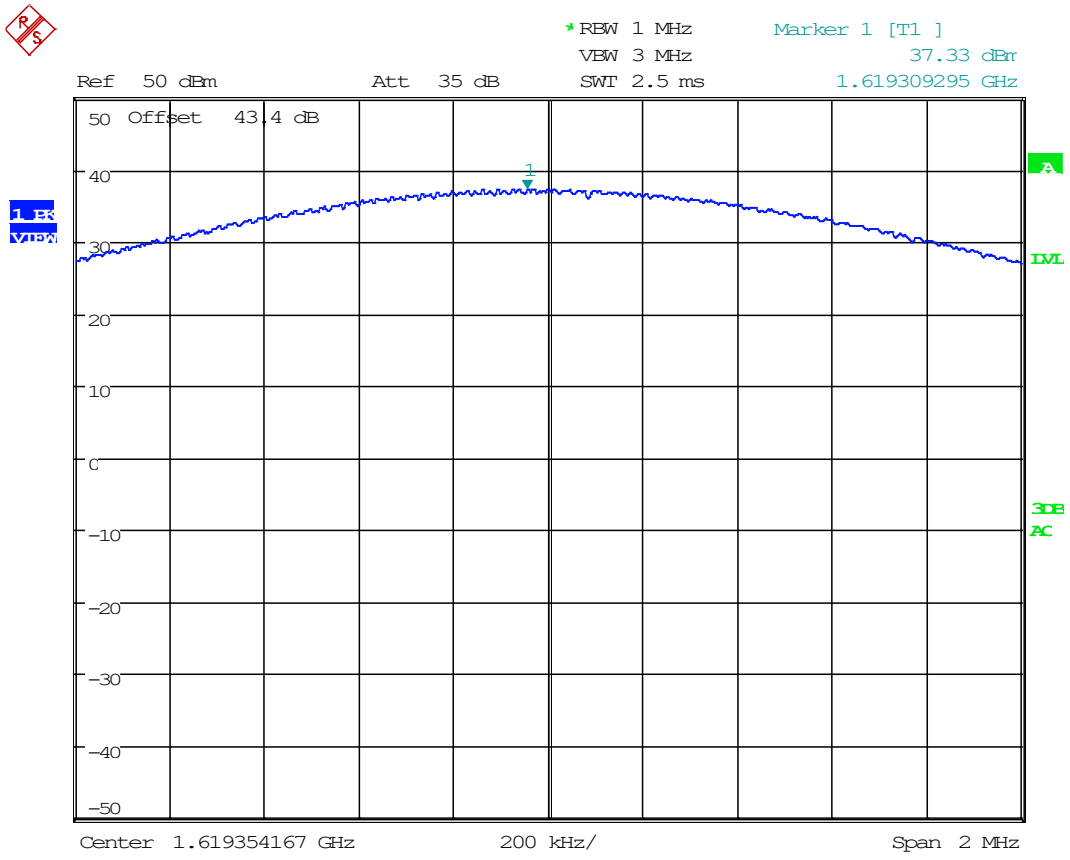
8.2.3 B1, Ch 81, RF Power Output Plot, 1619.354167 MHz



Date: 19.SEP.2022 15:08:05

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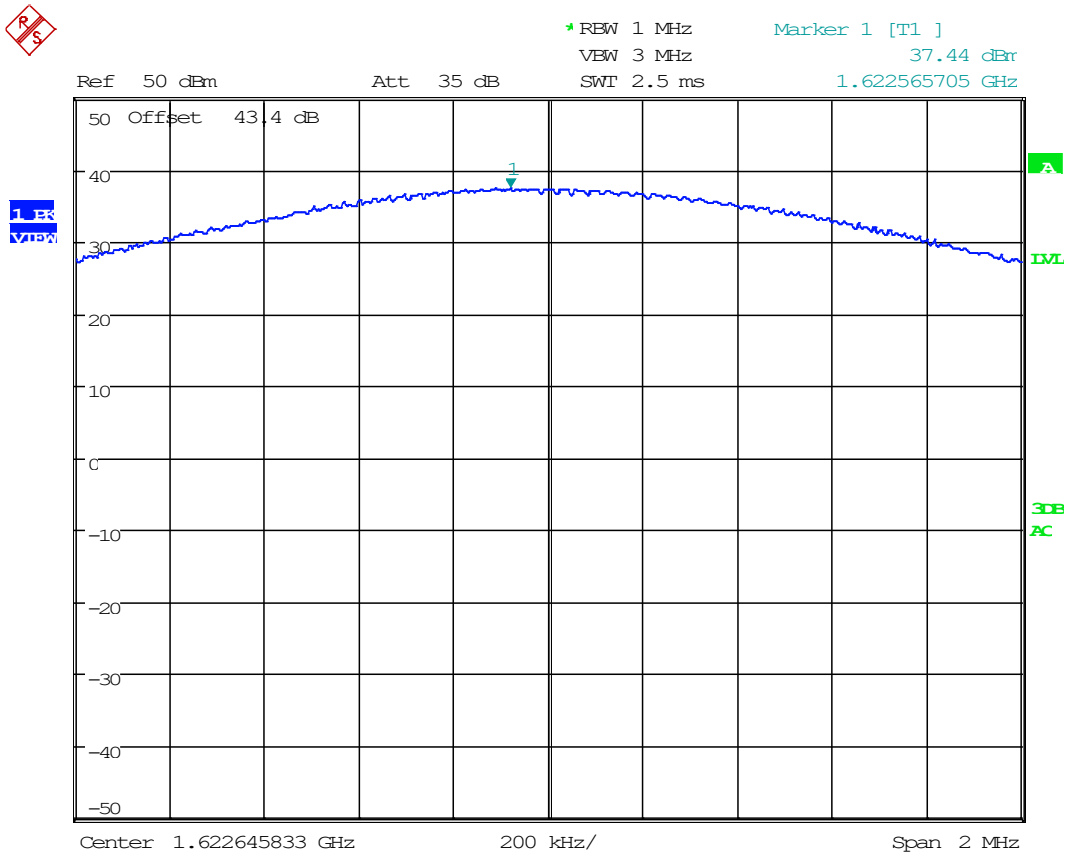
8.2.4 B1, Ch 160, RF Power Output Plot, 1622.645833 MHz



Date: 19.SEP.2022 15:09:55

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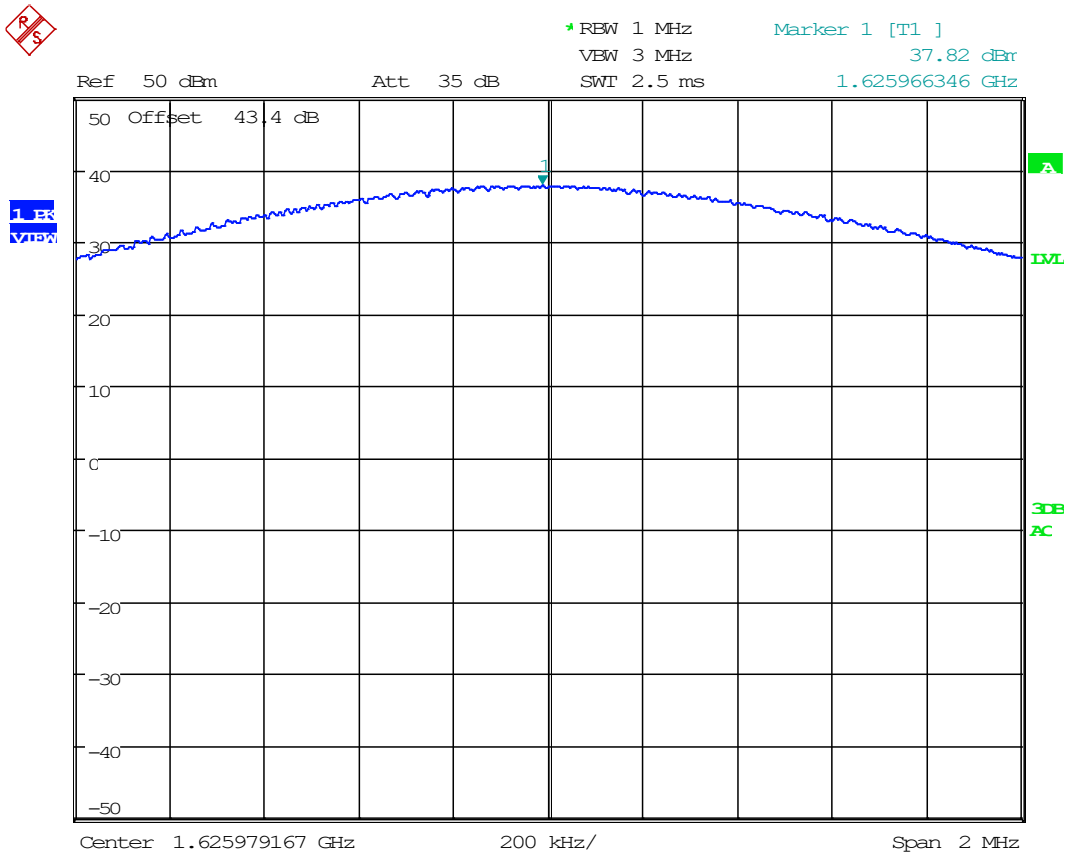
8.2.5 B1, Ch 240, RF Power Output Plot, 1625.979167 MHz



Date: 19.SEP.2022 15:12:00

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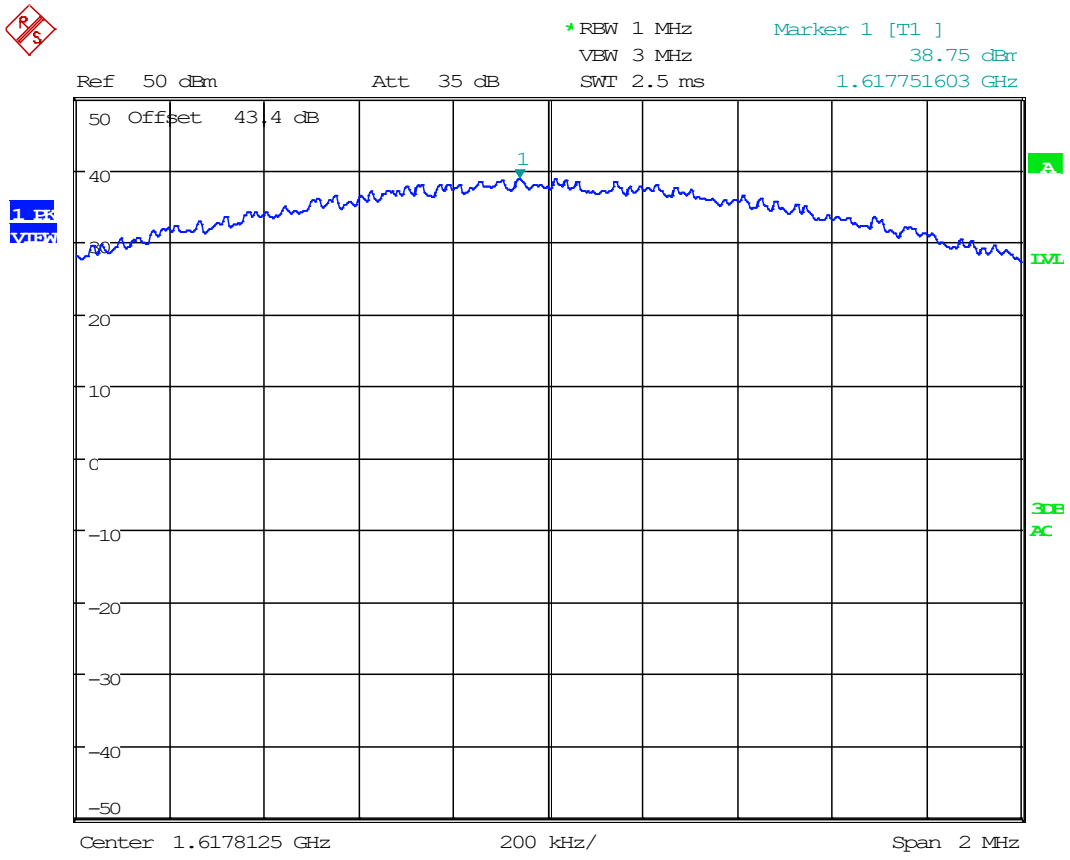
8.2.6 C1, Ch 44, RF Power Output Plot, 1617.8125 MHz



Date: 19.SEP.2022 15:44:28

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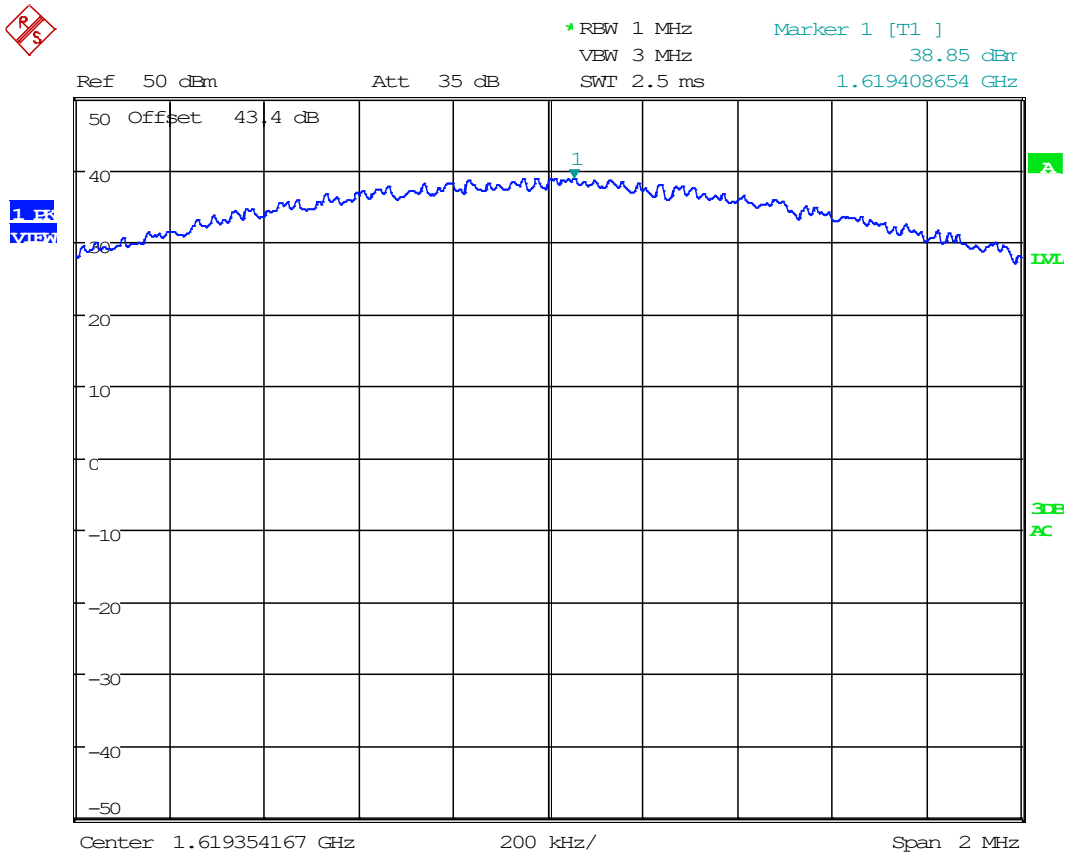
8.2.7 C1, Ch 81, RF Power Output Plot, 1619.354167 MHz



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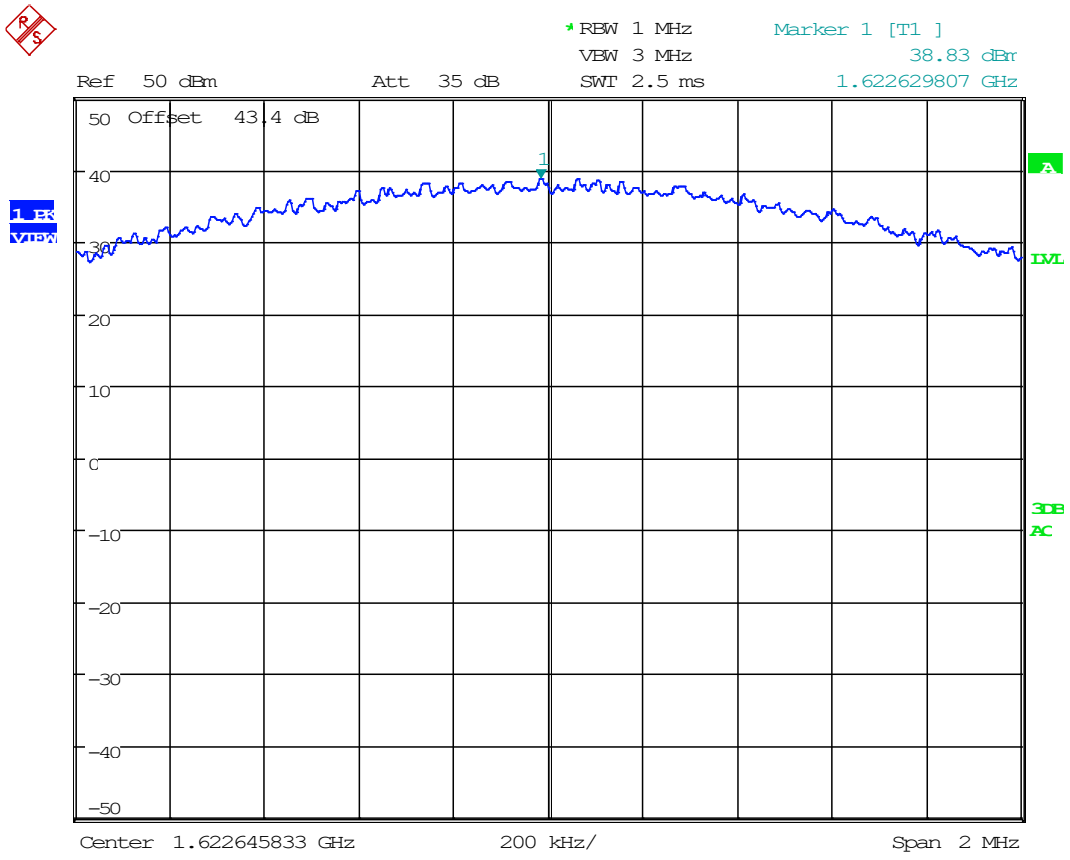
8.2.8 C1, Ch 160, RF Power Output Plot, 1622.645833 MHz



Date: 19.SEP.2022 15:17:29

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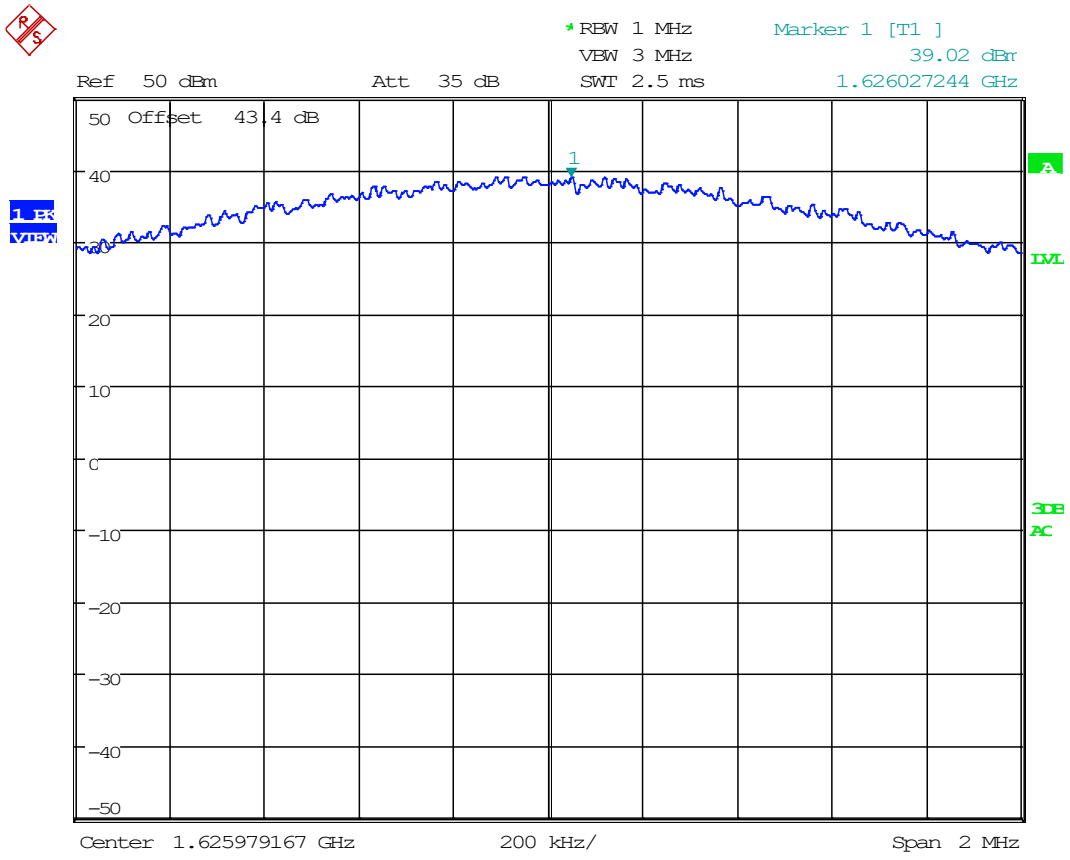
8.2.9 C1, Ch 240, RF Power Output Plot, 1625.979167 MHz



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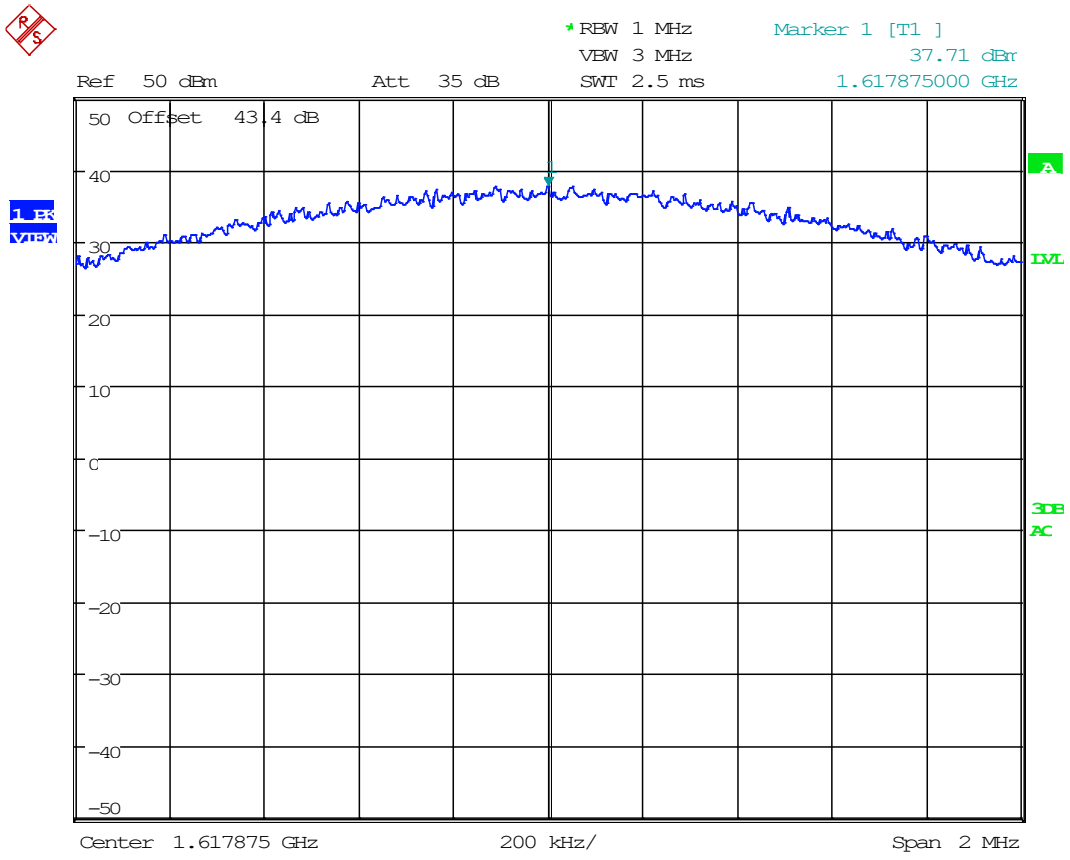
8.2.10 C2, Ch 45, RF Power Output Plot, 1617.875 MHz



Date: 19.SEP.2022 15:45:33

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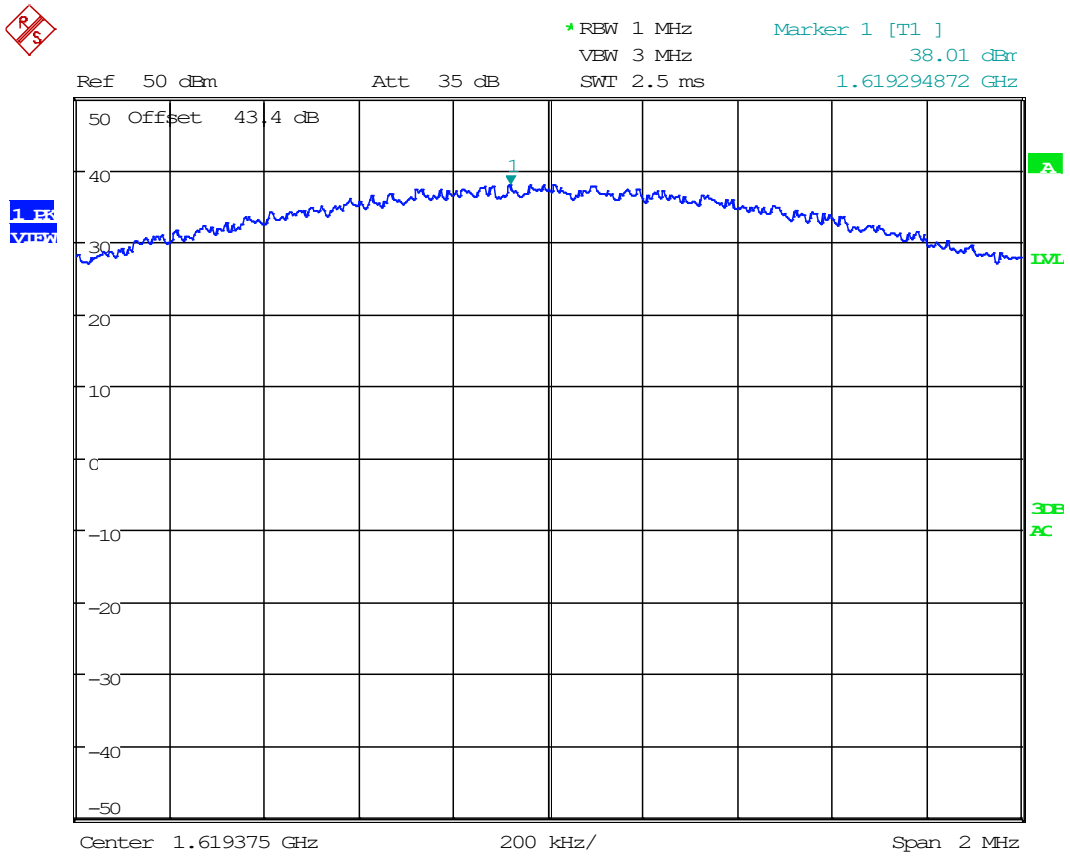
8.2.11 C2, Ch 81, RF Power Output Plot, 1619.375 MHz



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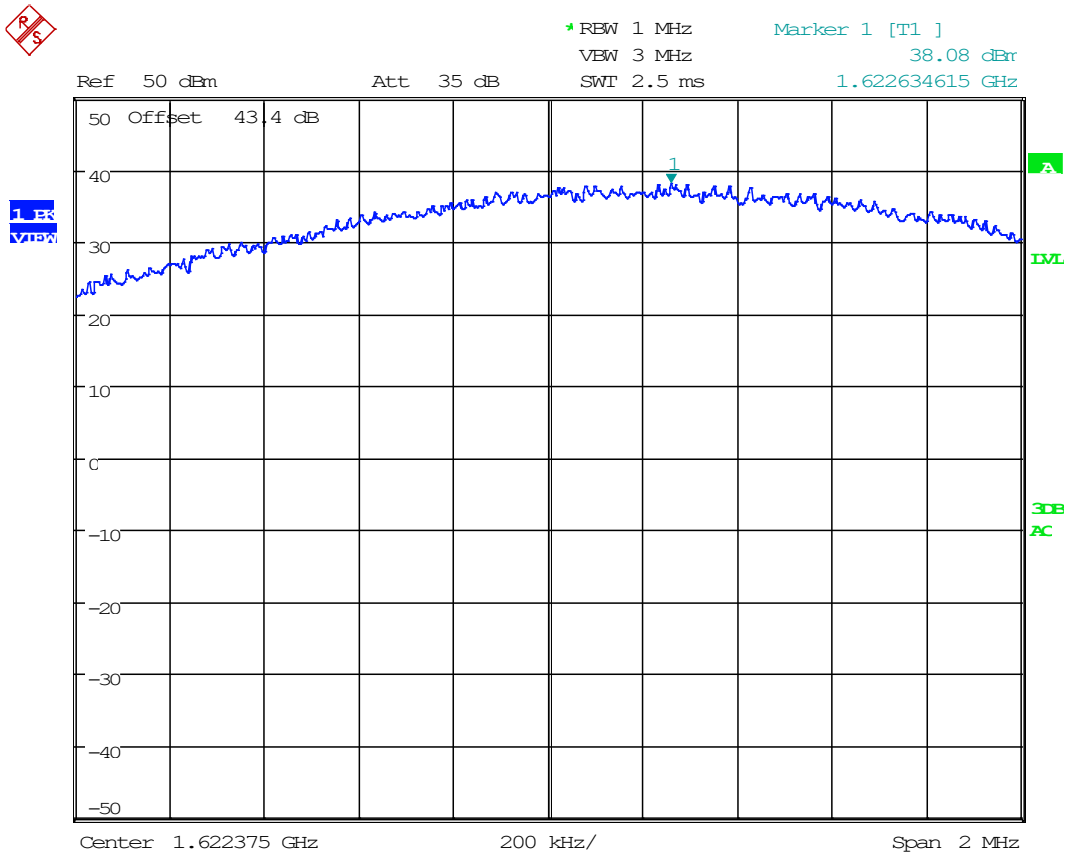
8.2.12 C2, Ch 160, RF Power Output Plot, 1622.625 MHz



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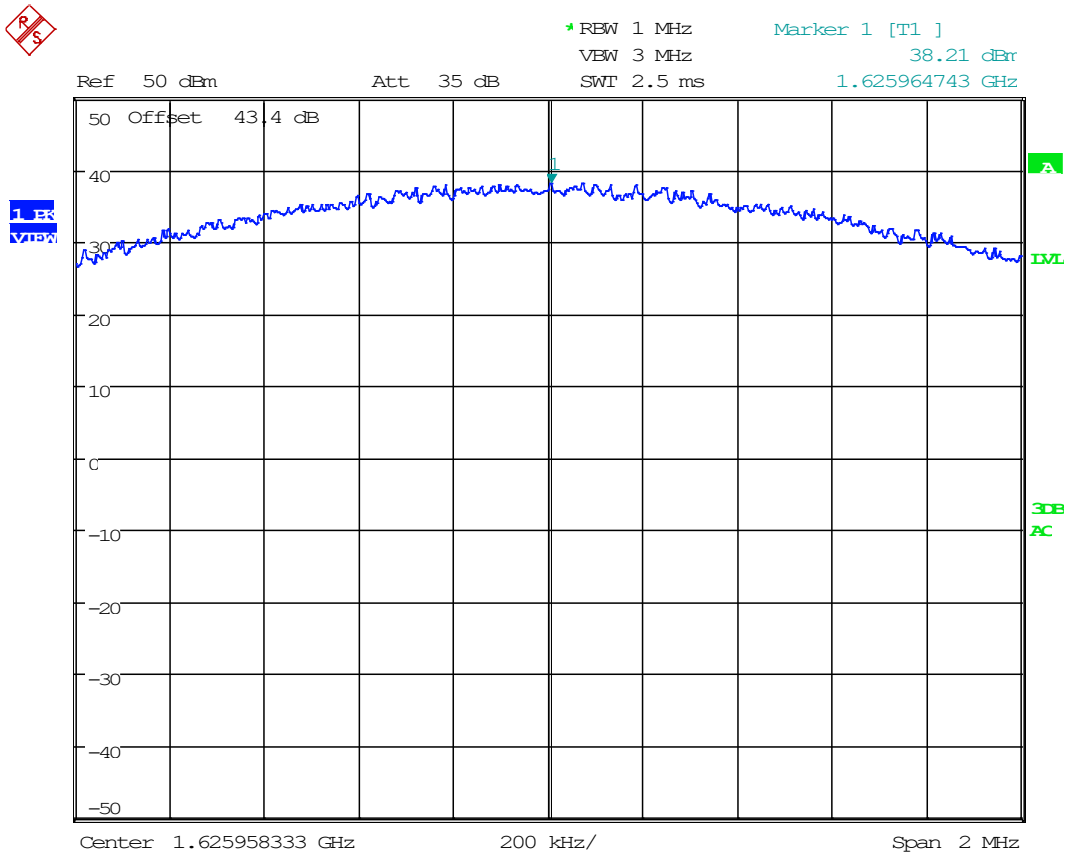
8.2.13 C2, Ch 240, RF Power Output Plot, 1625.958333 MHz



Date: 19.SEP.2022 15:27:00

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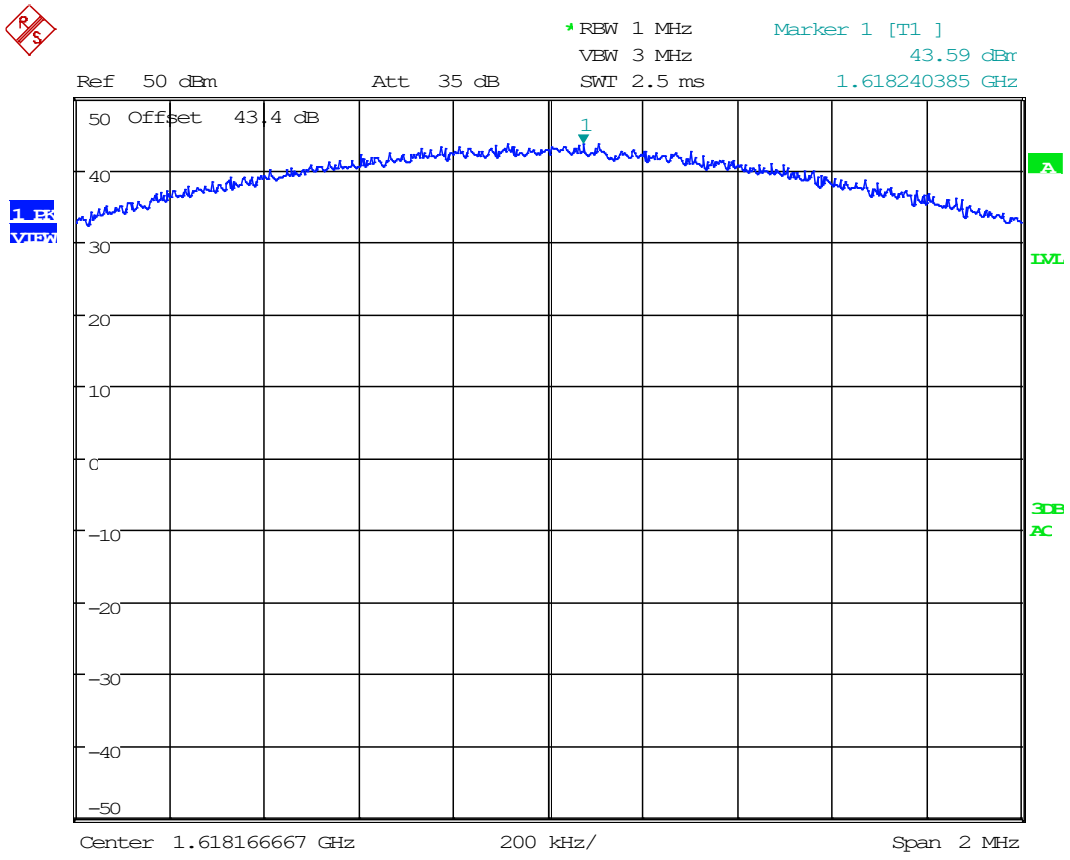
8.2.14 C8Q, Ch 49, RF Power Output Plot, 1618.1666667 MHz



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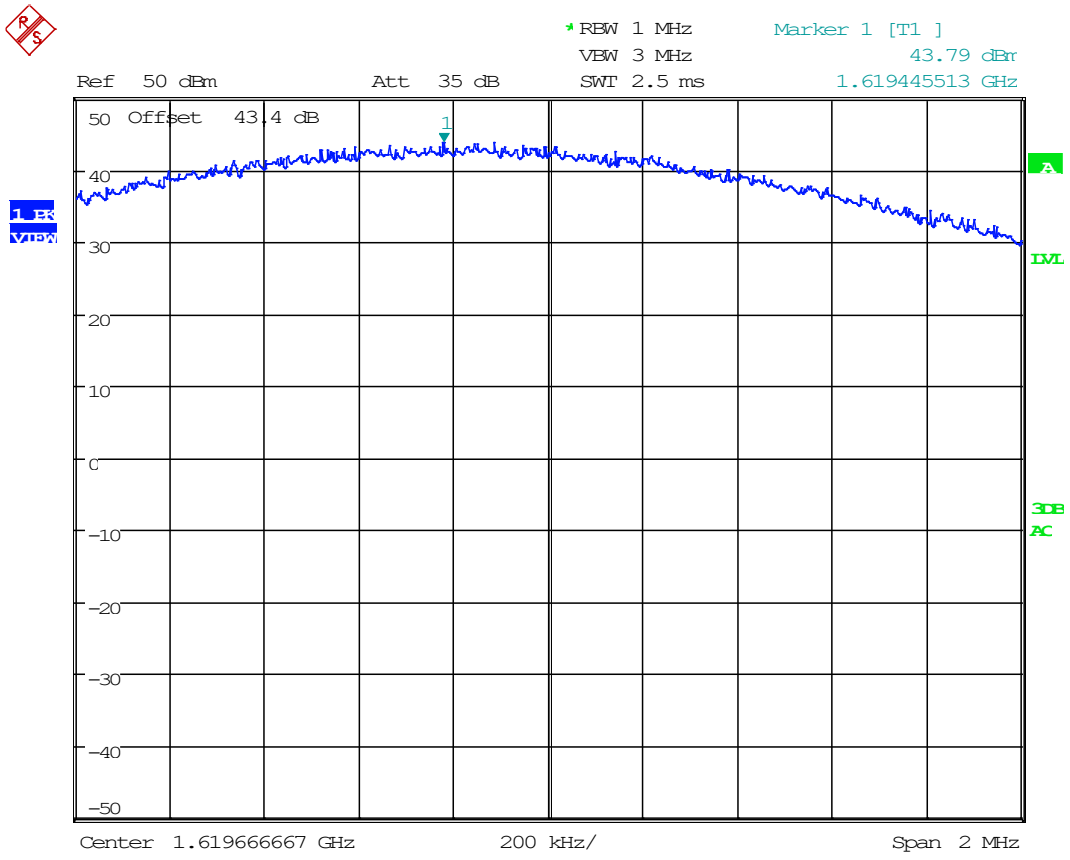
8.2.15 C8Q, Ch 81, RF Power Output Plot, 1619.5 MHz



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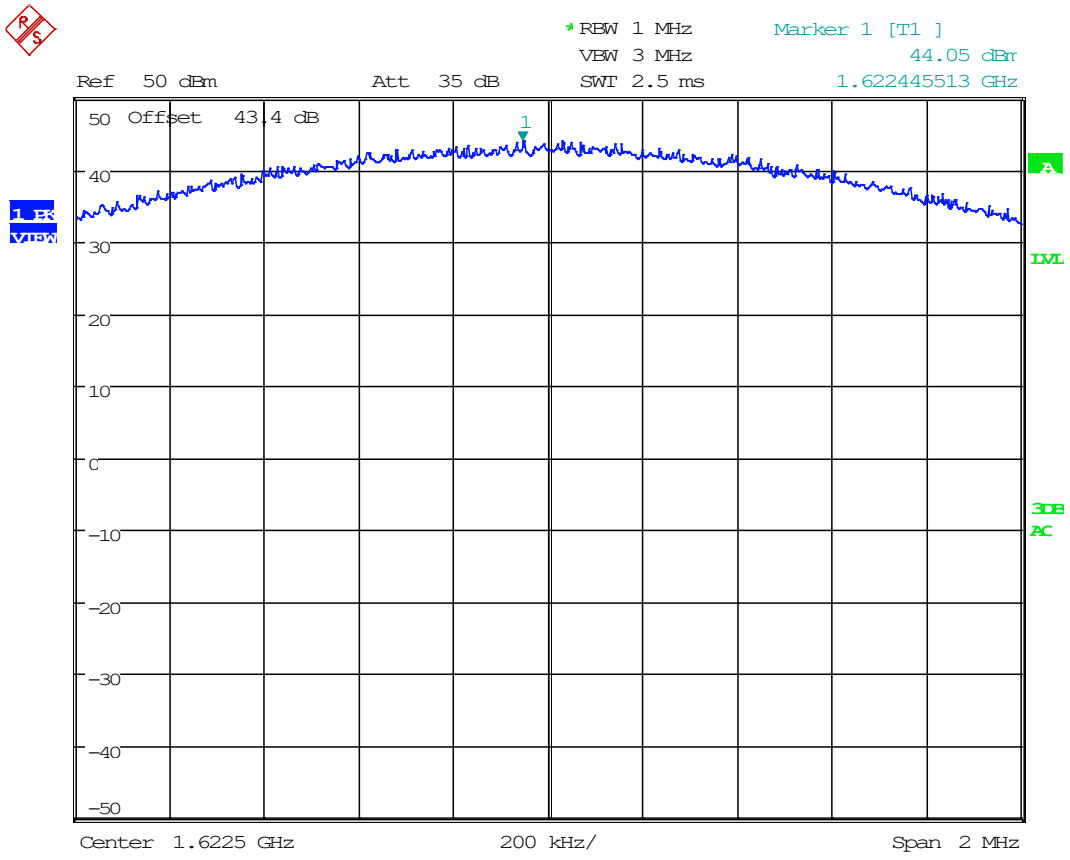
8.2.16 C8Q, Ch 160, RF Power Output Plot, 1622.5 MHz



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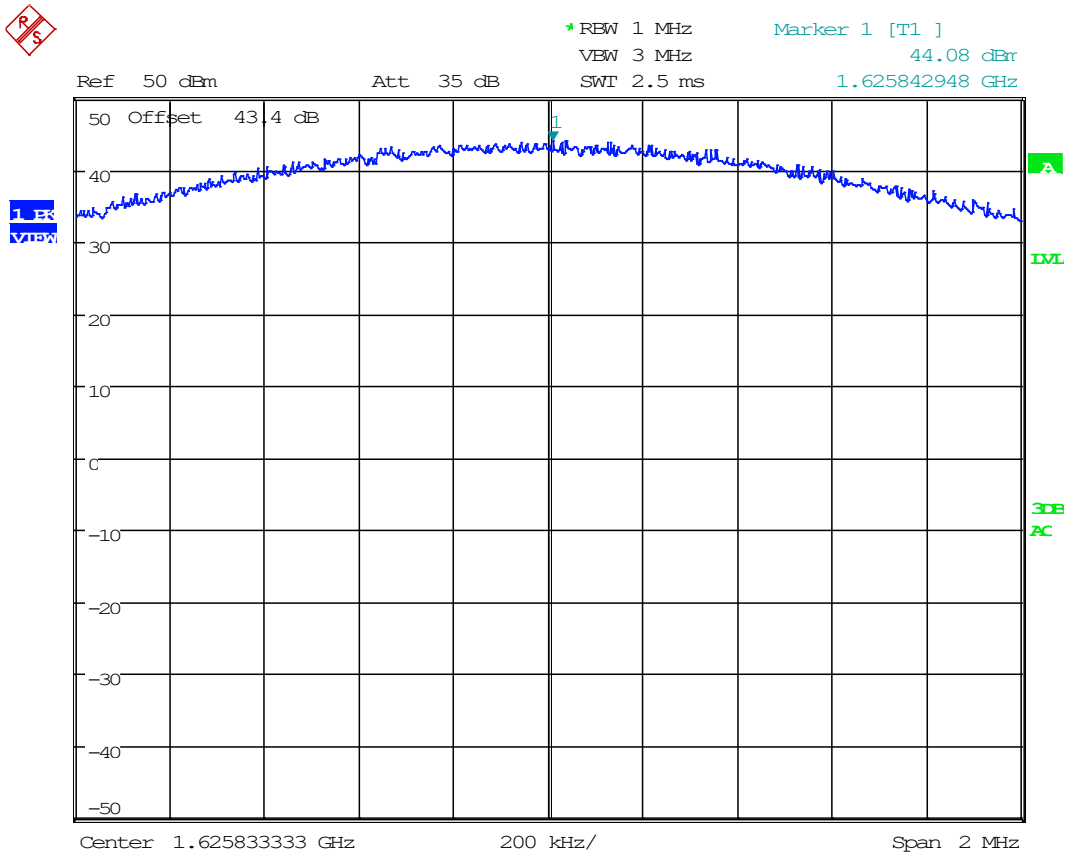
8.2.17 C8Q, Ch 240, RF Power Output Plot, 1625.833333 MHz



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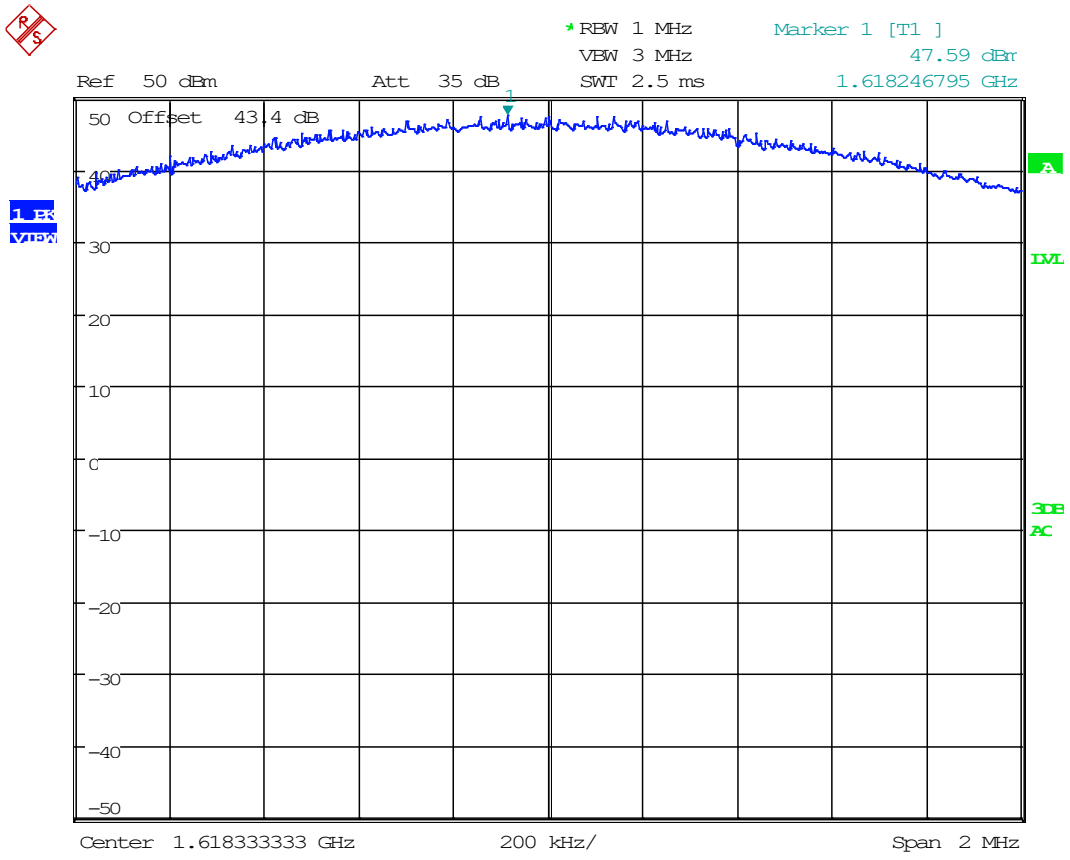
8.2.18 2C8Q, Ch 49, RF Power Output Plot, 1618.333333 MHz



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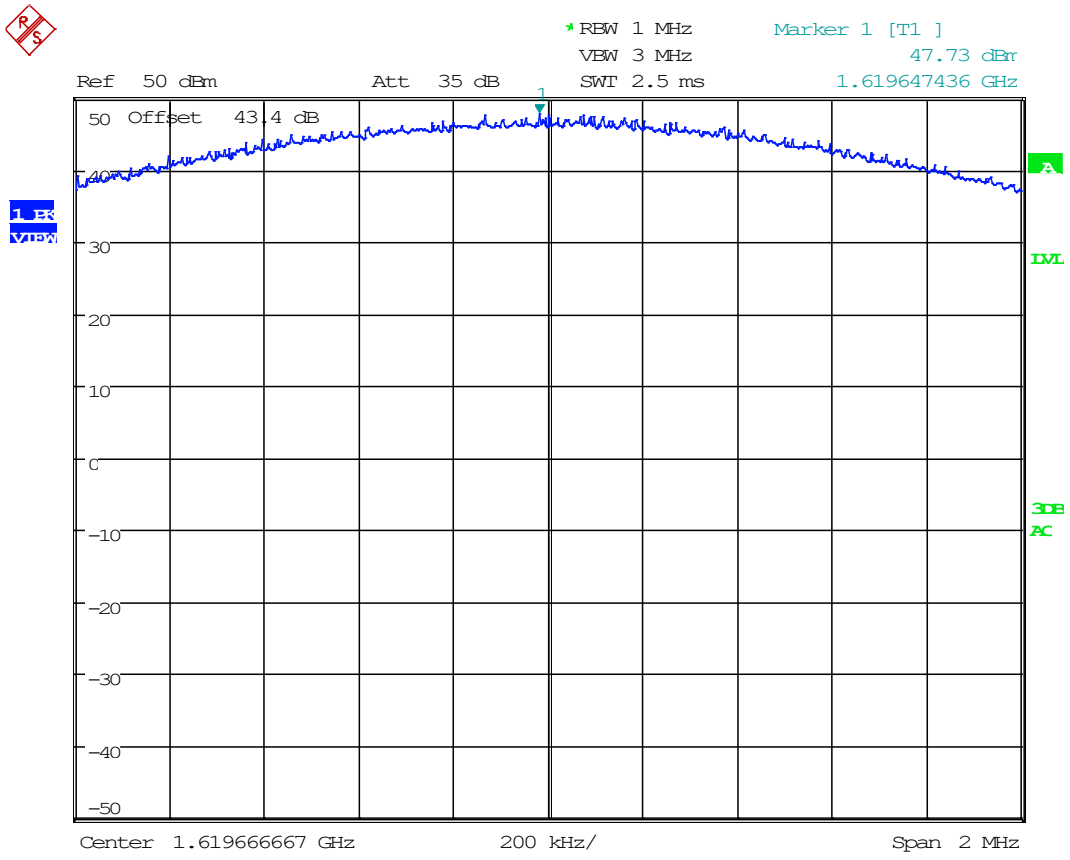
8.2.19 2C8Q, Ch 81, RF Power Output Plot, 1619.666667 MHz



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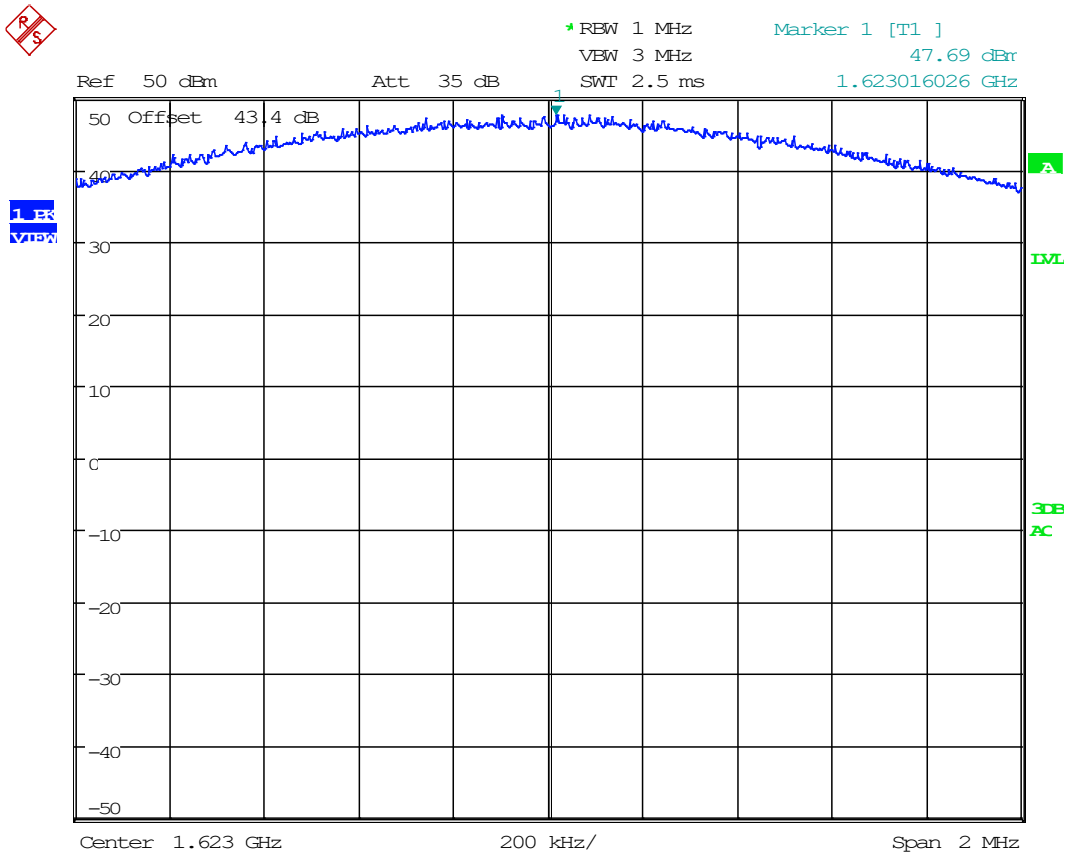
8.2.20 2C8Q, Ch 161, RF Power Output Plot, 1623.0 MHz



Date: 19.SEP.2022 15:33:38

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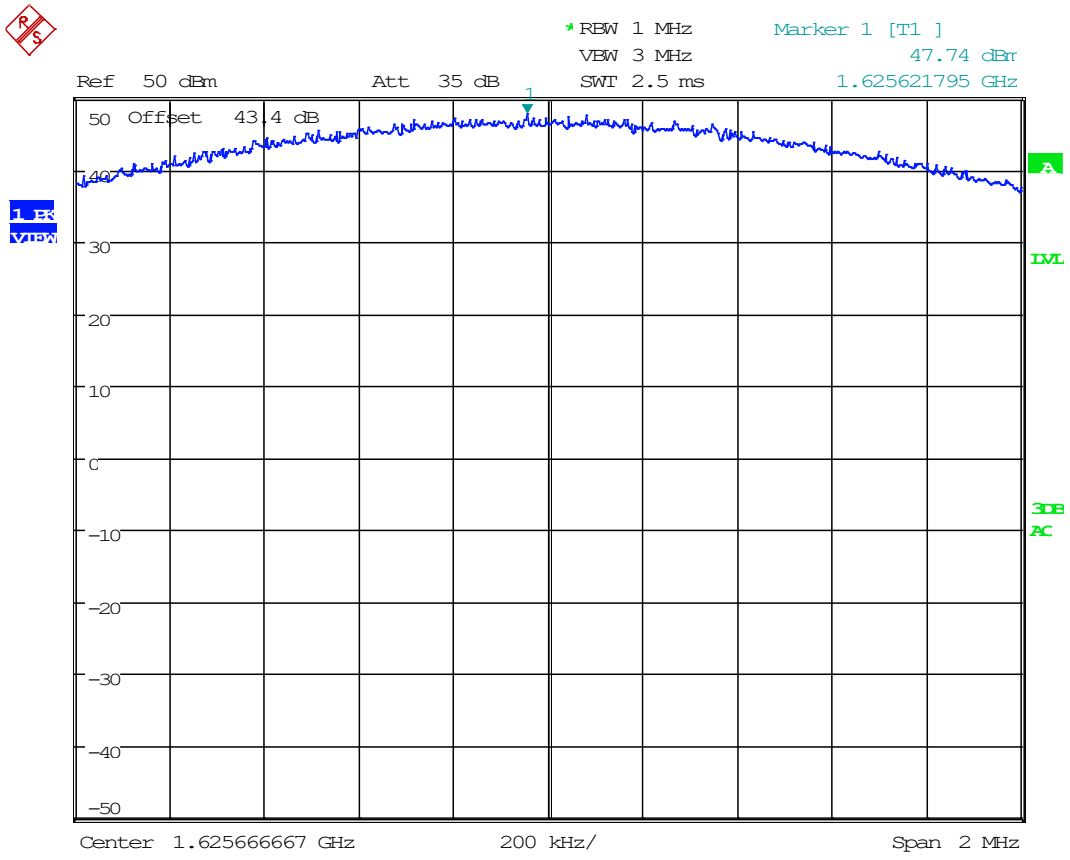
8.2.21 2C8Q, Ch 232, RF Power Output Plot, 1625.666667 MHz



Date: 19.SEP.2022 15:38:10

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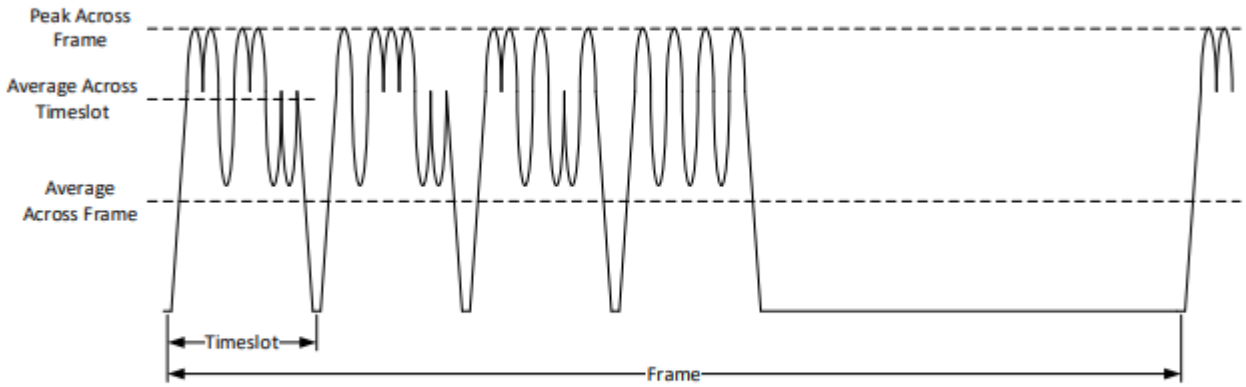
8.3 Manufacturer Defined EIPR Averaging

Effective Isotropic Radiated Power (EIRP) Definition

The following figure and notes define the different RF power values that may be measured depending on the detector and averaging period used.



EIRP – The radiated power value which is a summation of conducted output power (dBW) and passive antenna gain (dBic).

Average Across Timeslot (AAT) – RMS average power across a single active timeslot. Typically measured in the time domain (0 Hz Span) using a spectrum analyzer averaging measurement function. **Note this is the default EIRP definition used in the IRT system specification for nominal and backoff EIRP values.**

Peak Across Frame (PAF) – Peak instantaneous power value at any time within the TDMA frame. Typically measured using a spectrum analyzer peak detector with a dwell time greater than the frame time (90 ms) for each frequency point. This value is approximately the AAT plus the peak to average power ratio (PAPR). PAPR values range from approximately 3 dB to 7 dB depending on the waveform and number of carriers being used.

Average Across Frame (AAF) – RMS average power across the complete 90 ms frame. Typically measured using a spectrum analyzer averaging detector with a dwell time greater than the frame time (90 ms) for each frequency point. This value is approximately the AAT scaled by the duty cycle. The duty cycle can range from 9.2% (8.3 ms / 90 ms) for a single active timeslot to 36.9% (33.2 ms / 90 ms) for all four active timeslots. **Note the value is used for long term average power in the Radiation Hazard Assessment.**

Example values for a 2C8A waveform, 0 dB backoff are given in the following table.

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EIRP Definition	EIRP Value	EIRP Equation (dBW)
AAT	18.2 dBW (66 W)	Default Measurement
PAF	25.2 dBW (331 W)	AAT + PAPR (7 dB)
AAF (1 Timeslot)	7.8 dBW (6 W)	AAT + $10*\log_{10}$(Duty Cycle)
AAF (4 Timeslot)	13.9 dBW (24.5 W)	AAT + $10*\log_{10}$(Duty Cycle)

Further description in the "IRT-4400 Circuit Description" exhibit.

Manufacture defined maximum average RF power output of 48.2 dBm with a waveform peak-to-average power ratio (PAPR) of 7 dB.

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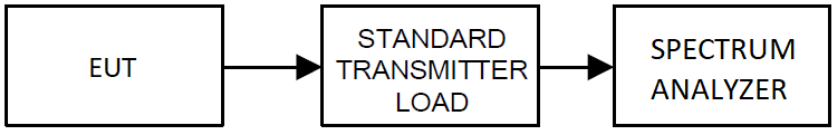
8.4 Occupied Bandwidth

Limits from FCC Parts 2.1049, and 87.135, and test procedure from ANSI C63.26-2015.

Test Setup


Test Results	
Rule Part	Operating Range (MHz)
Part 87	1617.775-1626.5

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8.4.1 99% Bandwidth Table

Test Results, Occupied Bandwidth					
Mode	Channel	Frequency	Emission Designator	Occupied Bandwidth (kHz)	Bandwidth Type
B1	44	1617.8125	G1D	31.073	99%
	81	1619.354167	G1D	31.106	99%
	160	1622.645833	G1D	31.921	99%
	240	1625.979167	G1D	32.032	99%
C1	44	1617.8125	G1D	32.301	99%
	81	1619.354167	G1D	32.305	99%
	160	1622.645833	G1D	31.958	99%
	240	1625.979167	G1D	32.458	99%
C2	45	1617.875	G1E, G1W	65.017	99%
	81	1619.375	G1E, G1W	64.94	99%
	160	1622.625	G1E, G1W	65.228	99%
	240	1625.958333	G1E, G1W	64.939	99%
C8Q	49	1618.1666667	G1E, G1W	260.879	99%
	81	1619.50	G1E, G1W	258.668	99%
	160	1622.50	G1E, G1W	258.086	99%
	240	1625.833333	G1E, G1W	256.627	99%
2C8Q	49	1618.333333	G1E, G1W	589.867	99%
	81	1619.666667	G1E, G1W	590.537	99%
	161	1623.00	G1E, G1W	587.02	99%
	232	1625.666667	G1E, G1W	587.065	99%

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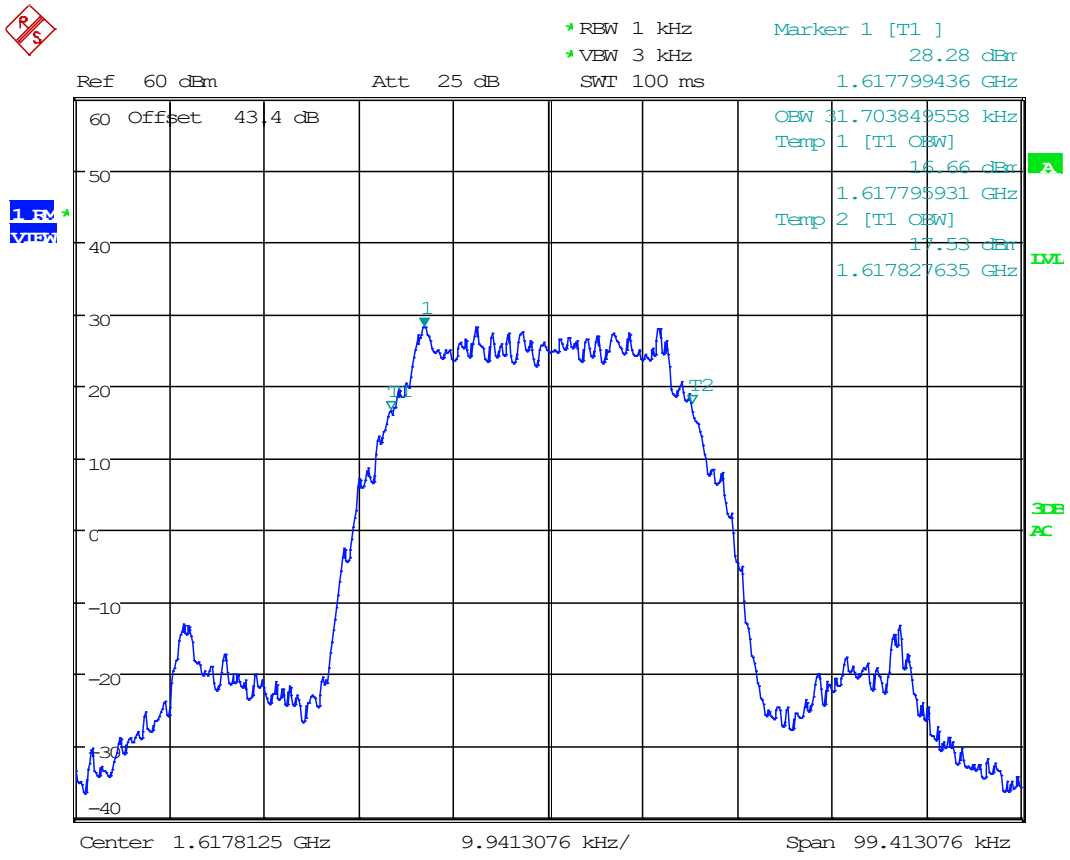
8.4.2 B1, Ch 44, 99% Bandwidth Plot, 1617.8125 MHz



Date: 16.SEP.2022 16:17:29

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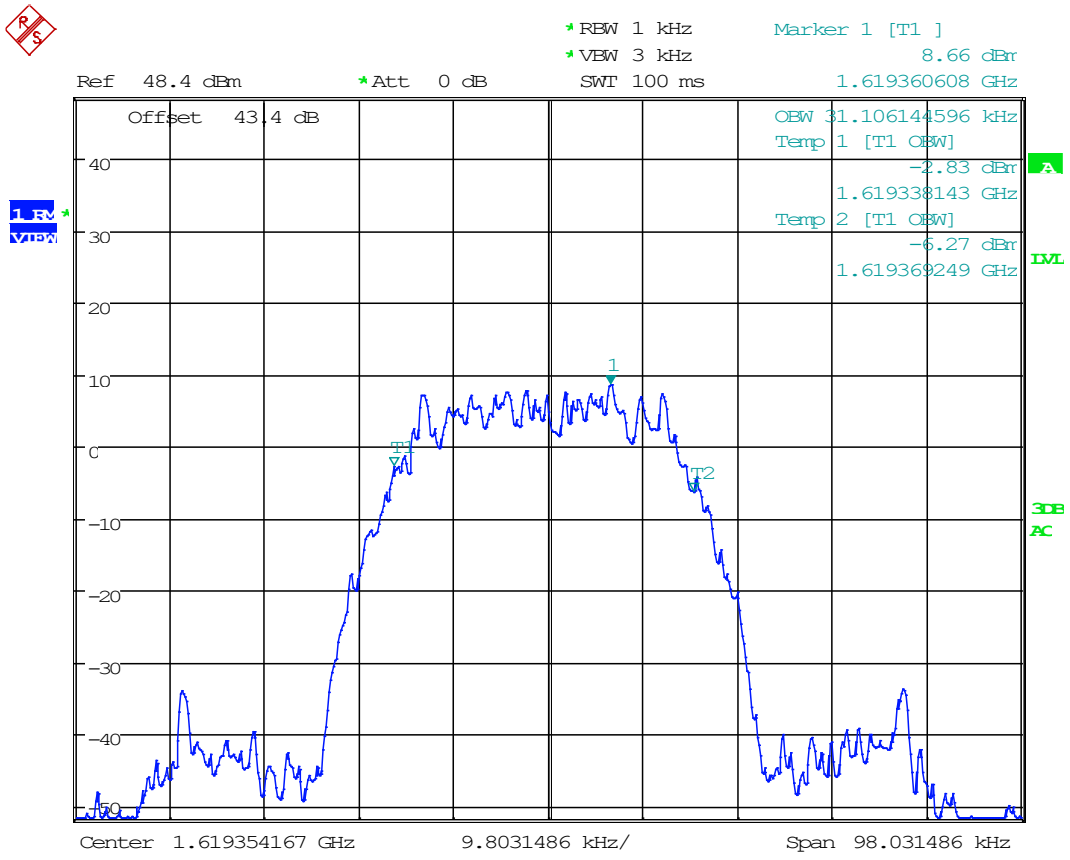
8.4.3 B1, Ch 81, 99% Bandwidth Plot, 1619.354167 MHz



Date: 29.AUG.2022 10:26:29

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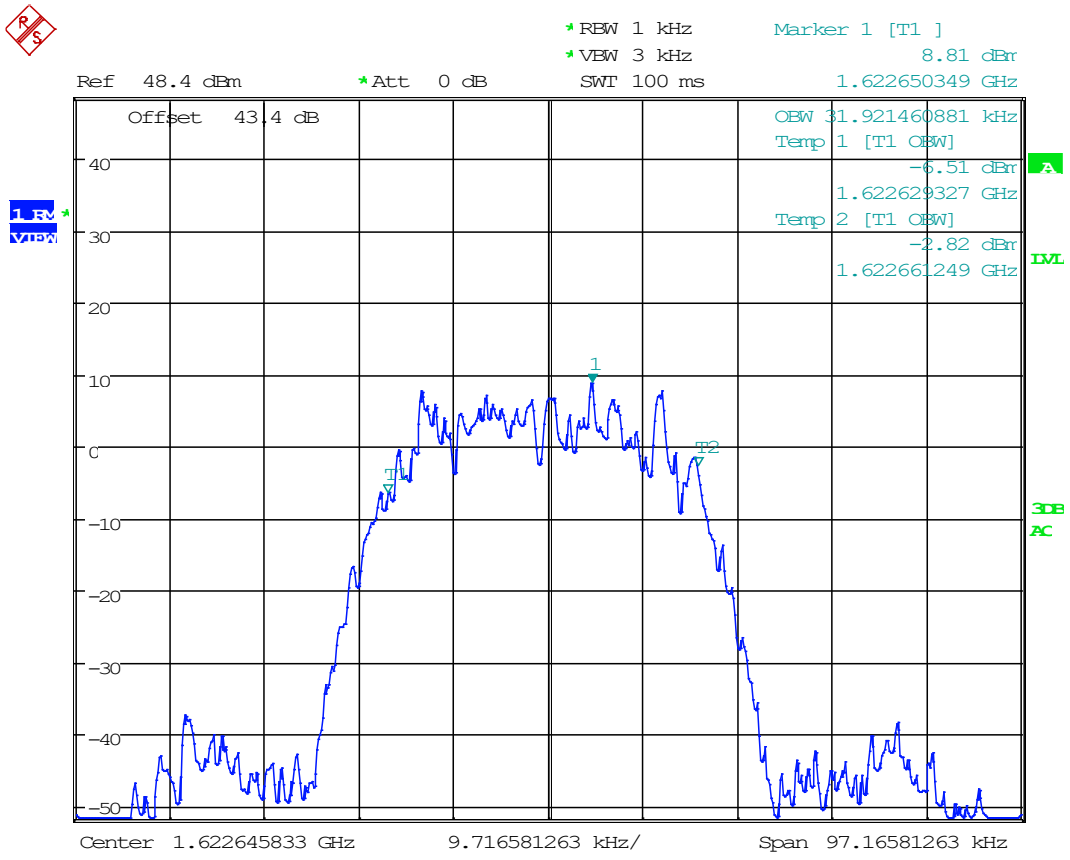
8.4.4 B1, Ch 160, 99% Bandwidth Plot, 1622.645833 MHz



Date: 29.AUG.2022 10:36:13

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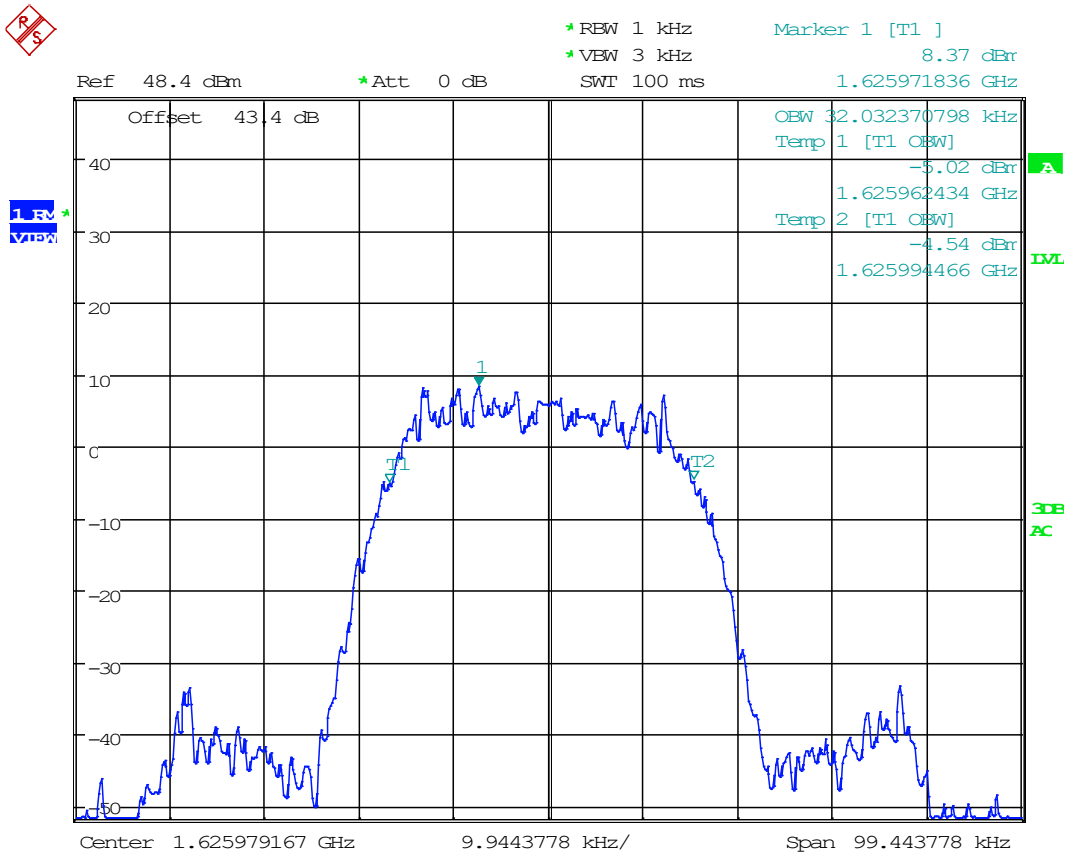
8.4.5 B1, Ch 240, 99% Bandwidth Plot, 1625.979167 MHz



Date: 29.AUG.2022 10:45:52

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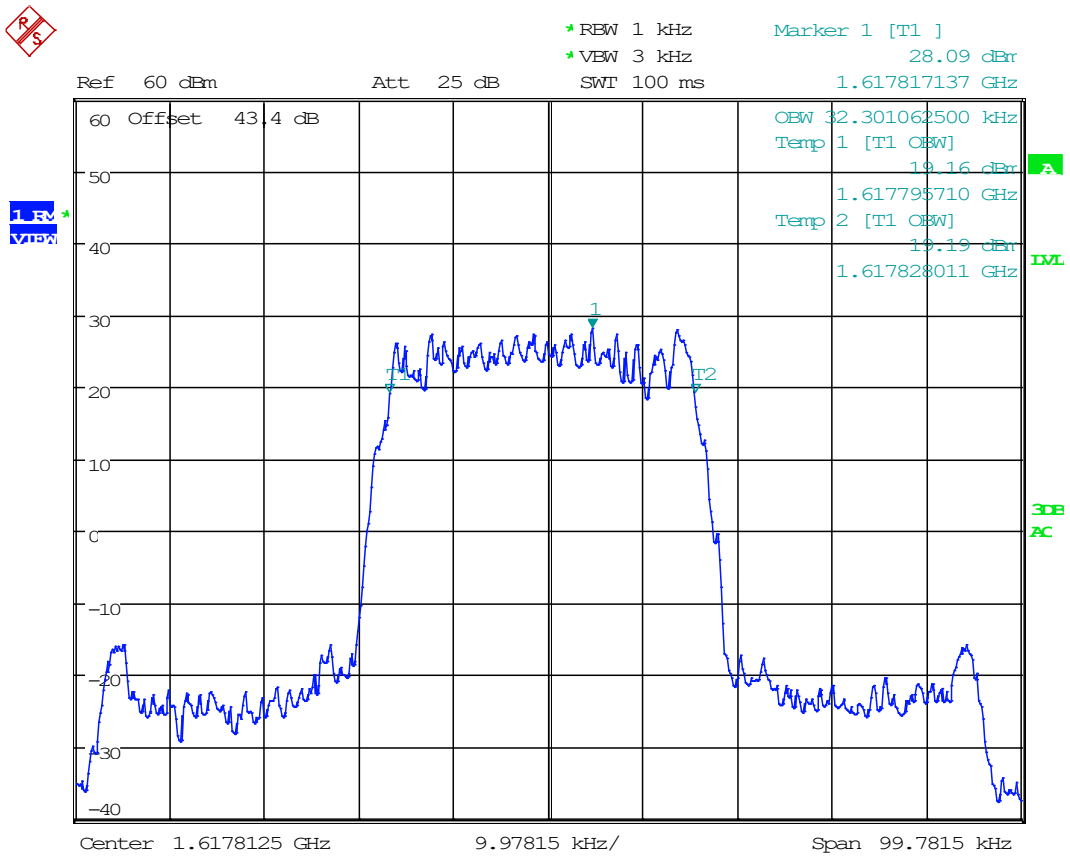
8.4.6 C1, Ch 44, 99% Bandwidth Plot, 1617.8125 MHz



Date: 16.SEP.2022 16:20:02

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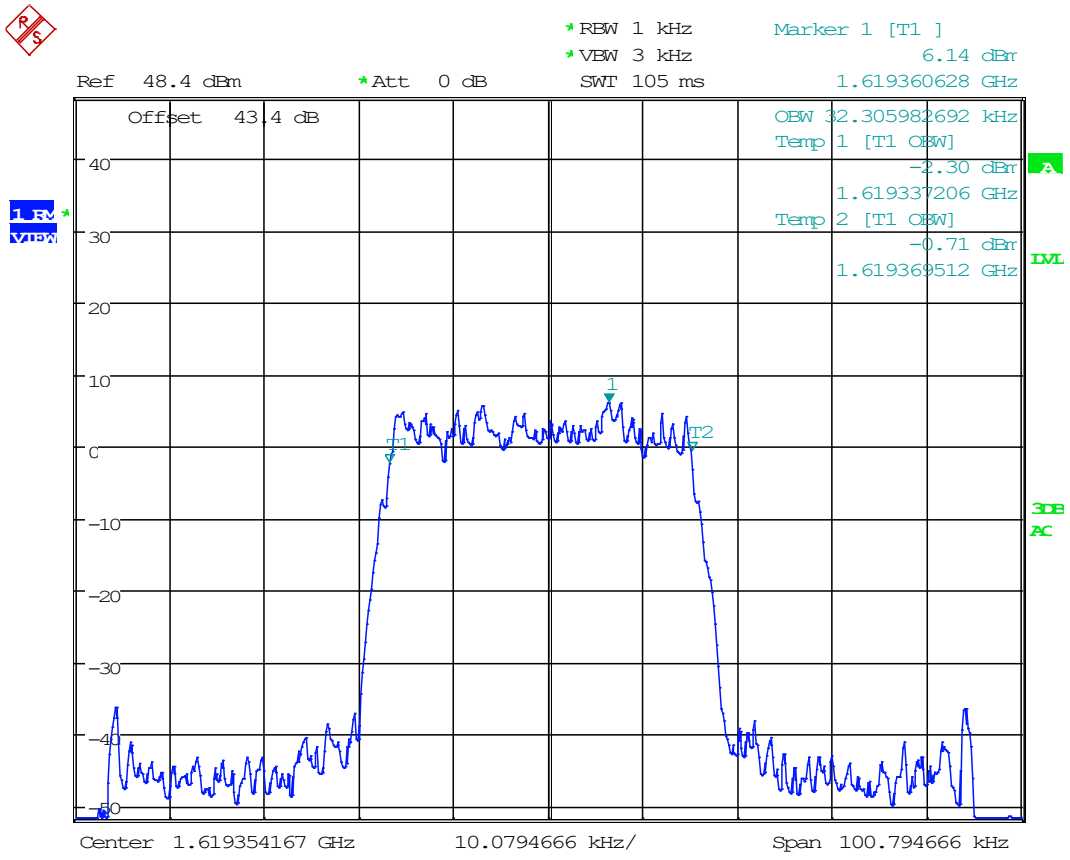
8.4.7 C1, Ch 81, 99% Bandwidth Plot, 1619.354167 MHz



Date: 29.AUG.2022 10:27:46

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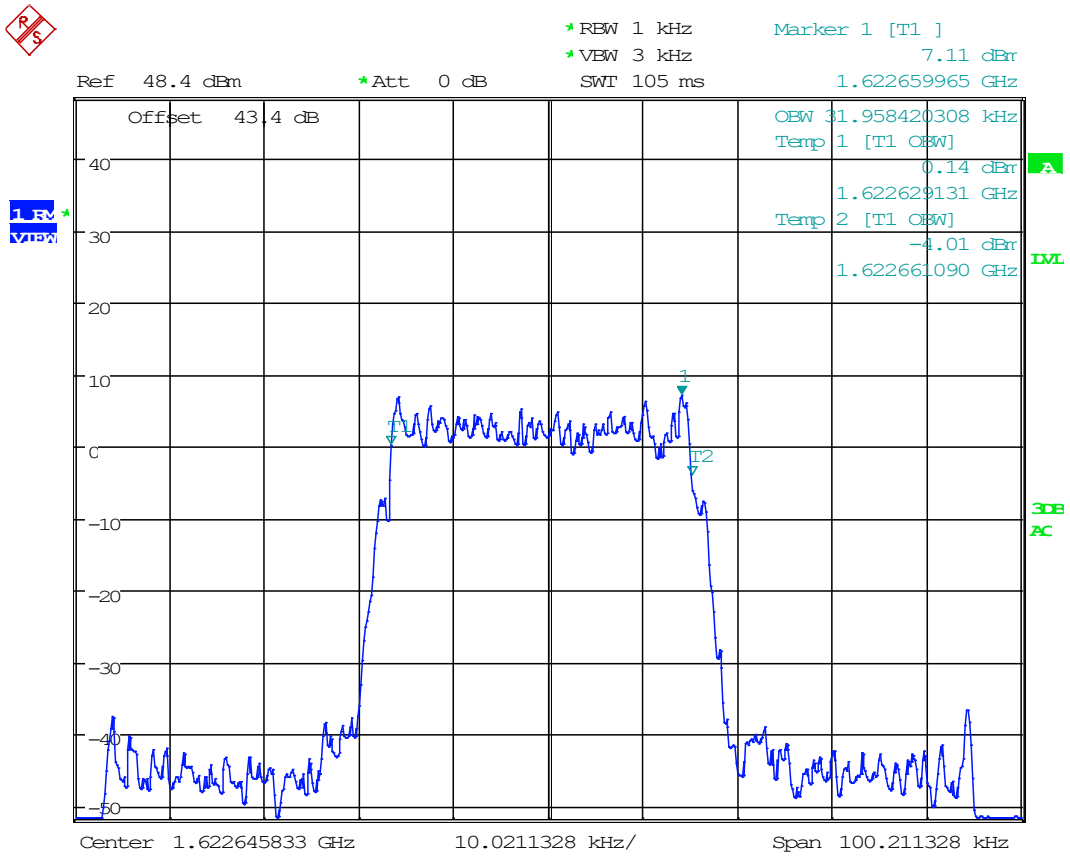
8.4.8 C1, Ch 160, 99% Bandwidth Plot, 1622.645833 MHz



Date: 29.AUG.2022 10:37:37

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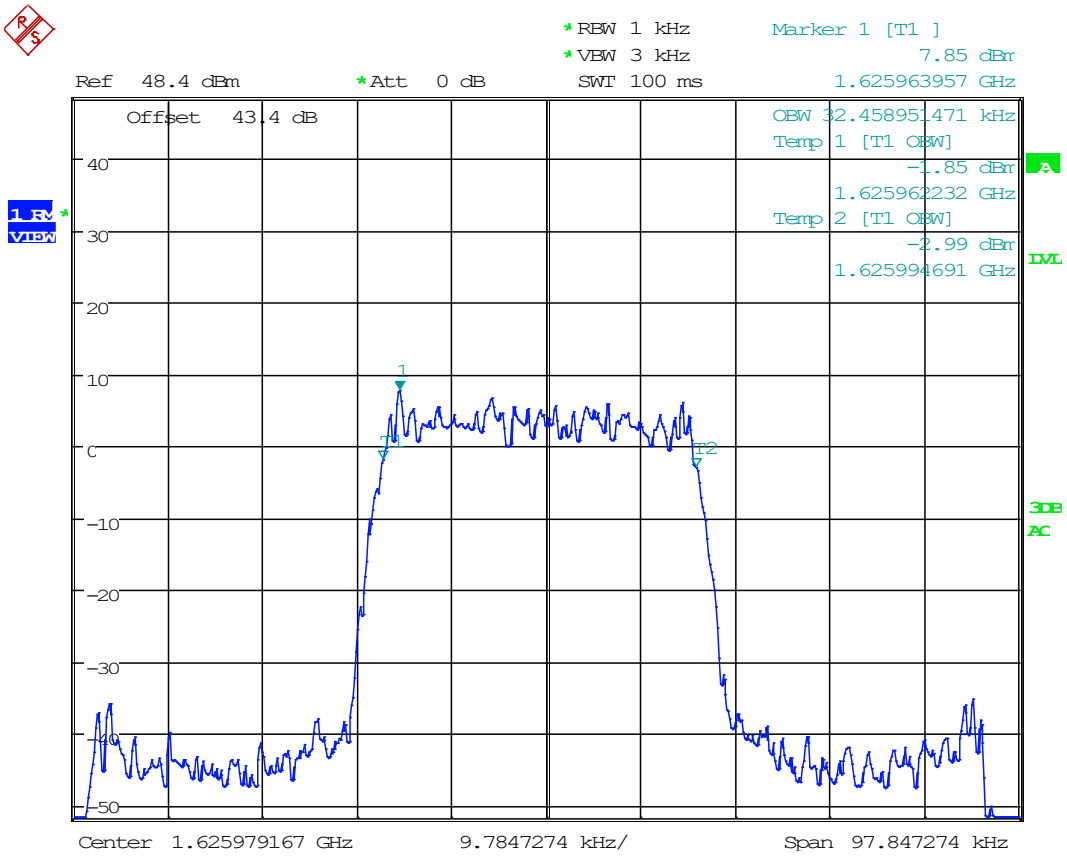
8.4.9 C1, Ch 240, 99% Bandwidth Plot, 1625.979167 MHz



Date: 29.AUG.2022 10:47:01

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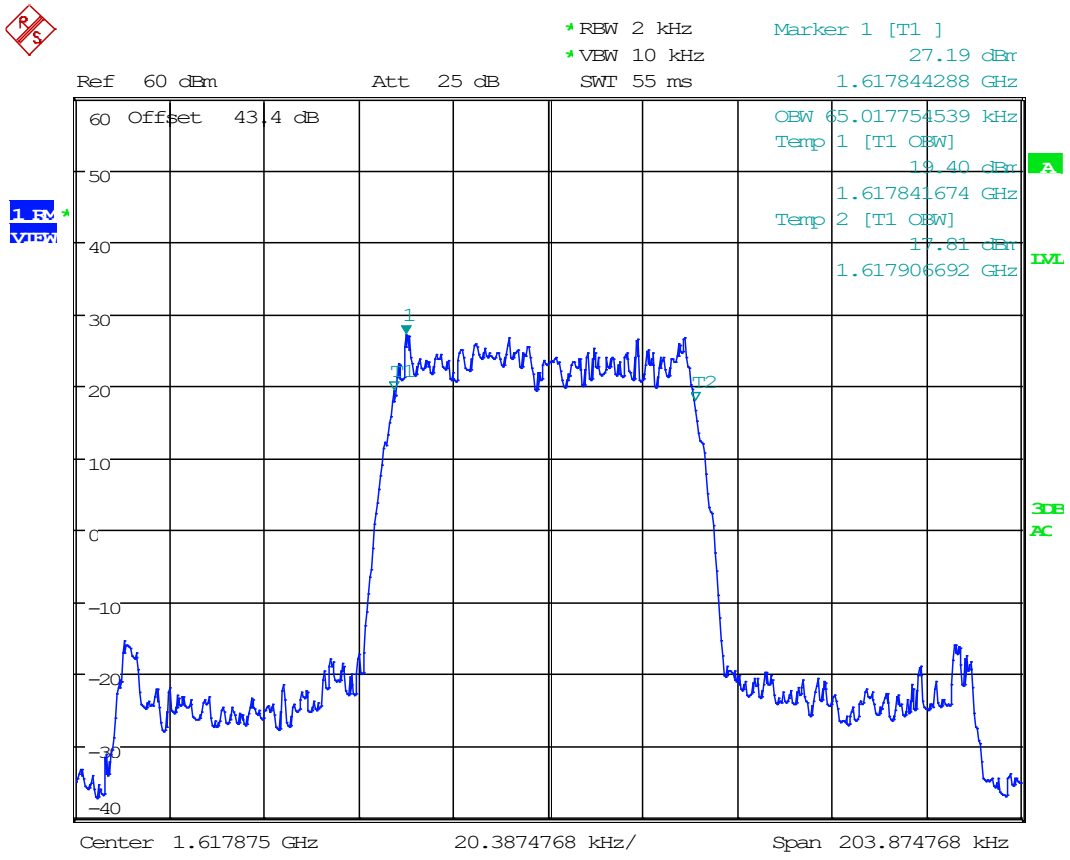
8.4.10 C2, Ch 45, 99% Bandwidth Plot, 1617.875 MHz



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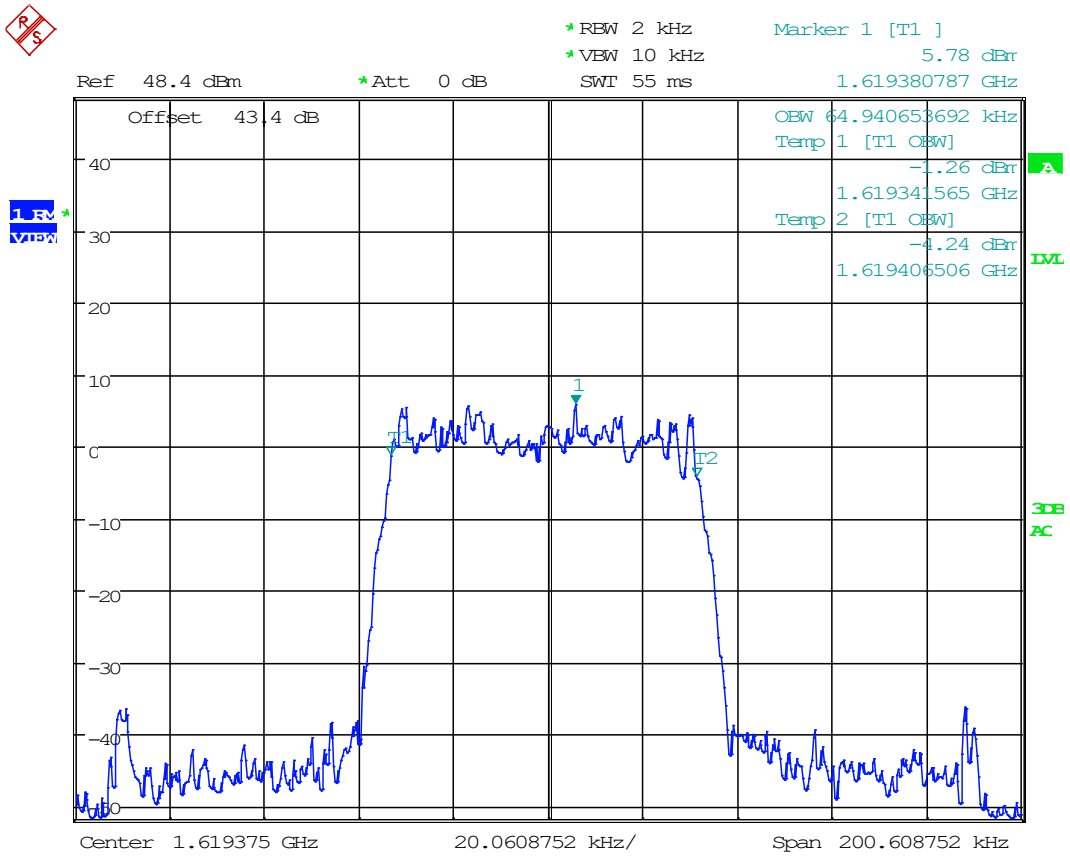
8.4.11 C2, Ch 81, 99% Bandwidth Plot, 1619.375 MHz



Date: 29.AUG.2022 10:29:43

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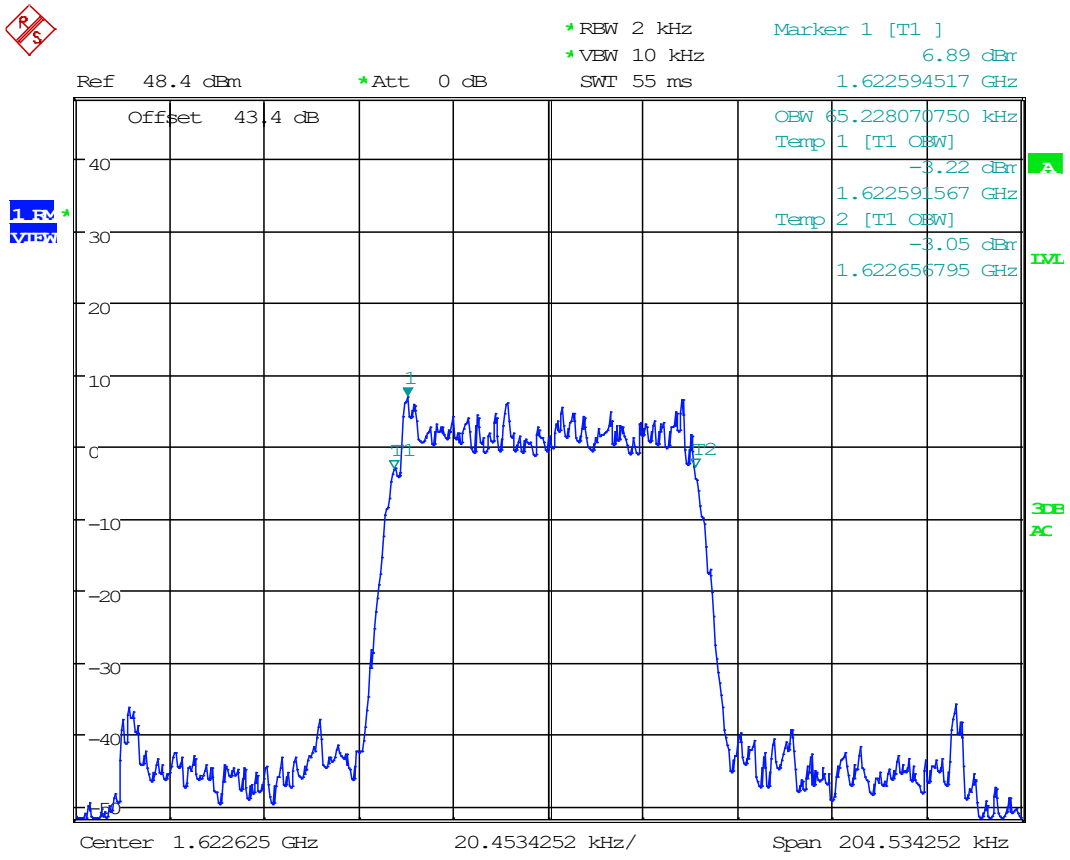
8.4.12 C2, Ch 160, 99% Bandwidth Plot, 1622.625 MHz



Date: 29.AUG.2022 10:38:53

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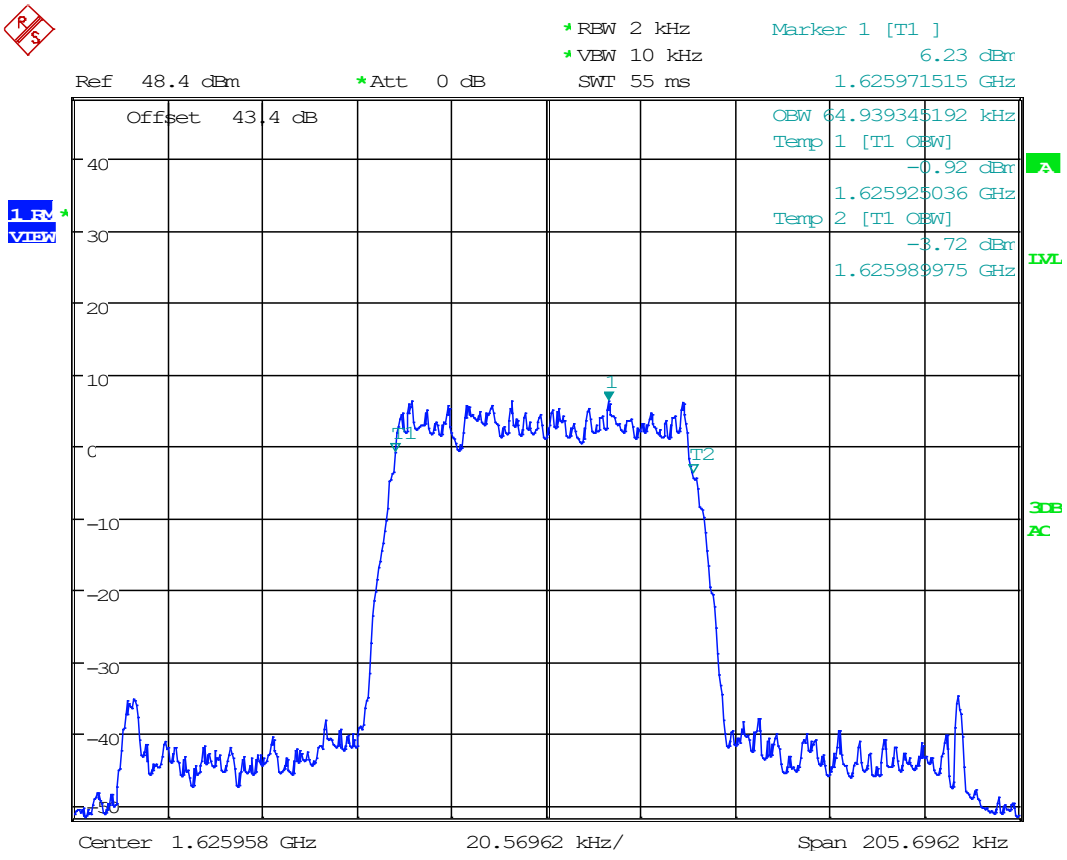
8.4.13 C2, Ch 240, 99% Bandwidth Plot, 1625.958333 MHz



Date: 29.AUG.2022 10:48:27

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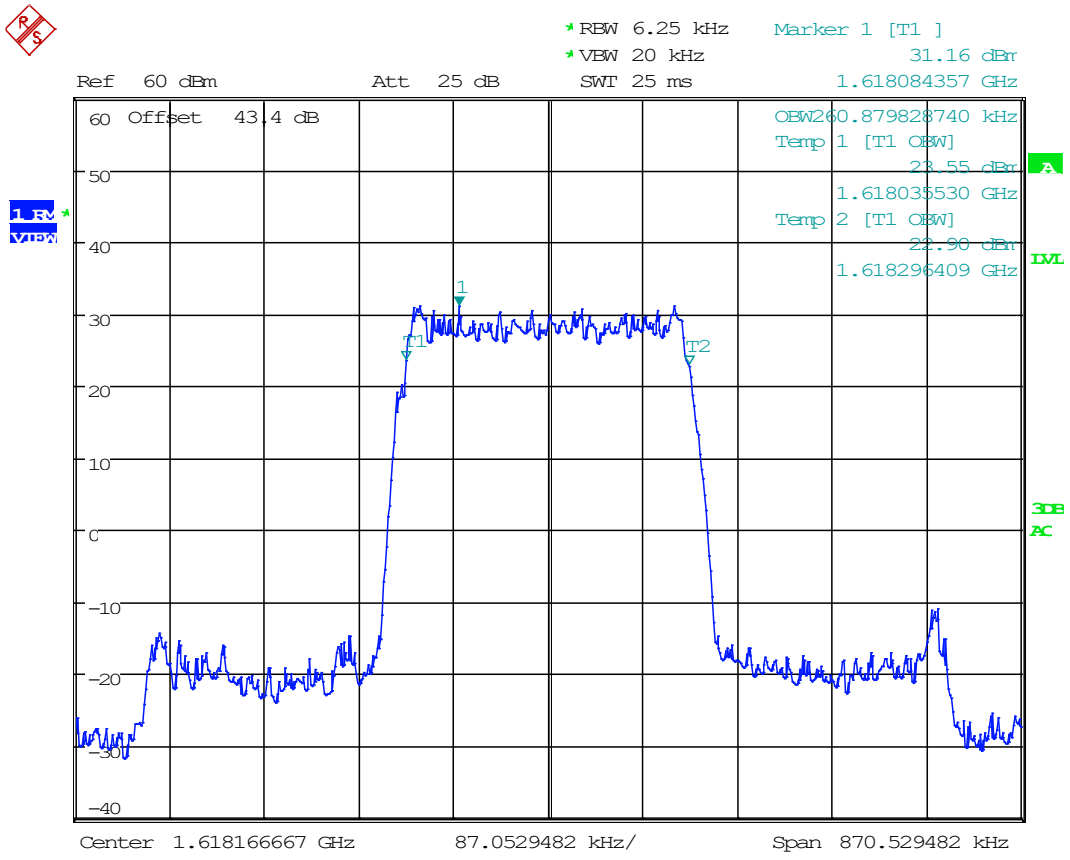
8.4.14 C8Q, Ch 49, 99% Bandwidth Plot, 1618.166667 MHz



Date: 16.SEP.2022 16:23:28

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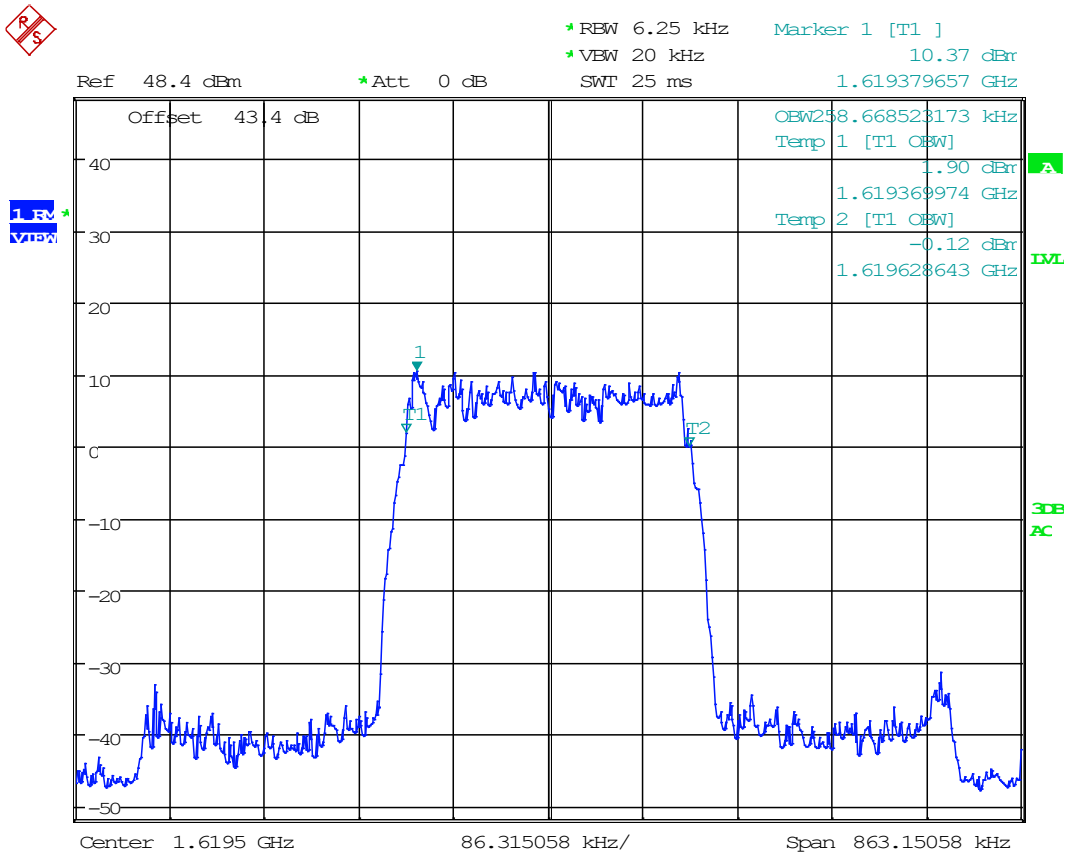
8.4.15 C8Q, Ch 81, 99% Bandwidth Plot, 1619.5 MHz



Date: 29.AUG.2022 10:31:20

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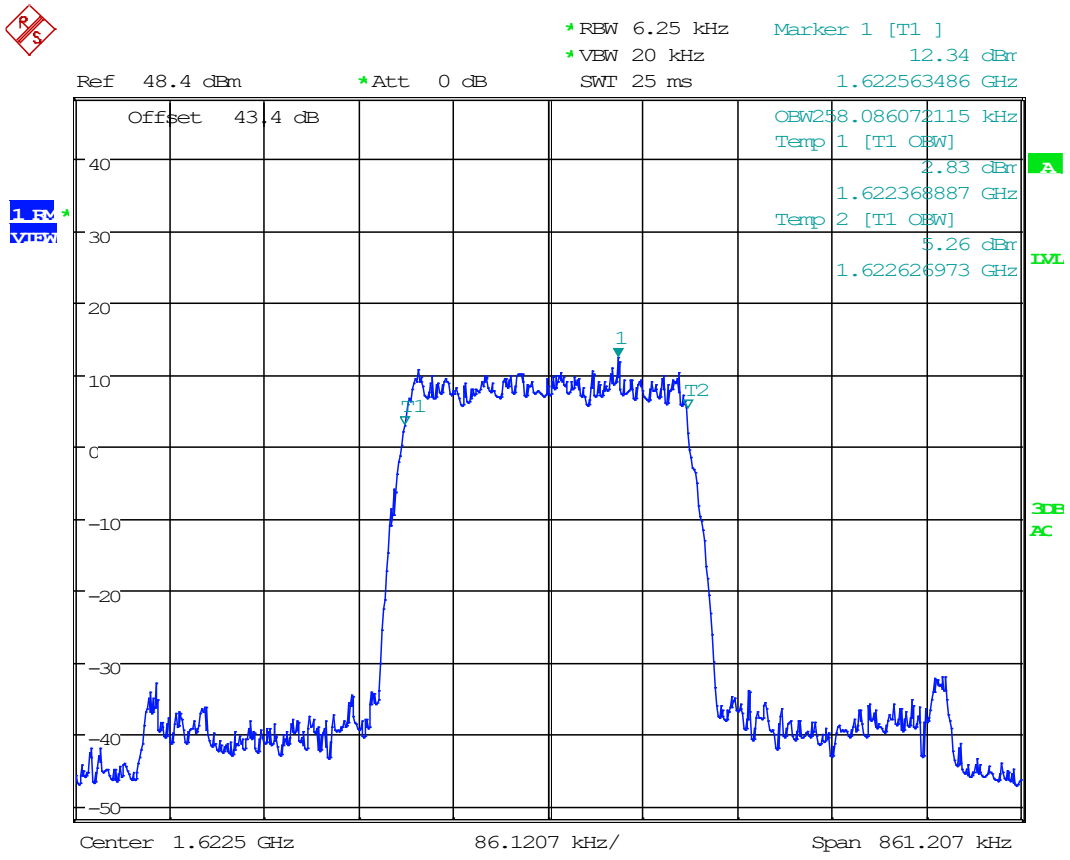
8.4.16 C8Q, Ch 160, 99% Bandwidth Plot, 1622.5 MHz



Date: 29.AUG.2022 10:40:26

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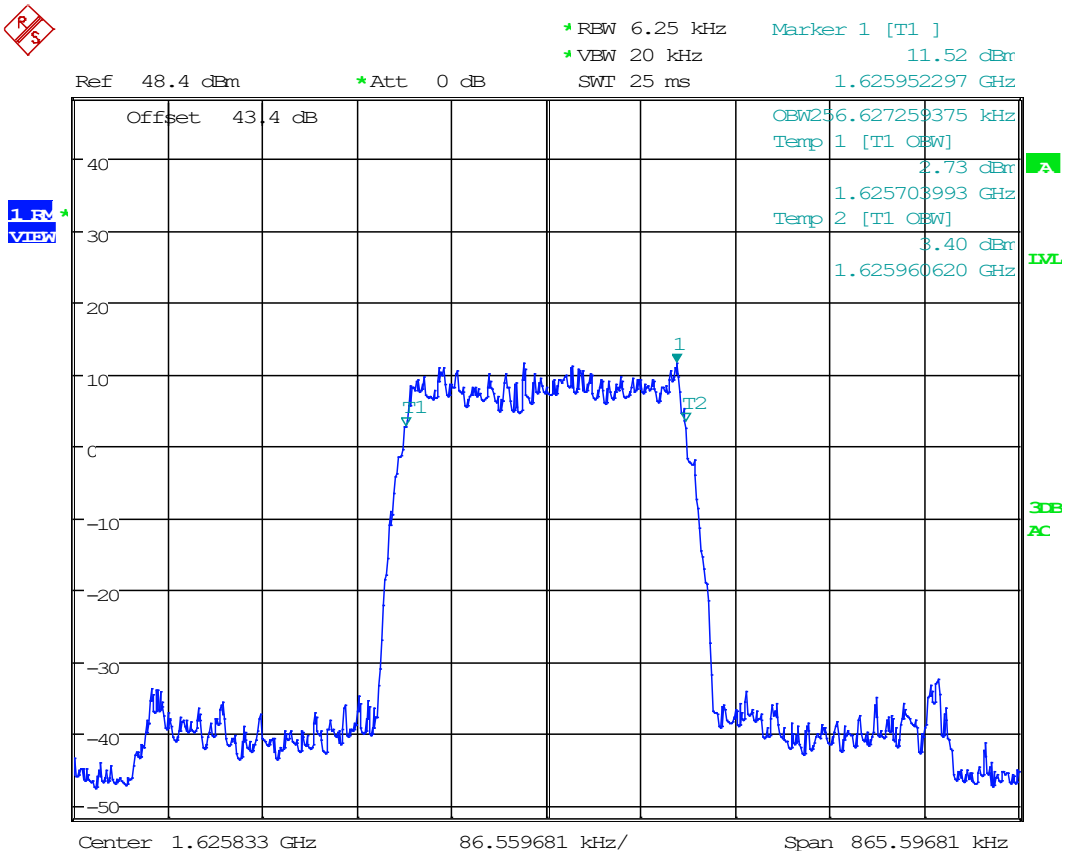
8.4.17 C8Q, Ch 240, 99% Bandwidth Plot, 1625.833333 MHz



Date: 29.AUG.2022 10:49:44

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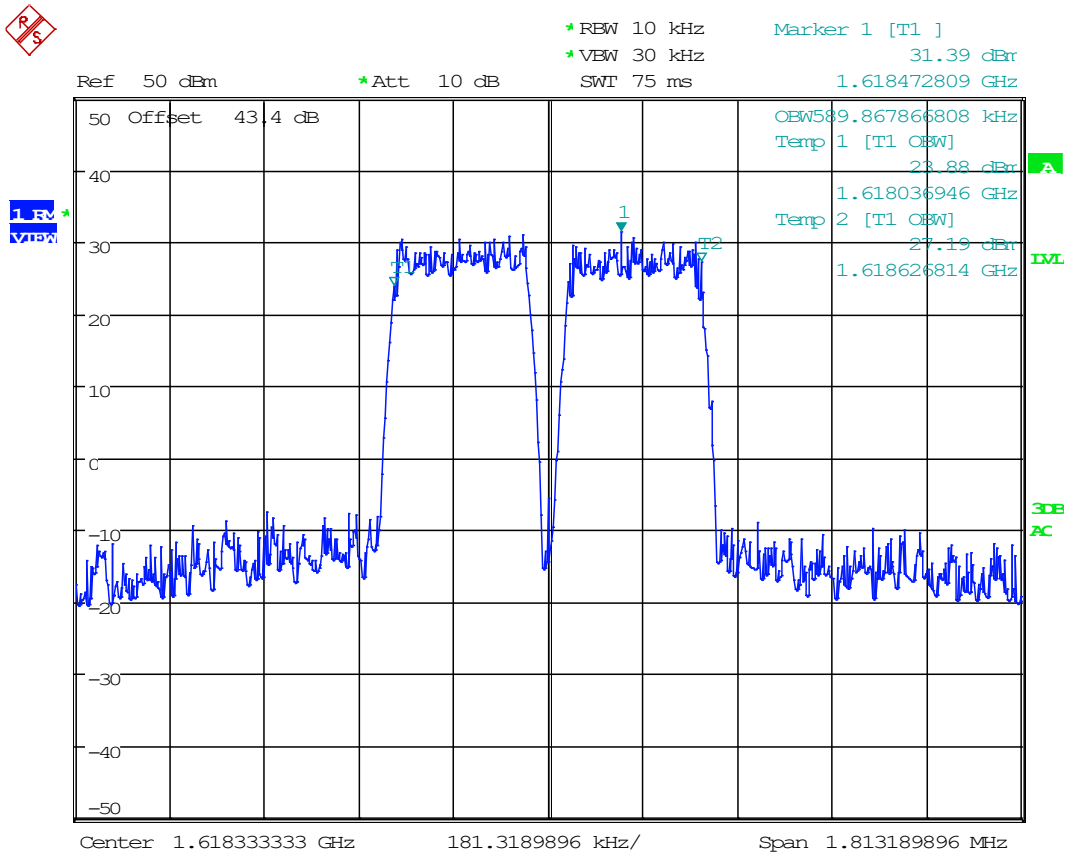
8.4.18 2C8Q, Ch 49, 99% Bandwidth Plot, 1618.333333 MHz



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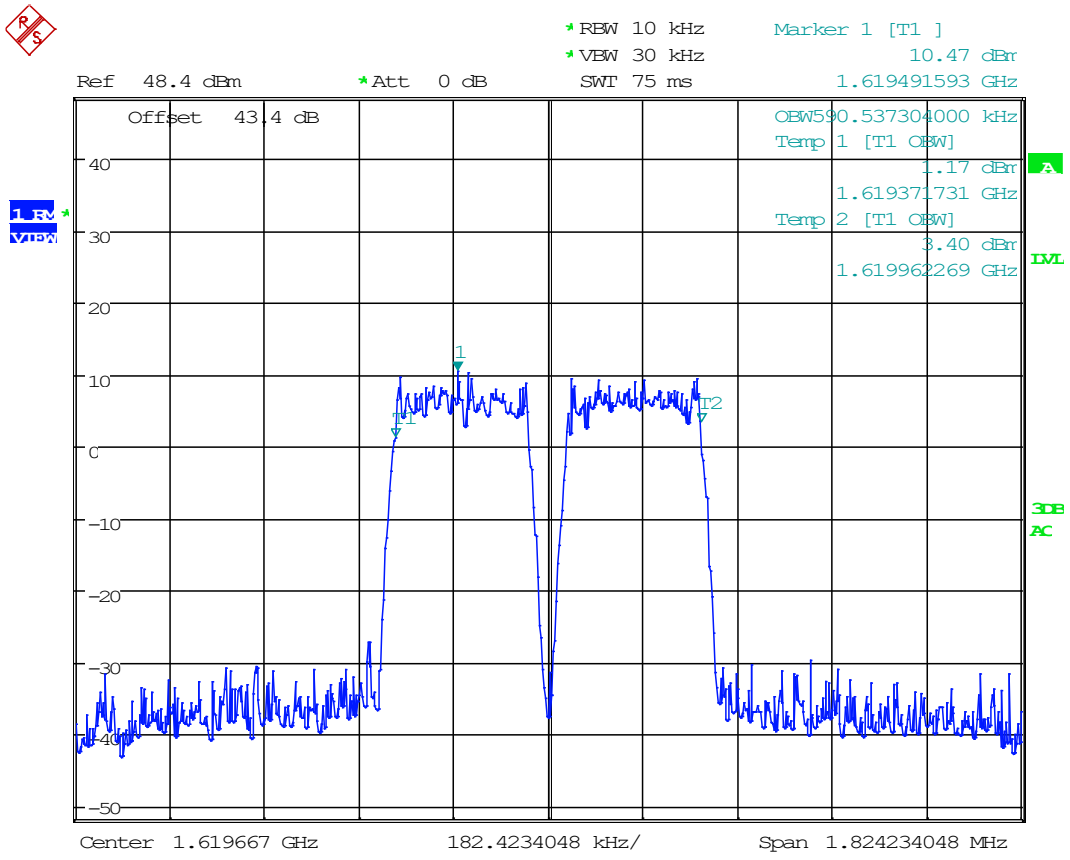
8.4.19 2C8Q, Ch 81, 99% Bandwidth Plot, 1619.666667 MHz



Date: 29.AUG.2022 10:33:17

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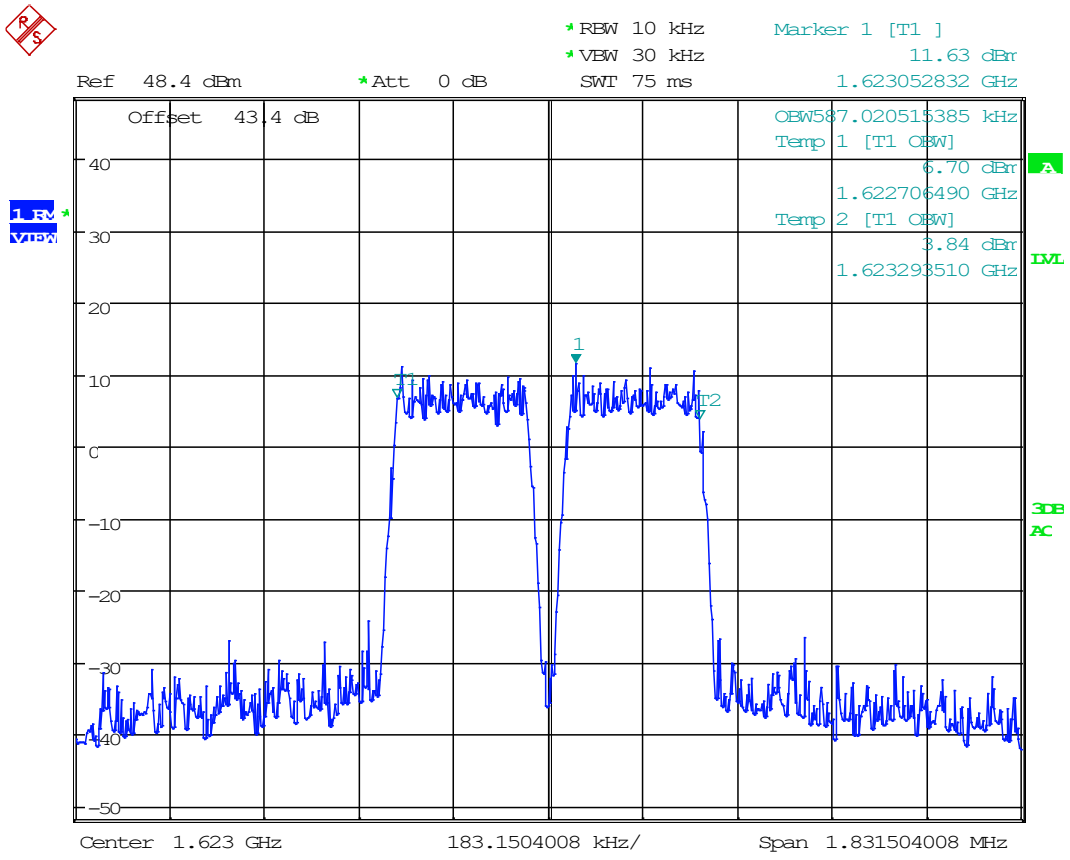
8.4.20 2C8Q, Ch 161, 99% Bandwidth Plot, 1623.0 MHz



Date: 29.AUG.2022 10:43:57

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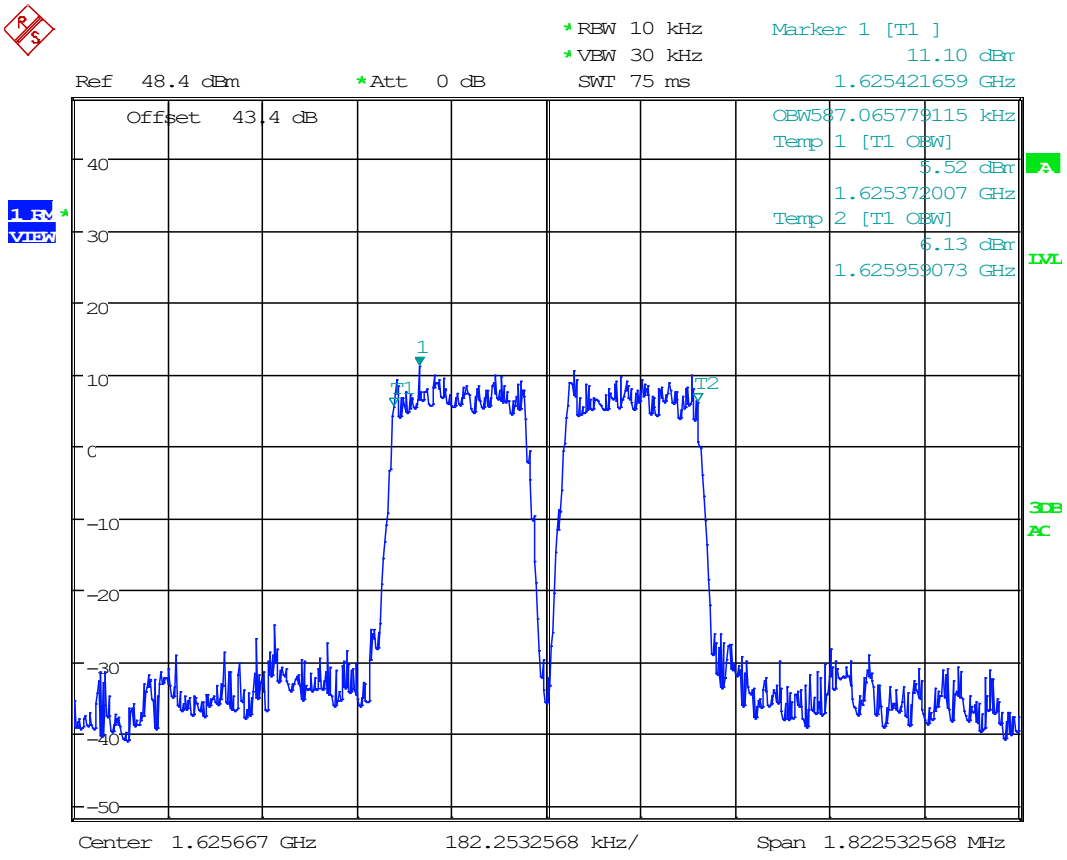
8.4.21 2C8Q, Ch 232, 99% Bandwidth Plot, 1625.666667 MHz



Date: 29.AUG.2022 10:51:09

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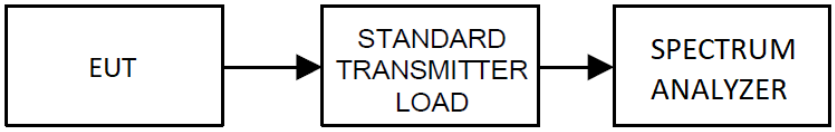
Occupied Bandwidth, Spectrum Plots

8.1 Emission Limitations, In-Band

Limits from FCC Parts 2.1049, and 87.139(i)(3), and test procedure from ANSI C63.26-2015.

Test Setup


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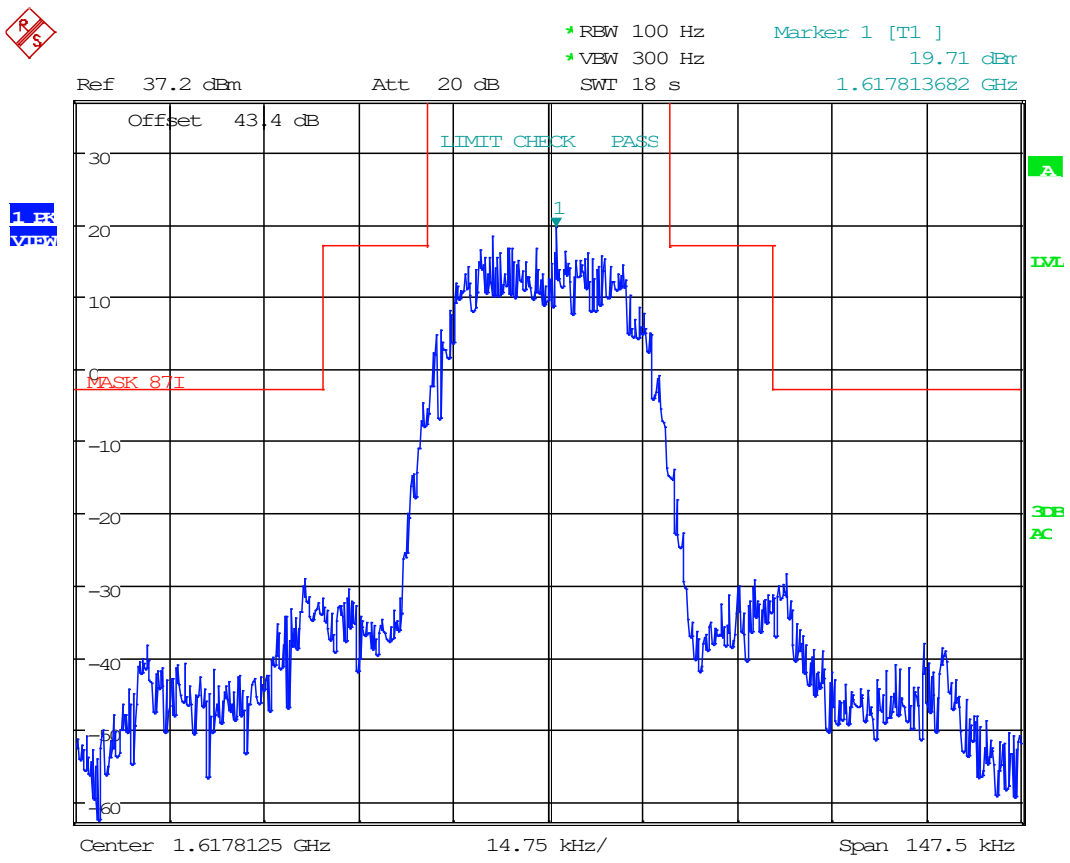
8.1.1 B1, Ch 44, Emission Mask, 1617.8125 MHz



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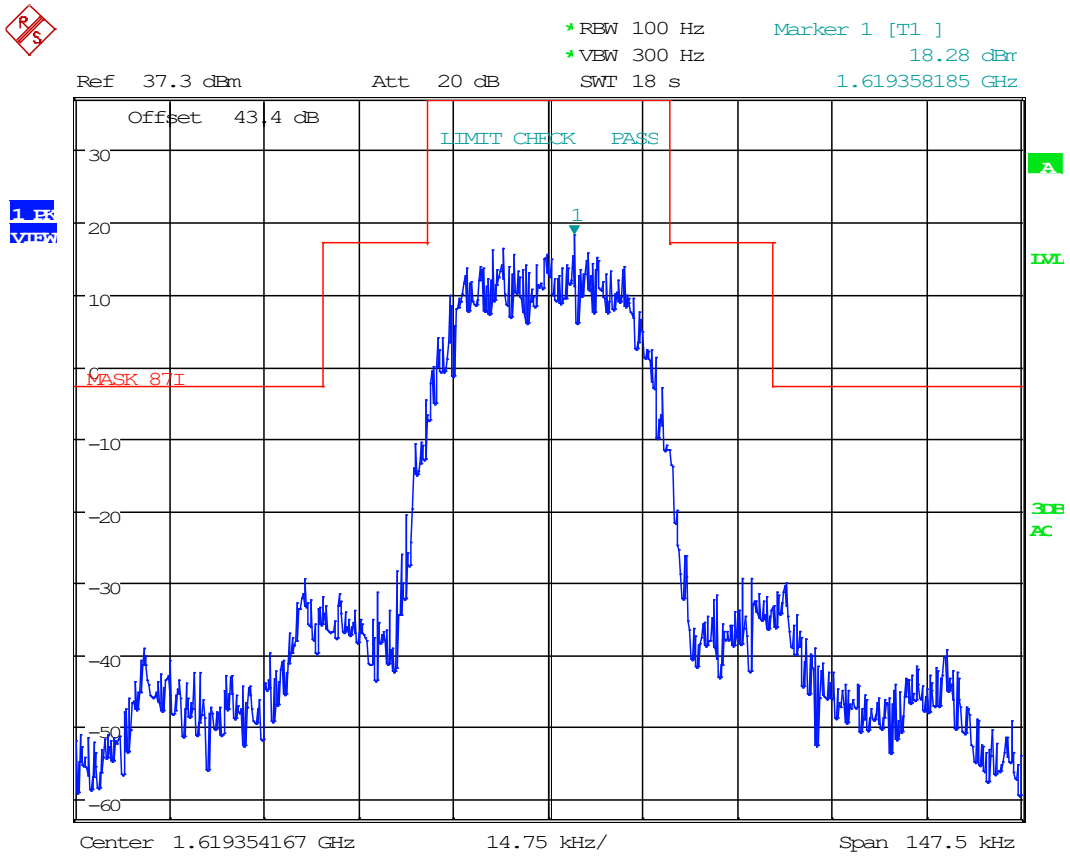
8.1.2 B1, Ch 81, Emission Mask, 1619.354167 MHz



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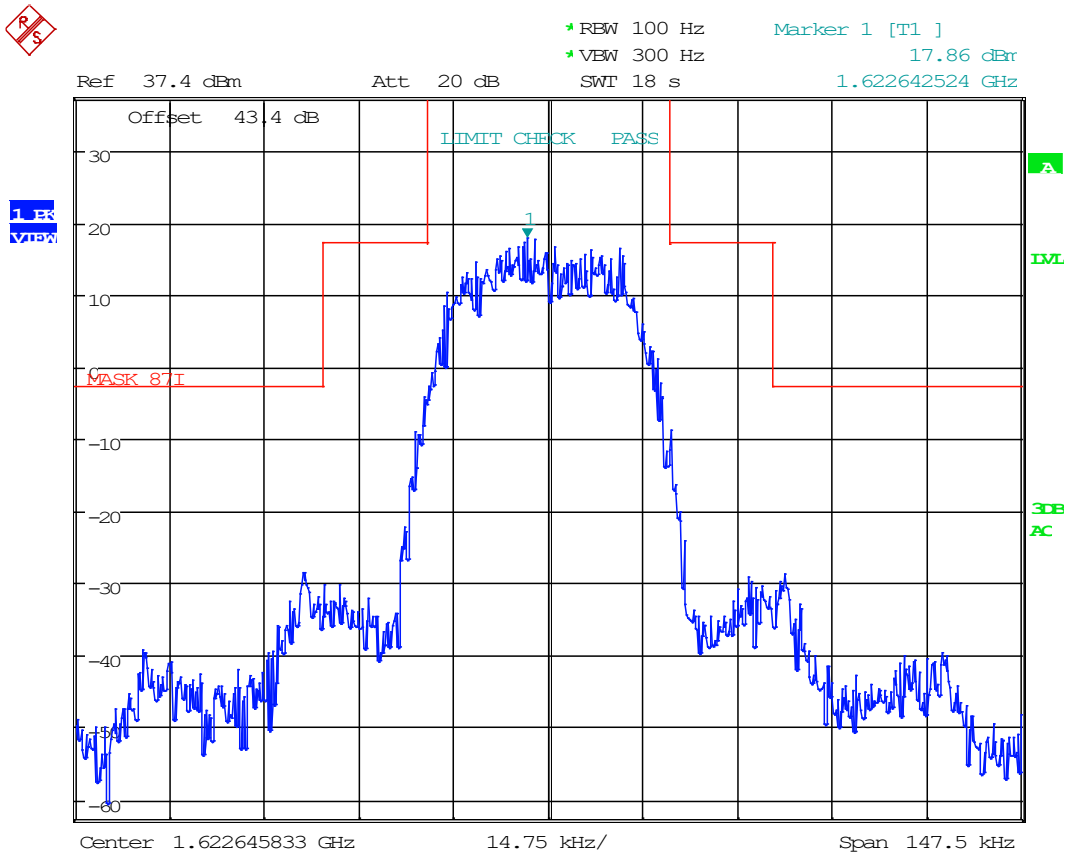
8.1.3 B1, Ch 160, Emission Mask, 1622.645833 MHz



Date: 20.SEP.2022 09:11:43

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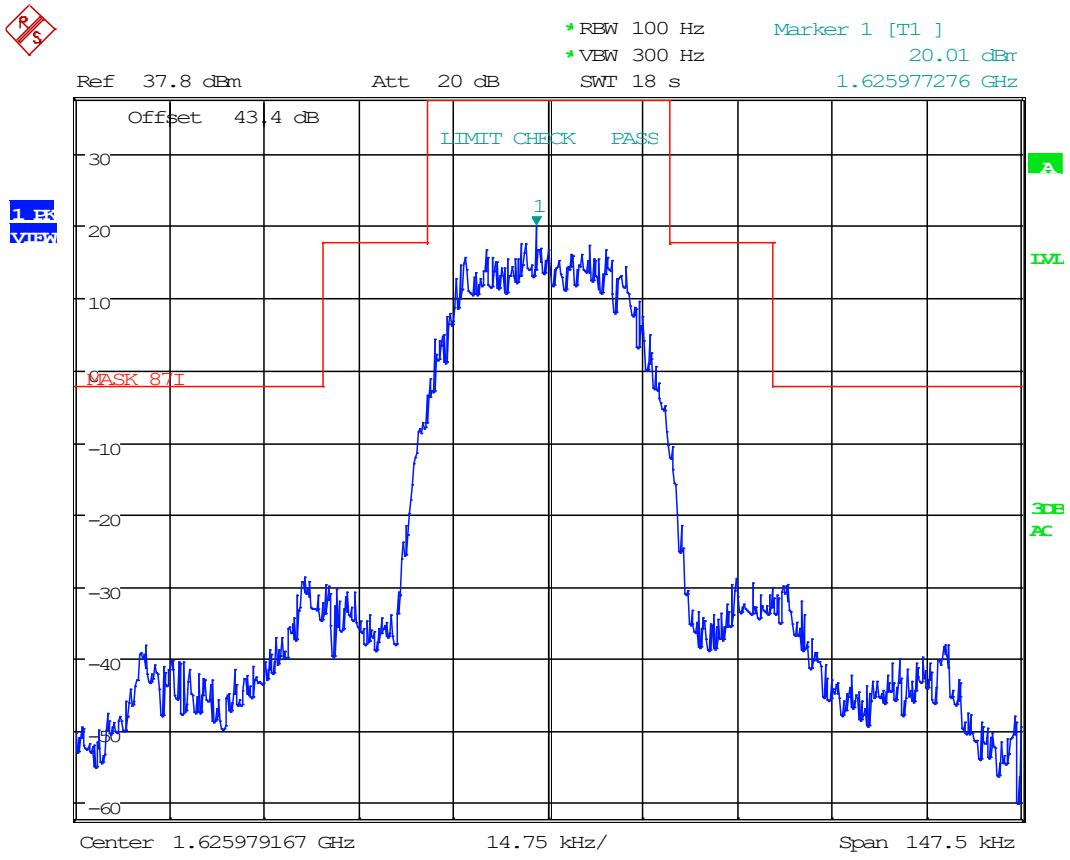
8.1.4 B1, Ch 240, Emission Mask, 1625.979167 MHz



Date: 20.SEP.2022 09:17:43

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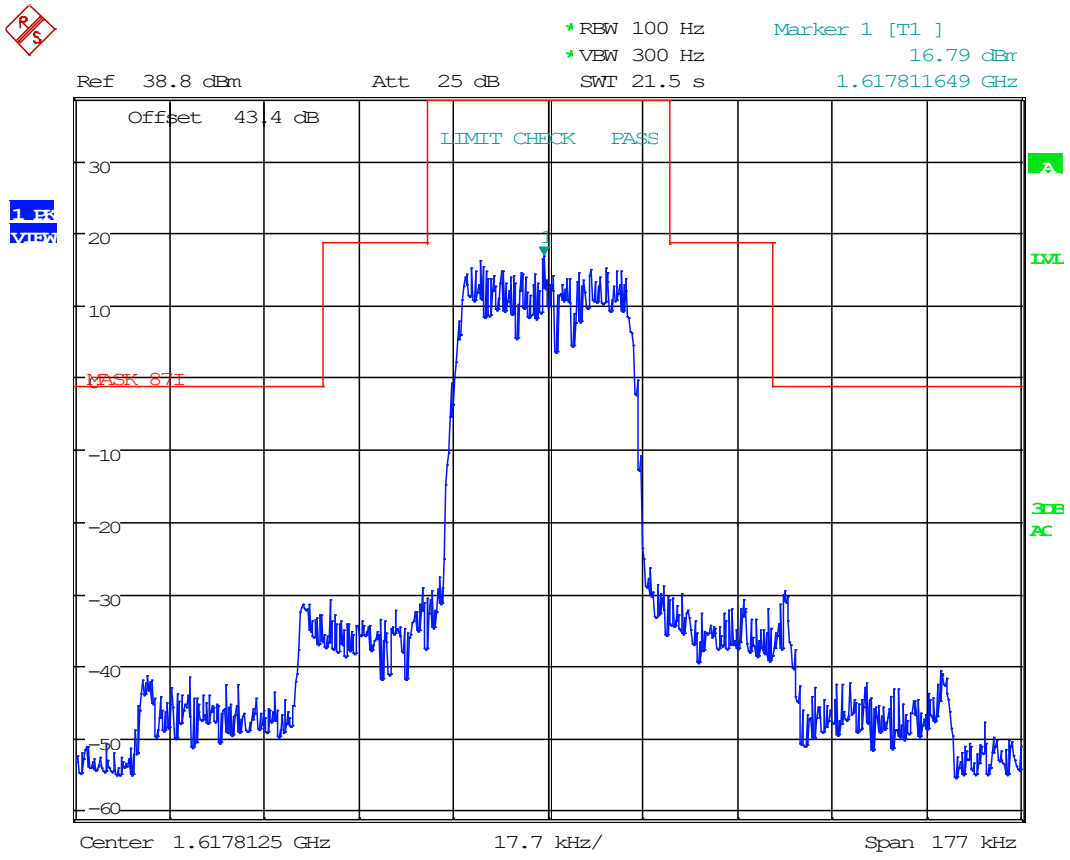
8.1.5 C1, Ch 44, Emission Mask, 1617.8125 MHz



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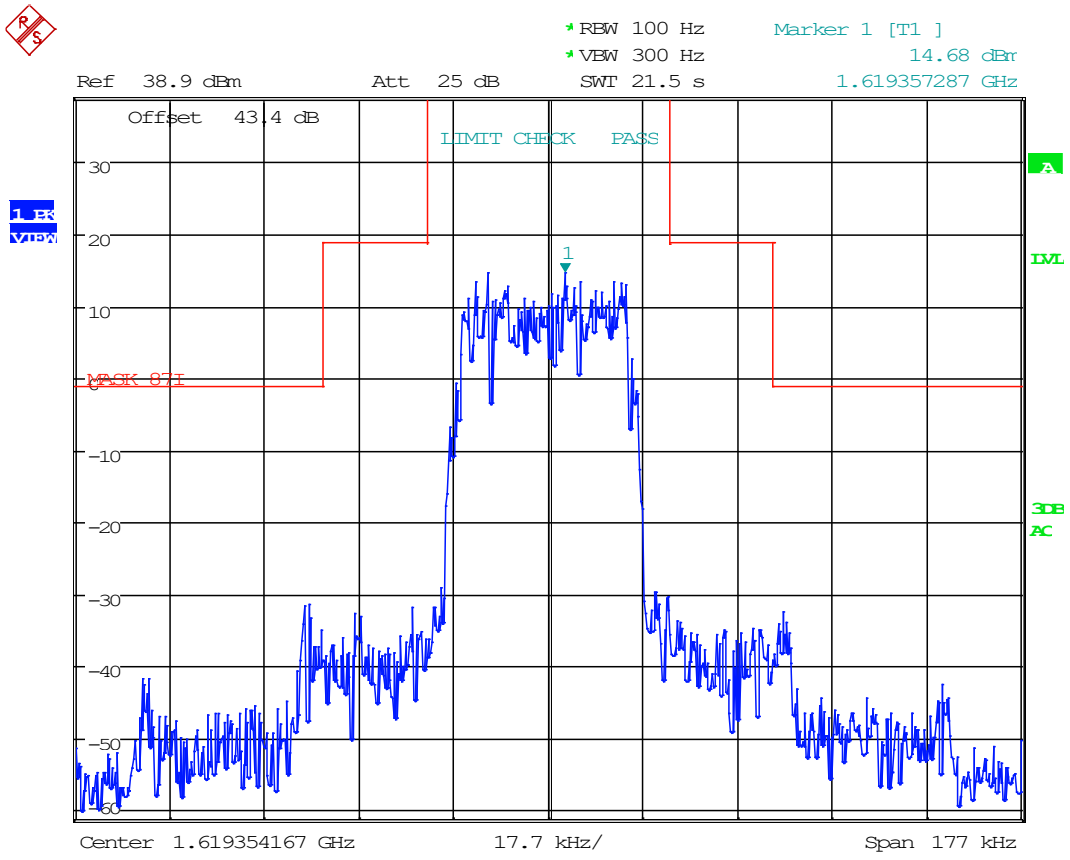
8.1.6 C1, Ch 81, Emission Mask, 1619.354167 MHz



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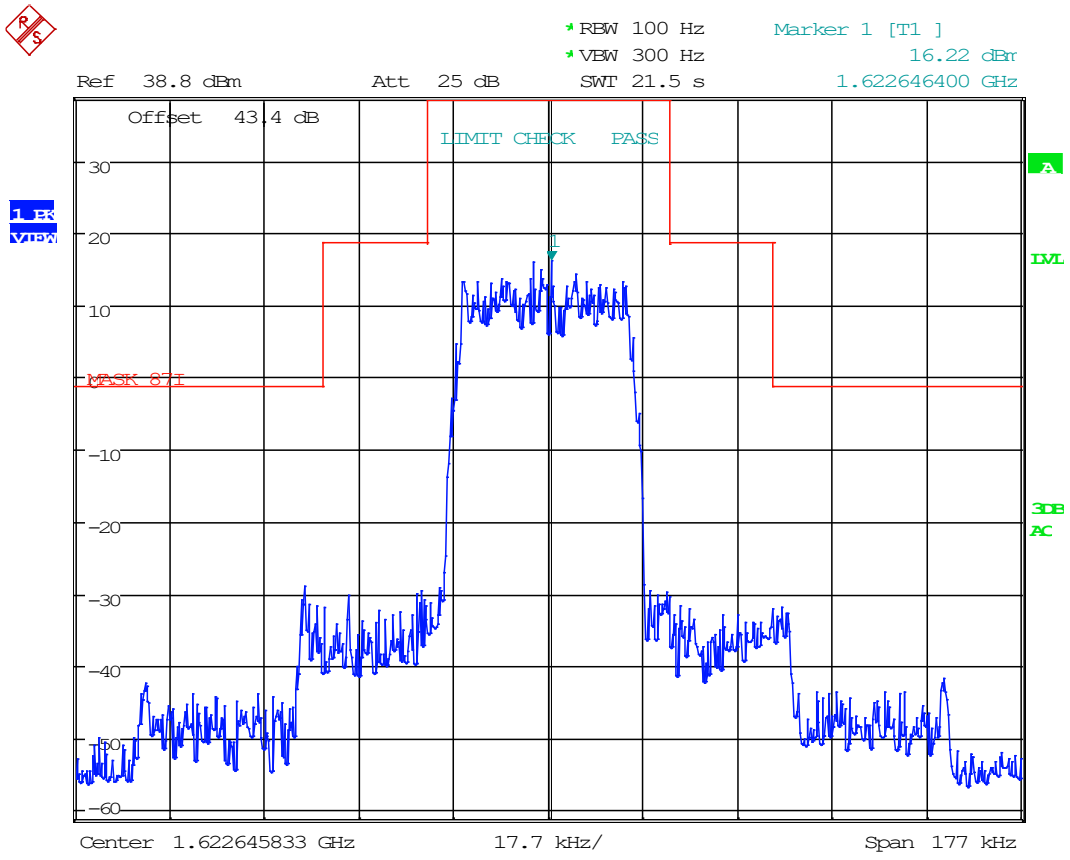
8.1.7 C1, Ch 160, Emission Mask, 1622.645833 MHz



Date: 20.SEP.2022 08:57:30

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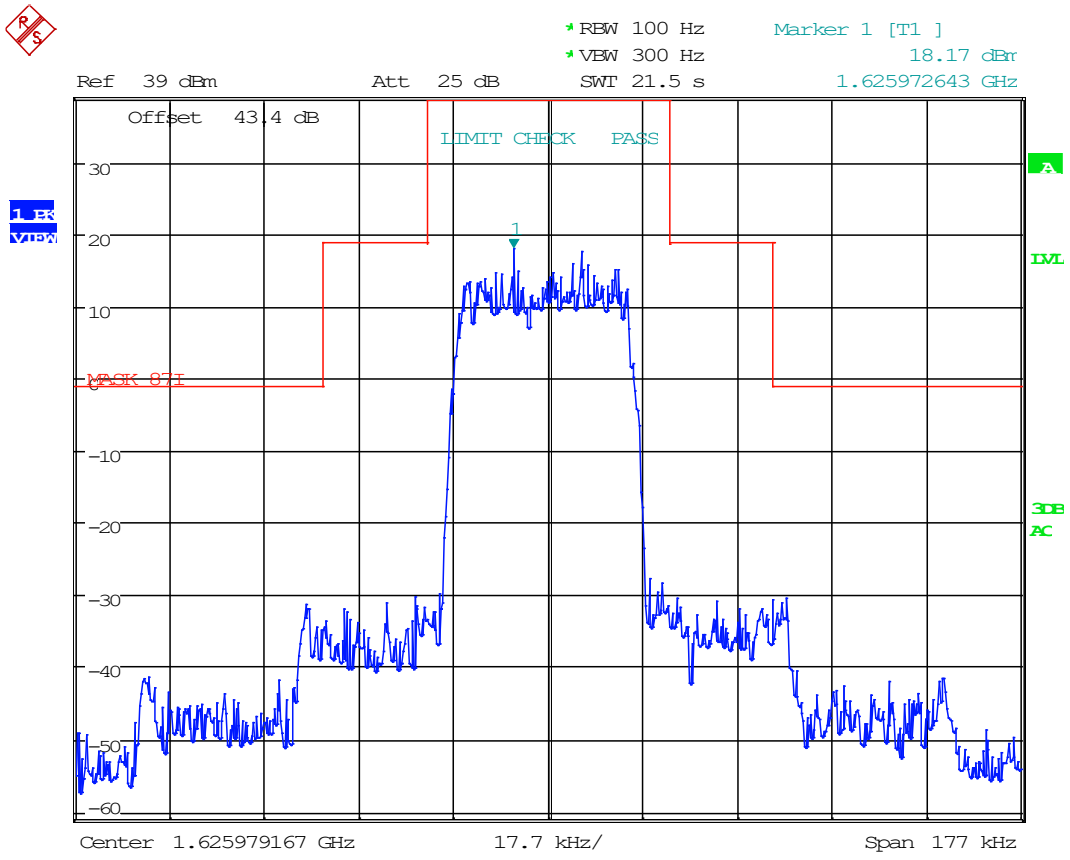
8.1.8 C1, Ch 240, Emission Mask, 1625.979167 MHz



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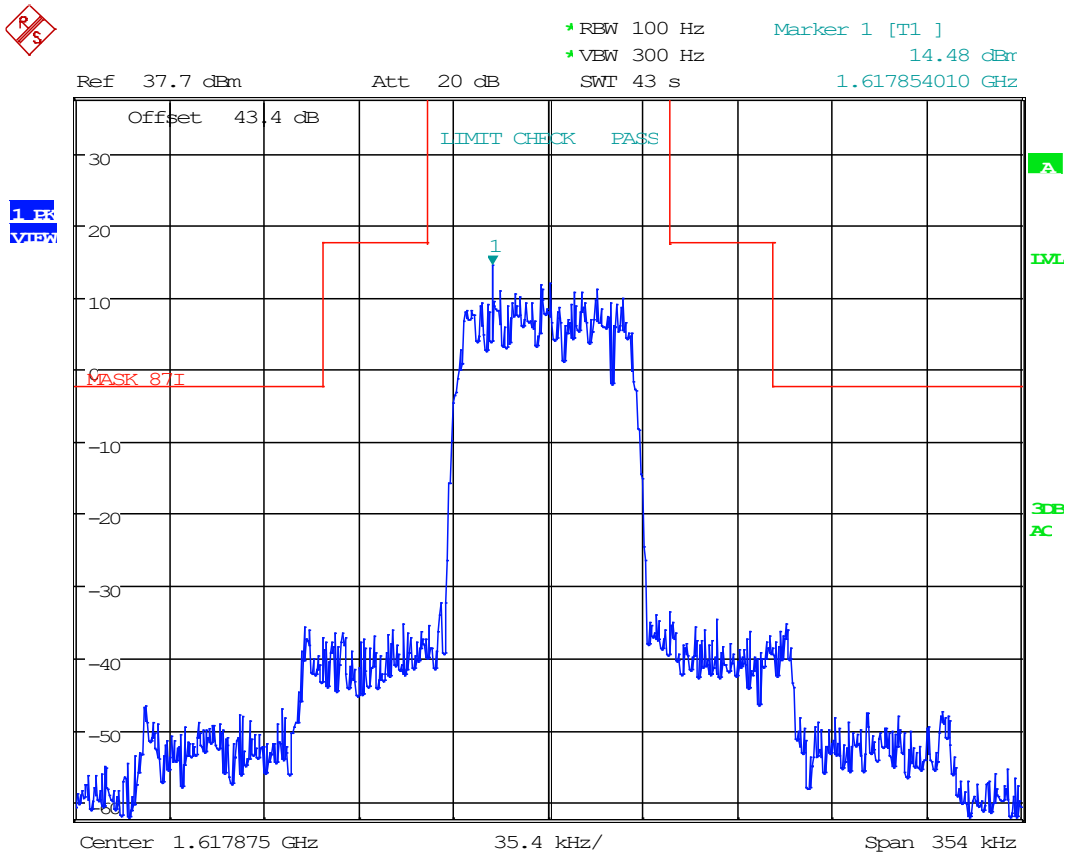
8.1.9 C2, Ch 45, Emission Mask, 1617.875 MHz



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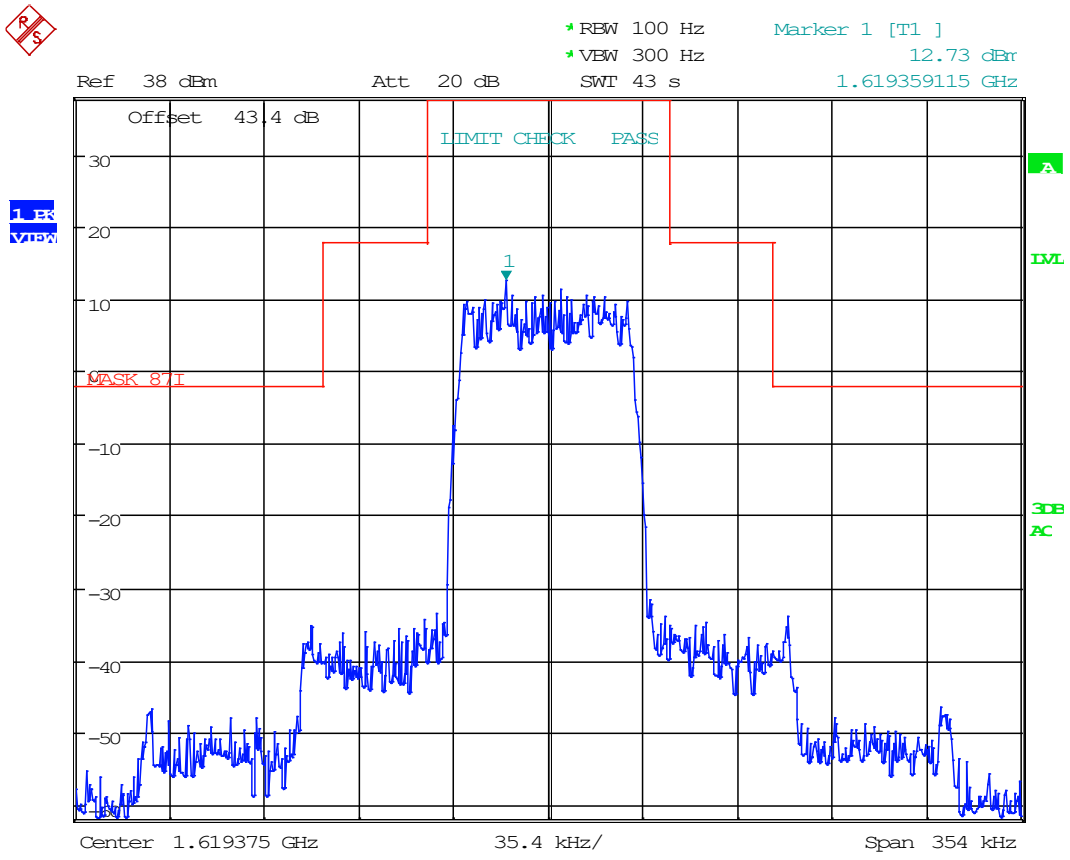
8.1.10 C2, Ch 81, Emission Mask, 1619.375 MHz



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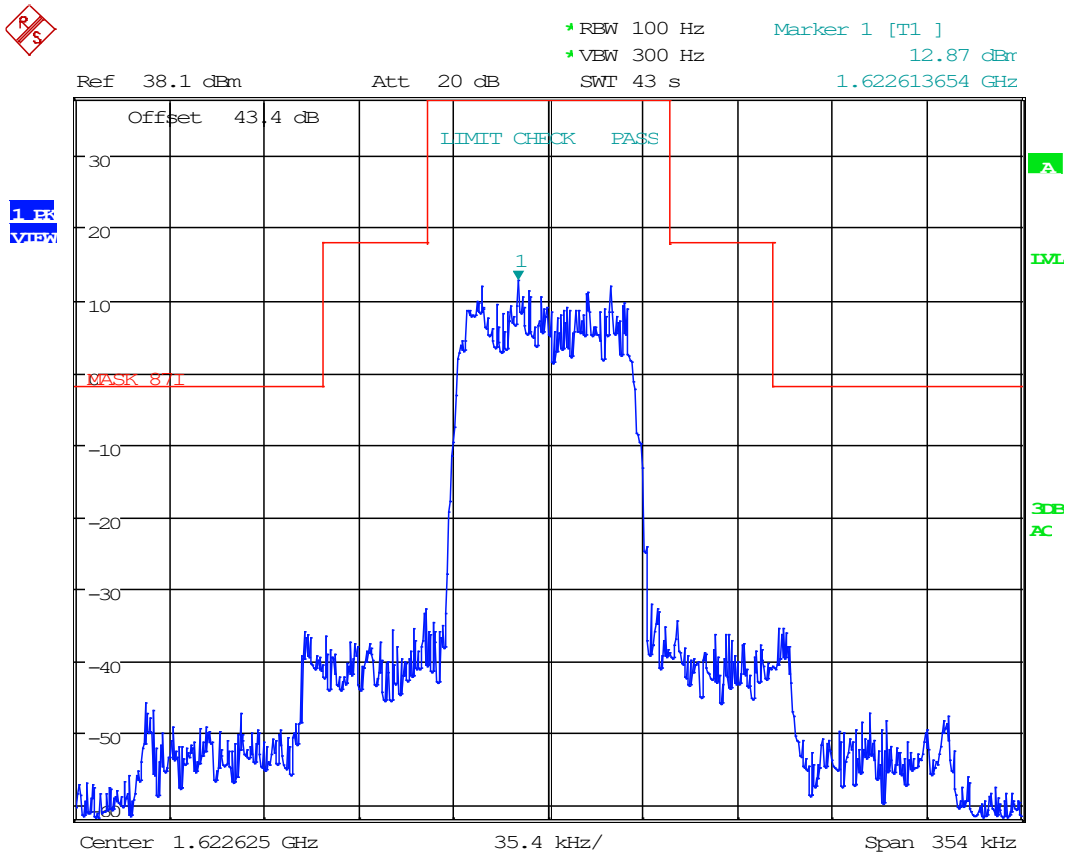
8.1.11 C2, Ch 160, Emission Mask, 1622.625 MHz



Date: 20.SEP.2022 08:41:10

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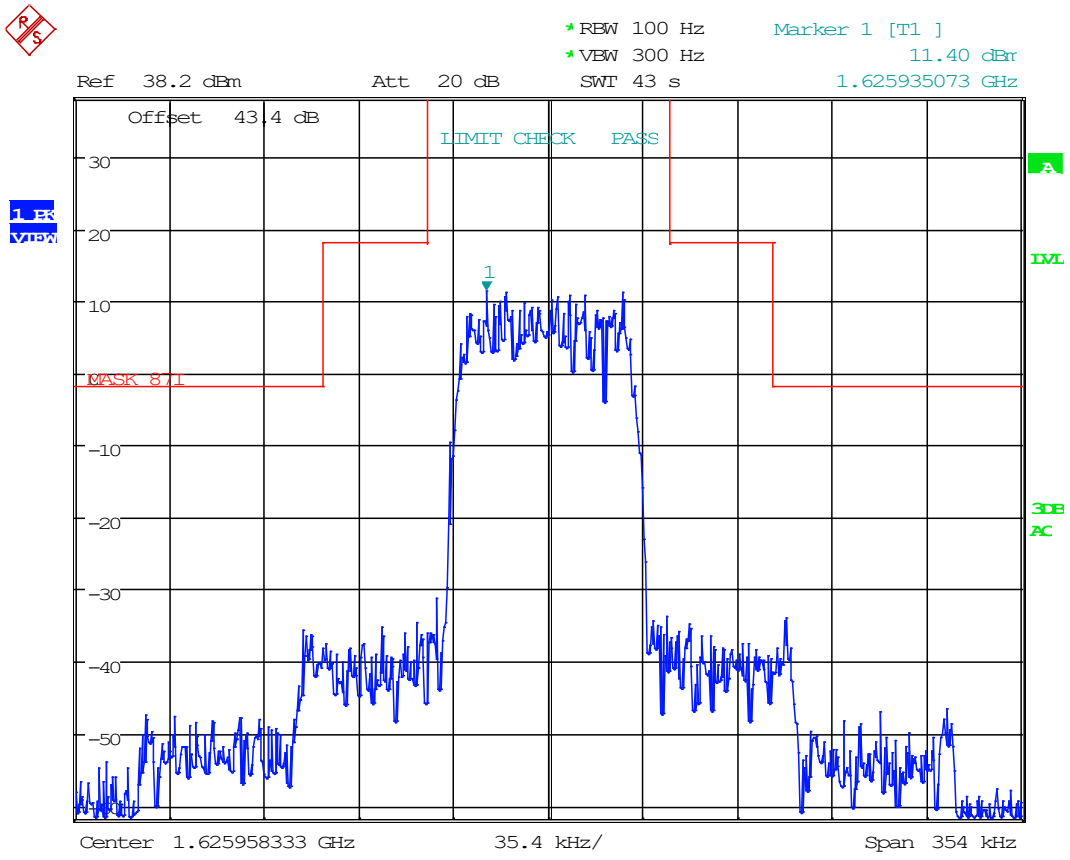
8.1.12 C2, Ch 240, Emission Mask, 1625.958333 MHz



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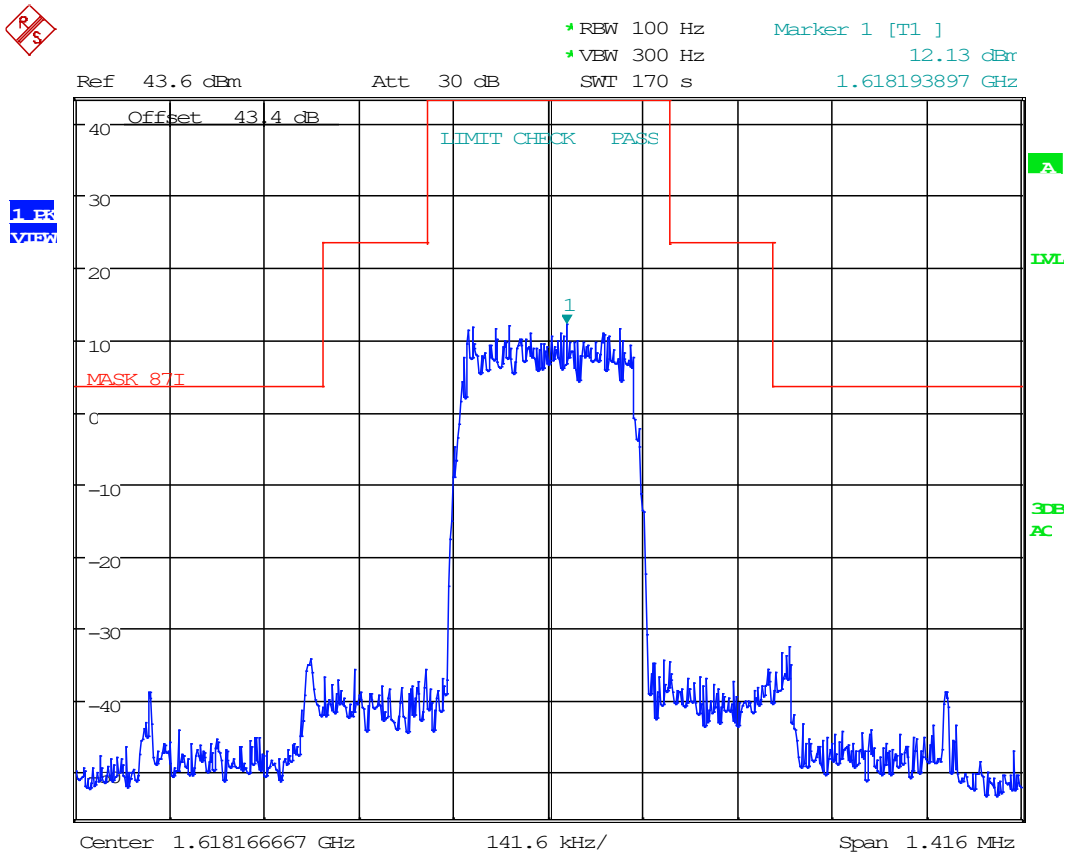
8.1.13 C8Q, Ch 49, Emission Mask, 1618.1666667 MHz



Date: 19.SEP.2022 16:36:08

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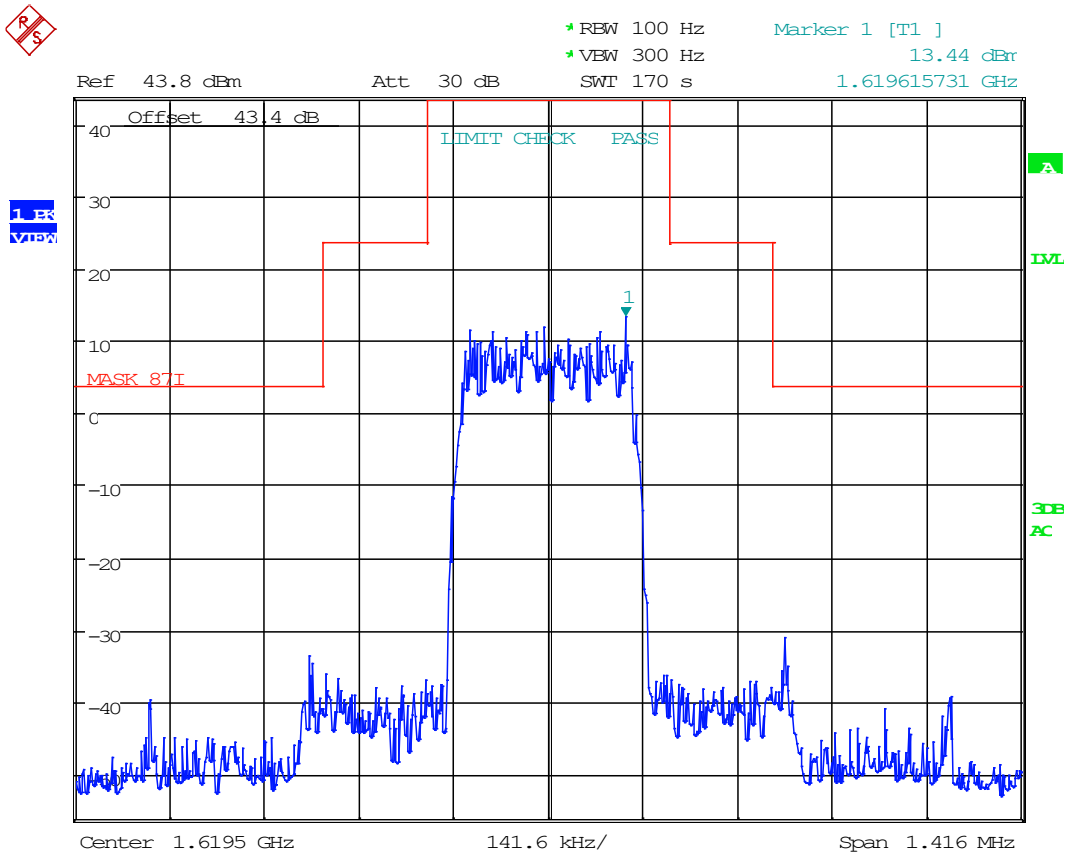
8.1.14 C8Q, Ch 81, Emission Mask, 1619.5 MHz



Date: 19.SEP.2022 17:16:15

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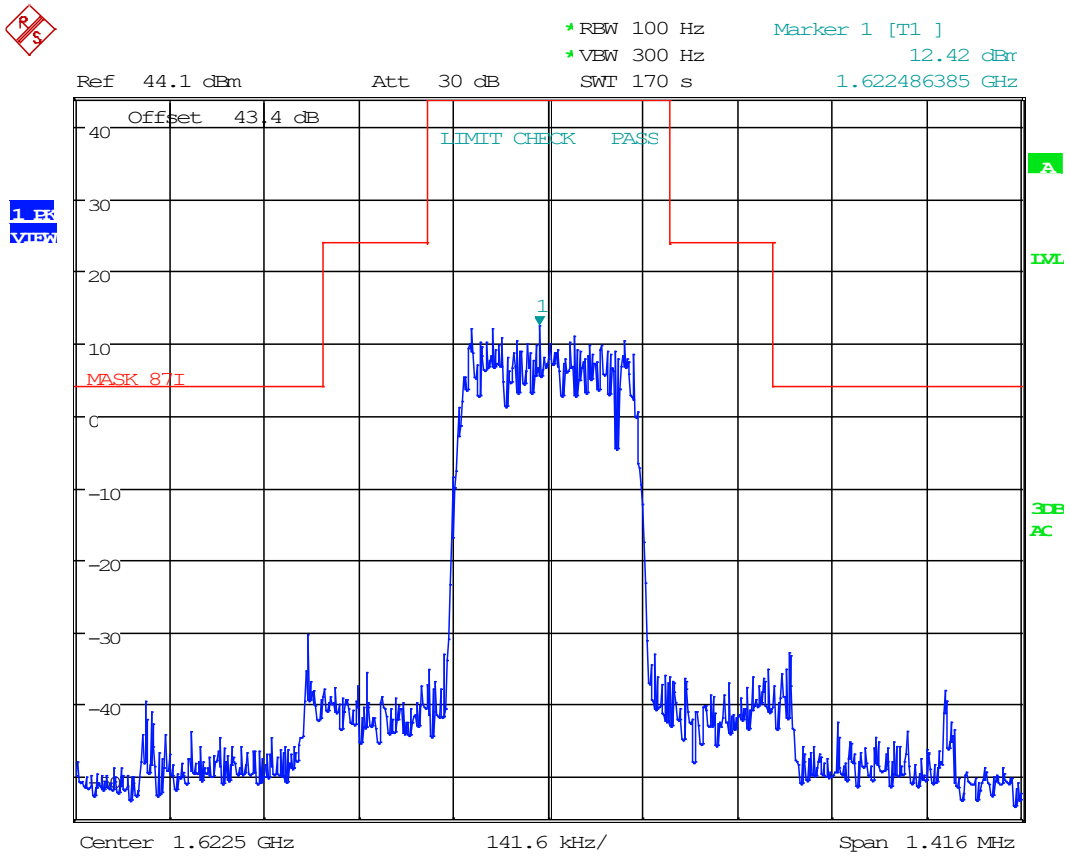
8.1.15 C8Q, Ch 160, Emission Mask, 1622.5 MHz



Date: 19.SEP.2022 17:20:20

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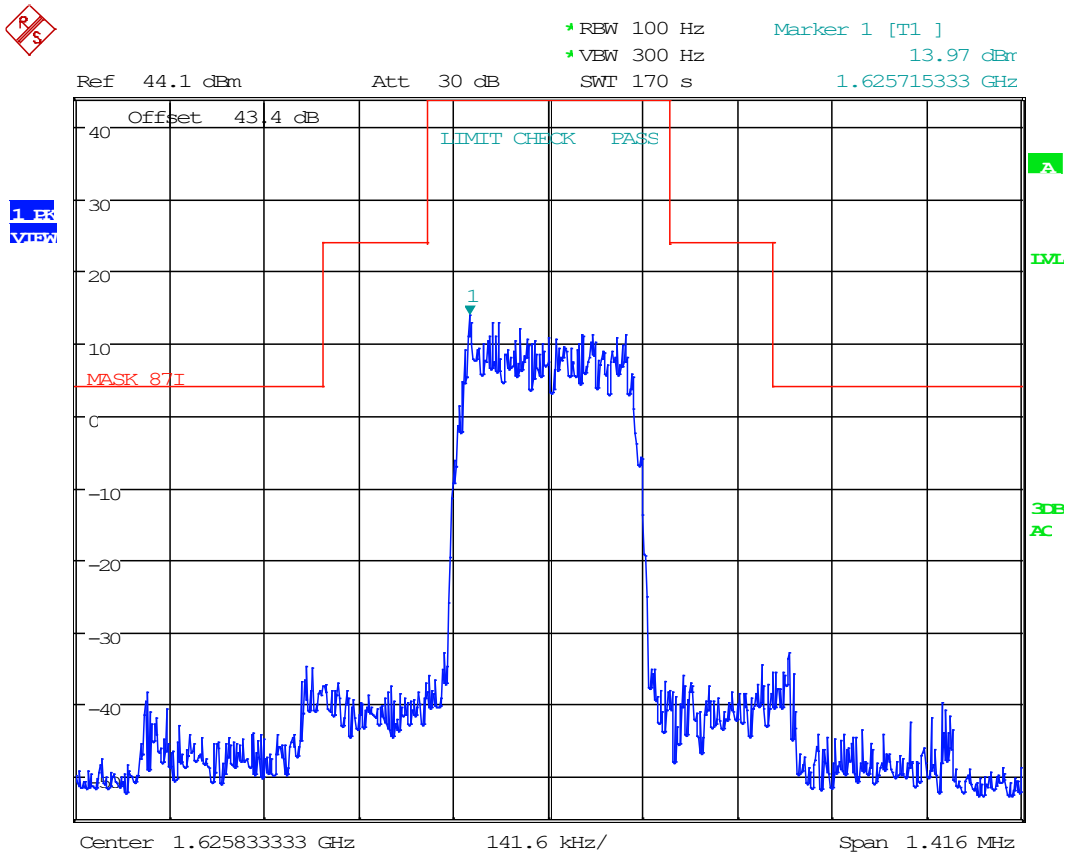
8.1.16 C8Q, Ch 240, Emission Mask, 1625.833333 MHz



Date: 19.SEP.2022 17:25:32

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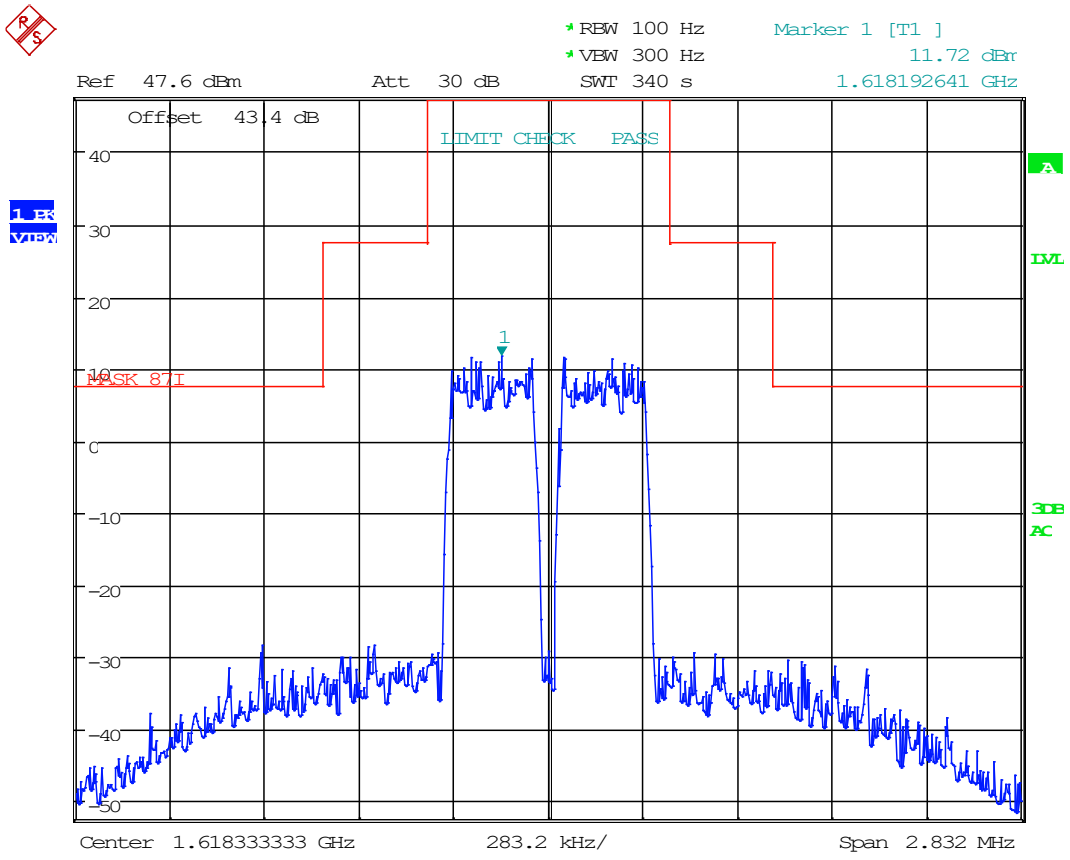
8.1.17 2C8Q, Ch 49, Emission Mask, 1618.333333 MHz



Date: 19.SEP.2022 16:45:49

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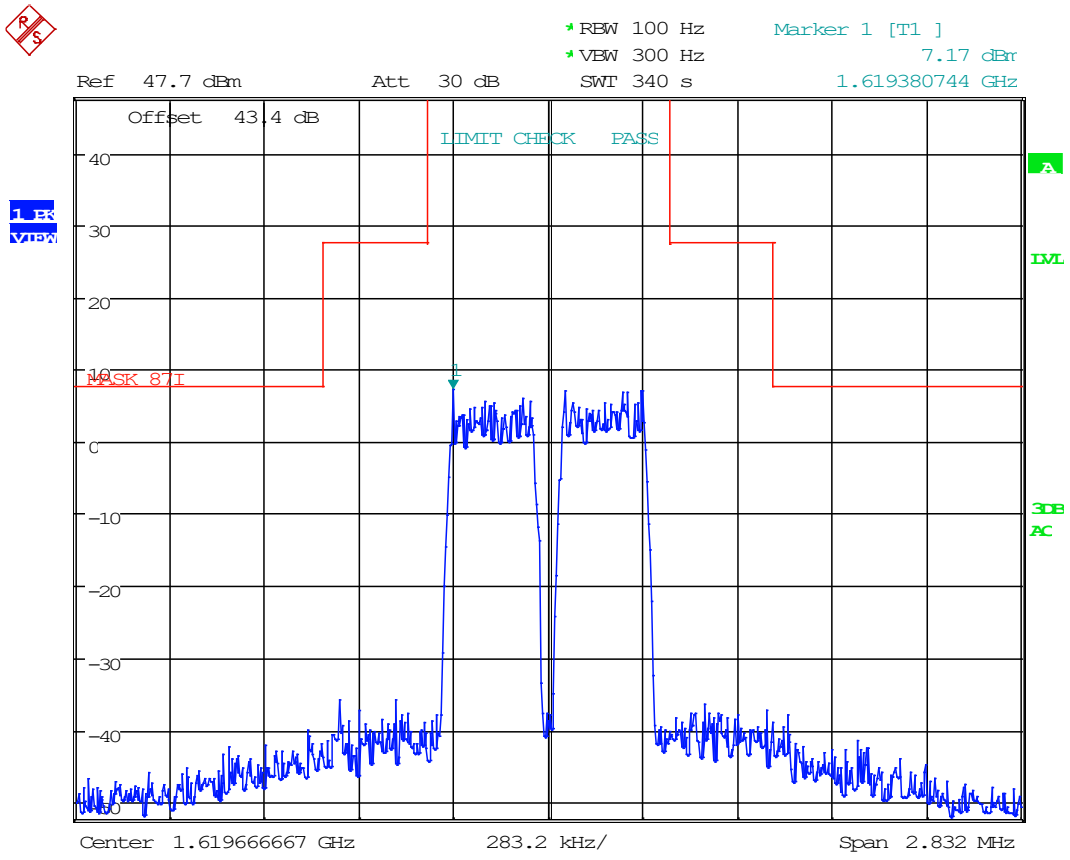
8.1.18 2C8Q, Ch 81, Emission Mask, 1619.666667 MHz



Date: 19.SEP.2022 16:53:34

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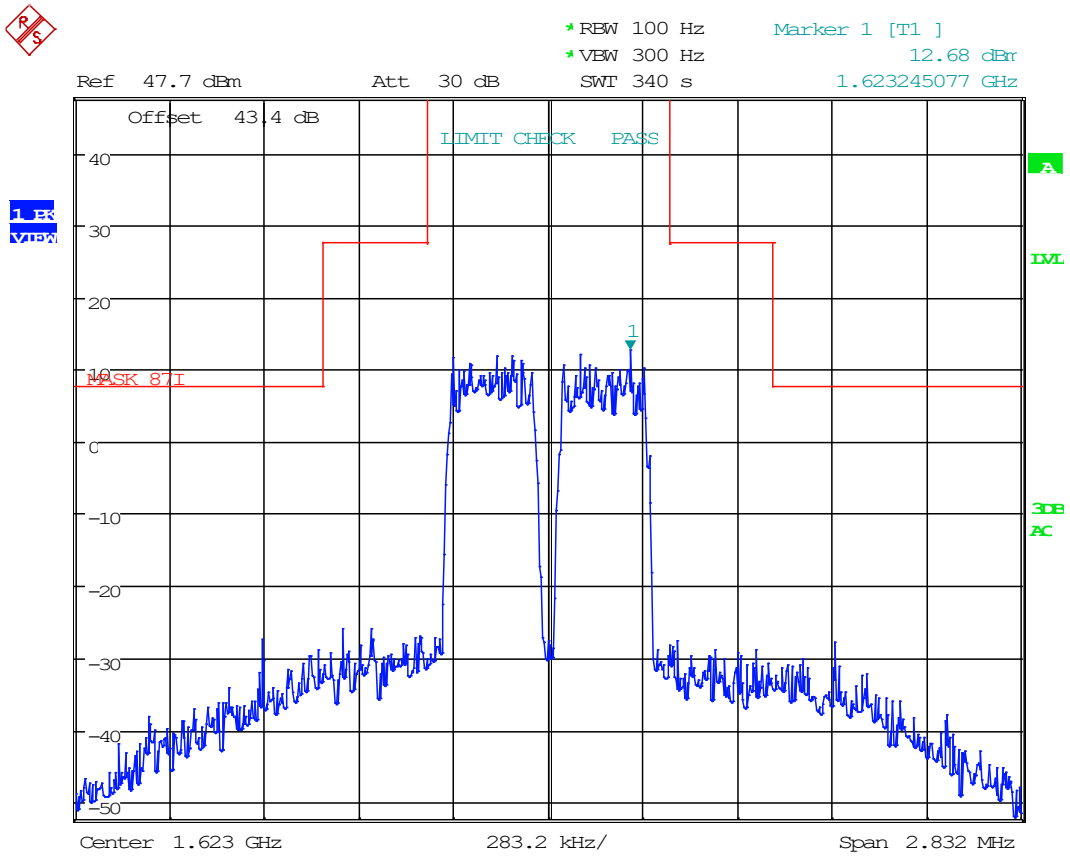
8.1.19 2C8Q, Ch 161, Emission Mask, 1623.0 MHz



Date: 19.SEP.2022 17:00:58

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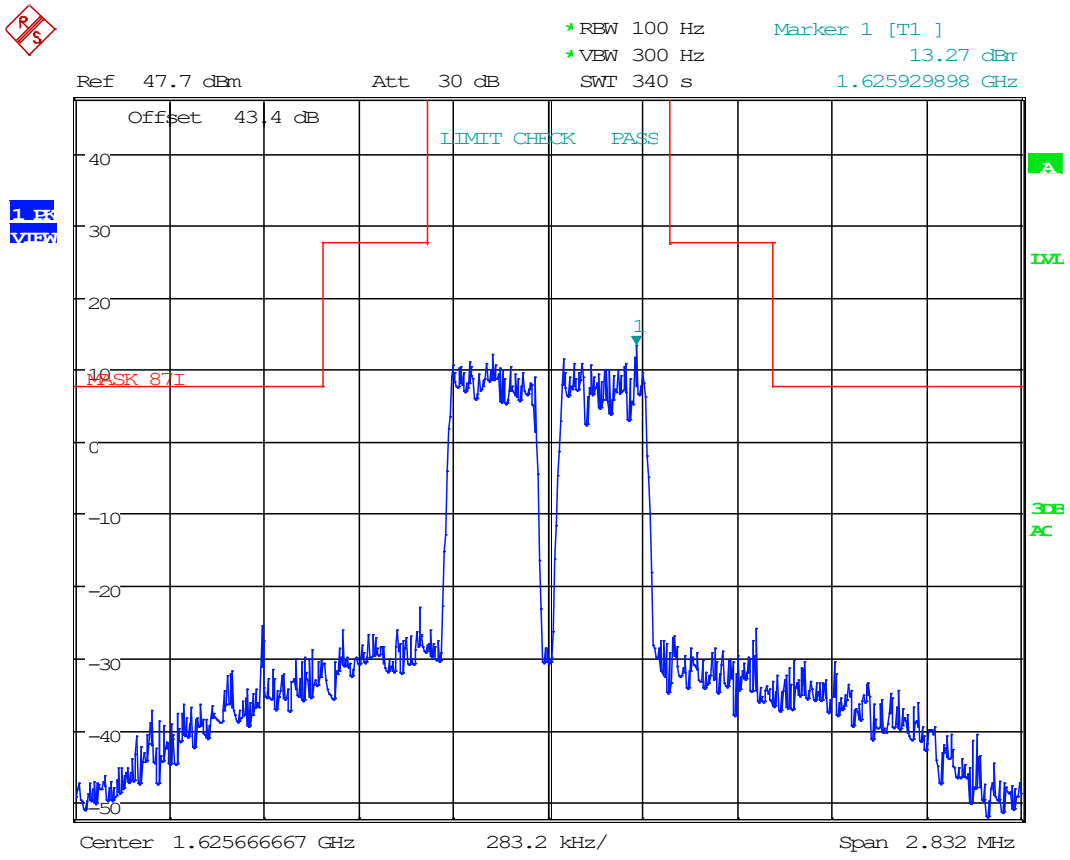
8.1.20 2C8Q, Ch 232, Emission Mask, 1625.666667 MHz



Date: 19.SEP.2022 17:09:13

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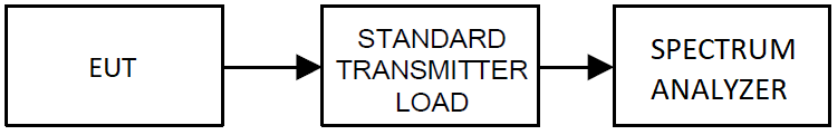
Conducted Emissions Mask, Spectrum Plots

8.2 Spurious Emissions at Antenna Terminals, Conducted

Limits from FCC Parts 2.1051, and 87.139(d); and test procedure from ANSI C63.26-2015.

Conducted Test Setup


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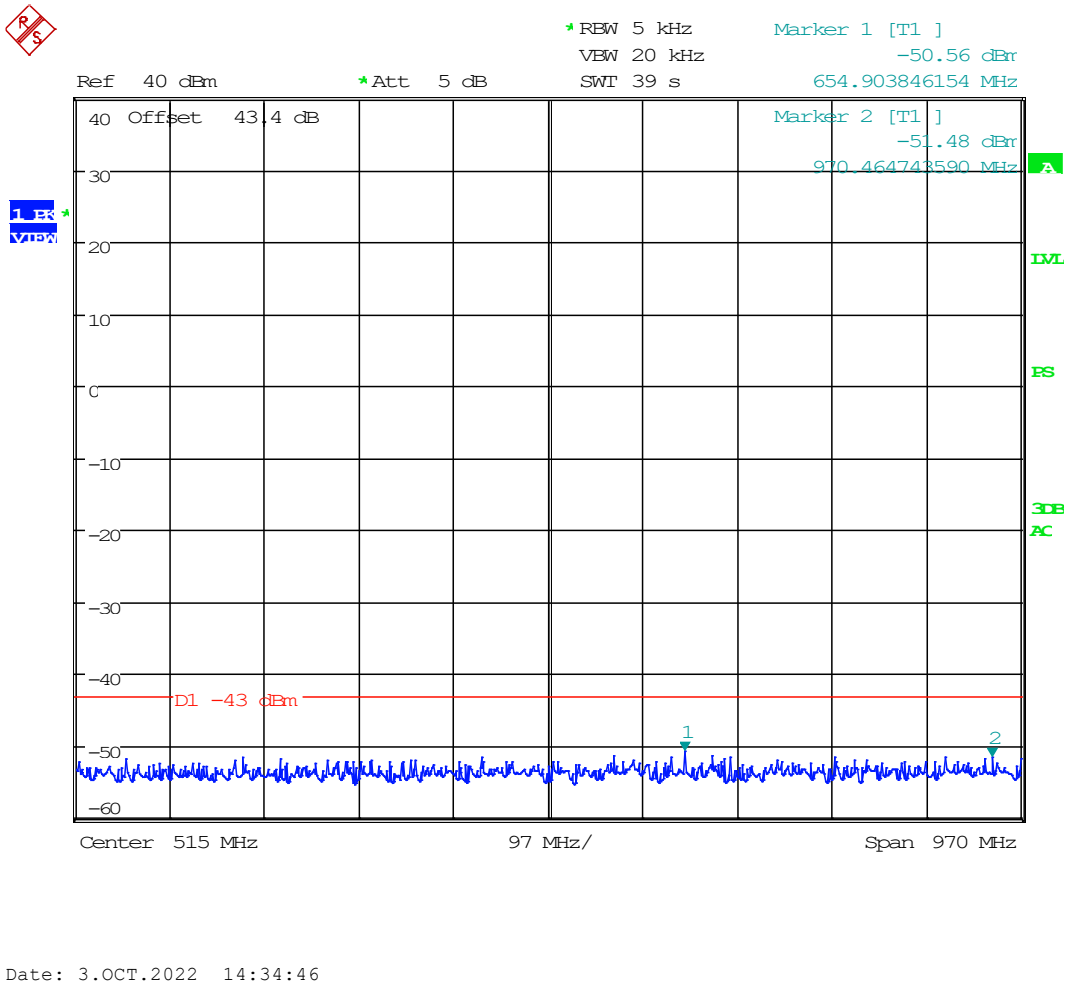
8.2.1 2C8Q, Ch 49, Conducted Emissions, Below 1GHz, 1617.8125 MHz



Note: inline filter added

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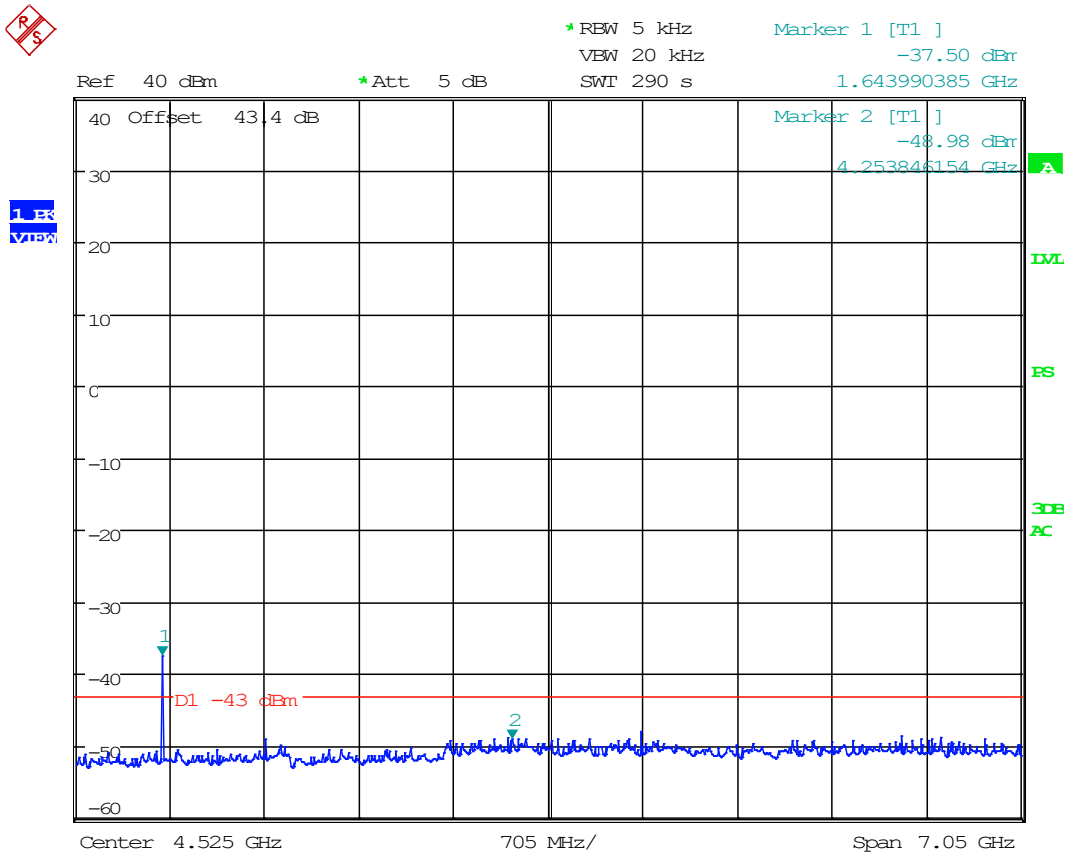
8.2.2 2C8Q, Ch 49, Conducted Emissions, Above 1GHz, 1617.8125 MHz



Note: inline filter added

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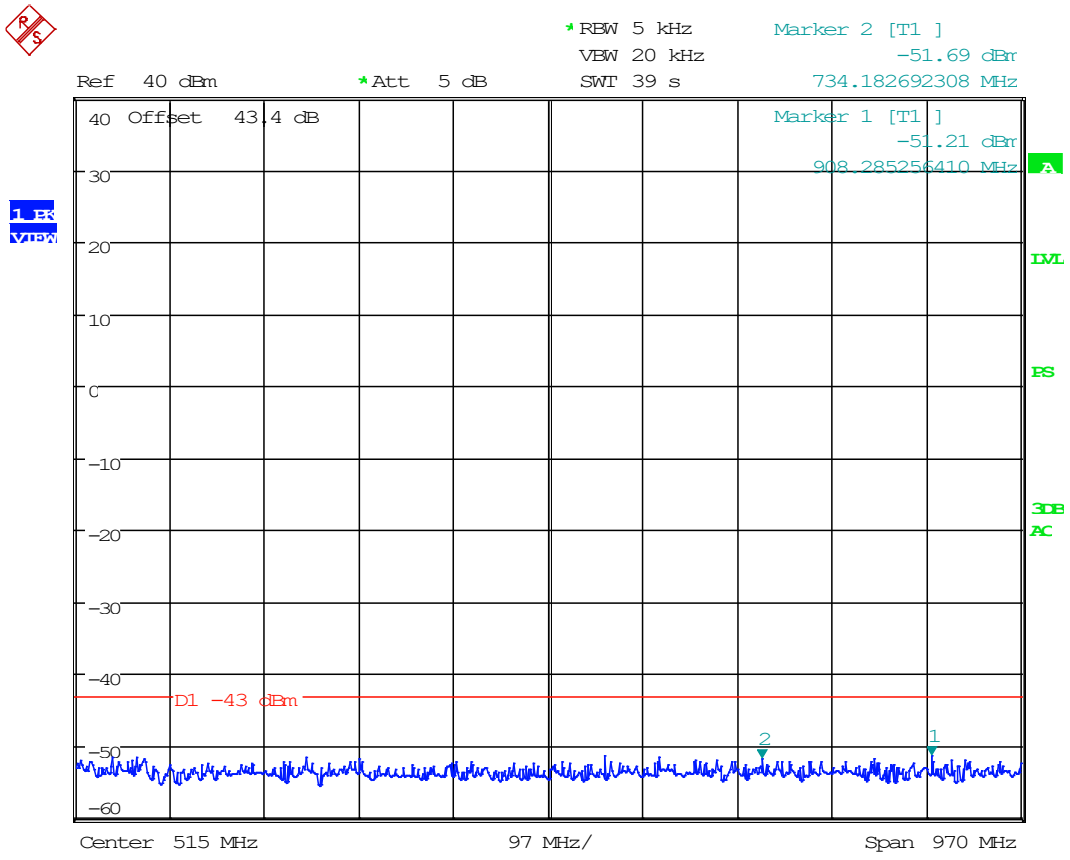
8.2.3 2C8Q, Ch 81, Conducted Emissions, Below 1GHz, 1619.666667 MHz



Date: 29.AUG.2022 16:53:27

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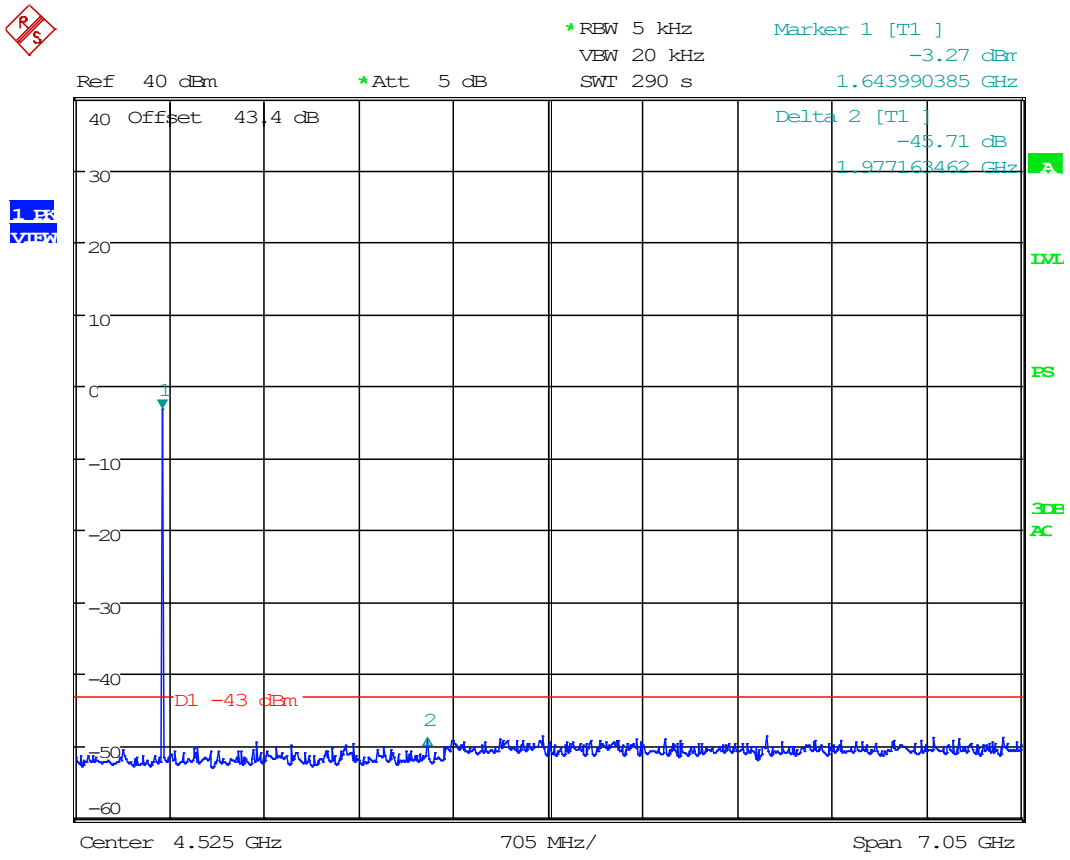
8.2.4 2C8Q, Ch 81, Conducted Emissions, Above 1GHz, 1619.666667 MHz



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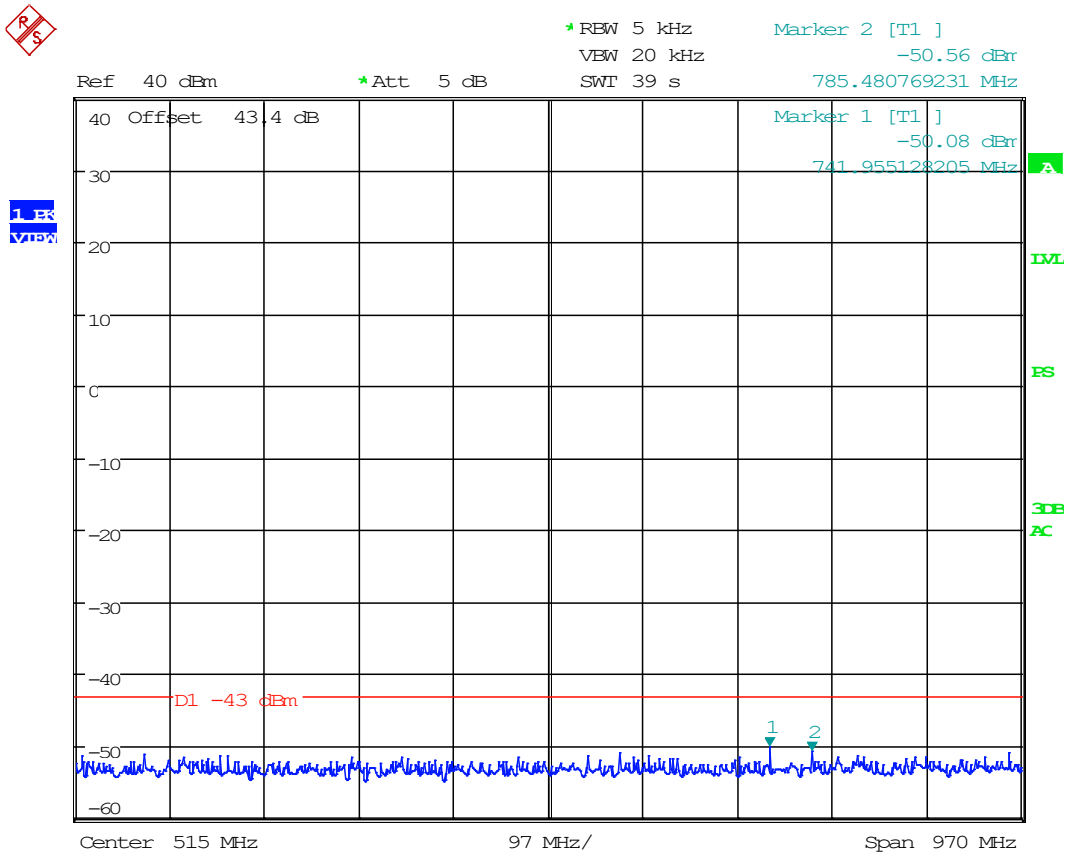
8.2.5 2C8Q, Ch 161, Conducted Emissions, Below 1GHz, 1623.0 MHz



Date: 29.AUG.2022 16:56:26

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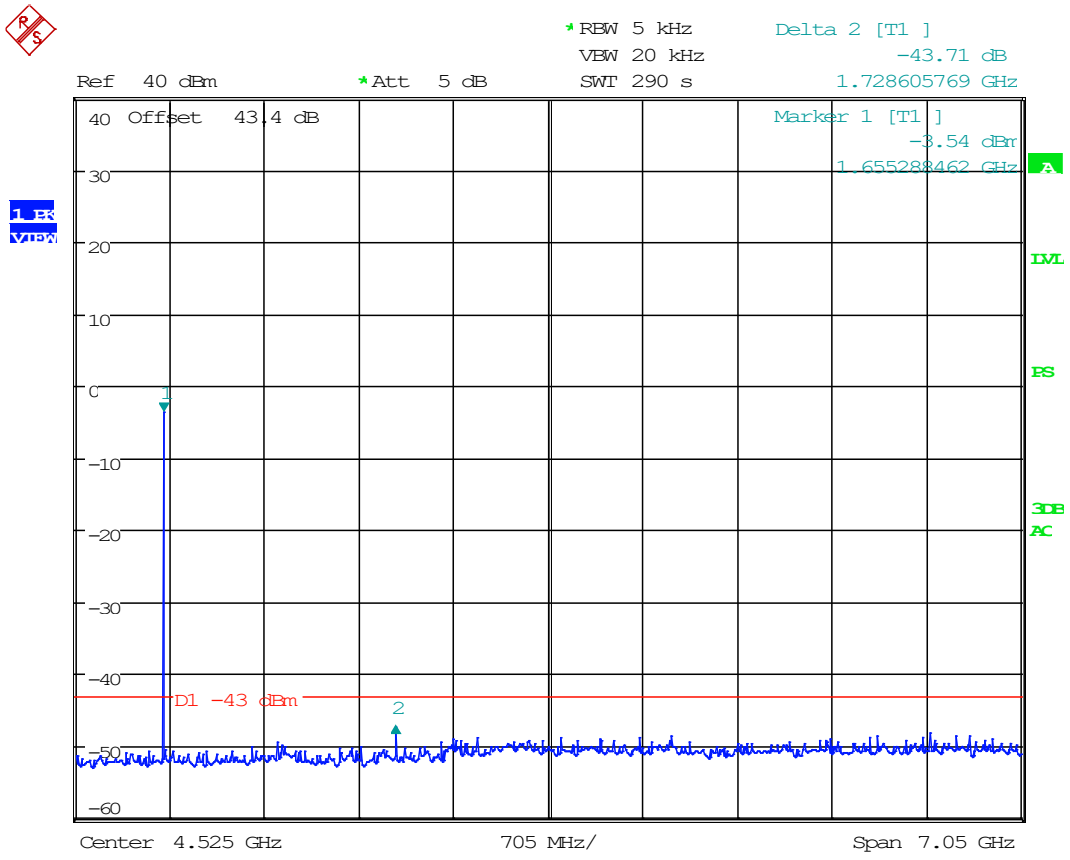
8.2.6 2C8Q, Ch 161, Conducted Emissions, Above 1GHz, 1623.0 MHz



Date: 29.AUG.2022 17:14:07

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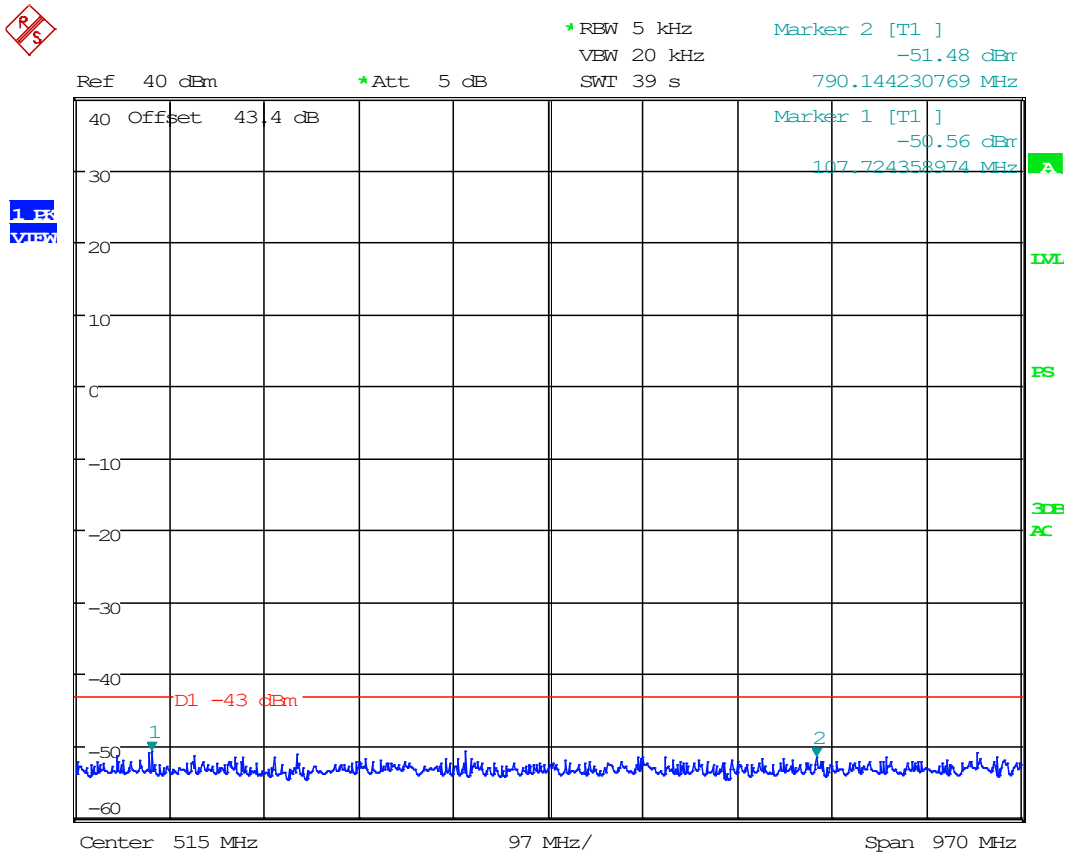
8.2.7 2C8Q, Ch, 232, Conducted Emissions, Below 1GHz, 1625.666667 MHz



Date: 29.AUG.2022 16:59:35

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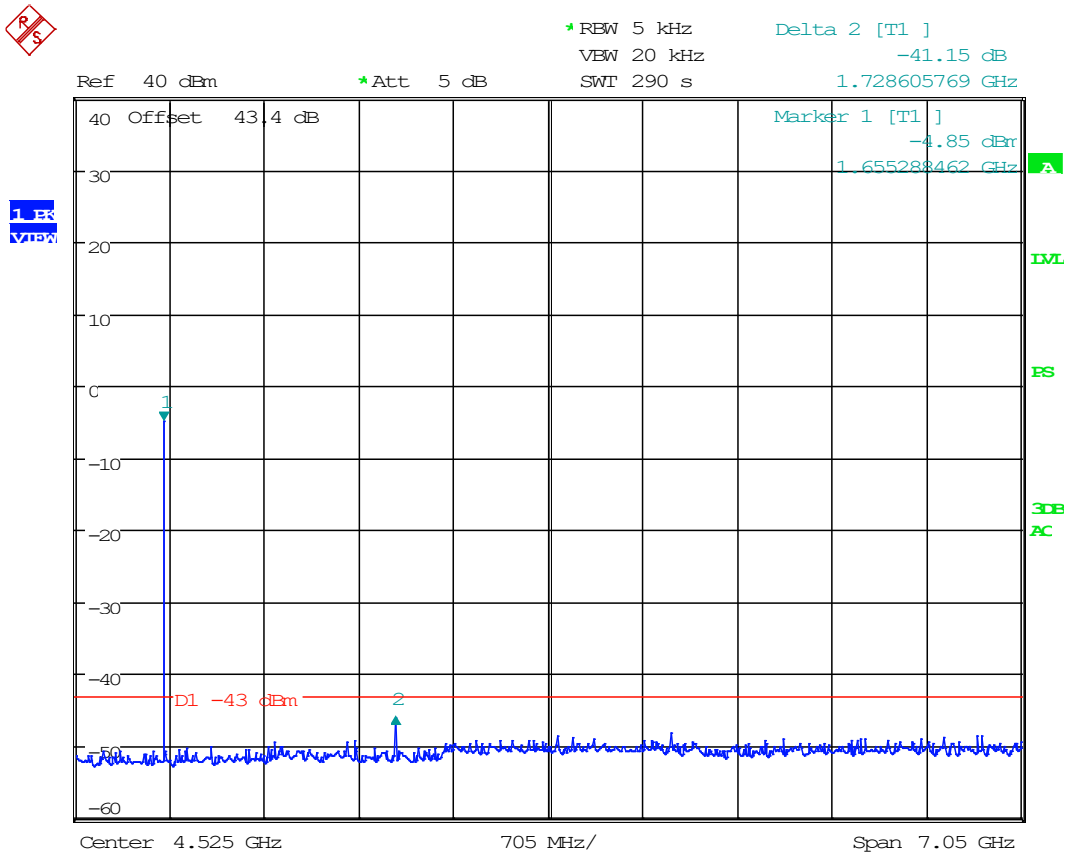
8.2.8 2C8Q, Ch 232, Conducted Emissions, Above 1GHz, 1625.666667 MHz



Date: 29.AUG.2022 17:08:11

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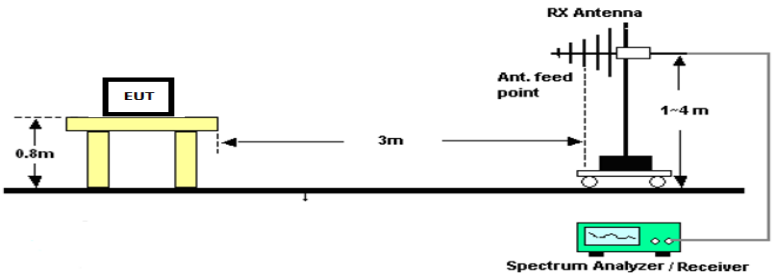
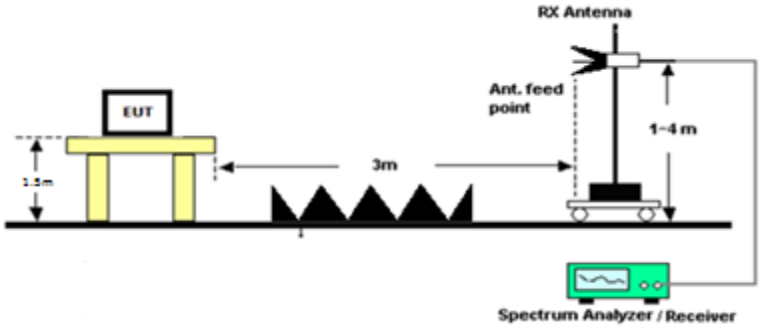
8.3 Field Strength of Spurious Emissions

Limits from FCC Parts 2.1053, 87.139 (a); and test procedure from ANSI C63.26-2015.

Radiated Test Setup, 30 – 1000 MHz


Radiated Test Setup, Above 1000 MHz


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Radiated Emissions, Tabular Data

8.3.1 Radiated Emissions, 1618.333333 MHz

Tuned Frequency (MHz)	Emission Frequency (MHz)	Detector	Meter Reading (dBuV)	Antenna Polarity	Coax Loss (dB)	Antenna Correction Factor (dB/m)	Distance (m)	Field Strength (dBµV/m)	ERP (dBm)	Spurious Limit (dBm)	Margin (dB)
1618.33	3236.67	PK	17.10	H	6.64	32.68	3.00	56.42	-40.95	-13.00	27.95
1618.33	3236.67	PK	22.37	V	6.64	32.68	3.00	61.69	-35.68	-13.00	22.68
1618.33	4855.00	PK	16.79	H	7.24	33.94	3.00	57.97	-39.41	-13.00	26.41
1618.33	4855.00	PK	16.46	V	7.24	33.94	3.00	57.64	-39.74	-13.00	26.74
1618.33	6473.33	PK	20.46	H	9.03	35.53	3.00	65.02	-32.36	-13.00	19.36
1618.33	6473.33	PK	20.57	V	9.03	35.53	3.00	65.13	-32.25	-13.00	19.25
1618.33	8091.67	PK	15.06	H	9.91	35.79	3.00	60.77	-36.61	-13.00	23.61
1618.33	8091.67	PK	14.59	V	9.91	35.79	3.00	60.30	-37.08	-13.00	24.08
1618.33	9710.00	PK	15.31	H	10.88	36.85	3.00	63.04	-34.34	-13.00	21.34
1618.33	9710.00	PK	15.70	V	10.88	36.85	3.00	63.43	-33.95	-13.00	20.95
1618.33	11328.33	PK	15.77	H	11.90	38.65	3.00	66.32	-31.06	-13.00	18.06
1618.33	11328.33	PK	16.57	V	11.90	38.65	3.00	67.12	-30.26	-13.00	17.26
1618.33	12946.67	PK	15.90	H	12.78	39.20	3.00	67.88	-29.49	-13.00	16.49
1618.33	12946.67	PK	16.48	V	12.78	39.20	3.00	68.46	-28.91	-13.00	15.91
1618.33	14565.00	PK	16.21	H	13.79	40.17	3.00	70.17	-27.21	-13.00	14.21
1618.33	14565.00	PK	16.94	V	13.79	40.17	3.00	70.90	-26.48	-13.00	13.48
1618.33	16183.33	PK	16.24	H	14.69	41.63	3.00	72.56	-24.82	-13.00	11.82
1618.33	16183.33	PK	17.55	V	14.69	41.63	3.00	73.87	-23.51	-13.00	10.51

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8.3.2 Radiated Emissions, 1619.666667 MHz

Tuned Frequency (MHz)	Emission Frequency (MHz)	Detector	Meter Reading (dBuV)	Antenna Polarity	Coax Loss (dB)	Antenna Correction Factor (dB/m)	Distance (m)	Field Strength (dBµV/m)	ERP (dBm)	Spurious Limit (dBm)	Margin (dB)
1619.67	3239.33	PK	20.07	H	6.64	32.68	3.00	59.39	-37.98	-13.00	24.98
1619.67	3239.33	PK	22.70	V	6.64	32.68	3.00	62.02	-35.35	-13.00	22.35
1619.67	4859.00	PK	16.29	H	7.25	33.94	3.00	57.48	-39.90	-13.00	26.90
1619.67	4859.00	PK	16.25	V	7.25	33.94	3.00	57.44	-39.94	-13.00	26.94
1619.67	6478.67	PK	20.83	H	9.04	35.53	3.00	65.40	-31.98	-13.00	18.98
1619.67	6478.67	PK	20.63	V	9.04	35.53	3.00	65.20	-32.18	-13.00	19.18
1619.67	8098.33	PK	14.75	H	9.92	35.80	3.00	60.47	-36.91	-13.00	23.91
1619.67	8098.33	PK	14.97	V	9.92	35.80	3.00	60.69	-36.69	-13.00	23.69
1619.67	9718.00	PK	16.14	H	10.89	36.84	3.00	63.87	-33.51	-13.00	20.51
1619.67	9718.00	PK	15.42	V	10.89	36.84	3.00	63.15	-34.23	-13.00	21.23
1619.67	11337.67	PK	16.25	H	11.86	38.67	3.00	66.77	-30.60	-13.00	17.60
1619.67	11337.67	PK	16.02	V	11.86	38.67	3.00	66.54	-30.83	-13.00	17.83
1619.67	12957.33	PK	15.88	H	12.77	39.22	3.00	67.87	-29.51	-13.00	16.51
1619.67	12957.33	PK	15.63	V	12.77	39.22	3.00	67.62	-29.76	-13.00	16.76
1619.67	14577.00	PK	16.13	H	13.78	40.21	3.00	70.12	-27.26	-13.00	14.26
1619.67	14577.00	PK	16.36	V	13.78	40.21	3.00	70.35	-27.03	-13.00	14.03
1619.67	16196.67	PK	16.25	H	14.67	41.62	3.00	72.53	-24.84	-13.00	11.84
1619.67	16196.67	PK	16.46	V	14.67	41.62	3.00	72.74	-24.63	-13.00	11.63

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8.3.3 Radiated Emissions, 1623.0 MHz

Tuned Frequency (MHz)	Emission Frequency (MHz)	Detector	Meter Reading (dBuV)	Antenna Polarity	Coax Loss (dB)	Antenna Correction Factor (dB/m)	Distance (m)	Field Strength (dBµV/m)	ERP (dBm)	Spurious Limit (dBm)	Margin (dB)
1623.00	3246.00	PK	20.65	H	6.65	32.68	3.00	59.98	-37.40	-13.00	24.40
1623.00	3246.00	PK	22.22	V	6.65	32.68	3.00	61.55	-35.83	-13.00	22.83
1623.00	4869.00	PK	16.84	H	7.27	33.93	3.00	58.05	-39.33	-13.00	26.33
1623.00	4869.00	PK	16.25	V	7.27	33.93	3.00	57.46	-39.92	-13.00	26.92
1623.00	6492.00	PK	20.74	H	9.07	35.53	3.00	65.34	-32.03	-13.00	19.03
1623.00	6492.00	PK	20.97	V	9.07	35.53	3.00	65.57	-31.80	-13.00	18.80
1623.00	8115.00	PK	14.66	H	9.95	35.80	3.00	60.41	-36.97	-13.00	23.97
1623.00	8115.00	PK	14.67	V	9.95	35.80	3.00	60.42	-36.96	-13.00	23.96
1623.00	9738.00	PK	15.80	H	10.92	36.82	3.00	63.54	-33.84	-13.00	20.84
1623.00	9738.00	PK	15.37	V	10.92	36.82	3.00	63.11	-34.27	-13.00	21.27
1623.00	11361.00	PK	16.07	H	11.75	38.73	3.00	66.55	-30.83	-13.00	17.83
1623.00	11361.00	PK	17.03	V	11.75	38.73	3.00	67.51	-29.87	-13.00	16.87
1623.00	12984.00	PK	16.14	H	12.73	39.26	3.00	68.13	-29.25	-13.00	16.25
1623.00	12984.00	PK	16.40	V	12.73	39.26	3.00	68.39	-28.99	-13.00	15.99
1623.00	14607.00	PK	16.59	H	13.78	40.27	3.00	70.64	-26.74	-13.00	13.74
1623.00	14607.00	PK	16.79	V	13.78	40.27	3.00	70.84	-26.54	-13.00	13.54
1623.00	16230.00	PK	16.36	H	14.59	41.69	3.00	72.64	-24.74	-13.00	11.74
1623.00	16230.00	PK	16.25	V	14.59	41.69	3.00	72.53	-24.85	-13.00	11.85

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8.3.4 Radiated Emissions, 1625.666667 MHz

Tuned Frequency (MHz)	Emission Frequency (MHz)	Detector	Meter Reading (dBuV)	Antenna Polarity	Coax Loss (dB)	Antenna Correction Factor (dB/m)	Distance (m)	Field Strength (dBµV/m)	ERP (dBm)	Spurious Limit (dBm)	Margin (dB)
1625.67	3251.33	PK	20.98	H	6.65	32.68	3.00	60.31	-37.07	-13.00	24.07
1625.67	3251.33	PK	23.96	V	6.65	32.68	3.00	63.29	-34.09	-13.00	21.09
1625.67	4877.00	PK	16.31	H	7.31	33.93	3.00	57.54	-39.83	-13.00	26.83
1625.67	4877.00	PK	16.63	V	7.31	33.93	3.00	57.86	-39.51	-13.00	26.51
1625.67	6502.67	PK	20.85	H	9.09	35.54	3.00	65.48	-31.90	-13.00	18.90
1625.67	6502.67	PK	21.64	V	9.09	35.54	3.00	66.27	-31.11	-13.00	18.11
1625.67	8128.33	PK	14.37	H	9.96	35.80	3.00	60.13	-37.25	-13.00	24.25
1625.67	8128.33	PK	14.33	V	9.96	35.80	3.00	60.09	-37.29	-13.00	24.29
1625.67	9754.00	PK	15.89	H	10.95	36.82	3.00	63.66	-33.72	-13.00	20.72
1625.67	9754.00	PK	15.06	V	10.95	36.82	3.00	62.83	-34.55	-13.00	21.55
1625.67	11379.67	PK	16.46	H	11.67	38.80	3.00	66.93	-30.44	-13.00	17.44
1625.67	11379.67	PK	16.54	V	11.67	38.80	3.00	67.01	-30.36	-13.00	17.36
1625.67	13005.33	PK	15.82	H	12.73	39.29	3.00	67.83	-29.55	-13.00	16.55
1625.67	13005.33	PK	16.20	V	12.73	39.29	3.00	68.21	-29.17	-13.00	16.17
1625.67	14631.00	PK	16.28	H	13.73	40.27	3.00	70.28	-27.10	-13.00	14.10
1625.67	14631.00	PK	16.01	V	13.73	40.27	3.00	70.01	-27.37	-13.00	14.37
1625.67	16256.67	PK	15.89	H	14.54	41.75	3.00	72.18	-25.20	-13.00	12.20
1625.67	16256.67	PK	16.00	V	14.54	41.75	3.00	72.29	-25.09	-13.00	12.09

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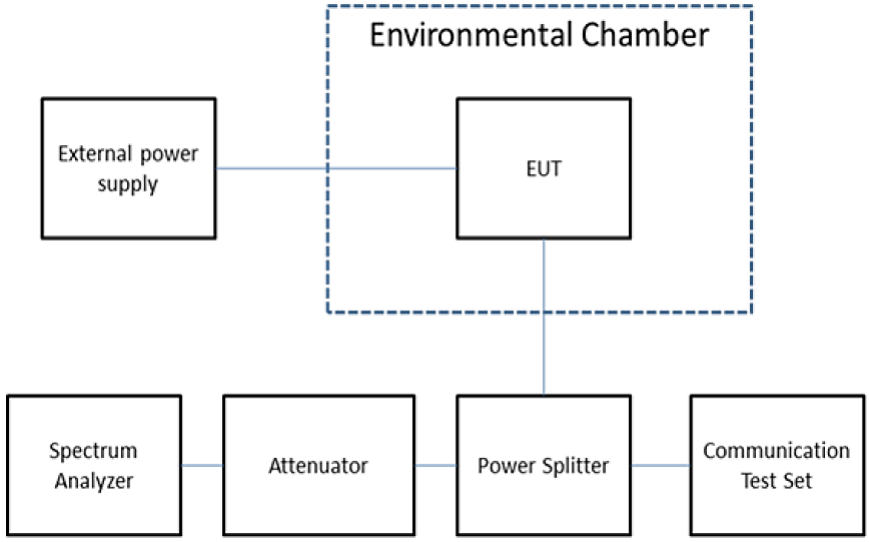
8.4 Frequency Stability

Limits from FCC Parts 2.1055, and 87.133; and test procedure from ANSI C63.26-2015.

Test Setup


Test Results, Mode 1		
Tuned Frequency (MHz)	Max Deviation (kHz)	Limit (ppm)
1619.354167	-1.653	20

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8.4.1 Frequency Stability Data

FCC Part 87 Limit	20.0	ppm
FCC Part 87 Limit	32387.069	Hz
FCC Part 87 Lower Limit	1619.321083	MHz
FCC Part 87 Upper Limit	1619.385857	MHz
Rated Supply Voltage	28.0	○ AC ◉ DC

Temperature / Voltage Variation

Temperature (°C)	Supplied Voltage (V)	Frequency (MHz)	Deviation (kHz)
-20	28.0	1619.355123	-1.653
-10	28.0	1619.354683	-1.213
0	28.0	1619.35374	-0.270
+10	28.0	1619.35343	0.039
+20 (reference)	28.0	1619.35347	0.000
+20	23.8	1619.35356	-0.094
+20	32.2	1619.35352	-0.047
+30	28.0	1619.35507	-1.599
+40	28.0	1619.35487	-1.395
+50	28.0	1619.35425	-0.782

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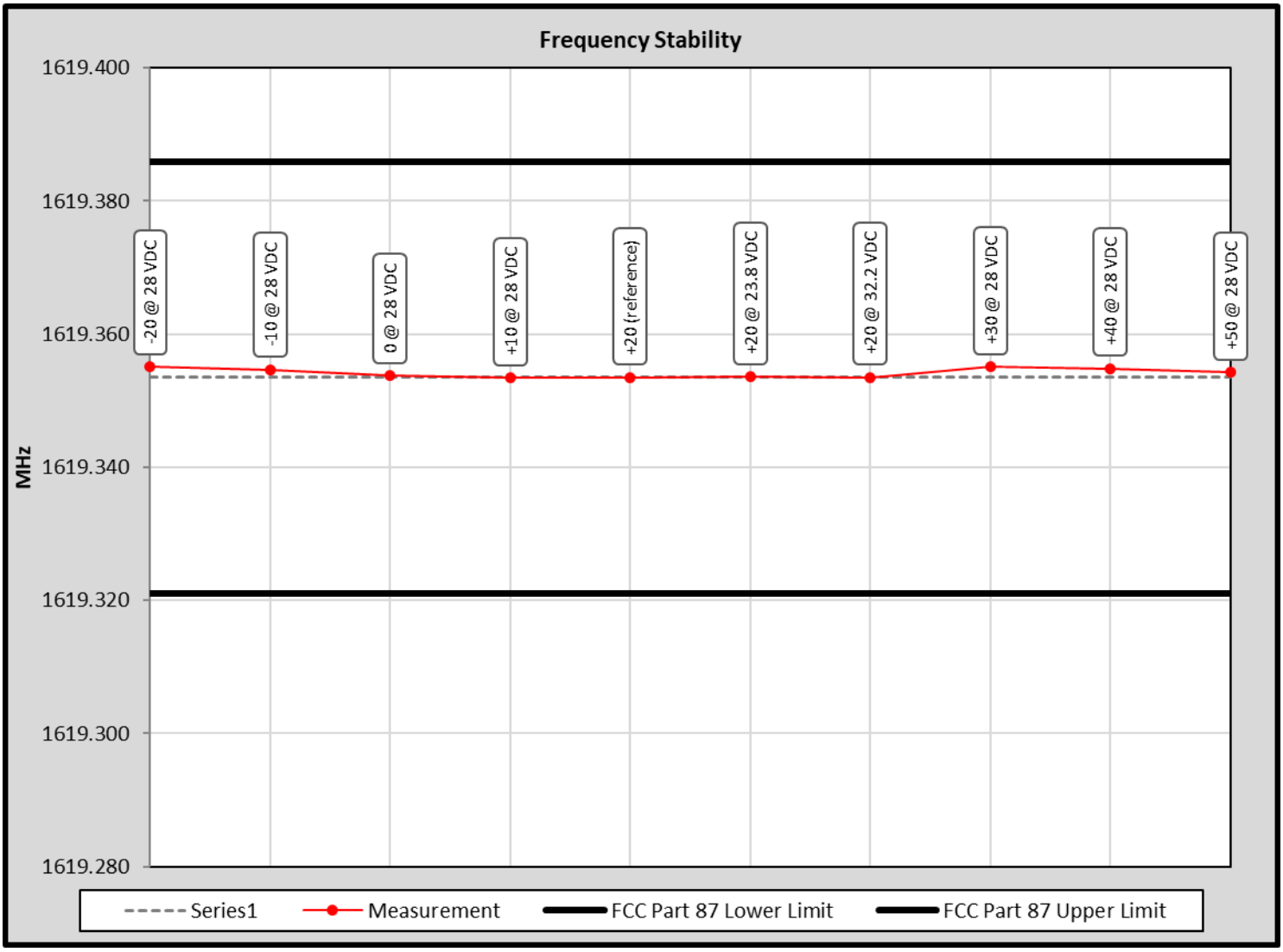
8.4.2 Frequency Stability Plot



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9. ANNEX-A - Photographs of the EUT

Photographs of the EUT and any manufacturer supplied accessories to be used with the EUT are in separate supplementary documents labelled EXTERNAL PHOTOS and INTERNAL PHOTOS.

10. ANNEX-B – Test Setup Photographs

Test setup photographs are located in a separate supplementary ANNEX-B document.

11. History of Test Report Changes

Test Report #	Revision #	Description	Date of Issue
TR_3854-22_FCC 87_	1	Initial release	9/20/2022
	2	Updated Page 7,15, added section 8.3	1/13/2023

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END OF TEST REPORT

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