TEST REPORT

Report Number : R15511125-E1

Applicant	:	Cambridge Broadband Networks Group Ltd 1A-1B Enterprise House, Chivers Way, Histon Cambridge, UK
Model	:	VectaStar NR
FCC ID	:	2BNBX-CBGNHB2X2M2B
EUT Description	:	n260 Base Station
Test Standard	:	FCC 47 CFR PART 30 BASE STATION TRANSMITTER (5G)

Date Of Issue:
2025-02-11

Prepared by:
UL LLC
12 Laboratory Dr.
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ACCREDITED
CERT #0751.06

Revision History

Rev.	Issue Date	Revisions	Revised By
V1	2025-01-27	Initial issue	Henry Lindbo
V2	2025-02-11	Misc. editorial updates	Mike Antola

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UL LLC
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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: Cambridge Broadband Networks Group Ltd

EUT DESCRIPTION: n260 Base Station

MODEL: VectaStar NR

SERIAL NUMBERS: AA000004, AA000030

SAMPLE RECEIVE DATE: 2024-12-09

DATE TESTED: 2024-12-09 to 2025-01-02

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
FCC PART 30 Base Station Transmitter (5G)	Complies

UL LLC tested the above equipment in accordance with the requirements set forth in the above standards. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical components. All samples tested were in good operating condition throughout the entire test program. Measurement Uncertainties are published for informational purposes only and were not taken into account unless noted otherwise.

This document may not be altered or revised in any way unless done so by UL LLC and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL LLC will constitute fraud and shall nullify the document.

Approved & Released For
UL LLC By:

Mike Antola
Senior Staff Engineer
Consumer Technology Division
UL LLC

Prepared By:

Henry Lindbo
Associate Project Engineer
Consumer Technology Division
UL LLC

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with following methods.

1. FCC CFR 47 Part 2
2. FCC CFR 47 Part 30
3. ANSI C63.26-2015
4. KDB 842590 D01 Upper Microwave Flexible Use Service v01r02
5. KDB 971168 D01 Power Meas. License Digital Systems v03r01
6. KDB 662911 D01 Multiple Transmitter Output v02r01

3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 12 Laboratory Dr., RTP, NC 27709, USA and 2800 Perimeter Park Dr., Suite B, Morrisville, NC 27560, USA. The following table identifies which facilities were utilized for radiated emission measurements documented in this report. Specific facilities are also identified in the test results sections.

2800 Perimeter Park Dr. *	12 Laboratory Dr.
☐ Chamber 1	☐ Chamber A
☐ Chamber 2	☐ Chamber C
☒ Chamber 3 – mmWave	
☒ Chamber 4	
☐ Chamber 5 – mmWave	

*-In order to maintain far-field separation based on maximum EUT antenna dimension, all in-band measurements were made at an indoor test site located at 2800 Perimeter Dark Dr.

UL LLC is accredited by A2LA, Cert. No. 751.06, for all testing performed within the scope of this report. Testing was performed at the locations noted below.

	Address	ISED CABID	ISED Company Number	FCC Registration
☐	12 Laboratory Drive Research Triangle Park, NC 27709, U.S.A.	US0067	2180C	825374
☒	2800 Perimeter Dr., Suite B, Morrisville, NC 27560, U.S.A.		27265	

Chamber 3 is a fully anechoic chamber dedicated to make measurements to TRP limits from 18-40 GHz, and field strength, EIRP and TRP measurements at and above 40 GHz. The measurement antenna is nominally 1.5 m high in accordance with C63.10-2020 procedures developed by the C63 mmWave Joint Task Group for inclusion in the next editions of C63.10 and C63.26, and applicable FCC KDB documents. The absorber reflectivity fully supports chamber performance over this frequency range. The dimensions of the chambers are approximately 6.7m (L) by 3.7m (W) by 3.1m (H).

4. CALIBRATION AND UNCERTAINTY

4.1. METROLOGICAL TRACEABILITY

All test and measuring equipment utilized to perform the tests documented in this report are calibrated on a regular basis, with a maximum time between calibrations of one year or the manufacturers' recommendation, whichever is less, and where applicable is traceable to recognized national standards.

4.2. DECISION RULES

The Decision Rule is based on Simple Acceptance in accordance with ISO Guide 98-4:2012 Clause 8.2. (Measurement uncertainty is not taken into account when stating conformity with a specified requirement.)

4.3. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

PARAMETER	U_{LAB}
Worst Case Radiated Disturbance, 9KHz to 30 MHz	2.52 dB
Worst Case Radiated Disturbance, 30 to 1000 MHz	4.88 dB
Worst Case Radiated Disturbance, 1000 to 18000 MHz	4.24 dB
Worst Case Radiated Disturbance, 18000 to 26000 MHz	4.37 dB
Worst Case Radiated Disturbance, 26000 to 40000 MHz	5.17 dB
Worst Case Radiated Disturbance >40000 MHz	2.85 dB
Temperature	±0.9 °C
Voltages	±0.45 %
Time	±0.02 %

Uncertainty figures are valid to a confidence level of 95%.

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The EUT is a FR2 Outdoor Small Cell base station that operates in the n260 band. The EUT is powered exclusively from a -48Vdc source.

5.2. MAXIMUM OUTPUT EIRP

The transmitter has a maximum output peak EIRP as follows:

Frequency (MHz)	Mode	Output PK EIRP (dBm)
37417.44	256QAM, 8CC, 100MHz	61.84

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The antenna(s) gain and type, as provided by the manufacturer are as follows:

The antenna dimensions are 72.2 mm x 198.3 mm.

The radio utilizes a dual polarization phased array antenna, with a maximum gain of 28.3 dBi.

5.4. SOFTWARE AND FIRMWARE

EUT Firmware version used for testing: version 2.1.5 (CU/DU) / 4.10.1 (Layer 1)

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12 Laboratory Dr., RTP, NC 27709, USA TEL: (919) 549-1400

5.5. WORST CASE ORIENTATION

For all 5G NR FR2 Bands, the worst-case scenario for all measurements is based on the EIRP measurement investigation results, comparing to TRP limit to demonstrate compliance. EIRPs were measured on QPSK, 16QAM, 64QAM, and 256QAM modulations. It was found that 256QAM results were worst case.

The EIRPs of Bandedge and radiated spurious emissions is compared to the TRP limit to demonstrate compliance.

The fundamental and radiated spurious emission were investigated in multiple orientations. The final optimum position resulting in the highest EIRP for the frequency or band under investigation is placed on an open-air fixture allowing no blockage of the signal as measured by the receiving antenna.

5.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

PERIPHERAL SUPPORT EQUIPMENT LIST			
Description	**Manufacturer**	**Model**	**Serial Number**
Support laptop	DELL	Latitude 5540	8LW8K34
DC power supply	Ametek	CW2501	2319A02736
DC power supply	Sorensen	DCS60-18E	9904B1027
GPS antenna	Wha Yu Industrial Co	C393-690345-A	Non-serialized production unit

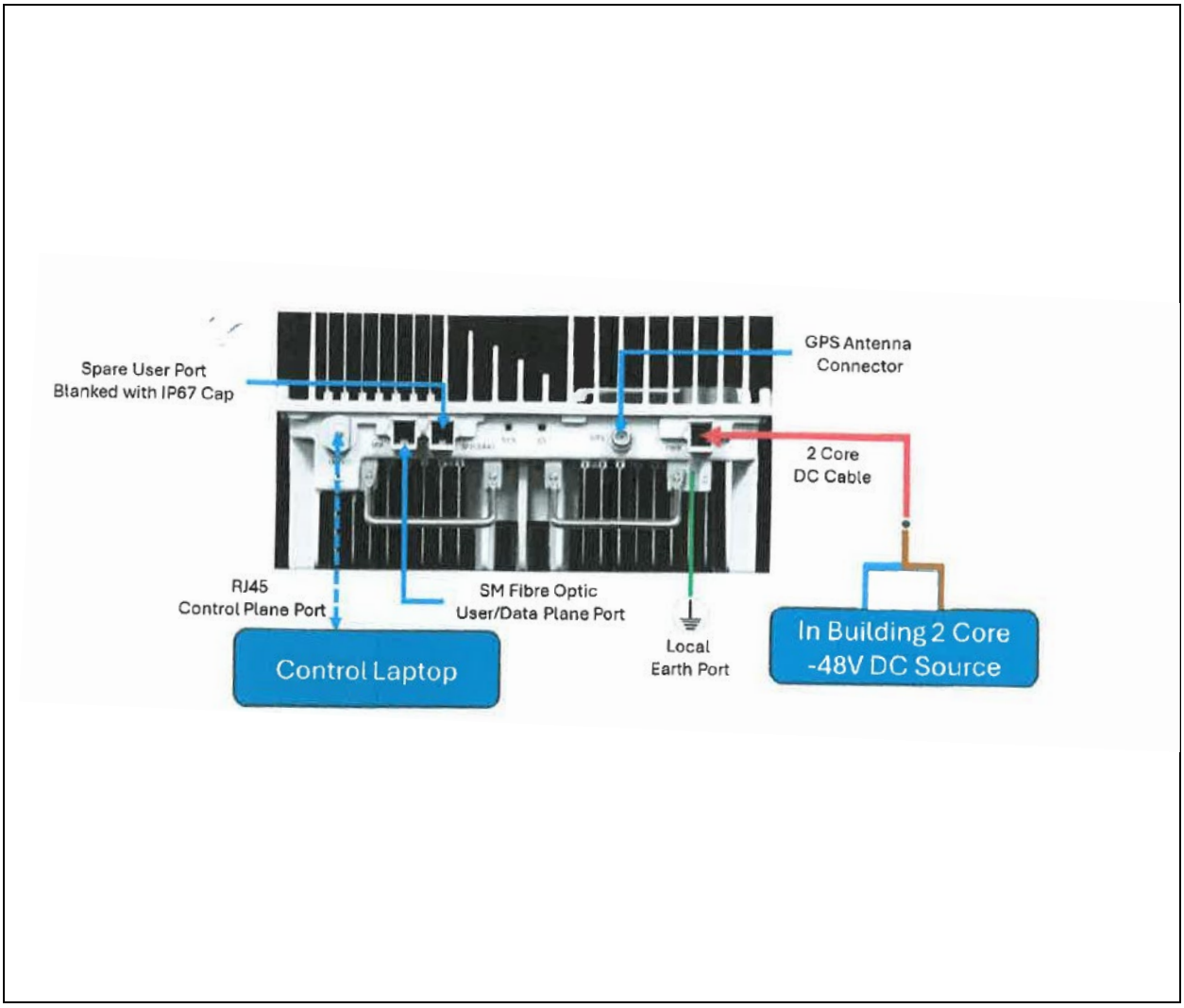
I/O CABLES

I/O Cable List					
Cable No.	**Port**	**# of identical ports**	**Cable Type**	**Cable Length (m)**	**Remarks**
1	Ethernet	2	Unshielded	>3	Service Port
2	DC	1	Unshielded	>3	Power Input
3	N coaxial	1	Coaxial	<3	GPS Port

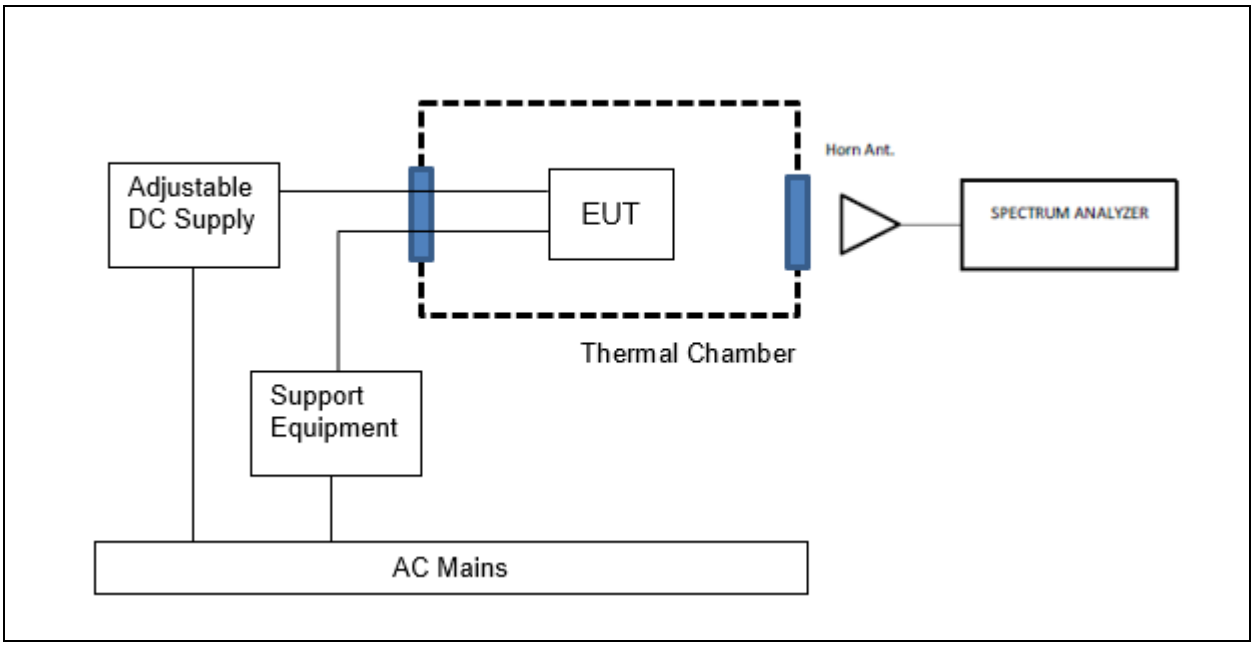
TEST SETUP

All testing was performed using FTM (Factory Test Mode) software at continuous Tx operation. When implemented out in the field, the EUT will operate with a maximum uplink configuration (i.e., a maximum uplink duty cycle of 100%).

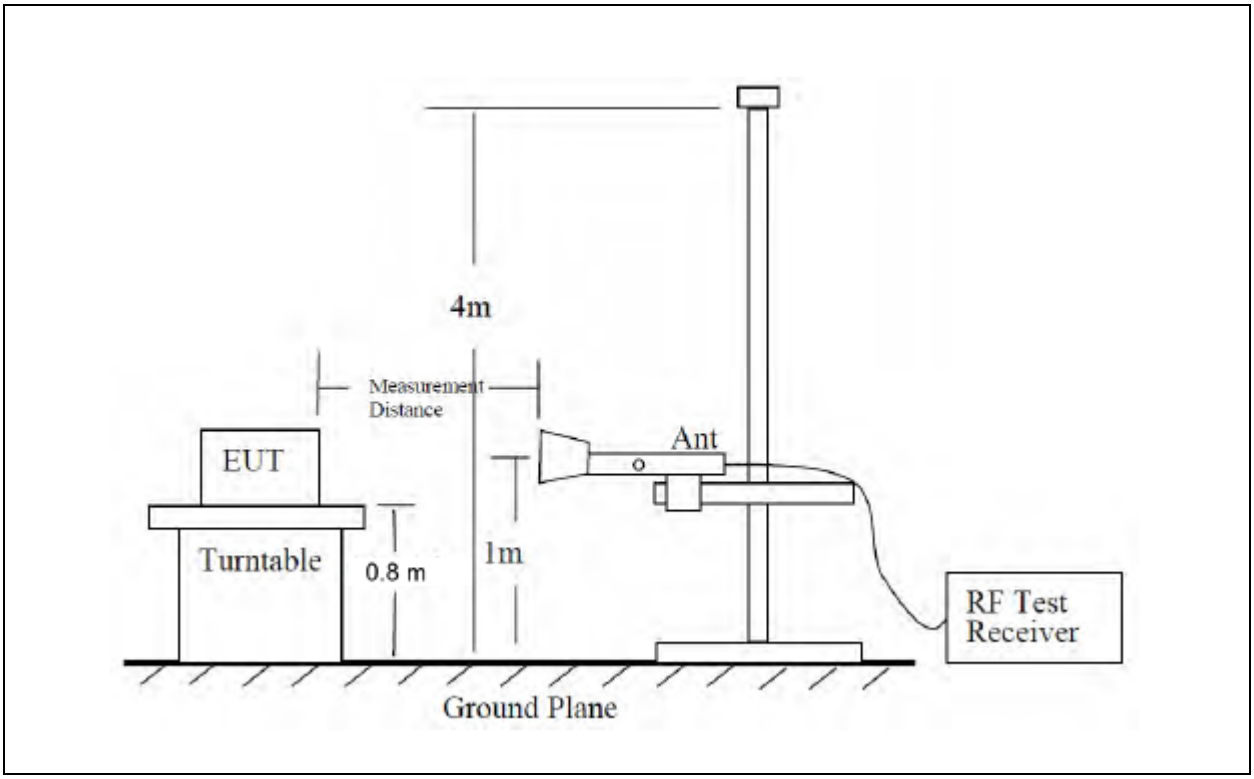
SETUP DIAGRAM FOR TESTS



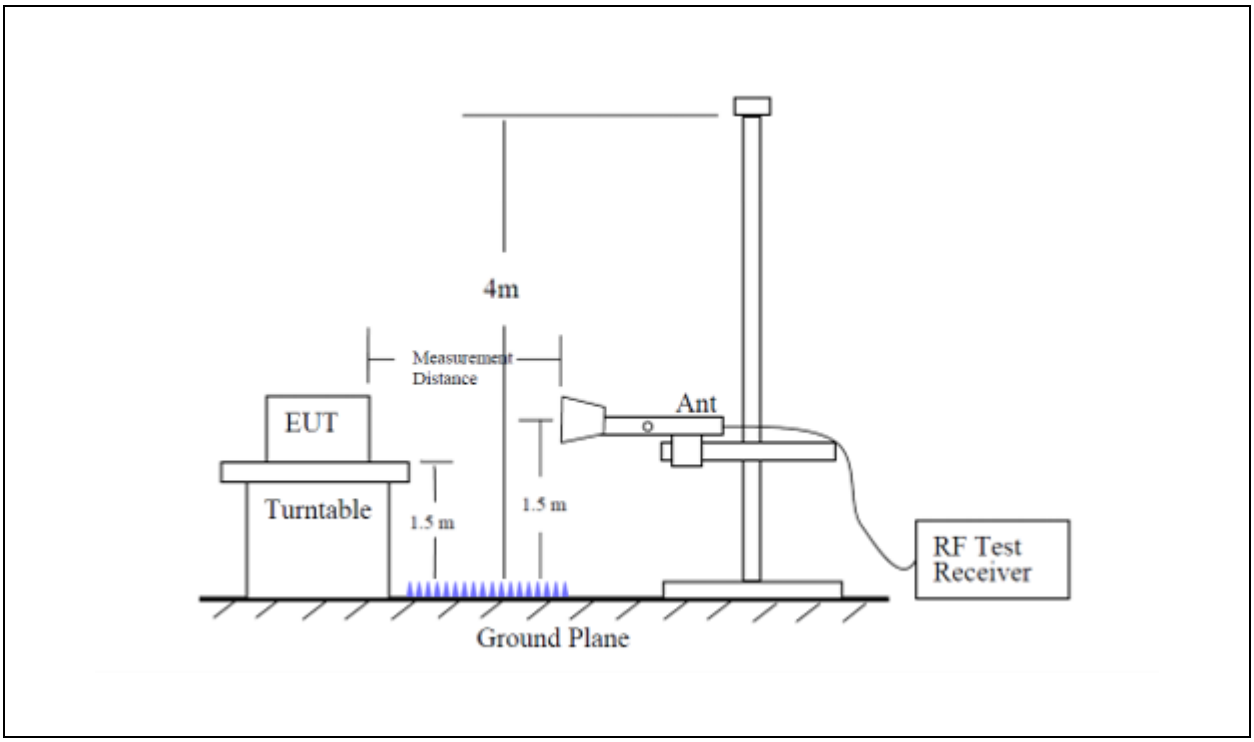
FREQUENCY STABILITY



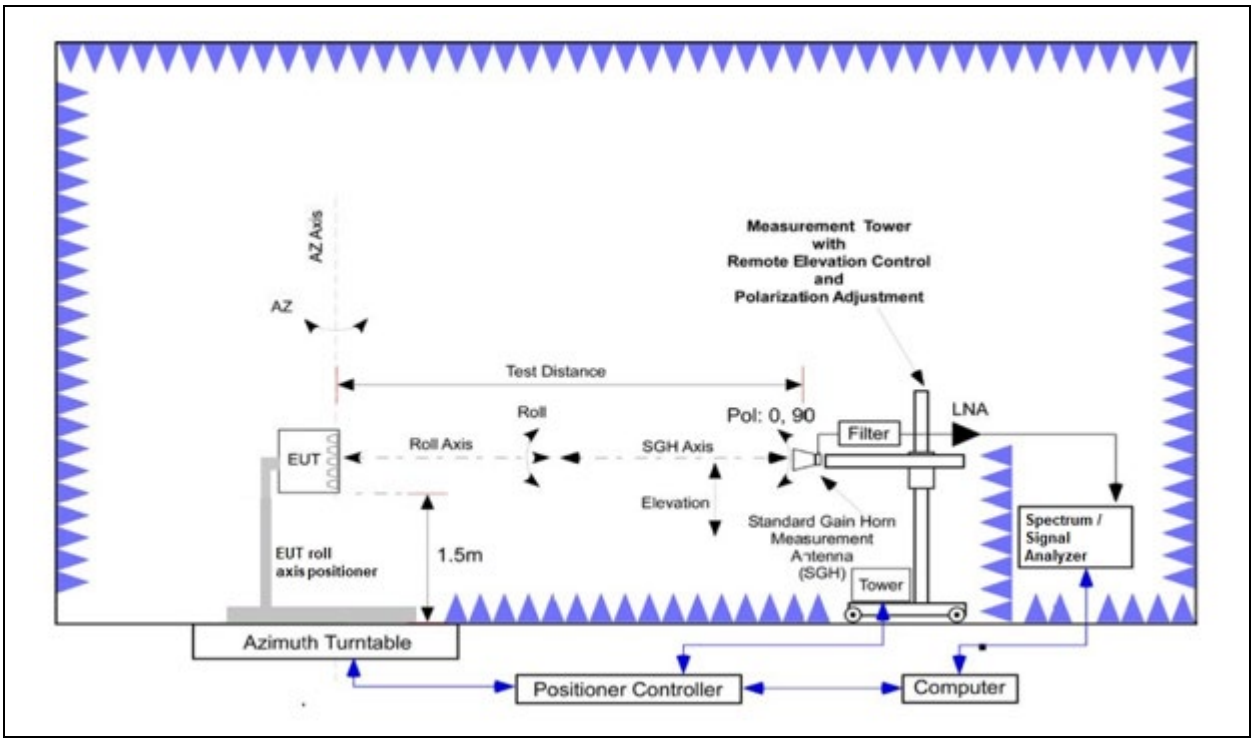
TEST SITE DIAGRAM – BELOW 1 GHz



TEST SITE DIAGRAM – 1-18 GHz



TEST SITE DIAGRAM – ABOVE 18 GHz



FAR-FIELD DISTANCE AND MEASUREMENT DISTANCE

The equipment under test was transmitting while connected to its integral antenna and is placed on a turntable.

The measurement distance is in the far field per formula $2D^2/\lambda$ where D is the larger dimension of the EUT antenna for in-band measurements and receive antenna for all other measurements.

For fundamental & band edge emissions, the largest far-field distance of the EUT antenna was used. The largest dimension of the largest antenna configuration is approximately 20 mm, which yields a far field measurement distance of approximately 11 meters at 40 GHz. As such, all in-band testing was performed at a 11-meter distance.

For above 18 GHz spurious emissions, the far-field distance is based on the measurement antenna. The EUT is manipulated through all orthogonal planes representative of its typical use to achieve the highest EIRP reading on the receive spectrum analyzer.

Frequency Range (GHz)	Wavelength (m)	Far Field Distance (m)	Measurement Distance Used (m)
18-26.5	0.0113	1.91	3.00
26.5-40	0.0075	1.48	3.00
40-50	0.0060	1.01	3.00
50-75	0.0040	0.66	3.00
75-110	0.0027	0.45	3.00
110-170	0.0018	0.29	3.00
170-200	0.0015	0.19	1.00

Radiated power levels are investigated while the receive antenna was rotated through all angles to determine the worst-case polarization/positioning.

6. TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment was utilized for the tests documented in this report:

Test Equipment Used – Frequency Stability (Morrisville – Conducted 1)

Equipment ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
179892	Environmental Meter	Fisher Scientific	15-077-963	2024-08-12	2025-08-12
81018	PSA Analyzer	Agilent	E4446A	2024-07-31	2025-07-31
212231	Horn Antenna, 26.5-40GHz	Com Power	AH-640	2024-03-01	2025-03-01
236852	CW-AC Power Source	Ametek	CW2501	NA	NA
207726	Temp/Humid Chamber	Thermotron	SM-32-8200	2024-01-12	2025-01-12

Test Equipment Used - Radiated Disturbance Emissions Test Equipment (Morrisville – Chamber 4)

Equip. ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
	0.009-30MHz				
135144	Active Loop Antenna	ETS-Lindgren	6502	2024-10-02	2025-10-02
	30-1000 MHz				
90628	Hybrid Broadband Antenna	Sunol Sciences Corp.	JB3	2024-01-02	2026-01-02
	1-18 GHz				
89509	Double-Ridged Waveguide Horn Antenna, 1 to 18 GHz	ETS Lindgren	3117	2023-05-23	2025-05-23
	Gain-Loss Chains				
207638	Gain-loss string: 0.009-30MHz	Various	Various	2024-05-22	2025-05-22
207639	Gain-loss string: 25-1000MHz	Various	Various	2024-05-22	2025-05-22
207640	Gain-loss string: 1-18GHz	Various	Various	2024-05-22	2025-05-22
	Receiver & Software				
197955	Spectrum Analyzer	Rohde & Schwarz	ESW44	2024-04-16	2025-04-16
SOFTEMI	EMI Software	UL	Version 9.5 (18 Oct 2021)		
	Additional Equipment used				
241204	Environmental Meter	Fisher Scientific	15-077-963	2023-09-05	2025-09-05
236853	DC Power Source	California Instruments	AST3001	NA	NA

Test Equipment Used - mmWave Test Equipment (Morrisville – Chamber 3)

Equip. ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
	18-40 GHz				
204907	Horn Antenna, 18-26.5GHz	Com Power	AH-826	2024-02-14	2025-02-28
204908	Horn Antenna, 26.5-40GHz	Com Power	AH-640	2024-02-14	2025-02-28
204705	Horn Antenna, 26.5-40GHz	Com Power	AH-640	2023-07-20	2025-07-20
	40-50 GHz				
206209	Standard Gain Horn, 40-50GHz	Custom Microwave Inc.	HO22R	2024-02-14	2025-02-28
205910	Low Noise Amplifier	Eravant	SBL-3335033040-2222-E1	2024-03-14	2025-03-31
207949	Band Pass Filter	Eravant	SWF-4510460-2F2F-B1	2024-03-14	2025-03-31
222197	Band Pass Filter	Eravant	SWF-46308340-22-B1	2024-03-14	2025-03-31
	50-75 GHz				
206203	Standard Gain Horn, 50-75GHz	Custom Microwave Inc.	HO15R	2024-02-14	2025-02-28
206607	WR15 Downconverter	VDI	WR15.0SAX-F	2024-04-16	2025-04-30
205911	Low Noise Amplifier	Eravant	SBL-5037531850-1515-E1	2024-04-02	2025-04-30
	75-110 GHz				
206222	Standard Gain Horn, 75-110GHz	Custom Microwave Inc.	HO10R	2024-02-14	2025-02-28
207249	WR10 Downconverter	VDI	WR10.0SAX-F	2024-04-16	2025-04-30
205913	Low Noise Amplifier	Eravant	SBL-7531142050-1010-E1	2024-04-03	2025-04-30
	110-170 GHz				
206242	Standard Gain Horn, 110-170GHz	Custom Microwave Inc.	HO6R	2024-02-14	2025-02-28
206555	WR6.5 Downconverter	VDI	WR6.5SAX-F	2024-04-16	2025-04-30
205912	Low Noise Amplifier	Eravant	SBL-1141741860-0606-E1	2024-04-18	2025-04-30
	170-260 GHz				
206244	Standard Gain Horn, 170-260GHz	Custom Microwave Inc.	HO4R	2024-02-14	2025-02-28
206556	WR4.3 Downconverter	VDI	WR4.3SAX-F	2024-04-16	2025-04-30
	Receiver & Software				
214284	Spectrum Analyzer	Rohde & Schwarz	FSW50	2024-02-04	2025-02-04

Equip. ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
mmWave	mmWave Software	UL	V2022.7.29		
	Additional Equipment used				
239539	Environmental Meter	Fisher Scientific	15-077-963	2023-07-19	2025-07-19
252124	Laser Measure	Bosch	3601K72X10	2024-10-21	2025-10-21

All horn antennas at and above 40 GHz are standard gain horns. In accordance with ANSI C63.10 clause 4.4.3 (a) Standard gain horns need not be periodically recalibrated, unless damage or deterioration is suspected or known to have occurred. If a standard gain horn is not periodically recalibrated, then its critical dimensions (see IEEE Std 1309-2005) shall be verified and documented on an annual basis.

UL measures the critical dimensions on an annual basis and checks for damage and deterioration before each test.

7. SUMMARY TABLE

FCC Part Section	Test Description	Test Limit	Test Condition	Test Result
2.1049	Occupied Bandwidth	N/A	Radiated	Compliant
2.1046 30.202	Equivalent Isotropic Radiated Power (EIRP)	+75 dBm / 100 MHz EIRP	Radiated	Compliant
2.1051 30.203	Out-of-Band Emissions at the Band Edge	-13 dBm/MHz for All out-of-band emissions. -5 dBm/MHz from the band edge up to 10% of the channel BW	Radiated	Compliant
2.1051 30.203	Spurious Emissions	-13 dBm/MHz for all out-of-band emissions	Radiated	Compliant
2.1055	Frequency Stability	N/A	Radiated	Compliant

8. APPLICABLE LIMITS AND TEST RESULTS

8.1. OUTDOOR SITE SUBSTITUTION MEASUREMENTS

EIRP was measured and calculated using the equations in ANSI C63.26-2015 Annex C.5.2 then compared to TRP limits. The total correction factors of horn antenna gain, cable loss and far-field path loss were calculated using equations C.8 and C.9, and pre-loaded into the spectrum analyzer.

Sample calculation:

Total Correction Factor for Radiated RF Output Power = Cable Loss (dB) – Horn Ant Gain (dBi) + Path Loss @ 11m (dB)
= 5.26 – 23.31 + 86.14
= 68.09 dB

EIRP = $P_{measured}$ (dBm), where Total Correction Factor preloaded.

Total Correction Factor for Band Edge Conducted Output Power = Cable Loss (dB) – Horn Ant Gain (dBi) + Path Loss @ 11m (dB) – EUT Antenna Gain (dBi)
= 5.26 – 23.31 + 86.14 – 15.5
= 52.59 dB

Conducted Power = $P_{measured}$ (dBm), where Total Correction Factor preloaded.

As the anechoic chamber meets applicable validation requirements in KDB 842590, the theoretical path loss value is used for 3-meter testing in accordance with C63.26 Clause 5.5.4.

The substitution measurement method per C63.26 Clause 5.5.3 was used for the 11-meter indoor non-chamber measurements. In lieu of the theoretical calculated free space propagation path loss (see C63.26 Equation C.9), substitution measurements were performed to determine the actual free space path loss of the test site at the measurement distance.

Derivation of the Measured Path Loss:

$EIRP = P_T + G_T – L_C$ C63.26 Equation (C.3)

Where,

P_T = transmitter output power
G_T = gain of transmitting antenna
L_C = signal loss in connecting cable between transmitter and antenna

$EIRP = P_R + L_P$ C63.26 Equation (C.7)

Where,

P_R = adjusted received power level
L_P = basic free-space propagation path loss

$P_R – P_{meas} – G_R + L_C + L_{atten} – G_{amp}$ C63.26 Equation (C.8)

Where,

P_{meas} = measured power level
G_R = gain of receive antenna
L_C = signal loss in measurement cable
L_{atten} = value of external attenuation (if used)*
G_{amp} = value of external amplification (if used)*

*-External attenuation or amplification not used for these measurements

Combining Equations. C.3, C.7 and C.8 yields:

Pt + Gtx – Lctx = Pmeas – Grx + Lcrx + Latten – Gamp + Lp

Re-arranging to express path loss as a function of the other parameters:

Lp = Pt + Gtx – Lctx - Pmeas + Grx - Lcrx - Latten + Gamp

Example Calculation for 37 GHz:

L_P = 15 + 23.61 – 4.7 – (-33.32) + 23.61 – 4.7 – 0 + 0

$L_{PMeasured}$ = 86.14 dB

Free Space Path Loss (Theoretical):

$L_P = 20\log F + 20\log d – 27.5$

Where,

L_P = free space propagation path loss, in dB
F = center frequency of radiated EUT signal, in MHz
d = measurement distance, in m

Example Calculation:

$L_P = 20\log(37000) + 20\log(11) – 27.5$

L_P = 91.36 + 20.83 – 27.5

$L_{PTheoretical}$ = 84.69 dB

TESTED BY

Employee IDs: 11322
Test Dates: 2024-12-09
Test Location: MOR Indoor Test Site

The following table shows the results of the substitution measurements to derive the actual free space propagation path loss value.

Config	Channel	F (MHz)	d (m)	L_P
1CCx100	Low	37100	11	84.72
	Mid	38500	11	85.04
	High	39000	11	85.15
	Low BE	37000	11	84.69
	High BE	40000	11	85.37
1CCx200	Low	37200	11	84.74
	High	39700	11	85.30
4CCx100	Low	37300	11	84.76
	High	39600	11	85.28
4CCx200	Low	37400	11	84.79
	High	39500	11	85.26
8CCx100	Low	37400	11	84.79
	High	39500	11	85.26

8.2. OCCUPIED BANDWITH

RULE PART

FCC: §2.1049

LIMIT

For reporting purposes only

TEST PROCEDURES

99% bandwidth measurement function of the signal analyzer was used to measure 99% occupied.

- RBW = 1 – 5% of OBW
- VBW ≥ 3 x RBW
- Detector = Peak
- Trace mode = Max Hold
- Sweep = Auto Couple
- The trace was allowed to stabilize

KDB 842590 D01 Upper Microwave Flexible Use Service v01 r02 Section 4.3
ANSI C63.26-2015 Clause 5.4.4.

Testing was performed at 11-meter measurement distance.

All modulations were investigated to determine worst case configuration. All modes of operations were investigated, and results are reported in this section.

To minimize report size, the worst-case plots of each modulation are provided to demonstrate the test parameter setting on signal analyzer. The tabular data includes data for the other combination of test modes.

RESULTS

See the following pages.

TESTED BY

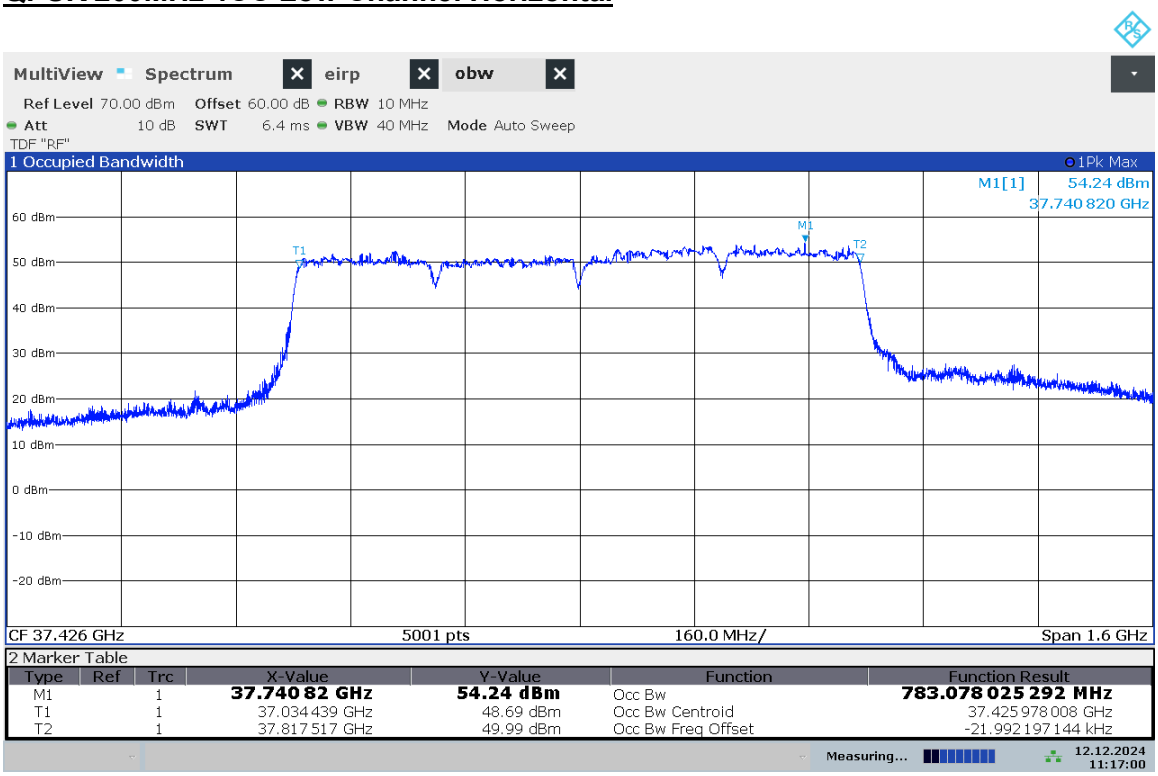
Employee IDs: 23854
Test Dates: 2024-12-10 to 2024-12-27
Test Location: MOR indoor test site

8.2.1. OCCUPIED BANDWIDTH RESULTS

Modulation	Channel	Frequency (GHz)	Channel BW (MHz)	Horizontal Measured OBW (MHz)	Vertical Measured OBW (MHz)
QPSK	Low	37.05456	100MHz 1CC	94.749	94.906
	Mid	38.4024		94.752	98.847
	High	39.94032		94.829	95.041
	Low	37.1064	200MHz 1CC	191.950	192.897
	Mid	38.4024		192.817	193.415
	High	39.88848		193.310	193.687
	Low	37.21008	400MHz 1CC	378.407	378.087
	Mid	38.4024		379.633	379.421
	High	39.7848		378.711	379.545
	Low	37.41744	200MHz 4CC	783.078	783.122
	Mid	38.4024		783.599	784.641
	High	39.59472		783.698	785.930
	Low	37.41744	100MHz 8CC	786.964	787.685
	Mid	38.4024		787.858	788.894
	High	39.59472		788.983	790.738
16QAM	Low	37.05456	100MHz 1CC	95.028	95.421
	Mid	38.4024		94.624	95.156
	High	39.94032		95.034	95.400
	Low	37.1064	200MHz 1CC	191.005	192.439
	Mid	38.4024		191.831	192.812
	High	39.88848		192.759	193.678
	Low	37.21008	400MHz 1CC	378.462	378.574
	Mid	38.4024		379.723	380.264
	High	39.7848		379.084	380.691
	Low	37.41744	200MHz 4CC	784.165	784.911
	Mid	38.4024		784.415	785.804
	High	39.59472		785.432	787.184
	Low	37.41744	100MHz 8CC	790.109	789.113
	Mid	38.4024		790.953	790.109
	High	39.59472		791.067	791.002

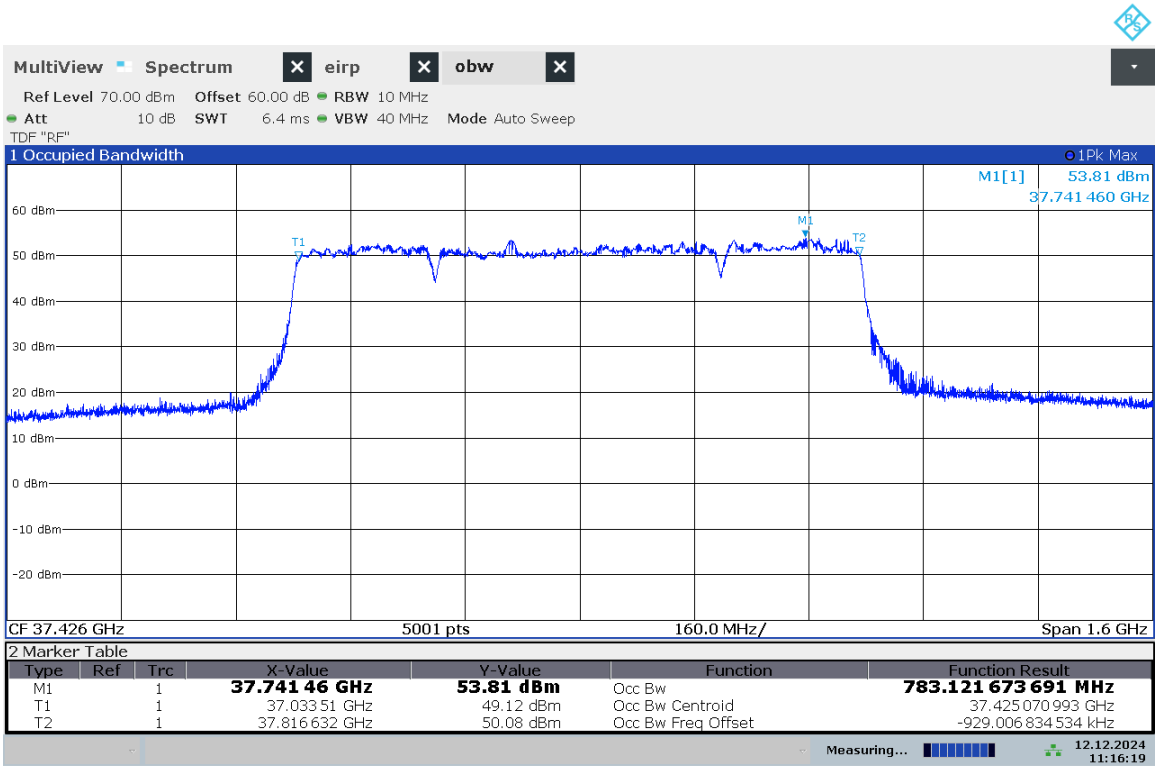
Modulation	Channel	Frequency (GHz)	Channel BW (MHz)	Horizontal Measured OBW (MHz)	Vertical Measured OBW (MHz)
64QAM	Low	37.05456	100MHz 1CC	94.798	95.024
	Mid	38.4024		94.784	94.807
	High	39.94032		94.996	95.097
	Low	37.1064	200MHz 1CC	192.185	193.269
	Mid	38.4024		192.395	194.385
	High	39.88848		193.361	194.107
	Low	37.21008	400MHz 1CC	378.629	379.692
	Mid	38.4024		379.654	380.718
	High	39.7848		379.260	381.622
	Low	37.41744	200MHz 4CC	785.243	782.872
	Mid	38.4024		786.174	785.255
	High	39.59472		786.362	785.763
	Low	37.41744	100MHz 8CC	788.904	787.904
	Mid	38.4024		790.281	789.585
	High	39.59472		790.777	791.035
256QAM	Low	37.05456	100MHz 1CC	94.798	94.733
	Mid	38.4024		94.689	94.746
	High	39.94032		94.861	94.945
	Low	37.1064	200MHz 1CC	191.552	192.504
	Mid	38.4024		192.662	192.881
	High	39.88848		193.043	193.605
	Low	37.21008	400MHz 1CC	378.639	378.269
	Mid	38.4024		379.683	379.535
	High	39.7848		379.751	380.267
	Low	37.41744	200MHz 4CC	770.913	772.995
	Mid	38.4024		771.497	774.255
	High	39.59472		771.727	775.502
	Low	37.41744	100MHz 8CC	774.451	774.689
	Mid	38.4024		775.172	776.080
	High	39.59472		775.651	777.172

QPSK 200MHz 4CC Low Channel Horizontal



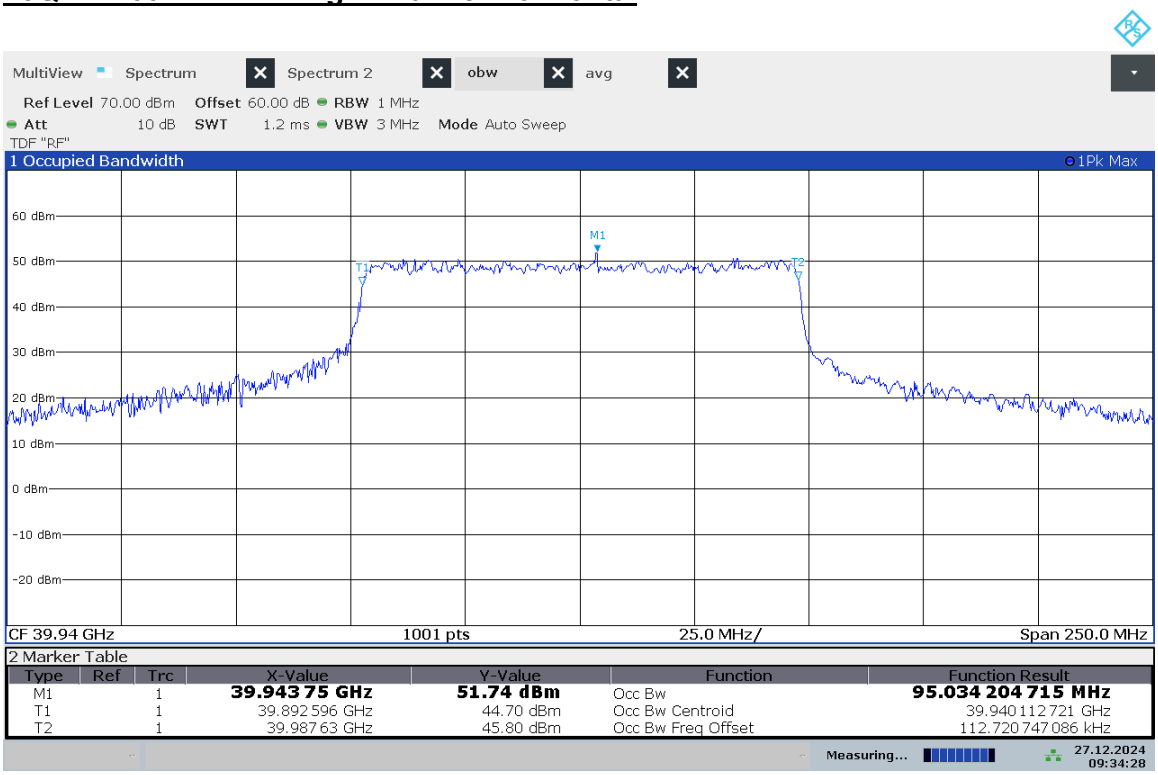
11:17:01 12.12.2024

QPSK 200MHz 4CC Low Channel Vertical



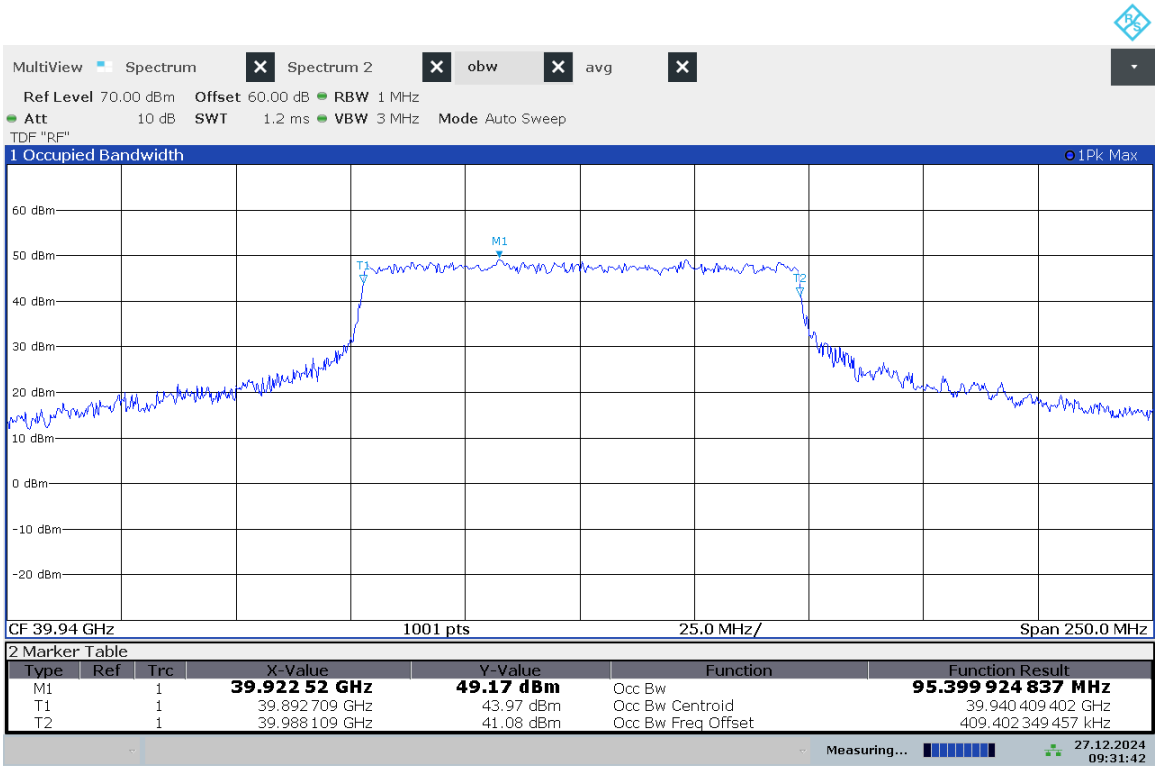
11:16:20 12.12.2024

16QAM 100MHz 1CC High Channel Horizontal



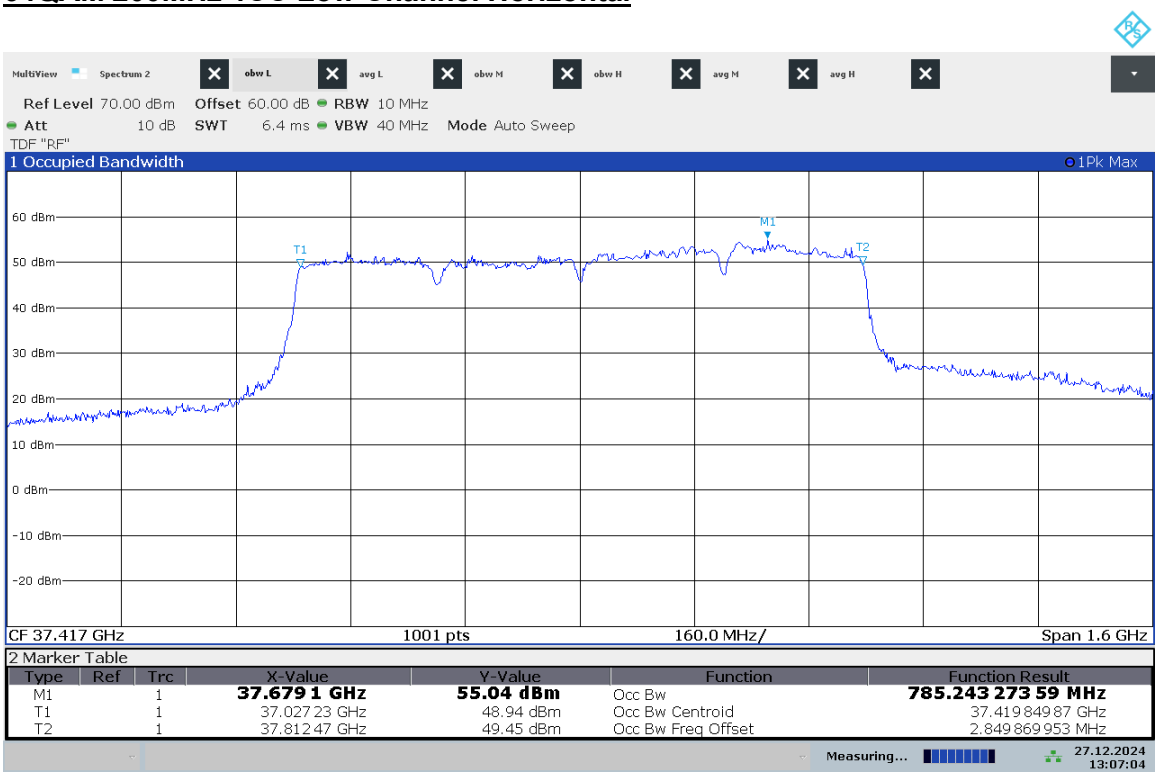
09:34:28 27.12.2024

16QAM 100MHz 1CC High Channel Vertical



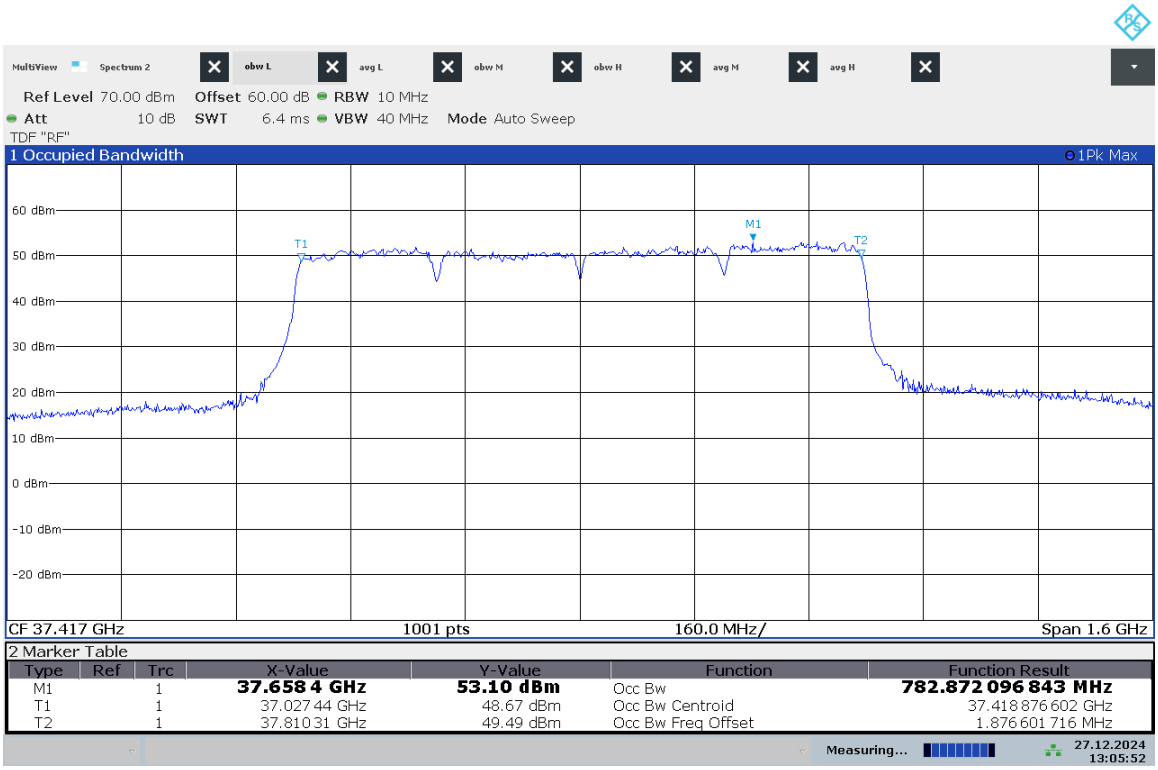
09:31:42 27.12.2024

64QAM 200MHz 4CC Low Channel Horizontal



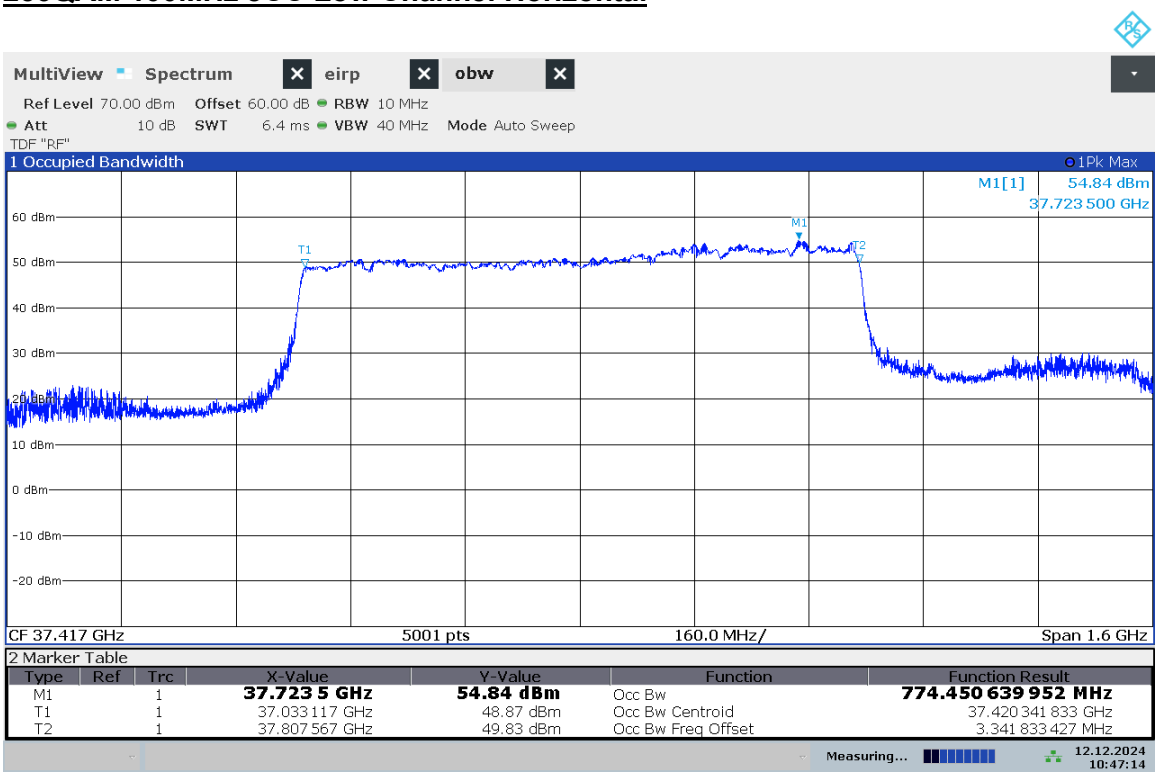
13:07:05 27.12.2024

64QAM 200MHz 4CC Low Channel Vertical



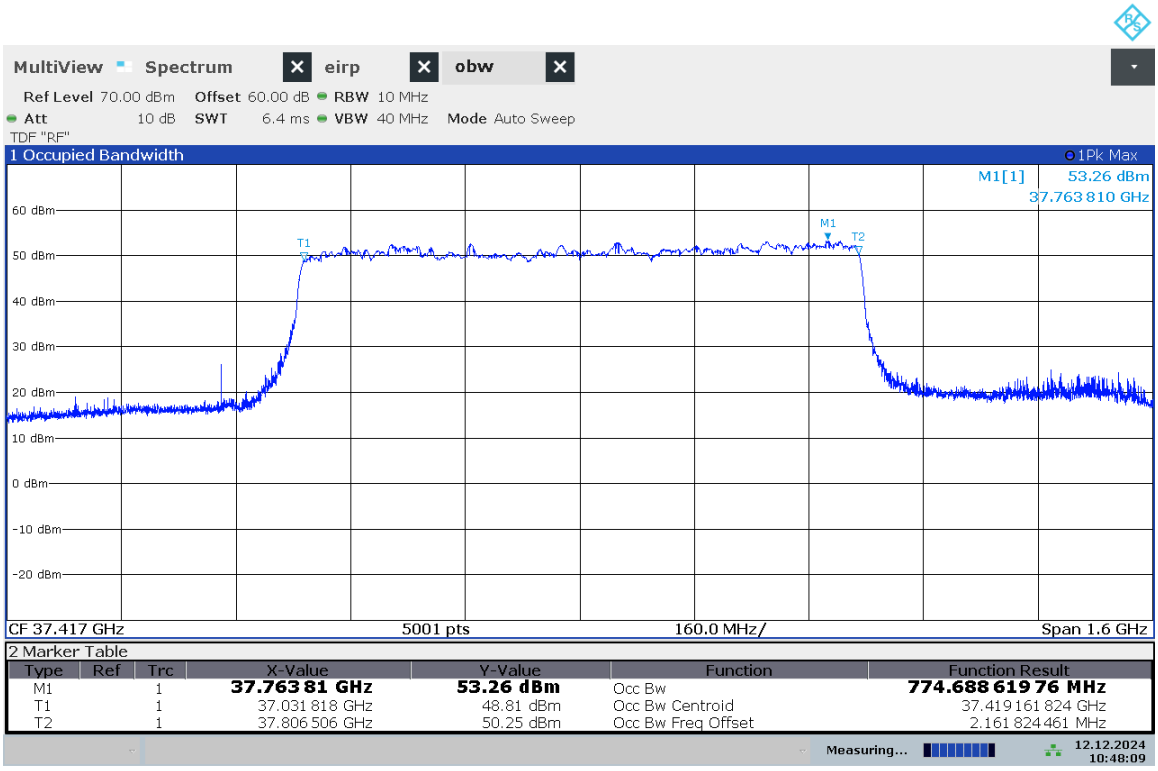
13:05:53 27.12.2024

256QAM 100MHz 8CC Low Channel Horizontal



10:47:14 12.12.2024

256QAM 100MHz 8CC Low Channel Vertical



10:48:09 12.12.2024

8.3. EQUIVALENT ISOTROPIC RADIATED POWER

RULE PART(S)

FCC: §2.1046, §30.202

LIMIT

30.202 (a) – For fixed and base stations operating in connection with mobile systems, the average power of the sum of all antenna elements is limited to an equivalent isotropic radiated power (EIRP) density of +75 dBm/100 MHz. For channel bandwidths less than 100 megahertz the EIRP must be reduced proportionally and linearly based on the bandwidth relative to 100 megahertz.

TEST PROCEDURES

Radiated power measurements are performed using the signal analyzer's "channel power" measurement capability for signals with continuous operation.

- RBW = 1 – 5% of the OBW
- VBW ≥ 3 x RBW
- Span = 2x to 3x the OBW
- Number of measurement points in sweep > 2 x span / RBW
- Sweep time = auto-couple
- Detector = RMS
- Trace mode = Average over 100 sweeps

KDB 842590 D01 Upper Microwave Flexible Use Service v01 r02 Section 4.2
ANSI C63.26-2015 Clause 5.2, Clause 5.5, Clause 6.4, and Annex C.5.2

EIRP measurements of variable frequency bands were performed at the far field test distance listed in Section 5.6.

EIRP was calculated using the equations on ANSI C63.26-2015 Annex C.5.2. The total correction factors of horn antenna gain, cable loss and far-field path loss were calculated using equation C.8 and C.9 and pre-loaded into spectrum analyzer.

Sample calculation of EIRP:

Total Correction Factor = Cable Loss (dB) – Horn Ant Gain (dBi) + Path Loss (dB)
= 4 – 23 + 71
= 52 dB

EIRP = $P_{measured}$ (dBm), where Total Correction Factor preloaded

To properly display signal levels on the plots, the pre-loaded correction factors were intentionally lowered by 60 dB and an offset factor of 60 dB was applied on the spectrum analyzer to compensate the true correction factors across the frequency range of measurement.

Radiated power levels are investigated while the receive antenna was rotated through all angles to determine the worst-case polarization/positioning.

Worse-Case Configurations

QPSK, 16QAM, 64QAM, and 256QAM modulations were all investigated in all bandwidths and low/mid/high channel configurations. The highest power mode is 256QAM, 8CC, 100MHz bandwidth, low channel. Full data is provided for all combinations.

To minimize report size, the worst-case plots of each modulation are provided to demonstrate the test parameter setting on signal analyzer. The tabular data includes data for the other combination of test modes.

RESULTS

See the following pages.

TESTED BY

Employee IDs: 23854
Test Dates: 2024-12-10 to 2024-12-27
Test Locations: MOR indoor test site

8.3.1. EIRP RESULTS

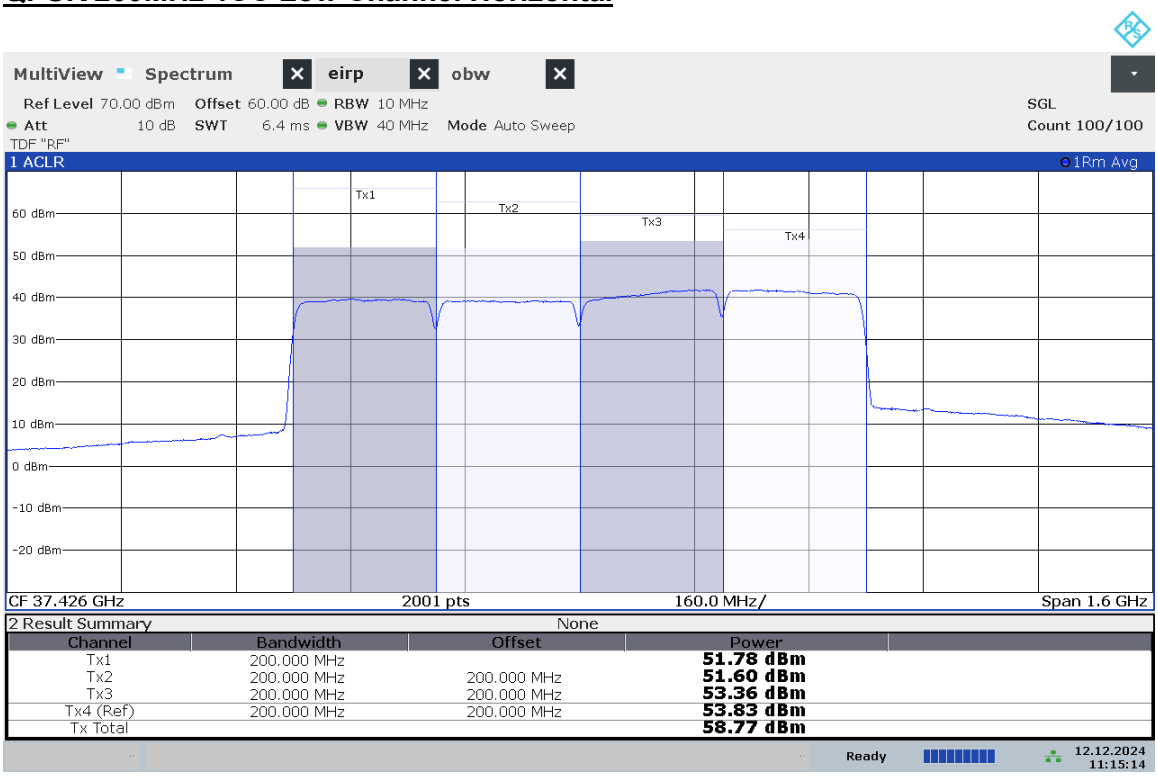
Modulation	Channel	Frequency (GHz)	Channel BW (MHz)	Horizontal Measured Avg EIRP (dBm)	Vertical Measured Avg EIRP (dBm)	Total Avg EIRP (dBm)	EIRP Limit (dBm/ 100MHz)	Margin (dB)
QPSK	Low	37.05456	100MHz 1CC	58.10	57.93	61.03	75	-13.97
	Mid	38.4024		58.06	57.75	60.92	75	-14.08
	High	39.94032		58.47	58.59	61.54	75	-13.46
	Low	37.1064	200MHz 1CC	57.84	58.09	60.98	75	-14.02
	Mid	38.4024		58.04	57.81	60.94	75	-14.06
	High	39.88848		58.25	57.93	61.10	75	-13.90
	Low	37.21008	400MHz 1CC	57.60	57.97	60.80	75	-14.20
	Mid	38.4024		58.22	57.97	61.11	75	-13.89
	High	39.7848		58.03	57.81	60.93	75	-14.07
	Low	37.41744	200MHz 4CC	58.77	58.77	61.78	75	-13.22
	Mid	38.4024		58.58	58.49	61.55	75	-13.45
	High	39.59472		58.52	58.55	61.55	75	-13.45
	Low	37.41744	100MHz 8CC	58.16	58.09	61.14	75	-13.86
	Mid	38.4024		57.92	57.76	60.85	75	-14.15
	High	39.59472		57.69	57.71	60.71	75	-14.29
16QAM	Low	37.05456	100MHz 1CC	57.15	57.35	60.26	75	-14.74
	Mid	38.4024		57.65	57.74	60.71	75	-14.29
	High	39.94032		58.71	57.87	61.32	75	-13.68
	Low	37.1064	200MHz 1CC	57.76	57.67	60.73	75	-14.27
	Mid	38.4024		58.13	57.37	60.78	75	-14.22
	High	39.88848		57.92	57.49	60.72	75	-14.28
	Low	37.21008	400MHz 1CC	53.35	56.54	58.24	75	-16.76
	Mid	38.4024		58.15	57.56	60.88	75	-14.12
	High	39.7848		57.57	56.96	60.29	75	-14.71
	Low	37.41744	200MHz 4CC	58.52	58.01	61.28	75	-13.72
	Mid	38.4024		58.40	58.01	61.22	75	-13.78
	High	39.59472		58.06	57.71	60.90	75	-14.10
	Low	37.41744	100MHz 8CC	58.25	57.82	61.05	75	-13.95
	Mid	38.4024		58.25	57.85	61.06	75	-13.94
	High	39.59472		57.81	57.48	60.66	75	-14.34

Note: Since the total power across the entire emission bandwidth for channels wider than 100MHz is below the limit per 100MHz, the device complies.

Modulation	Channel	Frequency (GHz)	Channel BW (MHz)	Horizontal Measured Avg EIRP (dBm)	Vertical Measured Avg EIRP (dBm)	Total Avg EIRP (dBm)	EIRP Limit (dBm/ 100MHz)	Margin (dB)
64QAM	Low	37.05456	100MHz 1CC	57.96	57.64	60.81	75	-14.19
	Mid	38.4024		58.34	57.73	61.06	75	-13.94
	High	39.94032		58.34	57.75	61.07	75	-13.93
	Low	37.1064	200MHz 1CC	57.87	57.77	60.83	75	-14.17
	Mid	38.4024		58.09	57.37	60.76	75	-14.24
	High	39.88848		57.93	57.48	60.72	75	-14.28
	Low	37.21008	400MHz 1CC	57.41	57.56	60.50	75	-14.50
	Mid	38.4024		58.09	57.52	60.82	75	-14.18
	High	39.7848		57.50	56.88	60.21	75	-14.79
	Low	37.41744	200MHz 4CC	58.36	57.98	61.18	75	-13.82
	Mid	38.4024		58.30	57.88	61.11	75	-13.89
	High	39.59472		57.78	57.49	60.65	75	-14.35
	Low	37.41744	100MHz 8CC	58.13	58.17	61.16	75	-13.84
	Mid	38.4024		58.15	57.73	60.96	75	-14.04
	High	39.59472		57.72	57.43	60.59	75	-14.41
256QAM	Low	37.05456	100MHz 1CC	57.85	57.68	60.78	75	-14.22
	Mid	38.4024		58.39	57.34	60.91	75	-14.09
	High	39.94032		58.44	57.77	61.13	75	-13.87
	Low	37.1064	200MHz 1CC	57.83	57.57	60.71	75	-14.29
	Mid	38.4024		58.08	57.32	60.73	75	-14.27
	High	39.88848		58.01	57.41	60.73	75	-14.27
	Low	37.21008	400MHz 1CC	57.42	57.52	60.48	75	-14.52
	Mid	38.4024		58.17	57.53	60.87	75	-14.13
	High	39.7848		57.54	57.00	60.29	75	-14.71
	Low	37.41744	200MHz 4CC	58.76	58.69	61.74	75	-13.26
	Mid	38.4024		58.44	58.26	61.36	75	-13.64
	High	39.59472		58.16	58.19	61.19	75	-13.81
	Low	37.41744	100MHz 8CC	58.88	58.78	61.84	75	-13.16
	Mid	38.4024		58.53	58.34	61.45	75	-13.55
	High	39.59472		58.24	58.31	61.29	75	-13.71

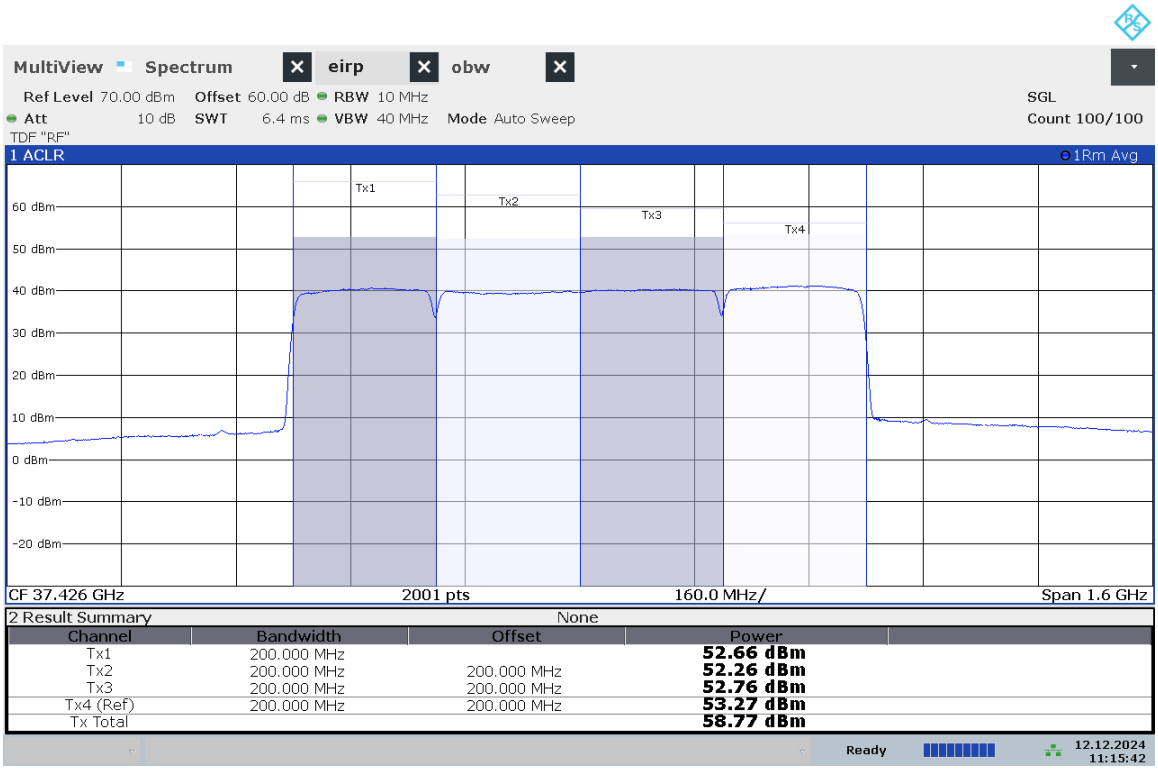
Note: Since the total power across the entire emission bandwidth for channels wider than 100MHz is below the limit per 100MHz, the device complies.

QPSK 200MHz 4CC Low Channel Horizontal



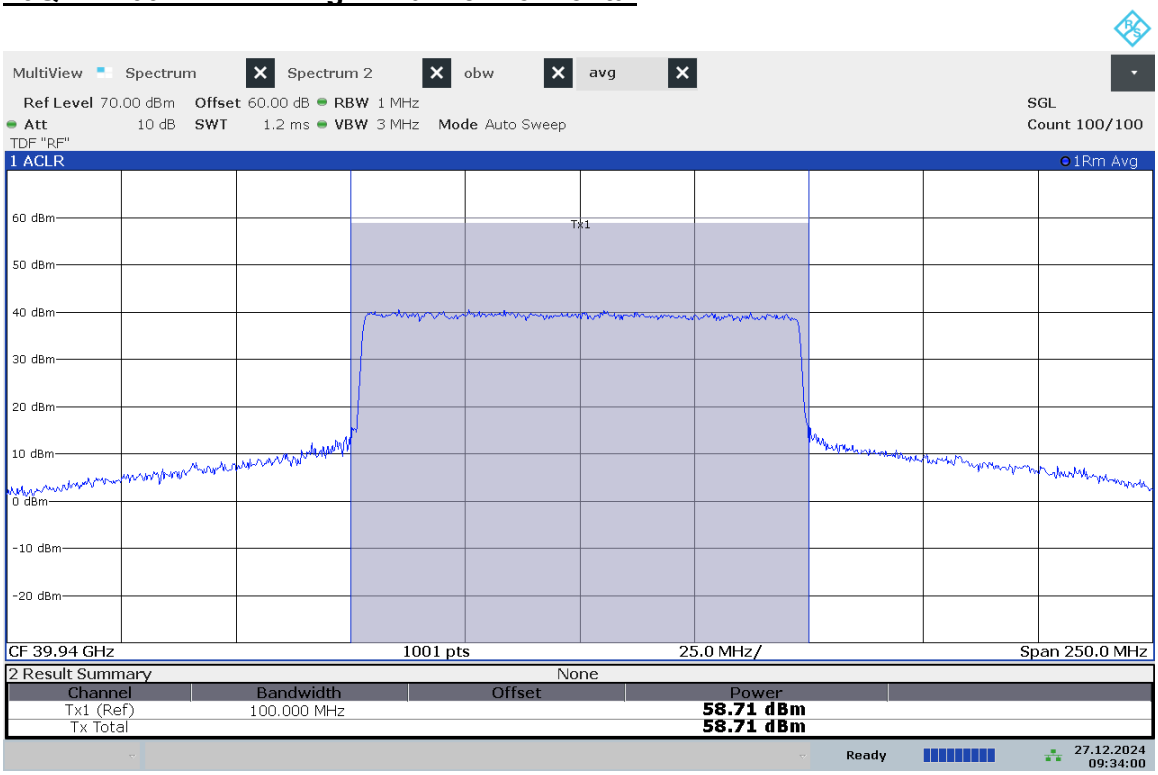
11:15:15 12.12.2024

QPSK 200MHz 4CC Low Channel Vertical



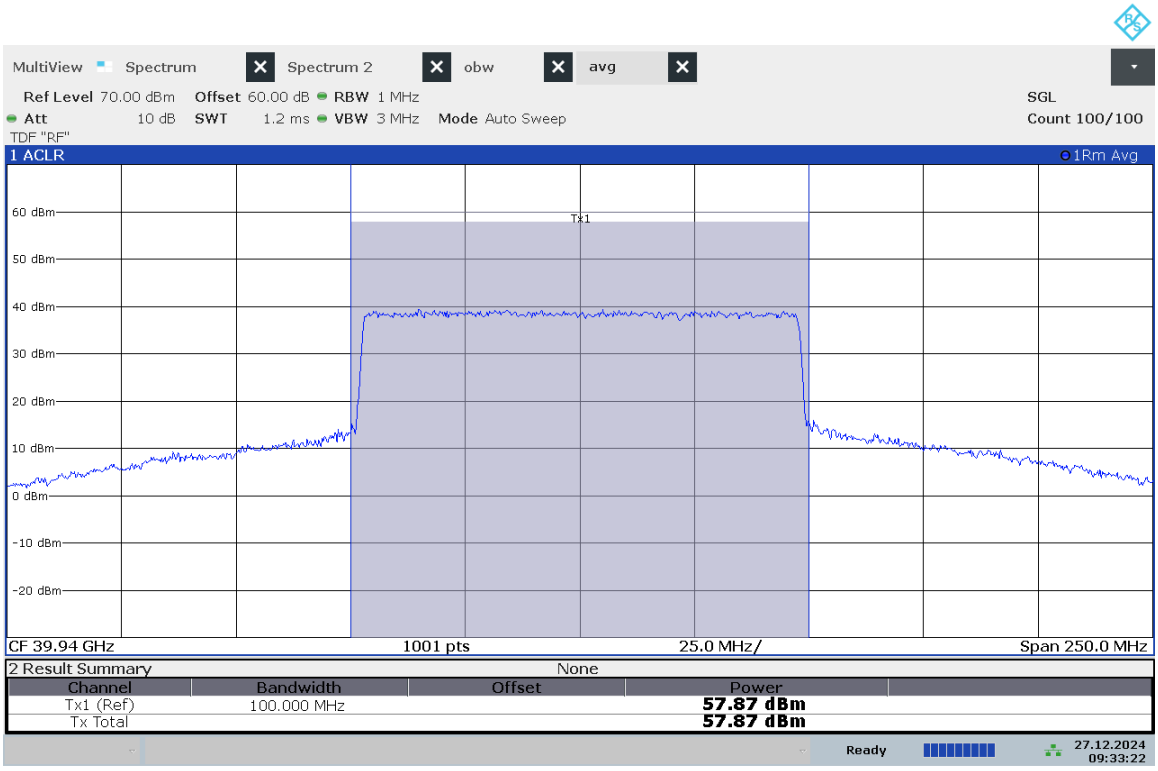
11:15:43 12.12.2024

16QAM 100MHz 1CC High Channel Horizontal



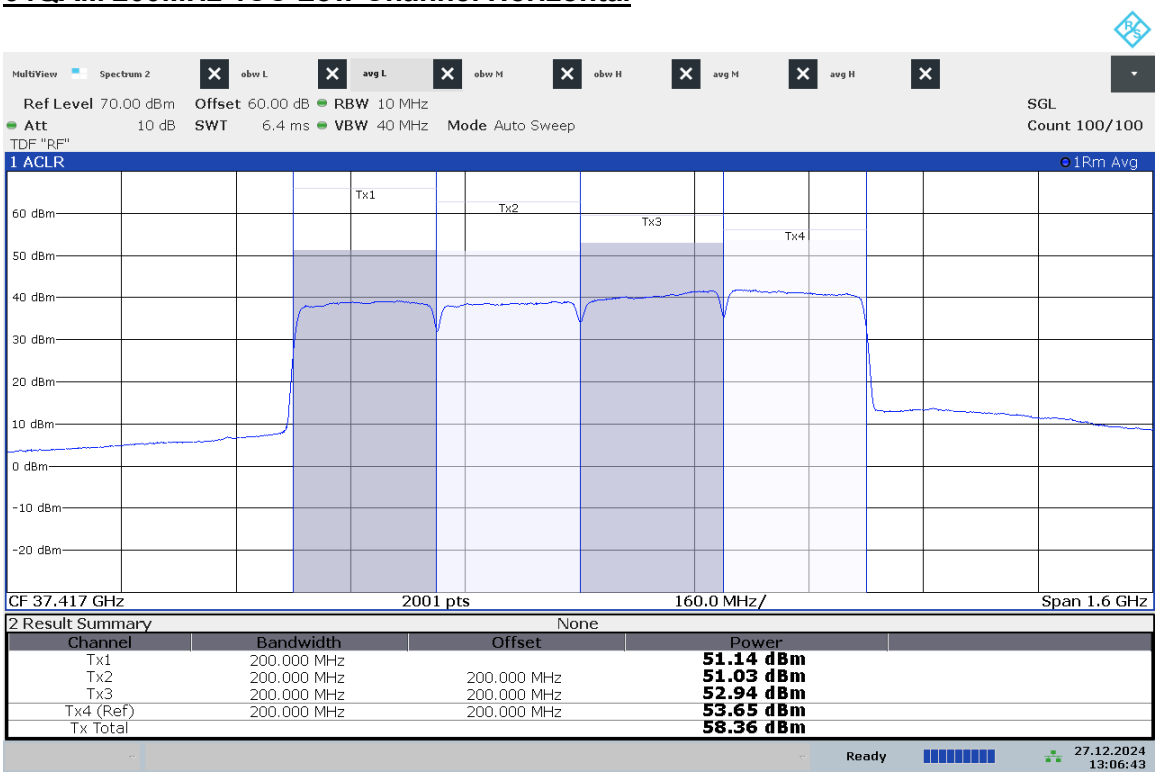
09:34:00 27.12.2024

16QAM 100MHz 1CC High Channel Vertical



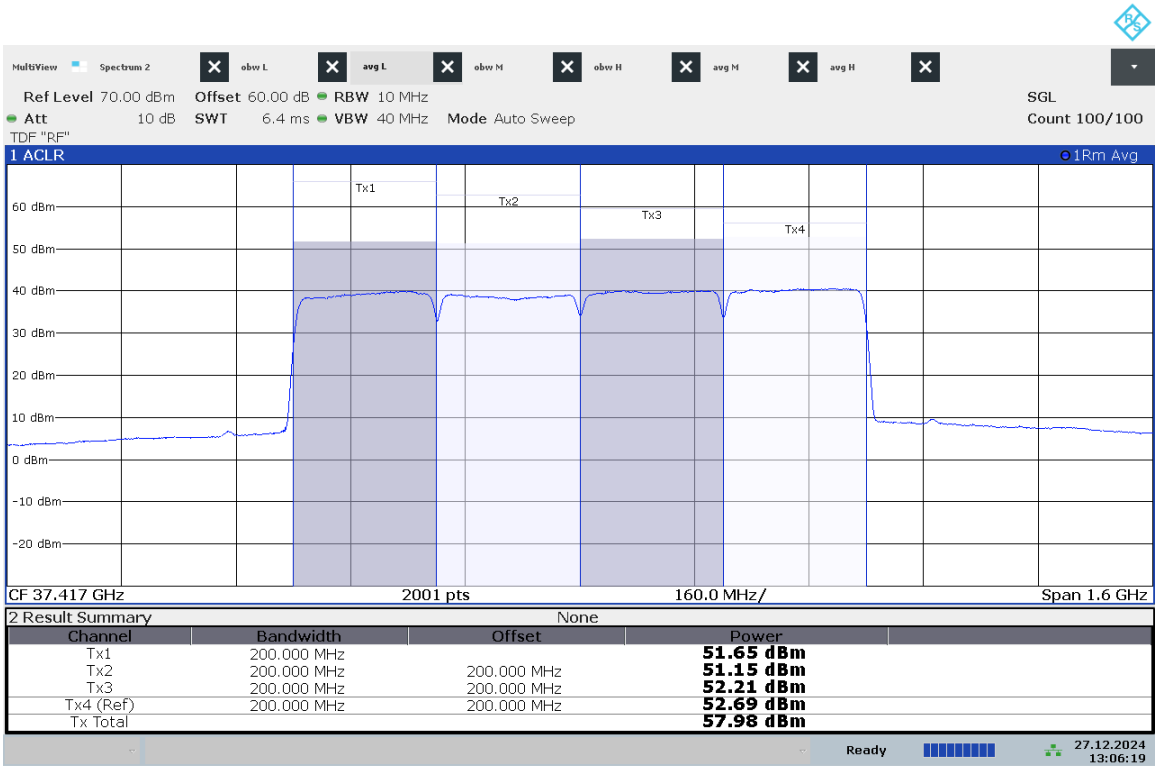
09:33:22 27.12.2024

64QAM 200MHz 4CC Low Channel Horizontal



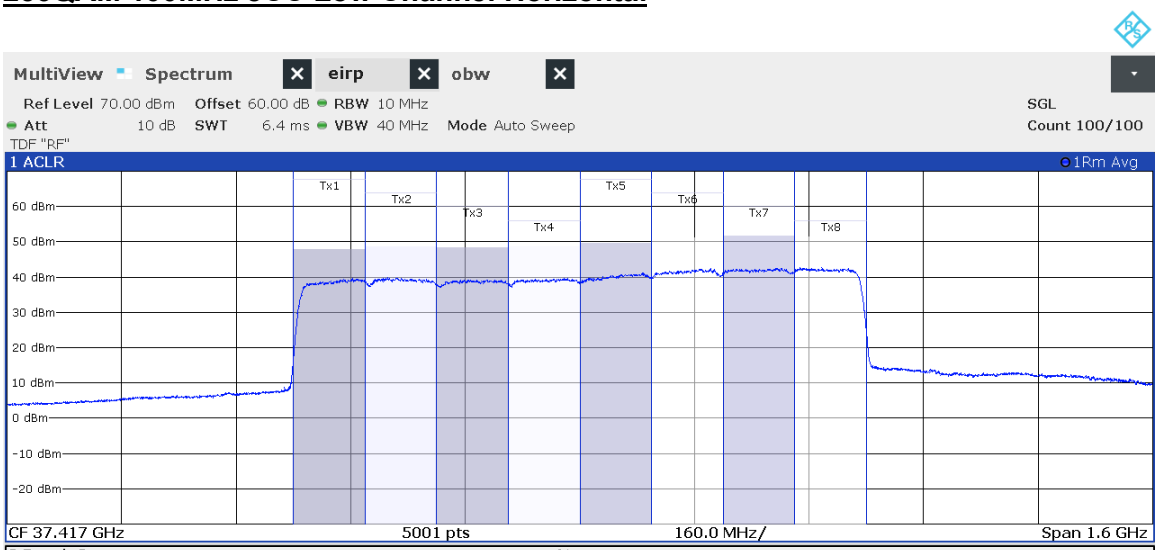
13:06:44 27.12.2024

64QAM 200MHz 4CC Low Channel Vertical



13:06:20 27.12.2024

256QAM 100MHz 8CC Low Channel Horizontal

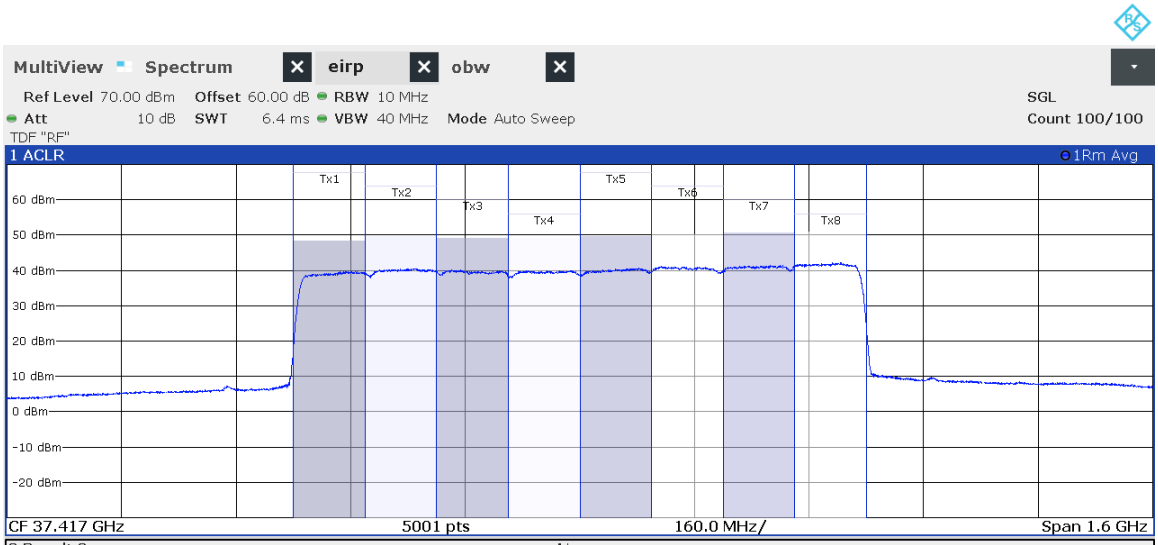


2 Result Summary — None

Channel	Bandwidth	Offset	Power
Tx1	100.000 MHz		**47.81 dBm**
Tx2	100.000 MHz	100.000 MHz	**48.69 dBm**
Tx3	100.000 MHz	100.000 MHz	**48.29 dBm**
Tx4	100.000 MHz	100.000 MHz	**48.64 dBm**
Tx5	100.000 MHz	100.000 MHz	**49.70 dBm**
Tx6	100.000 MHz	100.000 MHz	**51.08 dBm**
Tx7 (Ref)	100.000 MHz	100.000 MHz	**51.52 dBm**
Tx8	100.000 MHz	100.000 MHz	**51.30 dBm**
Tx Total			**58.88 dBm**

10:46:19 12.12.2024

256QAM 100MHz 8CC Low Channel Vertical



2 Result Summary — None

Channel	Bandwidth	Offset	Power
Tx1	100.000 MHz		**48.28 dBm**
Tx2	100.000 MHz	100.000 MHz	**49.57 dBm**
Tx3	100.000 MHz	100.000 MHz	**49.19 dBm**
Tx4	100.000 MHz	100.000 MHz	**49.10 dBm**
Tx5	100.000 MHz	100.000 MHz	**49.58 dBm**
Tx6	100.000 MHz	100.000 MHz	**50.21 dBm**
Tx7	100.000 MHz	100.000 MHz	**50.54 dBm**
Tx8 (Ref)	100.000 MHz	100.000 MHz	**50.90 dBm**
Tx Total			**58.78 dBm**

10:45:47 12.12.2024

8.4. BAND EDGE EMISSIONS

RULE PART(S)

FCC: §2.1051, §30.203

LIMITS

30.203 (a) - The conductive power or the total radiated power of any emission outside a licensee's frequency block shall be −13 dBm/MHz or lower. However, in the bands immediately outside and adjacent to the licensee's frequency block, having a bandwidth equal to 10 percent of the channel bandwidth, the conductive power or the total radiated power of any emission shall be −5 dBm/MHz or lower.

TEST PROCEDURE

- RBW = 1 MHz
- VBW ≥ 3 x RBW
- Number of measurement points in sweep > 2 x span / RBW
- Sweep time = auto-couple
- Detector = RMS
- Trace mode = Average

KDB 842590 D01 Upper Microwave Flexible Use Service v01 r02 Section 4.2
ANSI C63.26-2015 Clause 5.2, Clause 5.5, Clause 6.4, and Annex C.5.2

Band Edge measurements of variable frequency bands were performed at the far field test distance listed in Section 5.6.

EIRP was calculated using the equations on ANSI C63.26-2015 Annex C.5.2. The total correction factors of horn antenna gain, cable loss and far-field path loss were calculated using equations C.8 and C.9, and pre-loaded into spectrum analyzer. The data was further corrected using the EUT antenna gain per KDB 842590 Section 4.4.2.5.

Sample calculation of EIRP:

Total Correction Factor = Cable Loss (dB) – Horn Ant Gain (dBi) + Path Loss (dB)
= 4 – 23 + 71
= 52 dB

EIRP = $P_{measured}$ (dBm), where Total Correction Factor preloaded.

To properly display of signal level on the plots, the pre-loaded correction factors were intentional lowered by 60 dB and an offset factor of 60 dB was applied on spectrum analyzer to compensate the true correction factors across the frequency range of measurement.

Worse-Case Configuration

QPSK, 16QAM, 64QAM, and 256QAM modulations were all investigated in all bandwidths and low/high channel configurations. Full data is provided for all combinations.

To minimize report size, the worst-case plots of each modulation are provided to demonstrate the test parameter setting on signal analyzer. The tabular data includes data for the other combination of test modes.

RESULTS

See the following pages.

TESTED BY

Employee IDs: 23854
Test Dates: 2024-12-12 to 2024-12-23
Test Location: MOR indoor test site

8.4.1. BAND EDGE RESULTS

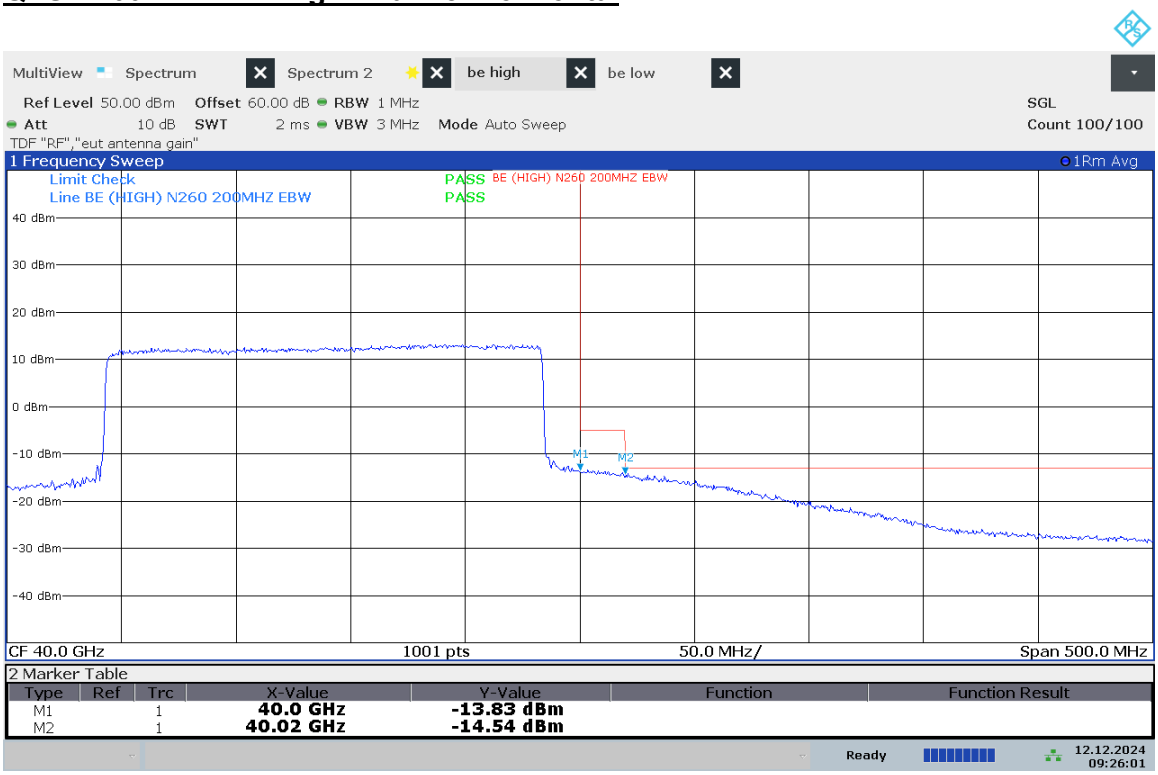
Modulation	Channel	Frequency (GHz)	Channel BW (MHz)	Test Frequency (GHz)	Horizontal Measured Avg EIRP (dBm)	Vertical Measured Avg EIRP (dBm)	EIRP Limit (dBm)	Horizontal Margin (dB)	Vertical Margin (dB)
QPSK	Low	37.05456	100MHz 1CC	36.99	-23.45	-25.57	-13	-10.45	-12.57
	Low			37	-19.59	-20.29	-5	-14.59	-15.29
	High	39.94032		40	-17.49	-17.28	-5	-12.49	-12.28
	High			40.01	-19.06	-18.26	-13	-6.06	-5.26
	Low	37.1064	200MHz 1CC	36.98	-28.38	-28.95	-13	-15.38	-15.95
	Low			37	-25.45	-25.18	-5	-20.45	-20.18
	High	39.88848		40	-13.83	-15.82	-5	-8.83	-10.82
	High			40.02	-14.54	-16.92	-13	-1.54	-3.92
	Low	37.21008	400MHz 1CC	36.96	-31.20	-31.63	-13	-18.20	-18.63
	Low			37	-28.96	-29.44	-5	-23.96	-24.44
	High	39.7848		40	-23.09	-21.84	-5	-18.09	-16.84
	High			40.04	-23.98	-22.89	-13	-10.98	-9.89
	Low	37.41744	200MHz 4CC	36.92	-31.53	-32.72	-13	-18.53	-19.72
	Low			37	-30.14	-31.84	-5	-25.14	-26.84
	High	39.59472		40	-25.02	-24.15	-5	-20.02	-19.15
	High			40.08	-26.47	-25.38	-13	-13.47	-12.38
	Low	37.41744	100MHz 8CC	36.92	-35.18	-33.00	-13	-22.18	-20.00
	Low			37	-34.32	-31.99	-5	-29.32	-26.99
	High	39.59472		40	-25.39	-24.46	-5	-20.39	-19.46
	High			40.08	-26.18	-25.06	-13	-13.18	-12.06

Modulation	Channel	Frequency (GHz)	Channel BW (MHz)	Test Frequency (GHz)	Horizontal Measured Avg EIRP (dBm)	Vertical Measured Avg EIRP (dBm)	EIRP Limit (dBm)	Horizontal Margin (dB)	Vertical Margin (dB)
16QAM	Low	37.05456	100MHz 1CC	36.99	-24.33	-26.53	-13	-11.33	-13.53
	Low			37	-19.92	-24.03	-5	-14.92	-19.03
	High	39.94032		40	-20.55	-18.41	-5	-15.55	-13.41
	High			40.01	-21.34	-19.49	-13	-8.34	-6.49
	Low	37.1064	200MHz 1CC	36.98	-30.77	-30.16	-13	-17.77	-17.16
	Low			37	-28.09	-25.96	-5	-23.09	-20.96
	High	39.88848		40	-22.23	-19.96	-5	-17.23	-14.96
	High			40.02	-23.67	-21.53	-13	-10.67	-8.53
	Low	37.21008	400MHz 1CC	36.96	-31.86	-31.87	-13	-18.86	-18.87
	Low			37	-30.45	-29.81	-5	-25.45	-24.81
	High	39.7848		40	-24.96	-23.30	-5	-19.96	-18.30
	High			40.04	-26.15	-23.83	-13	-13.15	-10.83
	Low	37.41744	200MHz 4CC	36.92	-32.88	-34.32	-13	-19.88	-21.32
	Low			37	-32.26	-33.06	-5	-27.26	-28.06
	High	39.59472		40	-27.64	-25.19	-5	-22.64	-20.19
	High			40.08	-28.24	-26.29	-13	-15.24	-13.29
	Low	37.41744	100MHz 8CC	36.92	-33.60	-33.59	-13	-20.60	-20.59
	Low			37	-31.73	-32.54	-5	-26.73	-27.54
	High	39.59472		40	-27.14	-25.13	-5	-22.14	-20.13
	High			40.08	-28.26	-26.58	-13	-15.26	-13.58

Modulation	Channel	Frequency (GHz)	Channel BW (MHz)	Test Frequency (GHz)	Horizontal Measured Avg EIRP (dBm)	Vertical Measured Avg EIRP (dBm)	EIRP Limit (dBm)	Horizontal Margin (dB)	Vertical Margin (dB)
64QAM	Low	37.05456	100MHz 1CC	36.99	-23.72	-24.01	-13	-10.72	-11.01
	Low			37	-19.50	-21.98	-5	-14.50	-16.98
	High	39.94032		40	-20.66	-18.38	-5	-15.66	-13.38
	High			40.01	-21.75	-19.32	-13	-8.75	-6.32
	Low	37.1064	200MHz 1CC	36.98	-30.15	-28.98	-13	-17.15	-15.98
	Low			37	-27.18	-24.15	-5	-22.18	-19.15
	High	39.88848		40	-22.46	-21.02	-5	-17.46	-16.02
	High			40.02	-24.31	-21.23	-13	-11.31	-8.23
	Low	37.21008	400MHz 1CC	36.96	-32.74	-32.70	-13	-19.74	-19.70
	Low			37	-30.17	-30.09	-5	-25.17	-25.09
	High	39.7848		40	-25.39	-22.54	-5	-20.39	-17.54
	High			40.04	-25.73	-24.00	-13	-12.73	-11.00
	Low	37.41744	200MHz 4CC	36.92	-33.05	-33.91	-13	-20.05	-20.91
	Low			37	-31.52	-33.18	-5	-26.52	-28.18
	High	39.59472		40	-27.66	-25.12	-5	-22.66	-20.12
	High			40.08	-28.19	-26.57	-13	-15.19	-13.57
	Low	37.41744	100MHz 8CC	36.92	-33.07	-33.62	-13	-20.07	-20.62
	Low			37	-31.45	-32.75	-5	-26.45	-27.75
	High	39.59472		40	-27.38	-24.91	-5	-22.38	-19.91
	High			40.08	-28.18	-26.48	-13	-15.18	-13.48

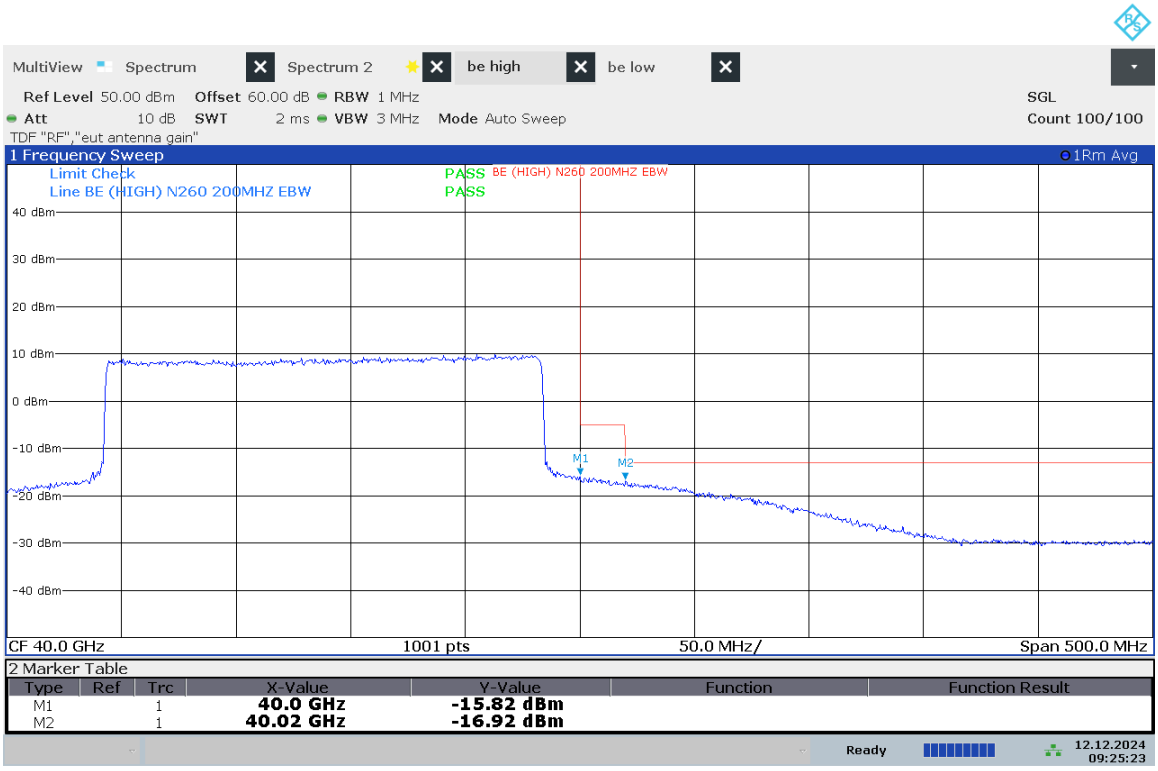
Modulation	Channel	Frequency (GHz)	Channel BW (MHz)	Test Frequency (GHz)	Horizontal Measured Avg EIRP (dBm)	Vertical Measured Avg EIRP (dBm)	EIRP Limit (dBm)	Horizontal Margin (dB)	Vertical Margin (dB)
256QAM	Low	37.05456	100MHz 1CC	36.99	-24.24	-24.46	-13	-11.24	-11.46
	Low			37	-19.33	-18.63	-5	-14.33	-13.63
	High	39.94032		40	-19.52	-17.29	-5	-14.52	-12.29
	High			40.01	-19.61	-18.06	-13	-6.61	-5.06
	Low	37.1064	200MHz 1CC	36.98	-27.77	-28.82	-13	-14.77	-15.82
	Low			37	-25.19	-24.85	-5	-20.19	-19.85
	High	39.88848		40	-21.73	-19.72	-5	-16.73	-14.72
	High			40.02	-21.59	-21.16	-13	-8.59	-8.16
	Low	37.21008	400MHz 1CC	36.96	-31.78	-32.84	-13	-18.78	-19.84
	Low			37	-29.68	-29.99	-5	-24.68	-24.99
	High	39.7848		40	-24.35	-22.40	-5	-19.35	-17.40
	High			40.04	-25.32	-23.83	-13	-12.32	-10.83
	Low	37.41744	200MHz 4CC	36.92	-32.29	-32.93	-13	-19.29	-19.93
	Low			37	-31.04	-32.09	-5	-26.04	-27.09
	High	39.59472		40	-26.24	-24.01	-5	-21.24	-19.01
	High			40.08	-26.74	-25.24	-13	-13.74	-12.24
	Low	37.41744	100MHz 8CC	36.92	-31.56	-32.90	-13	-18.56	-19.90
	Low			37	-31.24	-31.90	-5	-26.24	-26.90
	High	39.59472		40	-25.51	-24.16	-5	-20.51	-19.16
	High			40.08	-26.55	-25.52	-13	-13.55	-12.52

QPSK 200MHz 1CC High Channel Horizontal



09:26:02 12.12.2024

QPSK 200MHz 1CC High Channel Vertical



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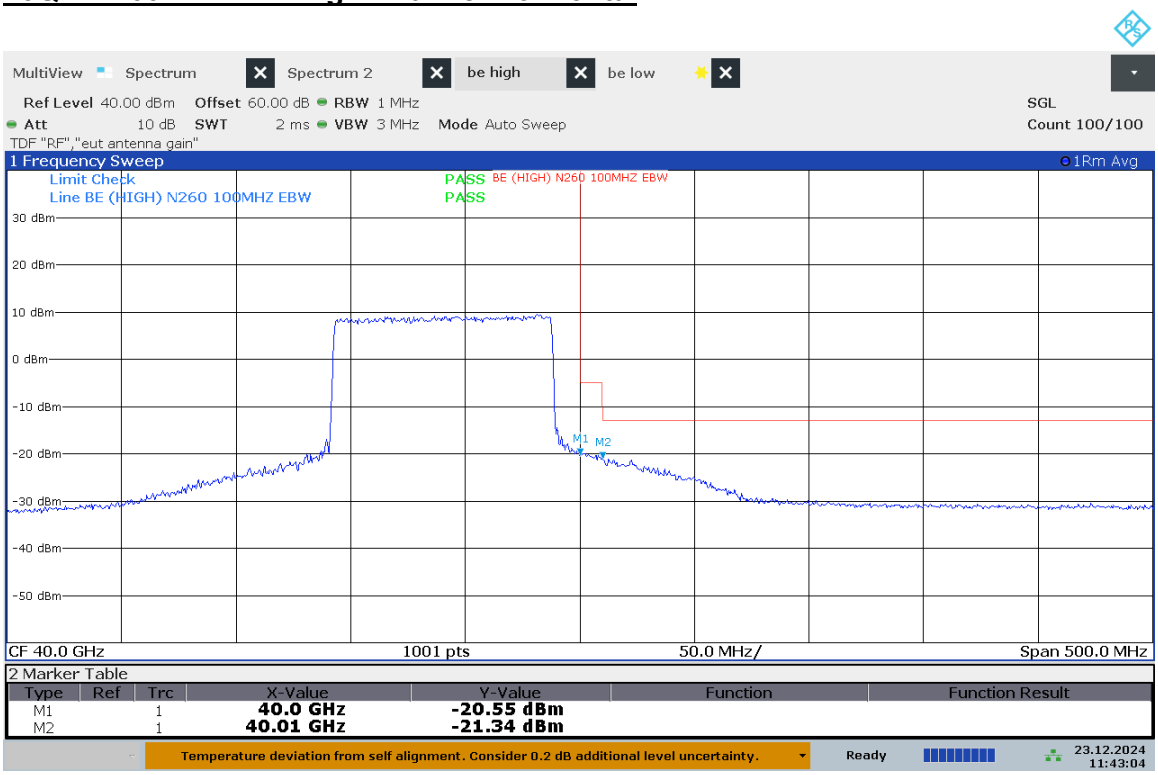
16QAM 100MHz 1CC High Channel Horizontal



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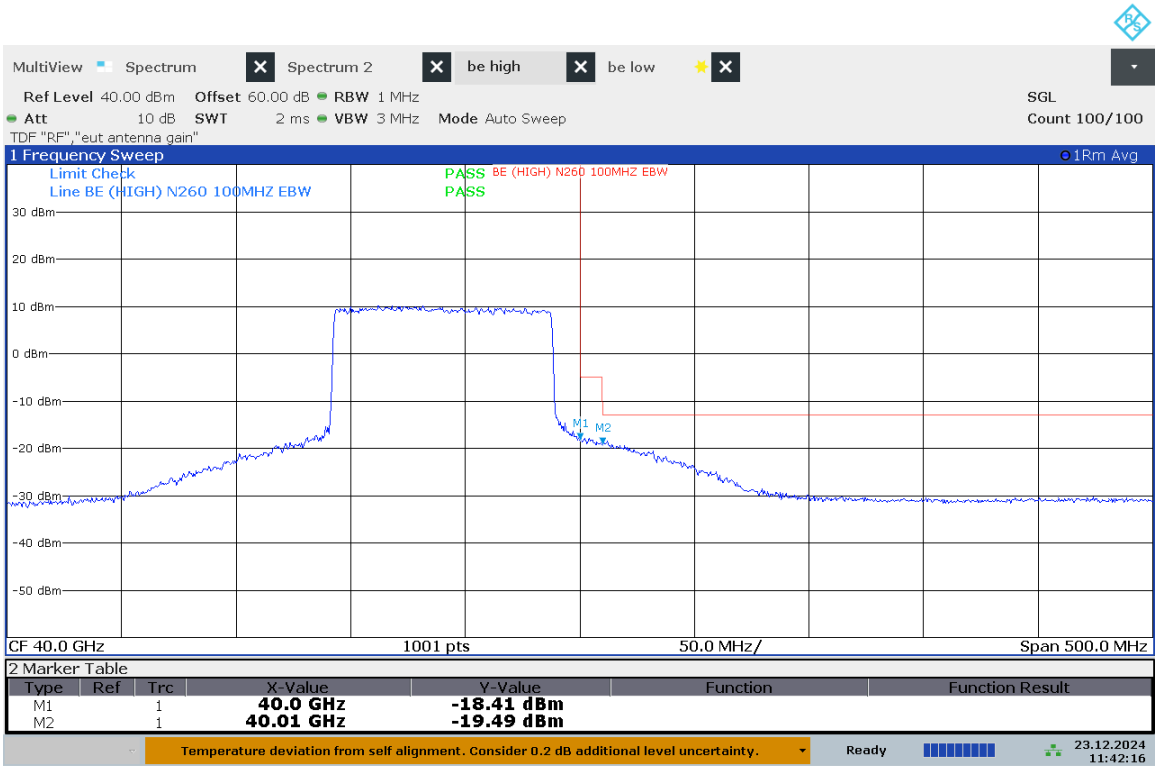
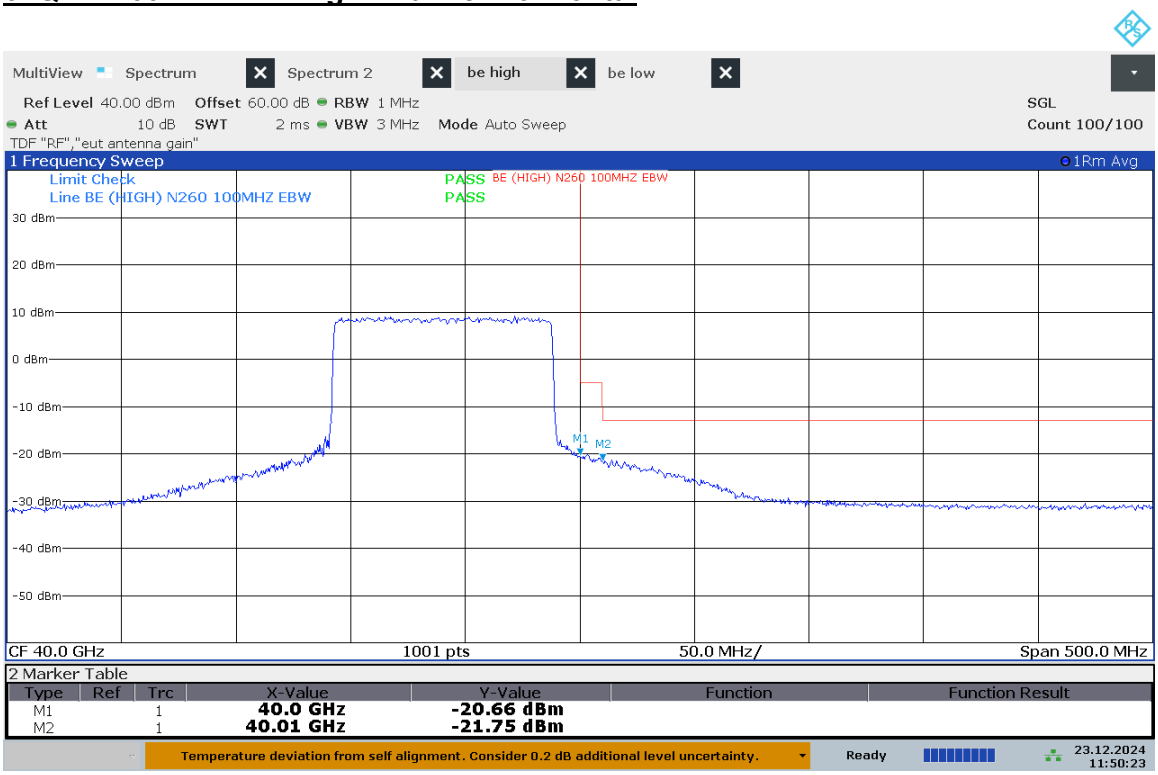
16QAM 100MHz 1CC High Channel Vertical



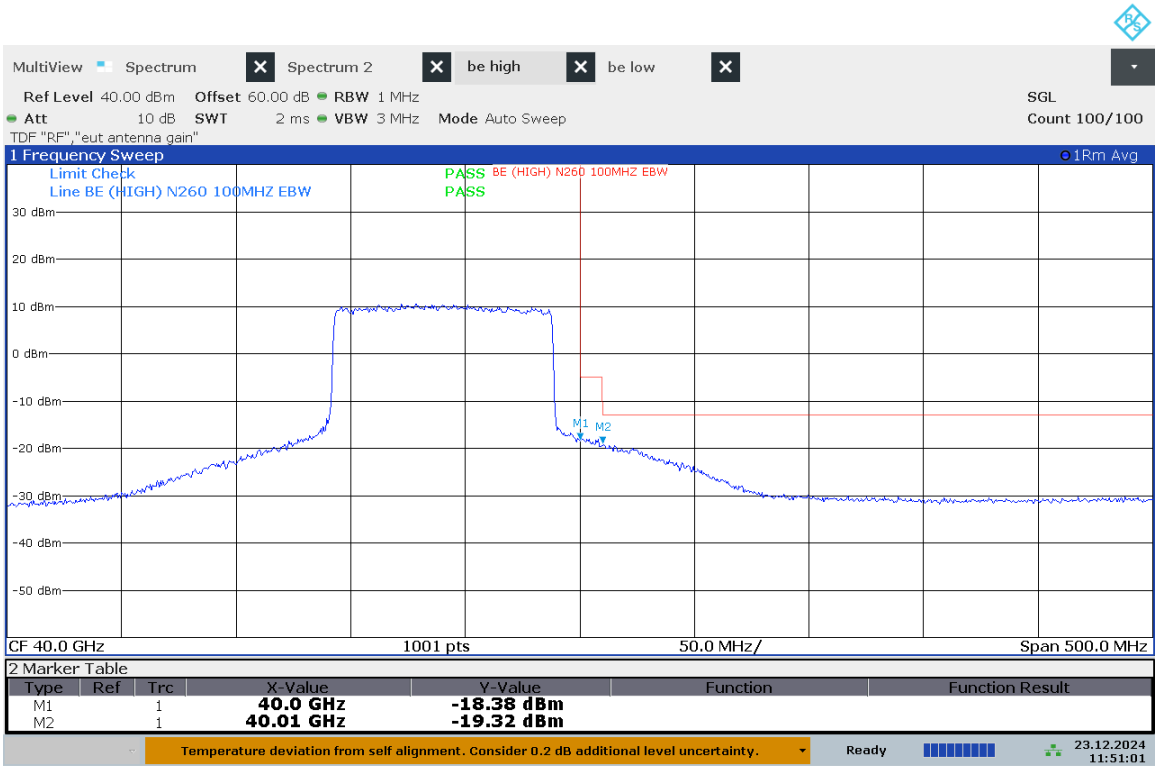
11:42:17 23.12.2024

64QAM 100MHz 1CC High Channel Horizontal



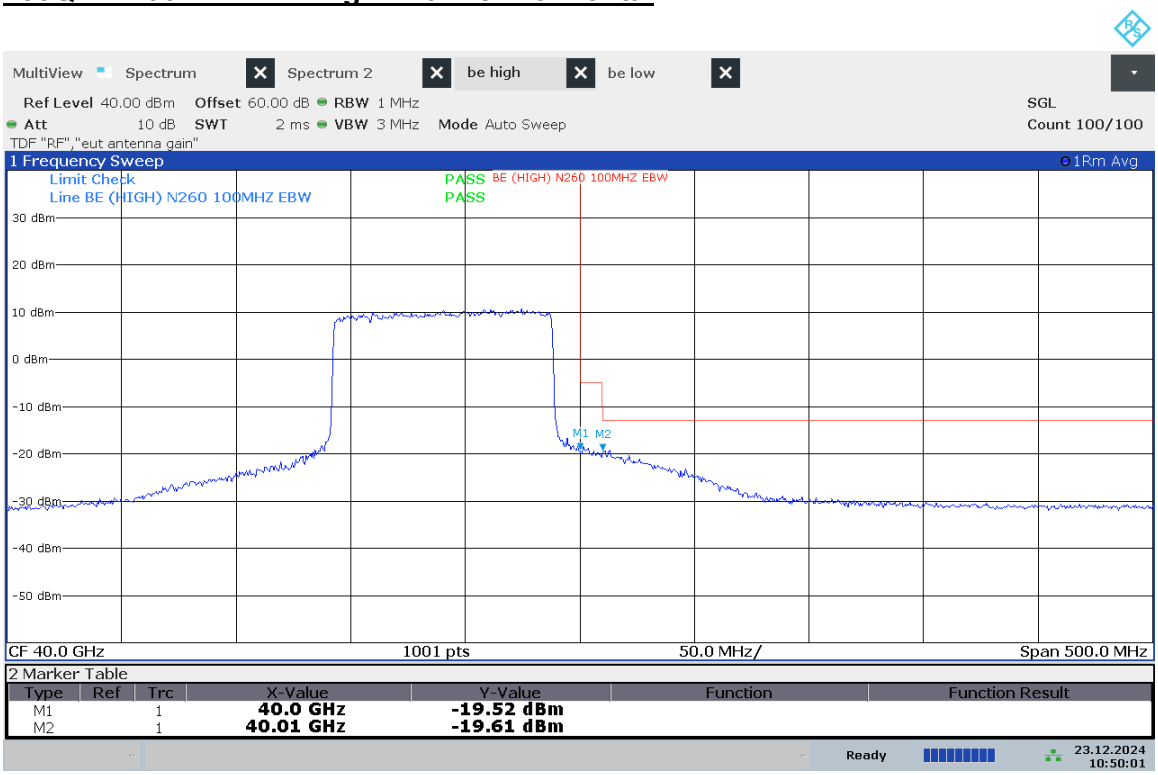
11:50:24 23.12.2024

64QAM 100MHz 1CC High Channel Vertical



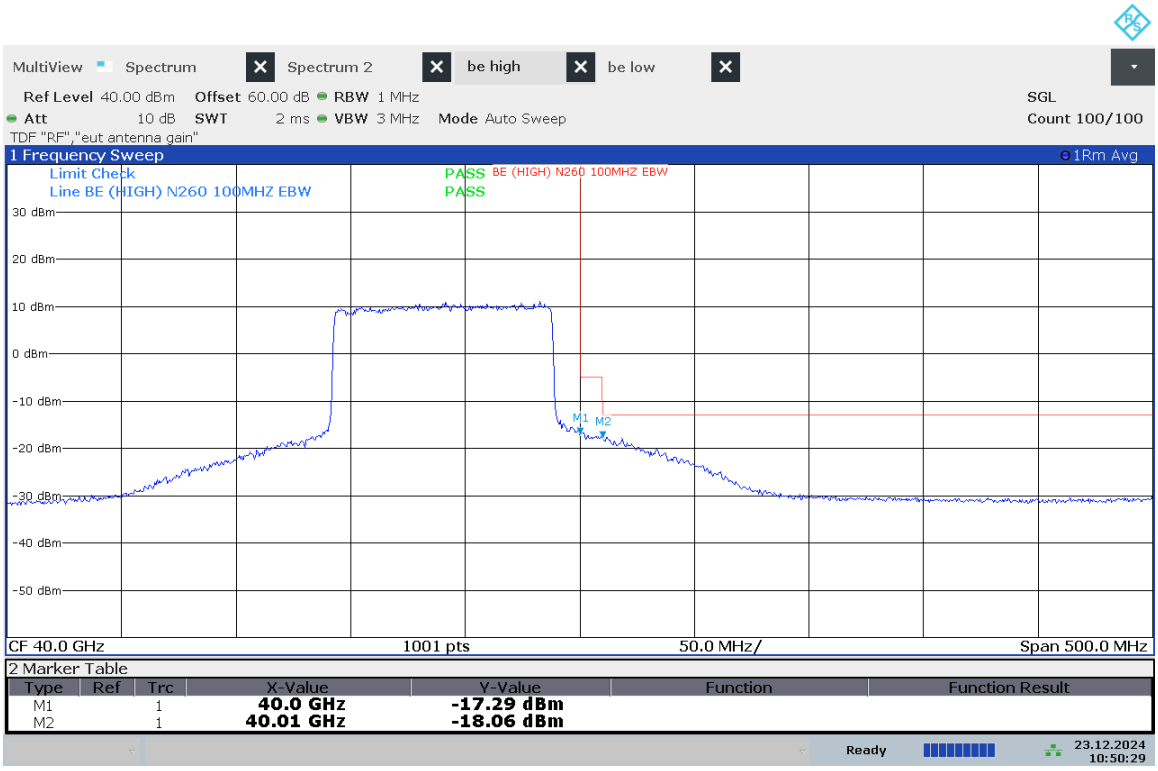
11:51:01 23.12.2024

256QAM 100MHz 1CC High Channel Horizontal



10:50:02 23.12.2024

256QAM 100MHz 1CC High Channel Vertical



10:50:30 23.12.2024

8.5. RADIATED SPURIOUS EMISSIONS

RULE PART(S)

FCC: §2.1051, §30.203

LIMIT

30.203 - (a) The conductive power or the total radiated power of any emission outside a licensee's frequency block shall be −13 dBm/MHz or lower.

TEST PROCEDURE

KDB 842590 D01 Upper Microwave Flexible Use Service v01 r02 Section 4.4.3.
ANSI C63.26-2015 Clause 5.5.4 and Annex C.5.2.

All radiated spurious emissions were measured as either EIRP or TRP (where appropriate) to compare with the §30.203 TRP limits to demonstrate compliance.

RSE was investigated from 30 MHz – 200 GHz on n260 band.

Plots below 18 GHz are corrected field strength levels, measured at 3-meter test distance. The average EIRP reported below is calculated per section 5.2.7 of ANSI C63.26-2015 which states: EIRP (dBm) = E (dBμV/m) + 20log(D) − 104.8; where D is the measurement distance (in the far field region) in m. The field strength E is calculated E (dBμV/m) = Spectrum Analyzer Level (dBm) + Antenna Factor (dB/m) + Cable Loss (dB) + 107. All appropriate Antenna Factor and Cable Loss have been applied in the spectrum analyzer for each measurement.

RSEs from 1 – 200 GHz were measured at 1.5 meters height.

RSEs above 18 GHz were measured at the appropriate far field distances listed on Section 5.6 on this report (FAR-FIELD DISTANCE AND MEASUREMENT DISTANCE). RSEs from 18 – 50 GHz were measured using a spectrum analyzer or EMI receiver with an internal preamplifier when applicable. Emissions above 50 GHz were measured using a downconverter with spectrum analyzer, while an external LNA was used when applicable.

EIRP of RSE was calculated using the equations on ANSI C63.26-2015 Annex C.5.2. The total correction factor of cable loss, horn antenna gain, harmonic mixer loss, LNA gain and far-field path loss were calculated using equations C.8 and C.9 and pre-loaded into the spectrum analyzer.

Sample calculation of EIRP:

Total Correction Factor = Cable Loss (dB) – Horn Ant Gain (dBi) + Mixer Loss (dB) – LNA Gain (dB) + Path Loss (dB)
= 4 – 23 + 12 – 30 + 71
= 34 dB

EIRP = $P_{measured}$ (dBm), where Total Correction Factor preloaded.

Worse-Case Configuration

All RSEs were measured for the configuration with the highest EIRP (Low Channel 256QAM 100MHz 8CC) as representing the worst case. Data from low, mid, and high channels was taken from 1 GHz to 200 GHz, and for low channel only from 9 kHz to 1GHz.

Where the measured EIRP value is greater than the limit, a TRP measurement is made, otherwise the EIRP value is compared with the §30.203 TRP limits to demonstrate compliance.

RESULTS

See the following pages.

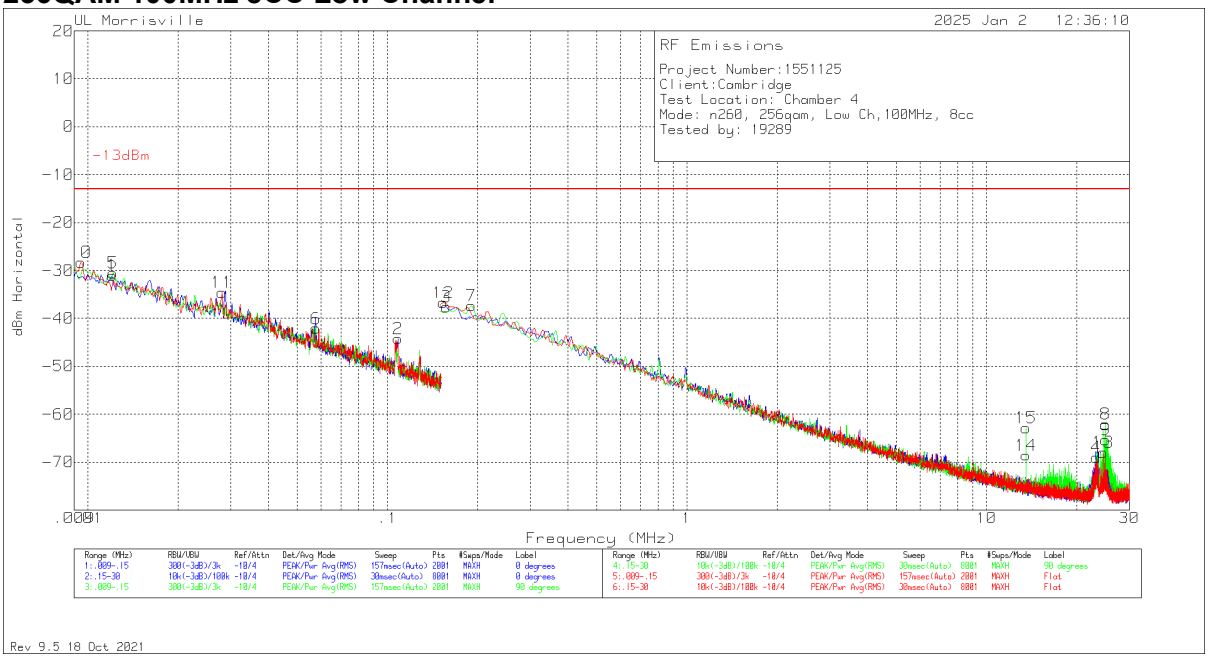
TESTED BY

Below 40 GHz Test Site: Chamber 4
Employee IDs: 19289
Test Dates: 2025-01-02

Above 40 GHz Test Site: Chamber 3
Employee IDs: 23854
Test Dates: 2024-12-31 to 2025-01-03

8.5.1. RADIATED EMISSIONS 0.009-30 MHz

256QAM 100MHz 8CC Low Channel

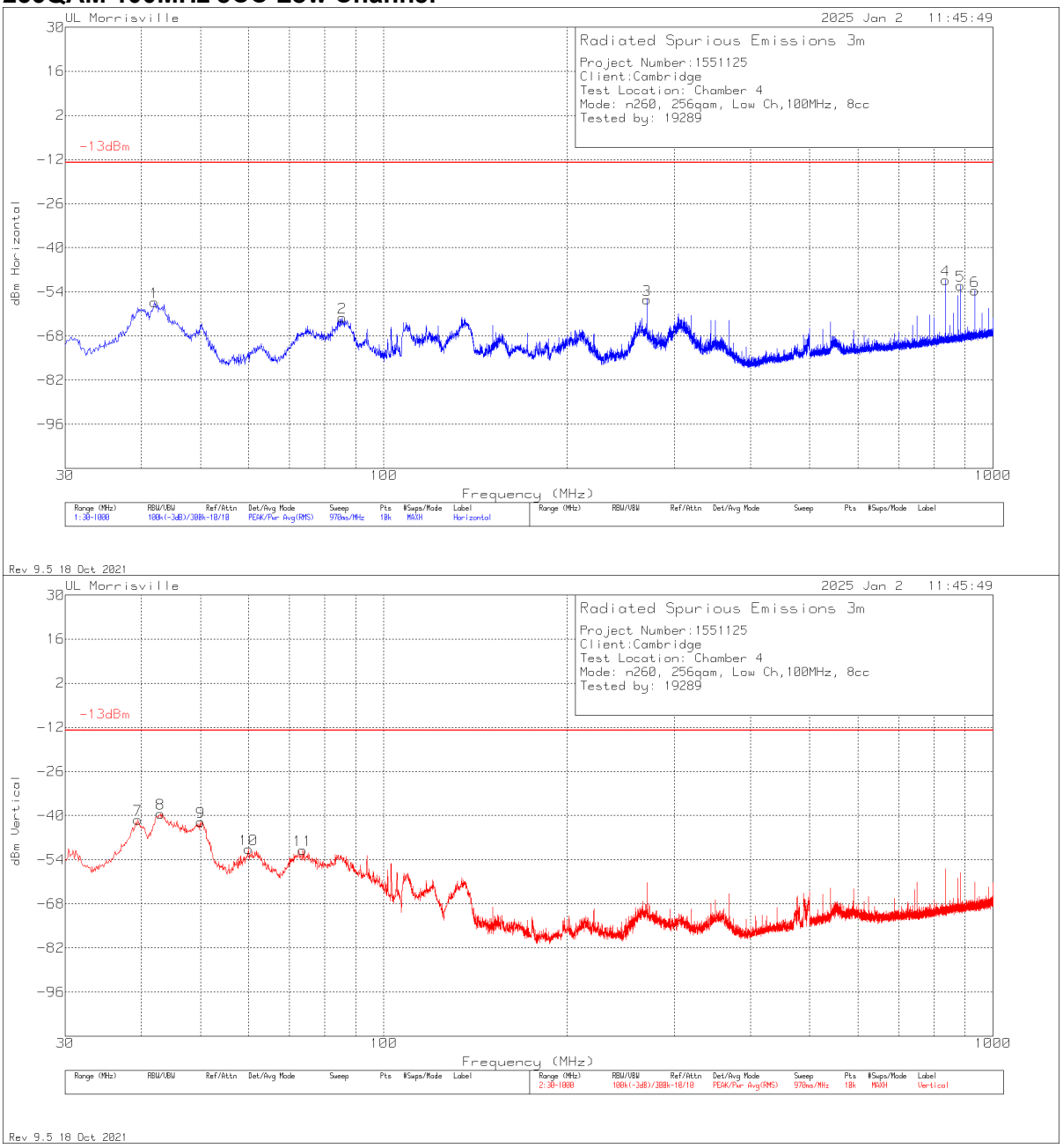


Marker	Frequency (MHz)	Meter Reading (dBm)	Det	135144 (dB/m)	Gain/Loss (dB)	Conversion Factor (dB)	Corrected Reading dBm	-13dBm	PK Margin (dB)	Azimuth (Degs)	Loop Angle
10	.0095	-58.93	Pk	18.7	.1	11.8	-28.33	-13	-15.33	0-360	Flat
1	.01205	-60.23	Pk	17.3	.1	11.8	-31.03	-13	-18.03	0-360	0 degs
5	.01212	-59.68	Pk	17.3	.1	11.8	-30.48	-13	-17.48	0-360	90 degs
11	.02803	-59.8	Pk	13.3	.1	11.8	-34.6	-13	-21.6	0-360	Flat
6	.05764	-65.41	Pk	11.4	.1	11.8	-42.11	-13	-29.11	0-360	90 degs
2	.10833	-67.21	Pk	11.1	.1	11.8	-44.21	-13	-31.21	0-360	0 degs
12	.15373	-59.63	Pk	11	.1	11.8	-36.73	-13	-23.73	0-360	Flat
3	.15746	-60.52	Pk	11	.1	11.8	-37.62	-13	-24.62	0-360	0 degs
7	.19104	-60.19	Pk	11	.1	11.8	-37.29	-13	-24.29	0-360	90 degs
14	13.55921	-90.66	Pk	9.8	.5	11.8	-68.56	-13	-55.56	0-360	0 degs
15	13.55921	-84.92	Pk	9.8	.5	11.8	-62.82	-13	-49.82	0-360	90 degs
4	23.21504	-89.86	Pk	8.5	.6	11.8	-68.96	-13	-55.96	0-360	0 degs
13	24.47612	-88.65	Pk	8.3	.6	11.8	-67.95	-13	-54.95	0-360	Flat
8	24.94996	-82.68	Pk	8.2	.6	11.8	-62.08	-13	-49.08	0-360	90 degs
9	24.95369	-85.95	Pk	8.2	.6	11.8	-65.35	-13	-52.35	0-360	0 degs

Pk - Peak detector

8.5.2. RADIATED EMISSIONS 30-1000 MHz

256QAM 100MHz 8CC Low Channel

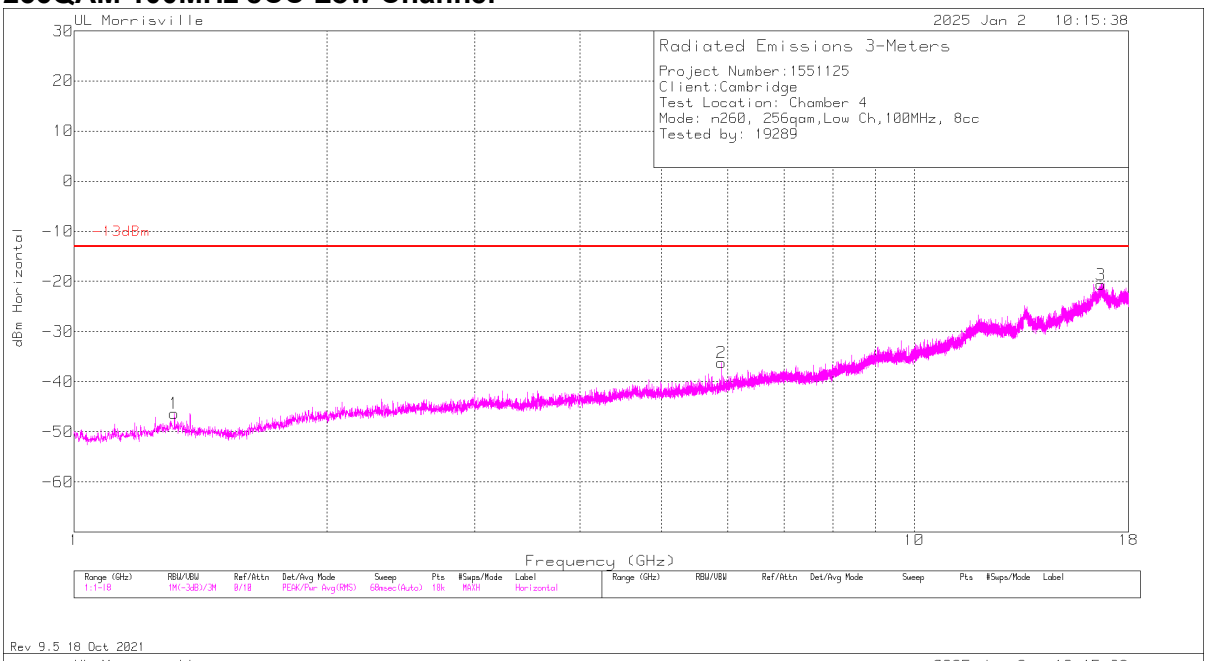


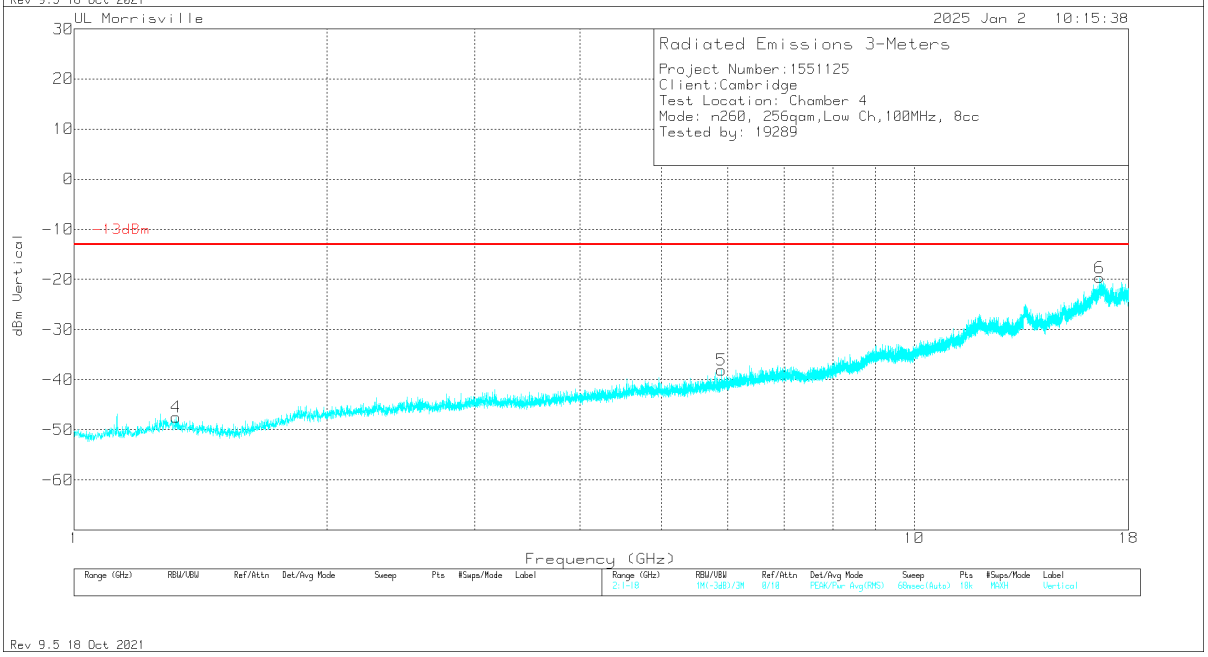
Marker	Frequency (MHz)	Meter Reading (dBm)	Det	90628 (dB/m)	Gain/Loss (dB)	Conversion Factor (dB)	Corrected Reading dBm	-13dBm	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
7	39.506	-41.47	Pk	20.3	-31.9	11.8	-41.27	-13	-28.27	0-360	100	V
1	42.028	-55.66	Pk	18.5	-31.9	11.8	-57.26	-13	-44.26	0-360	100	H
8	42.998	-36.95	Pk	17.8	-32	11.8	-39.35	-13	-26.35	0-360	100	V
9	50.079	-36.1	Pk	14.1	-31.8	11.8	-42	-13	-29	0-360	100	V
10	59.973	-44.48	Pk	13.8	-31.8	11.8	-50.68	-13	-37.68	0-360	100	V
11	73.553	-45.39	Pk	14.3	-31.7	11.8	-50.99	-13	-37.99	0-360	100	V
2	85.484	-55.9	Pk	13.5	-31.5	11.8	-62.1	-13	-49.1	0-360	100	H
3	270.269	-57.08	Pk	19.3	-30.5	11.8	-56.48	-13	-43.48	0-360	100	H
4	835.585	-61.71	Pk	27.7	-28	11.8	-50.21	-13	-37.21	0-360	100	H
5	884.764	-64.38	Pk	28.1	-27.5	11.8	-51.98	-13	-38.98	0-360	100	H
6	933.943	-67.07	Pk	28.5	-26.9	11.8	-53.67	-13	-40.67	0-360	100	H

Pk - Peak detector

8.5.3. RADIATED EMISSIONS 1-18 GHz

256QAM 100MHz 8CC Low Channel

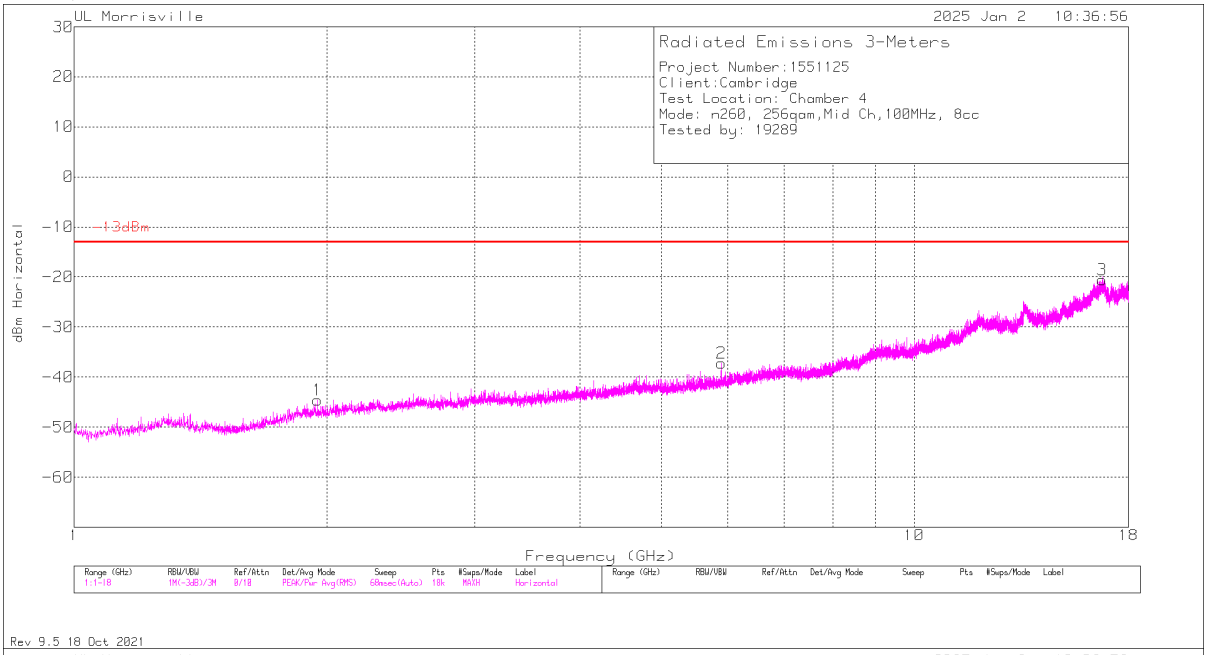


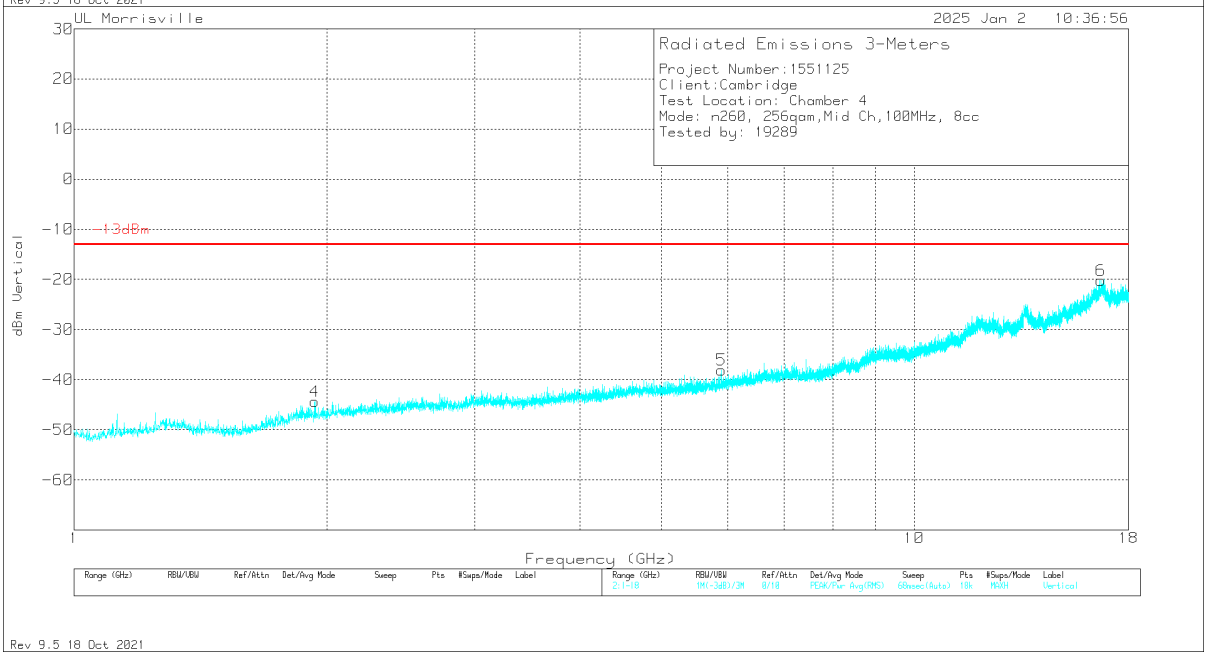


Marker	Frequency (GHz)	Meter Reading (dBm)	Det	89509 ACF (dB/m)	Gain/Loss (dB)	CF (dB)	Corrected Reading dBm	-13dBm	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	1.31639	-61.19	Pk	29	-26	11.8	-46.39	-13	-33.39	0-360	100	H
4	1.323	-62.38	Pk	29	-25.9	11.8	-47.48	-13	-34.48	0-360	200	V
2	5.89789	-62.69	Pk	34.9	-20.2	11.8	-36.19	-13	-23.19	0-360	100	H
5	5.89789	-64.57	Pk	34.9	-20.2	11.8	-38.07	-13	-25.07	0-360	300	V
6	16.62205	-65.33	Pk	41.6	-7.7	11.8	-19.63	-13	-6.63	0-360	300	V
3	16.67871	-65.83	Pk	41.8	-8.4	11.8	-20.63	-13	-7.63	0-360	100	H

Pk - Peak detector

256QAM 100MHz 8CC Mid Channel

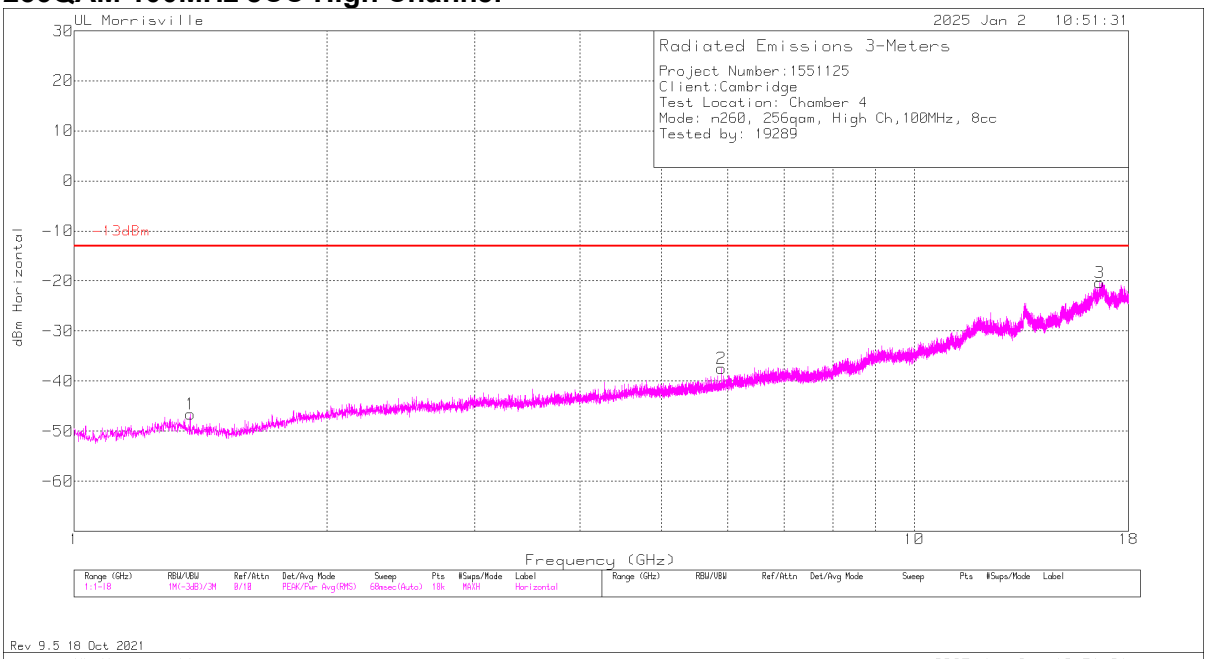


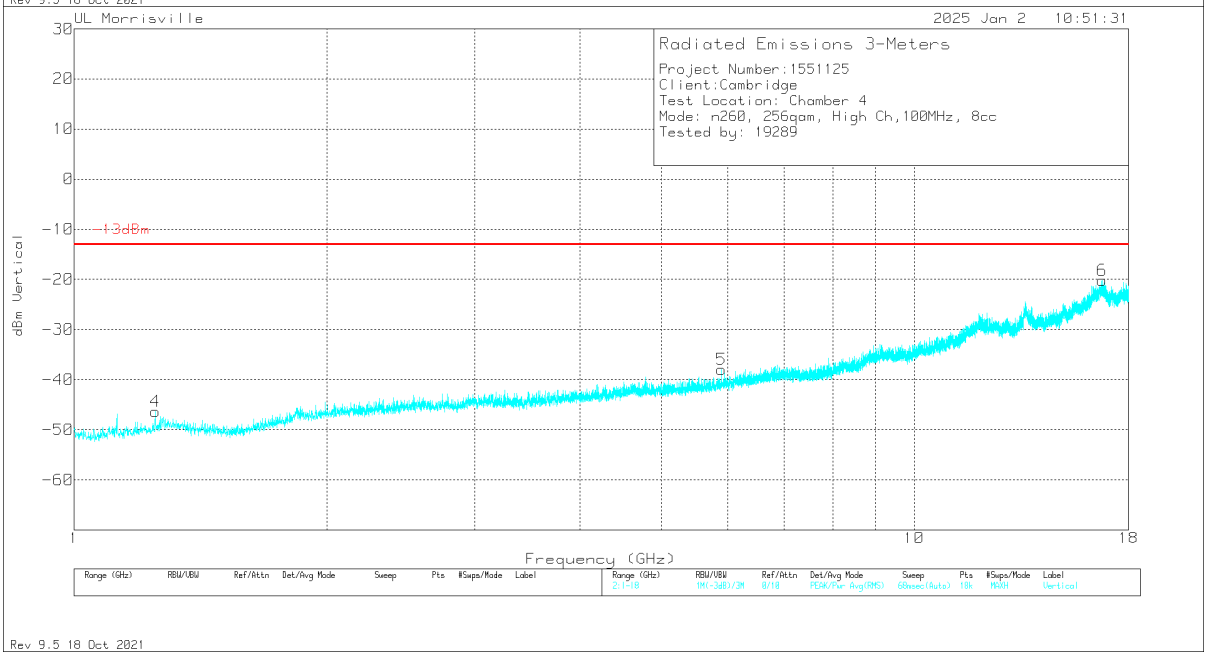


Marker	Frequency (GHz)	Meter Reading (dBm)	Det	89509 ACF (dB/m)	Gain/Loss (dB)	CF (dB)	Corrected Reading dBm	-13dBm	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
4	1.93406	-60.8	Pk	30.7	-26.1	11.8	-44.4	-13	-31.4	0-360	300	V
1	1.94917	-61.08	Pk	30.8	-26.1	11.8	-44.58	-13	-31.58	0-360	100	H
2	5.89789	-63.76	Pk	34.9	-20.2	11.8	-37.26	-13	-24.26	0-360	100	H
5	5.89789	-64.62	Pk	34.9	-20.2	11.8	-38.12	-13	-25.12	0-360	200	V
6	16.69477	-65.74	Pk	41.8	-8.1	11.8	-20.24	-13	-7.24	0-360	300	V
3	16.73538	-66.44	Pk	41.9	-7.8	11.8	-20.54	-13	-7.54	0-360	100	H

Pk - Peak detector

256QAM 100MHz 8CC High Channel



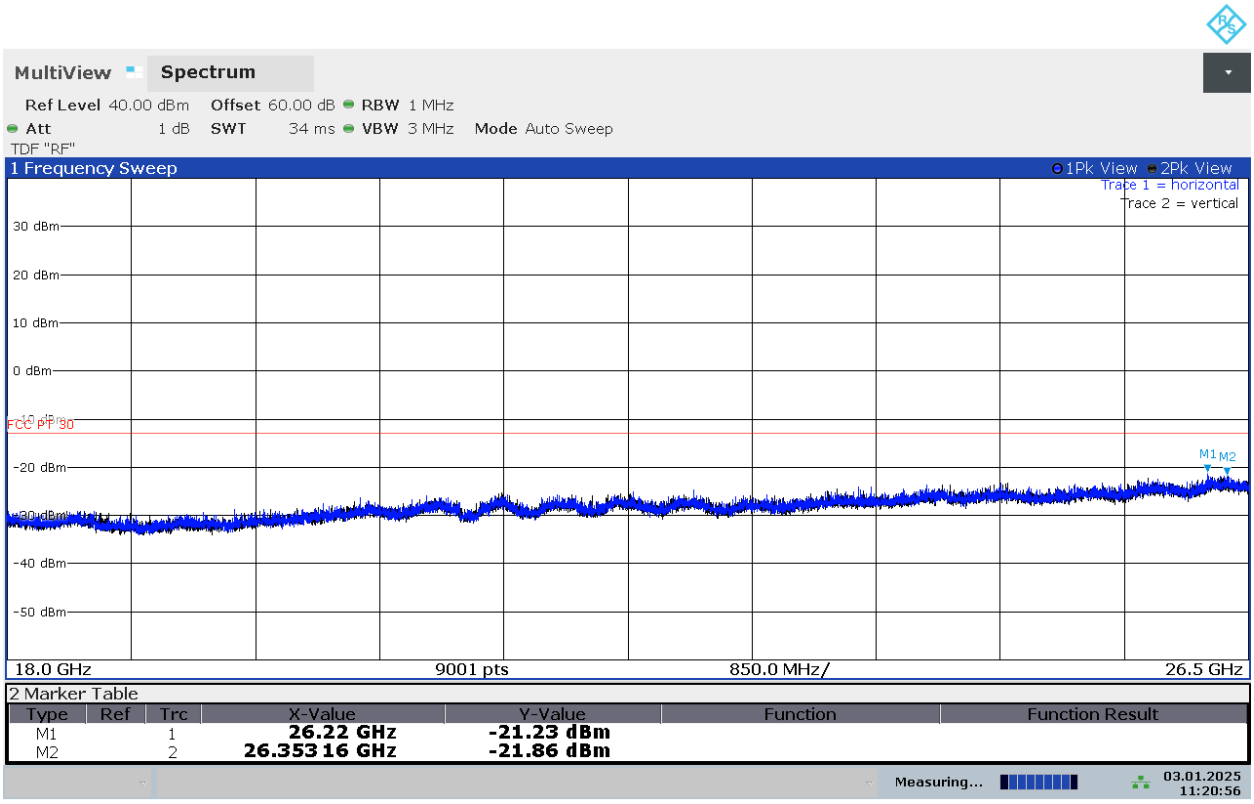


Marker	Frequency (GHz)	Meter Reading (dBm)	Det	89509 ACF (dB/m)	Gain/Loss (dB)	CF (dB)	Corrected Reading dBm	-13dBm	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
4	1.24933	-60.86	Pk	28.5	-25.8	11.8	-46.36	-13	-33.36	0-360	300	V
1	1.37494	-60.75	Pk	28.4	-26	11.8	-46.55	-13	-33.55	0-360	200	H
2	5.89789	-63.94	Pk	34.9	-20.2	11.8	-37.44	-13	-24.44	0-360	100	H
5	5.89789	-64.47	Pk	34.9	-20.2	11.8	-37.97	-13	-24.97	0-360	200	V
3	16.62299	-66.06	Pk	41.6	-7.7	11.8	-20.36	-13	-7.36	0-360	100	H
6	16.73255	-66.3	Pk	41.9	-7.6	11.8	-20.2	-13	-7.2	0-360	200	V

Pk - Peak detector

8.5.4. RADIATED EMISSIONS 18-26.5 GHz

256QAM 100MHz 8CC Low Channel



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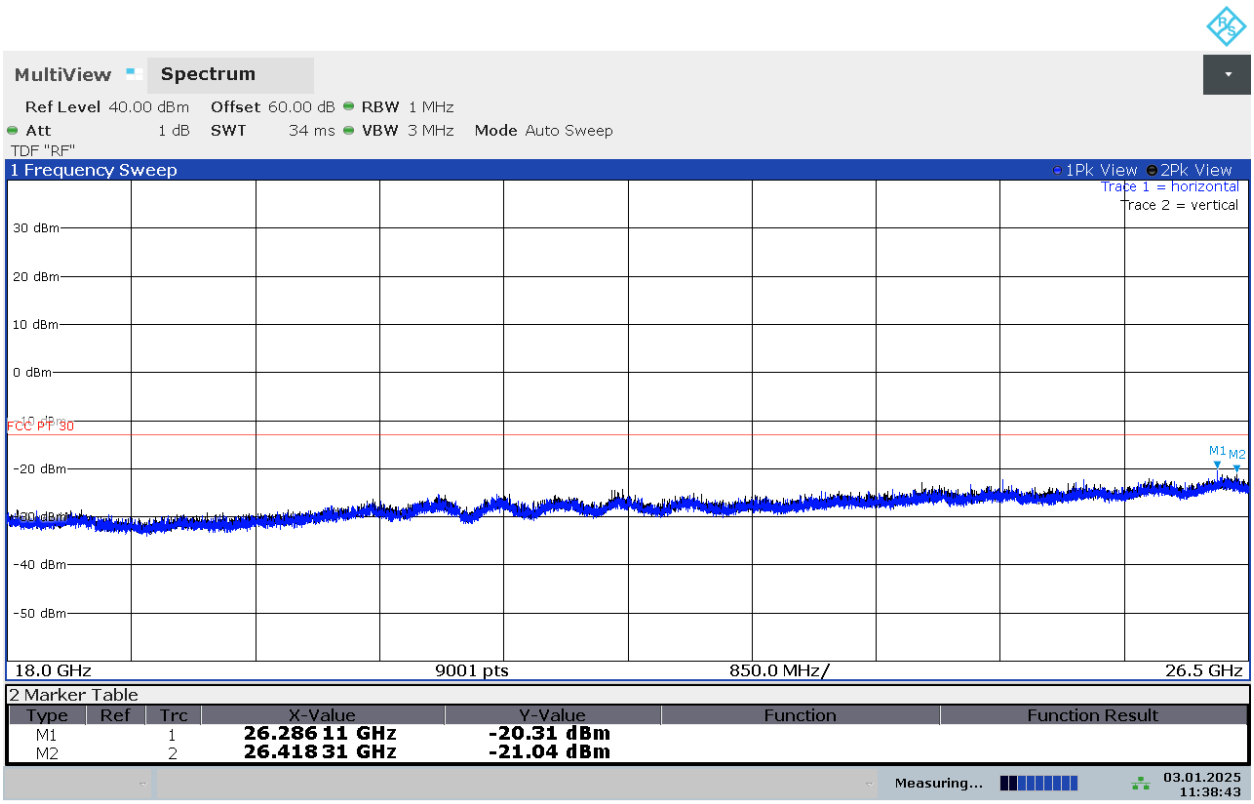
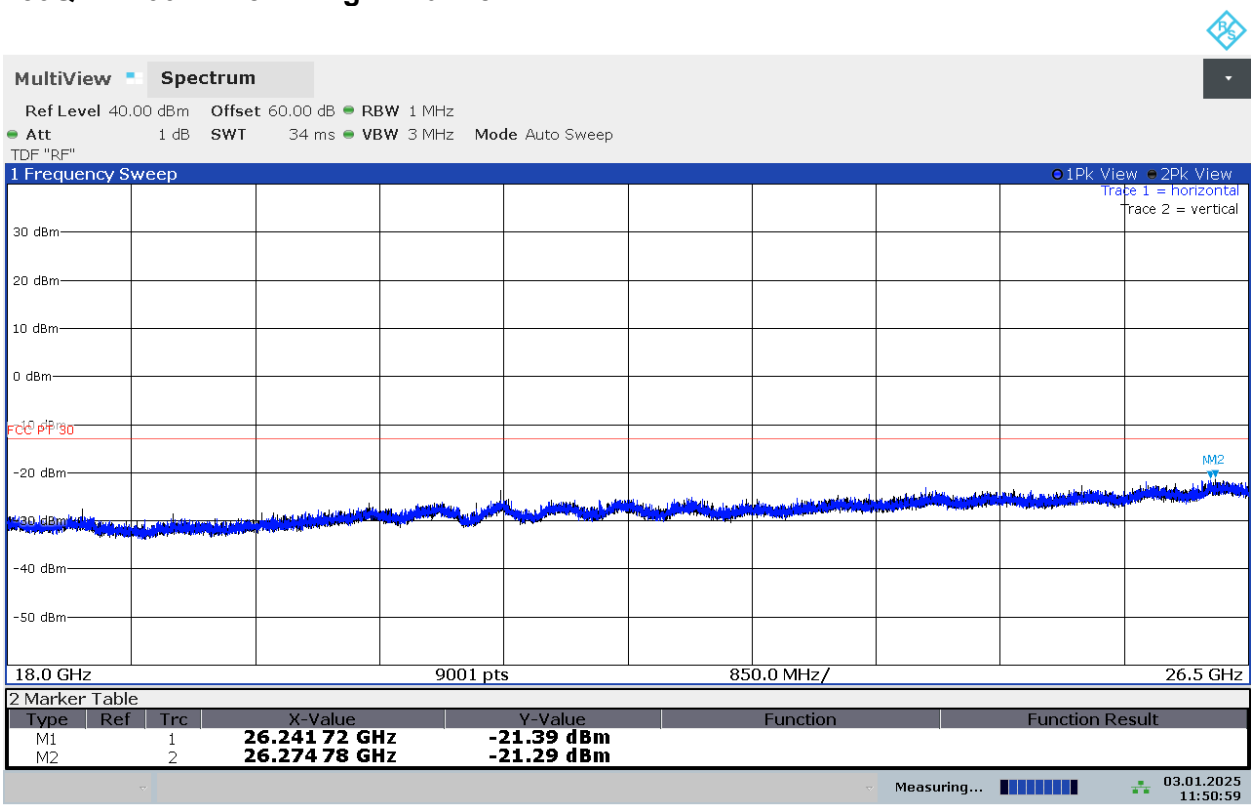
256QAM 100MHz 8CC Mid Channel

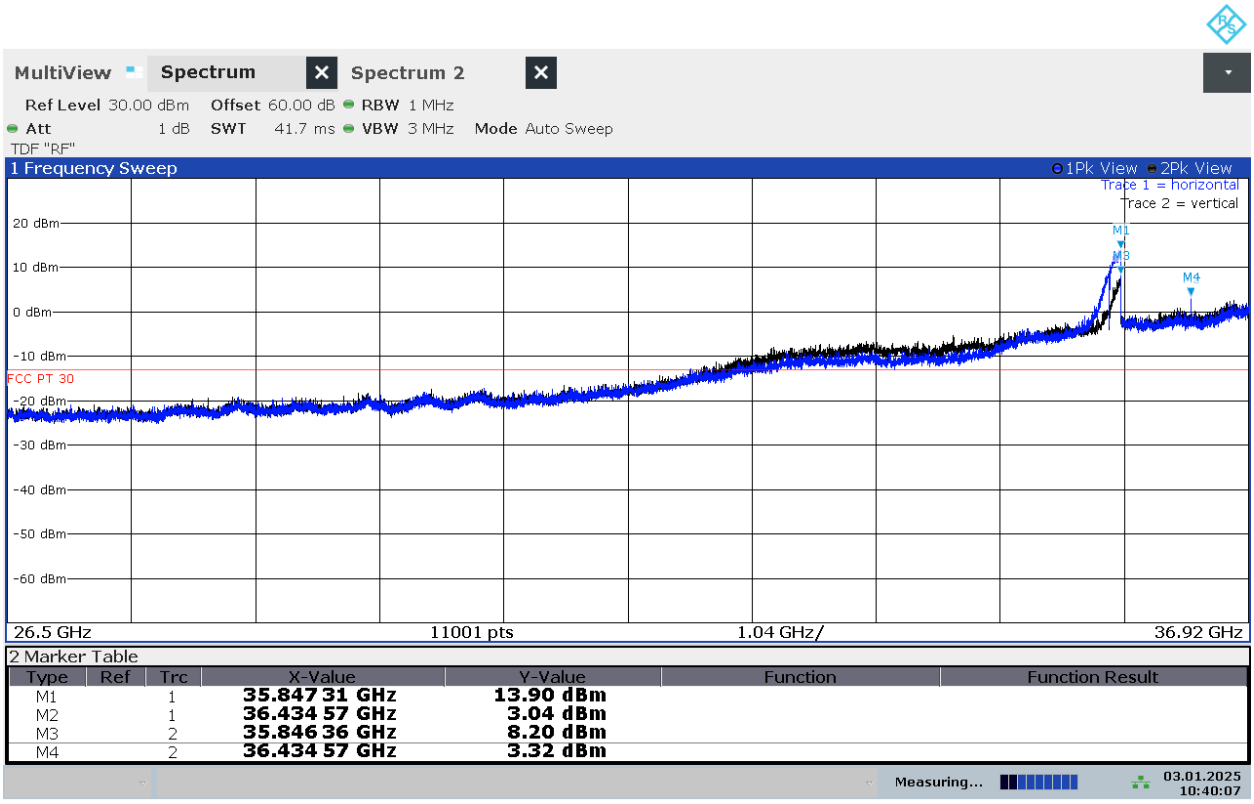


256QAM 100MHz 8CC High Channel



8.5.5. RADIATED EMISSIONS 26.5-40 GHz

256QAM 100MHz 8CC Low Channel



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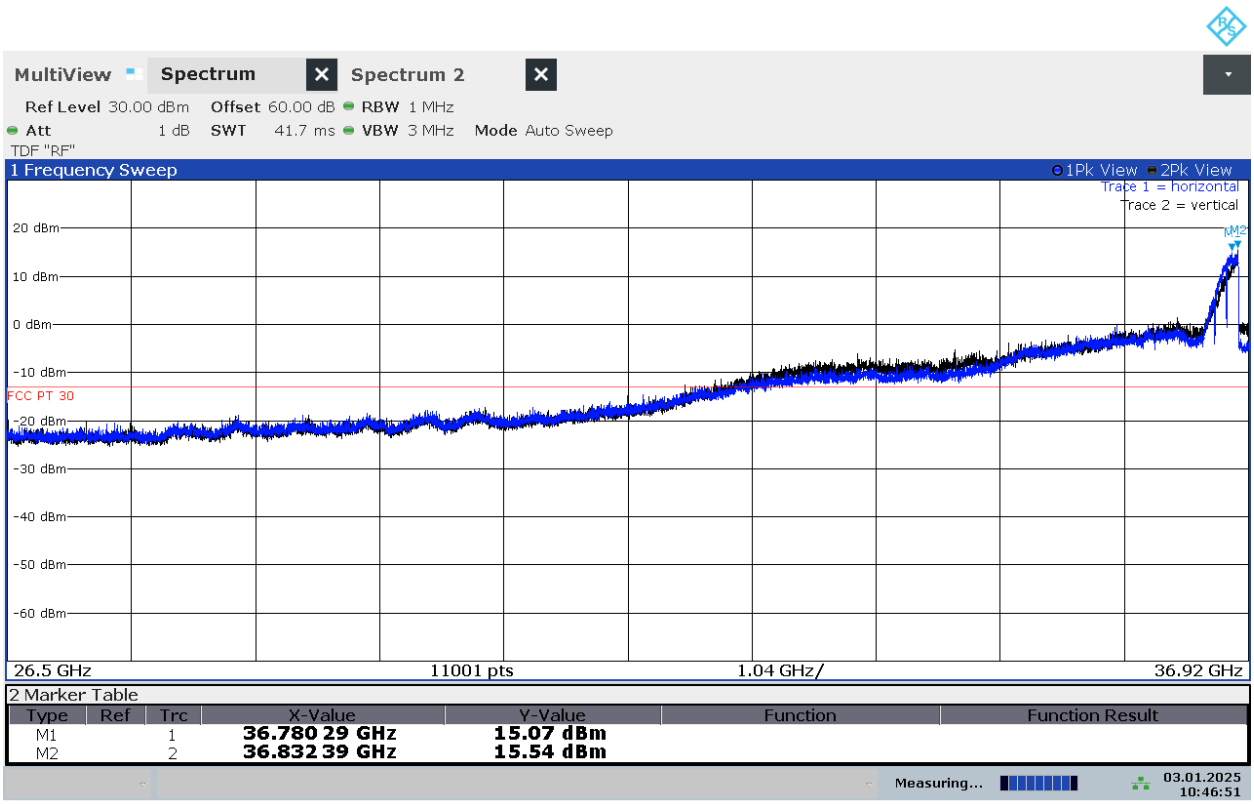
Marker	Frequency (GHz)	Meas. Distance (m)	TRP Method	Corrected TRP (dBm)	TRP Limit (dBm)	Margin (dB)
1 / 3	35.8461	3	Spherical	-16.88	-13	-3.88
2 / 4	36.4335	3	Spherical	-20.40	-13	-7.40

TRP measured using the Spherical Grid Method per KDB 842590, Section 4.4.3.3.4

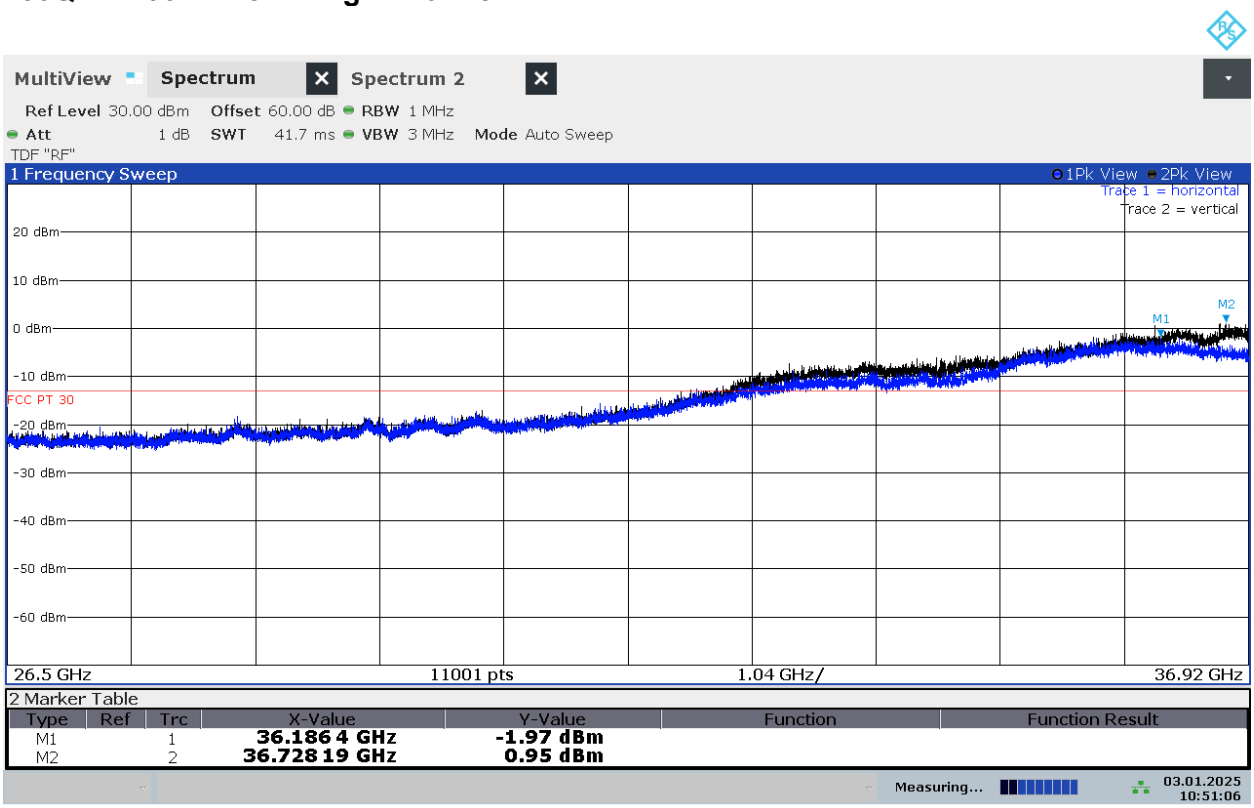
256QAM 100MHz 8CC Mid Channel



Marker	Frequency (GHz)	Meas. Distance (m)	TRP Method	Corrected TRP (dBm)	TRP Limit (dBm)	Margin (dB)
1 / 2	36.8311	3	Spherical	-14.30	-13	-1.30

TRP measured using the Spherical Grid Method per KDB 842590, Section 4.4.3.3.4

256QAM 100MHz 8CC High Channel



10:51:07 03.01.2025

Marker	Frequency (GHz)	Meas. Distance (m)	Rx Ant Polarity (H/V)	Corrected Avg EIRP (dBm)	TRP Limit (dBm)	Margin (dB)
1	35.958	3	H	-14.05	-13	-1.05

Marker	Frequency (GHz)	Meas. Distance (m)	TRP Method	Corrected TRP (dBm)	TRP Limit (dBm)	Margin (dB)
2	36.881	3	Equal Sector	-17.10	-13	-4.10

TRP measured using the Equal Sector Method per KDB 842590, Section 4.4.3.3.3

8.5.6. RADIATED EMISSIONS 40-43 GHz

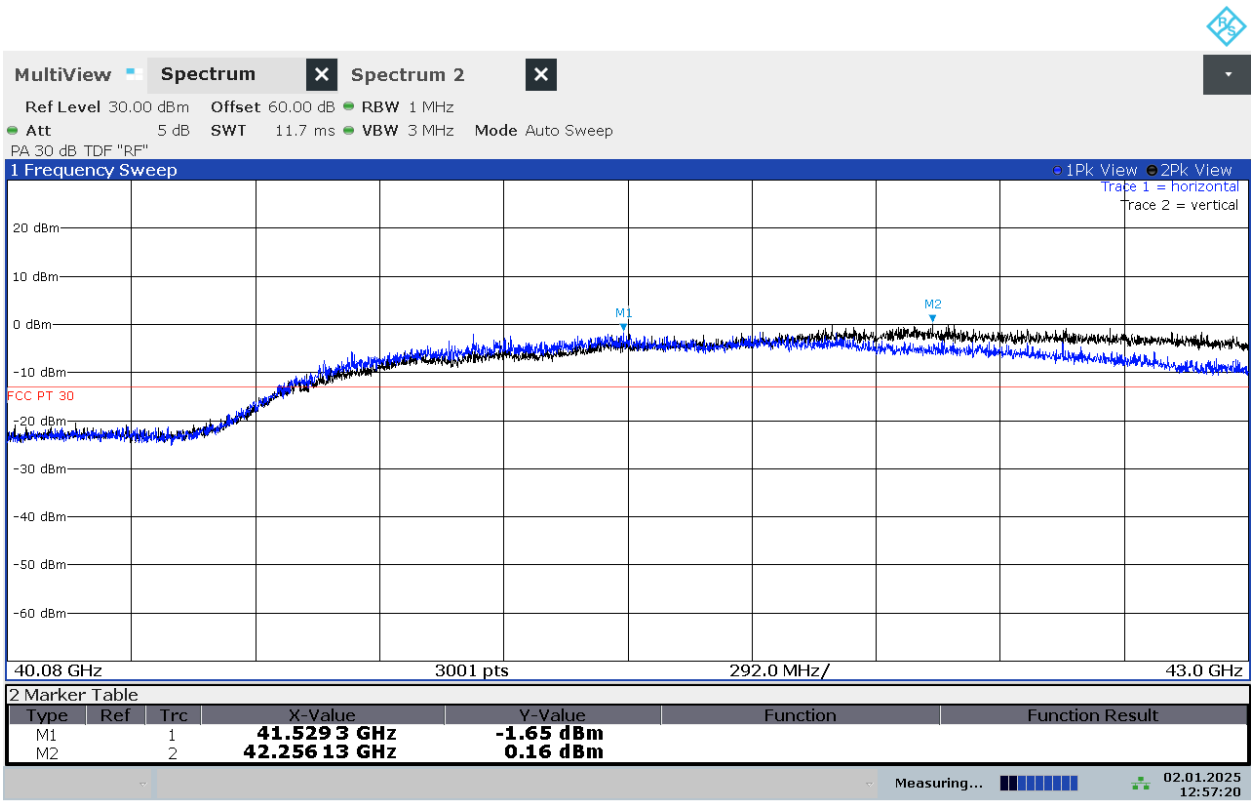
256QAM 100MHz 8CC Low Channel

Marker	Frequency (GHz)	Meas. Distance (m)	Rx Ant Polarity (H/V)	Corrected Avg EIRP (dBm)	TRP Limit (dBm)	Margin (dB)
1	41.5377	3	H	-13.57	-13	-0.57

Marker	Frequency (GHz)	Meas. Distance (m)	TRP Method	Corrected TRP (dBm)	TRP Limit (dBm)	Margin (dB)
2	42.207	3	Equal Sector	-16.84	-13	-3.84

TRP measured using the Equal Sector Method per KDB 842590, Section 4.4.3.3.3

256QAM 100MHz 8CC Mid Channel



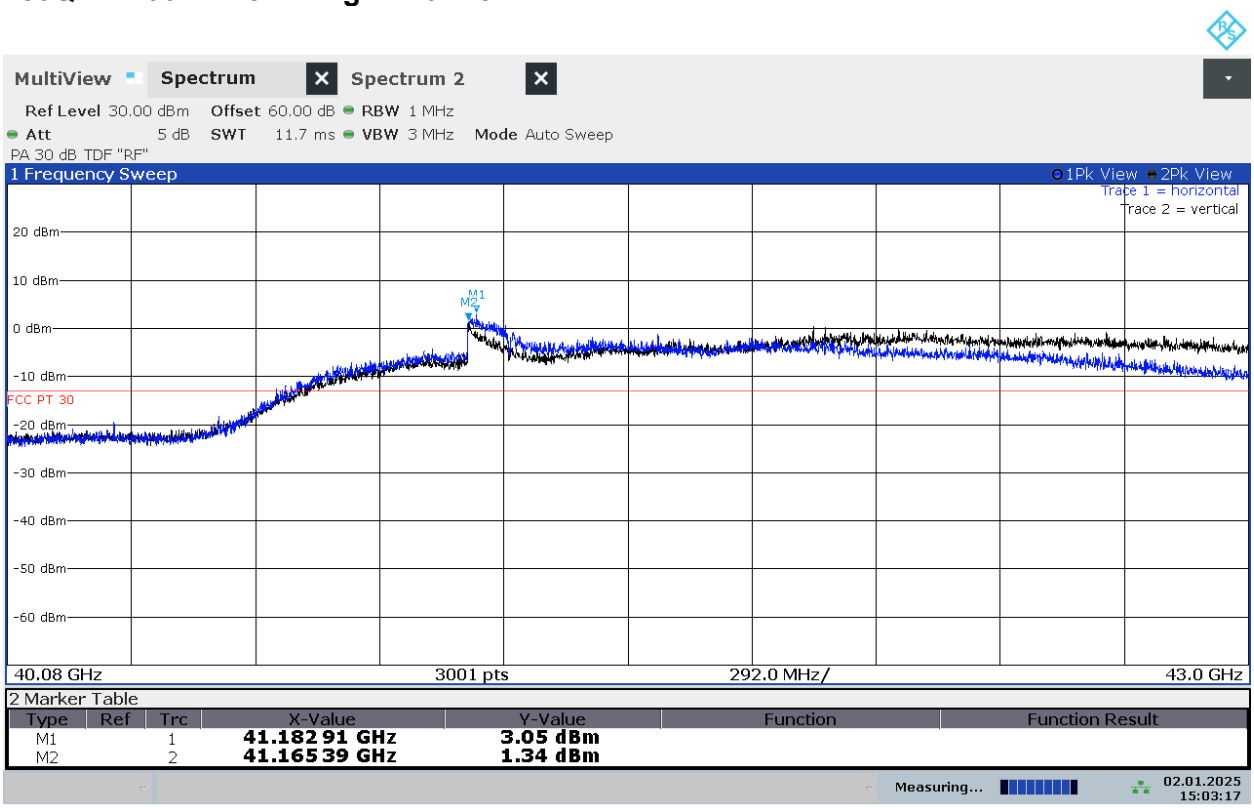
12:57:20 02.01.2025

Marker	Frequency (GHz)	Meas. Distance (m)	Rx Ant Polarity (H/V)	Corrected Avg EIRP (dBm)	TRP Limit (dBm)	Margin (dB)
1	41.5452	3	H	-13.79	-13	-0.79

Marker	Frequency (GHz)	Meas. Distance (m)	TRP Method	Corrected TRP (dBm)	TRP Limit (dBm)	Margin (dB)
2	42.217	3	Equal Sector	-17.00	-13	-4.00

TRP measured using the Equal Sector Method per KDB 842590, Section 4.4.3.3.3

256QAM 100MHz 8CC High Channel

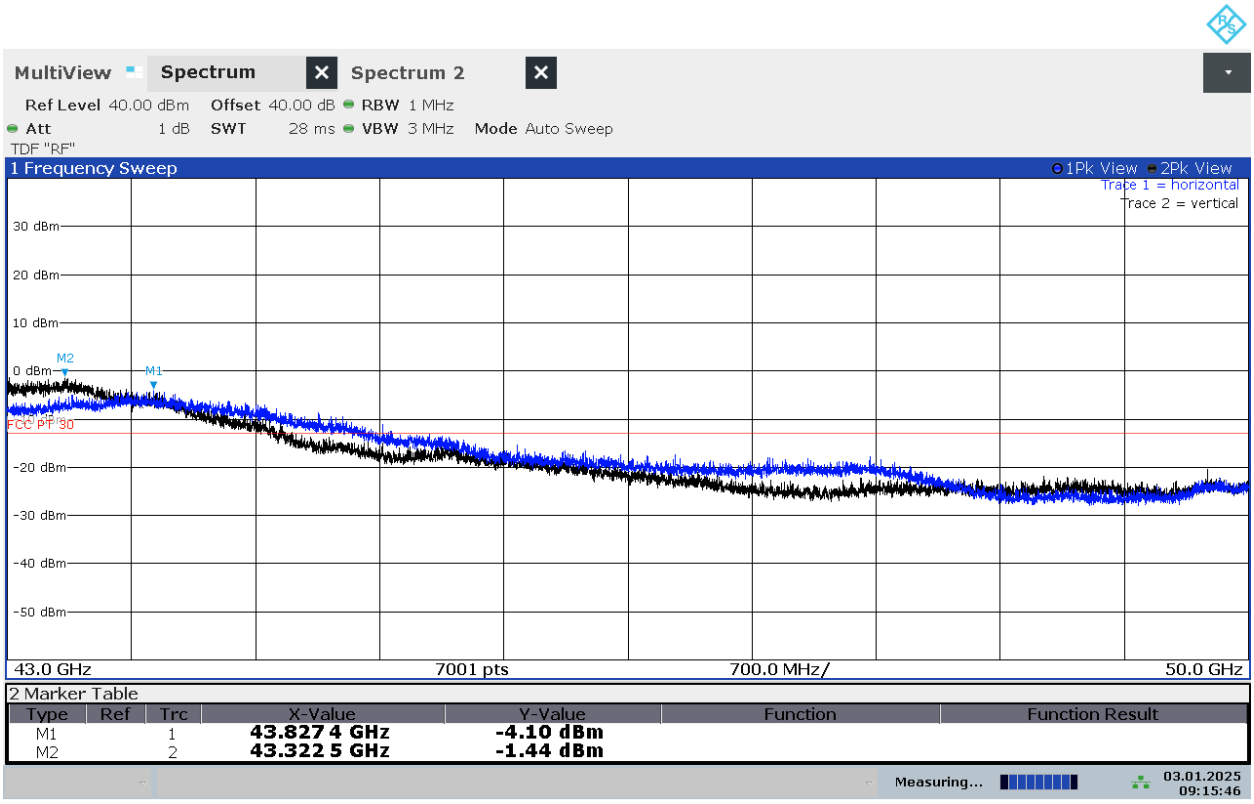


Marker	Frequency (GHz)	Meas. Distance (m)	TRP Method	Corrected TRP (dBm)	TRP Limit (dBm)	Margin (dB)
1 / 2	41.166	3	Equal Sector	-14.51	-13	-1.51

TRP measured using the Equal Sector Method per KDB 842590, Section 4.4.3.3.3

8.5.7. RADIATED EMISSIONS 43-50 GHz

256QAM 100MHz 8CC Low Channel

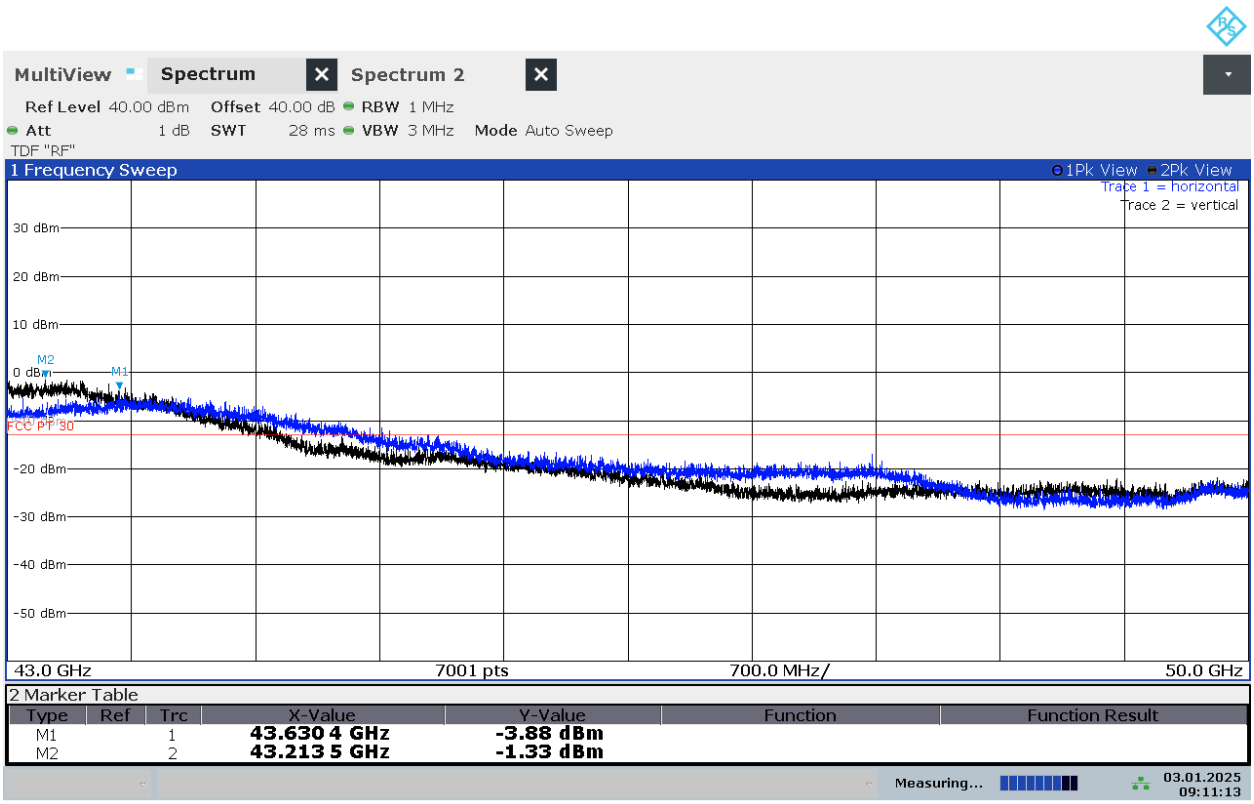


Marker	Frequency (GHz)	Meas. Distance (m)	Rx Ant Polarity (H/V)	Corrected Avg EIRP (dBm)	TRP Limit (dBm)	Margin (dB)
1	43.6848	3	H	-16.66	-13	-3.66

Marker	Frequency (GHz)	Meas. Distance (m)	TRP Method	Corrected TRP (dBm)	TRP Limit (dBm)	Margin (dB)
2	43.065	3	Equal Sector	-20.25	-13	-7.25

TRP measured using the Equal Sector Method per KDB 842590, Section 4.4.3.3.3

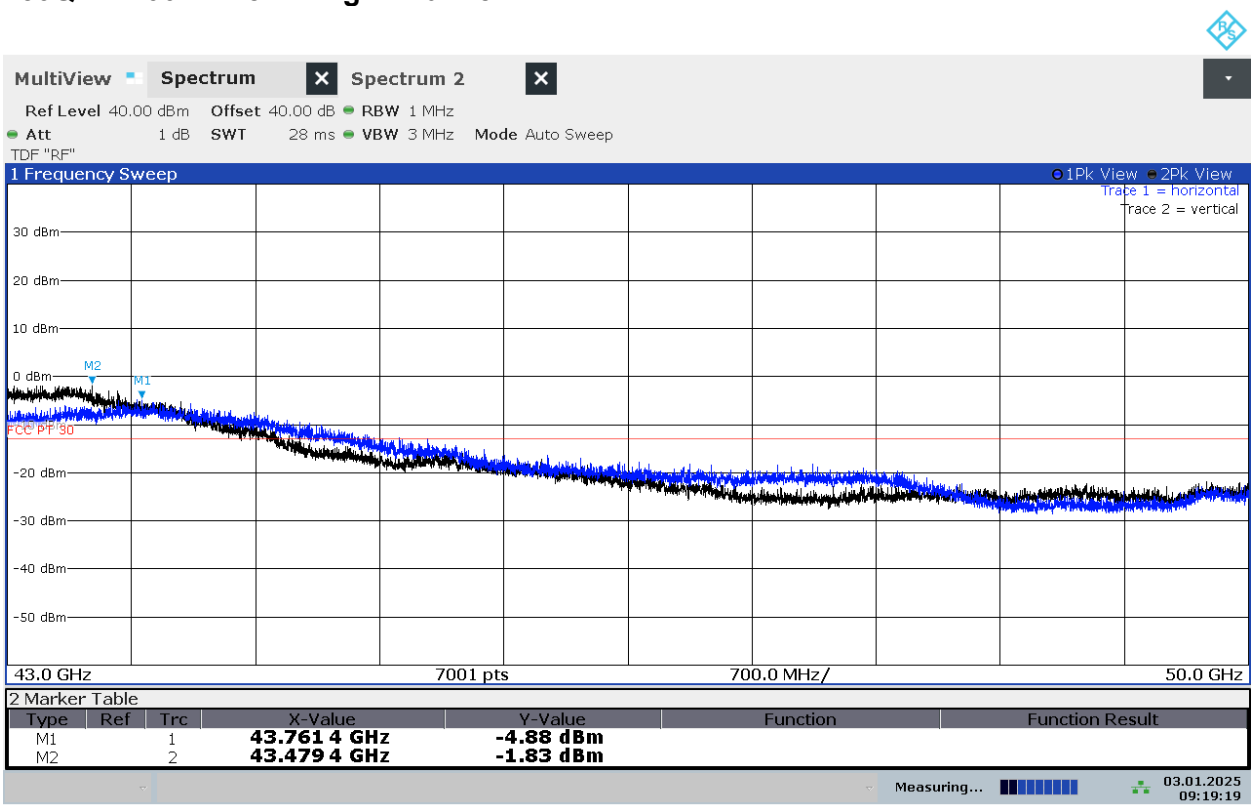
256QAM 100MHz 8CC Mid Channel



09:11:13 03.01.2025

Marker	Frequency (GHz)	Meas. Distance (m)	Rx Ant Polarity (H/V)	Corrected Avg EIRP (dBm)	TRP Limit (dBm)	Margin (dB)
1	43.6748	3	H	-16.74	-13	-3.74
2	43.0115	3	V	-13.08	-13	-0.08

256QAM 100MHz 8CC High Channel

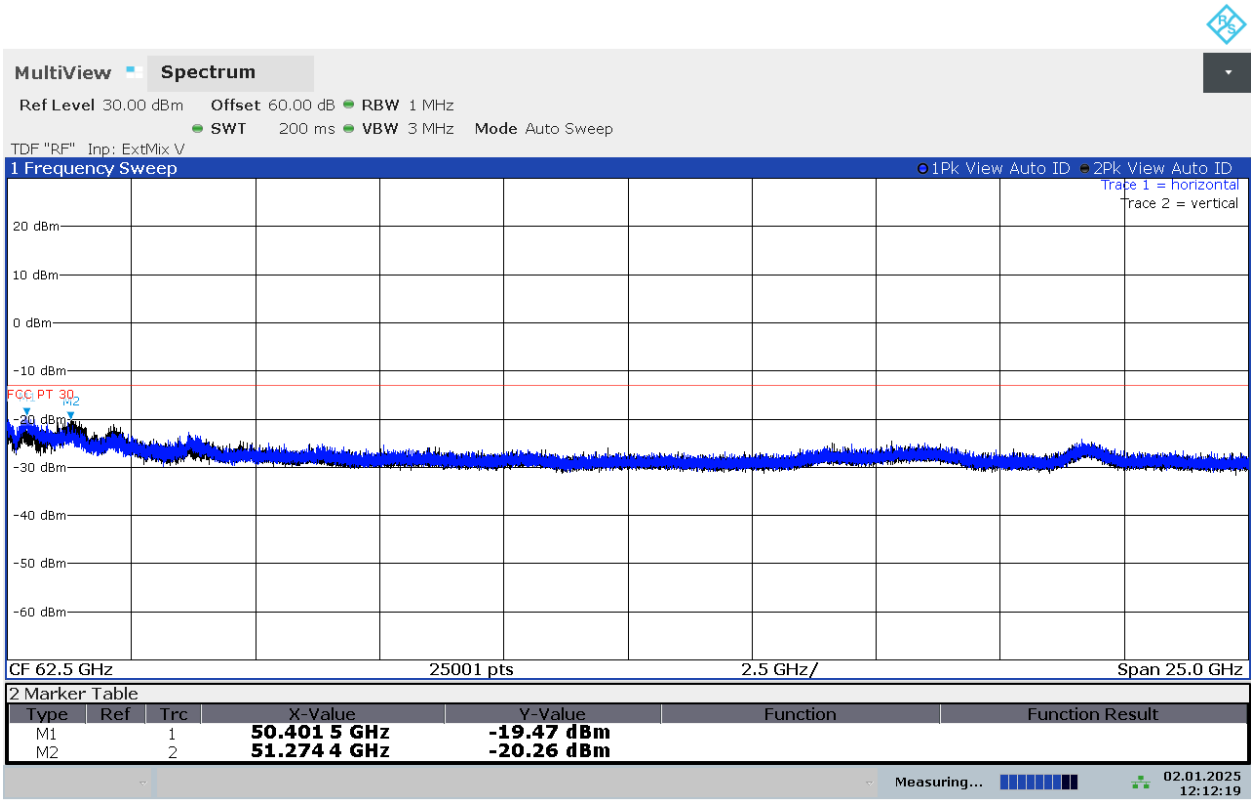


09:19:19 03.01.2025

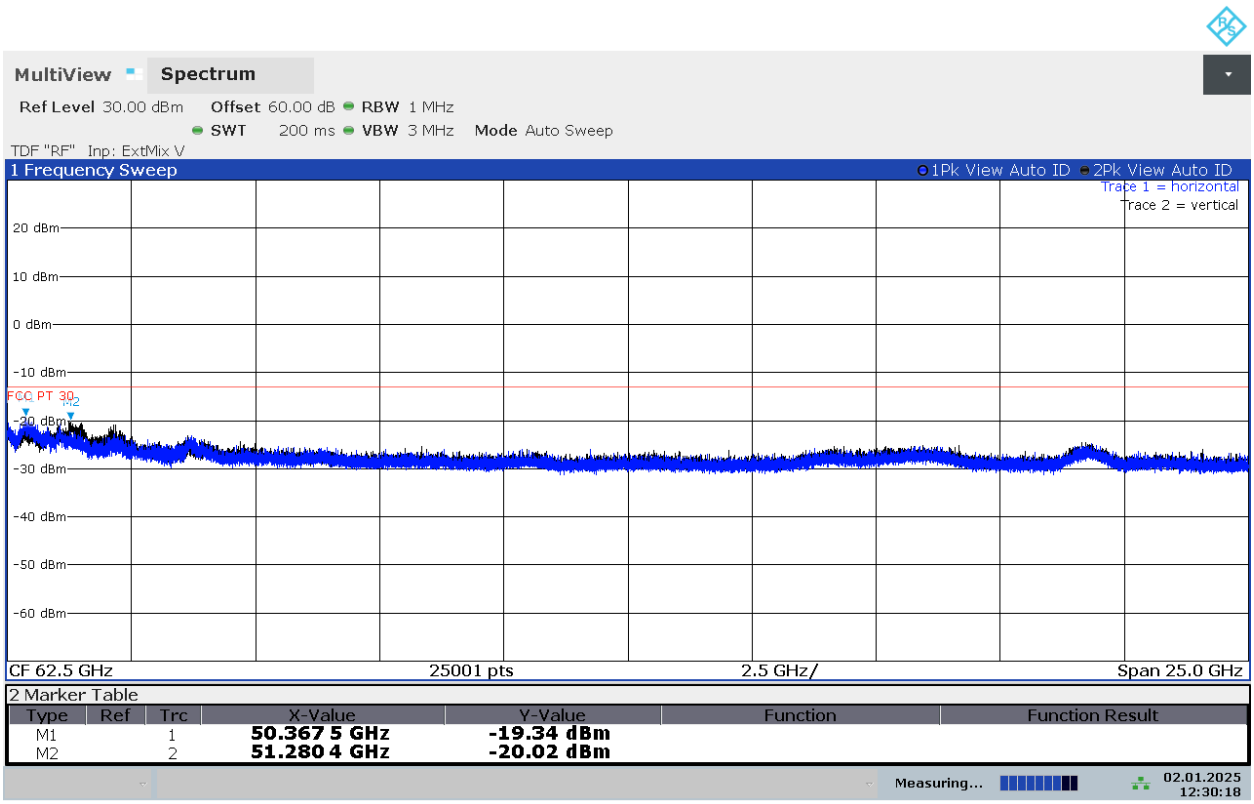
Marker	Frequency (GHz)	Meas. Distance (m)	Rx Ant Polarity (H/V)	Corrected Avg EIRP (dBm)	TRP Limit (dBm)	Margin (dB)
1	43.6818	3	H	-17.16	-13	-4.16
2	43.0025	3	V	-13.21	-13	-0.21

8.5.8. RADIATED EMISSIONS 50-75 GHz

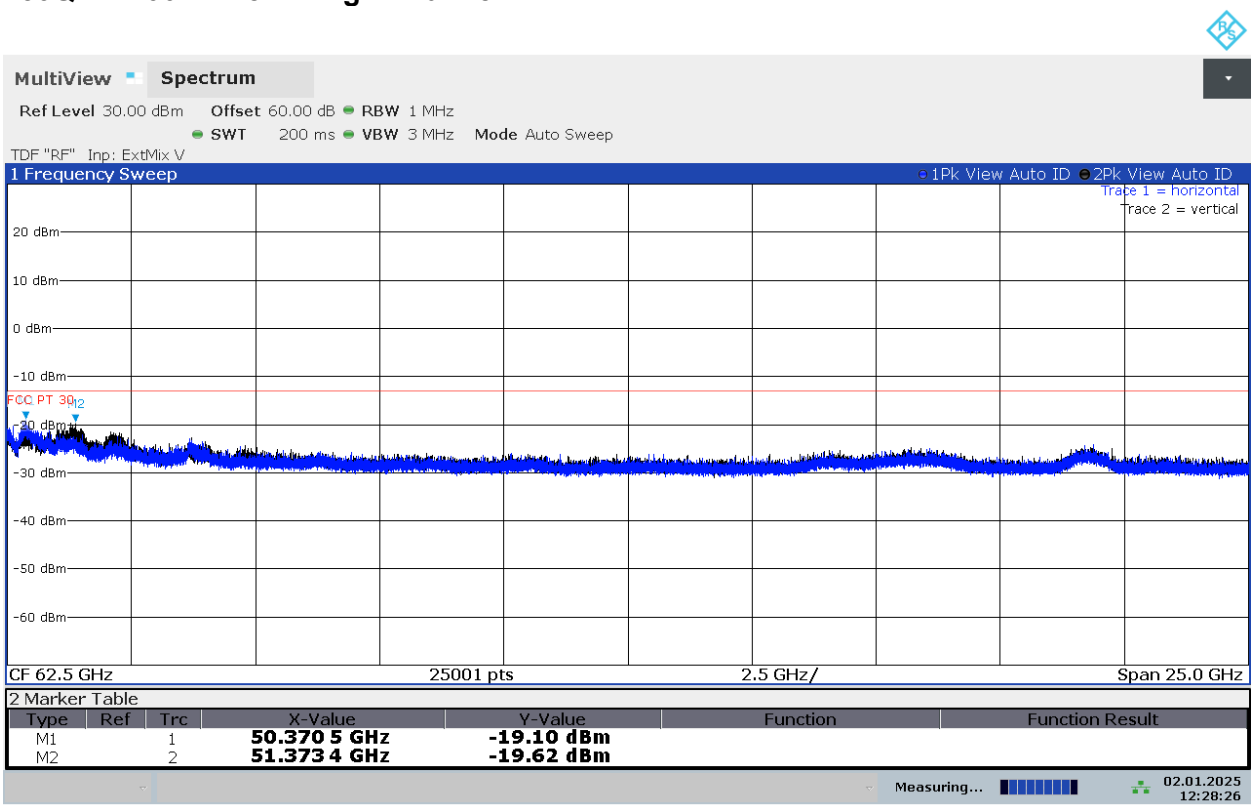
256QAM 100MHz 8CC Low Channel



256QAM 100MHz 8CC Mid Channel

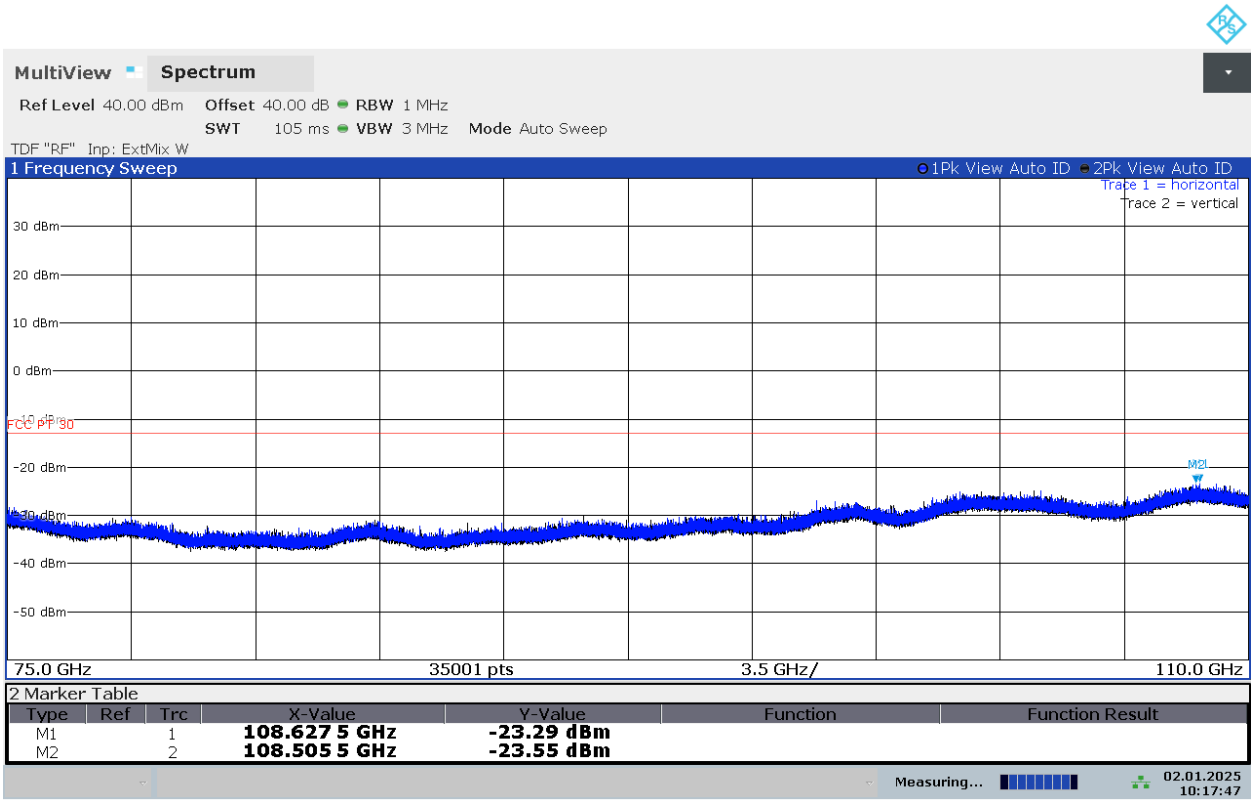


256QAM 100MHz 8CC High Channel

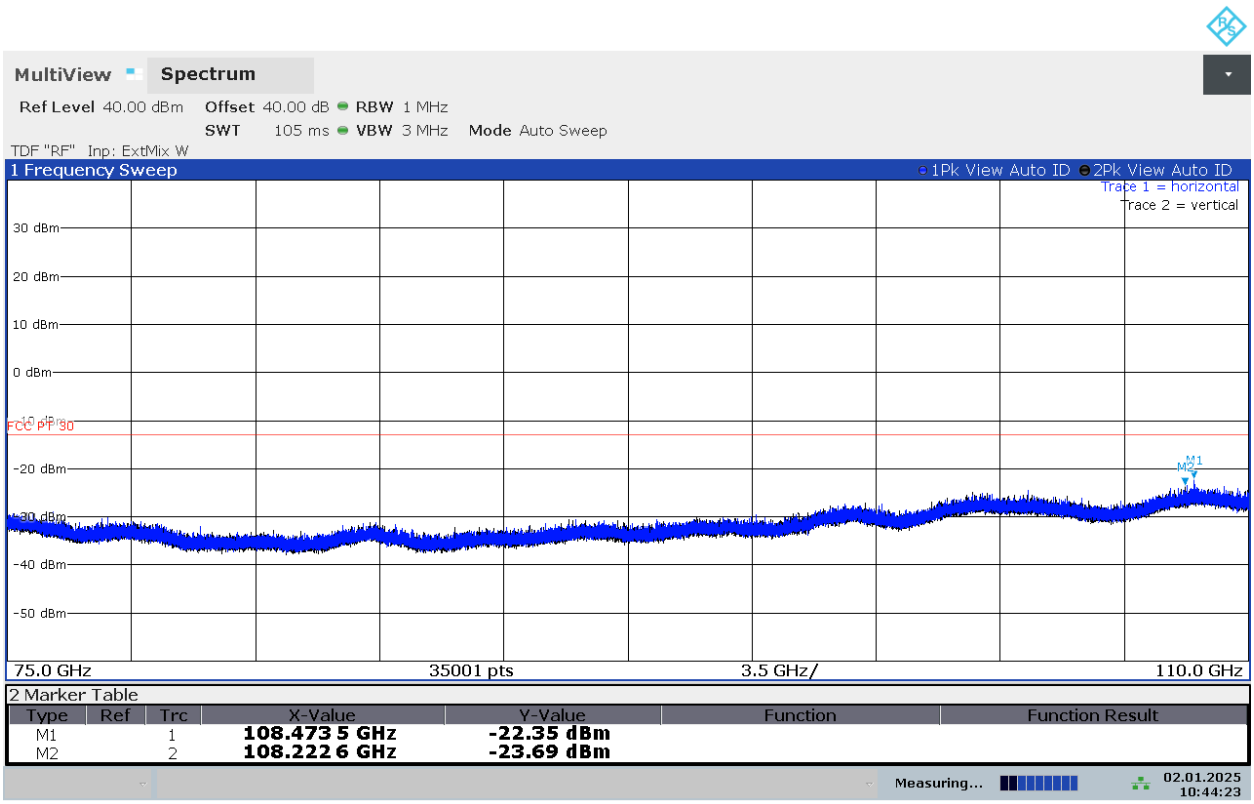


8.5.9. RADIATED EMISSIONS 75-110 GHz

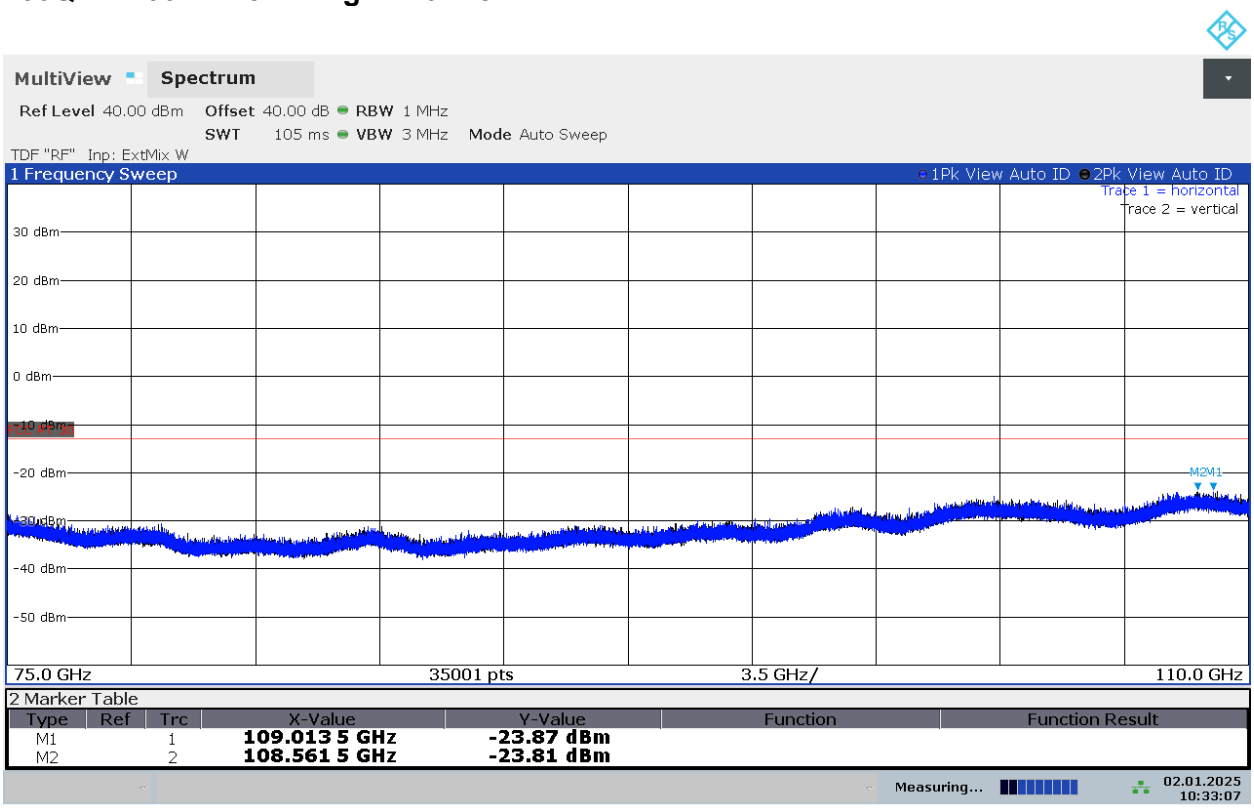
256QAM 100MHz 8CC Low Channel



256QAM 100MHz 8CC Mid Channel



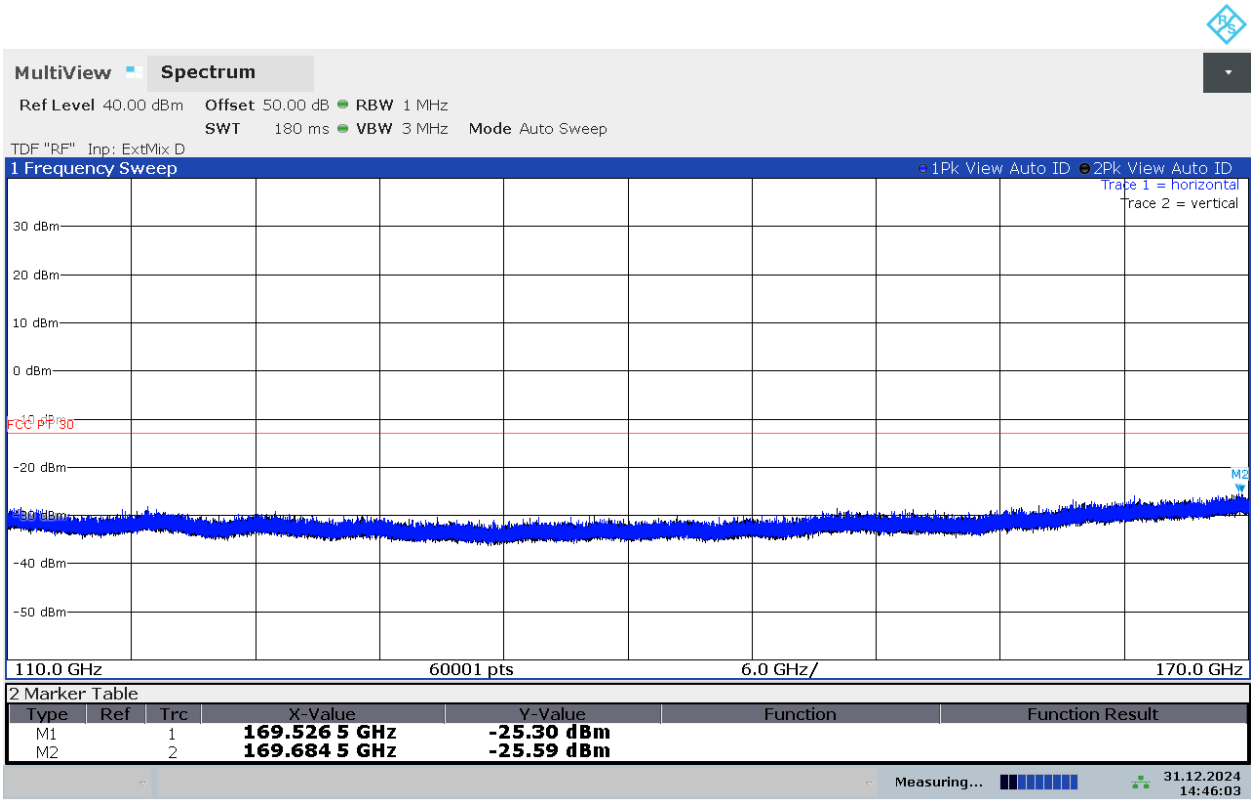
256QAM 100MHz 8CC High Channel



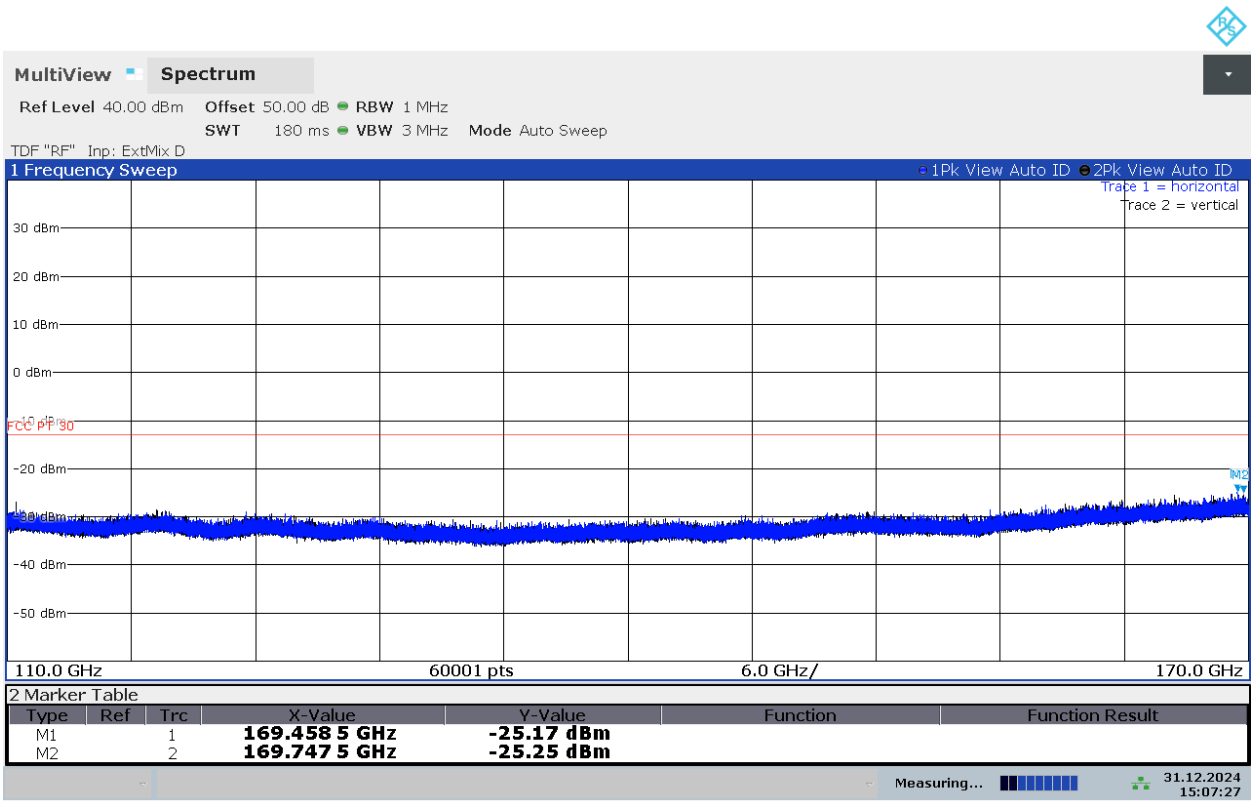
10:33:07 02.01.2025

8.5.10. RADIATED EMISSIONS 110-170 GHz

256QAM 100MHz 8CC Low Channel

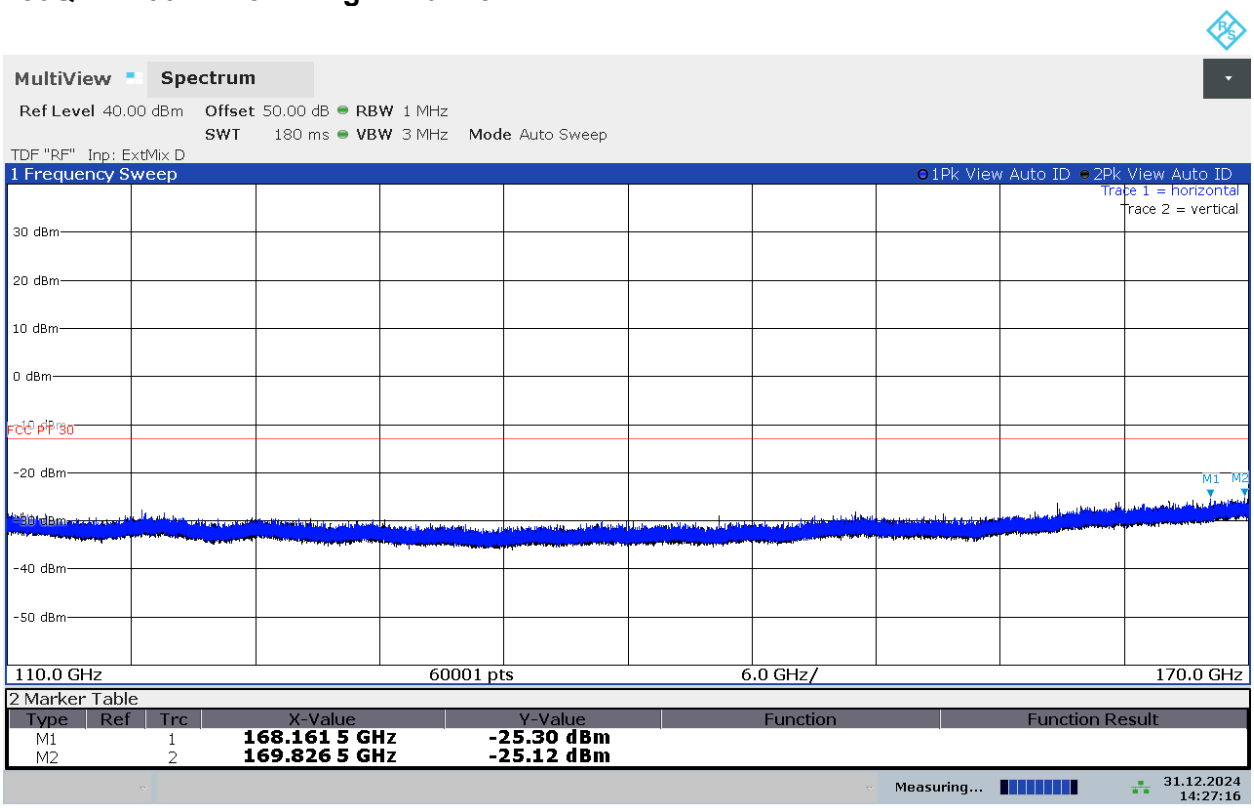


256QAM 100MHz 8CC Mid Channel



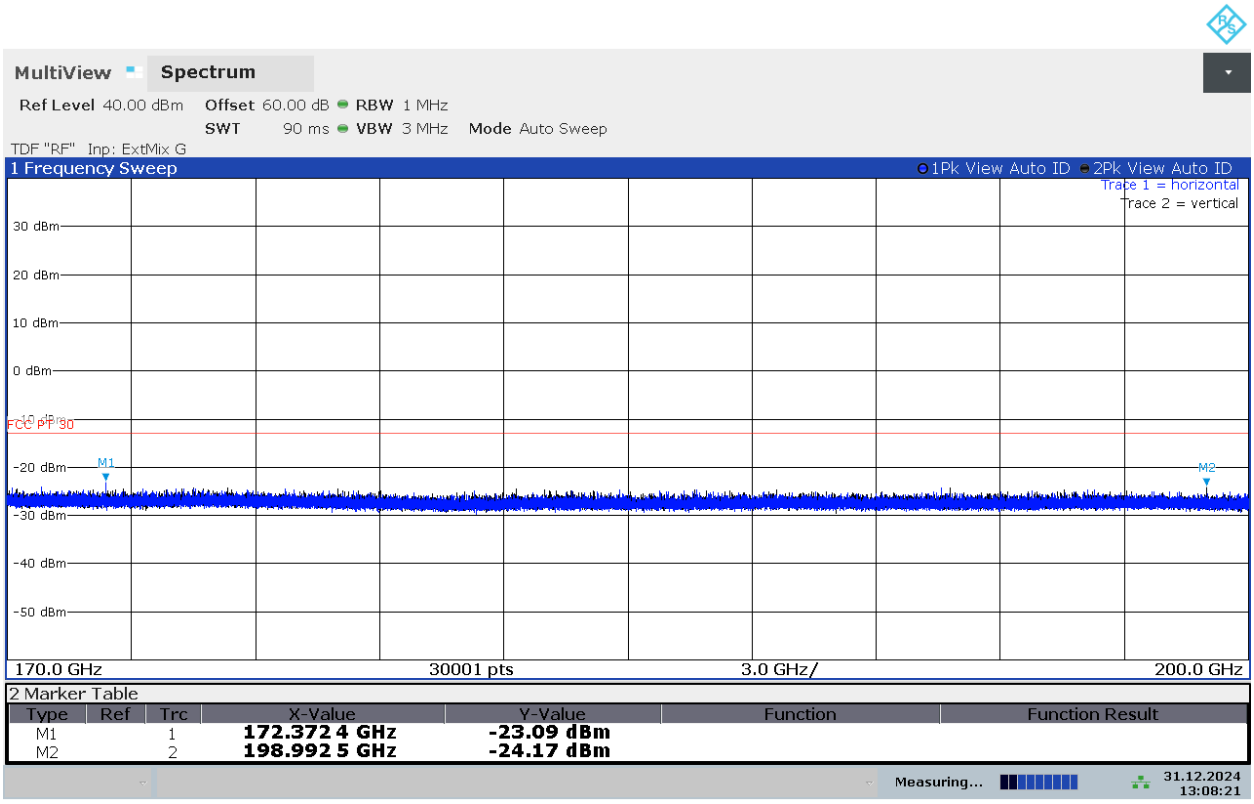
15:07:27 31.12.2024

256QAM 100MHz 8CC High Channel



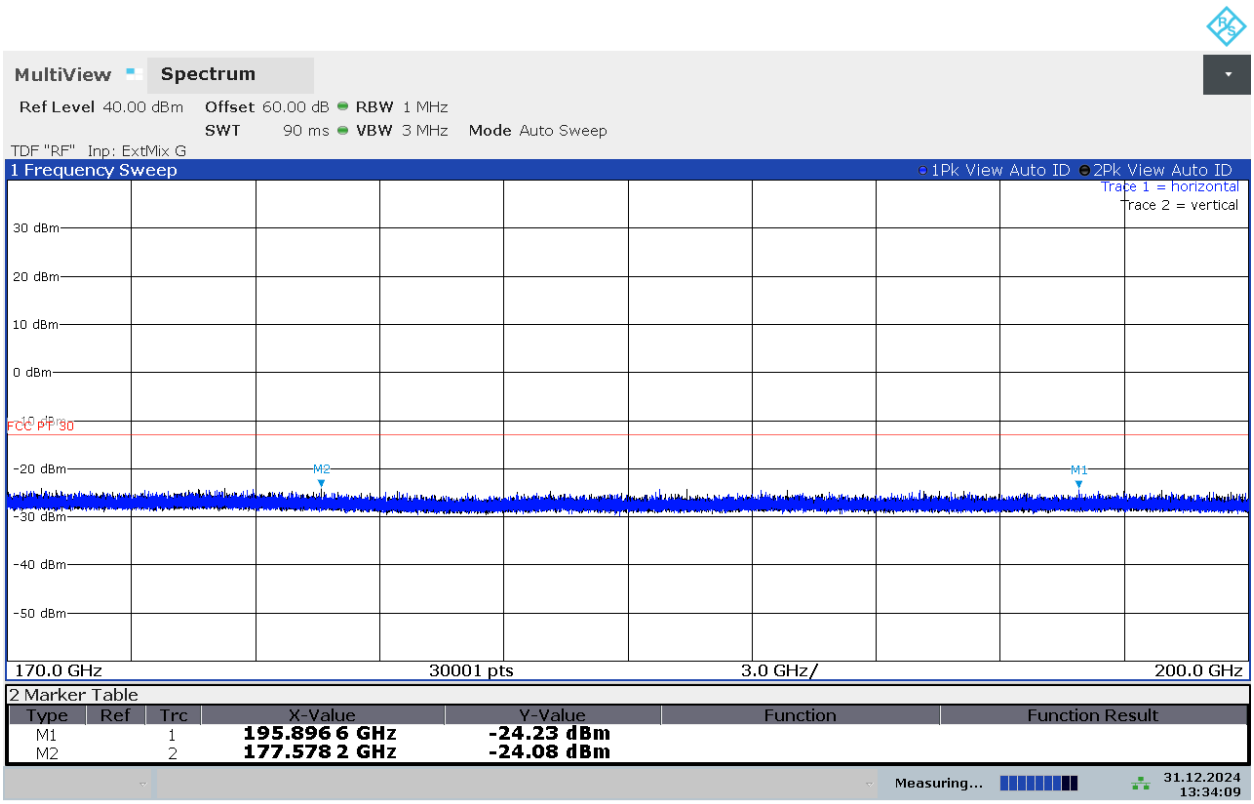
8.5.11. RADIATED EMISSIONS 170-200 GHz

256QAM 100MHz 8CC Low Channel

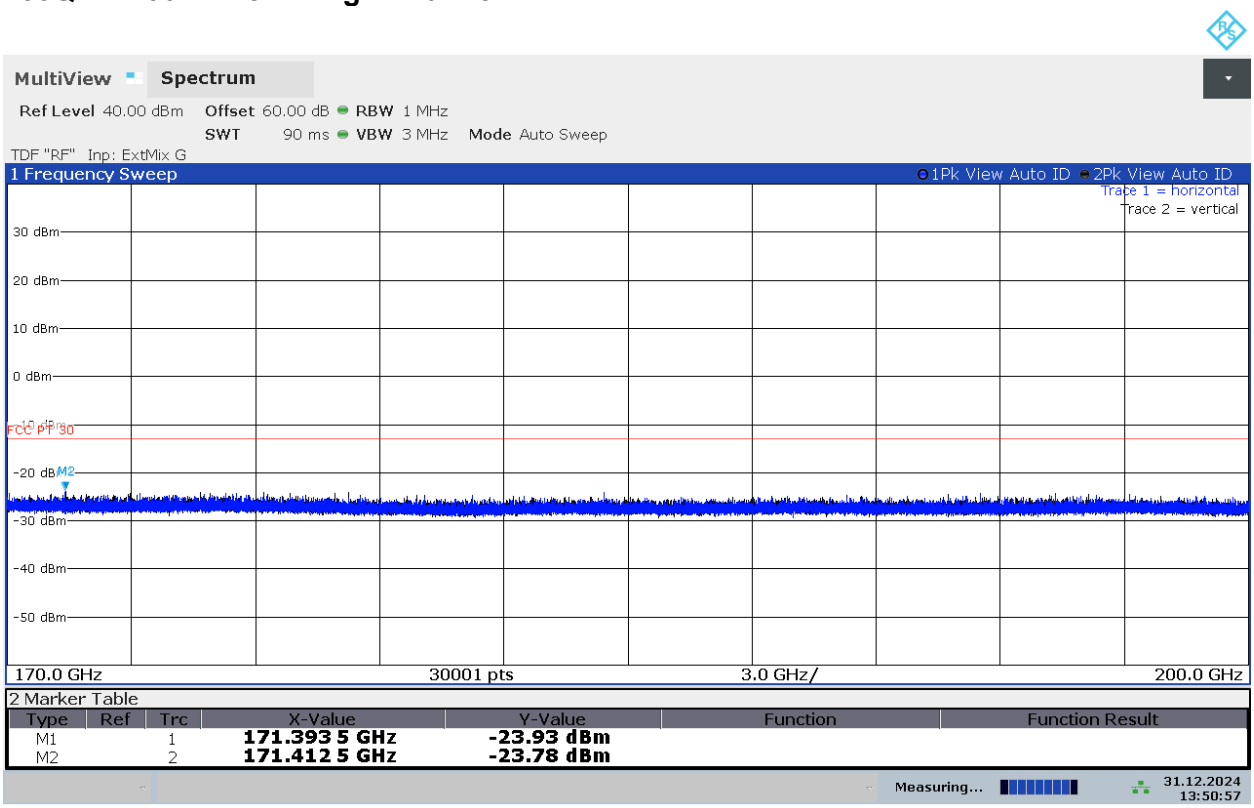


13:08:22 31.12.2024

256QAM 100MHz 8CC Mid Channel



256QAM 100MHz 8CC High Channel



8.6. FREQUENCY STABILITY

RULE PART(S)

FCC: §2.1055

LIMIT

For reporting purposes only

TEST PROCEDURES

KDB 842590 D01 Upper Microwave Flexible Use Service v01 r02 Section 4.5
ANSI C63.26-2015 Section 5.6

Test procedures for temperature variation:

- Position the EUT in temperature/humidity chamber with power off.
- Set chamber temperature to -30°C and stabilize the EUT for at least 30 minutes.
- Record maximum change in frequency within one minute after powering the EUT.
- Increase chamber temperature at 10°C intervals from -30°C to 50°C. Record maximum change in frequency at each temperature.
- A period of at least 30 minutes is provided to allow stabilization of the equipment at each temperature level.

- Temp. = −30°C to +50°C

Test procedures for voltage variation:

- Position the EUT in temperature/humidity chamber with power off.
- Set chamber temperature to 20°C.
- Record maximum frequency change within one minute after powering the EUT.
- The primary supply voltage is varied from 85% to 115% of the nominal value .

- Voltage = (85% - 115%)
  Nominal: -48.0 VDC; Low: -40.8 VDC; High: -55.2 VDC.

The measurements were performed with the CW signal at 38.4GHz.

RESULTS

See the following page.

TESTED BY

Employee IDs: 104463/85502
Test Dates: 2024-12-22
Test Location: COND1

RESULTS

Nominal Frequency:	38.4	GHz		
Nominal Voltage:	-48	Vdc		
Temperature (°C)	**Voltage (V)**	**Measured Frequency (GHz)**	**Measured Frequency (MHz)**	**Delta (kHz)**
-30	-48	38.40000050	38400.00050	-0.170
-20	-48	38.40000050	38400.00050	-0.170
-10	-48	38.40000033	38400.00033	-0.340
0	-48	38.40000033	38400.00033	-0.340
10	-48	38.40000033	38400.00033	-0.340
20	**-48**	**38.40000067**	**38400.00067**	**Reference**
20	-40.8	38.40017000	38400.17000	169.330
20	-55.2	38.40000000	38400.00000	-0.670
30	-48	38.40000000	38400.00000	-0.670
40	-48	38.40000000	38400.00000	-0.670
50	-48	38.40000000	38400.00000	-0.670

9. SETUP PHOTOS

Please refer to report R15511125-EP1 for setup photos.

APPENDIX A

DOWNCONVERTER CERTIFICATE OF CONFORMANCE

DocuSign Envelope ID: A5AEB988-C8D6-49AC-A690-1A9E74631AA6

Virginia Diodes, Inc
979 2nd St. SE
Suite 309
Charlottesville, VA 22902
Phone: 434-297-3257
Fax: 434-297-3258

Certificate of Conformance

To: Underwriters Laboratory
2800 Perimeter Park Drive
Suite B
Morrisville, NC 27560
United States

From: Virginia Diodes, Inc
979 2nd St. SE
Suite 309
Charlottesville, VA 22902

Packing List No:	241624	**Today's Date:**	04/16/2024
Shipping Date:	4/16/2024	**PO Number:**	7202173250

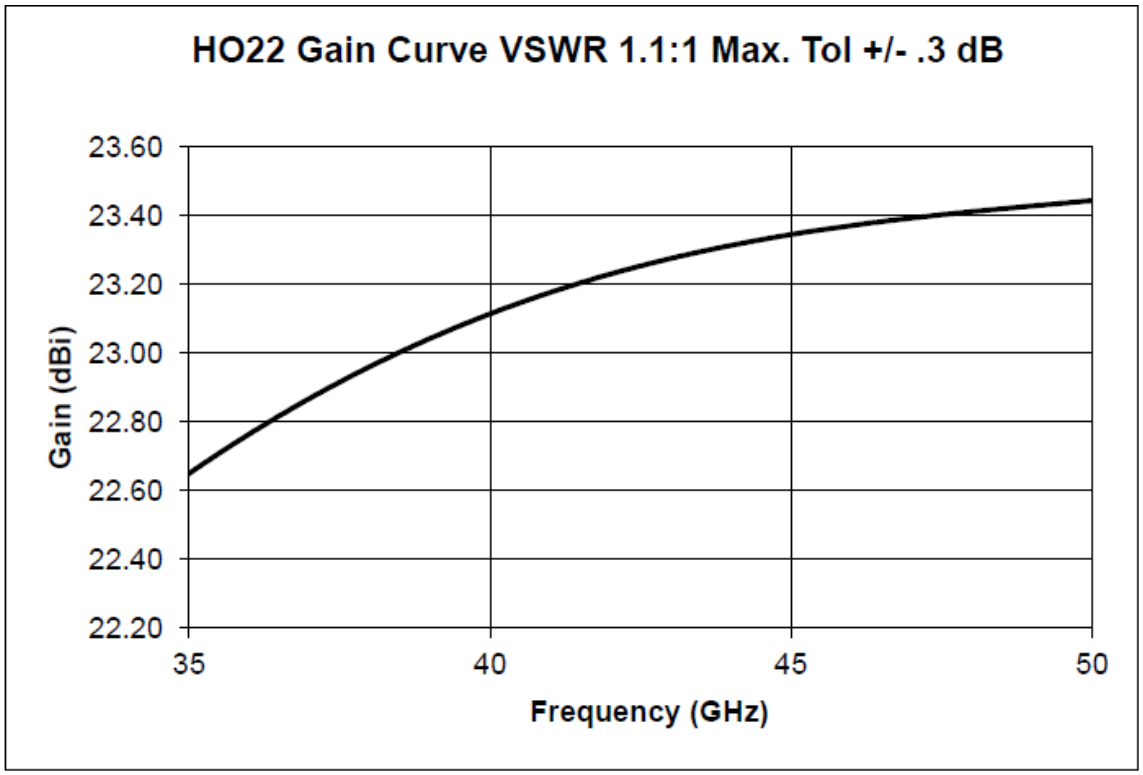
Quantity Shipped	Unit	Description	Order-Job Number
1	EA	RECAL-WR4.3SAX-F - WR4.3SAX-F / SN: SAX 823	240110A-01
1	EA	RECAL-WR6.5SAX-F - WR6.5SAX-F / SN: SAX 822	240110A-02
1	EA	RECAL-WR10SAX-F - WR10SAX-F / SN: SAX 821	240110A-03
1	EA	RECAL-WR15SAX-F - WR15SAX-F / SN: SAX 820	240110A-04

The VDI product(s) in this shipment meet(s) the guidelines for performance specifications established in accordance with the corresponding Purchase Order. Data presented in the User Guide, where applicable, has been obtained in accordance with VDI's Quality Management System. All instruments, used to obtain data, which require calibration have been calibrated with equipment traceable to the National Institute of Standards and Technology (NIST) and through NIST to the International System of Units (SI).

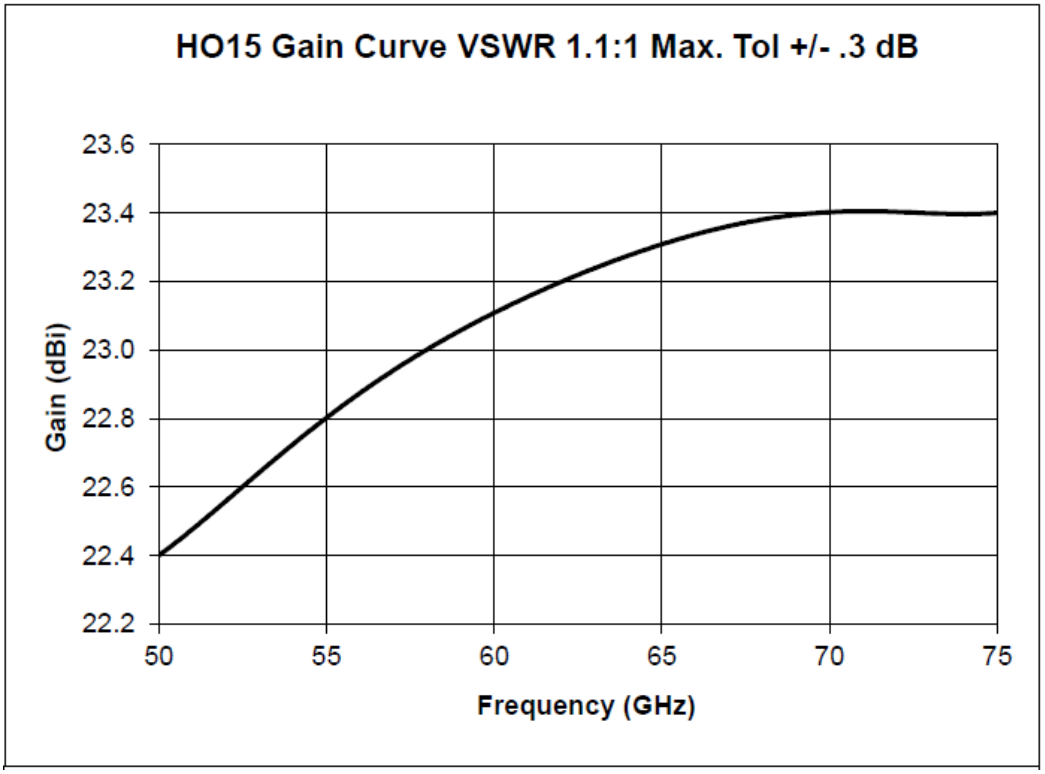
Authorized Signature
Virginia Diodes, Inc

BP

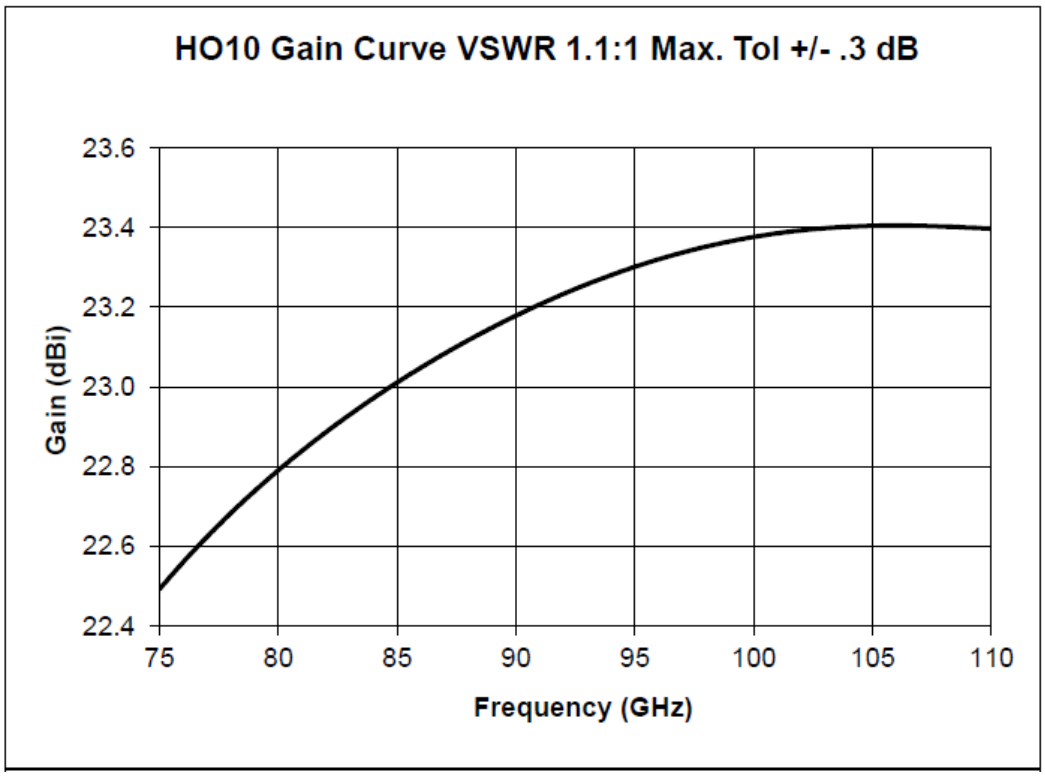
35-50 GHz CMI HO22R HORN ANTENNA



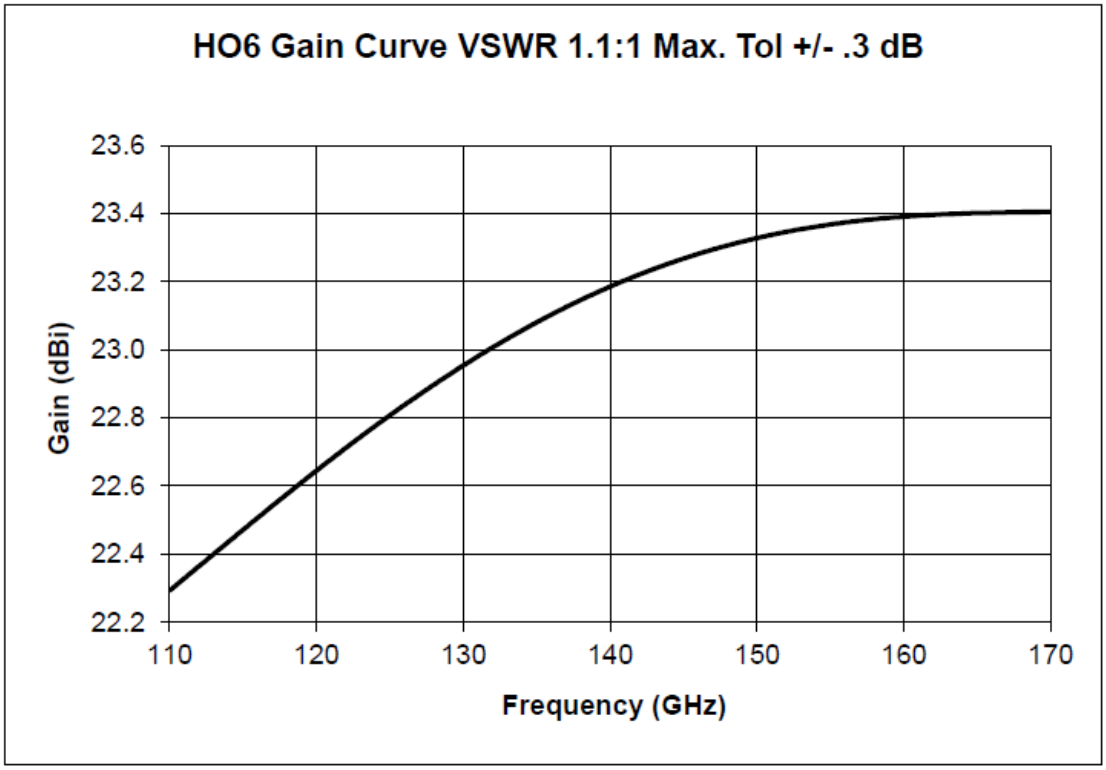
50-75 GHz CMI HO15R HORN ANTENNA



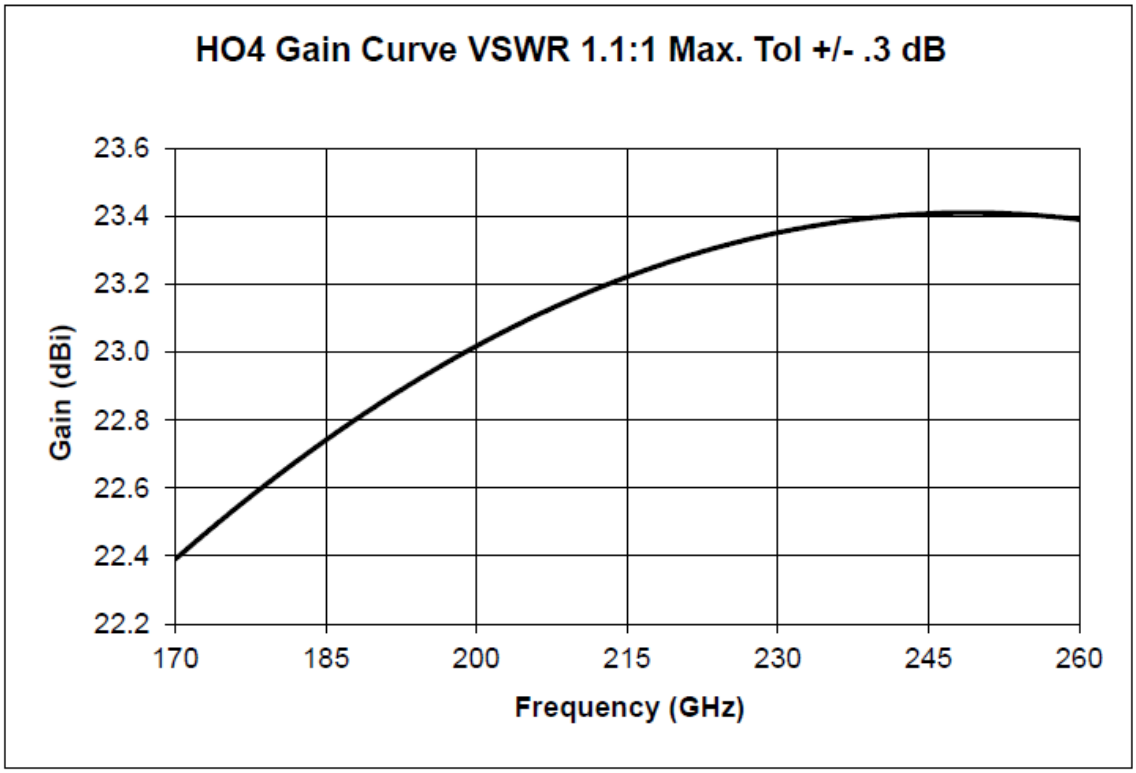
75-110 GHz CMI HO10R HORN ANTENNA



110-170 GHz CMI HO6R HORN ANTENNA



170-260 GHz CMI HO4R HORN ANTENNA



LABORATORY ACCREDITATION

Accredited Laboratory

A2LA has accredited

UL LLC

Research Triangle Park, North Carolina

for technical competence in the field of

Electrical Testing

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017 *General requirements for the competence of testing and calibration laboratories*. This laboratory also meets the A2LA R256- Specific Requirements FDA ASCA Accreditation Program. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (*refer to joint ISO-ILAC-IAF Communiqué dated April 2017*).

Presented this 4th day of March 2024.

Mr. Trace McInturff, Vice President, Accreditation Services
For the Accreditation Council
Certificate Number 0751.06
Valid to February 28, 2026

For the tests to which this accreditation applies, please refer to the laboratory's Electrical Scope of Accreditation.

END OF REPORT

UL LLC
12 Laboratory Dr., RTP, NC 27709, USA TEL: (919) 549-1400