Testing
NVLAP Lab Code 200087-0

Application For Grant of Certification

In accordance with FCC CFR 47 Part 2, FCC CFR 47 Part 25 and Industry Canada RSS-170 Issue 4

For

Model: GMN-0278300

1616.0-1626.5 MHz
Mobile Earth Station

FCC ID: IPH-0452800

IC: 1792A-0452800

FOR

Garmin International, Inc.

1200 East 151st Street
Olathe, KS 66062
FCC Designation: US5305
IC Test Site Registration: 3041A-1

Authorized Signatory:
Patrick Powell
Rogers Labs, a division of The Compatibility Center LLC

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Rogers Labs, a division of The Compatibility Center LLC

7915 Nieman Rd.
Lenexa, KS 66214
Phone / Fax (913) 660-0666

Engineering Test Report For Application for Grant of Authorization

In accordance with FCC CFR 47 Part 2, FCC CFR 47 Part 25 and Industry Canada RSS-170 Issue 4 Licensed Non-Broadcast Short Burst Data Transceiver module

For

Garmin International, Inc.

1200 East 151st Street
Olathe, KS 66062

Model: GMN-0278300
Mobile Earth Station
Frequency Range 1616.0-1626.5 MHz
FCC ID: IPH-0452800
IC: 1792A-0452800

Test Report Number: 241216
Test Date: December 16, 2024 – January 15, 2025

Certifying Engineer:

Patrick Powell
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Revisions

Revision 1 Issued March 30, 2025 – Initial Release.

Foreword

The following information is submitted for consideration in processing for and obtaining Grant of Authorization. This report is intended to present verification of compliance of FCC CFR 47 Part, FCC CFR 47 Part 25 and Industry Canada RSS-170 Issue 4. The GMN-0278300 was investigated as the manufacturer provided. The product is a self-contained transceiver module operating in the 1616-1626.5 MHz frequency band.

Name of Applicant: Garmin International, Inc.
1200 East 151st Street
Olathe, KS 66062

Model: GMN-0278300
FCC I.D.: IPH-0452800 IC: 1792A-0452800
Frequency Range: 1616.0-1626.5 MHz

Modes	Frequency Range (MHz)	Operating Power (W)	99 % Occupied Bandwidth (kHz)	-26dB Occupied Bandwidth (kHz)
B1	1616-1626.5	17.4	30.0	35.3
C1	1616-1626.5	22.4	32.8	36.6
C2	1616-1626.5	20.9	64.4	73.4
C8	1616-1626.5	75.9	260.0	291.5

Opinion / Interpretation of Results

Specification Clause			Test Description	Result
47CFR Pt 25	47CFR Pt 2	RSS-170		
25.202 (d)	2.1055	5.2	Frequency Tolerance	Pass
25.202 (f)	2.1053	5.4.3.1	Emissions Limitations	Pass
25.204	2.1046	5.3	Power Limitations	Pass
--	2.1047	--	Modulation Characteristics	Pass
25.216	--	5.4.3	Limits on Emissions from MES for Protection of Aeronautical Radionavigation-Satellite Service	Pass
--	2.1049	4.6.1	Occupied Bandwidth	Pass

Equipment Tested

Equipment	Model / PN	Serial Number
EUT	GMN-0278300	81Y000406
EUT test cable harness	N/A	N/A
Antenna active subassembly	N/A	N/A
TNC to TNC Connector	N/A	N/A
RS-232 to serial adapter	N/A	N/A
Laptop Computer	Latitude 74870	EFSPSN2

Test results in this report relate only to the items tested

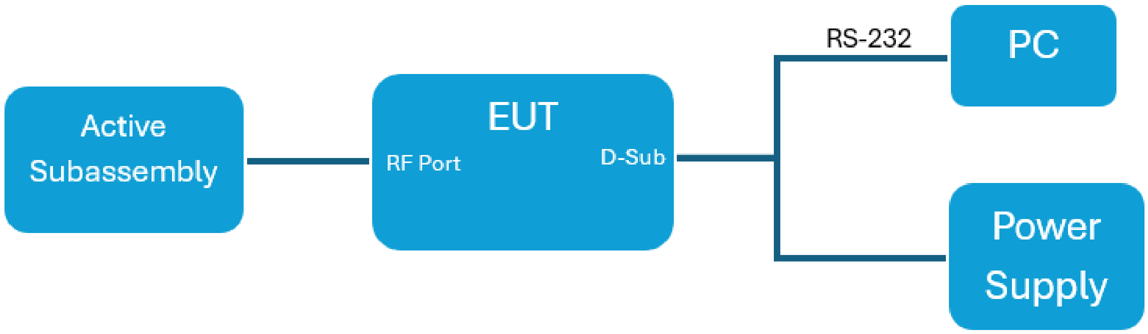
S/W (FVIN): 1.5.5

Equipment Function

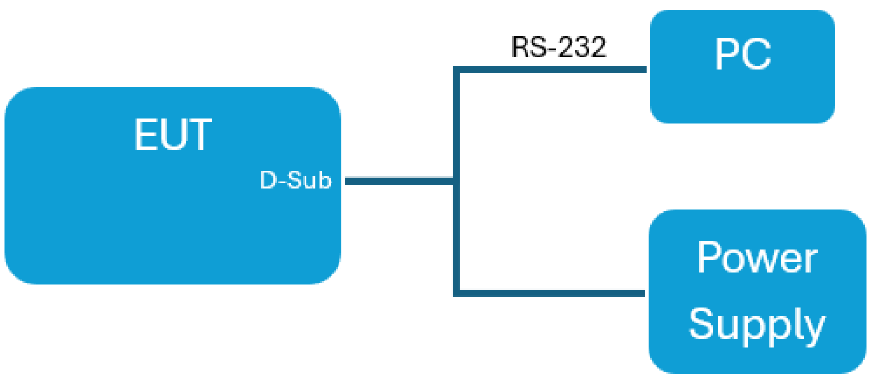
The EUT is a remote mounted avionics product that provides data transfer via the Iridium Certus network in the 1616-1626.5 MHz range. Only one of the four modulation types can transmit at a time and the maximum possible duty cycle for this radio is 36.4%.

Equipment Configuration

With Antenna active subassembly:



Without Antenna active subassembly:



Equipment Modes

Modes	Frequency Band	Modulations	Nominal TX Power	Channel Spacing US	Raw Data Rates
B1	1616-1626.5 MHz	DEQPSK	39.2 dBm	41.667 kHz	4.6 kbps
C1	1616-1626.5 MHz	QPSK	39 dBm	41.667 kHz	5.5 kbps
C2	1616-1626.5 MHz	QPSK	38 dBm	83.333 kHz	11.0 kbps
C8	1616-1626.5 MHz	QPSK	44 dBm	333.333 kHz	44.1 kbps

Application for Certification

(1) The full name and mailing address of the manufacturer of the device and the applicant for certification.
Garmin International, Inc. 1200 East 151st Street, Olathe, KS 66062

(2) FCC identifier. FCC ID: IPH-0452800 IC: 1792A-0452800

(3) Type of Station: Mobile Earth Station

(4) Type or types of emission.

Mode B1: 35K7Q7W

Mode C1: 37K7Q7W

Mode C2: 73K7Q7W

Mode C8: 292K7Q7W

(5) Frequency range. 1616.0-1626.5 MHz

(6) Range of operating power values or specific operating power levels, and description of any means provided for variation of operating power. All nominal at antenna port:

Mode B1: 8.3 W

Mode C1: 7.9 W

Mode C2: 6.3 W

Mode C8: 25.1 W

(7) Tune-up procedure over the power range, or at specific operating power levels.

Refer to Exhibit for Alignment Procedure.

(8) A schematic diagram and a description of all circuitry and devices provided for determining and stabilizing frequency, for suppression of spurious radiation, for limiting modulation, and for limiting power.

Refer to Exhibit for Circuit information and theory of operation.

(9) A photograph or drawing of the equipment identification plate or label showing the information to be placed thereon.

Refer to Exhibit for Photograph or Drawing.

(10) For equipment employing digital modulation techniques, a detailed description of the modulation system to be used, including the response characteristics (frequency, phase and amplitude) of any filters provided, and a description of the modulating wave train, shall be submitted for the maximum rated conditions under which the equipment will be operated.

Not applicable

(11) The data required by §§2.1046 through 2.1057, inclusive, measured in accordance with the procedures set out in §2.1041.

Data is contained in this application

(12) Applications for certification required by §25.129 of this chapter shall include any additional equipment test data required by that section.

Data is contained in this application or application exhibits.

(13) An application for certification of a software defined radio must include the information required by §2.944.

Does not apply to this device or application.

(14) Applications for certification of equipment operating under part 27 of this chapter, that a manufacturer is seeking to certify for operation in the:

(i) 1755-1780 MHz, 2155-2180 MHz, or both bands shall include a statement indicating compliance with the pairing of 1710-1780 and 2110-2180 MHz specified in §§27.5(h) and 27.75 of this chapter.

(ii) 1695-1710 MHz, 1755-1780 MHz, or both bands shall include a statement indicating compliance with §27.77 of this chapter.

(iii) 600 MHz band shall include a statement indicating compliance with §27.75 of this chapter.

Does not apply to this device or application.

(15) Before equipment operating under part 90 of this chapter and capable of operating on the 700 MHz interoperability channels (See §90.531(b)(1) of this chapter) may be marketed or sold, the manufacturer thereof shall have a Compliance Assessment Program Supplier's Declaration of Conformity and Summary Test Report or, alternatively, a document detailing how the manufacturer determined that its equipment complies with §90.548 of this chapter and that the equipment is interoperable across vendors. Submission of a 700 MHz narrowband radio for certification will constitute a representation by the manufacturer that the radio will be shown, by testing, to be interoperable across vendors before it is marketed or sold.

Does not apply to this device or application.

(16) Contain at least one drawing or photograph showing the test set-up for each of the required types of tests applicable to the device for which certification is requested. These drawings or photographs must show enough detail to confirm other information contained in the test report. Any photographs used must be focused originals without glare or dark spots and must clearly show the test configuration used.

Data is contained in this application or application exhibits.

Applicable Standards & Test Procedures

In accordance with the 47CFR, dated January 13, 2025, Part 2, Subpart J, Paragraphs 2.907, 2.911, 2.913, 2.925, 2.926, 2.1031 through 2.1057, and applicable parts of paragraphs 25.202, 25.204, 25.216, 25.129, and Industry Canada standards RSS-GEN Issue 5, and RSS-170 Issue 4 the following information is submitted. Testing was performed as described in ANSI C63.26: 2015.

Test Site Locations

Conducted EMI	AC line conducted emissions testing performed in a shielded screen room located at Rogers Labs, a division of The Compatibility Center LLC, 7915 Nieman Rd., Lenexa, KS (or satellite location).
Antenna port	Antenna port conducted emissions testing was performed in a shielded screen room located at Rogers Labs, a division of The Compatibility Center LLC, 7915 Nieman Rd., Lenexa, KS (or satellite location).
Radiated EMI	The radiated emissions tests were performed at the 3 meters Semi-Anechoic Chamber (SAC) located at Rogers Labs, a division of The Compatibility Center LLC, 7915 Nieman Rd., Lenexa, KS or at the 3 meters Semi-Anechoic Chamber (SAC) in the satellite location.

Registered Site information: FCC Site: US5305, ISED: 3041A, CAB Identifier: US0096

NVLAP Accreditation Lab code 200087-0

Units of Measurements

Conducted EMI Data is in dBµV; dB referenced to one microvolt

Radiated EMI Data is in dBµV/m; dB/m referenced to one microvolt per meter

Sample Calculation:

RFS = Radiated Field Strength, FSM = Field Strength Measured

A.F. = Receive antenna factor, Gain = amplification gains and/or cable losses

RFS (dBµV/m @ 3m) = FSM (dBµV) + A.F. (dB) - Gain (dB)

Frequency: 9 kHz-30 MHz	Frequency: 30 MHz- 1 GHZ	Frequency: Above 1 GHz
Loop Antenna	Broadband Biconilog	Horn
RBW = 9 kHz	RBW = 120 kHz	RBW = 1 MHz
VBW = 30 kHz	VBW = 500 kHz	VBW = 3 MHz
Sweep time = Auto	Sweep time = Auto	Sweep time = Auto
Detector = PK, QP	Detector = PK, QP	Detector = PK, AV
Antenna Height 1m	Antenna Height 1-4m	Antenna Height 1-4m

Environmental Conditions

Ambient Temperature 21.4° C

Relative Humidity 29%

Atmospheric Pressure 1022.0 mb

Statement of Modifications and Deviations

No modifications to the EUT were required for the unit to demonstrate compliance with the CFR47 Parts 2 and 25, RSS-GEN, and RSS-170 Issue 4 emission requirements. There were no deviations to the specifications.

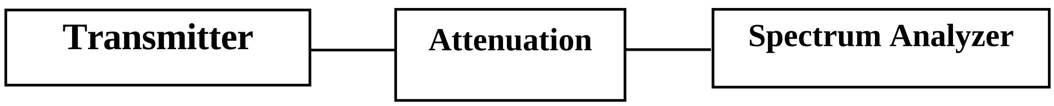
Transmitter Power Output

Measurements Required

Measurements shall be made to establish the radio frequency power delivered by the transmitter into the standard output termination. The power output shall be monitored and recorded and no adjustment shall be made to the transmitter after the test has begun, except as noted below:

If the power output is adjustable, measurements shall be made for the highest and lowest power levels. Output transmitter power is not user selectable.

Test Arrangement



The radio frequency power output was measured at the antenna terminal by placing 40.0 dB attenuation in the antenna line and observing the emission with the spectrum analyzer. The spectrum analyzer and attenuation offered an impedance of 50Ω to match the impedance of the standard antenna. A Rohde & Schwarz ESU40 Spectrum Analyzer was used to measure the radio frequency power at the antenna port. Data was taken in dBm and converted to watts as shown in the following Table. Data was taken per CFR47 Paragraph 2.1046(a) and applicable paragraphs of Part 25.202.

Test Results

Table 1 Transmitter Power Results (all Modes / Channels)

Modes	Frequency	RBW (kHz)	Power (dBm)	e.i.r.p. w/ 3dBi antenna (dBm)	Power (dBW)	Limit (dBW)
B1	1616.0	30	42.4	45.4	15.4	40.0
B1	1621.0	30	42.4	45.4	15.4	40.0
B1	1626.0	30	42.4	45.4	15.4	40.0
C1	1616.0	50	43.1	46.1	16.1	40.0
C1	1621.0	50	43.5	46.5	16.5	40.0
C1	1626.0	50	43.1	46.1	16.1	40.0
C2	1616.0	100	43.2	46.2	16.2	40.0
C2	1621.0	100	43.2	46.2	16.2	40.0
C2	1626.0	100	43.2	46.2	16.2	40.0
C8	1616.0	300	48.8	51.8	21.8	40.0
C8	1621.0	300	48.7	51.7	21.7	40.0
C8	1626.0	300	48.6	51.6	21.6	40.0

The EUT demonstrated compliance with specifications of CFR47 Paragraph 2.1046(a) and applicable Parts of 2, 25.202 & 25.204. There are no deviations to the specifications.

Conclusion

The EUT demonstrated compliance with specifications of CFR47 Paragraph 2.1046(a) and applicable Parts of 2 and 25.202. There are no deviations to the specifications. There are no deviations or exceptions to the specifications.

Spurious Emissions at Antenna Terminals

Measurements Required

The radio frequency voltage or power generated within the equipment and appearing on a spurious frequency shall be checked at the equipment output terminals when properly loaded with a suitable artificial antenna.

Emissions removed from the assigned frequency by more than 250 percent of the authorized bandwidth must be attenuated at least 43 +10log (Po) below the fundamental emission power level. The following equations represent the calculated attenuation offset level for the equipment operating with rated output power of each Mode in this device.

Mode B1: Limit for 17.4-Watt transmitter

Limit (dBc) = 43 + 10 Log (Po)
= 43 + 10 Log (17.4)
= 55.4 dBc

Mode C1: Limit for 22.4-Watt transmitter

Limit (dBc) = 43 + 10 Log (Po)
= 43 + 10 Log (22.4)
= 56.5 dBc

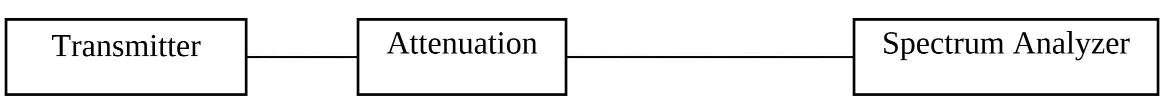
Mode C2: Limit for 20.9-Watt transmitter

Limit (dBc) = 43 + 10 Log (Po)
= 43 + 10 Log (20.9)
= 56.2 dBc

Mode C8: Limit for 75.9-Watt transmitter

Limit (dBc) = 43 + 10 Log (Po)
= 43 + 10 Log (75.9)
= 61.8 dBc

Test Arrangement



The radio frequency output was coupled to a Rohde & Schwarz ESU40 Spectrum Analyzer during antenna port conducted emissions measurements. The spectrum analyzer was used to observe the radio frequency spectrum with the transmitter modulated per section 2.1049 and operated in all normal modes. The frequency spectrum from 9 kHz to 35,000 MHz was observed.

Refer to Figures 1 through 48 for plots of spurious emissions at the antenna port.
Refer to data presented in tables 2 through 5 for spurious emission at antenna port details.

Data was taken per CFR47 2.1051, 2.1057, and applicable paragraphs of Part 25.202. There are no deviations to the specifications.

Test Results

Figure 1 Plot of emissions across Frequency spectrum (Mode B1 / Ch. 1)

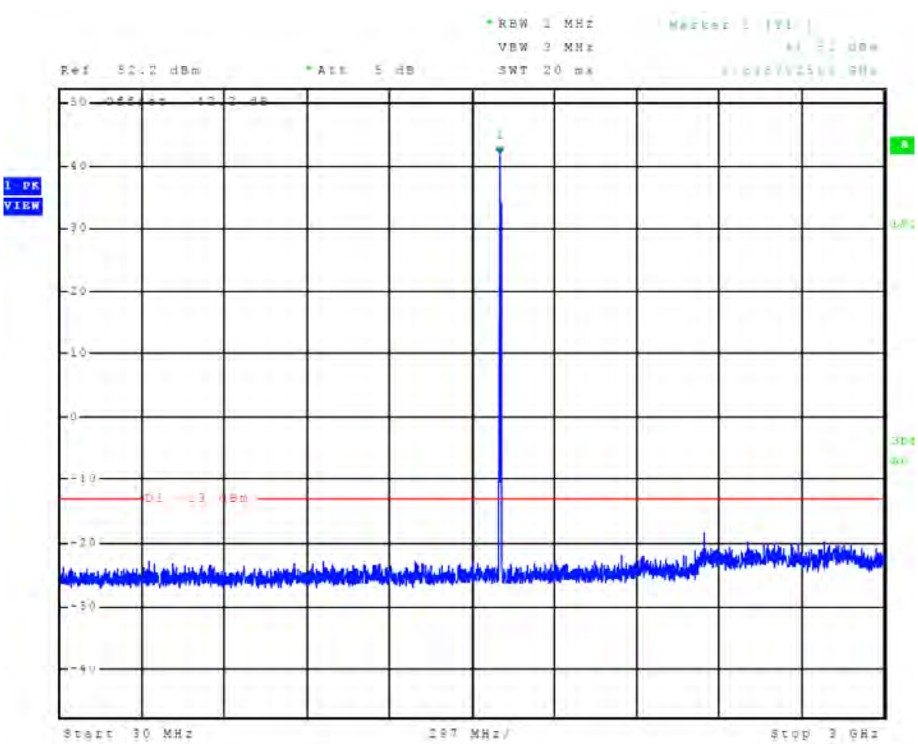


Figure 2 Plot of emissions across Frequency spectrum (Mode B1 / Ch. 1)

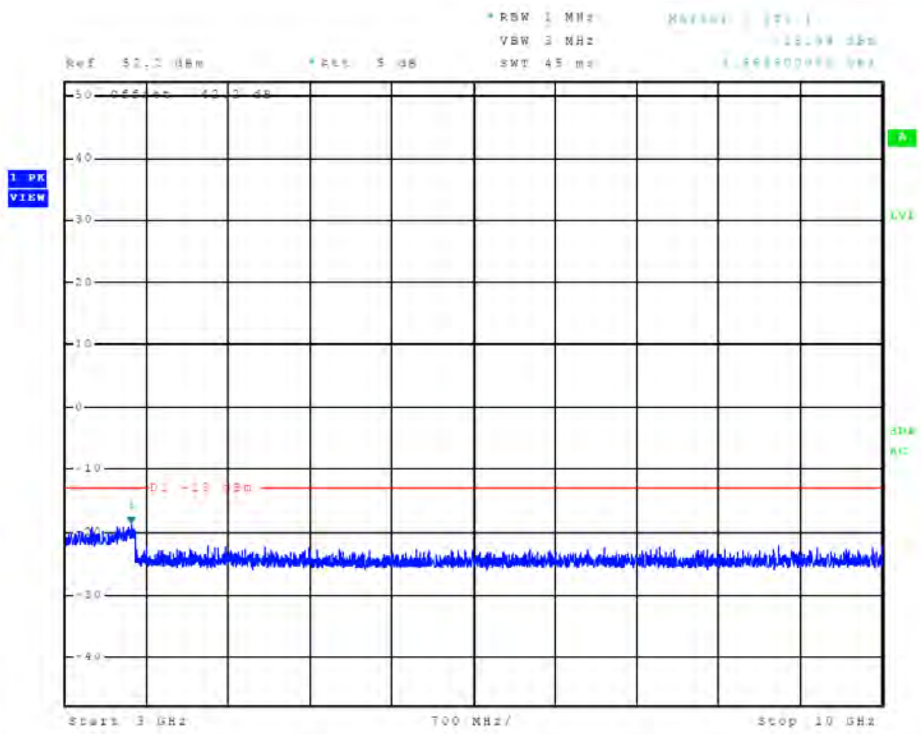


Figure 3 Plot of emissions across Frequency spectrum (Mode B1 / Ch. 1)

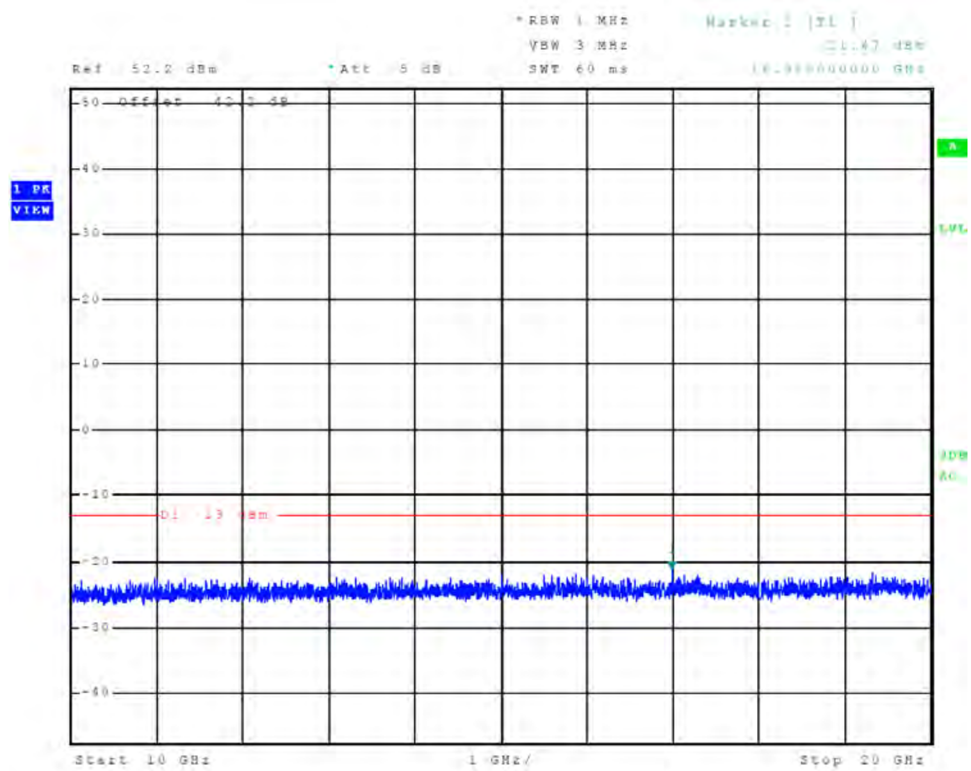


Figure 4 Plot of emissions across Frequency spectrum (Mode B1 / Ch. 1)

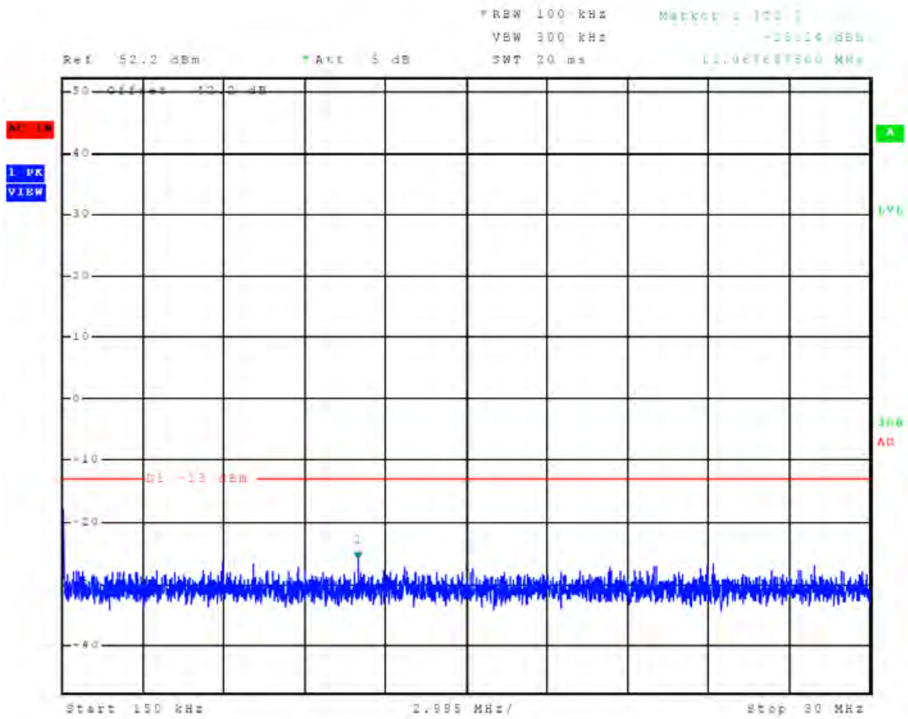


Figure 5 Plot of emissions across Frequency spectrum (Mode B1 / Ch. 121)

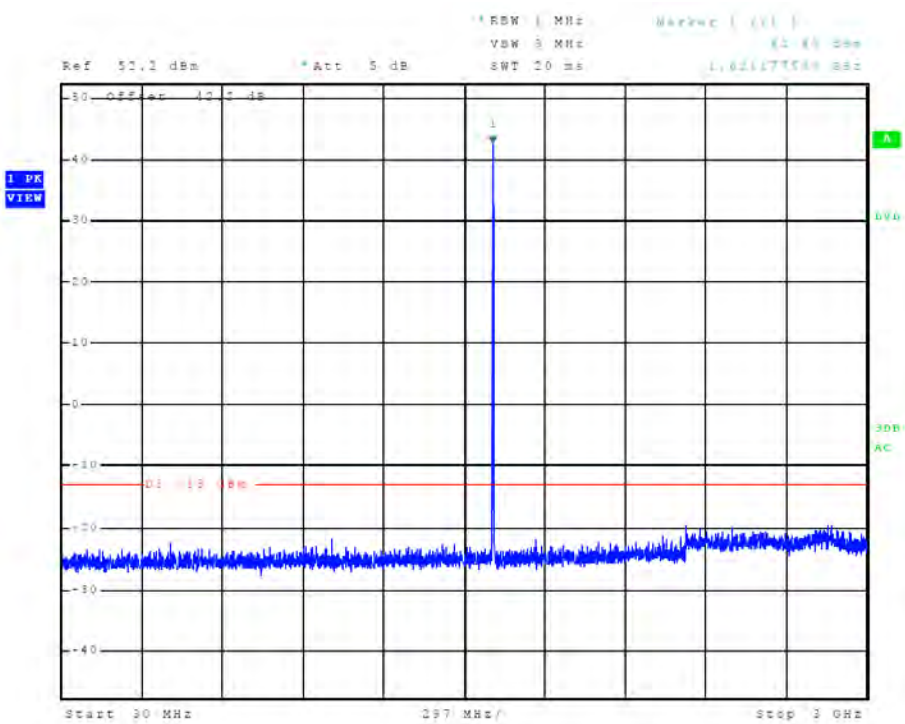


Figure 6 Plot of emissions across Frequency spectrum (Mode B1 / Ch. 121)

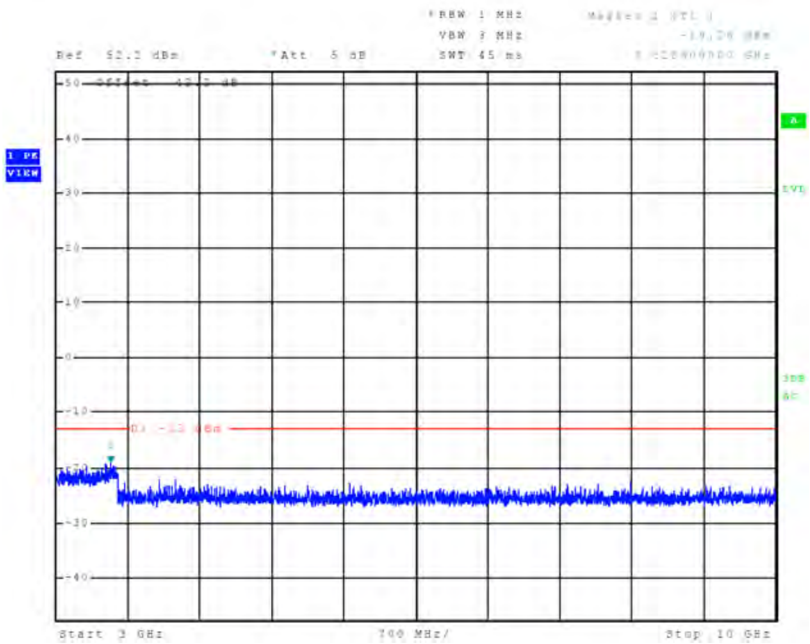


Figure 7 Plot of emissions across Frequency spectrum (Mode B1 / Ch. 121)

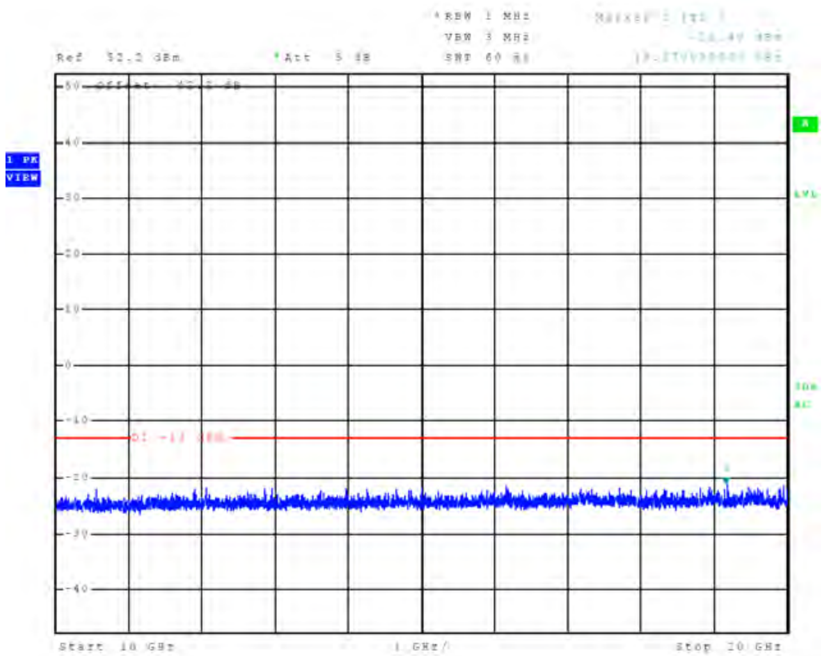


Figure 8 Plot of emissions across Frequency spectrum (Mode B1 / Ch. 121)

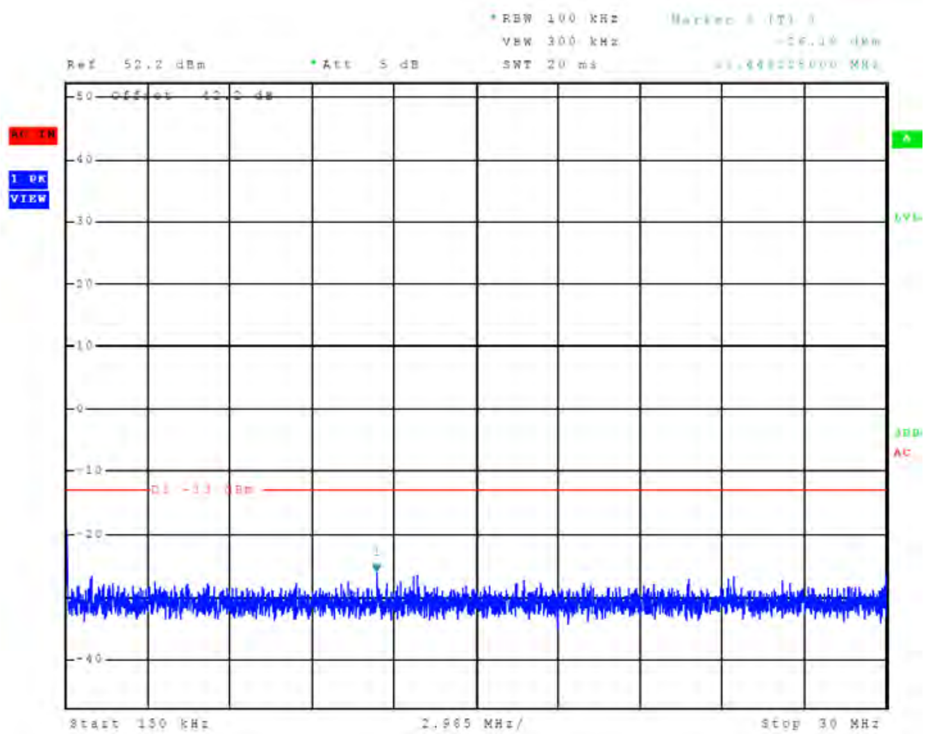


Figure 9 Plot of emissions across Frequency spectrum (Mode B1 / Ch. 240)

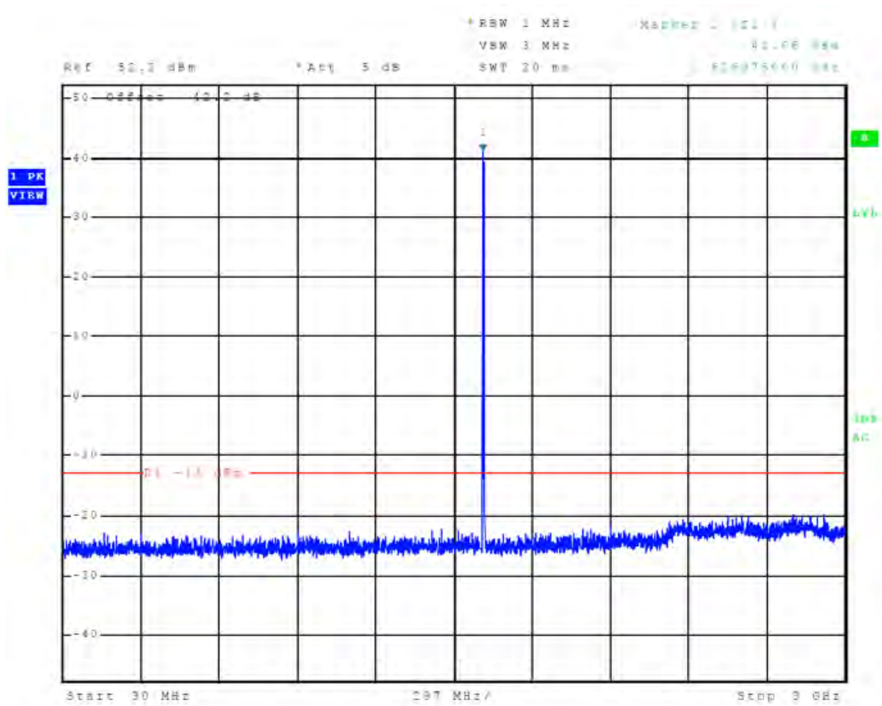


Figure 10 Plot of emissions across Frequency spectrum (Mode B1 / Ch. 240)

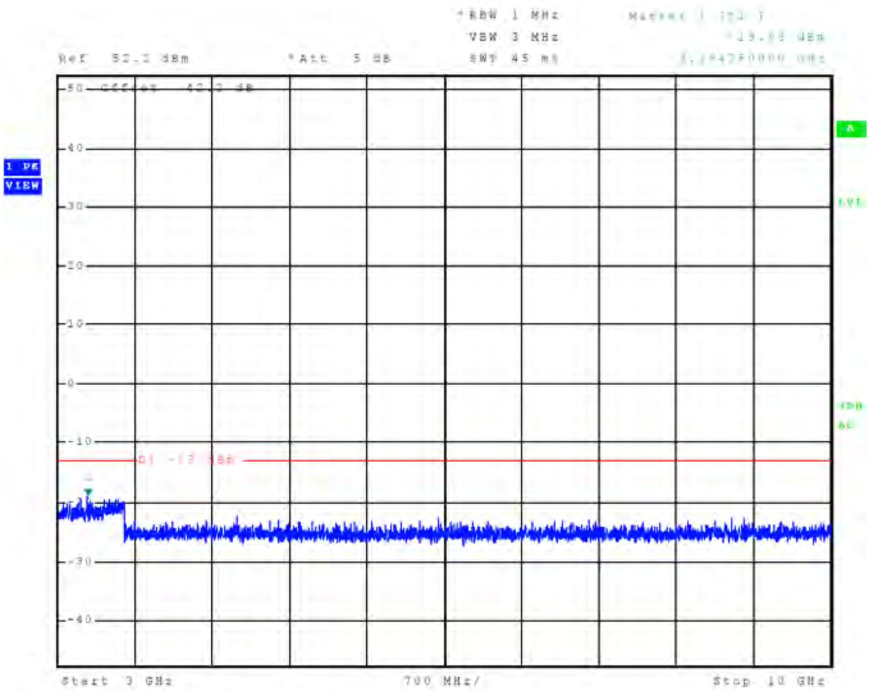


Figure 11 Plot of emissions across Frequency spectrum (Mode B1 / Ch. 240)

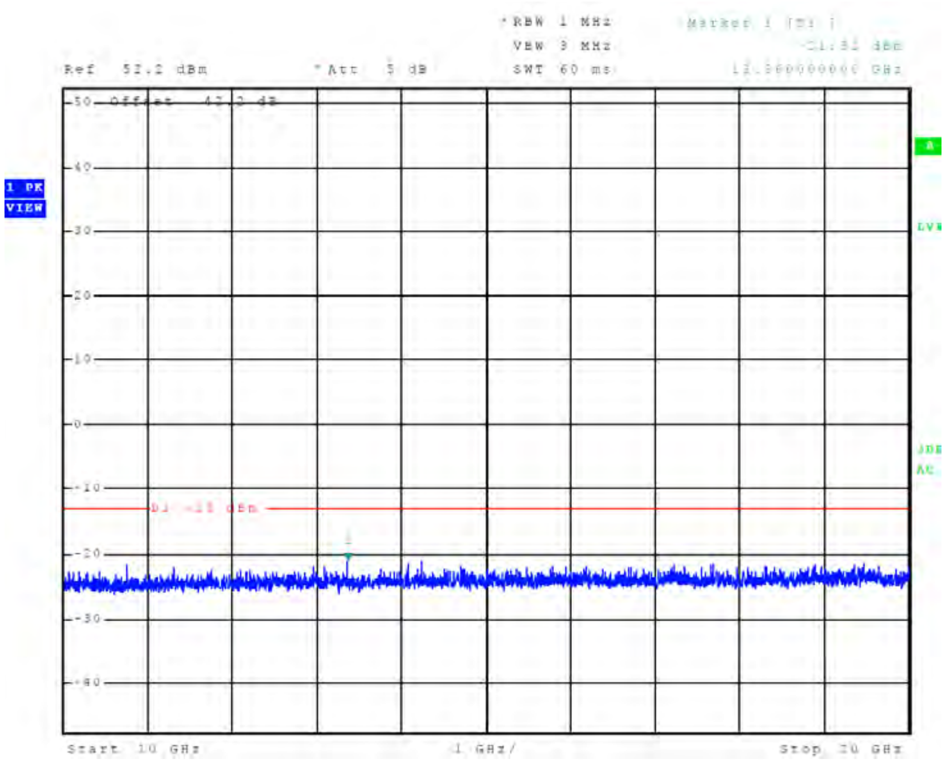


Figure 12 Plot of emissions across Frequency spectrum (Mode B1 / Ch. 240)

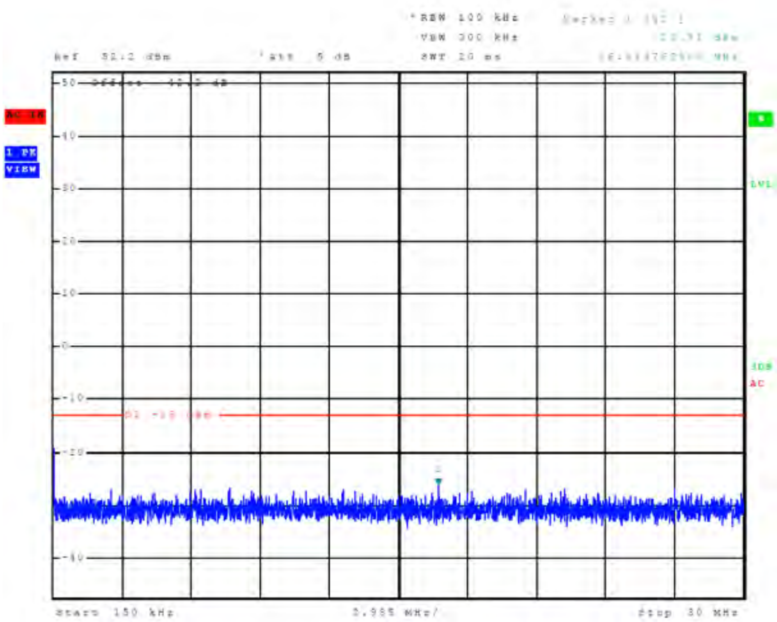


Figure 13 Plot of emissions across Frequency spectrum (Mode C1 / Ch. 1)

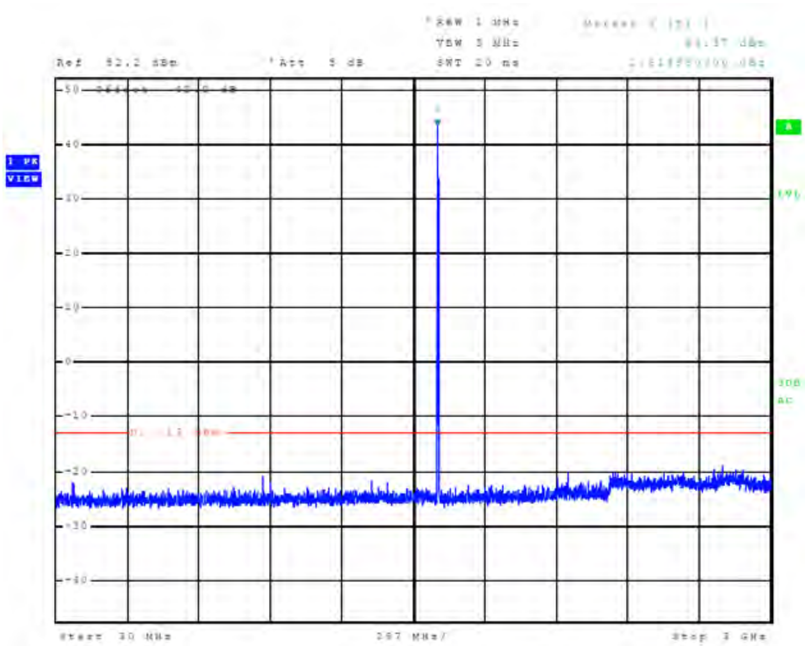


Figure 14 Plot of emissions across Frequency spectrum (Mode C1 / Ch. 1)

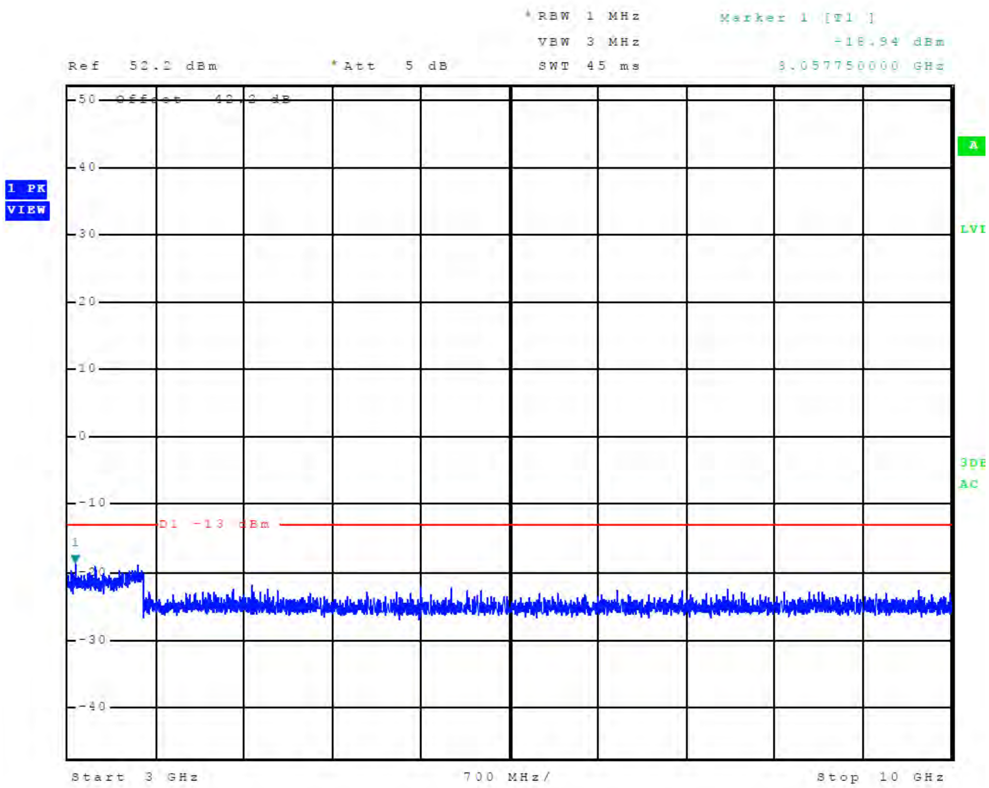


Figure 15 Plot of emissions across Frequency spectrum (Mode C1 / Ch. 1)

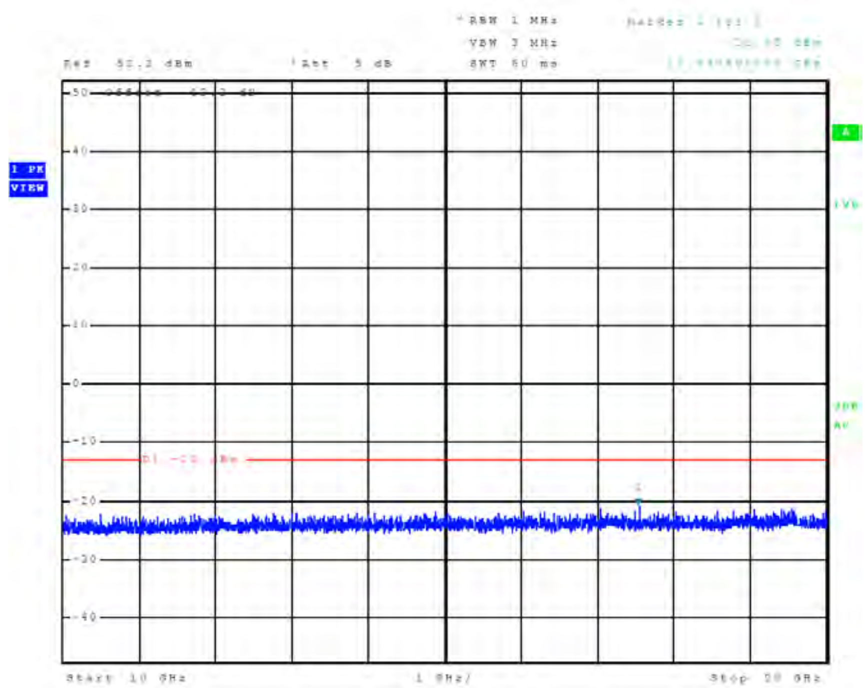


Figure 16 Plot of emissions across Frequency spectrum (Mode C1 / Ch. 1)

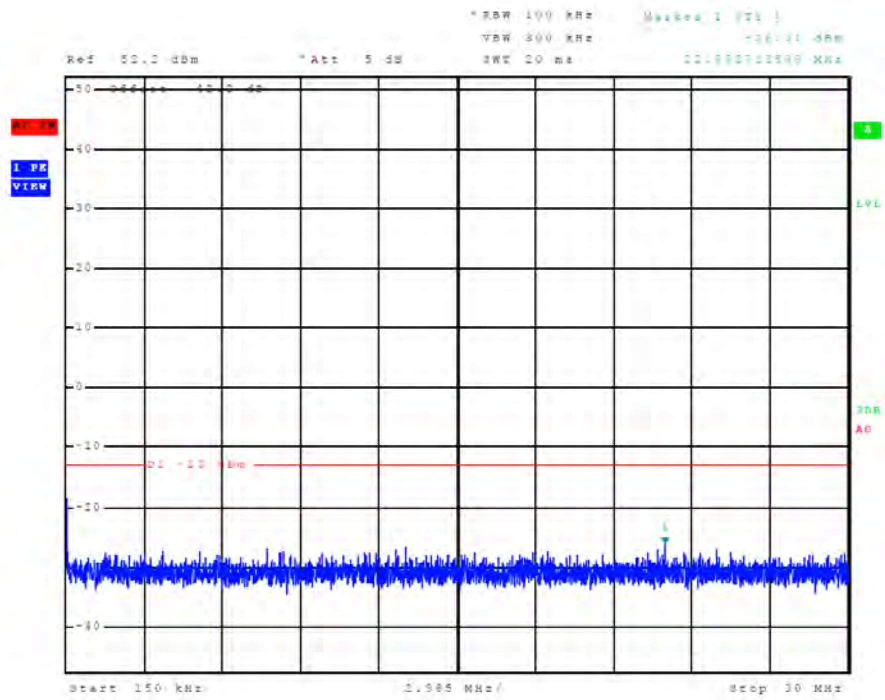


Figure 17 Plot of emissions across Frequency spectrum (Mode C1 / Ch. 121)

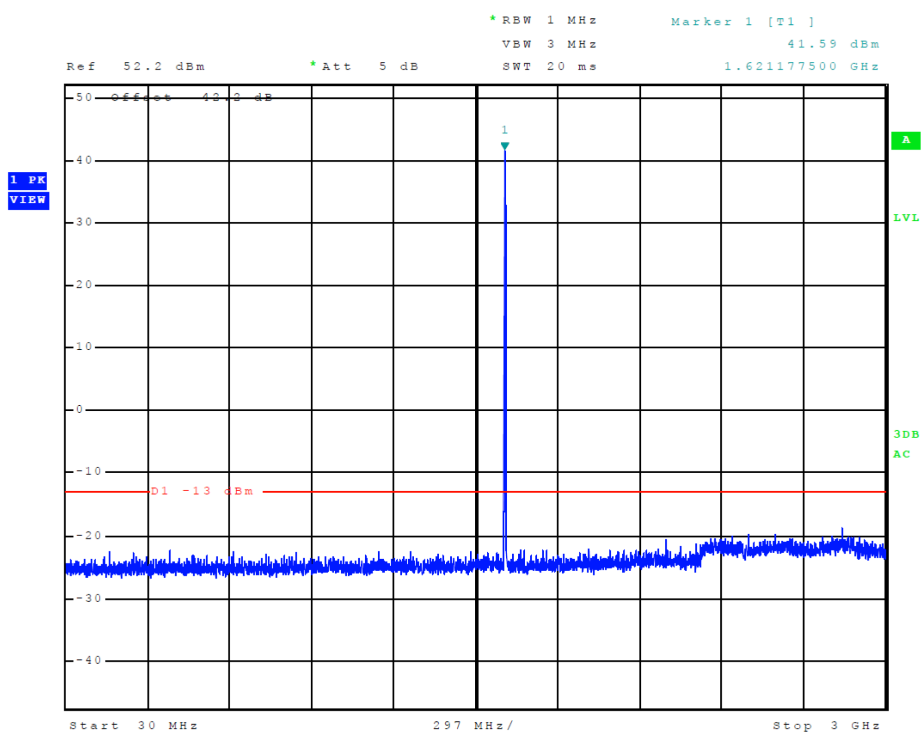


Figure 18 Plot of emissions across Frequency spectrum (Mode C1 / Ch. 121)

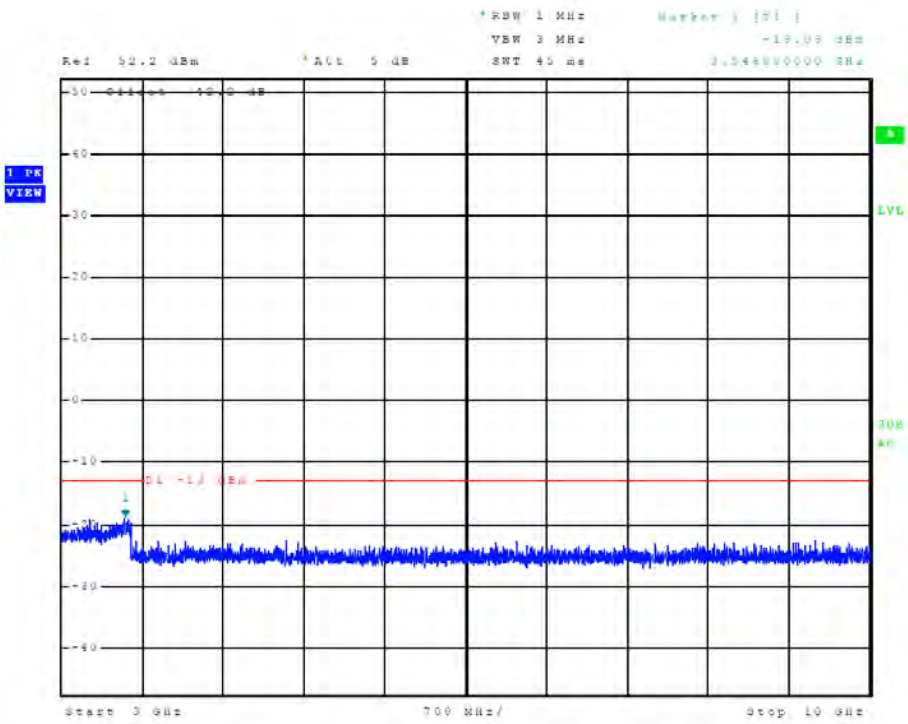


Figure 19 Plot of emissions across Frequency spectrum (Mode C1 / Ch. 121)

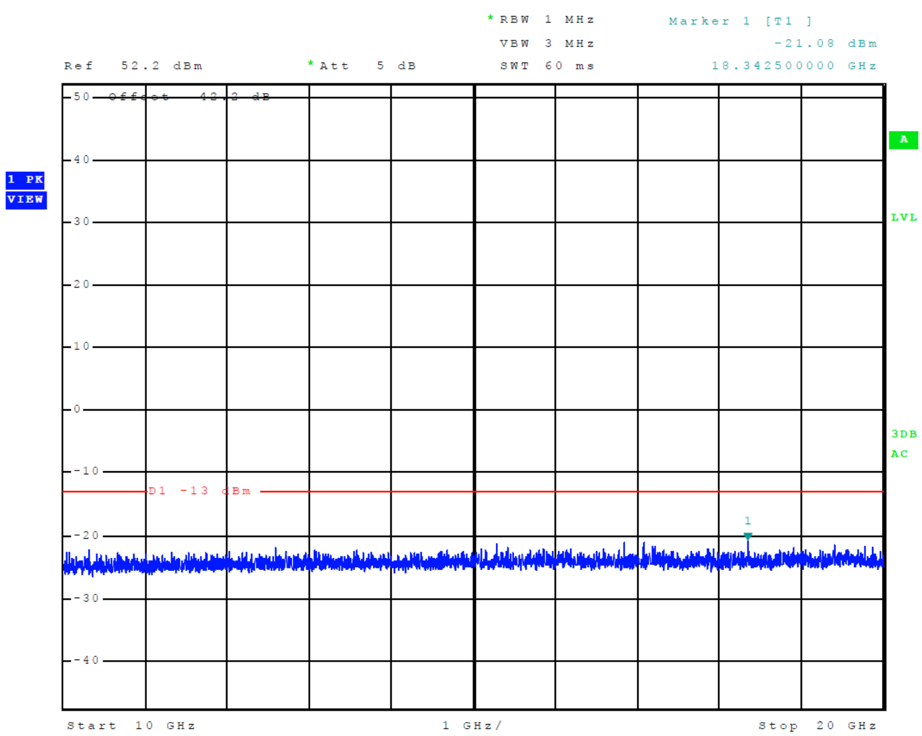


Figure 20 Plot of emissions across Frequency spectrum (Mode C1 / Ch. 121)

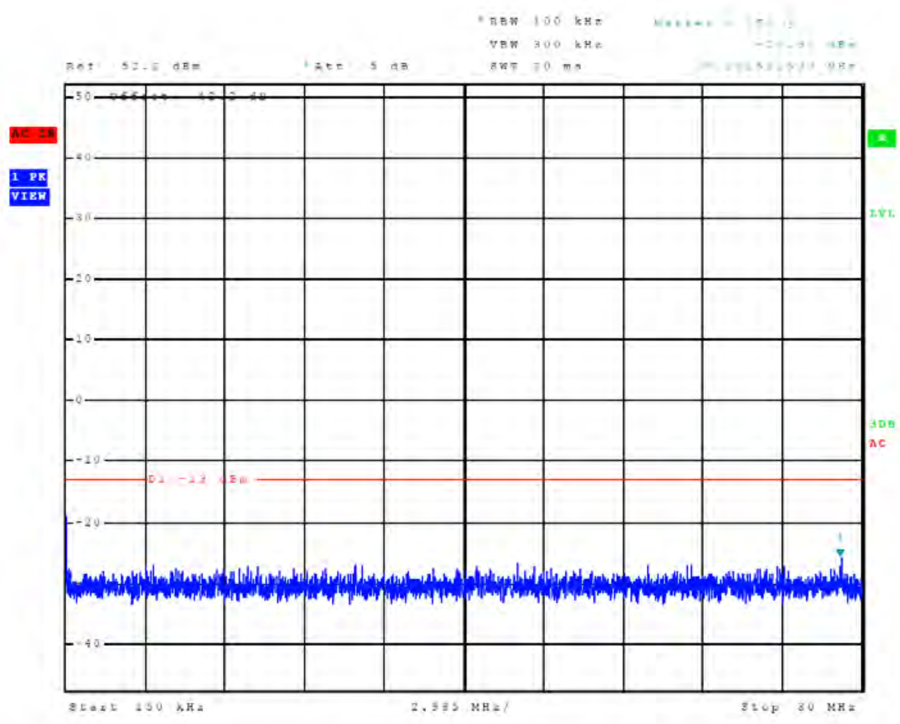


Figure 21 Plot of emissions across Frequency spectrum (Mode C1 / Ch. 240)

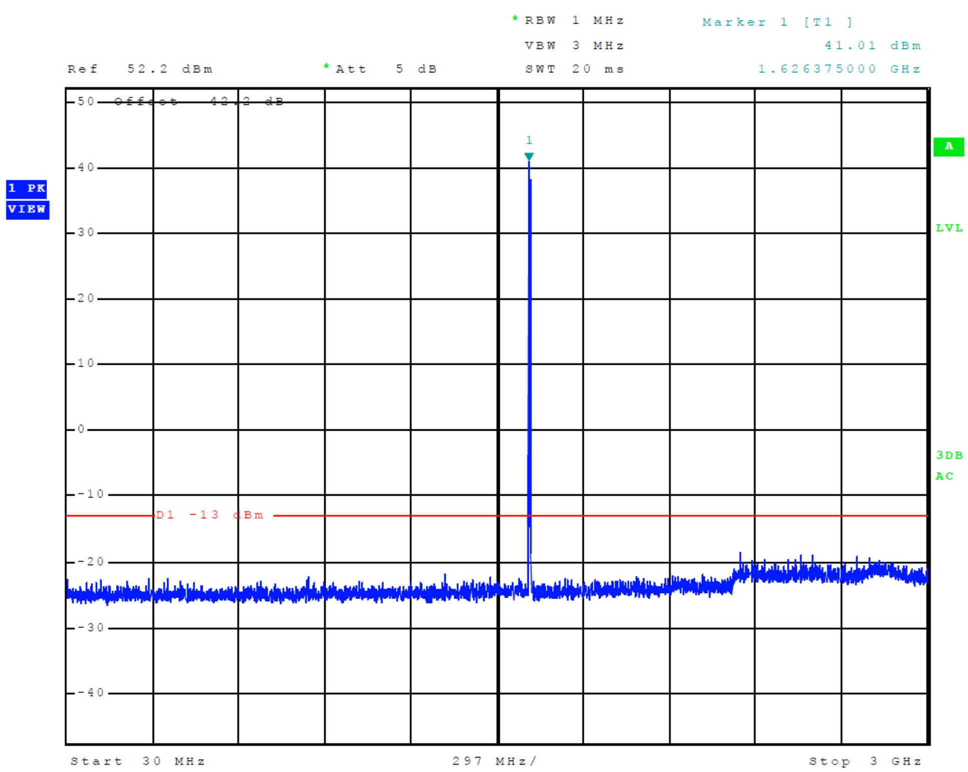


Figure 22 Plot of emissions across Frequency spectrum (Mode C1 / Ch. 240)

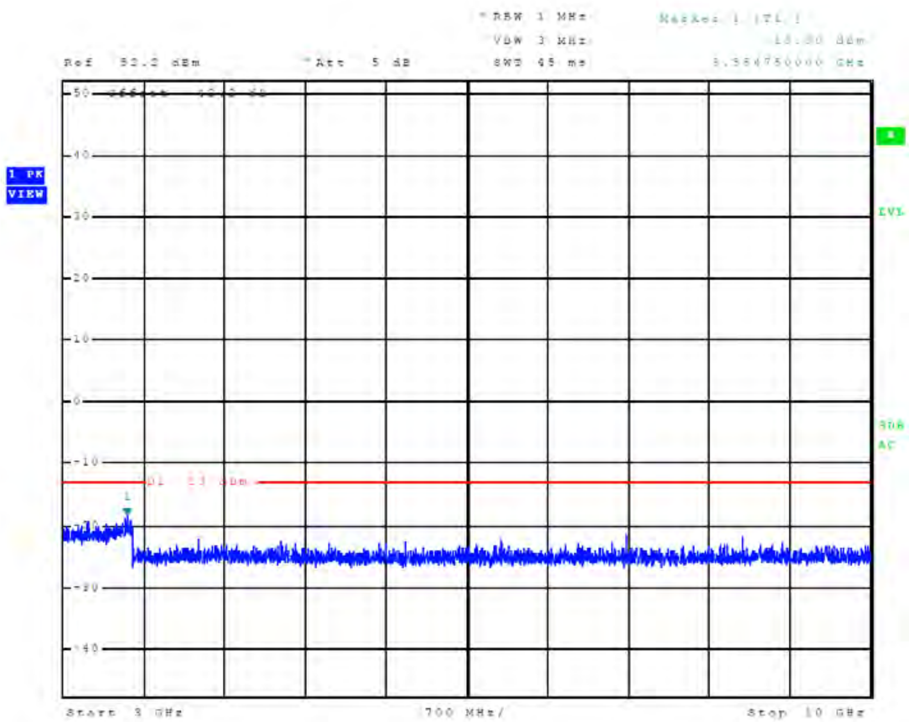


Figure 23 Plot of emissions across Frequency spectrum (Mode C1 / Ch. 240)

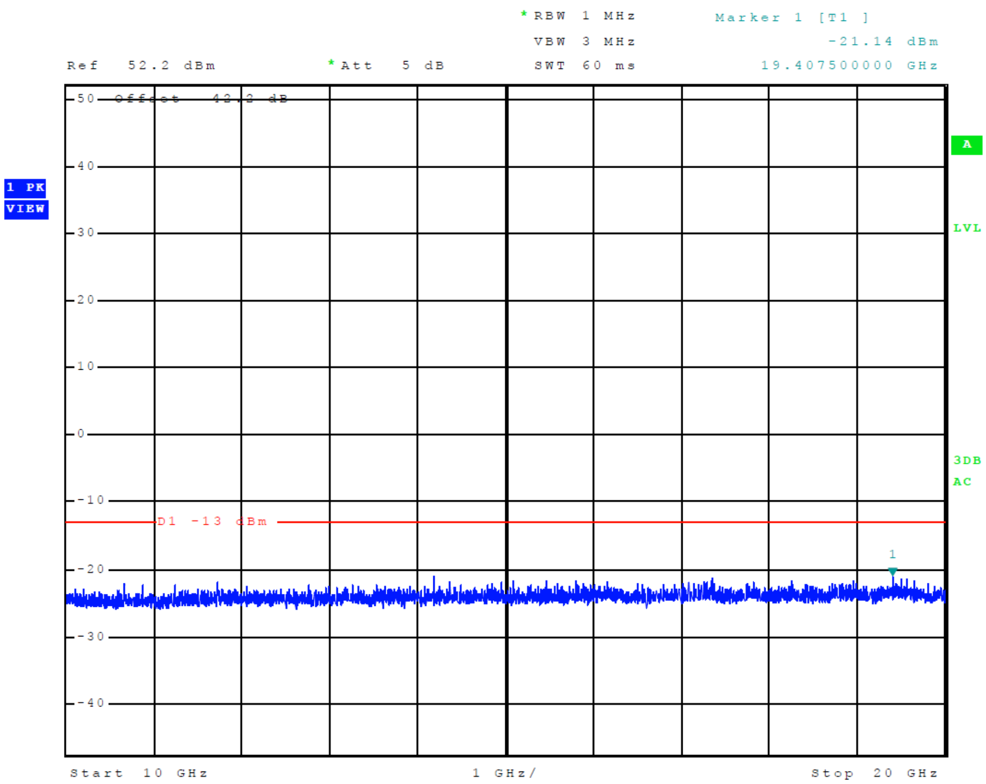


Figure 24 Plot of emissions across Frequency spectrum (Mode C1 / Ch. 240)

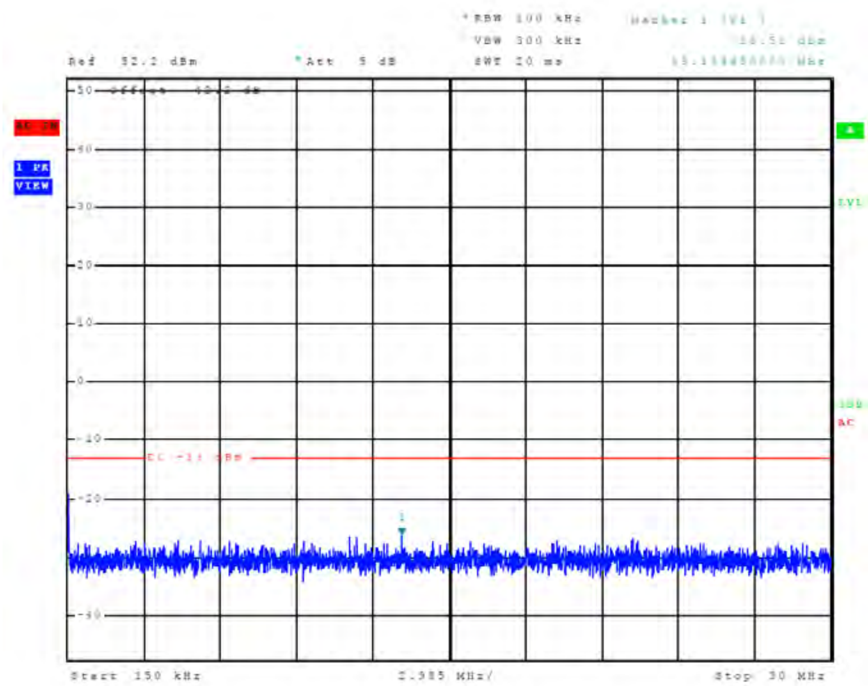


Figure 25 Plot of emissions across Frequency spectrum (Mode C2 / Ch. 1)

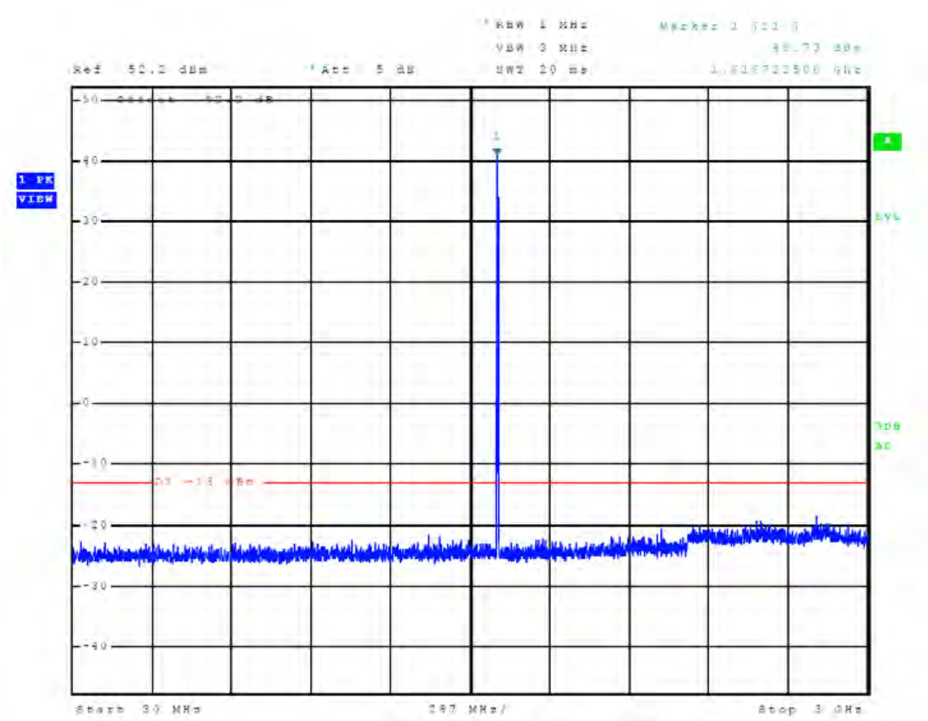


Figure 26 Plot of emissions across Frequency spectrum (Mode C2 / Ch. 1)

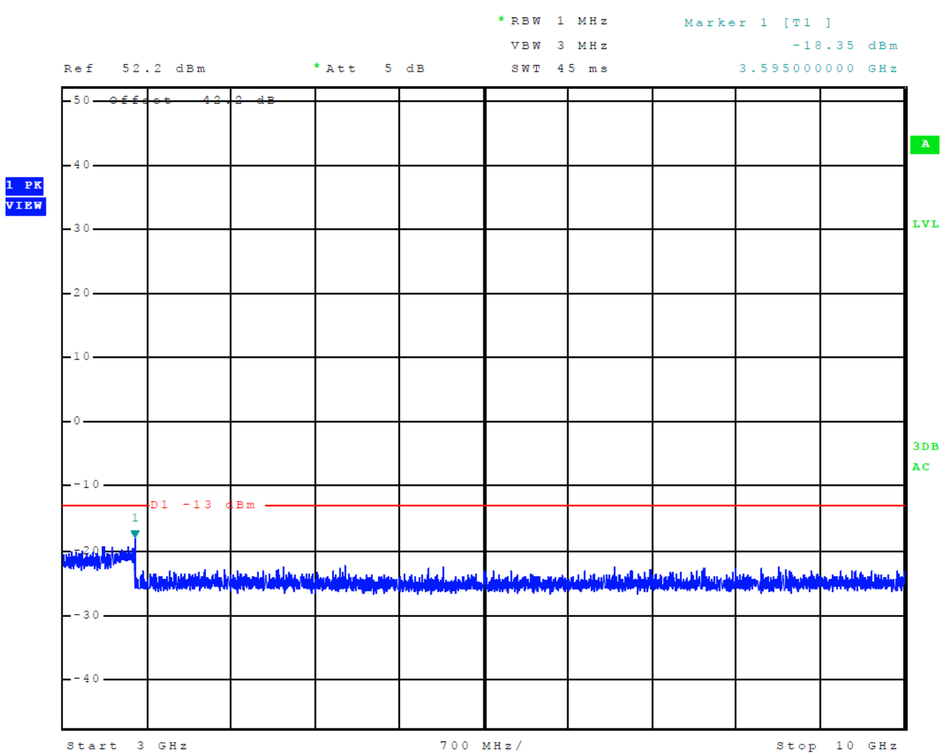


Figure 27 Plot of emissions across Frequency spectrum (Mode C2 / Ch. 1)

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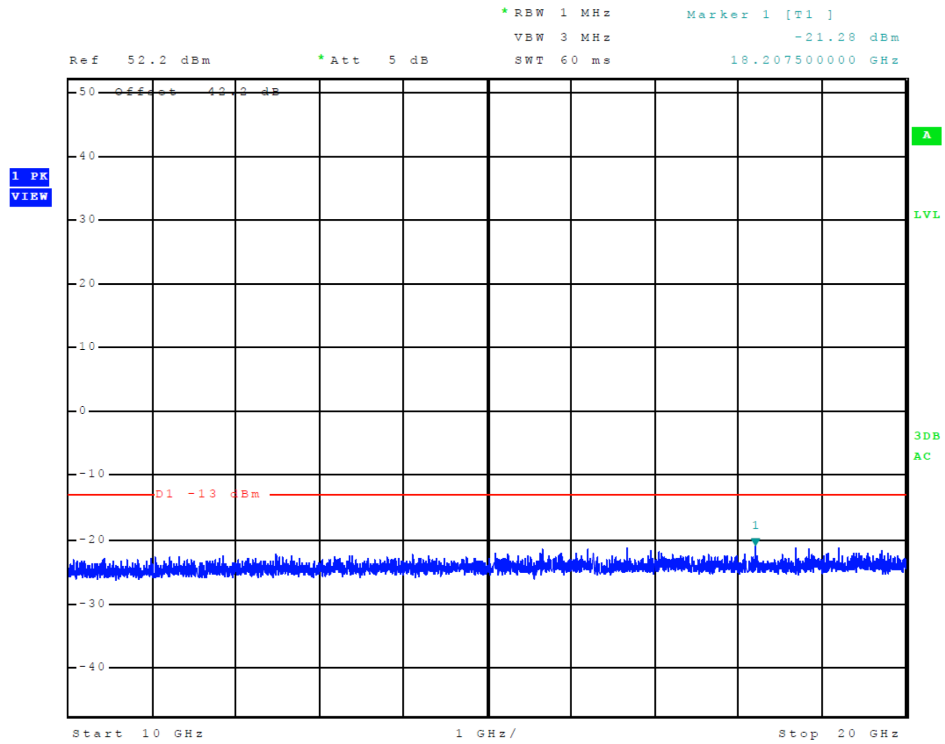


Figure 28 Plot of emissions across Frequency spectrum (Mode C2 / Ch. 1)

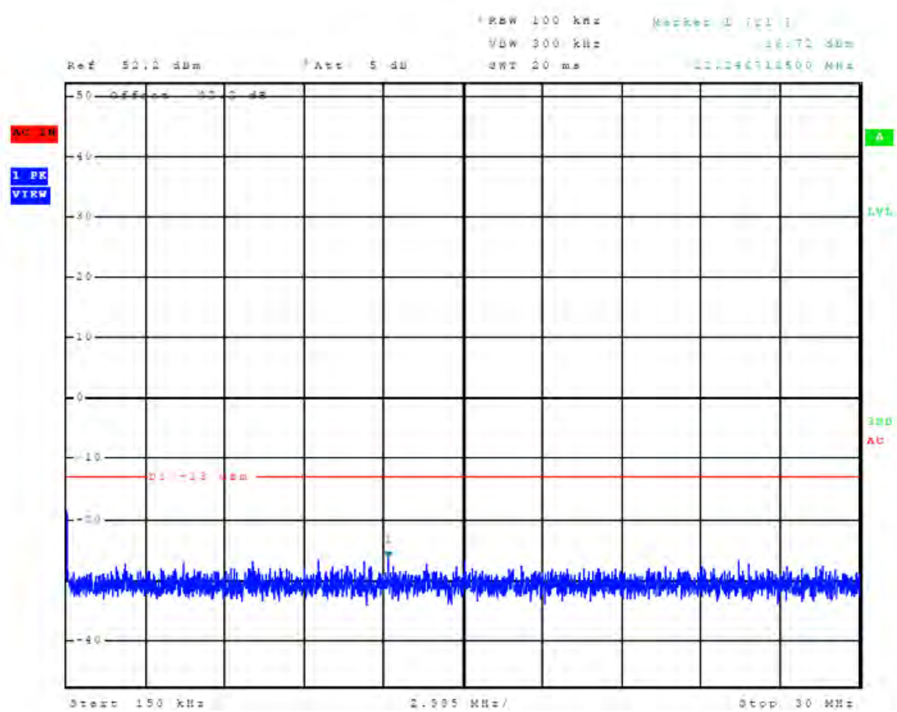


Figure 29 Plot of emissions across Frequency spectrum (Mode C2 / Ch. 121)

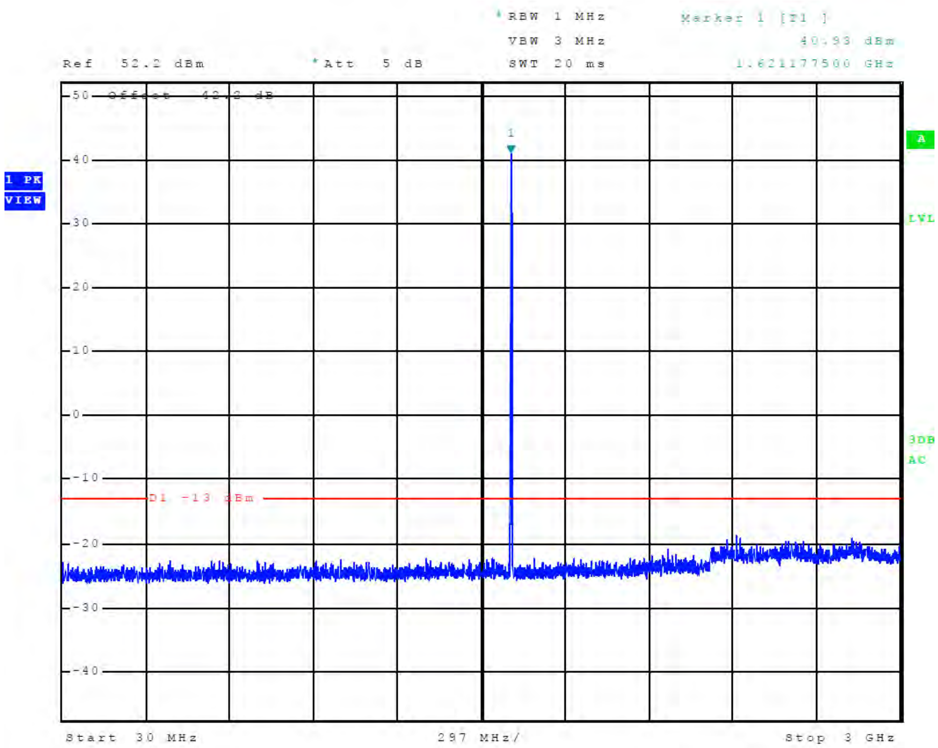


Figure 30 Plot of emissions across Frequency spectrum (Mode C2 / Ch. 121)

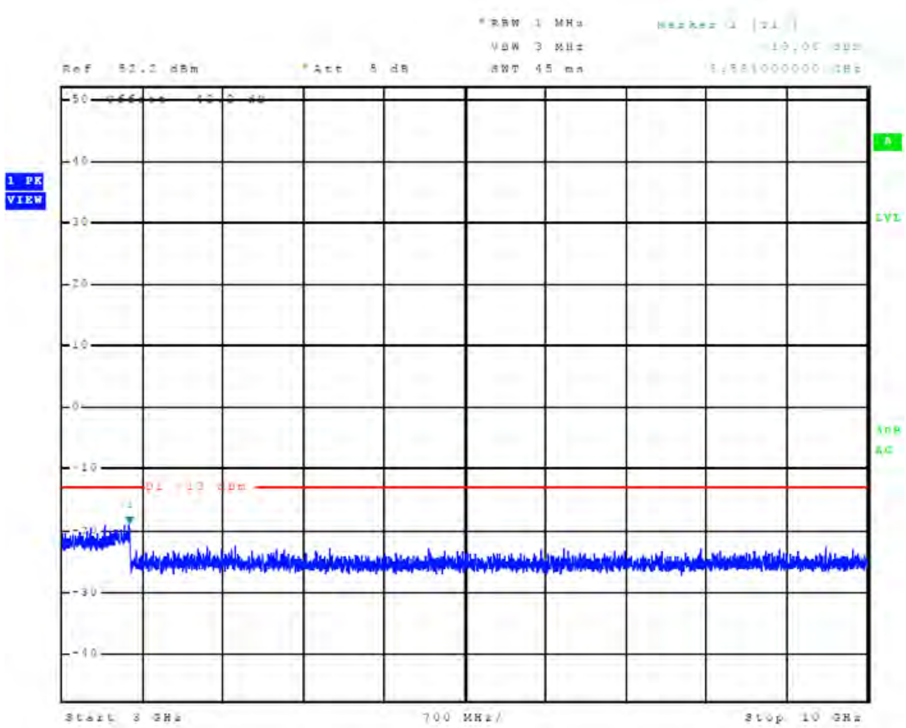


Figure 31 Plot of emissions across Frequency spectrum (Mode C2 / Ch. 121)

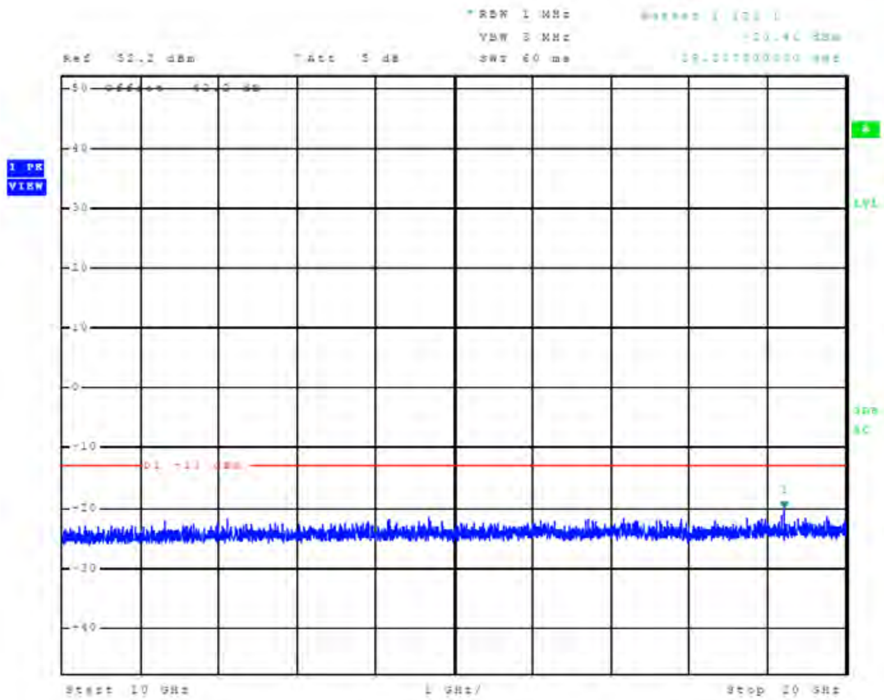


Figure 32 Plot of emissions across Frequency spectrum (Mode C2 / Ch. 121)

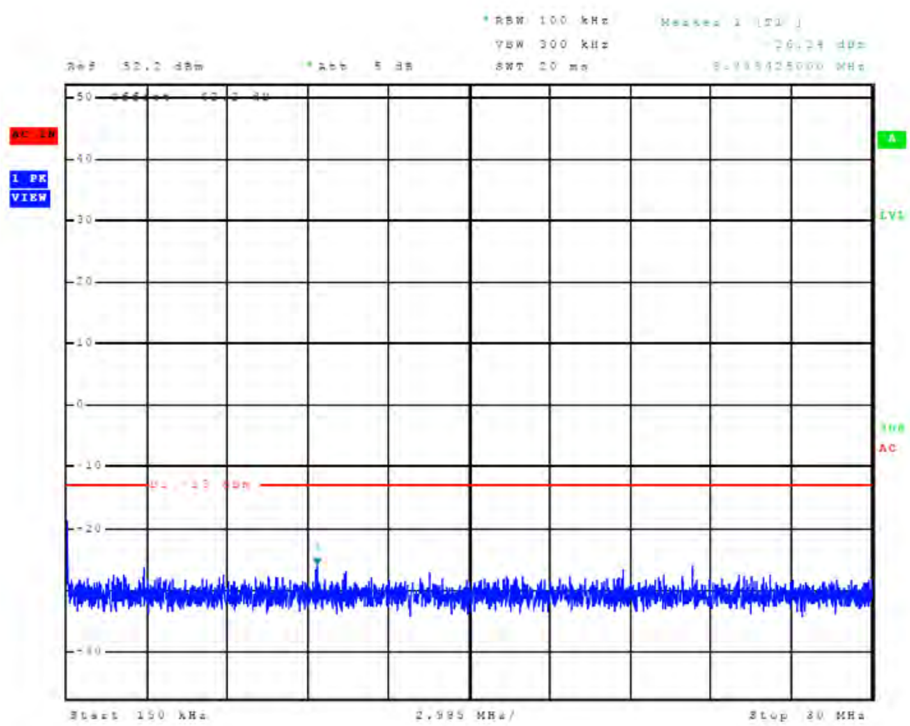


Figure 33 Plot of emissions across Frequency spectrum (Mode C2 / Ch. 240)

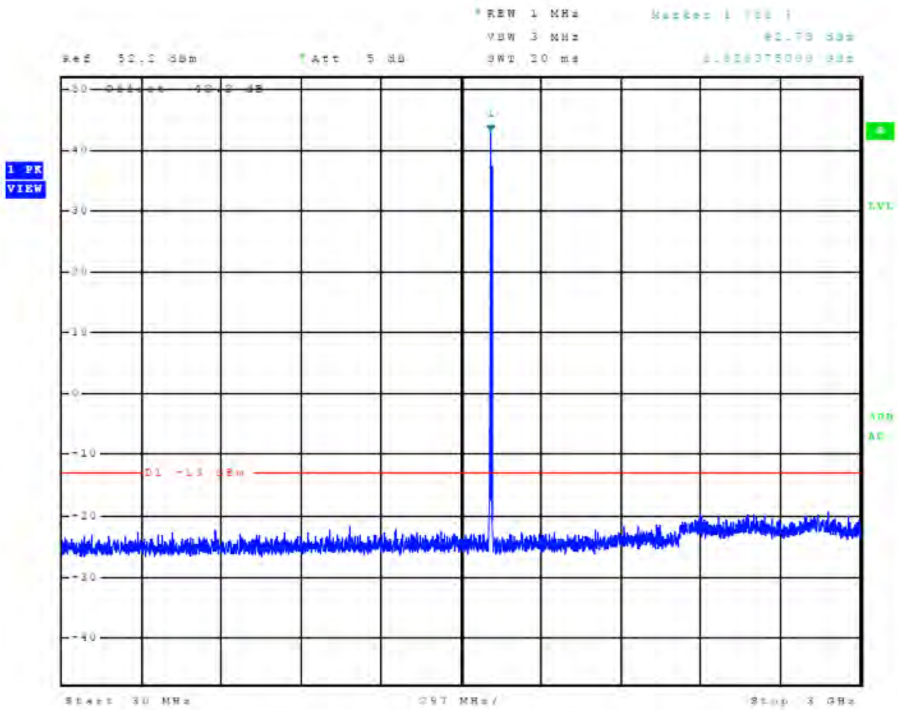


Figure 34 Plot of emissions across Frequency spectrum (Mode C2 / Ch. 240)

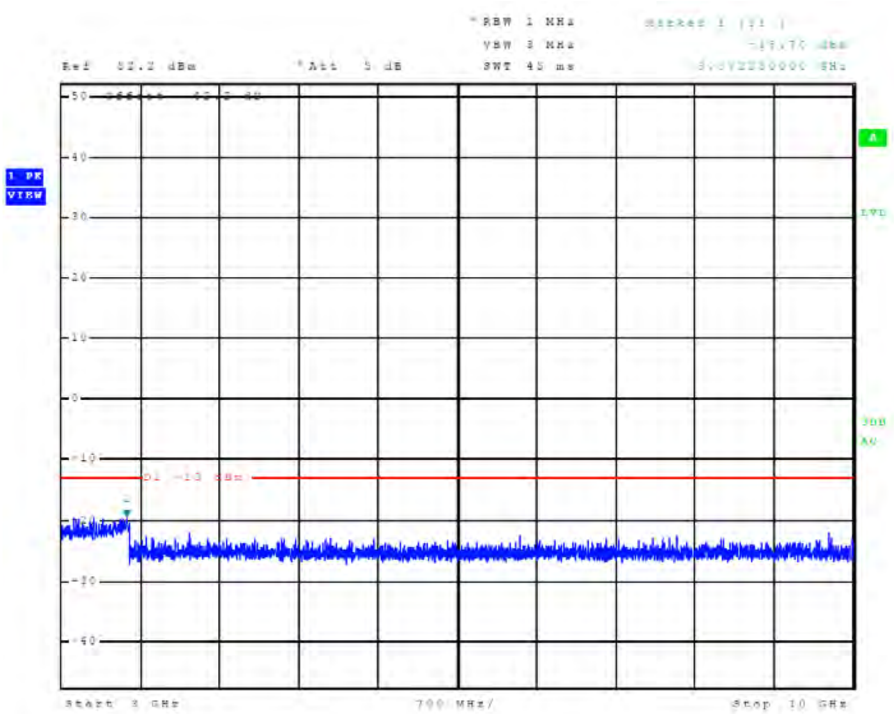


Figure 35 Plot of emissions across Frequency spectrum (Mode C2 / Ch. 240)

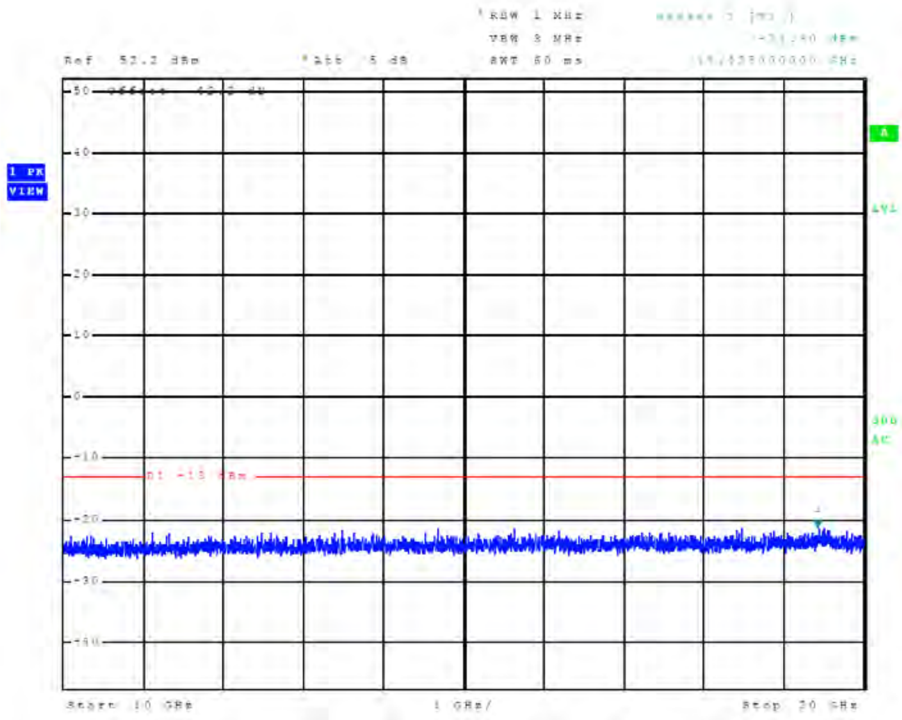


Figure 36 Plot of emissions across Frequency spectrum (Mode C2 / Ch. 240)

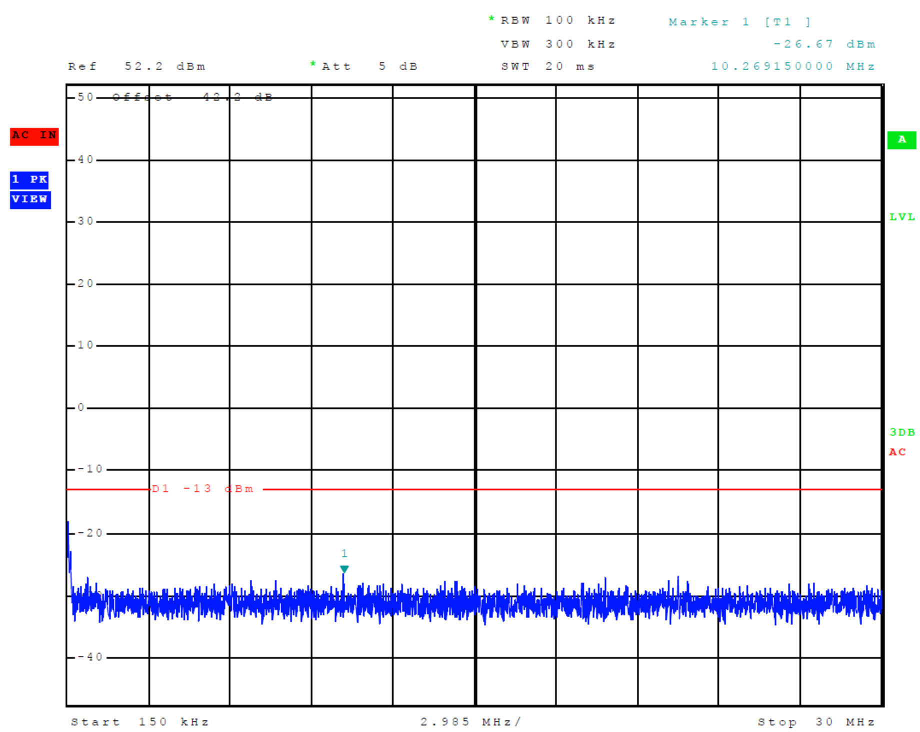


Figure 37 Plot of emissions across Frequency spectrum (Mode C8 / Ch. 1)

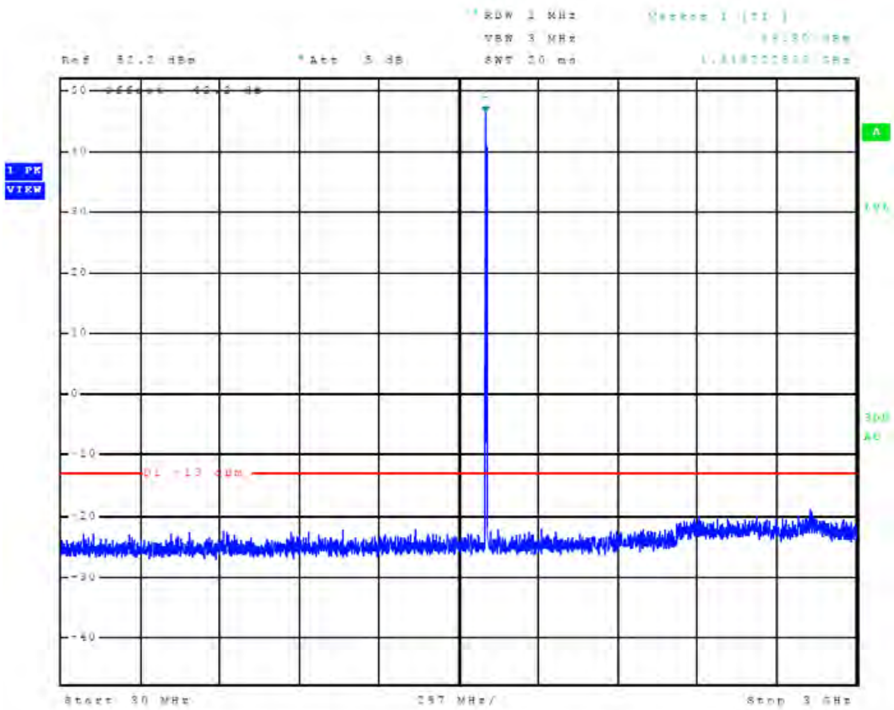


Figure 38 Plot of emissions across Frequency spectrum (Mode C8 / Ch. 1)

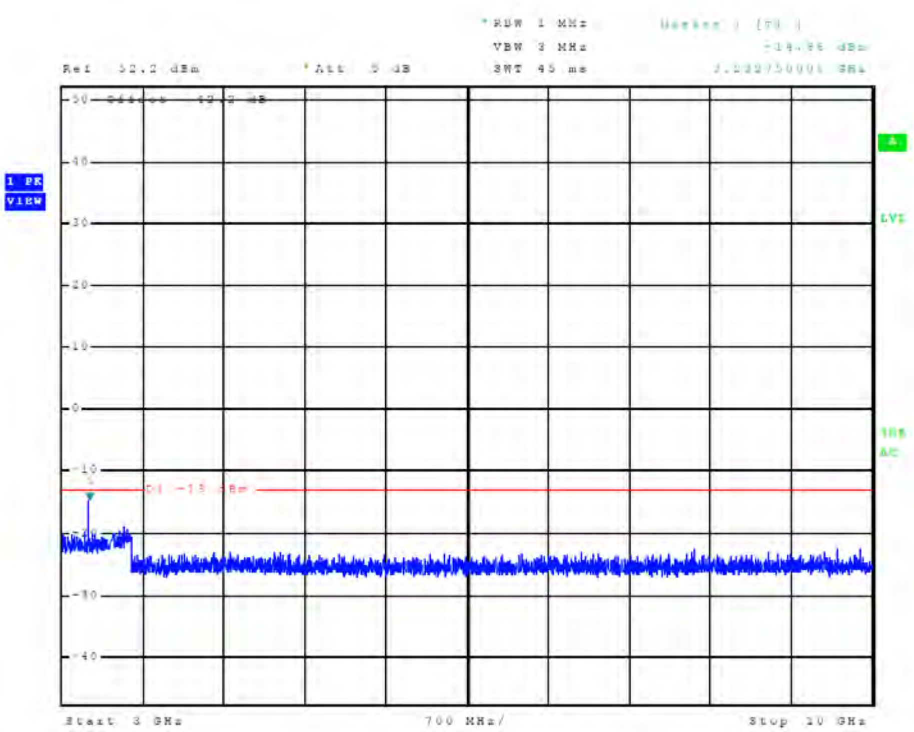


Figure 39 Plot of emissions across Frequency spectrum (Mode C8 / Ch. 1)

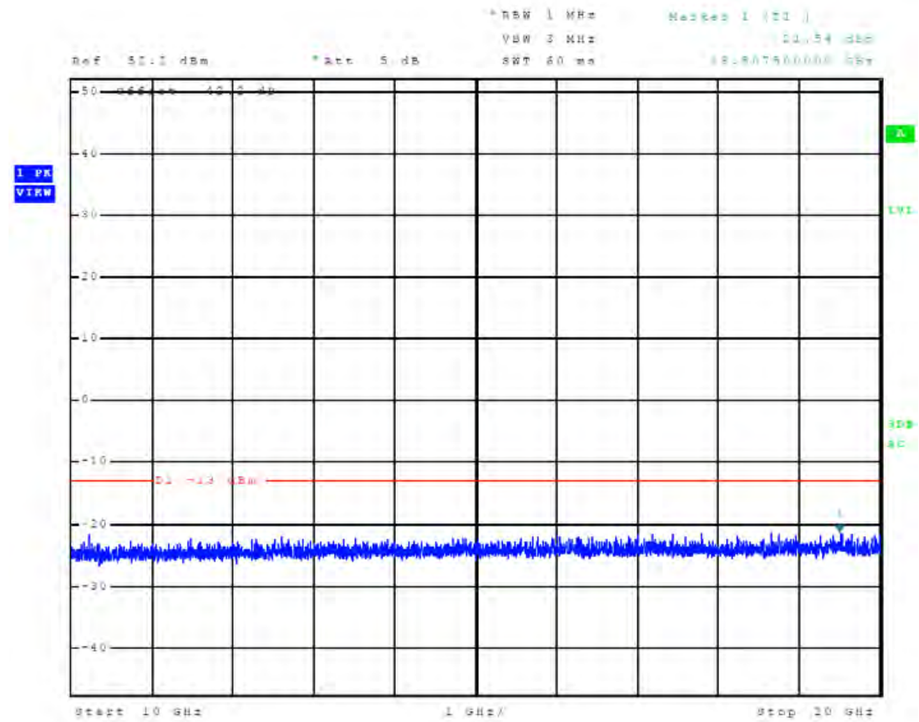


Figure 40 Plot of emissions across Frequency spectrum (Mode C8 / Ch. 1)

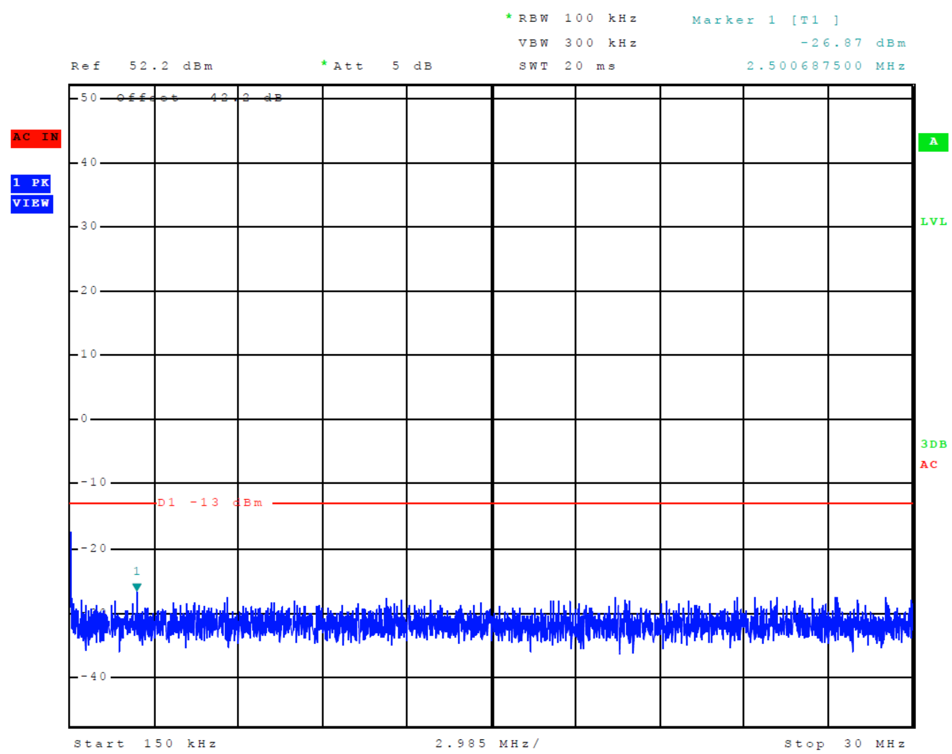


Figure 41 Plot of emissions across Frequency spectrum (Mode C8 / Ch. 121)

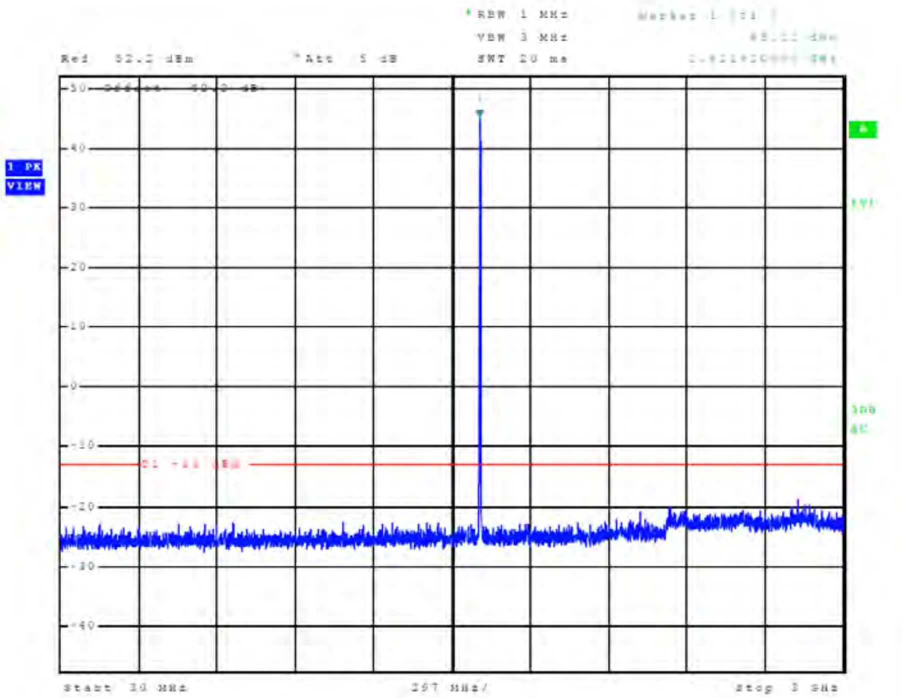


Figure 42 Plot of emissions across Frequency spectrum (Mode C8 / Ch. 121)

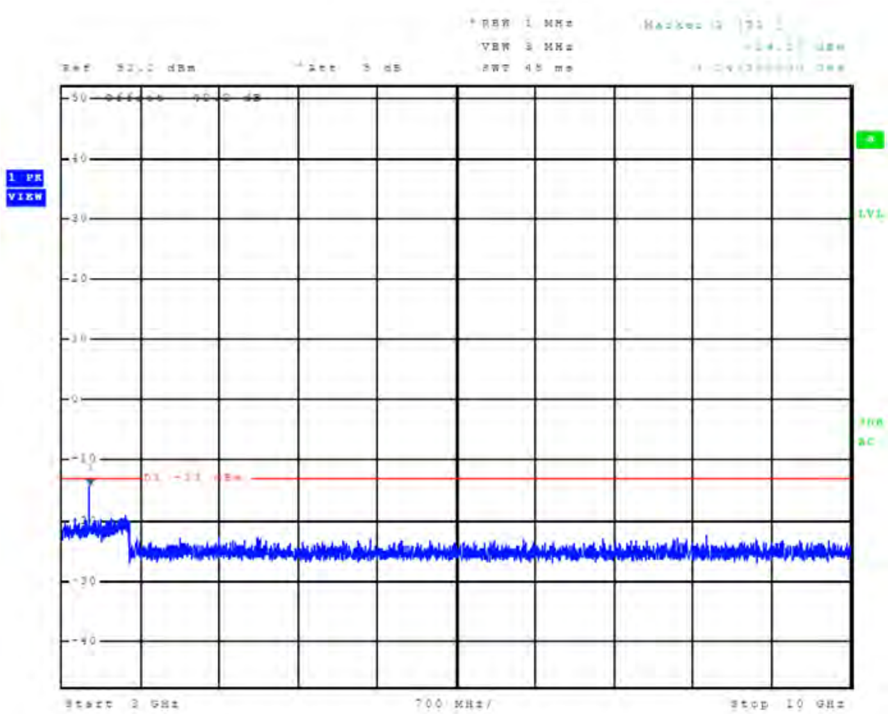


Figure 43 Plot of emissions across Frequency spectrum (Mode C8 / Ch. 121)

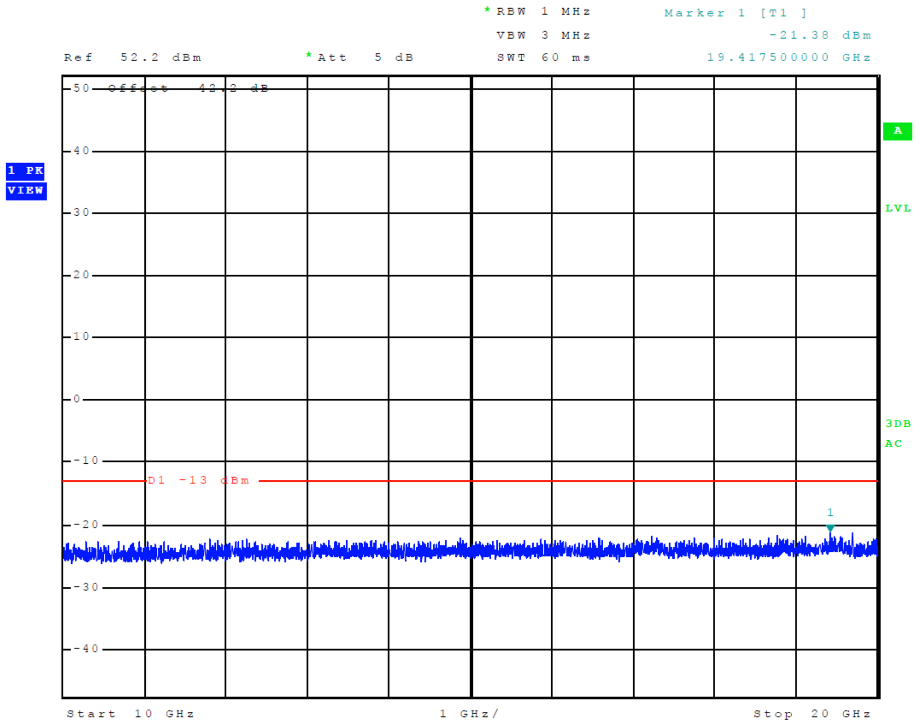


Figure 44 Plot of emissions across Frequency spectrum (Mode C8 / Ch. 121)

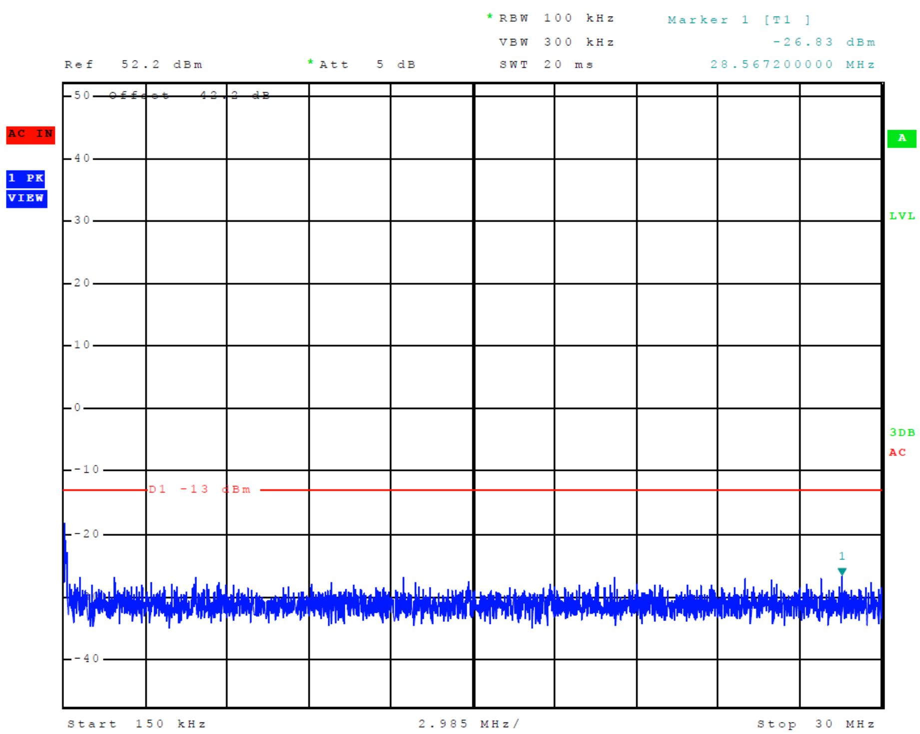


Figure 45 Plot of emissions across Frequency spectrum (Mode C8 / Ch. 240)

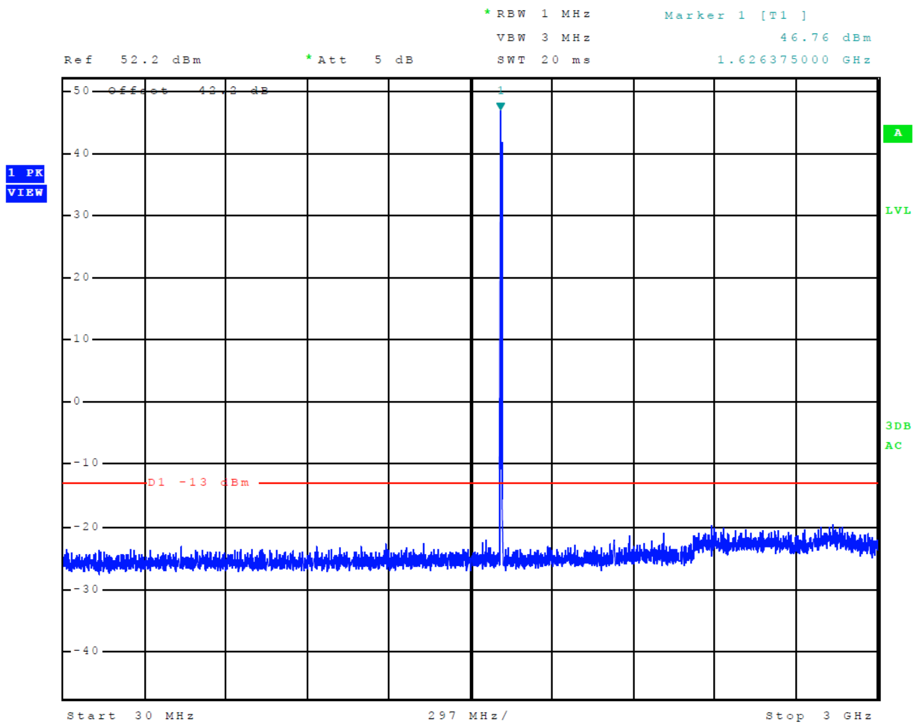


Figure 46 Plot of emissions across Frequency spectrum (Mode C8 / Ch. 240)

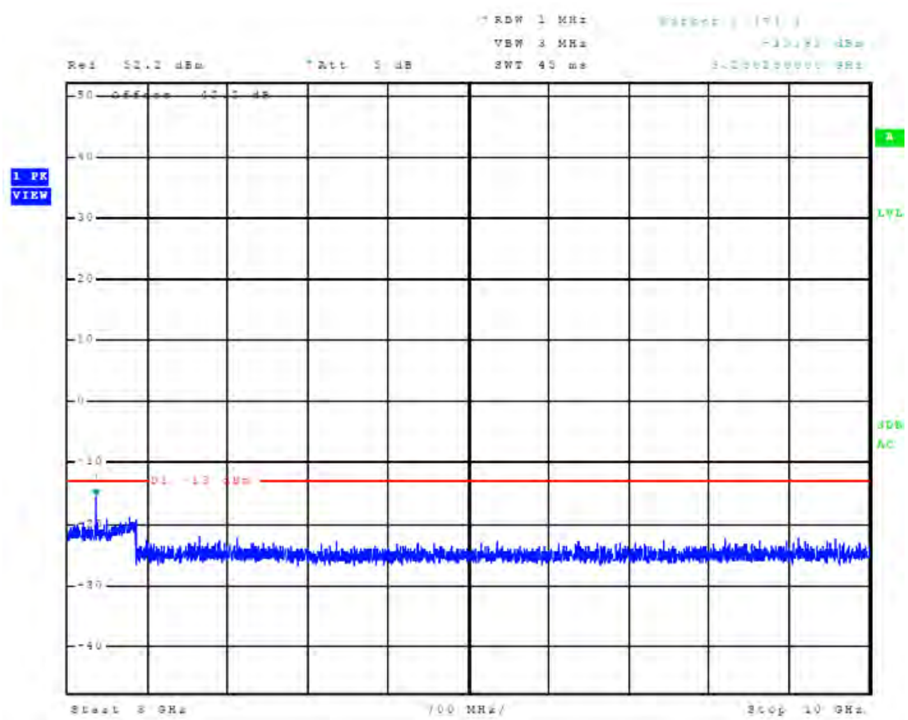


Figure 47 Plot of emissions across Frequency spectrum (Mode C8 / Ch. 240)

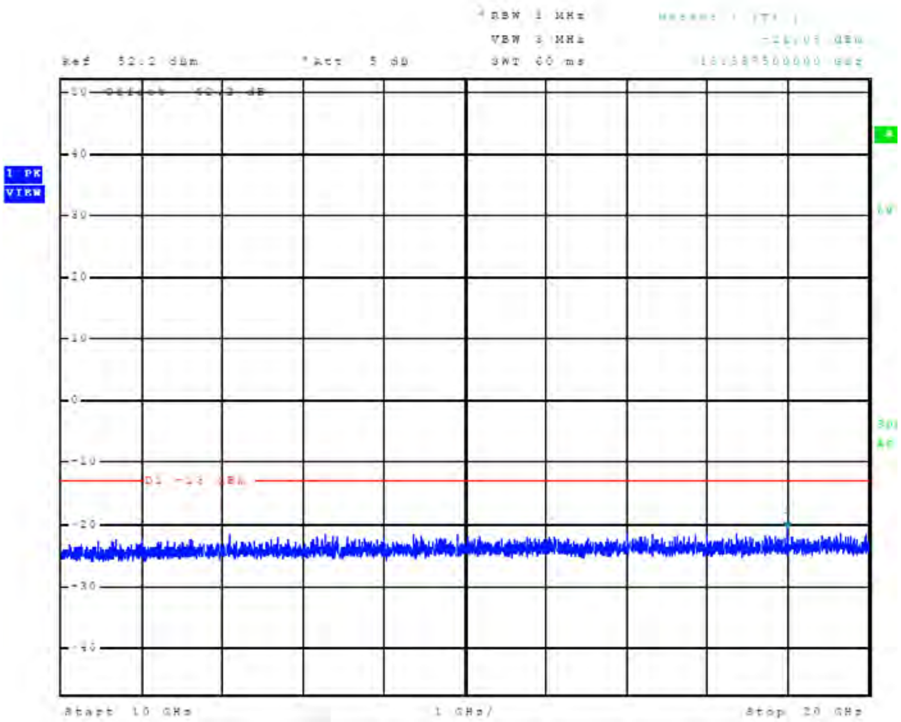


Figure 48 Plot of emissions across Frequency spectrum (Mode C8 / Ch. 240)

Transmitter Antenna Conducted Emission Data Tables

Table 2 Transmitter Antenna Conducted Emissions Data (Mode B1)

Frequency (MHz)	Harmonic Frequency (MHz)	Output Power (dBm)
1616.0	3232.0	-40.20
	4848.1	-41.40
	6464.1	-47.50
	8080.1	-46.50
	9696.1	-47.40
	11312.1	-46.70
1621.0	3242.0	-47.60
	4863.1	-40.00
	6484.1	-47.00
	8105.1	-47.50
	9726.1	-47.70
	11347.1	-47.30
1626.0	3252.0	-47.20
	4877.9	-39.50
	6503.9	-47.50
	8129.9	-47.40
	9755.9	-47.50
	11381.9	-46.60

Table 3 Transmitter Antenna Conducted Emissions Data (Mode C1)

Frequency (MHz)	Harmonic Frequency (MHz)	Output Power (dBm)
1616.0	3232.0	-47.80
	4848.1	-45.30
	6464.1	-47.50
	8080.1	-47.00
	9696.1	-47.10
	11312.1	-46.50
1621.0	3242.0	-44.10
	4863.1	-46.00
	6484.1	-47.20
	8105.1	-47.90
	9726.1	-47.60
	11347.1	-46.60
1626.0	3252.0	-48.70
	4877.9	-44.00
	6503.9	-47.40
	8129.9	-46.70
	9755.9	-47.50
	11381.9	-46.10

Table 4 Transmitter Antenna Conducted Emissions Data (Mode C2)

Frequency (MHz)	Harmonic Frequency (MHz)	Output Power (dBm)
1616.0	3232.0	-44.30
	4848.1	-46.10
	6464.1	-47.90
	8080.1	-47.40
	9696.1	-46.50
	11312.1	-45.80
1621.0	3242.0	-45.00
	4863.1	-45.30
	6484.1	-47.40
	8105.1	-47.30
	9726.1	-47.60
	11347.1	-46.30
1626.0	3252.0	-47.80
	4877.9	-45.90
	6503.9	-47.20
	8129.9	-46.80
	9755.9	-47.50
	11381.9	-46.10

Table 5 Transmitter Antenna Conducted Emissions Data (Mode C8)

Frequency (MHz)	Harmonic Frequency (MHz)	Output Power (dBm)
1616.0	3232.0	-46.20
	4848.1	-46.10
	6464.1	-47.40
	8080.1	-47.60
	9696.1	-47.10
	11312.1	-46.90
1621.0	3242.0	-43.50
	4863.1	-44.50
	6484.1	-47.70
	8105.1	-47.60
	9726.1	-46.30
	11347.1	-46.60
1626.0	3252.0	-46.70
	4877.9	-46.30
	6503.9	-47.70
	8129.9	-47.80
	9755.9	-47.50
	11381.9	-46.10

Conclusion

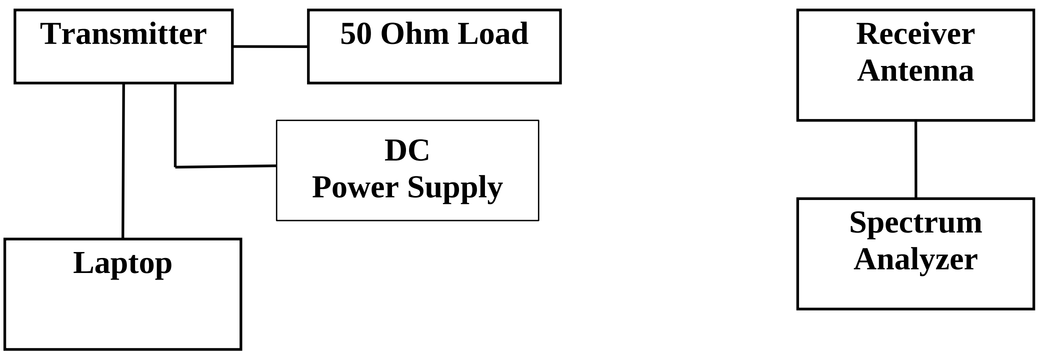
The EUT demonstrated compliance with specifications of CFR47 2.1051, 2.1057, and applicable paragraphs of Part 25.202 & 25.204. There are no deviations to the specifications. There are no deviations or exceptions to the specifications.

Field Strength of Spurious Radiation (Unwanted Emissions)

Measurements Required

Measurements shall be made to detect spurious emissions that may be radiated directly from the cabinet, control circuits, power leads, or intermediate circuit elements under normal conditions of installation and operation. This equipment is typically remote mounted with interface cabling connecting the display control unit to the cabinet. The test sample offered for testing required interfacing with additional test control panels offering operation and communications with all functions of transmitter.

Test Arrangement



The test setup was assembled in a screen room for preliminary screening. The transmitter was placed on a supporting platform 0.8 meters above the ground plane and at a distance of 1 meter from the receive antenna, plots were taken of the general radiated emissions. A final radiated emission testing was performed with the transmitter placed on a supporting turntable platform 0.8 meters above the ground plane and at a distance of 3 meters from the Field Strength Measuring (FSM) antenna. The EUT was operational and radiating into a 50Ω load. The receiving antenna was raised and lowered from 1m to 4m in height to obtain the maximum reading of spurious radiation from the EUT, cabinet, and interface cabling. The turntable was rotated though 360 degrees to locate the position registering the highest amplitude of emission. The frequency spectrum was then searched for spurious emissions generated from the transmitter, interface cabling, and test setup. The amplitude of each spurious emission was maximized by raising and lowering the FSM antenna, and rotating the turntable before final data was recorded. The frequency spectrum from 9 kHz to 35,000 MHz was investigated during radiated emissions testing. A Loop antenna was used for measurements between 9 kHz and 30 MHz. Biconilog antenna was used for frequency measurements of 30 to 1000 MHz. A double-ridge horn antenna was used for frequencies of 1000 MHz to 35,000 MHz. Emission levels were measured and recorded from the spectrum analyzer in dBμV. Data was taken at the Rogers Labs, Inc. 3 meters Semi-Anechoic Chamber (SAC). The transmitter was then removed and replaced with a substitution antenna, amplification as required, and signal generator. The signal from the generator was then adjusted such that the amplitude received was the same as that previously recorded for each frequency. This step was repeated for both horizontal and vertical polarizations. The power in dBm required to produce the desired signal level was then recorded from the signal generator. The power in dBm was then calculated by reducing the previous readings by the gain in the substitution antenna. A description of the test facility is on file with the FCC and Industry Canada (refer to annex for site registration letters).

All spurious emissions must be attenuated at least 43 +10log (Po) below the fundamental emission power level. The following equations represent the calculated attenuation levels for the equipment.

Mode B1: Limit for 17.4-Watt transmitter

Limit (dBc) = 43 + 10 Log (Po)
= 43 + 10 Log (17.4)
= 55.4 dBc (equates to absolute level of -13dBm)

Mode C1: Limit for 22.4-Watt transmitter

Limit (dBc) = 43 + 10 Log (Po)
= 43 + 10 Log (22.4)
= 56.5 dBc (equates to absolute level of -13dBm)

Mode C2: Limit for 20.9-Watt transmitter

Limit (dBc) = 43 + 10 Log (Po)
= 43 + 10 Log (20.9)
= 56.2 dBc (equates to absolute level of -13dBm)

Mode C8: Limit for 75.9-Watt transmitter

Limit (dBc) = 43 + 10 Log (Po)
= 43 + 10 Log (75.9)
= 61.8 dBc (equates to absolute level of -13dBm)

Refer to data presented in tables 6 through 9 for radiated emission details.

Test Results

Table 6 Spurious Radiated Emission (Mode B1)

Frequency	Amplitude of Emission (dBµV)		Signal Level to dipole required to Reproduce(dBm)		Emission level below carrier (dBc)		Limit (dBm)
MHz	Horizontal	Vertical	Horizontal	Vertical	Horizontal	Vertical	
3232.0	36.8	38.2	-58.43	-57.03	-100.8	-99.4	-13
4848.1	38.4	38.6	-56.83	-56.63	-99.2	-99.0	-13
6464.1	41.5	41.5	-53.73	-53.73	-96.1	-96.1	-13
8080.1	42.9	42.8	-52.33	-52.43	-94.7	-94.8	-13
9696.1	46.0	45.9	-49.23	-49.33	-91.6	-91.7	-13
11312.1	47.7	47.6	-47.53	-47.63	-89.9	-90.0	-13
3242.0	36.2	37.6	-59.03	-57.63	-101.4	-100.0	-13
4863.1	38.2	38.3	-57.03	-56.93	-99.4	-99.3	-13
6484.1	40.7	41.0	-54.53	-54.23	-96.9	-96.6	-13
8105.1	43.5	43.5	-51.73	-51.73	-94.1	-94.1	-13
9726.1	44.6	44.6	-50.63	-50.63	-93.0	-93.0	-13
11347.1	49.8	49.8	-45.43	-45.43	-87.8	-87.8	-13
3252.0	36.5	36.2	-58.73	-59.03	-101.1	-101.4	-13
4878.0	37.8	37.8	-57.43	-57.43	-99.8	-99.8	-13
6504.0	40.9	40.9	-54.33	-54.33	-96.7	-96.7	-13
8130.0	43.5	43.5	-51.73	-51.73	-94.1	-94.1	-13
9756.0	46.3	46.3	-48.93	-48.93	-91.3	-91.3	-13
11382.0	49.2	49.2	-46.03	-46.03	-88.4	-88.4	-13

Other emissions present had amplitudes at least 20 dB below the limit. Peak and Quasi-Peak amplitude emissions are recorded above for frequencies below 1000 MHz. Peak and Average amplitude emissions are recorded above for frequencies above 1000 MHz.

Table 7 Spurious Radiated Emission (Mode C1)

Frequency	Amplitude of Emission (dBµV)		Signal Level to dipole required to Reproduce(dBm)		Emission level below carrier (dBc)		Limit (dBm)
MHz	Horizontal	Vertical	Horizontal	Vertical	Horizontal	Vertical	
3232.0	36.9	37.5	-58.33	-57.73	-101.4	-100.8	-13
4848.1	38.4	38.5	-56.83	-56.73	-99.9	-99.8	-13
6464.1	41.0	41.1	-54.23	-54.13	-97.3	-97.2	-13
8080.1	42.8	42.9	-52.43	-52.33	-95.5	-95.4	-13
9696.1	45.9	45.9	-49.33	-49.33	-92.4	-92.4	-13
11312.1	47.6	47.6	-47.63	-47.63	-90.7	-90.7	-13
3242.0	36.1	36.5	-59.13	-58.73	-102.6	-102.2	-13
4863.1	38.2	38.3	-57.03	-56.93	-100.5	-100.4	-13
6484.1	40.6	40.6	-54.63	-54.63	-98.1	-98.1	-13
8105.1	43.5	43.5	-51.73	-51.73	-95.2	-95.2	-13
9726.1	44.6	44.6	-50.63	-50.63	-94.1	-94.1	-13
11347.1	49.8	49.8	-45.43	-45.43	-88.9	-88.9	-13
3252.0	36.3	36.0	-58.93	-59.23	-102.0	-102.3	-13
4878.0	37.7	37.8	-57.53	-57.43	-100.6	-100.5	-13
6504.0	41.0	41.0	-54.23	-54.23	-97.3	-97.3	-13
8130.0	43.5	43.5	-51.73	-51.73	-94.8	-94.8	-13
9756.0	46.3	46.3	-48.93	-48.93	-92.0	-92.0	-13
11382.0	49.0	49.0	-46.23	-46.23	-89.3	-89.3	-13

Other emissions present had amplitudes at least 20 dB below the limit. Peak and Quasi-Peak amplitude emissions are recorded above for frequencies below 1000 MHz. Peak and Average amplitude emissions are recorded above for frequencies above 1000 MHz.

Table 8 Spurious Radiated Emission (Mode C2)

Frequency	Amplitude of Emission (dBµV)		Signal Level to dipole required to Reproduce(dBm)		Emission level below carrier (dBc)		Limit (dBm)
MHz	Horizontal	Vertical	Horizontal	Vertical	Horizontal	Vertical	
3232.0	36.9	36.9	-58.33	-58.33	-101.5	-101.5	-13
4848.1	38.4	38.4	-56.83	-56.83	-100.0	-100.0	-13
6464.1	41.1	41.1	-54.13	-54.13	-97.3	-97.3	-13
8080.1	42.8	42.8	-52.43	-52.43	-95.6	-95.6	-13
9696.1	45.9	45.9	-49.33	-49.33	-92.5	-92.5	-13
11312.1	47.6	47.6	-47.63	-47.63	-90.8	-90.8	-13
3242.0	36.4	36.1	-58.83	-59.13	-102.0	-102.3	-13
4863.1	38.2	38.2	-57.03	-57.03	-100.2	-100.2	-13
6484.1	40.6	40.5	-54.63	-54.73	-97.8	-97.9	-13
8105.1	43.5	43.5	-51.73	-51.73	-94.9	-94.9	-13
9726.1	44.6	44.6	-50.63	-50.63	-93.8	-93.8	-13
11347.1	49.7	49.8	-45.53	-45.43	-88.7	-88.6	-13
3252.0	36.2	35.7	-59.03	-59.53	-102.2	-102.7	-13
4878.0	37.8	37.8	-57.43	-57.43	-100.6	-100.6	-13
6504.0	41.0	41.0	-54.23	-54.23	-97.4	-97.4	-13
8130.0	43.5	43.5	-51.73	-51.73	-94.9	-94.9	-13
9756.0	46.3	46.3	-48.93	-48.93	-92.1	-92.1	-13
11382.0	49.0	49.0	-46.23	-46.23	-89.4	-89.4	-13

Other emissions present had amplitudes at least 20 dB below the limit. Peak and Quasi-Peak amplitude emissions are recorded above for frequencies below 1000 MHz. Peak and Average amplitude emissions are recorded above for frequencies above 1000 MHz.

Table 9 Spurious Radiated Emission (Mode C8)

Frequency	Amplitude of Emission (dBµV)		Signal Level to dipole required to Reproduce(dBm)		Emission level below carrier (dBc)		Limit (dBm)
MHz	Horizontal	Vertical	Horizontal	Vertical	Horizontal	Vertical	
3232.0	40.7	40.1	-54.53	-55.13	-103.3	-103.9	-13
4848.1	38.4	38.6	-56.83	-56.63	-105.6	-105.4	-13
6464.1	41.5	41.5	-53.73	-53.73	-102.5	-102.5	-13
8080.1	42.9	42.8	-52.33	-52.43	-101.1	-101.2	-13
9696.1	46.0	45.9	-49.23	-49.33	-98.0	-98.1	-13
11312.1	47.7	47.6	-47.53	-47.63	-96.3	-96.4	-13
3242.0	38.6	39.3	-56.63	-55.93	-105.3	-104.6	-13
4863.1	38.3	38.3	-56.93	-56.93	-105.6	-105.6	-13
6484.1	41.0	41.0	-54.23	-54.23	-102.9	-102.9	-13
8105.1	43.5	43.5	-51.73	-51.73	-100.4	-100.4	-13
9726.1	44.7	44.7	-50.53	-50.53	-99.2	-99.2	-13
11347.1	49.8	49.8	-45.43	-45.43	-94.1	-94.1	-13
3252.0	37.7	37.5	-57.53	-57.73	-106.1	-106.3	-13
4878.0	37.8	37.9	-57.43	-57.33	-106.0	-105.9	-13
6504.0	41.0	40.9	-54.23	-54.33	-102.8	-102.9	-13
8130.0	43.5	43.6	-51.73	-51.63	-100.3	-100.2	-13
9756.0	46.4	46.4	-48.83	-48.83	-97.4	-97.4	-13
11382.0	49.2	49.2	-46.03	-46.03	-94.6	-94.6	-13

Other emissions present had amplitudes at least 20 dB below the limit. Peak and Quasi-Peak amplitude emissions are recorded above for frequencies below 1000 MHz. Peak and Average amplitude emissions are recorded above for frequencies above 1000 MHz.

Conclusion

The EUT demonstrated compliance with specifications of CFR47 Paragraph 2.1046(a) and applicable Parts of 2 and 25.202. There are no deviations to the specifications. There are no deviations or exceptions to the specifications.

Emissions Limitations, Operation in the Band 1616.0-1626.5 MHz

Measurements Required

The test was applied in accordance with the test method requirements of FCC CFR 47 Part 25.202(f), FCC CFR 47 Part 2.1051, 2.1053 and RSS-170 Issue 4.

For emissions removed less than 250% of the authorized bandwidth from the assigned frequency, measurements were performed conducted as follows:

The EUT antenna connection port was connected to a spectrum analyzer via a cable and attenuator. The EUT was transmitting at maximum power, for lowest, middle and highest channels. The EUT was modulated as stated in the manufactures application form from internal signal. The path loss between the EUT and analyzer was entered in to the spectrum analyzer as an attenuation offset. The reference level for the mask was set to the manufacturers declared maximum output power. The analyzer was configured with a RBW and VBW of 3 kHz and 100 kHz respectfully with the trace set to max hold using an RMS detector. 10Log (4/3) = 1.25 dB was added to the reference level offset to make the result relative to any 4-kHz band as per the requirement in 25.202(f). The mask as specified in clause 25.202(f) was then applied.

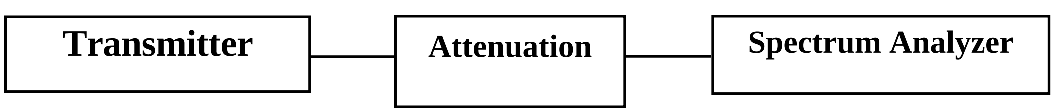
For emissions removed more than 250% of the authorized bandwidth from the assigned frequency, measurements were performed both conducted and radiated as follows:

Conducted: A network analyzer was used to measure the path loss and the worst case was entered as a reference level offset in to the spectrum analyzer. From 9 kHz to 3 GHz, the EUT was connected to a spectrum analyzer via an attenuator and cable. Between 3 GHz and 20 GHz a 3 GHz high pass filter was used. The EUT was configured to maximum power on lowest, middle or top highest channels with normal modulation (from EUT internal source). The spectrum analyzer was configured with an RBW and VBW of 1 MHz and 3 MHz respectfully with the trace set to max hold using an RMS detector.

Radiated; A preliminary profile of the Spurious Radiated Emissions was obtained up to a minimum of the 10th harmonic of the highest internally generated frequency by operating the EUT in a screen room. Measurements of emissions from the EUT were obtained with the Measurement Antenna in both Horizontal and Vertical Polarizations. The profiling produced a list of the worst-case emissions. Using the information from the preliminary profiling of the EUT, the list of emissions was then confirmed on the Semi-Anechoic Chamber (SAC). Emission levels were maximized by adjusting the receive antenna height, antenna polarization and turntable azimuth. The EUT was set to transmit on maximum power in turn on lowest, middle and highest channels.

For any emissions found the EUT was then removed from the SAC and replaced with a substitution antenna. Using a signal generator, the level was adjusted to achieve the same value on the measuring instrument as previously recorded with the EUT. The final result was determined by a calculation using the signal generator level, antenna gains and losses, and cable loss. Radiated emissions measurements were performed at a 3m distance unless otherwise stated.

Test Arrangement



Refer to figures 49 through 64 displaying plots of emissions information taken at the antenna port demonstrating compliance with requirements. Refer to data presented in tables 10 through 13 for antenna conducted emissions details.

Mode B1

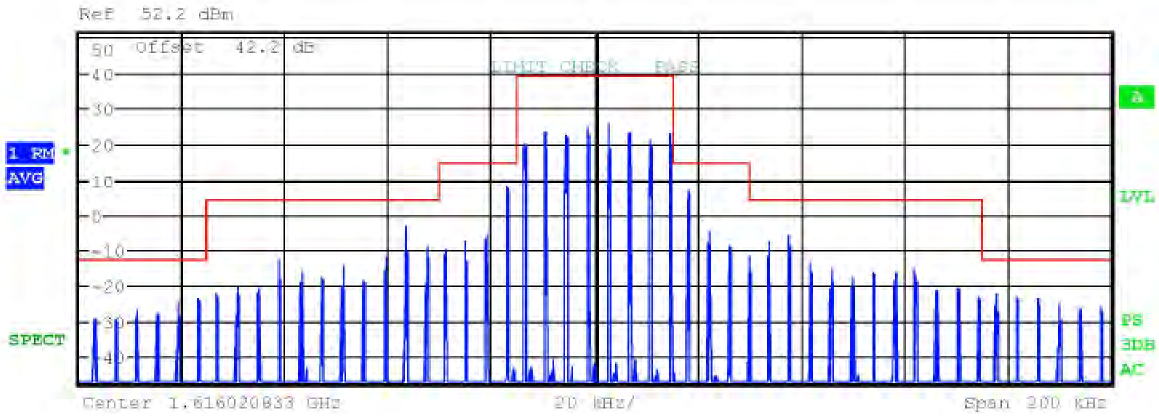


Figure 49 Plot of emissions with emission mask (Mode B1 / Ch. 1)

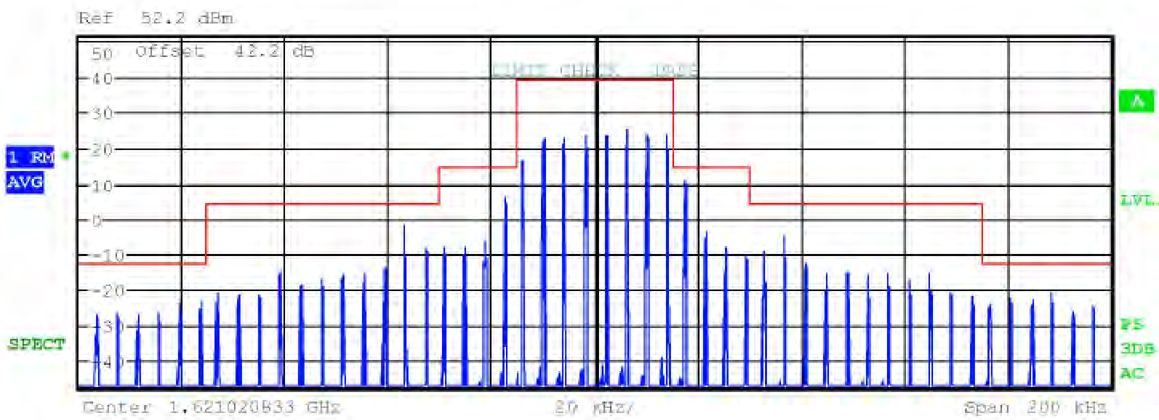


Figure 50 Plot of emissions with emission mask (Mode B1 / Ch. 101)

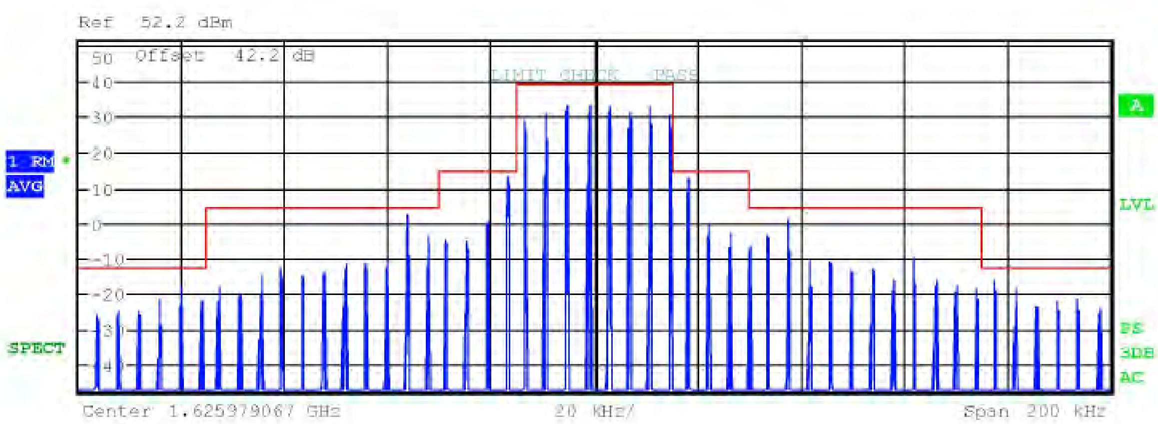


Figure 51 Plot of emissions with emission mask (Mode B1 / Ch. 240)

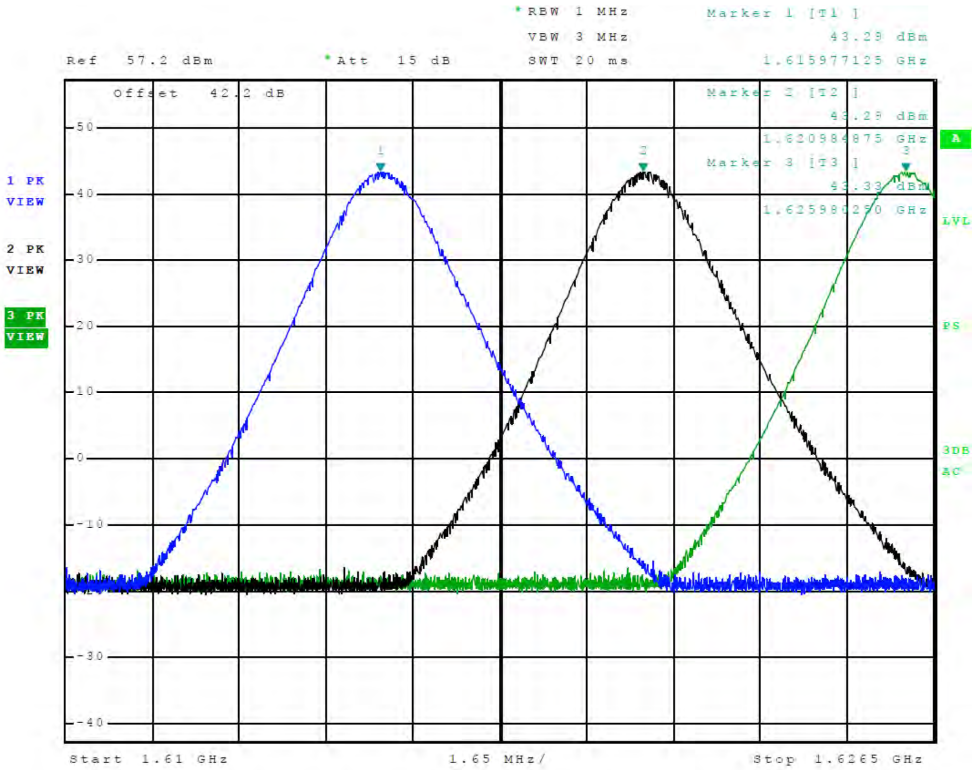


Figure 52 Plot of Operation across Frequency band (Mode B1)

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Mode C1

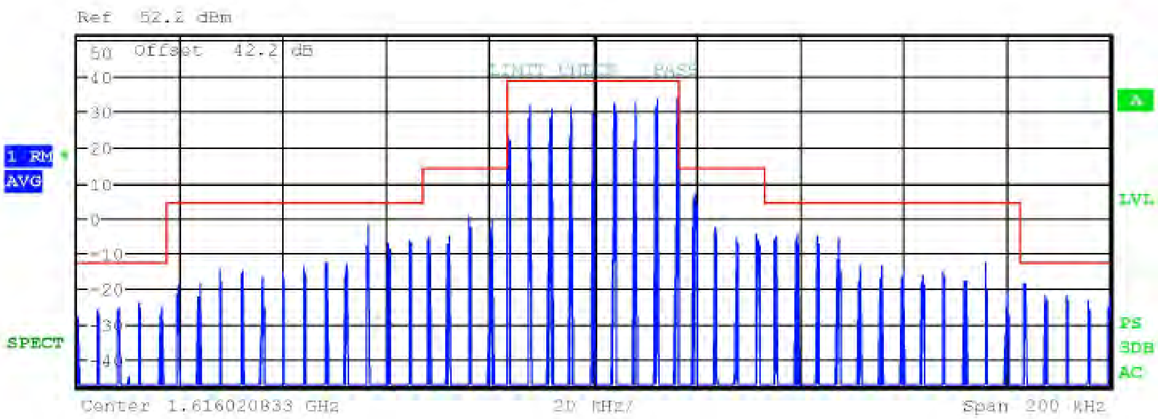

Figure 53 Plot of emissions with emission mask (Mode C1 / Ch. 1)

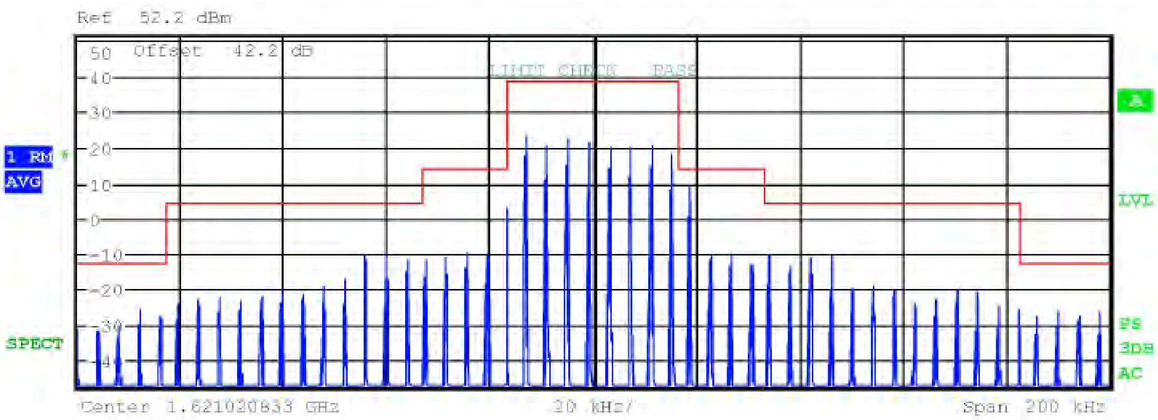

Figure 54 Plot of emissions with emission mask (Mode C1 / Ch. 121)

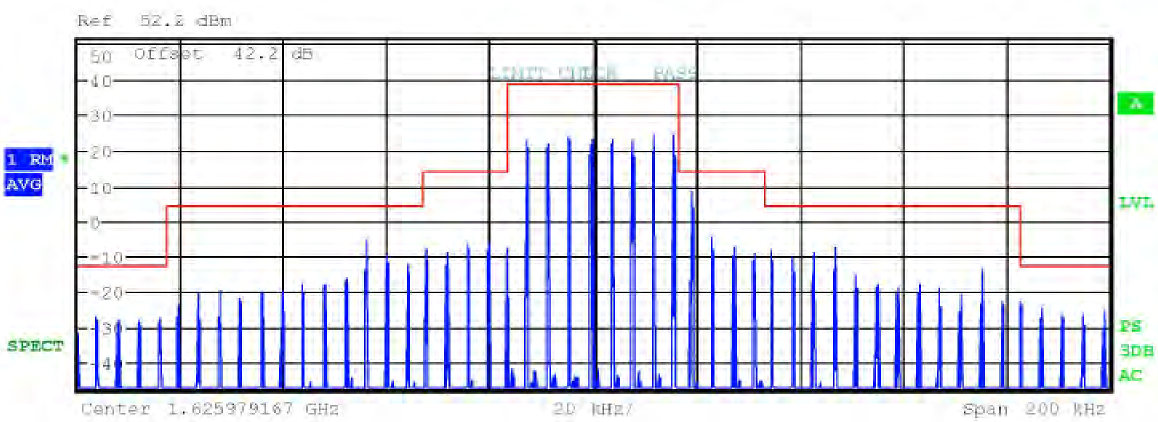

Figure 55 Plot of emissions with emission mask (Mode C1 / Ch. 240)

Testing
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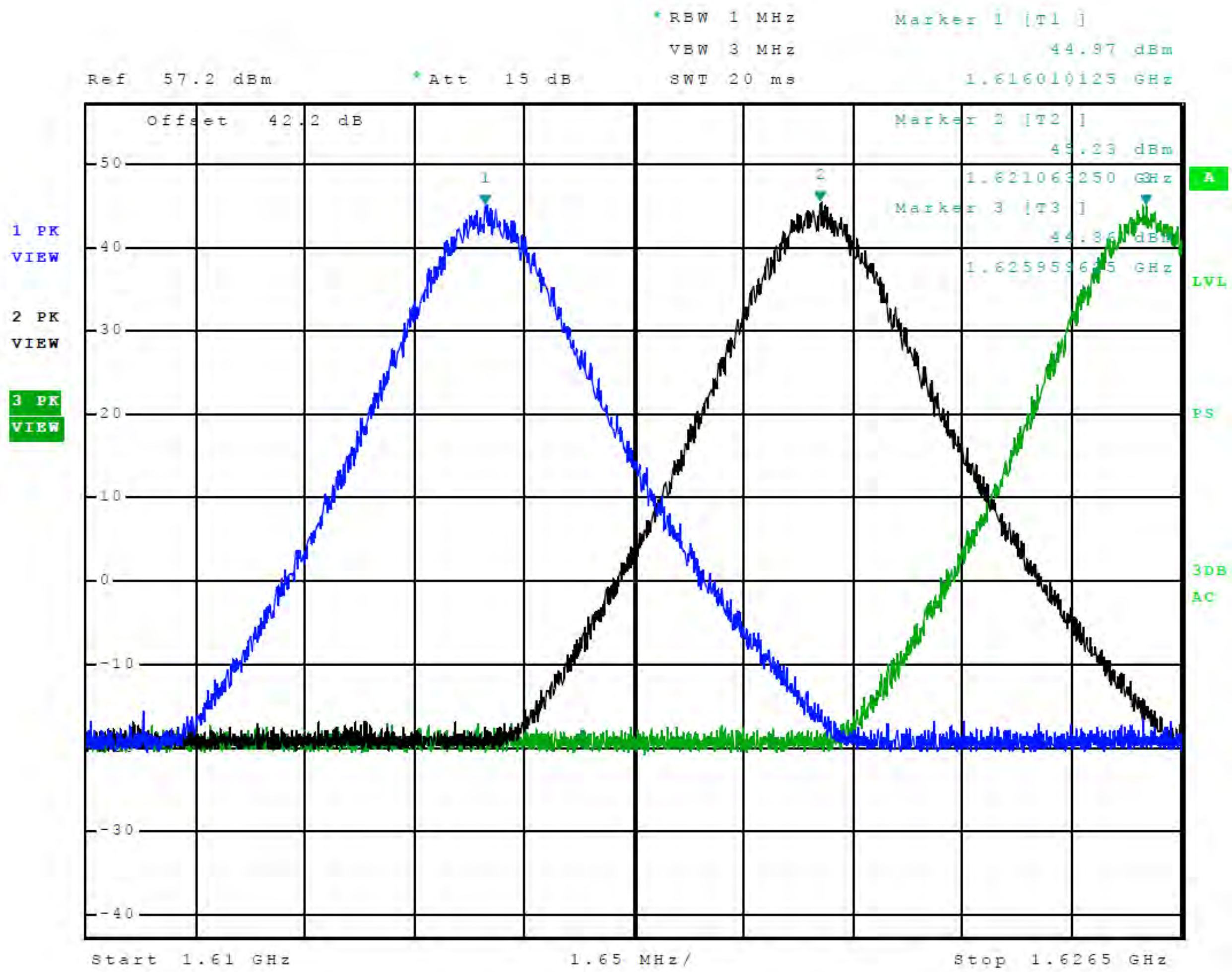


Figure 56 Plot of Operation across Frequency band (Mode C1)

Testing
NVLAP Lab Code 200087-0

Mode C2

Figure 57 Plot of emissions with emission mask (Mode C2 / Ch. 1)

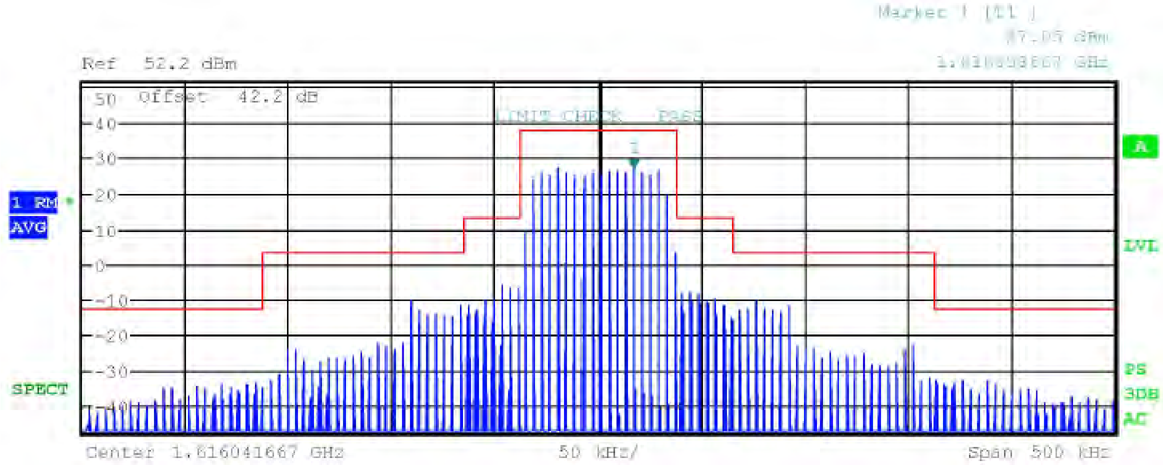


Figure 58 Plot of emissions with emission mask (Mode C2 / Ch. 121)

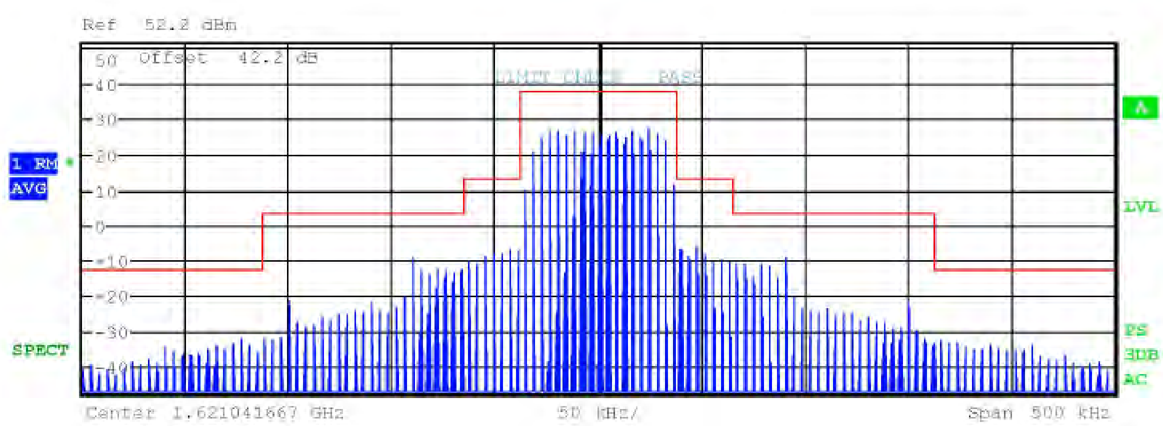
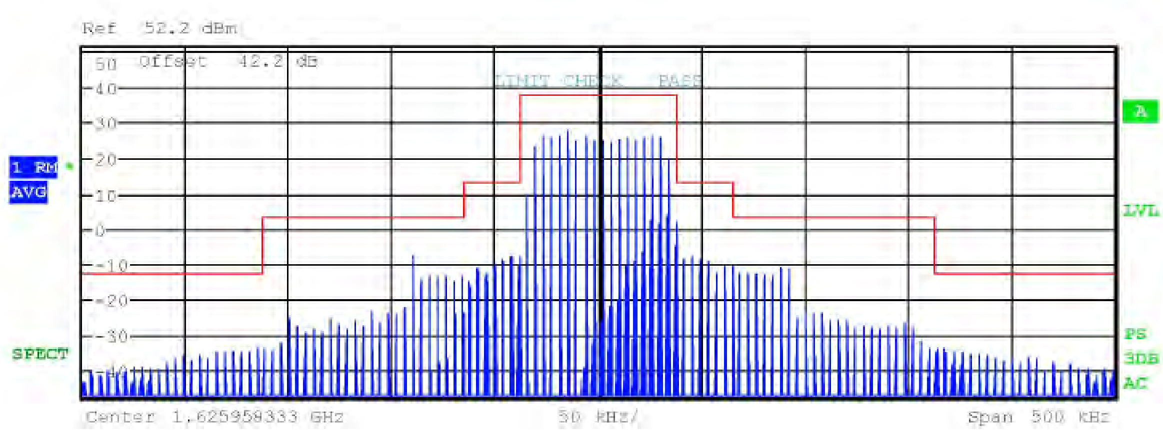


Figure 59 Plot of emissions with emission mask (Mode C2 / Ch. 240)



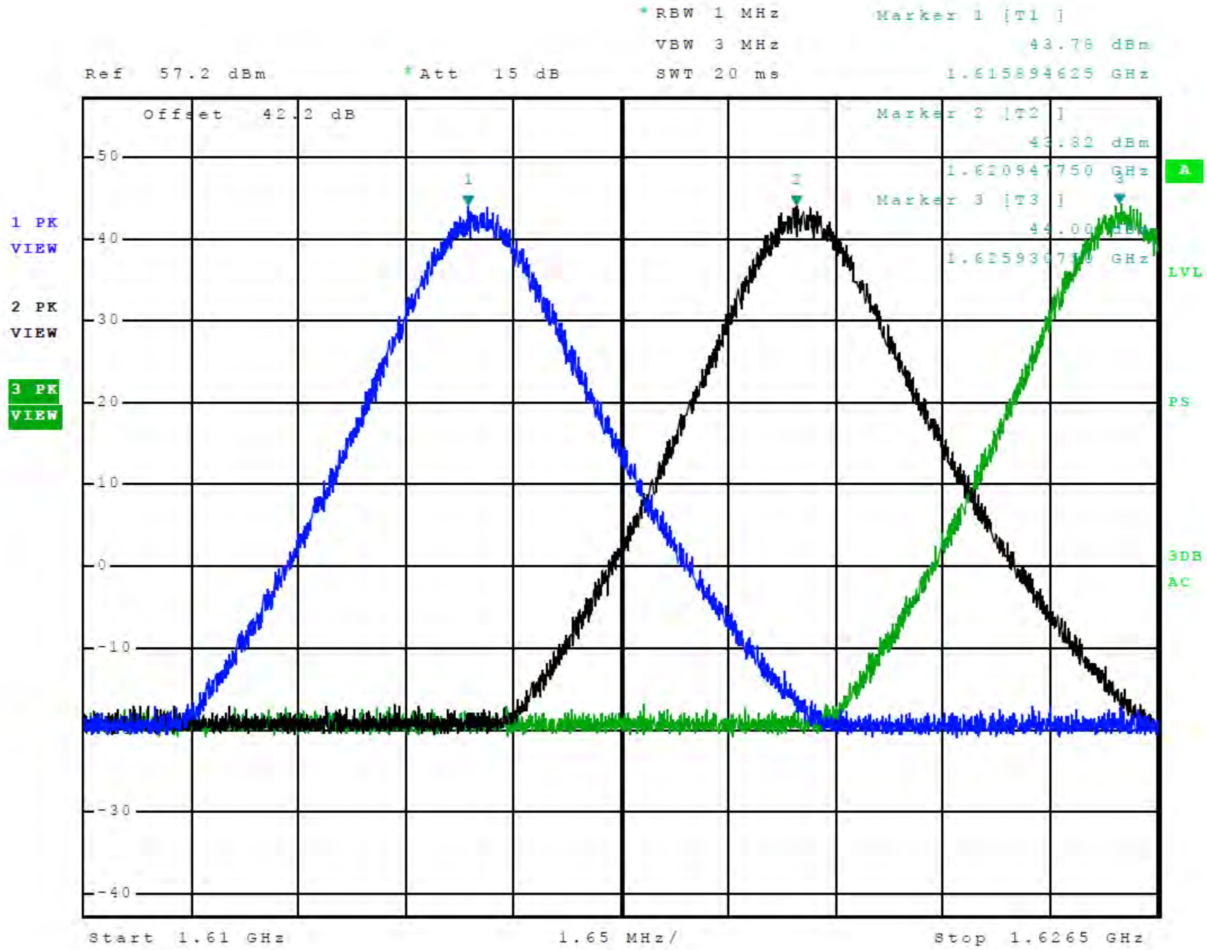


Figure 60 Plot of Operation across Frequency band (Mode C2)

Mode C8

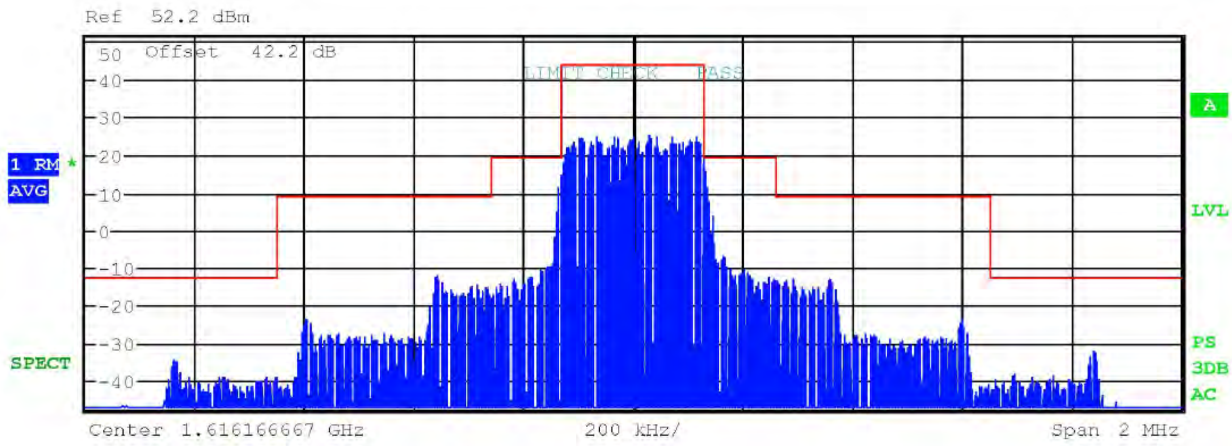


Figure 61 Plot of emissions with emission mask (Mode C8 / Ch. 1)

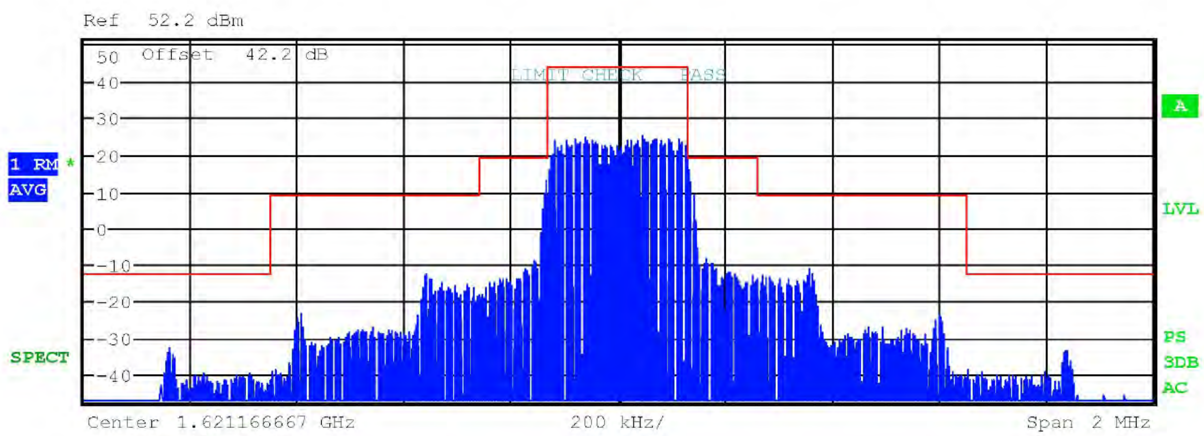


Figure 62 Plot of emissions with emission mask (Mode C8 / Ch. 121)

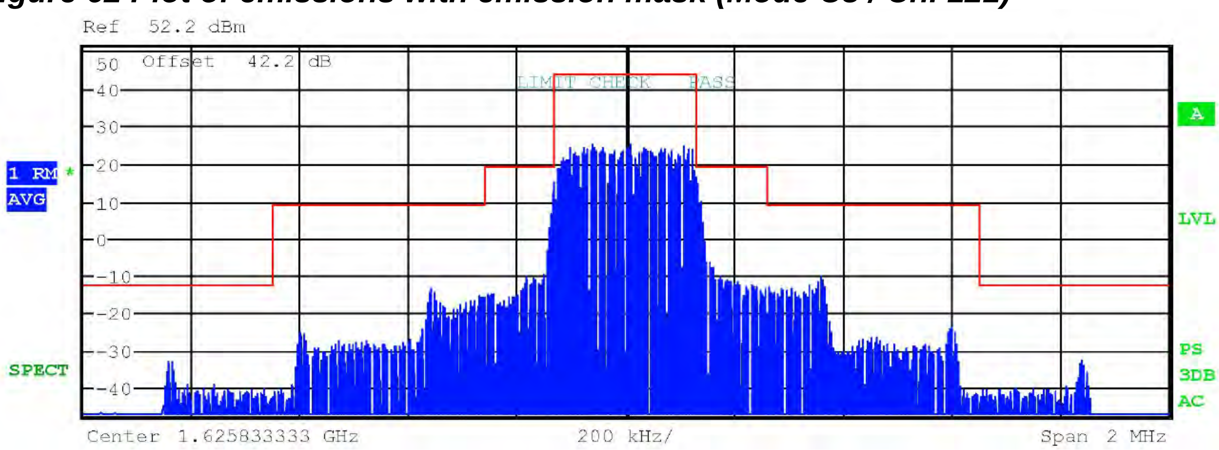


Figure 63 Plot of emissions with emission mask (Mode C8 / Ch. 240)

Testing
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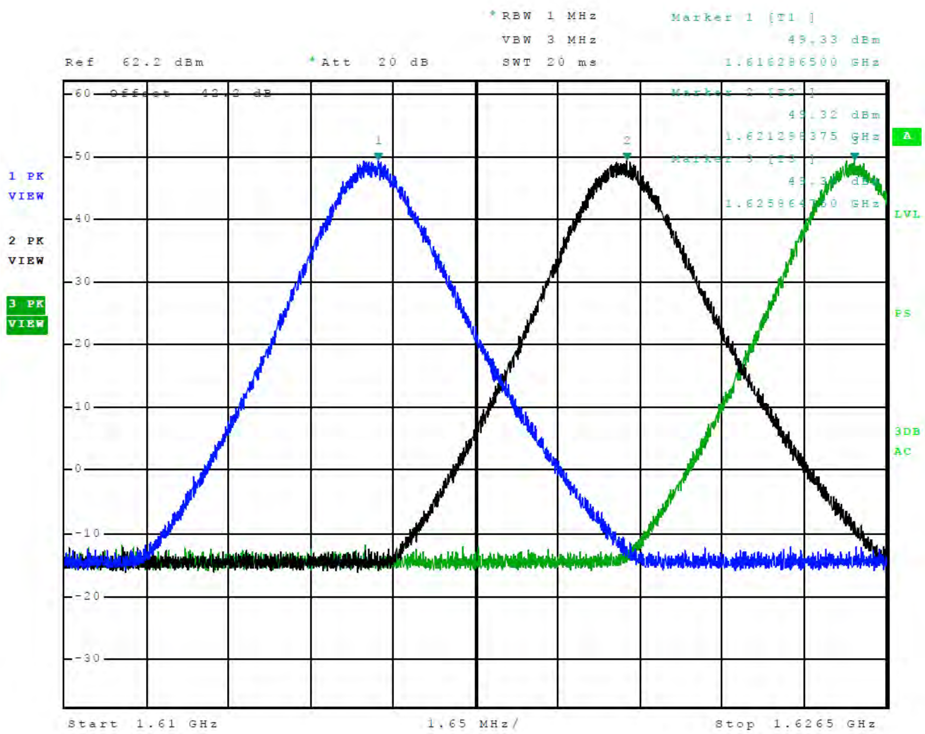


Figure 64 Plot of Operation across Frequency band (Mode C8)

Table 10 Transmitter Antenna Conducted Emissions Data (Mode B1)

Frequency (MHz)	Harmonic Frequency (MHz)	Output Power (dBm)
1616.0		42.37
	3232.0	-40.20
	4848.1	-41.40
	6464.1	-47.50
	8080.1	-46.50
	9696.1	-47.40
	11312.1	-46.70
1621.0		42.40
	3242.0	-47.60
	4863.1	-40.00
	6484.1	-47.00
	8105.1	-47.50
	9726.1	-47.70
	11347.1	-47.30
1626.0		42.39
	3252.0	-47.20
	4877.9	-39.50
	6503.9	-47.50
	8129.9	-47.40
	9755.9	-47.50
	11381.9	-46.60

Table 11 Transmitter Antenna Conducted Emissions Data (Mode C1)

Frequency (MHz)	Harmonic Frequency (MHz)	Output Power (dBm)
1616.0		43.12
	3232.0	-47.80
	4848.1	-45.30
	6464.1	-47.50
	8080.1	-47.00
	9696.1	-47.10
	11312.1	-46.50
1621.0		43.50
	3242.0	-44.10
	4863.1	-46.00
	6484.1	-47.20
	8105.1	-47.90
	9726.1	-47.60
	11347.1	-46.60
1626.0		43.10
	3252.0	-48.70
	4877.9	-44.00
	6503.9	-47.40
	8129.9	-46.70
	9755.9	-47.50
	11381.9	-46.10

Table 12 Transmitter Antenna Conducted Emissions Data (Mode C2)

Frequency (MHz)	Harmonic Frequency (MHz)	Output Power (dBm)
1616.0		43.20
	3232.0	-44.30
	4848.1	-46.10
	6464.1	-47.90
	8080.1	-47.40
	9696.1	-46.50
	11312.1	-45.80
1621.0		43.17
	3242.0	-45.00
	4863.1	-45.30
	6484.1	-47.40
	8105.1	-47.30
	9726.1	-47.60
	11347.1	-46.30
1626.0		43.18
	3252.0	-47.80
	4877.9	-45.90
	6503.9	-47.20
	8129.9	-46.80
	9755.9	-47.50
	11381.9	-46.10

Table 13 Transmitter Antenna Conducted Emissions Data (Mode C8)

Frequency (MHz)	Harmonic Frequency (MHz)	Output Power (dBm)
1616.0		48.80
	3232.0	-46.20
	4848.1	-46.10
	6464.1	-47.40
	8080.1	-47.60
	9696.1	-47.10
	11312.1	-46.90
1621.0		48.74
	3242.0	-43.50
	4863.1	-44.50
	6484.1	-47.70
	8105.1	-47.60
	9726.1	-46.30
	11347.1	-46.60
1626.0		48.56
	3252.0	-46.70
	4877.9	-46.30
	6503.9	-47.70
	8129.9	-47.80
	9755.9	-47.50
	11381.9	-46.10

Summary of Results for Emissions of Intentional Radiator

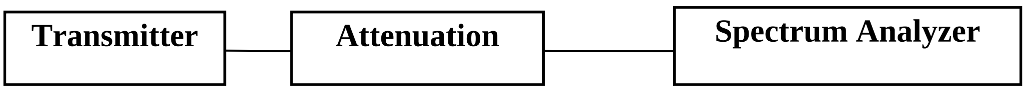
The EUT demonstrated antenna port conducted peak output power of 48.8 dBm, 75,858.8 milliwatts (75.9 Watts). The EUT demonstrated a minimum out of band radiated emission margin of at least 20 dB below requirements. The EUT tested was observed in compliance with the emissions requirements of 47CFR Part 25 and Industry Canada RSS-170 Issue 4.

Occupied Bandwidth

Measurements Required

The occupied bandwidth, that is the frequency bandwidth such that below its lower and above its upper frequency limits, the mean powers radiated are equal to 0.5 percent of the total mean power radiated by a given emission or the 26-dB down bandwidth.

Test Arrangement



A Rohde & Schwarz ESU 40 spectrum analyzer was used to observe the radio frequency spectrum with the transmitter operating in normal modes. The power ratio in dB representing 99% of the total mean power was recorded from the spectrum analyzer measurements. Refer to figures 65 through 72 displaying plots of 99% and -26dB occupied bandwidth measurements.

Table 14 Occupied Bandwidth Results (All Modes / Channels)

Modes	Channel #	Frequency	99 % Occupied Bandwidth (kHz)	-26dB Occupied Bandwidth (kHz)
B1	1	1616.0	30.0	35.2
B1	121	1621.0	30.0	35.0
B1	240	1626.0	29.5	35.3
C1	1	1616.0	32.4	36.4
C1	121	1621.0	32.8	36.5
C1	240	1626.0	32.6	36.6
C2	1	1616.0	64.4	72.7
C2	121	1621.0	64.2	73.4
C2	240	1626.0	64.4	73.4
C8	1	1616.0	258.3	291.3
C8	121	1621.0	258.8	291.5
C8	240	1626.0	260.0	290.8

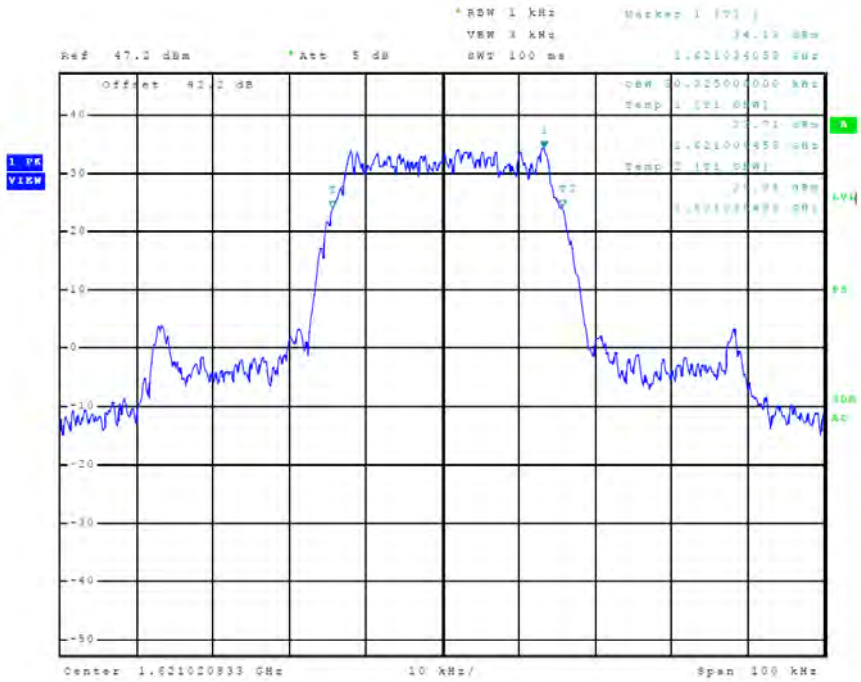


Figure 65 Plot of 99% OBW (Mode B1 / Channel 121)

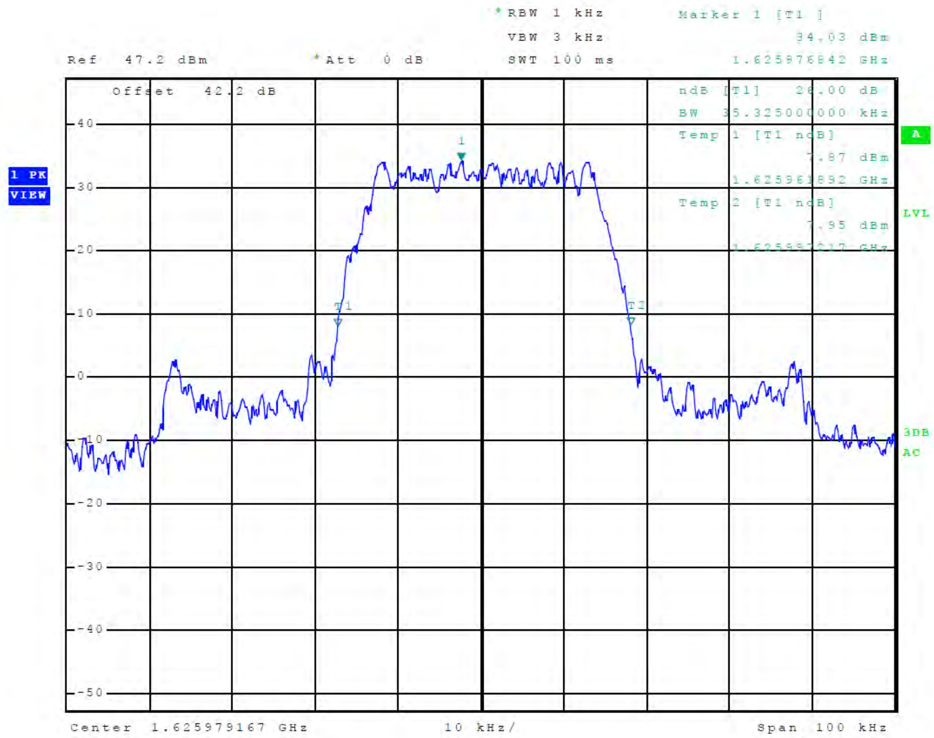


Figure 66 Plot of -26dB OBW (Mode B1 / Channel 240)

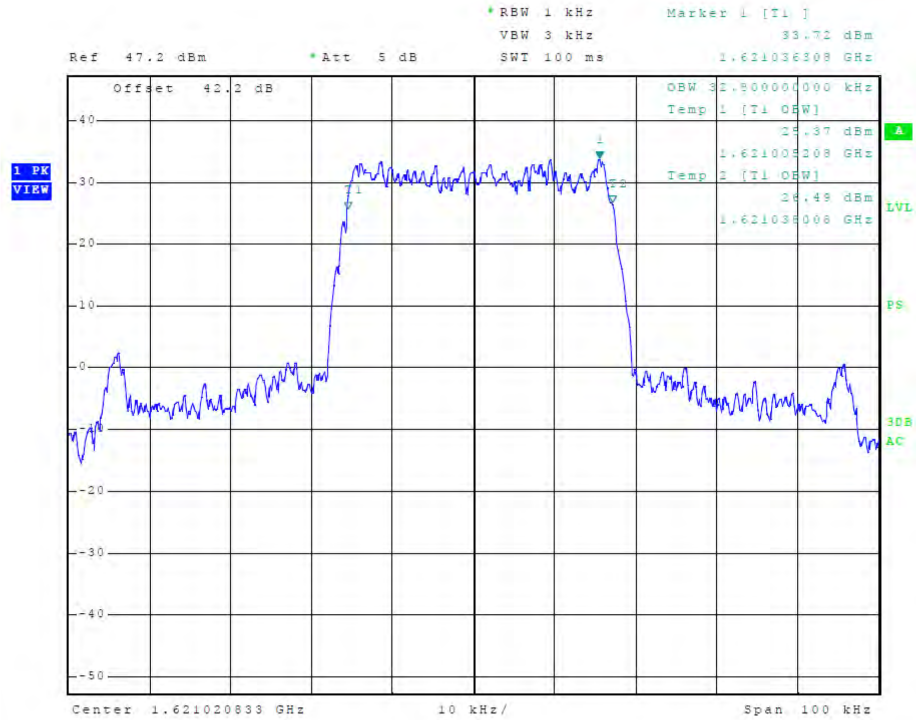


Figure 67 Plot of 99% OBW (Mode C1 / Channel 121)

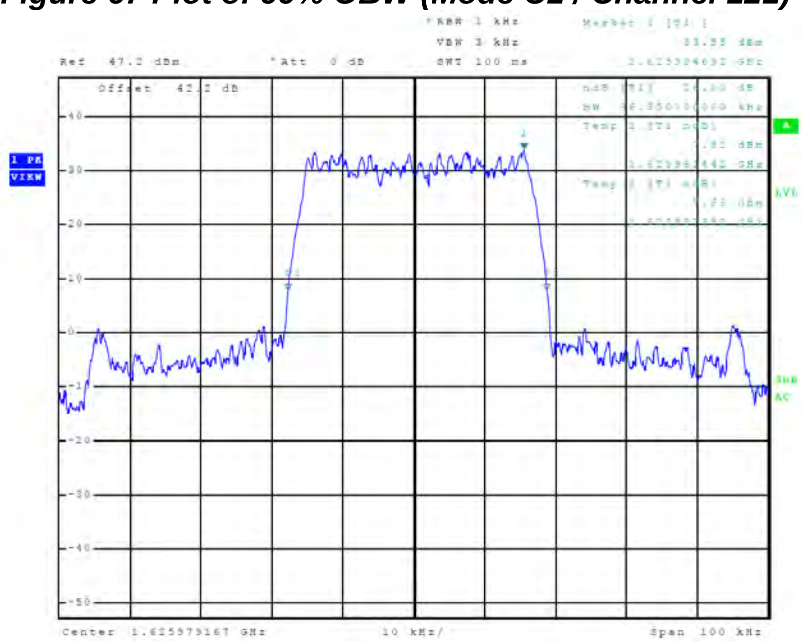


Figure 68 Plot of -26dB OBW (Mode C1 / Channel 240)

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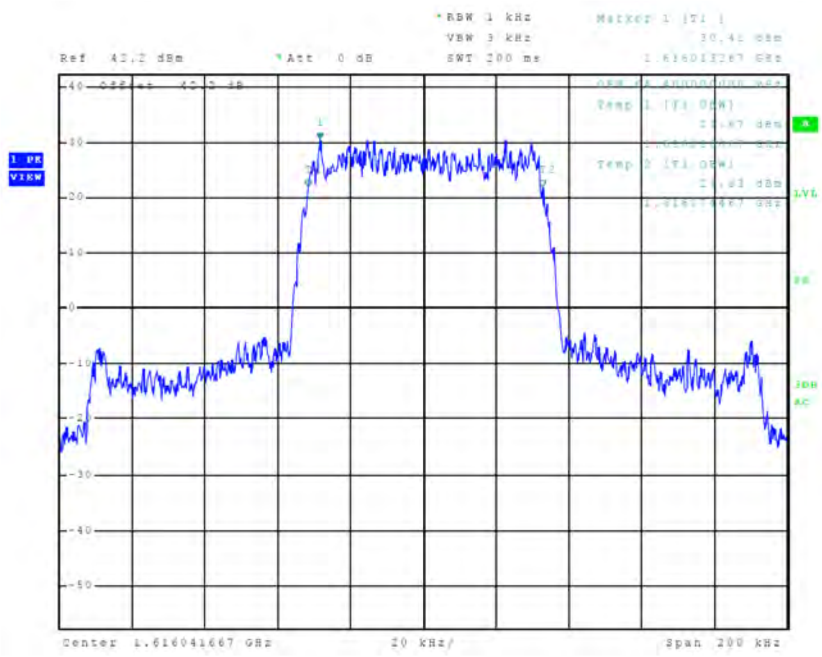


Figure 69 Plot of 99% OBW (Mode C2 / Channel 1)

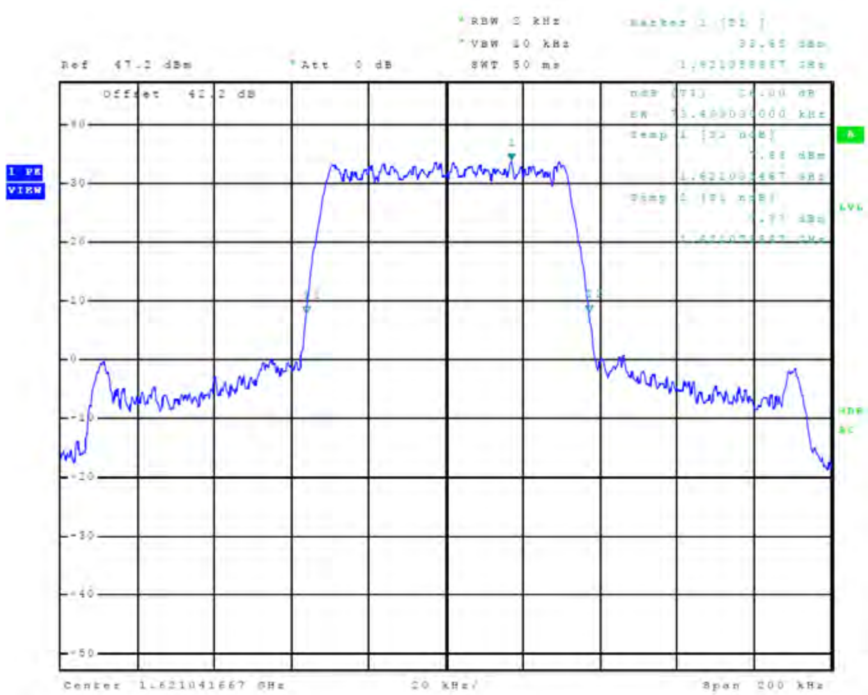


Figure 70 Plot of -26dB OBW (Mode C2 / Channel 121)

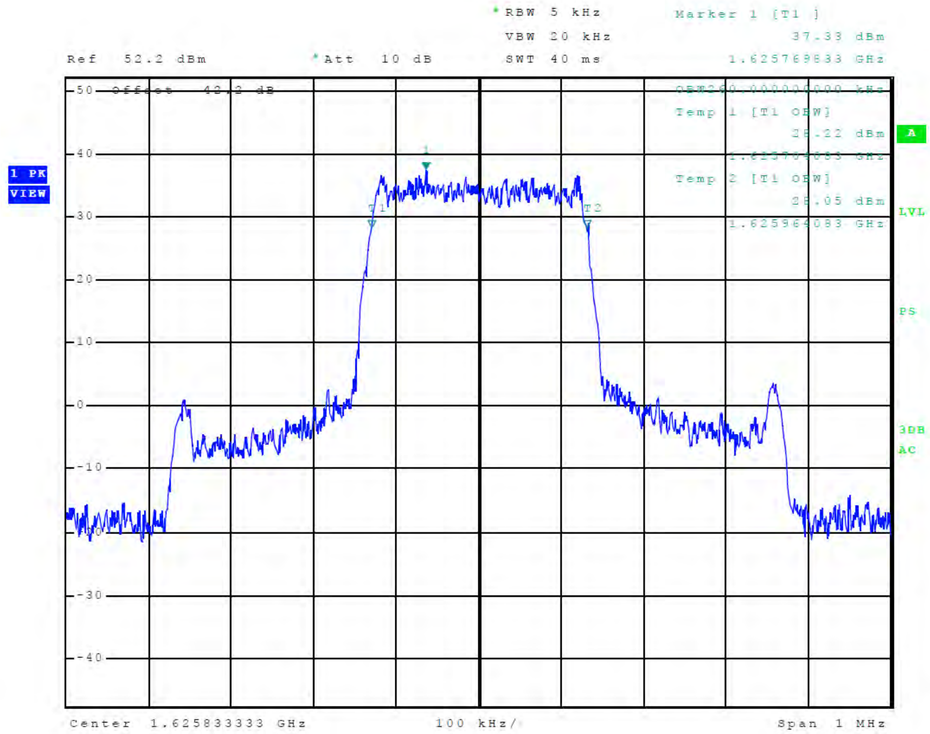


Figure 71 Plot of 99% OBW (Mode C8 / Channel 240)

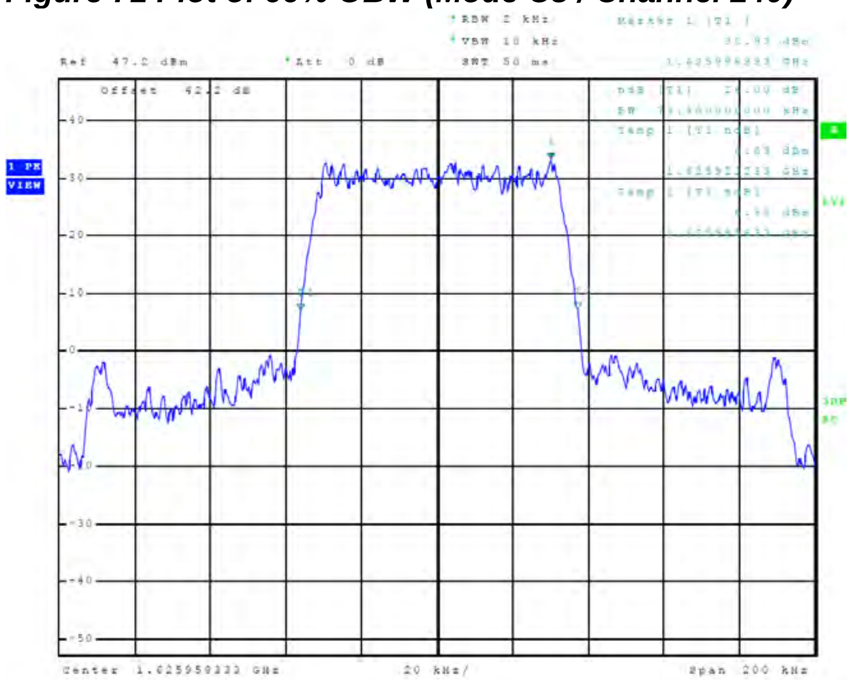


Figure 72 Plot of -26dB OBW (Mode C8 / Channel 240)

Conclusion

The EUT demonstrated compliance with specifications of CFR47 Paragraph 2.1046(a) and applicable Parts of 2 and 25.202. There are no deviations to the specifications.

Frequency Stability

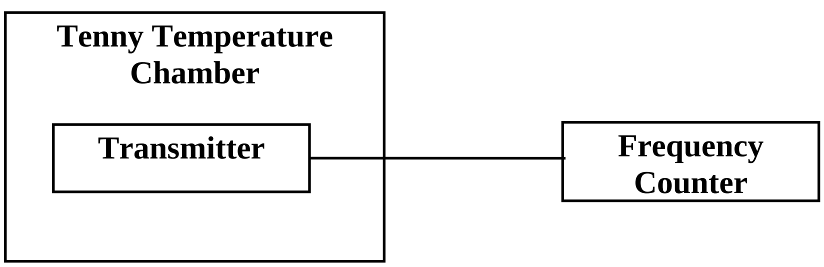
Measurements Required

The frequency stability shall be measured with variations of ambient temperature from -30° to +50° centigrade. Measurements shall be made at the extremes of the temperature range and at intervals of not more than 10° centigrade through the range. A period sufficient to stabilize all of the components of the oscillator circuit at each temperature level shall be allowed prior to frequency measurement. In addition to temperature stability, the frequency stability shall be measured with variation of primary supply voltage as follows:

(1) Vary primary supply voltage from 85 to 115 percent of the nominal value.

(2) The supply voltage shall be measured at the input to the cable normally provided with the equipment, or at the power supply terminals if cables are not normally provided.

Test Arrangement



The measurement procedure outlined below were followed.

Step 1: The transmitter shall be installed in an environmental test chamber whose temperature is controllable. Provision shall be made to measure the frequency of the transmitter.
Step 2: With the transmitter inoperative (power switched “OFF”), the temperature of the test chamber shall be adjusted to +25°C. After a temperature stabilization period of one hour at +25°C, the transmitter shall be switched “ON” with standard test voltage applied.
Step 3: The carrier shall be keyed “ON”, and the transmitter shall be operated at full radio frequency power output at the duty cycle, for which it is rated, for duration of at least 5 minutes. The radio frequency carrier frequency shall be monitored and measurements shall be recorded.
Step 4: The test procedures outlined in Steps 2 and 3, shall be repeated after stabilizing the transmitter at the environmental temperatures specified, -30°C to +50°C in 10-degree increments.

The frequency stability was measured with variations in the power supply voltage from 85 to 115 percent of the nominal value. The frequency was measured and the variation in parts per million calculated. Data was taken per CFR47 Paragraphs 2.1055 and applicable paragraphs of Part 25.202. Limit per 25.202(d) for Earth stations: 0.001% of the reference frequency (same as 10 PPM).

Table 15 Frequency Stability vs. Temperature Results

Chnl Frequency 1616.225 MHz	Frequency Stability Vs. Temperature Ambient Frequency (1616.224614 MHz)								
Temperature °C	-30	-20	-10	0	+10	+20	+30	+40	+50
Change (Hz)	-483	-246	-121	58	63	0	-67	104	271
PPM	0.299	0.152	0.075	0.036	0.039	0.000	0.041	0.064	0.168
%	0.000030	0.000015	0.000007	0.000004	0.000004	0.000000	0.000004	0.000006	0.000017
Limit (PPM)	10	10	10	10	10	10	10	10	10
Limit (%)	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001

Table 16 Frequency Stability vs. Input Power Supply Voltage Results

Frequency (1616.225 MHz)	Frequency Stability Vs. Voltage Variation 28.0 volts nominal; Results in Hz change		
Voltage V_{dc}	23.8	28.0	32.2
Change (Hz)	-4697	0	903
PPM	2.906	0.000	0.559
%	0.000291	0.000000	0.000056
Limit (PPM)	10	10	10
Limit (%)	0.001	0.001	0.001

Conclusion

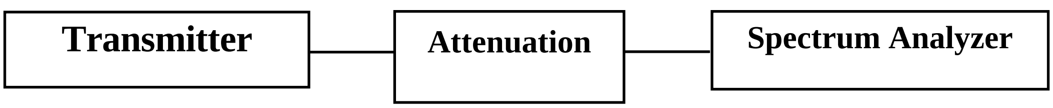
The EUT demonstrated compliance with specifications of CFR47 Paragraph 2.1046(a) and applicable Parts of 25.202. There are no deviations or exceptions to the specifications.

E. I. R. P Density of Unwanted Emissions

Measurements Required

Measurements shall be made to establish the E.I.R.P Density of unwanted emissions in accordance with 47CFR 25.216 and RSS-170 Issue 4 paragraph 5.4.3. Measurements were made to confirm the power density of emissions in the 1605-1610 MHz band-segment, to an extent as determined by linear interpolation from −70 dBW/MHz at 1605 MHz to −10 dBW/MHz at 1610 MHz, averaged over any 2-millisecond active transmission interval demonstrated compliance. The e.i.r.p of discrete emissions of less than 700 Hz bandwidth from such stations shall not exceed a level determined by linear interpolation from −80 dBW at 1605 MHz to −20 dBW at 1610 MHz, averaged over any 2-millisecond active transmission interval.

Test Arrangement



The radio frequency power output was measured at the antenna terminal by placing 12.5 dB attenuation in the antenna line and observing the emission with the spectrum analyzer. The EUT was set to transmit at maximum power using modulation as described by the manufacturer directions. The EUT was connected to a spectrum analyzer via a cable and attenuator and tuned to the assigned frequency. The gated trigger of the analyzer was used so that average measurements were taken over a 2 ms period of the active burst. The spectrum analyzer was adjusted to show the frequency range of interest on screen with an RBW & VBW of 1 MHz and 3 MHz respectfully. Any spur within 20 dB of -70 dBW/MHz (-40 dBm/MHz) was investigated further to determine the bandwidth of the emission. Each spur was individually investigated and the RBW of the analyzer was reduced to allow an approximation of the emission bandwidth of the spur. It was confirmed that all discrete emissions demonstrated a power density less than -80 dBW/MHz. The limit was reduced by 3 dB to take in to consideration the maximum antenna gain allowed as declared by the manufacturer. Plots were made of antenna port conducted emissions in demonstration of compliance. Refer to figures 73 through 97 displaying compliance with E.I.R.P. requirements.

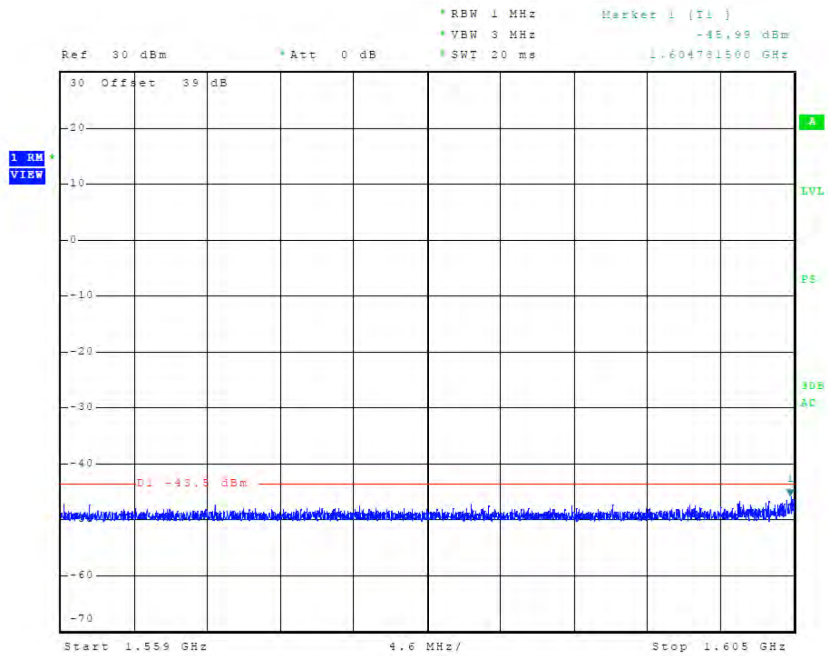


Figure 73 Plot of E.I.R.P. density of unwanted emissions (Mode B1 / Ch. 1)

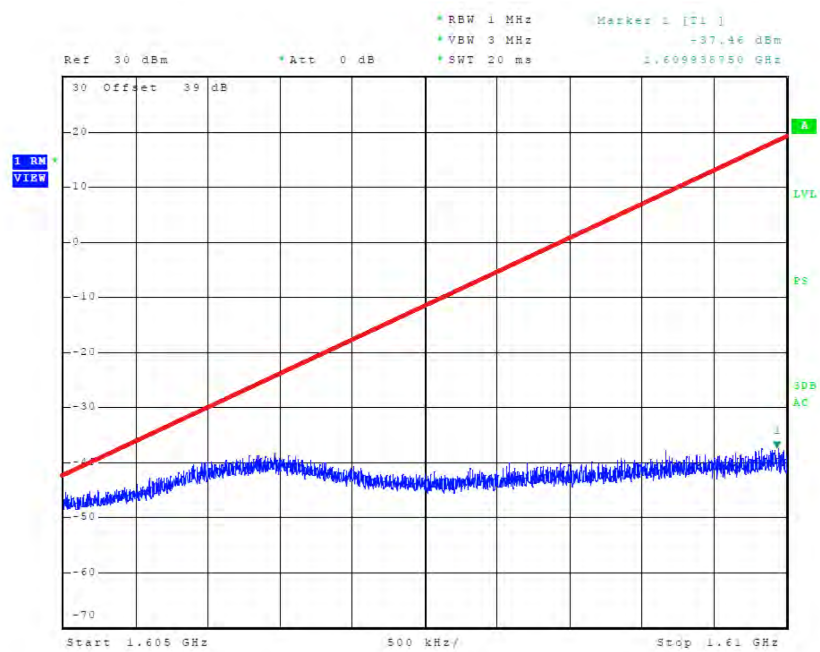


Figure 74 Plot of E.I.R.P. density of unwanted emissions (Mode B1 / Ch. 1)

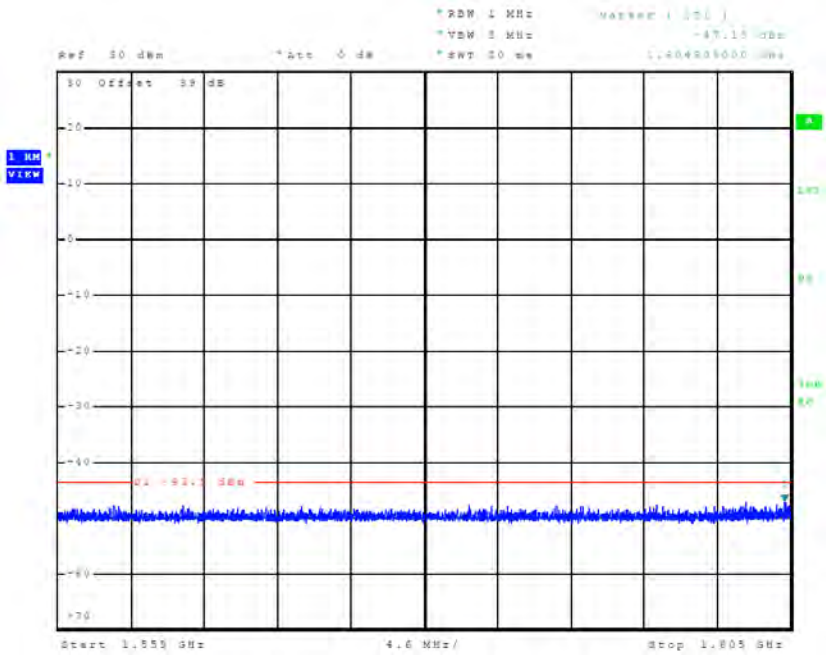


Figure 75 Plot of E.I.R.P. density of unwanted emissions (Mode B1 / Ch. 121)

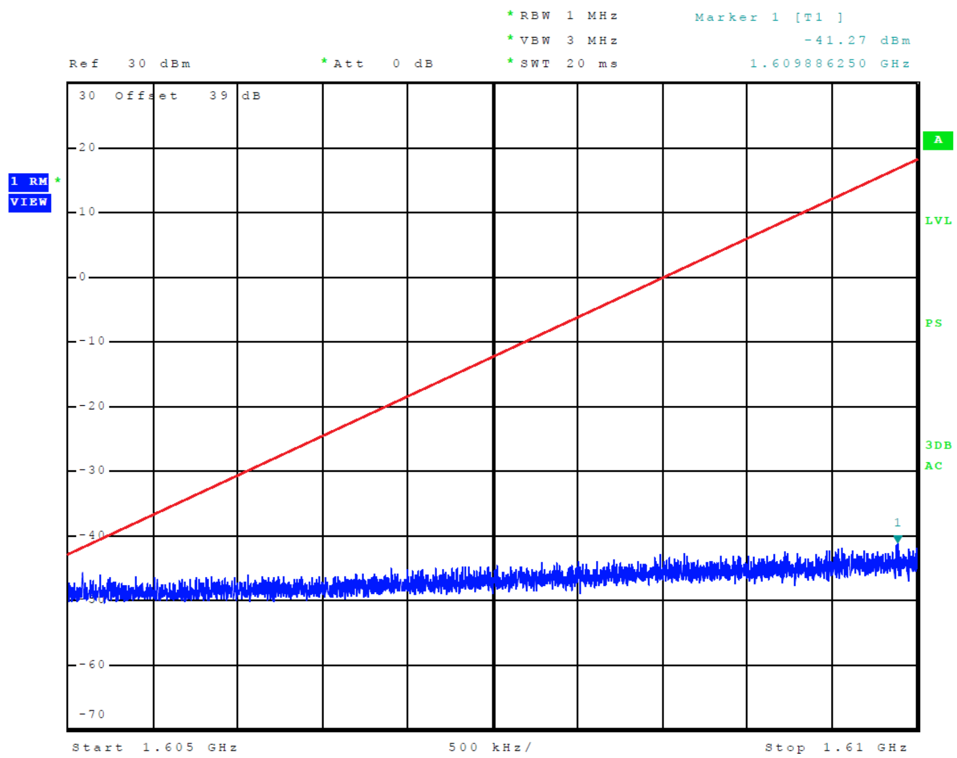


Figure 76 Plot of E.I.R.P. density of unwanted emissions (Mode B1 / Ch. 121)

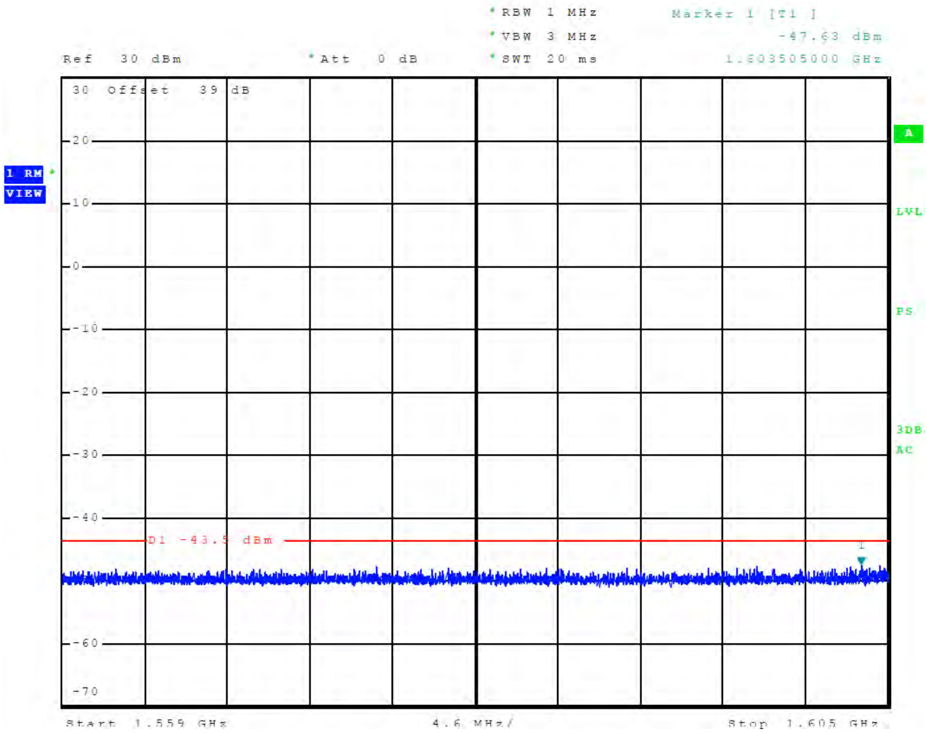


Figure 77 Plot of E.I.R.P. density of unwanted emissions (Mode B1 / Ch. 240)

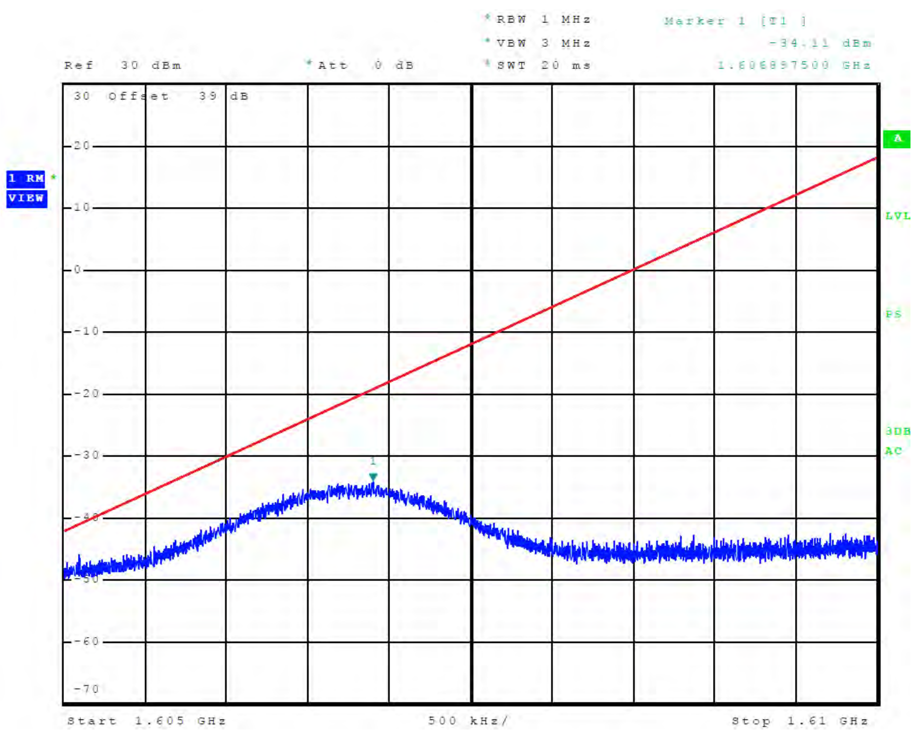


Figure 78 Plot of E.I.R.P. density of unwanted emissions (Mode B1 / Ch. 240)

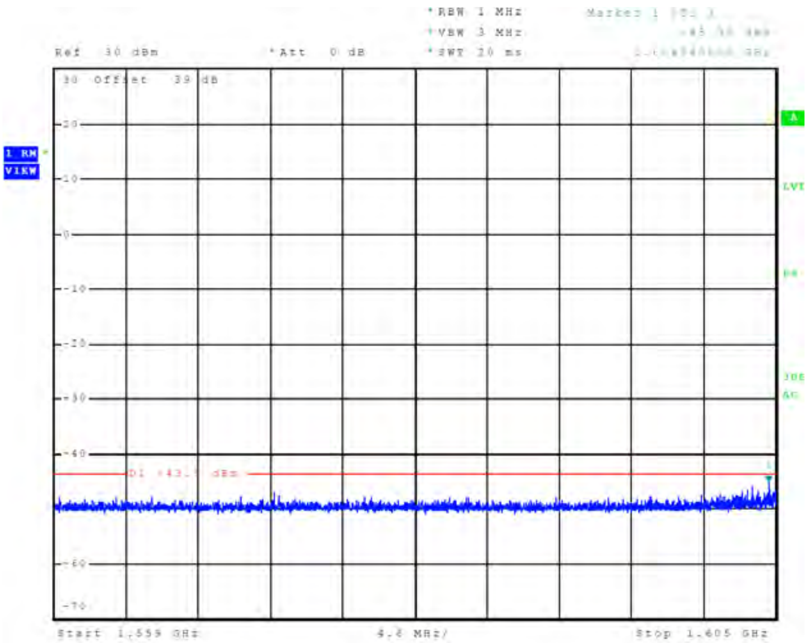


Figure 79 Plot of E.I.R.P. density of unwanted emissions (Mode C1 / Ch. 1)

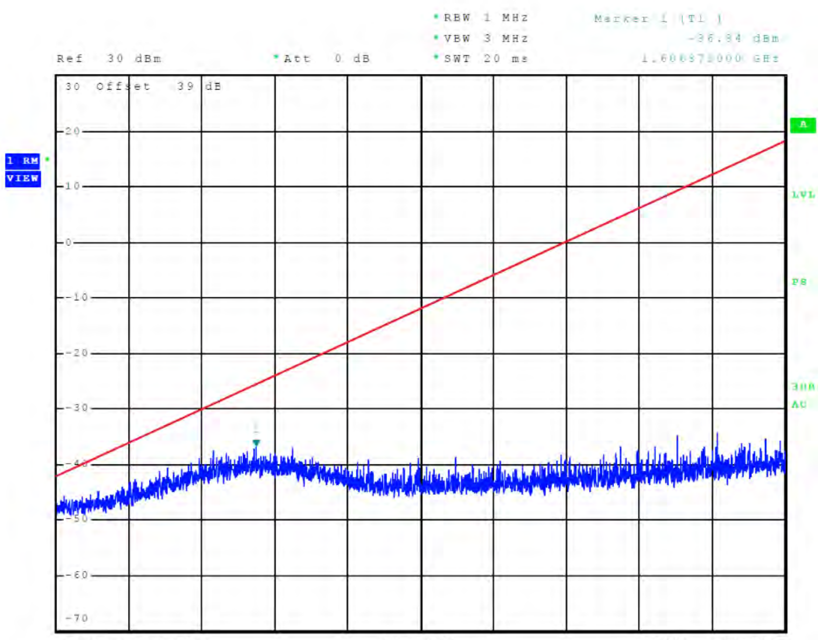


Figure 80 Plot of E.I.R.P. density of unwanted emissions (Mode C1 / Ch. 1)

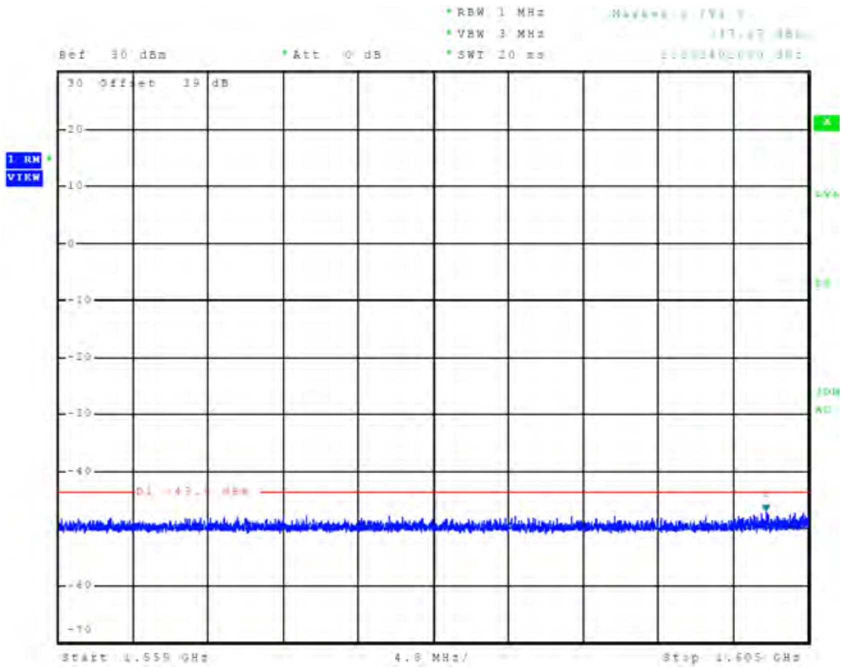


Figure 81 Plot of E.I.R.P. density of unwanted emissions (Mode C1 / Ch. 121)

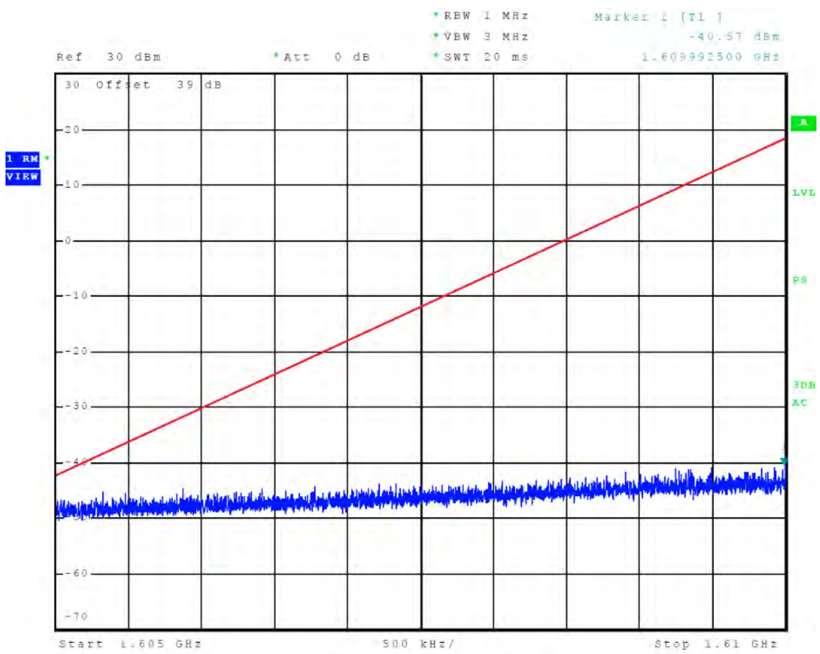


Figure 82 Plot of E.I.R.P. density of unwanted emissions (Mode C1 / Ch. 121)

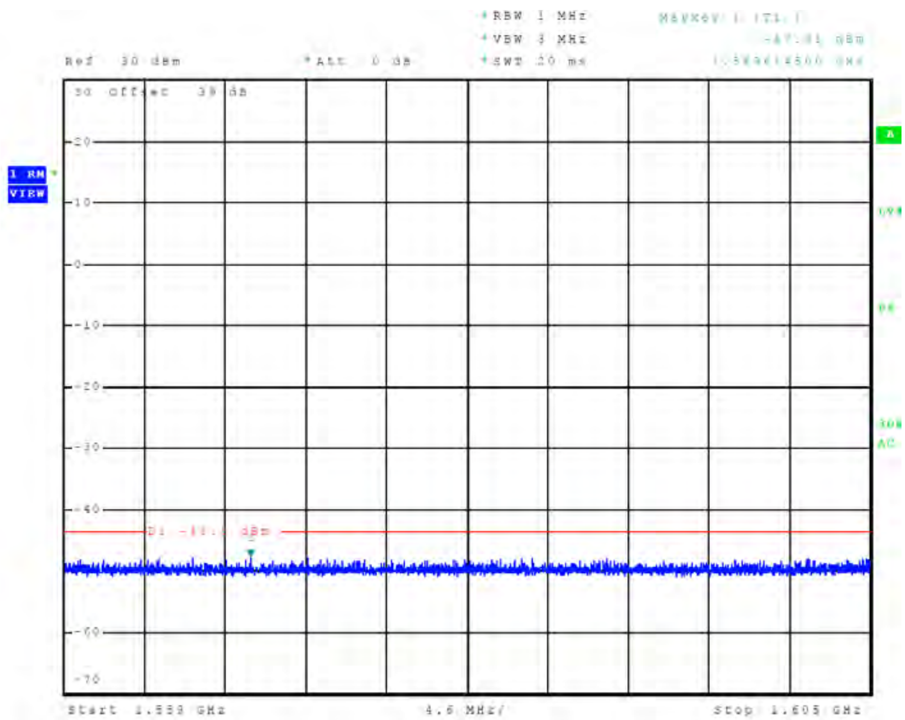


Figure 83 Plot of E.I.R.P. density of unwanted emissions (Mode C1 / Ch. 240)

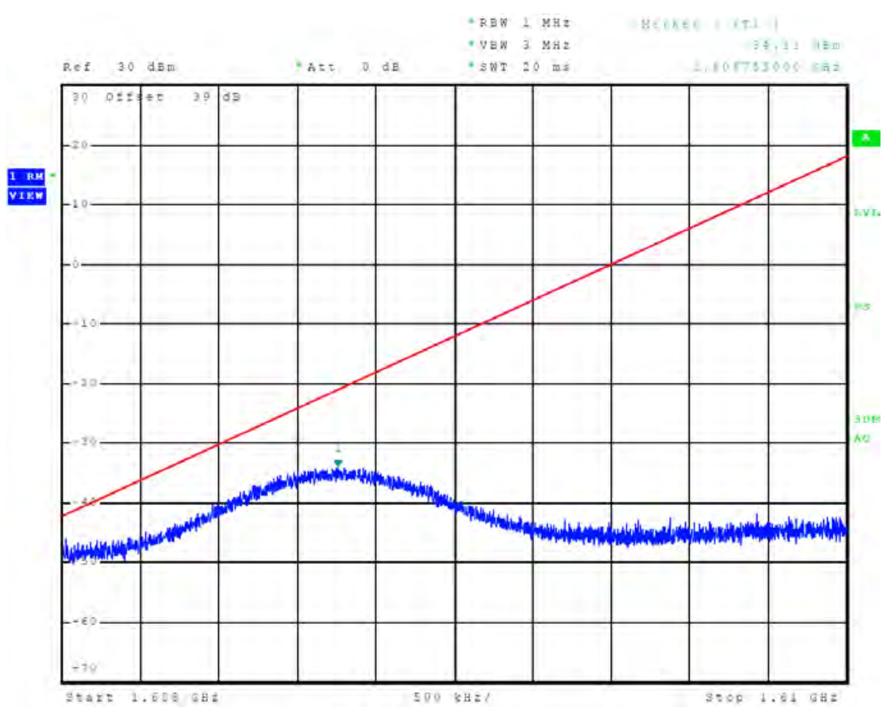


Figure 84 Plot of E.I.R.P. density of unwanted emissions (Mode C1 / Ch. 240)

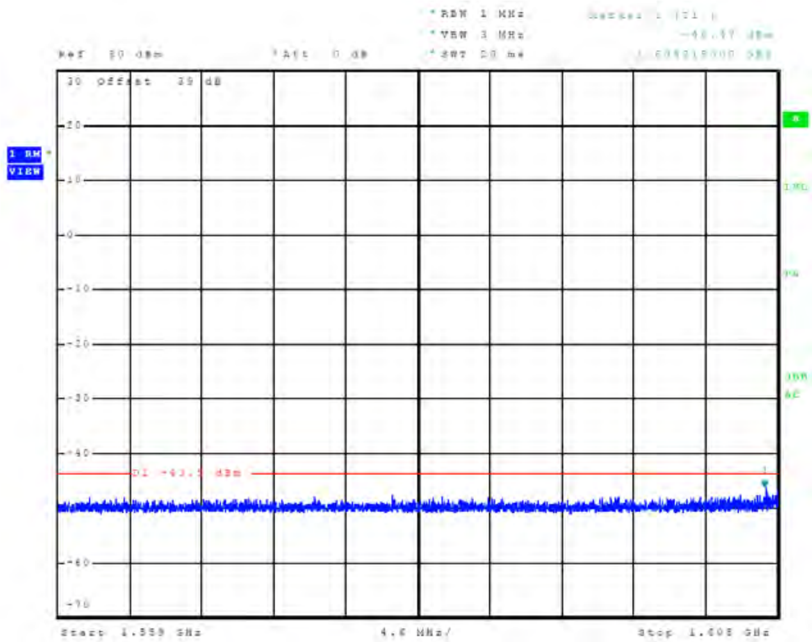


Figure 85 Plot of E.I.R.P. density of unwanted emissions (Mode C2 / Ch. 1)

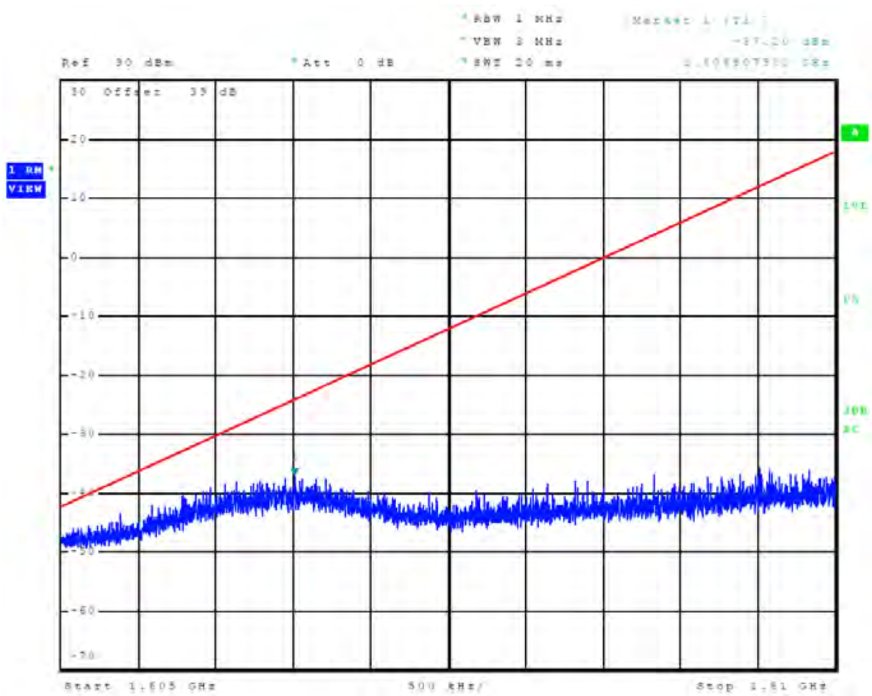


Figure 86 Plot of E.I.R.P. density of unwanted emissions (Mode C2 / Ch. 1)

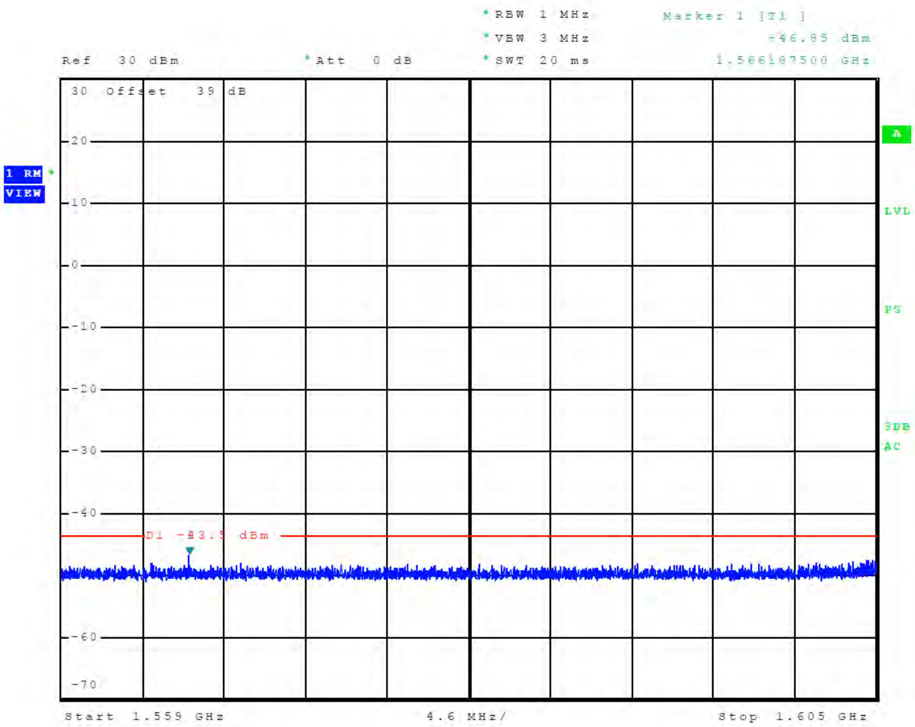


Figure 87 Plot of E.I.R.P. density of unwanted emissions (Mode C2 / Ch. 121)

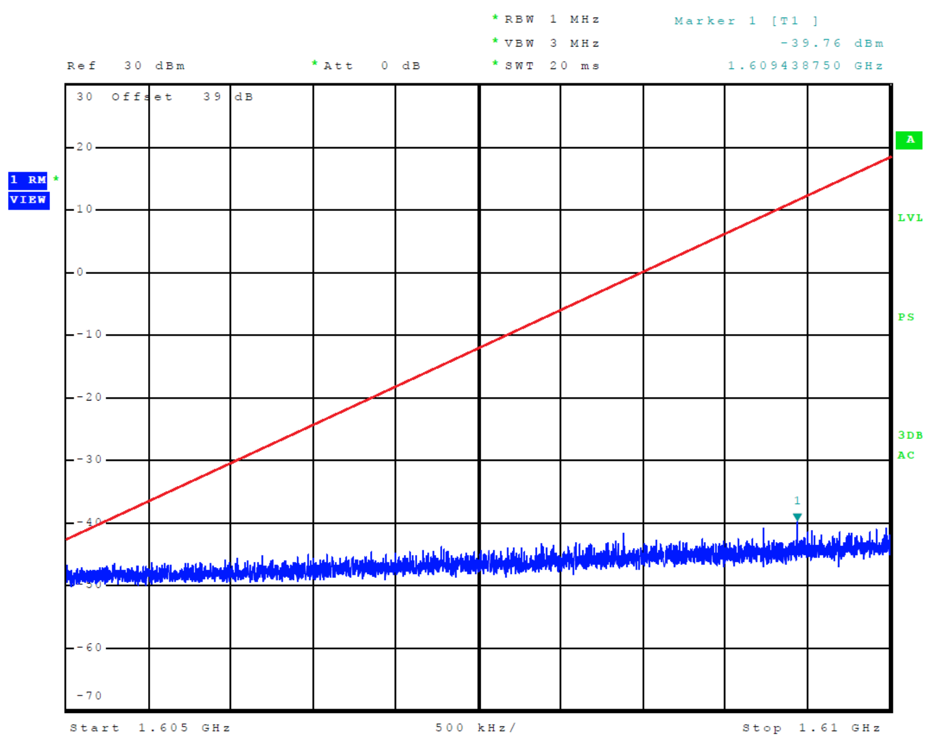


Figure 88 Plot of E.I.R.P. density of unwanted emissions (Mode C2 / Ch. 121)

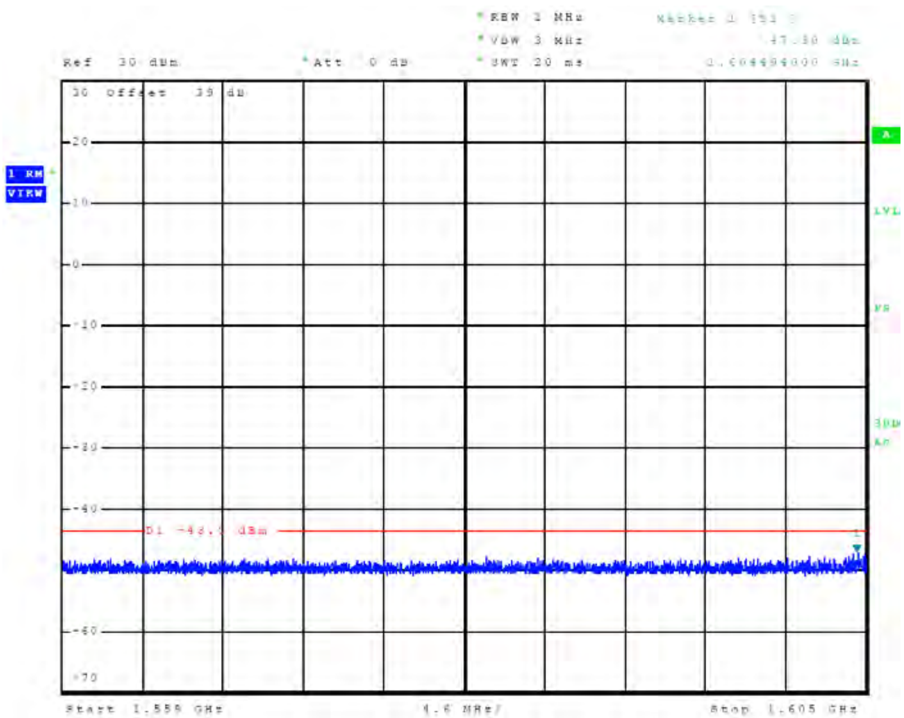


Figure 89 Plot of E.I.R.P. density of unwanted emissions (Mode C2 / Ch. 240)

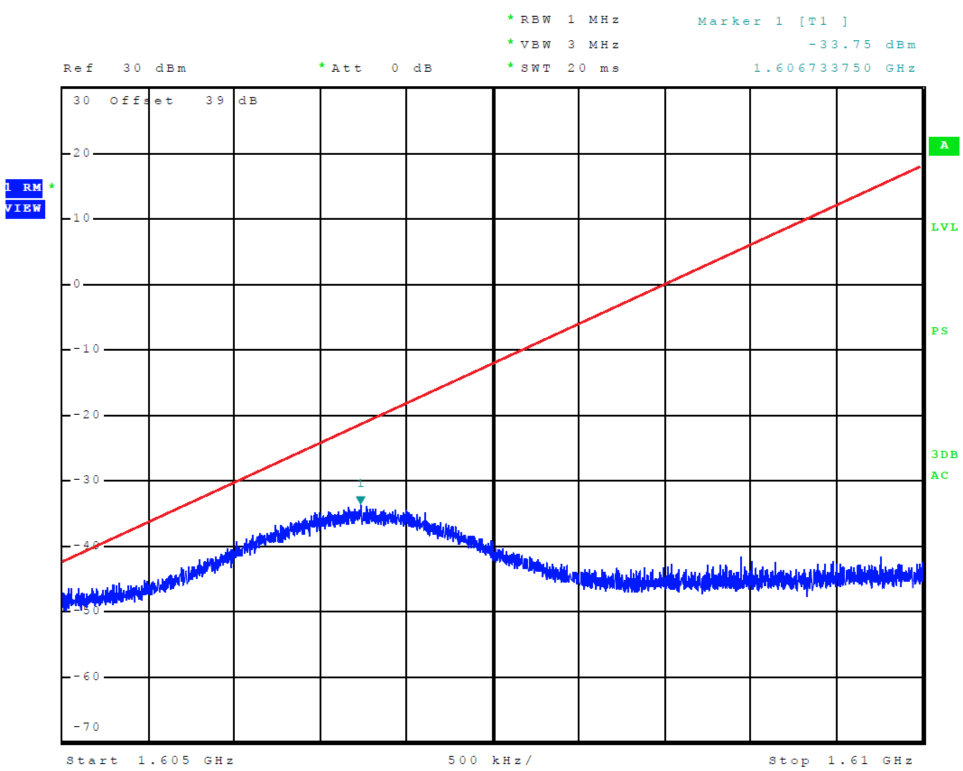


Figure 90 Plot of E.I.R.P. density of unwanted emissions (Mode C2 / Ch. 240)

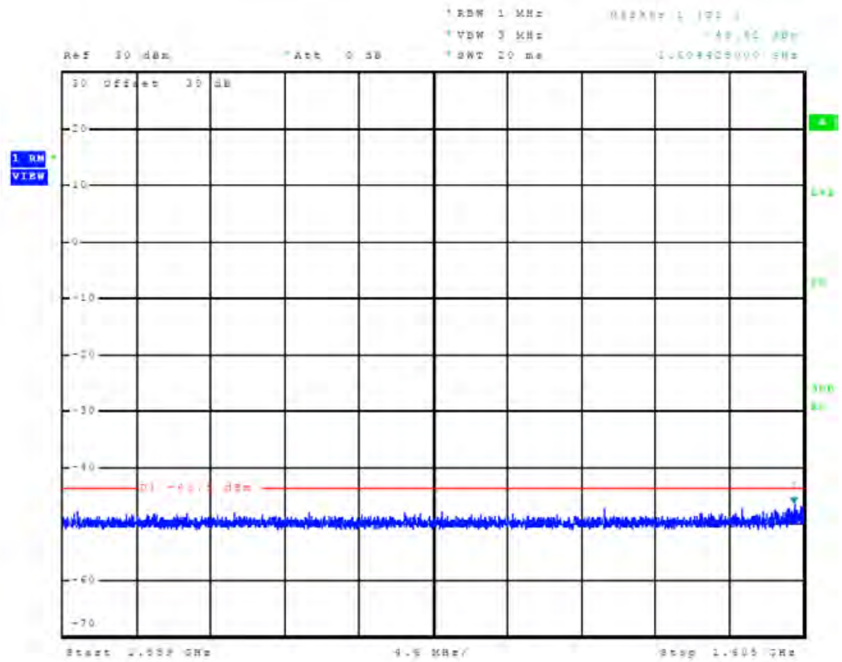


Figure 91 Plot of E.I.R.P. density of unwanted emissions (Mode C8 / Ch. 1)

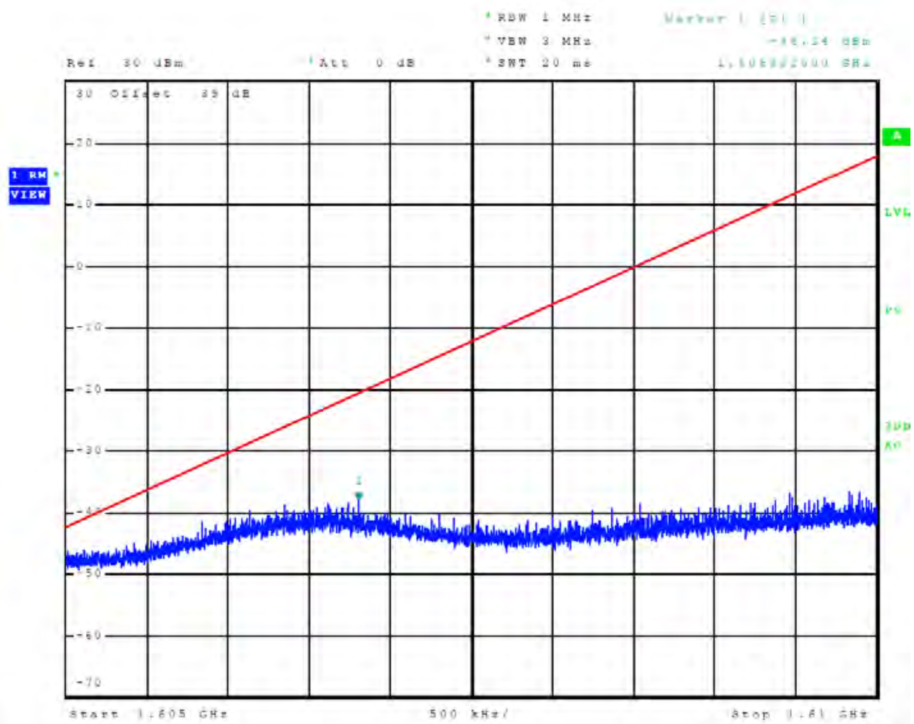


Figure 92 Plot of E.I.R.P. density of unwanted emissions (Mode C8 / Ch. 1)

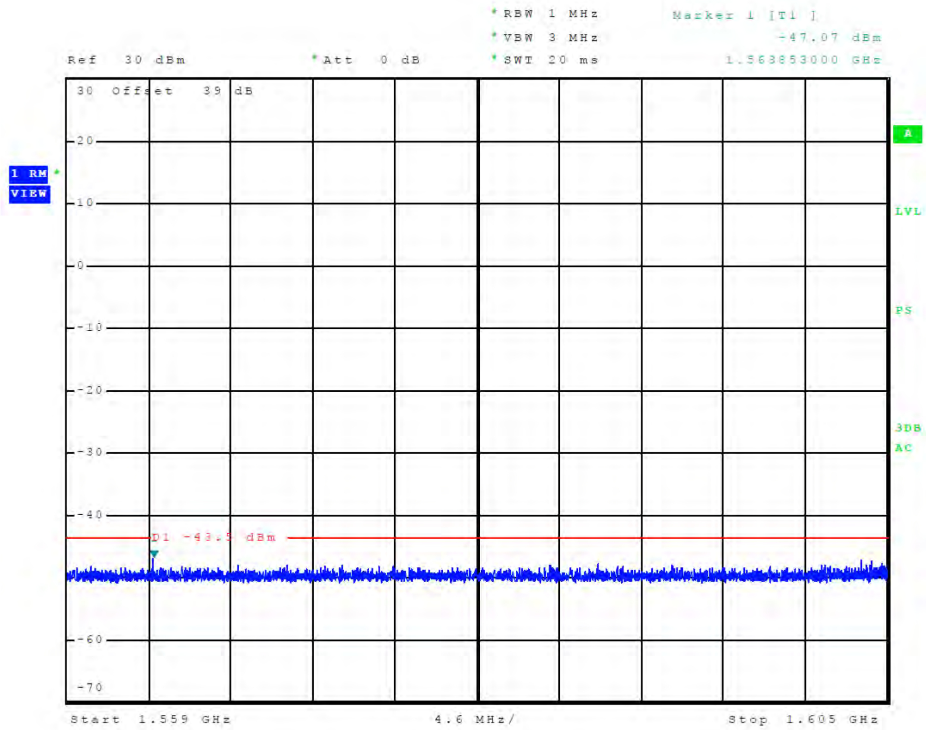


Figure 93 Plot of E.I.R.P. density of unwanted emissions (Mode C8 / Ch. 121)

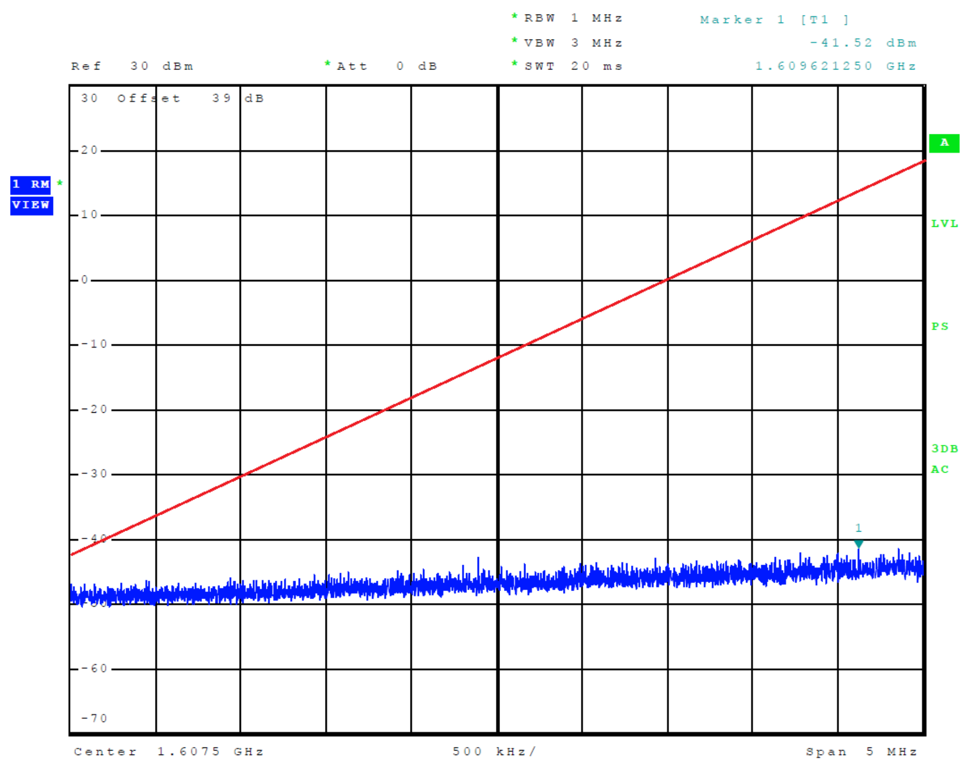


Figure 94 Plot of E.I.R.P. density of unwanted emissions (Mode C8 / Ch. 121)

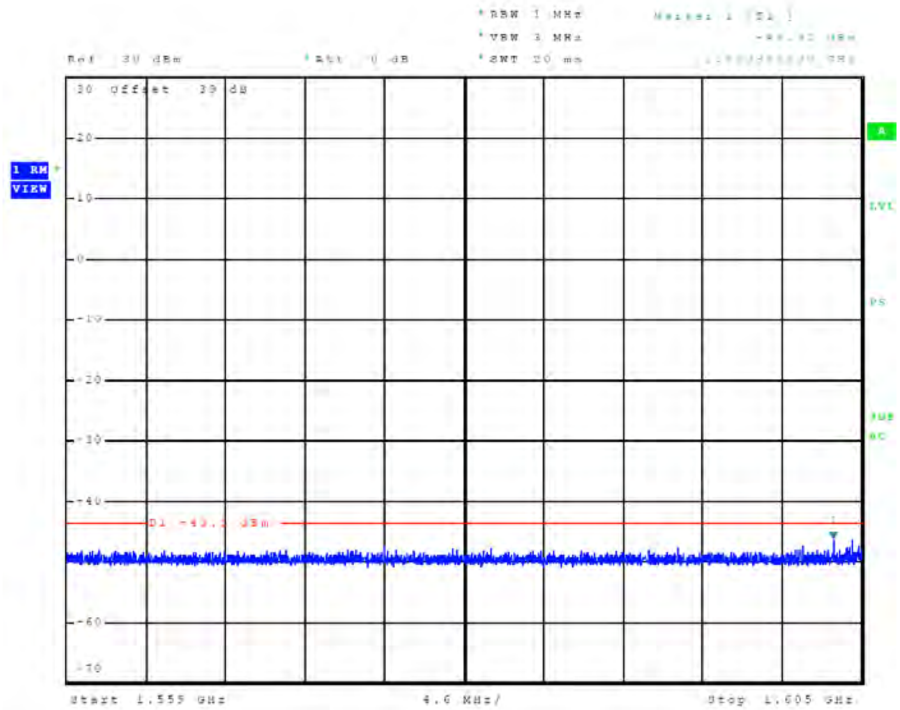


Figure 95 Plot of E.I.R.P. density of unwanted emissions (Mode C8 / Ch. 240)

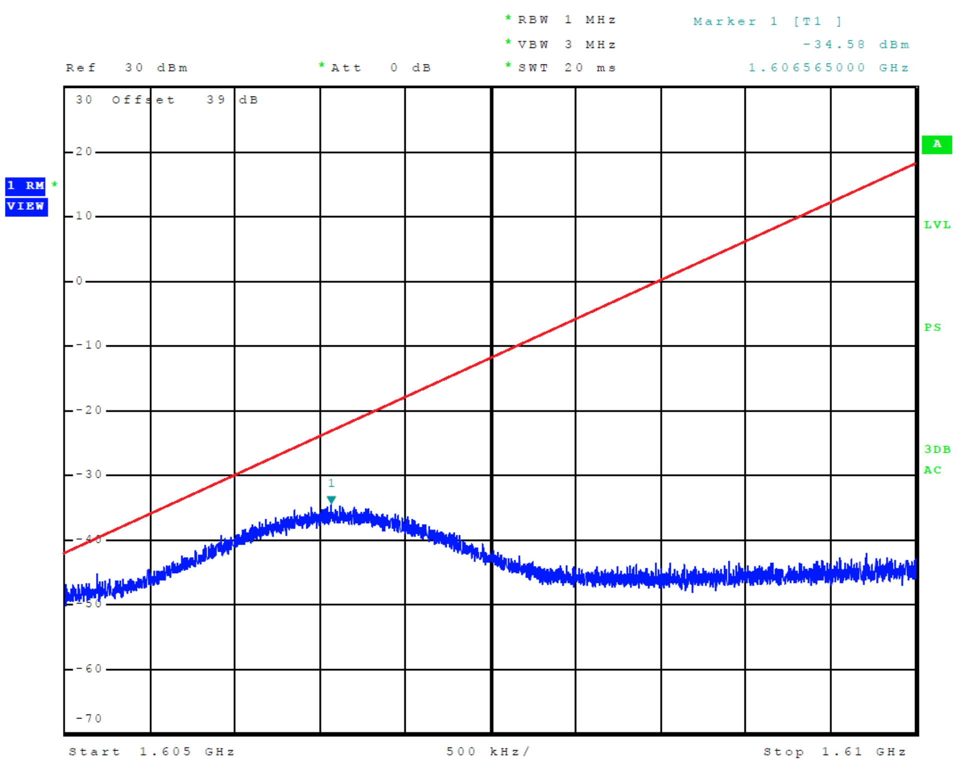


Figure 96 Plot of E.I.R.P. density of unwanted emissions (Mode C8 / Ch. 240)

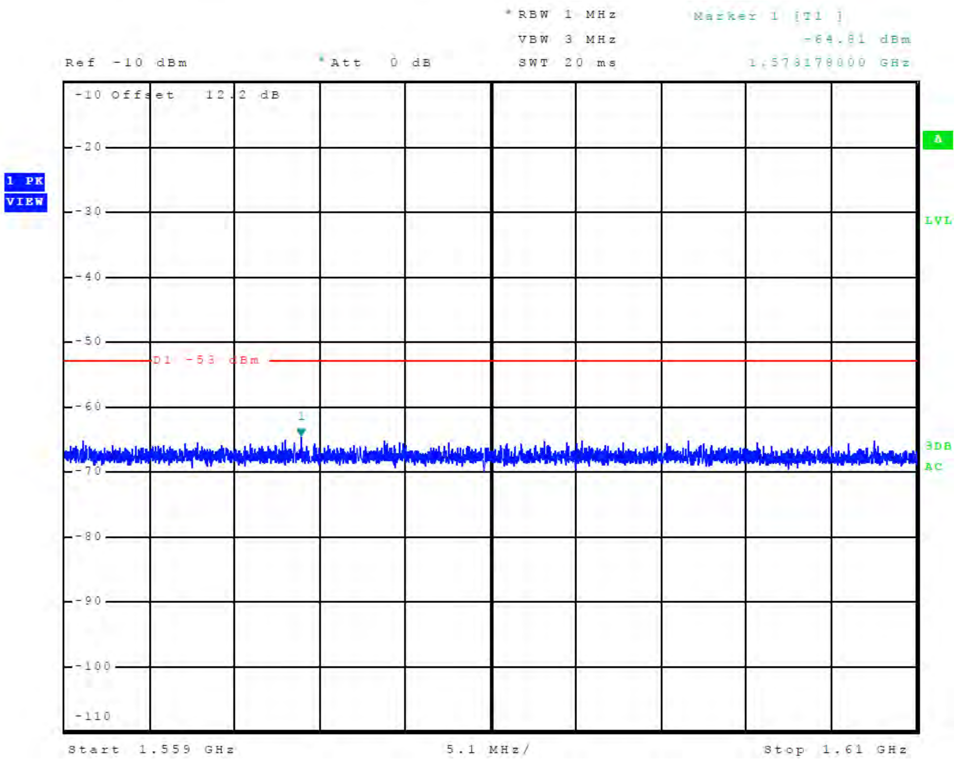


Figure 97 Plot of E.I.R.P. density of unwanted emissions carrier-off

Table 17 E.I.R.P. Density Broadband Emissions Data

Modes	Channel #	Frequency	Max e.i.r.p. density (dBm/MHz)	Max e.i.r.p. density (dBW/MHz)
B1	1	1616.0	-37.5	-67.5
B1	121	1621.0	-41.3	-71.3
B1	240	1626.0	-34.1	-64.1
C1	1	1616.0	-36.8	-66.8
C1	121	1621.0	-40.6	-70.6
C1	240	1626.0	-34.1	-64.1
C2	1	1616.0	-37.2	-67.2
C2	121	1621.0	-39.8	-69.8
C2	240	1626.0	-33.8	-63.8
C8	1	1616.0	-38.1	-68.1
C8	121	1621.0	-41.5	-71.5
C8	240	1626.0	-34.6	-64.6

The EUT demonstrated compliance with specifications of CFR47 Paragraph 2.1046(a) and applicable Parts of 2 and 25.216(g) (h) and RSS-170 5.4. There are no deviations to the specifications.

Annex

- Annex A Measurement Uncertainty Calculations
- Annex B Rogers Labs Test Equipment List
- Annex C Laboratory Certificate of Accreditation

Annex A Measurement Uncertainty Calculations

The measurement uncertainty was calculated for all measurements listed in this test report according To CISPR 16–4. Result of measurement uncertainty calculations are recorded below. Component and process variability of production devices similar to those tested may result in additional deviations. The manufacturer has the sole responsibility of continued compliance.

Measurement	Expanded Measurement Uncertainty $U_{(lab)}$
3 Meter Horizontal 0.009-1000 MHz Measurements	4.16
3 Meter Vertical 0.009-1000 MHz Measurements	4.33
3 Meter Measurements 1-18 GHz	5.46
3 Meter Measurements 18-40 GHz	5.16
10 Meter Horizontal Measurements 0.009-1000 MHz	4.15
10 Meter Vertical Measurements 0.009-1000 MHz	4.32
AC Line Conducted	1.75
Antenna Port Conducted power	1.17
Frequency Stability	1.00E-11
Temperature	1.6˚C
Humidity	3%

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Annex B Test Equipment

Equipment	Manufacturer	Model (SN)	Band	Cal Date(m/d/y)	Due
☒ LISN	FCC	FCC-LISN-50-25-10(1PA) (160611)	.15-30MHz	3/25/2024	3/25/2025
☐ LISN: Fischer Custom Communications Model: FCC-LISN-50-16-2-08				3/25/2024	3/25/2025
☒ Cable	Huber & Suhner Inc.	Sucoflex102ea(L10M)(303073)	9kHz-40 GHz	9/16/2024	9/16/2025
☒ Cable	Huber & Suhner Inc.	Sucoflex102ea(1.5M)(303069)	9kHz-40 GHz	9/16/2024	9/16/2025
☒ Cable	Huber & Suhner Inc.	Sucoflex102ea(1.5M)(303070)	9kHz-40 GHz	9/16/2024	9/16/2025
☒ Cable	Belden	RG-58 (L1-CAT3-11509)	9kHz-30 MHz	9/16/2024	9/16/2025
☐ Cable	Belden	RG-58 (L2-CAT3-11509)	9kHz-30 MHz	9/16/2024	9/16/2025
☒ Antenna	Com Power	AL-130 (121055)	.001-30 MHz	9/16/2024	9/16/2025
☐ Antenna:	EMCO	6509	.001-30 MHz	9/16/2024	9/16/2026
☒ Antenna	ARA	BCD-235-B (169)	20-350MHz	9/16/2024	9/16/2025
☒ Antenna	Sunol	JB-6 (A100709)	30-1000 MHz	9/16/2024	9/16/2025
☐ Antenna	ETS-Lindgren	3147 (40582)	200-1000MHz	9/16/2024	9/16/2026
☒ Antenna	ETS-Lindgren	3117 (200389)	1-18 GHz	3/25/2024	3/25/2026
☒ Antenna	Com Power	AH-118 (10110)	1-18 GHz	9/16/2024	9/16/2026
☒ Antenna	Com Power	AH-1840 (101046)	18-40 GHz	3/27/2023	3/27/2025
☒ Analyzer	Rohde & Schwarz	ESU40 (100108)	20Hz-40GHz	7/8/2024	7/8/2025
☒ Analyzer	Rohde & Schwarz	ESW44 (101534)	20Hz-44GHz	1/26/2024	1/26/2025
☐ Analyzer	Rohde & Schwarz	FS-Z60, 90, 140, and 220	40GHz-220GHz	12/22/2017	12/22/2027
☐ Amplifier	Com-Power	PA-010 (171003)	100Hz-30MHz	9/16/2024	9/16/2025
☐ Amplifier	Com-Power	CPPA-102 (01254)	1-1000 MHz	9/16/2024	9/16/2025
☒ Amplifier	Com-Power	PAM-118A (551014)	0.5-18 GHz	9/16/2024	9/16/2025
☒ Amplifier	Com-Power	PAM-840A (461328)	18-40 GHz	9/16/2024	9/16/2025
☒ Pwr Sensor	Rohde & Schwarz	NRP33T	0.05-33 GHz	9/26/2023	9/26/2025
☒ Power meter	Agilent	N1911A with N1921A	0.05-40 GHz	3/25/2024	3/25/2025
☒ Generator	Rohde & Schwarz	SMB100A6 (100150)	20Hz-6 GHz	3/25/2024	3/25/2025
☒ Generator	Rohde & Schwarz	SMBV100A6 (260771)	20Hz-6 GHz	3/25/2024	3/25/2025
☐ RF Filter	Micro-Tronics	BRC50722 (009).9G notch	30-18000 MHz	3/25/2024	3/25/2025
☐ RF Filter	Micro-Tronics	HPM50114 (017)1.5G HPF	30-18000 MHz	3/25/2024	3/25/2025
☐ RF Filter	Micro-Tronics	HPM50117 (063) 3G HPF	30-18000 MHz	3/25/2024	3/25/2025
☐ RF Filter	Micro-Tronics	HPM50105 (059) 6G HPF	30-18000 MHz	3/25/2024	3/25/2025
☒ RF Filter	Micro-Tronics	BRM50702 (172) 2G notch	30-18000 MHz	3/25/2024	3/25/2025
☒ RF Filter	Micro-Tronics	BRC50703 (G102) 5G notch	30-18000 MHz	3/25/2024	3/25/2025
☒ RF Filter	Micro-Tronics	BRC50705 (024) 5G notch	30-18000 MHz	3/25/2024	3/25/2025
☐ Attenuator	Fairview	SA6NFNF100W-40 (1625)	30-18000 MHz	3/25/2024	3/25/2025
☒ Attenuator	Mini-Circuits	VAT-3W2+ (1436)	30-6000 MHz	3/25/2024	3/25/2025
☒ Attenuator	Mini-Circuits	VAT-3W2+ (1445)	30-6000 MHz	3/25/2024	3/25/2025
☒ Attenuator	Mini-Circuits	VAT-3W2+ (1735)	30-6000 MHz	3/25/2024	3/25/2025
☒ Attenuator	Mini-Circuits	VAT-6W2+ (1438)	30-6000 MHz	3/25/2024	3/25/2025
☐ Attenuator	Mini-Circuits	VAT-6W2+ (1736)	30-6000 MHz	3/25/2024	3/25/2025

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☒ Weather station Davis 6152 (A70927D44N) 7/11/2024 7/11/2025

Equipment	Manufacturer	Model (SN)	Band	Cal Date(m/d/y)	Due
☐ Frequency Counter: Leader		LDC-825 (8060153)		3/28/2023	3/28/2025
☐ ISN	Com-Power	Model ISN T-8 (600111)		3/25/2024	3/25/2025
☐ LISN	Compliance Design	FCC-LISN-2.Mod.cd,(126)	.15-30MHz	9/16/2024	9/16/2025
☐ LISN:	Com-Power	Model LI-220A		9/16/2024	9/16/2026
☒ LISN:	Com-Power	Model LI-550C		9/16/2024	9/16/2025
☒ Cable	Huber & Suhner Inc.	Sucoflex102ea(1.5M)(303072)	9kHz-40 GHz	9/16/2024	9/16/2025
☒ Cable	Huber & Suhner Inc.	Sucoflex102ea(L1M)(281183)	9kHz-40 GHz	9/16/2024	9/16/2025
☒ Cable	Huber & Suhner Inc.	Sucoflex102ea(L4M)(281184)	9kHz-40 GHz	9/16/2024	9/16/2025
☒ Cable	Huber & Suhner Inc.	Sucoflex102ea(L10M)(317546)	9kHz-40 GHz	9/16/2024	9/16/2025
☒ Cable	Time Microwave	4M-750HF290-750 (L4M)	9kHz-24 GHz	9/16/2024	9/16/2025
☒ Cable	Mini-Circuits	KBL-2M-LOW+ (23090329)	9kHz-40 GHz	3/25/2024	3/25/2025
☐ RF Filter	Micro-Tronics	BRC17663 (001) 9.3-9.5 notch	30-1800 MHz	3/28/2023	3/28/2025
☐ RF Filter	Micro-Tronics	BRC19565 (001) 9.2-9.6 notch	30-1800 MHz	3/28/2023	3/28/2025
☒ Analyzer	HP	8562A (3051A05950)	9kHz-125GHz	3/25/2024	3/25/2025
☐ Wave Form Generator	Keysight	33500B (MY57400128)		3/25/2024	3/25/2025
☐ Antenna:	Solar	9229-1 & 9230-1		2/10/2024	2/10/2025
☐ CDN:	Com-Power	Model CDN325E		10/11/2022	10/11/2024
☐ Oscilloscope	Scope: Tektronix	MDO 4104		2/10/2024	2/10/2025
☐ EMC Transient Generator	HVT	TR 3000		2/10/2024	2/10/2025
☐ AC Power Source (Ametech, California Instruments)				2/10/2024	2/10/2025
☒ Field Intensity Meter: EFM-018				2/10/2024	2/10/2025
☒ ESD Simulator: MZ-15				2/10/2024	2/10/2025
☐ Injection Clamp Luthi Model EM101				not required	
☐ R.F. Power Amp ACS 230-50W				not required	
☐ R.F. Power Amp EIN Model: A301				not required	
☐ R.F. Power Amp A.R. Model: 10W 1010M7				not required	
☐ R.F. Power Amp A.R. Model: 50U1000				not required	
☒ Temperature Chamber				not required	
☒ Shielded Room				not required	

POSSIBLY USE FOR GARMIN GPS TESTING

☐ GNSS Sig Gen SG80K, SN: GNSS-00952 not required

Annex C Laboratory Certificate of Accreditation

United States Department of Commerce
National Institute of Standards and Technology

Certificate of Accreditation to ISO/IEC 17025:2017

NVLAP LAB CODE: 200087-0

Rogers Labs, a division of The Compatibility Center LLC
Lenexa, KS

is accredited by the National Voluntary Laboratory Accreditation Program for specific services, listed on the Scope of Accreditation, for:

Electromagnetic Compatibility & Telecommunications

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communique dated January 2009).

2024-03-18 through 2025-03-31
Effective Dates

For the National Voluntary Laboratory Accreditation Program

United States Department of Commerce
National Institute of Standards and Technology

Certificate of Accreditation to ISO/IEC 17025:2017

NVLAP LAB CODE: 200087-0

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2025-03-11 through 2026-03-31
Effective Dates

For the National Voluntary Laboratory Accreditation Program