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Test report

351607-1TRFWL

Date of issue: April 28, 2020

Applicant:

Nokia

Product:

Point-to-Point Microwave Radio

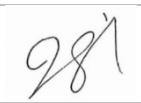
Model: 3DB29106AA **Model variant: 3DB29206AA**

Specifications:

- FCC 47 CFR Part 15 Subpart E, §15.407
  Unlicensed National Information Infrastructure Devices
- RSS-247, Issue 2, Section 6, February 2017
  Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and License-Exempt Local Area Network (LE-LAN) Devices

Test location

Company name:	Nemko USA Inc.
Address:	2210 Faraday Ave, Suite 150
City:	Carlsbad
Province:	California
Postal code:	92008
Country:	USA
Telephone:	+1 760 444 3500
Website:	www.nemko.com
FCC Site Number	Test Firm Registration Number: 392943 Designation Number: US5058
ISED Test Site	2040B-3

Tested by:	Martha Espinoza, Wireless Engineer
Reviewed by:	James Cunningham, Wireless Supervisor
Date:	April 29, 2020
Signature:	

Limits of responsibility

Note that the results contained in this report relate only to the items tested and were obtained in the period between the date of initial receipt of samples and the date of issue of the report.
This test report has been completed in accordance with the requirements of ISO/IEC 17025. All results contain in this report are within Nemko USA's ISO/IEC 17025 accreditation.
This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the U.S. Government.

Copyright notification

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Section 1. Report summary

1.1 Applicant and manufacturer

Company name	Nokia
Address	3201 Olympus Boulevard
City	Dallas
Province/State	Texas
Postal/Zip code	75019
Country	U.S.A.

1.2 Test specifications

FCC 47 CFR Part 15, Subpart E, Clause 15.407	Unlicensed National Information Infrastructure Devices
RSS-247, Issue 2	Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and License-Exempt Local Area Network (LE-LAN) Devices

1.3 Test methods

789033 D02 General UNII Test Procedures New Rules v02r01 (December 14, 2017)	Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices Part 15, Subpart E
ANSI C63.10 v2013	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices

1.4 Statement of compliance

In the configuration tested, the EUT was found compliant.

Testing was completed against all relevant requirements of the test standard. Results obtained indicate that the product under test complies in full with the requirements tested. The test results relate only to the items tested.

See “Summary of test results” for full details.

1.5 Exclusions

None

1.6 Test report revision history

Revision #	Details of changes made to test report
392730-TRFWL	Original report issued

Section 2. Summary of test results

2.1 FCC Part 15 Subpart C, general requirements test results

Part	Test description	Verdict
§15.31(e)	Variation of power source	Pass[1]
§15.203	Antenna requirement	Pass[2]

Notes: [1]Measurements of the variation of the input power or the radiated signal level of the fundamental frequency component of the emission, as appropriate, was performed with the supply voltage varied between 85 % and 115 % of the nominal rated supply voltage. No noticeable output power variation was observed

[2]The EUT uses external antenna that will be professionally installed by the manufacturer or other responsible party.

2.2 FCC Part 15 Subpart E, test results

Part	Test description	Verdict
§15.403(i)	Emission bandwidth	Pass
§15.407(a)(1)	Power and density limits within 5.15–5.25 GHz band	Not applicable
§15.407(a)(2)	Power and density limits within 5.25–5.35 GHz and 5.47–5.725 GHz bands	Not applicable
§15.407(a)(3)	Power and density limits within 5.725–5.85 GHz band	Pass
§15.407(b)(1)	Undesirable emission limits for 5.15–5.25 GHz band	Not applicable
§15.407(b)(2)	Undesirable emission limits for 5.25–5.35 GHz band	Not applicable
§15.407(b)(3)	Undesirable emission limits for 5.47–5.725 GHz bands	Not applicable
§15.407(b)(4)	Undesirable emission limits for 5.725–5.85 GHz band	Pass
§15.407(b)(6)[1]	Conducted limits for U-NII devices using an AC power line	Not applicable
§15.407(e)[1]	Minimum 6 dB bandwidth of U-NII devices within the 5.725-5.85 GHz band	Pass
§15.407(g)	Frequency stability	Pass
§15.407(h)(1)[2]	Transmit power control (TPC)	Not applicable
§15.407(h)(2)[2]	Dynamic Frequency Selection (DFS)	Not applicable

Notes: [1]EUT is power it with -48 VDC and it is not necessary to test AC power line.

[2]DFS and TPC requirements are only applicable to 5.25–5.35 GHz and 5.47–5.725 GHz bands

2.3 RSS-Gen, Issue 5, test results

Part	Test description	Verdict
6.7	Occupied Bandwidth	Pass
7.3	Receiver radiated emission limits	Not applicable
7.4	Receiver conducted emission limits	Not applicable
8.8	Power Line Conducted Emissions Limits for License-Exempt Radio Apparatus	Not applicable
8.11	Frequency stability	Pass

Notes

2.4 IC RSS-247, Issue 2, test results

Section	Test description	Verdict
6.1 (1)[1]	Types of Modulation	Pass
6.2.1 (1)	Power limits for 5150–5250 MHz band	Not applicable
6.2.2 (1)	Power limits for 5250–5350 MHz band	Not applicable
6.2.3 (1)	Power limits for 5470–5600 MHz and 5650–5725 MHz bands	Not applicable
6.2.4 (1)	Power limits for 5725–5850 MHz band	Pass
6.2.4 (1)	Minimum 6 dB bandwidth	Pass
6.2.1 (2)	Unwanted emission limits for 5150–5250 MHz band	Not applicable
6.2.2 (2)	Unwanted emission limits for 5250–5350 MHz band	Not applicable
6.2.2 (2)	TPC requirements for devices with a maximum e.i.r.p. greater than 500 mW	Not applicable
6.2.2 (3)	E.I.R.P. at different elevations restrictions for 5250–5350 MHz band	Not applicable
6.2.3 (2)	Unwanted emission limits for 5470–5600 MHz and 5650–5725 MHz bands	Not applicable
6.2.4 (2)	Unwanted emission limits for 5725–5850 MHz band	Pass
6.3	Dynamic Frequency Selection (DFS) for devices operating in the bands 5250–5350 MHz, 5470–5600 MHz and 5650–5725 MHz	Not applicable

Notes: [1]The EUT employs digital modulations 4-QAM.

Section 3. Equipment under test (EUT) details

3.1 Sample information

Receipt date	February 20, 2020
Nemko sample ID number	392730

3.2 EUT information

Product name	WAVENCE UBT-S and UBT-T 6GHz HP (POINT-TO-POINT MICROWAVE RADIO)
Model	3DB29106AA and 3DB29206AA
Model variant	SINGLE TRANSCEIVER and TWIN TRANSCEIVER
Serial numbers	SH1921N01WK; SH1921N01WJ

The Single and the Twin both utilize identical transmitter boards. Therefore, testing of transmitter characteristics detailed in this report was from the 3DB29206AA TWIN device. Additionally, with respect to the 3DB29206AA (TWIN) the antennas are directional and their emissions patterns do not overlap.

3.3 Technical information

Applicant IC company number	N/A
IC UPN number	N/A
RSS number and Issue number	N/A
Frequency band	5725–5850 MHz
Frequency Min (MHz)	5731 MHz
Frequency Max (MHz)	5844 MHz
RF power Min (W), Conducted	0.820 W (29.14 dBm)
RF power Max (W), Conducted	0.928 W (29.68 dBm)
Field strength, Units @ distance	N/A
Measured BW (MHz) (99%)	8.865 MHz; 27.546 MHz
Calculated BW (kHz), as per TRC-43	N/A
Type of modulation	4-QAM (worst case used for testing)
Emission classification (F1D, G1D, D1D)	D7W
Transmitter spurious, Units @ distance	49.63 dBµV/m @ 3m
Power requirements	-48 VDC
Antenna information	The EUT uses unique external antenna that is professionally installed. Antenna nominal peak gain is 38 dBi.

[1]EIRP = Conducted power + Antenna gain (38 dBi)

3.4 Product description and theory of operation

EUT is a transceiver to support operators as they transition to 4.5G, 4.9G and eventually 5G networks. The whole band was explored in four sub-bands which were declared by manufacturer. Low, middle and high channel were measured in each sub-band with a declared bandwidth of 10 MHz, except middle channel in each sub-band was measured too at 30 MHz bandwidth.

3.5 EUT exercise details

EUT is configured via TCP/IP (Ethernet) using Nokia Wavence Web Interface. Once ethernet connection with the EUT is established, corresponding Radio settings were selected to set the EUT in continues transmission mode using channel, modulation and bandwidth. Additional to the web interface setup, a physical setup shall to be done for each sub-band, using two UBT-T Radios (Ultra Broadband Transceiver-Twin) and four AIM (Antenna Interface Module).
Firmware Version of the EUT at the time of testing was V08.06.7G. Software version and document at time of testing was Wavence-A 19A and the documented instructions was from UBT_5GHz Web Interface Operation.

3.6 EUT setup diagram

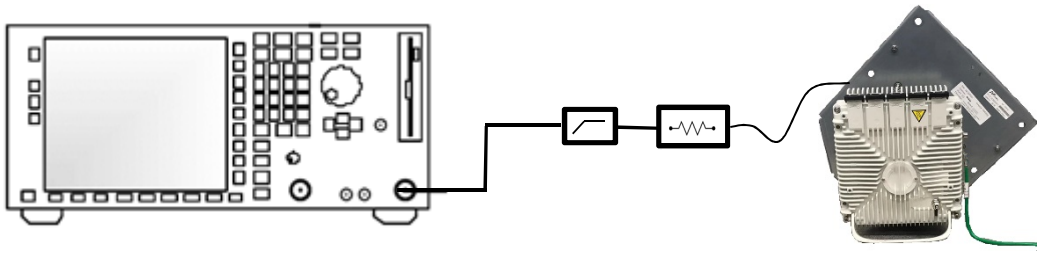


Figure 3.6-1: *Setup diagram*

3.7 EUT sub assemblies and support equipment

Table 3.7-1: *EUT sub assemblies*

Description	Brand name	Model/Part number	Serial number	Rev.
Antenna Interface Module	Nokia	AIM-S SB1 (3DB28582AAAA)	G1195000036	--
Antenna Interface Module	Nokia	AIM-S SB2 (3DB28582BAAA)	G1195000038	--
Antenna Interface Module	Nokia	AIM-S SB1P (3DB28582AAAA)	G1195000035	--
Antenna Interface Module	Nokia	AIM-S SB2P (3DB28507BAAA)	G1195000037	--
Waveguide Straight Adaptor	M Wave Design	137SA1209	0821-04	--
Waveguide Straight Adaptor	M Wave Design	137SA1209	0821-01	--
Waveguide Supporting Plate	Mossini	--------	3CC58334AAAA 01	--
Waveguide Supporting Plate	Mossini	--------	3CC58334AAAA 01	--

Table 3.7-2: *EUT interface ports*

Description	Qty.
SMA 2.4 RF port	1
Power Port (PWR)	1
Ethernet (Port1)	1
SMP (Port2 and Port3)	2
Signal XPIC/MIMO (Port4)	1

Table 3.7-3: *Support equipment*

Description	Brand name	Model/Part number	Serial number	Rev.
DC Power Supply	Hewlett Packard	6030A	CPN A48311	--
Laptop	Dell	Latitude 7480	3HZG1N2	--

Table 3.7-4: *Inter-connection cables*

Cable description	From	To	Length (m)
DC power cable with Octis connector	DC power supply	Power port	10.0
Cat5 cable	Laptop	Port 2	10.0
6AWG Ground wire	EUT chassis	Ground plane	1.5

Section 4. Engineering considerations

4.1 Modifications incorporated in the EUT

There were no modifications performed to the EUT during this assessment.

4.2 Technical judgment

None

4.3 Deviations from laboratory tests procedures

No deviations were made from laboratory procedures.

Section 5. Test conditions

5.1 Atmospheric conditions

Temperature	15–30 °C
Relative humidity	20–75 %
Air pressure	860–1060 mbar

When it is impracticable to carry out tests under these conditions, a note to this effect stating the ambient temperature and relative humidity during the tests shall be recorded and stated.

5.2 Power supply range

The normal test voltage for equipment to be connected to the mains shall be the nominal mains voltage. For the purpose of the present document, the nominal voltage shall be the declared voltage, or any of the declared voltages ±5 %, for which the equipment was designed.

Section 6. Measurement uncertainty

6.1 Uncertainty of measurement

Measurement uncertainty budgets for the tests are detailed below. Measurement uncertainty calculations assume a coverage factor of K = 2 with 95% certainty.

Test name	Measurement uncertainty, dB
All antenna port measurements	0.55
Conducted spurious emissions	1.13
Radiated spurious emissions	3.78
AC power line conducted emissions	3.55

Section 7. Test equipment

7.1 Test equipment list

Table 7.1-1: *Equipment list*

Equipment	Manufacturer	Model no.	Asset no.	Cal cycle	Next cal.
Signal and spectrum analyzer	Rohde & Schwarz	FSW 43.5 GHz	E1302	1 Year	01-10-2021
EMC Test Receiver	Rohde & Schwarz	ESU 40	E1131	1 Year	11-19-2020
Antenna, Bilog	Schaffner-Chase	CBL6111C	1480	1 Year	04-18-2020
Antenna, Horn	ETS-Lindgren	3117	E1139	2 Years	03-21-2021
Pre-Amplifier	ETS-Lindgren	3117-PA	E1139	2 Years	03-21-2021
High-pass filter	Wainwright Instruments GMBH	WHKX10-5850-6500-18000-40SS	E1208	VOU	VOU
Notch filter 5.15-5.85 GHz	Micro-Tronics	BRM50716-01	E1140	VOU	VOU
High-pass filter 15-26 GHz	SAGE Millimeter Inc.	SCF-15312340-42KFKF-H1	E1157	VOU	VOU
High-pass filter 22-40 GHz	SAGE Millimeter Inc.	SCF-22318340-28KFKF-H1	E1158	VOU	VOU
Attenuator 20 dB	Mini-Circuits	C407-20	E1201	VOU	VOU

Note: NCR - no calibration required, VOU - verify on use

Section 8. Testing data

8.1 FCC 15.407(a)(3) and RSS-247 6.2.4.1 - Maximum conducted output power

8.1.1 Definitions and limits

FCC:
(3) For the band 5.725-5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. However, fixed point-to-point U-NII devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.
Note to paragraph (a)(3): The Commission strongly recommends that parties employing U-NII devices to provide critical communications services should determine if there are any nearby Government radar systems that could affect their operation.
(4) The maximum conducted output power must be measured over any interval of continuous transmission using instrumentation calibrated in terms of an rms-equivalent voltage.

ISED:
6.2.4.1 Power limits
The maximum conducted output power shall not exceed 1 W. The output power spectral density shall not exceed 30 dBm in any 500 kHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the output power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. However, fixed point-to-point devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power. Fixed point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications and multiple collocated transmitters transmitting the same information.

8.1.2 Test summary

Test date:	March 2, 2020	Temperature:	20 °C
Test engineer:	Martha Espinoza	Air pressure:	1006 mbar
Verdict:	Pass	Relative humidity:	37 %

8.1.3 Observations, settings and special notes

- EUT was set to transmit with 100 % duty cycle.
- EUT can transmit in four bands: SB1, SB2, SBP1 and SBP2. Each case has a different physical setup, where the radio (UBT: Ultra broadband transceiver) must be assembled with the antenna interface module (AIM) depending of the chosen band (the frequencies and bandwidths showed below, were declared by manufacturer):

SB1	Bandwidth	SB2	Bandwidth	SBP1	Bandwidth	SBP2	Bandwidth
5731 MHz	10 MHz	5761 MHz	10 MHz	5794 MHz	10 MHz	5824 MHz	10 MHz
5741 MHz	10 MHz	5771 MHz	10 MHz	5804 MHz	10 MHz	5834 MHz	10 MHz
5751 MHz	10 MHz	5781 MHz	10 MHz	5814 MHz	10 MHz	5844 MHz	10 MHz
5741 MHz	30 MHz	5771 MHz	30 MHz	5804 MHz	30 MHz	5834 MHz	30 MHz

- UBT can support ten different modulations: 4QAM, 16QAM, 32QAM, 64QAM, 128QAM, 256QAM, 512QAM, 1024QAM, 2048QAM and 4096QAM. A lot of measurements can be done from these options, however, a quick power measurement of all the modulations to determine which is this worst case was made it use a power meter. This measurement was taken with this equipment because it provides a quick measurement and it permitted to optimize time although the maximum conducted output power will be done with spectrum analyzer method. The steps of these previous tests are listed below:

8.1.3 Observations, settings and special notes continued

1) The single unit was measured using the ten modulations only in the SBP1 band. 4QAM was determined as worst case because the maximum conducted output power was identified in this modulation.
2) Once defined the 4QAM as worst case, the power was measured in the four sub-bands: SB1, SB2, SBP1 and SBP2.

Note: EUT transmit at maximum power in each case.

The intent is to test at 100% duty cycle; however, a small reduction in duty cycle (to no lower than 98%) is permitted if required by the EUT for amplitude control purposes. Band power function of the spectrum analyzer must be used.

A 20.5 dB offset was used for this test, which include the 20dB attenuator and cable losses.

FCC: KDB 789033 (E)(2)(b), method SA-1; Spectrum analyzer settings:

Resolution bandwidth:	1 MHz
Video bandwidth:	3 MHz
Detector mode:	RMS
Trace average:	At least 100 traces
Sweep time:	Auto
Number of points:	≥ 2 x span / RBW

8.1.4 Test data

This data was taken using as mentioned before, using the 4QAM modulation because it was determined as the worst case. All the frequencies were measured with a 10 MHz bandwidth, except middle channel which was measured at 10 MHz and 30 MHz bandwidth by manufacturer requirement.

OBW	SB1		Limit (dBm)	Margin (dB)	SB2		Limit (dBm)	Margin (dB)
	Frequency (MHz)	Power (dBm)			Frequency (MHz)	Power (dBm)		
10 MHz	5731	29.59	30	0.41	5761	29.56	30	0.44
10 MHz	5741	29.68	30	0.32	5771	29.43	30	0.57
10 MHz	5751	29.46	30	0.54	5781	29.32	30	0.68
30 MHz	5741	29.59	30	0.41	5771	29.44	30	0.56

Table 8.1-1: *Maximum conducted output power for SB1 and SB2 bands.*

OBW	SBP1		Limit (dBm)	Margin (dB)	SBP2		Limit (dBm)	Margin (dB)
	Frequency (MHz)	Power (dBm)			Frequency (MHz)	Power (dBm)		
10 MHz	5794	29.14	30	0.86	5824	29.15	30	0.85
10 MHz	5804	29.37	30	0.63	5834	29.34	30	0.66
10 MHz	5814	29.36	30	0.64	5844	29.55	30	0.45
30 MHz	5804	29.34	30	0.66	5834	29.37	30	0.63

Table 8.1-2: *Maximum conducted output power for SBP1 and SBP2 bands.*

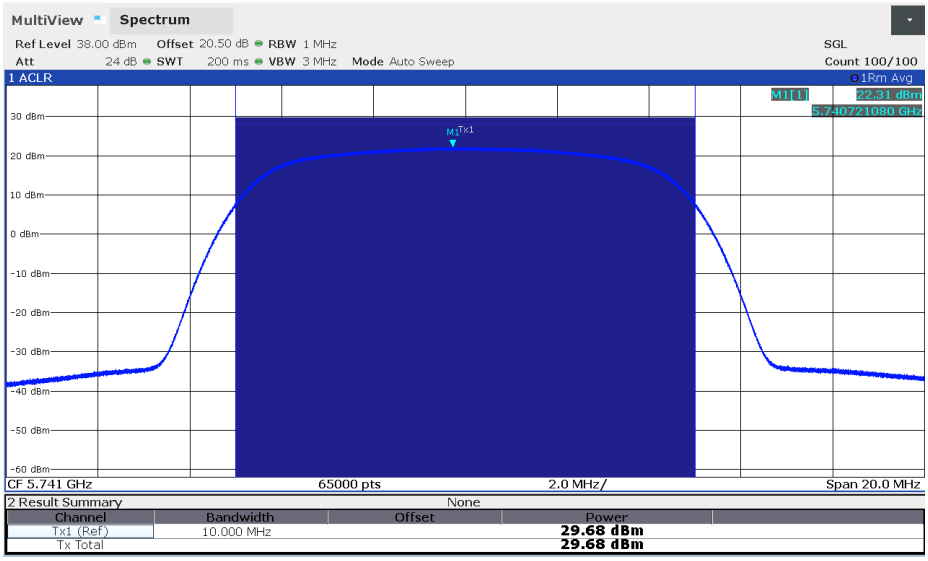


Figure 8.1-2: *Maximum conducted output power, SB1 band (5741 MHz channel, 10 MHz OBW)*

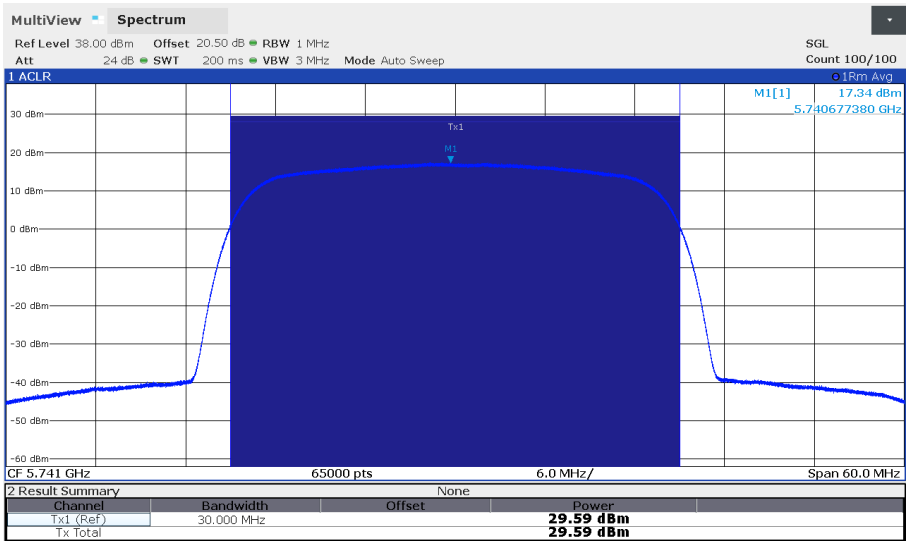


Figure 8.1-2: *Maximum conducted output power, SB1 band (5741 MHz channel, 30 MHz OBW)*

8.2 FCC 15.403(i) Emission bandwidth (EBW)

8.2.1 Definitions and limits

FCC:
For purposes of this subpart the emission bandwidth shall be determined by measuring the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, that are 26 dB down relative to the maximum level of the modulated carrier. Determination of the emissions bandwidth is based on the use of measurement instrumentation employing a peak detector function with an instrument resolution bandwidth approximately equal to 1.0 percent of the emission bandwidth of the device under measurement.

8.2.2 Test summary

Test date:	March 9, 2020	Temperature:	23 °C
Test engineer:	Martha Espinoza	Air pressure:	1002 mbar
Verdict:	Pass	Relative humidity:	32 %

8.2.3 Observations, settings and special notes

FCC: KDB 789033 (C)(1); Spectrum analyzer settings:

Resolution bandwidth:	1% of the emission bandwidth declared by manufacturer
Video bandwidth:	> RBW
Detector mode:	Peak
Trace mode:	Max hold

A 20.5 dB offset was used for this test, which include the 20dB attenuator and cable losses.

8.2.4 Test data

This data was taken using as mentioned before, using the 4QAM modulation because it was determined as the worst case. All the frequencies were measured with a 10 MHz bandwidth, except middle channel which was measured at 10 MHz and 30 MHz bandwidth by manufacturer requirement.

SB1		OBW declared by manufacturer	SB2		OBW declared by manufacturer
Frequency (MHz)	26 dB BW (MHz)		Frequency (MHz)	26 dB BW (MHz)	
5731	9.86	10 MHz	5761	9.83	10 MHz
5741	9.85	10 MHz	5771	9.85	10 MHz
5751	9.88	10 MHz	5781	9.84	10 MHz
5741	30.72	30 MHz	5771	30.75	30 MHz

Table 8.2-1: *26 dB emission bandwidth for SB1 and SB2 bands.*

SBP1		OBW declared by manufacturer	SBP2		OBW declared by manufacturer
Frequency (MHz)	26 dB BW (MHz)		Frequency (MHz)	26 dB BW (MHz)	
5794	9.87	10 MHz	5824	9.81	10 MHz
5804	9.88	10 MHz	5834	9.87	10 MHz
5814	9.86	10 MHz	5844	9.84	10 MHz
5804	30.59	30 MHz	5834	30.46	30 MHz

Table 8.2-2: *26 dB emission bandwidth for SBP1 and SBP2 bands.*

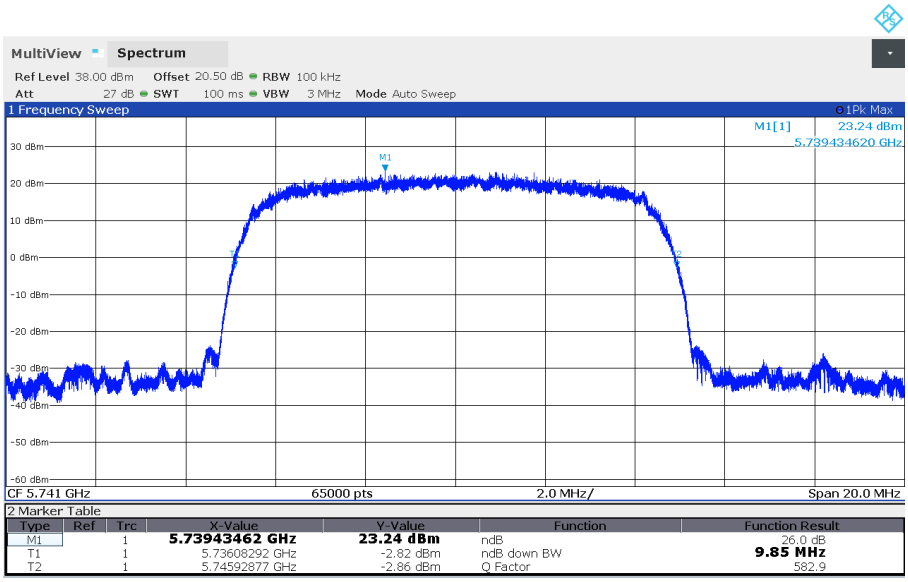


Figure 8.2-1: *26 dB emission bandwidth, SB1 band (5741 MHz channel, 10 MHz OBW)*

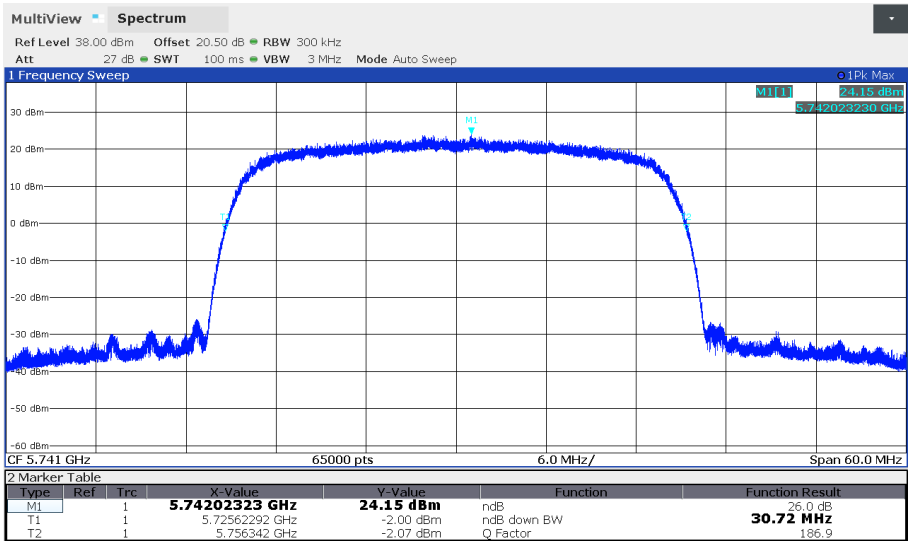


Figure 8.2-2: *26 dB emission bandwidth, SB1 band (5741 MHz channel, 30 MHz OBW)*

8.3 FCC 15.407(a)(5) Power Limits (PSD)

8.3.1 Definitions and limits

FCC:
For the band 5.725-5.85 GHz, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. However, fixed point-to-point U-NII devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.
(5) The maximum power spectral density is measured as a conducted emission by direct connection of a calibrated test instrument to the equipment under test. If the device cannot be connected directly, alternative techniques acceptable to the Commission may be used. Measurements in the 5.725-5.85 GHz band are made over a reference bandwidth of 500 kHz or the 26 dB emission bandwidth of the device, whichever is less. Measurements in the 5.15-5.25 GHz, 5.25-5.35 GHz, and the 5.47-5.725 GHz bands are made over a bandwidth of 1 MHz or the 26 dB emission bandwidth of the device, whichever is less. A narrower resolution bandwidth can be used, provided that the measured power is integrated over the full reference bandwidth.

8.3.2 Test summary

Test date:	March 9, 2020	Temperature:	23 °C
Test engineer:	Martha Espinoza	Air pressure:	1002 mbar
Verdict:	Pass	Relative humidity:	32%

8.3.3 Observations, settings and special notes

FCC: KDB 789033 (F)(1)
The rules require “maximum power spectral density” measurements where the intent is to measure the maximum value of the time average of the power spectral density measured during a period of continuous transmission. Refer to III.A for additional guidance for devices that use channel aggregation.
1. Create an average power spectrum for the EUT operating mode being tested by following the instructions in II.E.2. for measuring maximum conducted output power using a spectrum analyzer or EMI receiver: select the appropriate test method (SA-1, SA-2, SA-3, or alternatives to each) and apply it up to, but not including, the step labeled, “Compute power….” (This procedure is required even if the maximum conducted output power measurement was performed using a power meter, method PM.)
4. The result is the Maximum PSD over 1 MHz reference bandwidth.
5. For devices operating in the band 5.725−5.85 GHz, the rules specify a measurement bandwidth of 500 kHz. Many spectrum analyzers do not have 500 kHz RBW, thus a narrower RBW may need to be used. The rules permit the use of RBWs less than 1 MHz, or 500 kHz, “provided that the measured power is integrated over the full reference bandwidth” to show the total power over the specified measurement bandwidth (i.e., 1 MHz, or 500 kHz

FCC: KDB 789033 (E)(2)(b) method SA-1; Spectrum analyzer settings:

Resolution bandwidth:	500 kHz
Video bandwidth:	2 MHz
Detector mode:	RMS
Trace average:	At least 100 traces
Sweep time:	Auto
Number of points:	≥ 2 x span / RBW

A 20.5 dB offset was used for this test, which include the 20dB attenuator and cable losses.

8.3.4 Test data

This data was taken using as mentioned before, using the 4QAM modulation because it was determined as the worst case. All the frequencies were measured with a 10 MHz bandwidth, except middle channel which was measured at 10 MHz and 30 MHz bandwidth by manufacturer requirement.

OBW	SB1		Limit (dBm)	Margin (dB)	SB2		Limit (dBm)	Margin (dB)
	Frequency (MHz)	PSD (dBm)			Frequency (MHz)	PSD (dBm)		
10 MHz	5731	20.06	30	9.94	5761	19.68	30	10.32
10 MHz	5741	20.06	30	9.94	5771	19.54	30	10.46
10 MHz	5751	20.22	30	9.78	5781	19.50	30	10.50
30 MHz	5741	15.12	30	14.88	5771	14.58	30	15.42

Table 8.3-1: *Maximum power spectral density for SB1 and SB2 bands.*

OBW	SBP1		Limit (dBm)	Margin (dB)	SBP2		Limit (dBm)	Margin (dB)
	Frequency (MHz)	PSD (dBm)			Frequency (MHz)	PSD (dBm)		
10 MHz	5794	19.29	30	10.71	5824	19.35	30	10.65
10 MHz	5804	19.71	30	10.29	5834	19.73	30	10.27
10 MHz	5814	19.65	30	10.35	5844	19.84	30	10.16
30 MHz	5804	14.49	30	15.51	5834	14.47	30	15.53

Table 8.3-2: *Maximum power spectral density for SBP1 and SBP2 bands.*

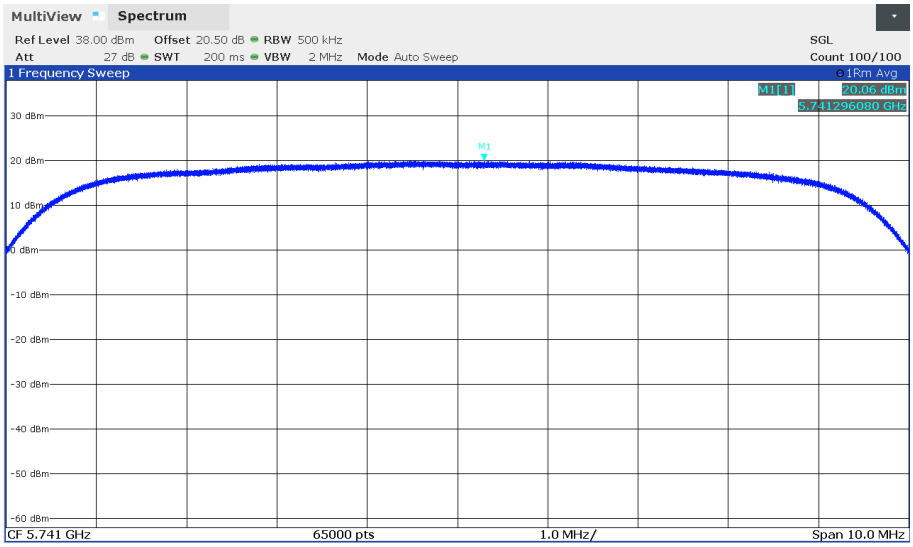


Figure 8.3-1: *Maximum power spectral density, SB1 band (5741 MHz channel, 10 MHz OBW)*

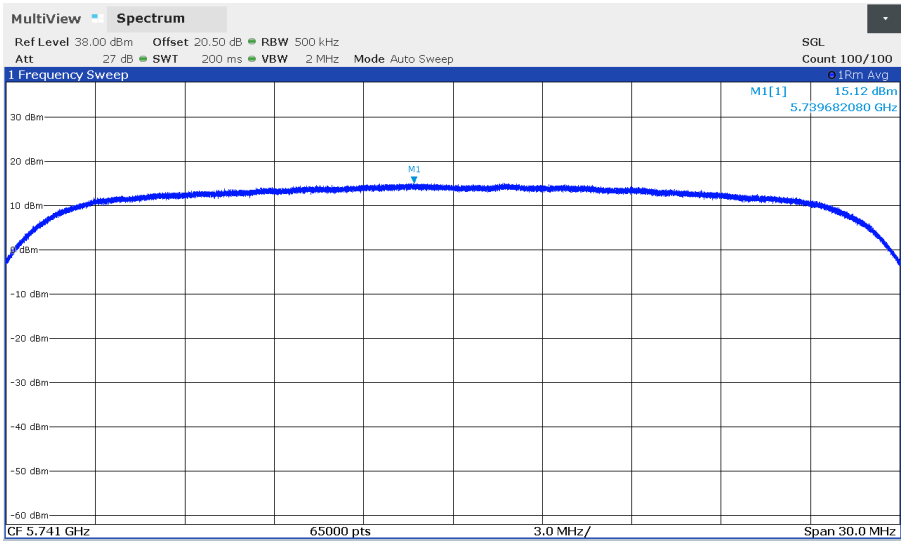


Figure 8.3-2: *Maximum power spectral density, SB1 band (5741 MHz channel, 30 MHz OBW)*

8.4 FCC 15.407(e) Minimum 6 dB bandwidth

8.4.1 Definitions and limits

FCC:
Within the 5.725-5.85 GHz band, the minimum 6 dB bandwidth of U-NII devices shall be at least 500 kHz.

ISED:
For equipment operating in the band 5725-5850 MHz, the minimum 6 dB bandwidth shall be at least 500 kHz.

8.4.2 Test summary

Test date:	March 11, 2020	Temperature:	24 °C
Test engineer:	Martha Espinoza	Air pressure:	1005 mbar
Verdict:	Pass	Relative humidity:	41 %

8.4.3 Observations, settings and special notes

FCC: KDB 789033 (F)(1)
Section 15.407(e) specifies the minimum 6 dB emission bandwidth of at least 500 kHz for the band 5.725−5.85 GHz. The following procedure shall be used for measuring this bandwidth:

FCC: KDB 789033 (C)(2)(b); Spectrum analyzer settings:

Resolution bandwidth:	100 kHz
Video bandwidth:	300 kHz
Detector mode:	Peak
Trace mode:	Max hold
Sweep time:	Auto

A 20.5 dB offset was used for this test, which include the 20dB attenuator and cable losses.

8.4.4 Test data

This data was taken using as mentioned before, using the 4QAM modulation because it was determined as the worst case. All the frequencies were measured with a 10 MHz bandwidth, except middle channel which was measured at 10 MHz and 30 MHz bandwidth by manufacturer requirement.

OBW Declared	SB1		Limit (kHz) at least	Margin (kHz)	SB2		Limit (kHz) at least	Margin (kHz)
	Frequency (MHz)	6 dB OBW (kHz)			Frequency (MHz)	Margin (kHz)		
10 MHz	5731	4820	500	4320	5761	4940	500	4440
10 MHz	5741	3460	500	2960	5771	4700	500	4200
10 MHz	5751	4960	500	4460	5781	4640	500	4140
30 MHz	5741	6240	500	5740	5771	10360	500	9860

Table 8.4-1: *Minimum 6 dB bandwidth for SB1 and SB2 bands.*

OBW Declared	SBP1		Limit (kHz) at least	Margin (kHz)	SBP2		Limit (kHz) at least	Margin (kHz)
	Frequency (MHz)	6 dB OBW (kHz)			Frequency (MHz)	Margin (kHz)		
10 MHz	5794	4310	500	3810	5824	5000	500	4500
10 MHz	5804	4380	500	3880	5834	4880	500	4380
10 MHz	5814	5100	500	4600	5844	6530	500	6030
30 MHz	5804	13810	500	133310	5834	16090	500	15590

Table 8.4-2: *Minimum 6 dB bandwidth for SBP1 and SBP2 bands.*

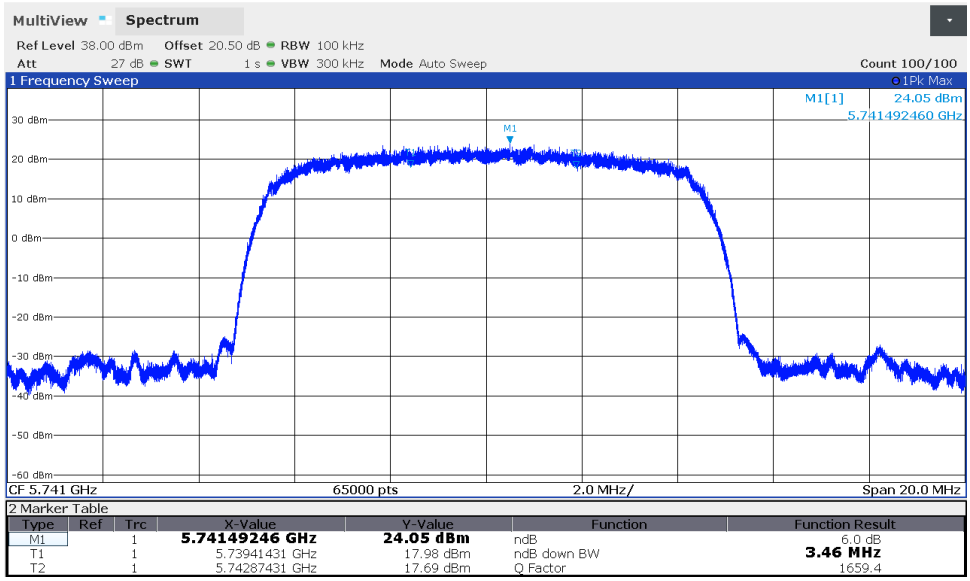


Figure 8.4-1: *Minimum 6 dB bandwidth, SB1 band (5741 MHz channel, 10 MHz OBW)*

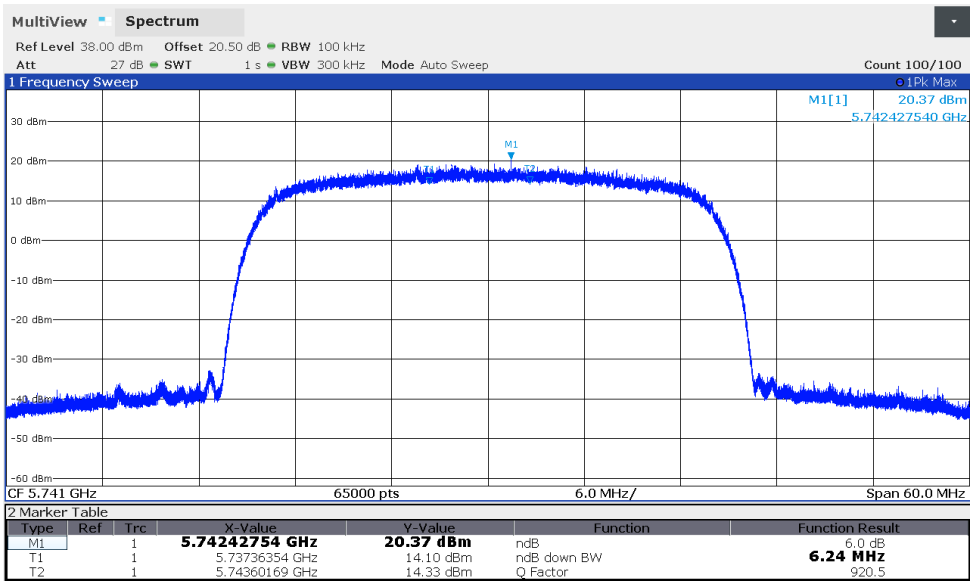


Figure 8.4-2: *Minimum 6 dB bandwidth, SB1 band (5741 MHz channel, 30 MHz OBW)*

8.5 FCC 15.407(b) and RSS-247 6.2.4.2 Spurious (out-of-band) emissions

8.5.1 Definitions and limits

FCC:

(b) *Undesirable emission limits.* Except as shown in paragraph (b)(7) of this section, the maximum emissions outside of the frequency bands of operation shall be attenuated in accordance with the following limits:

(1) For transmitters operating in the 5.15-5.25 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of −27 dBm/MHz.

(2) For transmitters operating in the 5.25-5.35 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of −27 dBm/MHz.

(3) For transmitters operating in the 5.47-5.725 GHz band: All emissions outside of the 5.47-5.725 GHz band shall not exceed an e.i.r.p. of −27 dBm/MHz.

(4) For transmitters operating in the 5.725-5.85 GHz band:
(i) All emissions shall be limited to a level of −27 dBm/MHz at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.

(5) The emission measurements shall be performed using a minimum resolution bandwidth of 1 MHz. A lower resolution bandwidth may be employed near the band edge, when necessary, provided the measured energy is integrated to show the total power over 1 MHz.

(6) Unwanted emissions below 1 GHz must comply with the general field strength limits set forth in §15.209. Further, any U-NII devices using an AC power line are required to comply also with the conducted limits set forth in §15.207

(7) The provisions of § 15.205 apply to intentional radiators operating under this section.

(8) When measuring the emission limits, the nominal carrier frequency shall be adjusted as close to the upper and lower frequency block edges as the design of the equipment permits.

15.205 Restricted bands of operation.

(a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090-0.110	16.42-16.423	399.9-410	4.5-5.15
[1]0.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2690-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	[2]
13.36-13.41			

[1]Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz. [2]Above 38.

ISED:

Devices operating in the band 5725-5850 MHz shall have e.i.r.p. of unwanted emissions comply with the following:
a) 27 dBm/MHz at frequencies from the band edges decreasing linearly to 15.6 dBm/MHz at 5 MHz above or below the band edges;
b) 15.6 dBm/MHz at 5 MHz above or below the band edges decreasing linearly to 10 dBm/MHz at 25 MHz above or below the band edges;
c) 10 dBm/MHz at 25 MHz above or below the band edges decreasing linearly to -27 dBm/MHz at 75 MHz above or below the band edges; and
d) -27 dBm/MHz at frequencies more than 75 MHz above or below the band edges.

8.5.2 Test summary

Test date:	16 – 20 March 2020	Temperature:	20; 23; 22; 21; 20 °C
Test engineer:	Martha Espinoza	Air pressure:	1002; 1002; 1004; 1005;1001 mbar
Verdict:	Pass	Relative humidity:	41; 45; 39; 42;48 %

8.5.3 Observations, settings and special notes

- The spectrum was searched from 30 MHz to 40 GHz.
- EUT was set to transmit with 100 % duty cycle.
- The out-of-band emissions were verified using channel bandwidth of 10 MHz (low, middle and high channels) and 30 MHz (only middle channel of each band). Low channel from the lowest band and high channel from the highest band were evaluated near the band-edges.
- In order to reduce the receiver noise floor, the measurements in the range from 1 GHz to 4.5 GHz were performed using a 5.15-5.85 GHz Notch filter. A 20 dB attenuator was used in the range from 4.5 to 6.4 GHz to measure the band edges section.
- To avoid the saturation of the test receiver, a combination of the 5-15-5.85 GHz Notch and 6.4-18 GHz High-pass filters were used for the measurements in the 6.4-18 GHz range. Measurements above 18 GHz were performed using 15-26 GHz and 22-40 GHz High-pass filters.
- An offset of 38 dB was used which corresponds to the nominal antenna peak gain in all the cases, except in the range from 15-22 GHz for sub-bands SB1P and SB2P where a 37.1 dB offset which corresponds to the antenna gain in the third harmonic was used. Note: These values were declared by manufacturer.
- Additional TDF correction factor was used to account for the losses in the test cable, attenuator and Notch/High-pass filters.
- 100 kHz RBW was used in some measurements (above 1 GHz measurements) because 1 MHz RBW plot has less than 6 dB below from limit line (because of high noise floor caused by use of attenuator) and with this change of RBW seeks to show there are not any spurious in the frequency range sought.
- This data was taken using as mentioned before, using the 4QAM modulation because it was determined as the worst case. All the frequencies were measured with a 10 MHz bandwidth, except middle channel which was measured at 10 MHz and 30 MHz bandwidth by manufacturer requirement.

Spectrum analyzer for peak conducted measurements below 1 GHz:

Resolution bandwidth:	100 kHz
Video bandwidth:	300 kHz
Detector mode:	Peak
Trace mode:	Max Hold

Spectrum analyzer for peak conducted measurements above 1 GHz:

Resolution bandwidth:	1 MHz
Video bandwidth:	3 MHz
Detector mode:	Peak
Trace mode:	Max Hold

8.5.4 Test data

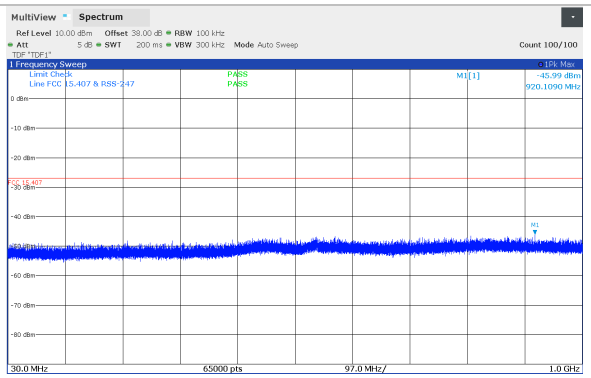


Figure 8.5-1: Conducted spurious emissions 0.03 – 1 GHz, 10 MHz Channel BW, Low channel (5731 MHz), SB1 Band

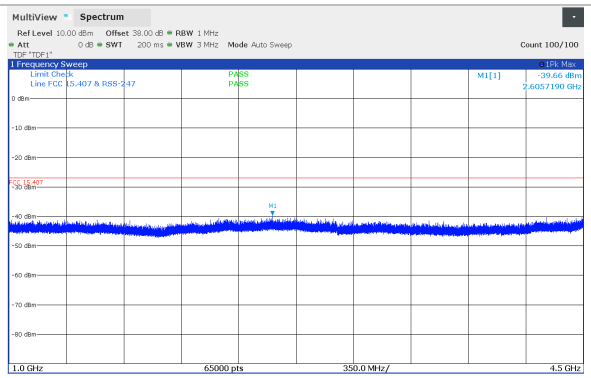


Figure 8.5-2: Conducted spurious emissions 1 – 4.5 GHz, 10 MHz Channel BW, Low channel (5731 MHz), SB1 Band

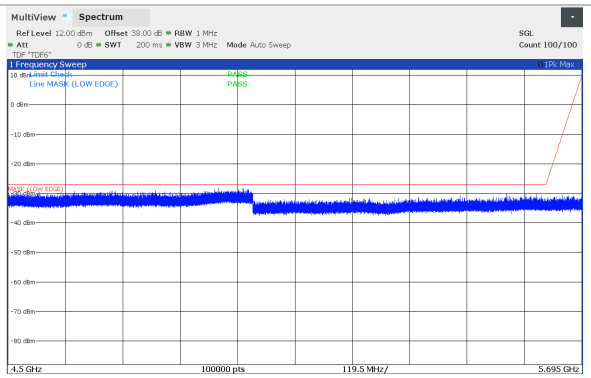


Figure 8.5-3: Conducted spurious emissions 4.5 – 5.695 GHz, 10 MHz Channel BW, Low channel (5731 MHz), SB1 Band

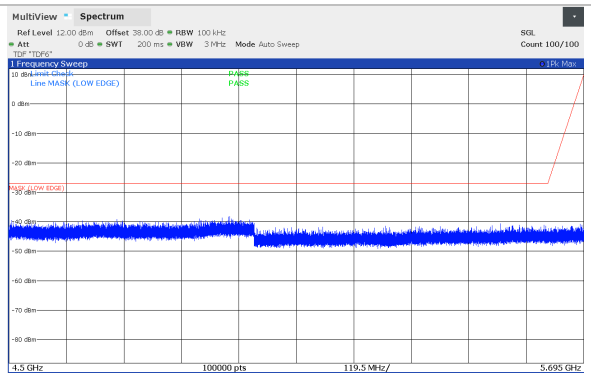


Figure 8.5-4: Conducted spurious emissions 4.5 – 5.695 GHz, 10 MHz Channel BW, Low channel (5731 MHz), SB1 Band, <u>*100 kHz RBW</u>

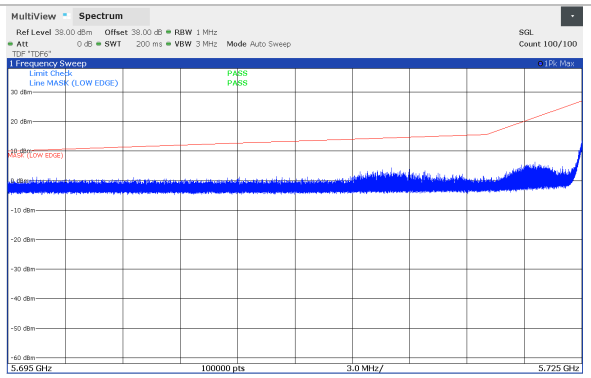


Figure 8.5-5: Conducted spurious emissions 5.695 – 5.725 GHz, 10 MHz Channel BW, Low channel (5731 MHz), SB1 Band

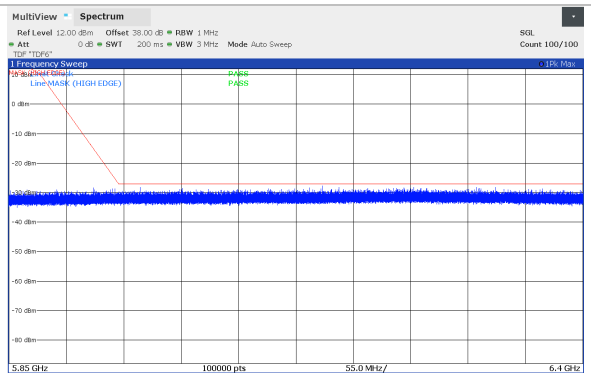


Figure 8.5-6: Conducted spurious emissions 5.850 – 6.4 GHz, 10 MHz Channel BW, Low channel (5731 MHz), SB1 Band

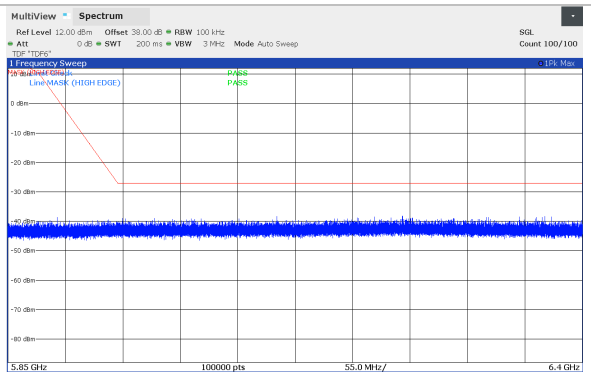


Figure 8.5-7: Conducted spurious emissions 5.850 – 6.4 GHz, 10 MHz Channel BW, Low channel (5731 MHz), SB1 Band, *100 kHz RBW

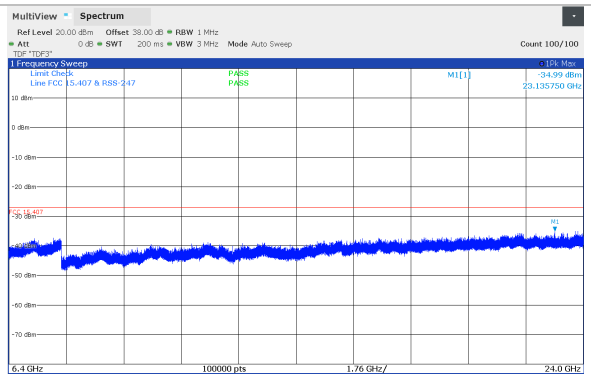


Figure 8.5-8: Conducted spurious emissions 6.4 - 24 GHz, 10 MHz Channel BW, Low channel (5731 MHz), SB1 Band

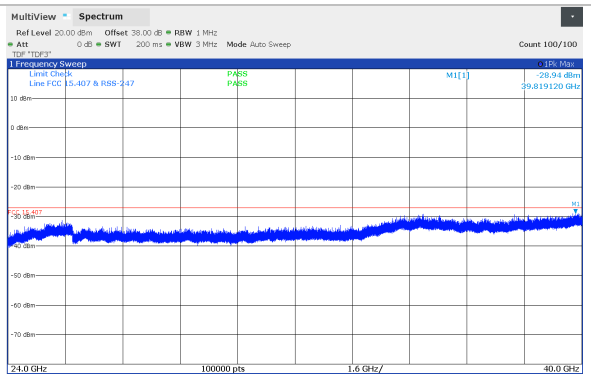


Figure 8.5-9: Conducted spurious emissions 24 - 40 GHz, 10 MHz Channel BW, Low channel (5731 MHz), SB1 Band

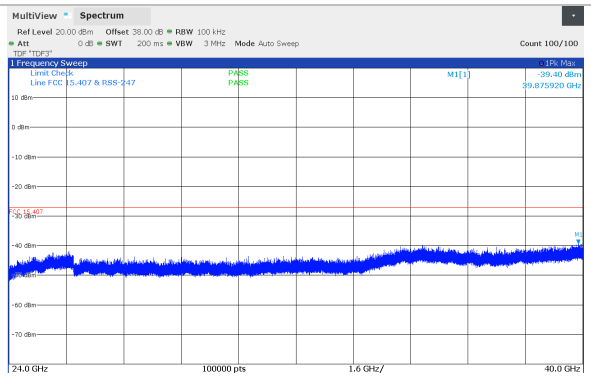


Figure 8.5-10: Conducted spurious emissions 24 - 40 GHz, 10 MHz Channel BW, Low channel (5731 MHz), SB1 Band, *100 kHz RBW

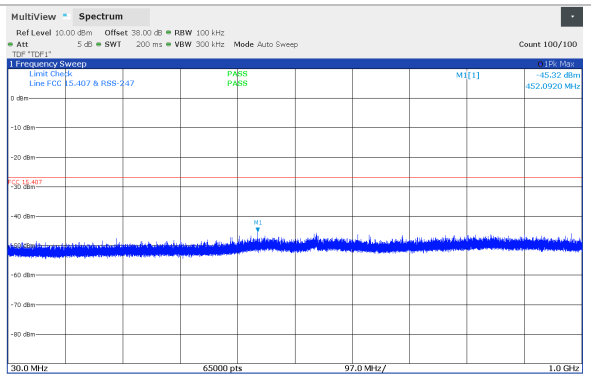


Figure 8.5-11: Conducted spurious emissions 0.03 - 1 GHz, 10 MHz Channel BW, Middle channel (5741 MHz), SB1 Band

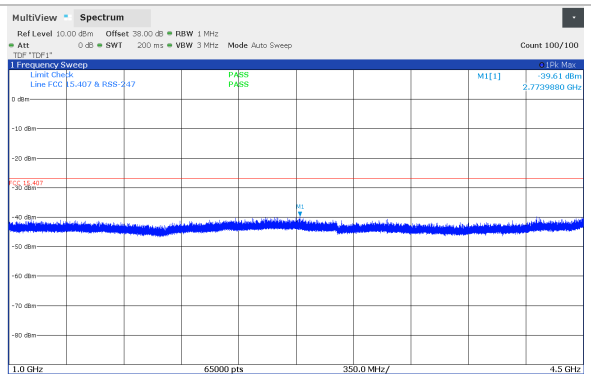


Figure 8.5-12: Conducted spurious emissions 1 – 4.5 GHz, 10 MHz Channel BW, Middle channel (5741 MHz), SB1 Band

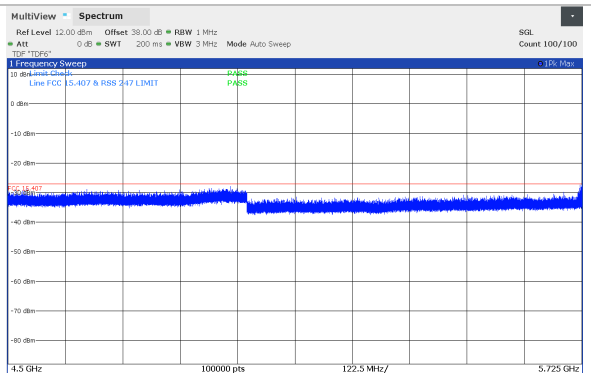


Figure 8.5-13: Conducted spurious emissions 4.5 – 5.725 GHz, 10 MHz Channel BW, Middle channel (5741 MHz), SB1 Band

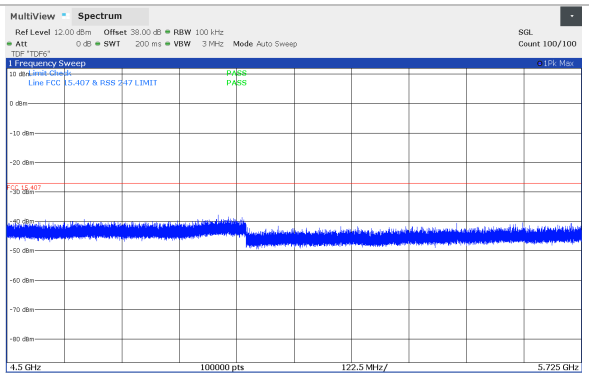


Figure 8.5-14: Conducted spurious emissions 4.5 – 5.725 GHz, 10 MHz Channel BW, Middle channel (5741 MHz), SB1 Band, <u>*100 kHz RBW</u>

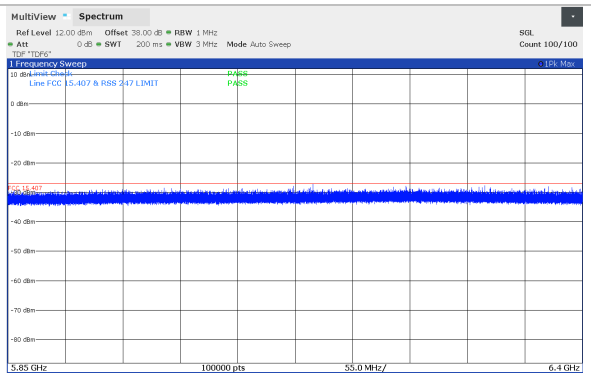


Figure 8.5-15: Conducted spurious emissions 5.850 – 6.4 GHz, 10 MHz Channel BW, Middle channel (5741 MHz), SB1 Band

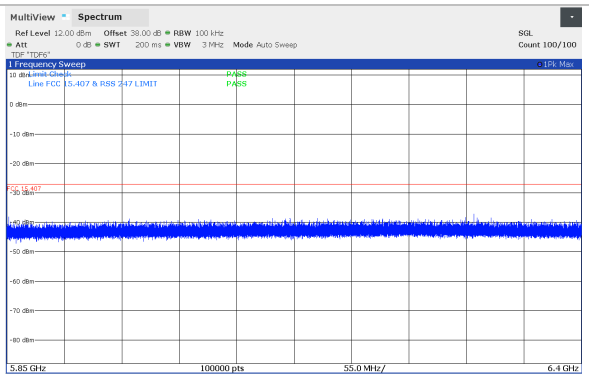


Figure 8.5-16: Conducted spurious emissions 5.850 – 6.4 GHz, 10 MHz Channel BW, Middle channel (5741 MHz), SB1 Band, <u>*100 kHz RBW</u>

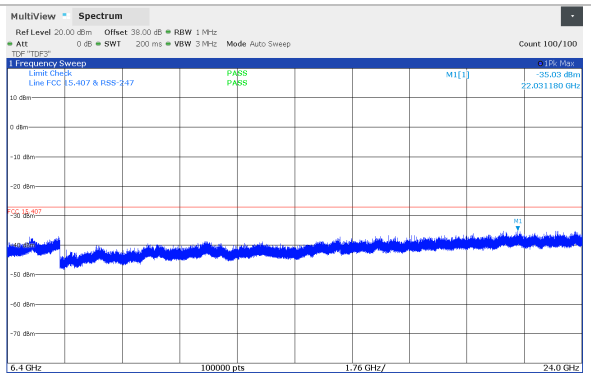


Figure 8.5-17: Conducted spurious emissions 6.4 - 24 GHz, 10 MHz Channel BW, Middle channel (5741 MHz), SB1 Band

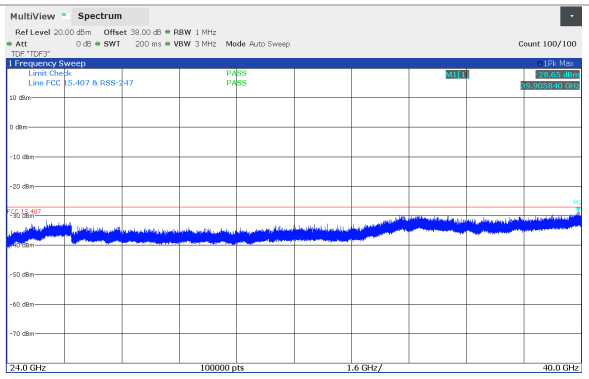


Figure 8.5-18: Conducted spurious emissions 24 - 40 GHz, 10 MHz Channel BW, Middle channel (5741 MHz), SB1 Band

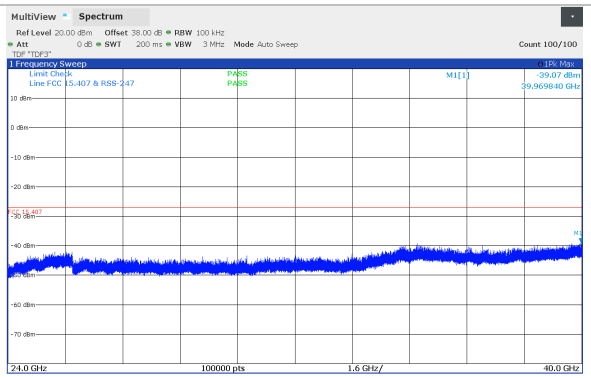


Figure 8.5-19: Conducted spurious emissions 24 - 40 GHz, 10 MHz Channel BW, Middle channel (5741 MHz), SB1 Band, *100 kHz RBW

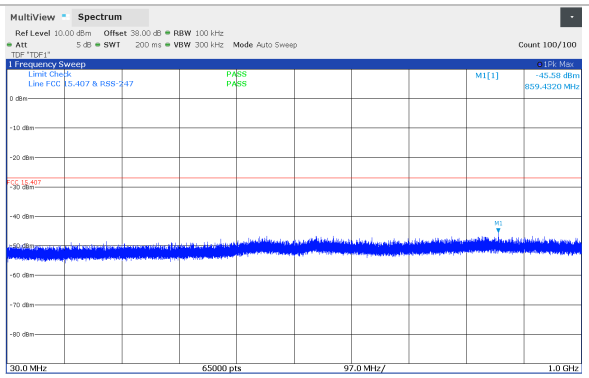


Figure 8.5-20: Conducted spurious emissions 0.03 - 1 GHz, 30 MHz Channel BW, Middle channel (5741 MHz), SB1 Band

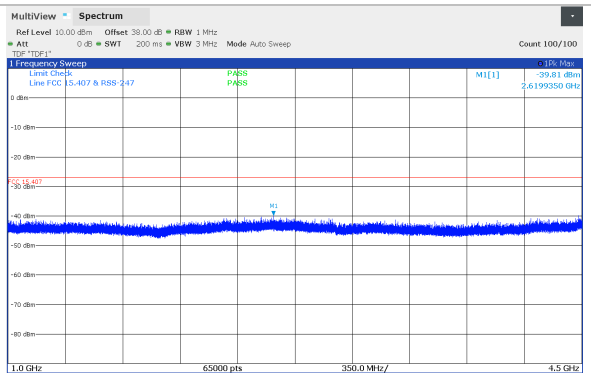


Figure 8.5-21: Conducted spurious emissions 1 – 4.5 GHz, 30 MHz Channel BW, Middle channel (5741 MHz), SB1 Band

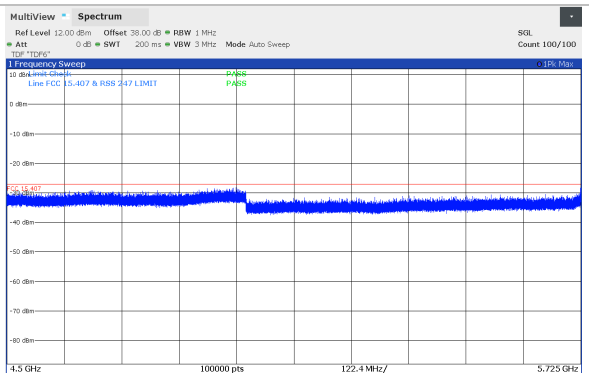


Figure 8.5-22: Conducted spurious emissions 4.5 – 5.725 GHz, 30 MHz Channel BW, Middle channel (5741 MHz), SB1 Band

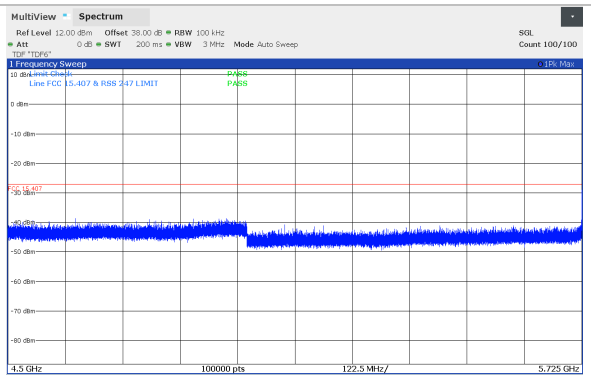


Figure 8.5-23: Conducted spurious emissions 4.5 – 5.725 GHz, 30 MHz Channel BW, Middle channel (5741 MHz), SB1 Band, *100 kHz RBW

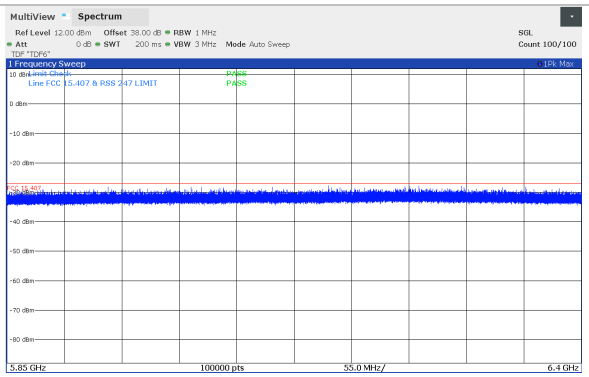


Figure 8.5-24: Conducted spurious emissions 5.850 – 6.4 GHz, 30 MHz Channel BW, Middle channel (5741 MHz), SB1 Band

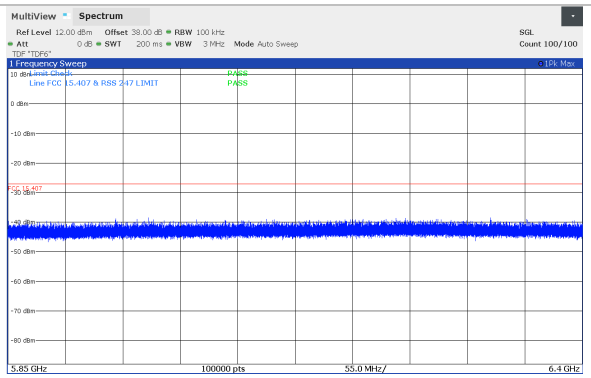


Figure 8.5-25: Conducted spurious emissions 5.850 – 6.4 GHz, 30 MHz Channel BW, Middle channel (5741 MHz), SB1 Band, *100 kHz RBW

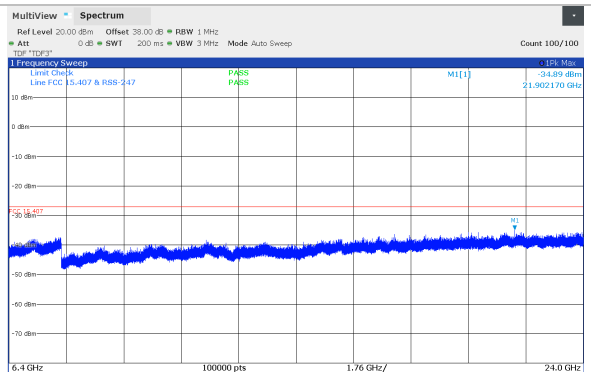


Figure 8.5-26: Conducted spurious emissions 6.4 - 24 GHz, 30 MHz Channel BW, Middle channel (5741 MHz), SB1 Band

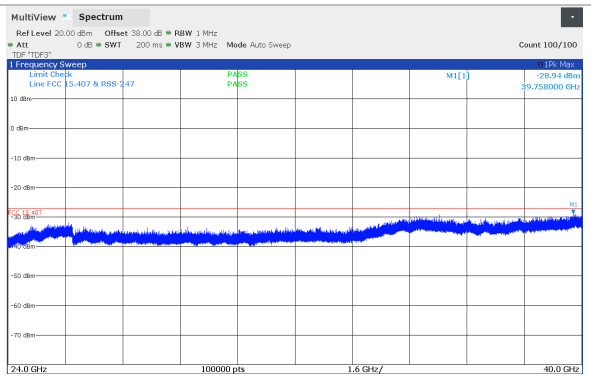


Figure 8.5-27: Conducted spurious emissions 24 - 40 GHz, 30 MHz Channel BW, Middle channel (5741 MHz), SB1 Band

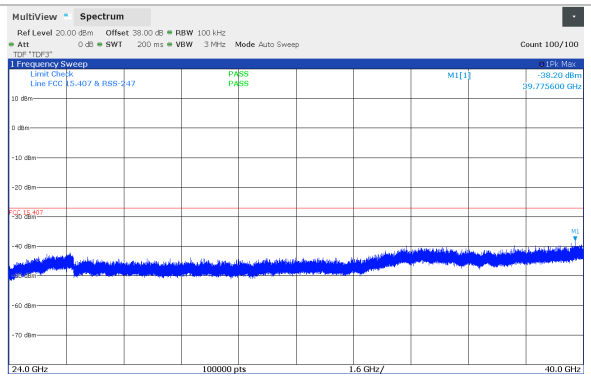


Figure 8.5-28: Conducted spurious emissions 24 - 40 GHz, 30 MHz Channel BW, Middle channel (5741 MHz), SB1 Band, *100 kHz RBW

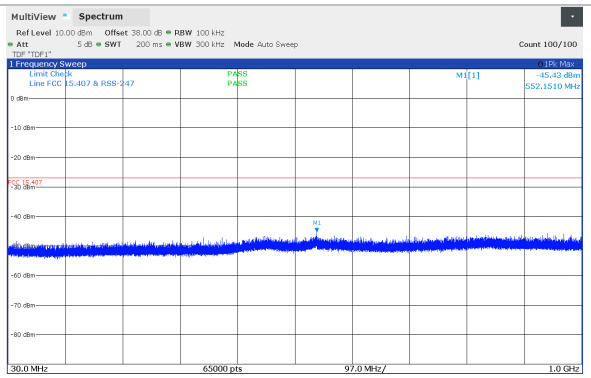


Figure 8.5-29: Conducted spurious emissions 0.03 - 1 GHz, 10 MHz Channel BW, High channel (5751 MHz), SB1 Band

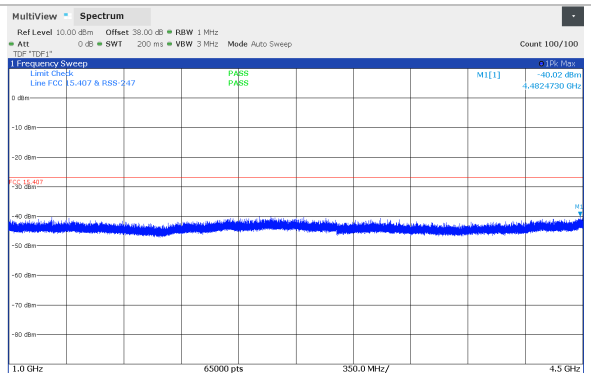


Figure 8.5-30: Conducted spurious emissions 1 – 4.5 GHz, 10 MHz Channel BW, High channel (5751 MHz), SB1 Band

8.5.4 Test data continued

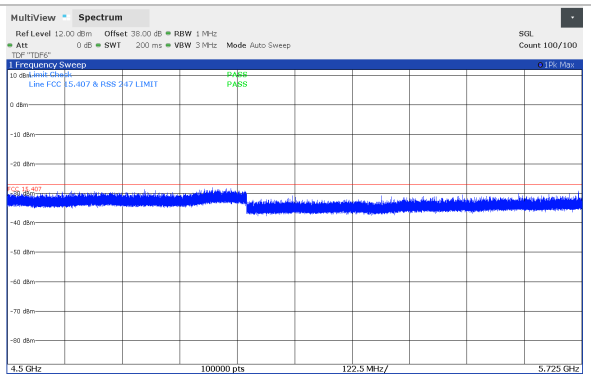


Figure 8.5-31: Conducted spurious emissions 4.5 – 5.725 GHz, 10 MHz Channel BW, High channel (5751 MHz), SB1 Band

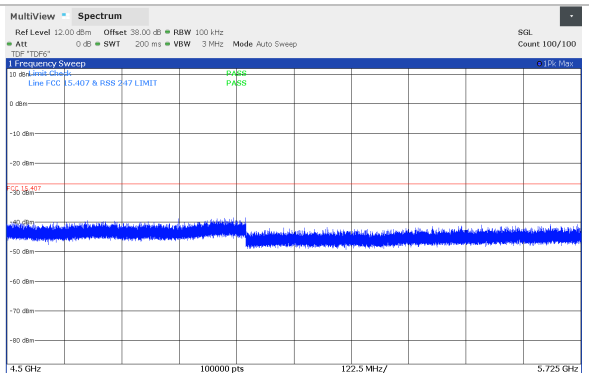


Figure 8.5-32: Conducted spurious emissions 4.5 – 5.725 GHz, 10 MHz Channel BW, High channel (5751 MHz), SB1 Band, *100 kHz RBW

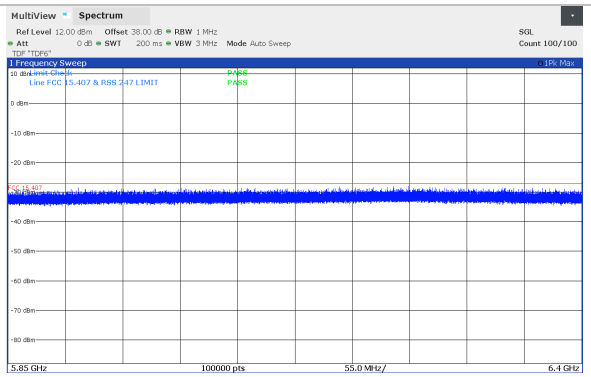


Figure 8.5-33: Conducted spurious emissions 5.850 – 6.4 GHz, 10 MHz Channel BW, High channel (5751 MHz), SB1 Band

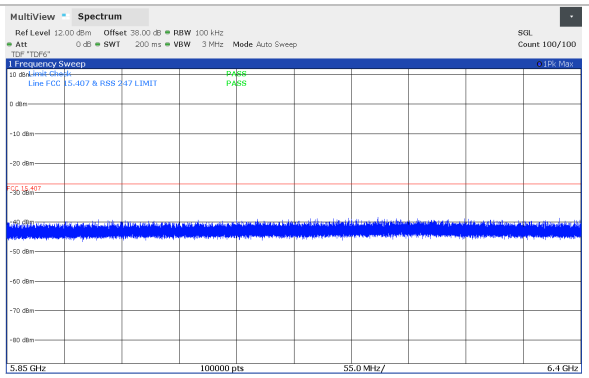


Figure 8.5-34: Conducted spurious emissions 5.850 – 6.4 GHz, 10 MHz Channel BW, High channel (5751 MHz), SB1 Band, *100 kHz RBW

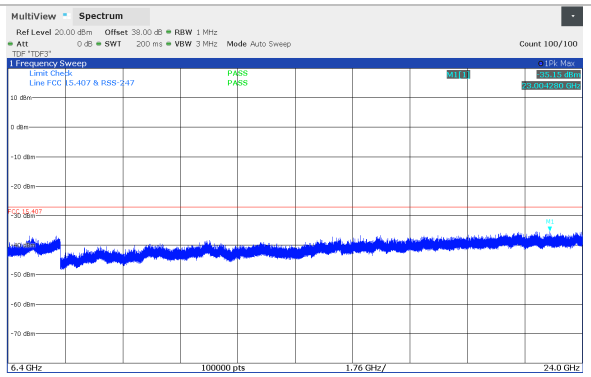


Figure 8.5-35: Conducted spurious emissions 6.4 - 24 GHz, 10 MHz Channel BW, High channel (5751 MHz), SB1 Band

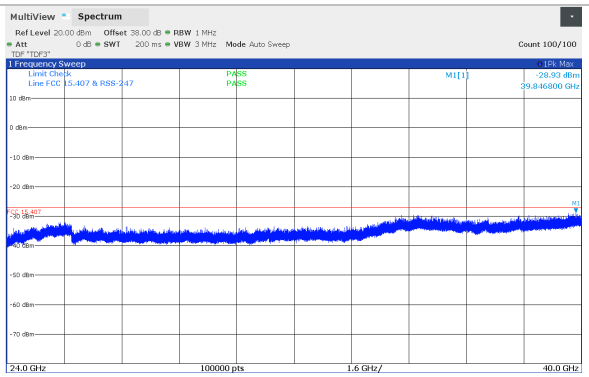


Figure 8.5-36: Conducted spurious emissions 24 - 40 GHz, 10 MHz Channel BW, High channel (5751 MHz), SB1 Band

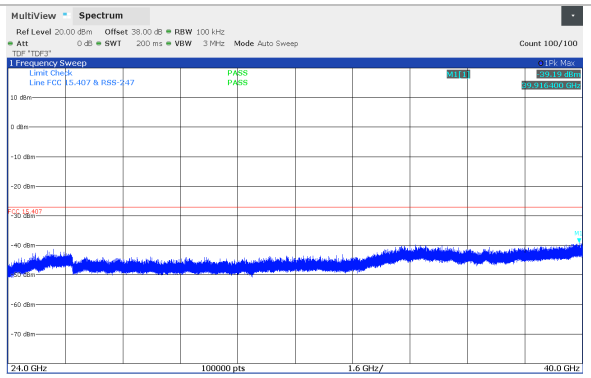


Figure 8.5-37: Conducted spurious emissions 24 - 40 GHz, 10 MHz Channel BW, High channel (5751 MHz), SB1 Band, *100 kHz RBW

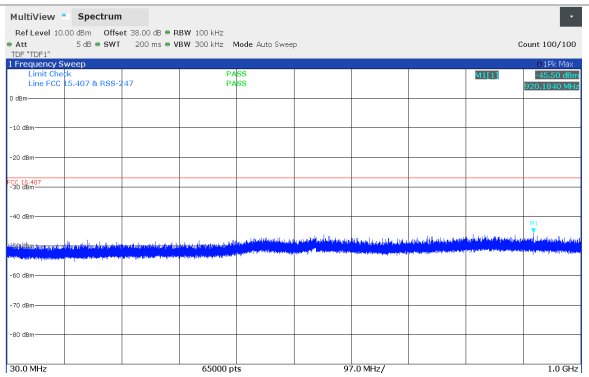


Figure 8.5-38: Conducted spurious emissions 0.03 - 1 GHz, 10 MHz Channel BW, Low channel (5761 MHz), SB2 Band

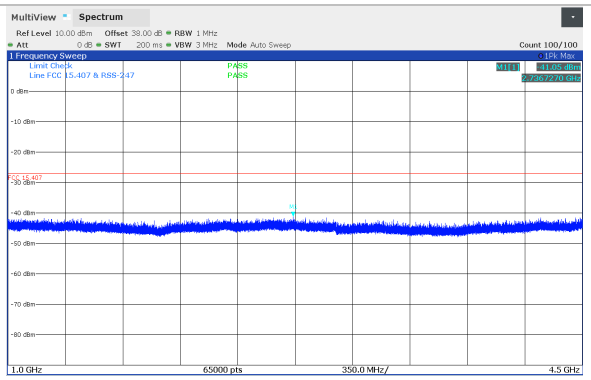


Figure 8.5-39: Conducted spurious emissions 1 – 4.5 GHz, 10 MHz Channel BW, Low channel (5761 MHz), SB2 Band

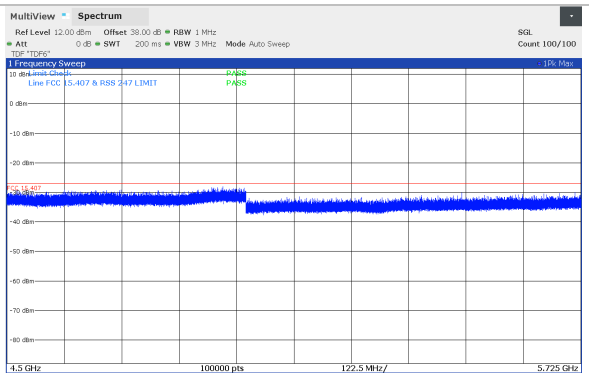


Figure 8.5-40: Conducted spurious emissions 4.5 – 5.725 GHz, 10 MHz Channel BW, Low channel (5761 MHz), SB2 Band

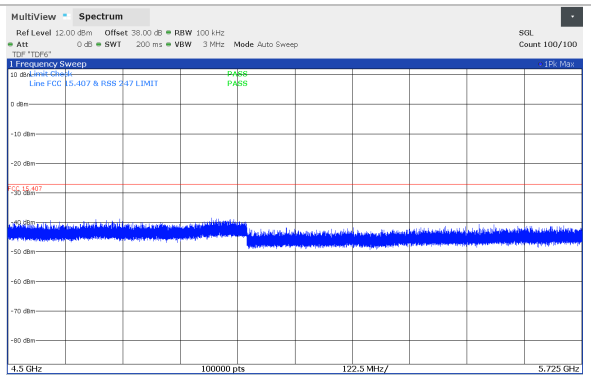


Figure 8.5-41: Conducted spurious emissions 4.5 – 5.725 GHz, 10 MHz Channel BW, Low channel (5761 MHz), SB2 Band, *100 kHz RBW

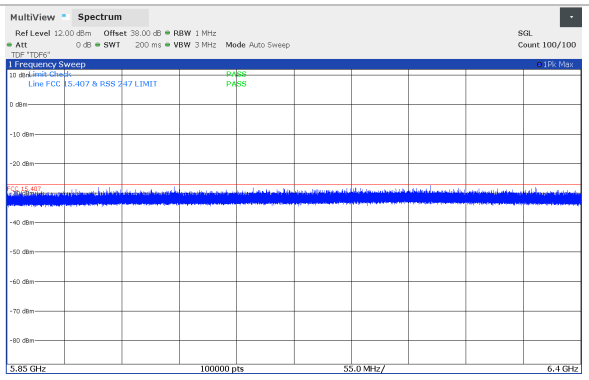


Figure 8.5-42: Conducted spurious emissions 5.850 – 6.4 GHz, 10 MHz Channel BW, Low channel (5761 MHz), SB2 Band

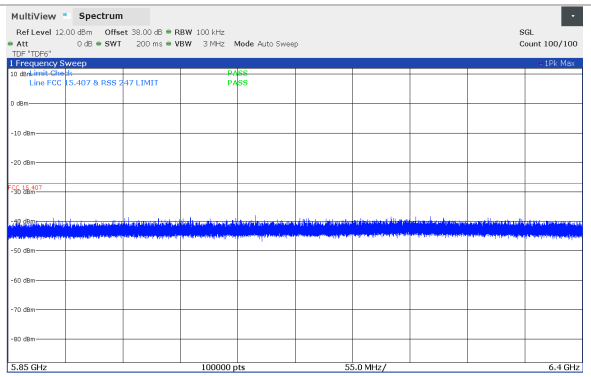


Figure 8.5-43: Conducted spurious emissions 5.850 – 6.4 GHz, 10 MHz Channel BW, Low channel (5761 MHz), SB2 Band, *100 kHz RBW

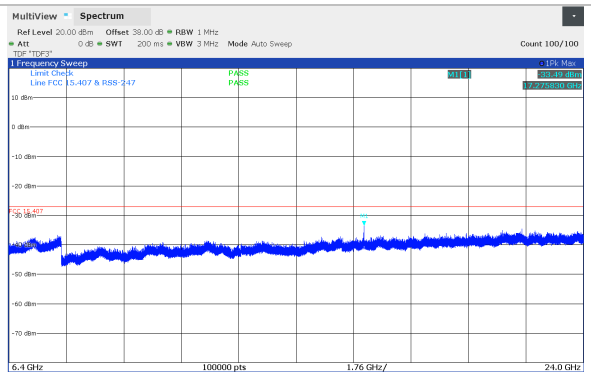


Figure 8.5-44 Conducted spurious emissions 6.4 - 24 GHz, 10 MHz Channel BW, Low channel (5761 MHz), SB2 Band

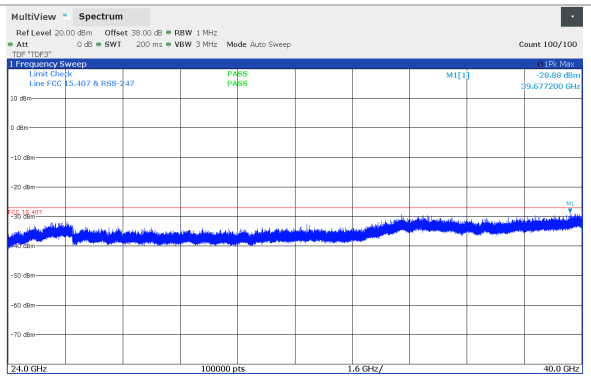


Figure 8.5-45: Conducted spurious emissions 24 - 40 GHz, 10 MHz Channel BW, Low channel (5761 MHz), SB2 Band

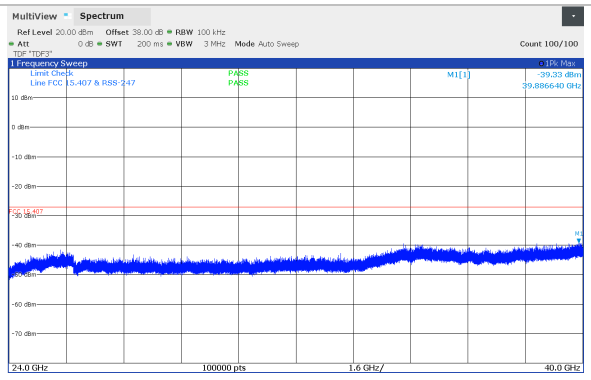


Figure 8.5-46: Conducted spurious emissions 24 - 40 GHz, 10 MHz Channel BW, Low channel (5761 MHz), SB2 Band, *100 kHz RBW

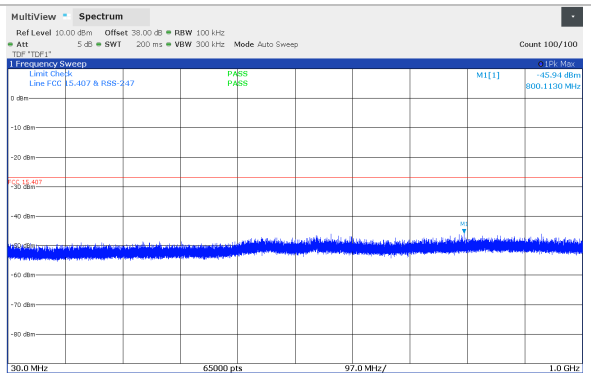


Figure 8.5-47: Conducted spurious emissions 0.03 - 1 GHz, 10 MHz Channel BW, Middle channel (5771 MHz), SB2 Band

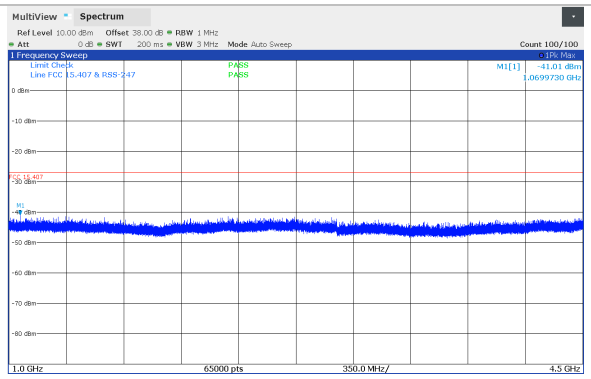


Figure 8.5-48: Conducted spurious emissions 1 – 4.5 GHz, 10 MHz Channel BW, Middle channel (5771 MHz), SB2 Band

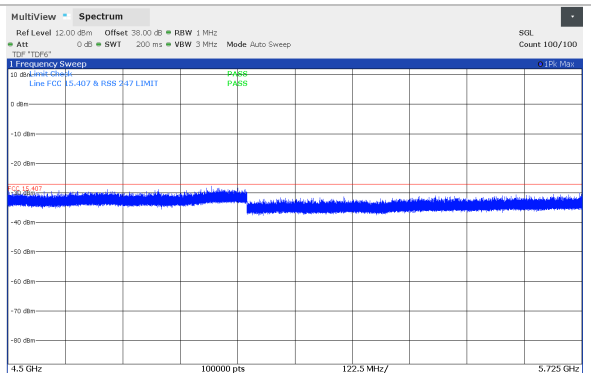


Figure 8.5-49: Conducted spurious emissions 4.5 – 5.725 GHz, 10 MHz Channel BW, Middle channel (5771 MHz), SB2 Band

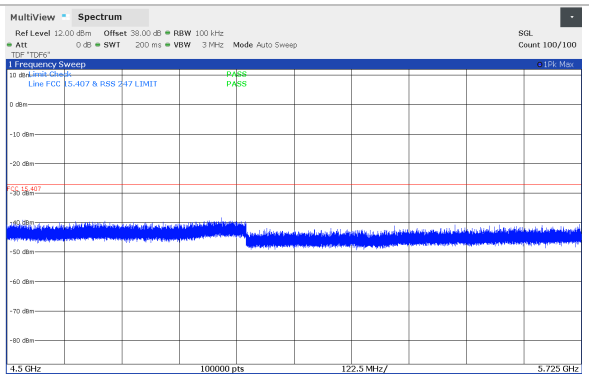


Figure 8.5-50 Conducted spurious emissions 4.5 – 5.725 GHz, 10 MHz Channel BW, Middle channel (5771 MHz), SB2 Band, <u>*100 kHz RBW</u>

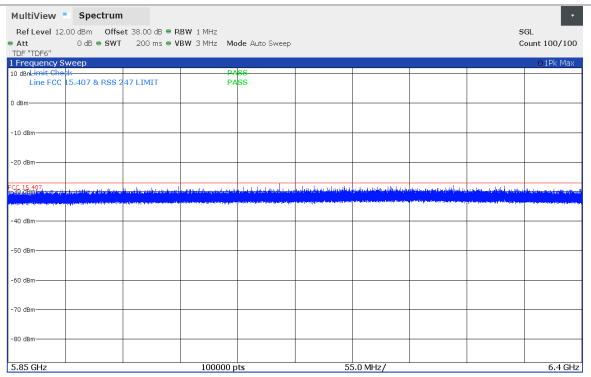


Figure 8.5-51: Conducted spurious emissions 5.850 – 6.4 GHz, 10 MHz Channel BW, Middle channel (5771 MHz), SB2 Band

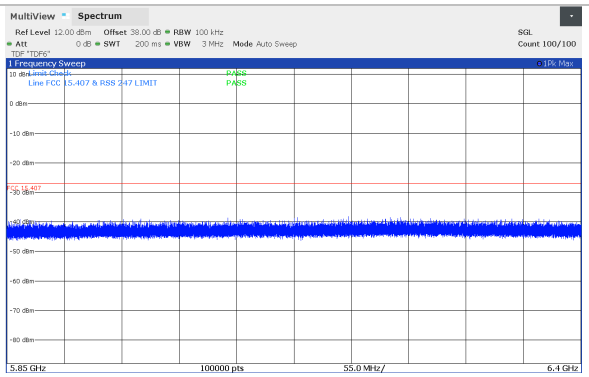


Figure 8.5-52: Conducted spurious emissions 5.850 – 6.4 GHz, 10 MHz Channel BW, Middle channel (5771 MHz), SB2 Band, <u>*100 kHz RBW</u>

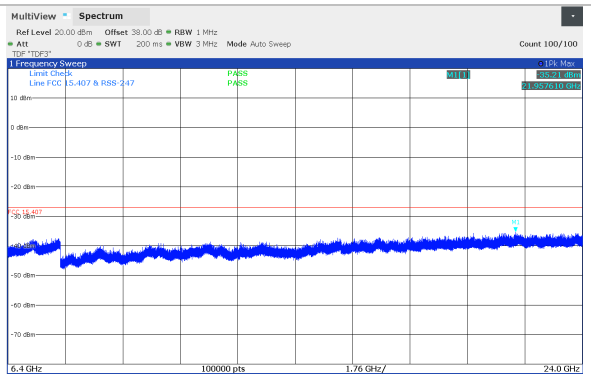


Figure 8.5-53: Conducted spurious emissions 6.4 - 24 GHz, 10 MHz Channel BW, Middle channel (5771 MHz), SB2 Band

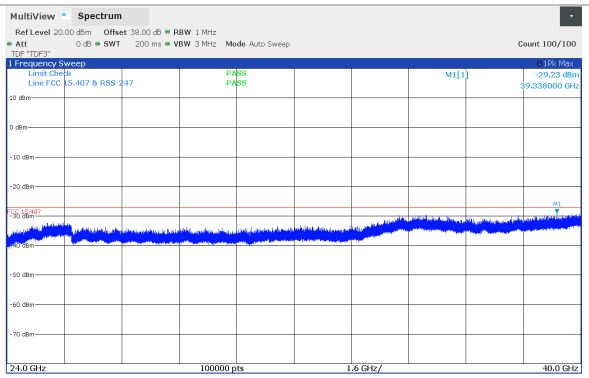


Figure 8.5-54: Conducted spurious emissions 24 - 40 GHz, 10 MHz Channel BW, Middle channel (5771 MHz), SB2 Band

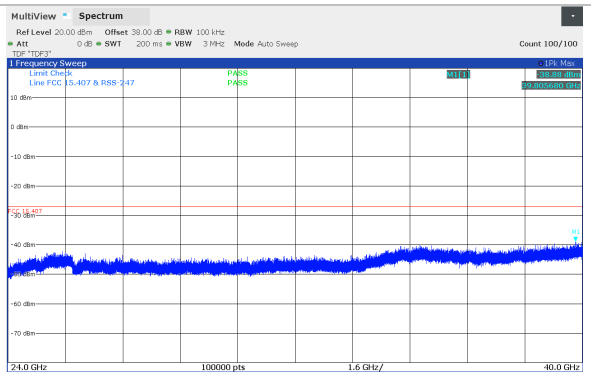


Figure 8.5-55: Conducted spurious emissions 24 - 40 GHz, 10 MHz Channel BW, Middle channel (5771 MHz), SB2 Band, *100 kHz RBW

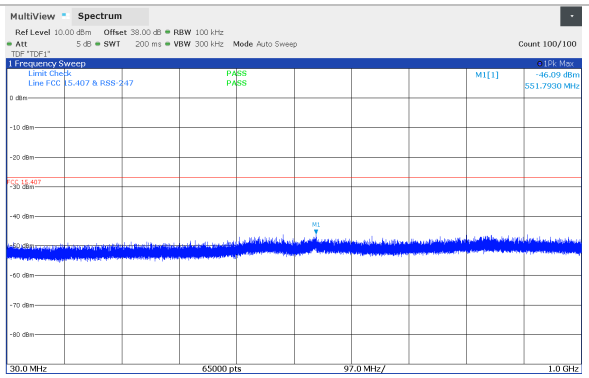


Figure 8.5-56: Conducted spurious emissions 0.03 - 1 GHz, 30 MHz Channel BW, Middle channel (5771 MHz), SB2 Band

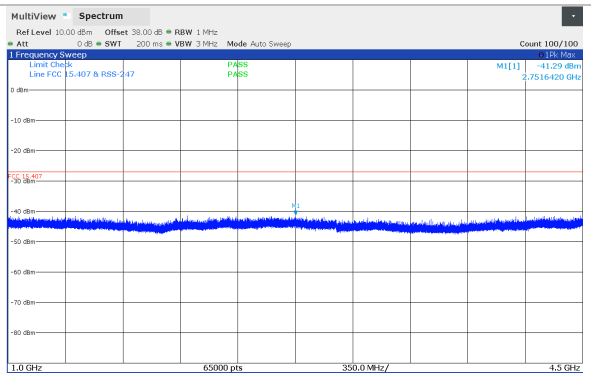


Figure 8.5-57: Conducted spurious emissions 1 – 4.5 GHz, 30 MHz Channel BW, Middle channel (5771 MHz), SB2 Band

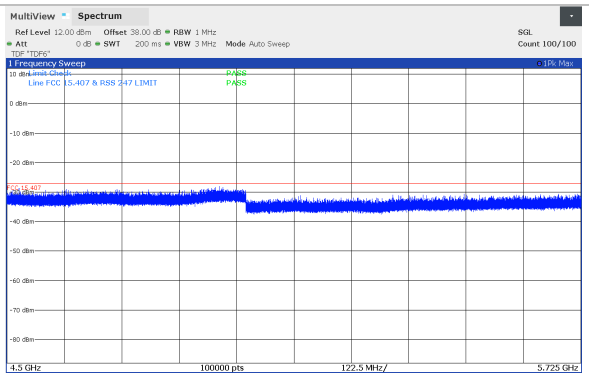


Figure 8.5-58: Conducted spurious emissions 4.5 – 5.725 GHz, 30 MHz Channel BW, Middle channel (5771 MHz), SB2 Band

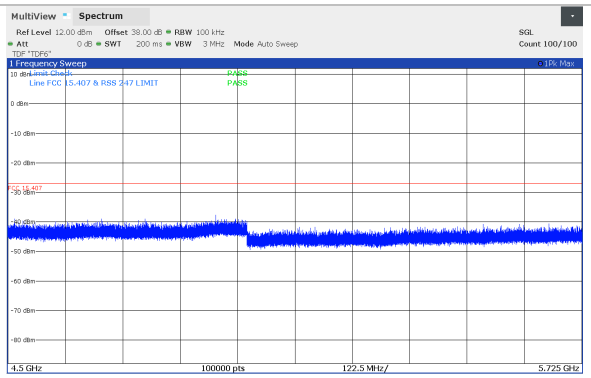


Figure 8.5-59: Conducted spurious emissions 4.5 – 5.725 GHz, 30 MHz Channel BW, Middle channel (5771 MHz), SB2 Band, *100 kHz RBW

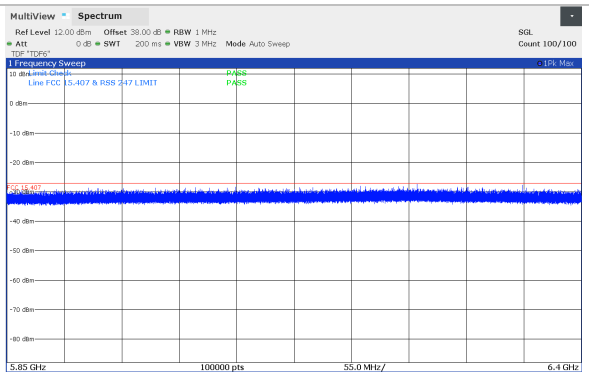


Figure 8.5-60: Conducted spurious emissions 5.850 – 6.4 GHz, 30 MHz Channel BW, Middle channel (5771 MHz), SB2 Band

8.5.4 Test data continued

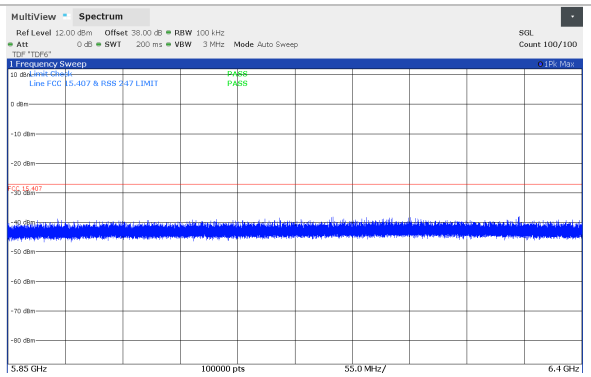


Figure 8.5-61: Conducted spurious emissions 5.850 – 6.4 GHz, 30 MHz Channel BW, Middle channel (5771 MHz), SB2 Band, *100 kHz RBW

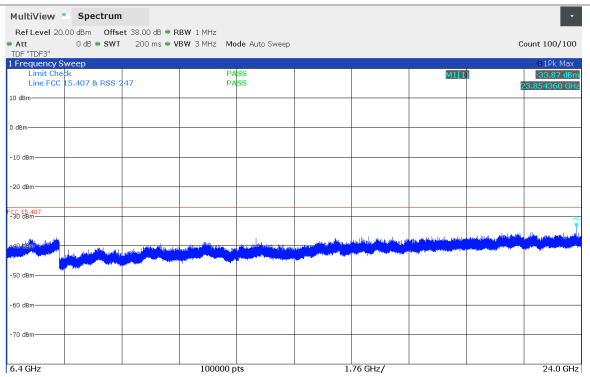


Figure 8.5-62: Conducted spurious emissions 6.4 – 24 GHz, 30 MHz Channel BW, Middle channel (5771 MHz), SB2 Band

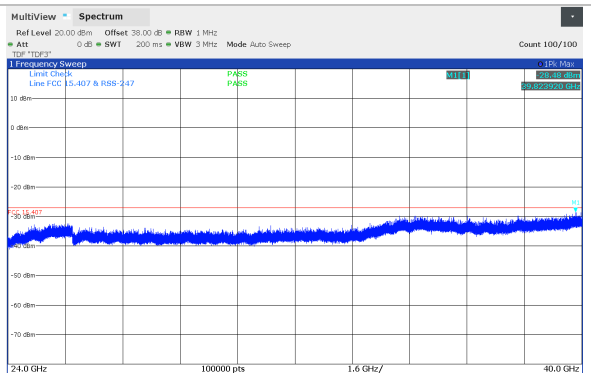


Figure 8.5-63: Conducted spurious emissions 24 - 40 GHz, 30 MHz Channel BW, Middle channel (5771 MHz), SB2 Band

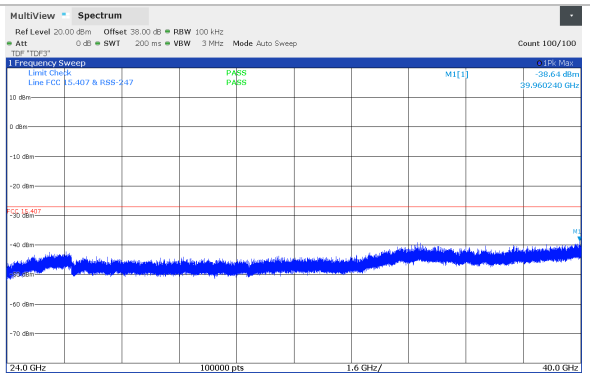


Figure 8.5-64: Conducted spurious emissions 24 - 40 GHz, 30 MHz Channel BW, Middle channel (5771 MHz), SB2 Band, *100 kHz RBW

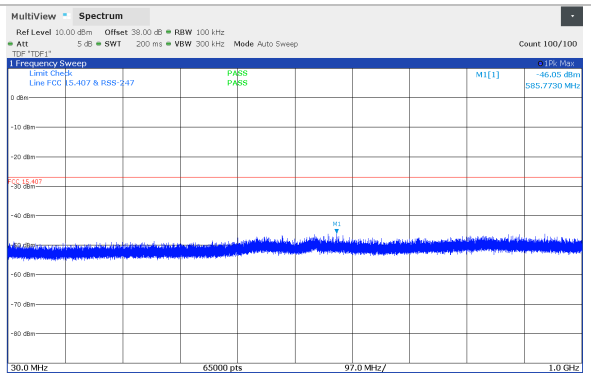


Figure 8.5-65: Conducted spurious emissions 0.03 - 1 GHz, 10 MHz Channel BW, High channel (5781 MHz), SB2 Band

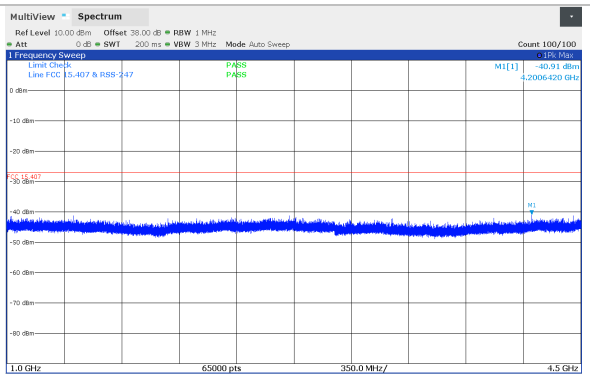


Figure 8.5-66: Conducted spurious emissions 1 – 4.5 GHz, 10 MHz Channel BW, High channel (5781 MHz), SB2 Band

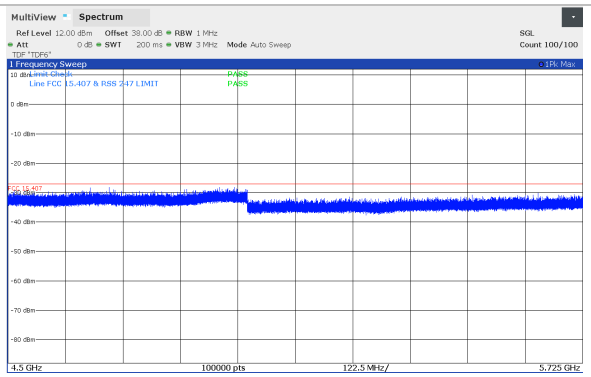


Figure 8.5-67: Conducted spurious emissions 4.5 – 5.725 GHz, 10 MHz Channel BW, High channel (5781 MHz), SB2 Band

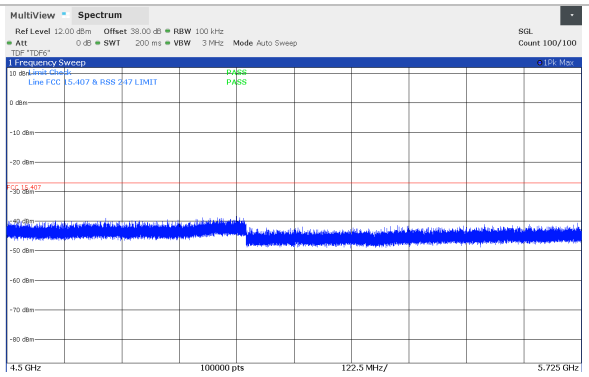


Figure 8.5-68: Conducted spurious emissions 4.5 – 5.725 GHz, 10 MHz Channel BW, High channel (5781 MHz), SB2 Band, *100 kHz RBW

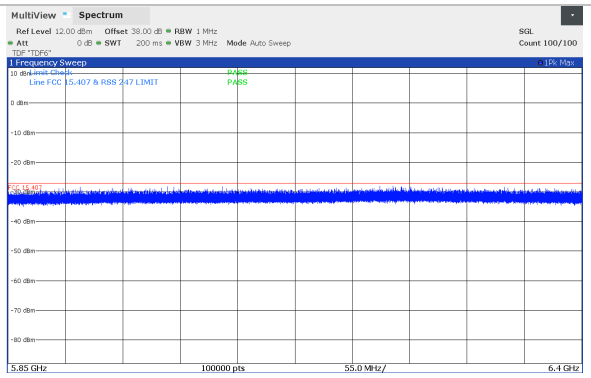


Figure 8.5-69: Conducted spurious emissions 5.850 – 6.4 GHz, 10 MHz Channel BW, High channel (5781 MHz), SB2 Band

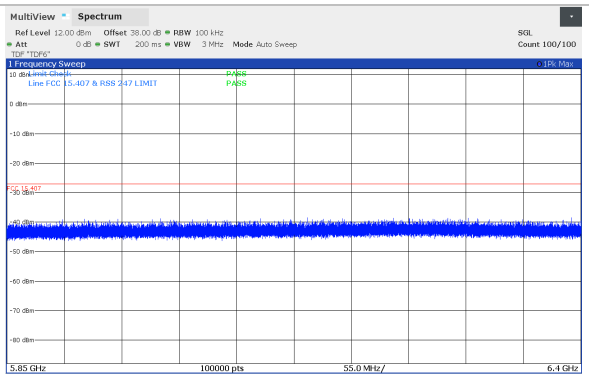


Figure 8.5-70: Conducted spurious emissions 5.850 – 6.4 GHz, 10 MHz Channel BW, High channel (5781 MHz), SB2 Band, *100 kHz RBW

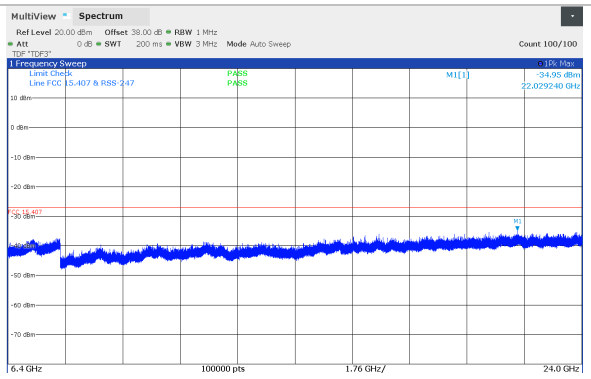


Figure 8.5-71: Conducted spurious emissions 6.4 - 24 GHz, 10 MHz Channel BW, High channel (5781 MHz), SB2 Band

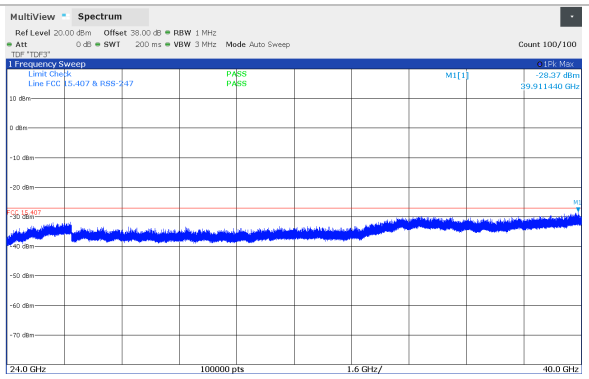


Figure 8.5-72: Conducted spurious emissions 24 - 40 GHz, 10 MHz Channel BW, High channel (5781 MHz), SB2 Band

8.5.4 Test data continued

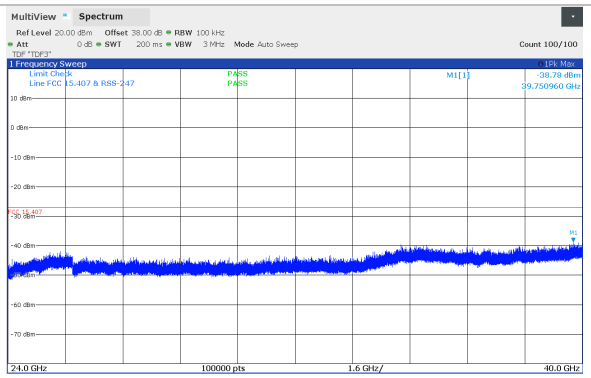


Figure 8.5-73: Conducted spurious emissions 24 - 40 GHz, 10 MHz Channel BW, High channel (5781 MHz), SB2 Band, *100 kHz RBW

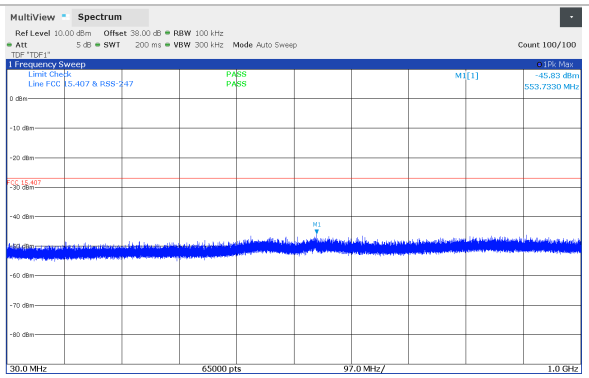


Figure 8.5-74: Conducted spurious emissions 0.03 - 1 GHz, 10 MHz Channel BW, Low channel (5794 MHz), SB1P Band

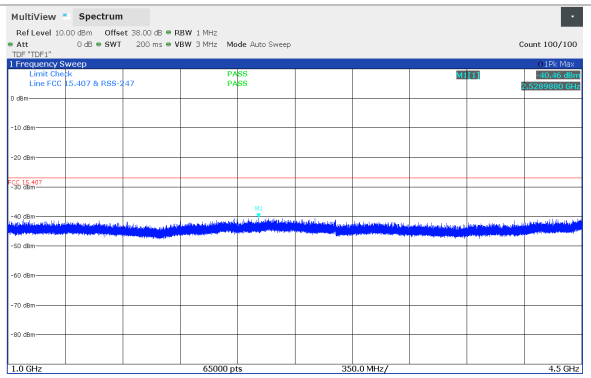


Figure 8.5-75: Conducted spurious emissions 1 – 4.5 GHz, 10 MHz Channel BW, Low channel (5794 MHz), SB1P Band

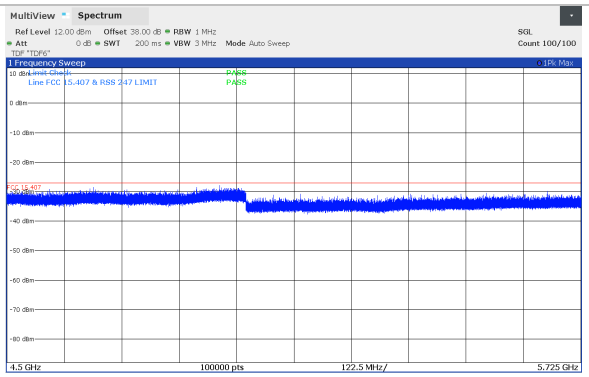


Figure 8.5-76: Conducted spurious emissions 4.5 – 5.725 GHz, 10 MHz Channel BW, Low channel (5794 MHz), SB1P Band

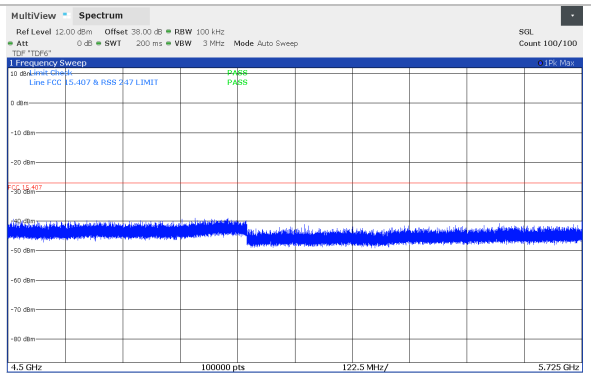


Figure 8.5-77: Conducted spurious emissions 4.5 – 5.725 GHz, 10 MHz Channel BW, Low channel (5794 MHz), SB1P Band, *100 kHz RBW

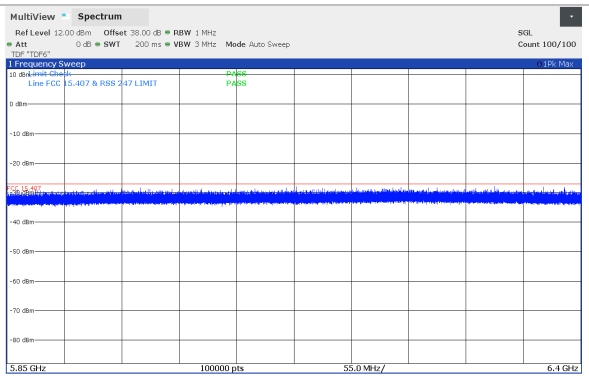


Figure 8.5-78: Conducted spurious emissions 5.850 – 6.4 GHz, 10 MHz Channel BW, Low channel (5794 MHz), SB1P Band

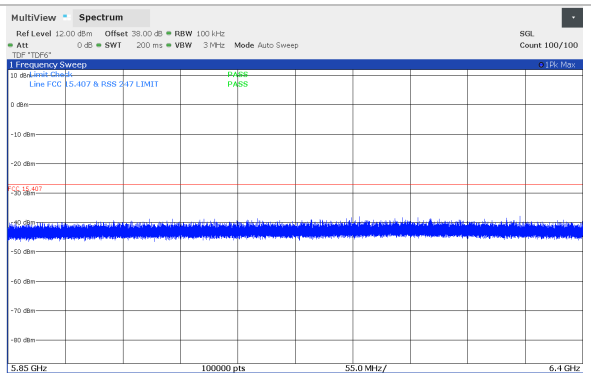


Figure 8.5-79: Conducted spurious emissions 5.850 – 6.4 GHz, 10 MHz Channel BW, Low channel (5794 MHz), SB1P Band, <u>*100 kHz RBW</u>

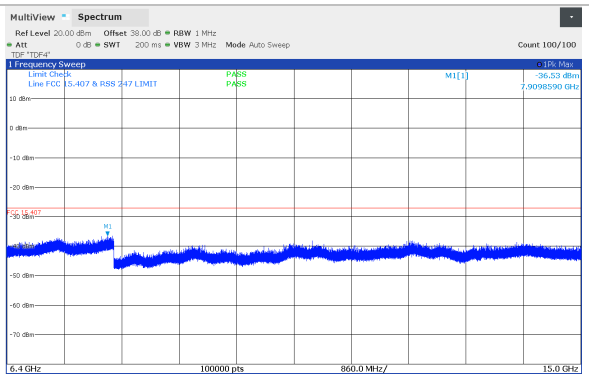


Figure 8.5-80: Conducted spurious emissions 6.4 – 15 GHz, 10 MHz Channel BW, Low channel (5794 MHz), SB1P Band

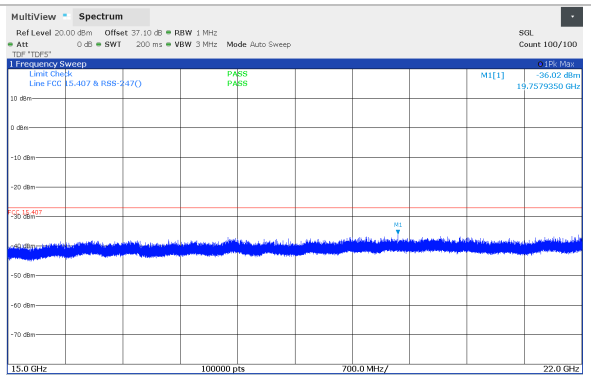


Figure 8.5-81: Conducted spurious emissions 15 - 22 GHz, 10 MHz Channel BW, Low channel (5794 MHz), SB1P Band

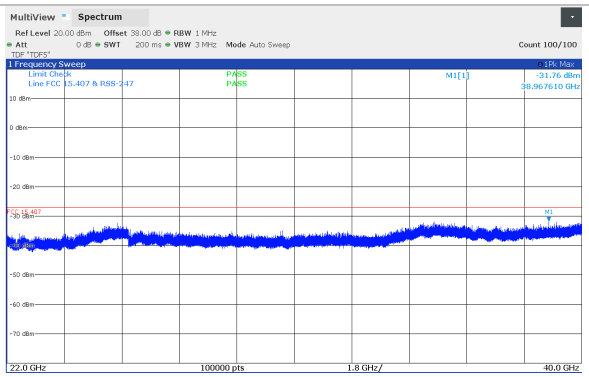


Figure 8.5-82: Conducted spurious emissions 22 - 40 GHz, 10 MHz Channel BW, Low channel (5794 MHz), SB1P Band

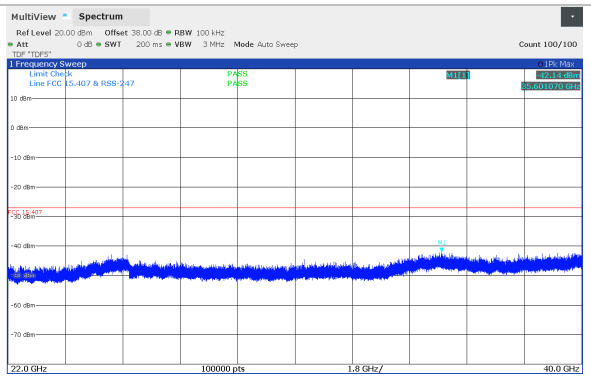


Figure 8.5-83: Conducted spurious emissions 22 - 40 GHz, 10 MHz Channel BW, Low channel (5794 MHz), SB1P Band, <u>*100 kHz RBW</u>

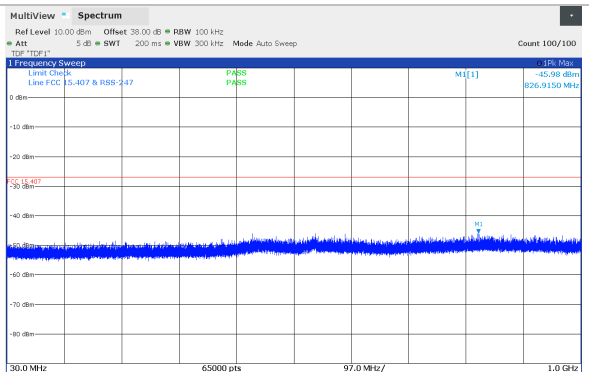


Figure 8.5-84: Conducted spurious emissions 0.03 - 1 GHz, 10 MHz Channel BW, Middle channel (5804 MHz), SB1P Band

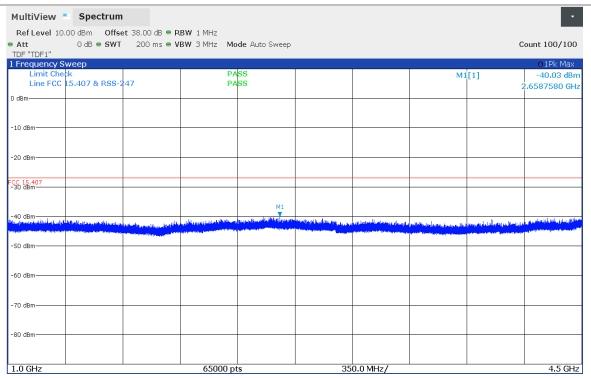


Figure 8.5-85: Conducted spurious emissions 1 – 4.5 GHz, 10 MHz Channel BW, Middle channel (5804 MHz), SB1P Band

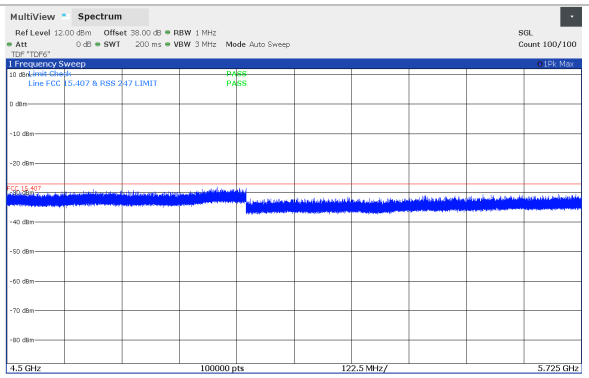


Figure 8.5-86: Conducted spurious emissions 4.5 – 5.725 GHz, 10 MHz Channel BW, Middle channel (5804 MHz), SB1P Band

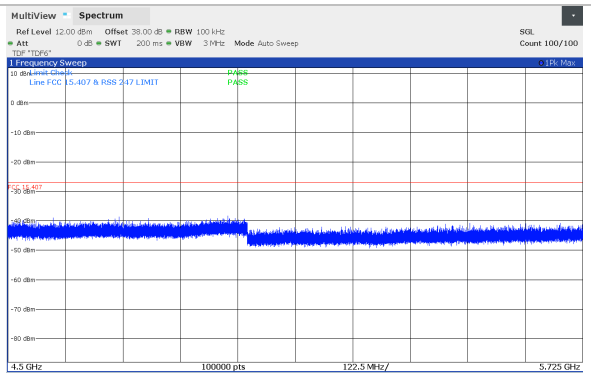


Figure 8.5-87: Conducted spurious emissions 4.5 – 5.725 GHz, 10 MHz Channel BW, Middle channel (5804 MHz), SB1P Band, <u>*100 kHz RBW</u>

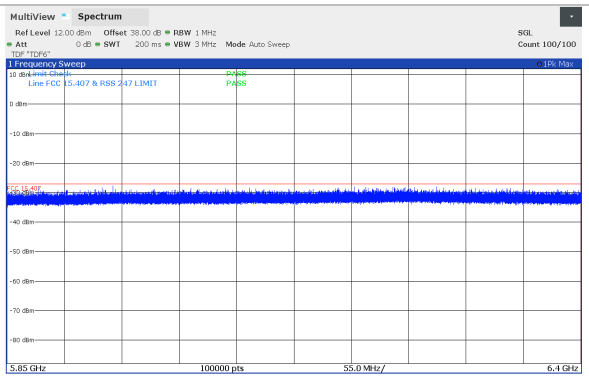


Figure 8.5-88: Conducted spurious emissions 5.850 – 6.4 GHz, 10 MHz Channel BW, Middle channel (5804 MHz), SB1P Band

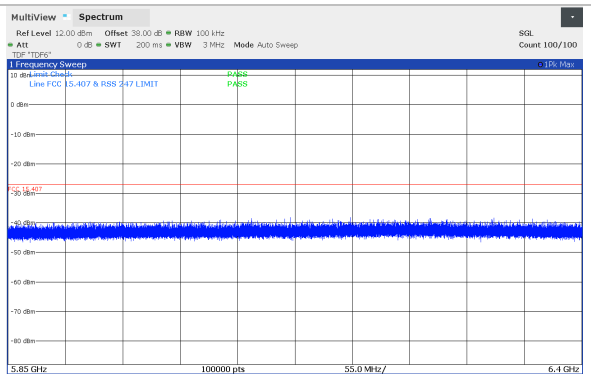


Figure 8.5-89: Conducted spurious emissions 5.850 – 6.4 GHz, 10 MHz Channel BW, Middle channel (5804 MHz), SB1P Band, <u>*100 kHz RBW</u>

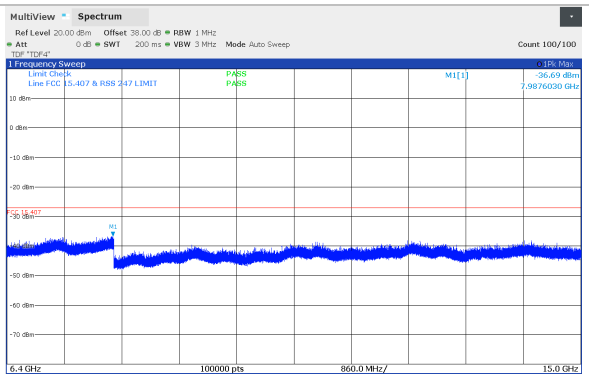


Figure 8.5-90: Conducted spurious emissions 6.4 - 15 GHz, 10 MHz Channel BW, Middle channel (5804 MHz), SB1P Band

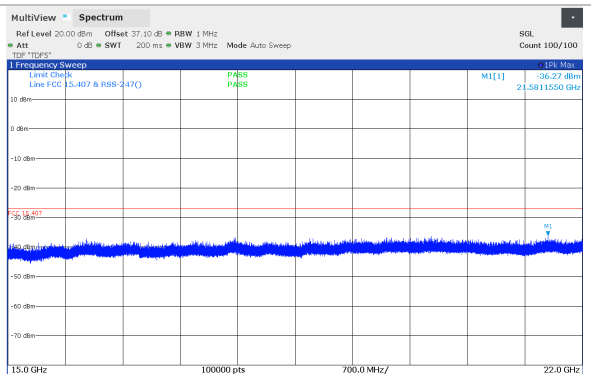


Figure 8.5-91: Conducted spurious emissions 15 - 22 GHz, 10 MHz Channel BW, Middle channel (5804 MHz), SB1P Band

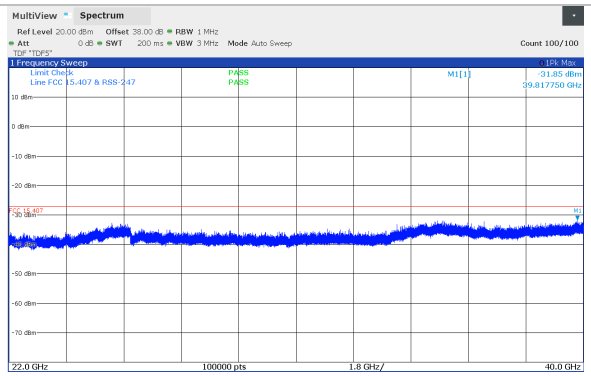


Figure 8.5-92: Conducted spurious emissions 22 - 40 GHz, 10 MHz Channel BW, Middle channel (5804 MHz), SB1P Band

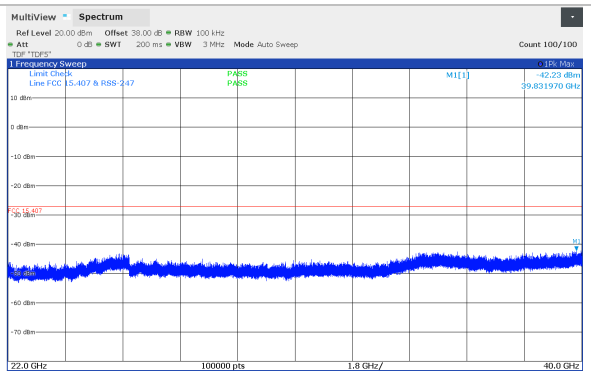


Figure 8.5-93: Conducted spurious emissions 22 - 40 GHz, 10 MHz Channel BW, Middle channel (5804 MHz), SB1P Band, <u>*100 kHz RBW</u>

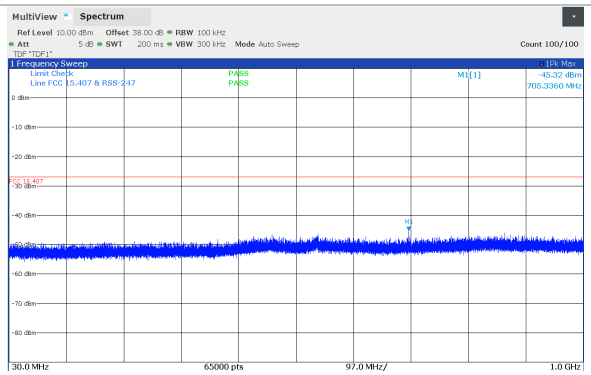


Figure 8.5-94: Conducted spurious emissions 0.03 - 1 GHz, 30 MHz Channel BW, Middle channel (5804 MHz), SB1P Band

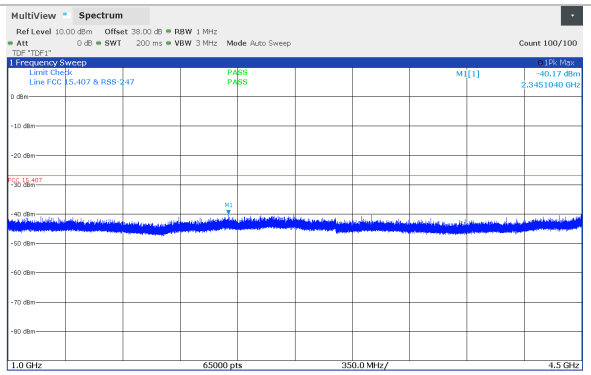


Figure 8.5-95: Conducted spurious emissions 1 – 4.5 GHz, 30 MHz Channel BW, Middle channel (5804 MHz), SB1P Band

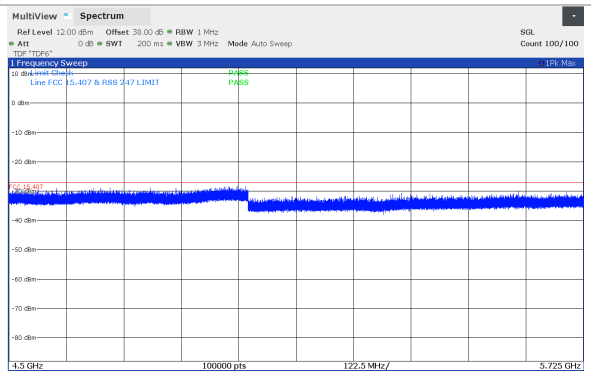


Figure 8.5-96: Conducted spurious emissions 4.5 – 5.725 GHz, 30 MHz Channel BW, Middle channel (5804 MHz), SB1P Band

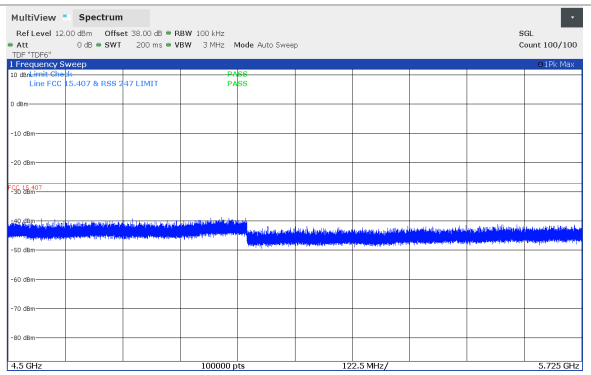


Figure 8.5-97: Conducted spurious emissions 4.5 – 5.725 GHz, 30 MHz Channel BW, Middle channel (5804 MHz), SB1P Band, *100 kHz RBW

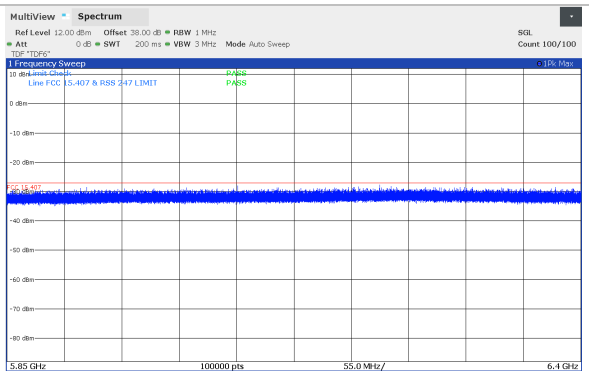


Figure 8.5-98: Conducted spurious emissions 5.850 – 6.4 GHz, 30 MHz Channel BW, Middle channel (5804 MHz), SB1P Band

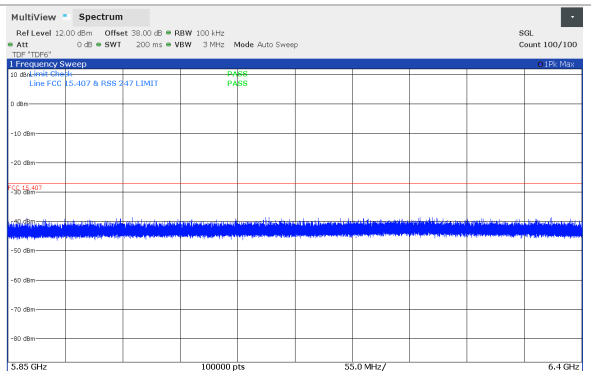


Figure 8.5-99: Conducted spurious emissions 5.850 – 6.4 GHz, 30 MHz Channel BW, Middle channel (5804 MHz), SB1P Band, *100 kHz RBW

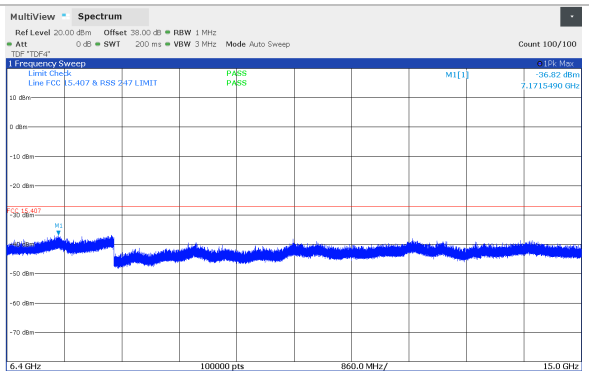


Figure 8.5-100: Conducted spurious emissions 6.4 – 15 GHz, 30 MHz Channel BW, Middle channel (5804 MHz), SB1P Band

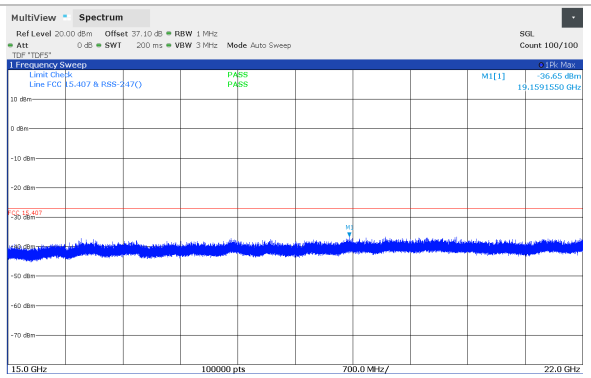


Figure 8.5-101: Conducted spurious emissions 15 - 22 GHz, 30 MHz Channel BW, Middle channel (5804 MHz), SB1P Band

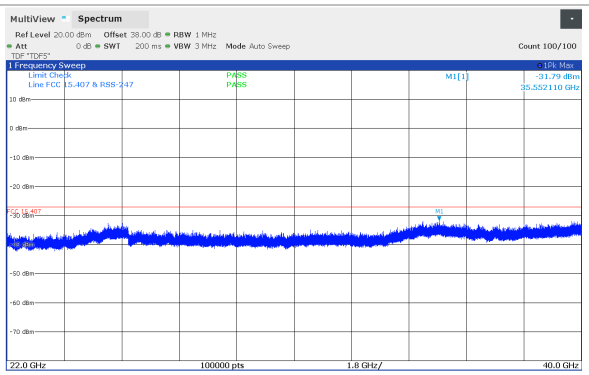


Figure 8.5-102: Conducted spurious emissions 22 - 40 GHz, 30 MHz Channel BW, Middle channel (5804 MHz), SB1P Band

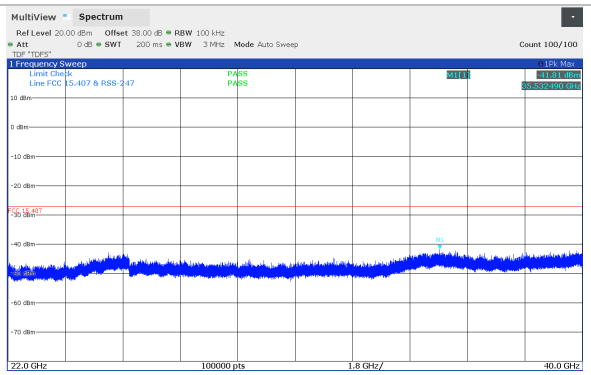


Figure 8.5-103: Conducted spurious emissions 22 - 40 GHz, 30 MHz Channel BW, Middle channel (5804 MHz), SB1P Band, *100 kHz RBW

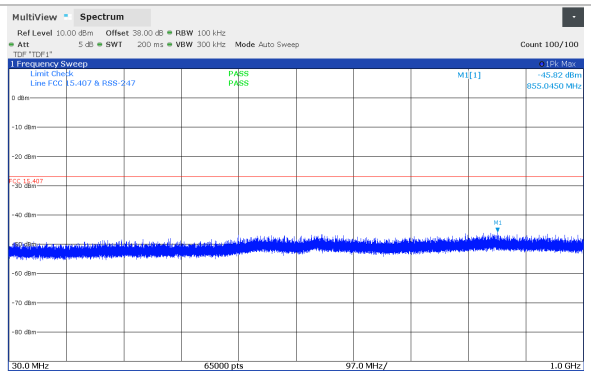


Figure 8.5-104: Conducted spurious emissions 0.03 - 1 GHz, 10 MHz Channel BW, High channel (5814 MHz), SB1P Band

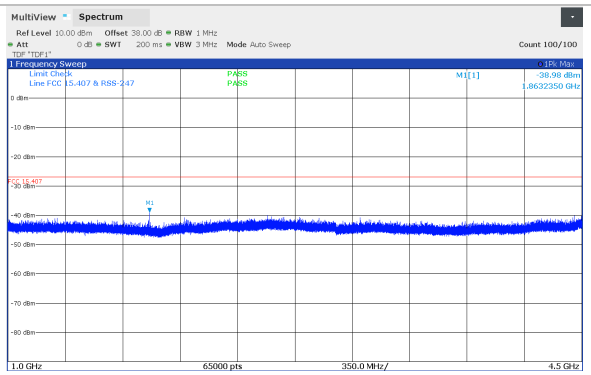


Figure 8.5-105: Conducted spurious emissions 1 – 4.5 GHz, 10 MHz Channel BW, High channel (5814 MHz), SB1P Band

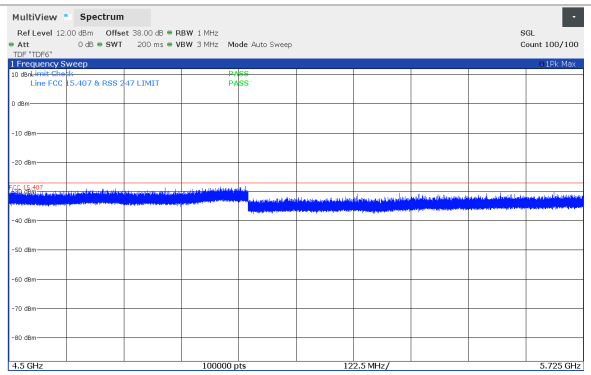


Figure 8.5-106: Conducted spurious emissions 4.5 – 5.725 GHz, 10 MHz Channel BW, High channel (5814 MHz), SB1P Band

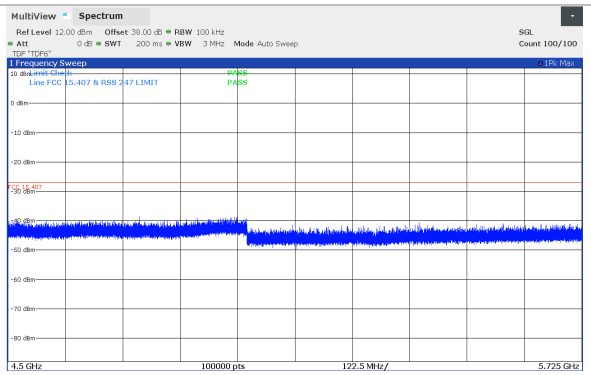


Figure 8.5-107: Conducted spurious emissions 4.5 – 5.725 GHz, 10 MHz Channel BW, High channel (5814 MHz), SB1P Band, *100 kHz RBW

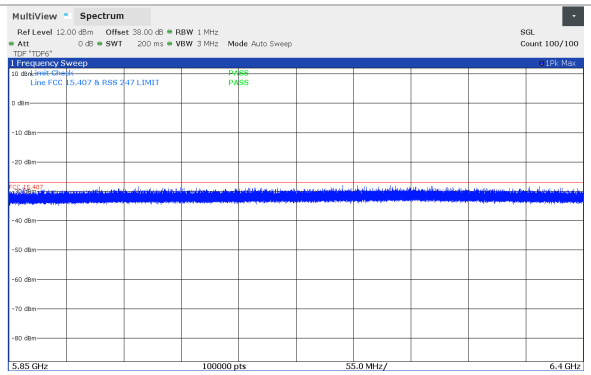


Figure 8.5-108: Conducted spurious emissions 5.850 – 6.4 GHz, 10 MHz Channel BW, High channel (5814 MHz), SB1P Band

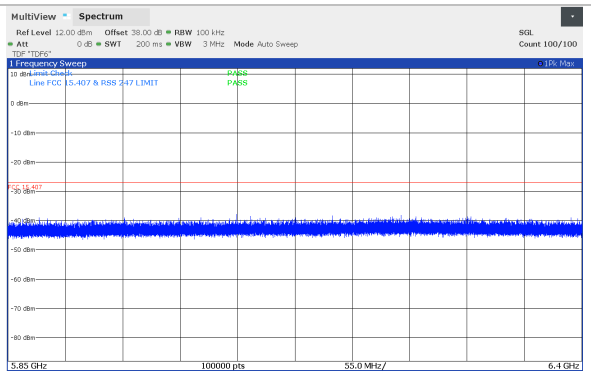


Figure 8.5-109: Conducted spurious emissions 5.850 – 6.4 GHz, 10 MHz Channel BW, High channel (5814 MHz), SB1P Band, <u>*100 kHz RBW</u>

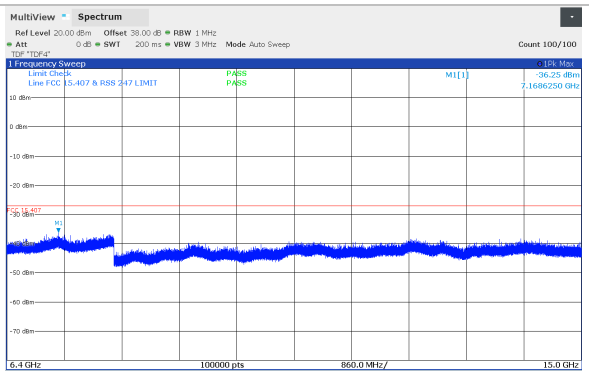


Figure 8.5-110: Conducted spurious emissions 6.4 - 15 GHz, 10 MHz Channel BW, High channel (5814 MHz), SB1P Band

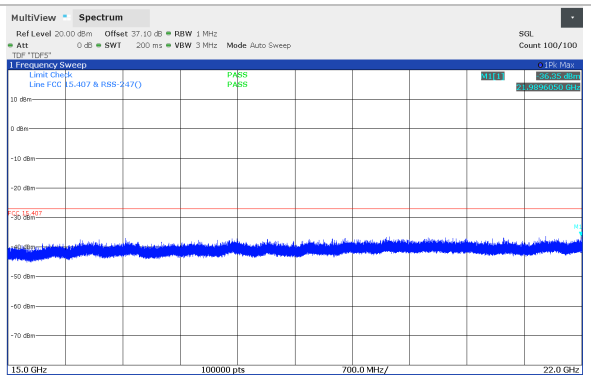


Figure 8.5-111: Conducted spurious emissions 15 - 22 GHz, 10 MHz Channel BW, High channel (5814 MHz), SB1P Band

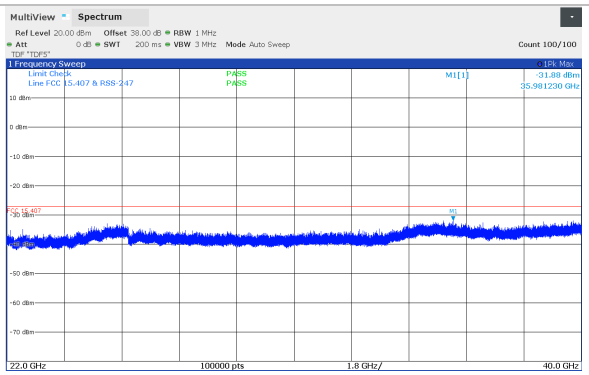


Figure 8.5-112: Conducted spurious emissions 22 - 40GHz, 10 MHz Channel BW, High channel (5814 MHz), SB1P Band

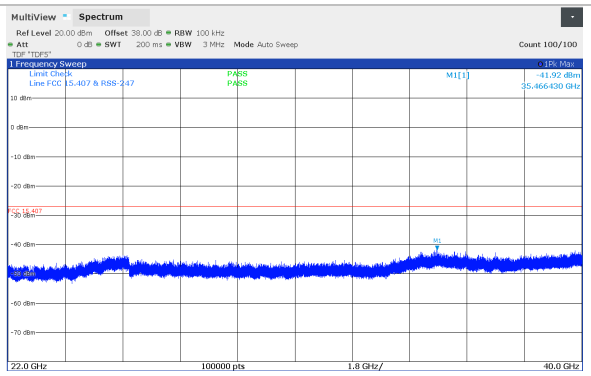


Figure 8.5-113: Conducted spurious emissions 22 - 40GHz, 10 MHz Channel BW, High channel (5814 MHz), SB1P Band, <u>*100 kHz RBW</u>

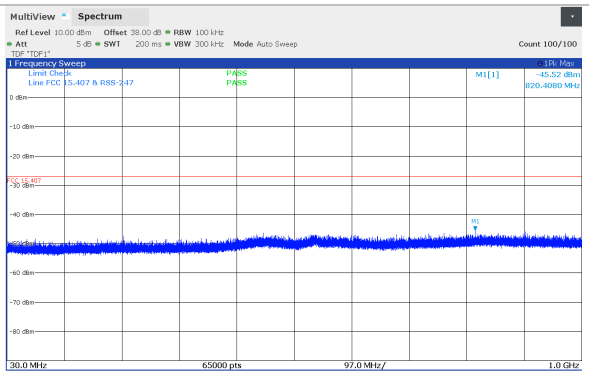


Figure 8.5-114: Conducted spurious emissions 0.03 - 1 GHz, 10 MHz Channel BW, Low channel (5824 MHz), SB2P Band

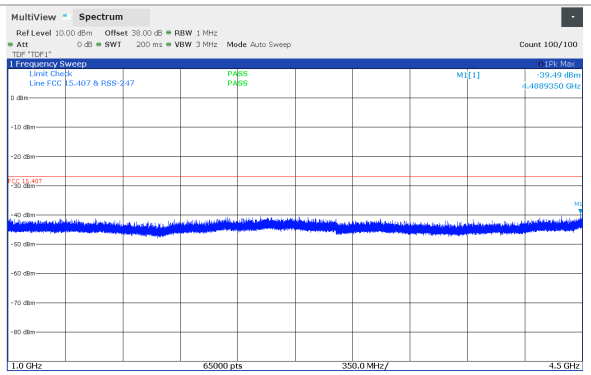


Figure 8.5-115: Conducted spurious emissions 1 – 4.5 GHz, 10 MHz Channel BW, Low channel (5824 MHz), SB2P Band

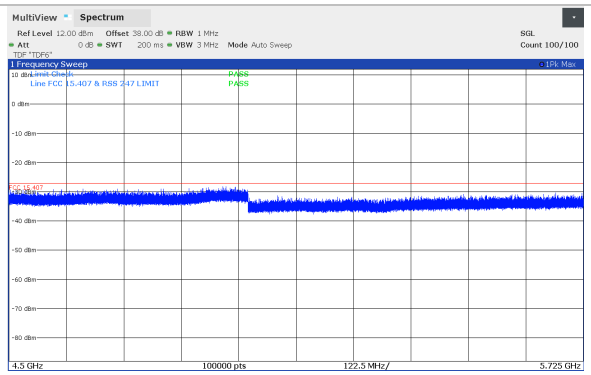


Figure 8.5-116: Conducted spurious emissions 4.5 – 5.725 GHz, 10 MHz Channel BW, Low channel (5824 MHz), SB2P Band

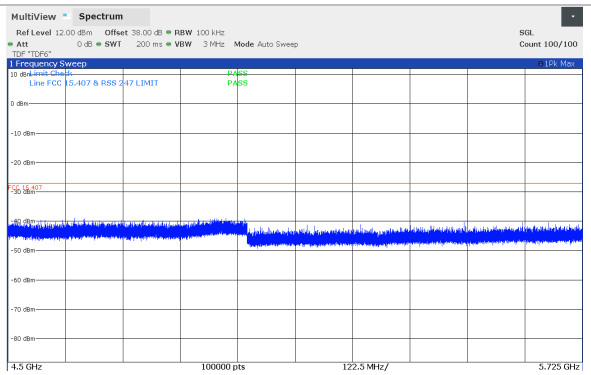


Figure 8.5-117: Conducted spurious emissions 4.5 – 5.725 GHz, 10 MHz Channel BW, Low channel (5824 MHz), SB2P Band, <u>*100 kHz RBW</u>

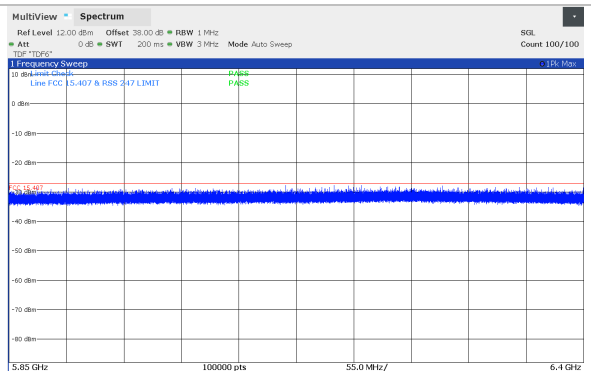


Figure 8.5-118: Conducted spurious emissions 5.850 – 6.4 GHz, 10 MHz Channel BW, Low channel (5824 MHz), SB2P Band

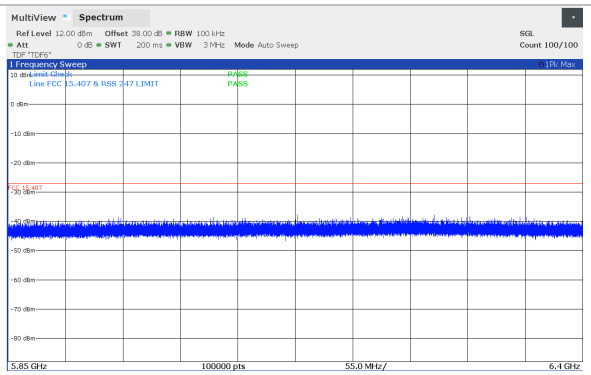


Figure 8.5-119: Conducted spurious emissions 5.850 – 6.4 GHz, 10 MHz Channel BW, Low channel (5824 MHz), SB2P Band, <u>*100 kHz RBW</u>

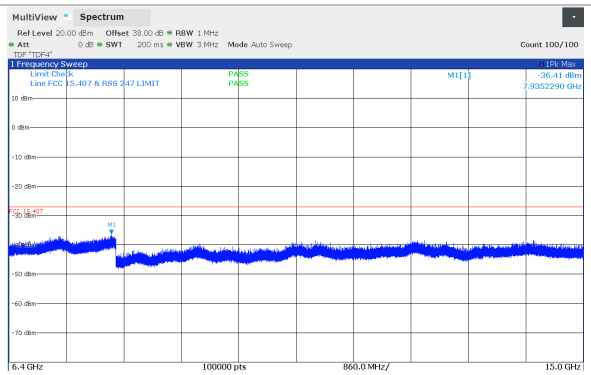


Figure 8.5-120: Conducted spurious emissions 6.4 – 15 GHz, 10 MHz Channel BW, Low channel (5824 MHz), SB2P Band

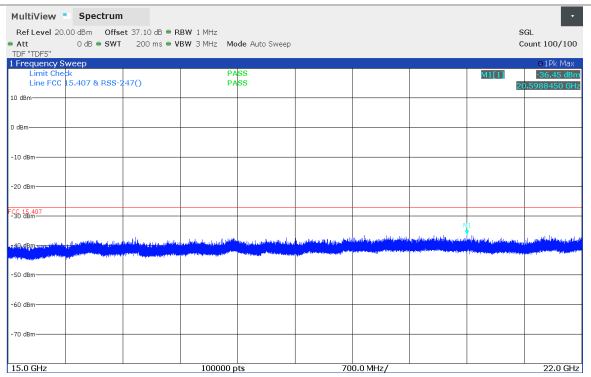


Figure 8.5-121: Conducted spurious emissions 15 - 22 GHz, 10 MHz Channel BW, Low channel (5824 MHz), SB2P Band

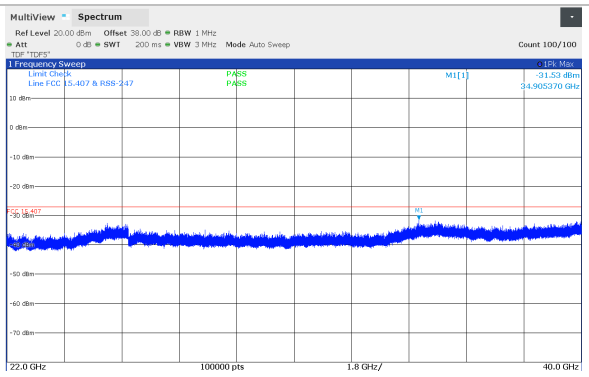


Figure 8.5-122: Conducted spurious emissions 22 - 40 GHz, 10 MHz Channel BW, Low channel (5824 MHz), SB2P Band

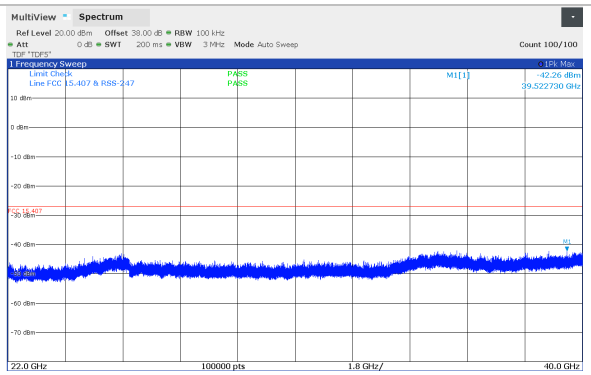


Figure 8.5-123: Conducted spurious emissions 22 - 40 GHz, 10 MHz Channel BW, Low channel (5824 MHz), SB2P Band, *100 kHz RBW

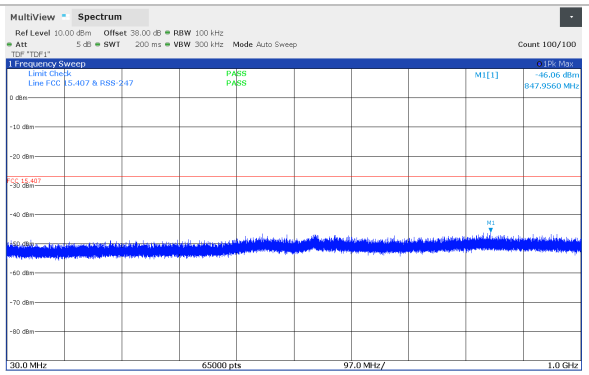


Figure 8.5-124: Conducted spurious emissions 0.03 - 1 GHz, 10 MHz Channel BW, Middle channel (5834 MHz), SB2P Band

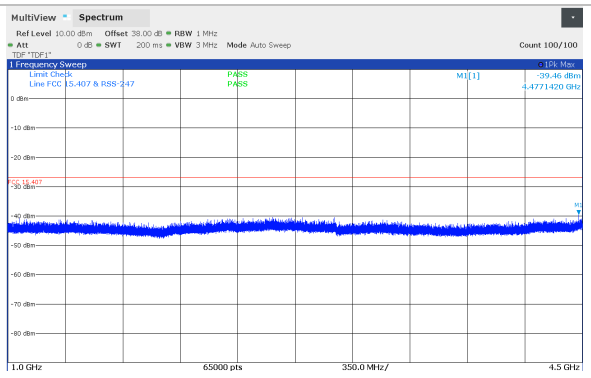


Figure 8.5-125: Conducted spurious emissions 1 – 4.5 GHz, 10 MHz Channel BW, Middle channel (5834 MHz), SB2P Band

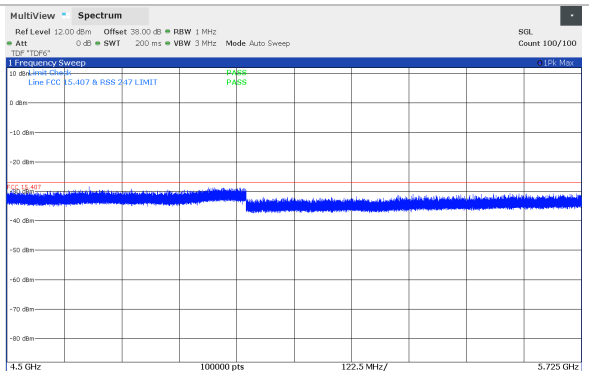


Figure 8.5-126: Conducted spurious emissions 4.5 – 5.725 GHz, 10 MHz Channel BW, Middle channel (5834 MHz), SB2P Band

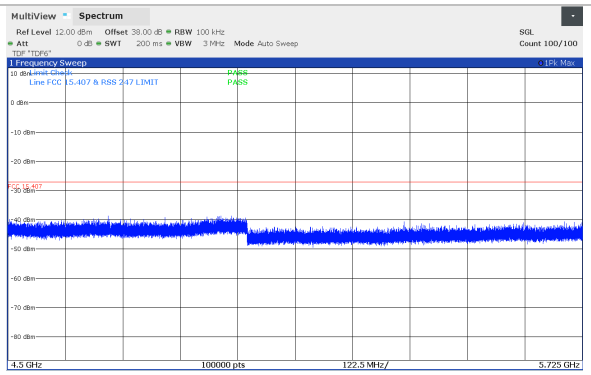


Figure 8.5-127: Conducted spurious emissions 4.5 – 5.725 GHz, 10 MHz Channel BW, Middle channel (5834 MHz), SB2P Band, *100 kHz RBW

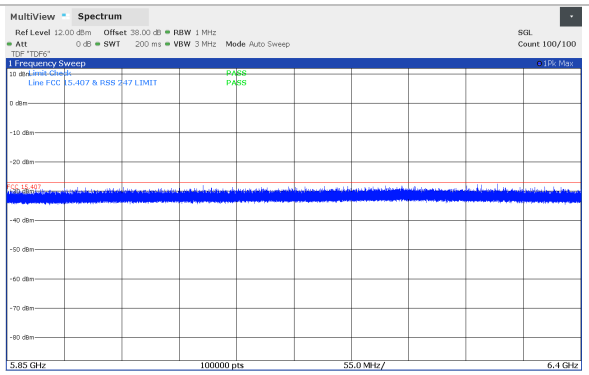


Figure 8.5-128: Conducted spurious emissions 5.850 – 6.4 GHz, 10 MHz Channel BW, Middle channel (5834 MHz), SB2P Band

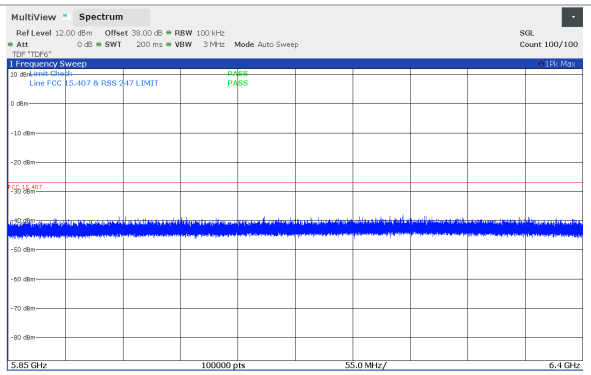


Figure 8.5-129: Conducted spurious emissions 5.850 – 6.4 GHz, 10 MHz Channel BW, Middle channel (5834 MHz), SB2P Band, *100 kHz RBW

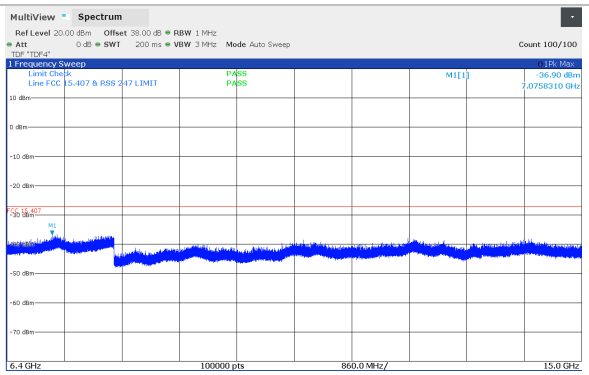


Figure 8.5-130: Conducted spurious emissions 6.4 – 15 GHz, 10 MHz Channel BW, Middle channel (5834 MHz), SB2P Band

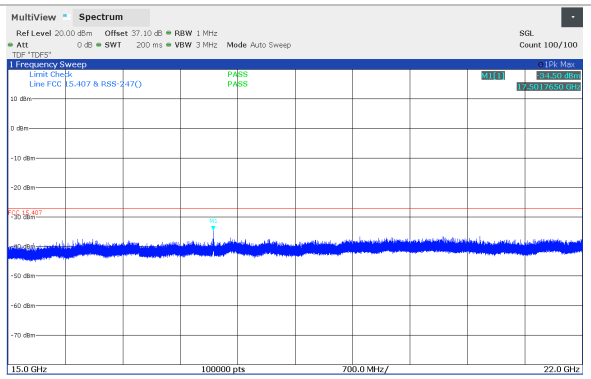


Figure 8.5-131: Conducted spurious emissions 15 - 22 GHz, 10 MHz Channel BW, Middle channel (5834 MHz), SB2P Band

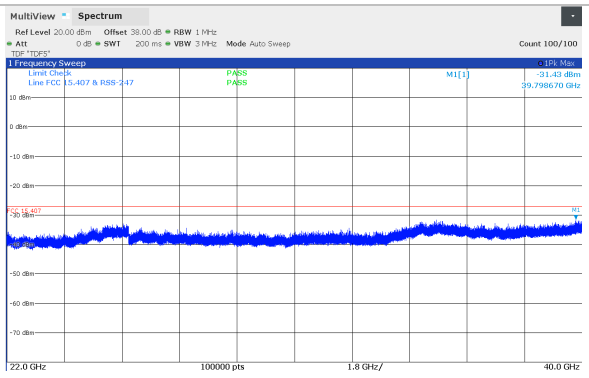


Figure 8.5-132: Conducted spurious emissions 22 - 40 GHz, 10 MHz Channel BW, Middle channel (5834 MHz), SB2P Band

8.5.4 Test data continued

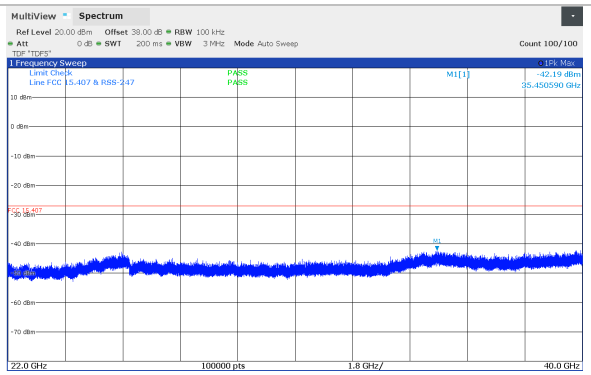


Figure 8.5-133: Conducted spurious emissions 22 – 40 GHz, 10 MHz Channel BW, Middle channel (5834 MHz), SB2P Band, *100 kHz RBW

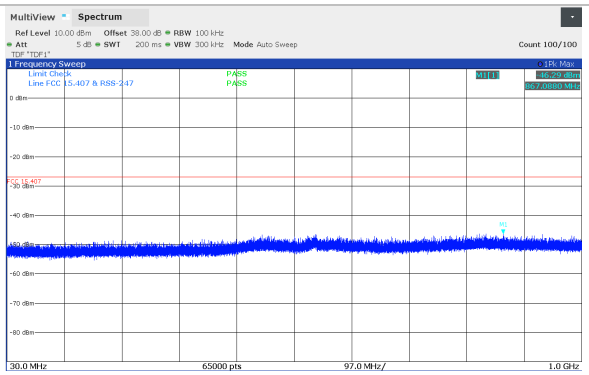


Figure 8.5-134: Conducted spurious emissions 0.03 - 1 GHz, 30 MHz Channel BW, Middle channel (5834 MHz), SB2P Band

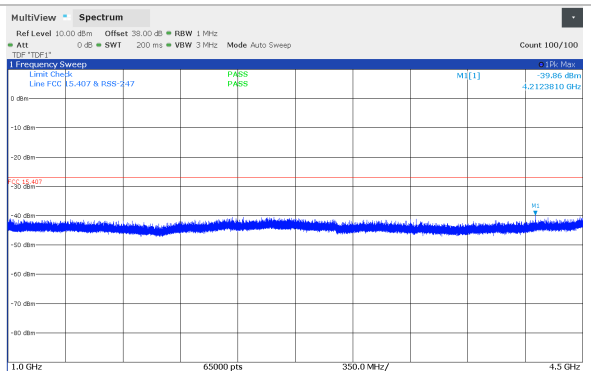


Figure 8.5-135: Conducted spurious emissions 1 – 4.5 GHz, 30 MHz Channel BW, Middle channel (5834 MHz), SB2P Band

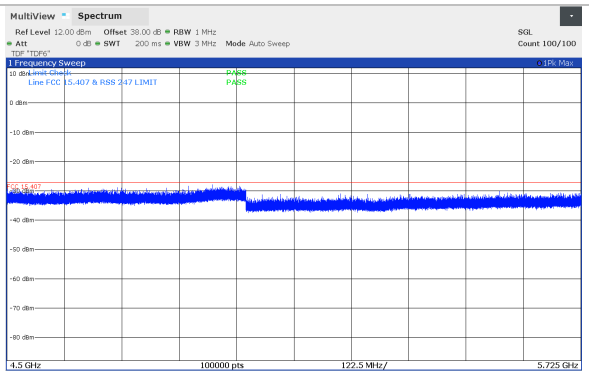


Figure 8.5-136: Conducted spurious emissions 4.5 – 5.725 GHz, 30 MHz Channel BW, Middle channel (5834 MHz), SB2P Band

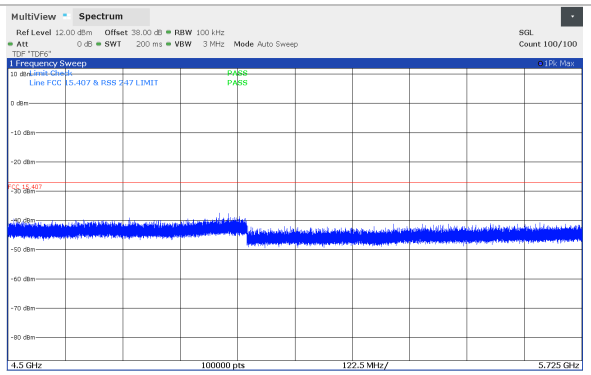


Figure 8.5-137: Conducted spurious emissions 4.5 – 5.725 GHz, 30 MHz Channel BW, Middle channel (5834 MHz), SB2P Band, *100 kHz RBW

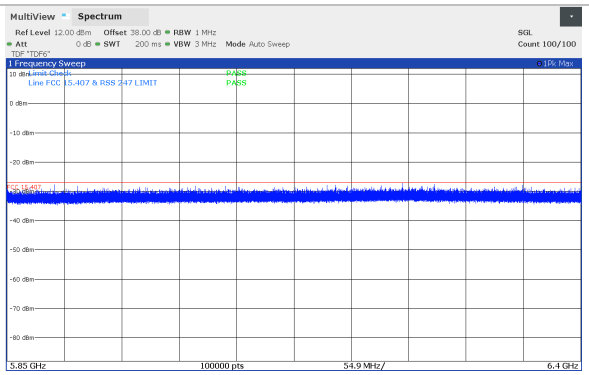


Figure 8.5-138: Conducted spurious emissions 5.850 – 6.4 GHz, 30 MHz Channel BW, Middle channel (5834 MHz), SB2P Band

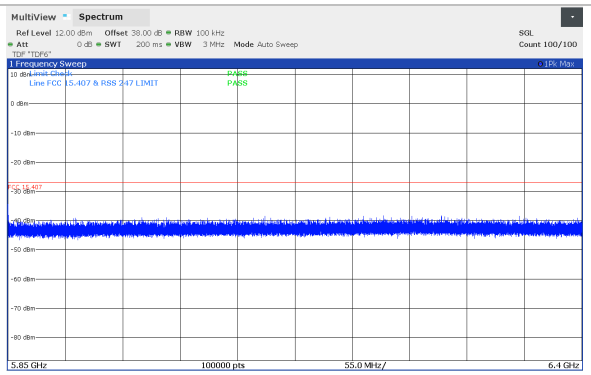


Figure 8.5-139: Conducted spurious emissions 5.850 – 6.4 GHz, 30 MHz Channel BW, Middle channel (5834 MHz), SB2P Band, *100 kHz RBW

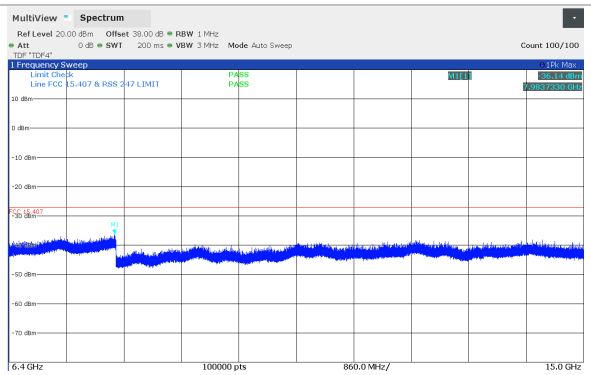


Figure 8.5-140: Conducted spurious emissions 6.4 - 15 GHz, 30 MHz Channel BW, Middle channel (5834 MHz), SB2P Band

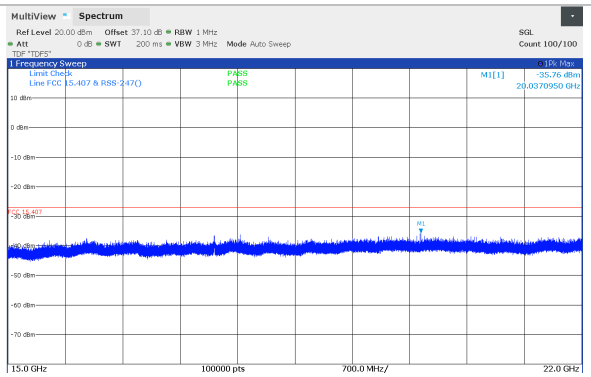


Figure 8.5-141: Conducted spurious emissions 15 - 22 GHz, 30 MHz Channel BW, Middle channel (5834 MHz), SB2P Band

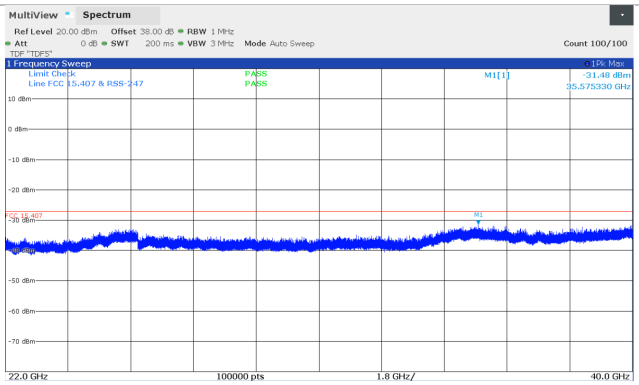


Figure 8.5-142: Conducted spurious emissions 22 - 40 GHz, 30 MHz Channel BW, Middle channel (5834 MHz), SB2P Band

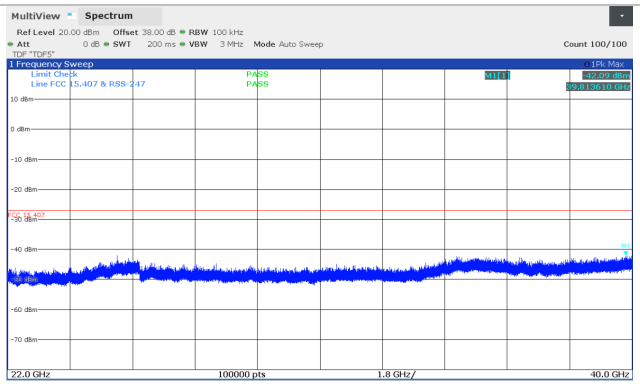


Figure 8.5-143: Conducted spurious emissions 22 - 40 GHz, 30 MHz Channel BW, Middle channel (5834 MHz), SB2P Band, *100 kHz RBW

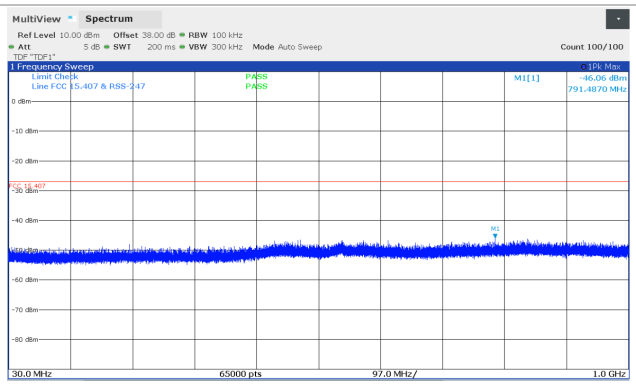


Figure 8.5-144: Conducted spurious emissions 0.03 - 1 GHz, 10 MHz Channel BW, High channel (5844 MHz), SB2P Band

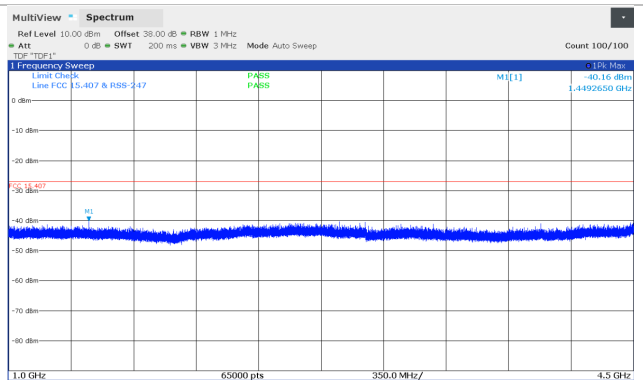


Figure 8.5-145: Conducted spurious emissions 1 – 4.5 GHz, 10 MHz Channel BW, High channel (5844 MHz), SB2P Band

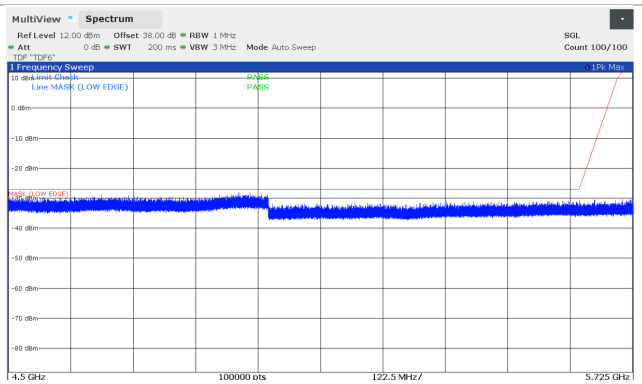


Figure 8.5-146: Conducted spurious emissions 4.5 – 5.725 GHz, 10 MHz Channel BW, High channel (5844 MHz), SB2P Band

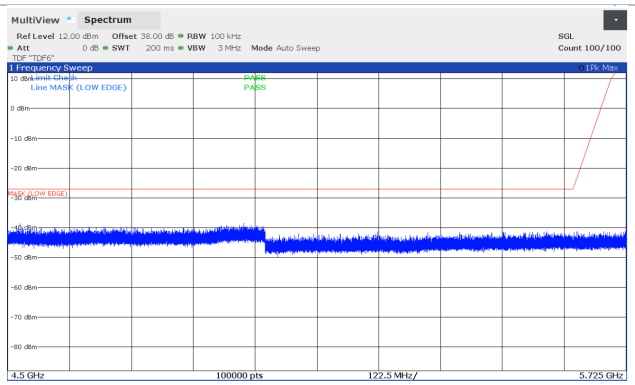


Figure 8.5-147: Conducted spurious emissions 4.5 – 5.725 GHz, 10 MHz Channel BW, High channel (5844 MHz), SB2P Band, <u>*100 kHz RBW</u>

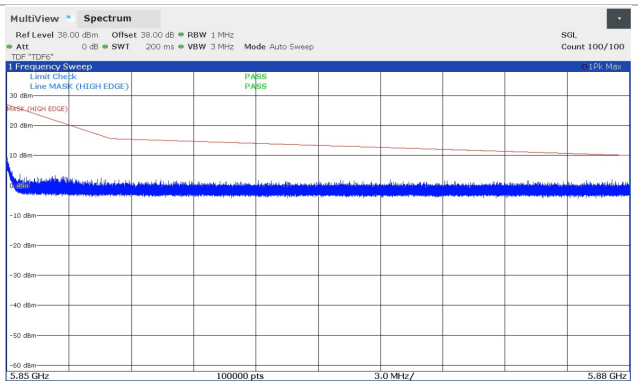


Figure 8.5-148: Conducted spurious emissions 5.850 – 5.880 GHz, 10 MHz Channel BW, High channel (5844 MHz), SB2P Band

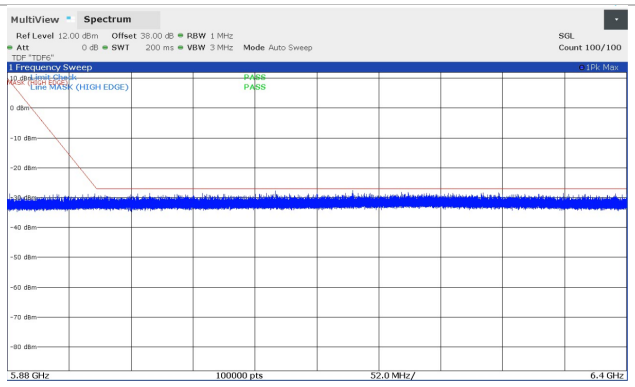


Figure 8.5-149: Conducted spurious emissions 5.880 – 6.4 GHz, 10 MHz Channel BW, High channel (5844 MHz), SB2P Band

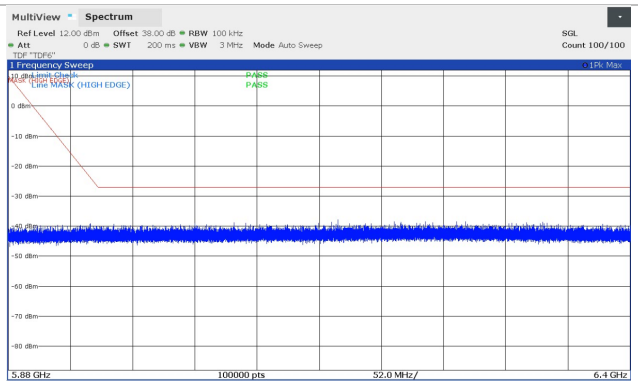


Figure 8.5-150: Conducted spurious emissions 5.880 – 6.4 GHz, 10 MHz Channel BW, High channel (5844 MHz), SB2P Band, <u>*100 kHz RBW</u>

8.5.4 Test data continued

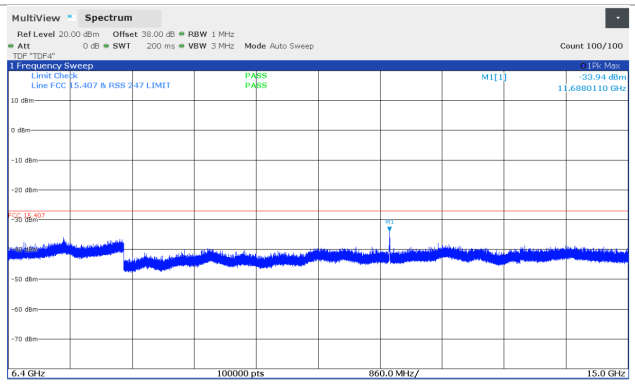


Figure 8.5-151: Conducted spurious emissions 6.4 - 15 GHz, 10 MHz Channel BW, High channel (5844 MHz), SB2P Band

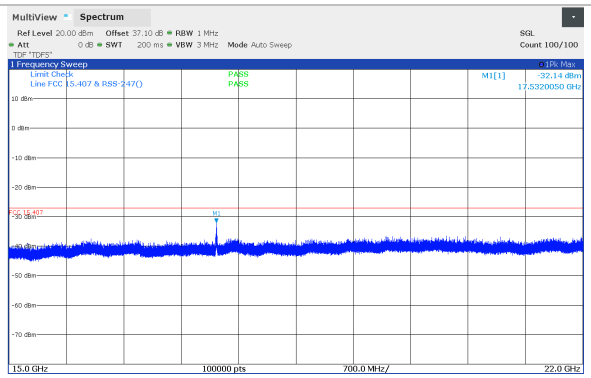


Figure 8.5-152: Conducted spurious emissions 15 - 22 GHz, 10 MHz Channel BW, High channel (5844 MHz), SB2P Band

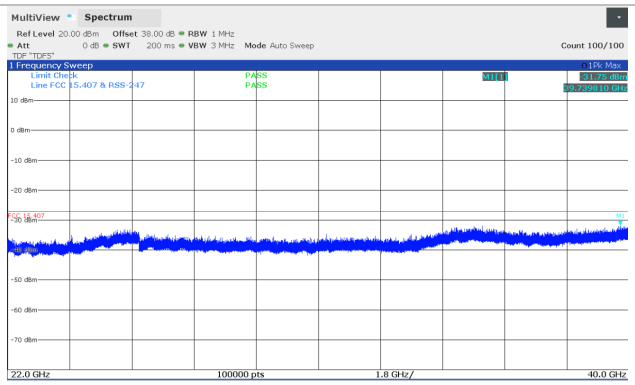


Figure 8.5-153: Conducted spurious emissions 22 - 40 GHz, 10 MHz Channel BW, High channel (5844 MHz), SB2P Band

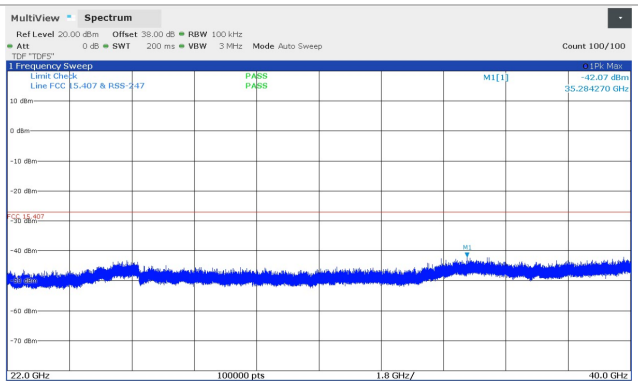


Figure 8.5-154: Conducted spurious emissions 22 - 40 GHz, 10 MHz Channel BW, High channel (5844 MHz), SB2P Band, <u>*100 kHz RBW</u>

Note: Limit is -27 dBm except band edges. EUT complies.
Offset of 38 dB (38 dBi to simulate the antenna gain) +TDF (for cable loss, filter, attenuator, etc., depending of each case) were added.

Offset of 37.1 dB (37.1 dBi to simulate the antenna gain in the third harmonic – as declared by client) +TDF (two high-pass filters + cable losses) were added only in the range from 15- 22 GHz because the third harmonic is present in the sub-band SB2P.

8.6 FCC 15.407 (g) Frequency stability and RSS-GEN 6.7 99% Occupied bandwidth

8.6.1 Definitions and limits

FCC:
The 99% occupied bandwidth is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers are each equal to 0.5% of the total mean power of the given emission.
(g) Manufacturers of U-NII devices are responsible for ensuring frequency stability such that an emission is maintained within the band of operation under all conditions of normal operation as specified in the user's manual.
Frequency stability is a measure of the frequency drift due to temperature and supply voltage variations, with reference to the frequency measured at +20 C and rated supply voltage.
a) At 10 C intervals of temperatures between -30 C and +50 C at the manufacturer's rated supply voltage, and
b) At +20 C temperature and ±15% supply voltage variations. If a product is specified to operate over a range of input voltage, then the 15% variation is applied to the lowermost voltage and the +15% is applied to the uppermost voltage.
c) Temperature range declared by manufacturer: -40 C - +55 C.
d) Voltage range declared by manufacturer: (-30 VDC) – (-57.6 VDC).

ISED:
The occupied bandwidth or the "99% emission bandwidth" is defined as the frequency range between two points, one above and the other below the carrier frequency, within which 99% of the total transmitted power of the fundamental transmitted emission is contained. The occupied bandwidth shall be reported for all equipment in addition to the specified bandwidth required in the applicable RSSs.

8.6.2 Test summary

Test date:	March 3, 2020 ; March 5, 2020	Temperature:	21 °C; 20 °C
Test engineer:	Martha Espinoza	Air pressure:	1004 mbar; 1003 mbar
Verdict:	Pass	Relative humidity:	38 %; 46 %

8.6.3 Observations, settings and special notes

- Only the lowest and highest channel were evaluated for this test looking for a movement outside the complete band.
- 99% OBW was taken as reference measurement for this test. A limit line was used in the lower side and another one in the upper side from the complete band (5725 MHz and 5850 MHz) to visualize any movement easily.

Spectrum analyzer settings:

Resolution bandwidth:	1% - 5% OBW
Video bandwidth:	≥ 3 RBW
Detector mode:	Peak
Trace mode:	Max hold
Sweep time:	Auto
Span:	1.5 – 5 Times OBW

20.5 dB and 21 dB offset were used for this test, which include the 20dB attenuator and cable losses.

8.6.4 Test data

This data was taken using as mentioned before, using the 4QAM modulation because it was determined as the worst case. All the frequencies were measured with a 10 MHz bandwidth, except middle channel which was measured at 10 MHz and 30 MHz bandwidth by manufacturer requirement.

SB1		OBW declared by manufacturer	SB2		OBW declared by manufacturer
Frequency (MHz)	99% OBW (MHz)		Frequency (MHz)	99% OBW (MHz)	
5731	8.865	10 MHz	5761	8.852	10 MHz
5741	8.852	10 MHz	5771	8.861	10 MHz
5751	8.862	10 MHz	5781	8.859	10 MHz
5741	27.546	30 MHz	5771	27.540	30 MHz

Table 8.6-1: *99% occupied bandwidth for SB1 and SB2 bands.*

SBP1		OBW declared by manufacturer	SBP2		OBW declared by manufacturer
Frequency (MHz)	99% OBW (MHz)		Frequency (MHz)	99% OBW (MHz)	
5794	8.847	10 MHz	5824	8.859	10 MHz
5804	8.855	10 MHz	5834	8.865	10 MHz
5814	8.860	10 MHz	5844	8.854	10 MHz
5804	27.454	30 MHz	5834	27.456	30 MHz

Table 8.6-2: *99% occupied bandwidth for SBP1 and SBP2 bands.*

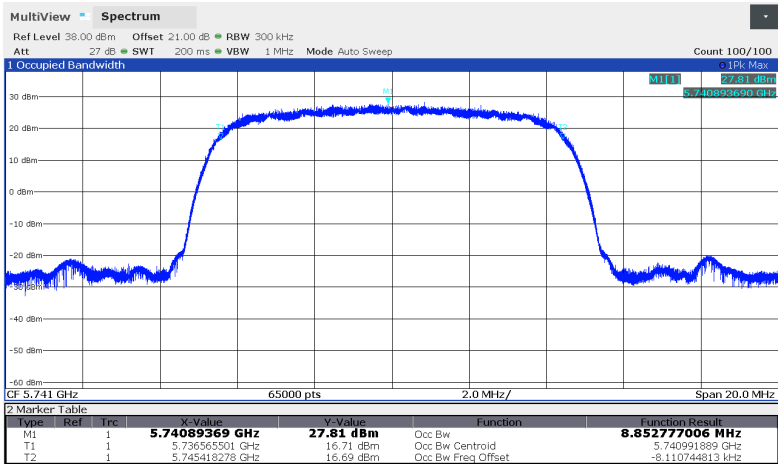


Figure 8.6-1: 99% OBW, 10 MHz Channel BW, middle channel 5741 MHz, SB1 Band

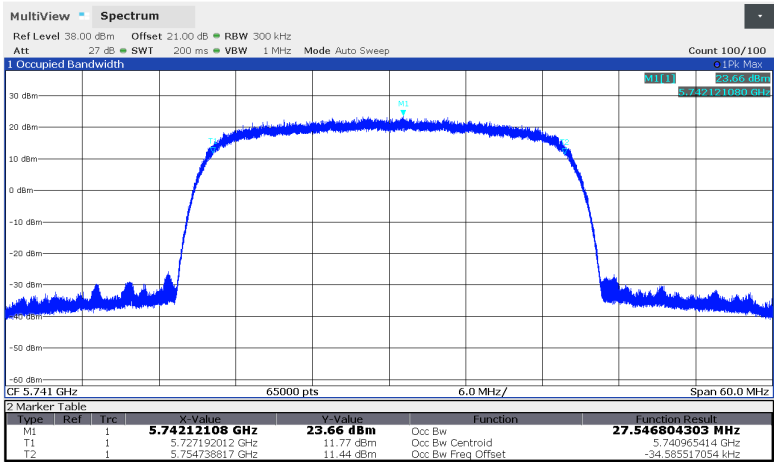


Figure 8.6-2: 99% OBW, 30 MHz Channel BW, middle channel 5741 MHz, SB1 Band

8.6.4 Test data continued

Frequency error versus temperature and supply voltage				
Temperature (C)	Frequency (MHz) Low channel (5731 MHz)	ppm	Frequency (MHz) Low channel (5850 MHz)	ppm
+50	5726.558856	0.615	5839.571507	0.439
+40	5726.562270	0.019	5839.572390	0.711
+30	5726.564718	0.409	5839.573345	0.224
+20	5726.562377	Reference	5839.573193	Reference
+10	5726.566791	0.771	5839.573133	0.434
0	5726.569090	1.173	5839.572963	0.249
-10	5726.568117	1.003	5839.572072	0.079
-20	5726.567509	0.897	5839.570628	0.079
-30	5726.567296	0.859	5839.569465	0.069
85% of nominal voltage (-40.8 V)	5726.565877	0.612	5839.572735	0.254
115% of nominal voltage (-55.2 V)	5726.555164	1.260	5839.572500	0.549
Nominal voltage (-48 V)	5726.562377	Reference	5839.573193	Reference
NOTE—Parts per million (ppm) is obtained as the difference from the reference frequency (in Hz) divided by the reference frequency (in MHz).				

Table 8.6-3: *Frequency stability summary: frequency error versus temperature and supply voltage.*

Note: This standard does not specify a ppm value as a limit. This table is just for reference and the only requirement by standard is the fundamental emission must to be inside to the band assigned. The next plots show a limit line with the edge of the band (lowest frequency limit: 5725 MHz and highest frequency limit: 5850 MHz), where is easy to see that the fundamental emission stays inside to the limit despite the temperature and voltage variation which means, the EUT is in compliance with this test.

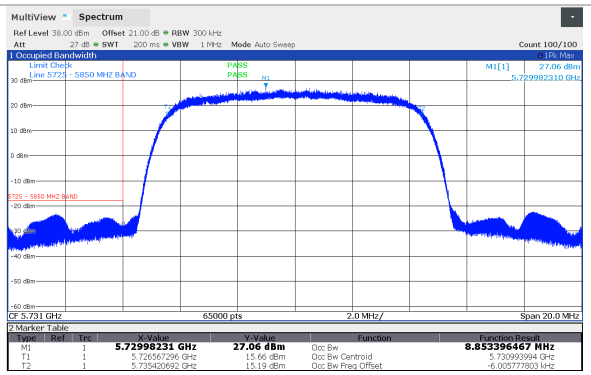


Figure 8.6-17: Frequency stability, 99% OBW, 10 MHz Channel BW, Lowest channel (5831 MHz), SB1 Band (-30°C; -48 VDC)

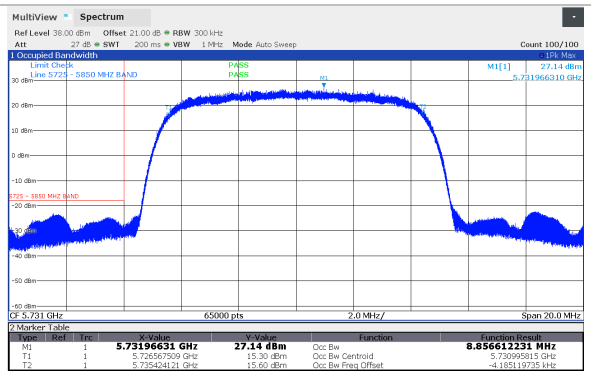


Figure 8.6-18: Frequency stability, 99% OBW, 10 MHz Channel BW, Lowest channel (5831 MHz), SB1 Band (-20°C; -48 VDC)

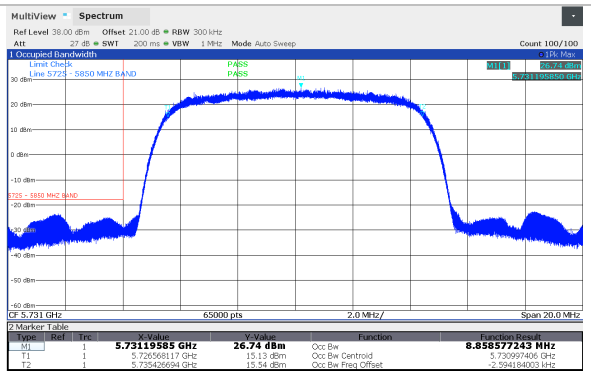


Figure 8.6-19: Frequency stability, 99% OBW, 10 MHz Channel BW, Lowest channel (5831 MHz), SB1 Band (-10°C; -48 VDC)

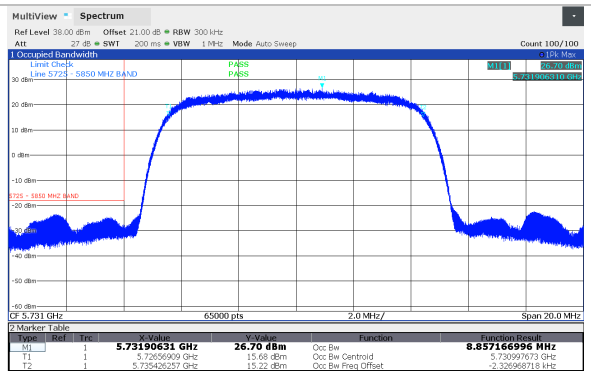


Figure 8.6-20: Frequency stability, 99% OBW, 10 MHz Channel BW, Lowest channel (5831 MHz), SB1 Band (0°C; -48 VDC)

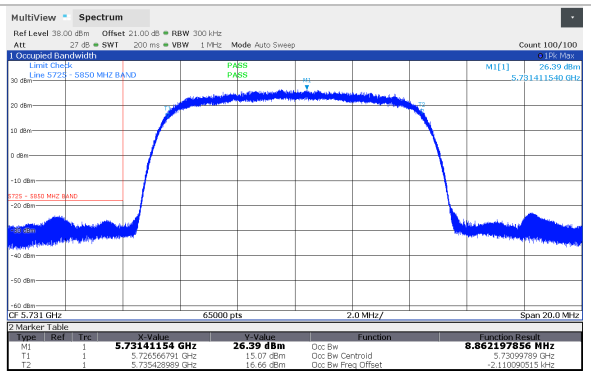


Figure 8.6-21: Frequency stability, 99% OBW, 10 MHz Channel BW, Lowest channel (5831 MHz), SB1 Band (10°C; -48 VDC)

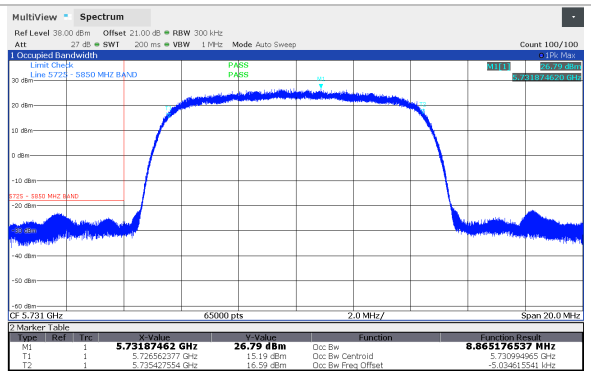


Figure 8.6-22: Frequency stability, 99% OBW, 10 MHz Channel BW, Lowest channel (5831 MHz), SB1 Band (20°C; -48 VDC)

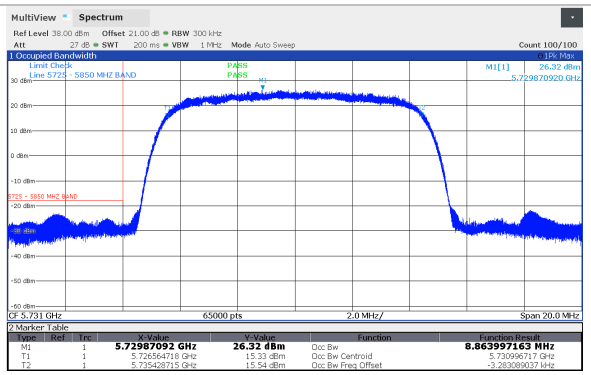


Figure 8.6-23: Frequency stability, 99% OBW, 10 MHz Channel BW, Lowest channel (5831 MHz), SB1 Band (+30°C; -48 VDC)

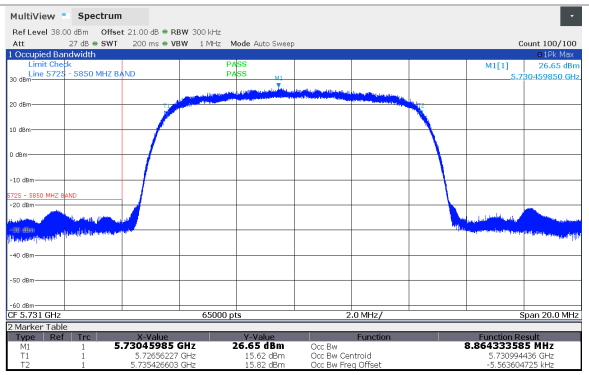


Figure 8.6-24: Frequency stability, 99% OBW, 10 MHz Channel BW, Lowest channel (5831 MHz), SB1 Band (+40°C; -48 VDC)

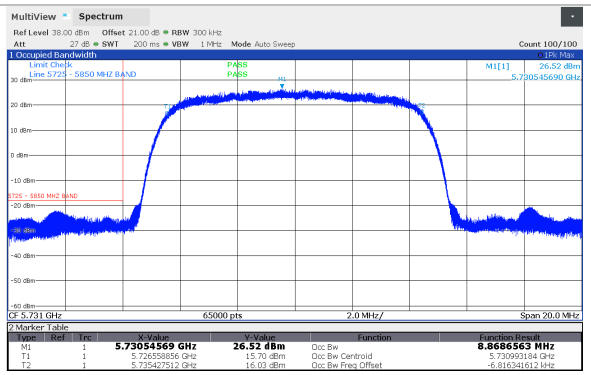


Figure 8.6-25: Frequency stability, 99% OBW, 10 MHz Channel BW, Lowest channel (5831 MHz), SB1 Band (+50°C; -48 VDC)

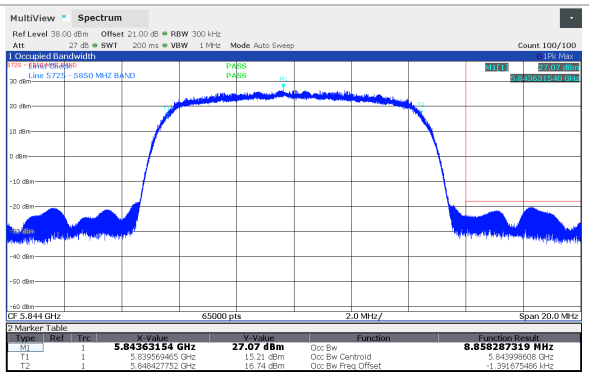


Figure 8.6-26: Frequency stability, 99% OBW, 10 MHz Channel BW, Highest channel (5844 MHz), SB2P Band (-30°C; -48 VDC)

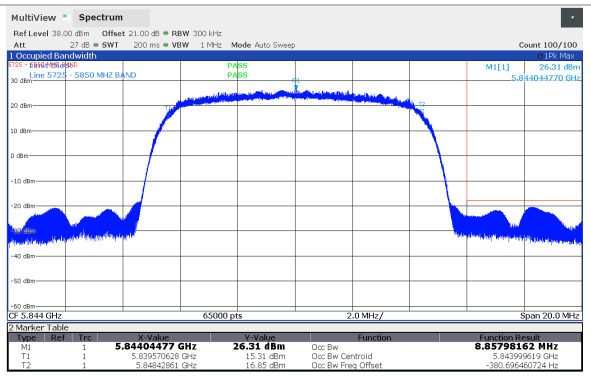


Figure 8.6-27: Frequency stability, 99% OBW, 10 MHz Channel BW, Highest channel (5844 MHz), SB2P Band (-20°C; -48 VDC)

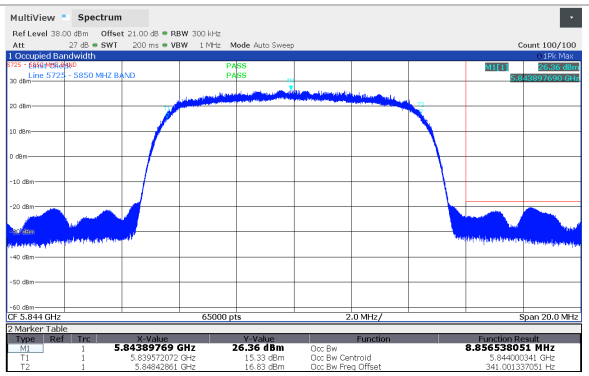


Figure 8.6-28: Frequency stability, 99% OBW, 10 MHz Channel BW, Highest channel (5844 MHz), SB2P Band (-10°C; -48 VDC)

8.6.4 Test data continued

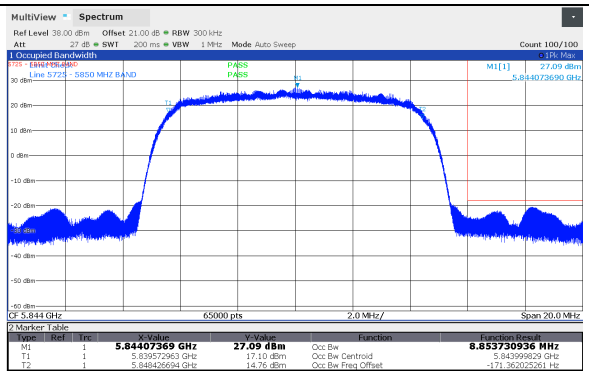


Figure 8.6-29: Frequency stability, 99% OBW, 10 MHz Channel BW, Highest channel (5844 MHz), SB1 Band (0°C; -48 VDC)

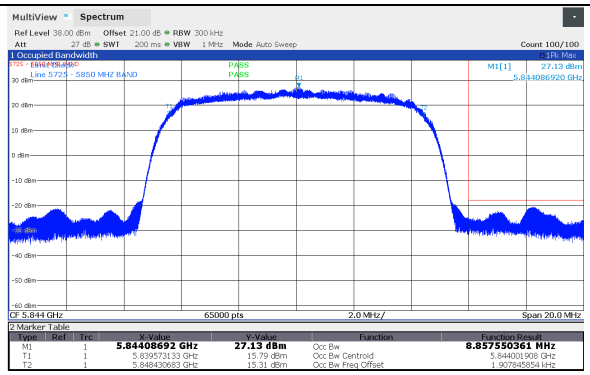


Figure 8.6-30: Frequency stability, 99% OBW, 10 MHz Channel BW, Highest channel (5844 MHz), SB1 Band (+10°C; -48 VDC)

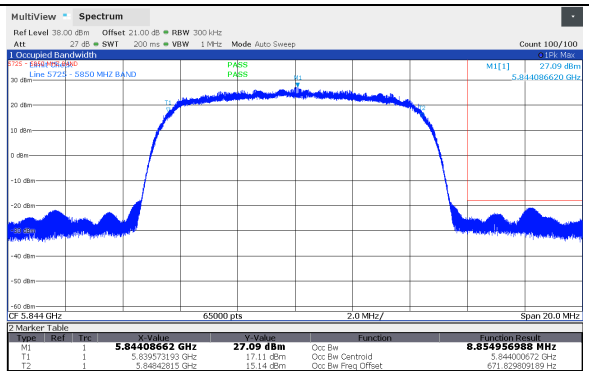


Figure 8.6-31: Frequency stability, 99% OBW, 10 MHz Channel BW, Highest channel (5844 MHz), SB1 Band (+20°C; -48 VDC)

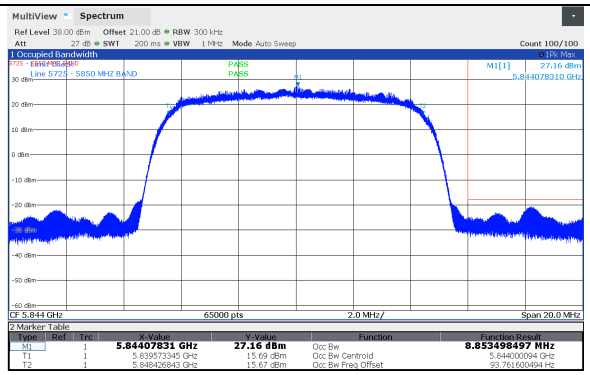


Figure 8.6-32: Frequency stability, 99% OBW, 10 MHz Channel BW, Highest channel (5844 MHz), SB2P Band (+30°C; -48 VDC)

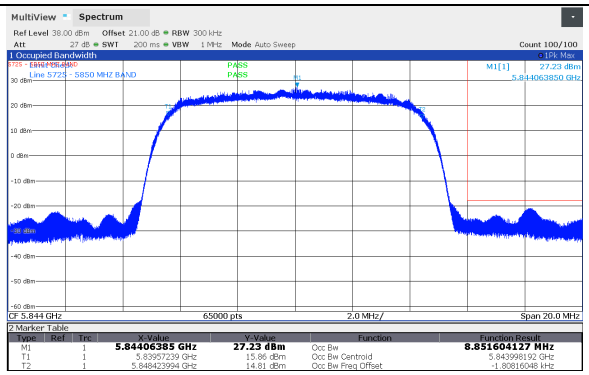


Figure 8.6-33: Frequency stability, 99% OBW, 10 MHz Channel BW, Highest channel (5844 MHz), SB2P Band (+40°C; -48 VDC)

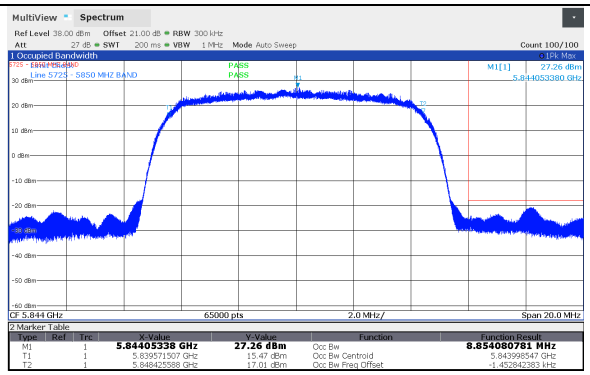


Figure 8.6-34: Frequency stability, 99% OBW, 10 MHz Channel BW, Highest channel (5844 MHz), SB2P Band (+50°C; -48 VDC)

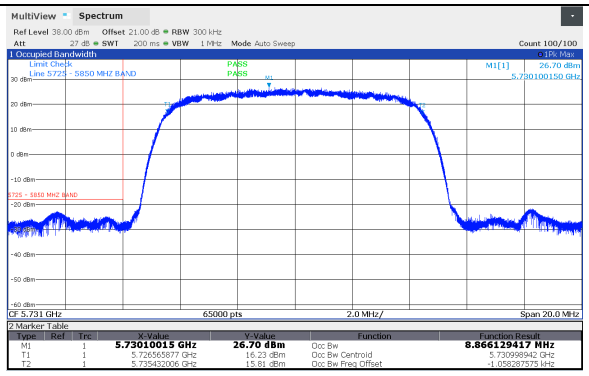


Figure 8.6-35: Frequency stability, 99% OBW, 10 MHz Channel BW, Lowest channel (5831 MHz), SB1 Band (+20°C; -40.8 VDC)

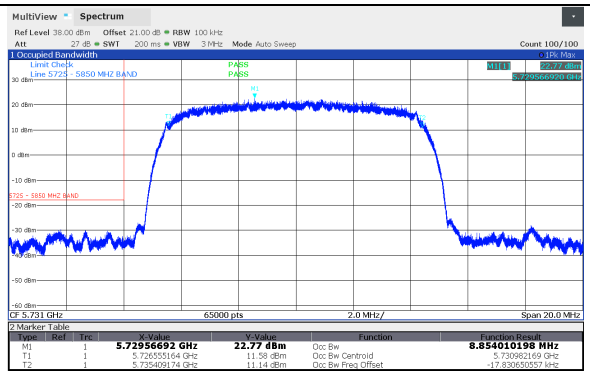


Figure 8.6-36: Frequency stability, 99% OBW, 10 MHz Channel BW, Lowest channel (5831 MHz), SB1 Band (+50°C; -55.2 VDC)

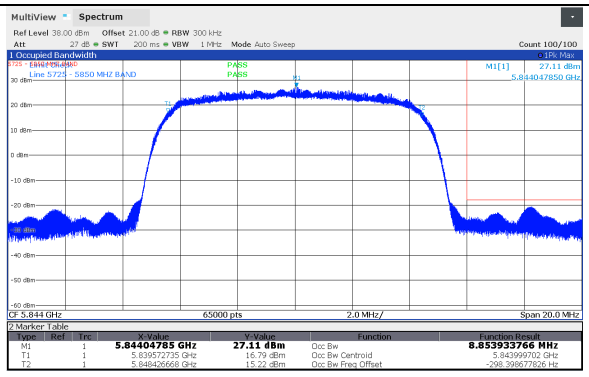


Figure 8.6-37: Frequency stability, 99% OBW, 10 MHz Channel BW, Highest channel (5844 MHz), SB2P Band (+20°C; -40.8 VDC)

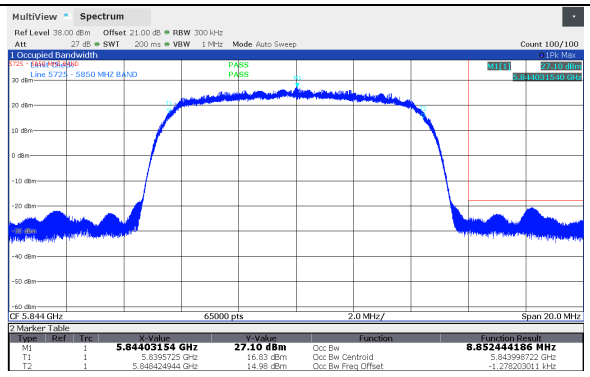


Figure 8.6-38: Frequency stability, 99% OBW, 10 MHz Channel BW, Highest channel (5844 MHz), SB2P Band (+50°C; -55.2 VDC)

8.7 FCC 15.407 (6) Radiated spurious emission test

8.7.1 Definitions and limits

FCC:
(6) Unwanted emissions below 1 GHz must comply with the general field strength limits set forth in §15.209. Further, any U-NII devices using an AC power line are required to comply also with the conducted limits set forth in §15.207.
(7) The provisions of §15.205 apply to intentional radiators operating under this section.

An additional consideration when performing conducted measurements of restricted-band emissions it that unwanted emissions radiating from the EUT cabinet, control circuits, power leads, or intermediate circuit elements will likely go undetected in a conducted measurement configuration. To address this concern, a radiated test shall be performance to ensure that emissions emanating from the EUT cabinet (rather than from the antenna port) also comply with the applicable limits. For these cabinet radiated spurious emission measurements, the EUT transmit antenna may be replaced with a termination matching the nominal impedance of the antenna. Procedures for performing radiated measurements are specified in 6.3, 6.5 and 6.6. All detected emissions shall comply with the applicable requirements.

8.7.2 Test summary

Test date:	March 9, 2020 ; March 10, 2020	Temperature:	22 °C ; 23 °C
Test engineer:	Martha Espinoza	Air pressure:	1003 mbar ; 1005 mbar
Verdict:	Pass	Relative humidity:	34 % ; 41 %

8.7.3 Setup details

EUT setup configuration	Table top
Test facility	3 m Semi anechoic chamber
Measuring distance	3 m
Antenna height variation	1–4 m
Turn table position	0–360°
Measurement details	A preview measurement was generated with receiver in continuous scan or sweep mode while the EUT was rotated and antenna adjusted to maximize radiated emission. Emissions detected within 6 dB or above limit were re-measured with the appropriate detector against the correlating limit and recorded as the final measurement.

Receiver/spectrum analyzer settings for frequencies below 1 GHz:

Resolution bandwidth	120 kHz
Video bandwidth	300 kHz
Detector mode	– Peak (Preview measurement) – Quasi-peak (Final measurement)
Trace mode	Max Hold
Measurement time	– 100 ms (Peak preview measurement) – 5000 ms (Quasi-peak final measurement)

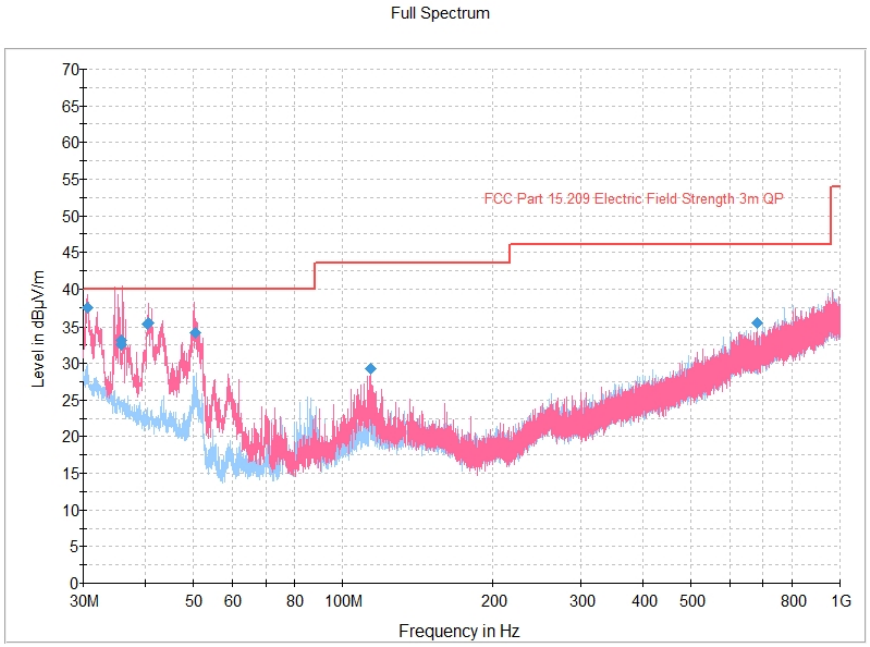
Receiver/spectrum analyzer settings for frequencies above 1 GHz:

Resolution bandwidth	1 MHz
Video bandwidth	3 MHz
Detector mode	Peak (Preview measurement) Peak and CAverage (Final measurement)
Trace mode	Max Hold
Measurement time	– 100 ms (Peak preview measurement) – 5000 ms (Peak and CAverage final measurement)

8.7.4 Observations, settings and special notes

This data was taken using as mentioned before, using the 4QAM modulation because it was determined as the worst case. All the middle channels were measured with a 10 MHz bandwidth as a representative case. The frequency range measured was from 30 MHz to 18 GHz. A dummy load was connected to the conducted radio output for replacing the external antenna.

8.7.5 Test data



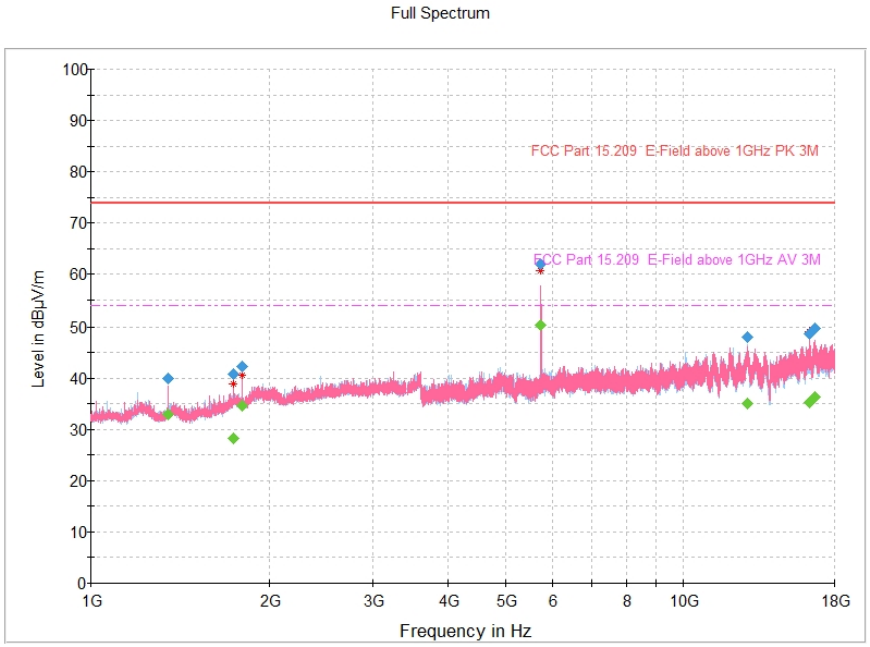
The spectral plot is a summation of a vertical and horizontal scan. The spectral scan has been corrected with the associated transducer factors (i.e. antenna factors, cable loss, amplifier gains, and attenuators).

Figure 8.7-1: *Radiated disturbance spectral plot (30 to 1000 MHz). Middle channel, 5741 MHz, SB1 Band*

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
30.560000	37.51	40.00	2.49	1000.0	120.000	102.0	V	36.0	26.1
35.736000	32.60	40.00	7.40	1000.0	120.000	107.0	V	110.0	23.3
35.861667	33.12	40.00	6.88	1000.0	120.000	98.0	V	226.0	23.2
40.516667	35.36	40.00	4.64	1000.0	120.000	102.0	V	337.0	20.7
40.533000	35.58	40.00	4.42	1000.0	120.000	98.0	V	177.0	20.6
50.465333	34.15	40.00	5.85	1000.0	120.000	104.0	V	123.0	15.6
113.646333	29.23	43.50	14.27	1000.0	120.000	402.0	V	322.0	18.8
682.648333	35.45	46.00	10.55	1000.0	120.000	225.0	H	194.0	29.6

Table 8.7-1: *Radiated disturbance (Quasi-Peak) results. Middle channel, 5741 MHz, SB1 Band*

Notes:
[1] Field strength (dBµV/m) = receiver/spectrum analyzer value (dBµV) + correction factor (dB)
[2] Correction factor = antenna factor ACF (dB) + cable loss (dB)
[3] The maximum measured value observed over a period of 1 second was recorded.



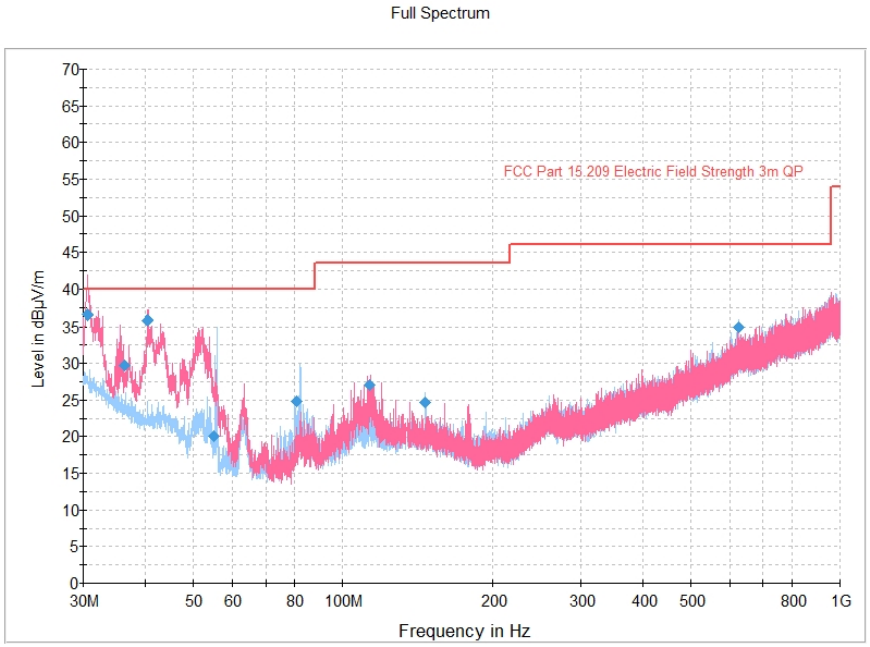
The spectral plot is a summation of a vertical and horizontal scan. The spectral scan has been corrected with the associated transducer factors (i.e. antenna factors, cable loss, amplifier gains, and attenuators).

Figure 8.7-2: *Radiated disturbance spectral plot (1 – 18 GHz). Middle channel, 5741 MHz, SB1 Band*

Frequency (MHz)	MaxPeak (dBµV/m)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1349.866667	40.00	---	73.90	33.90	5000.0	1000.000	203.0	V	46.0	-15.1
1349.866667	---	32.86	53.90	21.04	5000.0	1000.000	203.0	V	46.0	-15.1
1739.900000	---	28.18	53.90	25.72	5000.0	1000.000	100.0	V	0.0	-13.2
1739.900000	40.68	---	73.90	33.22	5000.0	1000.000	100.0	V	0.0	-13.2
1800.133333	---	34.67	53.90	19.23	5000.0	1000.000	208.0	V	347.0	-12.9
1800.133333	42.26	---	73.90	31.64	5000.0	1000.000	208.0	V	347.0	-12.9
5740.666667	Fundamental				5000.0	1000.000	191.0	V	355.0	-2.3
5740.666667	Fundamental				5000.0	1000.000	191.0	V	355.0	-2.3
12824.333333	47.99	---	73.90	25.91	5000.0	1000.000	256.0	H	78.0	6.5
12824.333333	---	34.99	53.90	18.91	5000.0	1000.000	256.0	H	78.0	6.5
16339.433333	48.64	---	73.90	25.26	5000.0	1000.000	247.0	H	336.0	10.1
16339.433333	---	35.30	53.90	18.60	5000.0	1000.000	247.0	H	336.0	10.1
16663.333333	---	36.27	53.90	17.63	5000.0	1000.000	200.0	V	105.0	10.7
16663.333333	49.63	---	73.90	24.27	5000.0	1000.000	200.0	V	105.0	10.7

Table 8.7-2: *Radiated disturbance (Peak and CAverage) results. Middle channel, 5741 MHz, SB1 Band*

Notes:
[1] Field strength (dBµV/m) = receiver/spectrum analyzer value (dBµV) + correction factor (dB)
[2] Correction factor = antenna factor ACF (dB) + cable loss (dB)
[3] The maximum measured value observed over a period of 5 seconds was recorded.



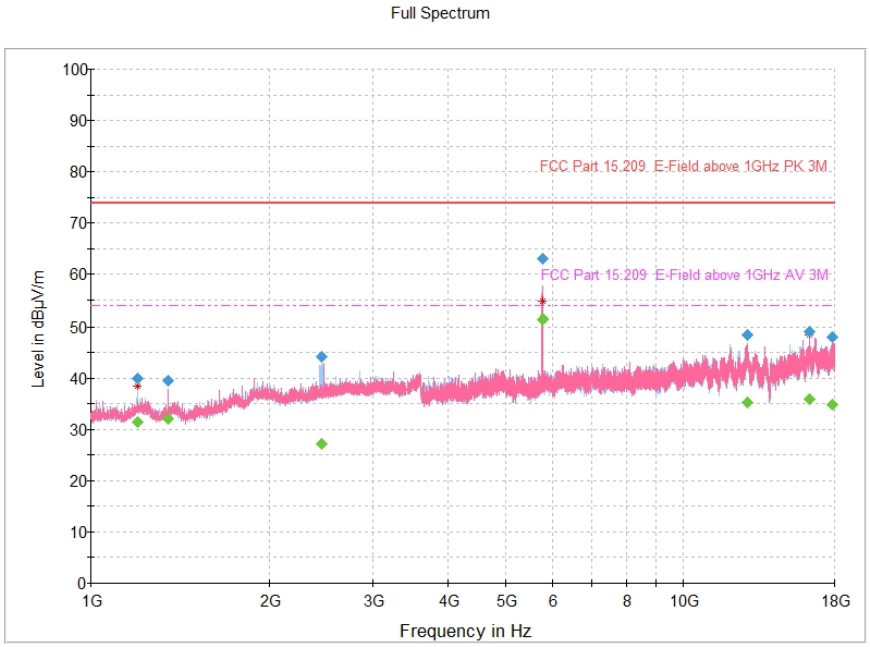
The spectral plot is a summation of a vertical and horizontal scan. The spectral scan has been corrected with the associated transducer factors (i.e. antenna factors, cable loss, amplifier gains, and attenuators).

Figure 8.7-1: *Radiated disturbance spectral plot (30 to 1000 MHz). Middle channel, 5771 MHz, SB2 Band*

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
30.560000	36.51	40.00	3.49	1000.0	120.000	104.0	V	223.0	26.1
36.321333	29.79	40.00	10.21	1000.0	120.000	115.0	V	147.0	22.9
40.493000	35.89	40.00	4.11	1000.0	120.000	109.0	V	340.0	20.7
54.889667	19.99	40.00	20.01	1000.0	120.000	150.0	H	232.0	13.7
80.792000	24.89	40.00	15.11	1000.0	120.000	215.0	H	112.0	14.8
113.206333	27.05	43.50	16.45	1000.0	120.000	354.0	V	10.0	18.8
146.069000	24.66	43.50	18.84	1000.0	120.000	185.0	H	171.0	19.2
624.294333	34.86	46.00	11.14	1000.0	120.000	377.0	H	211.0	28.9

Table 8.7-1: *Radiated disturbance (Quasi-Peak) results. Middle channel, 5771 MHz, SB2 Band*

Notes:
[1] Field strength (dBµV/m) = receiver/spectrum analyzer value (dBµV) + correction factor (dB)
[2] Correction factor = antenna factor ACF (dB) + cable loss (dB)
[3] The maximum measured value observed over a period of 1 second was recorded.



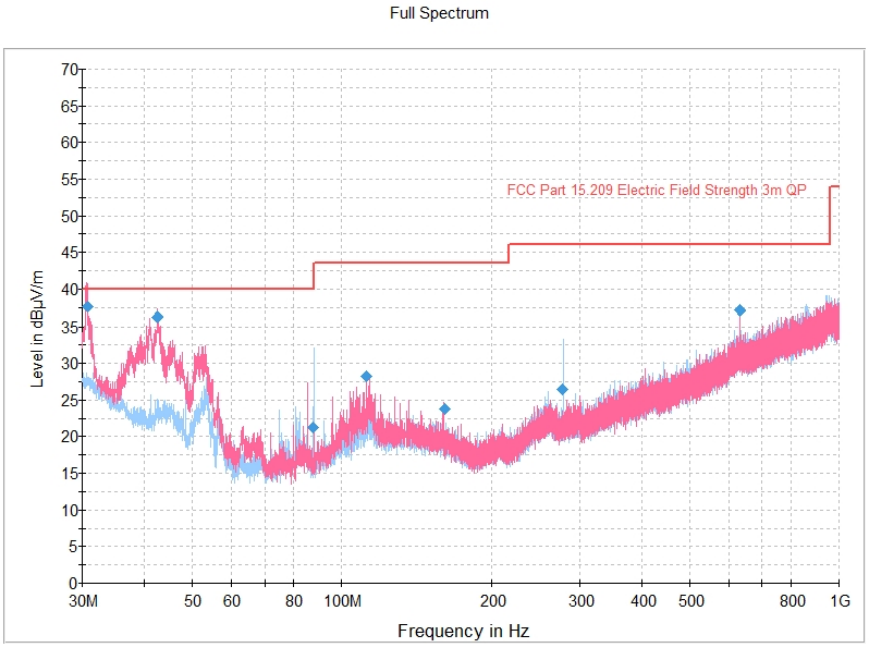
The spectral plot is a summation of a vertical and horizontal scan. The spectral scan has been corrected with the associated transducer factors (i.e. antenna factors, cable loss, amplifier gains, and attenuators).

Figure 8.7-2: *Radiated disturbance spectral plot (1 – 18 GHz). Middle channel, 5771 MHz, SB2 Band*

Frequency (MHz)	MaxPeak (dBµV/m)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1199.866667	---	31.47	53.90	22.43	5000.0	1000.000	198.0	H	127.0	-14.5
1199.866667	39.89	---	73.90	34.01	5000.0	1000.000	198.0	H	127.0	-14.5
1350.033333	---	32.06	53.90	21.84	5000.0	1000.000	205.0	V	326.0	-15.1
1350.033333	39.50	---	73.90	34.40	5000.0	1000.000	205.0	V	326.0	-15.1
2460.200000	44.15	---	73.90	29.75	5000.0	1000.000	363.0	H	250.0	-10.5
2460.200000	---	27.20	53.90	26.70	5000.0	1000.000	363.0	H	250.0	-10.5
5771.066667	Fundamental				5000.0	1000.000	186.0	V	215.0	-2.1
5771.066667	Fundamental				5000.0	1000.000	186.0	V	215.0	-2.1
12831.533333	48.34	---	73.90	25.56	5000.0	1000.000	329.0	H	94.0	6.5
12831.533333	---	35.28	53.90	18.62	5000.0	1000.000	329.0	H	94.0	6.5
16305.633333	49.03	---	73.90	24.87	5000.0	1000.000	325.0	H	215.0	10.3
16305.633333	---	35.81	53.90	18.09	5000.0	1000.000	325.0	H	215.0	10.3
17816.200000	---	34.86	53.90	19.04	5000.0	1000.000	332.0	V	210.0	10.9
17816.200000	47.98	---	73.90	25.92	5000.0	1000.000	332.0	V	210.0	10.9

Table 8.7-2: *Radiated disturbance (Peak and CAverage) results. Middle channel, 5771 MHz, SB2 Band*

Notes:
[1] Field strength (dBµV/m) = receiver/spectrum analyzer value (dBµV) + correction factor (dB)
[2] Correction factor = antenna factor ACF (dB) + cable loss (dB)
[3] The maximum measured value observed over a period of 5 seconds was recorded.



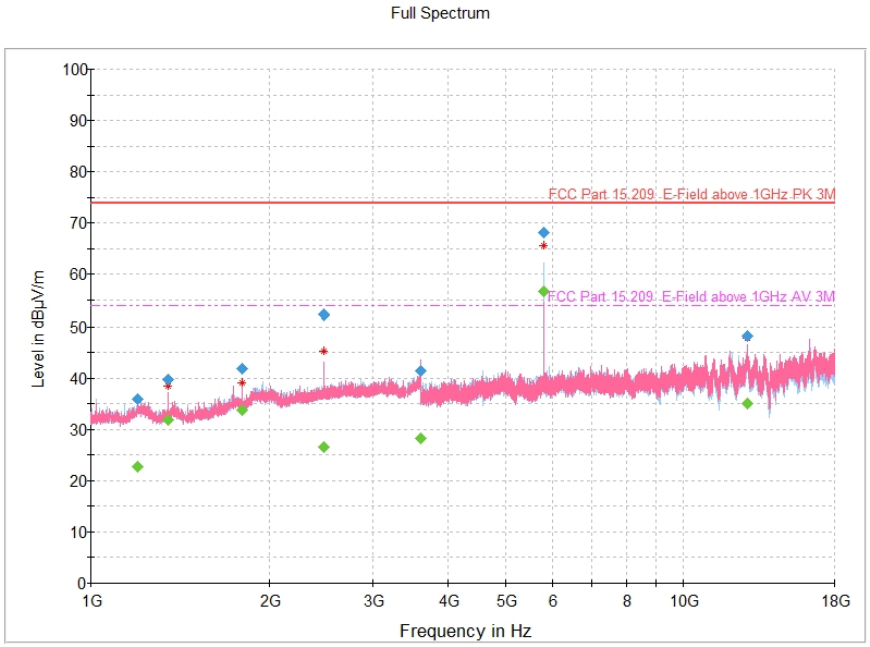
The spectral plot is a summation of a vertical and horizontal scan. The spectral scan has been corrected with the associated transducer factors (i.e. antenna factors, cable loss, amplifier gains, and attenuators).

Figure 8.7-1: *Radiated disturbance spectral plot (30 to 1000 MHz). Middle channel, 5804 MHz, SB1P Band*

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
30.720000	37.64	40.00	2.36	1000.0	120.000	118.0	V	228.0	26.0
42.505333	36.25	40.00	3.75	1000.0	120.000	104.0	V	128.0	19.6
87.484333	21.25	40.00	18.75	1000.0	120.000	145.0	H	248.0	15.6
112.037333	28.17	43.50	15.33	1000.0	120.000	383.0	V	45.0	18.7
160.332333	23.85	43.50	19.65	1000.0	120.000	368.0	V	322.0	18.4
277.415333	26.42	46.00	19.58	1000.0	120.000	372.0	H	339.0	21.0
630.009667	37.14	46.00	8.86	1000.0	120.000	203.0	V	8.0	29.1

Table 8.7-1: *Radiated disturbance (Quasi-Peak) results. Middle channel, 5804 MHz, SB1P Band*

Notes:
[1] Field strength (dBµV/m) = receiver/spectrum analyzer value (dBµV) + correction factor (dB)
[2] Correction factor = antenna factor ACF (dB) + cable loss (dB)
[3] The maximum measured value observed over a period of 1 second was recorded.



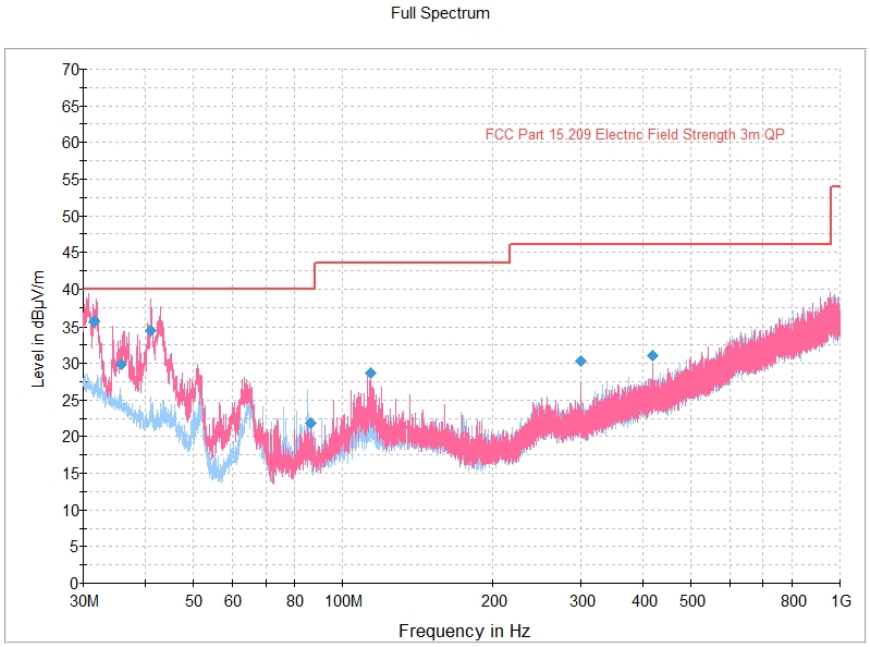
The spectral plot is a summation of a vertical and horizontal scan. The spectral scan has been corrected with the associated transducer factors (i.e. antenna factors, cable loss, amplifier gains, and attenuators).

Figure 8.7-2: *Radiated disturbance spectral plot (1 – 18 GHz). Middle channel, 5804 MHz, SB1P Band*

Frequency (MHz)	MaxPeak (dBµV/m)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1198.266667	---	22.78	53.90	31.12	5000.0	1000.000	162.0	V	228.0	-14.5
1198.266667	35.85	---	73.90	38.05	5000.0	1000.000	162.0	V	228.0	-14.5
1350.033333	39.73	---	73.90	34.17	5000.0	1000.000	205.0	V	182.0	-15.1
1350.033333	---	31.89	53.90	22.01	5000.0	1000.000	205.0	V	182.0	-15.1
1800.133333	41.83	---	73.90	32.07	5000.0	1000.000	209.0	V	87.0	-12.9
1800.133333	---	33.76	53.90	20.14	5000.0	1000.000	209.0	V	87.0	-12.9
2479.966667	---	26.44	53.90	27.46	5000.0	1000.000	154.0	V	264.0	-10.5
2479.966667	52.28	---	73.90	21.62	5000.0	1000.000	154.0	V	264.0	-10.5
3599.133333	---	28.34	53.90	25.56	5000.0	1000.000	123.0	V	246.0	-6.3
3599.133333	41.44	---	73.90	32.46	5000.0	1000.000	123.0	V	246.0	-6.3
5803.966667	Fundamental				5000.0	1000.000	121.0	H	341.0	-1.8
5803.966667	Fundamental				5000.0	1000.000	121.0	H	341.0	-1.8
12825.566667	---	34.93	53.90	18.97	5000.0	1000.000	312.0	V	136.0	6.5
12825.566667	48.10	---	73.90	25.80	5000.0	1000.000	312.0	V	136.0	6.5

Table 8.7-2: *Radiated disturbance (Peak and CAverage) results. Middle channel, 5804 MHz, SB1P Band*

Notes:
[1] Field strength (dBµV/m) = receiver/spectrum analyzer value (dBµV) + correction factor (dB)
[2] Correction factor = antenna factor ACF (dB) + cable loss (dB)
[3] The maximum measured value observed over a period of 5 seconds was recorded.



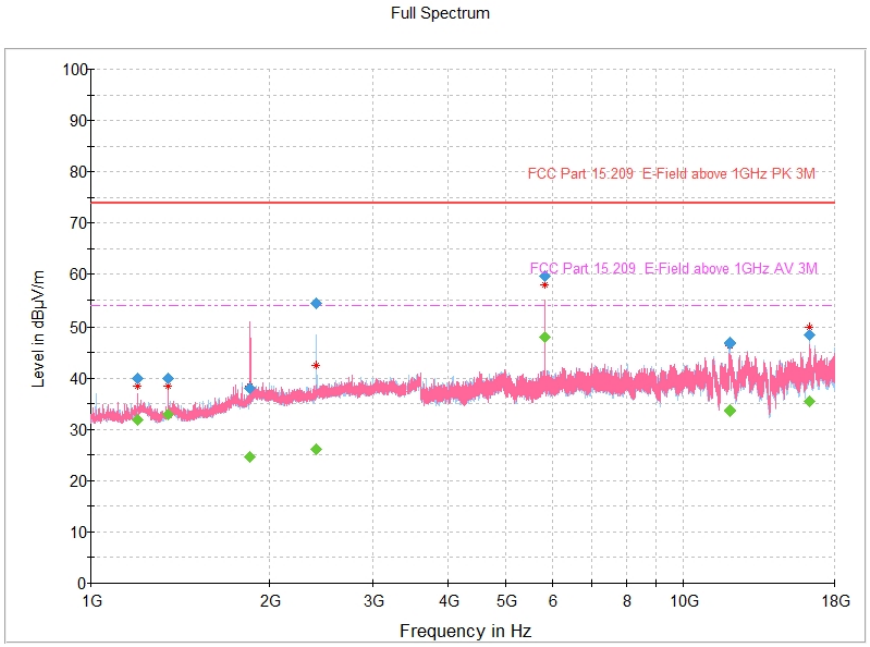
The spectral plot is a summation of a vertical and horizontal scan. The spectral scan has been corrected with the associated transducer factors (i.e. antenna factors, cable loss, amplifier gains, and attenuators).

Figure 8.7-1: *Radiated disturbance spectral plot (30 to 1000 MHz). Middle channel, 5834 MHz, SB2P Band*

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
31.560000	35.70	40.00	4.30	1000.0	120.000	124.0	V	10.0	25.5
35.742000	29.88	40.00	10.12	1000.0	120.000	124.0	V	223.0	23.3
41.082667	34.45	40.00	5.55	1000.0	120.000	110.0	V	337.0	20.3
86.096000	21.86	40.00	18.14	1000.0	120.000	196.0	H	76.0	15.4
113.662000	28.67	43.50	14.83	1000.0	120.000	356.0	V	114.0	18.8
300.023333	30.35	46.00	15.65	1000.0	120.000	103.0	V	10.0	21.6
419.724667	30.99	46.00	15.01	1000.0	120.000	125.0	V	309.0	25.4

Table 8.7-1: *Radiated disturbance (Quasi-Peak) results. Middle channel, 5834 MHz, SB2P Band*

Notes:
[1] Field strength (dBµV/m) = receiver/spectrum analyzer value (dBµV) + correction factor (dB)
[2] Correction factor = antenna factor ACF (dB) + cable loss (dB)
[3] The maximum measured value observed over a period of 1 second was recorded.



The spectral plot is a summation of a vertical and horizontal scan. The spectral scan has been corrected with the associated transducer factors (i.e. antenna factors, cable loss, amplifier gains, and attenuators).

Figure 8.7-2: *Radiated disturbance spectral plot (1 – 18 GHz). Middle channel, 5834 MHz, SB2P Band*

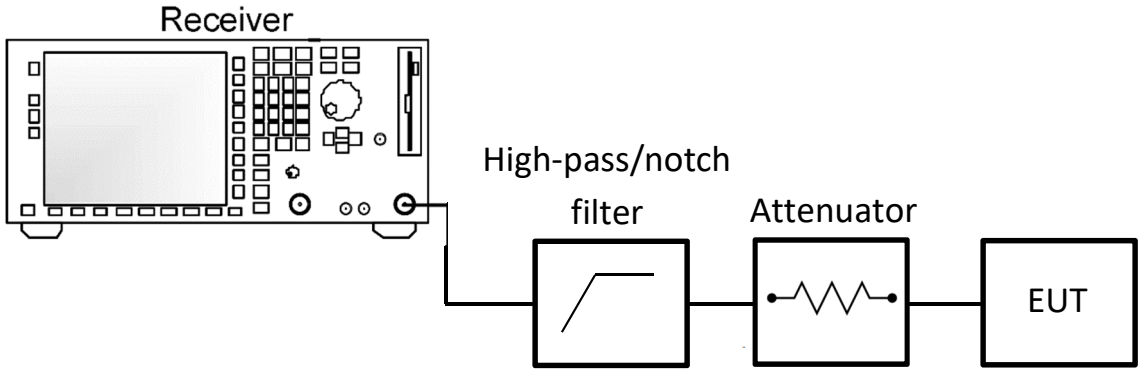
Frequency (MHz)	MaxPeak (dBµV/m)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1200.033333	---	31.81	53.90	22.09	5000.0	1000.000	210.0	H	96.0	-14.5
1200.033333	39.89	---	73.90	34.01	5000.0	1000.000	210.0	H	96.0	-14.5
1350.033333	---	32.82	53.90	21.08	5000.0	1000.000	203.0	V	22.0	-15.1
1350.033333	39.85	---	73.90	34.05	5000.0	1000.000	203.0	V	22.0	-15.1
1859.233333	38.08	---	73.90	35.82	5000.0	1000.000	219.0	V	87.0	-12.1
1859.233333	---	24.73	53.90	29.17	5000.0	1000.000	219.0	V	87.0	-12.1
2402.333333	54.26	---	73.90	19.64	5000.0	1000.000	119.0	H	52.0	-11.0
2402.333333	---	26.17	53.90	27.73	5000.0	1000.000	119.0	H	52.0	-11.0
5833.900000	Fundamental				5000.0	1000.000	191.0	V	0.0	-1.8
5833.900000	Fundamental				5000.0	1000.000	191.0	V	0.0	-1.8
11975.266667	46.99	---	73.90	26.91	5000.0	1000.000	268.0	H	21.0	3.5
11975.266667	---	33.63	53.90	20.27	5000.0	1000.000	268.0	H	21.0	3.5
11984.466667	---	33.68	53.90	20.22	5000.0	1000.000	357.0	H	45.0	3.6
11984.466667	46.69	---	73.90	27.21	5000.0	1000.000	357.0	H	45.0	3.6
16301.800000	---	35.54	53.90	18.36	5000.0	1000.000	310.0	H	238.0	10.3
16301.800000	48.49	---	73.90	25.41	5000.0	1000.000	310.0	H	238.0	10.3

Table 8.7-2: *Radiated disturbance (Peak and CAverage) results. Middle channel, 5834 MHz, SB2P Band*

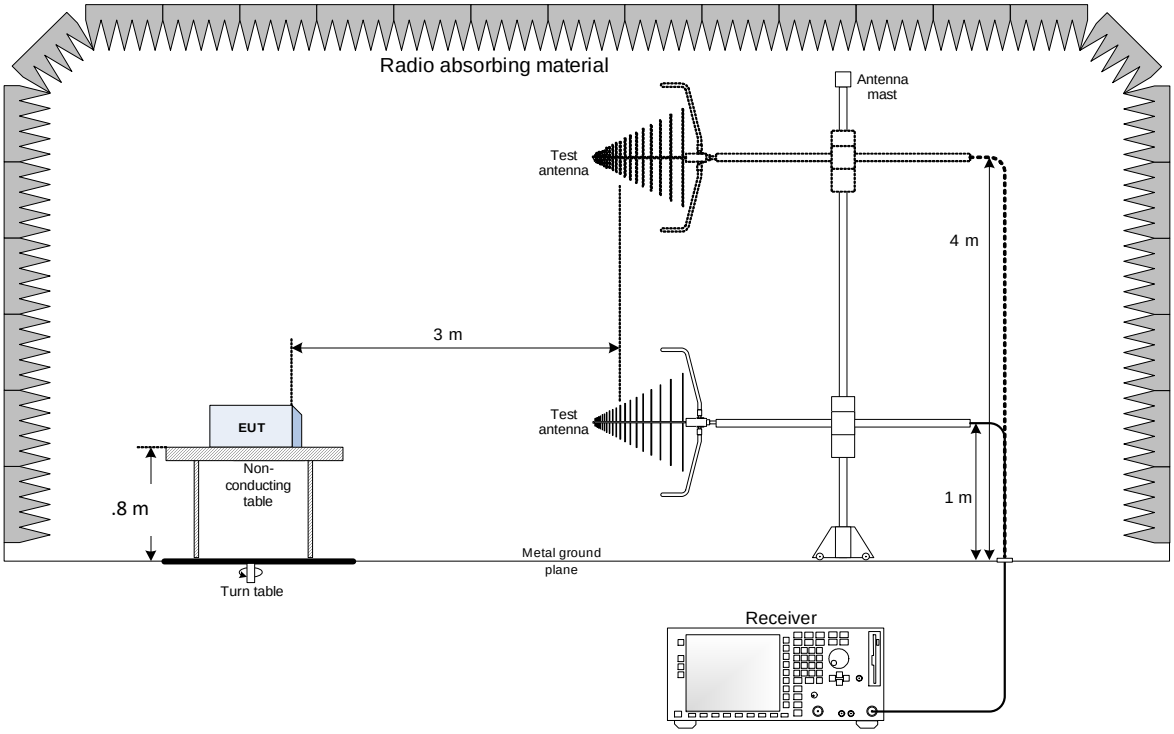
Notes:
[1] Field strength (dBµV/m) = receiver/spectrum analyzer value (dBµV) + correction factor (dB)
[2] Correction factor = antenna factor ACF (dB) + cable loss (dB)
[3] The maximum measured value observed over a period of 5 seconds was recorded.

Section 9. Block diagrams of test set-ups

9.1 Conducted emissions set-up



9.2 Radiated emissions set-up below 1 GHz



9.3 Radiated emissions set-up above 1 GHz