

FCC and ISED Canada Testing of the

Esprit Model Inc.
JETIDS16G2US

In accordance with FCC 47 CFR part 15.247 and
ISED Canada's Radio Standards Specifications
RSS-247

Prepared for: Esprit Model Inc.
1240 Clearmont st. NW
Palm Bay, FL 32905

FCC ID: ONTJETIDS16G2US
IC: 10491A-JETDS16G2US

COMMERCIAL-IN-CONFIDENCE

Document Number: TP72163751.100 | Version Number: 01



America

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RESPONSIBLE FOR	NAME	DATE	SIGNATURE
Authorized Signatory	Peter Walsh	2021 -April-12	
Testing	Thierry Jean-Charles	2021-April-12	

Signatures in this approval box have checked this document in line with the requirements of TÜV SÜD Product Service document control rules.

FCC Accreditation
Designation Number US1063 Tampa, FL Test Laboratory
Innovation, Science, and Economic Development Canada
Accreditation
Site Number 2087A-2 Tampa, FL Test Laboratory

EXECUTIVE SUMMARY

Samples of this product were tested and found to be in compliance with 15.247 and ISED Canada's RSS-247



A2LA Cert. No. 2955.15

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1 Report Summary

1.1 Report Modification Record

Alterations and additions to this report will be issued to the holders of each copy in the form of a complete document.

Issue	Description of Change	Date of Issue
1	First Issue	2021-April-12

1.2 Introduction

The purpose of this report is to demonstrate compliance with Part 15 Subpart C of the FCC's Code of Federal Regulations Section 15.247 and Innovation Science and Economic Development Canada's Radio Standards Specification RSS-247 for the tests documented herein.



Applicant	Esprit Model Inc.
Manufacturer	Esprit Model Inc.
Applicant's Email Address	zb@espritmodel.com
Model Number(s)	JETIDS16G2US
Serial Number(s)	203600148
FCC ID	ONTJETIDS16G2US
ISED Certification Number	10491A-JETDS16G2US
Hardware Version(s)	DS-16II
Software Version(s)	5.05
Number of Samples Tested	1
Test Specification/Issue/Date	US Code of Federal Regulations (CFR): Title 47, Part 15, Subpart C: Radio Frequency Devices, Intentional Radiators, 2021 Innovation, Science and Economic Development Canada Radio Standards Specification: RSS-247 — Digital Transmission Systems (DTSS), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices, Issue 2, February 2017
Test Plan/Issue/Date	2020-October-12
Order Number	72163751
Date	2020-October-16
Date of Receipt of EUT	2020-November-10
Start of Test	2020-November-12
Finish of Test	2021-February-15
Name of Engineer(s)	Thierry Jean-Charles and Jean N. Rene
Related Document(s)	ANSI C63.10-2013: American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices FCC OET KDB Publication 558074 D01 15.247 Meas Guidance v05r02: Guidance for Compliance Measurements on Digital Transmission System, Frequency Hopping Spread Spectrum System, and Hybrid System Devices Operating under Section 15.247 of the FCC Rules, April 2, 2019. US Code of Federal Regulations (CFR): Title 47, Part 2, Subpart J: Equipment Authorization Procedures, 2021. Innovation, Science and Economic Development Canada Radio Standards Specification: RSS-GEN - General Requirements for Compliance of Radio Apparatus, Issue 5, Amendment 1, March 2019.



1.3 Brief Summary of Results

A brief summary of the tests carried out in accordance with FCC Part 15.247 and ISED Canada's RSS-247 is shown below.

Table 1.3-1: Test Result Summary

Test Parameter	Test Plan (Yes/No)	Test Result	FCC 47 CFR Rule Part	ISED Canada's RSS	Test Report Page No
Antenna Requirement	Yes	Pass	15.203, 15.204	-----	10
Carrier Frequency Separation	Yes	Pass	15.247(a)(1)	RSS-247 5.1(b)	11
Number of Hopping Channels	Yes	Pass	15.247(a)(1)(iii)	RSS-247 5.1(d)	14
Channel Dwell Time	Yes	Pass	15.247(a)(1)(iii)	RSS-247 5.1(d)	17
20 dB Bandwidth	Yes	Pass	15.247(a)(1)(i)	RSS-247 5.1(a)	22
99% Bandwidth	Yes	Pass	-----	RSS-GEN 6.7	27
Peak Output Power	Yes	Pass	15.247(b)(3)	RSS-247 5.4(d)	32
Band-Edge Compliance of RF Conducted Emissions	Yes	Pass	15.247(d)	RSS-247 5.5	37
RF Conducted Spurious Emissions	Yes	Pass	15.247(d)	RSS-247 5.5	43
Radiated Spurious Emissions into Restricted Frequency Bands	Yes	Pass	15.205, 15.209	RSS-GEN 8.9, 8.10	48
Power Spectral Density	Yes	Pass	15.247(e)	RSS-247 5.2(b)	55
AC Power Line Conducted Emissions	Yes	Pass	15.207	RSS-GEN 8.8	60



1.4 Product Information

1.4.1 Technical Description

The Equipment Under Test (EUT) was a remote control which includes one 900 MHz LoRa and two 2.4 GHz transceivers. Each of the 2.4 GHz transceivers is configured with two antenna ports. The 900 MHz and 2.4 GHz transceivers can transmit simultaneously.

Technical Details

Mode of Operation: LoRa
 Frequency Range: 902.5 MHz - 927.3 MHz
 Number of Channels: 32
 Channel Separation: 800 kHz
 Data Rate: SF = 6: 9.375 kbps
 SF= 7: 5.468 kbps
 Modulations: Chirp Spread Spectrum (CSS)
 Antenna Type/Gain: PCB Antenna / 3 dBi
 Input Power: 3.6 VDC Battery, 12 VDC Power Supply

A full description and detailed product specification details are available from the manufacturer.

Table 1.4.1-1 – Cable Descriptions

Cable/Port	Description
Audio	1.2m, Not Shielded, Earbuds to EUT
Power	1.8 m, Not Shielded, Power Supply to EUT

Table 1.4.1-2 – Support Equipment Descriptions

Make/Model	Description
N/A	Earbuds
JETI Model / SYS1531-2412-W2	12 VDC Power Supply, S/N: G190405015683



Declaration of Build Status

EQUIPMENT DESCRIPTION	
Model Name/Number	JETI Duplex DS-16 G2
Part Number	JETI DS-16II
Hardware Version	DS-16II
Software Version	5.05
FCC ID (if applicable)	ONTJETIDS16G2US
ISED ID (if applicable)	10491A-JETDS16G2US
Technical Description (Please provide a brief description of the intended use of the equipment)	Transmitter for radio-controlled toys

UN-INTENTIONAL RADIATOR	
Highest frequency generated or used in the device or on which the device operates or tunes	2.480 GHz
Lowest frequency generated or used in the device or on which the device operates or tunes	16 MHz
Class A Digital Device (Use in commercial, industrial or business environment) ☐	
Class B Digital Device (Use in residential environment only) ☒	

Power Source			
AC	Single Phase	Three Phase	Nominal Voltage
	☒	☐	
External DC	Nominal Voltage		Maximum Current
	12 vdc		500 ma
Battery	Nominal Voltage		Battery Operating End Point Voltage
	3.6 vdc		3.3 vdc

EXTREME CONDITIONS			
Maximum temperature	+85	°C	Minimum temperature -40 °C

Ancillaries
Please list all ancillaries which will be used with the device.

I hereby declare that the information supplied is correct and complete.

Name: Danny Melnik

Position held: Engineer

Date: 4-12-2021



1.4.2 Modes of Operation

The EUT was evaluated for the 900 MHz LoRa radio configured with power setting 14. Both spreading factors 6 and 7 were evaluated and where applicable, the worst case results are reported.

1.4.3 Monitoring of Performance

The transmitter powers off when connected to the AC Mains. The power line conducted emissions were performed for the EUT off and charging as per normal operation.

Preliminary radiated emissions measurements were performed for the EUT in three orthogonal orientations on the table top. The worst case orientation, EUT flat on the table top, was tested in full for the worst-case spreading factor configuration, SF = 7, and is reported in this document.

The EUT was also evaluated for intermodulation products for the 2.4 GHz and 900 MHz transmitters operating simultaneously. All intermodulations products were found to be in compliance.

For the RF conducted measurements, temporary RF connectors were connected to the antenna ports to allow direct coupling to the spectrum analyzer.

1.4.4 Performance Criteria

The EUT was evaluated to the requirements listed below.

Table 1.4.4 -1: Performance Criteria

Parameter	Requirement
Antenna Requirement	FCC: Section 15.203. 15.204
Carrier Frequency Separation	FCC: Section 15.247(a)(1); ISED Canada: RSS-247 5.1(b)
Number of Hopping Channels	FCC: Section 15.247(a)(1)(iii); ISED Canada: RSS-247 5.1(d)
Dwell Time	FCC: Section 15.247(a)(1)(iii); ISED Canada: RSS-247 5.1(d)
20 dB Bandwidth	FCC: Section 15.247(a)(1)(i); ISED Canada: RSS-247 5.1(a)
99% Bandwidth	ISED Canada: RSS-GEN 6.7
Peak Output Power	FCC: Section 15.247(b)(1); ISED Canada: RSS-247 5.4(b)
Band-Edge Compliance of RF Conducted Emissions	FCC: Section 15.247(d); ISED Canada: RSS-247 5.5
RF Conducted Spurious Emissions	FCC: Section 15.247(d); ISED Canada: RSS-247 5.5
Radiated Spurious Emissions into Restricted Frequency Bands	FCC: Sections 15.205, 15.209; ISED Canada: RSS-GEN 8.9, 8.10
Power Spectral Density	FCC: Section 15.247(e); ISED Canada: RSS-247(b)
AC Power Line Conducted Emissions	FCC: Section 15.207; ISED Canada: RSS-GEN 8.8

1.5 Deviations from the Standard

The evaluation was performed without any deviations from the test standards.



1.6 EUT Modification Record

The table below details modifications made to the EUT during the test program. The modifications incorporated during each test are recorded on the appropriate test pages.

Modification State	Description of Modification still fitted to EUT	Modification Fitted By	Date Modification Fitted
None			

No modifications were necessary to meet the test requirements. The modification associated with the unintentional emissions requirements are documented in the Supplier's Declaration of Conformity (SDOC) test report.

1.7 Test Location

TÜV SÜD Product Service conducted the following tests at our Tampa FL Test Laboratory.

Test Name	Name of Engineer(s)	Accreditation
DC Powered Operating		
Antenna Requirement	Thierry Jean-Charles	A2LA
Carrier Frequency Separation	Thierry Jean-Charles	A2LA
Number of Hopping Channels	Thierry Jean-Charles	A2LA
Dwell Time	Thierry Jean-Charles	A2LA
20 dB Bandwidth	Thierry Jean-Charles	A2LA
99% Bandwidth	Thierry Jean-Charles	A2LA
Peak Output Power	Thierry Jean-Charles	A2LA
Band-Edge Compliance of RF Conducted Emissions	Thierry Jean-Charles	A2LA
RF Conducted Spurious Emissions	Thierry Jean-Charles	A2LA
Radiated Spurious Emissions into Restricted Frequency Bands	Thierry Jean-Charles and Jean N. Rene	A2LA
Power Spectral Density	Thierry Jean-Charles	A2LA
Power Line Conducted Emissions	Thierry Jean-Charles	A2LA

Office Address:

TÜV SÜD America, Inc.
5610 W. Sligh Ave, Suite 100
Tampa, FL 33634
USA



2 Test Details

2.1 Antenna Requirements

2.1.1 Specification Reference

FCC: Section 15.203, 15.204

2.1.2 Equipment Under Test and Modification State

S/N: 203600148

2.1.3 Date of Test

2/3/2021

2.1.4 Test Method

N/A

2.1.5 Environmental Conditions

Ambient Temperature N/A

Relative Humidity N/A

Atmospheric Pressure N/A

2.1.6 Test Results

Limit Clause FCC Sections: 15.203, 15,204

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

The EUT is using an internal 3 dBi PCB antenna which connects to the transmitter PCB via a U.FL. connector. The antenna is not easily accessible or replaceable by the end-user and therefore meets the requirements of FCC Section 15.203.

2.1.7 Test Location and Test Equipment Used

This test was carried out in TÜV SÜD America, Inc., 5610 W. Sligh Ave, Suite 100, Tampa, FL 33634, USA.

As this was a visual inspection, no test equipment was used.



2.2 Carrier Frequency Separation

2.2.1 Specification Reference

FCC: Section 15.247(a)(1)
ISED Canada: RSS-247 5.1(c)

2.2.2 Equipment Under Test and Modification State

S/N: 203600148

2.2.3 Date of Test

2/15/2021

2.2.4 Test Method

The RF output port of the EUT was directly connected to the input of the spectrum analyzer. The span of the spectrum analyzer was set wide enough to capture two adjacent peaks and the RBW and VBW were set to approximately 30% of the channel spacing.

2.2.5 Environmental Conditions

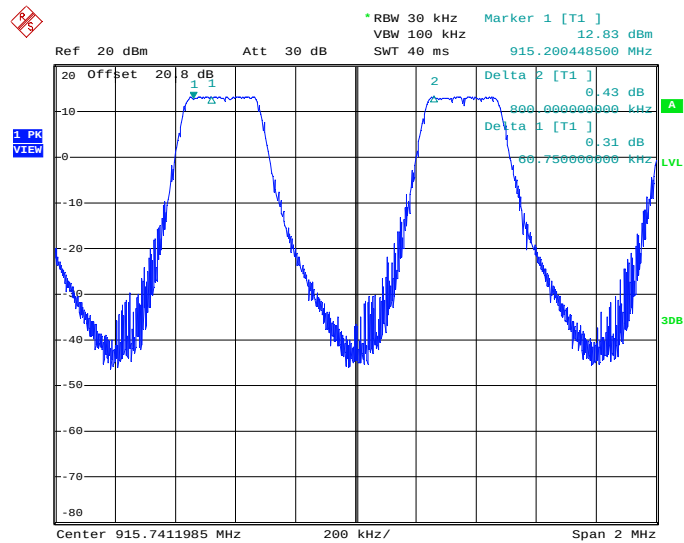
Ambient Temperature	24.6°C
Relative Humidity	52.8 %
Atmospheric Pressure	1012.9 mbar

2.2.6 Test Results

DC Powered Operating

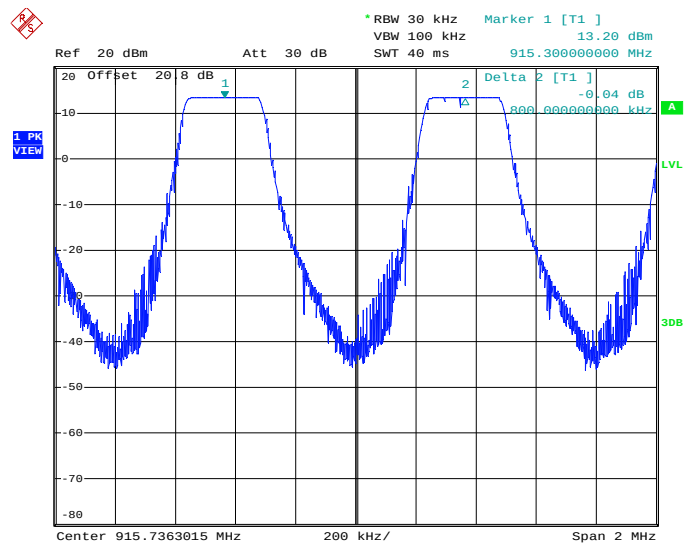
Limit Clause FCC Part 15.247(a)(1); ISED RSS-247 5.1 (c)

The Carrier Frequency Separation was measured to be 800 kHz.



Date: 15.FEB.2021 09:56:54

Figure 2.2.6-1: Carrier Frequency Separation Test Results – SF6



Date: 15.FEB.2021 10:11:12

Figure 2.2.6-2: Carrier Frequency Separation Test Results – SF7



2.2.7 Test Location and Test Equipment Used

This test was carried out in TÜV SÜD America, Inc., 5610 W. Sligh Ave, Suite 100, Tampa, FL 33634, USA.

Instrument	Manufacturer	Type No	TE No	Software / Firmware Revision	Calibration Period (months)	Calibration Due
Spectrum Analyzer	Rohde & Schwarz	FSP40	BEMC00283	4.50 SP5	24	04-Oct-2021
Attenuator 20dB, 2.9 mm-M/F, DC-40GHz 2 W	Aeroflex Inmet	40AH2W-20	BEMC02111	N/A	12	25-Jul-2021
Duratest High Frequency Cable 26.5 GHz	Teledyne Storm Products	921-0101-036	BEMC02112	N/A	12	19-Oct-2021

TU - Traceability Unscheduled

O/P MON - Traceability Unscheduled

N/A - Not Applicable



2.3 Number of Hopping Channels

2.3.1 Specification Reference

FCC: Section 15.247(a)(1)(i)
ISED Canada: RSS-247 5.1(c)

2.3.2 Equipment Under Test and Modification State

S/N: 203600148

2.3.3 Date of Test

2/15/2021

2.3.4 Test Method

The RF output port of the EUT was directly connected to the input of the spectrum analyzer. The span of the spectrum analyzer was set wide enough to capture the number of hopping channels. The peak detector max hold function was enabled for the measurements.

2.3.5 Environmental Conditions

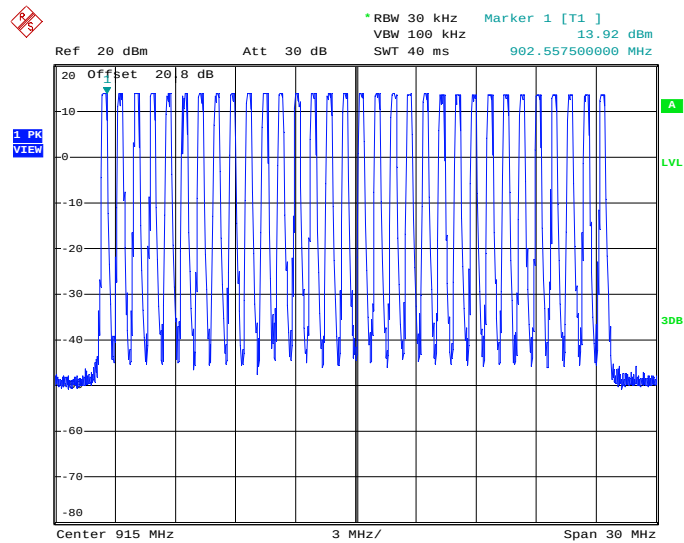
Ambient Temperature	24.6°C
Relative Humidity	53 %
Atmospheric Pressure	1012.9 mbar

2.3.6 Test Results

DC Powered Operating

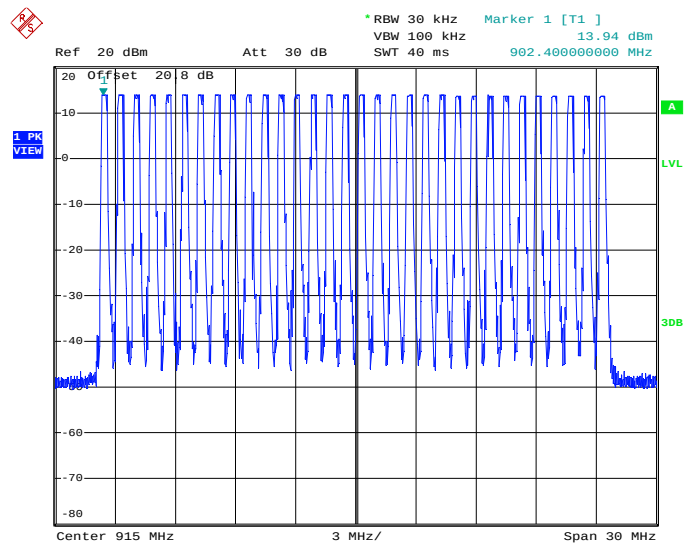
Limit Clause FCC Part 15.247(a)(1)(i); ISED RSS-247 5.1(c)

The number of hopping frequencies was measured to be 32.



Date: 15.FEB.2021 09:33:17

Figure 2.3.6-1: Number of Hopping Channels test Results – SF6



Date: 15.FEB.2021 09:22:44

Figure 2.3.6-2: Number of Hopping Channels test Results – SF7



2.3.7 Test Location and Test Equipment Used

This test was carried out in TÜV SÜD America, Inc., 5610 W. Sligh Ave, Suite 100, Tampa, FL 33634, USA.

Instrument	Manufacturer	Type No	TE No	Software / Firmware Revision	Calibration Period (months)	Calibration Due
Spectrum Analyzer	Rohde & Schwarz	FSP40	BEMC00283	4.50 SP5	24	04-Oct-2021
Attenuator 20dB, 2.9 mm-M/F, DC-40GHz 2 W	Aeroflex Inmet	40AH2W-20	BEMC02111	N/A	12	25-Jul-2021
Duratest High Frequency Cable 26.5 GHz	Teledyne Storm Products	921-0101-036	BEMC02112	N/A	12	19-Oct-2021

TU - Traceability Unscheduled

O/P MON - Traceability Unscheduled

N/A - Not Applicable



2.4 Channel Dwell Time

2.4.1 Specification Reference

FCC: Section 15.247(f)
ISED Canada: RSS-247 5.3(a)

2.4.2 Equipment Under Test and Modification State

S/N: 203600148

2.4.3 Date of Test

2/15/2021

2.4.4 Test Method

The RF output port of the EUT was directly connected to the input of the spectrum analyzer. The span of the spectrum analyzer was set 0 Hz centered on a hopping channel. The RBW was set to less than 30% of the channel spacing and the sweep time adjusted to capture the entire dwell time per channel with peak detector max hold function.

2.4.5 Environmental Conditions

Ambient Temperature 24.6°C
Relative Humidity 52.9 %
Atmospheric Pressure 1012.8 mbar

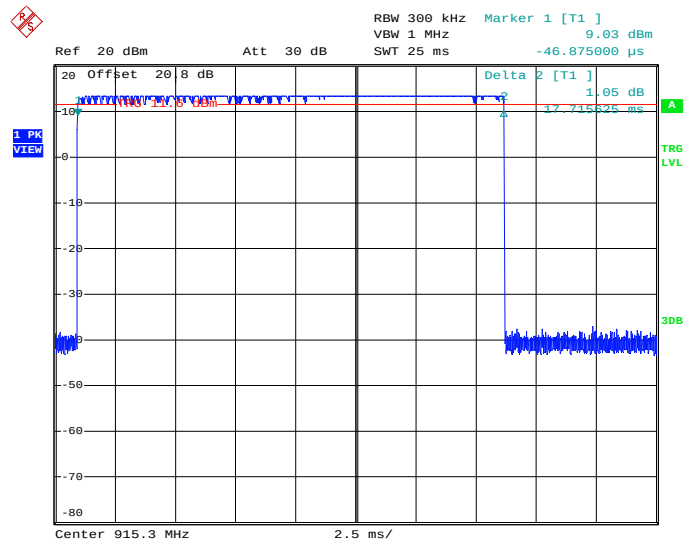
2.4.6 Test Results

DC Powered Operating

Limit Clause FCC Part 15.247(f); ISED RSS-247 5.3 (a)

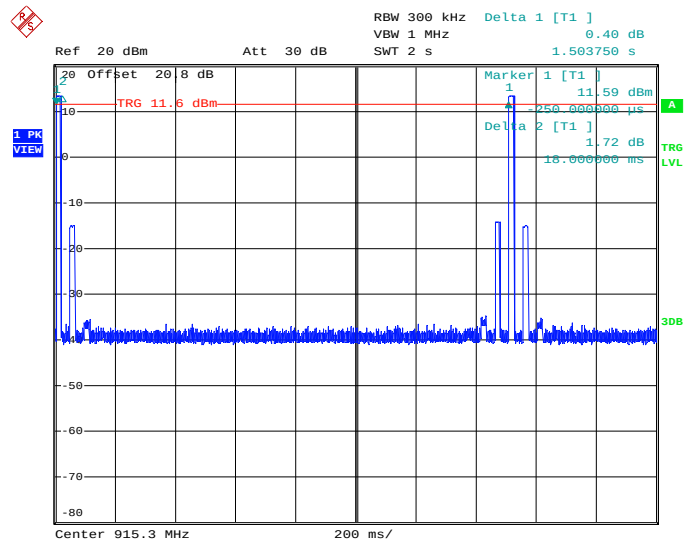
Table 2.4.6-1: Channel Dwell Time Test Results

Spreading Factor	Number of hops on a 12.8 s Cycle (NHPC)	Measured Dwell Times (ms)	Dwell Times on a 12.8 s Cycle (ms)	Limit (ms)	Status
SF = 6	9	17.716	159.44	400	PASS
SF = 7	9	17.031	153.28	400	PASS



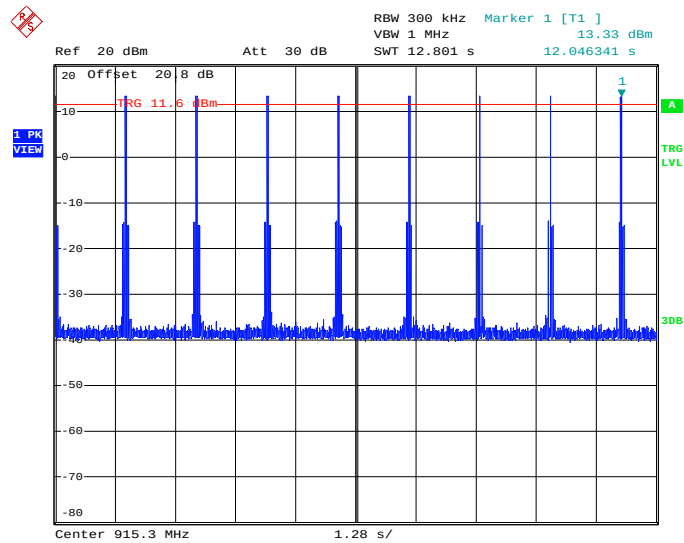
Date: 15.FEB.2021 10:21:23

Figure 2.4.6-1: Channel Dwell Time Test Results – SF6



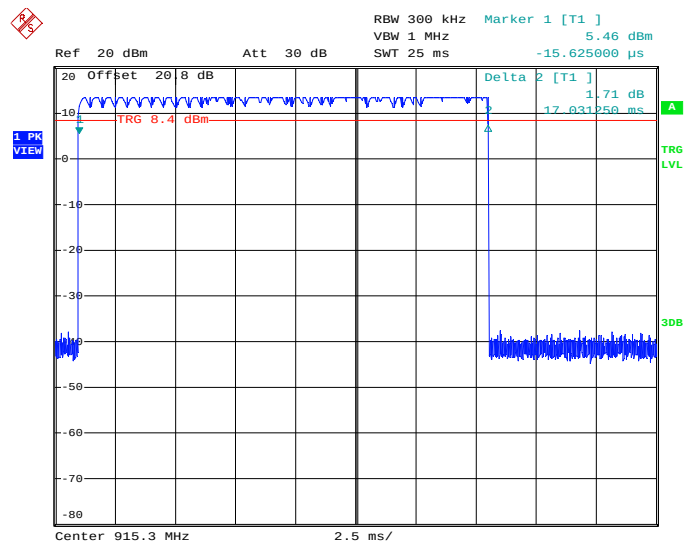
Date: 15.FEB.2021 10:35:17

Figure 2.4.6-2: Channel Dwell Time Test Results – F6



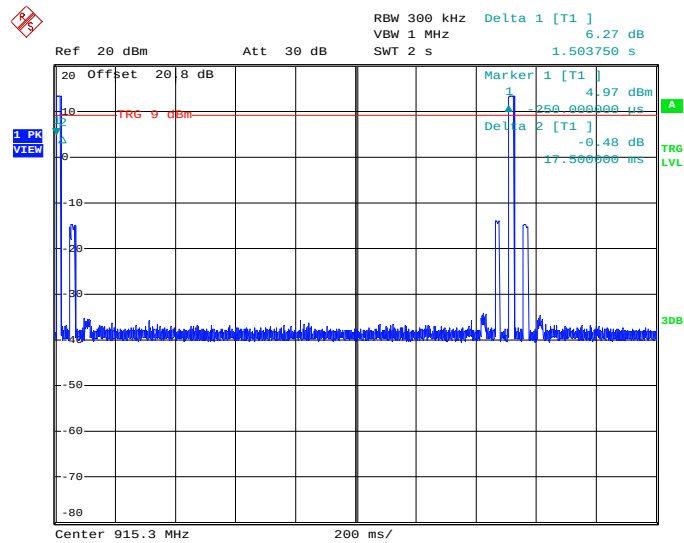
Date: 15.FEB.2021 11:10:56

Figure 2.4.6-3: Channel Dwell Time Test Results – SF6



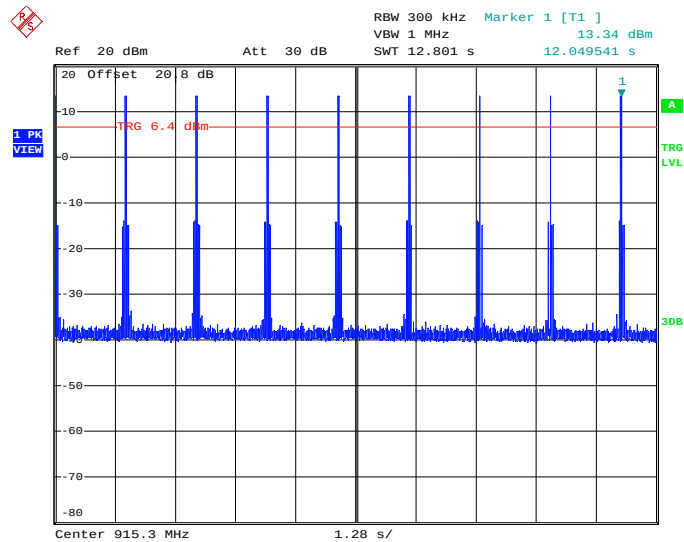
Date: 15.FEB.2021 10:16:18

Figure 2.4.6-4: Channel Dwell Time Test Results – SF7



Date: 15.FEB.2021 10:46:27

Figure 2.4.6-5: Channel Dwell Time Test Results – SF7



Date: 15.FEB.2021 11:07:21

Figure 2.4.6-6: Channel Dwell Time Test Results – SF7



2.4.7 Test Location and Test Equipment Used

This test was carried out in TÜV SÜD America, Inc., 5610 W. Sligh Ave, Suite 100, Tampa, FL 33634, USA.

Instrument	Manufacturer	Type No	TE No	Software / Firmware Revision	Calibration Period (months)	Calibration Due
Spectrum Analyzer	Rohde & Schwarz	FSP40	BEMC00283	4.50 SP5	24	04-Oct-2021
Attenuator 20dB, 2.9 mm-M/F, DC-40GHz 2 W	Aeroflex Inmet	40AH2W-20	BEMC02111	N/A	12	25-Jul-2021
Duratest High Frequency Cable 26.5 GHz	Teledyne Storm Products	921-0101-036	BEMC02112	N/A	12	19-Oct-2021

TU - Traceability Unscheduled

O/P MON - Traceability Unscheduled

N/A - Not Applicable



2.5 20 dB Bandwidth

2.5.1 Specification Reference

FCC: Section 15.247(a)(1)(i)
ISED Canada: RSS-247 5.1(a)

2.5.2 Equipment Under Test and Modification State

S/N: 203600148

2.5.3 Date of Test

2/9/2021

2.5.4 Test Method

The RF output port of the EUT was directly connected to the input of the spectrum analyzer. The spectrum analyzer span was set to 2 to 5 times the estimated bandwidth of the emission. The RBW was set to 1% to 5% of the estimated emission bandwidth. The trace was recorded using the max hold function with a peak detector.

2.5.5 Environmental Conditions

Ambient Temperature 24.9°C
Relative Humidity 45.7 %
Atmospheric Pressure 1019.9 mbar

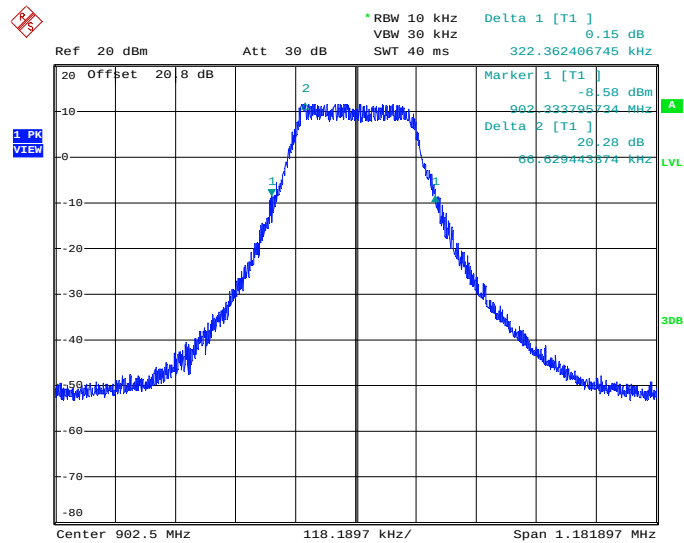
2.5.6 Test Results

DC Powered Operating

Limit Clause FCC Part 15.247(a)(1)(i), ISED RSS-247 5.1(a)

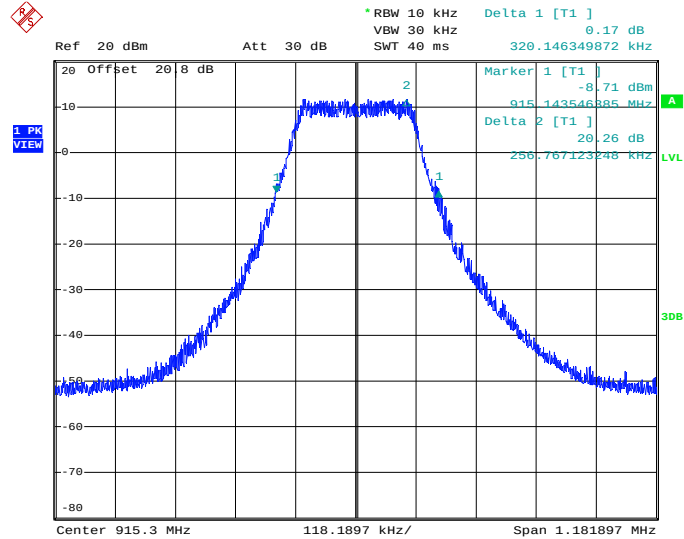
Table 2.5.6-1: 20 dB Bandwidth Test Results – SF6

Frequency (MHz)	20 dB Bandwidth (kHz)
902.5	322.3624
915.3	320.1463
927.3	321.1805



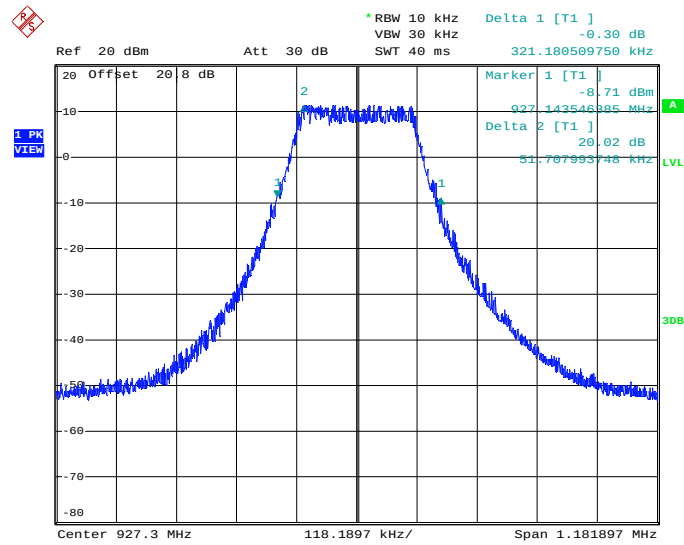
Date: 9.FEB.2021 15:50:35

Figure 2.5.6-1: 20 dB Bandwidth Test Results – Low Channel – SF6



Date: 9.FEB.2021 16:15:46

Figure 2.5.6-2: 20 dB Bandwidth Test Results – Middle Channel – SF6

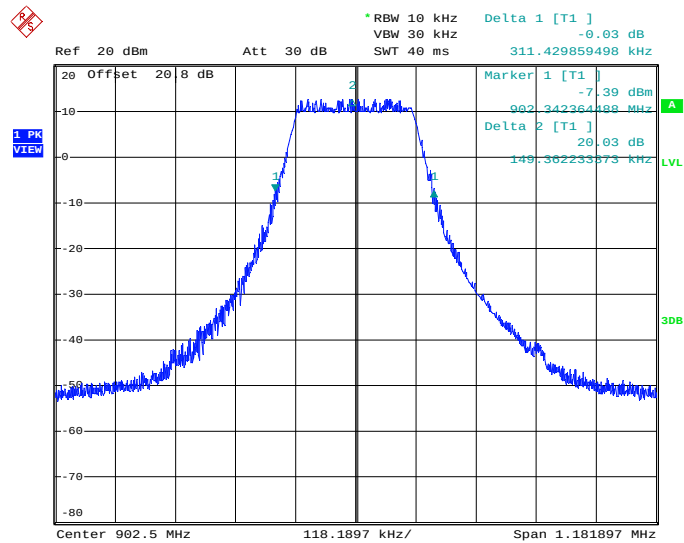


Date: 9.FEB.2021 16:35:50

Figure 2.5.6-3: 20 dB Bandwidth Test Results – High Channel – SF6

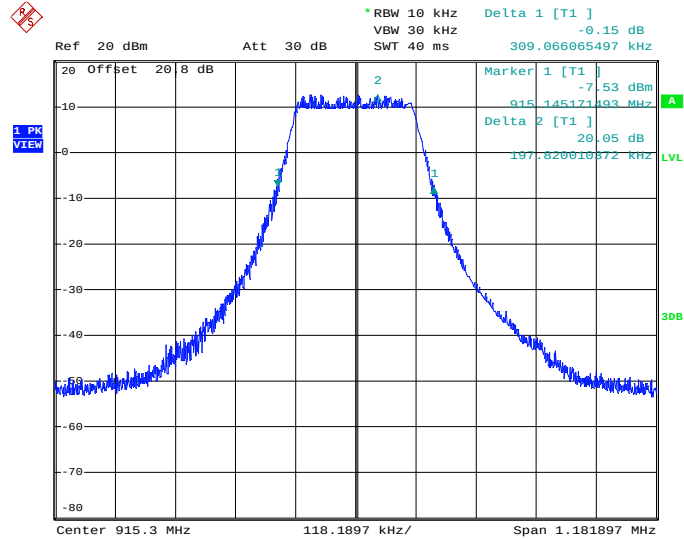
Table 2.5.6-2: 20 dB Bandwidth Test Results – SF7

Frequency (MHz)	20 dB Bandwidth (kHz)
902.5	311.4299
915.3	309.0661
927.3	309.6570



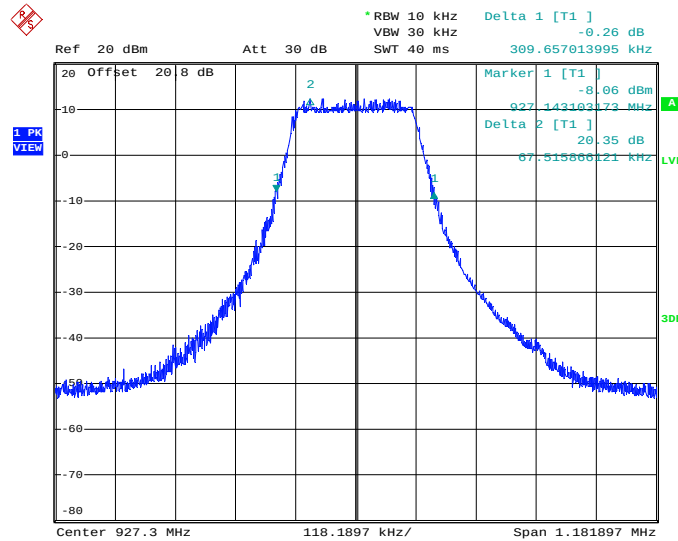
Date: 9.FEB.2021 15:59:47

Figure 2.5.6-4: 20 dB Bandwidth Test Results – Low Channel – SF7



Date: 9.FEB.2021 16:21:36

Figure 2.5.6-5: 20 dB Bandwidth Test Results – Middle Channel – SF7



Date: 9.FEB.2021 16:28:05

Figure 2.5.6-6: 20 dB Bandwidth Test Results – High Channel – SF7

2.5.7 Test Location and Test Equipment Used

This test was carried out in TÜV SÜD America, Inc., 5610 W. Sligh Ave, Suite 100, Tampa, FL 33634, USA.

Instrument	Manufacturer	Type No	TE No	Software / Firmware Revision	Calibration Period (months)	Calibration Due
Spectrum Analyzer	Rohde & Schwarz	FSP40	BEMC00283	4.50 SP5	24	04-Oct-2021
Attenuator 20dB, 2.9 mm-M/F, DC-40GHz 2 W	Aeroflex Inmet	40AH2W-20	BEMC02111	N/A	12	25-Jul-2021
Duratest High Frequency Cable 26.5 GHz	Teledyne Storm Products	921-0101-036	BEMC02112	N/A	12	19-Oct-2021

TU - Traceability Unscheduled

O/P MON - Traceability Unscheduled

N/A - Not Applicable



2.6 99% Bandwidth

2.6.1 Specification Reference

ISED Canada: RSS-GEN 6.7

2.6.2 Equipment Under Test and Modification State

S/N: 203600148

2.6.3 Date of Test

2/2/2021

2.6.4 Test Method

The 99% occupied bandwidth was measured with the spectrum analyzer span set to fully display the emission. The RBW was set to 1% to 5% of the approximated bandwidth. The occupied 99% bandwidth was measured by using the bandwidth measurement function of the spectrum analyzer with a peak detector.

2.6.5 Environmental Conditions

Ambient Temperature 25.7°C
Relative Humidity 34.1 %
Atmospheric Pressure 1016.3 mbar

2.6.6 Test Results

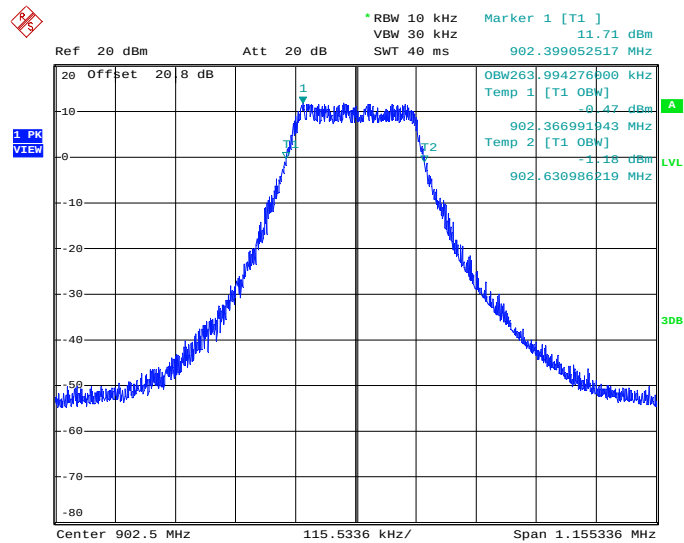
DC Powered Operating

Limit Clause ISED RSS-GEN 6.7

SF6 – Antenna 1

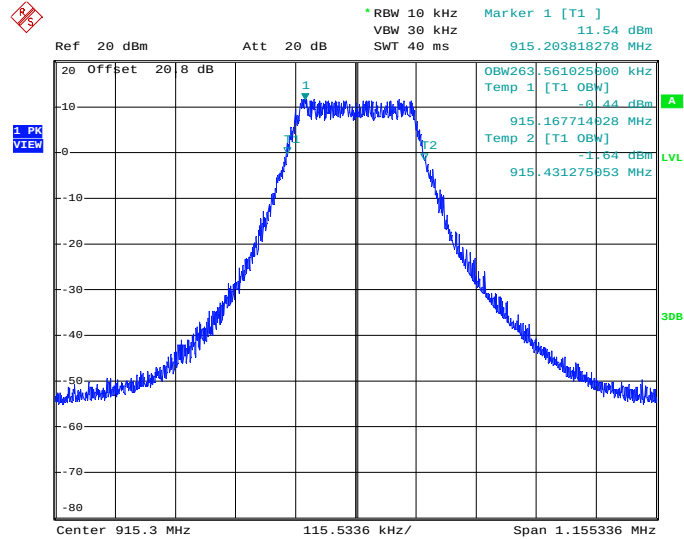
Table 2.6.6-1: 99% Bandwidth Test Results – SF6

Frequency (MHz)	99% Bandwidth (kHz)
902.5	263.9943
915.3	263.5610
927.3	262.6945



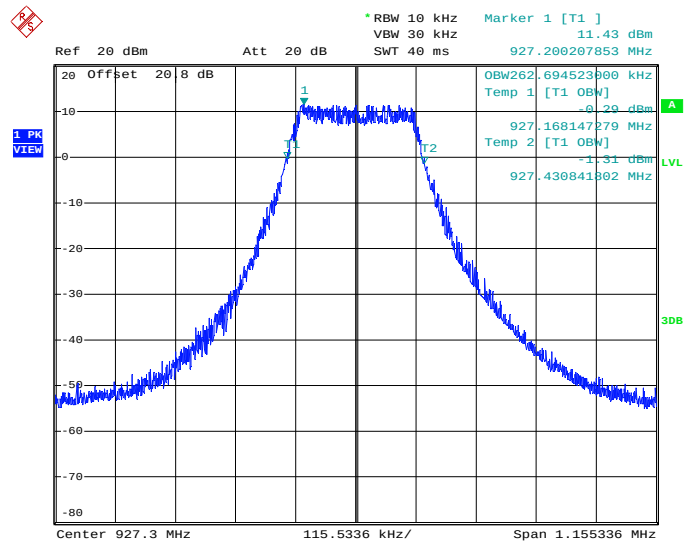
Date: 2.FEB.2021 20:06:27

Figure 2.6.6-1: 99% Bandwidth Test Results – Low Channel – SF6



Date: 2.FEB.2021 20:40:12

Figure 2.6.6-2: 99% Bandwidth Test Results – Middle Channel – SF6

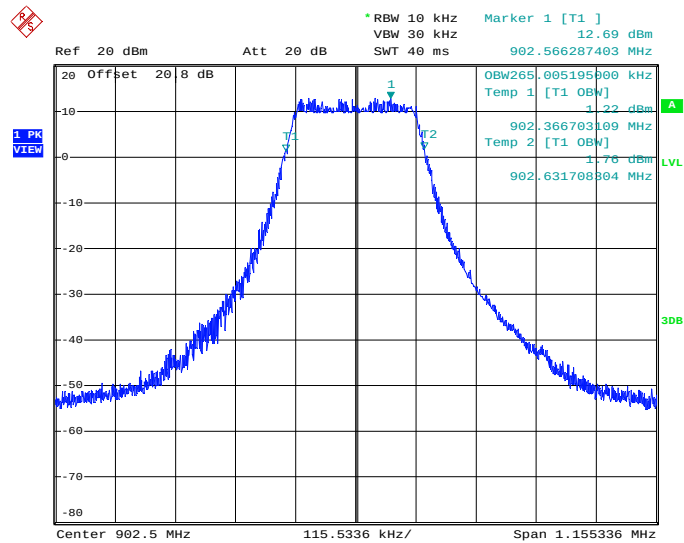


Date: 2.FEB.2021 21:46:16

Figure 2.6.6-3: 99% Bandwidth Test Results – High Channel – SF6

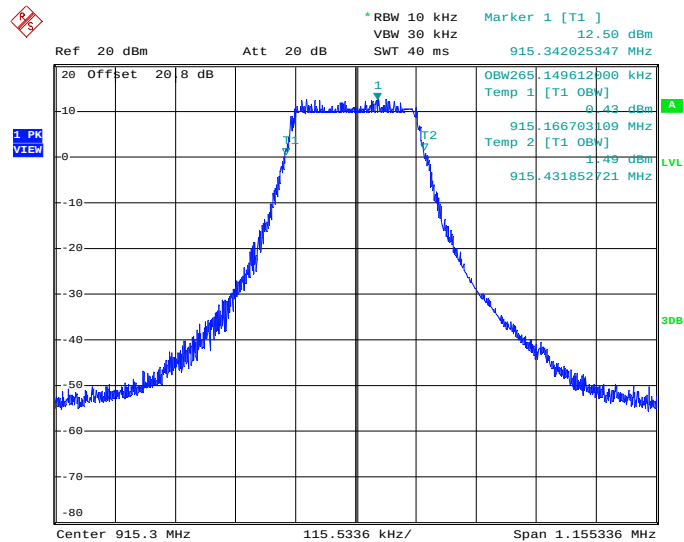
Table 2.6.6-2: 99% Bandwidth Test Results – SF7

Frequency (MHz)	99% Bandwidth (kHz)
902.5	265.0052
915.3	265.1496
927.3	264.5719



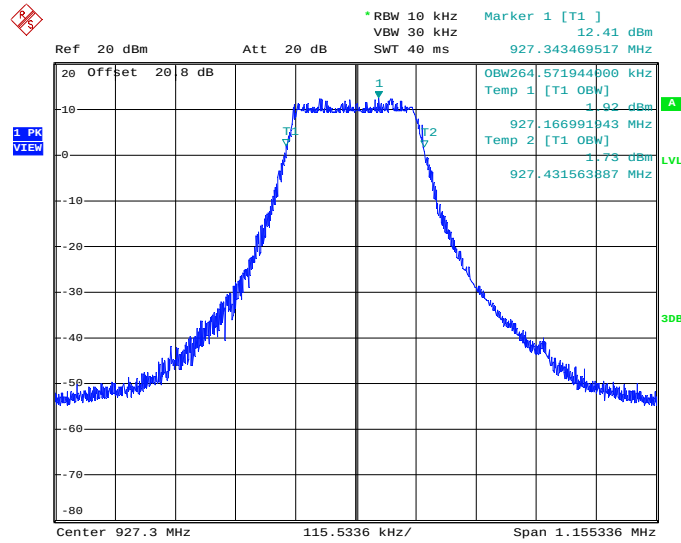
Date: 2.FEB.2021 19:36:59

Figure 2.6.6-4: 99% Bandwidth Test Results – Low Channel – SF7



Date: 2.FEB.2021 21:00:45

Figure 2.6.6-5: 99% Bandwidth Test Results – Middle Channel – SF7



Date: 2.FEB.2021 21:24:39

Figure 2.6.6-6: 99% Bandwidth Test Results – High Channel – SF7

2.6.7 Test Location and Test Equipment Used

This test was carried out in TÜV SÜD America, Inc., 5610 W. Sligh Ave, Suite 100, Tampa, FL 33634, USA.

Instrument	Manufacturer	Type No	TE No	Software / Firmware Revision	Calibration Period (months)	Calibration Due
Spectrum Analyzer	Rohde & Schwarz	FSP40	BEMC00283	4.50 SP5	24	04-Oct-2021
Attenuator 20dB, 2.9 mm-M/F, DC-40GHz 2 W	Aeroflex Inmet	40AH2W-20	BEMC02111	N/A	12	25-Jul-2021
Duratest High Frequency Cable 26.5 GHz	Teledyne Storm Products	921-0101-036	BEMC02112	N/A	12	19-Oct-2021

TU - Traceability Unscheduled
 O/P MON - Traceability Unscheduled
 N/A - Not Applicable



2.7 Peak Output Power

2.7.1 Specification Reference

FCC Section 15.247(b)(2)
ISED Canada: RSS-247 5.4(a)

2.7.2 Equipment Under Test and Modification State

S/N: 203600148

2.7.3 Date of Test

2/2/2021

2.7.4 Test Method

The fundamental emission output power was measured in accordance with ANSI C63.10 Subclause 7.8.5. The RF output of the equipment under test was directly connected to the input of the spectrum analyzer through suitable attenuation.

2.7.5 Environmental Conditions

Ambient Temperature 25.7°C
Relative Humidity 34.1 %
Atmospheric Pressure 1016.3 mbar

2.7.6 Test Results

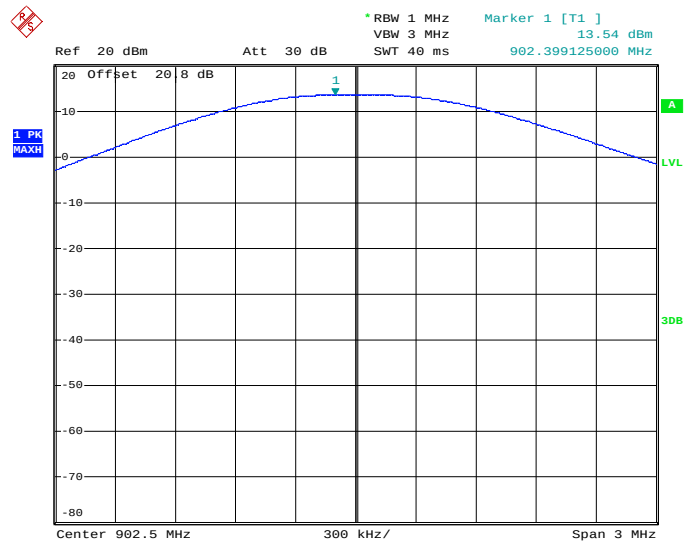
DC Powered Operating

Limit Clause FCC Part 15.247(b)(2), ISED RSS-247 5.4(a)

The Maximum Output Power allowed for frequency hopping systems employing at least 50 channels is 1 Watt (30 dBm). For frequency hopping systems employing less than 50 hopping channels but at least 25 hopping channels the power limit is 0.25 Watts (24 dBm).

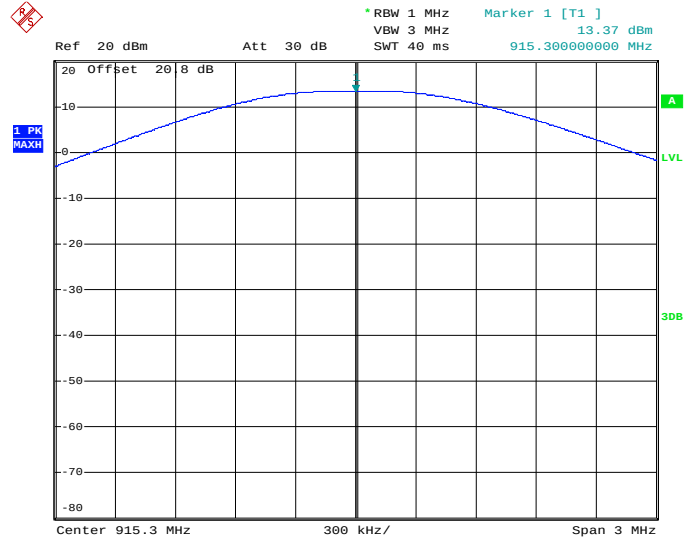
Table 2.7.6-1: Maximum Output Power Test Results – SF6

Frequency (MHz)	Measured Power (dBm)
902.5	13.54
915.3	13.37
927.3	13.24



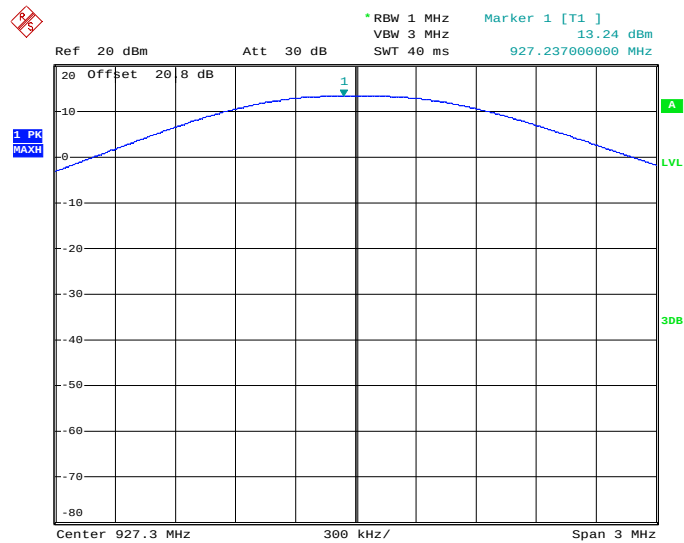
Date: 2.FEB.2021 20:08:05

Figure 2.7.6-1: Maximum Output Power Test Results – Low Channel – SF6



Date: 2.FEB.2021 20:41:49

Figure 2.7.6-2: Maximum Output Power Test Results – Middle Channel – SF6

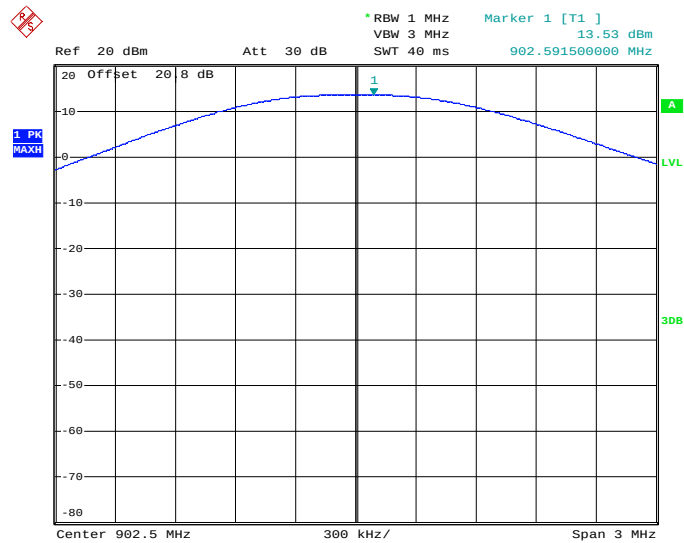


Date: 2.FEB.2021 21:47:53

Figure 2.7.6-3: Maximum Output Power Test Results – High Channel – SF6

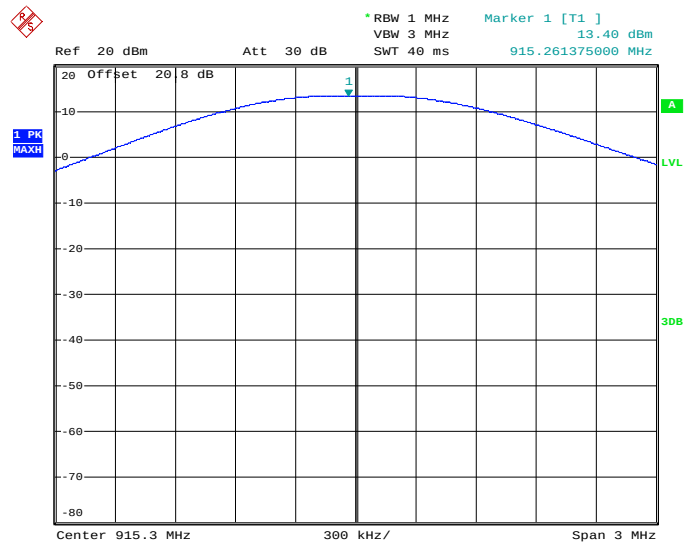
Table 2.7.6-2: Maximum Output Power Test Results – SF7

Frequency (MHz)	Measured Power (dBm)
902.5	13.53
915.3	13.40
927.3	13.16



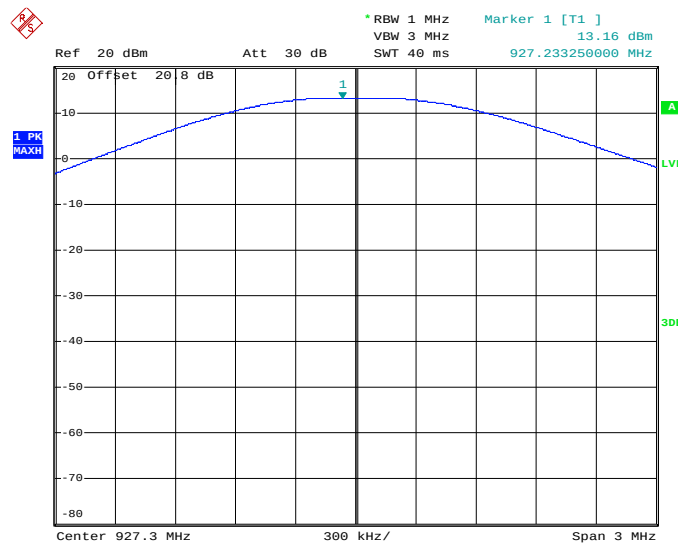
Date: 2.FEB.2021 19:38:36

Figure 2.7.6-4: Maximum Output Power Test Results – Low Channel – SF7



Date: 2.FEB.2021 21:02:22

Figure 2.7.6-5: Maximum Output Power Test Results – Middle Channel – SF7



Date: 2.FEB.2021 21:26:16

Figure 2.7.6-6: Maximum Output Power Test Results – High Channel – SF7

2.7.7 Test Location and Test Equipment Used

This test was carried out in TÜV SÜD America, Inc., 5610 W. Sligh Ave, Suite 100, Tampa, FL 33634, USA.

Instrument	Manufacturer	Type No	TE No	Software / Firmware Revision	Calibration Period (months)	Calibration Due
Spectrum Analyzer	Rohde & Schwarz	FSP40	BEMC00283	4.50 SP5	24	04-Oct-2021
Attenuator 20dB, 2.9 mm-M/F, DC-40GHz 2 W	Aeroflex Inmet	40AH2W-20	BEMC02111	N/A	12	25-Jul-2021
Duratest High Frequency Cable 26.5 GHz	Teledyne Storm Products	921-0101-036	BEMC02112	N/A	12	19-Oct-2021

TU - Traceability Unscheduled

O/P MON - Traceability Unscheduled

N/A - Not Applicable



2.8 Band-Edge Compliance of RF Conducted Emissions

2.8.1 Specification Reference

FCC: Section 15.247(d)
ISED Canada: RSS-247 5.5

2.8.2 Equipment Under Test and Modification State

S/N: 203600148

2.8.3 Date of Test

2/2/2021 to 2/9/2021

2.8.4 Test Method

The RF Conducted Emissions at the Band-Edges were measured in accordance with Subclause 7.8.6 of ANSI C63.10. The RF output port of the EUT was connected to the input of the spectrum analyzer through suitable attenuation. The EUT was investigated at the lowest and highest channel available to determine band-edge compliance. For each measurement the spectrum analyzer's RBW was set to 100 kHz, and the VBW was set to ≥ 300 kHz.

2.8.5 Environmental Conditions

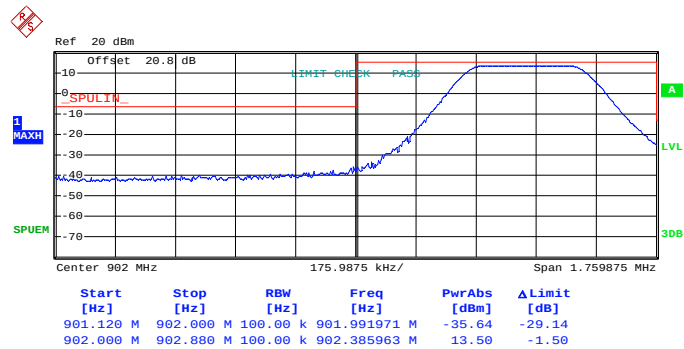
Ambient Temperature	25.6 °C
Relative Humidity	34.2 %
Atmospheric Pressure	1016 mbar

2.8.6 Test Results

DC Powered Operating

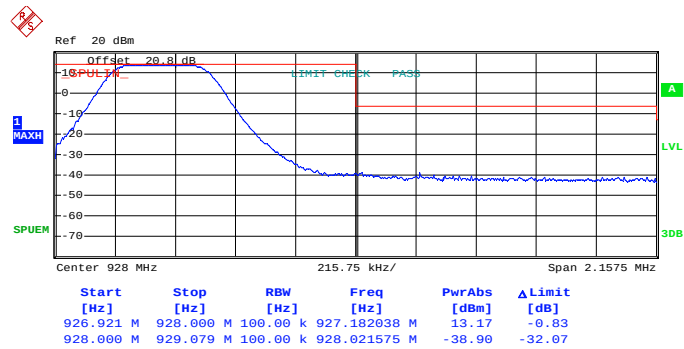
Limit Clause FCC Section 15.247(d), ISED Canada: RSS-247 5.5

In any 100 kHz bandwidth outside of the frequency band the radio frequency power shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of desired power. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required shall be 30 dB instead of 20 dB.



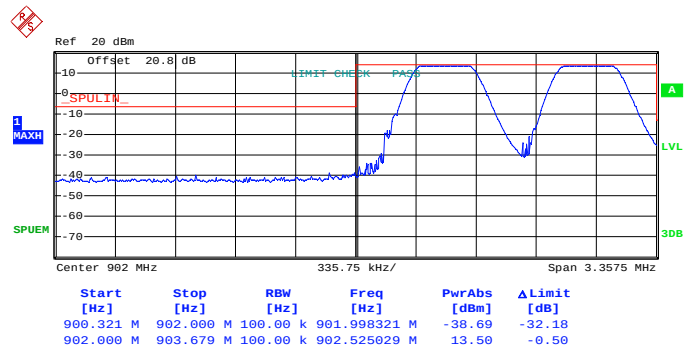
Date: 2.FEB.2021 20:13:27

Figure 2.8.6-1: RF Conducted Band-Edge – Low Channel – Hopping Off – SF6



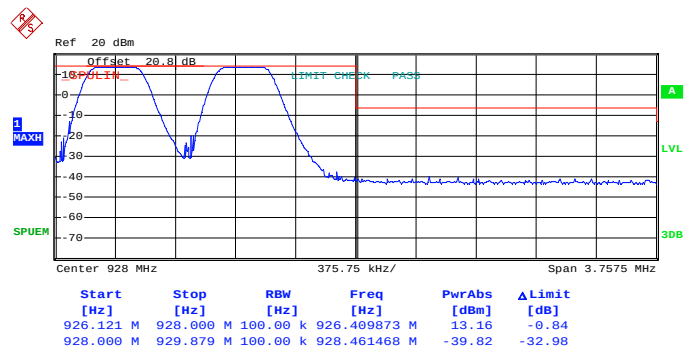
Date: 2.FEB.2021 21:53:17

Figure 2.8.6-2: RF Conducted Band-Edge – High Channel – Hopping Off – SF6



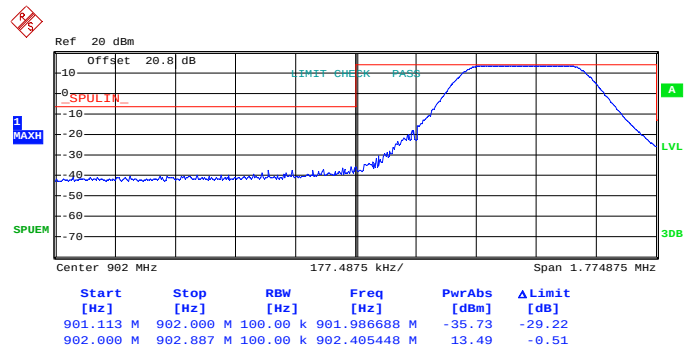
Date: 9.FEB.2021 15:23:45

Figure 2.8.6-3: RF Conducted Band-Edge – Hopping – SF6



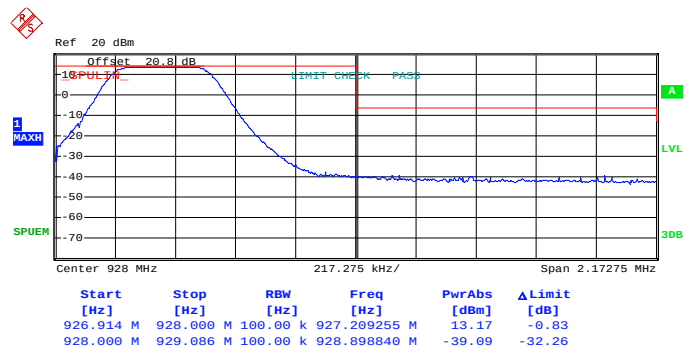
Date: 9.FEB.2021 15:14:58

Figure 2.8.6-4: RF Conducted Band-Edge – Hopping – SF6



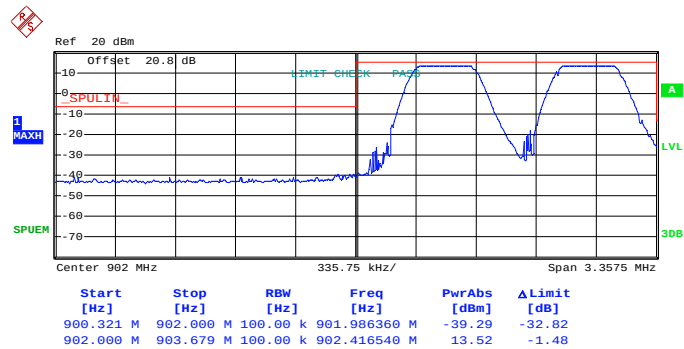
Date: 2.FEB.2021 19:43:58

Figure 2.8.6-5: RF Conducted Band-Edge – Low Channel – Hopping Off – SF7



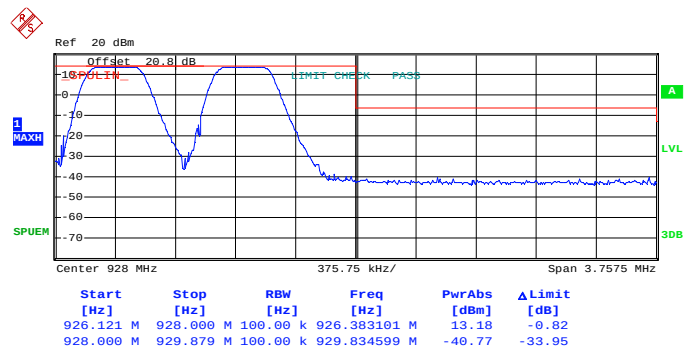
Date: 2.FEB.2021 21:31:38

Figure 2.8.6-6: RF Conducted Band-Edge – High Channel – Hopping Off – SF7



Date: 9.FEB.2021 15:03:13

Figure 2.8.6-7: RF Conducted Band-Edge – Hopping – SF7



Date: 9.FEB.2021 15:09:22

Figure 2.8.6-8: RF Conducted Band-Edge – Hopping – SF7



2.8.7 Test Location and Test Equipment Used

This test was carried out in TÜV SÜD America, Inc., 5610 W. Sligh Ave, Suite 100, Tampa, FL 33634, USA.

Instrument	Manufacturer	Type No	TE No	Software / Firmware Revision	Calibration Period (months)	Calibration Due
Spectrum Analyzer	Rohde & Schwarz	FSP40	BEMC00283	4.50 SP5	24	04-Oct-2021
Attenuator 20dB, 2.9 mm-M/F, DC-40GHz 2 W	Aeroflex Inmet	40AH2W-20	BEMC02111	N/A	12	25-Jul-2021
Duratest High Frequency Cable 26.5 GHz	Teledyne Storm Products	921-0101-036	BEMC02112	N/A	12	19-Oct-2021

TU - Traceability Unscheduled

O/P MON - Traceability Unscheduled

N/A - Not Applicable



2.9 RF Conducted Spurious Emissions

2.9.1 Specification Reference

FCC: Section 15.247(d)
ISED Canada: RSS-247 5.5

2.9.2 Equipment Under Test and Modification State

S/N: 203600148

2.9.3 Date of Test

2/2/2021

2.9.4 Test Method

The RF Conducted Spurious Emissions were measured in accordance with Subclause 7.8.8 of ANSI C63.10. The RF output port of the equipment under test was directly connected to the input of the spectrum analyzer. The EUT was investigated for conducted spurious emissions from 30 MHz to 10 GHz, 10 times the highest fundamental frequency. Measurements were made at the low, center and high channels of the EUT. For each measurement, the spectrum analyzer's RBW was set to 100 kHz and the VBW was set to 300 kHz. The peak Max Hold function of the analyzer was utilized.

2.9.5 Environmental Conditions

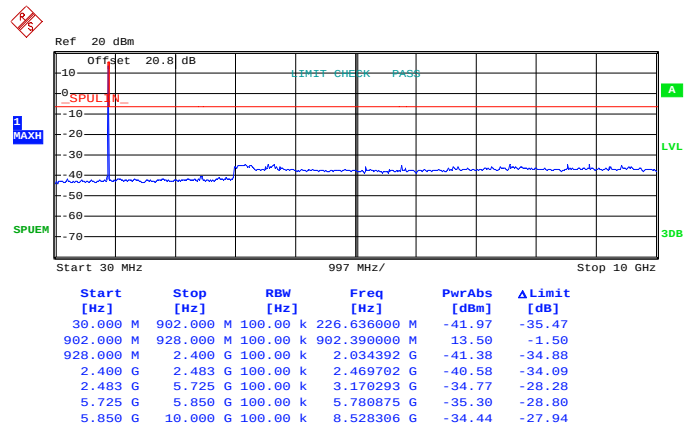
Ambient Temperature	25.6 °C
Relative Humidity	34.2 %
Atmospheric Pressure	1016 mbar

2.9.6 Test Results

DC Powered Operating

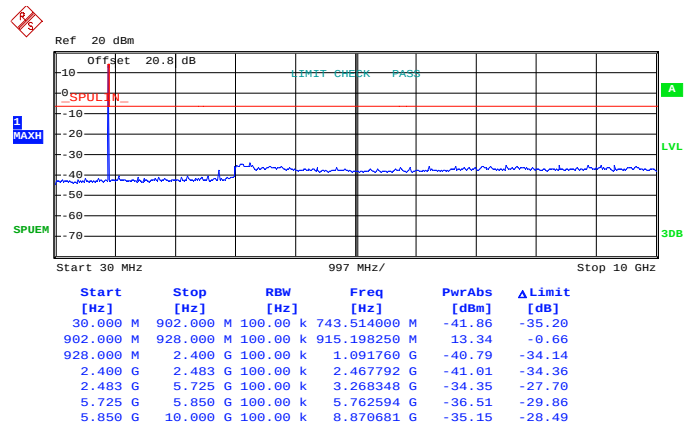
Limit Clause FCC Section 15.247(d), ISED Canada: RSS-247 5.5

In any 100 kHz bandwidth outside of the frequency band the radio frequency power shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of desired power. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required shall be 30 dB instead of 20 dB.



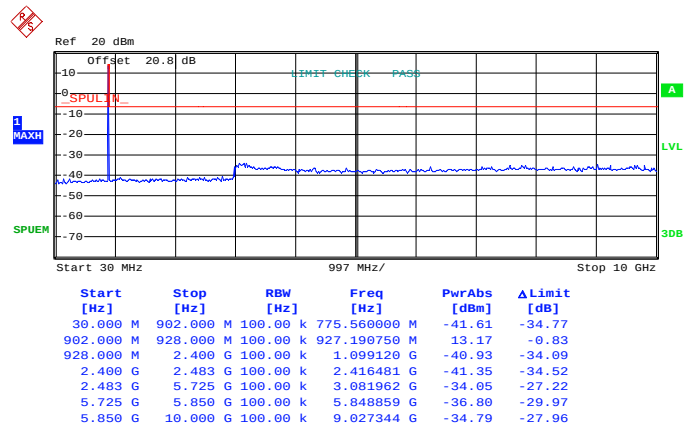
Date: 2.FEB.2021 20:15:41

Figure 2.9.6-1: Conducted Spurious Emissions Results – Low Channel – SF6



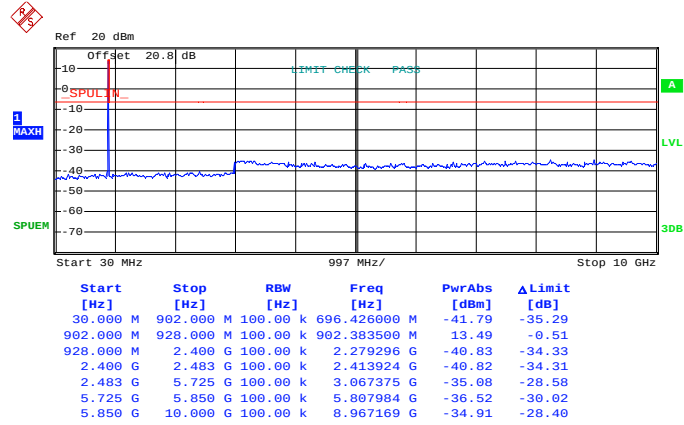
Date: 2.FEB.2021 20:49:25

Figure 2.9.6-2: Conducted Spurious Emissions Results – Middle Channel – SF6



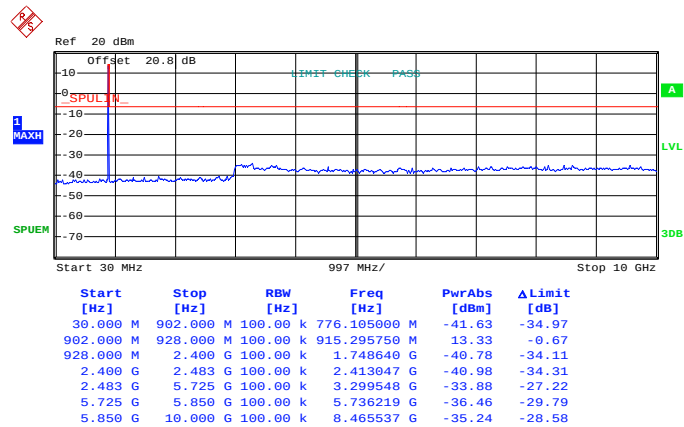
Date: 2.FEB.2021 21:55:31

Figure 2.9.6-3: Conducted Spurious Emissions Results – High Channel – SF6



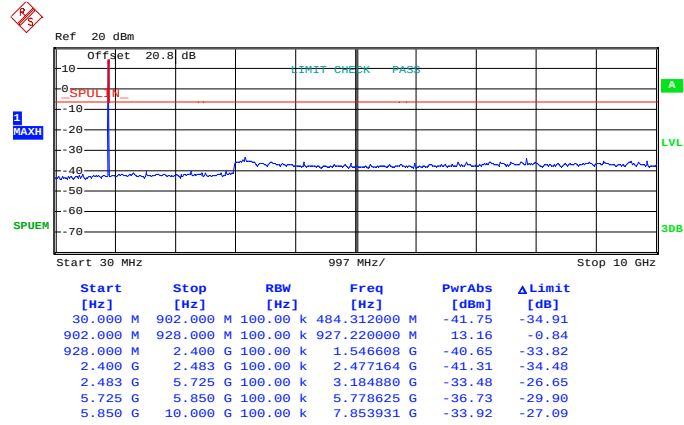
Date: 2.FEB.2021 19:46:12

Figure 2.9.6-4: Conducted Spurious Emissions Results – Low Channel – SF7



Date: 2.FEB.2021 21:09:58

Figure 2.9.6-5: Conducted Spurious Emissions Results – Middle Channel – SF7



Date: 2.FEB.2021 21:33:52

Figure 2.9.6-6: Conducted Spurious Emissions Results – High Channel – SF7



2.9.7 Test Location and Test Equipment Used

This test was carried out in TÜV SÜD America, Inc., 5610 W. Sligh Ave, Suite 100, Tampa, FL 33634, USA.

Instrument	Manufacturer	Type No	TE No	Software / Firmware Revision	Calibration Period (months)	Calibration Due
Spectrum Analyzer	Rohde & Schwarz	FSP40	BEMC00283	4.50 SP5	24	04-Oct-2021
Attenuator 20dB, 2.9 mm-M/F, DC-40GHz 2 W	Aeroflex Inmet	40AH2W-20	BEMC02111	N/A	12	25-Jul-2021
Duratest High Frequency Cable 26.5 GHz	Teledyne Storm Products	921-0101-036	BEMC02112	N/A	12	19-Oct-2021

TU - Traceability Unscheduled

O/P MON - Traceability Unscheduled

N/A - Not Applicable



2.10 Radiated Spurious Emissions into Restricted Frequency Bands

2.10.1 Specification Reference

FCC Sections: 15.205, 15.209;
ISED Canada: RSS-GEN 8.9, 8.10

2.10.2 Equipment Under Test and Modification State

S/N: 203600148

2.10.3 Date of Test

11/18/2020 to 2/1/2021

2.10.4 Test Method

Radiated emissions tests were made over the frequency range of 9 kHz to 10 GHz, 10 times the highest fundamental frequency. Each emission found to be in a restricted band as defined by section 15.205, including any emission at the operational band-edge, was compared to the radiated emission limits as defined in Section 15.209.

For measurements below 30 MHz, the receive antenna height was set to 1 m and the EUT was rotated through 360 degrees. The resolution bandwidth was set to 200 Hz below 150 kHz and to 9 kHz above 150 kHz.

The EUT was rotated through 360° and the receive antenna height was varied from 1m to 4m so that the maximum radiated emissions level would be detected. For frequencies below 1000 MHz, quasi-peak measurements were made using a resolution bandwidth RBW of 120 kHz and a video bandwidth VBW of 300 kHz. For frequencies above 1000 MHz, peak measurements are made with RBW of 1 MHz and VBW of 3 MHz. Average measurements are performed in the linear scale using VBW of 30 Hz.

2.10.5 Duty Cycle Correction

The EUT was configured to transmit at the maximum duty cycle allowed by the test firmware during the evaluation. A Duty Cycle Correction was not applied to the average measurements for the corrected average results.

2.10.6 Environmental Conditions

Ambient Temperature	26.8 °C
Relative Humidity	39.1 %
Atmospheric Pressure	1023.7 mbar



2.10.7 Test Results

DC Powered Operating

Limit Clause FCC Sections 15.205, 15.209, ISED Canada: RSS-GEN 8.9, 8.10

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009-0.490	2400/F(kHz)	300
0.4090-1.705	24000/F(kHz)	30
1.705-30.0	30	30
30-88	100**	3
88-216	150**	3
216-960	200**	3
Above 960	500	3



Table 2.10.7-1: Radiated Spurious Emissions in the Restricted Bands Results

Frequency (MHz)	Level (dBuV)		Antenna Polarity (H/V)	Correction Factors (dB)	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg			pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
Low Channel										
2707.5	58.09	54.66	H	-4.32	53.77	50.34	74.0	54.0	20.2	3.7
2707.5	55.05	50.67	V	-4.32	50.73	46.35	74.0	54.0	23.3	7.6
3610	49.58	45.28	H	-3.38	46.20	41.90	74.0	54.0	27.8	12.1
3610	50.69	45.48	V	-3.38	47.31	42.10	74.0	54.0	26.7	11.9
4512.5	53.75	51.78	H	-0.92	52.83	50.86	74.0	54.0	21.2	3.1
4512.5	55.01	52.74	V	-0.92	54.09	51.82	74.0	54.0	19.9	2.2
5415	47.12	42.69	H	1.44	48.56	44.13	74.0	54.0	25.4	9.9
5415	48.73	45.24	V	1.44	50.17	46.68	74.0	54.0	23.8	7.3
8122.5	46.03	41.21	H	4.71	50.74	45.92	74.0	54.0	23.3	8.1
8122.5	46.93	42.56	V	4.71	51.64	47.27	74.0	54.0	22.4	6.7
9025	40.32	30.39	H	5.62	45.94	36.01	74.0	54.0	28.1	18.0
9025	42.40	34.22	V	5.62	48.02	39.84	74.0	54.0	26.0	14.2
Middle Channel										
2745.9	57.12	51.69	H	-4.25	52.87	47.44	74.0	54.0	21.1	6.6
2745.9	53.13	46.49	V	-4.25	48.88	42.24	74.0	54.0	25.1	11.8
3661.2	49.84	45.89	H	-3.26	46.58	42.63	74.0	54.0	27.4	11.4
3661.2	49.90	45.74	V	-3.26	46.64	42.48	74.0	54.0	27.4	11.5
4576.5	54.17	51.30	H	-0.78	53.39	50.52	74.0	54.0	20.6	3.5
4576.5	51.97	49.03	V	-0.78	51.19	48.25	74.0	54.0	22.8	5.8
7322.4	41.01	29.96	H	3.61	44.62	33.57	74.0	54.0	29.4	20.4
7322.4	43.82	33.74	V	3.61	47.43	37.35	74.0	54.0	26.6	16.6
8237.7	42.96	34.22	H	4.87	47.83	39.09	74.0	54.0	26.2	14.9
8237.7	44.13	39.44	V	4.87	49.00	44.31	74.0	54.0	25.0	9.7
9153	39.87	30.19	H	5.44	45.31	35.63	74.0	54.0	28.7	18.4
9153	41.13	31.10	V	5.44	46.57	36.54	74.0	54.0	27.4	17.5
High Channel										
2781.9	62.87	52.43	H	-4.18	58.69	48.25	74.0	54.0	15.3	5.8
2781.9	58.83	49.50	V	-4.18	54.65	45.32	74.0	54.0	19.4	8.7
3709.2	50.98	48.07	H	-3.14	47.84	44.93	74.0	54.0	26.2	9.1
3709.2	50.31	46.45	V	-3.14	47.17	43.31	74.0	54.0	26.8	10.7
4636.5	52.27	50.09	H	-0.65	51.62	49.44	74.0	54.0	22.4	4.6
4636.5	51.84	49.09	V	-0.65	51.19	48.44	74.0	54.0	22.8	5.6
7418.4	43.00	35.61	H	3.65	46.65	39.26	74.0	54.0	27.4	14.7
7418.4	45.00	38.09	V	3.65	48.65	41.74	74.0	54.0	25.4	12.3
8345.7	42.39	34.85	H	5.02	47.41	39.87	74.0	54.0	26.6	14.1
8345.7	44.37	38.89	V	5.02	49.39	43.91	74.0	54.0	24.6	10.1

Notes:

- All emissions above 9.2 GHz were attenuated below the limits and the noise floor of the measurement equipment.
- The emissions below 1 GHz were generated by the digital device which was evaluated in full in the SDOC test report.

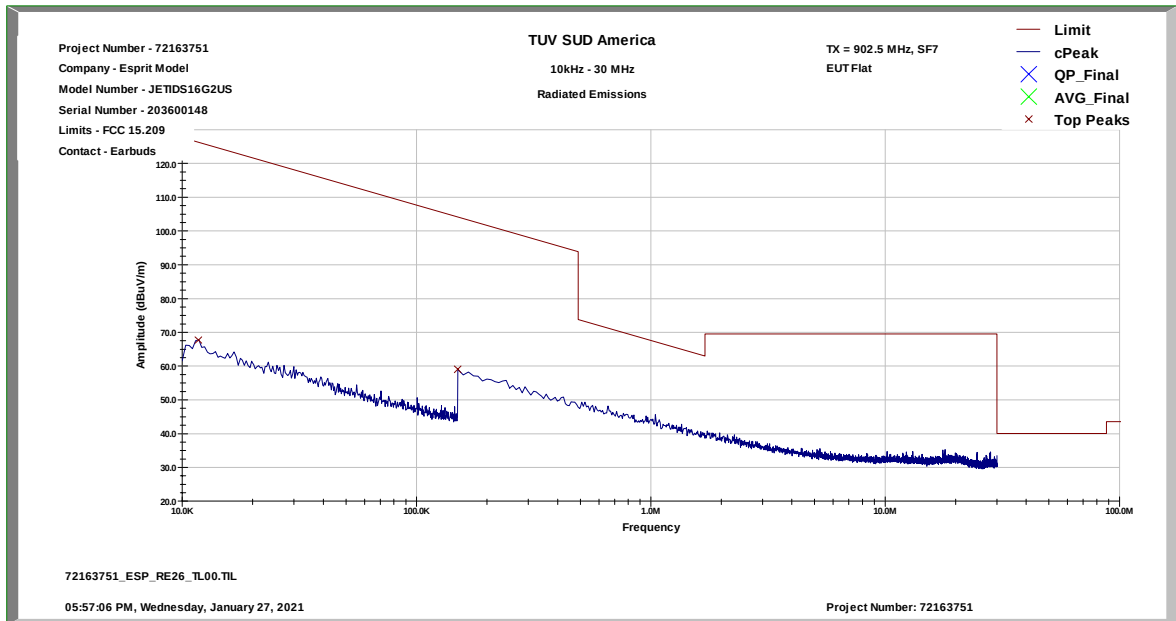


Figure 2.10.7-1: Representative Radiated Emissions Pre-Scans – below 30 MHz

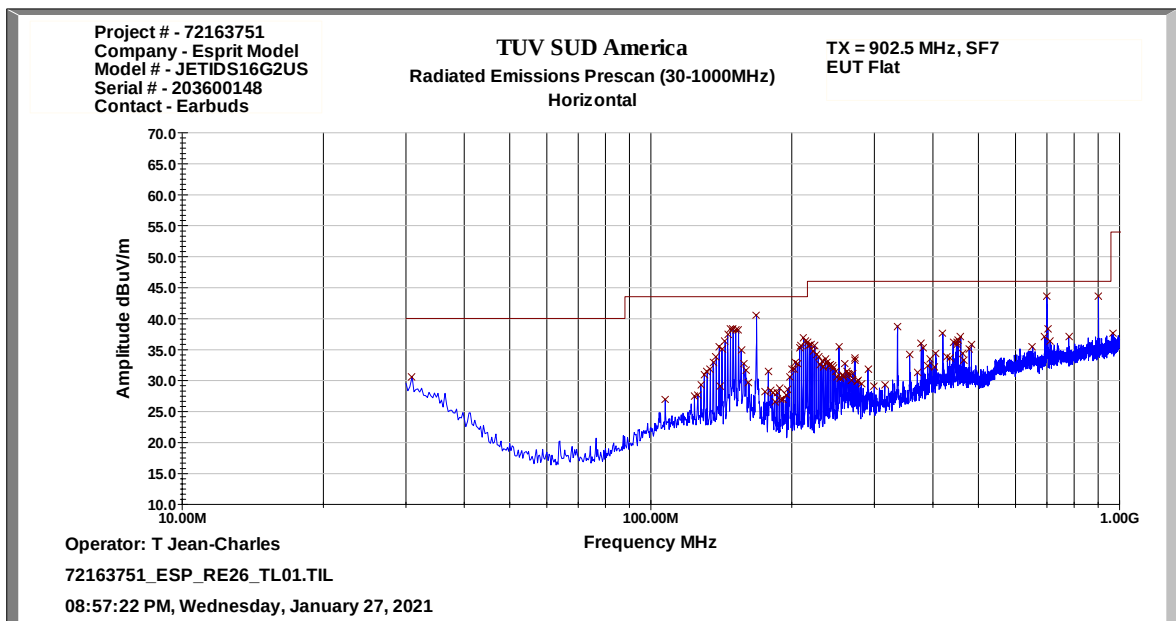


Figure 2.10.7-2: Representative Radiated Emissions Pre-Scans – 30 MHz – 1 GHz – Horizontal Polarization

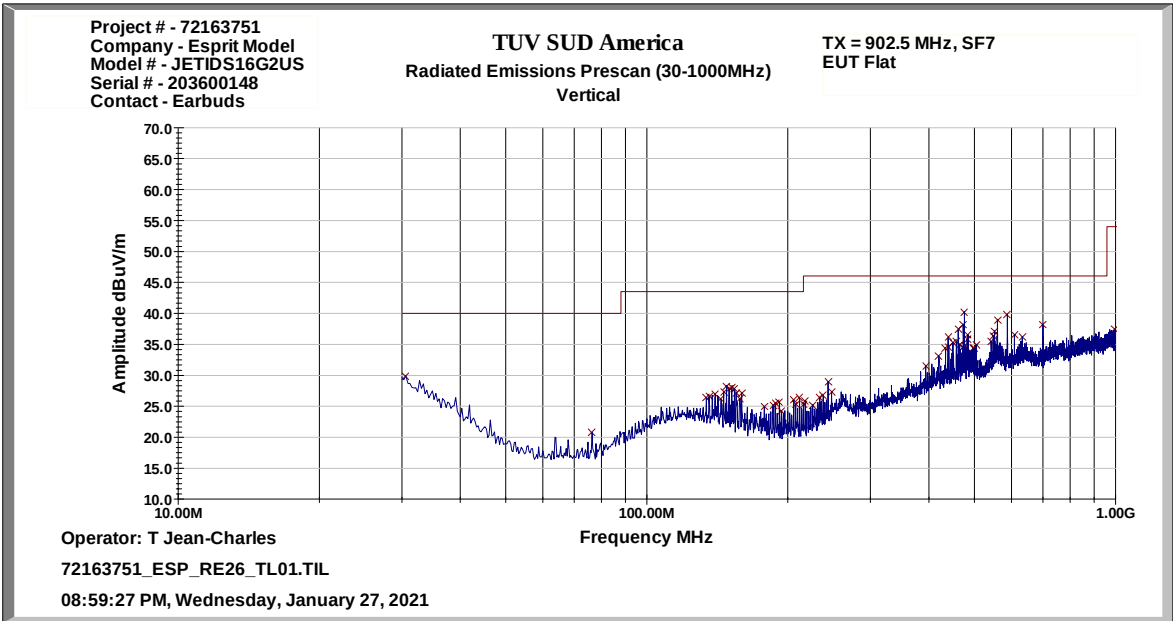


Figure 2.10.7-3: Representative Radiated Emissions Pre-Scans – 30 MHz – 1 GHz – Vertical Polarization

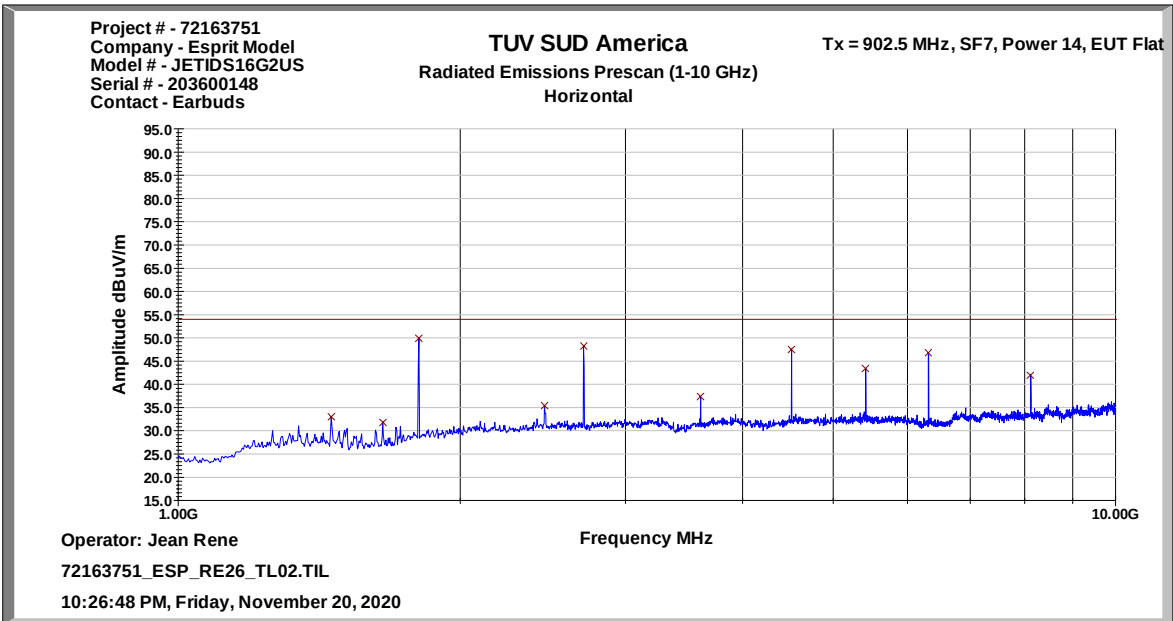


Figure 2.10.7-4: Representative Radiated Emissions Pre-Scans – 1 GHz – 10 GHz – Horizontal Polarization

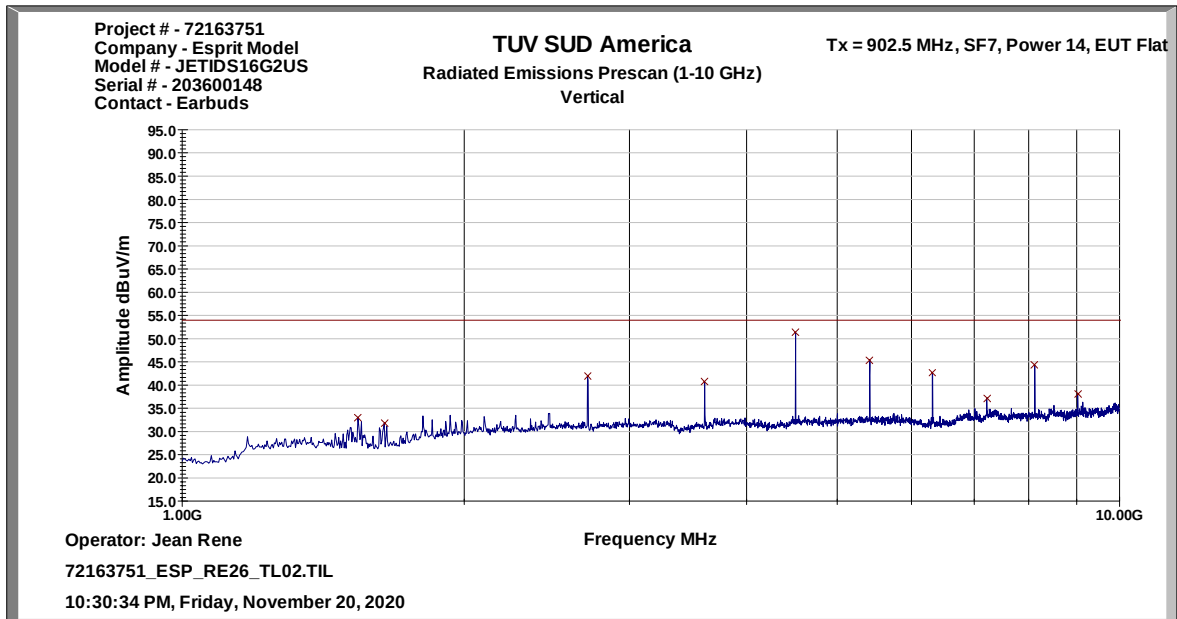


Figure 2.10.7-5: Representative Radiated Emissions Pre-Scans Scans – 1 GHz – 10 GHz – Vertical Polarization

2.10.8 Sample Calculations

$$R_C = R_U + CF_T$$

Where:

CF_T	=	Total Correction Factor (AF+CA+AG)-DC (Average Measurements Only)
R_U	=	Uncorrected Reading
R_C	=	Corrected Level
AF	=	Antenna Factor
CA	=	Cable Attenuation
AG	=	Amplifier Gain
DC	=	Duty Cycle Correction Factor

Example Calculation: Peak

Corrected Level: $58.09 + (-4.32) = 53.77$ dB μ V/m

Margin: 74 dB μ V/m – 53.77 dB μ V/m = 20.23 dB

Example Calculation: Average

Corrected Level: $54.66 + (-4.32) - 0 = 50.34$ dB μ V/m

Margin: 54 dB μ V/m – 50.34 dB μ V/m = 3.66 dB



2.10.9 Test Location and Test Equipment Used

This test was carried out in TÜV SÜD America, Inc., 5610 W. Sligh Ave, Suite 100, Tampa, FL 33634, USA.

Instrument	Manufacturer	Type No	TE No	Software / Firmware Revision	Calibration Period (months)	Calibration Due
Notch Filter	Trilithic, Inc.	7NM867/122-X1-AA	BEMC02069	N/A	12	21-Jan-2022
Tile Automation Software	ETS Lindgren	TILE4! - Version 4.2.A	BEMC02095	4.2A	N/A	NCR
BI LOG PERIODIC, ANTENNA	Schaffner	CBL6112B	TEMC00005	N/A	24	31-Oct-2021
EMC Analyzer	Agilent	E7405A	TEMC00012	A.09.02	24	27-Mar-2022
Loop Antenna	Com Power	AL-130	TEMC00025	N/A	24	26-Sep-2021
EMC Chamber	Panasheild	N/A	TEMC00031	N/A	24	28-Jan-2023
Double Ridge Guide Horn	ETS Lindgren	3117	TEMC00061	N/A	24	07-Feb-2022
PAM-118A	Com-Power Corporation	PAM-118A	TEMC00160	N/A	12	16-Mar-2021
1.2 GHz High Pass Filter	Micro-Tronics	HPM50108-01	TEMC00175	N/A	12	12-Mar-2021
A81-0303 18 GHz Cable Set	Teledyne Storm Products	A81-0303-360/96	TEMC00201	N/A	12	22-Apr-2021

TU - Traceability Unscheduled

O/P MON - Traceability Unscheduled

N/A - Not Applicable

NCR – No Calibration Required



2.11 Power Spectral Density

2.11.1 Specification Reference

FCC: Section 15.247(f)
ISED Canada: RSS-247 5.3(b)

2.11.2 Equipment Under Test and Modification State

S/N: 203600148

2.11.3 Date of Test

2/2/2021

2.11.4 Test Method

The power spectral density was measured in accordance with ANSI C63.10 Subclause 11.10.2 Method PKPSD (peak PSD). The RF output port of the EUT was directly connected to the input of the spectrum analyzer. Offset values were input for cable and external attenuation. The spectrum analyzer RBW was set to 3 kHz and VBW to 10 kHz. The Span was adjusted to 1.5 times the DTS bandwidth and the sweep time was set to auto. The measurements were performed using a Peak detector.

2.11.5 Environmental Conditions

Ambient Temperature 25.6 °C
Relative Humidity 34.3 %
Atmospheric Pressure 1016 mbar

2.11.6 Test Results

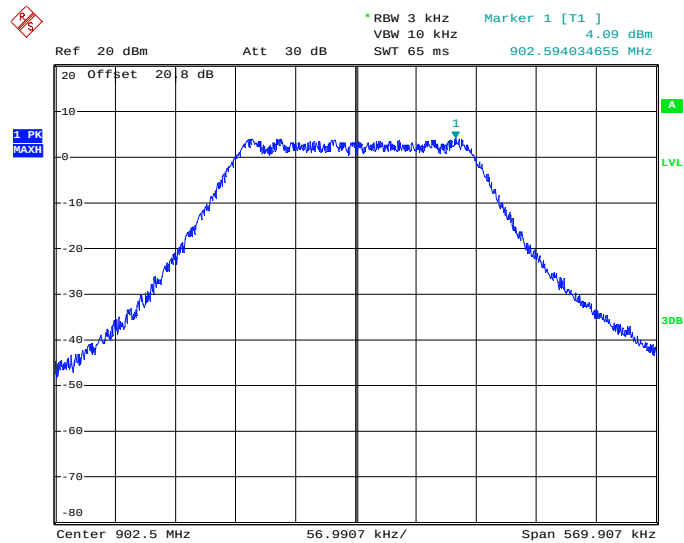
DC Powered Operating

Limit Clause FCC Section 15.247(f), ISED Canada: RSS-247 5.3(b)

The power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time of continuous transmission.

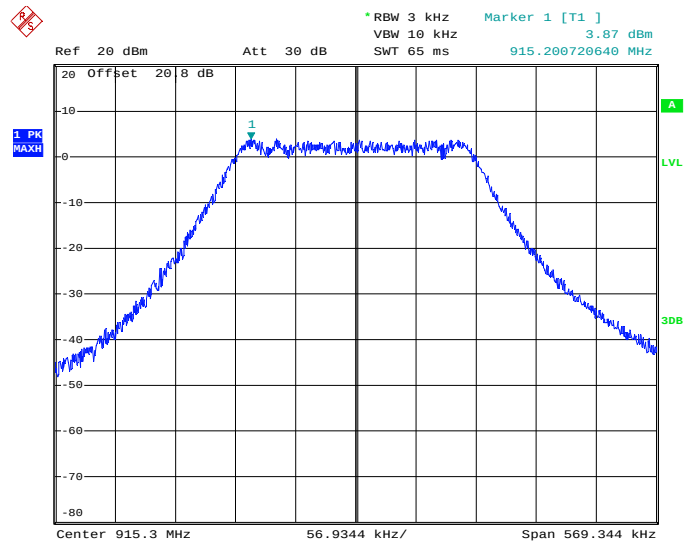
Table 2.11.6-1: Power Spectral Density Test Results – SF6

Frequency (MHz)	Measured Level (dBm)	Limit (dBm)	Margin (dB)
902.5	4.09	8.0	3.91
915.3	3.87	8.0	4.13
927.3	3.78	8.0	4.22



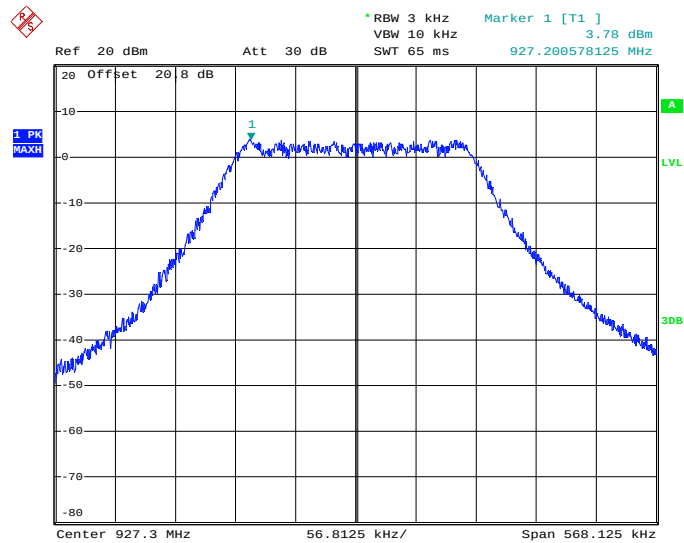
Date: 2.FEB.2021 20:11:18

Figure 2.11.6-1: Power Spectral Density Test Results – Low Channel – SF6



Date: 2.FEB.2021 20:45:03

Figure 2.11.6-2: Power Spectral Density Test Results – Middle Channel – SF6

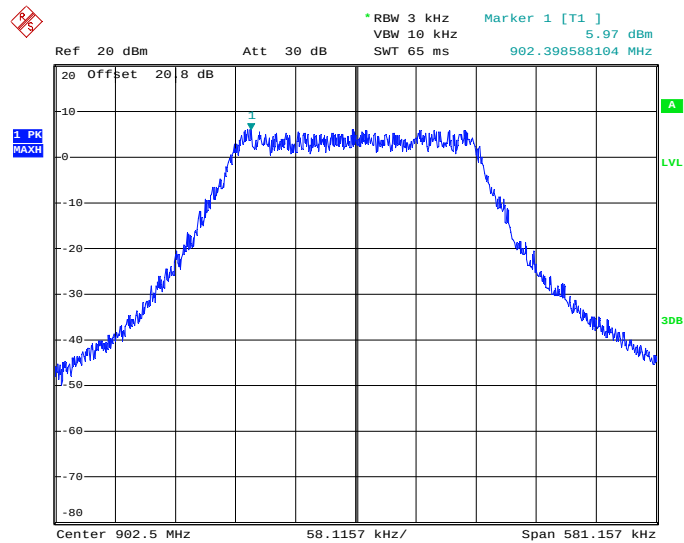


Date: 2.FEB.2021 21:51:08

Figure 2.11.6-3: Power Spectral Density Test Results – High Channel – SF6

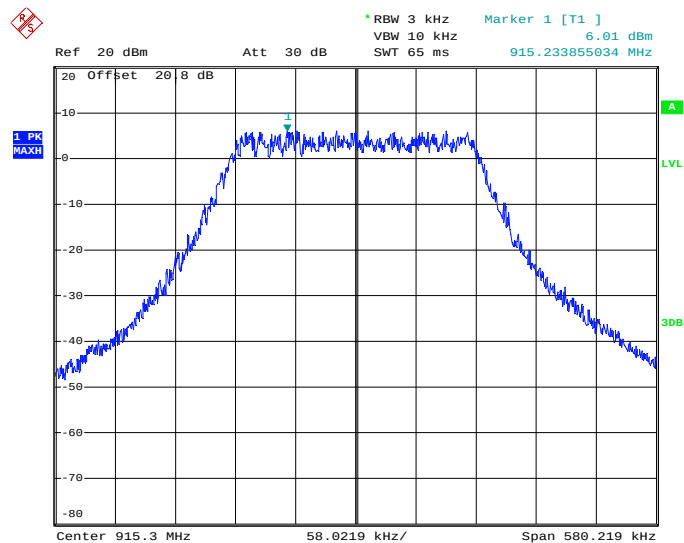
Table 2.11.6-2: Power Spectral Density Test Results – SF7

Frequency (MHz)	Measured Level (dBm)	Limit (dBm)	Margin (dB)
902.5	5.97	8.0	2.03
915.3	6.01	8.0	1.99
927.3	5.75	8.0	2.25



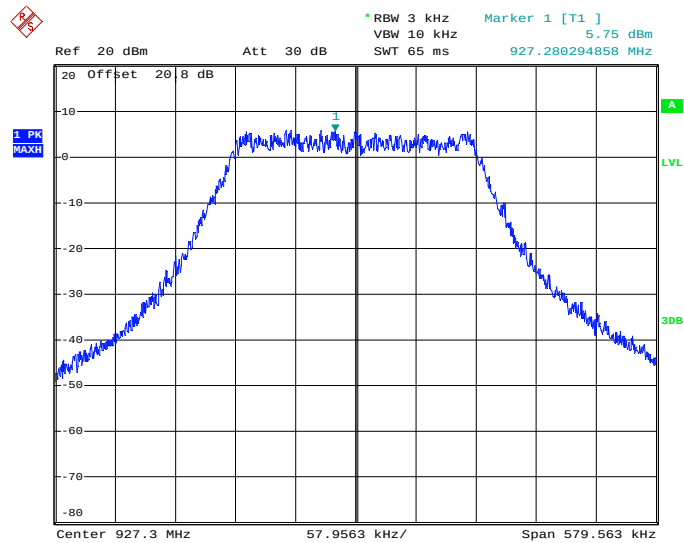
Date: 2.FEB.2021 19:41:50

Figure 2.11.6-4: Power Spectral Density Test Results – Low Channel – SF7



Date: 2.FEB.2021 21:05:36

Figure 2.11.6-5: Power Spectral Density Test Results – Middle Channel – SF7



Date: 2.FEB.2021 21:29:29

Figure 2.11.6-6: Power Spectral Density Test Results – High Channel – SF7

2.11.7 Test Location and Test Equipment Used

This test was carried out in TÜV SÜD America, Inc., 5610 W. Sligh Ave, Suite 100, Tampa, FL 33634, USA.

Instrument	Manufacturer	Type No	TE No	Software / Firmware Revision	Calibration Period (months)	Calibration Due
Spectrum Analyzer	Rohde & Schwarz	FSP40	BEMC00283	4.50 SP5	24	04-Oct-2021
Attenuator 20dB, 2.9 mm-M/F, DC-40GHz 2 W	Aeroflex Inmet	40AH2W-20	BEMC02111	N/A	12	25-Jul-2021
Duratest High Frequency Cable 26.5 GHz	Teledyne Storm Products	921-0101-036	BEMC02112	N/A	12	19-Oct-2021

TU - Traceability Unscheduled
O/P MON - Traceability Unscheduled
N/A - Not Applicable



2.12 AC Power Line Conducted Emissions

2.12.1 Specification Reference

FCC: Section 15.207
ISED Canada; RSS-GEN 8.8

2.12.2 Equipment Under Test and Modification State

S/N: 203600148

2.12.3 Date of Test

1/29/2021

2.12.4 Test Method

ANSI C63.10 section 6.2 was the guiding document for this evaluation. Conducted emissions were performed from 150 kHz to 30 MHz with the spectrum analyzer's resolution bandwidth set to 9 kHz and the video bandwidth set to 30 kHz. The calculation for the conducted emissions is as follows:

Corrected Reading = Analyzer Reading + LISN Loss + Cable Loss
Margin = Applicable Limit - Corrected Reading

2.12.5 Environmental Conditions

Ambient Temperature 24.5 °C
Relative Humidity 45.2 %
Atmospheric Pressure 1018.3 mbar

2.12.6 Test Results

Frequency of Emission (MHz)	Conducted Limit (dBμV)	
	Quasi-Peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

*Decreases with the logarithm of the frequency.

**Table 2.12.6-1: Power Line Conducted Emissions – Quasi-Peak Detector Results**

Frequency (MHz)	Quasi-peak (dBμV)	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)
0.150000	55.32	N	10.2	10.68	66.00
0.213000	44.11	N	10.3	18.98	63.09
0.406500	37.32	N	10.3	20.40	57.72
0.753000	28.69	N	10.4	27.31	56.00
2.004000	27.60	N	10.5	28.40	56.00
3.115500	26.45	N	10.6	29.55	56.00
3.493500	26.77	N	10.6	29.23	56.00
4.092000	26.57	N	10.6	29.43	56.00
8.254500	30.58	N	10.9	29.42	60.00

Table 2.12.6-2: Power Line Conducted Emissions – Average Detector Results

Frequency (MHz)	Average (dBμV)	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)
0.150000	39.03	N	10.2	16.97	56.00
0.177000	32.57	N	10.2	22.06	54.63
0.222000	32.52	N	10.3	20.23	52.74
0.384000	27.26	N	10.3	20.93	48.19
0.406500	28.15	N	10.3	19.57	47.72
0.762000	20.27	N	10.4	25.73	46.00
2.031000	21.12	N	10.5	24.88	46.00
2.188500	20.81	N	10.5	25.19	46.00
8.088000	24.86	N	10.9	25.14	50.00

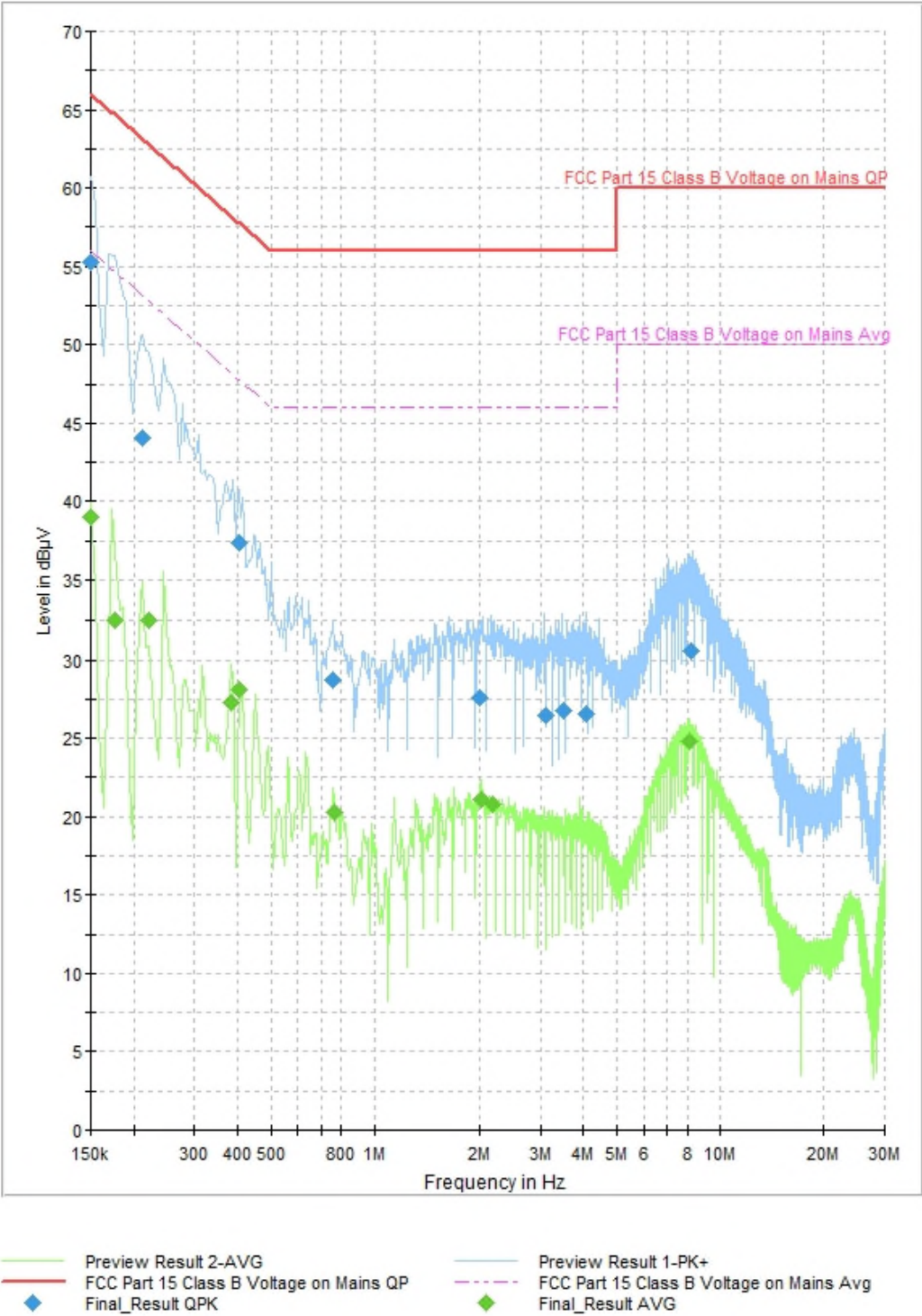


Figure 2.12.6-1: Graphical Results – AC Mains Composite Line and Neutral Plots



2.12.7 Test Location and Test Equipment Used

This test was carried out in TÜV SÜD America, Inc., 5610 W. Sligh Ave, Suite 100, Tampa, FL 33634, USA.

Instrument	Manufacturer	Type No	TE No	Software / Firmware Revision	Calibration Period (months)	Calibration Due
LISN	Rohde & Schwarz	ESH3-Z5	TEMC00002	N/A	24	30-Sep-2021
EMI Test Receiver	Rohde & Schwarz	ESCS30	TEMC00011	2.3002.0102.36	24	03-Oct-2021
RFI/EMI Shielded Enclosure	UNIVERSAL SHIELDING CORP.	N/A	TEMC00100	N/A	N/A	NCR
Test Software	Rohde & Schwarz	EMC32	TEMC00184	10.50.00	N/A	NCR

TU - Traceability Unscheduled

O/P MON - Traceability Unscheduled

N/A - Not Applicable



3 Test Equipment Information

3.1 General Test Equipment Used

Instrument	Manufacturer	Type No	TE No	Software / Firmware Revision	Calibration Period (months)	Calibration Due
Spectrum Analyzer	Rohde & Schwarz	FSP40	BEMC00283	4.50 SP5	24	04-Oct-2021
Notch Filter	Trilithic, Inc.	7NM867/122-X1-AA	BEMC02069	N/A	12	21-Jan-2022
Tile Automation Software	ETS Lindgren	TILE4! - Version 4.2.A	BEMC02095	4.2A	N/A	NCR
Attenuator 20dB, 2.9 mm-M/F, DC-40GHz 2 W	Aeroflex Inmet	40AH2W-20	BEMC02111	N/A	12	25-Jul-2021
Duratest High Frequency Cable 26.5GHz	Teledyne Storm Products	921-0101-036	BEMC02112	N/A	12	19-Oct-2021
LISN	Rohde & Schwarz	ESH3-Z5	TEMC00002	N/A	24	30-Sep-2021
BI LOG PERIODIC, ANTENNA	Schaffner	CBL6112B	TEMC00005	N/A	24	31-Oct-2021
EMI Test Receiver	Rohde & Schwarz	ESCS30	TEMC00011	2.3002.01 02.36	24	03-Oct-2021
EMC Analyzer	Agilent	E7405A	TEMC00012	A.09.02	24	27-Mar-2022
Loop Antenna	Com Power	AL-130	TEMC00025	N/A	24	26-Sep-2021
EMC Chamber	Panashield	N/A	TEMC00031	N/A	24	28-Jan-2023
Double Ridge Guide Horn	ETS Lindgren	3117	TEMC00061	N/A	24	07-Feb-2022
RFI/EMI Shielded Enclosure	UNIVERSAL SHIELDING CORP.	N/A	TEMC00100	N/A	N/A	NCR
PAM-118A	Com-Power Corporation	PAM-118A	TEMC00160	N/A	12	16-Mar-2021
1.2 GHz High Pass Filter	Micro-Tronics	HPM50108-01	TEMC00175	N/A	12	12-Mar-2021
Test Software	Rohde & Schwarz	EMC32	TEMC00184	10.50.00	N/A	NCR
A81-0303 18 GHz Cable Set	Teledyne Storm Products	A81-0303-360/96	TEMC00201	N/A	12	22-Apr-2021

TU - Traceability Unscheduled
O/P MON - Traceability Unscheduled
N/A - Not Applicable
NCR – No Calibration Required



4 **Diagram of Test Set-ups**

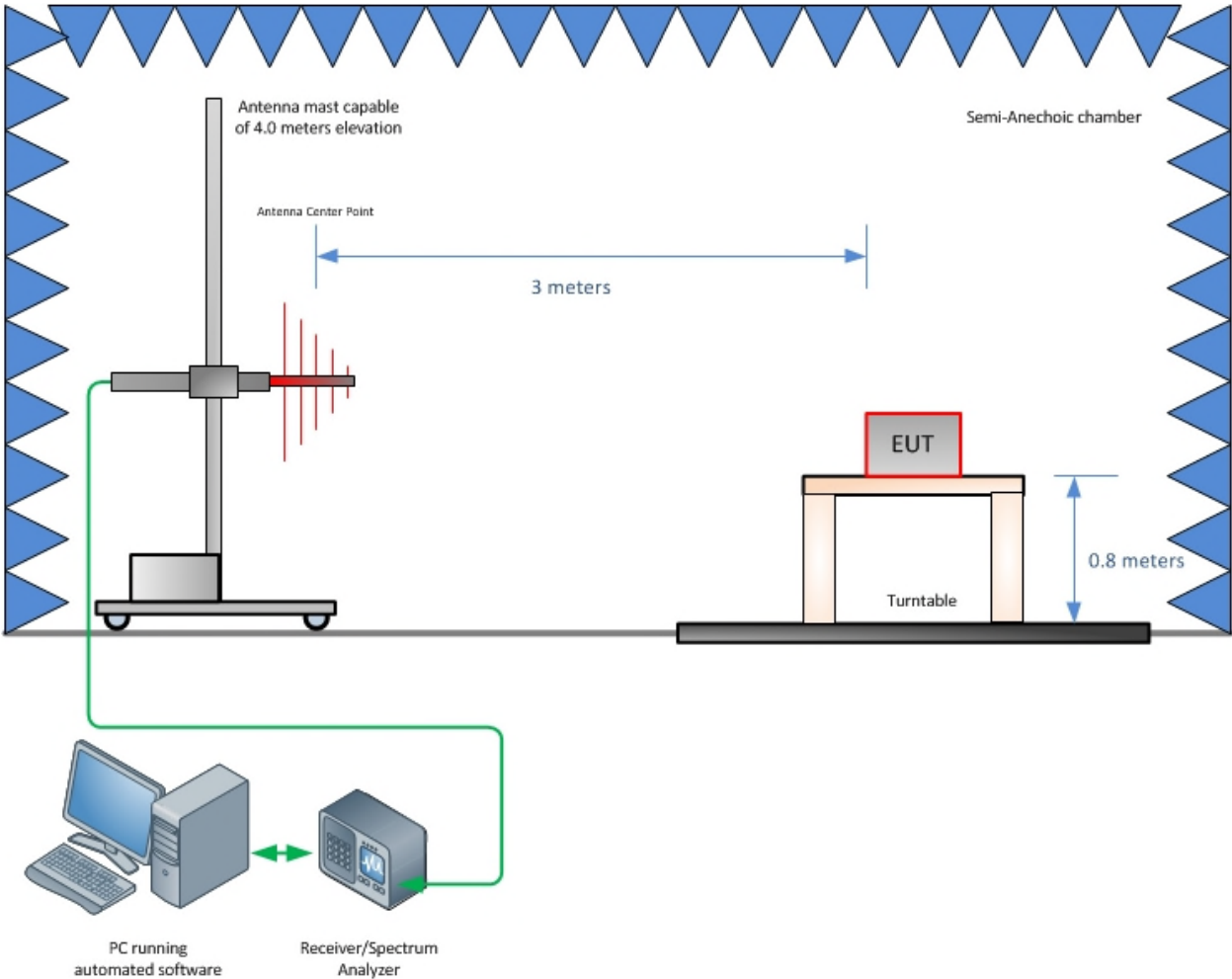


Figure 4-1 - Radiated Emissions Test Setup up to 1 GHz

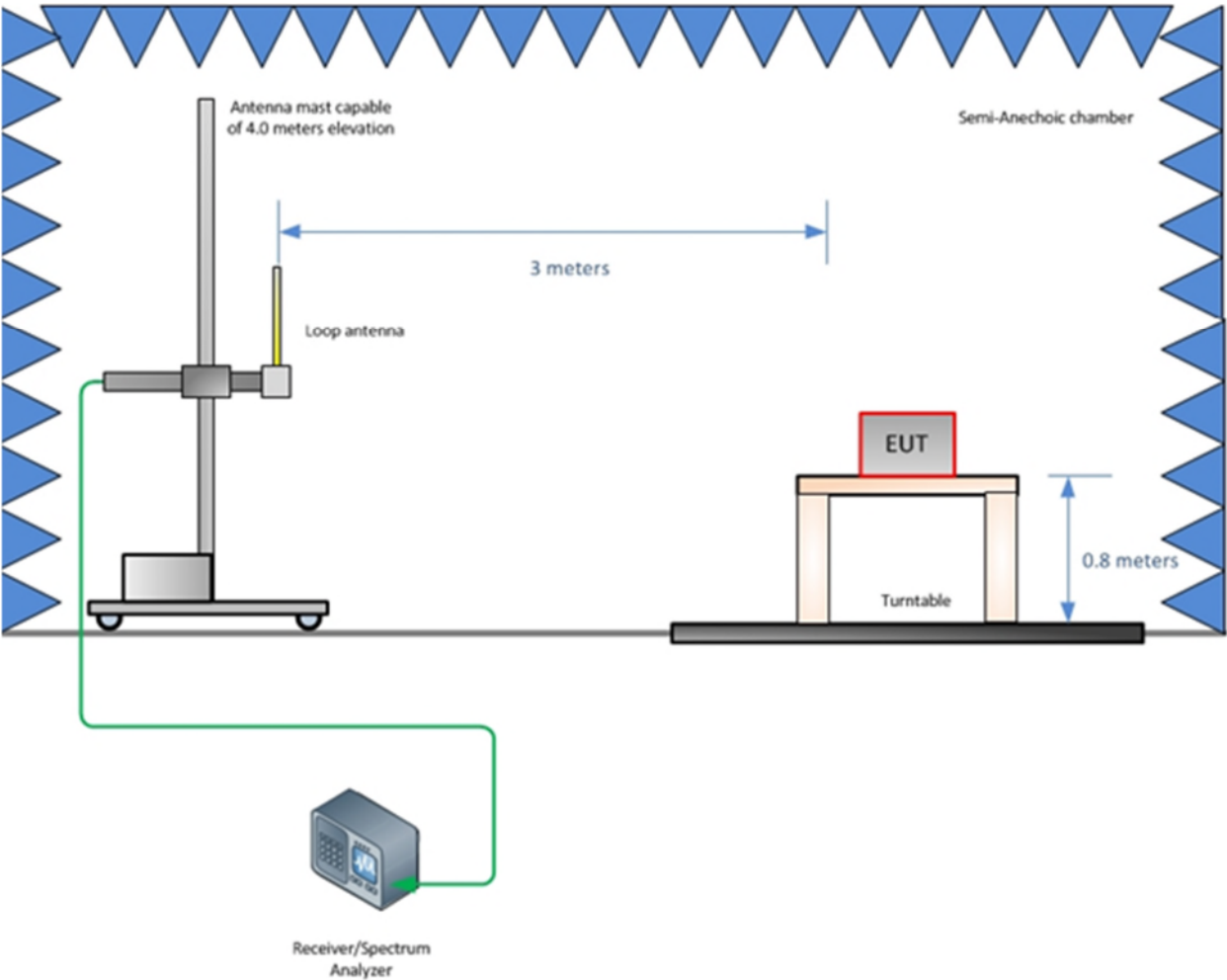


Figure 4-2 - Radiated Emissions Test Setup up to 30 MHz

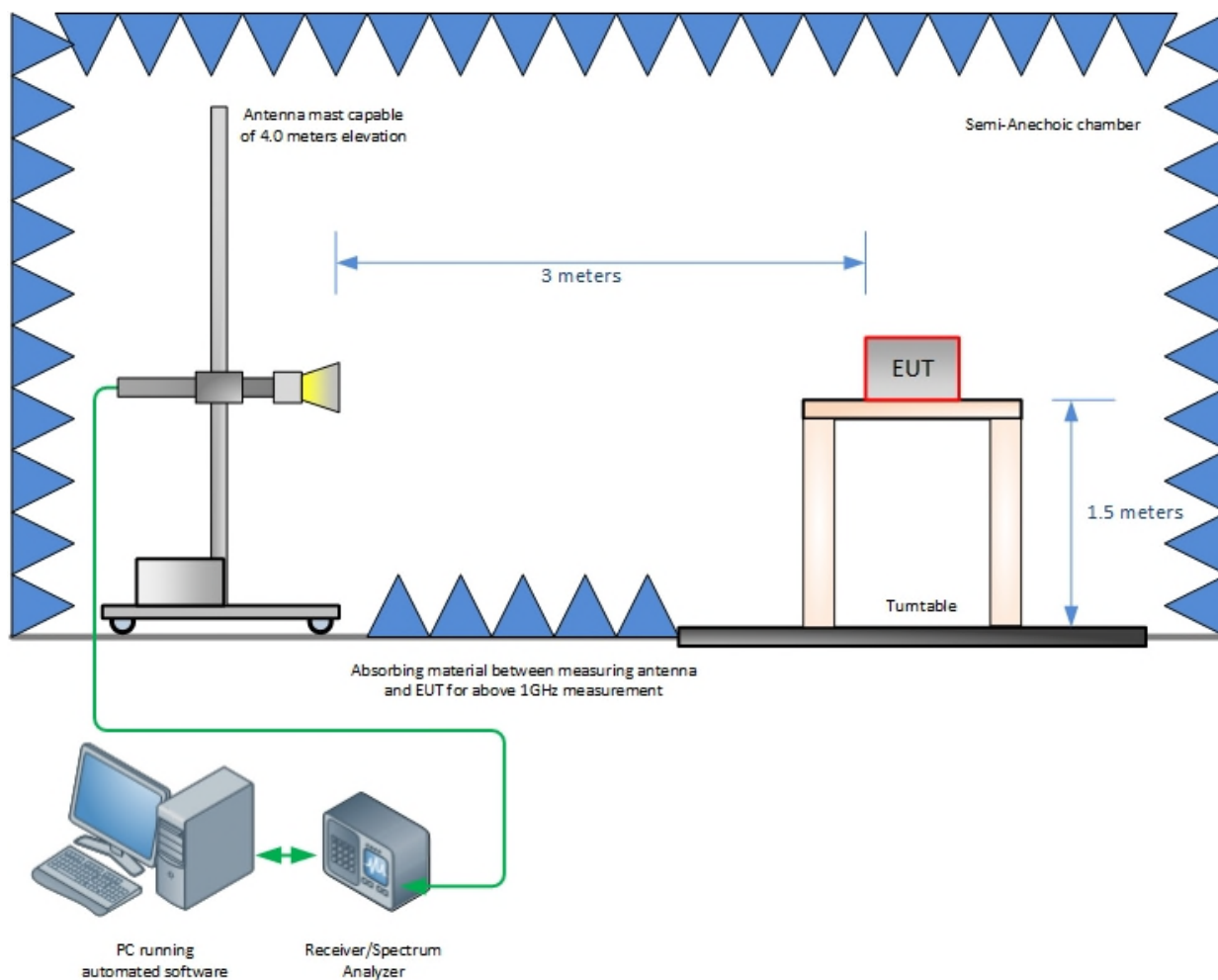


Figure 4-3 - Radiated Emissions Test Setup above 1 GHz

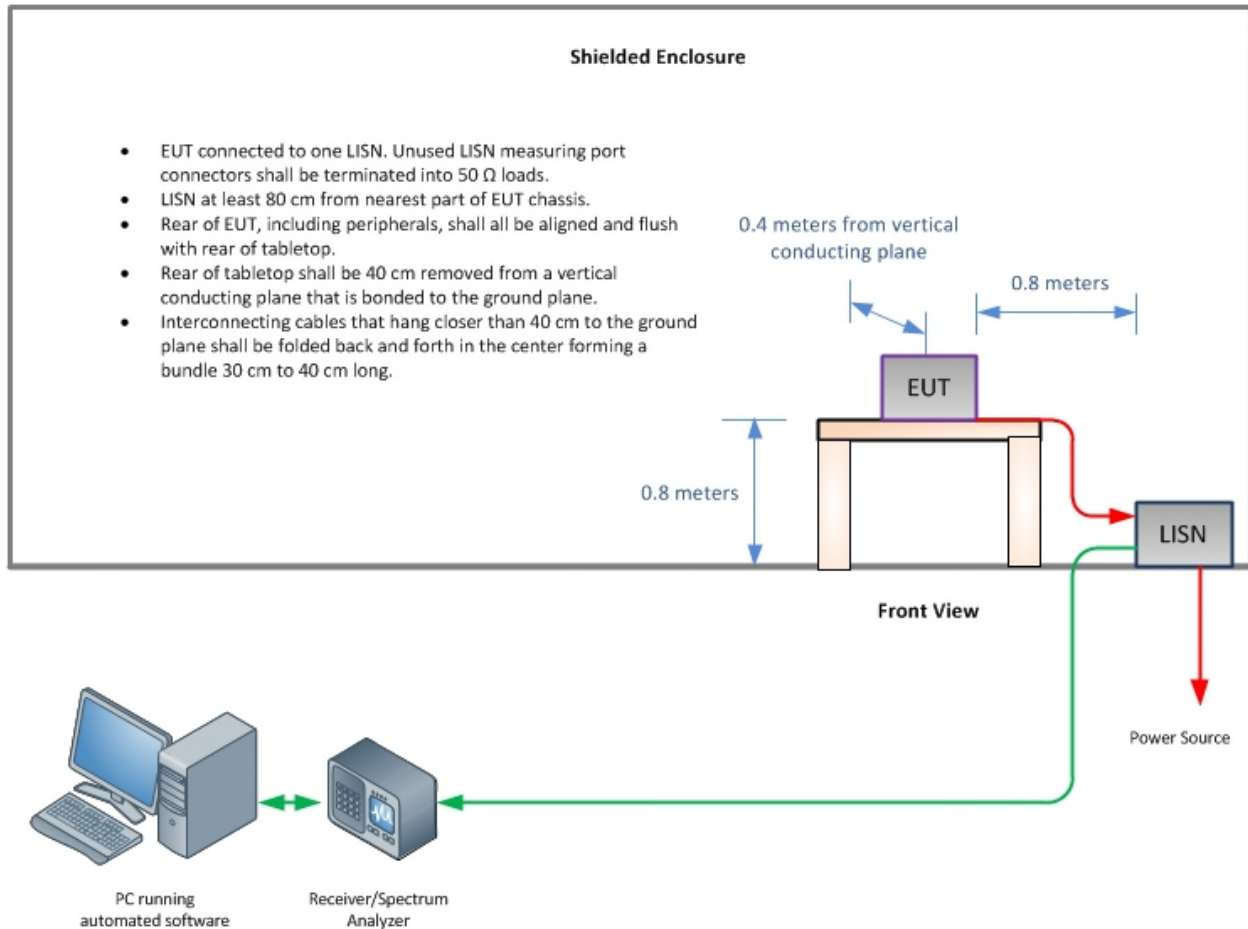


Figure 4-4 – Conducted Emissions Test Setup



5 Measurement Uncertainty

For a 95% confidence level, the measurement uncertainties for defined systems are:

Table 5-1 - Values of U_{CISPR} and U_{Lab}

Measurement	U_{CISPR}	U_{Lab}
Conducted disturbance (mains port) (9 kHz – 150 kHz) (150 kHz – 30 MHz)	3.8 dB 3.4 dB	3.71 dB 3.31 dB
Conducted disturbance (telecom port) (150 kHz – 30 MHz 55 dB LCL) (150 kHz – 30 MHz 65 dB LCL) (150 kHz – 30 MHz 75 dB LCL)	5.0 dB 5.0 dB 5.0 dB	4.11 dB 4.50 dB 4.94 dB
Radiated disturbance (electric field strength on an open area test site or alternative test site) (30 MHz – 1 000 MHz) (1 – 6 GHz) (6-18 GHz)	6.3 dB 5.2 dB 5.5 dB	5.85 dB 4.48 dB 4.48 dB

Notes:

U_{CISPR} resembles a value of measurement uncertainty for a specific test, which was determined by considering uncertainties associated with the quantities listed in CISPR 16-4-2:2011.



6 Accreditation, Disclaimers and Copyright

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