Certification Test Report

FCC ID: ONTJETIDS24US
IC: 10491A-JETIDS24US

FCC Rule Part: 15.247
ISED Canada's Radio Standards Specification: RSS-247

Report Number: BO72131445.101

Applicant: Esprit Model, Inc.

Model(s): JETIDS24US

Test Begin Date: **October 3, 2017**
Test End Date: **January 30, 2018**

Report Issue Date: January 30, 2018

FOR THE SCOPE OF ACCREDITATION UNDER CERTIFICATE NUMBER AT-1533

This report must not be used by the client to claim product certification, approval, or endorsement by ANAB, ANSI, or any agency of the Federal Government.

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This report contains 72 pages

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1 GENERAL

1.1 Purpose

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.

1.2 Applicant Information

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

1.3 Product Description

The Esprit Model JETIDS24US is a remote control. The device includes a 900 MHz transceiver and two 2.4 GHz transceivers which are identified as primary and secondary, respectively. The radios are not capable of transmitting simultaneously. Each of the 2.4 GHz transceivers provides two antenna ports. Transmission occurs from one antenna at the time based on signal strength. The test report documents the compliance of the 2.4 GHz transceivers.

Technical Details

Mode of Operation:	IEEE 802.15.4 (2.4 GHz Zigbee)
Frequency Range:	2405 MHz - 2480 MHz
Number of Channels:	16
Channel Separation:	5 MHz
Modulations:	O-QPSK
Antenna Type/Gain:	Whip antenna, 2.1 dBi
Input Power:	12 VDC

Model Number: JETIDS24US

Test Sample Serial Number(s): SAMPLE20, SAMPLE19

Test Sample Condition: The EUT was in good operating condition without any physical damage.

1.4 Test Methodology and Considerations

The EUT was evaluated for radiated and RF conducted emissions. The EUT is software configured to turn off within five seconds of being connected to the AC Mains. The power line conducted emissions evaluation was performed with the EUT charging while being off.

For the radiated emissions evaluation, preliminary measurements were performed for the EUT in three orthogonal orientations for each for the 2.4 GHz radios. Additional measurements were performed to determine the antenna path leading to the highest emissions. The worst-case orientations were determined to be the EUT flat on the tabletop for the radiated band-edge measurements and the EUT setup vertically (standing) for the radiated spurious emissions measurements, as documented in the test setup photo exhibit. The worst-case results for each of the 2.4 GHz radios are reported herein.

The RF conducted emissions were performed on both antenna paths of the 2.4 GHz radios. A temporary RF connector was used at the antenna ports to facilitate direct coupling to a spectrum analyzer.

The EUT was evaluated for the 900 MHz radio and for unintentional emissions. Ferrites were used for compliance to the unintentional emissions evaluation. The results and modifications on the EUT are documented in separate test reports.

Test Software Power Settings: Channels 11 to 25: Attenuation 7, Channel 26: Attenuation 15.

2 TEST FACILITIES

2.1 Location

The radiated and conducted emissions test sites are located at the following address:

TÜV SÜD America, Inc.
3998 FAU Blvd, Suite 310
Boca Raton, Florida 33431
Phone: (561) 961-5585
Fax: (561) 961-5587
http://www.tuv-sud-america.com

2.2 Laboratory Accreditations/Recognitions/Certifications

TÜV SÜD America, Inc. is accredited to ISO/IEC 17025 by ANSI-ASQ National Accreditation Board under their ANAB program and has been issued certificate number AT-1533 in recognition of this accreditation. Unless otherwise specified, all test methods described within this report are covered under the ISO/IEC 17025 scope of accreditation.

FCC Test Firm Registration #: 475089
Innovation, Science and Economic Development Canada Lab Code: 4175C

2.3 Radiated & Conducted Emissions Test Site Description

2.3.1 Semi-Anechoic Chamber Test Site

The EMC radiated test facility consists of an RF-shielded enclosure. The interior dimensions of the indoor semi-anechoic chamber are approximately 48 feet (14.6 m) long by 36 feet (10.8 m) wide by 24 feet (7.3 m) high and consist of rigid, 1/8 inch (0.32 cm) steel-clad, wood core modular panels with steel framing. In the shielded enclosure, the faces of the panels are galvanized and the chamber is self-supporting. 8-foot RF absorbing cones are installed on 4 walls and the ceiling. The steel-clad ground plane is covered with vinyl flooring.

The turntable is driven by pneumatic motor, which can support a 2000 lb. load. The turntable is flush with the chamber floor which it is connected to, around its circumference, with a continuous metallic loaded spring. An EMCO Model 1060 Multi-device controller controls the turntable position.

A pneumatic motor is used to control antenna polarizations and height relative to the ground. The height information is displayed on the control unit EMCO Model 1050.

The control room is an RF shielded enclosure attached to the semi-anechoic chamber with two bulkhead panels for connecting RF, and control cables. The dimension of the room is 7.3 m x 4.9 m x 3 m high and the entrance doors of both control and conducted rooms are 3 feet (0.91 m) by 7 feet (2.13 m).

A diagram of the Semi-Anechoic Chamber Test Site is shown in Figure 2.3.1-1 below:

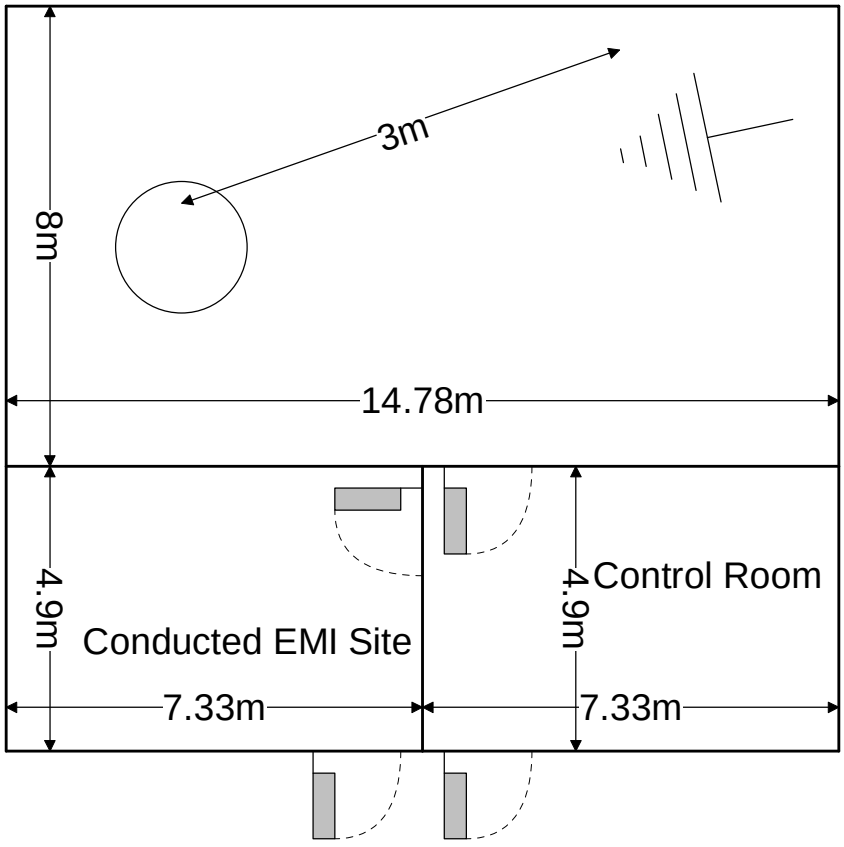

Figure 2.3.1-1: Semi-Anechoic Chamber Test Site

2.3.2 Conducted Emissions Test Site Description

The dimensions of the shielded conducted room are 7.3 x 4.9 x 3 m^3. The power line conducted emission site includes two LISNs: a Solar Model 8028-50 50 Ω/50 µH and a Rohde and Schwarz Model ESH3-Z5, which are installed as shown in the figure below. For evaluations requiring 230 V, 50 Hz AC input, a Polarad LISN (S/N 879341/048) is used in conjunction with a California Instruments signal generator Model 2001RP-OP1.

A diagram of the room is shown below in figure 2.3.2-1:

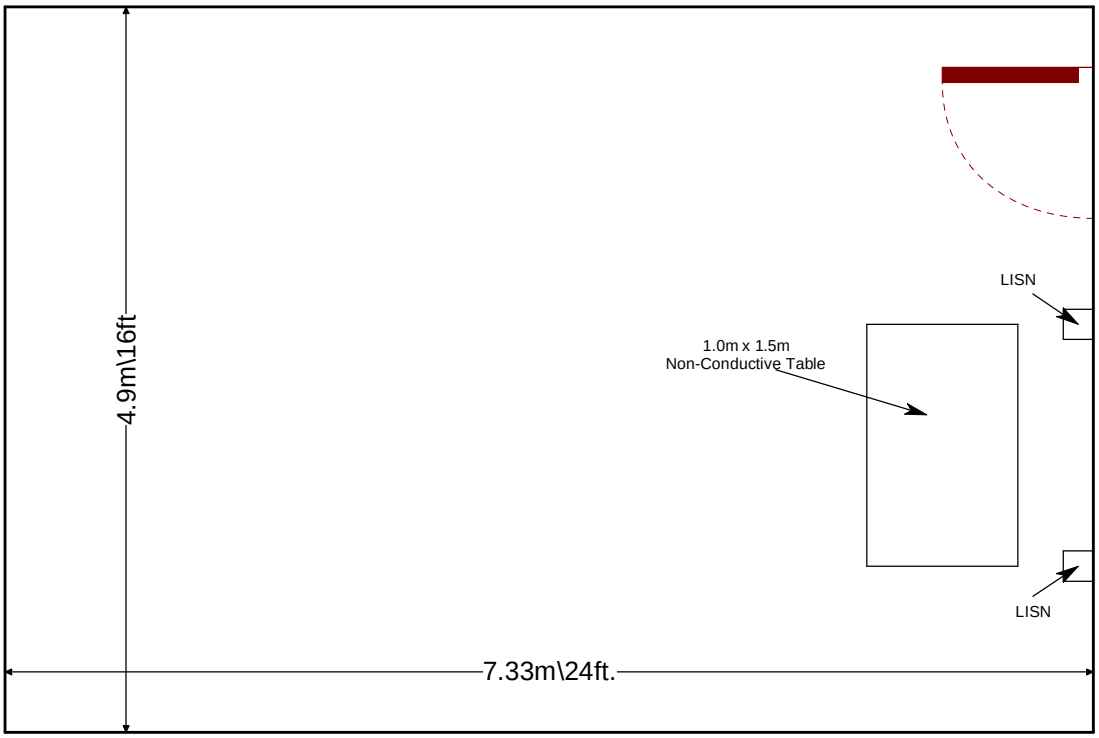

Figure 2.3.2-1: AC Mains Conducted EMI Site

3 APPLICABLE STANDARD REFERENCES

The following standards were used:

- ANSI C63.10-2013: American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices
- US Code of Federal Regulations (CFR): Title 47, Part 2, Subpart J: Equipment Authorization Procedures, 2017.
- US Code of Federal Regulations (CFR): Title 47, Part 15, Subpart C: Radio Frequency Devices, Intentional Radiators, 2017
- 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.
- Innovation, Science and Economic Development Canada Radio Standards Specification: RSS-GEN – General Requirements for Compliance of Radio Apparatus, Issue 4, November 2014.

4 LIST OF TEST EQUIPMENT

The calibration interval of test equipment is annually or the manufacturer's recommendations. Where the calibration interval deviates from the annual cycle based on the instrument manufacturer's recommendations, it shall be stated below.

Table 4-1: Test Equipment List

AssetID	Manufacturer	Model #	Equipment Type	Serial #	Last Calibration Date	Calibration Due Date
BEMC00078	EMCO	6502	Antennas	9104-2608	5/11/2016	5/11/2018
BEMC00282	Microwave Circuits	H2G020G4	Filters	74541	5/23/2017	5/23/2018
BEMC00283	Rohde & Schwarz	FSP40	Spectrum Analyzers	1000033	7/21/2016	7/21/2018
BEMC00523	Agilent	E7405	Spectrum Analyzers	MY45103293	12/9/2016	12/9/2018
BEMC00653	Suhner	SF-102A	Cables	0944/2A	9/5/2017	9/5/2018
BEMC02003	EMCO	3108	Antennas	2148	2/29/2016	2/28/2018
BEMC02005	FAU EMI R&D Lab	Lazarus	Antennas	EM001	2/16/2016	2/16/2018
BEMC02006	EMCO	3115	Antennas	2573	4/7/2017	4/7/2019
BEMC02008	COM-Power	AH-826	Antennas	81009	NCR	NCR
BEMC02011	Hewlett-Packard	HP 8447D	Amplifiers	2443A03952	10/27/2017	10/27/2018
BEMC02045	ACS Boca	Conducted Cable Set	Cable Set	2045	10/26/2017	10/26/2018
BEMC02082	Teledyne Storm Products	90-010-048	Cables	2082	4/7/2017	4/7/2018
BEMC02086	Merrimac	FAN-6-10K	Attenuators	23148-83-1	10/27/2027	10/27/2018
BEMC02089	Agilent Technologies, Inc.	83017A	Amplifiers	3123A00214	12/2/2016	12/2/2017
BEMC02095	ETS Lindgren	TILE4! - Version 4.2.A	Software	85242	NCR	NCR
BEMC02111	Aeroflex Inmet	40AH2W-20	Attenuator	2111	7/20/2017	7/20/2018
BEMC02121	ACS Boca	Radiated Cable Set	Cable Set	2121	7/31/2017	7/31/2018
BEMC02138	Hewlett-Packard	8449B	Pre-Amplifier	3008A00320	12/1/2017	12/1/2018
BEMC03004	Teseq	CFL 9206A	Attenuators	34720	8/29/2017	8/29/2018
NBLE03366	Agilent	E4440A	Spectrum Analyzer	MY42510427	10/24/2017	10/24/2018
TEMC00153	Rohde and Schwarz	ESH3-Z5	LISN	894785/012	9/27/2017	9/27/2018

Notes:

- **NCR=No Calibration Required**
- **The assets were only used during the active period of the calibration cycle.**

5 SUPPORT EQUIPMENT

Table 5-1: EUT and Support Equipment (Radiated Emissions)

Item #	Type Device	Manufacturer	Model/Part #	Serial #
1	EUT	Esprit Model	JETIDS24US	SAMPLE20

Table 5-2: EUT and Support Equipment (Power Line Conducted Emissions)

Item #	Type Device	Manufacturer	Model/Part #	Serial #
1	EUT	Esprit Model	JETIDS24US	SAMPLE19
2	EUT Switching AC Adapter	SUNNY Computer Technology Europe s.r.o.	SYS1531-2412-W2	G160404103657
3	Ferrite	Laird	28A0807-0A2	N/A

Table 5-3: Cable Description (Power Line Conducted Emissions)

Cable #	Cable Type	Length	Shield	Termination
A	Power	1.40 m	No	EUT to AC Adapter
B	Extension Power Cord	1.82 m	No	EUT AC Adapter to AC Mains

6 EQUIPMENT UNDER TEST SETUP BLOCK DIAGRAM

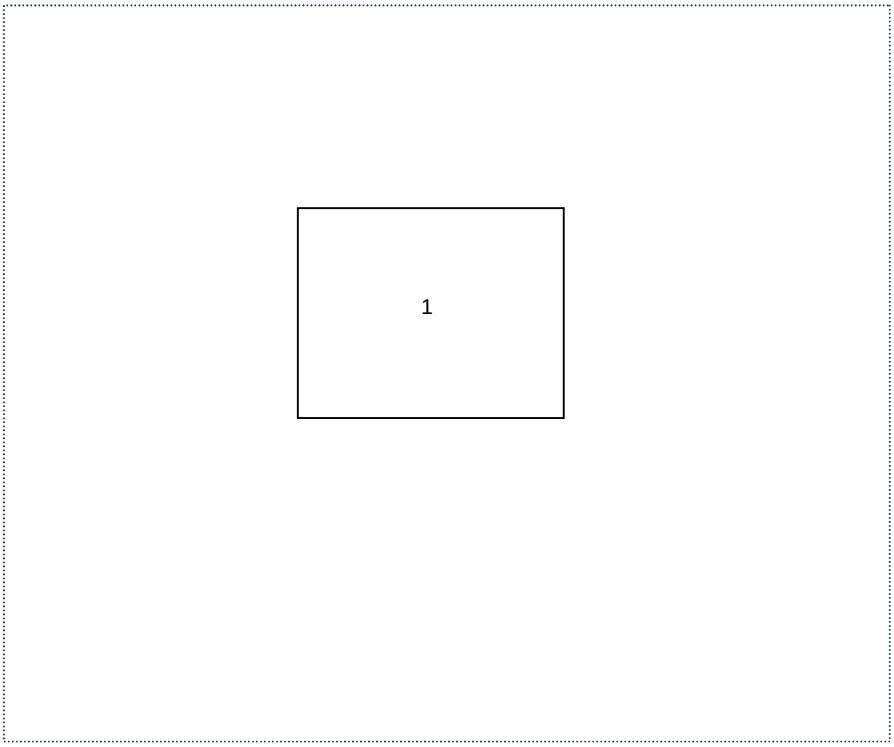

Figure 6-1: EUT and Support Equipment Block Diagram – Radiated Emissions

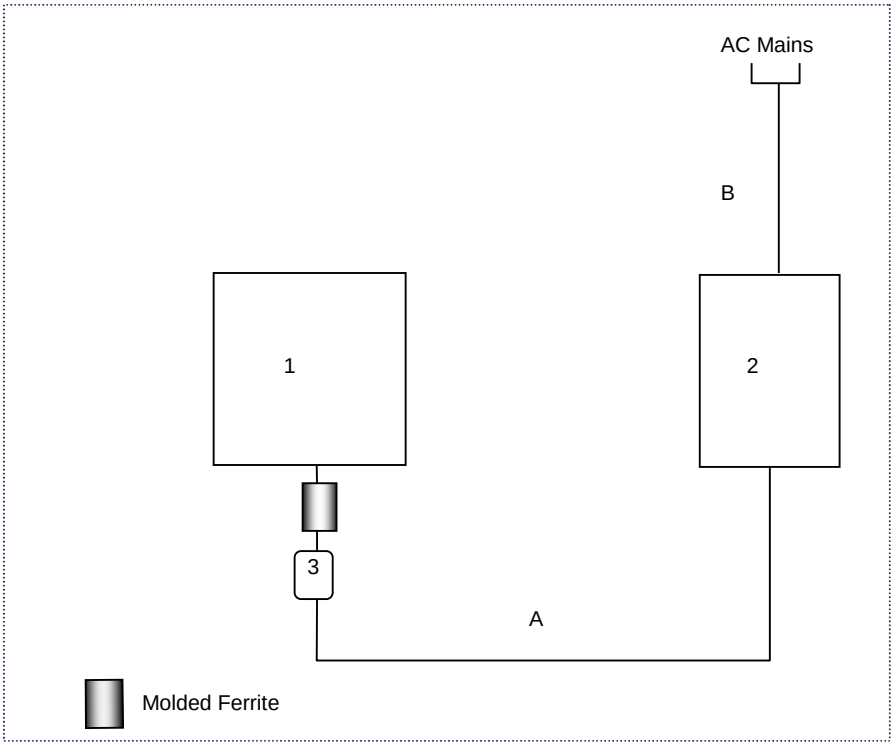

Figure 6-2: EUT and Support Equipment Block Diagram – Power Line Conducted Emissions

7 SUMMARY OF TESTS

Along with the tabular data shown below, plots were taken of all signals deemed important enough to document.

7.1 Antenna Requirement – FCC: Section 15.203

The EUT uses 2.1 dBi whip antennas for the 2.4 GHz radios which are connected to PCB via u. FL connectors. The connectors are deemed unique and thus meet the requirements of FCC Section 15.203.

7.2 Peak Output Power - FCC Section 15.247(b)(1) IC: RSS-247 5.4(b)

7.2.1 Measurement Procedure (Conducted Method)

The RF output port of the EUT was directly connected to the input of the spectrum analyzer through suitable attenuation.

7.2.2 Measurement Results

Performed by: Thierry Jean-Charles

Table 7.2.2-1 RF Output Power (AP1)

Frequency (MHz)	Power (dBm)
2405	19.86
2440	19.95
2480	6.34

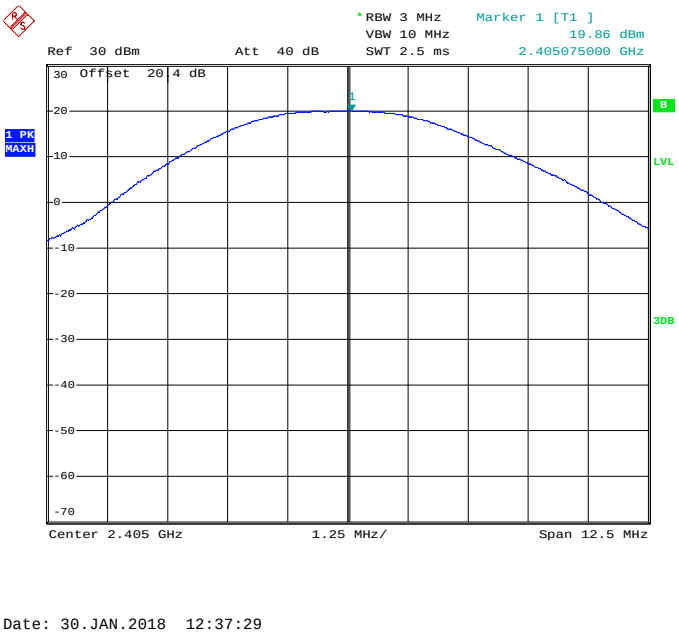

Figure 7.2.2-1: RF Output Power - Low Channel (AP1)

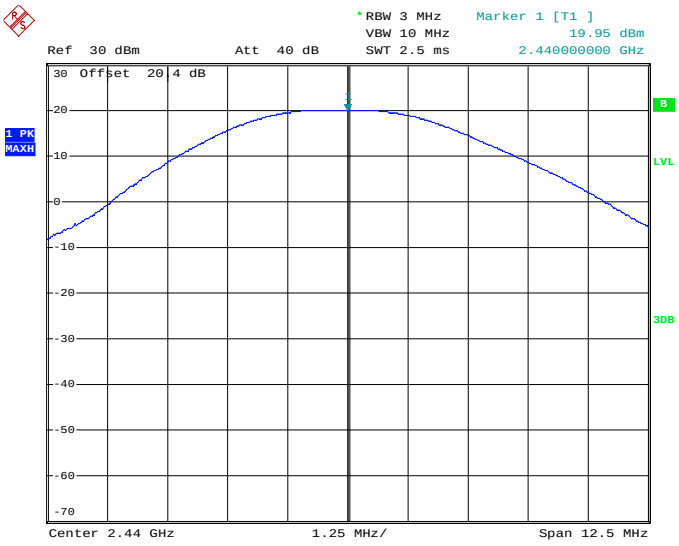

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Figure 7.2.2-2: RF Output Power - Middle Channel (AP1)

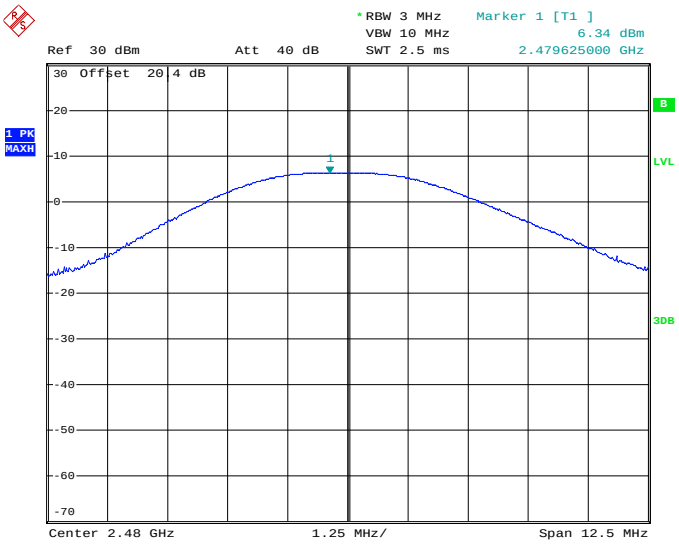

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Figure 7.2.2-3: RF Output Power - High Channel (AP1)

Table 7.2.2-2: RF Output Power (AP2)

Frequency (MHz)	Power (dBm)
2405	20.84
2440	20.38
2480	7.93

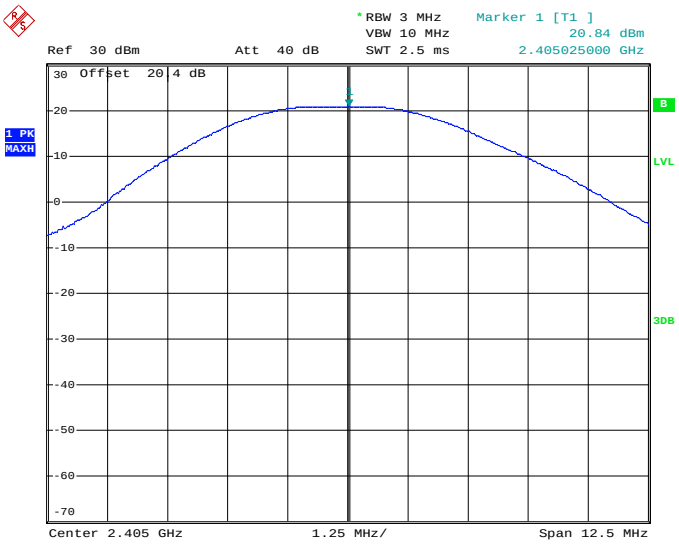

Figure 7.2.2-4: RF Output Power - Low Channel (AP2)

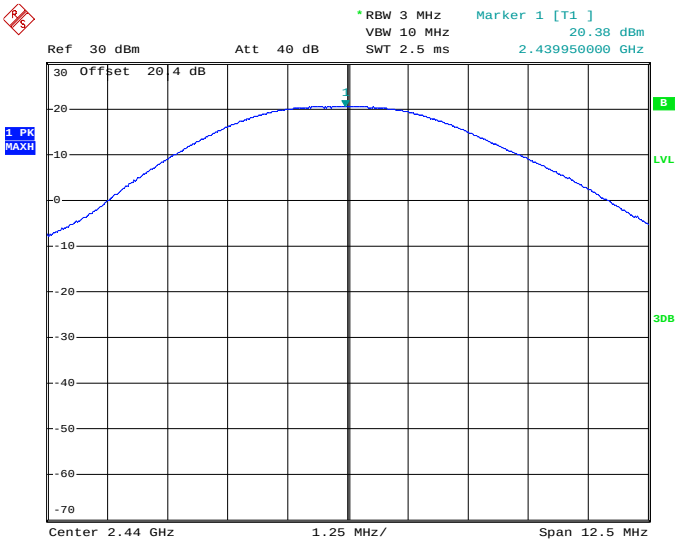

Figure 7.2.2-5: RF Output Power - Middle Channel (AP2)

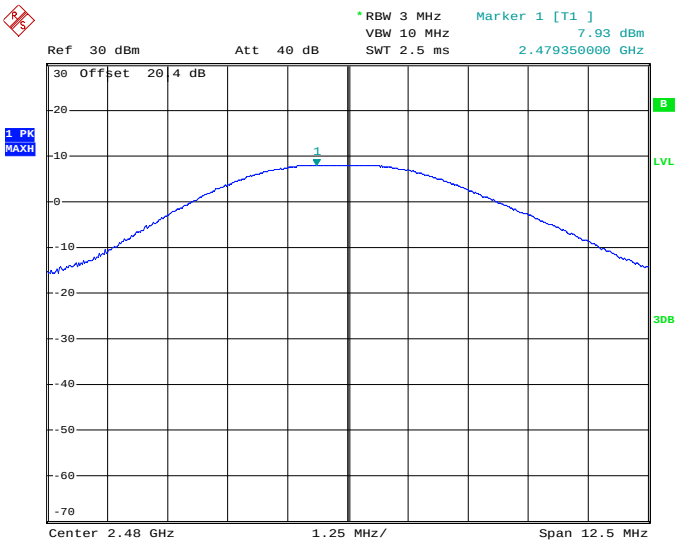

Figure 7.2.2-6: RF Output Power - High Channel (AP2)

Table 7.2.2-3: RF Output Power (AS1)

Frequency (MHz)	Power (dBm)
2405	19.68
2440	19.68
2480	5.91

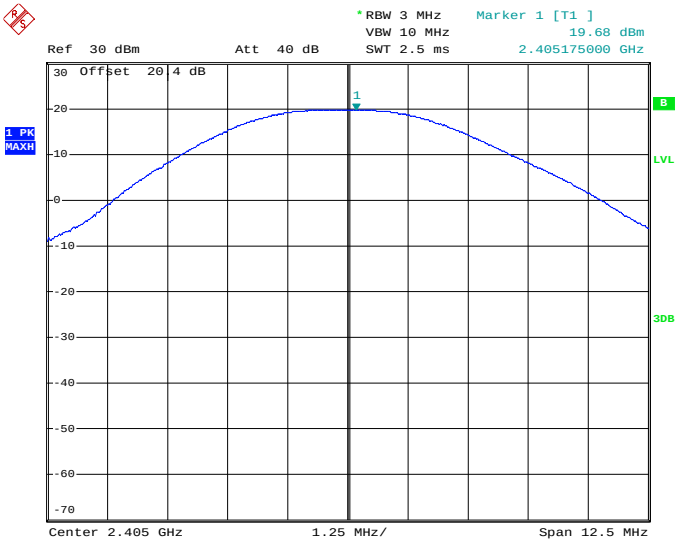

Figure 7.2.2-7: RF Output Power - Low Channel (AS1)

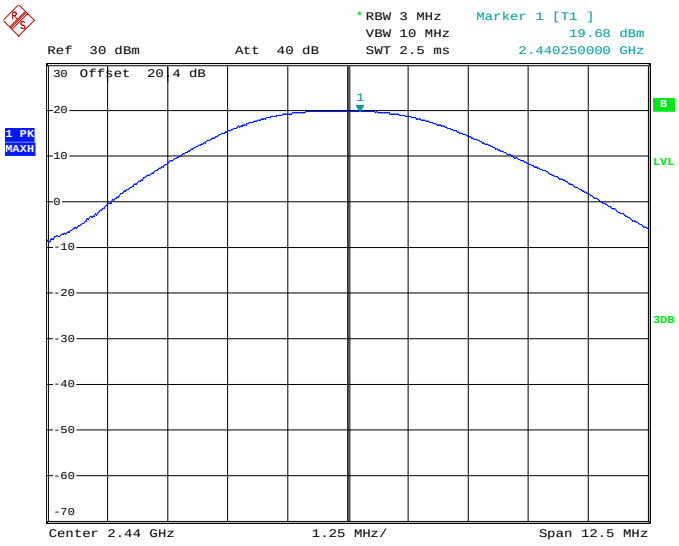

Figure 7.2.2-8: RF Output Power - Middle Channel (AS1)

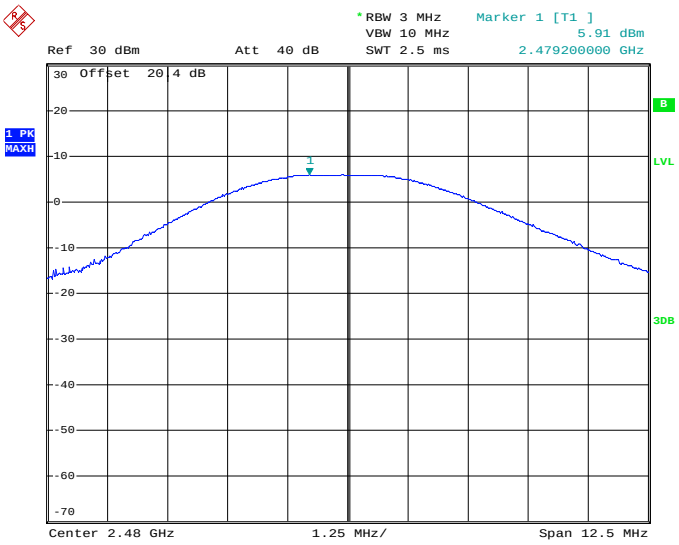

Figure 7.2.2-9: RF Output Power - High Channel (AS1)

Table 7.2.2-4: RF Output Power (AS2)

Frequency (MHz)	Power (dBm)
2405	20.10
2440	20.22
2480	7.19

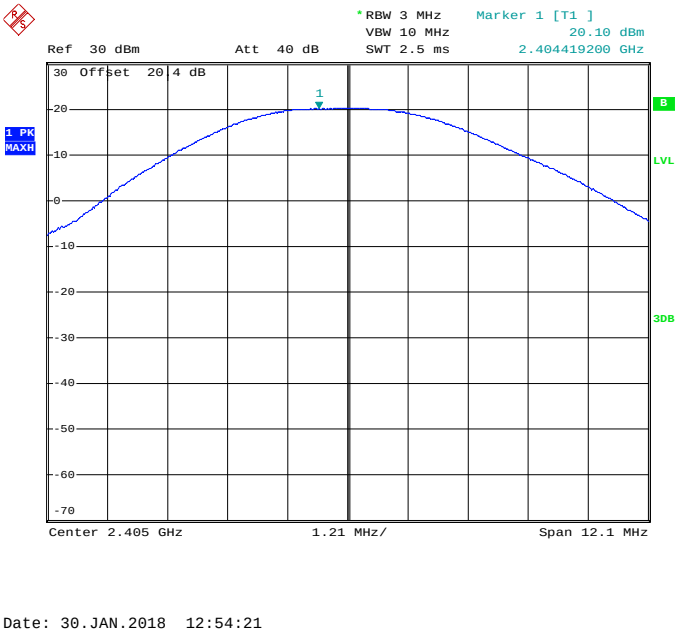

Figure 7.2.2-10: RF Output Power - Low Channel (AS2)

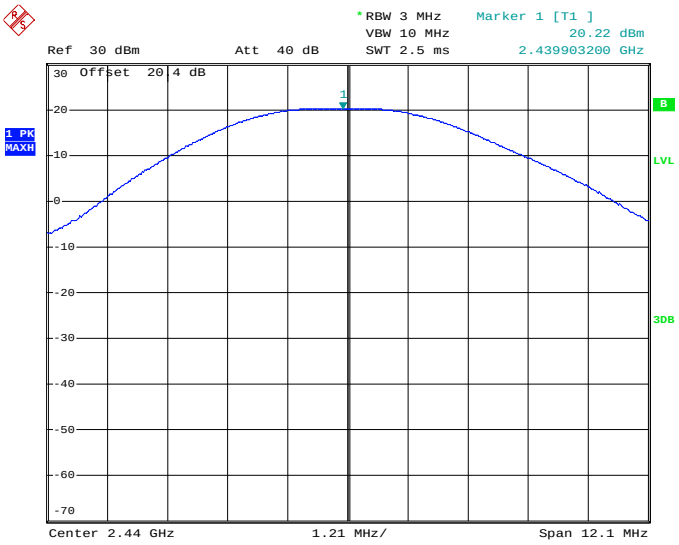

Figure 7.2.2-11: RF Output Power - Middle Channel (AS2)

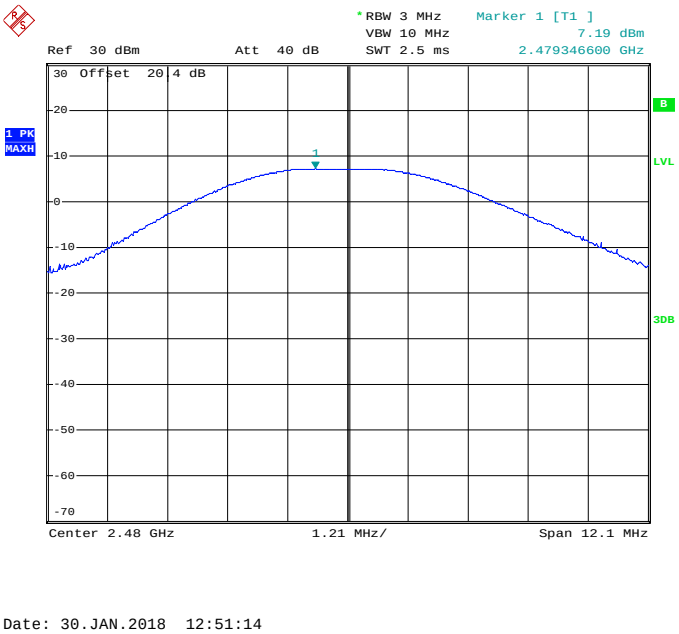

Figure 7.2.2-12: RF Output Power - High Channel (AS2)

7.3 Channel Usage Requirements

7.3.1 Carrier Frequency Separation – FCC: Section 15.247(a)(1) IC: RSS-247 5.1(b)

7.3.1.1 Measurement Procedure

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.

7.3.1.2 Measurement Results

Performed by: Thierry Jean-Charles

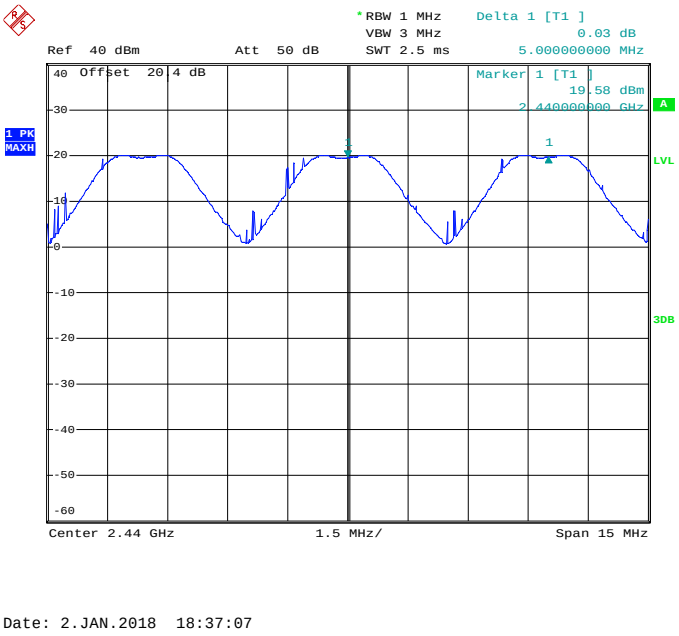

Figure 7.3.1.2-1: Carrier Frequency Separation (AP1)

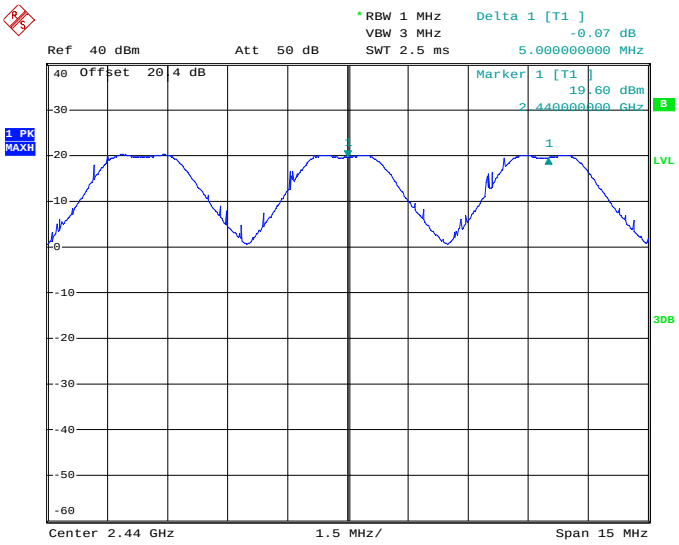

Figure 7.3.1.2-2: Carrier Frequency Separation (AP2)

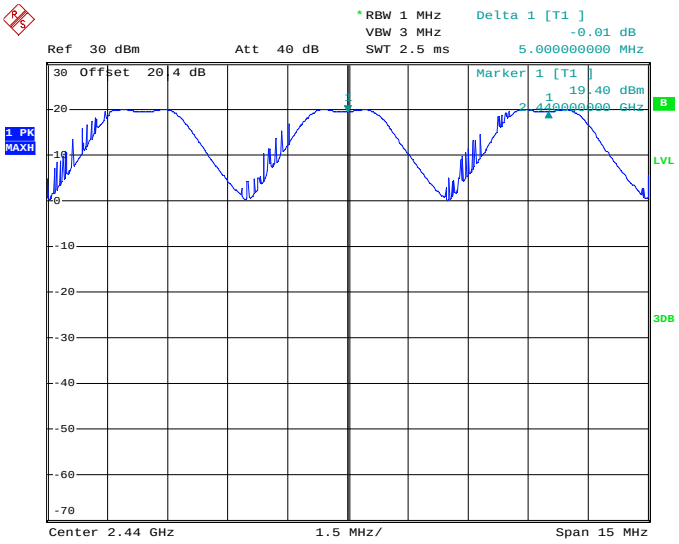

Figure 7.3.1.2-3: Carrier Frequency Separation (AS1)

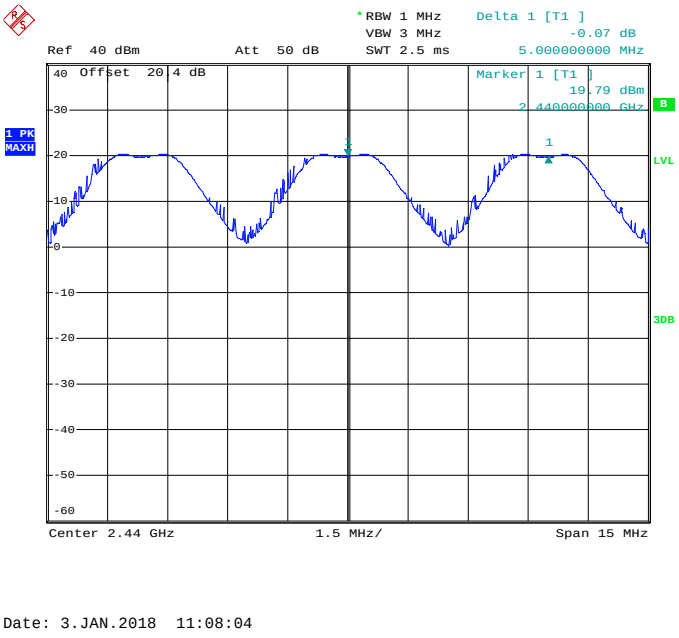

Figure 7.3.1.2-4: Carrier Frequency Separation (AS2)

7.3.2 Number of Hopping Channels – FCC: Section 15.247(a)(1)(iii) IC: RSS-247 5.1(d)

7.3.2.1 Measurement Procedure

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.

7.3.2.2 Measurement Results

Performed by: Thierry Jean-Charles

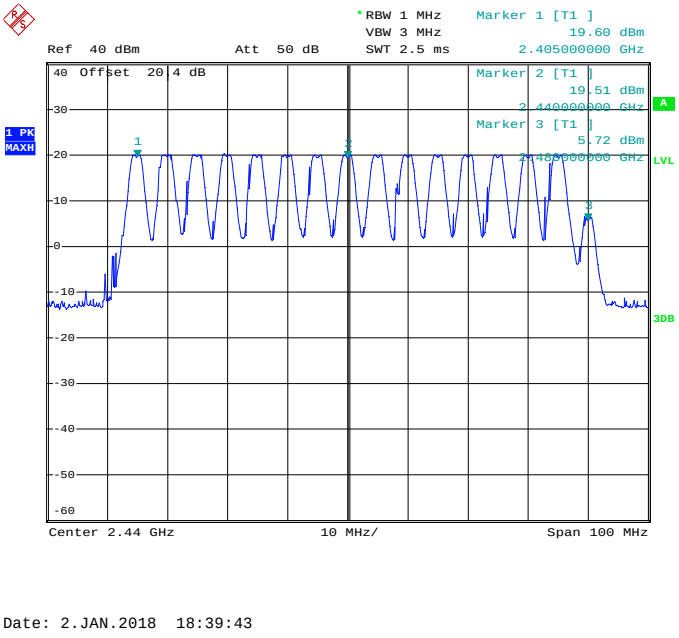

Figure 7.3.2.2-1: Number of Hopping Channels (AP1)

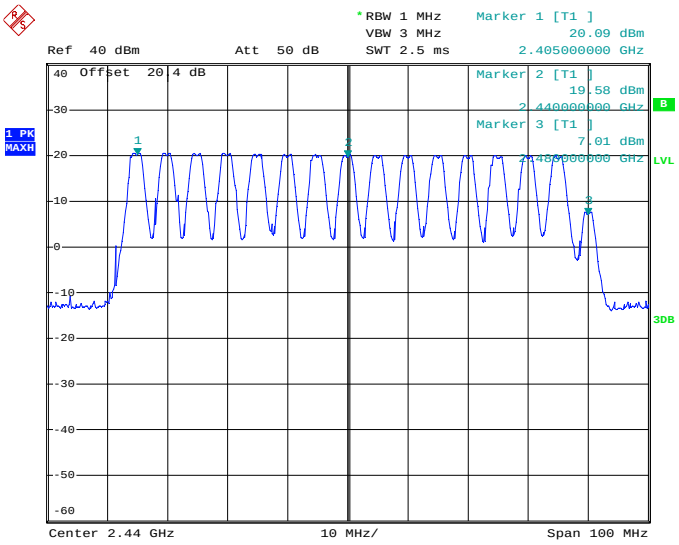

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Figure 7.3.2.2-2: Number of Hopping Channels (AP2)

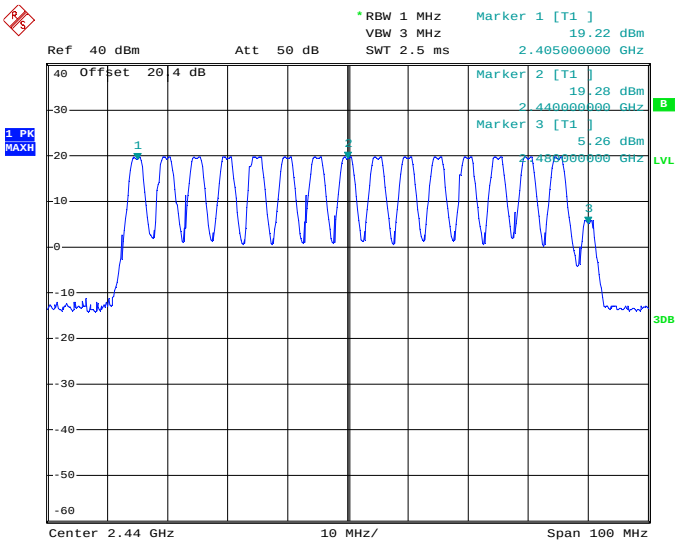

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Figure 7.3.2.2-3: Number of Hopping Channels (AS1)

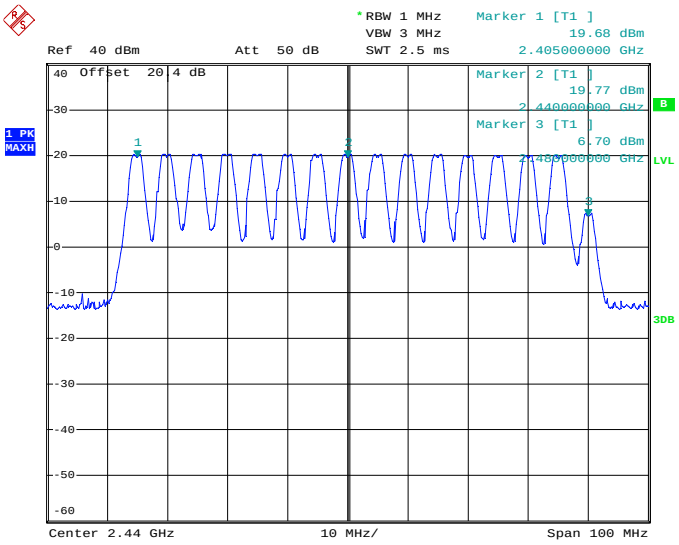

Figure 7.3.2.2-4: Number of Hopping Channels (AS2)

7.3.3 Channel Dwell Time – FCC: Section 15.247(a)(1)(iii) IC: RSS-247 5.1(d)

7.3.3.1 Measurement Procedure

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.

7.3.3.2 Measurement Results

Performed by: Thierry Jean-Charles

Table 7.3.3.2-1: Dwell Time on a 6.4 Second Cycle

Number of Hops Per Sec. (NHPS)	Number of Hops per Channel Per Sec. (NHPCPS)	Number of hops on a 6.4 s Cycle (NHPC)	Measured Dwell Times (ms)	Dwell Times on a 6.4 s Cycle	Limit (ms)	Status
100	6.25	40	2.010	80.40	400	PASS

*Notes:

Period = 10 ms
NHPS = (1000ms /10ms
NHPCPS = NHPS/16
NHPC = NHPCPS * 6.4 s
Dwell Time per Cycle = NHPC* Measured Dwell Time

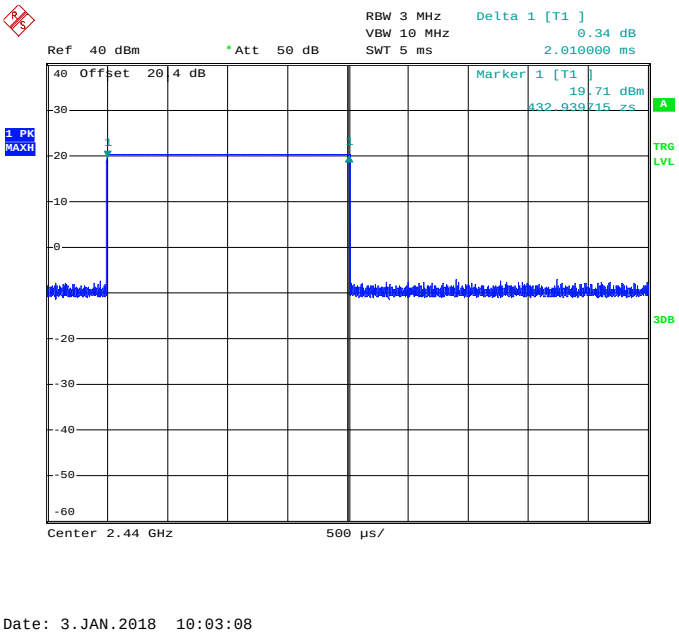

Figure 7.3.3.2-1: Channel Dwell Time – AP1

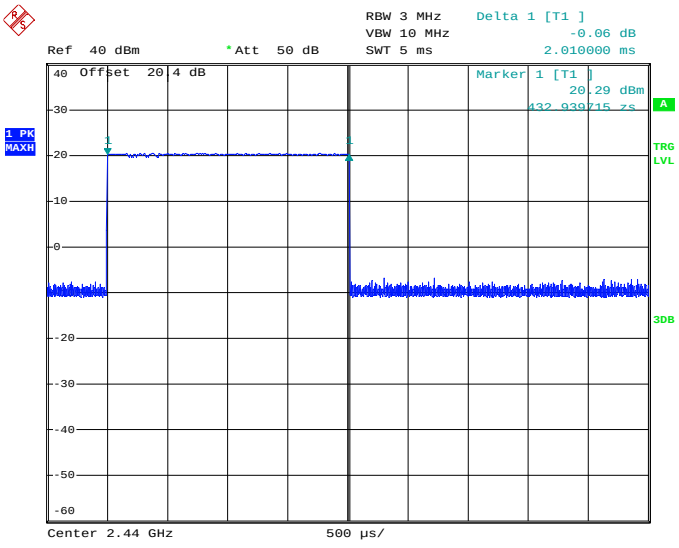

Figure 7.3.3.2-2: Channel Dwell Time – AP2

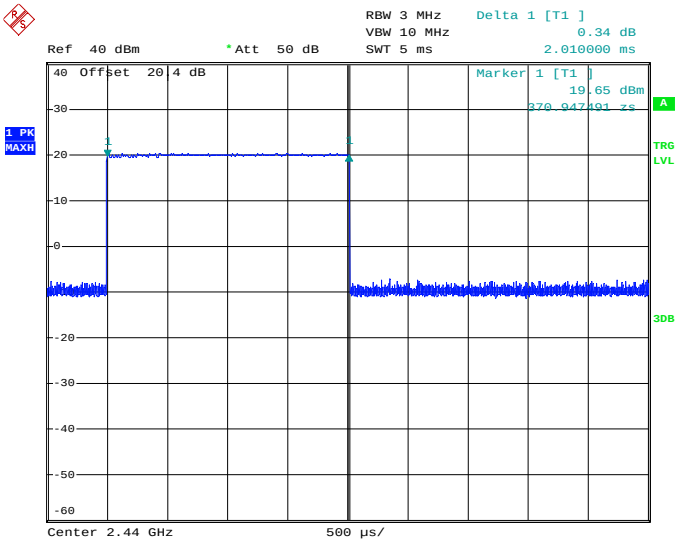

Figure 7.3.3.2-3: Channel Dwell Time – AS1

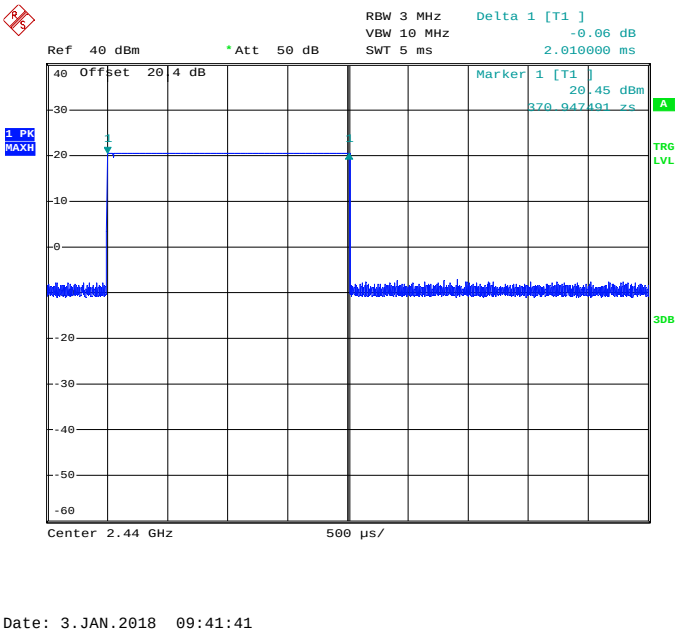

Figure 7.3.3.2-4: Channel Dwell Time – AS2

7.3.4 20dB / 99% Bandwidth - FCC: Section 15.247(a)(1)(i) IC: RSS-247 5.1(a)

7.3.4.1 Measurement Procedure

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 set to max hold with a peak detector active. The N dB function of the spectrum analyzer was used to measure the 20 dB bandwidth.

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 99% bandwidth equipment function of the spectrum analyzer and a peak detector.

7.3.4.2 Measurement Results

Performed by: Thierry Jean-Charles

Table 7.3.4.2-1: 20dB / 99% Bandwidth (AP1)

Frequency (MHz)	20dB Bandwidth (kHz)	99% Bandwidth (kHz)
2405	2523.0	2306.0
2440	2554.0	2349.7
2480	2576.0	2493.8

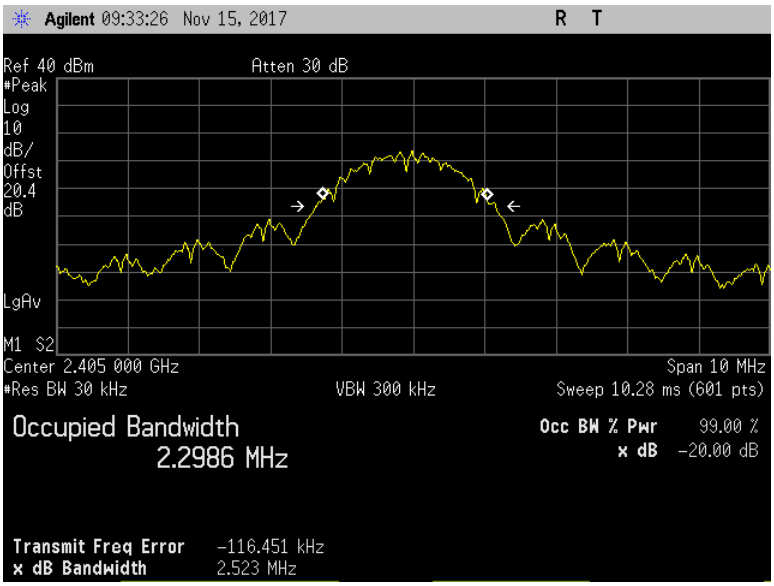

Figure 7.3.4.2-1: 20 dB BW – Low Channel (AP1)

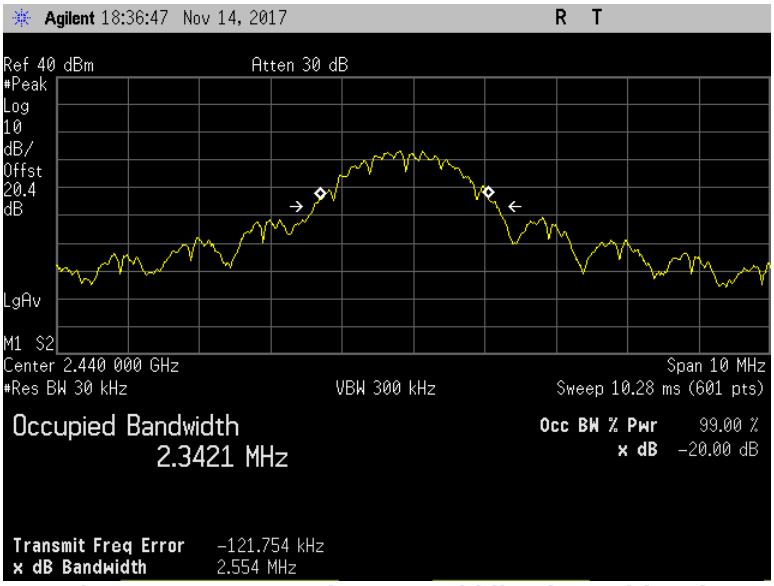

Figure 7.3.4.2-2: 20 dB BW – Middle Channel (AP1)

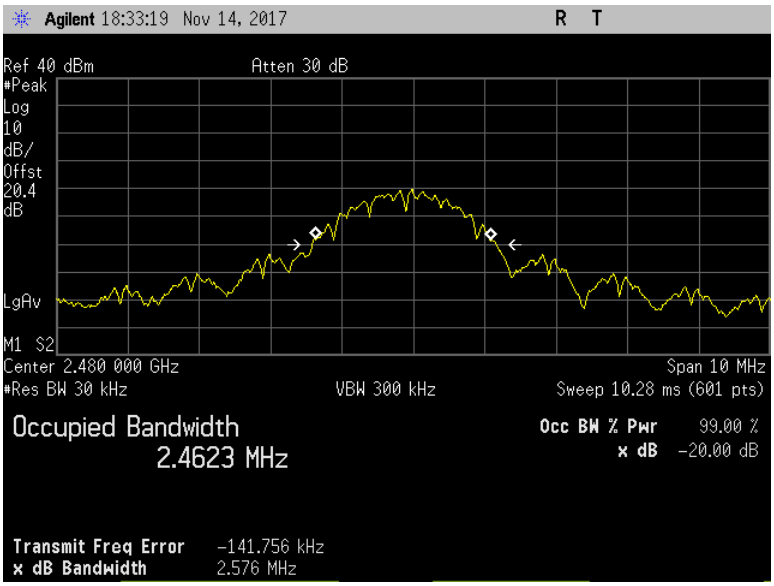

Figure 7.3.4.2-3: 20 dB BW – High Channel (AP1)

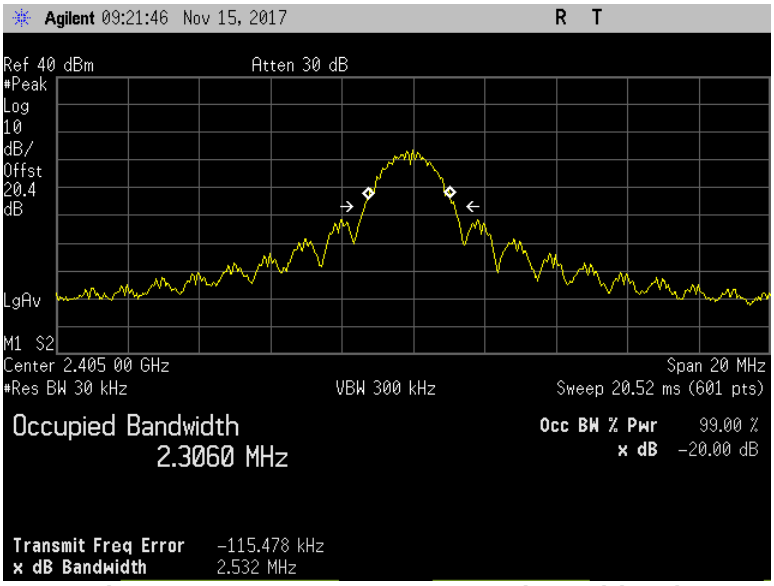

Figure 7.3.4.2-4: 99% BW – Low Channel (AP1)

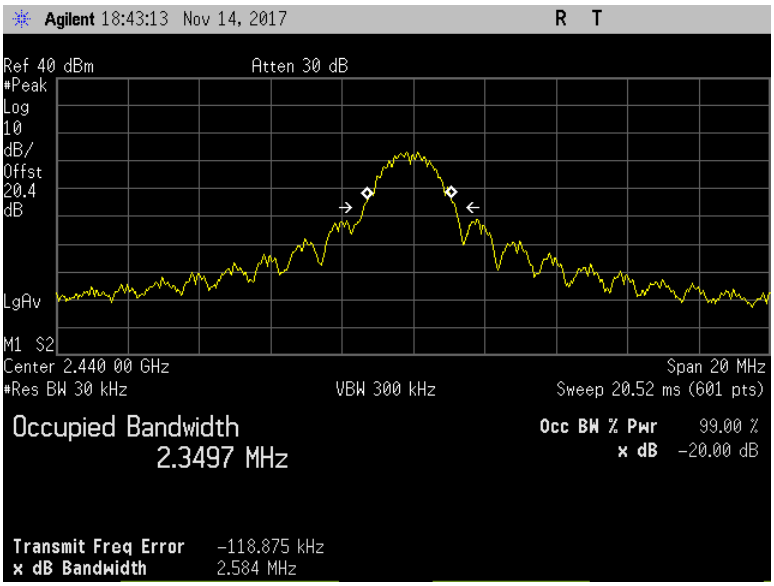

Figure 7.3.4.2-5: 99% BW – Middle Channel (AP1)

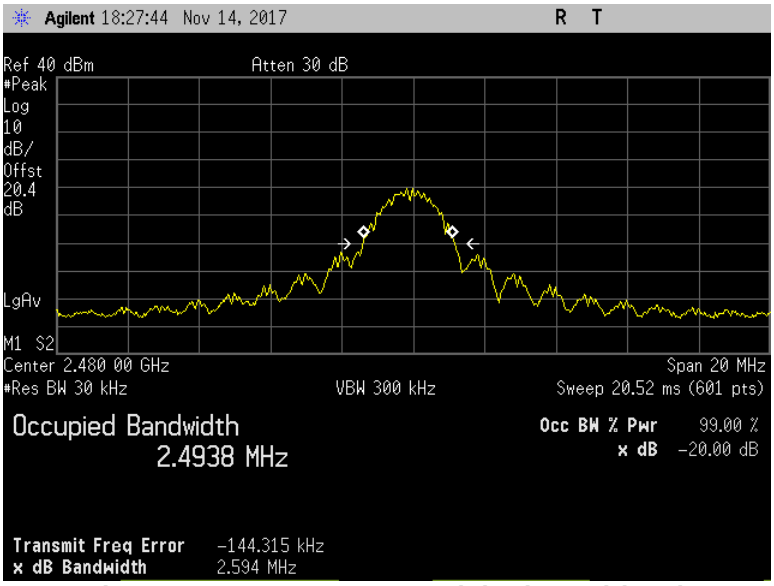

Figure 7.3.4.2-6: 99% BW – High Channel (AP1)

Table 7.3.4.2-2: 20dB / 99% Bandwidth (AP2)

Frequency (MHz)	20dB Bandwidth (kHz)	99% Bandwidth (kHz)
2405	2515.0	2327.8
2440	2541.0	2332.2
2480	2591.0	2807.2

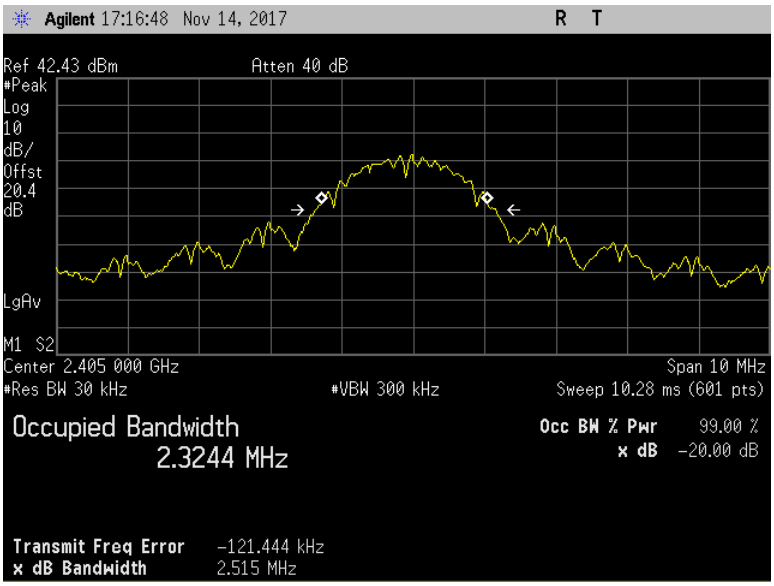

Figure 7.3.4.2-7: 20 dB BW – Low Channel (AP2)

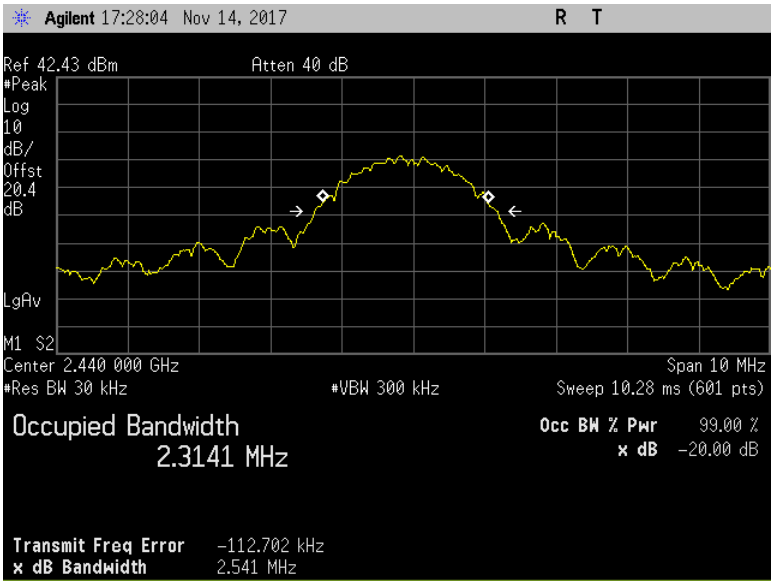

Figure 7.3.4.2-8: 20 dB BW – Middle Channel (AP2)

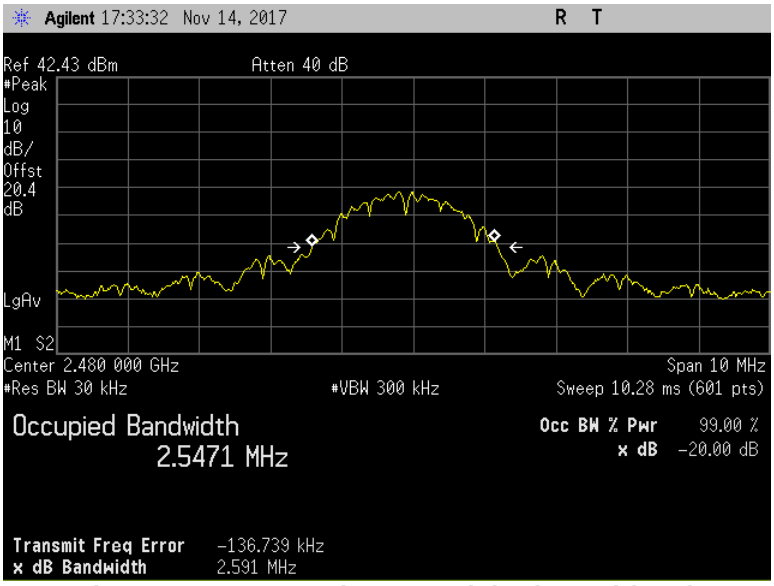

Figure 7.3.4.2-9: 20 dB BW – High Channel (AP2)

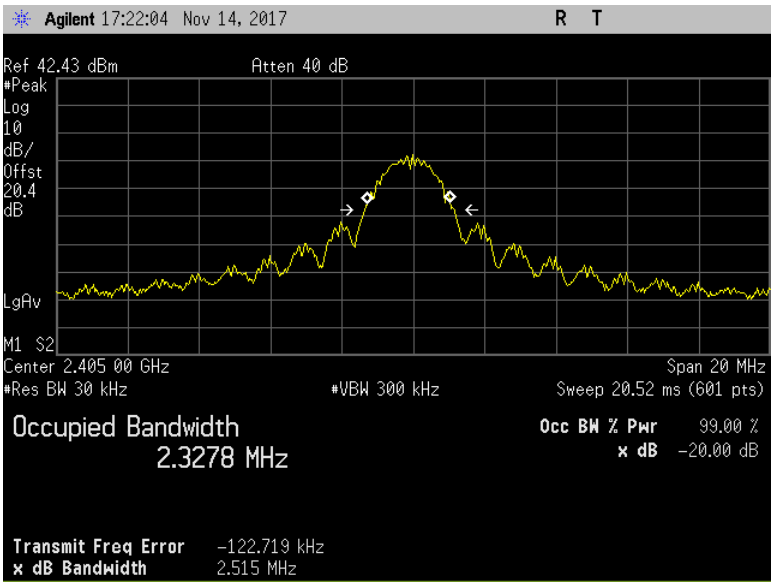

Figure 7.3.4.2-10: 99% BW – Low Channel (AP2)

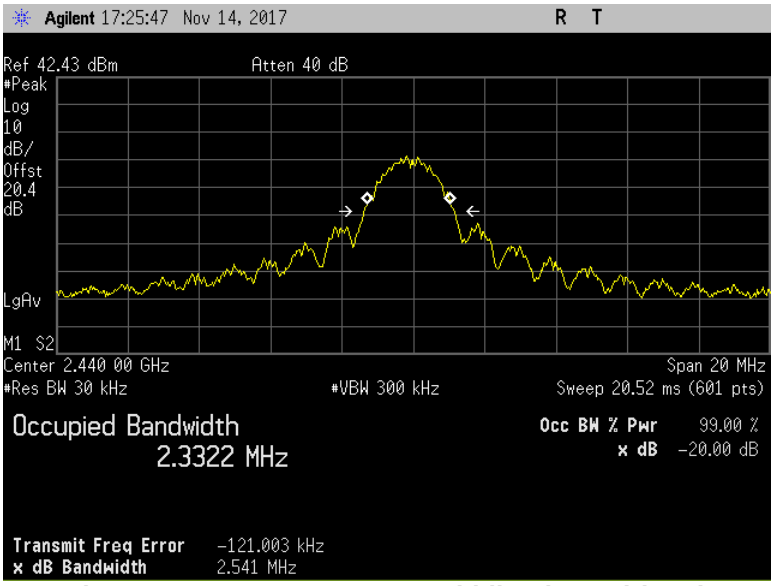

Figure 7.3.4.2-11: 99% BW – Middle Channel (AP2)

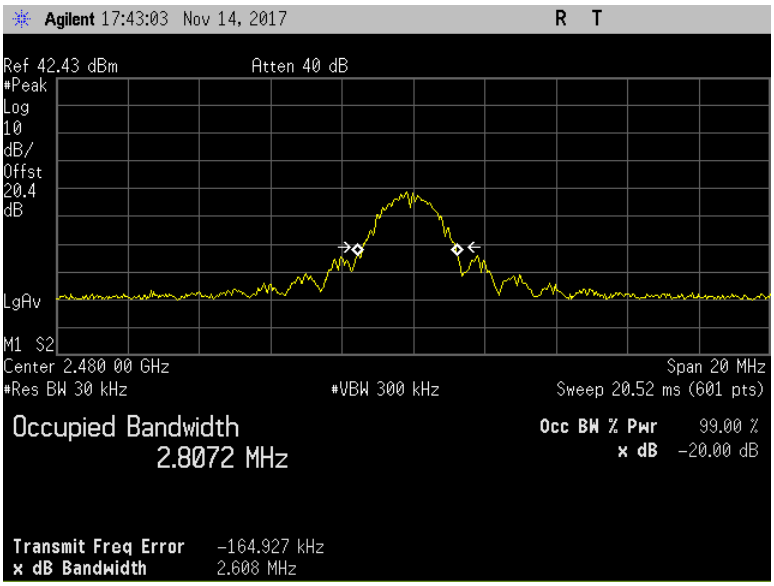

Figure 7.3.4.2-12: 99% BW – High Channel (AP2)

Table 7.3.4.2-3: 20dB / 99% Bandwidth (AS1)

Frequency (MHz)	20dB Bandwidth (kHz)	99% Bandwidth (kHz)
2405	2500.0	2298.9
2440	2534.0	2321.6
2480	2579.0	2450.0

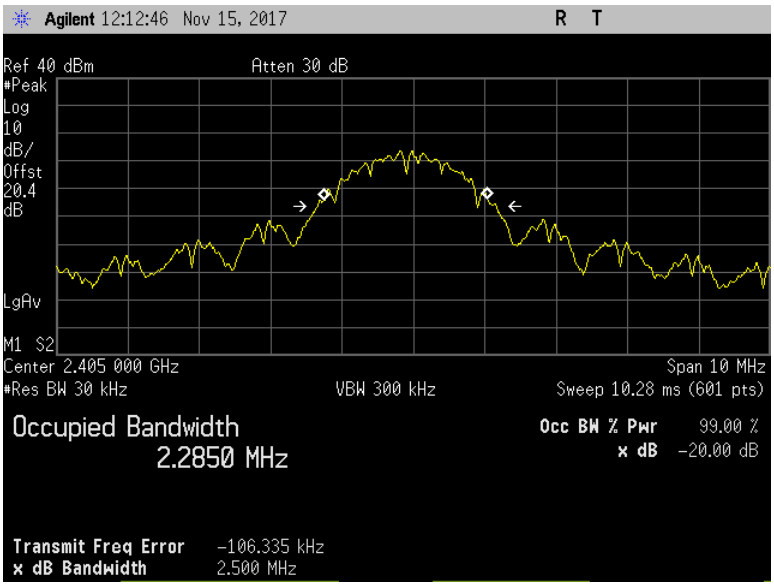

Figure 7.3.4.2-13: 20 dB BW – Low Channel (AS1)

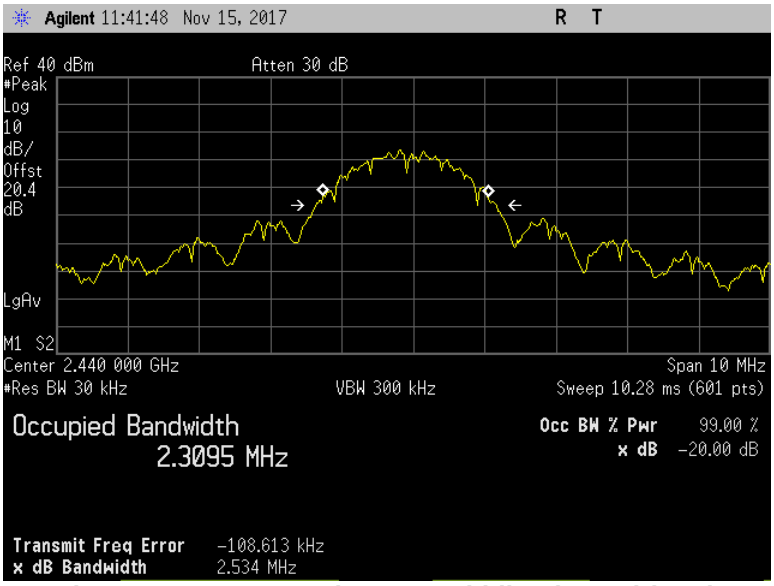

Figure 7.3.4.2-14: 20 dB BW – Middle Channel (AS1)

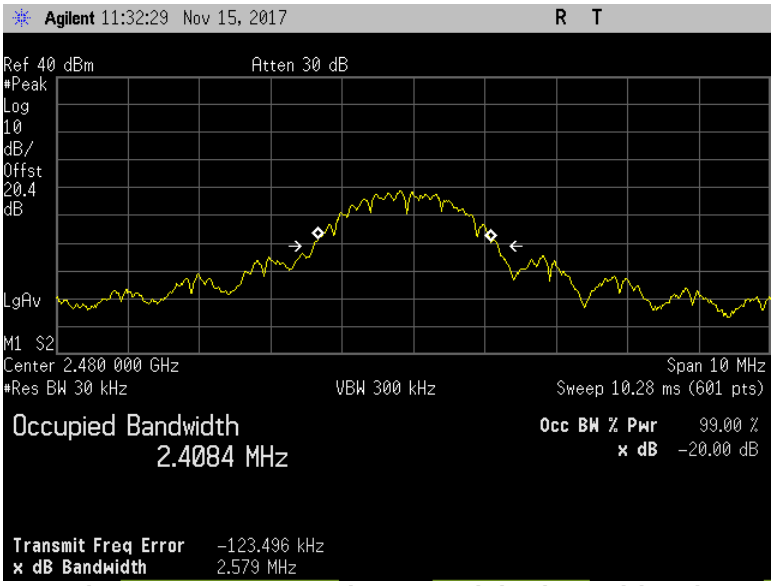

Figure 7.3.4.2-15: 20 dB BW – High Channel (AS1)

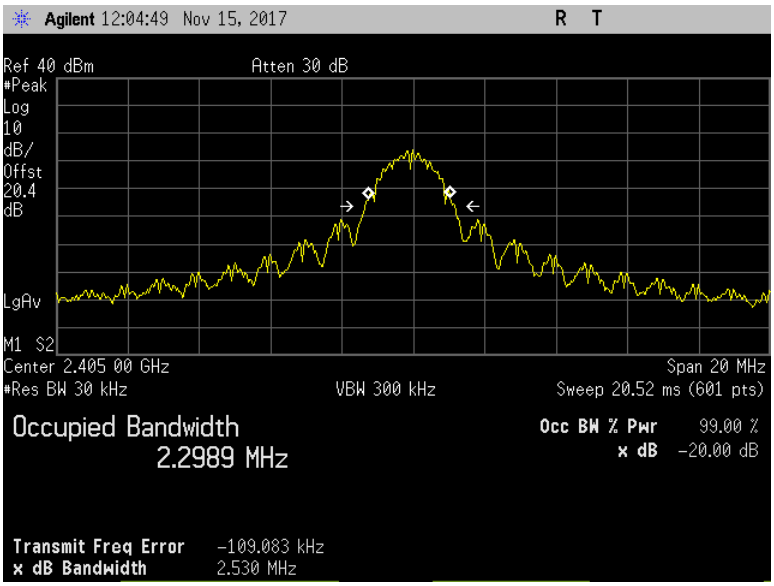

Figure 7.3.4.2-16: 99% BW – Low Channel (AS1)

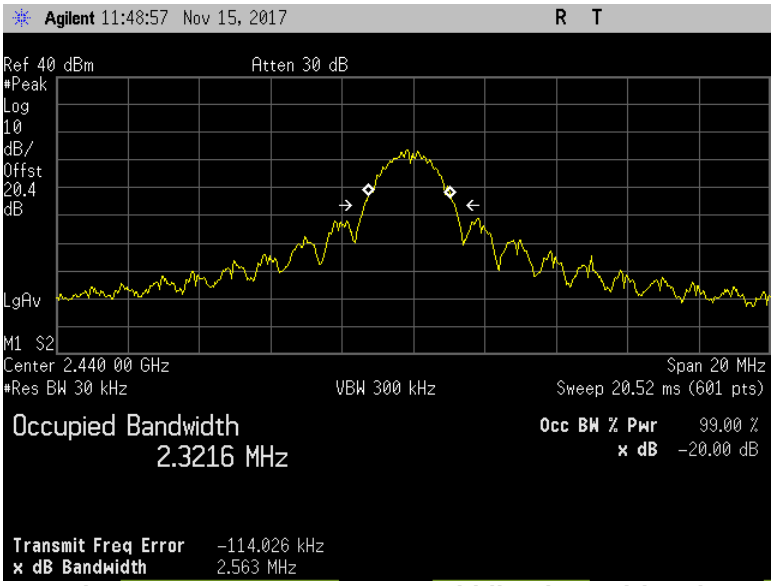

Figure 7.3.4.2-17: 99% BW – Middle Channel (AS1)

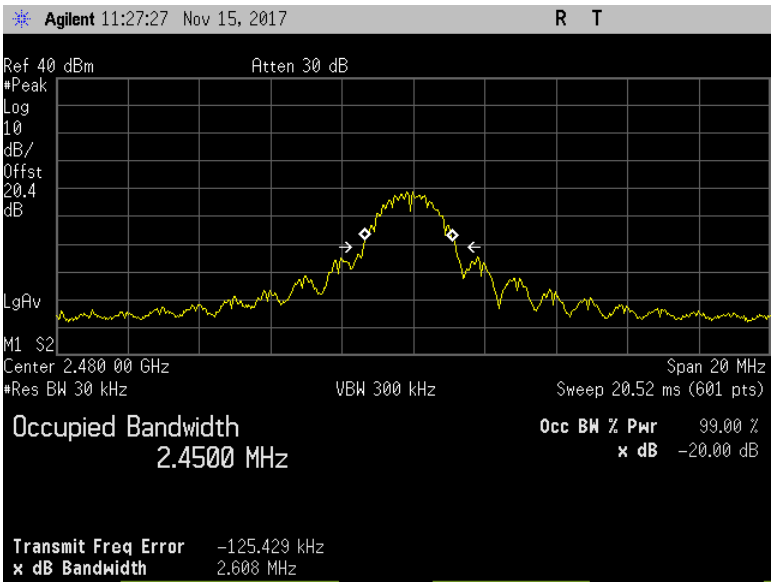

Figure 7.3.4.2-18: 99% BW – High Channel (AS1)

Table 7.3.4.2-4: 20dB / 99% Bandwidth (AS2)

Frequency (MHz)	20dB Bandwidth (kHz)	99% Bandwidth (kHz)
2405	2478.0	2276.9
2440	2526.0	2302.4
2480	2560.0	2385.9

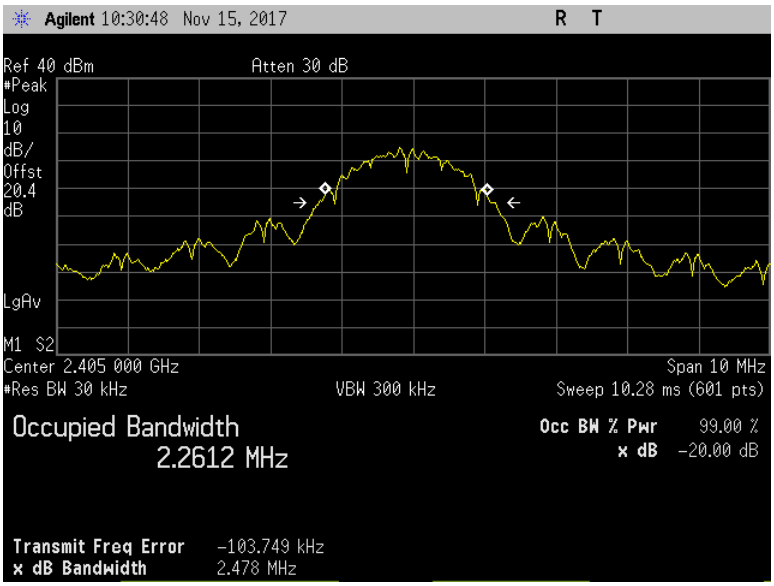

Figure 7.3.4.2-19: 20 dB BW – Low Channel (AS2)

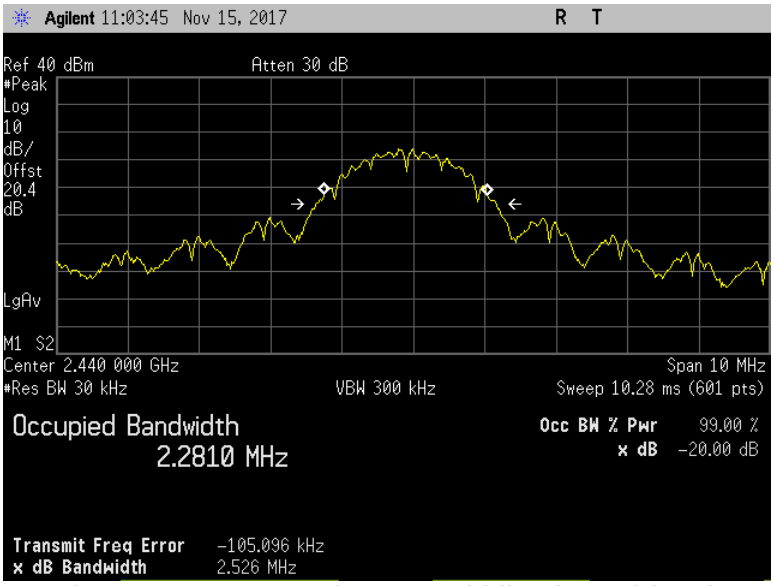

Figure 7.3.4.2-20: 20 dB BW – Middle Channel (AS2)

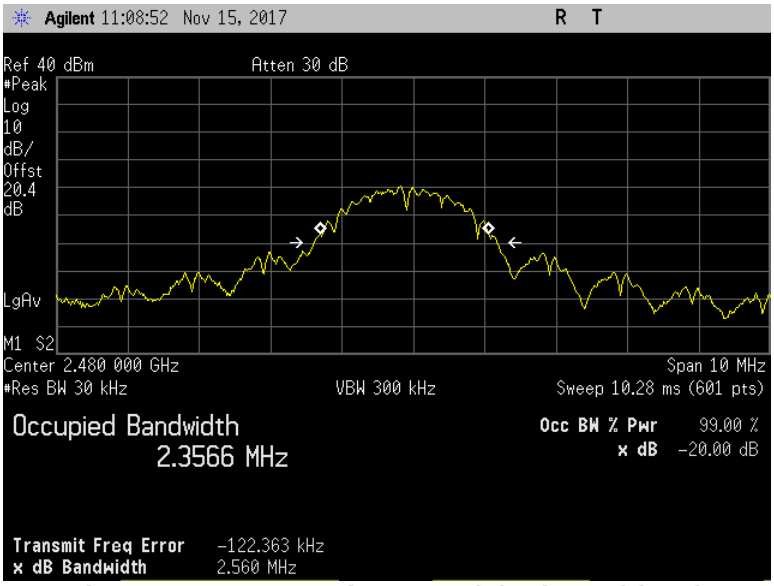

Figure 7.3.4.2-21: 20 dB BW – High Channel (AS2)

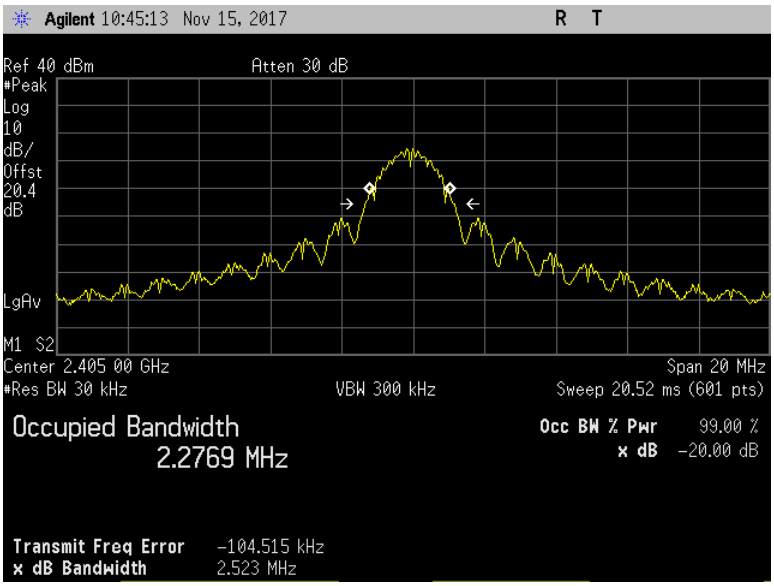

Figure 7.3.4.2-22: 99% BW – Low Channel (AS2)

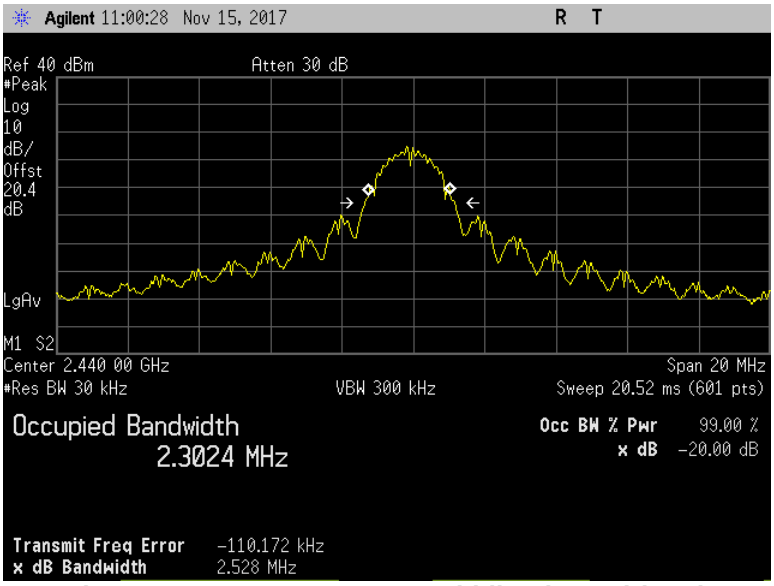

Figure 7.3.4.2-23: 99% BW – Middle Channel (AS2)

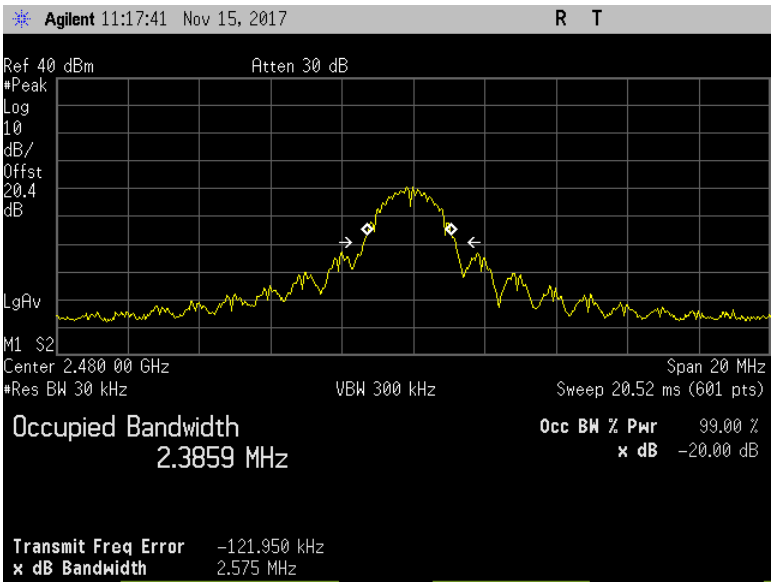

Figure 7.3.4.2-24: 99% BW – High Channel (AS2)

7.4 Band-Edge Compliance and Spurious Emissions-FCC 15.247(d) IC: RSS-247 5.5

7.4.1 Band-Edge Compliance of RF Conducted Emissions

7.4.1.1 Measurement Procedure

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, which is ≥ 1% of the span, and the VBW was set to >= 300 kHz.

7.4.1.2 Measurement Results

Performed by: Thierry Jean-Charles

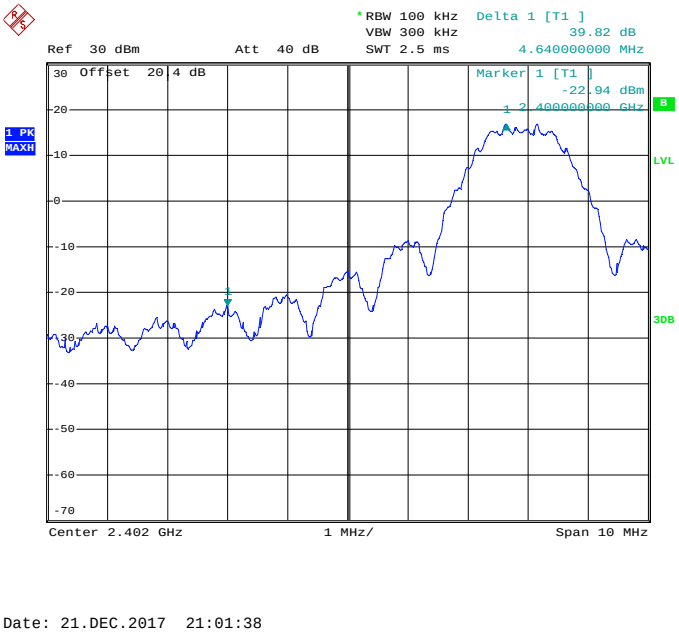

Figure 7.4.1.2-1: Lower Band-edge (AP1)

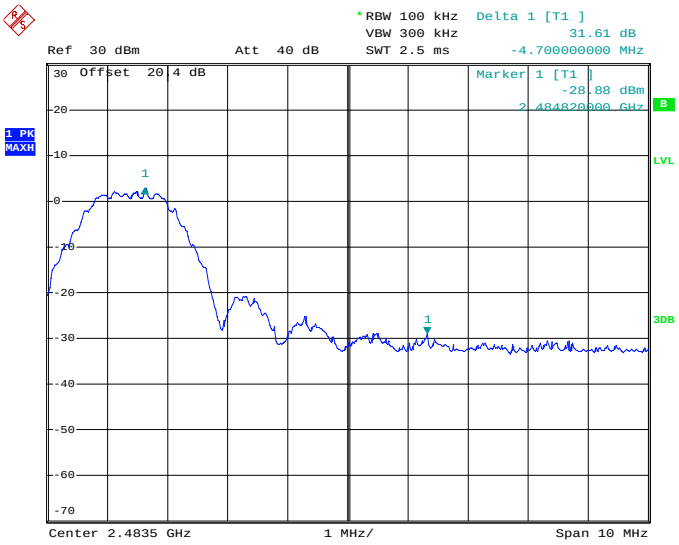

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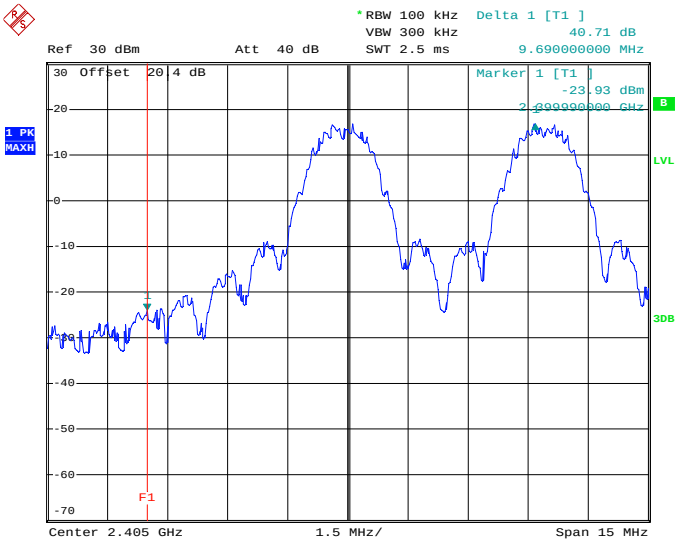
Figure 7.4.1.2-2: Upper Band-edge (AP1)



Date: 2.JAN.2018 19:10:04

Figure 7.4.1.2-3: Lower Band-edge – Hopping Mode (AP1)

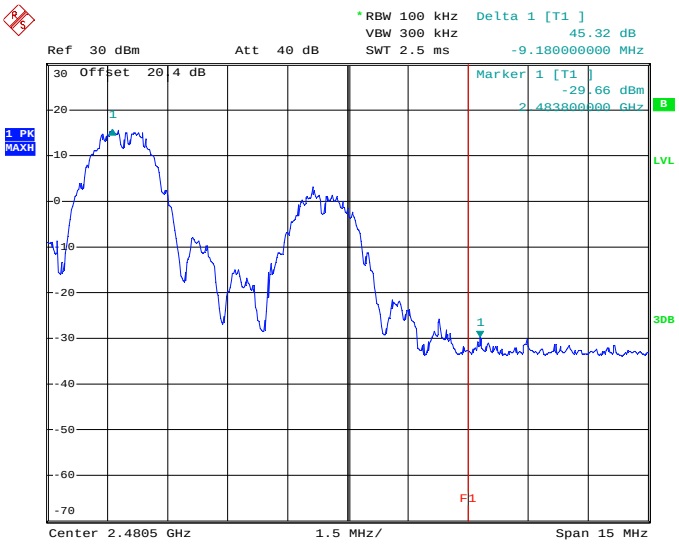


Figure 7.4.1.2-4: Upper Band-edge – Hopping Mode (AP1)

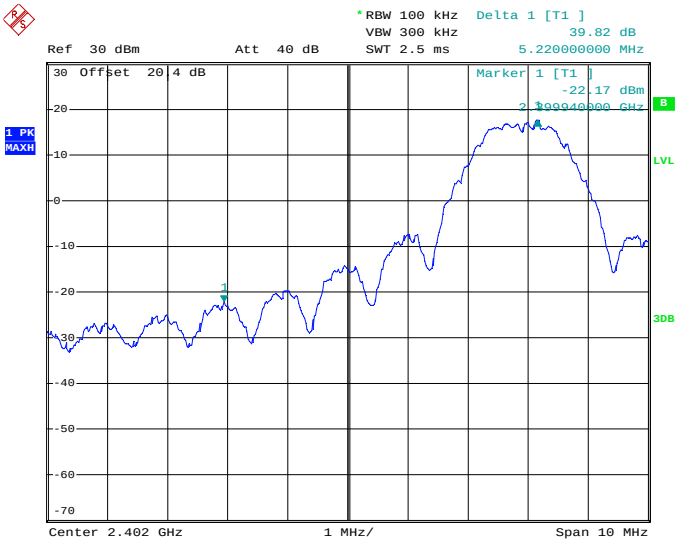


Figure 7.4.1.2-5: Lower Band-edge (AP2)

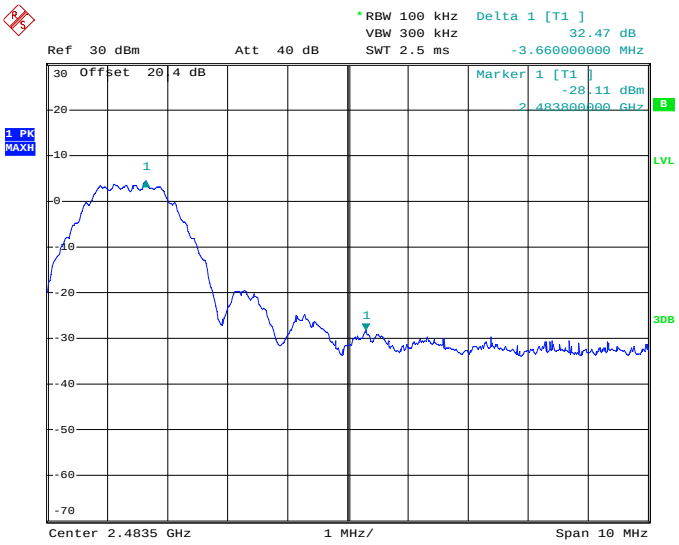


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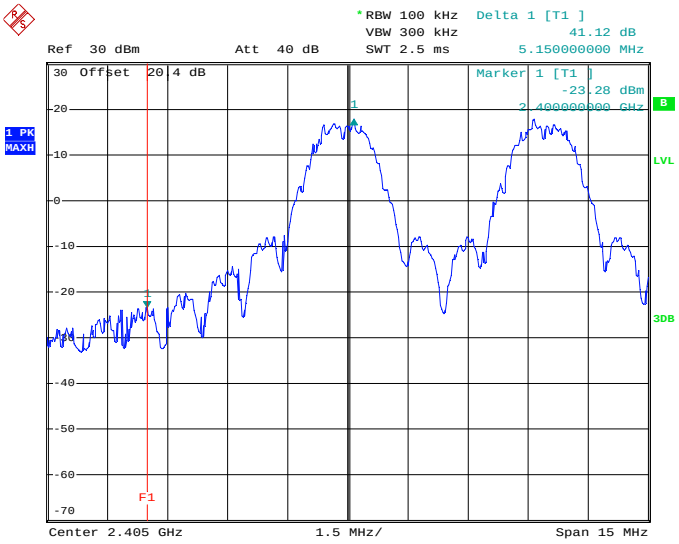
Figure 7.4.1.2-6: Upper Band-edge (AP2)



Date: 2.JAN.2018 19:20:31

Figure 7.4.1.2-7: Lower Band-edge – Hopping Mode (AP2)

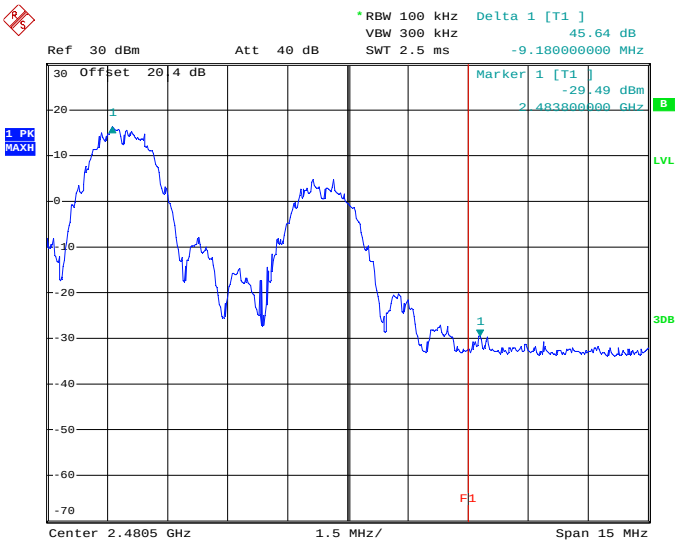


Figure 7.4.1.2-8: Upper Band-edge – Hopping Mode (AP2)

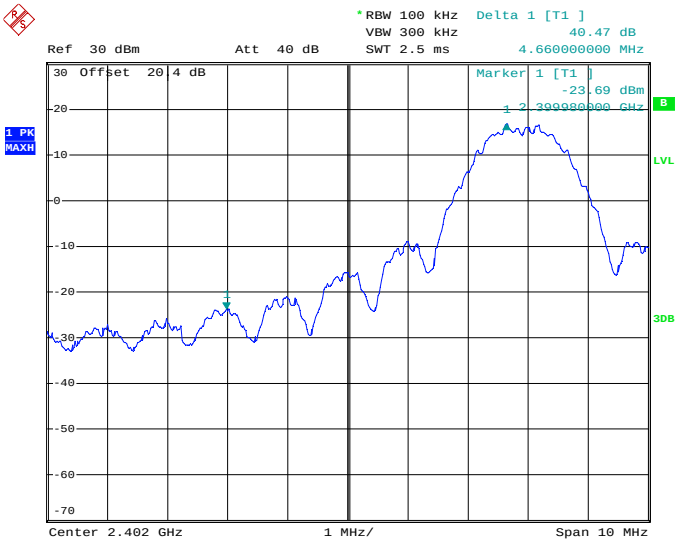
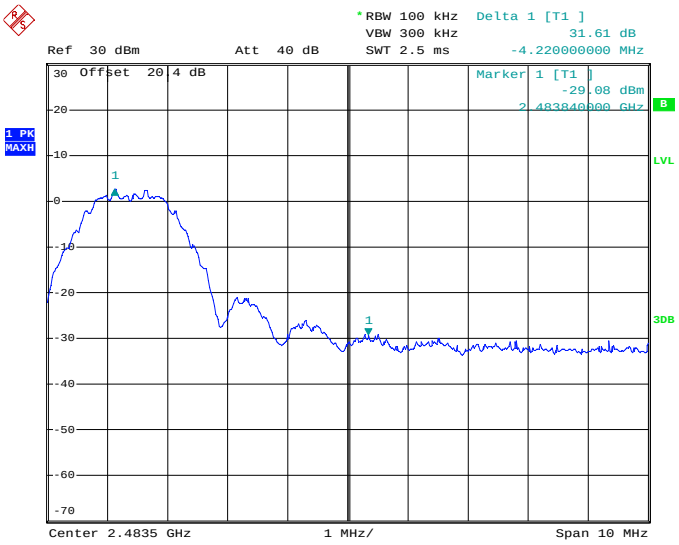
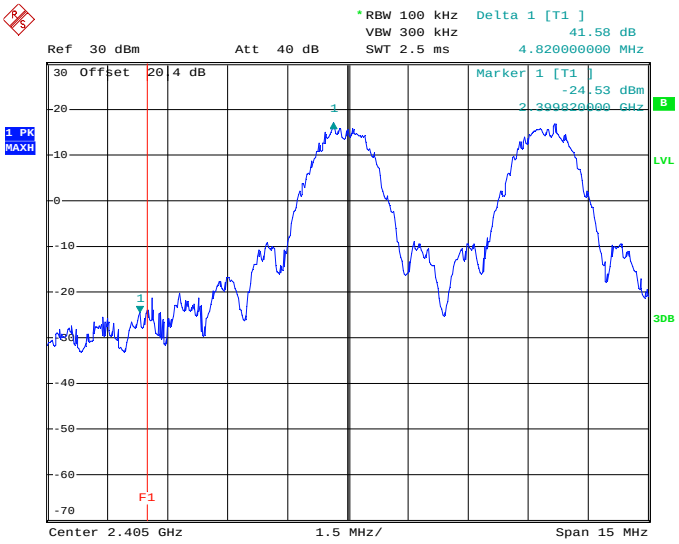


Figure 7.4.1.2-9: Lower Band-edge (AS1)



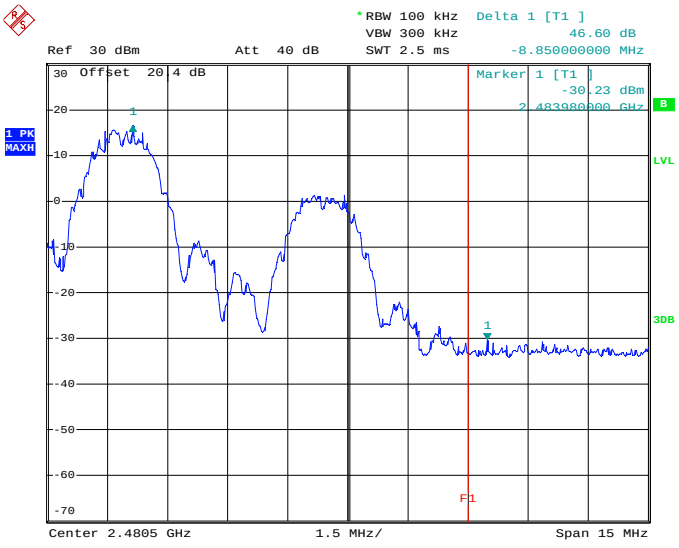
Date: 21.DEC.2017 20:26:40

Figure 7.4.1.2-10: Upper Band-edge (AS1)



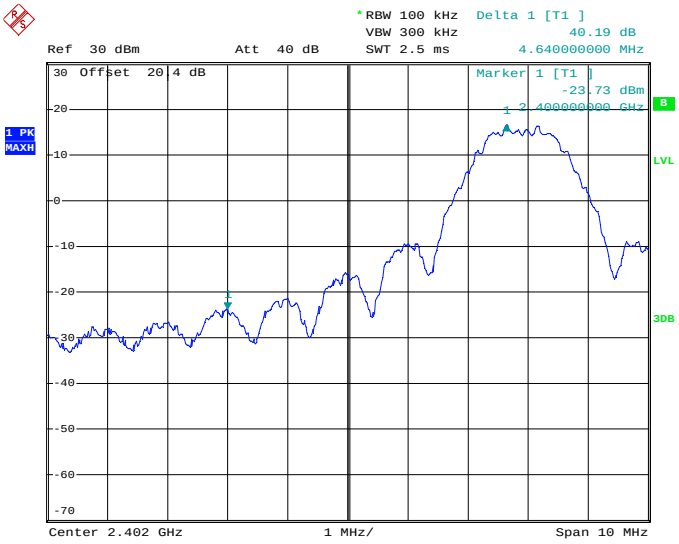
Date: 2.JAN.2018 19:36:06

Figure 7.4.1.2-11: Lower Band-edge – Hopping Mode (AS1)



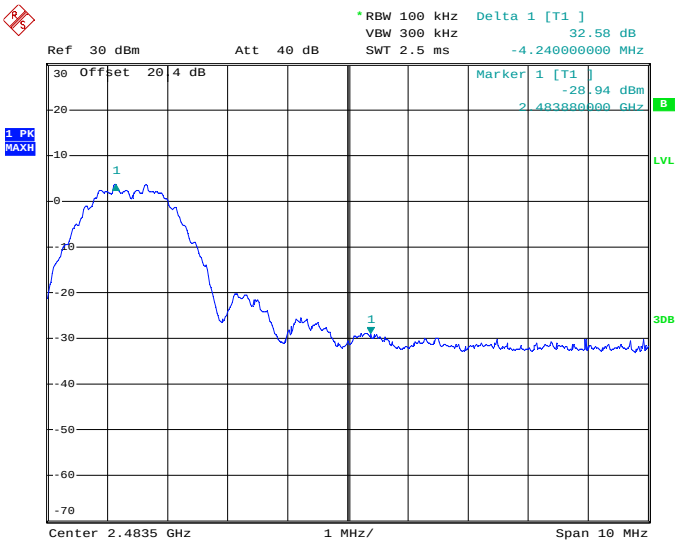
Date: 2.JAN.2018 19:32:27

Figure 7.4.1.2-12: Upper Band-edge – Hopping Mode (AS1)



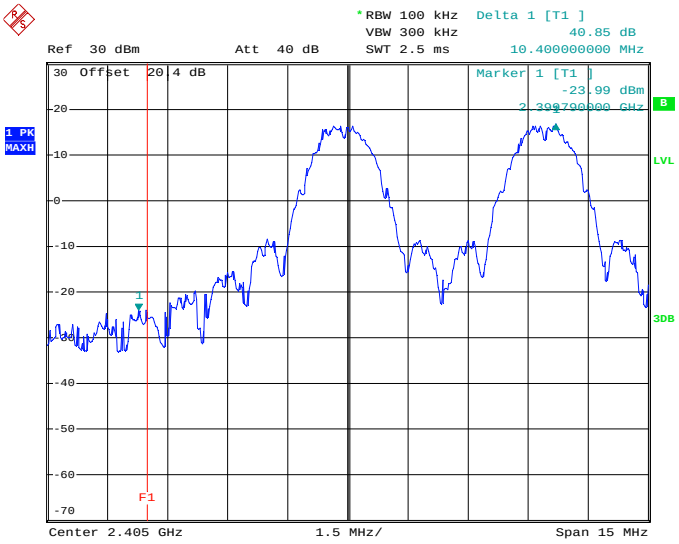
Date: 21.DEC.2017 19:49:25

Figure 7.4.1.2-13: Lower Band-edge (AS2)



Date: 21.DEC.2017 19:46:45

Figure 7.4.1.2-14: Upper Band-edge (AS2)



Date: 2.JAN.2018 19:26:02

Figure 7.4.1.2-15: Lower Band-edge – Hopping Mode (AS2)

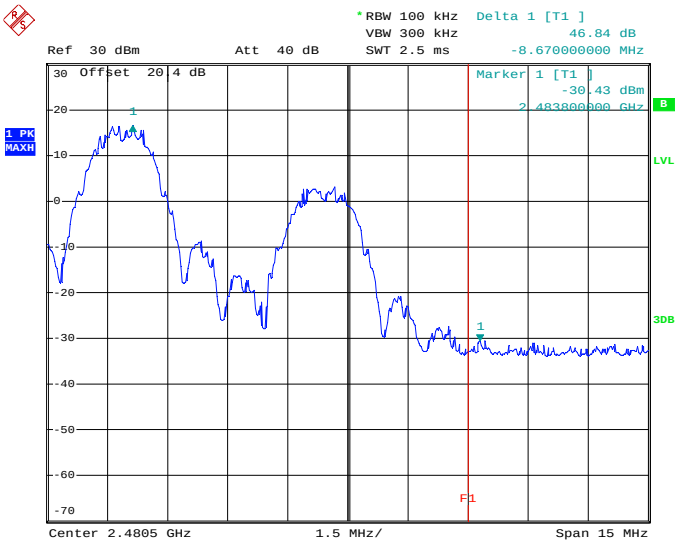


Figure 7.4.1.2-16: Upper Band-edge – Hopping Mode (AS2)

7.4.2 RF Conducted Spurious Emissions – FCC: Section 15.247(d); ISED Canada: RSS-247 5.5

7.4.2.1 Measurement Procedure

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 26 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.

7.4.2.2 Measurement Results

Performed by: Thierry Jean-Charles

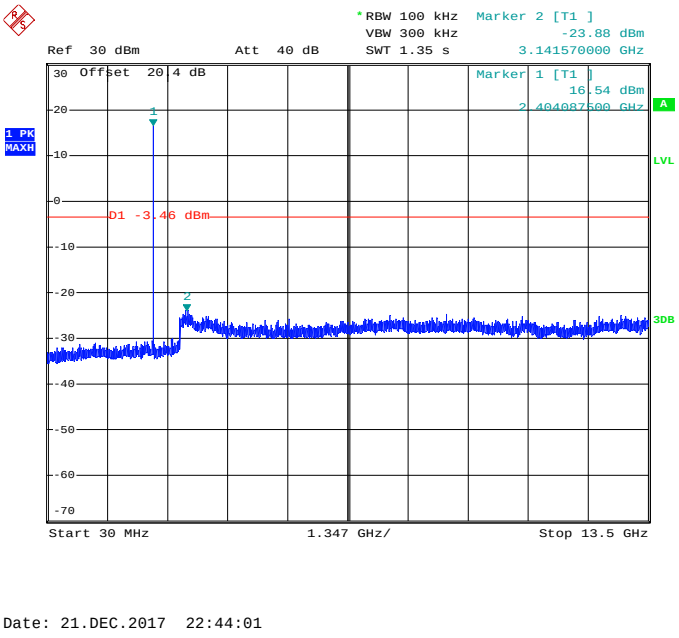
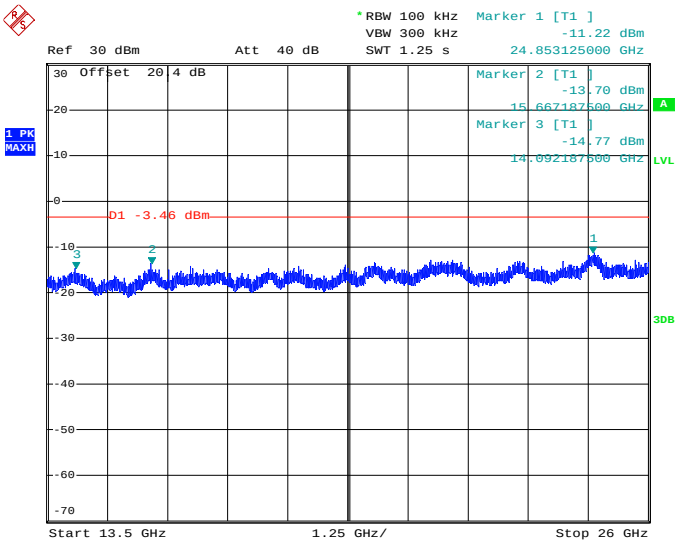
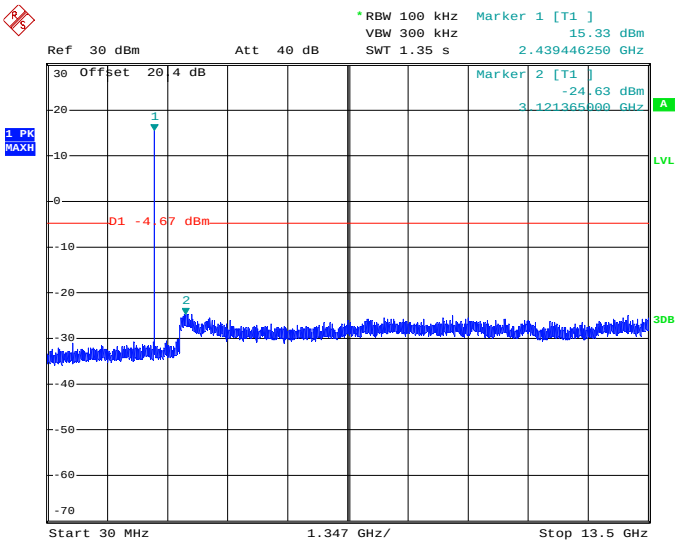


Figure 7.4.2.2-1: 30 MHz – 13.5 GHz – Low Channel (AP1)



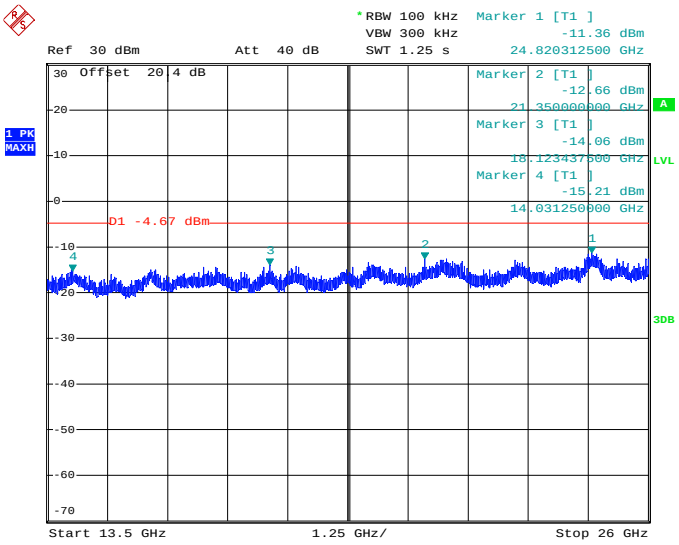
Date: 21.DEC.2017 22:47:53

Figure 7.4.2.2-2: 13.5 GHz – 26 GHz – Low Channel (AP1)



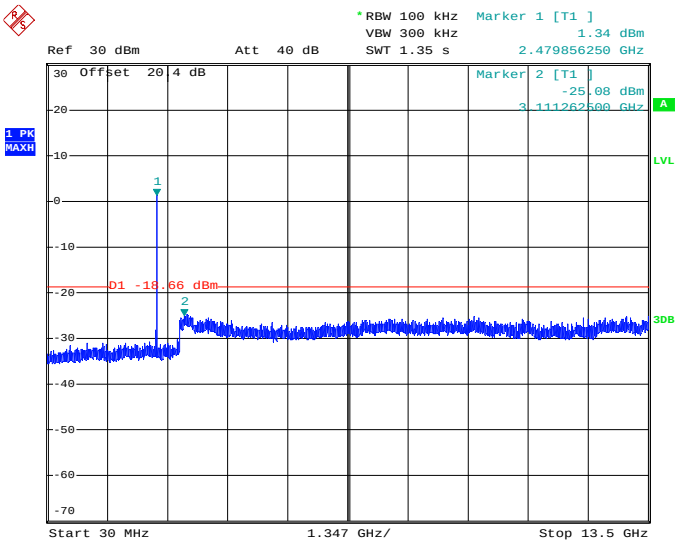
Date: 21.DEC.2017 21:05:56

Figure 7.4.2.2-3: 30 MHz – 13.5 GHz – Middle Channel (AP1)



Date: 21.DEC.2017 21:07:46

Figure 7.4.2.2-4: 13.5 GHz – 26 GHz – Middle Channel (AP1)



Date: 21.DEC.2017 21:13:31

Figure 7.4.2.2-5: 30 MHz – 13.5 GHz – High Channel (AP1)

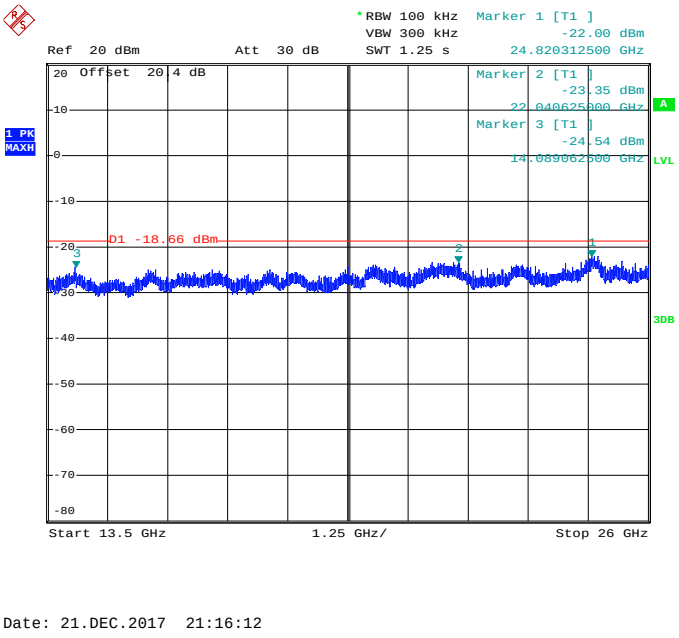
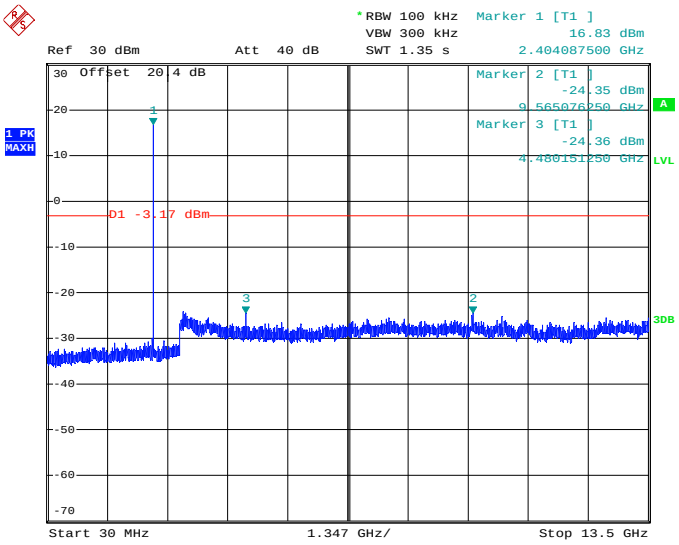
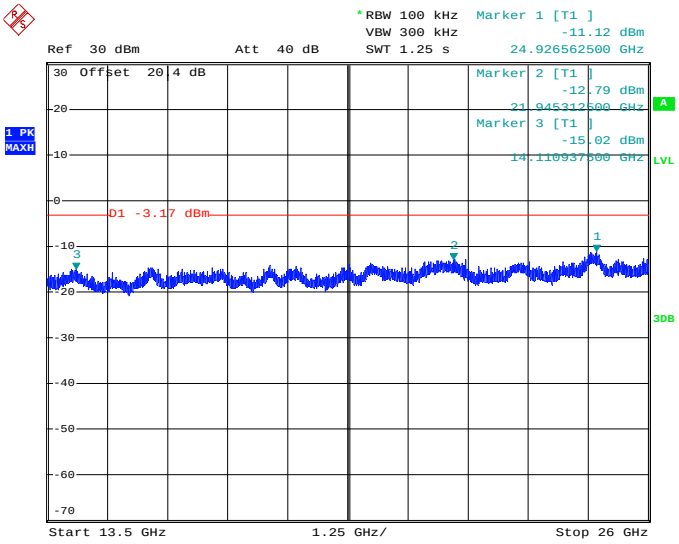


Figure 7.4.2.2-6: 13.5 GHz – 26 GHz – High Channel (AP1)



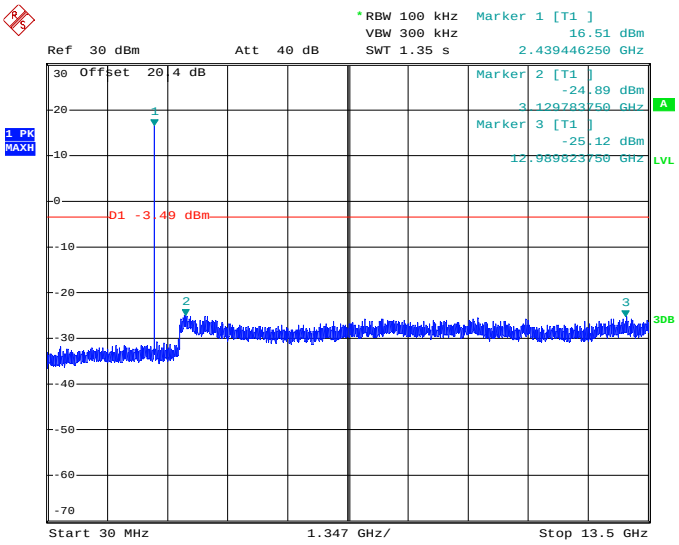
Date: 21.DEC.2017 22:14:40

Figure 7.4.2.2-7: 30 MHz – 13.5 GHz – Low Channel (AP2)



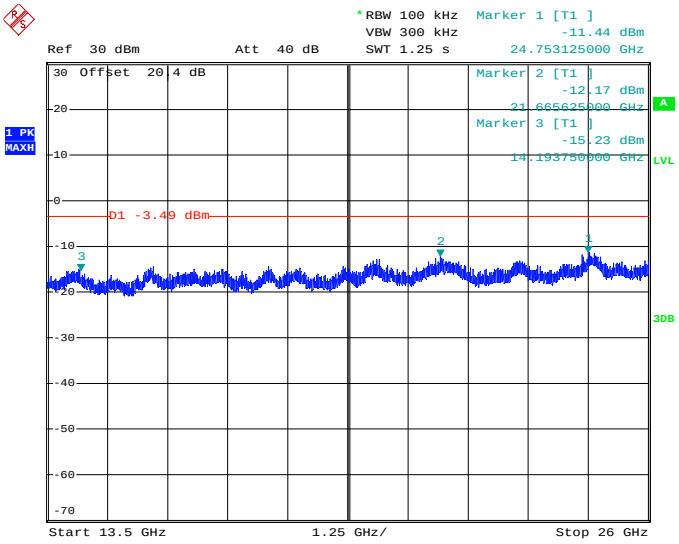
Date: 21.DEC.2017 22:18:33

Figure 7.4.2.2-8: 13.5 GHz – 26 GHz – Low Channel (AP2)



Date: 21.DEC.2017 21:38:04

Figure 7.4.2.2-9: 30 MHz – 13.5 GHz – Middle Channel (AP2)



Date: 21.DEC.2017 21:40:32

Figure 7.4.2.2-10: 13.5 GHz – 26 GHz – Middle Channel (AP2)

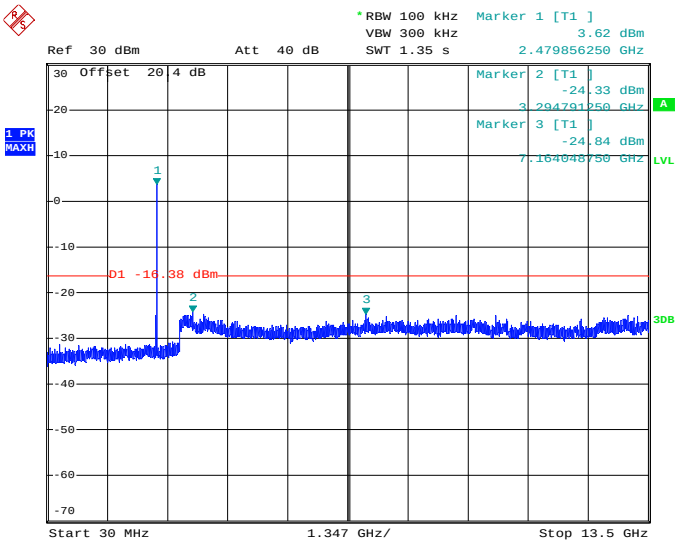


Figure 7.4.2.2-11: 30 MHz – 13.5 GHz High Channel (AP2)

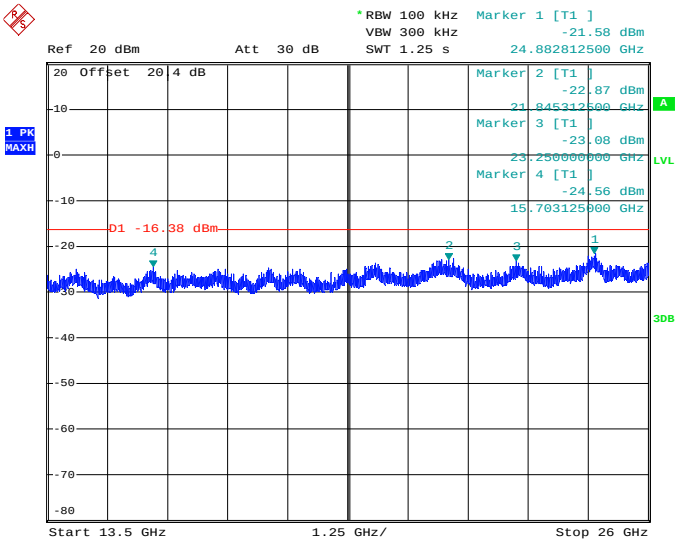
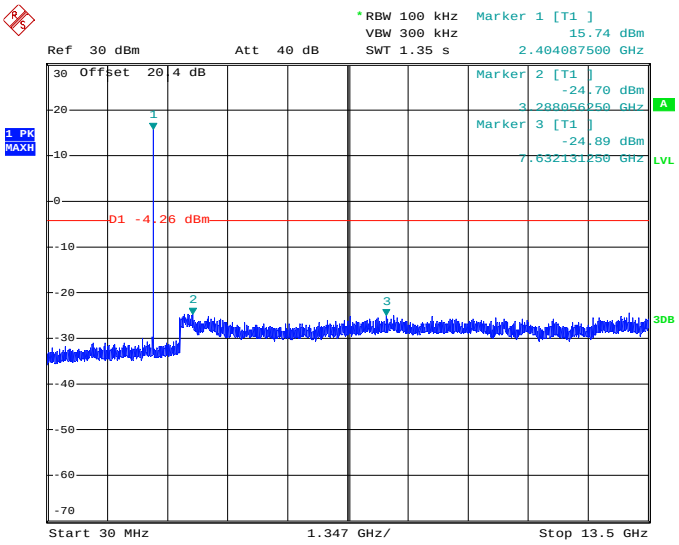
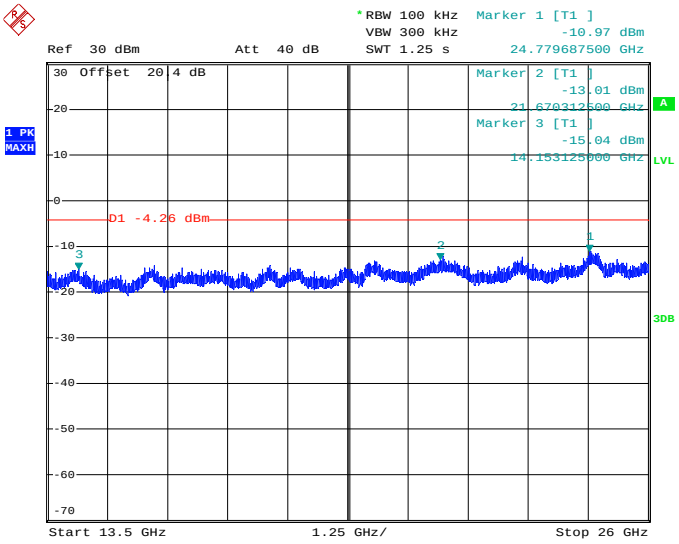


Figure 7.4.2.2-12: 13.5 GHz – 26 GHz – High Channel (AP2)



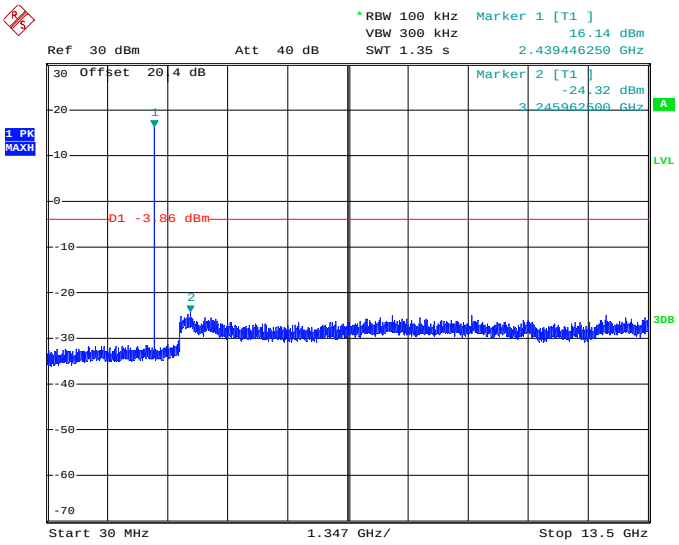
Date: 21.DEC.2017 20:03:44

Figure 7.4.2.2-13: 30 MHz – 13.5 GHz – Low Channel (AS1)



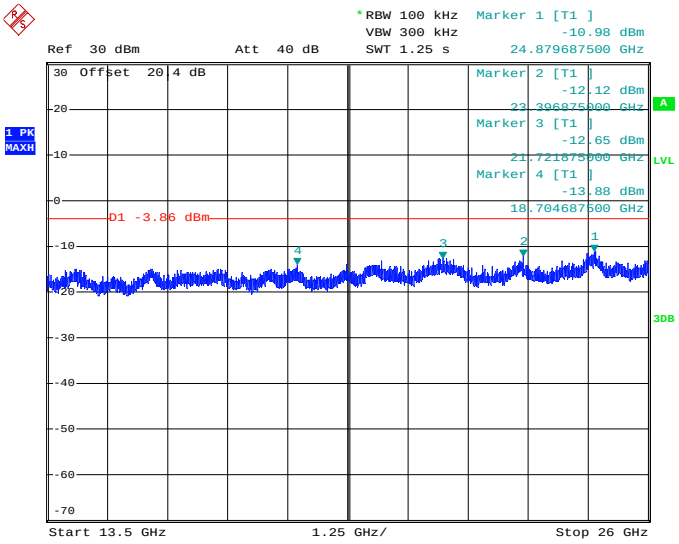
Date: 21.DEC.2017 20:07:10

Figure 7.4.2.2-14: 13.5 GHz – 26 GHz – Low Channel (AS1)



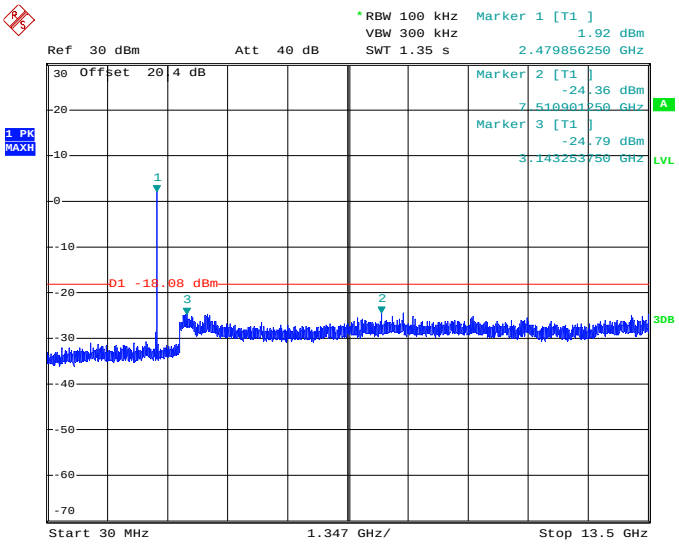
Date: 21.DEC.2017 20:11:14

Figure 7.4.2.2-15: 30 MHz – 13.5 GHz – Middle Channel (AS1)



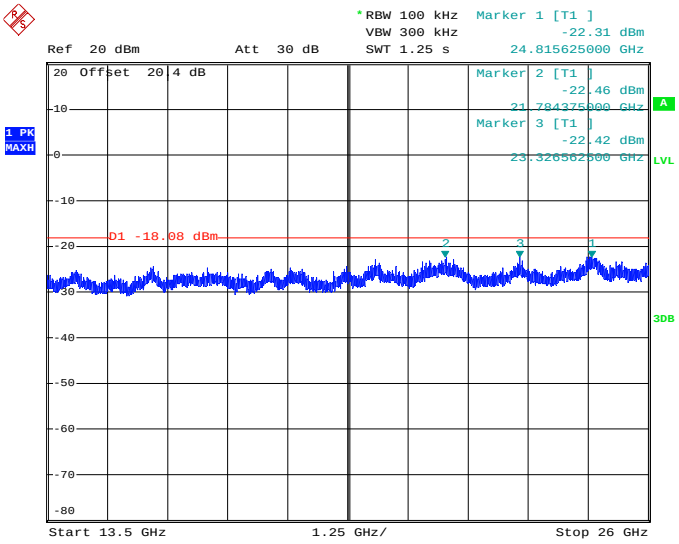
Date: 21.DEC.2017 20:13:53

Figure 7.4.2.2-16: 13.5 GHz – 26 GHz – Middle Channel (AS1)



Date: 21.DEC.2017 20:18:24

Figure 7.4.2.2-17: 30 MHz – 13.5 GHz – High Channel (AS1)



Date: 21.DEC.2017 20:21:16

Figure 7.4.2.2-18: 13.5 GHz – 26 GHz – High Channel (AS1)

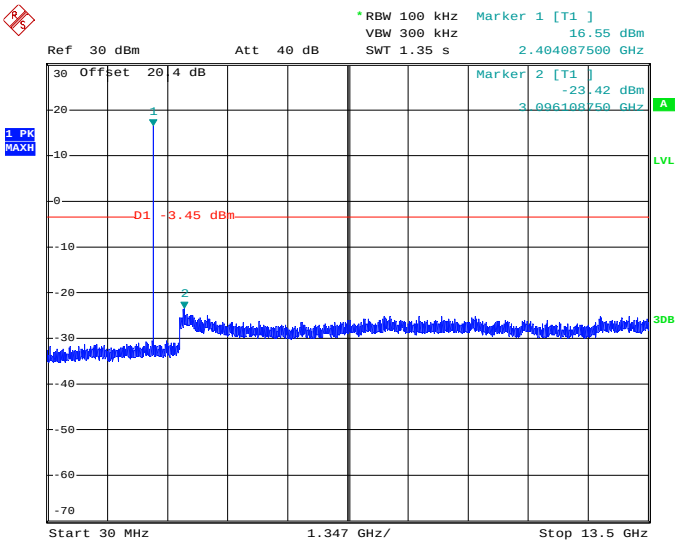


Figure 7.4.2.2-19: 30 MHz – 13.5 GHz – Low Channel (AS2)

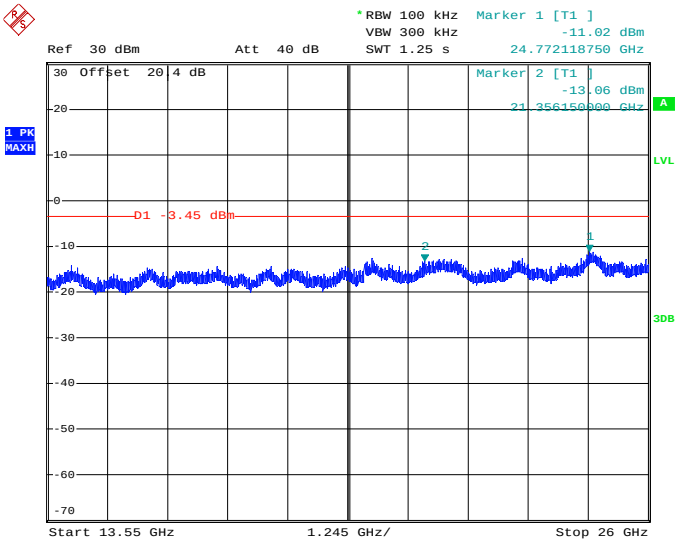
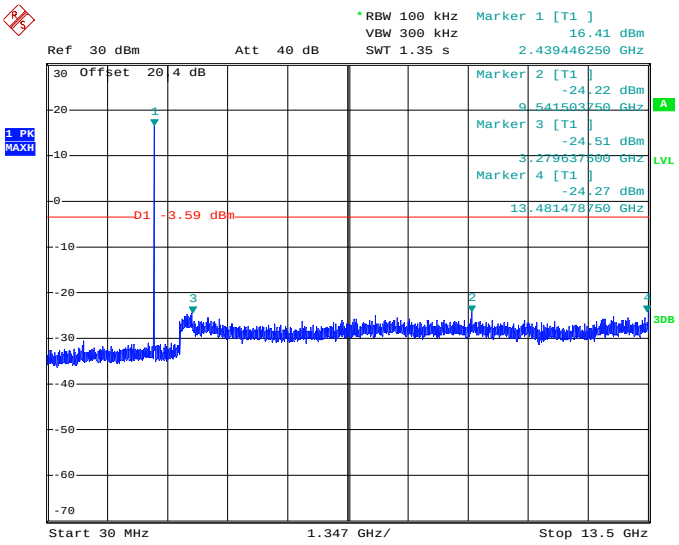
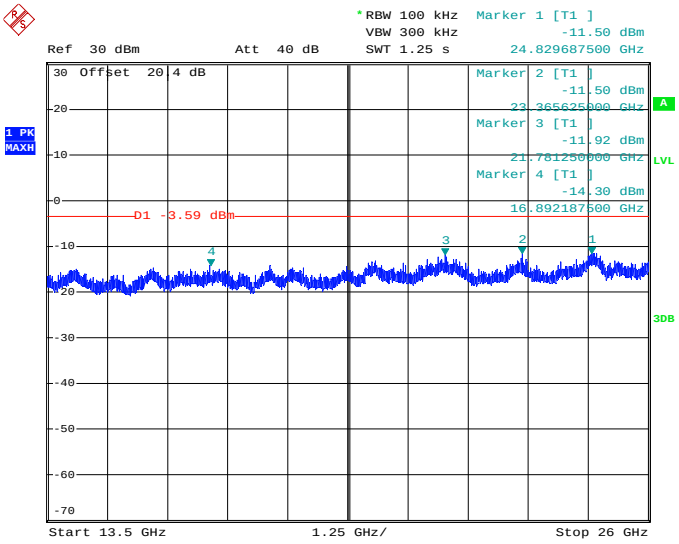


Figure 7.4.2.2-20: 13.5 GHz – 26 GHz – Low Channel (AS2)



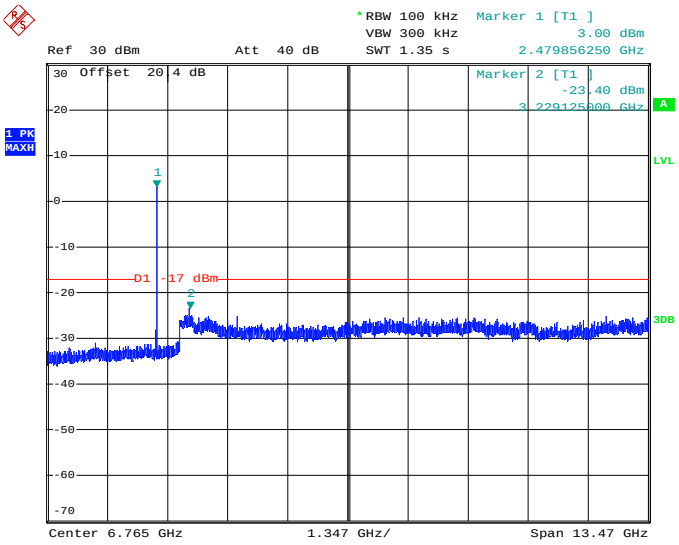
Date: 21.DEC.2017 19:11:36

Figure 7.4.2.2-21: 30 MHz – 13.5 GHz – Middle Channel (AS2)



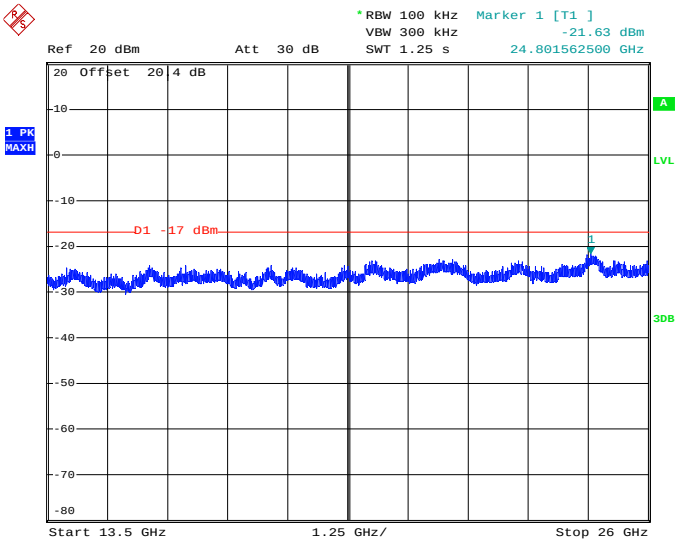
Date: 21.DEC.2017 19:14:20

Figure 7.4.2.2-22: 13.5 GHz – 26 GHz – Middle Channel (AS2)



Date: 21.DEC.2017 18:41:19

Figure 7.4.2.2-23: 30 MHz – 13.5 GHz High Channel (AS2)



Date: 21.DEC.2017 18:49:19

Figure 7.4.2.2-24: 13.5 GHz – 26 GHz – High Channel (AS2)

7.4.3 Radiated Spurious Emissions into Restricted Frequency Bands – FCC: Sections 15.205, 15.209; ISED Canada: RSS-Gen 8.9, 8.10

7.4.3.1 Measurement Procedure

Radiated emissions tests were made over the frequency range of 9 kHz to 26 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 1m 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.

7.4.3.2 Measurement Results

Performed by: Jean Rene, Thierry Jean-Charles

Radiated band-edge and spurious emissions found in the restricted frequency bands of 9 kHz to 26 GHz are reported in the tables below.

Table 7.4.3.2-1: Radiated Spurious Emissions Tabulated Data - Primary

Frequency (MHz)	Level (dBuV)		Antenna Polarity	Correction Factors	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg	(H/V)	(dB)	pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
Low Channel = 2405 MHz										
2390	65.5	55.73	H	-4.94	60.56	16.86	74.0	54.0	13.4	37.1
2390	60.21	48.34	V	-4.94	55.27	9.47	74.0	54.0	18.7	44.5
4810	50.46	41.11	H	4.05	54.51	11.22	74.0	54.0	19.5	42.8
4810	47.98	37.54	V	4.05	52.03	7.65	74.0	54.0	22.0	46.4
12025	54.69	46.70	H	16.81	71.50	29.57	83.5	63.5	12.0	33.9
12025	55.65	47.81	V	16.81	72.46	30.68	83.5	63.5	11.0	32.8
19240	50.90	41.15	H	10.75	61.65	17.96	83.5	63.5	21.8	45.5
19240	53.59	44.80	V	10.75	64.34	21.61	83.5	63.5	19.2	41.9
Middle Channel = 2440 MHz										
4880	49.95	40.04	H	4.34	54.29	10.45	74.0	54.0	19.7	43.6
4880	47.73	35.60	V	4.34	52.07	6.01	74.0	54.0	21.9	48.0
7320	51.42	42.09	H	9.42	60.84	17.58	74.0	54.0	13.2	36.4
7320	53.42	44.92	V	9.42	62.84	20.41	74.0	54.0	11.2	33.6
12200	54.36	46.07	H	17.24	71.60	29.37	83.5	63.5	11.9	34.1
12200	53.86	45.60	V	17.24	71.10	28.90	83.5	63.5	12.4	34.6
19520	48.18	37.03	H	11.00	59.18	14.10	83.5	63.5	24.3	49.4
19520	51.10	40.88	V	11.00	62.10	17.95	83.5	63.5	21.4	45.6
High Channel = 2480 MHz										
2483.5	75.18	65.74	H	-4.51	70.67	27.29	74.0	54.0	3.3	26.7
2483.5	70.58	60.79	V	-4.51	66.07	22.34	74.0	54.0	7.9	31.7
4960	43.89	30.66	H	4.69	48.58	1.41	74.0	54.0	25.4	52.6

Notes:

- **All emissions above 19.52 GHz were attenuated below the limits and the noise floor of the measurement equipment.**
- **The average measurements were further corrected using a duty cycle correction factor of 20*log(2.01/100) = -33.93 dB.**
- **The emissions above 10 GHz were performed at a test distance of 1m. The limits are corrected accordingly using a distance correction factor of 20*log(3) = 9.5 dB.**
- **The worst cased band-edge emissions were observed on the antenna path 1 (AP1) while the worst spurious emissions were observed on the antenna path 2 (AP2).**

Table 7.4.3.2-2: Radiated Spurious Emissions Tabulated Data - Secondary

Frequency (MHz)	Level (dBuV)		Antenna Polarity	Correction Factors	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg	(H/V)	(dB)	pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
Low Channel = 2405 MHz										
2390	65.61	55.93	H	-4.94	60.67	17.06	74.0	54.0	13.3	36.9
2390	60.67	49.15	V	-4.94	55.73	10.28	74.0	54.0	18.3	43.7
4810	46.43	35.83	H	4.05	50.48	5.94	74.0	54.0	23.5	48.1
4810	45.61	34.52	V	4.05	49.66	4.63	74.0	54.0	24.3	49.4
12025	50.35	41.54	H	16.81	67.16	24.41	83.5	63.5	16.3	39.1
12025	49.68	40.59	V	16.81	66.49	23.46	83.5	63.5	17.0	40.0
19240	50.19	40.32	H	10.75	60.94	17.13	83.5	63.5	22.6	46.4
19240	50.37	40.43	V	10.75	61.12	17.24	83.5	63.5	22.4	46.3
Middle Channel = 2440 MHz										
4880	44.52	31.63	H	4.34	48.86	2.04	74.0	54.0	25.1	52.0
4880	45.84	33.44	V	4.34	50.18	3.85	74.0	54.0	23.8	50.2
7320	51.14	41.51	H	9.42	60.56	17.00	74.0	54.0	13.4	37.0
7320	53.26	44.54	V	9.42	62.68	20.03	74.0	54.0	11.3	34.0
12200	48.46	39.15	H	17.24	65.70	22.45	83.5	63.5	17.8	41.1
12200	48.96	39.73	V	17.24	66.20	23.03	83.5	63.5	17.3	40.5
19520	46.95	35.55	H	11.00	57.95	12.62	83.5	63.5	25.5	50.9
19520	47.00	35.73	V	11.00	58.00	12.80	83.5	63.5	25.5	50.7
High Channel = 2480 MHz										
2483.5	77.04	67.49	H	-4.51	72.53	29.04	74.0	54.0	1.5	25.0
2483.5	69.31	59.39	V	-4.51	64.80	20.94	74.0	54.0	9.2	33.1

Notes:

- **All emissions above 19.52 GHz were attenuated below the limits and the noise floor of the measurement equipment.**
- **The average measurements were further corrected using a duty cycle correction factor of 20*log(2.01/100) = -33.93 dB.**
- **The emissions above 10 GHz were performed at a test distance of 1m. The limits are corrected accordingly using a distance correction factor of 20*log(3) = 9.5 dB.**
- **The worst cased band-edge emissions were observed on the antenna path 1 (AS1) while the worst spurious emissions were observed on the antenna path 2 (AS2).**

7.4.4 Sample Calculation:

$R_C = R_U + CF_T$

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: 65.5+ (-4.94) = 60.56 dBµV/m
Margin: 74 dBµV/m – 60.56 dBµV/m = 13.4dB

Example Calculation: Average
Corrected Level: 55.73 + (-4.94) - 33.93 = 16.86 dBµV/m
Margin: 54 dBµV/m – 16.86 dBµV/m = 37.1 dB

7.5 Power Line Conducted Emissions – FCC: Section 15.207; ISED Canada: RSS-Gen 8.8

7.5.1 Measurement Procedure

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

7.5.2 Measurement Results

Performed by: Thierry Jean-Charles

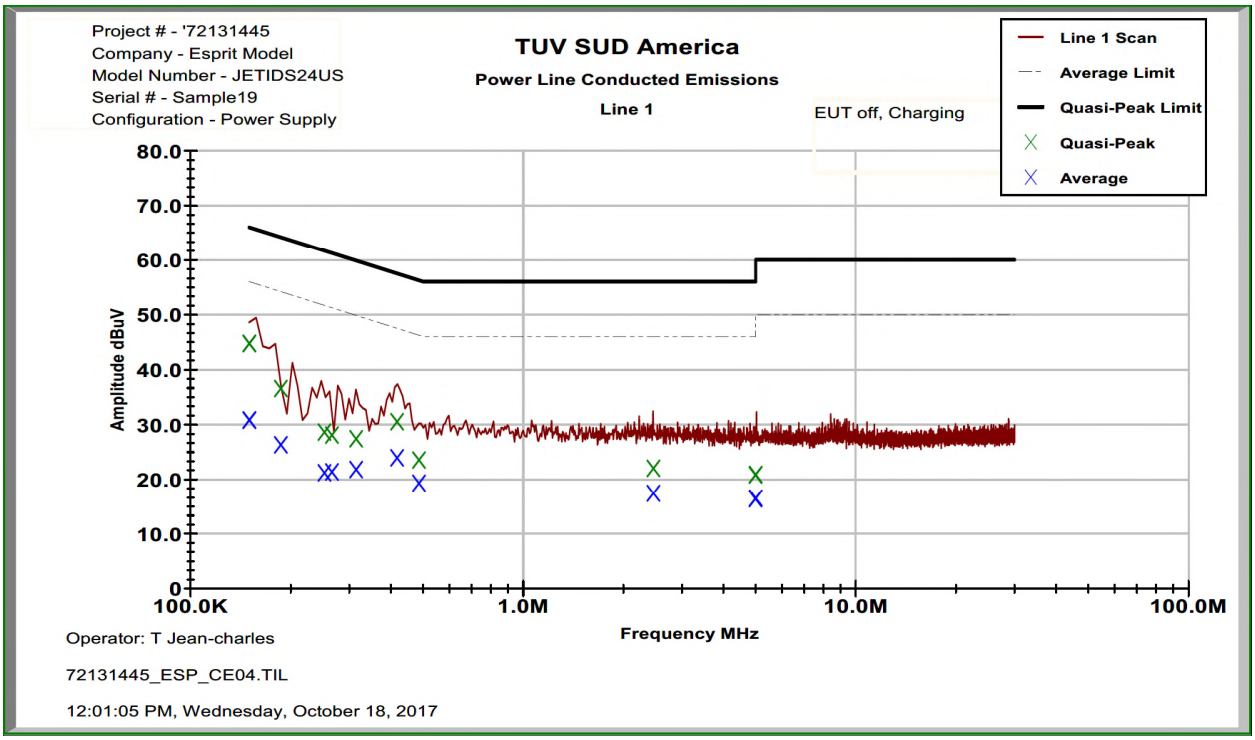


Figure 7.5.2-1: Conducted Emissions Results – Line 1

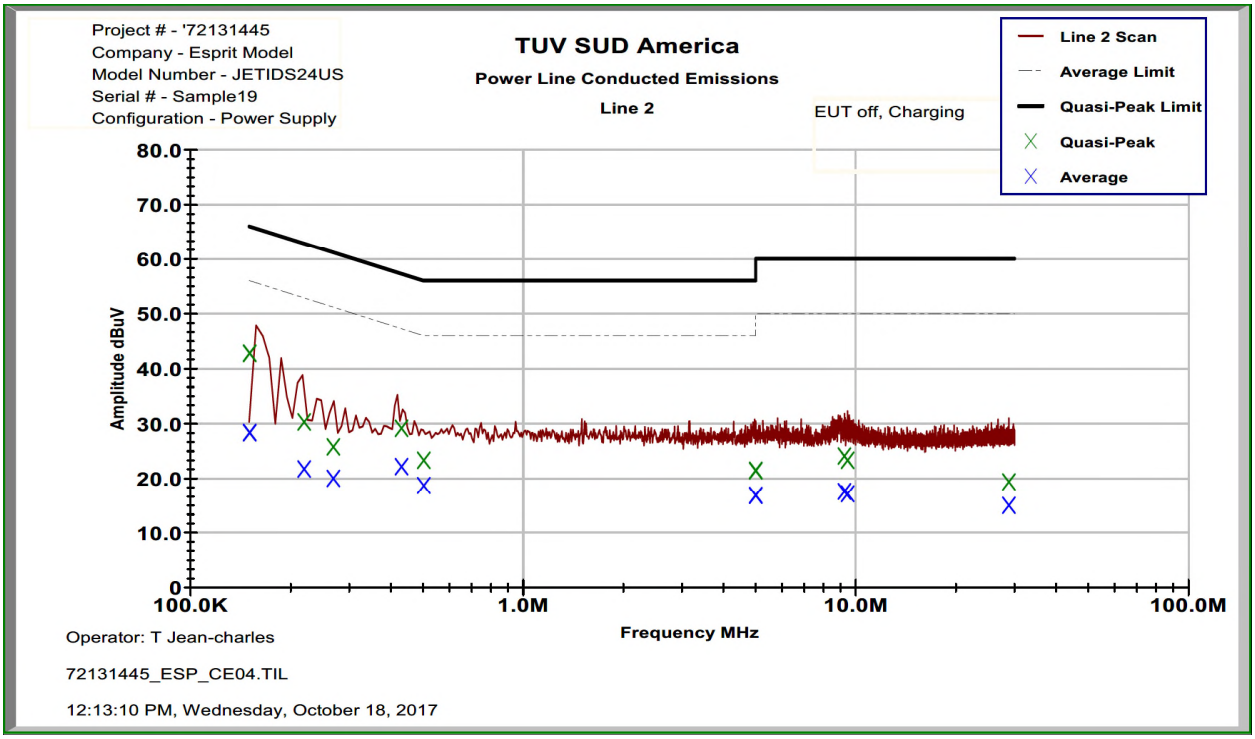


Figure 7.5.2-2: Conducted Emissions Results – Line 2

Table 7.5.2-1: Conducted EMI Results

☒ Line 1 ☒ Line 2 ☐ Line 3
☐ Line 4
☐ To Ground ☒ Floating
☐ Telecom Port _____
☒ dBµV ☐ dBµA

Plot Number:
72131445_ESP_CE04
Power Supply Description: 12 VDC Power Supply

Frequency (MHz)	Uncorrected Reading		Total Correction Factor (dB)	Corrected Level		Limit		Margin (dB)	
	Quasi-Peak	Average		Quasi-Peak	Average	Quasi-Peak	Average	Quasi-Peak	Average
Line 1									
0.150126	34.461	20.545	10.01	44.47	30.56	65.99	55.99	21.5	25.4
0.186788	26.248	15.999	10.01	36.26	26.01	64.18	54.18	27.9	28.2
0.252612	18.301	10.908	10.01	28.31	20.92	61.67	51.67	33.4	30.8
0.266012	17.773	11.058	10.01	27.78	21.07	61.24	51.24	33.5	30.2
0.314524	17.107	11.468	10.03	27.14	21.50	59.85	49.85	32.7	28.4
0.41765	20.208	13.611	10.04	30.25	23.65	57.49	47.49	27.2	23.8
0.48615	13.232	8.966	10.04	23.28	19.01	56.23	46.23	33.0	27.2
2.46036	11.462	6.863	10.20	21.66	17.06	56.00	46.00	34.3	28.9
4.98765	10.06	5.626	10.41	20.47	16.03	56.00	46.00	35.5	30.0
5.00025	10.104	5.737	10.49	20.59	16.22	60.00	50.00	39.4	33.8
Line 2									
0.150617	32.527	18.078	10.06	42.59	28.14	65.97	55.97	23.4	27.8
0.219613	19.998	11.44	10.06	30.06	21.50	62.83	52.83	32.8	31.3
0.268599	15.491	9.699	10.06	25.55	19.76	61.16	51.16	35.6	31.4
0.4303	18.848	11.848	10.08	28.93	21.93	57.25	47.25	28.3	25.3
0.5026	12.985	8.362	10.08	23.07	18.44	56.00	46.00	32.9	27.6
5.00085	10.715	6.041	10.50	21.21	16.54	60.00	50.00	38.8	33.5
5.00135	10.643	6.129	10.50	21.14	16.63	60.00	50.00	38.9	33.4
9.23707	13.026	6.501	10.83	23.85	17.33	60.00	50.00	36.1	32.7
9.44141	12.207	6.053	10.84	23.05	16.89	60.00	50.00	37.0	33.1
28.8415	7.133	2.783	11.94	19.07	14.72	60.00	50.00	40.9	35.3

8 MEASUREMENT UNCERTAINTIES

The expanded laboratory measurement uncertainty figures (U_{Lab}) provided below correspond to an expansion factor (coverage factor) k = 1.96 which provide confidence levels of 95%.

Table 8-1: Measurement Uncertainties

Parameter	U_{lab}
Occupied Channel Bandwidth	± 0.009 %
RF Conducted Output Power	± 1.15 dB
Power Spectral Density	± 1.15 dB
Antenna Port Conducted Emissions	± 1.15 dB
Radiated Emissions ≤ 1GHz	± 5.86 dB
Radiated Emissions > 1GHz	± 4.65 dB
Temperature	± 0.860 °C
Radio Frequency	$\pm 2.832 \times 10^{-8}$
AC Power Line Conducted Emissions	±3.72 dB

9 CONCLUSION

In the opinion of TÜV SÜD America, Inc. the model JETIDS24US, manufactured by Esprit Model, Inc., meets the requirements of FCC Part 15.247 and Industry Canada's Radio Standards Specification RSS-247 for the tests documented herein.

END REPORT