Excellence in Compliance Testing

Certification Test Report

FCC ID: ONTJETIDS16US
IC: 10491A-JETIDS16US

FCC Rule Part: 15.247
IC Radio Standards Specification: RSS-210

ACS Report Number: 12-2162.W06.1A

Manufacturer: Esprit Model
Model: JETIDS16US

Test Begin Date: **December 13, 2012**
Test End Date: **March 8, 2013**

Report Issue Date: March 25, 2013

ACCREDITED TESTING

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 ACLASS, ANSI, or any agency of the Federal Government.

Project Manager:

Thierry Jean-Charles
EMC Engineer
Advanced Compliance Solutions, Inc.

Reviewed by:

Kirby Munroe
Director, Wireless Certifications
Advanced Compliance Solutions, Inc.

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 and Industry Canada's Radio Standards Specification RSS-210.

1.2 Manufacturer Information

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

1.3 Product description

The JETIDS16US is a 2.4 GHz wireless transceiver for remote controlled toys. The remote control encloses two transceiver boards with two antennas each. Transmission alternates between the two boards every 10ms. Each transceiver board provides two antenna paths which do not transmit simultaneously. Only one antenna is transmitting at a time and the criteria for the antenna selection per transceiver board is based on the receive signal strength. The unit also includes a display and a USB port for data communication with a computer.

Band of Operation:	2405 MHz - 2475 MHz
Number of Channels:	15
Mode of Operation:	FH/DSSS
Modulation Format:	O-QPSK
Antenna Type/Gain:	Coaxial Wire Antenna, 2.14 dBi
Operating Voltage:	12 VDC

Model Number: JETIDS16US

Test Sample Serial Number(s): JETI Model 4

Test Sample Condition: The samples were in good conditions with no observable physical damages.

1.4 Test Methodology and Considerations

The unit was evaluated at the antenna ports as well as for radiated and power line conducted emissions for each transceiver board and antenna port. The antennas and transceiver board combinations are identified as AP1, AP2, AS1, and AS2 in this document. AP1 and AP2 correspond to antennas 1 and 2 of the primary board, while AS1 and AS2 refer to the antennas of the secondary board. Where applicable, the data is provided for the worst case configuration.

Preliminary radiated emissions measurements were performed with the unit set in three orthogonal orientations and the final measurements were performed on the orientation leading to the highest emissions. Additional preliminary measurements were performed at the channels adjacent to the extreme channels using the settings defined in the product Theory of Operation. These channels were found to be in compliance as well.

The RF conducted measurements were performed with a temporary connector at the antenna ports.

Power line conducted emissions were measured for each transmitter module in the constant hopping mode. Data is reported for the configuration leading to the highest emissions as compared to the limits.

The power settings used for the evaluation for all board and antenna configurations are listed below:

Channel 11 (2405 MHz): 14
Channel 19 (2440 MHz): 7
Channel 25 (2475 MHz): 14

The EUT was also evaluated for unintentional emissions when operating as a computer peripheral device. In order to meet the requirements, the following modifications were implemented:

Ferrite on USB cable: Laird 28A0807-0A2 (3 passes)
Ferrite on power cable: Laird 28A0807-0A2 (4 passes)

The results are documented separately in a Declaration of conformity/Verification test report.

2 TEST FACILITIES

2.1 Location

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

Advanced Compliance Solutions, Inc.
3998 FAU Blvd, Suite 310
Boca Raton, Florida 33431
Phone: (561) 961-5585
Fax: (561) 961-5587
www.acstestlab.com

FCC Test Firm Registration #: 587595
Industry Canada Lab Code: 4175C

2.2 Laboratory Accreditations/Recognitions/Certifications

ACS is accredited to ISO/IEC 17025 by ANSI-ASQ National Accreditation Board under their ACLASS 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.

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 floor.

The turntable is driven by pneumatic motor, which is capable of supporting a 2000 lb. load. The turntable is flushed with the chamber floor which it is connected to, around its circumference, with a continuous metallic loaded spring. An EMCO Model 1050 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:

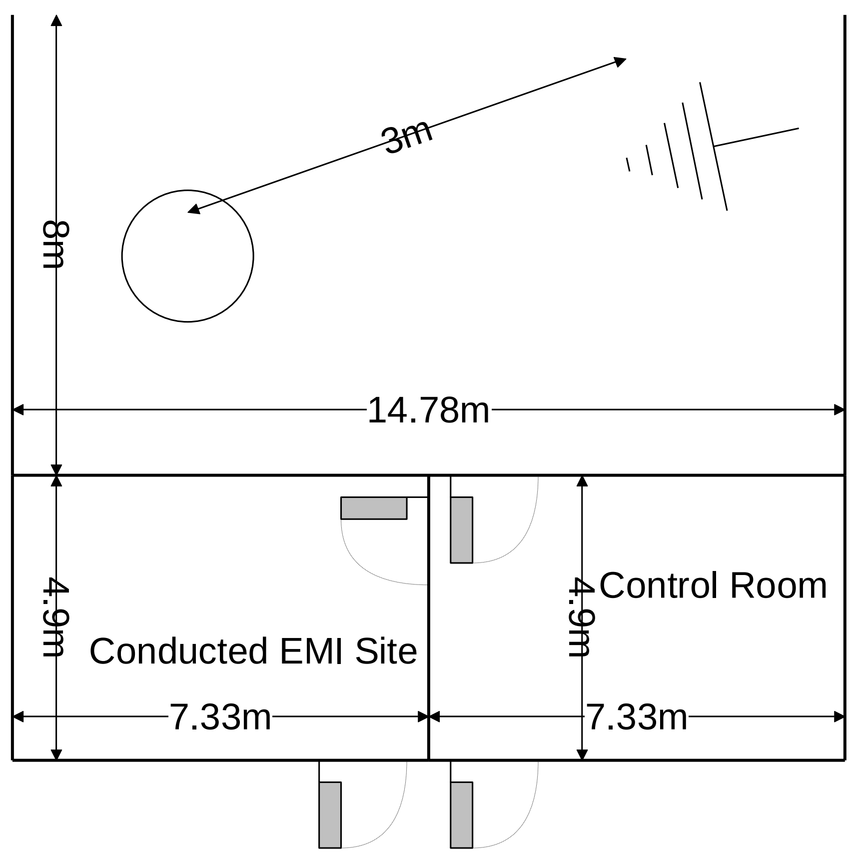

Figure 2.3.1-1: Semi-Anechoic Chamber Test Site

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. As per ANSI C63.4 2003 requirements, the data were taken using two LISNs; a Solar Model 8028-50 50 Ω/50 µH and an EMCO Model 3825, which are installed as shown in Photograph 3. For 220 V, 50 Hz, a Polarad LISN (S/N 879341/048) is used in conjunction with a 1 kVA, 50 Hz/220 V EDGAR variable frequency generator, Model 1001B, to filter conducted noise from the generator.

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

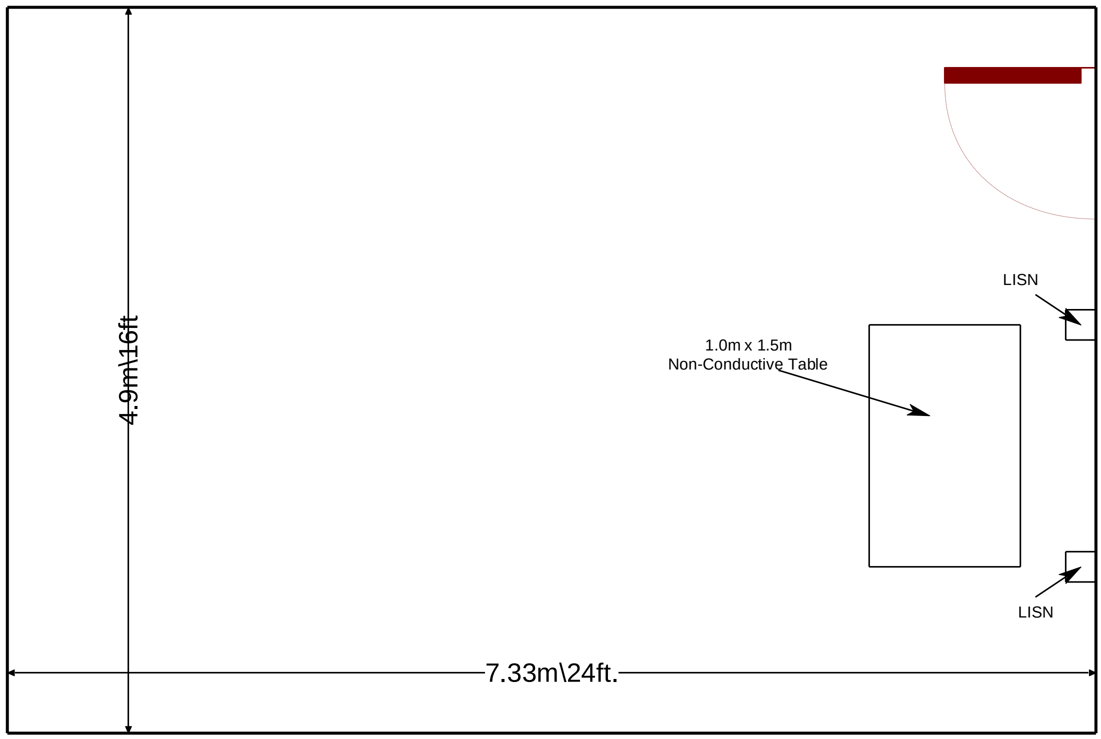

Figure 2.3.2-1: AC Mains Conducted EMI Site

3 APPLICABLE STANDARD REFERENCES

The following standards were used:

- ANSI C63.4-2003: Method of Measurements of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the 9KHz to 40GHz
- ANSI C63.10-2009: Standard for Testing Unlicensed Wireless Devices
- US Code of Federal Regulations (CFR): Title 47, Part 2, Subpart J: Equipment Authorization Procedures, 2013
- US Code of Federal Regulations (CFR): Title 47, Part 15, Subpart C: Radio Frequency Devices, Intentional Radiators, 2013
- FCC Public Notice DA 00-705 - Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems, March 30, 2000
- Industry Canada Radio Standards Specification: RSS-210 - Low-power License-exempt Radiocommunication Devices (All Frequency Bands): Category I Equipment, Issue 8 December 2010.
- Industry Canada Radio Standards Specification: RSS-GEN – General Requirements and Information for the Certification of Radiocommunication Equipment, Issue 3, December 2010.

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

AssetID	Manufacturer	Model #	Equipment Type	Serial #	Last Calibration Date	Calibration Due Date
523	Agilent	E7405	Spectrum Analyzers	MY45103293	1/5/2011	1/5/2013
523	Agilent	E7405	Spectrum Analyzers	MY45103293	1/8/2013	1/8/2015
524	Chase	CBL6111	Antennas	1138	1/7/2011	1/7/2013
524	Chase	CBL6111	Antennas	1138	1/7/2013	1/7/2015
2006	EMCO	3115	Antennas	2573	3/2/2011	3/2/2013
2006	EMCO	3115	Antennas	2573	3/5/2013	3/5/2015
2007	EMCO	3115	Antennas	2419	1/18/2012	1/18/2014
2008	COM-Power	AH-826	Antennas	81009	NCR	NCR
2011	Hewlett-Packard	HP 8447D	Amplifiers	2443A03952	1/2/2012	1/2/2013
2011	Hewlett-Packard	HP 8447D	Amplifiers	2443A03952	12/31/2012	12/31/2013
2022	EMCO	LISN3825/2R	LISN	1095	8/19/2011	8/19/2013
2037	ACS Boca	Chamber EMI Cable Set	Cable Set	2037	1/2/2012	1/2/2013
2037	ACS Boca	Chamber EMI Cable Set	Cable Set	2037	1/1/2013	1/1/2014
2044	QMI	N/A	Cables	2044	1/2/2012	1/2/2013
2044	QMI	N/A	Cables	2044	12/31/2012	12/31/2013
2045	ACS Boca	Conducted Cable Set	Cable Set	2045	1/2/2012	1/2/2013
2045	ACS Boca	Conducted Cable Set	Cable Set	2045	12/31/2012	12/31/2013
2064	CIR Q-TEL	FHT/22-10K-13/50-3A/3A	Filter	9	12/30/2011	12/30/2012
2064	CIR Q-TEL	FHT/22-10K-13/50-3A/3A	Filter	9	12/31/2012	12/31/2013
2070	Mini Circuits	VHF-8400+	Filter	2070	1/19/2012	1/19/2013
2070	Mini Circuits	VHF-8400+	Filter	2070	12/31/2012	12/31/2013
2072	Mini Circuits	VHF-3100+	Filter	30737	1/19/2012	1/19/2013
2072	Mini Circuits	VHF-3100+	Filter	30737	12/31/2012	12/31/2013
2075	Hewlett Packard	8495B	Attenuators	2626A11012	1/2/2012	1/2/2013
2075	Hewlett Packard	8495B	Attenuators	2626A11012	12/31/2012	12/31/2013
2076	Hewlett Packard	HP5061-5458	Cables	2076	1/2/2012	1/2/2013
2076	Hewlett Packard	HP5061-5458	Cables	2076	12/29/2012	12/29/2013
2082	Teledyne Storm Products	90-010-048	Cables	2082	5/31/2012	5/31/2013
2086	Merrimac	FAN-6-10K	Attenuators	23148-83-1	12/30/2011	12/30/2012
2086	Merrimac	FAN-6-10K	Attenuators	23148-83-1	12/29/2012	12/29/2013
2089	Agilent Technologies, Inc.	83017A	Amplifiers	3123A00214	12/22/2011	12/22/2012
2089	Agilent Technologies, Inc.	83017A	Amplifiers	3123A00214	12/20/2012	12/20/2013
2091	Agilent Technologies, Inc.	8573A	Spectrum Analyzers	2407A03233	12/12/2011	12/12/2013
2095	ETS Lindgren	TILE4! - Version 4.2.A	Software	85242	NCR	NCR

Notes:

- **NCR=No Calibration Required**
- **Asset 2006 was only used during its active calibration cycle.**

5 SUPPORT EQUIPMENT

Table 5-1: Support Equipment (Stand-alone)

Item	Equipment Type	Manufacturer	Model Number	Serial Number
No support equipment was used for the radiated emissions evaluation.				

Table 5-2: Support Equipment (With charger)

Item	Equipment Type	Manufacturer	Model Number	Serial Number
1	12 VDC Power Supply	Jeti Model	SYS1428-2412-W2	G120602007990
2	Ferrite	Laird	28A0807-0A2	N/A

6 EQUIPMENT UNDER TEST SETUP BLOCK DIAGRAM

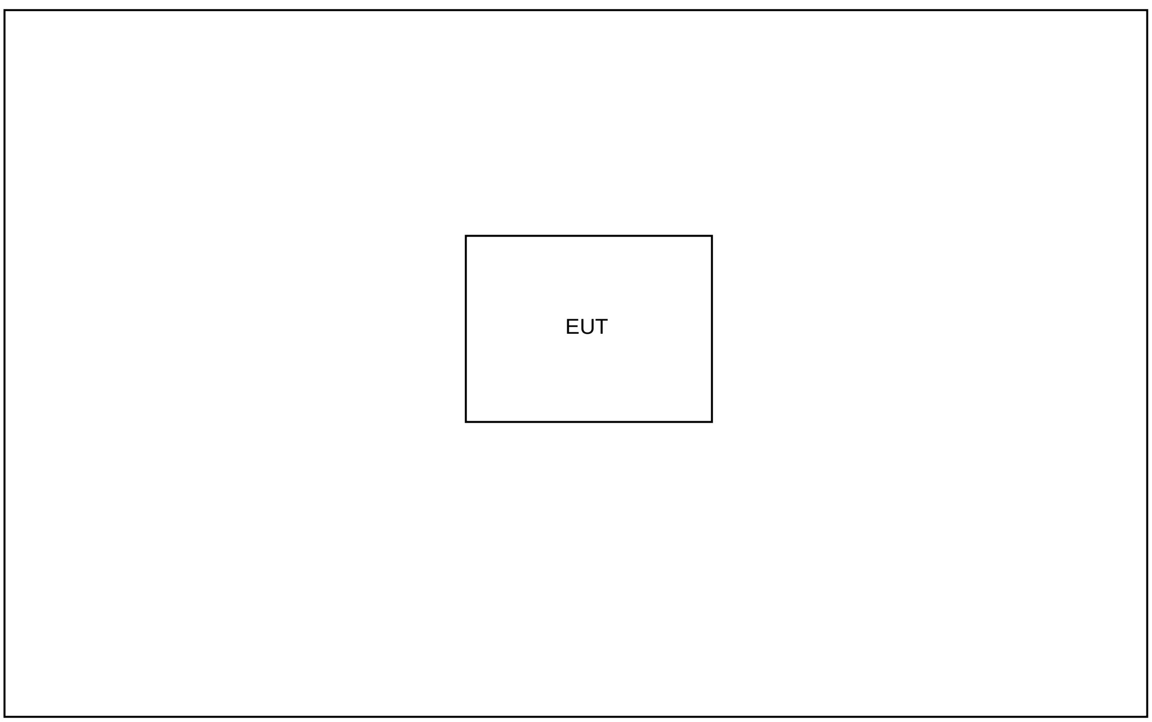

Figure 6-1: Radiated Emissions Setup

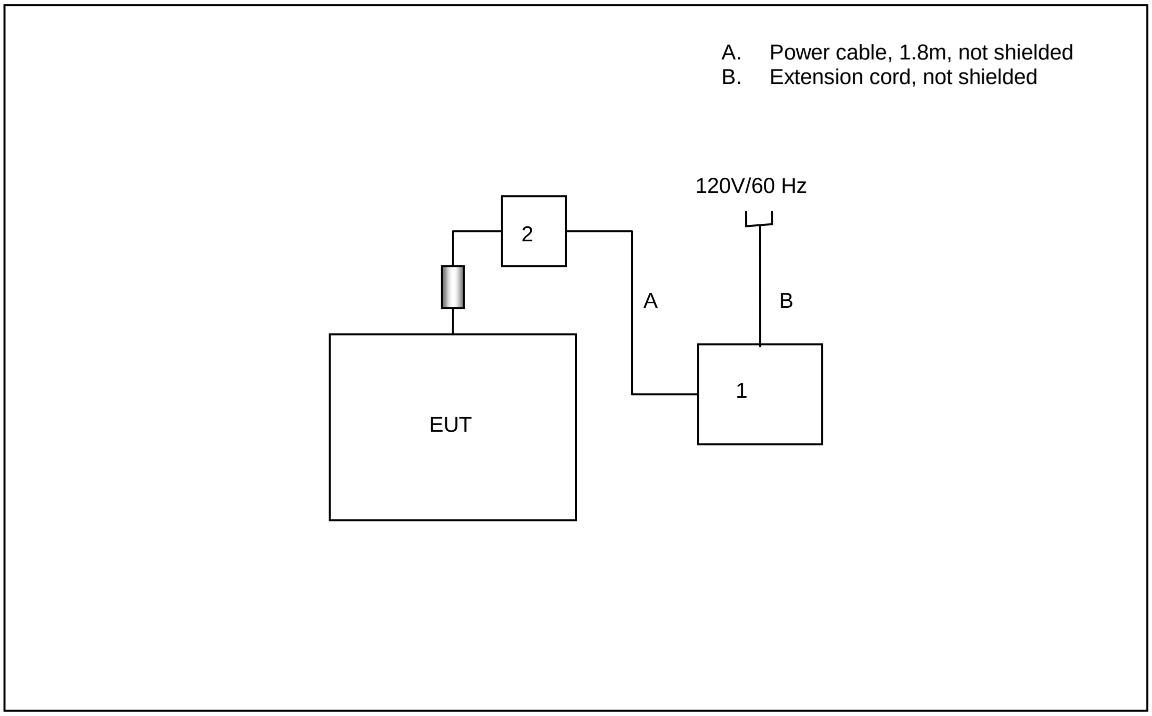

Figure 6-2: Power Line Conducted Emissions Setup

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 JETIDC16US uses 2.14 dBi antennas for both transceiver boards which are located inside of the unit, underneath the display. The antennas and transceiver boards use u. FL. connectors, thus meeting the requirements of 15.203.

7.2 Power Line Conducted Emissions – FCC: Section 15.207 IC: RSS-Gen 7.2.4

7.2.1 Measurement Procedure

ANSI C63.4 sections 6 and 7 were the guiding documents 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

7.2.2 Measurement Results

Results are shown below.

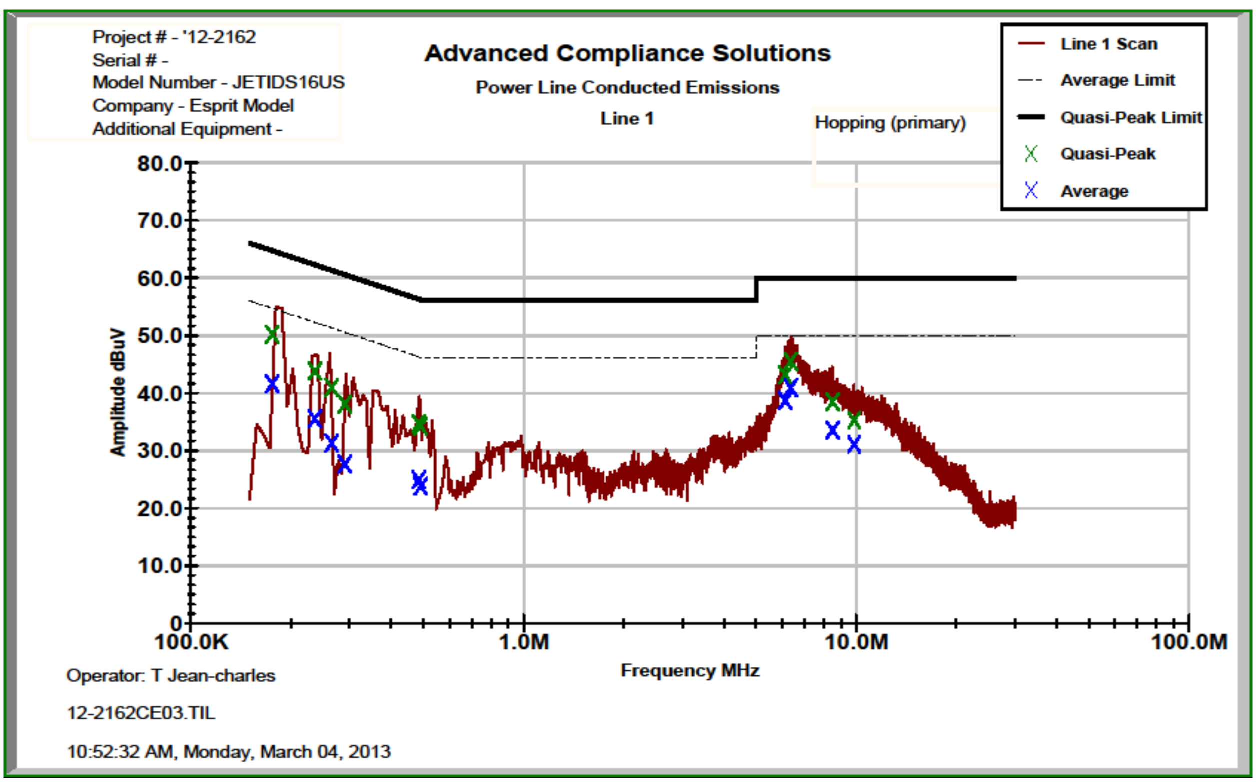

Figure 7.2.2-1: Conducted Emissions Results – Line 1

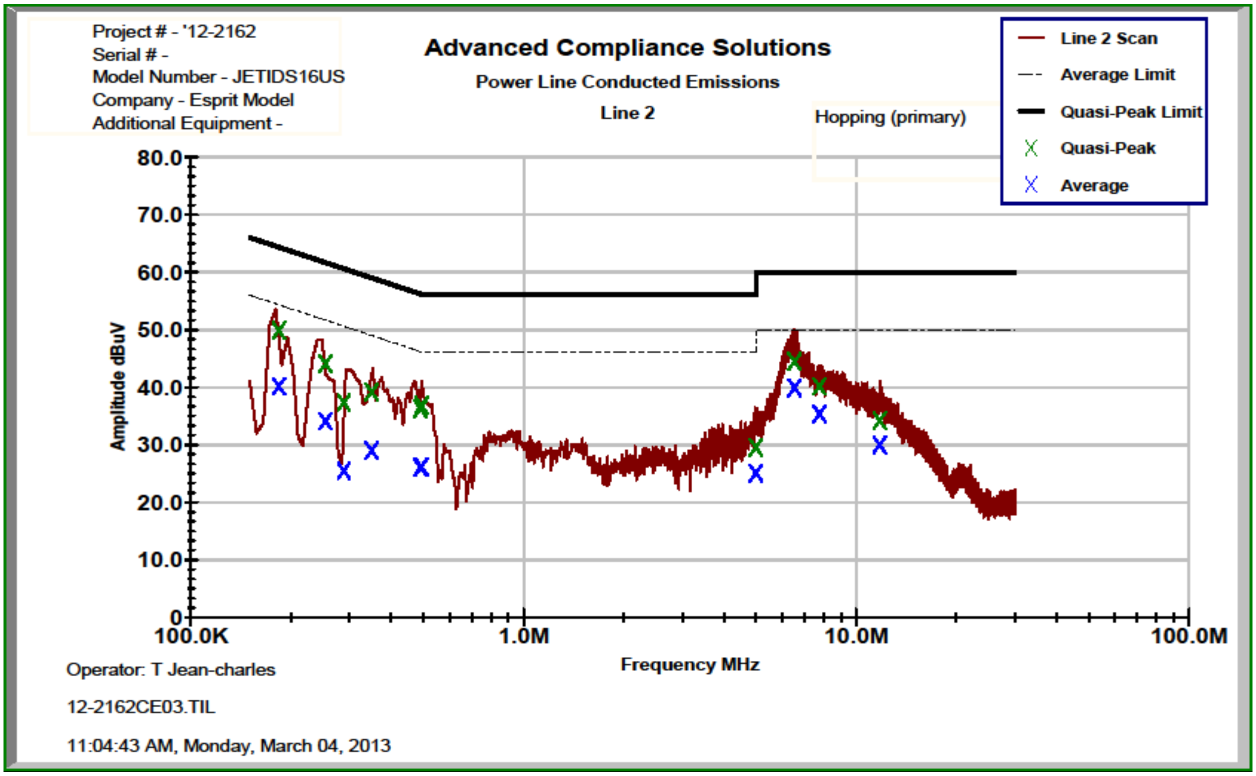

Figure 7.2.2-2: Conducted Emissions Results – Line 2

Table 7.2.2-1: Conducted EMI Results

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

Plot Number: 12-2162CE03
Power Supply Description: 12 VDC

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									
0.1754	48.919	40.326	1.31	50.23	41.64	64.70	54.70	14.5	13.1
0.2354	42.816	34.596	1.04	43.86	35.64	62.26	52.26	18.4	16.6
0.264638	40.121	30.462	0.86	40.98	31.32	61.28	51.28	20.3	20.0
0.289838	37.319	26.812	0.84	38.16	27.65	60.53	50.53	22.4	22.9
0.4837	34.194	24.382	0.55	34.74	24.93	56.28	46.28	21.5	21.3
0.490162	33.73	23.25	0.55	34.28	23.80	56.16	46.16	21.9	22.4
6.11419	42.378	37.913	0.82	43.20	38.74	60.00	50.00	16.8	11.3
6.33996	44.76	40.137	0.86	45.62	41.00	60.00	50.00	14.4	9.0
8.4885	37.273	32.373	1.00	38.28	33.38	60.00	50.00	21.7	16.6
9.83971	32.601	28.394	1.20	33.80	29.59	60.00	50.00	26.2	20.4
Line 2									
0.1836	48.608	38.889	1.33	49.94	40.22	64.32	54.32	14.4	14.1
0.253612	43.212	33.2	0.89	44.10	34.09	61.64	51.64	17.5	17.5
0.28785	36.541	24.685	0.86	37.40	25.55	60.59	50.59	23.2	25.0
0.349038	38.47	28.309	0.73	39.20	29.04	58.99	48.99	19.8	19.9
0.488838	35.713	25.484	0.58	36.30	26.07	56.19	46.19	19.9	20.1
0.49245	36.311	25.596	0.58	36.89	26.18	56.13	46.13	19.2	19.9
4.9901	28.869	24.426	0.59	29.46	25.02	56.00	46.00	26.5	21.0
6.51586	43.681	39.159	0.89	44.57	40.05	60.00	50.00	15.4	9.9
7.73966	39.21	34.435	0.90	40.11	35.34	60.00	50.00	19.9	14.7
11.7477	31.512	27.3	2.83	34.34	30.13	60.00	50.00	25.7	19.9

* Note: Results are reported for the EUT configuration leading to the worst case emissions.

7.3 Peak Output Power - FCC Section 15.247(b)(1) IC: RSS-210 A8.4(2)

7.3.1 Measurement Procedure (Conducted Method)

The RF output port of the EUT was directly connected to the input of the spectrum analyzer. The display values were corrected for cable and external attenuation.

7.3.2 Measurement Results

Results are shown below.

Table 7.3.2-1: RF Output Power – AP1

Frequency (MHz)	Power (dBm)
2405	10.61
2440	19.43
2475	9.424

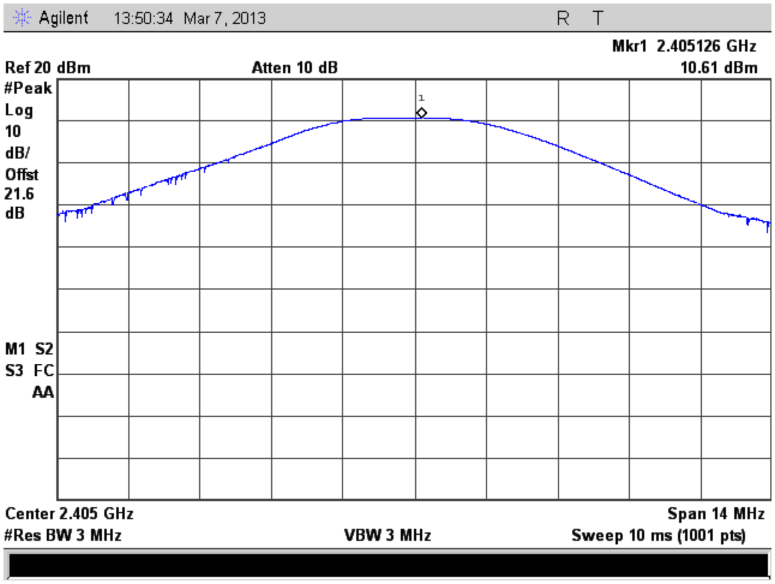

Figure 7.3.2-1: RF Output Power - Low Channel – AP1

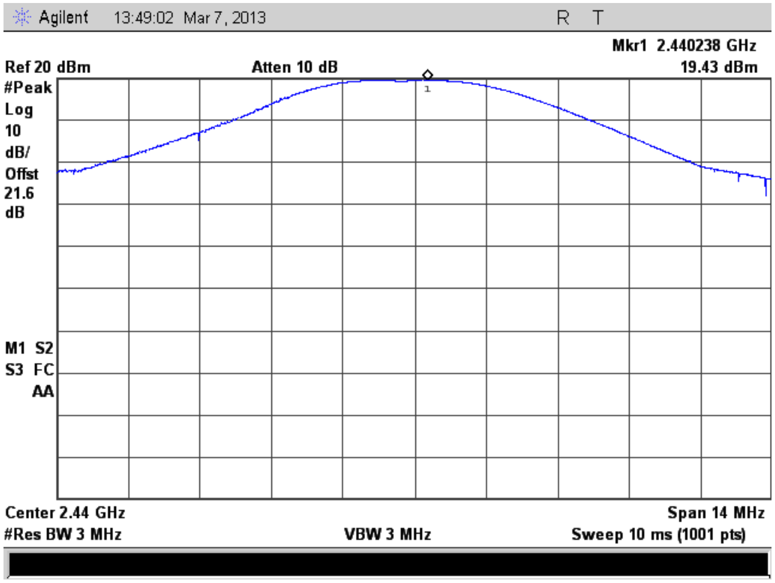

Figure 7.3.2-2: RF Output Power - Middle Channel – AP1

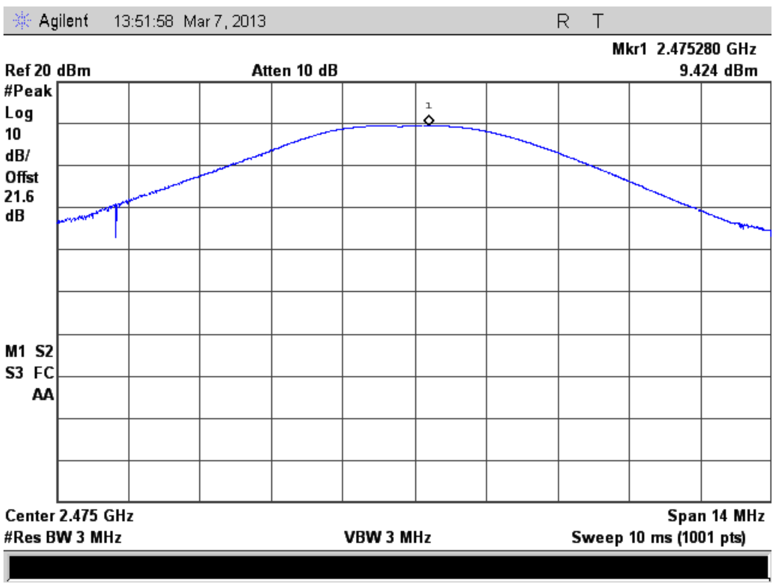

Figure 7.3.2-3: RF Output Power - High Channel – AP1

Table 7.3.2-2: RF Output Power – AP2

Frequency (MHz)	Power (dBm)
2405	12.35
2440	19.56
2475	10.30

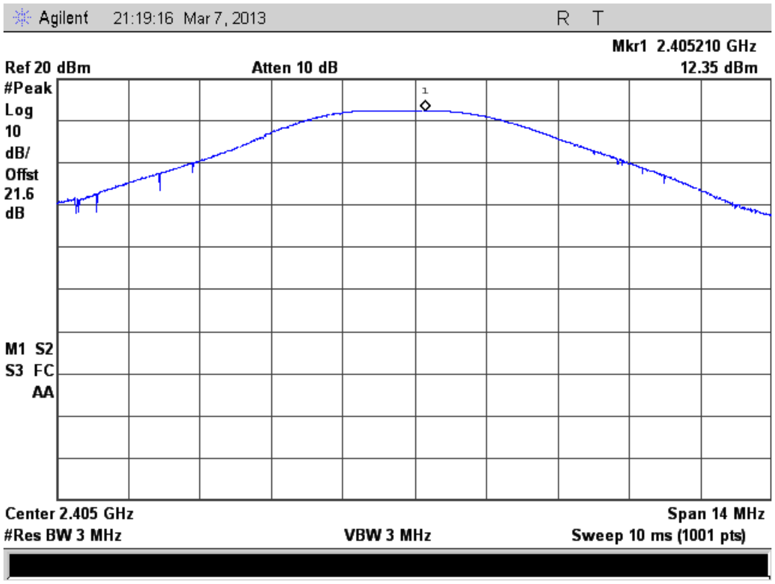

Figure 7.3.2-4: RF Output Power - Low Channel – AP2

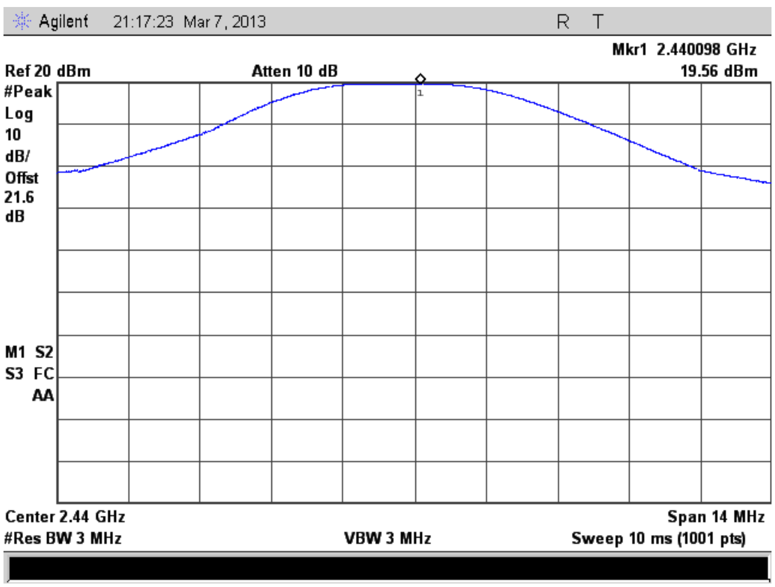

Figure 7.3.2-5: RF Output Power - Middle Channel – AP2

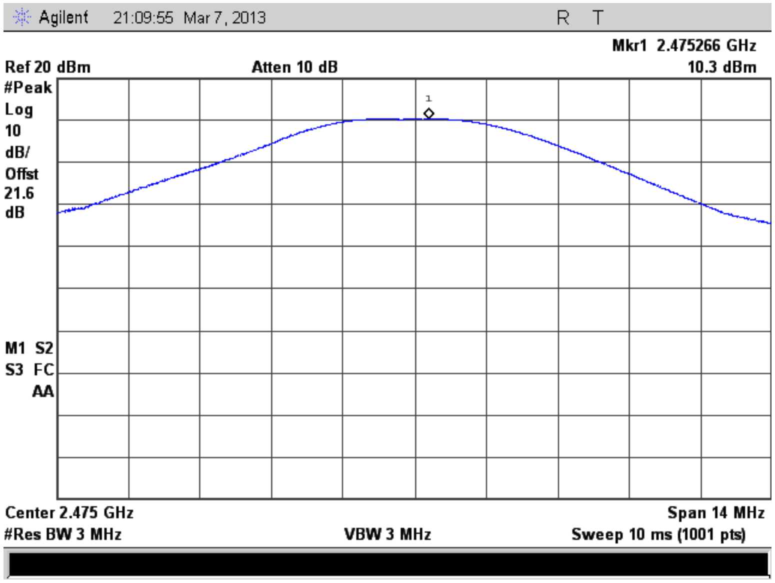

Figure 7.3.2-6: RF Output Power - High Channel – AP2

Table 7.3.2-3: RF Output Power AS1

Frequency (MHz)	Power (dBm)
2405	10.54
2440	19.48
2475	9.916

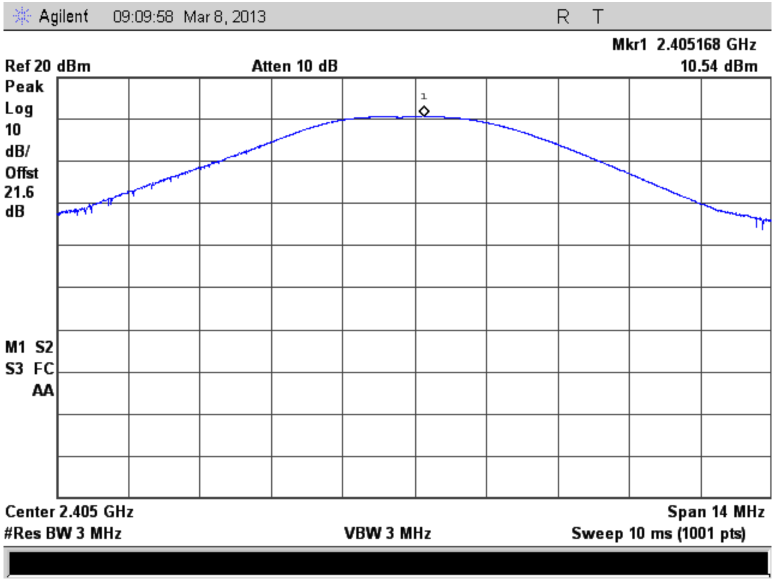

Figure 7.3.2-7: RF Output Power - Low Channel – AS1

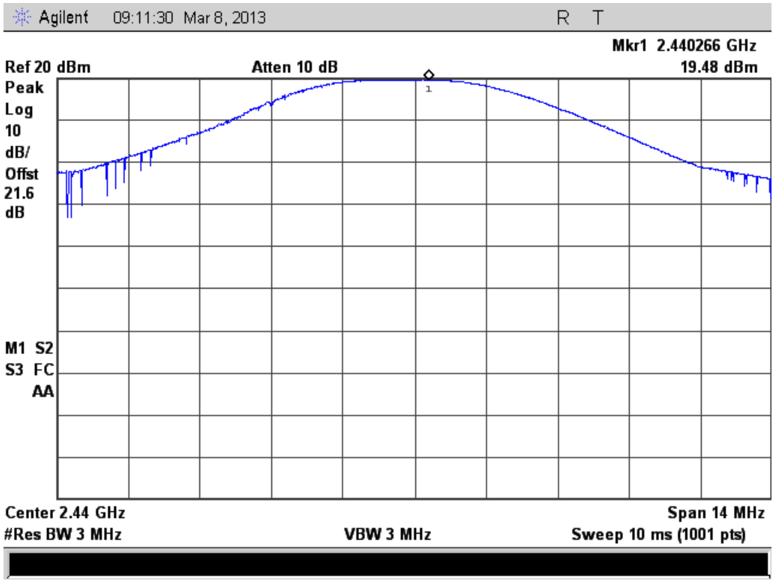

Figure 7.3.2-8: RF Output Power - Middle Channel – AS1

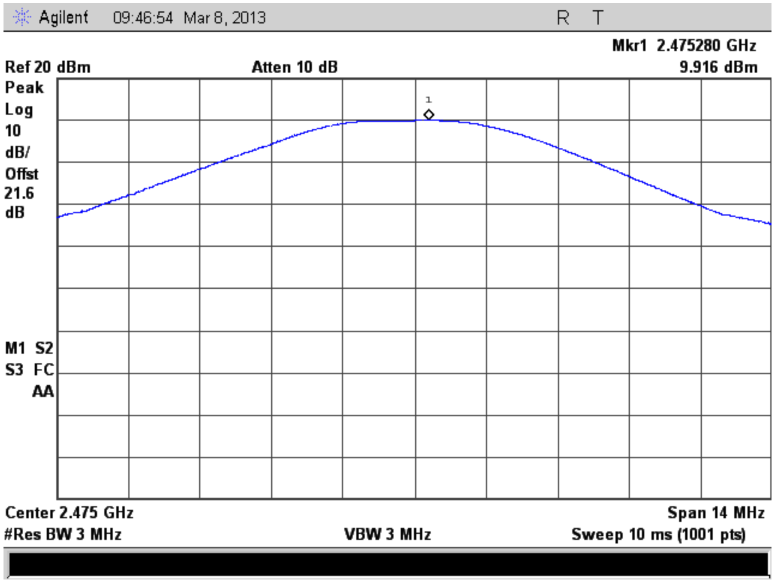

Figure 7.3.2-9: RF Output Power - High Channel – AS1

Table 7.3.2-4: RF Output Power – AS2

Frequency (MHz)	Power (dBm)
2405	12.10
2440	19.49
2475	10.27

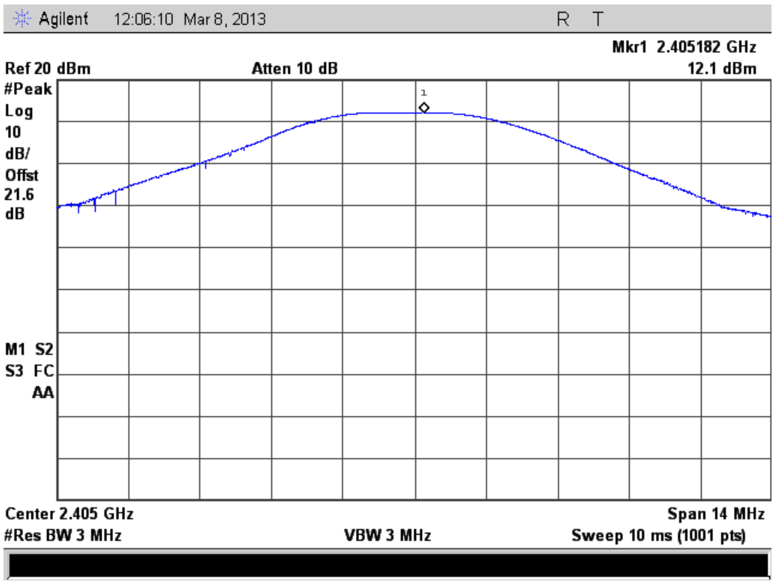

Figure 7.3.2-10: RF Output Power - Low Channel – AS2

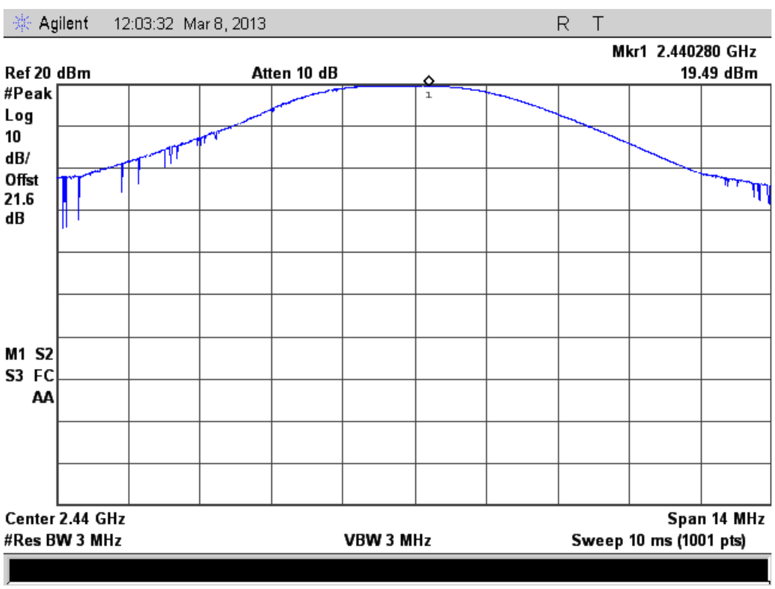

Figure 7.3.2-11: RF Output Power - Middle Channel – AS2

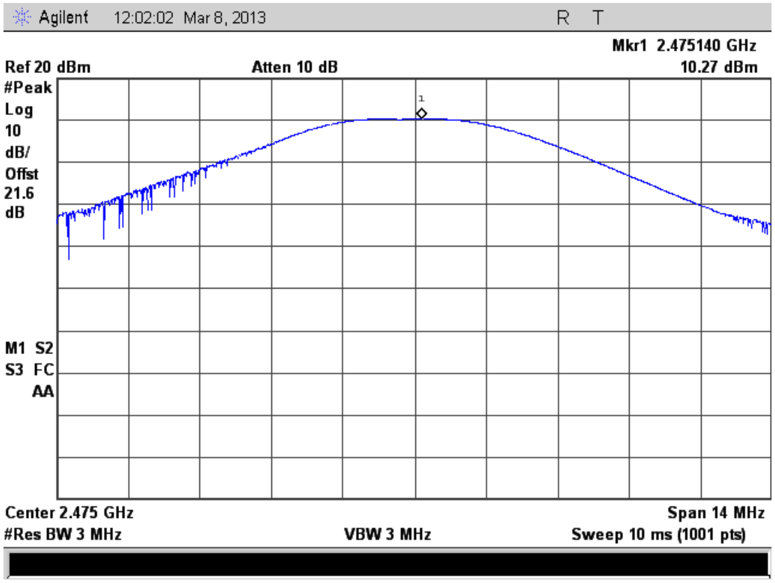

Figure 7.3.2-12: RF Output Power - High Channel – AS2

7.4 Channel Usage Requirements

7.4.1 Carrier Frequency Separation – FCC: Section 15.247(a)(1) IC: RSS-210 A8.1(b)

7.4.1.1 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 ≥ 1% of the span.

7.4.1.2 Measurement Results

Results are shown below.

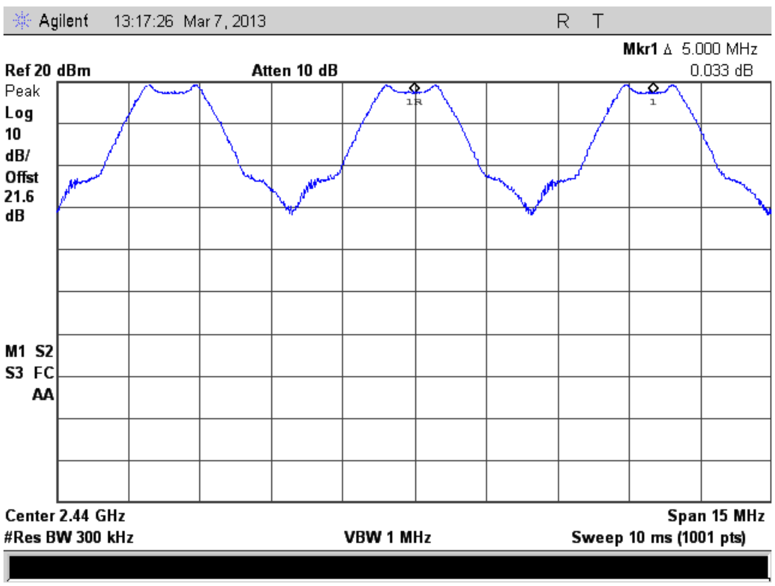

Figure 7.4.1.2-1: Carrier Frequency Separation – AP1

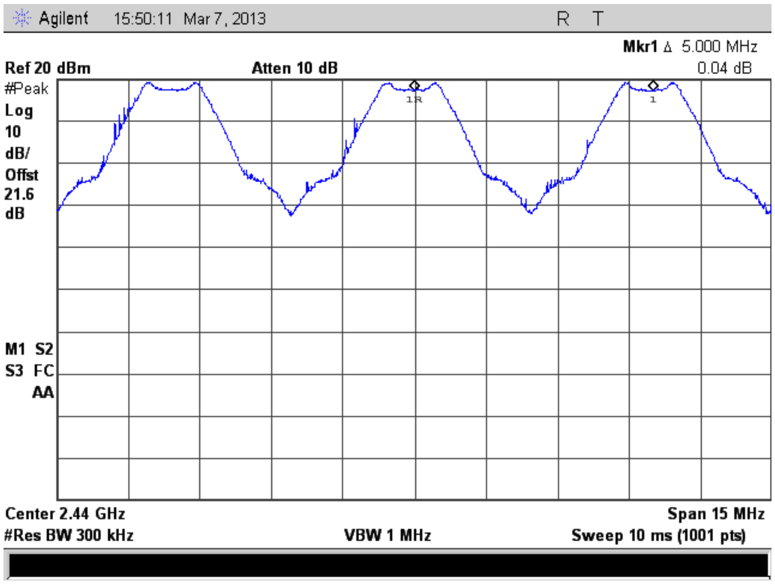

Figure 7.4.1.2-2: Carrier Frequency Separation – AP2

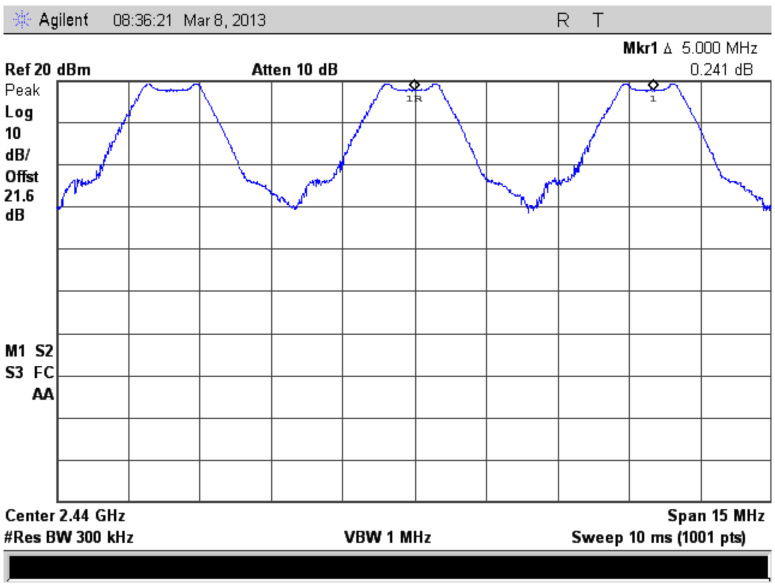

Figure 7.4.1.2-3: Carrier Frequency Separation – AS1

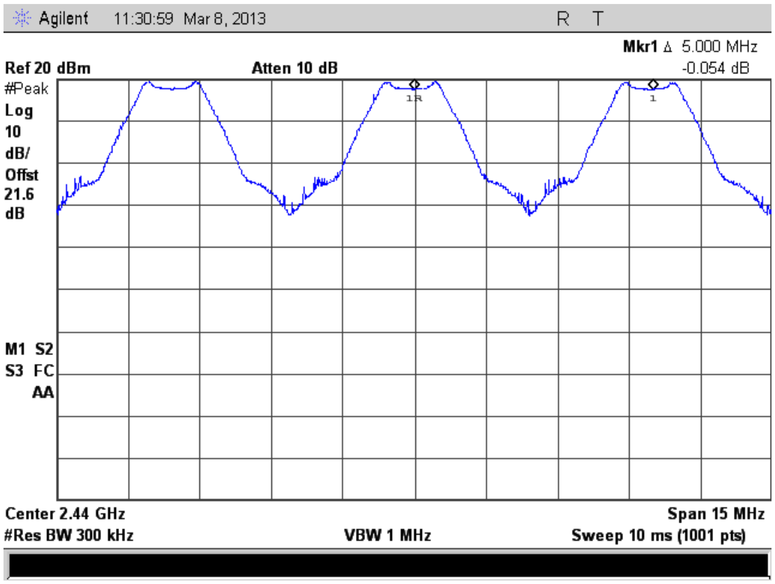

Figure 7.4.1.2-4: Carrier Frequency Separation – AS2

7.4.2 Number of Hopping Channels – FCC: Section 15.247(a)(1)(iii) IC: RSS-210 A8.1(d)

7.4.2.1 Measurement Procedure

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

7.4.2.2 Measurement Results

Results are shown below.

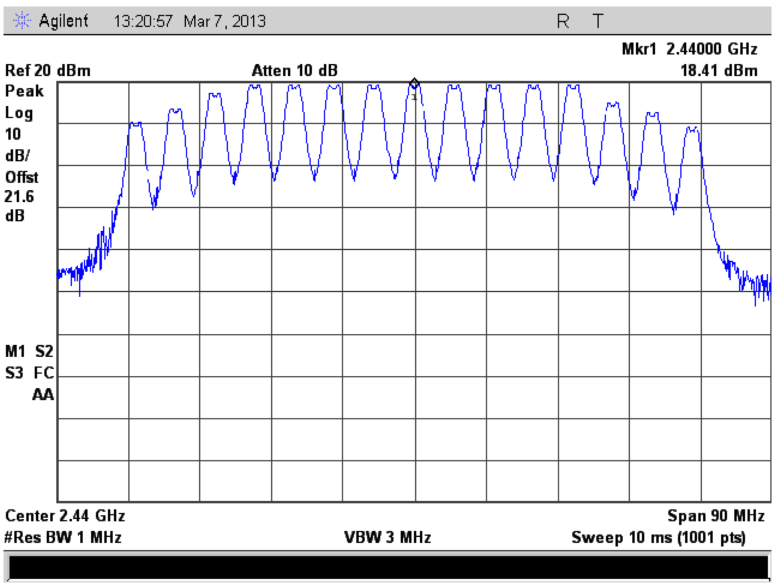

Figure 7.4.2.2-1: Number of Hopping Channels – AP1

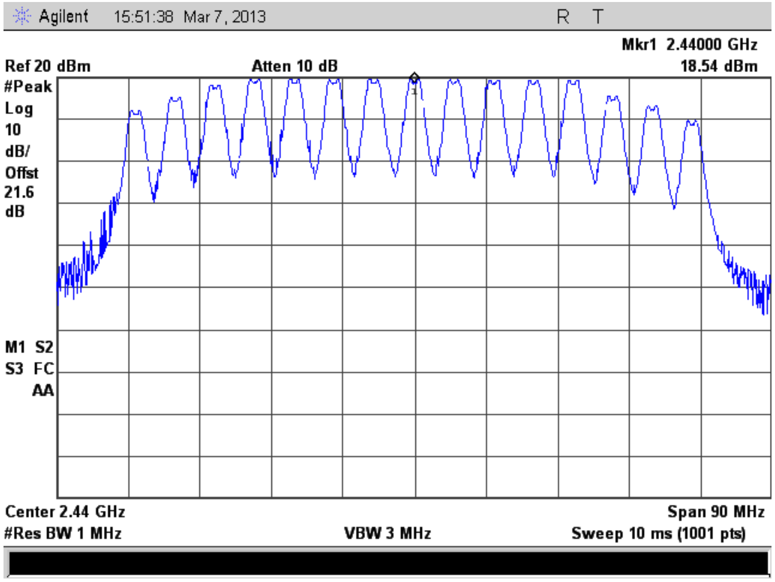

Figure 7.4.2.2-2: Number of Hopping Channels – AP2

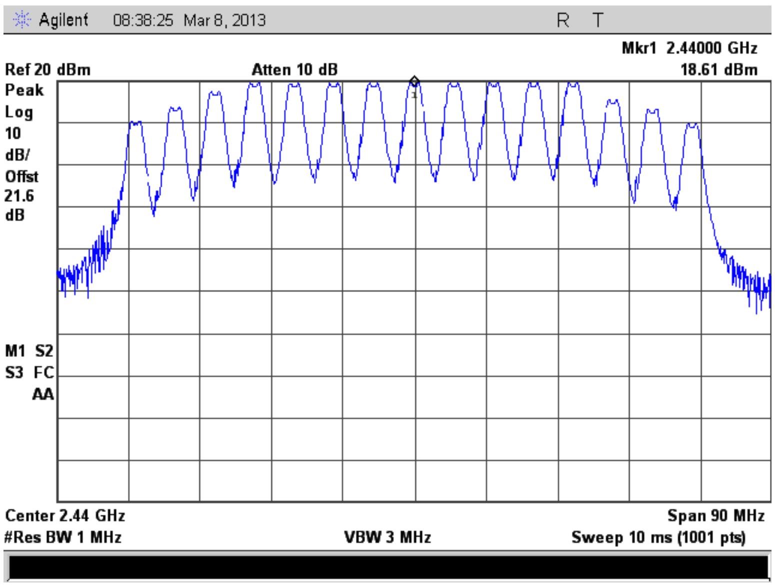

Figure 7.4.2.2-3: Number of Hopping Channels – AS1

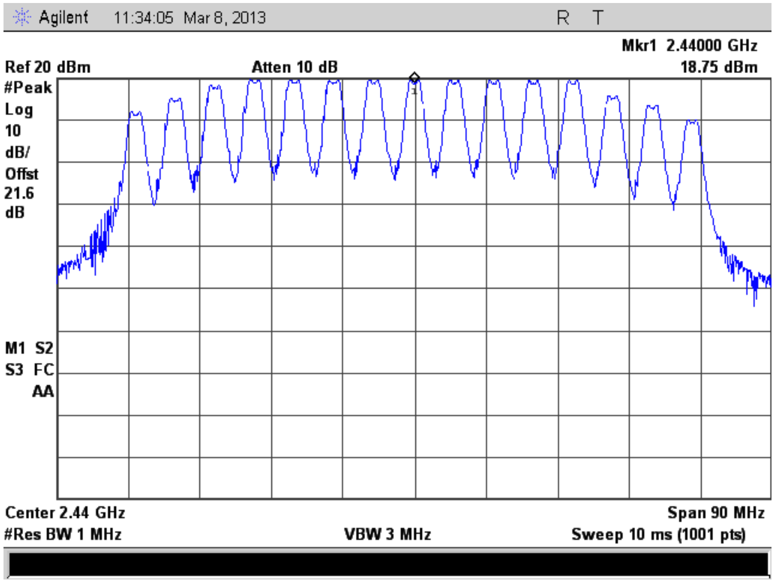

Figure 7.4.2.2-4: Number of Hopping Channels – AS2

7.4.3 Channel Dwell Time – FCC: Section 15.247(a)(1)(iii) IC: RSS-210 A8.1(d)

7.4.3.1 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 1 MHz and the sweep time adjusted to capture the entire dwell time per channel with peak detector max hold function.

7.4.3.2 Measurement Results

Results are shown below.

Table 7.4.3.2-1 Dwell Time on a 6 Second Cycle

Mode of Operation	Number of Hops Per Sec. (NHPS)	Number of Hops per Channel Per Sec. (NHPCPS)	Number of hops on a 6 s Cycle (NHPC)	Measured Dwell Times (ms)	Dwell Times on a 6 s Cycle (ms)	Limit (ms)	Status
AP1	100	6.67	40	2.050	82.00	400	PASS
AP2	100	6.67	40	2.070	82.80	400	PASS
AS1	100	6.67	40	2.050	82.00	400	PASS
AS2	100	6.67	40	2.050	82.00	400	PASS

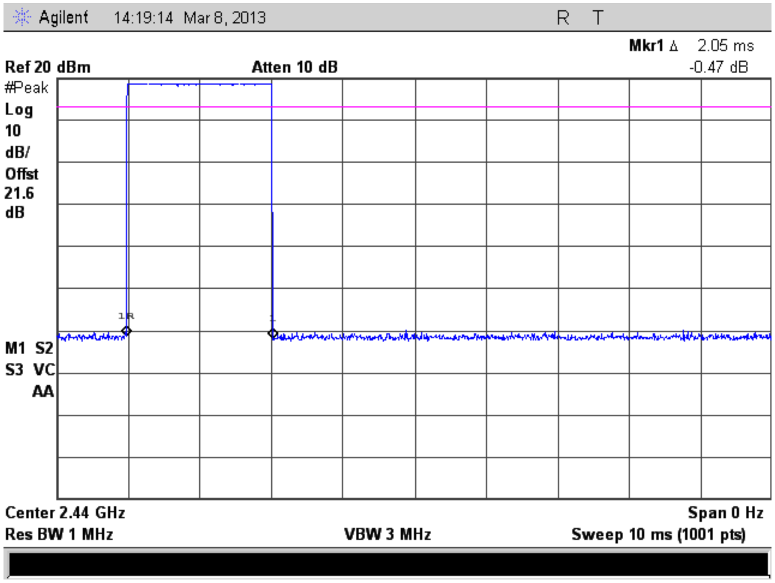

Figure 7.4.3.2-1: Channel Dwell Time – AP1

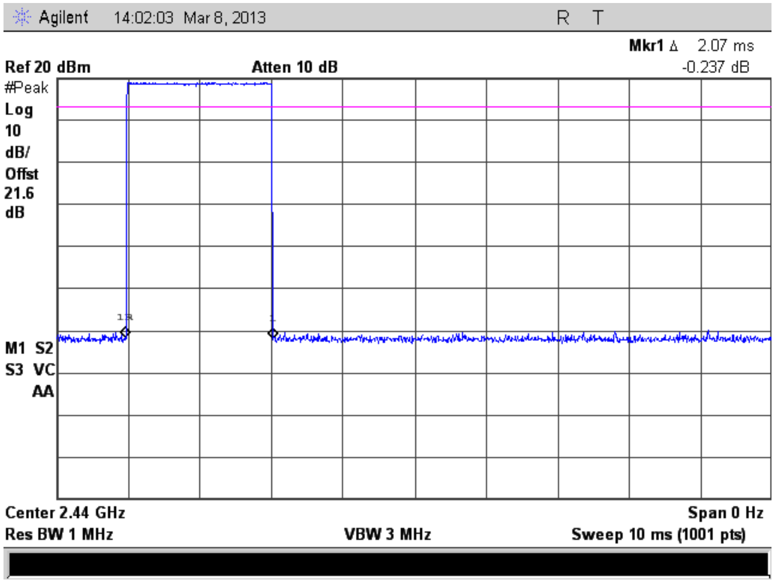

Figure 7.4.3.2-2: Channel Dwell Time – AP2

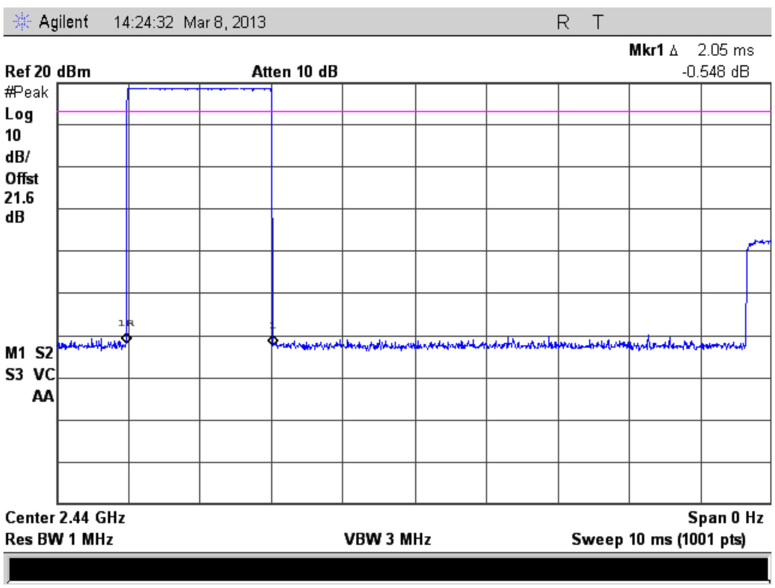

Figure 7.4.3.2-3: Channel Dwell Time – AS1

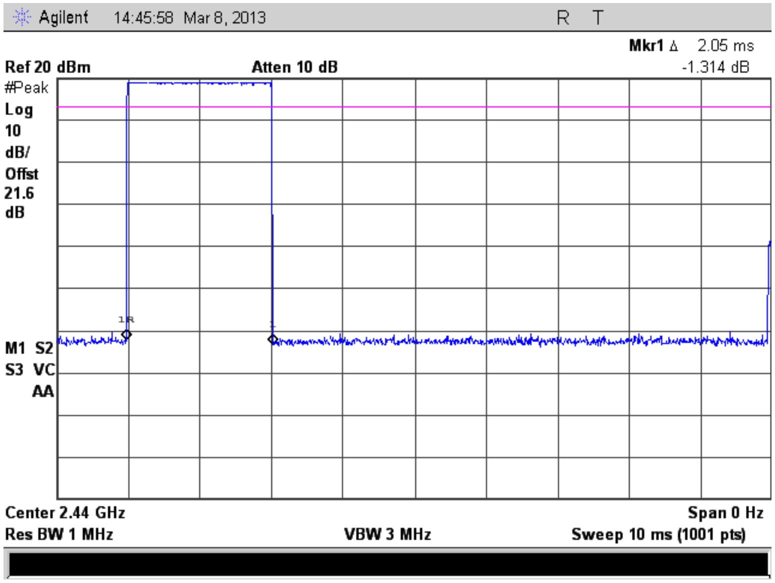

Figure 7.4.3.2-4: Channel Dwell Time – AS2

7.4.4 20dB / 99% Bandwidth - FCC: Section 15.247(a)(1)(i) IC: RSS-210 A8.1(a)

7.4.4.1 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 3 times the estimated bandwidth of the emission. The RBW was to ≥ 1% of the estimated emission bandwidth. The trace was set to max hold with a peak detector active. The Delta function of the analyzer was utilized to determine the 20 dB bandwidth of the emission.

The 99% occupied bandwidth was measured with the spectrum analyzer span set to fully display the emission, including the emissions skirts. The RBW was to 1% of the span. . The occupied 99% bandwidth was measured by using a delta marker at the lower and upper frequencies leading to 0.5% of the total power.

7.4.4.2 Measurement Results

Results are shown below.

Table 7.4.4.2-1: 20dB / 99% Bandwidth – AP1

Frequency [MHz]	20dB Bandwidth [kHz]	99% Bandwidth [kHz]
2405	2653	2440
2440	2681	2460
2475	2730	2520

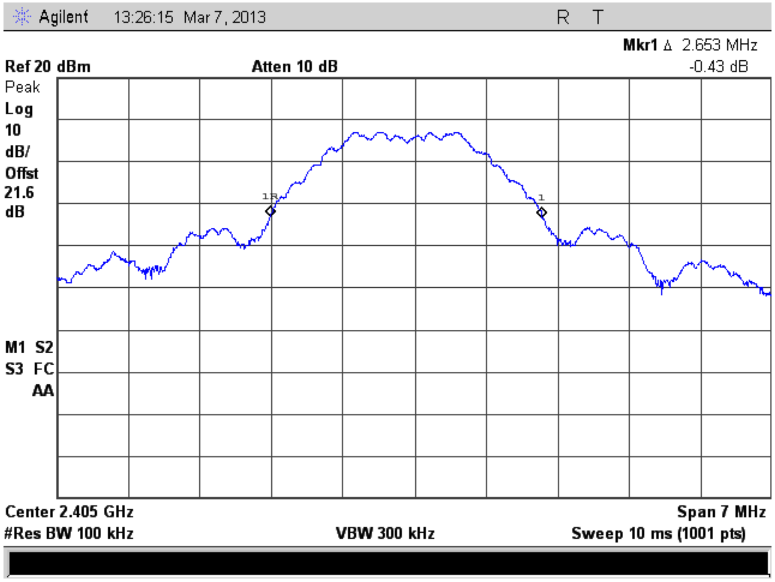

Figure 7.4.4.2-1: 20dB BW Low Channel – AP1

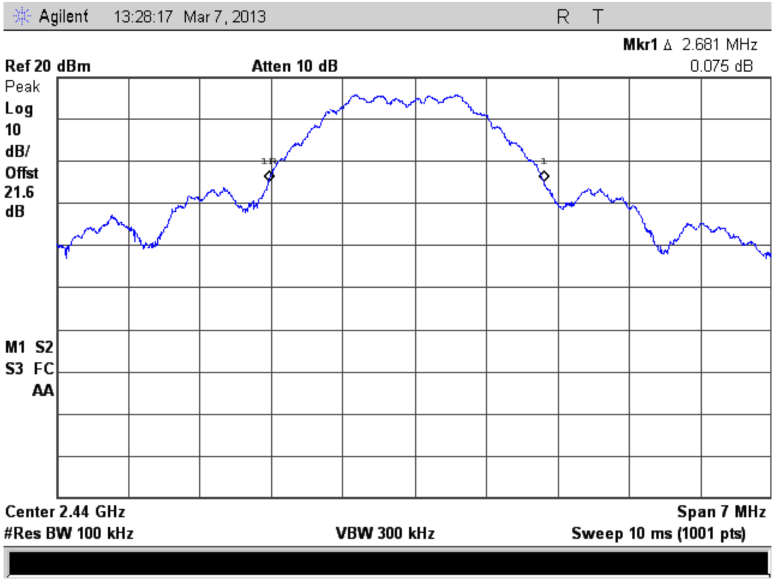

Figure 7.4.4.2-2: 20dB BW Middle Channel – AP1

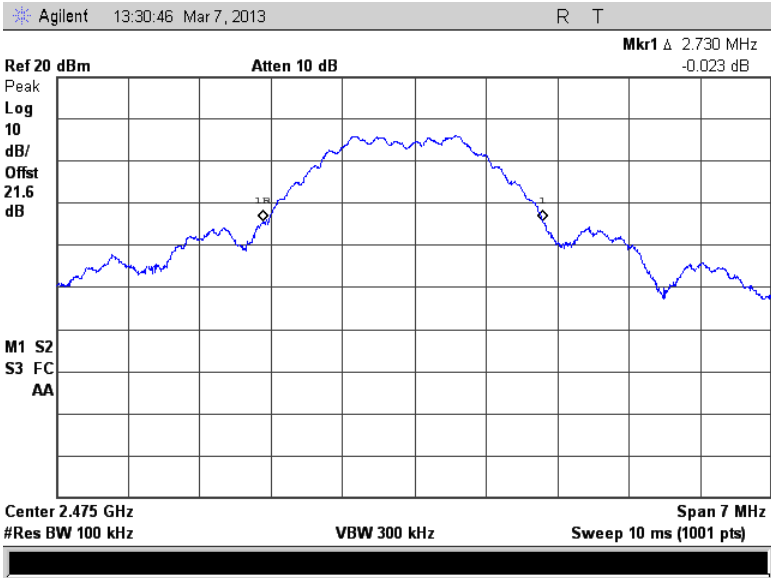

Figure 7.4.4.2-3: 20dB BW High Channel – AP1

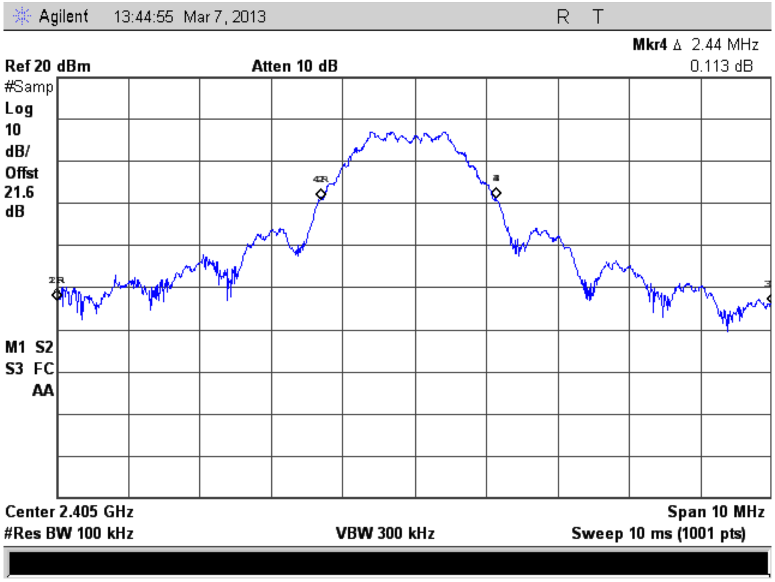

Figure 7.4.4.2-4: 99% OBW Low Channel – AP1

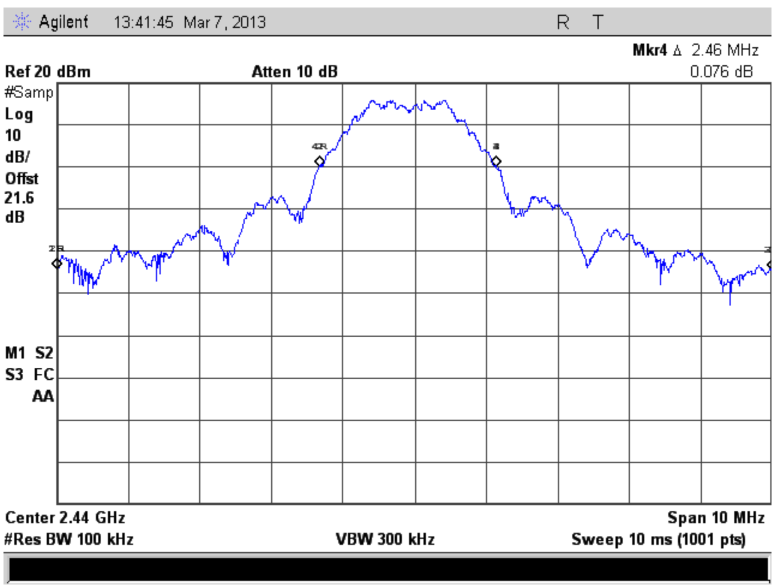

Figure 7.4.4.2-5: 99% OBW Middle Channel – AP1

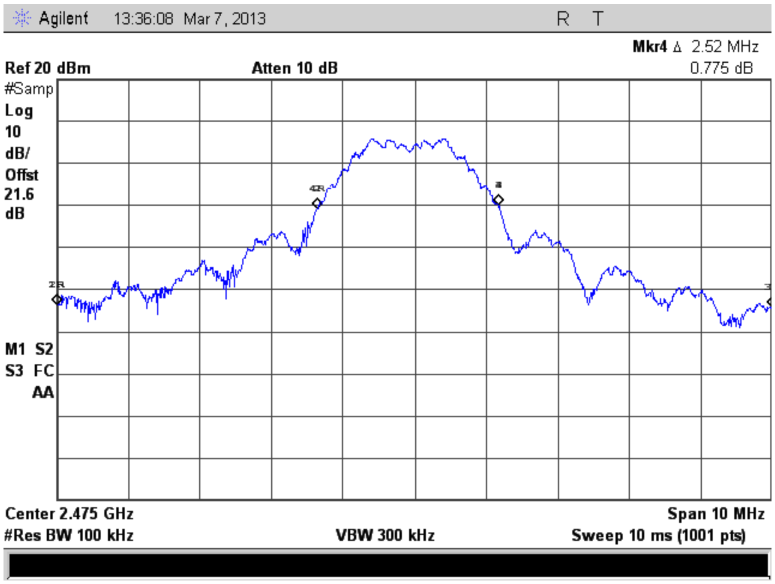

Figure 7.4.4.2-6: 99% OBW High Channel – AP1

Table 7.4.4.2-2: 20dB / 99% Bandwidth – AP2

Frequency [MHz]	20dB Bandwidth [kHz]	99% Bandwidth [kHz]
2405	2702	2420
2440	2765	2450
2475	2681	2510

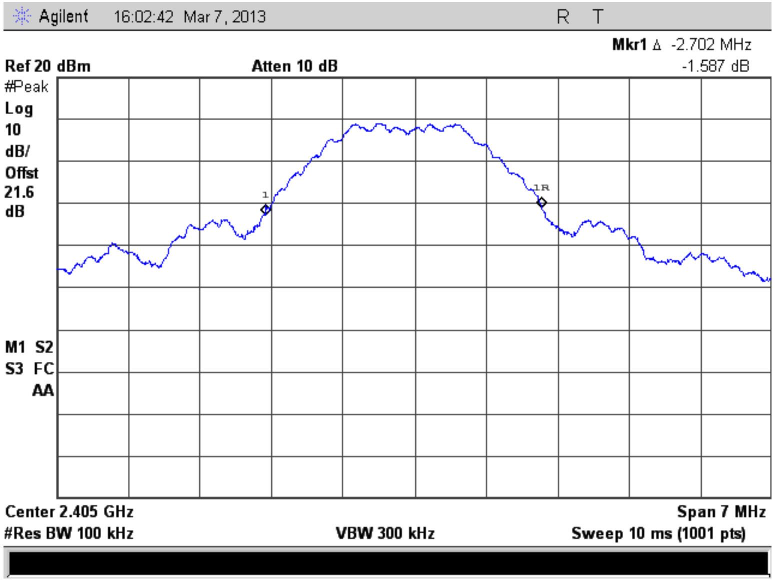

Figure 7.4.4.2-7: 20dB BW Low Channel – AP2

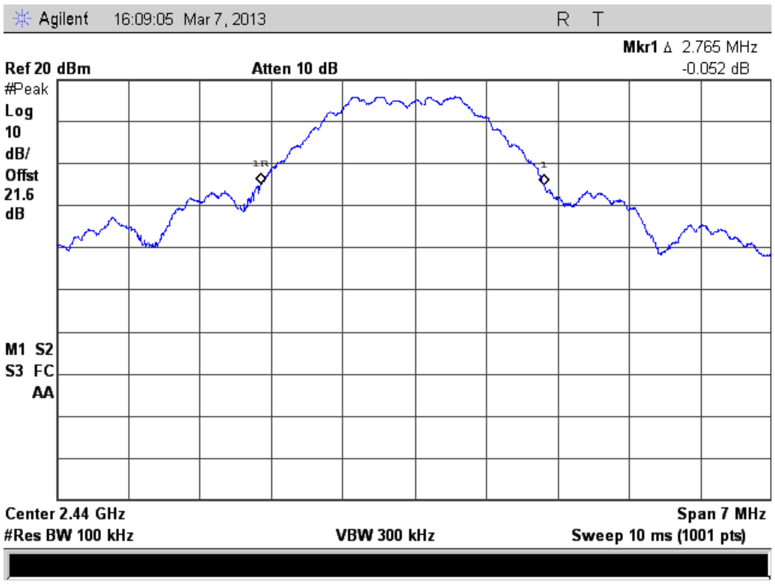

Figure 7.4.4.2-8: 20dB BW Middle Channel – AP2

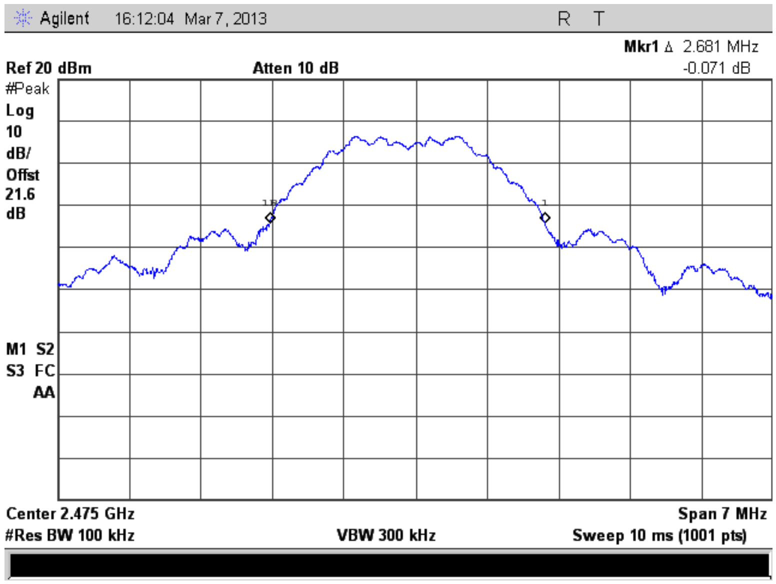

Figure 7.4.4.2-9: 20dB BW High Channel – AP2

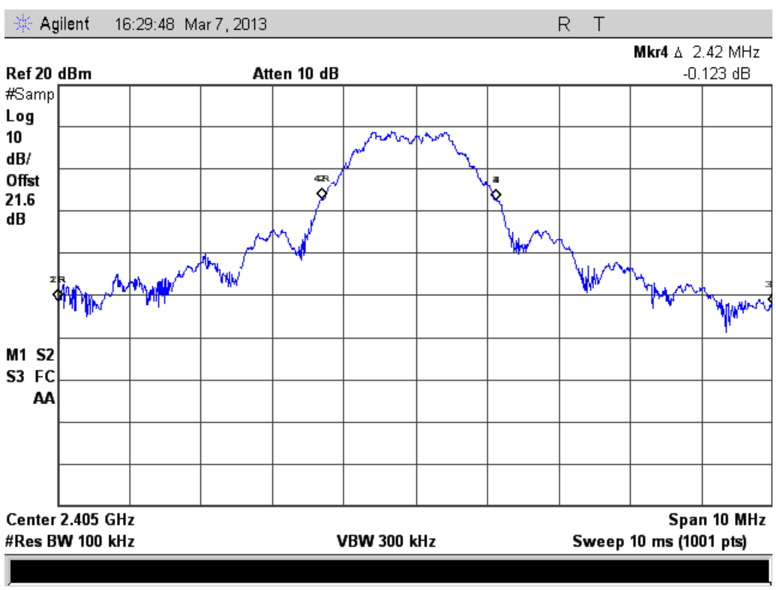

Figure 7.4.4.2-10: 99% OBW Low Channel AP2

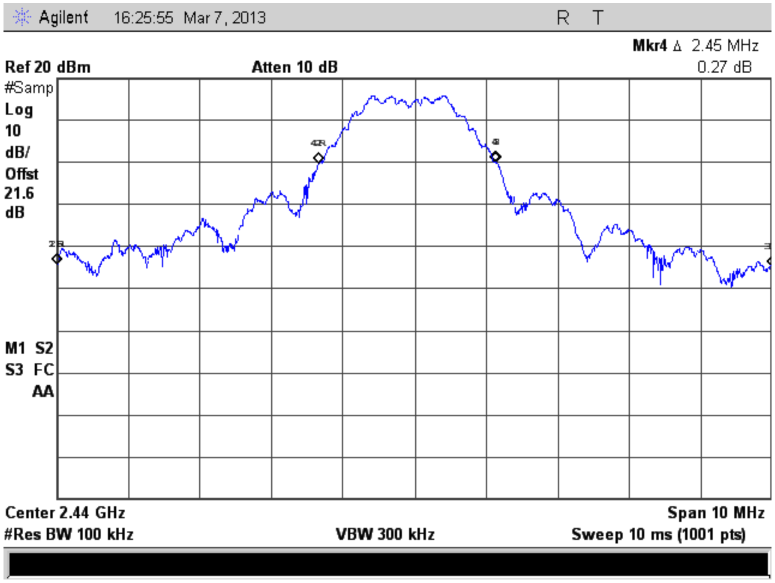

Figure 7.4.4.2-11: 99% OBW Middle Channel – AP2

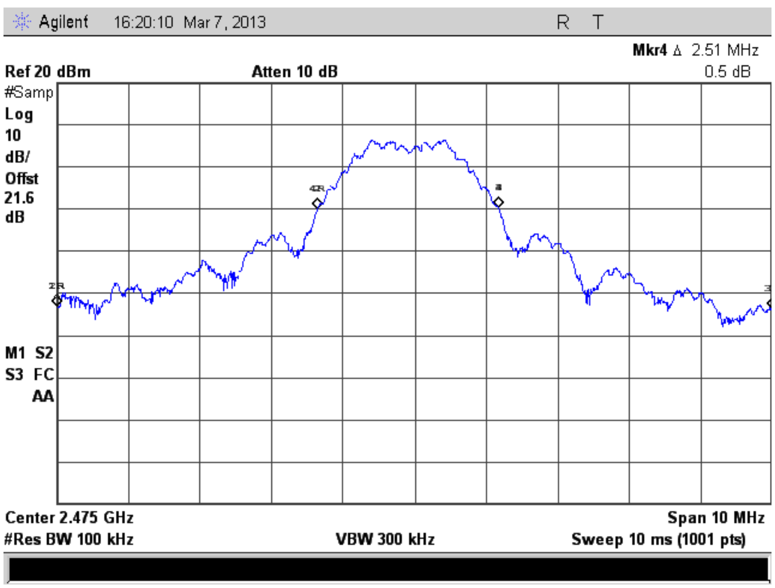

Figure 7.4.4.2-12: 99% OBW High Channel – AP2

Table 7.4.4.2-3: 20dB / 99% Bandwidth – AS1

Frequency [MHz]	20dB Bandwidth [kHz]	99% Bandwidth [kHz]
2405	2618	2360
2440	2632	2370
2475	2674	2450

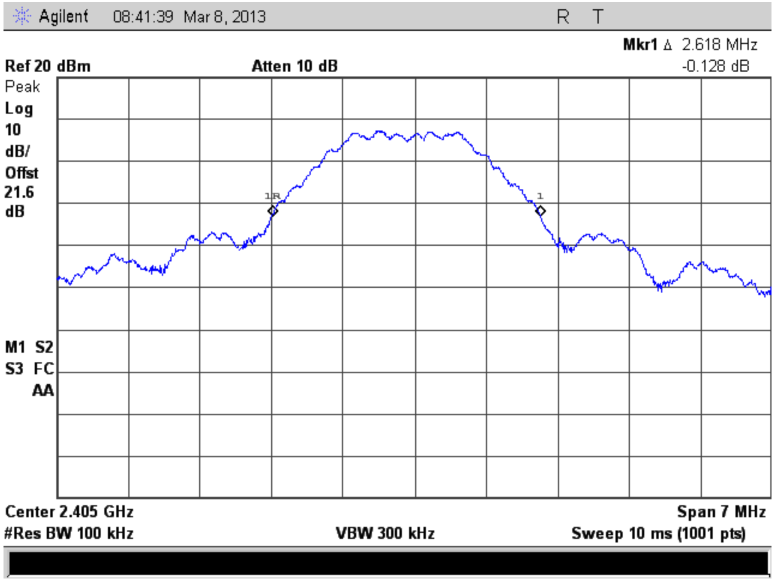

Figure 7.4.4.2-13: 20dB BW Low Channel – AS1

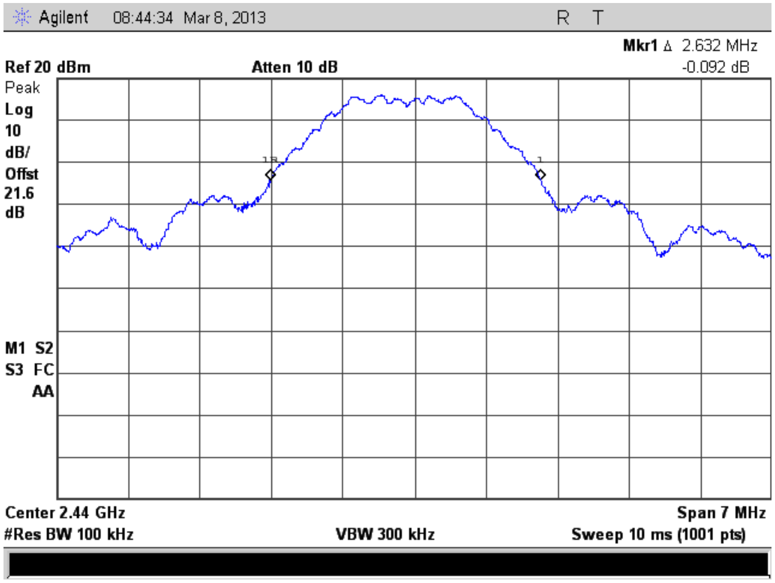

Figure 7.4.4.2-14: 20dB BW Middle Channel – AS1

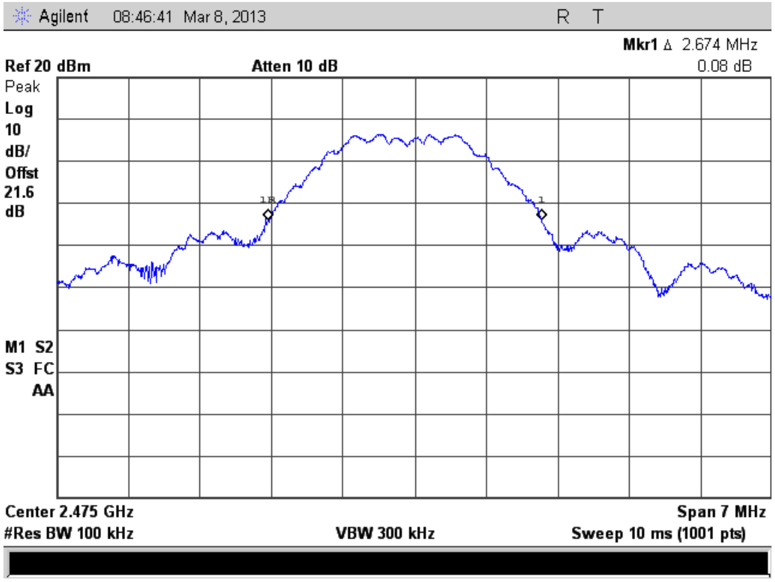

Figure 7.4.4.2-15: 20dB BW High Channel – AS1

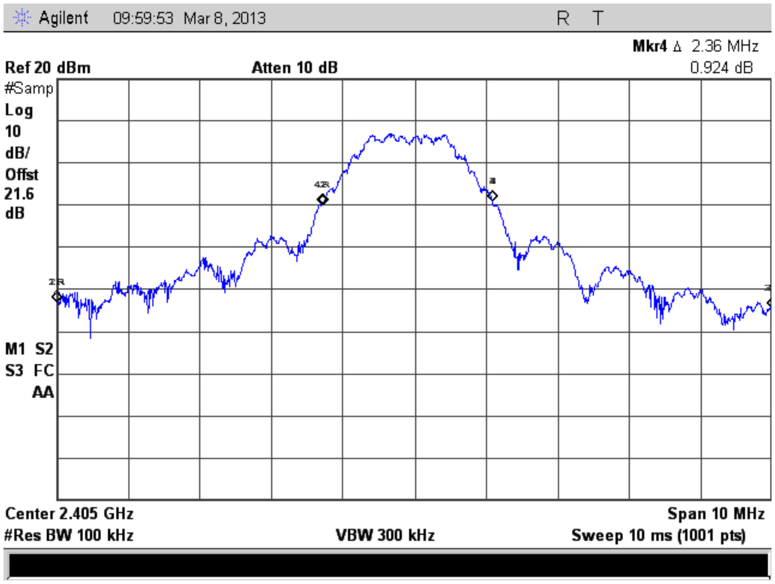

Figure 7.4.4.2-16: 99% OBW Low Channel – AS1

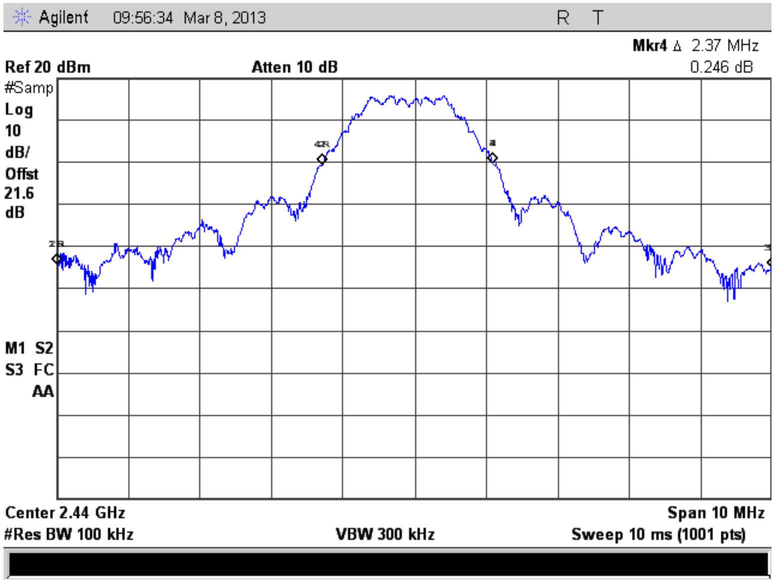

Figure 7.4.4.2-17: 99% OBW Middle Channel – AS1

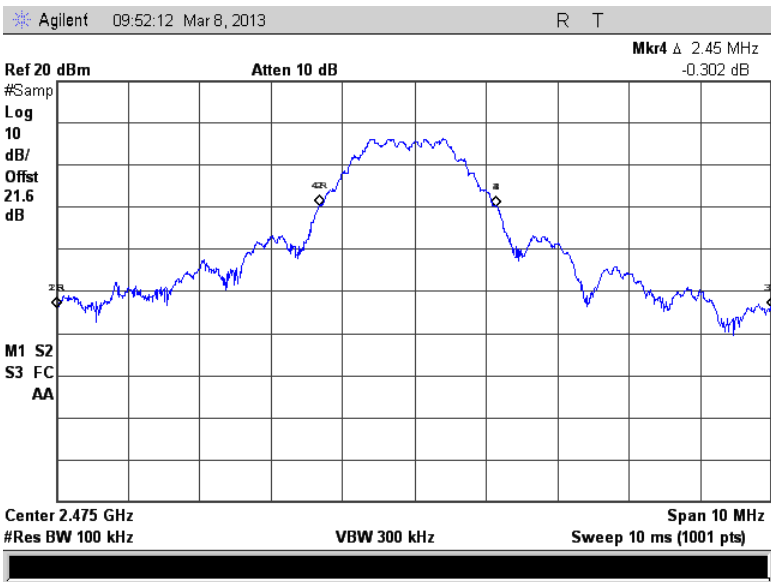

Figure 7.4.4.2-18: 99% OBW High Channel – AS1

Table 7.4.4.2-4: 20dB / 99% Bandwidth – AS2

Frequency [MHz]	20dB Bandwidth [kHz]	99% Bandwidth [kHz]
2405	2625	2350
2440	2632	2370
2475	2660	2420

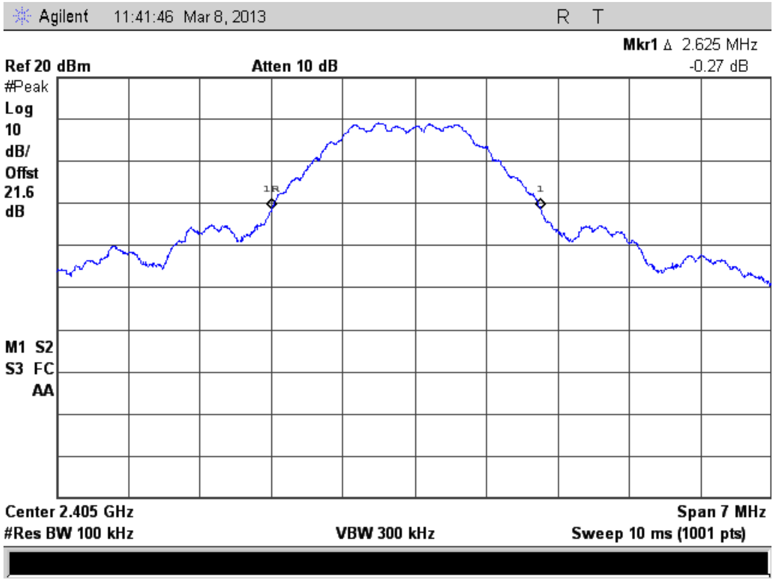

Figure 7.4.4.2-19: 20dB BW Low Channel – AS2

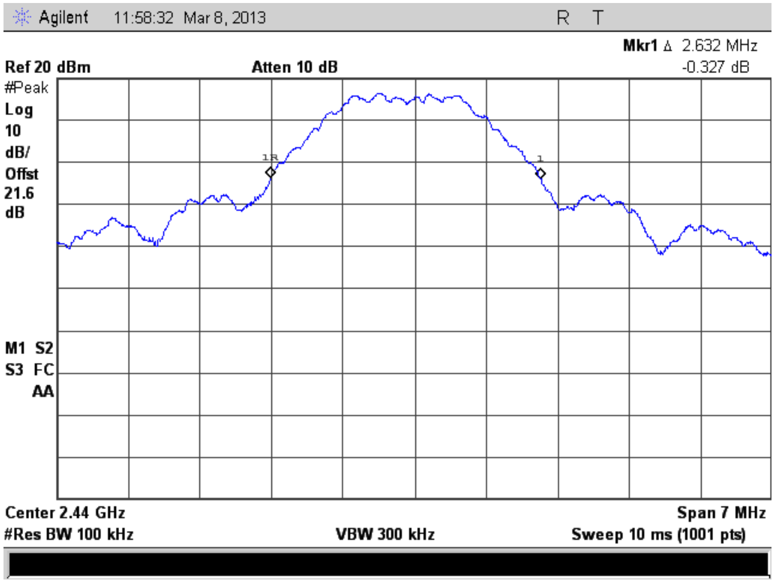

Figure 7.4.4.2-20: 20dB BW Middle Channel – AS2

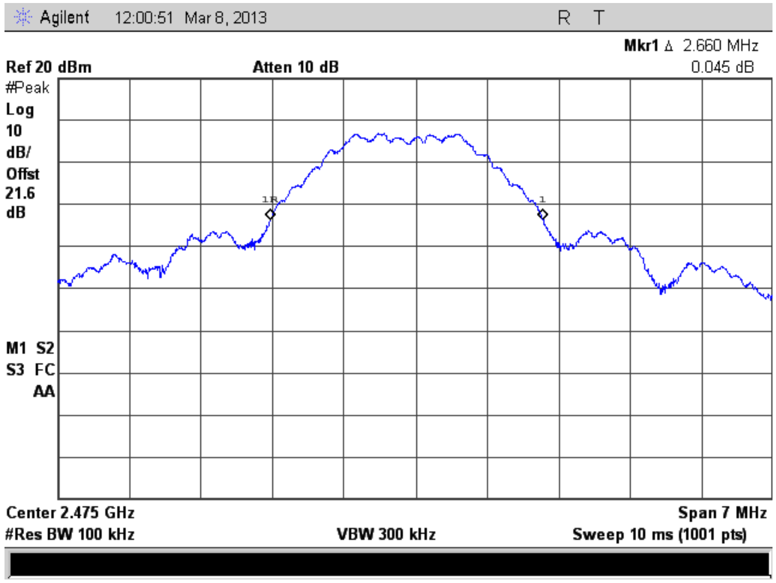

Figure 7.4.4.2-21: 20dB BW High Channel – AS2

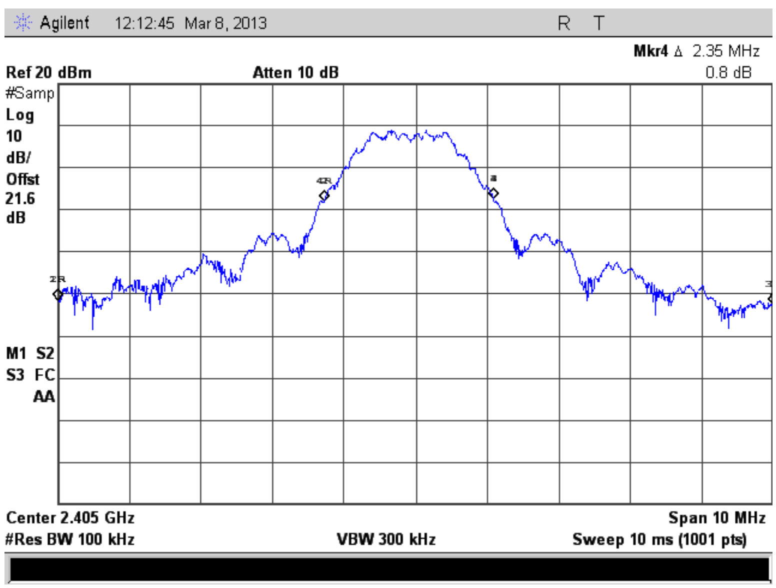

Figure 7.4.4.2-22: 99% OBW Low Channel – AS2

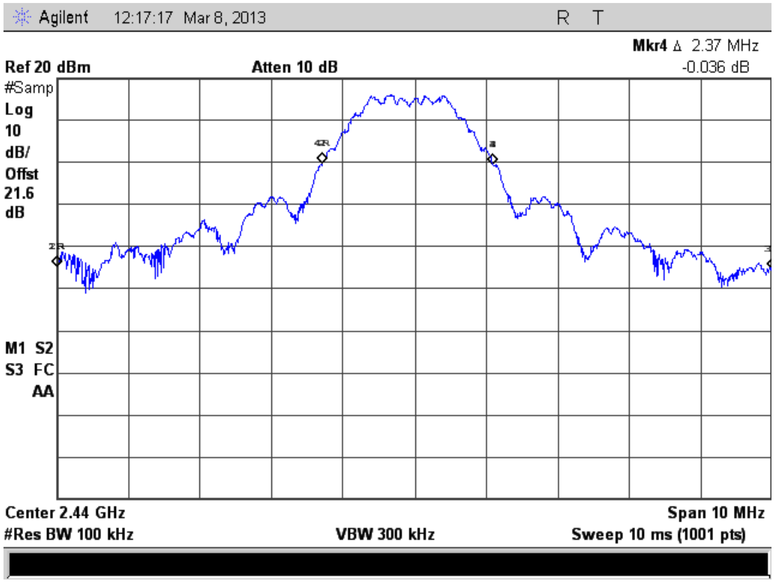

Figure 7.4.4.2-23: 99% OBW Middle Channel – AS2

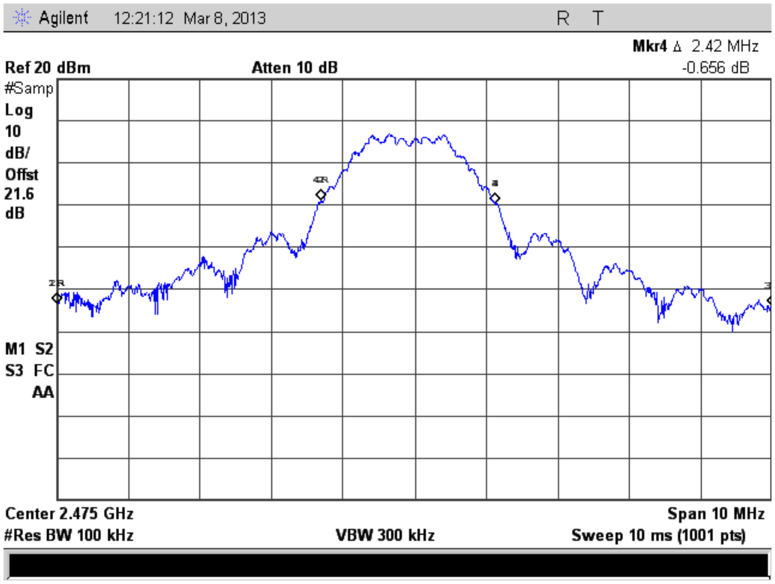

Figure 7.4.4.2-24: 99% OBW High Channel – AS2

7.5 Band-Edge Compliance and Spurious Emissions-FCC 15.247(d) IC:RSS-210 A8.5

7.5.1 Band-Edge Compliance of RF Conducted Emissions

7.5.1.1 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.

7.5.1.2 Measurement Results

Results are shown below.

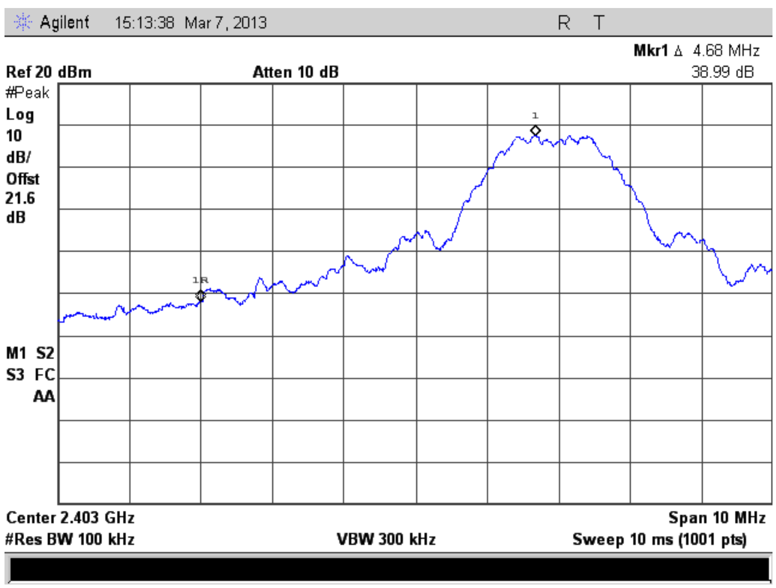

Figure 7.5.1.2-1: Lower Band-edge – Continuous Mode – AP1

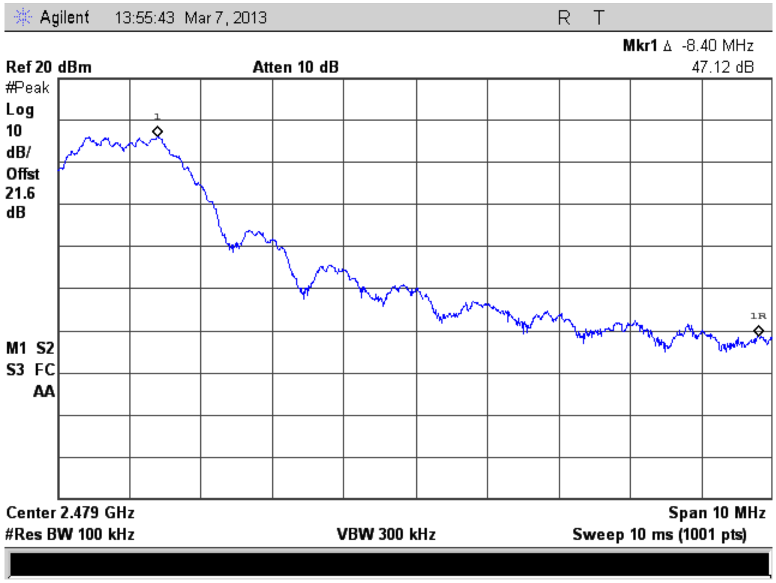

Figure 7.5.1.2-2: Upper Band-edge – Continuous Mode – AP1

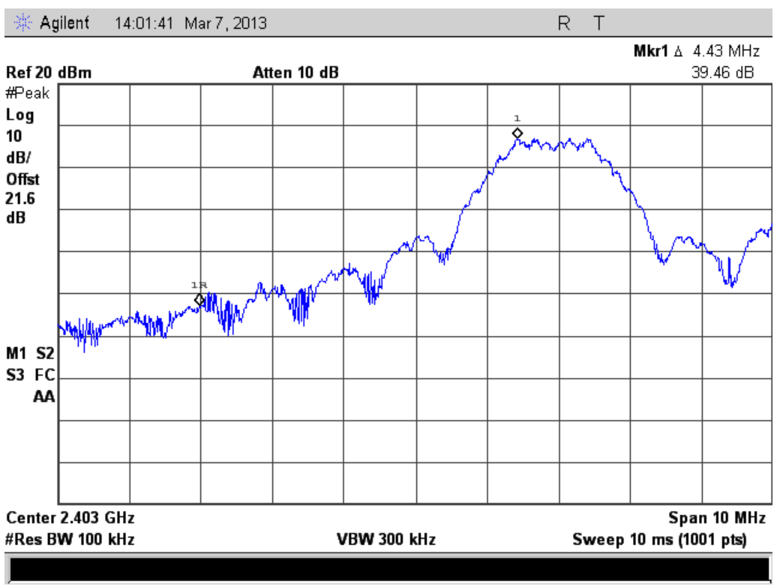

Figure 7.5.1.2-3: Lower Band-edge – Hopping Mode – AP1

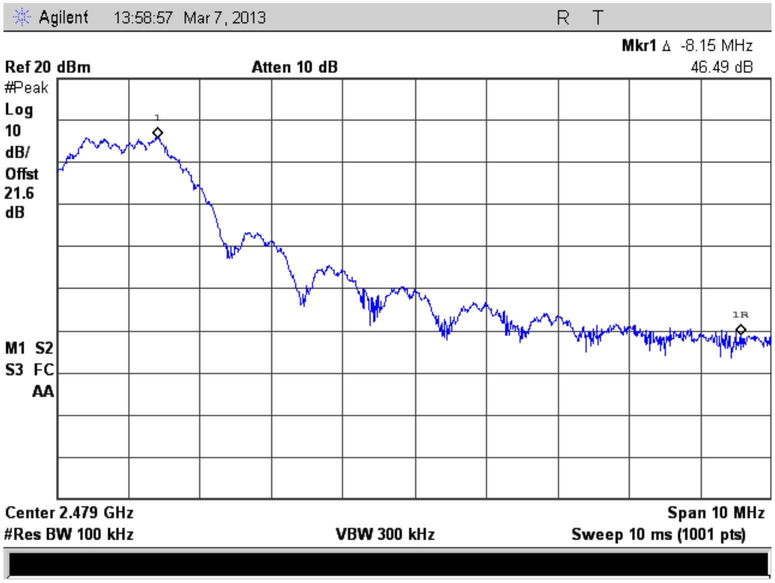

Figure 7.5.1.2-4: Upper Band-edge – Hopping Mode – AP1

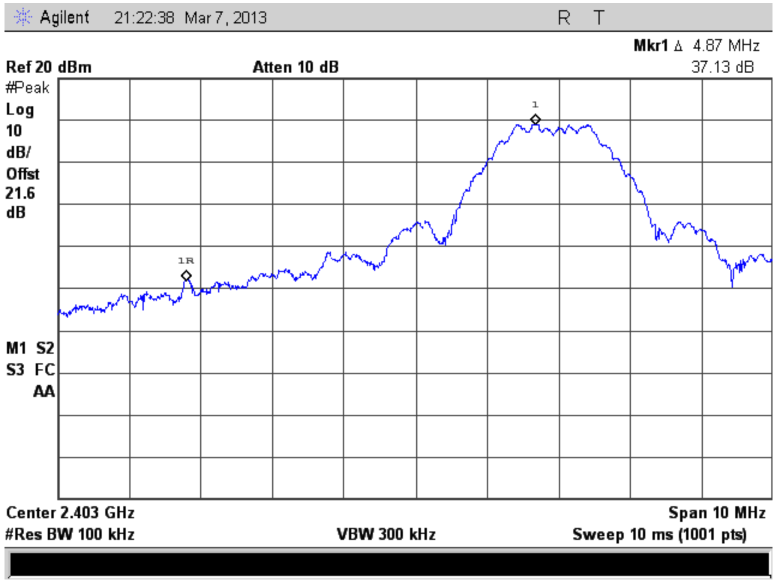

Figure 7.5.1.2-5: Lower Band-edge – Continuous Mode – AP2

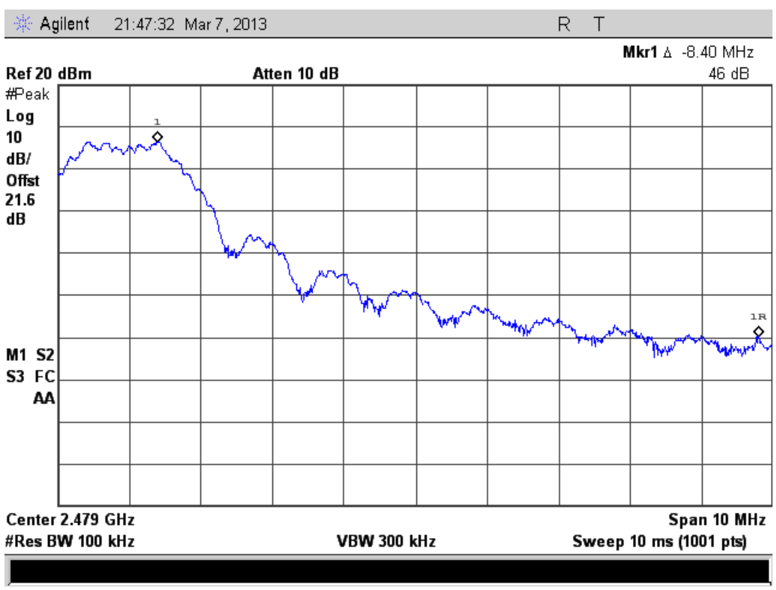

Figure 7.5.1.2-6: Upper Band-edge – Continuous Mode – AP2

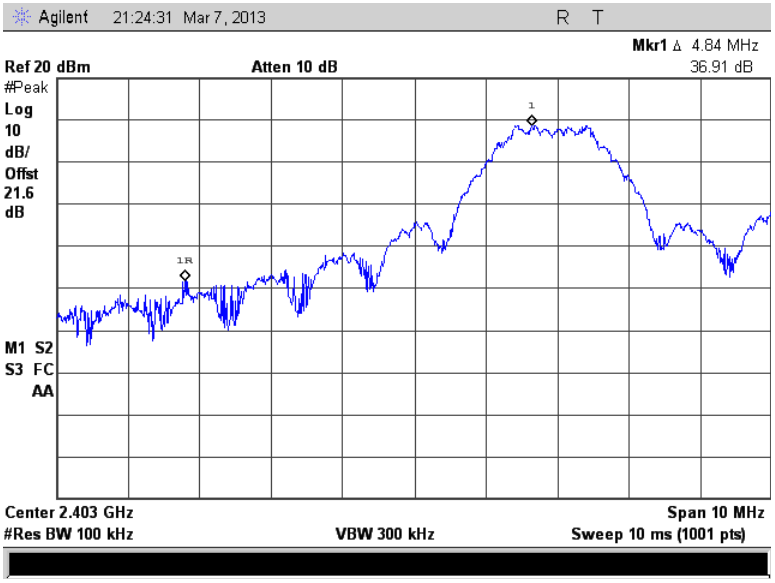

Figure 7.5.1.2-7: Lower Band-edge – Hopping Mode – AP2

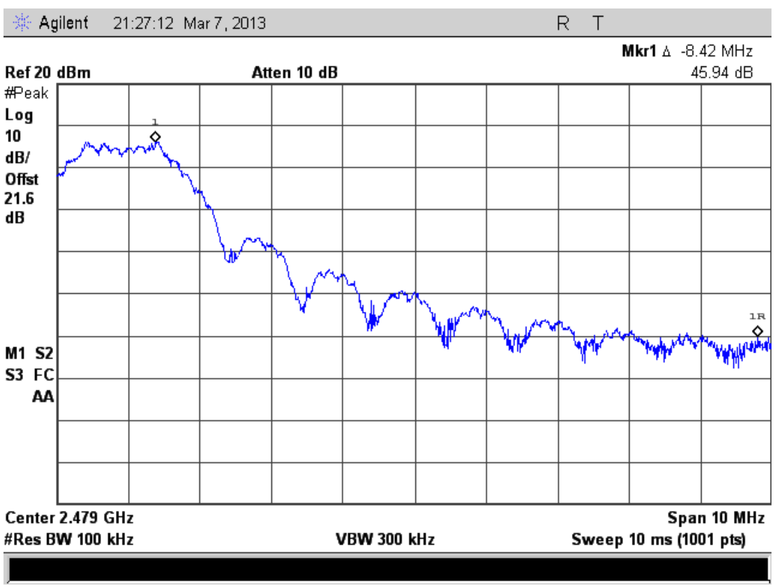

Figure 7.5.1.2-8: Upper Band-edge – Hopping Mode – AP2

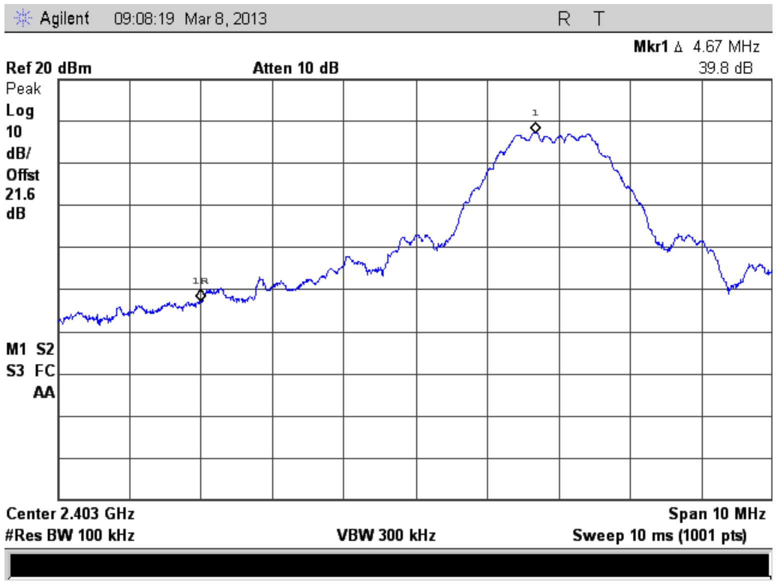

Figure 7.5.1.2-9: Lower Band-edge – Continuous Mode – AS1

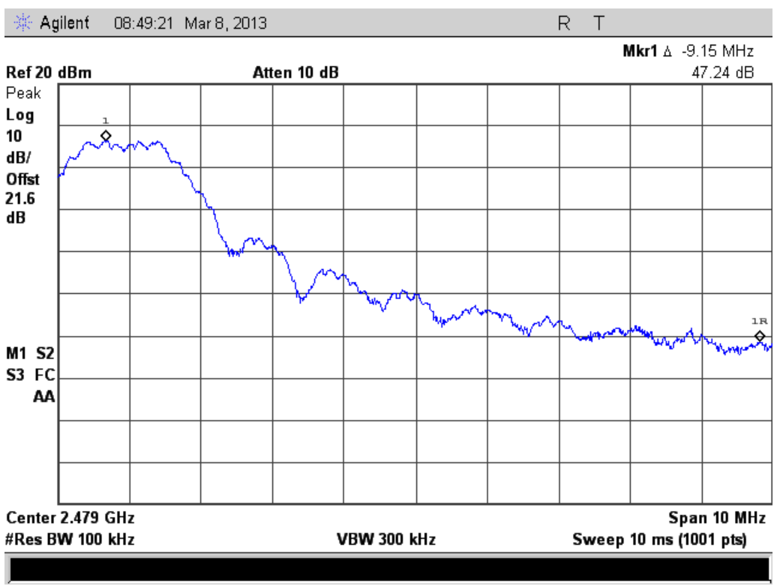

Figure 7.5.1.2-10: Upper Band-edge – Continuous Mode – AS1

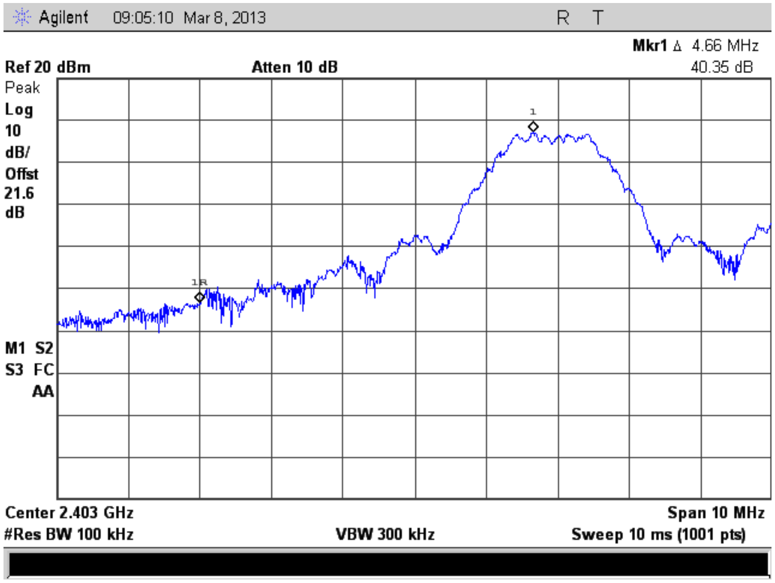

Figure 7.5.1.2-11: Lower Band-edge – Hopping Mode – AS1

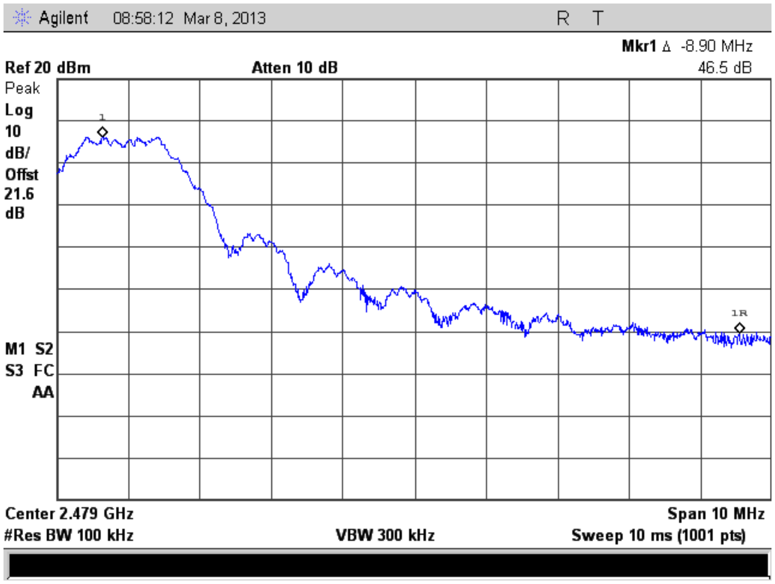

Figure 7.5.1.2-12: Upper Band-edge – Hopping Mode – AS1

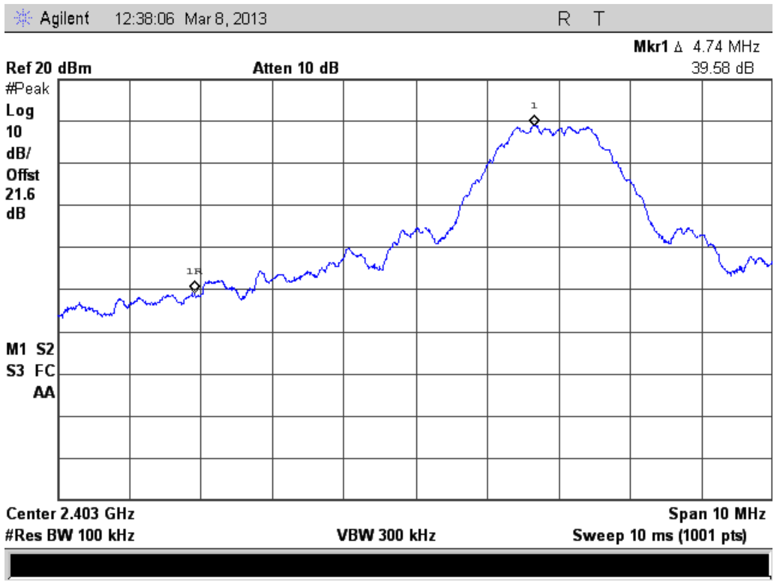

Figure 7.5.1.2-13: Lower Band-edge – Continuous Mode – AS2

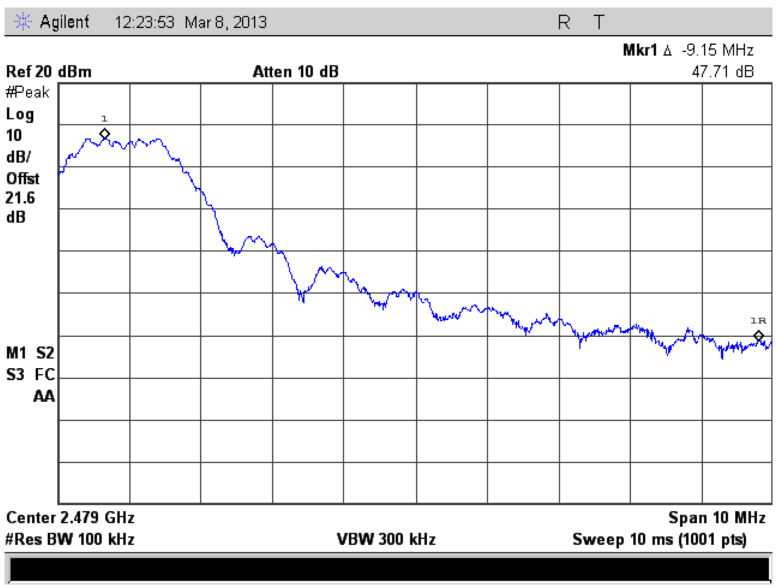

Figure 7.5.1.2-14: Upper Band-edge – Continuous Mode – AS2

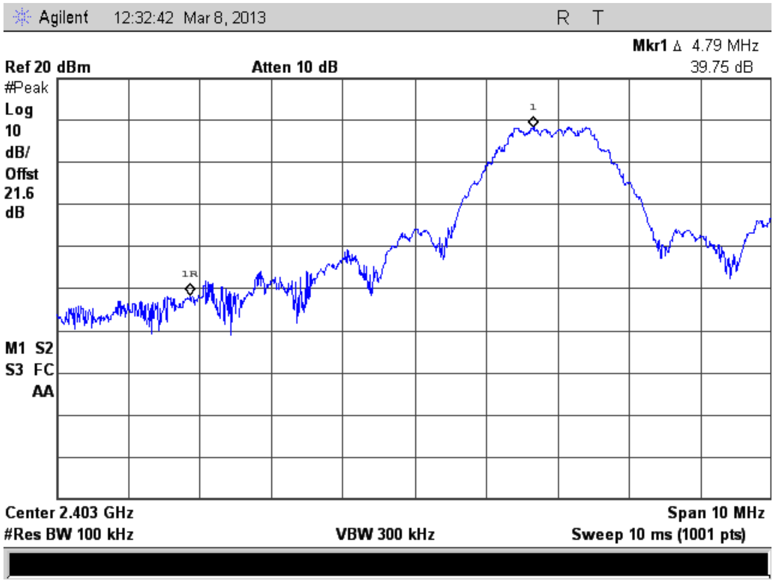

Figure 7.5.1.2-15: Lower Band-edge – Hopping Mode – AS2

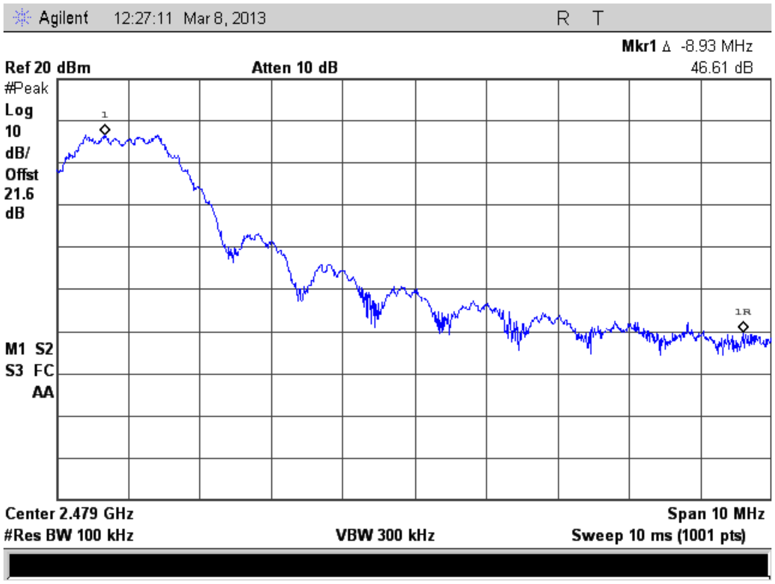

Figure 7.5.1.2-16: Upper Band-edge – Hopping Mode – AS2

7.5.2 RF Conducted Spurious Emissions

7.5.2.1 Measurement Procedure

The RF output port of the EUT was connected to the spectrum analyzer input using a 20 dB attenuator. The EUT was investigated for conducted spurious emissions from 30MHz 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. A peak detector function was used with the trace set to max hold. The levels were corrected for cable and attenuator losses.

7.5.2.2 Measurement Results

Results are shown below.

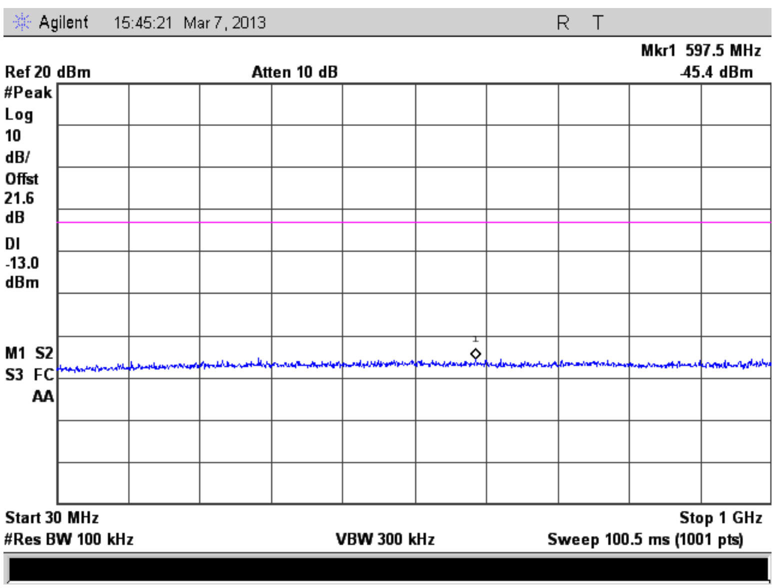

Figure 7.5.2.2-1: 30 MHz – 1 GHz – Low Channel – AP1

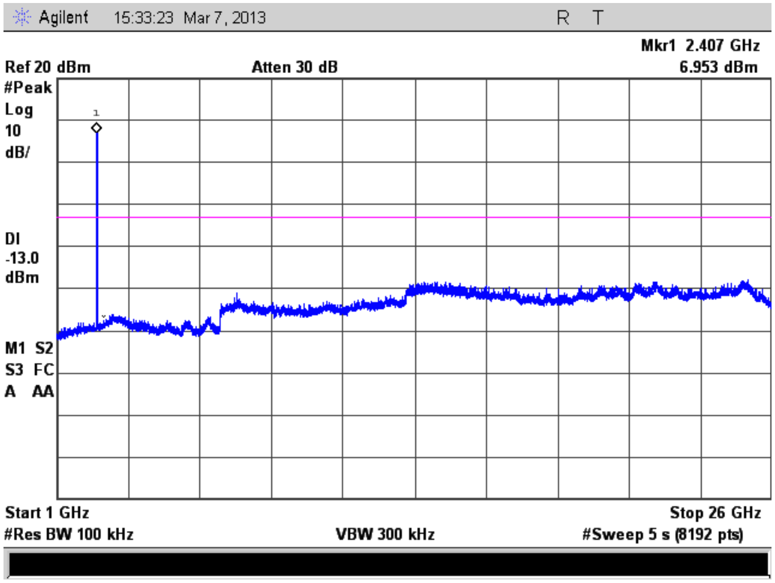

Figure 7.5.2.2-2: 1 GHz –26 GHz – Low Channel – AP1

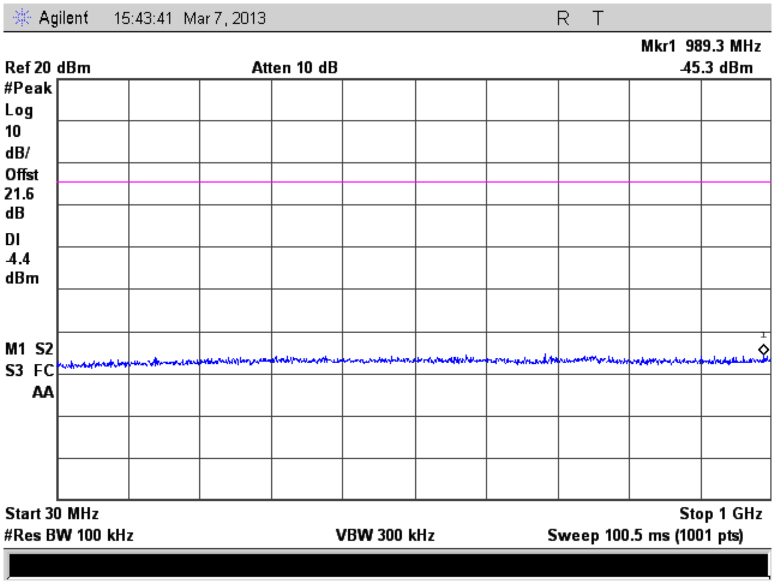

Figure 7.5.2.2-3: 30 MHz – 1 GHz – Middle Channel – AP1

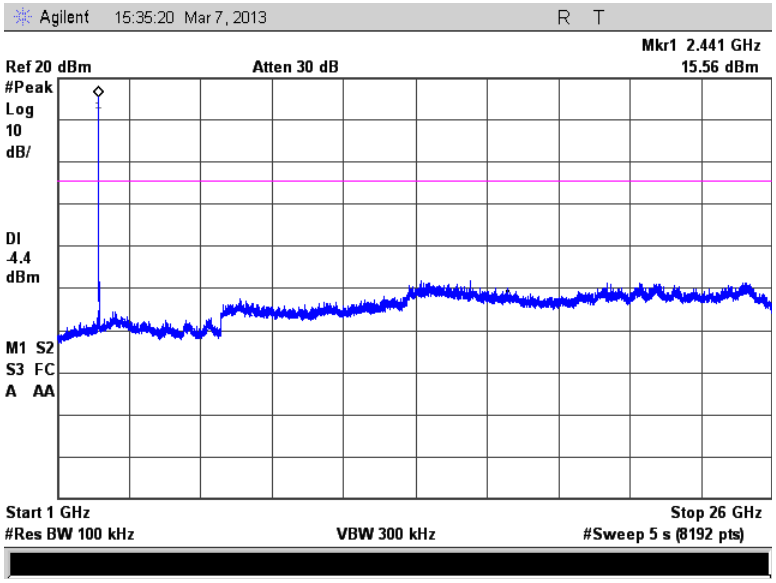

Figure 7.5.2.2-4: 1 GHz –26 GHz – Middle Channel – AP1

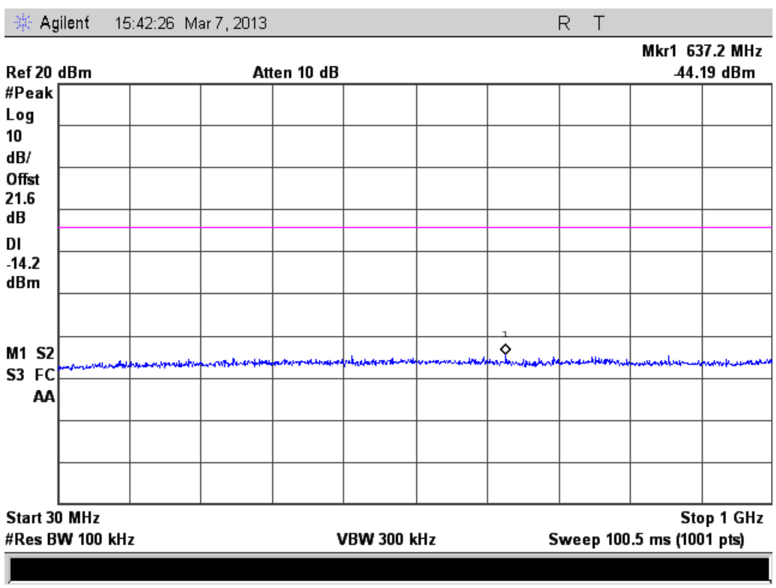

Figure 7.5.2.2-5: 30 MHz – 1 GHz – High Channel – AP1

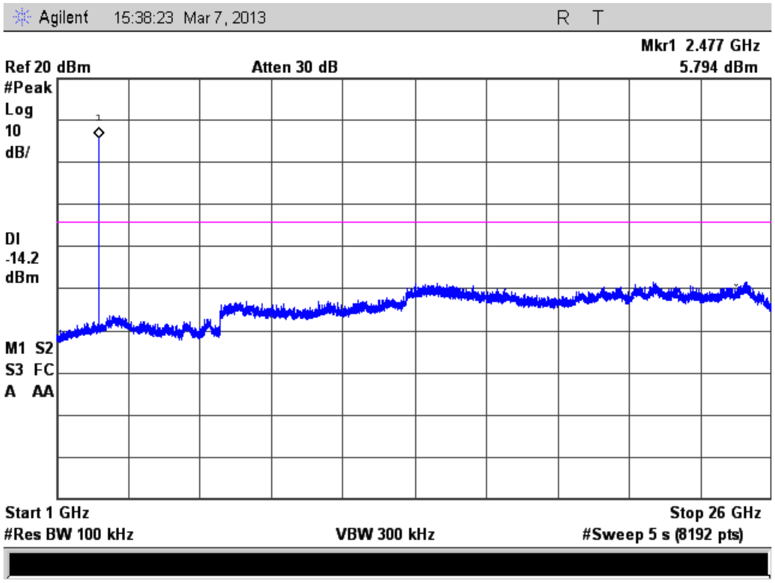

Figure 7.5.2.2-6: 1 GHz –26 GHz – High Channel – AP1

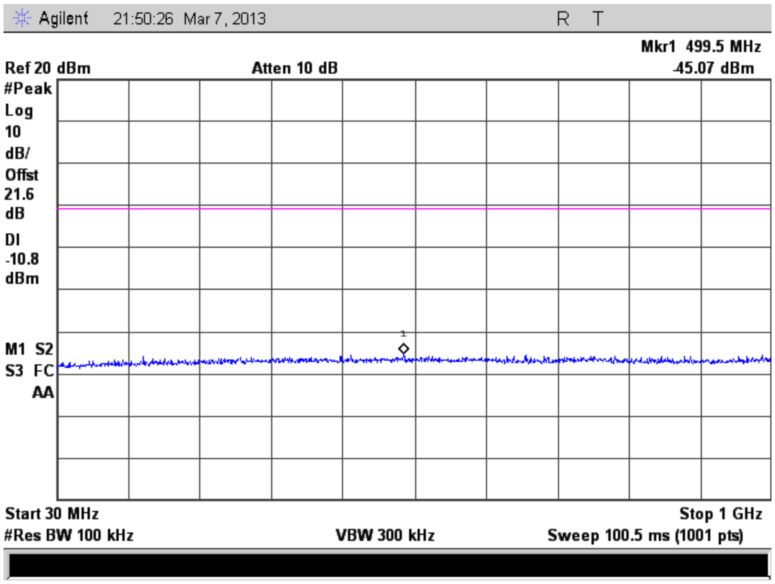

Figure 7.5.2.2-7: 30 MHz – 1 GHz – Low Channel – AP2

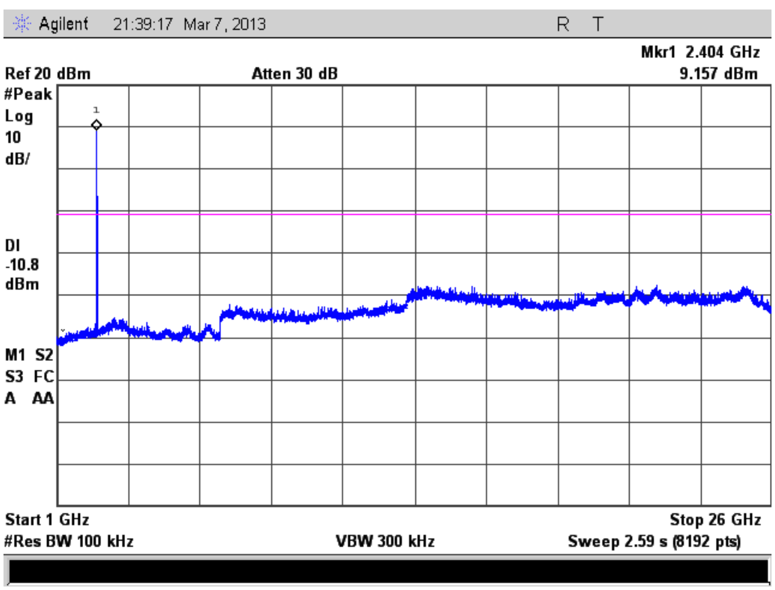

Figure 7.5.2.2-8: 1 GHz –26 GHz – Low Channel – AP2

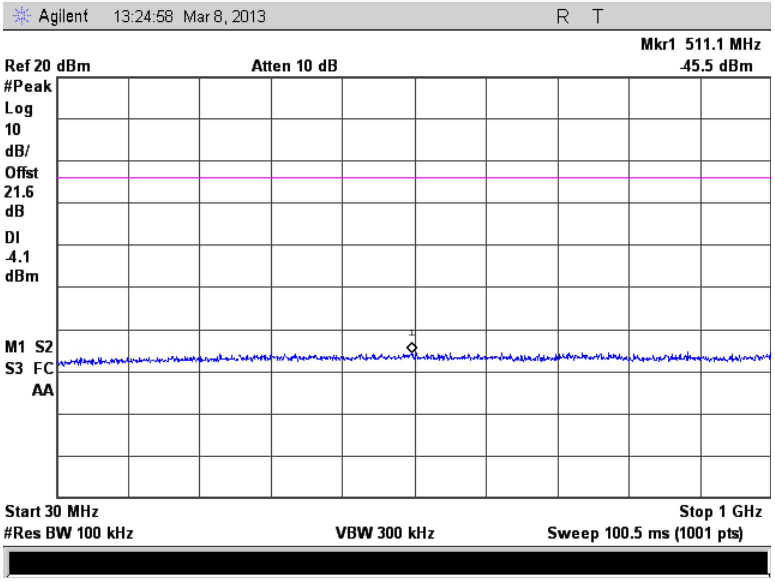

Figure 7.5.2.2-9: 30 MHz – 1 GHz – Middle Channel – AP2

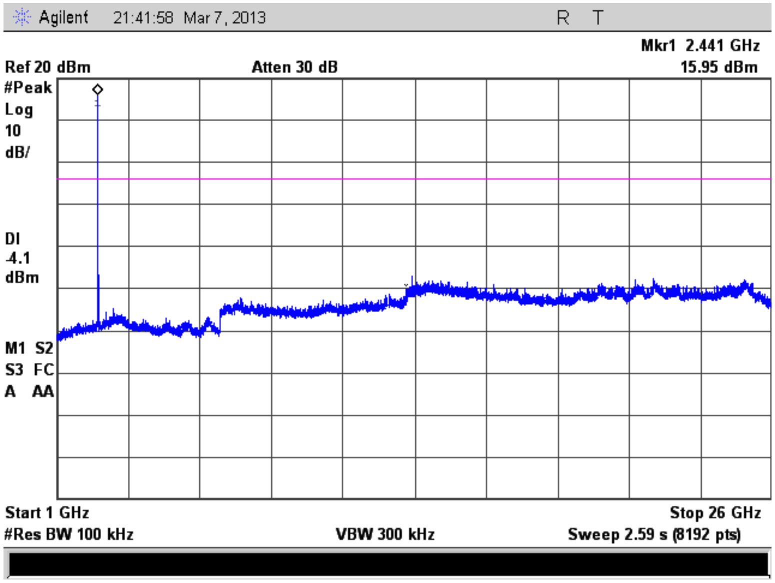

Figure 7.5.2.2-10: 1 GHz –26 GHz – Middle Channel – AP2

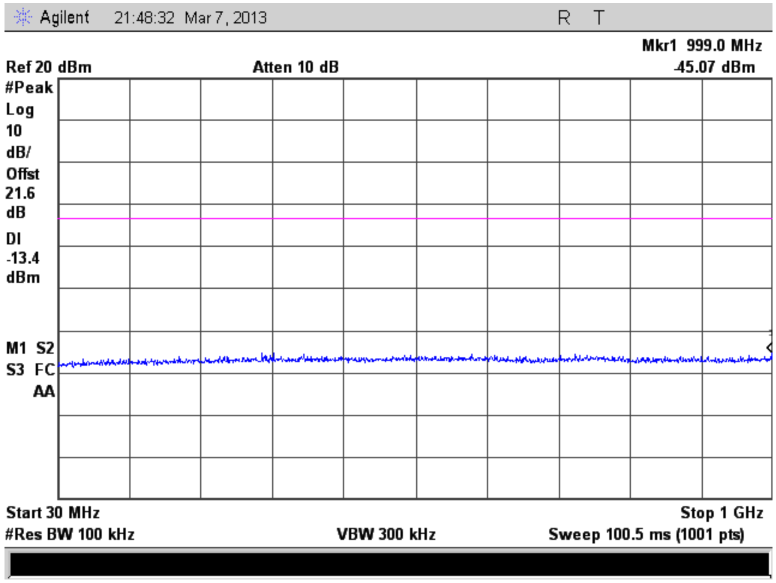

Figure 7.5.2.2-11: 30 MHz – 1 GHz – High Channel – AP2

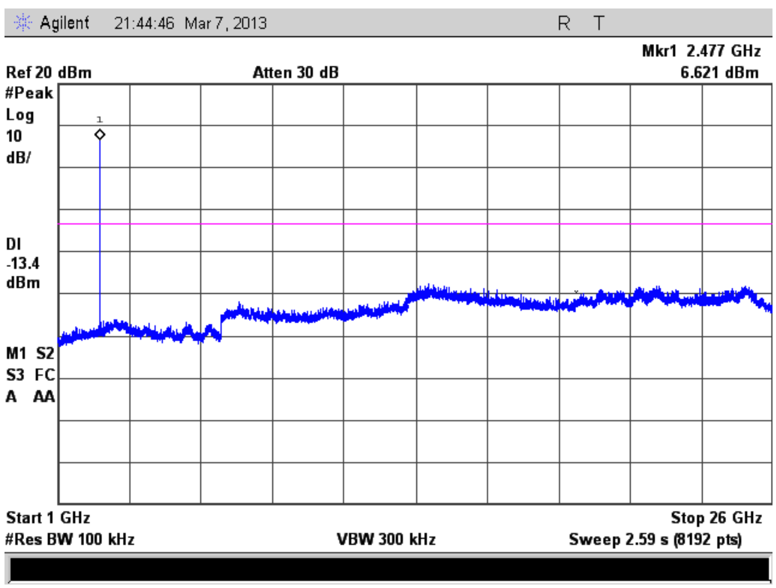

Figure 7.5.2.2-12: 1 GHz –26 GHz – High Channel – AP2

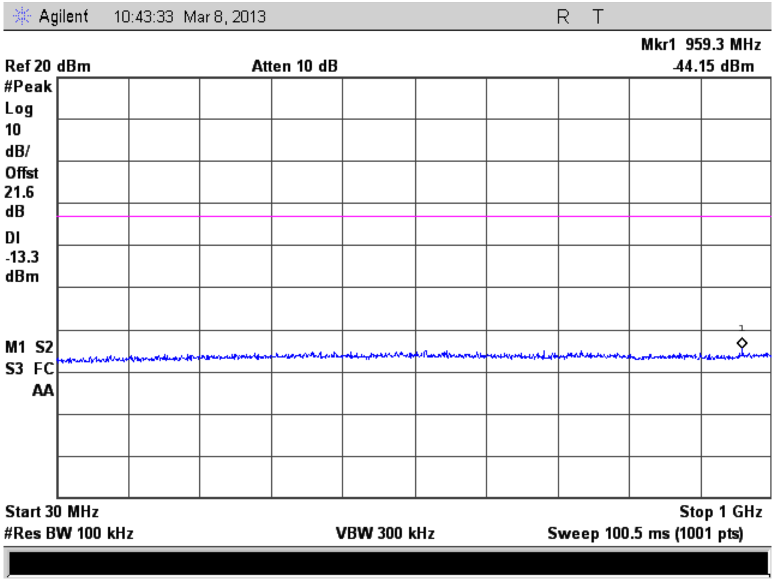

Figure 7.5.2.2-13: 30 MHz – 1 GHz – Low Channel – AS1

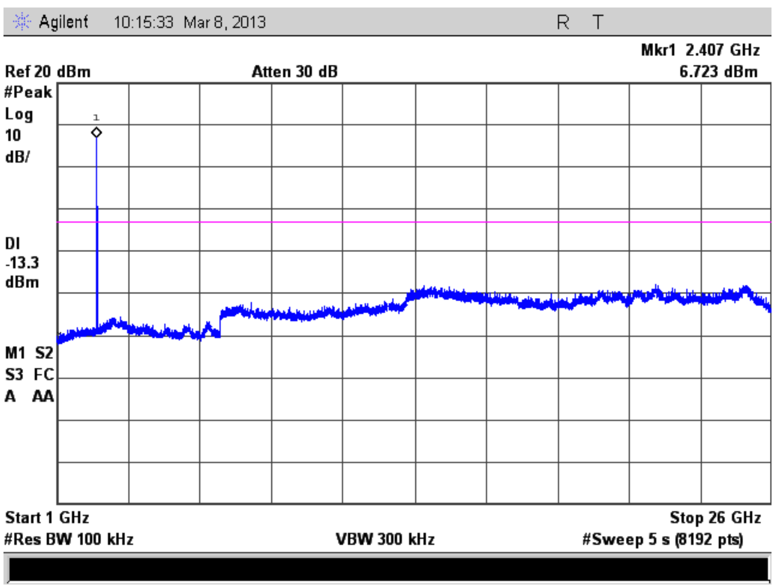

Figure 7.5.2.2-14: 1 GHz –26 GHz – Low Channel – AS1

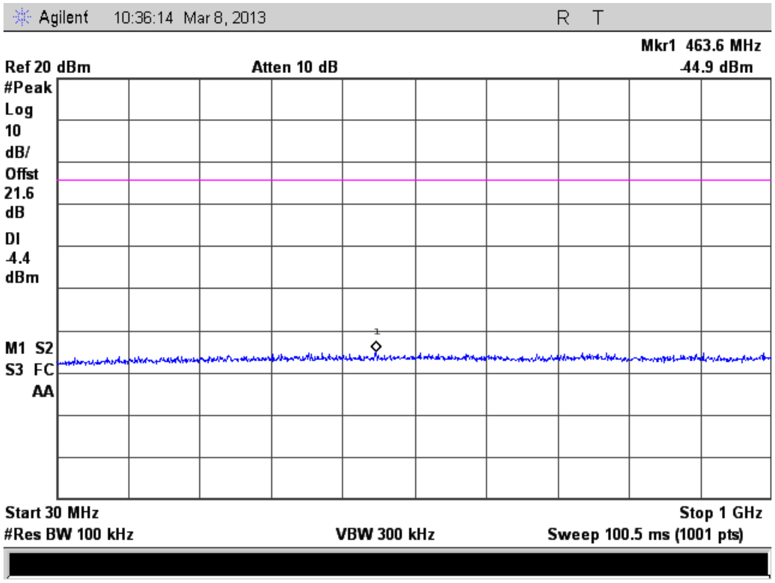

Figure 7.5.2.2-15: 30 MHz – 1 GHz – Middle Channel – AS1

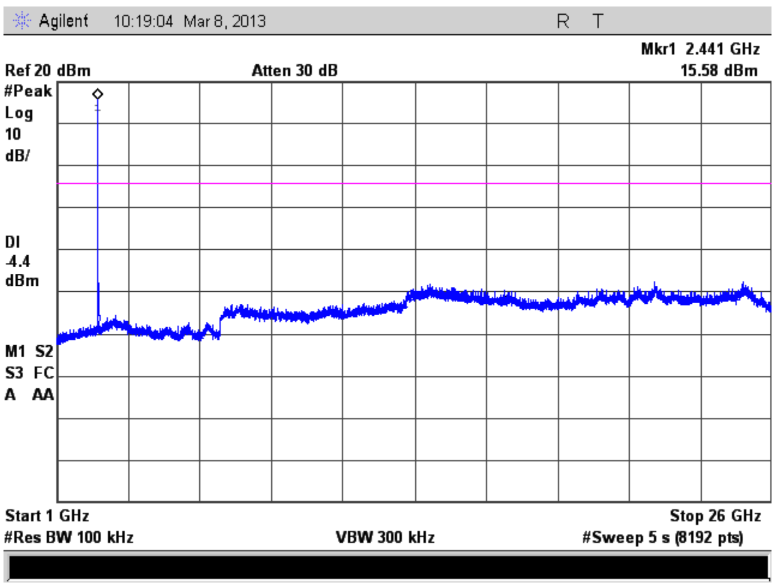

Figure 7.5.2.2-16: 1 GHz –26 GHz – Middle Channel – AS1

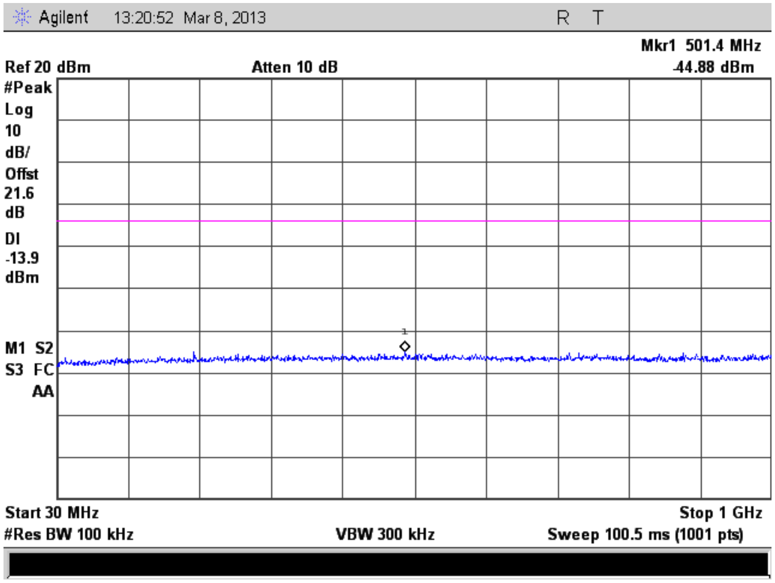

Figure 7.5.2.2-17: 30 MHz – 1 GHz – High Channel – AS1

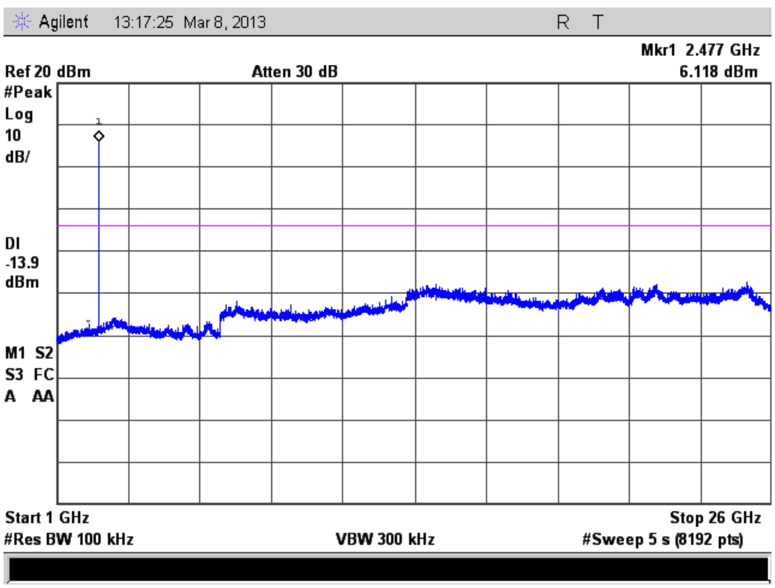

Figure 7.5.2.2-18: 1 GHz –26 GHz – High Channel – AS1

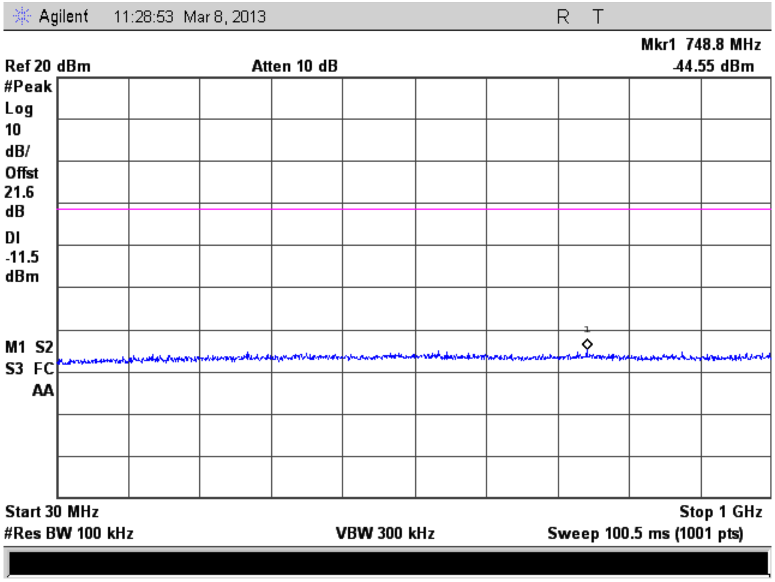

Figure 7.5.2.2-19: 30 MHz – 1 GHz – Low Channel – AS2

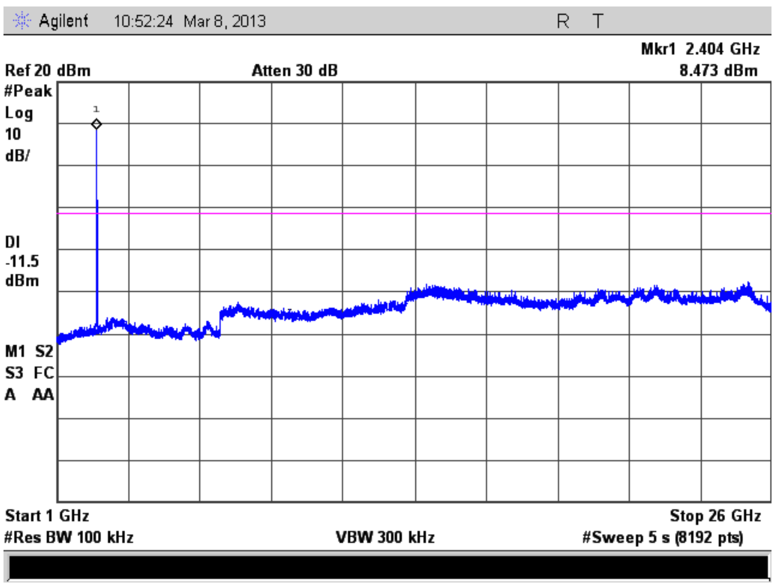

Figure 7.5.2.2-20: 1 GHz –26 GHz – Low Channel – AS2

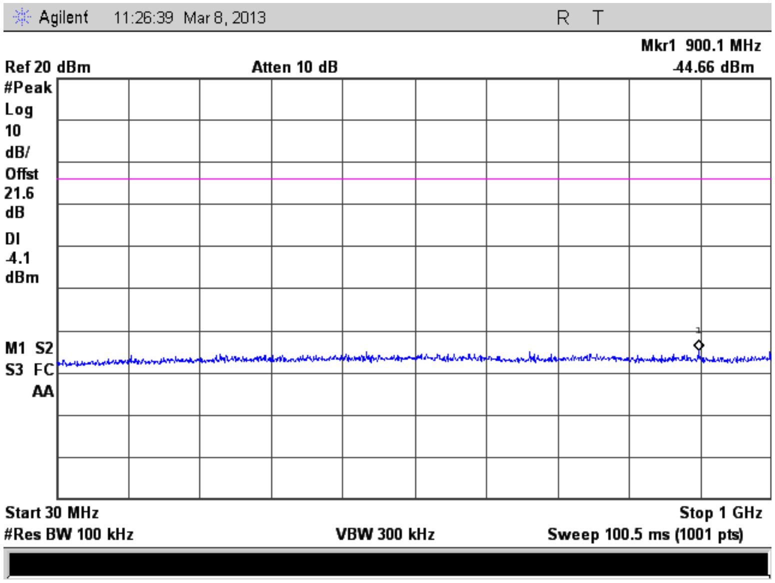

Figure 7.5.2.2-21: 30 MHz – 1 GHz – Middle Channel – AS2

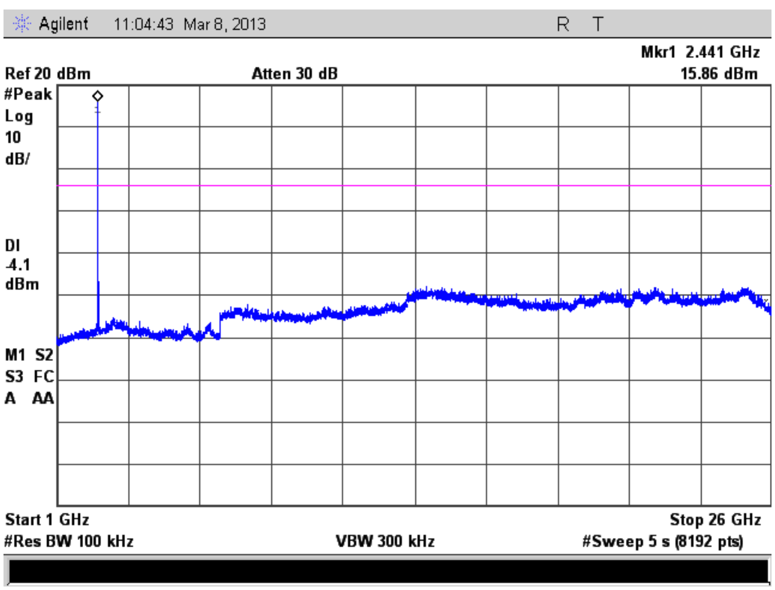

Figure 7.5.2.2-22: 1 GHz –26 GHz – Middle Channel – AS2

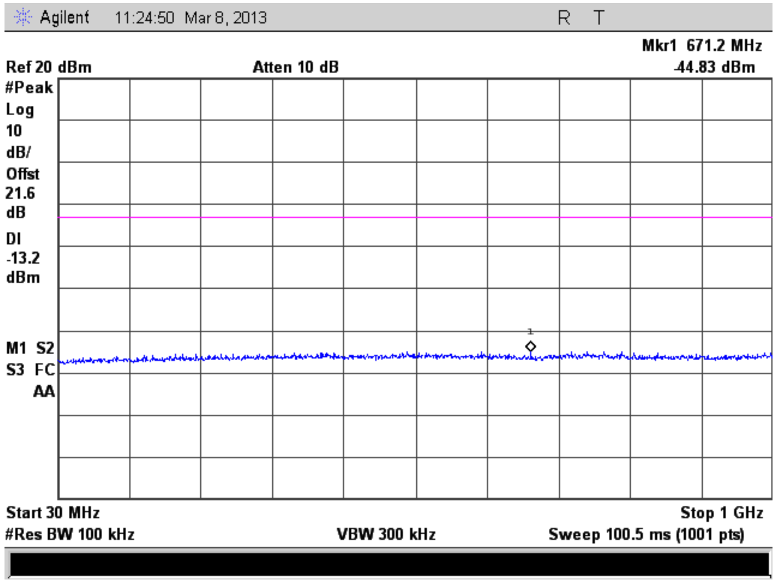

Figure 7.5.2.2-23: 30 MHz – 1 GHz – High Channel – AS2

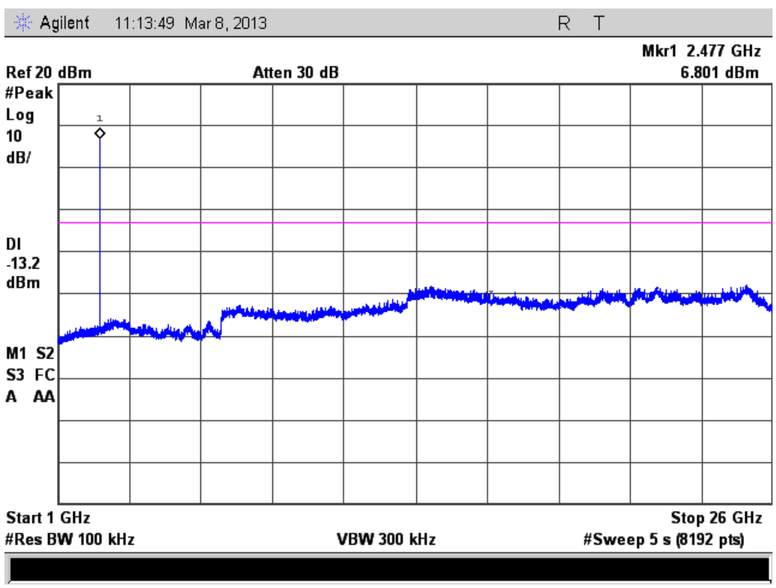

Figure 7.5.2.2-24: 1 GHz –26 GHz – High Channel – AS2

7.5.3 Radiated Spurious Emissions - FCC Section 15.205 IC: RSS-Gen 7.2.5

7.5.3.1 Measurement Procedure

Radiated emissions tests were made over the frequency range of 30 MHz to 26 GHz, 10 times the highest fundamental frequency.

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 1000MHz, 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 and average measurements made with RBW and VBW of 1 MHz and 3 MHz respectively.

The EUT was caused to generate a continuous carrier signal on the hopping channel. The average measurements were corrected using the logarithm of the dwell time over 100 ms period.

7.5.3.2 Measurement Results

Band-edge and radiated spurious emissions found in the band of 30MHz to 26 GHz are reported in the tables below.

Table 7.5.3.2-1: Radiated Spurious Emissions Tabulated Data – AP1

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	79.84	57.70	H	-9.03	70.81	14.99	74.0	54.0	3.2	39.0
2390	67.91	47.70	V	-9.03	58.88	4.99	74.0	54.0	15.1	49.0
4810	53.36	43.20	H	-2.23	51.13	7.36	74.0	54.0	22.9	46.6
4810	54.11	45.80	V	-2.23	51.88	9.96	74.0	54.0	22.1	44.0
19240	43.64	31.17	V	9.25	52.89	6.81	83.5	63.5	30.6	56.7
Middle Channel (2440 MHz)										
4880	54.91	47.13	H	-1.27	53.64	12.18	74.0	54.0	20.4	41.8
4880	59.29	52.17	V	-1.27	58.02	17.22	74.0	54.0	16.0	36.8
7320	56.44	47.73	H	3.20	59.64	17.25	74.0	54.0	14.4	36.8
7320	57.46	49.26	V	3.20	60.66	18.78	74.0	54.0	13.3	35.2
12200	47.39	35.71	H	11.12	58.51	13.15	83.5	63.5	25.0	50.4
12200	51.75	41.91	V	11.12	62.87	19.35	83.5	63.5	20.6	44.2
19520	44.30	33.14	H	9.51	53.81	8.97	83.5	63.5	29.7	54.5
19520	46.54	36.01	V	9.51	56.05	11.84	83.5	63.5	27.4	51.7
High Channel (2475 MHz)										
2483.5	80.61	63.45	H	-8.66	71.95	21.11	74.0	54.0	2.0	32.9
2483.5	69.89	53.20	V	-8.66	61.23	10.86	74.0	54.0	12.8	43.1
4950	50.18	39.73	H	-2.10	48.08	3.95	74.0	54.0	25.9	50.1
4950	52.28	43.09	V	-2.10	50.18	7.31	74.0	54.0	23.8	46.7
7425	47.44	34.64	H	3.49	50.93	4.45	74.0	54.0	23.1	49.6
7425	49.57	37.40	V	3.49	53.06	7.21	74.0	54.0	20.9	46.8
12375	45.32	33.37	H	11.72	57.04	11.40	83.5	63.5	26.5	52.1
12375	48.78	37.91	V	11.72	60.50	15.94	83.5	63.5	23.0	47.6

Notes:

- The average measurements were further corrected using a duty cycle correction factor corresponding to the logarithm of the dwell time over 100 ms = 20*log(2.07/100) ≈ -33.68 dB.
- The emissions above 10 GHz were measured at a distance of 1m. The limits are corrected accordingly using a distance factor of 20*log(3/1) ≈ 9.5 dB.
- All emissions above 19520 MHz were attenuated below the limits and the noise floor of the measurement equipment.

Table 7.5.3.2-2: Radiated Spurious Emissions Tabulated Data – AP2

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	78.26	55.74	H	-9.03	69.23	13.03	74.0	54.0	4.8	41.0
2390	77.06	54.26	V	-9.03	68.03	11.55	74.0	54.0	6.0	42.5
4810	49.19	38.51	H	-2.23	46.96	2.60	74.0	54.0	27.0	51.4
4810	49.34	38.84	V	-2.23	47.11	2.93	74.0	54.0	26.9	51.1
12025	44.31	31.75	H	11.75	56.06	9.82	83.5	63.5	27.4	53.7
12025	46.88	33.20	V	11.75	58.63	11.27	83.5	63.5	24.9	52.2
Middle Channel (2440 MHz)										
4880	47.27	35.98	H	-1.27	46.00	1.03	74.0	54.0	28.0	53.0
4880	50.23	39.80	V	-1.27	48.96	4.85	74.0	54.0	25.0	49.2
7320	55.92	47.05	H	3.20	59.12	16.57	74.0	54.0	14.9	37.4
7320	58.36	50.14	V	3.20	61.56	19.66	74.0	54.0	12.4	34.3
12200	45.53	33.43	H	11.12	56.65	10.87	83.5	63.5	26.9	52.6
12200	46.87	35.47	V	11.12	57.99	12.91	83.5	63.5	25.5	50.6
High Channel (2475 MHz)										
2483.5	73.35	56.04	H	-8.66	64.69	13.70	74.0	54.0	9.3	40.3
2483.5	70.08	52.63	V	-8.66	61.42	10.29	74.0	54.0	12.6	43.7
4950	46.38	33.56	H	-2.10	44.28	-2.22	74.0	54.0	29.7	56.2
4950	45.88	33.71	V	-2.10	43.78	-2.07	74.0	54.0	30.2	56.1

Notes:

- The average measurements were further corrected using a duty cycle correction factor corresponding to the logarithm of the dwell time over 100 ms = 20*log(2.07/100) ≈ -33.68 dB.
- The emissions above 10 GHz were measured at a distance of 1m. The limits are corrected accordingly using a distance factor of 20*log(3/1) ≈ 9.5 dB.
- All emissions above 12200 MHz were attenuated below the limits and the noise floor of the measurement equipment.

Table 7.5.3.2-3: Radiated Spurious Emissions Tabulated Data – AS1

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	77.96	56.83	H	-9.03	68.93	14.12	74.0	54.0	5.1	39.9
2390	68.76	49.15	V	-9.03	59.73	6.44	74.0	54.0	14.3	47.6
4810	47.85	36.20	H	-2.23	45.62	0.29	74.0	54.0	28.4	53.7
4810	48.82	38.45	V	-2.23	46.59	2.54	74.0	54.0	27.4	51.5
12025	45.18	32.00	V	11.75	56.93	10.07	83.5	63.5	26.6	53.4
Middle Channel (2440 MHz)										
4880	51.13	40.00	H	-1.27	49.86	5.05	74.0	54.0	24.1	49.0
4880	50.52	40.57	V	-1.27	49.25	5.62	74.0	54.0	24.8	48.4
7320	60.24	52.06	H	3.20	63.44	21.58	74.0	54.0	10.6	32.4
7320	60.86	52.90	V	3.20	64.06	22.42	74.0	54.0	9.9	31.6
12200	49.38	38.85	H	11.12	60.50	16.29	83.5	63.5	23.0	47.2
12200	53.55	44.18	V	11.12	64.67	21.62	83.5	63.5	18.8	41.9
19520	43.82	31.84	H	9.51	53.33	7.67	83.5	63.5	30.2	55.8
19520	45.29	33.51	V	9.51	54.80	9.34	83.5	63.5	28.7	54.2
High Channel (2475 MHz)										
2483.5	81.21	63.69	H	-8.66	72.55	21.35	74.0	54.0	1.4	32.6
2483.5	73.11	55.69	V	-8.66	64.45	13.35	74.0	54.0	9.5	40.6
4950	49.79	39.60	H	-2.10	47.69	3.82	74.0	54.0	26.3	50.2
4950	48.08	36.75	V	-2.10	45.98	0.97	74.0	54.0	28.0	53.0
7425	47.30	34.83	H	3.49	50.79	4.64	74.0	54.0	23.2	49.4
7425	48.54	37.28	V	3.49	52.03	7.09	74.0	54.0	22.0	46.9
12375	46.14	33.91	H	11.72	57.86	11.94	83.5	63.5	25.6	51.6
12375	47.11	35.19	V	11.72	58.83	13.22	83.5	63.5	24.7	50.3

Notes:

- The average measurements were further corrected using a duty cycle correction factor corresponding to the logarithm of the dwell time over 100 ms = 20*log(2.07/100) ≈ -33.68 dB.
- The emissions above 10 GHz were measured at a distance of 1m. The limits are corrected accordingly using a distance factor of 20*log(3/1) ≈ 9.5 dB.
- All emissions above 19520 MHz were attenuated below the limits and the noise floor of the measurement equipment.

Table 7.5.3.2-4: Radiated Spurious Emissions Tabulated Data – AS2

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	71.79	50.92	H	-9.03	62.76	8.21	74.0	54.0	11.2	45.8
2390	66.93	47.27	V	-9.03	57.90	4.56	74.0	54.0	16.1	49.4
4810	47.72	36.00	H	-2.23	45.49	0.09	74.0	54.0	28.5	53.9
4810	48.89	38.30	V	-2.23	46.66	2.39	74.0	54.0	27.3	51.6
Middle Channel (2440 MHz)										
4880	50.40	39.52	H	-1.27	49.13	4.57	74.0	54.0	24.9	49.4
4880	52.05	42.26	V	-1.27	50.78	7.31	74.0	54.0	23.2	46.7
7320	62.27	54.54	H	3.20	65.47	24.06	74.0	54.0	8.5	29.9
7320	62.76	55.11	V	3.20	65.96	24.63	74.0	54.0	8.0	29.4
12200	53.07	44.07	H	11.12	64.19	21.51	83.5	63.5	19.3	42.0
12200	56.76	48.63	V	11.12	67.88	26.07	83.5	63.5	15.6	37.4
19520	45.97	35.22	H	9.51	55.48	11.05	83.5	63.5	28.0	52.4
19520	47.67	37.75	V	9.51	57.18	13.58	83.5	63.5	26.3	49.9
High Channel (2475 MHz)										
2483.5	78.07	61.55	H	-8.66	69.41	19.21	74.0	54.0	4.6	34.8
2483.5	70.87	54.52	V	-8.66	62.21	12.18	74.0	54.0	11.8	41.8
4950	50.67	40.29	H	-2.10	48.57	4.51	74.0	54.0	25.4	49.5
4950	50.17	39.89	V	-2.10	48.07	4.11	74.0	54.0	25.9	49.9
7425	48.49	36.29	H	3.49	51.98	6.10	74.0	54.0	22.0	47.9
7425	48.43	36.15	V	3.49	51.92	5.96	74.0	54.0	22.1	48.0
12375	44.74	31.02	V	11.72	56.46	9.05	83.5	63.5	27.0	54.4

Notes:

- The average measurements were further corrected using a duty cycle correction factor corresponding to the logarithm of the dwell time over 100 ms = 20*log(2.07/100) ≈ -33.68 dB.
- The emissions above 10 GHz were measured at a distance of 1m. The limits are corrected accordingly using a distance factor of 20*log(3/1) ≈ 9.5 dB.
- All emissions above 19520 MHz were attenuated below the limits and the noise floor of the measurement equipment.

7.5.3.3 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

Duty Cycle Correction Factor
DC = 20*log(2.07/100) = -33.68 dB

Example Calculation: Peak
Corrected Level: 79.84+ (-9.03) = 70.81dBµV/m
Margin: 74 dBuV/m – 70.81dBµV/m = 3.2dB

Example Calculation: Average
Corrected Level: 57.7 + (-9.03) – 33.68= 14.99dBµV/m
Margin: 54 dBuV/m – 14.99dBµV/m = 39.0dB

8 CONCLUSION

In the opinion of ACS, Inc., the JETIDS16US manufactured by Esprit Model meets the requirements of FCC Part 15 subpart C and Industry Canada's Radio Standards Specification RSS-210.

END REPORT