TEST REPORT

Test Report No. : UL-RPT-RP-12070862-117 FCC

Applicant	:	Busch-Jaeger Elektro GmbH
Model No.	:	SAP-S-3-US System Access Point 2.0
FCC ID	:	2AO6WSAP-S-3-US
Technology	:	*IEEE 802.15.4 (Free@home)*
Test Standard(s)	:	FCC Parts 15.207, 15.209 & 15.247
		For details of applied tests refer to test result summary

1. This test report shall not be reproduced in full or partial, without the written approval of UL International Germany GmbH.
2. The results in this report apply only to the sample tested.
3. The test results in this report are traceable to the national or international standards.
4. Test Report Version 1.3 - Supersedes Version 1.2
5. Result of the tested sample: **PASS**

Prepared by: Segun I. Adeniji
Title: Engineer
Date: 28.May.2018

Approved by: Jakob, Reschke
Title: Senior Test Engineer
Date: 13.June.2018

Deutsche Akkreditierungsstelle
D-PL-19381-02-00

This laboratory is accredited by DAkkS.
The tests reported herein have been performed in accordance with its' terms of accreditation.

UL INTERNATIONAL GERMANY GMBH
Hedelfinger Str. 61
70327 Stuttgart, Germany
STU.CTECHLab@ul.com

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1. Customer Information

1.1.Applicant Information

Company Name:	Busch-Jaeger Elektro GmbH
Company Address:	Freisenberg straße 2, 58513 Luedenscheid, Germany
Company Phone No.:	--
Company E-Mail:	--
Contact Person:	Martin Klett
Contact E-Mail Address:	Martin.klett@de.abb.com
Contact Phone No.:	+49 2351 956 1842

1.2.Manufacturer Information

Company Name:	Busch-Jaeger Elektro GmbH
Company Address:	Freisenberg straße 2, 58513 Luedenscheid, Germany
Company Phone No.:	--
Company E-Mail:	--
Contact Person:	Martin Klett
Contact E-Mail Address:	Martin.klett@de.abb.com
Contact Phone No.:	+49 2351 956 1842

2. Summary of Testing

2.1. General Information

Applied Standards

Specification Reference:	47CFR15.247
Specification Title:	Code of Federal Regulations Volume 47 (Telecommunications): Part 15 Subpart C (Intentional Radiators) - Section 15.247
Specification Reference:	47CFR15.207 and 47CFR15.209
Specification Title:	Code of Federal Regulations Volume 47 (Telecommunications): Part 15 Subpart C (Intentional Radiators) - Sections 15.207 and 15.209
Test Firm Registration:	399704

Location

Location of Testing:	UL International Germany GmbH Hedelfinger Str. 61 70327 Stuttgart Germany

Date information

Order Date:	30 November 2017
EUT arrived:	24 January, 07 March and 03 May 2018
Test Dates:	24 January 2018 to 22 May 2018
EUT returned:	N/A

2.2. Summary of Test Results

Clause	Measurement	Complied	Did not comply	Not performed	Not applicable
Part 15.207	Transmitter AC Conducted Emissions(1)	☒	☐	☐	☐
Part 15.247(a)(2)	Transmitter Minimum 6 dB Bandwidth	☒	☐	☐	☐
Part 15.247(e)	Transmitter Power Spectral Density	☒	☐	☐	☐
Part 15.247(b)(3)	Transmitter Maximum Peak Output Power	☒	☐	☐	☐
Part 15.247(d)/15.209	Transmitter Radiated Emissions	☒	☐	☐	☐
Part 15.247(d)/15.209	Transmitter Band Edge Radiated Emissions	☒	☐	☐	☐

2.3. Methods and Procedures

Reference:	ANSI C63.10-2013
Title:	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices
Reference:	KDB 558074 D01 DTS Meas Guidance v04 April 5, 2017
Title:	Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under section §15.247

2.4. Deviations from the Test Specification

For the measurements contained within this test report, there were no deviations from, additions to, or exclusions from the test specification identified above.

3. Equipment Under Test (EUT)

3.1. Identification of Equipment Under Test (EUT)

EUT Description	Radio Test Sample (with Integrated Antennas / External Antenna Port)
Brand Name:	ABB
Model Name or Number:	SAP-S-3-US System Access Point 2.0
Test Sample Serial Number:	S13
Hardware Version Number:	Version 0.1 D1125
Software Version Number:	Version 1.793
FCC ID:	2AO6WSAP-S-3-US

EUT Description	Radio Test Sample (with Integrated Antennas / External Antenna Port)
Brand Name:	ABB
Model Name or Number:	SAP-S-3-US System Access Point 2.0
Test Sample Serial Number:	S14
Hardware Version Number:	Version 0.1 D1125
Software Version Number:	Version 1.793 (with HD wireless test software)
FCC ID:	2AO6WSAP-S-3-US

EUT Description	Radiated Sample (with Integrated Antennas / External Antenna Port)
Brand Name:	ABB
Model Name or Number:	SAP-S-3-US System Access Point 2.0
Test Sample Serial Number:	S12
Hardware Version Number:	Version 0.1 D1125
Software Version Number:	Version 1.793 (with an additional software (2.1.7) build 5658)
FCC ID:	2AO6WSAP-S-3-US

3.2. Description of EUT

The equipment under test was a System Access Point 2.0 integrating an IEEE 802.15.4. RF technology.

3.3. Modifications Incorporated in the EUT

No modifications were applied to the EUT during testing.

3.4. Additional Information Related to Testing

Technology Tested:	*IEEE 802.15.4 (Digital Transmission System)*		
Type of Unit:	Transceiver		
Transmit Frequency Range:	2405 MHz to 2480 MHz		
Power Levels	2405 MHz-2475 MHz : Level 8	2480 MHz : Level 14	
Channel Spacing:	5 MHz		
Modulation:	O-QPSK		
Data Rate:	250 kbit/s		
Power Supply Requirement(s):	Nominal	3.3 VDC	
Transmit Channels Tested:	**Channel ID**	**RF Channel Number**	**Channel Frequency (MHz)**
	Bottom	11	2405
	Middle	18	2440
	Top	26	2480
Supported Antenna Type:	**Internal SMD Metal Antenna**	**Internal SMD Chip Antenna**	**External λ/2 Dipole Antenna**
Antenna Part Designation:	PRO-OB-536 OnBoard™ SMD	Johansson-2450AT18D0100	Kinsun-6642 B03141-15M, Kinsun 6642-2.4G-SMA
Antenna Type:	Omnidirectional	Omnidirectional	Omnidirectional
Antenna Gain:	Max. 1.50 dBi	Typ. 1.50 dBi	Max. 1.51 dBi

3.5. Support Equipment

The following support equipment was used to exercise the EUT during testing:

A. Support Equipment (In-house)

Item	Description	Brand Name	Model Name or Number	Serial Number
1				
2				
3				

B. Support Equipment (Manufacturer supplied)

Item	Description	Brand Name	Model Name or Number	Serial Number
1	Laptop	Lenovo	W530	Not marked/stated
2	USB-Serial Adapter	Not marked/stated	FTDI232	Not marked/stated
3	Power Supply	CINCON	TRE15R240-ASUE-12G681	Not marked/stated

4. Operation and Monitoring of the EUT during Testing

4.1. Operating Modes

The EUT was tested in the following operating mode(s):
☒ Transmitting at maximum power with modulation and maximum possible data length

4.2. Configuration and Peripherals

The EUT was tested in the following configuration(s):

- The EUT was powered via 24 VDC power supply that later supplies an internal 3.3 VDC power to the chip module.
- Controlled using a software application on the laptop PC supplied by the customer. The application was used to enable continuous transmission and to select the test channels as required.
- The power level 8 was used for all channels except for top channel 2480 MHz where a reduced power level 14 was used as defined by the customer.
- The EUT conducted sample was used for 6 dB bandwidth, power spectral density and maximum peak output power.
- The EUT radiated sample was used for radiated spurious emissions tests for the two internal antenna types & one external antenna type.
- EMC32 v10.1 from Rohde and Schwarz was used for the transmitter conducted measurement.

5. Measurements, Examinations and Derived Results

5.1. General Comments

Measurement uncertainties are evaluated in accordance with current best practice. Our reported expanded uncertainties are based on standard uncertainties, which are multiplied by an appropriate coverage factor to provide a statistical confidence level of approximately 95%. Please refer to Section 6 *Measurement Uncertainty* for details.

In accordance with DAkkS requirements all the measurement equipment is on a calibration schedule. All equipment was within the calibration period on the date of testing.

5.2. Test Results

5.2.1. Transmitter AC Conducted Spurious Emissions

Test Summary:

Test Engineer:	Asim Shahzad	**Test Date:**	08 March, 22 May 2018
Test Sample Serial Number:	S12		
Test Site Identification	SR 7/8		

FCC Reference:	Part 15.207
Test Method Used:	ANSI C63.10 Section 6.2 / FCC KDB 174176

Environmental Conditions:

Temperature (°C):	21
Relative Humidity (%):	38

Settings of the Instrument

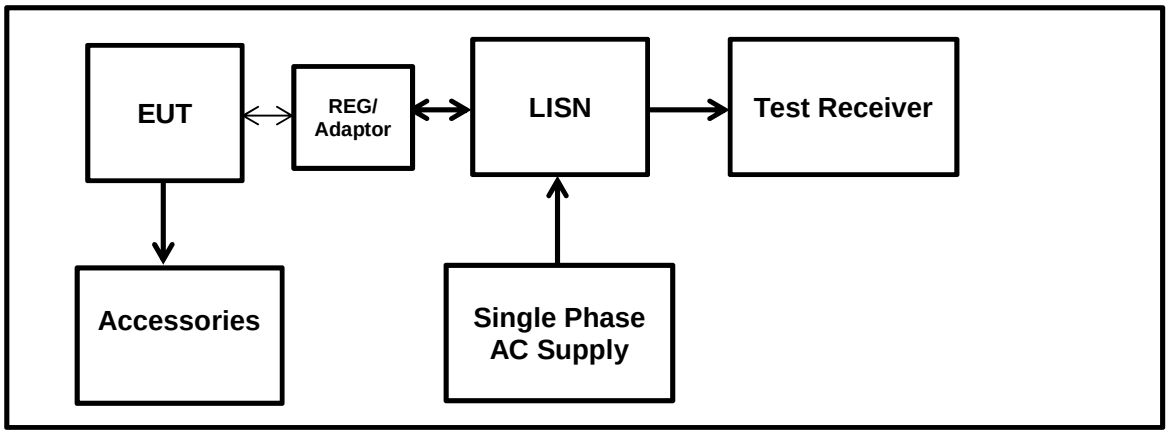
Detector	Quasi Peak/ Average Peak

Note(s):

1. The EUT was connected to an AC/DC Adaptor or REG.
2. The EUT Adaptor/REG was connected to a 120 VAC 60 Hz single phase supply via a LISN.
3. The EUT USB ports were terminated and EUT was connected to the Internet router via ISN.
4. The final measured value, for the given emission, in the table below incorporates the cable loss.
5. All other emissions shown on the pre-scan plot were investigated and found to be ambient or >20 dB below the applicable limit or below the measurement system noise floor.
6. Measurements were performed in shielded room (SR7/ 8 Asset Number 1603671). The EUT was placed at a height of 80 cm above the reference ground plane and in a distance of 40 cm from the vertical ground plane at the edge of the table.

Transmitter AC Conducted Spurious Emissions (continued)

Test setup:



2.4GHz WLANTx Mode Supplied via Adapter:

Results: Live / Quasi Peak/ Internal SMD Metal Antenna

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.3897	Live	36.5	58.1	21.6	Complied
0.43231	Live	38	57.2	19.2	Complied
0.70358	Live	31.5	56	24.5	Complied
1.11836	Live	30.7	56	25.3	Complied
4.76064	Live	26.3	56	29.7	Complied
24.35013	Live	31	60	29	Complied

Results: Live / Average / Internal SMD Metal Antenna

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.3897	Live	33.3	48.1	14.8	Complied
0.43231	Live	27.9	47.2	19.3	Complied
0.70358	Live	22.6	46	23.4	Complied
1.11836	Live	21.6	46	24.4	Complied
4.76064	Live	15.7	46	30.3	Complied
24.35013	Live	23	50	27	Complied

Results: Neutral / Quasi Peak / Internal SMD Metal Antenna

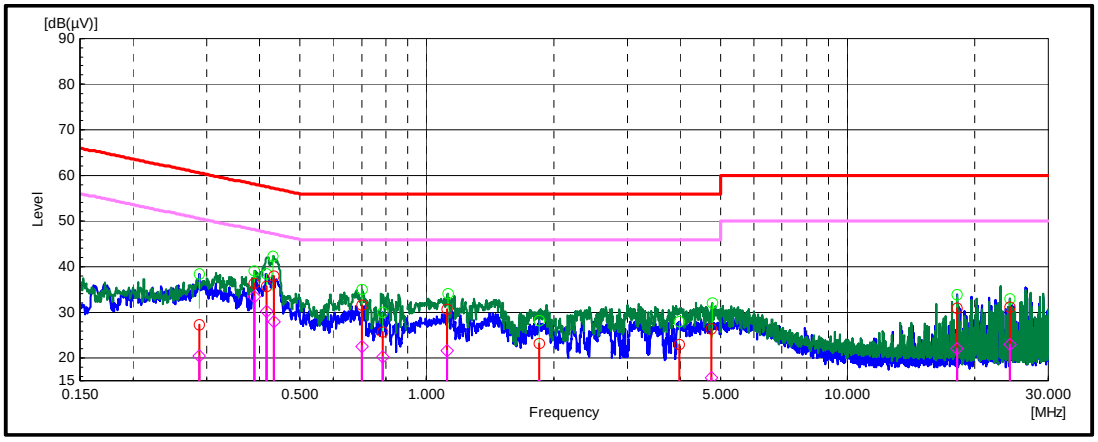
Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
27.2	Neutral	27.2	60.6	33.4	Complied
35.7	Neutral	35.7	57.5	21.8	Complied
25.7	Neutral	25.7	56	30.3	Complied
23.1	Neutral	23.1	56	32.9	Complied
22.9	Neutral	22.9	56	33.1	Complied
31	Neutral	31	60	29	Complied

Results: Neutral / Average / Internal SMD Metal Antenna

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
27.2	Neutral	20.4	50.6	30.2	Complied
35.7	Neutral	30.2	47.5	17.3	Complied
25.7	Neutral	20.1	46	25.9	Complied
23.1	Neutral	13.9	46	32.1	Complied
22.9	Neutral	11.9	46	34.1	Complied
31	Neutral	22	50	28	Complied

Result: Pass

Plot: Live and Neutral Line/ Internal SMD Metal Antenna



Note: These plots are pre-scans and for indication purposes only. For final measurements, see accompanying tables.

2.4 GHz WLANTx Mode Supplied via Adapter:

Results: Live / Quasi Peak/ Internal SMD Chip Antenna

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.43383	Live	39.6	58.1	17.6	Complied
1.16752	Live	27.7	57.2	28.3	Complied
3.84363	Live	22.7	56	33.3	Complied
21.57906	Live	32.2	56	27.8	Complied
24.00153	Live	44.3	56	15.7	Complied
26.23186	Live	38.1	60	21.9	Complied

Results: Live / Average / Internal SMD Chip Antenna

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.43383	Live	36.4	47.2	10.8	Complied
1.16752	Live	24.2	46	21.8	Complied
3.84363	Live	15.2	46	30.8	Complied
21.57906	Live	26	50	24	Complied
24.00153	Live	35.6	50	14.4	Complied
26.23186	Live	30.8	50	19.2	Complied

Results: Neutral / Quasi Peak / Internal SMD Chip Antenna

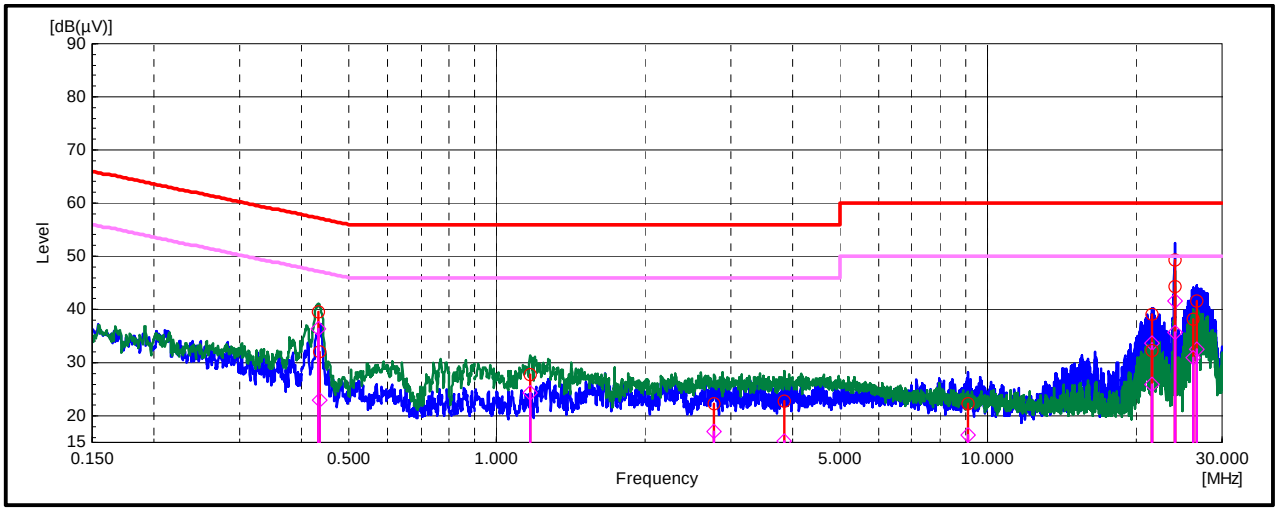
Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.43475	Neutral	32	57.2	25.2	Complied
2.76984	Neutral	22.3	56	33.7	Complied
9.11797	Neutral	22.3	60	37.7	Complied
21.61669	Neutral	39.1	60	20.9	Complied
24.00279	Neutral	49.3	60	10.7	Complied
26.57834	Neutral	41.7	60	18.3	Complied

Results: Neutral / Average / Internal SMD Chip Antenna

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.43475	Neutral	23	47.2	24.2	Complied
2.76984	Neutral	17	46	29	Complied
9.11797	Neutral	16.5	50	33.5	Complied
21.61669	Neutral	33.5	50	16.5	Complied
24.00279	Neutral	41.7	50	8.3	Complied
26.57834	Neutral	32.6	50	17.4	Complied

Result: Pass

Plot: Live and Neutral Line/ Internal SMD Chip Antenna



Note: These plots are pre-scans and for indication purposes only. For final measurements, see accompanying tables.

2.4 GHz WLANTx Mode Supplied via Adapter:

Results: Live / Quasi Peak/ External λ/2 Dipole Antenna

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.42924	Live	43.9	57.3	13.4	Complied
0.77339	Live	34.8	56	21.2	Complied
1.13895	Live	32.7	56	23.3	Complied
3.9975	Live	30.2	56	25.8	Complied
24.00097	Live	45.4	60	14.6	Complied
26.65732	Live	37.2	60	22.8	Complied

Results: Live / Average / External λ/2 Dipole Antenna

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.42924	Live	39.9	47.3	7.4	Complied
0.77339	Live	29.8	46	16.2	Complied
1.13895	Live	26.2	46	19.8	Complied
3.9975	Live	20	46	26	Complied
24.00097	Live	35	50	15	Complied
26.65732	Live	28.6	50	21.4	Complied

Results: Neutral / Quasi Peak / External λ/2 Dipole Antenna

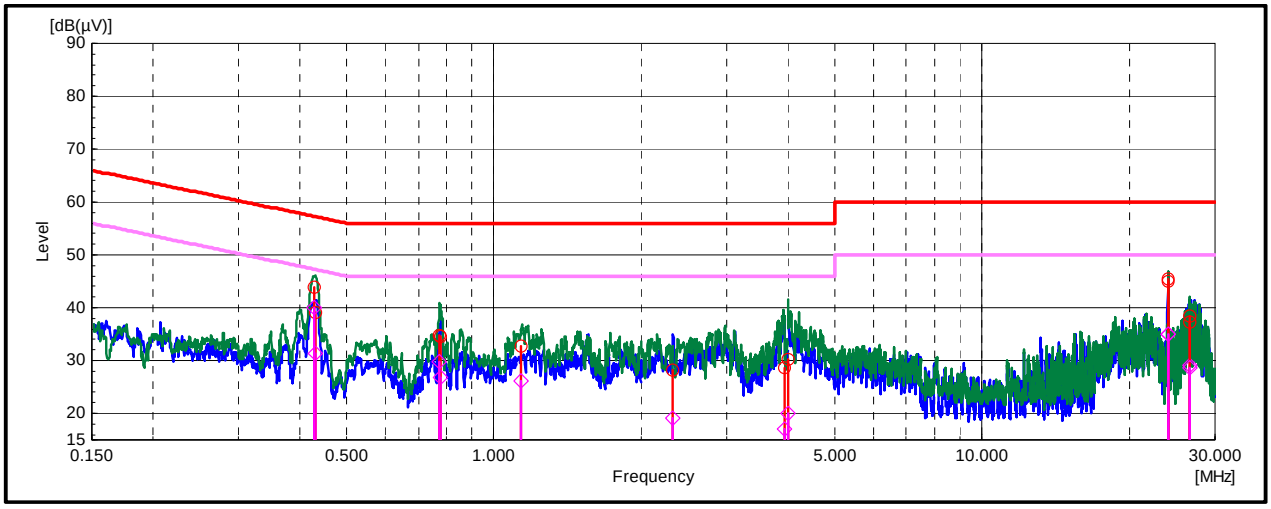
Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.42975	Neutral	39.1	57.3	18.2	Complied
0.77743	Neutral	34.5	56	21.5	Complied
2.32611	Neutral	28.1	56	27.9	Complied
3.93104	Neutral	28.6	56	27.4	Complied
24.00209	Neutral	44.9	60	15.1	Complied
26.65648	Neutral	38.4	60	21.6	Complied

Results: Neutral / Average / External λ/2 Dipole Antenna

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.42975	Neutral	31.3	47.3	16	Complied
0.77743	Neutral	26.8	46	19.2	Complied
2.32611	Neutral	19	46	27	Complied
3.93104	Neutral	17	46	29	Complied
24.00209	Neutral	35	50	15	Complied
26.65648	Neutral	29.2	50	20.8	Complied

Result: Pass

Plot: Live and Neutral Line/ External λ/2 Dipole Antenna



Note: These plots are pre-scans and for indication purposes only. For final measurements, see accompanying tables.

2.4 GHz WLAN Tx Mode TCP ON Supplied via REG:

Results: Live / Quasi Peak/ Internal SMD Metal Antenna

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.21405	Live	54.4	63	8.6	Complied
0.42209	Live	55.3	57.4	2.1	Complied
0.63288	Live	50.3	56	5.7	Complied
0.94357	Live	43.7	56	12.3	Complied
1.65202	Live	32.5	56	23.5	Complied
16.80887	Live	33.5	60	26.5	Complied

Results: Live / Average / Internal SMD Metal Antenna

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.21405	Live	41.3	53	11.7	Complied
0.42209	Live	44.9	47.4	2.5	Complied
0.63288	Live	40.9	46	5.1	Complied
0.94357	Live	33.3	46	12.7	Complied
1.65202	Live	15.9	46	30.1	Complied
16.80887	Live	24.2	50	25.8	Complied

Results: Neutral / Quasi Peak / Internal SMD Metal Antenna

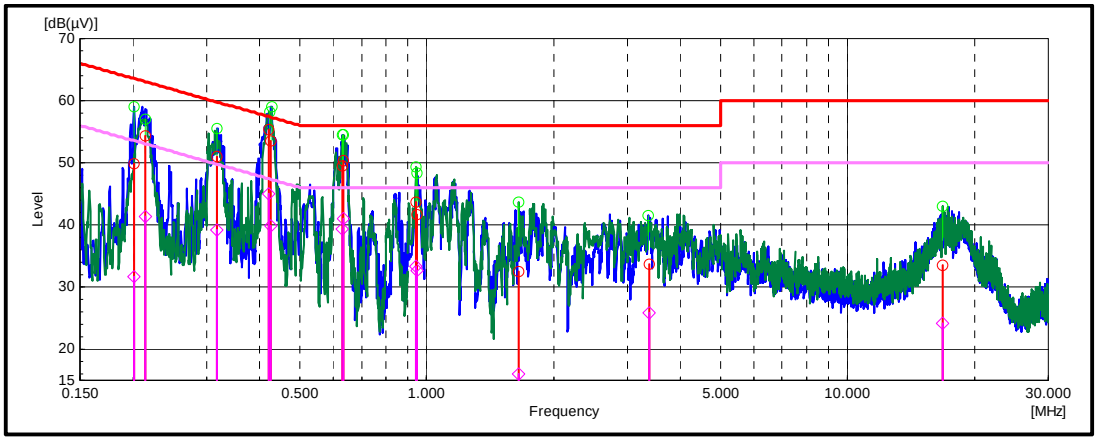
Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.20155	Neutral	49.9	63.5	13.6	Complied
0.31705	Neutral	51	59.8	8.8	Complied
0.42612	Neutral	53.5	57.3	3.8	Complied
0.63152	Neutral	49.4	56	6.6	Complied
0.95003	Neutral	41.7	56	14.3	Complied
3.37012	Neutral	33.7	56	22.3	Complied

Results: Neutral / Average / Internal SMD Metal Antenna

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.20155	Neutral	31.7	53.5	21.8	Complied
0.31705	Neutral	39.2	49.8	10.6	Complied
0.42612	Neutral	39.9	47.3	7.4	Complied
0.63152	Neutral	39.4	46	6.6	Complied
0.95003	Neutral	32.7	46	13.3	Complied
3.37012	Neutral	25.8	46	20.2	Complied

Result: Pass

Plot: Live and Neutral Line/ Internal SMD Metal Antenna



Note: These plots are pre-scans and for indication purposes only. For final measurements, see accompanying tables.

5 GHz WLAN Tx Mode Supplied via REG IEEE 802.15.4 ON:

Results: Live / Quasi Peak/ Internal SMD Metal Antenna

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.23208	Live	55.2	62.4	7.2	Complied
0.34858	Live	56.3	59	2.7	Complied
0.58935	Live	49.9	56	6.1	Complied
0.81601	Live	46	56	10	Complied
3.26142	Live	36.1	56	19.9	Complied
17.03758	Live	33.8	60	26.2	Complied

Results: Live / Average / Internal SMD Metal Antenna

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.21405	Live	43.1	52.4	9.3	Complied
0.42209	Live	44.8	49	4.2	Complied
0.63288	Live	38	46	8	Complied
0.94357	Live	35.8	46	10.2	Complied
1.65202	Live	28	46	18	Complied
16.80887	Live	24.9	50	25.1	Complied

Results: Neutral / Quasi Peak / Internal SMD Metal Antenna

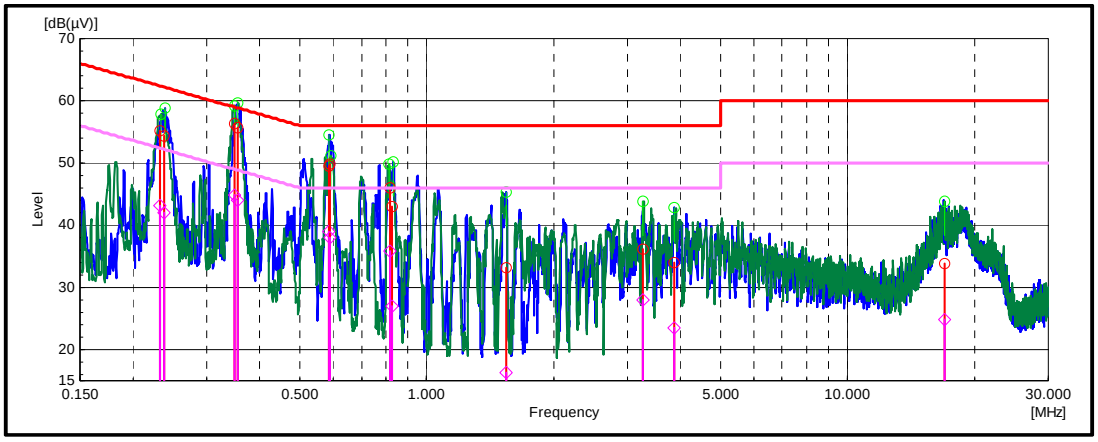
Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.23716	Neutral	54.4	62.2	7.8	Complied
0.35512	Neutral	55.6	58.8	3.2	Complied
0.58392	Neutral	49.4	56	6.6	Complied
0.82947	Neutral	43.1	56	12.9	Complied
1.54401	Neutral	33.2	56	22.8	Complied
3.87645	Neutral	34.1	56	21.9	Complied

Results: Neutral / Average / Internal SMD Metal Antenna

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.23716	Neutral	42.1	52.2	10.1	Complied
0.35512	Neutral	44	48.8	4.8	Complied
0.58392	Neutral	39	46	7	Complied
0.82947	Neutral	27	46	19	Complied
1.54401	Neutral	16.4	46	29.6	Complied
3.87645	Neutral	23.4	46	22.6	Complied

Result: Pass

Plot: Live and Neutral Line/ Internal SMD Metal Antenna



Note: These plots are pre-scans and for indication purposes only. For final measurements, see accompanying tables.

5 GHz WLANTx Mode Supplied via Adaptor IEEE 802.15.4 ON:

Results: Live / Quasi Peak/ Internal SMD Chip Antenna

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.42993	Live	39.3	57.3	18	Complied
1.25239	Live	25.2	56	30.8	Complied
4.18885	Live	22.1	56	33.9	Complied
21.57809	Live	32.8	60	27.2	Complied
24.00223	Live	45.1	60	14.9	Complied
26.65326	Live	37.5	60	22.5	Complied

Results: Live / Average / Internal SMD Chip Antenna

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.42993	Live	37.3	47.3	10	Complied
1.25239	Live	19.8	46	26.2	Complied
4.18885	Live	14.2	46	31.8	Complied
21.57809	Live	26.7	50	23.3	Complied
24.00223	Live	36.4	50	13.6	Complied
26.65326	Live	29.9	50	20.1	Complied

Results: Neutral / Quasi Peak / Internal SMD Chip Antenna

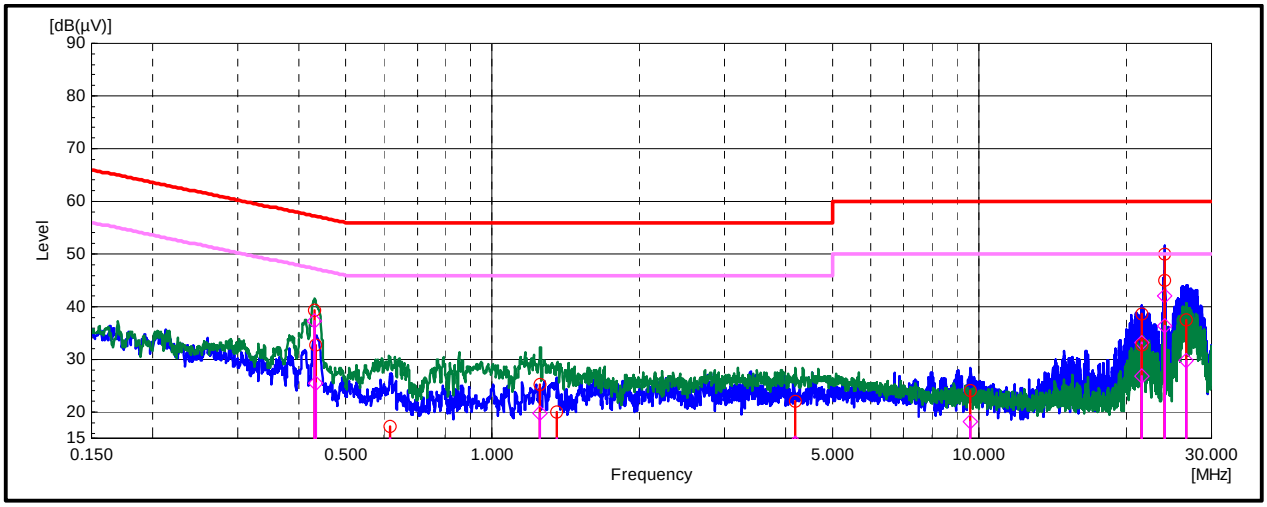
Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.43269	Neutral	32.8	57.2	24.4	Complied
0.61683	Neutral	17.3	56	38.7	Complied
1.35454	Neutral	19.9	56	36.1	Complied
9.61658	Neutral	24.2	60	35.8	Complied
21.61501	Neutral	38.7	60	21.3	Complied
24.00364	Neutral	49.9	60	10.1	Complied

Results: Neutral / Average / Internal SMD Chip Antenna

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.43269	Neutral	25.5	47.2	21.7	Complied
0.61683	Neutral	11.3	46	34.7	Complied
1.35454	Neutral	9.4	46	36.6	Complied
9.61658	Neutral	18.2	50	31.8	Complied
21.61501	Neutral	33.2	50	16.8	Complied
24.00364	Neutral	42.1	50	7.9	Complied

Result: Pass

Plot: Live and Neutral Line/ Internal SMD Chip Antenna



Note: These plots are pre-scans and for indication purposes only. For final measurements, see accompanying tables.

5 GHz WLANTx Mode Supplied via Adaptor IEEE 802.15.4 ON:

Results: Live / Quasi Peak/ External λ/2 Dipole Antenna

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.42881	Live	42.4	57.3	14.9	Complied
0.77459	Live	33.1	56	22.9	Complied
3.10383	Live	31.7	56	24.3	Complied
3.92219	Live	28.9	56	27.1	Complied
24.00195	Live	45.1	60	14.9	Complied
27.50294	Live	36.5	60	23.5	Complied

Results: Live / Average / External λ/2 Dipole Antenna

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.42881	Live	37.1	47.3	10.2	Complied
0.77459	Live	27.4	46	18.6	Complied
3.10383	Live	23.1	46	22.9	Complied
3.92219	Live	19	46	27	Complied
24.00195	Live	34.7	50	15.3	Complied
27.50294	Live	27.6	50	22.4	Complied

Results: Neutral / Quasi Peak / External λ/2 Dipole Antenna

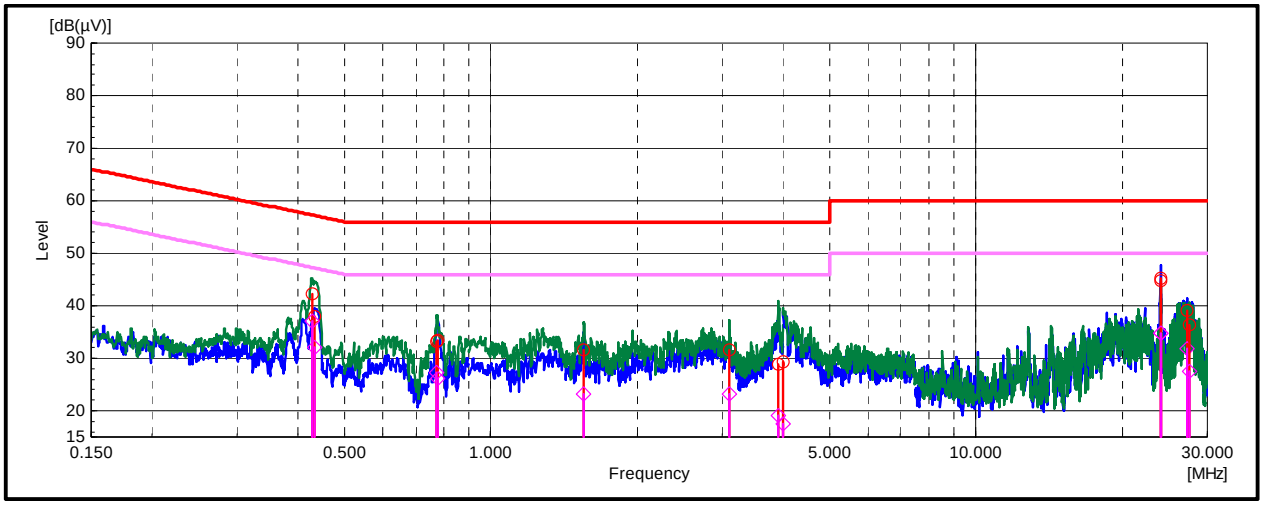
Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.4325	Neutral	37.9	57.2	19.3	Complied
0.77732	Neutral	33.3	56	22.7	Complied
1.55333	Neutral	31.6	56	24.4	Complied
3.99513	Neutral	29.2	56	26.8	Complied
24.00223	Neutral	44.9	60	15.1	Complied
27.27007	Neutral	39.1	60	20.9	Complied

Results: Neutral / Average / External λ/2 Dipole Antenna

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.4325	Neutral	32	47.2	15.2	Complied
0.77732	Neutral	26.2	46	19.8	Complied
1.55333	Neutral	23.2	46	22.8	Complied
3.99513	Neutral	17.4	46	28.6	Complied
24.00223	Neutral	34.9	50	15.1	Complied
27.27007	Neutral	31.8	50	18.2	Complied

Result: Pass

Plot: Live and Neutral Line/ External λ/2 Dipole Antenna



Note: These plots are pre-scans and for indication purposes only. For final measurements, see accompanying tables.

5.2.2. Transmitter Minimum 6 dB Bandwidth

Test Summary:

Test Engineer:	Segun I. Adeniji	**Test Date:**	24 January 2018
Test Sample Serial Number:	S13		
Test Site Identification	SR 9		

FCC Reference:	Part 15.247(a)(2)
Test Method Used:	FCC KDB 558074 Section 8.1 Option 1

Environmental Conditions:

Temperature (°C):	24
Relative Humidity (%):	35

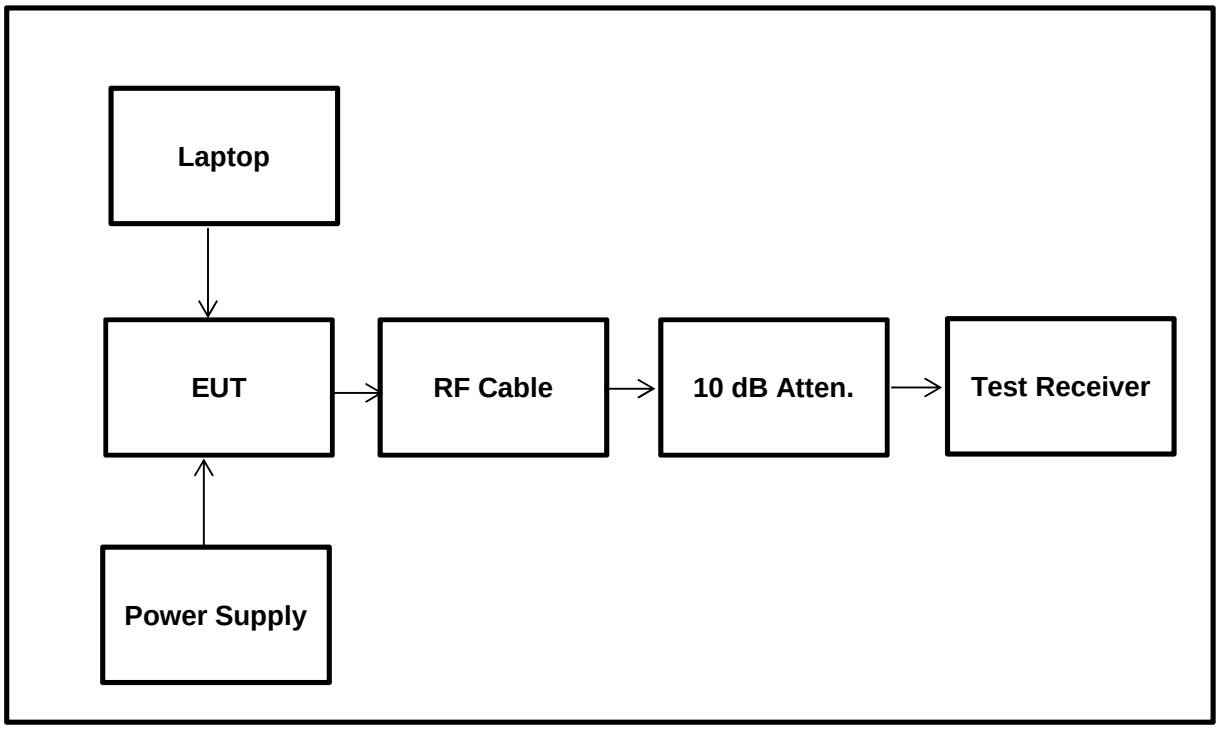
Settings of the Instrument

RBW/VBW	100 kHz/ 300 kHz
Span	10 MHz
Sweep time	Auto
Detector	Peak

Note(s):

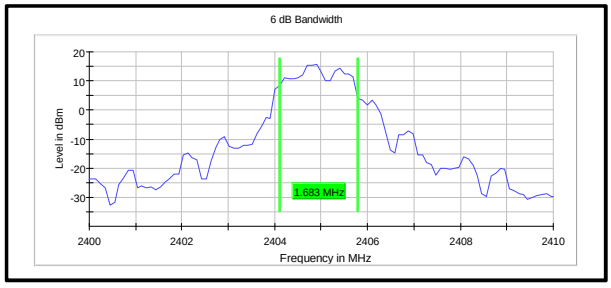
1. 6 dB DTS bandwidth tests were performed using a spectrum analyser in accordance with FCC KDB 558074 Section 8.1 Option 1 measurement procedure. The spectrum analyser resolution bandwidth was set to 100 kHz and video bandwidth 300 kHz. A peak detector was used, sweep time was set to auto and the trace mode was Max Hold. The DTS bandwidth was measured at 6 dB down from the peak of the signal.
2. The spectrum analyser was connected to the RF port on the EUT using suitable attenuation and RF cable.

Test Setup:

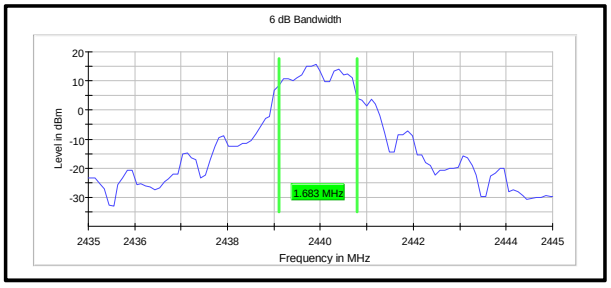


Results:

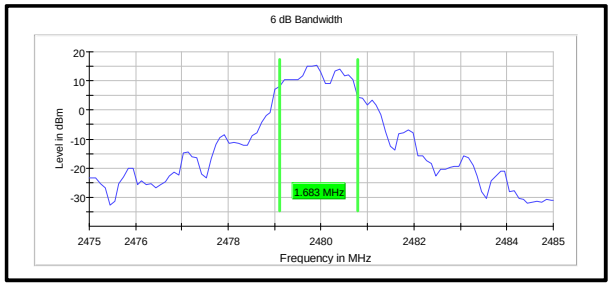
Channel	6 dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)	Result
Bottom	1683.168	≥500	1183.168	Complied
Middle	1683.168	≥500	1183.168	Complied
Top	1683.168	≥500	1183.168	Complied



Bottom Channel



Middle Channel



Top Channel

Result: Pass

5.2.3. Transmitter Power Spectral Density

Test Summary:

Test Engineer:	Segun I. Adeniji	**Test Date:**	24 January 2018
Test Sample Serial Number:	S13		
Test Site Identification	SR 9		

FCC Reference:	Part 15.247(e)
Test Method Used:	FCC KDB 558074 Section 10.2

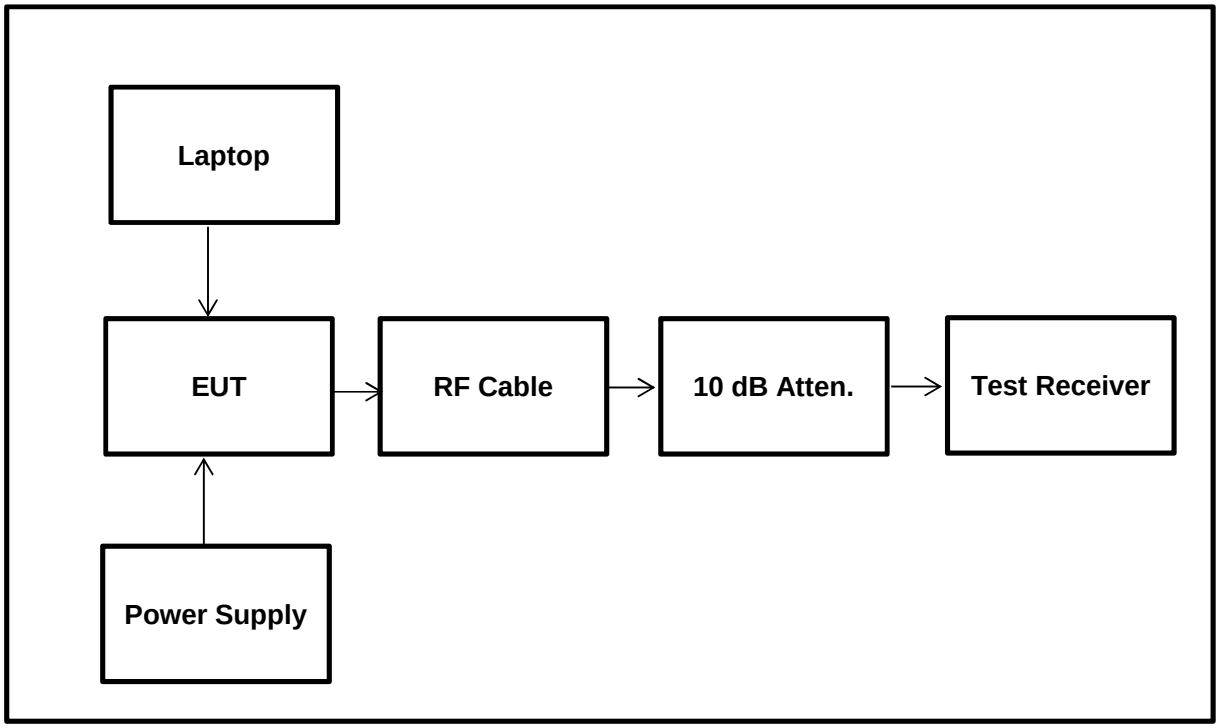
Environmental Conditions:

Temperature (°C):	24
Relative Humidity (%):	35

Note(s):

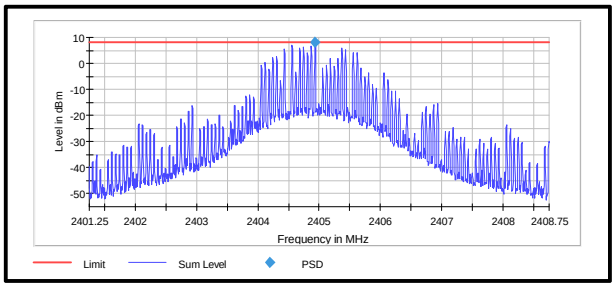
1. Transmitter Power Spectral Density tests in all bands were performed using a spectrum analyser in accordance with FCC KDB 558074 Section 10.2
2. The signal analyser resolution bandwidth was set to 3 kHz and video bandwidth of 10 kHz. A peak detector was used, sweep time was set to auto and trace mode was Max Hold. The span was set to 1.5 times the measured DTS bandwidth. A marker was placed at the peak of the signal and the results recorded in the table below.
3. The spectrum analyser was connected to the RF port on the EUT using suitable attenuation and RF cable. An RF level offset was incorporated in the measurement software such that the spectrum analyser result is adjusted to compensate for the loss of the attenuator and RF cable.
4. These tests were performed conducted as the EUT has as an external antenna port.

Test Setup:

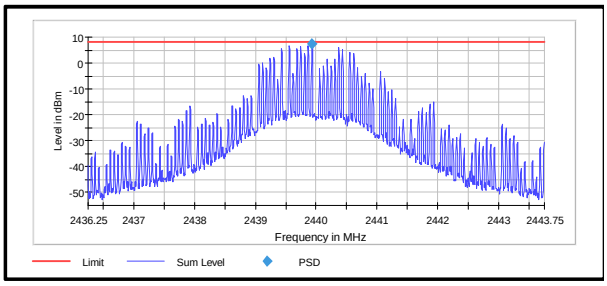


Results:

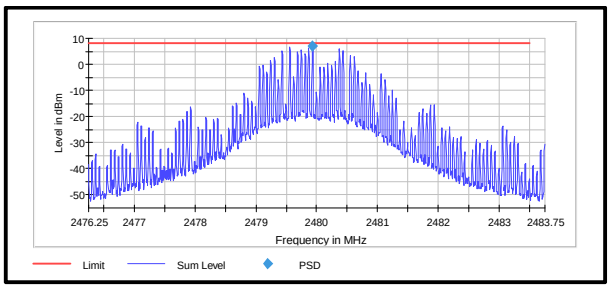
Channel	Output Power (dBm / 3 kHz)	Limit (dBm / 3 kHz)	Margin (dB)	Result
Bottom	7.908	8.0	0.092	Complied
Middle	7.437	8.0	0.563	Complied
Top	7.153	8.0	0.847	Complied



Bottom Channel



Middle Channel



Top Channel

Result: Pass

5.2.4. Transmitter Maximum Peak Output Power

Test Summary:

Test Engineer:	Segun I. Adeniji	**Test Date:**	24 January 2018
Test Sample Serial Number:	S13		
Test Site Identification	SR 9		

FCC Reference:	Part 15.247(b)(3)
Test Method Used:	FCC KDB 558074 Section 9.1 Subsection 9.1.1

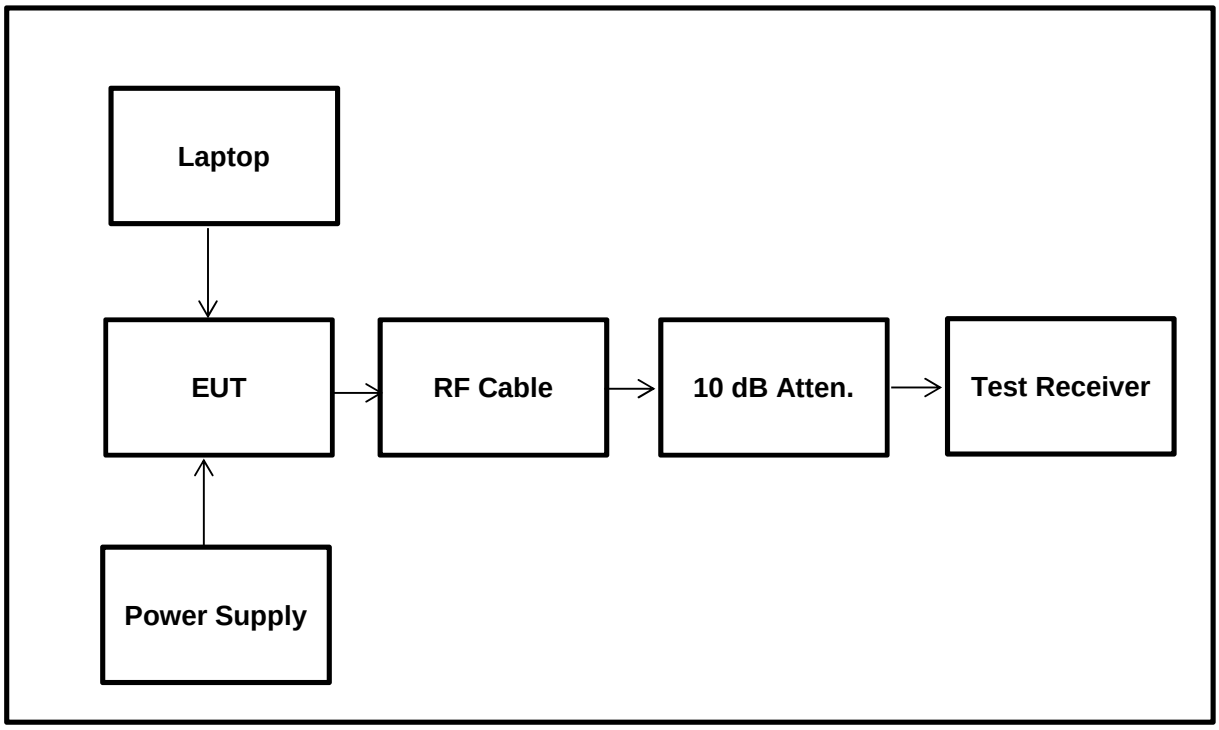
Environmental Conditions:

Temperature (°C):	24
Relative Humidity (%):	35

Note(s):

1. Conducted power tests were performed using a spectrum analyser in accordance with FCC KDB 558074 Section 9.1 with the RBW > *DTS bandwidth* procedure.
2. The signal analyser resolution bandwidth was set to 10 MHz and video bandwidth of 28 MHz. A peak detector was used, sweep time was set to auto and trace mode was Max Hold. The span was set to 30 MHz. A marker was placed at the peak of the signal and the results recorded in the table below.
3. The spectrum analyser was connected to the RF port on the EUT using suitable attenuation and RF cable. An RF level offset was incorporated in the measurement software such that the spectrum analyser result is adjusted to compensate for the loss of the attenuator and RF cable.
4. The highest declared antenna gain was added to conducted power obtain the EIRP.

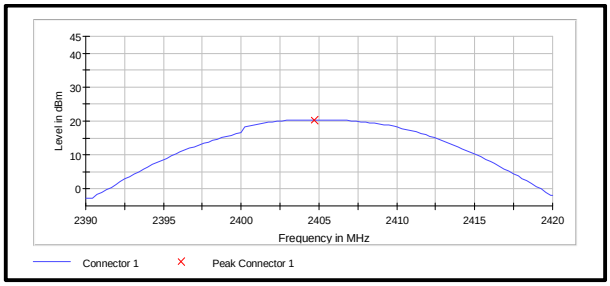
Test Setup:



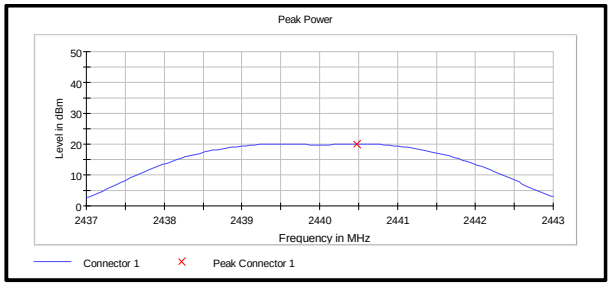
Results:

Channel	Conducted Peak Power (dBm)	Conducted Peak Power Limit (dBm)	Margin (dB)	Result
Bottom	18.9	30.0	11.1	Complied
Middle	18.6	30.0	11.4	Complied
Top	17.3	30.0	12.7	Complied

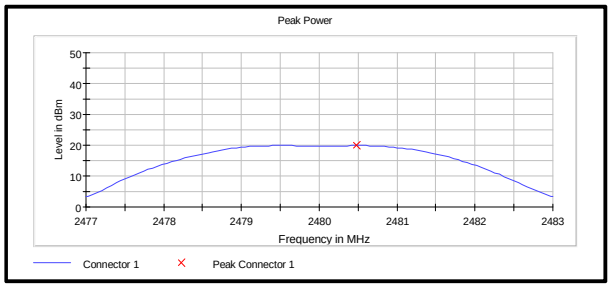
Channel	Conducted Peak Power (dBm)	Declared Antenna Gain (dBi)	EIRP (dBm)	De Facto EIRP Limit (dBm)	Margin (dB)	Result
Bottom	18.9	1.50	20.40	36.0	15.60	Complied
Middle	18.6	1.50	20.10	36.0	15.90	Complied
Top	17.3	1.50	18.80	36.0	17.20	Complied



Bottom Channel



Middle Channel



Top Channel

Result: Pass

5.2.5. Transmitter Radiated Emissions

Test Summary:

Test Engineer:	Segun I. Adeniji	**Test Date:**	07 March, 08 May 2018
Test Sample Serial Number:	S13, S14		
Test Site Identification	SR 1/2		

FCC Reference:	Parts 15.247(d) & 15.209(a)
Test Method Used:	ANSI C63.10 Sections 6.3 and 6.5
Frequency Range	30 MHz to 1000 MHz

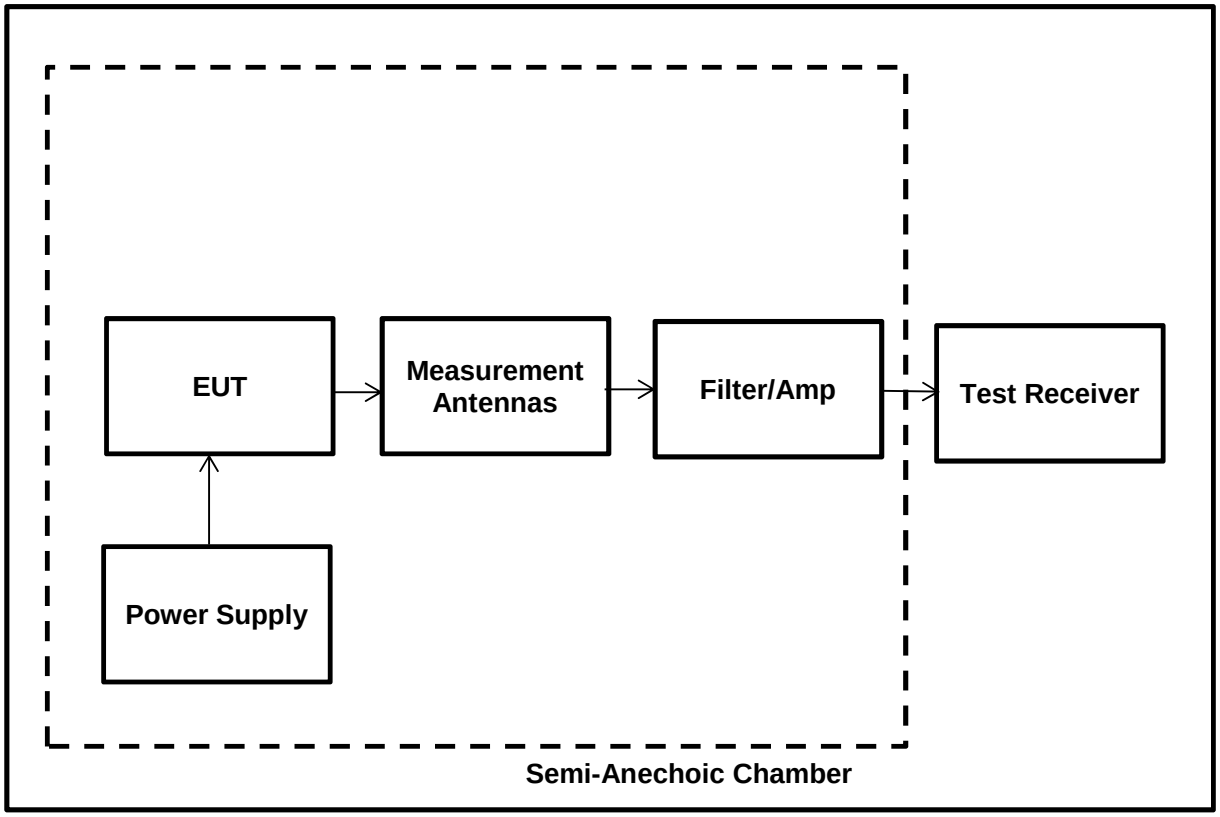
Environmental Conditions:

Temperature (°C):	23
Relative Humidity (%):	31

Note(s):

1. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
2. The preliminary scans showed similar emission levels below 1 GHz, for each channel of operation. Therefore final radiated emissions measurements were performed with the EUT set to the bottom channel only.
3. Measurements below 1 GHz were performed in a semi-anechoic chamber at a distance of 3 metres. The EUT was placed at a height of 80 cm above the reference ground plane in the centre of the chamber turntable. Maximum emission levels were determined by height searching the measurement antenna over the range 1 metre to 4 metres.
4. Pre-scans were performed and markers placed on the highest measured levels. The test receiver resolution bandwidth was set to 100 kHz and video bandwidth 300 kHz. A peak detector was used, sweep time was set to auto and trace mode was Max Hold.
5. Final measurements were performed on the marker frequencies and the results entered into the table below. The test receiver resolution bandwidth was set to 120 kHz, using a CISPR quasi-peak detector and span big enough to see the whole emission.

Test Setup:


EUT
Measurement Antennas
Filter/Amp
Test Receiver
Power Supply
Semi-Anechoic Chamber

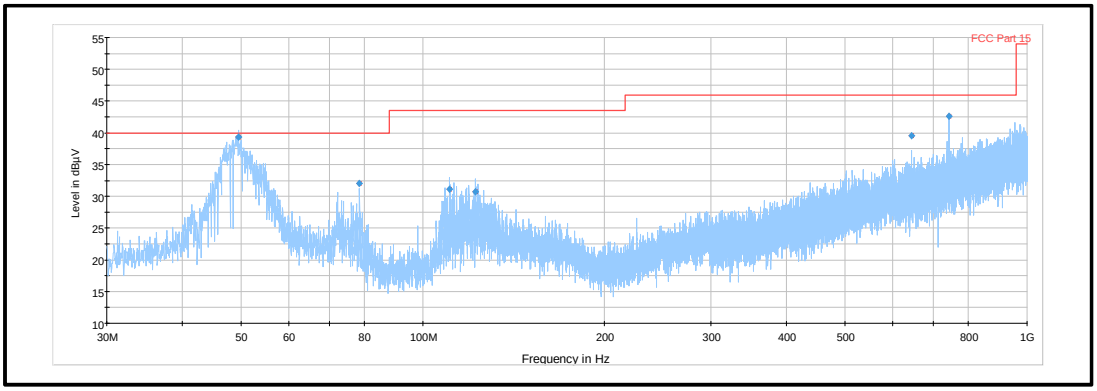
Results: Bottom Channel/Peak/Internal SMD Metal Antenna

Frequency (MHz)	Antenna Polarization	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
49.53	V	39.39	40.0	0.61	Complied
78.55	V	32.03	40.0	7.97	Complied
122.07	V	30.72	43.50	12.78	Complied
643.45	H	39.59	46.0	6.41	Complied
742.45	H	42.64	46.0	3.36	Complied

Results: Bottom Channel/Quasi-Peak/Internal SMD Metal Antenna

Frequency (MHz)	Antenna Polarization	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
49.41	V	33.78	40.0	6.22	Complied

Plot: 30 MHz – 1GHz



Note: This plot is a pre-scan and for indication purposes only. For final measurements, see accompanying table.

Result: Pass

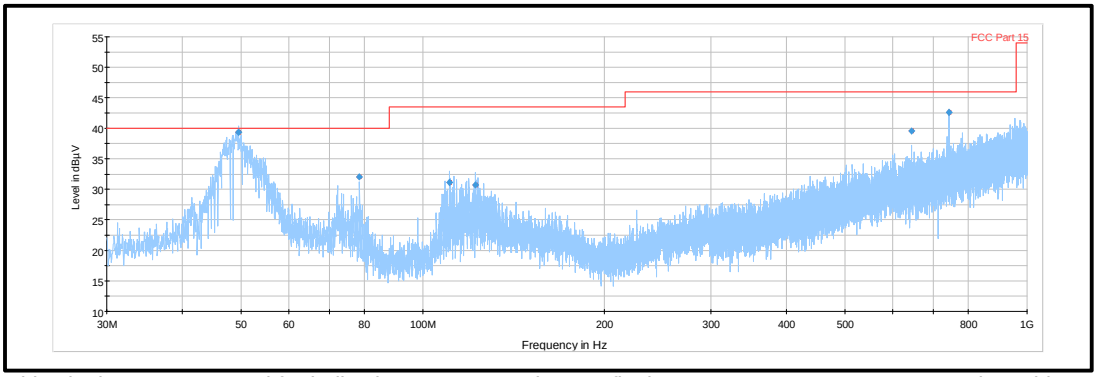
Results: Bottom Channel/Peak/Internal SMD Chip Antenna

Frequency (MHz)	Antenna Polarization	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
41.80	Vertical	39.31	40.0	0.69	Complied
45.97	Vertical	30.75	40.0	9.25	Complied
65.52	Vertical	31.68	43.50	11.82	Complied
124.25	Vertical	38.01	46.0	7.99	Complied

Results: Bottom Channel/Quasi-Peak/Internal SMD Chip Antenna

Frequency (MHz)	Antenna Polarization	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
49.41	V	35.38	40.0	4.62	Complied

Plot: 30 MHz – 1GHz



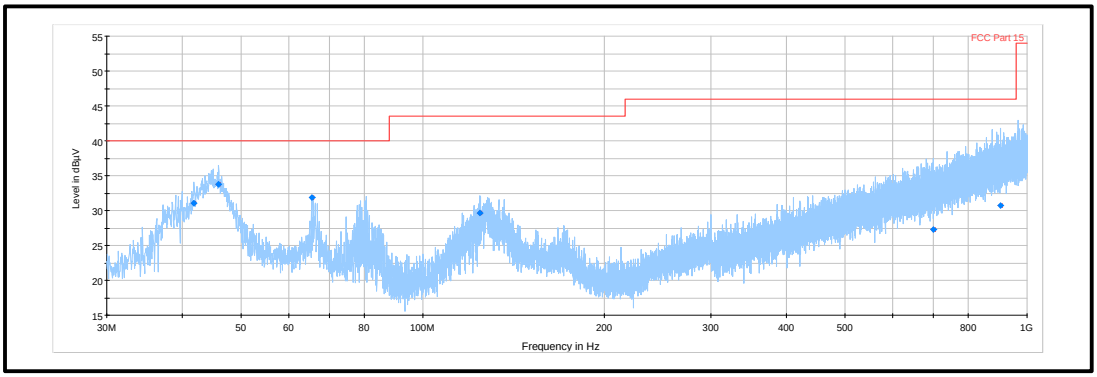
Note: This plot is a pre-scan and for indication purposes only. For final measurements, see accompanying table.

Result: Pass

Results: Bottom Channel/Peak/External λ/2 Dipole Antenna

Frequency (MHz)	Antenna Polarization	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
41.83	Vertical	31.06	40.00	8.94	Complied
45.93	Vertical	33.80	40.00	6.20	Complied
65.50	Vertical	31.91	40.00	8.09	Complied
124.18	Vertical	29.70	43.50	13.80	Complied

Plot: 30 MHz – 1GHz



Note: This plot is a pre-scan and for indication purposes only. For final measurements, see accompanying table.

Result: Pass

Test Summary:

Test Engineer:	Segun I. Adeniji	**Test Date:**	08 March, 08 May 2018
Test Sample Serial Number:	S13, S14		
Test Site Identification	SR 1/2		

FCC Reference:	Parts 15.247(d) & 15.209(a)
Test Method Used:	FCC KDB 558074 Sections 11 & 12 referencing ANSI C63.10 Sections 6.3 and 6.6
Frequency Range	1 GHz to 25 GHz

Environmental Conditions:

Temperature (°C):	24
Relative Humidity (%):	33

Note(s):

1. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
2. All the spurious emissions detected were re-investigated and re-measured with an average detector and in this case the emission was compared to the peak limit. For frequency range between 18 GHz and 25 GHz, no critical emission was found so only the measurement receiver noise floor level has been measured and recorded in the table The peak level was compared to the average limit as opposed to being compared to the peak limit because this is the more onerous limit. Only the bottom channel plot was included in the report as similar result was obtained on both middle and top channels.
3. The emission shown around the 2.4 GHz is the EUT fundamental.
4. Measurements above 1 GHz were performed in a semi-anechoic chamber at a distance of 3 metres. The EUT was placed at a height of 1.5 m above the reference ground plane in the centre of the chamber turntable. Maximum emission levels were determined by height searching the measurement antenna over the range 1 metre to 4 metres.
5. Pre-scans were performed and a marker placed on the highest measured level of the appropriate plot. The test receiver resolution bandwidth was set to 1 MHz and video bandwidth 3 MHz. The sweep time was set to auto.
6. *In accordance with ANSI C63.10 Section 6.6.4.3, Note 1, if the peak measured value complies with the average limit, it is unnecessary to perform an average measurement.
7. The reference level for the emission in the non-restricted band was established by following KDB 558074 Section 11.2 procedure.

Results: Peak / Bottom Channel/ Internal SMD Metal Antenna

Frequency (MHz)	Antenna Polarization	Level (dBµV/m)	Peak Limit (dBµV/m)	Margin (dB)	Result
4809.5	H	56.57	74.0	17.43	Complied

Results: Average / Bottom Channel/ Internal SMD Metal Antenna

Frequency (MHz)	Antenna Polarization	Level (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)	Result
4809.5	H	45.28	54.0	8.72	Complied

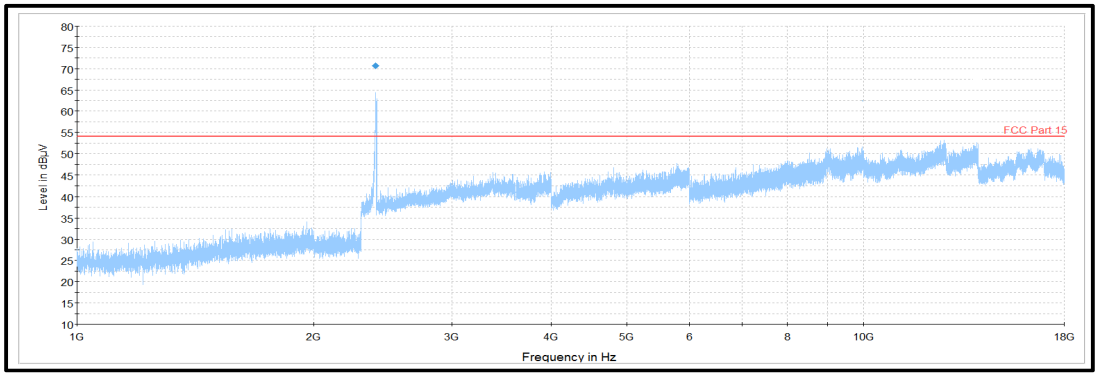
Results: Peak / Middle Channel/ Internal SMD Metal Antenna

Frequency (MHz)	Antenna Polarization	Level (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)	Result
5473.0	H	53.46	54.0	0.54	Complied

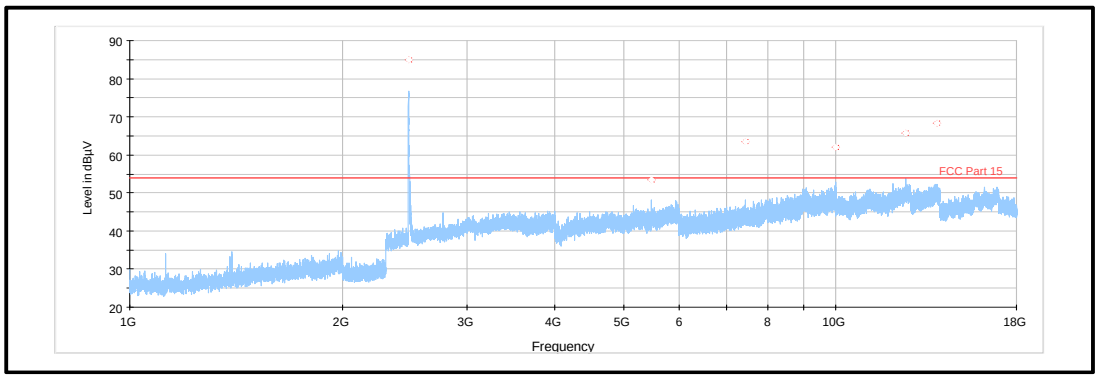
Results: Peak / Top Channel/ Internal SMD Metal Antenna

Frequency (MHz)	Antenna Polarization	Level (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)	Result
5473.0	H	53.48	54.0	0.52	Complied

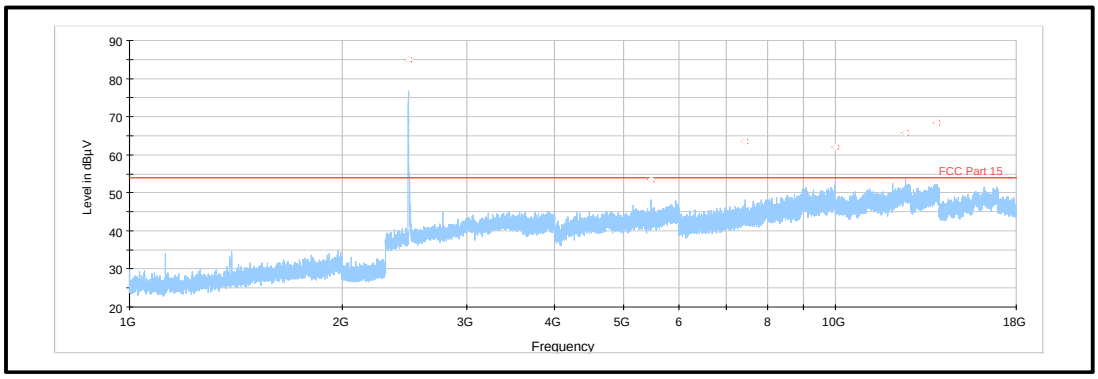
Result: Pass



Plot: 1 GHz – 18GHz (Bottom channel) measured with peak detector

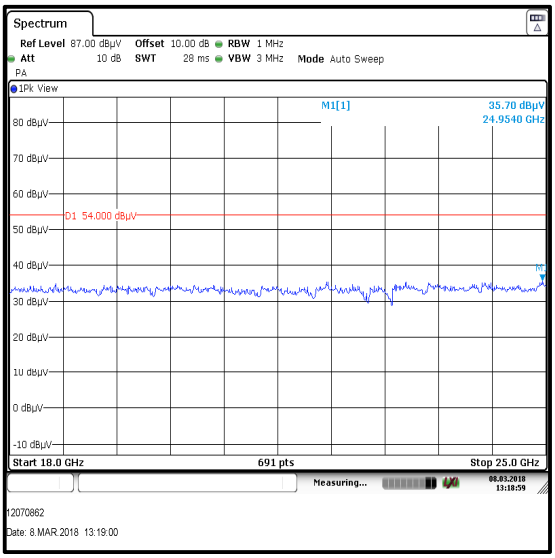


Plot: 1 GHz – 18GHz (Middle channel) measured with peak detector



Plot: 1 GHz – 18GHz (Top channel) measured with peak detector

Note: The above plots are pre-scans and for indication purposes only. For final measurements, see accompanying tables and the following plot.



Plot: 18 GHz – 25GHz (Bottom / Middle / Top channel) measured with peak detector

Results: Peak / Bottom Channel/ Internal SMD Chip Antenna

Frequency (MHz)	Antenna Polarization	Level (dBµV/m)	Peak Limit (dBµV/m)	Margin (dB)	Result
5472.8	H	53.22	54.0	0.78	Complied

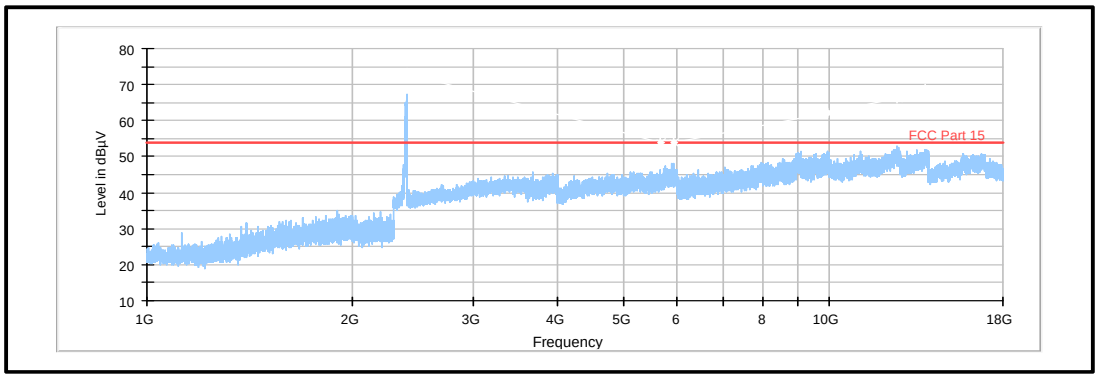
Results: Peak / Middle Channel/ Internal SMD Chip Antenna

Frequency (MHz)	Antenna Polarization	Level (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)	Result
5473.9	H	53.43	54.0	0.57	Complied

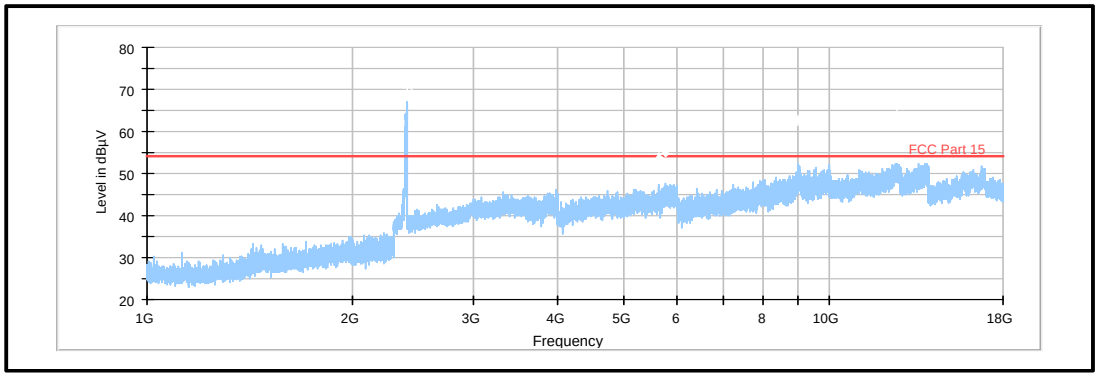
Results: Peak / Top Channel / Internal SMD Chip Antenna

Frequency (MHz)	Antenna Polarization	Level (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)	Result
5473.9	H	53.34	54.0	0.66	Complied

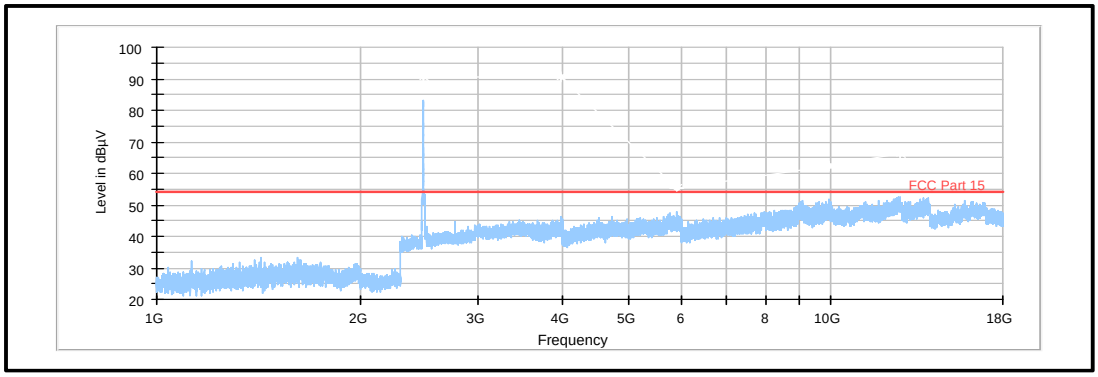
Result: Pass



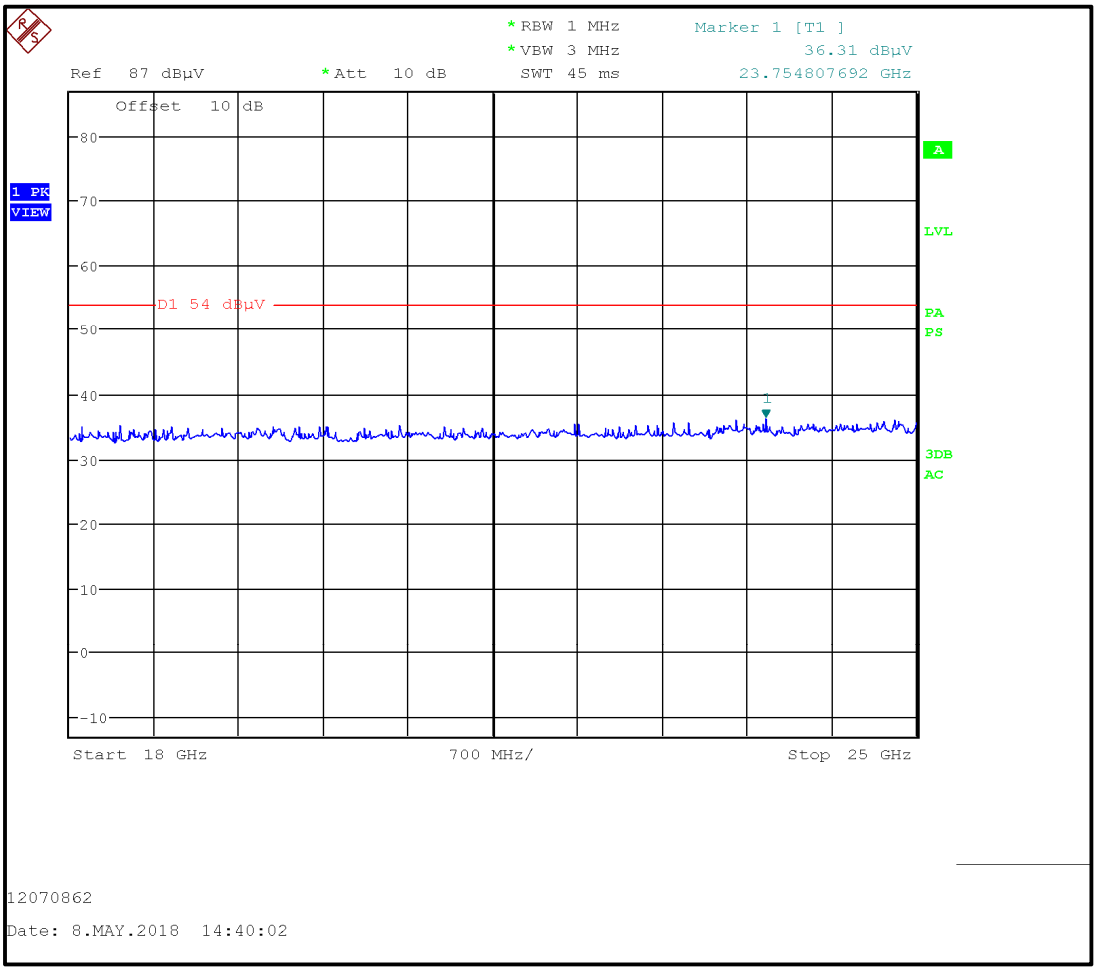
Plot: 1 GHz – 18GHz (Bottom channel) measured with peak detector



Plot: 1 GHz – 18GHz (Middle channel) measured with peak detector



Plot: 1 GHz – 18GHz (Top channel) measured with peak detector



Plot: 18 GHz – 25GHz (Bottom / Middle / Top channel) measured with peak detector

Results: Peak / Bottom Channel/ External λ/2 Dipole Antenna

Frequency (MHz)	Antenna Polarization	Level (dBµV/m)	Peak Limit (dBµV/m)	Margin (dB)	Result
5474.5	H	53.01	54.0	0.99	Complied

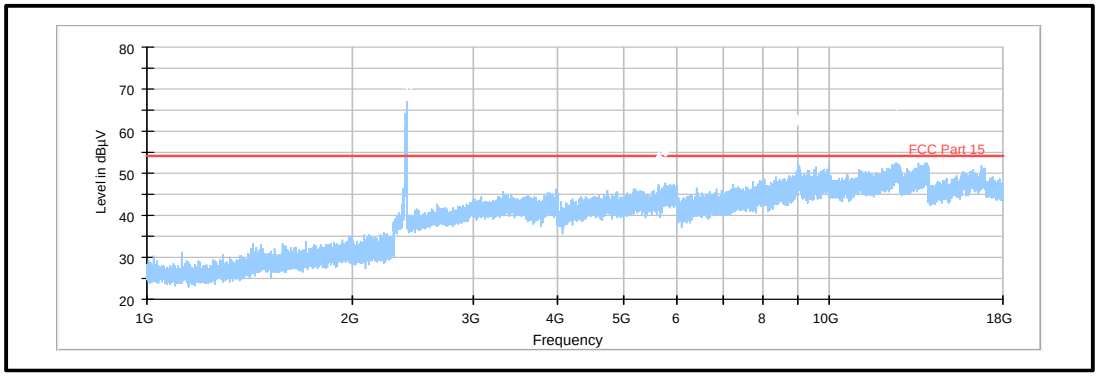
Results: Peak / Middle Channel/ External λ/2 Dipole Antenna

Frequency (MHz)	Antenna Polarization	Level (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)	Result
5474.5	H	53.19	54.0	0.81	Complied

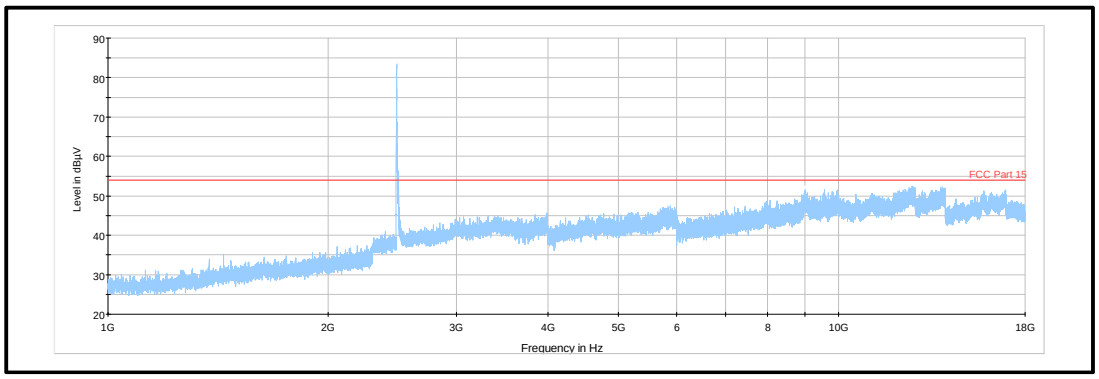
Results: Peak / Top Channel/ External λ/2 Dipole Antenna

Frequency (MHz)	Antenna Polarization	Level (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)	Result
5474.5	H	53.02	54.0	0.98	Complied

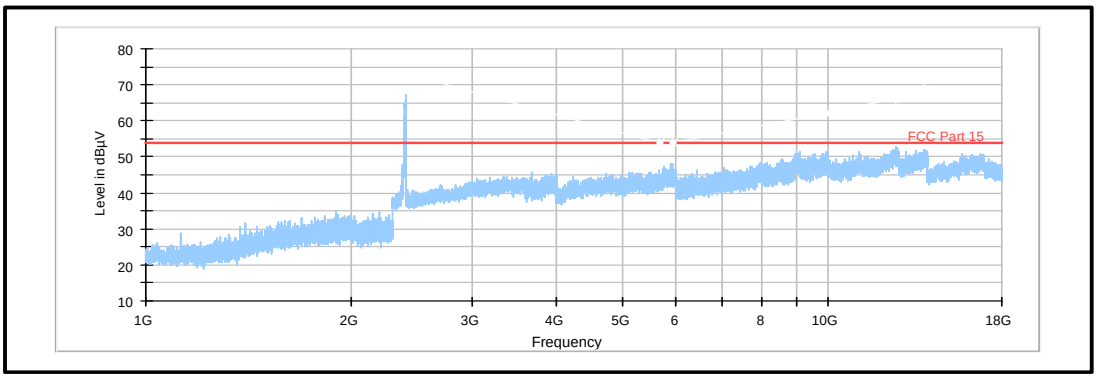
Result: Pass



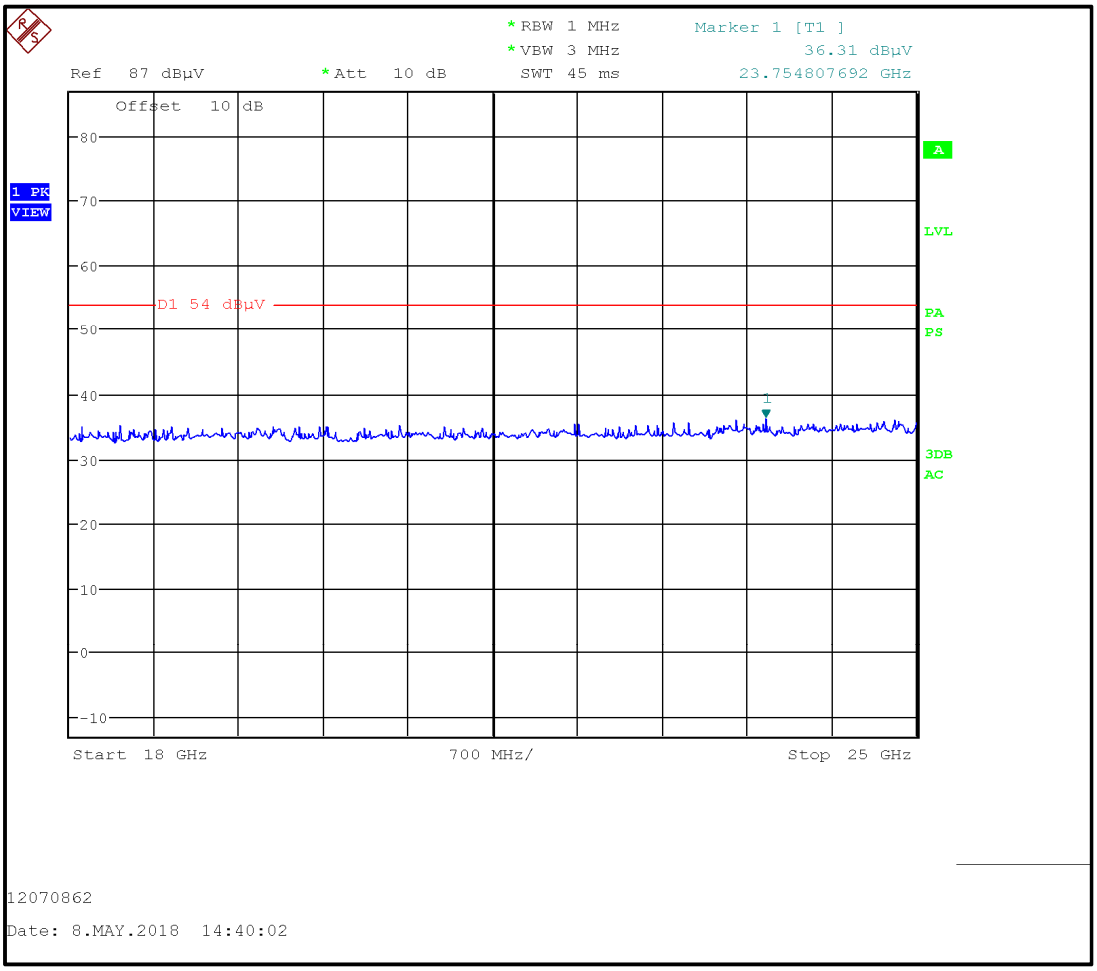
Plot: 1 GHz – 18GHz (Bottom channel) measured with peak detector



Plot: 1 GHz – 18GHz (Middle channel) measured with peak detector



Plot: 1 GHz – 18GHz (Top channel) measured with peak detector



Plot: 18 GHz – 25GHz (Bottom / Middle / Top channel) measured with peak detector

5.2.6. Transmitter Band Edge Radiated Emissions

Test Summary:

Test Engineer:	Segun I. Adeniji	**Test Date:**	07 March, 03 May 2018
Test Sample Serial Number:	S13, S14		
Test Site Identification	SR 1/2		

FCC Reference:	Parts 15.247(d) & 15.209(a) & (b)
Test Method Used:	ANSI C63.10 Section 6.10.4, 6.10.5 & KDB 558074 Section 11

Environmental Conditions:

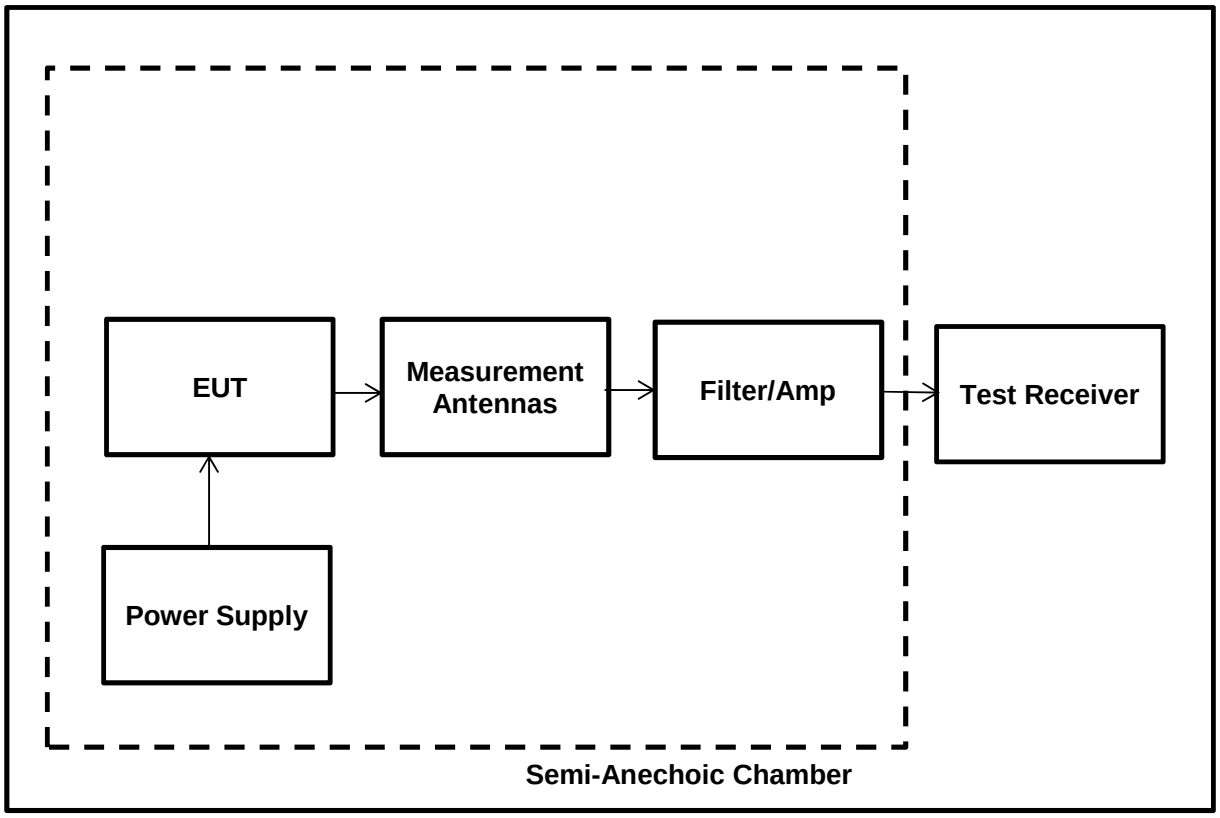
Temperature (°C):	23
Relative Humidity (%):	31

Note(s):

1. As the lower band edges fall within non-restricted bands, only peak measurements are required. In accordance with FCC KDB 558074 Section 11.1, the test method in Section 11.3 was followed: the test receiver resolution bandwidth was set to 100 kHz and video bandwidth 300 kHz. A peak detector was used, sweep time was set to auto and trace mode was Max Hold. The test receiver was left to sweep for a sufficient length of time in order to maximise the carrier level and out-of-band emissions. A marker and corresponding reference level line were placed on the peak of the carrier. As the maximum peak conducted output power was measured using a peak detector in accordance with FCC KDB 558074 Section 9.1.1 an out-of-band limit line was placed 20 dB below the peak level (FCC KDB 558074 Section 11.1(a)). A marker was placed on the band edge spot frequencies and a second marker placed on the highest emission level in the adjacent non-restricted band of operation (where a higher level emission was present). Marker frequencies and levels were recorded.
2. As the upper band edge falls within a restricted band both peak and average measurements were recorded by placing a marker at the edge of the band. For peak measurements the test receiver resolution bandwidth was set to 1 MHz and the video bandwidth 3 MHz. A peak detector was used, sweep time was set to auto and trace mode was Max Hold. For average measurements the test receiver resolution bandwidth was set to 1 MHz and the video bandwidth 3 MHz. An average detector was used, sweep time was set to auto and trace mode was Max Hold. The test receiver was left to sweep for a sufficient length of time in order to maximise the carrier level and out-of-band emissions. A marker was placed on the band edge spot frequencies and a second marker placed on the highest emission level in the adjacent restricted band of operation (where a higher level emission was present). Marker frequencies and levels were recorded.
3. There is a restricted band 10 MHz below the lower band edge. The test receiver was set up as follows: the RBW set to 1 MHz, the VBW set to 3 MHz, with the sweep time set to auto couple. Peak and average measurements were performed with their respective detectors. Markers were placed on the highest point on each trace.
4. *Emissions in restricted bands: In accordance with C63.10 Section 6.6.4.3, Note 1, where the peak detected amplitude was shown to comply with the average limit, an average measurement was not performed.

   **The final upper band edge average measurement was performed using the integration method stated in FCC KDB 558074 Section 13.3.1 and the result was compliant.

Test Setup:


EUT
Measurement Antennas
Filter/Amp
Test Receiver
Power Supply
Semi-Anechoic Chamber

Results: Lower Band Edge/Peak/ Internal SMD Metal Antenna

Frequency (MHz)	Level (dBµV/m)	-20 dBc Limit (dBµV/m)	Margin (dB)	Result
2400.000	59.53	83.75	24.22	Complied

Results: Upper Band Edge / Restricted Band / Peak/ Internal SMD Metal Antenna

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2483.500	68.88	74.0	5.12	Complied

Results: Upper Band Edge / Internal SMD Metal Antenna

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2483.500	53.82	54.0	0.18	Complied

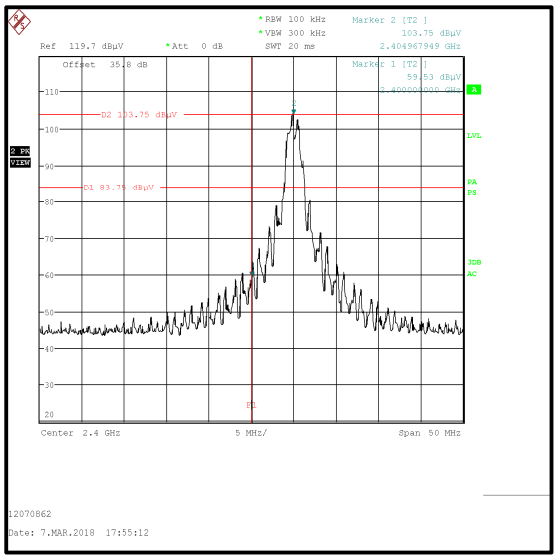
Results: 2310 to 2390 MHz Restricted Band / Peak / Internal SMD Metal Antenna

Frequency (MHz)	Peak Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2389.487	58.11	74.0	15.89	Complied

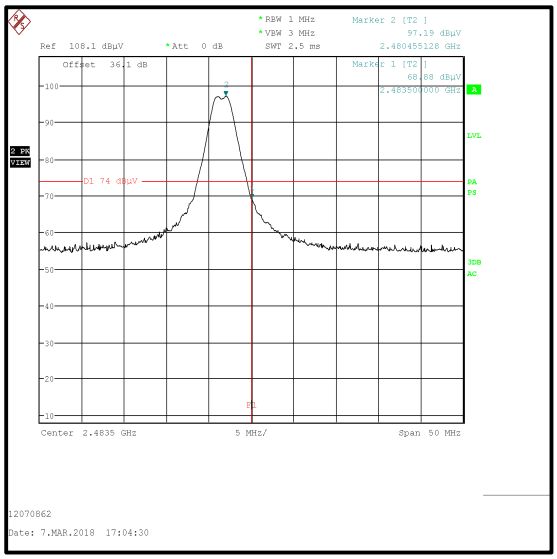
Results: 2310 to 2390 MHz Restricted Band / Average / Internal SMD Metal Antenna

Frequency (MHz)	Peak Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2389.487	48.45	54.0	5.55	Complied

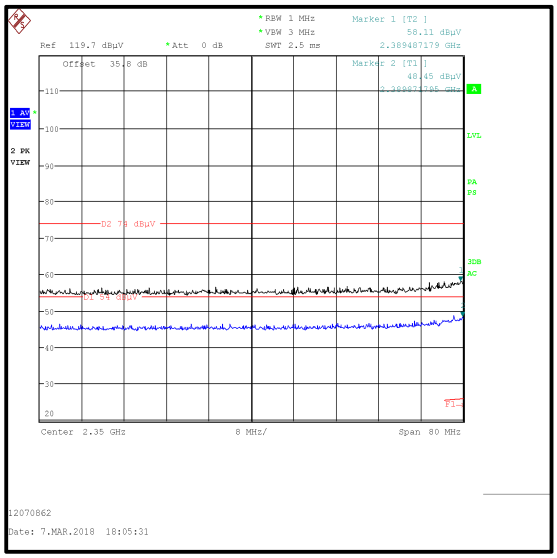
Results: Band Edge/ Internal SMD Metal Antenna



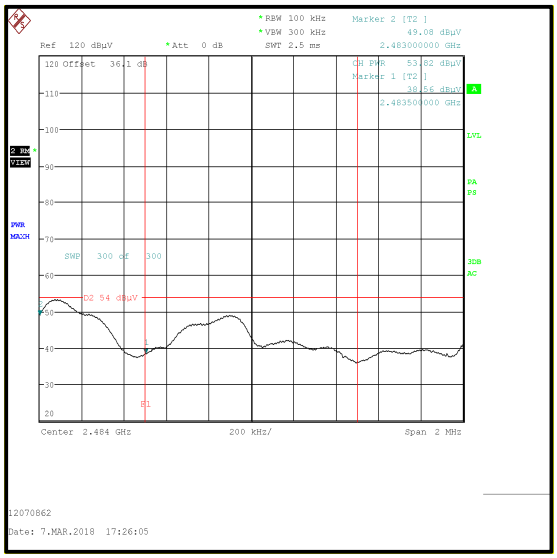
Lower Band Edge Peak Measurement



Upper Band Edge Peak Measurement



2310 MHz to 2390 MHz Restricted Band Plot



Upper Band Edge Integrated

Results: Lower Band Edge/Peak/ Internal SMD Chip Antenna

Frequency (MHz)	Level (dBµV/m)	-20 dBc Limit (dBµV/m)	Margin (dB)	Result
2400.000	66.51	99.43	32.92	Complied

Results: Upper Band Edge / Restricted Band / Peak/ Internal SMD Chip Antenna

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2483.500	70.88	74.0	3.12	Complied

Results: Upper Band Edge / Integrated/ Internal SMD Chip Antenna

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2483.500	53.51	54.0	0.49	Complied

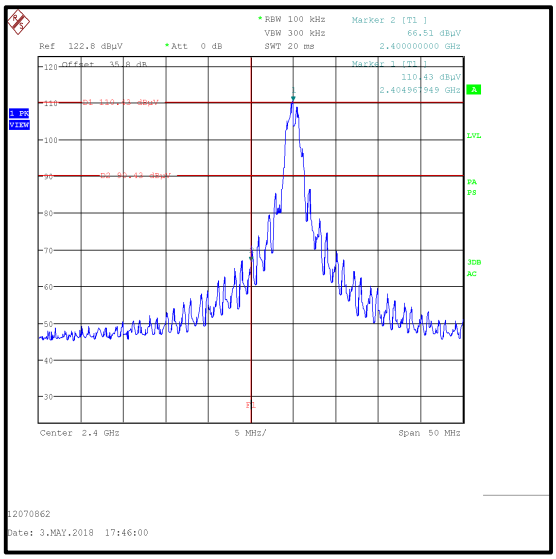
Results: 2310 to 2390 MHz Restricted Band / Peak/ Internal SMD Chip Antenna

Frequency (MHz)	Peak Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2389.487	62.01	74.0	11.99	Complied

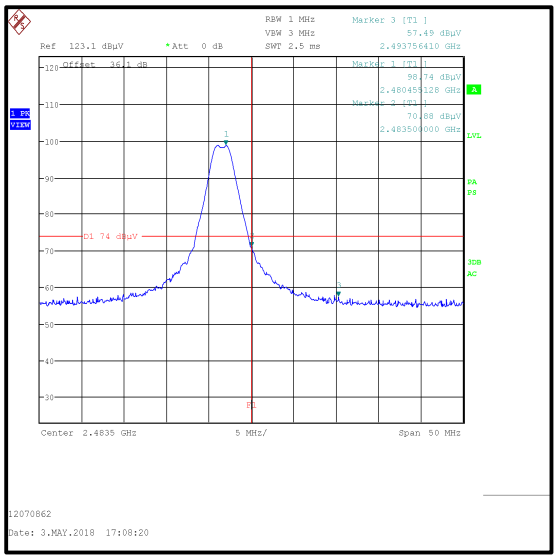
Results: 2310 to 2390 MHz Restricted Band / Average/ Internal SMD Chip Antenna

Frequency (MHz)	Peak Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2389.487	52.85	54.0	1.15	Complied

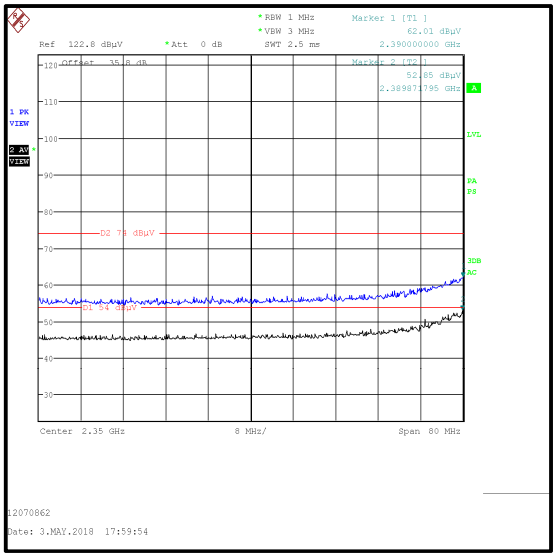
Results: Band Edge/Internal SMD Chip Antenna



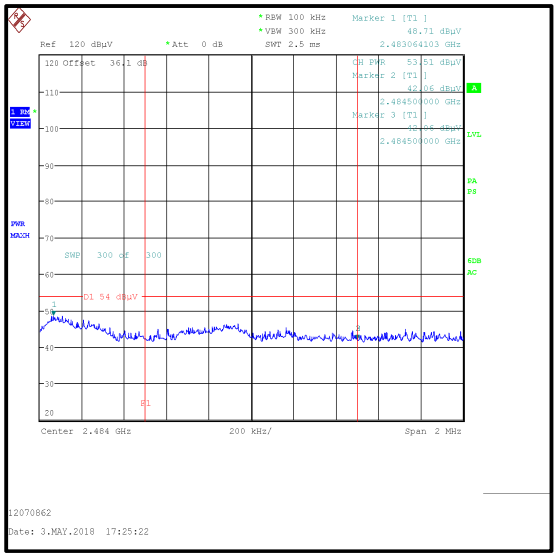
Lower Band Edge Peak Measurement



Upper Band Edge Peak Measurement



2310 MHz to 2390 MHz Restricted Band Plot



Upper Band Edge Integrated

Results: Lower Band Edge/Peak/External λ/2 Dipole Antenna

Frequency (MHz)	Level (dBµV/m)	-20 dBc Limit (dBµV/m)	Margin (dB)	Result
2400.000	62.91	87.18	24.27	Complied

Results: Upper Band Edge / Restricted Band / Peak/External λ/2 Dipole Antenna

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2483.500	70.47	74.0	3.53	Complied

Results: Upper Band Edge / Integrated/External λ/2 Dipole Antenna

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2483.500	53.67	54.0	0.33	Complied

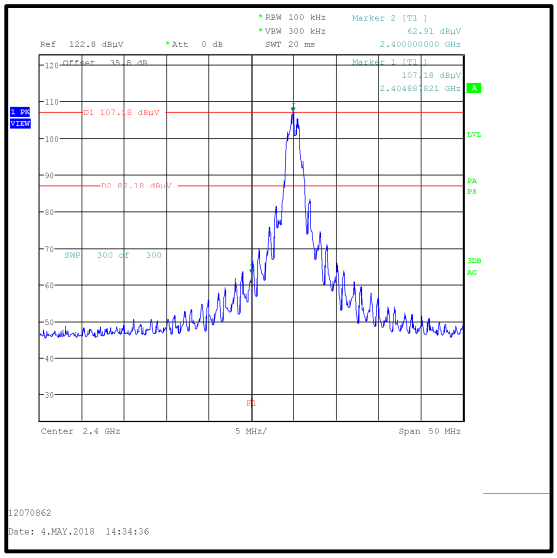
Results: 2310 to 2390 MHz Restricted Band / Peak/External λ/2 Dipole Antenna

Frequency (MHz)	Peak Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2389.487	59.24	74.0	14.76	Complied

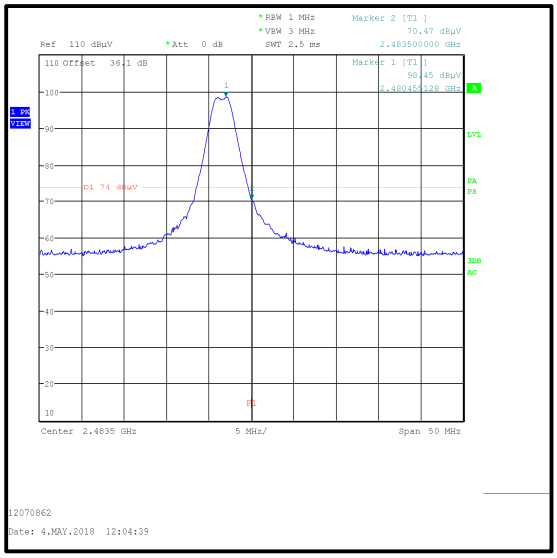
Results: 2310 to 2390 MHz Restricted Band / Average/External λ/2 Dipole Antenna

Frequency (MHz)	Peak Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2389.487	50.25	54.0	3.75	Complied

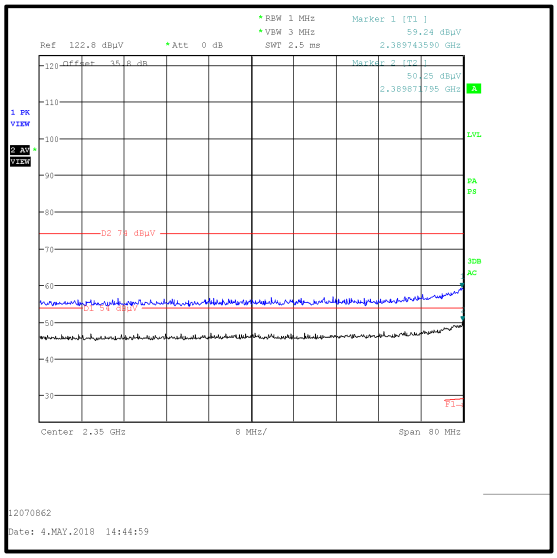
Results: Band Edge/External λ/2 Dipole Antenna



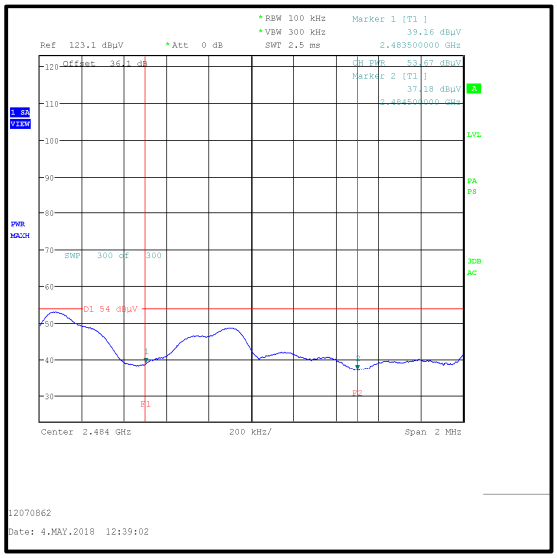
Lower Band Edge Peak Measurement



Upper Band Edge Peak Measurement



2310 MHz to 2390 MHz Restricted Band Plot



Upper Band Edge Integrated

5.2.6.1. Measurement Uncertainty

The expression of uncertainty of a measurement result allows realistic comparison of results with reference values and limits given in specifications and standards.

The uncertainty of the result may need to be taken into account when interpreting the measurement results.

The reported expanded uncertainties below are based on a standard uncertainty multiplied by an appropriate coverage factor such that a confidence level of approximately 95% is maintained. For the purposes of this document “approximately” is interpreted as meaning “effectively” or “for most practical purposes”.

Measurement Type	Confidence Level (%)	Calculated Uncertainty
AC Conducted Spurious Emissions	95%	±2.49 dB
Radiated Maximum Peak Output Power	95%	±3.10 dB
Conducted Maximum Peak Output Power	95%	±0.59 dB
Conducted Spurious Emissions	95%	±0.59 dB
Radiated Spurious Emissions	95%	±3.10 dB
Band Edge Radiated Emissions	95%	±3.10 dB
Minimum 6 dB Bandwidth	95%	±0.87 %
99% Emission Bandwidth	95%	±0.87 %
20 dB Bandwidth	95%	±0.87 %
Power Spectral Density	95%	±0.59 dB

The methods used to calculate the above uncertainties are in line with those recommended within the various measurement specifications. Where measurement specifications do not include guidelines for the evaluation of measurement uncertainty the published guidance of the appropriate accreditation body is followed.

6. Used equipment

Test site: SR 1/2

ID	Manufacturer	Type	Model	Serial No.	Calibration Date	Cal. Cycle
350	Rohde & Schwarz	Receiver, EMI Test	ESIB7	836697/014	7/13/2017	12
377	Bonn Elektronik	Amplifier, Low Noise Pre	BLMA 0118-1A	025294B	7/11/2017	12
423	Bonn Elektronik	Amplifier, Low Noise Pre	BLMA 1840-1A	055929	7/12/2017	12
460	Deisl	Turntable	DT 4250 S		n/a	n/a
465	Schwarzbeck	Antenna, Trilog Broadband	VULB 9168	9168-240	8/8/2016	36
496	Rohde & Schwarz	Antenna, log. - periodical	HL050	100297	7/20/2016	24
587	Maturo	antenna mast, tilting	TAM 4.0-E	011/7180311	n/a	n/a
588	Maturo	Controller	NCD	029/7180311	n/a	n/a
591	Rohde & Schwarz	Receiver	ESU 40	100244/040	7/12/2017	12
608	Rohde & Schwarz	Switch Matrix	OSP 120	101227	4/8/2014	60
614	Wainwright Instruments	Highpass Filter 3GHz	WHKX10-	1	Lab verification	n/a
615	Wainwright Instruments	Highpass Filter 1GHz	WHKX12-	3	Lab verification	n/a
620	Bonn Elektronik	pre-amplifier	BLNA 0110-01N	1510111	7/12/2017	24
628	Maturo	Antenna mast	CAM 4.0-P	224/19590716	n/a	n/a
629	Maturo	Kippeinrichtung	KE 2.5-R-M	MAT002	n/a	n/a

Test site: SR 9

ID	Manufacturer	Type	Model	Serial No.	Calibration Date	Cal. Cycle
424	EMCO	Antenna, Horn	EMCO 3116	00046537	7/28/2016	24
634	Rohde & Schwarz	Wireless Devices Test System	TS8997		7/11/2017	12
636	Rohde & Schwarz	switching unit	OSP120	101698	7/14/2017	12
637	Rohde & Schwarz	Spectrum Analyzer	FSV40	101587	7/11/2017	12
195	SPS	Power Supply	TOE8842-24	51455	Verified by Multimeter	12
216	Agilent	Multimeter	34401A	US36017458	7/11/2017	24

Test site: SR 7/8

ID	Manufacturer	Type	Model	Serial No.	Calibration Date	Cal. Cycle
22	Rohde & Schwarz	Artificial Mains	50 Ohm// 50uH	831767/014	7/12/2017	12
215	Rohde & Schwarz	Artificial Mains Network	9 kHz - 30 MHz; 3 phase	879675/002	7/12/2017	12
350	Rohde & Schwarz	Receiver, EMI Test	20 Hz - 7 GHz	836697/014	7/13/2017	12
616	Rohde & Schwarz	ISN	8 wire ISN for CAT6	101656	7/13/2017	12

7. Report Revision History

Version Number	Revision Details		
	Page No(s)	**Clause**	**Details**
1.0	-	-	Initial Version
1.1	1, 7, 9	3.0, 4.2	FCC ID added, Used power setting was updated
1.2	33, 39, 49	5.2.5, 5.2.6	Measurement results of Internal SMD Chip Antenna & External λ/2 Dipole Antenna added
1.3	8, 35	3.4, 5.2.4	Antenna Gain changed