

File Number **20/36400547M2**

TEST REPORT

Radiofrequency

Petitioner's Reference: VI-grade Srl

Customer Address : Via Galileo Galilei 42
33010 Tavagnacco (UD)
Italy

Equipment: Biotelemetry apparatus (WiFi)

Brand:	VI-Grade	Model:	BioBox
s/n:	BT00010-00	Internal Id:	9094/1

Result: complies

It has been tested and complies the standard specifications Applicable / s
See specifications applied on page 13

Applicable Standards

ERM standard/s:

FCC Rules 47 CFR Part 15 Subpart C: Radio Frequency Devices (Intentional Radiators)

RSS-Gen Issue 5 Amendment 1 - General Requirements for Compliance of Radio Apparatus.

RSS-247 Issue 2 - Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices.

Date of issue: Bellaterra, March 25, 2020

M2: This report replaces and annuls the report with certificate number 20/36400547M1 dated 03-24-2020.

Modifications performed: Added results table with Maximum conducted output power calculations in page 45

A handwritten signature in black ink, appearing to read 'Fernando Rivas'.

Fernando Rivas Fernández
Technical Manager
Electrical and Electronics
LGAI Technological Center S.A.

The results refer only and exclusively to the sample, product or material delivered for testing in "Equipment Received" section below. The equipment has been tested under conditions stipulated by standard(s) quoted in this document.

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This is the first page of the document, which consists of 62 pages of which 47 are annexes.

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1. EQUIPMENT RECEIVED AND TESTED

EQUIPMENT: Biotelemetry apparatus (WiFi)			
Brand:	VI-Grade	Model:	BioBox
s/n:	BT00010-00	Power Supply:	3.7V DC (Lithium Battery)
FVIN:	V1.0	HVIN:	V1.0
FCC ID:	2AU4RBIOTELEMETRY	Test program	--
IC:	25643-BIOTEL		
Max internal EUT frequency	2.5 GHz		

Product description:

(Information declared by the manufacturer, Applus+ is not responsible)

VI-Biotelemetry is a hardware and software turn-key solution provided by VI-Grade to acquire, elaborate and stream some physiological signals generated by human body.

Type of Equipment	Combined equipment.	Equipment Type	TX/RX
Modulations	802.11b(DSSS): CCK,DQPSK,DBPSK 802.11g(OFDM): BPSK,QPSK,16-QAM,64-QAM 802.11n(OFDM): BPSK,QPSK,16-QAM,64-QAM		
Radio technology	2.4 GHz WiFi	Operation frequency	2412MHz-2462MHz
Number of channels	11		

DESCRIPTION OF AVAILABLE ANTENNAS

Integrated PCB Antenna with a maximum gain of -0.3dBi

Test product reception:	2019-12-10
Test initial date:	2019-12-10
Test final date:	2020-03-04

Test configuration

Power Supply: 3.7V DC (Lithium Battery)
Set-up: Tabletop
Test exercise: One equipment capable of transmitting continuously in 1, 7 or 11 channel, respectively, at fixed RF output power
Normal test temperature: 15°C to 35°C

Modulation	Test exercise
IEEE 802.11b*	Tx continuous Channel 1:2412 MHz
IEEE 802.11g*	Tx continuous Channel 1:2412 MHz
IEEE 802.11n*	Tx continuous Channel 1:2412 MHz
IEEE 802.11b*	Tx continuous Channel 7:2442 MHz
IEEE 802.11g*	Tx continuous Channel 7:2442 MHz
IEEE 802.11n*	Tx continuous Channel 7:2442 MHz
IEEE 802.11b*	Tx continuous Channel 11:2462 MHz
IEEE 802.11g*	Tx continuous Channel 11:2462 MHz
IEEE 802.11n*	Tx continuous Channel 11:2462 MHz

Test Modes Reported
(Worst case modes)

***Special FW version used to operate in the described test mode**

Equipment size: 10 x 5.5 x 2.3 cm

Auxiliary and control equipment

Intel BOXNUC8i3BEK2 Mini PC with Ubuntu OS

Input/output wires

FCC/ISED certified power supply adaptor (120Vac 60Hz)

Field Strength Calculation

The field strength (level) is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading.

The basic equation is as follow:

$$\mathbf{FS = RA + AF + CF - AG}$$

Where FS = Field Strength (Level)

- RA = Receiver Amplitude (Meter Reading)
- AF = Antenna Factor
- CF = Cable Factor
- AG = Amplifier Gain

Margin value = Emission level – Limit value

Example:

RA: 14.0dB μ V / AF: 16.5 dBm-1 / CF: 3.5dB / AG: 15dB

- Total factor: 5dBm-1

Field level: 19.0dB μ V/m (-21.0dB for margin if limit is 40dB μ V/m)

Modification performed

No modification was performed

2. APPLICABLE STANDARDS

TEST APPLICABLE STANDARDS

Standard: FCC Rules 47 CFR Part 15 C, RSS-Gen Issue 5 Amendment 1, RSS-247 Issue 2 based on standards.

Basic standard: ANSI C63.10:2013

- Unwanted Radiated Emission (9kHz -26GHz): FCC 15.205(a) / 15.209 (a) / 15.247 (c) / RSS-247 Issue 2, February 2017 (5.5)
- Unwanted emissions into non-Restricted Frequency Bands (Radiated) (30MHz -26GHz): FCC 15.247 (d) and RSS-247 5.5
- Unwanted Emissions (Radiated) / Band Edge: FCC 15.247 (d) and RSS-247 5.5

Technical standards considered: KDB 558074 D01 15.247 Meas Guidance v05r02

Basic standard: ANSI C63.10:2013

- Maximum Conducted Output Power: FCC 15.247 (b) (1) and RSS-247 5.4 (b)*

**The DUT does not have external antenna connector, thus the test is performed using radiated method*

Basic standard: ANSI C63.10:2013

- Occupied Bandwidth 6dB: FCC 15.247 (a) (2) and RSS-247 5.2 (a)
- Occupied Bandwidth (99%): RSS-GEN 6.7

Basic standard: ANSI C63.10:2013

- Maximum Power Spectral Density: FCC 15.247 (e) and RSS-247 5.2 (b)

Basic standard: FCC Title 47 part 15 Subpart C

- Antenna Requirements: FCC 15.203

Basic standard: ANSI C63.10:2013

- Frequency Stability: RSS-GEN 6.11*

*Test Not Applicable: The fundamental emissions of the EUT are fully kept within the permitted operating frequency band 2.4GHz – 2.4835GHz

Acceptance criteria for the test

According to standards

FCC Title 47 part 15 Subpart C
ANSI C63.10:2013
RSS-Gen Issue 5 Amendment 1
RSS-247 Issue 2

Test facilities ID

FCC Test Firm Registration Number:	507478
ISED Assigned Code:	5766A
CABID	ES0002

Test procedures

Unwanted Radiated Emission / Band Edge and Unwanted emissions into non Restricted Frequency Bands	C5401665
Maximum Conducted Output Power	C5401665
Occupied Channel Bandwidth	C5401665
Maximum Power Spectral Density	C5401665
Frequency Stability measurements	C5401665

Measuring uncertainties

Radiated emission tests (9 kHz to 1 GHz)	± 4.3 dB
Radiated emission tests above 1 GHz to 40 GHz	± 4.3 dB
RF output power measurements [Radiated]	± 4.3 dB
RF bandwidth measurements	± 2.31 kHz
Power spectral density measurements [Radiated]	± 4.3 dB
Frequency stability measurements (-20° C to + 50°C)	±1.8x10E-7

Expanded uncertainty measurement is obtained multiplying the typical uncertainty measurement with a coverage factor k=2, which corresponds to a confidence level of 95% for a normal distribution.

Modifications

No modifications were made.

USED EQUIPMENT

RADIO-FREQUENCY RADIATED EMISSIONS (9kHz – 30MHz)					
EQUIPMENT	BRAND	MODEL	NUMBER	LAST CALIBRATION	NEXT CALIBRATION
EMI Test Receiver	ROHDE & SCHWARZ	ESU 40	1041155	06/09/2019	06/09/2020
LOOP ANTENNA	EMCO	6502	05-ER-019	04/12/2018	04/06/2020
RF CABLE	HUBER+SUHNER	SF103/11N/16N/4000MM	1041909	06/02/2019	06/02/2020*
RF CABLE	HUBER+SUHNER	CLR67 NANA 10000 P01 FR	1042114	30/01/2019	30/01/2020*
TEST SOFTWARE	RHODE & SCHWARZ	EMC32 v.10.50.00	1041158	--	--
MAST-TABLE CONTROLLER	COMTEST	4630 - 100	104369	--	--
SEMI ANECHOIC CHAMBER SAC2	EUROSHIELD	TC2	104563	04/07/2019	04/07/2020

RADIO-FREQUENCY RADIATED EMISSIONS (30MHz – 1GHz)					
EQUIPMENT	BRAND	MODEL	NUMBER	LAST CALIBRATION	NEXT CALIBRATION
EMI Test Receiver	ROHDE & SCHWARZ	ESU 40	1041155	06/09/2019	06/09/2020
BILOG ANTENNA	SCHWARZBECK MESS-ELEKTRONIK	VULB 9162	1042229	24/04/2019	24/04/2020
ATTENUATOR 3dB	HUBER+SUHNER	6803.17.B	1042020	29/08/2019	29/08/2020
RF CABLE	HUBER+SUHNER	SF103/11N/16N/4000MM	1041909	06/02/2019	06/02/2020*
RF CABLE	HUBER+SUHNER	CLR67 NANA 10000 P01 FR	1042114	30/01/2019	30/01/2020*
TEST SOFTWARE	RHODE & SCHWARZ	EMC32 v.10.50.00	1041158	--	--
MAST-TABLE CONTROLLER	COMTEST	4630 - 100	104369	--	--
SEMI ANECHOIC CHAMBER SAC2	EUROSHIELD	TC2	104563	04/07/2019	04/07/2020

MAXIMUM CONDUCTED OUTPUT POWER, OCCUPIED BANDWIDTH, MAXIMUM POWER SPECTRAL DENSITY and BAND EDGE					
INSTRUMENT	BRAND	MODEL	NUMBER	LAST CALIBRATION	NEXT CALIBRATION
EMI TEST RECEIVER	ROHDE & SCHWARZ	ESW26	1041791	07/05/2019	07/05/2020
SEMI ANECHOIC CHAMBER SAC2	EUROSHIELD	TC2	104563	04/07/2019	04/07/2020
HORN ANTENNA	EMCO	3115	05-ER-182	29/08/2019	29/08/2020
RF CABLE	HUBER+SUHNER	SF104	1042242	12/08/2019	12/08/2020

*Note: The tests performed with this equipment were carried out within its calibration period. Calibration Interval of this instrument is one year.

RADIO-FREQUENCY RADIATED EMISSIONS (1 GHz – 18GHz)					
EQUIPMENT	BRAND	MODEL	NUMBER	LAST CALIBRATION	NEXT CALIBRATION
HORN ANTENNA	EMCO	3115	05-ER-017	29/08/2019	29/08/2020
EMI Test Receiver	ROHDE & SCHWARZ	ESU 40	1041155	06/09/2019	06/09/2020
RF CABLE	HUBER+SUHNER	SUCOFLEX 100	1041627	22/03/2019	22/03/2020
RF CABLE	HUBER+SUHNER	ST26	1041825	19/09/2019	19/09/2020
PRE AMPLIFIER	BONN Elektronik	BLMA 0118-M	1041733	10/05/2019	10/05/2020
TEST SOFTWARE	RHODE & SCHWARZ	EMC32 v.10.50.00	1041158	--	--
MAST-TABLE CONTROLLER	COMTEST	4630 - 100	104369	--	--
SEMI ANECHOIC CHAMBER SAC2	EUROSHIELD	TC2	104563	04/07/2019	04/07/2020

RADIO-FREQUENCY RADIATED EMISSIONS (18 GHz – 26GHz)					
EQUIPMENT	BRAND	MODEL	NUMBER	LAST CALIBRATION	NEXT CALIBRATION
LOGPERIODIC ANTENNA	ROHDE & SCHWARZ	HL050	1041226	12/03/2019	12/03/2022
EMI Test Receiver	ROHDE & SCHWARZ	ESU 40	1041155	06/09/2019	06/09/2020
RF CABLE	HUBER+SUHNER	SUCOFLEX 100	1041627	22/03/2019	22/03/2020
RF CABLE	HUBER+SUHNER	ST26	1041825	19/09/2019	19/09/2020
PRE AMPLIFIER	BONN ELEKTRONIK	BLMA 1826-4A	1041808	09/08/2019	09/08/2020
TEST SOFTWARE	RHODE & SCHWARZ	EMC32 v.10.50.00	1041158	--	--
MAST-TABLE CONTROLLER	COMTEST	4630 - 100	104369	--	--
SEMI ANECHOIC CHAMBER SAC2	EUROSHIELD	TC2	104563	04/07/2019	04/07/2020

UNWANTED EMISSIONS INTO NON-RESTRICTED FREQUENCY BANDS (30 MHz -1 GHz)					
INSTRUMENT	BRAND	MODEL	NUMBER	LAST CALIBRATION	NEXT CALIBRATION
EMI TEST RECEIVER	ROHDE & SCHWARZ	ESW26	1041791	07/05/2019	07/05/2020
SEMIANECHOIC CHAMBER SAC2	EUROSHIELD	TC2	104563	04/07/2019	04/07/2020
BILOG ANTENNA	SCHWARZBECK	VULB 9162	1042229	24/04/2019	24/04/2020
3 dB ATTENUATOR	HUBER+SUHNER	6803.17.B	1042020	29/08/2019	29/08/2020
RF CABLE	HUBER+SUHNER	SF103/11N/16N/4000MM	1041909	06/02/2019	06/02/2020*
RF CABLE	HUBER+SUHNER	SF104	1042242	12/08/2019	12/08/2020

*Note: The tests performed with this equipment were carried out within its calibration period. Calibration Interval of this instrument is one year.

UNWANTED EMISSIONS INTO NON-RESTRICTED FREQUENCY BANDS (1 GHz -26 GHz)					
INSTRUMENT	BRAND	MODEL	NUMBER	LAST CALIBRATION	NEXT CALIBRATION
EMI TEST RECEIVER	ROHDE & SCHWARZ	ESW26	1041791	07/05/2019	07/05/2020
SEMIANNECHOIC CHAMBER SAC2	EUROSHIELD	TC2	104563	04/07/2019	04/07/2020
LOGOPERIODIC ANTENNA	ROHDE & SCHWARZ	HL050	1041226	12/03/2019	12/03/2020
PREAMPLIFIER	BONN ELEKTRONIK	BLMA 0118-M	1041733	10/05/2019	10/05/2020
PREAMPLIFIER	BONN ELEKTRONIK	BLMA 1826-4A	1041808	09/08/2019	09/08/2020
RF CABLE	ASTROLAB	32026-29094-290954-48TC	1041547	20/09/2019	20/09/2020
RF CABLE	HUBER+SUHNER	SUCOFLEX 100	1041627	22/03/2019	22/03/2020

AUXILIARY EQUIPMENT					
INSTRUMENT	BRAND	MODEL	NUMBER	LAST CALIBRATION	NEXT CALIBRATION
THERMOHIGROMETER	PCE	THB 40	1042022	19/06/2019	19/06/2020

Environmental conditions

In the control chamber, the following limits were not exceeded during the test:

Temperature	Min = 15°C Max = 35°C
Relative Humidity	Min = 20% Max = 80%
Shielding Effectiveness	>100dB
Reference Resistance to Earth	< 1 Ohm

In the semianechoic chamber, the following limits were not exceeded during the test.

Temperature	Min = 15°C Max = 35°C
Relative Humidity	Min = 45% Max = 60%
Air Pressure	Min = 860 mbar Max = 1060 mbar
Shielding Effectiveness	>100dB
Reference Resistance to Earth	< 1 Ohm
Normal Site Attenuation (NSA)	< ±4 dB at 3 m distance between item under test and receiver antenna, (30 MHz to 1000 MHz)
Site VSWR	< ±6 dB at 3m distance between item under test and receiver antenna, (1 GHz to 18 GHz)
Field homogeneity	More than 75% of illuminated surface is between 0 and 6 dB (26 MHz to 18 GHz).

In the chamber for conducted measurements, the following limits were not exceeded during the test:

Temperature	Min = 15°C Max = 35°C
Relative Humidity	Min = 45% Max = 60%
Air pressure	Min. = 860 mbar Max. = 1060 mbar
Shielding Effectiveness	>100dB
Reference Resistance to Earth	< 1 Ohm

See results sheets

3. RESULT

PRODUCT: Biotelemetry apparatus (WiFi)				
Brand:	VI-Grade	PMN:	BioBox	
s/n:	BT00010-00	Power Supply:	3.7V DC (Lithium Battery)	
TESTING		RESULTS		
Unwanted Radiated Emission		Pass	Note: 4	
Unwanted emissions into non-Restricted Frequency Bands and Band Edge		Pass	Note: 4	
Maximum Conducted Output Power (Radiated Method)		Pass	Note: 4	
Occupied Bandwidth (6dB and 99%)		Pass	Note: 4	
Maximum Power Spectral Density		Pass	Note: 4	
Antenna Requirements		Pass		
Frequency Stability Measurements		N/A		

1: The measured results are above the upper limit, even considering the uncertainty interval.
2: The measured results are above the specified limits, but within the uncertainty interval. It is therefore not possible to state compliance based on the 95% level of confidence. However, the results indicate that non-compliance is more probable than compliance
3: The measured results are below the specified limits, but within the uncertainty interval. It is therefore not possible to state compliance based on the 95% level of confidence. However, the results indicate that compliance is more probable than non-compliance
4: The measured results are within the limits, including the uncertainty interval.

Service Quality Assurance

Applus+, guarantees that this work has been made in accordance with our Quality and Sustainability System, fulfilling the contractual conditions and legal norms.

Within our improvement program we would be grateful if you would send us any commentary that you consider opportune, to the person in charge who signs this document, or to the Quality Manager of Applus+, in the following e-mail address: satisfaccion.cliente@applus.com

4. ANNEXES

Test Results

Unwanted Radiated Emissions

The test site semi-anechoic chamber has met the requirement of NSA tolerance 4 dB according to the standards: ANSI C63.10-2013. The test distance is 3m. The setup is according to the requirements in Section 13.1.4.1 of ANSI C63.10-2013.

According to FCC Part 15.247(d): radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)). According to FCC Part15.205, Restricted bands.

MHz	MHz	MHz	GHz
0.090-0.110	16.42-16.423	399.9-410	4.5-5.15
10.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2690-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	(2)
13.36-13.41			

20dBc in any 100 kHz bandwidth outside the operating frequency band. In case the emission fall within the restricted band specified on 15.205(a), then the 15.209(a) limit in the table below has to be followed.

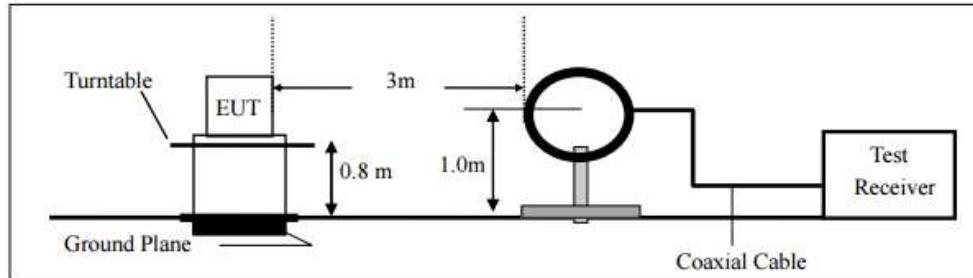
Restricted Frequency(MHz)	Field Strength (μ V/m)	Field Strength (dB μ V/m)	Measurement Distance
0.009~0.490	2400/F(KHz)	20 log (μ V/m)	300
0.490~1.705	2400/F(KHz)	20 log (μ V/m)	30
1.705~30.0	30	29.5	30
30-88	100	40	3
88-216	150	43.5	3
216-960	200	46	3
Above 960	500	54	3

Limits of Radiated Emission Measurement (Above 1000MHz)

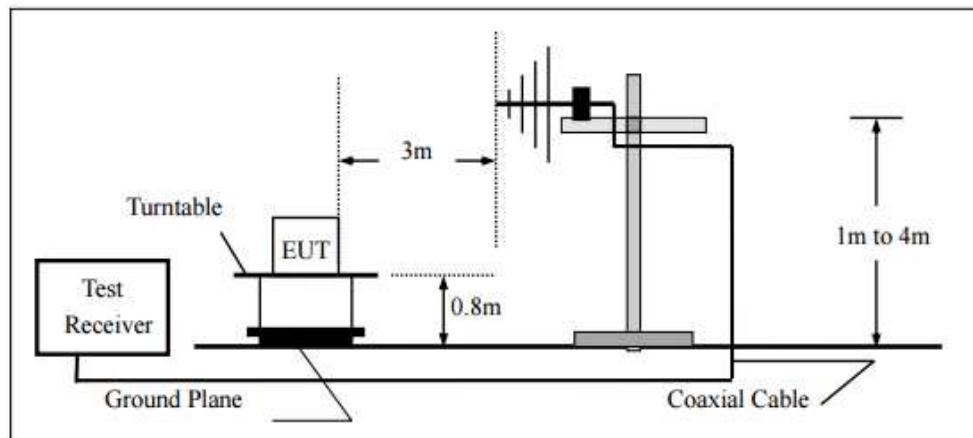
Frequency(MHz)	Class B (dB μ V/m) (at 3M)	
	PEAK	AVERAGE
Above 1000	74	54

Test Configuration

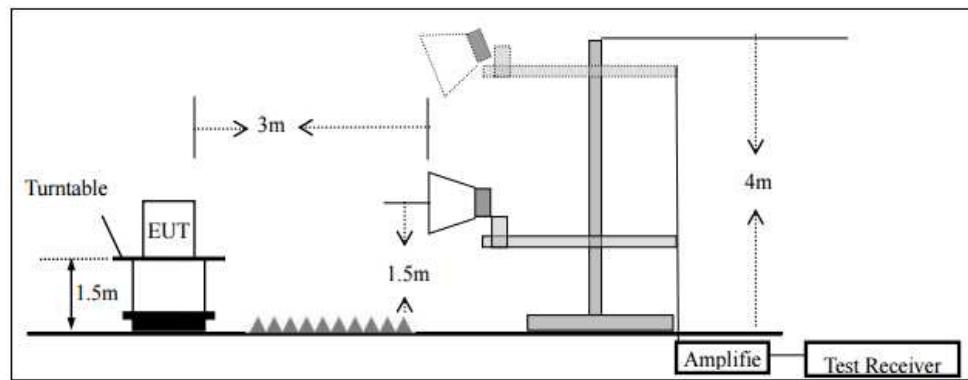
- **For radiated emissions below 30MHz:**



- **For radiated emissions from 30MHz to 1000MHz:**



- **For radiated emissions above 1000MHz:**



Test Procedures

The measuring distance of at 3 m shall be used for measurements at frequency up to 1GHz. For frequencies above 1GHz, any suitable measuring distance may be used.

The EUT was placed on the top of a rotating table 0.8 m for below 1GHz and 1.5m for above 1GHz the ground at a 3 meter. The table was rotated 360 degrees to determine the position of the highest radiation.

The height of the equipment or of the substitution antenna shall be 0.8 m for below 1GHz and 1.5m for above 1GHz; the height of the test antenna shall vary between 1 m to 4 m. Both horizontal and vertical polarizations of the antenna are set to make the measurement.

For the radiated emission test above 1GHz:

Place the measurement antenna away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response. The measurement antenna may have to be higher or lower than the EUT, depending on the radiation pattern of the emission and staying aimed at the emission source for receiving the maximum signal. The final measurement antenna elevation shall be that which maximizes the emissions. The measurement antenna elevation for maximum emissions shall be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane.

The initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured.

If the Peak Mode measured value compliance with and lower than Quasi Peak Mode Limit, the EUT shall be deemed to meet QP Limits and then no additional QP Mode measurement performed.

For the actual test configuration, please refer to the related Item –EUT Test Photos.

Note: Both horizontal and vertical antenna polarities were tested and performed pretest to three orthogonal axis. The worst case emissions were reported.

During the radiated emission test, the Spectrum Analyzer was set with the following configurations:

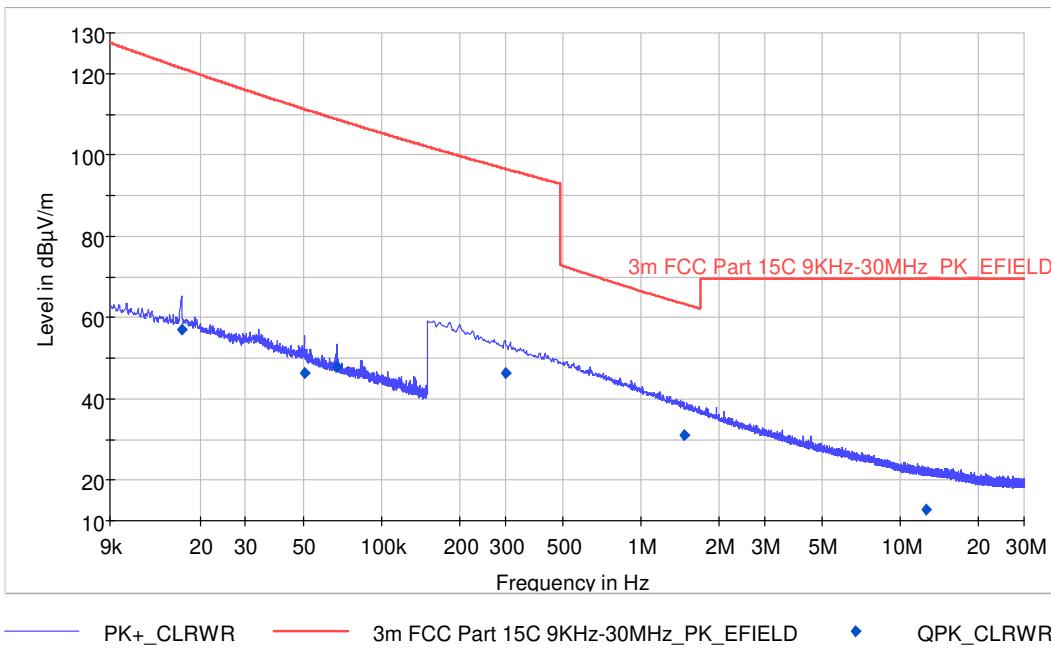
Frequency band (MHz)	Function	Resolution Bandwidth	Video Bandwidth
30 to 1000	QP	120 kHz	300 kHz
Above 1000	Peak	1 MHz	1 MHz
	Average	1 MHz	10 Hz

Note: for the frequency ranges below 30 MHz, if a narrower RBW is used for these ranges , the measured value should add a RBW correction factor (RBWCF) where RBWCF [dB] = $10 \times \lg(100 \text{ [kHz]}/\text{narrower RBW [kHz]})$. the narrower RBW is 1 kHz and RBWCF is 20 dB for the frequency 9 kHz to 150 kHz, and the narrower RBW is 10 kHz and RBWCF is 10 dB for the frequency 150 kHz to 30 MHz.

UNWANTED RADIATED EMISSIONS														
Technician: Pau Aguilà / Jose M. Llauradó / Gerardo Ballesteros			Frequency range: 9KHz – 26 GHz											
Test date: 2019-12-10/2020-01-08														
Basic standards: ANSI C63.10-2013 and RSS-Gen Issue 5 Amendment 1														
<table border="1"><tr><td>Temperature:</td><td>21.6</td><td>°C</td></tr><tr><td>Humidity:</td><td>39.2</td><td>%</td></tr><tr><td>Atm. Pressure:</td><td>997.2</td><td>hPa</td></tr></table>						Temperature:	21.6	°C	Humidity:	39.2	%	Atm. Pressure:	997.2	hPa
Temperature:	21.6	°C												
Humidity:	39.2	%												
Atm. Pressure:	997.2	hPa												
EUT: Tabletop	Class B	Test Area SAC2	Distance 3 m	PreScan Worst-case mode	Evaluation Individual									
RESULTS: Pass														
Identification DUT: Device under test AUX: Auxiliary Devices SYS: DUT + AUX BB : Broad-band NB : Narrow-band QP: Quasi-peak		Emissions Limit + I <= QP I=Uncertainty		Main emission source and type DUT, NB										
Comments														

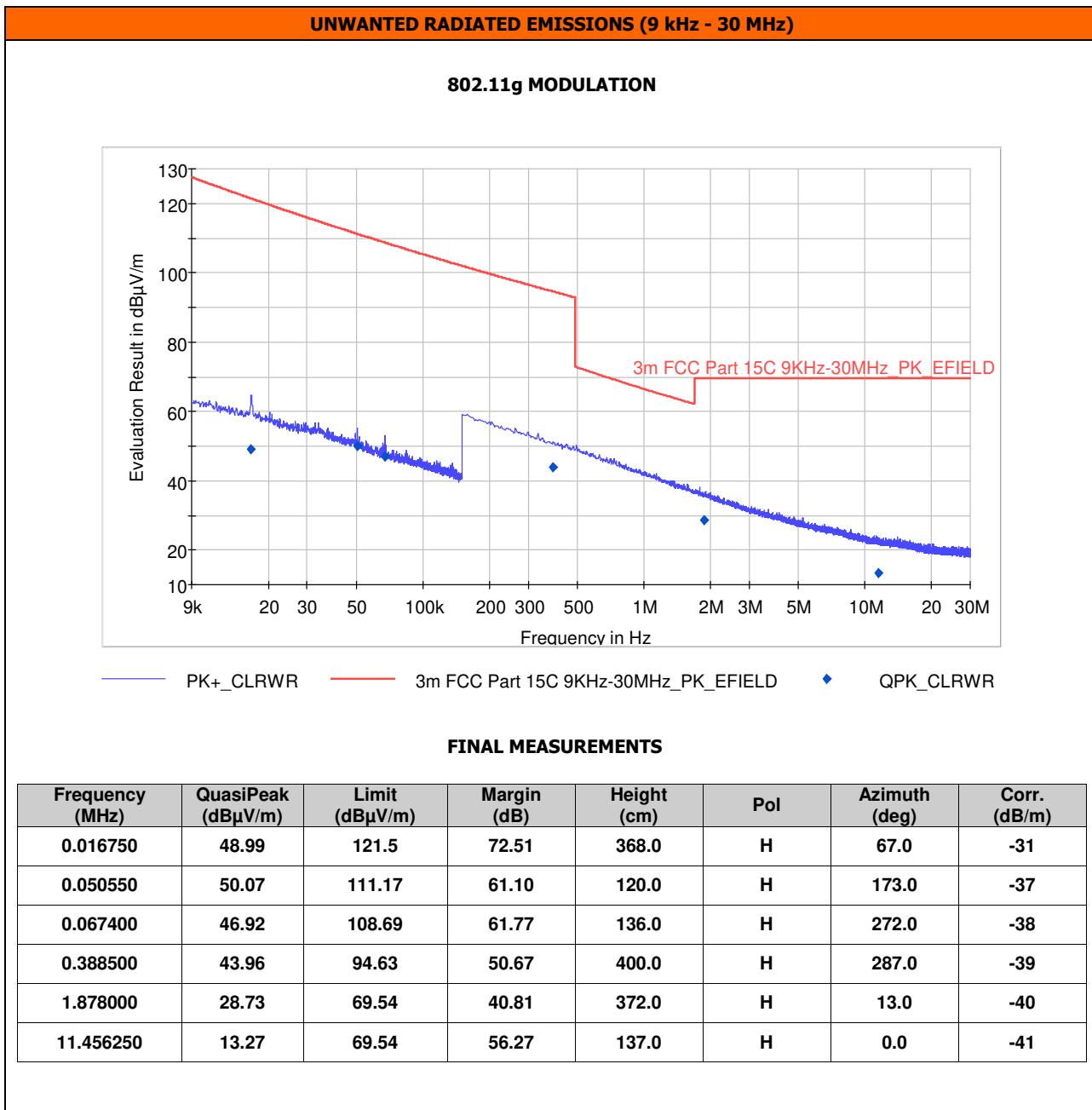
UNWANTED RADIATED EMISSIONS (9 kHz - 30 MHz)

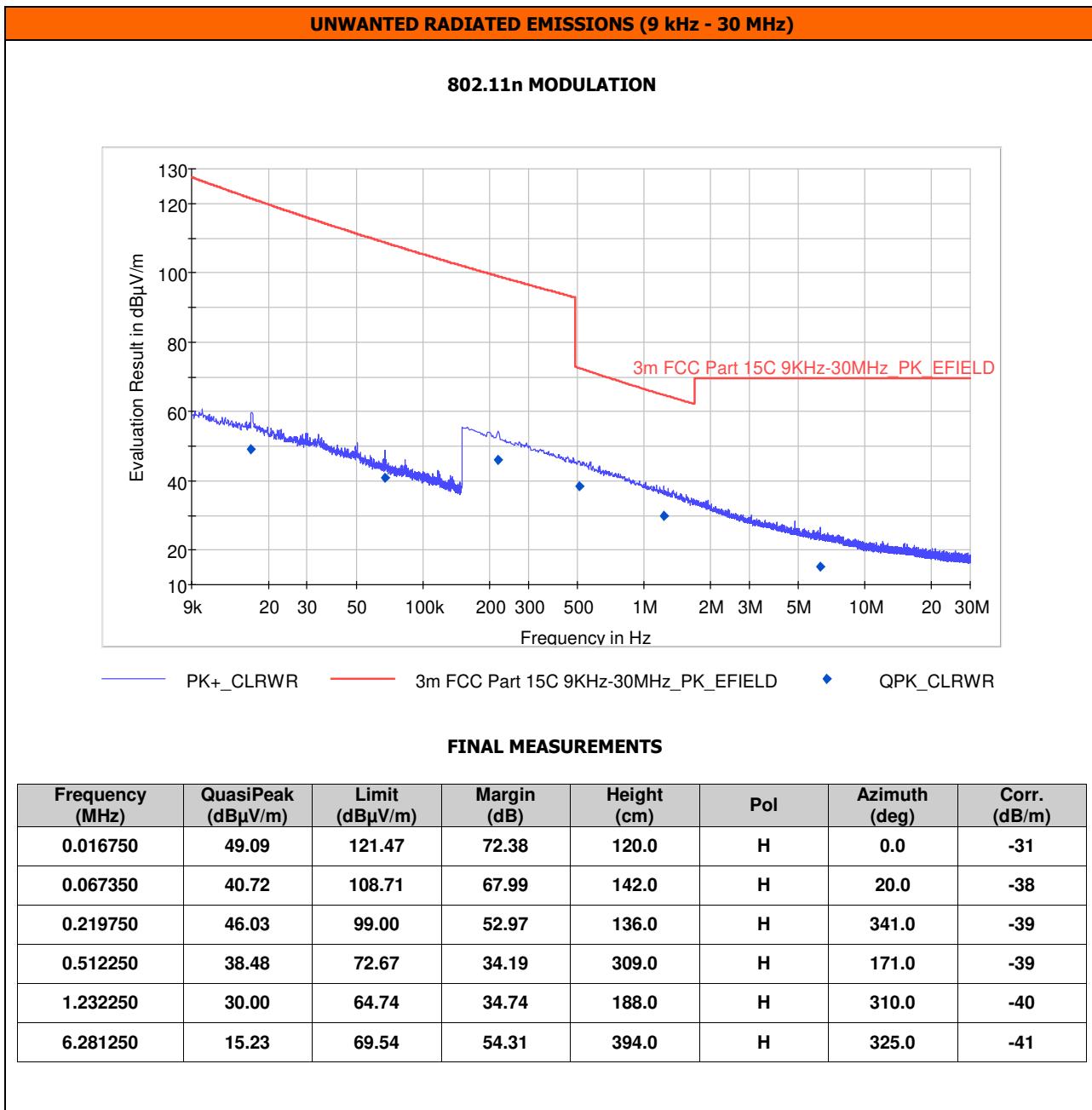
802.11b MODULATION

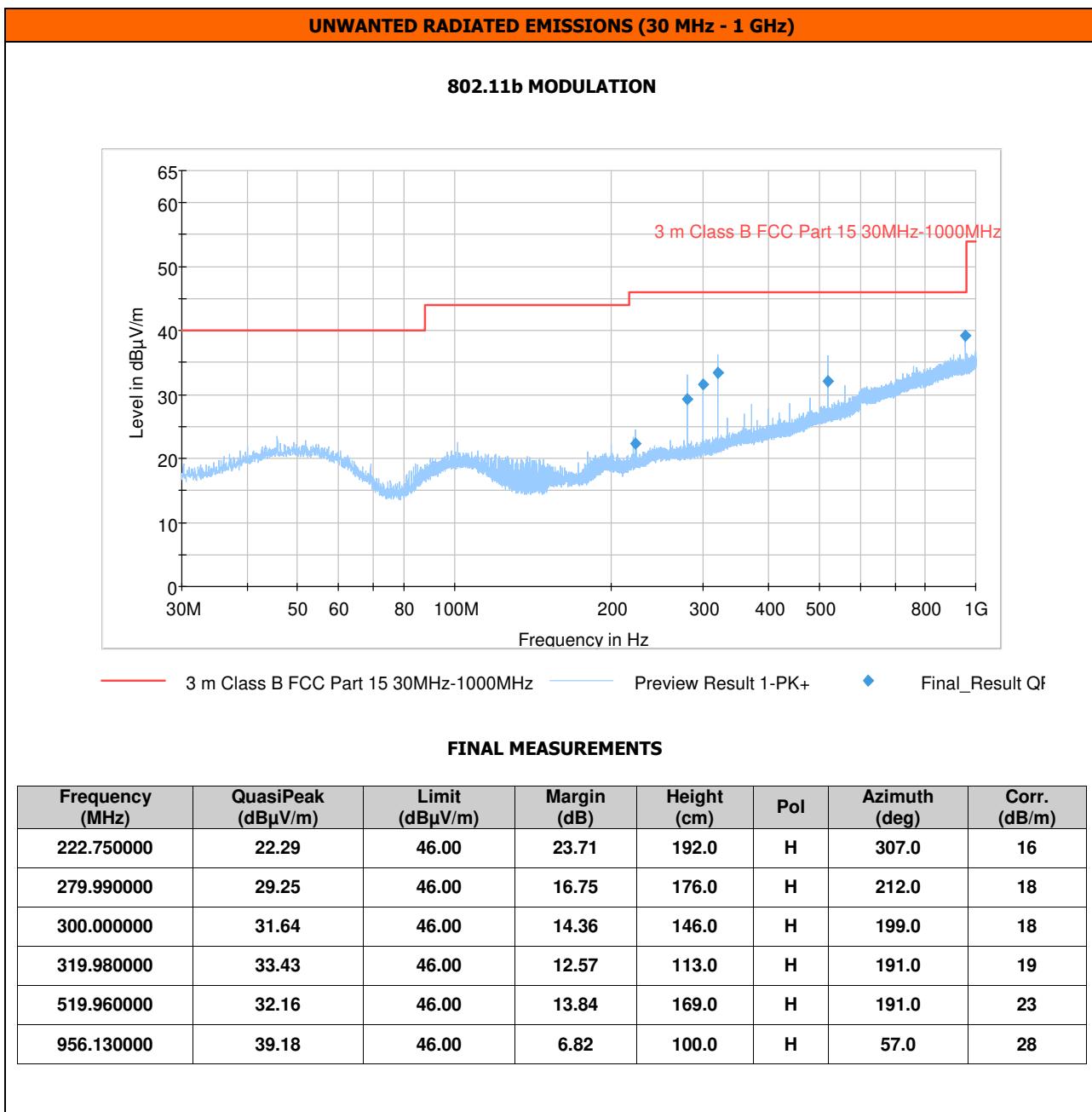


FINAL MEASUREMENTS

Frequency (MHz)	QuasiPeak (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
0.016950	57.11	121.33	64.22	124.0	H	165.0	-31
0.050500	46.40	111.28	64.88	152.0	H	34.0	-37
0.067450	47.78	108.74	60.96	138.0	H	152.0	-38
0.300750	46.26	96.61	50.35	305.0	H	7.0	-39
1.466250	31.20	63.31	32.11	190.0	H	341.0	-40
12.576750	12.82	69.54	56.72	124.0	H	156.0	-42

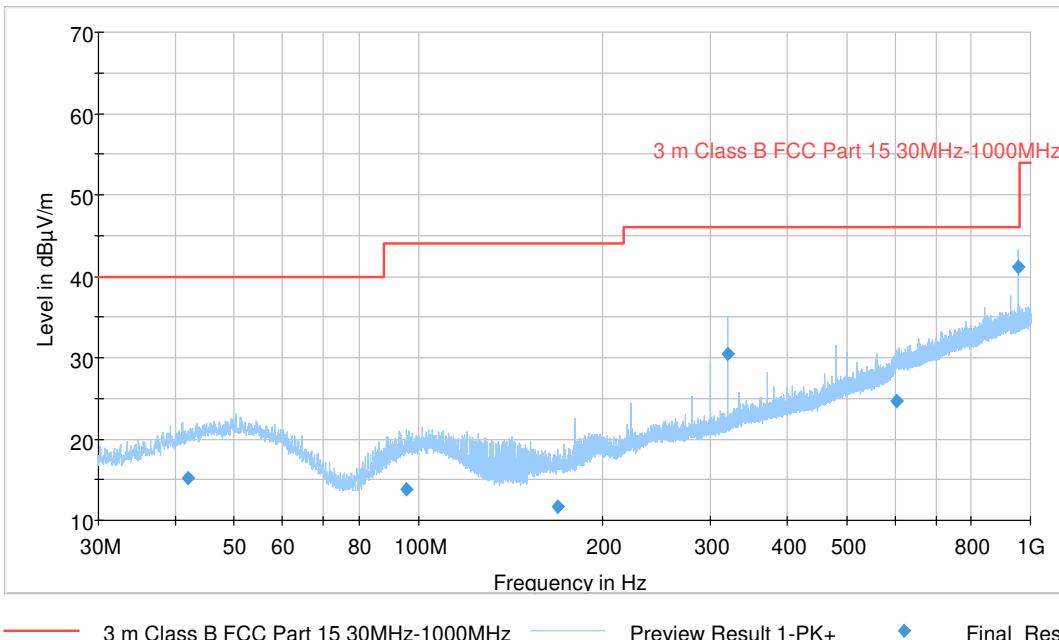






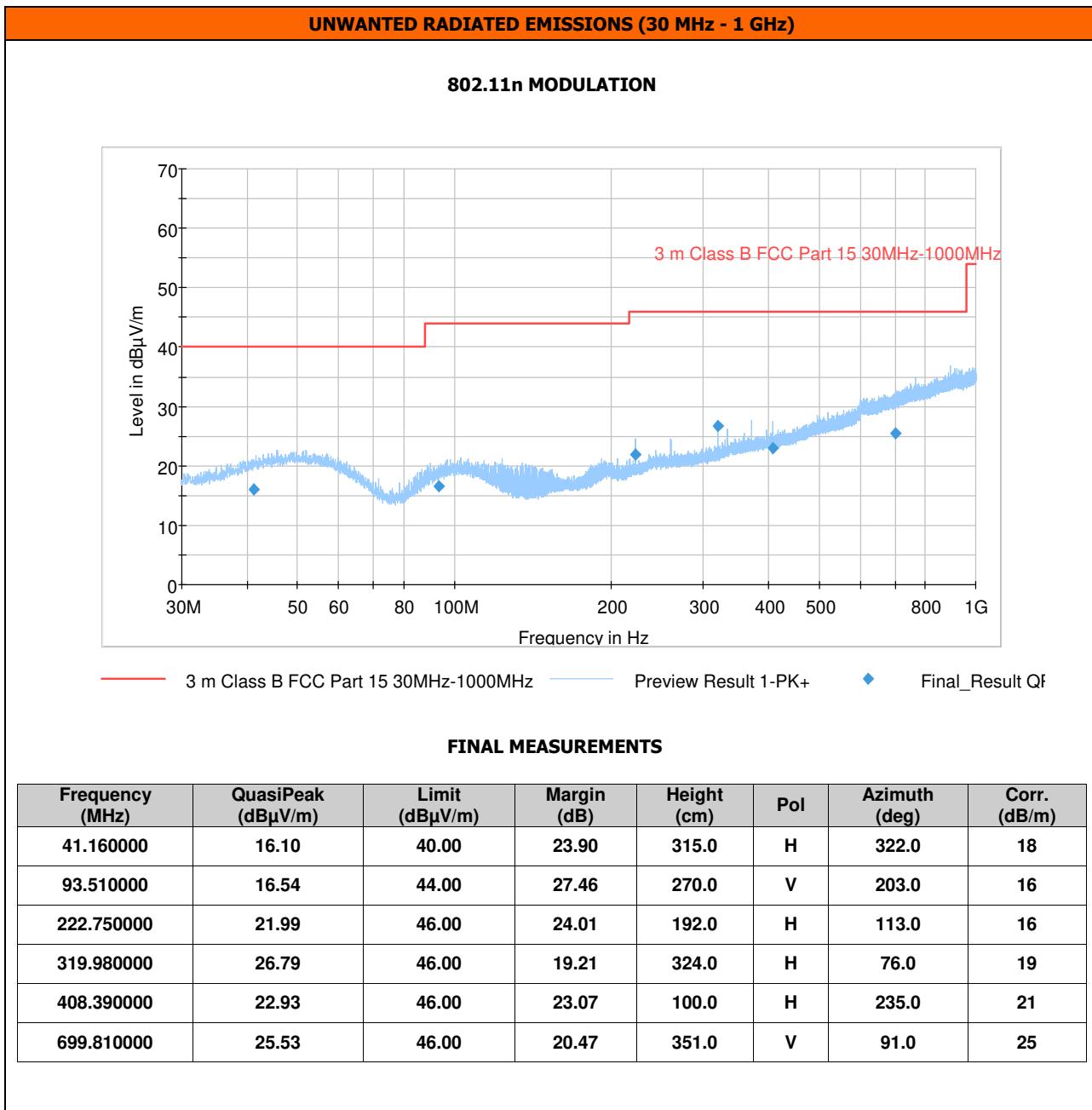
UNWANTED RADIATED EMISSIONS (30 MHz - 1 GHz)

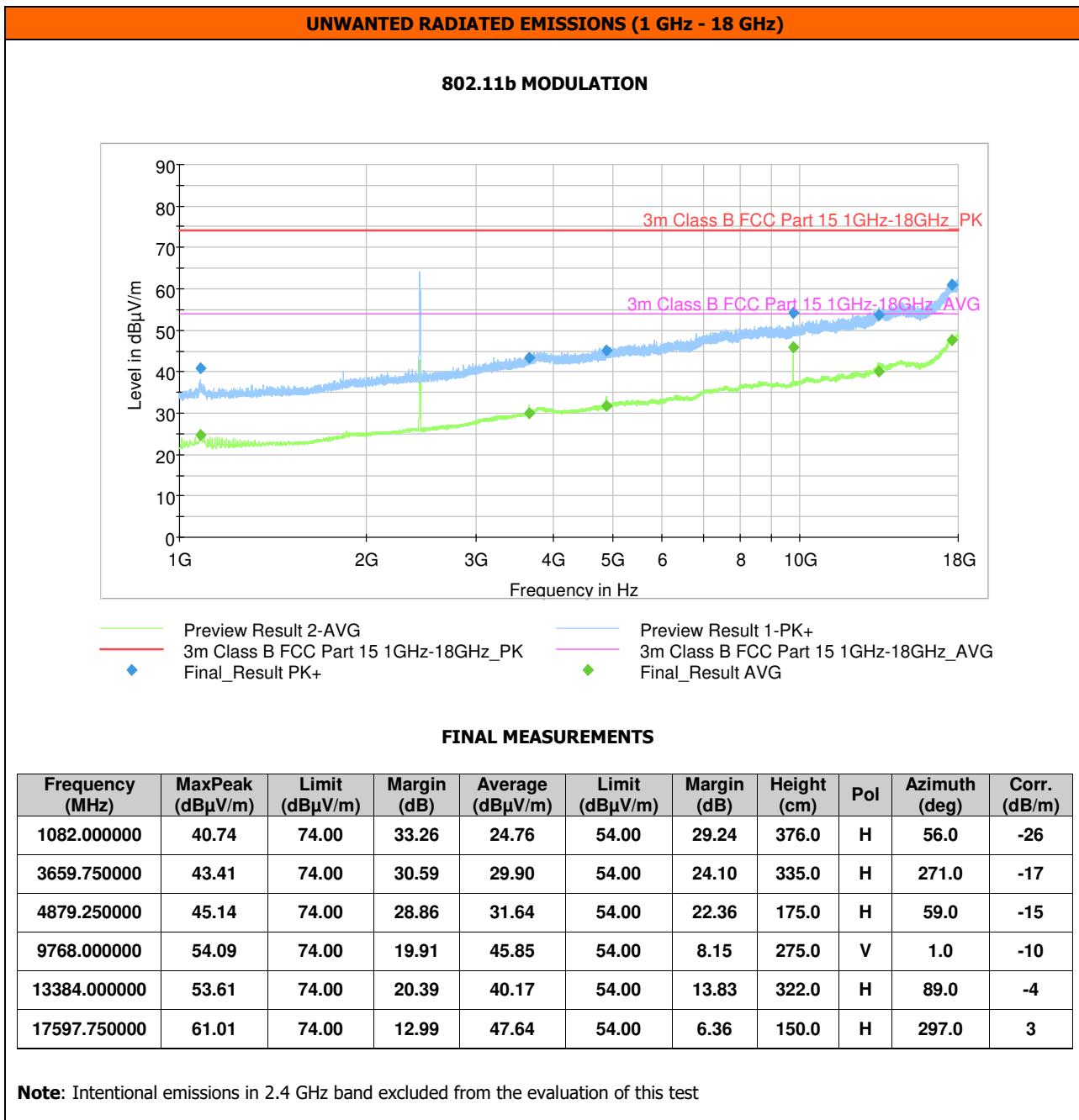
802.11g MODULATION

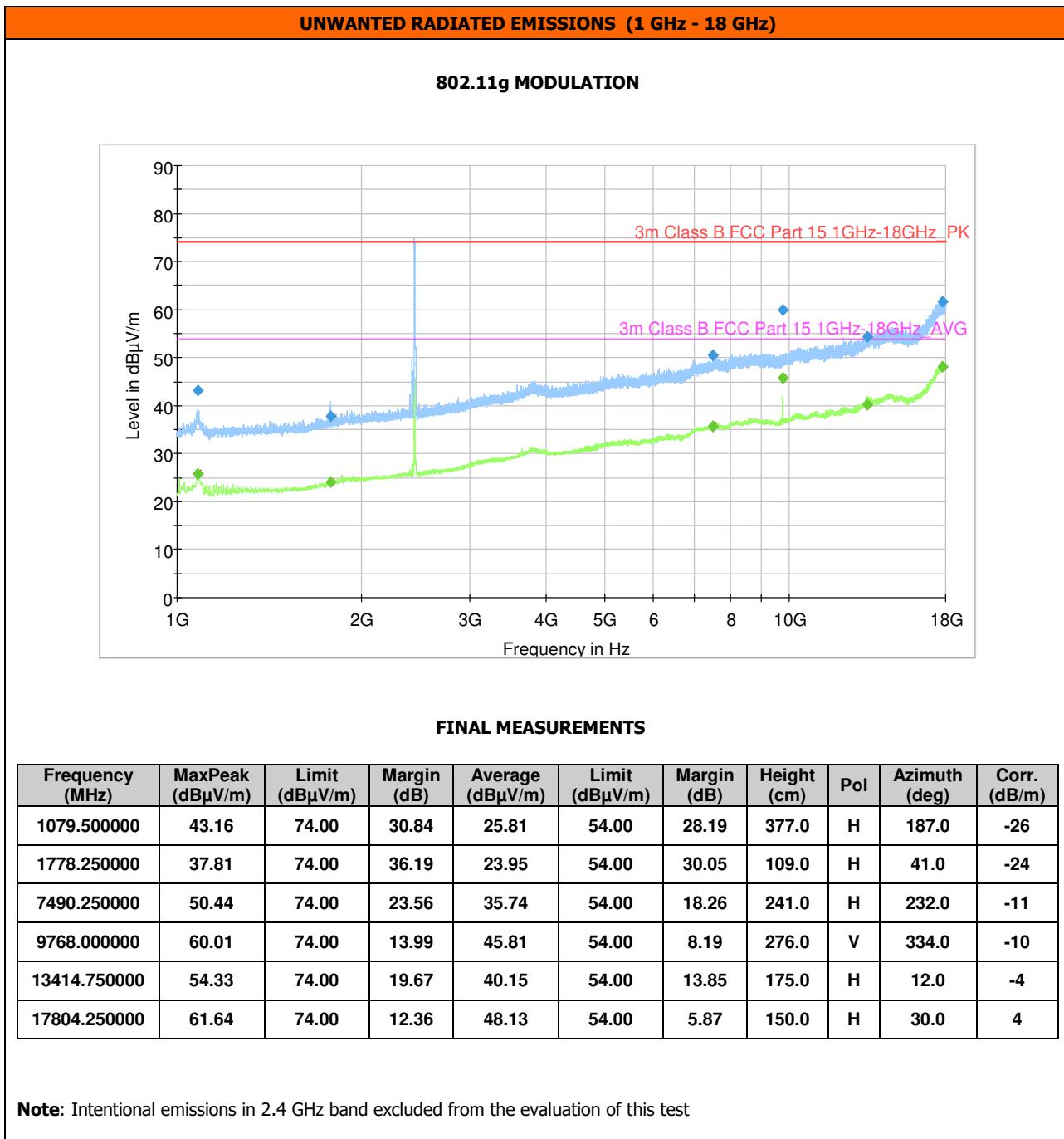


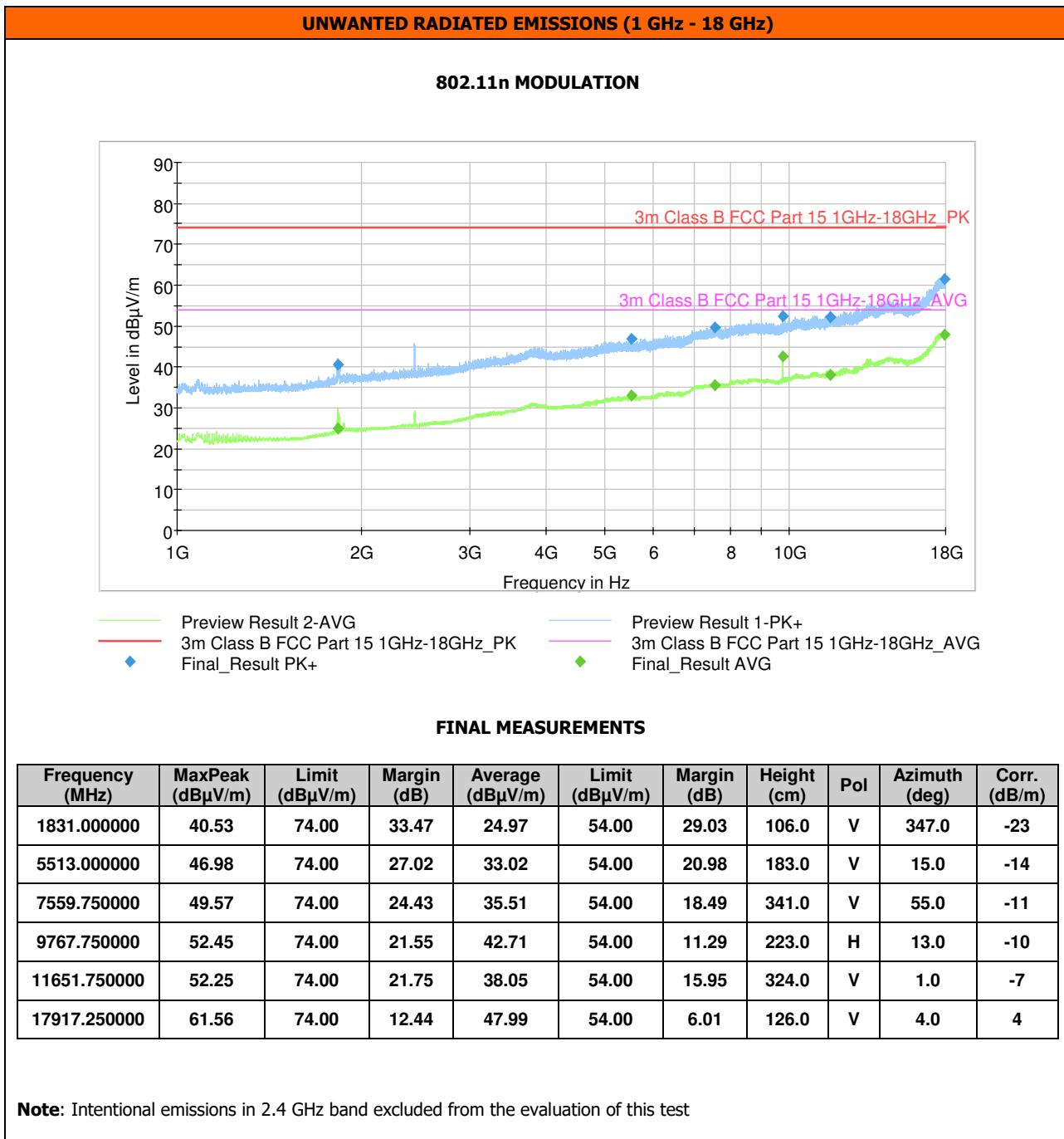
FINAL MEASUREMENTS

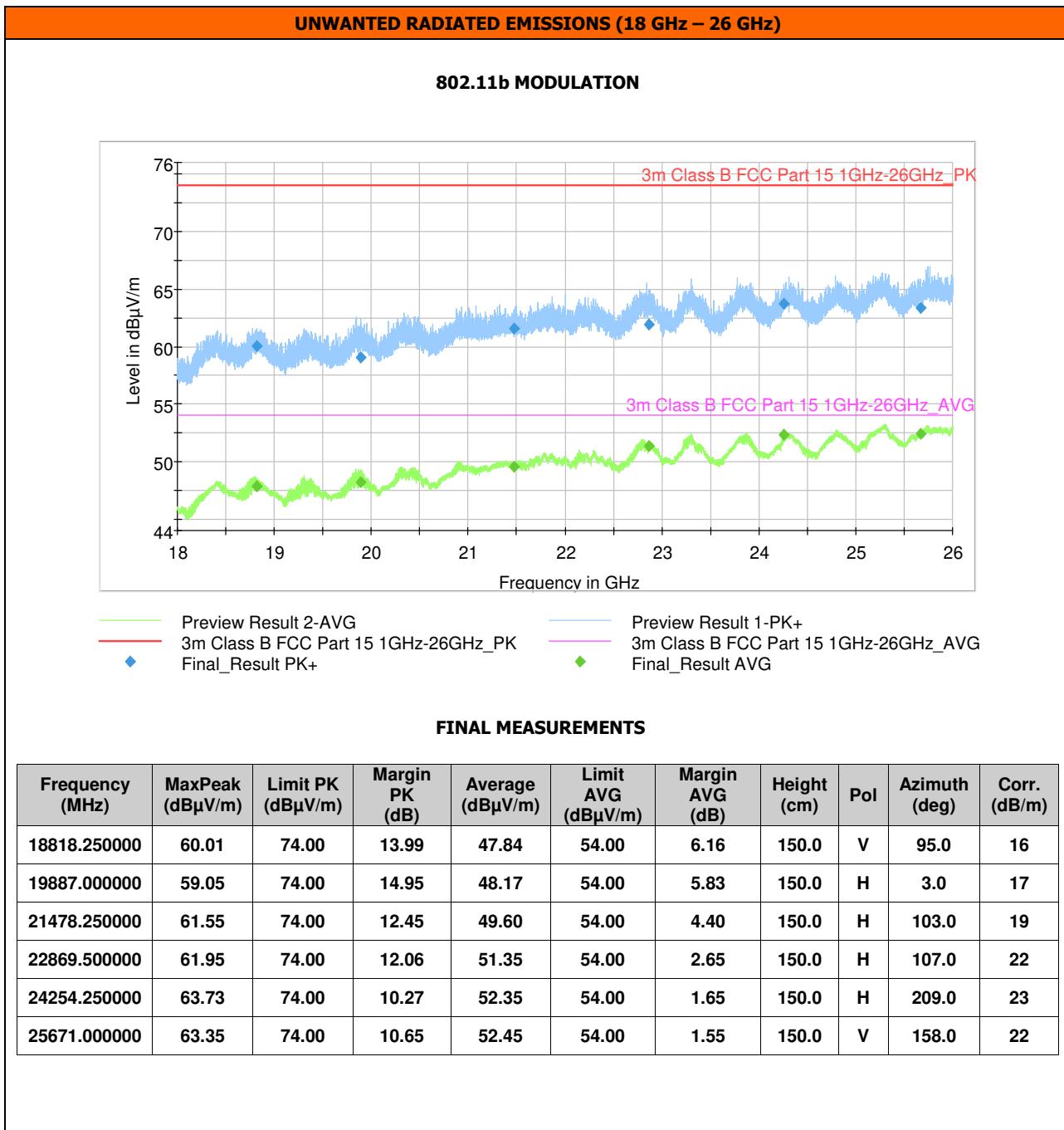
Frequency (MHz)	QuasiPeak (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
42.000000	15.22	40.00	24.78	135.0	V	270.0	18
95.670000	13.89	44.00	30.11	128.0	V	311.0	16
168.780000	11.74	44.00	32.26	235.0	H	331.0	13
320.010000	30.50	46.00	15.50	142.0	H	3.0	19
603.690000	24.65	46.00	21.35	379.0	H	2.0	24
956.250000	41.10	46.00	4.90	139.0	H	103.0	28

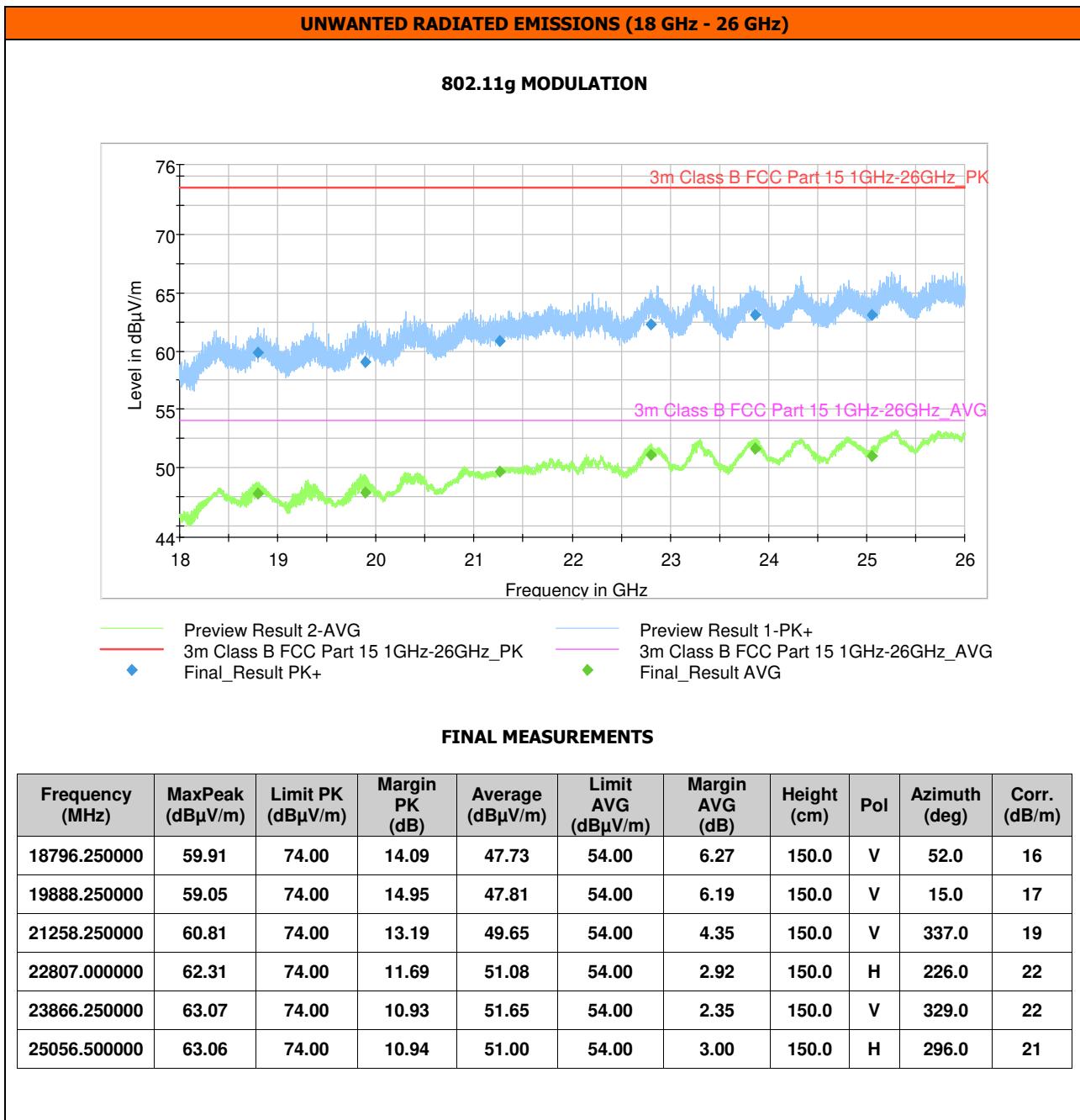


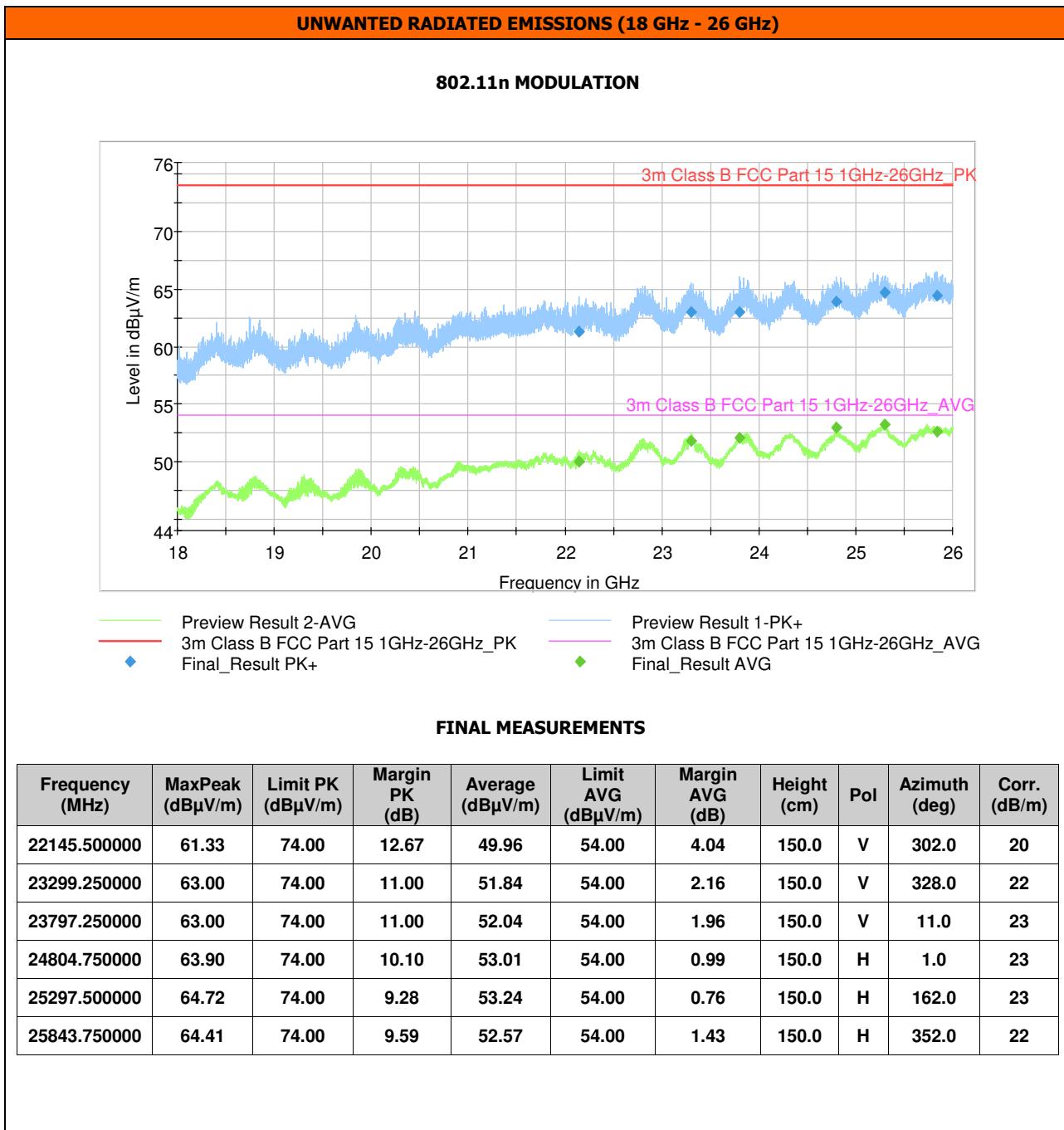












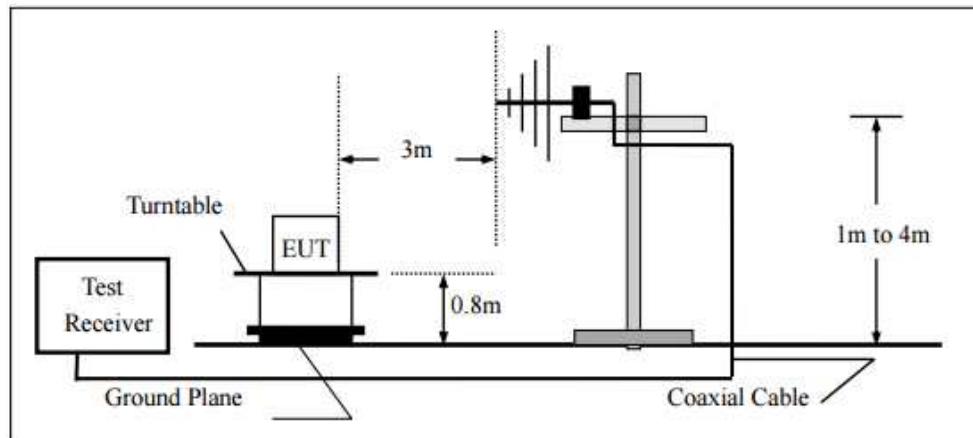
Unwanted emissions into non-Restricted Frequency Bands and Band Edge

Limits

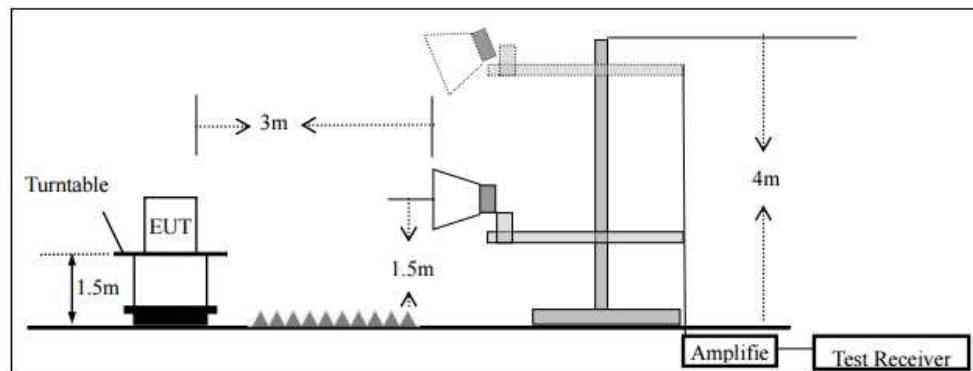
According to FCC 15.247 (d) and RSS-247 5.5, the peak output power measured in any 100 kHz bandwidth outside of the authorized frequency band shall be attenuated by at least 30 dB relative to the maximum in-band peak PSD level in 100 kHz.

Test Configuration

- For radiated emissions from 30MHz to 1000MHz:



- For radiated emissions above 1000MHz:



Test Procedure

Reference Level Measurement

1. Set the RBW = 100 kHz, VBW = 300 kHz, Detector = peak.
2. Set Sweep time = auto couple, Trace mode = max hold.
3. Allow trace to fully stabilize.
4. Use the peak marker function to determine the maximum amplitude level.

Unwanted Emissions Level Measurement

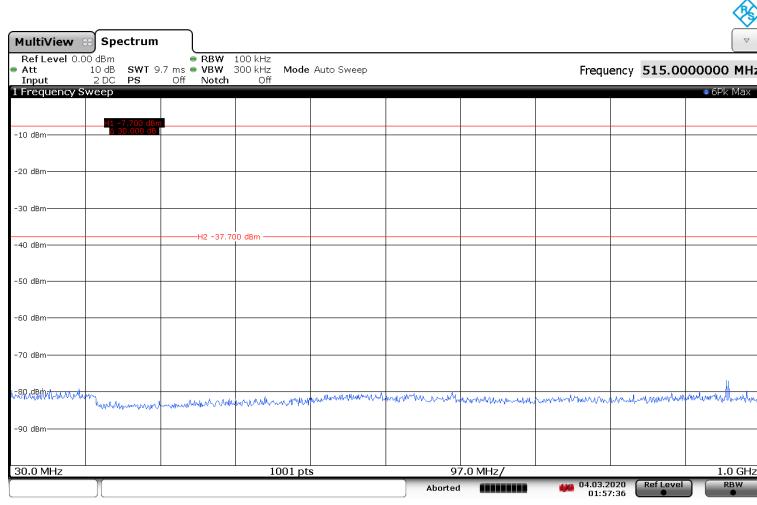
1. Set RBW = 100 kHz, VBW = 300 kHz, Detector = peak.
2. Trace Mode = max hold, Sweep = auto couple.
3. Allow the trace to stabilize.

Use peak marker function to determine maximum amplitude of all unwanted emissions within any 100 kHz bandwidth.

UNWANTED EMISSIONS INTO NON-RESTRICTED FREQUENCY BANDS						
Technician: Jose M. Llauradó	Test Area: Semi-Anechoic Chamber, SAC-2					
Test date: 2020-03-04						
Basic standards: ANSI C63.10-2013 and RSS-Gen Issue 5 Amendment 1						
Temperature: 21.7 °C						
Humidity: 39.5 %						
Atm. Pressure: 1010.2 hPa						
RESULTS: Pass						
Unwanted emissions into Non-Restricted Frequency Bands						
Channel	Frequency (MHz)	Modulation	Power difference from carrier level (dB)	Limit (dB)	Result	Comment
1	2412	802.11b	Above 30 dB	At least 30 dB	PASS	Maximum Radiation Position Height: 350 cm Pol.: H Azimuth: 0 deg
		802.11g	Above 30 dB	At least 30 dB	PASS	
		802.11n	Above 30 dB	At least 30 dB	PASS	
7	2442	802.11b	Above 30 dB	At least 30 dB	PASS	
		802.11g	Above 30 dB	At least 30 dB	PASS	
		802.11n	Above 30 dB	At least 30 dB	PASS	
11	2462	802.11b	Above 30 dB	At least 30 dB	PASS	
		802.11g	Above 30 dB	At least 30 dB	PASS	
		802.11n	Above 30 dB	At least 30 dB	PASS	
Comments:						

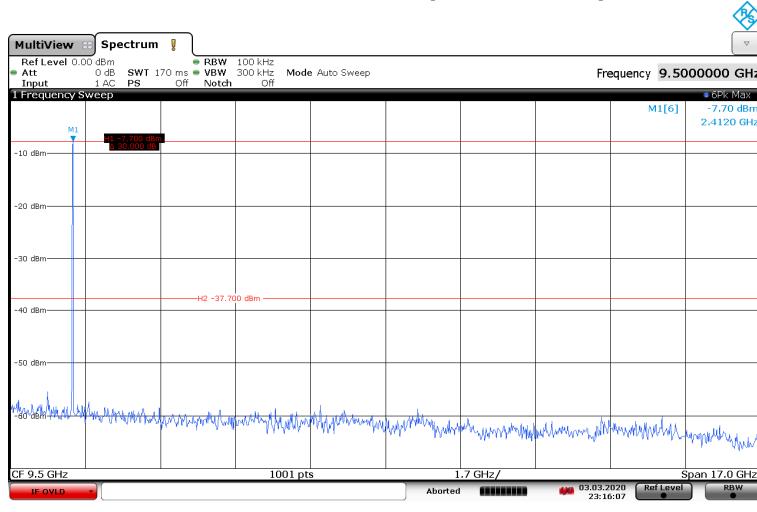
UNWANTED EMISSIONS INTO NON-RESTRICTED FREQUENCY BANDS

Channel 1 IEEE 802.11b (30MHz to 1GHz)



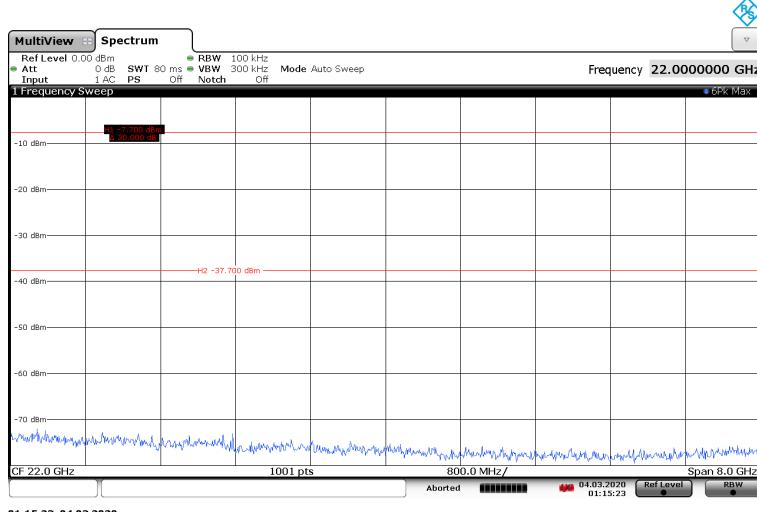
01:57:36 04.03.2020

Channel 1 IEEE 802.11b (1GHz to 18GHz)



23:16:08 03.03.2020

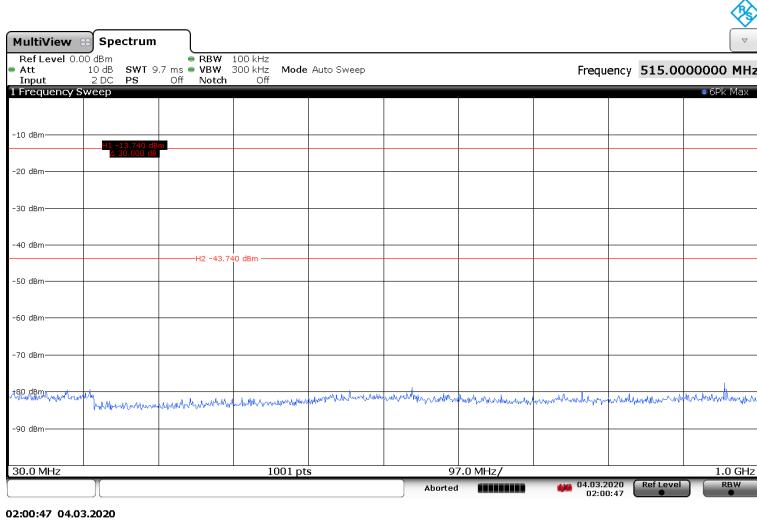
Channel 1 IEEE 802.11b (18GHz to 26GHz)



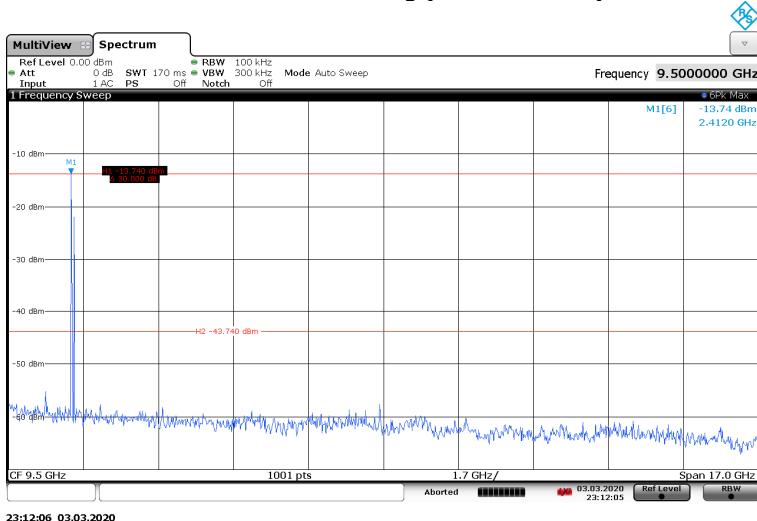
01:15:23 04.03.2020

UNWANTED EMISSIONS INTO NON-RESTRICTED FREQUENCY BANDS

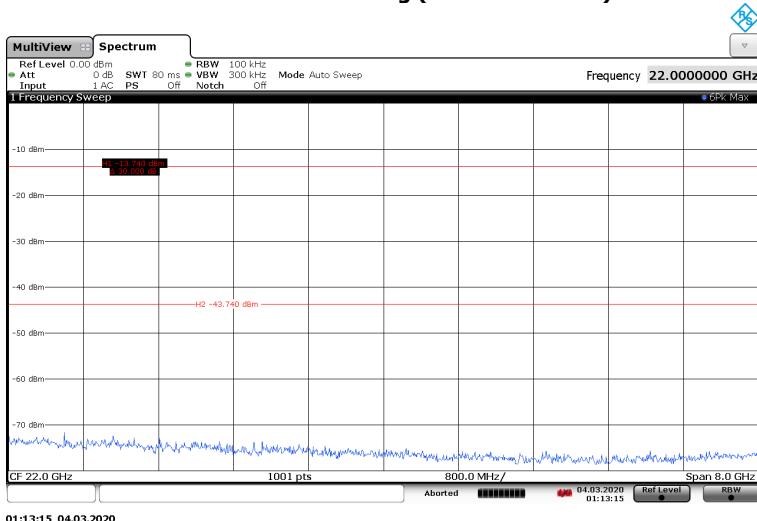
Channel 1 IEEE 802.11g (30MHz to 1GHz)



Channel 1 IEEE 802.11g (1GHz to 18GHz)

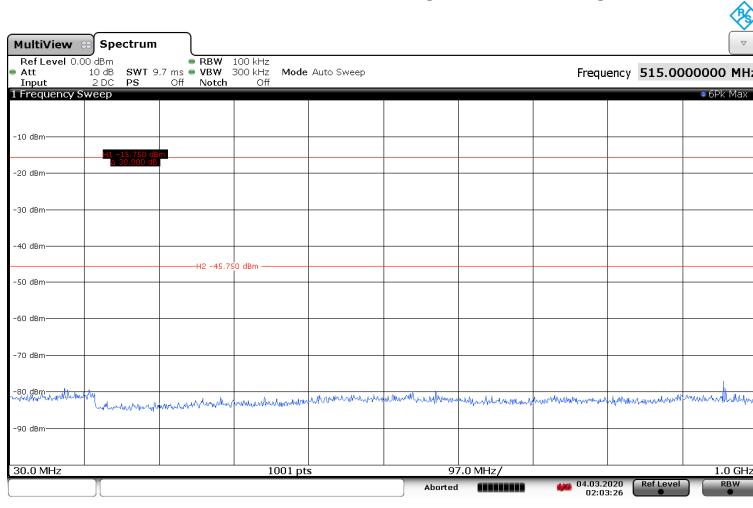


Channel 1 IEEE 802.11g (18GHz to 26GHz)

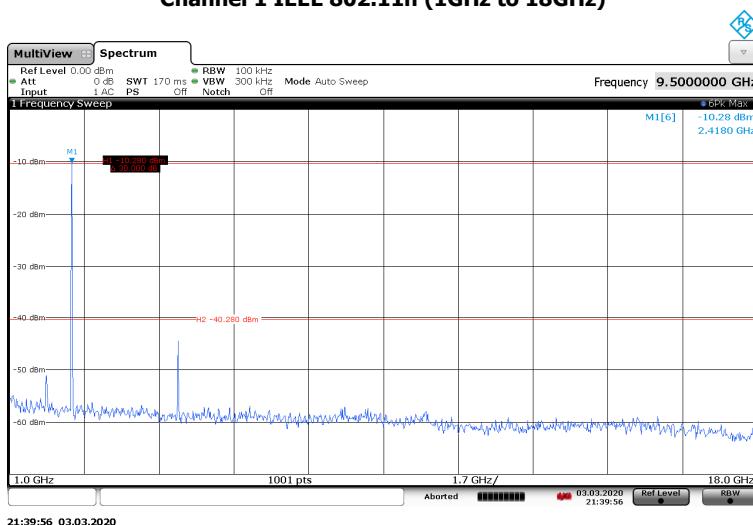


UNWANTED EMISSIONS INTO NON-RESTRICTED FREQUENCY BANDS

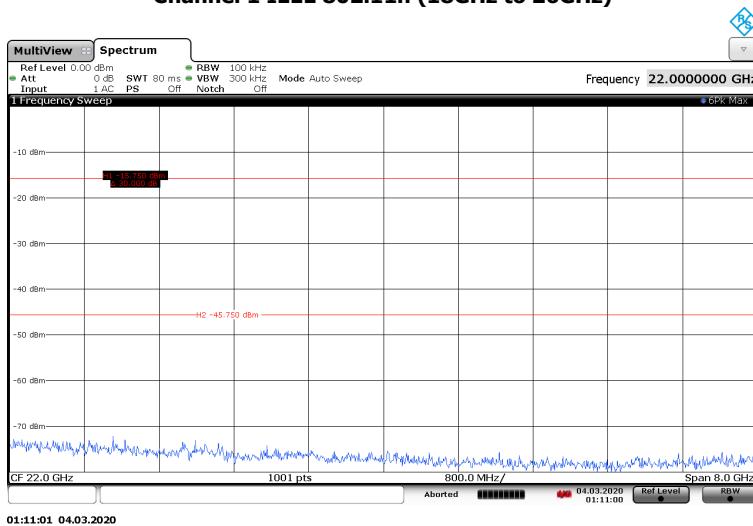
Channel 1 IEEE 802.11n (30MHz to 1GHz)



Channel 1 IEEE 802.11n (1GHz to 18GHz)

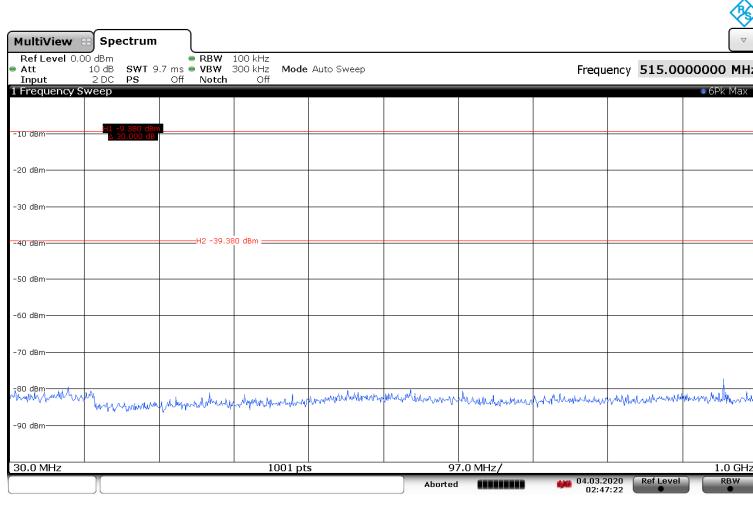


Channel 1 IEEE 802.11n (18GHz to 26GHz)

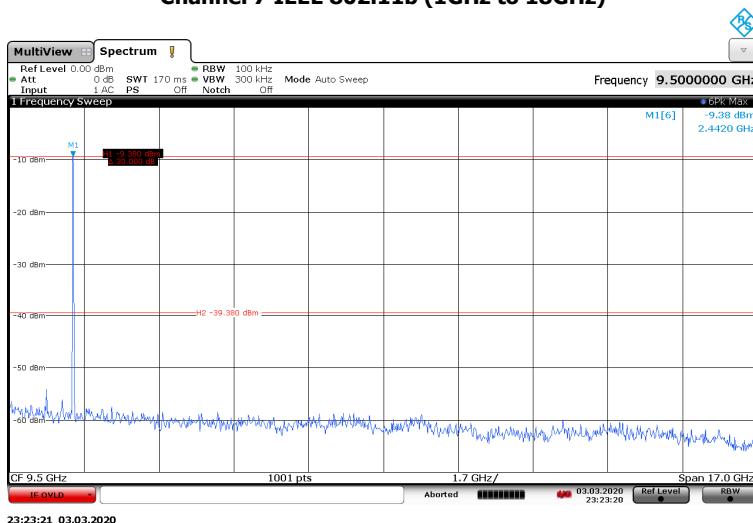


UNWANTED EMISSIONS INTO NON-RESTRICTED FREQUENCY BANDS

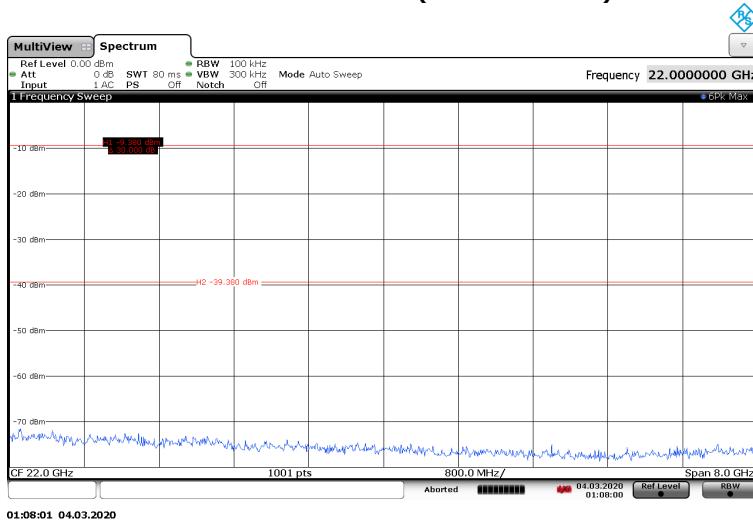
Channel 7 IEEE 802.11b (30MHz to 1GHz)



Channel 7 IEEE 802.11b (1GHz to 18GHz)

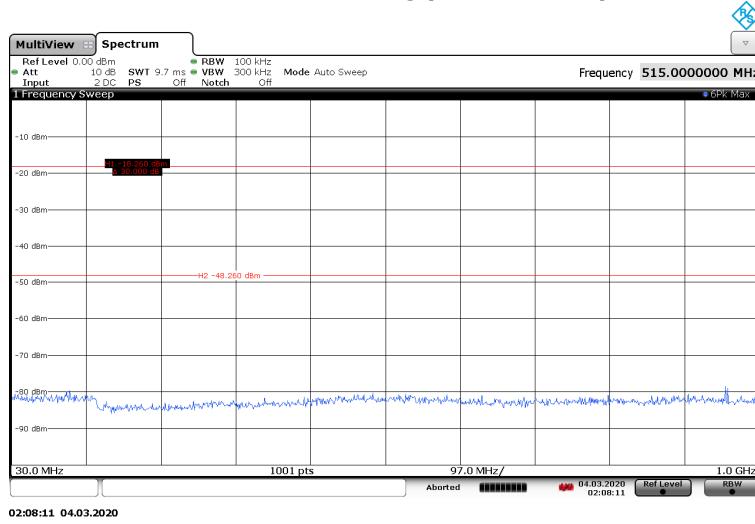


Channel 7 IEEE 802.11b (18GHz to 26GHz)

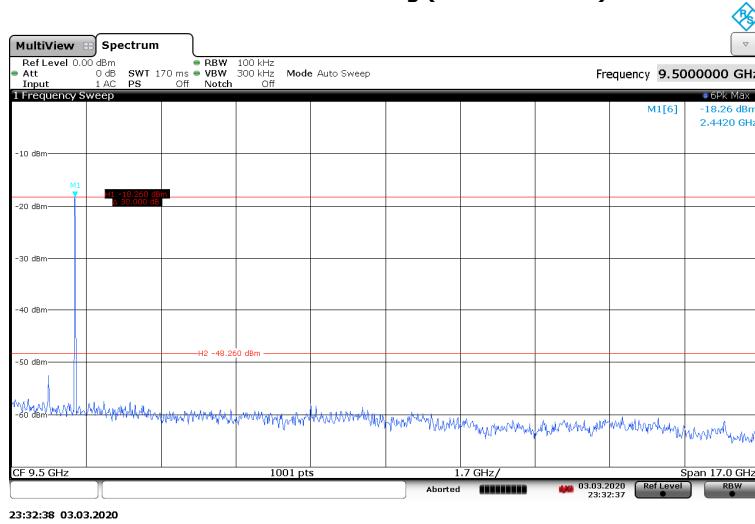


UNWANTED EMISSIONS INTO NON-RESTRICTED FREQUENCY BANDS

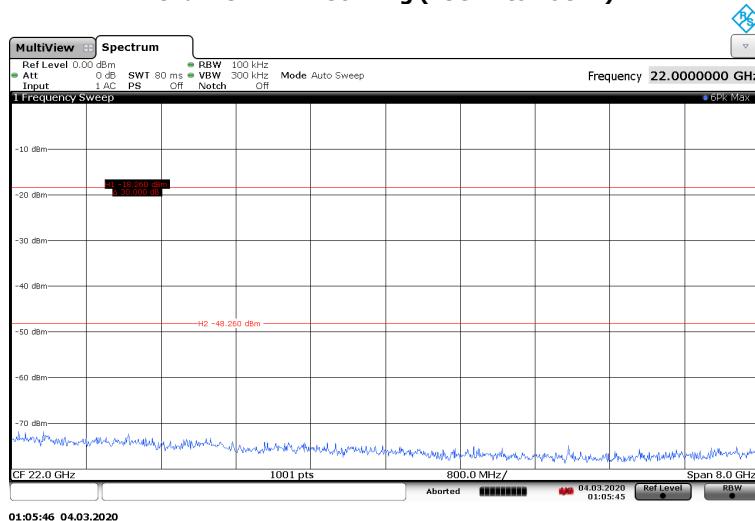
Channel 7 IEEE 802.11g (30MHz to 1GHz)



Channel 7 IEEE 802.11g (1GHz to 18GHz)

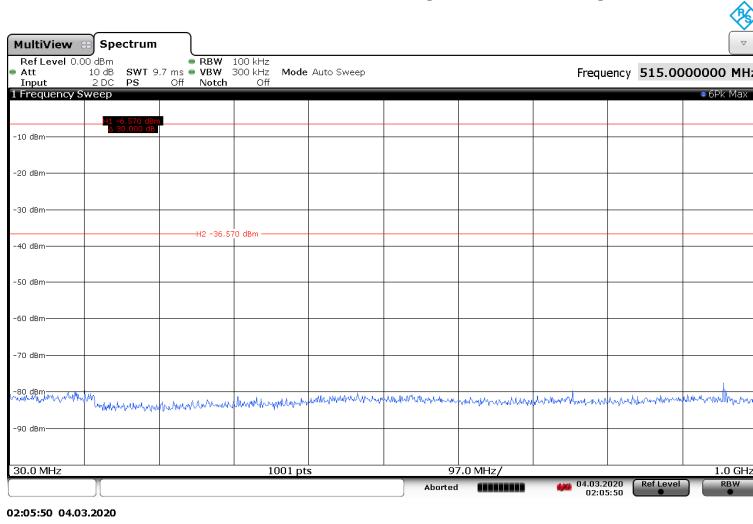


Channel 7 IEEE 802.11g (18GHz to 26GHz)

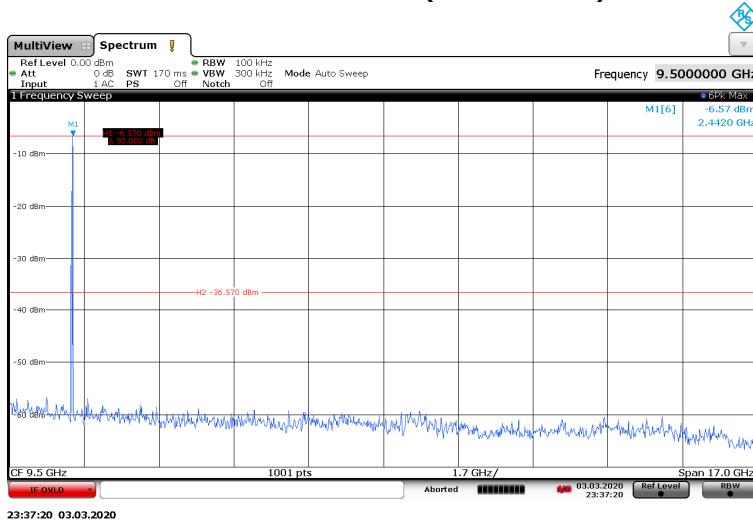


UNWANTED EMISSIONS INTO NON-RESTRICTED FREQUENCY BANDS

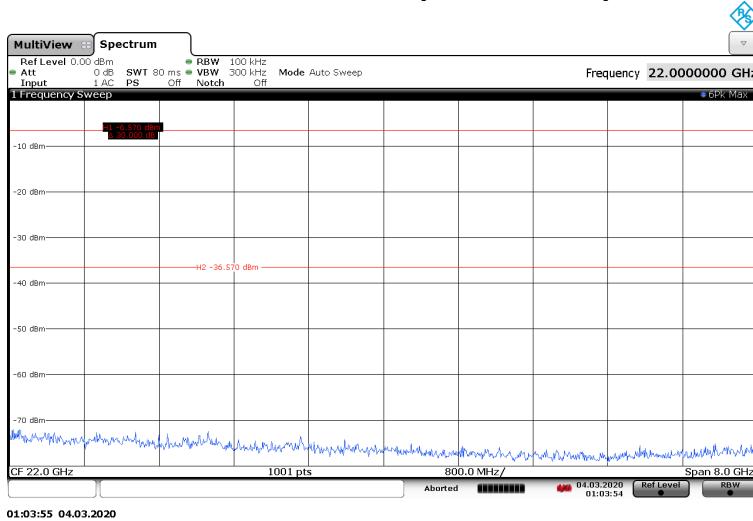
Channel 7 IEEE 802.11n (30MHz to 1GHz)



Channel 7 IEEE 802.11n (1GHz to 18GHz)

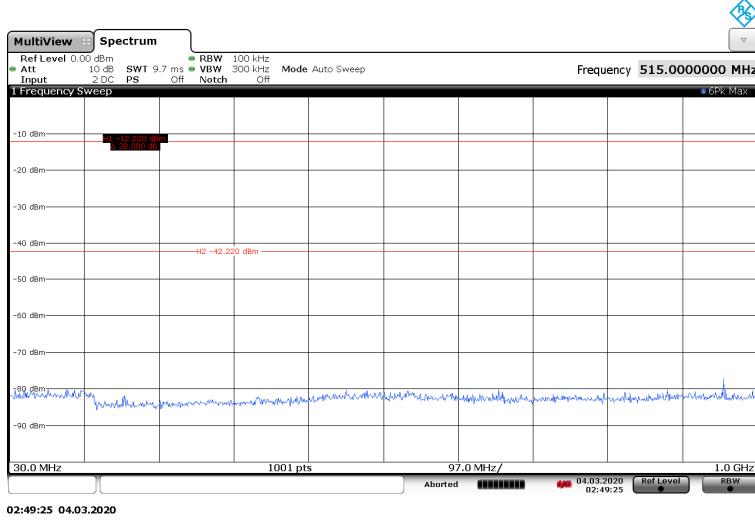


Channel 7 IEEE 802.11n (18GHz to 26GHz)

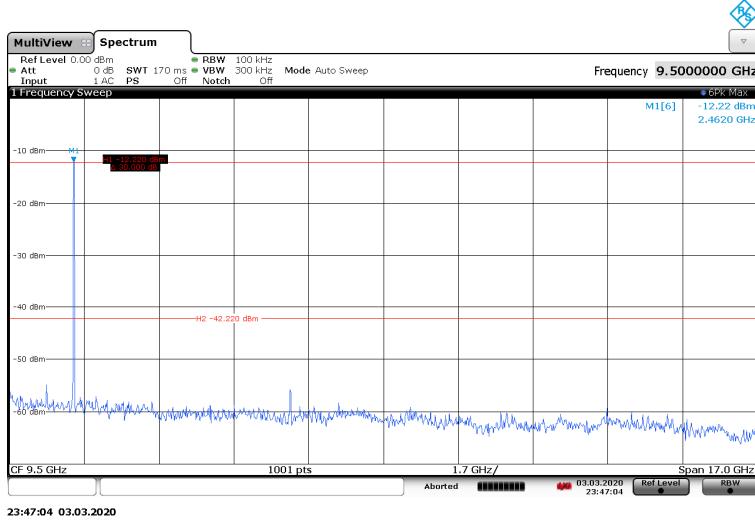


UNWANTED EMISSIONS INTO NON-RESTRICTED FREQUENCY BANDS

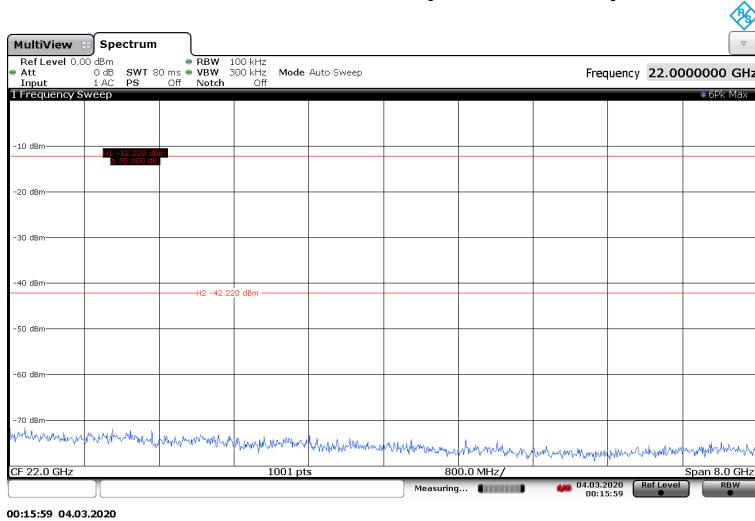
Channel 11 IEEE 802.11b (30MHz to 1GHz)



Channel 11 IEEE 802.11b (1GHz to 18GHz)

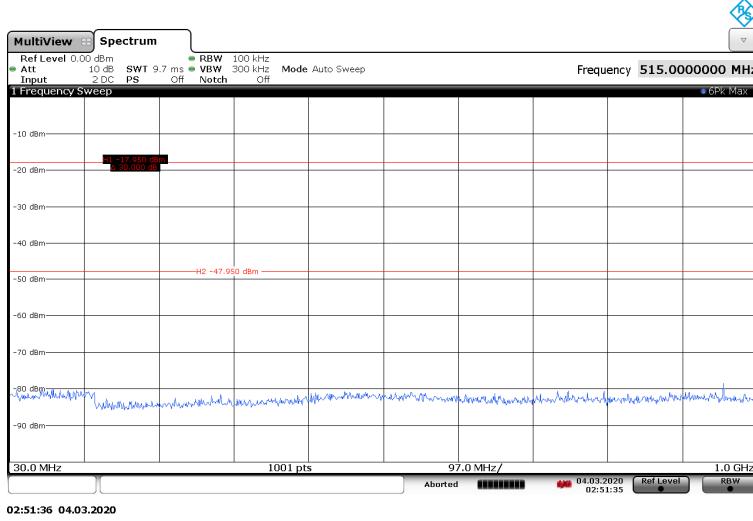


Channel 11 IEEE 802.11b (18GHz to 26GHz)

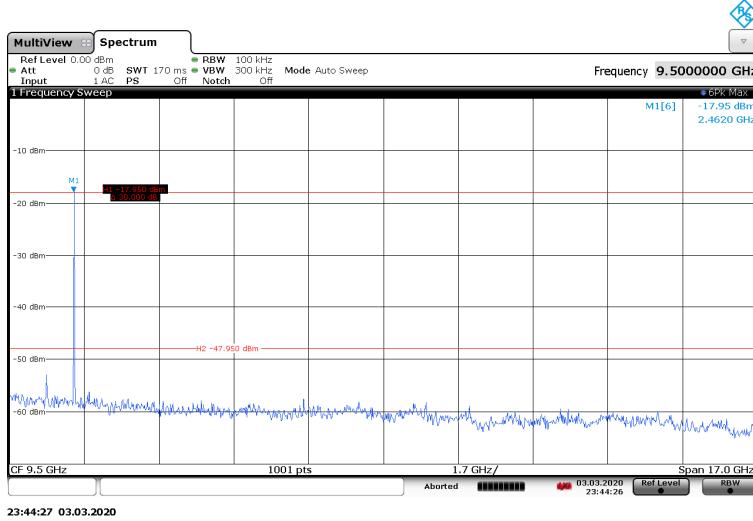


UNWANTED EMISSIONS INTO NON-RESTRICTED FREQUENCY BANDS

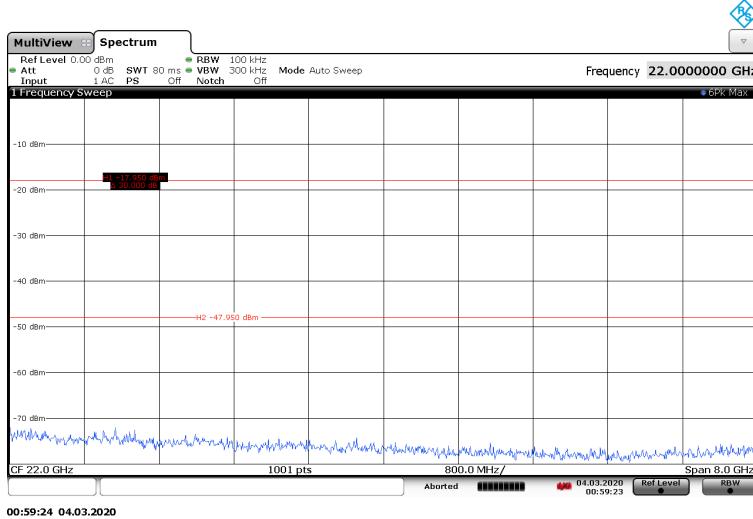
Channel 11 IEEE 802.11g (30MHz to 1GHz)



Channel 11 IEEE 802.11g (1GHz to 18GHz)

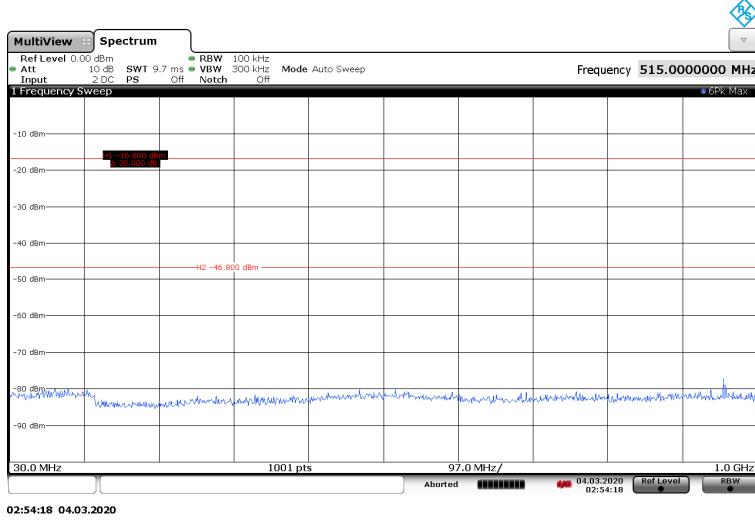


Channel 11 IEEE 802.11g (18GHz to 26GHz)

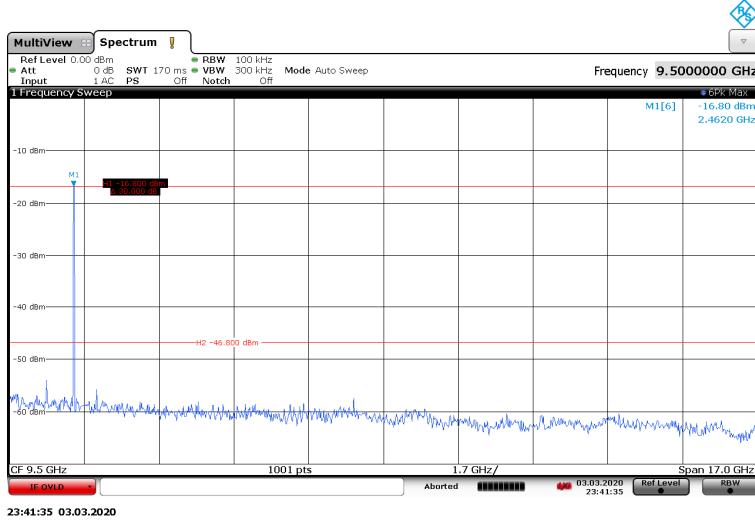


UNWANTED EMISSIONS INTO NON-RESTRICTED FREQUENCY BANDS

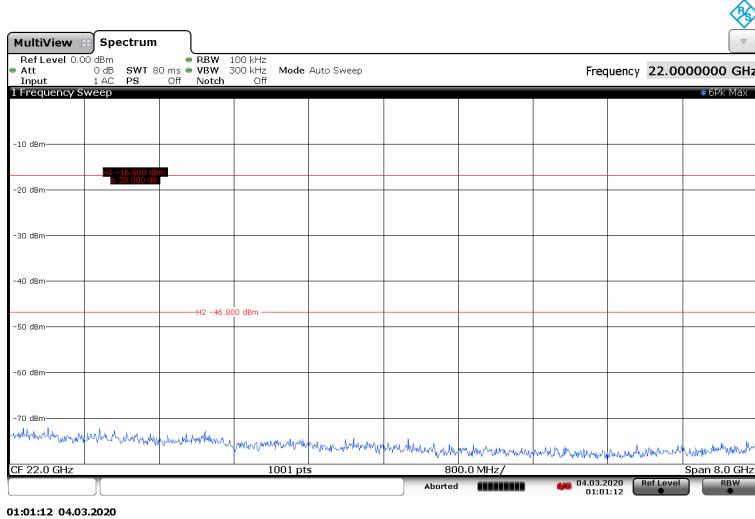
Channel 11 IEEE 802.11n (30MHz to 1GHz)



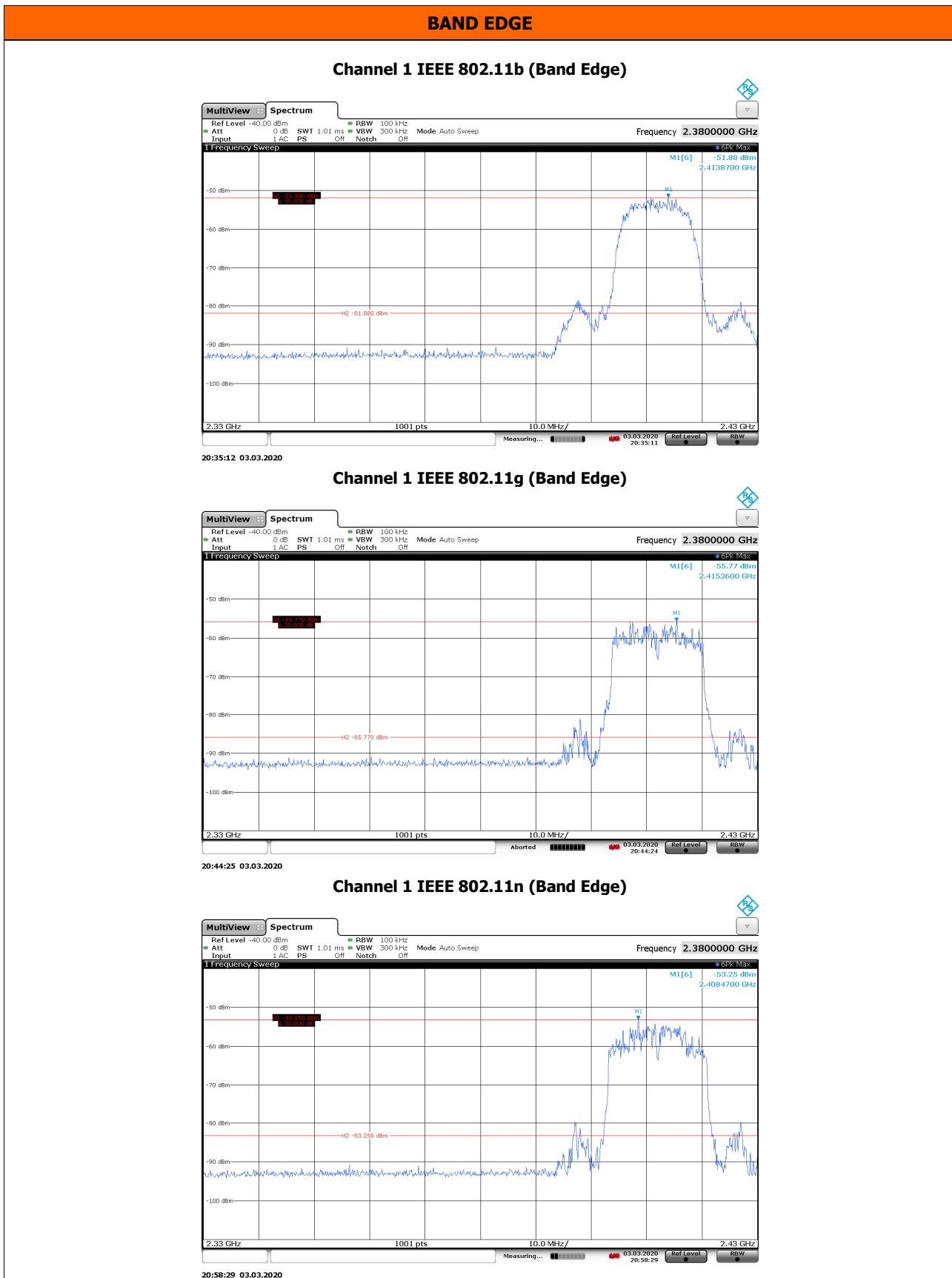
Channel 11 IEEE 802.11n (1GHz to 18GHz)

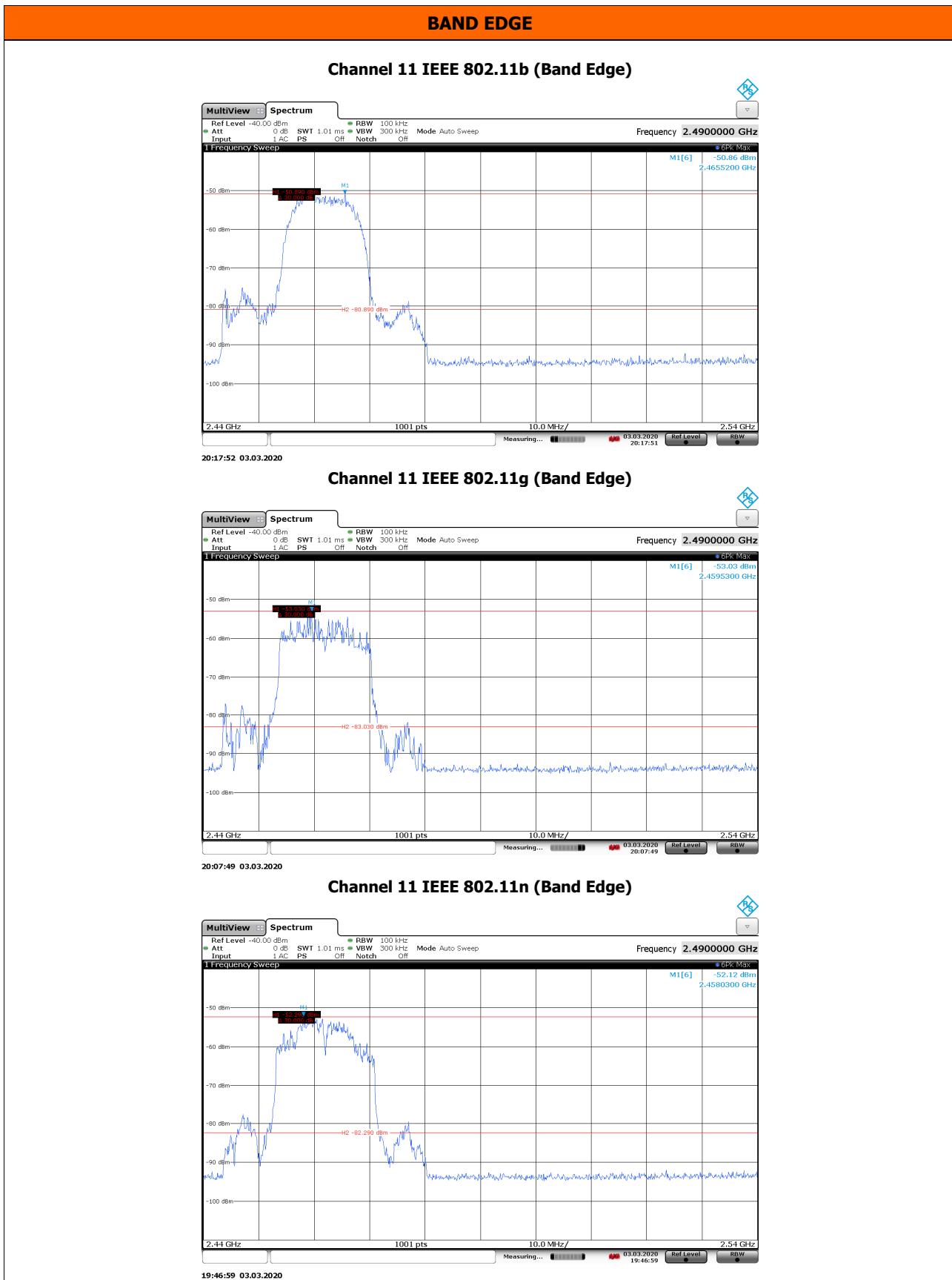


Channel 11 IEEE 802.11n (18GHz to 26GHz)



BAND EDGE															
Technician: Pau Aguilà			Test Area: Semi-Anechoic Chamber, SAC-2												
Test date: 2020-03-03															
Basic standards: ANSI C63.10-2013 and RSS-Gen Issue 5 Amendment 1															
<table border="1"><tr><td>Temperature:</td><td>21.7</td><td>°C</td></tr><tr><td>Humidity:</td><td>39.5</td><td>%</td></tr><tr><td>Atm. Pressure:</td><td>1010.2</td><td>hPa</td></tr></table>							Temperature:	21.7	°C	Humidity:	39.5	%	Atm. Pressure:	1010.2	hPa
Temperature:	21.7	°C													
Humidity:	39.5	%													
Atm. Pressure:	1010.2	hPa													
RESULTS: Pass															
Band-Edge Emissions															
Channel	Frequency (MHz)	Modulation	Power difference from carrier level (dB)	Limit (dB)	Result	Comment									
1	2412	802.11b	Above 30 dB	At least 30 dB	PASS	Maximum Radiation Position Height: 350 cm Pol.: H Azimuth: 0 deg									
		802.11g	Above 30 dB	At least 30 dB	PASS										
		802.11n	Above 30 dB	At least 30 dB	PASS										
11	2462	802.11b	Above 30 dB	At least 30 dB	PASS										
		802.11g	Above 30 dB	At least 30 dB	PASS										
		802.11n	Above 30 dB	At least 30 dB	PASS										
Comments:															





Maximum Conducted Output Power

Limits

According to FCC Part 15.247(b), maximum conducted output power shall not exceed 1 Watt (30 dBm). The conducted output power limit specified of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Thus, the limit E.I.R.P considered is 4 Watt (36dBm)

According to RSS-247 5.4 (b), maximum conducted output power shall not exceed 1W (30dBm) and the E.I.R.P shall not exceed 4 Watt (36 dBm).

Test Setup

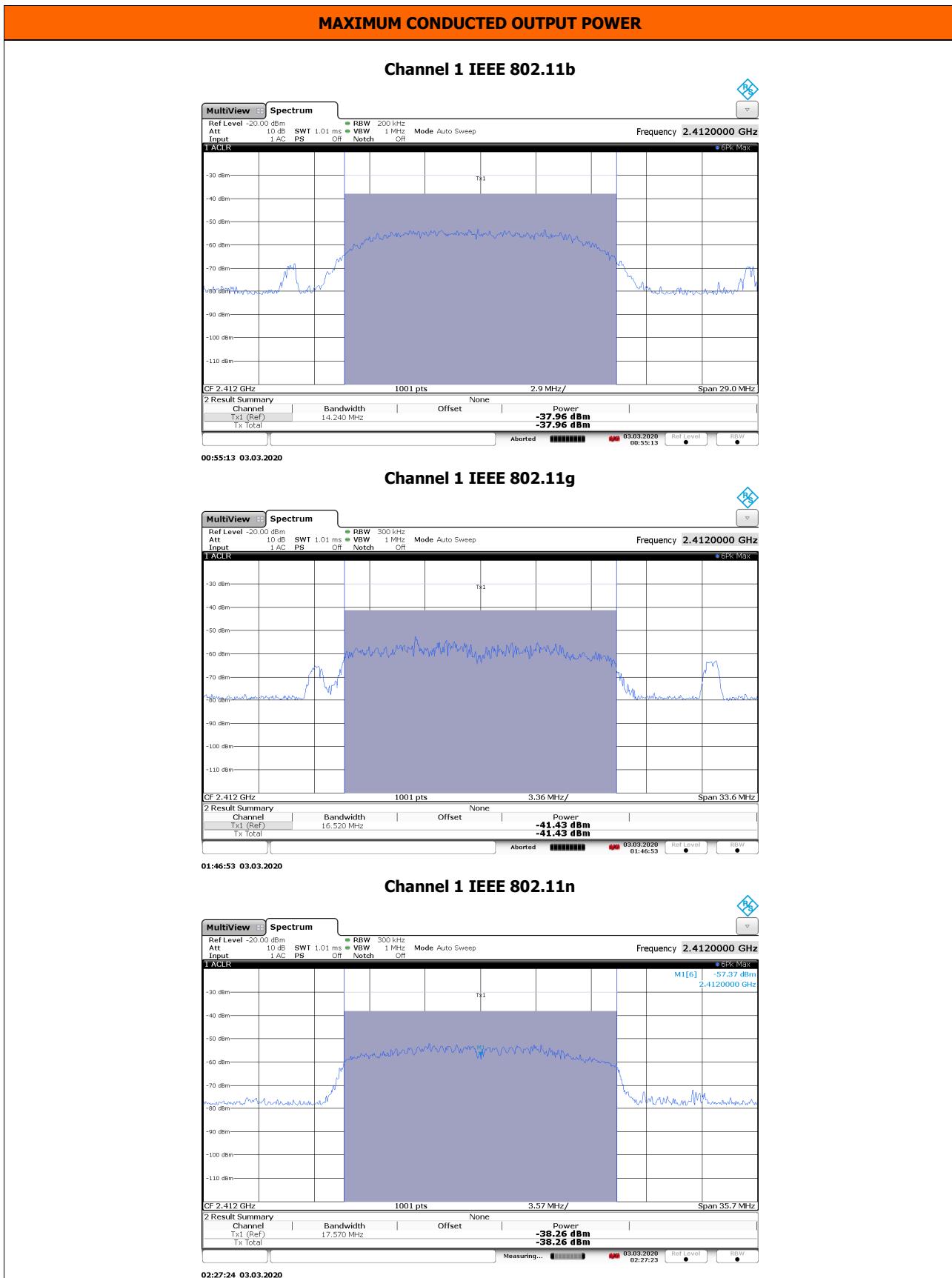
The actual test setup configuration is identical to the one described previously for the Unwanted emissions into non-Restricted Frequency Bands test in case of Radiated emissions above 1000MHz.

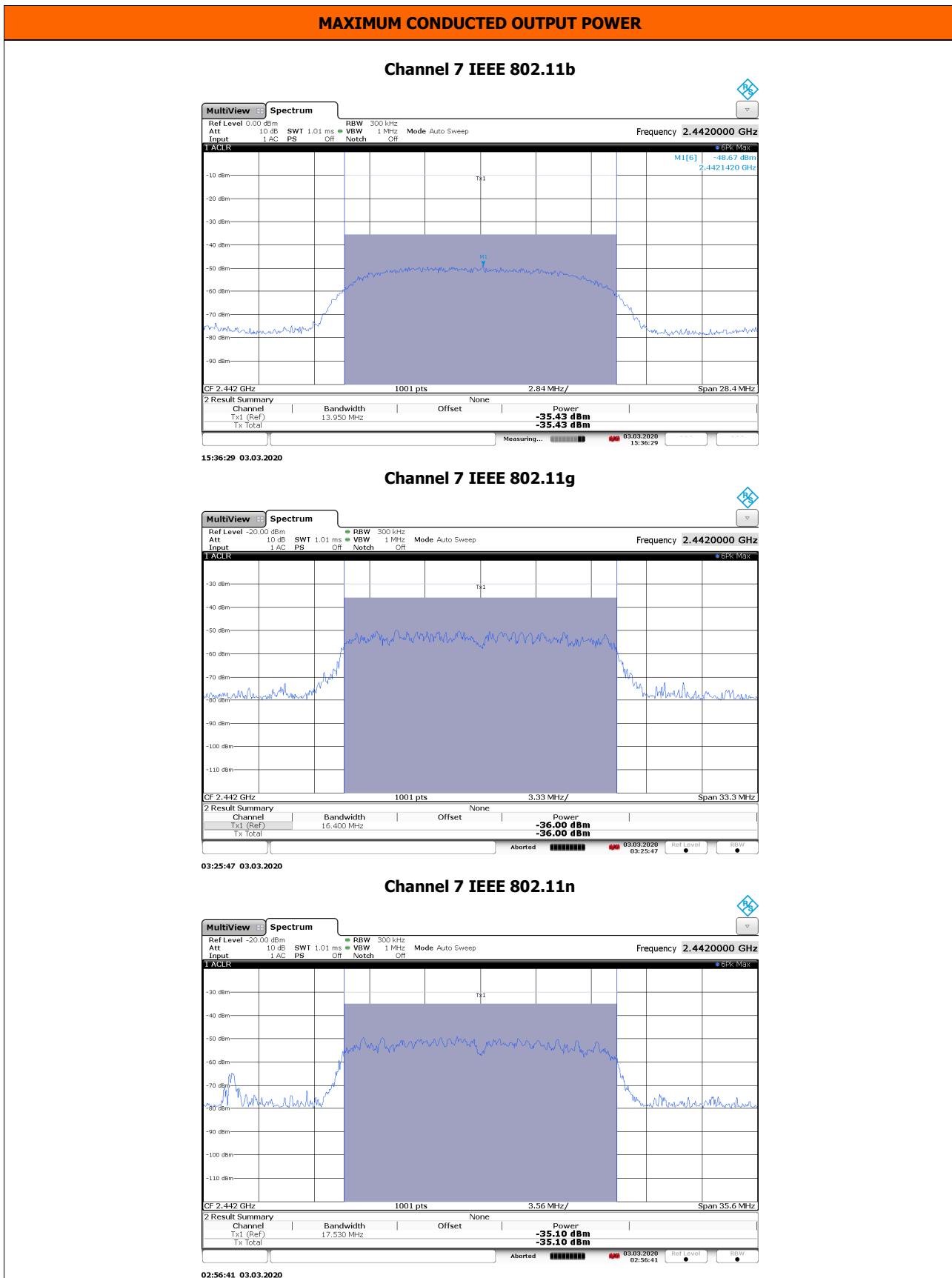
Test Procedure

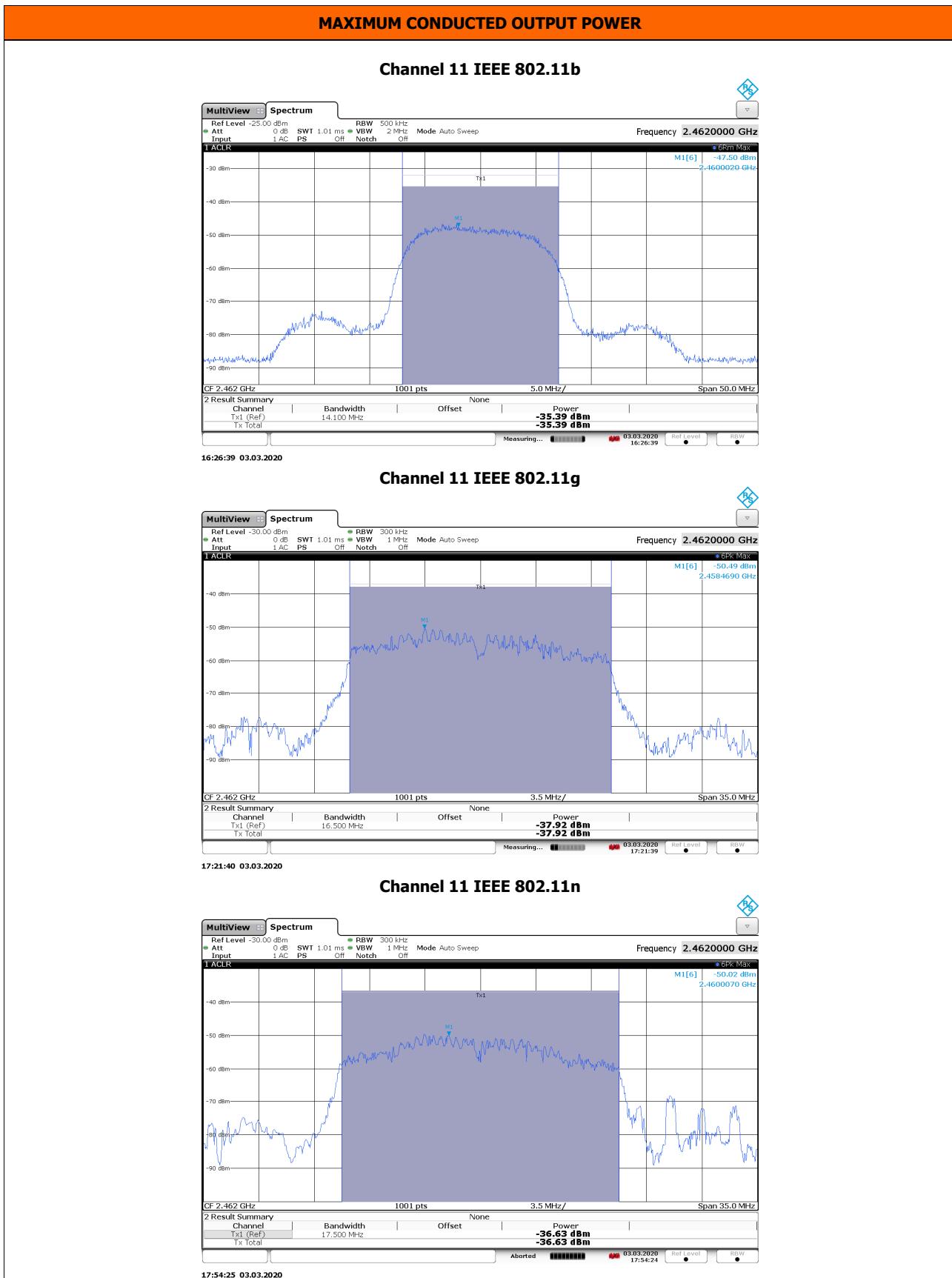
The testing follows KDB 558074 DTS 01 Meas. Guidance v03r05

- 1) The path loss was compensated to the results for each measurement, using substitution method.
- 2) Set to the maximum power setting and enable the EUT transmit continuously.
The EUT was operating in controlled its channel.
- 3) Use the following spectrum analyzer settings:
Span = the frequency band of operation
Sweep = auto
Detector function = Avg
Trace = max hold

MAXIMUM CONDUCTED OUTPUT POWER																		
Technician: Pau Aguilà																		
Test date: 2020-03-03																		
Basic standards: ANSI C63.10-2013 and RSS-Gen Issue 5 Amendment 1																		
<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="padding: 2px;">Temperature:</td><td style="padding: 2px;">23.7</td><td style="padding: 2px;">°C</td></tr> <tr> <td style="padding: 2px;">Humidity:</td><td style="padding: 2px;">35.2</td><td style="padding: 2px;">%</td></tr> <tr> <td style="padding: 2px;">Atm. Pressure:</td><td style="padding: 2px;">1004.1</td><td style="padding: 2px;">hPa</td></tr> </table>										Temperature:	23.7	°C	Humidity:	35.2	%	Atm. Pressure:	1004.1	hPa
Temperature:	23.7	°C																
Humidity:	35.2	%																
Atm. Pressure:	1004.1	hPa																
RESULTS: Pass																		
Channel	Frequency (MHz)	Modulation	Measured EIRP (dBm)	Correction (dB)	Max EIRP (dBm)	FCC Limit (dBm)	RSS Limit (dBm)	Result	Comment									
1	2412	802.11b	-37.96	43.48	5.52	36	36	PASS	Maximum Radiation Position Height: 350 cm Pol.: H Azimuth: 0 deg									
		802.11g	-41.43	42.81	1.38													
		802.11n	-38.26	43.48	5.22													
7	2442	802.11b	-35.43	43.48	8.05	36	36	PASS										
		802.11g	-36.00	42.81	6.81													
		802.11n	-35.10	43.48	8.38													
11	2462	802.11b	-35.39	43.48	8.09	36	36	PASS										
		802.11g	-37.92	42.81	4.89													
		802.11n	-36.63	43.48	6.85													
Channel	Frequency (MHz)	Modulation	Max EIRP (dBm)	Max Antenna Gain (dBi)	Max Conducted Output Power Calculated (dBm)	FCC Limit (dBm)	RSS Limit (dBm)	Result	Comment									
1	2412	802.11b	5.52	-0.3	5.82	30	30	PASS										
		802.11g	1.38		1.68													
		802.11n	5.22		5.52													
7	2442	802.11b	8.05		8.35	30	30	PASS										
		802.11g	6.81		7.11													
		802.11n	8.38		8.68													
11	2462	802.11b	8.09		8.39	30	30	PASS										
		802.11g	4.89		5.19													
		802.11n	6.85		7.15													
Comments:																		
Test performed using radiated method according to KDB 558074 D01 15.247 Meas Guidance																		
Correction obtained using substitution method																		
Maximum Conducted Output Power Calculated = Max. EIRP measured – Max Antenna Gain																		







Occupied Bandwidth

Limits

According to FCC Part 15.247(a)(2) and RSS-247 5.2 (a), the minimum 6 dB bandwidth shall be at least 500 kHz.

Test Setup

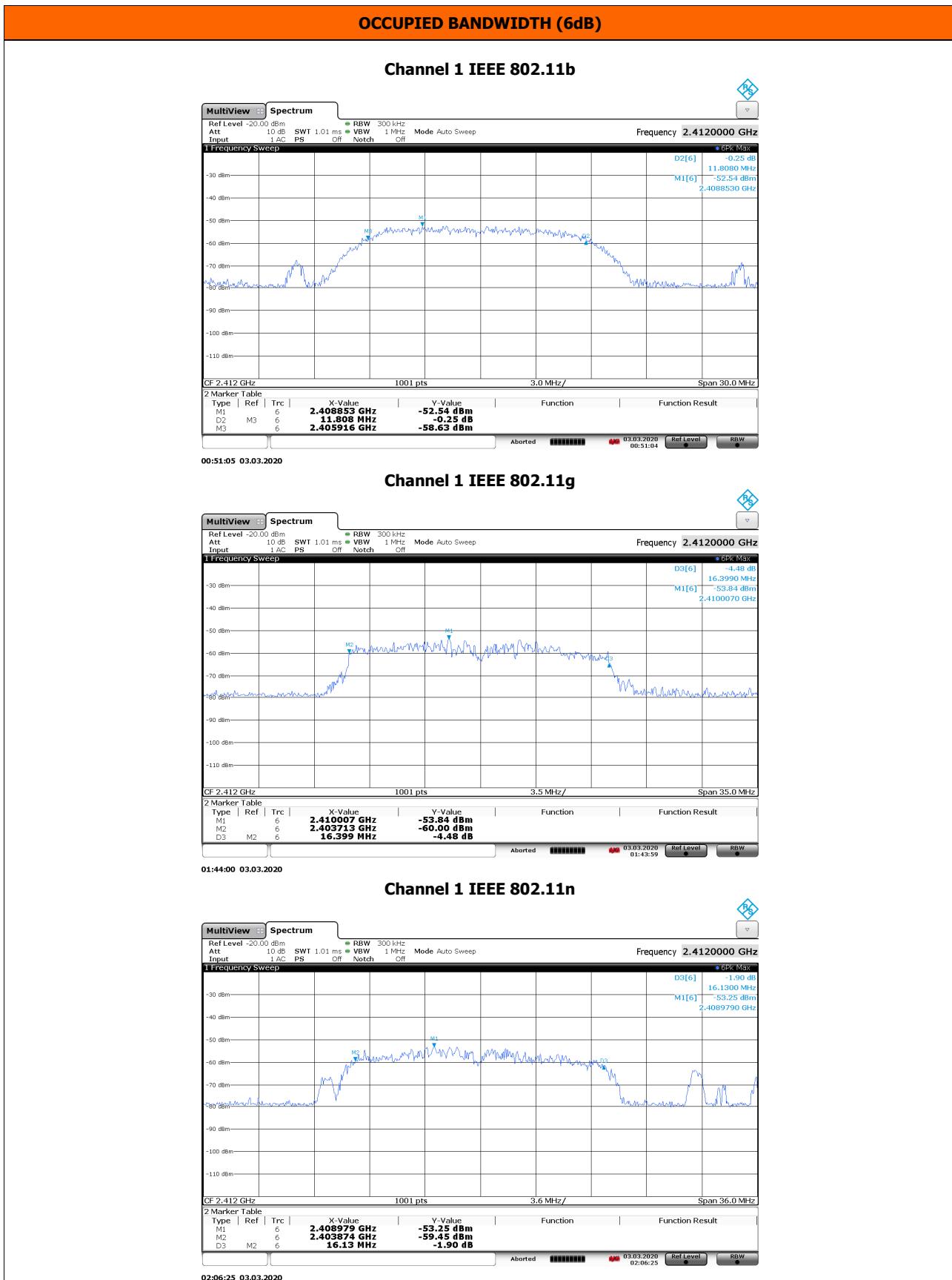
The actual test setup configuration is identical to the one described previously for the Unwanted emissions into non-Restricted Frequency Bands test in case of Radiated emissions above 1000MHz.

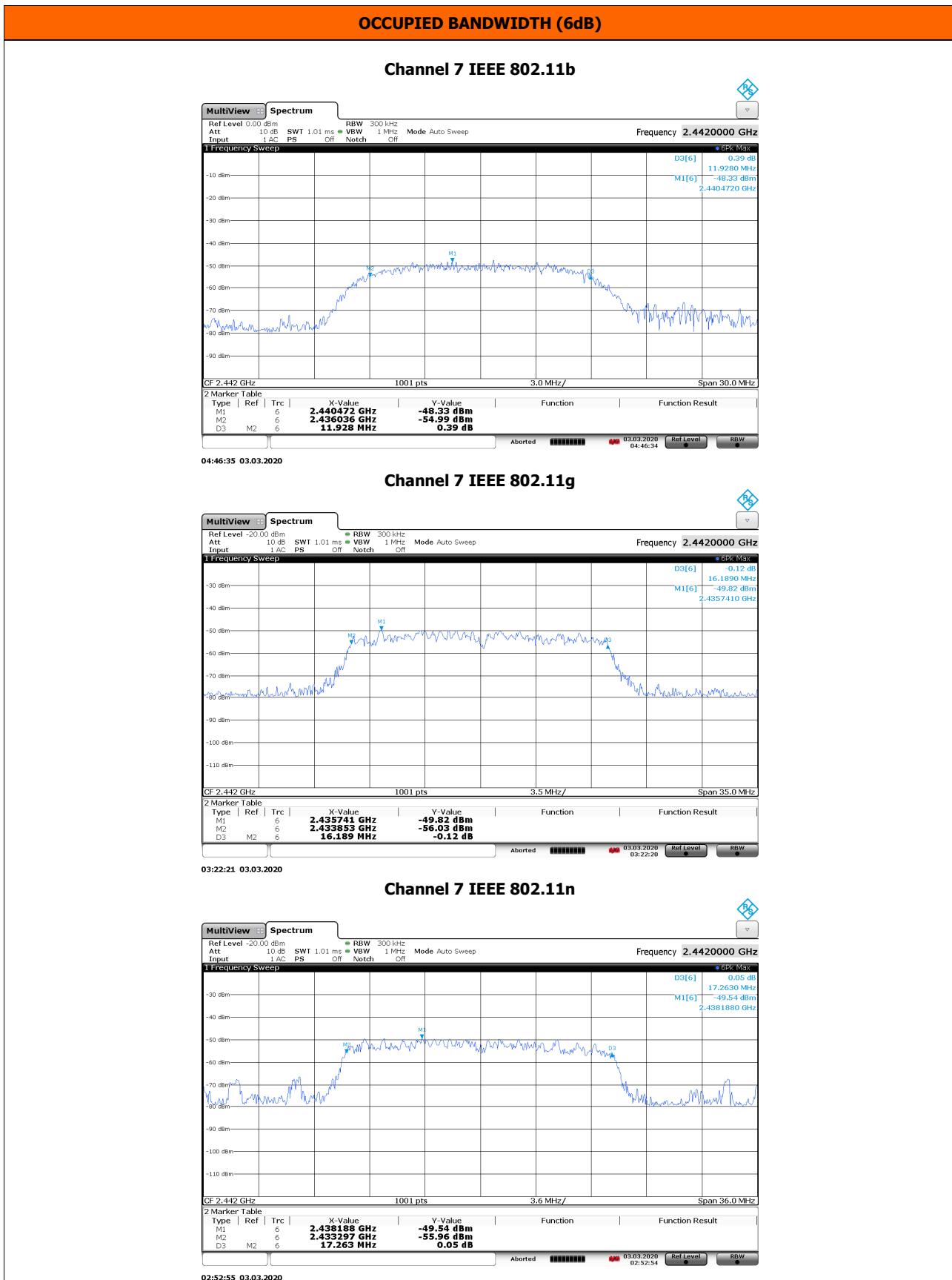
Test Procedure

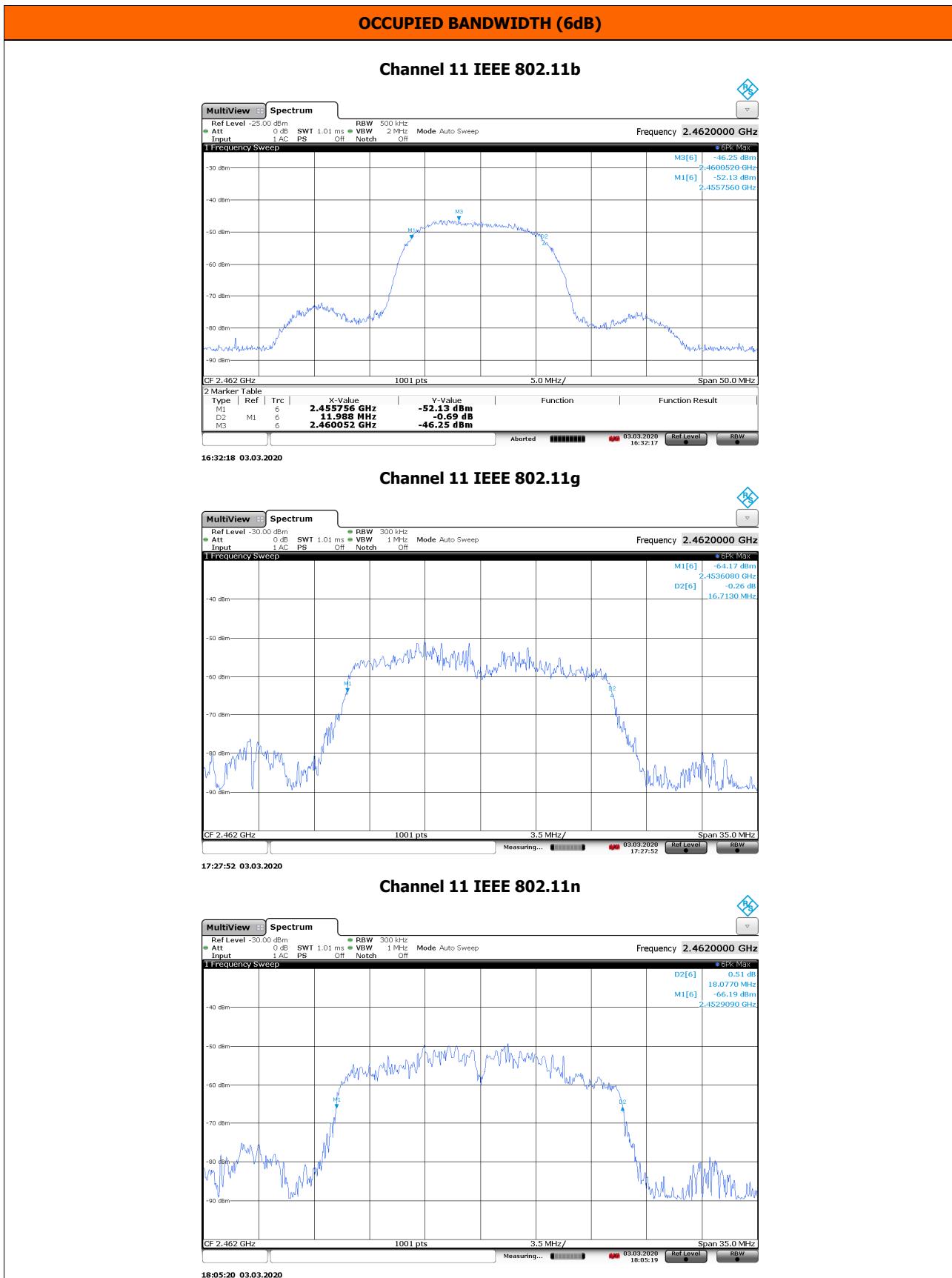
The testing follows KDB 558074 DTS 01 Meas. Guidance v03r05

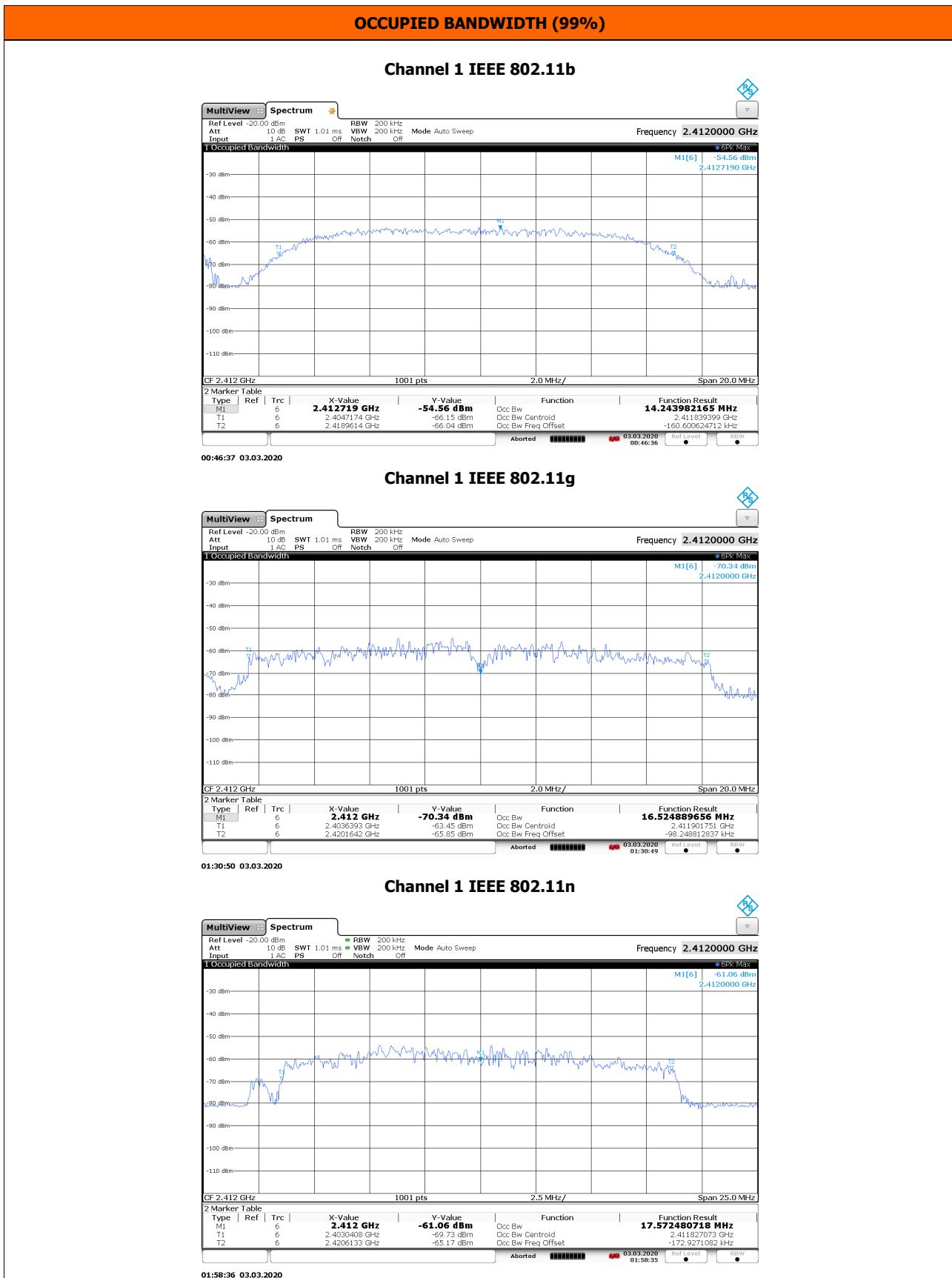
- 1) The path loss was compensated to the results for each measurement.
- 2) Set to the maximum power setting and enable the EUT transmit continuously.
The EUT was operating in controlled its channel.
- 3) Use the following spectrum analyzer settings:
Span = the frequency band of operation
RBW = 100KHz
VBW \geq 3*RBW
Sweep = auto
Detector function = peak
Trace = max hold

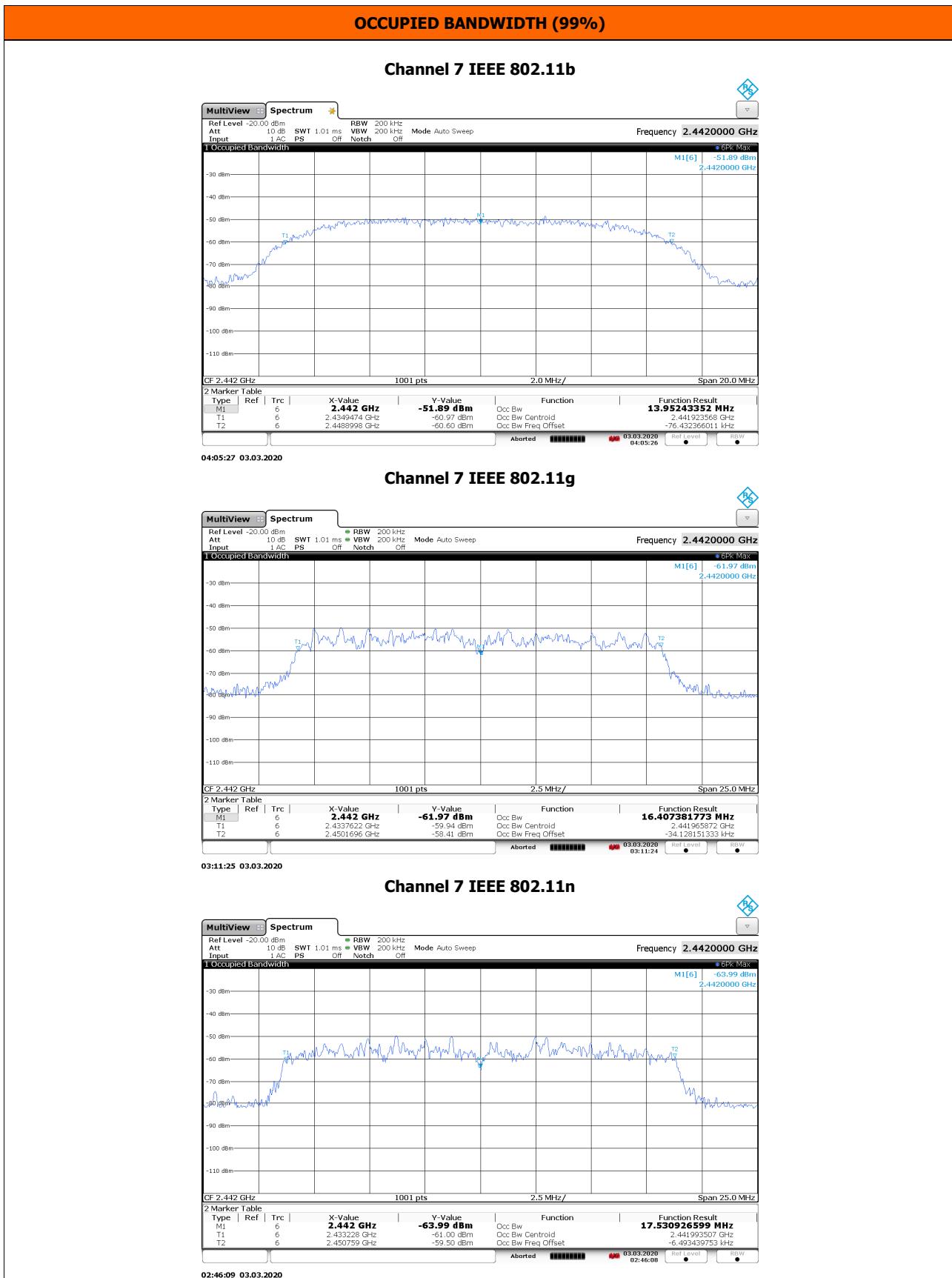
OCCUPIED BANDWIDTH																																														
Technician: Pau Aguilà																																														
Test date: 2020-03-03																																														
Basic standards: ANSI C63.10-2013 and RSS-Gen Issue 5 Amendment 1																																														
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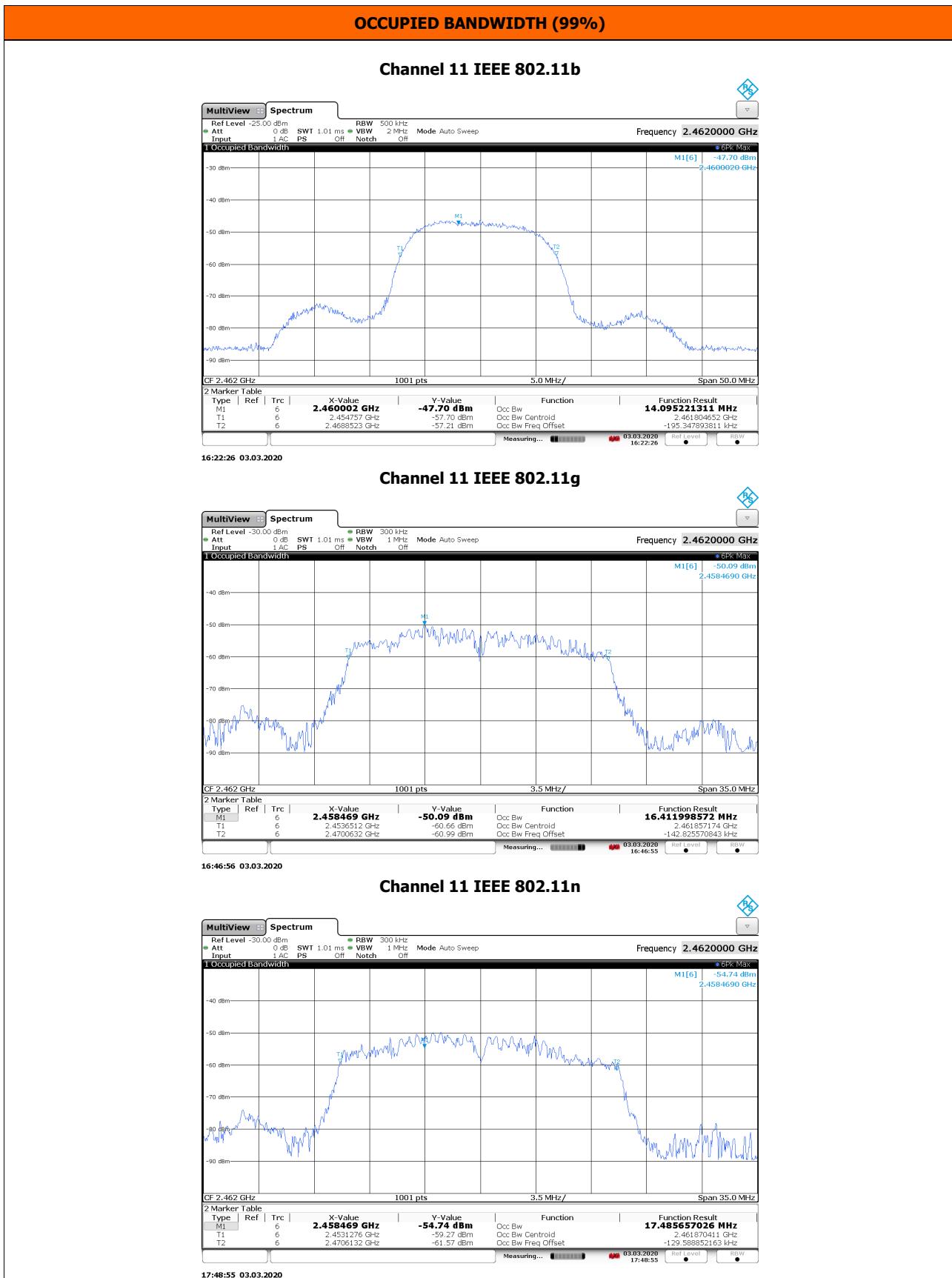












Maximum Power Spectral Density

Limits

According to FCC Part 15.247(e) and RSS-247 5.2 (b), the peak power spectral density shall not be greater than 8dBm in any 3kHz band at any time interval of continuous transmission

Test Setup

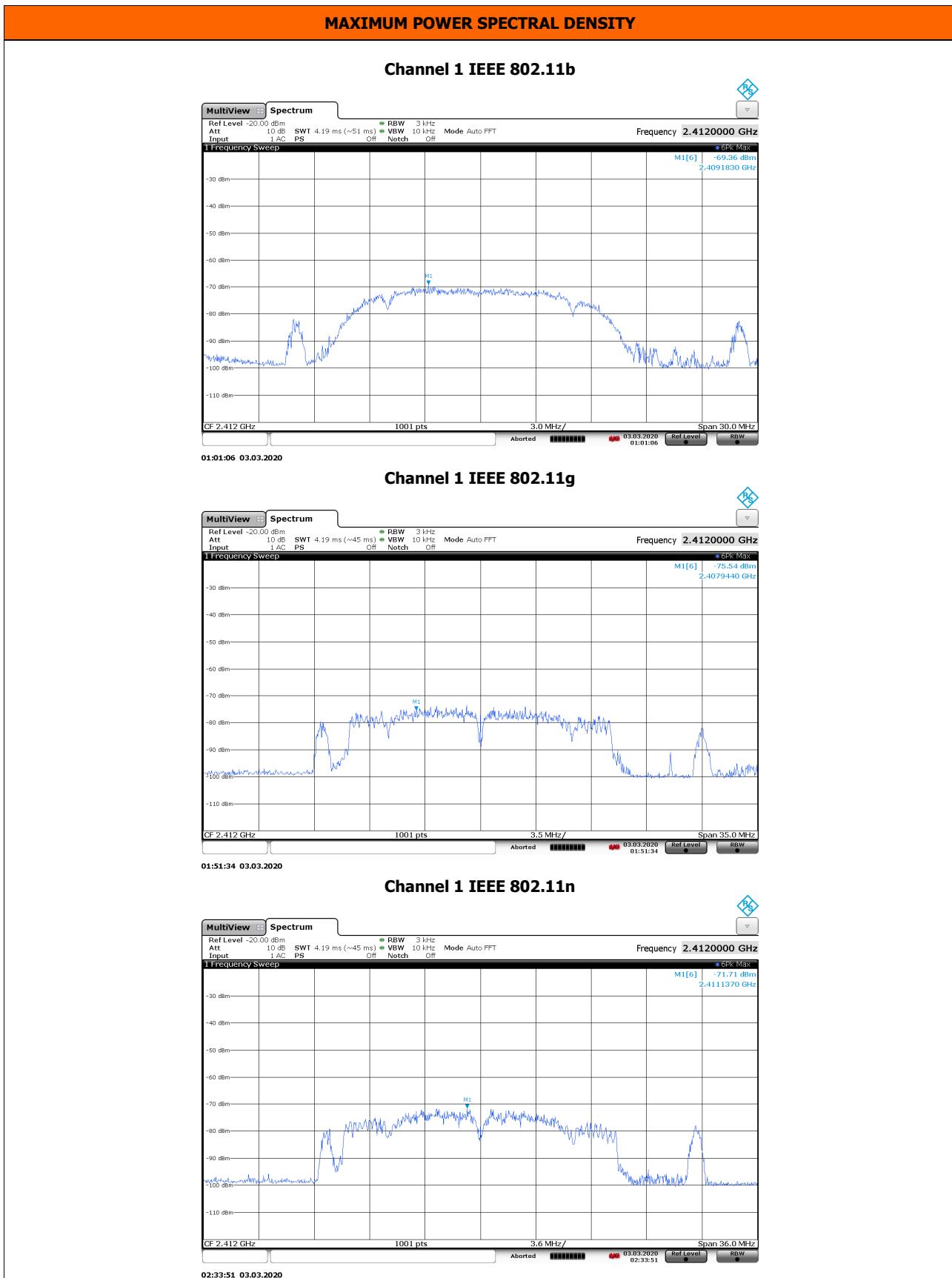
The actual test setup configuration is identical to the one described previously for the Unwanted emissions into Restricted Frequency Bands test in case of Radiated emissions above 1000MHz.

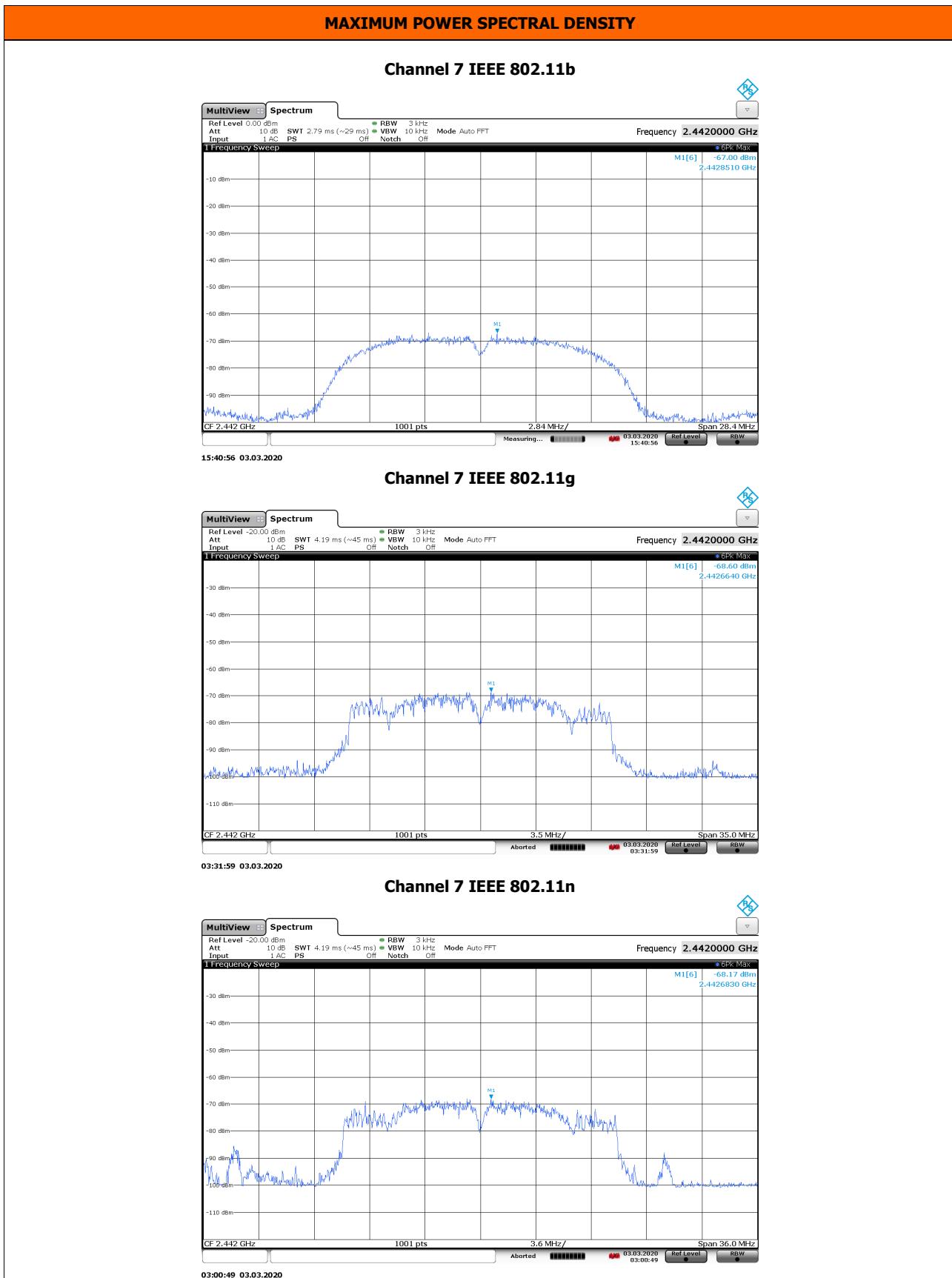
Test Procedure

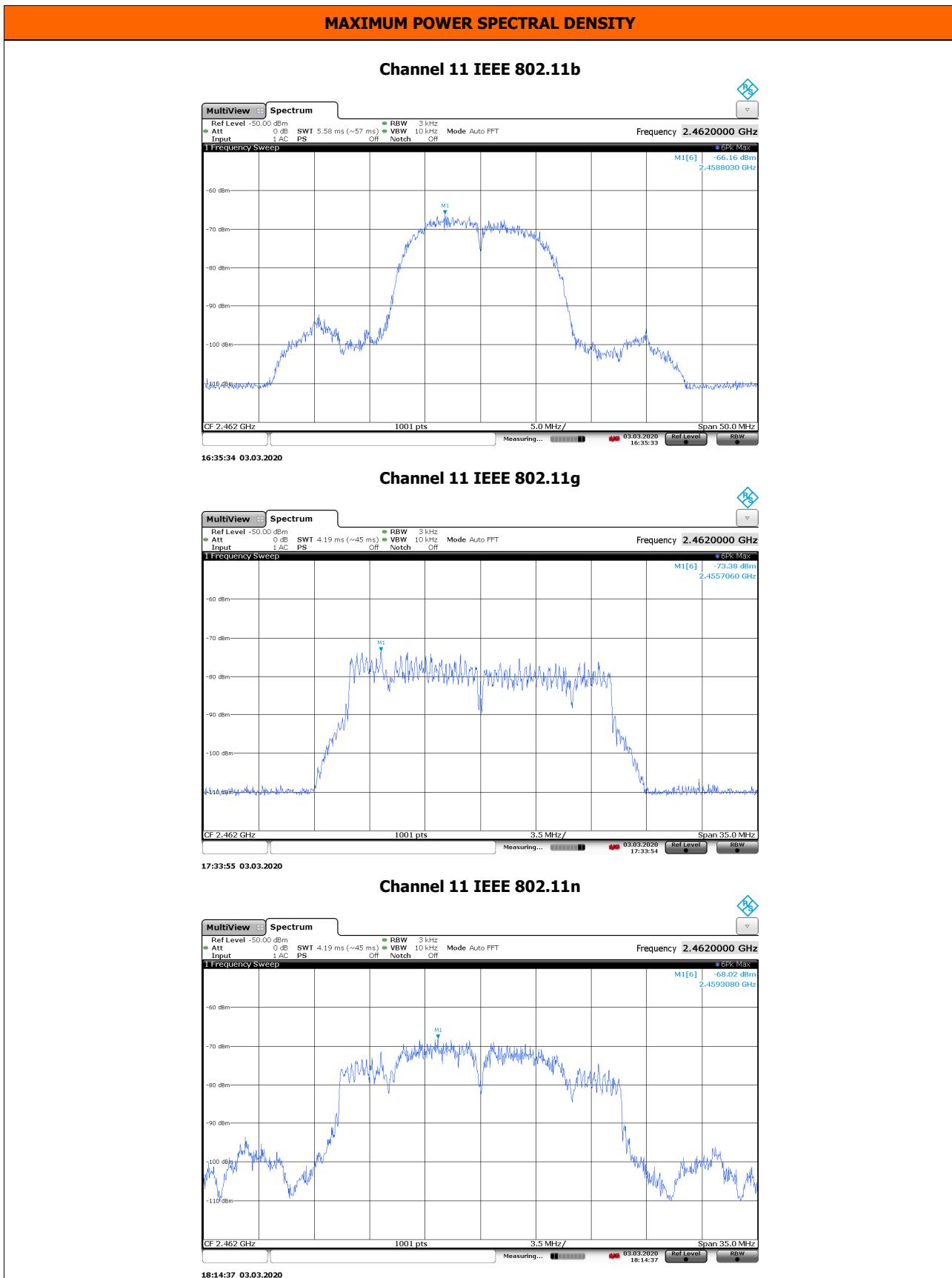
Maximum (average) conducted output power was used to demonstrate compliance to the fundamental output power limit.

- 1) The path loss was compensated to the results for each measurement.
- 2) Set to the maximum power setting and enable the EUT transmit continuously.
The EUT was operating in controlled its channel.
- 3) Use the following spectrum analyzer settings: Set the RBW = 3kHz, VBW = 10kHz.
- 4) Detector = RMS, Sweep time = auto couple.
- 5) Employ trace averaging (RMS) mode over a minimum of 100 traces
- 6) Use the peak marker function to determine the maximum amplitude level. Use the peak marker function to determine the maximum amplitude level

MAXIMUM POWER SPECTRAL DENSITY												
Technician: Pau Aguilà Test date: 2020-03-04												
Basic standards: ANSI C63.10-2013 and RSS-Gen Issue 5 Amendment 1												
Temperature: 26.6 °C Humidity: 39.0 % Atm. Pressure: 1017.4 hPa												
RESULTS: Pass												
Channel	Freq. (MHz)	Modulation	Measured PSD (dBm/3KHz)	Correction (dB)	PSD (dBm/3kHz)	Limit (dBm/3kHz)	Result	Comment				
1	2412	802.11b	-69.36	43.48	-25.88	8dBm/3kHz	PASS	Maximum Radiation Position				
		802.11g	-75.54	42.81	-32.73							
		802.11n	-71.71	43.48	-28.23							
7	2442	802.11b	-67.00	43.48	-23.52	8dBm/3kHz	PASS	Height: 350 cm Pol.: H Azimuth: 0 deg				
		802.11g	-68.60	42.81	-25.79							
		802.11n	-68.17	43.48	-24.69							
11	2462	802.11b	-66.16	43.48	-22.68	8dBm/3kHz	PASS					
		802.11g	-73.38	42.81	-30.57							
		802.11n	-68.02	43.48	-24.54							
Comments:												
Test performed using radiated method Correction obtained using substitution method												







ANTENNA REQUIREMENTS	
Basic standard: FCC Title 47 part 15 Subpart C	
Procedure: C5401665	
RESULTS: Pass	
Comments:	
<p>Excerpt from 15.203 of the FCC Rules/Regulations:</p> <p>"An intentional radiator antenna shall be designed to ensure that no antenna other than furnished by the responsible party can be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the previsions of this section."</p> <p>The antennas of the Biotelemetry apparatus (WiFi) are permanently attached.</p> <p>There are no provisions for connection to an external antenna.</p>	

END OF TEST REPORT