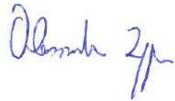


Test Report 47 CFR FCC Part 15 subpart C Intentional Radiators	
Report reference no.	28112294-001
FCC Designation Number	IT0008
FCC Test Firm Registration #	804595
Tested by (name + signature)	 Alessandro Zappa \ Tester
Approved by (name + signature)	 Giovanni Molteni \ TM
Date of issue	December, 20 2018
Total number of pages	31 Pages
Testing Laboratory	TÜV Rheinland Italia S.r.l.
Address	Via Mattei 3 - 20010 - Pogliano Milanese (MI) – Italy
Applicant's name	Power-One Italy S.p.A.
Address	Via S. Giorgio, 642 - 52028 Terranuova Bracciolini, Arezzo, Italy
Test item description	WiFi radio module
Trade Mark	
Manufacturer	Power One Italy S.p.a.
Model/Type reference	VSN300S
Ratings	24Vdc (powered by inverter)
	FCC ID: X6W-VSN300S
Sample	
Samples received on	December, 3 rd 2018
TUV reference samples	170606 (sampled by the customer)
Samples tested n.	1
Testing	
Start Date:	December, 3 rd 2018
End Date:	December, 20 th 2018
<i>The results in this Test Report are exclusively referred to the tested samples. Without the written authorization of TÜV Rheinland Italia S.r.l., this document can be reproduced only integrally</i>	

RELEASE CONTROL RECORD		
TEST REPORT NUMBER	REASON OF CHANGE	DATE OF ISSUE
28112294-001	Original release	December, 10, 2018

SUMMARY

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1. Reference Standards	
Standard	Description
FCC Part 15 (Subpart C)	§15.247 Operation within the bands 902-928 MHz, 2400-2483,5 MHz, and 5725-5850 MHz.
FCC Part 15 (Subpart C)	§15.207 Conducted Limits
FCC Part 15 (Subpart C)	§15.209 Radiated emission limits; general requirements
FCC Part 15 (Subpart C)	§15.203 Antenna Requirement
ANSI C63.4:2009	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
ANSI C63.10:2013	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices
FCC GUIDE 15.247 (DTS): April 8,2016	Guidance for performing compliance measurements on digital transmission systems (dts) operating under §15.247

2. Summary of testing:			
FCC Rule Part	Test Item	Result	Remarks
15.207	AC POWER CONDUCTED EMISSION	N/A	---
15.205 15.209 15.247(d)	RADIATED EMISSIONS	PASS	Meet the requirement of limit
15.247(b)(3)(4)	OUTPUT POWER	PASS	Meet the requirement of limit
15.203	ANTENNA REQUIREMENT	PASS	Professional equipment (RP SMA)
15.247(b)	RF EXPOSURE REQUIREMENTS	PASS	Meet the requirement of limit

Possible test case verdicts:

- test case does not apply to the test object: N/A
- test object does meet the requirement: PASS
- test object does not meet the requirement: FAIL

NOTE

This test report is an upgrade of test report n° **28111054_005** issued by TÜV Rheinland Italia in date April 16 2018.

EUT has been partially retested due to a new hardware release (see paragraph 3 'General product information' for details about difference between current and previous hardware release).

FCC ID: X6W-VSN300S (FCC ID of the original device).

General remarks:

The test results presented in this report relate only to the object tested.

The results contained in this report reflect the results for this particular model and serial number. It is the responsibility of the manufacturer to ensure that all production models meet the intent of the requirements detailed within this report.

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"(see Enclosure #)" refers to additional information appended to the report.

"(see appended table)" refers to a table appended to the report.

Throughout this report a comma (point) is used as the decimal separator.

3. General product information

EUT is a wifi radio module

Difference between current hardware release and previous release tested in TR 28111054_005:

- **New oscillator** item **XTAL5** model CEC Panda Crystal Technology Electronics, Type HLX-TE-1.8-26.0000M-D-A-G-TR - STE-0006 (MEC) substitutes previous item **XTAL4** model Kyocera, Model KT2520K, Type KT2520K26000AAW18TAS

New flash memory item **U13** , possible models :

Kingston p/n KE4CN2H5C

Micron p/n MTFC4GMDEA-4M IT-TR

Micron p/n MTFC4GMVEA-4MIT

Sandisk p/n SDIN8DE2-4G-XI

Toshiba p/n THGBMAG5A1JBWR

substitutes previous item **U13** , possible models:

Kingston p/n EMMC04G-W627-Y02U

Kingston p/n KE4CN2H5C

Micron p/n MTFC4GACAJCN-4M IT-TR

Sandisk p/n SDIN8DE2-4G-XI

Toshiba p/n THGBMAG5A1JBWR

4. General Chipset information

ModuloRadio /Radio Module

Costruttore /Manufacturer	Murata
Modello /Model	LBEP5CLXRC-701
N°serie /Serial no.	YCU.00123

Antenna /Main Antenna

Costruttore /Manufacturer	Comepoch Technology Corp.																
Modello /Model	EA-79F (2.4GHz with Swivel RP-SMA)																
N°serie /Serial no.	---																
Caratteristiche tecniche /Technical details	See datasheet "zfa.00008.pdf" EA-79F E-Plane <table><tr><th>Freq(MHz)</th><th>peak (dBi)</th><th>Angle(°)</th><th>Avg(dBi)</th></tr><tr><td>2400</td><td>3.11</td><td>73.99</td><td>-2.37</td></tr><tr><td>2450</td><td>2.95</td><td>73.99</td><td>-2.35</td></tr><tr><td>2500</td><td>3.32</td><td>75.99</td><td>-1.87</td></tr></table>	Freq(MHz)	peak (dBi)	Angle(°)	Avg(dBi)	2400	3.11	73.99	-2.37	2450	2.95	73.99	-2.35	2500	3.32	75.99	-1.87
Freq(MHz)	peak (dBi)	Angle(°)	Avg(dBi)														
2400	3.11	73.99	-2.37														
2450	2.95	73.99	-2.35														
2500	3.32	75.99	-1.87														

5. General Antenna information



6. Equipment Used During Test				
Use*	Product Type	Manufacturer	Model	Comments
EUT	Radio module	Power One Italy S.p.a.	VSM300S	---
AE	Q1 board	Power One Italy S.p.a.	VKA.V1Q04.0	Used to set the WiFi Module
AE	PC	Lenovo	T430	Used to set the WiFi Module
Note: * Use : EUT - Equipment Under Test, AE - Auxiliary/Associated Equipment, or SIM - Simulator (Not Subjected to Test) No other Auxiliary/Associated Equipment was connected/installed on the EUT				

7. Input/Output Ports:				
CONNECTIONS				
Port		Description	Connection	Cable lenght
1	Enclosure	Port not present	----	----
2	AC Power Port	Port not present	----	----
3	DC Power Port	24Vdc	Powered by inverter	---
*Note: AC = AC Power Port DC = DC Power Port N/E = Non-Electrical I/O = Signal Input or Output Port (Not Involved in Process Control) TP = Telecommunication Ports				

8. Power Interface						
Mode #	Voltage (V)	Current (A)	Power (W)	Frequency (DC/AC-Hz)	Phases (#)	Comments
Rated	24Vdc	0,5	12	DC	---	---

9. EUT Operation Modes	
Operation mode	Description
#1	EUT turn on with Wi-Fi Module in transmission mode

10. EUT Configuration Modes:	
Mode #	Description
---	---

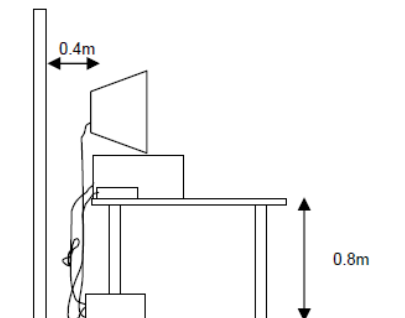
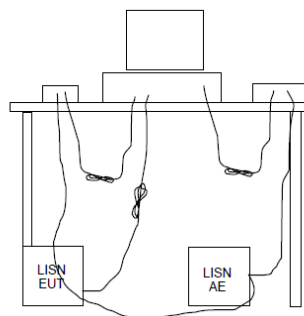
11. Test Conditions and Results – AC POWER CONDUCTED EMISSION

11	TEST: AC Power Conducted Emission			N/A
Parameters required prior to the test	Laboratory Ambient Temperature (°C)		15 to 35 °C	
	Relative Humidity (%)		30 to 60 %	
Parameters recorded during the test	Laboratory Ambient Temperature (°C)		21°C	
	Relative Humidity (%)		56%	
	Air pressure (hPa)		1020	
—	Frequency		Application Point	
Fully configured sample tested at the power line frequency	24Vdc		AC Mains	
Equipment mode:	Operation mode		#1	
FCC Standard	§15.207			
Frequency (MHz)	Quasi-peak (dBuV)	Average (dBuV)	Result	
0.15-0.5	66 to 56	56 to 46	N/A	
0.5-5	56	46	N/A	
5-30	60	50	N/A	

Except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 µH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

Frequency of emission (MHz)	Conducted limit (dBµV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

Further information to test setup



12. Test Conditions and Results – RADIATED EMISSION

12	TEST: Radiated Emission		PASS
Parameters required prior to the test	Laboratory Ambient Temperature (°C)	15 to 35 °C	
	Relative Humidity (%)	30 to 60 %	
Parameters recorded during the test	Laboratory Ambient Temperature (°C)	22°C	
	Relative Humidity (%)	54%	
	Air pressure (hPa)	1020	
—	Frequency	Application Point	
Fully configured sample tested at the power line frequency	24Vdc	Enclosure	
Equipment mode:	Operation mode	#1	
FCC Standard	§15.205; §15.209; §15.247		
Frequency (MHz)	Quasi-peak (dBuV)	Average (dBuV)	Result
0.15-0.5	66 to 56	56 to 46	PASS
0.5-5	56	46	PASS
5-30	60	50	PASS

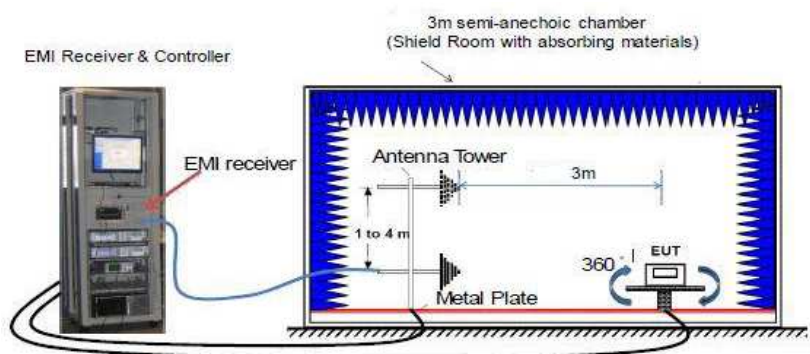
Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table :

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

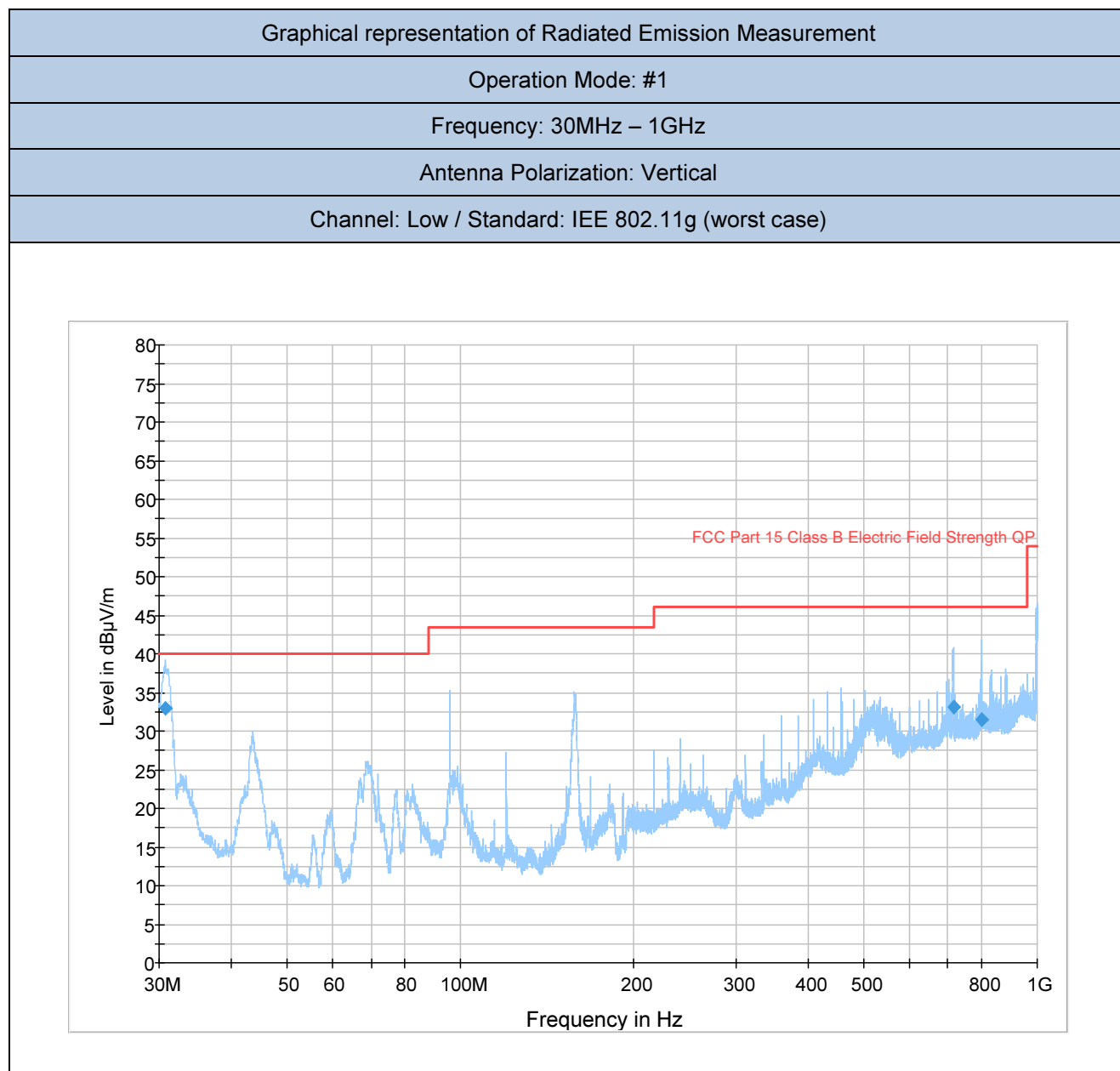
**Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this part, e.g., §§15.231 and 15.241.

Further information to test setup.

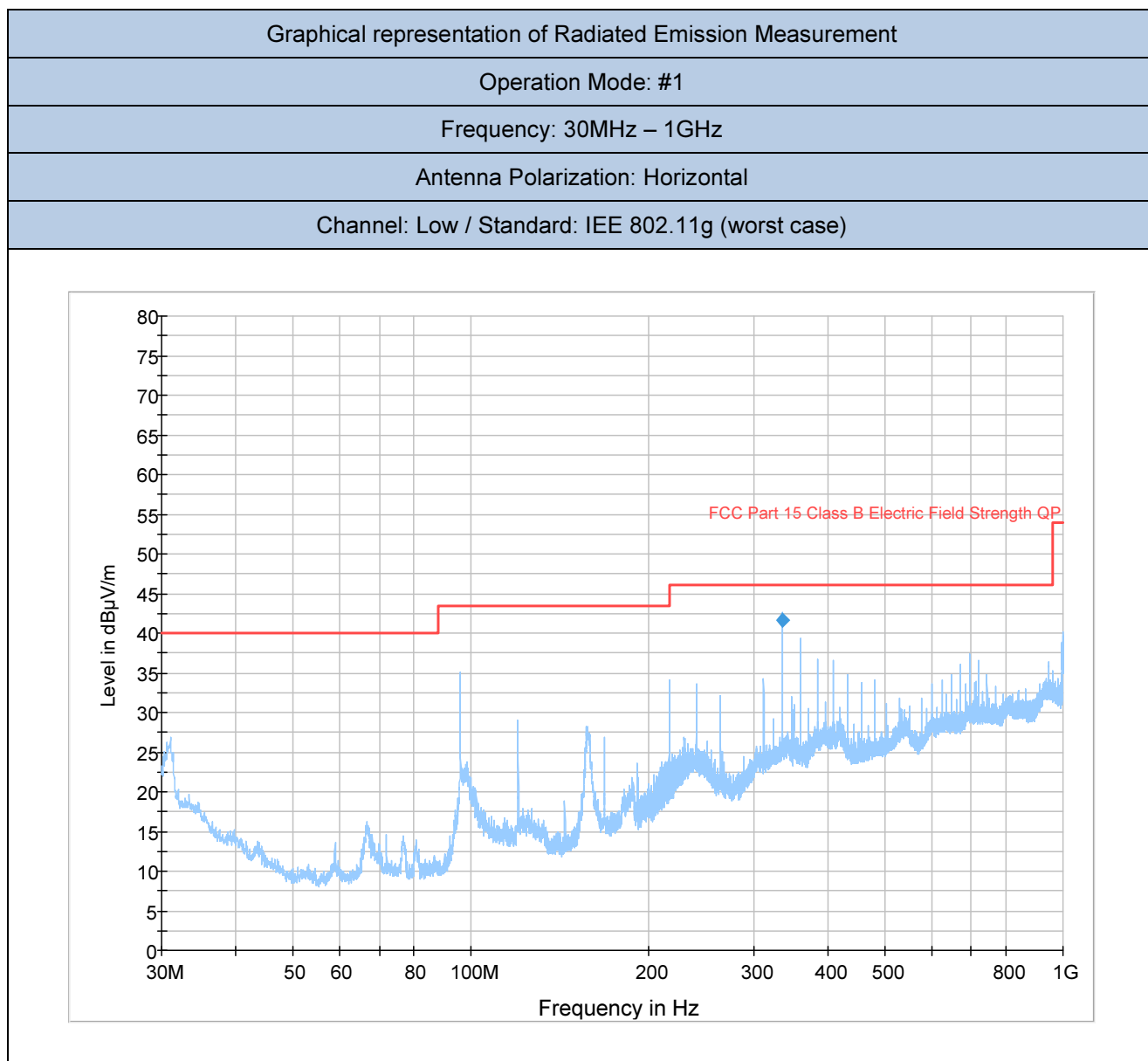
For frequencies above 1GHz, the anechoic material is also placed on the metallic floor between EUT and Antenna



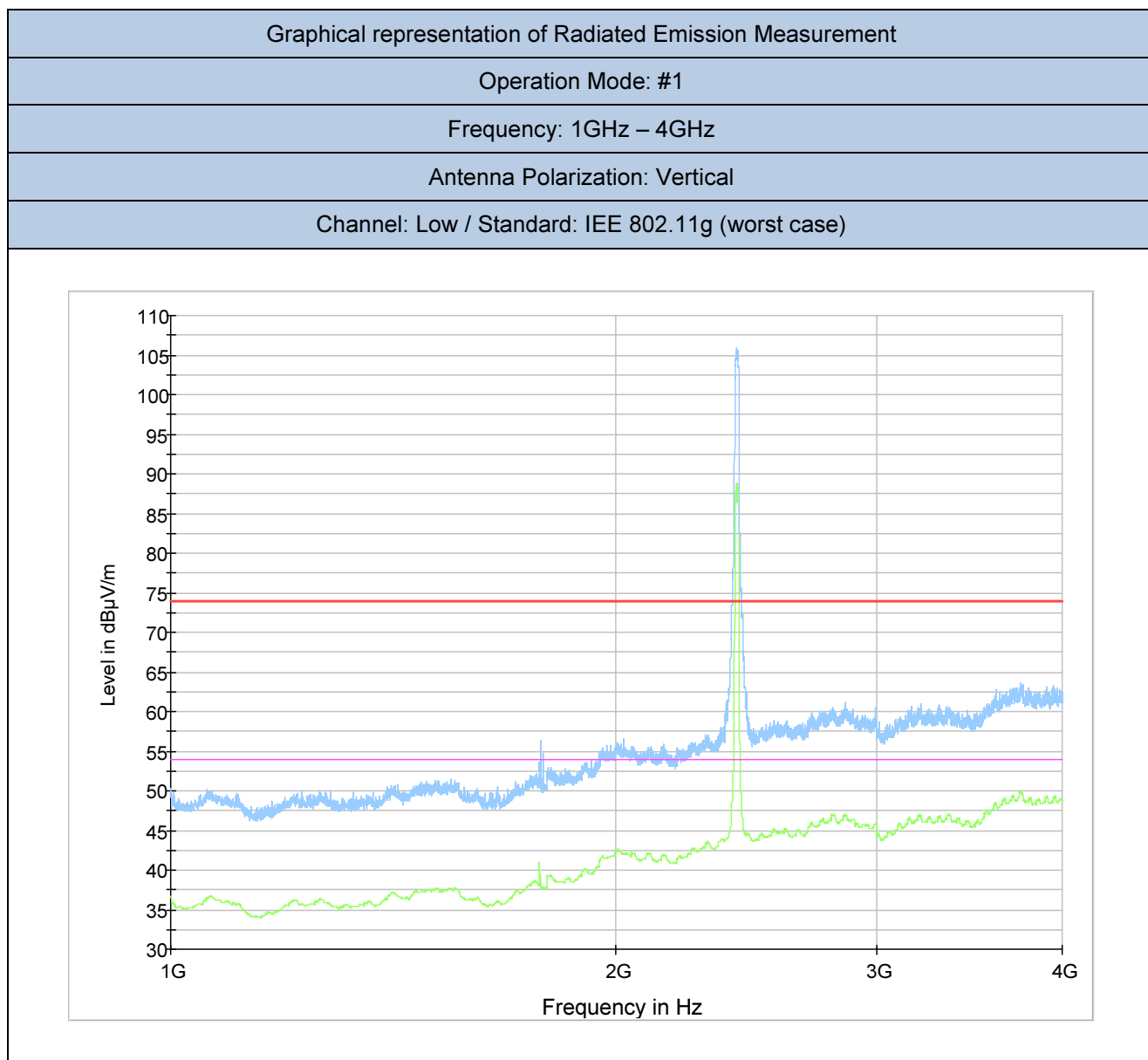
Test Equipment Used					
Description	Manufacturer	Model	Identifier	Calibration date	Calibration due
CSSA	ETS Lindgren	FACT3	87020484	07/2017	07/2019
EMI Test Receiver	R&S	ESW44	87020967	06/2018	06/2019
Antenna BiConiLog	ETS Lindgren	3142E	87020457	04/2017	04/2020
Antenna Horn with Preamplifier	ETS Lindgren	3117-PA	87020458	04/2017	04/2020
2xAntenna Horn with Preamplifier	ETS Lindgren	114514 120722	87020459 87020460	05/2017	05/2020

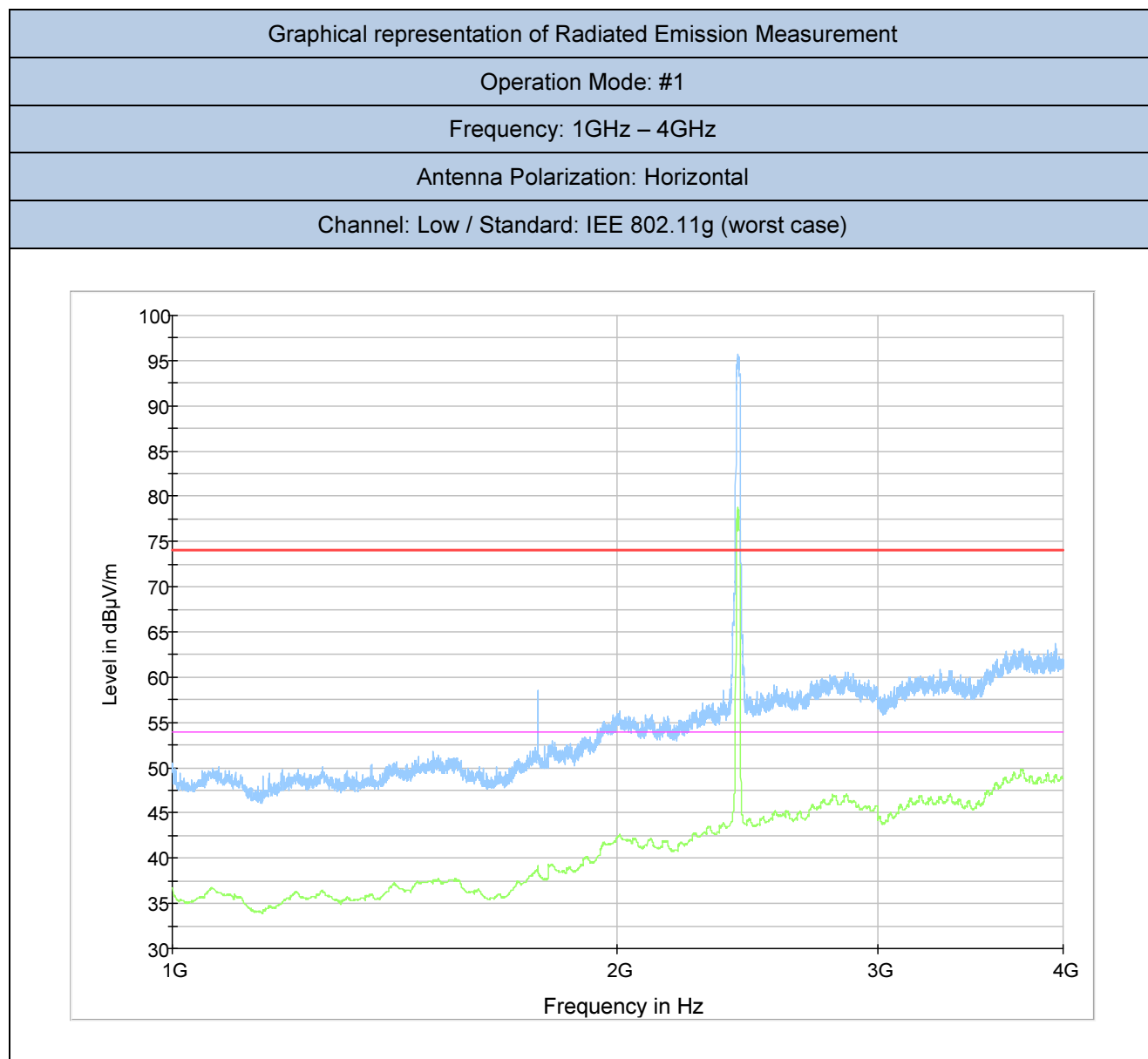


Tabulated results of Radiated Emission Measurement									
Operation Mode: #1									
Frequency: 30MHz – 1GHz Vertical									
Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
30.720000	32.87	40.00	7.13	1000.0	120.000	99.0	V	165.0	15.8
714.630000	33.13	46.00	12.87	1000.0	120.000	112.0	V	93.0	26.2
799.950000	31.52	46.00	14.48	1000.0	120.000	120.0	V	78.0	27.3

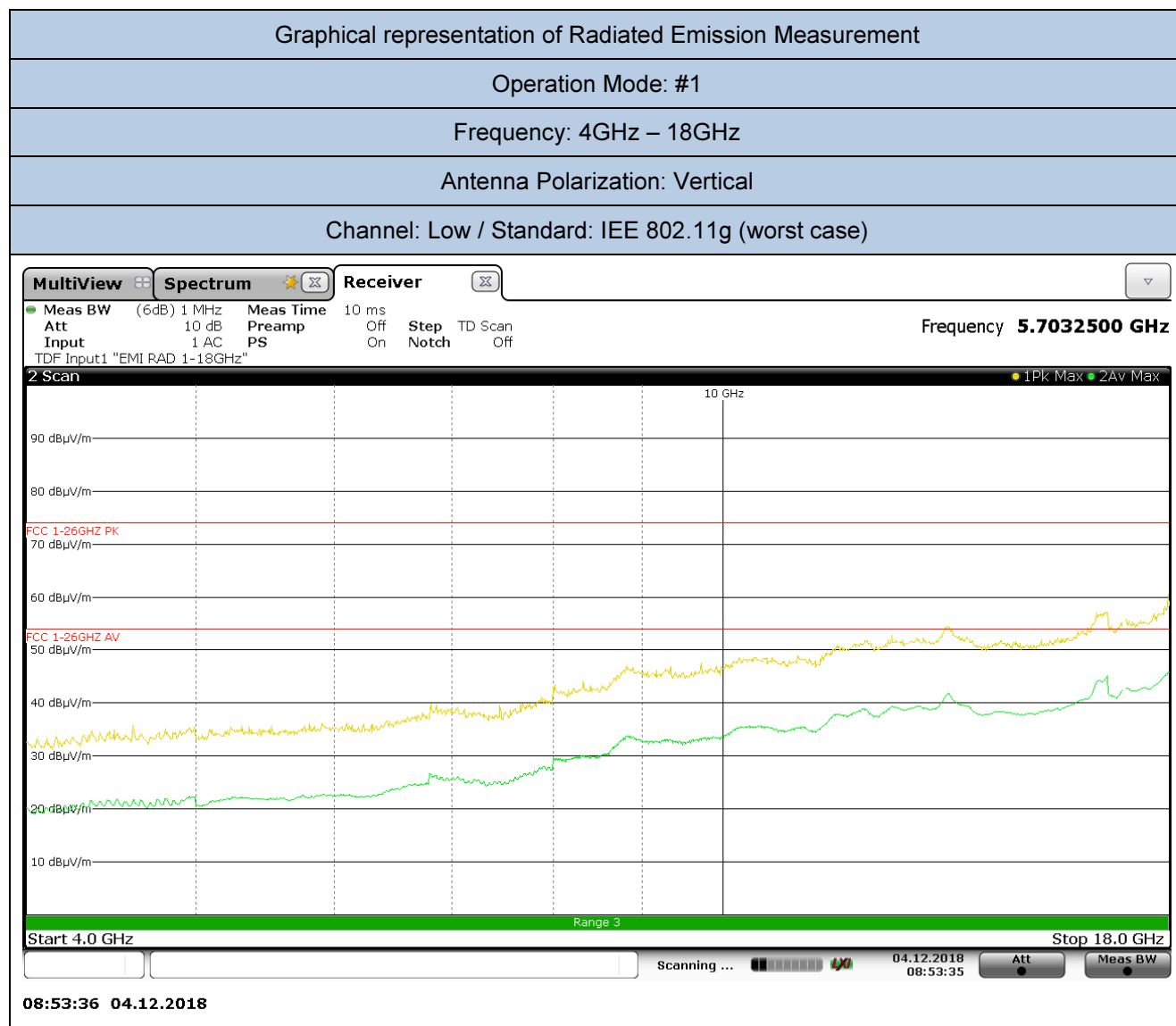


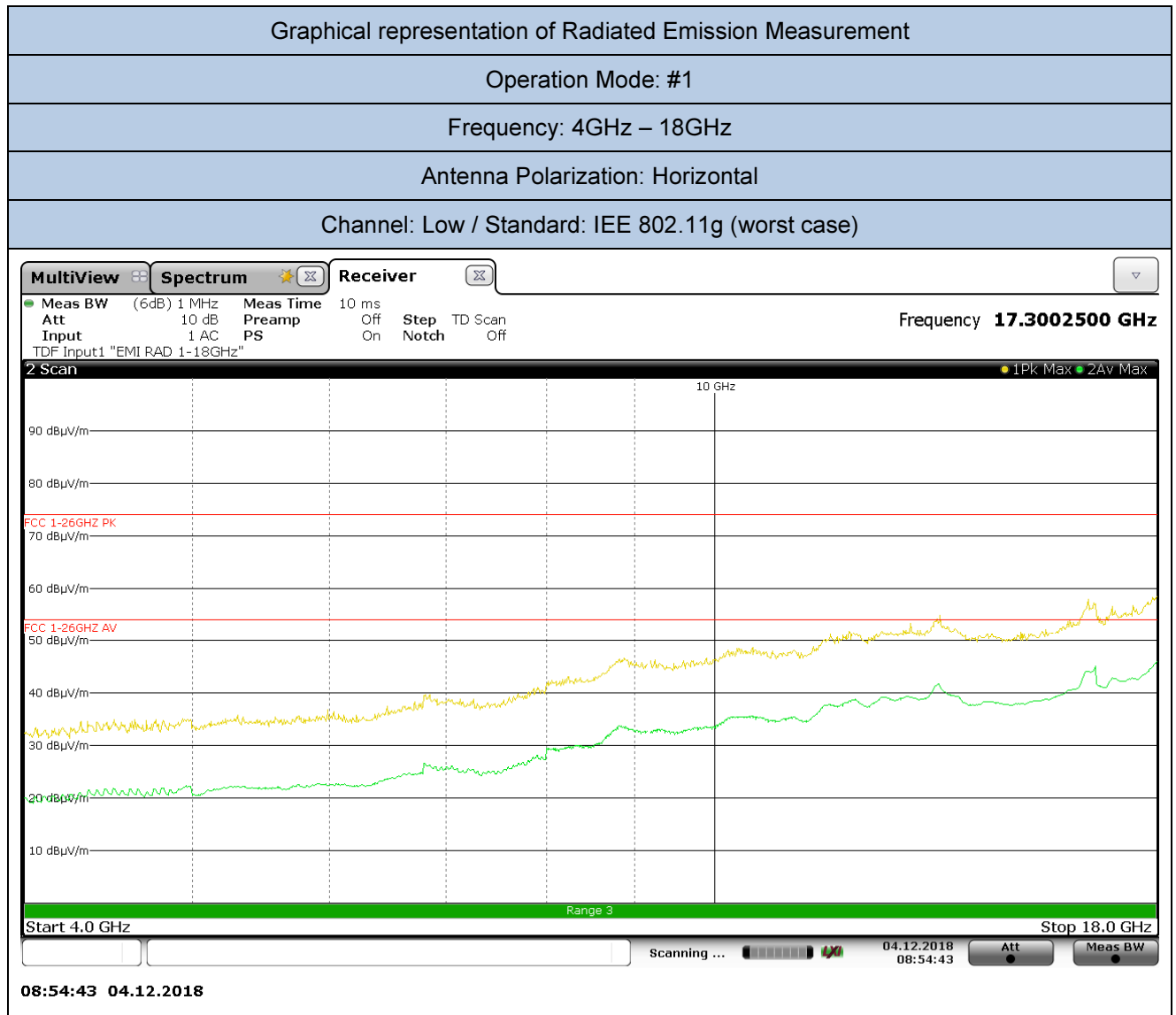
Tabulated results of Radiated Emission Measurement									
Operation Mode: #1									
Frequency: 30MHz – 1GHz Horizontal									
Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
336.030000	41.67	46.00	4.33	1000.0	120.000	112.0	H	274.0	16.9



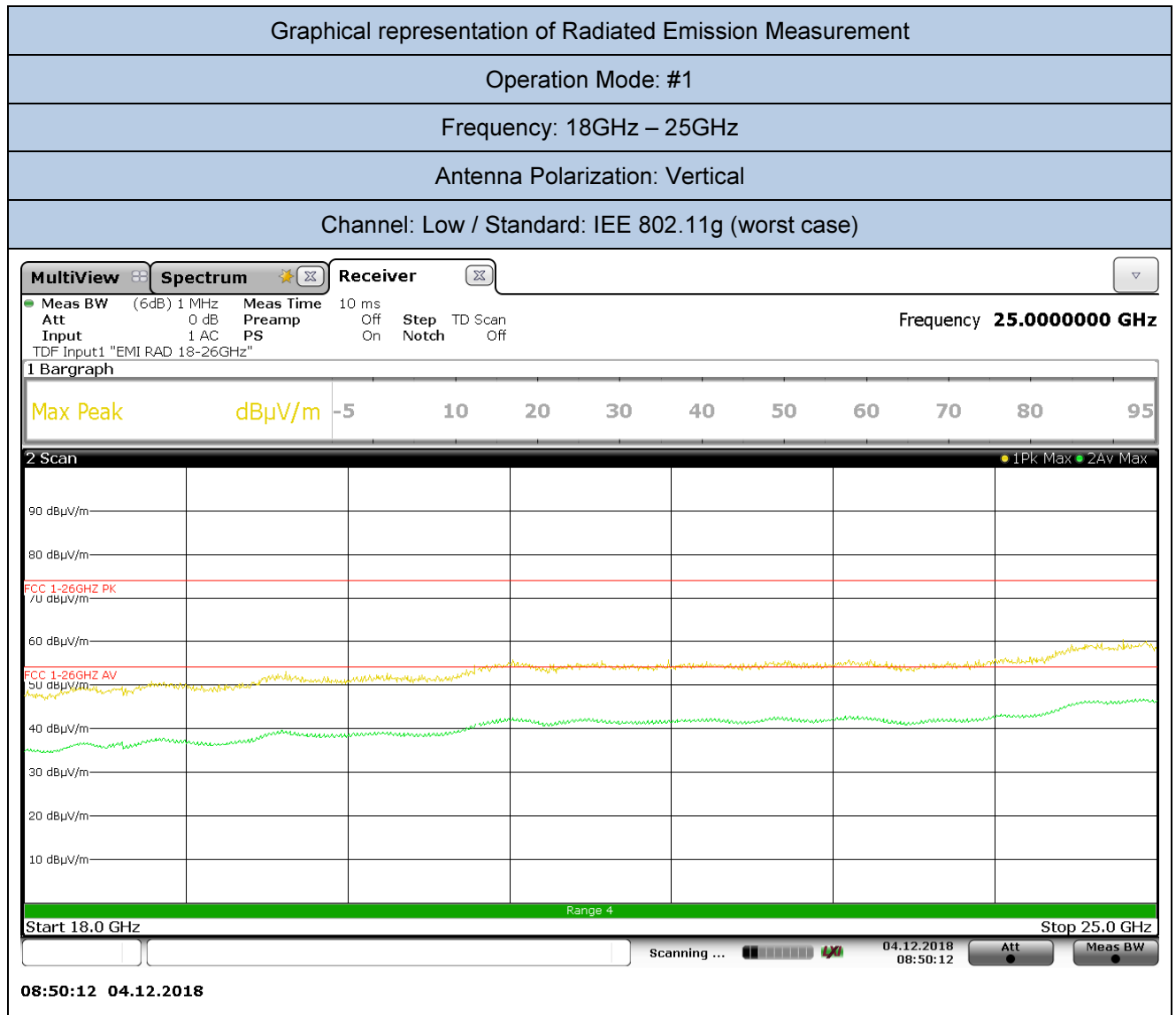


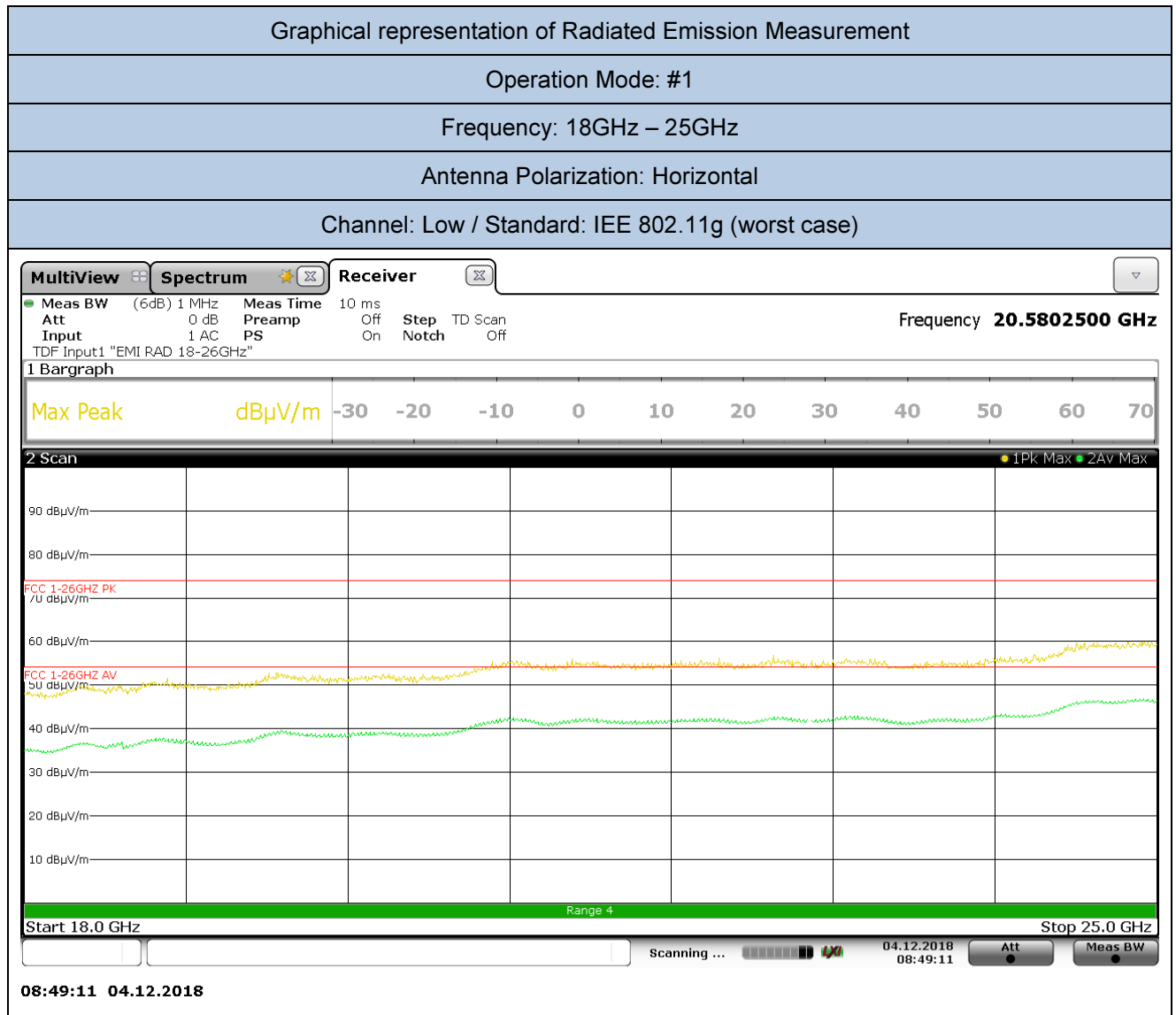
Tabulated results of Radiated Emission Measurement
Operation Mode: #1
Frequency: 1GHz - 6GHz





Tabulated results of Radiated Emission Measurement	
Operation Mode: #1	
Frequency: 4GHz - 18GHz	





Tabulated results of Radiated Emission Measurement	
Operation Mode: #1	
Frequency: 18GHz - 25GHz	

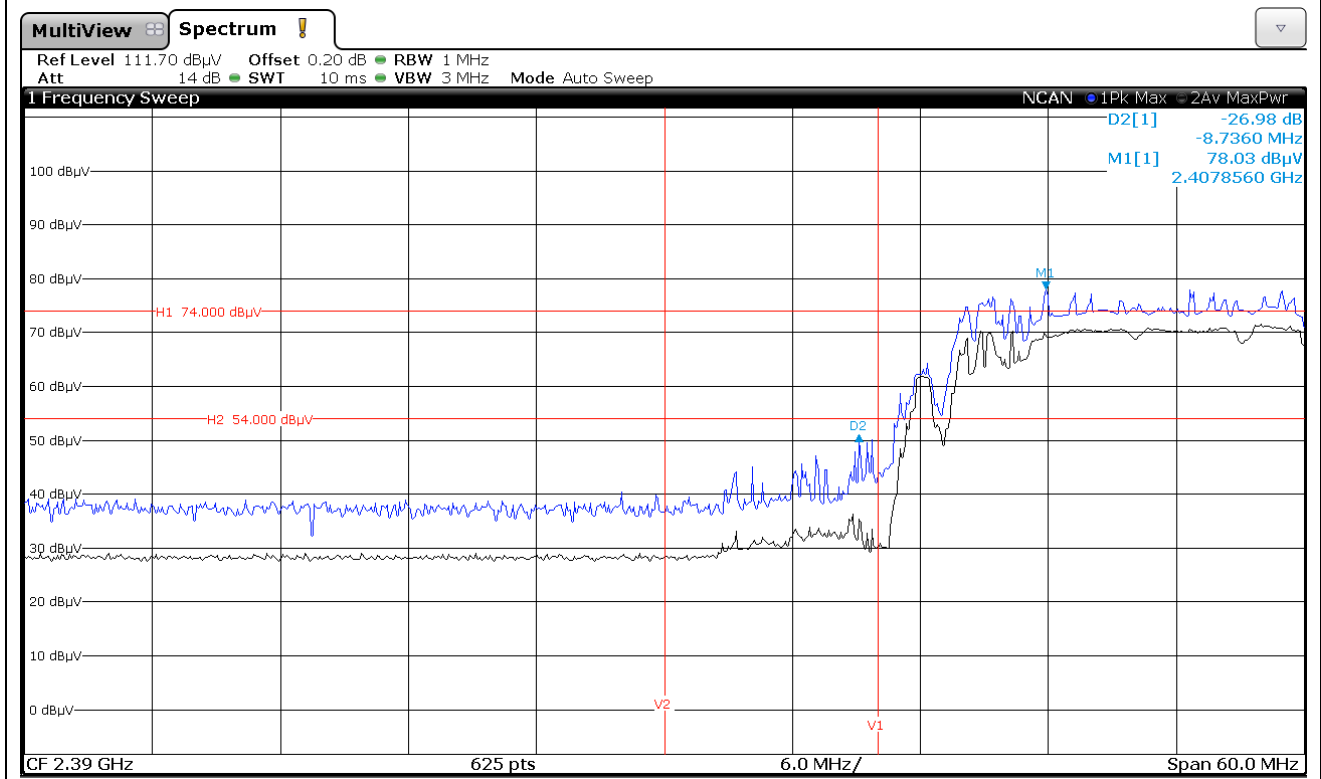
Graphical representation of Antenna Port Spurious Emission - Radiated

Operation Mode: #1

Standard: IEE 802.11g (worst case)

Channel: Low

BAND EDGE



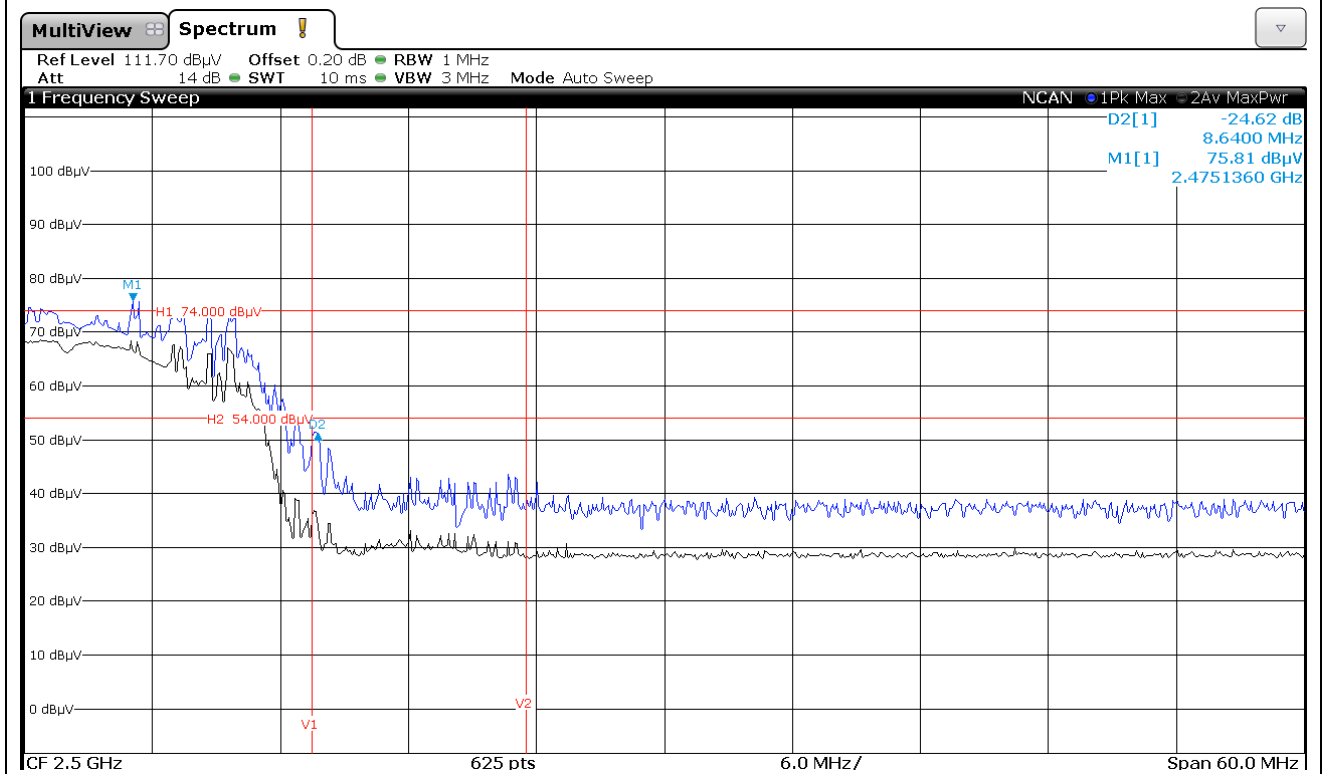
Graphical representation of Antenna Port Spurious Emission - Radiated

Operation Mode: #1

Standard: IEE 802.11g (worst case)

Channel: High

BAND EDGE



13. Test Conditions and Results – OUTPUT POWER

13	TEST: Output Power (conducted)		PASS
Parameters required prior to the test	Laboratory Ambient Temperature (°C)	15 to 35 °C	
	Relative Humidity (%)	30 to 60 %	
Parameters recorded during the test	Laboratory Ambient Temperature (°C)	22,5°C	
	Relative Humidity (%)	51%	
	Air pressure (hPa)	1020	
—	Frequency	Application Point	
Fully configured sample tested at the power line frequency	24Vdc	SMA Connector	
Equipment mode:	Operation mode	#1	
FCC Standard	§15.247		
(b) The maximum peak conducted output power of the intentional radiator shall not exceed the following: (1) For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts. (2) For frequency hopping systems operating in the 902-928 MHz band: 1 watt for systems employing at least 50 hopping channels; and, 0.25 watts for systems employing less than 50 hopping channels, but at least 25 hopping channels, as permitted under paragraph (a)(1)(i) of this section. (3) For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode. (4) The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.			
Further information to test setup	EUT Attenuator (optional) Spectrum Analyzer (or Power Meter)		

Test Equipment Used					
Description	Manufacturer	Model	Identifier	Calibration date	Calibration due
Fast Power Sensor USB SENSOR HUB	R&S	NRP-Z81 NRP-Z5	87020796	08/2018	08/2019
20dB Attenuator	RS Components	Huber & Suhner	87020534	10/2018	10/2019

Test result of Peak Output Power (802.11b)

Channel	Channel Frequency (MHz)	Output Power			Limit
		Output power conducted (dBm)	Antenna gain (dBi)	Total Power (W)	(W)
1	2412	13.10	3.11	0.0417	1
6	2437	13.00	2.95	0.0393	1
11	2462	12.90	2.95	0.0384	1

Test result of Peak Output Power (802.11g)

Channel	Channel Frequency (MHz)	Output Power			Limit
		Output power conducted (dBm)	Antenna gain (dBi)	Total Power (W)	(W)
1	2412	10.22	3.11	0.0215	1
6	2437	10.20	2.95	0.0206	1
11	2462	10.15	2.95	0.0204	1

Test result of Peak Output Power (802.11n 20MHz)

Channel	Channel Frequency (MHz)	Output Power			Limit
		Output power conducted (dBm)	Antenna gain (dBi)	Total Power (W)	(W)
1	2412	8.836	3.11	0.0076	1
6	2437	8.647	2.95	0.0073	1
11	2462	8.493	2.95	0.0070	1

Test result of Peak Output Power (802.11n 40MHz)

Channel	Channel Frequency (MHz)	Output Power			Limit
		Output power conducted (dBm)	Antenna gain (dB)	Total Power (W)	(W)
3	2422	4.724	3.11	0.0029	1
6	2437	5.129	2.95	0.0032	1
9	2452	4.976	2.95	0.0031	1

14. Test Conditions and Results – RF EXPOSURE REQUIREMENTS

14	TEST: RF Exposure Requirements		PASS
Parameters required prior to the test	Laboratory Ambient Temperature (°C)	15 to 35 °C	
	Relative Humidity (%)	30 to 60 %	
Parameters recorded during the test	Laboratory Ambient Temperature (°C)	---	
	Relative Humidity (%)	---	
	Air pressure (hPa)	1020	
—	Frequency	Application Point	
Fully configured sample tested at the power line frequency	24Vdc	Enclosure	
Equipment mode:	Operation mode	#1 #2 #3	
FCC Standard	§15.247		
General Test Configuration			
Calculation uses the free space transmission formula:			
$S = \frac{PG}{4\pi r^2} \quad \text{or equivalent} \quad S = \frac{EIRP}{4\pi r^2}$			
where			
P = input power of the antenna			
G = antenna gain relative to an isotropic antenna			
r = distance from the antenna to the point of investigation.			
EIRP = Effective Isotropic Radiated Power			
Summary of Results			
Device COMPLIES with Power Density requirements at 20cm separation			
Directional Gain Calculation			
Antenna: 3.11dBi (see pag.8)			

SAR Test Exclusion Thresholds for 100 MHz – 6 GHz and ≥ 50 mm

447498 D01 General RF Exposure Guidance v06 – Appendix A

MHz	50	60	70	80	90	mm
100	474	481	487	494	501	SAR Test Exclusion Threshold (mW)
150	387	397	407	417	427	
300	274	294	314	334	354	
450	224	254	284	314	344	
835	164	220	275	331	387	
900	158	218	278	338	398	
1500	122	222	322	422	522	
1900	108	209	309	409	509	
2450	96	196	296	396	496	
3600	79	179	279	379	479	
5200	66	166	266	366	466	
5400	65	165	265	365	465	
5800	62	162	262	362	462	

The *test separation distances* ≥ 80 mm is applied to determine SAR test exclusion.

Protocol b (worst case)

RESULTS			
CH	TX Frequency (MHz)	Measured Power at Antenna Connector (dBm)	Antenna Gain (dBi)
1	2412	13.10	3.11

CH	TX Frequency (MHz)	Radiated power (dBm)	E.I.R.P. (mW)	Distance (mm)	{[Power allowed at numeric threshold for 80 mm in step a)] + [(test separation distance – 80 mm)·10]} mW, for > 1500 MHz and ≤ 6 GHz	Limits
1	2412	16.21	42	80	42mW	328mW

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