10.4 DTS bandwidth

Test set-up and execution

- FCC Rules and Regulation; Titles 47 Part 15.247
- ANSI C63.10 cl. 11.8
- KDB 558074 D01 DTS Meas Guidance v04 cl. 8
- Internal procedure PM001
- See clause 4 of this test report
- Test date: September 20th, 2018
- Technician: A. Bertezzolo

Test configuration

Test site:
Laboratory

Auxiliary equipment:
See clause 4 of this test report

EUT exercising

See clause 4 of this test report

Test equipment used

CMC S295, 20 dB attenuator
Measurement uncertainty: See clause 7 of this test report

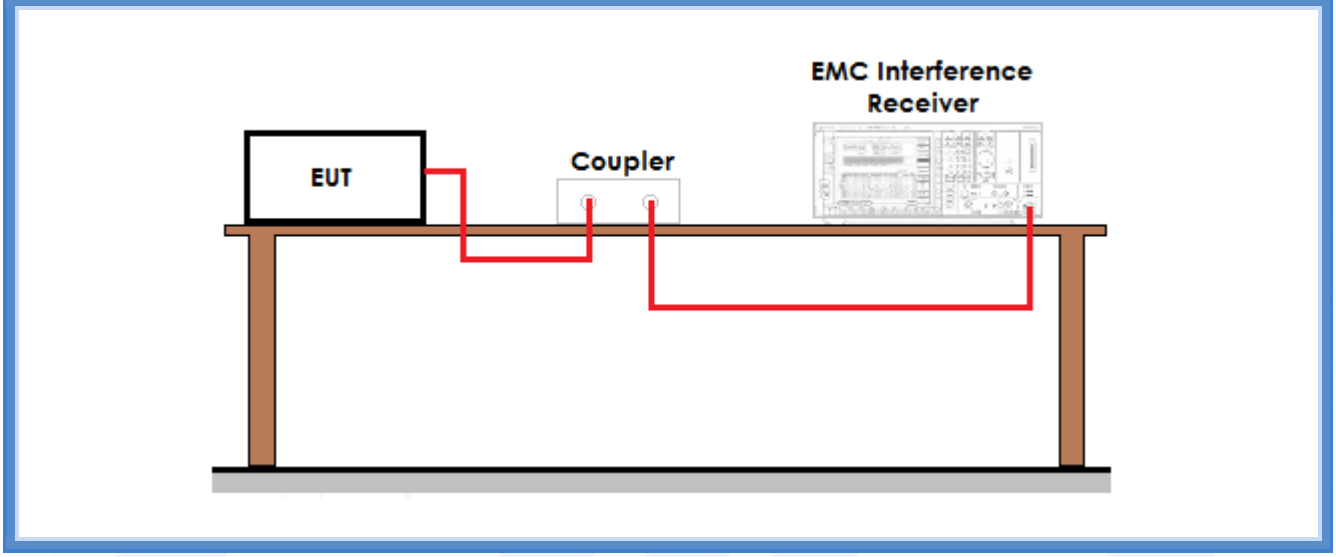
Test specification

Systems using digital modulation techniques may operate in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

Environmental conditions

Temperature (°C)	*Atmospheric pressure (kPa)*	*Relative humidity (%)*
22	100	45

Setup



Result

WiFi n mode

Channel	*Graphs*	*6 dB bandwidth (kHz)*	*Limits (kHz)*	*Results*
Lowest	G172055_01	8602	At least 500	Complies
Medium	G172055_02	8536	At least 500	Complies
Highest	G172055_03	8569	At least 500	Complies

Remarks: the total attenuation value is due to the 20 dB attenuator and the cable provided by the manufacturer calibrated before the test. The measured value has been obtained by considering the attenuation value directly during the scan

WiFi g mode

Channel	*Graphs*	*6 dB bandwidth (kHz)*	*Limits (kHz)*	*Results*
Highest	G172055_04	16436	At least 500	Complies
Medium	G172055_05	16436	At least 500	Complies
Lowest	G172055_06	16434	At least 500	Complies

Remarks: the total attenuation value is due to the 20 dB attenuator and the cable provided by the manufacturer calibrated before the test. The measured value has been obtained by considering the attenuation value directly during the scan

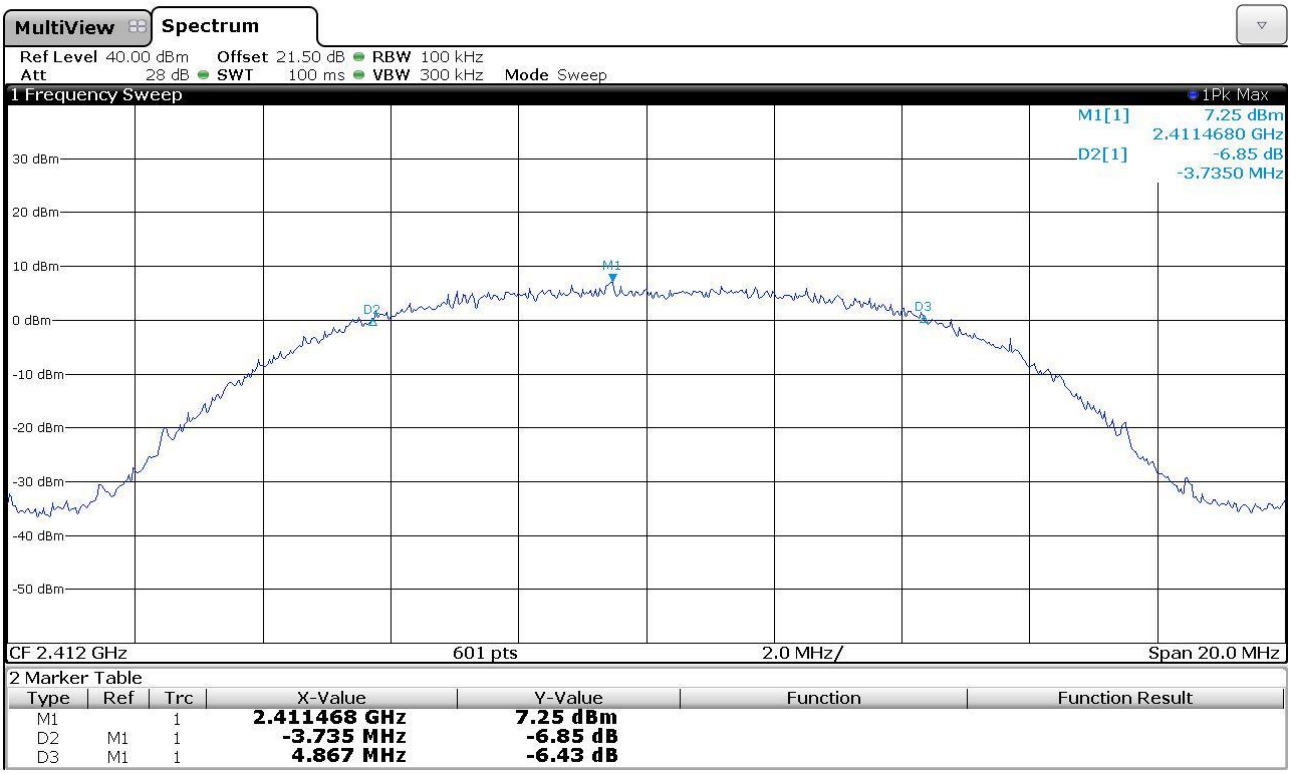
WiFi b mode

Channel	*Graphs*	*6 dB bandwidth (kHz)*	*Limits (kHz)*	*Results*
Lowest	G172055_07	17201	At least 500	Complies
Medium	G172055_08	17333	At least 500	Complies
Highest	G172055_09	17100	At least 500	Complies

Remarks: the total attenuation value is due to the 20 dB attenuator and the cable provided by the manufacturer calibrated before the test. The measured value has been obtained by considering the attenuation value directly during the scan

Graphs

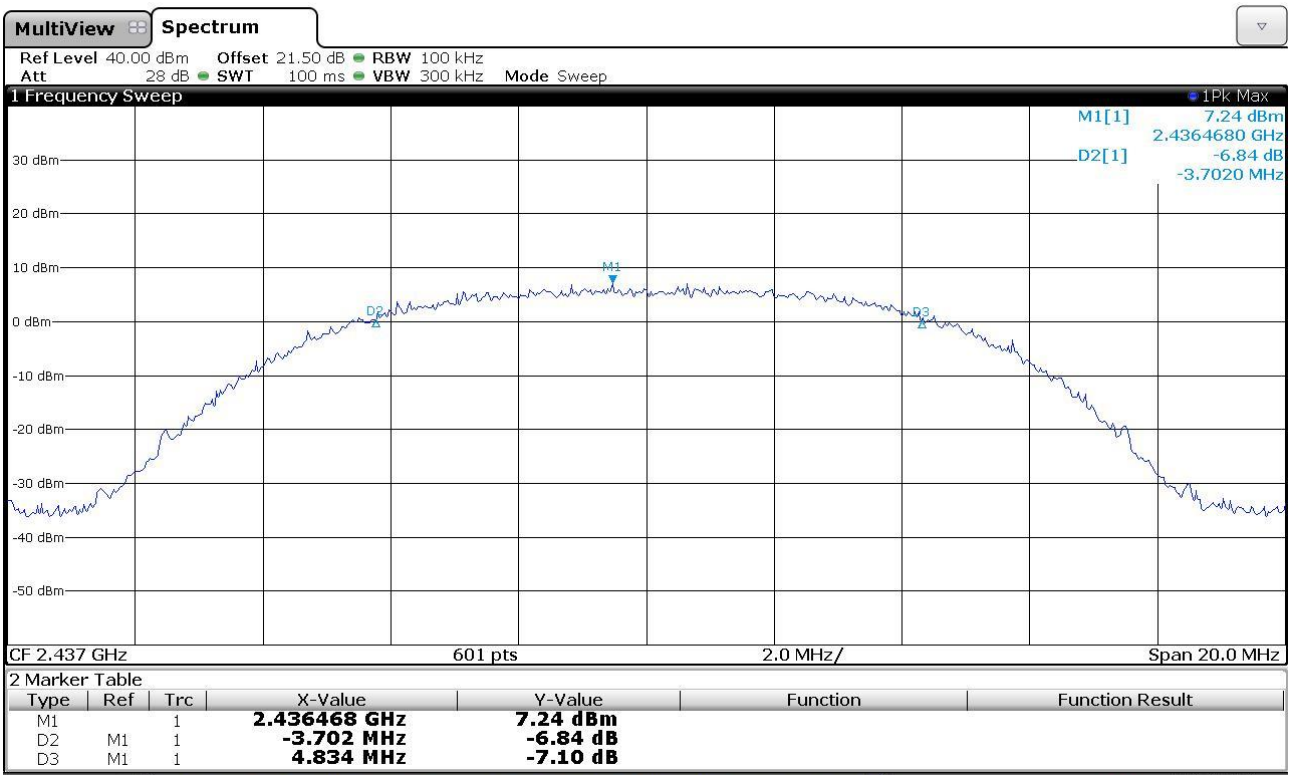
Bertezzolo 172055_01



2 Marker Table

Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	**2.411468 GHz**	**7.25 dBm**		
D2	M1	1	**-3.735 MHz**	**-6.85 dB**		
D3	M1	1	**4.867 MHz**	**-6.43 dB**		

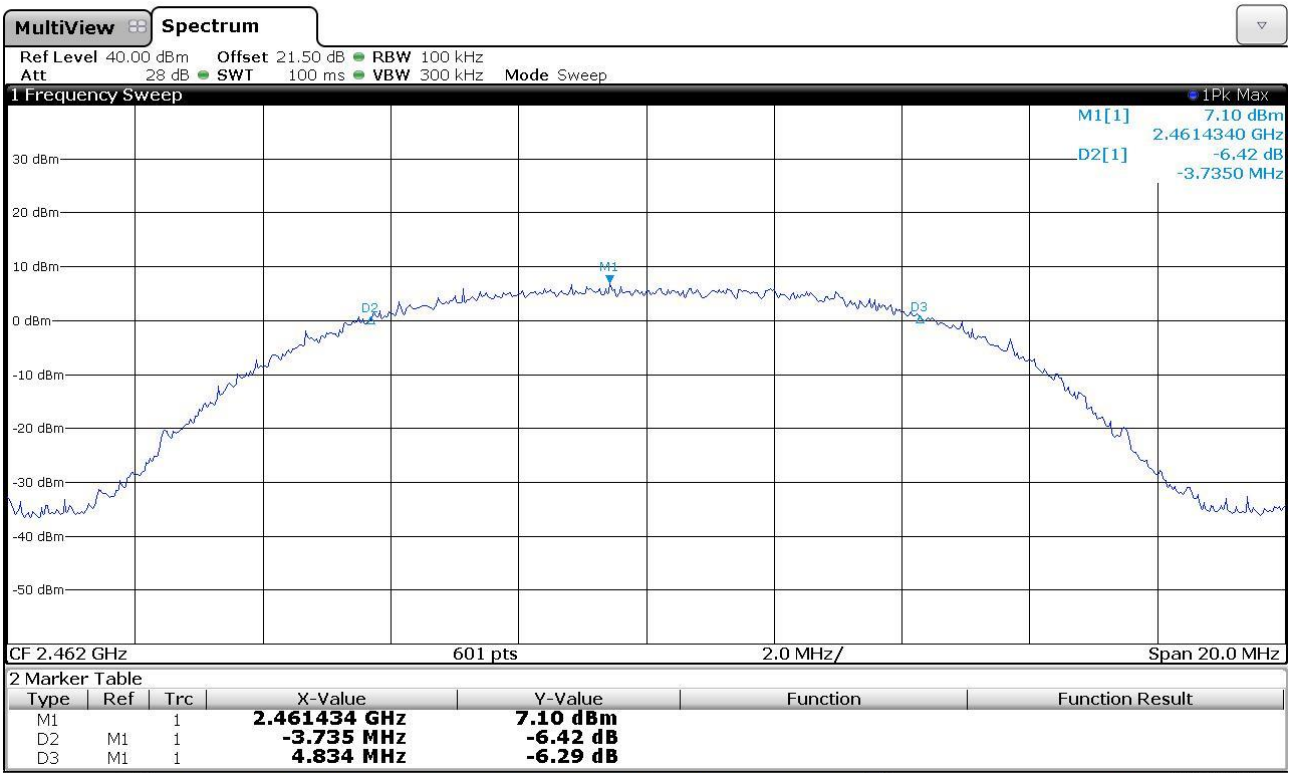
Bertezzolo 172055_02



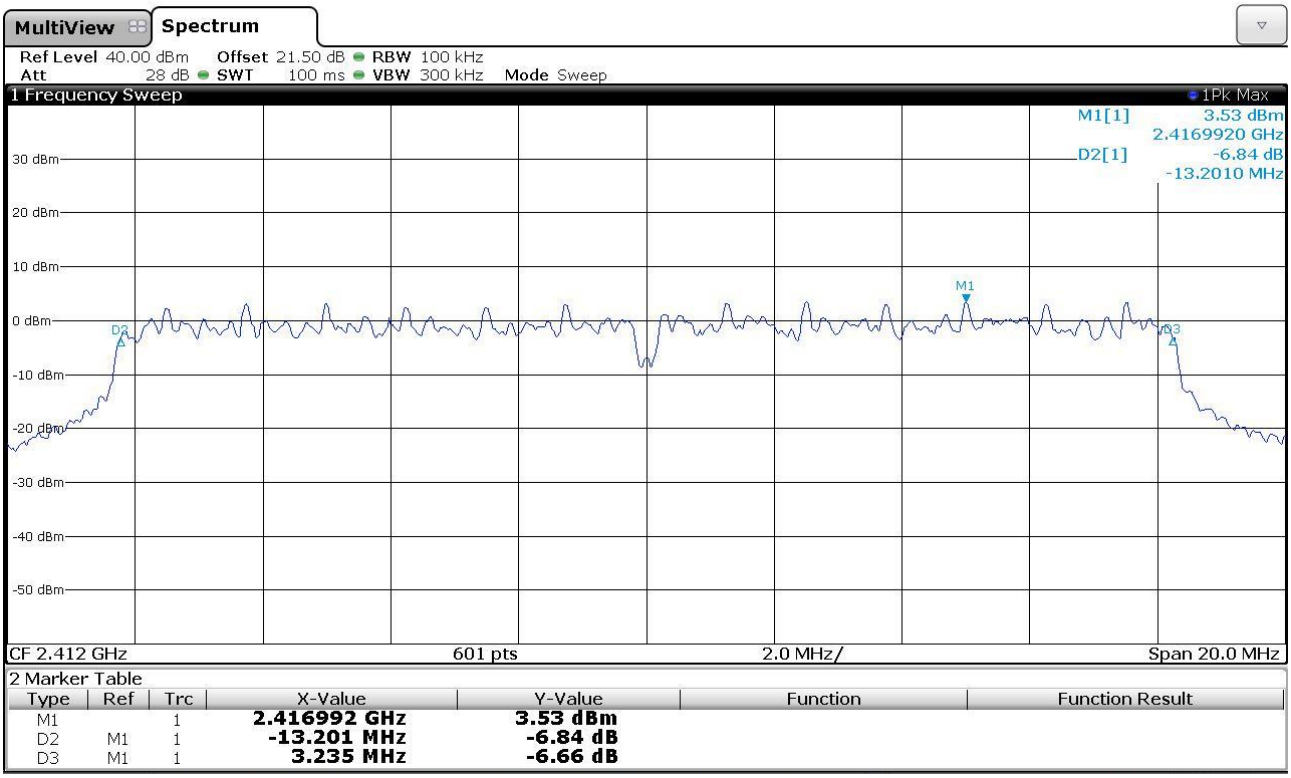
2 Marker Table

Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	**2.436468 GHz**	**7.24 dBm**		
D2	M1	1	**-3.702 MHz**	**-6.84 dB**		
D3	M1	1	**4.834 MHz**	**-7.10 dB**		

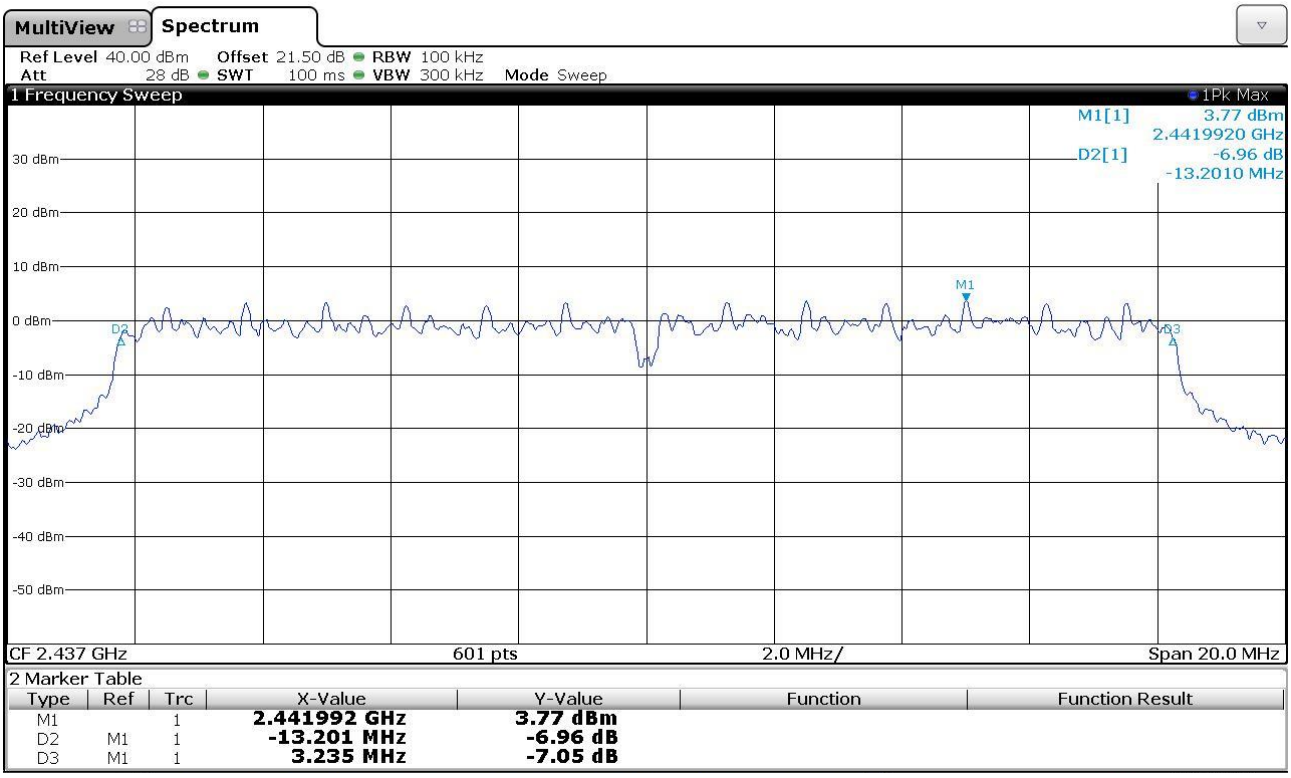
Bertezzolo 172055_03



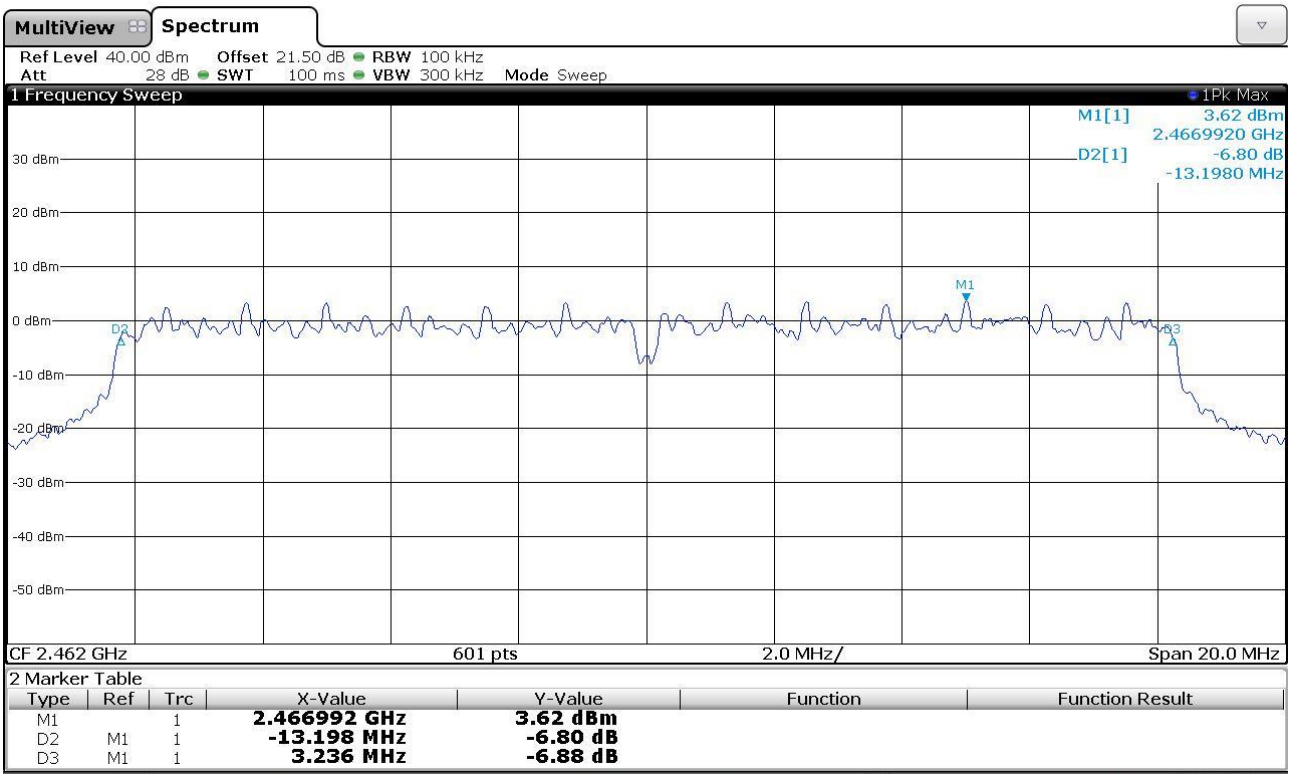
Bertezzolo 172055_04



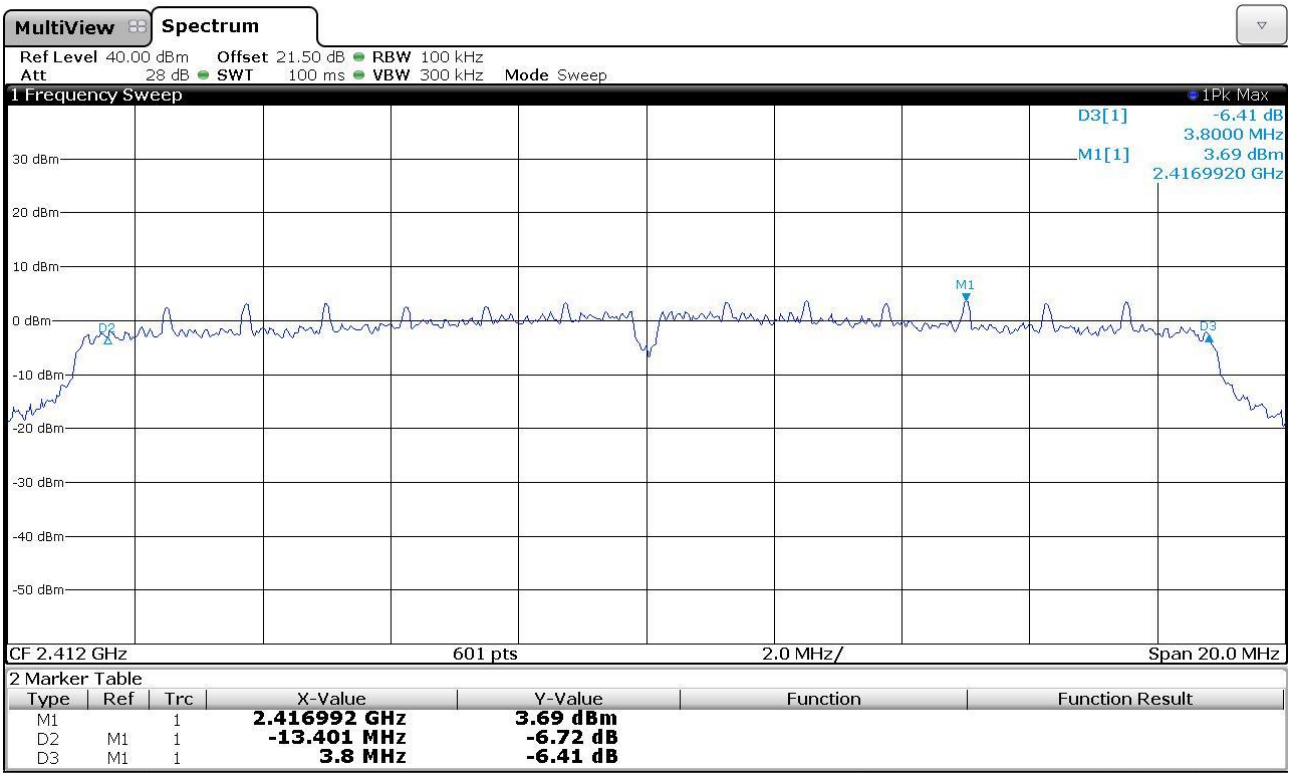
Bertezzolo 172055_05



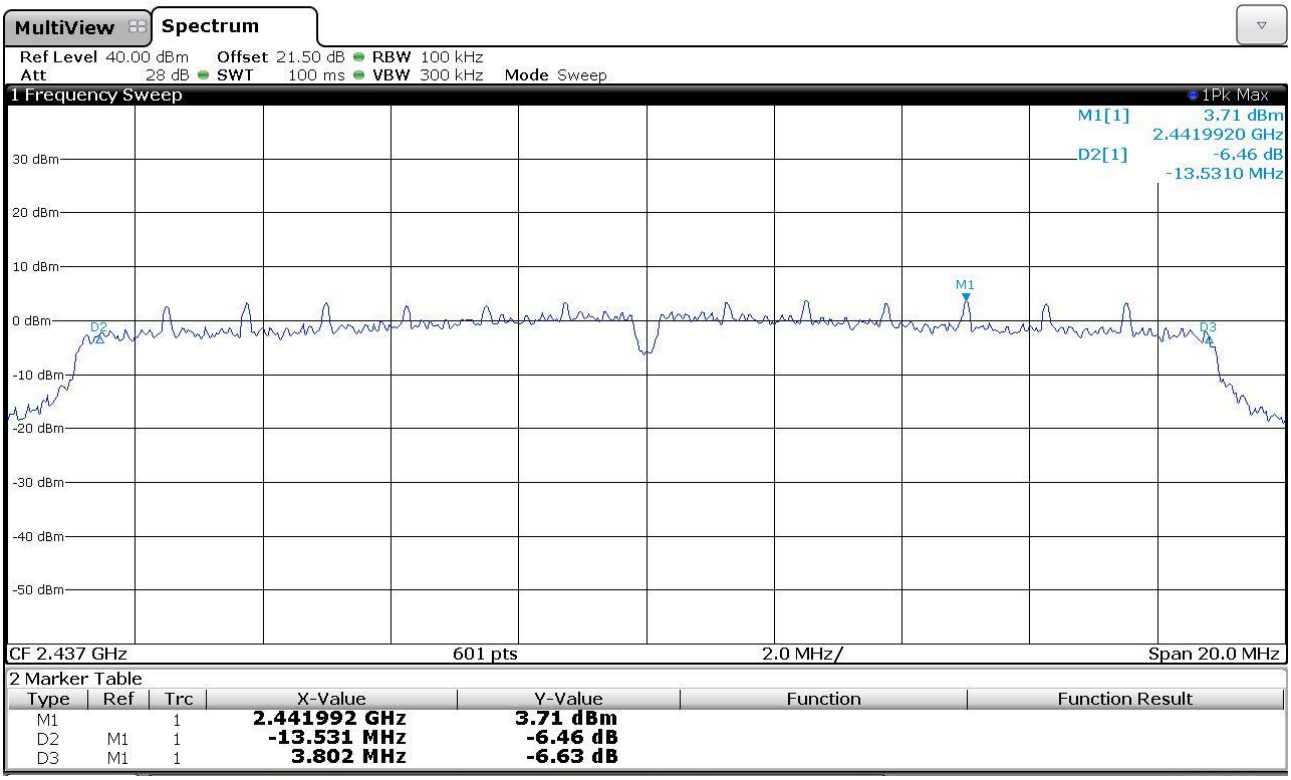
Bertezzolo 172055_06



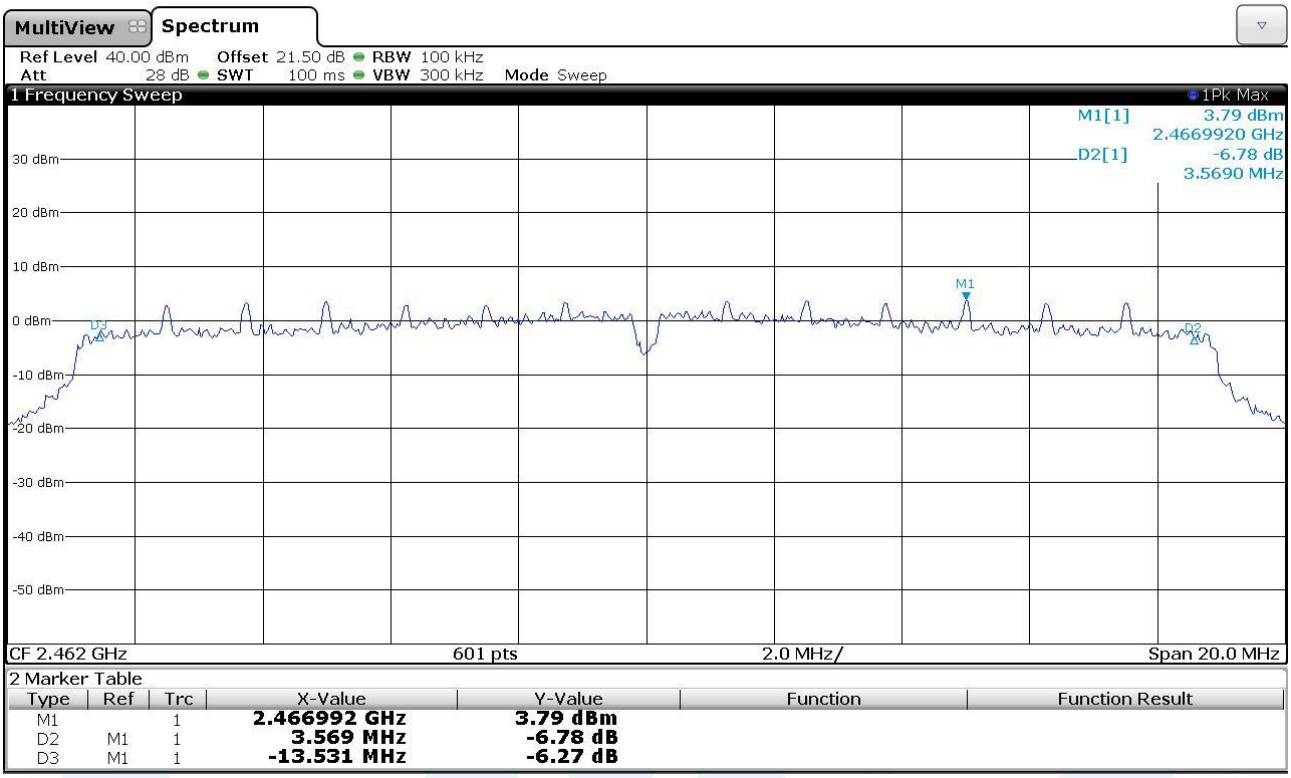
Bertezzolo 172055_07



Bertezzolo 172055_08



Bertezzolo 172055_09



Result: The requirements are met

10.5 Band edge

Test set-up and execution

- FCC Rules and Regulation; Titles 47 Part 15.247 (d)
- ANSI C63.10 cl. 11.13
- KDB 558074 D01 DTS Meas Guidance v04 cl. 13
- Internal procedure PM001
- See clause 4 of this test report
- Test date: June 22nd, 2018
- Technician: A. Bertezzolo

Test configuration

Test site:
Semi-anechoic chamber

Auxiliary equipment:
See clause 4 of this test report

EUT exercising

See clause 4 of this test report

Test equipment used

CMC S108, CMC S136, CMC S164
Measurement uncertainty: See clause 7 of this test report

Test specification

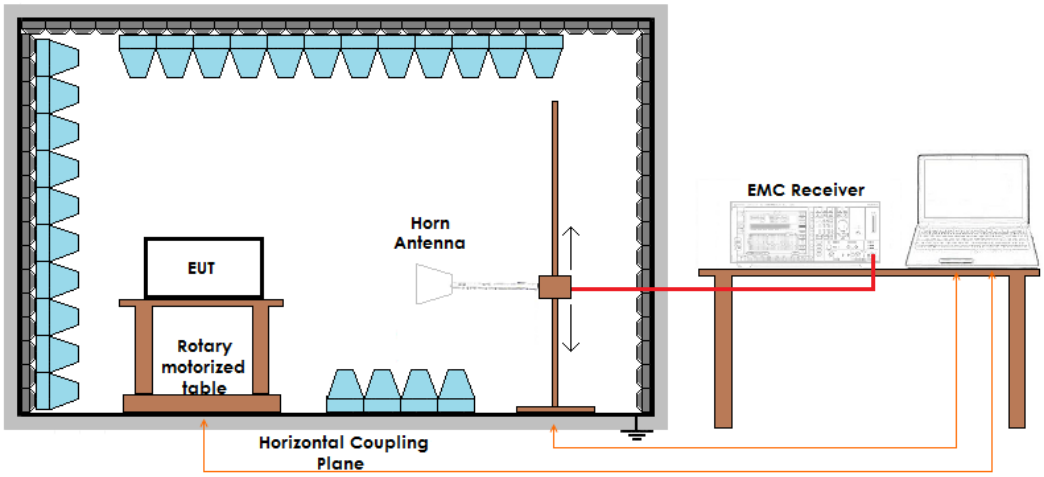
See FCC Part 15.247
EUT height about the floor: 150 cm
EUT – Antenna distance: 3 m

Environmental conditions

Temperature (°C)	*Atmospheric pressure (kPa)*	*Relative humidity (%)*
21	100	45

Acceptance limits: operation within the band 2400 – 2483,5 MHz

Setup



Result

WiFi b mode

Channel	Bandwidth	Graph(s)	Results	
Lowest	1 MHz	G172055N10Q	2401,410000 MHz	Complies
	100 kHz	G17205510R		
	100 kHz	G17205510S		
Highest	1 MHz	G172055N10T	2472,923000 MHz	Complies
Remarks: The vertical red line marked as F1 show the 2390 MHz frequency, end of the restricted frequency band below 2400 MHz				

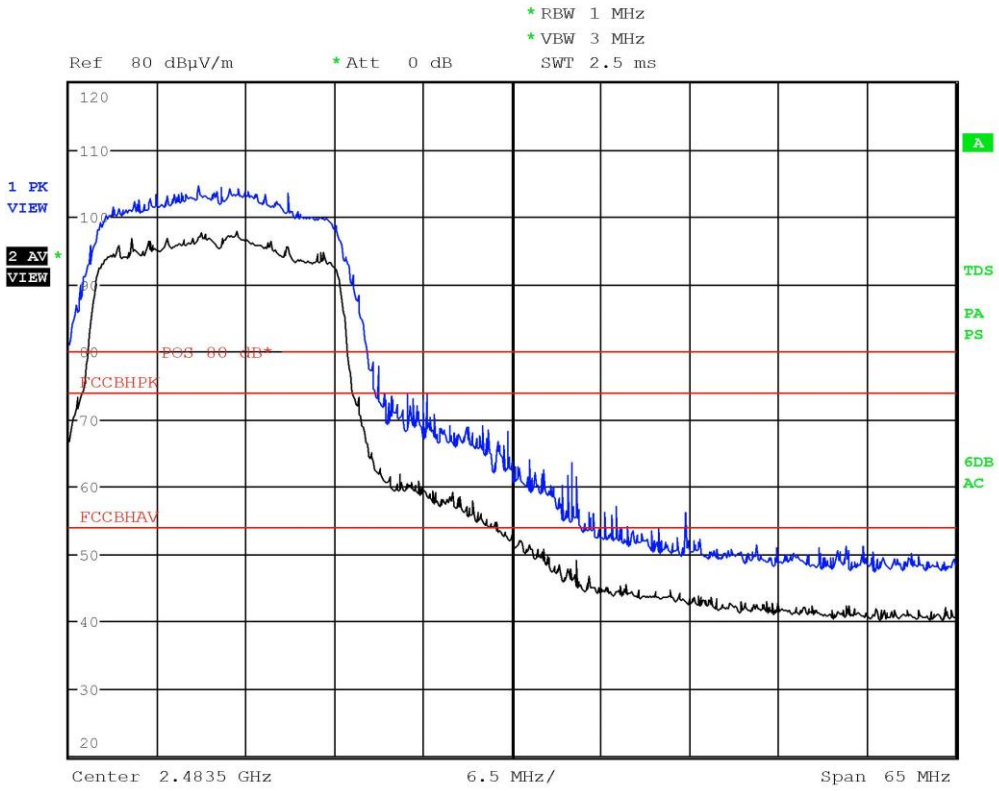
WiFi g mode

Channel	Bandwidth	Graph(s)	Results	
Lowest	1 MHz	G17205510I	2403,205129 MHz	Complies
	100 kHz	G17205510L		
	100 kHz	G17205510M		
Highest	1 MHz	G17205510H	2481,729167 MHz	Complies
Remarks: The vertical red line marked as F1 show the 2390 MHz frequency, end of the restricted frequency band below 2400 MHz				

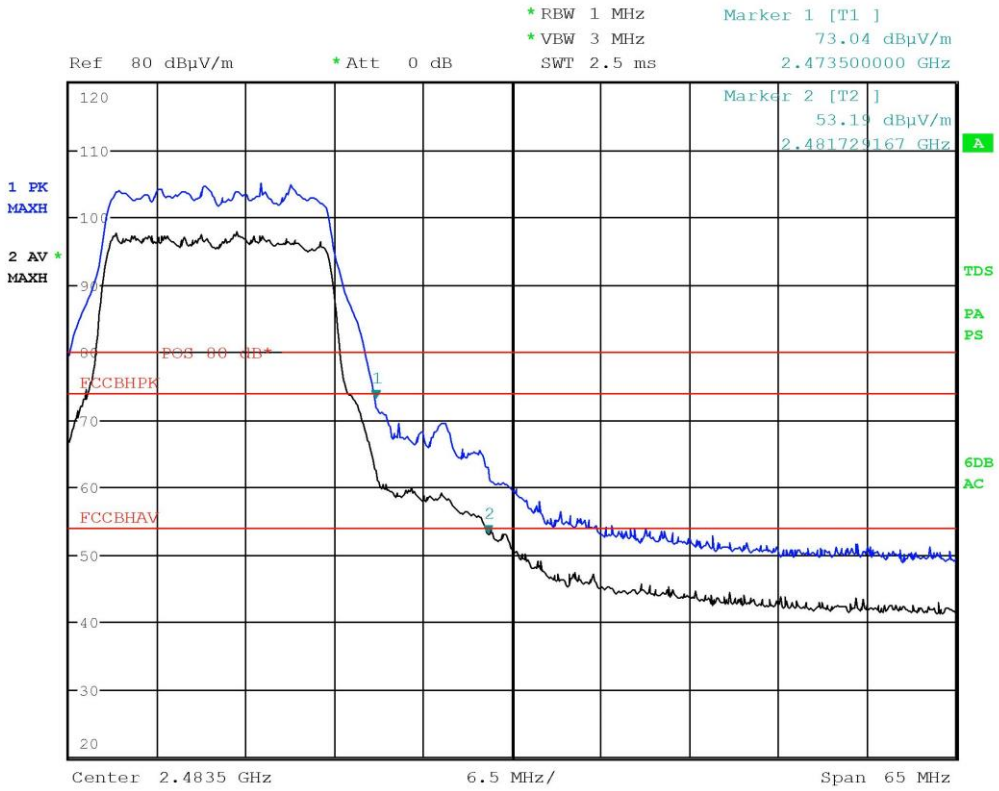
WiFi n mode

Channel	Bandwidth	Graph(s)	Results	
Lowest	1 MHz	G172055N10N	2402,564103 MHz	Complies
	100 kHz	G17205510O		
	100 kHz	G17205510P		
Highest	1 MHz	G17205510G	2482,458333 MHz	Complies
Remarks: The vertical red line marked as F1 show the 2390 MHz frequency, end of the restricted frequency band below 2400 MHz				

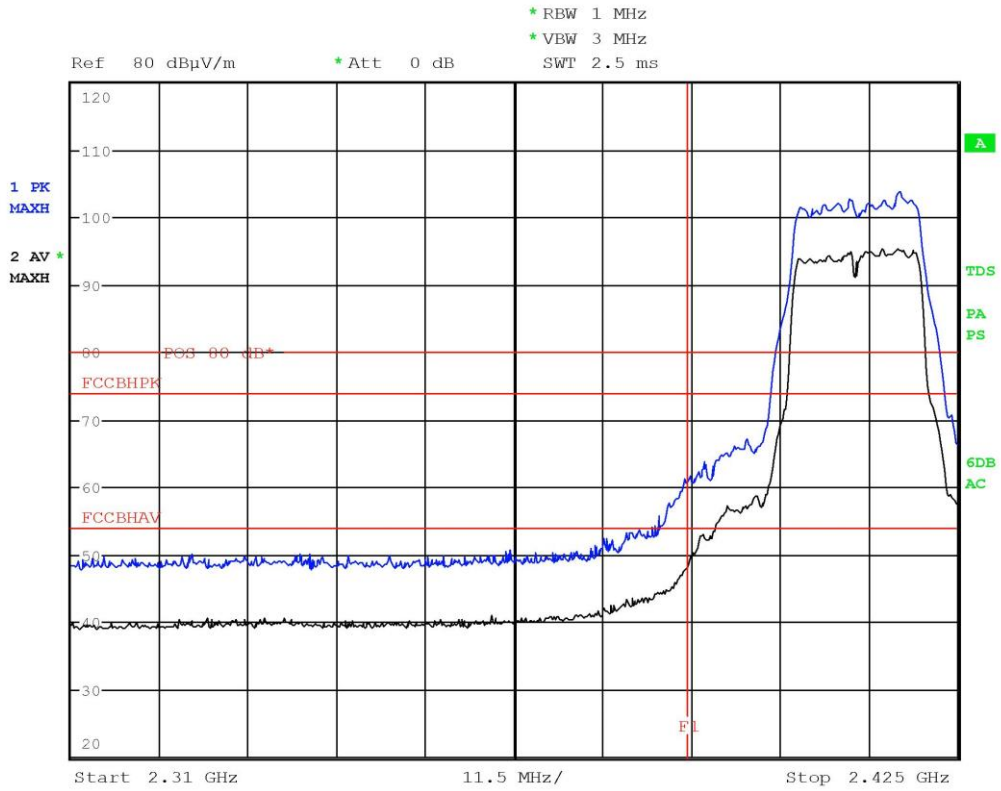
Graphs



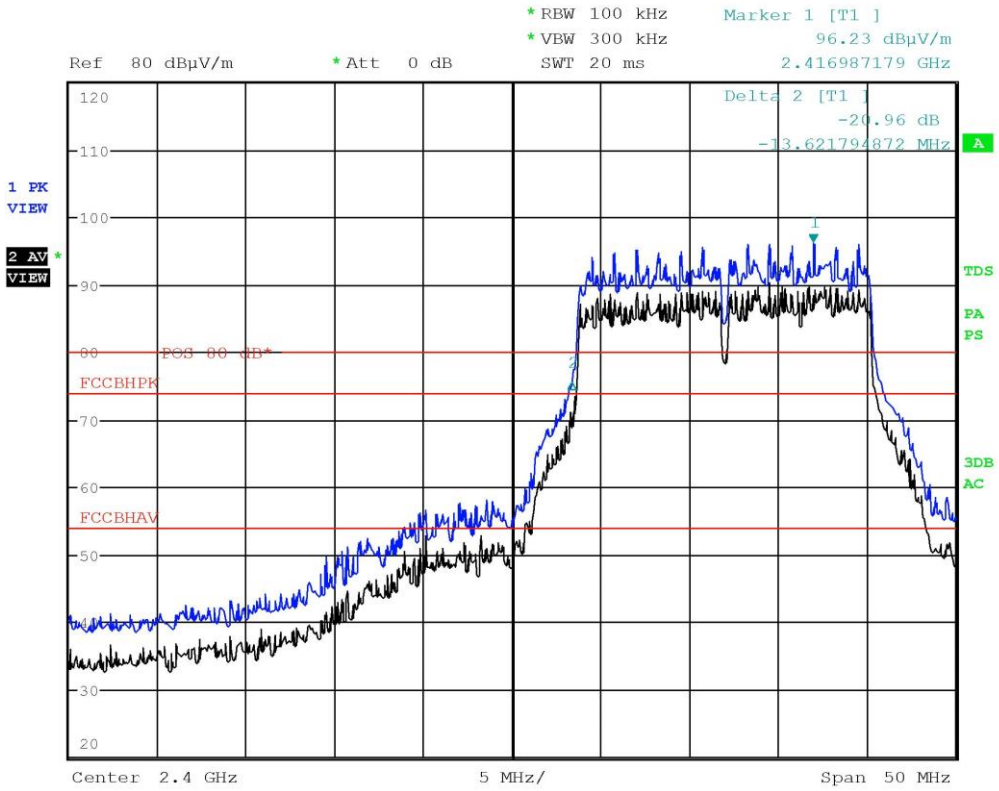
Bertezzolo 17205510G



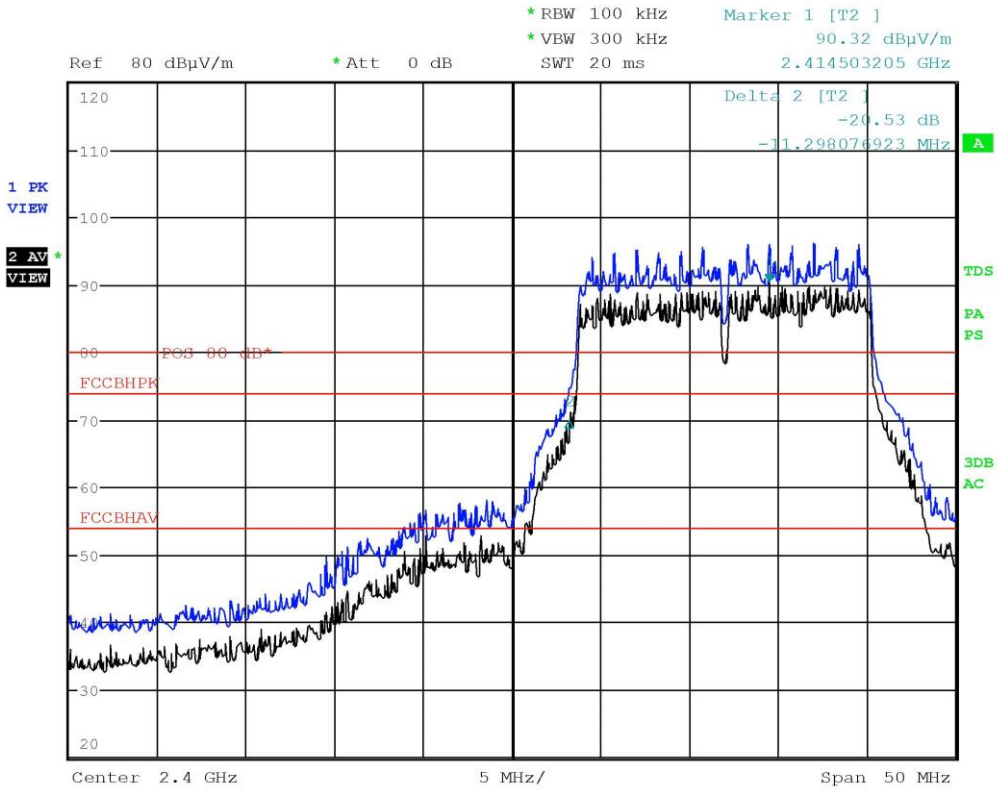
Bertezzolo 17205510H



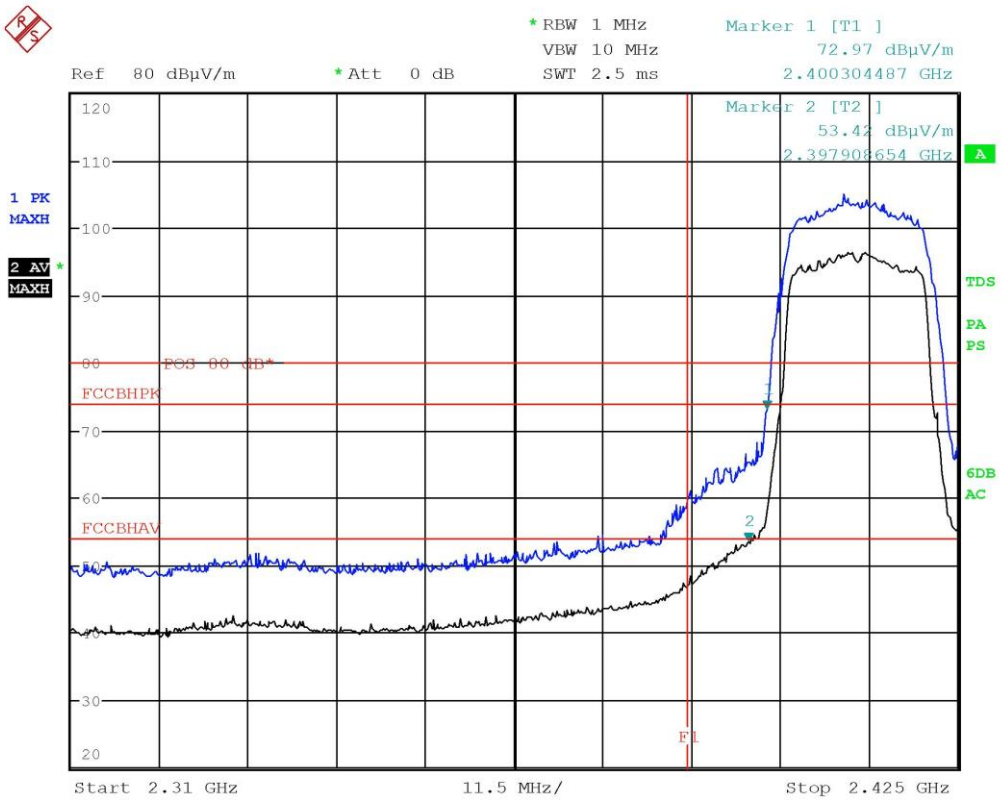
Bertezzolo 17205510I



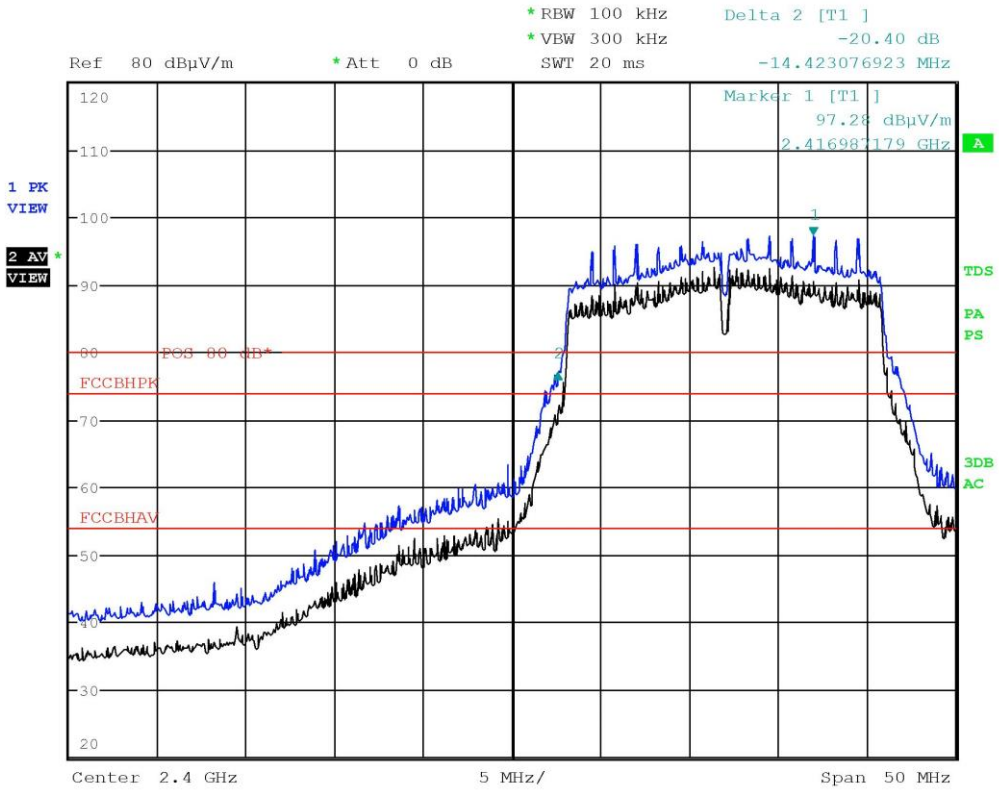
Bertezzolo 17205510L



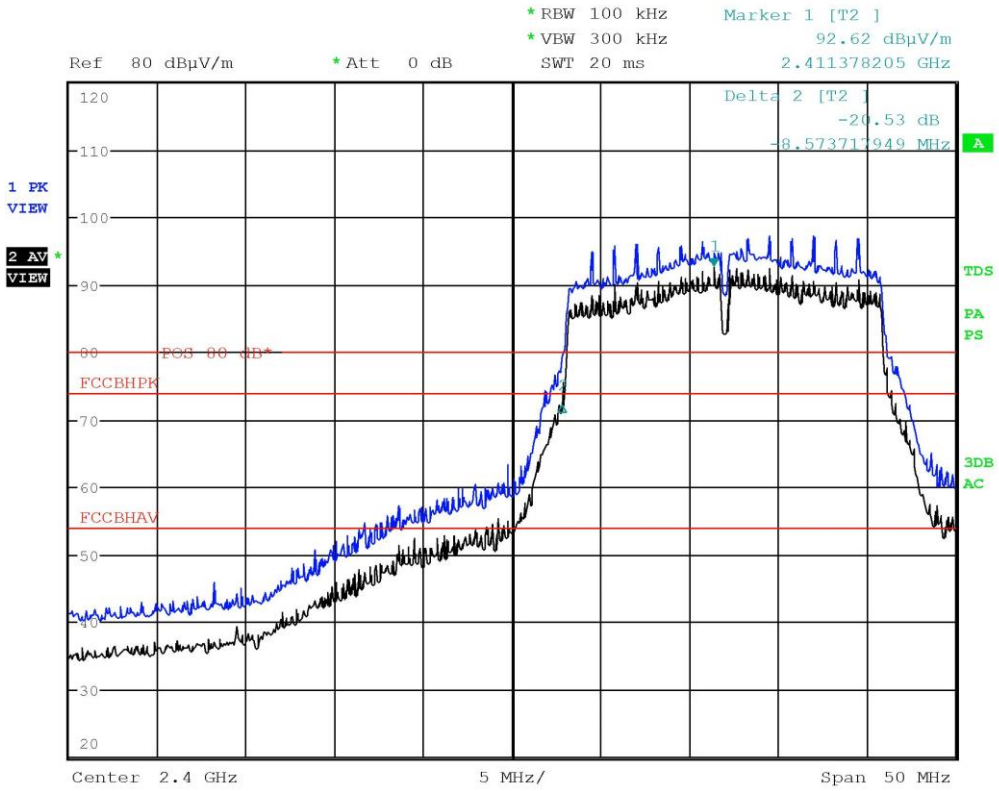
Bertezzolo 17205510M



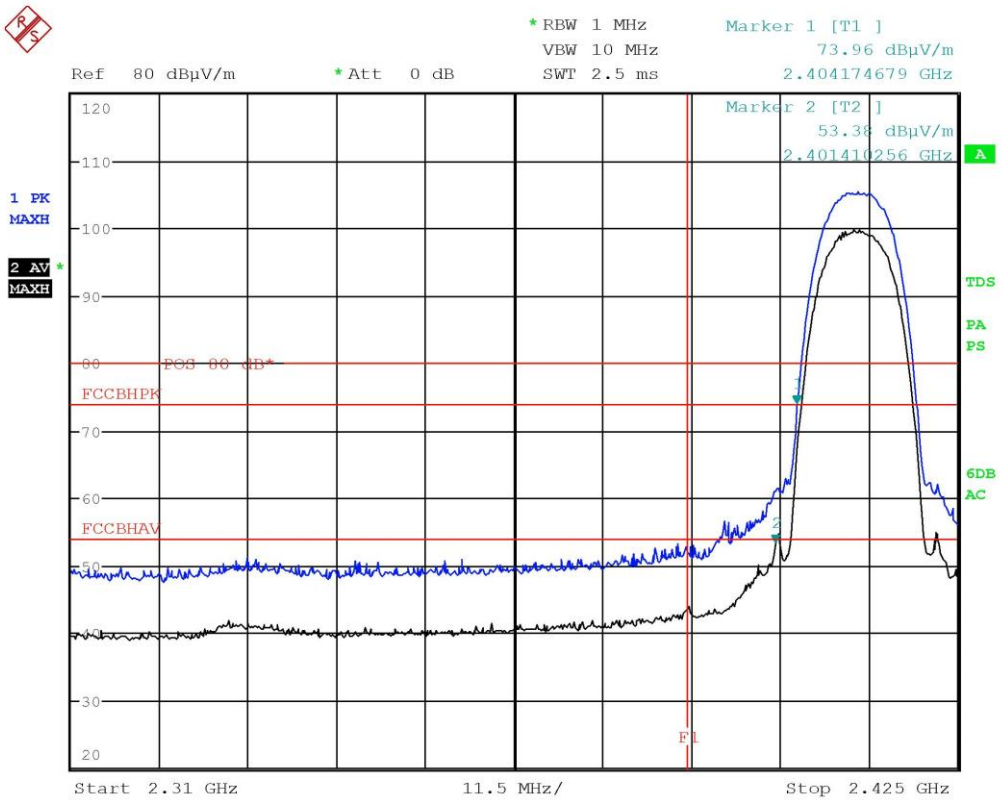
Bertezzolo 172055N10N



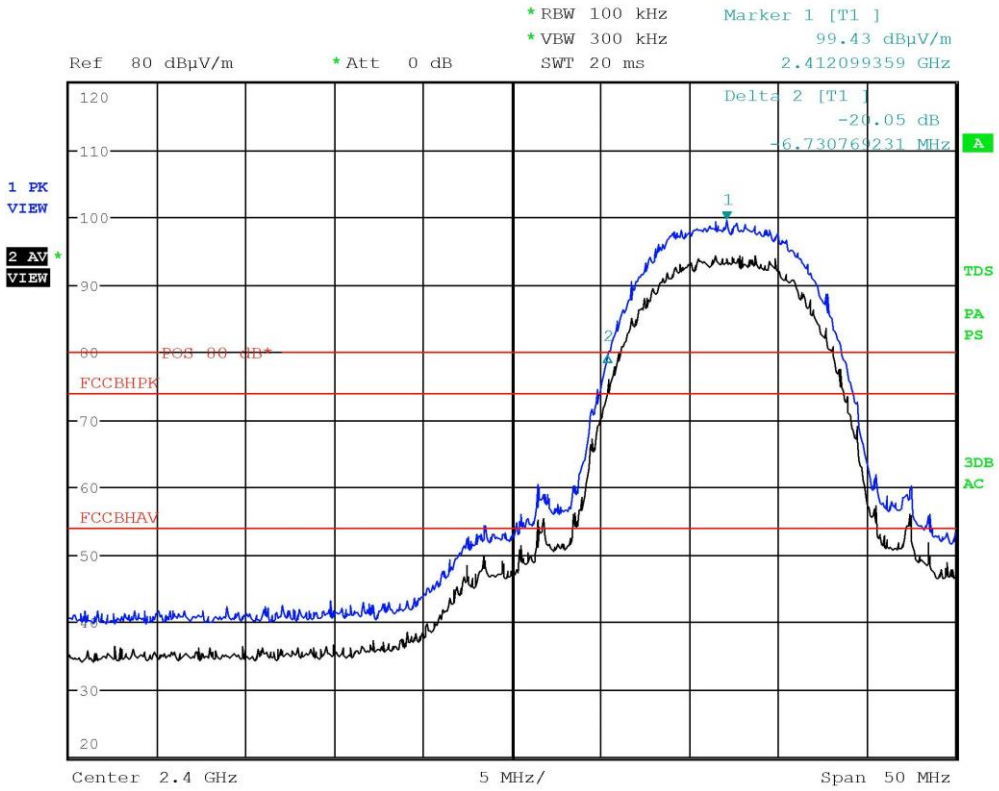
Bertezzolo 172055100



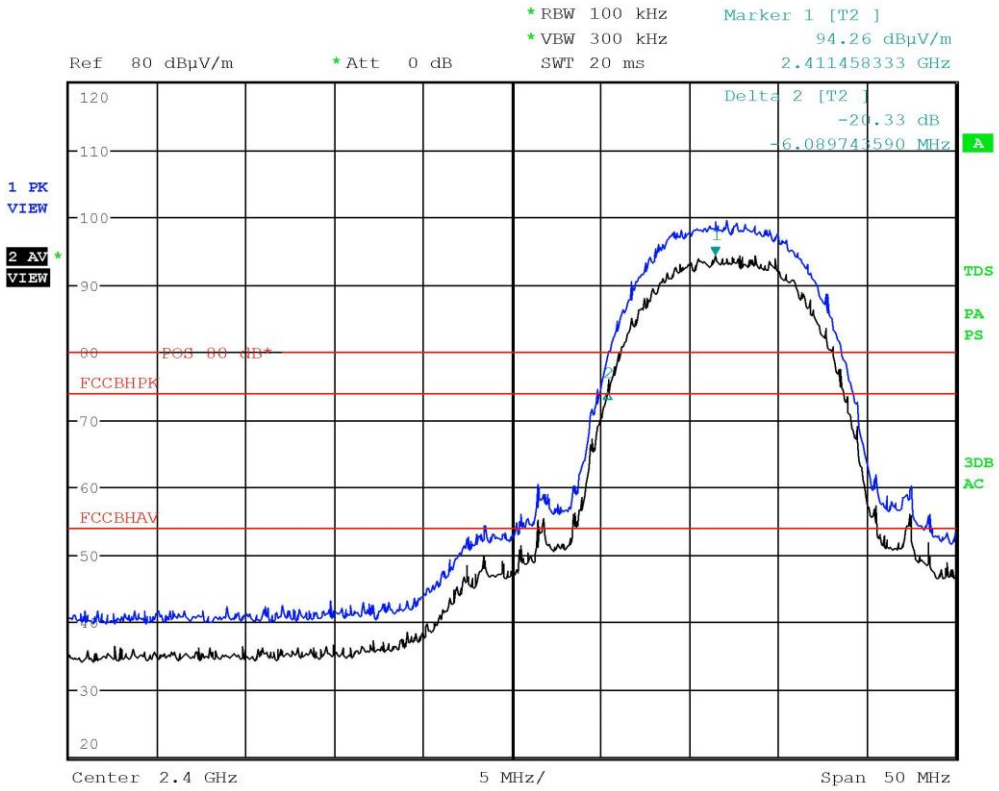
Bertezzolo 17205510P



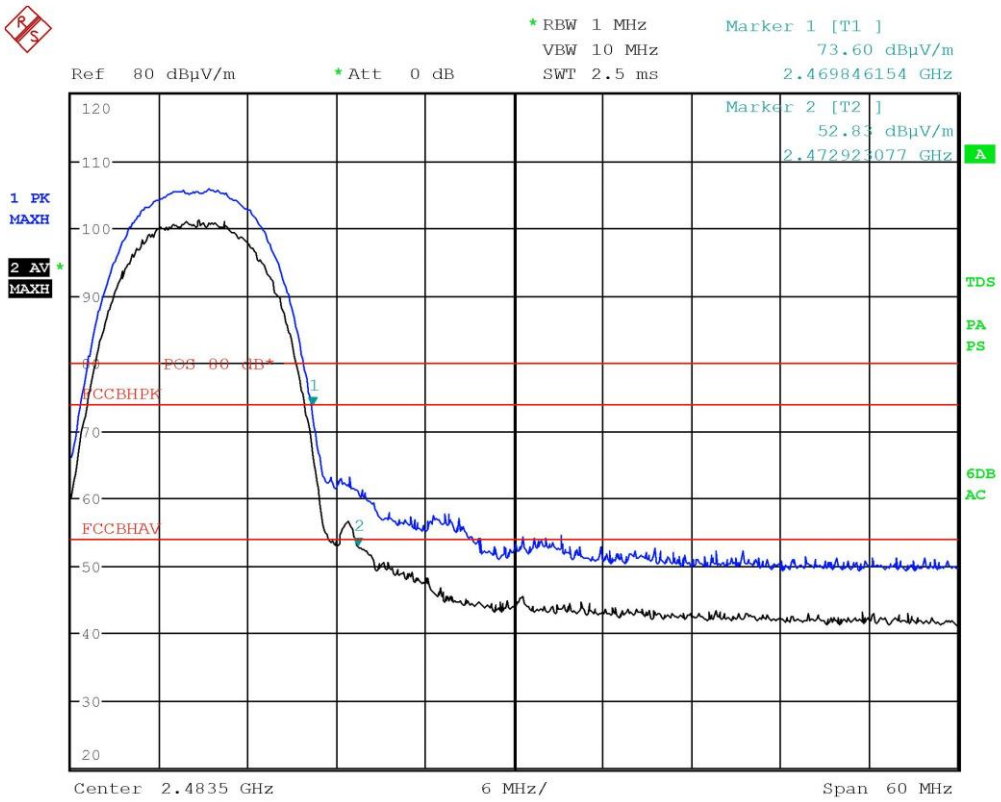
Bertezzolo 172055N10Q



Bertezzolo 17205510R



Bertezzolo 17205510S



Bertezzolo 172055N10T

Result: The requirements are met

10.6 Fundamental emission output power

Test set-up and execution

- FCC Rules and Regulation; Titles 47 Part 15.247
- ANSI C63.10 cl. 11.9.1.1
- KDB 558074 D01 DTS Meas Guidance v04 cl. 9.1.1
- Internal procedure PM001
- See clause 4 of this test report
- Test date: September 20th, 2018
- Technician: A. Bertezzolo

Test configuration

Test site:
Laboratory

Auxiliary equipment:
See clause 4 of this test report

EUT exercising

See clause 4 of this test report

Test equipment used

CMC S295, 20 dB attenuator
Measurement uncertainty: See clause 7 of this test report

Test specification

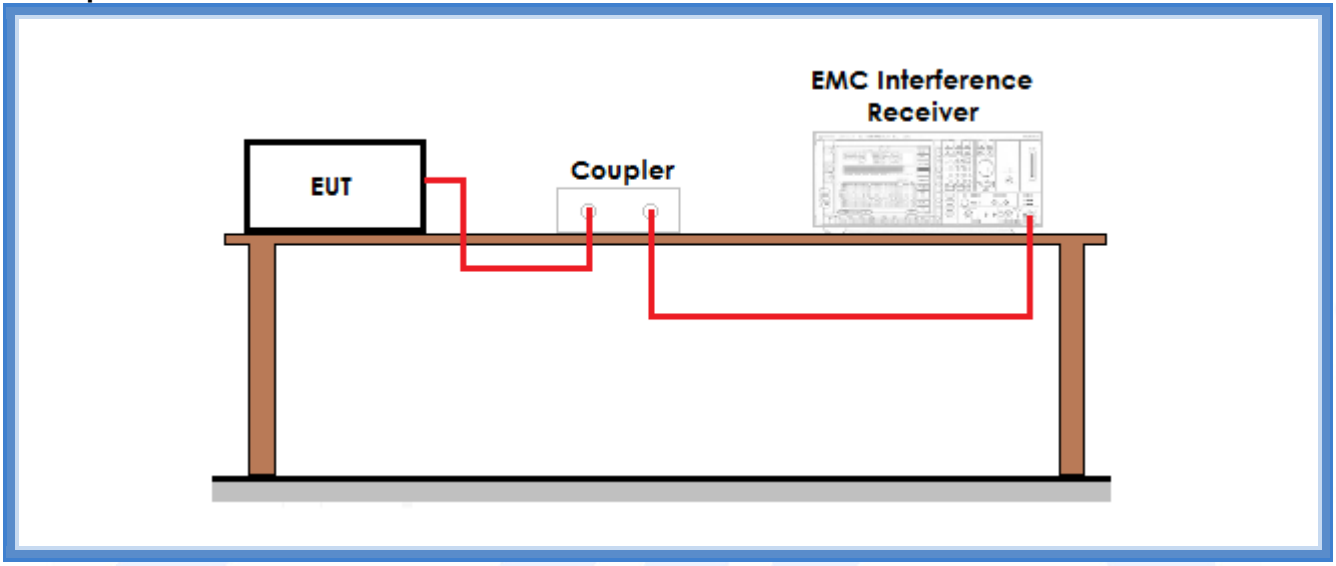
Port: antenna connector

Environmental conditions

Temperature (°C)	*Atmospheric pressure (kPa)*	*Relative humidity (%)*
22	100	42

Acceptance limits:
For systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands: 1 Watt

Setup



Result

WiFi b mode

Channel	*Graphs*	*Measured level (dBm)*	*Calculated level (W)*
Lowest	G172055_19	17,36	0,0545
Medium	G172055_20	17,43	0,0553
Highest	G172055_21	17,34	0,0542

Remarks: the total attenuation value is due to the 20 dB attenuator and the cable provided by the manufacturer calibrated before the test. The measured value has been obtained by considering the attenuation value directly during the scan

WiFi g mode

Channel	*Graphs*	*Measured level (dBm)*	*Calculated level (W)*
Lowest	G172055_22	22,67	0,1849
Medium	G172055_23	22,63	0,1832
Highest	G172055_24	22,75	0,1884

Remarks: the total attenuation value is due to the 20 dB attenuator and the cable provided by the manufacturer calibrated before the test. The measured value has been obtained by considering the attenuation value directly during the scan

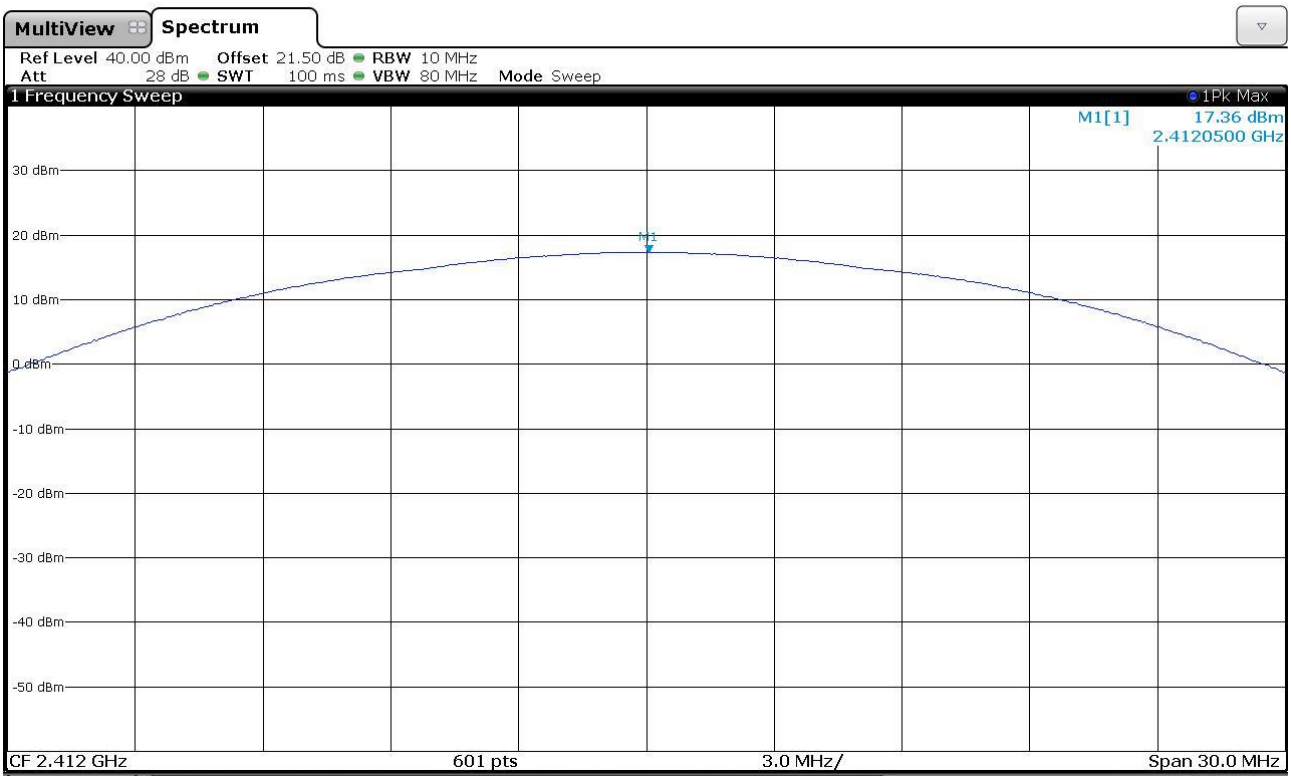
WiFi n mode

Channel	*Graphs*	*Measured level (dBm)*	*Calculated level (W)*
Lowest	G172055_25	24,33	0,2710
Medium	G172055_26	24,46	0,2793
Highest	G172055_27	24,57	0,2864

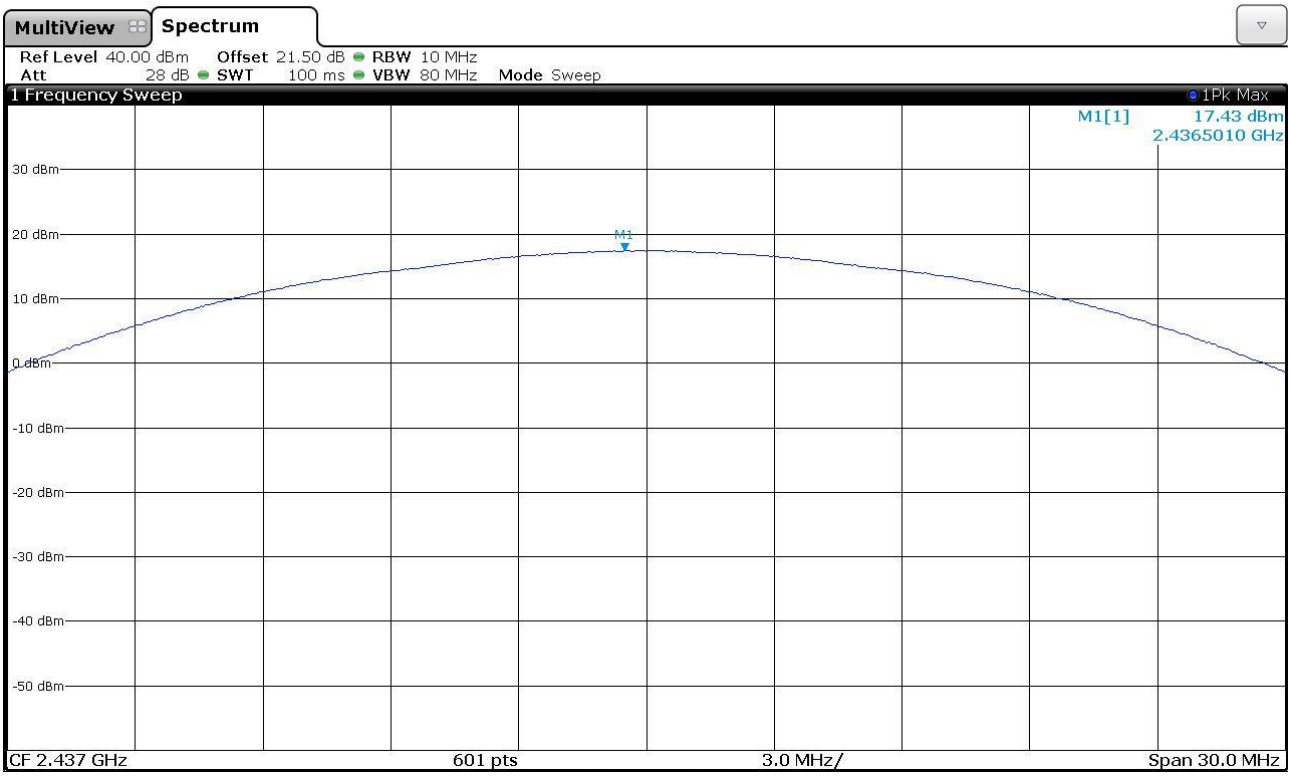
Remarks: the total attenuation value is due to the 20 dB attenuator and the cable provided by the manufacturer calibrated before the test. The measured value has been obtained by considering the attenuation value directly during the scan

Graphs

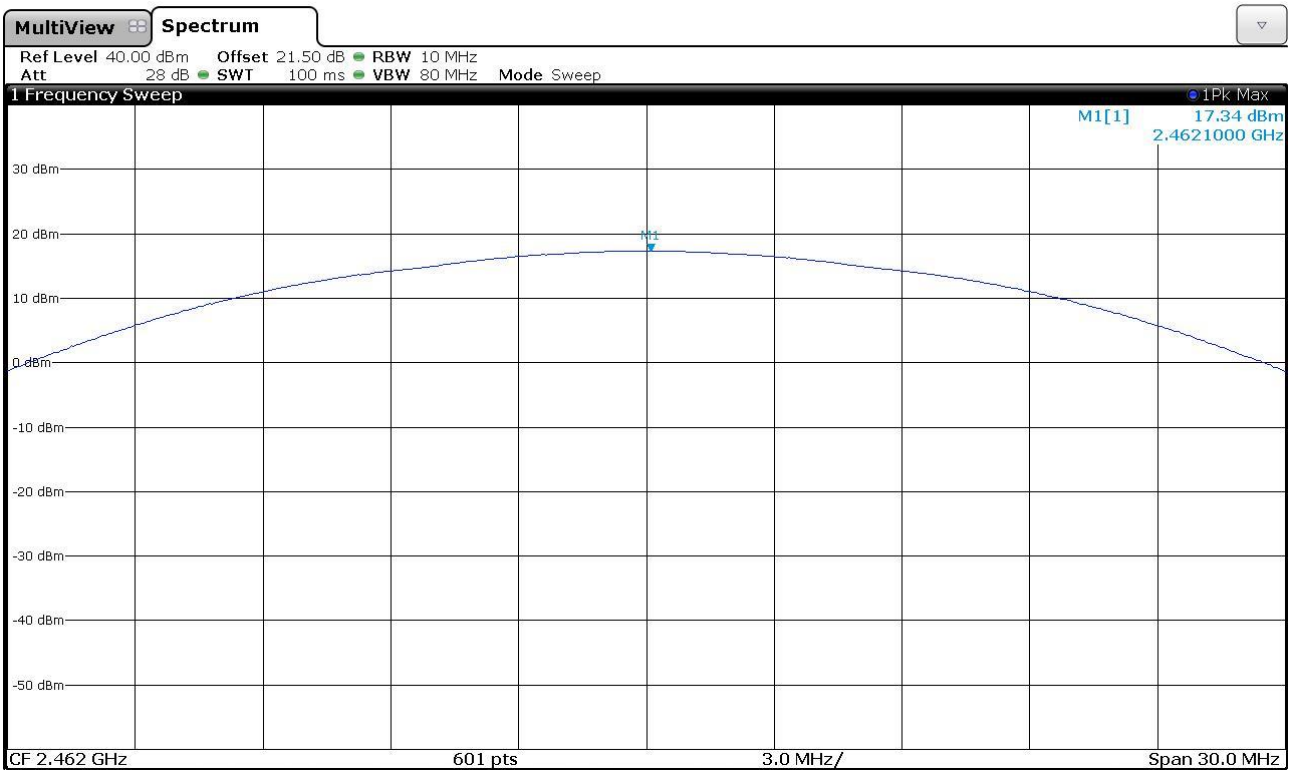
Bertezzolo 172055_19



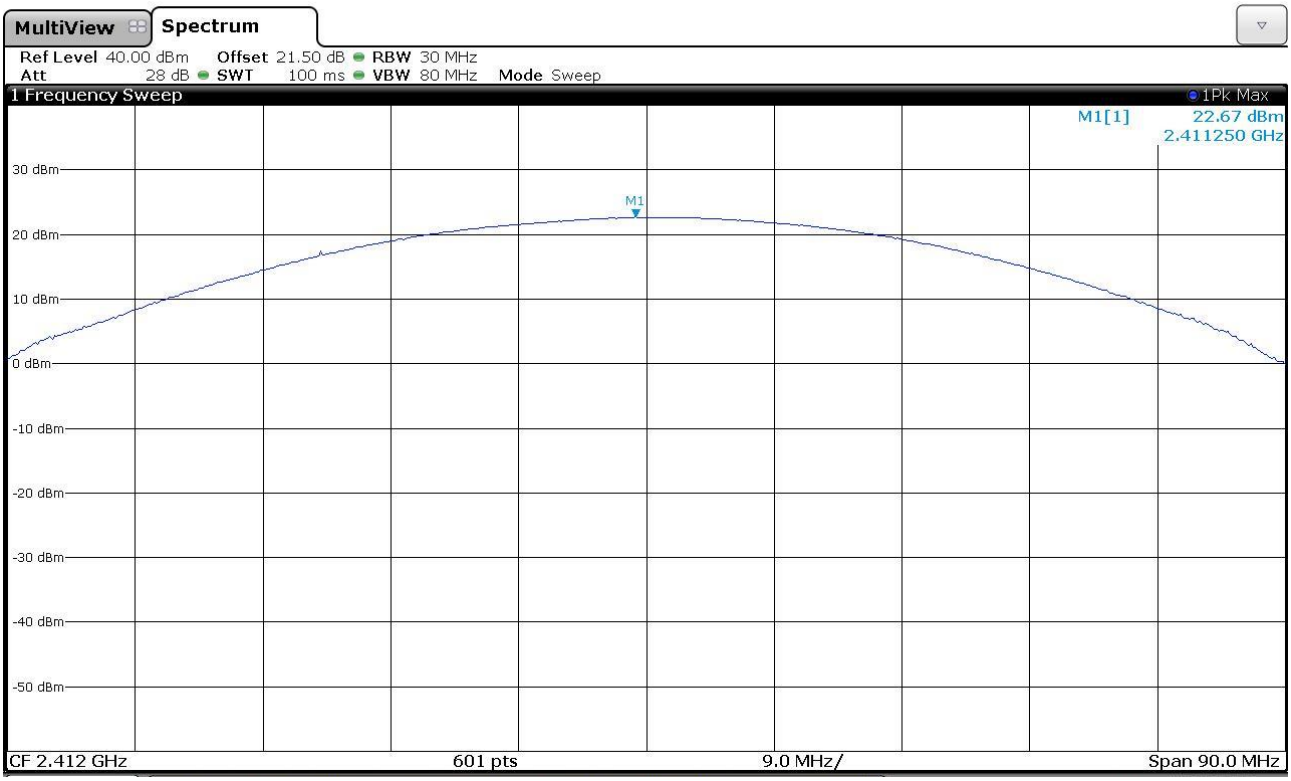
Bertezzolo 172055_20



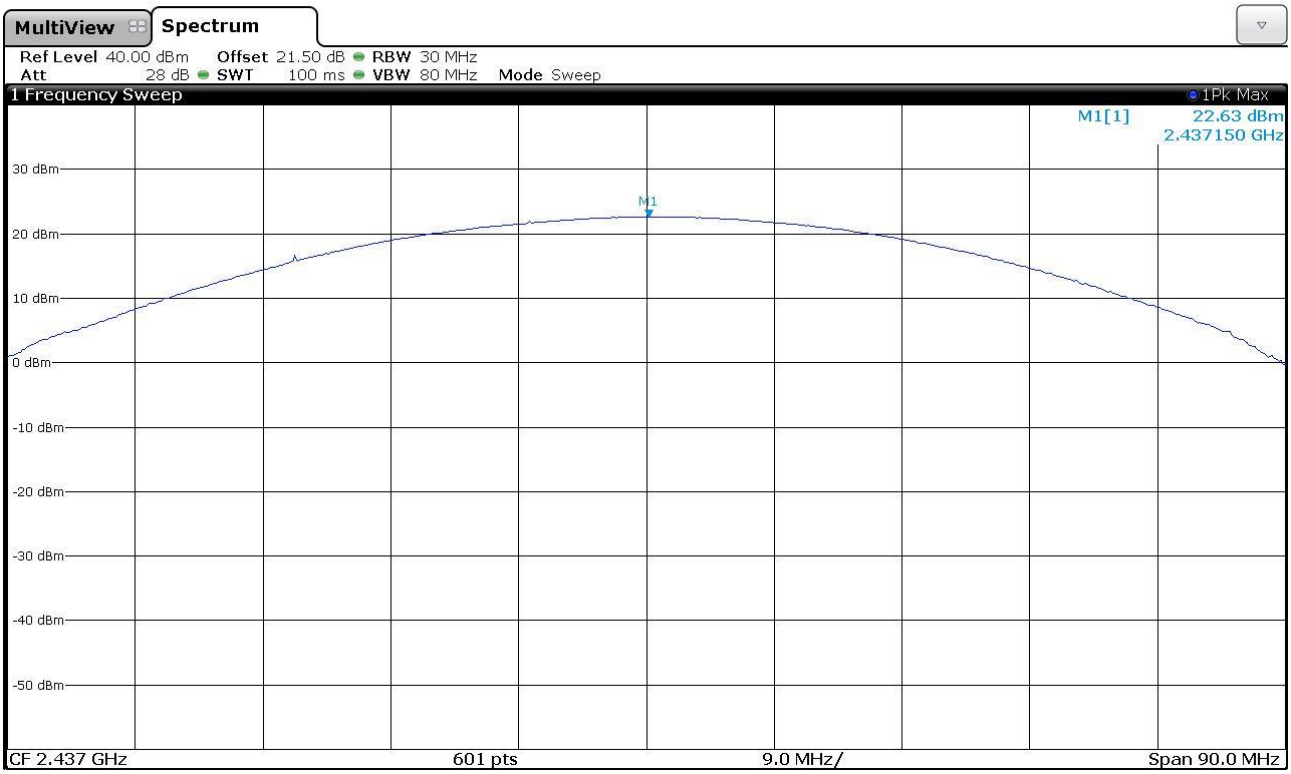
Bertezzolo 172055_21



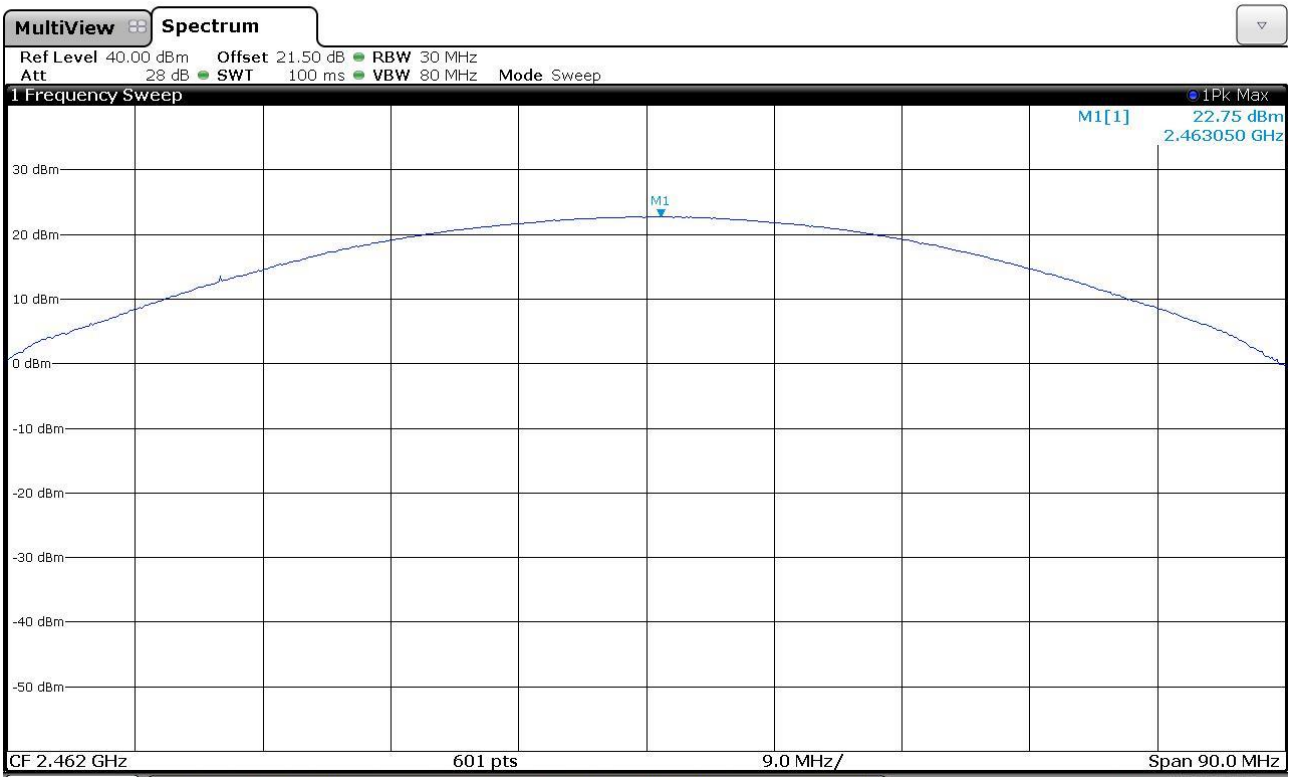
Bertezzolo 172055_22



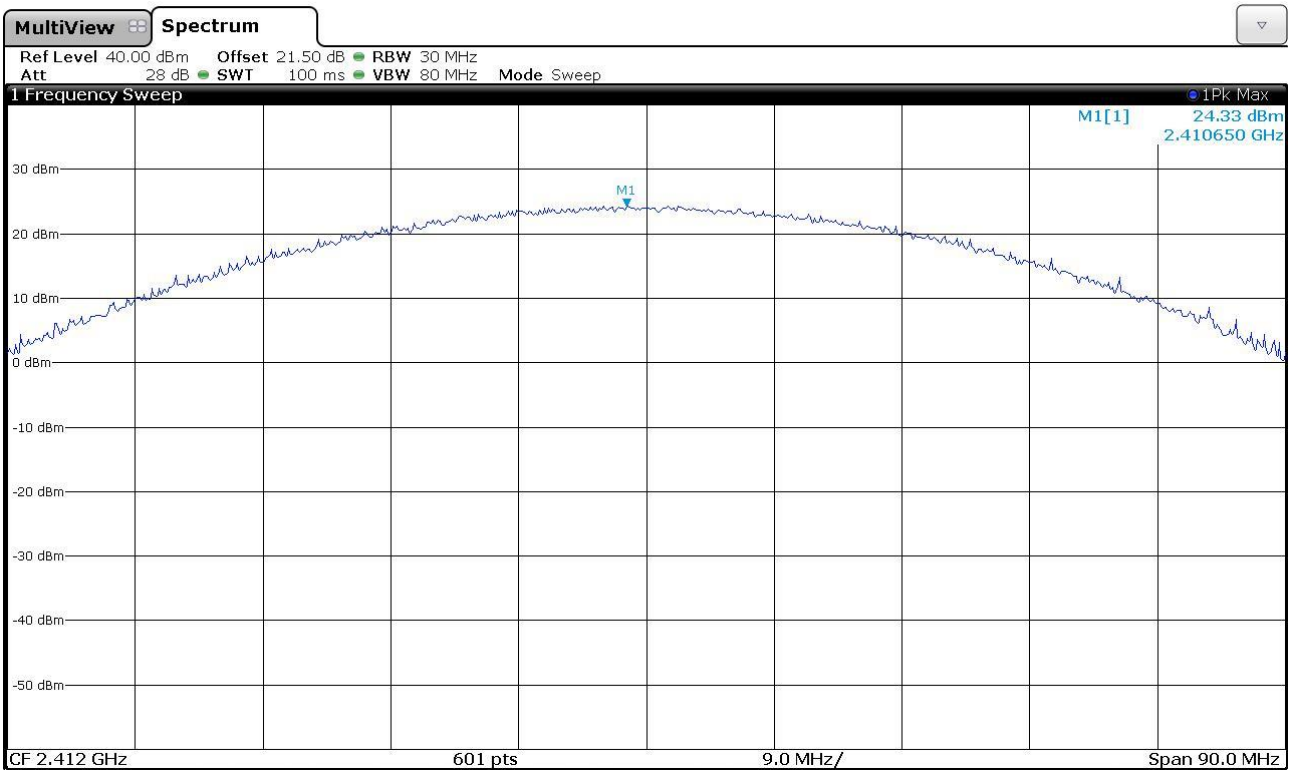
Bertezzolo 172055_23



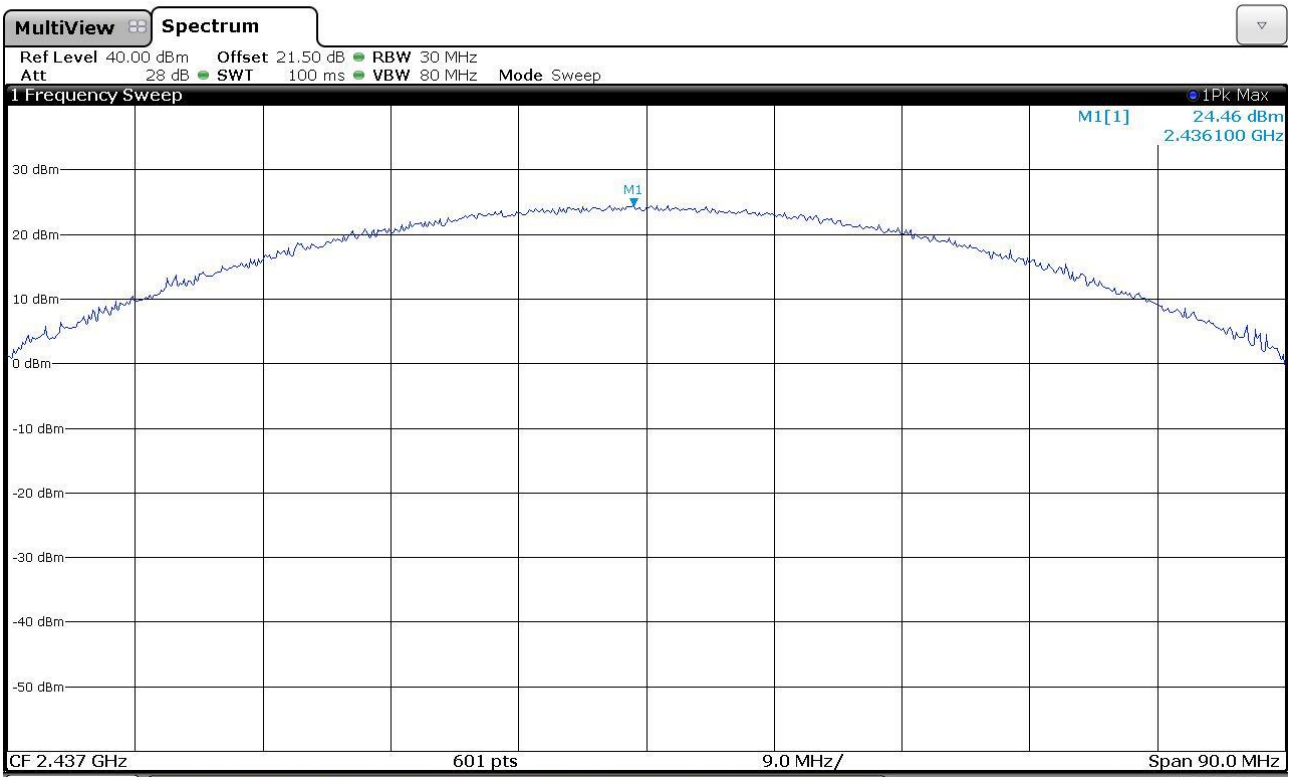
Bertezzolo 172055_24



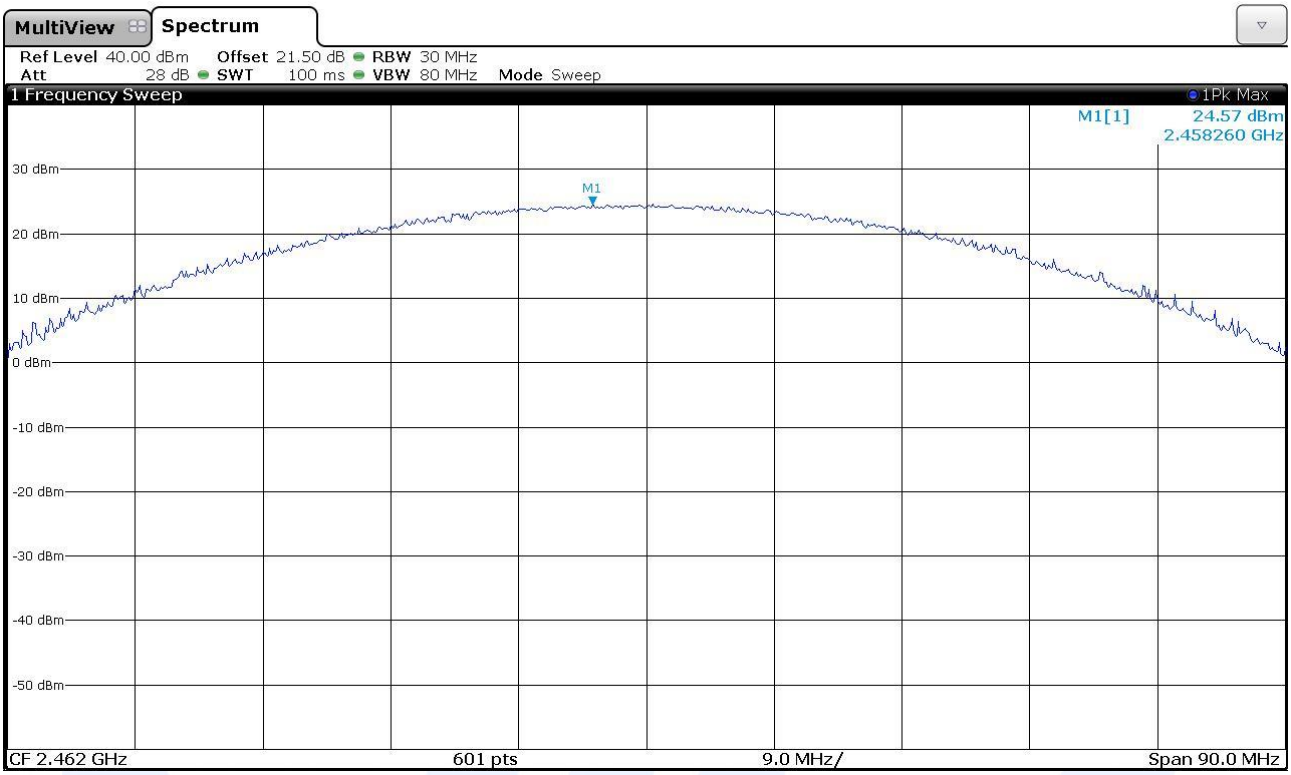
Bertezzolo 172055_25



Bertezzolo 172055_26



Bertezzolo 172055_27



Result: The requirements are met

10.7 Maximum power spectral density level in the fundamental emission

Test set-up and execution

- FCC Rules and Regulation; Titles 47 Part 15.247
- ANSI C63.10 cl. 11.10
- KDB 558074 D01 DTS Meas Guidance v04 cl. 10.2
- Internal procedure PM001
- See clause 4 of this test report
- Test date: September 20th, 2018
- Technician: A. Bertezzolo

Test configuration

Test site:
Laboratory

Auxiliary equipment:
See clause 4 of this test report

EUT exercising

See clause 4 of this test report

Test equipment used

CMC S295, 20 dB attenuator
Measurement uncertainty: See clause 7 of this test report

Test specification

Port: antenna connector

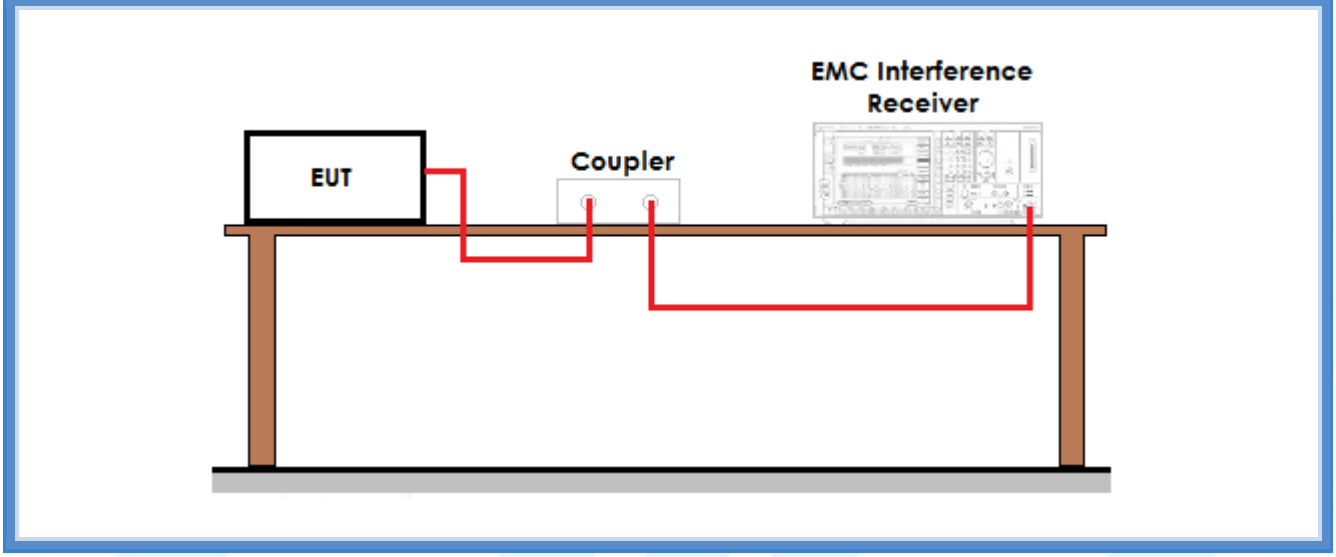
Environmental conditions

Temperature (°C)	*Atmospheric pressure (kPa)*	*Relative humidity (%)*
22	100	42

Acceptance limits:

Frequency Range	*Power Spectral Density*
2400 – 2483,5 MHz	8 dBm/3 kHz 6,31 mW/3 kHz

Setup



Result

WiFi b mode

Channel	*Graphs*	*Measured level (dBm/100 kHz)*
Lowest	G172055_10	7,17
Medium	G172055_11	7,48
Highest	G172055_12	6,71

Remarks: the total attenuation value is due to the 20 dB attenuator and the cable provided by the manufacturer calibrated before the test. The measured value has been obtained by considering the attenuation value directly during the scan

WiFi g mode

Channel	*Graphs*	*Measured level (dBm/100 kHz)*
Lowest	G172055_13	3,50
Medium	G172055_14	3,61
Highest	G172055_15	3,67

Remarks: the total attenuation value is due to the 20 dB attenuator and the cable provided by the manufacturer calibrated before the test. The measured value has been obtained by considering the attenuation value directly during the scan

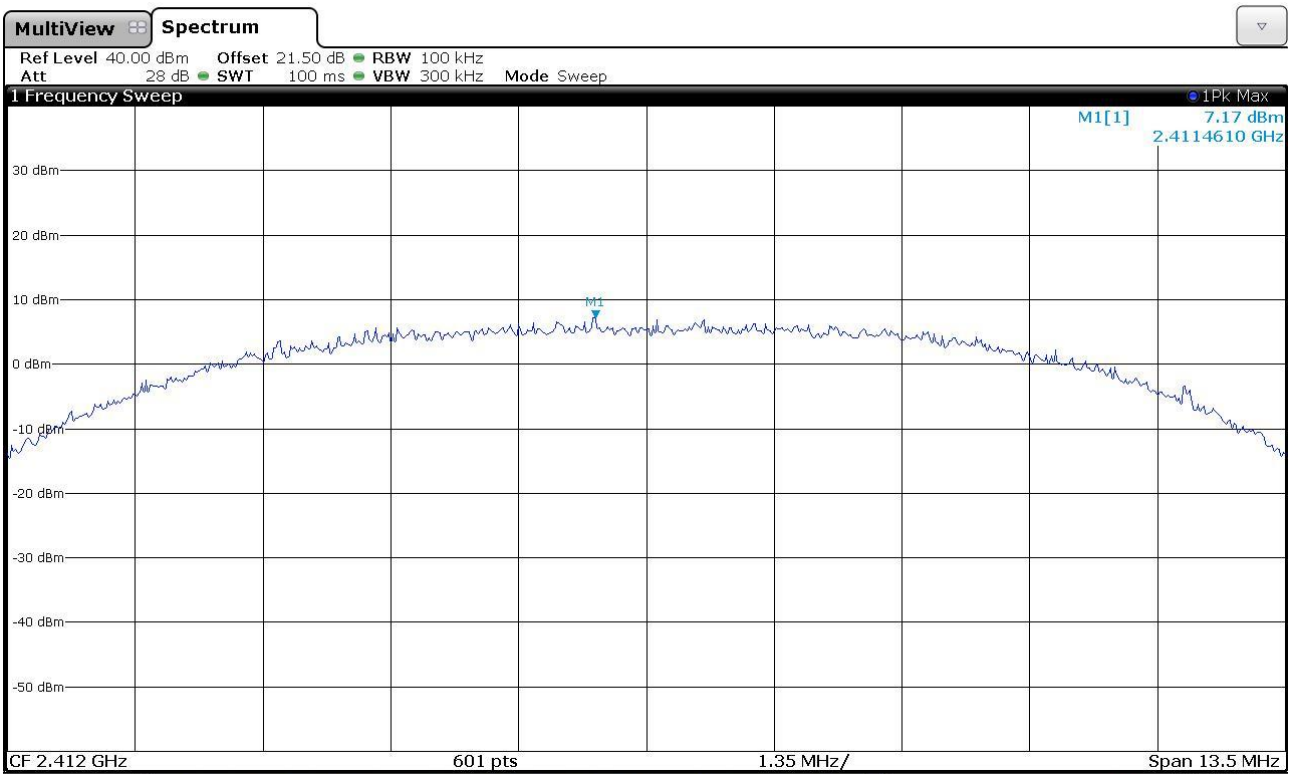
WiFi n mode

Channel	*Graphs*	*Measured level (dBm/100 kHz)*
Lowest	G172055_16	3,75
Medium	G172055_17	3,79
Highest	G172055_18	3,84

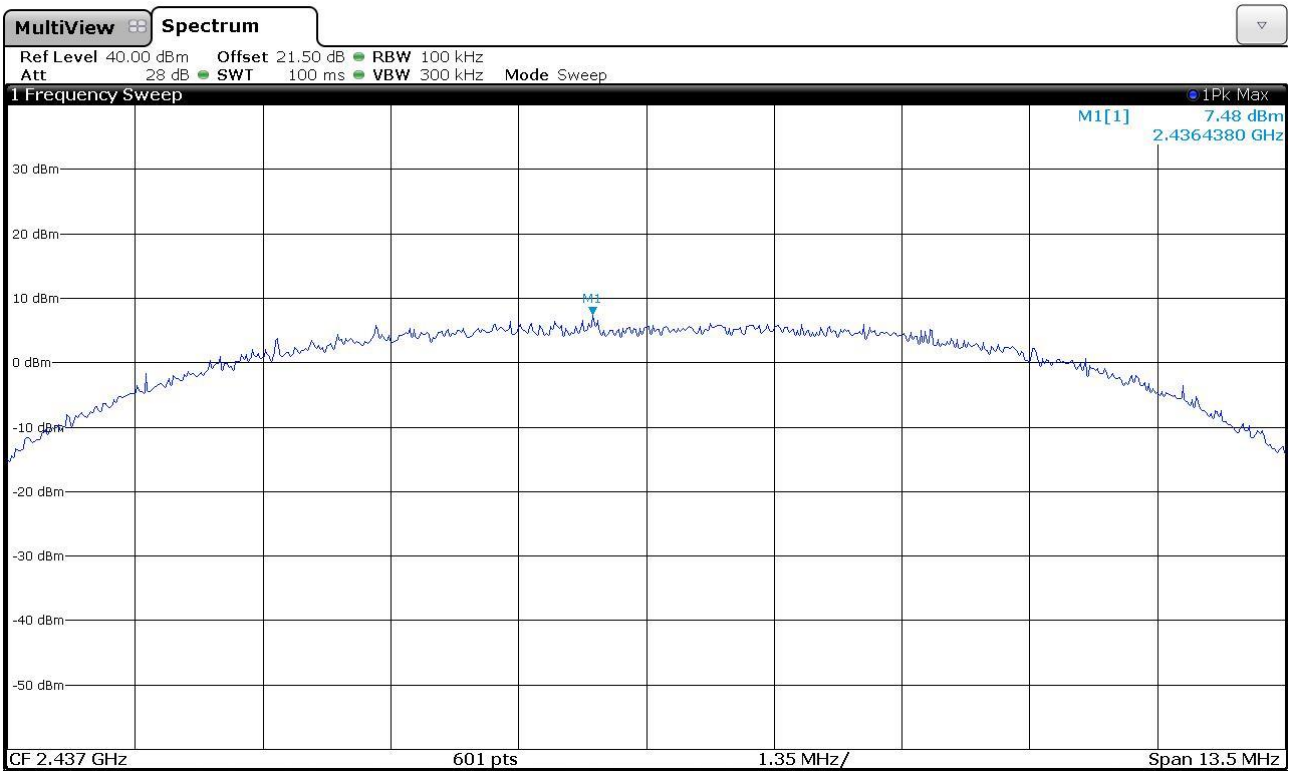
Remarks: the total attenuation value is due to the 20 dB attenuator and the cable provided by the manufacturer calibrated before the test. The measured value has been obtained by considering the attenuation value directly during the scan

Graphs

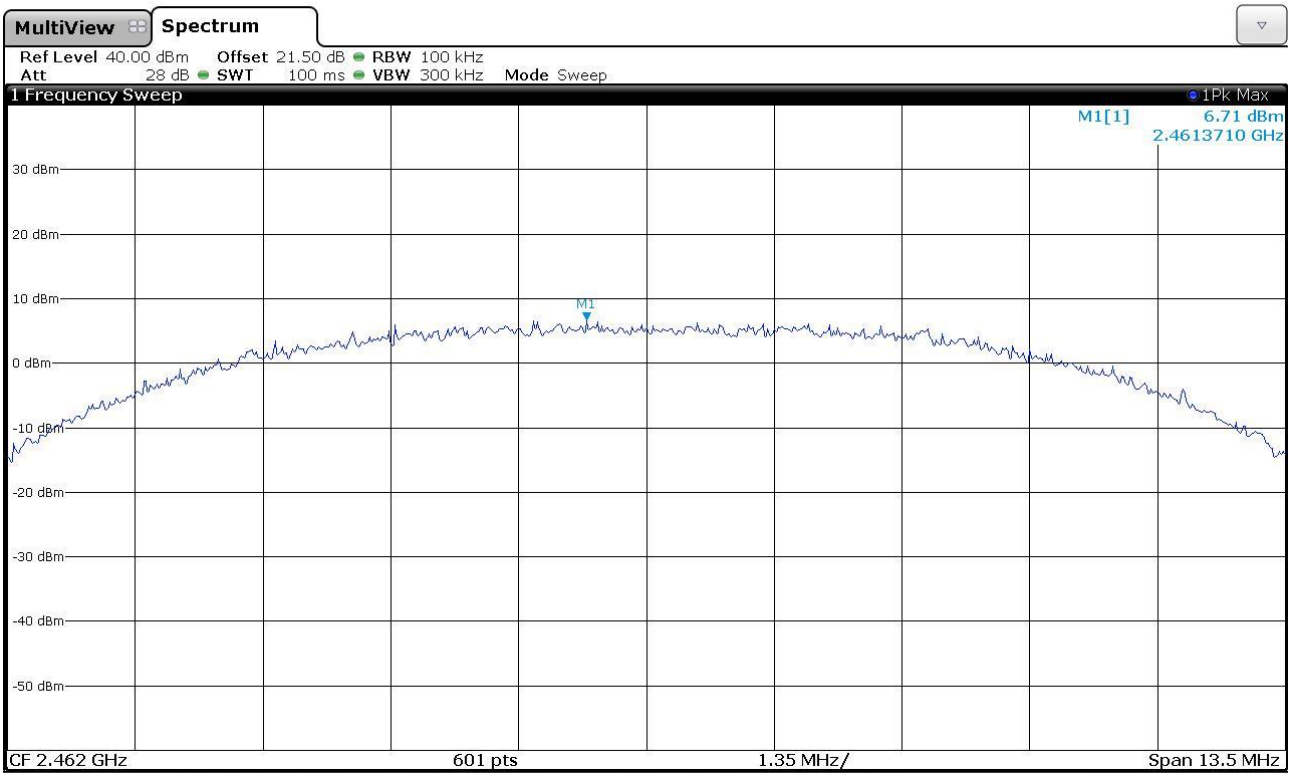
Bertezzolo 172055_10



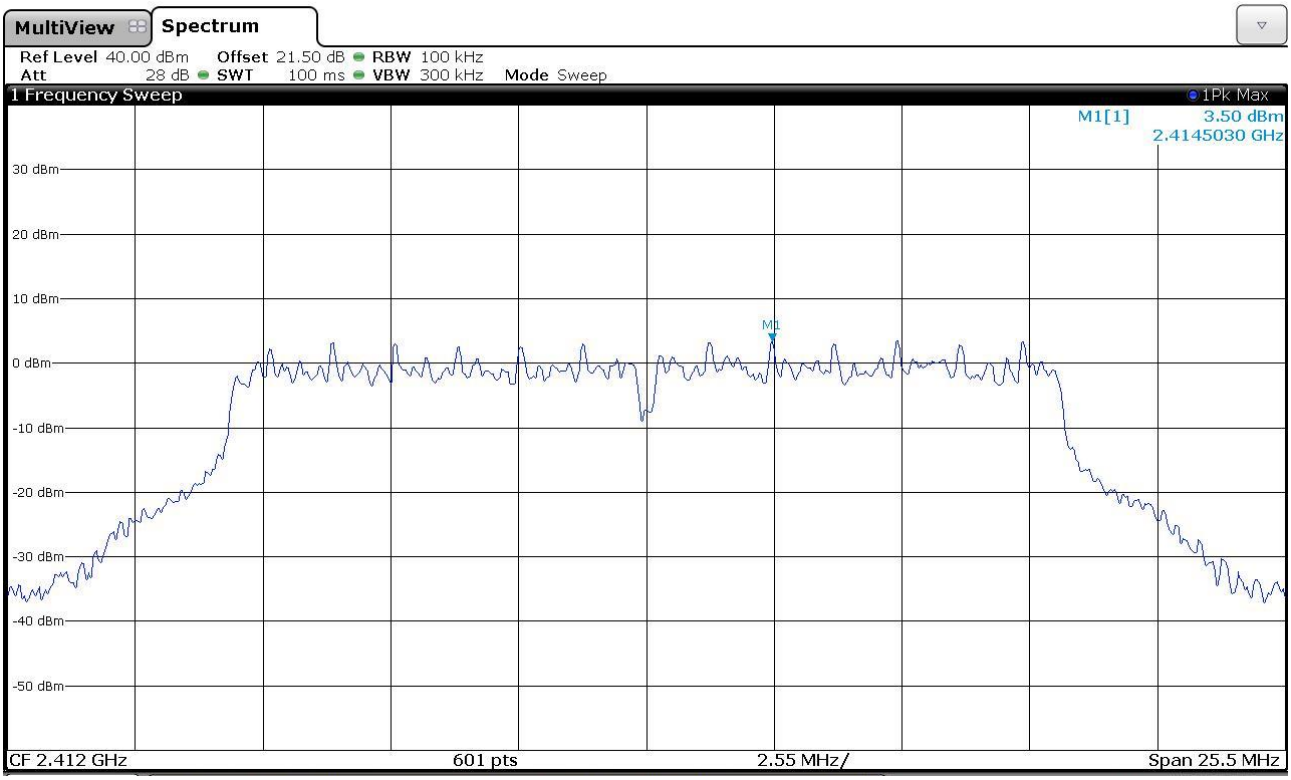
Bertezzolo 172055_11



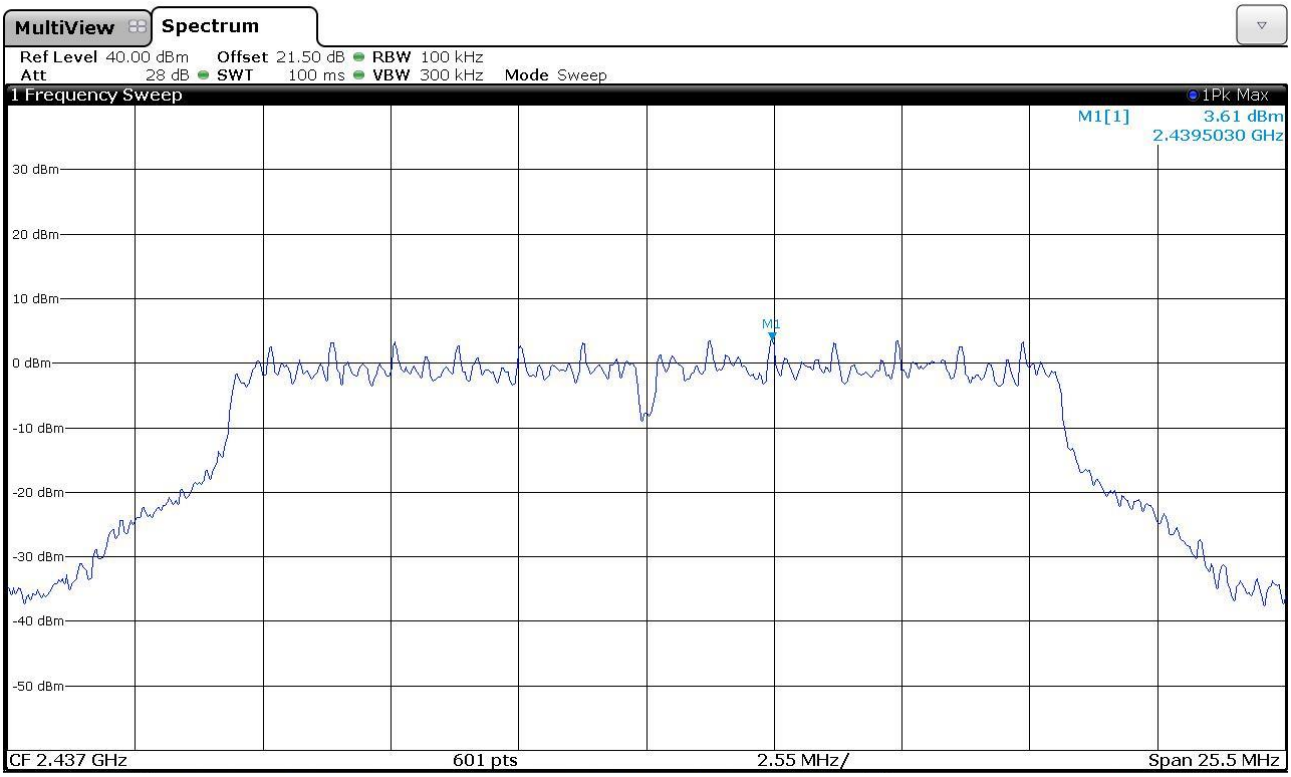
Bertezzolo 172055_12



Bertezzolo 172055_13



Bertezzolo 172055_14



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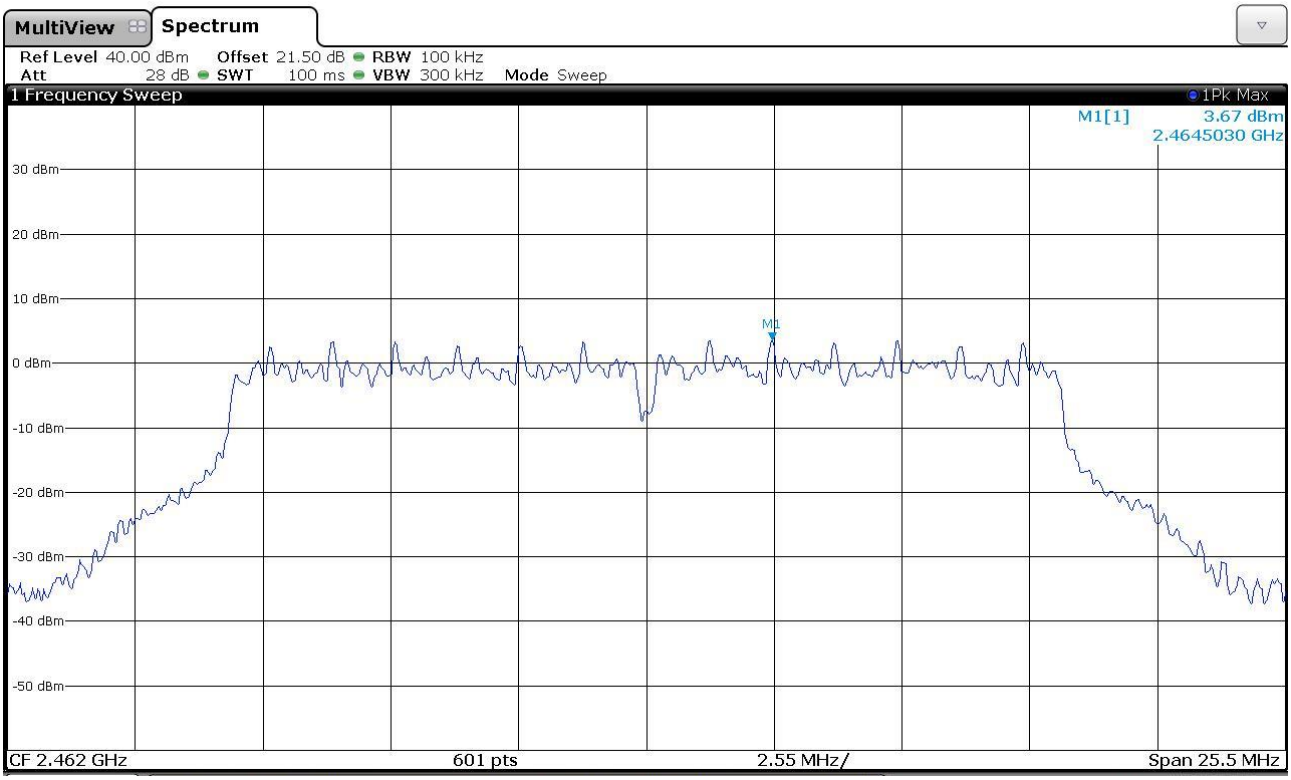

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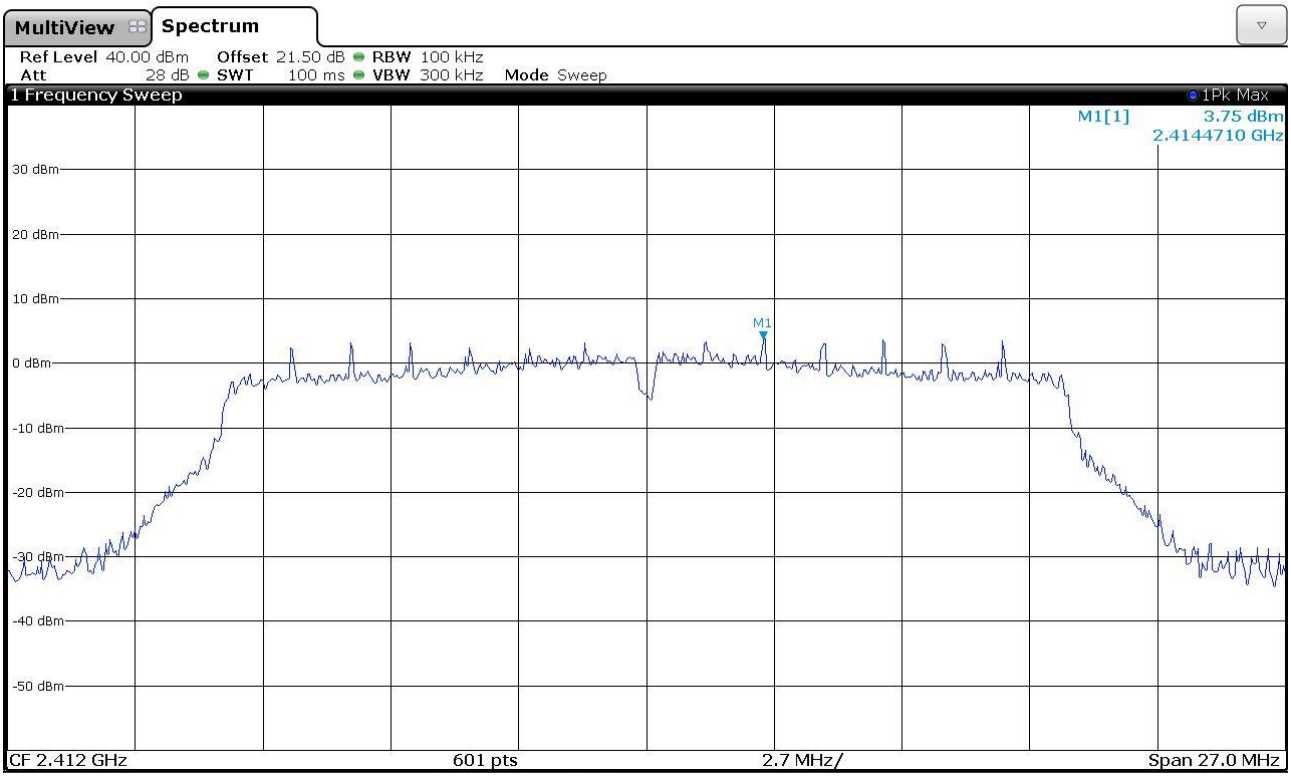
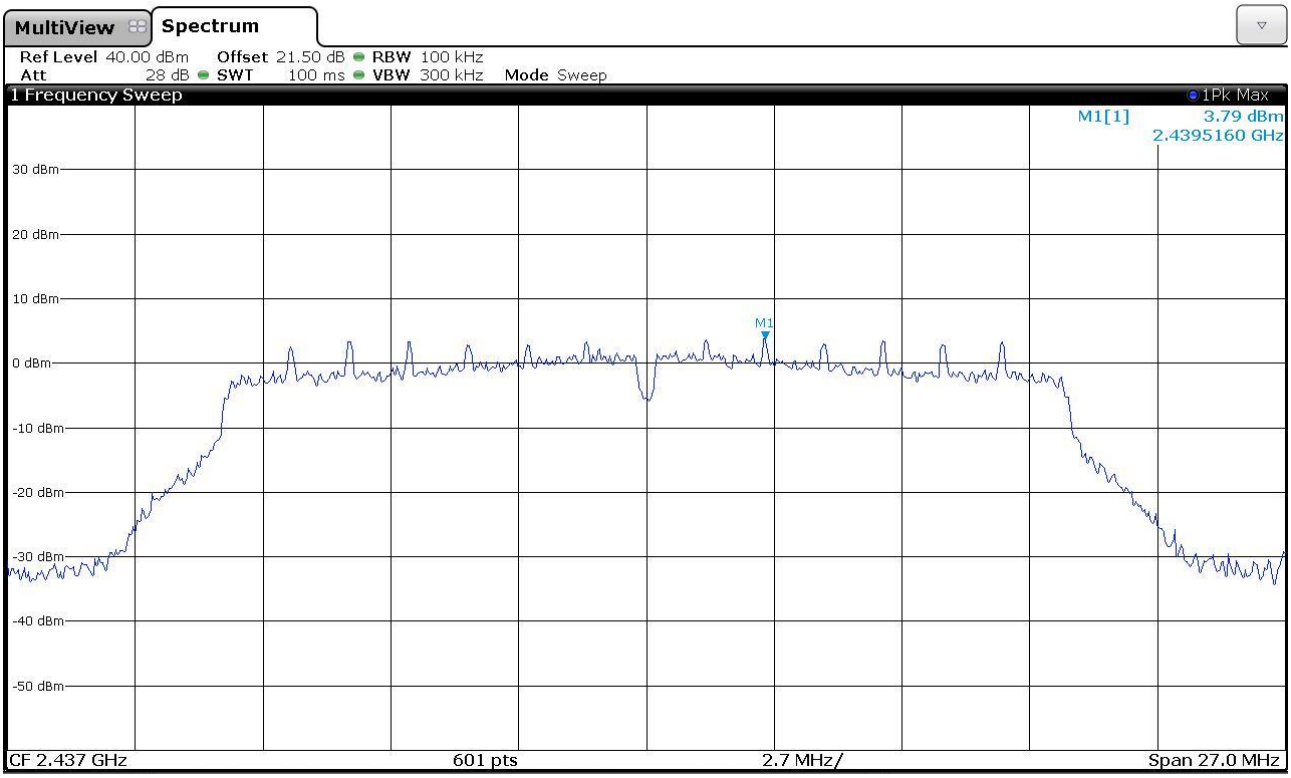
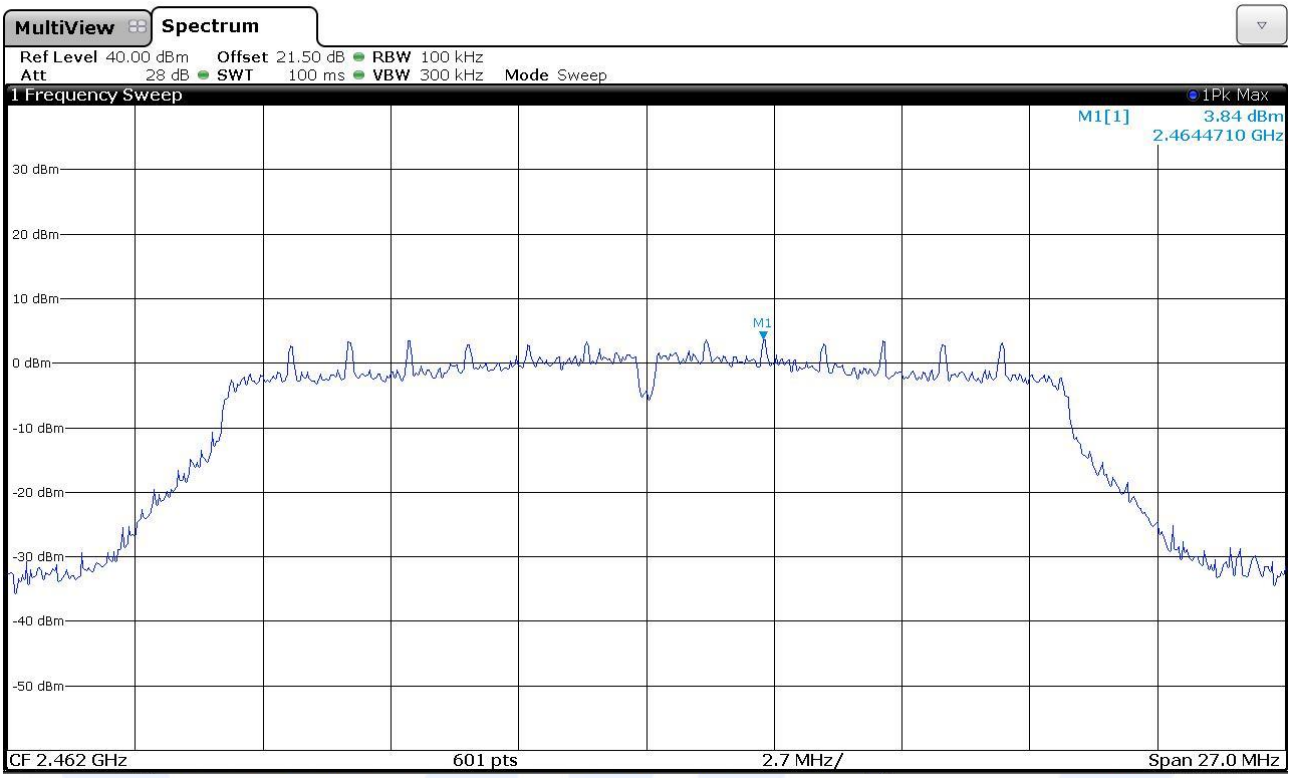


Bertezzolo 172055_17



Bertezzolo 172055_18



Result: The requirements are met

10.8 Spurious Emission

Test set-up and execution

- FCC Rules and Regulation; Titles 47 Part. 15.209
- KDB 558074 D01 DTS Meas Guidance v04 cl. 11 and 12
- ANSI C63.10 cl. 6.6
- Internal procedure PM001
- See clause 4 of this test report
- Test date: March 2nd, 2018
- Technician: A. Bertezzolo

Test configuration

Test site:
Semi-anechoic chamber

Auxiliary equipment:
See clause 4 of this test report

EUT exercising

See clause 4 of this test report

Test equipment used

CMC S164, CMC S241, CMC S251, CMC S290, CMC S298
Measurement uncertainty: See clause 7 of this test report

Test specification

Port: Enclosure
Antenna polarization: Horizontal (H) – Vertical (V)
EUT height about the floor: 150 cm
EUT – Antenna distance: 3 m
Detector AV + Peak

Environmental conditions

Temperature (°C)	*Atmospheric pressure (kPa)*	*Relative humidity (%)*
22	100	45

Acceptance limits

Acceptance limits for emissions in restricted frequency bands		
Frequency (MHz)	*AV limits [dB(µV/m)]*	*Peak limits [dB(µV/m)]*
> 1000	54	74

The restricted frequency bands are listed in the following table

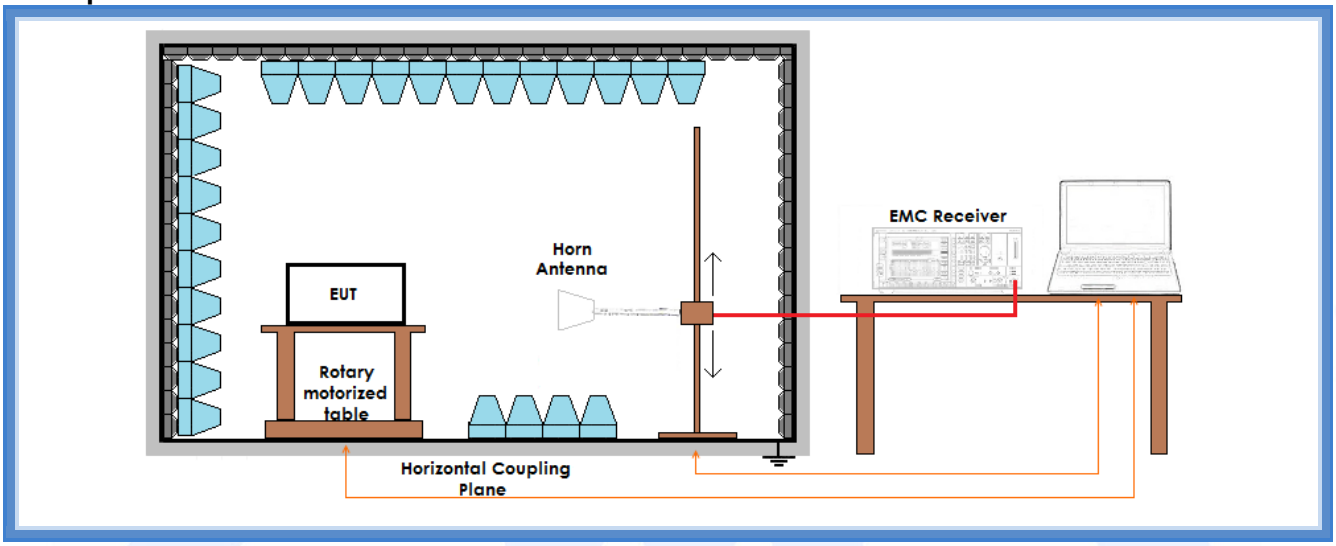
MHz	***MHz***	***MHz***	***GHz***
0,09 – 0,110	16,42 – 16,423	399,9 – 410	4,5 – 5,15
0,495 – 0,505	16,69475 – 16,69525	608 – 614	5,35 – 5,46
2,1735 – 2,1905	16,80425 – 16,80475	960 – 1240	7,25 – 7,75
4,125 – 4,128	25,5 – 25,67	1300 – 1427	8,025 – 8,5
4,17725 – 4,17775	37,5 – 38,25	1435 – 1626,5	9,0 – 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	108 – 121,94	1718,8 – 1722,2	13,25 – 13,4
6,31175 – 6,31225	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
8,41425 – 8,41475	162,0125 – 167,17	3260 – 3267	23,6 – 24
12,29 – 12,293	167,72 – 173,2	3332 – 3339	31,2 – 31,8
12,57675 – 12,57725	322 – 335,4	3600 – 4400	Above 38,6
13,36 – 13,41			

Acceptance limits for emissions in non-restricted frequency bands

The DTS rules specify that in any 100 kHz bandwidth outside of the authorized frequency band, the power shall be attenuated according to the following conditions:

a) If the maximum peak conducted output power procedure was used to demonstrate compliance as described in 9.1, then the peak output power measured in any 100 kHz bandwidth outside of the authorized frequency band shall be attenuated by at least 20 dB relative to the maximum in-band peak PSD level in 100 kHz
b) If maximum conducted (average) output power was used to demonstrate compliance as described in 9.2, then the peak power 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.
c) In either case, attenuation to levels below the 15.209 general radiated emissions limits is not required

Setup



Result – AV detector

WiFi b mode

Harmonic	*Limits (dBµV/m)*	*Level (dBµV/m)*			*Results*
		Lowest channel	*Medium channel*	*Highest channel*	
II	54	More than 20 dB below limit	More than 20 dB below limit	More than 20 dB below limit	Complies
III	54	36,71	36,26	38,95	Complies
IV	54	More than 20 dB below limit	More than 20 dB below limit	More than 20 dB below limit	Complies
V	54	More than 20 dB below limit	More than 20 dB below limit	More than 20 dB below limit	Complies
VI	54	More than 20 dB below limit	More than 20 dB below limit	More than 20 dB below limit	Complies
VII	54	More than 20 dB below limit	More than 20 dB below limit	More than 20 dB below limit	Complies
VIII	54	More than 20 dB below limit	More than 20 dB below limit	More than 20 dB below limit	Complies
IX	54	More than 20 dB below limit	More than 20 dB below limit	More than 20 dB below limit	Complies
X	54	More than 20 dB below limit	More than 20 dB below limit	More than 20 dB below limit	Complies

Remarks: EUT was tested in 3 orthogonal planes. The results in this table show the highest values. No spurious other then harmonics have been found. The results have been extrapolated to the specified distance using an extrapolation factor. For all harmonics it was considered the limit of 54 dBµV/m as a worst case.

WiFi g mode

Harmonic	*Limits (dBµV/m)*	*Level (dBµV/m)*			*Results*
		Lowest channel	*Medium channel*	*Highest channel*	
II	54	More than 20 dB below limit	More than 20 dB below limit	More than 20 dB below limit	Complies
III	54	46,78	46,22	48,33	Complies
IV	54	More than 20 dB below limit	More than 20 dB below limit	More than 20 dB below limit	Complies
V	54	More than 20 dB below limit	More than 20 dB below limit	More than 20 dB below limit	Complies
VI	54	More than 20 dB below limit	More than 20 dB below limit	More than 20 dB below limit	Complies
VII	54	More than 20 dB below limit	More than 20 dB below limit	More than 20 dB below limit	Complies
VIII	54	More than 20 dB below limit	More than 20 dB below limit	More than 20 dB below limit	Complies
IX	54	More than 20 dB below limit	More than 20 dB below limit	More than 20 dB below limit	Complies
X	54	More than 20 dB below limit	More than 20 dB below limit	More than 20 dB below limit	Complies

Remarks: EUT was tested in 3 orthogonal planes. The results in this table show the highest values. No spurious other then harmonics have been found. The results have been extrapolated to the specified distance using an extrapolation factor. For all harmonics it was considered the limit of 54 dBµV/m as a worst case.

WiFi n mode

Harmonic	*Limits (dBµV/m)*	*Level (dBµV/m)*			*Results*
		Lowest channel	*Medium channel*	*Highest channel*	
II	54	More than 20 dB below limit	More than 20 dB below limit	More than 20 dB below limit	Complies
III	54	46,14	46,45	49,34	Complies
IV	54	More than 20 dB below limit	More than 20 dB below limit	More than 20 dB below limit	Complies
V	54	More than 20 dB below limit	More than 20 dB below limit	More than 20 dB below limit	Complies
VI	54	More than 20 dB below limit	More than 20 dB below limit	More than 20 dB below limit	Complies
VII	54	More than 20 dB below limit	More than 20 dB below limit	More than 20 dB below limit	Complies
VIII	54	More than 20 dB below limit	More than 20 dB below limit	More than 20 dB below limit	Complies
IX	54	More than 20 dB below limit	More than 20 dB below limit	More than 20 dB below limit	Complies
X	54	More than 20 dB below limit	More than 20 dB below limit	More than 20 dB below limit	Complies

Remarks: EUT was tested in 3 orthogonal planes. The results in this table show the highest values. No spurious other then harmonics have been found. The results have been extrapolated to the specified distance using an extrapolation factor. For all harmonics it was considered the limit of 54 dBµV/m as a worst case.

Result – Peak detector

WiFi b mode

Harmonic	*Limits (dBµV/m)*	*Level (dBµV/m)*			*Results*
		Lowest channel	*Medium channel*	*Highest channel*	
II	74	More than 20 dB below limit	More than 20 dB below limit	More than 20 dB below limit	Complies
III	74	46,01	45,68	48,64	Complies
IV	74	More than 20 dB below limit	More than 20 dB below limit	More than 20 dB below limit	Complies
V	74	More than 20 dB below limit	More than 20 dB below limit	More than 20 dB below limit	Complies
VI	74	More than 20 dB below limit	More than 20 dB below limit	More than 20 dB below limit	Complies
VII	74	More than 20 dB below limit	More than 20 dB below limit	More than 20 dB below limit	Complies
VIII	74	More than 20 dB below limit	More than 20 dB below limit	More than 20 dB below limit	Complies
IX	74	More than 20 dB below limit	More than 20 dB below limit	More than 20 dB below limit	Complies
X	74	More than 20 dB below limit	More than 20 dB below limit	More than 20 dB below limit	Complies

Remarks: EUT was tested in 3 orthogonal planes. The results in this table show the highest values. No spurious other then harmonics have been found. The results have been extrapolated to the specified distance using an extrapolation factor. For all harmonics it was considered the limit of 74 dBµV/m as a worst case.

WiFi g mode

Harmonic	*Limits (dBµV/m)*	*Level (dBµV/m)*			*Results*
		Lowest channel	*Medium channel*	*Highest channel*	
II	74	More than 20 dB below limit	More than 20 dB below limit	More than 20 dB below limit	Complies
III	74	63,08	63,34	65,60	Complies
IV	74	More than 20 dB below limit	More than 20 dB below limit	More than 20 dB below limit	Complies
V	74	More than 20 dB below limit	More than 20 dB below limit	More than 20 dB below limit	Complies
VI	74	More than 20 dB below limit	More than 20 dB below limit	More than 20 dB below limit	Complies
VII	74	More than 20 dB below limit	More than 20 dB below limit	More than 20 dB below limit	Complies
VIII	74	More than 20 dB below limit	More than 20 dB below limit	More than 20 dB below limit	Complies
IX	74	More than 20 dB below limit	More than 20 dB below limit	More than 20 dB below limit	Complies
X	74	More than 20 dB below limit	More than 20 dB below limit	More than 20 dB below limit	Complies
Remarks: EUT was tested in 3 orthogonal planes. The results in this table show the highest values. No spurious other then harmonics have been found. The results have been extrapolated to the specified distance using an extrapolation factor. For all harmonics it was considered the limit of 74 dBµV/m as a worst case.					

WiFi n mode

Harmonic	*Limits (dBµV/m)*	*Level (dBµV/m)*			*Results*
		Lowest channel	*Medium channel*	*Highest channel*	
II	74	More than 20 dB below limit	More than 20 dB below limit	More than 20 dB below limit	Complies
III	74	65,48	67,37	68,30	Complies
IV	74	More than 20 dB below limit	More than 20 dB below limit	More than 20 dB below limit	Complies
V	74	More than 20 dB below limit	More than 20 dB below limit	More than 20 dB below limit	Complies
VI	74	More than 20 dB below limit	More than 20 dB below limit	More than 20 dB below limit	Complies
VII	74	More than 20 dB below limit	More than 20 dB below limit	More than 20 dB below limit	Complies
VIII	74	More than 20 dB below limit	More than 20 dB below limit	More than 20 dB below limit	Complies
IX	74	More than 20 dB below limit	More than 20 dB below limit	More than 20 dB below limit	Complies
X	74	More than 20 dB below limit	More than 20 dB below limit	More than 20 dB below limit	Complies
Remarks: EUT was tested in 3 orthogonal planes. The results in this table show the highest values. No spurious other then harmonics have been found. The results have been extrapolated to the specified distance using an extrapolation factor. For all harmonics it was considered the limit of 74 dBµV/m as a worst case.					

Result: The requirements are met