

Test Report No:
81844RRF.002

Test Report

ETSI EN 300 440 v2.2.1 (2018-07)

(*) Identification of item tested	R2EX All-In-One Unit
(*) Trademark	Marelli
(*) Model and /or type reference	HUR2XE10B1
(*) Other identification of the product	N/A
(*) Features	AM/FM/DAB rx, BT 5.0, WLAN 5.8GHz, 2G/3G/4G modem, GNSS rx HW version: PTD3 SW version: R19.2
Manufacturer	Marelli Europe S.p.A. V.le A. Borletti 61/63 - 20011 Corbetta (MI) - ITALY
Test method requested, standard	ETSI EN 300 440 V2.2.1 (2018-07): Short Range Device (SRD); Radio equipment to be used in the 1GHz to 40GHz frequency range; Harmonised Standard for access to radio spectrum.
Summary	IN COMPLIANCE
Approved by (name / position & signature)	José Manuel Gómez Galván EMC Consumer & RF Lab. Manager
Date of issue	2026-02-09
Report template No.	FDT08_27 (*) "Data provided by the client"

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Competences and guarantees

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The results presented in this Test Report apply only to the particular item under test established in this document.

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General conditions

1. This report is only referred to the item that has undergone the test.
2. This report does not constitute or imply on its own an approval of the product by the Certification Bodies or competent Authorities.
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Uncertainty

Uncertainty (factor $k=2$) was calculated according to the DEKRA Testing and Certification S.A.U. internal document PODT000.

The total uncertainty of the measurement system for the radiated emissions of EUT from 25 MHz to 1 GHz is:
Measurement uncertainty $\leq \pm 5,35$ dB with factor ($k = 2$).

The total uncertainty of the measurement system for the radiated emissions of EUT from 1 GHz to 17 GHz is:
Measurement uncertainty $\leq \pm 4,32$ dB with factor ($k = 2$).

The total uncertainty of the measurement system for the radiated emissions of EUT from 17 GHz to 40 GHz is:
Measurement uncertainty $\leq \pm 5,51$ dB with factor ($k = 2$).

The total uncertainty of the measurement system for the conducted testing of EUT is:

Transmitter. Permitted range of operating frequencies: Measurement uncertainty $\leq \pm 18,51$ kHz

Transmitter. Equivalent isotropic radiated power (e.i.r.p.): Measurement uncertainty $\leq \pm 2,008$ dB

Receiver. Blocking or desensitization: Measurement uncertainty $\leq \pm 3,207$ dB

Data provided by the client

The following data has been provided by the client:

1. Information relating to the description of the sample ("Identification of the item tested", "Trademark", "Model and/or type reference tested").
2. The sample consists of a R2EX All-In-One Unit. Automotive All-In-One Unit, including Infotainment and Telematics functions.

DEKRA Testing and Certification S.A.U. declines any responsibility with respect to the information provided by the client and that may affect the validity of results. The laboratory is not responsible for such information and it is not covered by accreditation.

Usage of samples

Samples undergoing test have been selected by: The client.

Id	Control Number	Description	Model	Serial N°	Date of Reception	Application
S/01	81844B_80.1	R2EX All-In-One Unit	HUR2XE10B1	1JCGF900267F	2025-08-04	Element Under Test
S/01	81844B_44.1	MAIN Harness	-	-	2025-06-24	Auxiliary Element
S/01	81844B_71.1	Fakra to 4 Fakra Cable	-	-	2025-06-24	Auxiliary Element
S/01	81844B_12.1	Fakra to 4 Fakra Cable	-	-	2025-06-09	Auxiliary Element
S/01	81844B_10.1	Fakra Cable	-	-	2025-06-09	Auxiliary Element
S/01	81844B_16.1	Fakra Cable	-	-	2025-06-09	Auxiliary Element
S/01	81844B_23.1	CANBOX	-	-	2025-06-24	Auxiliary Element
S/01	81844B_28.1	TLS AUDIO	-	-	2025-06-24	Auxiliary Element
S/01	81844B_01.1	DISPLAY R2EX	-	-	2025-06-09	Auxiliary Element
S/01	81844B_05.1	TLS 1	-	-	2025-06-09	Auxiliary Element
S/01	81844B_06.1	TLS 2	-	-	2025-06-09	Auxiliary Element
S/01	81844B_07.1	USB213C	-	-	2025-06-09	Auxiliary Element
S/01	81844B_08.1	USB Cable	-	-	2025-06-09	Auxiliary Element

Id	Control Number	Description	Model	Serial N°	Date of Reception	Application
S/01	81844B_09.1	USB Adapter	-	-	2025-06-09	Auxiliary Element
S/02	81844B_82.1	R2EX All-In-One Unit	HUR2XS10B1	1JCGF901G67F	2025-09-12	Element Under Test
S/02	81844B_17.1	Display R2EX	-	-	2025-06-24	Auxiliary Element
S/02	81844B_23.1	CANBOX	-	-	2025-06-24	Auxiliary Element
S/02	81844B_36.1	Fakra Cable	-	-	2025-06-24	Auxiliary Element
S/02	81844B_37.1	Fakra to SMA Cable	-	-	2025-06-24	Auxiliary Element
S/02	81844B_75.1	USB Adapter	-	-	2025-06-24	Auxiliary Element
S/02	81844B_76.1	USB – Fakra Adapter	-	-	2025-06-24	Auxiliary Element
S/03	81844B_89.1	R2EX All-In-One Unit	HUR2XE10B1	1JVAF9019V8F	2025-10-08	Element Under Test
S/03	81844B_17.1	Display R2EX	-	-	2025-06-24	Auxiliary Element
S/03	81844B_23.1	CANBOX	-	-	2025-06-24	Auxiliary Element
S/03	81844B_36.1	Fakra Cable	-	-	2025-06-24	Auxiliary Element
S/03	81844B_37.1	Fakra to SMA Cable	-	-	2025-06-24	Auxiliary Element
S/03	81844B_75.1	USB Adapter	-	-	2025-06-24	Auxiliary Element
S/03	81844B_76.1	USB – Fakra Adapter	-	-	2025-06-24	Auxiliary Element

Notes referenced to samples during the project:

Id	Type
S/01	Samples used for radiated tests
S/02	Samples used for conducted tests except RF output power and Receiver Blocking tests.
S/03	Samples used only for RF output power and Receiver Blocking tests.

Test sample description

Ports..... :	Port name and description		Cable				
			Specified max length [m]	Attached during test	Shielded	Coupled to patient ⁽³⁾	
	Connector A (black, main harness)		>3	[X]	[]	[]	
	Connector B (grey, main harness)		>3	[X]	[]	[]	
	Connector C (FM/AM, DAB, WIFI/BT ANT1, WIFI/BT ANT2)		>3	[X]	[X]	[]	
	Connector D (display)		>3	[X]	[X]	[]	
	Connector E (GNSS, CAM, LTE, GSM)		>3	[X]	[X]	[]	
Connector F (USB)		>3	[X]	[X]	[]		
Supplementary information to the ports..... :	the shielding in Connector C and E is intended on each single signal, not on overall connector						
Rated power supply :	Voltage and Frequency		Reference poles				
			L1	L2	L3	N	PE
	[]	AC:	[]	[]	[]	[]	[]
	[X]	DC: 13,5 Vdc (Vmin-Vmax: 9 - 16 Vdc)					
[]	DC: shielded cables: any voltage inside is <13.5Vdc						
Rated Power..... :							
Clock frequencies..... :							
Other parameters..... :							
Software version..... :	R19.2						
Hardware version..... :	PTD3						
Dimensions in cm (W x H x D)..... :							
Mounting position..... :	[]	Table top equipment					
	[]	Wall/Ceiling mounted equipment					
	[]	Floor standing equipment					
	[]	Hand-held equipment					
	[X]	Other: automotive interior environment, installation in the dashboard of vehicles					
Modules/parts..... :	Module/parts of test item			Type		Manufacturer	
							
Accessories (not part of the test item)..... :	Description			Type		Manufacturer	
							
Documents as provided by the applicant..... :	Description			File name		Issue date	
							

⁽³⁾ Only for Medical Equipment

Identification of the client

Marelli Europe S.p.A.
V.le A. Borletti 61/63 - 20011 Corbetta (MI) - ITALY

Testing period and place

Test Location	DEKRA Testing and Certification S.A.U. Severo Ochoa, 6 29590, Málaga, SPAIN
Date (start)	2025-09-29
Date (finish)	2026-01-28

Document history

Report number	Date	Description
81844RRF.001	2026-02-09	First release.

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. = 75 %

In the semi-anechoic chamber, the following limits were not exceeded during the test:

Temperature	Min. = 15 °C Max. = 35 °C
Relative humidity	Min. = 20 % Max. = 75 %

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. = 20 % Max. = 75 %

Remarks and comments

The tests have been performed by the technical personnel: Valentín Andarias, Carmen Vázquez, Álvaro Gutiérrez.

Control No.	Equipment	Model	Manufacturer	Next Calibration
04825	SEMIANECHOIC ABSORBER LINED CHAMBER	FACT 3 200 STP	ETS LINDGREN	N/A
04826	SHIELDED ROOM	S101	ETS LINDGREN	N/A
07547	TEMPERATURE AND HUMIDITY PROBE	HWg-STE	HW GROUP	2026-04-22
07548	TEMPERATURE AND HUMIDITY PROBE	HWg-STE	HW GROUP	2026-04-22
04578	HYBRID BILOG ANTENNA 30MHZ-6GHz	3142E	ETS LINDGREN	2026-06-01
07611	PREAMPLIFIER BOX	--	INTERNAL	2026-01-23
06165	EMI TEST RECEIVER 9kHz-7GHz	ESR7	ROHDE AND SCHWARZ	2025-12-27
04611	HORN ANTENNA 1-18GHz	BBHA 9120 D	SCHWARZBECK MESS- ELEKTRONIK	2026-01-16
05705	PRE-AMPLIFIER G>40dB 1-18 GHz	BLMA 0118-1M	BONN ELEKTRONIK	2026-07-23
04657	HORN ANTENNA 18-40GHz	BBHA 9170	SCHWARZBECK	2026-06-12
10573	PRE-AMPLIFIER G>46dB 18-40 GHz	BLMA 1840-5G	BONN ELEKTRONIK	2026-03-07
04716	SIGNAL AND SPECTRUM ANALYZER 2Hz-50GHz	FSW50	ROHDE AND SCHWARZ	2026-08-02
09762	DC POWER SUPPLY 200V/25A	EA-PSI-9200-25-DT	ELEKTRO-AUTOMATIC	N/A
05850	DIGITAL MULTIMETER	179	FLUKE	2026-11-06
04848	SOFTWARE FOR EMC/RF TESTING	EMC32	ROHDE AND SCHWARZ	N/A
06793	SHIELDED ROOM	S101	ETS LINDGREN	N/A
06611	TEMPERATURE AND HUMIDITY PROBE	HWg-STE	HW GROUP	2026-04-21
07794	SIGNAL AND SPECTRUM ANALYZER 10Hz-40GHz	FSV40	ROHDE AND SCHWARZ	2027-06-10
00915	SIGNAL GENERATOR 10MHZ-18GHZ	SWM05	ROHDE AND SCHWARZ	2026-12-04
08002	TEMPERATURE CHAMBER MK56 BINDER	MK 56	BINDER	2026-02-12
07798	WMS32	WMS32	ROHDE AND SCHWARZ	N/A
00922	POWER SUPPLY DC 40 V / 40 A	NGPE 40/40	ROHDE AND SCHWARZ	2027-10-02

Control No.	Equipment	Model	Manufacturer	Next Calibration
07758	DIGITAL MULTIMETER	175	FLUKE	2026-11-06

Testing verdicts

Not Applicable:	N/A
Pass:	P
Fail:	F
Not Measured:	N/M

Summary

WLAN 5 GHz SISO and MIMO: 5.725 GHz - 5.85 GHz Band (U-NII-3)

ETSI EN 300 440			
Requirement – Test case		Verdict	Remark
4.2.2	Transmitter. Equivalent isotropic radiated power (e.i.r.p.)	P	
4.2.3	Transmitter. Permitted range of operating frequencies	P	
4.2.4	Transmitter. Unwanted emissions in the spurious domain (radiated)	P	
4.2.5	Transmitter. Duty Cycle	P	
4.2.6	Additional requirements for FHSS equipment	N/A	
4.3.3	Receiver. Adjacent channel selectivity	N/A	
4.3.4	Receiver. Blocking or desensitization	P	
4.3.5	Receiver. Spurious radiations (radiated)	P	
4.4	Spectrum access techniques	N/A	
G.1.0./ G.1.1.	2.45 GHz RFID systems. Effective radiated power	N/A	
G.1.2.	2.45 GHz RFID systems. Spectrum mask	N/A	
4.6.1.	GBSAR systems. Effective radiated power	N/A	
4.6.2.	GBSAR systems. Permitted range of operating frequencies	N/A	
4.6.3.0	GBSAR systems. DAA threshold	N/A	
4.6.3.1.1.	GBSAR systems. Minimum listen time	N/A	
4.6.3.1.2.	GBSAR systems. Minimum listen time after detection	N/A	
4.6.3.1.3.	GBSAR systems. Maximum transmitter on-time	N/A	
4.6.3.1.4.	GBSAR systems. Minimum transmitter off-time	N/A	
4.6.4.	GBSAR systems. Antenna pattern	N/A	
<u>Supplementary information and remarks:</u>			
None.			

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TEST CONDITIONS

(*): Data provided by the Applicant.

POWER SUPPLY (*):

Vnominal: 13.5 Vdc
Vmin: 9 Vdc
Vmax: 16 Vdc
Type of Power Supply: Battery

ANTENNA (*):

Type of Antenna: Internal
Maximum Declared Antenna Gain: 3 dBi

TEMPERATURE (*):

Tnormal: +15 to +35
Tminimum: -35 °C
Tmaximum: +70 °C

TEST FREQUENCIES (*):

- Nominal Channel Bandwidth 1: 20 MHz.

Mode	Sub-band (MHz)	Channel	
802.11 a20/n20/ac20	5735 to 5835	CH 149: 5745 MHz	Low

- Nominal Channel Bandwidth 2: 40 MHz

Mode	Sub-band (MHz)	Channel	
802.11 n40/ac40	5735 to 5835	CH 151: 5755 MHz	Low

- Nominal Channel Bandwidth 3: 80 MHz

Mode	Sub-band (MHz)	Channel	
802.11 ac80	5735 to 5835	CH 155: 5775 MHz	Single

The EUT was set in test mode to operate in a continuous transmit mode or receiving mode on the test channels as required and in each of the different modulation modes.

The data rates of 6 Mbps for 802.11 a20, HT20 for 802.11 n20, HT40 for 802.11 n40, VHT20 for 802.11 ac20, VHT40 for 802.11 ac40, VHT80 for 802.11 ac80 were selected based on preliminary testing that identified those rates corresponding to the worst-cases in terms of RF output power and spurious emissions levels.

CONDUCTED MEASUREMENTS:

The equipment under test was set up in a shielded room and connected to the spectrum analyzer or power meter using low-loss RF cables with SMA type connectors. The reading on the spectrum analyzer or power meter is corrected taking into account the cable loss.

Preliminary conducted PSD measurements determined that the worst-cases are as follows:

- Worst-case 802.11 a20/n20/ac20: 802.11 ac20.
- Worst-case 802.11 n40/ac40: 802.11 n40.

RADIATED MEASUREMENTS:

All radiated tests were performed in an anechoic chamber.

The measurement antenna is situated at a distance of 3 m for the frequency range 25 MHz - 17 GHz and at a distance of 1 m for the frequency range 17 GHz - 40 GHz.

The equipment under test was set up on a non-conductive platform above the ground plane and its situation and orientation were varied to find the maximum radiated emission. It was also rotated 360°. Measurements were made in both horizontal and vertical planes of polarization.

Preliminary tests determined 802.11 n20 with HT20 data rate as the worst-case mode in terms of radiated PSD levels.

PRODUCT INFORMATION

Information	Description
Radio features:	802.11 a20 / n20, n40 / ac20, ac40, ac80.
Modulations:	OFDM.
Operating Frequency Range:	Sub-band: 5725 – 5875 MHz.
Nominal Channel Bandwidth 1:	20 MHz
Nominal Channel Bandwidth 2:	40 MHz
Nominal Channel Bandwidth 3:	80 MHz
Maximum RF Output Power (e.i.r.p.):	+9 dBm
Operation mode 1: Antenna Equipment.	Equipment with two antennas
Spread Spectrum:	Yes (OFDM modulation)

TEST CASES DETAILS

4.2.2 Transmitter. Equivalent isotropically radiated power (e.i.r.p.)

Limits

The transmitter maximum e.i.r.p. under normal and extreme test conditions shall not exceed the values given in the following table.

Frequency Bands	Power e.i.r.p.	Application	Notes
2400 MHz to 2483.5 MHz	10 mW (10 dBm)	Non-specific short range devices	
2400 MHz to 2483.5 MHz	25 mW (13.98 dBm)	Radio determination devices	
(a) 2446 MHz to 2454 MHz	500 mW (26.99 dBm)	Radio Frequency Identification (RFID) devices	See also table 4 and Annex G
(b) 2446 MHz to 2454 MHz	4 W (36.02 dBm)	Radio Frequency Identification (RFID) devices	See also table 4 and Annex G
5725 MHz to 5875 MHz	25 mW (13.98 dBm)	Non-specific short range devices	
9200 MHz to 9500 MHz	25 mW (13.98 dBm)	Radio determination devices	
9500 MHz to 9975 MHz	25 mW (13.98 dBm)	Radio determination devices	
10.5 GHz to 10.6 GHz	500 mW (26.99 dBm)	Radio determination devices	
13.4 GHz to 14.0 GHz	25 mW (13.98 dBm)	Radio determination devices	
17.1 GHz to 17.3 GHz	400 mW (26 dBm)	Radio determination devices	See Annex H
24.00 GHz to 24.25 GHz	100 mW (20 dBm)	Non-specific short range devices and Radio determination devices	

NOTE: The spectrum ranges in some entries are not harmonized throughout all EU territory, specifically entries 4, 9, and 11 have been identified as such. Implementers are cautioned to refer to CEPT/ERC Recommendation 70-03 as well as current National Radio plans to verify acceptance within intended regions of use.

Results

SISO Chain 1:

6dBBW:

Mode	Low Channel
802.11 ac20	15,1420
802.11 n40	35.1179
802.11 ac80	75.1086 (Single Channel)

- **802.11 ac20:**

Test Conditions / Channel			Maximum E.I.R.P (dBm)
			Low
Normal	Tnominal	Vnominal	13.100
Extreme	Tminimum	Vminimum	13.240
		Vmaximum	13.250
	Tmaximum	Vminimum	12.630
		Vmaximum	12.630

- **802.11 n40:**

Test Conditions / Channel			Maximum E.I.R.P (dBm)
			Low
Normal	Tnominal	Vnominal	13.597
Extreme	Tminimum	Vminimum	13.707
		Vmaximum	13.717
	Tmaximum	Vminimum	13.027
		Vmaximum	13.027

- **802.11 ac80:**

Test Conditions/Channel			Maximum E.I.R.P (dBm)
			Single
Normal	Tnominal	Vnominal	11.964
Extreme	Tminimum	Vminimum	12.314
		Vmaximum	12.324
	Tmaximum	Vminimum	11.784
		Vmaximum	11.784

Verdict

Pass

SISO Chain 2:

6dBBW:

Mode	Low Channel
802.11 a20	15.1376
802.11 ac40	35.0992
802.11 ac80	75.0837 (Single Channel)

- 802.11 a20:

Test Conditions / Channel			Maximum E.I.R.P (dBm)
			Low
Normal	Tnominal	Vnominal	11.450
Extreme	Tminimum	Vminimum	12.510
		Vmaximum	12.540
	Tmaximum	Vminimum	7.630
		Vmaximum	7.590

- 802.11 ac40:

Test Conditions / Channel			Maximum E.I.R.P (dBm)
			Low
Normal	Tnominal	Vnominal	12.067
Extreme	Tminimum	Vminimum	12.837
		Vmaximum	12.837
	Tmaximum	Vminimum	8.587
		Vmaximum	8.607

- 802.11 ac80:

Test Conditions/Channel			Maximum E.I.R.P (dBm)
			Single
Normal	Tnominal	Vnominal	11.122
Extreme	Tminimum	Vminimum	11.802
		Vmaximum	11.812
	Tmaximum	Vminimum	8.772
		Vmaximum	11.412

Verdict

Pass

MIMO Chain 1 & Chain 2:

6dBBW:

Mode	Low Channel
802.11 a20	15.133
802.11 ac40	35.102
802.11 ac80	75.090 (Single Channel)

802.11 a20:

Test Conditions / Channel			Maximum E.I.R.P (dBm)
			Low
Normal	Tnominal	Vnominal	12.160
Extreme	Tminimum	Vminimum	12.966
		Vmaximum	13.000
	Tmaximum	Vminimum	9.544
		Vmaximum	9.611

802.11 ac40:

Test Conditions / Channel			Maximum E.I.R.P (dBm)
			Low
Normal	Tnominal	Vnominal	13..094
Extreme	Tminimum	Vminimum	13.909
		Vmaximum	13.940
	Tmaximum	Vminimum	10.214
		Vmaximum	10.240

802.11 ac80:

Test Conditions / Channel			Maximum E.I.R.P (dBm)
			Low
Normal	Tnominal	Vnominal	12.940
Extreme	Tminimum	Vminimum	13.705
		Vmaximum	13.692
	Tmaximum	Vminimum	10.246
		Vmaximum	10.260

Verdict

Pass

4.2.3 Transmitter. Permitted range of operating frequencies

Limits

The width of the power spectrum envelope is $f_H - f_L$ for a given operating frequency. In equipment that allows adjustment or selection of different operating frequencies, the power envelope takes up different positions in the allowed band. The frequency range is determined by the Low value of f_L and the High value of f_H resulting from the adjustment of the equipment to the Low and High operating frequencies.

The occupied bandwidth (i.e. the bandwidth in which 99 % of the wanted emission is contained) and the necessary bandwidth of the transmitter shall fall within the assigned frequency band.

For all equipment the frequency range shall lie within the frequency band given by clause 4.2.2.4, table 2. For non-harmonized frequency bands the available frequency range may differ between national administrations.

Results

SISO Chain 1 (worst-case):

- **802.11 ac20:**

TEST CONDITIONS		Frequency at which -75 dBm/Hz occurs		Width of the Power Spectrum Envelope
		FL (MHz)	FH (MHz)	FH-FL (MHz)
Tnominal	Vnominal	5736.07460	5753.91870	17.8441
Tminimum	Vminimum	5736.07330	5753.91070	17.8374
	Vmaximum	5736.07330	5753.91870	17.8454
Tmaximum	Vminimum	5736.08130	5753.91070	17.8294
	Vmaximum	5736.07730	5753.91070	17.8334
Extreme frequencies (MHz)		5735.08130	5736.91870	17.83740

• **802.11 n40:**

TEST CONDITIONS		Frequency at which -75 dBm/Hz occurs		Width of the Power Spectrum Envelope
		FL (MHz)	FH (MHz)	FH-FL (MHz)
Tnominal	Vnominal	5736.72260	5773.27570	36.5531
Tminimum	Vminimum	5736.72070	5773.26500	36.5443
	Vmaximum	5736.72070	5773.27300	36.5523
Tmaximum	Vminimum	5736.72260	5773.27930	36.5567
	Vmaximum	5736.72260	5773.27130	36.5487
Extreme frequencies (MHz)		5736.72260	5773.27930	36.55670

• **802.11 ac80:**

TEST CONDITIONS		Frequency at which -75 dBm/Hz occurs		Width of the Power Spectrum Envelope
		FL (MHz)	FH (MHz)	FH-FL (MHz)
Tnominal	Vnominal	5736.72300	5813.21900	76.4960
Tminimum	Vminimum	5736.72100	5813.21400	76.4930
	Vmaximum	5736.72100	5813.23000	76.5090
Tmaximum	Vminimum	5736.73900	5813.21900	76.4800
	Vmaximum	5736.78700	5813.21900	76.4320
Extreme frequencies (MHz)		5736.78700	5736.23000	76.44300

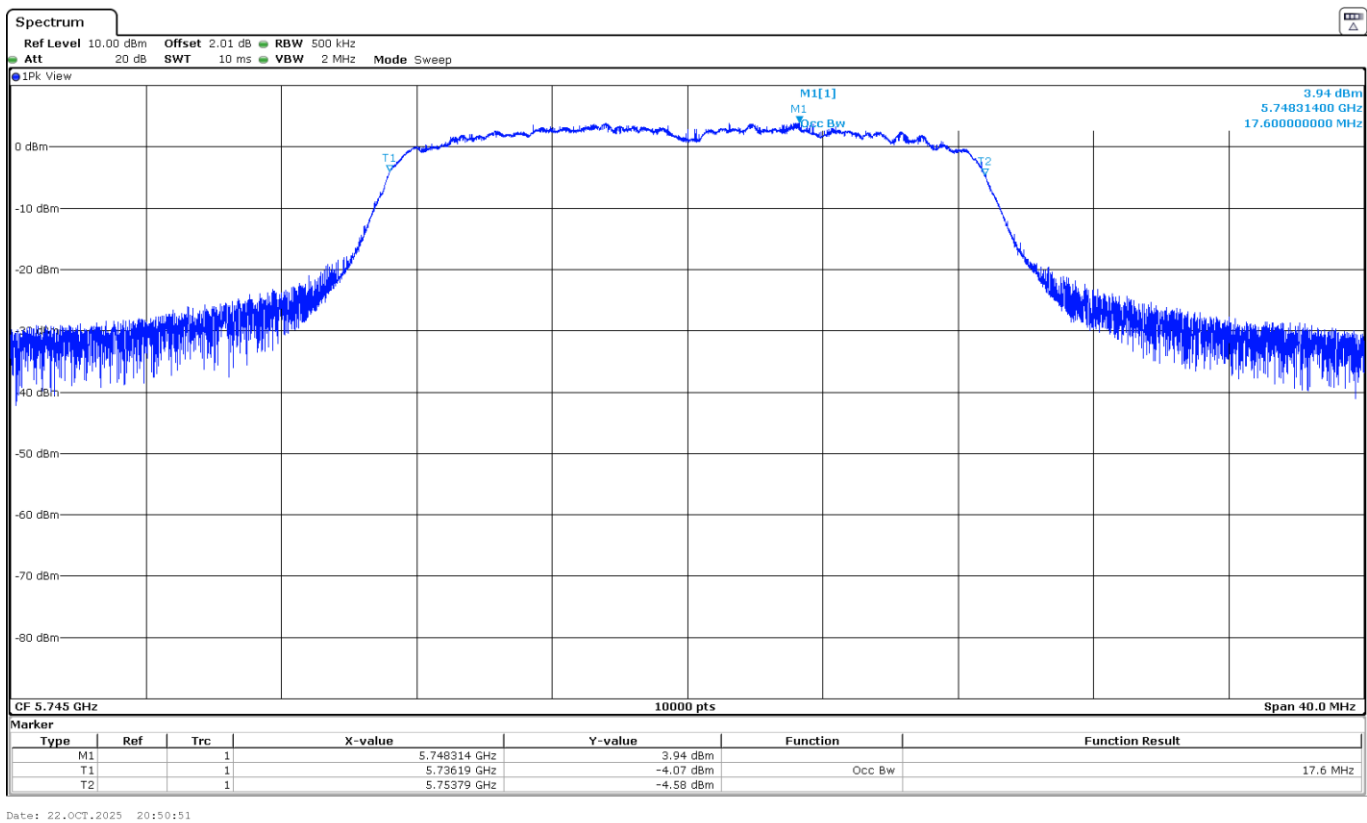
Verdict

Pass

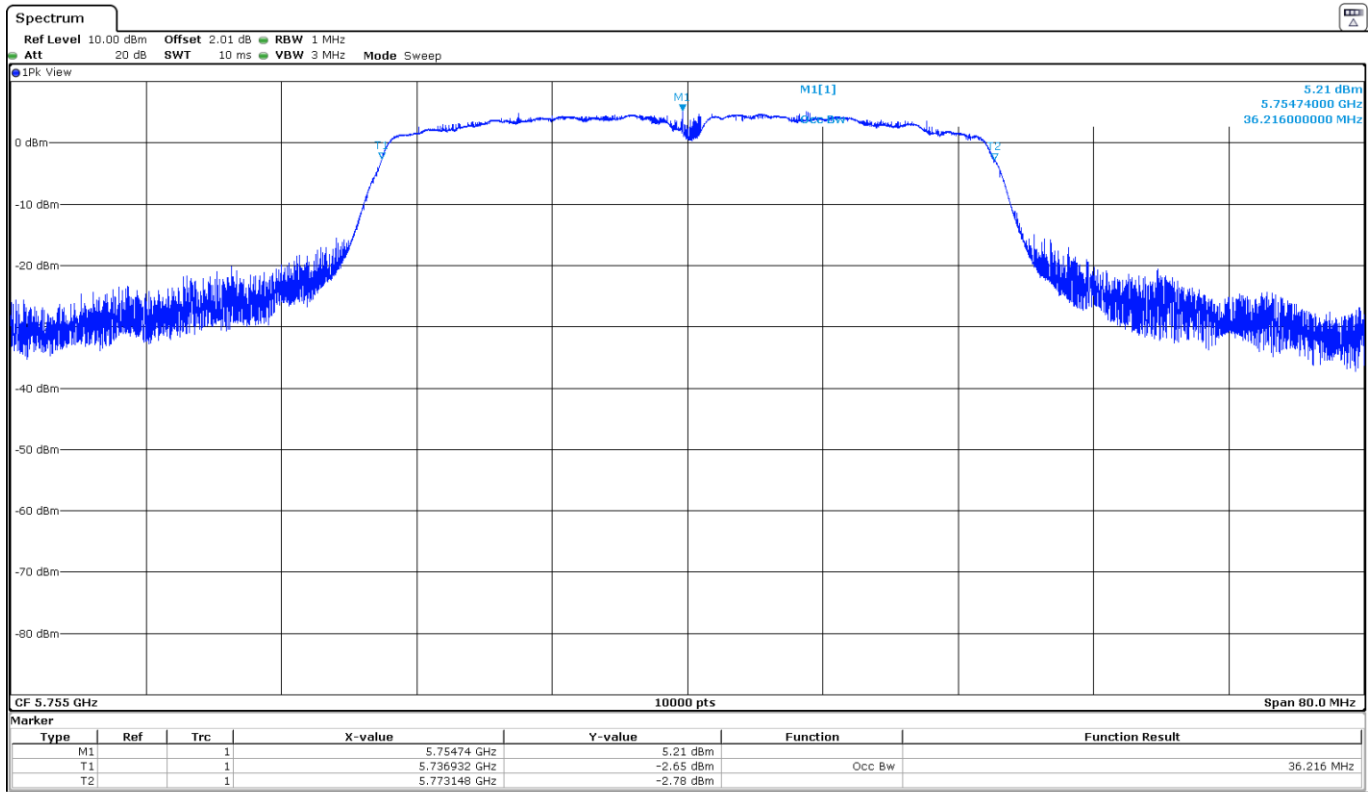
Attachments

Occupied Bandwidth

- 802.11 ac20:
- Low Channel:

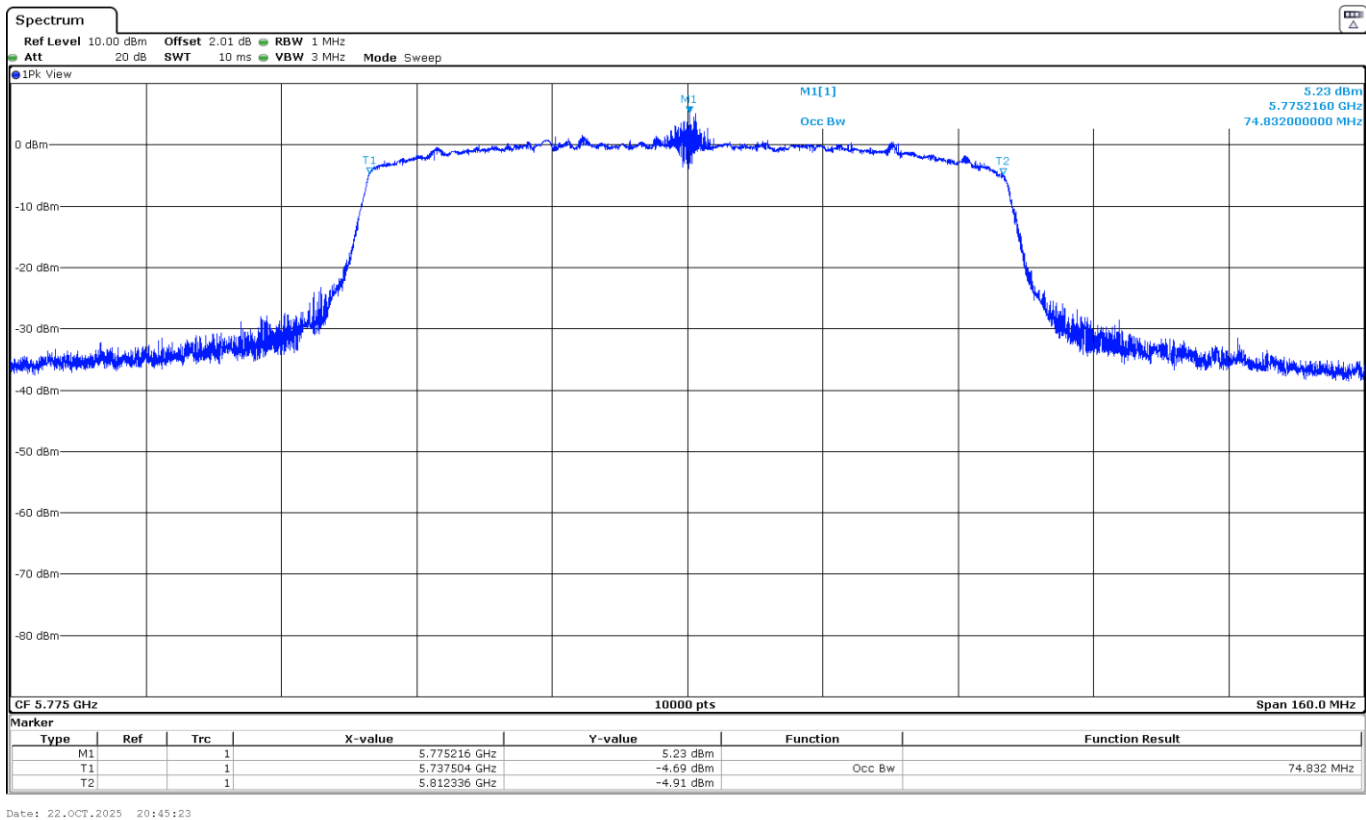


- 802.11 n40:
- Low Channel:



Date: 22.OCT.2025 20:41:40

- 802.11 ac80:
- Single Channel:



4.2.4 Transmitter. Unwanted emissions in the spurious domain

Limits

The power of any unwanted emission in the spurious domain, shall not exceed the following values given in the table:

State	47 to 74 MHz 87.5 to 108 MHz 174 to 230 MHz 470 to 862 MHz	Other frequencies below 1000 MHz	Frequencies above 1000 MHz
Operating	4 nW (-54 dBm)	250 nW (-36 dBm)	1 µW (-30 dBm)
Standby	2 nW (-57 dBm)	2 nW (-57 dBm)	20 nW (-47 dBm)

Results

- SISO Chain 1:**

The level of spurious emissions was measured as their effective radiated power when radiated by the cabinet.

Reported results below are for this worst-case mode.

Frequency range 25 MHz - 17 GHz:

Frequency (MHz)	QuasiPeak (dBm)	Limit (dBm)	Polarization
471.976563	-61.16	-54.00	H
491.537500	-60.98	-54.00	V
786.444531	-61.77	-54.00	H

Frequency range 17 GHz - 40 GHz:

The spurious frequencies detected do not depend on the operating channel.

No spurious frequencies at less than 10 dB below the limit.

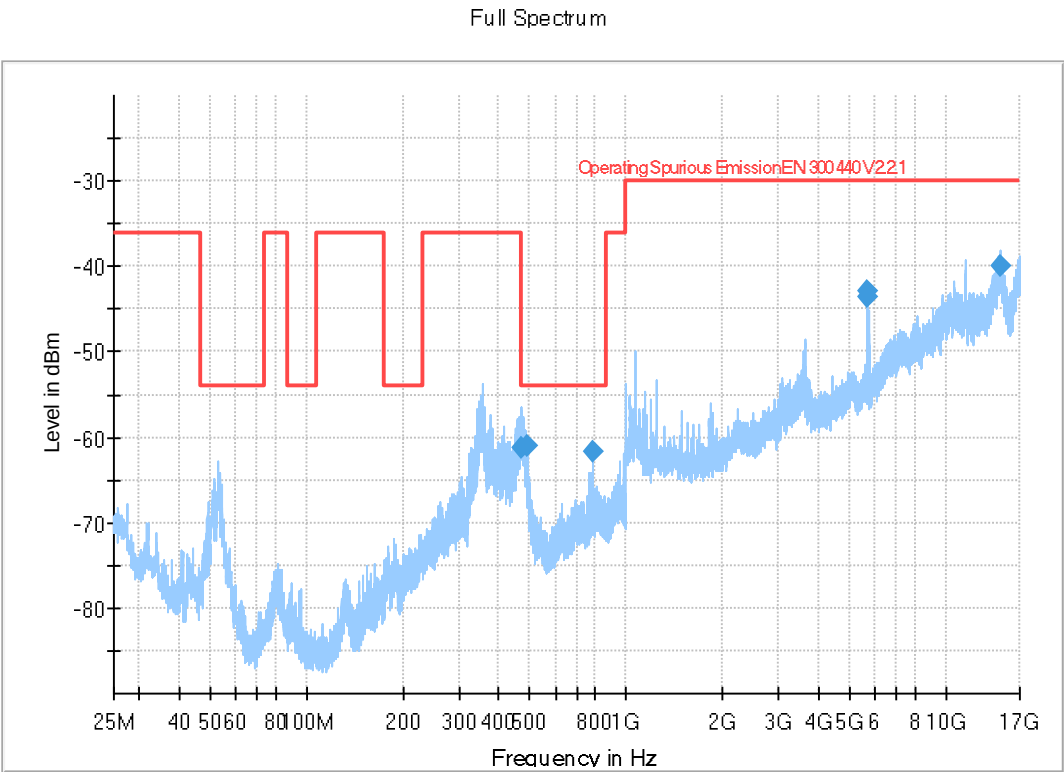
Verdict

Pass

Attachments

Frequency Range GHz = [0.025, 17] Modulation = 802.11ac HT20 (OFDM MCS0)
Frequency MHz = 5745.00000 Active Port = 1

Images:



Tables:

Spectrum Analyzer Parameters

Subrange	Step Size	Detectors	IF BW	Meas. Time	Preamp
25 MHz - 1 GHz	60 kHz	QPK	120 kHz	15 s	0 dB
1 GHz - 7 GHz	300 kHz	PK+	1 MHz	15 s	0 dB
7 GHz - 17 GHz	300 kHz	PK+	1 MHz	15 s	0 dB

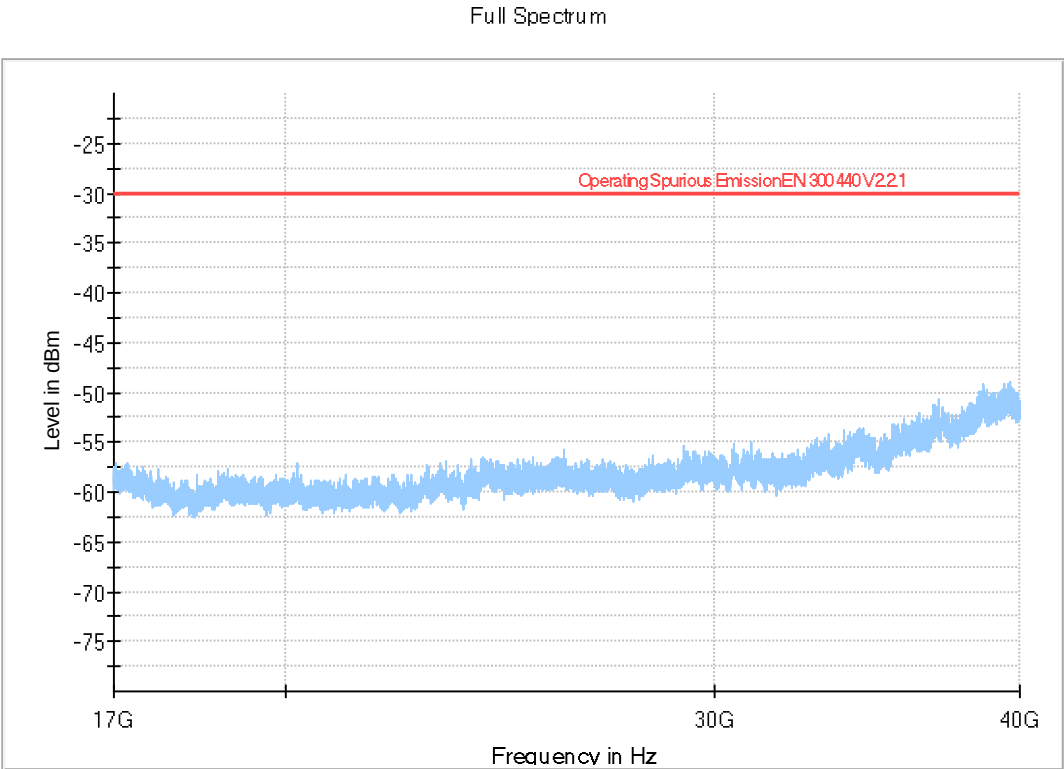
Frequency Range GHz = [17, 40]

Modulation = 802.11ac HT20 (OFDM MCS0)

Frequency MHz = The spurious frequencies detected do not depend on the operating channel.

Active Port = 1

Images:



Tables:
Spectrum Analyzer Parameters

Subrange	Step Size	Detectors	IF BW	Meas. Time	Preamp
17 GHz - 40 GHz	300 kHz	PK+	1 MHz	15 s	0 dB

- **SISO Chain 2:**

The level of spurious emissions was measured as their effective radiated power when radiated by the cabinet.

Reported results below are for this worst-case mode.

Frequency range 25 MHz - 17 GHz:

No spurious frequencies at less than 10 dB below the limit.

Frequency range 17 GHz - 40 GHz:

The spurious frequencies detected do not depend on the operating channel.

No spurious frequencies at less than 10 dB below the limit.

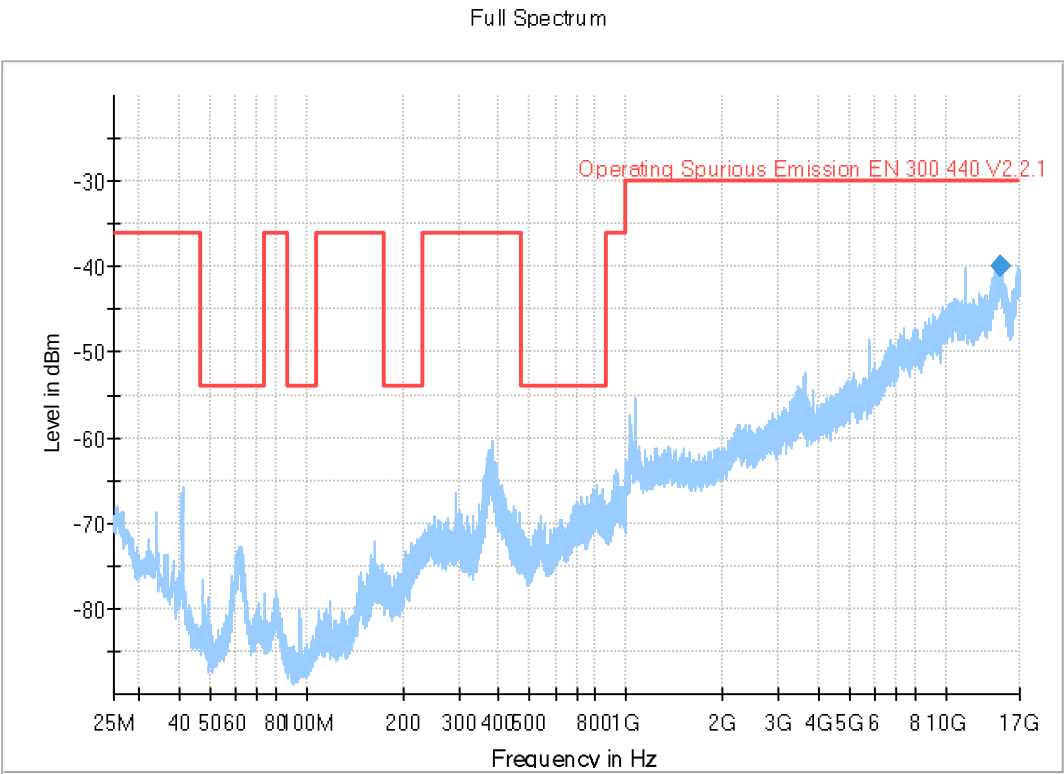
Verdict

Pass

Attachments

Frequency Range GHz = [0.025, 17] Modulation = 802.11ac HT20 (OFDM MCS0)
Frequency MHz = 5745.00000 Active Port = 2

Images:



Tables:

Spectrum Analyzer Parameters

Subrange	Step Size	Detectors	IF BW	Meas. Time	Preamp
25 MHz - 1 GHz	60 kHz	QPK	120 kHz	15 s	0 dB
1 GHz - 7 GHz	300 kHz	PK+	1 MHz	15 s	0 dB
7 GHz - 17 GHz	300 kHz	PK+	1 MHz	15 s	0 dB

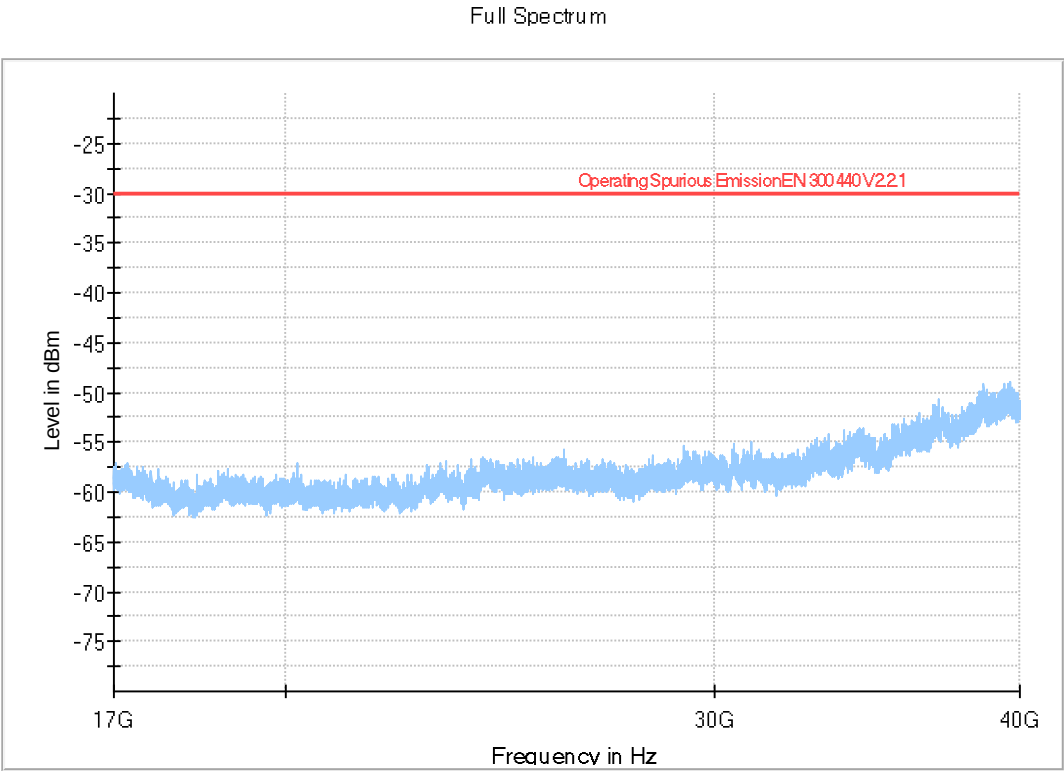
Frequency Range GHz = [17, 40]

Modulation = 802.11ac HT20 (OFDM MCS0)

Frequency MHz = The spurious frequencies detected do not depend on the operating channel.

Active Port = 2

Images:



Tables:

Spectrum Analyzer Parameters

Subrange	Step Size	Detectors	IF BW	Meas. Time	Preamp
17 GHz - 40 GHz	300 kHz	PK+	1 MHz	15 s	0 dB

• **MIMO Chain 1 & Chain 2:**

The level of spurious emissions was measured as their effective radiated power when radiated by the cabinet.
Reported results below are for this worst-case mode.

Frequency range 25 MHz - 17 GHz:

Spurious frequencies at less than 10 dB below the limit:

Frequency (MHz)	QuasiPeak (dBm)	Limit (dBm)	Margin (dB)	Pol
11488.000000	-35.49	-30.00	5.49	V

Frequency range 17 GHz - 40 GHz:

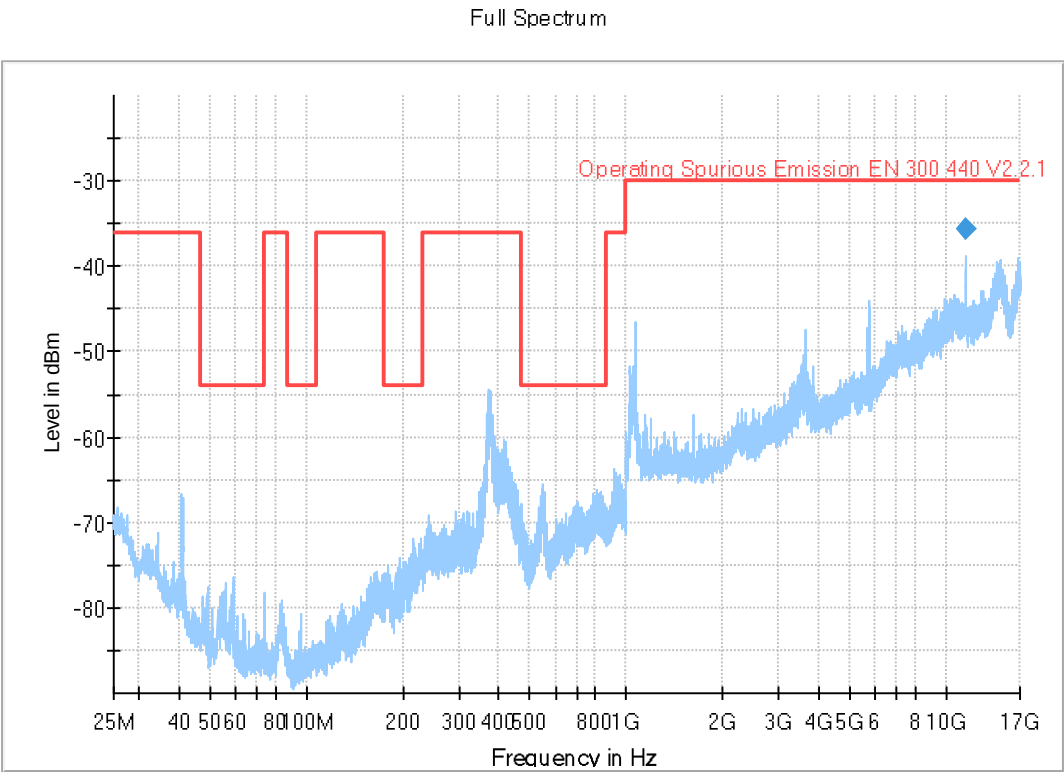
The spurious frequencies detected do not depend on the operating channel.
No spurious frequencies at less than 10 dB below the limit.

Verdict
Pass

Attachments

Frequency Range GHz = [0.025, 17] Modulation = 802.11ac HT20 (OFDM MCS0)
Frequency MHz = 5745.00000 Active Port = 2

Images:



Tables:
Spectrum Analyzer Parameters

Subrange	Step Size	Detectors	IF BW	Meas. Time	Preamp
25 MHz - 1 GHz	60 kHz	QPK	120 kHz	15 s	0 dB
1 GHz - 7 GHz	300 kHz	PK+	1 MHz	15 s	0 dB
7 GHz - 17 GHz	300 kHz	PK+	1 MHz	15 s	0 dB

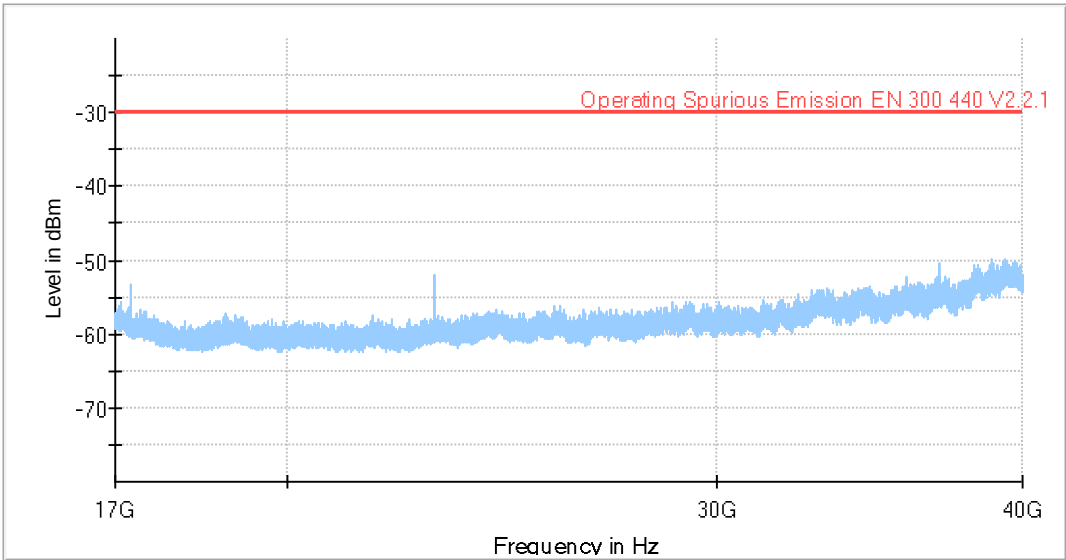
Frequency Range GHz = [17, 40]

Modulation = 802.11ac HT20 (OFDM MCS0)

Frequency MHz = The spurious frequencies detected do not depend on the operating channel.

Active Port = 2

Images:



Tables:
Spectrum Analyzer Parameters

Subrange	Step Size	Detectors	IF BW	Meas. Time	Preamp
17 GHz - 40 GHz	300 kHz	PK+	1 MHz	15 s	0 dB

4.2.5 Transmitter. Duty cycle

Limits

The following table defines the maximum duty cycle within a 1 hour period.

Frequency Bands	Duty Cycle	Application	Notes
2400 MHz to 2483.5 MHz	No restriction	Generic use	
2400 MHz to 2483.5 MHz	No restriction	Radiodetermination	
(a) 2446 MHz to 2454 MHz	No restriction	RFID	Limits shown in Annex G shall apply
(b) 2446 MHz to 2454 MHz	$\leq 15\%$	RFID	Limits shown in Annex G shall apply
5725 MHz to 5875 MHz	No restriction	Generic use	
9200 MHz to 9500 MHz	No restriction	Radiodetermination	
9500 MHz to 9975 MHz	No restriction	Radiodetermination:	
10.5 GHz to 10.6 GHz	No restriction	Radiodetermination	
13.4 GHz to 14.0 GHz	No restriction	Radiodetermination	
17.1 GHz to 17.3 GHz	DAA or equivalent techniques	Radiodetermination, limited to GBSAR detecting and movement and alert applications	Limits shown in Annex I shall apply
24.00 GHz to 24.25 GHz	No restriction	Generic use and for Radiodetermination	

NOTE: The spectrum ranges in some entries are not harmonized throughout all EU territory, specifically entries 4, 9, and 11 have been identified as such. Implementers are cautioned to refer to CEPT/ERC Recommendation 70-03 as well as current National Radio plans to verify acceptance within intended regions of use.

Results

• SISO Chain 1:

There is no restriction for duty cycle in the frequency band 5725 MHz to 5875 MHz for generic use.

The measurement was extrapolated to an observation interval of 1 hour:

Mode	Duty Cycle (%)
802.11 ac20	86.69
802.11 n40	86.95
802.11 ac80	72.54

- **SISO Chain 2:**

There is no restriction for duty cycle in the frequency band 5725 MHz to 5875 MHz for generic use.

The measurement was extrapolated to an observation interval of 1 hour:

Mode	Duty Cycle (%)
802.11 a20	94.63
802.11 ac40	90.64
802.11 ac80	80.12

- **MIMO Chain 1 & Chain 2:**

There is no restriction for duty cycle in the frequency band 5725 MHz to 5875 MHz for generic use.

The measurement was extrapolated to an observation interval of 1 hour:

Mode	Duty Cycle (%)
802.11 a20	95.02
802.11 ac40	82.43
802.11 ac80	70.68

Verdict

Pass

4.3.4 Receiver. Blocking or desensitization

Limits

The blocking level, for any frequency within the specified ranges, shall not be less than the values given in the following table, except at frequencies on which spurious responses are found.

Receiver category	Limit
1	-30 dBm + k
2	-45 dBm + k
3	-60 dBm + k

The correction factor, k, is as follows:

$$k = -20\log f - 10\log BW$$

Where:

- f is the frequency in GHz.
- BW is the occupied bandwidth in MHz.
- The factor k is limited within the following: $-40 \text{ dB} < k < 0 \text{ dB}$.

Results

- **SISO Chain 1:**

Receiver Declared Category: 2

- **Nominal Channel Bandwidth 1: 20 MHz**

Test performed over 802.11 ac20 modulation.

Nominal Receiving Frequency: 5745 MHz

$k = -28.1961$

Unwanted Signal Frequency (MHz)	Blocking level at DUT (dBm)	Limit (dBm)
5535	-28,065	-73.196
5955	-27,065	
5335	-26,065	
6155	-24,065	
4735	-24,065	
6755	-20,065	

- **Nominal Channel Bandwidth 2: 40 MHz**

Test performed over 802.11 n40 modulation.

Nominal Receiving Frequency: 5755 MHz

k = -31.2215

Unwanted Signal Frequency (MHz)	Blocking level at DUT (dBm)	Limit (dBm)
5335	-29,065	-76.222
6175	-29,065	
4935	-27,065	
6575	-21,065	
3735	-17,065	
7775	-13,065	

- **Nominal Channel Bandwidth 3: 80 MHz**

Test performed over 802.11 ac80 modulation.

Nominal Receiving Frequency: 5775 MHz

k = -34.26193964

Unwanted Signal Frequency (MHz)	Blocking level at DUT (dBm)	Limit (dBm)
4935	-27,065	-79.262
6615	-20,065	
4135	-21,065	
7415	-15,065	
1735	7,935	
9815	6,935	

Verdict

Pass

- **SISO Chain 2:**

Receiver Declared Category: 2

- **Nominal Channel Bandwidth 1: 20 MHz**

Test performed over 802.11 ac20 modulation.

Nominal Receiving Frequency: 5745 MHz

k = -28.1961

Unwanted Signal Frequency (MHz)	Blocking level at DUT (dBm)	Limit (dBm)
5535	-28.065	-73.19610062
5955	-27.065	
5335	-26.065	
6155	-24.065	
4735	-24.065	
6755	-20.065	

- **Nominal Channel Bandwidth 2: 40 MHz**

Test performed over 802.11 n40 modulation.

Nominal Receiving Frequency: 5755 MHz

k = -31.2215

Unwanted Signal Frequency (MHz)	Blocking level at DUT (dBm)	Limit (dBm)
5335	-29.065	-76.22150647
6175	-29.065	
4935	-27.065	
6575	-21.065	
3735	-17.065	
7775	-13.065	

- **Nominal Channel Bandwidth 3:** **80 MHz**

Test performed over 802.11 ac80 modulation.

Nominal Receiving Frequency: 5775 MHz

k = -34.26193964

Unwanted Signal Frequency (MHz)	Blocking level at DUT (dBm)	Limit (dBm)
4935	-27.065	-79.26193964
6615	-20.065	
4135	-21.065	
7415	-15.065	
1735	7.935	
9815	6.935	

Verdict

Pass

• **MIMO Chain 1 & Chain 2:**

Receiver Declared Category: 2

• **Nominal Channel Bandwidth 1: 20 MHz**

Test performed over 802.11 ac20 modulation.

Nominal Receiving Frequency: 5745 MHz

k = -28.1961

Unwanted Signal Frequency (MHz)	Blocking level at DUT (dBm)	Limit (dBm)
5535	-30.929	-73.19610062
5955	-28.929	
5335	-28.929	
6155	-24.929	
4735	-22.929	
6755	-13.929	

• **Nominal Channel Bandwidth 2: 40 MHz**

Test performed over 802.11 n40 modulation.

Nominal Receiving Frequency: 5755 MHz

k = -31.2215

Unwanted Signal Frequency (MHz)	Blocking level at DUT (dBm)	Limit (dBm)
5335	-28.929	-76.22150647
6175	-24.929	
4935	-24.929	
6575	-18.929	
3735	-3.929	
7775	-3.929	

- Nominal Channel Bandwidth 3: 80 MHz

Test performed over 802.11 ac80 modulation.

Nominal Receiving Frequency: 5775 MHz

k = -34.26193964

Unwanted Signal Frequency (MHz)	Blocking level at DUT (dBm)	Limit (dBm)
4935	-24.929	-79.26193964
6615	-14.929	
4135	-3.929	
7415	-4.929	
1735	-3.929	
9815	-3.929	

Verdict

Pass

4.3.5 Receiver. Spurious radiations

Limits

The power of any unwanted emission in the spurious domain, shall not exceed the following values given in the table:

State	47 to 74 MHz 87.5 to 108 MHz 174 to 230 MHz 470 to 862 MHz	Other frequencies below 1000 MHz	Frequencies above 1000 MHz
Operating	4 nW (-54 dBm)	250 nW (-36 dBm)	1 µW (-30 dBm)
Standby	2 nW (-57 dBm)	2 nW (-57 dBm)	20 nW (-47 dBm)

Results

- **SISO Chain 1:**

The level of spurious emissions was measured as their effective radiated power when radiated by the cabinet.

The spurious frequencies detected do not depend either on the operating channel or the modulation mode.

Frequency range 25 MHz - 1 GHz:

Spurious frequencies at less than 10 dB below the limit:

Frequency (MHz)	MaxPeak (dBm)	Limit (dBm)	Margin (dB)
27.955469	-70.96	-57.00	13.96
35.420313	-68.23	-57.00	11.23
54.859375	-83.49	-57.00	26.49
337.700781	-67.92	-57.00	10.92
462.013281	-54.53	-57.00	-2.47
786.444531	-62.25	-57.00	5.25

Frequency range 1 - 40 GHz:

No spurious frequencies at less than 10 dB below the limit.

Verdict

Pass

Attachments

Frequency Range GHz = [0.025, 40]

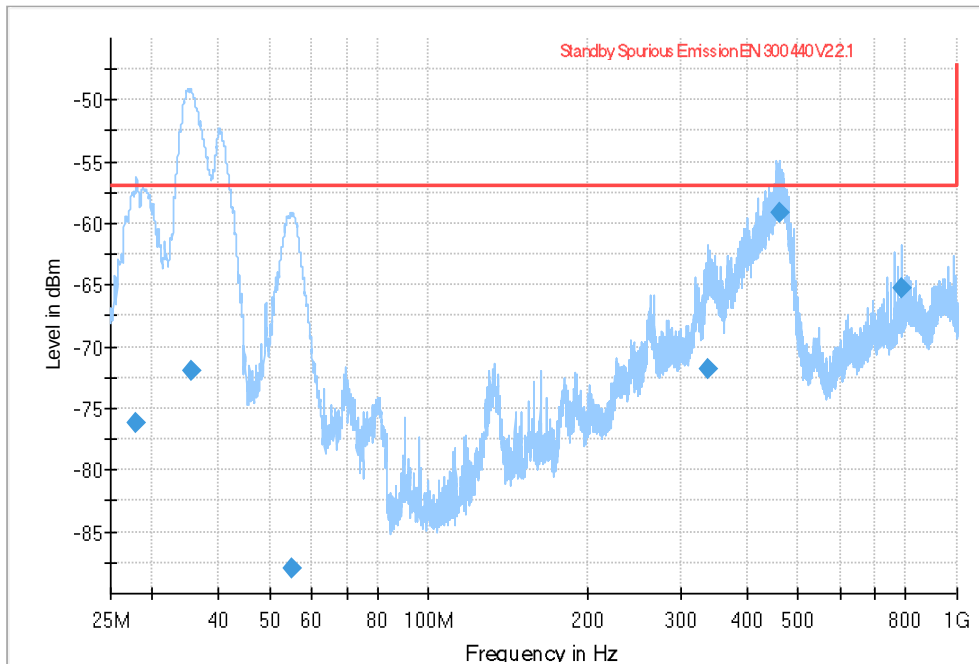
Modulation = The spurious frequencies detected do not depend on the modulation mode

Frequency MHz = The spurious frequencies detected do not depend on the operating channel

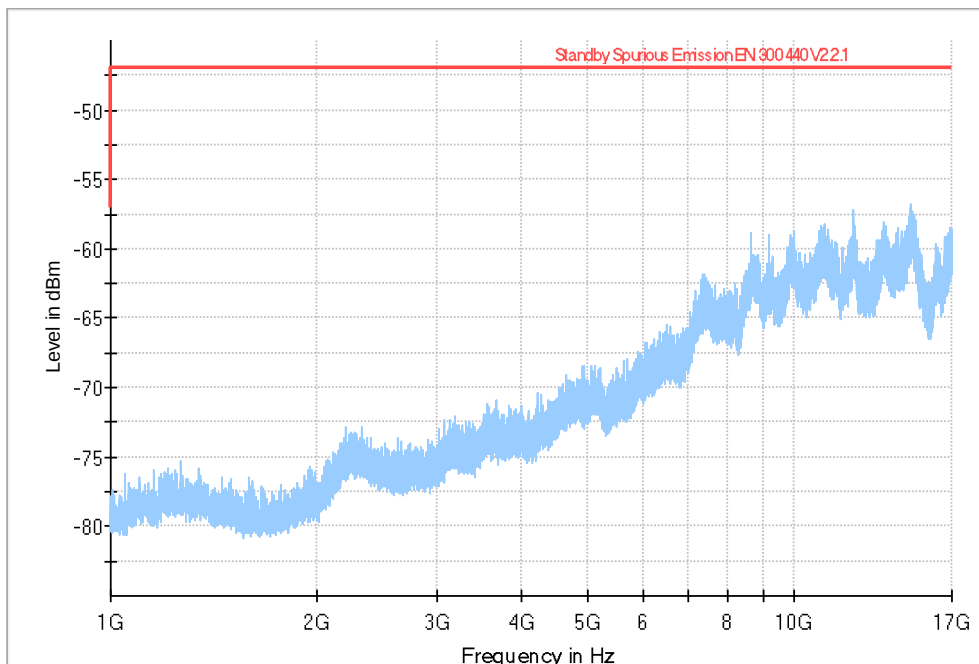
Active Port = 1

Images:

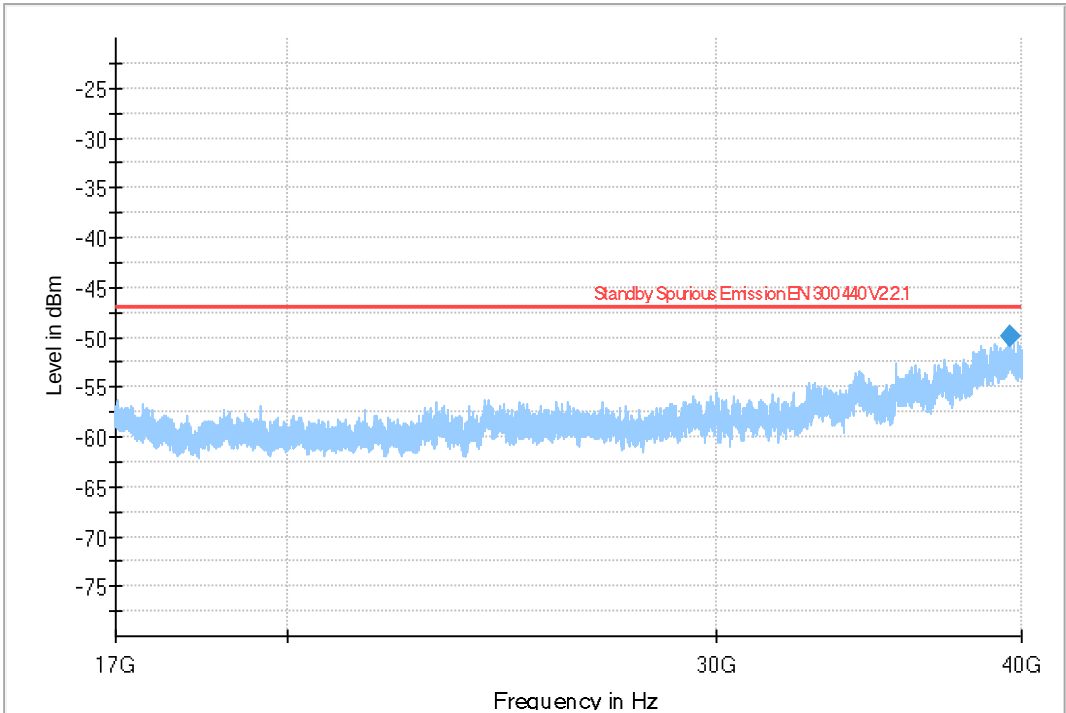
Full Spectrum



Full Spectrum



Full Spectrum



Tables:
Spectrum Analyzer Parameters

Subrange	Step Size	Detectors	IF BW	Meas. Time	Preamp
25 MHz - 1 GHz	30,469 kHz	PK+	100 kHz	0,03 s	0 dB
1 GHz - 17 GHz	246,154 kHz	PK+	1 MHz	1 s	0 dB
17 GHz - 40 GHz	353,846 kHz	PK+	1 MHz	1 s	0 dB

- **SISO Chain 2:**

The level of spurious emissions was measured as their effective radiated power when radiated by the cabinet.

The spurious frequencies detected do not depend either on the operating channel or the modulation mode.

Frequency range 25 MHz - 1 GHz:

Spurious frequencies at less than 10 dB below the limit:

Frequency (MHz)	MaxPeak (dBm)	Limit (dBm)	Margin (dB)
368.657031	-62.19	-57.00	5.19

Frequency range 1 - 40 GHz:

Spurious frequencies at less than 10 dB below the limit:

Frequency (MHz)	MaxPeak (dBm)	Limit (dBm)	Margin (dB)
39648.276923	-49.65	-47.00	2.65

Verdict

Pass

Attachments

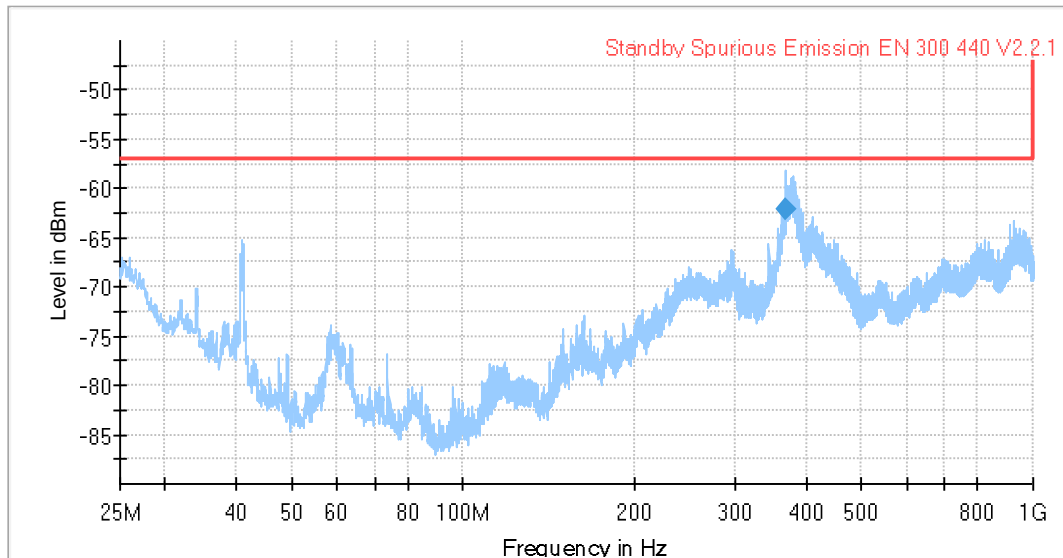
Frequency Range GHz = [0.025, 40]

Modulation = The spurious frequencies detected do not depend on the modulation mode

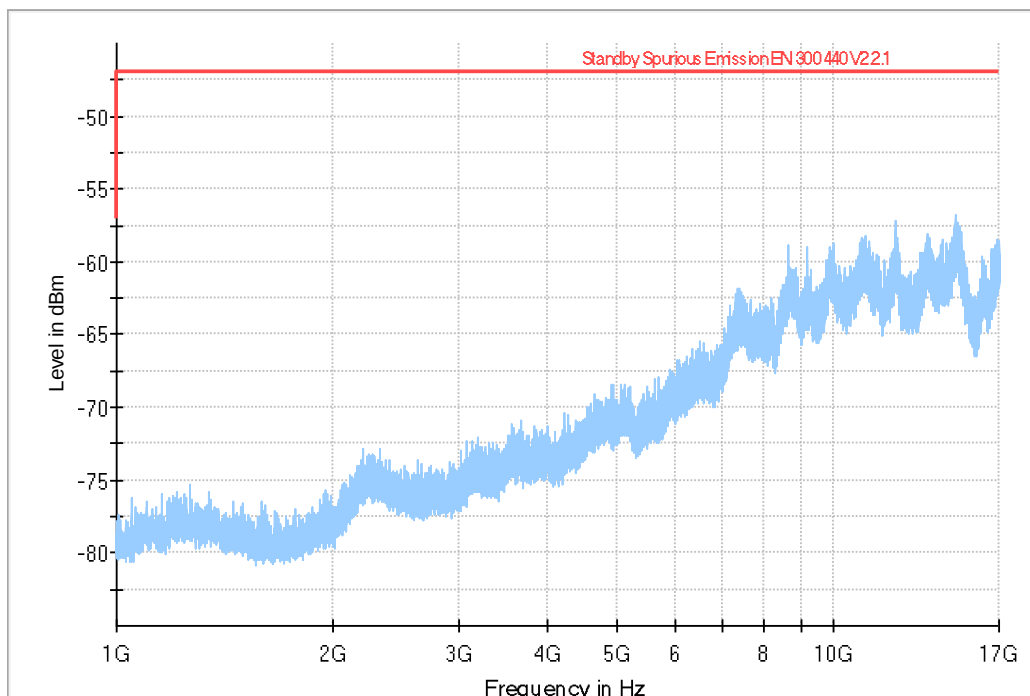
Frequency MHz = The spurious frequencies detected do not depend on the operating channel

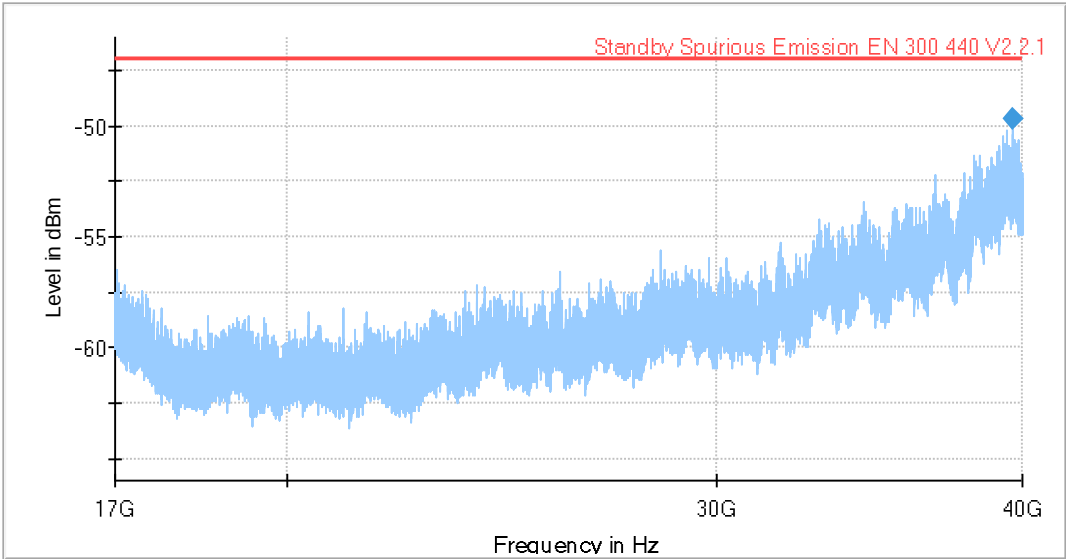
Active Port = 2

Images:



Full Spectrum





Tables:
Spectrum Analyzer Parameters

Subrange	Step Size	Detectors	IF BW	Meas. Time	Preamp
25 MHz - 1 GHz	30,469 kHz	PK+	100 kHz	0,03 s	0 dB
1 GHz - 17 GHz	246,154 kHz	PK+	1 MHz	1 s	0 dB
17 GHz - 40 GHz	353,846 kHz	PK+	1 MHz	1 s	0 dB

• **MIMO Chain 1 & Chain 2:**

The level of spurious emissions was measured as their effective radiated power when radiated by the cabinet.

The spurious frequencies detected do not depend either on the operating channel or the modulation mode.

Frequency range 25 MHz - 1 GHz:

Spurious frequencies at less than 10 dB below the limit:

Frequency (MHz)	MaxPeak (dBm)	Limit (dBm)	Margin (dB)
368.657031	-63.20	-57.00	6.20

Frequency range 1 - 40 GHz:

No spurious frequencies at less than 10 dB below the limit.

Verdict

Pass

Attachments

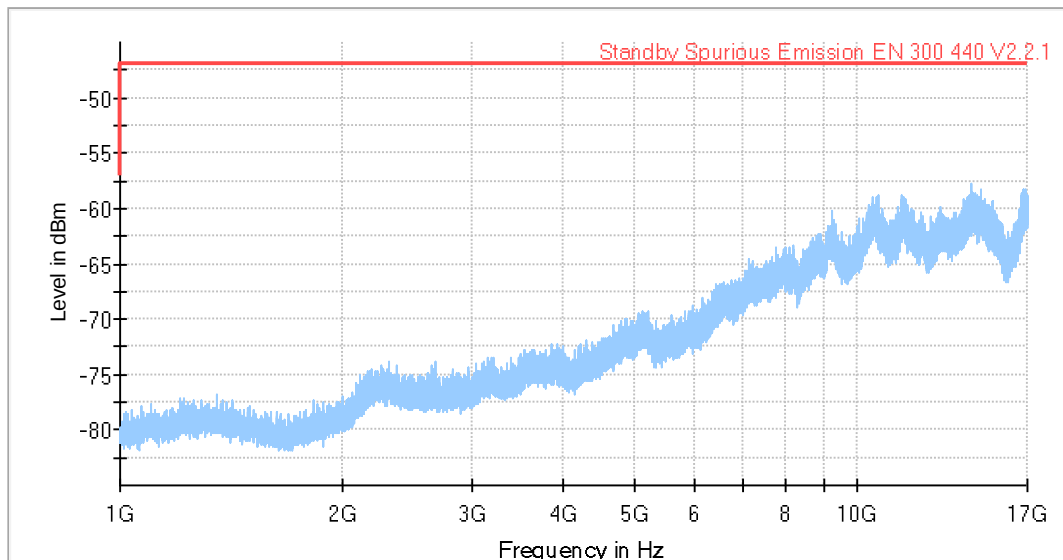
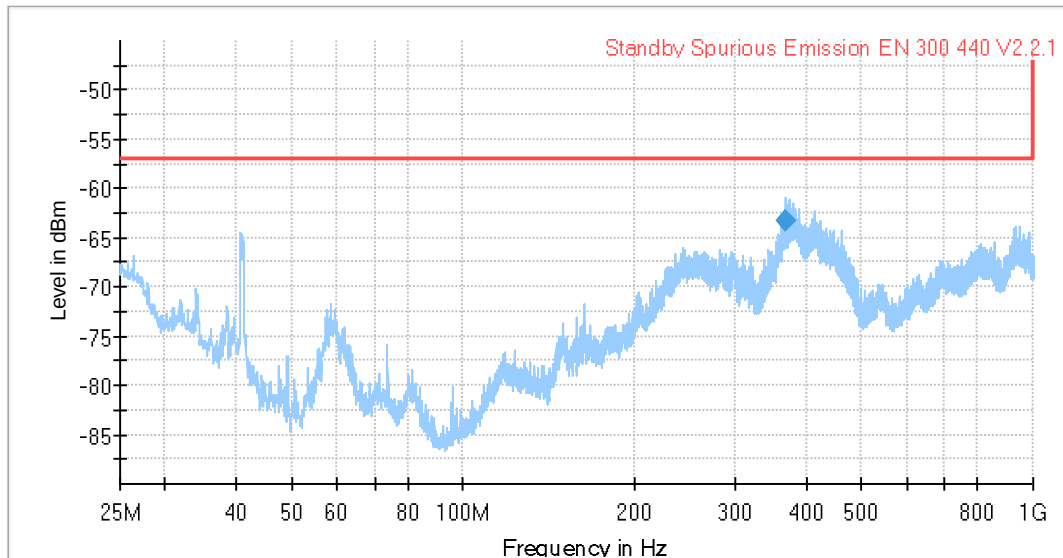
Frequency Range GHz = [0.025, 40]

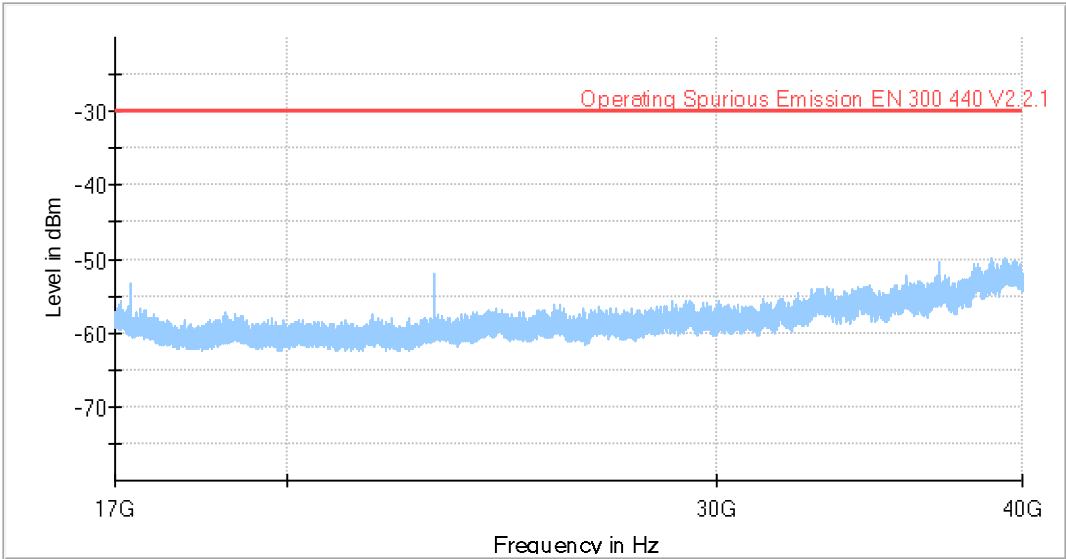
Modulation = The spurious frequencies detected do not depend on the modulation mode

Frequency MHz = The spurious frequencies detected do not depend on the operating channel

Active Port = 1 & 2

Images:



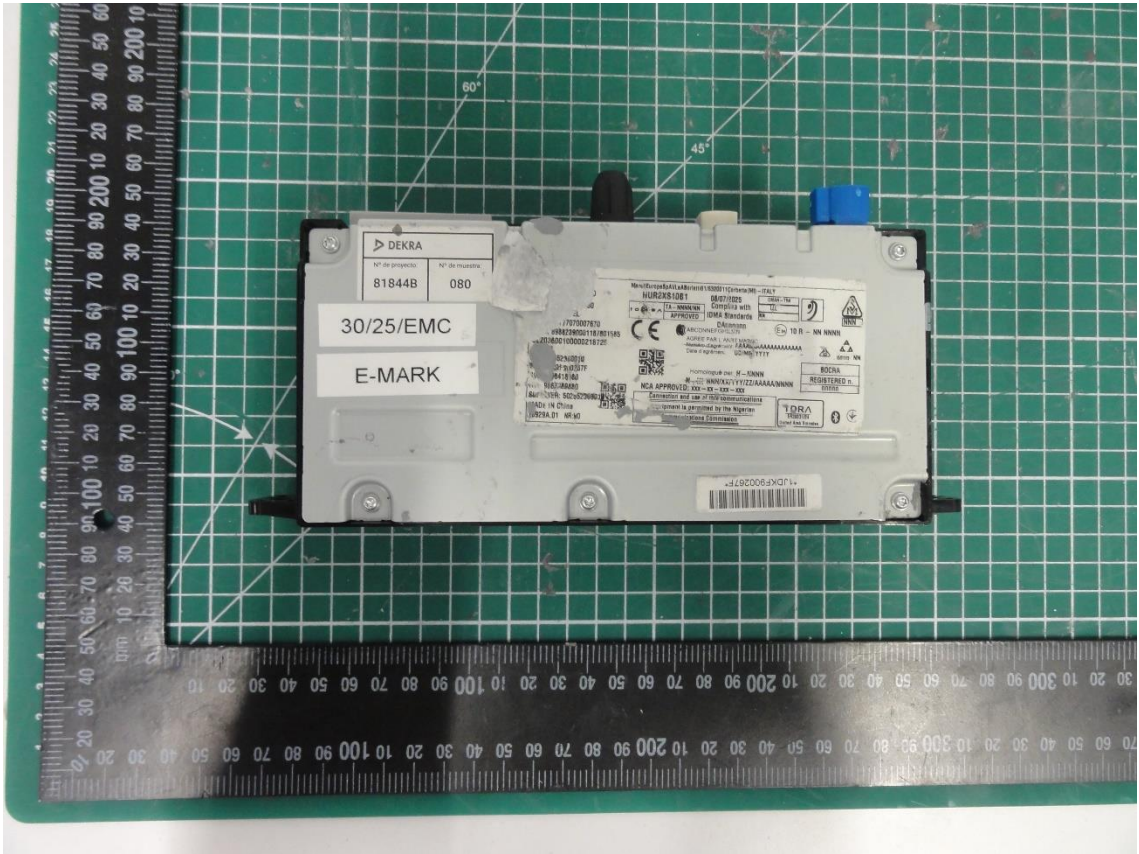


Tables:
Spectrum Analyzer Parameters

Subrange	Step Size	Detectors	IF BW	Meas. Time	Preamp
25 MHz - 1 GHz	30,469 kHz	PK+	100 kHz	0,03 s	0 dB
1 GHz - 17 GHz	246,154 kHz	PK+	1 MHz	1 s	0 dB
17 GHz - 40 GHz	353,846 kHz	PK+	1 MHz	1 s	0 dB

Appendix B: Photographs

EQUIPMENT VIEW FOR RADIATED TESTS



EQUIPMENT VIEW FOR CONDUCTED TESTS



