EN 300 328 V2.2.2
AS/NZS 4268:2017 A1

TEST REPORT

WiFi Module

MODEL NUMBER: VS19250

REPORT NUMBER: 4790425813-2

ISSUE DATE: June 1, 2022

Prepared for

ViewSonic Corporation
10 Pointe Dr., Suite 200, Brea, CA 92821, USA

Prepared by

UL Verification Services (Guangzhou) Co., Ltd, Song Shan Lake Branch

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Revision History

Rev.	Issue Date	Revisions	Revised By
V0	06/01/2022	Initial Issue	

Note: This is a copy report base on 4790081439-10 which is issued by UL Verification Services (Guangzhou) Co., Ltd, Song Shan Lake Branch on January 17, 2022. The customer wants to add a new applicant and change the model name but everything about the EUT remain unchanged, so we update the test report without any test. For other data, please refer to the original report.

Summary of Test Results			
Clause	Test Item	Limit/Requirements	Results
Transmitter Parameters			
4.3.1.2	RF Output Power	20 dBm	Pass
4.3.1.3	Duty Cycle, Tx-Sequence, Tx-Gap	The Duty Cycle ≤ the maximum value declared by the manufacturer. Tx-Sequence ≤ 5 ms Tx-gap ≤ 5 ms	N/A (Note 2)
4.3.1.4	Accumulated Transmit Time, Frequency Occupation and Hopping Sequence	Accumulated Transmit Time ≤ 400 ms Hopping Sequence(s) shall contain at least N hopping frequencies at all times, where N is either 15 or the result of 15 MHz divided by the minimum Hopping Frequency Separation in MHz, whichever is the greater. Frequency Occupation shall be occupied at least once within a period not exceeding four times the product of the dwell time and the number of hopping frequencies in use.	Pass
4.3.1.5	Hopping Frequency Separation	Greater than 100 kHz	Pass
4.3.1.6	Medium Utilization (MU) Factor	Less than 10 %	N/A (Note 2)
4.3.1.7	Adaptivity (Adaptive FHSS)	Refer to ETSI EN 300 328 V2.2.2 clause 4.3.1.7.2.2 & 4.3.1.7.2.3 & 4.3.1.7.4	N/A (Note 1)
4.3.1.8	Occupied Channel Bandwidth	Within the band given in table 1	Pass
4.3.1.9	Transmitter Unwanted Emissions in The Out-of-Band Domain	Refer to ETSI EN 300 328 V2.2.2 Figure 1	Pass
4.3.1.10	Transmitter Unwanted Emissions in The Spurious Domain	Refer to ETSI EN 300 328 V2.2.2 Table 4	Pass
Receiver Parameters			
4.3.1.11	Receiver Spurious Emissions	Refer to ETSI EN 300 328 V2.2.2 Table 5	Pass
4.3.1.12	Receiver Blocking	Refer to ETSI EN 300 328 V2.2.2 clause 4.3.1.12.4	Pass
4.3.1.13	Geo-location Capability	Refer to ETSI EN 300 328 V2.2.2 Clause 4.3.1.13.3	Not Support
Note:	1. N/A means not applicable. 2. These requirements do not apply for equipment with a declared RF Output power of less than 10 dBm e.i.r.p. or for equipment when operating in a mode where the RF Output power is less than 10 dBm e.i.r.p. 3. This requirement does not apply to adaptive FHSS equipment unless operating in a non-adaptive mode. 4. This test report is only published to and used by the applicant, and it is not for evidence purpose in China. 5. The measurement result for the sample received is <Pass> according to < EN 300 328 V2.2.2 and AS/NZS 4268:2017 A1 > when <Accuracy Method> decision rule is applied.		

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1. ATTESTATION OF TEST RESULTS

Applicant Information

Company Name:	ViewSonic Corporation
Address:	10 Pointe Dr., Suite 200, Brea, CA 92821, USA

Manufacturer Information

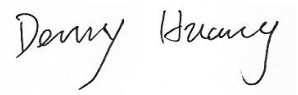
Company Name:	ViewSonic Corporation
Address:	10 Pointe Dr., Suite 200, Brea, CA 92821, USA

EUT Information

EUT Name:	WiFi Module
Model:	VS19250
Sample Received Date:	August 31, 2021
Sample Status:	Normal
Sample ID:	4175726
Date of Tested:	September 1, 2021 ~ September 24, 2021

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
ETSI EN 300 328 V2.2.2 (2019-07)	**PASS**
AS/NZS 4268:2017 A1	**PASS**

Prepared By:



Denny Huang
Project Engineer

Checked By:

Shawn Wen
Laboratory Leader

Approved By:

Stephen Guo
Laboratory Manager

2. TEST METHODOLOGY

All tests were performed in accordance with the procedures documented in ETSI EN 300 328 V2.2.2 (2019-07) and AS/NZS 4268:2017 A1.

3. FACILITIES AND ACCREDITATION

Accreditation Certificate	**A2LA (Certificate No.: 4102.01)** UL Verification Services (Guangzhou) Co., Ltd. Song Shan Lake Branch. has been assessed and proved to be in compliance with A2LA. **FCC (FCC Designation No.: CN1187)** UL Verification Services (Guangzhou) Co., Ltd. Song Shan Lake Branch. Has been recognized to perform compliance testing on equipment subject to the Commission's Declaration of Conformity (DoC) and Certification rules **ISED (Company No.: 21320)** UL Verification Services (Guangzhou) Co., Ltd. Song Shan Lake Branch. has been registered and fully described in a report filed with Industry Canada. The Company Number is 21320. **VCCI (Registration No.: G-20019, R-20004, C-20012 and T-20011)** UL Verification Services (Guangzhou) Co., Ltd. Song Shan Lake Branch. has been assessed and proved to be in compliance with VCCI, the Membership No. is 3793. Facility Name: Chamber D, the VCCI registration No. is G-20019 and R-20004 Shielding Room B, the VCCI registration No. is C-20012 and T-20011

Note: All tests measurement facilities use to collect the measurement data are located at Building 10, Innovation Technology Park, Song Shan Lake Hi tech Development Zone, Dongguan, 523808, China

4. CALIBRATION AND UNCERTAINTY

4.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations and is traceable to recognized national standards.

4.2. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

Test Case	Description	Limit	Uncertainties
5.3.2.2.1.1	RF Output Power	±1.5 dB	1.15
5.3.2.2.1.2	Duty Cycle	±5 %	0.03
	Tx Sequence	±5 %	0.03
	Tx Gap	±5 %	0.03
5.3.2.2.1.3	Medium Utilisation	±5 %	0.10
5.3.3.2.1	Power Spectral Density	±3 dB	1.21
5.3.4.2.1	Accumulated Dwell Time	±5 %	0.05
	Minimum Frequency Occupation Time	±5 %	0.15
5.3.5.2.1	Hopping Frequency Separation	-	0.24
5.3.8.2.1	Occupied Channel Bandwidth	±5 %	1.71
5.3.9..2.1	Out-of-band emissions	±3 dB	1.39
5.3.10.2.1	Transmitter unwanted emissions in the spurious domain		
	30 MHz to 1 GHz	±3 dB	0.64
	1 GHz to 12.75GHz	±3 dB	1.68
5.3.11.2.1	Receiver Spurious emission		
	30 MHz to 1 GHz	±3 dB	0.64
	1 GHz to 12.75GHz	±3 dB	1.68

Test Item	Uncertainty
Uncertainty for Radiation Emission test	4.62 dB (30 MHz-1 GHz)
	3.50 dB (1 GHz-18 GHz)
Note: This uncertainty represents an expanded uncertainty expressed at approximately the 95 % confidence level using a coverage factor of k=2.	

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

EUT Name	WiFi Module		
Model	VS19250		
Technology	Bluetooth – BR & EDR		
Transmit Frequency Range	2402 MHz ~ 2480 MHz		
Mode	Basic Rate	Enhanced Data Rate	
Modulation	GFSK	∏/4-DQPSK	8DPSK
Packet Type (Maximum Payload):	DH5	2DH5	3DH5
Data Rate	1 Mbps	2 Mbps	3 Mbps
Ratings	DC 5 V		
Wireless Module	AIC8800D		

5.2. RECEIVER CATEGORIES

EUT belong to	Receiver categories	Relevant receiver clauses
☐	1	Adaptive equipment with a maximum RF output power greater than 10 dBm e.i.r.p.
☒	2	Non-adaptive equipment with a Medium Utilization (MU) factor greater than 1 % and less than or equal to 10 % or equipment (adaptive or non-adaptive) with a maximum RF output power greater than 0 dBm e.i.r.p. and less than or equal to 10 dBm e.i.r.p.
☐	3	non-adaptive equipment with a maximum Medium Utilization (MU) factor of 1 % (irrespective of the maximum RF output power); or equipment (adaptive or non-adaptive) with a maximum RF output power of 0 dBm e.i.r.p.

5.3. CHANNEL LIST

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	2402	20	2422	40	2442	60	2462
1	2403	21	2423	41	2443	61	2463
2	2404	22	2424	42	2444	62	2464
3	2405	23	2425	43	2445	63	2465
4	2406	24	2426	44	2446	64	2466
5	2407	25	2427	45	2447	65	2467
6	2408	26	2428	46	2448	66	2468
7	2409	27	2429	47	2449	67	2469
8	2410	28	2430	48	2450	68	2470
9	2411	29	2431	49	2451	69	2471
10	2412	30	2432	50	2452	70	2472
11	2413	31	2433	51	2453	71	2473
12	2414	32	2434	52	2454	72	2474
13	2415	33	2435	53	2455	73	2475
14	2416	34	2436	54	2456	74	2476
15	2417	35	2437	55	2457	75	2477
16	2418	36	2438	56	2458	76	2478
17	2419	37	2439	57	2459	77	2479
18	2420	38	2440	58	2460	78	2480
19	2421	39	2441	59	2461	/	/

5.4. MAXIMUM AVERAGE EIRP

Test Mode	Frequency (MHz)	Channel Number	Max AVG EIRP (dBm)
GFSK	2402 ~ 2480	0-78[79]	7.29
8DPSK	2402 ~ 2480	0-78[79]	1.99

5.5. TEST CHANNEL CONFIGURATION

Test Mode	Test Channel	Frequency
GFSK	CH 0(Low Channel), CH 39(MID Channel), CH 78(High Channel)	2402 MHz, 2441 MHz, 2480 MHz
8DPSK	CH 0(Low Channel), CH 39(MID Channel), CH 78(High Channel)	2402 MHz, 2441 MHz, 2480 MHz
GFSK	Hopping	2402 MHz ~ 2480 MHz
8DPSK	Hopping	2402 MHz ~ 2480 MHz

5.6. PACKET TYPE CONFIGURATION

Test Mode	Packet Type	Setting(Packet Length)
GFSK	DH1	27
	DH3	183
	DH5	339
∏/4-DQPSK	2-DH1	54
	2-DH3	367
	2-DH5	679
8DPSK	3-DH1	83
	3-DH3	552
	3-DH5	1021

5.7. WORST-CASE CONFIGURATIONS

Bluetooth Mode	Modulation Technology	Modulation Type	Data Rate (Mbps)
BR	FHSS	GFSK	1Mbit/s
EDR	FHSS	8DPSK	3Mbit/s

Note: Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates.

5.8. THE WORSE CASE POWER SETTING PARAMETER

The Worse Case Power Setting Parameter under 2400 ~ 2483.5MHz Band				
Test Software		SecureCRT		
Modulation Type	Test Channel	Test Channel		
		CH 00	CH 39	CH 78
GFSK	1	Default	Default	Default
8DPSK	1	Default	Default	Default

5.9. DESCRIPTION OF AVAILABLE ANTENNAS

Antenna	Frequency (MHz)	Antenna Type	MAX Antenna Gain (dBi)
1	2402 ~ 2480	PCB	3.15

Test Mode	Transmit and Receive Mode	Description
GFSK	☒1TX, 1RX	Antenna 1 can be used as transmitting/receiving antenna.
8DPSK	☒1TX, 1RX	Antenna 1 can be used as transmitting/receiving antenna.

Note: The value of the antenna gain was declared by customer.

5.10. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Item	Equipment	Brand Name	Model Name	Remarks
1	Laptop	Lenovo	XIAOXIN 5000	/
2	Main Board	/	/	/
3	Serial to USB Board	/	/	/
3	AC Power Adapter	/	/	

I/O CABLES

Cable No	Port	Connector Type	Cable Type	Cable Length(m)	Remarks
1	USB	/	Unshielded	1.0	/

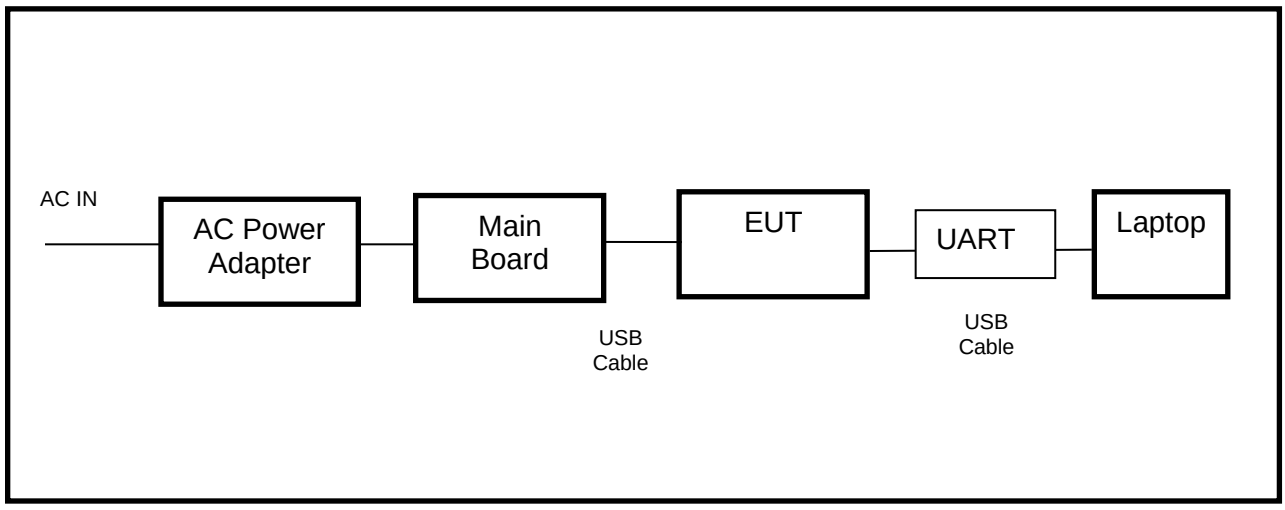
ACCESSORIES

Item	Accessory	Brand Name	Model Name	Description
/	/	/	/	/

TEST SETUP

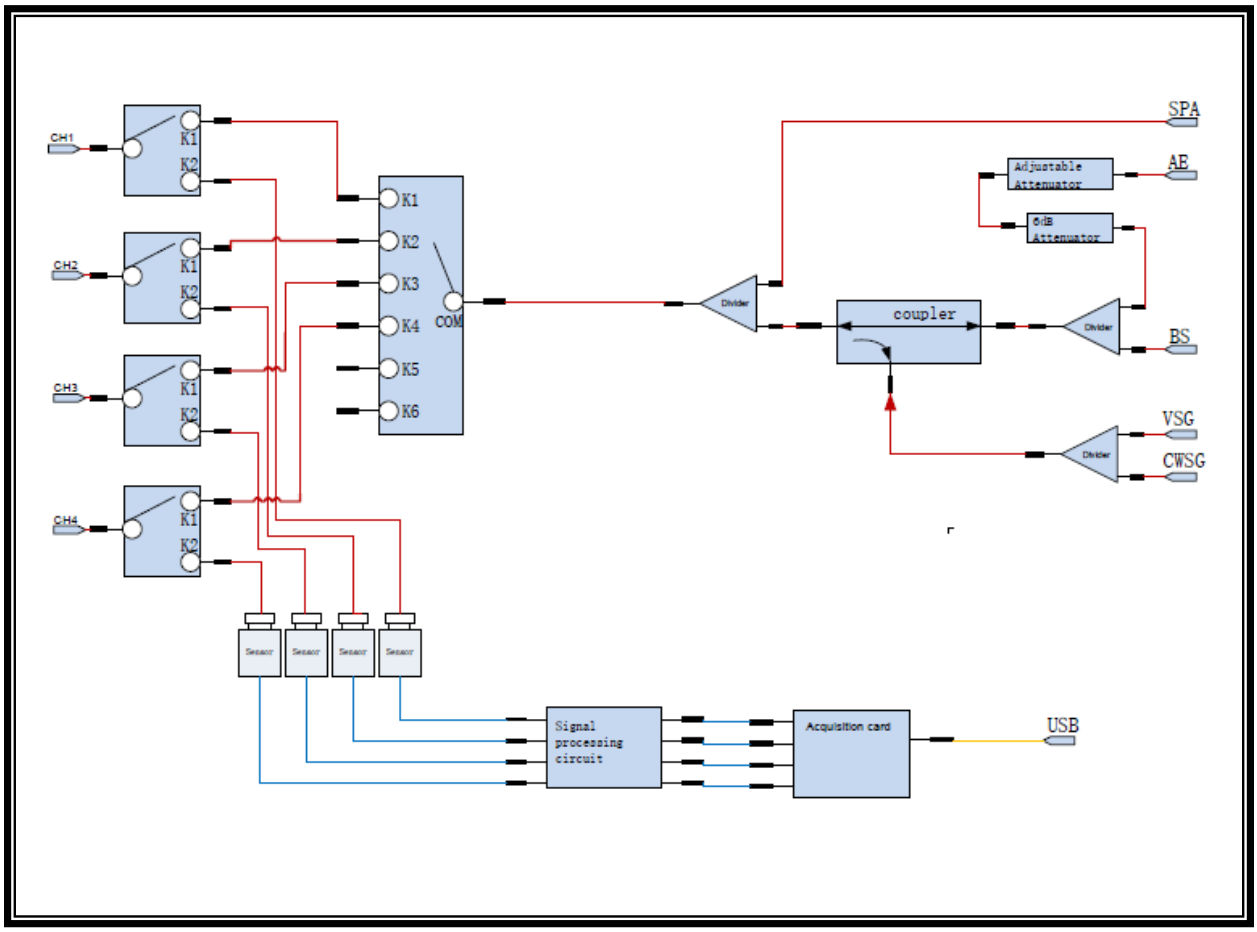
The EUT can work in engineering mode with a software through a Laptop.

SETUP DIAGRAM FOR TESTS



5.11. TEST SYSTEM CONFIGURATION

Tonscend SRD Test System



5.12. DESCRIPTION OF THE EQUIPMENT UNDER TESTED

(INFORMATION AS REQUIRED BY EN 300 328 V2.2.2, CLAUSE 5.4.1)

a)	**Modulation Type**		
	☒ FHSS		
	☐ non-FHSS		
b)	FHSS Equipment Description		
	The Number of Hopping Frequencies	The Maximum	79
		The Minimum	20
	The (average) dwell time	371.850ms	
c)	**Adaptive / Non-adaptive Equipment**		
	☐ Non-adaptive Equipment		
	☒ Adaptive Equipment Without the Possibility to Switch to A Non-adaptive Mode		
	☐ Adaptive Equipment Which can also operate in A Non-adaptive Mode		
d)	**Adaptive Equipment Description**		
	The maximum Channel Occupancy Time implemented by the equipment	/	
	☒ The equipment has implemented an LBT mechanism		
	☐ The equipment has implemented a DAA mechanism		
	☐ The equipment can operate in more than one adaptive mode		
e)	**The different transmit operating modes**		
	☒ Operating mode 1 (single antenna)	☒ Equipment with only one antenna	
		☐ Equipment with two diversity antennas but only one antenna active at any moment in time	
		☐ Smart Antenna Systems with two or more antennas, but operating in a (legacy) mode where only one antenna is used (e.g. IEEE 802.11™ legacy mode in smart antenna systems)	
	☐ Operating mode 2: Smart Antenna Systems - Multiple Antennas without beam forming	☐ Single spatial stream/Standard throughput/(e.g. IEEE 802.11™ legacy mode)	
		☐ High Throughput (> 1 spatial stream) using Nominal Channel Bandwidth 1	
		☐ High Throughput (> 1 spatial stream) using Nominal Channel Bandwidth 2	
	☐ Operating mode 3: Smart Antenna Systems - Multiple Antennas with beam forming	☐ Single spatial stream/Standard throughput (e.g. IEEE 802.11™ legacy mode)	
		☐ High Throughput (> 1 spatial stream) using Nominal Channel Bandwidth 1	
		☐ High Throughput (> 1 spatial stream) using Nominal Channel Bandwidth 2	
f)	**In case of Smart Antenna Systems**		
	The number of Receive chains		1
	The number of Transmit chains		1
	In case of beam forming, the maximum (additional) beam forming gain:		/
g)	**Operating Frequency Range(s) of the equipment**		
	Operating Frequency Range	2402 MHz to 2480 MHz	
h)	**Nominal Channel Bandwidth(s)**		
	Occupied Channel Bandwidth	1.2235MHz	

i)	**Type of Equipment**						
	☒ Stand-Alone						
	☐ Plug-in radio Equipment						
	☐ Combined Equipment						
j)	**The extreme operating conditions that apply to the equipment**						
	Operating temperature range	0 °C to 40 °C					
k)	**The intended combination(s) of the radio equipment power settings and one or more antenna assemblies and their corresponding e.i.r.p levels**						
	Antenna Type	☒ Integral Antenna	Antenna Gain	3.15 dBi			
		☐ Dedicated Antennas (equipment with antenna connector)	☐ Single power level with corresponding antenna(s)	Gain			
			☐ Multiple power settings and corresponding antenna(s)	Power Level 1			
				Power Level 2			
				Power Level 3			
l)	**The nominal voltages of the stand-alone radio equipment or the nominal voltages of the combined (host) equipment or test jig in case of plug-in devices:**						
	Details provided are for the	☒ Testing of stand-alone equipment					
		☐ Combined equipment					
		☐ Test jig					
	Supply Voltage	☐ AC mains	State AC voltage				
		☒ DC	State DC voltage	☐ Internal Power Supply			
				☐ External Power Supply or AC/DC adapter			
				☐ Battery			
				☒ Other	DC 5 V		
m)	**The equipment type**						
	☒ Bluetooth®						
	☐ IEEE 802.11™ [i.3]						
	☐ Proprietary						
n)	**Geo-location capability supported by the equipment**	☐ Yes ☐ The geographical location determined by the equipment as defined in clause 4.3.1.13.2 or clause 4.3.2.12.2 is not accessible to the user.					
		☒ No					

6. MEASURING INSTRUMENT AND SOFTWARE USED

Tonsend RF Test System					
Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Due. Date
Wideband Radio Communication Tester	R&S	CMW500	155523	Nov.20,2020	Nov.19,2021
PXA Signal Analyzer	Keysight	N9030A	MY55410512	Nov.20,2020	Nov.19,2021
MXG Vector Signal Generator	Keysight	N5182B	MY56200284	Nov.20,2020	Nov.19,2021
MXG Vector Signal Generator	Keysight	N5172B	MY56200301	Nov.20,2020	Nov.19,2021

Software			
Description	Manufacturer	Name	Version
Tonsend SRD Test System	Tonsend	JS1120-3 RF Test System	2.6.77.0518

RSE Test System					
Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Due. Date
Spectrum Analyzer	R&S	FSV40	101117	Nov.20,2020	Nov.19,2021
Trilog broadband antenna	Schwarzbeck	VULB9163	01061	Feb.28,2020	Feb.28,2023
Horn Antenna	ETS-Lindgren	3117	00213191	Feb.28,2020	Feb.28,2023
Preamplifier	TDK	PA-02-001-3000	TRS-305-00067	Nov.12,2020	Nov.11,2021
Preamplifier	TDK	PA-02-0118	TRS-305-00067	Nov.20,2020	Nov.19,2021
High Gain Horn Antenna	Schwarzbeck	BBHA-9170	697	July 20, 2021	July 19, 2024
Preamplifier	TDK	PA-02-2	TRS-307-00002	Nov.12,2020	Nov.11,2021
Preamplifier	TDK	PA-02-3	TRS-308-00002	Nov.12,2020	Nov.11,2021
Band Reject Filter	Wainwright	WRCJV8-2350-2400-2483.5-2533.5-40SS	4	Nov.12,2020	Nov.11,2021
Highpass Filter	Wainwright	WHKX10-2700-3000-1800-40SS	24	Nov.12,2020	Nov.11,2021

Software			
Description	Manufacturer	Name	Version
For TDK RSE Test System	TDK	TDK Emission lab	V10.81

7. TEST PROCEDURES AND RESULTS

7.1. NORMAL AND EXTREME CONDITIONS

LIMITS

None; for reporting purposes only.

RESULTS

	Normal Test Conditions	Extreme Test Conditions
Relative Humidity	45% ~ 55%	N/A
Atmospheric Pressure	100 kPa ~ 102 kPa	N/A
Temperature	T_{nom} (Normal Temperature): 22 °C ~ 28 °C	LT (Low Temperature): 0 °C
		HT (High Temperature): 40 °C
Supply Voltage	V_{nom} (Normal Voltage): DC 5 V	N/A
		N/A

7.2. OCCUPIED CHANNEL BANDWIDTH

LIMITS

OCCUPIED CHANNEL BANDWIDTH		
Condition		Limit
All types of equipment		Each hopping frequency shall be within the 2400 to 2483.5 MHz band
Additional requirement	For non-adaptive FHSS equipment with e.i.r.p. greater than 10 dBm	Each hopping frequency shall be less than 5 MHz

TEST PROCEDURE

Refer to ETSI EN 300 328 V2.2.2 (2019-07) clause 5.4.7

Measurement	
☒Conducted measurement	☐Radiated measurement

Connect the UUT to the spectrum analyser and use the following settings:

Center Frequency	The center frequency of the channel under test
Frequency Span	2 × Nominal Channel Bandwidth
Detector	RMS
RBW	~ 1 % of the span without going below 1 %
VBW	3 × RBW
Trace	Max hold
Sweep Time	1s

TEST ENVIRONMENT

Temperature	27.3 °C	Relative Humidity	54.4 %
Atmosphere Pressure	101 kPa	Test Voltage	DC 5 V

RESULTS

Please refer to appendix B.

7.3. RF OUTPUT POWER

LIMIT

RF OUTPUT POWER	
Condition	Limit
☐ Non-adaptive Equipment	For Non-adaptive FHSS equipment, the manufacturer may have declared a reduced RF Output Power (see clause 5.4.1 m)) and associated Duty Cycle (see clause 5.4.1 e)) that will ensure that the equipment meets the requirement for the Medium Utilization (MU) factor further described in clause 4.3.1.6. This is verified by the conformance test referred to in clause 4.3.1.6.4. For non-adaptive FHSS equipment, where the manufacturer has declared an RF output power lower than 20 dBm e.i.r.p., the RF output power shall be equal to or less than that declared value.
☒ Adaptive Equipment	FHSS equipment shall be equal to or less than 20 dBm.

TEST PROCEDURE

Refer to ETSI EN 300 328 V2.2.2 (2019-07) Clause 5.4.2

The power sensor was used for power measurement, and it use a fast power sensor with a minimum sensitivity of -40 dBm and capable of minimum 1 MS/s.

The test software was used to control the power detector and the sampling unit.

For adaptive equipment, the measurement duration shall be long enough to ensure a minimum number of bursts (at least 10) are captured.

Measurement	
☒Conducted measurement	☐Radiated measurement

CALCULATIONS

Add the (stated) antenna assembly gain G in dBi of the individual antenna.
• In case of smart antenna systems operating in mode with beamforming (see clause 5.3.2.2.4), add the additional beamforming gain Y in dB.
• If more than one antenna assembly is intended for this power setting, the maximum overall antenna gain (G or G + Y) shall be used.
• The RF Output Power (Pout) shall be calculated using the formula below:

$$P_{out} = A + G + Y$$

TEST ENVIRONMENT

Temperature	27.3 °C	Relative Humidity	54.4 %
Atmosphere Pressure	101 kPa	Test Voltage	DC 5 V

RESULTS

Please refer to appendix A.

7.4. ACCUMULATED TRANSMIT TIME, FREQUENCY OCCUPATION AND HOPPING SEQUENCE

LIMIT

DWELL TIME		
Condition	Limit	
☐ Non-adaptive frequency hopping systems	Shall not be greater than 15 ms within any observation period of 15 ms multiplied by the minimum number of hopping frequencies (N) that have to be used.	
☒ Adaptive frequency hopping systems	Shall not be greater than 400 ms within any observation period of 400 ms multiplied by the minimum number of hopping frequencies (N) that have to be used.	
MINIMUM FREQUENCY OCCUPATION TIME		
Condition	Limit	
☐ Non-adaptive frequency hopping systems ☒ Adaptive frequency hopping system	Option 1	Each hopping frequency of the Hopping Sequence shall be occupied at least once within a period not exceeding four times the product of the dwell time and the number of hopping frequencies in use.
	Option 2	The occupation probability for each frequency shall be between ((1 / U) × 25 %) and 77 % where U is the number of hopping frequencies in use.
HOPPING SEQUENCE (S)		
Condition	Limit	
☐ Non-adaptive frequency hopping systems	Shall contain at least N hopping frequencies where N is either 5 or the result of 15 MHz divided by the minimum Hopping Frequency Separation in MHz, whichever is the greater.	
☒ Adaptive frequency hopping systems	shall be capable of operating over a minimum of 70 % of the 2.4 GHz to 2.4835 GHz band	
	Shall contain at least N hopping frequencies at all times, where N is either 15 or the result of 15 MHz divided by the minimum Hopping Frequency Separation in MHz, whichever is the greater.	

TEST PROCEDURE

Refer to ETSI EN 300 328 V2.2.2 (2019-07) Clause 5.4.4

Connect the UUT to the spectrum analyser and use the following settings:

Frequency Center	Equal to the hopping frequency being investigated
Frequency Span	0 Hz
Trance Mode	Clear / Write
Trigger Mode	Free Run
Detector	RMS
Sweep Point	30000
Sweep Time	Equal to the applicable observation period (see clause 4.3.1.4.3.1 or clause 4.3.1.4.3.2)
RBW	~ 50 % of the Occupied Channel Bandwidth
VBW	≥ RBW

TEST ENVIRONMENT

Temperature	27.3 °C	Relative Humidity	54.4 %
Atmosphere Pressure	101 kPa	Test Voltage	DC 5 V

RESULTS

Please refer to appendix C.

7.5. HOPPING FREQUENCY SEPARATION

LIMIT

HOPPING FREQUENCY SEPARATION	
Condition	Limit
☐ Non-adaptive frequency hopping systems	Shall be equal to or greater than the Occupied Channel Bandwidth (see clause 4.3.1.8), with a minimum separation of 100 kHz.
☒ Adaptive frequency hopping systems	The minimum Hopping Frequency Separation shall be 100 kHz.

TEST PROCEDURE

Refer to ETSI EN 300 328 V2.2.2 (2019-07) Clause 5.4.5

Measurement	
☒Conducted measurement	☐Radiated measurement

Connect the UUT to the spectrum analyser and use the following settings:

Center Frequency	Centre of the two adjacent hopping frequencies
Frequency Span	Sufficient to see the complete power envelope of both hopping frequencies
Detector Mode	Max Peak
RBW	1 % of the span
VBW	3 × RBW
Trace	Max hold
Sweep Time	Auto

TEST ENVIRONMENT

Temperature	27.3 °C	Relative Humidity	54.4 %
Atmosphere Pressure	101 kPa	Test Voltage	DC 5 V

RESULTS

Please refer to appendix D.

7.6. TRANSMITTER UNWANTED EMISSIONS IN THE OUT-OF-BAND DOMAIN

LIMITS

Transmitter Unwanted Emissions in The Out-Of-Band Domain	
Condition	Limit
Under Normal Test Condition	The transmitter unwanted emissions in the out-of-band domain shall not exceed the values provided by the mask in figure 1.

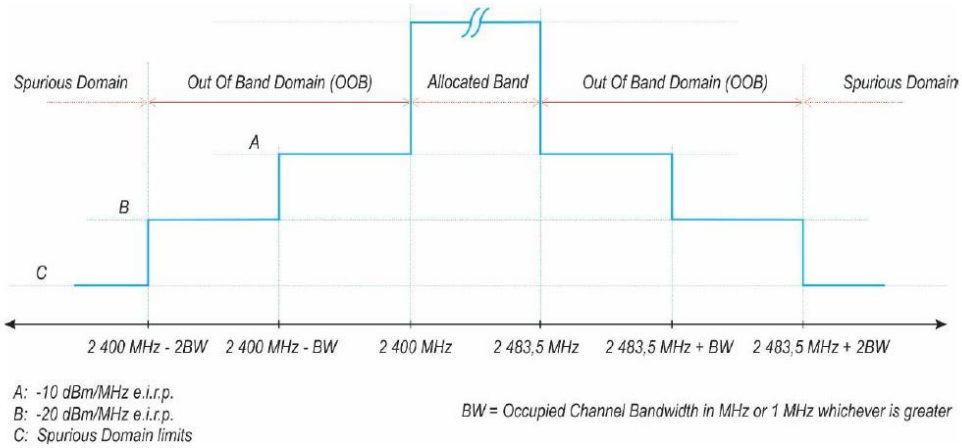


Figure 1: Transmit mask

TEST PROCEDURE

Refer to ETSI EN 300 328 V2.2.2 (2019-07) clause 5.4.8

Measurement	
☒Conducted measurement	☐Radiated measurement

Connect the UUT to the spectrum analyser and use the following settings:

Measurement Mode	Time Domain Power
Span	Zero Span
Filter Mode	Channel Filter
Trace Mode	Max Hold
Trigger Mode	Video Trigger
Detector Mode	RMS
Sweep Point	Sweep time [µs] / (1 µs) with a maximum of 30 000
Sweep Mode	> 120 % of the duration of the longest burst detected during the measurement of the RF Output Power
Trigger Mode	Video
RBW / VBW	1 MHz / 3 MHz

TEST ENVIRONMENT

Temperature	27.3 °C	Relative Humidity	54.4 %
Atmosphere Pressure	101 kPa	Test Voltage	DC 5 V

RESULTS

Please refer to appendix E.

7.7. TRANSMITTER UNWANTED EMISSIONS IN THE SPURIOUS DOMAIN

LIMITS

The transmitter unwanted emissions in the spurious domain shall not exceed the values given in table 4.
In case of equipment with antenna connectors, these limits apply to emissions at the antenna port (conducted). For emissions radiated by the cabinet or emissions radiated by integral antenna equipment (without antenna connectors), these limits are e.r.p. for emissions up to 1 GHz and e.i.r.p. for emissions above 1 GHz.

Table 4: Transmitter limits for spurious emissions

Frequency range	Maximum power	Bandwidth
30 MHz to 47 MHz	-36 dBm	100 kHz
47 MHz to 74 MHz	-54 dBm	100 kHz
74 MHz to 87,5 MHz	-36 dBm	100 kHz
87,5 MHz to 118 MHz	-54 dBm	100 kHz
118 MHz to 174 MHz	-36 dBm	100 kHz
174 MHz to 230 MHz	-54 dBm	100 kHz
230 MHz to 470 MHz	-36 dBm	100 kHz
470 MHz to 694 MHz	-54 dBm	100 kHz
694 MHz to 1 GHz	-36 dBm	100 kHz
1 GHz to 12,75 GHz	-30 dBm	1 MHz

TEST PROCEDURE

Refer to ETSI EN 300 328 V2.2.2 (2019-07) clause 5.4.9

Measurement	
☒Conducted measurement	☒Radiated measurement

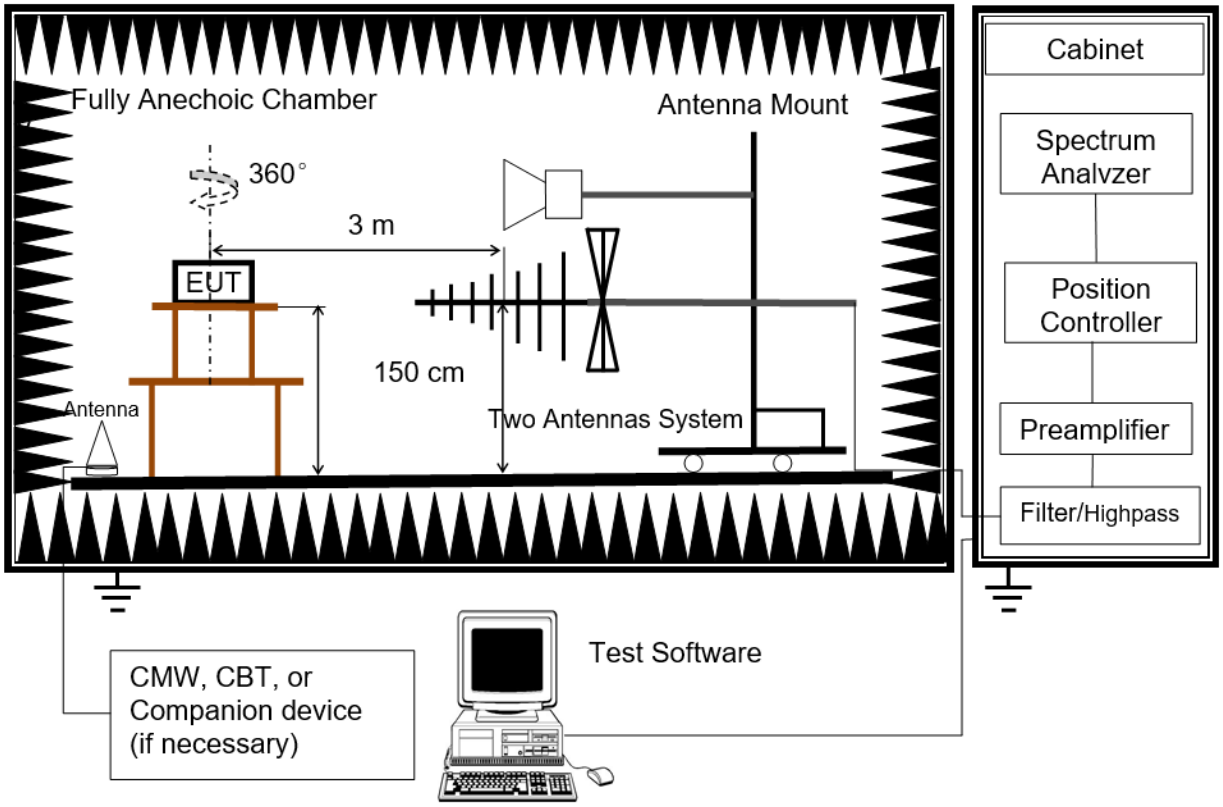
Spectrum analyser settings for pre-scan:

RBW	100 kHz (< 1 GHz) / 1 MHz (> 1 GHz)
VBW	300 kHz (< 1 GHz) / 3 MHz (> 1 GHz)
Detector Mode	Peak
Filter type	3 dB (Gaussian)
Trace Mode	Max hold
Sweep Points	⩾ 19 400 (< 1 GHz); ⩾ 23 500 (> 1 GHz); for spectrum analysers not supporting this high number of sweep points, the frequency band may be segmented.
Sweep Time	For non continuous transmissions (duty cycle less than 100 %), the sweep time shall be sufficiently long, such that for each 100 kHz frequency step, the measurement time is greater than two transmissions of the UUT, on any channel. For FHSS equipment operating in a normal operating (hopping not disabled) mode, the sweep time shall be further increased to capture multiple transmissions on any of the hopping frequencies. The above sweep time setting may result in long measuring times in case of FHSS equipment. To avoid such long measuring times, an FFT analyser may be used.

Spectrum analyser settings for the emissions identified during the pre-scan:

Measurement Mode	Time Domain Power
Centre Frequency	Frequency of the emission identified during the pre-scan
RBW	100 kHz (< 1 GHz) / 1 MHz (> 1 GHz)
VBW	300 kHz (< 1 GHz) / 3 MHz (> 1 GHz)
Frequency Span	Zero Span
Sweep Mode	Single Sweep
Detector Mode	RMS
Trace Mode	Max hold
Trigger Mode	Video (burst signals) or Manual (continuous signals)
Sweep Points	Sweep time [µs] / (1 µs) with a maximum of 30 000
Sweep Time	> 120 % of the duration of the longest burst detected during the measurement of the RF Output Power

TEST SETUP



TEST ENVIRONMENT

For Conducted measurement:

Temperature	27.3 °C	Relative Humidity	54.4 %
Atmosphere Pressure	101 kPa	Test Voltage	DC 5 V

For Radiated measurement

Temperature	24.5 °C	Relative Humidity	66 %
Atmosphere Pressure	101 kPa	Test Voltage	DC 5 V

RESULTS

Please refer to appendix F.

7.8. RECEIVER SPURIOUS EMISSIONS

LIMITS

The receiver spurious emissions shall not exceed the values given in table 5.
In case of FHSS equipment with antenna connectors, these limits apply to emissions at the antenna port (conducted).
For emissions radiated by the cabinet or emissions radiated by integral antenna equipment (without antenna connectors), these limits are e.r.p. for emissions up to 1 GHz and e.i.r.p. for emissions above 1 GHz.

Table 5: Spurious emission limits for receivers

Frequency range	Maximum power	Bandwidth
30 MHz to 1 GHz	-57 dBm	100 kHz
1 GHz to 12,75 GHz	-47 dBm	1 MHz

TEST PROCEDURE

Please refer to ETSI EN 300 328 V2.2.2 (2019-07) Clause 5.4.10

Measurement	
☒Conducted measurement	☒Radiated measurement

Please refer to ETSI EN 300 328 V2.2.2 (2019-07) Clause 5.4.10

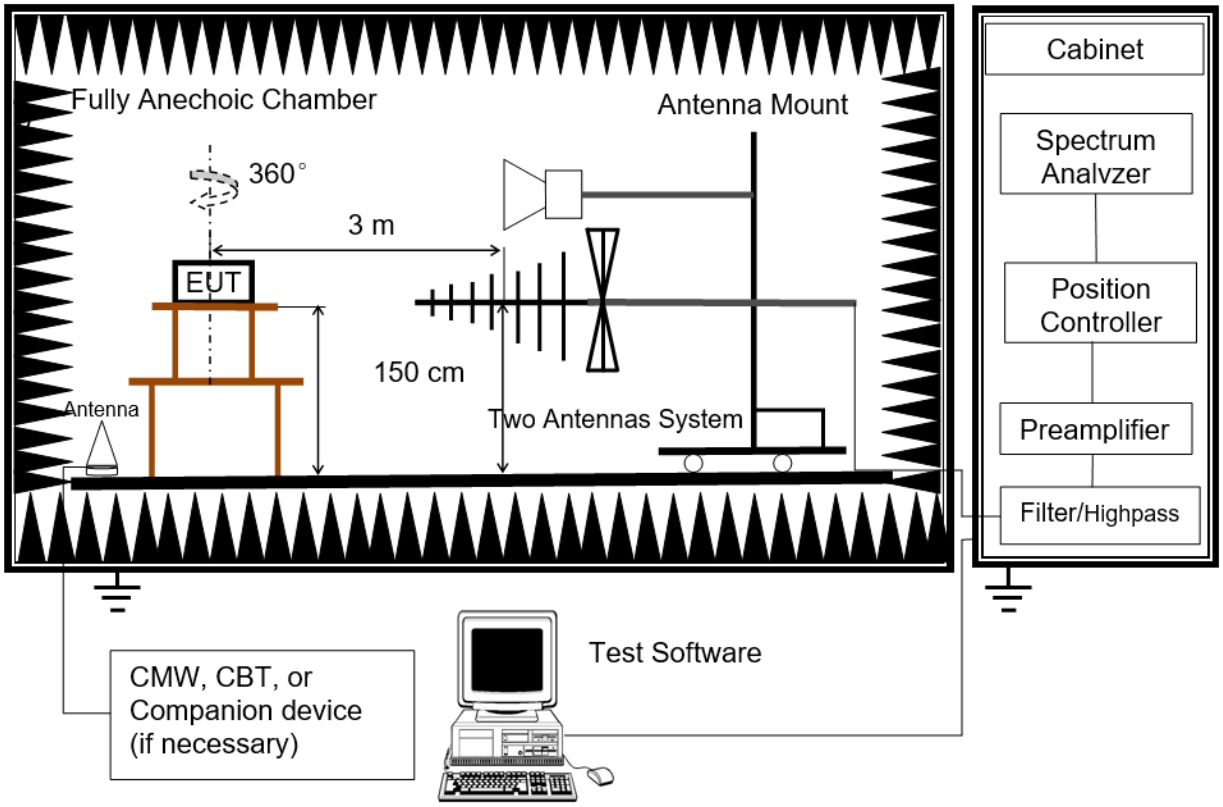
Spectrum analyser settings for pre-scan:

RBW	100 kHz (< 1 GHz) / 1 MHz (> 1 GHz)
VBW	300 kHz (< 1 GHz) / 3 MHz (> 1 GHz)
Detector Mode	Peak
Filter type	3 dB (Gaussian)
Trace Mode	Max hold
Sweep Points	⩾ 19 400 (< 1 GHz); ⩾ 23 500 (> 1 GHz); for spectrum analysers not supporting this high number of sweep points, the frequency band may be segmented.
Sweep Time	Auto

Spectrum analyser settings for the emissions identified during the pre-scan:

Measurement Mode	Time Domain Power
Centre Frequency	Frequency of the emission identified during the pre-scan
RBW	100 kHz (< 1 GHz) / 1 MHz (> 1 GHz)
VBW	300 kHz (< 1 GHz) / 3 MHz (> 1 GHz)
Frequency Span	Zero Span
Sweep Mode	Single Sweep
Detector Mode	RMS
Trace Mode	Max hold
Trigger Mode	Video (burst signals) or Manual (continuous signals)
Sweep Points	⩾ 30 000
Sweep Time	30 ms

TEST SETUP



TEST ENVIRONMENT

For Conducted measurement:

Temperature	27.3 °C	Relative Humidity	54.4 %
Atmosphere Pressure	101 kPa	Test Voltage	DC 5 V

For Radiated measurement

Temperature	24.5 °C	Relative Humidity	66 %
Atmosphere Pressure	101 kPa	Test Voltage	DC 5 V

RESULTS

Please refer to appendix G.

7.9. RECEIVER BLOCKING

LIMITS

Performance Criteria
For equipment that supports a PER or FER test to be performed, the minimum performance criterion shall be a PER or FER less than or equal to 10 %.
For equipment that does not support a PER or a FER test to be performed, the minimum performance criterion shall be no loss of the wireless transmission function needed for the intended use of the equipment.

While maintaining the minimum performance criteria as defined in clause 4.3.1.12.3, the blocking levels at specified frequency offsets shall be equal to or greater than the limits defined for the applicable receiver category provided in table 6, table 7 or table 8.

☐ Receiver Category 1

Table 6: Receiver Blocking parameters for Receiver Category 1 equipment

Wanted signal mean power from companion device (dBm) (see notes 1 and 4)	Blocking signal frequency (MHz)	Blocking signal power (dBm) (see note 4)	Type of blocking signal
(-133 dBm + 10 × $\log_{10}$(OCBW)) or -68 dBm whichever is less (see note 2)	2 380 2 504	-34	CW
(-139 dBm + 10 × $\log_{10}$(OCBW)) or -74 dBm whichever is less (see note 3)	2 300 2 330 2 360 2 524 2 584 2 674		
NOTE 1: OCBW is in Hz. NOTE 2: In case of radiated measurements using a companion device and the level of the wanted signal from the companion device cannot be determined, a relative test may be performed using a wanted signal up to P_{min} + 26 dB where P_{min} is the minimum level of wanted signal required to meet the minimum performance criteria as defined in clause 4.3.1.12.3 in the absence of any blocking signal. NOTE 3: In case of radiated measurements using a companion device and the level of the wanted signal from the companion device cannot be determined, a relative test may be performed using a wanted signal up to P_{min} + 20 dB where P_{min} is the minimum level of wanted signal required to meet the minimum performance criteria as defined in clause 4.3.1.12.3 in the absence of any blocking signal. NOTE 4: The level specified is the level at the UUT receiver input assuming a 0 dBi antenna assembly gain. In case of conducted measurements, this level has to be corrected for the (in-band) antenna assembly gain (G). In case of radiated measurements, this level is equivalent to a power flux density (PFD) in front of the UUT antenna with the UUT being configured/positioned as recorded in clause 5.4.3.2.2.			

☒ Receiver Category 2

Table 7: Receiver Blocking parameters receiver Category 2 equipment

Wanted signal mean power from companion device (dBm) (see notes 1 and 3)	Blocking signal frequency (MHz)	Blocking signal power (dBm) (see note 3)	Type of blocking signal
(-139 dBm + 10 × $\log_{10}$(OCBW) + 10 dB) or (-74 dBm + 10 dB) whichever is less (see note 2)	2 380 2 504 2 300 2 584	-34	CW
NOTE 1: OCBW is in Hz. NOTE 2: In case of radiated measurements using a companion device and the level of the wanted signal from the companion device cannot be determined, a relative test may be performed using a wanted signal up to P_{min} + 26 dB where P_{min} is the minimum level of wanted signal required to meet the minimum performance criteria as defined in clause 4.3.1.12.3 in the absence of any blocking signal. NOTE 3: The level specified is the level at the UUT receiver input assuming a 0 dBi antenna assembly gain. In case of conducted measurements, this level has to be corrected for the (in-band) antenna assembly gain (G). In case of radiated measurements, this level is equivalent to a power flux density (PFD) in front of the UUT antenna with the UUT being configured/positioned as recorded in clause 5.4.3.2.2.			

☐ Receiver Category 3

Table 8: Receiver Blocking parameters receiver Category 3 equipment

Wanted signal mean power from companion device (dBm) (see notes 1 and 3)	Blocking signal frequency (MHz)	Blocking signal power (dBm) (see note 3)	Type of blocking signal
(-139 dBm + 10 × $\log_{10}$(OCBW) + 20 dB) or (-74 dBm + 20 dB) whichever is less (see note 2)	2 380 2 504 2 300 2 584	-34	CW
NOTE 1: OCBW is in Hz. NOTE 2: In case of radiated measurements using a companion device and the level of the wanted signal from the companion device cannot be determined, a relative the test may be performed using a wanted signal up to P_{min} + 30 dB where P_{min} is the minimum level of wanted signal required to meet the minimum performance criteria as defined in clause 4.3.1.12.3 in the absence of any blocking signal. NOTE 3: The level specified is the level at the UUT receiver input assuming a 0 dBi antenna assembly gain. In case of conducted measurements, this level has to be corrected for the (in-band) antenna assembly gain (G). In case of radiated measurements, this level is equivalent to a power flux density (PFD) in front of the UUT antenna with the UUT being configured/positioned as recorded in clause 5.4.3.2.2.			

TEST PROCEDURE

Please refer to ETSI EN 300 328 V2.2.2 (2019-07) Clause 5.4.11

Measurement	
☒Conducted measurement	☐Radiated measurement

Step 1:
• For non-FHSS equipment, the UUT shall be set to the lowest operating channel on which the blocking test has to be performed (see clause 5.4.11.1).
Step 2:
• The blocking signal generator is set to the first frequency as defined in the appropriate table corresponding to the receiver category and type of equipment.
Step 3:
• With the blocking signal generator switched off, a communication link is established between the UUT and the associated companion device using the test setup shown in figure 6.
• Unless the option provided in note 2 of the applicable table referred to in clause 5.4.11.2.1 is used, the level of the wanted signal shall be set to the value provided in the table corresponding to the receiver category and type of equipment. The test procedure defined in clause 5.4.2, and more in particular clause 5.4.2.2.1.2, can be used to measure the (conducted) level of the wanted signal however no correction shall be made for antenna gain of the companion device (step 6 in clause 5.4.2.2.1.2 shall be ignored). This level may be measured directly at the output of the companion device and a correction is made for the coupling loss into the UUT. The actual level for the wanted signal shall be recorded in the test report.
• When the option provided in note 2 of the applicable table referred to in clause 5.4.11.2.1 is used, the attenuation of the variable attenuator shall be increased in 1 dB steps to a value at which the minimum performance criteria as specified in clause 4.3.1.12.3 or clause 4.3.2.11.3 is still met. The resulting level for the wanted signal at the input of the UUT is Pmin. This signal level (Pmin) is increased by the value provided in note 2 of the applicable table corresponding to the receiver category and type of equipment.
Step 4:
• The blocking signal at the UUT is set to the level provided in the table corresponding to the receiver category and type of equipment.
• If the performance criteria as specified in clause 4.3.1.12.3 or clause 4.3.2.11.3 are met then proceed to step 6.
Step 5:
• If the performance criteria as specified in clause 4.3.1.12.3 or clause 4.3.2.11.3 is not met, step 3 and step 4 shall be repeated after that the frequency of the blocking signal set in step 2 has been increased with a value equal to the Occupied Channel Bandwidth except:
- For the blocking frequency 2 380 MHz, where this frequency offset shall be less than or equal to 10 MHz. If this frequency offset is more than 7 MHz, the level of the wanted signal shall be increased by 3 dB.
- For the blocking frequency 2 503,5 MHz, where this frequency offset shall be less than or equal to 10 MHz. If this frequency offset is more than 7 MHz, the level of the wanted signal shall be decreased by 3 dB.
• If the performance criteria as specified in clause 4.3.1.12.3 or clause 4.3.2.11.3 is still not met, step 3 and step 4 shall be repeated after that the frequency of the blocking signal set in step 2 has been decreased with a value equal to the Occupied Channel Bandwidth except:

- For the blocking frequency 2 380 MHz, where this frequency offset shall be less than or equal to 10 MHz. If this frequency offset is more than 7 MHz, the level of the wanted signal shall be decreased by 3 dB.
- For the blocking frequency 2 503,5 MHz, where this frequency offset shall be less than or equal to 10 MHz. If this frequency offset is more than 7 MHz, the level of the wanted signal shall be increased by 3 dB.

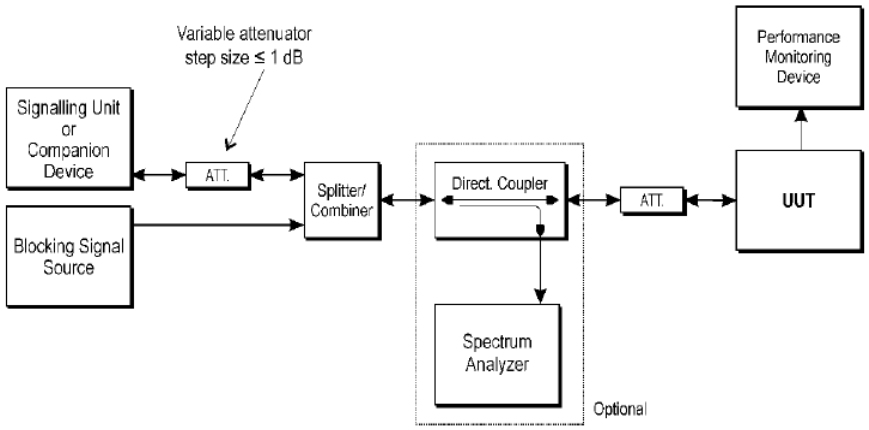
• If the performance criteria as specified in clause 4.3.1.12.3 or clause 4.3.2.11.3 is still not met, the UUT fails to comply with the Receiver Blocking requirement and step 6 and step 7 are no longer required.
• It shall be recorded in the test report whether the shift of blocking frequencies as described in the present step was used.

Step 6:
• Repeat step 4 and step 5 for each remaining combination of frequency and level for the blocking signal as provided in the table corresponding to the receiver category and type of equipment.

Step 7:
• For non-FHSS equipment, repeat step 2 to step 6 with the UUT operating at the highest operating channel on which the blocking test has to be performed (see clause 5.4.11.1).

Step 8:
• It shall be assessed and recorded in the test report whether the UUT complies with the Receiver Blocking requirement.

TEST SETUP



TEST ENVIRONMENT

Temperature	24.5 °C	Relative Humidity	56.8 %
Atmosphere Pressure	101 kPa	Test Voltage	DC 5 V

RESULTS

Please refer to Appendix H.

8. GEO-LOCATION CAPABILITY

REQUIREMENTS

Geo-location capability is a feature of the equipment to determine its geographical location with the purpose to configure itself according to the regulatory requirements applicable at the geographical location where it operates.
The geo-location capability may be present in the equipment or in an external device (temporary) associated with the equipment operating at the same geographical location during the initial power up of the equipment. The geographical location may also be available in equipment already installed and operating at the same geographical location.

The geographical location determined by the FHSS equipment as defined in clause 4.3.1.13.2 shall not be accessible to the user in a way that would allow the user to alter it.

GEO-LOCATION CAPABILITY FUNCTION DESCRIBE FOR EUT

Not Support.

CONCLUSION

N/A

9. Appendix

9.1. Appendix A: RF Output Power

9.1.1. Test Result

Test Condition	Test Mode	Antenna	Channel	EIRP[dBm]	Limit[dBm]	Verdict
NTNV	DH5	Ant1	Hop	7.29	20	PASS
	3DH5	Ant1	Hop	1.99	20	PASS

Test Condition	Test Mode	Antenna	Channel	EIRP[dBm]	Limit[dBm]	Verdict
LTNV	DH5	Ant1	Hop	6.94	20	PASS
	3DH5	Ant1	Hop	1.61	20	PASS

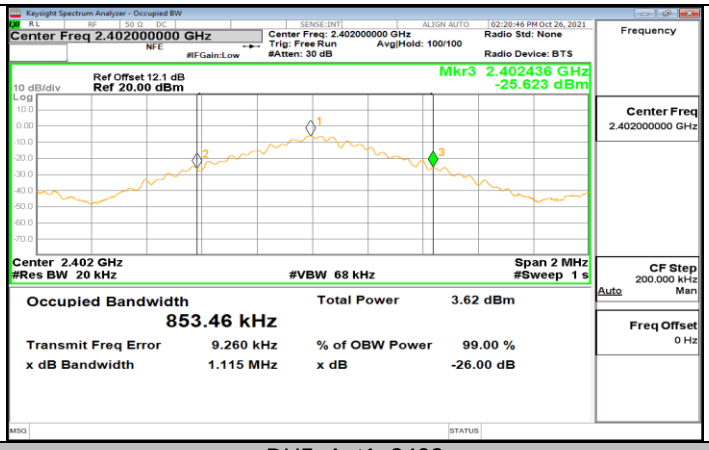
Test Condition	Test Mode	Antenna	Channel	EIRP[dBm]	Limit[dBm]	Verdict
HTNV	DH5	Ant1	Hop	6.89	20	PASS
	3DH5	Ant1	Hop	1.65	20	PASS

9.2. Appendix B: Occupied Channel Bandwidth

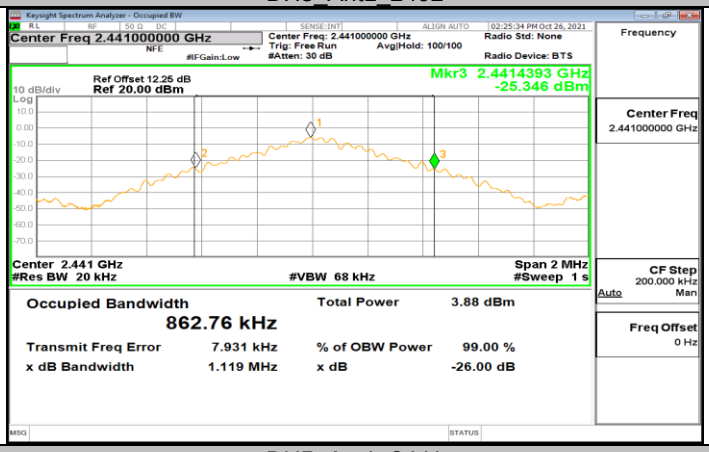
9.2.1. Test Result

Test Mode	Antenna	Channel	OCB[MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
DH5	Ant1	2402	0.85346	2401.5825	2402.4360	2400 to 2483.5	PASS
		2441	0.86276	2440.5766	2441.4393	2400 to 2483.5	PASS
		2480	0.85987	2479.5792	2480.4391	2400 to 2483.5	PASS
3DH5	Ant1	2402	1.1993	2401.4102	2402.6095	2400 to 2483.5	PASS
		2441	1.2235	2440.3976	2441.6211	2400 to 2483.5	PASS
		2480	1.1978	2479.4113	2480.6091	2400 to 2483.5	PASS

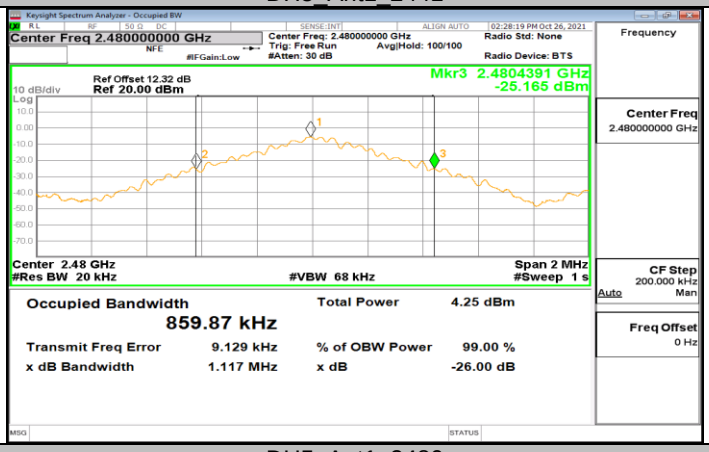
9.2.2. Test Graphs



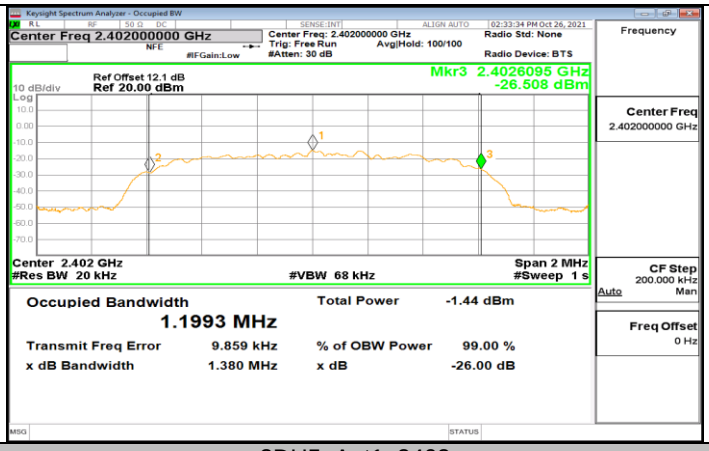
DH5_Ant1_2402



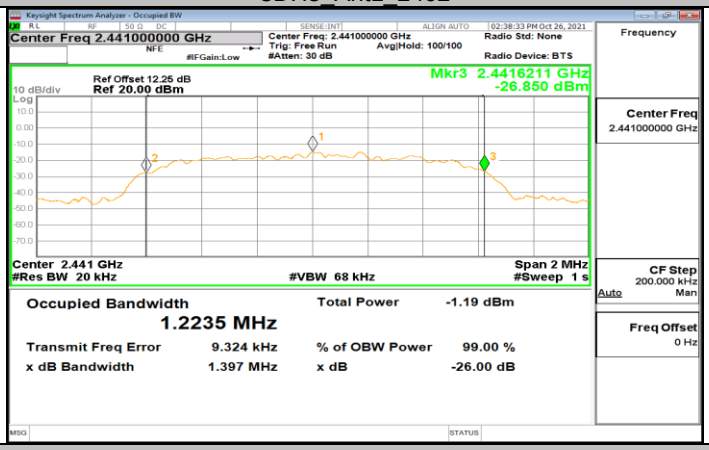
DH5_Ant1_2441



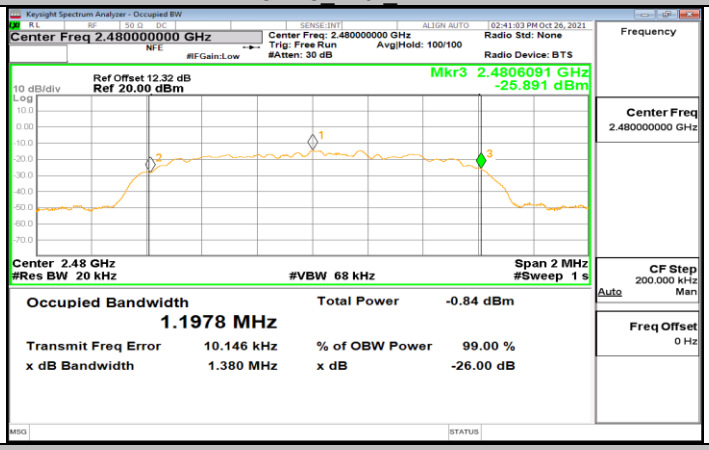
DH5_Ant1_2480



3DH5_Ant1_2402



3DH5_Ant1_2441



3DH5_Ant1_2480

9.3. Appendix C: Accumulated Transmit Time, Frequency Occupation and Hopping Sequence

9.3.1. Test Result

Accumulated Transmit Time

Test Mode	Antenna	Channel	Result [ms]	Limit[ms]	Verdict
DH5	Ant1	Hop_2402	336.035	400	PASS
		Hop_2480	371.850	400	PASS
3DH5	Ant1	Hop_2402	365.530	400	PASS
		Hop_2480	369.743	400	PASS

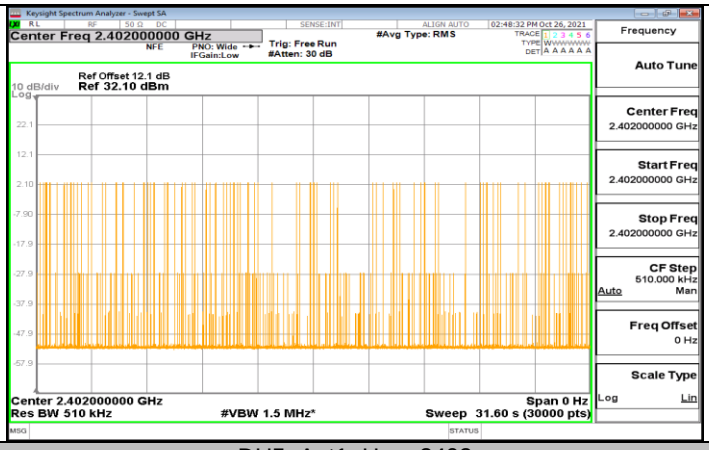
Frequency Occupation

Test Mode	Antenna	Channel	Result [Num.]	Limit [Num.]	Verdict
DH5	Ant1	Hop_2402	2	1	PASS
		Hop_2480	3	1	PASS
3DH5	Ant1	Hop_2402	5	1	PASS
		Hop_2480	1	1	PASS

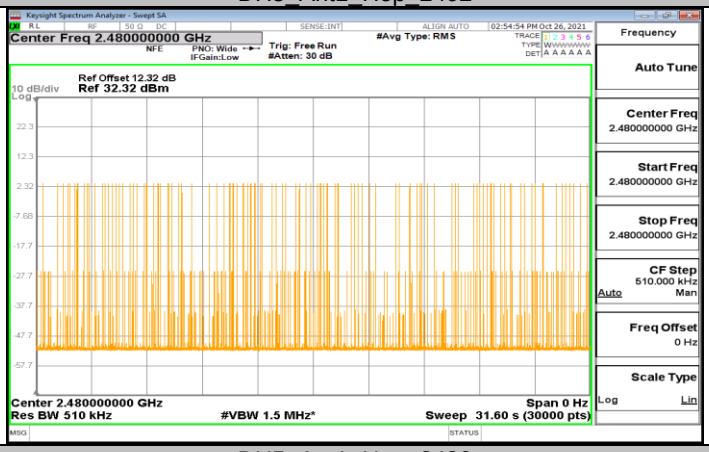
Hopping Sequence

Test Mode	Antenna	Channel	Hop. [Num.]	Limit[Num.]	Band Use [%]	Limit [%]	Verdict
DH5	Ant1	Hop_2402	79	15	94.68	70	PASS
3DH5	Ant1	Hop_2402	79	15	94.98	70	PASS

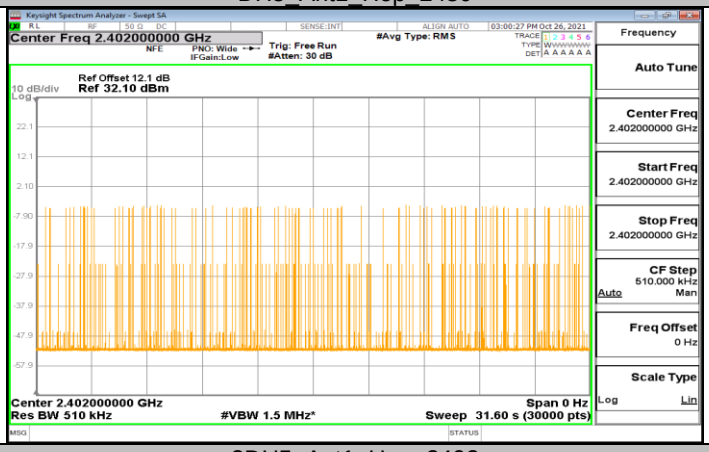
9.3.2. Test Graphs



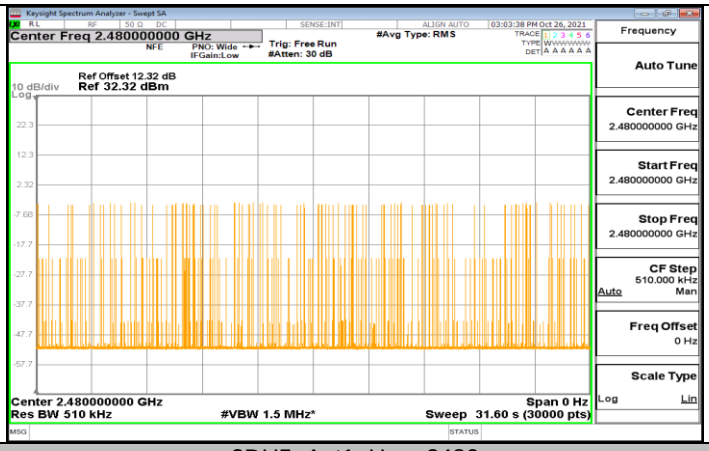
DH5_Ant1_Hop_2402



DH5_Ant1_Hop_2480



3DH5_Ant1_Hop_2402



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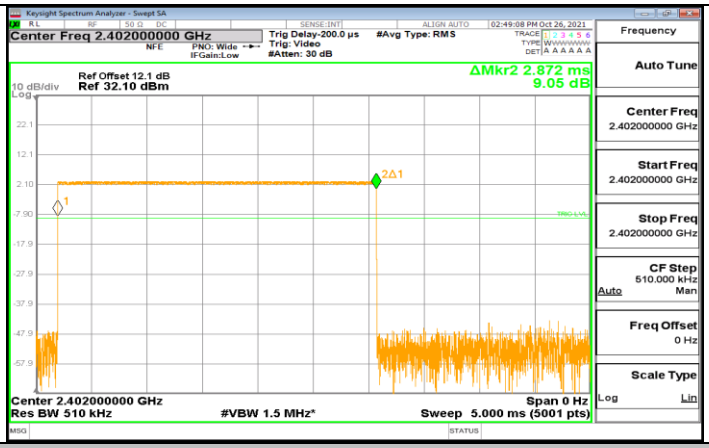
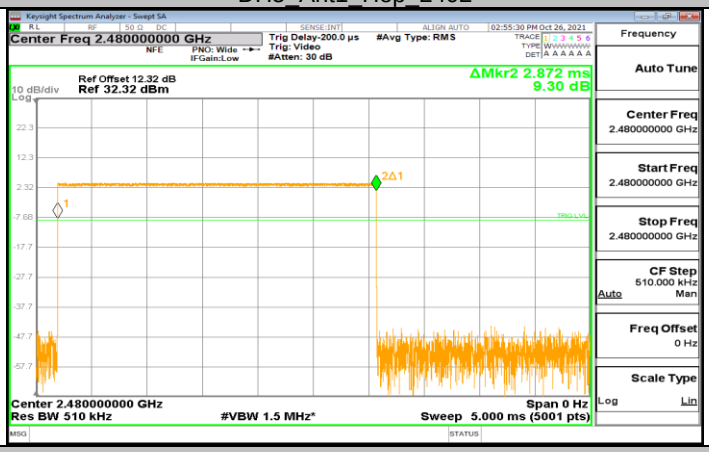


DH5_Ant1_Hop_2402

DH5_Ant1_Hop_2402



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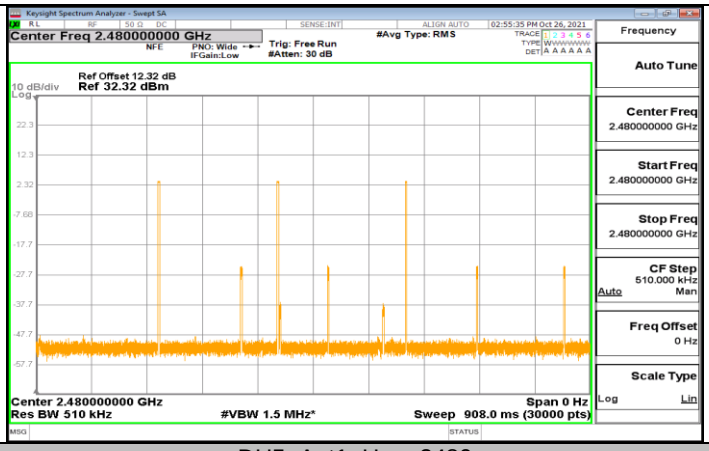
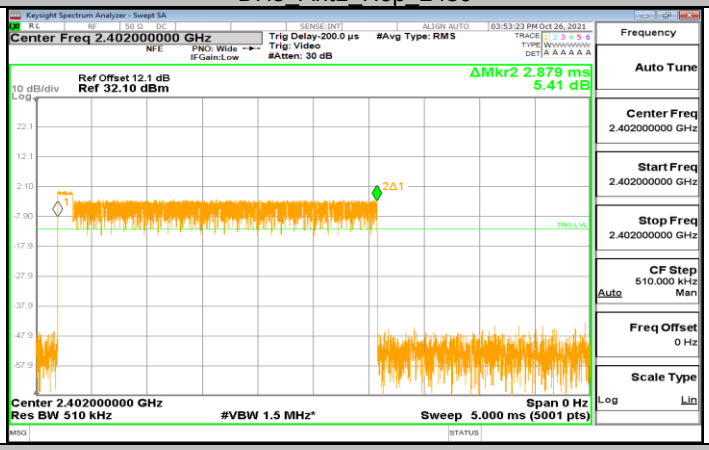
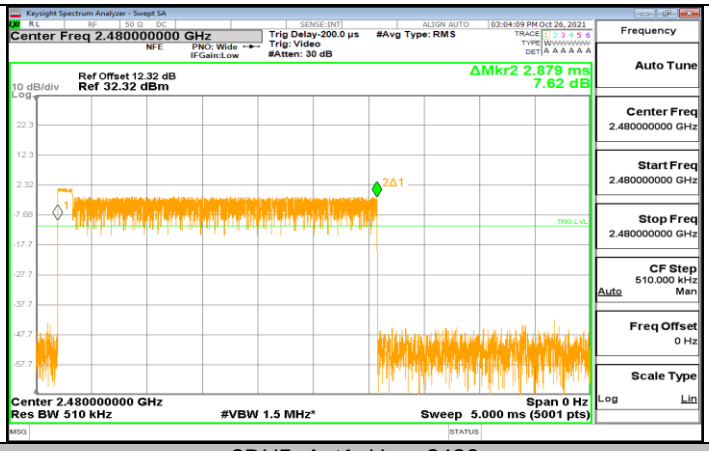


DH5_Ant1_Hop_2480



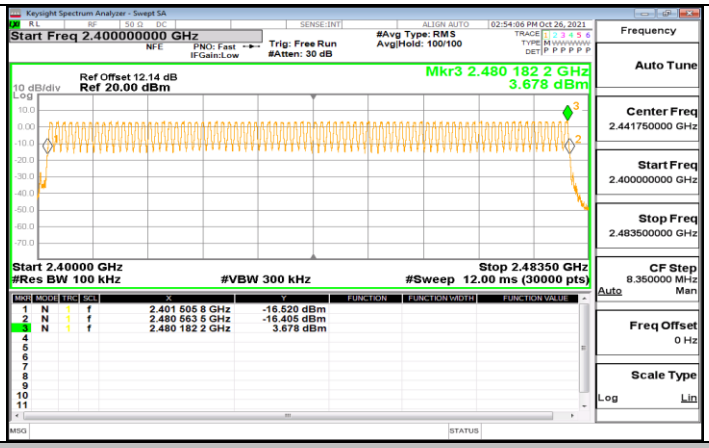
3DH5_Ant1_Hop_2402

3DH5_Ant1_Hop_2402

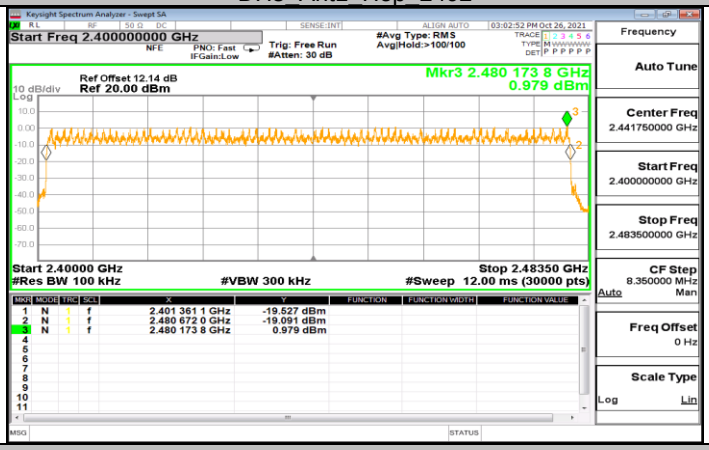


3DH5_Ant1_Hop_2480

3DH5_Ant1_Hop_2480



DH5_Ant1_Hop_2402



3DH5_Ant1_Hop_2402

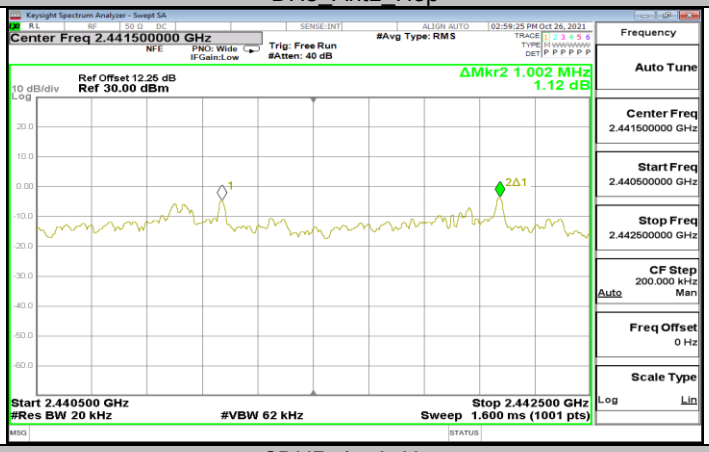
9.4. Appendix D: Hopping Frequency Separation

9.4.1. Test Result

Test Mode	Antenna	Channel	Result [MHz]	Limit[MHz]	Verdict
DH5	Ant1	Hop	0.998	0.100	PASS
3DH5	Ant1	Hop	1.002	0.100	PASS

9.4.2. Test Graphs

DH5_Ant1_Hop



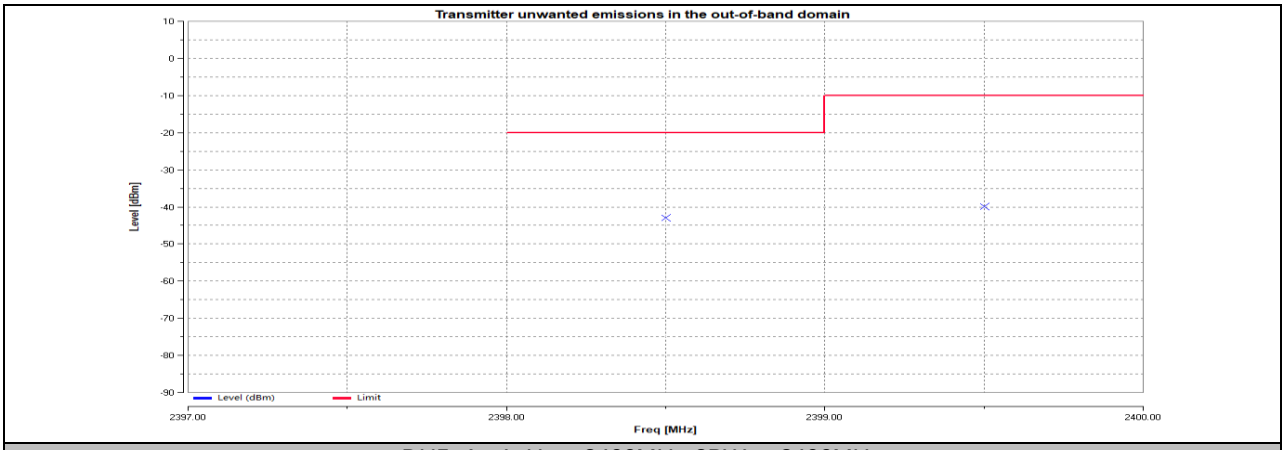
3DH5_Ant1_Hop

9.5. Appendix E: Transmitter Unwanted Emissions In The Out-Of-Band Domain

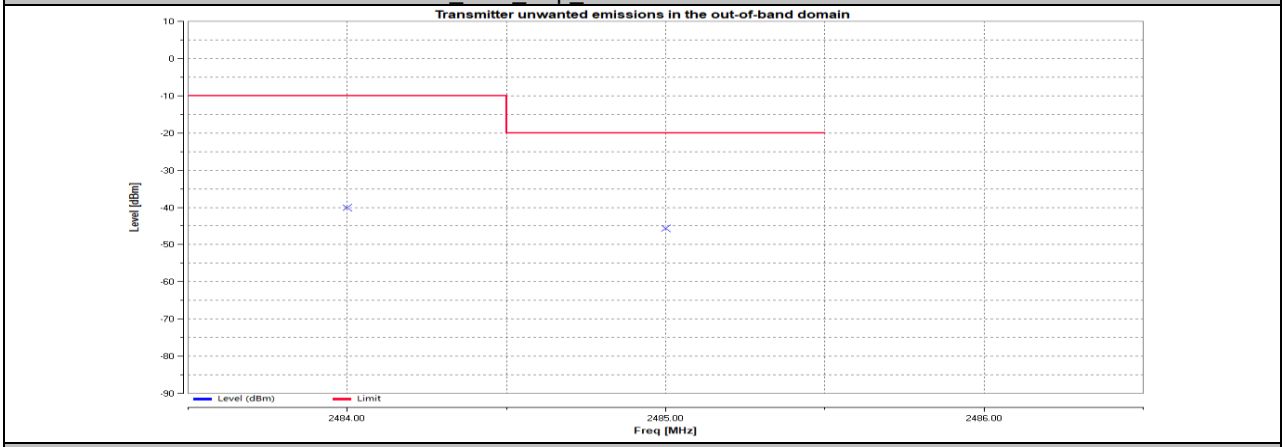
9.5.1. Test Result

Test Mode	Antenna	Channel	Freq. [MHz]	Level[dBm]	Limit[dBm]	Verdict
DH5	Ant1	Hop	2398.5	-42.93	-20.00	PASS
			2399.5	-39.88	-10.00	PASS
			2484	-40.02	-10.00	PASS
			2485	-45.66	-20.00	PASS
3DH5	Ant1	Hop	2398.1014	-50.11	-20.00	PASS
			2398.3007	-42.71	-20.00	PASS
			2399.3007	-44.05	-10.00	PASS
			2399.5	-43.80	-10.00	PASS
			2484	-45.11	-10.00	PASS
			2484.1993	-42.89	-10.00	PASS
			2485.1993	-48.38	-20.00	PASS
			2485.3986	-48.89	-20.00	PASS

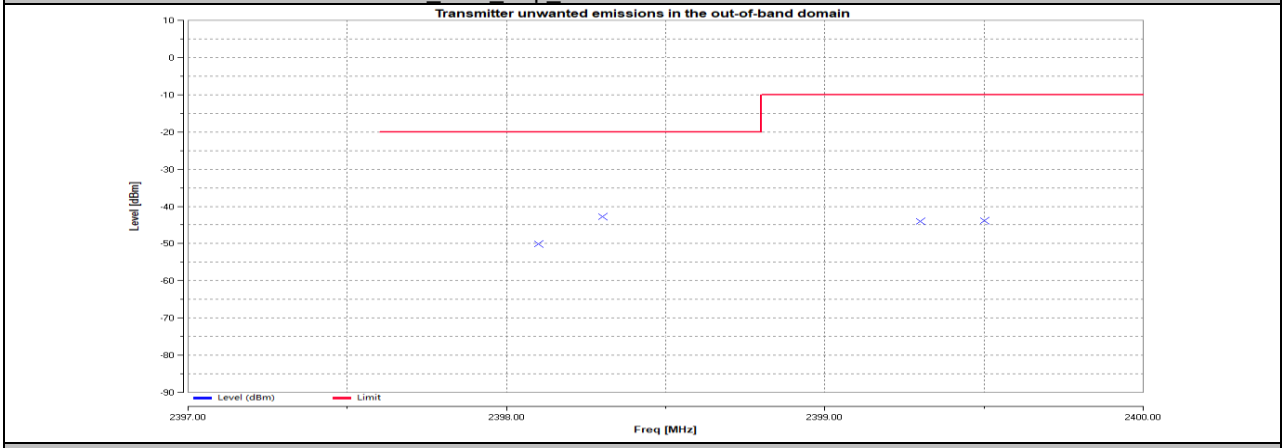
9.5.2. Test Graphs



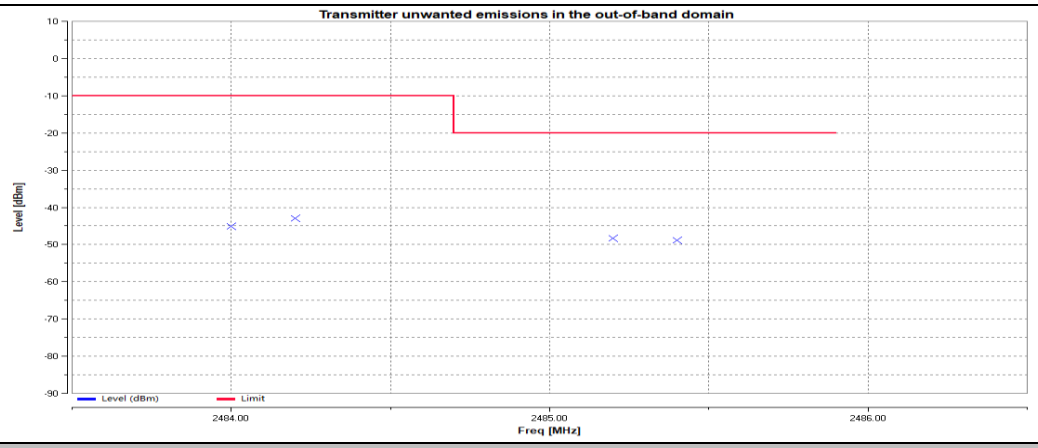
DH5_Ant1_Hop_2400MHz-2BW to 2400MHz



DH5_Ant1_Hop_2483.5MHz to 2483.5MHz+2BW



3DH5_Ant1_Hop_2400MHz-2BW to 2400MHz



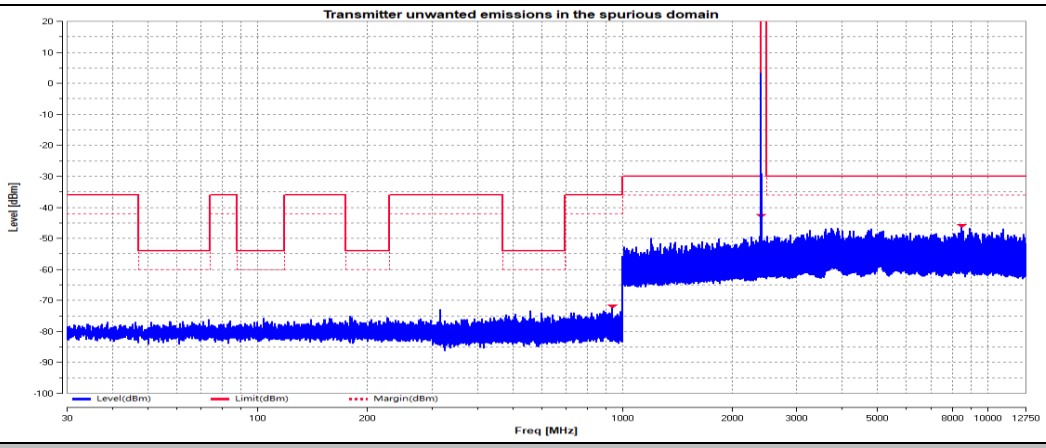
3DH5_Ant1_Hop_2483.5MHz to 2483.5MHz+2BW

9.6. Appendix F: Transmitter Unwanted Emissions In The Spurious Domain

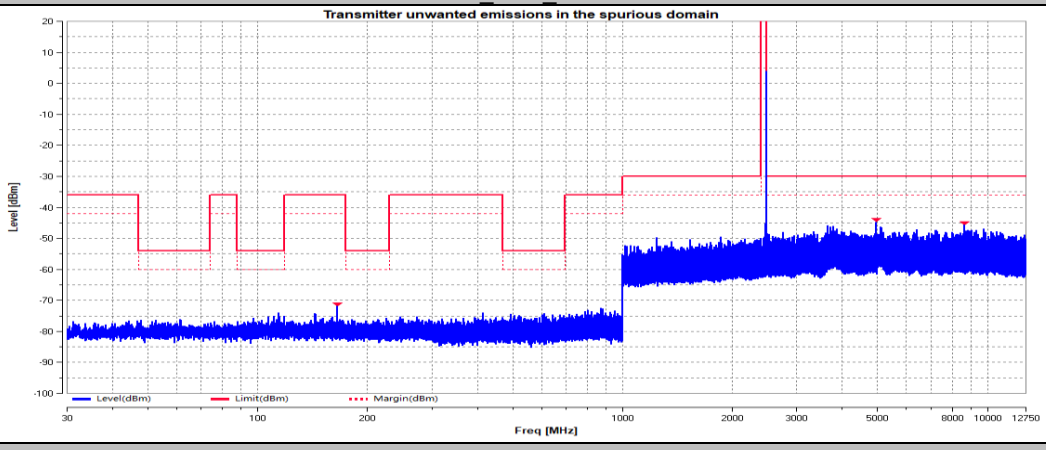
9.6.1. Conducted Test Result-Pre-scan

Test Mode	Antenna	Channel	Freq. [MHz]	Level[dBm]	Limit[dBm]	Verdict
DH5	Ant1	2402	938.92	-72.5	-36	PASS
			2397.65	-43.39	-30	PASS
			8484	-46.52	-30	PASS
		2480	165.32	-71.89	-36	PASS
			4960	-44.72	-30	PASS
			8645.46	-45.68	-30	PASS
3DH5	Ant1	2402	600.51	-71.02	-54	PASS
			3002.47	-42.56	-30	PASS
			11464.23	-46.79	-30	PASS
		2480	912.89	-72.79	-36	PASS
			3100.34	-41.82	-30	PASS
			8086.41	-45.1	-30	PASS

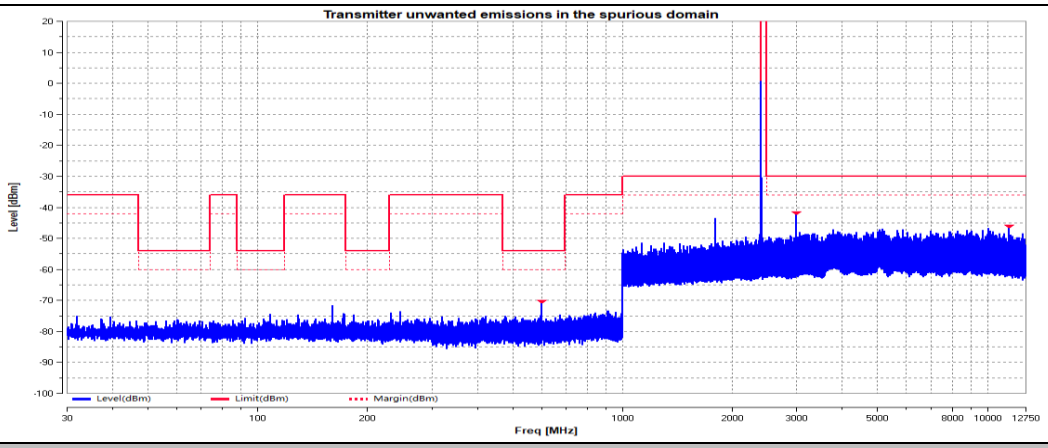
9.6.2. Conducted Test Graphs-Pre-scan



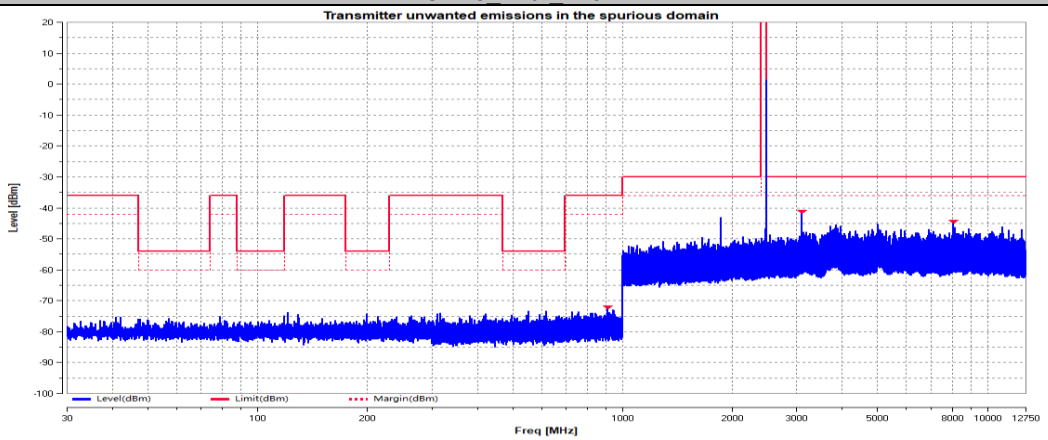
DH5_Ant1_2402



DH5_Ant1_2480



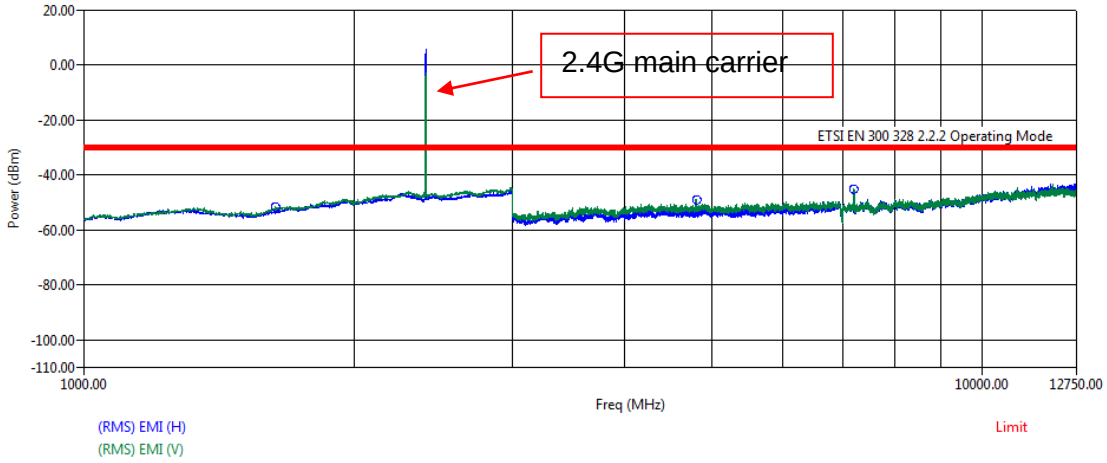
3DH5_Ant1_2402



3DH5_Ant1_2480

9.6.3. Radiated Test Result

Transmitter unwanted emissions in the spurious domain above 1 GHz			
Measurement Method	Radiated	Polar:	Horizontal & Vertical
Test Mode:	GFSK	Test Channel:	CH 0



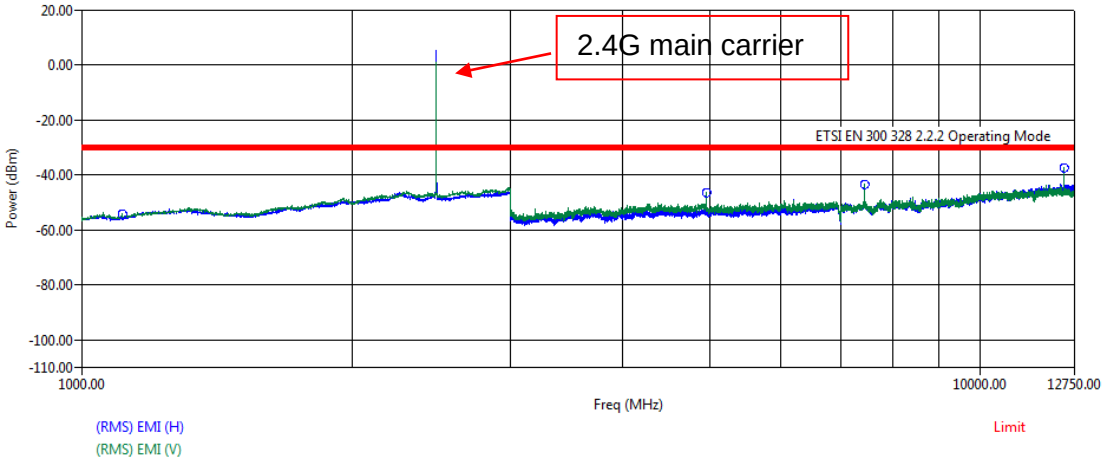
Freq (MHz)	(RMS) Trace (H) (dBuV)	ERP Factor (H) (dB)	Transducer (H) (dB)	Cable (H) (dB)	Preamp (H) (dB)	(RMS) EMI (H) (dBm)	Limit (dBm)	(RMS) Margin (H) (dB)
1635.00	6.47	-66.45	0.00	5.83	0.00	-54.15	-30.00	-24.15
4804.00	42.34	-61.06	0.00	10.20	43.32	-51.84	-30.00	-21.84
7206.00	45.01	-62.31	0.00	12.76	42.13	-46.67	-30.00	-16.67

Freq (MHz)	(RMS) Trace (V) (dBuV)	ERP Factor (V) (dB)	Transducer (V) (dB)	Cable (V) (dB)	Preamp (V) (dB)	(RMS) EMI (V) (dBm)	Limit (dBm)	(RMS) Margin (V) (dB)
1635.00	8.02	-65.45	0.00	5.83	0.00	-51.60	-30.00	-21.60
4804.00	43.30	-59.05	0.00	10.20	43.32	-48.87	-30.00	-18.87
7206.00	46.91	-62.42	0.00	12.76	42.13	-44.88	-30.00	-14.88

Note: EMI=Trace + Cable(Loss) + ERP Factor + Transducer
Margin=EMI – Limit

Note: 2.4G main carrier was recorded in the plot.

Transmitter unwanted emissions in the spurious domain above 1 GHz			
Measurement Method	Radiated	Polar:	Horizontal & Vertical
Test Mode:	GFSK	Test Channel:	CH 78



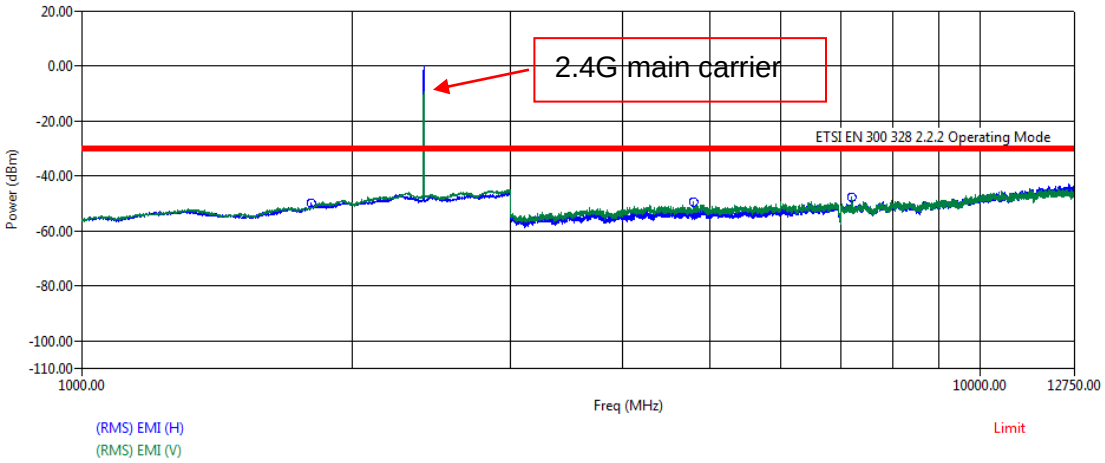
Freq (MHz)	(RMS) Trace (H) (dBuV)	ERP Factor (H) (dB)	Transducer (H) (dB)	Cable (H) (dB)	Preamp (H) (dB)	(RMS) EMI (H) (dBm)	Limit (dBm)	(RMS) Margin (H) (dB)
1107.50	6.27	-67.18	0.00	4.81	0.00	-56.11	-30.00	-26.11
4960.00	42.80	-60.70	0.00	10.46	43.30	-50.74	-30.00	-20.74
7440.00	43.77	-62.27	0.00	13.23	42.03	-47.30	-30.00	-17.30
12400.00	44.03	-58.92	0.00	16.93	42.03	-39.99	-30.00	-9.99

Freq (MHz)	(RMS) Trace (V) (dBuV)	ERP Factor (V) (dB)	Transducer (V) (dB)	Cable (V) (dB)	Preamp (V) (dB)	(RMS) EMI (V) (dBm)	Limit (dBm)	(RMS) Margin (V) (dB)
1107.50	8.06	-66.75	0.00	4.81	0.00	-53.88	-30.00	-23.88
4960.00	45.88	-59.38	0.00	10.46	43.30	-46.34	-30.00	-16.34
7440.00	47.54	-62.18	0.00	13.23	42.03	-43.44	-30.00	-13.44
12400.00	47.86	-59.99	0.00	16.93	42.03	-37.23	-30.00	-7.23

Note: EMI=Trace + Cable(Loss) + ERP Factor + Transducer
Margin=EMI – Limit

Note: 2.4G main carrier was recorded in the plot.

Transmitter unwanted emissions in the spurious domain above 1 GHz			
Measurement Method	Radiated	Polar:	Horizontal & Vertical
Test Mode:	8DPSK	Test Channel:	CH 0



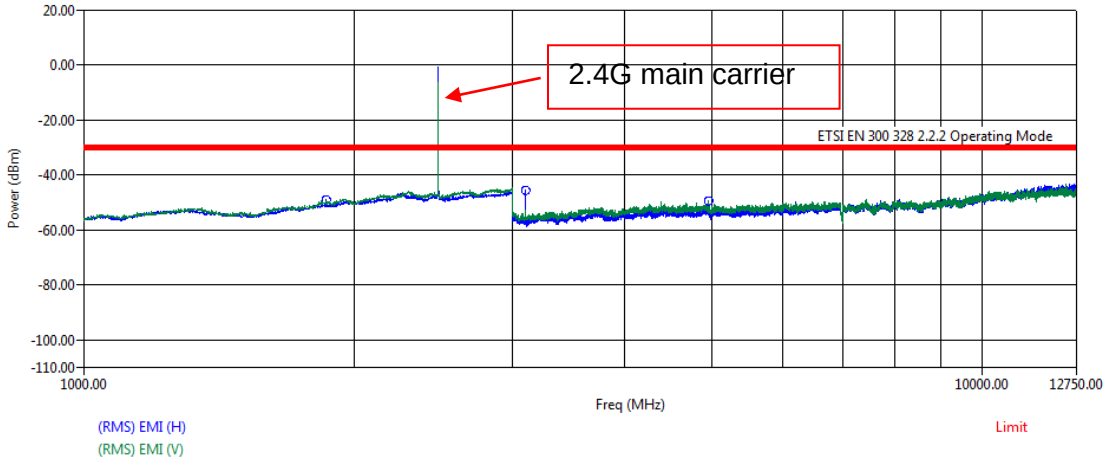
Freq (MHz)	(RMS) Trace (H) (dBuV)	ERP Factor (H) (dB)	Transducer (H) (dB)	Cable (H) (dB)	Preamp (H) (dB)	(RMS) EMI (H) (dBm)	Limit (dBm)	(RMS) Margin (H) (dB)
1801.50	9.13	-64.96	0.00	6.11	0.00	-49.71	-30.00	-19.71
4802.50	39.43	-61.09	0.00	10.19	43.32	-54.78	-30.00	-24.78
7206.00	41.51	-62.31	0.00	12.76	42.13	-50.17	-30.00	-20.17

Freq (MHz)	(RMS) Trace (V) (dBuV)	ERP Factor (V) (dB)	Transducer (V) (dB)	Cable (V) (dB)	Preamp (V) (dB)	(RMS) EMI (V) (dBm)	Limit (dBm)	(RMS) Margin (V) (dB)
1801.50	7.20	-64.92	0.00	6.11	0.00	-51.61	-30.00	-21.61
4802.50	42.79	-59.07	0.00	10.19	43.32	-49.41	-30.00	-19.41
7206.00	44.10	-62.42	0.00	12.76	42.13	-47.68	-30.00	-17.68

Note: EMI=Trace + Cable(Loss) + ERP Factor + Transducer
Margin=EMI – Limit

Note: 2.4G main carrier was recorded in the plot.

Transmitter unwanted emissions in the spurious domain above 1 GHz			
Measurement Method	Radiated	Polar:	Horizontal & Vertical
Test Mode:	8DPSK	Test Channel:	CH 78



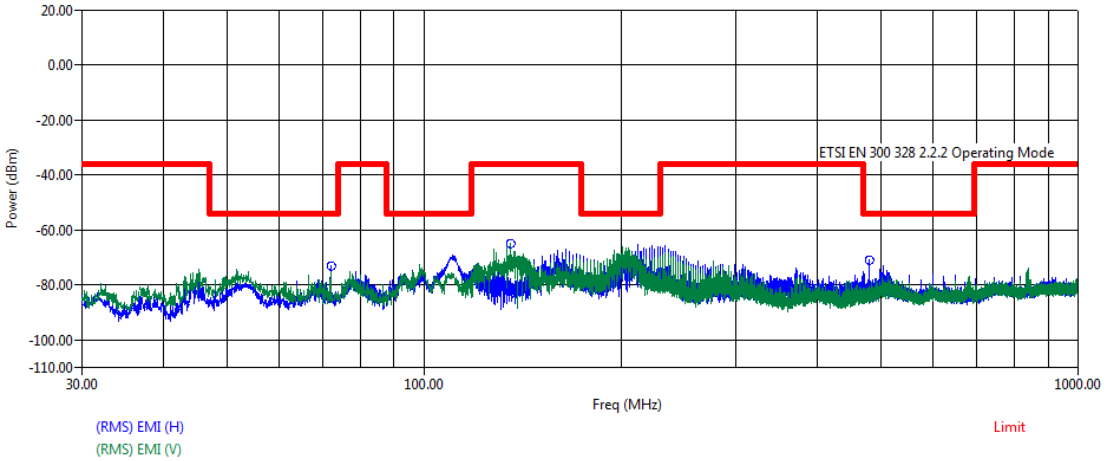
Freq (MHz)	(RMS) Trace (H) (dBuV)	ERP Factor (H) (dB)	Transducer (H) (dB)	Cable (H) (dB)	Preamp (H) (dB)	(RMS) EMI (H) (dBm)	Limit (dBm)	(RMS) Margin (H) (dB)
1860.00	9.47	-64.50	0.00	6.30	0.00	-48.74	-30.00	-18.74
3100.00	52.99	-63.98	0.00	9.17	43.49	-45.31	-30.00	-15.31
4958.50	39.04	-60.68	0.00	10.46	43.30	-54.48	-30.00	-24.48

Freq (MHz)	(RMS) Trace (V) (dBuV)	ERP Factor (V) (dB)	Transducer (V) (dB)	Cable (V) (dB)	Preamp (V) (dB)	(RMS) EMI (V) (dBm)	Limit (dBm)	(RMS) Margin (V) (dB)
1860.00	7.52	-63.45	0.00	6.30	0.00	-49.63	-30.00	-19.63
3100.00	43.87	-62.43	0.00	9.17	43.49	-52.88	-30.00	-22.88
4958.50	43.09	-59.37	0.00	10.46	43.30	-49.12	-30.00	-19.12

Note: EMI=Trace + Cable(Loss) + ERP Factor + Transducer
Margin=EMI – Limit

Note: 2.4G main carrier was recorded in the plot.

Transmitter unwanted emissions in the spurious domain below 1 GHz			
Measurement Method	Radiated	Polar:	Horizontal & Vertical
Test Mode:	GFSK	Test Channel:	CH 0

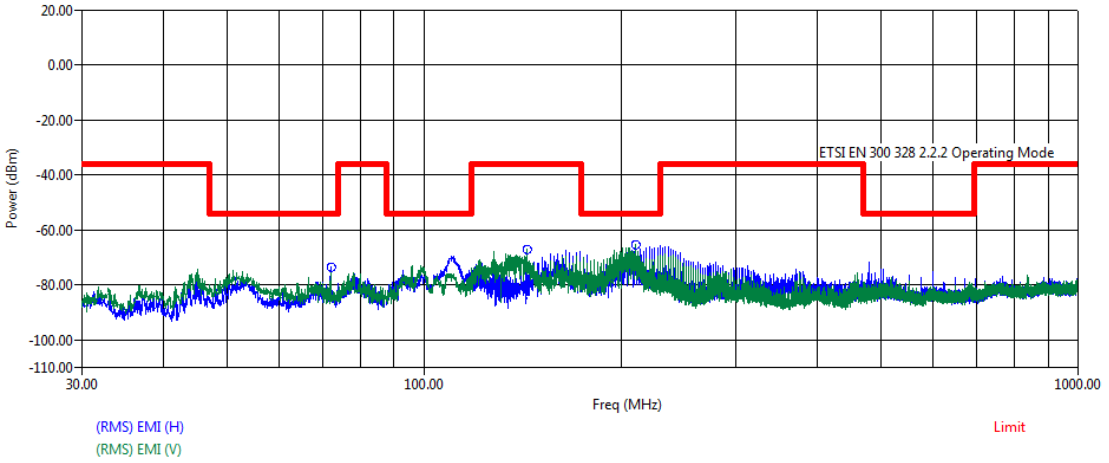


Freq (MHz)	(RMS) Trace (H) (dBuV)	ERP Factor (H) (dB)	Transducer (H) (dB)	Cable (H) (dB)	Preamp (H) (dB)	(RMS) EMI (H) (dBm)	Limit (dBm)	(RMS) Margin (H) (dB)
72.00	56.90	-88.46	0.00	1.07	42.54	-73.04	-54.00	-19.04
135.80	49.67	-88.92	0.00	1.55	42.67	-80.37	-36.00	-44.37
480.00	50.82	-81.93	0.00	2.90	42.79	-70.99	-54.00	-16.99

Freq (MHz)	(RMS) Trace (V) (dBuV)	ERP Factor (V) (dB)	Transducer (V) (dB)	Cable (V) (dB)	Preamp (V) (dB)	(RMS) EMI (V) (dBm)	Limit (dBm)	(RMS) Margin (V) (dB)
72.00	54.70	-88.56	0.00	1.07	42.54	-75.34	-54.00	-21.34
135.80	65.97	-89.66	0.00	1.55	42.67	-64.80	-36.00	-28.80
480.00	41.11	-81.67	0.00	2.90	42.79	-80.45	-54.00	-26.45

Note: EMI=Trace + Cable(Loss) + ERP Factor + Transducer
Margin=EMI – Limit

Transmitter unwanted emissions in the spurious domain below 1 GHz			
Measurement Method	Radiated	Polar:	Horizontal & Vertical
Test Mode:	GFSK	Test Channel:	CH 78



Freq (MHz)	(RMS) Trace (H) (dBuV)	ERP Factor (H) (dB)	Transducer (H) (dB)	Cable (H) (dB)	Preamp (H) (dB)	(RMS) EMI (H) (dBm)	Limit (dBm)	(RMS) Margin (H) (dB)
71.95	56.62	-88.45	0.00	1.07	42.54	-73.31	-54.00	-19.31
143.80	52.18	-89.16	0.00	1.59	42.64	-78.03	-36.00	-42.03
210.25	51.08	-86.65	0.00	1.95	42.52	-76.14	-54.00	-22.14

Freq (MHz)	(RMS) Trace (V) (dBuV)	ERP Factor (V) (dB)	Transducer (V) (dB)	Cable (V) (dB)	Preamp (V) (dB)	(RMS) EMI (V) (dBm)	Limit (dBm)	(RMS) Margin (V) (dB)
71.95	54.54	-88.55	0.00	1.07	42.54	-75.48	-54.00	-21.48
143.80	62.61	-88.52	0.00	1.59	42.64	-66.96	-36.00	-30.96
210.25	62.18	-86.65	0.00	1.95	42.52	-65.04	-54.00	-11.04

Note: EMI=Trace + Cable(Loss) + ERP Factor + Transducer
Margin=EMI – Limit

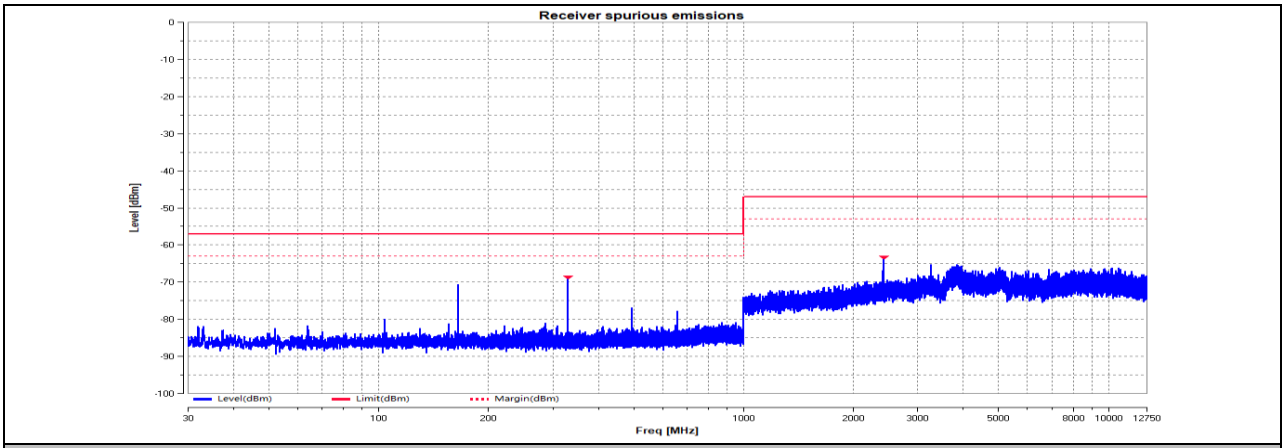
Note All the modes had been tested, but only the worst data was recorded in the report.

9.7. Appendix G: Receiver Spurious Emissions

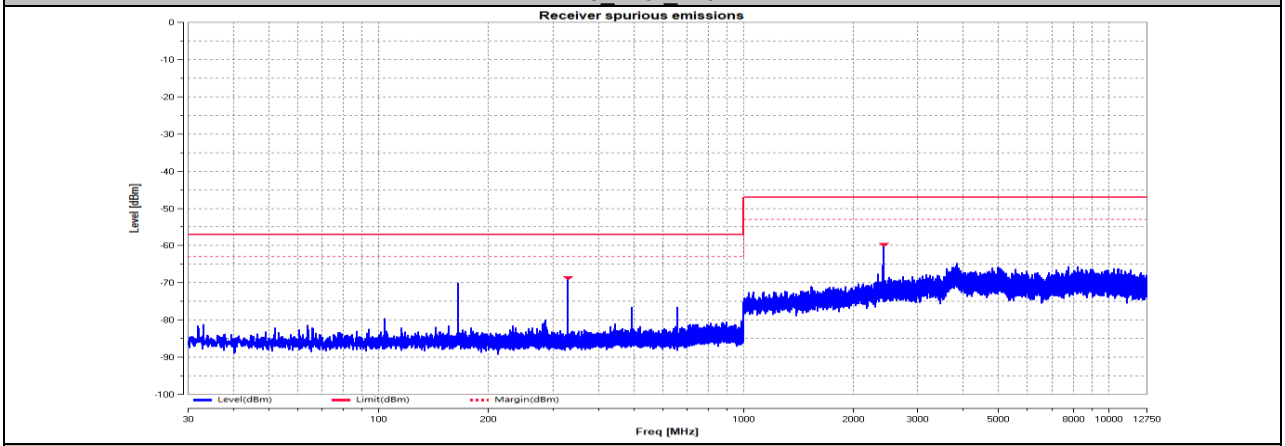
9.7.1. Conducted Test Result-Pre-scan

Test Mode	Antenna	Channel	Freq. [MHz]	Level[dBm]	Limit[dBm]	Verdict
DH5	Ant1	2402	330.6	-69.22	-57.00	PASS
			2420.18	-63.9	-47.00	PASS
		2480	330.6	-69.19	-57.00	PASS
			2421.36	-60.34	-47.00	PASS
3DH5	Ant1	2402	330.6	-69.5	-57.00	PASS
			2419.4	-61.56	-47.00	PASS
		2480	330.6	-69.3	-57.00	PASS
			2402.56	-64.36	-47.00	PASS

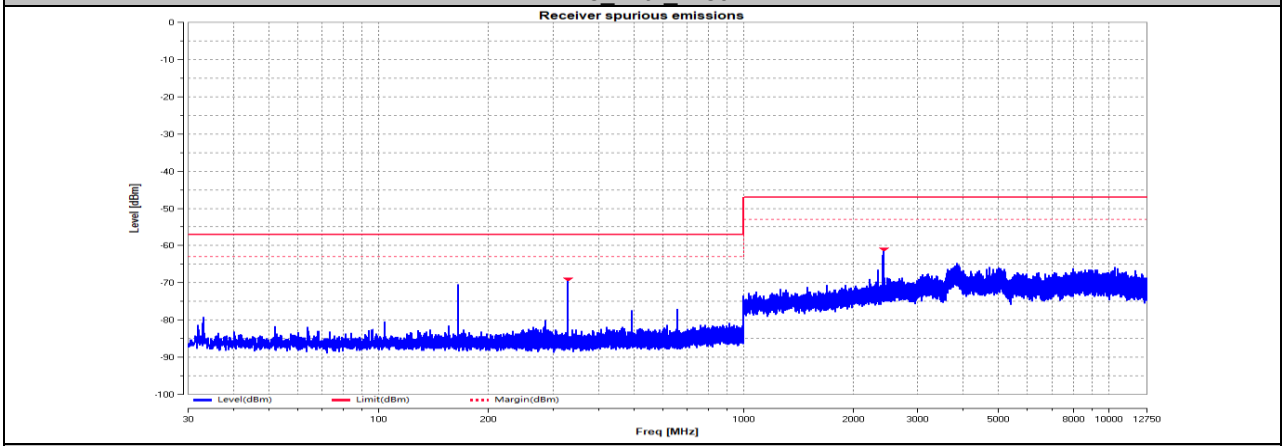
9.7.2. Conducted Test Graphs-Pre-scan



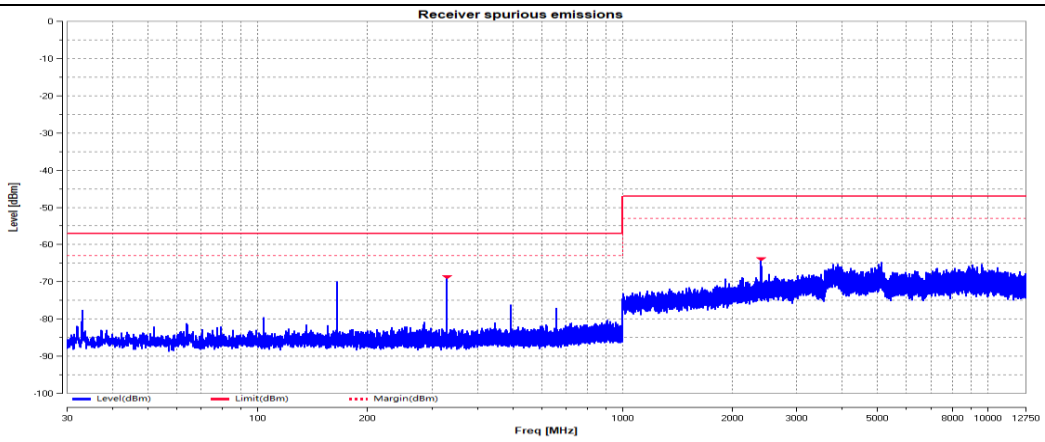
DH5_Ant1_2402



DH5_Ant1_2480



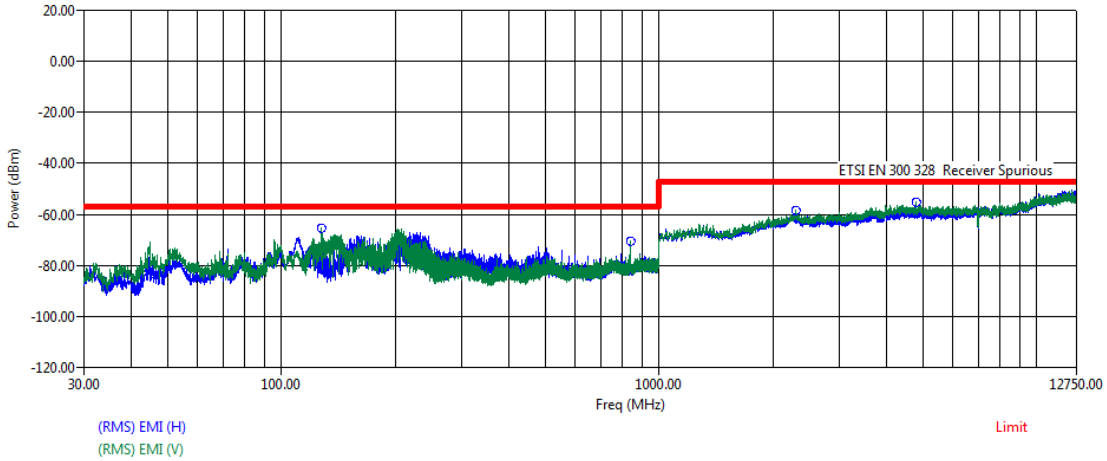
3DH5_Ant1_2402



3DH5_Ant1_2480

9.7.3. Radiated Test Result

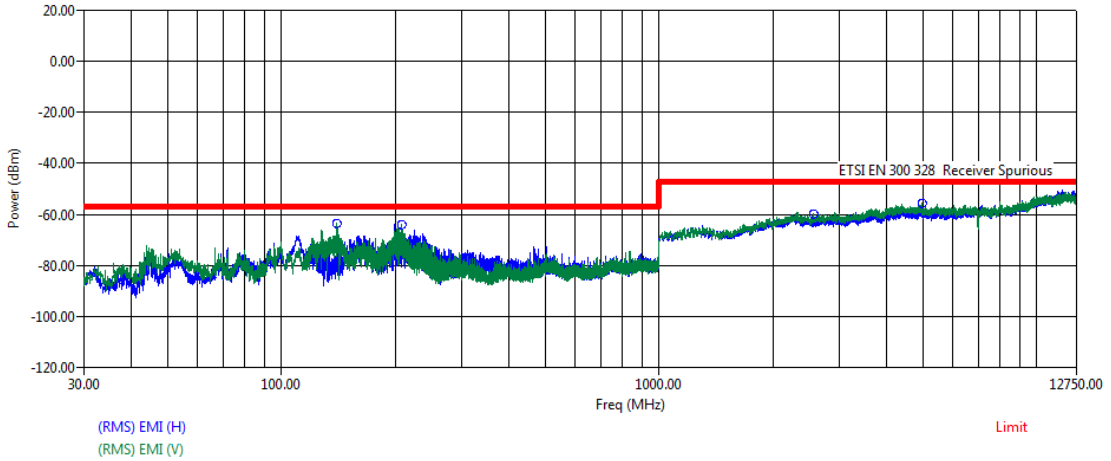
Receiver spurious emissions above 1 GHz worst case			
Measurement Method	Radiated	Polar:	Horizontal & Vertical
Test Mode:	GFSK	Test Channel:	CH 0



Freq (MHz)	(RMS) Trace (H) (dBuV)	ERP Factor (H) (dB)	Transducer (H) (dB)	Cable (H) (dB)	Preamp (H) (dB)	(RMS) EMI (H) (dBm)	Limit (dBm)	(RMS) Margin (H) (dB)
127.90	53.71	-88.01	0.00	1.45	42.69	-75.55	-57.00	-18.55
838.75	36.94	-79.62	0.00	3.92	42.46	-81.21	-57.00	-24.21
2297.00	42.23	-62.53	0.00	6.51	48.24	-62.03	-47.00	-15.03
4802.50	42.95	-61.09	0.00	9.30	48.32	-57.16	-47.00	-10.16
Freq (MHz)	(RMS) Trace (V) (dBuV)	ERP Factor (V) (dB)	Transducer (V) (dB)	Cable (V) (dB)	Preamp (V) (dB)	(RMS) EMI (V) (dBm)	Limit (dBm)	(RMS) Margin (V) (dB)
127.90	65.67	-89.65	0.00	1.45	42.69	-65.23	-57.00	-8.23
838.75	47.43	-79.48	0.00	3.92	42.46	-70.59	-57.00	-13.59
2297.00	44.29	-61.10	0.00	6.51	48.24	-58.53	-47.00	-11.53
4802.50	43.08	-59.07	0.00	9.30	48.32	-55.01	-47.00	-8.01

Note: EMI=Trace + Cable(Loss) + ERP Factor + Transducer
Margin=EMI - Limit

Receiver spurious emissions above 1 GHz worst case			
Measurement Method	Radiated	Polar:	Horizontal & Vertical
Test Mode:	GFSK	Test Channel:	CH 78



Freq (MHz)	(RMS) Trace (H) (dBuV)	ERP Factor (H) (dB)	Transducer (H) (dB)	Cable (H) (dB)	Preamp (H) (dB)	(RMS) EMI (H) (dBm)	Limit (dBm)	(RMS) Margin (H) (dB)
140.25	51.39	-89.20	0.00	1.61	42.65	-78.85	-57.00	-21.85
208.00	60.92	-86.57	0.00	1.92	42.51	-66.24	-57.00	-9.24
2556.50	41.17	-63.90	0.00	6.80	48.34	-64.27	-47.00	-17.27
4958.50	42.04	-60.68	0.00	9.64	48.30	-57.31	-47.00	-10.31
Freq (MHz)	(RMS) Trace (V) (dBuV)	ERP Factor (V) (dB)	Transducer (V) (dB)	Cable (V) (dB)	Preamp (V) (dB)	(RMS) EMI (V) (dBm)	Limit (dBm)	(RMS) Margin (V) (dB)
140.25	66.91	-89.22	0.00	1.61	42.65	-63.35	-57.00	-6.35
208.00	63.00	-86.40	0.00	1.92	42.51	-64.00	-57.00	-7.00
2556.50	44.55	-62.64	0.00	6.80	48.34	-59.64	-47.00	-12.64
4958.50	42.62	-59.37	0.00	9.64	48.30	-55.42	-47.00	-8.42

Note: EMI=Trace + Cable(Loss) + ERP Factor + Transducer
Margin=EMI - Limit

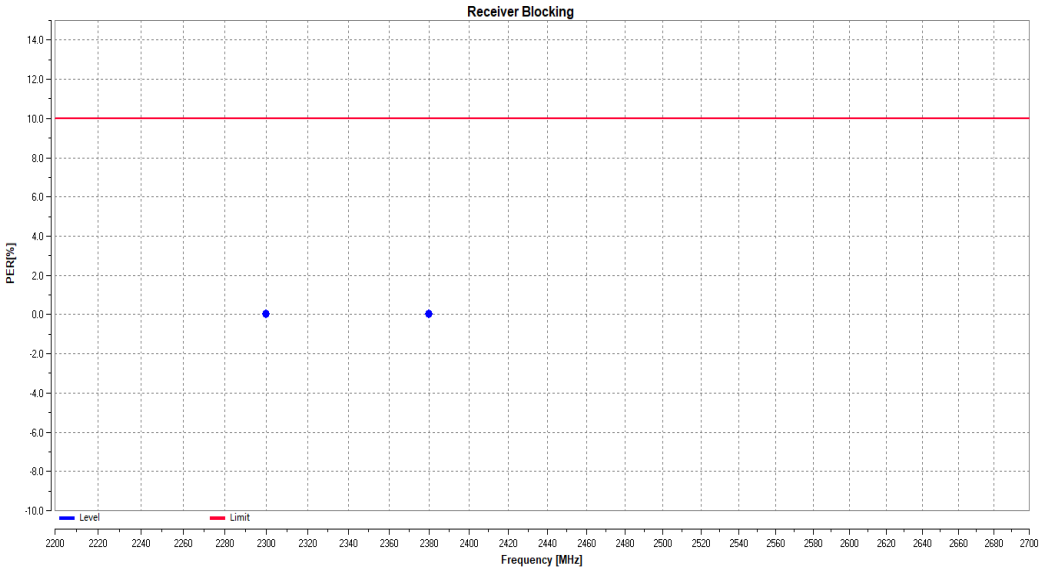
Note All the modes had been tested, but only the worst data was recorded in the report.

9.8. Appendix H: Receiver Blocking

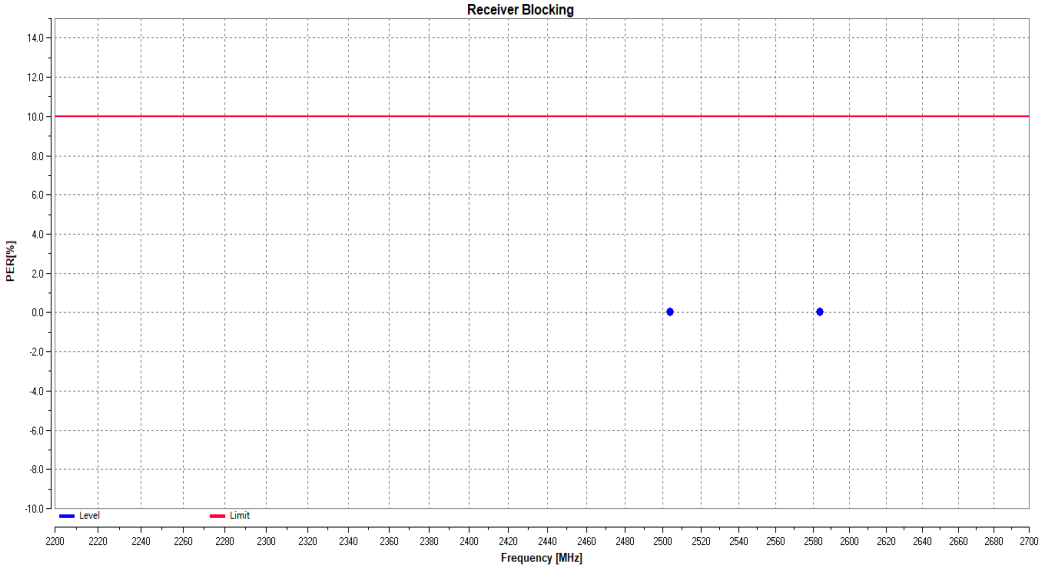
9.8.1. Test Result

Test Mode	Freq. [MHz]	CW [dBm]	PER [%]	Limit [%]	Verdict
DH5	2300	-30.85	0.00	<=10	PASS
	2380	-30.85	0.00	<=10	PASS
	2504	-30.85	0.00	<=10	PASS
	2584	-30.85	0.00	<= 10	PASS

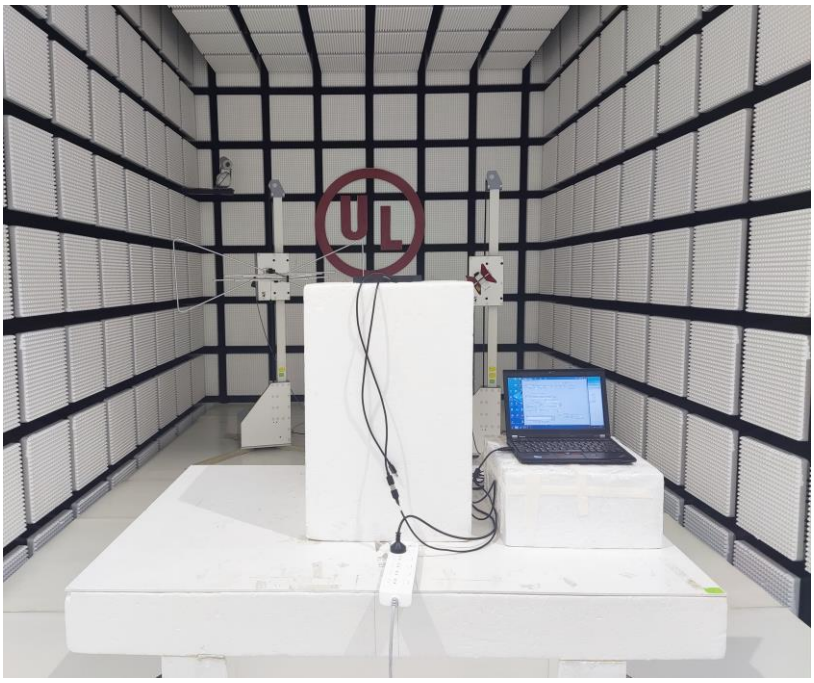
GFSK_2402



GFSK_2480



RADIATED SPURIOUS EMISSIONS TEST PHOTOS



END OF REPORT