CE Test Report

Equipment	:	**802.11abn (1x1) + Bluetooth (2.1) module**
Model No.	:	**SDC-SSD40NBT**
Brand Name	:	**Laird Technologies**
Applicant	:	**Laird Technologies**
Address	:	**W66N220 Commerce Court, Cedarburg, Wisconsin 53012, USA**
Standard	:	**EN 300 328 V2.1.1 (2016-11)**
Received Date	:	**Apr. 06, 2017**
Tested Date	:	**Mar. 25 ~ Mar. 28 2016 (for original test)** **Apr. 25, 2017 (for new test)**

We, International Certification Corp., would like to declare that the tested sample has been evaluated and in compliance with the requirement of the above standards. The test results contained in this report refer exclusively to the product. It may be duplicated completely for legal use with the approval of the applicant. It shall not be reproduced except in full without the written approval of our laboratory.

Reviewed by: **Approved by:**

James Fan / Assistant Manager **Gary Chang / Manager**

Testing Laboratory 2732

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Release Record

Report No.	Version	Description	Issued Date
ER442903-02AD	Rev. 01	Initial issue	May 16, 2017

Summary of Test Results

Ref. Std. Clause	Test Items	Measured	Result
4.3.1.2	RF Output Power	EIRP (dBm): 4.66	Pass
4.3.1.3	Duty cycle, Tx-Sequence, Tx-gap	Only for non-adaptive equipment	N/A
4.3.1.4	Dwell time, Minimum Frequency Occupation & Hopping Sequence	Meet the requirement of limit.	Pass
4.3.1.5	Hopping Frequency Separation	Meet the requirement of limit.	Pass
4.3.1.6	Medium Utilisation (MU) factor	Only for non-adaptive equipment	N/A
4.3.1.7	Adaptivity	The RF Output power is less than 10 dBm e.i.r.p. This item is not applicable	N/A
4.3.1.8	Occupied Channel Bandwidth	Meet the requirement of limit.	Pass
4.3.1.9	Transmitter unwanted emissions in the out of band domain	Meet the requirement of limit.	Pass
4.3.1.10	Transmitter unwanted emissions in the spurious domain	Meet the requirement of limit.	Pass
4.3.1.11	Receiver spurious emissions	Meet the requirement of limit.	Pass
4.3.1.12	Receiver Blocking	Meet the requirement of limit.	Pass
4.3.1.13	Geo-location capability	The device has no geo-location capability.	N/A

1 General Description

1.1 Information

This report is issued as a supplementary report to original ICC report no. ER442903-01AD. The difference is concerned with following items:

- ✧ Updating standard version from V1.9.1 to V2.1.1.
- ✧ New applicant address

Therefore, related test items had been performed and presented in the following sections.

1.1.1 Specification of the Equipment under Test (EUT)

RF General Information				
Frequency Range (MHz)	**Bluetooth Mode**	**Ch. Frequency (MHz)**	**Channel Number**	**Data Rate**
2400-2483.5	BR V2.1	2402-2480	0-78 [79]	1 Mbps
2400-2483.5	EDR V2.1	2402-2480	0-78 [79]	2 Mbps
2400-2483.5	EDR V2.1	2402-2480	0-78 [79]	3 Mbps
Note 1: Bluetooth BR uses a GFSK modulation. Note 2: Bluetooth EDR uses a combination of π/4-DQPSK and 8DPSK modulation.				

1.1.2 Antenna Details

Ant. No.	Brand / Model	Type	Connector	Operating Frequencies (MHz) / Antenna Gain (dBi)			
				2400~2483.5	**5150~5250**	**5250~5350**	**5470~5725**
1	Cisco AIR-ANT 4941	Dipole	RP-TNC plug	2	---	---	---
2	Radiall Larsen R380.500.314	Dipole	RP-TNC plug	1.6	5	5	5

1.1.3 EUT Operational Condition

Power Supply Type	3.3Vdc from host		
SW Version	22.3.4.29		
Operational Climatic	☒ Tnom (20°C)	☒ Tmax (55°C)	☒ Tmin (-20°C)

1.1.4 Accessories

N/A

1.1.5 Channel List

Frequency band (MHz)				2400~2483.5			
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	--	--

1.1.6 Test Tool and Duty Cycle

Test Tool	Booltooth SRU
Duty Cycle Of Test Signal (%)	75.13% - BR 73.44% - EDR
Duty Factor (dB)	1.24 - BR 1.34 - EDR

1.1.7 Power Setting

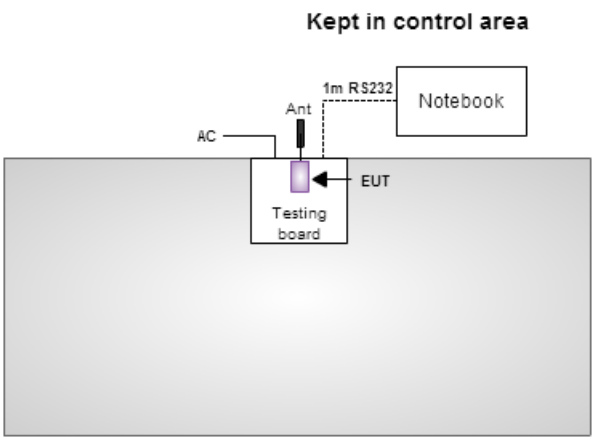
Modulation Mode	**Test Frequency (MHz)**		
	2402	**2441**	**2480**
BR-1Mbps	Default	Default	Default
EDR-3Mbps	Default	Default	Default

1.2 Local Support Equipment List

Support Equipment List					
No.	**Equipment**	**Brand**	**Model**	**FCC ID**	**Signal cable / Length (m)**
1	Notebook	DELL	E6430	DoC	---
2	Testing board	---	---	---	---

1.3 Test Setup Chart

Test Setup Diagram



1.4 Test Equipment List and Calibration Data

Test Item	Radiated Emissions				
Test Site	Fully-anechoic chamber 1 / (05CH01-WS)				
Tested Date	Mar. 28, 2016				
Instrument	**Manufacturer**	**Model No.**	**Serial No.**	**Calibration Date**	**Calibration Until**
Spectrum Analyzer	Agilent	N9010A	MY54200247	Aug. 24, 2015	Aug. 23, 2016
Bilog Antenna	SCHWARZBECK	VULB9168	VULB9168-524	Oct. 03, 2015	Oct. 02, 2016
Horn Antenna 1G-18G	SCHWARZBECK	BBHA 9120 D	BBHA 9120 D 1094	Oct. 20, 2015	Oct. 19, 2016
Horn Antenna 18G-40G	SCHWARZBECK	BBHA 9170	BBHA 9170508	Jan. 04, 2016	Jan. 03, 2017
Preamplifier	Agilent	83017A	MY39501310	Dec. 11, 2015	Dec. 10, 2016
Preamplifier	EMC	EMC02325	980146	Oct. 14, 2015	Oct. 13, 2016
Preamplifier	EMC	EMC184045B	980192	Sep. 01, 2015	Aug. 31, 2016
RF Cable	HUBER+SUHNER	SUCOFLEX104	MY16609/4	Dec. 04, 2015	Dec. 03, 2016
RF Cable	HUBER+SUHNER	SUCOFLEX104	MY16608/4	Dec. 04, 2015	Dec. 03, 2016
RF Cable	HUBER+SUHNER	SUCOFLEX104	MY16617/4	Dec. 04, 2015	Dec. 03, 2016
LF cable 3M	Woken	CFD400NL-LW	CFD400NL-005	Dec. 04, 2015	Dec. 03, 2016
LF cable 10M	Woken	CFD400NL-LW	CFD400NL-006	Dec. 04, 2015	Dec. 03, 2016
Measurement Software	AUDIX	e3	6.120210g	NA	NA
Note: Calibration Interval of instruments listed above is one year.					

Test Item	RF Conducted				
Test Site	(TH01-WS)				
Tested Date	Mar. 25, 2016				
Instrument	**Manufacturer**	**Model No.**	**Serial No.**	**Calibration Date**	**Calibration Until**
Spectrum Analyzer	ROHDE&SCHWARZ	FSV40	101486	Oct. 14, 2015	Oct. 13, 2016
TEMP&HUMIDITY CHAMBER	GIANT FORCE	GCT-225-40-SP-SD	MAF1212-002	Nov. 27, 2015	Nov. 26, 2016
Power Sensor	Agilent	U2021XA	MY53480019	Feb. 02, 2016	Feb. 01, 2017
Power Sensor	Agilent	U2021XA	MY53510003	Feb. 02, 2016	Feb. 01, 2017
Power Sensor	Agilent	U2021XA	MY54070003	Feb. 15, 2016	Feb. 14, 2017
Power Sensor	Agilent	U2021XA	MY54060013	Feb. 15, 2016	Feb. 14, 2017
Signal Generator	R&S	SMB100A	175727	Oct. 05, 2015	Oct. 04, 2016
Combiner(1X2)	woken	0120A02201801O	DOM2AEW1A22	Dec. 17, 2015	Dec. 16, 2016
Combiner(1X4)	woken	0120A04056002D	111204	Dec. 17, 2015	Dec. 16, 2016
Measurement Software	Sporton	Sporton_1	1.3.30	NA	NA
Measurement Software	Agilent	EN RF test	1.1501125	NA	NA
Note: Calibration Interval of instruments listed above is one year.					

Test Item	Receiver Blocking				
Test Site	(05CH01-WS)				
Tested Date	Apr. 25, 2017				
Instrument	**Manufacturer**	**Model No.**	**Serial No.**	**Calibration Date**	**Calibration Until**
Wireless connectivity tester	ROHDE&SCHWARZ	CMW270	100856	Nov. 07, 2016	Nov. 06, 2017
Signal Generator	R&S	SMB100A	175727	Oct. 19, 2016	Oct. 18, 2017
RF Cable	HUBER+SUHNER	SUCOFLEX_104	500202/4	Dec. 16, 2016	Dec. 15, 2017
RF Cable	HUBER+SUHNER	SUCOFLEX_104	296088/4	Dec. 16, 2016	Dec. 15, 2017
RF Cable	HUBER+SUHNER	SUCOFLEX_104	329023/4	Dec. 16, 2016	Dec. 15, 2017
Note: Calibration Interval of instruments listed above is one year.					

1.5 Testing Applied Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

EN 300 328 V2.1.1 (2016-11)

1.6 Measurement Uncertainty

ISO/IEC 17025 requires that an estimate of the measurement uncertainties associated with the emissions test results be included in the report. The measurement uncertainties given below are based on a 95% confidence level (based on a coverage factor (k=2)

Measurement Uncertainty		
Parameters	**Uncertainty**	**Limit**
Occupied Channel Bandwidth	±0.0034 %	±5 %
RF output power, conducted	±0.537 dB	±1,5 dB
Power Spectral Density, conducted	±0.463 dB	±3 dB
Unwanted Emissions, conducted	±2.505 dB	±3 dB
All emissions, radiated	±3.401 dB	±6 dB
Temperature	±0.6 ^{o}C	±3 °C
Supply voltages	±0.16 %	±3 %
Time	±0.1 %	±5 %

2 Test Configuration

2.1 Testing Condition

Test Item	Test Site	Ambient Condition	Tested By
RF Conducted	TH01-WS	24°C / 63%	Nic Guan
Radiated Emission	05CH01-WS	24°C / 65%	Chris Zeng
Receiver Blocking	05CH01-WS	22.5°C / 64%	Jack Li

2.2 The Worst Test Modes and Channel Details

Test item	Modulation Mode	Test Frequency (MHz)	Data Rate	Test Configuration
RF Output Power	GFSK 8DPSK	Hopping Hopping	1 Mbps 3 Mbps	---
Accumulated Transmit Time Minimum Frequency Occupation Hopping Sequence	GFSK 8DPSK	Hopping Hopping	1 Mbps 3 Mbps	---
Hopping Frequency Separation	GFSK 8DPSK	two-adjacent	1 Mbps 3 Mbps	---
Occupied Channel Bandwidth	GFSK 8DPSK	2402 / 2480 2402 / 2480	1 Mbps 3 Mbps	---
Transmitter unwanted emissions in the OOB domain	GFSK 8DPSK	Hopping Hopping	1 Mbps 3 Mbps	---
Transmitter Spurious Emissions Receiver Spurious Emissions	GFSK 8DPSK	2402 / 2480 2402 / 2480	1 Mbps 3 Mbps	---
Receiver Blocking	GFSK	Hopping	1 Mbps	---

NOTE:

1. 2 antennas are used for this device (Dipole antenna with 2 dBi gain & Dipole antenna with 1.6 dBi gain.) After pre-test, highest gain antenna is selected to perform radiated emission test.

3 Transmitter Test Results

3.1 RF Output Power

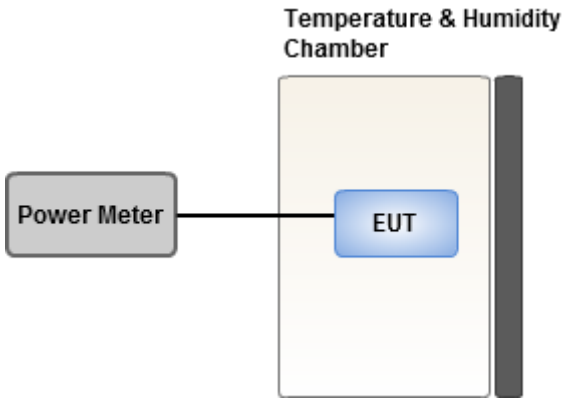
3.1.1 Limit of RF Output Power

The maximum RF output power shall be equal to or less than 20 dBm

3.1.2 Test Procedures

Reference to clause 5.4.2.2 of ETSI EN 300 328 V2.1.1 (2016-11).

3.1.3 Test Setup



3.1.4 Test Result of RF Output Power

Condition	Modulation Mode	Freq. (MHz)	EIRP Power	Limit (dBm)
TnomVnom	BR-1Mbps	Hopping	3.91	20
TminVnom	BR-1Mbps	Hopping	**4.66**	20
TmaxVnom	BR-1Mbps	Hopping	3.43	20
TnomVnom	EDR-3Mbps	Hopping	4.02	20
TminVnom	EDR-3Mbps	Hopping	4.63	20
TmaxVnom	EDR-3Mbps	Hopping	3.43	20

3.2 Accumulated Transmit Time, Minimum Frequency Occupation and Hopping Sequence

3.2.1 Limit of Accumulated Transmit Time, Minimum Frequency Occupation and Hopping Sequence

Adaptive mode

Adaptive Frequency Hopping equipment shall be capable of operating over a minimum of 70 % of the band 2.4GHz to 2.4835GHz. The Accumulated Transmit Time on any hopping frequency 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. In order for the equipment to comply with the Frequency Occupation requirement, it shall meet either of the following two options:

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. The hopping sequence(s) shall contain at least N hopping frequencies at all times, where N is 15 or 15 divided by the minimum Hopping Frequency Separation in MHz, whichever is the greater.

Non-Adaptive mode

The Accumulated Transmit Time on any hopping frequency 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. Non-adaptive medical devices requiring reverse compatibility with other medical devices placed on the market that are compliant with version 1.7.1 or earlier versions of ETSI EN 300 328, are allowed to have an operating mode in which the maximum Accumulated Transmit Time is 400 ms within any observation period of 400 ms multiplied by the minimum number of hopping frequencies (N) that have to be used, only when communicating to these legacy devices already placed on the market. In order for the equipment to comply with the Frequency Occupation requirement, it shall meet either of the following two options:

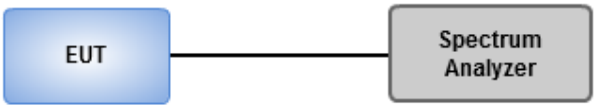
Option 1: Each hopping frequency of the hopping sequence shall be occupied at least once within a period not exceeding four times the product of the dwell time and the number of hopping frequencies in use.

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. The hopping sequence(s) shall contain at least N hopping frequencies where N is 15 or 15 divided by the minimum Hopping Frequency Separation in MHz, whichever is the greater.

3.2.2 Test Procedures

Reference to clause 5.4.4.2 of ETSI EN 300 328 V2.1.1 (2016-11).

3.2.3 Test Setup



3.2.4 Test Result of Hopping Sequence

Modulation Mode	Freq. (MHz)	Hopping Mode	Hopping Channels	Hopping Channels Limits	F_l 20dB (MHz)	F_h 20dB (MHz)	Min. Hopping Range (%)	Min. Hopping Range Limit (%)
BR-1Mbps	Hopping	Non-AFH	79	15	N/A	N/A	N/A	N/A
EDR-3Mbps	Hopping	AFH	20	20	2417	2479	79.49%	70.00%

3.2.5 Test Result of Accumulated Transmit Time

Modulation Mode	Freq. (MHz)	Hopping Mode	Worst Duty Cycle Data Packet	Minimum Number of Hop Freq. (N)	Dwell Time per Hop (ms)	Number of Hop in [N x MDT]	[N x MDT] (s)	Dwell Time in [N x MDT] (ms)	Max. Dwell Time (MDT) Limit (ms)
BR-1Mbps	Hopping	Non-AFH	DH5	79	2.96	106.6	31.6	315.54	400.00
EDR-3Mbps	Hopping	AFH	DH5	20	3.18	106.6	8	338.99	400.00

3.2.6 Test Result of Minimum Frequency Occupation

Modulation Mode	Freq. (MHz)	Hopping Mode	Worst Duty Cycle Data Packet	Actual No. of Hopping Freq. (N)	Dwell Time per Hop (ms)	No. of Hop in [4 x dwell time per hop x N]	[4 x dwell time per hop x N] (ms)	Dwell Time in [4 x dwell time per hop x N] (ms)	Min. No. of Hopping Limit in [4 x dwell time per hop x N]
BR-1Mbps	Hopping	Non-AFH	DH5	79	2.96	3.16	935.36	9.35	1
EDR-3Mbps	Hopping	AFH	DH5	20	3.18	3.16	254.40	10.05	1

3.3 Hopping Frequency Separation

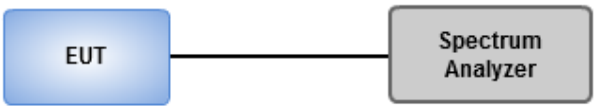
3.3.1 Limit of Hopping Frequency Separation

For adaptive Frequency Hopping equipment, the minimum Hopping Frequency Separation shall be 100 kHz. For non-adaptive Frequency Hopping equipment, the Hopping Frequency Separation shall be equal or greater than the Occupied Channel Bandwidth, with a minimum separation of 100 kHz.

3.3.2 Test Procedures

Reference to clause 5.4.5.2 of ETSI EN 300 328 V2.1.1 (2016-11).

3.3.3 Test Setup



3.3.4 Test Result of Hopping Frequency Separation

Modulation Mode	Freq. (MHz)	Hopping Mode	$F2402_{PK}$ (MHz)	$F2403_{PK}$ (MHz)	F_{HS} (MHz)	Limit F_{HS} (kHz)
BR-1Mbps	two-adjacent	Non-AFH	2402.152	2403.152	1.0000	100
EDR-3Mbps	two-adjacent	AFH	2402.152	2403.152	1.0000	100

3.4 Occupied Channel Bandwidth

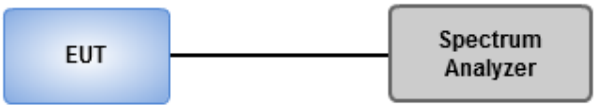
3.4.1 Limit of Occupied Channel Bandwidth

The Occupied Channel Bandwidth for each hopping frequency shall fall completely within 2.4~2.4835 GHz. For non-adaptive Frequency Hopping equipment with e.i.r.p greater than 10 dBm, the Occupied Channel Bandwidth for every occupied hopping frequency shall be equal to or less than the value declared by the supplier. This declared value shall not be greater than 5 MHz.

3.4.2 Test Procedures

Reference to clause 5.4.7.2 of ETSI EN 300 328 V2.1.1 (2016-11).

3.4.3 Test Setup

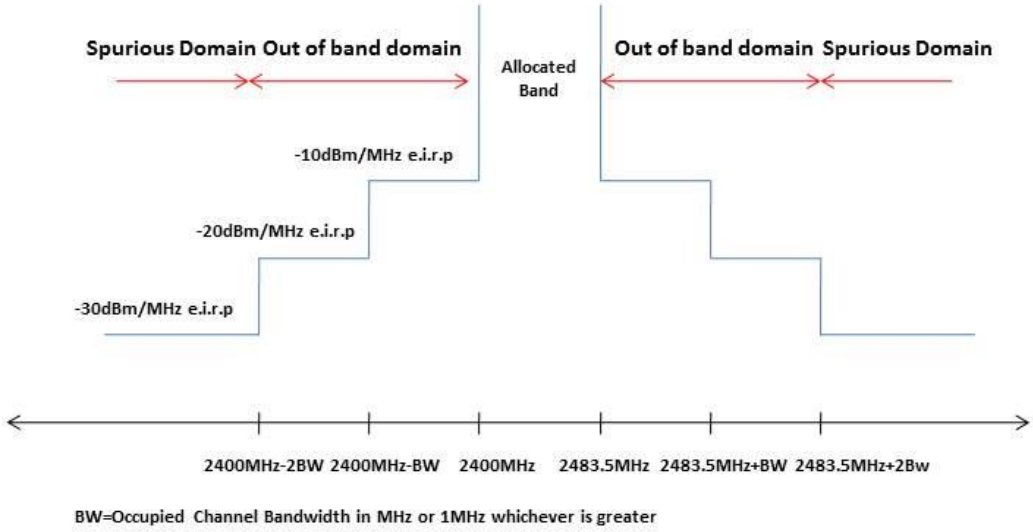


3.4.4 Test Result of Occupied Channel Bandwidth

Modulation Mode	Frequency (MHz)	99% Bandwidth (MHz)	F_L at 99% BW (MHz)	F_H at 99% BW (MHz)	20dB Bandwidth (MHz)	Limit F_L / F_H (MHz)
BR-1Mbps	2402	0.90	2401.54	2402.44	0.96	2400.0
BR-1Mbps	2480	0.90	2479.54	2480.44	0.96	2483.5
EDR-3Mbps	2402	1.21	2401.38	2402.59	1.35	2400.0
EDR-3Mbps	2480	1.21	2479.38	2480.59	1.35	2483.5

3.5 Transmitter Unwanted Emissions in the Out-Of-Band Domain

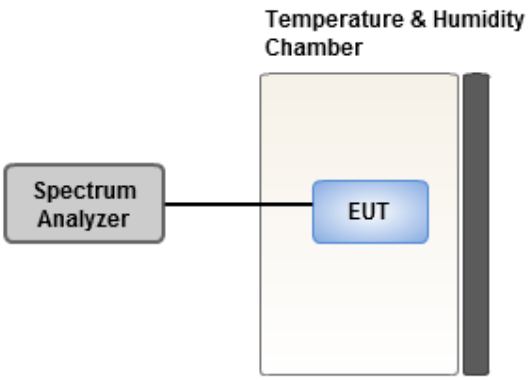
3.5.1 Limit of Transmitter Unwanted Emissions in the Out-Of-Band Domain



3.5.2 Test Procedures

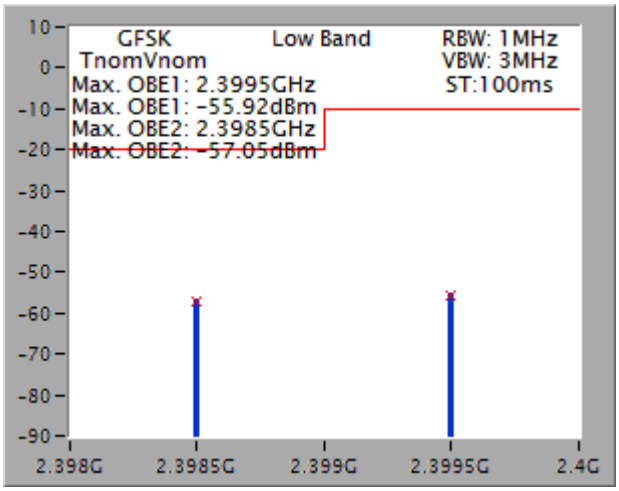
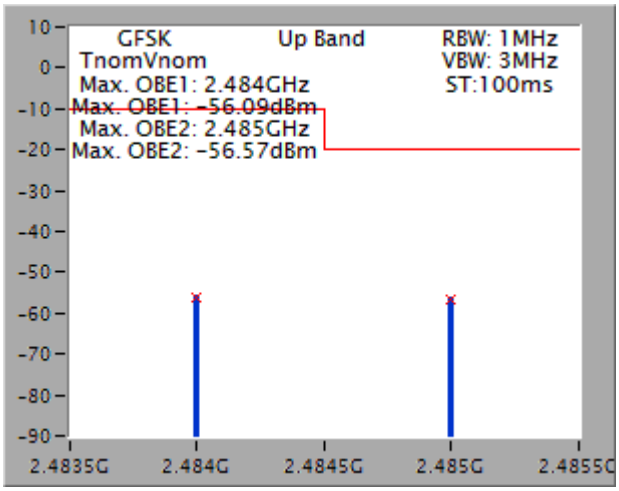
Reference to clause 5.4.8.2 of ETSI EN 300 328 V2.1.1 (2016-11).

3.5.3 Test Setup

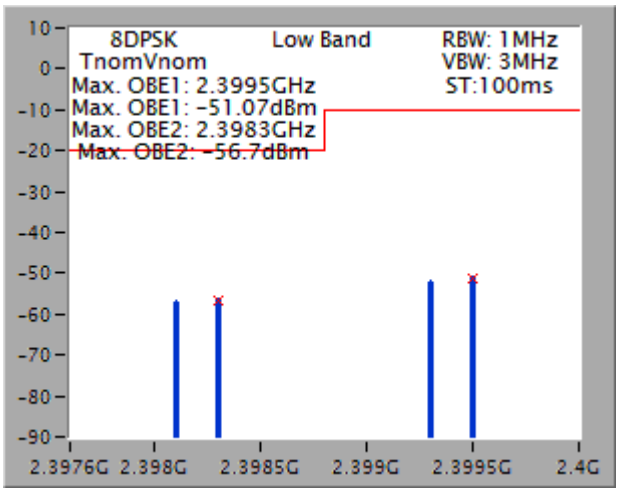


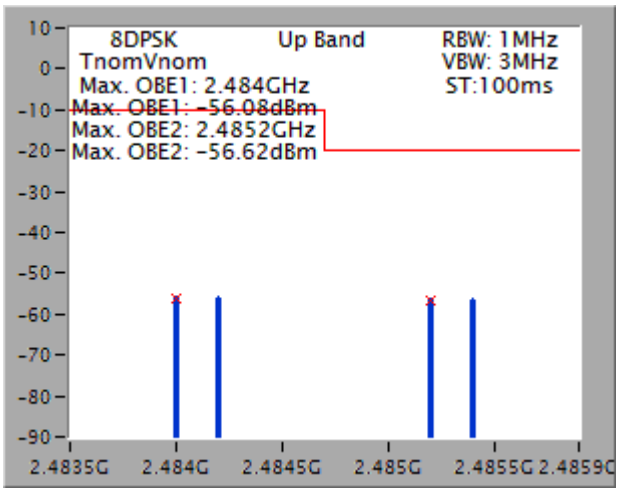
3.5.4 Test Result of Transmitter Unwanted Emissions in the Out-Of-Band Domain

Condition	Modulation Mode	Freq. (MHz)	OOB Freq. (MHz)	OOB Emissions (dBm)	Limit (dBm)
TnomVnom	BR-1Mbps	Hopping	2399.5	-55.92	-10
TnomVnom	BR-1Mbps	Hopping	2398.5	-57.05	-20
TnomVnom	BR-1Mbps	Hopping	2484.0	-56.09	-10
TnomVnom	BR-1Mbps	Hopping	2485.0	-56.57	-20

Low Band	Up Band
	

Condition	Modulation Mode	Freq. (MHz)	OOB Freq. (MHz)	OOB Emissions (dBm)	Limit (dBm)
TnomVnom	EDR-3Mbps	Hopping	2399.5	-51.07	-10
TnomVnom	EDR-3Mbps	Hopping	2398.3	-56.70	-20
TnomVnom	EDR-3Mbps	Hopping	2484.0	-56.08	-10
TnomVnom	EDR-3Mbps	Hopping	2485.2	-56.62	-20
Low Band			**Up Band**		





3.6 Transmitter Unwanted Emissions In The Spurious Domain

3.6.1 Limit of Transmitter Unwanted Emissions In The Spurious Domain

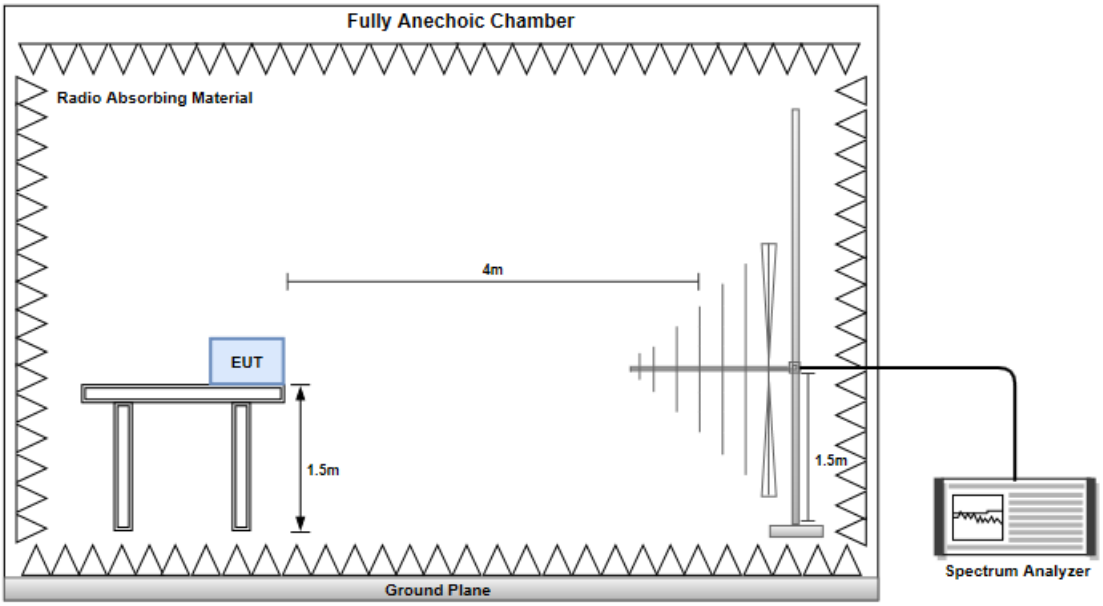
Frequency Range (MHz)	Maximum power (dBm)	Bandwidth (kHz)
30 to 47	-36	100
47 to 74	-54	100
74 to 87.5	-36	100
87.5 to 118	-54	100
118 to 174	-36	100
174 to 230	-54	100
230 to 470	-36	100
470 to 862	-54	100
862 to 1000	-36	100
1000 to 12750	-30	1000

3.6.2 Test Procedures

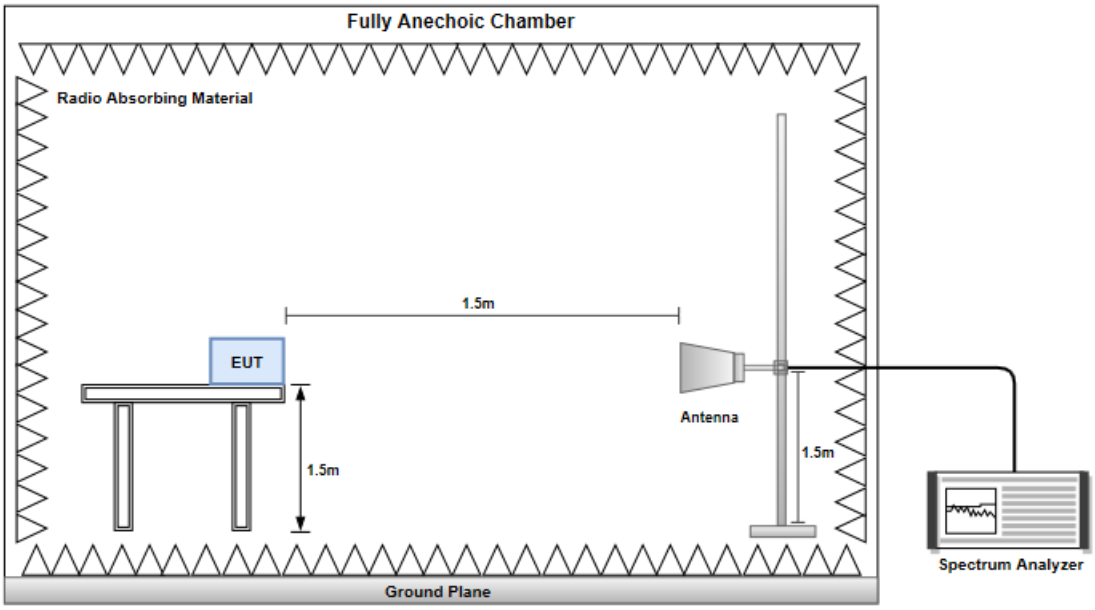
Reference to clause 5.4.9.2 of ETSI EN 300 328 V2.1.1 (2016-11).

3.6.3 Test Setup

Below 1GHz

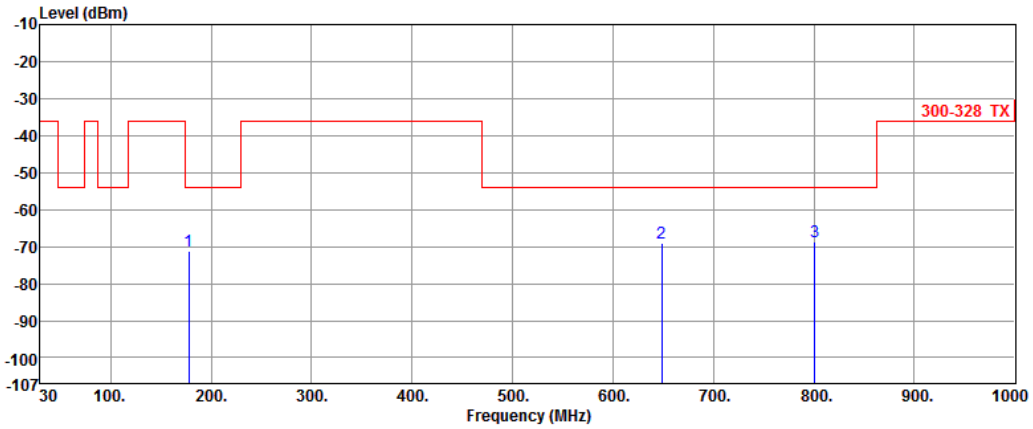


Above 1 GHz



3.6.4 Transmitter Radiated Unwanted Emissions (Below 1GHz)

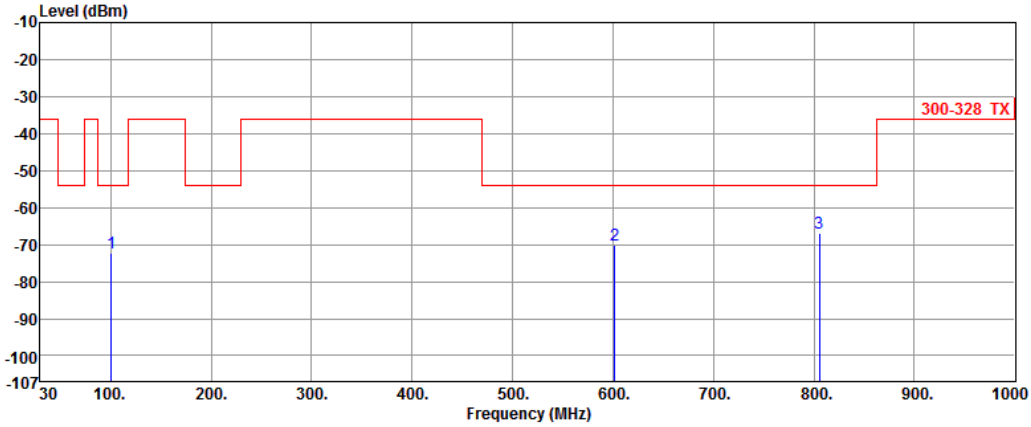
Modulation	GFSK	**Test Freq. (MHz)**	2402
Polarization	Horizontal		



	Freq.	Measured value	Limit	Margin	Factor	Reading
	MHz	dBm	dBm	dB	dB	dBm
1	177.54	-71.23	-54.00	-17.23	-3.06	-68.17
2	648.53	-68.95	-54.00	-14.95	6.46	-75.41
3	800.54	-68.57	-54.00	-14.57	8.24	-76.81

Note 1: Measured Value (dBm) = Reading (dBm) + Factor (dB)
Note 2: Margin (dB) = Measured Value (dBm) – Limit (dBm)

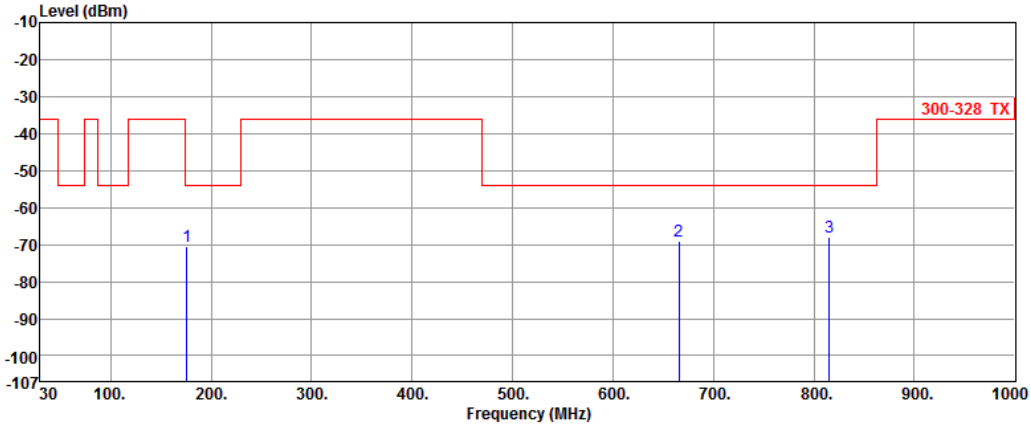
Modulation	GFSK	Test Freq. (MHz)	2402
Polarization	Vertical		



	Freq.	Measured value	Limit	Margin	Factor	Reading
	MHz	dBm	dBm	dB	dB	dBm
1	100.54	-72.30	-54.00	-18.30	-4.92	-67.38
2	601.46	-70.10	-54.00	-16.10	5.98	-76.08
3	805.54	-66.77	-54.00	-12.77	8.91	-75.68

Note 1: Measured Value (dBm) = Reading (dBm) + Factor (dB)
Note 2: Margin (dB) = Measured Value (dBm) – Limit (dBm)

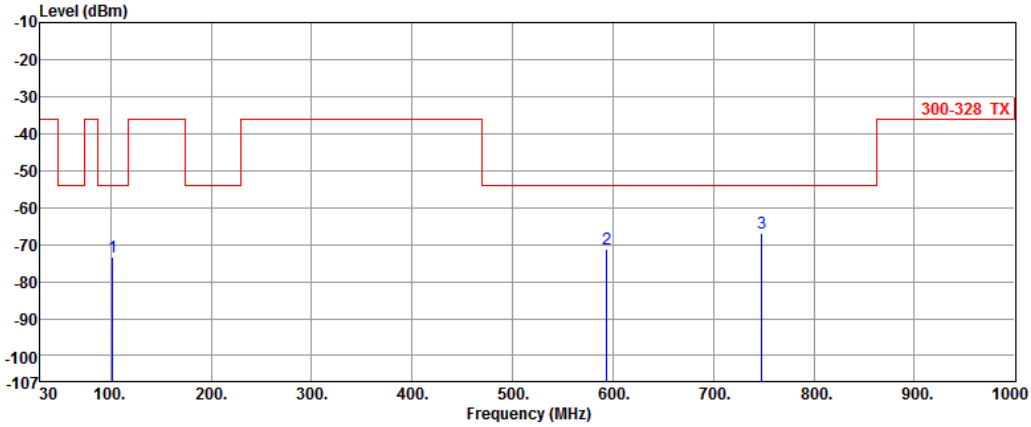
Modulation	GFSK	Test Freq. (MHz)	2480
Polarization	Horizontal		



	Freq.	Measured value	Limit	Margin	Factor	Reading
	MHz	dBm	dBm	dB	dB	dBm
1	175.56	-70.52	-54.00	-16.52	-2.65	-67.87
2	665.65	-68.95	-54.00	-14.95	7.09	-76.04
3	815.56	-67.94	-54.00	-13.94	8.56	-76.50

Note 1: Measured Value (dBm) = Reading (dBm) + Factor (dB)
Note 2: Margin (dB) = Measured Value (dBm) – Limit (dBm)

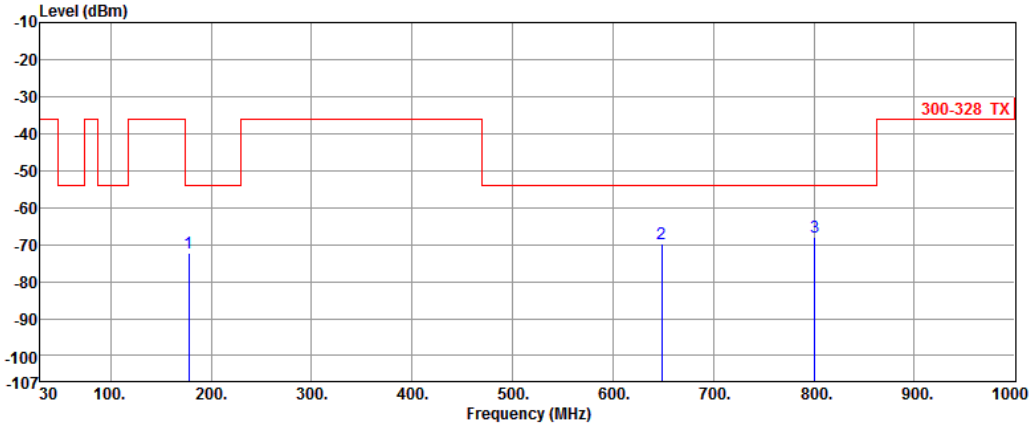
Modulation	GFSK	Test Freq. (MHz)	2480
Polarization	Vertical		



	Freq.	Measured value	Limit	Margin	Factor	Reading
	MHz	dBm	dBm	dB	dB	dBm
1	101.78	-73.28	-54.00	-19.28	-4.91	-68.37
2	593.57	-71.24	-54.00	-17.24	5.62	-76.86
3	747.80	-66.87	-54.00	-12.87	8.99	-75.86

Note 1: Measured Value (dBm) = Reading (dBm) + Factor (dB)
Note 2: Margin (dB) = Measured Value (dBm) – Limit (dBm)

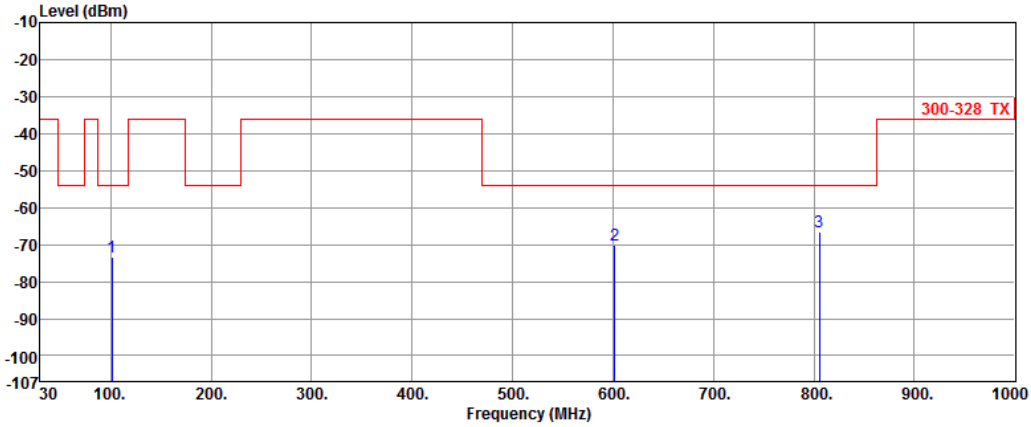
Modulation	8DPSK	Test Freq. (MHz)	2402
Polarization	Horizontal		



	Freq.	Measured value	Limit	Margin	Factor	Reading
	MHz	dBm	dBm	dB	dB	dBm
1	177.52	-72.23	-54.00	-18.23	-3.06	-69.17
2	648.53	-69.95	-54.00	-15.95	6.46	-76.41
3	800.57	-68.07	-54.00	-14.07	8.24	-76.31

Note 1: Measured Value (dBm) = Reading (dBm) + Factor (dB)
Note 2: Margin (dB) = Measured Value (dBm) – Limit (dBm)

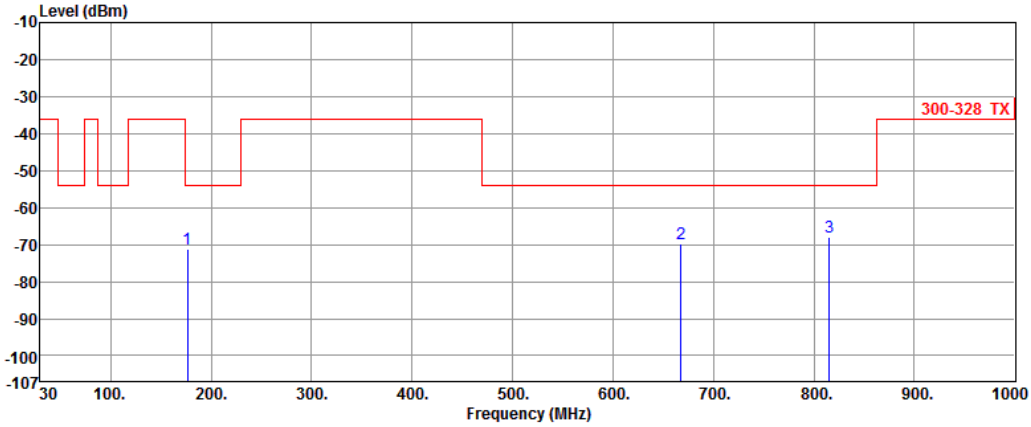
Modulation	8DPSK	Test Freq. (MHz)	2402
Polarization	Vertical		



	Freq.	Measured value	Limit	Margin	Factor	Reading
	MHz	dBm	dBm	dB	dB	dBm
1	101.53	-73.30	-54.00	-19.30	-4.91	-68.39
2	601.54	-70.07	-54.00	-16.07	5.99	-76.06
3	805.57	-66.66	-54.00	-12.66	8.91	-75.57

Note 1: Measured Value (dBm) = Reading (dBm) + Factor (dB)
Note 2: Margin (dB) = Measured Value (dBm) – Limit (dBm)

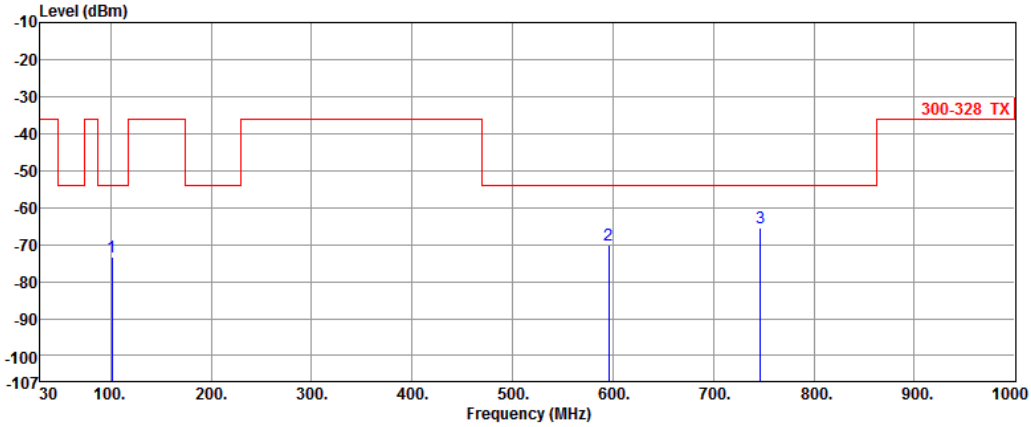
Modulation	8DPSK	Test Freq. (MHz)	2480
Polarization	Horizontal		



	Freq.	Measured value	Limit	Margin	Factor	Reading
	MHz	dBm	dBm	dB	dB	dBm
1	176.35	-71.22	-54.00	-17.22	-2.81	-68.41
2	667.54	-69.71	-54.00	-15.71	7.03	-76.74
3	815.54	-67.86	-54.00	-13.86	8.56	-76.42

Note 1: Measured Value (dBm) = Reading (dBm) + Factor (dB)
Note 2: Margin (dB) = Measured Value (dBm) – Limit (dBm)

Modulation	8DPSK	Test Freq. (MHz)	2480
Polarization	Vertical		

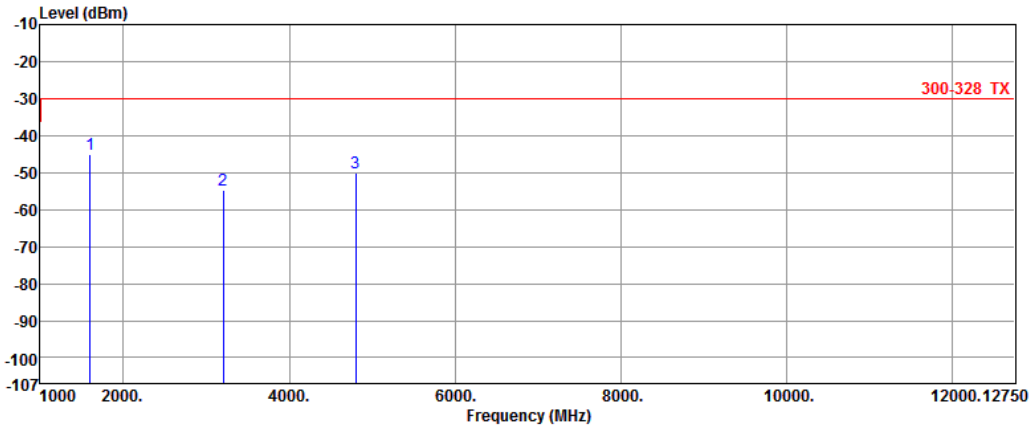


	Freq.	Measured value	Limit	Margin	Factor	Reading
	MHz	dBm	dBm	dB	dB	dBm
1	101.54	-73.45	-54.00	-19.45	-4.91	-68.54
2	595.54	-70.19	-54.00	-16.19	5.70	-75.89
3	746.54	-65.38	-54.00	-11.38	8.98	-74.36

Note 1: Measured Value (dBm) = Reading (dBm) + Factor (dB)
Note 2: Margin (dB) = Measured Value (dBm) – Limit (dBm)

3.6.5 Transmitter Radiated Unwanted Emissions (Above 1GHz)

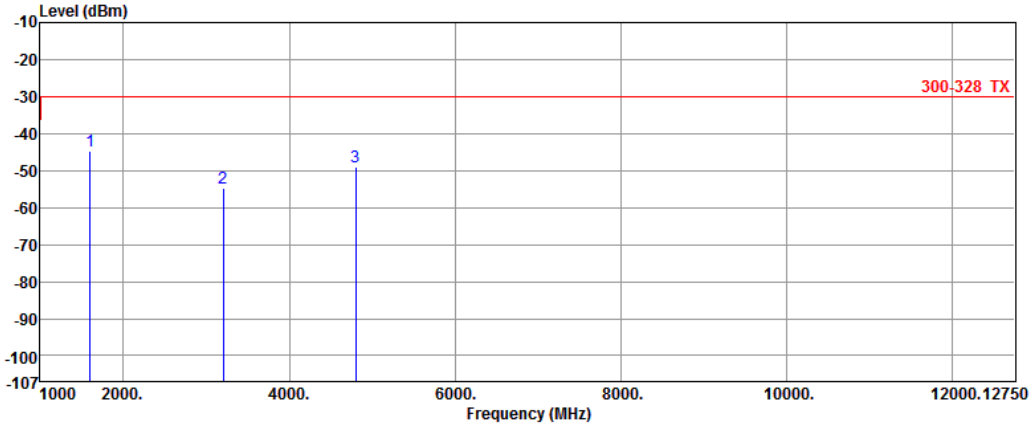
Modulation	GFSK	**Test Freq. (MHz)**	2402
Polarization	Horizontal		



	Freq.	Measured value	Limit	Margin	Factor	Reading
	MHz	dBm	dBm	dB	dB	dBm
1	1601.42	-45.25	-30.00	-15.25	-0.11	-45.14
2	3204.48	-54.58	-30.00	-24.58	6.83	-61.41
3	4804.39	-50.00	-30.00	-20.00	11.64	-61.64

Note 1: Measured Value (dBm) = Reading (dBm) + Factor (dB)
Note 2: Margin (dB) = Measured Value (dBm) – Limit (dBm)

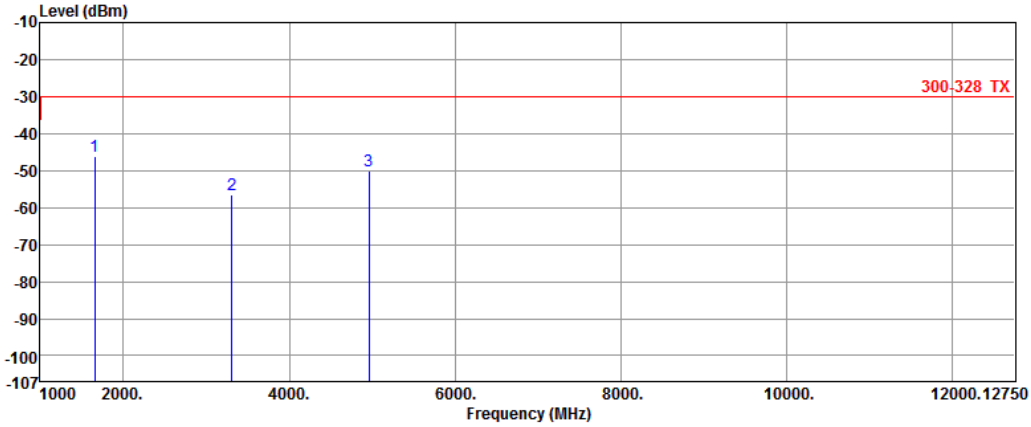
Modulation	GFSK	Test Freq. (MHz)	2402
Polarization	Vertical		



	Freq.	Measured value	Limit	Margin	Factor	Reading
	MHz	dBm	dBm	dB	dB	dBm
1	1601.41	-44.73	-30.00	-14.73	-0.89	-43.84
2	3202.90	-54.64	-30.00	-24.64	6.82	-61.46
3	4804.01	-48.96	-30.00	-18.96	11.89	-60.85

Note 1: Measured Value (dBm) = Reading (dBm) + Factor (dB)
Note 2: Margin (dB) = Measured Value (dBm) – Limit (dBm)

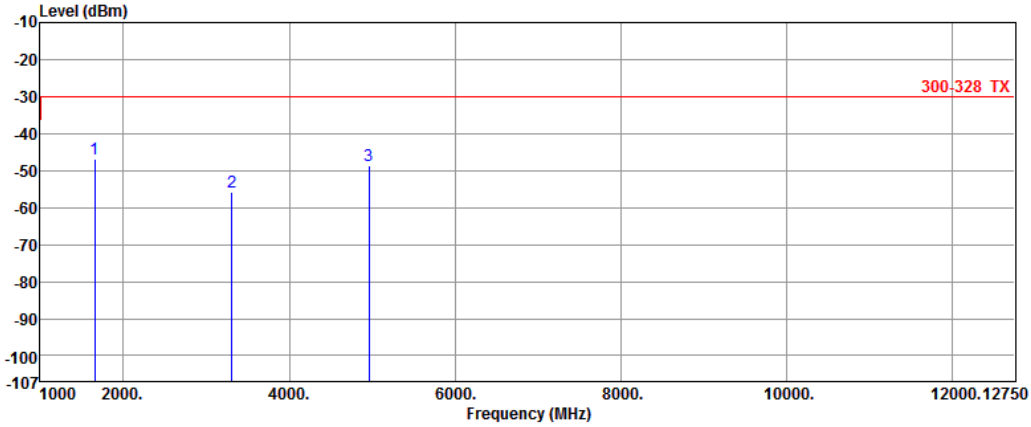
Modulation	GFSK	Test Freq. (MHz)	2480
Polarization	Horizontal		



	Freq.	Measured value	Limit	Margin	Factor	Reading
	MHz	dBm	dBm	dB	dB	dBm
1	1653.14	-46.30	-30.00	-16.30	-0.10	-46.20
2	3307.88	-56.39	-30.00	-26.39	7.54	-63.93
3	4960.53	-49.96	-30.00	-19.96	12.24	-62.20

Note 1: Measured Value (dBm) = Reading (dBm) + Factor (dB)
Note 2: Margin (dB) = Measured Value (dBm) – Limit (dBm)

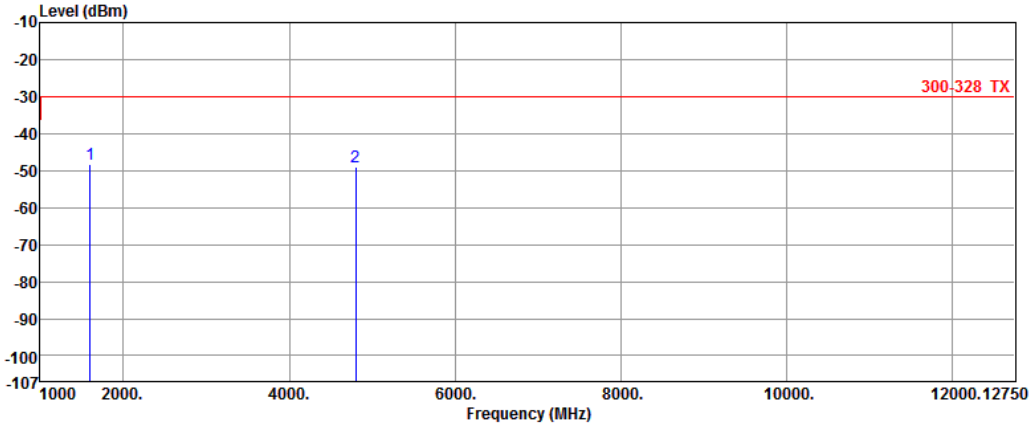
Modulation	GFSK	Test Freq. (MHz)	2480
Polarization	Vertical		



	Freq.	Measured value	Limit	Margin	Factor	Reading
	MHz	dBm	dBm	dB	dB	dBm
1	1653.40	-46.99	-30.00	-16.99	-0.92	-46.07
2	3305.76	-55.75	-30.00	-25.75	5.64	-61.39
3	4960.69	-48.61	-30.00	-18.61	11.66	-60.27

Note 1: Measured Value (dBm) = Reading (dBm) + Factor (dB)
Note 2: Margin (dB) = Measured Value (dBm) – Limit (dBm)

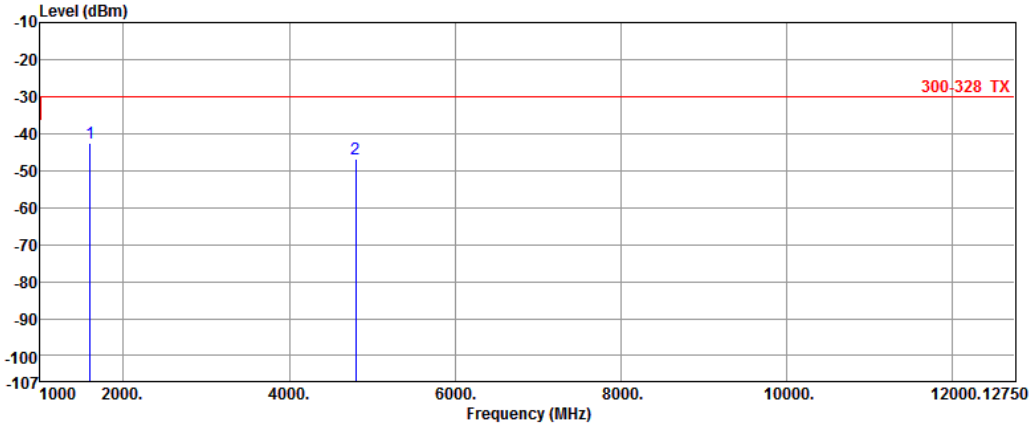
Modulation	8DPSK	Test Freq. (MHz)	2402
Polarization	Horizontal		



	Freq.	Measured value	Limit	Margin	Factor	Reading
	MHz	dBm	dBm	dB	dB	dBm
1	1600.00	-48.33	-30.00	-18.33	-0.12	-48.21
2	4803.49	-49.09	-30.00	-19.09	11.64	-60.73

Note 1: Measured Value (dBm) = Reading (dBm) + Factor (dB)
Note 2: Margin (dB) = Measured Value (dBm) – Limit (dBm)

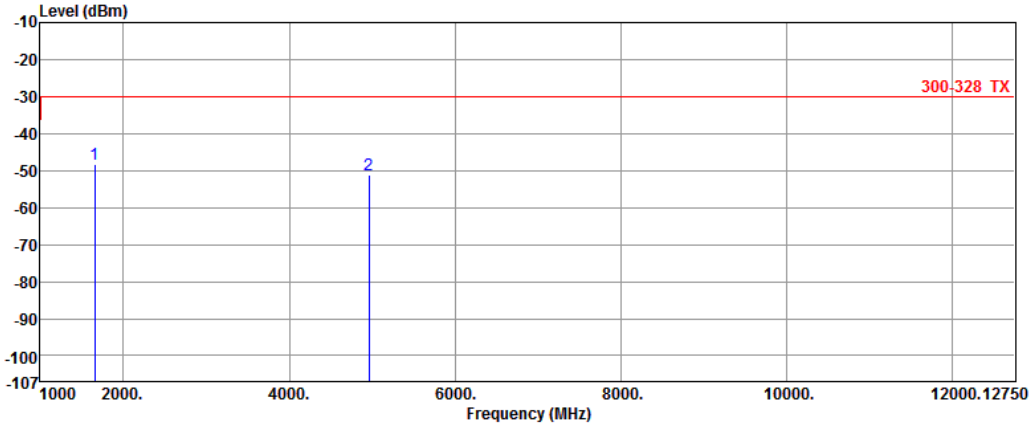
Modulation	8DPSK	Test Freq. (MHz)	2402
Polarization	Vertical		



	Freq.	Measured value	Limit	Margin	Factor	Reading
	MHz	dBm	dBm	dB	dB	dBm
1	1601.25	-42.45	-30.00	-12.45	-0.89	-41.56
2	4803.81	-46.75	-30.00	-16.75	11.89	-58.64

Note 1: Measured Value (dBm) = Reading (dBm) + Factor (dB)
Note 2: Margin (dB) = Measured Value (dBm) – Limit (dBm)

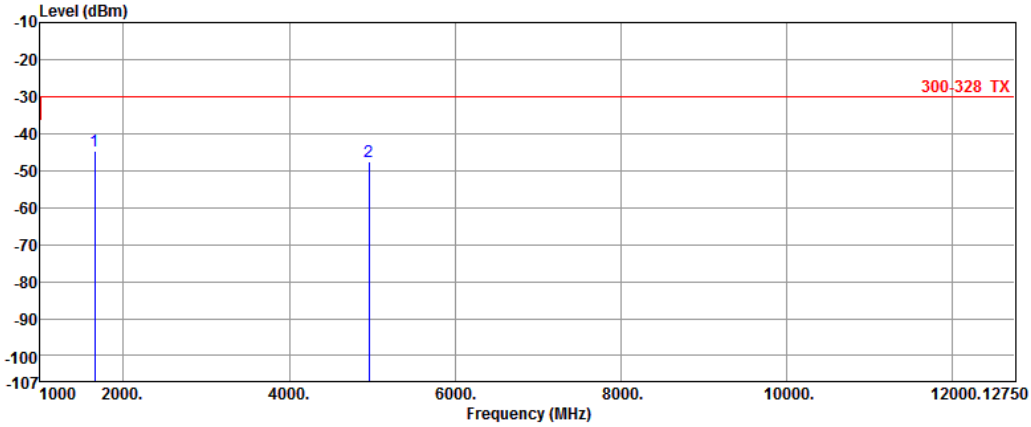
Modulation	8DPSK	Test Freq. (MHz)	2480
Polarization	Horizontal		



	Freq.	Measured value	Limit	Margin	Factor	Reading
	MHz	dBm	dBm	dB	dB	dBm
1	1653.06	-48.16	-30.00	-18.16	-0.10	-48.06
2	4961.00	-51.09	-30.00	-21.09	12.24	-63.33

Note 1: Measured Value (dBm) = Reading (dBm) + Factor (dB)
Note 2: Margin (dB) = Measured Value (dBm) – Limit (dBm)

Modulation	8DPSK	Test Freq. (MHz)	2480
Polarization	Vertical		



	Freq.	Measured value	Limit	Margin	Factor	Reading
	MHz	dBm	dBm	dB	dB	dBm
1	1653.30	-44.61	-30.00	-14.61	-0.92	-43.69
2	4959.71	-47.74	-30.00	-17.74	11.66	-59.40

Note 1: Measured Value (dBm) = Reading (dBm) + Factor (dB)
Note 2: Margin (dB) = Measured Value (dBm) – Limit (dBm)

4 Receiver Test Results

4.1 Receiver Spurious Emissions

4.1.1 Limit of Receiver Spurious Emissions

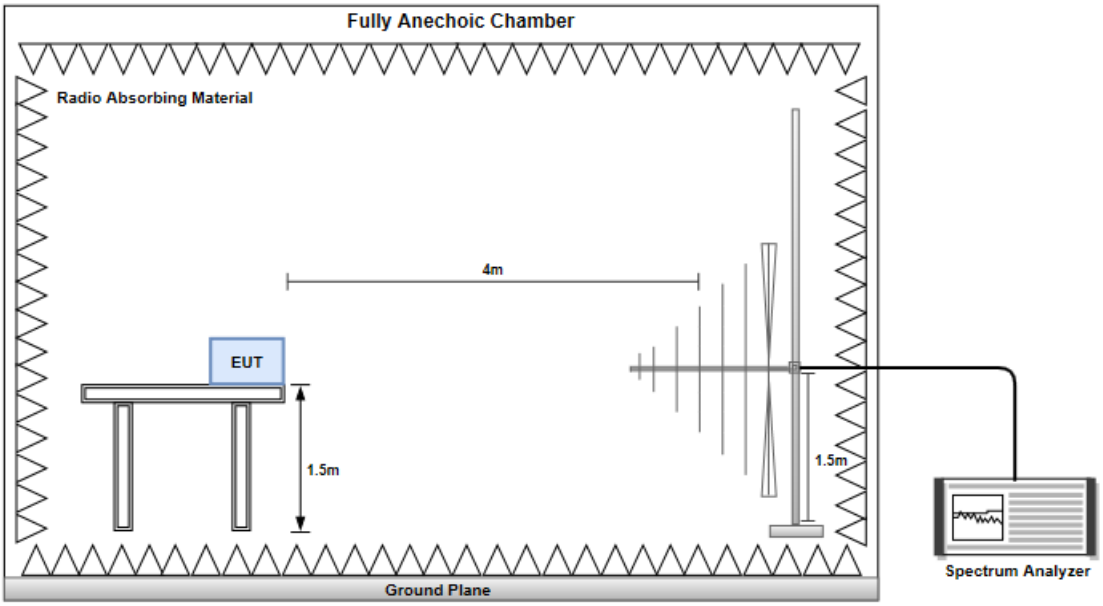
Frequency Range	Maximum power (dBm)	Measurement bandwidth(kHz)
30 MHz to 1 GHz	-57	100
Above 1 GHz to 12,75 GHz	-47	1000

4.1.2 Test Procedures

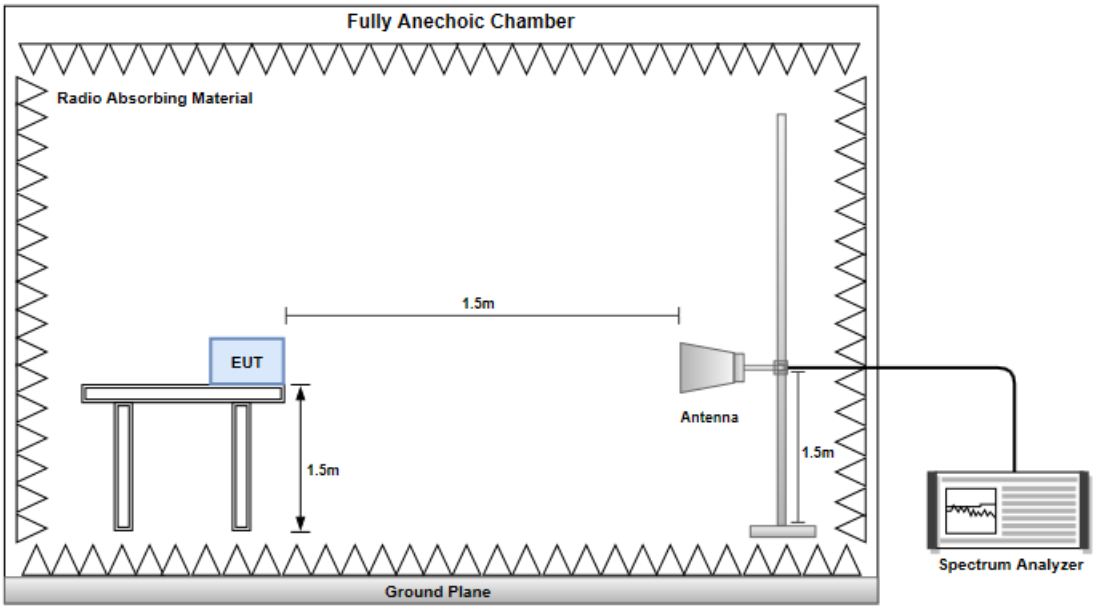
Reference to clause 5.4.10.2 of ETSI EN 300 328 V2.1.1 (2016-11).

4.1.3 Test Setup

Below 1GHz

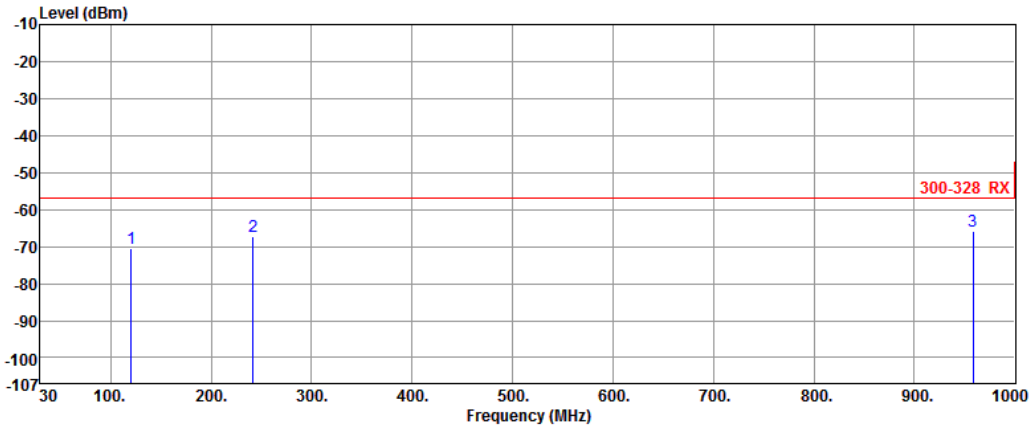


Above 1 GHz



4.1.4 Receiver Radiated Unwanted Emissions (Below 1GHz)

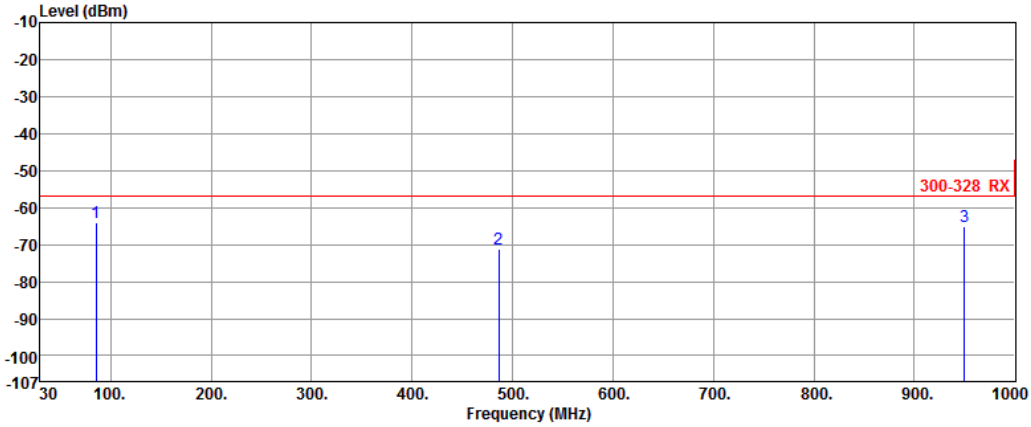
Modulation	GFSK	**Test Freq. (MHz)**	2402
Polarization	Horizontal		



	Freq.	Measured value	Limit	Margin	Factor	Reading
	MHz	dBm	dBm	dB	dB	dBm
1	120.54	-70.55	-57.00	-13.55	-5.23	-65.32
2	241.54	-67.38	-57.00	-10.38	-1.83	-65.55
3	958.54	-65.83	-57.00	-8.83	11.00	-76.83

Note 1: Measured Value (dBm) = Reading (dBm) + Factor (dB)
Note 2: Margin (dB) = Measured Value (dBm) – Limit (dBm)

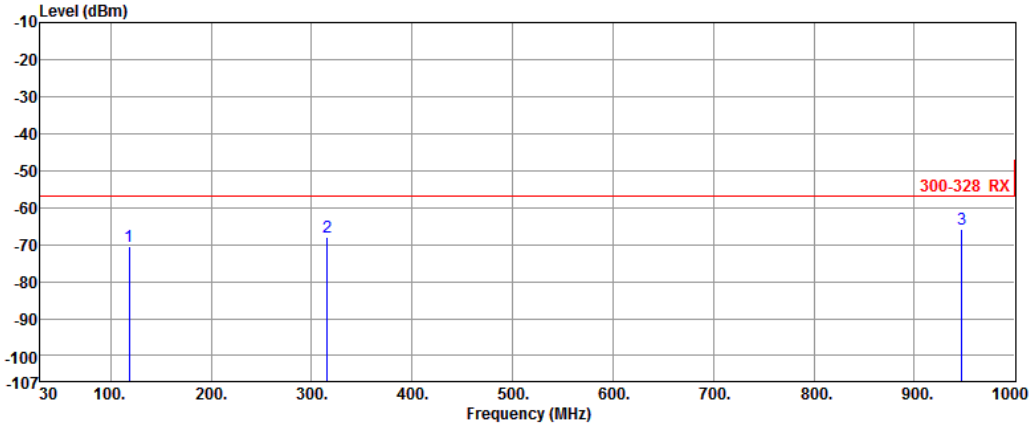
Modulation	GFSK	Test Freq. (MHz)	2402
Polarization	Vertical		



	Freq.	Measured value	Limit	Margin	Factor	Reading
	MHz	dBm	dBm	dB	dB	dBm
1	85.36	-64.01	-57.00	-7.01	-5.91	-58.10
2	486.45	-71.10	-57.00	-14.10	2.54	-73.64
3	949.54	-64.95	-57.00	-7.95	10.82	-75.77

Note 1: Measured Value (dBm) = Reading (dBm) + Factor (dB)
Note 2: Margin (dB) = Measured Value (dBm) – Limit (dBm)

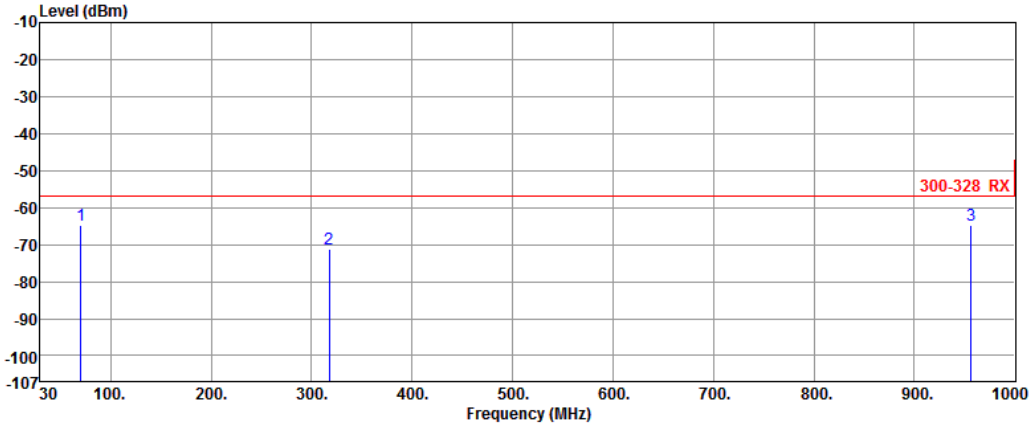
Modulation	GFSK	Test Freq. (MHz)	2480
Polarization	Horizontal		



	Freq.	Measured value	Limit	Margin	Factor	Reading
	MHz	dBm	dBm	dB	dB	dBm
1	118.35	-70.64	-57.00	-13.64	-5.43	-65.21
2	315.55	-68.15	-57.00	-11.15	-0.02	-68.13
3	947.54	-65.73	-57.00	-8.73	11.33	-77.06

Note 1: Measured Value (dBm) = Reading (dBm) + Factor (dB)
Note 2: Margin (dB) = Measured Value (dBm) – Limit (dBm)

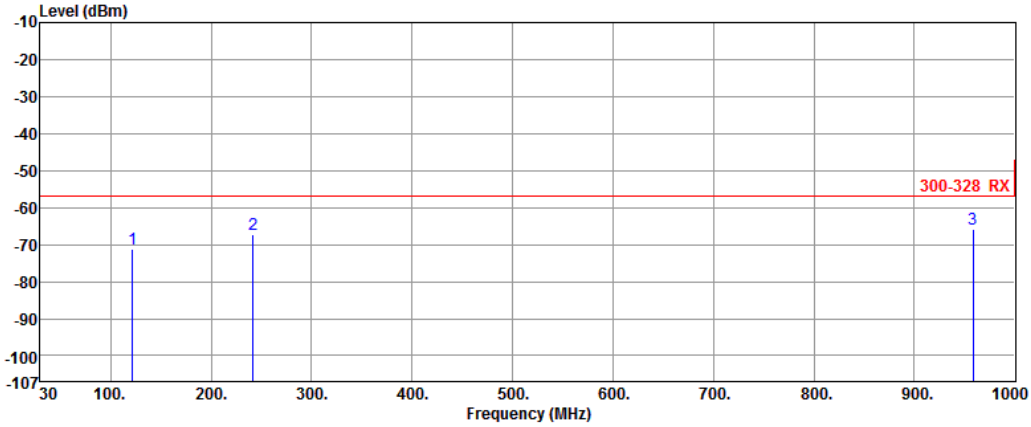
Modulation	GFSK	Test Freq. (MHz)	2480
Polarization	Vertical		



	Freq.	Measured value	Limit	Margin	Factor	Reading
	MHz	dBm	dBm	dB	dB	dBm
1	70.54	-64.87	-57.00	-7.87	-2.41	-62.46
2	317.45	-71.06	-57.00	-14.06	-0.61	-70.45
3	956.54	-64.82	-57.00	-7.82	10.74	-75.56

Note 1: Measured Value (dBm) = Reading (dBm) + Factor (dB)
Note 2: Margin (dB) = Measured Value (dBm) – Limit (dBm)

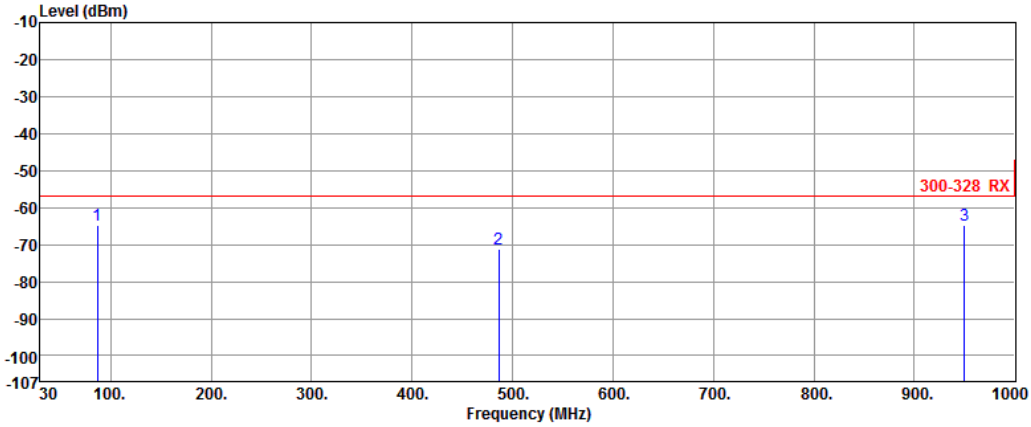
Modulation	8DPSK	Test Freq. (MHz)	2402
Polarization	Horizontal		



	Freq.	Measured value	Limit	Margin	Factor	Reading
	MHz	dBm	dBm	dB	dB	dBm
1	121.54	-71.26	-57.00	-14.26	-5.09	-66.17
2	241.35	-67.32	-57.00	-10.32	-1.82	-65.50
3	958.53	-65.83	-57.00	-8.83	11.00	-76.83

Note 1: Measured Value (dBm) = Reading (dBm) + Factor (dB)
Note 2: Margin (dB) = Measured Value (dBm) – Limit (dBm)

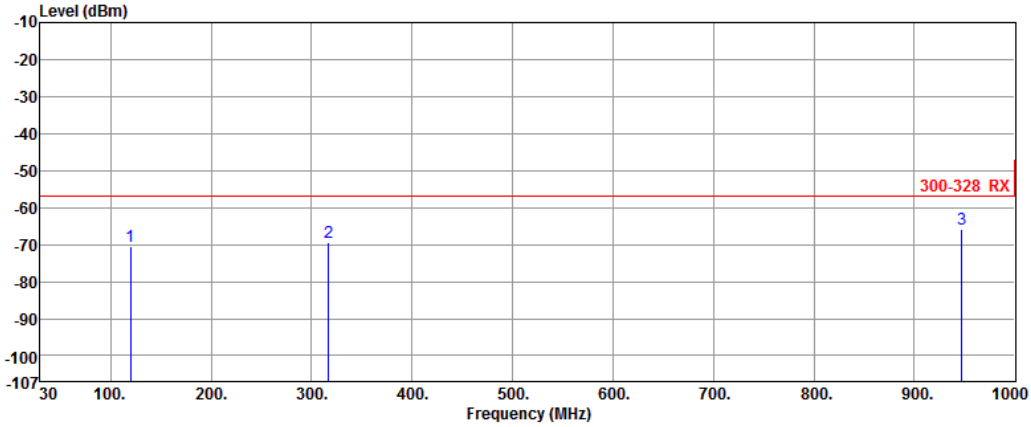
Modulation	8DPSK	Test Freq. (MHz)	2402
Polarization	Vertical		



	Freq.	Measured value	Limit	Margin	Factor	Reading
	MHz	dBm	dBm	dB	dB	dBm
1	86.54	-64.67	-57.00	-7.67	-5.88	-58.79
2	486.54	-71.10	-57.00	-14.10	2.55	-73.65
3	949.54	-64.93	-57.00	-7.93	10.82	-75.75

Note 1: Measured Value (dBm) = Reading (dBm) + Factor (dB)
Note 2: Margin (dB) = Measured Value (dBm) – Limit (dBm)

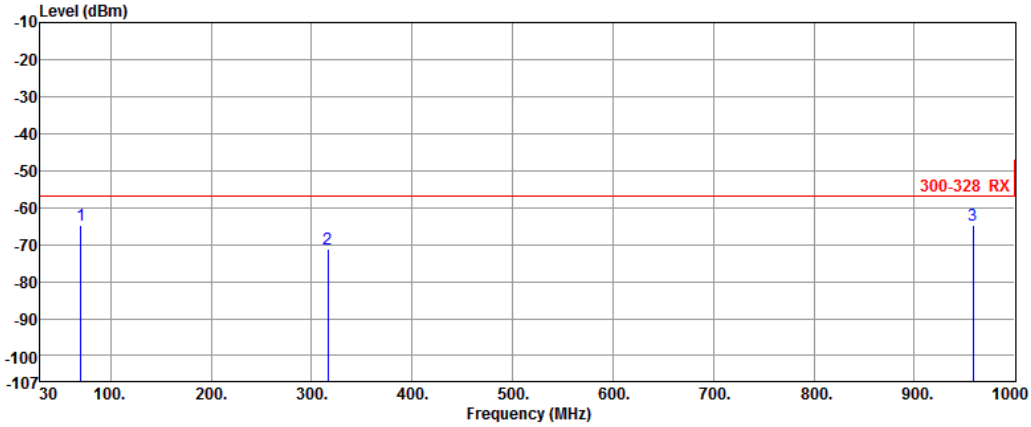
Modulation	8DPSK	Test Freq. (MHz)	2480
Polarization	Horizontal		



	Freq.	Measured value	Limit	Margin	Factor	Reading
	MHz	dBm	dBm	dB	dB	dBm
1	119.54	-70.60	-57.00	-13.60	-5.34	-65.26
2	316.54	-69.37	-57.00	-12.37	0.00	-69.37
3	947.54	-65.76	-57.00	-8.76	11.33	-77.09

Note 1: Measured Value (dBm) = Reading (dBm) + Factor (dB)
Note 2: Margin (dB) = Measured Value (dBm) – Limit (dBm)

Modulation	8DPSK	Test Freq. (MHz)	2480
Polarization	Vertical		

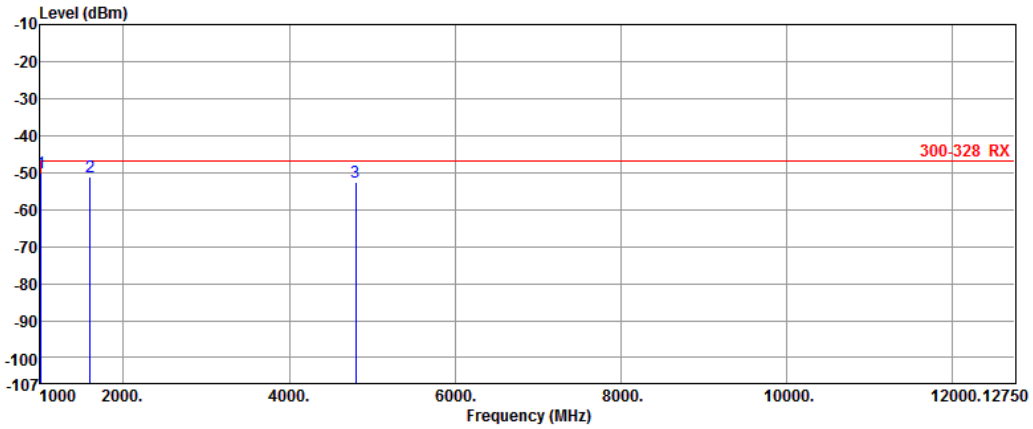


	Freq.	Measured value	Limit	Margin	Factor	Reading
	MHz	dBm	dBm	dB	dB	dBm
1	70.54	-64.86	-57.00	-7.86	-2.41	-62.45
2	316.00	-71.22	-57.00	-14.22	-0.66	-70.56
3	958.54	-64.90	-57.00	-7.90	10.74	-75.64

Note 1: Measured Value (dBm) = Reading (dBm) + Factor (dB)
Note 2: Margin (dB) = Measured Value (dBm) – Limit (dBm)

4.1.5 Receiver Radiated Unwanted Emissions (Above 1GHz)

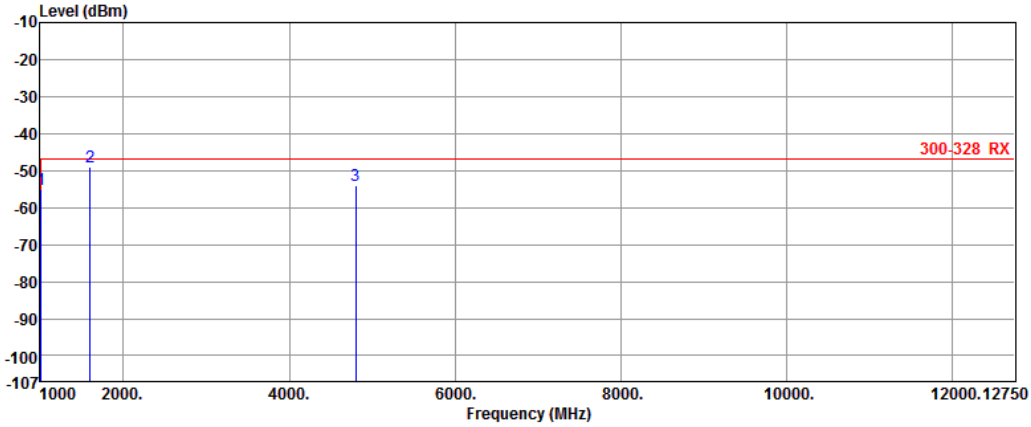
Modulation	GFSK	**Test Freq. (MHz)**	2402
Polarization	Horizontal		



	Freq.	Measured value	Limit	Margin	Factor	Reading
	MHz	dBm	dBm	dB	dB	dBm
1	1007.97	-50.17	-47.00	-3.17	-2.83	-47.34
2	1602.68	-51.28	-47.00	-4.28	-0.11	-51.17
3	4804.00	-52.63	-47.00	-5.63	11.64	-64.27

Note 1: Measured Value (dBm) = Reading (dBm) + Factor (dB)
Note 2: Margin (dB) = Measured Value (dBm) – Limit (dBm)

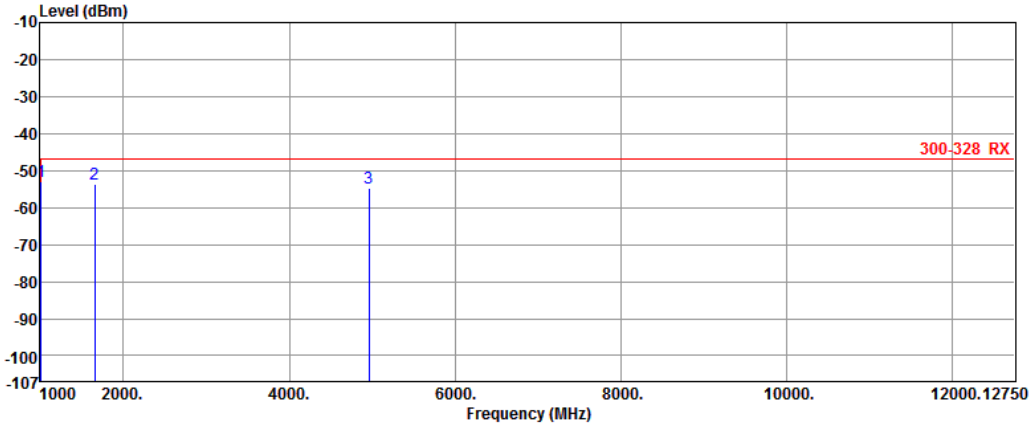
Modulation	GFSK	Test Freq. (MHz)	2402
Polarization	Vertical		



	Freq.	Measured value	Limit	Margin	Factor	Reading
	MHz	dBm	dBm	dB	dB	dBm
1	1007.50	-55.11	-47.00	-8.11	-3.23	-51.88
2	1602.68	-49.08	-47.00	-2.08	-0.90	-48.18
3	4802.16	-53.94	-47.00	-6.94	11.91	-65.85

Note 1: Measured Value (dBm) = Reading (dBm) + Factor (dB)
Note 2: Margin (dB) = Measured Value (dBm) – Limit (dBm)

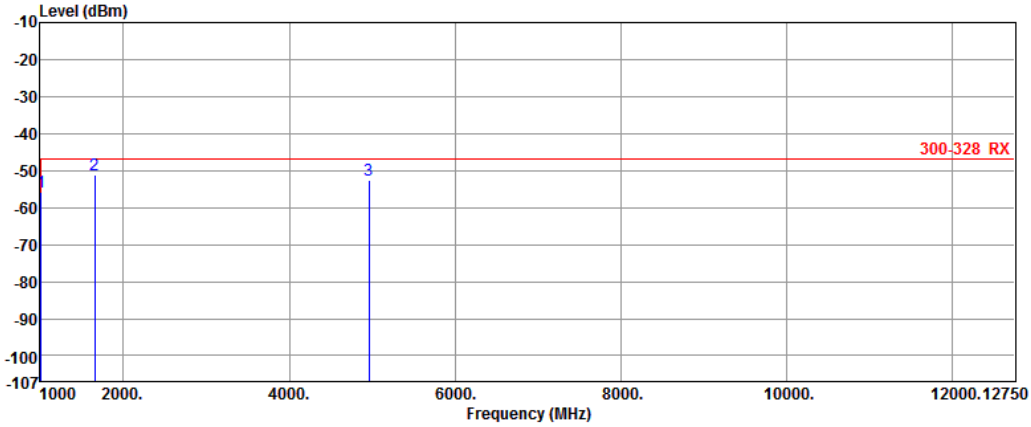
Modulation	GFSK	Test Freq. (MHz)	2480
Polarization	Horizontal		



	Freq.	Measured value	Limit	Margin	Factor	Reading
	MHz	dBm	dBm	dB	dB	dBm
1	1007.07	-52.89	-47.00	-5.89	-2.84	-50.05
2	1654.71	-53.51	-47.00	-6.51	-0.11	-53.40
3	4960.87	-54.77	-47.00	-7.77	12.24	-67.01

Note 1: Measured Value (dBm) = Reading (dBm) + Factor (dB)
Note 2: Margin (dB) = Measured Value (dBm) – Limit (dBm)

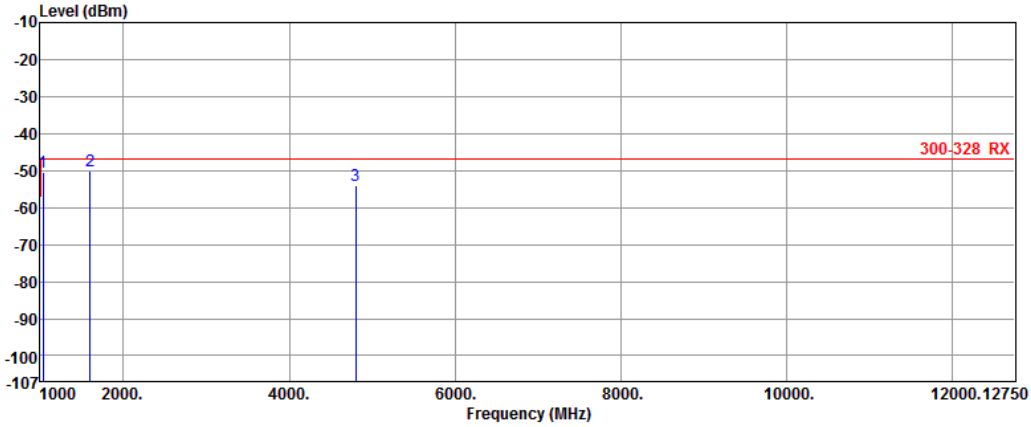
Modulation	GFSK	Test Freq. (MHz)	2480
Polarization	Vertical		



	Freq.	Measured value	Limit	Margin	Factor	Reading
	MHz	dBm	dBm	dB	dB	dBm
1	1007.65	-55.82	-47.00	-8.82	-3.23	-52.59
2	1654.61	-51.11	-47.00	-4.11	-0.92	-50.19
3	4960.99	-52.57	-47.00	-5.57	11.67	-64.24

Note 1: Measured Value (dBm) = Reading (dBm) + Factor (dB)
Note 2: Margin (dB) = Measured Value (dBm) – Limit (dBm)

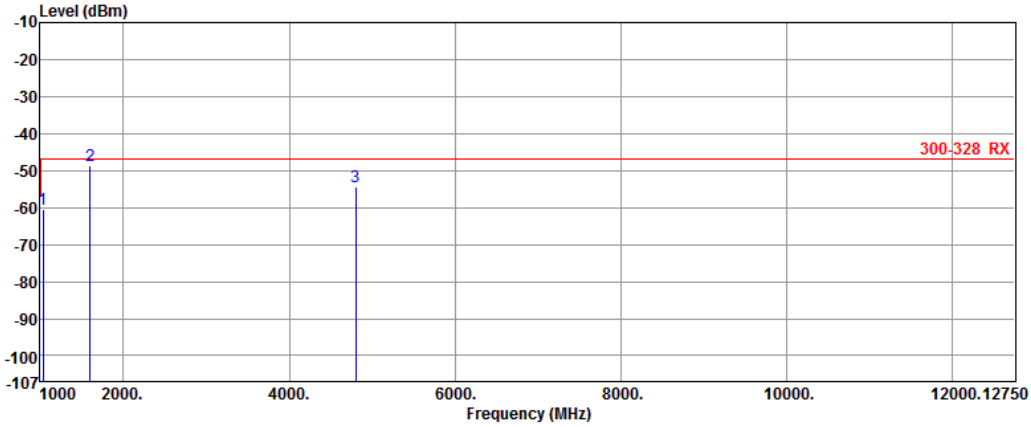
Modulation	8DPSK	Test Freq. (MHz)	2402
Polarization	Horizontal		



	Freq.	Measured value	Limit	Margin	Factor	Reading
	MHz	dBm	dBm	dB	dB	dBm
1	1032.07	-50.58	-47.00	-3.58	-2.68	-47.90
2	1602.70	-50.01	-47.00	-3.01	-0.11	-49.90
3	4802.46	-53.85	-47.00	-6.85	11.65	-65.50

Note 1: Measured Value (dBm) = Reading (dBm) + Factor (dB)
Note 2: Margin (dB) = Measured Value (dBm) – Limit (dBm)

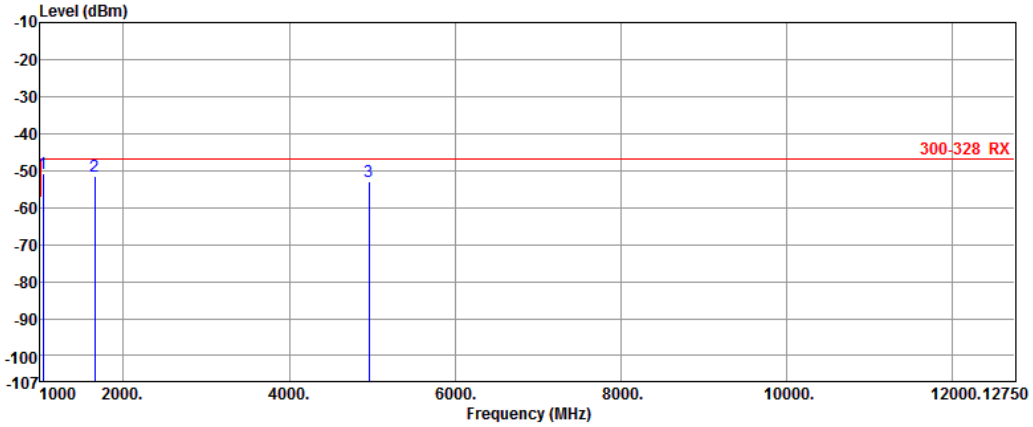
Modulation	8DPSK	Test Freq. (MHz)	2402
Polarization	Vertical		



	Freq.	Measured value	Limit	Margin	Factor	Reading
	MHz	dBm	dBm	dB	dB	dBm
1	1032.10	-60.45	-47.00	-13.45	-3.10	-57.35
2	1602.70	-48.66	-47.00	-1.66	-0.90	-47.76
3	4801.97	-54.28	-47.00	-7.28	11.91	-66.19

Note 1: Measured Value (dBm) = Reading (dBm) + Factor (dB)
Note 2: Margin (dB) = Measured Value (dBm) – Limit (dBm)

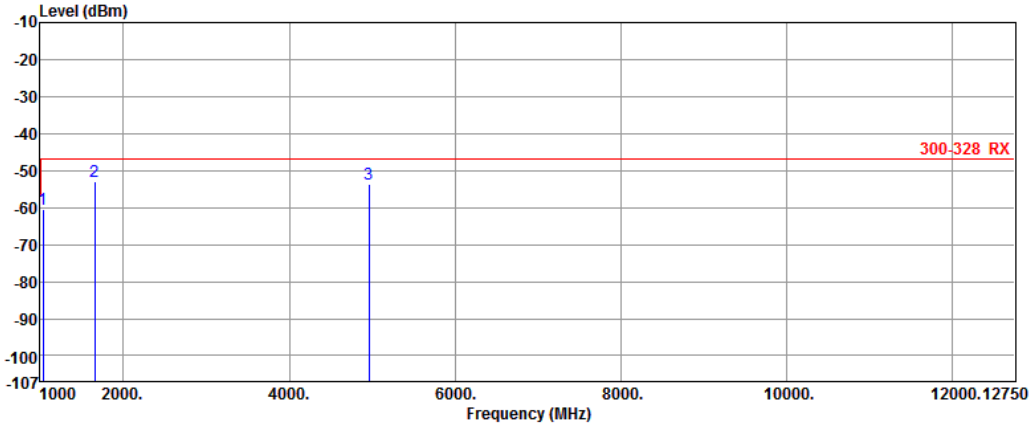
Modulation	8DPSK	Test Freq. (MHz)	2480
Polarization	Horizontal		



	Freq.	Measured value	Limit	Margin	Factor	Reading
	MHz	dBm	dBm	dB	dB	dBm
1	1032.06	-50.63	-47.00	-3.63	-2.68	-47.95
2	1654.67	-51.60	-47.00	-4.60	-0.11	-51.49
3	4958.30	-52.79	-47.00	-5.79	12.21	-65.00

Note 1: Measured Value (dBm) = Reading (dBm) + Factor (dB)
Note 2: Margin (dB) = Measured Value (dBm) – Limit (dBm)

Modulation	8DPSK	Test Freq. (MHz)	2480
Polarization	Vertical		



	Freq.	Measured value	Limit	Margin	Factor	Reading
	MHz	dBm	dBm	dB	dB	dBm
1	1032.06	-60.49	-47.00	-13.49	-3.10	-57.39
2	1654.69	-52.95	-47.00	-5.95	-0.92	-52.03
3	4961.62	-53.53	-47.00	-6.53	11.67	-65.20

Note 1: Measured Value (dBm) = Reading (dBm) + Factor (dB)
Note 2: Margin (dB) = Measured Value (dBm) – Limit (dBm)

5 Receiver Blocking Test Results

5.1 Receiver Blocking

5.1.1 Limit of Receiver Blocking

Receiver Blocking Parameters for Receiver Category 1 Equipment Limit			
Wanted Signal Mean Power from Companion Device (dBm)	**Blocking Signal Frequency (MHz)**	**Blocking Signal Power (dBm) (see Note 2)**	**Type of Blocking Signal**
P_{min} + 6 dB	2 380 2 503,5	-53	CW
P_{min} + 6 dB	2 300 2 330 2 360	-47	CW
P_{min} + 6 dB	2 523,5 2 553,5 2 583,5 2 613,5 2 643,5 2 673,5	-47	CW
Note 1: P_{min} is the minimum level of the wanted signal (in dBm) required to meet the minimum performance criteria (The minimum performance criterion shall be a PER less than or equal to 10 %) in the absence of any blocking signal. Note 2: The levels specified are levels in front of the UUT antenna. In case of conducted measurements, the levels have to be corrected by the actual antenna assembly gain.			

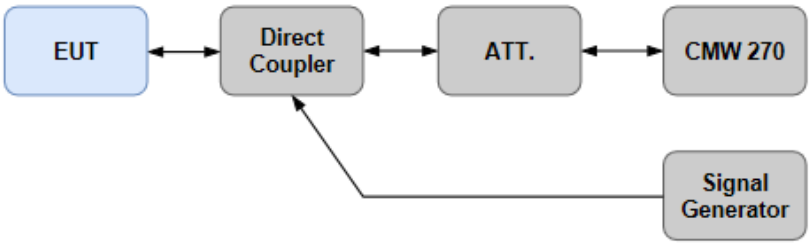
Receiver Blocking Parameters for Receiver Category 2 Equipment Limit			
Wanted Signal Mean Power from Companion Device (dBm)	**Blocking Signal Frequency (MHz)**	**Blocking Signal Power (dBm) (see Note 2)**	**Type of Blocking Signal**
P_{min} + 6 dB	2 380 2 503,5	-57	CW
P_{min} + 6 dB	2 300 2 583,5	-47	CW
Note 1: P_{min} is the minimum level of the wanted signal (in dBm) required to meet the minimum performance criteria (The minimum performance criterion shall be a PER less than or equal to 10 %) in the absence of any blocking signal. Note 2: The levels specified are levels in front of the UUT antenna. In case of conducted measurements, the levels have to be corrected by the actual antenna assembly gain.			

Receiver Blocking Parameters for Receiver Category 3 Equipment Limit			
Wanted Signal Mean Power from Companion Device (dBm)	**Blocking Signal Frequency (MHz)**	**Blocking Signal Power (dBm) (see Note 2)**	**Type of Blocking Signal**
P_{min} + 12 dB	2 380 2 503,5	-57	CW
P_{min} + 12 dB	2 300 2 583,5	-47	CW
Note 1: P_{min} is the minimum level of the wanted signal (in dBm) required to meet the minimum performance criteria (The minimum performance criterion shall be a PER less than or equal to 10 %) in the absence of any blocking signal. Note 2: The levels specified are levels in front of the UUT antenna. In case of conducted measurements, the levels have to be corrected by the actual antenna assembly gain.			

5.1.2 Test Procedures

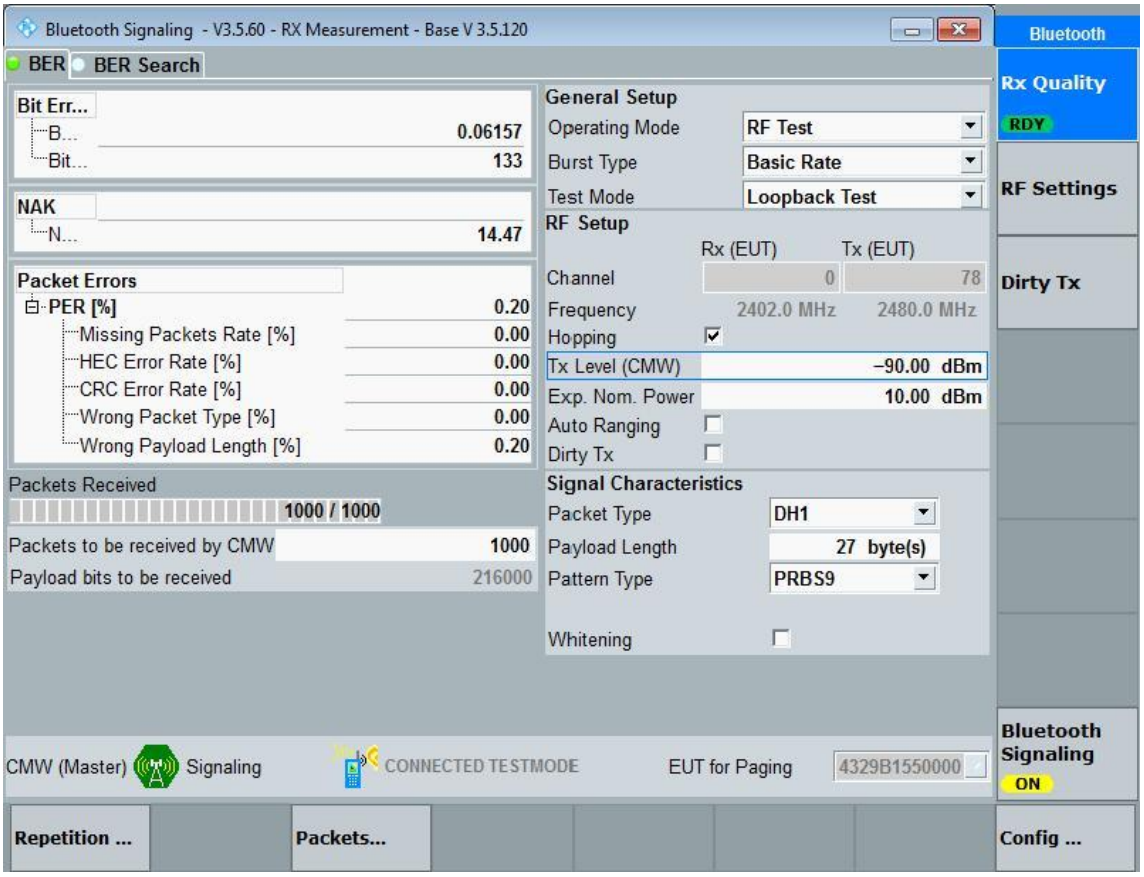
Reference to clause 5.4.11.2 of ETSI EN 300 328 V2.1.1 (2016-11).

5.1.3 Test Setup



5.1.4 Test Result of Receiver Blocking

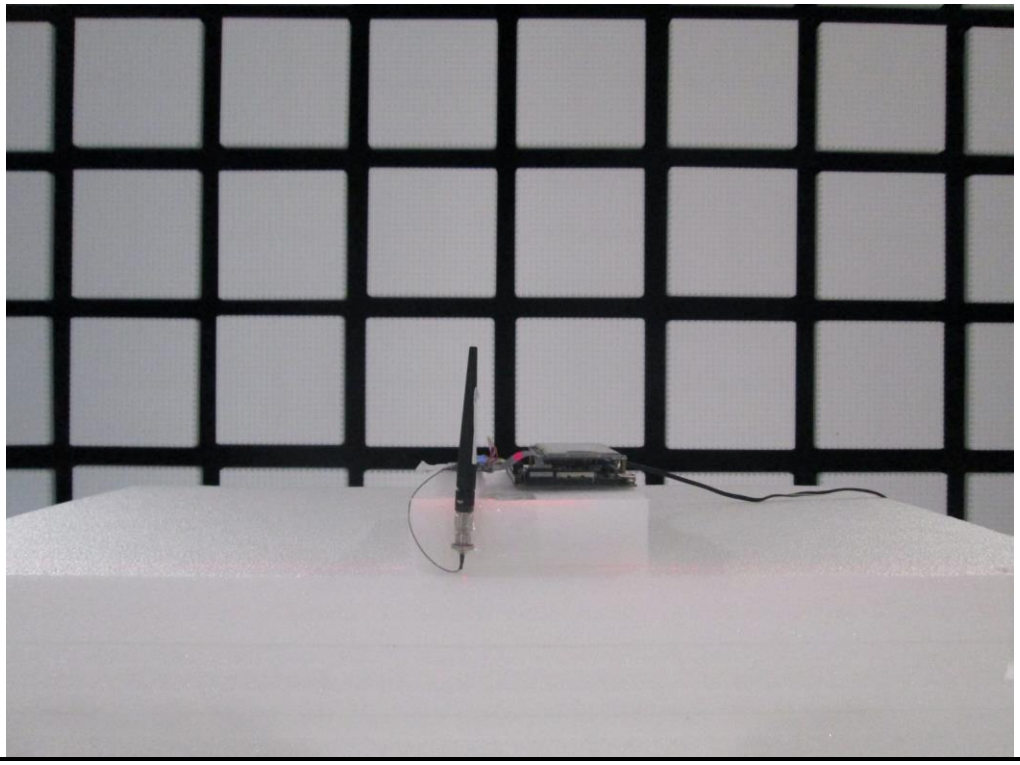
Hopping mode

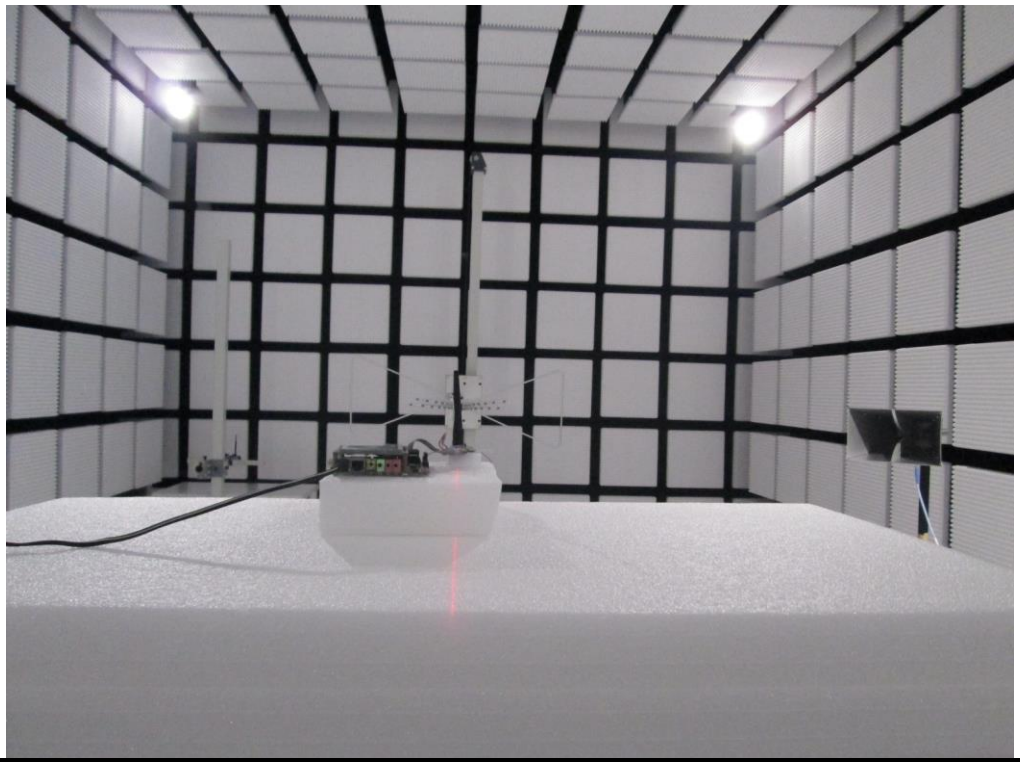


BER Minimum Performance Criteria	0.1 %		
Sensitivity Level	-90		**dBm**
Want Signal Mean Power form Companion Device (dBm)	**Blocking Signal Frequency (MHz)**	**Blocking Signal Power (dBm)**	**Test Result**
-84	2380.0	-55	Pass
-84	2503.5		Pass
-84	2300.0	-45	Pass
-84	2583.5		Pass

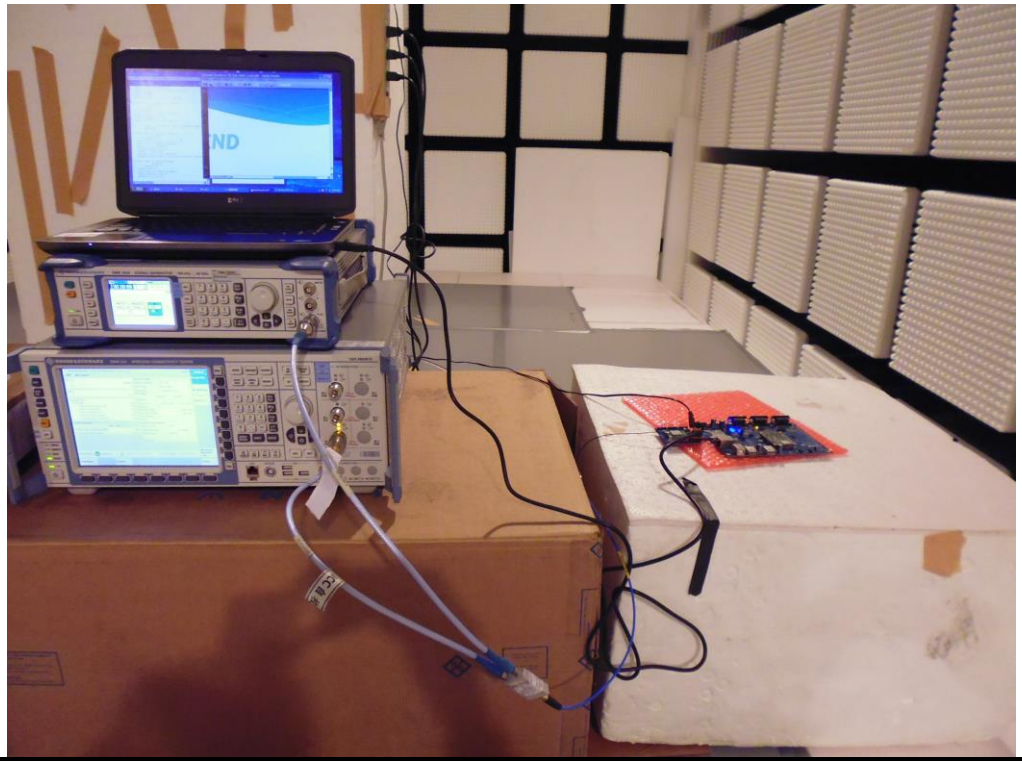
6 Photographs of the Test Configuration

Spurious Emission Test





Receiver Blocking Test



7 Test laboratory information

Established in 2012, ICC provides foremost EMC & RF Testing and advisory consultation services by our skilled engineers and technicians. Our services employ a wide variety of advanced edge test equipment and one of the widest certification extents in the business.

International Certification Corp (EMC and Wireless Communication Laboratory), it is our definitive objective is to institute long term, trust-based associations with our clients. The expectation we set up with our clients is based on outstanding service, practical expertise and devotion to a certified value structure. Our passion is to grant our clients with best EMC / RF services by oriented knowledgeable and accommodating staff.

Our Test sites are located at Linkou District and Kwei Shan District. Location map can be found on our website http://www.icertifi.com.tw.

Linkou	**Kwei Shan**	**Kwei Shan Site II**
Tel: 886-2-2601-1640	Tel: 886-3-271-8666	Tel: 886-3-271-8640
No. 30-2, Ding Fwu Tsuen, Lin Kou District, New Taipei City, Taiwan, R.O.C.	No. 3-1, Lane 6, Wen San 3rd St., Kwei Shan District, Tao Yuan City 333, Taiwan, R.O.C.	No. 14-1, Lane 19, Wen San 3rd St., Kwei Shan District, Tao Yuan City 333, Taiwan, R.O.C..

If you have any suggestion, please feel free to contact us as below information

Tel: 886-3-271-8666
Fax: 886-3-318-0155
Email: ICC_Service@icertifi.com.tw

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