AS/NZS Test Report

Equipment	:	**Summit SOM 8M Plus System-on-Module - WiFi 5 + Bluetooth 5.3**
Model No.	:	**Summit SOM 8M Plus**
Brand Name	:	**Laird Connectivity**
Applicant	:	**Laird Connectivity LLC**
Address	:	**W66N220 Commerce Court, Cedarburg, WI 53012 United States Of America**
Standard	:	**AS/NZS 4268:2017**
Received Date	:	**Oct. 28, 2021**
Tested Date	:	**Nov 15, 2021 ~ Feb. 18, 2022**

We, International Certification Corporation, 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 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**

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Release Record

Report No.	Version	Description	Issued Date
AR1O2803AD	Rev. 01	Initial issue	Mar. 24, 2022

Summary of Test Results

Ref. Std. Clause (ACMA 4268)	Ref. Std. Clause (EN 300 328)	Test Items	Measured	Result
6.3	4.3.1.2	RF Output Power	EIRP (dBm): 10.87	Pass
---	4.3.1.3	Duty cycle, Tx-Sequence, Tx-gap	Only for non-adaptive equipment	N/A
Row 55	4.3.1.4	Dwell time, Minimum Frequency Occupation & Hopping Sequence	Meet the requirement of limit.	Pass
6.6	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	Meet the requirement of limit.	Pass
6.5	4.3.1.8	Emission Bandwidth	Meet the requirement of limit.	Pass
6.6	4.3.1.8	Emission Bandwidth	Meet the requirement of limit.	Pass
6.4	4.3.1.9	Transmitter unwanted emissions in the out of band domain	Meet the requirement of limit.	Pass
6.4	4.3.1.10	Transmitter unwanted emissions in the spurious domain	Meet the requirement of limit.	Pass
7.2	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

Declaration of Conformity:
The test results with all measurement uncertainty excluded are presented in accordance with the regulation limits or requirements declared by manufacturers.
Comments and Explanations:
The declared of product specification for EUT presented in the report are provided by the manufacturer, and the manufacturer takes all the responsibilities for the accuracy of product specification.

1 General Description

1.1 Information

The device has 3 hardware configurations as below:

No.	Brand name	Model Name	Part Number	Description
1	Laird Connectivity	Summit SOM 8M Plus	453-00070	512MB LPDDR4 and 8GB eMMC
2			453-00071	1GB LPDDR4 and 8GB eMMC
3			453-00072	2GB LPDDR4 and 16GB eMMC

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	2402-2480	0-78 [79]	1 Mbps
2400-2483.5	EDR	2402-2480	0-78 [79]	2 Mbps
2400-2483.5	EDR	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.	Model	Part Number	Type	Connector	Gain (dBi)
1	Nanoblade	CAF94505	PCB Dipole	IPEX U.FL	2.0
2	Mini NanoBlade Flex	MAF95310	PCB Dipole	IPEX U.FL	2.8
3	FlexMIMO	EFD2455A3S-10MHF1	PCB Dipole	IPEX U.FL	2.0
4	2.4/5.5 GHz FlexPIFA	001-0016	PIFA	IPEX U.FL	2.5
5	001-0009	001-0009	Dipole	RP-SMA	2.0

1.1.3 EUT Operational Condition

Power Supply Type	5Vdc from host		
S/W Version for RF	image-summitsom-mfg-imx8mp-summitsom_2g-20211211212204		
S/W Version for Normal	image-summitsom-cmd-imx8mp-summitsom_512m-20211211215354		
Operational Climatic	☒ Tnom (20°C)	☒ Tmax (85°C)	☒ Tmin (-30°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	Command	
Modulation Mode	Duty Cycle Of Test Signal (%)	Duty Factor (dB)
BR-1Mbps	44.18%	3.55
EDR-3Mbps	46.65%	3.31

1.1.7 Power Index of Test Tool

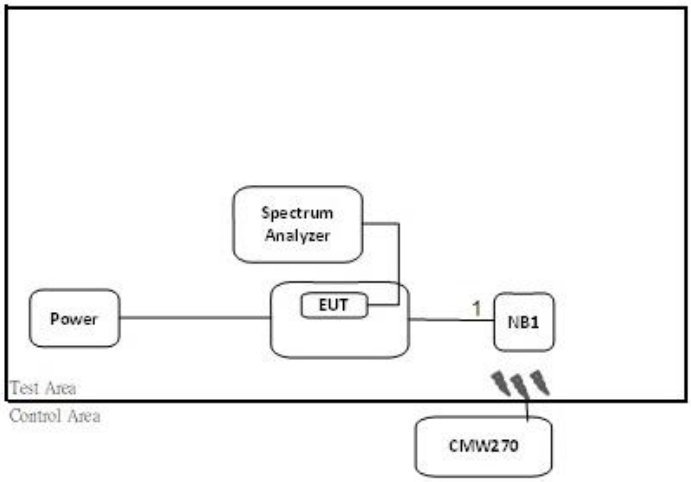
Modulation Mode	Test Frequency (MHz)		
	2402	2441	2480
BR-1Mbps	Default	Default	Default
EDR-3Mbps	Default	Default	Default

1.2 Local Support Equipment List

Support Equipment List					
No.	**Equipment**	**Brand**	**Model**	**S/N**	**Remarks**
1	Notebook	DELL	Latitude 3400	GKZLWZ2	---

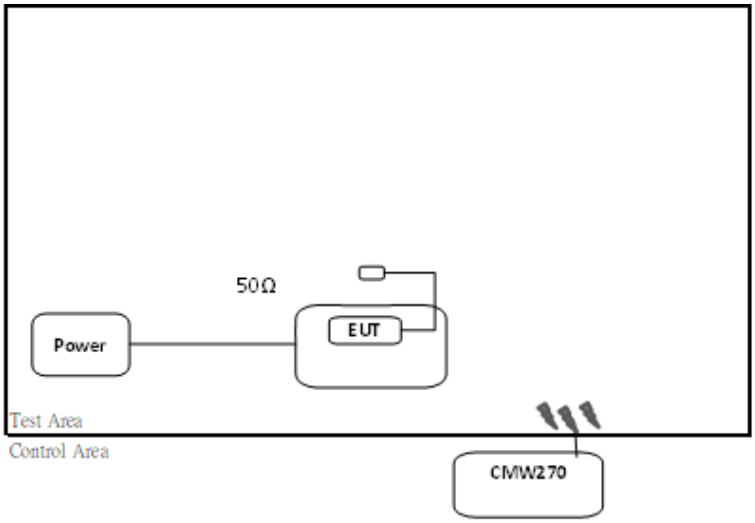
1.3 Test Setup Chart

Test Setup Diagram (Conducted)



No.	Signal cable / Length (m)
1	USB console, 1m with shielded

Test Setup Diagram (Radiated)



1.4 Test Equipment List and Calibration Data

Test Item	Conducted Emissions				
Test Site	Fully-anechoic chamber 1 / (05CH01-WS)				
Test Date	Nov. 17, 2021				
Instrument	**Brand**	**Model No.**	**Serial No.**	**Calibration Date**	**Calibration Until**
Spectrum Analyzer	Agilent	N9010A	MY54200247	Oct. 19, 2021	Oct. 18, 2022
Wireless connectivity tester	ROHDE&SCHWARZ	CMW270	100856	Nov.01,2021	Oct.31,2022
RF Cable	EMC	EMC104-35M-35 M-1000	210904	Oct. 12, 2021	Oct. 11, 2022
Measurement Software	AUDIX	e3	6.120210g	NA	NA
Note: Calibration Interval of instruments listed above is one year.					

Test Item	Radiated Emissions				
Test Site	Fully-anechoic chamber 1 / (05CH01-WS)				
Test Date	Nov. 17, 2021				
Instrument	**Brand**	**Model No.**	**Serial No.**	**Calibration Date**	**Calibration Until**
Spectrum Analyzer	Agilent	N9010A	MY54200247	Oct. 19, 2021	Oct. 18, 2022
Bilog Antenna	SCHWARZBECK	VULB9168	VULB9168-524	Nov. 05, 2021	Nov. 04, 2022
Horn Antenna 1G-18G	SCHWARZBECK	BBHA 9120 D	BBHA 9120 D 1094	Nov. 09, 2021	Nov. 08, 2022
Wireless connectivity tester	ROHDE&SCHWARZ	CMW270	100856	Nov. 01,2021	Oct. 31,2022
Preamplifier	Agilent	83017A	MY53270013	Jan. 18, 2021	Jan. 17, 2022
Preamplifier	EMC	EMC02325	980146	Oct. 19, 2021	Oct. 18, 2022
RF Cable	EMC	EMC104-35M-35 M-1000	210904	Oct. 12, 2021	Oct. 11, 2022
RF Cable	HUBER+SUHNER	SUCOFLEX104	MY16608/4	Oct. 12, 2021	Oct. 11, 2022
RF Cable	HUBER+SUHNER	SUCOFLEX104	MY16617/4	Oct. 12, 2021	Oct. 11, 2022
LF cable 3M	Woken	CFD400NL-LW	CFD400NL-005	Oct. 12, 2021	Oct. 11, 2022
LF cable 10M	Woken	CFD400NL-LW	CFD400NL-006	Oct. 12, 2021	Oct. 11, 2022
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)				
Test Date	Feb. 18, 2022				
Instrument	**Brand**	**Model No.**	**Serial No.**	**Calibration Date**	**Calibration Until**
Spectrum Analyzer	R&S	FSV40	101063	Apr. 19, 2021	Apr. 18, 2022
TEMP&HUMIDITY CHAMBER	GIANT FORCE	GCT-225-40-SP-SD	MAF1212-002	May 25, 2021	May 24, 2022
Wireless connectivity tester	ROHDE&SCHWARZ	CMW270	100856	Nov. 01,2021	Oct. 31,2022
DC POWER SOURCE	GW INSTEK	GPC-6030D	GES855395	Nov. 08 2021	Nov. 07, 2022
Power Sensor	Agilent	U2021XA	MY53480019	Feb. 19, 2021	Feb. 18, 2022
Power Sensor	Agilent	U2021XA	MY53510003	Feb. 19, 2021	Feb. 18, 2022
RF cable	EMC	EMC104-35M-35M-1000	210928	Oct. 15 2021	Oct. 14, 2022
RF Cable	EMC	EMC104-35M-35M-1000	210929	Oct. 15 2021	Oct. 14, 2022
Measurement Software	Sporton	Sporton_1	1.3.30	NA	NA
Note: Calibration Interval of instruments listed above is one year.					

Test Item	Adaptivity				
Test Site	(TH01-WS)				
Test Date	Dec. 30, 2021				
Instrument	**Brand**	**Model No.**	**Serial No.**	**Calibration Date**	**Calibration Until**
Spectrum	Keysight	N9010A	MY54510374	Aug. 25, 2021	Aug. 24, 2022
RF cable-4M	HUBER+SUHNER	SUCOFLEX_104	MY15686/4	Oct. 12, 2021	Oct. 11, 2022
RF cable-0.5M	HUBER+SUHNER	SUCOFLEX_104	296081/4	Oct. 14, 2021	Oct. 13, 2022
RF cable-0.2M	HUBER+SUHNER	SUCOFLEX_104	329023/4	Oct. 14, 2021	Oct. 13, 2022
RF cable-0.2M	HUBER+SUHNER	SUCOFLEX_104	329021/4	Oct. 14, 2021	Oct. 13, 2022
MXG-B RF Vector Signal Generator	Agilent	N5182B	MY53050081	May 16, 2021	May 15, 2022
Signal Generator	R&S	SMB100A	175727	Jan. 07, 2021	Jan. 06, 2022
Preamplifier	Burgeon	BPS-530	100219	Nov. 16, 2021	Nov. 15, 2022
Oscilloscope	National Instruments	USB-5133	F651FF	Aug. 09, 2021	Aug. 08, 2022
Combiner(1X2)	Woken	2WAYDIV-1	0120A02056002D	Oct. 12, 2021	Oct. 11, 2022
Combiner(1X2)	Woken	2WAYDIV-2	0120A02056002D	Oct. 14, 2021	Oct. 13, 2022
Combiner(1X4)	Woken	4WAYDIV	0120A042011010	Oct. 14, 2021	Oct. 13, 2022
Direction Coupler	Marvelous Microwave	MVE4514-20	20	Oct. 14, 2021	Oct. 13, 2022
Attenuator	Warison	WATT-6SR1211	01	Oct. 12, 2021	Oct. 11, 2022
Wireless Connectivity Tester	ROHDE&SCHWARZ	CMW270	100856	Nov. 01, 2021	Oct. 31, 2022
Note: Calibration Interval of instruments listed above is one year.					

Test Item	Receiver Blocking				
Test Site	(05CH01-WS)				
Test Date	Nov. 22, 2021				
Instrument	**Brand**	**Model No.**	**Serial No.**	**Calibration Date**	**Calibration Until**
Wireless connectivity tester	ROHDE&SCHWARZ	CMW270	100856	Nov. 01, 2021	Oct. 31, 2022
Signal Generator	ROHDE&SCHWARZ	SMB100A	175727	Jan. 07, 2021	Jan. 06, 2022
RF Cable	HUBER+SUHNER	SUCOFLEX_104	500202/4	Oct. 14, 2021	Oct. 13, 2022
RF Cable	HUBER+SUHNER	SUCOFLEX_104	296088/4	Oct. 14, 2021	Oct. 13, 2022
RF Cable	HUBER+SUHNER	SUCOFLEX_104	329023/4	Oct. 14, 2021	Oct. 13, 2022
Combiner(1X2)	WOKEN	2WAYDIV	12101200003	Oct. 14, 2021	Oct. 13, 2022
Note: Calibration Interval of instruments listed above is one year.					

Test Item	Radiated Emissions				
Test Site	(10CH02-HY)				
Test Date	Nov. 15, 2021				
Instrument	**Manufacturer**	**Model No.**	**Serial No.**	**Calibration Date**	**Calibration Until**
10m Semi Anechoic Chamber	TDK	SAC-10M	10CH02-HY	Sep. 18, 2021	Sep. 17, 2022
Receiver	Keysight	N9030A	MY52260140	May 05 ,2021	May 04 ,2022
Loop Antenna	TESEQ	HLA 6120	31244	Mar. 16 , 2021	Mar. 15, 2022
Turn Table	EM Electronics	EM 1000	60546	--	---
RF Cable-R10m	MTJ	RG223/U + RG8/U	CB026-DOOR	Sep. 15, 2021	Sep. 14, 2022
Software	Audix	E3	6.12 160809	--	---
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:

AS/NZS 4268:2017
EN 300 328 V2.2.2 (2019-07)

1.6 Deviation from Test Standard and Measurement Procedure

None

1.7 Measurement Uncertainty

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	±0.592 dB	±1.5 dB
Power Spectral Density, conducted	±0.583 dB	±3 dB
Unwanted Emissions, conducted	±2.715 dB	±3 dB
All emissions, radiated	±3.14 dB	±6 dB
Temperature	±0.4 ºC	±3 °C
Supply voltages	±0.15 %	±3 %
Time	±0.1 %	±5 %

2 Test Configuration

2.1 Testing Facility

Test Laboratory	International Certification Corporation
Test Site	TH01-WS, 05CH01-WS
Address of Test Site	No.3-1, Lane 6, Wen San 3rd St., Kwei Shan Dist., Tao Yuan City 33381, Taiwan (R.O.C.)

Test Laboratory	Sporton International Inc. Hsinhua Laboratory
Test Site	10CH02-HY
Address of Test Site	No. 52, Huaya 1st Rd., Guishan Dist., Taoyuan City 333411, Taiwan (R.O.C.) Tel: 886-3-327-3456, Fax: 886-3-327-0973

Note: * ICC lab subcontracts this test item to Sporton Lab (TAF: 3785).
Sporton Lab is a TAF accreditation test firm and also is an approved provider of ICC lab.

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	1, 2, 3
Accumulated Transmit Time Minimum Frequency Occupation Hopping Sequence	GFSK 8DPSK	Hopping Hopping	1 Mbps 3 Mbps	1
Hopping Frequency Separation	GFSK 8DPSK	two-adjacent	1 Mbps 3 Mbps	1
Emission Bandwidth and Operating frequencies	GFSK 8DPSK	2402 / 2480 2402 / 2480	1 Mbps 3 Mbps	1
Transmitter unwanted emissions in the OOB domain	GFSK 8DPSK	Hopping Hopping	1 Mbps 3 Mbps	1
Transmitter Spurious Emissions >30 MHz Receiver Spurious Emissions >30 MHz	GFSK 8DPSK	2402 / 2480 2402 / 2480	1 Mbps 3 Mbps	1 Note3
Transmitter Spurious Emissions ≤ 30 MHz Receiver Spurious Emissions ≤ 30 MHz	GFSK 8DPSK	2402 / 2480 2402 / 2480	1 Mbps 3 Mbps	1, 2, 3
Adaptivity	GFSK 8DPSK	2402 / 2480 2402 / 2480	1 Mbps 3 Mbps	3
Receiver Blocking	GFSK	Hopping	1 Mbps	1

NOTE:
1. The EUT was pretested with 3 orientations placed on the table for the radiated emission measurement – X, Y, and Z-plane. The **Z-plane** result was found as the worst case and was shown in this report.
2. Test configurations are listed as below:
   1) Configuration 1: Part Number: MAF95310 with PCB Dipole Antenna
   2) Configuration 2: Part Number: 001-0016 with PIFA Antenna
   3) Configuration 3: Part Number: 001-0009 with Dipole Antenna
3. The 50Ω terminators are connected to antenna port of EUT for radiated emission measurement.

3 Transmitter Test Results

3.1 RF Output Power

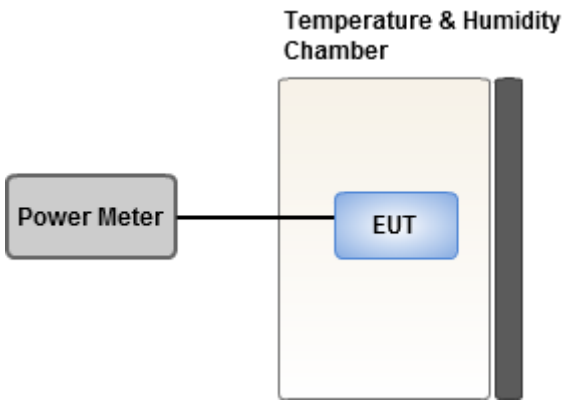
3.1.1 Limit of RF Output Power

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 V2.2.2 (2019-07).

3.1.3 Test Setup



3.1.4 Test Result of RF Output Power

Ambient Condition	22°C / 65%	Tested By	Alan Tang

Configuration 1

Condition	Modulation Mode	Freq. (MHz)	EIRP Power(dBm)	Limit (dBm)
TnomVnom	BR-1Mbps	Hopping	10.33	20
TminVnom	BR-1Mbps	Hopping	10.87	20
TmaxVnom	BR-1Mbps	Hopping	10.75	20
TnomVnom	EDR-3Mbps	Hopping	9.68	20
TminVnom	EDR-3Mbps	Hopping	10.36	20
TmaxVnom	EDR-3Mbps	Hopping	9.65	20

Note:
1) Test method is conducted.
2) EIRP = Measured conducted power + Antenna gain. (2.8dBi)

Configuration 2

Condition	Modulation Mode	Freq. (MHz)	EIRP Power(dBm)	Limit (dBm)
TnomVnom	BR-1Mbps	Hopping	10.03	20
TminVnom	BR-1Mbps	Hopping	10.57	20
TmaxVnom	BR-1Mbps	Hopping	10.45	20
TnomVnom	EDR-3Mbps	Hopping	9.38	20
TminVnom	EDR-3Mbps	Hopping	10.06	20
TmaxVnom	EDR-3Mbps	Hopping	9.35	20

Note:
1) Test method is conducted.
2) EIRP = Measured conducted power + Antenna gain. (2.5dBi)

Configuration 3

Condition	Modulation Mode	Freq. (MHz)	EIRP Power(dBm)	Limit (dBm)
TnomVnom	BR-1Mbps	Hopping	9.53	20
TminVnom	BR-1Mbps	Hopping	10.07	20
TmaxVnom	BR-1Mbps	Hopping	9.95	20
TnomVnom	EDR-3Mbps	Hopping	8.88	20
TminVnom	EDR-3Mbps	Hopping	9.56	20
TmaxVnom	EDR-3Mbps	Hopping	8.85	20

Note:
1) Test method is conducted.
2) EIRP = Measured conducted power + Antenna gain. (2.0dBi)

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:

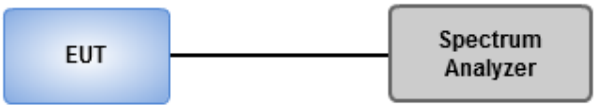
Option 1: Each hopping frequency of the hopping sequence shall be occupied at least once within a period not exceeding four times the product of the dwell time and the number of hopping frequencies in use.

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 V2.2.2 (2019-07).

3.2.3 Test Setup



3.2.4 Test Result of Accumulated Transmit Time, Minimum Frequency Occupation and Hopping Sequence

Ambient Condition	22°C / 65%	**Tested By**	Alan Tang

Summary

Mode	Max-Hop No
2.4-2.4835GHz	-
BT-BR(1Mbps)	79
BT-EDR(3Mbps)	79

Result

Mode	Result	Hopping No	Limit
BT-BR(1Mbps)	-	-	-
2441MHz_TnomVnom	Pass	79	15
BT-EDR(3Mbps)	-	-	-
2441MHz_TnomVnom	Pass	79	15

Summary

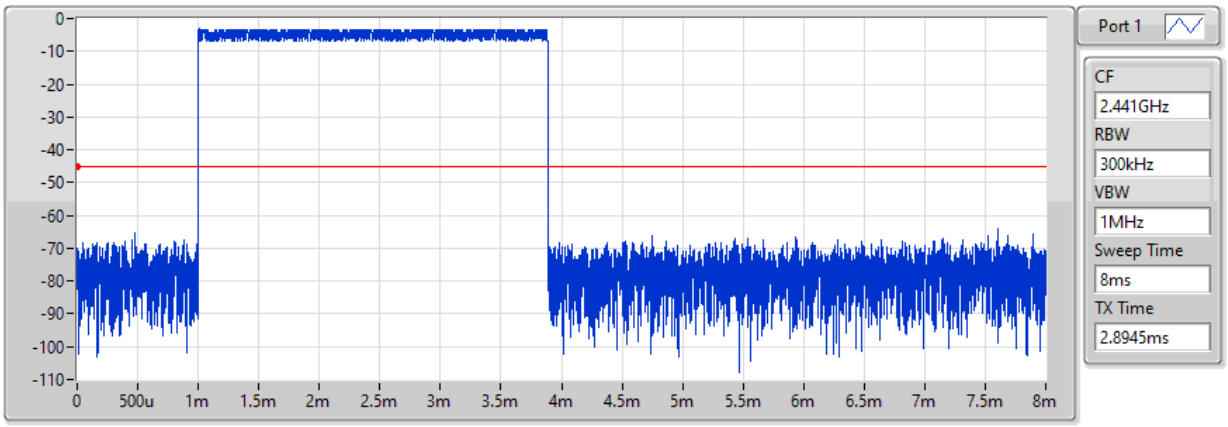
Mode	Max-Dwell (s)
2.4-2.4835GHz	-
BT-BR(1Mbps)	154.350352m
BT-EDR(3Mbps)	154.323688m

Result

Mode	Result	Function	Hopping Ch	ATT Period (s)	ATT (s)	ATT Limit (s)	Dwell/Ch (s)	FO Period (s)	FO (Hop)	FO Limit (Hop)
BT-BR(1Mbps)	-	-	-	-	-	-	-	-	-	-
Hopping Mode_TnomVnom	Pass	Non-AFH	79	1.185	11.578m	15m	3.75m	1.185	4	1
Hopping Mode_TnomVnom	Pass	AFH	20	8	154.350352m	400m	7.5m	600m	4	1
BT-EDR(3Mbps)	-	-	-	-	-	-	-	-	-	-
Hopping Mode_TnomVnom	Pass	Non-AFH	79	1.185	9.611m	15m	3.75m	1.185	4	1
Hopping Mode_TnomVnom	Pass	AFH	20	8	154.323688m	400m	7.5m	600m	4	1

BT-BR(1Mbps) ATT Non-AFH

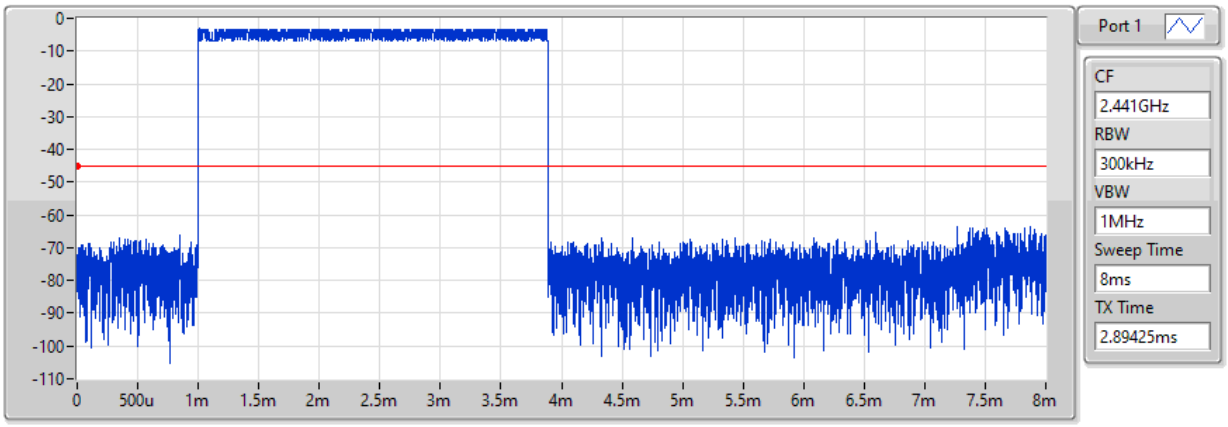
Hopping Mode_TnomVnom



Function	Hopping Ch	ATT Period(s)	ATT(s)	ATT Limit(s)	Dwell/Ch(s)	FO Period(s)	FO(Hop)	FO Limit(Hop)
Non-AFH	79	1.185	11.578m	15m	3.75m	1.185	4	1

BT-BR(1Mbps) ATT AFH

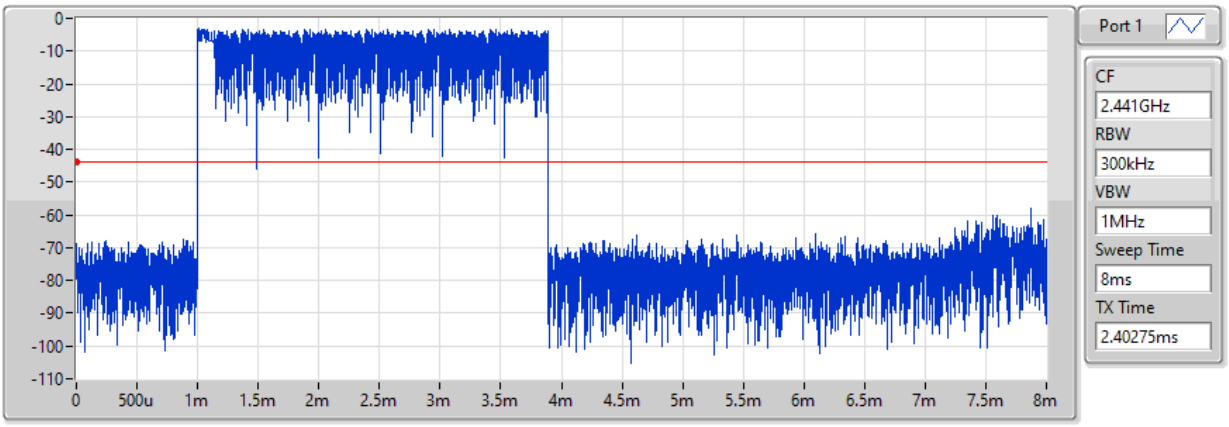
Hopping Mode_TnomVnom



Function	Hopping Ch	ATT Period(s)	ATT(s)	ATT Limit(s)	Dwell/Ch(s)	FO Period(s)	FO(Hop)	FO Limit(Hop)
AFH	20	8	154.350352m	400m	7.5m	600m	4	1

BT-EDR(3Mbps) ATT Non-AFH

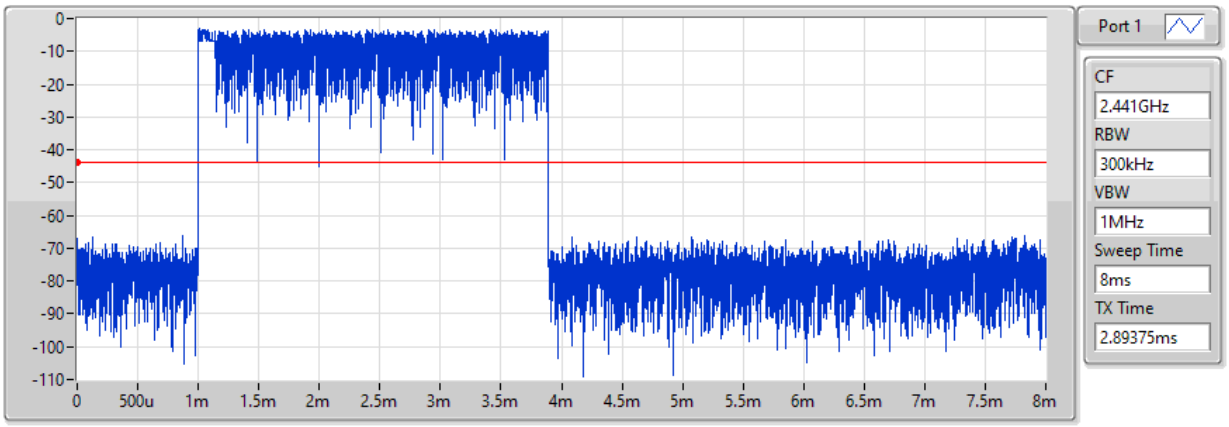
Hopping Mode_TnomVnom



Function	Hopping Ch	ATT Period(s)	ATT(s)	ATT Limit(s)	Dwell/Ch(s)	FO Period(s)	FO(Hop)	FO Limit(Hop)
Non-AFH	79	1.185	9.611m	15m	3.75m	1.185	4	1

BT-EDR(3Mbps) ATT AFH

Hopping Mode_TnomVnom



Function	Hopping Ch	ATT Period(s)	ATT(s)	ATT Limit(s)	Dwell/Ch(s)	FO Period(s)	FO(Hop)	FO Limit(Hop)
AFH	20	8	154.323688m	400m	7.5m	600m	4	1

3.3 Hopping Frequency Separation

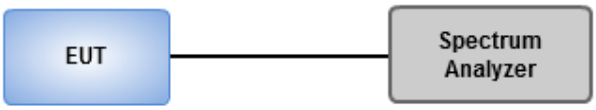
3.3.1 Limit of Hopping Frequency Separation

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 V2.2.2 (2019-07).

3.3.3 Test Setup



3.3.4 Test Result of Hopping Frequency Separation

Ambient Condition	22°C / 65%	**Tested By**	Alan Tang

Summary

Mode	Max-Space (Hz)	Min-Space (Hz)
2.4-2.4835GHz	-	-
BT-BR(1Mbps)	997.5k	997.5k
BT-EDR(3Mbps)	1.0005M	1.0005M

Result

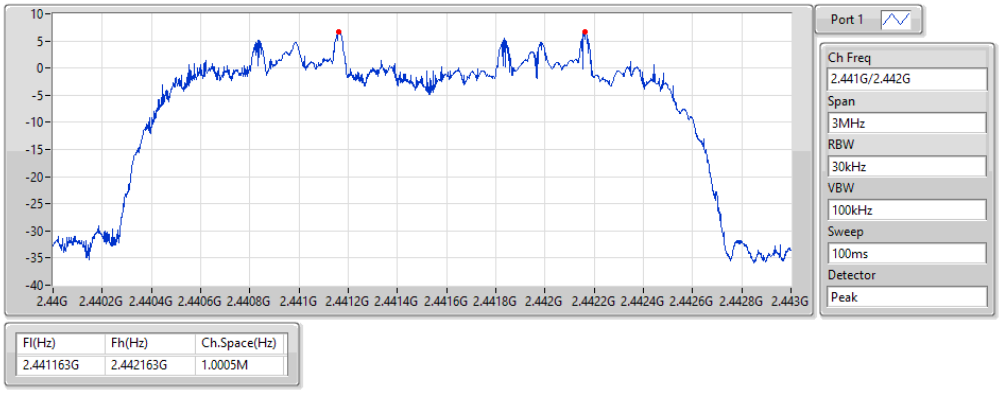
Mode	Result	Fl (Hz)	Fh (Hz)	Ch.Space (Hz)	Limit (Hz)
BT-BR(1Mbps)	-	-	-	-	-
2441MHz_TnomVnom	Pass	2.441163G	2.44216G	997.5k	100k
BT-EDR(3Mbps)	-	-	-	-	-
2441MHz_TnomVnom	Pass	2.441163G	2.442163G	1.0005M	100k

BT-BR(1Mbps) **Channel Separation**

2.441G/2.442GHz

BT-EDR(3Mbps) **Channel Separation**

2.441G/2.442GHz



3.4 Emission Bandwidth and Operating Frequencies

3.4.1 Limit of Emission Bandwidth and Operating Frequencies

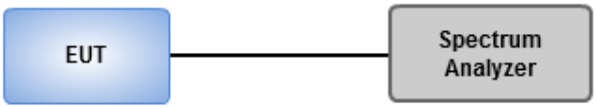
The Emission Bandwidth for each frequency shall fall completely within 2.4~2.4835 GHz.

For non-adaptive Frequency Hopping equipment with e.i.r.p greater than 10 dBm, the Emission 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 V2.2.2 (2019-07).

3.4.3 Test Setup



3.4.4 Test Result of Emission Bandwidth and Operating Frequencies

Ambient Condition	22°C / 65%	Tested By	Alan Tang

Summary

Mode	OBW (Hz)	ITU-Code
2.4-2.4835GHz	-	-
BT-BR(1Mbps)	879.449k	879KF1D
BT-EDR(3Mbps)	1.198M	1M19G1D

OBW = 99% occupied bandwidth;

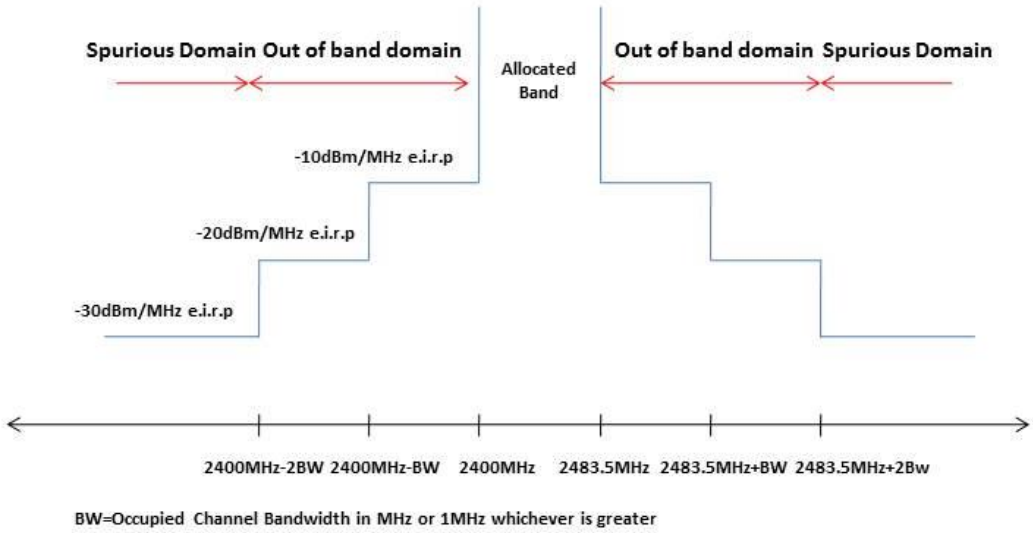
Result

Mode	Result	Limit (Hz)	fl-OBW (Hz)	fh-OBW (Hz)	OBW (Hz)	N dB (Hz)
BT-BR(1Mbps)	-	-	-	-	-	-
2402MHz_TnomVnom	Pass	2.4-2.4835G	2.401558G	2.402438G	879.449k	951k
2480MHz_TnomVnom	Pass	2.4-2.4835G	2.479557G	2.480434G	877.493k	938k
BT-EDR(3Mbps)	-	-	-	-	-	-
2402MHz_TnomVnom	Pass	2.4-2.4835G	2.4014G	2.402598G	1.198M	1.34M
2480MHz_TnomVnom	Pass	2.4-2.4835G	2.479398G	2.480596G	1.198M	1.338M

fl-OBW = fl lower edge 99% occupied bandwidth; **fh-OBW** = fh higher edge 99% occupied bandwidth; **OBW** = 99% occupied bandwidth;
N dB = 20dB down bandwidth;

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

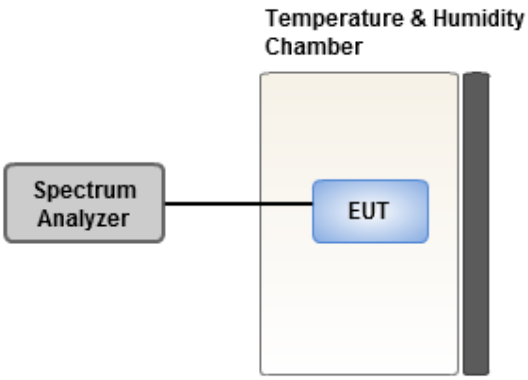
3.5.1 Limit of Transmitter Unwanted Emissions in the Out-Of-Band Domain



3.5.2 Test Procedures

Reference to clause 5.4.8.2 of ETSI EN 300 328 V2.2.2 (2019-07).

3.5.3 Test Setup



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

Ambient Condition	22°C / 65%	Tested By	Alan Tang

Summary

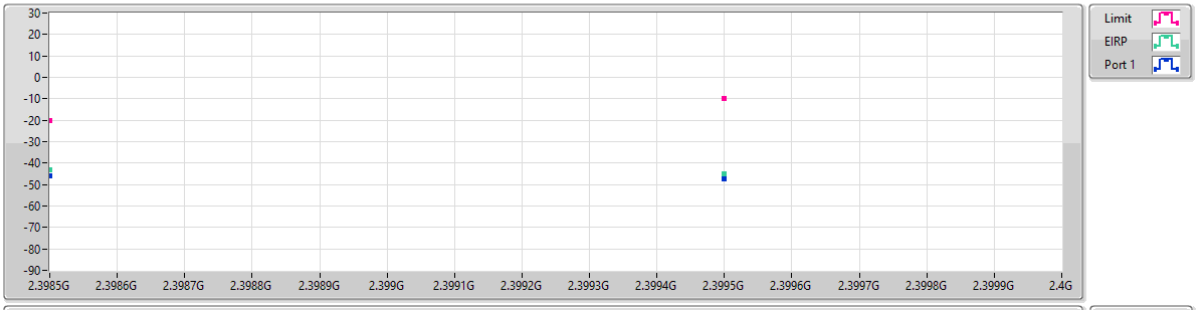
Mode	EIRP-A (dBm)	Limit-A (dBm)	EIRP-B (dBm)	Limit-B (dBm)
2.4-2.4835GHz	-	-	-	-
BT-BR(1Mbps)	-44.45	-10	-43.33	-20
BT-EDR(3Mbps)	-36.18	-10	-42.25	-20

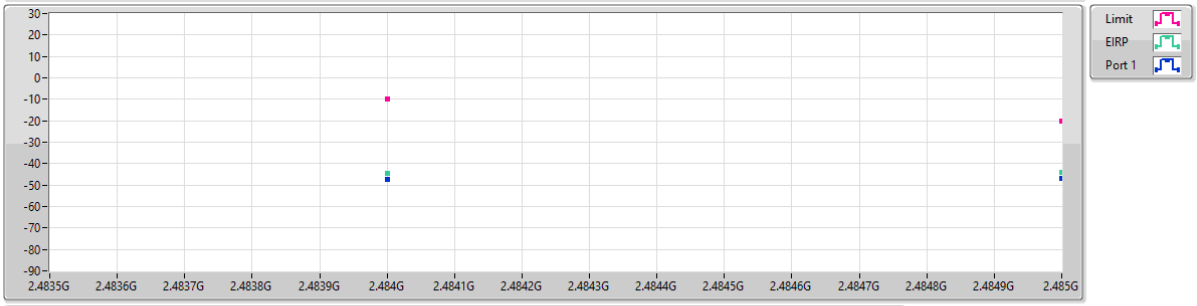
Result

Mode	Result	Freq (Hz)	EIRP (dBm)	Limit (dBm)	Freq (Hz)	EIRP (dBm)	Limit (dBm)
BT-BR(1Mbps)	-	-	-	-	-	-	-
Hopping Mode_TnomVnom	Pass	2.3985G	-43.33	-20	2.3995G	-44.77	-10
Hopping Mode_TnomVnom	Pass	2.485G	-44.23	-20	2.484G	-44.45	-10
BT-EDR(3Mbps)	-	-	-	-	-	-	-
Hopping Mode_TnomVnom	Pass	2.398106G	-42.25	-20	2.3995G	-36.18	-10
Hopping Mode_TnomVnom	Pass	2.485394G	-43.55	-20	2.484G	-44.27	-10

BT-BR(1Mbps) **Mask**

Hopping Mode_TnomVnom

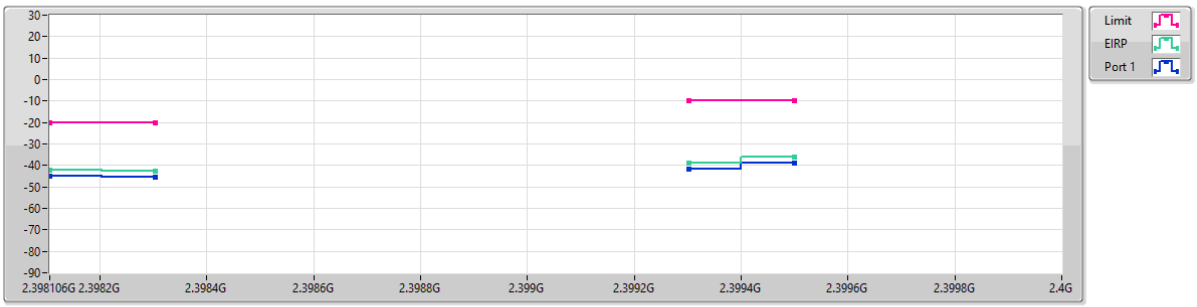


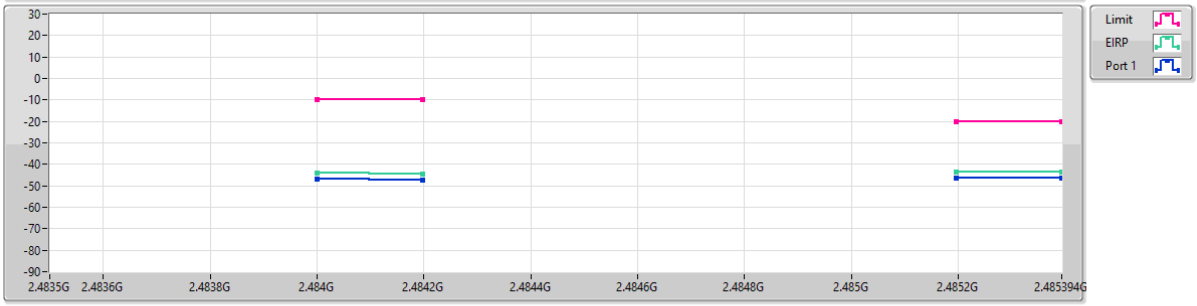


Freq(Hz)	EIRP(dBm)	Limit(dBm)	Freq(Hz)	EIRP(dBm)	Limit(dBm)	Freq(Hz)	EIRP(dBm)	Limit(dBm)	Freq(Hz)	EIRP(dBm)	Limit(dBm)
2.3985G	-43.33	-20	2.3995G	-44.77	-10	2.484G	-44.45	-10	2.485G	-44.23	-20

BT-EDR(3Mbps) **Mask**

Hopping Mode_TnomVnom





Freq(Hz)	EIRP(dBm)	Limit(dBm)	Freq(Hz)	EIRP(dBm)	Limit(dBm)	Freq(Hz)	EIRP(dBm)	Limit(dBm)	Freq(Hz)	EIRP(dBm)	Limit(dBm)
2.398106G	-42.25	-20	2.3995G	-36.18	-10	2.484G	-44.27	-10	2.485394G	-43.55	-20

3.6 Transmitter Unwanted Emissions in the Spurious Domain

3.6.1 Limit of Transmitter Unwanted Emissions in the Spurious Domain

Spurious Emissions Limit (Peak Power)	Frequency Range	Measurement Bandwidth
-56 dBW (2.5μW) e.i.r.p (59 dBμV/m at 10 metres)	< 150 kHz	1 kHz
	150 kHz – 30 MHz	10 kHz

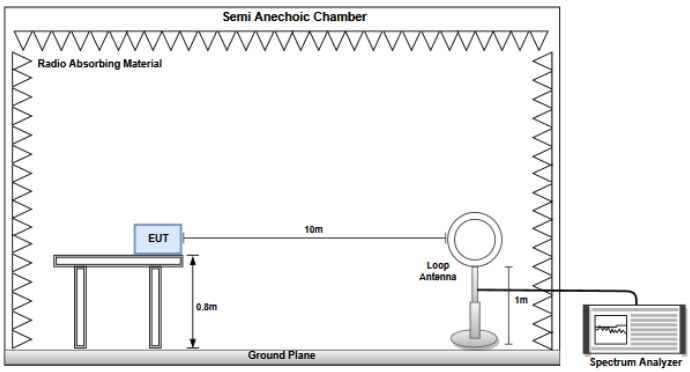
Frequency Range (MHz)	Maximum power (dBm)	Bandwidth (kHz)
30 to 47	-36	100
47 to 74	-54	100
74 to 87,5	-36	100
87,5 to 118	-54	100
118 to 174	-36	100
174 to 230	-54	100
230 to 470	-36	100
470 to 694	-54	100
694 to 1000	-36	100
1000 to 12750	-30	1000

3.6.2 Test Procedures

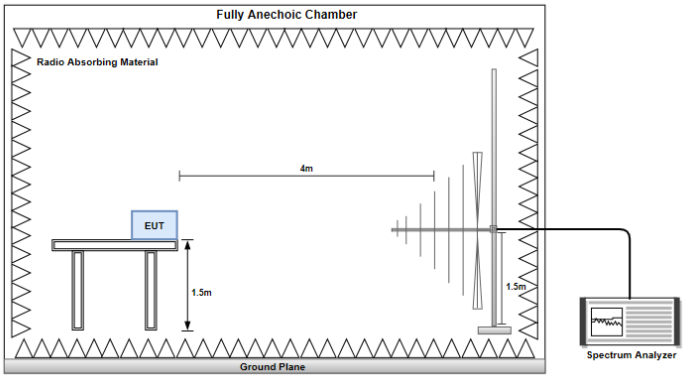
Reference to clause 5.4.9.2 of ETSI EN 300 328 V2.2.2 (2019-07).

3.6.3 Test Setup

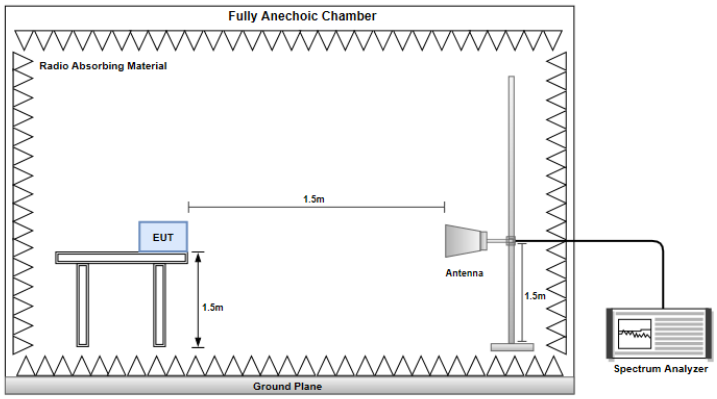
Below 30MHz



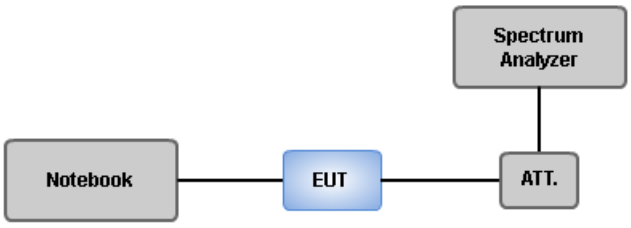
Below 1GHz



Above 1 GHz



Conducted Emission

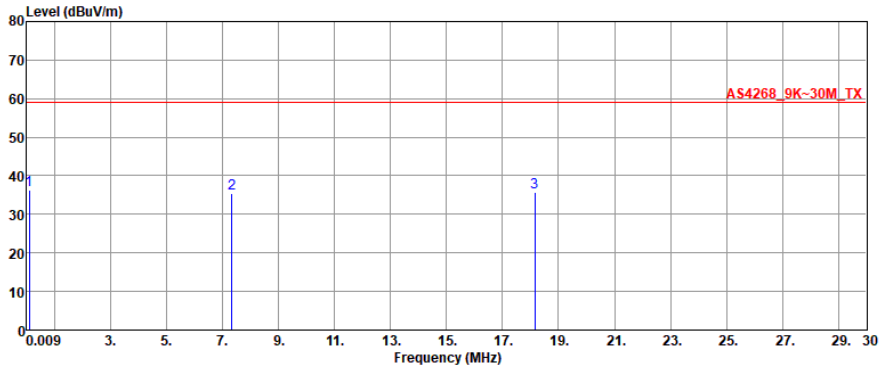


3.6.4 Transmitter Radiated Unwanted Emissions (≤ 30MHz)

Configuration 1

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

Test By :Joy Zheng Temperature:24 Humidity(%):65



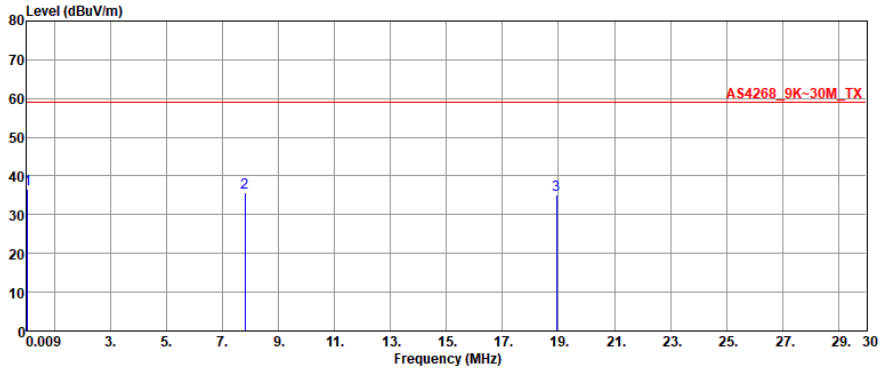
	Freq.	Measured value	Limit	Margin	Factor	Reading
	MHz	dBuV/m	dBuV/m	dB	dB	dBuV
1	0.08	36.29	59.00	-22.71	19.03	17.26
2	7.32	35.47	59.00	-23.53	20.39	15.08
3	18.16	35.58	59.00	-23.42	21.87	13.71

Note 1: Measured Value (dBm) = Reading (dBm) + Factor (dB).

Note 2: Margin (dB) = Measured Value (dBm) – Limit (dBm).

Modulation	GFSK	**Test Freq. (MHz)**	2480

Test By :Joy Zheng Temperature:24 Humidity(%):65



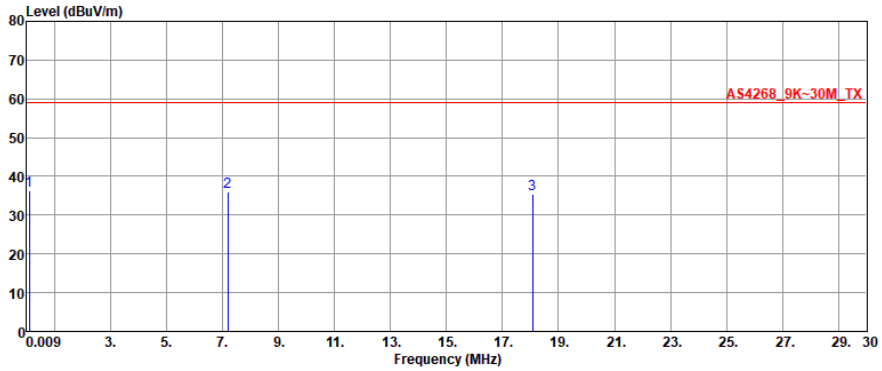
	Freq.	Measured value	Limit	Margin	Factor	Reading
	MHz	dBuV/m	dBuV/m	dB	dB	dBuV
1	0.04	36.64	59.00	-22.36	19.79	16.85
2	7.79	35.75	59.00	-23.25	20.51	15.24
3	18.94	35.27	59.00	-23.73	21.94	13.33

Note 1: Measured Value (dBm) = Reading (dBm) + Factor (dB).

Note 2: Margin (dB) = Measured Value (dBm) – Limit (dBm).

Modulation	8DPSK	Test Freq. (MHz)	2402

Test By :Joy Zheng Temperature:24 Humidity(%):65



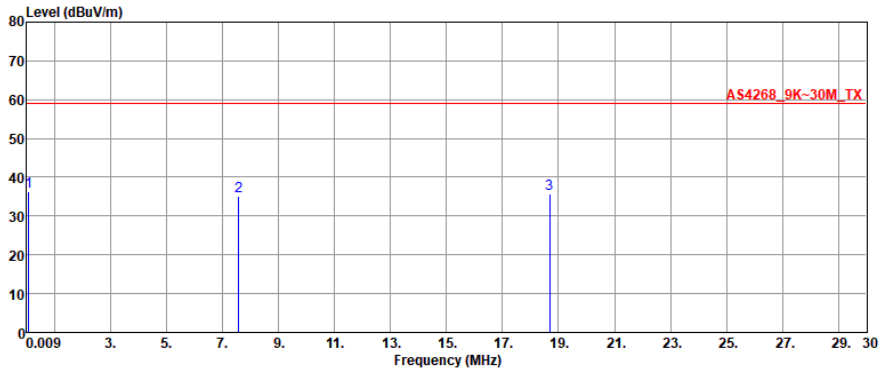
	Freq.	Measured value	Limit	Margin	Factor	Reading
	MHz	dBuV/m	dBuV/m	dB	dB	dBuV
1	0.09	36.24	59.00	-22.76	18.89	17.35
2	7.18	35.95	59.00	-23.05	20.35	15.60
3	18.07	35.47	59.00	-23.53	21.87	13.60

Note 1: Measured Value (dBm) = Reading (dBm) + Factor (dB).

Note 2: Margin (dB) = Measured Value (dBm) – Limit (dBm).

Modulation	8DPSK	Test Freq. (MHz)	2480

Test By :Joy Zheng Temperature:24 Humidity(%):65



	Freq.	Measured value	Limit	Margin	Factor	Reading
	MHz	dBuV/m	dBuV/m	dB	dB	dBuV
1	0.08	36.36	59.00	-22.64	19.16	17.20
2	7.57	35.11	59.00	-23.89	20.46	14.65
3	18.68	35.72	59.00	-23.28	21.91	13.81

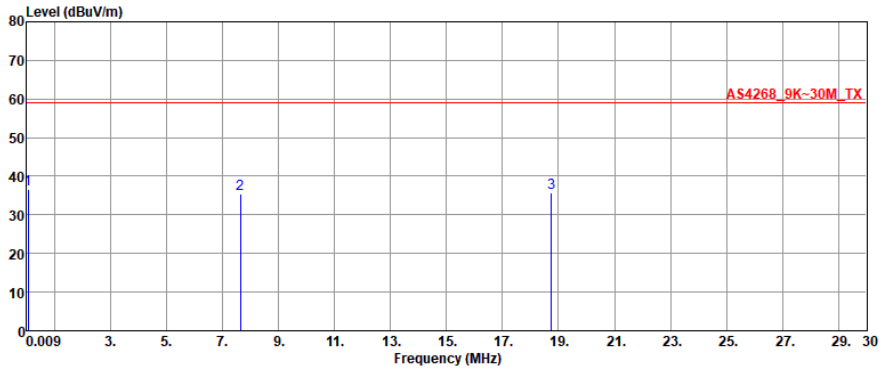
Note 1: Measured Value (dBm) = Reading (dBm) + Factor (dB).

Note 2: Margin (dB) = Measured Value (dBm) – Limit (dBm).

Configuration 2

Modulation	GFSK	Test Freq. (MHz)	2402

Test By :Joy Zheng Temperature:24 Humidity(%):65

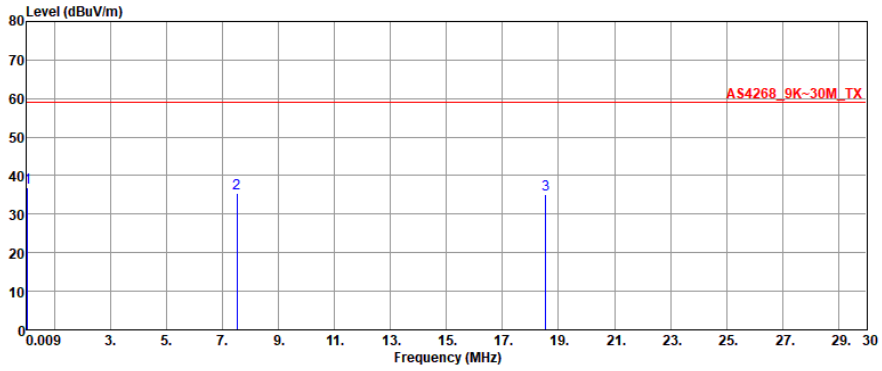


	Freq. MHz	Measured value dBuV/m	Limit dBuV/m	Margin dB	Factor dB	Reading dBuV
1	0.05	36.62	59.00	-22.38	19.74	16.88
2	7.64	35.29	59.00	-23.71	20.48	14.81
3	18.75	35.86	59.00	-23.14	21.92	13.94

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

Modulation	GFSK	Test Freq. (MHz)	2480

Test By :Joy Zheng Temperature:24 Humidity(%):65

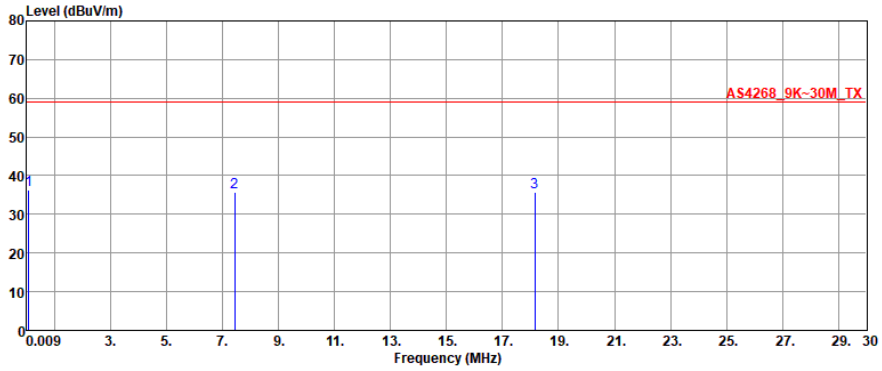


	Freq. MHz	Measured value dBuV/m	Limit dBuV/m	Margin dB	Factor dB	Reading dBuV
1	0.02	36.89	59.00	-22.11	19.44	17.45
2	7.51	35.46	59.00	-23.54	20.44	15.02
3	18.54	35.12	59.00	-23.88	21.90	13.22

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

Modulation	8DPSK	Test Freq. (MHz)	2402

Test By :Joy Zheng Temperature:24 Humidity(%):65



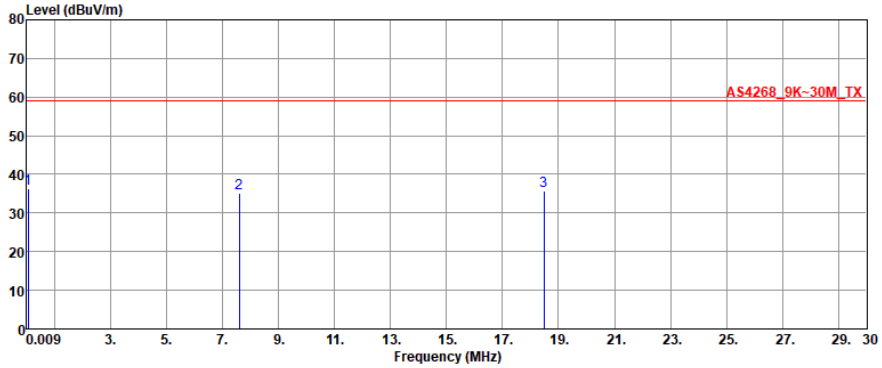
	Freq. MHz	Measured value dBuV/m	Limit dBuV/m	Margin dB	Factor dB	Reading dBuV
1	0.08	36.31	59.00	-22.69	19.10	17.21
2	7.43	35.62	59.00	-23.38	20.41	15.21
3	18.15	35.58	59.00	-23.42	21.87	13.71

Note 1: Measured Value (dBm) = Reading (dBm) + Factor (dB).

Note 2: Margin (dB) = Measured Value (dBm) – Limit (dBm).

Modulation	8DPSK	Test Freq. (MHz)	2480

Test By :Joy Zheng Temperature:24 Humidity(%):65



	Freq. MHz	Measured value dBuV/m	Limit dBuV/m	Margin dB	Factor dB	Reading dBuV
1	0.06	36.37	59.00	-22.63	19.60	16.77
2	7.59	35.13	59.00	-23.87	20.46	14.67
3	18.49	35.84	59.00	-23.16	21.90	13.94

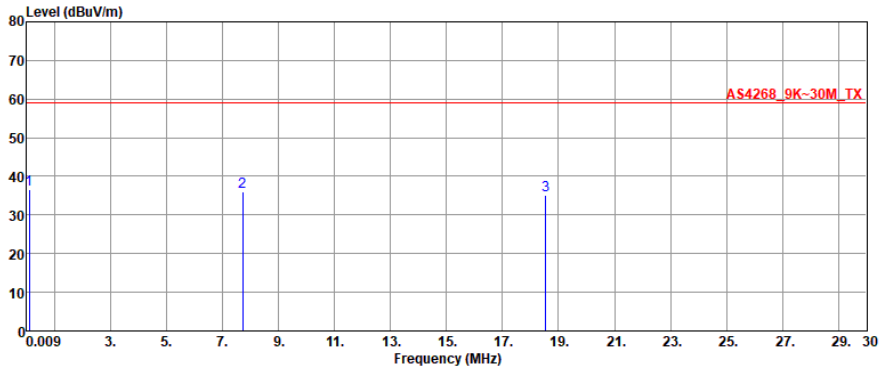
Note 1: Measured Value (dBm) = Reading (dBm) + Factor (dB).

Note 2: Margin (dB) = Measured Value (dBm) – Limit (dBm).

Configuration 3

Modulation	GFSK	Test Freq. (MHz)	2402

Test By :Joy Zheng Temperature:24 Humidity(%):65



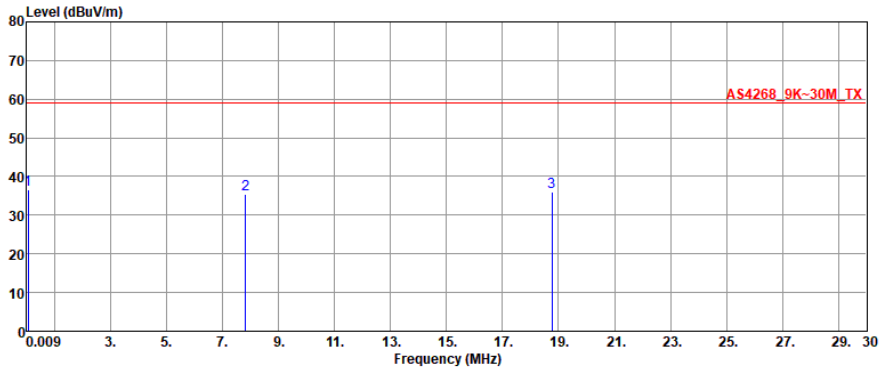
	Freq.	Measured value	Limit	Margin	Factor	Reading
	MHz	dBuV/m	dBuV/m	dB	dB	dBuV
1	0.09	36.61	59.00	-22.39	18.89	17.72
2	7.72	35.89	59.00	-23.11	20.50	15.39
3	18.54	35.25	59.00	-23.75	21.90	13.35

Note 1: Measured Value (dBm) = Reading (dBm) + Factor (dB).

Note 2: Margin (dB) = Measured Value (dBm) – Limit (dBm).

Modulation	GFSK	Test Freq. (MHz)	2480

Test By :Joy Zheng Temperature:24 Humidity(%):65



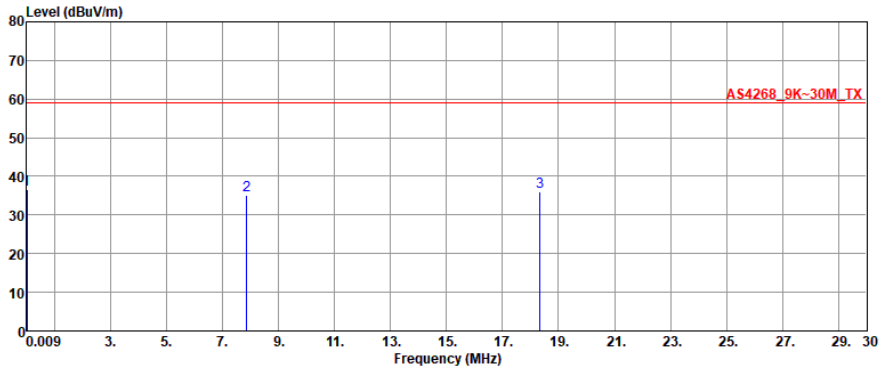
	Freq.	Measured value	Limit	Margin	Factor	Reading
	MHz	dBuV/m	dBuV/m	dB	dB	dBuV
1	0.05	36.56	59.00	-22.44	19.75	16.81
2	7.82	35.41	59.00	-23.59	20.52	14.89
3	18.76	35.97	59.00	-23.03	21.92	14.05

Note 1: Measured Value (dBm) = Reading (dBm) + Factor (dB).

Note 2: Margin (dB) = Measured Value (dBm) – Limit (dBm).

Modulation	8DPSK	Test Freq. (MHz)	2402

Test By :Joy Zheng Temperature:24 Humidity(%):65



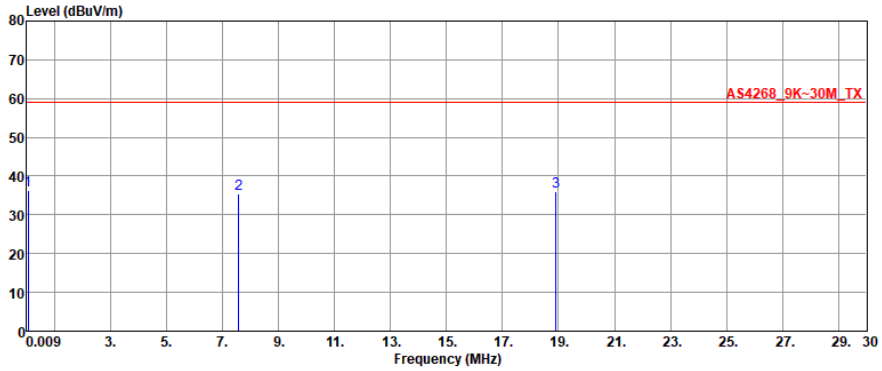
	Freq. MHz	Measured value dBuV/m	Limit dBuV/m	Margin dB	Factor dB	Reading dBuV
1	0.01	36.74	59.00	-22.26	18.61	18.13
2	7.87	35.08	59.00	-23.92	20.53	14.55
3	18.34	35.87	59.00	-23.13	21.89	13.98

Note 1: Measured Value (dBm) = Reading (dBm) + Factor (dB).

Note 2: Margin (dB) = Measured Value (dBm) – Limit (dBm).

Modulation	8DPSK	Test Freq. (MHz)	2480

Test By :Joy Zheng Temperature:24 Humidity(%):65



	Freq. MHz	Measured value dBuV/m	Limit dBuV/m	Margin dB	Factor dB	Reading dBuV
1	0.04	36.17	59.00	-22.83	19.77	16.40
2	7.57	35.47	59.00	-23.53	20.46	15.01
3	18.91	35.95	59.00	-23.05	21.94	14.01

Note 1: Measured Value (dBm) = Reading (dBm) + Factor (dB).

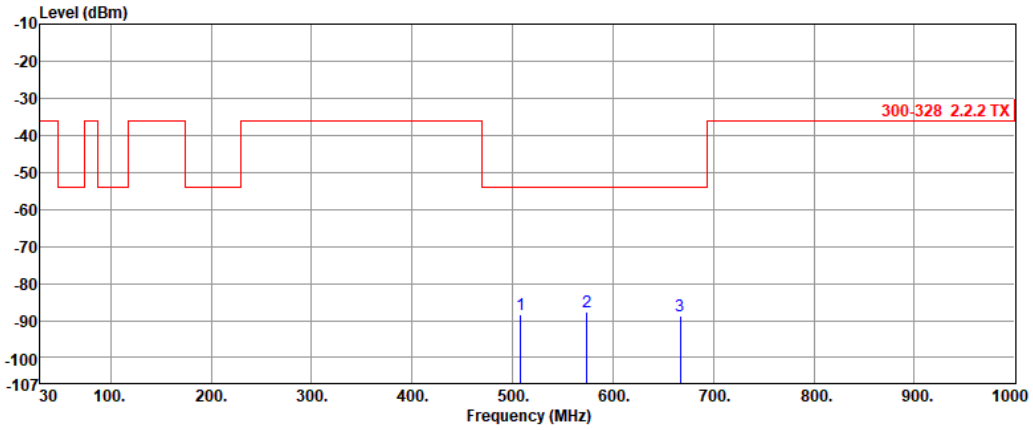
Note 2: Margin (dB) = Measured Value (dBm) – Limit (dBm).

Configuration 1

3.6.5 Transmitter Conducted Unwanted Emissions (Below 1GHz)

Modulation	GFSK	Test Freq. (MHz)	2402

Test By :Alan Tang Temperature:24 Humidity(%):65

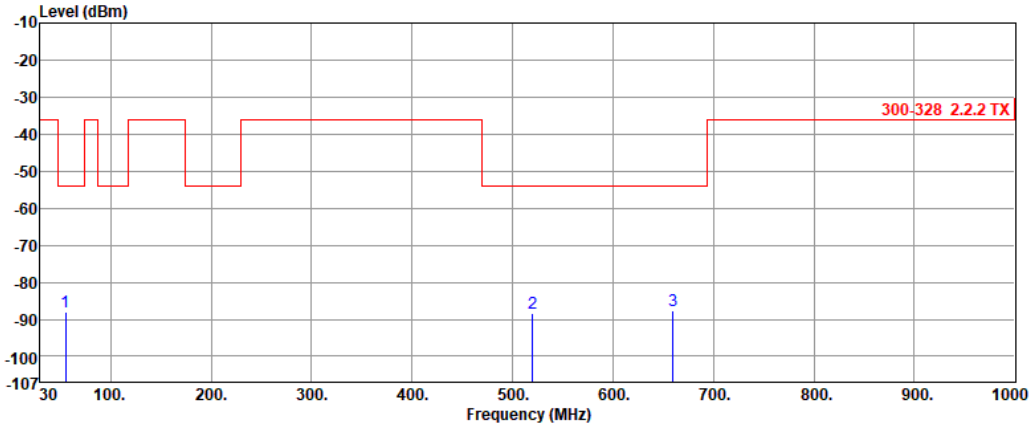


	Freq.	Measured value	Limit	Margin	Factor	Reading
	MHz	dBm	dBm	dB	dB	dBm
1	508.21	-88.23	-54.00	-34.23	0.00	-88.23
2	574.17	-87.67	-54.00	-33.67	0.00	-87.67
3	667.29	-88.73	-54.00	-34.73	0.00	-88.73

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

Modulation	GFSK	Test Freq. (MHz)	2480

Test By :Alan Tang Temperature:24 Humidity(%):65

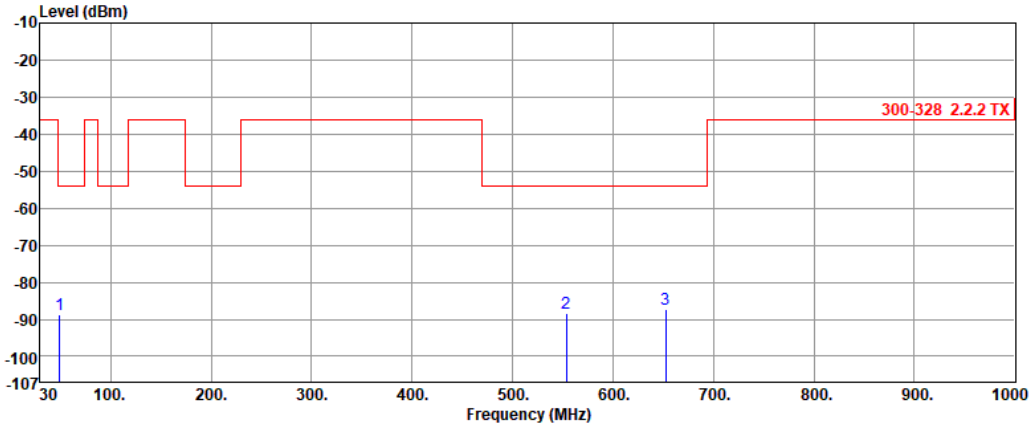


	Freq.	Measured value	Limit	Margin	Factor	Reading
	MHz	dBm	dBm	dB	dB	dBm
1	55.22	-88.21	-54.00	-34.21	0.00	-88.21
2	519.85	-88.39	-54.00	-34.39	0.00	-88.39
3	659.53	-87.66	-54.00	-33.66	0.00	-87.66

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

Modulation	8DPSK	Test Freq. (MHz)	2402

Test By :Alan Tang Temperature:24 Humidity(%):65

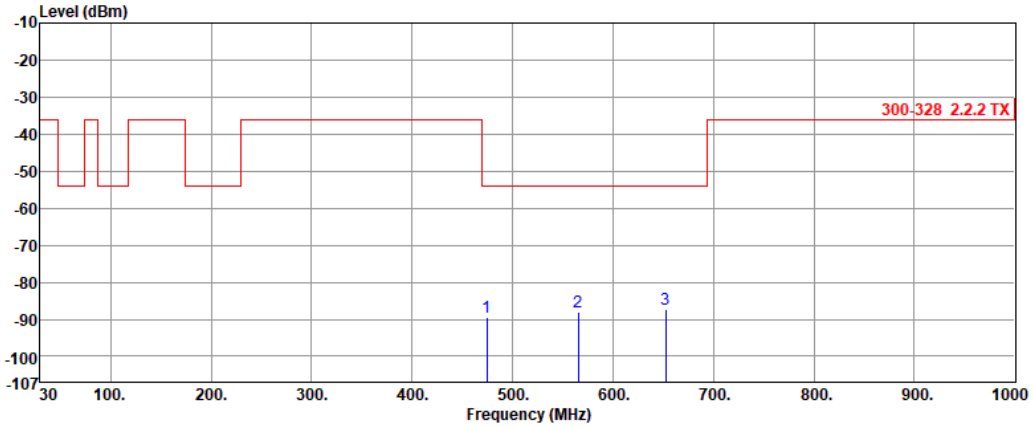


	Freq.	Measured value	Limit	Margin	Factor	Reading
	MHz	dBm	dBm	dB	dB	dBm
1	49.40	-88.79	-54.00	-34.79	0.00	-88.79
2	553.80	-88.23	-54.00	-34.23	0.00	-88.23
3	652.74	-87.46	-54.00	-33.46	0.00	-87.46

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

Modulation	8DPSK	Test Freq. (MHz)	2480

Test By :Alan Tang Temperature:24 Humidity(%):65



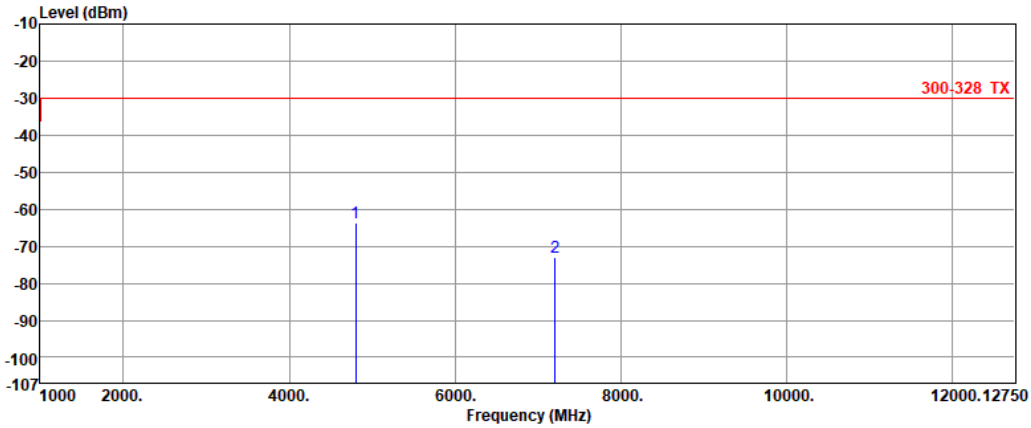
	Freq.	Measured value	Limit	Margin	Factor	Reading
	MHz	dBm	dBm	dB	dB	dBm
1	474.26	-89.50	-54.00	-35.50	0.00	-89.50
2	565.44	-88.04	-54.00	-34.04	0.00	-88.04
3	652.74	-87.19	-54.00	-33.19	0.00	-87.19

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

3.6.6 Transmitter Conducted Unwanted Emissions (Above 1GHz)

Modulation	GFSK	Test Freq. (MHz)	2402

Test By :Alan Tang Temperature:24 Humidity(%):65

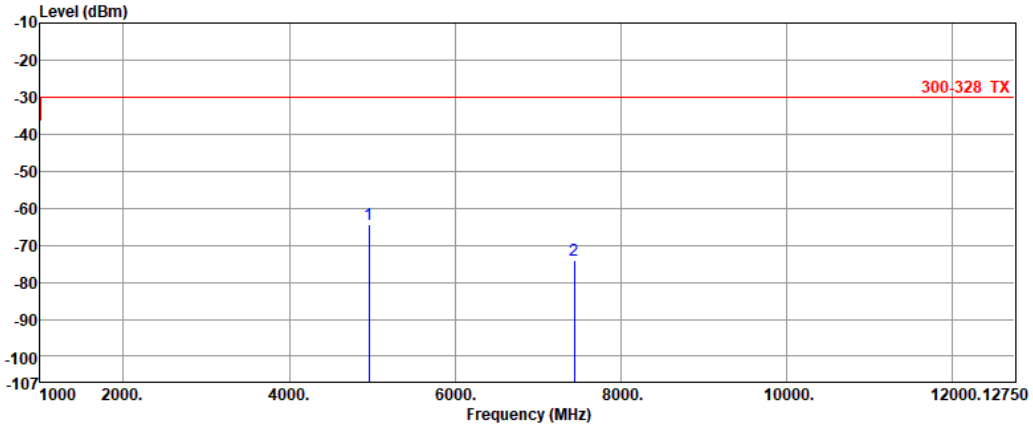


	Freq.	Measured value	Limit	Margin	Factor	Reading
	MHz	dBm	dBm	dB	dB	dBm
1	4803.67	-63.85	-30.00	-33.85	0.00	-63.85
2	7206.44	-73.00	-30.00	-43.00	0.00	-73.00

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

Modulation	GFSK	Test Freq. (MHz)	2480

Test By :Alan Tang Temperature:24 Humidity(%):65

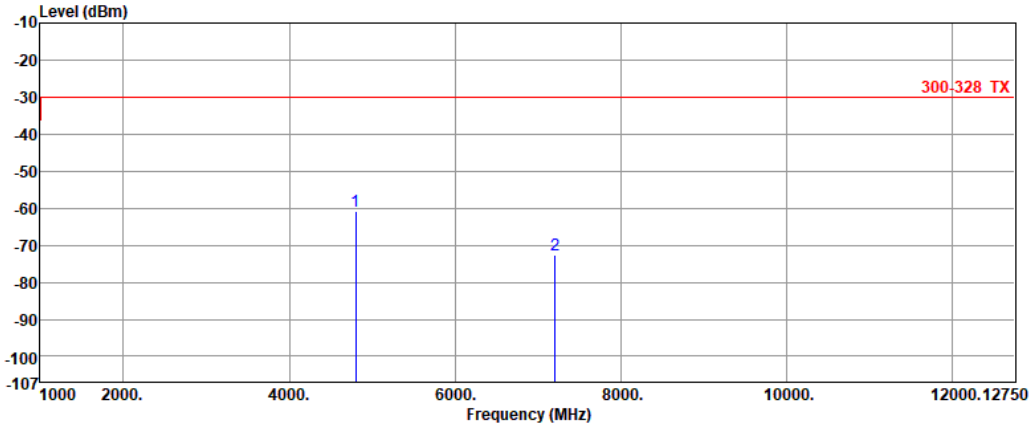


	Freq.	Measured value	Limit	Margin	Factor	Reading
	MHz	dBm	dBm	dB	dB	dBm
1	4960.35	-64.53	-30.00	-34.53	0.00	-64.53
2	7440.22	-74.20	-30.00	-44.20	0.00	-74.20

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

Modulation	8DPSK	Test Freq. (MHz)	2402

Test By :Alan Tang Temperature:24 Humidity(%):65

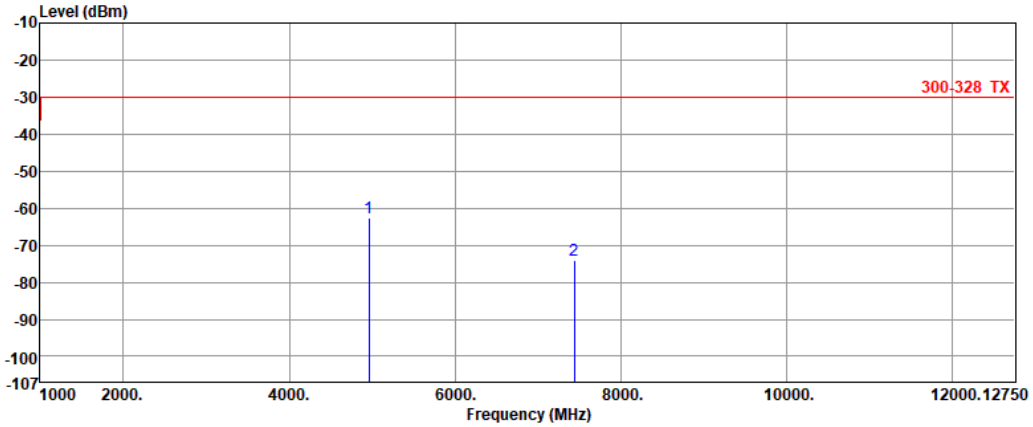


	Freq.	Measured value	Limit	Margin	Factor	Reading
	MHz	dBm	dBm	dB	dB	dBm
1	4804.31	-60.85	-30.00	-30.85	0.00	-60.85
2	7206.19	-72.79	-30.00	-42.79	0.00	-72.79

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

Modulation	8DPSK	Test Freq. (MHz)	2480

Test By :Alan Tang Temperature:24 Humidity(%):65



	Freq.	Measured value	Limit	Margin	Factor	Reading
	MHz	dBm	dBm	dB	dB	dBm
1	4959.86	-62.48	-30.00	-32.48	0.00	-62.48
2	7439.63	-74.19	-30.00	-44.19	0.00	-74.19

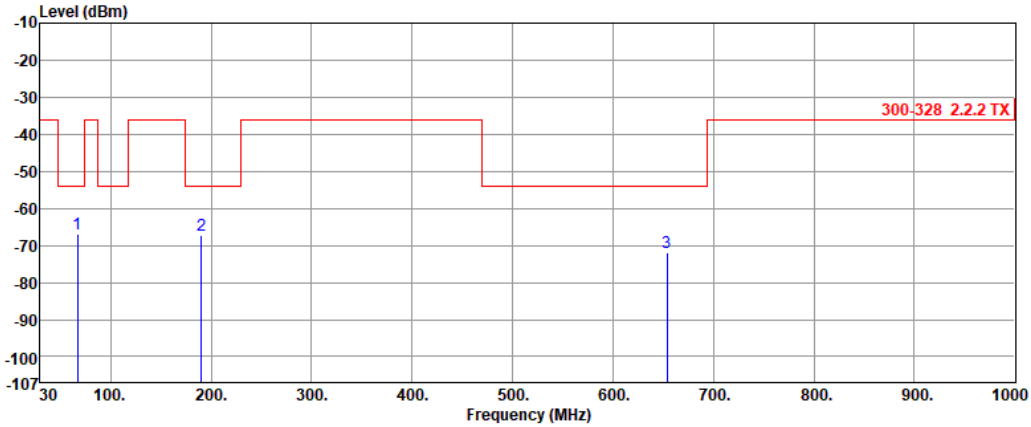
Note 1: Measured Value (dBm) = Reading (dBm) + Factor (dB)
Note 2: Margin (dB) = Measured Value (dBm) – Limit (dBm)

Configuration 1

3.6.7 Transmitter Radiated Unwanted Emissions (Below 1GHz)

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

Test By :Alan Tang Temperature:24 Humidity(%):65

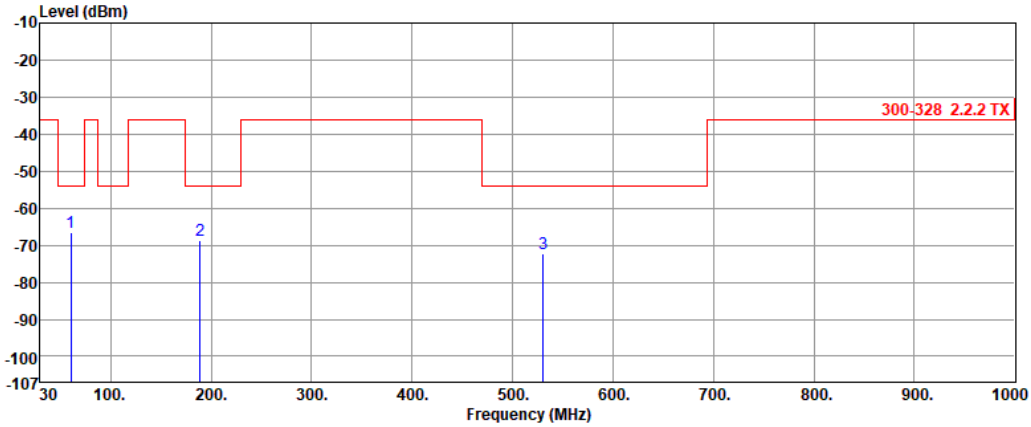


	Freq.	Measured value	Limit	Margin	Factor	Reading
	MHz	dBm	dBm	dB	dB	dBm
1	66.86	-66.98	-54.00	-12.98	-3.75	-63.23
2	190.05	-67.14	-54.00	-13.14	-3.98	-63.16
3	653.71	-71.75	-54.00	-17.75	5.09	-76.84

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		

Test By :Alan Tang Temperature:24 Humidity(%):65

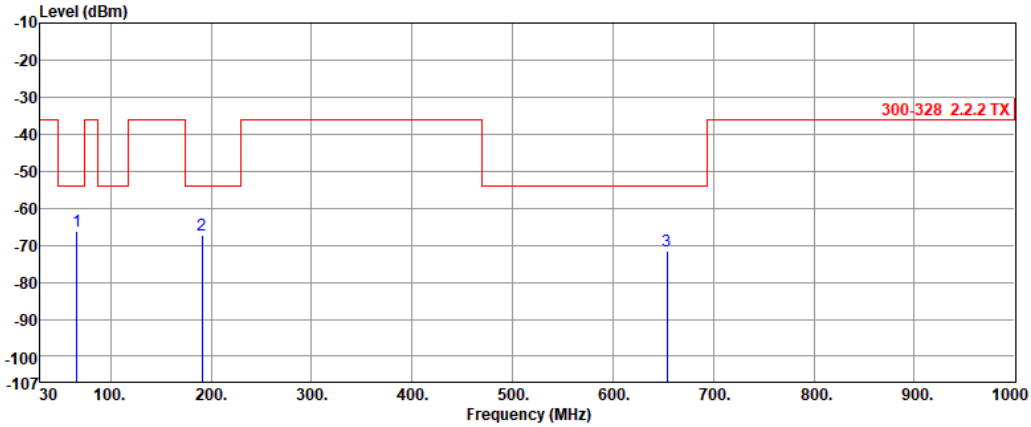


	Freq.	Measured value	Limit	Margin	Factor	Reading
	MHz	dBm	dBm	dB	dB	dBm
1	60.07	-66.45	-54.00	-12.45	-3.37	-63.08
2	189.08	-68.57	-54.00	-14.57	-3.32	-65.25
3	530.52	-72.28	-54.00	-18.28	2.80	-75.08

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		

Test By :Alan Tang Temperature:24 Humidity(%):65

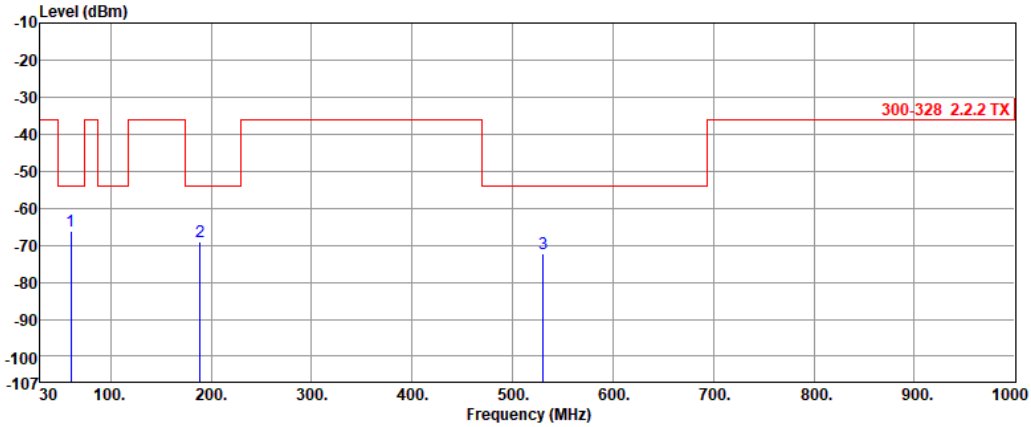


	Freq.	Measured value	Limit	Margin	Factor	Reading
	MHz	dBm	dBm	dB	dB	dBm
1	66.13	-66.29	-54.00	-12.29	-3.56	-62.73
2	190.69	-67.10	-54.00	-13.10	-4.11	-62.99
3	653.87	-71.54	-54.00	-17.54	5.09	-76.63

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		

Test By :Alan Tang Temperature:24 Humidity(%):65

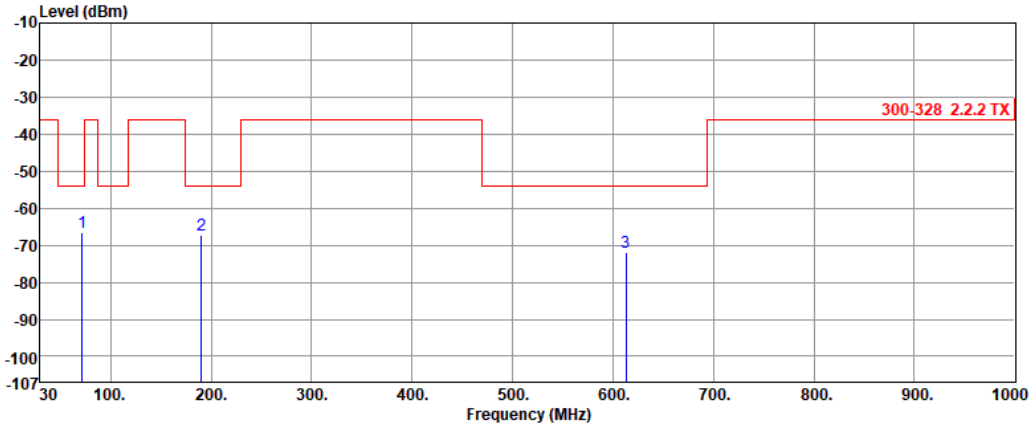


	Freq.	Measured value	Limit	Margin	Factor	Reading
	MHz	dBm	dBm	dB	dB	dBm
1	60.18	-66.07	-54.00	-12.07	-3.40	-62.67
2	189.22	-68.93	-54.00	-14.93	-3.34	-65.59
3	530.67	-72.45	-54.00	-18.45	2.80	-75.25

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		

Test By :Alan Tang Temperature:24 Humidity(%):65

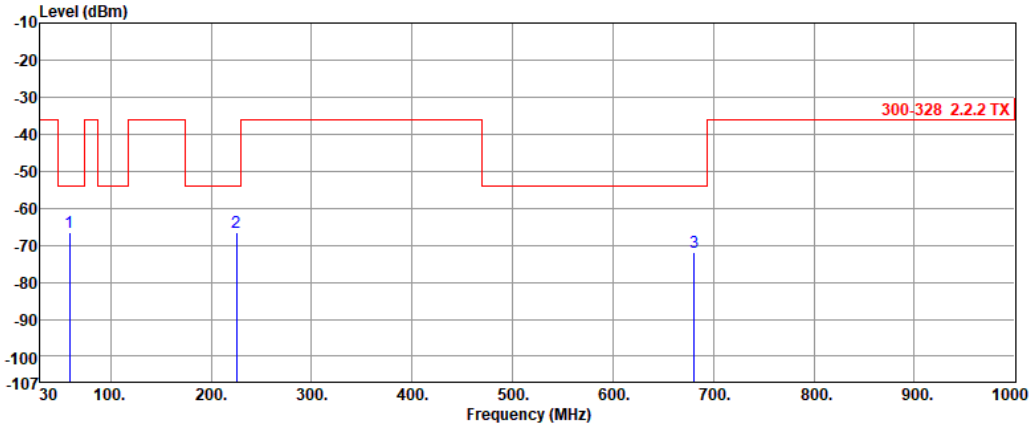


	Freq.	Measured value	Limit	Margin	Factor	Reading
	MHz	dBm	dBm	dB	dB	dBm
1	71.71	-66.73	-54.00	-12.73	-5.14	-61.59
2	190.05	-67.22	-54.00	-13.22	-3.98	-63.24
3	612.97	-71.91	-54.00	-17.91	5.05	-76.96

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		

Test By :Alan Tang Temperature:24 Humidity(%):65

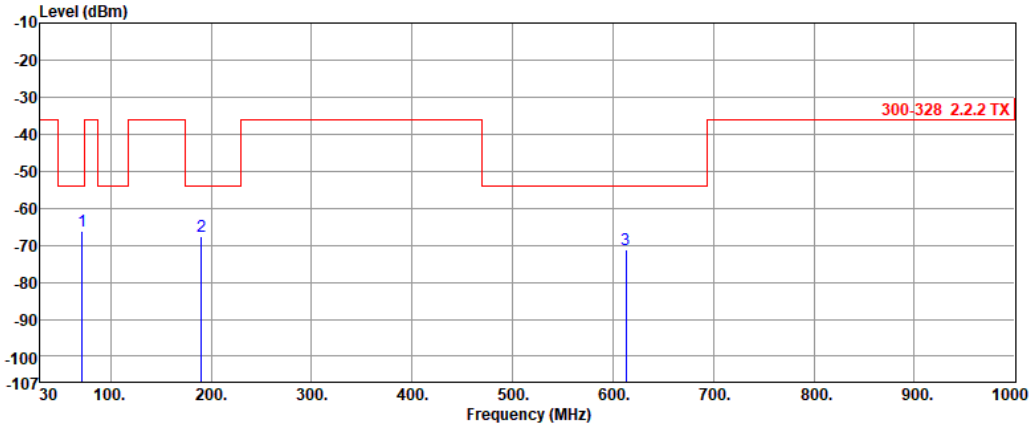


	Freq.	Measured value	Limit	Margin	Factor	Reading
	MHz	dBm	dBm	dB	dB	dBm
1	59.10	-66.47	-54.00	-12.47	-3.02	-63.45
2	224.97	-66.47	-54.00	-12.47	-5.76	-60.71
3	680.87	-71.96	-54.00	-17.96	5.50	-77.46

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		

Test By :Alan Tang Temperature:24 Humidity(%):65

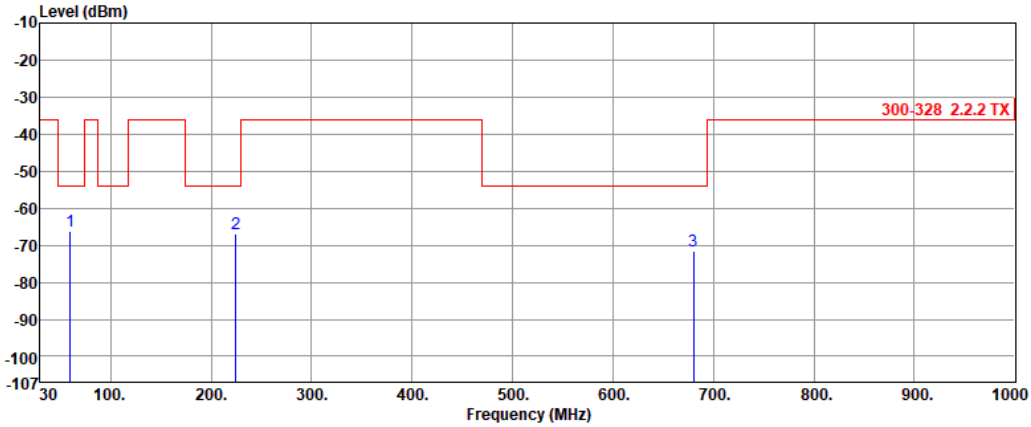


	Freq.	Measured value	Limit	Margin	Factor	Reading
	MHz	dBm	dBm	dB	dB	dBm
1	71.37	-66.26	-54.00	-12.26	-5.03	-61.23
2	190.14	-67.78	-54.00	-13.78	-3.99	-63.79
3	612.93	-71.03	-54.00	-17.03	5.05	-76.08

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		

Test By :Alan Tang Temperature:24 Humidity(%):65



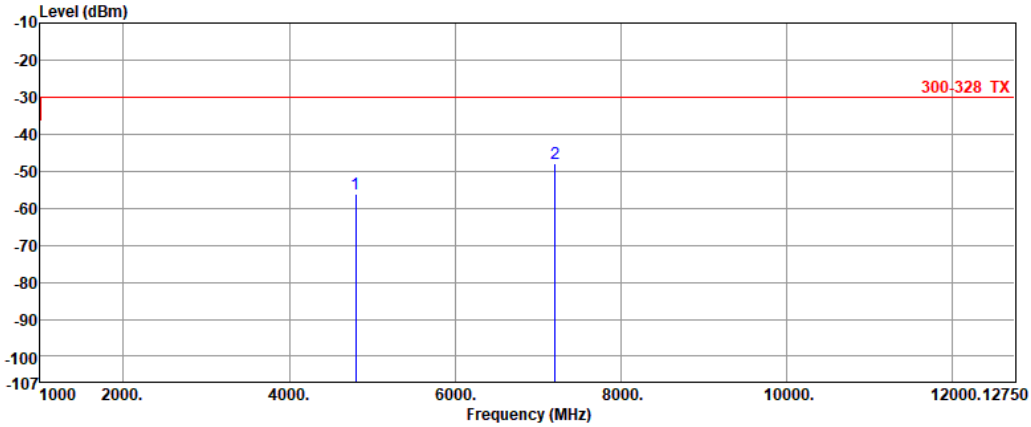
	Freq.	Measured value	Limit	Margin	Factor	Reading
	MHz	dBm	dBm	dB	dB	dBm
1	59.75	-66.13	-54.00	-12.13	-3.26	-62.87
2	224.83	-66.96	-54.00	-12.96	-5.76	-61.20
3	680.36	-71.57	-54.00	-17.57	5.51	-77.08

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

3.6.8 Transmitter Radiated Unwanted Emissions (Above 1GHz)

Modulation	GFSK	Test Freq. (MHz)	2402
Polarization	Horizontal		

Test By :Alan Tang Temperature:24 Humidity(%):65

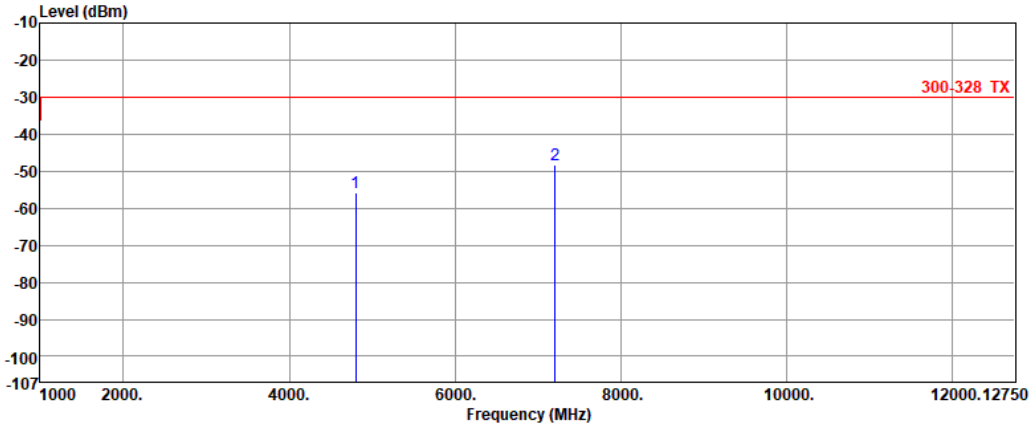


	Freq.	Measured value	Limit	Margin	Factor	Reading
	MHz	dBm	dBm	dB	dB	dBm
1	4804.20	-56.14	-30.00	-26.14	7.55	-63.69
2	7205.58	-48.12	-30.00	-18.12	15.37	-63.49

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		

Test By :Alan Tang Temperature:24 Humidity(%):65

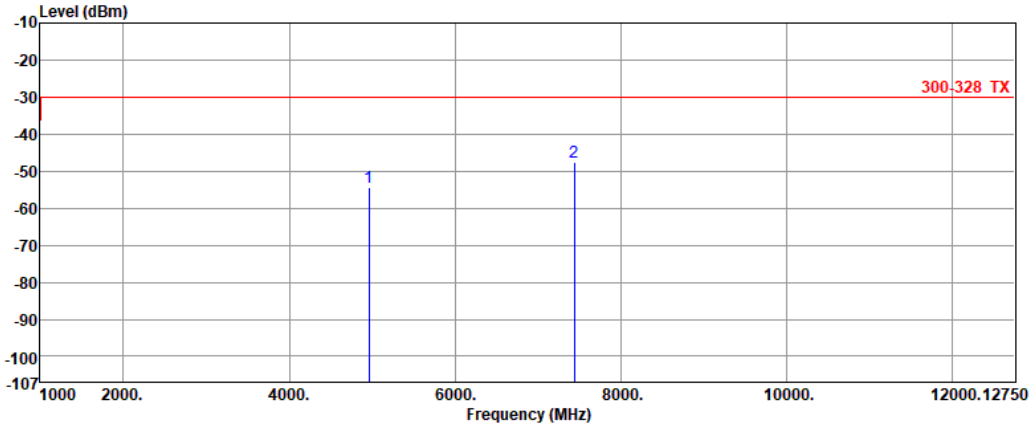


	Freq.	Measured value	Limit	Margin	Factor	Reading
	MHz	dBm	dBm	dB	dB	dBm
1	4804.30	-55.76	-30.00	-25.76	7.46	-63.22
2	7205.92	-48.15	-30.00	-18.15	14.67	-62.82

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		

Test By :Alan Tang Temperature:24 Humidity(%):65

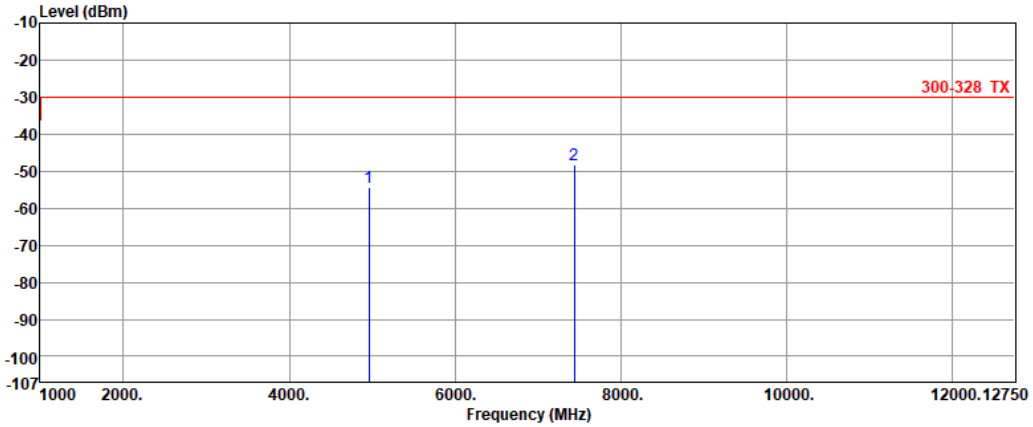


	Freq.	Measured value	Limit	Margin	Factor	Reading
	MHz	dBm	dBm	dB	dB	dBm
1	4960.20	-54.39	-30.00	-24.39	9.09	-63.48
2	7440.43	-47.74	-30.00	-17.74	15.38	-63.12

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		

Test By :Alan Tang Temperature:24 Humidity(%):65

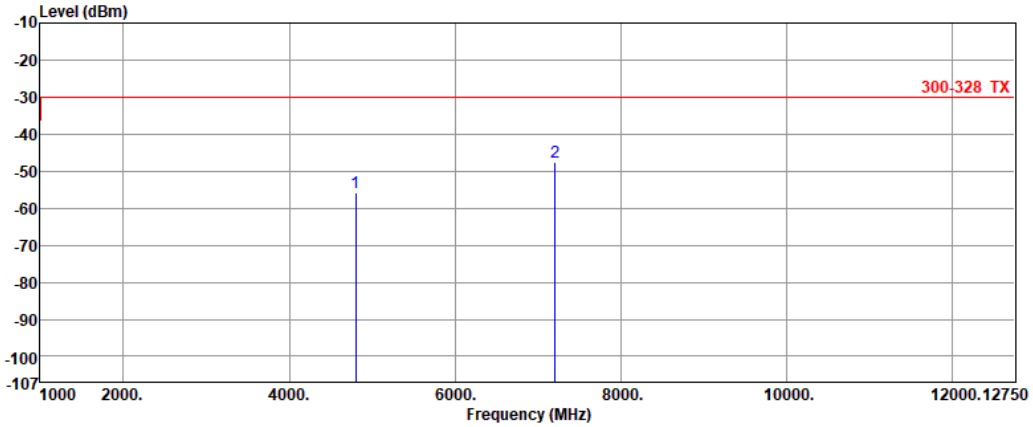


	Freq.	Measured value	Limit	Margin	Factor	Reading
	MHz	dBm	dBm	dB	dB	dBm
1	4959.77	-54.37	-30.00	-24.37	9.10	-63.47
2	7440.46	-48.46	-30.00	-18.46	15.14	-63.60

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		

Test By :Alan Tang Temperature:24 Humidity(%):65

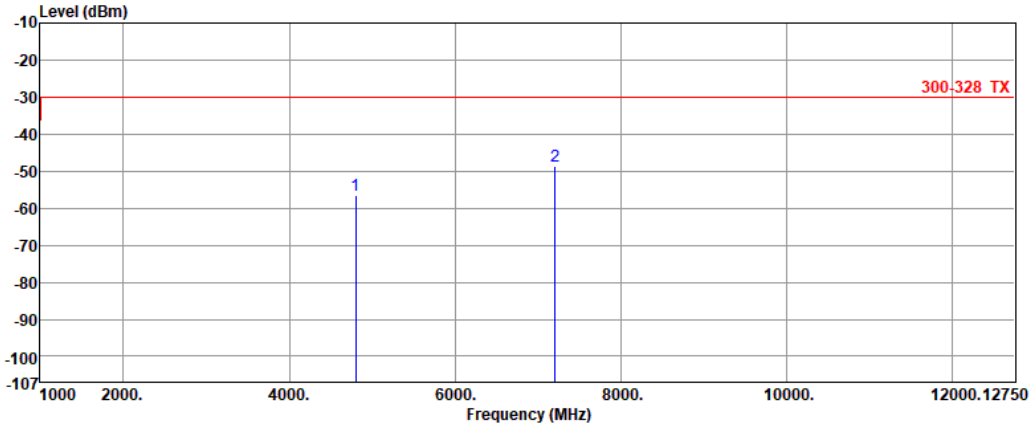


	Freq.	Measured value	Limit	Margin	Factor	Reading
	MHz	dBm	dBm	dB	dB	dBm
1	4803.59	-55.95	-30.00	-25.95	7.54	-63.49
2	7206.49	-47.75	-30.00	-17.75	15.37	-63.12

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		

Test By :Alan Tang Temperature:24 Humidity(%):65

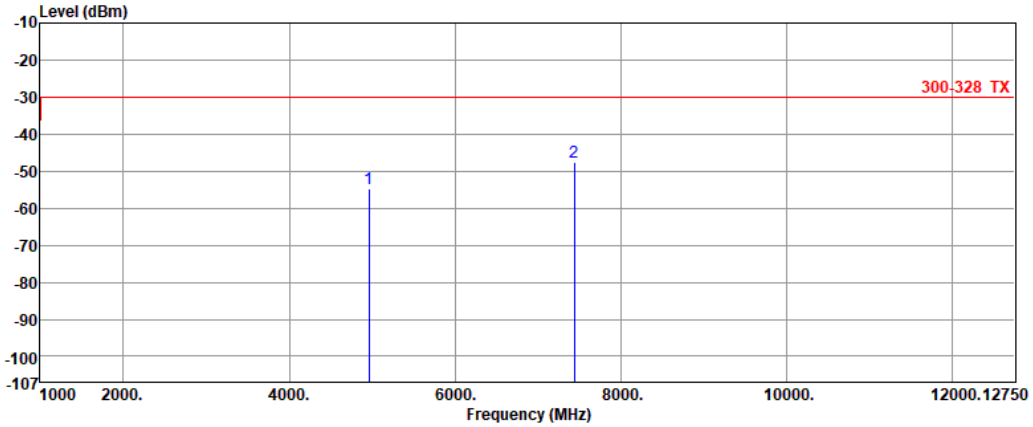


	Freq.	Measured value	Limit	Margin	Factor	Reading
	MHz	dBm	dBm	dB	dB	dBm
1	4803.64	-56.44	-30.00	-26.44	7.45	-63.89
2	7206.19	-48.74	-30.00	-18.74	14.67	-63.41

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		

Test By :Alan Tang Temperature:24 Humidity(%):65

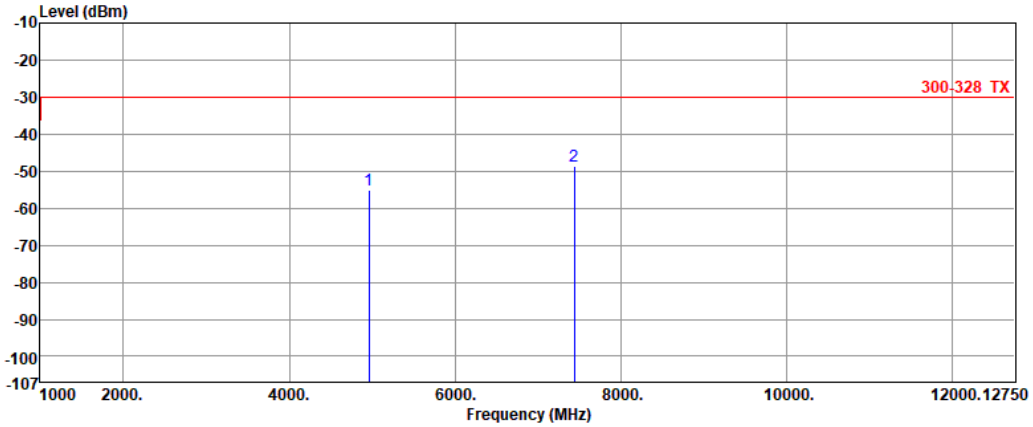


	Freq.	Measured value	Limit	Margin	Factor	Reading
	MHz	dBm	dBm	dB	dB	dBm
1	4959.70	-54.59	-30.00	-24.59	9.09	-63.68
2	7439.59	-47.65	-30.00	-17.65	15.39	-63.04

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		

Test By :Alan Tang Temperature:24 Humidity(%):65



	Freq.	Measured value	Limit	Margin	Factor	Reading
	MHz	dBm	dBm	dB	dB	dBm
1	4959.68	-54.95	-30.00	-24.95	9.10	-64.05
2	7440.21	-48.83	-30.00	-18.83	15.14	-63.97

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

Spurious Emissions Limit (Peak Power)	Frequency Range	Measurement Bandwidth
-56 dBW (2.5μW) e.i.r.p (59 dBμV/m at 10 metres)	< 150 kHz	1 kHz
	150 kHz – 30 MHz	10 kHz

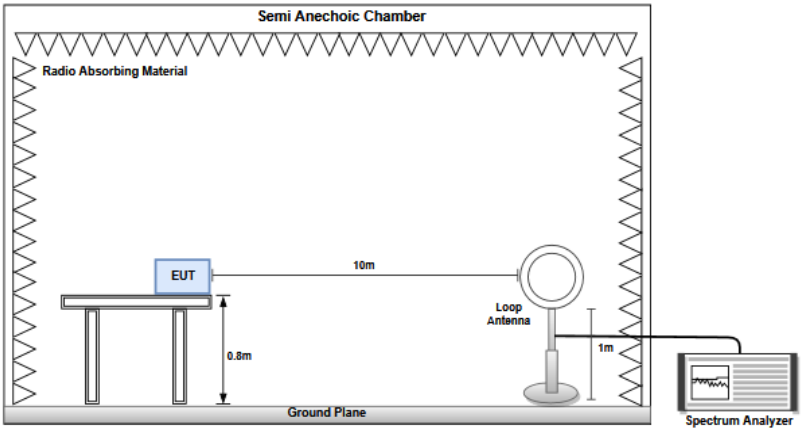
Frequency Range	Maximum power (dBm)	Measurement bandwidth(kHz)
30 MHz to 1 GHz	-57	100
Above 1 GHz to 12,75 GHz	-47	1000

4.1.2 Test Procedures

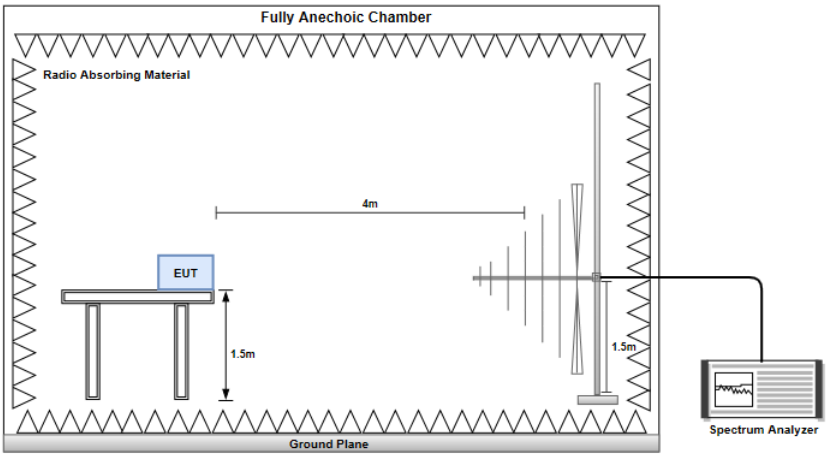
Reference to clause 5.4.10.2 of ETSI EN 300 328 V2.2.2 (2019-07).

4.1.3 Test Setup

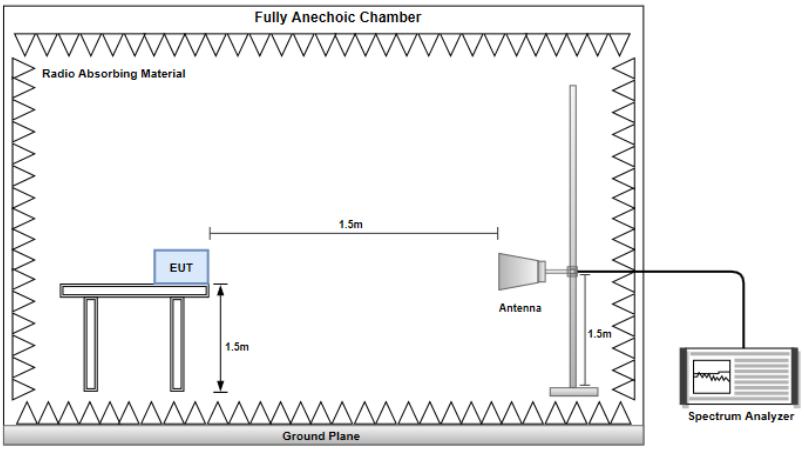
Below 30MHz



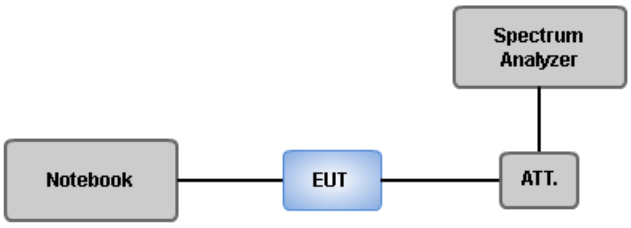
Below 1GHz



Above 1 GHz



Conducted Emission

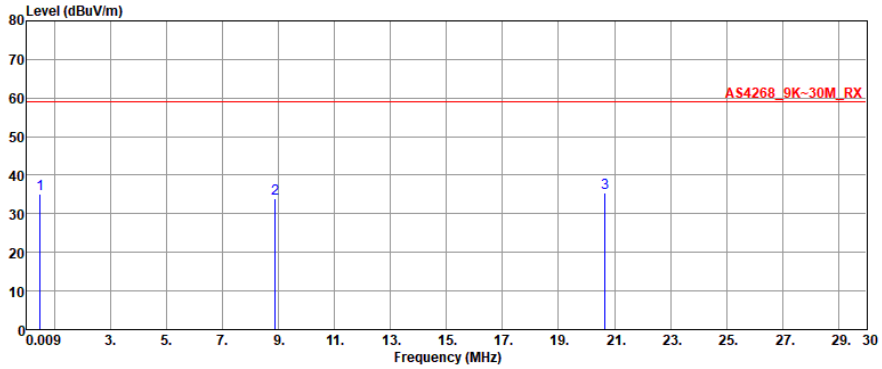


4.1.4 Receiver Radiated Unwanted Emissions (≤ 30MHz)

Configuration 1

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

Test By :Joy Zheng Temperature:24 Humidity(%):65



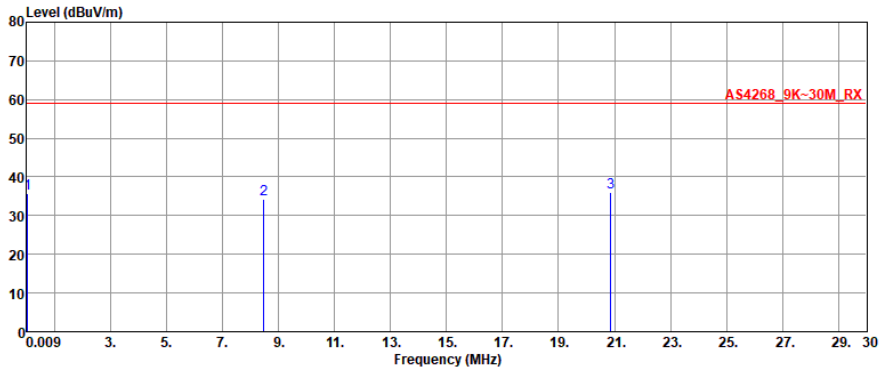
	Freq. MHz	Measured value dBuV/m	Limit dBuV/m	Margin dB	Factor dB	Reading dBuV
1	0.48	35.13	59.00	-23.87	19.34	15.79
2	8.87	34.01	59.00	-24.99	20.77	13.24
3	20.65	35.37	59.00	-23.63	22.05	13.32

Note 1: Measured Value (dBm) = Reading (dBm) + Factor (dB).

Note 2: Margin (dB) = Measured Value (dBm) – Limit (dBm).

Modulation	GFSK	**Test Freq. (MHz)**	2480

Test By :Joy Zheng Temperature:24 Humidity(%):65



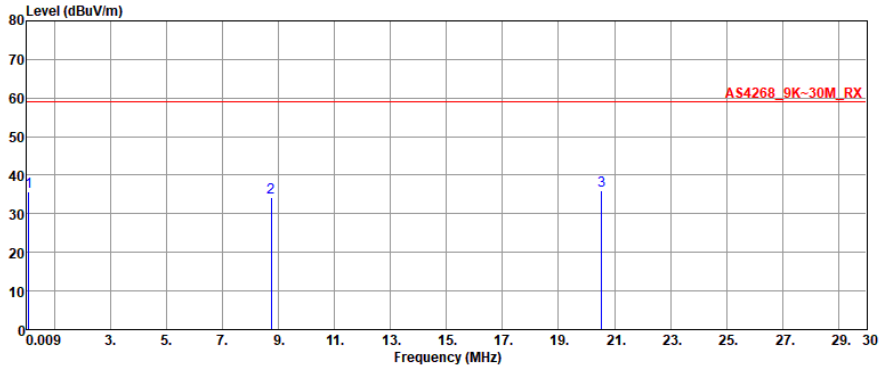
	Freq. MHz	Measured value dBuV/m	Limit dBuV/m	Margin dB	Factor dB	Reading dBuV
1	0.03	35.86	59.00	-23.14	19.68	16.18
2	8.46	34.17	59.00	-24.83	20.68	13.49
3	20.86	35.99	59.00	-23.01	22.06	13.93

Note 1: Measured Value (dBm) = Reading (dBm) + Factor (dB).

Note 2: Margin (dB) = Measured Value (dBm) – Limit (dBm).

Modulation	8DPSK	Test Freq. (MHz)	2402

Test By :Joy Zheng Temperature:24 Humidity(%):65



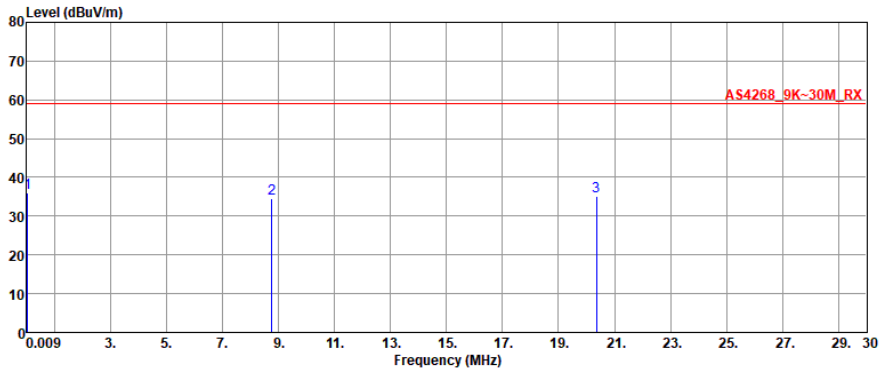
	Freq. MHz	Measured value dBuV/m	Limit dBuV/m	Margin dB	Factor dB	Reading dBuV
1	0.06	35.71	59.00	-23.29	19.43	16.28
2	8.73	34.26	59.00	-24.74	20.74	13.52
3	20.54	35.98	59.00	-23.02	22.05	13.93

Note 1: Measured Value (dBm) = Reading (dBm) + Factor (dB).

Note 2: Margin (dB) = Measured Value (dBm) – Limit (dBm).

Modulation	8DPSK	Test Freq. (MHz)	2480

Test By :Joy Zheng Temperature:24 Humidity(%):65



	Freq. MHz	Measured value dBuV/m	Limit dBuV/m	Margin dB	Factor dB	Reading dBuV
1	0.04	35.89	59.00	-23.11	19.80	16.09
2	8.76	34.42	59.00	-24.58	20.74	13.68
3	20.35	35.22	59.00	-23.78	22.04	13.18

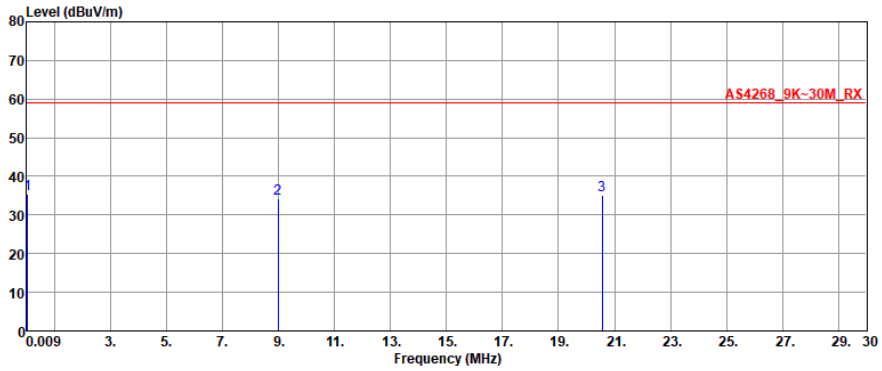
Note 1: Measured Value (dBm) = Reading (dBm) + Factor (dB).

Note 2: Margin (dB) = Measured Value (dBm) – Limit (dBm).

Configuration 2

Modulation	GFSK	Test Freq. (MHz)	2402

Test By :Joy Zheng Temperature:24 Humidity(%):65



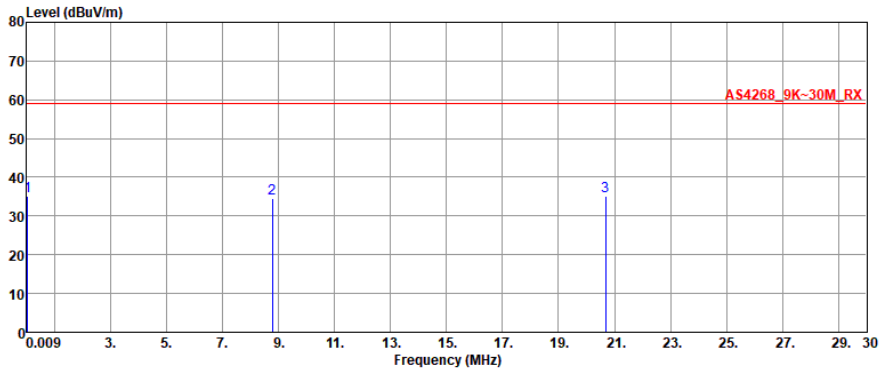
	Freq.	Measured value	Limit	Margin	Factor	Reading
	MHz	dBuV/m	dBuV/m	dB	dB	dBuV
1	0.03	35.51	59.00	-23.49	19.73	15.78
2	8.99	34.11	59.00	-24.89	20.79	13.32
3	20.56	35.23	59.00	-23.77	22.05	13.18

Note 1: Measured Value (dBm) = Reading (dBm) + Factor (dB).

Note 2: Margin (dB) = Measured Value (dBm) – Limit (dBm).

Modulation	GFSK	Test Freq. (MHz)	2480

Test By :Joy Zheng Temperature:24 Humidity(%):65



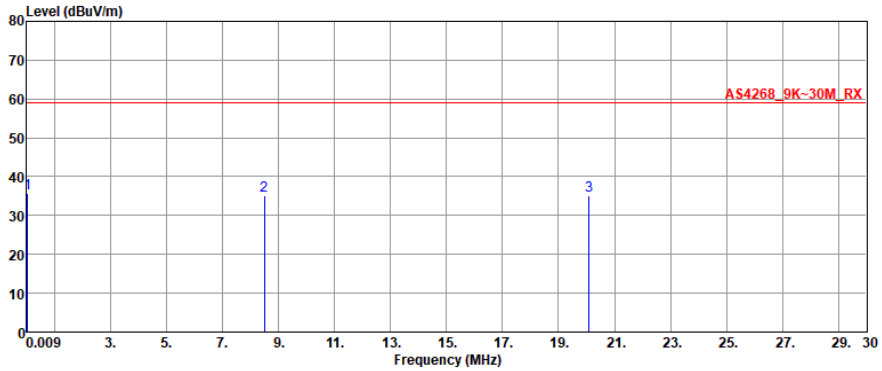
	Freq.	Measured value	Limit	Margin	Factor	Reading
	MHz	dBuV/m	dBuV/m	dB	dB	dBuV
1	0.04	35.23	59.00	-23.77	19.78	15.45
2	8.78	34.56	59.00	-24.44	20.75	13.81
3	20.68	35.09	59.00	-23.91	22.05	13.04

Note 1: Measured Value (dBm) = Reading (dBm) + Factor (dB).

Note 2: Margin (dB) = Measured Value (dBm) – Limit (dBm).

Modulation	8DPSK	Test Freq. (MHz)	2402

Test By :Joy Zheng Temperature:24 Humidity(%):65



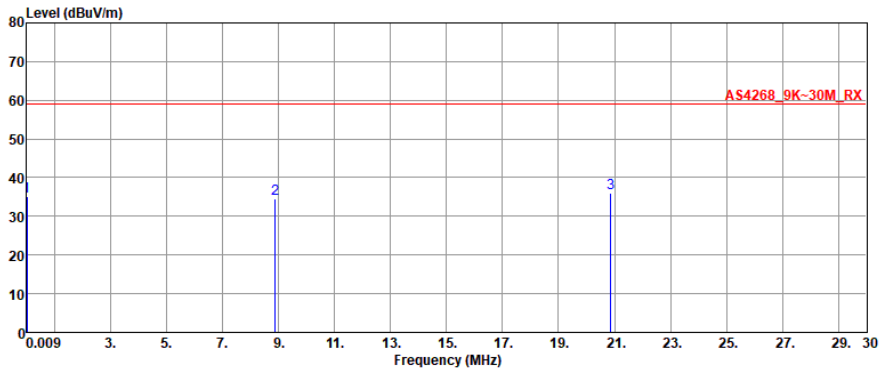
	Freq.	Measured value	Limit	Margin	Factor	Reading
	MHz	dBuV/m	dBuV/m	dB	dB	dBuV
1	0.04	35.72	59.00	-23.28	19.80	15.92
2	8.49	34.99	59.00	-24.01	20.68	14.31
3	20.08	35.19	59.00	-23.81	22.02	13.17

Note 1: Measured Value (dBm) = Reading (dBm) + Factor (dB).

Note 2: Margin (dB) = Measured Value (dBm) – Limit (dBm).

Modulation	8DPSK	Test Freq. (MHz)	2480

Test By :Joy Zheng Temperature:24 Humidity(%):65



	Freq.	Measured value	Limit	Margin	Factor	Reading
	MHz	dBuV/m	dBuV/m	dB	dB	dBuV
1	0.02	35.05	59.00	-23.95	19.00	16.05
2	8.88	34.56	59.00	-24.44	20.77	13.79
3	20.86	35.96	59.00	-23.04	22.06	13.90

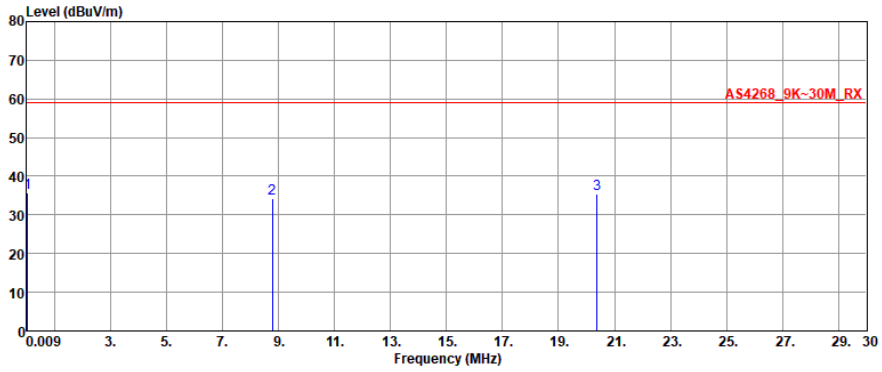
Note 1: Measured Value (dBm) = Reading (dBm) + Factor (dB).

Note 2: Margin (dB) = Measured Value (dBm) – Limit (dBm).

Configuration 3

Modulation	GFSK	Test Freq. (MHz)	2402

Test By :Joy Zheng Temperature:24 Humidity(%):65



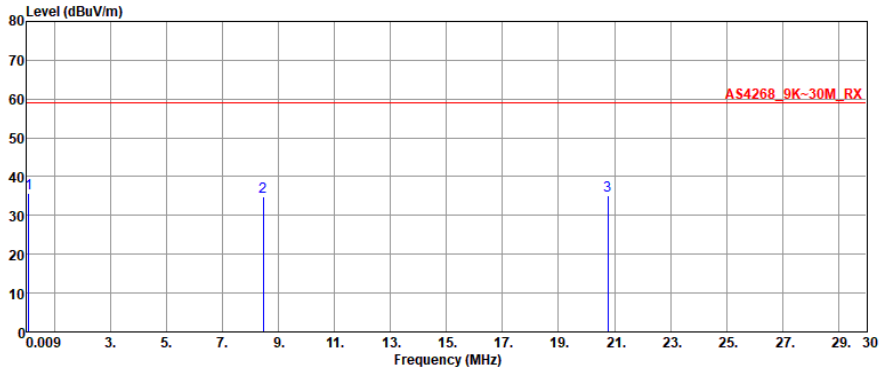
	Freq. MHz	Measured value dBuV/m	Limit dBuV/m	Margin dB	Factor dB	Reading dBuV
1	0.04	35.63	59.00	-23.37	19.79	15.84
2	8.78	34.24	59.00	-24.76	20.75	13.49
3	20.37	35.56	59.00	-23.44	22.04	13.52

Note 1: Measured Value (dBm) = Reading (dBm) + Factor (dB).

Note 2: Margin (dB) = Measured Value (dBm) – Limit (dBm).

Modulation	GFSK	Test Freq. (MHz)	2480

Test By :Joy Zheng Temperature:24 Humidity(%):65



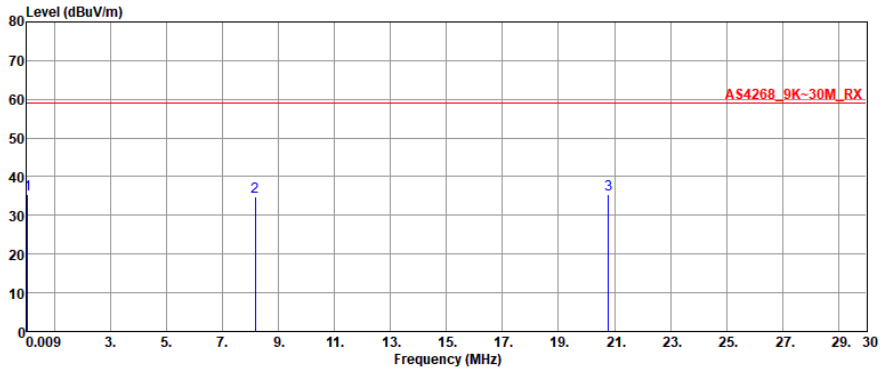
	Freq. MHz	Measured value dBuV/m	Limit dBuV/m	Margin dB	Factor dB	Reading dBuV
1	0.07	35.73	59.00	-23.27	19.32	16.41
2	8.46	34.82	59.00	-24.18	20.68	14.14
3	20.76	35.14	59.00	-23.86	22.06	13.08

Note 1: Measured Value (dBm) = Reading (dBm) + Factor (dB).

Note 2: Margin (dB) = Measured Value (dBm) – Limit (dBm).

Modulation	8DPSK	Test Freq. (MHz)	2402

Test By :Joy Zheng Temperature:24 Humidity(%):65



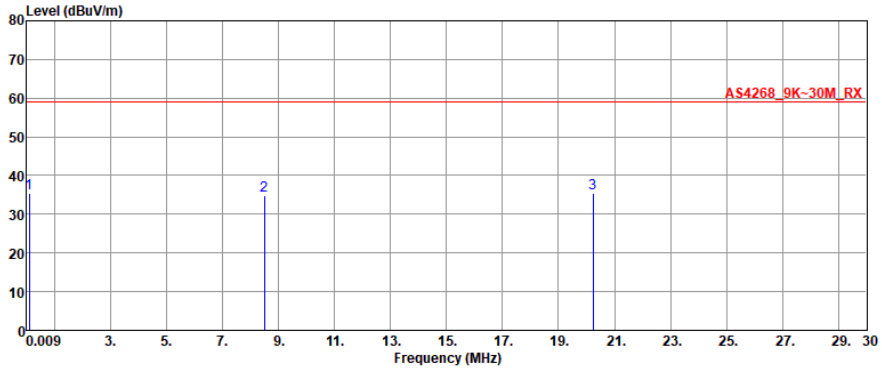
	Freq.	Measured value	Limit	Margin	Factor	Reading
	MHz	dBuV/m	dBuV/m	dB	dB	dBuV
1	0.03	35.57	59.00	-23.43	19.82	15.75
2	8.16	34.82	59.00	-24.18	20.60	14.22
3	20.78	35.30	59.00	-23.70	22.06	13.24

Note 1: Measured Value (dBm) = Reading (dBm) + Factor (dB).

Note 2: Margin (dB) = Measured Value (dBm) – Limit (dBm).

Modulation	8DPSK	Test Freq. (MHz)	2480

Test By :Joy Zheng Temperature:24 Humidity(%):65



	Freq.	Measured value	Limit	Margin	Factor	Reading
	MHz	dBuV/m	dBuV/m	dB	dB	dBuV
1	0.09	35.33	59.00	-23.67	18.97	16.36
2	8.50	34.89	59.00	-24.11	20.68	14.21
3	20.24	35.44	59.00	-23.56	22.03	13.41

Note 1: Measured Value (dBm) = Reading (dBm) + Factor (dB).

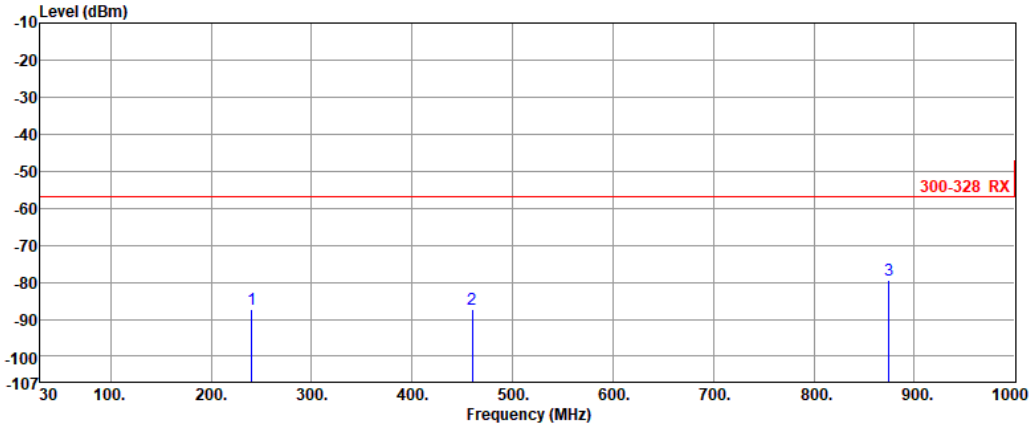
Note 2: Margin (dB) = Measured Value (dBm) – Limit (dBm).

Configuration 1

4.1.5 Receiver Conducted Unwanted Emissions (Below 1GHz)

Modulation	GFSK	Test Freq. (MHz)	2402

Test By :Alan Tang Temperature:24 Humidity(%):65

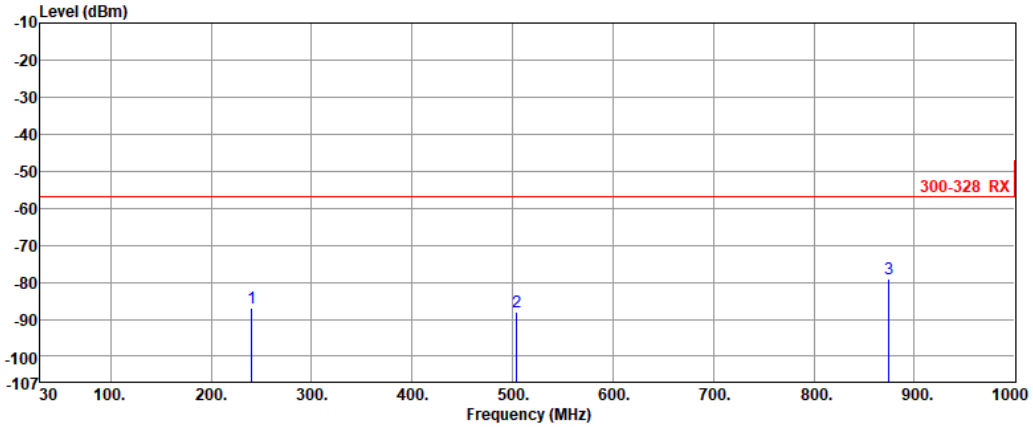


	Freq.	Measured value	Limit	Margin	Factor	Reading
	MHz	dBm	dBm	dB	dB	dBm
1	240.49	-87.43	-57.00	-30.43	0.00	-87.43
2	459.71	-87.22	-57.00	-30.22	0.00	-87.22
3	874.87	-79.31	-57.00	-22.31	0.00	-79.31

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

Modulation	GFSK	Test Freq. (MHz)	2480

Test By :Alan Tang Temperature:24 Humidity(%):65

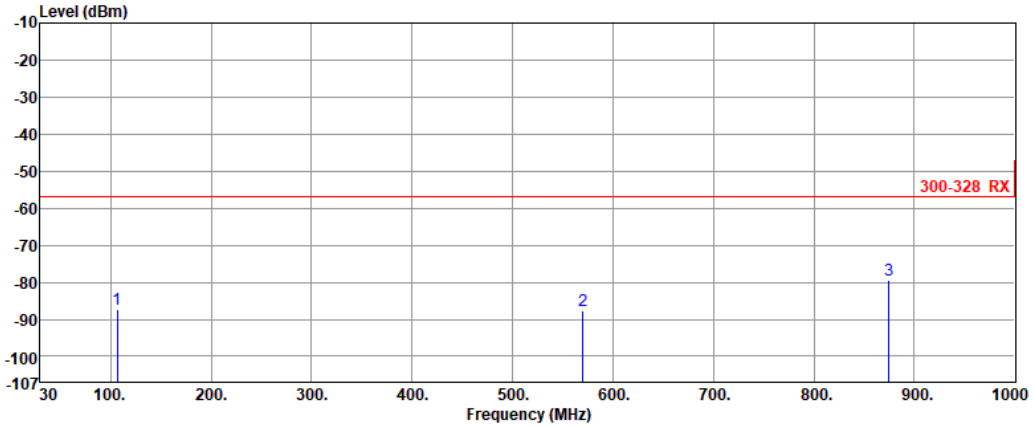


	Freq.	Measured value	Limit	Margin	Factor	Reading
	MHz	dBm	dBm	dB	dB	dBm
1	240.49	-86.91	-57.00	-29.91	0.00	-86.91
2	504.33	-87.89	-57.00	-30.89	0.00	-87.89
3	874.87	-79.02	-57.00	-22.02	0.00	-79.02

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

Modulation	8DPSK	Test Freq. (MHz)	2402

Test By :Alan Tang Temperature:24 Humidity(%):65

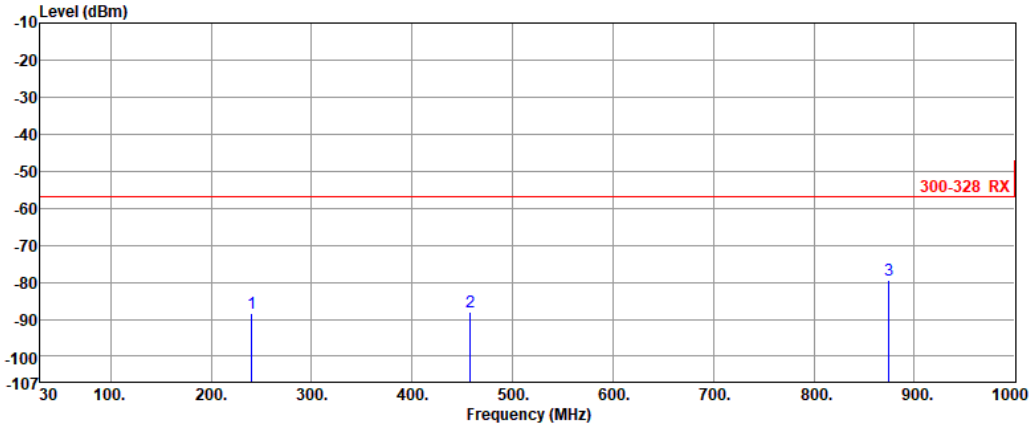


	Freq.	Measured value	Limit	Margin	Factor	Reading
	MHz	dBm	dBm	dB	dB	dBm
1	106.63	-87.39	-57.00	-30.39	0.00	-87.39
2	570.29	-87.83	-57.00	-30.83	0.00	-87.83
3	874.87	-79.37	-57.00	-22.37	0.00	-79.37

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

Modulation	8DPSK	Test Freq. (MHz)	2480

Test By :Alan Tang Temperature:24 Humidity(%):65



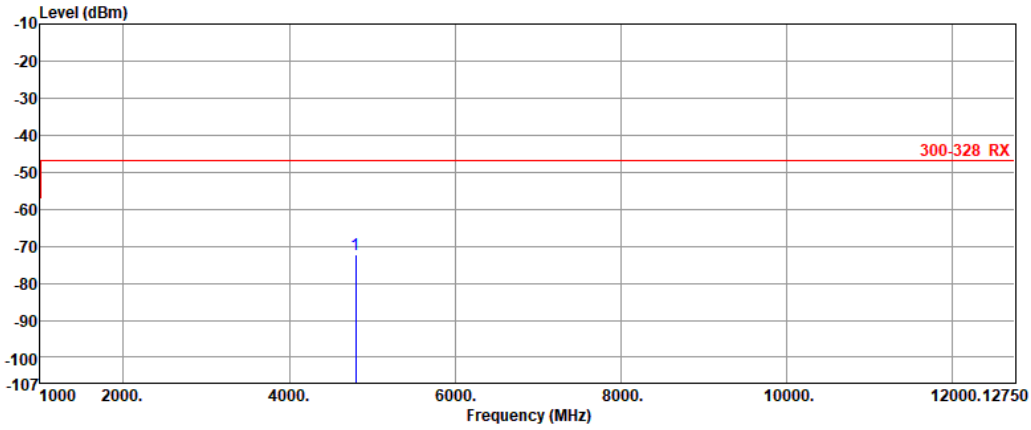
	Freq.	Measured value	Limit	Margin	Factor	Reading
	MHz	dBm	dBm	dB	dB	dBm
1	240.49	-88.49	-57.00	-31.49	0.00	-88.49
2	457.77	-88.11	-57.00	-31.11	0.00	-88.11
3	874.87	-79.44	-57.00	-22.44	0.00	-79.44

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

4.1.6 Receiver Conducted Unwanted Emissions (Above 1GHz)

Modulation	GFSK	Test Freq. (MHz)	2402

Test By :Alan Tang Temperature:24 Humidity(%):65

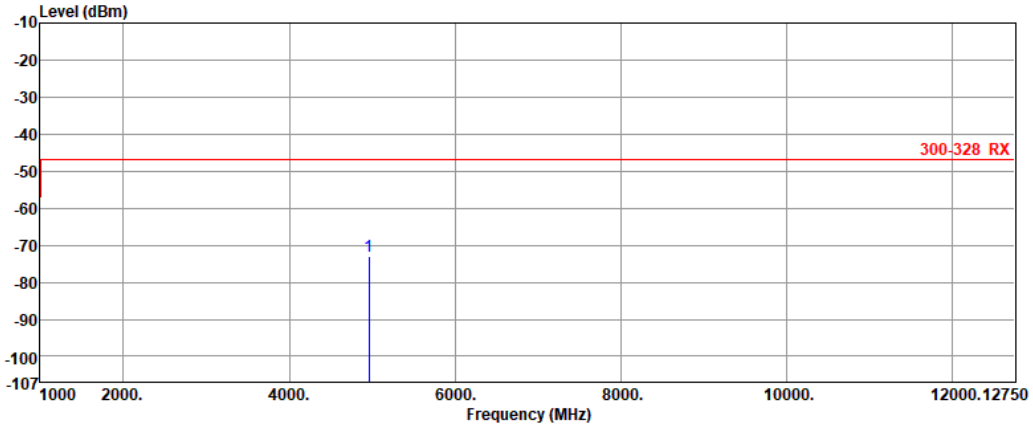


	Freq.	Measured value	Limit	Margin	Factor	Reading
	MHz	dBm	dBm	dB	dB	dBm
1	4803.70	-72.14	-47.00	-25.14	0.00	-72.14

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

Modulation	GFSK	Test Freq. (MHz)	2480

Test By :Alan Tang Temperature:24 Humidity(%):65

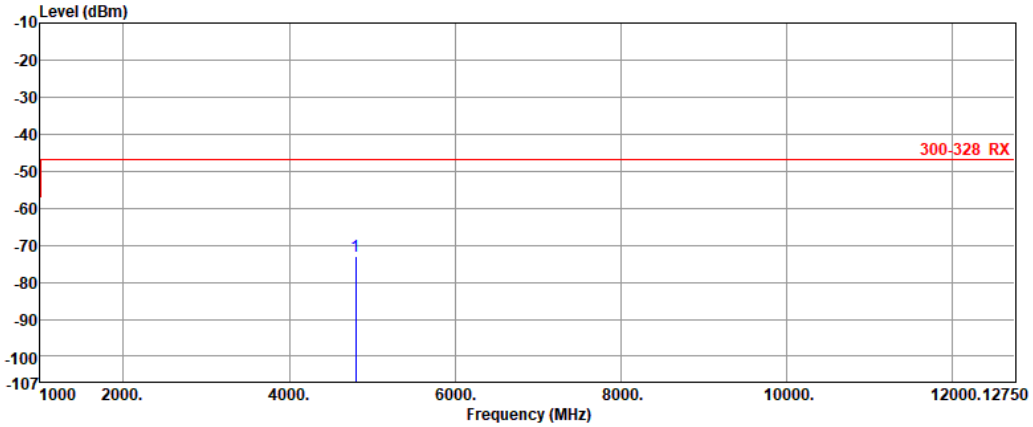


	Freq.	Measured value	Limit	Margin	Factor	Reading
	MHz	dBm	dBm	dB	dB	dBm
1	4960.44	-73.03	-47.00	-26.03	0.00	-73.03

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

Modulation	8DPSK	Test Freq. (MHz)	2402

Test By :Alan Tang Temperature:24 Humidity(%):65

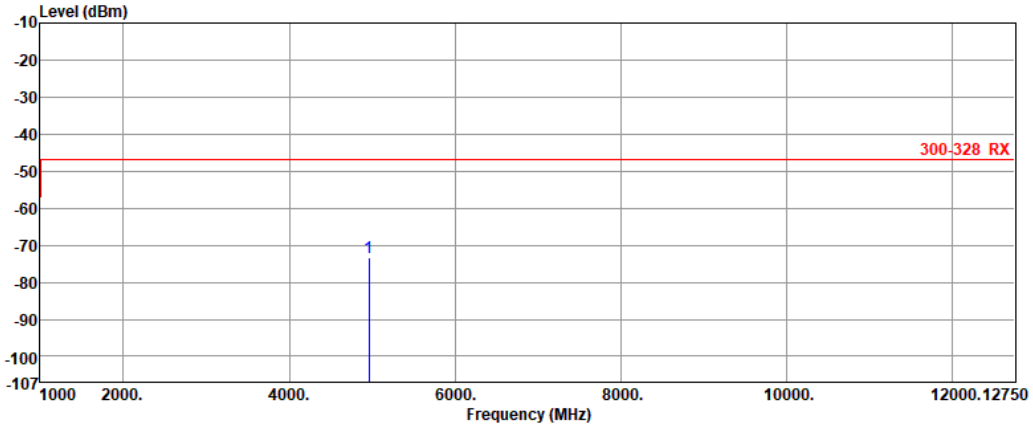


	Freq.	Measured value	Limit	Margin	Factor	Reading
	MHz	dBm	dBm	dB	dB	dBm
1	4804.49	-73.12	-47.00	-26.12	0.00	-73.12

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

Modulation	8DPSK	Test Freq. (MHz)	2480

Test By :Alan Tang Temperature:24 Humidity(%):65



	Freq.	Measured value	Limit	Margin	Factor	Reading
	MHz	dBm	dBm	dB	dB	dBm
1	4959.71	-73.37	-47.00	-26.37	0.00	-73.37

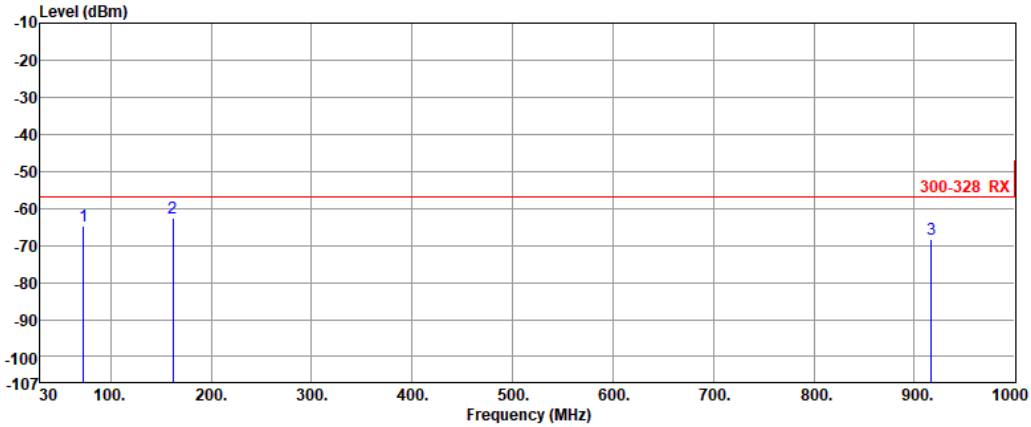
Note 1: Measured Value (dBm) = Reading (dBm) + Factor (dB)
Note 2: Margin (dB) = Measured Value (dBm) – Limit (dBm)

Configuration 1

4.1.7 Receiver Radiated Unwanted Emissions (Below 1GHz)

Modulation	GFSK	Test Freq. (MHz)	2402
Polarization	Horizontal		

Test By :Alan Tang Temperature:24 Humidity(%):65

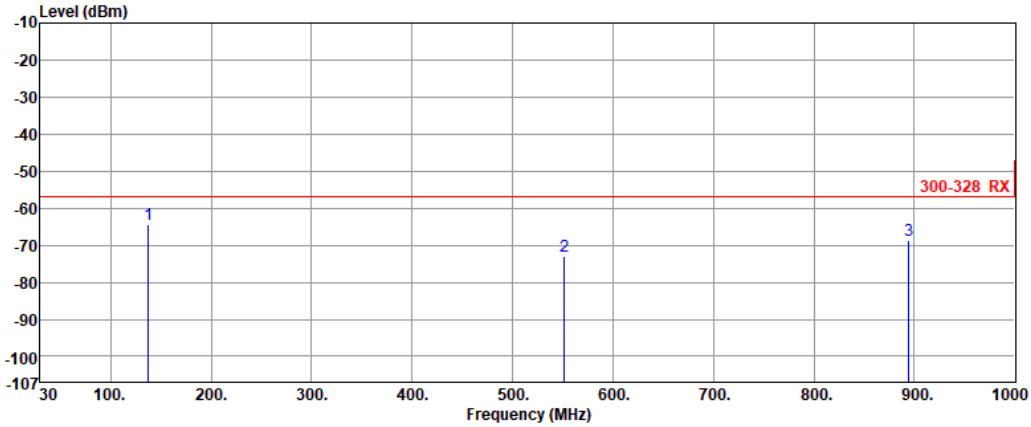


	Freq.	Measured value	Limit	Margin	Factor	Reading
	MHz	dBm	dBm	dB	dB	dBm
1	72.68	-64.93	-57.00	-7.93	-5.45	-59.48
2	161.92	-62.69	-57.00	-5.69	-0.78	-61.91
3	916.58	-68.19	-57.00	-11.19	9.51	-77.70

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		

Test By :Alan Tang Temperature:24 Humidity(%):65

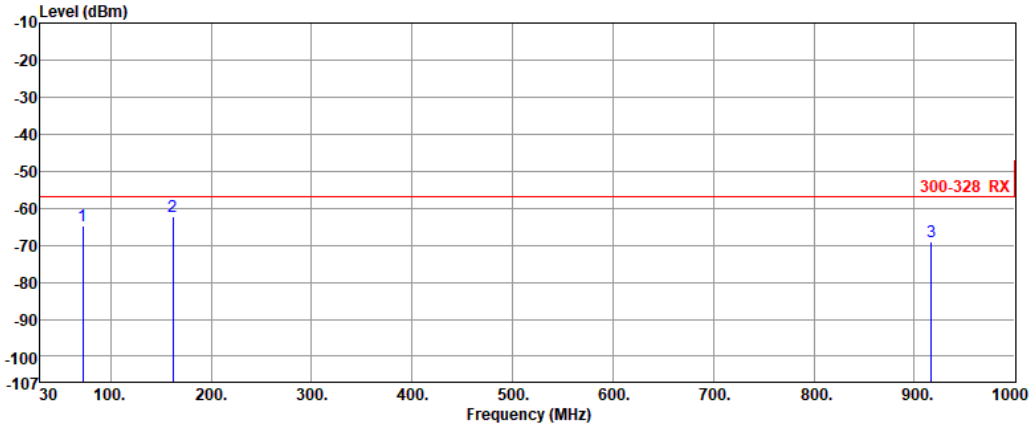


	Freq.	Measured value	Limit	Margin	Factor	Reading
	MHz	dBm	dBm	dB	dB	dBm
1	137.67	-64.42	-57.00	-7.42	-1.27	-63.15
2	551.86	-72.98	-57.00	-15.98	3.10	-76.08
3	894.27	-68.54	-57.00	-11.54	8.76	-77.30

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		

Test By :Alan Tang Temperature:24 Humidity(%):65

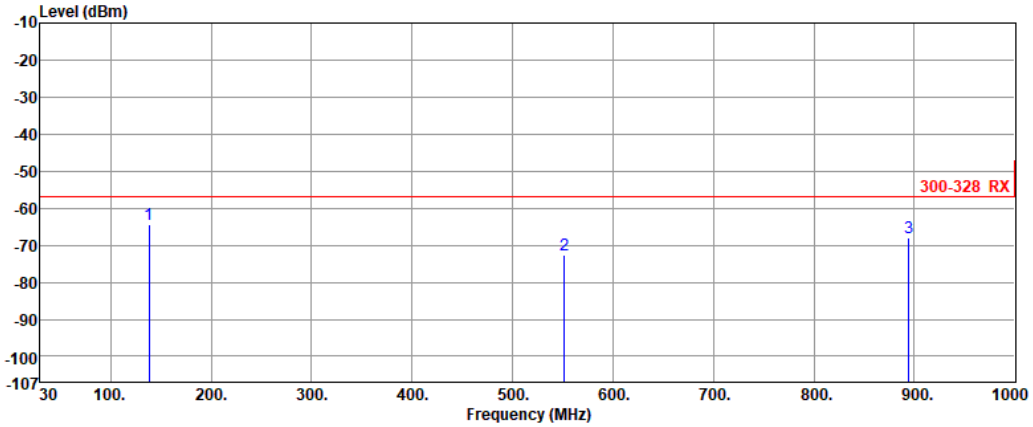


	Freq.	Measured value	Limit	Margin	Factor	Reading
	MHz	dBm	dBm	dB	dB	dBm
1	72.45	-64.67	-57.00	-7.67	-5.38	-59.29
2	161.89	-62.13	-57.00	-5.13	-0.78	-61.35
3	916.71	-68.91	-57.00	-11.91	9.51	-78.42

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		

Test By :Alan Tang Temperature:24 Humidity(%):65

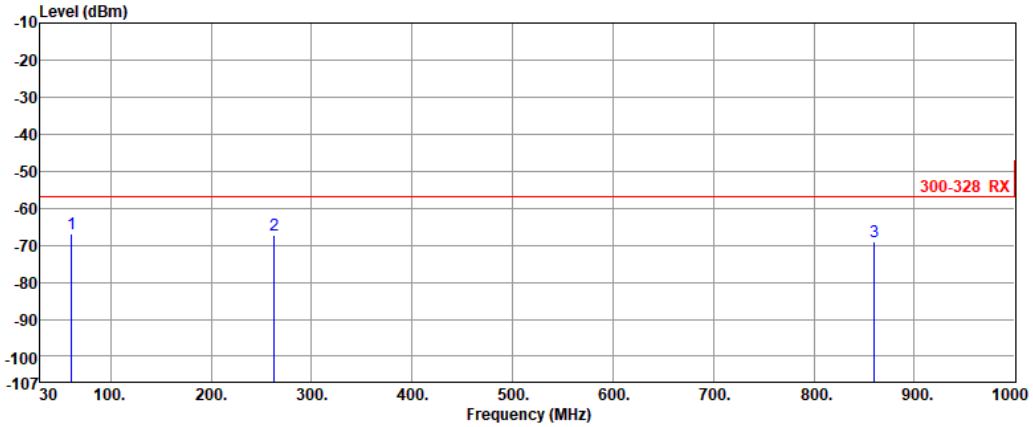


	Freq.	Measured value	Limit	Margin	Factor	Reading
	MHz	dBm	dBm	dB	dB	dBm
1	137.88	-64.23	-57.00	-7.23	-1.24	-62.99
2	551.47	-72.56	-57.00	-15.56	3.07	-75.63
3	894.70	-68.04	-57.00	-11.04	8.76	-76.80

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		

Test By :Alan Tang Temperature:24 Humidity(%):65

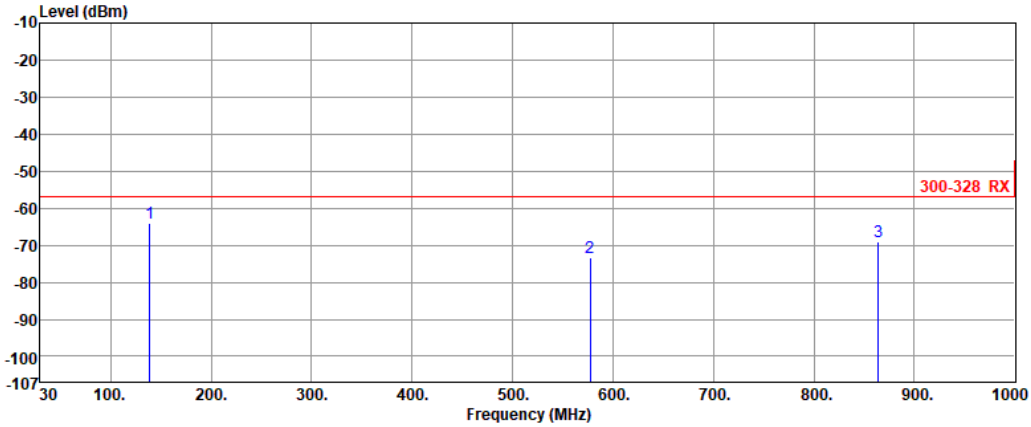


	Freq.	Measured value	Limit	Margin	Factor	Reading
	MHz	dBm	dBm	dB	dB	dBm
1	61.04	-66.93	-57.00	-9.93	-2.47	-64.46
2	262.80	-67.25	-57.00	-10.25	-3.04	-64.21
3	860.32	-68.91	-57.00	-11.91	8.25	-77.16

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		

Test By :Alan Tang Temperature:24 Humidity(%):65

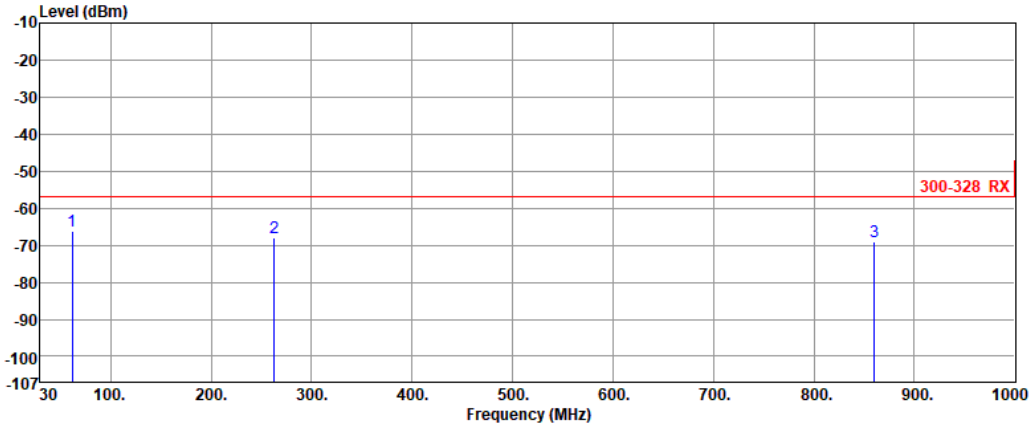


	Freq.	Measured value	Limit	Margin	Factor	Reading
	MHz	dBm	dBm	dB	dB	dBm
1	138.64	-64.22	-57.00	-7.22	-1.15	-63.07
2	577.08	-73.37	-57.00	-16.37	3.82	-77.19
3	864.20	-69.06	-57.00	-12.06	8.28	-77.34

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		

Test By :Alan Tang Temperature:24 Humidity(%):65

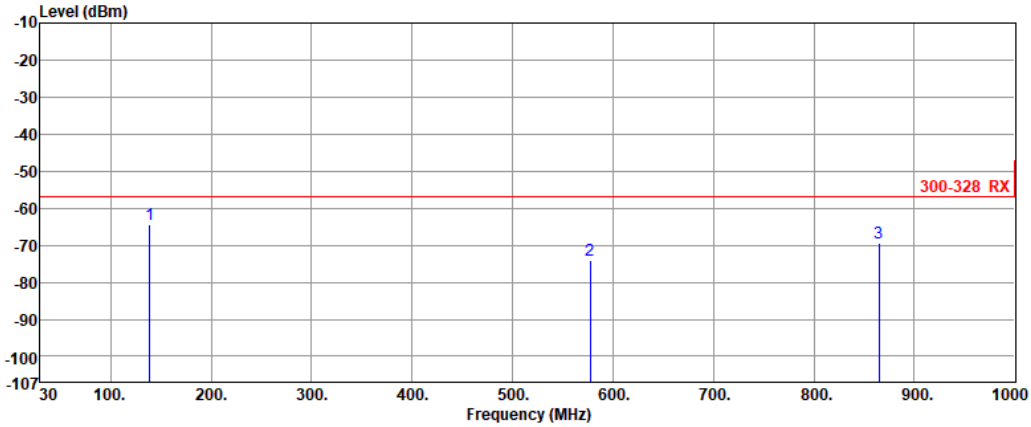


	Freq.	Measured value	Limit	Margin	Factor	Reading
	MHz	dBm	dBm	dB	dB	dBm
1	61.36	-66.11	-57.00	-9.11	-2.54	-63.57
2	262.48	-67.92	-57.00	-10.92	-3.06	-64.86
3	860.21	-68.97	-57.00	-11.97	8.25	-77.22

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		

Test By :Alan Tang Temperature:24 Humidity(%):65



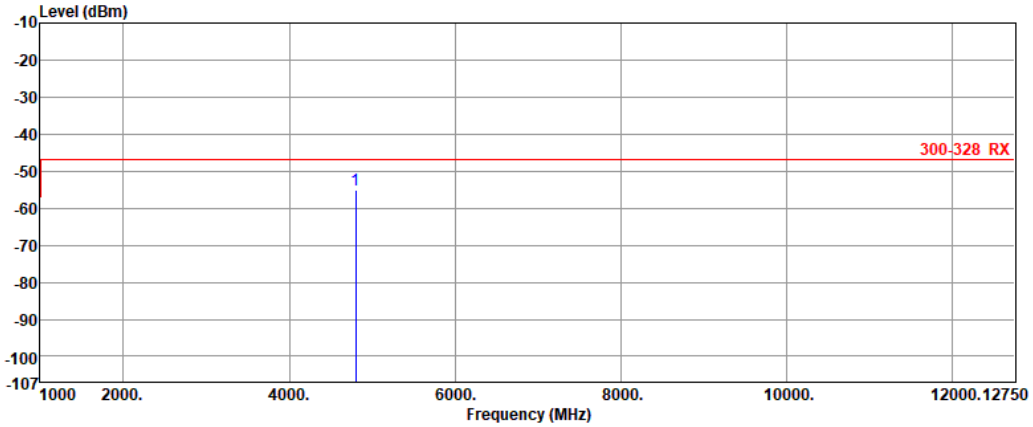
	Freq.	Measured value	Limit	Margin	Factor	Reading
	MHz	dBm	dBm	dB	dB	dBm
1	138.98	-64.54	-57.00	-7.54	-1.10	-63.44
2	577.23	-73.91	-57.00	-16.91	3.83	-77.74
3	864.60	-69.39	-57.00	-12.39	8.28	-77.67

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

4.1.8 Receiver Radiated Unwanted Emissions (Above 1GHz)

Modulation	GFSK	Test Freq. (MHz)	2402
Polarization	Horizontal		

Test By :Alan Tang Temperature:24 Humidity(%):65

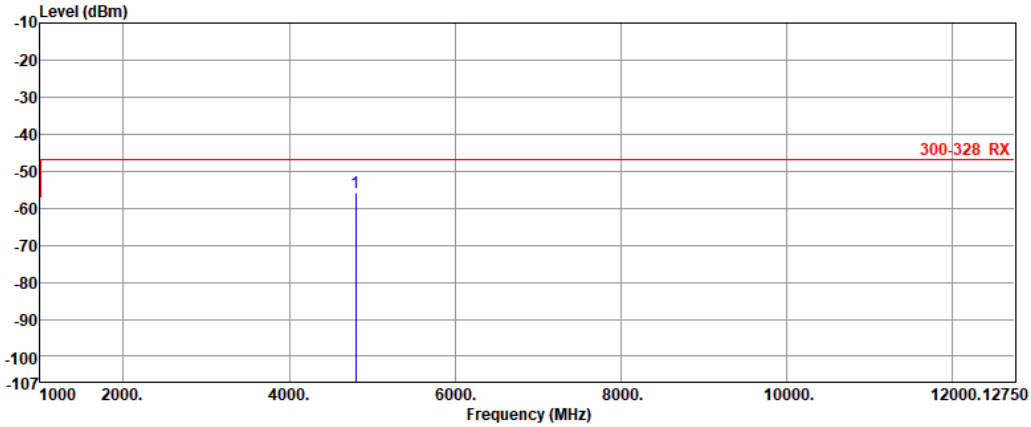


	Freq.	Measured value	Limit	Margin	Factor	Reading
	MHz	dBm	dBm	dB	dB	dBm
1	4803.57	-55.24	-47.00	-8.24	7.54	-62.78

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		

Test By :Alan Tang Temperature:24 Humidity(%):65

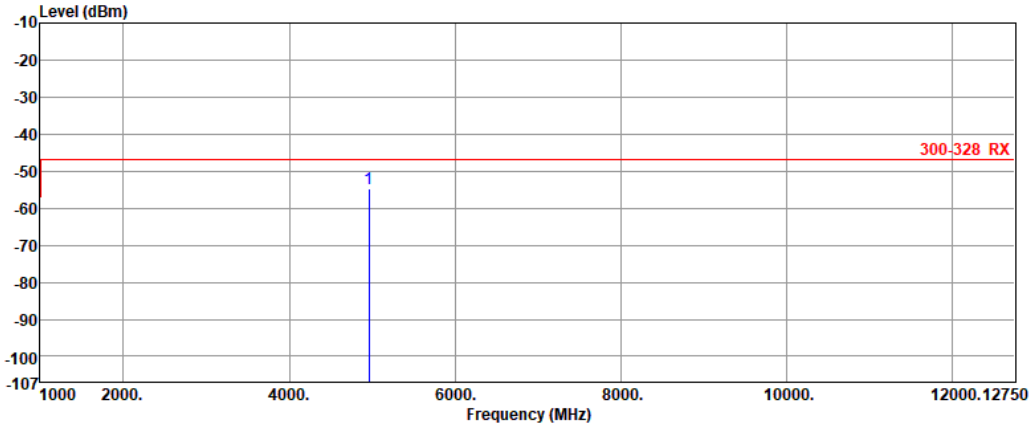


	Freq.	Measured value	Limit	Margin	Factor	Reading
	MHz	dBm	dBm	dB	dB	dBm
1	4802.17	-55.91	-47.00	-8.91	7.43	-63.34

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		

Test By :Alan Tang Temperature:24 Humidity(%):65

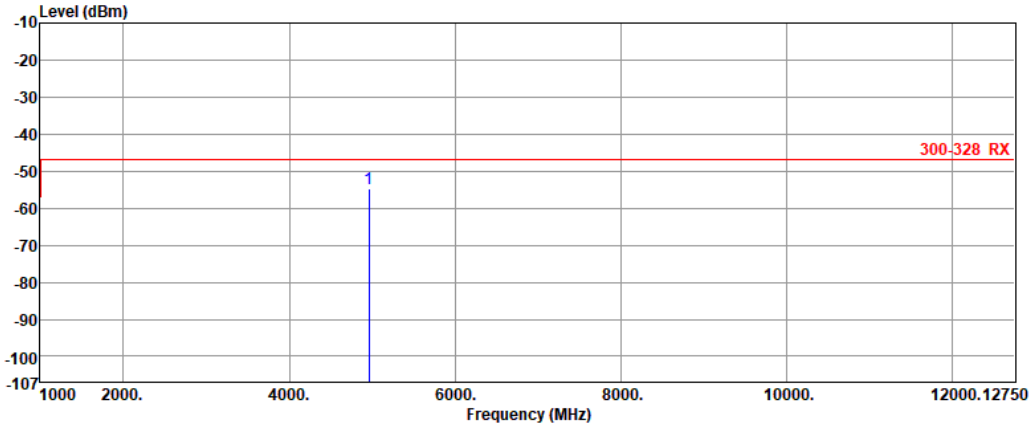


	Freq.	Measured value	Limit	Margin	Factor	Reading
	MHz	dBm	dBm	dB	dB	dBm
1	4959.99	-54.63	-47.00	-7.63	9.09	-63.72

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		

Test By :Alan Tang Temperature:24 Humidity(%):65

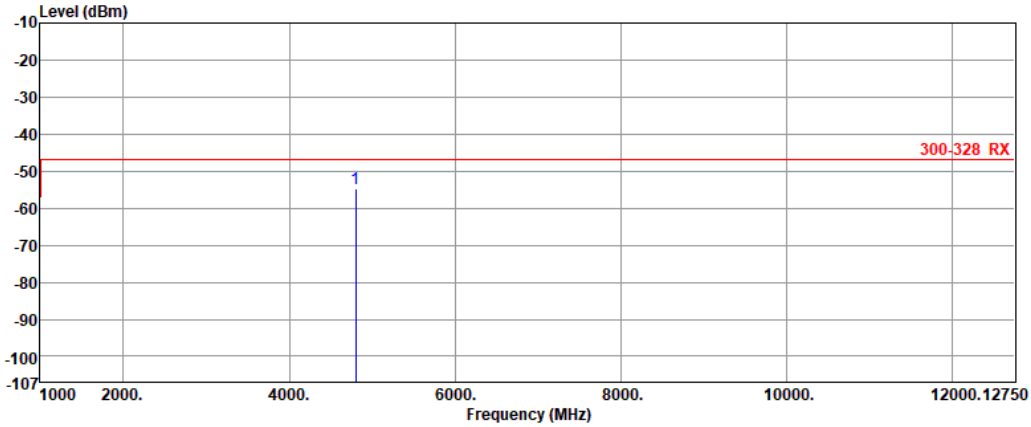


	Freq.	Measured value	Limit	Margin	Factor	Reading
	MHz	dBm	dBm	dB	dB	dBm
1	4960.42	-54.67	-47.00	-7.67	9.11	-63.78

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		

Test By :Alan Tang Temperature:24 Humidity(%):65

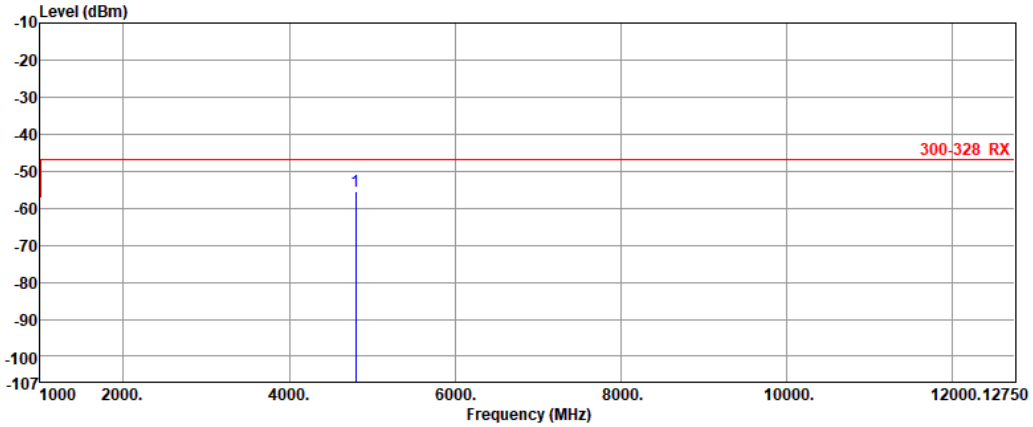


	Freq.	Measured value	Limit	Margin	Factor	Reading
	MHz	dBm	dBm	dB	dB	dBm
1	4803.91	-54.85	-47.00	-7.85	7.55	-62.40

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		

Test By :Alan Tang Temperature:24 Humidity(%):65

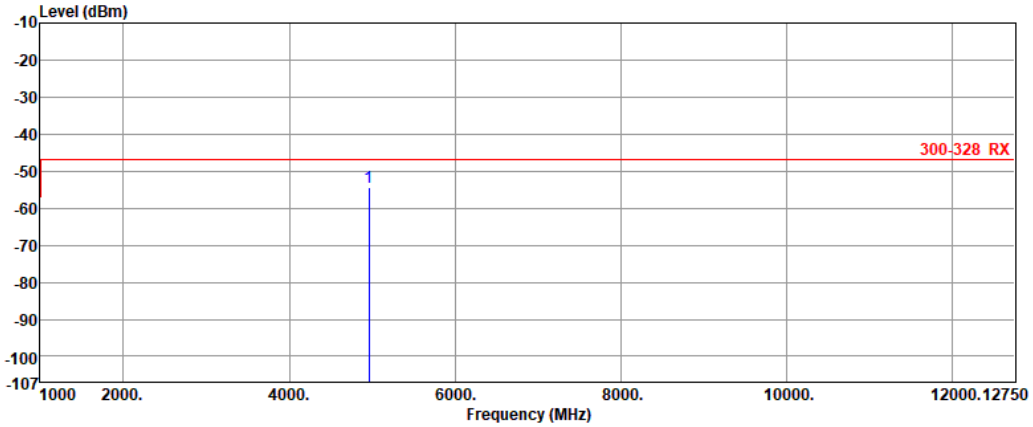


	Freq.	Measured value	Limit	Margin	Factor	Reading
	MHz	dBm	dBm	dB	dB	dBm
1	4804.08	-55.50	-47.00	-8.50	7.46	-62.96

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		

Test By :Alan Tang Temperature:24 Humidity(%):65

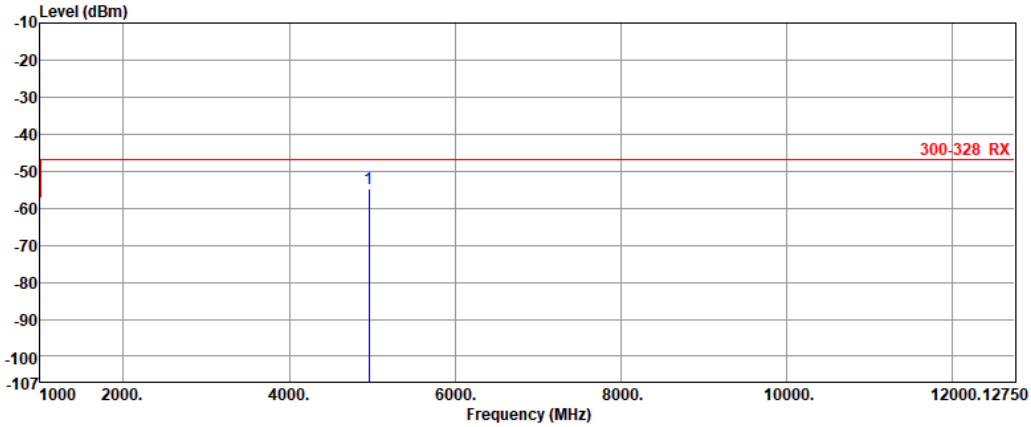


	Freq.	Measured value	Limit	Margin	Factor	Reading
	MHz	dBm	dBm	dB	dB	dBm
1	4959.82	-54.56	-47.00	-7.56	9.09	-63.65

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		

Test By :Alan Tang Temperature:24 Humidity(%):65



	Freq.	Measured value	Limit	Margin	Factor	Reading
	MHz	dBm	dBm	dB	dB	dBm
1	4959.72	-54.88	-47.00	-7.88	9.10	-63.98

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

5 Adaptivity Test Results

5.1 Adaptivity and Unwanted Signal Parameters

5.1.1 Limit of Adaptivity and Unwanted Signal Parameters

Adaptivity and Unwanted Signal Limit	
☒	Only for adaptive systems and RF Output Power > 10 dBm
☐	Non-LBT based Detect and Avoid: ◆ minimum remain unavailable = 1sec; ◆ minimum Idle Period time = 100us; ◆ maximum Channel Occupancy Time (COT) = 40ms ◆ detection threshold level = -70 dBm/MHz + 10 x $\log_{10}$(100mW / Pout) (Pout in mW e.i.r.p);
☐	LBT based Detect and Avoid (Frame Based Equipment): ◆ minimum Clear Channel Assessment (CCA) time = 18 us; ◆ COT = 1 ms to 10 ms ◆ Idle Period = 5% of COT ◆ detection threshold level = -70 dBm/MHz + 10 x $\log_{10}$(100mW / Pout) (Pout in mW e.i.r.p);
☒	LBT based Detect and Avoid (Load Based Equipment with spectrum sharing mechanism IEEE Std.): ◆ LBT based spectrum sharing mechanism may implement IEEE 802.11™-2012 [i.3] clause 9, clause 10, clause 16,clause 17, clause 19 and clause 20, or in IEEE 802.15.4™-2011 [i.4], clause 4, clause 5 and clause 8 ◆ detection threshold level = -70 dBm/MHz + 10 x $\log_{10}$(100mW / Pout) (Pout in mW e.i.r.p);
☒	Short Control Signalling Transmissions: ◆ Short Control Signalling Transmissions shall have a maximum duty cycle of 10 % within an observation period of 50 ms.

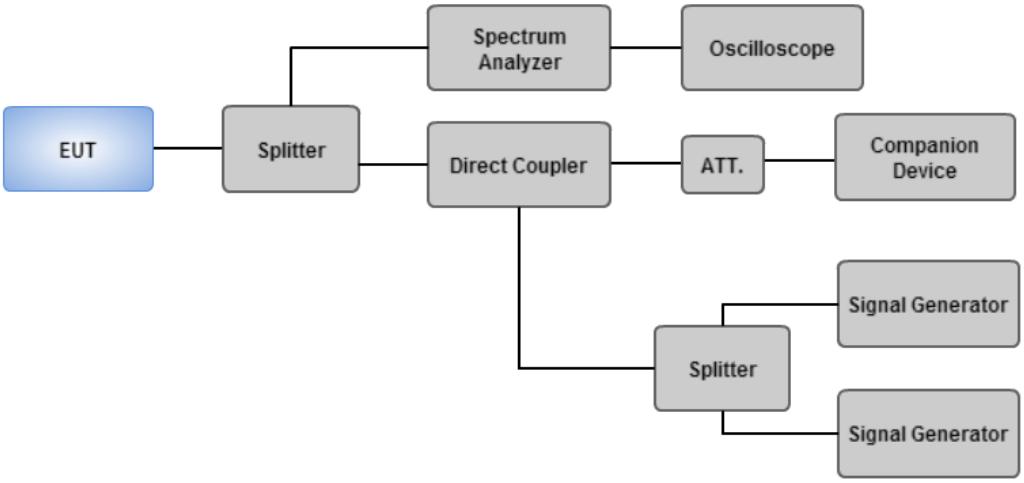
Unwanted Signal Parameters			
Equipment Type	**Wanted Signal Mean Power from Companion Device**	**Unwanted signal frequency (MHz)**	**Unwanted CW signal power (dBm)**
non-FHSS using LBT	sufficient to maintain the link (see note 3)	2395 or 2488,5 (see note 1)	-35 (see note 2)
non-FHSS using DAA	-30 dBm(see note 2)		

Note 1: The highest frequency shall be used for testing operating channels within the range 2 400 MHz to 2 442MHz, while the lowest frequency shall be used fortesting operating channels within the range 2 442 MHz to 2 483,5 MHz.
Note 2: 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 in front of the UUT antenna
Note 3: A typical conducted value which can be used in most cases is -50 dBm/MHz

5.1.2 Test Procedures

Reference to clause 5.4.6.2 of ETSI EN 300 328 V2.2.2 (2019-07).

5.1.3 Test Setup



5.1.4 Test Result of Adaptivity、Unwanted Signal and Short Control Signalling Transmissions

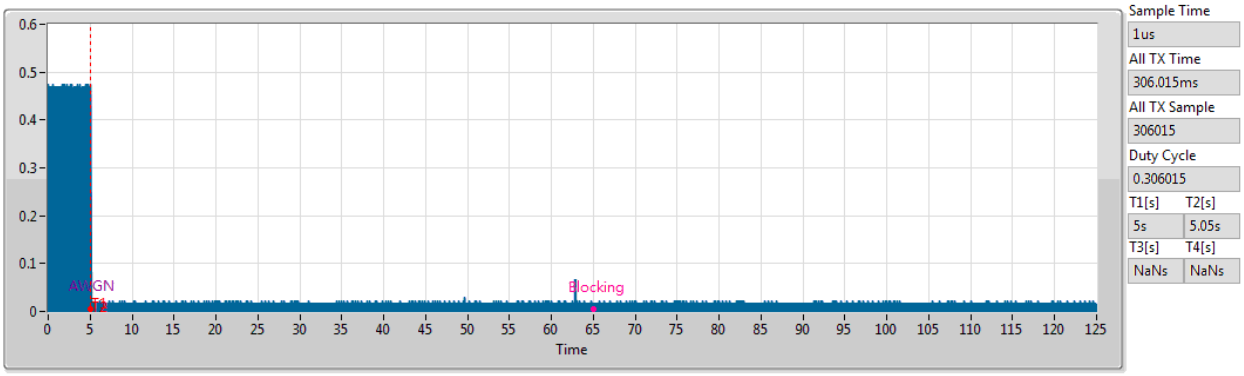
Ambient Condition	23°C / 67%	**Tested By**	Jack Li

Adaptivity and Unwanted Signal Result						
Adaptivity Detection Threshold Level (dBm)			-58.87			
Unwanted Signal Level (dBm)			-32.2			
Modulation Mode	**Freq. (MHz)**	**Short Control Signalling Transmissions (ms)**	**Channel Occupancy Time (ms)**	**Idle Period Time (μs)**	**Adaptivity**	**Unwanted Signal Test Status**
GFSK	2402	1.91	0.384	867	Pass	Pass
GFSK	2480	1.146	0.387	863		
8-DPSK	2402	1.961	0.388	844		
8-DPSK	2480	1.94	0.388	845		
Limit		< 5 ms	< 40 ms	>100μs		
Result		**Complied**				

5.1.5 Test Result of Adaptivity and Unwanted Signal Plots

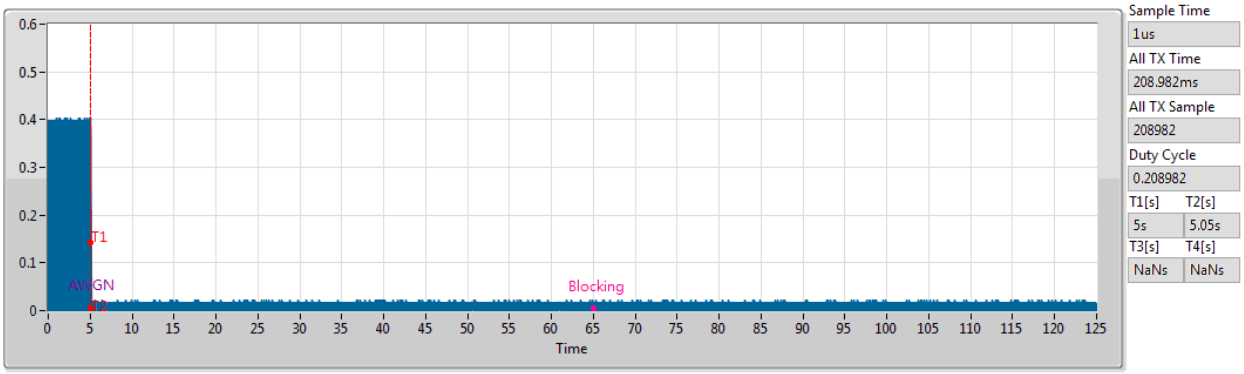
Adaptivity & Unwanted Signal Result Plots
Unwanted signal: 2488.5 MHz
GFSK - 2402MHz

Time Analysis



Unwanted signal: 2395 MHz
GFSK- 2480MHz

Time Analysis

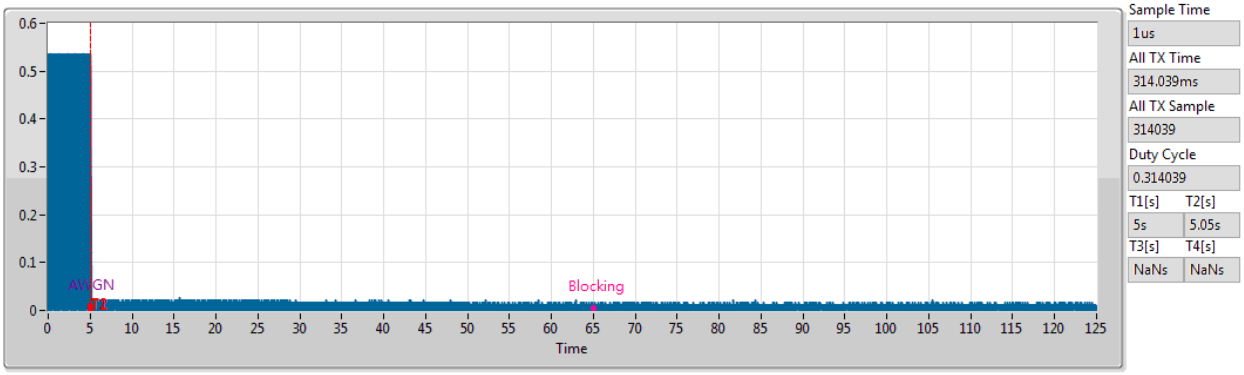


Adaptivity & Unwanted Signal Result Plots

Unwanted signal: 2488.5 MHz

8-DPSK- 2402MHz

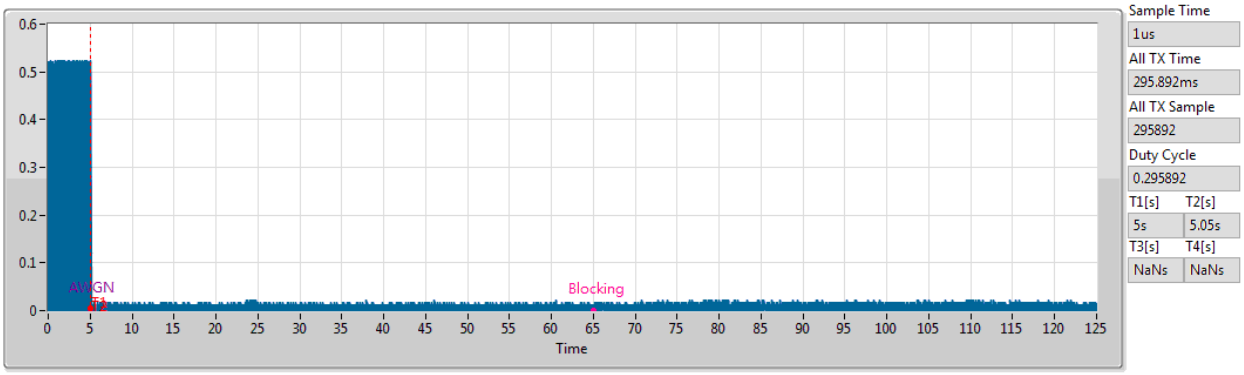
Time Analysis



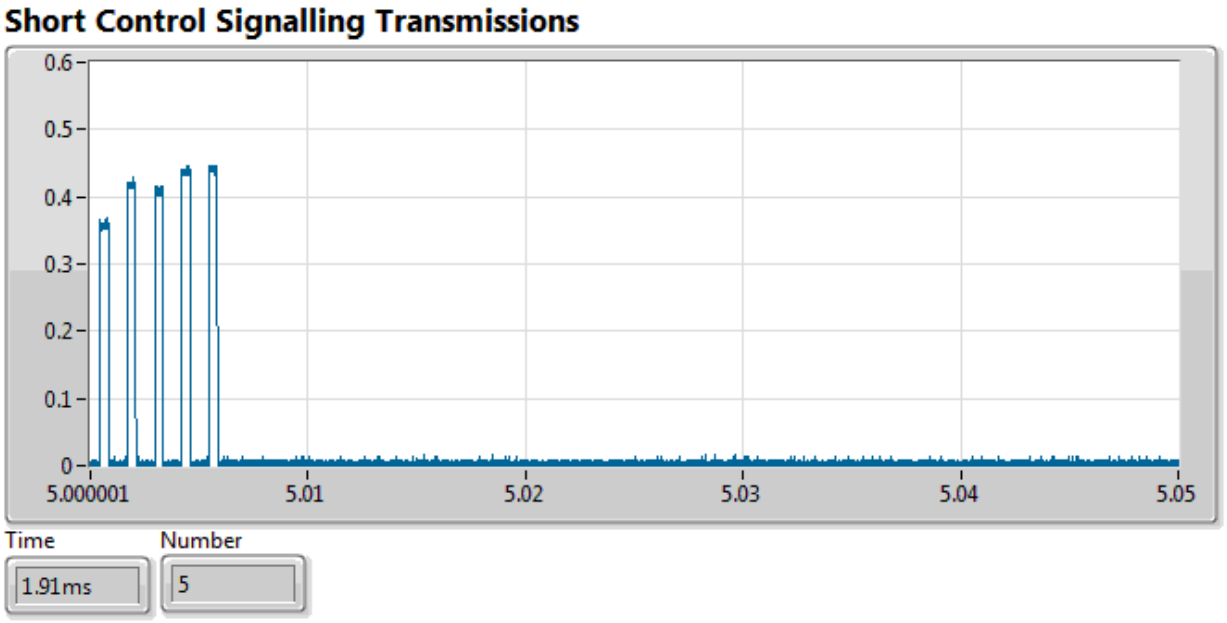
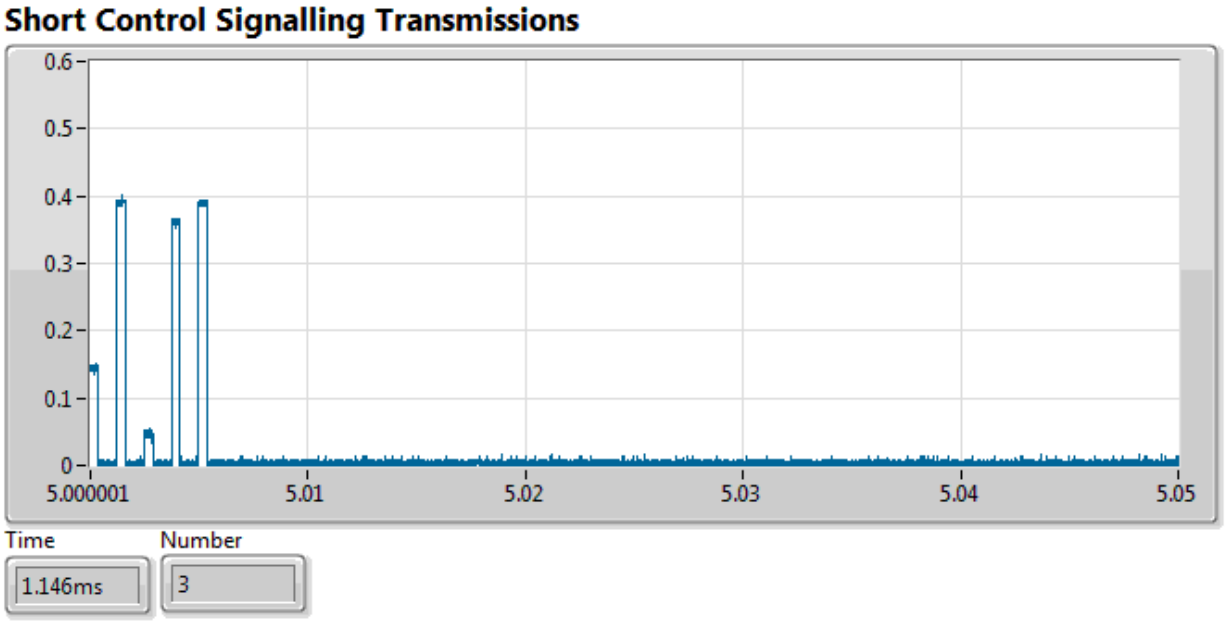
Unwanted signal: 2395 MHz

8-DPSK - 2480MHz

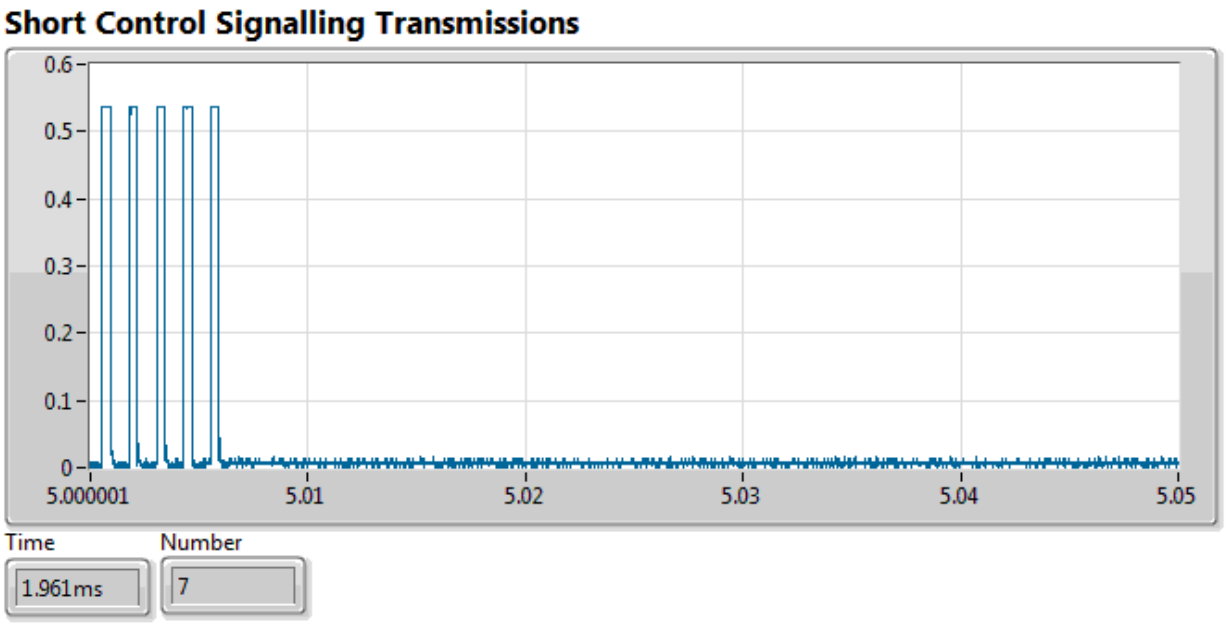
Time Analysis



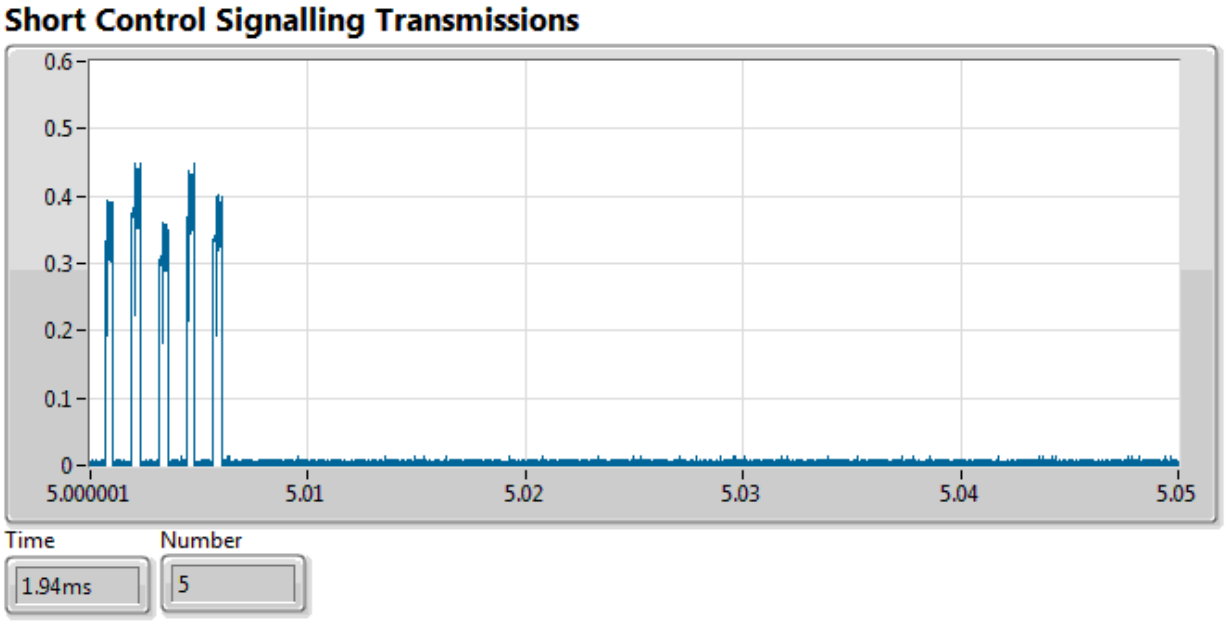
5.1.6 Test Result of Short Control Signalling Transmissions Plots

Short Control Signalling Transmissions Plots
GFSK - 2402MHz

GFSK - 2480MHz


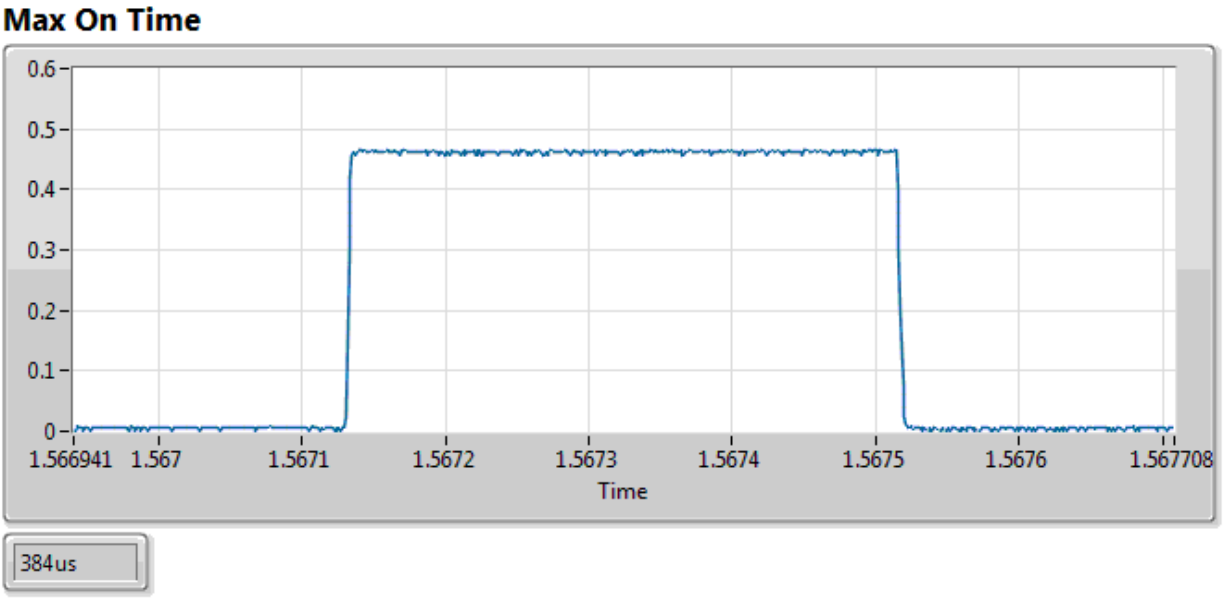
Short Control Signalling Transmissions Plots
8-DPSK - 2402MHz



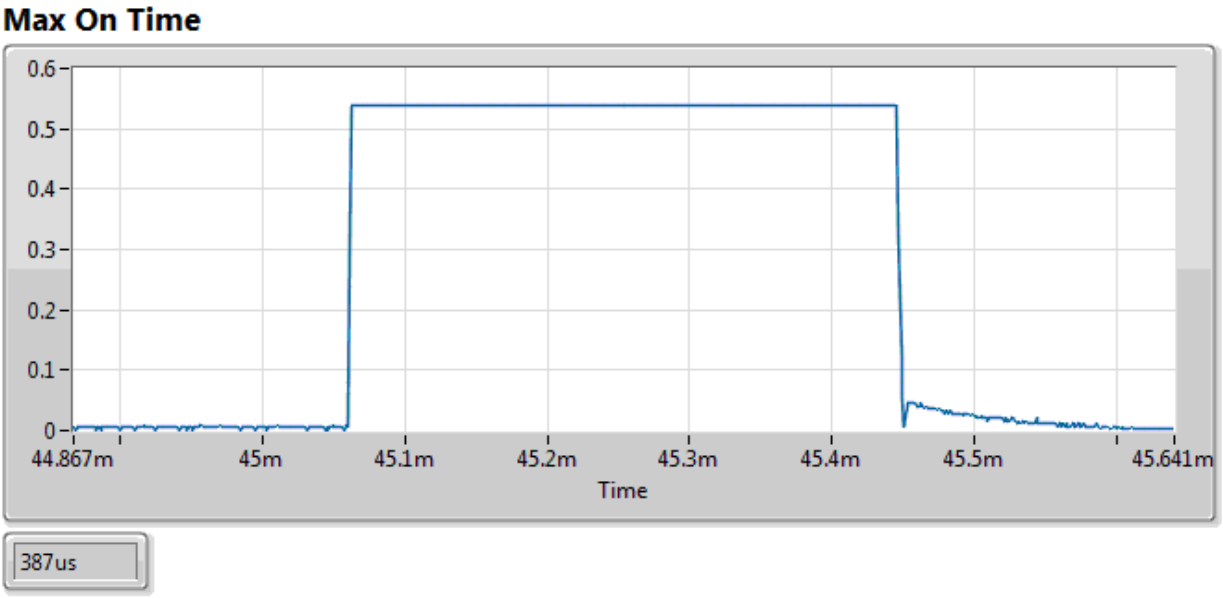
8-DPSK - 2480MHz



Channel Occupancy Time
GFSK - 2402MHz

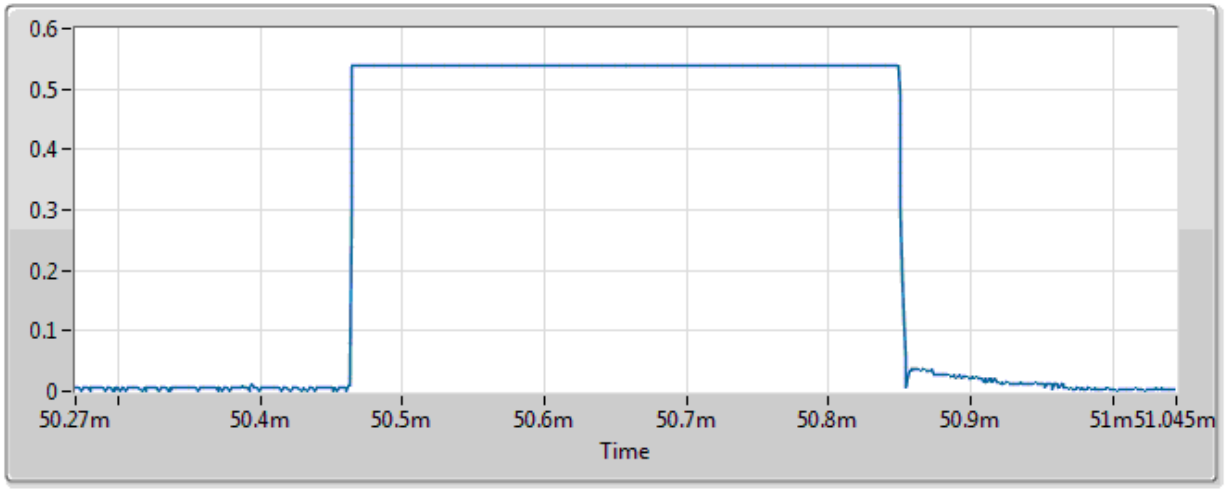


GFSK - 2480MHz



Channel Occupancy Time
8-DPSK - 2402MHz

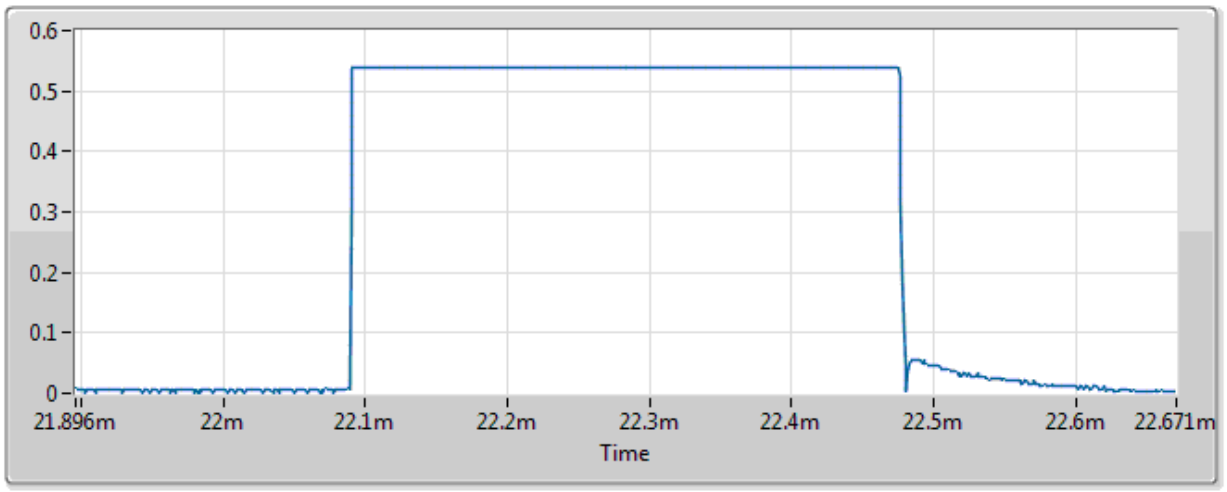
Max On Time



388us

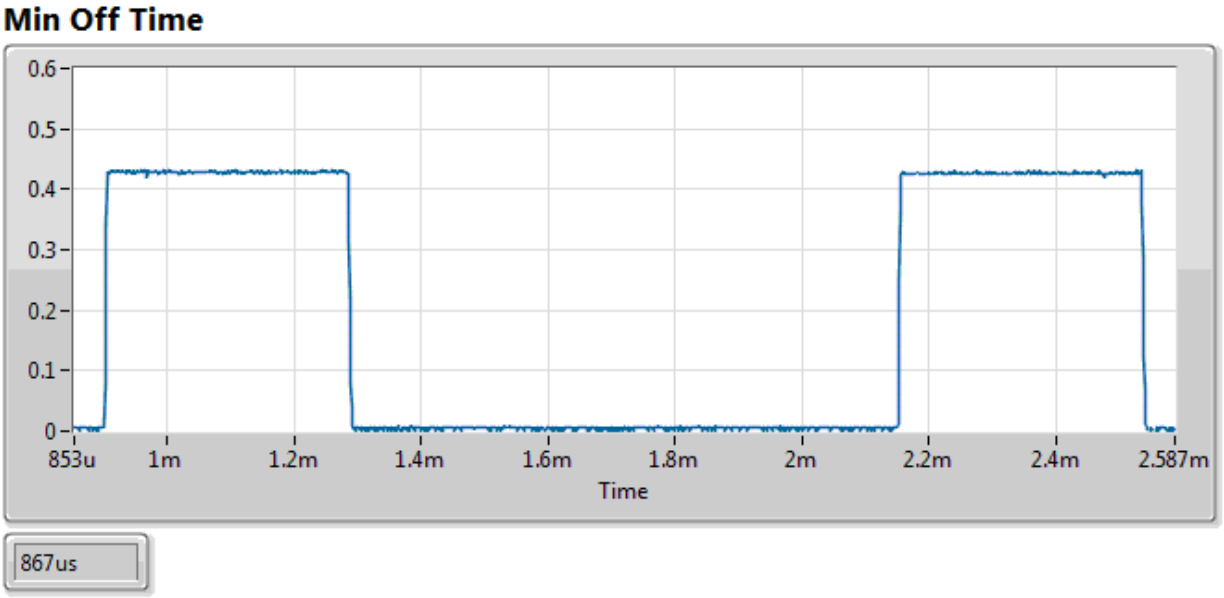
8-DPSK - 2480MHz

Max On Time

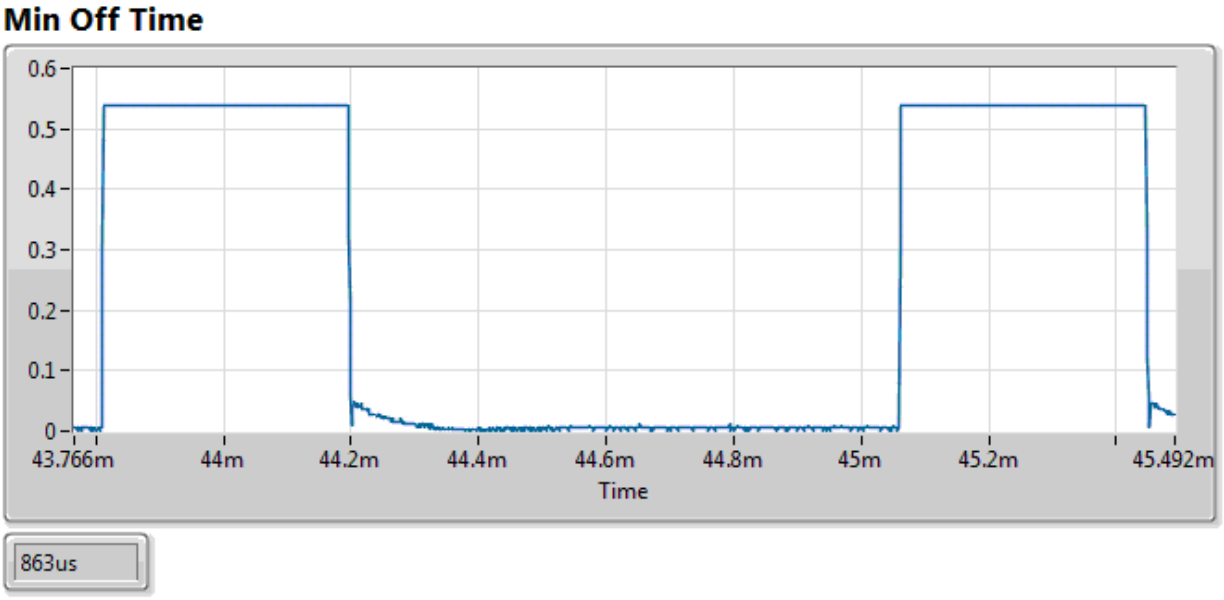


388us

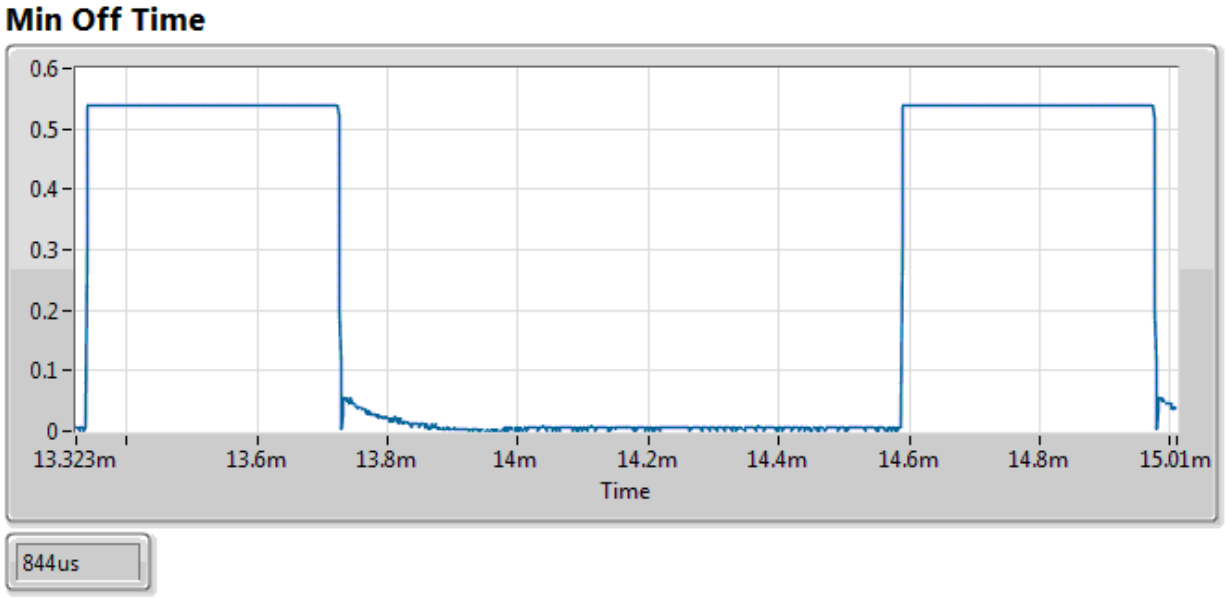
Idle Period Time
GFSK - 2402MHz



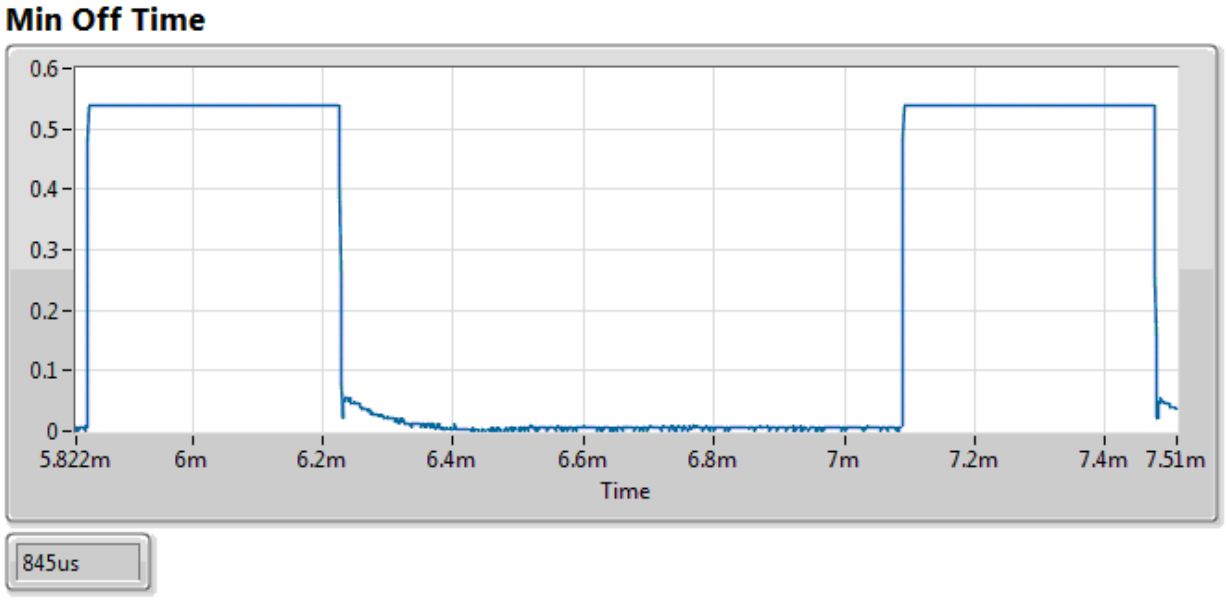
GFSK - 2480MHz



Idle Period Time
8-DPSK - 2402MHz



8-DPSK - 2480MHz



6 Receiver Blocking Test Results

6.1 Receiver Blocking

6.1.1 Limit of Receiver Blocking

Receiver Blocking Parameters for Receiver Category 1 Equipment Limit			
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 × log10(OCBW)) or -68 dBm whichever is less (see note 2)	2 380 2 504	-34	CW
(-139 dBm + 10 × log10(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.

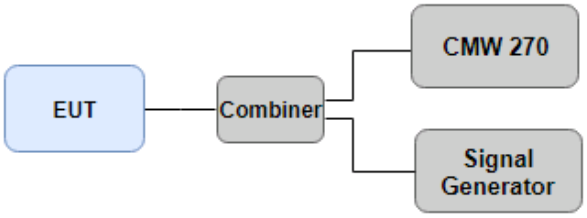
Receiver Blocking Parameters for Receiver Category 2 Equipment Limit			
Wanted Signal Mean Power from Companion Device (dBm) (see notes 1 and 3)	**Blocking Signal Frequency (MHz)**	**Blocking Signal Power (dBm) (see note 3)**	**Type of Blocking Signal**
(-139 dBm + 10 × log10(OCBW) + 10 dB) or (-74 dBm + 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.			

Receiver Blocking Parameters for Receiver Category 3 Equipment Limit			
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 × log10(OCBW) + 20 dB) or (-74 dBm + 20 dB) whichever is less	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.			

6.1.2 Test Procedures

Reference to clause 5.4.11.2 of ETSI EN 300 328 V2.2.2 (2019-07).

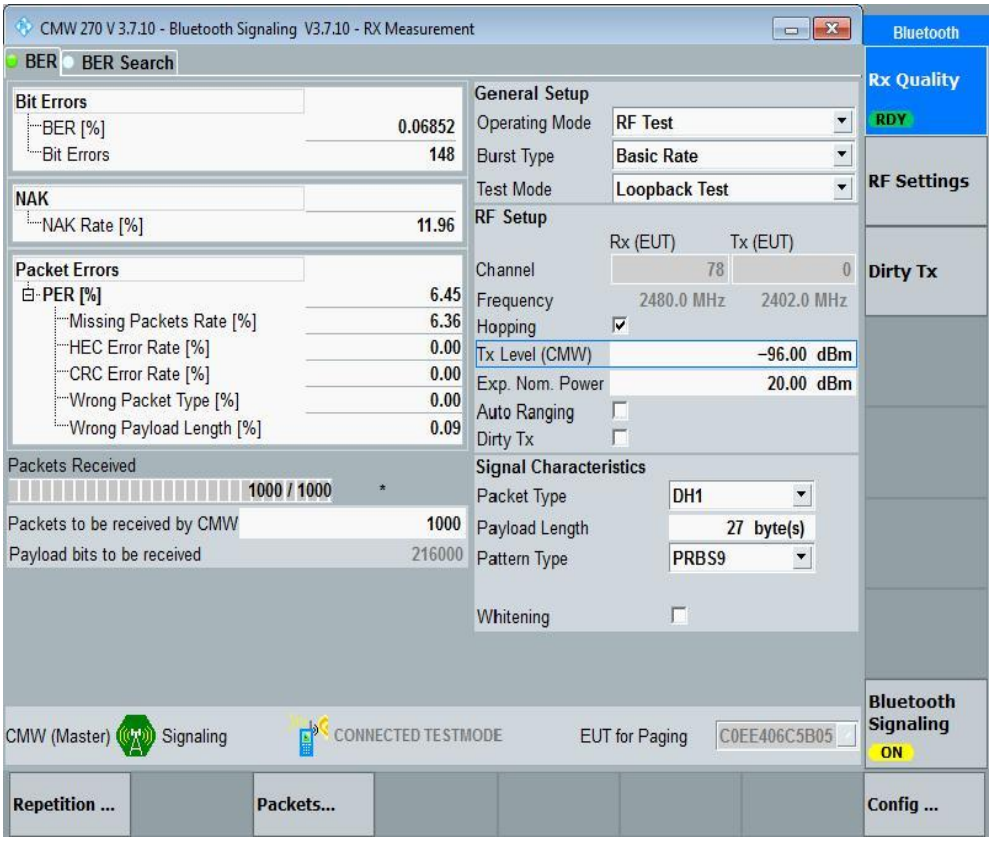
6.1.3 Test Setup



6.1.4 Test Result of Receiver Blocking

Ambient Condition	22°C / 65%	Tested By	Alan Tang

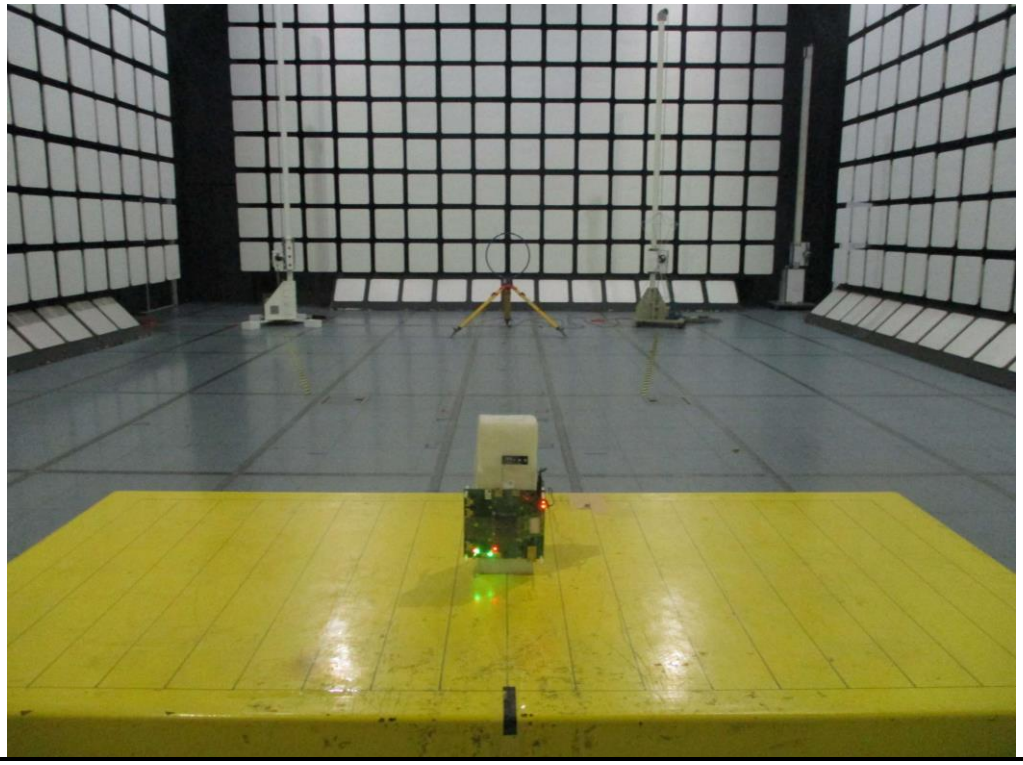
Hopping mode

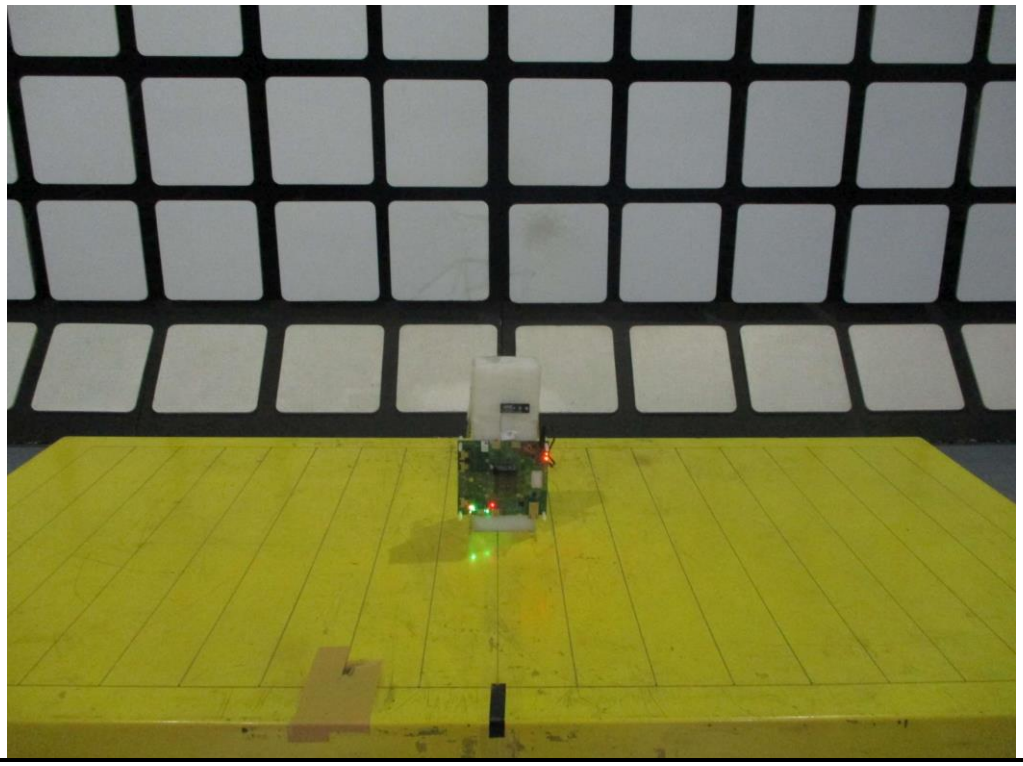


Receiver Category	1		
Performance Criteria Limit	PER ≤ 10 %		
Wanted Signal Mean Power from Companion Device (dBm)	**Blocking Signal Frequency (MHz)**	**Blocking Signal Power (dBm)**	**Test Result**
-70.76	2380	-31.2	Pass
-70.76	2504	-31.2	Pass
-76.76	2300	-31.2	Pass
-76.76	2330	-31.2	Pass
-76.76	2360	-31.2	Pass
-76.76	2524	-31.2	Pass
-76.76	2584	-31.2	Pass
-76.76	2674	-31.2	Pass

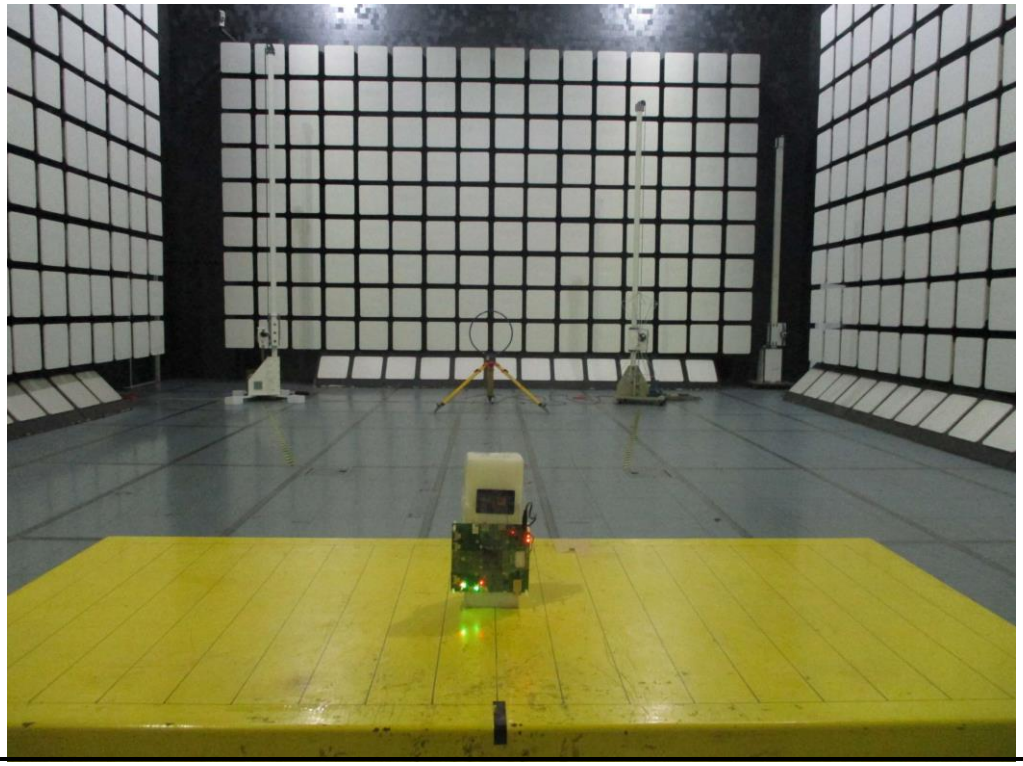
7 Photographs of the Test Configuration

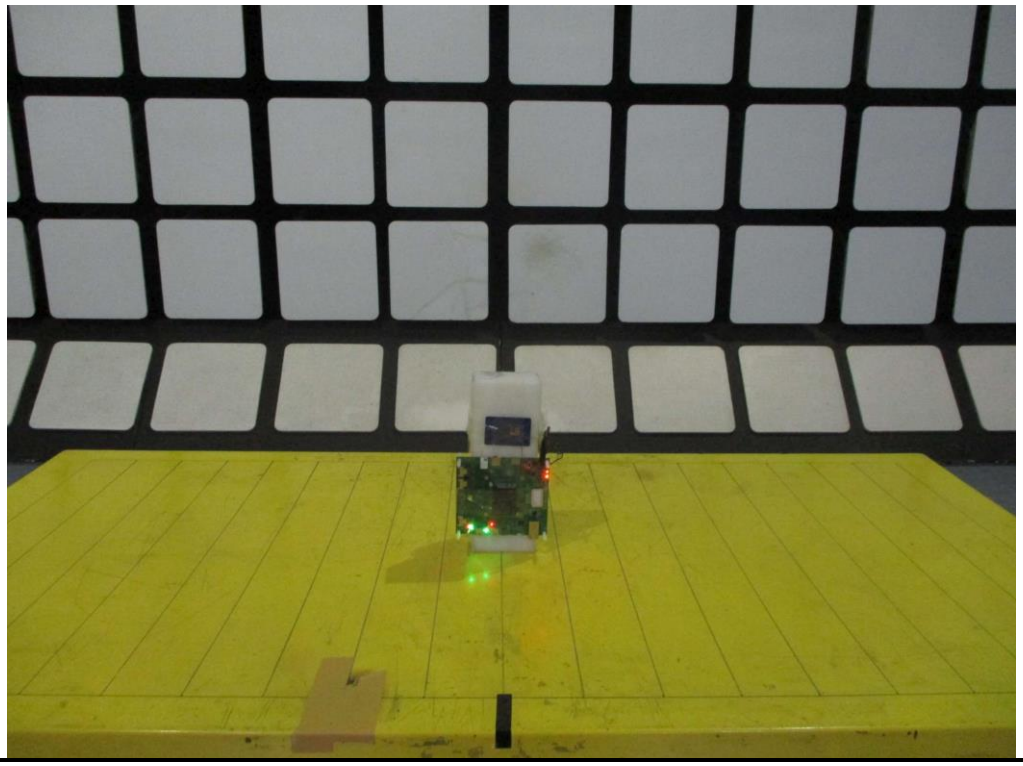
Spurious Emission below 30MHz Test (PCB Dipole Antenna)



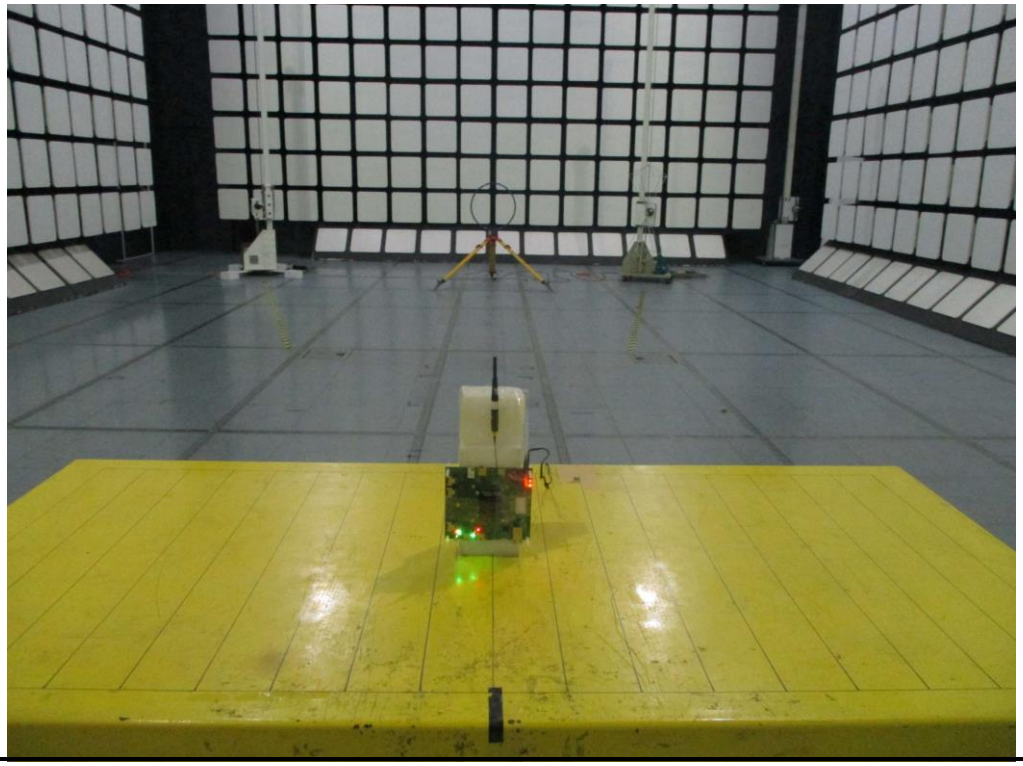


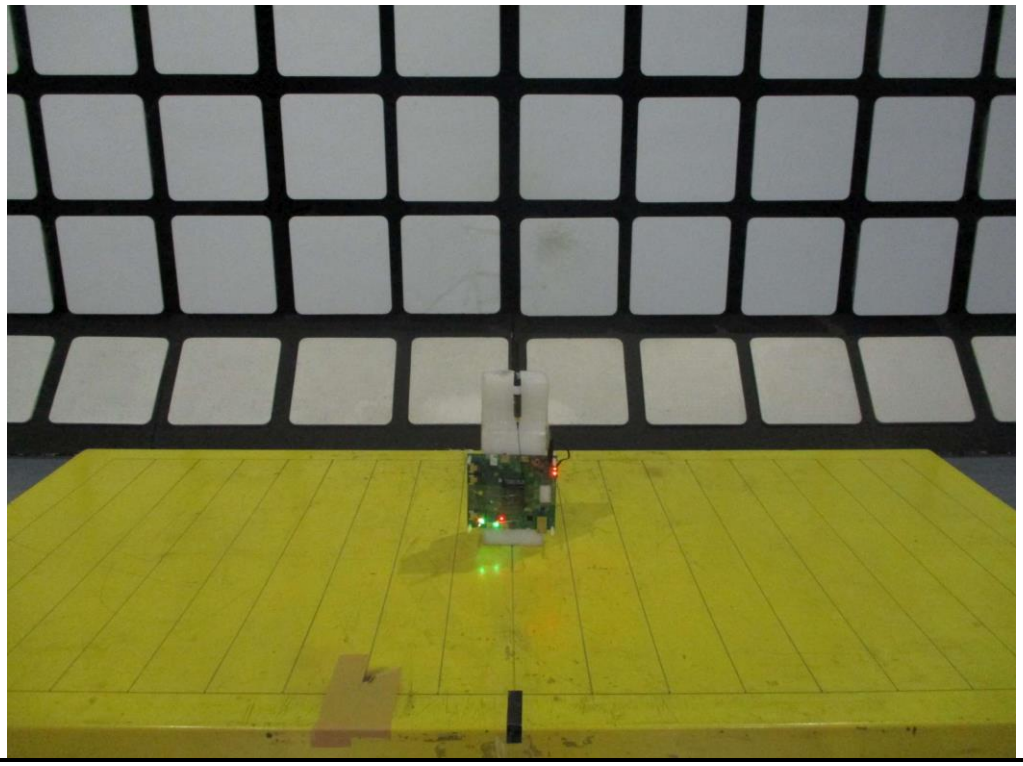
Spurious Emission below 30MHz Test (PIFA Antenna)



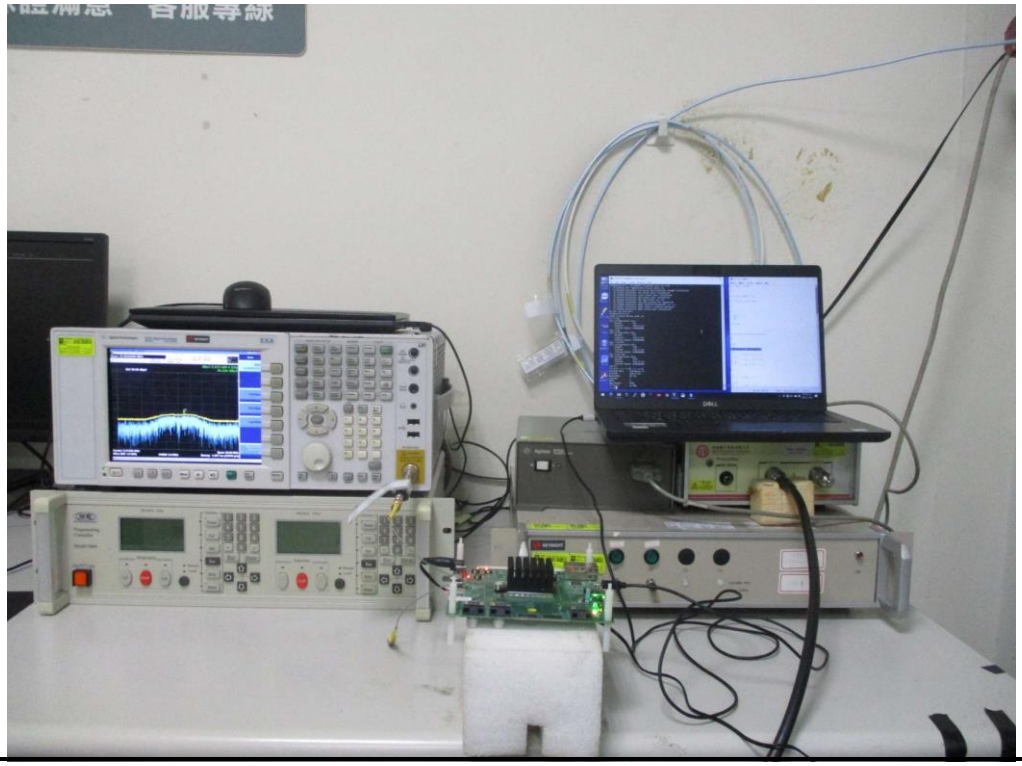


Spurious Emission below 30MHz Test (Dipole Antenna)

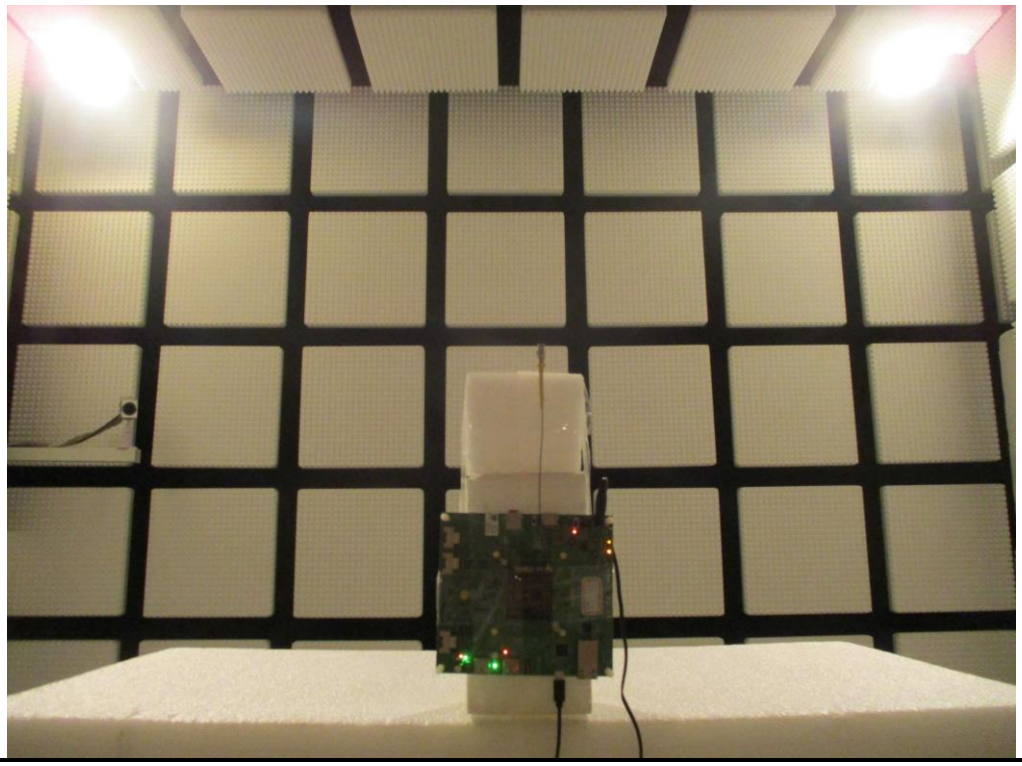




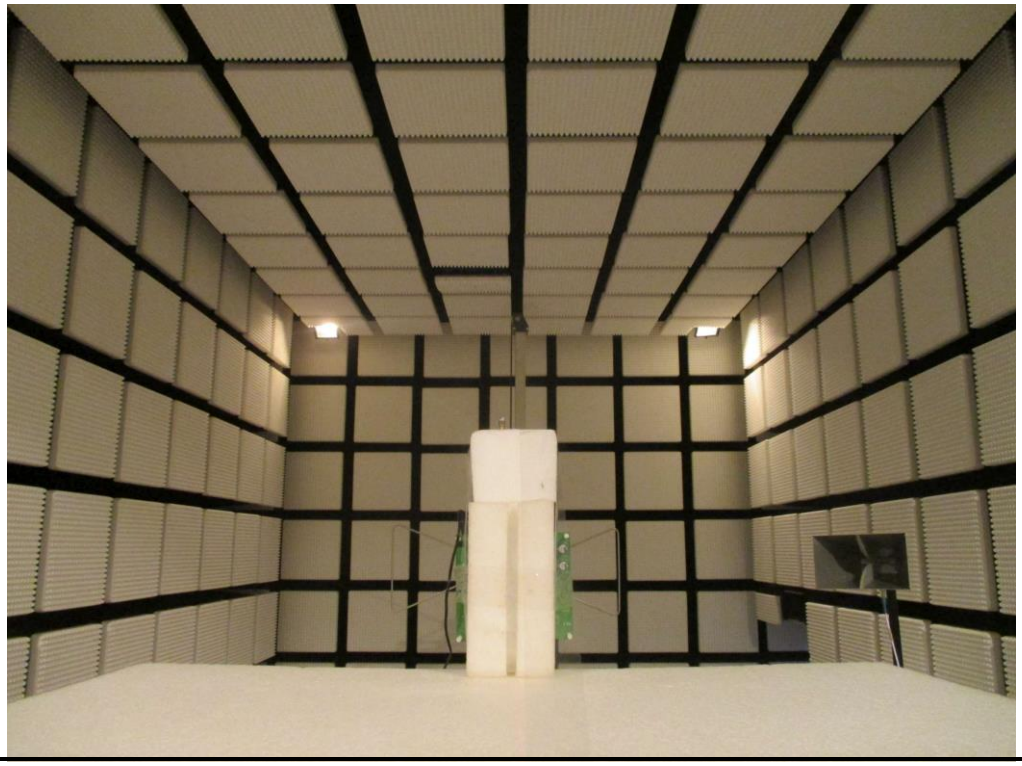
Spurious Emission Test (Conducted)



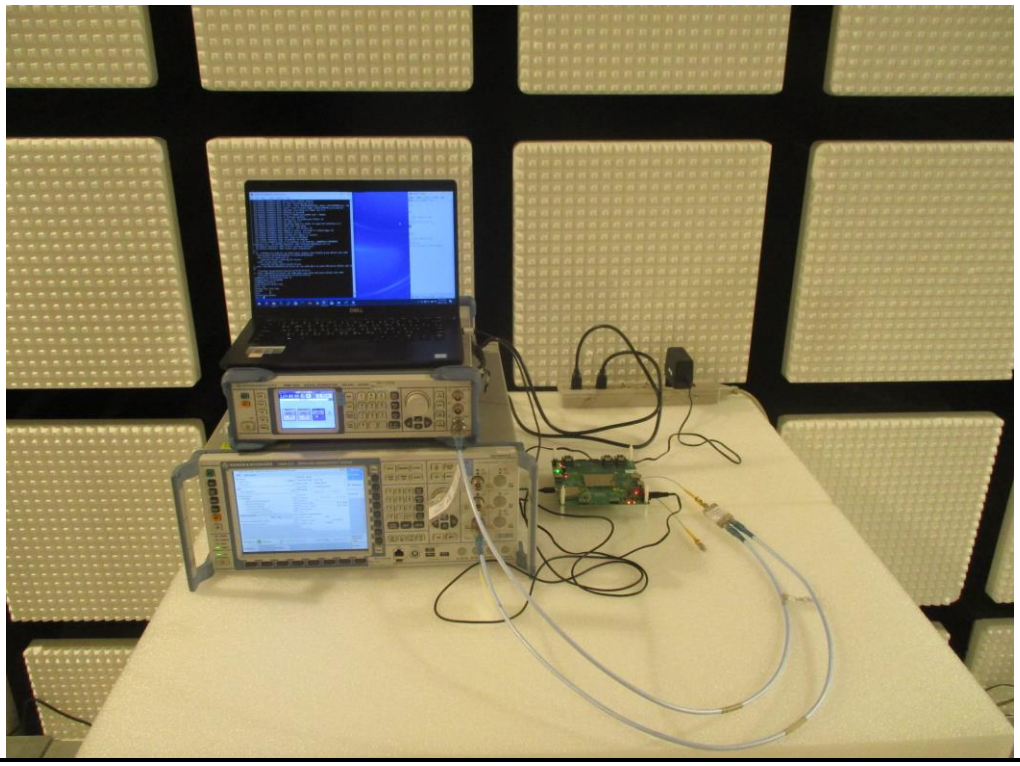
Spurious Emission above 30MHz Test (Radiated)



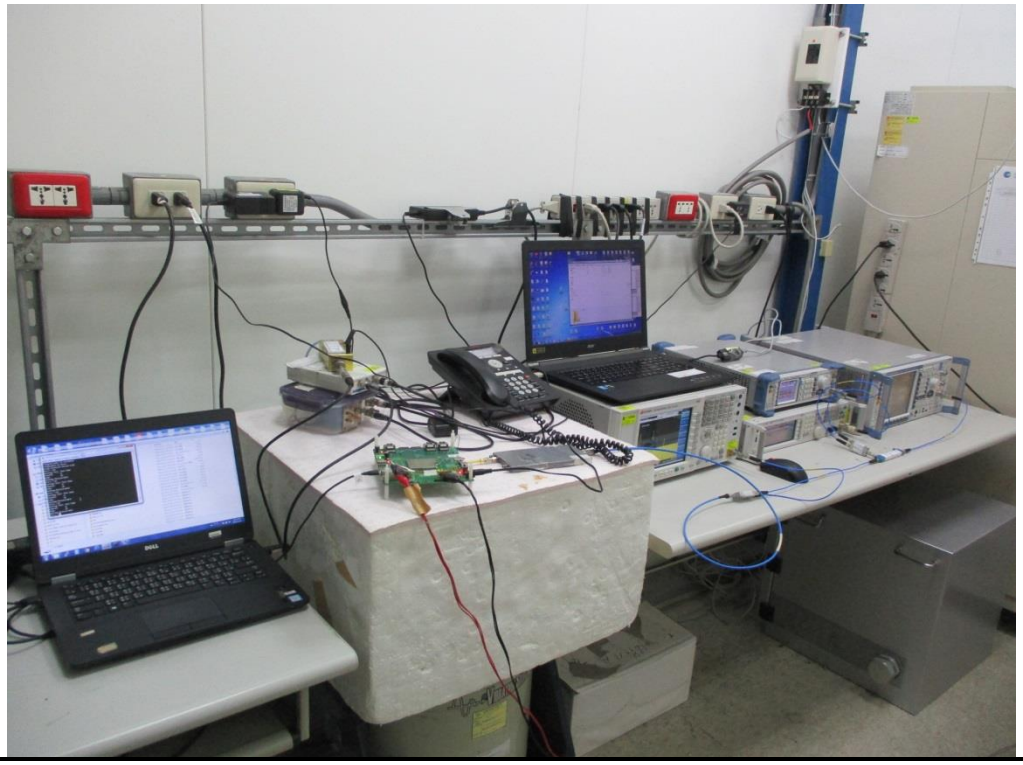
Spurious Emission above 30MHz Test (Radiated)



Receiver Blocking Test



Adaptivity, Unwanted Signal and Short Control Signalling Transmissions Test



8 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 Corporation (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

Tel: 886-2-2601-1640

No.30-2, Ding Fwu Tsuen, Lin Kou District, New Taipei City, Taiwan (R.O.C.)

Kwei Shan

Tel: 886-3-271-8666

No.3-1, Lane 6, Wen San 3rd St., Kwei Shan Dist., Tao Yuan City 33381, Taiwan (R.O.C.)

No.2-1, Lane 6, Wen San 3rd St., Kwei Shan Dist., Tao Yuan City 33381, Taiwan (R.O.C.)

Kwei Shan Site II

Tel: 886-3-271-8640

No.14-1, Lane 19, Wen San 3rd St., Kwei Shan Dist., 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: 886-3-318-0345
Email: ICC_Service@icertifi.com.tw

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