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Report No.: CQASZ160101320E-01
Report Version: V01

MEASUREMENT REPORT
Test Report

Applicant:	Shenzhen Yuejiang Technology Co., Ltd
Address of Applicant:	Bldg C2, 18/F, Nanshan iPark, No. 1001 Xueyuan Avenue, Nanshan District, Shenzhen, China
Manufacturer:	Shenzhen Yuejiang Technology Co., Ltd
Address of Manufacturer:	Bldg C2, 18/F, Nanshan iPark, No. 1001 Xueyuan Avenue, Nanshan District, Shenzhen, China
Equipment Under Test (EUT):	
Product:	Dobot arm
Model No.:	Dobot 100
Brand Name:	N/A
FCC ID:	2AHI4100WA168
Standards:	47 CFR Part 15, Subpart C
Date of Test:	2016-02-01 to 2016-02-24
Date of Issue:	2016-02-24
Test Result :	**PASS***

Reviewed By: _____
(Aaron Ma)

Approved By: _____
(Owen Zhou)

Shenzhen Centre Quality Accreditation Technology Co., Ltd.

* In the configuration tested, the EUT complied with the standards specified above.

2 Version

Revision History Of Report

Report No.	Version	Description	Issue Date
CQASZ160101320E-01	Rev.01	Initial report	2016-02-24

3 Test Summary

Test Item	Test Requirement	Test method	Result
Antenna Requirement	47 CFR Part 15, Subpart C Section 15.203/15.247 (c)	ANSI C63.10 (2013)	PASS
AC Power Line Conducted Emission	47 CFR Part 15, Subpart C Section 15.207	ANSI C63.10 (2013)	PASS
Conducted Peak Output Power	47 CFR Part 15, Subpart C Section 15.247 (b)(1)	ANSI C63.10 (2013)	PASS
20dB Occupied Bandwidth	47 CFR Part 15, Subpart C Section 15.247 (a)(1)	ANSI C63.10 (2013)	PASS
Carrier Frequencies Separation	47 CFR Part 15, Subpart C Section 15.247 (a)(1)	ANSI C63.10 (2013)	PASS
Hopping Channel Number	47 CFR Part 15, Subpart C Section 15.247 (a)(1)	ANSI C63.10 (2013)	PASS
Dwell Time	47 CFR Part 15, Subpart C Section 15.247 (a)(1)	ANSI C63.10 (2013)	PASS
Pseudorandom Frequency Hopping Sequence	47 CFR Part 15, Subpart C Section 15.247(b)(4)&TCB Exclusion List (7 July 2002)	ANSI C63.10 (2013)	PASS
Band-edge for RF Conducted Emissions	47 CFR Part 15, Subpart C Section 15.247(d)	ANSI C63.10 (2013)	PASS
RF Conducted Spurious Emissions	47 CFR Part 15, Subpart C Section 15.247(d)	ANSI C63.10 (2013)	PASS
Radiated Spurious emissions	47 CFR Part 15, Subpart C Section 15.205/15.209	ANSI C63.10 (2013)	PASS
Restricted bands around fundamental frequency (Radiated Emission)	47 CFR Part 15, Subpart C Section 15.205/15.209	ANSI C63.10 (2013)	PASS

4 Contents

5 General Information

5.1 Client Information

Applicant:	Shenzhen Yuejiang Technology Co., Ltd
Address of Applicant:	Bldg C2, 18/F, Nanshan iPark, No. 1001 Xueyuan Avenue, Nanshan District, Shenzhen, China
Manufacturer:	Shenzhen Yuejiang Technology Co., Ltd
Address of Manufacturer:	Bldg C2, 18/F, Nanshan iPark, No. 1001 Xueyuan Avenue, Nanshan District, Shenzhen, China

5.2 General Description of EUT

Product Name:	Dobot arm	
Model No.:	Dobot100	
Trade Mark:	N/A	
Hardware Version:	V1.0.0	
Software Version:	V1.0.0	
Operation Frequency:	2402MHz~2480MHz	
Bluetooth Version:	V3.0+EDR	
Modulation Technique:	Frequency Hopping Spread Spectrum(FHSS)	
Modulation Type:	GFSK, π/4DQPSK, 8DPSK	
Number of Channel:	79	
Hopping Channel Type:	Adaptive Frequency Hopping systems	
Sample Type:	Fixed production	
Test Software of EUT:	RFTest (manufacturer declare)	
Antenna Type:	Integral	
Antenna Gain:	0dBi	
Power Supply:	Adapter:	Input: AC100-240V 50/60Hz Output: DC12V 5A
	EUT Power Supply:	DC12V
	Bluetooth Module:	DC5V

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

Note:
In section 15.31(m), regards to the operating frequency range over 10 MHz, the Lowest frequency, the middle frequency, and the highest frequency of channel were selected to perform the test, and the selected channel see below:

Channel	Frequency
The Lowest channel	2402MHz
The Middle channel	2441MHz
The Highest channel	2480MHz

5.3 Test Environment

Operating Environment:	
Temperature:	25.0 °C
Humidity:	53 % RH
Atmospheric Pressure:	995mbar

5.4 Description of Support Units

The EUT has been tested with associated equipment below.

Description	Manufacturer	Model No.
AC/DC Adapter	DS	GMY-1260W-5F

5.5 Test Location

All tests were performed at:

Shenzhen CTL Testing Technology Co., Ltd., Shenzhen EMC Laboratory,

1/F.-A, Baisha Technology Park, No.3011, Shahexi Road, Nanshan District, Shenzhen, Guangdong, China

5.6 Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

FCC – Registration No.: 970318

Shenzhen CTL Testing Technology Co., Ltd. has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Registration 970318

5.7 Deviation from Standards

None.

5.8 Abnormalities from Standard Conditions

None.

5.9 Other Information Requested by the Customer

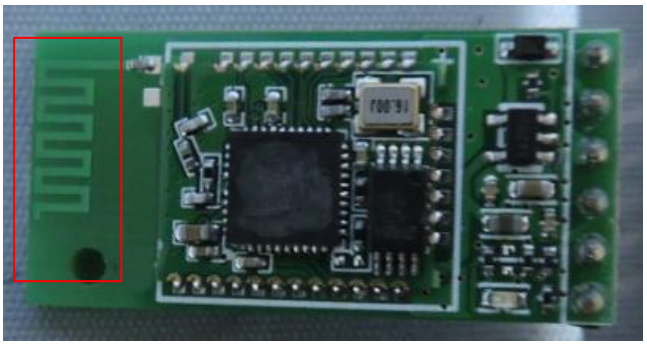
None.

5.10 Equipment List

Item	Test Equipment	Manufacturer	Model No.	Serial No.	Calibration Due Date
1	Bilog Antenna	Sunol Sciences Corp.	JB1	A061713	2016/06/01
2	EMI Test Receiver	ROHDE & SCHWARZ	ESCI3	103710	2016/06/01
3	Spectrum Analyzer	Agilent	E4407B	MY45108355	2016/05/20
4	Controller	EM Electronics	Controller EM 1000	N/A	2016/05/20
5	Horn Antenna	Sunol Sciences Corp.	DRH-118	A062013	2016/05/18
6	Ultra-Broadband Antenna	ShwarzBeck	BBHA9170	25841	2016/05/18
7	Active Loop Antenna	Daze	ZN30900A	N/A	2016/05/18
8	Spectrum Analyzer	R&S	FSU	MY41440676	2016/05/18
9	LISN	R&S	ENV216	101316	2016/06/01
10	LISN	SCHWARZBECK	NSLK8127	8127687	2016/06/01
11	Microwave Preamplifier	HP	8349B	3155A00882	2016/05/18
12	Preamplifier	HP	8447D	3113A07663	2016/05/18
13	Transient Limiter	Com-Power	LIT-153	532226	2016/06/01
14	Temperature/Humidity Meter	Gangxing	CTH-608	02	2016/05/19
15	Climate Chamber	ESPEC	EL-10KA	A20120523	2016/05/19
16	High-Pass Filter	K&L	9SH10-2700/X12750-O/O	N/A	2016/05/19
17	High-Pass Filter	K&L	41SH10-1375/U12750-O/O	N/A	2016/05/19
18	RF Cable(0-1GHz)	HUBER+SUHNER	RG174	N/A	2016/05/19
19	RF Cable(1-25GHz)	HUBER+SUHNER	RG214	N/A	2016/05/19
20	The temporary antenna Connector	MMCX-SMA	1547	23657478	2016/05/19

6 Test results and Measurement Data

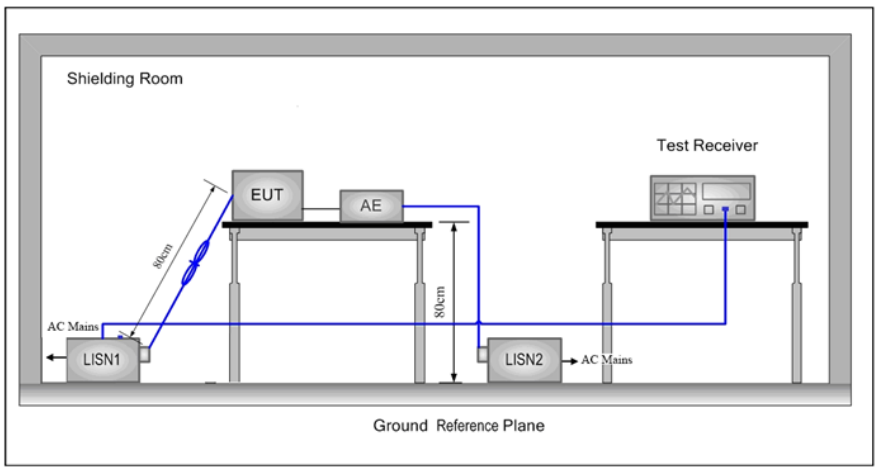
6.1 Antenna Requirement

Standard requirement:	47 CFR Part 15C Section 15.203 /247(c)
15.203 requirement: An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. 15.247(b) (4) requirement: The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.	
EUT Antenna:	
The antenna is integrated on the main PCB and no consideration of replacement. The best case gain of the antenna is 0dBi.	

Note:

The temporary antenna connector is soldered on the PCB board in order to perform conducted tests and this temporary antenna connector is listed in the equipment list.

6.2 Conducted Emissions

Test Requirement:	47 CFR Part 15C Section 15.207
Test Method:	ANSI C63.10: 2013
Test Frequency Range:	150kHz to 30MHz
Limit:	Frequency range (MHz) / Limit (dBuV): Quasi-peak / Average 0.15-0.5: 66 to 56* / 56 to 46* 0.5-5: 56 / 46 5-30: 60 / 50 * Decreases with the logarithm of the frequency.
Test Procedure:	1) The mains terminal disturbance voltage test was conducted in a shielded room. 2) The EUT was connected to AC power source through a LISN 1 (Line Impedance Stabilization Network) which provides a 50Ω/50μH + 5Ω linear impedance. The power cables of all other units of the EUT were connected to a second LISN 2, which was bonded to the ground reference plane in the same way as the LISN 1 for the unit being measured. A multiple socket outlet strip was used to connect multiple power cables to a single LISN provided the rating of the LISN was not exceeded. 3) The tabletop EUT was placed upon a non-metallic table 0.8m above the ground reference plane. And for floor-standing arrangement, the EUT was placed on the horizontal ground reference plane, 4) The test was performed with a vertical ground reference plane. The rear of the EUT shall be 0.4 m from the vertical ground reference plane. The vertical ground reference plane was bonded to the horizontal ground reference plane. The LISN 1 was placed 0.8 m from the boundary of the unit under test and bonded to a ground reference plane for LISNs mounted on top of the ground reference plane. This distance was between the closest points of the LISN 1 and the EUT. All other units of the EUT and associated equipment was at least 0.8 m from the LISN 2. 5) In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.10: 2013 on conducted measurement.
Test Setup:	

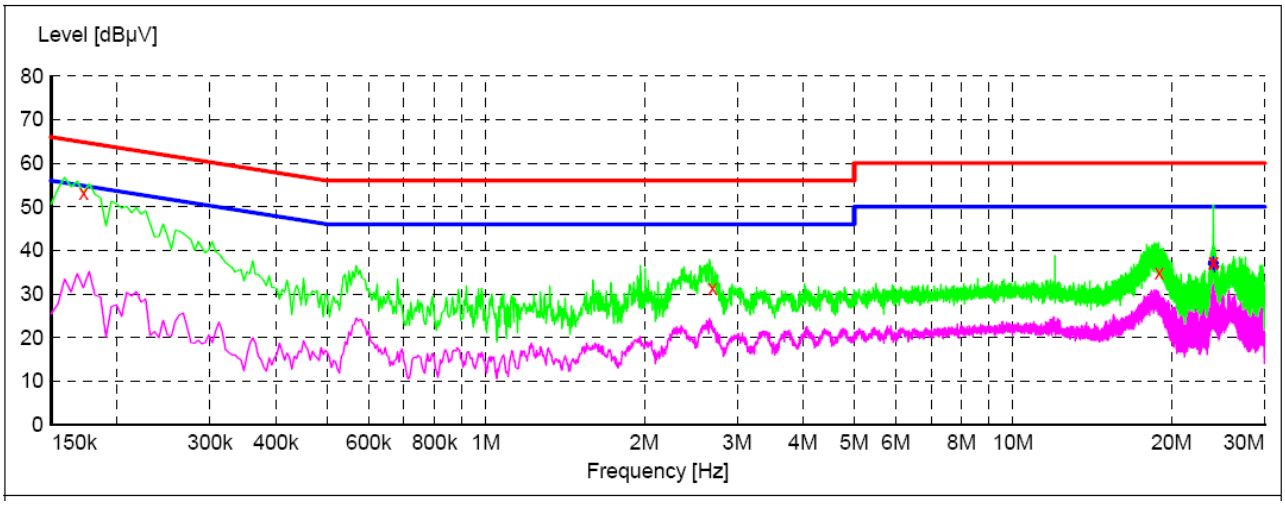
Exploratory Test Mode:	Non-hopping transmitting mode with all kind of modulation and all kind of data type at the lowest, middle, high channel.
Final Test Mode:	Through Pre-scan, find the DH1 of data type and GFSK modulation at the lowest channel is the worst case. Only the worst case is recorded in the report.
Instruments Used:	Refer to section 5.10 for details
Test Voltage:	AC 120V/60Hz
Test Results:	Pass

Measurement Data

An initial pre-scan was performed on the live and neutral lines with peak detector.

Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission were detected.

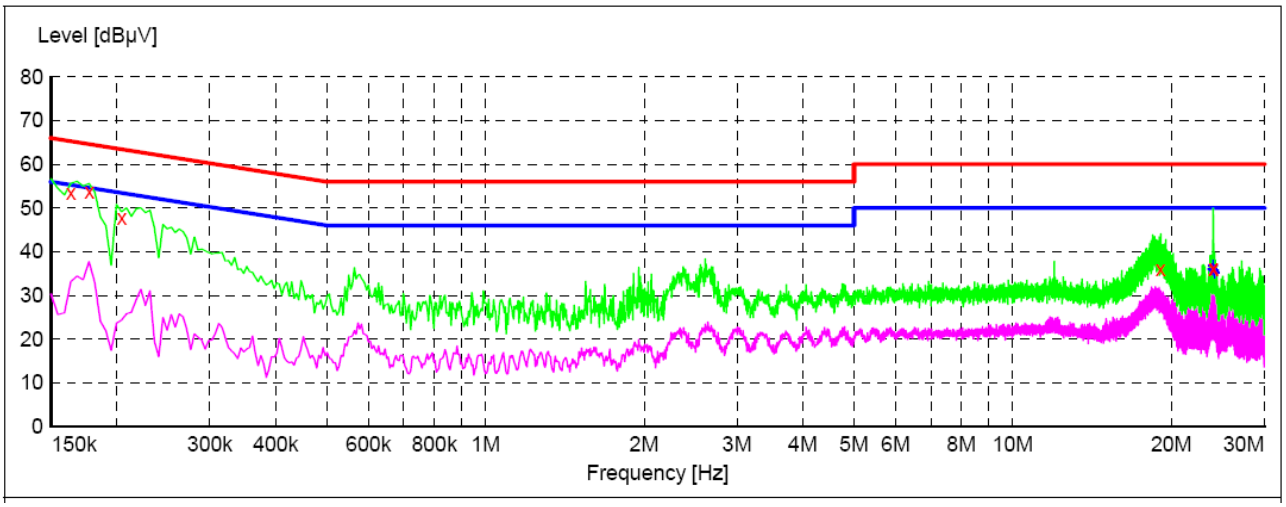
Live line:



Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.172501	53.10	10.2	65	11.7	QP	L1	GND
2.692501	31.40	10.4	56	24.6	QP	L1	GND
18.942001	34.80	10.9	60	25.2	QP	L1	GND
23.995501	37.10	11.1	60	22.9	QP	L1	GND
24.004501	37.30	11.1	60	22.7	QP	L1	GND
24.013501	37.40	11.1	60	22.6	QP	L1	GND

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
23.959501	36.70	11.1	50	13.3	AV	L1	GND
24.000001	37.30	11.1	50	12.7	AV	L1	GND
24.036001	37.10	11.1	50	12.9	AV	L1	GND
24.112501	36.20	11.1	50	13.8	AV	L1	GND

Neutral line:



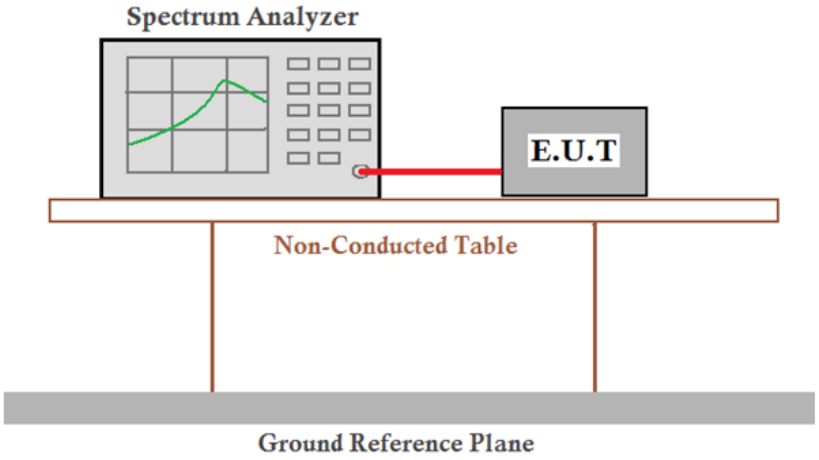
Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.163501	53.40	10.2	65	11.9	QP	N	GND
0.177001	53.60	10.2	65	11.0	QP	N	GND
0.204001	47.80	10.2	63	15.6	QP	N	GND
19.059001	36.10	10.9	60	23.9	QP	N	GND
24.004501	36.20	11.1	60	23.8	QP	N	GND
24.027001	35.90	11.1	60	24.1	QP	N	GND
Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
23.923501	36.00	11.1	50	14.0	AV	N	GND
24.000001	36.70	11.1	50	13.3	AV	N	GND
24.076501	35.80	11.1	50	14.2	AV	N	GND
24.153001	35.20	11.1	50	14.8	AV	N	GND

Notes:

1. The following Quasi-Peak and Average measurements were performed on the EUT:

2. Final Test Level =Receiver Reading + LISN Factor + Cable Loss.

6.3 Conducted Peak Output Power

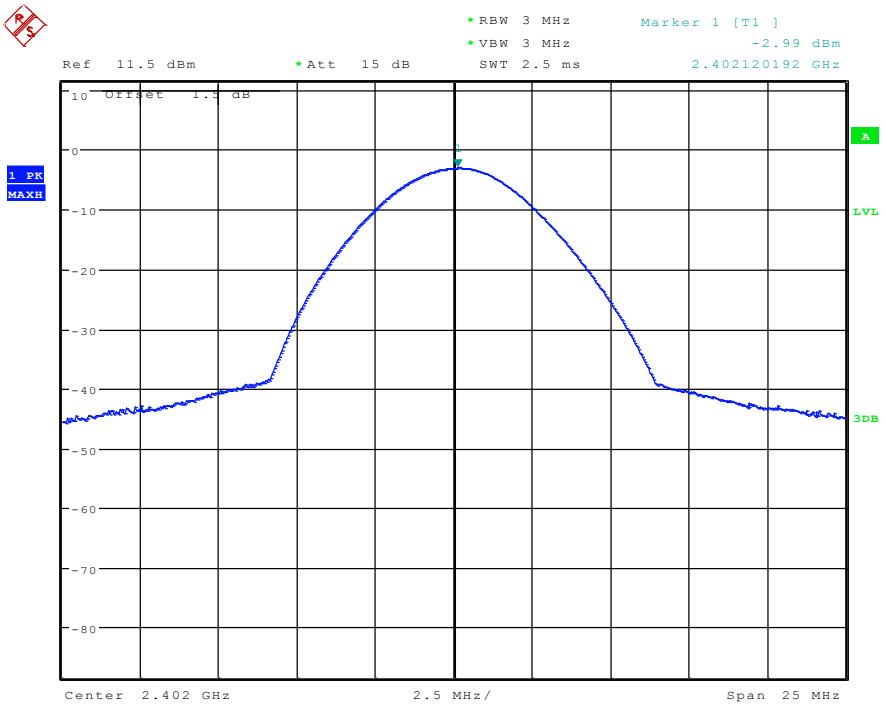
Test Requirement:	47 CFR Part 15C Section 15.247 (b)(1)
Test Method:	ANSI C63.10:2013
Test Setup:	 *Remark:* *Offset the High-Frequency cable loss 1.5dB in the spectrum analyzer.*
Limit:	30dBm
Exploratory Test Mode:	Non-hopping transmitting with all kind of modulation and all kind of data type
Final Test Mode:	Through Pre-scan, find the DH1 of data type is the worst case of GFSK modulation type, 2-DH1 of data type is the worst case of π/4DQPSK modulation type, 3-DH1 of data type is the worst case of 8DPSK modulation type.
Instruments Used:	Refer to section 5.10 for details
Test Results:	Pass

Measurement Data

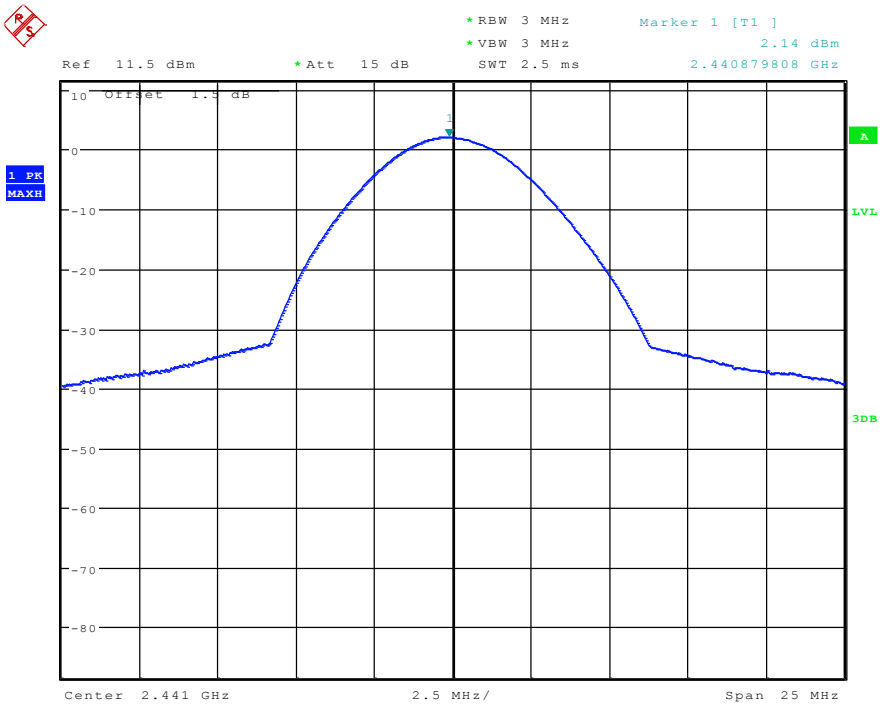
GFSK mode			
Test channel	Peak Output Power (dBm)	Limit (dBm)	Result
Lowest	-2.99	30.00	Pass
Middle	2.14	30.00	Pass
Highest	2.34	30.00	Pass
π/4DQPSK mode			
Test channel	Peak Output Power (dBm)	Limit (dBm)	Result
Lowest	-6.31	21.00	Pass
Middle	-1.42	21.00	Pass
Highest	-1.24	21.00	Pass
8DPSK mode			
Test channel	Peak Output Power (dBm)	Limit (dBm)	Result
Lowest	-5.67	21.00	Pass
Middle	-0.43	21.00	Pass
Highest	-0.31	21.00	Pass

Test plot as follows:

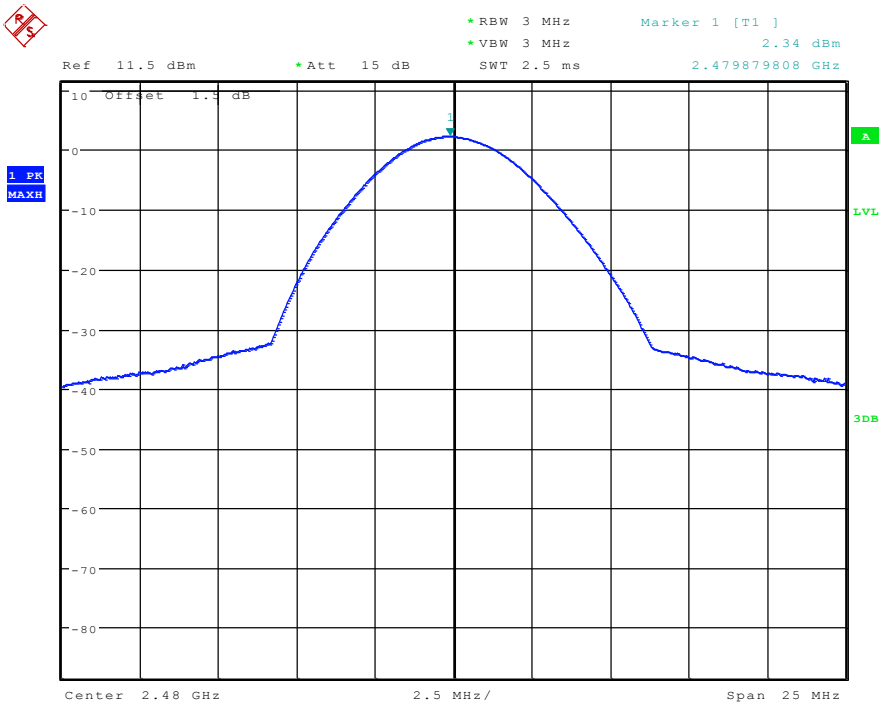
Test mode:	GFSK	Test channel:	Lowest



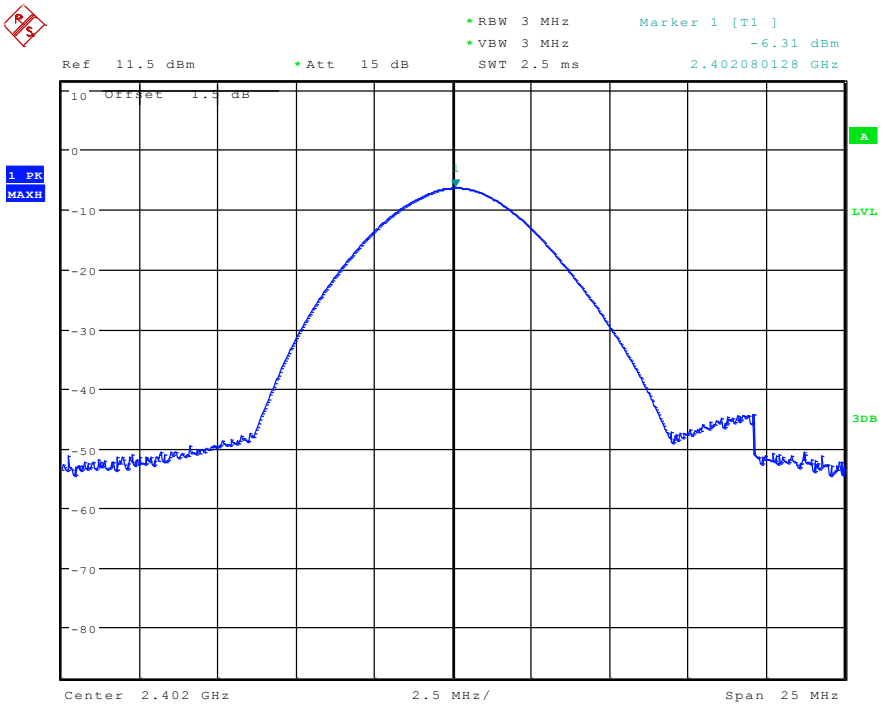
Test mode:	GFSK	Test channel:	Middle



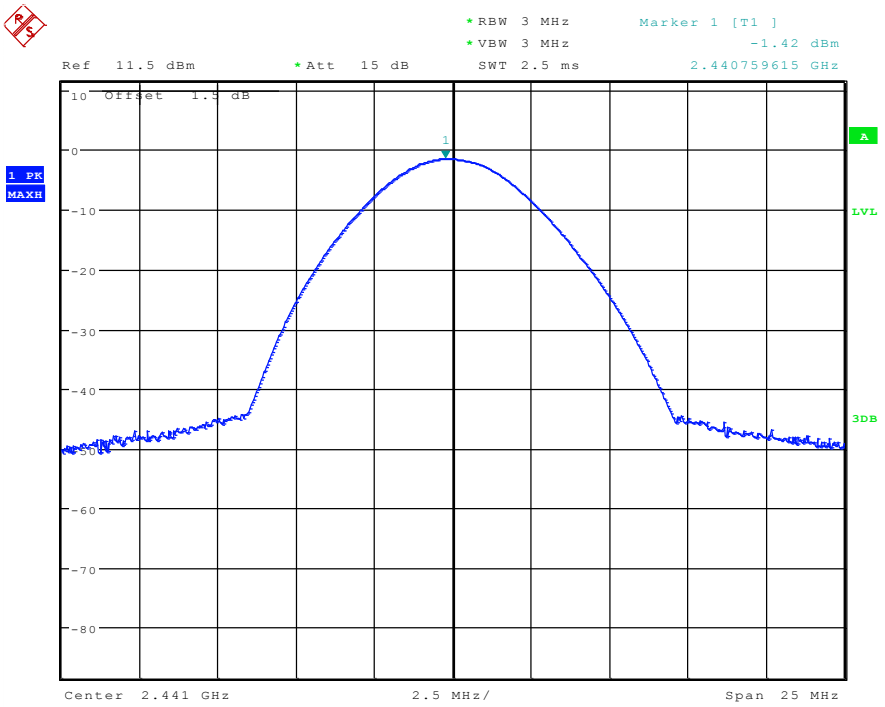
Test mode:	GFSK	Test channel:	Highest



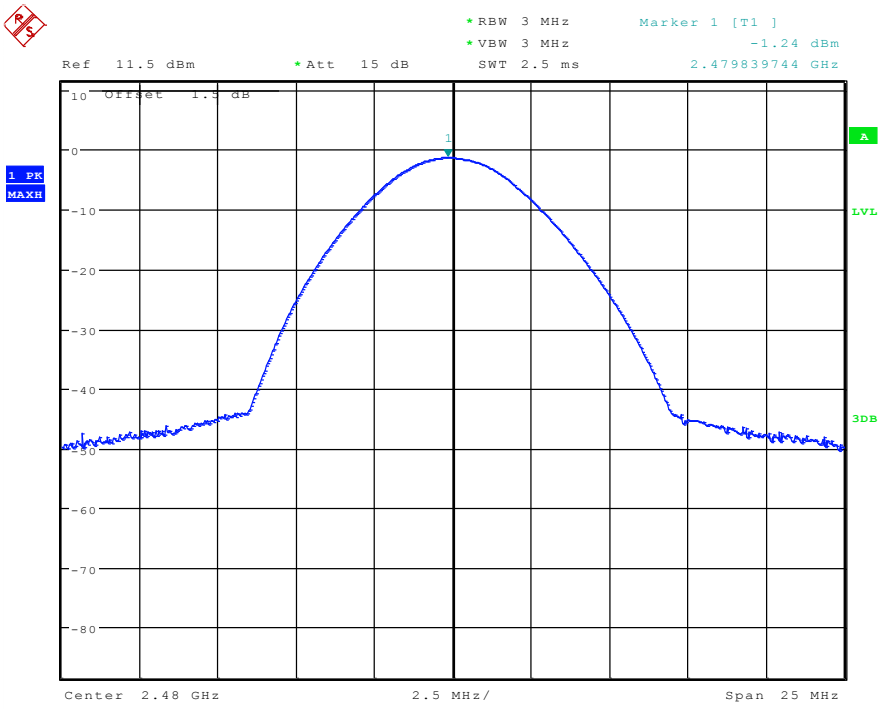
Test mode:	π/4DQPSK	Test channel:	Lowest



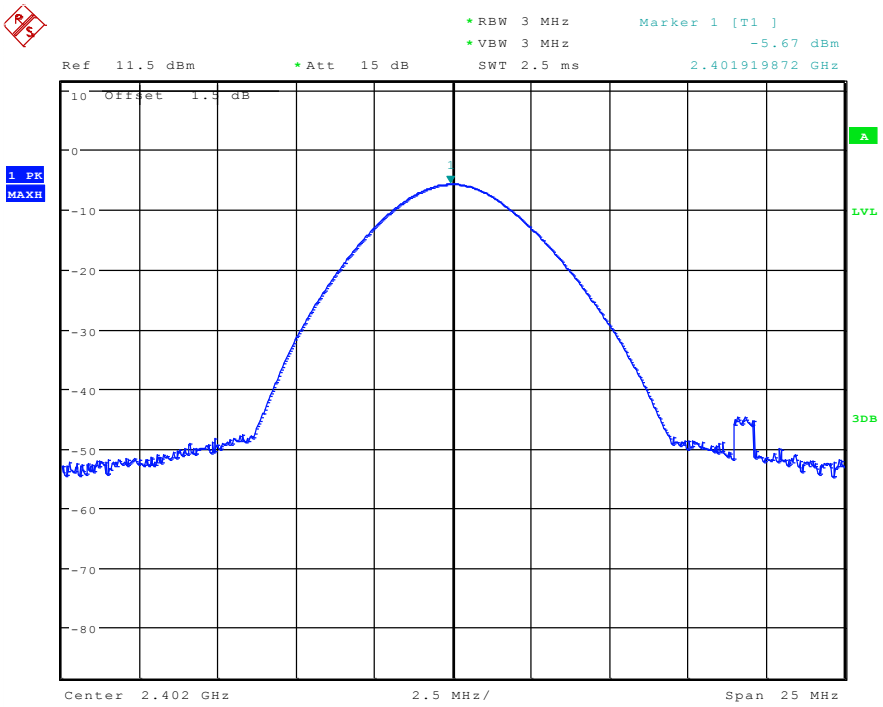
Test mode:	π/4DQPSK	Test channel:	Middle



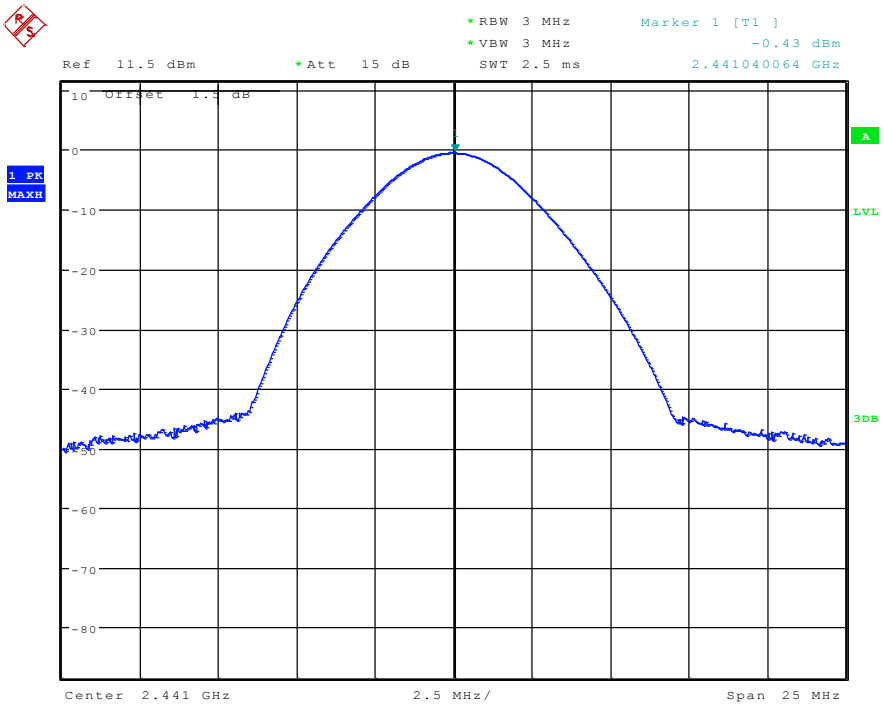
Test mode:	π/4DQPSK	Test channel:	Highest



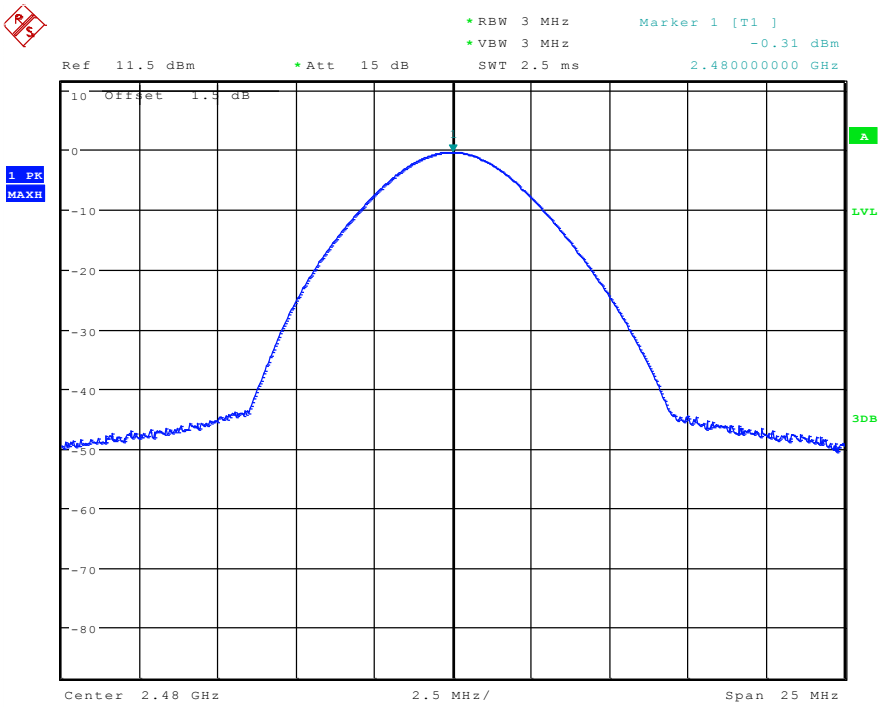
Test mode:	8DPSK	Test channel:	Lowest



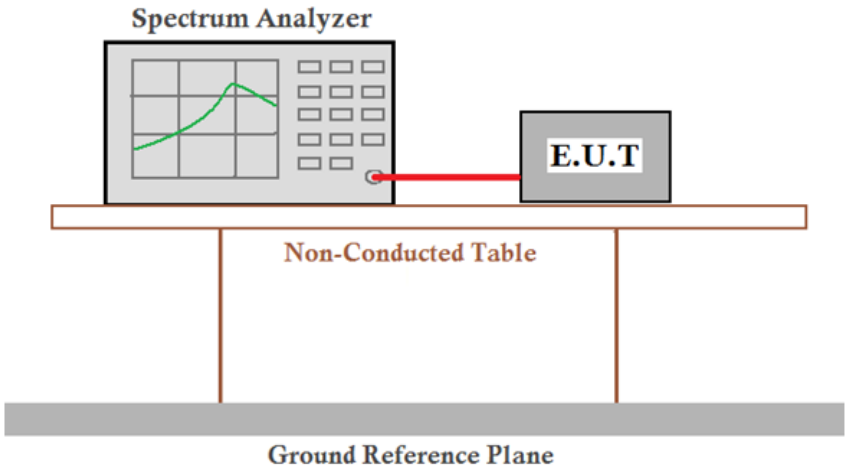
Test mode:	8DPSK	Test channel:	Middle



Test mode:	8DPSK	Test channel:	Highest



6.4 20dB Occupy Bandwidth

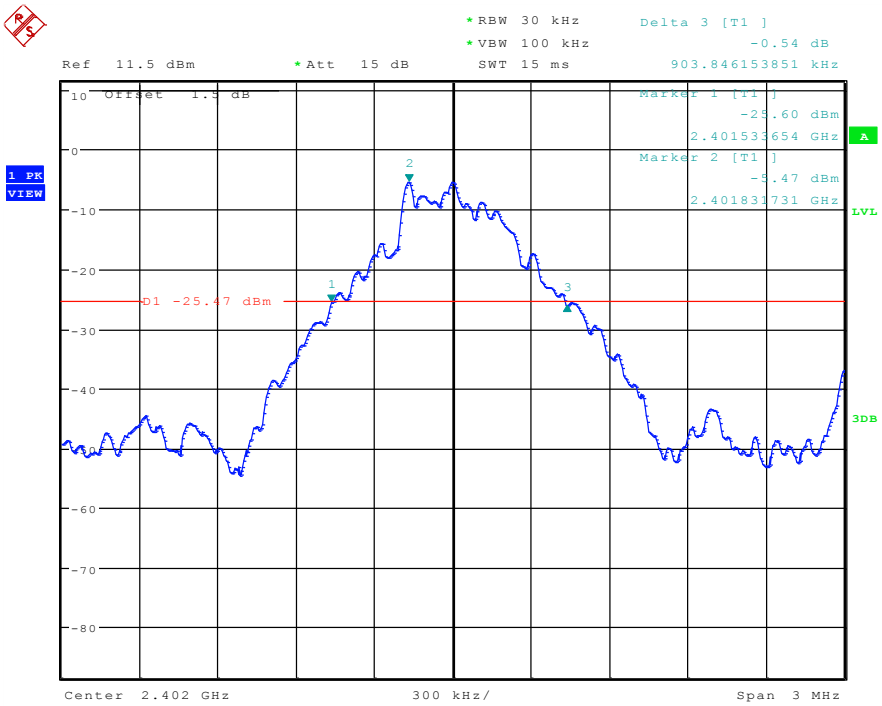
Test Requirement:	47 CFR Part 15C Section 15.247 (a)(1)
Test Method:	ANSI C63.10:2013
Test Setup:	
Limit:	NA
Exploratory Test Mode:	Non-hopping transmitting with all kind of modulation and all kind of data type
Final Test Mode:	Through Pre-scan, find the DH1 of data type is the worst case of GFSK modulation type, 2-DH1 of data type is the worst case of π/4DQPSK modulation type, 3-DH1 of data type is the worst case of 8DPSK modulation type.
Instruments Used:	Refer to section 5.10 for details
Test Results:	Pass

Measurement Data

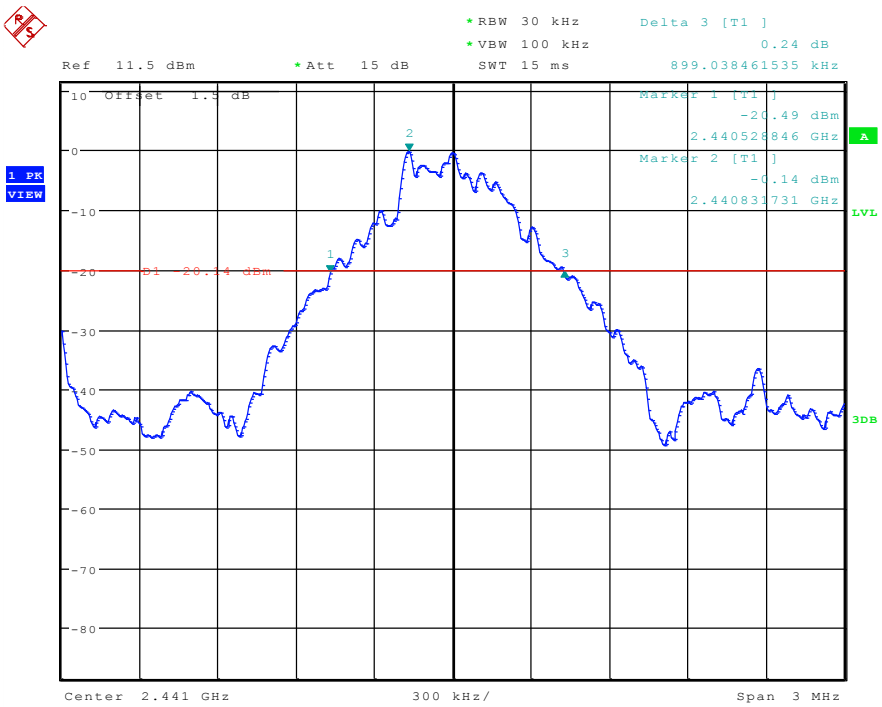
Test channel	20dB Occupy Bandwidth (kHz)		
	GFSK	π/4DQPSK	8DPSK
Lowest	903.85	1206.73	1211.54
Middle	899.04	1221.15	1221.15
Highest	903.85	1225.96	1230.77

Test plot as follows:

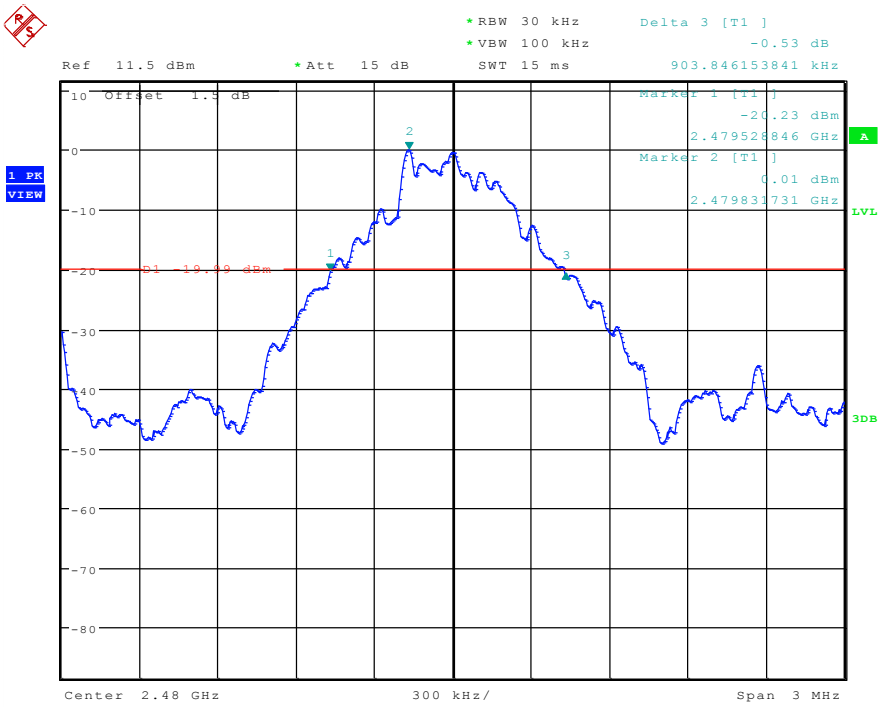
Test mode:	GFSK	Test channel:	Lowest



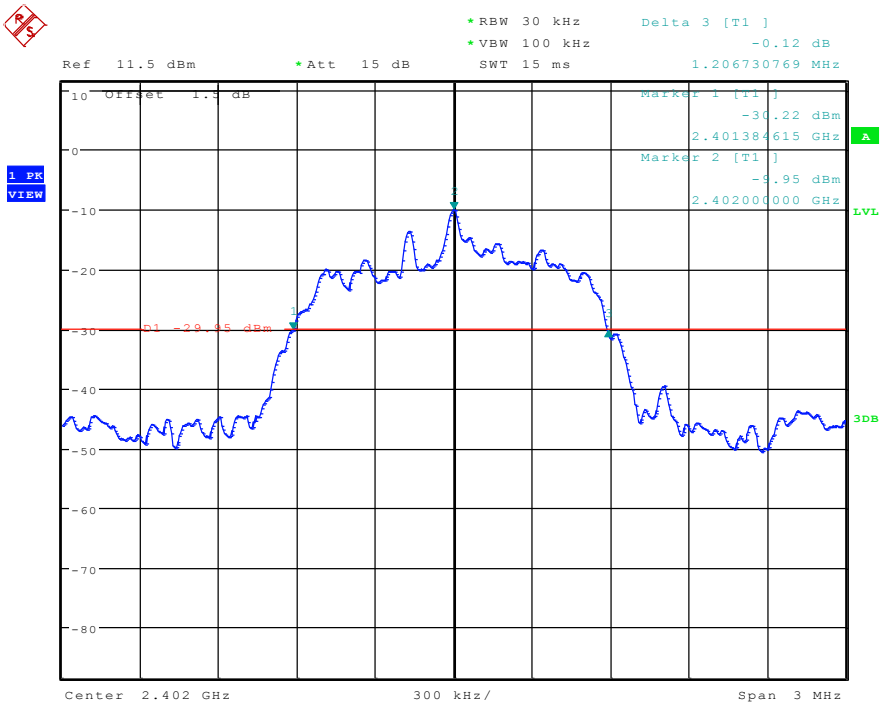
Test mode:	GFSK	Test channel:	Middle



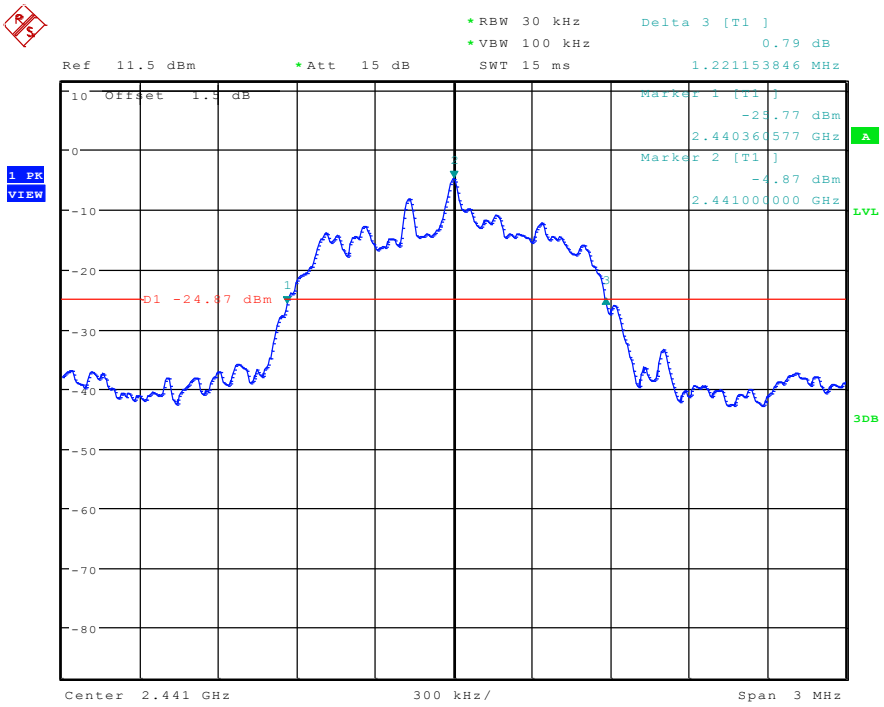
Test mode:	GFSK	Test channel:	Highest



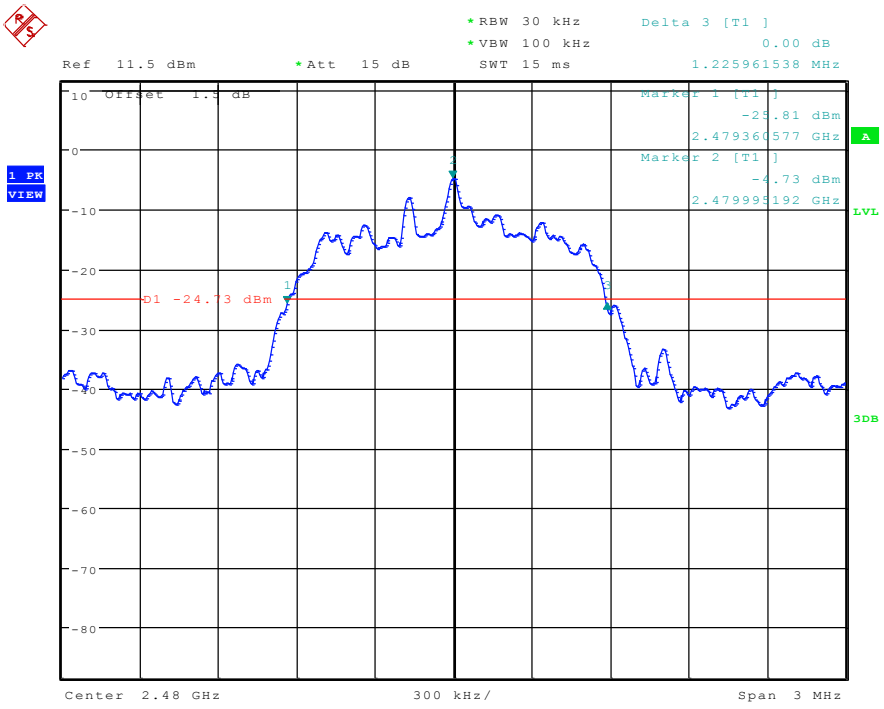
Test mode:	π/4DQPSK	Test channel:	Lowest



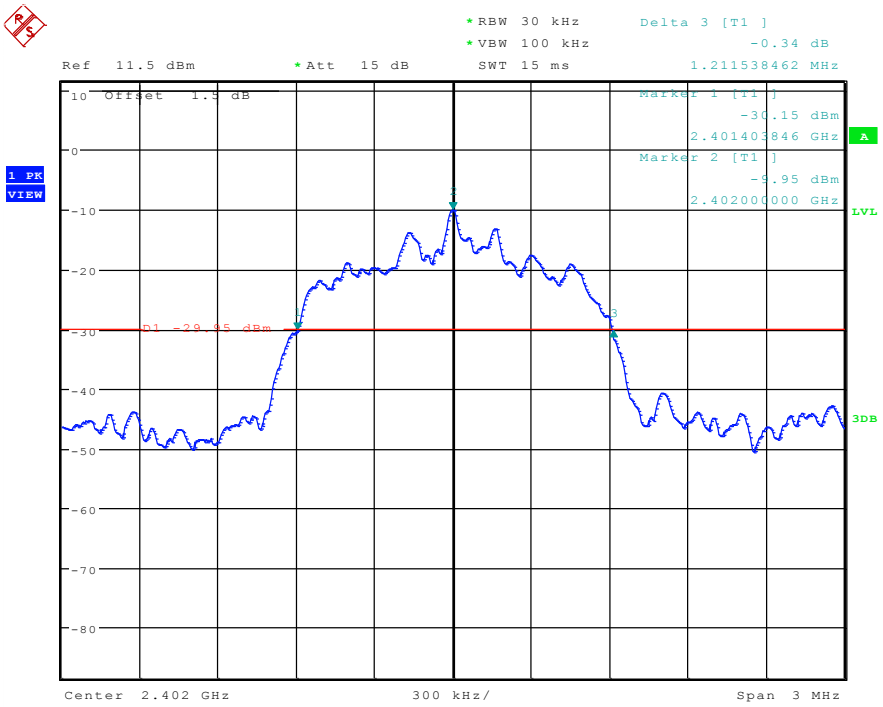
Test mode:	π/4DQPSK	Test channel:	Middle



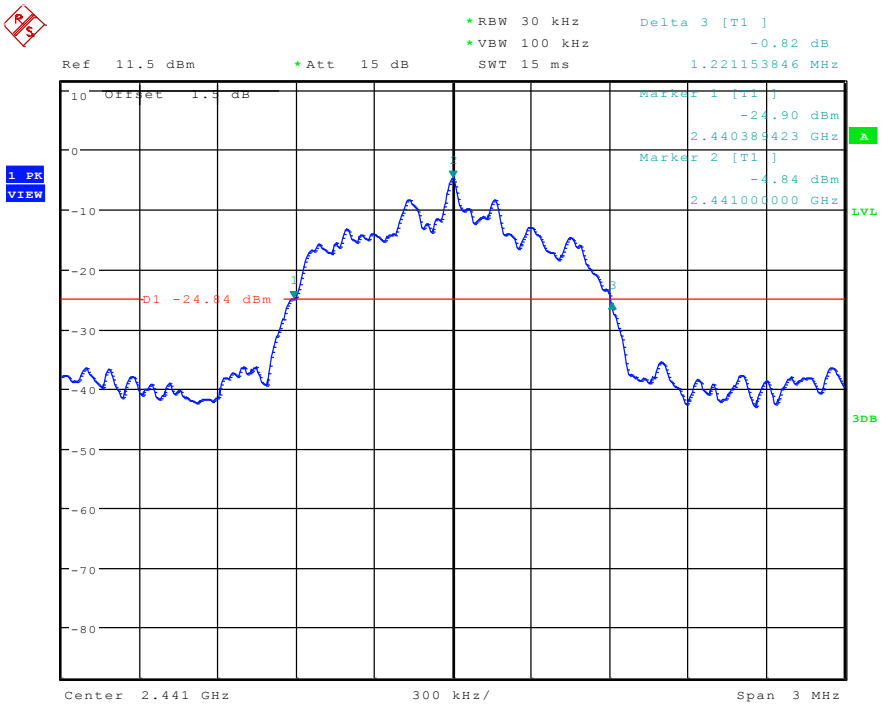
Test mode:	π/4DQPSK	Test channel:	Highest



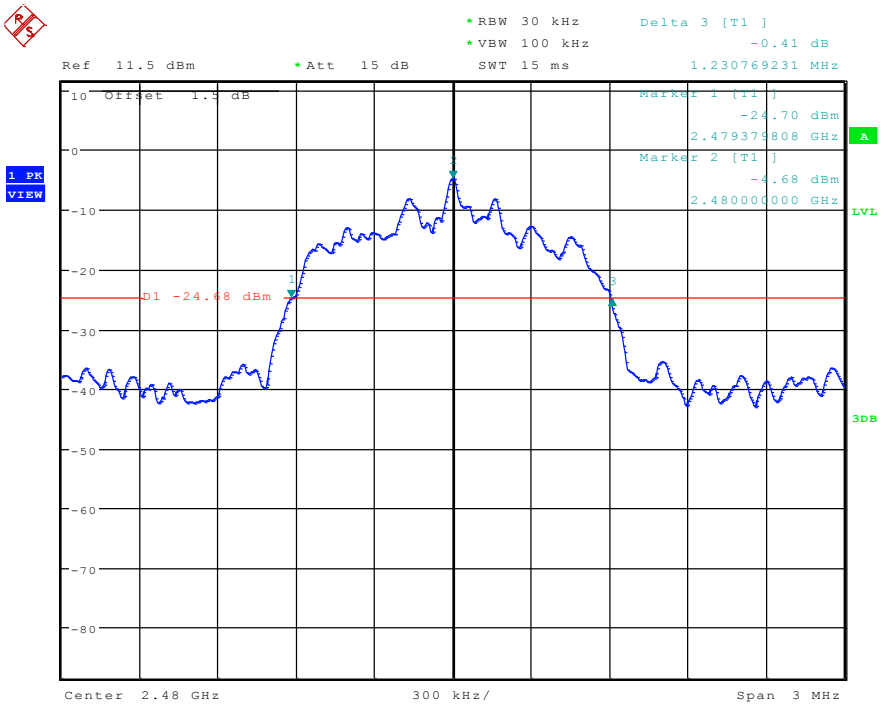
Test mode:	8DPSK	Test channel:	Lowest



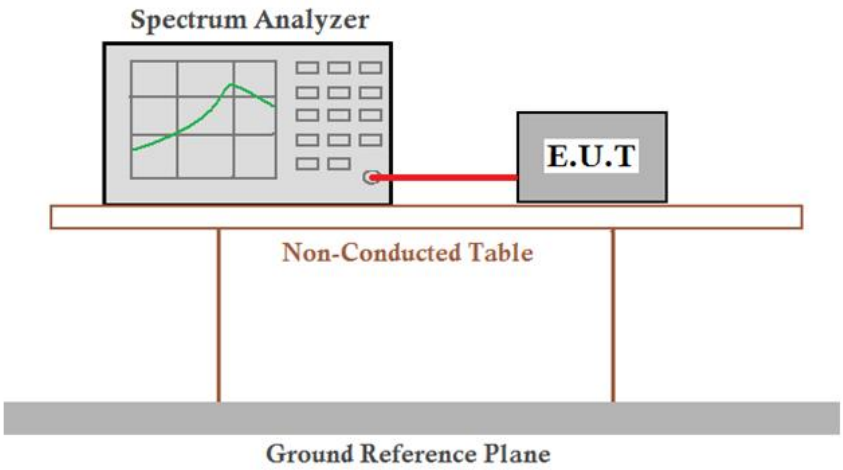
Test mode:	8DPSK	Test channel:	Middle



Test mode:	8DPSK	Test channel:	Highest



6.5 Carrier Frequencies Separation

Test Requirement:	47 CFR Part 15C Section 15.247 (a)(1)
Test Method:	ANSI C63.10:2013
Test Setup:	
Limit:	2/3 of the 20dB bandwidth
	Remark: the transmission power is less than 0.125W.
Exploratory Test Mode:	Hopping transmitting with all kind of modulation and all kind of data type
Final Test Mode:	Through Pre-scan, find the DH1 of data type is the worst case of GFSK modulation type, 2-DH1 of data type is the worst case of π/4DQPSK modulation type, 3-DH1 of data type is the worst case of 8DPSK modulation type.
Instruments Used:	Refer to section 5.10 for details
Test Results:	Pass

Measurement Data

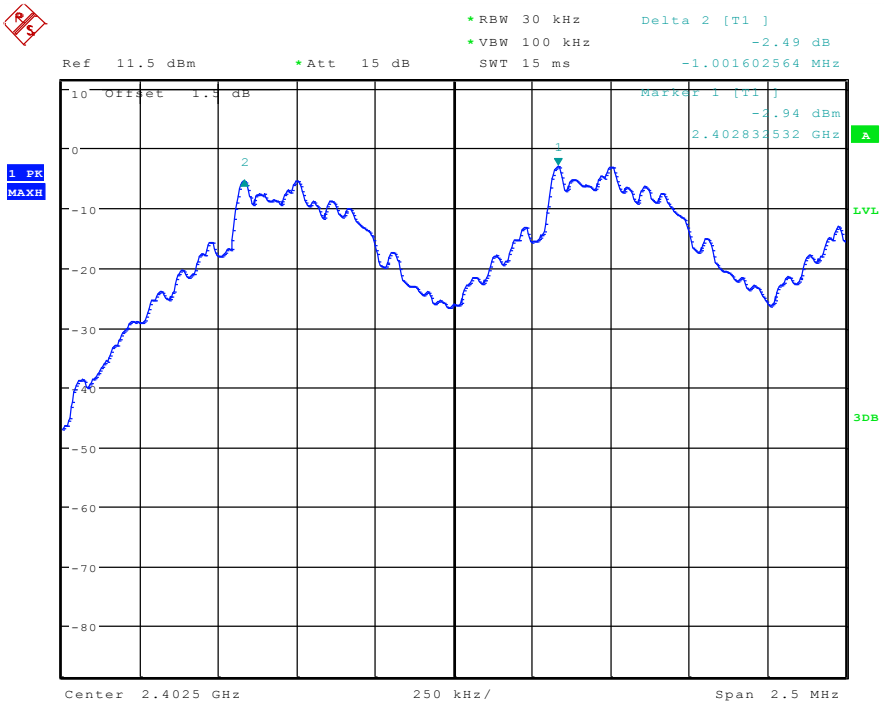
GFSK mode			
Test channel	Carrier Frequencies Separation (kHz)	Limit (kHz)	Result
Lowest	1001.6	≥602.57	Pass
Middle	1001.6	≥602.57	Pass
Highest	1001.6	≥602.57	Pass
π/4DQPSK mode			
Test channel	Carrier Frequencies Separation (kHz)	Limit (kHz)	Result
Lowest	1001.6	≥817.31	Pass
Middle	1001.6	≥817.31	Pass
Highest	1001.6	≥817.31	Pass
8DPSK mode			
Test channel	Carrier Frequencies Separation (kHz)	Limit (kHz)	Result
Lowest	1001.6	≥820.51	Pass
Middle	1001.6	≥820.51	Pass
Highest	1005.6	≥820.51	Pass

Note: According to section 6.4,

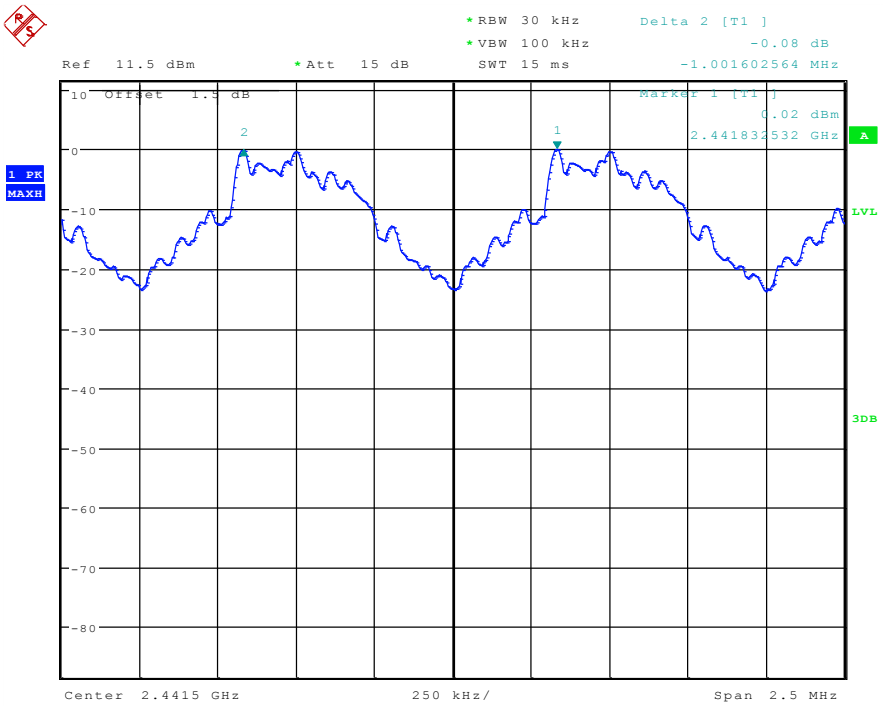
Mode	20dB bandwidth (kHz) (worse case)	Limit (kHz) (Carrier Frequencies Separation)
GFSK	903.85	602.57
π/4DQPSK	1225.96	817.31
8DPSK	1230.77	820.51

Test plot as follows:

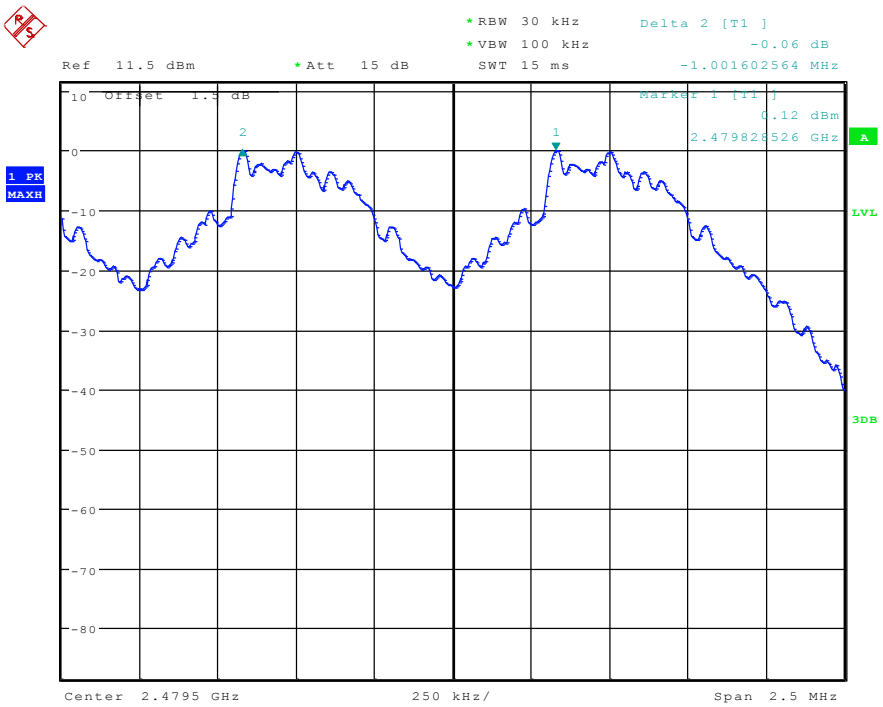
Test mode:	GFSK	Test channel:	Lowest



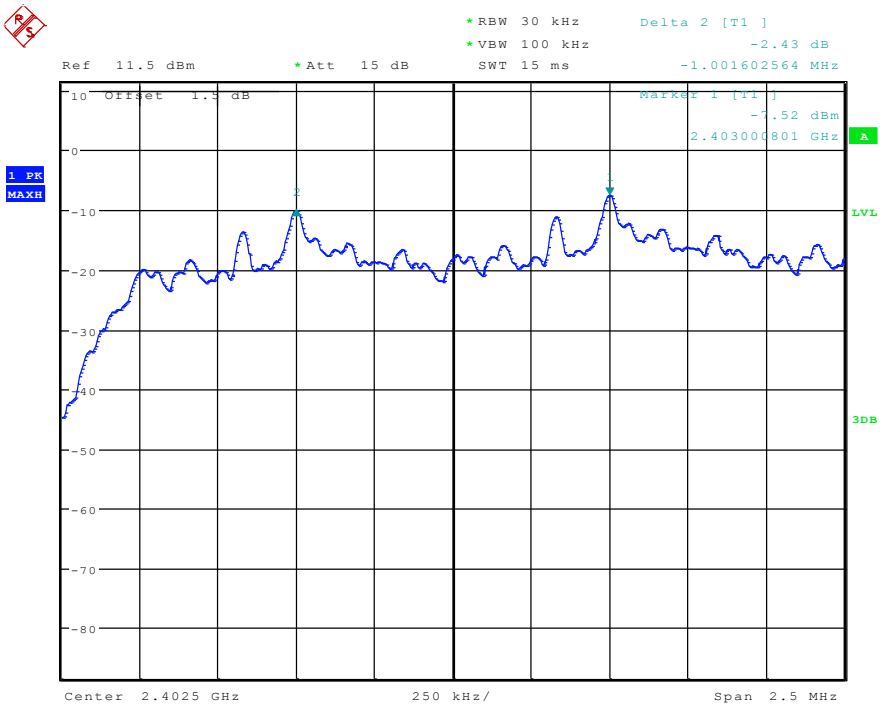
Test mode:	GFSK	Test channel:	Middle



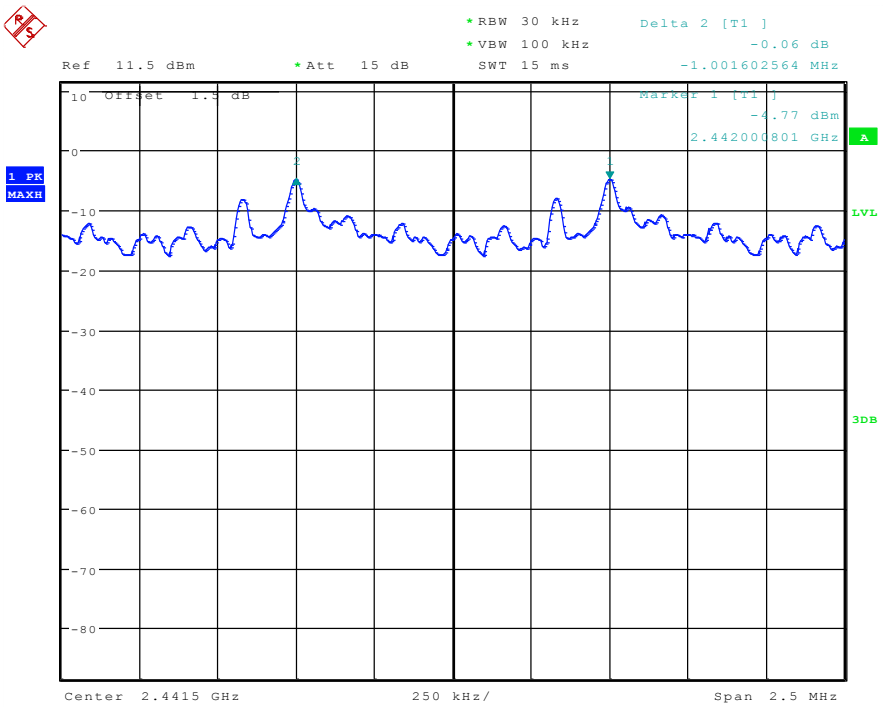
Test mode:	GFSK	Test channel:	Highest



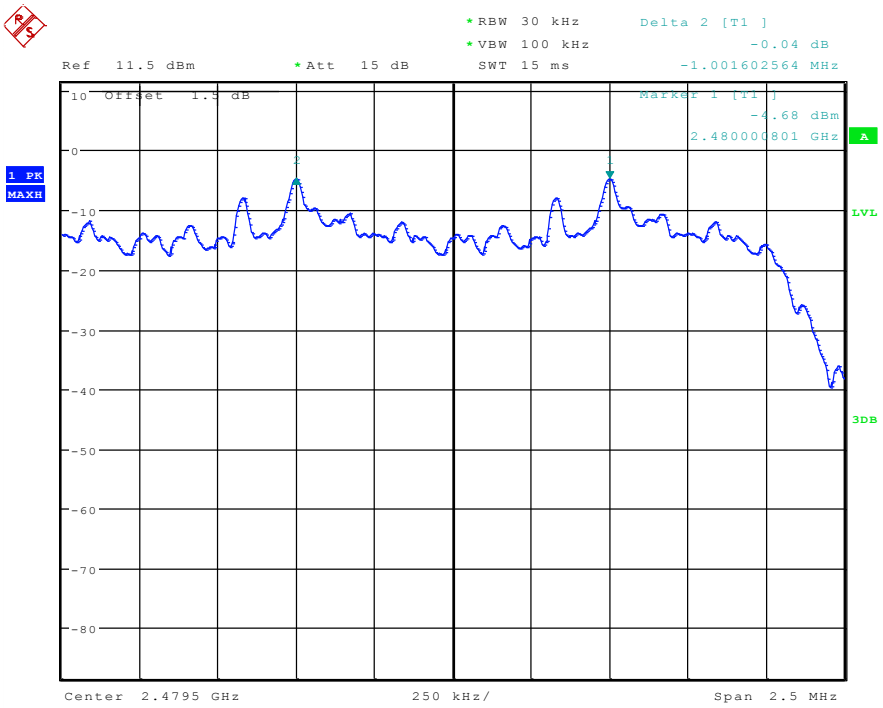
Test mode:	π/4DQPSK	Test channel:	Lowest



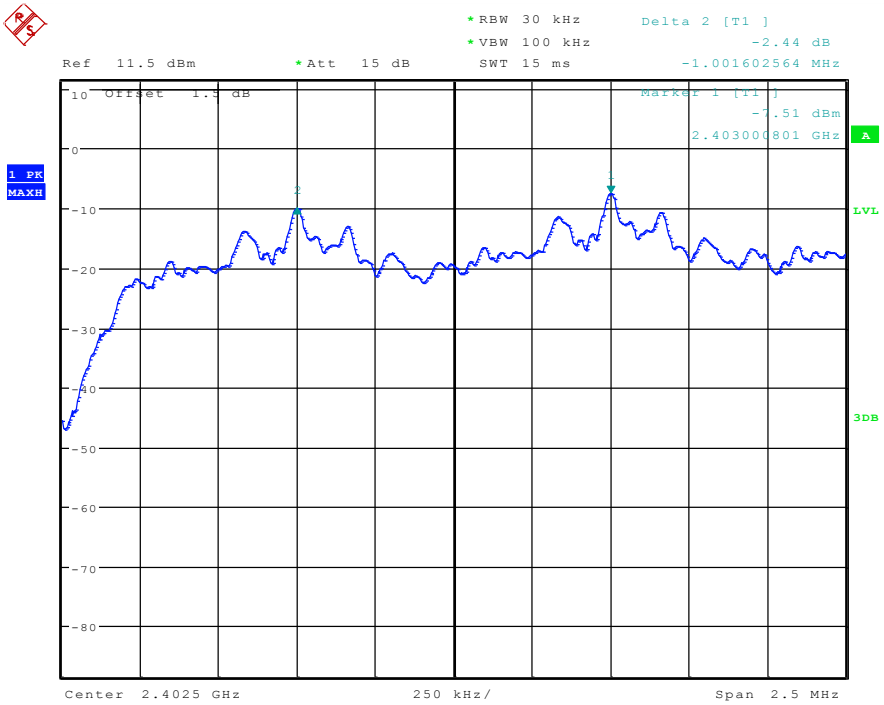
Test mode:	π/4DQPSK	Test channel:	Middle



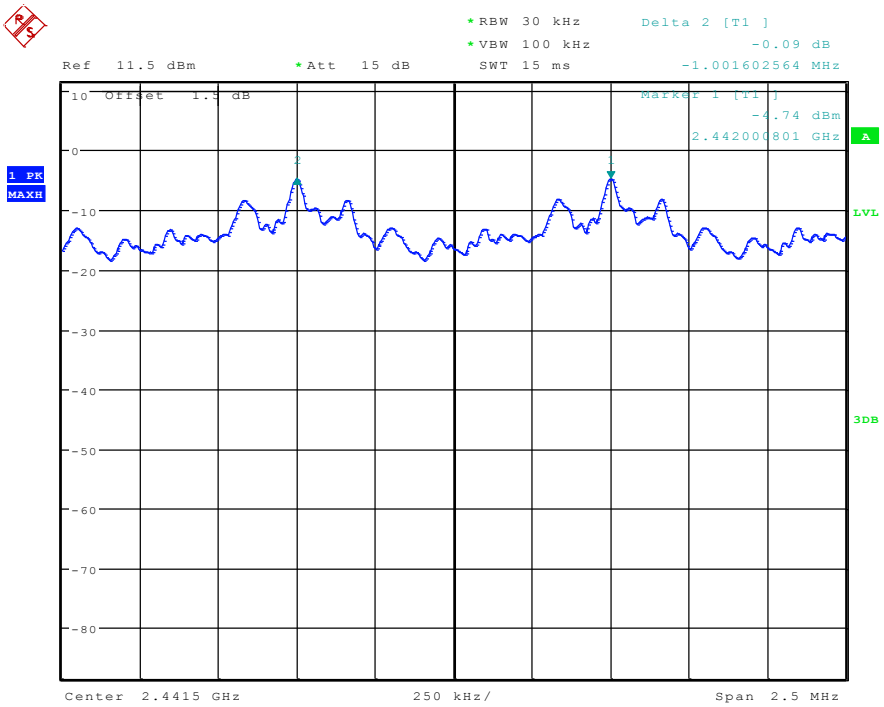
Test mode:	π/4DQPSK	Test channel:	Highest



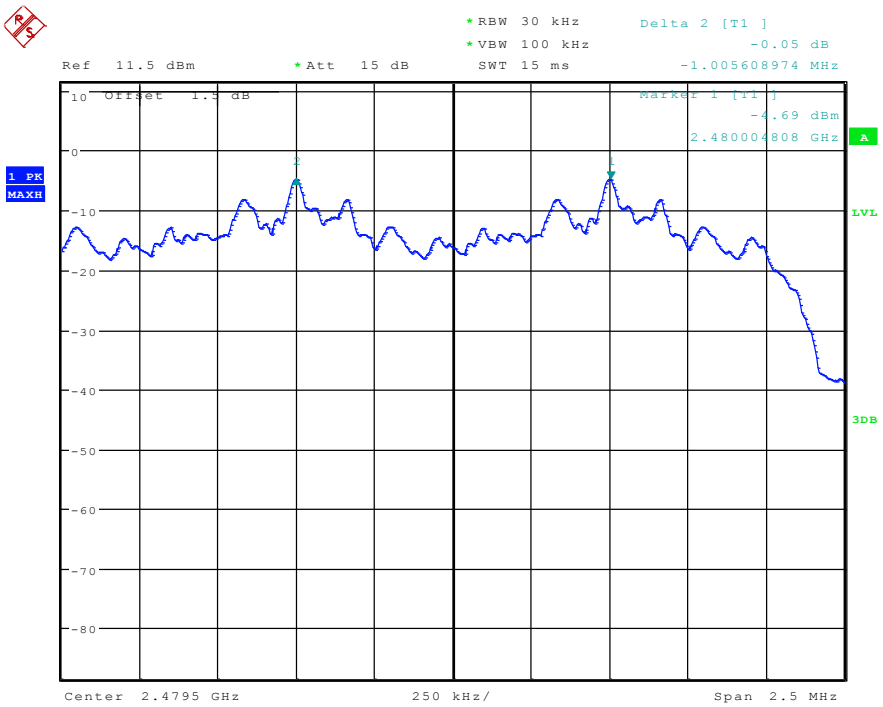
Test mode:	8DPSK	Test channel:	Lowest



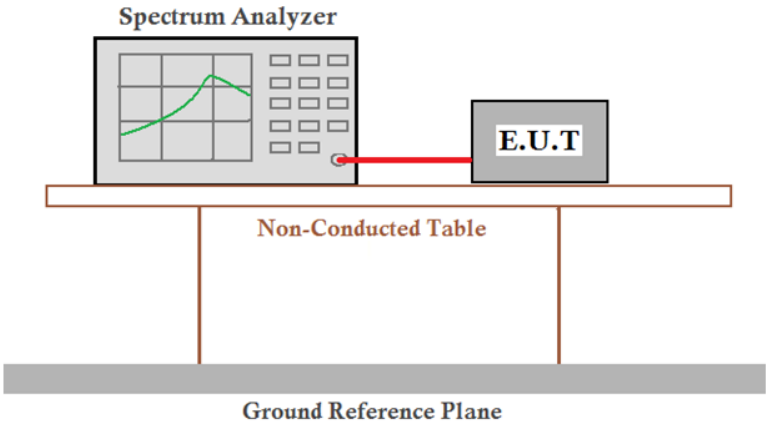
Test mode:	8DPSK	Test channel:	Middle



Test mode:	8DPSK	Test channel:	Highest



6.6 Hopping Channel Number

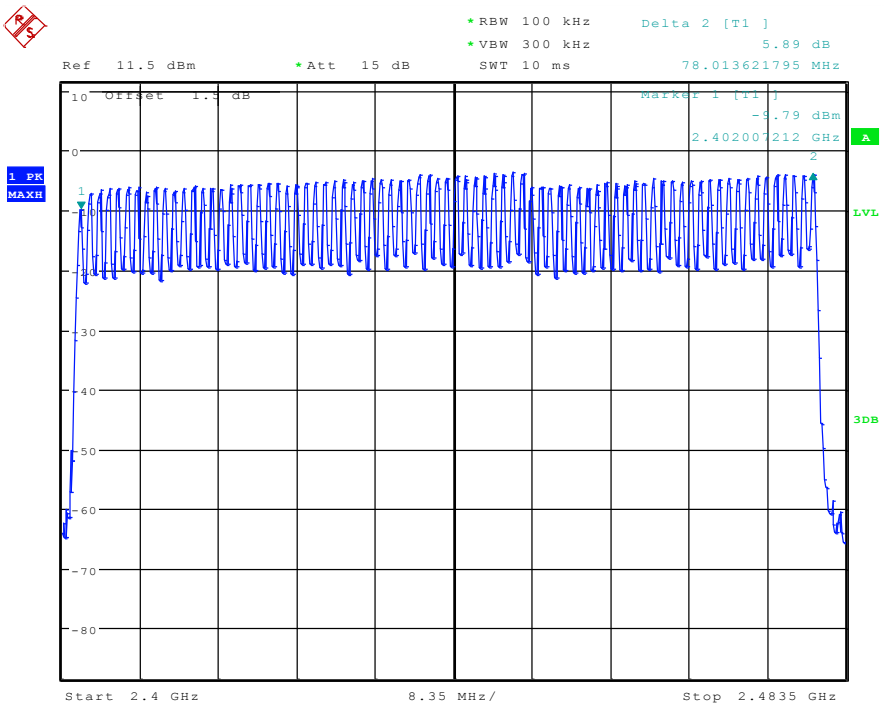
Test Requirement:	47 CFR Part 15C Section 15.247 (a)(1)
Test Method:	ANSI C63.10:2013
Test Setup:	
Limit:	At least 15 channels
Test Mode:	Hopping transmitting with all kind of modulation
Instruments Used:	Refer to section 5.10 for details
Test Results:	Pass

Measurement Data

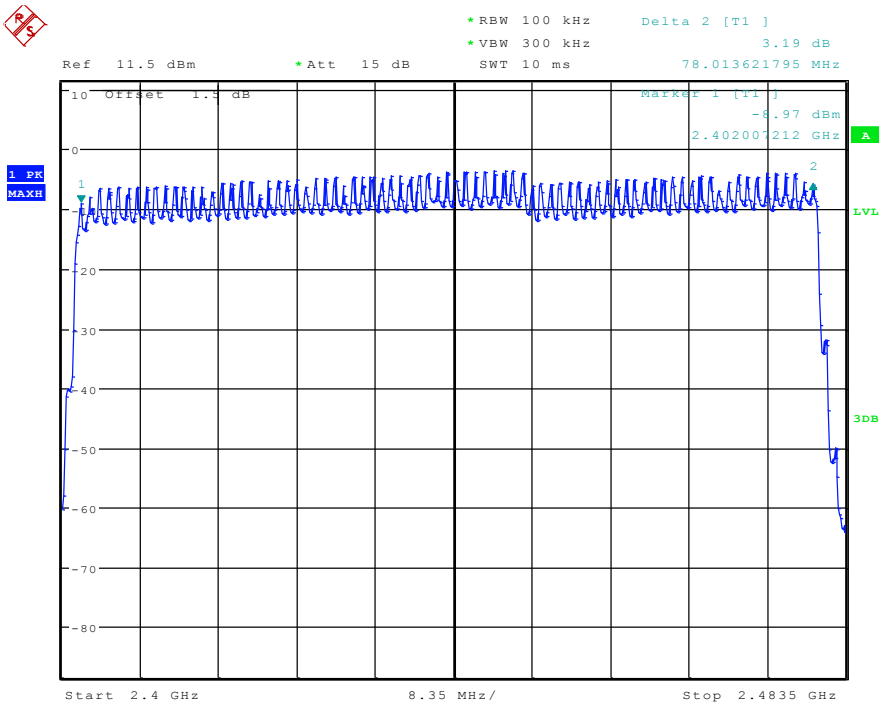
Mode	Hopping channel numbers	Limit
GFSK	79	≥15
π/4DQPSK	79	≥15
8DPSK	79	≥15

Test plot as follows:

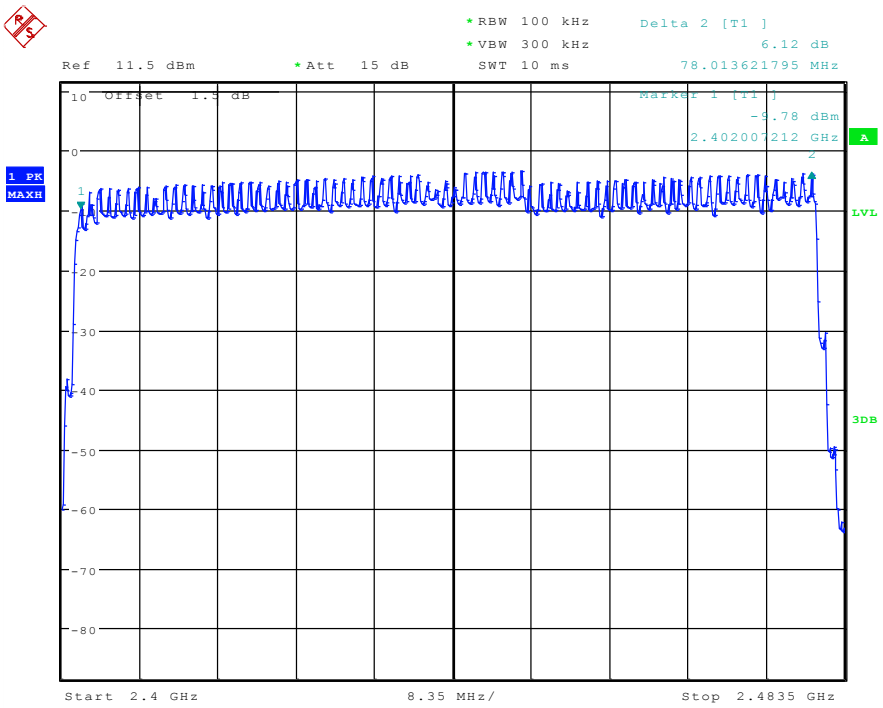
Test mode:	GFSK



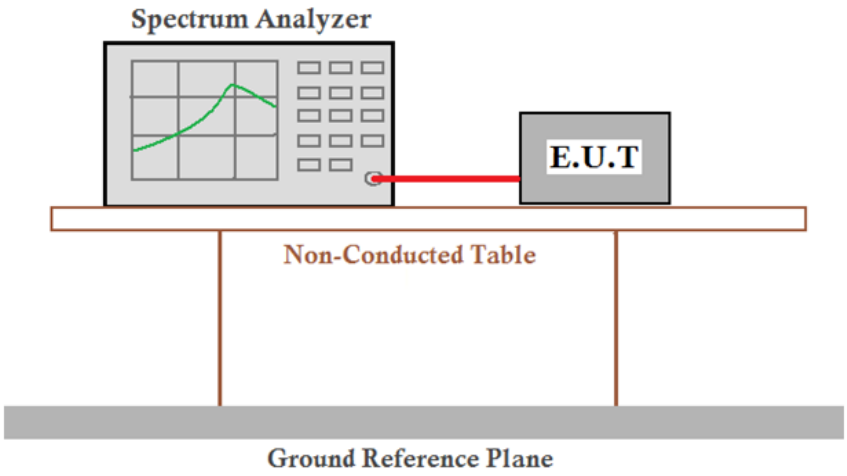
Test mode:	π/4DQPSK



Test mode:	8DPSK



6.7 Dwell Time

Test Requirement:	47 CFR Part 15C Section 15.247 (a)(1)
Test Method:	ANSI C63.10:2013
Test Setup:	
Instruments Used:	Refer to section 5.10 for details
Test Mode:	Hopping transmitting with all kind of modulation and all kind of data type.
Limit:	0.4 Second
Test Results:	Pass

Measurement Data

Mode	Packet	Dwell time (second)	Limit (second)
GFSK	DH1	0.123	≤0.4
	DH3	0.263	≤0.4
	DH5	0.307	≤0.4
π/4DQPSK	2-DH1	0.128	≤0.4
	2-DH3	0.264	≤0.4
	2-DH5	0.308	≤0.4
8DPSK	3-DH1	0.130	≤0.4
	3-DH3	0.264	≤0.4
	3-DH5	0.309	≤0.4

Test Result:

The test period: T= 0.4 Second/Channel x 79 Channel = 31.6 s

The lowest channel (2402MHz), middle channel (2441MHz), highest channel (2480MHz) as below

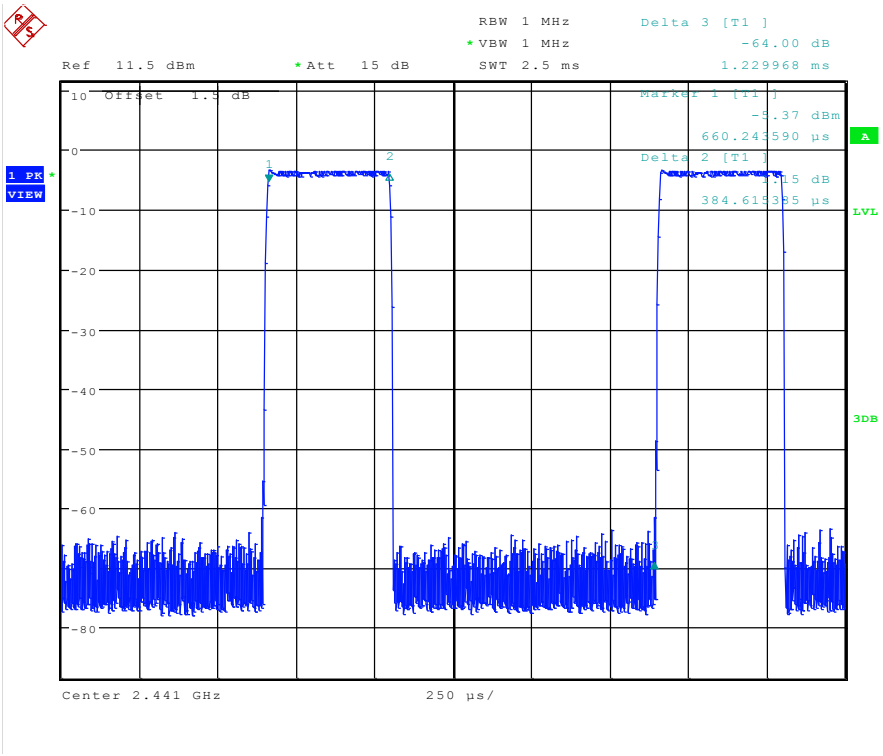
DH1 time slot=0.385(ms)*(1600/ (2*79))*31.6=123 ms

DH3 time slot=1.64(ms)*(1600/ (4*79))*31.6=263 ms

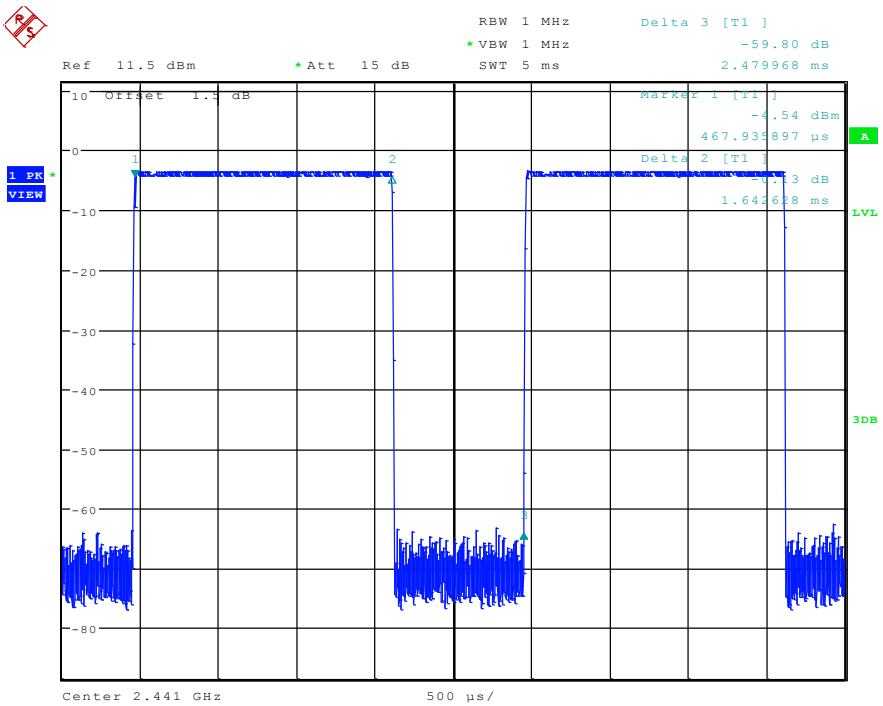
DH5 time slot=2.88(ms)*(1600/ (6*79))*31.6=307 ms

Test plot as follows:

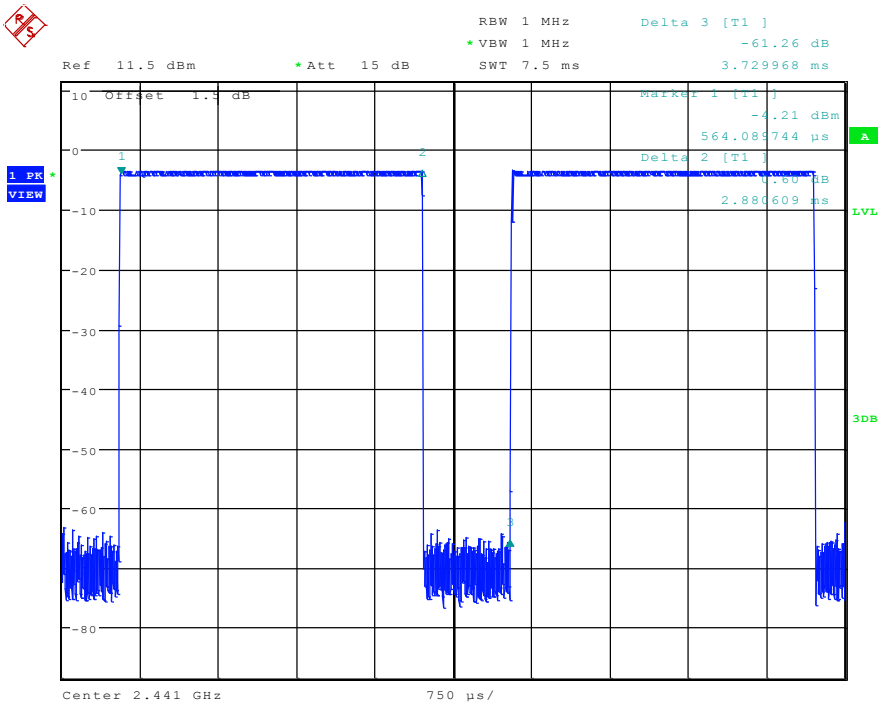
Test Packet:	DH1



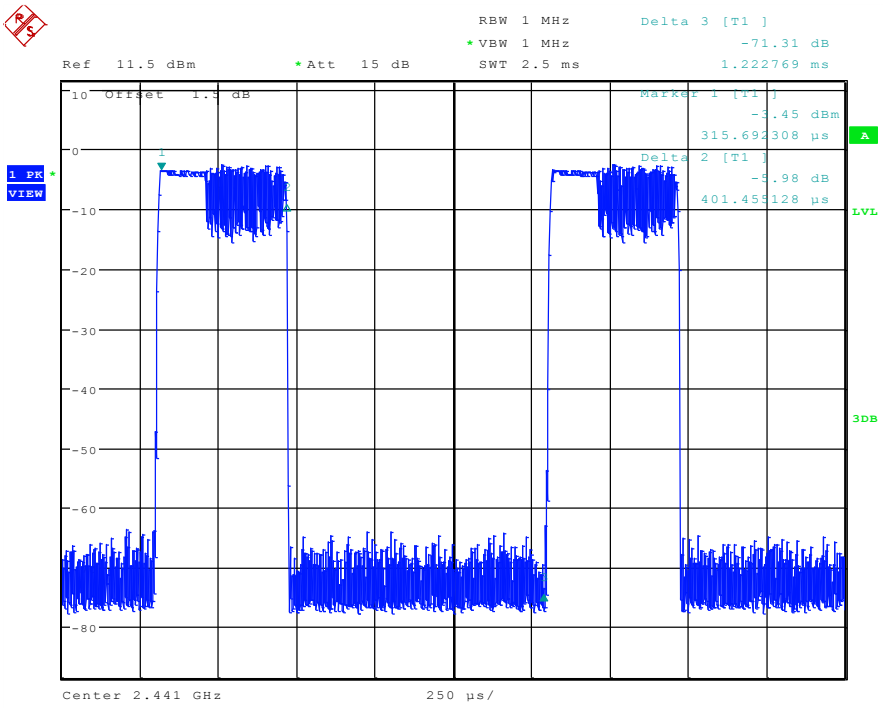
Test Packet:	DH3



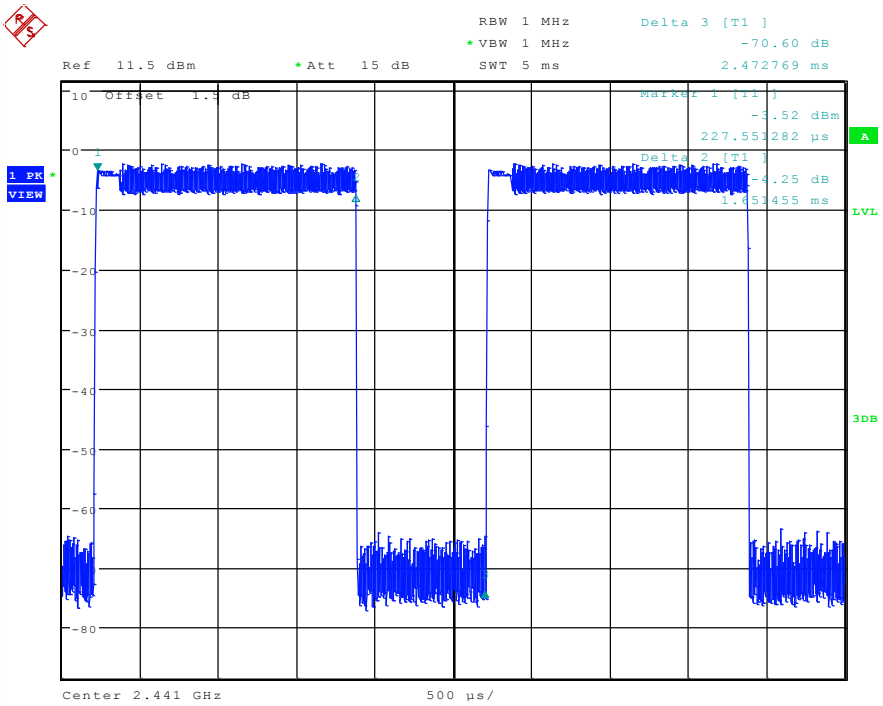
Test Packet:	DH5



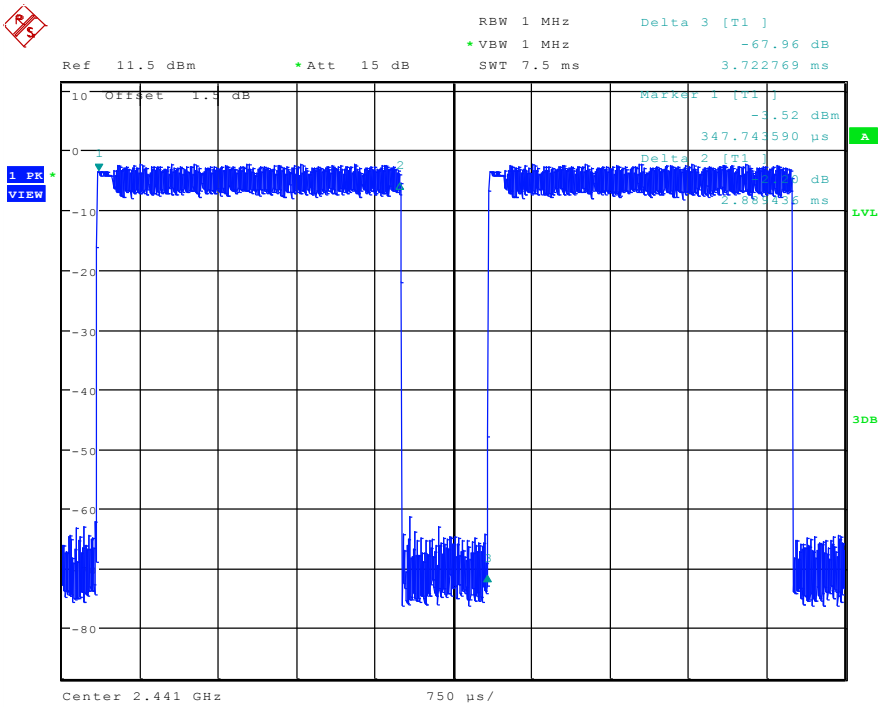
Test Packet:	2-DH1



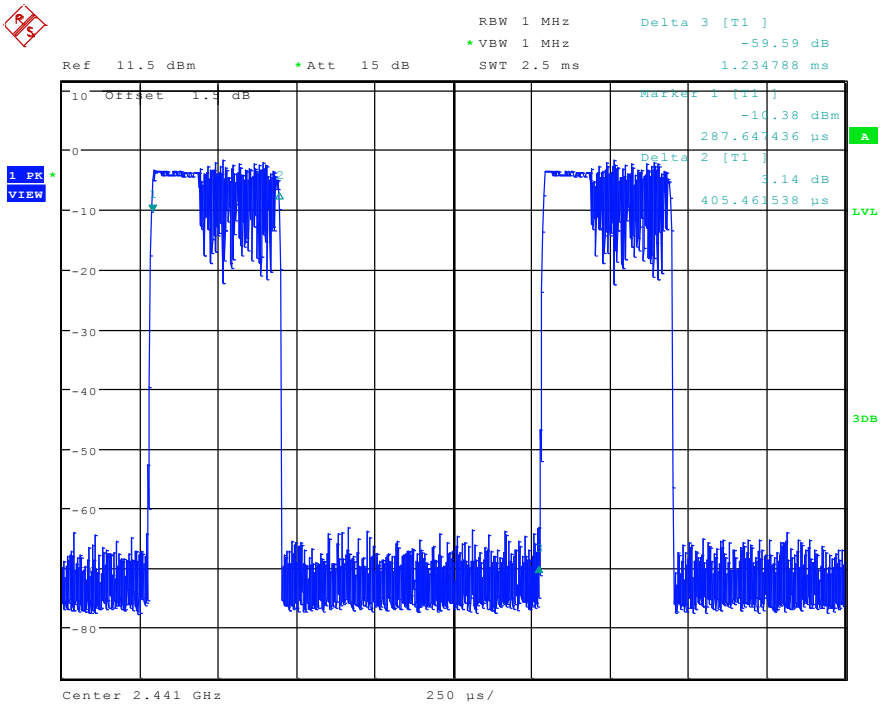
Test Packet:	2-DH3



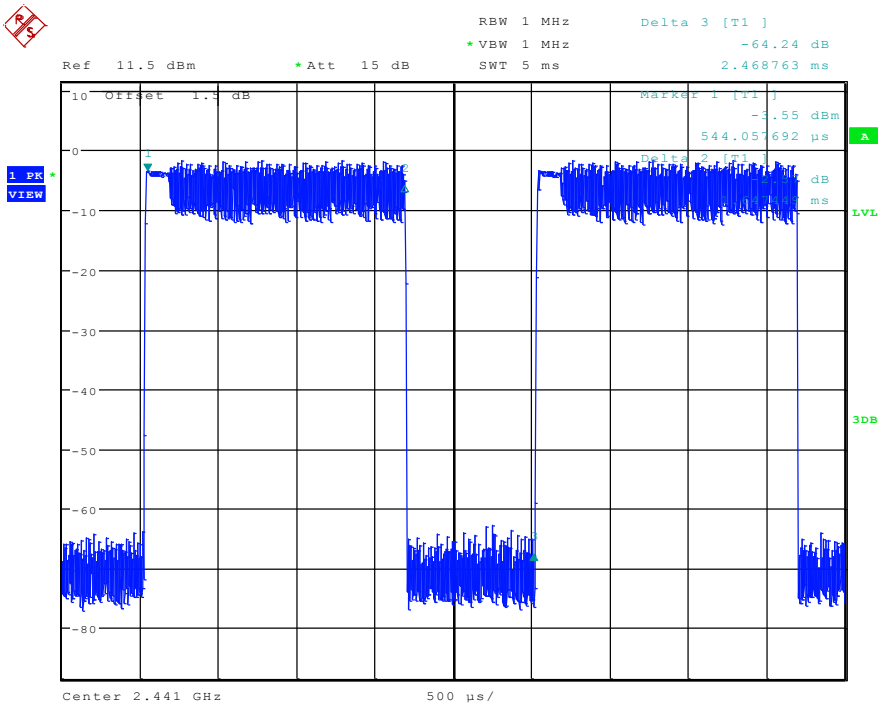
Test Packet:	2-DH5



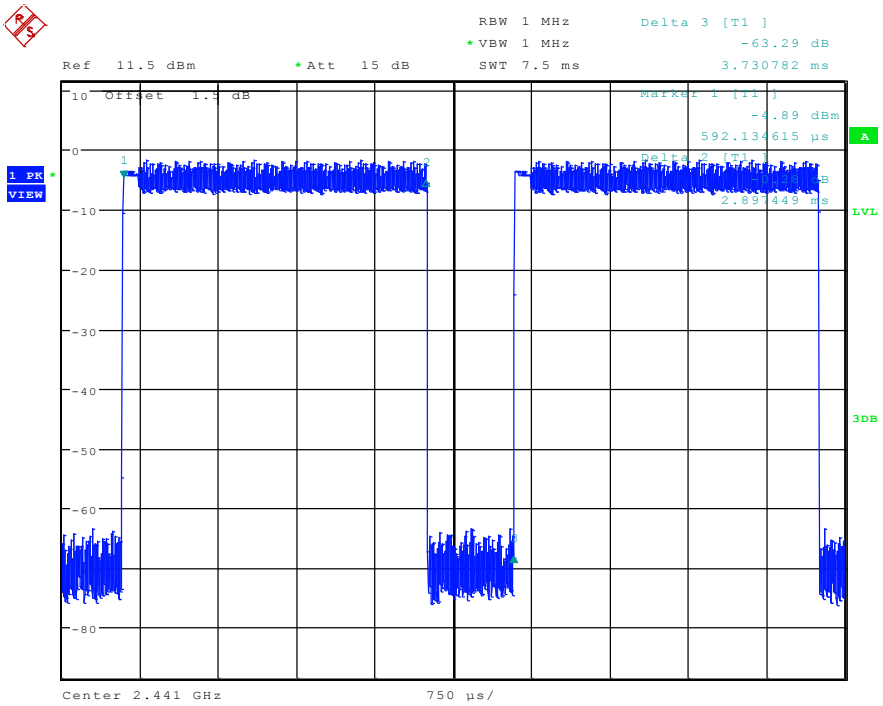
Test Packet:	3-DH1



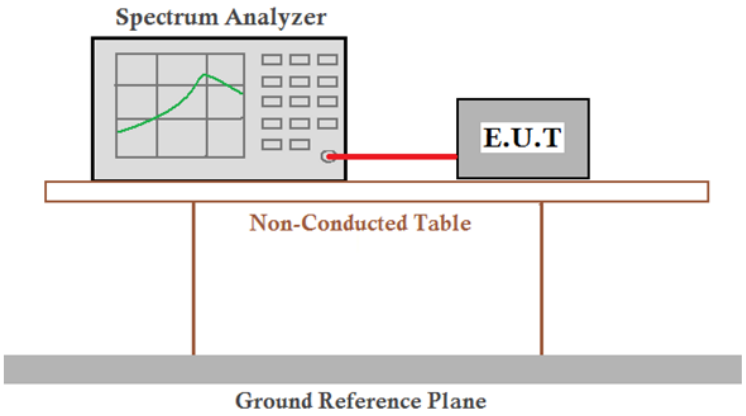
Test Packet:	3-DH3



Test Packet:	3-DH5

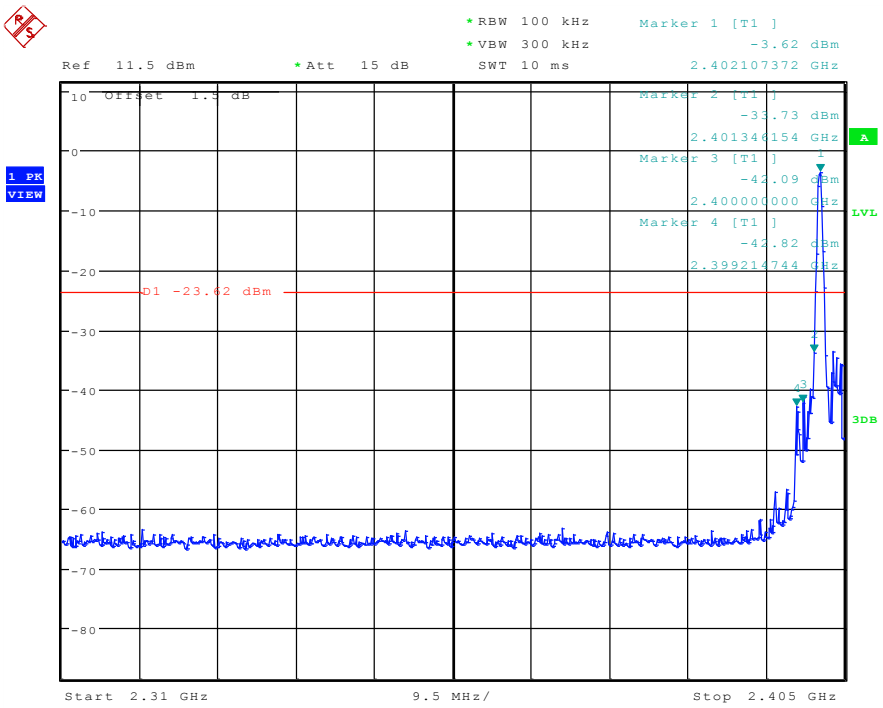


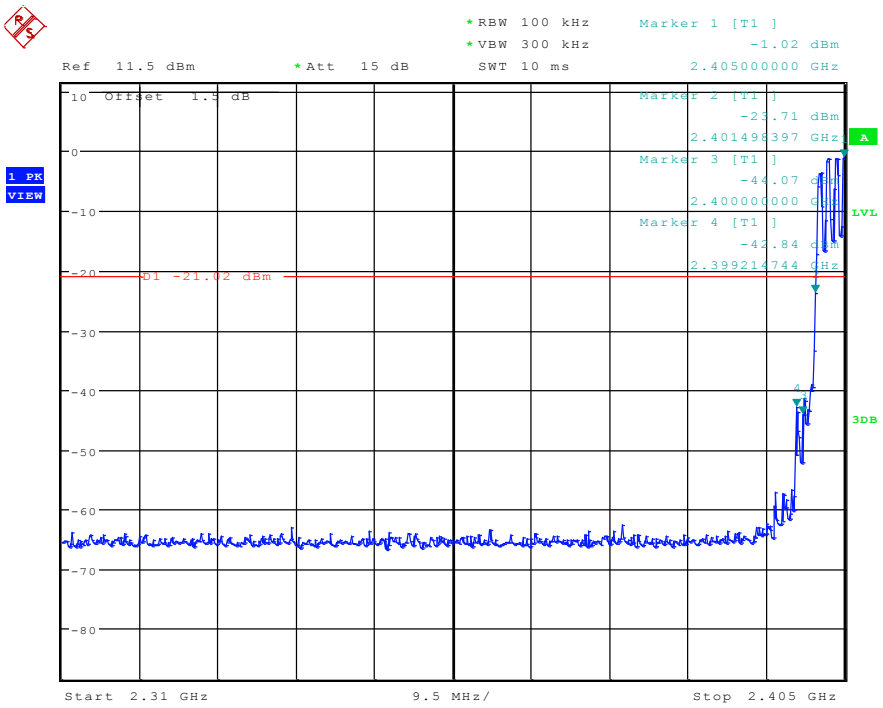
6.8 Band-edge for RF Conducted Emissions

Test Requirement:	47 CFR Part 15C Section 15.247 (d)
Test Method:	ANSI C63.10:2013
Test Setup:	 Remark: Offset the High-Frequency cable loss 1.5dB in the spectrum analyzer.
Limit:	In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.
Exploratory Test Mode:	Hopping and Non-hopping transmitting with all kind of modulation and all kind of data type
Final Test Mode:	Through Pre-scan, find the DH1 of data type is the worst case of GFSK modulation type, 2-DH1 of data type is the worst case of π/4DQPSK modulation type, 3-DH1 of data type is the worst case of 8DPSK modulation type.
Instruments Used:	Refer to section 5.10 for details
Test Results:	Pass

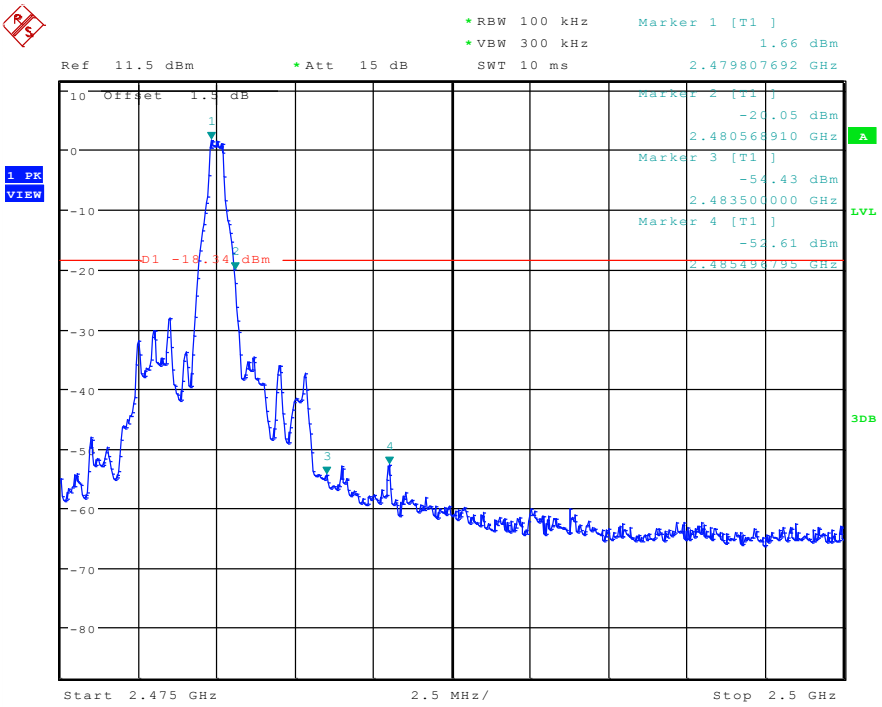
Test plot as follows:

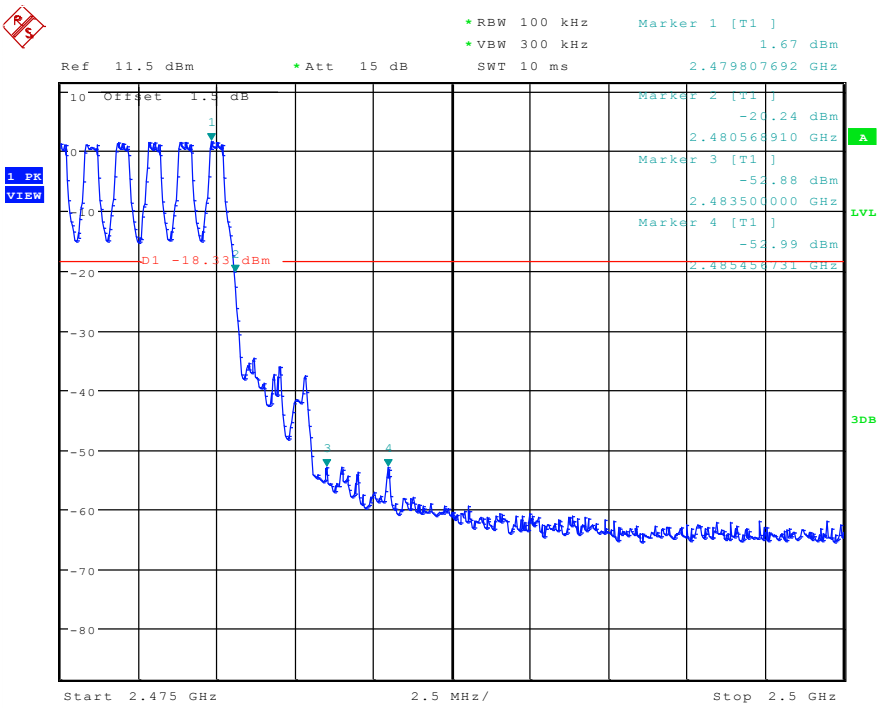
Test mode:	GFSK	Test channel:	Lowest



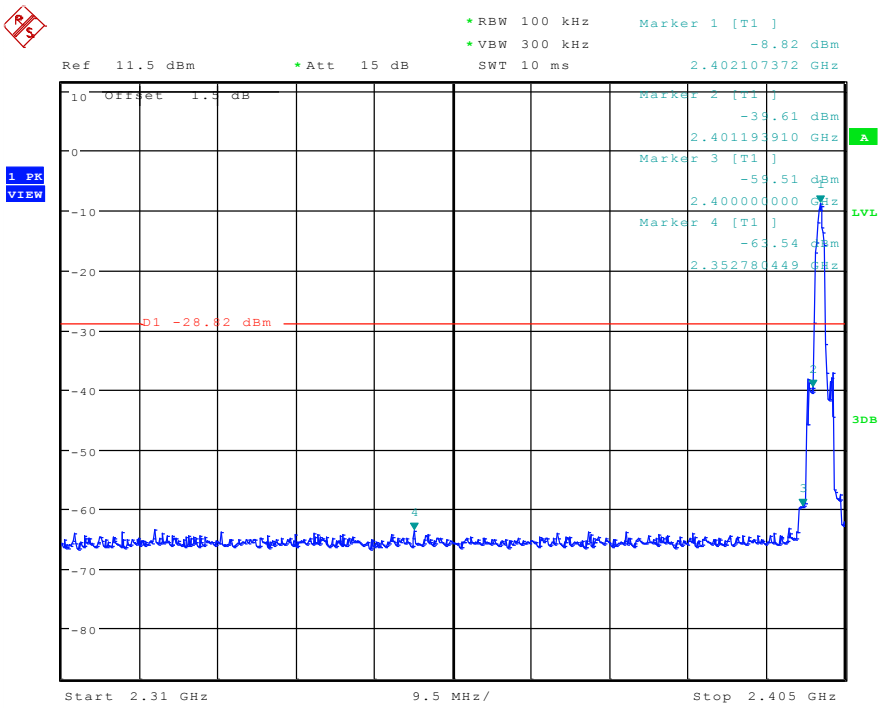


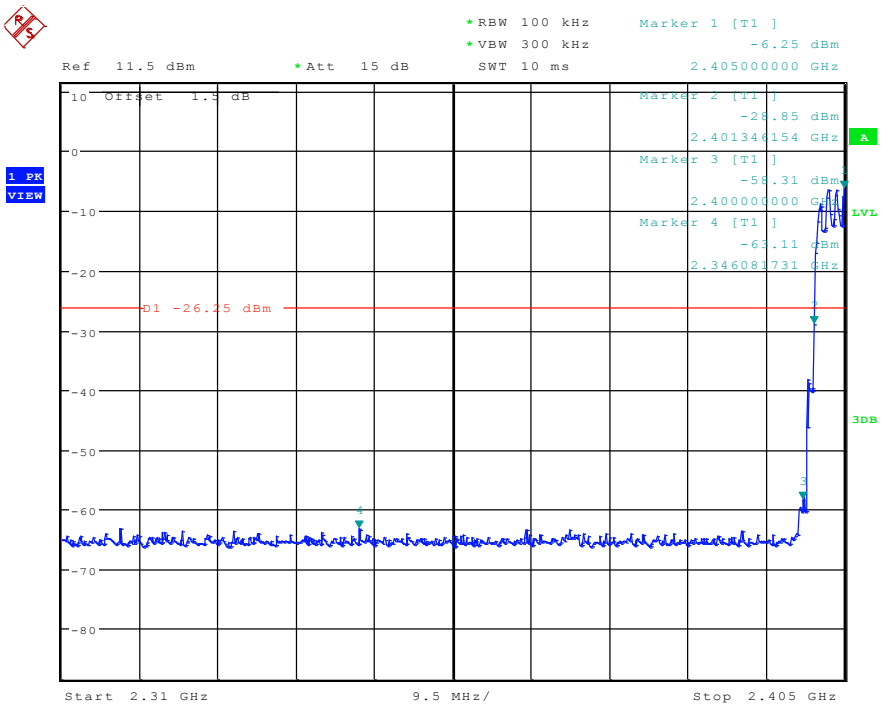
Test mode:	GFSK	Test channel:	Highest



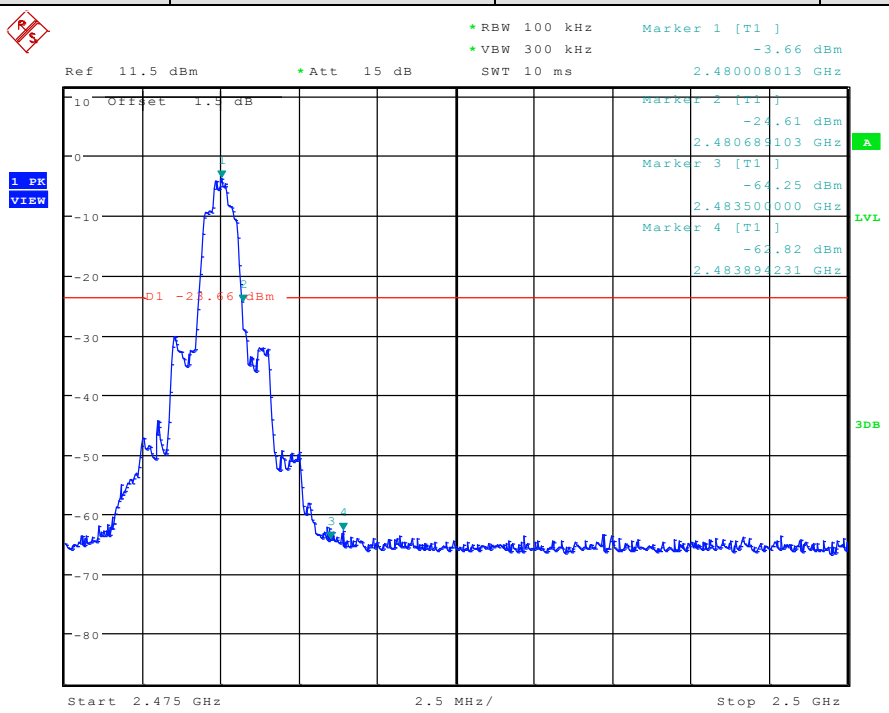


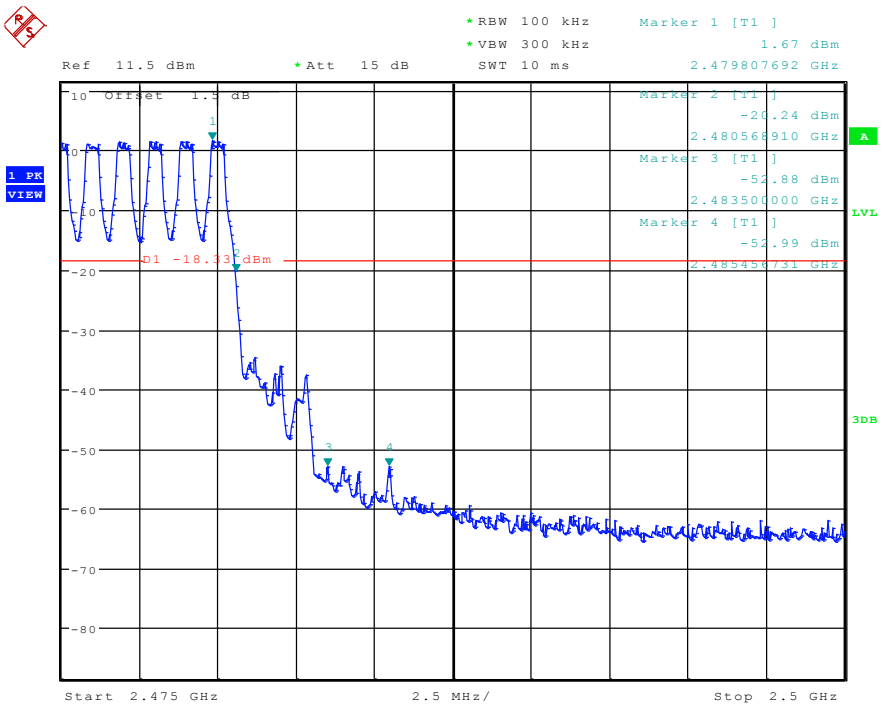
Test mode:	π/4DQPSK	Test channel:	Lowest



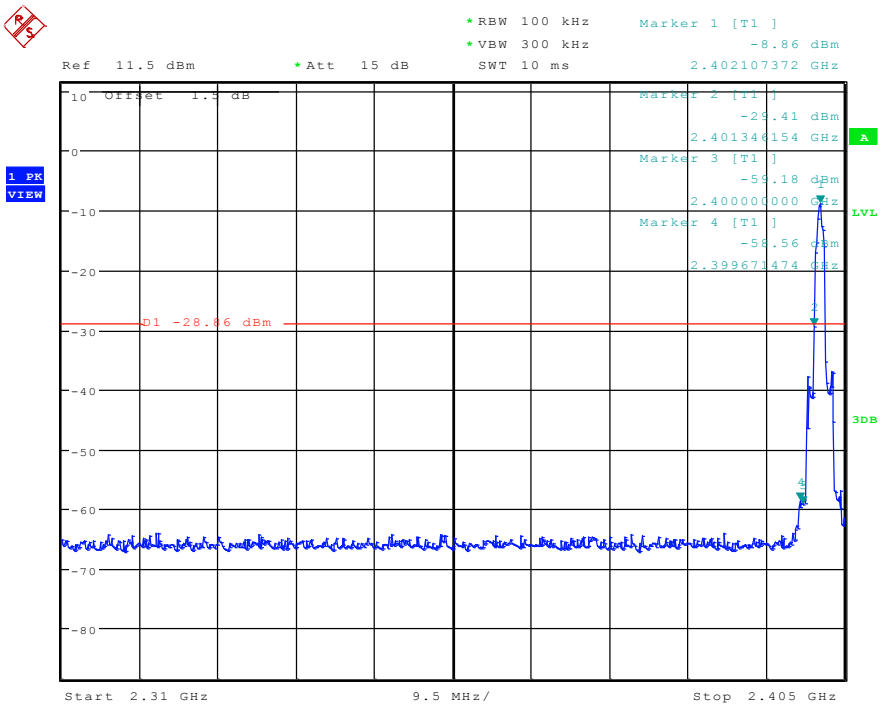


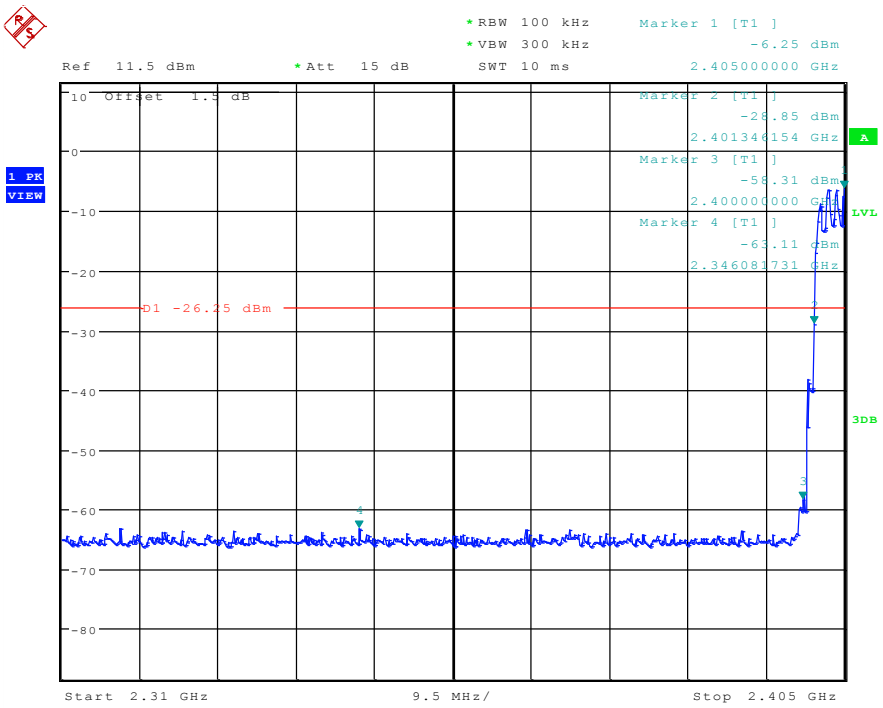
Test mode:	π/4DQPSK	Test channel:	Highest



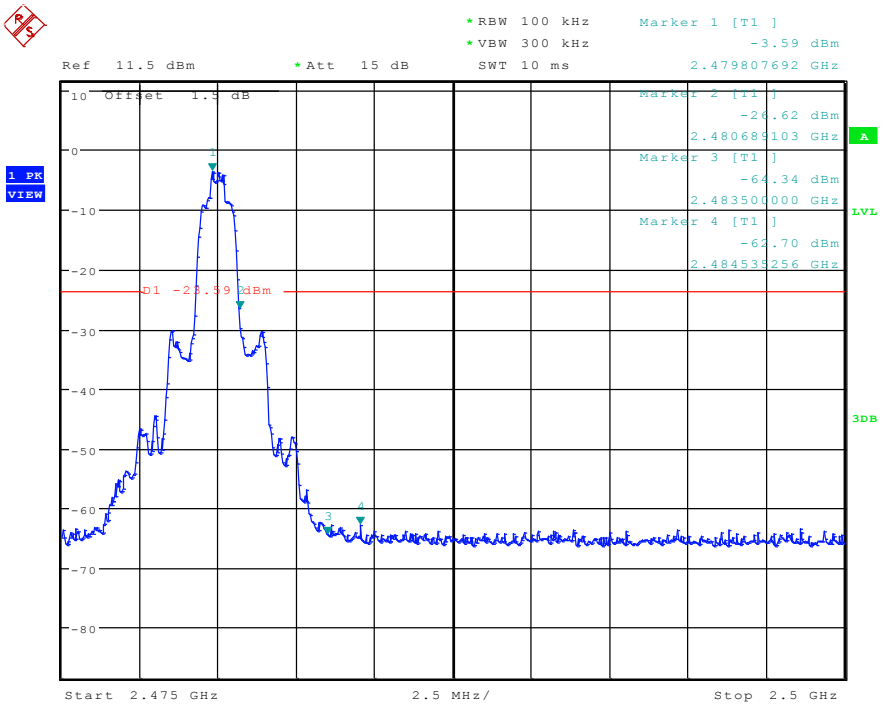


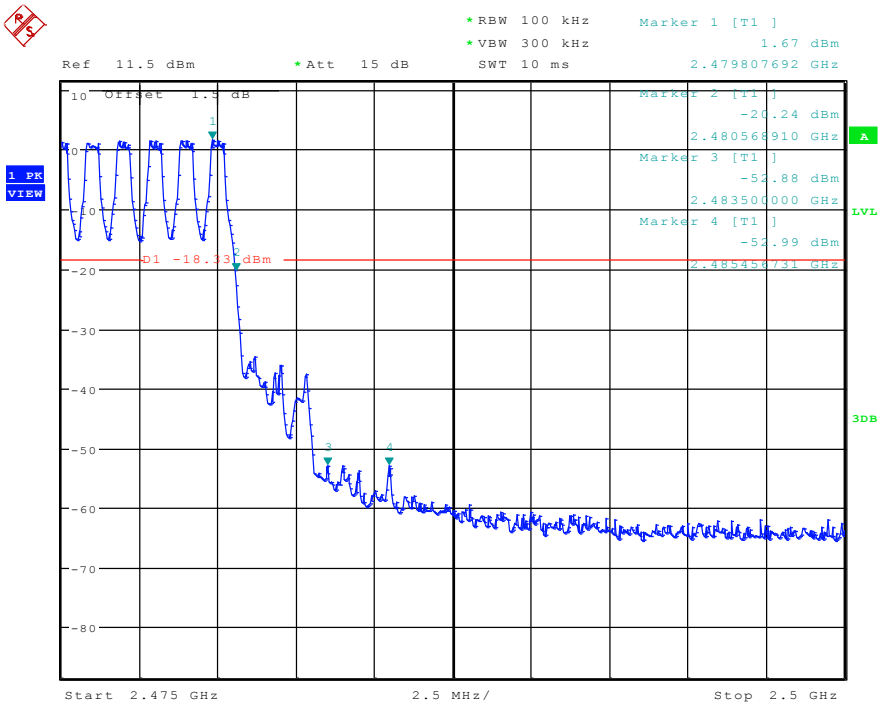
Test mode:	8DPSK	Test channel:	Lowest



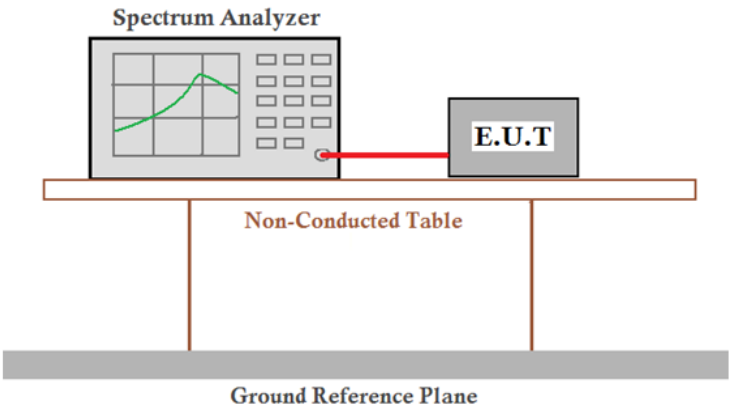


Test mode:	8DPSK	Test channel:	Highest

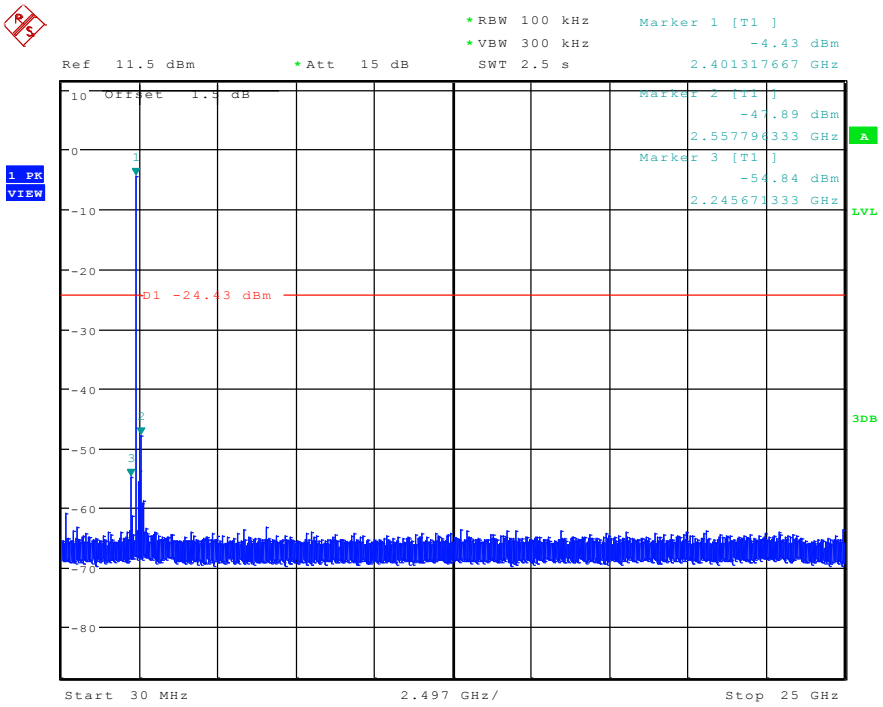


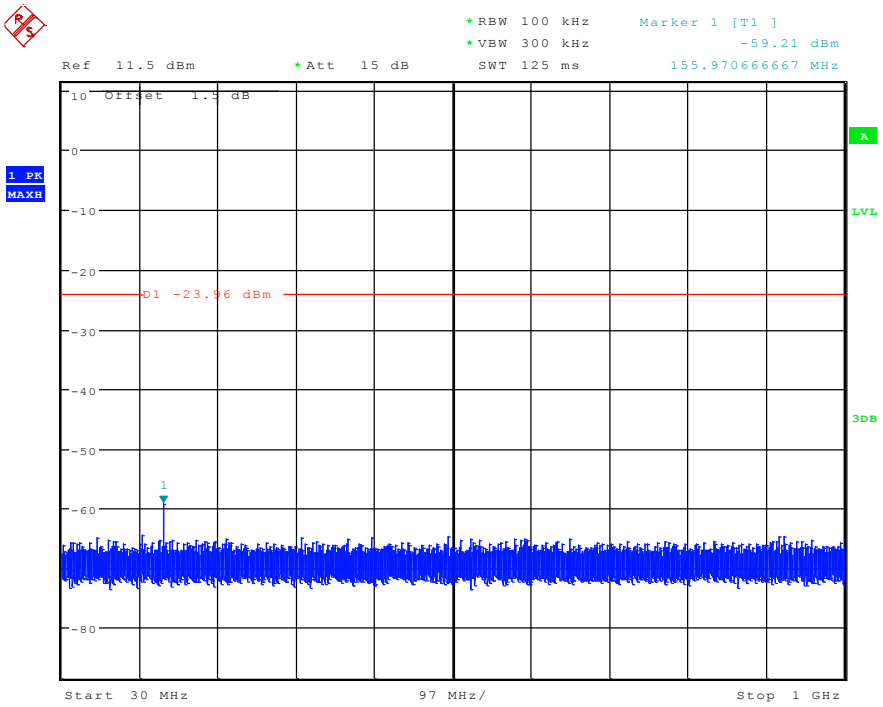


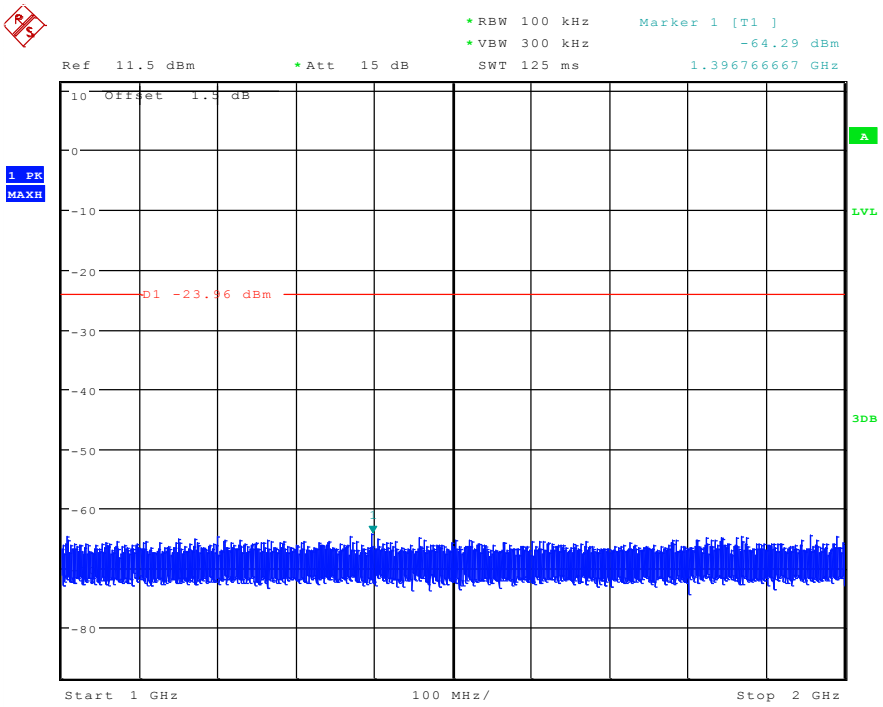
6.9 Spurious RF Conducted Emissions

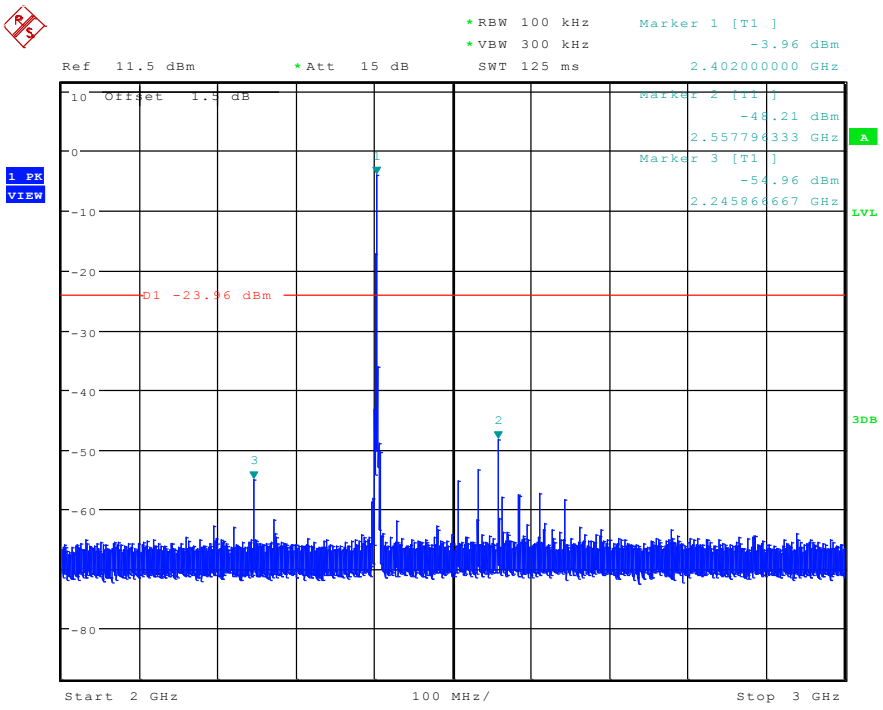
Test Requirement:	47 CFR Part 15C Section 15.247 (d)
Test Method:	ANSI C63.10:2013
Test Setup:	 Remark: Offset the High-Frequency cable loss 1.5dB in the spectrum analyzer.
Limit:	In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.
Exploratory Test Mode:	Non-hopping transmitting with all kind of modulation and all kind of data type
Final Test Mode:	Through Pre-scan, find the DH1 of data type is the worst case of GFSK modulation type, 2-DH1 of data type is the worst case of π/4DQPSK modulation type, 3-DH1 of data type is the worst case of 8DPSK modulation type.
Instruments Used:	Refer to section 5.10 for details
Test Results:	Pass

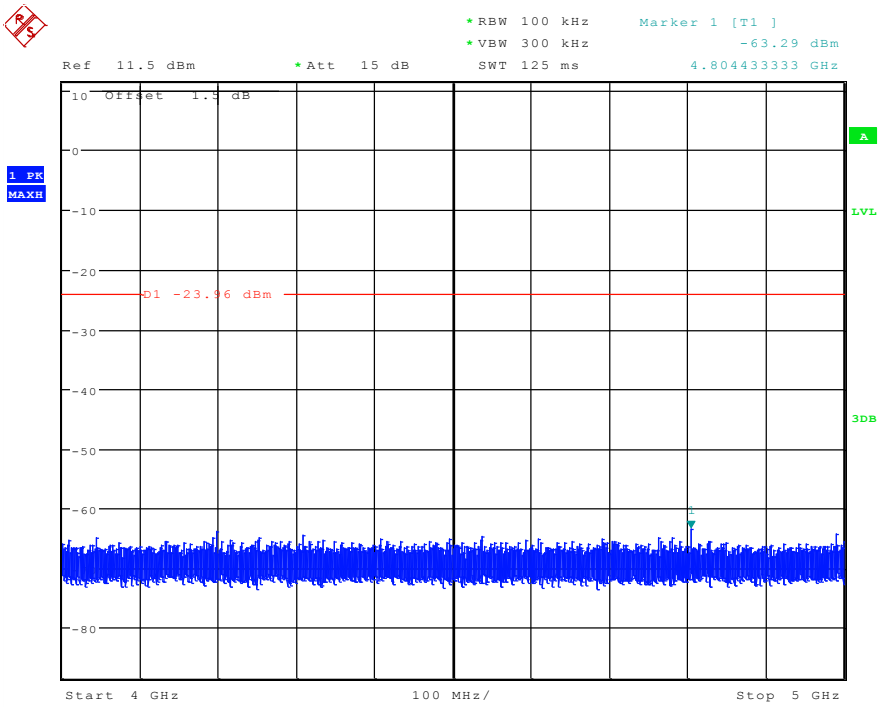
Test mode:	GFSK	Test channel:	Lowest



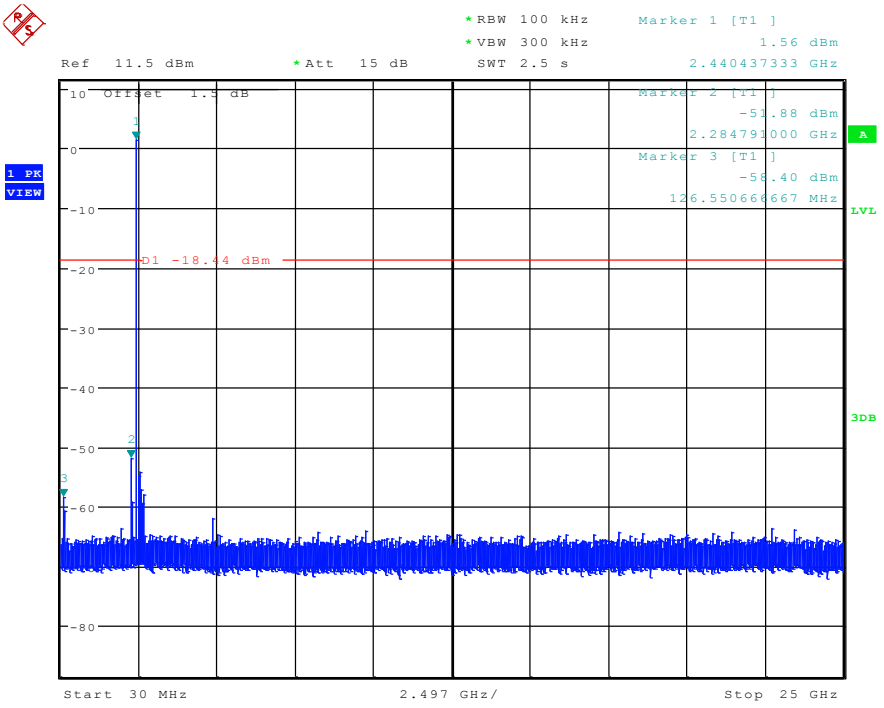


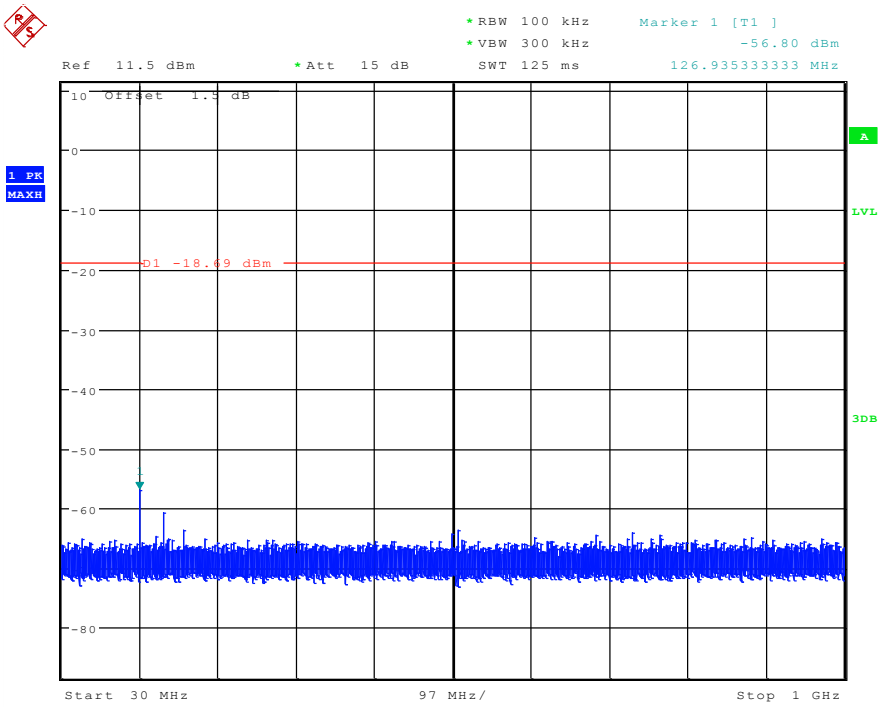

RBW 100 kHz
VBW 300 kHz
SWT 125 ms
Marker 1 [T1]
-64.29 dBm
1.396766667 GHz
Ref 11.5 dBm
Att 15 dB
Offset 1.5 dB
1 PK
MAXH
A
LVL
3DB
D1 -23.96 dBm
Start 1 GHz
100 MHz/
Stop 2 GHz

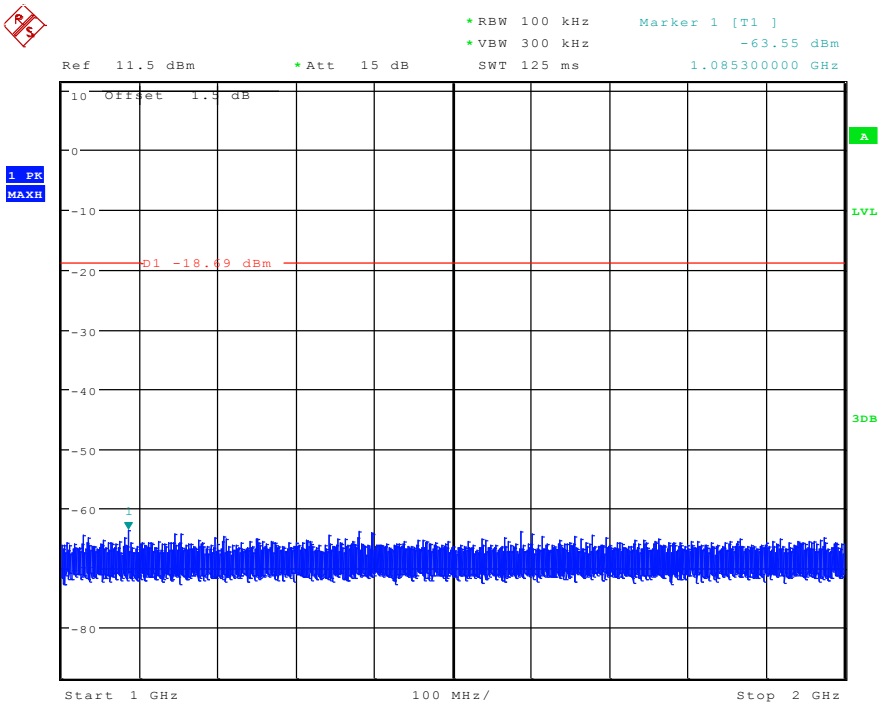

RBW 100 kHz
VBW 300 kHz
SWT 125 ms
Marker 1 [T1]
-3.96 dBm
2.402000000 GHz
Marker 2 [T1]
-48.21 dBm
2.557796333 GHz
Marker 3 [T1]
-54.96 dBm
2.245866667 GHz
Ref 11.5 dBm
Att 15 dB
Offset 1.5 dB
1 PK
VIEW
A
LVL
3DB
D1 -23.96 dBm
Start 2 GHz
100 MHz/
Stop 3 GHz

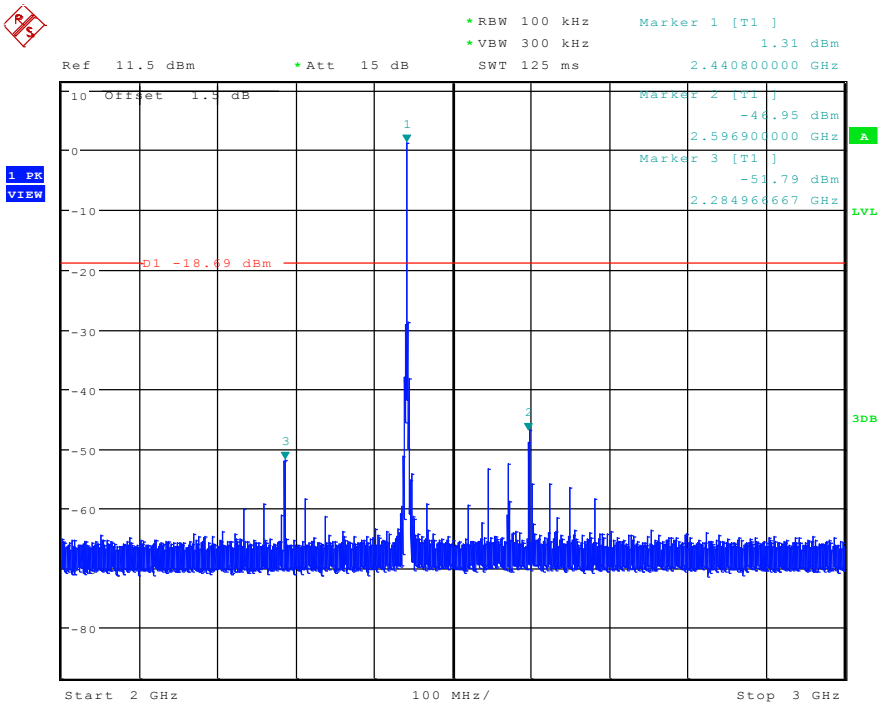


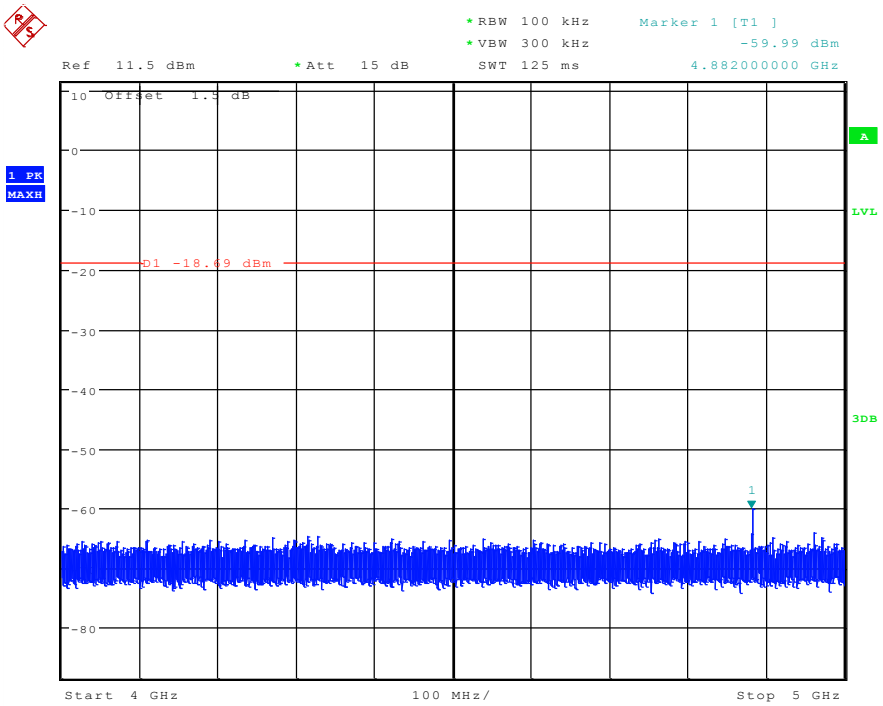
Test mode:	GFSK	Test channel:	Middle



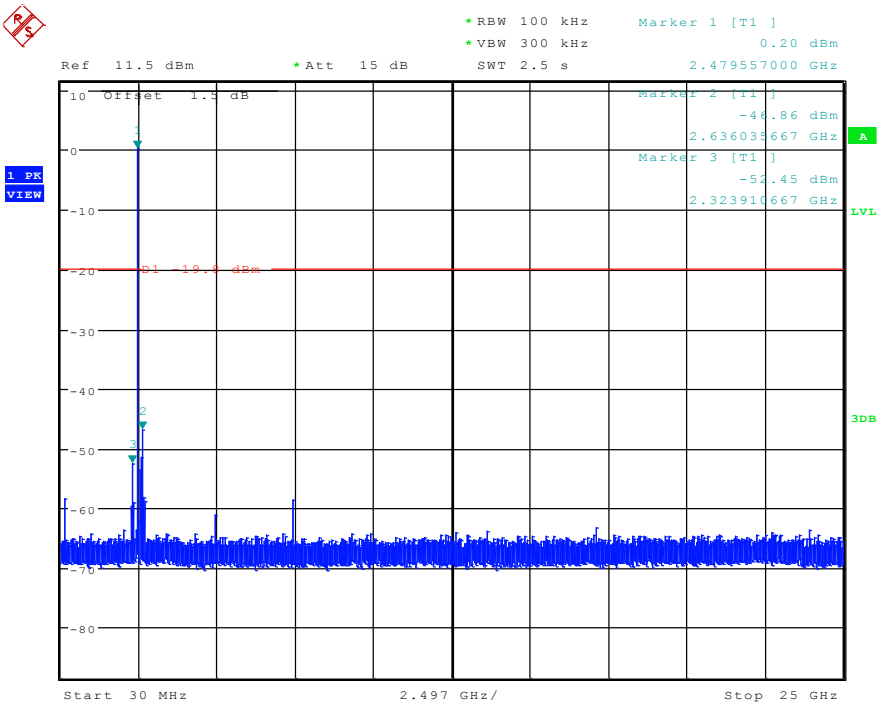

RBW 100 kHz
VBW 300 kHz
SWT 125 ms
Marker 1 [T1]
-56.80 dBm
126.935333333 MHz
Ref 11.5 dBm
Att 15 dB
Offset 1.5 dB
1 PK
MAXH
D1 -18.69 dBm
A
LVL
3DB
Start 30 MHz
97 MHz/
Stop 1 GHz

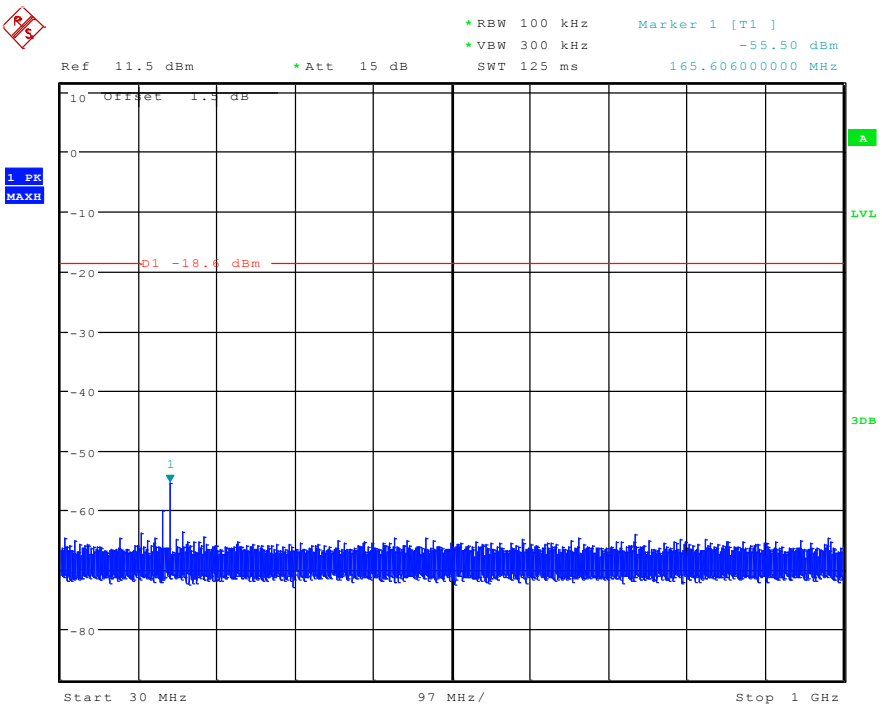

RBW 100 kHz
VBW 300 kHz
SWT 125 ms
Marker 1 [T1]
-63.55 dBm
1.085300000 GHz
Ref 11.5 dBm
Att 15 dB
Offset 1.5 dB
1 PK
MAXH
D1 -18.69 dBm
A
LVL
3DB
Start 1 GHz
100 MHz/
Stop 2 GHz

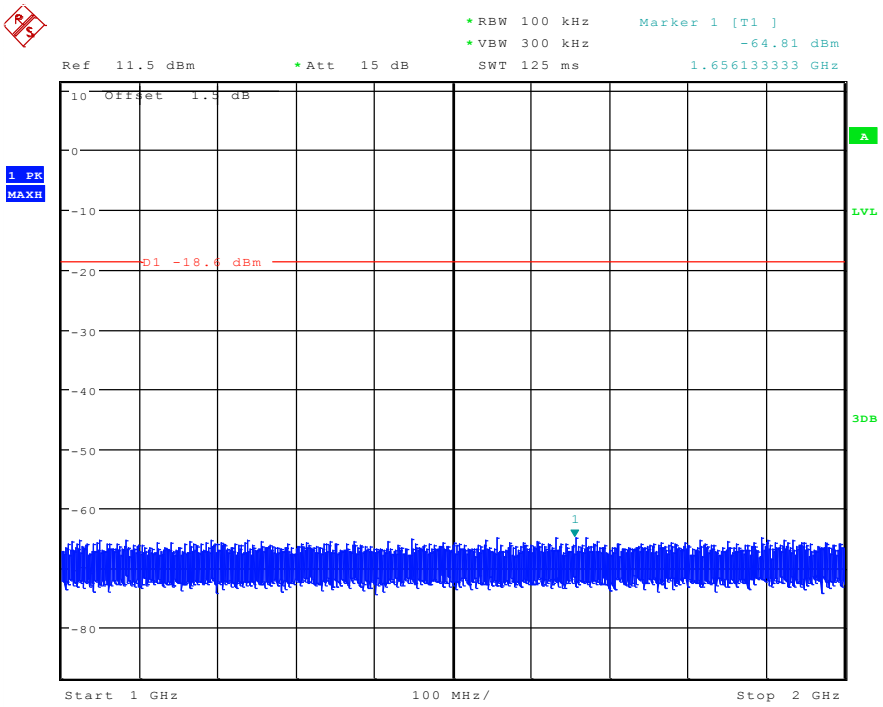

RBW 100 kHz
VBW 300 kHz
SWT 125 ms
Marker 1 [T1]
1.31 dBm
2.440800000 GHz
Marker 2 [T1]
-46.95 dBm
2.596900000 GHz
Marker 3 [T1]
-51.79 dBm
2.284966667 GHz
Ref 11.5 dBm
Att 15 dB
Offset 1.5 dB
1 PK
VIEW
D1 -18.69 dBm
A
LVL
3DB
Start 2 GHz
100 MHz/
Stop 3 GHz

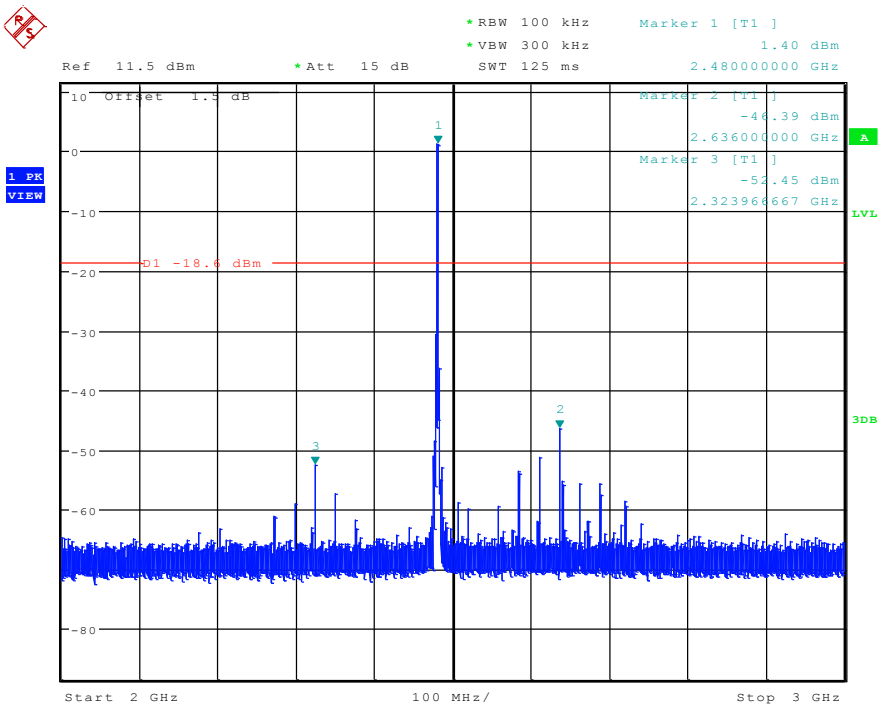

RBW 100 kHz
VBW 300 kHz
SWT 125 ms
Marker 1 [T1]
-59.99 dBm
4.882000000 GHz
Ref 11.5 dBm
Att 15 dB
Offset 1.5 dB
1 PK
MAXH
D1 -18.69 dBm
A
LVL
3DB
Start 4 GHz
100 MHz/
Stop 5 GHz

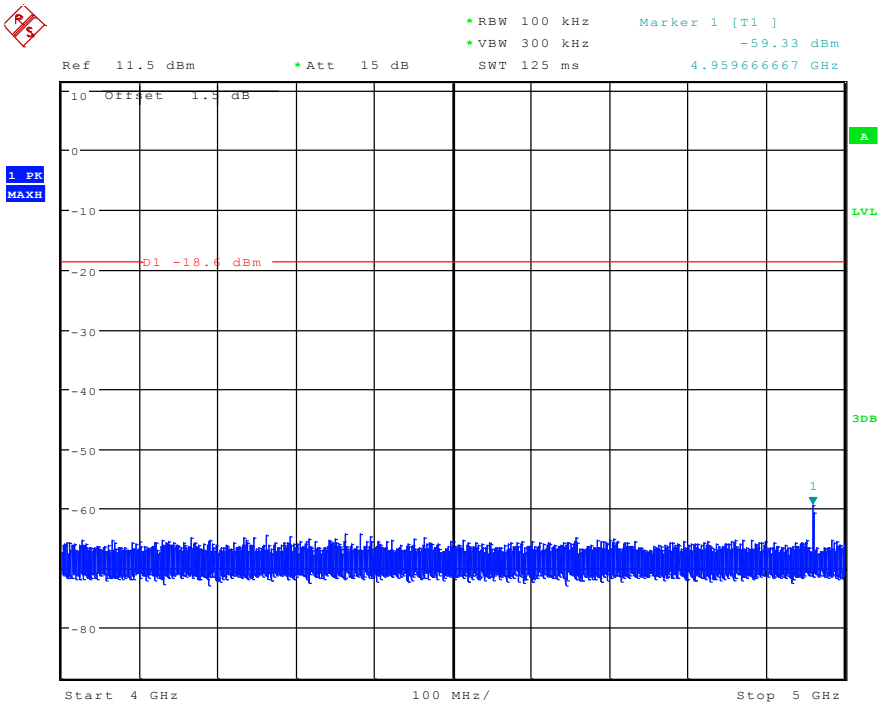
Test mode:	GFSK	Test channel:	Highest



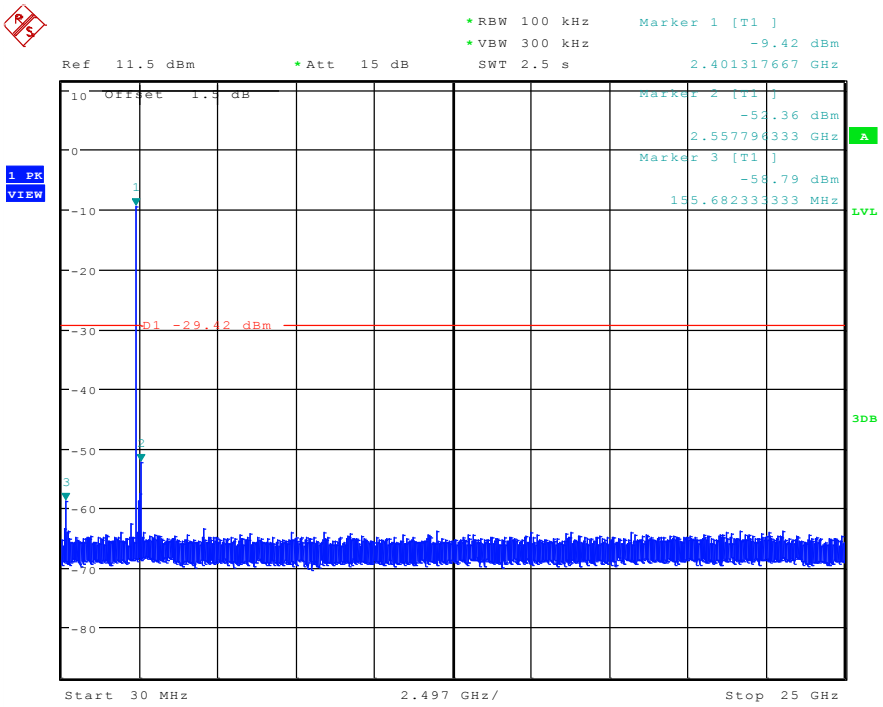


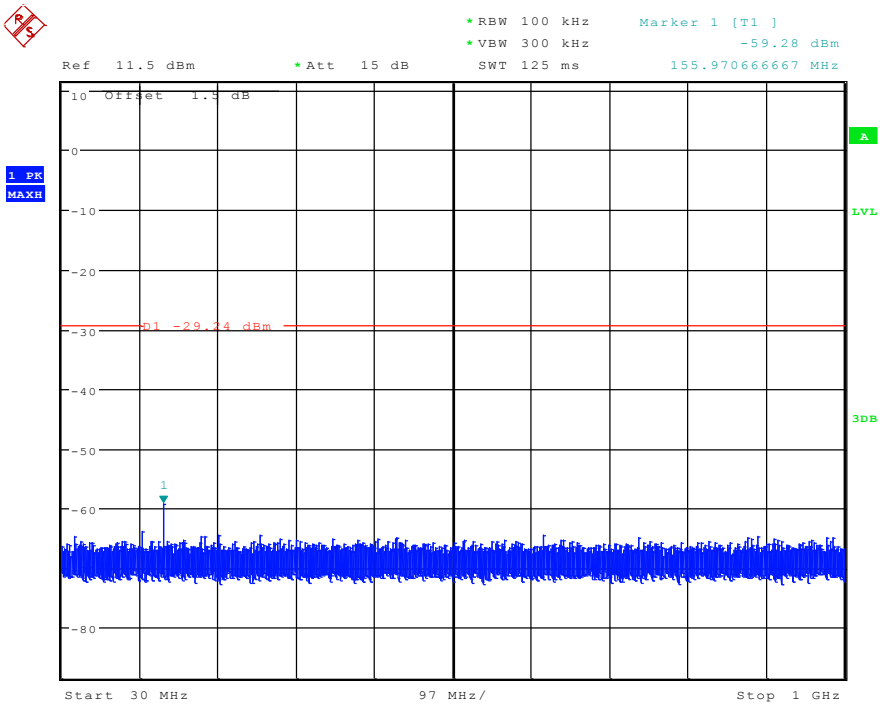

RBW 100 kHz
VBW 300 kHz
SWT 125 ms
Marker 1 [T1]
-64.81 dBm
1.656133333 GHz
Ref 11.5 dBm
Att 15 dB
Offset 1.5 dB
1 PK
MAXH
A
LVL
3DB
D1 -18.6 dBm
Start 1 GHz
100 MHz/
Stop 2 GHz

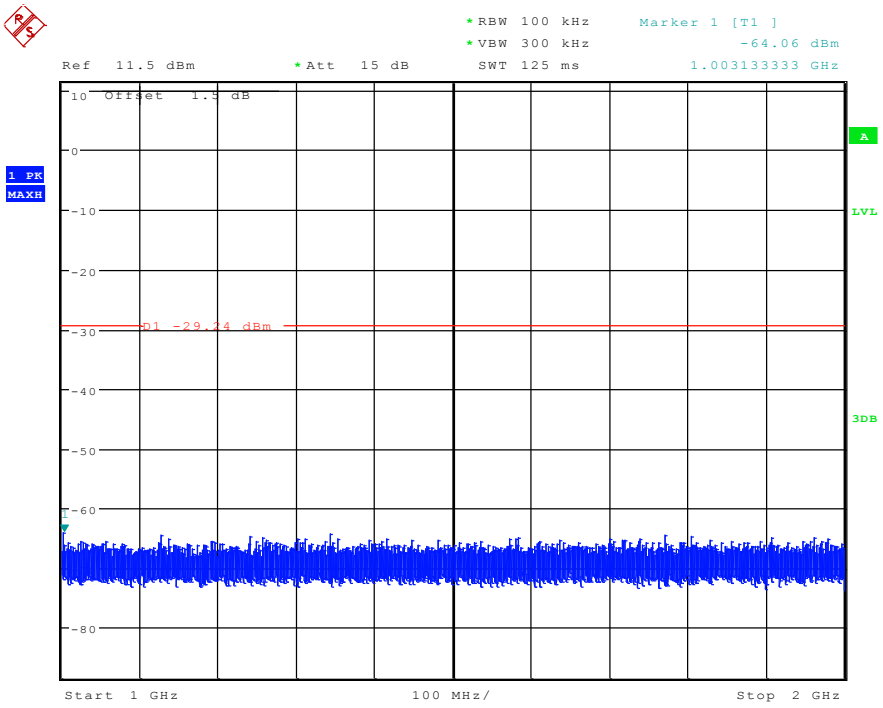

RBW 100 kHz
VBW 300 kHz
SWT 125 ms
Marker 1 [T1]
1.40 dBm
2.480000000 GHz
Marker 2 [T1]
-46.39 dBm
2.636000000 GHz
Marker 3 [T1]
-52.45 dBm
2.323966667 GHz
Ref 11.5 dBm
Att 15 dB
Offset 1.5 dB
1 PK
VIEW
A
LVL
3DB
D1 -18.6 dBm
Start 2 GHz
100 MHz/
Stop 3 GHz

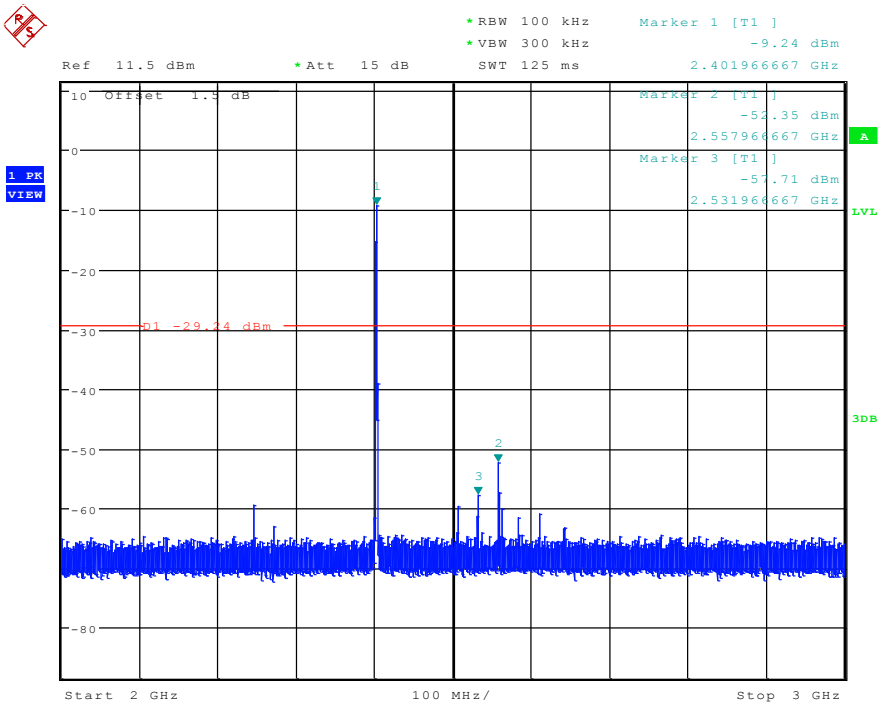


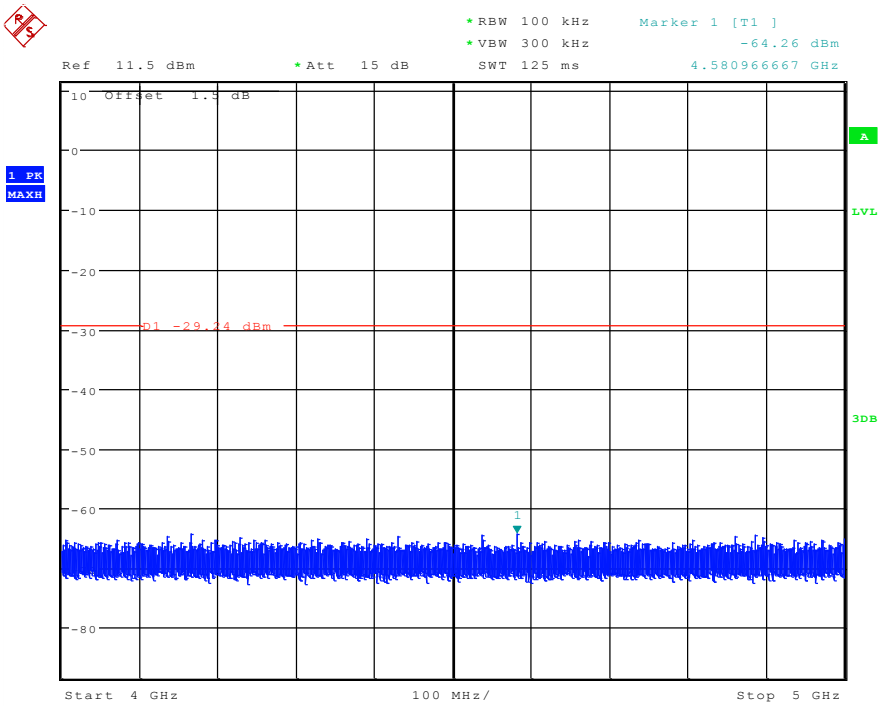
Test mode:	π/4DQPSK	Test channel:	Lowest



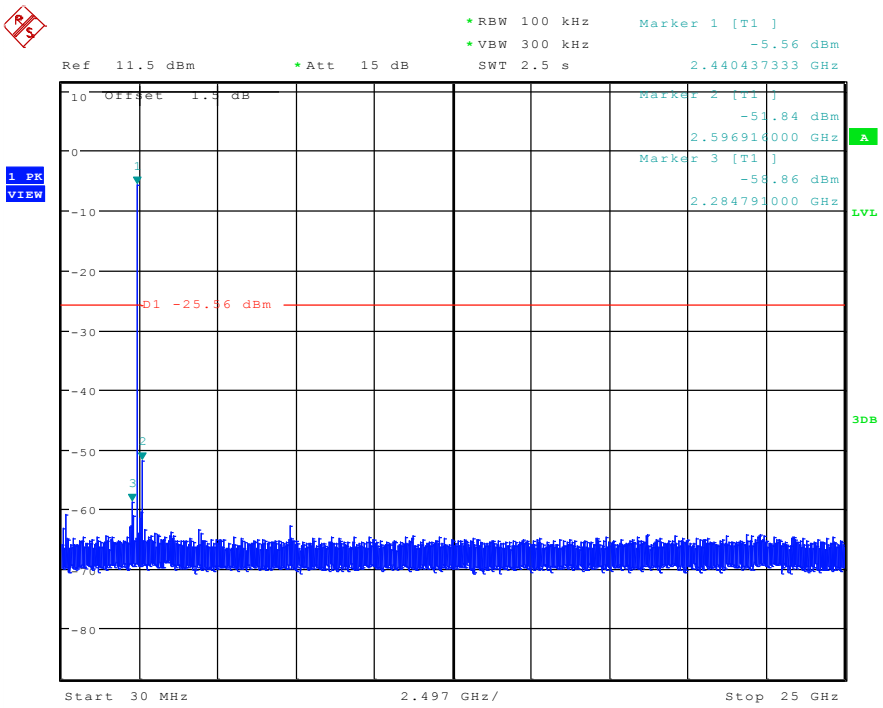

RBW 100 kHz
VBW 300 kHz
SWT 125 ms
Marker 1 [T1]
-59.28 dBm
155.970666667 MHz
Ref 11.5 dBm
Att 15 dB
Offset 1.5 dB
1 PK
MAXH
A
LVL
3DB
D1 -29.24 dBm
Start 30 MHz
97 MHz/
Stop 1 GHz

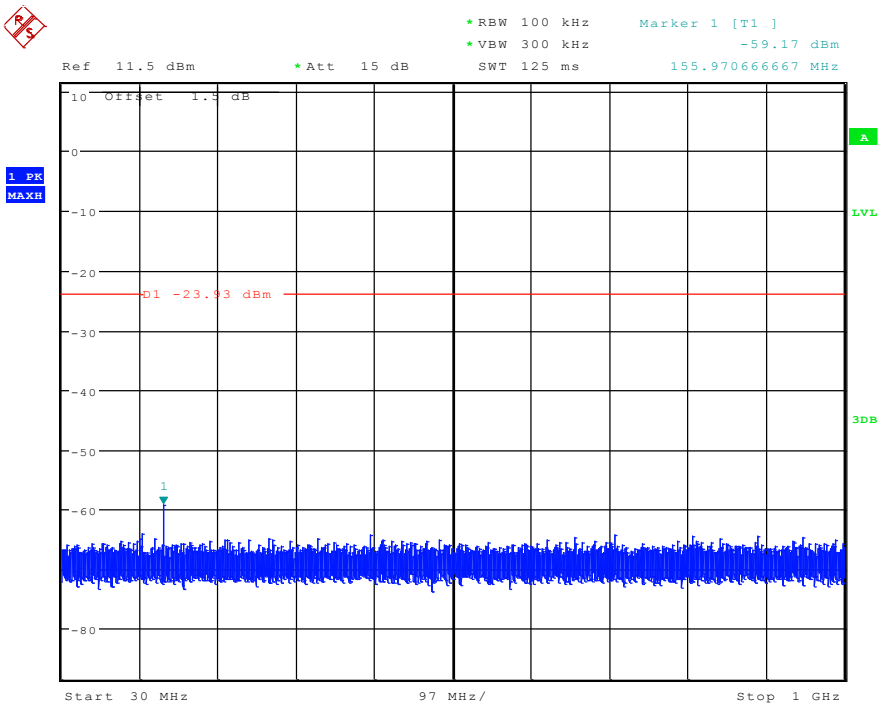

RBW 100 kHz
VBW 300 kHz
SWT 125 ms
Marker 1 [T1]
-64.06 dBm
1.003133333 GHz
Ref 11.5 dBm
Att 15 dB
Offset 1.5 dB
1 PK
MAXH
A
LVL
3DB
D1 -29.24 dBm
Start 1 GHz
100 MHz/
Stop 2 GHz

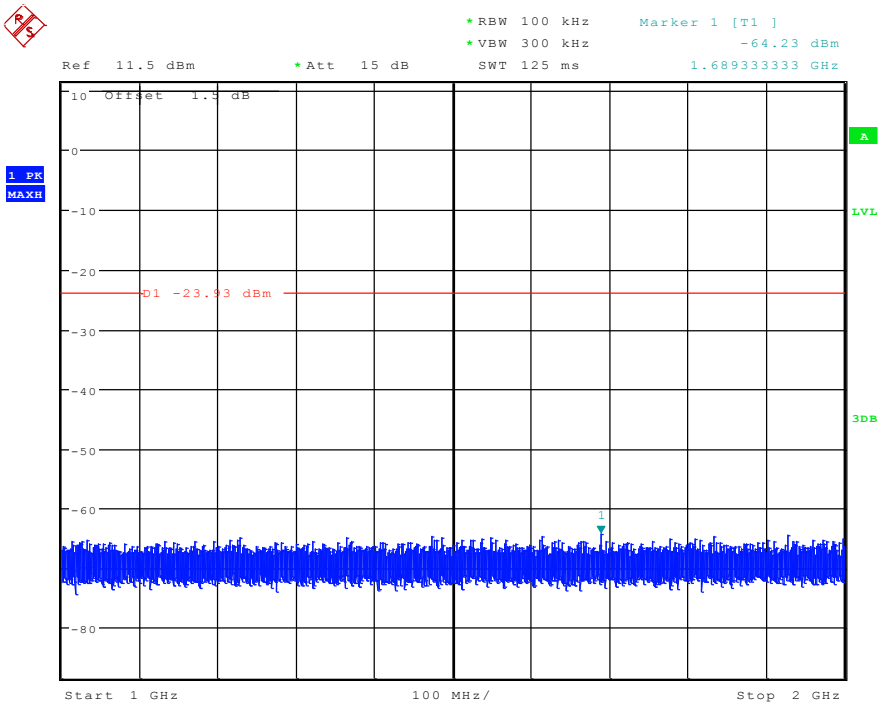

RBW 100 kHz
VBW 300 kHz
SWT 125 ms
Marker 1 [T1]
-9.24 dBm
2.401966667 GHz
Marker 2 [T1]
-52.35 dBm
2.557966667 GHz
Marker 3 [T1]
-57.71 dBm
2.531966667 GHz
Ref 11.5 dBm
Att 15 dB
Offset 1.5 dB
1 PK
VIEW
D1 -29.24 dBm
A
LVL
3DB
Start 2 GHz
100 MHz/
Stop 3 GHz

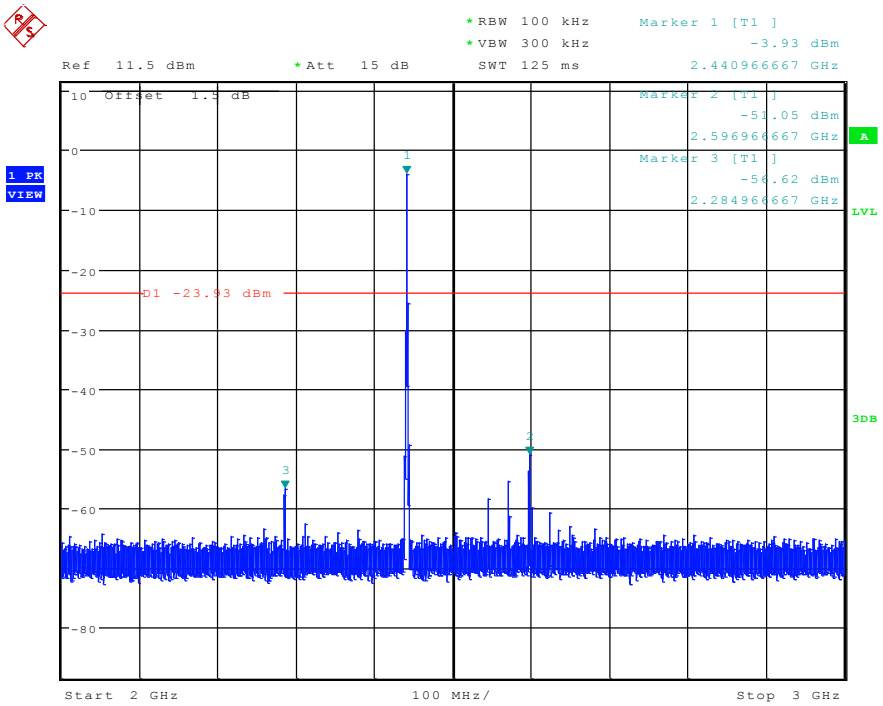

RBW 100 kHz
VBW 300 kHz
SWT 125 ms
Marker 1 [T1]
-64.26 dBm
4.580966667 GHz
Ref 11.5 dBm
Att 15 dB
Offset 1.5 dB
1 PK
MAXH
D1 -29.24 dBm
A
LVL
3DB
Start 4 GHz
100 MHz/
Stop 5 GHz

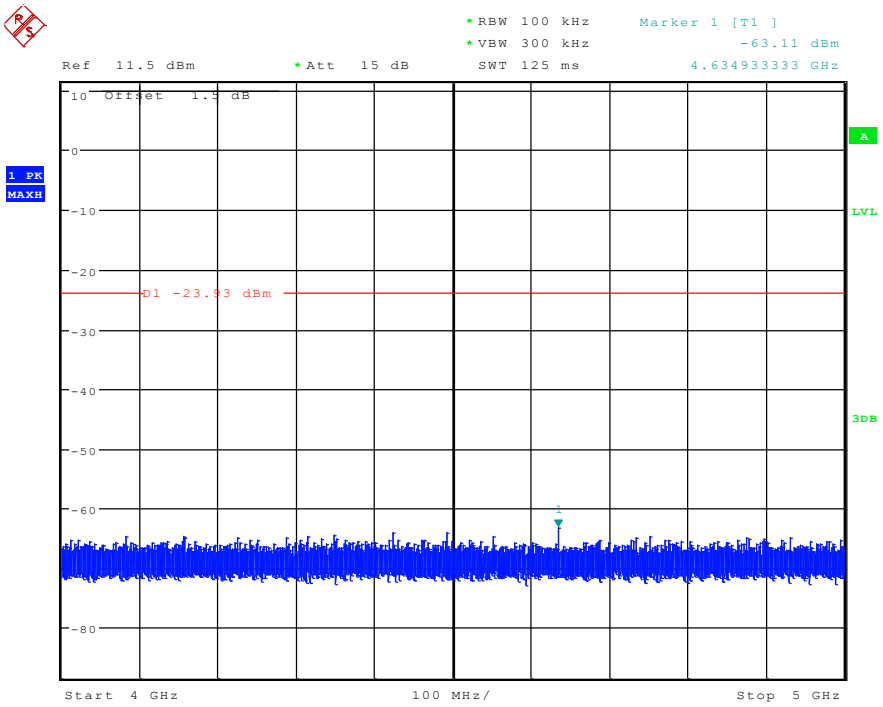
Test mode:	π/4DQPSK	Test channel:	Middle



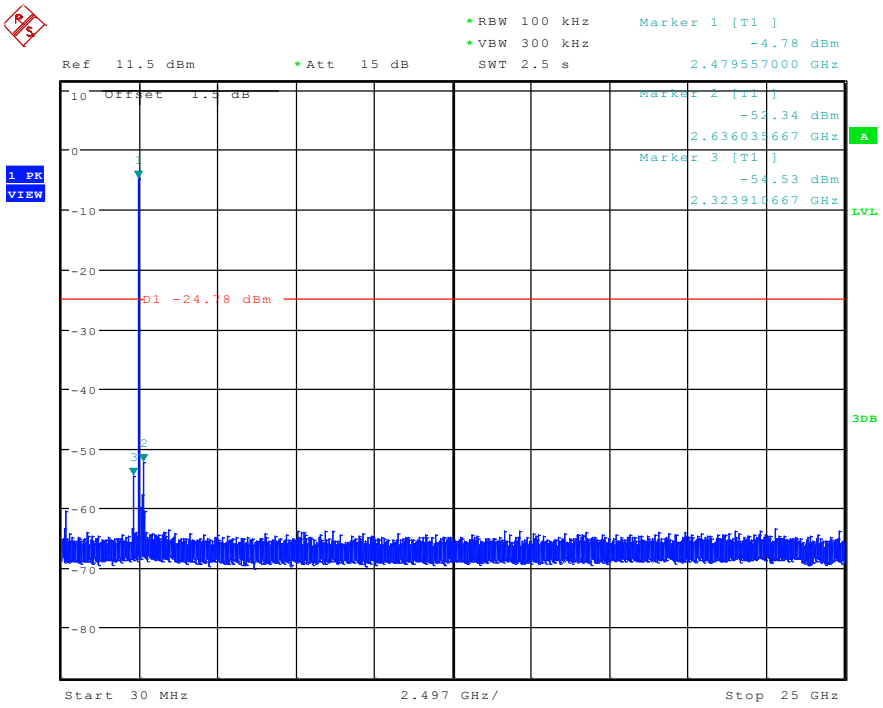


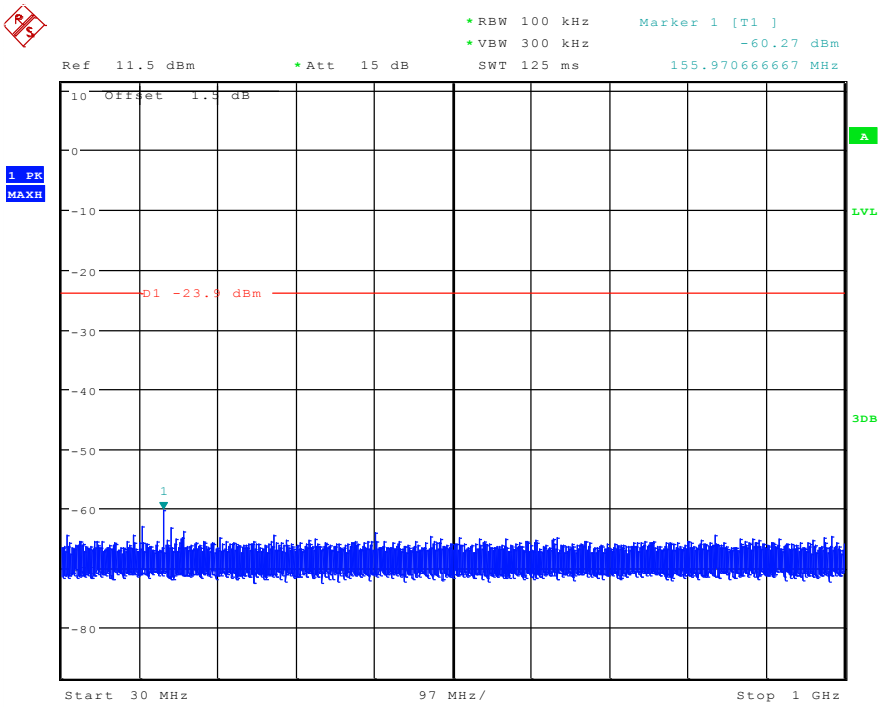

RBW 100 kHz
VBW 300 kHz
SWT 125 ms
Marker 1 [T1]
-64.23 dBm
1.689333333 GHz
Ref 11.5 dBm
Att 15 dB
Offset 1.5 dB
1 PK
MAXH
A
LVL
3DB
D1 -23.93 dBm
Start 1 GHz
100 MHz/
Stop 2 GHz

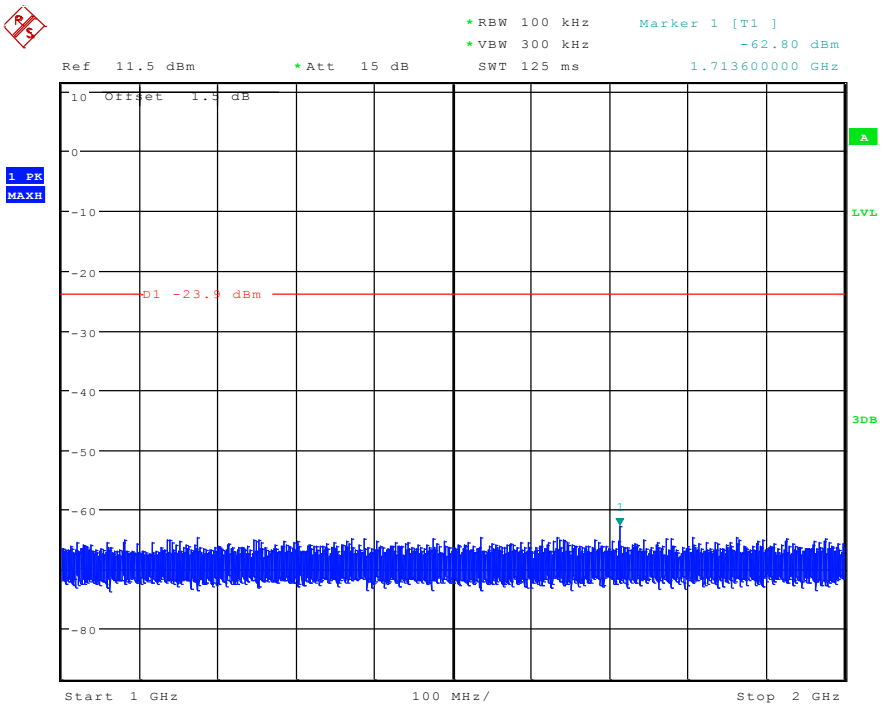

RBW 100 kHz
VBW 300 kHz
SWT 125 ms
Marker 1 [T1]
-3.93 dBm
2.440966667 GHz
Ref 11.5 dBm
Att 15 dB
Offset 1.5 dB
Marker 2 [T1]
-51.05 dBm
2.596966667 GHz
Marker 3 [T1]
-56.62 dBm
2.284966667 GHz
1 PK
VIEW
A
LVL
3DB
D1 -23.93 dBm
Start 2 GHz
100 MHz/
Stop 3 GHz

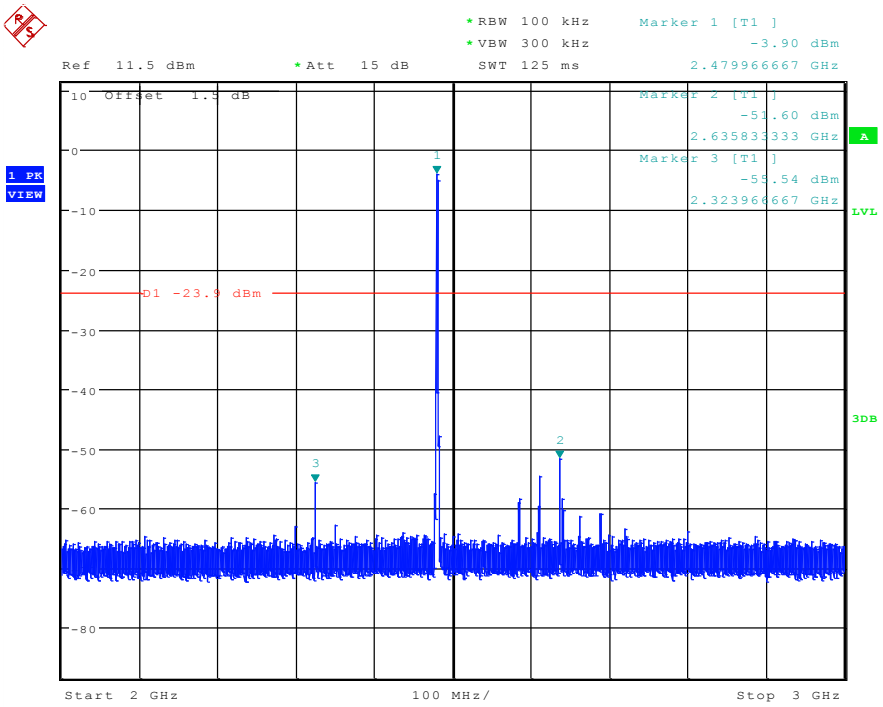


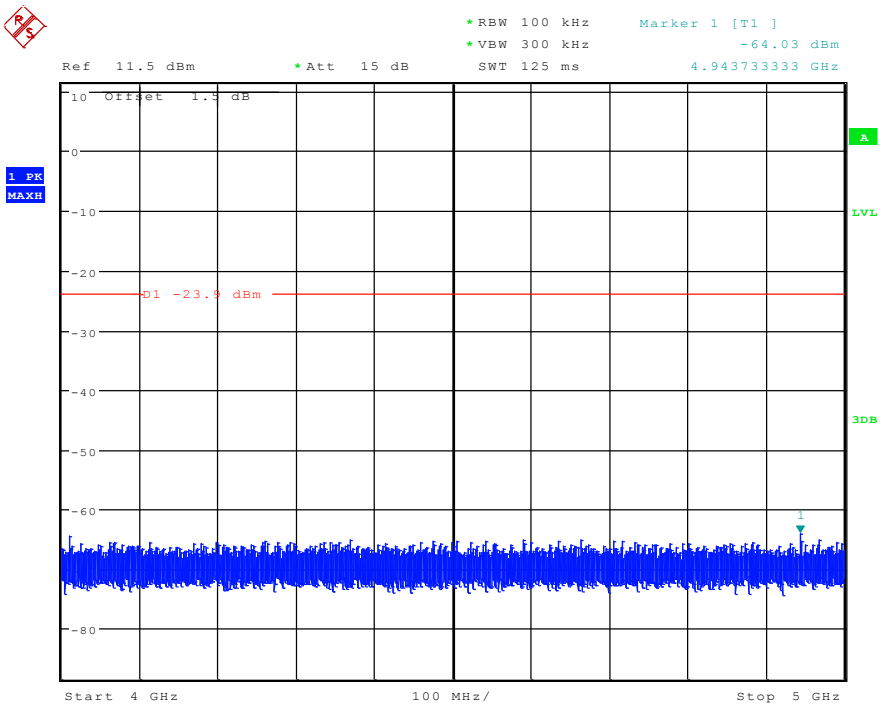
Test mode:	π/4DQPSK	Test channel:	Highest



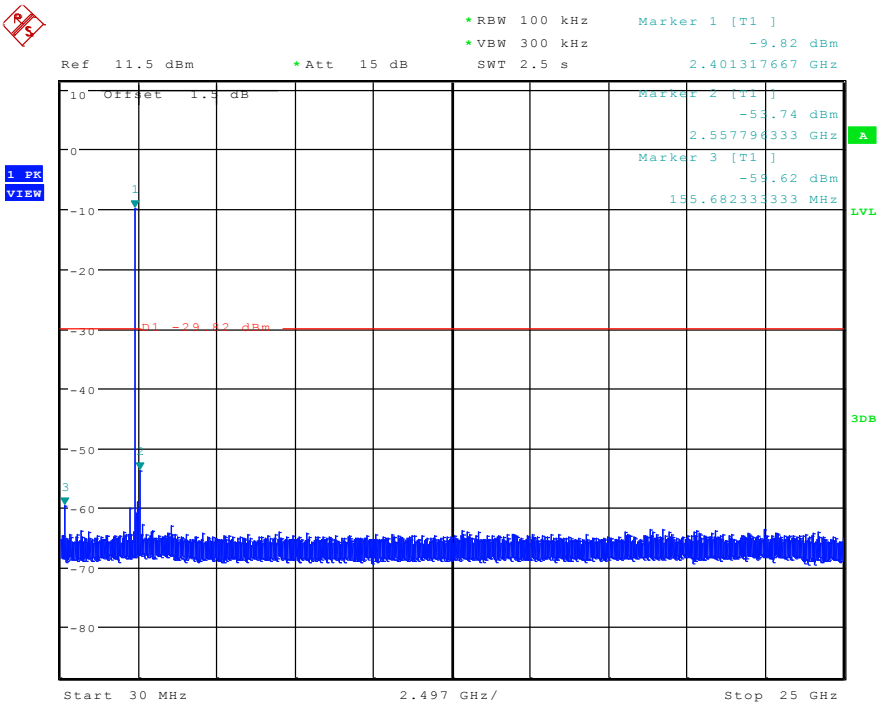

RBW 100 kHz
VBW 300 kHz
SWT 125 ms
Marker 1 [T1]
-60.27 dBm
155.970666667 MHz
Ref 11.5 dBm
Att 15 dB
Offset 1.5 dB
1 PK
MAXH
A
LVL
3DB
D1 -23.9 dBm
Start 30 MHz
97 MHz/
Stop 1 GHz

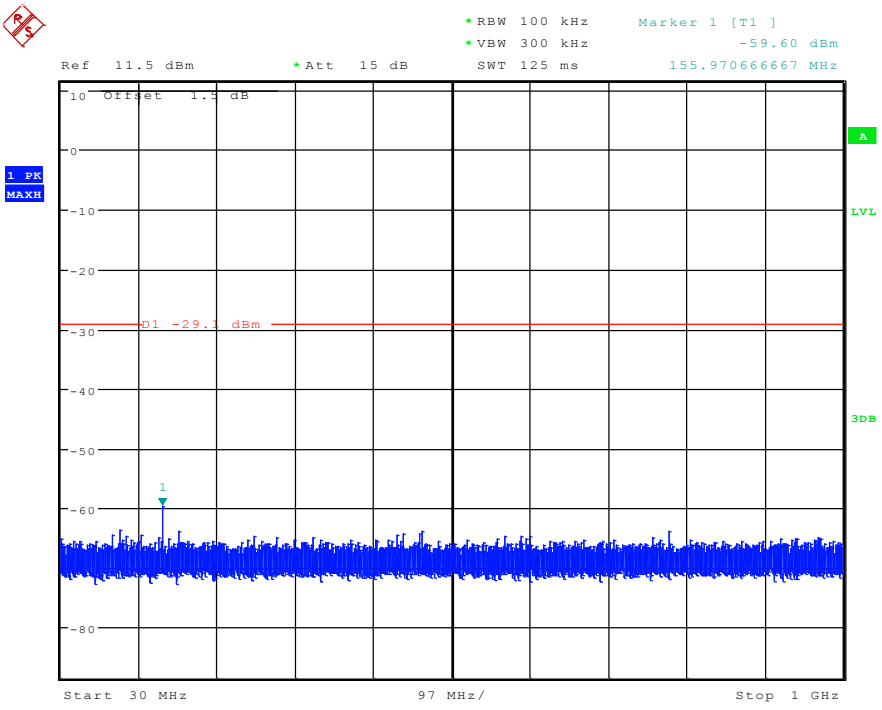

RBW 100 kHz
VBW 300 kHz
SWT 125 ms
Marker 1 [T1]
-62.80 dBm
1.713600000 GHz
Ref 11.5 dBm
Att 15 dB
Offset 1.5 dB
1 PK
MAXH
A
LVL
3DB
D1 -23.9 dBm
Start 1 GHz
100 MHz/
Stop 2 GHz

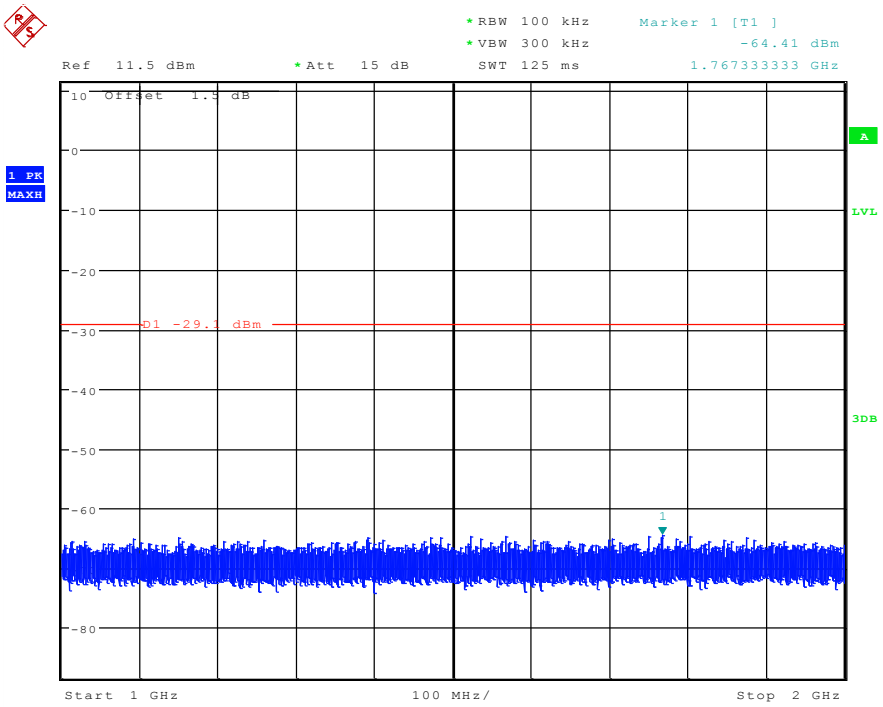

RBW 100 kHz
VBW 300 kHz
SWT 125 ms
Marker 1 [T1]
-3.90 dBm
2.479966667 GHz
Marker 2 [T1]
-51.60 dBm
2.635833333 GHz
Marker 3 [T1]
-55.54 dBm
2.323966667 GHz
Ref 11.5 dBm
Att 15 dB
Offset 1.5 dB
1 PK
VIEW
A
LVL
3DB
D1 -23.9 dBm
Start 2 GHz
100 MHz/
Stop 3 GHz

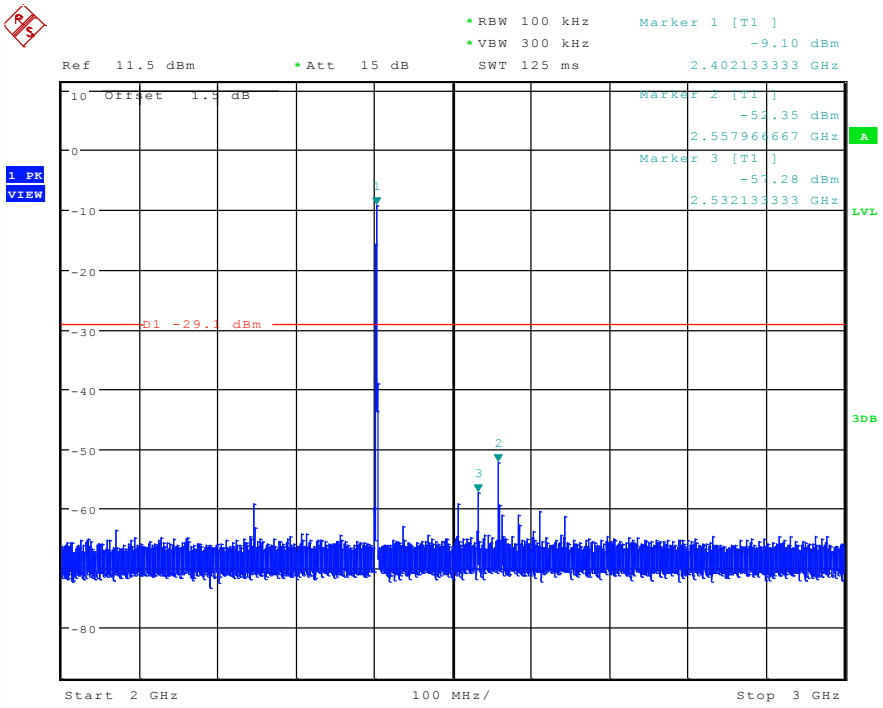

RBW 100 kHz
VBW 300 kHz
SWT 125 ms
Marker 1 [T1]
-64.03 dBm
4.943733333 GHz
Ref 11.5 dBm
Att 15 dB
Offset 1.5 dB
1 PK
MAXH
A
LVL
3DB
D1 -23.9 dBm
Start 4 GHz
100 MHz/
Stop 5 GHz

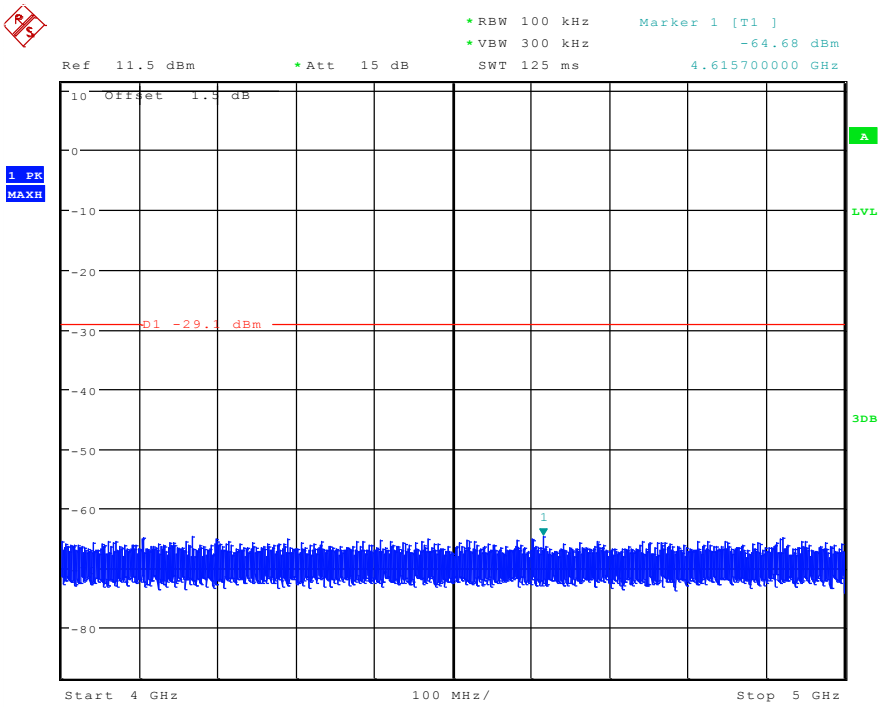
Test mode:	8DPSK	Test channel:	Lowest



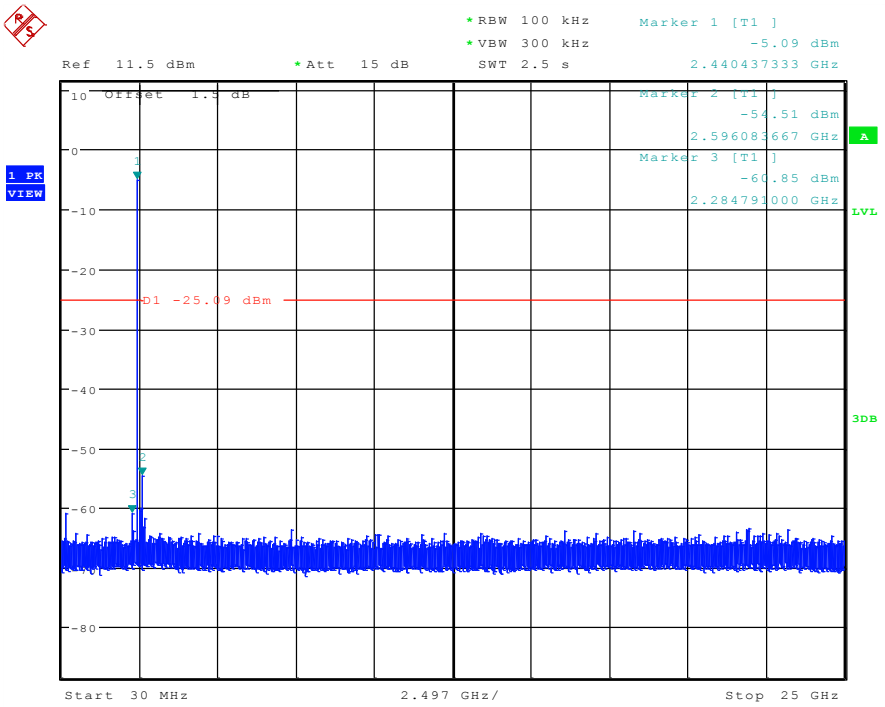


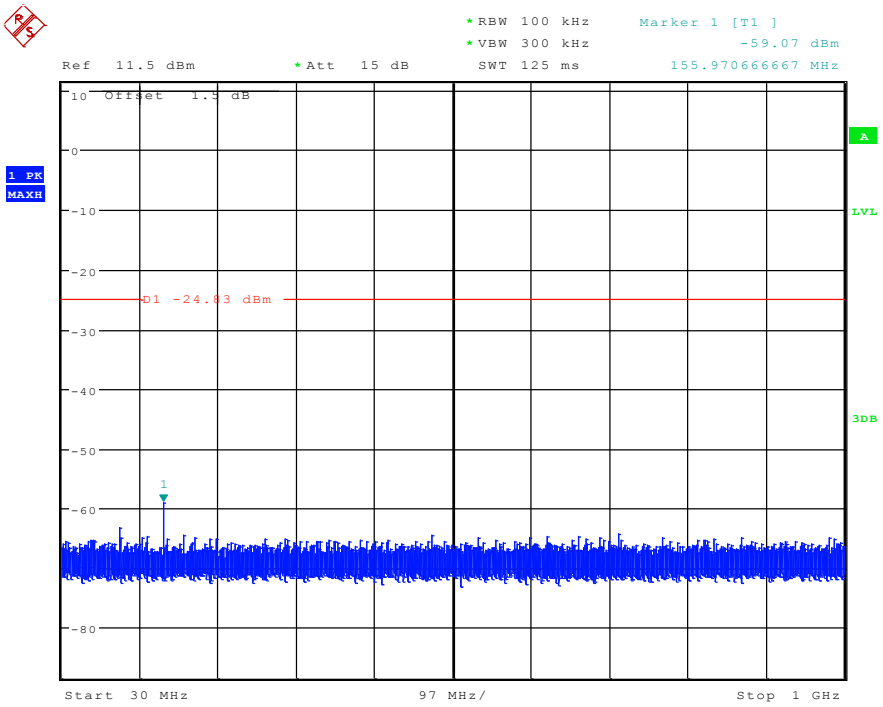

RBW 100 kHz
VBW 300 kHz
SWT 125 ms
Marker 1 [T1]
-64.41 dBm
1.767333333 GHz
Ref 11.5 dBm
Att 15 dB
Offset 1.5 dB
1 PK
MAXH
A
LVL
3DB
D1 -29.1 dBm
Start 1 GHz
100 MHz/
Stop 2 GHz

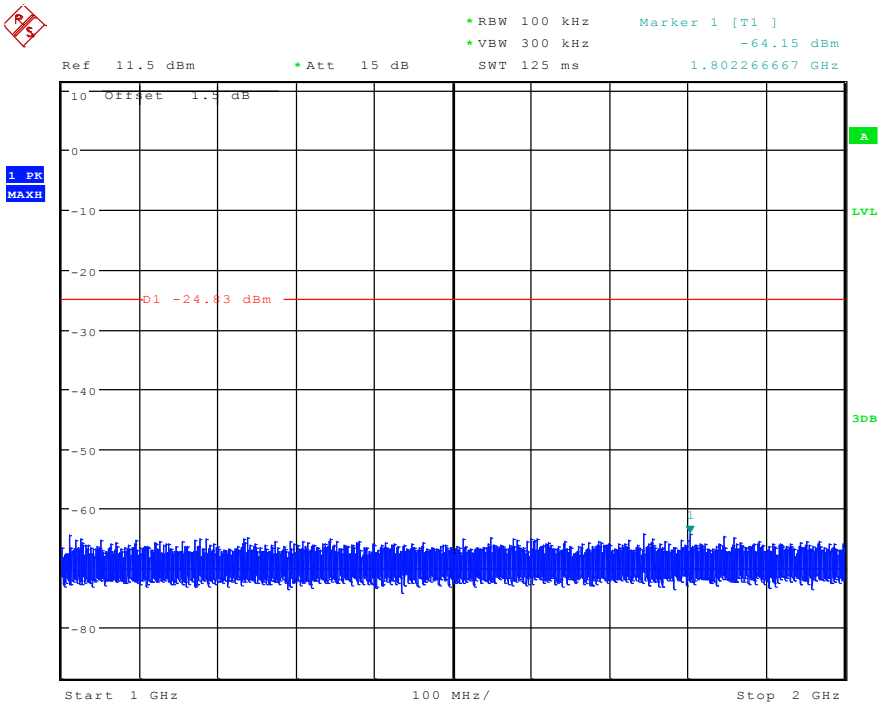

RBW 100 kHz
VBW 300 kHz
SWT 125 ms
Marker 1 [T1]
-9.10 dBm
2.402133333 GHz
Ref 11.5 dBm
Att 15 dB
Offset 1.5 dB
Marker 2 [T1]
-52.35 dBm
2.557966667 GHz
Marker 3 [T1]
-57.28 dBm
2.532133333 GHz
1 PK
VIEW
A
LVL
3DB
D1 -29.1 dBm
Start 2 GHz
100 MHz/
Stop 3 GHz

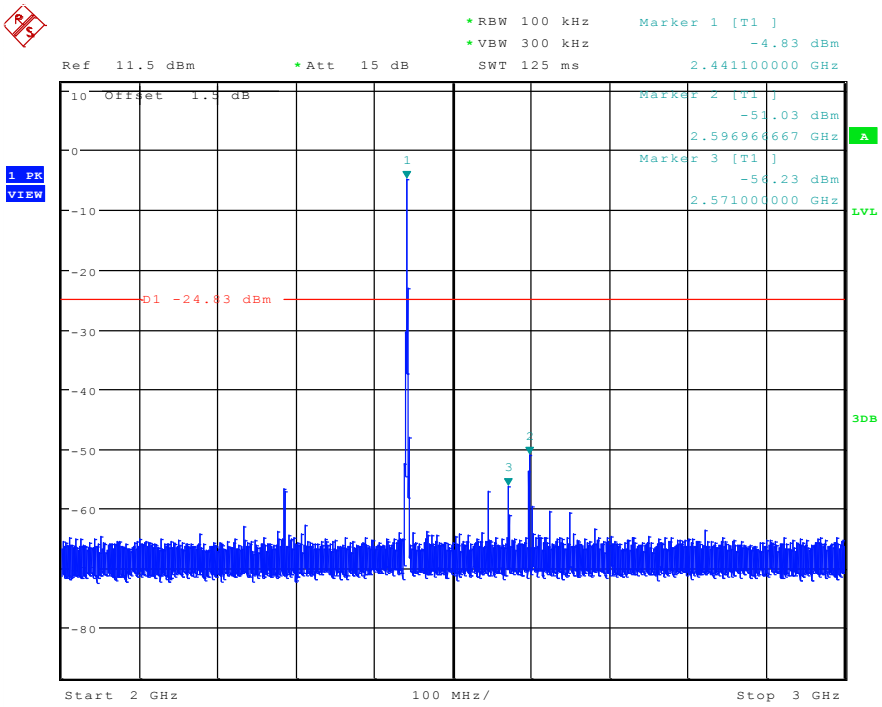


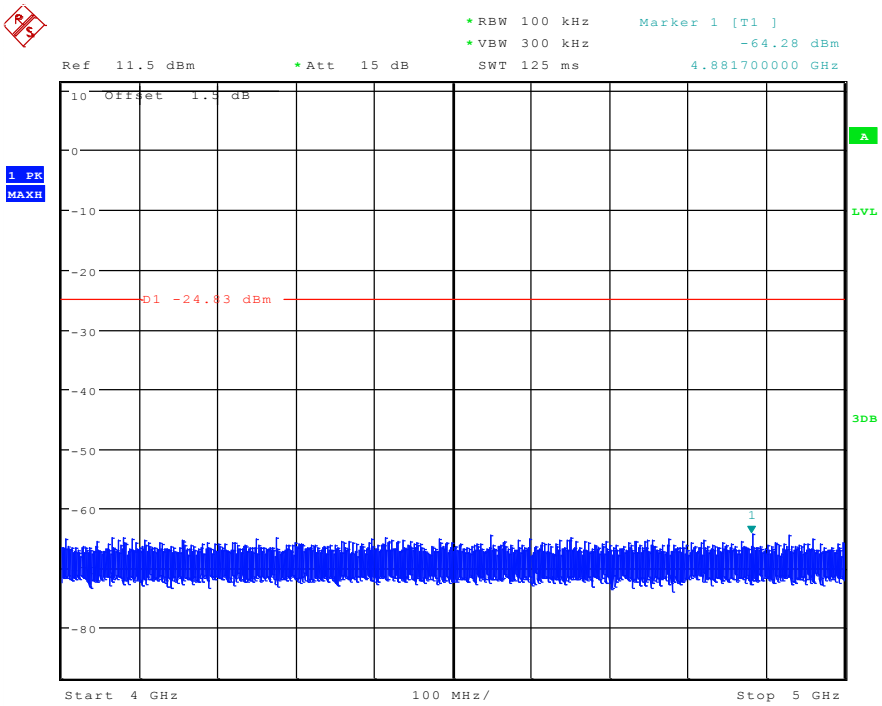
Test mode:	8DPSK	Test channel:	Middle



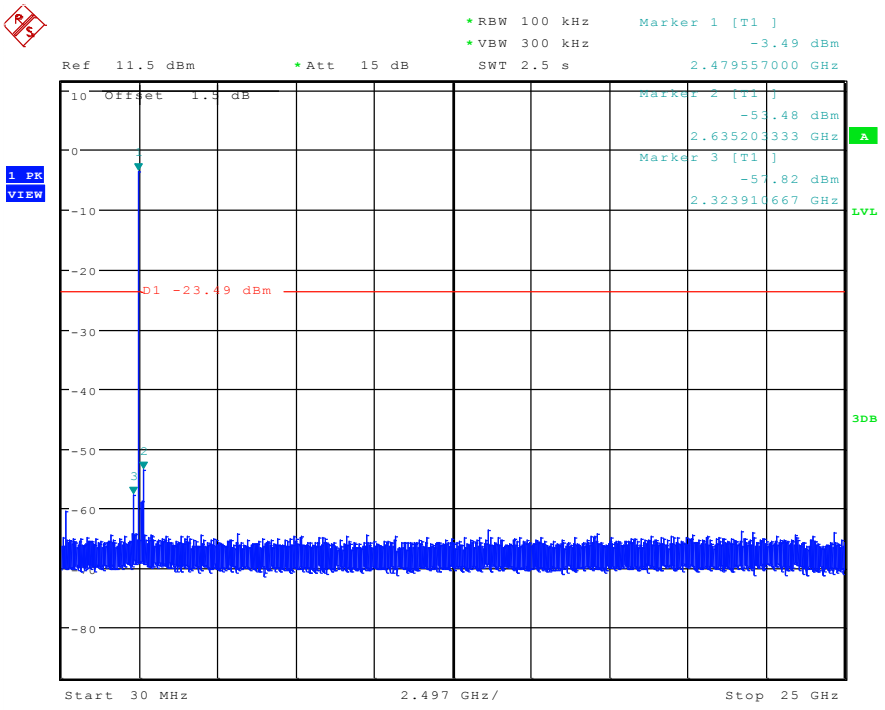

RBW 100 kHz
VBW 300 kHz
SWT 125 ms
Marker 1 [T1]
-59.07 dBm
155.970666667 MHz
Ref 11.5 dBm
Att 15 dB
Offset 1.5 dB
1 PK
MAXH
A
LVL
3DB
D1 -24.83 dBm
Start 30 MHz
97 MHz/
Stop 1 GHz

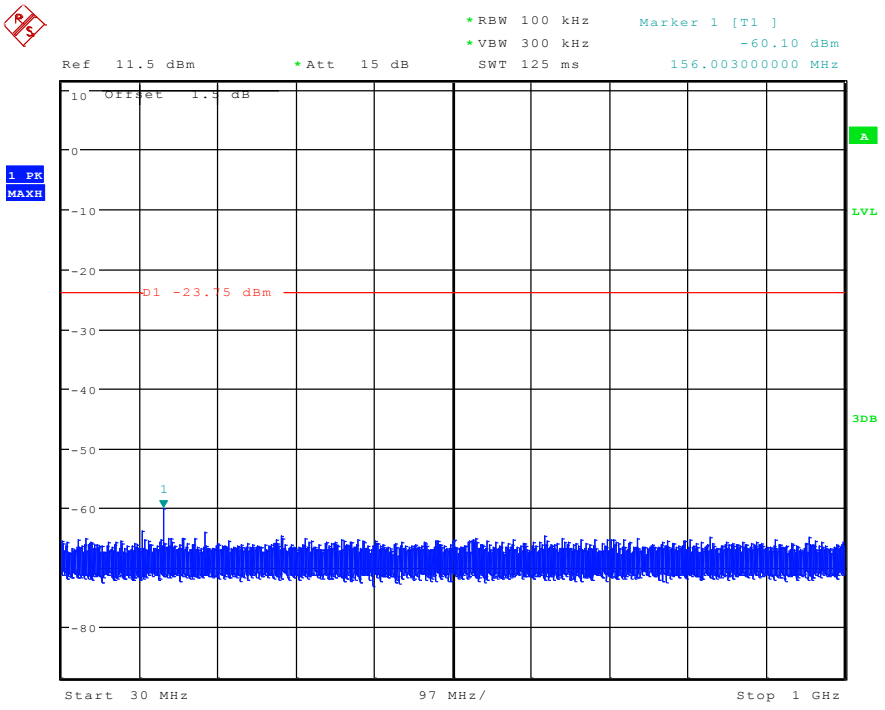

RBW 100 kHz
VBW 300 kHz
SWT 125 ms
Marker 1 [T1]
-64.15 dBm
1.802266667 GHz
Ref 11.5 dBm
Att 15 dB
Offset 1.5 dB
1 PK
MAXH
A
LVL
3DB
D1 -24.83 dBm
Start 1 GHz
100 MHz/
Stop 2 GHz

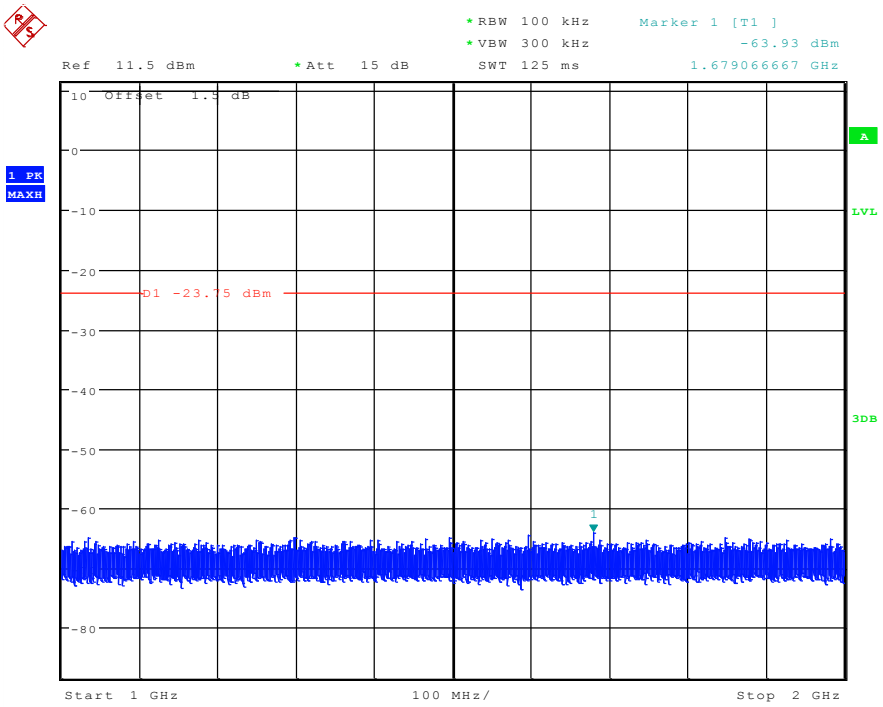

RBW 100 kHz
VBW 300 kHz
SWT 125 ms
Marker 1 [T1]
-4.83 dBm
2.441100000 GHz
Ref 11.5 dBm
Att 15 dB
Offset 1.5 dB
Marker 2 [T1]
-51.03 dBm
2.596966667 GHz
Marker 3 [T1]
-56.23 dBm
2.571000000 GHz
1 PK
VIEW
A
LVL
3DB
D1 -24.83 dBm
Start 2 GHz
100 MHz/
Stop 3 GHz

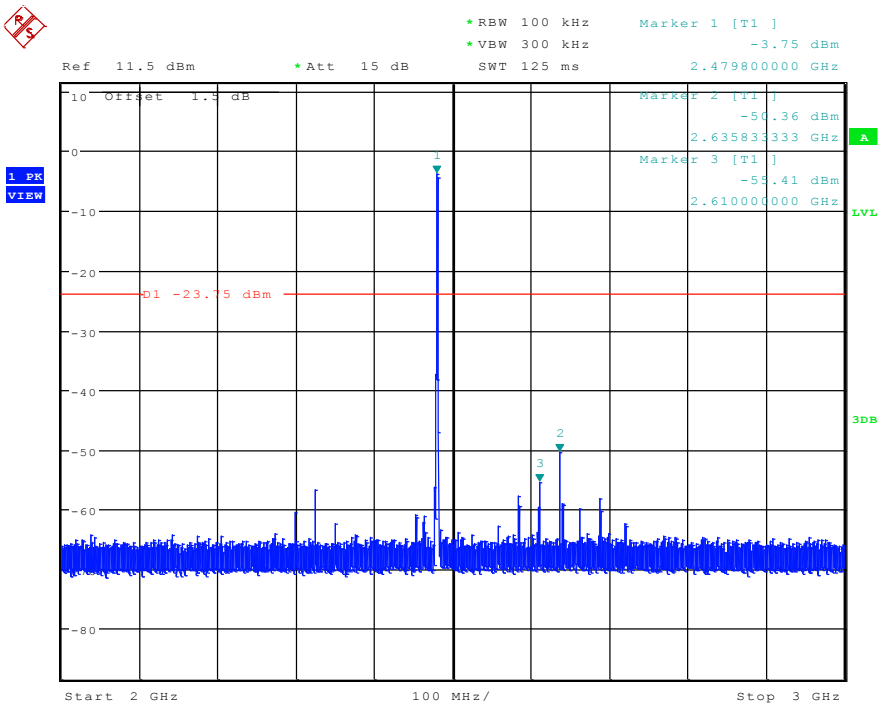

RBW 100 kHz
VBW 300 kHz
SWT 125 ms
Marker 1 [T1]
-64.28 dBm
4.881700000 GHz
Ref 11.5 dBm
Att 15 dB
Offset 1.5 dB
1 PK
MAXH
A
LVL
3DB
D1 -24.83 dBm
Start 4 GHz
100 MHz/
Stop 5 GHz

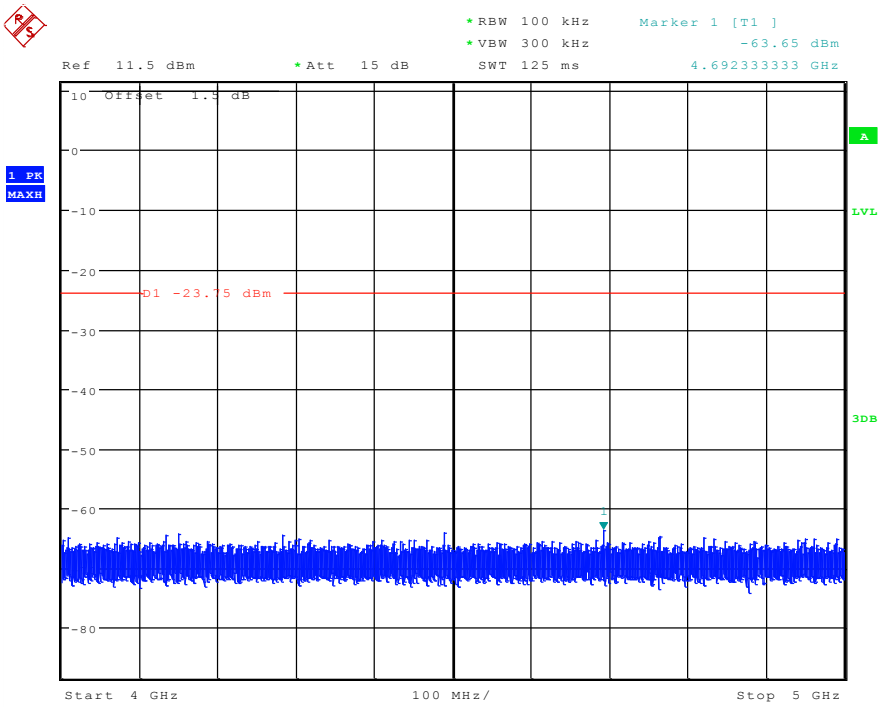
Test mode:	8DPSK	Test channel:	Highest






RBW 100 kHz
VBW 300 kHz
SWT 125 ms
Marker 1 [T1]
-63.93 dBm
1.679066667 GHz
Ref 11.5 dBm
Att 15 dB
Offset 1.5 dB
1 PK
MAXH
A
LVL
3DB
D1 -23.75 dBm
Start 1 GHz
100 MHz/
Stop 2 GHz


RBW 100 kHz
VBW 300 kHz
SWT 125 ms
Marker 1 [T1]
-3.75 dBm
2.479800000 GHz
Marker 2 [T1]
-50.36 dBm
2.635833333 GHz
Marker 3 [T1]
-59.41 dBm
2.610000000 GHz
Ref 11.5 dBm
Att 15 dB
Offset 1.5 dB
1 PK
VIEW
A
LVL
3DB
D1 -23.75 dBm
Start 2 GHz
100 MHz/
Stop 3 GHz



Remark:

Pretest 9kHz to 25GHz, find the highest point when testing, so only the worst data were shown in the test report. Per FCC Part 15.33 (a) and 15.31 (o) ,The amplitude of spurious emissions from intentional radiators which are attenuated more than 20 dB below the permissible value need not be reported unless specifically required elsewhere in this part.

6.10 Other requirements Frequency Hopping Spread Spectrum System

Test Requirement:	47 CFR Part 15C Section 15.247 (a)(1), (h) requirement:

The system shall hop to channel frequencies that are selected at the system hopping rate from a Pseudorandom ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

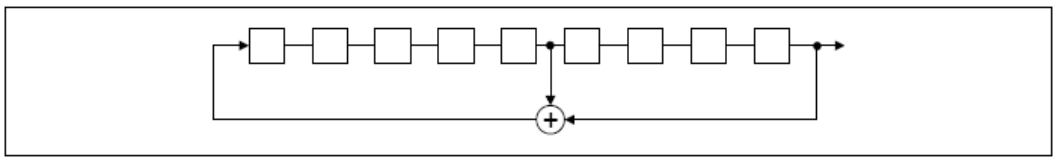
Frequency hopping spread spectrum systems are not required to employ all available hopping channels during each transmission. However, the system, consisting of both the transmitter and the receiver, must be designed to comply with all of the regulations in this section should the transmitter be presented with a continuous data (or information) stream. In addition, a system employing short transmission bursts must comply with the definition of a frequency hopping system and must distribute its transmissions over the minimum number of hopping channels specified in this section.

The incorporation of intelligence within a frequency hopping spread spectrum system that permits the system to recognize other users within the spectrum band so that it individually and independently chooses and adapts its hopsets to avoid hopping on occupied channels is permitted. The coordination of frequency hopping systems in any other manner for the express purpose of avoiding the simultaneous occupancy of individual hopping frequencies by multiple transmitters is not permitted.

Compliance for section 15.247(a)(1)

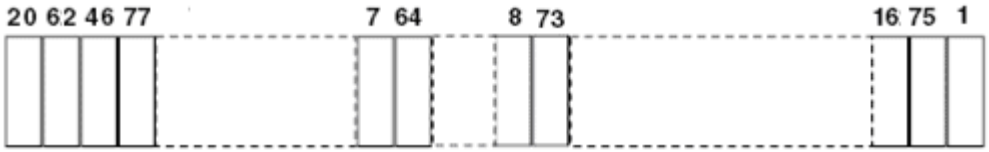
According to Bluetooth Core Specification, the pseudorandom sequence may be generated in a nine-stage shift register whose 5th and 9th stage
outputs are added in a modulo-two addition stage. And the result is fed back to the input of the first stage. The sequence begins with the first ONE of 9 consecutive ONEs; i.e. the shift register is initialized with nine ones.

- Number of shift register stages: 9
- Length of pseudo-random sequence: 2^9 -1 = 511 bits
- Longest sequence of zeros: 8 (non-inverted signal)



Linear Feedback Shift Register for Generation of the PRBS sequence

An example of Pseudorandom Frequency Hopping Sequence as follow:



Each frequency used equally on the average by each transmitter.
According to Bluetooth Core Specification, Bluetooth receivers are designed to have input and IF bandwidths that match the hopping channel bandwidths of any Bluetooth transmitters and shift frequencies in synchronization with the transmitted signals.

Compliance for section 15.247(g)

According to Bluetooth Core Specification, the Bluetooth system transmits the packet with the pseudorandom hopping frequency with a continuous data and the short burst transmission from the Bluetooth system is also transmitted under the frequency hopping system with the pseudorandom hopping frequency system.

Compliance for section 15.247(h)
According to Bluetooth Core specification, the Bluetooth system incorporates with an adaptive system to detect other user within the spectrum band so that it individually and independently to avoid hopping on the occupied channels. According to the Bluetooth Core specification, the Bluetooth system is designed not have the ability to coordinated with other FHSS System in an effort to avoid the simultaneous occupancy of individual hopping frequencies by multiple transmitter.

6.11 Radiated Spurious Emission

<table>
<tr><td>Test Requirement:</td><td>47 CFR Part 15C Section 15.209 and 15.205</td></tr>
<tr><td>Test Method:</td><td>ANSI C63.10: 2013</td></tr>
<tr><td>Test Site:</td><td>Measurement Distance: 3m (Semi-Anechoic Chamber)</td></tr>
<tr><td>Receiver Setup:</td><td>
<table>
<tr><th>Frequency</th><th>Detector</th><th>RBW</th><th>VBW</th><th>Remark</th></tr>
<tr><td>0.009MHz-0.090MHz</td><td>Peak</td><td>10kHz</td><td>30kHz</td><td>Peak</td></tr>
<tr><td>0.009MHz-0.090MHz</td><td>Average</td><td>10kHz</td><td>30kHz</td><td>Average</td></tr>
<tr><td>0.090MHz-0.110MHz</td><td>Quasi-peak</td><td>10kHz</td><td>30kHz</td><td>Quasi-peak</td></tr>
<tr><td>0.110MHz-0.490MHz</td><td>Peak</td><td>10kHz</td><td>30kHz</td><td>Peak</td></tr>
<tr><td>0.110MHz-0.490MHz</td><td>Average</td><td>10kHz</td><td>30kHz</td><td>Average</td></tr>
<tr><td>0.490MHz -30MHz</td><td>Quasi-peak</td><td>10kHz</td><td>30kHz</td><td>Quasi-peak</td></tr>
<tr><td>30MHz-1GHz</td><td>Quasi-peak</td><td>100 kHz</td><td>300kHz</td><td>Quasi-peak</td></tr>
<tr><td rowspan="2">Above 1GHz</td><td>Peak</td><td>1MHz</td><td>3MHz</td><td>Peak</td></tr>
<tr><td>Peak</td><td>1MHz</td><td>10Hz</td><td>Average</td></tr>
</table>
</td></tr>
<tr><td>Limit:</td><td>
<table>
<tr><th>Frequency</th><th>Field strength (microvolt/meter)</th><th>Limit (dBuV/m)</th><th>Remark</th><th>Measurement distance (m)</th></tr>
<tr><td>0.009MHz-0.490MHz</td><td>2400/F(kHz)</td><td>-</td><td>-</td><td>300</td></tr>
<tr><td>0.490MHz-1.705MHz</td><td>24000/F(kHz)</td><td>-</td><td>-</td><td>30</td></tr>
<tr><td>1.705MHz-30MHz</td><td>30</td><td>-</td><td>-</td><td>30</td></tr>
<tr><td>30MHz-88MHz</td><td>100</td><td>40.0</td><td>Quasi-peak</td><td>3</td></tr>
<tr><td>88MHz-216MHz</td><td>150</td><td>43.5</td><td>Quasi-peak</td><td>3</td></tr>
<tr><td>216MHz-960MHz</td><td>200</td><td>46.0</td><td>Quasi-peak</td><td>3</td></tr>
<tr><td>960MHz-1GHz</td><td>500</td><td>54.0</td><td>Quasi-peak</td><td>3</td></tr>
<tr><td>Above 1GHz</td><td>500</td><td>54.0</td><td>Average</td><td>3</td></tr>
</table>
Note: 15.35(b), Unless otherwise specified, the limit on peak radio frequency emissions is 20dB above the maximum permitted average emission limit applicable to the equipment under test. This peak limit applies to the total peak emission level radiated by the device.
</td></tr>
</table>

Test Setup:	

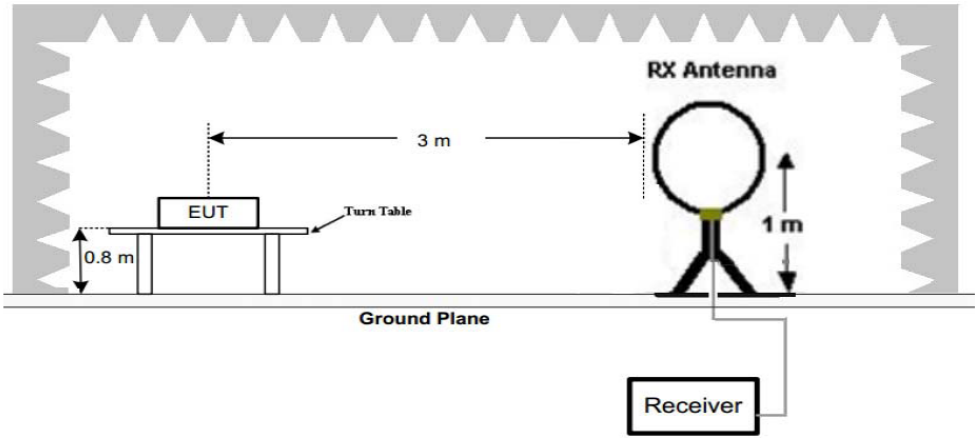


Figure 1. Below 30MHz

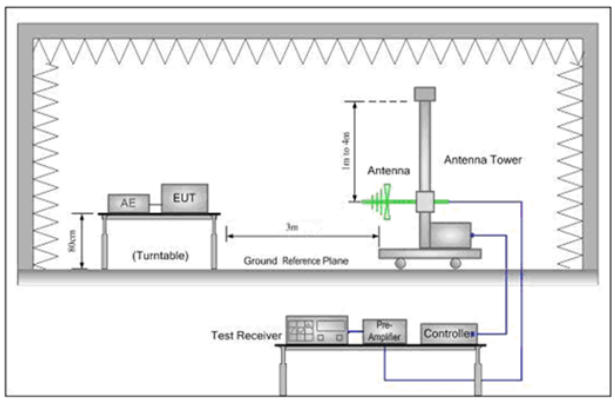


Figure 2. 30MHz to 1GHz

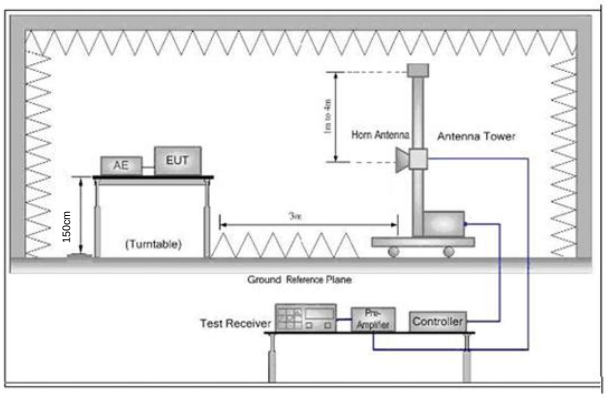


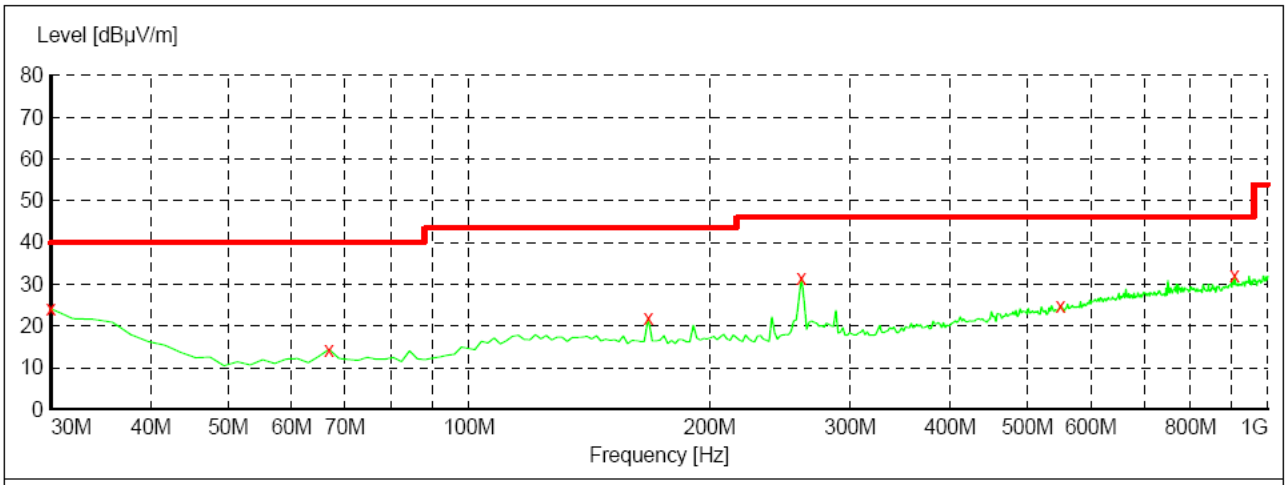
Figure 3. Above 1 GHz

Test Procedure:	a. 1) Below 1G: The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter semi-anechoic camber. The table was rotated 360 degrees to determine the position of the highest radiation. 2) Above 1G: The EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter semi-anechoic camber. The table was rotated 360 degrees to determine the position of the highest radiation. Note: For the radiated emission test above 1GHz: Place the measurement antenna away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response. The measurement antenna may have to be higher or lower than the EUT, depending on the radiation pattern of the emission and staying aimed at the emission source for receiving the maximum signal. The final measurement antenna elevation shall be that which maximizes the emissions. The measurement antenna elevation for maximum emissions shall be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane. b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower. c. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.

	d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading. e. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode. f. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet. g. Test the EUT in the lowest channel (2402MHz),the middle channel (2441MHz),the Highest channel (2480MHz) h. Repeat above procedures until all frequencies measured was complete.
Exploratory Test Mode:	Non-hopping transmitting mode with all kind of modulation and all kind of data type
Final Test Mode:	Through Pre-scan, find the DH1 of data type and GFSK modulation is the worst case. Pretest the EUT at Transmitting mode, For below 1GHz part, through pre-scan, the worst case is the lowest channel. Only the worst case is recorded in the report.
Instruments Used:	Refer to section 5.10 for details
Test Results:	Pass

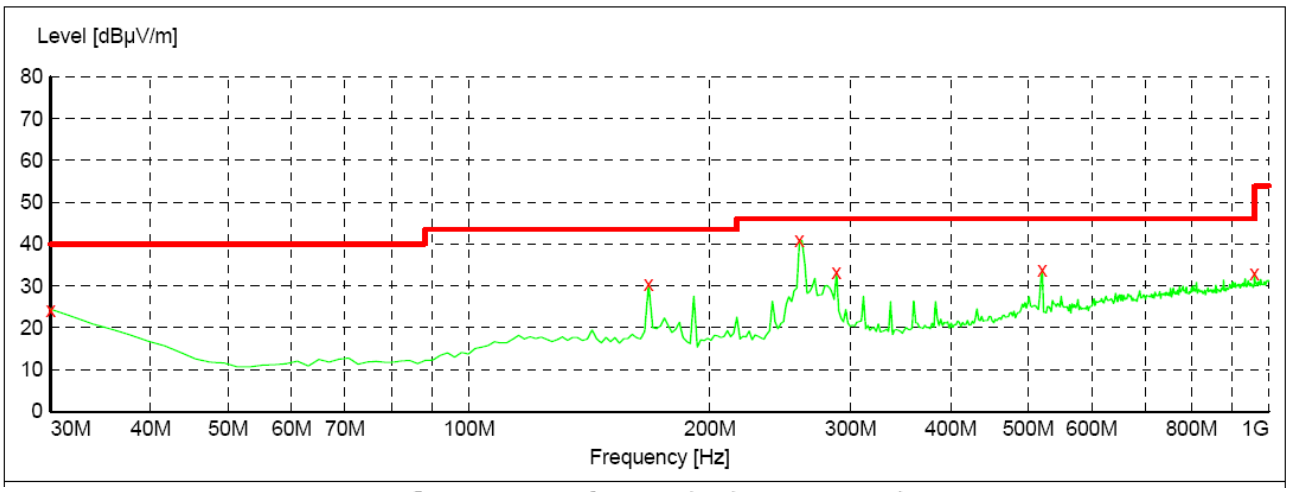
6.11.1 Radiated Emission below 1GHz

30MHz~1GHz (QP)		
Test mode:	Transmitting	Vertical



Frequency MHz	Level dBµV/m	Transd dB	Limit dBµV/m	Margin dB
30.000000	24.10	21.1	40.0	15.9
66.860000	14.40	8.4	40.0	25.6
167.740000	21.90	13.7	43.5	21.6
260.860000	31.60	15.0	46.0	14.4
549.920000	24.90	21.1	46.0	21.1
908.820000	32.20	26.2	46.0	13.8

Test mode:	Transmitting	Horizontal



Frequency MHz	Level dBµV/m	Transd dB	Limit dBµV/m	Margin dB
30.000000	24.40	21.1	40.0	15.6
167.740000	30.50	13.7	43.5	13.0
258.920000	41.10	14.9	46.0	4.9
288.020000	33.20	15.4	46.0	12.8
520.820000	33.80	20.5	46.0	12.2
959.260000	33.10	26.8	46.0	12.9

6.11.2 Transmitter Emission above 1GHz

Worse case mode:	GFSK(DH1)	Test channel:	Lowest

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Over (dB)	Detector Type	Ant. Pol. H/V
4804	48.29	-5.18	43.11	74	-30.89	peak	H
4804	36.37	-5.18	31.19	54	-22.81	AVG	H
7206	50.07	-6.45	43.62	74	-30.38	peak	H
7206	35.17	-6.45	28.72	54	-25.28	AVG	H
4804	48.42	-5.18	43.24	74	-30.76	peak	V
4804	36.66	-5.18	31.48	54	-22.52	AVG	V
7206	48.77	-6.45	42.32	74	-31.68	peak	V
7206	35.80	-6.45	29.35	54	-24.65	AVG	V

Worse case mode:	GFSK(DH1)	Test channel:	Middle

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Over (dB)	Detector Type	Ant. Pol. H/V
4882	48.48	-5.19	43.29	74	-30.71	peak	H
4882	36.95	-5.19	31.76	54	-22.24	AVG	H
7323	49.16	-6.47	42.69	74	-31.31	peak	H
7323	35.74	-6.47	29.27	54	-24.73	AVG	H
4882	49.02	-5.19	43.83	74	-30.17	peak	V
4882	36.02	-5.19	30.83	54	-23.17	AVG	V
7323	49.14	-6.47	42.67	74	-31.33	peak	V
7323	35.65	-6.47	29.18	54	-24.82	AVG	V

Worse case mode:	GFSK(DH1)	Test channel:	Highest

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Over (dB)	Detector Type	Ant. Pol. H/V
4960	49.44	-5.2	44.24	74	-29.76	peak	H
4960	37.22	-5.2	32.02	54	-21.98	AVG	H
7440	50.30	-6.47	43.83	74	-30.17	peak	H
7440	36.35	-6.47	29.88	54	-24.12	AVG	H
4960	50.03	-5.2	44.83	74	-29.17	peak	V
4960	37.34	-5.2	32.14	54	-21.86	AVG	V
7440	51.04	-6.47	44.57	74	-29.43	peak	V
7440	36.84	-6.47	30.37	54	-23.63	AVG	V

Remark:

1) The field strength is calculated by adding the Antenna Factor, Cable Factor & Preamplifier. The basic equation with a sample calculation is as follows:
   Final Test Level =Receiver Reading + Antenna Factor + Cable Factor – Preamplifier Factor
2) Scan from 9kHz to 25GHz, the disturbance above 13GHz and below 30MHz was very low, and the above harmonics were the highest point could be found when testing, so only the above harmonics had been displayed. The amplitude of spurious emissions from the radiator which are attenuated more than 20dB below the limit need not be reported.

6.12 Restricted bands around fundamental frequency

Test Requirement:	47 CFR Part 15C Section 15.209 and 15.205
Test Method:	ANSI C63.10: 2013
Test Site:	Measurement Distance: 3m (Semi-Anechoic Chamber)
Limit:	

Frequency	Limit (dBuV/m @3m)	Remark
30MHz-88MHz	40.0	Quasi-peak Value
88MHz-216MHz	43.5	Quasi-peak Value
216MHz-960MHz	46.0	Quasi-peak Value
960MHz-1GHz	54.0	Quasi-peak Value
Above 1GHz	54.0	Average Value
	74.0	Peak Value

Test Setup:

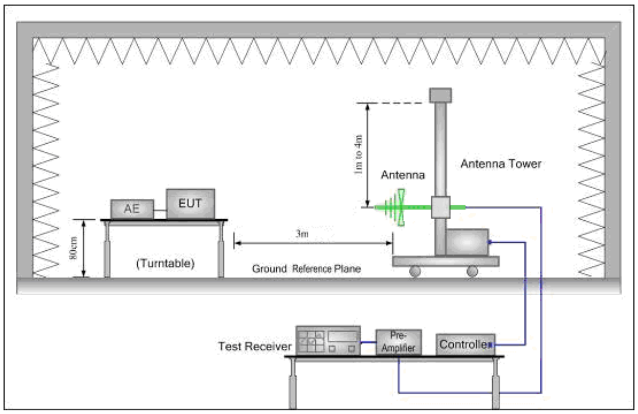


Figure 1. 30MHz to 1GHz

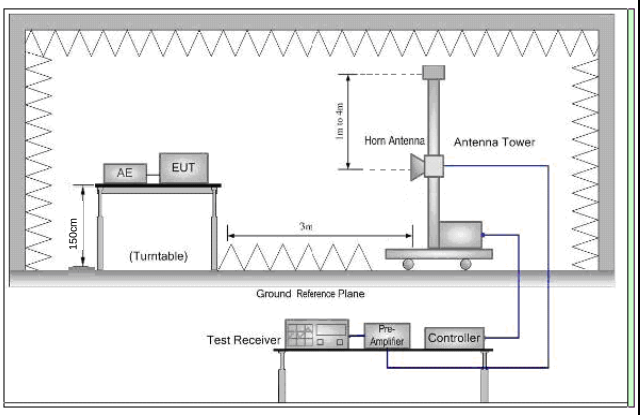


Figure 2. Above 1 GHz

Test Procedure:	a. 1) Below 1G: The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter semi-anechoic camber. The table was rotated 360 degrees to determine the position of the highest radiation. 2) Above 1G: The EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter semi-anechoic camber. The table was rotated 360 degrees to determine the position of the highest radiation. Note: For the radiated emission test above 1GHz: Place the measurement antenna away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response. The measurement antenna may have to be higher or lower than the EUT, depending on the radiation pattern of the emission and staying aimed at the emission source for receiving the maximum signal. The final measurement antenna elevation shall be that which maximizes the emissions. The measurement antenna elevation for maximum emissions shall be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane. b. c. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower. d. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement. e. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading. f. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode. g. Place a marker at the end of the restricted band closest to the transmit frequency to show compliance. Also measure any emissions in the restricted bands. Save the spectrum analyzer plot. Repeat for each power and modulation for lowest and highest channel h. Test the EUT in the lowest channel , the Highest channel i. Repeat above procedures until all frequencies measured was complete.
Exploratory Test Mode:	Non-hopping transmitting mode with all kind of modulation and all kind of data type
Final Test Mode:	Through Pre-scan, find the DH5 of data type and GFSK modulation is the worst case. Pretest the EUT at Transmitting mode, found the Transmitting mode which it is worse case Only the worst case is recorded in the report.
Instruments Used:	Refer to section 5.10 for details
Test Results:	Pass

Worse case mode:	GFSK (DH5)	Test channel:	Lowest	Remark:	Vertical

Frequency	Meter Reading	Factor	Emission Level	Limits	Over	Detector Type
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	
2390.00	48.90	-4.36	44.54	74	-29.46	peak
2390.00	35.79	-4.36	31.43	54	-22.57	AVG
2402.15	101.52	-4.37	97.15	74	23.15	peak
2402.15	88.36	-4.37	83.99	54	29.99	AVG

Worse case mode:	GFSK (DH5)	Test channel:	Lowest	Remark:	Horizontal

Frequency	Meter Reading	Factor	Emission Level	Limits	Over	Detector Type
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	
2390.00	45.74	-4.36	41.38	74	-32.62	peak
2390.00	34.42	-4.36	30.06	54	-23.94	AVG
2402.14	102.42	-4.37	98.05	74	24.05	peak
2402.14	78.24	-4.37	73.87	54	19.87	AVG

Worse case mode:	GFSK (DH5)	Test channel:	Highest	Remark:	Vertical

Frequency	Meter Reading	Factor	Emission Level	Limits	Over	Detector Type
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	
2479.78	104.25	-4.22	100.03	74	26.03	peak
2479.78	86.96	-4.22	82.74	54	28.74	AVG
2483.50	64.19	-4.22	59.97	74	-14.03	peak
2483.50	54.73	-4.22	50.51	54	-3.49	AVG

Worse case mode:	GFSK (DH5)	Test channel:	Highest	Remark:	Horizontal

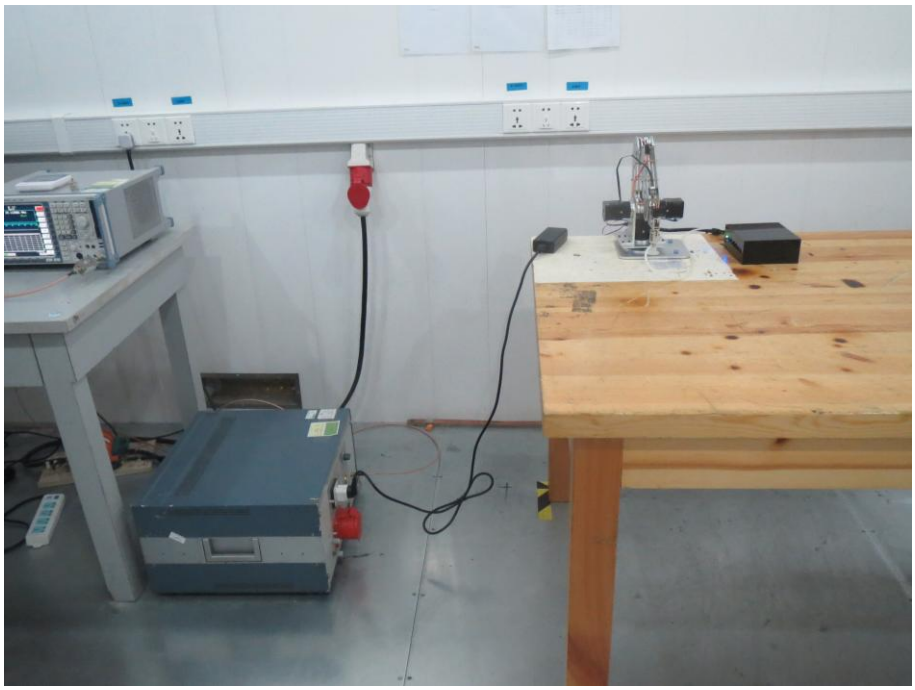
Frequency	Meter Reading	Factor	Emission Level	Limits	Over	Detector Type
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	
2479.73	102.48	-4.22	98.26	74	24.26	peak
2479.73	86.08	-4.22	81.86	54	27.86	AVG
2483.50	63.41	-4.22	59.19	74	-14.81	peak
2483.50	54.82	-4.22	50.60	54	-3.40	AVG

Note:
The field strength is calculated by adding the Antenna Factor, Cable Factor & Preamplifier. The basic equation with a sample calculation is as follows:

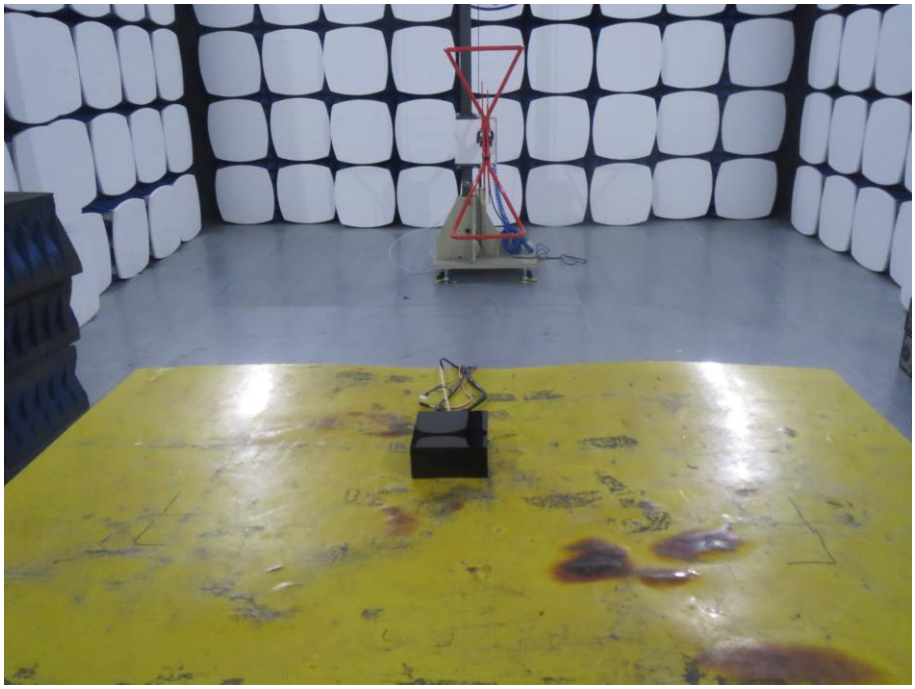
Final Test Level =Receiver Reading + Antenna Factor + Cable Factor – Preamplifier Factor

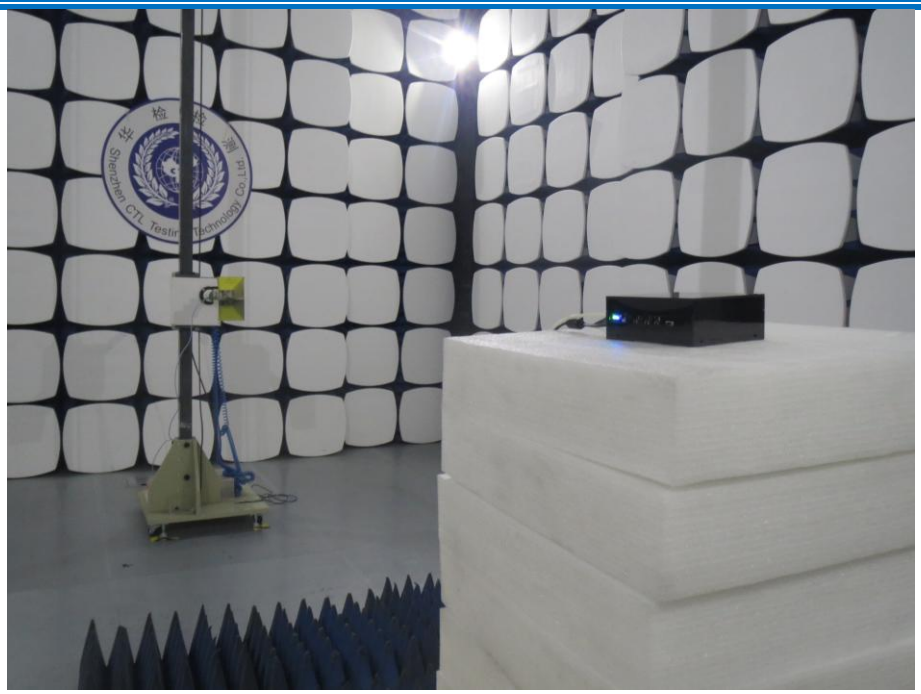
7 Photographs - EUT Test Setup

7.1 Conducted Emission



7.2 Radiated Emission





8 Photographs - EUT Constructional Details

Refer to Photographs of EUT Constructional Details of CQASZ160101319E.