SGS-CSTC Standards Technical Services Co., Ltd.
Shenzhen Branch

No. 1 Workshop, M-10, Middle section, Science & Technology Park,
Shenzhen, Guangdong, China 518057

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TEST REPORT

Application No.:	SZEM1704003525CR
Applicant:	INNOVATION SOUND TECHNOLOGY CO.,LTD.
Address of Applicant:	Building 2th, Industrial Area of HuaideCuihai, Fuyong Town, Shenzhen,China
Manufacturer:	Acoustic Innovation (Huizhou) CO.,LTD.
Address of Manufacturer:	Xiangshuihe Industrial Area, Dayawan Development District, Huizhou City, GuangDong Province, China
Factory:	Acoustic Innovation (Huizhou) CO.,LTD.
Address of Factory:	Xiangshuihe Industrial Area, Dayawan Development District, Huizhou City, GuangDong Province, China
Equipment Under Test (EUT):	
EUT Name:	Bluetooth Earphone
Model No.:	HA-FX29BT
FCC ID:	2AKSL-FX29BT
Trade Mark:	JVC
Standards:	47 CFR Part 15, Subpart C 15.247
Date of Receipt:	2017-04-26
Date of Test:	2017-04-27 to 2017-05-04
Date of Issue:	2017-05-11
Test Result :	**Pass***

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

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Jack Zhang
EMC Laboratory Manager

The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in this report. If the product in this report is used in any configuration other than that detailed in the report, the manufacturer must ensure the new system complies with all relevant standards. Any mention of SGS International Electrical Approvals or testing done by SGS International Electrical Approvals in connection with, distribution or use of the product described in this report must be approved by SGS International Electrical Approvals in writing.

Revision Record				
Version	**Chapter**	**Date**	**Modifier**	**Remark**
01		*2017-05-11*		*Original*

Authorized for issue by:				
Tested By				2017-05-11
		Jacky Li/Project Engineer		**Date**
Checked By				2017-05-11
		Eric Fu /Reviewer		**Date**

2 Test Summary

Radio Spectrum Technical Requirement				
Item	**Standard**	**Method**	**Requirement**	**Result**
Antenna Requirement	47 CFR Part 15, Subpart C 15.247	N/A	47 CFR Part 15, Subpart C 15.203 & 15.247(c)	Pass
Other requirements Frequency Hopping Spread Spectrum System Hopping Sequence	47 CFR Part 15, Subpart C 15.247	N/A	47 CFR Part 15, Subpart C 15.247(a)(1),(g),(h)	Pass

Radio Spectrum Matter Part				
Item	**Standard**	**Method**	**Requirement**	**Result**
Conducted Peak Output Power	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 7.8.5	47 CFR Part 15, Subpart C 15.247(b)(1)	Pass
20dB Bandwidth	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 7.8.7	47 CFR Part 15, Subpart C 15.247(a)(1)	Pass
Carrier Frequencies Separation	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 7.8.2	47 CFR Part 15, Subpart C 15.247a(1)	Pass
Hopping Channel Number	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 7.8.3	47 CFR Part 15, Subpart C 15.247a(1)(iii)	Pass
Dwell Time	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 7.8.4	47 CFR Part 15, Subpart C 15.247a(1)(iii)	Pass
Conducted Band Edges Measurement	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 7.8.6	47 CFR Part 15, Subpart C 15.247(d)	Pass
Conducted Spurious Emissions	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 7.8.8	47 CFR Part 15, Subpart C 15.247(d)	Pass
Radiated Emissions which fall in the restricted bands	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 6.10.5	47 CFR Part 15, Subpart C 15.205 & 15.209	Pass
Radiated Spurious Emissions	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 6.4,6.5,6.6	47 CFR Part 15, Subpart C 15.205 & 15.209	Pass

3 Contents

4 General Information

4.1 Details of E.U.T.

Product Name:	Bluetooth Earphone
Model No.:	HA-FX29BT
Bluetooth Version:	V4.1 Single mode
Operation Frequency:	2402MHz~2480MHz
Modulation Technique:	Frequency Hopping Spread Spectrum(FHSS)
Modulation Type:	GFSK, π/4DQPSK, 8DPSK
Number of Channel:	79
Antenna Type and Gain:	Type : Chip Antenna Gain :0.6dBi
Power supply:	DC 3.7V by battery(80mAh) Charging voltage: DC 5.0V, 0.5A
Cable:	USB cable: 0.4m, unshielded

4.2 Description of Support Units

The EUT can works as a Independent units

4.3 Measurement Uncertainty

No.	Item	Measurement Uncertainty
1	Radio Frequency	7.25 x 10-8
2	Duty cycle	0.37%
3	Occupied Bandwidth	3%
4	RF conducted power	0.75dB
5	RF power density	2.84dB
6	Conducted Spurious emissions	0.75dB
7	RF Radiated power	4.5dB (below 1GHz)
		4.8dB (above 1GHz)
8	Radiated Spurious emission test	4.5dB (30MHz-1GHz)
		4.8dB (1GHz-18GHz)
9	Temperature test	1°C
10	Humidity test	3%
11	Supply voltages	1.5%
12	Time	3%

4.4 Test Location

All tests were performed at:

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen Branch

No. 1 Workshop, M-10, Middle Section, Science & Technology Park, Shenzhen, Guangdong, China. 518057.

Tel: +86 755 2601 2053 Fax: +86 755 2671 0594

No tests were sub-contracted.

4.5 Test Facility

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

• CNAS (No. CNAS L2929)

CNAS has accredited SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen Branch EMC Lab to ISO/IEC 17025:2005 General Requirements for the Competence of Testing and Calibration Laboratories (CNAS-CL01 Accreditation Criteria for the Competence of Testing and Calibration Laboratories) for the competence in the field of testing.

• A2LA (Certificate No. 3816.01)

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory is accredited by the American Association for Laboratory Accreditation(A2LA). Certificate No. 3816.01.

• VCCI

The 10m Semi-anechoic chamber and Shielded Room of SGS-CSTC Standards Technical Services Co., Ltd. have been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: G-823, R-4188, T-1153 and C-2383 respectively.

• FCC – Registration No.: 556682

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory 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 No.: 556682.

• Industry Canada (IC)

Two 3m Semi-anechoic chambers and the 10m Semi-anechoic chamber of SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen Branch EMC Lab have been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 4620C-1, 4620C-2, 4620C-3.

4.6 Deviation from Standards

None

4.7 Abnormalities from Standard Conditions

None

5 Equipment List

RE in Chamber					
Test Equipment	**Manufacturer**	**Model No.**	**Inventory No.**	**Cal. Date (yyyy-mm-dd)**	**Cal. Due date (yyyy-mm-dd)**
3m Semi-Anechoic Chamber	AUDIX	N/A	SEM001-02	2016-05-10	2017-05-10
EXA Spectrum Analyzer	Agilent Technologies Inc	N9010A	SEM004-09	2016-07-19	2017-07-19
BiConiLog Antenna (26-3000MHz)	ETS-Lindgren	3142C	SEM003-02	2014-11-15	2017-11-15
Amplifier (0.1-1300MHz)	HP	8447D	SEM005-02	2016-10-09	2017-10-09
Horn Antenna (1-18GHz)	Rohde & Schwarz	HF907	SEM003-07	2015-06-14	2018-06-14
Horn Antenna (18-26GHz)	ETS-Lindgren	3160	SEM003-12	2014-11-24	2017-11-24
Horn Antenna(26GHz-40GHz)	A.H.Systems, inc.	SAS-573	SEM003-13	2015-02-12	2018-02-12
Low Noise Amplifier	Black Diamond Series	BDLNA-0118-352810	SEM005-05	2016-10-09	2017-10-09
Band filter	Amindeon	Asi 3314	SEM023-01	N/A	N/A

Conducted Peak Output Power					
Equipment	**Manufacturer**	**Model No**	**Inventory No**	**Cal Date**	**Cal Due Date**
DC Power Supply	ZhaoXin	RXN-305D	SEM011-02	2016-10-09	2017-10-09
Spectrum Analyzer	Rohde & Schwarz	FSP	SEM004-06	2016-10-09	2017-10-09
Power Meter	Rohde & Schwarz	NRVS	SEM014-02	2016-10-09	2017-10-09

20dB Bandwidth					
Equipment	**Manufacturer**	**Model No**	**Inventory No**	**Cal Date**	**Cal Due Date**
DC Power Supply	ZhaoXin	RXN-305D	SEM011-02	2016-10-09	2017-10-09
Spectrum Analyzer	Rohde & Schwarz	FSP	SEM004-06	2016-10-09	2017-10-09
Power Meter	Rohde & Schwarz	NRVS	SEM014-02	2016-10-09	2017-10-09

Carrier Frequencies Separation					
Equipment	**Manufacturer**	**Model No**	**Inventory No**	**Cal Date**	**Cal Due Date**
DC Power Supply	ZhaoXin	RXN-305D	SEM011-02	2016-10-09	2017-10-09
Spectrum Analyzer	Rohde & Schwarz	FSP	SEM004-06	2016-10-09	2017-10-09
Power Meter	Rohde & Schwarz	NRVS	SEM014-02	2016-10-09	2017-10-09

Hopping Channel Number					
Equipment	**Manufacturer**	**Model No**	**Inventory No**	**Cal Date**	**Cal Due Date**
DC Power Supply	ZhaoXin	RXN-305D	SEM011-02	2016-10-09	2017-10-09
Spectrum Analyzer	Rohde & Schwarz	FSP	SEM004-06	2016-10-09	2017-10-09
Power Meter	Rohde & Schwarz	NRVS	SEM014-02	2016-10-09	2017-10-09

Dwell Time					
Equipment	**Manufacturer**	**Model No**	**Inventory No**	**Cal Date**	**Cal Due Date**
DC Power Supply	ZhaoXin	RXN-305D	SEM011-02	2016-10-09	2017-10-09
Spectrum Analyzer	Rohde & Schwarz	FSP	SEM004-06	2016-10-09	2017-10-09
Power Meter	Rohde & Schwarz	NRVS	SEM014-02	2016-10-09	2017-10-09

Conducted Band Edges Measurement					
Equipment	**Manufacturer**	**Model No**	**Inventory No**	**Cal Date**	**Cal Due Date**
DC Power Supply	ZhaoXin	RXN-305D	SEM011-02	2016-10-09	2017-10-09
Spectrum Analyzer	Rohde & Schwarz	FSP	SEM004-06	2016-10-09	2017-10-09
Power Meter	Rohde & Schwarz	NRVS	SEM014-02	2016-10-09	2017-10-09

Conducted Spurious Emissions					
Equipment	**Manufacturer**	**Model No**	**Inventory No**	**Cal Date**	**Cal Due Date**
DC Power Supply	ZhaoXin	RXN-305D	SEM011-02	2016-10-09	2017-10-09
Spectrum Analyzer	Rohde & Schwarz	FSP	SEM004-06	2016-10-09	2017-10-09
Power Meter	Rohde & Schwarz	NRVS	SEM014-02	2016-10-09	2017-10-09

General used equipment					
Equipment	**Manufacturer**	**Model No**	**Inventory No**	**Cal Date**	**Cal Due Date**
Humidity/ Temperature Indicator	Shanghai Meteorological Industry Factory	ZJ1-2B	SEM002-03	2016-10-12	2017-10-12
Humidity/ Temperature Indicator	Shanghai Meteorological Industry Factory	ZJ1-2B	SEM002-04	2016-10-12	2017-10-12
Humidity/ Temperature Indicator	Mingle	N/A	SEM002-08	2016-10-12	2017-10-12
Barometer	Changchun Meteorological Industry Factory	DYM3	SEM002-01	2016-05-18	2017-05-18

6 Radio Spectrum Technical Requirement

6.1 Antenna Requirement

6.1.1 Test Requirement:

47 CFR Part 15, Subpart C 15.247

6.1.2 Conclusion

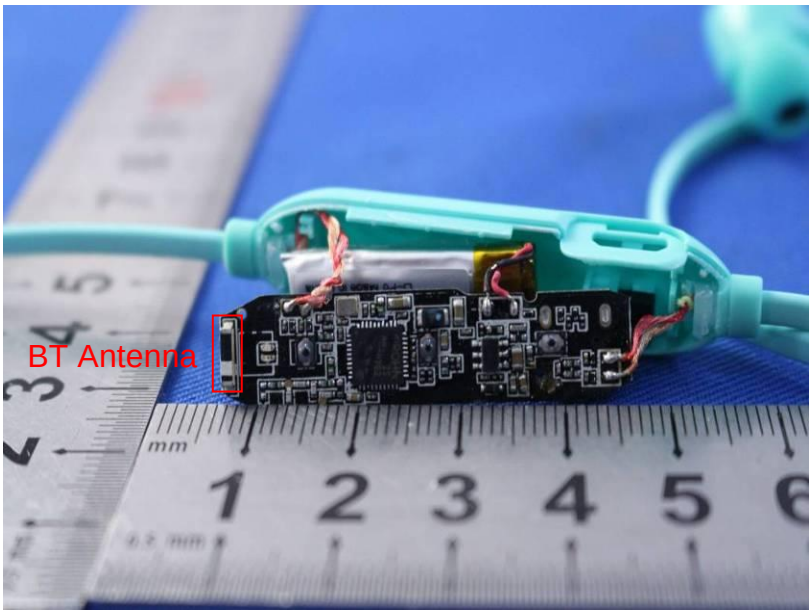
Standard Requirment:

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 0.6dBi.

6.2 Other requirements Frequency Hopping Spread Spectrum System Hopping Sequence

6.2.1 Test Requirement:

47 CFR Part 15, Subpart C 15.247

6.2.2 Conclusion

Standard Requirment:

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 Technical 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: 29 -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 Technical Specification, the receivers are designed to have input and IF bandwidths that match the hopping channel bandwidths of any transmitters and shift frequencies in synchronization with the transmitted signals.

Compliance for section 15.247(g):

According to Technical Specification, the 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 Technical specification, the system incorporates with an adaptive system to detect other user within the spectrum band so that it individ

7 Radio Spectrum Matter Test Results

7.1 Conducted Peak Output Power

Test Requirement 47 CFR Part 15, Subpart C 15.247(b)(1)
Test Method: ANSI C63.10 (2013) Section 7.8.5
Limit:

Frequency range(MHz)	Output power of the intentional radiator(watt)
902-928	1 for ≥50 hopping channels
	0.25 for 25≤ hopping channels <50
	1 for digital modulation
2400-2483.5	1 for ≥75 non-overlapping hopping channels
	0.125 for all other frequency hopping systems
	1 for digital modulation
5725-5850	1 for frequency hopping systems and digital modulation

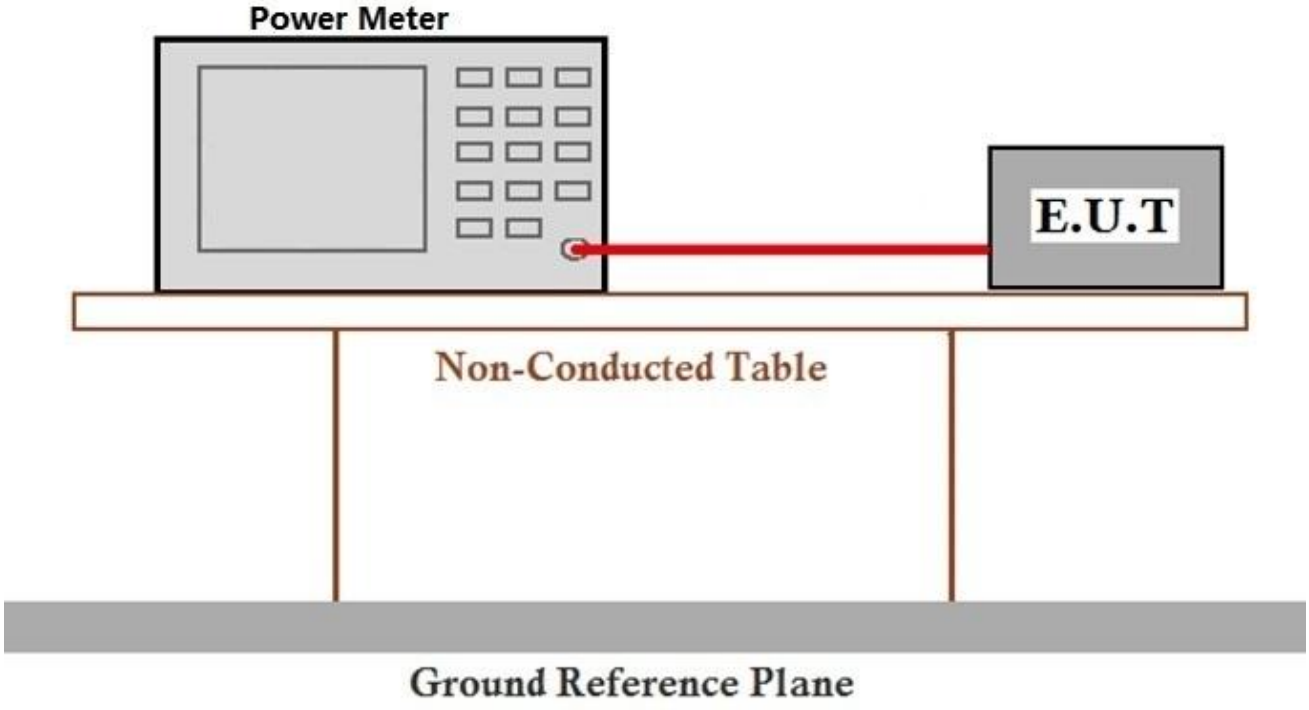
7.1.1 E.U.T. Operation

Operating Environment:

Temperature: 23 °C Humidity: 56 % RH Atmospheric Pressure: 1015 mbar

Pretest these mode to find the worst case: b: TX_non-Hop mode_Keep the EUT in continuously transmitting mode with GFSK modulation, π/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report.

7.1.2 Test Setup Diagram



7.1.3 Measurement Data

The detailed test data see: Appendix 15.247

7.2 20dB Bandwidth

Test Requirement	47 CFR Part 15, Subpart C 15.247(a)(1)
Test Method:	ANSI C63.10 (2013) Section 7.8.7

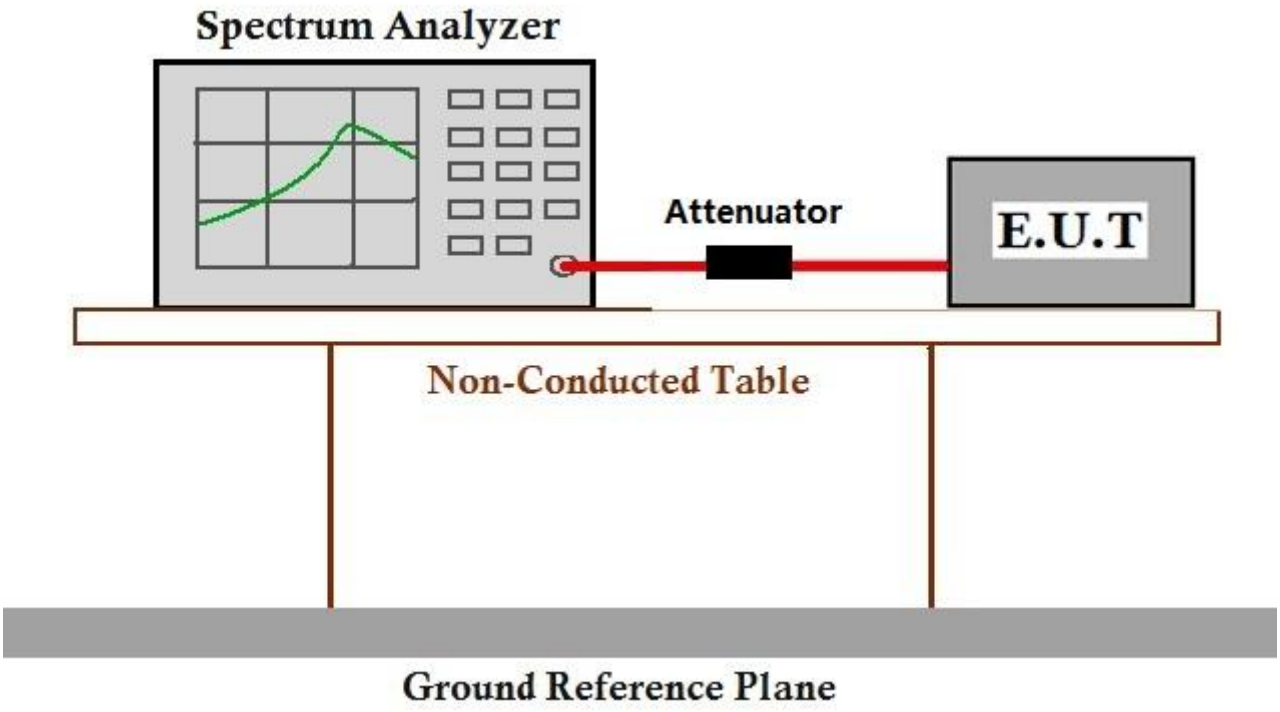
7.2.1 E.U.T. Operation

Operating Environment:

Temperature: 23 °C Humidity: 56 % RH Atmospheric Pressure: 1015 mbar

Pretest these mode to find the worst case: b: TX_non-Hop mode_Keep the EUT in continuously transmitting mode with GFSK modulation, π/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report.

7.2.2 Test Setup Diagram



7.2.3 Measurement Data

The detailed test data see: Appendix 15.247

7.3 Carrier Frequencies Separation

Test Requirement	47 CFR Part 15, Subpart C 15.247a(1)
Test Method:	ANSI C63.10 (2013) Section 7.8.2
Limit:	2/3 of the 20dB bandwidth base on the transmission power is less than 0.125W

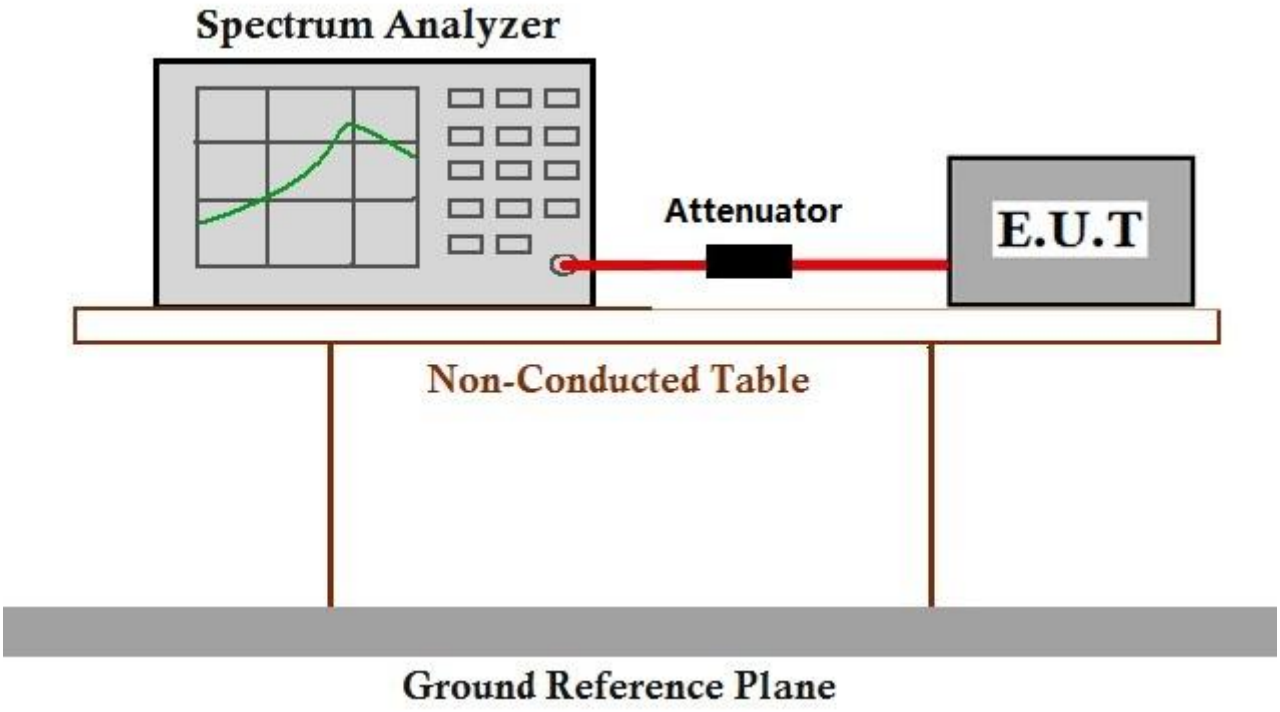
7.3.1 E.U.T. Operation

Operating Environment:

Temperature: 23 °C Humidity: 56 % RH Atmospheric Pressure: 1015 mbar

Pretest these mode to find the worst case: d: TX_Hop mode_Keep the EUT in frequency hopping mode with GFSK modulation, π/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report.

7.3.2 Test Setup Diagram



7.3.3 Measurement Data

The detailed test data see: Appendix 15.247

7.4 Hopping Channel Number

Test Requirement 47 CFR Part 15, Subpart C 15.247a(1)(iii)
Test Method: ANSI C63.10 (2013) Section 7.8.3
Limit:

Frequency range(MHz)	Number of hopping channels (minimum)
902-928	50 for 20dB bandwidth <250kHz
	25 for 20dB bandwidth ≥250kHz
2400-2483.5	15
5725-5850	75

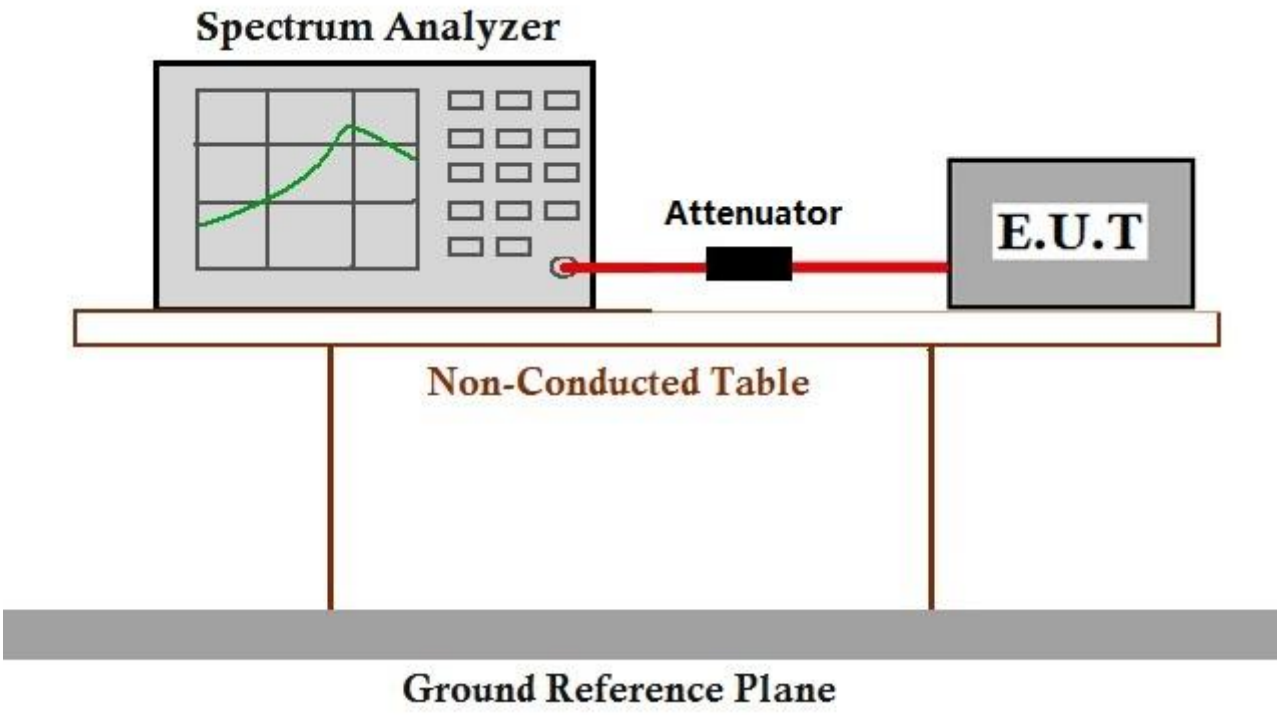
7.4.1 E.U.T. Operation

Operating Environment:

Temperature: 23 °C Humidity: 56 % RH Atmospheric Pressure: 1015 mbar

Pretest these mode to find the worst case: d: TX_Hop mode_Keep the EUT in frequency hopping mode with GFSK modulation, π/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report.

7.4.2 Test Setup Diagram



7.4.3 Measurement Data

The detailed test data see: Appendix 15.247

7.5 Dwell Time

Test Requirement 47 CFR Part 15, Subpart C 15.247a(1)(iii)
Test Method: ANSI C63.10 (2013) Section 7.8.4
Limit:

Frequency(MHz)	Limit
902-928	0.4S within a 20S period(20dB bandwidth<250kHz)
	0.4S within a 10S period(20dB bandwidth≥250kHz)
2400-2483.5	0.4S within a period of 0.4S multiplied by the number of hopping channels
5725-5850	0.4S within a 30S period

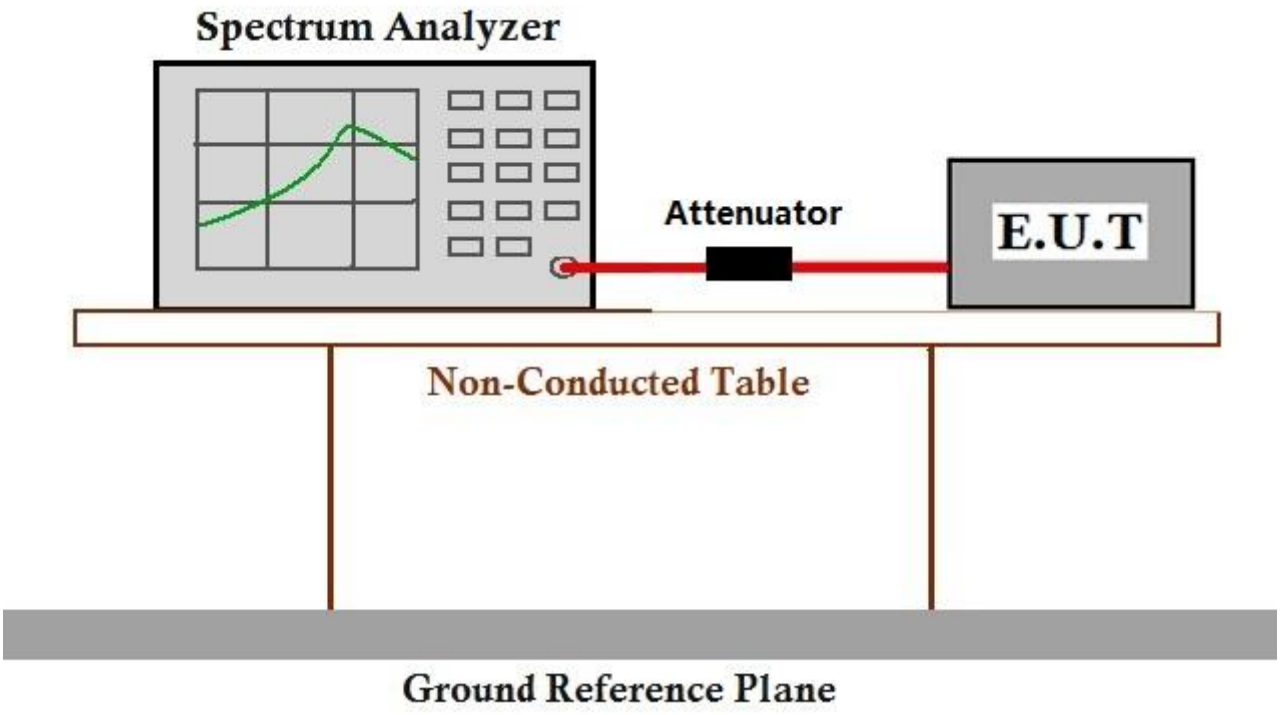
7.5.1 E.U.T. Operation

Operating Environment:

Temperature: 23 °C Humidity: 56 % RH Atmospheric Pressure: 1015 mbar

Pretest these mode to find the worst case: d: TX_Hop mode_Keep the EUT in frequency hopping mode with GFSK modulation, π/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report.

7.5.2 Test Setup Diagram



7.5.3 Measurement Data

The detailed test data see: Appendix 15.247

7.6 Conducted Band Edges Measurement

Test Requirement	47 CFR Part 15, Subpart C 15.247(d)
Test Method:	ANSI C63.10 (2013) Section 7.8.6

7.6.1 E.U.T. Operation

Operating Environment:

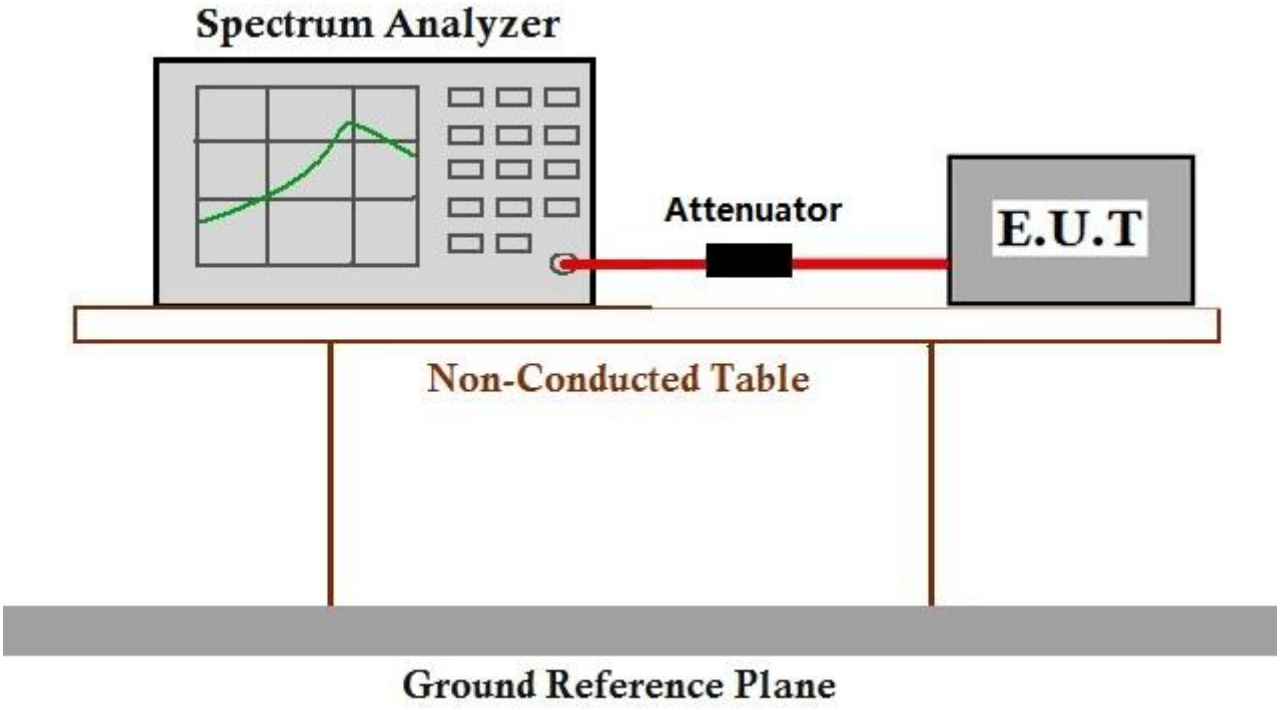
Temperature: 23 °C Humidity: 56 % RH Atmospheric Pressure: 1015 mbar

Pretest these mode to find the worst case:

b: TX_non-Hop mode_Keep the EUT in continuously transmitting mode with GFSK modulation, π/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report.

d: TX_Hop mode_Keep the EUT in frequency hopping mode with GFSK modulation, π/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report.

7.6.2 Test Setup Diagram



7.6.3 Measurement Data

The detailed test data see: Appendix 15.247

7.7 Conducted Spurious Emissions

Test Requirement	47 CFR Part 15, Subpart C 15.247(d)
Test Method:	ANSI C63.10 (2013) Section 7.8.8
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.

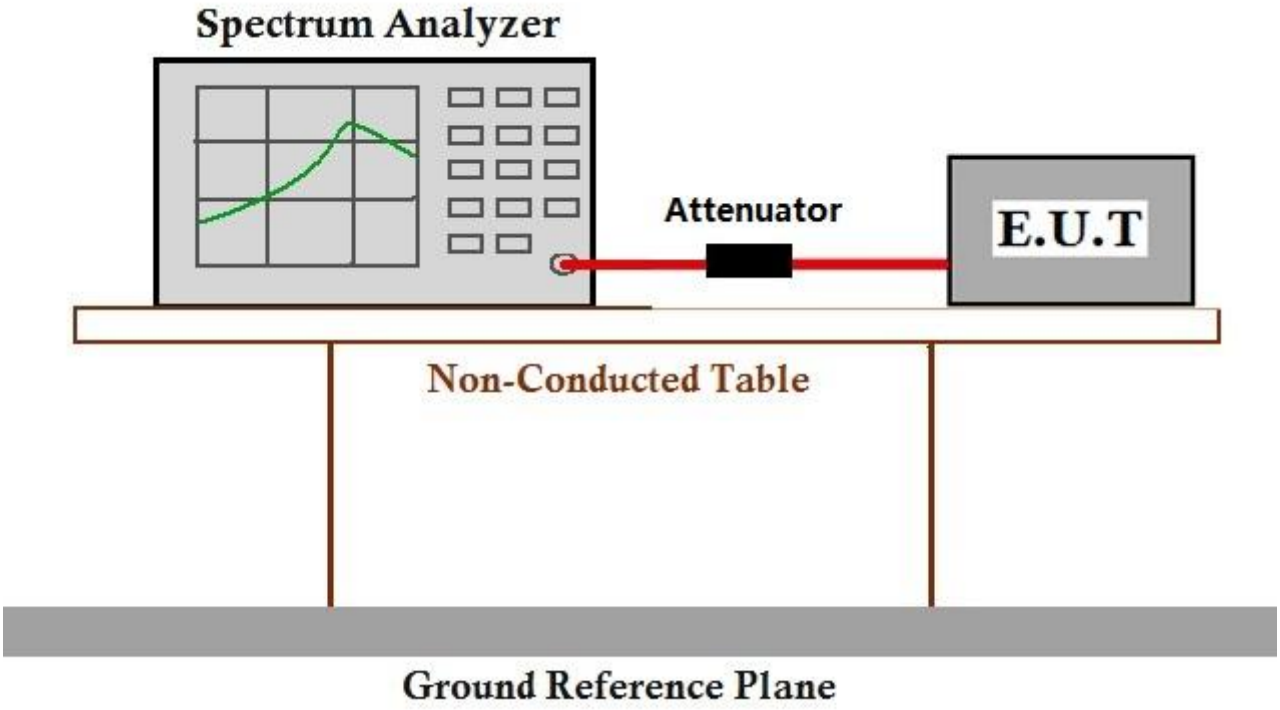
7.7.1 E.U.T. Operation

Operating Environment:

Temperature: 23 °C Humidity: 56 % RH Atmospheric Pressure: 1015 mbar

Pretest these mode to find the worst case: b: TX_non-Hop mode_Keep the EUT in continuously transmitting mode with GFSK modulation, π /4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report.

7.7.2 Test Setup Diagram



7.7.3 Measurement Data

The detailed test data see: Appendix 15.247

7.8 Radiated Emissions which fall in the restricted bands

Test Requirement 47 CFR Part 15, Subpart C 15.205 & 15.209
Test Method: ANSI C63.10 (2013) Section 6.10.5
Measurement Distance: 3m

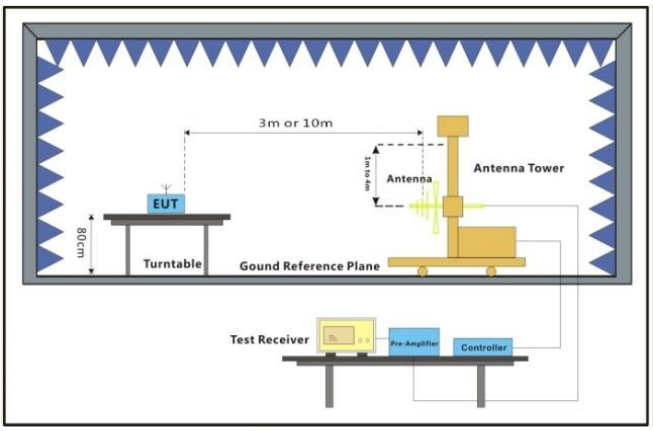
7.8.1 E.U.T. Operation

Operating Environment:

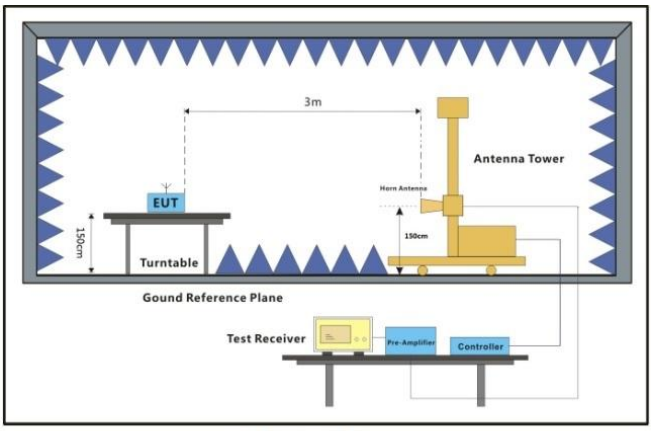
Temperature: 23 °C Humidity: 54 % RH Atmospheric Pressure: 1015 mbar

Pretest these mode to find the worst case: b: TX_non-Hop mode_Keep the EUT in continuously transmitting mode with GFSK modulation, π/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report.

7.8.2 Test Setup Diagram



30MHz-1GHz



Above 1GHz

7.8.3 Measurement Data

a. For below 1GHz, the EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 or 10 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.

b. For above 1GHz, the EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter fully-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.

c. The EUT was set 3 or 10 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 (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.

f. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

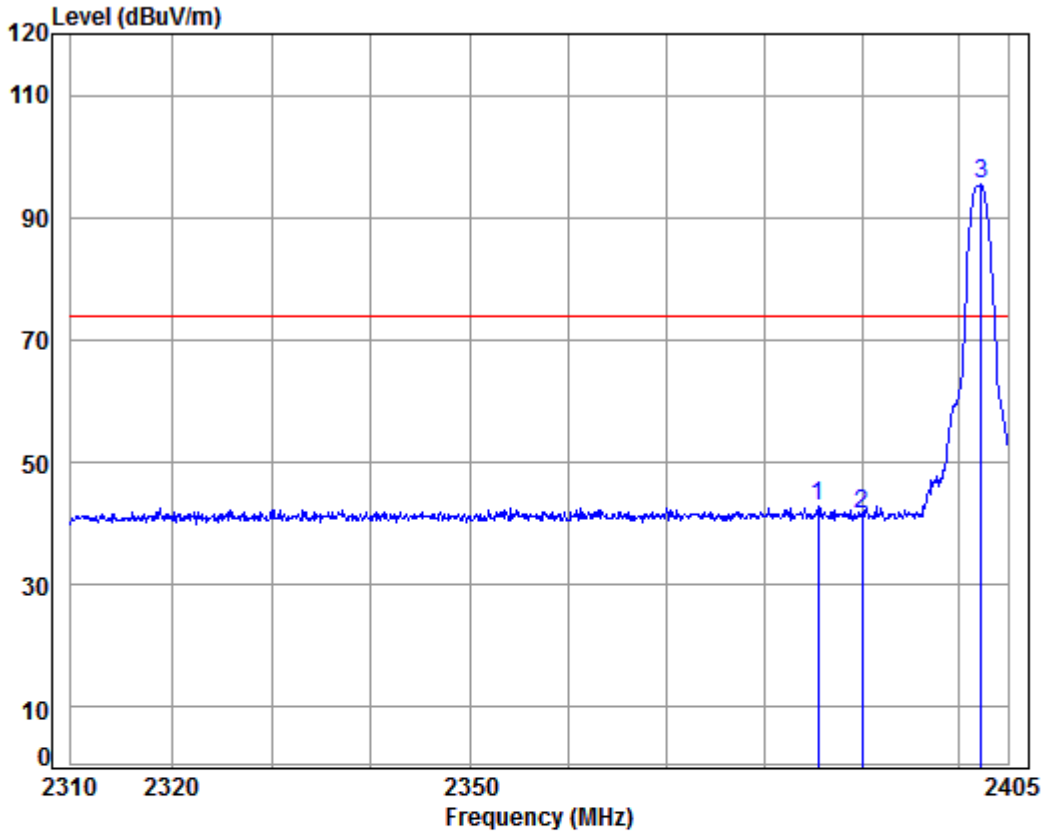
g. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

h. Test the EUT in the lowest channel,the middle channel,the Highest channel.

i. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is the worst case.

j. Repeat above procedures until all frequencies measured was complete.

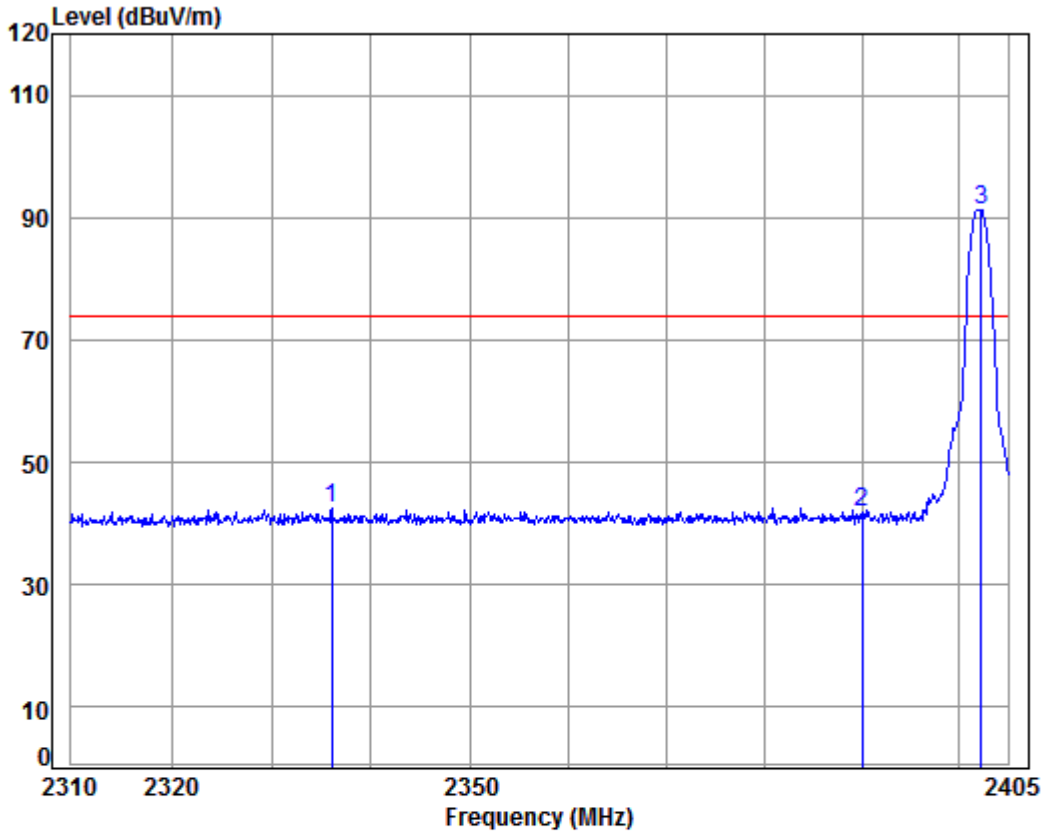
Mode:b; Polarization:Horizontal; Modulation Type:GFSK; ; Channel:Low



Condition: 3m HORIZONTAL
Job No: : 03525CR
Mode: : 2402 Band edge
: BT

	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	2385.404	5.33	29.06	37.96	46.25	42.68	74.00	-31.32	Peak
2	2390.000	5.34	29.08	37.96	45.14	41.60	74.00	-32.40	Peak
3 pp	2402.191	5.35	29.11	37.96	98.84	95.34	74.00	21.34	Peak

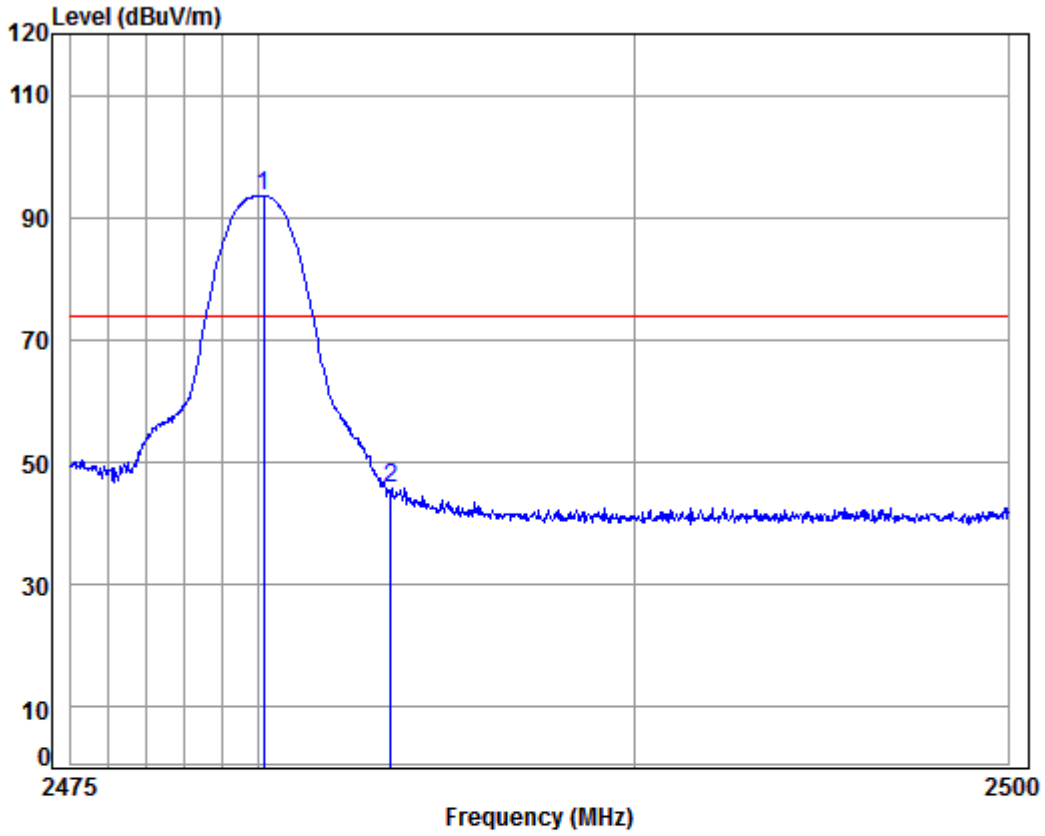
Mode:b; Polarization:Vertical; Modulation Type:GFSK; ; Channel:Low



Condition: 3m Vertical
Job No: : 03525CR
Mode: : 2402 Band edge
: BT

	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	2336.027	5.30	28.91	37.97	46.36	42.60	74.00	-31.40	Peak
2	2390.000	5.34	29.08	37.96	45.36	41.82	74.00	-32.18	Peak
3 pp	2402.191	5.35	29.11	37.96	94.79	91.29	74.00	17.29	Peak

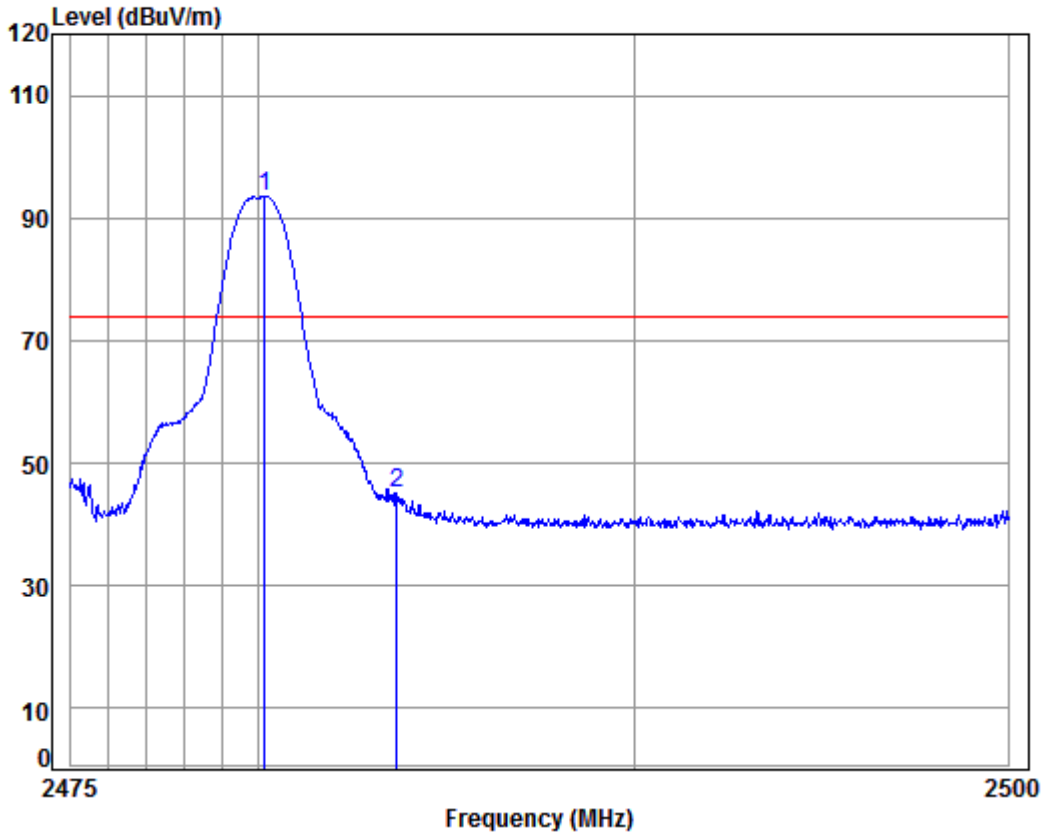
Mode:b; Polarization:Horizontal; Modulation Type:GFSK; ; Channel:High



Condition: 3m HORIZONTAL
Job No: : 03525CR
Mode: : 2480 Band edge
: BT

	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1 pp	2480.129	5.41	29.34	37.95	96.66	93.46	74.00	19.46	Peak
2	2483.500	5.41	29.35	37.95	48.94	45.75	74.00	-28.25	Peak

Mode:b; Polarization:Vertical; Modulation Type:GFSK; ; Channel:High



Condition: 3m VERTICAL
Job No: : 03525CR
Mode: : 2480 Band edge
: BT

	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1 pp	2480.154	5.41	29.34	37.95	96.67	93.47	74.00	19.47	Peak
2	2483.672	5.41	29.35	37.95	48.30	45.11	74.00	-28.89	Peak

Note: When peak detector test result below the average limit, there is no need to record the average detector test result.

7.9 Radiated Spurious Emissions

Test Requirement 47 CFR Part 15, Subpart C 15.205 & 15.209
Test Method: ANSI C63.10 (2013) Section 6.4,6.5,6.6
Measurement Distance: 3m
Limit:

Frequency(MHz)	Field strength(microvolts/meter)	Measurement distance(meters)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3
Remark: The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90kHz, 110-490kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation.		

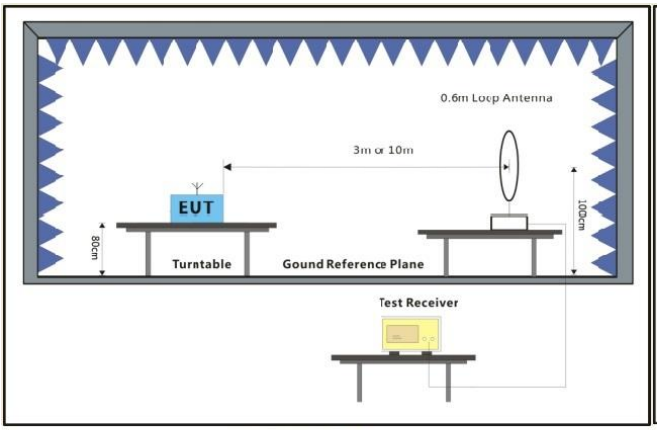
7.9.1 E.U.T. Operation

Operating Environment:

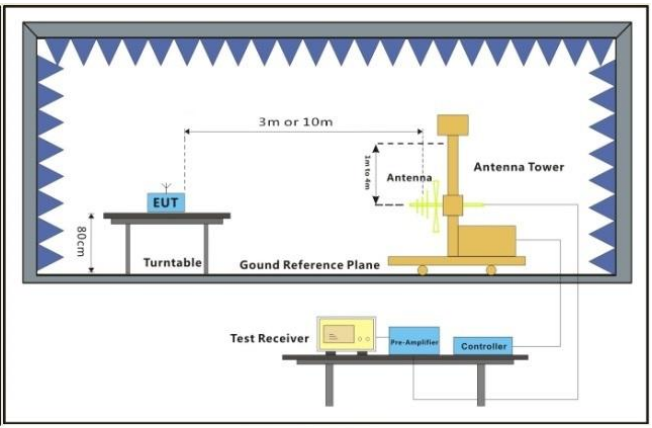
Temperature: 23 °C Humidity: 56 % RH Atmospheric Pressure: 1015 mbar

Pretest these mode to find the worst case: b: TX_non-Hop mode_Keep the EUT in continuously transmitting mode with GFSK modulation, π/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report.

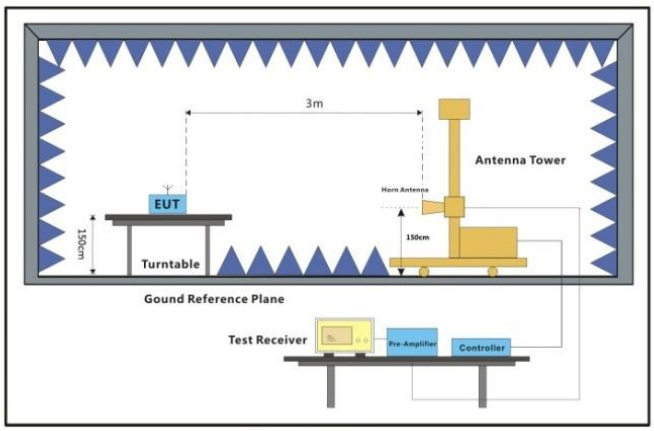
7.9.2 Test Setup Diagram



Below 30MHz



30MHz-1GHz



Above 1GHz

7.9.3 Measurement Data

a. For below 1GHz, the EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 or 10 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.

b. For above 1GHz, the EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter fully-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.

c. The EUT was set 3 or 10 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 (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.

f. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

g. 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.

h. Test the EUT in the lowest channel,the middle channel,the Highest channel.

i. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is the worst case.

j. Repeat above procedures until all frequencies measured was complete.

Mode:b; Polarization:Horizontal; Modulation Type:GFSK; ; Channel:Low

Freq (MHz)	Antenna_Factor (dB/m)	Cable_Loss (dB)	Preamp_Gain (dB)	Read_Level (dBuV)	Level (dBuV/m)	Limit_Line (dBuV/m)	Over_Limit (dB)	Remark
1335.141	25.11	4.27	38.07	48.52	40.33	74	-33.67	Peak
3587.818	32.46	6.37	37.96	43.40	44.79	74	-29.21	Peak
4804.000	34.16	7.73	38.40	46.63	50.51	74	-23.49	Peak
7206.000	36.42	9.65	37.12	44.21	53.42	74	-20.58	Peak
9608.000	37.52	11.06	35.09	39.80	53.74	74	-20.26	Peak
13365.320	38.65	13.91	38.37	39.31	53.95	74	-20.05	Peak

Mode:b; Polarization:Vertical; Modulation Type:GFSK; ; Channel:Low

Freq (MHz)	Antenna_Factor (dB/m)	Cable_Loss (dB)	Preamp_Gain (dB)	Read_Level (dBuV)	Level (dBuV/m)	Limit_Line (dBuV/m)	Over_Limit (dB)	Remark
1533.841	25.96	4.51	38.05	46.83	39.73	74	-34.27	Peak
3357.061	31.96	6.20	37.94	43.42	44.22	74	-29.78	Peak
4804.000	34.16	7.73	38.40	44.16	48.04	74	-25.96	Peak
7206.000	36.42	9.65	37.11	44.68	53.90	74	-20.1	Peak
9608.000	37.52	11.06	35.09	38.75	52.69	74	-21.31	Peak
13917.240	39.10	14.51	38.92	38.61	53.81	74	-20.19	Peak

Mode:b; Polarization:Horizontal; Modulation Type:GFSK; ; Channel:middle

Freq (MHz)	Antenna_Factor (dB/m)	Cable_Loss (dB)	Preamp_Gain (dB)	Read_Level (dBuV)	Level (dBuV/m)	Limit_Line (dBuV/m)	Over_Limit (dB)	Remark
1335.141	25.11	4.27	38.07	46.25	38.06	74	-35.94	Peak
3376.523	31.99	6.21	37.94	43.68	44.51	74	-29.49	Peak
4882.000	34.31	7.85	38.44	45.40	49.53	74	-24.47	Peak
7323.000	36.37	9.73	37.01	44.10	53.42	74	-20.58	Peak
9764.000	37.55	11.20	35.02	39.15	53.34	74	-20.66	Peak
14830.960	41.00	14.81	38.92	35.68	53.14	74	-20.86	Peak

Mode:b; Polarization:Vertical; Modulation Type:GFSK; ; Channel:middle

Freq (MHz)	Antenna_Factor (dB/m)	Cable_Loss (dB)	Preamp_Gain (dB)	Read_Level (dBuV)	Level (dBuV/m)	Limit_Line (dBuV/m)	Over_Limit (dB)	Remark
1762.112	26.92	4.77	38.02	42.09	36.37	74	-37.63	Peak
3505.809	32.22	6.30	37.95	44.51	45.61	74	-28.39	Peak
4882.000	34.31	7.85	38.44	43.46	47.59	74	-26.41	Peak
7323.000	36.37	9.73	37.01	43.98	53.30	74	-20.7	Peak
9764.000	37.55	11.2	35.02	39.43	53.62	74	-20.38	Peak
13559.880	38.67	14.17	38.56	38.56	53.31	74	-20.69	Peak

Mode:b; Polarization:Horizontal; Modulation Type:GFSK; ; Channel:High

Freq (MHz)	Antenna_Factor (dB/m)	Cable_Loss (dB)	Preamp_Gain (dB)	Read_Level (dBuV)	Level (dBuV/m)	Limit_Line (dBuV/m)	Over_Limit (dB)	Remark
1777.458	26.98	4.79	38.02	43.99	38.37	74	-35.63	Peak
3475.541	32.16	6.28	37.95	45.19	46.22	74	-27.78	Peak
4960.000	34.43	7.94	38.48	42.58	46.90	74	-27.10	Peak
7440.000	36.32	9.81	36.90	44.47	53.92	74	-20.08	Peak
9920.000	37.59	11.37	34.94	38.69	53.17	74	-20.83	Peak
13997.930	39.20	14.59	39.00	38.14	53.44	74	-20.56	Peak

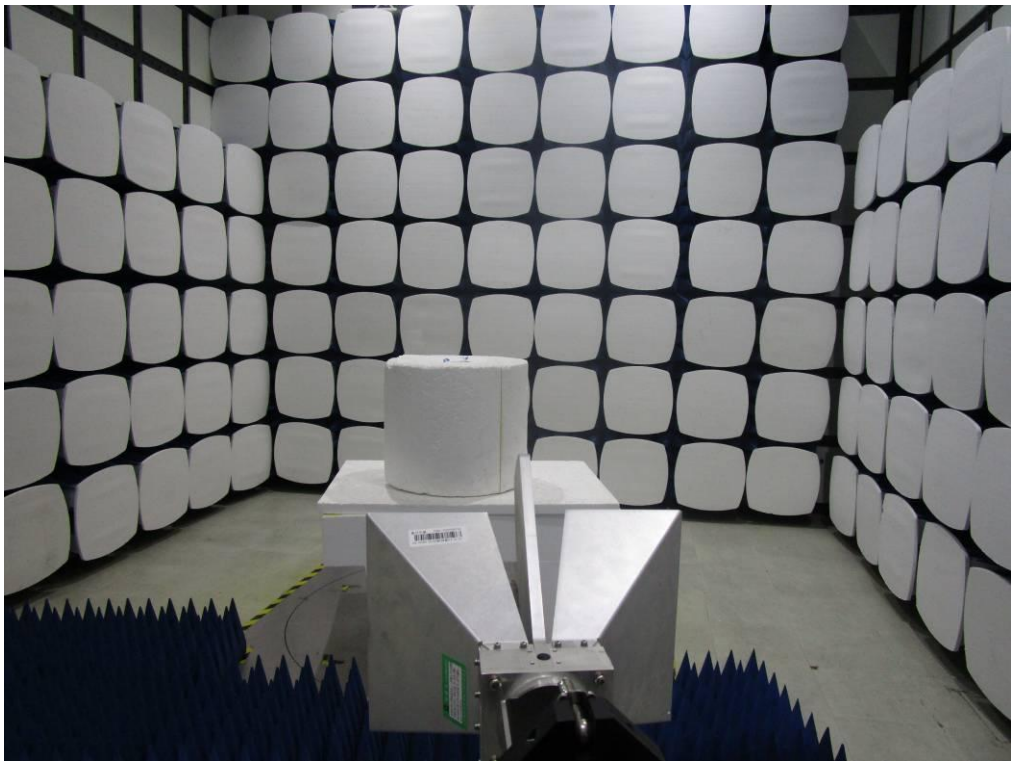
Mode:b; Polarization:Vertical; Modulation Type:GFSK; ; Channel:High

Freq (MHz)	Antenna_Factor (dB/m)	Cable_Loss (dB)	Preamp_Gain (dB)	Read_Level (dBuV)	Level (dBuV/m)	Limit_Line (dBuV/m)	Over_Limit (dB)	Remark
1402.384	25.40	4.35	38.06	41.40	33.58	74	-40.42	Peak
3671.746	32.70	6.44	37.97	42.75	44.43	74	-29.57	Peak
4960.000	34.43	7.94	38.48	42.44	46.76	74	-27.24	Peak
7440.000	36.33	9.81	36.91	44.08	53.53	74	-20.47	Peak
9920.000	37.59	11.37	34.94	38.62	53.10	74	-20.9	Peak
15850.410	41.26	15.53	37.96	34.23	53.67	74	-20.33	Peak

Note: When peak detector test result below the average limit, there is no need to record the average detector test result.

8 Photographs

8.1 Radiated Spurious Emissions Test Setup



8.2 EUT Constructional Details

Refer to Appendix A - Photographs of EUT Constructional Details for SZEM1704003525CR

9 Appendix

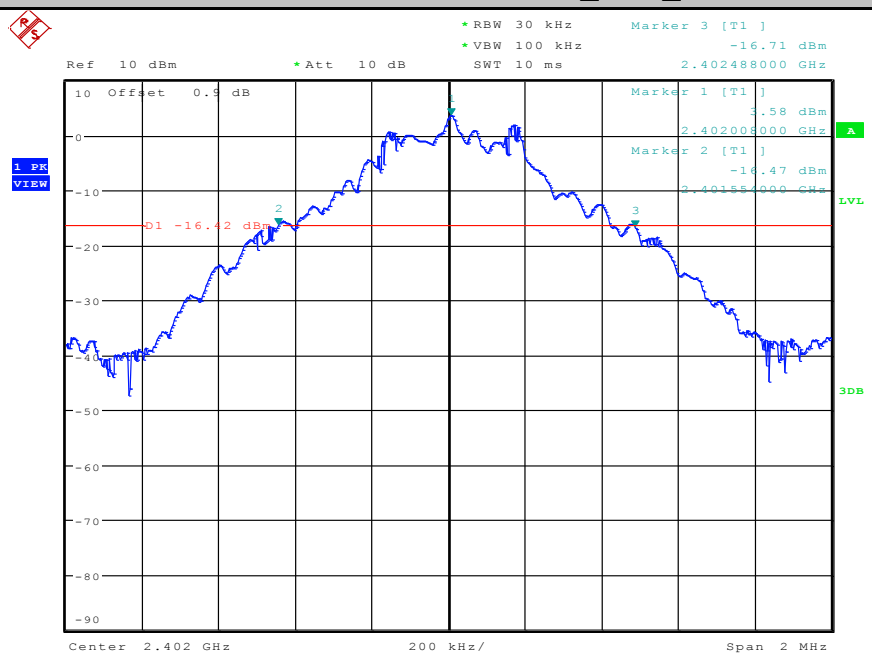
9.1 Appendix 15.247

1.20 dB Bandwidth

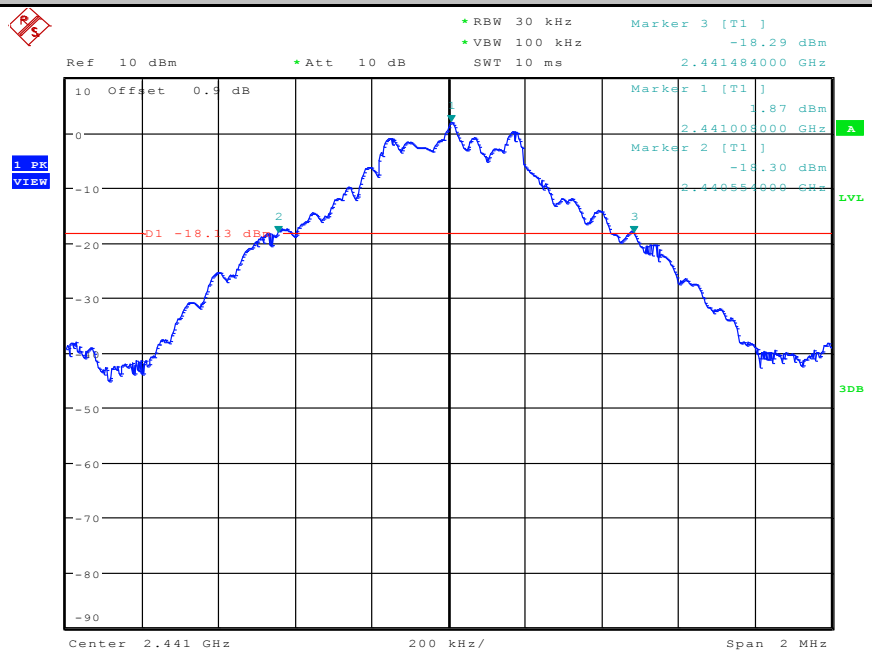
Test mode	Test channel	EBW[MHz]	Limit[MHz]	Verdict
DH5	2402	0.934	---	PASS
DH5	2441	0.930	---	PASS
DH5	2480	0.934	---	PASS
2DH5	2402	1.248	---	PASS
2DH5	2441	1.252	---	PASS
2DH5	2480	1.252	---	PASS
3DH5	2402	1.260	---	PASS
3DH5	2441	1.274	---	PASS
3DH5	2480	1.274	---	PASS

TEST PLOT

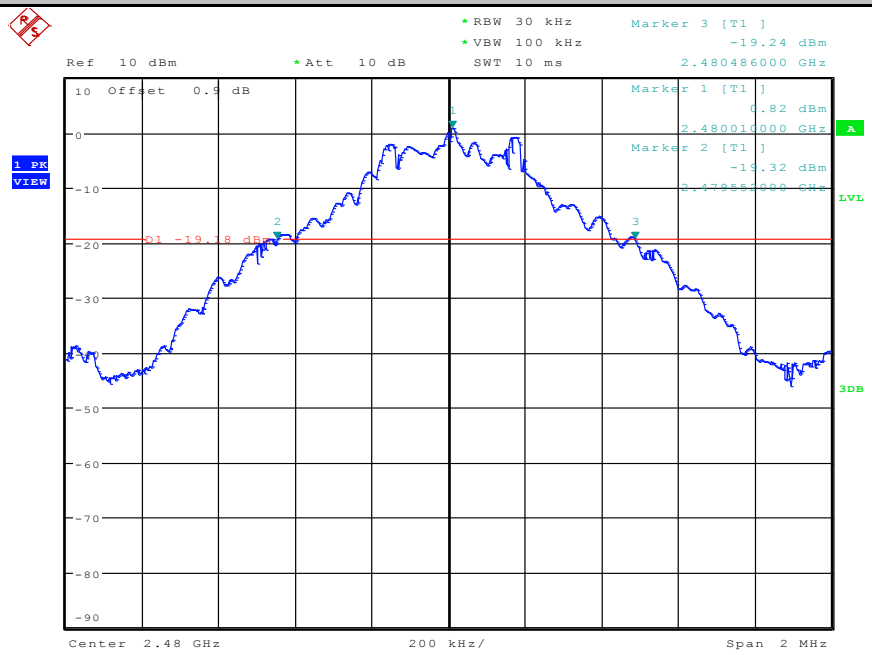
20 dB Bandwidth_DH5_2402



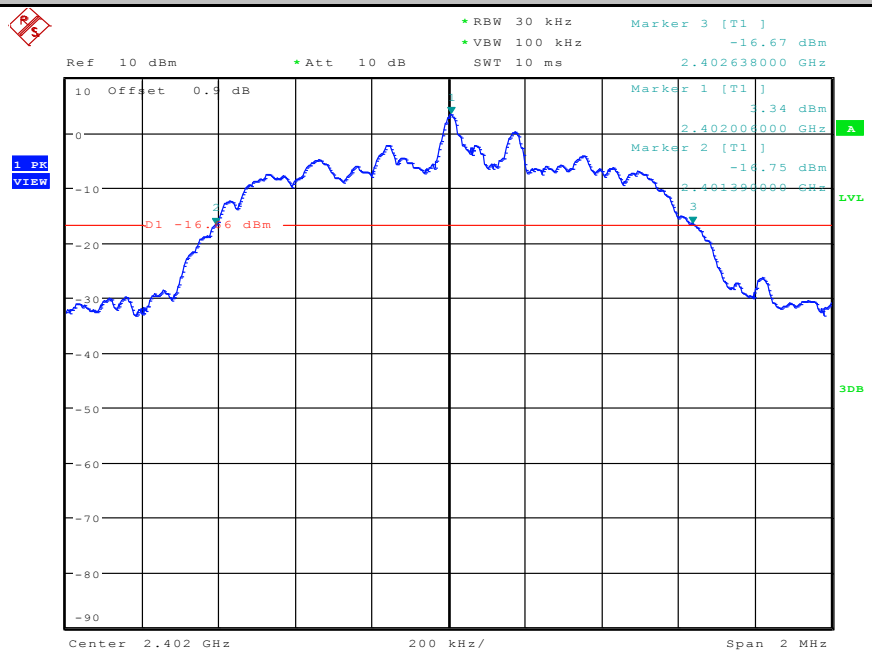
20 dB Bandwidth_DH5_2441



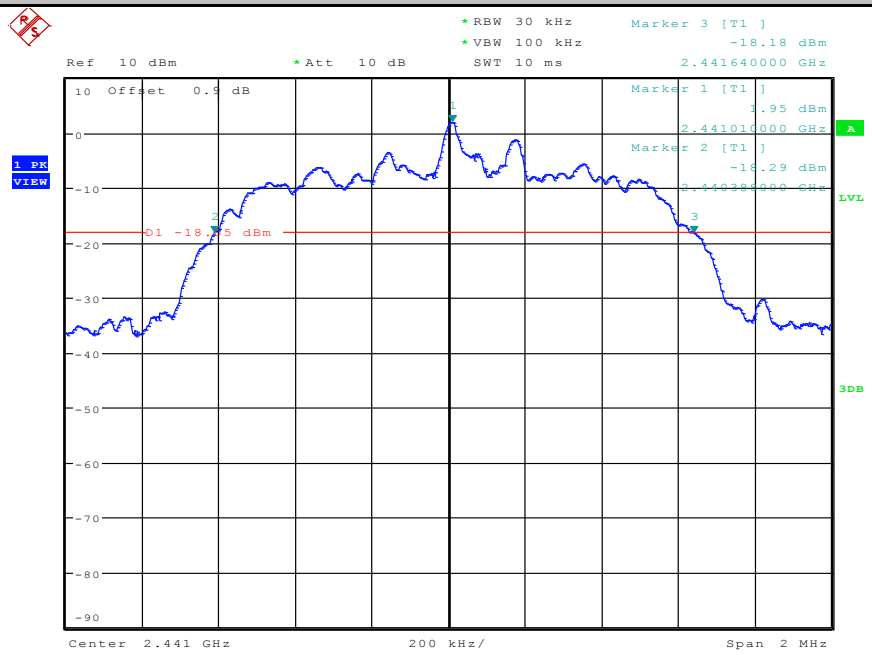
20 dB Bandwidth_DH5_2480



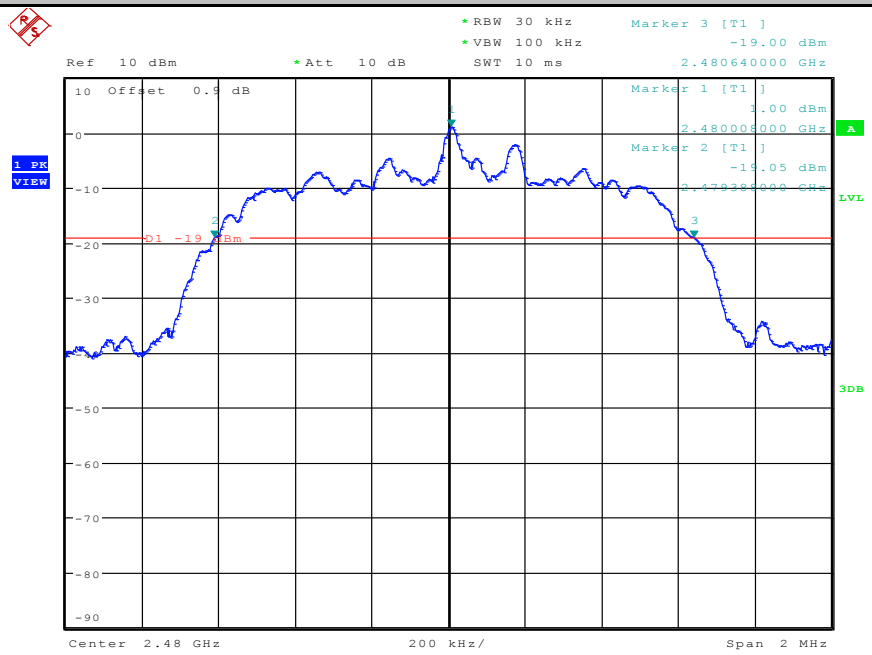
20 dB Bandwidth_2DH5_2402



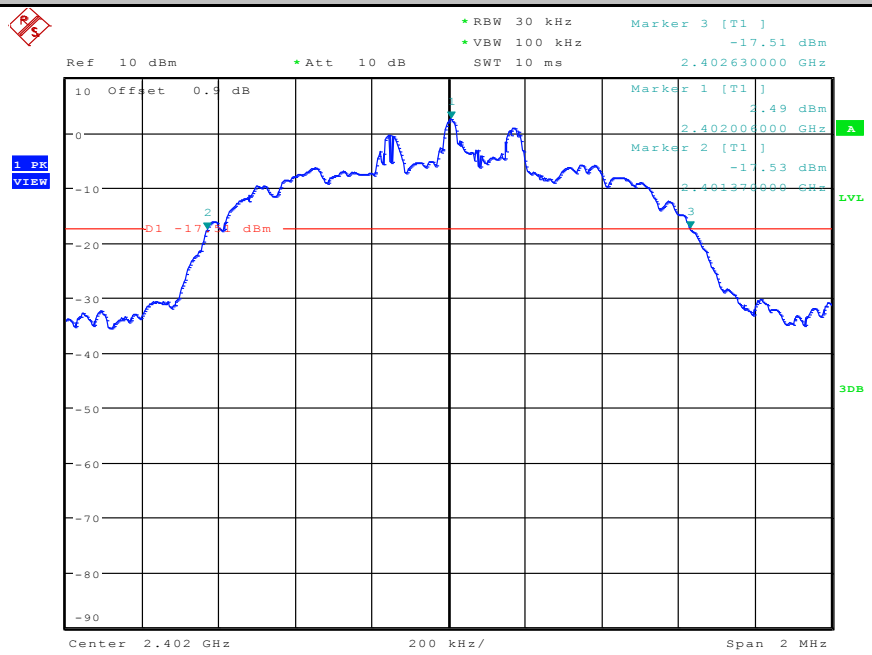
20 dB Bandwidth_2DH5_2441



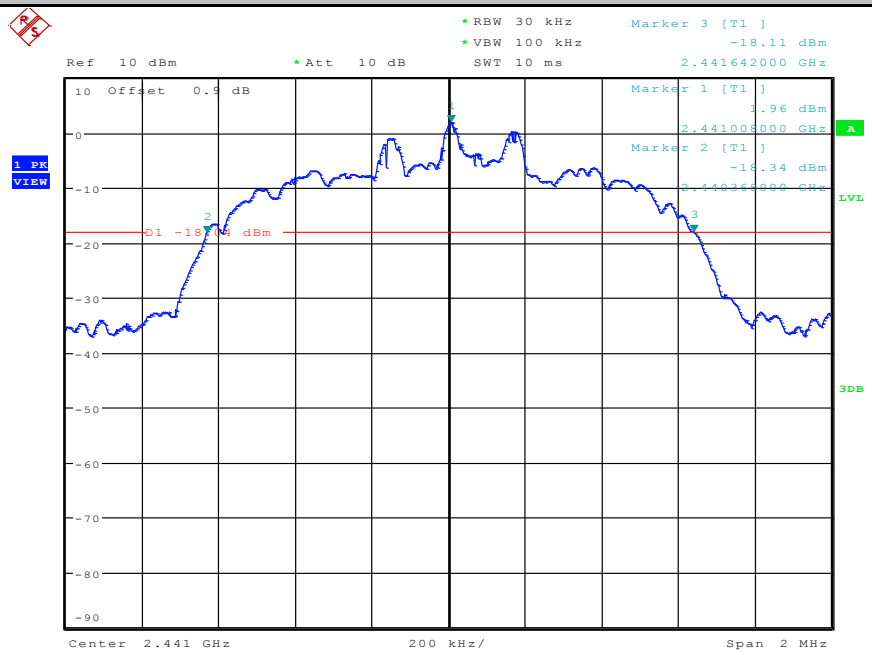
20 dB Bandwidth_2DH5_2480



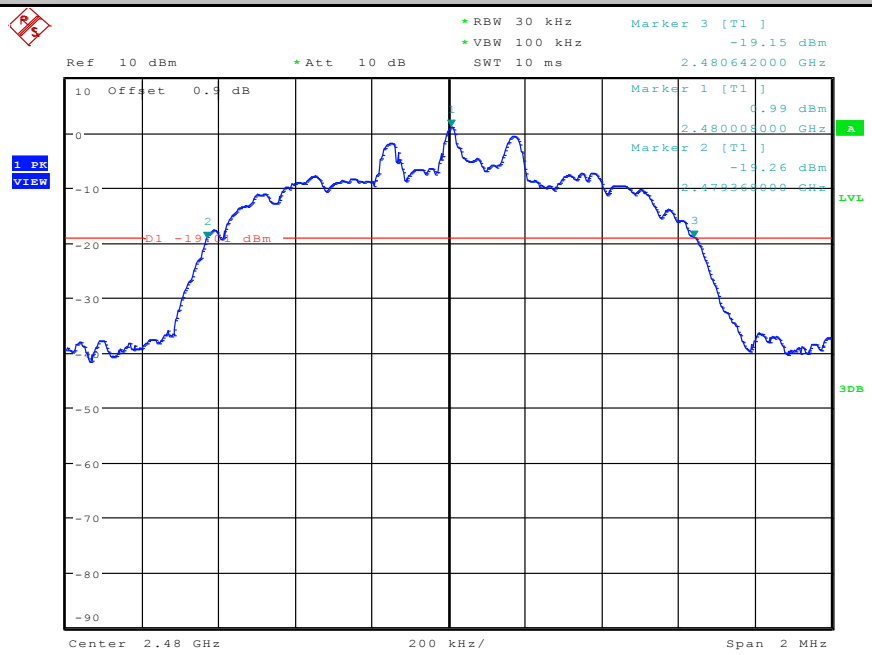
20 dB Bandwidth_3DH5_2402



20 dB Bandwidth_3DH5_2441



20 dB Bandwidth_3DH5_2480

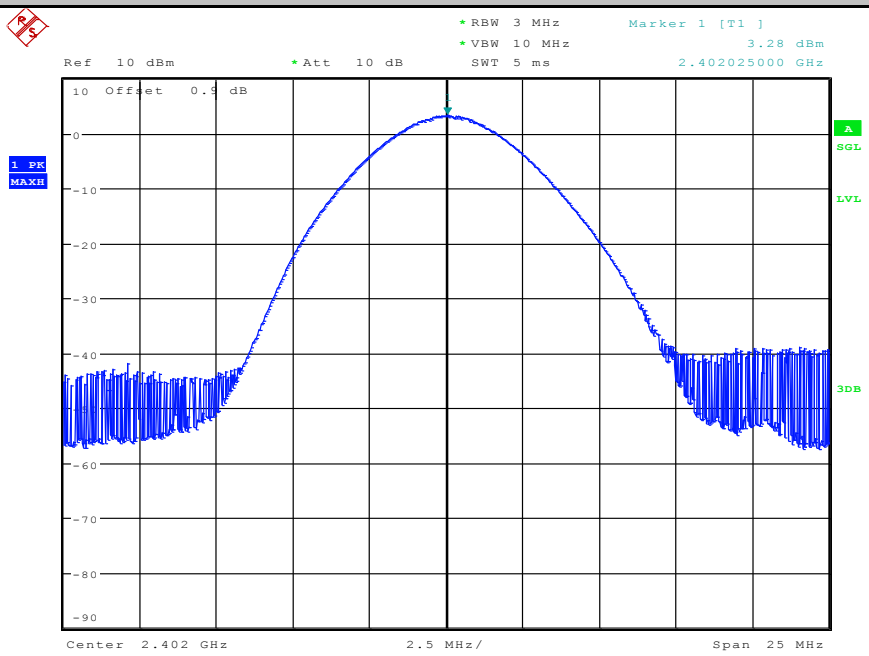


2.Conducted Peak Output Power

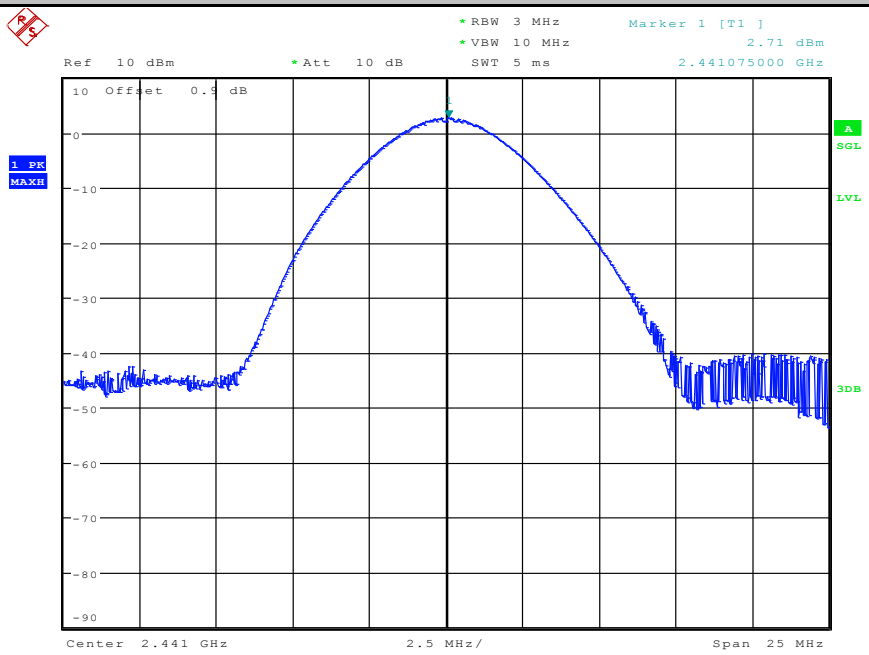
Test Mode	Test Channel	Power[dBm]	Limit[dBm	Verdict
DH5	2402	3.28	<20.97	PASS
DH5	2441	2.71	<20.97	PASS
DH5	2480	1.78	<20.97	PASS
2DH5	2402	3.65	<20.97	PASS
2DH5	2441	2.98	<20.97	PASS
2DH5	2480	2.08	<20.97	PASS
3DH5	2402	3.88	<20.97	PASS
3DH5	2441	3.18	<20.97	PASS
3DH5	2480	2.29	<20.97	PASS

TEST PLOT

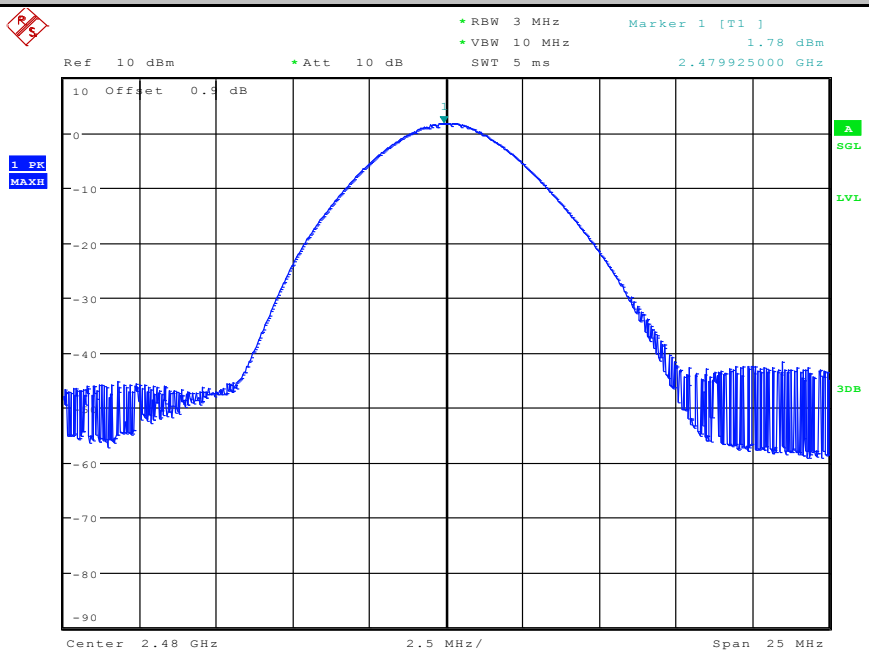
Conducted Peak Output Power_DH5_2402



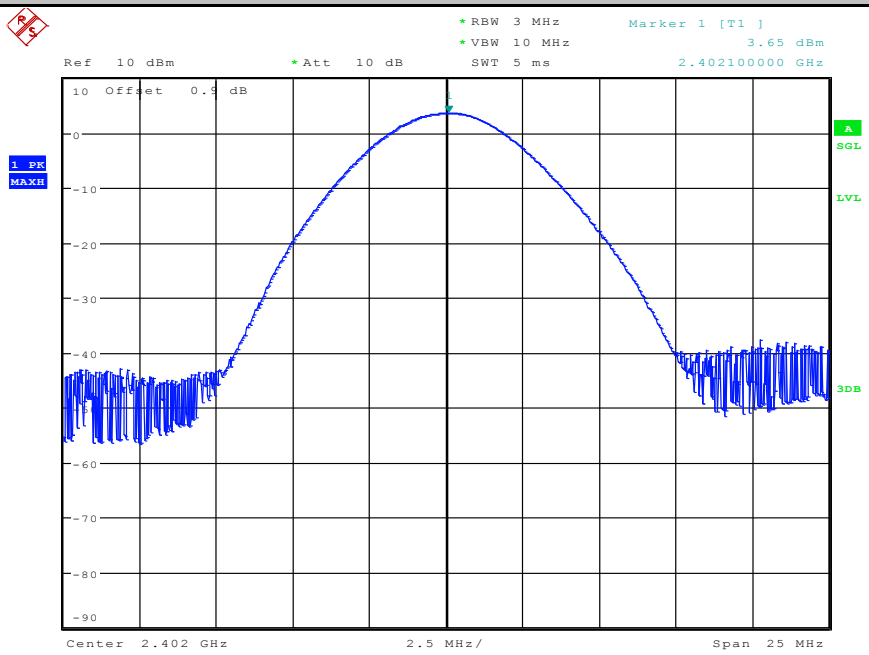
Conducted Peak Output Power_DH5_2441



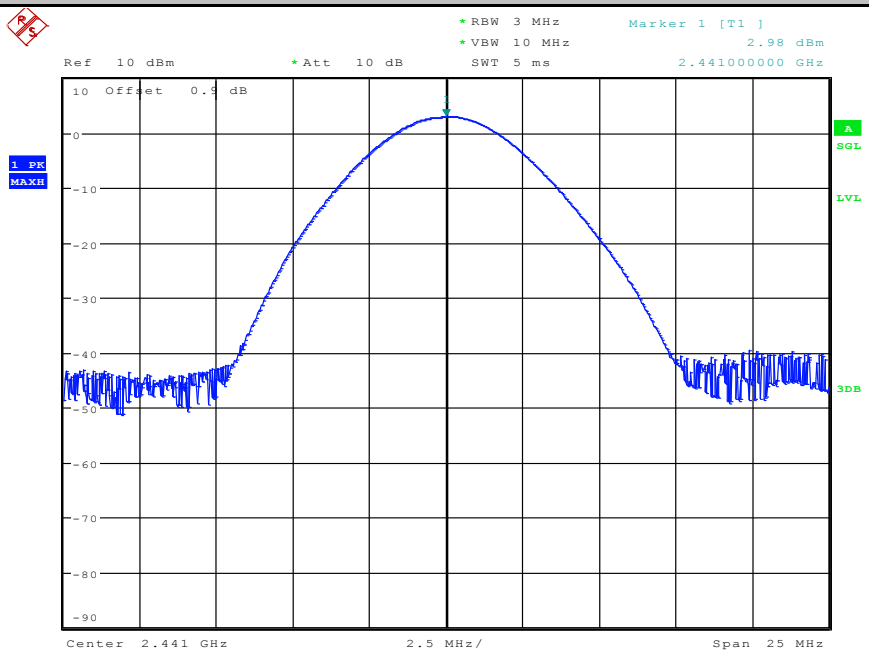
Conducted Peak Output Power_DH5_2480



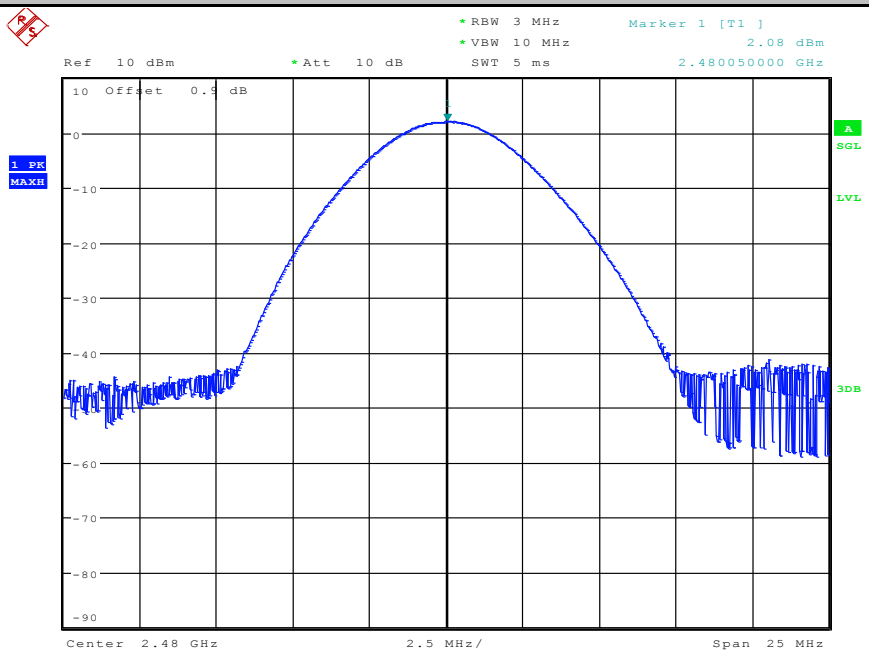
Conducted Peak Output Power_2DH5_2402



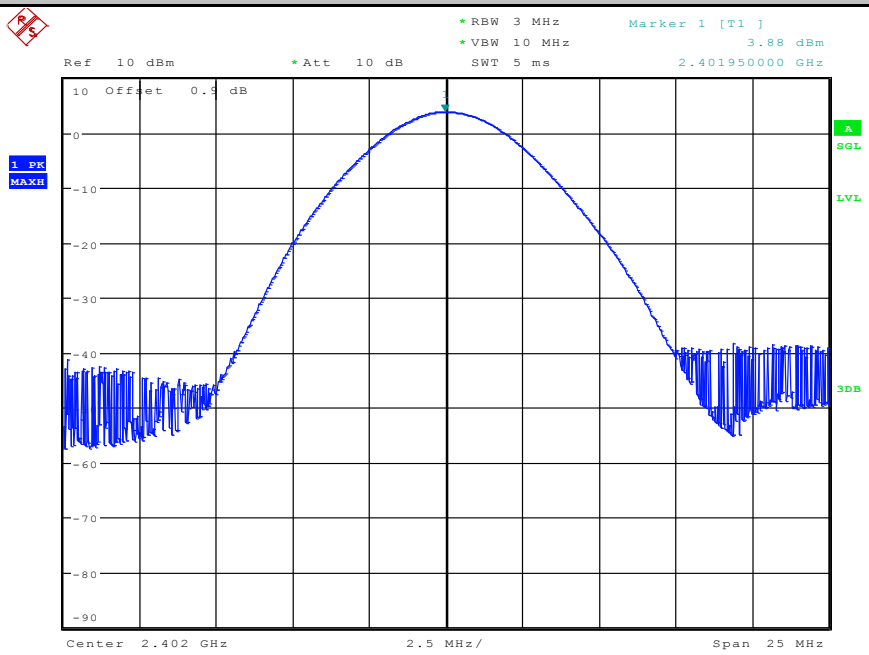
Conducted Peak Output Power_2DH5_2441



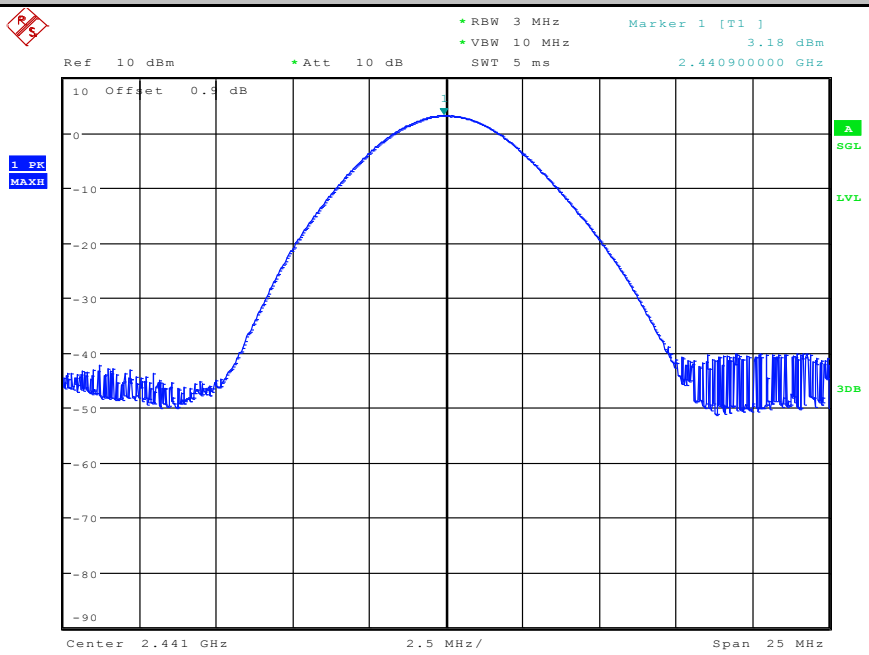
Conducted Peak Output Power_2DH5_2480



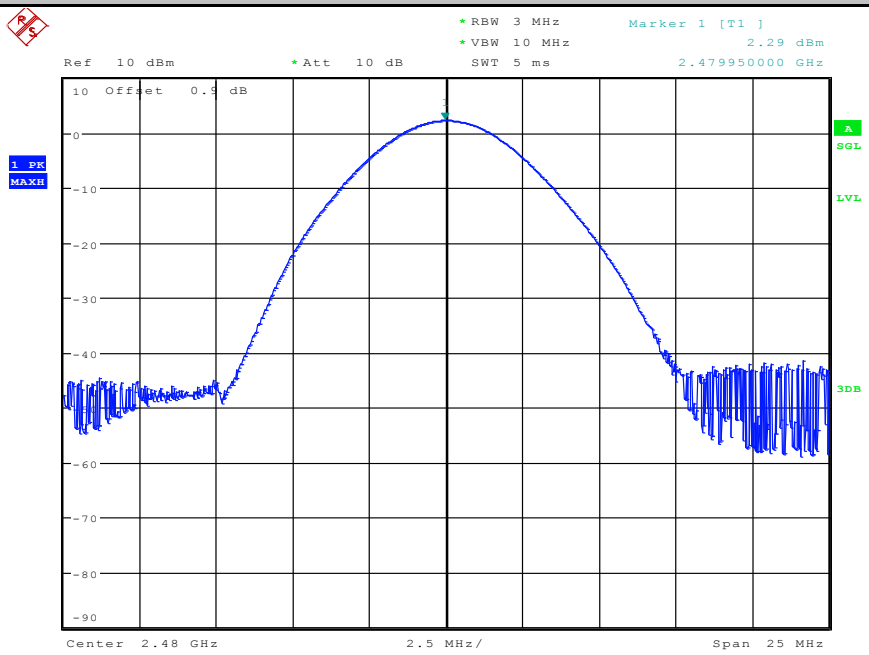
Conducted Peak Output Power_3DH5_2402



Conducted Peak Output Power_3DH5_2441



Conducted Peak Output Power_3DH5_2480

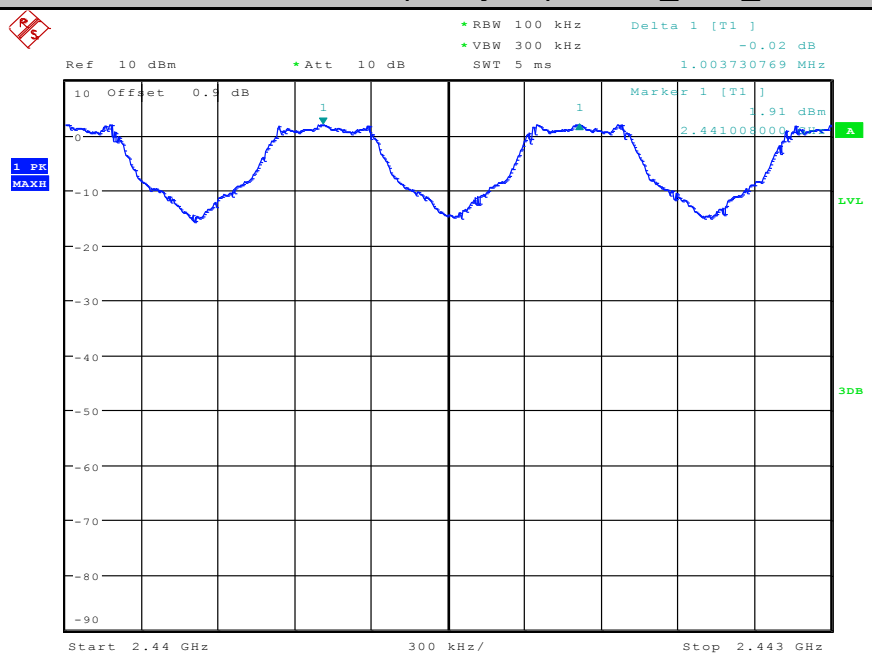


3. Carrier Frequency Separation.

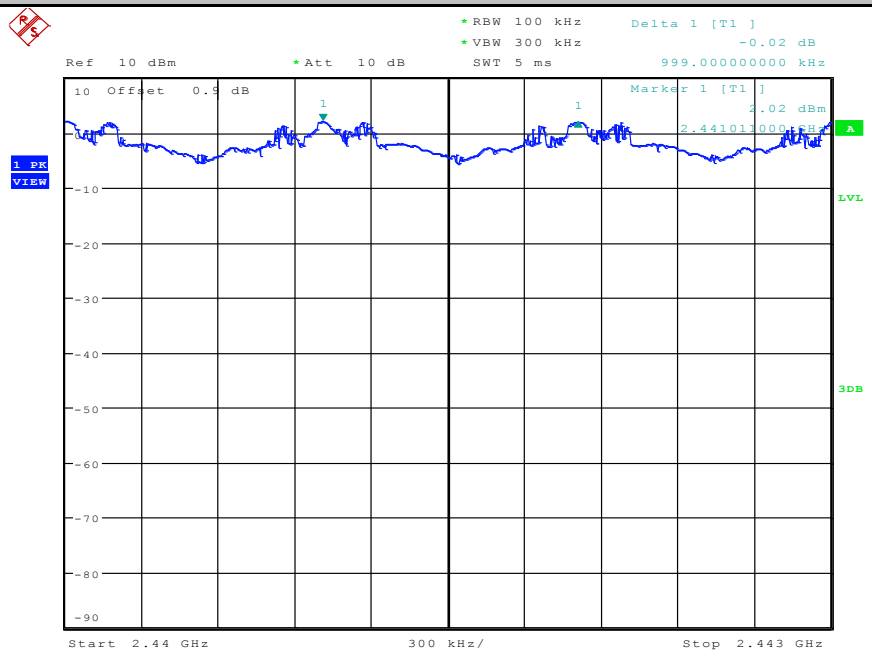
Test Mode	Test Channel	Result[MHz]	Limit[MHz]	Verdict
DH5	2441	1.004	>=0.623	PASS
2DH5	2441	0.999	>=0.835	PASS
3DH5	2441	0.999	>=0.849	PASS

TEST PLOT

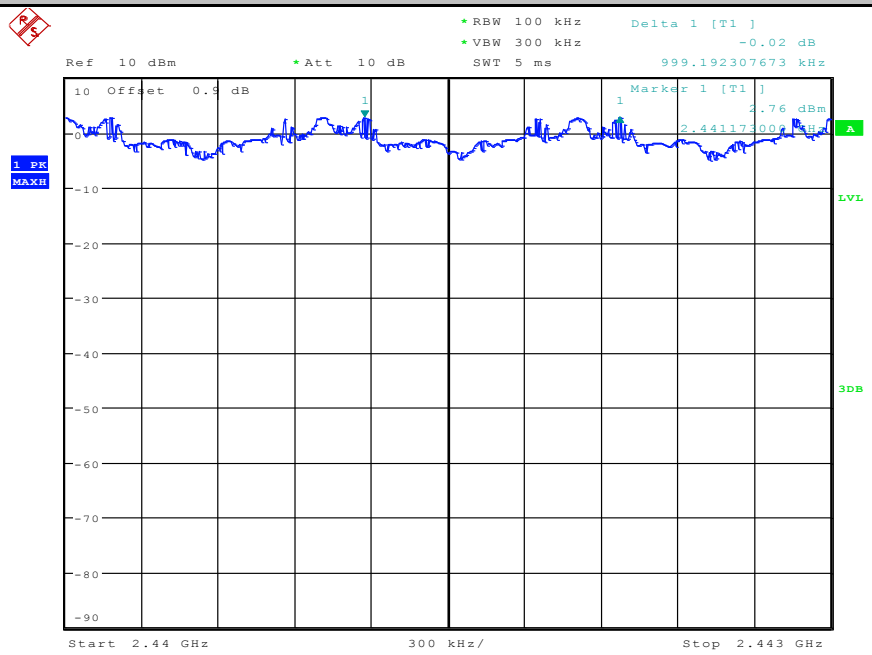
Carrier Frequency Separation_DH5_2441



Carrier Frequency Separation_2DH5_2441



Carrier Frequency Separation_3DH5_2441

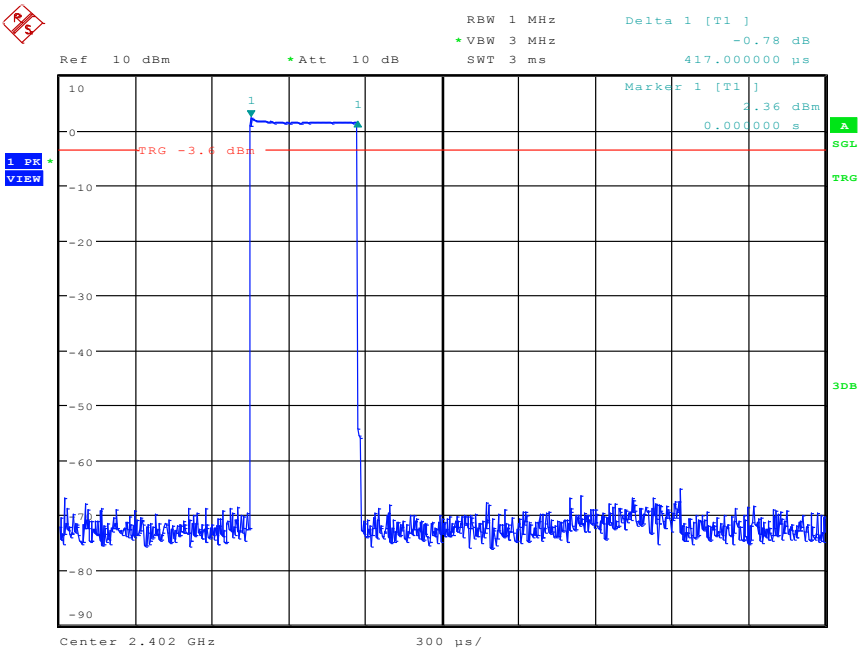


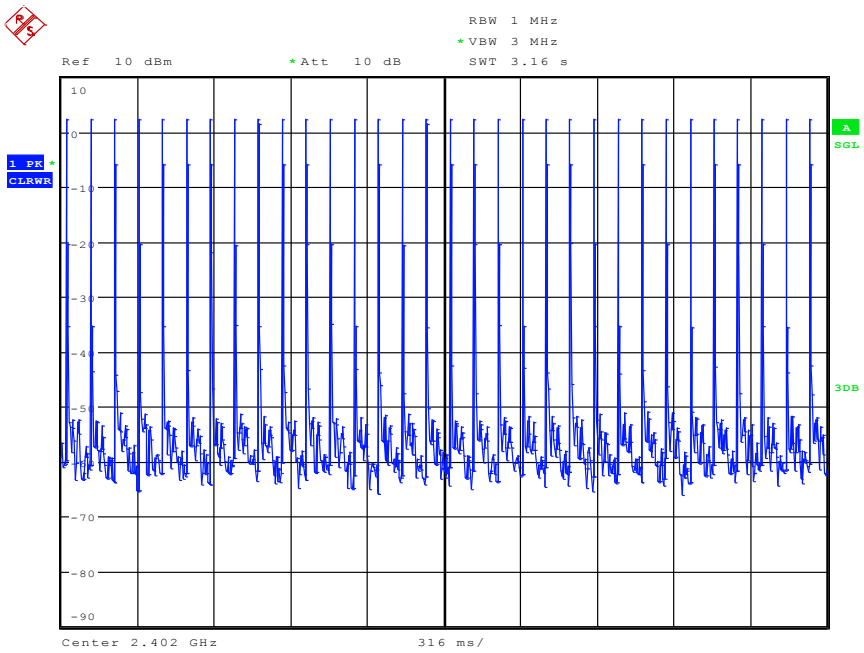
4. Dwell Time

Test Mode	Test Channel	Burst Width[ms/hop/ch]	Total Hops[hop*ch]	Dwell Time[s]	Limit[s]	Verdict
DH1	2402	0.42	320	0.134	<0.4	PASS
DH3	2402	1.68	160	0.269	<0.4	PASS
DH5	2402	2.92	100	0.292	<0.4	PASS
2DH1	2402	0.42	320	0.134	<0.4	PASS
2DH3	2402	1.69	160	0.27	<0.4	PASS
2DH5	2402	2.93	110	0.322	<0.4	PASS
3DH1	2402	0.43	320	0.138	<0.4	PASS
3DH3	2402	1.68	160	0.269	<0.4	PASS
3DH5	2402	2.93	110	0.322	<0.4	PASS

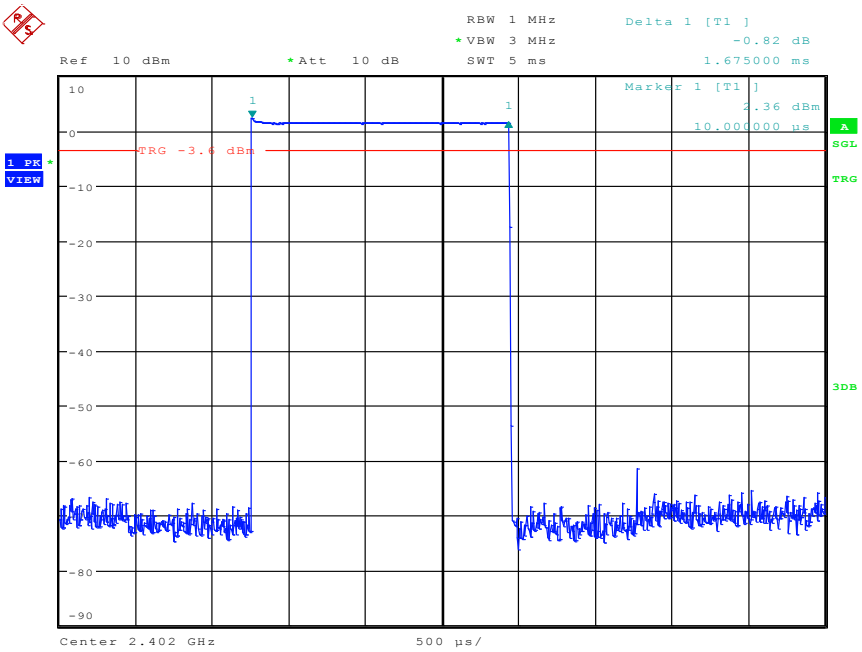
TEST PLOT

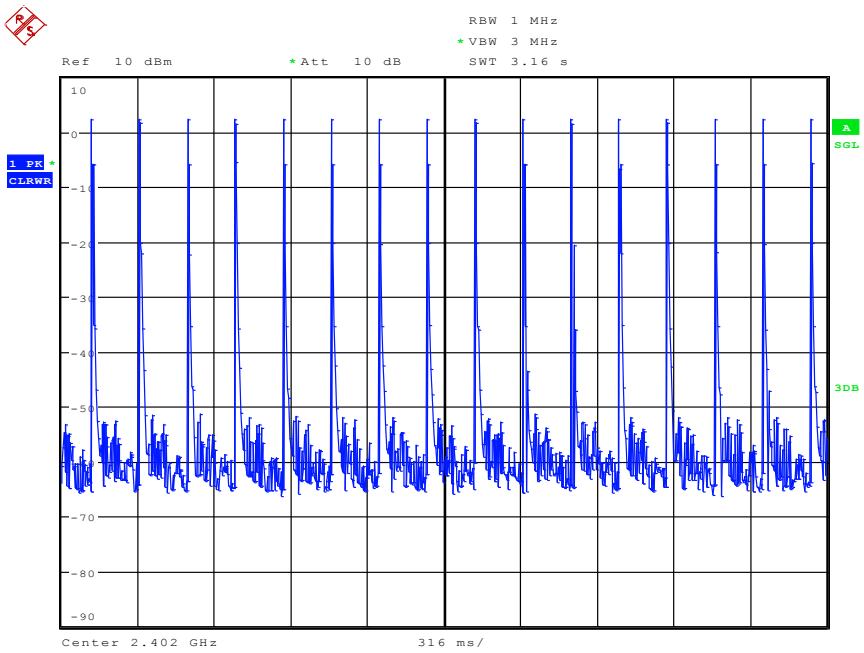
Dwell Time_DH1_2402



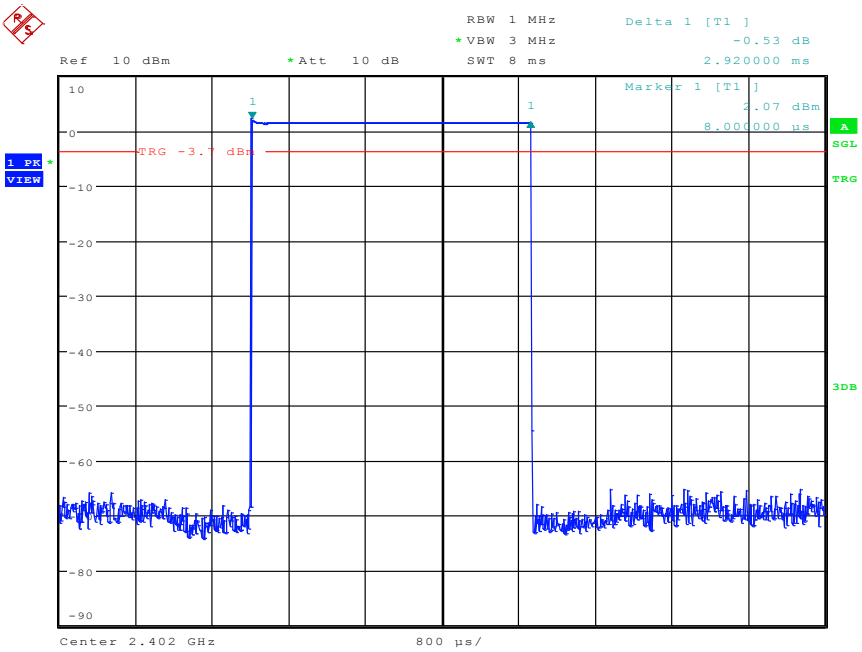


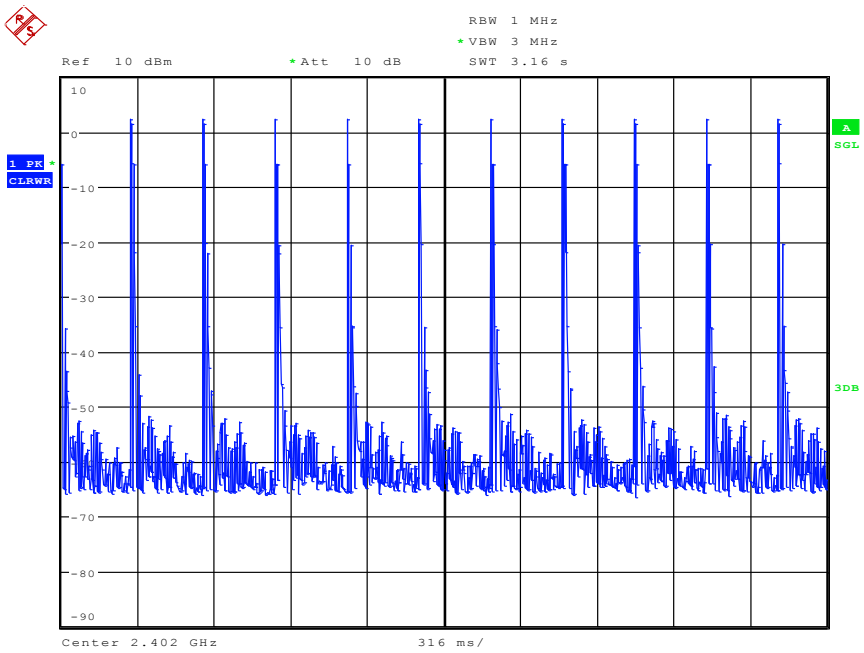
Dwell Time_DH3_2402



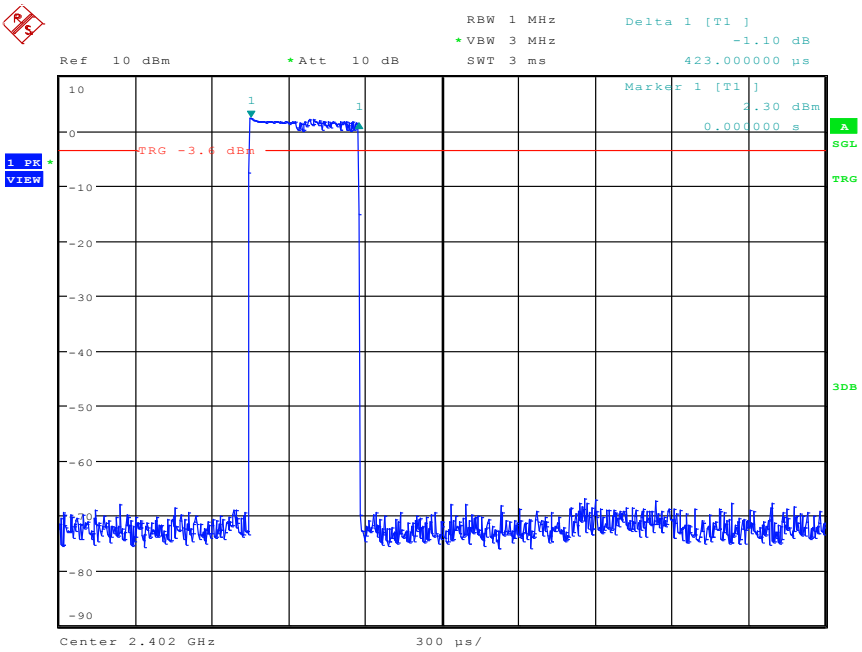


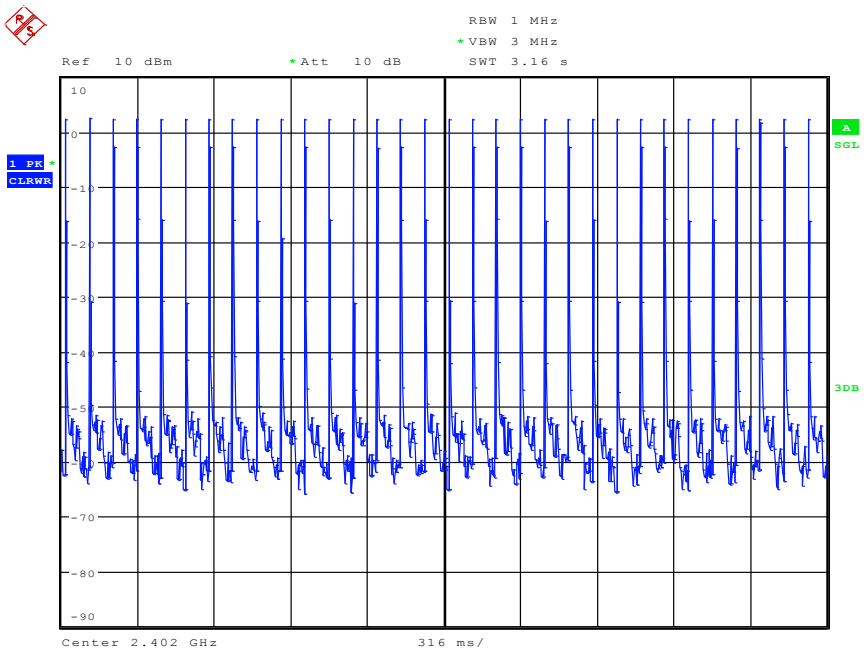
Dwell Time_DH5_2402



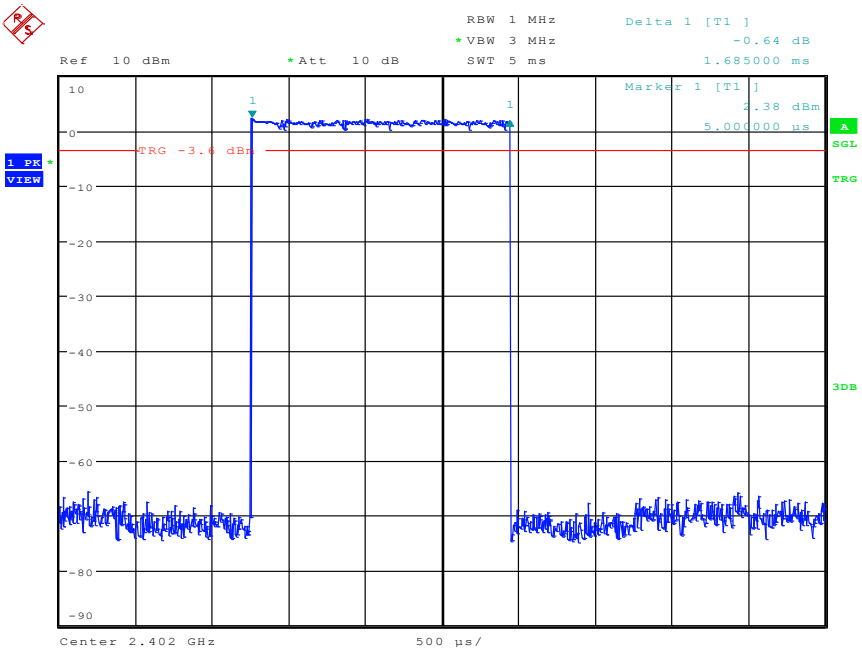


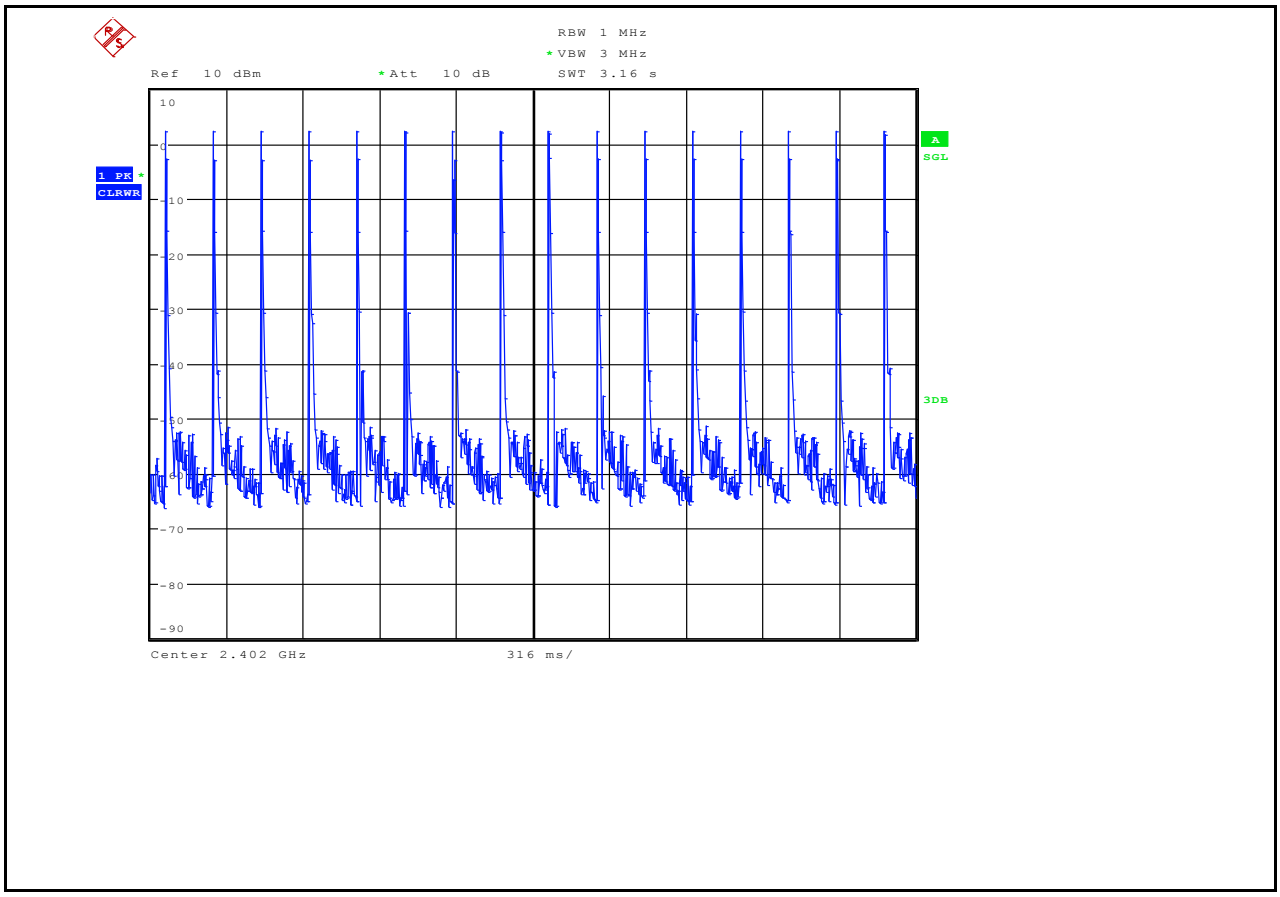
Dwell Time_2DH1_2402



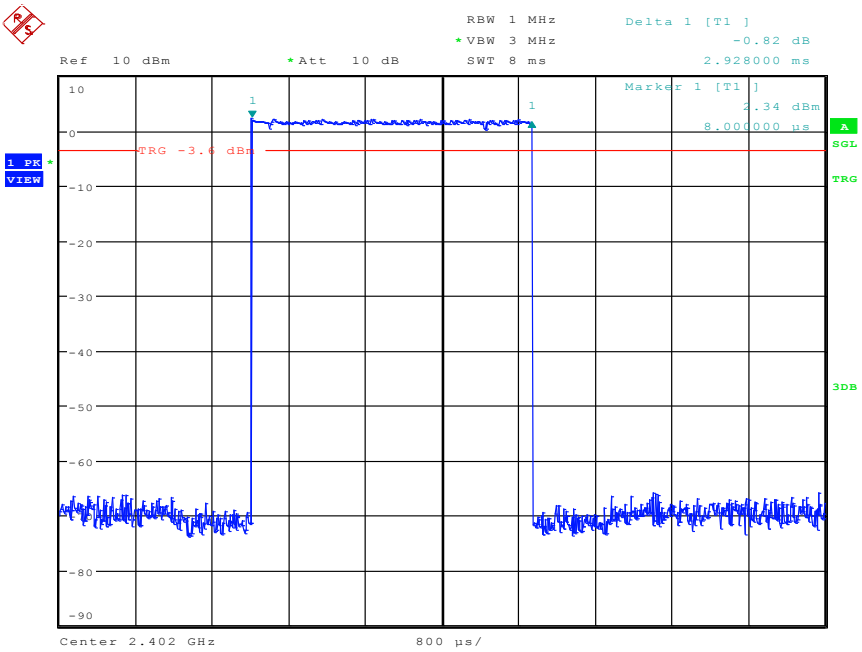


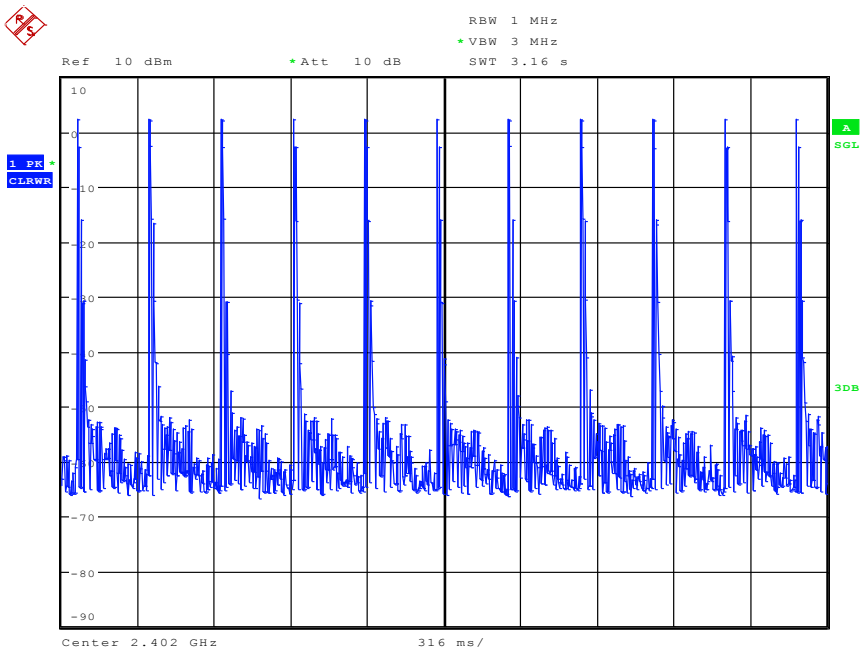
Dwell Time_2DH3_2402



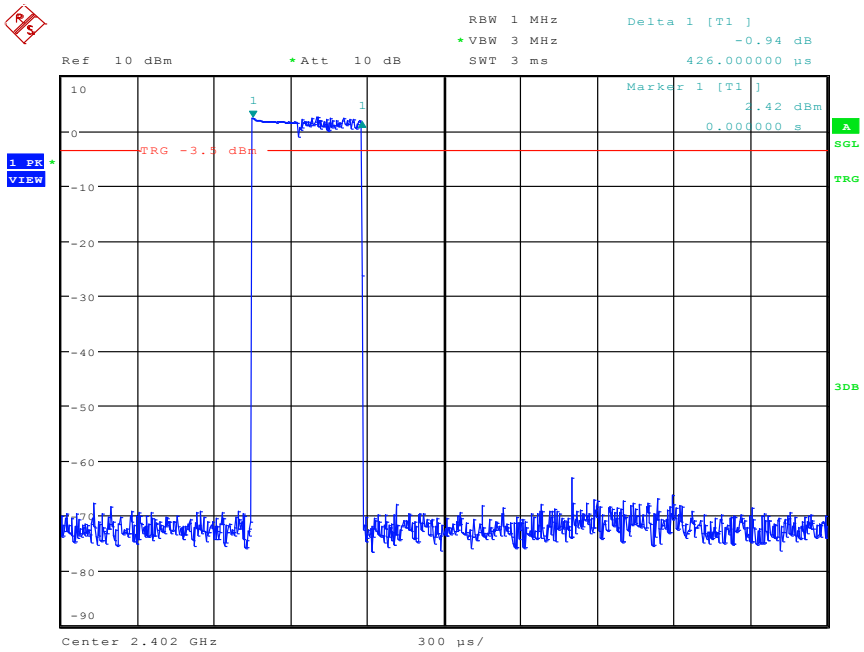


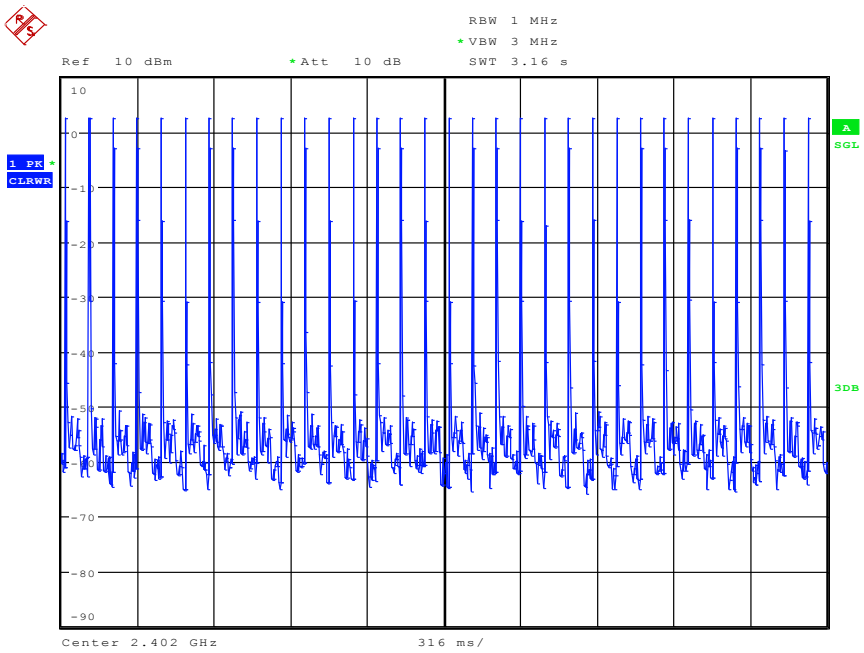
Dwell Time_2DH5_2402



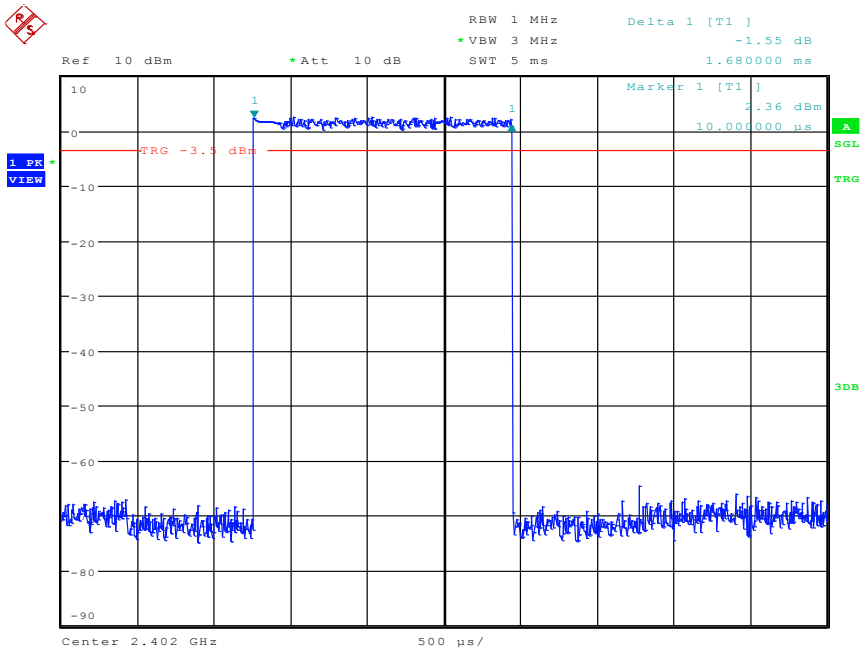


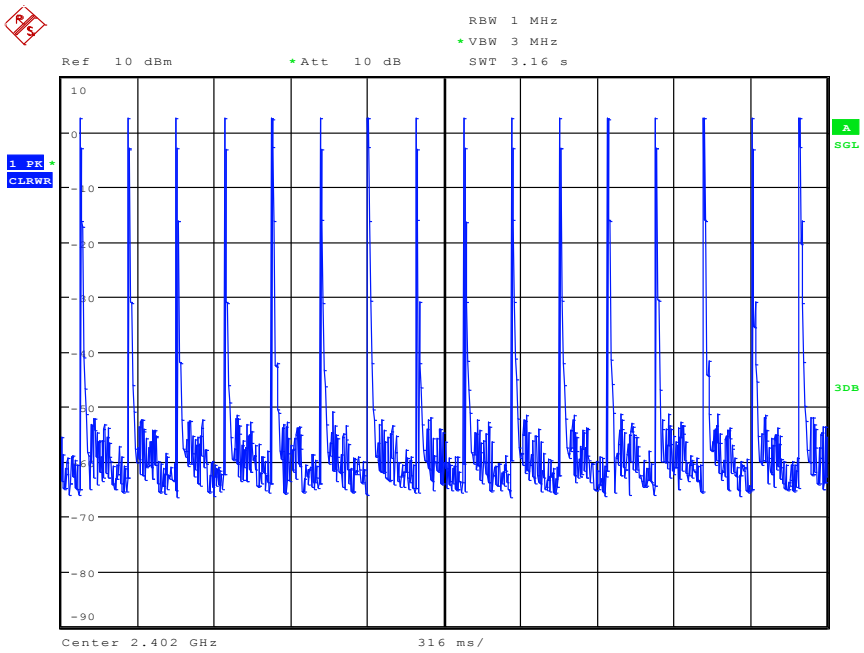
Dwell Time_3DH1_2402



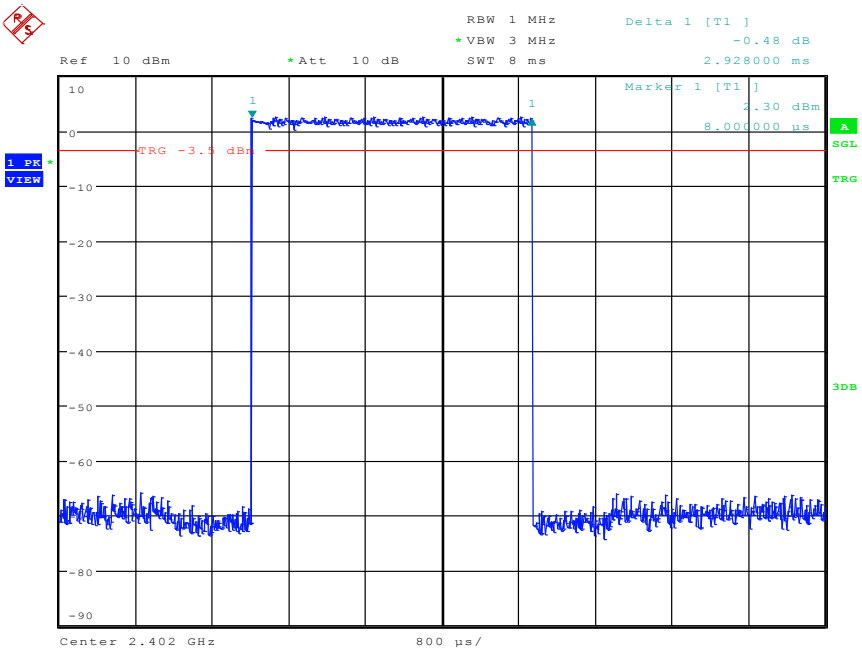


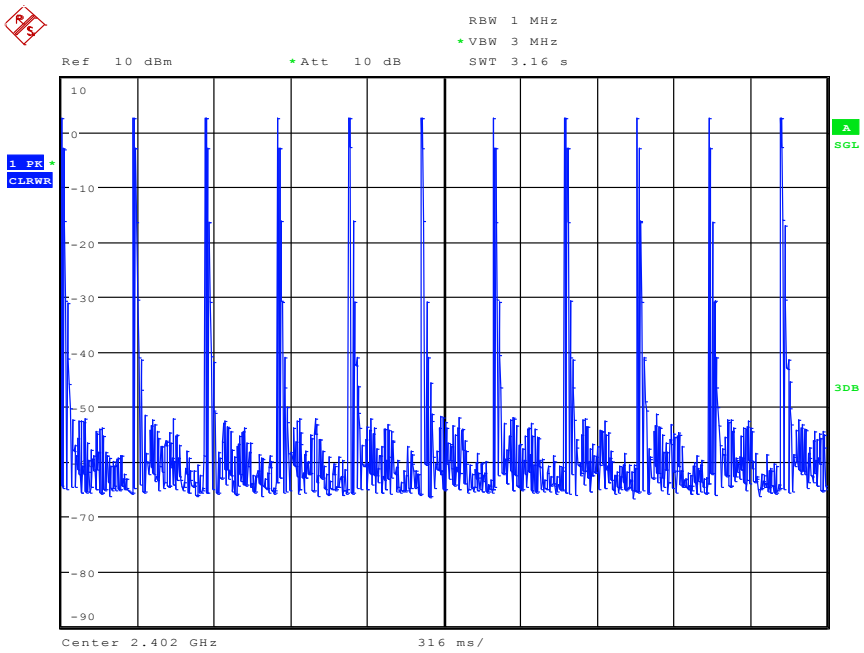
Dwell Time_3DH3_2402





Dwell Time_3DH5_2402



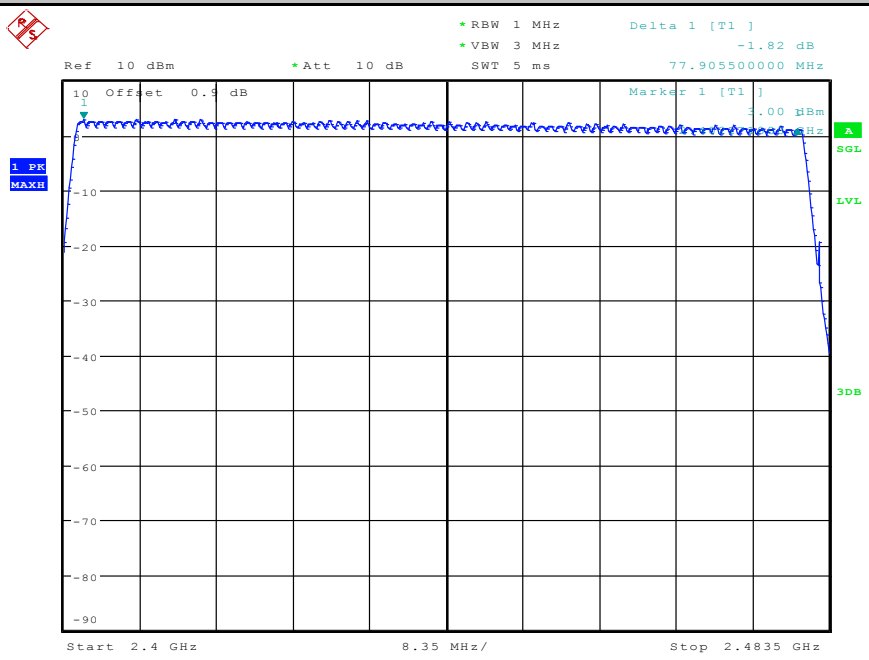


5. Hopping Channel Number

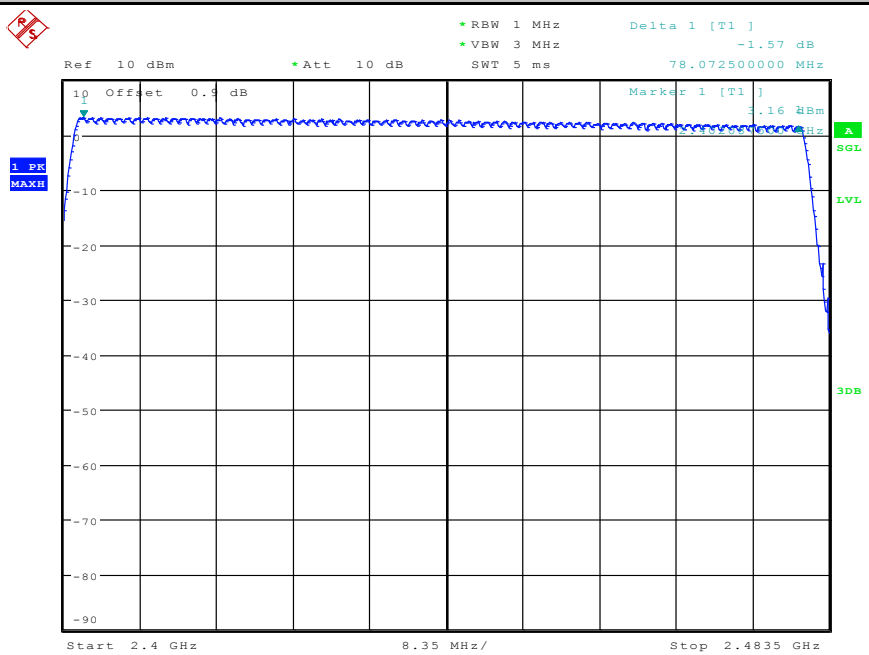
Test Mode	Test Channel	Number of Hopping Channel[N]	Limit[N	Verdic
DH5	2402	79	>=15	PASS
2DH5	2402	79	>=15	PASS
3DH5	2402	79	>=15	PASS

TEST PLOT

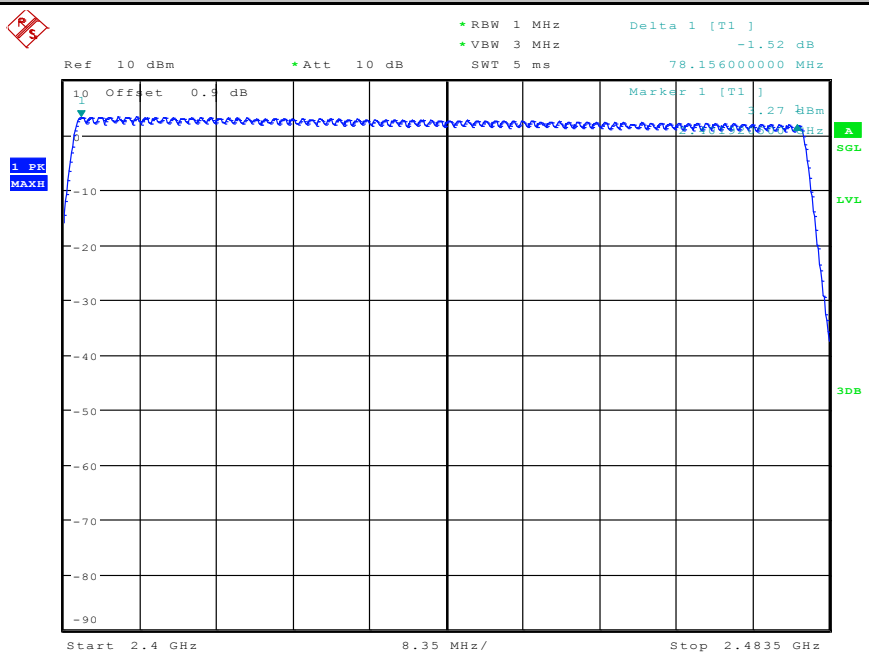
Hopping Channel Number_DH5_2402



Hopping Channel Number_2DH5_2402



Hopping Channel Number_3DH5_2402

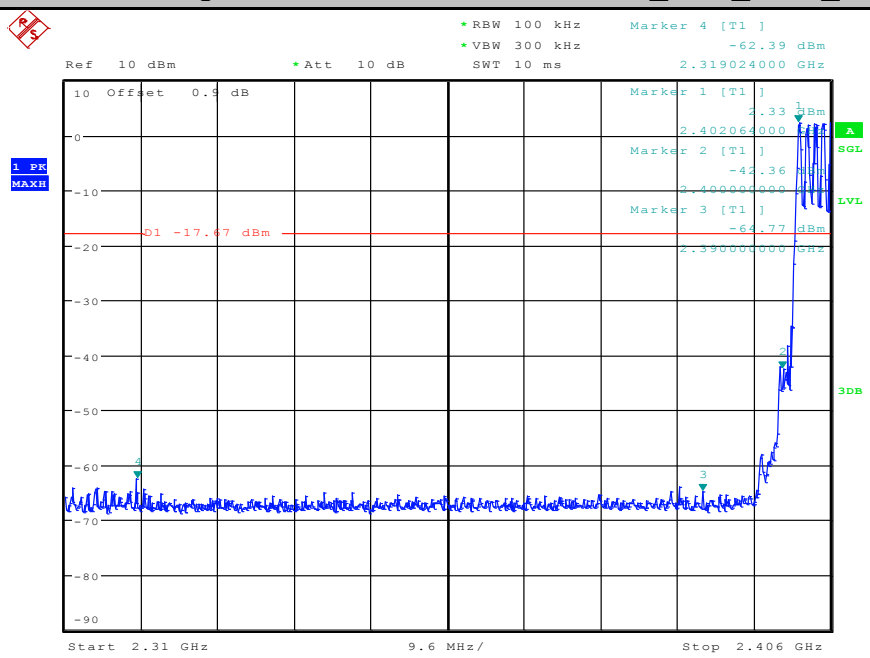


6. Band-edge for RF Conducted Emissions

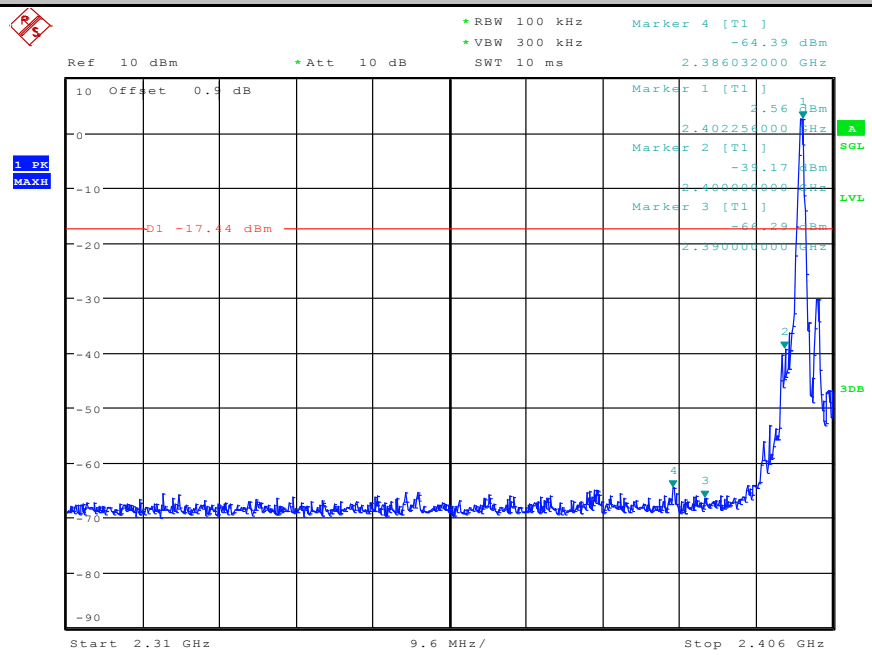
Test Mode	Test Channel	Hopping	Carrier Power[dBm]	Max. Spurious Level [dBm]	Limit[dBm]	Verdict
DH5	2402	On	2.330	-62.391	<-17.67	PASS
DH5	2402	Off	2.560	-64.393	<-17.44	PASS
DH5	2480	On	1.050	-54.954	<-18.95	PASS
DH5	2480	Off	0.980	-50.171	<-19.02	PASS
2DH5	2402	On	2.370	-62.768	<-17.63	PASS
2DH5	2402	Off	2.620	-63.220	<-17.38	PASS
2DH5	2480	On	0.790	-52.434	<-19.21	PASS
2DH5	2480	Off	1.050	-50.666	<-18.95	PASS
3DH5	2402	On	-1.100	-64.900	<-21.1	PASS
3DH5	2402	Off	2.540	-60.181	<-17.46	PASS
3DH5	2480	On	1.200	-54.850	<-18.8	PASS
3DH5	2480	Off	1.080	-51.026	<-18.92	PASS

TEST PLOT

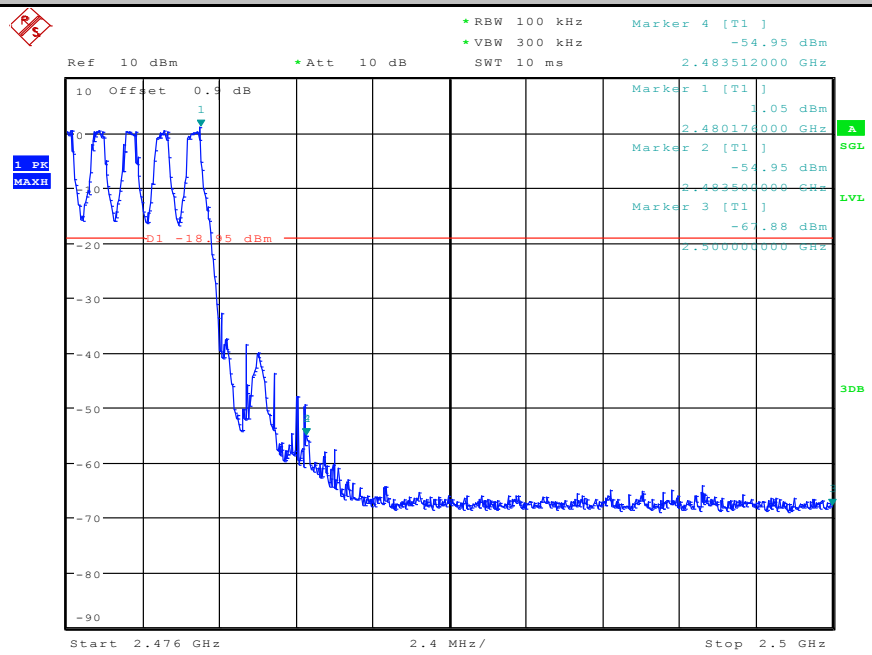
Band-edge for RF Conducted Emissions_DH5_2402_Hopping On



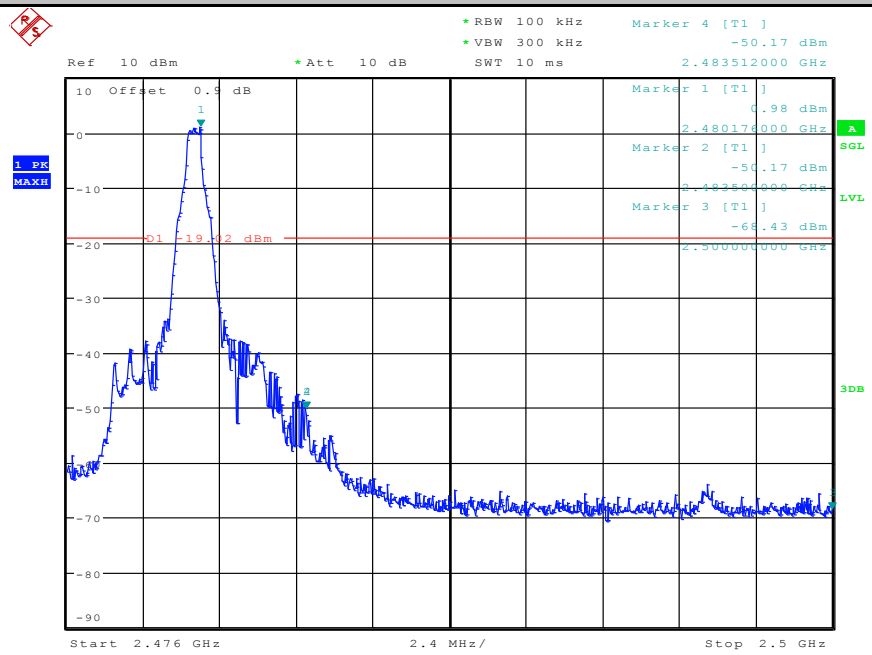
Band-edge for RF Conducted Emissions_DH5_2402_Hopping Off



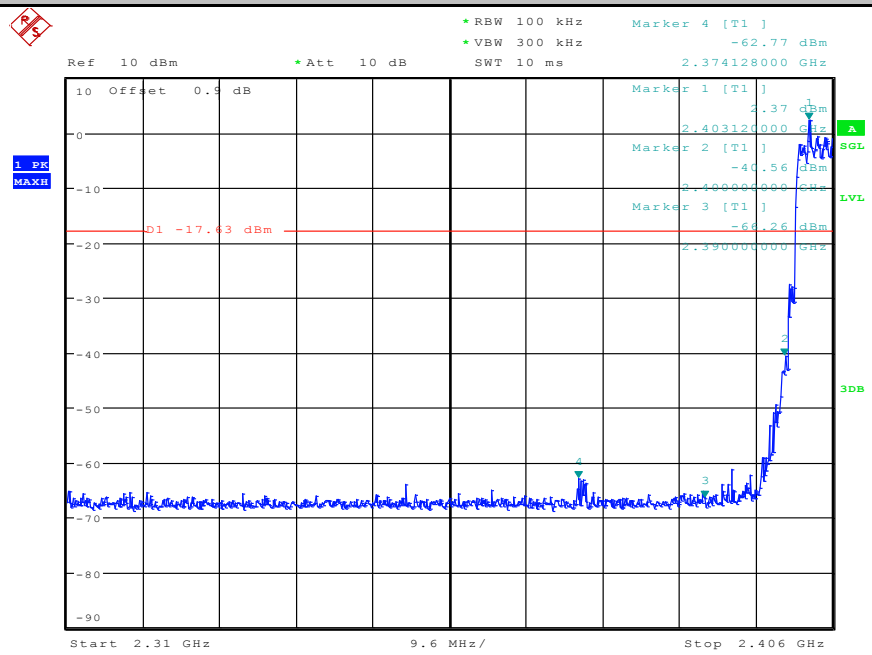
Band-edge for RF Conducted Emissions_DH5_2480_Hopping On



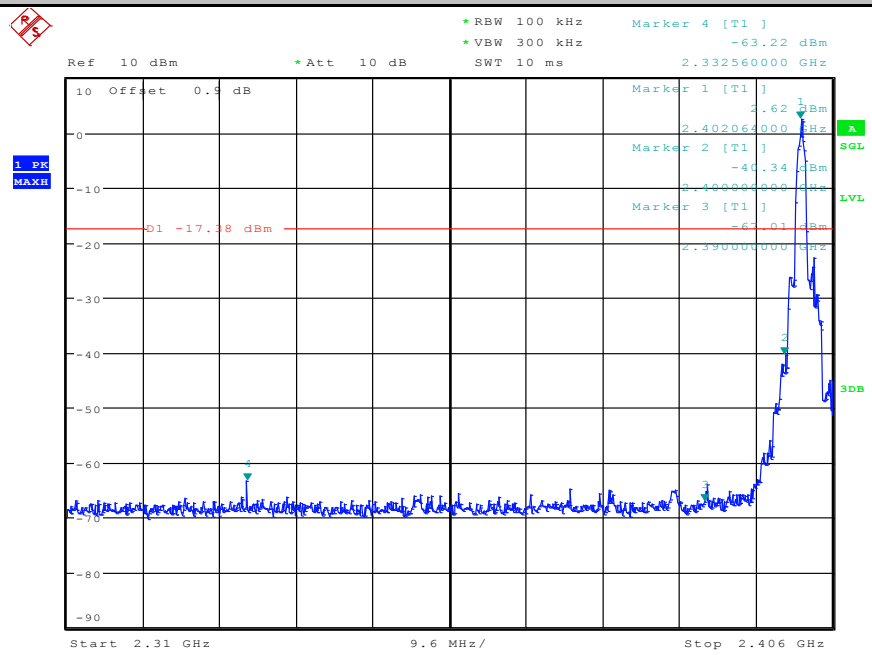
Band-edge for RF Conducted Emissions_DH5_2480_Hopping Off



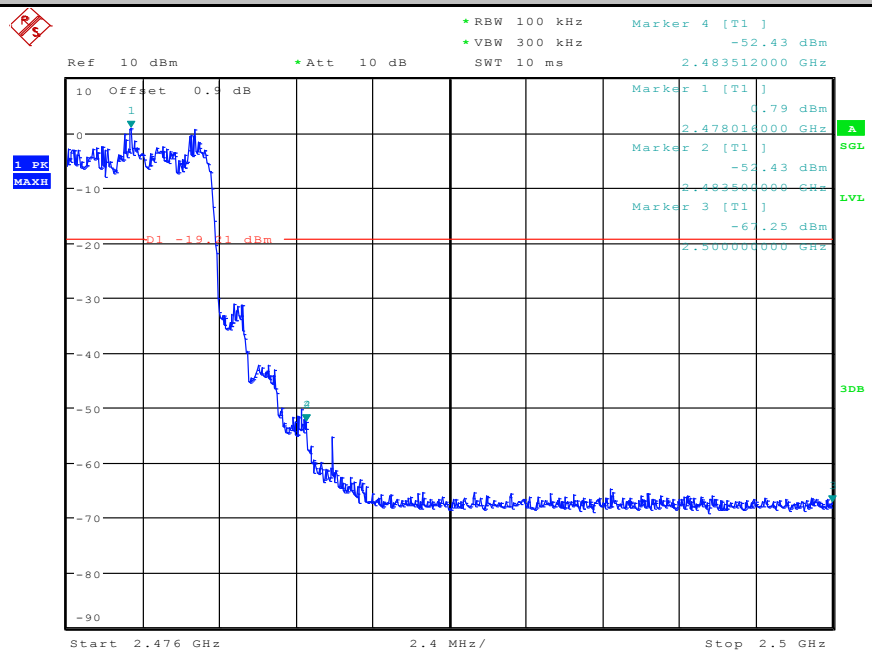
Band-edge for RF Conducted Emissions_2DH5_2402_Hopping On



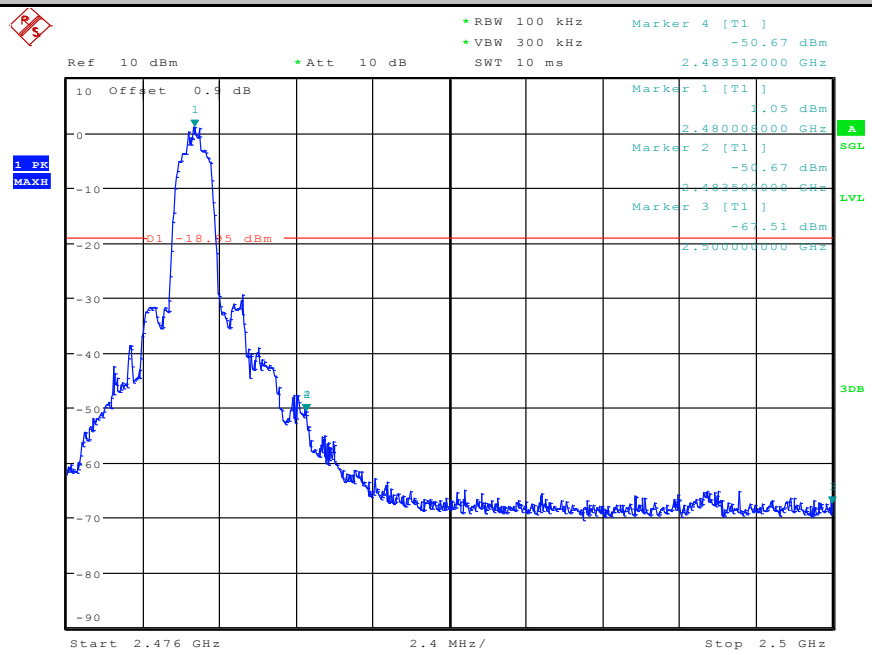
Band-edge for RF Conducted Emissions_2DH5_2402_Hopping Off



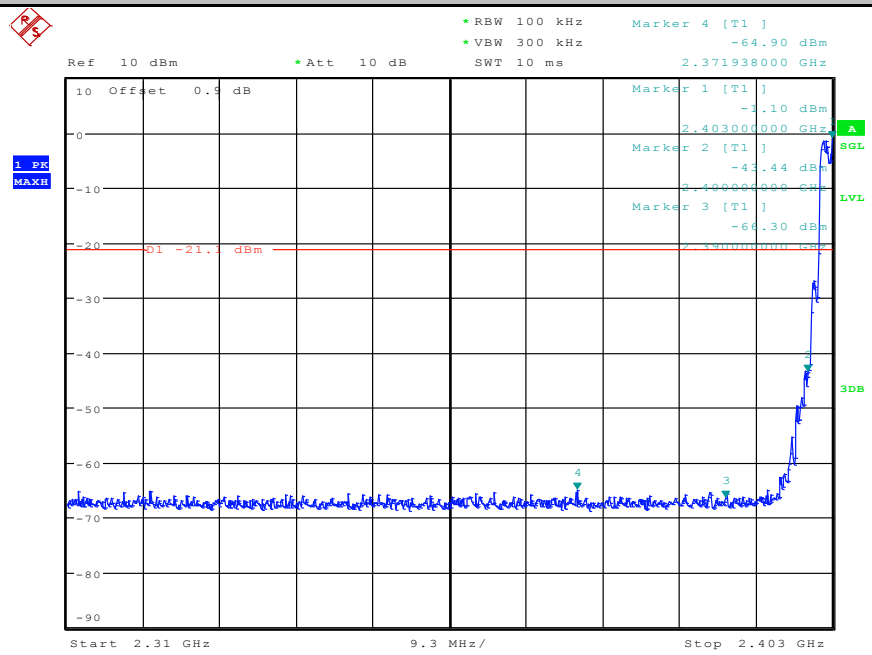
Band-edge for RF Conducted Emissions_2DH5_2480_Hopping On



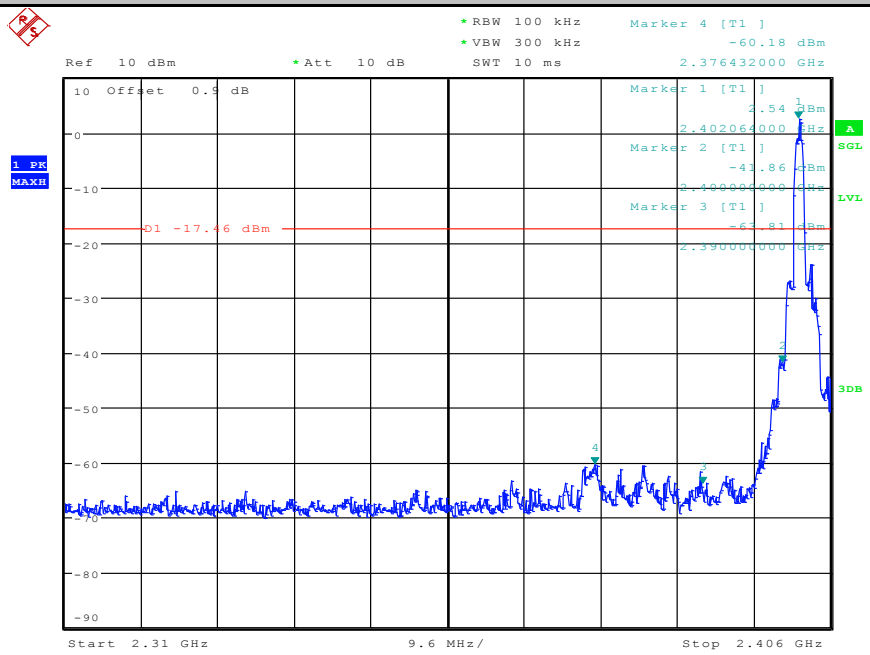
Band-edge for RF Conducted Emissions_2DH5_2480_Hopping Off



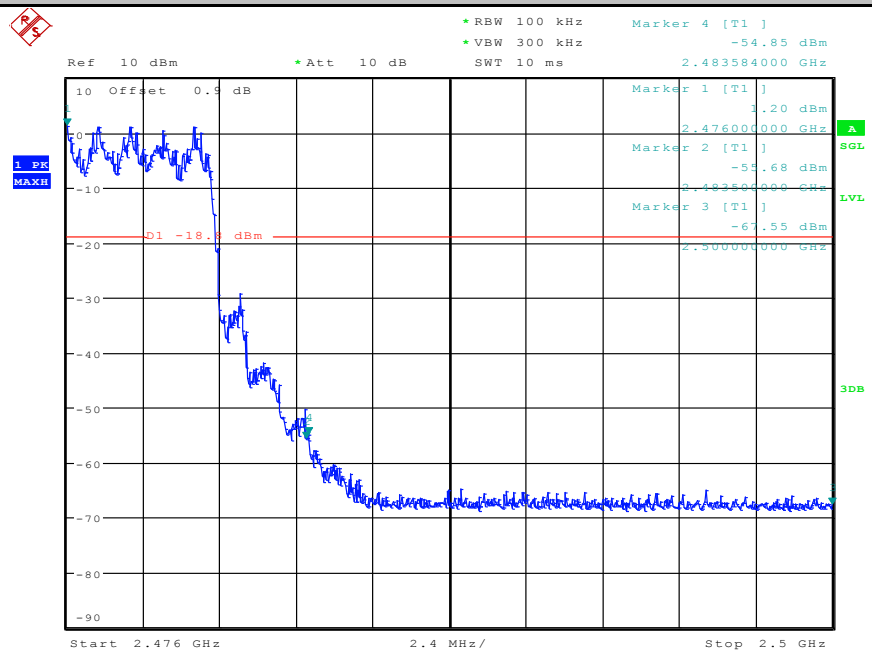
Band-edge for RF Conducted Emissions_3DH5_2402_Hopping On



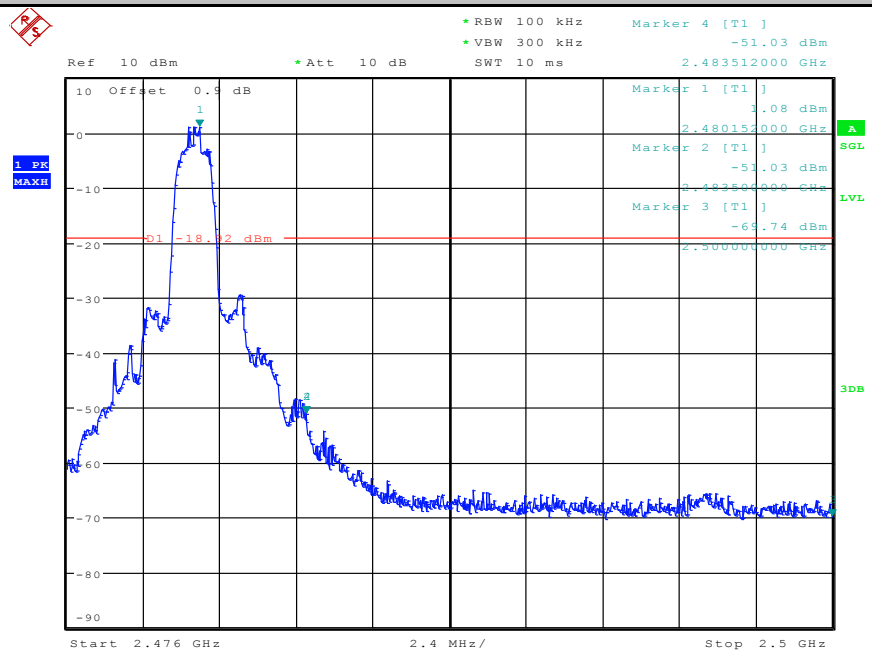
Band-edge for RF Conducted Emissions_3DH5_2402_Hopping Off



Band-edge for RF Conducted Emissions_3DH5_2480_Hopping On



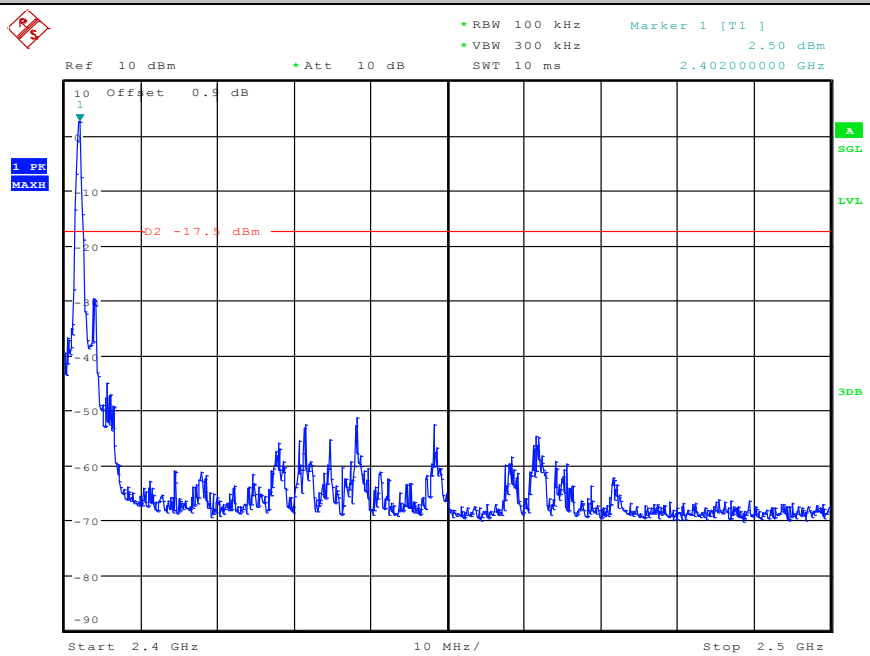
Band-edge for RF Conducted Emissions_3DH5_2480_Hopping Off

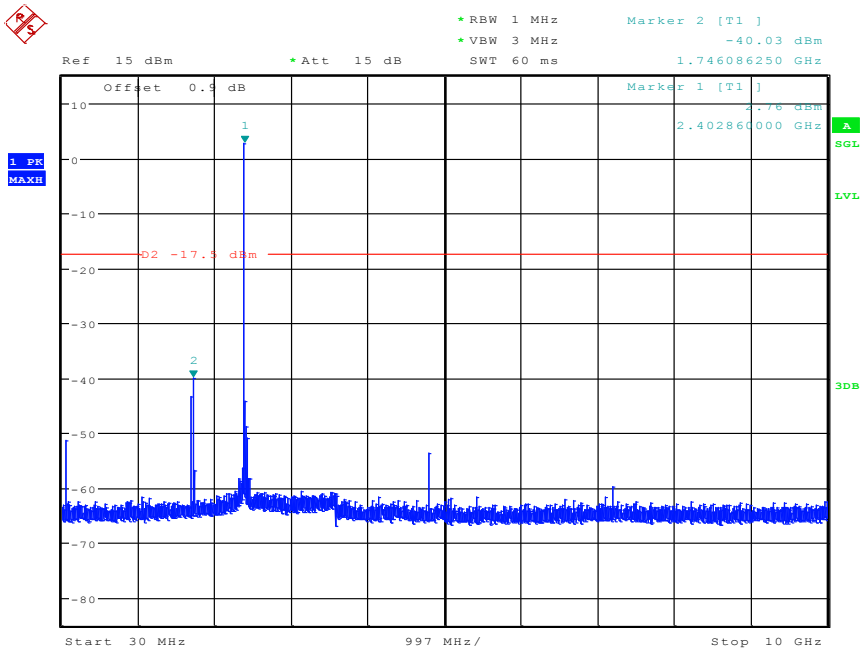


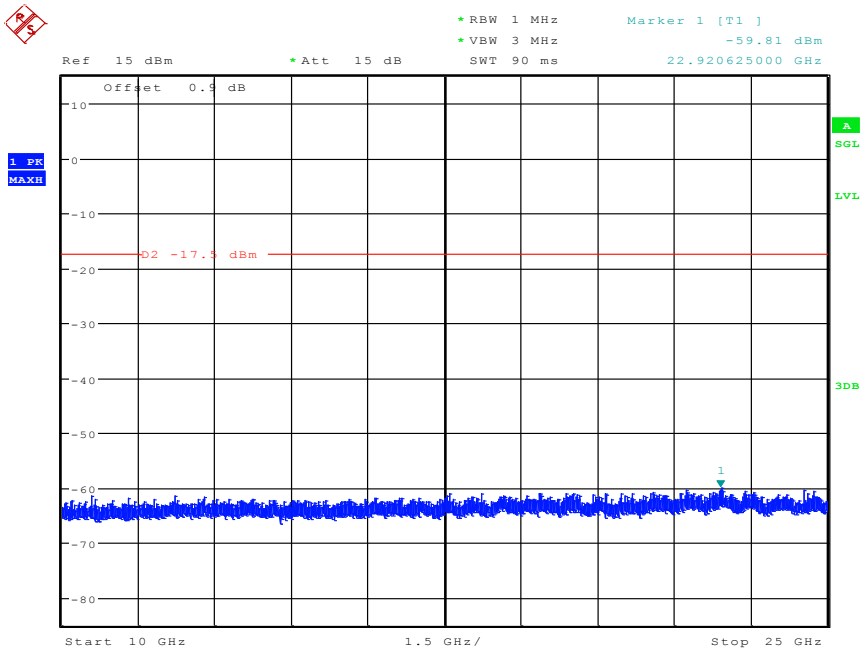
7. RF Conducted Spurious Emissions

Test Mode	Test Channel	StartFre [MHz]	StopFre [MHz]	RBW [kHz]	VBW [kHz]	Pref[dBm]	Max. Level [dBm]	Limit [dBm]	Verdict
DH5	2402	30	10000	1000	3000	2.5	-40.030	<-17.5	PASS
DH5	2402	10000	25000	1000	3000	2.5	-59.810	<-17.5	PASS
DH5	2441	30	10000	1000	3000	1.95	-39.580	<-18.05	PASS
DH5	2441	10000	25000	1000	3000	1.95	-60.290	<-18.05	PASS
DH5	2480	30	10000	1000	3000	1.02	-36.860	<-18.98	PASS
DH5	2480	10000	25000	1000	3000	1.02	-60.220	<-18.98	PASS
2DH5	2402	30	10000	1000	3000	2.84	-37.660	<-17.16	PASS
2DH5	2402	10000	25000	1000	3000	2.84	-60.130	<-17.16	PASS
2DH5	2441	30	10000	1000	3000	2.13	-52.350	<-17.87	PASS
2DH5	2441	10000	25000	1000	3000	2.13	-59.700	<-17.87	PASS
2DH5	2480	30	10000	1000	3000	1.1	-34.410	<-18.9	PASS
2DH5	2480	10000	25000	1000	3000	1.1	-59.870	<-18.9	PASS
3DH5	2402	30	10000	1000	3000	2.86	-51.380	<-17.14	PASS
3DH5	2402	10000	25000	1000	3000	2.86	-59.820	<-17.14	PASS
3DH5	2441	30	10000	1000	3000	2.05	-38.110	<-17.95	PASS
3DH5	2441	10000	25000	1000	3000	2.05	-59.610	<-	PASS

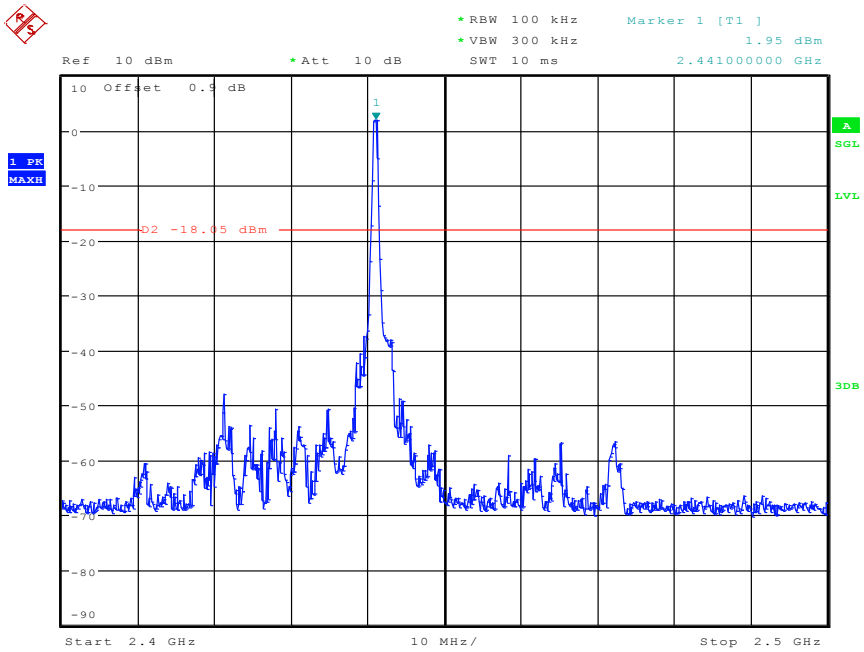
								17.95	
3DH5	2480	30	10000	1000	3000	1.33	-40.080	<-18.67	PASS
3DH5	2480	10000	25000	1000	3000	1.33	-60.030	<-18.67	PASS

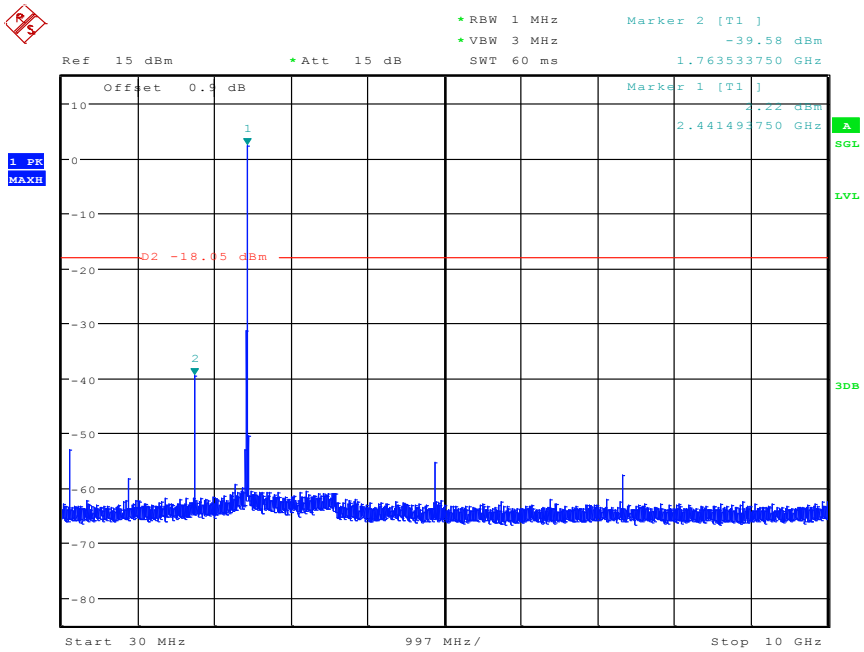
TEST PLOT	
RF Conducted Spurious Emissions_DH5_2402	
Pref	

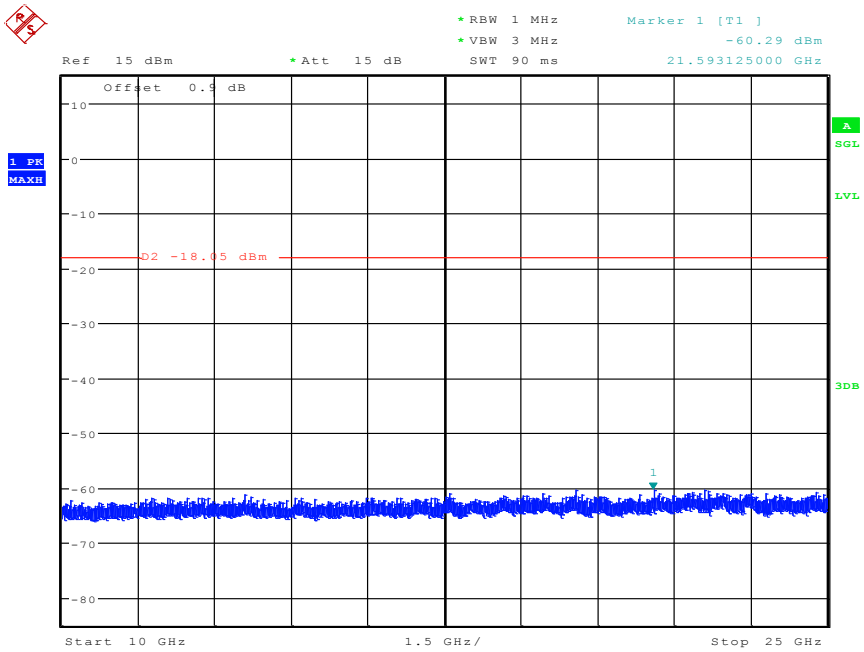
CSE_1	

CSE_2	

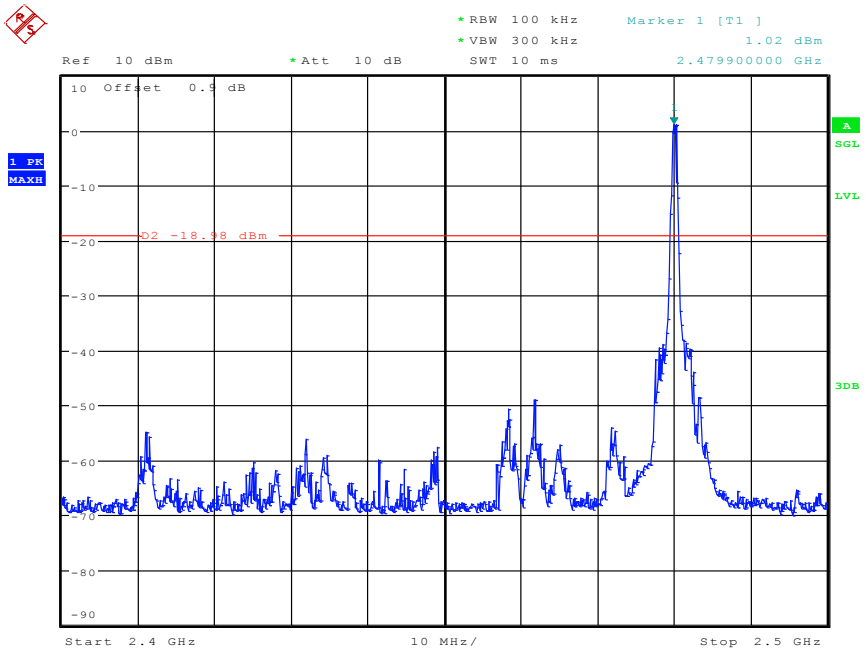
RF Conducted Spurious Emissions_DH5_2441

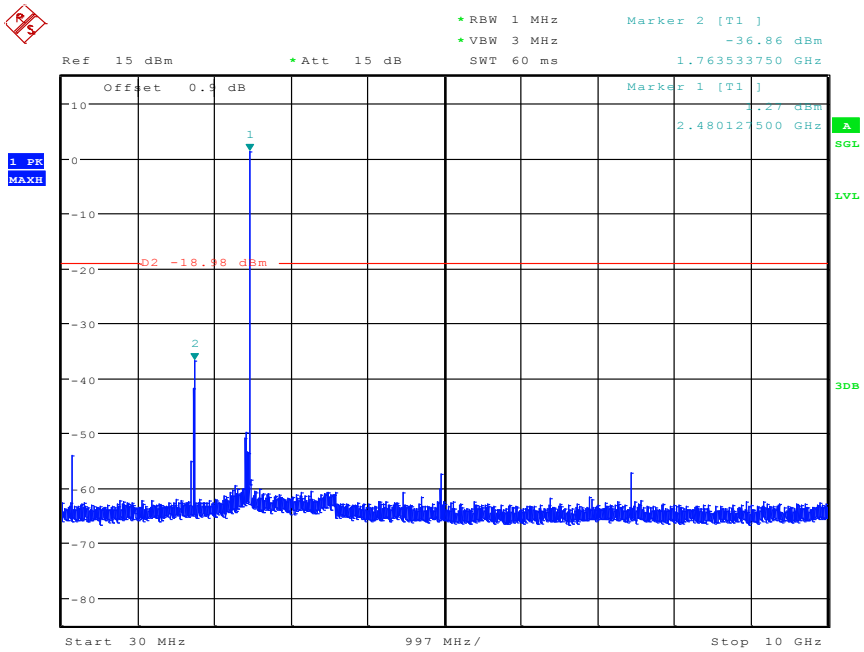
Pref	

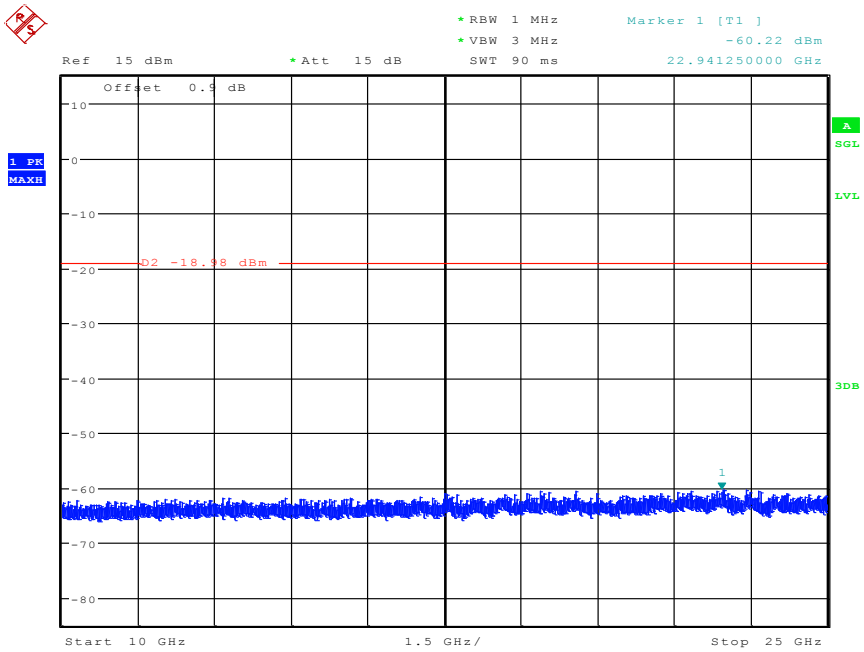
CSE_1	

CSE_2	

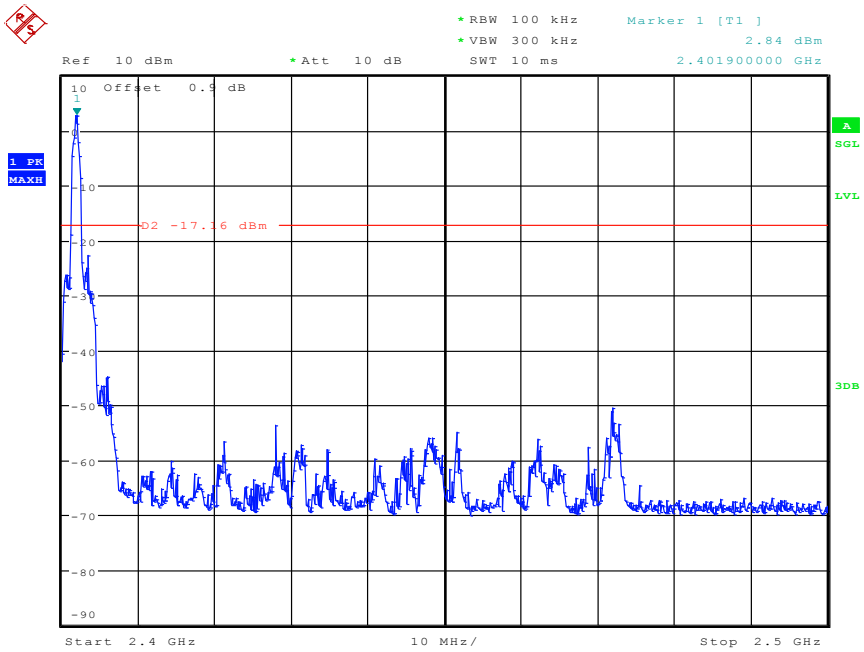
RF Conducted Spurious Emissions_DH5_2480

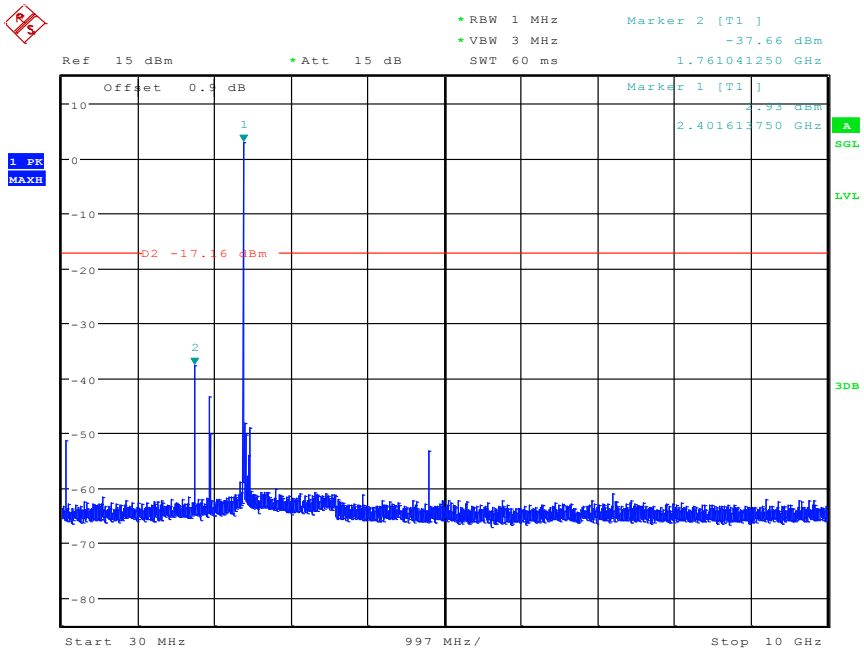
Pref	

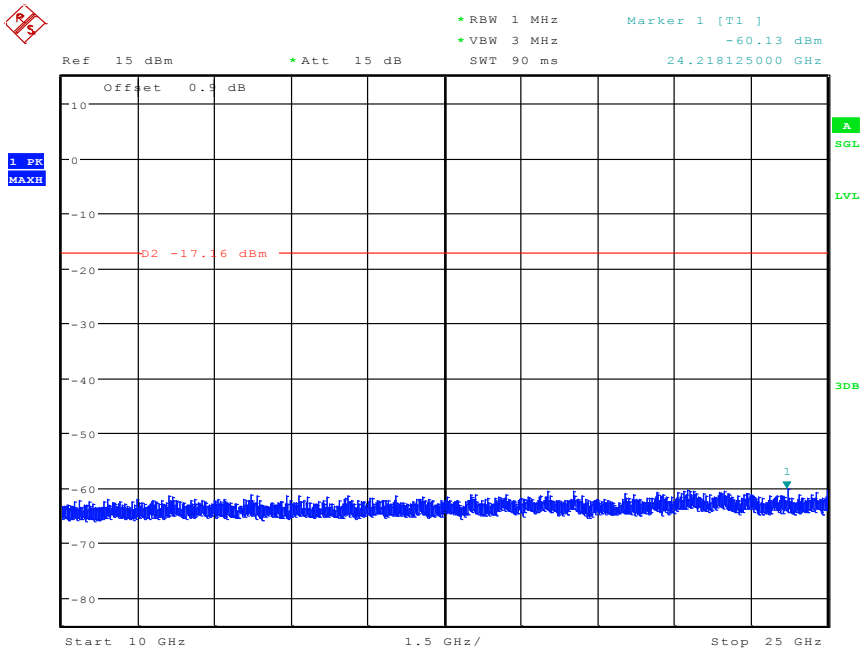
CSE_1	

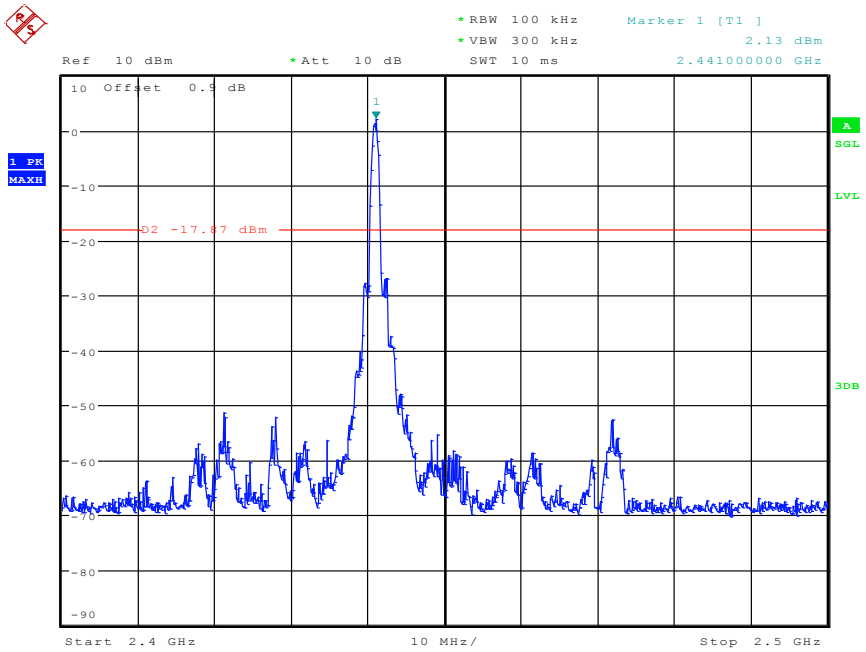
CSE_2	

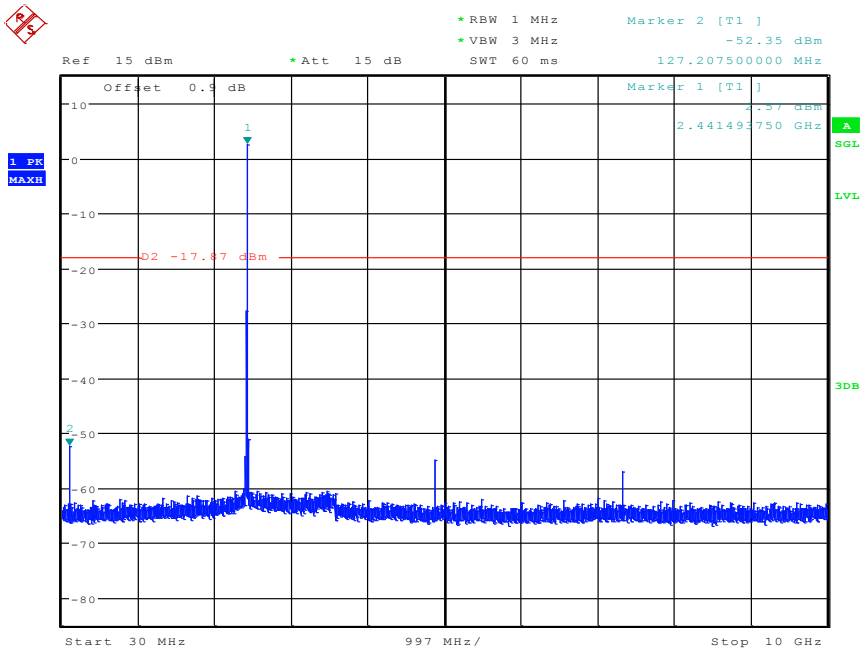
RF Conducted Spurious Emissions_2DH5_2402

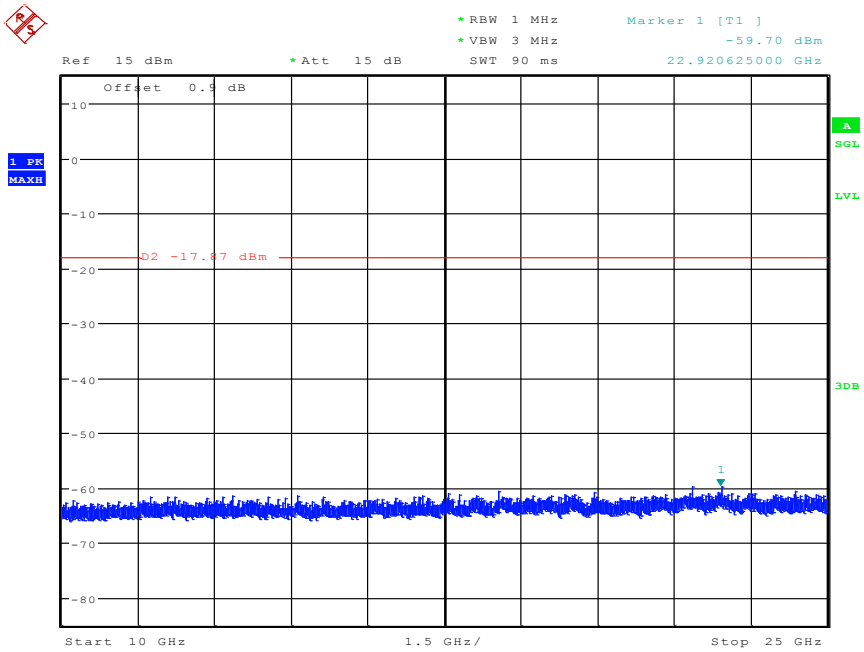
Pref	

CSE_1	

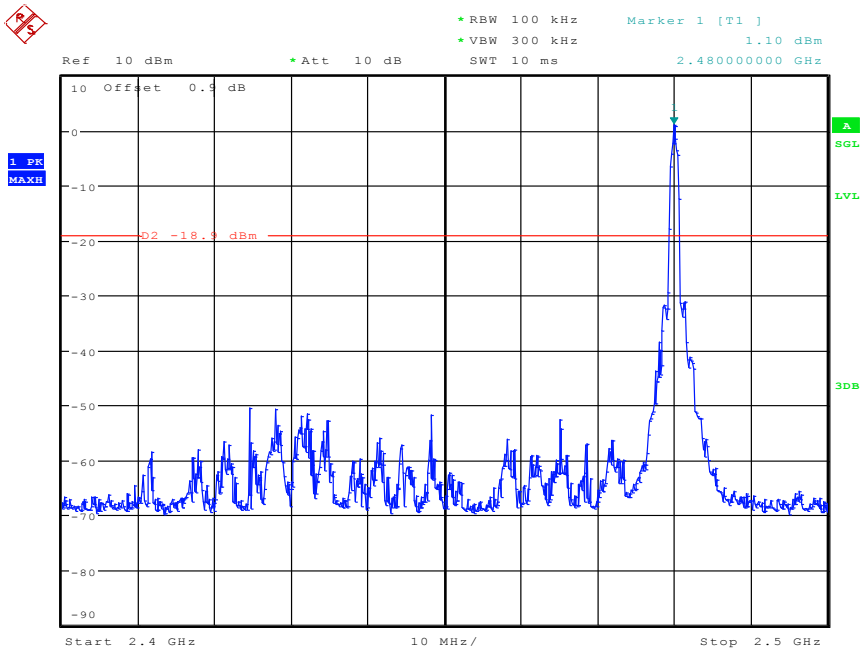
CSE_2	
RF Conducted Spurious Emissions_2DH5_2441	

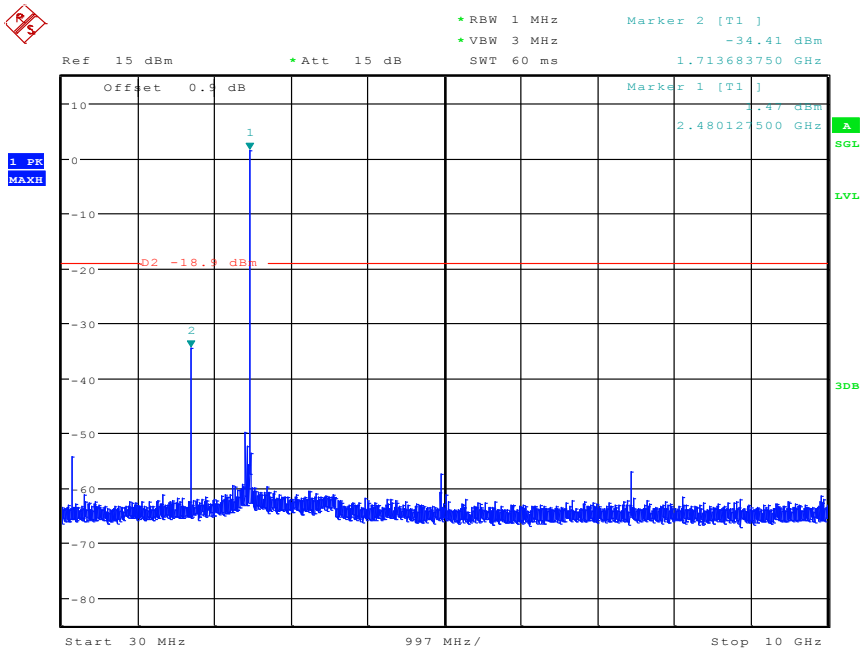
Pref	

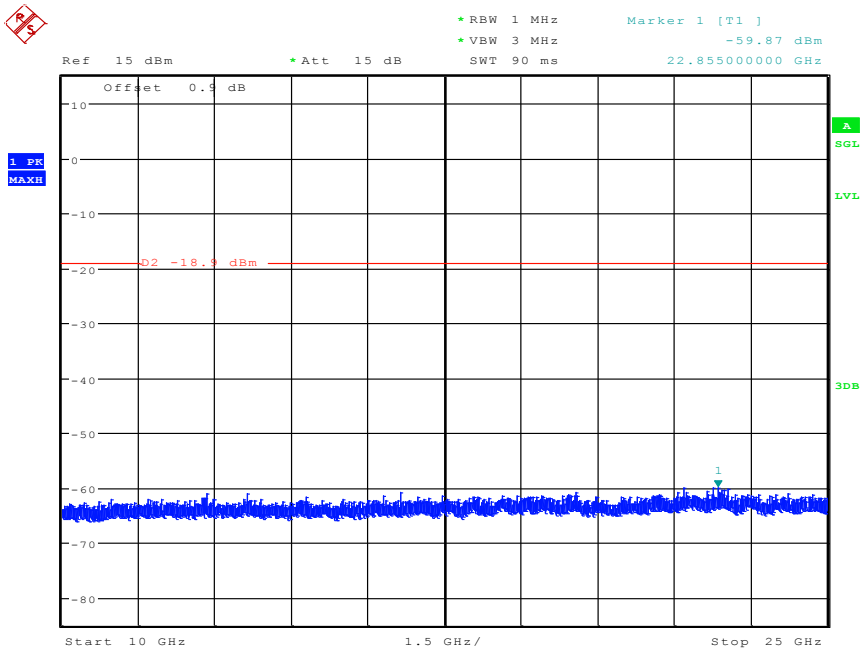
CSE_1	

CSE_2	

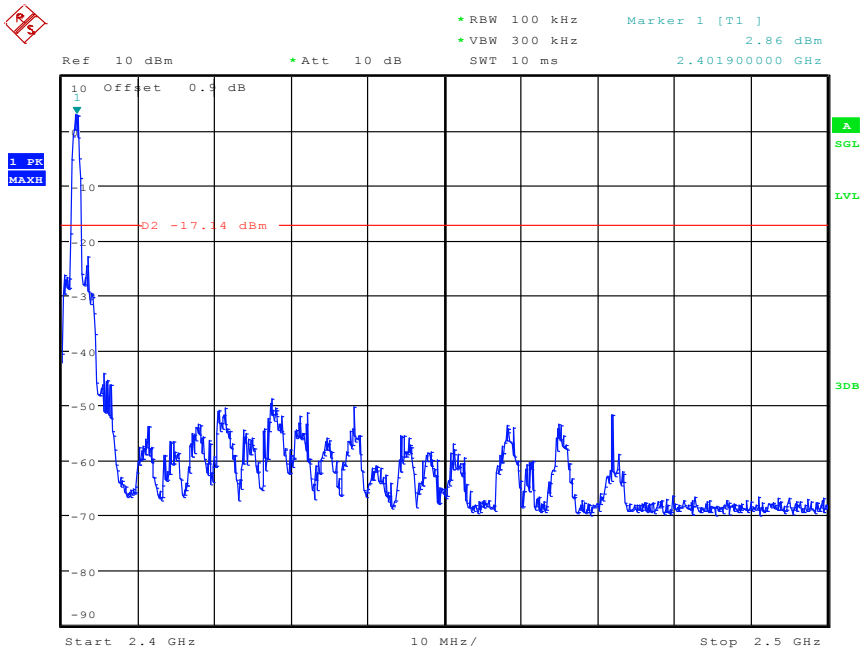
RF Conducted Spurious Emissions_2DH5_2480

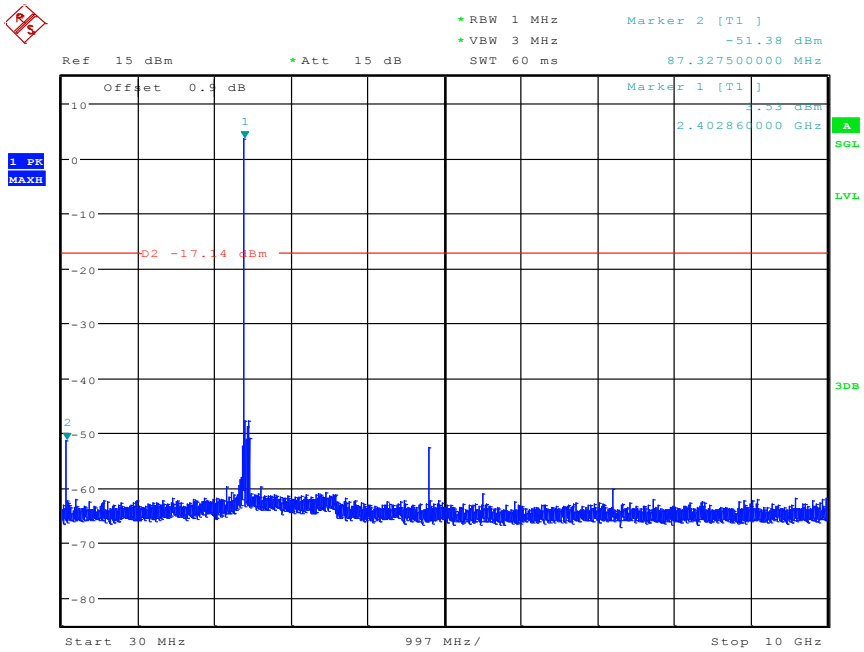
Pref	

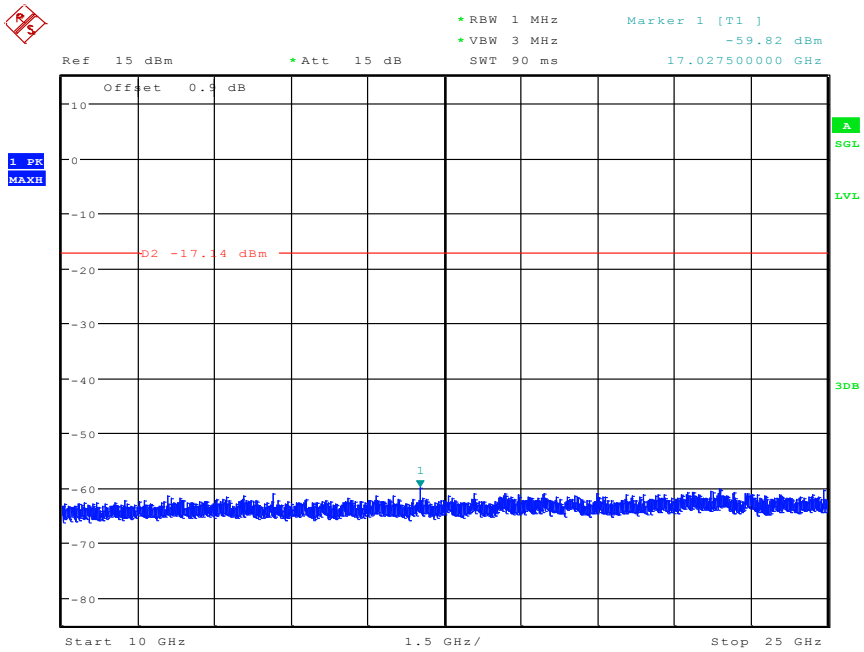
CSE_1	

CSE_2	

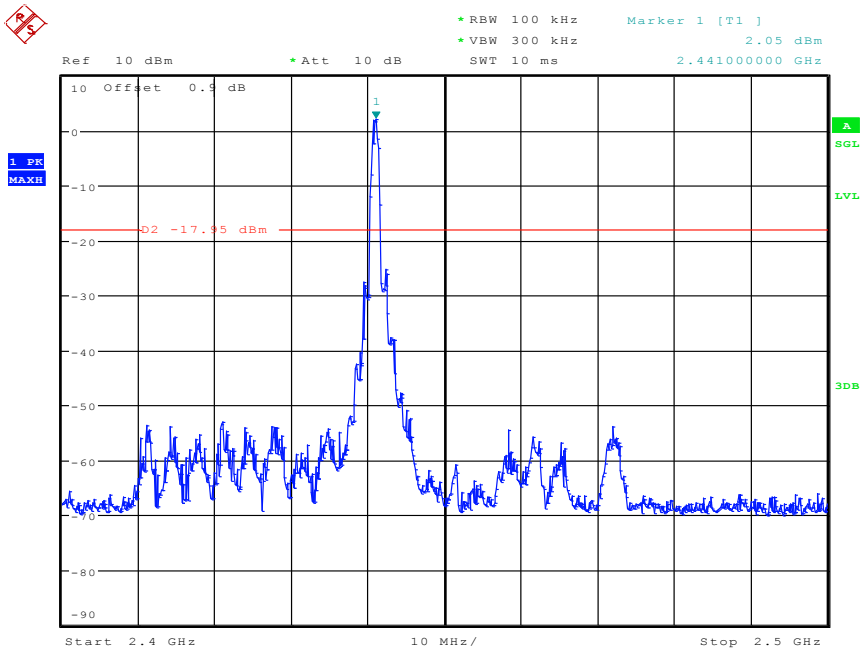
RF Conducted Spurious Emissions_3DH5_2402

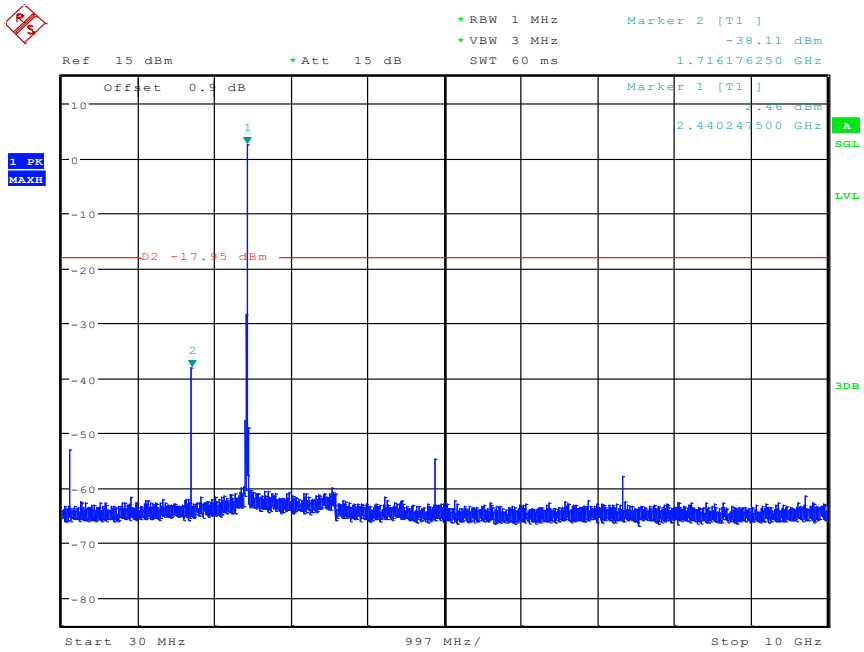
Pref	

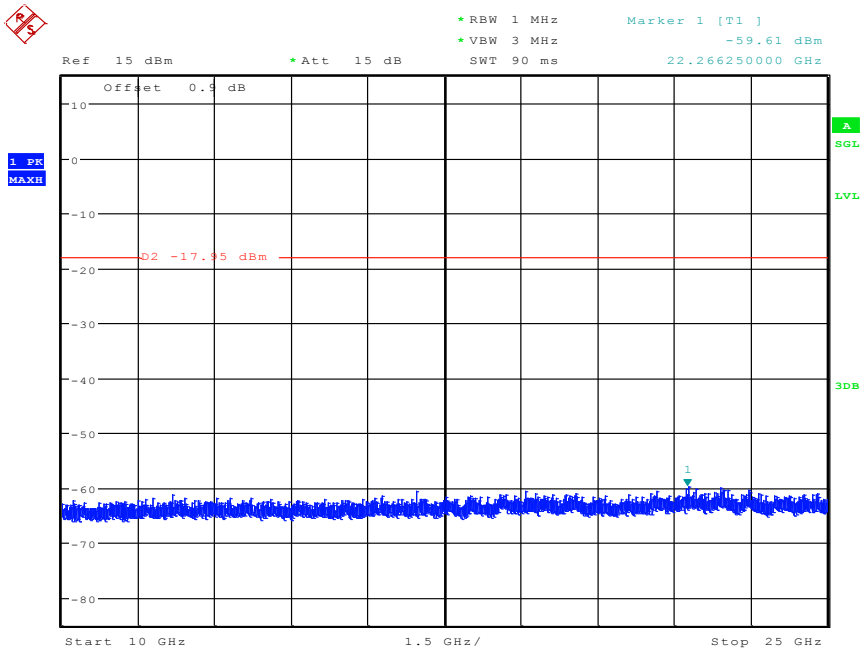
CSE_1	

CSE_2	

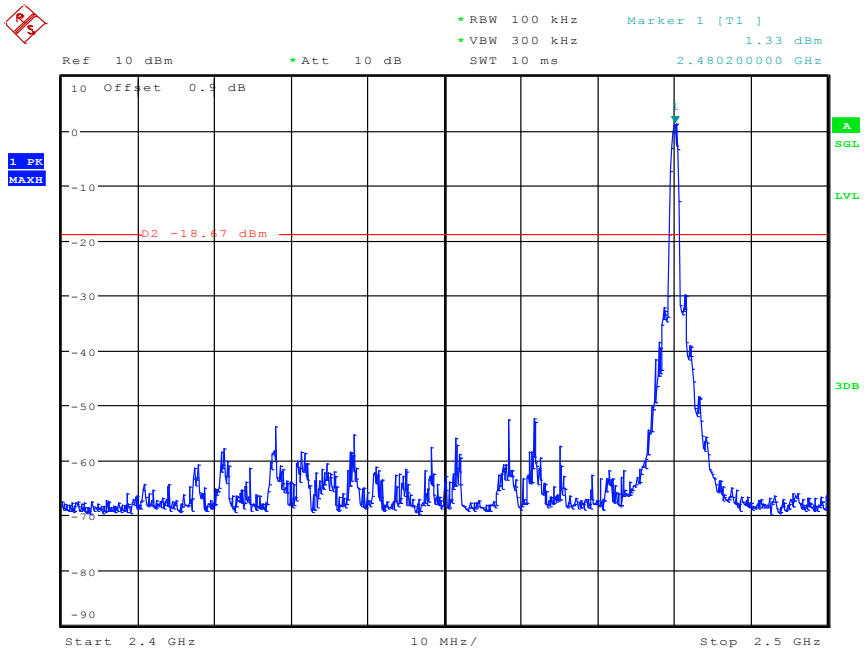
RF Conducted Spurious Emissions_3DH5_2441

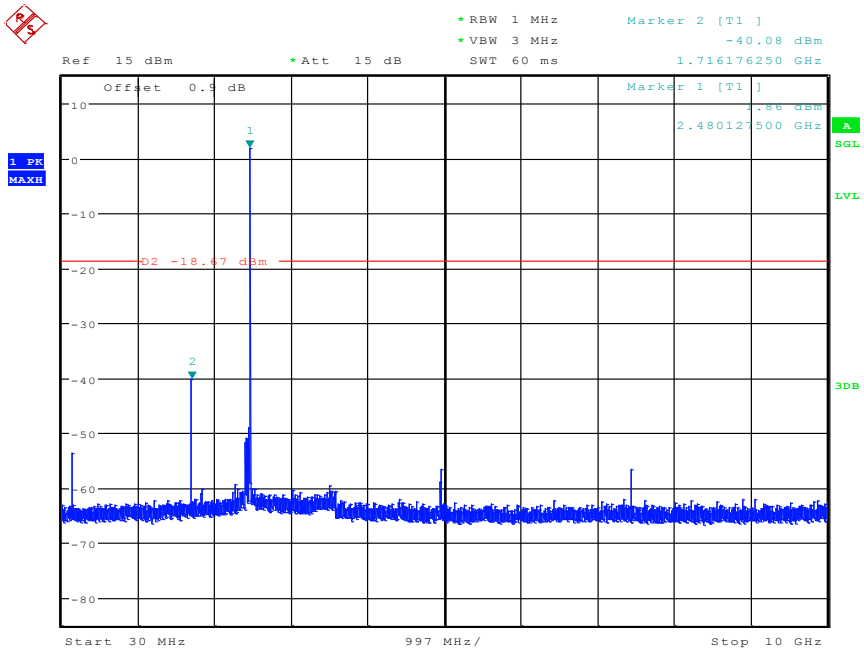
Pref	

CSE_1	

CSE_2	

RF Conducted Spurious Emissions_3DH5_2480

Pref	

CSE_1	
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