FCC CERTIFICATION TEST REPORT

Project Number	**: EA2206C-023**
Test Report Number	**: TR-W2208-011**
Type of Equipment	**: In-vehicle Infotainment System**
Model Name	**: XS90116CA**
Equipment Class	**: DSS - Part 15 Spread Spectrum Transmitter**
FCC ID	**: YE4XSG4V2B**
Applicant	**: Glosys Inc.**
Address	**: B2535, 27, Dongtancheomdansaneop 1-ro, Hwaseong-si, Gyeonggi-do, Republic of Korea**
Manufacturer	**: Glosys Inc.**
Address	**: B2535, 27, Dongtancheomdansaneop 1-ro, Hwaseong-si, Gyeonggi-do, Republic of Korea**
Regulation	**: FCC Part 15 Subpart C Section 15.247**
Total page of Report	**: 72 Pages**
Date of Receipt	**: 2022-06-14**
Date of Issue	**: 2022-08-04**
Test Result	**: PASS**

This test report only contains the result of a single test of the sample supplied for the examination.
It is not a generally valid assessment of the features of the respective products of the mass-production.

Prepared by Song, In-yong / Senior Engineer _____ 2022-08-04
Signature Date

Reviewed by Choi, Yeong-min / Technical Manager _____ 2022-08-04
Signature Date

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Release Control Record

Issue Report No.	Issued Date	Details/Revisions
TR-W2208-011	2022-08-04	Initial Release
-	-	-

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1. TEST SUMMARY

1.1 Regulations and results

The sample submitted for evaluation (Hereafter referred to as the EUT) has been tested in accordance with the following regulations or standards.

FCC Reference Section	Description	Result			
		P	F	NT	Note
15.247(a)(1)	20 dB Bandwidth Occupied Bandwidth	**P**			
15.247(a)(1)	Carrier Frequency Separation	**P**			
15.247 (a)(1)(iii)	Number of Hopping Frequencies	**P**			
15.247 (a)(1)(iii)	Time of Occupancy (Dwell Time)	**P**			
15.247(b)(1)	Maximum Peak Conducted Output power	**P**			
15.247(d)	Band Edge Conducted spurious emission	**P**			
15.205(a) 15.209(a)	Radiated spurious emissions	**P**			
15.207(a)	AC power line conducted emissions			**NT**	Note1

Remark:

P means Passed **F** means Failed **NT** means Not Tested

Note1. The EUT is a vehicle appliance and operates at DC 12 V, so the test was not required.

1.2 Test Methodology

The tests mentioned in clause 1.1 in this test report were performed according to FCC CFR 47 Part 2, CFR 47 Part 15 and ANSI C63.10-2013.

1.3 Additions, deviations, exclusions from standards

No additions, deviations or exclusions have been made from standard.

1.4 Purpose of the test

The test was performed to determine whether the equipment under test fulfills the requirements of the regulation stated in FCC Part 15 Subpart C Section 15.247.

1.5 Test Facility

The measurement facilities are located at 135-60 Gyeongchung-daero, Gonjiam-eup, Gwangju-si, Gyeonggi-do 12813, Korea. Our test facilities are accredited as a Conformity Assessment Body (CAB) by the FCC and ISED Canada, designated by the RRA (National Radio Research Agency), and accredited by KOLAS (Korea Laboratory Accreditation Scheme) in Korea and approved by TUV Rheinland, TUV SÜD and Korean Register of Shipping according to the requirement of ISO/IEC 17025.

Laboratory Qualification	Registration No.	Mark
FCC	KR0160	
ISED Canada	12721A	
RRA	KR0160	National Radio Research Agency
TUV Rheinland	UA 50314109-0002	TÜVRheinland
TUV SÜD	CARAT 094465 0004 Rev.00	
Korean Agency for Technology and Standards	KT733	
KOREAN REGISTER OF SHIPPING	PCT40841-TL001	

Remark. This report is not related to KOLAS accreditation and relevant regulation.

2. EUT (Equipment Under Test) INFORMATION

2.1 General Description

The Glosys Inc., Model XS90116CA (referred to as the EUT in this report) is an In-vehicle Infotainment System, which has Bluetooth, BR and EDR function. This test report covers only Bluetooth Function and unintentional radiator part of the EUT shall be covered another test report. The product specification described herein was obtained from product data sheet or user's manual.

Kind of Class	DSS – Part15 Spread Spectrum Transmitter
Operating Frequency	2 402 MHz ~ 2 480 MHz
Max. RF Output Power	5.36 dBm
Modulation Types	GFSK, π/4DQPSK / 8DPSK
Number of Channels	79 channels
Channel Spacing	1 MHz
Generated or used Freq. in EUT	32.768 kHz, 8 MHz,12 MHz, 14.318118 MHz, 24 MHz, 24.576 MHz, 25 MHz, 27 MHz
Type of Antenna	☐ Integrated Type ■ Dedicated Type (PCB Pattern antenna)
Antenna Gain	Peak gain: -7.7 dBi
Normal Test Voltage	DC 12 V
Electrical Rating	DC 11 ~ 16 V
Consumption in Sleep mode	<5 mA
Dimensions	218 x 60 x 161 mm
Weight	810 g
Test SW Version	CSR Bluesuite 2.5.8
RF power setting in TEST SW	EXT:255 / INT: 63

2.2 Additional Model

None

2.3 Available channel number and frequency

Operating Mode: Bluetooth BR/EDR, 1 MHz Channel Spacing					
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	2 402	27	2 429	54	2 456
1	2 403	28	2 430	55	2 457
2	2 404	29	2 431	56	2 458
3	2 405	30	2 432	57	2 459
4	2 406	31	2 433	58	2 460
5	2 407	32	2 434	59	2 461
6	2 408	33	2 435	60	2 462
7	2 409	34	2 436	61	2 463
8	2 410	35	2 437	62	2 464
9	2 411	36	2 438	63	2 465
10	2 412	37	2 439	64	2 466
11	2 413	38	2 440	65	2 467
12	2 414	39	2 441	66	2 468
13	2 415	40	2 442	67	2 469
14	2 416	41	2 443	68	2 470
15	2 417	42	2 444	69	2 471
16	2 418	43	2 445	70	2 472
17	2 419	44	2 446	71	2 473
18	2 420	45	2 447	72	2 474
19	2 421	46	2 448	73	2 475
20	2 422	47	2 449	74	2 476
21	2 423	48	2 450	75	2 477
22	2 424	49	2 451	76	2 478
23	2 425	50	2 452	77	2 479
24	2 426	51	2 453	78	2 480
25	2 427	52	2 454		
26	2 428	53	2 455		

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3. TEST CONDITION

3.1 Equipment Used During Test

The following peripheral devices and/or interface cables were connected during the measurement:

Description	Model No.	Serial No.	Manufacturer.
In-vehicle Infotainment System (EUT)	XS90116CA	N/A	Glosys Inc.
USB to SPI Converter	-	-	-
Notebook PC	15s-du0069TU	CND9503W22	HP
Adapter for Notebook PC	TPN-CA14	N/A	Chicony Power Technology (Chongqing) Co., Ltd.

3.2 Mode of operation during the test

Software used to control the EUT for staying in continuous transmitting mode is programmed.
The used modulation type for the testing is GFSK, π/4DQPSK and 8DPSK.

3.3 Preliminary Testing for Worst case configuration

For finding worst case configuration and operating mode, preliminary testing was performed and radiated emission and conducted emission tests were performed with the EUT set to transmit and receive at the channel with the highest output power as worst case scenario.

Based on preliminary testing following operating modes were selected for the final test as listed below.

Operating Mode	Data rate	Frequency	Measured Output Power(dBm)
BR (GFSK)	DH1	Low	2.02
		Middle	3.85
		High	5.36
	DH3	Low	2.00
		Middle	3.81
		High	5.25
	DH5	***Low***	***2.05***
		Middle	***3.87***
		High	***5.36***
EDR (π/4DQPSK)	2-DH1	Low	0.51
		Middle	2.77
		High	4.33
	2-DH3	Low	0.49
		Middle	2.77
		High	4.35
	2-DH5	***Low***	***0.52***
		Middle	***2.78***
		High	***4.35***
EDR (8DPSK)	3-DH1	Low	0.91
		Middle	3.06
		High	4.60
	3-DH3	Low	0.82
		Middle	3.03
		High	4.58
	3-DH5	***Low***	***0.94***
		Middle	***3.18***
		High	***4.64***

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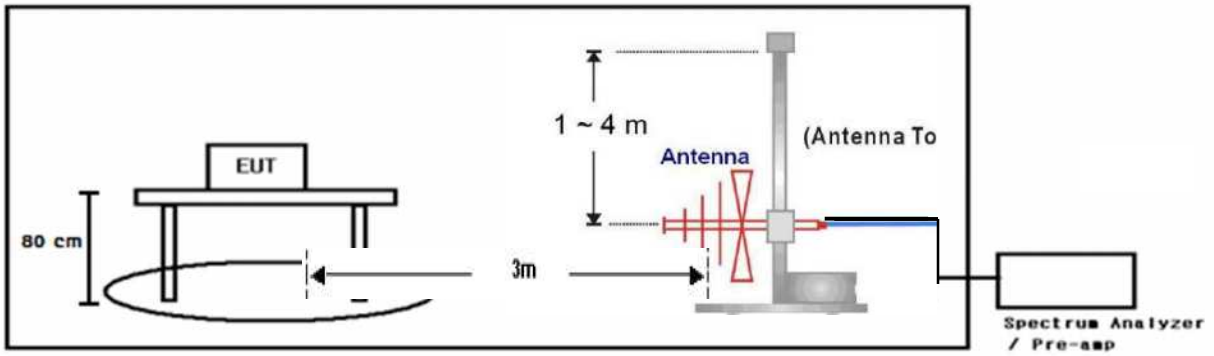
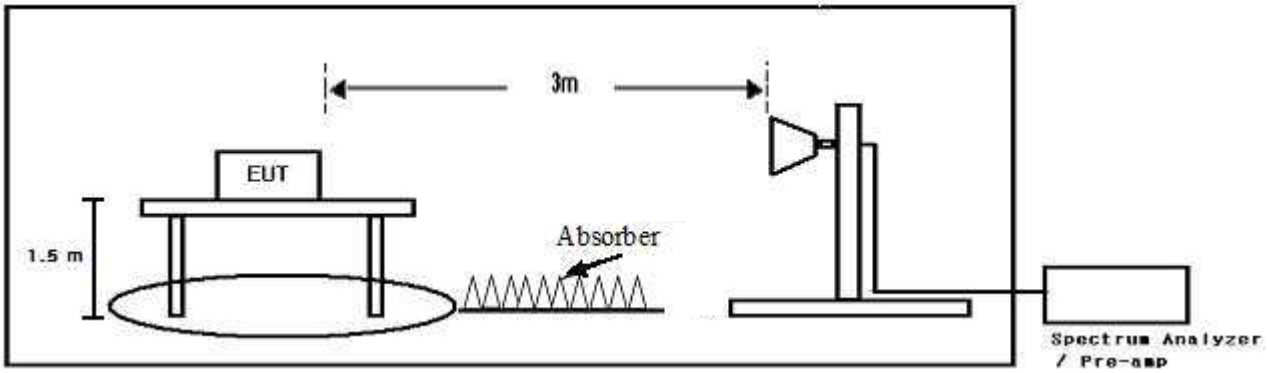
3.4 Test Setup Drawing

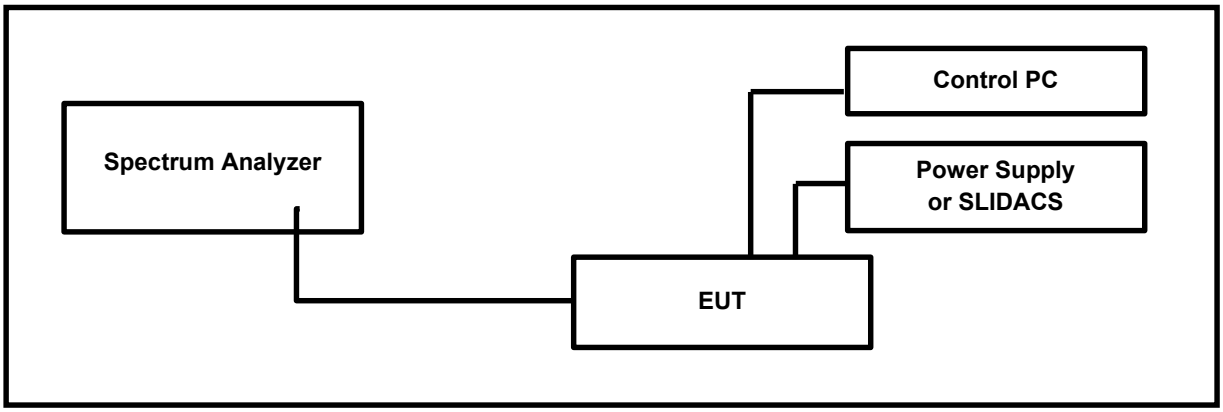
(Radiated Test below 1 GHz)



(Radiated Test above 1 GHz)



(Conducted Test)



3.5 EUT Modifications

- No EMC Relevant Modifications were performed by this test laboratory.

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4. ANTENNA REQUIREMENT

According to FCC CFR 47 Part 15 section 15.203, 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 shall be considered sufficient to comply with the provision of this section.

4.1 Antenna Description

Frequency Band (GHz)	Antenna Type	Max Peak Gain (dBi)	Connector Type
2.402 – 2.480	PCB Pattern Antenna	-7.7	-

4.2 Conclusion

The antenna type of the EUT is a PCB Pattern Antenna, so the EUT met the requirement.

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5. TEST RESULT

5.1 20 dB Bandwidth

5.1.1 Limit

Not applicable.

5.1.2 Method of Measurement

Reference to ANSI C63.10-2013 6.9.2 and 6.9.3

The transmitter output is connected to a spectrum analyzer with the RBW set to 30 kHz, VBW ≥ 3 X RBW, peak detector and max hold.

5.1.3 Test Data

Date of Test	2022-06-14	Temperature	(25.7 ± 0.8) °C
		Relative humidity	(56.5 ± 2.8) % R.H.
Test Result	***PASS***	Tested by	Do-heon, Kim

Operational Mode: Bluetooth BR (GFSK)		
Channel	Frequency (MHz)	20 dB Bandwidth (MHz)
Low	2 402	0.962
Middle	2 441	0.962
High	2 480	0.974
Operational Mode: Bluetooth EDR (8DPSK)		
Channel	Frequency (MHz)	20 dB Bandwidth (MHz)
Low	2 402	1.316
Middle	2 441	1.322
High	2 480	1.328

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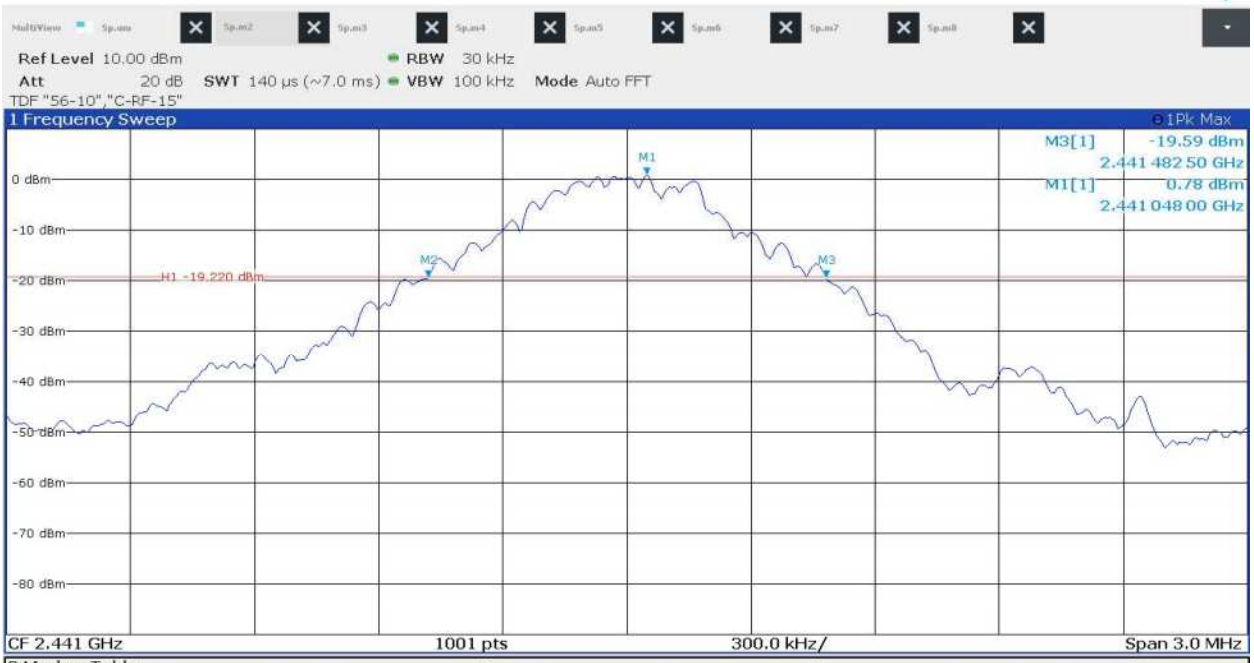
5.1.4 Test Plots

Operating Mode: Bluetooth BR (GFSK) (Low Channel)

2 Marker Table

Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	2.402 048 GHz	-1.15 dBm		
M2		1	2.401 520 5 GHz	-21.68 dBm		
M3		1	2.402 482 5 GHz	-21.47 dBm		

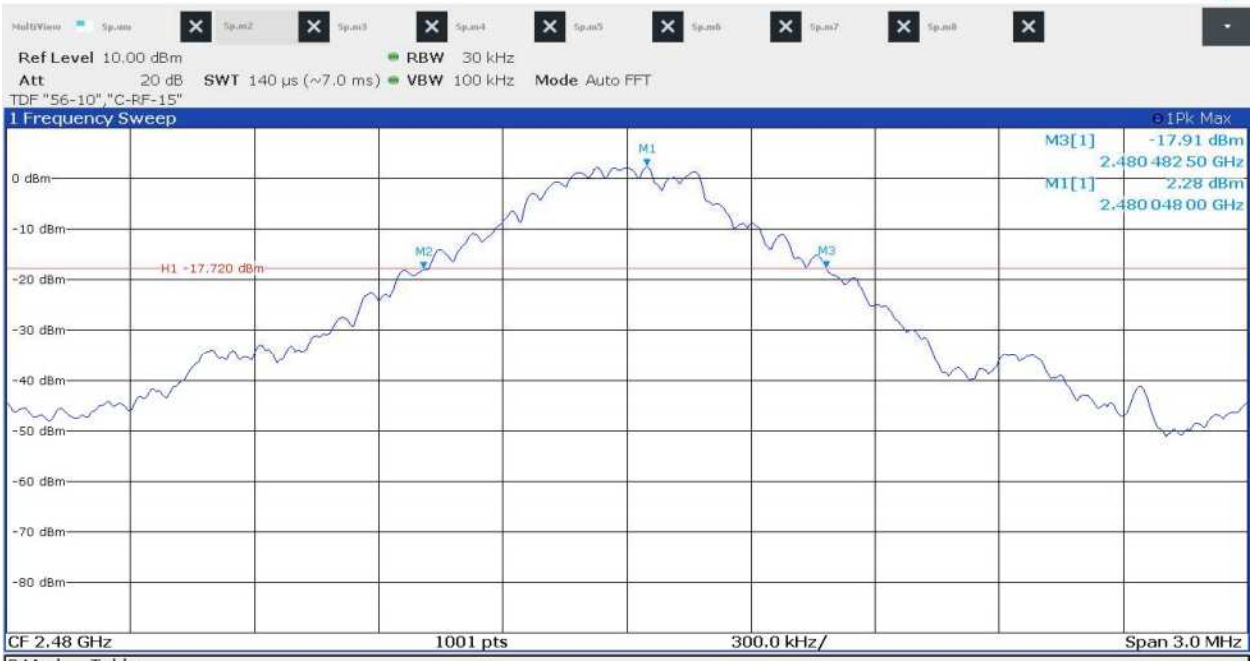
Operating Mode: Bluetooth BR (GFSK) (Middle Channel)



2 Marker Table

Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	2.441 048 GHz	0.78 dBm		
M2		1	2.440 520 5 GHz	-19.50 dBm		
M3		1	2.441 482 5 GHz	-19.59 dBm		

Operating Mode: Bluetooth BR (GFSK) (High Channel)



2 Marker Table

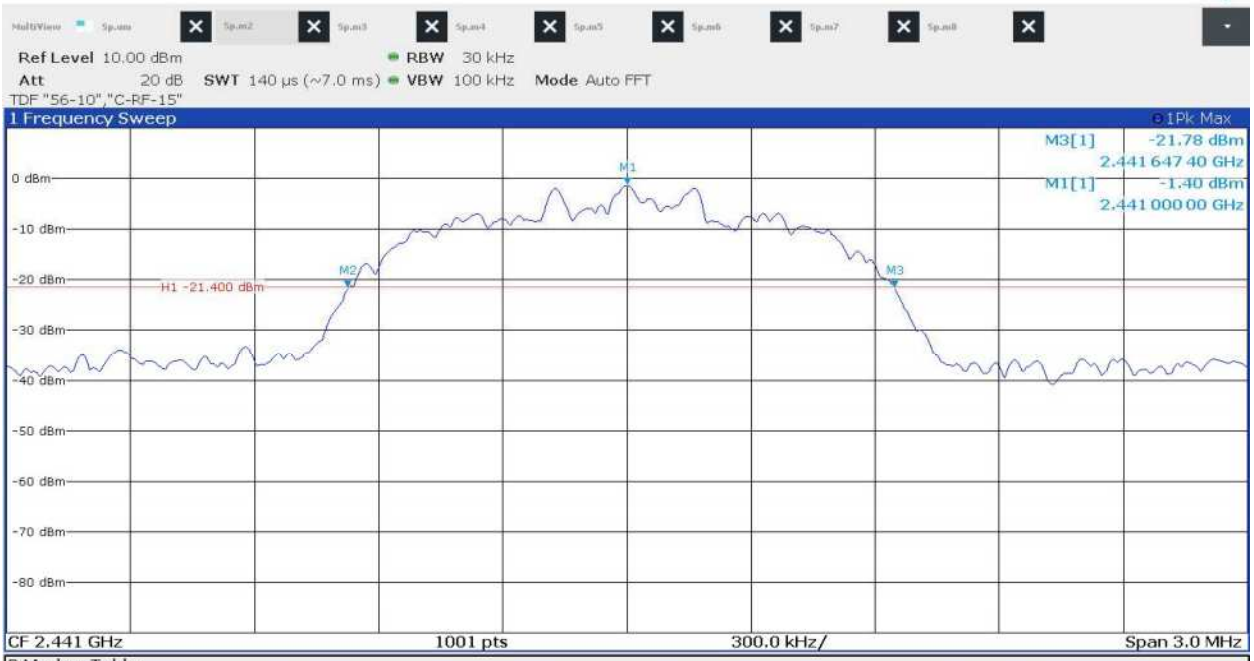
Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	2.480 048 GHz	2.28 dBm		
M2		1	2.479 508 5 GHz	-18.07 dBm		
M3		1	2.480 482 5 GHz	-17.91 dBm		

Operating Mode: Bluetooth EDR (8DPSK) (Low Channel)

2 Marker Table

Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	2.402 155 8 GHz	-3.75 dBm		
M2		1	2.401 328 7 GHz	-24.05 dBm		
M3		1	2.402 644 4 GHz	-24.01 dBm		

Operating Mode: Bluetooth EDR (8DPSK) (Middle Channel)



2 Marker Table

Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	2.441 GHz	-1.40 dBm		
M2		1	2.440 325 7 GHz	-21.72 dBm		
M3		1	2.441 647 4 GHz	-21.78 dBm		

Operating Mode: Bluetooth EDR (8DPSK) (High Channel)

2 Marker Table

Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	2.48 GHz	0.14 dBm		
M2		1	2.479 322 7 GHz	-20.46 dBm		
M3		1	2.480 650 3 GHz	-20.63 dBm		

5.2 99 % Bandwidth

5.2.1 Limit

Not applicable.

5.2.2 Method of Measurement

The transmitter output is connected to the spectrum analyzer. The RBW is set to 1 % to 5 % of the OBW.

The span is set to capture all products of the modulation process, including the emission skirts.

The VBW is set to 3 times the RBW. The sweep time is coupled and peak detection and max hold mode is used.

The spectrum analyzer internal 99% bandwidth function is utilized.

5.2.3 Test Data

Date of Test	2022-06-14	Temperature	(25.7 ± 0.8) °C
		Relative humidity	(56.5 ± 2.8) % R.H.
Test Result	***PASS***	Tested by	Do-heon, Kim

Operational Mode: Bluetooth BR (GFSK)		
Channel	Frequency (MHz)	99 % Bandwidth (MHz)
Low	2 402	0.885
Middle	2 441	0.881
High	2 480	0.878
Operational Mode: Bluetooth EDR (8DPSK)		
Channel	Frequency (MHz)	99 % Bandwidth (MHz)
Low	2 402	1.191
Middle	2 441	1.202
High	2 480	1.202

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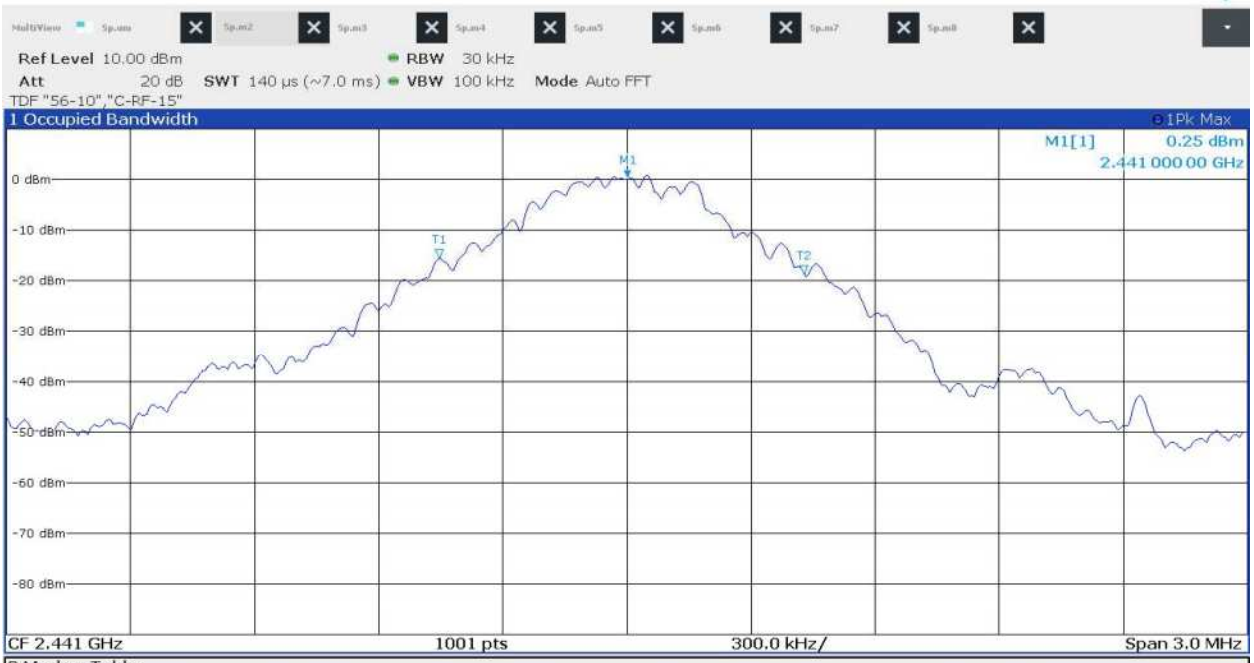
5.2.4 Test Plots

Operating Mode: Bluetooth BR (GFSK) (Low Channel)

2 Marker Table

Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	**2.402 GHz**	**-1.68 dBm**	Occ Bw	**884.853 668 025 kHz**
T1		1	2.401 554 54 GHz	-17.84 dBm	Occ Bw Centroid	2.401 996 97 GHz
T2		1	2.402 439 4 GHz	-19.83 dBm	Occ Bw Freq Offset	-3.030 341 147 kHz

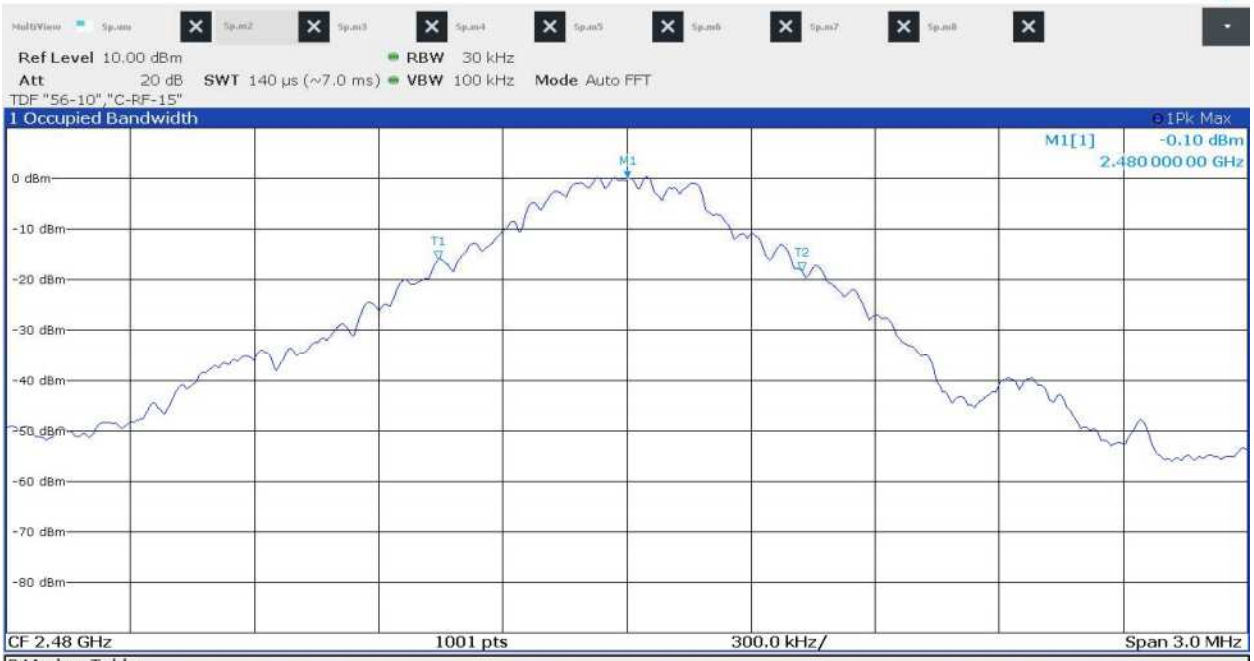
Operating Mode: Bluetooth BR (GFSK) (Middle Channel)



2 Marker Table

Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	**2.441 GHz**	**0.25 dBm**	Occ Bw	**881.215 444 894 kHz**
T1		1	2.440 547 4 GHz	-15.58 dBm	Occ Bw Centroid	2.440 988 01 GHz
T2		1	2.441 428 62 GHz	-18.64 dBm	Occ Bw Freq Offset	-11.990 357 236 kHz

Operating Mode: Bluetooth BR (GFSK) (High Channel)



2 Marker Table

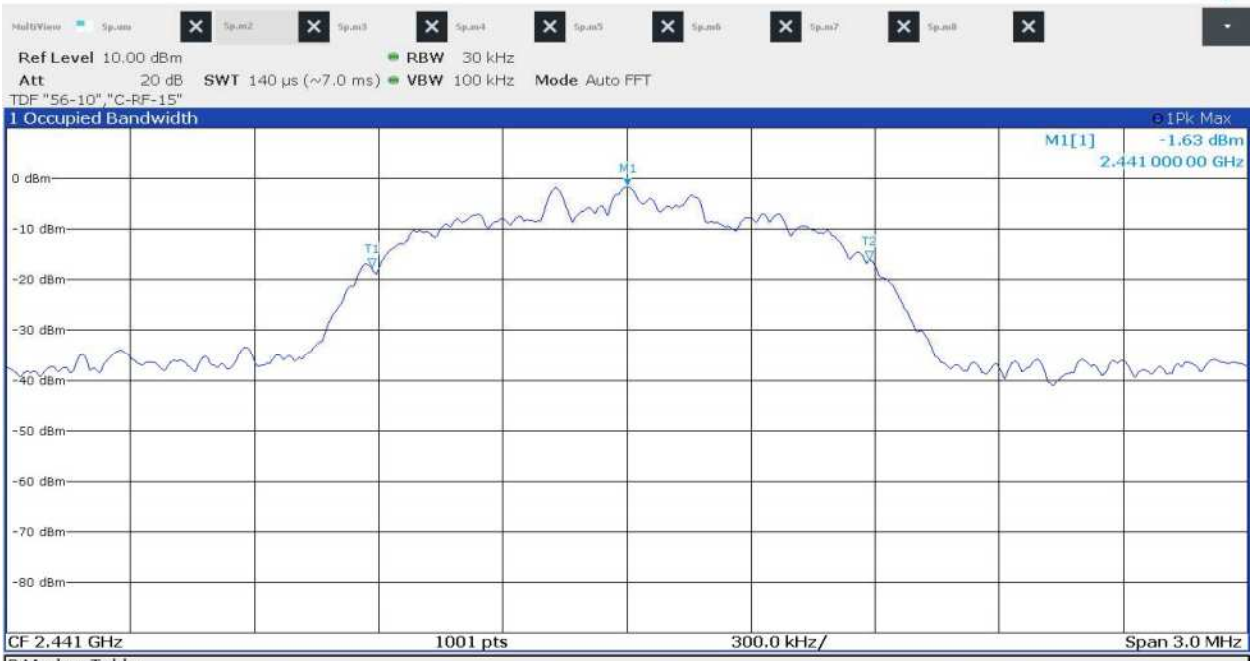
Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	**2.48 GHz**	**-0.10 dBm**	Occ Bw	**878.175 207 745 kHz**
T1		1	2.479 544 87 GHz	-15.97 dBm	Occ Bw Centroid	2.479 983 959 GHz
T2		1	2.480 423 05 GHz	-18.21 dBm	Occ Bw Freq Offset	-16.041 167 992 kHz

Operating Mode: Bluetooth EDR (8DPSK) (Low Channel)

2 Marker Table

Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	**2.402 GHz**	**-4.34 dBm**	Occ Bw	**1.191 480 816 MHz**
T1		1	2.401 388 71 GHz	-21.16 dBm	Occ Bw Centroid	2.401 984 453 GHz
T2		1	2.402 580 19 GHz	-19.02 dBm	Occ Bw Freq Offset	-15.547 296 821 kHz

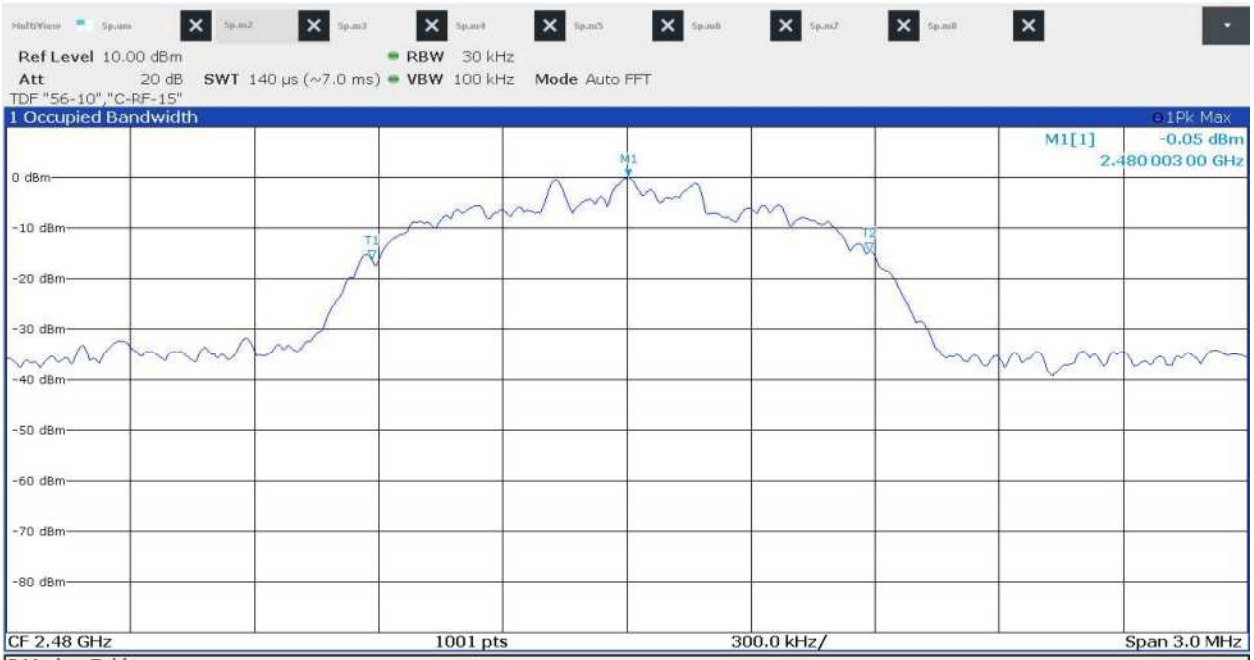
Operating Mode: Bluetooth EDR (8DPSK) (Middle Channel)



2 Marker Table

Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	**2.441 GHz**	**-1.63 dBm**	Occ Bw	**1.202 043 176 MHz**
T1		1	2.440 383 43 GHz	-17.63 dBm	Occ Bw Centroid	2.440 984 451 GHz
T2		1	2.441 585 47 GHz	-16.13 dBm	Occ Bw Freq Offset	-15.548 875 578 kHz

Operating Mode: Bluetooth EDR (8DPSK) (High Channel)



2 Marker Table

Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	**2.480 003 GHz**	**-0.05 dBm**	Occ Bw	**1.202 355 826 MHz**
T1		1	2.479 382 81 GHz	-15.99 dBm	Occ Bw Centroid	2.479 983 99 GHz
T2		1	2.480 585 17 GHz	-14.51 dBm	Occ Bw Freq Offset	-16.010 486 014 kHz

5.3 Carrier Frequency Separation

5.3.1 Limit

Acc. To section 15.247 (a)(1), frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater.

5.3.2 Method of Measurement

Reference to ANSI C63.10-2013 7.8.2

The Spectrum analyzer is set to

a) Span: Wide enough to capture the peaks of two adjacent channels.

b) RBW: Start with the RBW set to approximately 30% of the channel spacing; adjust as necessary to best identify the center of each individual channel.

c) Video (or average) bandwidth (VBW) ≥ RBW.

d) Sweep: Auto.

e) Detector function: Peak.

f) Trace: Max hold.

5.3.3 Test Data

Date of Test	2022-06-14	Temperature	(25.7 ± 0.8) °C
		Relative humidity	(56.5 ± 2.8) % R.H.
Test Result	***PASS***	Tested by	Do-heon, Kim

Operational Mode: Bluetooth BR (GFSK)				
Channel	Frequency (MHz)	Adjacent Hopping Channel Separation (kHz)	Two-third of 20dB bandwidth (kHz)	Minimum Bandwidth (kHz)
Low	2 402	1 001	641	25
Middle	2 441	1 001	641	25
High	2 480	1 001	649	25

Operational Mode: Bluetooth EDR (8DPSK)				
Channel	Frequency (MHz)	Adjacent Hopping Channel Separation (kHz)	Two-third of 20dB bandwidth (kHz)	Minimum Bandwidth (kHz)
Low	2 402	1 160	877	25
Middle	2 441	998	881	25
High	2 480	1 004	885	25

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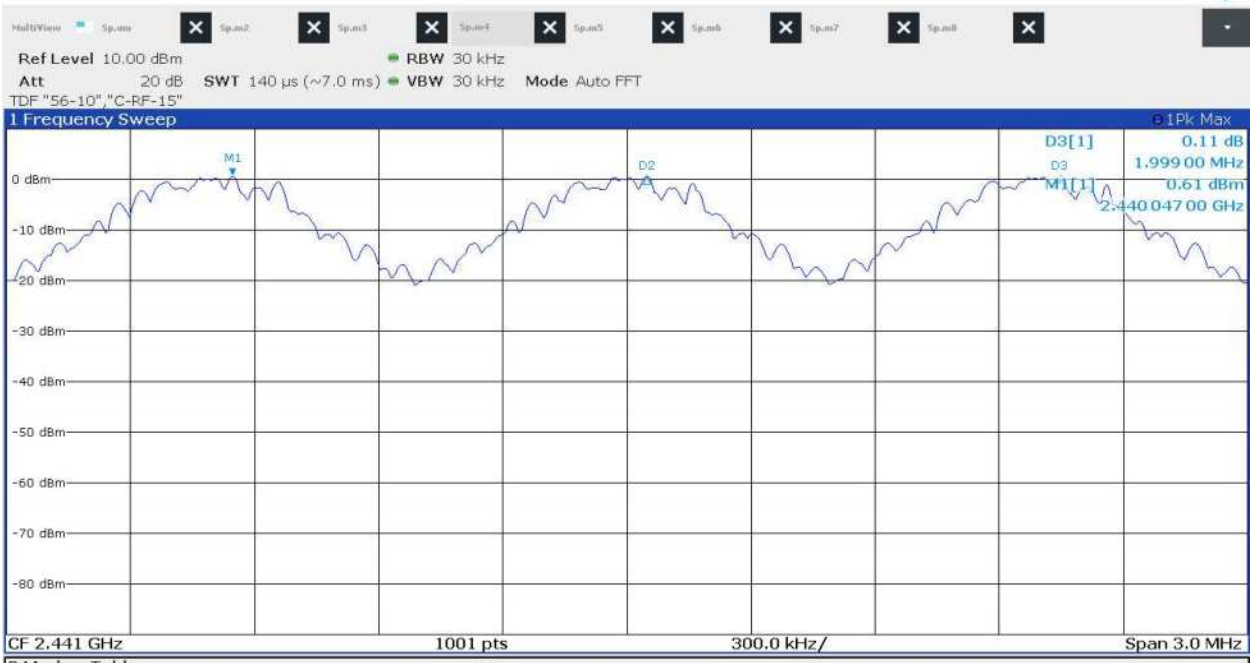
5.3.4 Test Plots

Operating Mode: Bluetooth BR (GFSK) (Low Channel)

2 Marker Table

Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	2.402 047 GHz	-1.26 dBm		
D2	M1	1	1.001 MHz	0.83 dB		
D3	M1	1	1.918 1 MHz	0.94 dB		

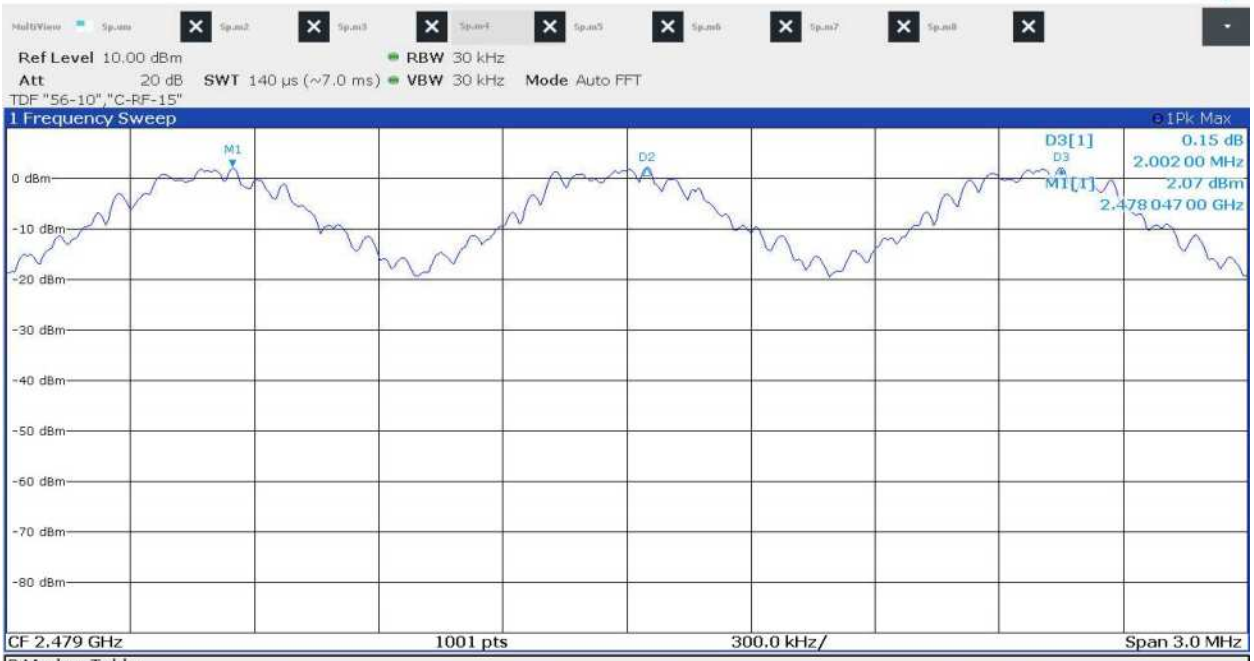
Operating Mode: Bluetooth BR (GFSK) (Middle Channel)



2 Marker Table

Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	2.440 047 GHz	0.61 dBm		
D2	M1	1	1.001 MHz	0.07 dB		
D3	M1	1	1.999 MHz	0.11 dB		

Operating Mode: Bluetooth BR (GFSK) (High Channel)



2 Marker Table

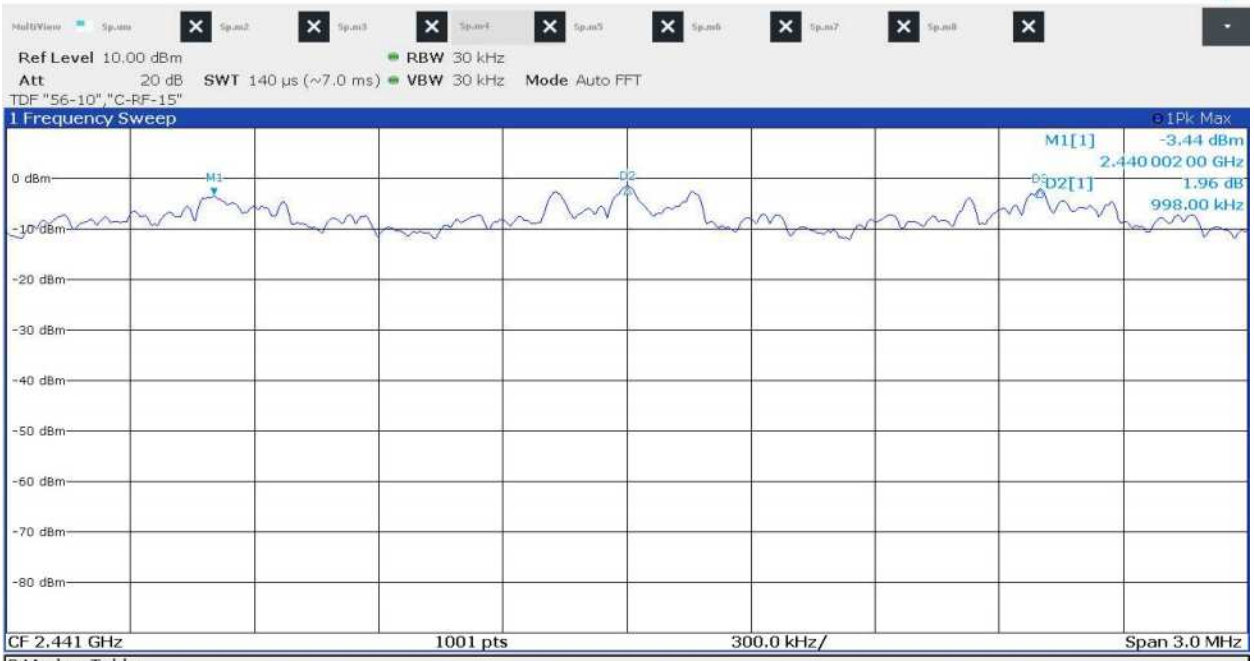
Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	2.478 047 GHz	2.07 dBm		
D2	M1	1	1.001 MHz	0.17 dB		
D3	M1	1	2.002 MHz	0.15 dB		

Operating Mode: Bluetooth EDR (8DPSK) (Low Channel)

2 Marker Table

Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	2.401 999 GHz	-4.69 dBm		
D2	M1	1	1.159 8 MHz	1.66 dB		
D3	M1	1	1.999 MHz	1.12 dB		

Operating Mode: Bluetooth EDR (8DPSK) (Middle Channel)



2 Marker Table

Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	2.440 002 GHz	-3.44 dBm		
D2	M1	1	998.0 kHz	1.96 dB		
D3	M1	1	1.996 MHz	1.47 dB		

Operating Mode: Bluetooth EDR (8DPSK) (High Channel)

2 Marker Table

Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	2.477 999 GHz	-0.67 dBm		
D2	M1	1	1.004 MHz	-0.33 dB		
D3	M1	1	2.157 8 MHz	1.23 dB		

5.4 Number of Hopping Channels

5.4.1 Limit

Acc. To section 15.247 (a)(1)(iii), frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels.

5.4.2 Method of Measurement

Reference to ANSI C63.10-2013 7.8.3

The Spectrum analyzer is set to

a) Span: The frequency band of operation. Depending on the number of channels the device supports, it may be necessary to divide the frequency range of operation across multiple spans, to allow the individual channels to be clearly seen.

b) RBW: To identify clearly the individual channels, set the RBW to less than 30% of the channel spacing or the 20 dB bandwidth, whichever is smaller.

c) VBW ≥ RBW.

d) Sweep: Auto.

e) Detector function: Peak.

f) Trace: Max hold.

g) Allow the trace to stabilize.

5.4.3 Test Data

Date of Test	2022-06-14	Temperature	(25.7 ± 0.8) °C
		Relative humidity	(56.5 ± 2.8) % R.H.
Test Result	***PASS***	Tested by	Do-heon, Kim

Operational Mode: Bluetooth BR (GFSK)	
Number of Hopping Channels	79

Operational Mode: Bluetooth EDR (8DPSK)	
Number of Hopping Channels	79

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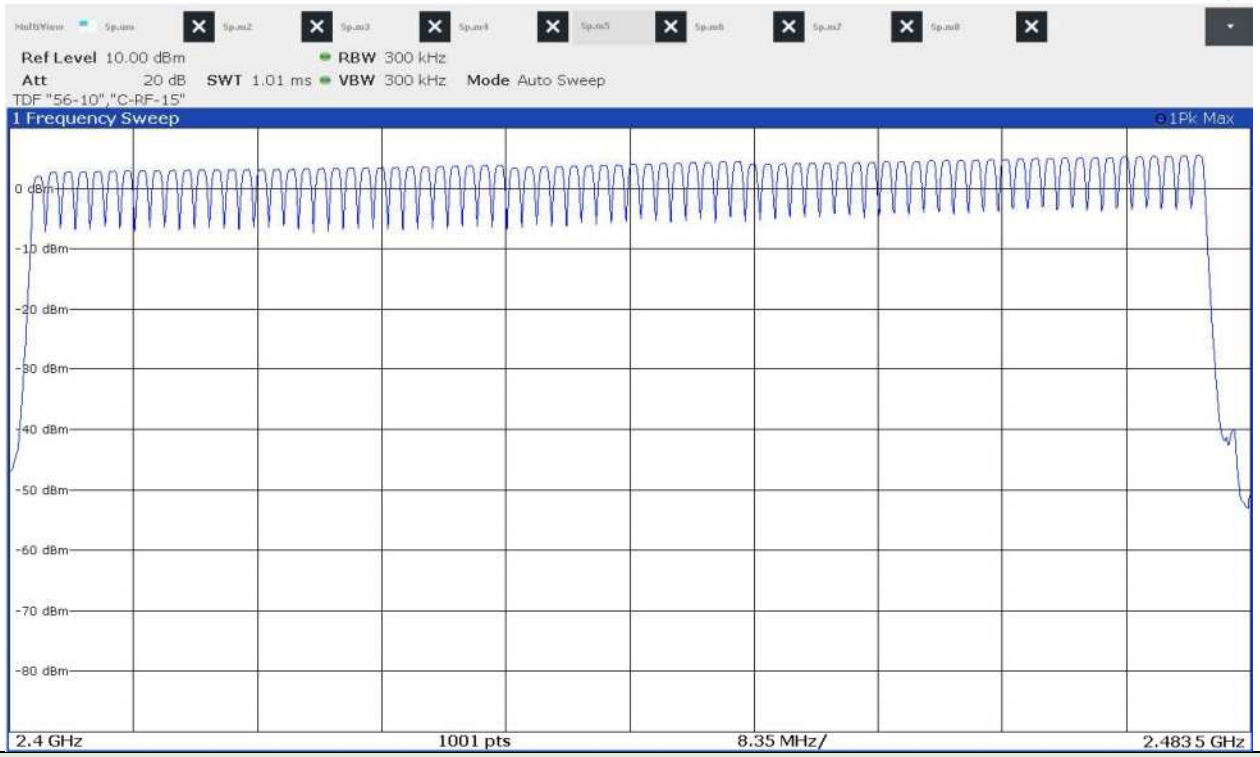
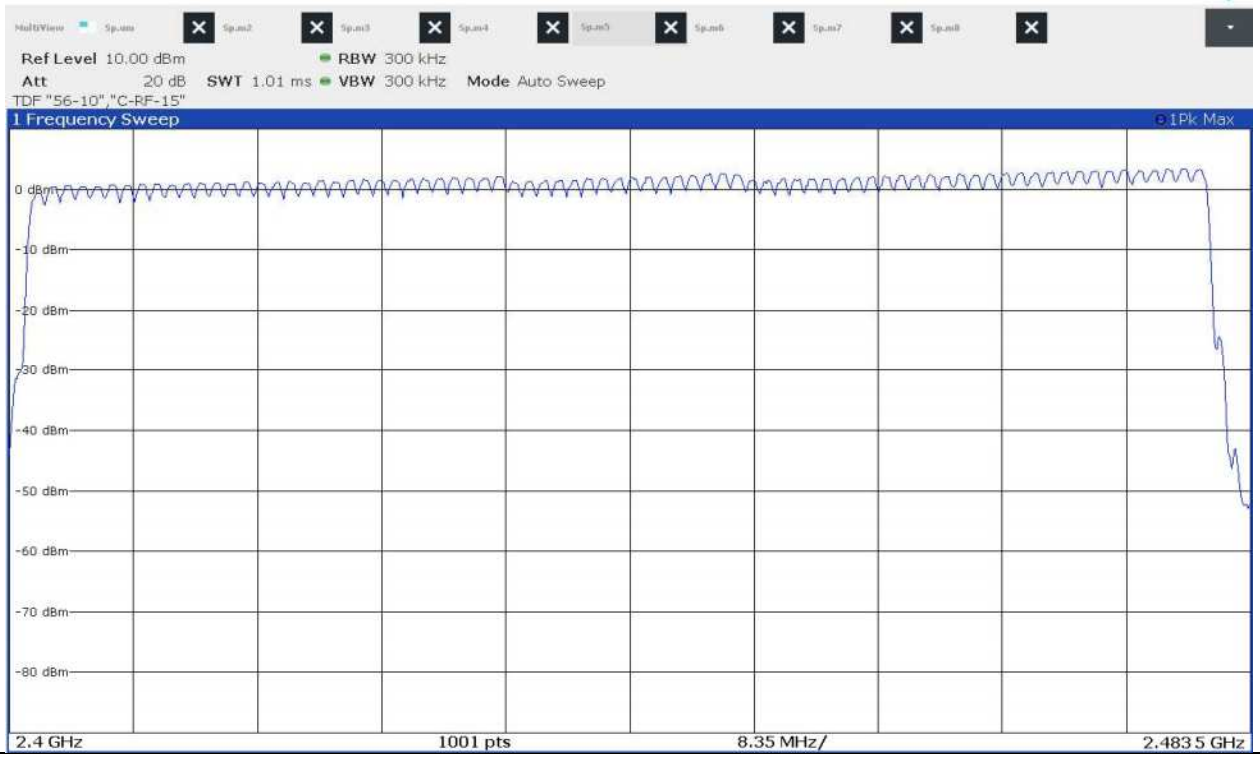
5.4.4 Test Plots

Operating Mode: Bluetooth BR (GFSK)



Operating Mode: Bluetooth EDR (8DPSK)



5.5 Time of Occupancy (Dwell Time)

5.5.1 Limit

Acc. To section 15.247 (a)(1)(iii), The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

5.5.2 Method of Measurement

Reference to ANSI C63.10-2013 7.8.4

The Spectrum analyzer is set to

a) Span: Zero span, centered on a hopping channel.

b) RBW shall be ≤ channel spacing and where possible RBW should be set >> 1 / T, where T is the expected dwell time per channel.

c) Sweep: As necessary to capture the entire dwell time per hopping channel; where possible use a video trigger and trigger delay so that the transmitted signal starts a little to the right of the start of the plot. The trigger level might need slight adjustment to prevent triggering when the system hops on an adjacent channel; a second plot might be needed with a longer sweep time to show two successive hops on a channel.

d) Detector function: Peak.

e) Trace: Max hold.

Use the marker-delta function to determine the transmit time per hop. If this value varies with different modes of operation (data rate, modulation format, number of hopping channels, etc.), then repeat this test for each variation in transmit time.

Repeat the measurement using a longer sweep time to determine the number of hops over the period specified in the requirements. The sweep time shall be equal to, or less than, the period specified in the requirements. Determine the number of hops over the sweep time and calculate the total number of hops in the period specified in the requirements, using the following equation:

(Number of hops in the period specified in the requirements) =

(number of hops on spectrum analyzer) × (period specified in the requirements / analyzer sweep time)

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5.5.3 Test Data

Date of Test	2022-06-14	Temperature	(25.7 ± 0.8) °C
		Relative humidity	(56.5 ± 2.8) % R.H.
Test Result	***PASS***	Tested by	Do-heon, Kim

Operational Mode: Bluetooth BR (GFSK)					
Packet size	Number of hopping Channels	Length of Transmission Time (ms)	Number of Transmission in a 31.6 (79 hopping * 0.4)	Result (s)	Limits (s)
DH1	79	0.380	320	0.122	0.4
DH3	79	1.630	160	0.261	0.4
DH5	79	2.888	106.6	0.308	0.4

Operational Mode: Bluetooth EDR (π/4DQPSK)					
Packet size	Number of hopping Channels	Length of Transmission Time (ms)	Number of Transmission in a 31.6 (79 hopping * 0.4)	Result (s)	Limits (s)
2-DH1	79	0.380	320	0.122	0.4
2-DH3	79	1.630	160	0.261	0.4
2-DH5	79	2.903	106.6	0.309	0.4

Operational Mode: Bluetooth EDR (8DPSK)					
Packet size	Number of hopping Channels	Length of Transmission Time (ms)	Number of Transmission in a 31.6 (79 hopping * 0.4)	Result (s)	Limits (s)
3-DH1	79	0.390	320	0.125	0.4
3-DH3	79	1.630	160	0.261	0.4
3-DH5	79	2.903	106.6	0.309	0.4

Note: Average time of occupancy = Transmit time per hop * Number of hopping channels in 31.6 s

According the Bluetooth Standard Specification, the nominal hop rate is 1600 hop/s. All Bluetooth units participating in the piconet are time and hop synchronized to the channel.

- The maximum number of hopping channels in 31.6 s for DH1 = 1600 / 2 / 79 * 31.6 =320
- The maximum number of hopping channels in 31.6 s for DH3 = 1600 / 4 / 79 * 31.6 =160
- The maximum number of hopping channels in 31.6 s for DH5 = 1600 / 6 / 79 * 31.6 =106.6

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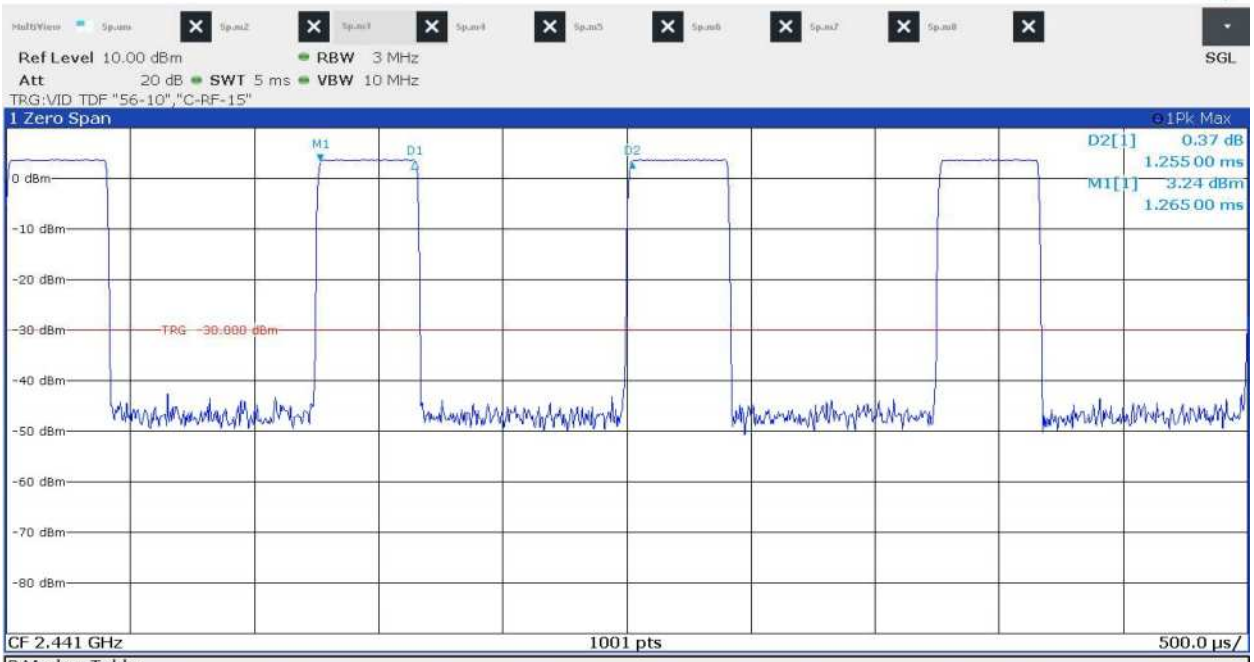
5.5.4 Test Plots

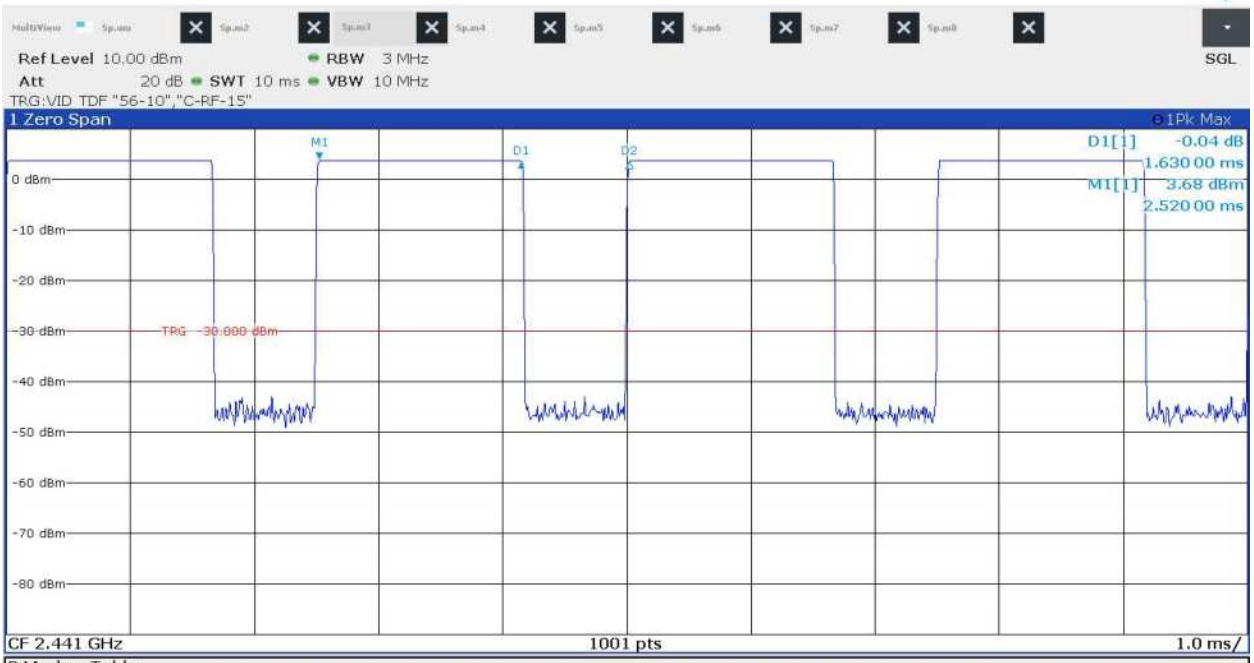
Operating Mode: Bluetooth BR (GFSK) Packet type DH1



2 Marker Table

Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	1.265 ms	3.24 dBm		
D1	M1	1	380.0 µs	0.34 dB		
D2	M1	1	1.255 ms	0.37 dB		

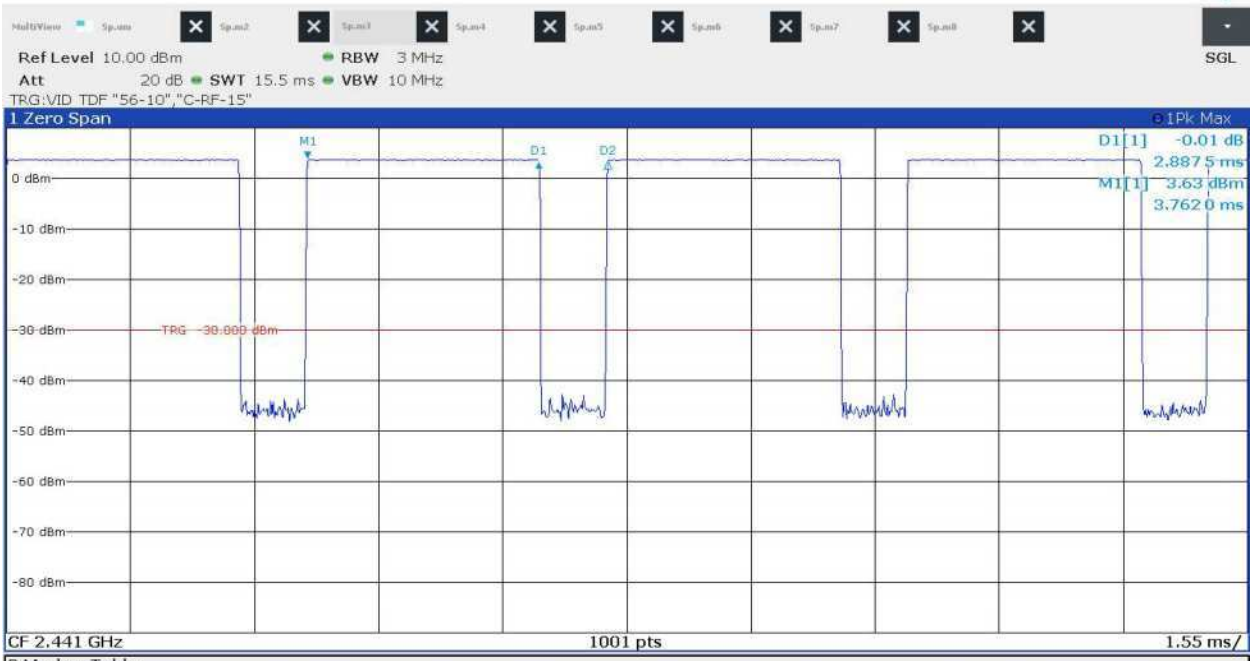
Operating Mode: Bluetooth BR (GFSK) Packet type DH3



2 Marker Table

Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	2.52 ms	3.68 dBm		
D1	M1	1	1.63 ms	-0.04 dB		
D2	M1	1	2.5 ms	0.00 dB		

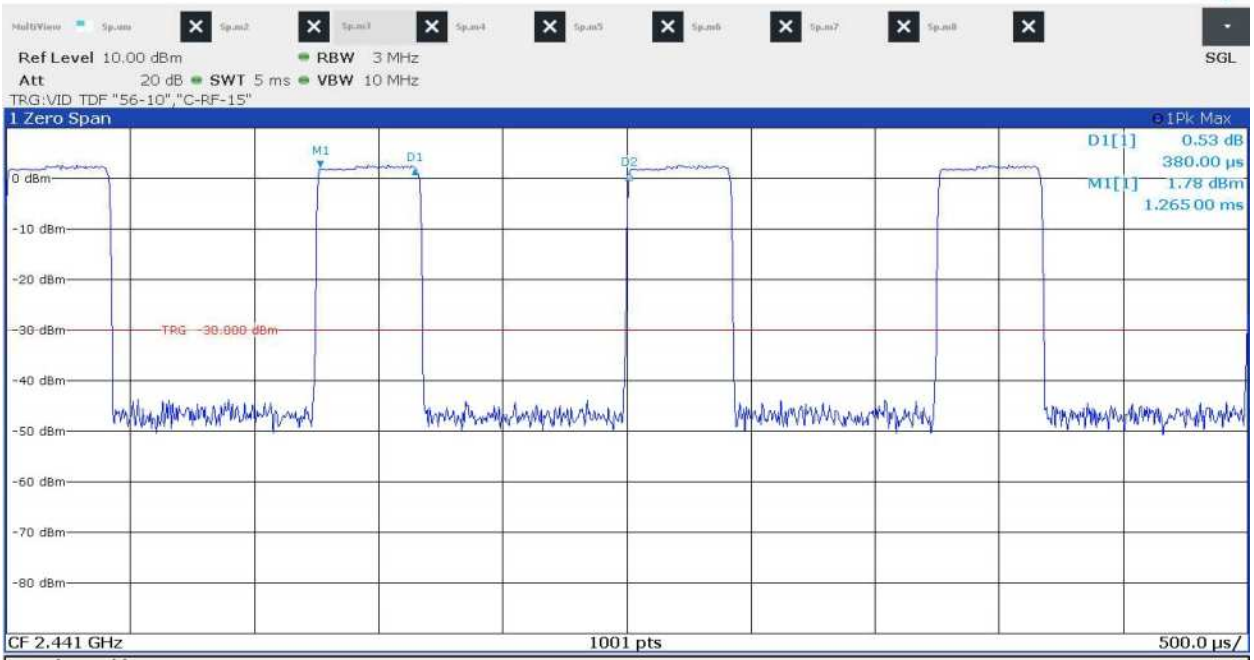
Operating Mode: Bluetooth BR (GFSK) Packet type DH5



2 Marker Table

Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	3.762 ms	3.63 dBm		
D1	M1	1	2.887 5 ms	-0.01 dB		
D2	M1	1	3.755 5 ms	-0.03 dB		

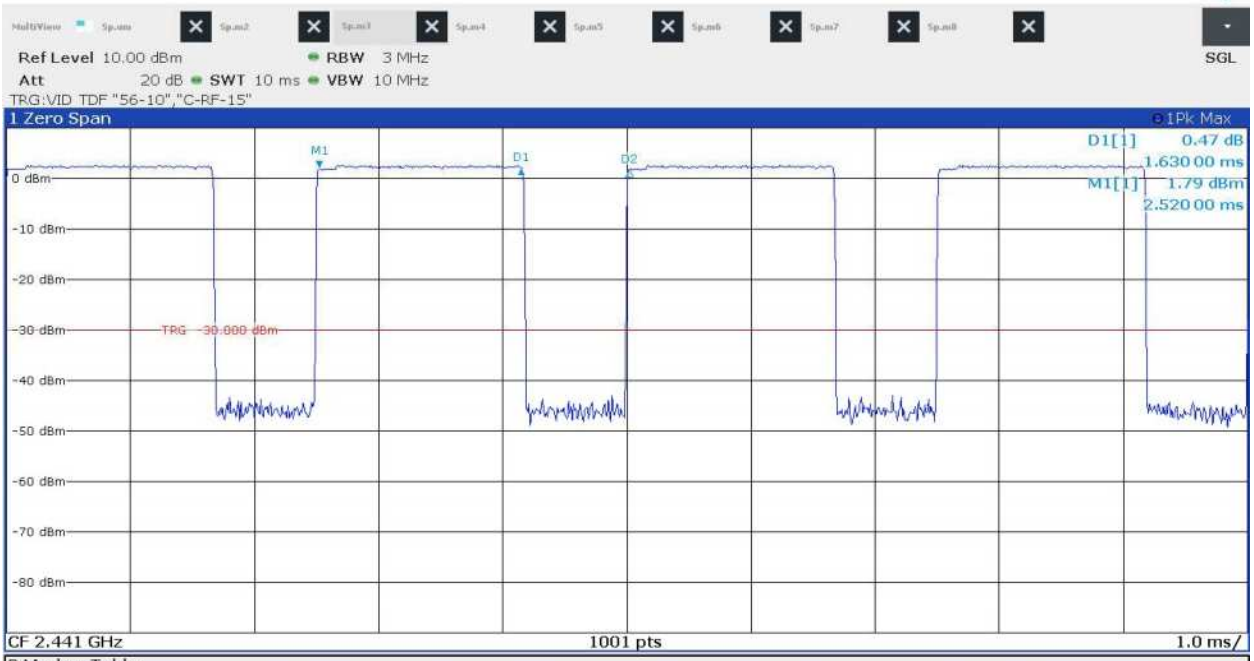
Operating Mode: Bluetooth EDR (π/4DQPSK) Packet type 2-DH1



2 Marker Table

Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	1.265 ms	1.78 dBm		
D1	M1	1	380.0 µs	0.53 dB		
D2	M1	1	1.245 ms	-0.53 dB		

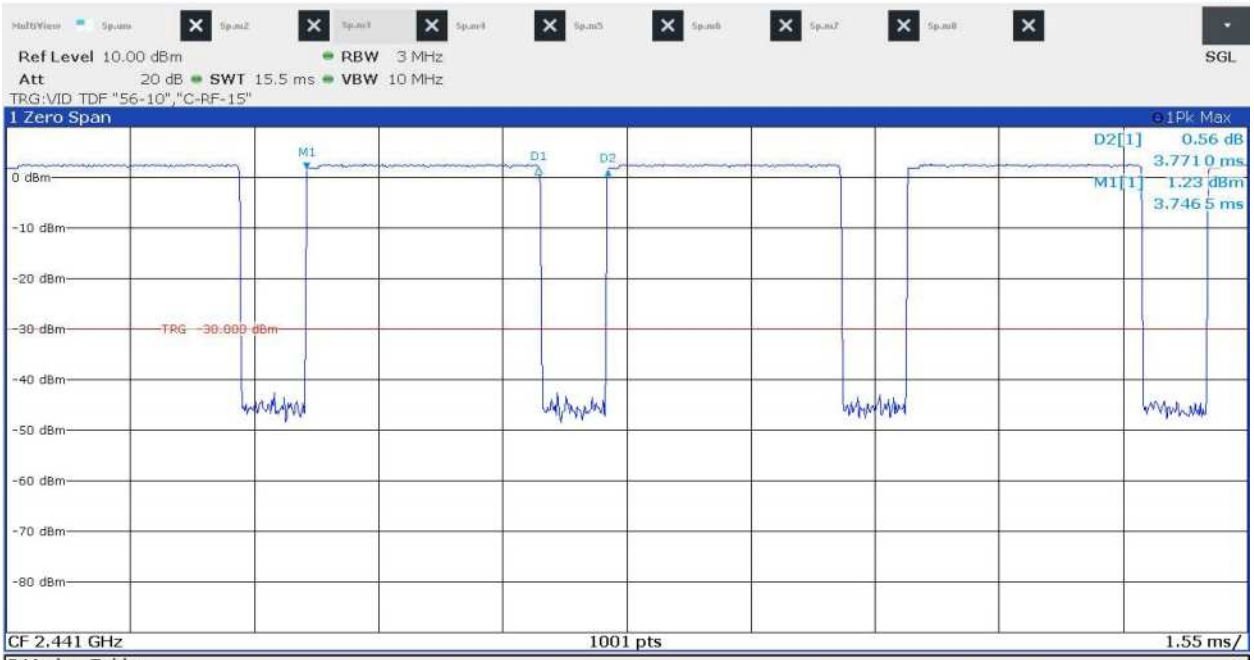
Operating Mode: Bluetooth EDR (π/4DQPSK) Packet type 2-DH3



2 Marker Table

Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	2.52 ms	1.79 dBm		
D1	M1	1	1.63 ms	0.47 dB		
D2	M1	1	2.5 ms	0.00 dB		

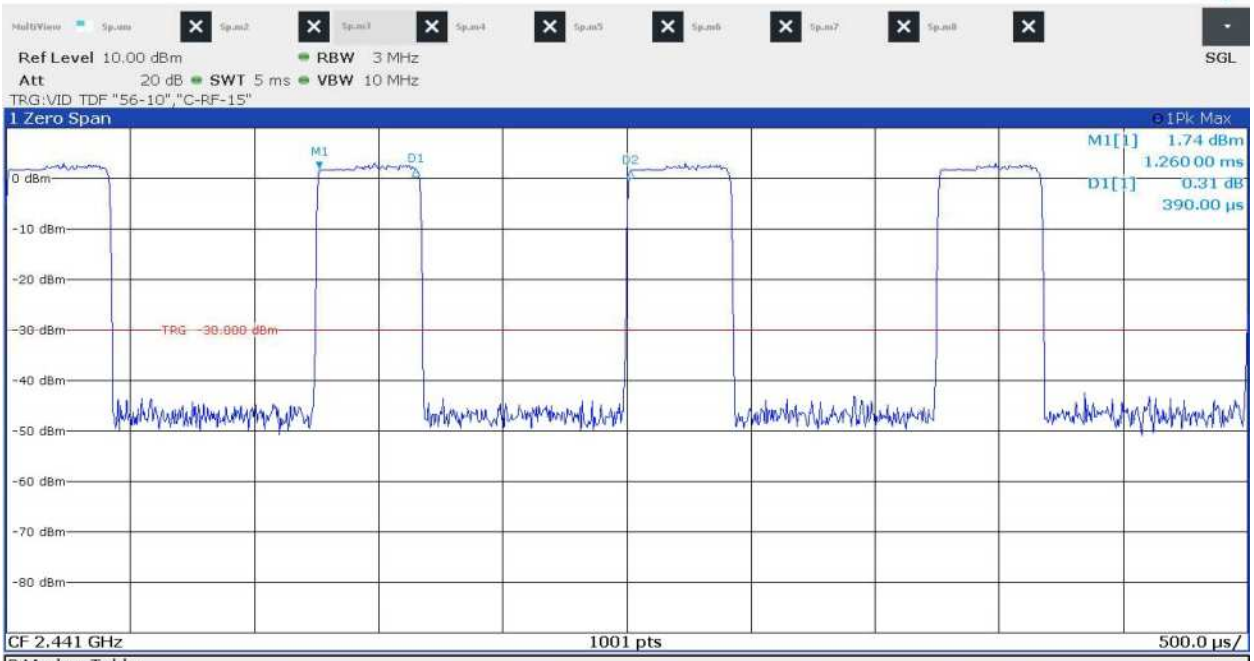
Operating Mode: Bluetooth EDR (π/4DQPSK) Packet type 2-DH5



2 Marker Table

Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	3.746 5 ms	1.23 dBm		
D1	M1	1	2.903 ms	0.93 dB		
D2	M1	1	3.771 ms	0.56 dB		

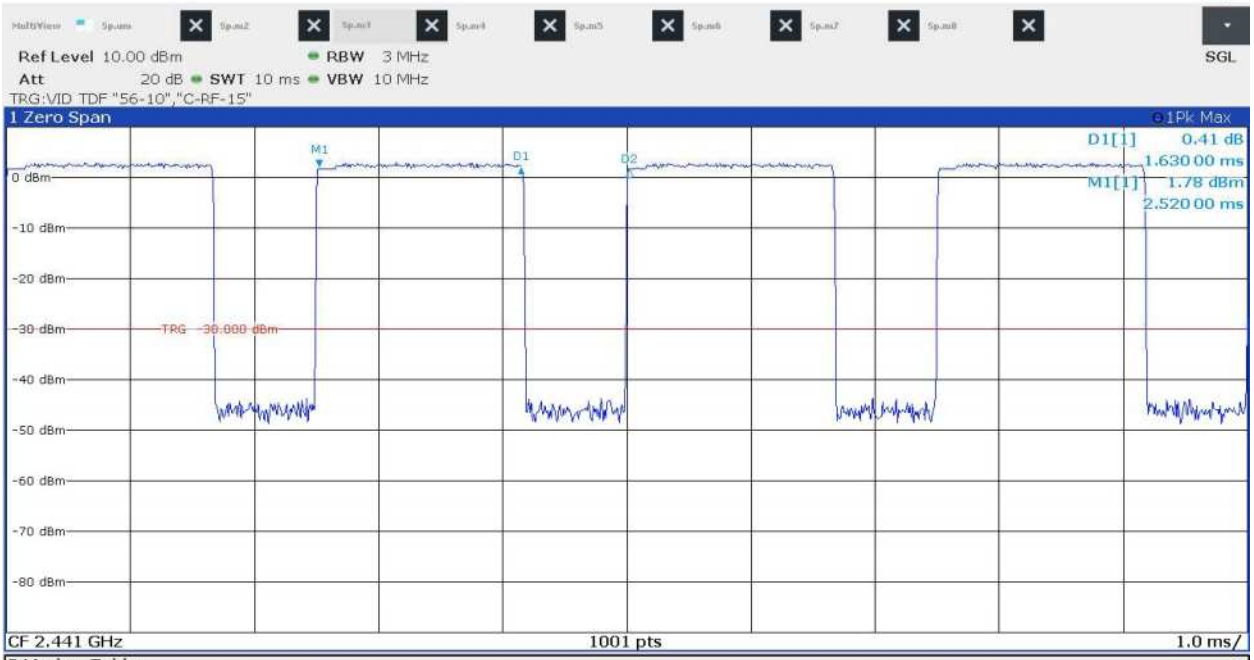
Operating Mode: Bluetooth EDR (8DPSK) Packet type 3-DH1



2 Marker Table

Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	**1.26 ms**	**1.74 dBm**		
D1	M1	1	**390.0 µs**	**0.31 dB**		
D2	M1	1	**1.255 ms**	**-0.01 dB**		

Operating Mode: Bluetooth EDR (8DPSK) Packet type 3-DH3



2 Marker Table

Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	**2.52 ms**	**1.78 dBm**		
D1	M1	1	**1.63 ms**	**0.41 dB**		
D2	M1	1	**2.5 ms**	**-0.02 dB**		

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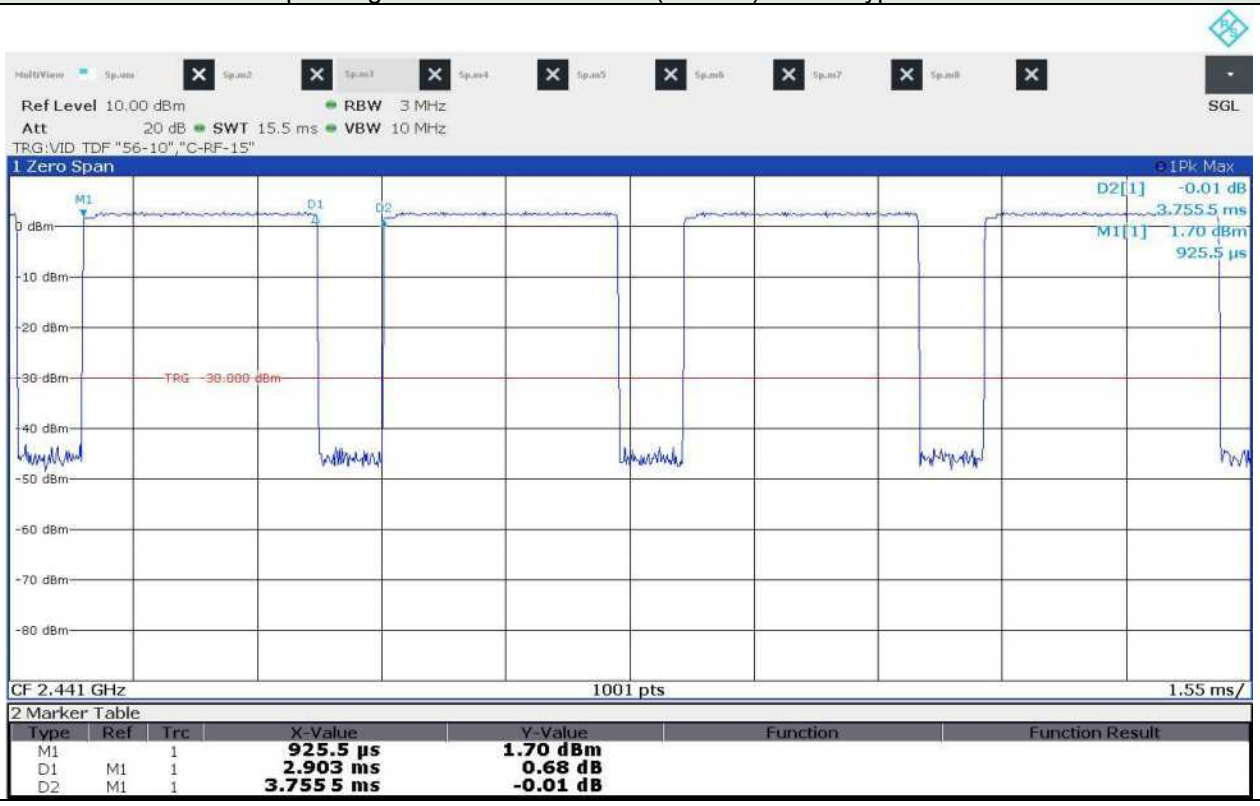
Operating Mode: Bluetooth EDR (8DPSK) Packet type 3-DH5



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5.6 Maximum Peak Conducted Output Power

5.6.1 Limit

Acc. To section 15.247 (b)(1), For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.

5.6.2 Method of Measurement

Reference to ANSI C63.10-2013 7.8.5

The Spectrum analyzer is set to

1) Span: Approximately five times the 20 dB bandwidth, centered on a hopping channel.
2) RBW > 20 dB bandwidth of the emission being measured.
3) VBW ≥ RBW.
4) Sweep: Auto.
5) Detector function: Peak.
6) Trace: Max hold.

5.6.3 Test Data for Output Power

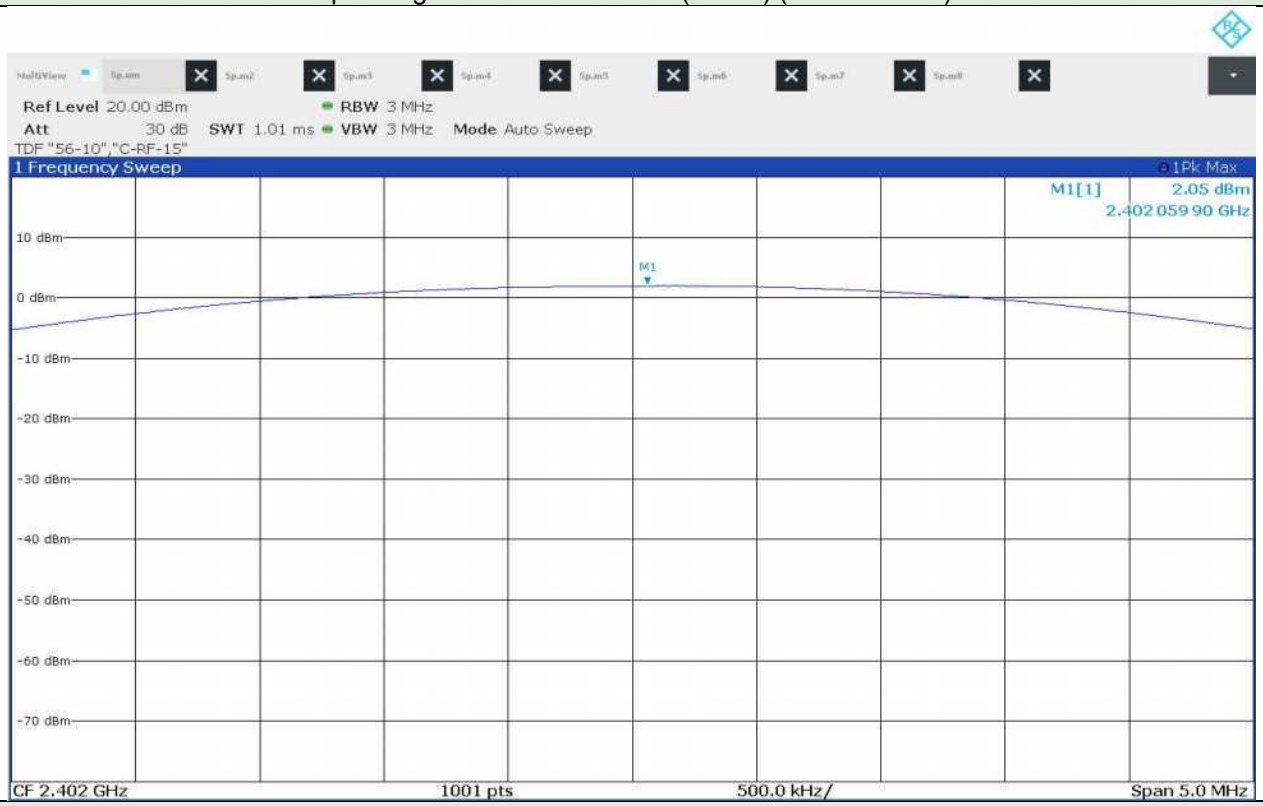
Date of Test	2022-06-14	Temperature	(25.7 ± 0.8) °C
		Relative humidity	(56.5 ± 2.8) % R.H.
Test Result	***PASS***	Tested by	Do-heon, Kim

Operating Mode: Bluetooth BR (GFSK)				
Channel	Frequency (MHz)	Measured Value (dBm)	Limit (dBm)	Margin (dB)
Low	2 402	2.05	30	27.95
Middle	2 441	3.87		26.13
High	2 480	5.36		24.64
Operating Mode: Bluetooth EDR (π/4DQPSK)				
Channel	Frequency (MHz)	Measured Value (dBm)	Limit (dBm)	Margin (dB)
Low	2 402	0.52	30	29.48
Middle	2 441	2.78		27.22
High	2 480	4.35		25.65
Operating Mode: Bluetooth EDR (8DPSK)				
Channel	Frequency (MHz)	Measured Value (dBm)	Limit (dBm)	Margin (dB)
Low	2 402	0.94	30	29.06
Middle	2 441	3.18		26.82
High	2 480	4.64		25.36

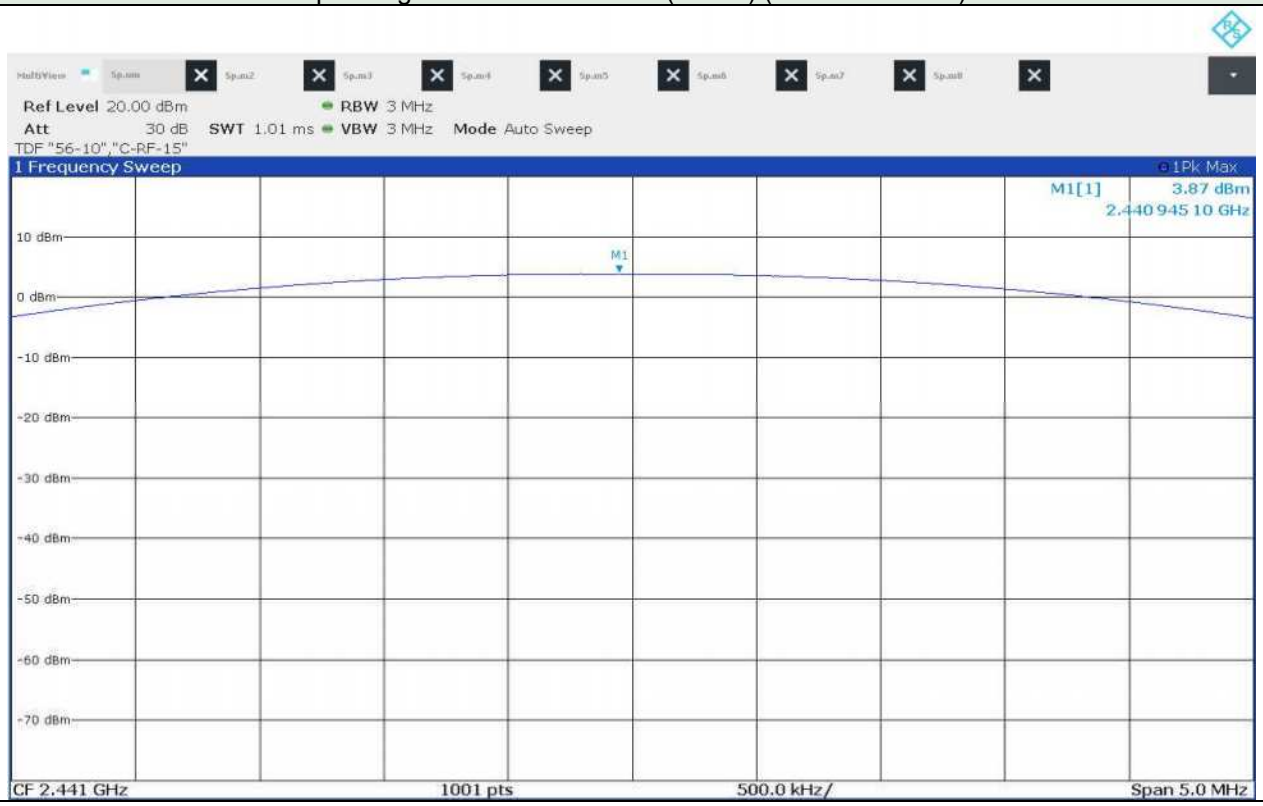
Remark. Margin = Limit – Measured Value

5.6.4 Test Plots

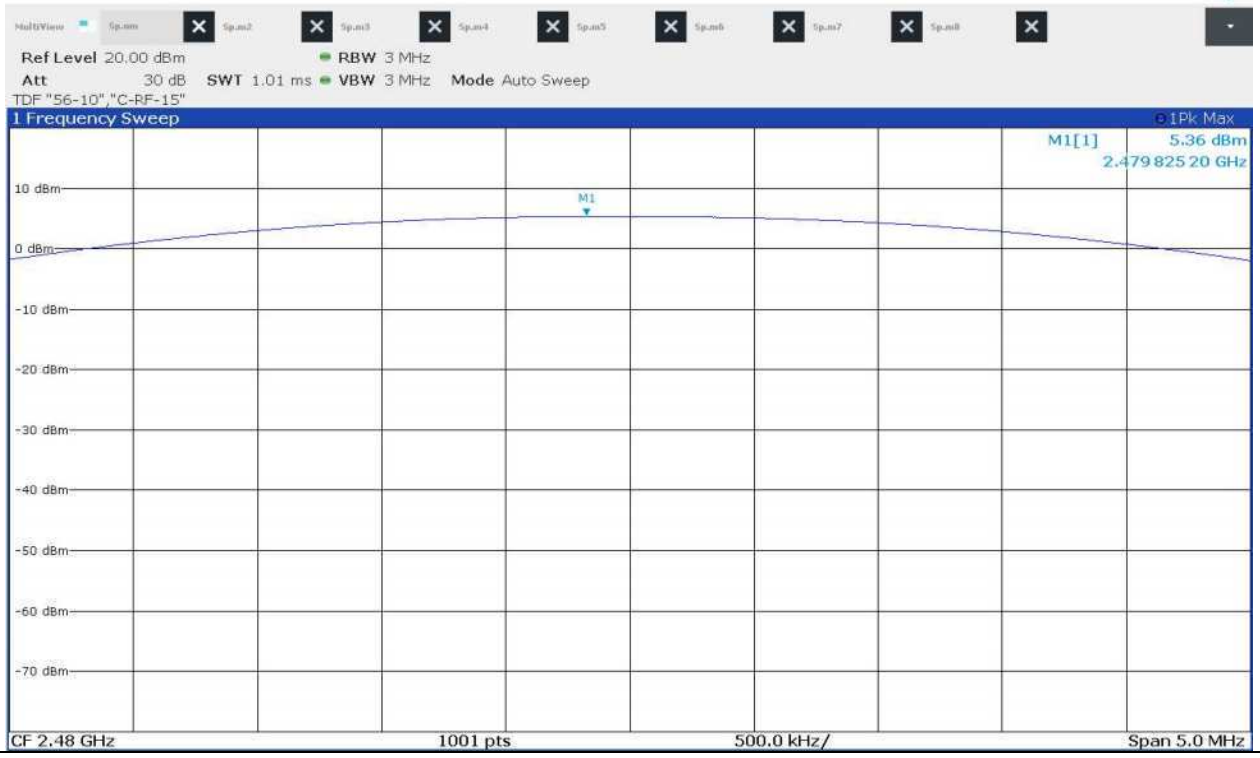
Operating Mode: Bluetooth BR (GFSK) (Low Channel)



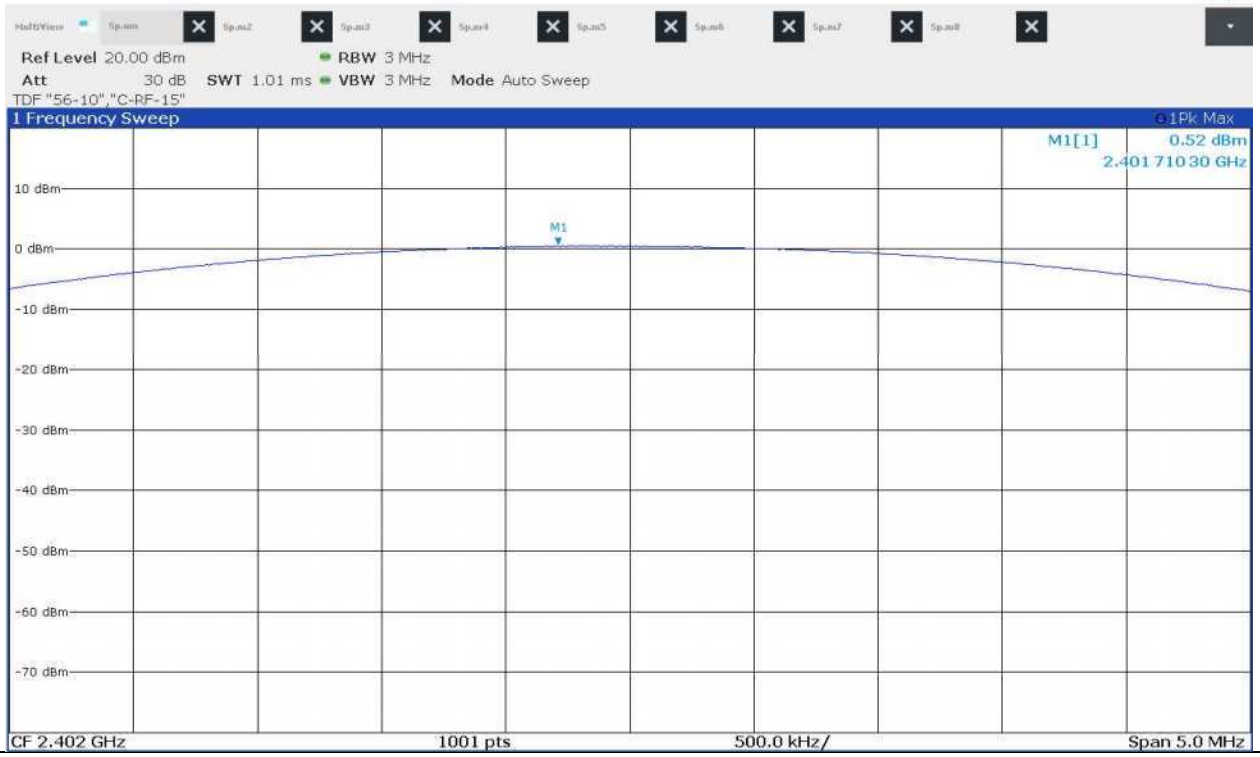
Operating Mode: Bluetooth BR (GFSK) (Middle Channel)



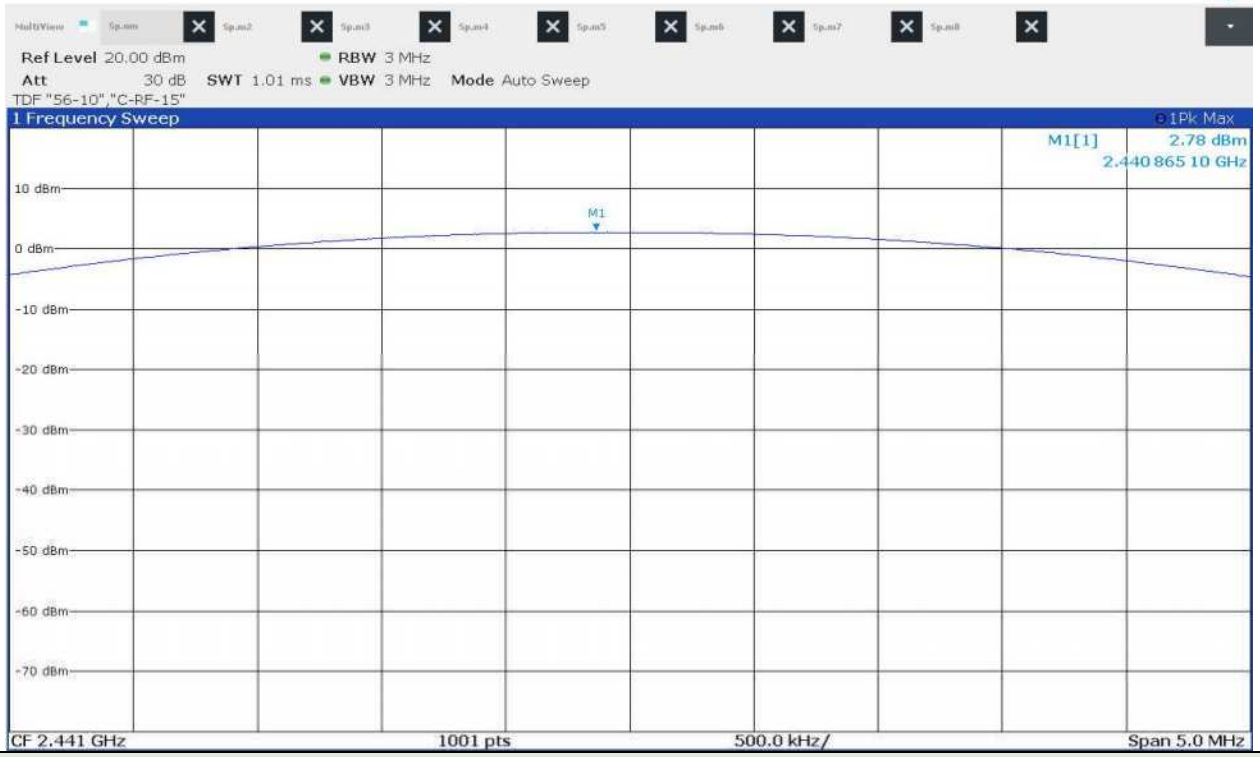
Operating Mode: Bluetooth BR (GFSK) (High Channel)



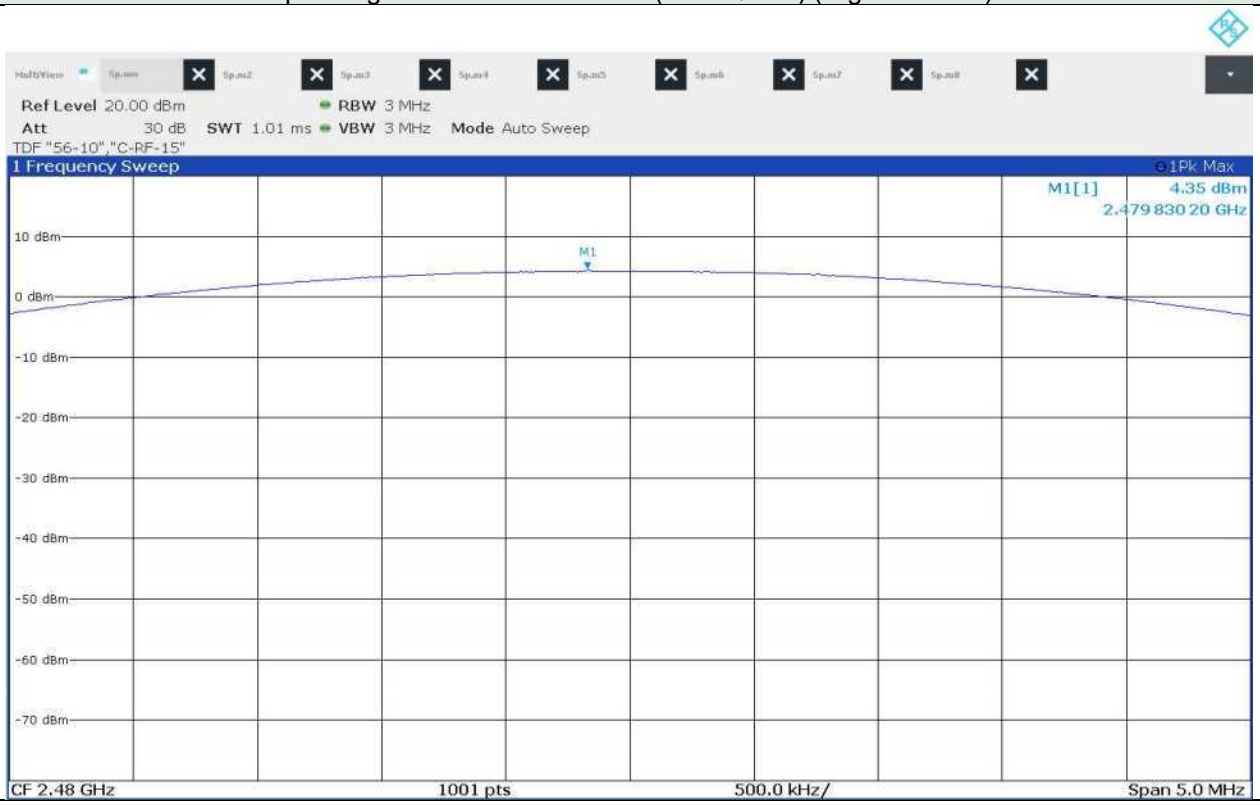
Operating Mode: Bluetooth EDR (π/4DQPSK) (Low Channel)



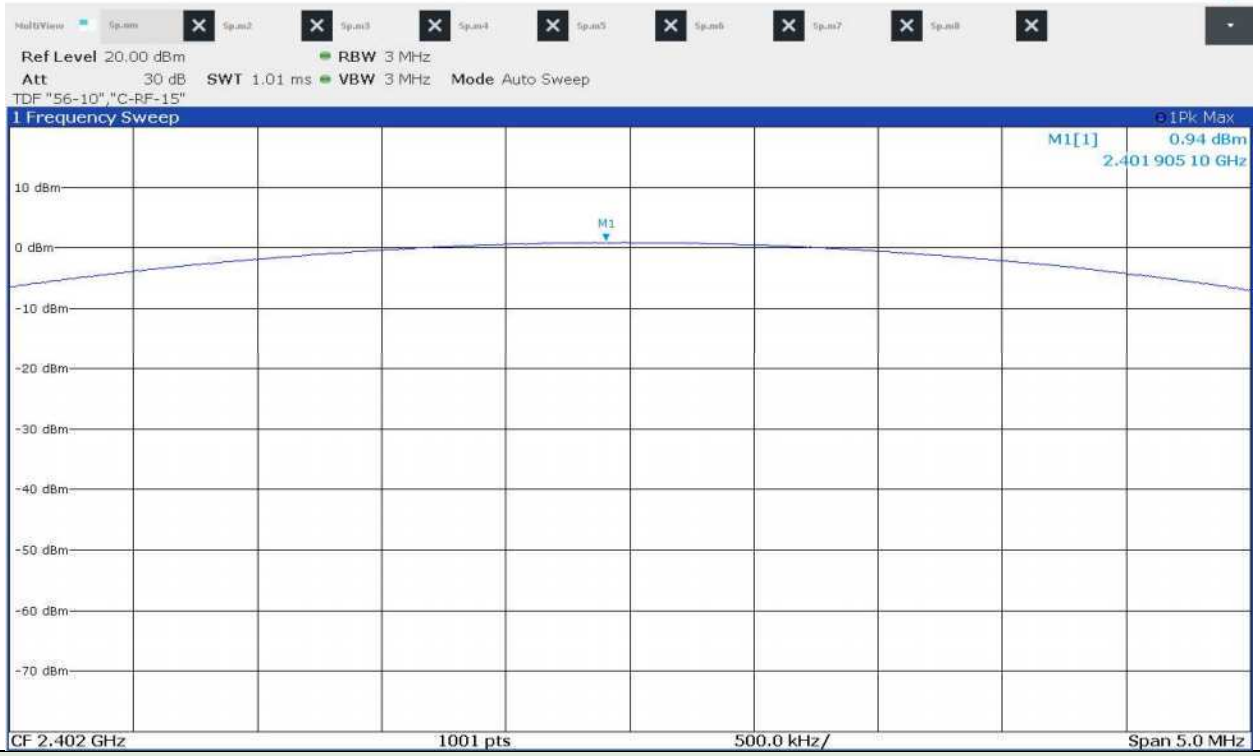
Operating Mode: Bluetooth EDR (π/4DQPSK) (Middle Channel)



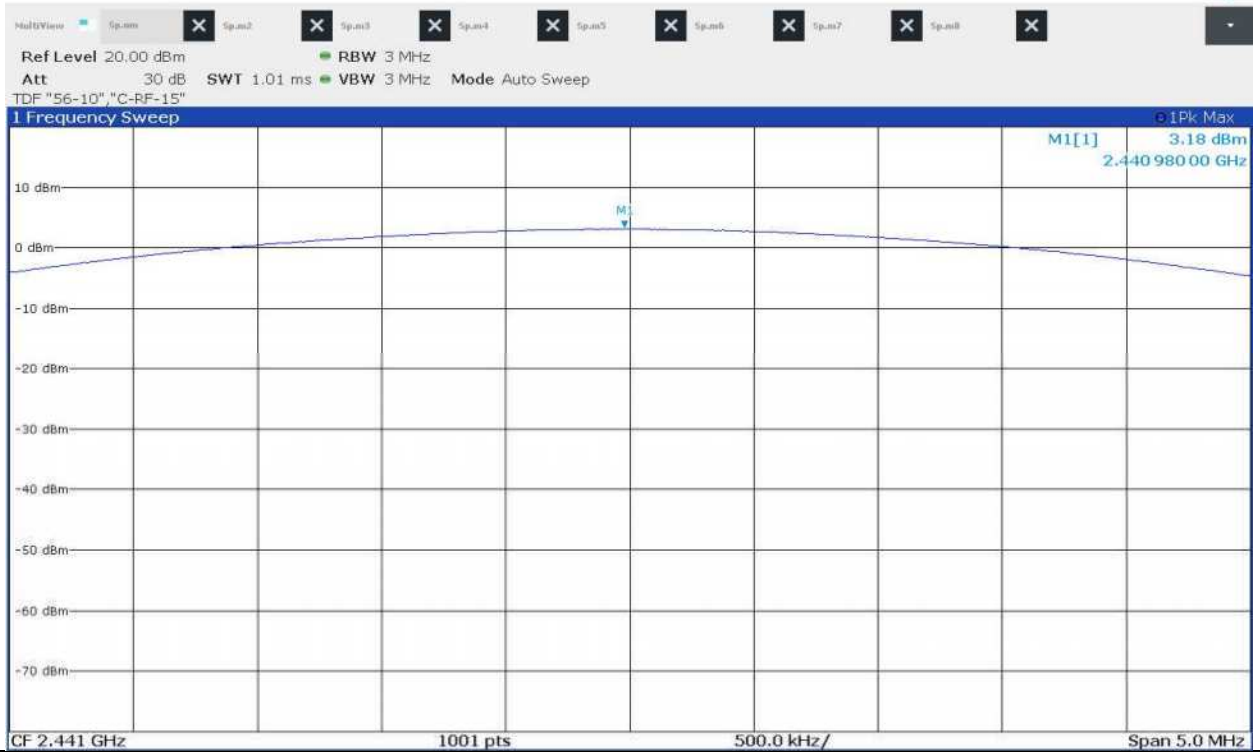
Operating Mode: Bluetooth EDR (π/4DQPSK) (High Channel)



Operating Mode: Bluetooth EDR (8DPSK) (Low Channel)



Operating Mode: Bluetooth EDR (8DPSK) (Middle Channel)



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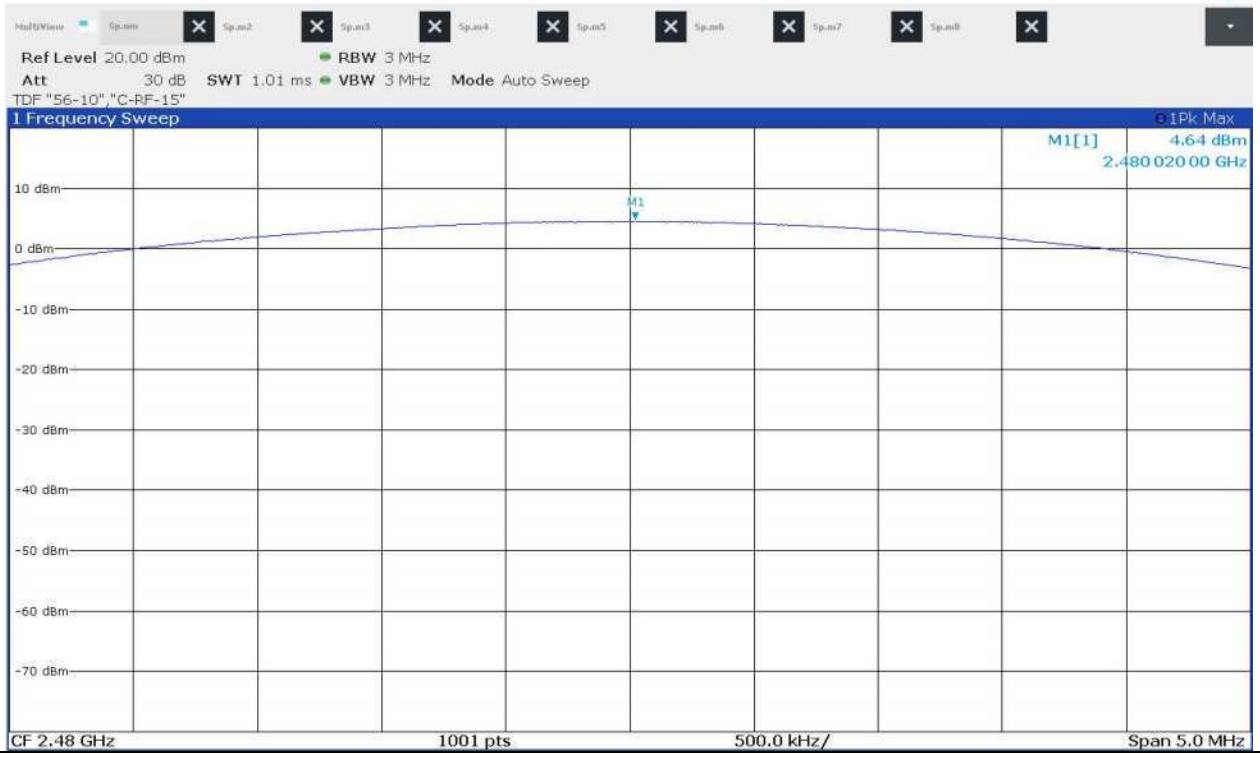
Operating Mode: Bluetooth EDR (8DPSK) (High Channel)



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5.7 Band-edge and Out of Band Emission

5.7.1 Limit

Acc. To section 15.247(d), In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated 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, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in 15.209(a) is not required. In addition, radiated emission which in the restricted band, as define in section §15.205(a), must also comply the radiated emission limits specified in section §15.209(a) (see section §15.205(c))

5.7.2 Method of Measurement

Reference to ANSI C63.10-2013 7.8.6 and 7.8.8

The Spectrum analyzer is set to

1) Span: 10 MHz.
2) RBW = 100 kHz
3) VBW ≥ RBW.
4) Sweep: Auto.
5) Detector function: Peak.
6) Trace: Max hold.

5.7.3 Test Data for Operating mode: Bluetooth BR

Date of Test	2022-06-14	Temperature	(25.7 ± 0.8) °C
		Relative humidity	(56.5 ± 2.8) % R.H.
Test Result	***PASS***	Tested by	Do-heon, Kim

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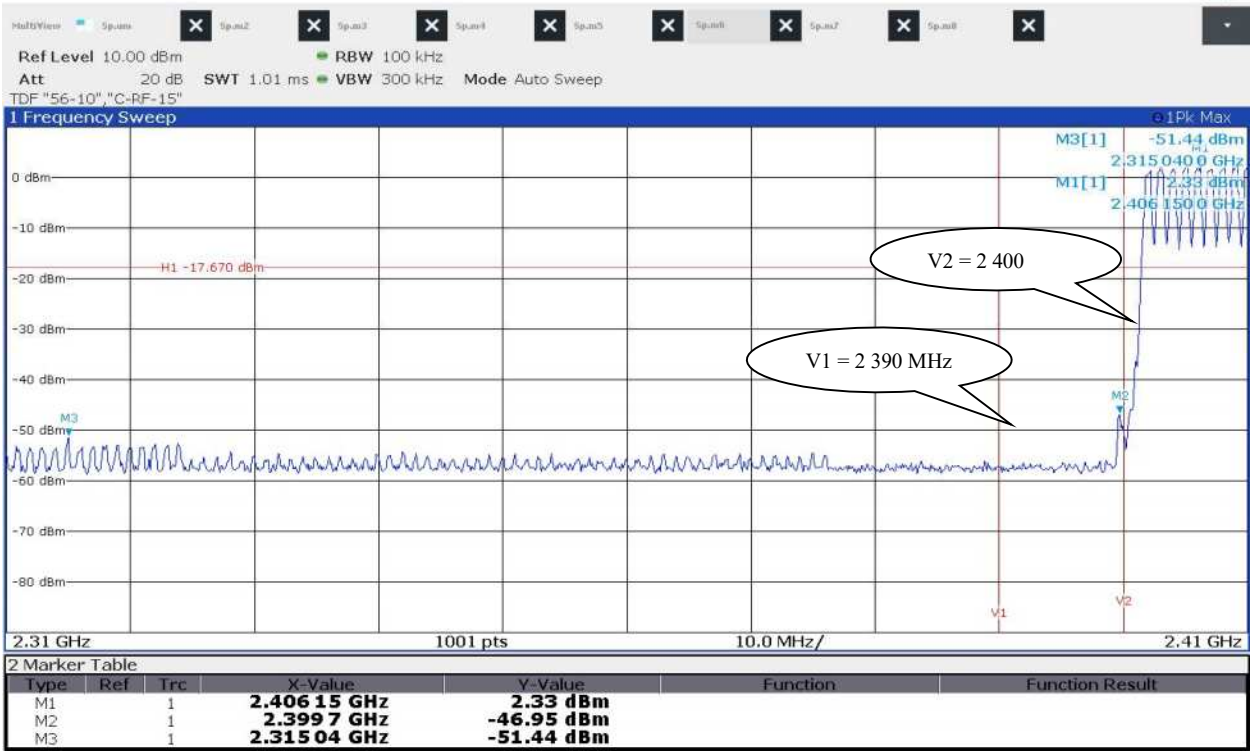
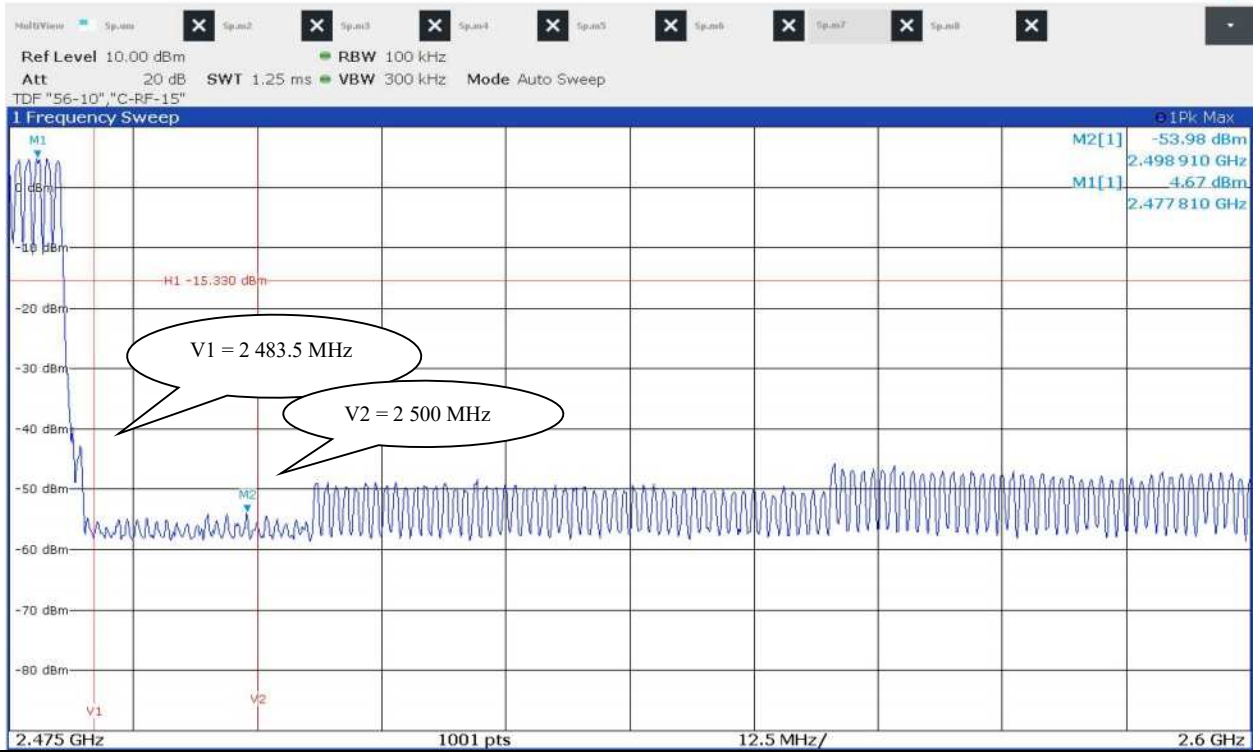
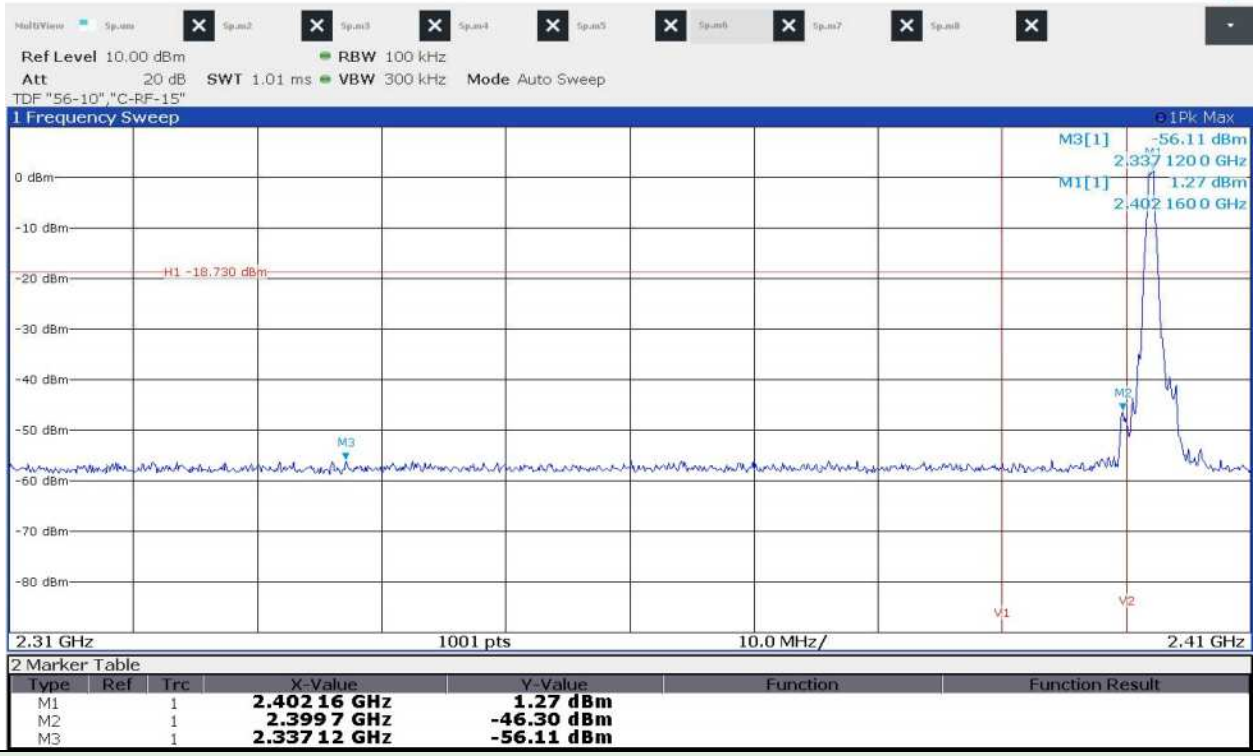
Band-edge and Restricted band – Hopping mode



Band-edge and Restricted band – Hopping mode

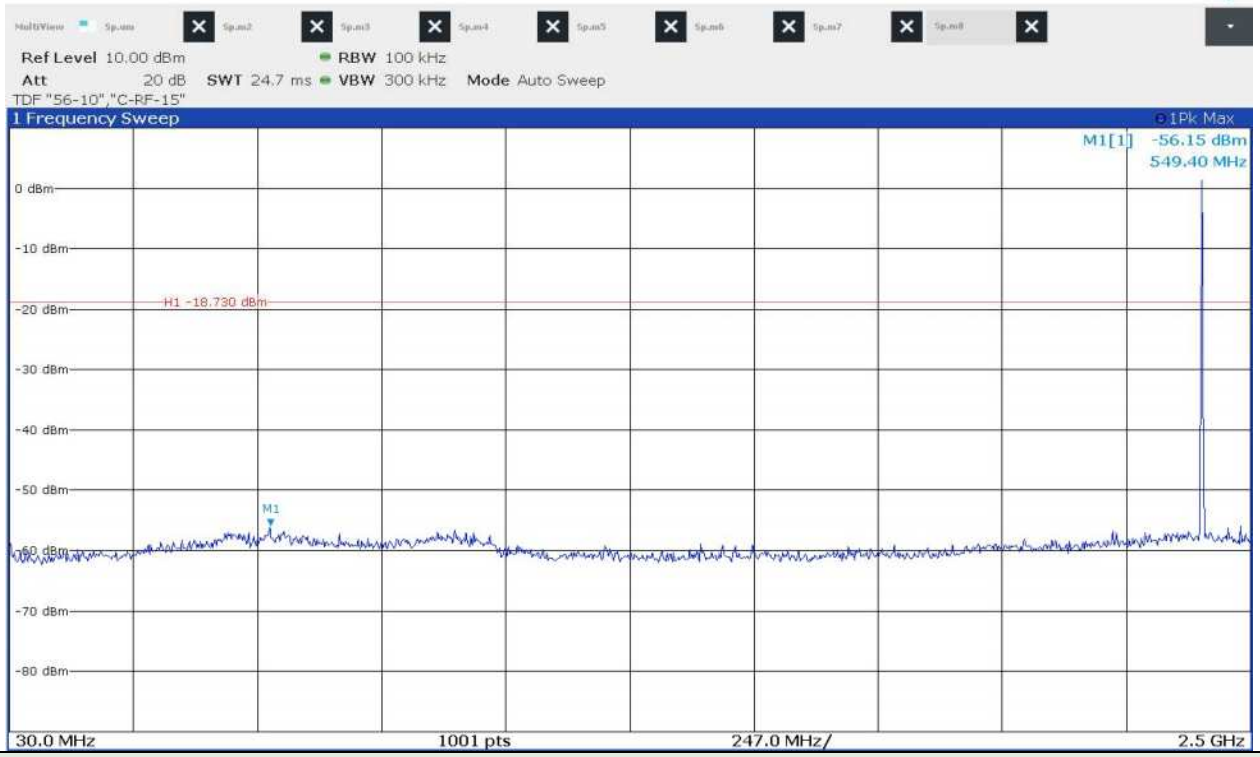


Band-edge and Restricted band – Non-hopping mode

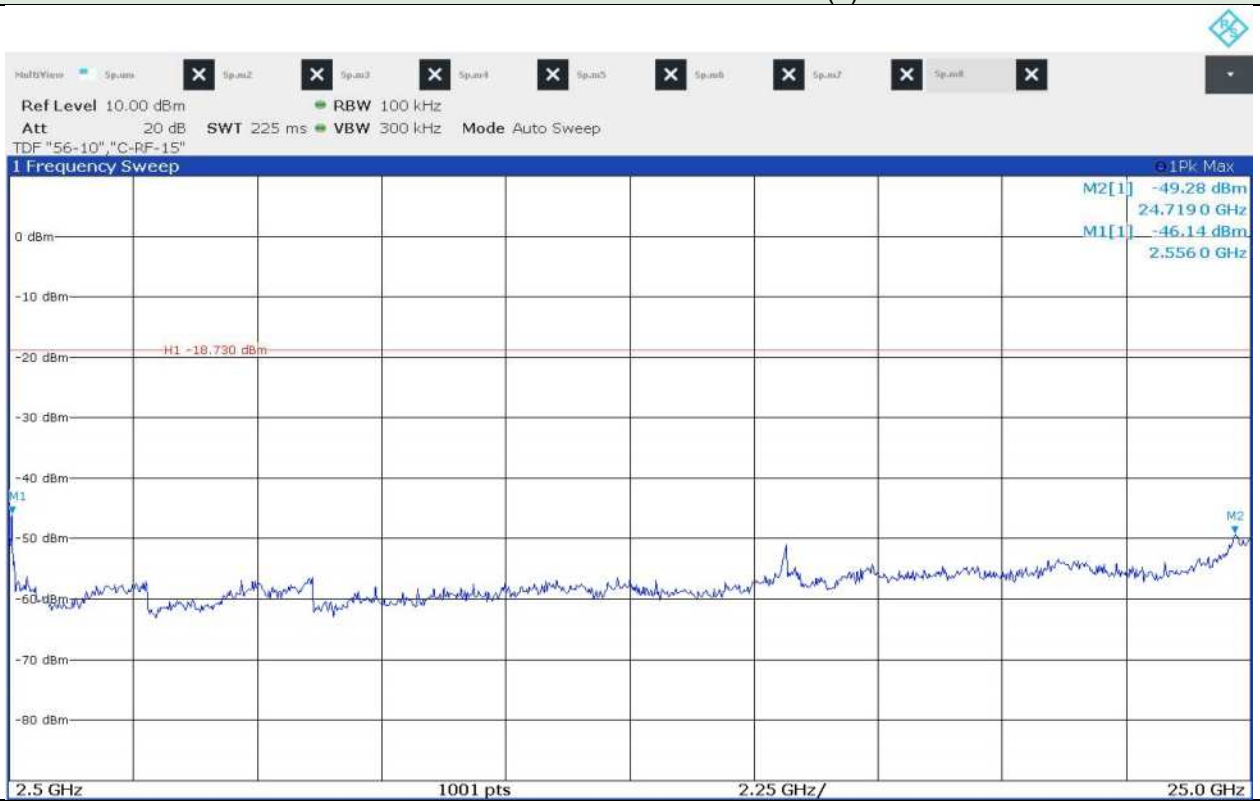


Band-edge and Restricted band – Non-hopping mode

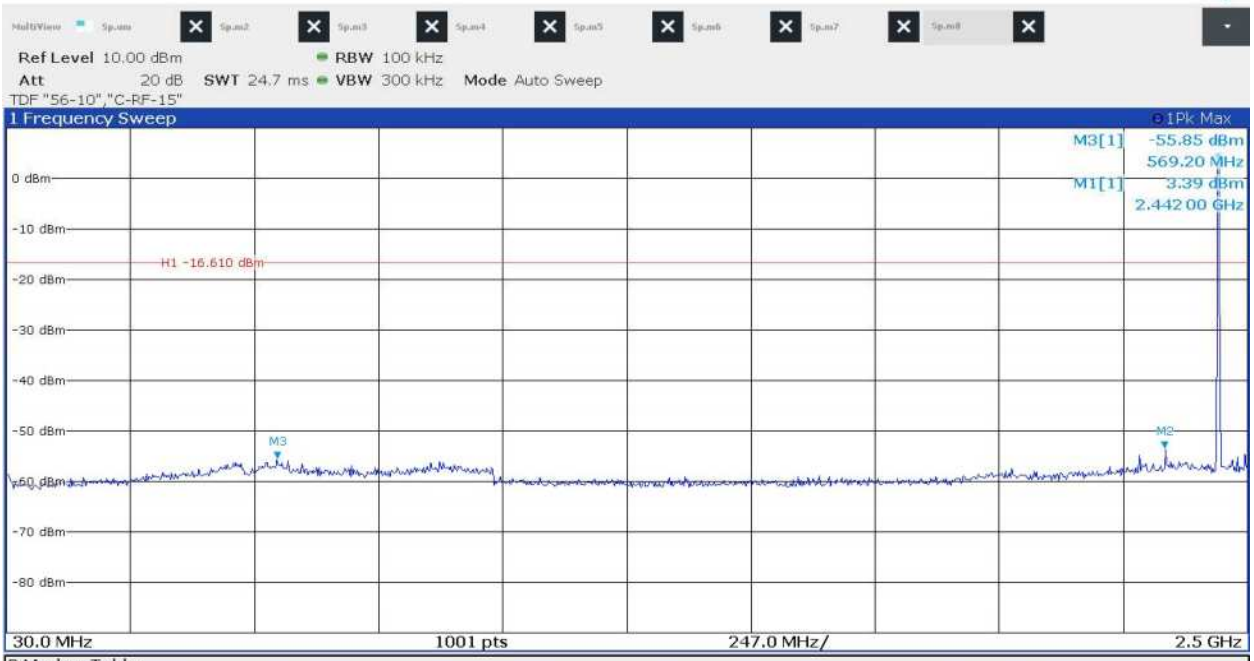
Non-restricted band – Low Channel (1)



Non-restricted band – Low Channel (2)



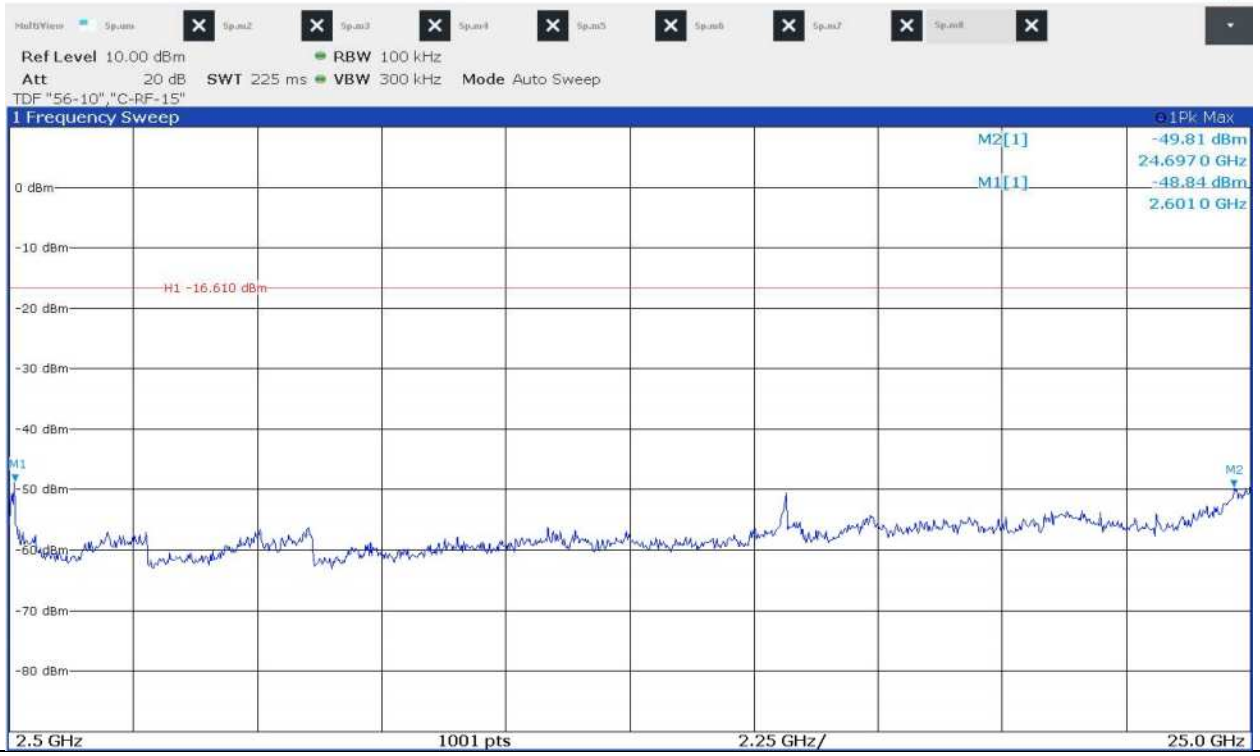
Non-restricted band – Middle Channel (1)



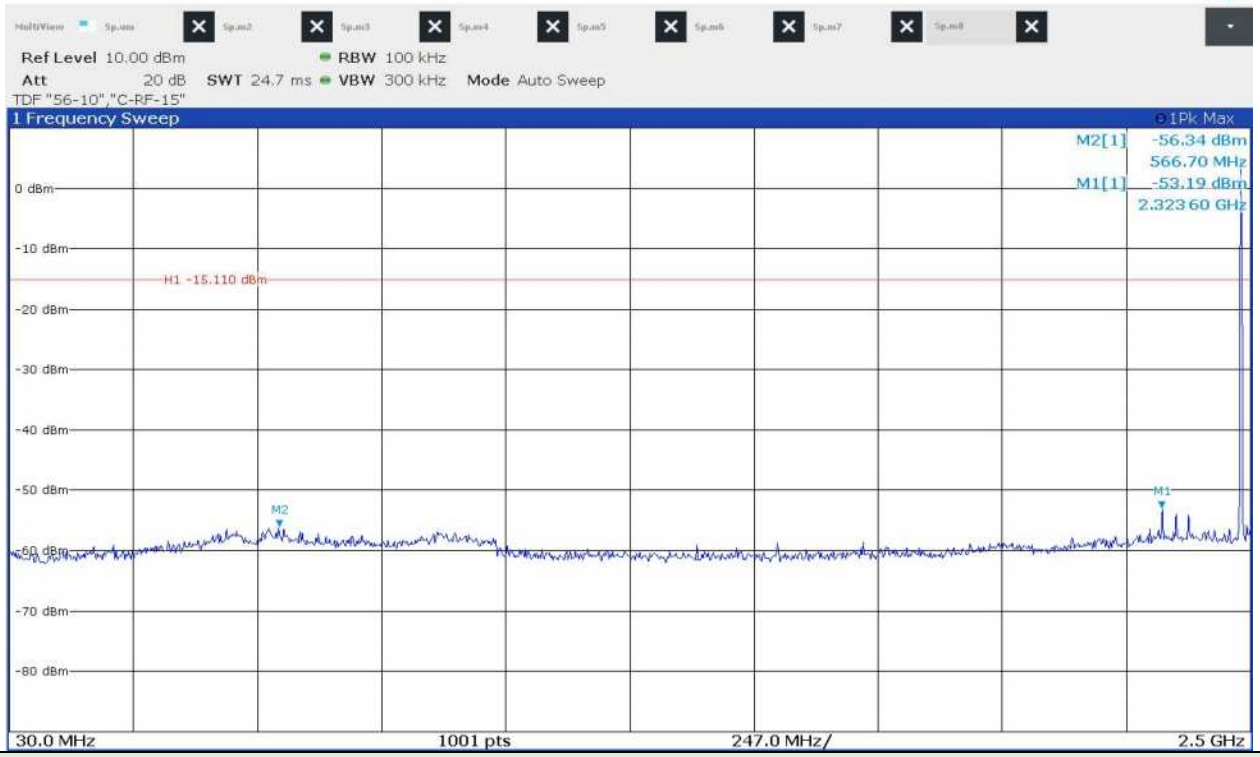
2 Marker Table

Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	2.442 GHz	3.39 dBm		
M2		1	2.335 9 GHz	-53.83 dBm		
M3		1	569.2 MHz	-55.85 dBm		

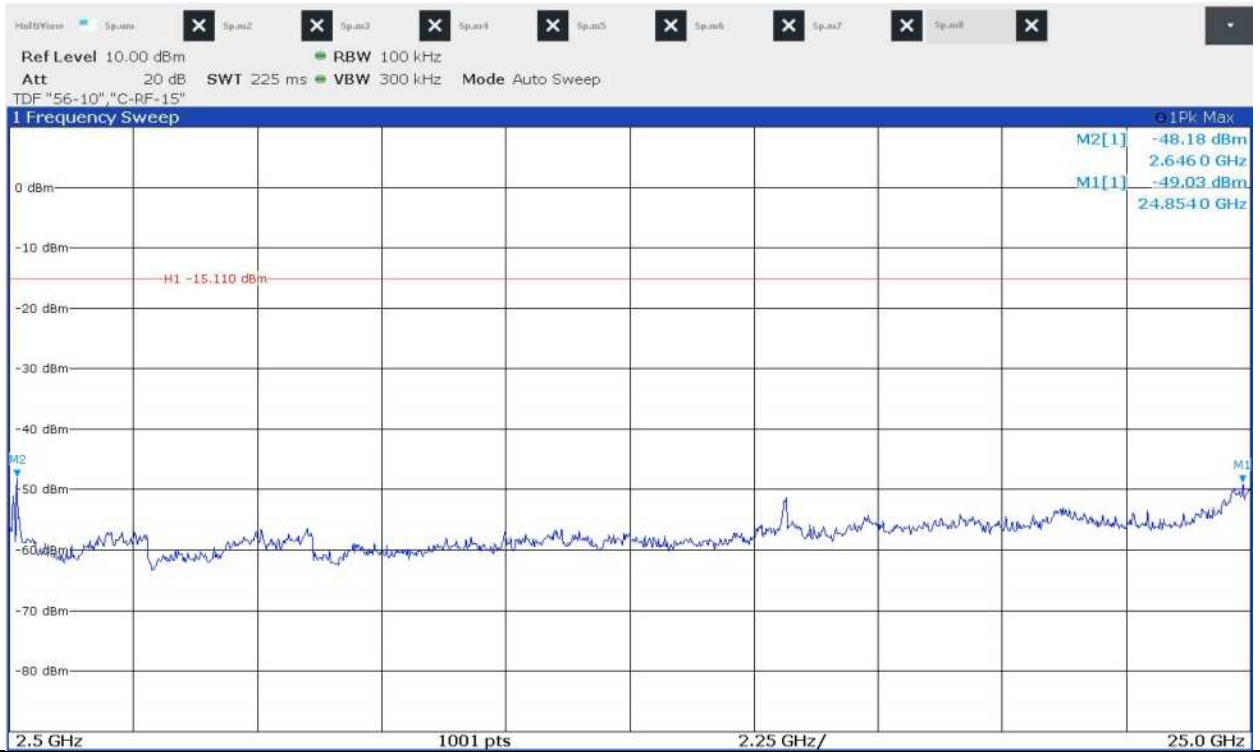
Non-restricted band – Middle Channel (2)



Non-restricted band – High Channel (1)



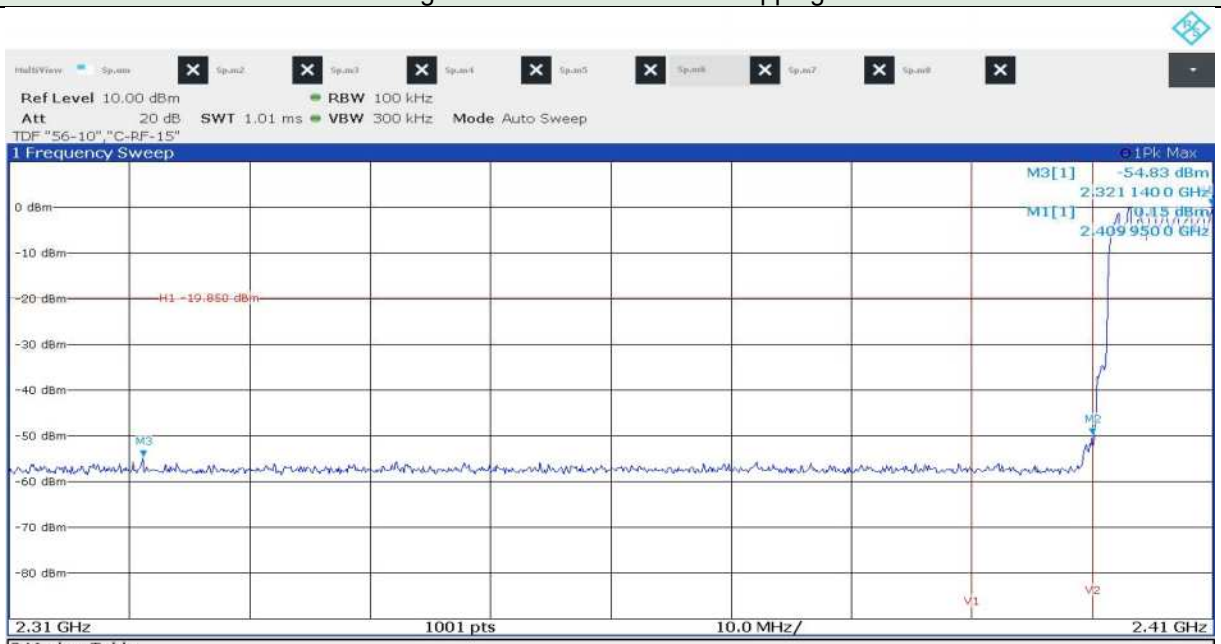
Non-restricted band – High Channel (2)



5.7.4 Test Data for Operating mode: Bluetooth EDR (8DPSK)

Date of Test	2022-06-14	Temperature	(25.7 ± 0.8) °C
		Relative humidity	(56.5 ± 2.8) % R.H.
Test Result	***PASS***	Tested by	Do-heon, Kim

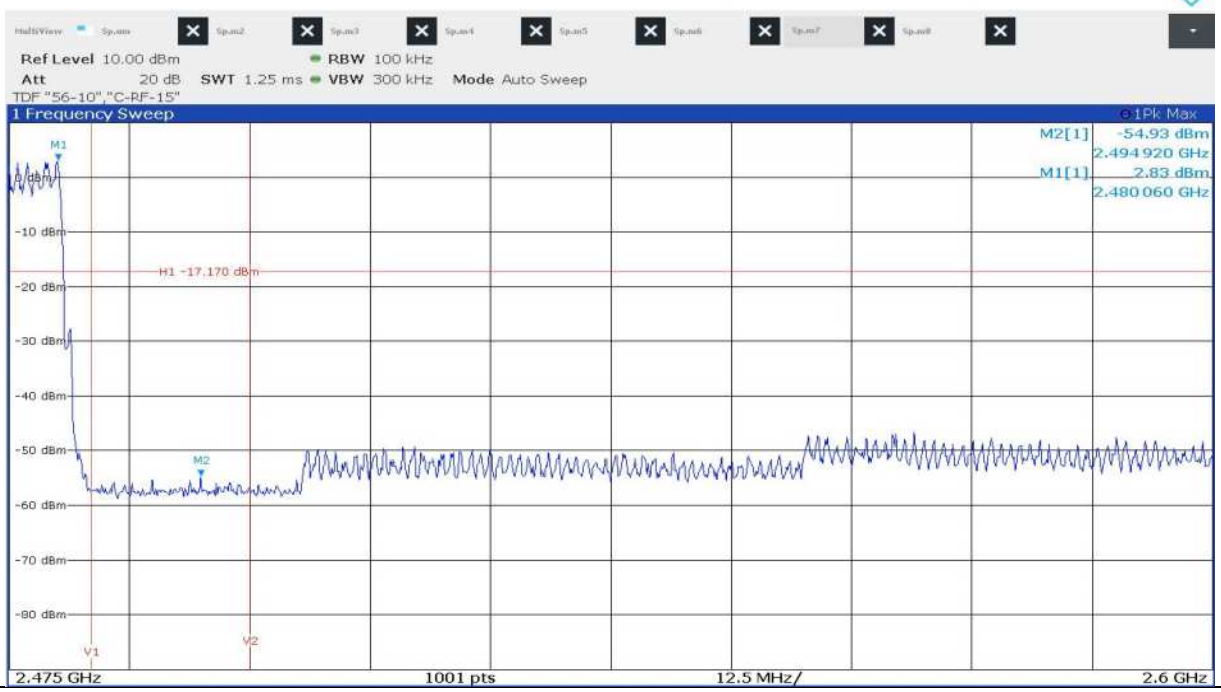
Band-edge and Restricted band – Hopping mode



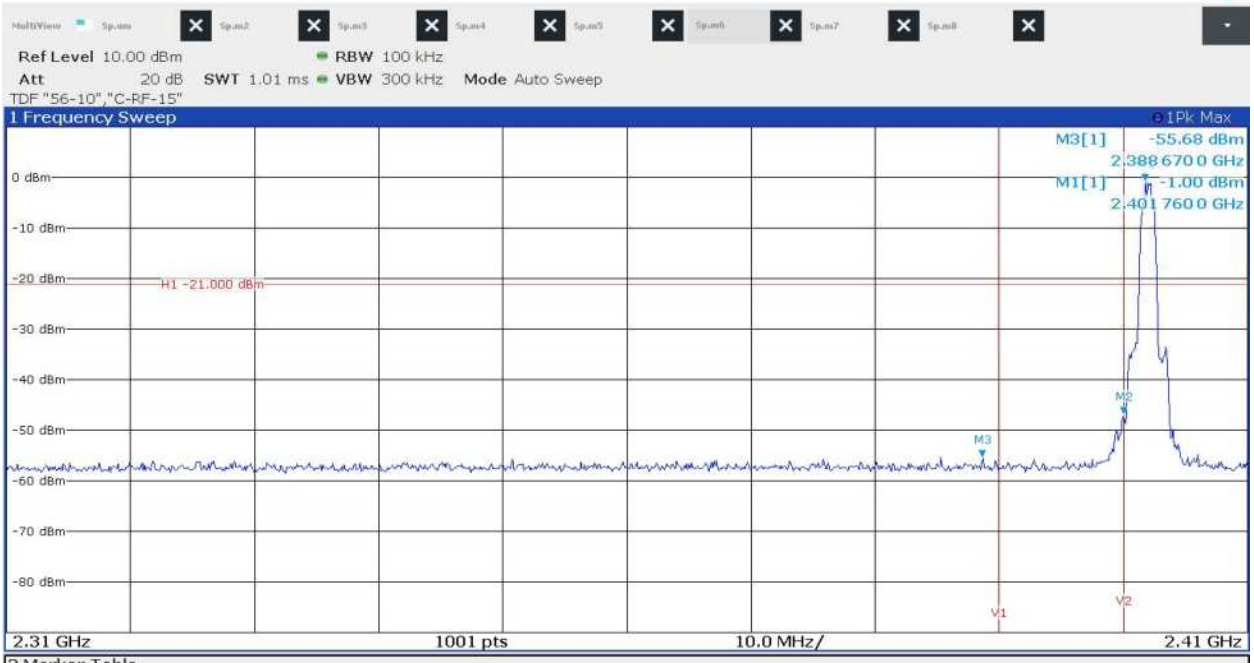
2 Marker Table

Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	2.409 95 GHz	0.15 dBm		
M2		1	2.4 GHz	-50.09 dBm		
M3		1	2.321 14 GHz	-54.83 dBm		

Band-edge and Restricted band – Hopping mode



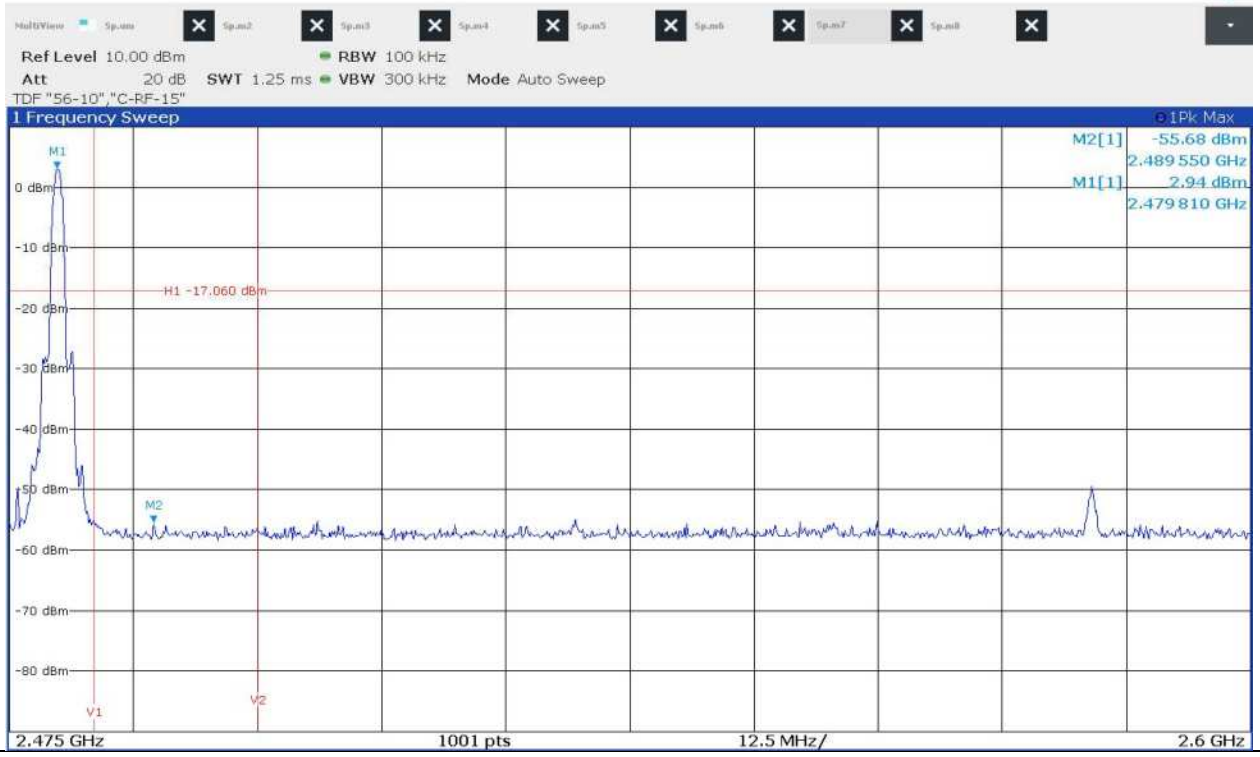
Band-edge and Restricted band – Non-hopping mode



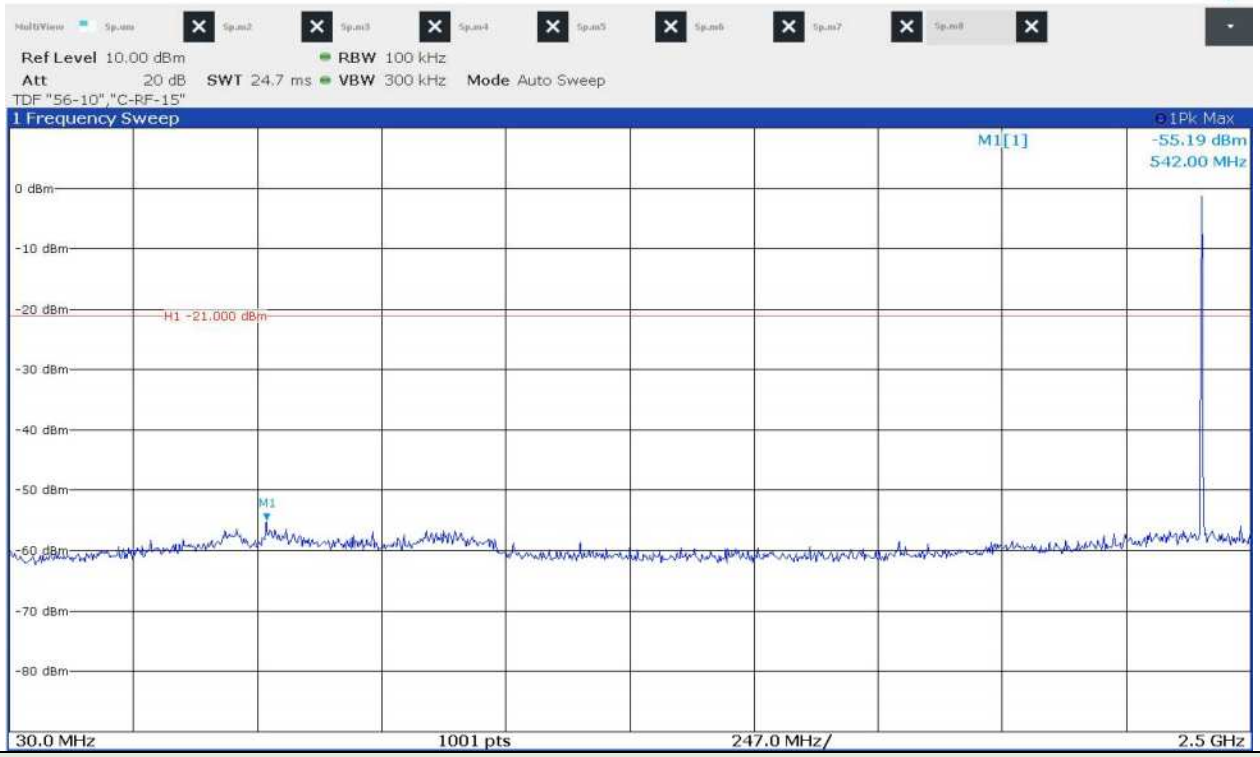
2 Marker Table

Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	2.401 76 GHz	-1.00 dBm		
M2		1	2.4 GHz	-47.15 dBm		
M3		1	2.388 67 GHz	-55.68 dBm		

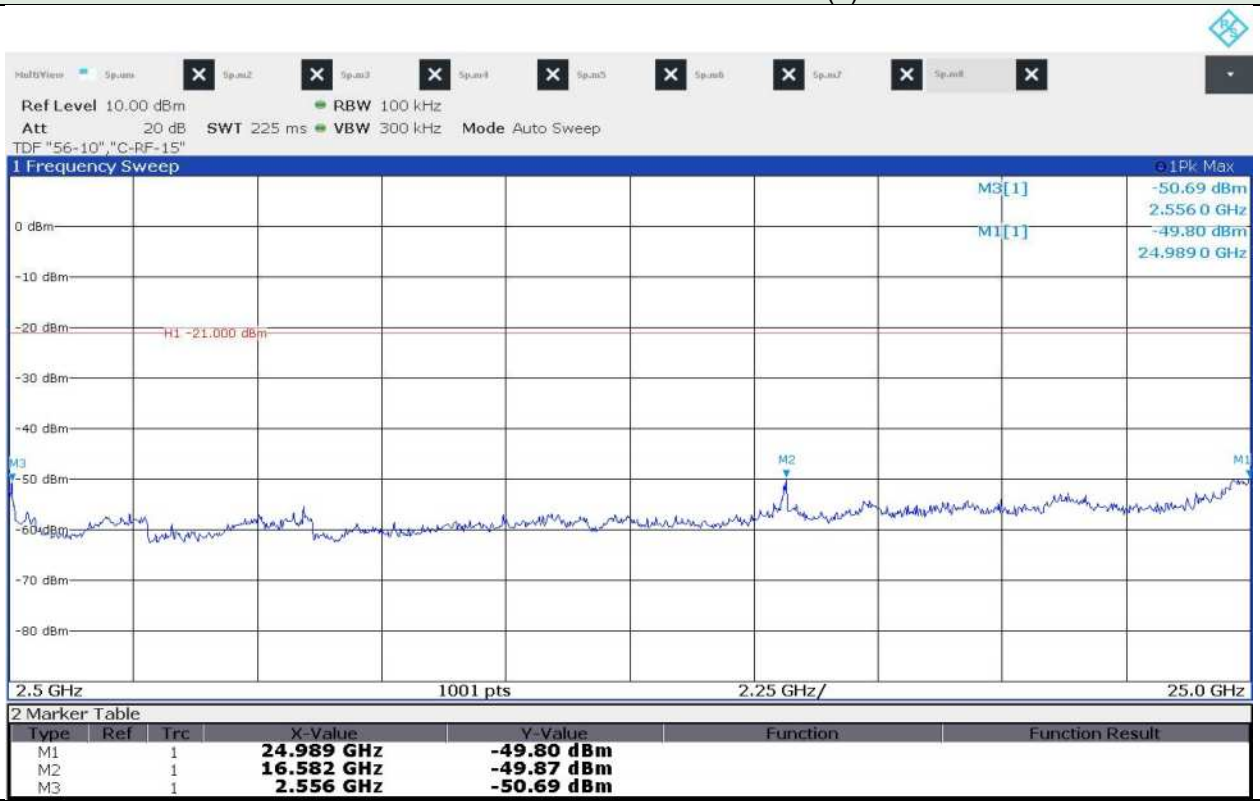
Band-edge and Restricted band – Non-hopping mode



Non-restricted band – Low Channel (1)

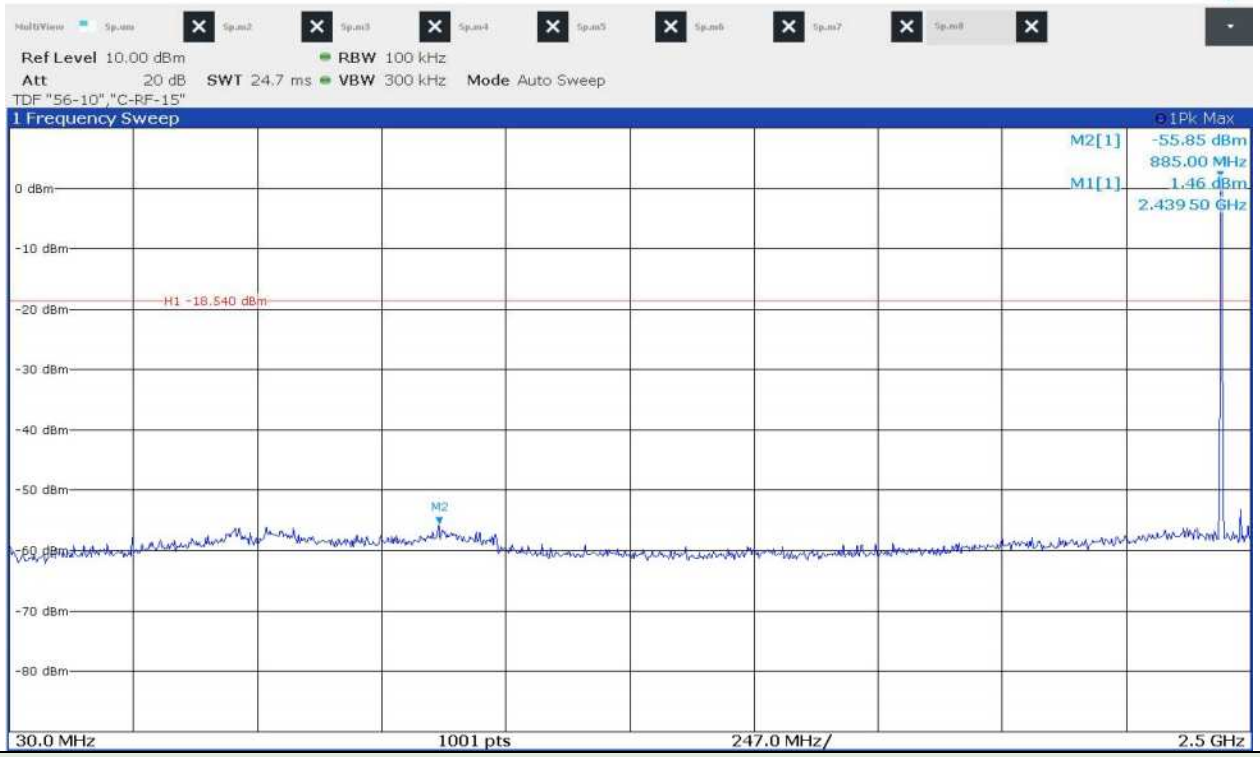


Non-restricted band – Low Channel (2)

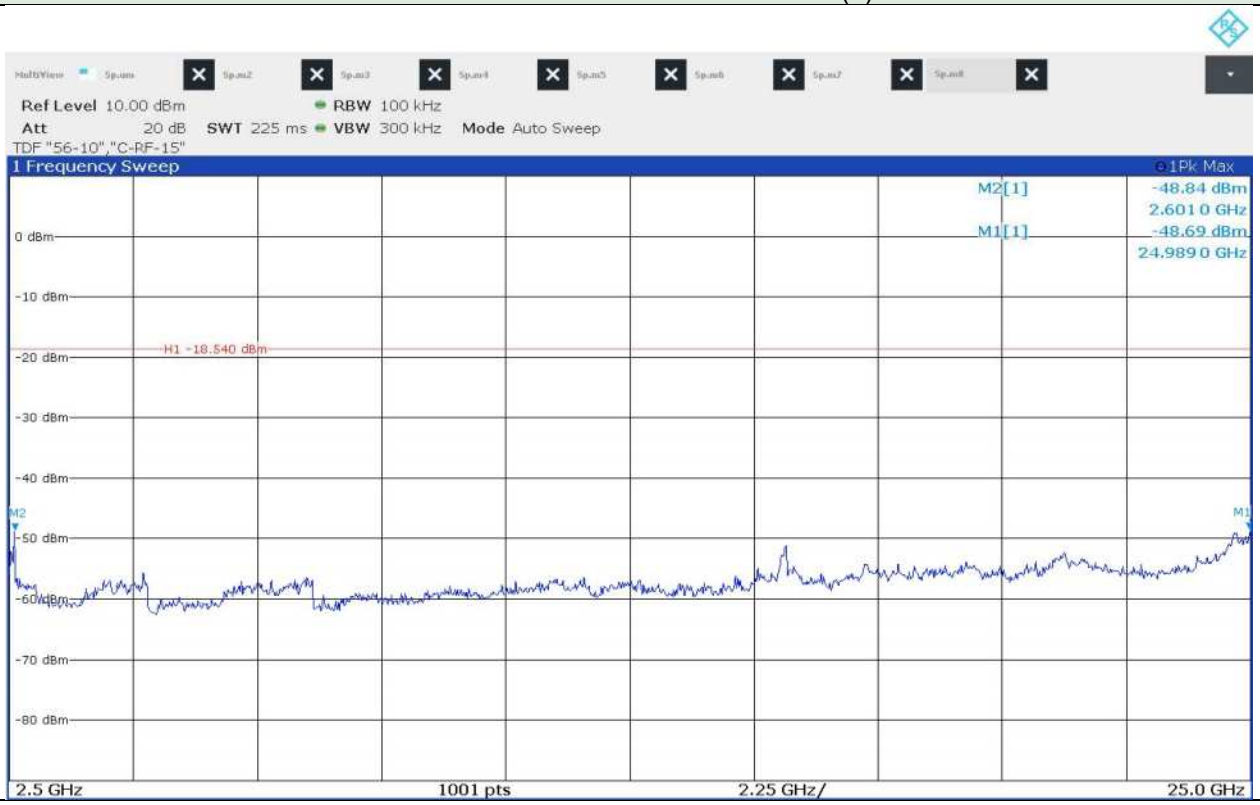


Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	24.989 GHz	-49.80 dBm		
M2		1	16.582 GHz	-49.87 dBm		
M3		1	2.556 GHz	-50.69 dBm		

Non-restricted band – Middle Channel (1)



Non-restricted band – Middle Channel (2)



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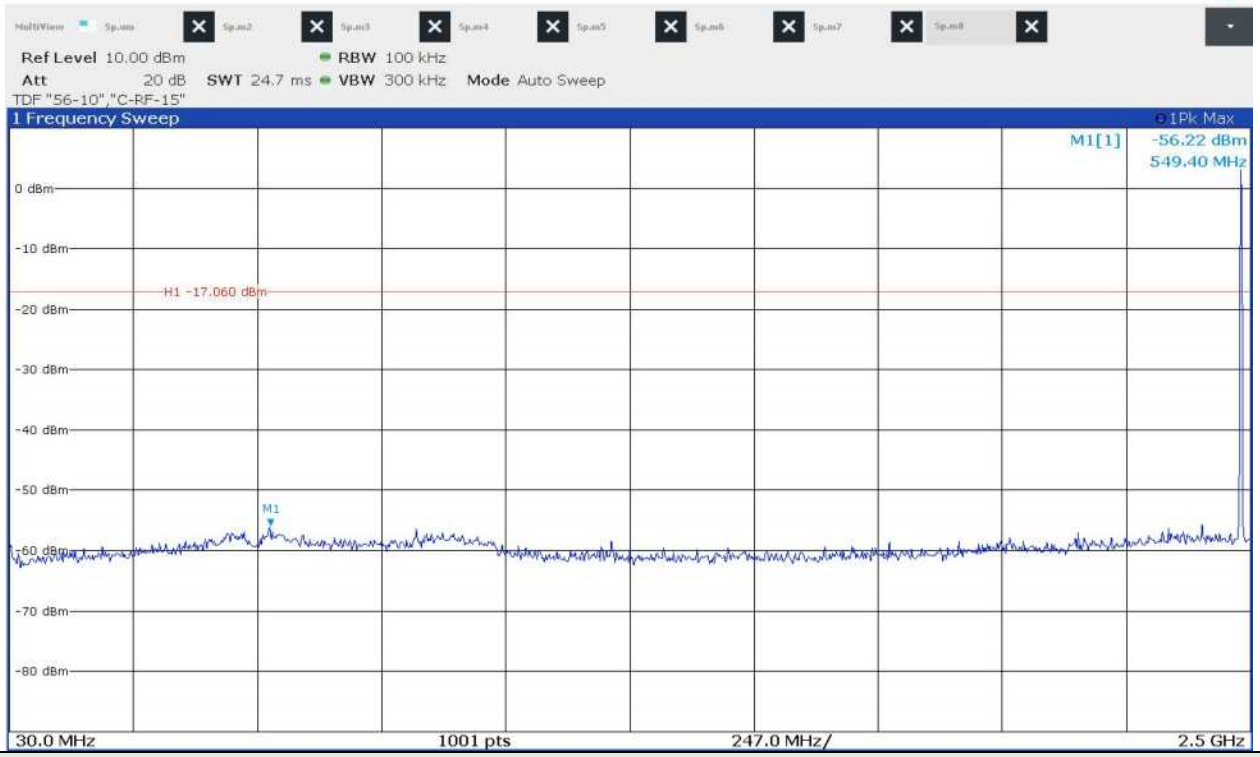
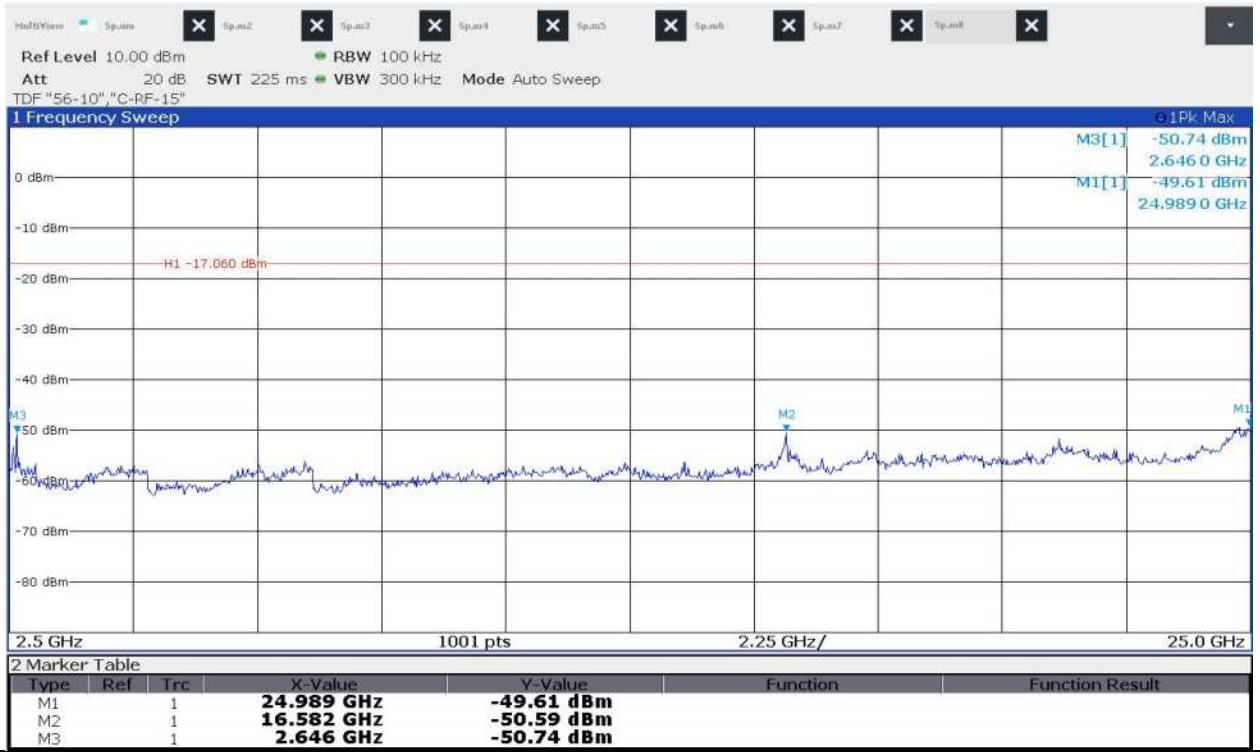
Non-restricted band – High Channel (1)



Non-restricted band – High Channel (2)



Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	24.989 GHz	-49.61 dBm		
M2		1	16.582 GHz	-50.59 dBm		
M3		1	2.646 GHz	-50.74 dBm		

5.8 Radiated Emission

5.8.1 Limit

Acc. To section 15.205,15.209, following table shall be applied.

Frequency Range (MHz)	Field Strength Limit (uV/m) at 3 m	Field Strength Limit (dBuV/m) at 3 m
30 – 88	100	40
88 – 216	150	43.5
216 – 960	200	46
Above 960	500	24

5.8.2 Method of Measurement

The radiated emissions measurements were on 3 m, semi-anechoic chamber. The EUT and other support equipment were placed on a non-conductive table 80 cm for below 1 GHz and 1.5 m for above 1 GHz above the ground plane. The interconnecting cables from outside test site were inserted into ferrite clamps at the point where the cables reach the turntable.

The frequency spectrum from 30 MHz to 25 GHz was scanned and emission levels maximized at each frequency recorded. The system was rotated 360°, and the antenna was varied in height between 1.0 m and 4.0 m in order to determine the maximum emission levels. This procedure was performed for both horizontal and vertical polarization of the receiving antenna.

For measurement below 1 GHz, the resolution bandwidth is set to 100 kHz for peak detection measurements or 120 kHz for quasi-peak detection measurements. Peak detection is used unless otherwise noted as quasi-peak.

For peak emission measurements above 1 GHz the resolution bandwidth is set to 1 MHz; the video bandwidth is set to 3 MHz and for average measurement, resolution bandwidth is set to 1 MHz; and the video bandwidth is set to 10 Hz, when duty cycle is more than 98 %. If duty cycle is less than 98 %, the video bandwidth is set to ≥ 1/T, where T is the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.

For measurements above 1 GHz the resolution bandwidth is set to 1 MHz; the video bandwidth is set to 3 MHz The spectrum from 30 MHz to 25 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in each applicable band.

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5.8.3 Test Site Requirement for KDB 414788 D01

Acc. to KDB 414788 D01 Radiated Test Site v01, Semi Anechoic Chamber (SAC) shall be verified test results below 30 MHz with Open Area Test Site (OATS), so we compared test results between the measurements from our SAC and an OATS and found test results almost same, so we ***declare test result for below 30 MHz from our SAC is valid and met the requirement acc. to KDB 414788 D01 Radiated Test Site v01***.

5.8.4 Measurement Uncertainty

Measurement uncertainties were not taken into account and following uncertainty levels have been estimated for tests performed on the apparatus. The measurement uncertainties are given with at least 95 % confidence.

Frequency Range	Uncertainty	Frequency Range	Uncertainty
9 kHz ~ 30 MHz	±2.1 dB	30 MHz ~ 1 GHz	±4.6 dB
1 GHz ~ 18 GHz	±4.9 dB	18 GHz ~25 GHz	±4.4 dB

5.8.5 Sample Calculated Example

At 80 MHz Limit = 40.0 dBuV/m

Result (dBuV/m)

= Receiver Reading (dBuV) + Antenna Factor (dB/m) - Pre-amplifier Gain (dB) + Cable Loss (dB) = 30

Margin = Limit – Result = 40 – 30 = 10 so the EUT has 10.0 dB margin at 80 MHz

5.8.6 Test Data

Date of Test	2022-06-17	Temperature	(23.3 ± 1.1) °C
		Relative humidity	(44.1 ± 1.1) % R.H.
Measurement Frequency Range		9 kHz ~ 25 GHz	
Test Result	***PASS***	Tested By	Do-heon, Kim

Frequency range	Detector Mode	Resolution BW	Video BW	Video Filtering	Measurement distance
Below 30 MHz	Peak or Q.P.	9 kHz	100 kHz	-	3 m
30 MHz ~ 1 000 MHz	Peak or Q.P.	100 kHz	300 kHz	-	3 m
Above 1 GHz	Peak	1 MHz	3 MHz		3 m
	Average	1 MHz	3 MHz		3 m

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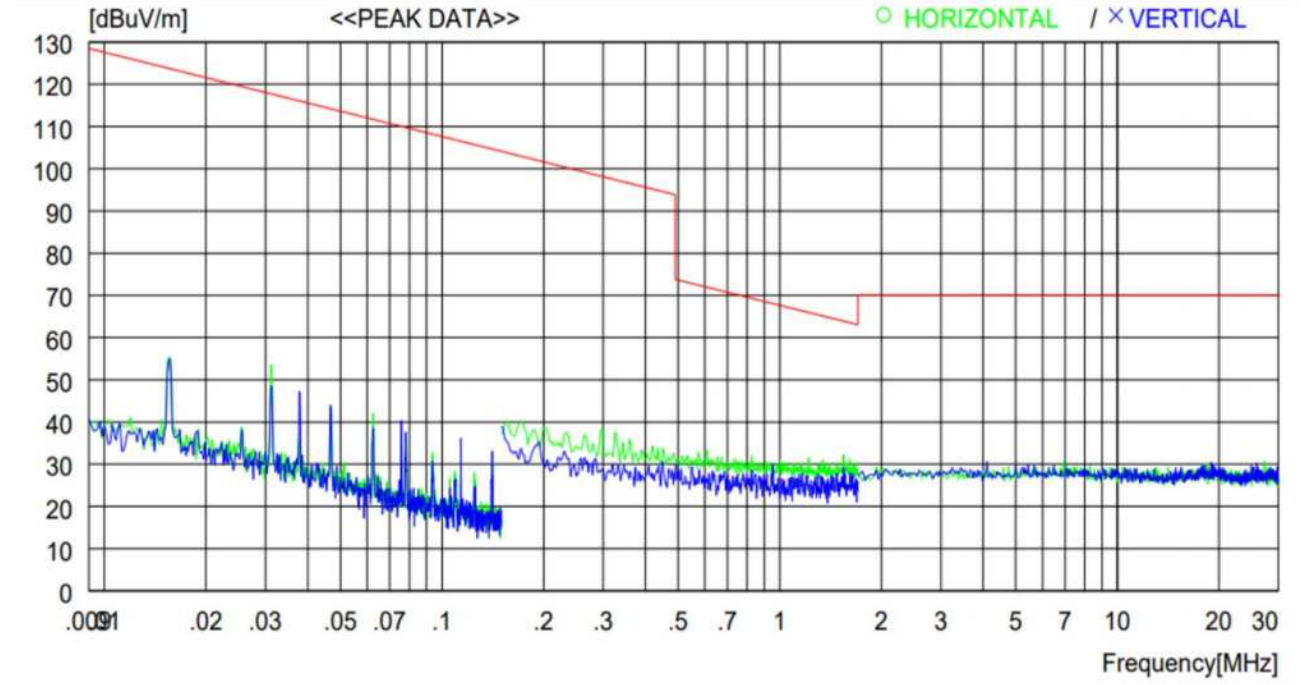
5.8.6.1 Test Data below 30 MHz

Graphical Test Data – Below 30 MHz



Tabulated Test Data – Low / Middle / High Channel

Frequency (MHz)	Receiver Reading (dBuV)	Detector Mode	Pol.	Ant. Factor (dB/m)	Corr. Factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Azimuth (Degree)
* Spurious emissions that 20 dB below the limits didn't be recorded										

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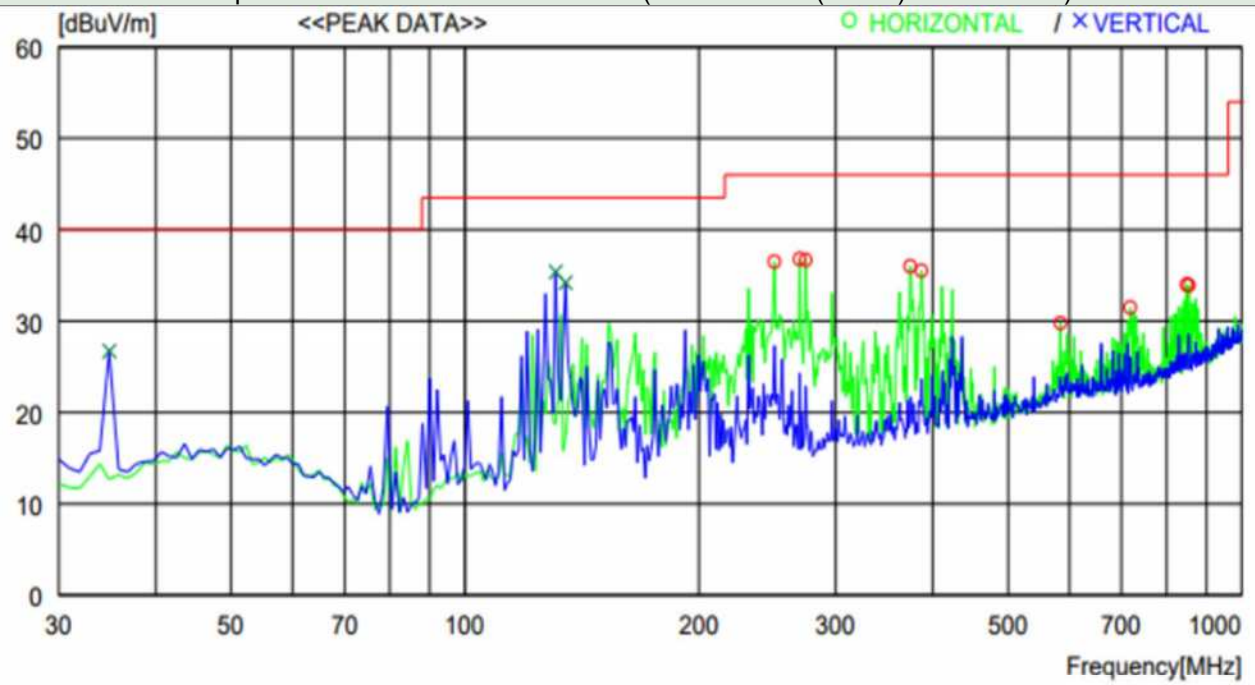
5.8.6.2 Test Data from 30 MHz to 1 GHz

5.8.6.2.1 Operating mode: Bluetooth BR (GFSK)

Graphical Test Data – Below 1 GHz – (Bluetooth BR (GFSK) Low channel)



No.	FREQ [MHz]	READING PEAK [dBuV]	ANT FACTOR [dB]	LOSS [dB]	GAIN [dB]	RESULT [dBuV/m]	LIMIT [dBuV/m]	MARGIN [dB]	ANTENNA [cm]	TABLE [DEG]
----- Horizontal ------										
1	250.190	47.7	12.6	8.4	32.2	36.5	46.0	9.5	100	359
2	269.590	47.7	12.8	8.5	32.2	36.8	46.0	9.2	100	359
3	274.440	47.5	12.9	8.5	32.2	36.7	46.0	9.3	100	359
4	374.350	44.0	15.0	9.0	32.0	36.0	46.0	10	100	359
5	386.960	43.2	15.3	9.1	32.1	35.5	46.0	10.5	100	26
6	583.868	33.5	18.9	10.0	32.6	29.8	46.0	16.2	200	54
7	718.694	34.4	19.9	10.5	33.3	31.5	46.0	14.5	100	207
8	848.670	34.6	21.6	11.0	33.2	34.0	46.0	12	100	160
9	854.490	34.4	21.7	11.0	33.2	33.9	46.0	12.1	100	359
----- Vertical ------										
10	34.850	41.5	11.4	6.7	32.9	26.7	40.0	13.3	200	359
11	130.880	51.7	8.8	7.6	32.7	35.4	43.5	8.1	200	330
12	134.760	50.8	8.5	7.6	32.7	34.2	43.5	9.3	300	353

Note: “H” means Horizontal polarity, “V” means Vertical polarity.

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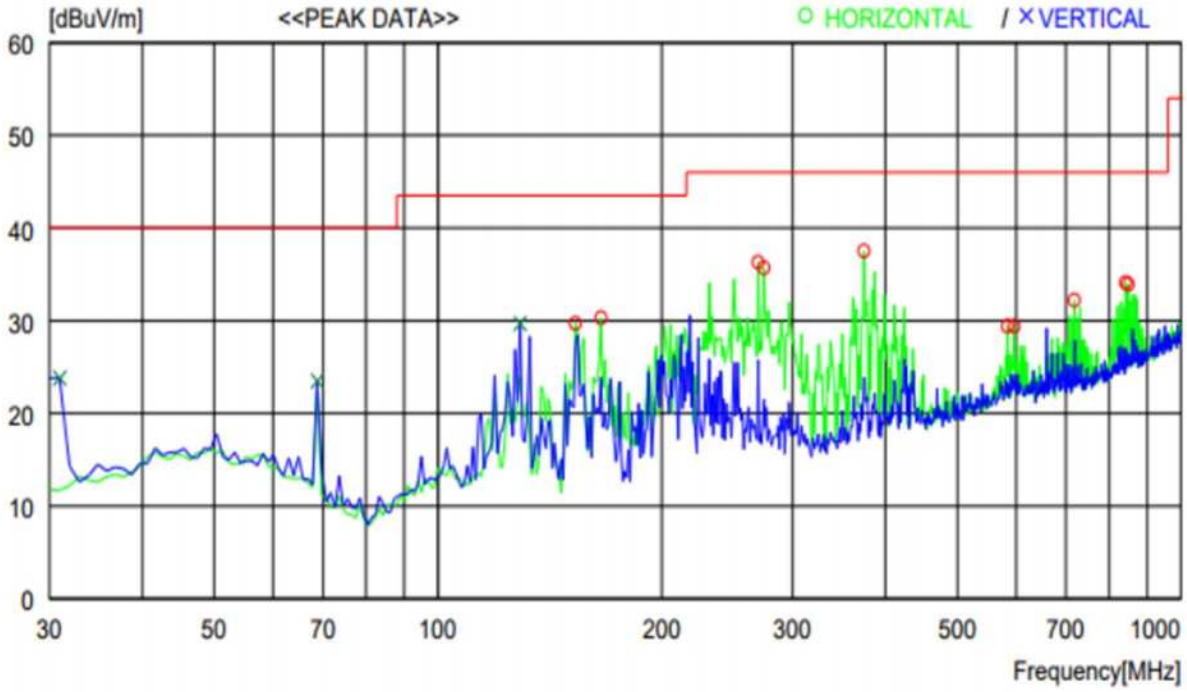
Graphical Test Data – Below 1 GHz – (Bluetooth BR (GFSK) Middle channel)



No.	FREQ [MHz]	READING PEAK [dBuV]	ANT FACTOR [dB]	LOSS [dB]	GAIN [dB]	RESULT [dBuV/m]	LIMIT [dBuV/m]	MARGIN [dB]	ANTENNA [cm]	TABLE [DEG]
----- Horizontal ------										
1	153.190	46.1	8.4	7.8	32.6	29.7	43.5	13.8	200	0
2	165.800	46.2	8.8	7.9	32.6	30.3	43.5	13.2	200	301
3	269.590	47.2	12.8	8.5	32.2	36.3	46.0	9.7	100	82
4	274.440	46.5	12.9	8.5	32.2	35.7	46.0	10.3	100	247
5	374.350	45.5	15.0	9.0	32.0	37.5	46.0	8.5	100	359
6	583.868	33.1	18.9	10.0	32.6	29.4	46.0	16.6	300	73
7	596.478	32.8	19.1	10.1	32.6	29.4	46.0	16.6	300	73
8	718.694	35.1	19.9	10.5	33.3	32.2	46.0	13.8	100	161
9	841.881	34.9	21.5	11.0	33.3	34.1	46.0	11.9	100	8
10	848.670	34.5	21.6	11.0	33.2	33.9	46.0	12.1	100	359
----- Vertical ------										
11	30.970	39.5	10.6	6.6	32.9	23.8	40.0	16.2	100	0
12	68.800	39.1	10.2	7.1	32.9	23.5	40.0	16.5	200	359
13	128.940	45.8	9.0	7.6	32.7	29.7	43.5	13.8	300	0

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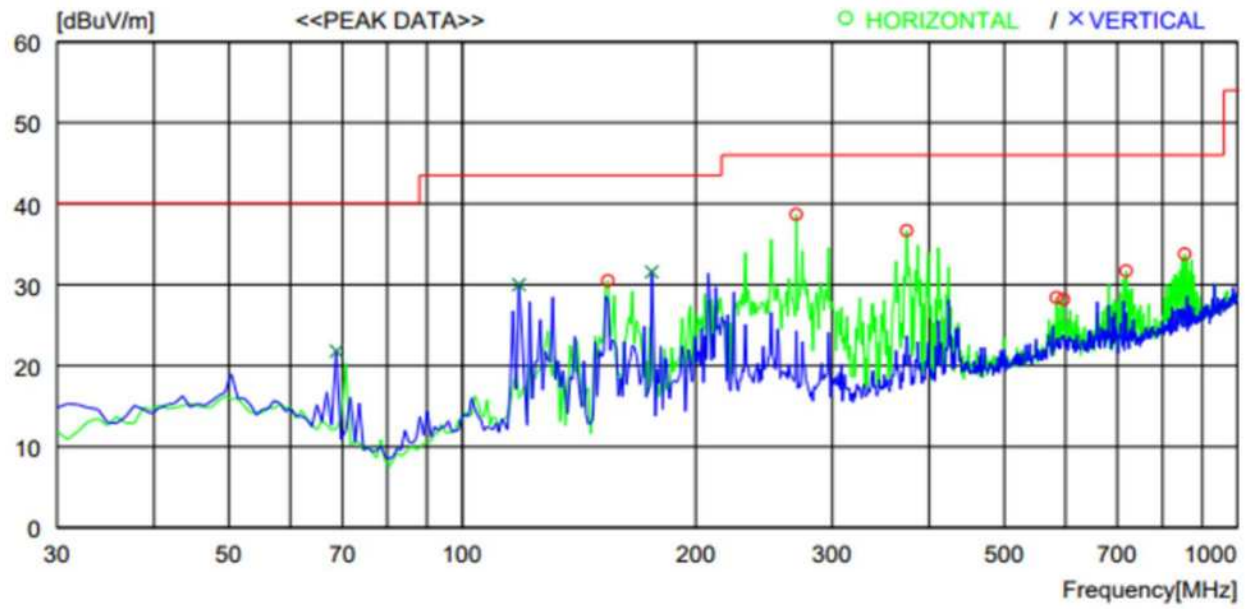
Graphical Test Data – Below 1 GHz – (Bluetooth BR (GFSK) High channel)



No.	FREQ [MHz]	READING PEAK [dBuV]	ANT FACTOR [dB]	LOSS [dB]	GAIN [dB]	RESULT [dBuV/m]	LIMIT [dBuV/m]	MARGIN [dB]	ANTENNA [cm]	TABLE [DEG]
----- Horizontal ------										
1	154.160	46.9	8.4	7.8	32.6	30.5	43.5	13	200	170
2	269.590	49.6	12.8	8.5	32.2	38.7	46.0	7.3	100	359
3	374.350	44.7	15.0	9.0	32.0	36.7	46.0	9.3	100	50
4	583.868	32.1	18.9	10.0	32.6	28.4	46.0	17.6	300	82
5	596.478	31.6	19.1	10.1	32.6	28.2	46.0	17.8	300	359
6	718.694	34.6	19.9	10.5	33.3	31.7	46.0	14.3	100	111
7	854.490	34.3	21.7	11.0	33.2	33.8	46.0	12.2	100	359
----- Vertical ------										
8	68.800	37.4	10.2	7.1	32.9	21.8	40.0	18.2	400	359
9	118.270	45.4	9.9	7.5	32.8	30.0	43.5	13.5	100	302
10	175.500	47.0	9.2	7.9	32.5	31.6	43.5	11.9	100	208

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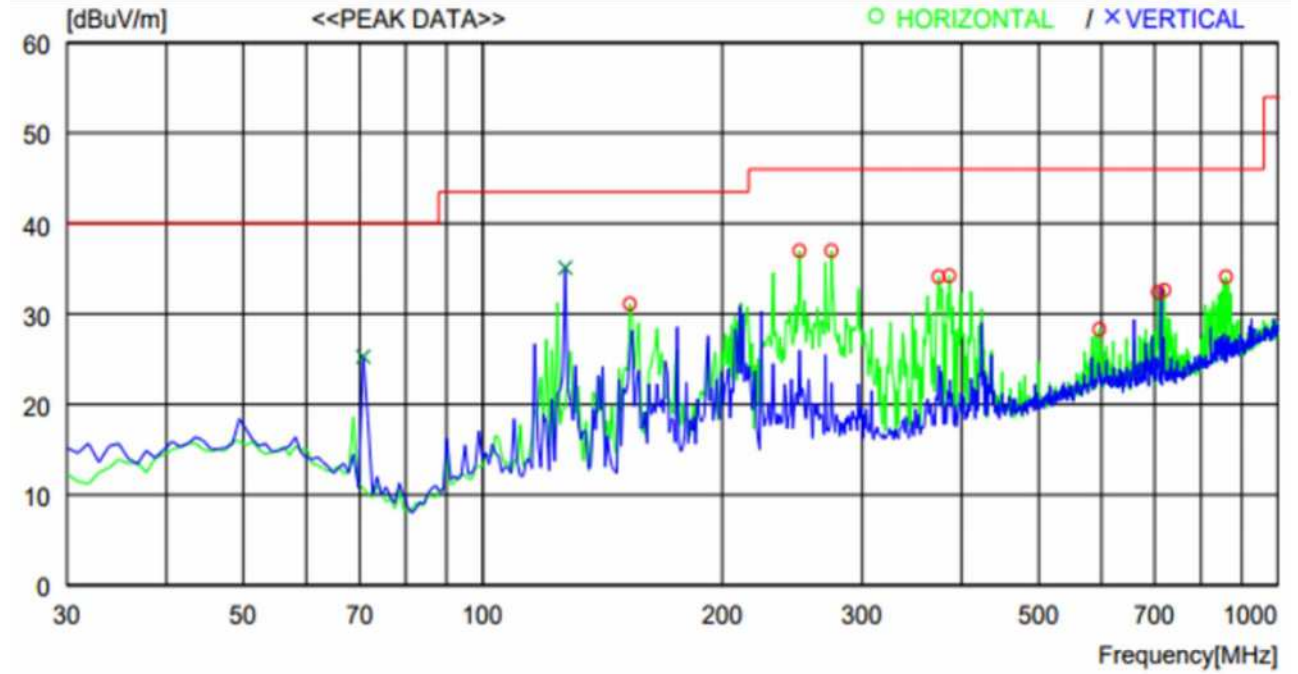
5.8.6.2.2 Operating mode: Bluetooth EDR (8DPSK)

Graphical Test Data – Below 1 GHz – (Bluetooth EDR (8DPSK) Low channel)



No.	FREQ [MHz]	READING PEAK [dBuV]	ANT FACTOR [dB]	LOSS [dB]	GAIN [dB]	RESULT [dBuV/m]	LIMIT [dBuV/m]	MARGIN [dB]	ANTENNA [cm]	TABLE [DEG]
----- Horizontal ------										
1	153.190	47.5	8.4	7.8	32.6	31.1	43.5	12.4	200	0
2	250.190	48.2	12.6	8.4	32.2	37.0	46.0	9	100	275
3	274.440	47.8	12.9	8.5	32.2	37.0	46.0	9	100	359
4	374.350	42.1	15.0	9.0	32.0	34.1	46.0	11.9	100	359
5	385.990	41.9	15.3	9.1	32.1	34.2	46.0	11.8	100	359
6	596.478	31.7	19.1	10.1	32.6	28.3	46.0	17.7	300	58
7	707.055	35.4	19.7	10.5	33.2	32.4	46.0	13.6	100	359
8	719.664	35.5	19.9	10.5	33.3	32.6	46.0	13.4	100	166
9	860.310	34.4	21.7	11.1	33.1	34.1	46.0	11.9	100	158
----- Vertical ------										
10	70.740	41.5	9.6	7.1	32.9	25.3	40.0	14.7	300	239
11	127.000	51.1	9.1	7.6	32.7	35.1	43.5	8.4	100	269

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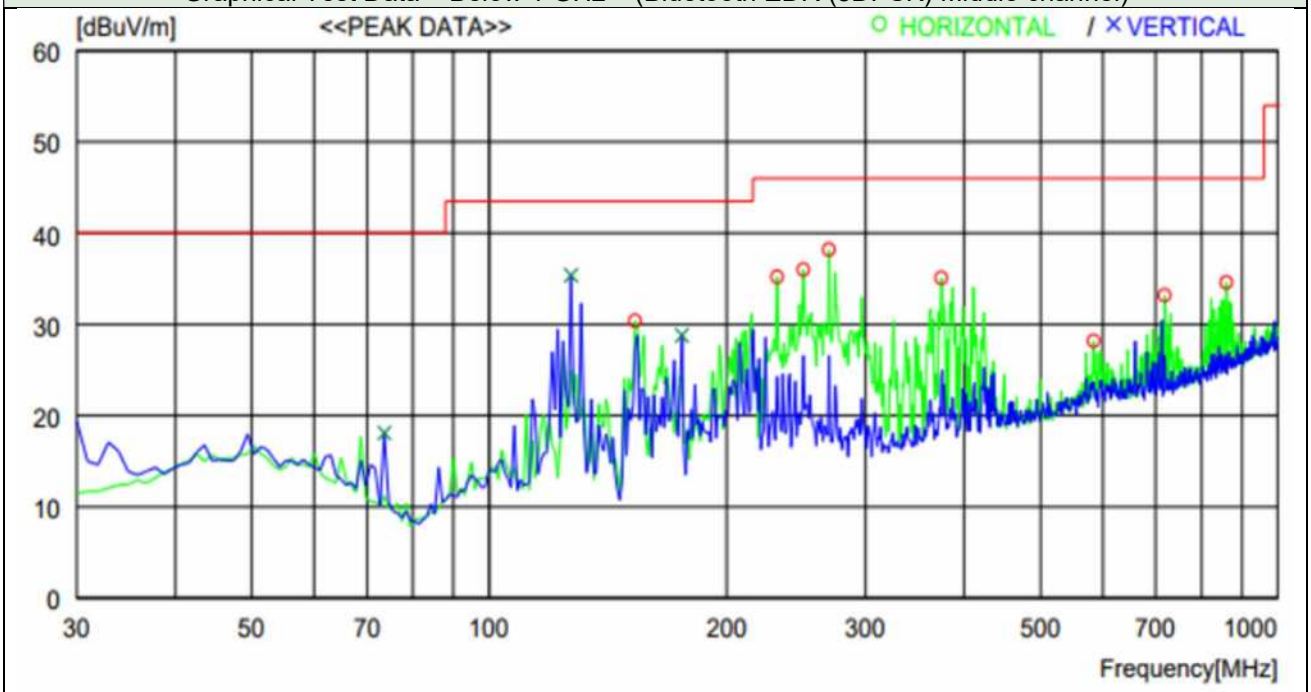
Graphical Test Data – Below 1 GHz – (Bluetooth EDR (8DPSK) Middle channel)



No.	FREQ [MHz]	READING PEAK [dBuV]	ANT FACTOR [dB]	LOSS [dB]	GAIN [dB]	RESULT [dBuV/m]	LIMIT [dBuV/m]	MARGIN [dB]	ANTENNA [cm]	TABLE [DEG]
----- Horizontal ------										
1	153.190	46.8	8.4	7.8	32.6	30.4	43.5	13.1	200	358
2	231.760	47.1	12.1	8.3	32.3	35.2	46.0	10.8	100	359
3	250.190	47.2	12.6	8.4	32.2	36.0	46.0	10	100	291
4	269.590	49.1	12.8	8.5	32.2	38.2	46.0	7.8	100	359
5	374.350	43.1	15.0	9.0	32.0	35.1	46.0	10.9	100	44
6	583.868	31.9	18.9	10.0	32.6	28.2	46.0	17.8	300	89
7	718.694	36.1	19.9	10.5	33.3	33.2	46.0	12.8	100	359
8	860.310	34.9	21.7	11.1	33.1	34.6	46.0	11.4	100	359
----- Vertical ------										
9	73.650	35.2	8.7	7.1	32.9	18.1	40.0	21.9	400	359
10	127.000	51.4	9.1	7.6	32.7	35.4	43.5	8.1	100	287
11	175.500	44.2	9.2	7.9	32.5	28.8	43.5	14.7	100	0

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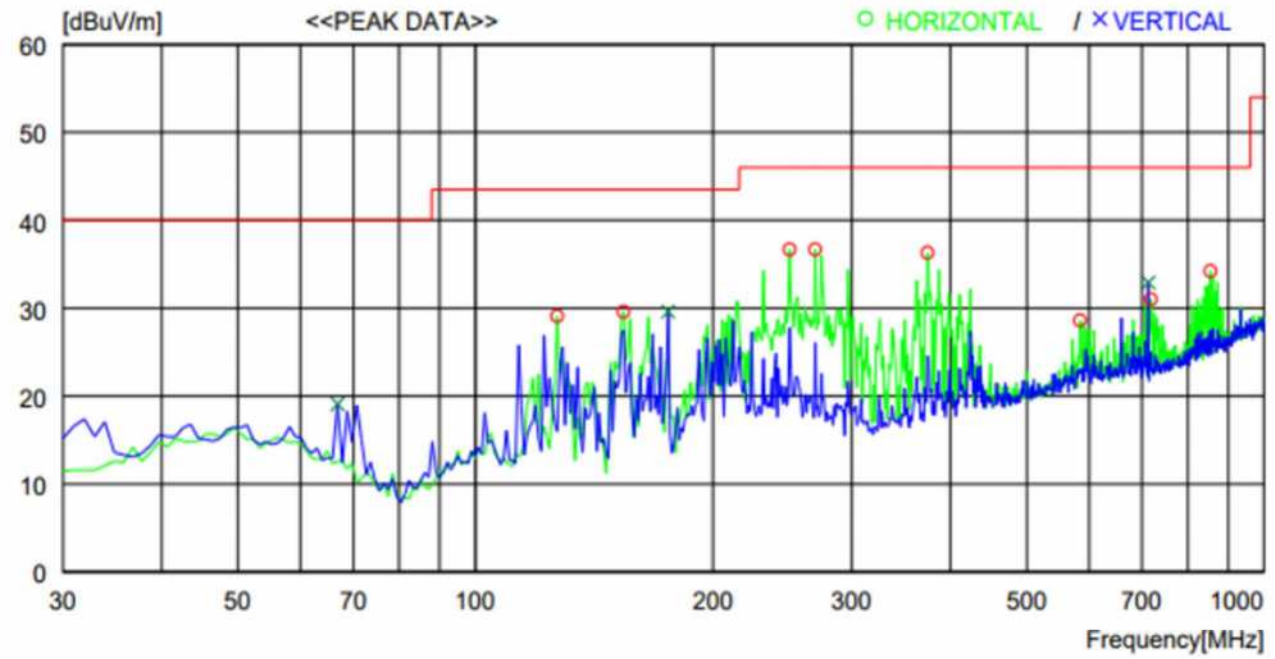
Graphical Test Data – Below 1 GHz – (Bluetooth EDR (8DPSK) High channel)



No.	FREQ [MHz]	READING PEAK [dBuV]	ANT FACTOR [dB]	LOSS [dB]	GAIN [dB]	RESULT [dBuV/m]	LIMIT [dBuV/m]	MARGIN [dB]	ANTENNA [cm]	TABLE [DEG]
----- Horizontal ------										
1	127.000	45.1	9.1	7.6	32.7	29.1	43.5	14.4	400	0
2	154.160	46.0	8.4	7.8	32.6	29.6	43.5	13.9	200	149
3	250.190	47.9	12.6	8.4	32.2	36.7	46.0	9.3	100	359
4	269.590	47.6	12.8	8.5	32.2	36.7	46.0	9.3	100	359
5	374.350	44.3	15.0	9.0	32.0	36.3	46.0	9.7	100	81
6	583.868	32.3	18.9	10.0	32.6	28.6	46.0	17.4	300	81
7	718.694	33.9	19.9	10.5	33.3	31.0	46.0	15	100	359
8	854.490	34.7	21.7	11.0	33.2	34.2	46.0	11.8	100	359
----- Vertical ------										
9	66.860	34.1	10.8	7.1	32.9	19.1	40.0	20.9	400	7
10	175.500	45.0	9.2	7.9	32.5	29.6	43.5	13.9	100	9
11	712.875	35.9	19.8	10.5	33.3	32.9	46.0	13.1	100	2

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5.8.6.3 Test Data above 1 GHz

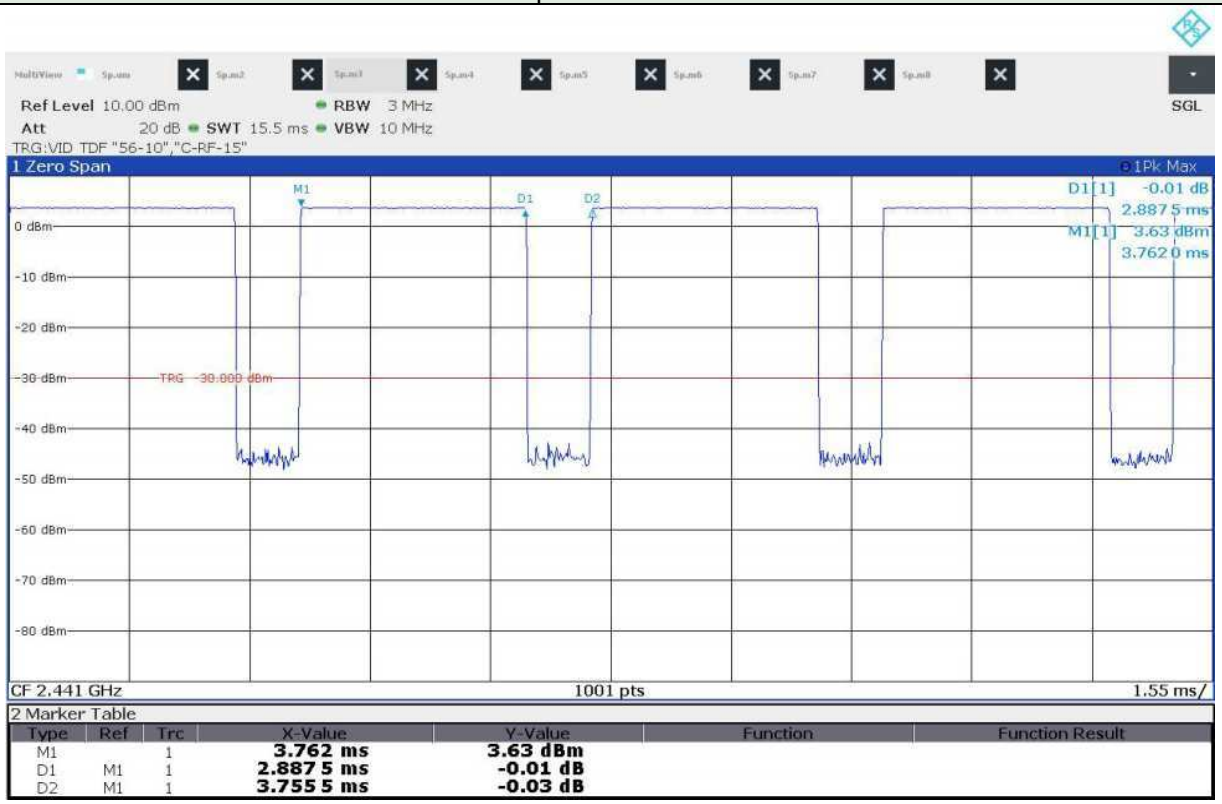
5.8.6.3.1 Operating mode: Bluetooth BR (GFSK)

Duty Cycle

Date of Test	2022-06-17	Temperature	(23.3 ± 1.1) °C
		Relative humidity	(44.1 ± 1.1) % R.H.
Measurement Distance	3 m	Tested By	Do-heon, Kim

Detector Mode	Resolution BW	Video BW	Sweep Time
PEAK	1 MHz	3 MHz	Auto
AVERAGE	1 MHz	3 MHz	Auto

Graphical Test Data



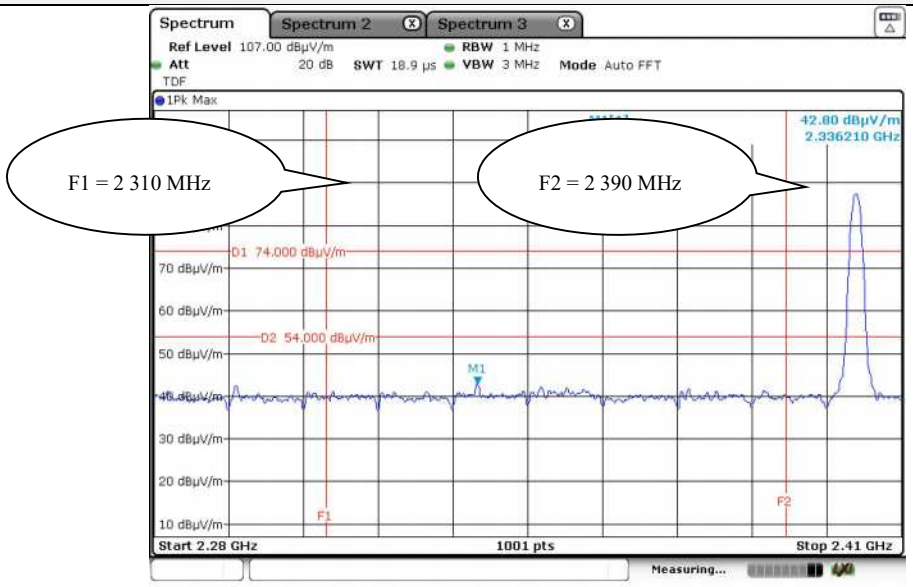
Tabulated Test Data

Operating Mode	On Time (ms)	On + Off Time (ms)	Duty Cycle (%)	Duty Factor (dB)
Bluetooth BR (DH5)	2.887 5	3.755 5	76.89	1.14

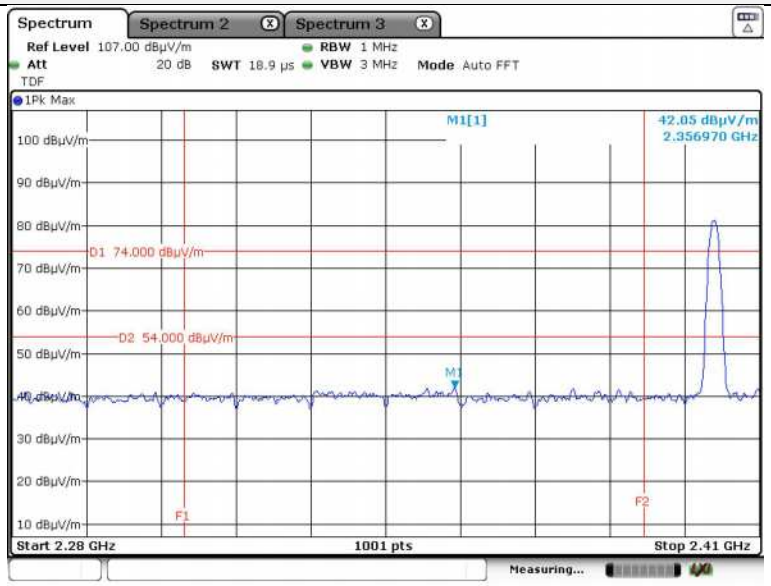
Band edge (Restricted band)

Graphical Test Data – Low Channel

Horizontal



Vertical



Tabulated Test Data – Low Channel

Freq. (MHz)	Detector Mode	Pol.	Measured Value (dBuV/m)	Duty Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Azimuth (Deg)
2 336.2	Peak	H	42.80	-	42.80	74.00	31.20	100	330
2 357.0	Peak	V	42.05	-	42.05	74.00	31.95	250	76

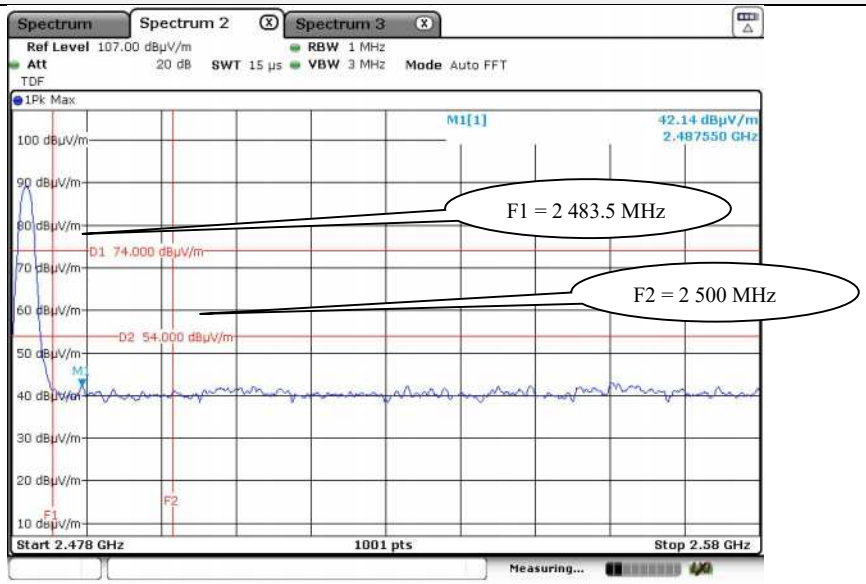
NOTE: "H" means Horizontal polarity, "V" means Vertical polarity.

Measured Value = Receiver reading + Antenna Factor + Cable Loss - Pre-amplifier Gain

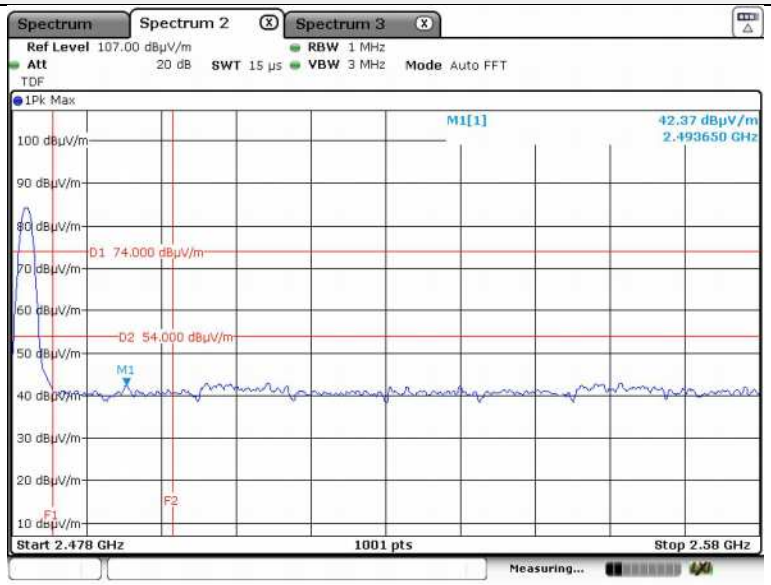
Since the peak data value did not exceed the average limit value, so it was not recorded.

Graphical Test Data – High Channel

Horizontal



Vertical



Tabulated Test Data – High Channel

Freq. (MHz)	Detector Mode	Pol.	Measured Value (dBuV/m)	Duty Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Azimuth (Deg)
2 487.6	Peak	H	42.14	-	42.14	74.00	31.86	100	339
2 493.7	Peak	V	42.37	-	42.37	74.00	31.63	250	68

5.8.6.3.2 Operating mode: Bluetooth EDR (8DPSK)

Duty Cycle

Date of Test	2022-06-17	Temperature	(23.3 ± 1.1) °C
		Relative humidity	(44.1 ± 1.1) % R.H.
Measurement Distance	3 m	Tested By	Do-heon, Kim

Detector Mode	Resolution BW	Video BW	Sweep Time
PEAK	1 MHz	3 MHz	Auto
AVERAGE	1 MHz	3 MHz	Auto

Graphical Test Data

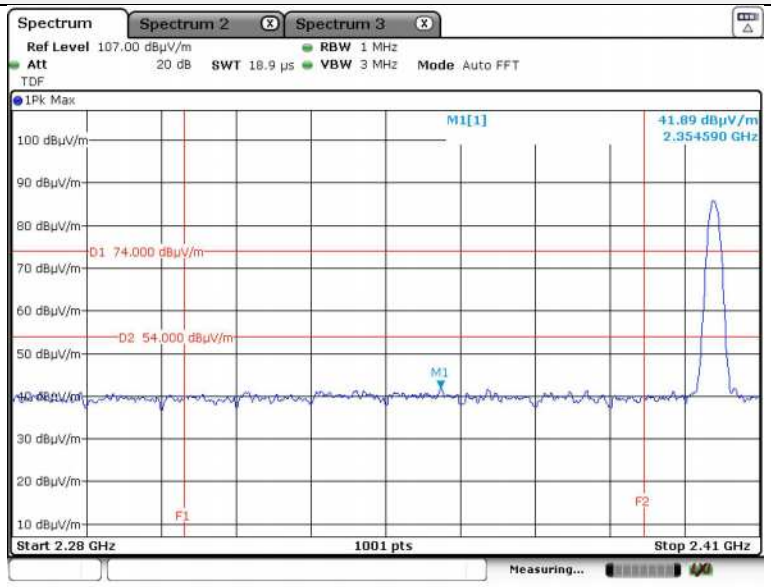
Tabulated Test Data

Operating Mode	On Time (ms)	On + Off Time (ms)	Duty Cycle (%)	Duty Factor (dB)
Bluetooth EDR (3-DH5)	2.903 0	3.755 5	77.30	1.12

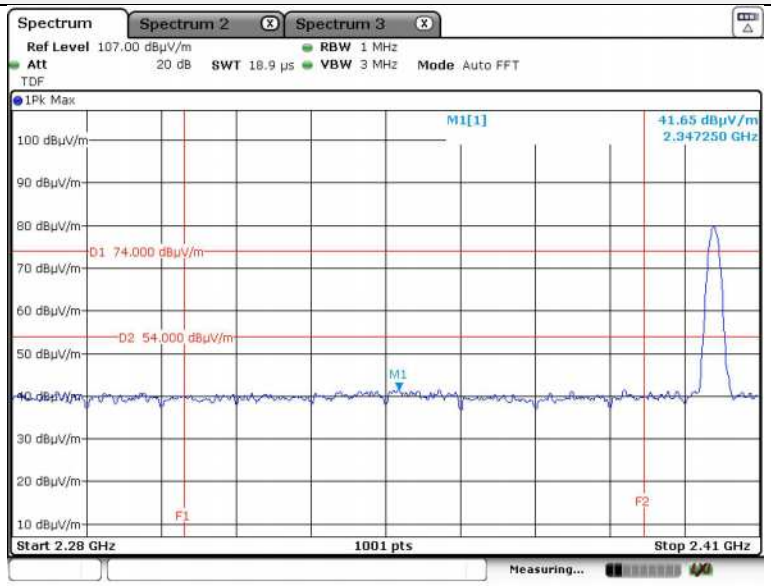
Band edge (Restricted band)

Graphical Test Data – Low Channel

Horizontal



Vertical



Tabulated Test Data – Low Channel

Freq. (MHz)	Detector Mode	Pol.	Measured Value (dBuV/m)	Duty Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Azimuth (Deg)
2 354.6	Peak	H	41.89	-	41.89	74.00	32.11	100	330
2 347.3	Peak	V	41.65	-	41.65	74.00	32.35	250	76

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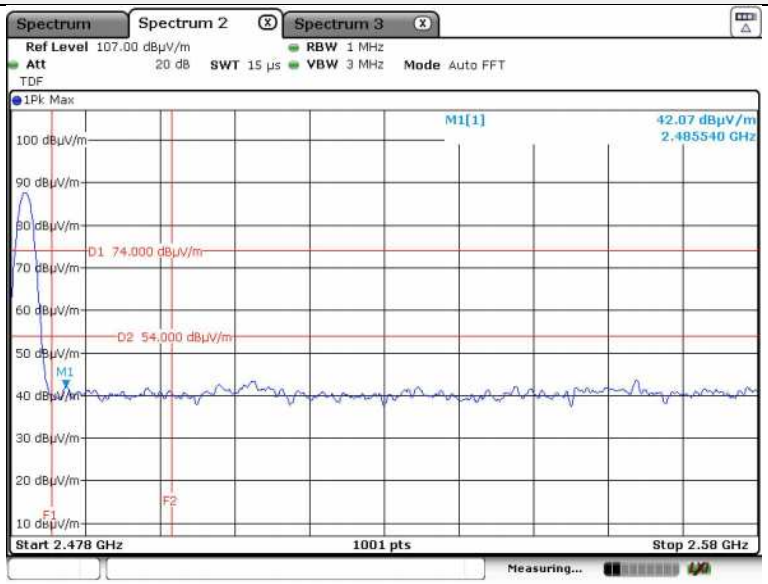
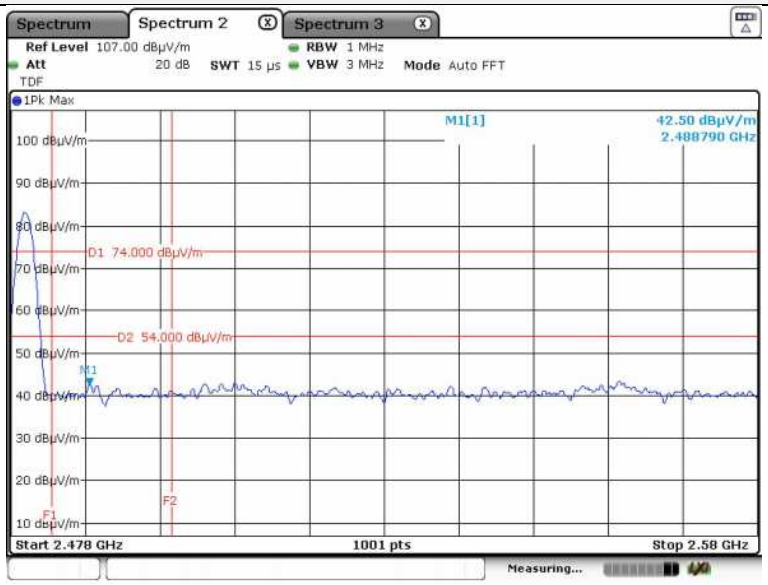
Graphical Test Data – High Channel

Horizontal



Vertical



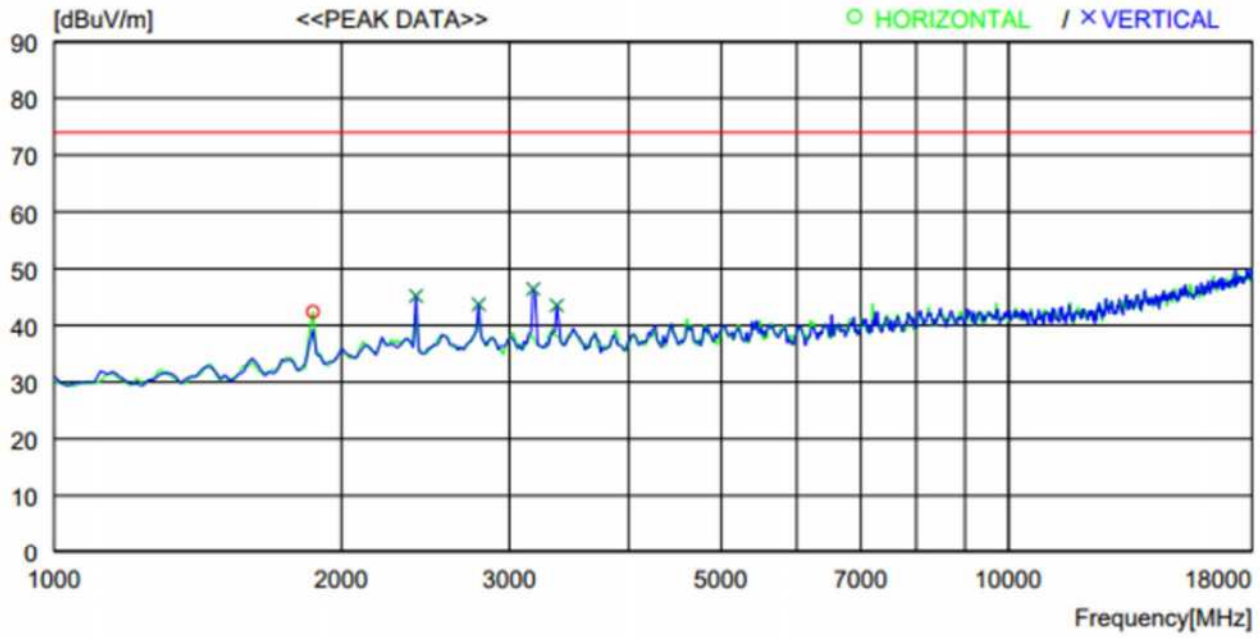
Tabulated Test Data – High Channel

Freq. (MHz)	Detector Mode	Pol.	Measured Value (dBuV/m)	Duty Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Azimuth (Deg)
2 485.5	Peak	H	42.07	-	42.07	74.00	31.93	100	339
2 488.8	Peak	V	42.50	-	42.50	74.00	31.50	250	68

5.8.6.4 Test Data for Harmonic & Spurious emission (1 GHz to 18 GHz)

5.8.6.4.1 Operating mode: Bluetooth BR (GFSK)

Graphical Test Data – Bluetooth BR Low Channel (Peak)



No.	FREQ [MHz]	READING PEAK [dBuV]	ANT FACTOR [dB]	LOSS [dB]	GAIN [dB]	RESULT [dBuV/m]	LIMIT [dBuV/m]	MARGIN [dB]	ANTENNA [cm]	TABLE [DEG]
----- Horizontal ------										
1	1867.000	50.0	27.9	4.0	39.5	42.4	74.0	31.6	100	204
----- Vertical ------										
2	2394.000	49.5	29.2	6.1	39.6	45.2	74.0	28.8	100	333
3	2785.000	46.6	30.2	6.6	39.7	43.7	74.0	30.3	100	359
4	3176.000	49.9	31.2	5.0	39.7	46.4	74.0	27.6	200	0
5	3363.000	46.4	31.7	5.2	39.8	43.5	74.0	30.5	200	0

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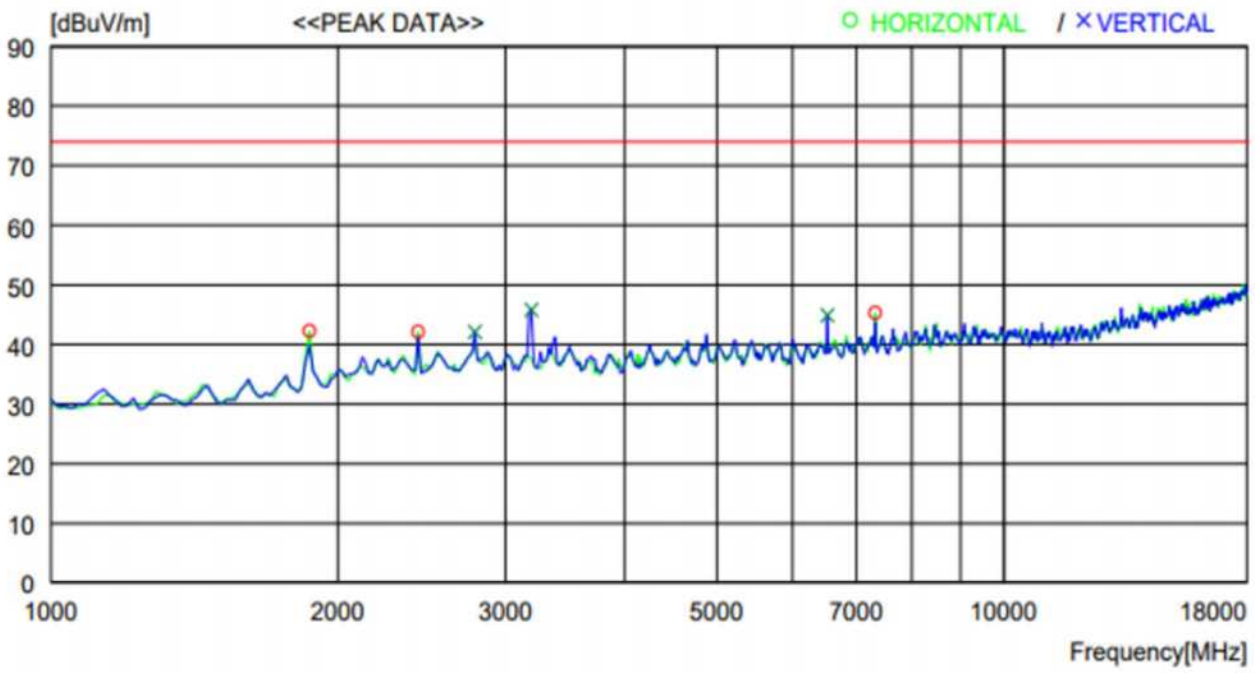
Graphical Test Data – Bluetooth BR Middle Channel (Peak)



No.	FREQ [MHz]	READING PEAK [dBuV]	ANT FACTOR [dB]	LOSS [dB]	GAIN [dB]	RESULT [dBuV/m]	LIMIT [dBuV/m]	MARGIN [dB]	ANTENNA [cm]	TABLE [DEG]
----- Horizontal ------										
1	1867.000	49.9	27.9	4.0	39.5	42.3	74.0	31.7	100	206
2	2428.000	46.4	29.2	6.1	39.6	42.1	74.0	31.9	200	51
3	7324.000	42.0	35.9	7.0	39.6	45.3	74.0	28.7	100	359
----- Vertical ------										
4	2785.000	45.0	30.2	6.6	39.7	42.1	74.0	31.9	100	359
5	3193.000	49.2	31.3	5.0	39.7	45.8	74.0	28.2	200	0
6	6525.000	42.9	35.2	6.6	39.8	44.9	74.0	29.1	200	0

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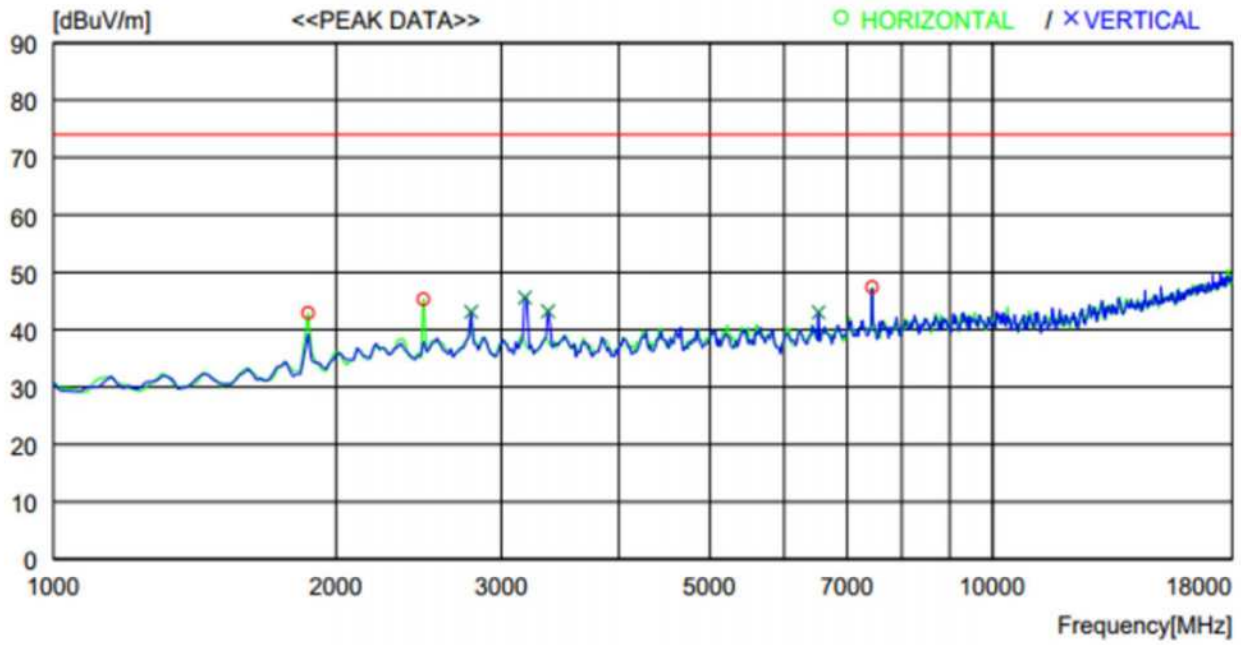
Graphical Test Data – Bluetooth BR High Channel (Peak)



No.	FREQ [MHz]	READING PEAK [dBuV]	ANT FACTOR [dB]	LOSS [dB]	GAIN [dB]	RESULT [dBuV/m]	LIMIT [dBuV/m]	MARGIN [dB]	ANTENNA [cm]	TABLE [DEG]
----- Horizontal ------										
1	1867.000	50.5	27.9	4.0	39.5	42.9	74.0	31.1	100	359
2	2479.000	49.5	29.3	6.1	39.6	45.3	74.0	28.7	200	0
3	7443.000	43.9	36.0	7.1	39.6	47.4	74.0	26.6	100	359
----- Vertical ------										
4	2785.000	46.0	30.2	6.6	39.7	43.1	74.0	30.9	200	347
5	3176.000	49.1	31.2	5.0	39.7	45.6	74.0	28.4	200	0
6	3363.000	46.1	31.7	5.2	39.8	43.2	74.0	30.8	200	15
7	6525.000	41.0	35.2	6.6	39.8	43.0	74.0	31	200	0

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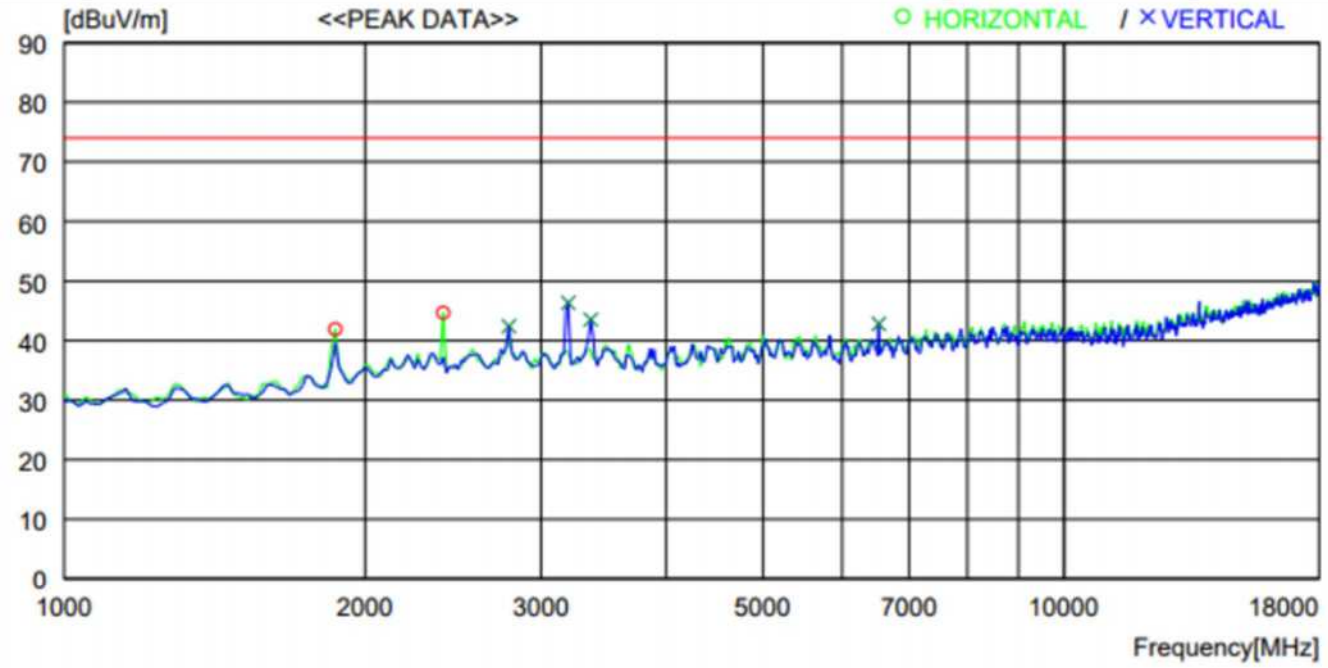
5.8.6.4.2 Operating mode: Bluetooth EDR (8DPSK)

Graphical Test Data – Bluetooth EDR Low Channel (Peak)



No.	FREQ [MHz]	READING PEAK [dBuV]	ANT FACTOR [dB]	LOSS [dB]	GAIN [dB]	RESULT [dBuV/m]	LIMIT [dBuV/m]	MARGIN [dB]	ANTENNA [cm]	TABLE [DEG]
----- Horizontal ------										
1	1867.000	49.5	27.9	4.0	39.5	41.9	74.0	32.1	100	359
2	2394.000	49.0	29.2	6.1	39.6	44.7	74.0	29.3	200	54
----- Vertical ------										
3	2785.000	45.3	30.2	6.6	39.7	42.4	74.0	31.6	200	349
4	3193.000	49.7	31.3	5.0	39.7	46.3	74.0	27.7	200	359
5	3363.000	46.4	31.7	5.2	39.8	43.5	74.0	30.5	200	21
6	6525.000	40.8	35.2	6.6	39.8	42.8	74.0	31.2	200	359

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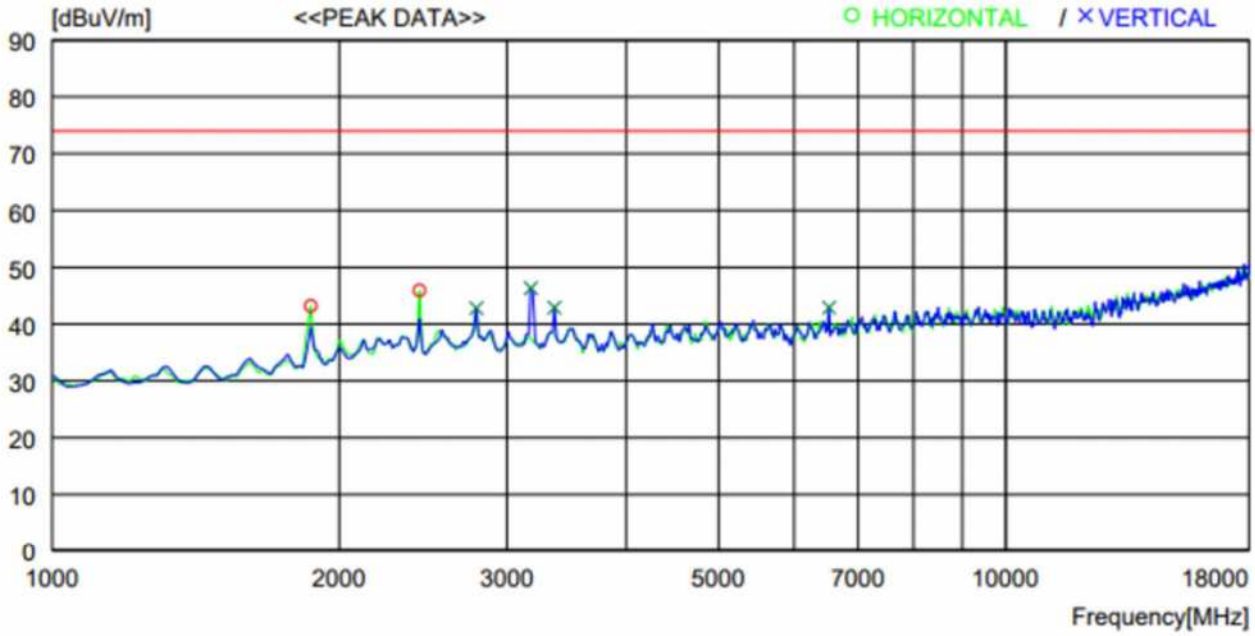
Graphical Test Data – Bluetooth EDR Middle Channel (Peak)



No.	FREQ [MHz]	READING PEAK [dBuV]	ANT FACTOR [dB]	LOSS [dB]	GAIN [dB]	RESULT [dBuV/m]	LIMIT [dBuV/m]	MARGIN [dB]	ANTENNA [cm]	TABLE [DEG]
----- Horizontal ------										
1	1867.000	50.8	27.9	4.0	39.5	43.2	74.0	30.8	100	183
2	2428.000	50.2	29.2	6.1	39.6	45.9	74.0	28.1	200	359
----- Vertical ------										
3	2785.000	45.7	30.2	6.6	39.7	42.8	74.0	31.2	200	359
4	3176.000	49.8	31.2	5.0	39.7	46.3	74.0	27.7	200	2
5	3363.000	45.8	31.7	5.2	39.8	42.9	74.0	31.1	200	359
6	6525.000	40.9	35.2	6.6	39.8	42.9	74.0	31.1	200	6

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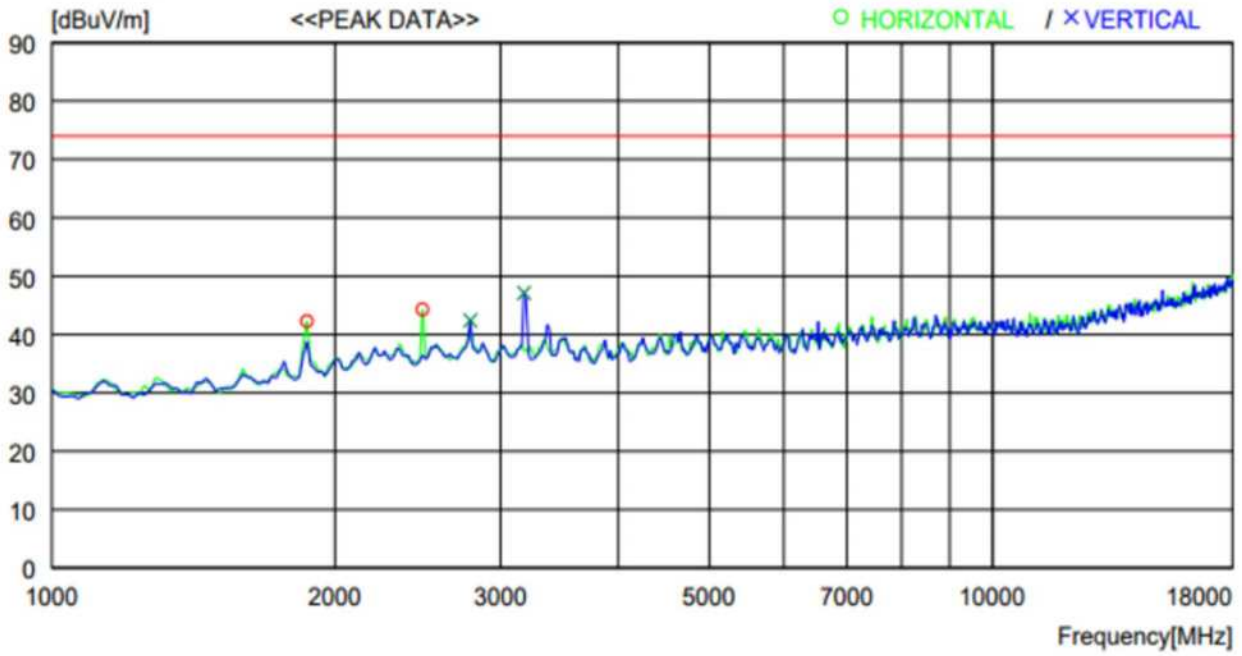
Graphical Test Data – Bluetooth EDR High Channel (Peak)



No.	FREQ [MHz]	READING PEAK [dBuV]	ANT FACTOR [dB]	LOSS [dB]	GAIN [dB]	RESULT [dBuV/m]	LIMIT [dBuV/m]	MARGIN [dB]	ANTENNA [cm]	TABLE [DEG]
----- Horizontal ------										
1	1867.000	49.9	27.9	4.0	39.5	42.3	74.0	31.7	100	0
2	2479.000	48.5	29.3	6.1	39.6	44.3	74.0	29.7	200	359
----- Vertical ------										
3	2785.000	45.3	30.2	6.6	39.7	42.4	74.0	31.6	100	354
4	3176.000	50.6	31.2	5.0	39.7	47.1	74.0	26.9	200	12

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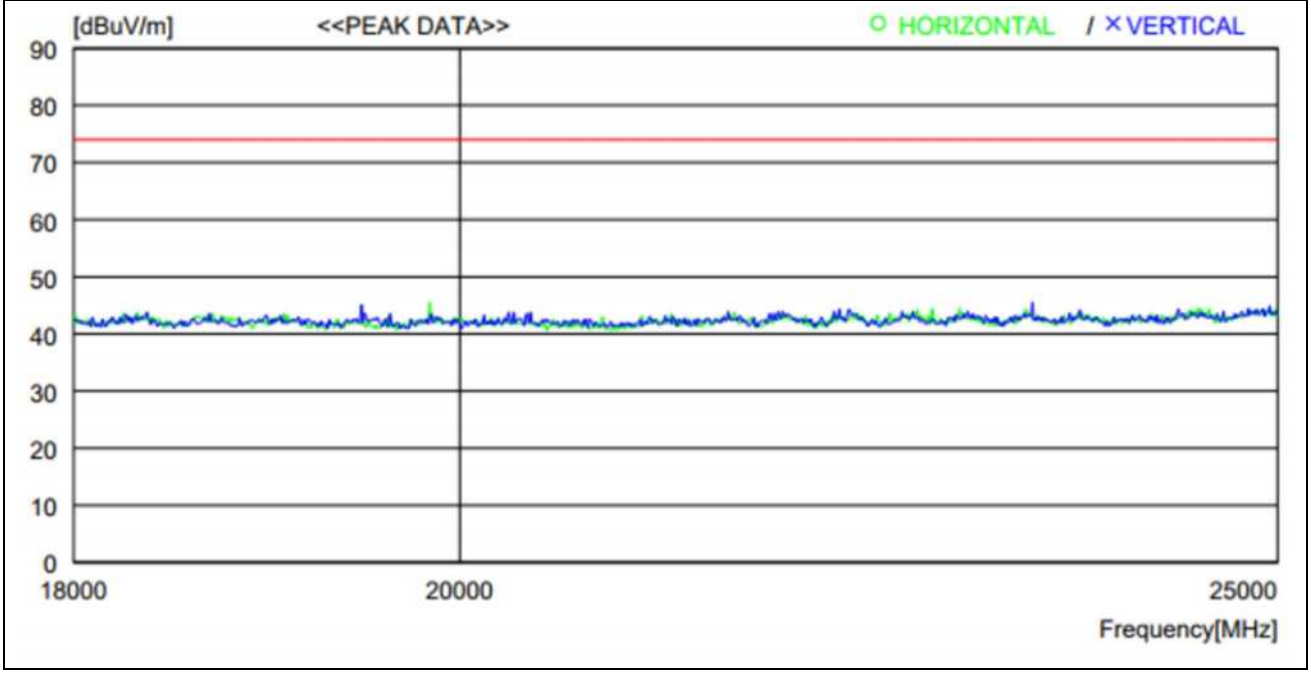
5.8.6.5 Test Data for Harmonic & Spurious emission (18 GHz to 25 GHz)

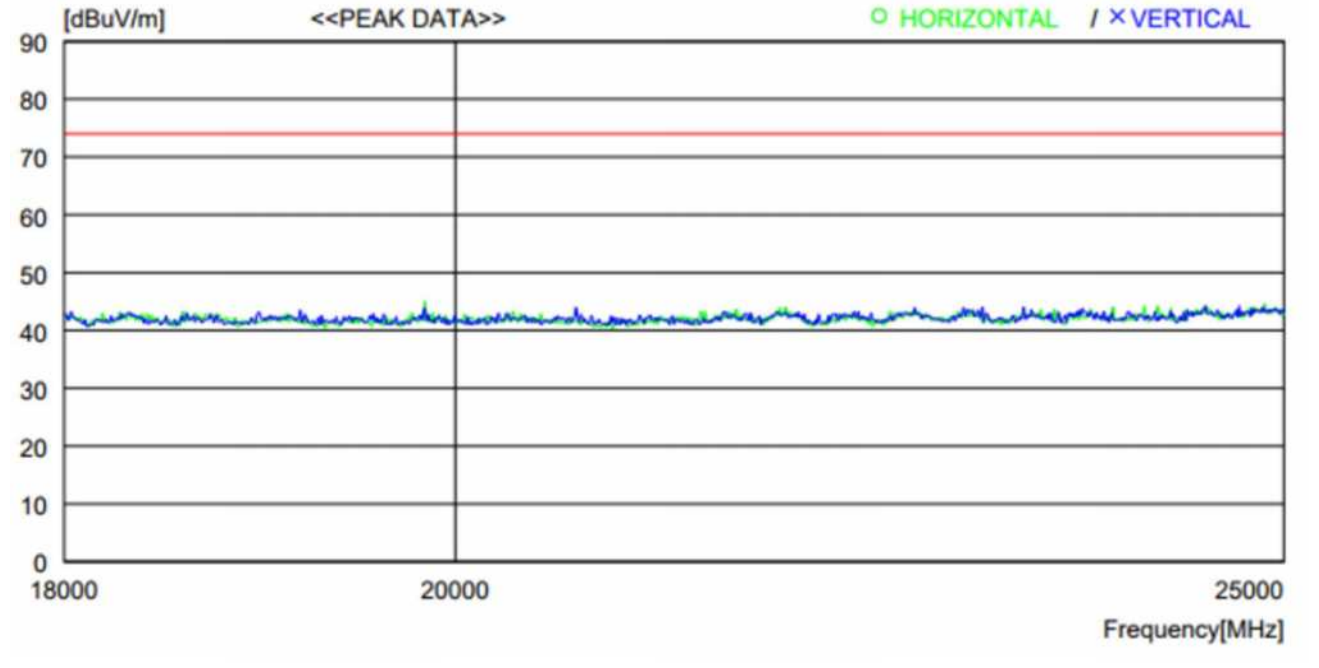
5.8.6.5.1 Operating mode: Bluetooth BR (GFSK)_Low Channel

Graphical Test Data



5.8.6.5.2 Operating mode: Bluetooth EDR (8DPSK)_Low Channel

Graphical Test Data



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Appendix I – Test Instrumentation

Description	Model No.	Serial No.	Manufacturer.	Due for Cal. Date	Cal. Interval
Signal & Spectrum Analyzer	FSW 43	100578	Rohde & Schwarz	2023-04-19	1 Y
Spectrum Analyzer	FSV 13	101243	Rohde & Schwarz	2023-01-13	1 Y
Signal Generator	SMF100A	257560	Rohde & Schwarz	2023-01-13	1 Y
Attenuator	56-10	58769	WEINSCHEL	2023-01-14	1 Y
Test Receiver	ESU 26	100303	Rohde & Schwarz	2023-01-13	1 Y
Loop Antenna	HFH2-Z2	100341	Rohde & Schwarz	2023-05-14	2 Y
DC Power Supply	6032A	SG41000637	Agilent	2023-03-10	1 Y
TRILOG Broadband Antenna	VULB9163	9163.799	Schwarzbeck	2023-09-28	2 Y
Horn Antenna	HF 907	102426	Rohde & Schwarz	2022-10-21	2 Y
Horn Antenna	BBHA 9170	BBHA 9170 #783	Schwarzbeck	2022-10-22	2 Y
Notch Filter	BRM50702	G318	MICRO-TRONICS	2022-11-01	1 Y
Attenuator	6dB	272.4110.50	Rohde & Schwarz	2023-01-13	1 Y
Pre-Amplifier	310N	344015	Sonoma Instrument	2023-01-13	1 Y
Pre-Amplifier	SCU 18D	19006450	Rohde & Schwarz	2023-04-15	1 Y
Pre-Amplifier	CBL18265035	28706	CERNEX	2023-03-07	1 Y
Turn Table	DT3000-3t	1310814	INNCO SYSTEM	-	N/A
Antenna Master	MA4000-EP	4600814	INNCO SYSTEM	-	N/A
Antenna Master	MA4000-XP-ET	-	INNCO SYSTEM	-	N/A
Camera Controller	HDCon4102	6531445048	PONTIS	-	N/A
CO3000 Controller	Co3000-4Port	CO3000/806/ 34130814/L	INNCO SYSTEM	-	N/A
CO3000 Controller	Co3000-4Port	CO3000/807/ 34130814/L	INNCO SYSTEM	-	N/A
Bluetooth Tester	TC-3000C	3000C000534	TESCOM	2023-07-15	1 Y

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