

TEST REPORT

of

FCC Part 15 Subpart C §15.247
IC RSS-247 Issue 4 and RSS-Gen Issue 6

FCC ID: A3LEIT5900
IC Certification: 649E-EIT5900

Equipment Under Test : Galaxy Smart Tag 3
Model Name : EI-T5900
Variant Model Name(s) : -
FCC Applicant : Samsung Electronics Co Ltd
IC Applicant : SAMSUNG ELECTRONICS CO. LTD.
Manufacturer : Samsung Electronics Co., Ltd.
Date of Receipt : 2026.06.17
Date of Test(s) : 2026.07.13 ~ 2026.08.13
Date of Issue : 2026.08.19

In the configuration tested, the EUT complied with the standards specified above. This test report does not assure KOLAS accreditation.

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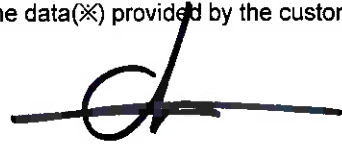
We are responsible for all the information of this test report except for the data(※) provided by the customer.

Tested by:



Finn Nam

Technical
Manager:



Jinhyoung Cho

SGS Korea Co., Ltd. Gunpo Laboratory

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1. General Information

1.1 Testing Laboratory

SGS Korea Co., Ltd. (Gunpo Laboratory)

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- Designation number: KR0150

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1.2. Details of Applicant

FCC Applicant : Samsung Electronics Co Ltd

FCC Address : 19 Chapin Rd., Building D, Pine Brook, New Jersey, United States, 07058

IC Applicant : SAMSUNG ELECTRONICS CO. LTD.

IC Address : 129 Samsung-ro, Yeongtong-gu, Suwon-Si, Gyeonggi-do, 16677, Korea (Republic Of)

Contact Person : Chun, Jenni

Phone No. : +1 973 808 6361

1.3. Details of Manufacturer

Company : Samsung Electronics Co., Ltd.

Address : 129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Republic of Korea

1.4. Description of EUT

Kind of Product	Galaxy Smart Tag3
Model Name	EI-T5900
Serial Number	Conducted: RF7L6C01CNXCIB Radiated: RF7L83100YXCIB
Power Supply	DC 3.0 V
Frequency Range	2 404 MHz ~ 2 478 MHz (Bluetooth Channel Sounding)
Modulation Technique	ASK
Number of Channels	72 channels (Bluetooth Channel Sounding)
Antenna Type	LDS Antenna
Antenna Gain*	-1.19 dBi
H/W Version	1.0
S/W Version	1.0
FVIN	N/A

1.5. Information about the FHSS characteristics:

1.5.1. Pseudorandom Frequency Hopping Sequence

The CS channel is represented by a channel hopping sequence hopping through the 72 available RF channels (out of 79 RF channels). The hopping sequence is determined by the CS Channel Map and the pseudo-random sequence generator negotiated between the Initiator and the Reflector during CS configuration. The phase and timing in the CS procedure are synchronized to the BLE Connection Anchor Point and the CS Sub-event timing. The CS procedure is divided into CS steps and sub-intervals, where each step corresponds to an RF hop frequency used for CS tones or packets. Consecutive steps correspond to different RF hop frequencies defined by the selected CS mode.

1.5.2. Equal Hopping Frequency Use

The channels of this system will be used equally over the long-term distribution of the hopsets.

1.5.3. System Receiver Input Bandwidth

Each channel bandwidth is 1 MHz.

The system receivers have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shift frequencies in synchronization with the transmitted signals.

1.5.4. Equipment Description

15.247(a) (1) that the Rx input bandwidths shift frequencies in synchronization with the transmitted signals.

15.247(g): the system is designed to comply with all of the regulations in Section 15.247 when the transmitter is presented with a continuous data (or information) system.

15.247(h): the system does not coordinate its channels selection/ hopping sequence with other frequency hopping systems for the express purpose of avoiding the simultaneous occupancy of individual hopping frequencies by multiple transmitters.

1.6. Test Equipment List

Equipment	Manufacturer	Model	S/N	Cal. Date	Cal. Interval	Cal. Due
Spectrum Analyzer	R&S	FSV30	103453	10/17/2025	Annual	10/17/2026
DC Power Supply	R&S	HMP2020	022802108	02/23/2026	Annual	02/23/2027
Attenuator	AEROFLEX / INMET	40AH2W-6	2	05/19/2026	Annual	05/19/2027
Power Sensor	R&S	NRP-Z81	100748	06/19/2026	Annual	06/19/2027
Signal Generator	R&S	SMA100B	106887	10/20/2025	Annual	10/20/2026
Spectrum Analyzer	R&S	FSW67	103242	01/26/2026	Annual	01/26/2027
Spectrum Analyzer	Agilent	N9020A	MY53421758	09/10/2025	Annual	09/10/2026
Loop Antenna	Schwarzbeck Mess-Elektronik	FMZB 1519	1519-039	10/01/2025	Biennial	10/01/2027
TRILOG BROADBAND ANTENNA	Schwarzbeck Mess-Elektronik	VULB9163	01126	03/09/2026	Biennial	03/09/2028
DOUBLE RIDGED HORN ANTENNA	R&S	HF906	100326	03/03/2026	Annual	03/03/2027
Horn Antenna	Schwarzbeck Mess-Elektronik	BBHA 9170	9170-540	12/05/2025	Annual	12/05/2026
High Pass Filter	Wainwright Instrument GmbH	WHK3.0/18G-10SS	344	06/26/2026	Annual	06/26/2027
SIGNAL CONDITIONING UNIT	R&S	SCU18F	101058	06/02/2026	Annual	06/02/2027
RF AMPLIFIER	H.P	8447F-OPT H64	2944A03909	03/31/2026	Annual	03/31/2027
Pre Amplifier	TESTEK	TK-PA1840H	130016	03/06/2026	Annual	03/06/2027
Coaxial Cable	SENSORVIEW	NMST-13A26-NMST-5 m	TPC2402190004	04/17/2026	Semi-Annual	10/17/2026
Coaxial Cable	SENSORVIEW	NMST-13A26-NMST-10 m	TPC2402190001	04/17/2026	Semi-Annual	10/17/2026
Coaxial Cable	Qualwave	QT50P-40-KK-1.5	24270074	04/10/2026	Semi-Annual	10/10/2026
Turn Table	Innco systems GmbH	DS 1200 S	N/A	N.C.R.	N/A	N.C.R.
Controller	Innco systems GmbH	CONTROLLER CO3000-4P	CO3000/963/383305 16/L	N.C.R.	N/A	N.C.R.
Antenna Mast	Innco systems GmbH	MA4640-XP-ET	MA4640/536/383305 16/L	N.C.R.	N/A	N.C.R.
Anechoic Chamber	SY Corporation	L × W × H (9.6 m × 6.4 m × 6.6 m)	N/A	N.C.R.	N/A	N.C.R.

1.7. Summary of Test Results

The EUT has been tested according to the following specifications:

APPLIED STANDARD: FCC Part15 Subpart C, ISSED RSS-247 Issue 4 and RSS-Gen Issue 6			
Section in FCC	Section in IC	Test Item(s)	Result
15.205(a) 15.209 15.247(d)	RSS-247 Issue 4 6.6 RSS-Gen Issue 6 7.4.3	Transmitter Radiated Spurious Emissions and Conducted Spurious Emission	Pass
15.247(a)(1)	RSS-247 Issue 4 6.3.1(a) RSS-Gen Issue 6 5.1	20 dB Bandwidth and 99 % Bandwidth	Pass
15.247(a)(1) 15.247(b)(1)	RSS-247 Issue 4 6.3.2	Maximum Peak Conducted Output Power	Pass
15.247(a)(1)	RSS-247 Issue 4 6.2.3.1(a)	Carrier Frequency Separation	Pass
15.247(a)(1)(iii)	RSS-247 Issue 4 6.2.3.1(b)	Number of Hopping Frequencies	Pass
15.247(a)(1)(iii)	RSS-247 Issue 4 6.2.3.1(b)	Time of Occupancy (Dwell Time)	Pass
15.207	RSS-Gen Issue 6 7.4.2	AC Power Line Conducted Emission	N/A ¹⁾

Note;

1) The AC power line test was not performed because the EUT use battery power for operation and which do not operate from the AC power lines.

1.8. Test Procedure(s)

The measurement procedures described in the American National Standard of Procedure for Compliance Testing of Unlicensed Wireless Devices (ANSI C63.10-2020 for FCC and ANSI C63.10-2020 + Cor.1-2023 + C63.10a-2024 + Errata to C63.10a-2024 for ISSED), as well as the guidance provided in KDB 558074 D01 15.247 Meas Guidance v05r02, were used in the measurement of the DUT.

All measurement procedures in the test report comply with both ANSI versions, with no effect on the test results

1.9. Sample Calculation

Where relevant, the following sample calculation is provided:

1.9.1. Conducted Test

Offset value (dB) = Attenuator (dB) + Cable loss (dB)

1.9.2. Radiation Test

Field strength level (dB μ V/m) = Measured level (dB μ V) + Antenna factor (dB/m) + Cable loss (dB) - Amplifier gain (dB)
+ Duty factor (dB)

1.10. Information of software for test and power setting

- Using the software of atmosic rf tool version 1.6.16.8 to testing of EUT.
- In this program, the power was set to 8.

1.11. Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

Parameter	Uncertainty	
Maximum Peak Conducted Output Power	0.35 dB	
99 % Bandwidth	4.95 kHz	
20 dB Bandwidth	4.57 kHz	
Conducted Spurious Emission	0.89 dB	
Time of Occupancy	0.01 ms	
Radiated Emission, 9 kHz to 30 MHz	H	3.60 dB
	V	3.60 dB
Radiated Emission, below 1 GHz	H	5.50 dB
	V	5.10 dB
Radiated Emission, above 1 GHz	H	3.50 dB
	V	3.40 dB

All measurement uncertainty values are shown with a coverage factor $k = 2$ to indicate a 95 % level of confidence.

1.12. Test Report Revision

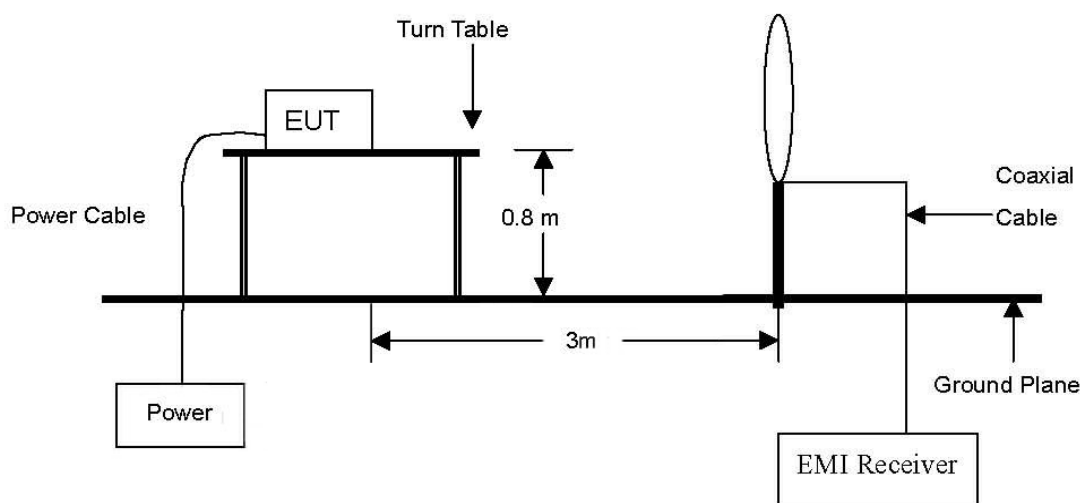
Revision	Report Number	Date of Issue	Description
0	F690501-RF-RTL007250	2026.08.19	Initial

2. Transmitter Radiated Spurious Emissions and Conducted Spurious Emissions

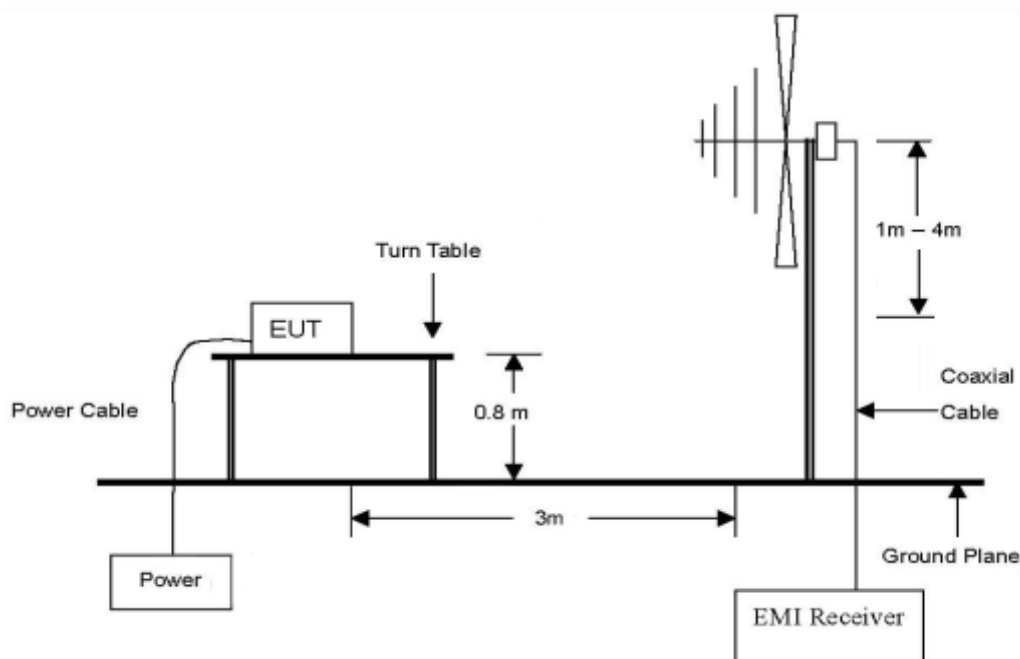
2.1. Test Setup

2.1.1. Transmitter Radiated Spurious Emissions

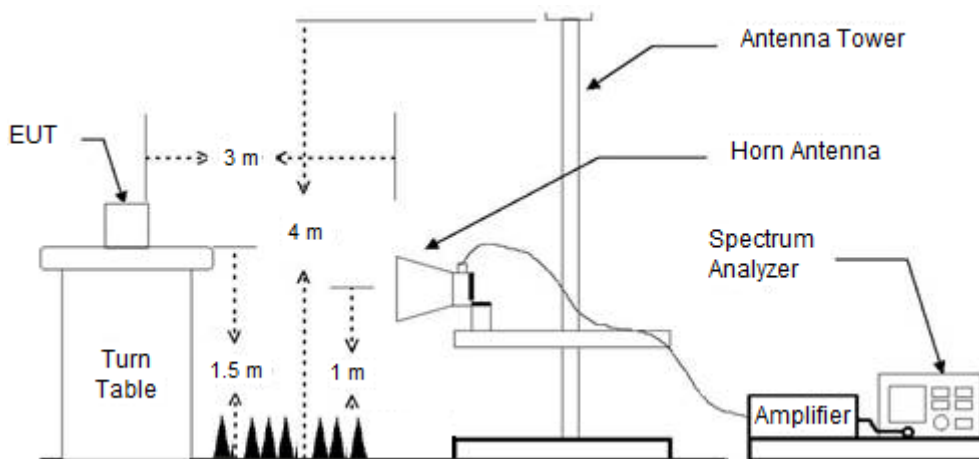
The diagram below shows the test setup that is utilized to make the measurements for emission from 9 kHz to 30 MHz.



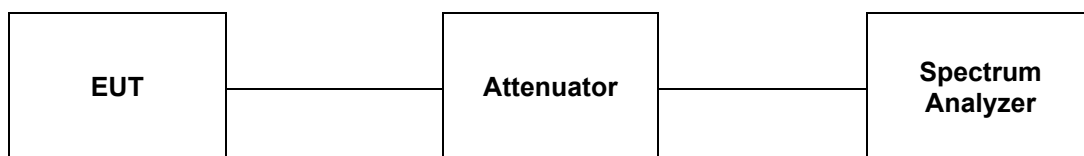
The diagram below shows the test setup that is utilized to make the measurements for emission from 30 MHz to 1 GHz.



The diagram below shows the test setup that is utilized to make the measurements for emission. The spurious emissions were investigated from 1 GHz to the 10th harmonic of the highest fundamental frequency or 40 GHz, whichever is lower.



2.1.2. Conducted Spurious Emissions



2.2. Limit

2.2.1. FCC

According to §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 fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

According to §15.209(a), except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field Strength ($\mu\text{V/m}$)	Measurement Distance (Meters)
0.009-0.490	2 400/F(kHz)	300
0.490-1.705	24 000/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

** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this part, e.g., §§15.231 and 15.241.

2.2.2. IC

According to RSS-247 Issue 4, 6.6, In any 100 kHz bandwidth outside the frequency band in which the spread spectrum device, digitally modulated device, or hybrid system is operating, the RF power that is produced 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 that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under section 6.3.2, the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength limits specified in RSS-Gen is not required.

According to RSS-Gen Issue 6, 7.4.3, The radio apparatus shall comply with the field strength limits shown in table 4 and table 5. Additionally, the level of any transmitter unwanted emission shall not exceed the level of the transmitter's fundamental emission.

Table 4 – General Field Strength Limits below 30 MHz

Frequency (MHz)	Magnetic field strength limit ⁱ (μA/m)	Measurement distance (m)
0.009 to 0.49	6.37/f (f in kHz)	300
0.49 to 1.705	63.7/f (f in kHz)	30
1.705 to 30	0.08	30
i. The more stringent limit shall apply at the transition frequency.		

Table 5 – General field strength limits at and above 30 MHz

Frequency (MHz)	Electric field strength limit ⁱ at 3m distance (μV/m)
30 to 88	100
88 to 216	150
216 to 960	200
> 960	500
i. The more stringent limit shall apply at the transition frequency.	

Note¹: The emission limits for the ranges 9-90 kHz and 110-490 kHz are based on measurements employing a linear average detector.

2.3. Test Procedures

Radiated emissions from the EUT were measured in accordance with sections 11.11 & 11.12 of ANSI C63.10-2020 (for FCC) and ANSI C63.10-2020 + Cor.1-2023 + C63.10a-2024 + Errata to C63.10a-2024 (for ISSED).

2.3.1. Test Procedures for emission below 30 MHz

1. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter anechoic chamber test site. The table was rotated 360 degrees to determine the position of the highest radiation.
2. Then antenna is a loop antenna is fixed at one meter above the ground to determine the maximum value of the field strength. Both parallel and perpendicular of the antenna are set to make the measurement.
3. For each suspected emission, the EUT was arranged to its worst case and then the table was turned from 0 degrees to 360 degrees to find the maximum reading.
4. The test-receiver system was set to average or quasi peak detect function and Specified Bandwidth with Maximum Hold Mode.

2.3.2. Test Procedures for emission from above 30 MHz

1. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter anechoic chamber test site below 1 GHz and 1.5 meter above the ground at a 3 meter anechoic chamber test site above 1 GHz. The table was rotated 360 degrees to determine the position of the highest radiation.
2. During performing radiated emission below 1 GHz, the EUT was set 3 meters away from the interference receiving antenna, which was mounted on the top of a variable-height antenna tower. During performing radiated emission above 1 GHz, the EUT was set 3 meter away from the interference-receiving antenna.
3. The antenna is a bi-log antenna, a horn antenna and its 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.
4. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the table was turned from 0 degrees to 360 degrees to find the maximum reading.
5. For measurements below 1 GHz 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.
6. For measurements Above 1 GHz resolution bandwidth is set to 1 MHz, the video bandwidth is set to 3 MHz for peak measurements.

2.3.3. Test Procedures for Average measurements

Radiated emissions for average measurements were according to section 7.8.8.2 of ANSI C63.10-2020 (for FCC) and ANSI C63.10-2020 + Cor.1-2023 + C63.10a-2024 + Errata to C63.10a-2024 (for ISSED)

Where average measurements of an emission are required it is permitted to determine the average value over 100 ms after accounting for the maximum dwell time per 1 MHz in any 100 ms period. The dwell time in any 100 ms period can include multiple hops on that frequency for devices which have a short dwell time.

The maximum dwell time per 1 MHz does need to account for cases where the channel spacing is less than the 1 MHz measurement bandwidth and for cases where the occupied bandwidth exceeds the channel spacing and the channels overlap. The maximum dwell time per 1 MHz is determined as follows:

Maximum dwell time per 1 MHz = dwell time per 100 ms per channel × (channel separation correction + overlapping channel correction) where:

- Channel separation correction = $[1 / \text{channel separation (MHz)}]$ for channel separation < 1 MHz, and = 1 for channel separation ≥ 1 MHz, as determined using the procedures of 7.8.2. If the average measurements are performed on the Nth harmonic, the channel separation value is N times the separation at the fundamental frequency.
- Overlapping channel correction = 0 when the 20 dB channel bandwidth < channel separation and 1 for when the 20 dB channel bandwidth > channel separation.

The average value may be determined as follows:

- a) From the peak value of the emission: The measured peak value in dBμV/m is corrected by $20 \log(\text{maximum dwell time in 100 ms} / 100)$.
- b) From the average value of the emission: When the average value has been measured with the device continuously transmitting (100% duty cycle) the measured average value in dBμV/m is corrected by $X \log(\text{maximum dwell time in 100 ms} / 100)$ where X = 10 if using an rms-average power detector (with output data in power terms) and X = 20 if using a linear voltage average detector (with output data in voltage terms).

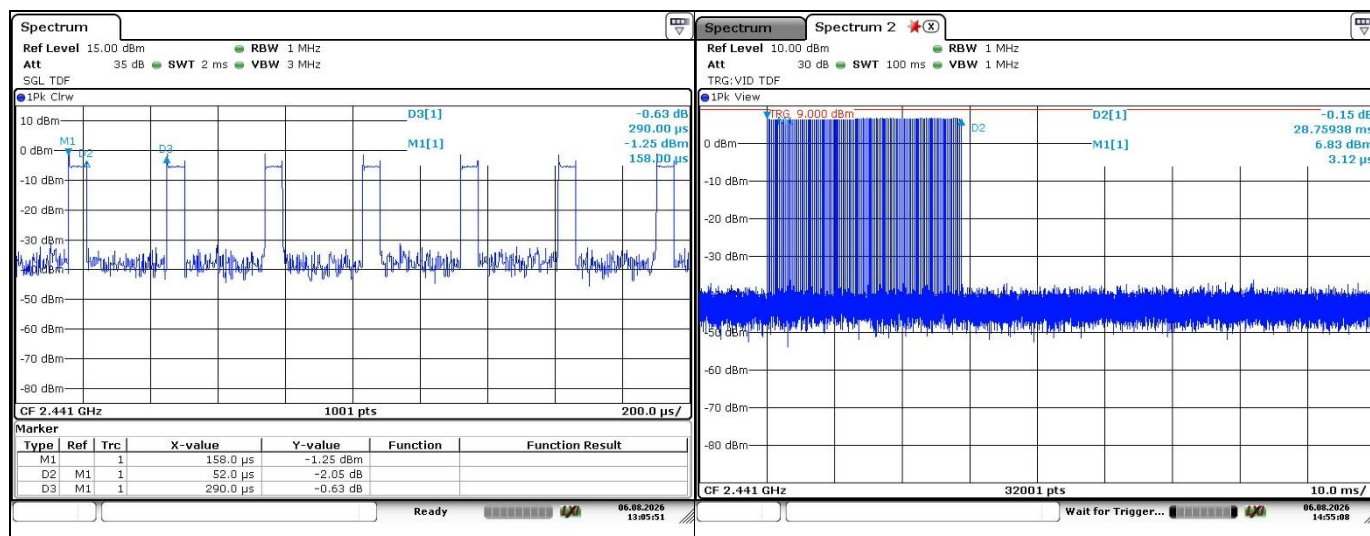
When the average value has been measured with the device operating with a duty cycle, equivalent to the maximum dwell time the measured average value is used. The averaging period shall be set to 100 ms. When measuring the average value using rms or voltage average detectors the resolution bandwidth is set according to the frequency of measurement (e.g., 1 MHz for measurements above 1 GHz – refer to 4.1.5.2.2), the video bandwidth is set to at least 3 times the resolution bandwidth and the measurement time is set to 100 ms. When the device is transmitting continuously or the period of the duty cycle is $\ll 100$ ms the measurement time can be reduced to enable faster measurements but should always be equal to or greater than the period of the duty cycle and at least ten times the symbol rate to ensure averaging over multiple symbols. When using a spectrum analyser the measurement time is the sweep time divided by the number of display points, or if using trace averaging, the number of sweeps multiplied by the number of points divided by the sweep time. Refer also to 4.1.3 for additional considerations related to setting reference level, average detection modes and bin size.

When using the reduced video bandwidth method to make an average measurement the resolution and video bandwidths shall be set as detailed in 4.1.5.2.3.

Application of a correction factor based on the dwell time per 1 MHz per 100 ms is based on current regulatory guidance but can be modified or removed in a future addition of guidance on testing FHSS. In this case the duty cycle factor to be applied would be the overall transmit duty cycle and not the duty cycle per channel

on time on Channel

dwelt time per 100 ms per channel



Radiated average emissions above 1 GHz were measured using an RMS detector with a resolution bandwidth (RBW) of 1 MHz and a video bandwidth (VBW) of 3 MHz while the EUT was operating in continuous transmission mode (100% duty cycle).

In accordance with ANSI C63.10 Section 7.8.8.2, the measured RMS average values were corrected by applying a Duty Cycle Correction Factor (DCCF) based on the maximum dwell time and internal pulse parameters within a 100 ms period under normal operating conditions.

$$T_{on} = 52 \mu s$$

$$T_{on+off} = 290 \mu s$$

$$\text{Duty cycle (\%)} = T_{on} / T_{on+off} = 17.93 \%$$

$$\text{Dwell time per 100 ms: } 28.759 \text{ ms} \times 0.1793 = 5.157 \text{ ms}$$

Duty Cycle Correction Factor (DCCF) Calculation:

$$10 \times \log (5.157 \text{ ms} / 100 \text{ ms}) = -12.88 \text{ dB}$$

2.3.4. Test Procedures for Conducted Spurious Emissions

2.3.4.1. Band-edge Compliance of RF Conducted Emissions

The transmitter output was connected to the spectrum analyzer.

Span = wide enough to capture the peak level of the emission operating on the channel closest to the band edge, as well as any modulation products which fall outside of the authorized band of operation.

RBW $\geq$ 100 kHz

VBW = 300 kHz

Sweep = auto

Detector function = peak

Trace = max hold

2.3.4.2. Spurious RF Conducted Emissions

The transmitter output was connected to the spectrum analyzer.

RBW = 1 MHz

VBW = 3 MHz

Sweep = auto

Detector function = peak

Trace = max hold

2.3.4.3. TDF function

- For plots showing conducted spurious emissions from 9 kHz to 25 GHz, all path loss of wide frequency range was investigated and compensated to spectrum analyzer as TDF function.

So, the reading values shown in plots were final result.

2.4. Test Results

Ambient temperature : $(23 \pm 1) ^\circ\text{C}$
 Relative humidity : 47 %

2.4.1. Radiated Spurious Emission below 1 000 MHz

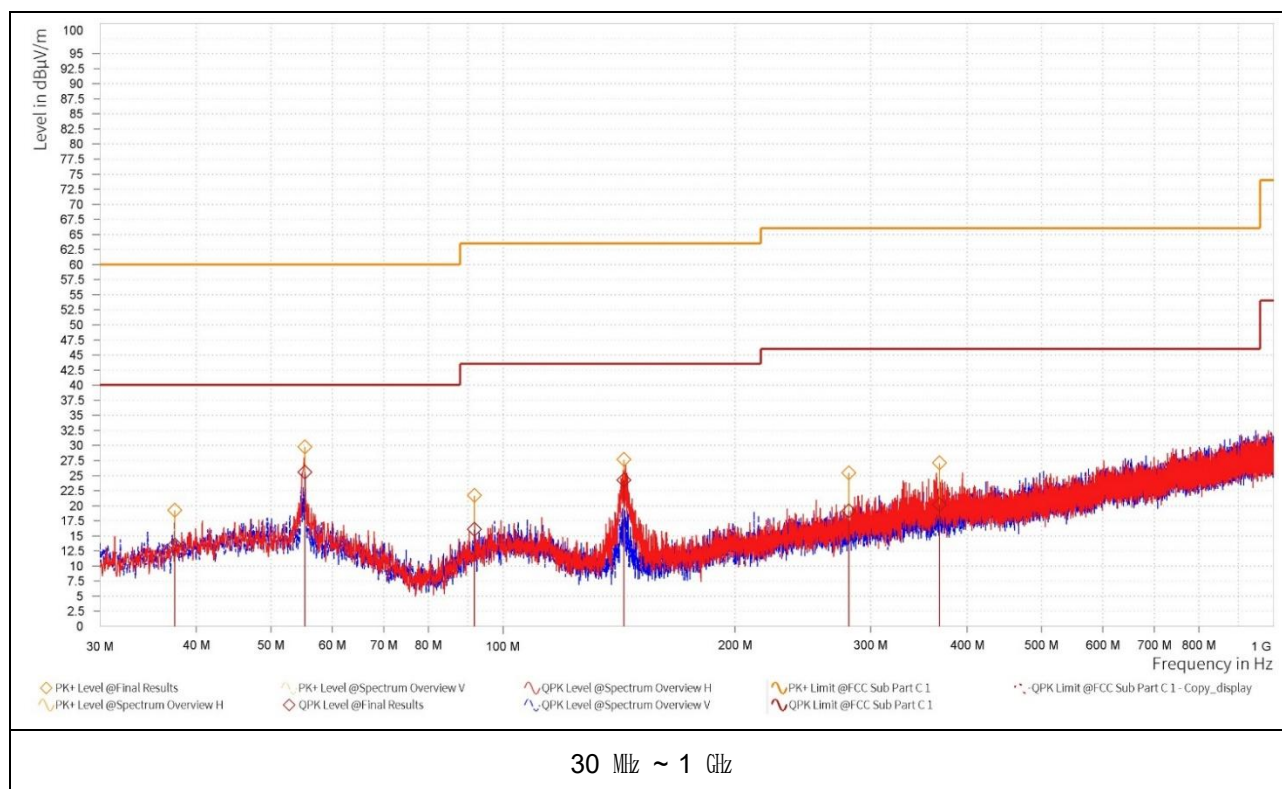
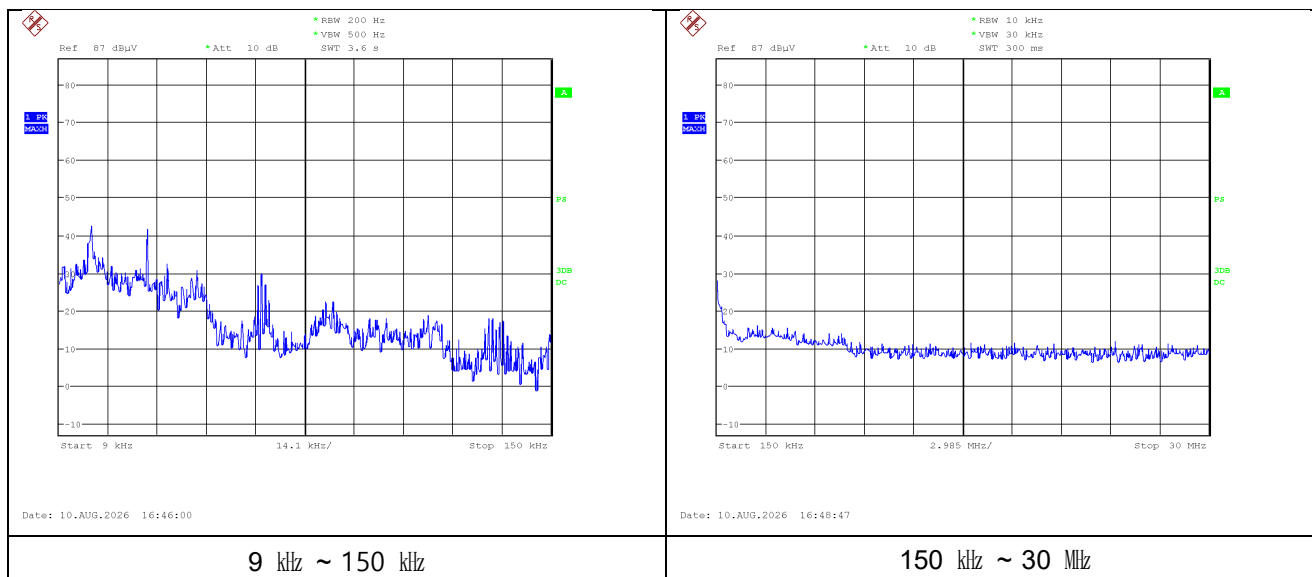
The frequency spectrum from 9 kHz to 1 000 MHz was investigated.

Radiated Emissions			Ant.	Correction Factors (dB/m)	Total	Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.		Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
55.33	33.36	Quasi Peak	H	-7.81	25.55	40.00	14.45
143.49	36.33	Quasi Peak	H	-12.10	24.23	43.50	19.27
Above 200.00	Not detected	-	-	-	-	-	-

Remark;

1. Spurious emissions for all channels and modes were investigated and almost the same below 1 GHz.
2. Test from 30 MHz to 1 000 MHz was performed using the software of ELEKTRA(V5.02) from Rohde & Schwarz GmbH & Co. KG.
3. Reported spurious emissions are in **High channel** as worst case among other modes and channels.
4. Radiated spurious emission measurement as below.
 (Actual = Reading + Correction)
 (Correction = Antenna Factor + AMP Factor + Cable Loss)
5. According to §15.31(o), emission levels are not report much lower than the limits by over 20 dB.

- Test plots



2.4.2. Radiated Spurious Emission above 1 000 MHz

The frequency spectrum above 1 000 MHz was investigated. All reading values are peak and average values.

Operating Mode: ASK

A. Low Channel (2 404 MHz)

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (MHz)	Reading (dBμV)	Detect Mode	Pol.	AF (dB/m)	CL (dB)	DF (dB)	Actual (dBμV/m)	Limit (dBμV/m)	Margin (dB)
*2 310.00	18.32	Peak	H	28.06	7.32	-	53.70	74.00	20.30
*2 310.00	8.10	Average	H	28.06	7.32	-12.88	30.60	54.00	23.40
*2 388.06	26.01	Peak	H	28.22	7.59	-	61.82	74.00	12.18
*2 388.49	8.34	Average	H	28.22	7.60	-12.88	31.28	54.00	22.72
*2 390.00	23.14	Peak	H	28.22	7.60	-	58.96	74.00	15.04
*2 390.00	8.10	Average	H	28.22	7.60	-12.88	31.04	54.00	22.96

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (MHz)	Reading (dBμV)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	DF (dB)	Actual (dBμV/m)	Limit (dBμV/m)	Margin (dB)
*4 807.90	44.57	Peak	H	33.02	-28.89	-	51.07	74.00	22.93
7 211.98	50.13	Peak	V	36.24	-28.23	-	58.88	74.00	15.12
9 615.99	52.23	Peak	H	36.24	-28.23	-	60.24	74.00	13.76
*12 020.10	39.02	Peak	H	37.52	-23.77	-	66.71	74.00	7.29
*12 020.30	21.34	Average	H	38.60	-20.04	-12.88	25.78	54.00	28.22
Above 12 100.00	Not detected	-	-	-	-	-	-	-	-

B. Middle Channel (2 440 MHz)

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (MHz)	Reading (dBμV)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	DF (dB)	Actual (dBμV/m)	Limit (dBμV/m)	Margin (dB)
*4 880.40	46.94	Peak	H	33.02	-28.89	-	51.07	74.00	22.93
*7 319.98	50.87	Peak	V	36.24	-28.23	-	58.88	74.00	15.12
*7 320.08	30.55	Average	V	36.24	-28.23	-12.88	25.68	54.00	28.32
9 759.89	52.96	Peak	H	37.52	-23.77	-	66.71	74.00	7.29
*12 200.00	41.08	Peak	H	38.60	-20.04	-	59.64	74.00	14.36
*12 200.32	22.03	Average	H	38.60	-20.04	-12.88	27.71	54.00	26.29
Above 12 300.00	Not detected	-	-	-	-	-	-	-	-

C. High Channel (2 478 MHz)

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (MHz)	Reading (dBμV)	Detect Mode	Pol.	AF (dB/m)	CL (dB)	DF (dB)	Actual (dBμV/m)	Limit (dBμV/m)	Margin (dB)
*2 483.50	30.39	Peak	H	28.40	7.61	-	66.40	74.00	7.60
*2 483.50	8.71	Average	H	28.40	7.61	-12.88	31.84	54.00	22.16
*2 483.56	30.45	Peak	H	28.40	7.61	-	66.46	74.00	7.54
*2 483.56	8.62	Average	H	28.40	7.61	-12.88	31.75	54.00	22.25
*2 500.00	19.00	Peak	H	28.50	7.69	-	55.19	74.00	18.81
*2 500.00	8.26	Average	H	28.50	7.69	-12.88	31.57	54.00	22.43

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (MHz)	Reading (dBμV)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	DF (dB)	Actual (dBμV/m)	Limit (dBμV/m)	Margin (dB)
*4 956.07	49.13	Peak	H	33.21	-29.11	-	53.23	74.00	20.77
*7 433.93	52.34	Peak	V	36.23	-29.64	-	58.93	74.00	15.07
*7 434.08	31.01	Average	V	36.23	-29.64	-12.88	24.72	54.00	29.28
9 911.98	52.26	Peak	H	37.62	-22.03	-	67.85	74.00	6.15
*12 389.97	39.79	Peak	H	38.60	-21.16	-	57.23	74.00	16.77
*12 390.07	22.12	Average	H	38.60	-21.16	-12.88	26.68	54.00	27.32
Above 12 400.00	Not detected	-	-	-	-	-	-	-	-

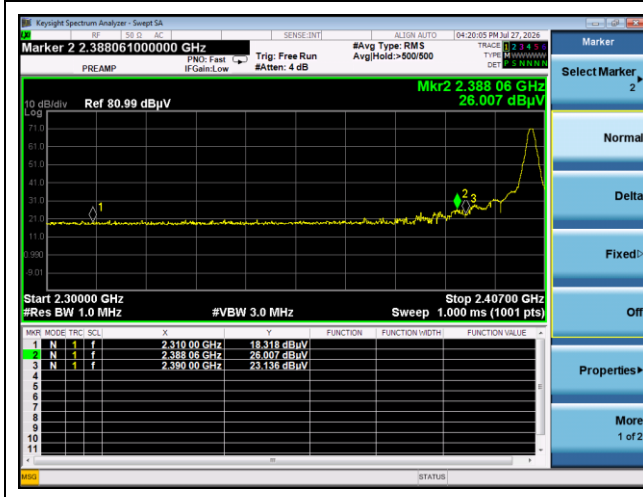
Remark;

1. "*" means the restricted band.
2. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
3. Radiated emissions measured in frequency above 1 000 MHz were made with an instrument using peak/average detector mode.
4. Actual = Reading + AF + CL + (DF) or Reading + AF + AMP + CL + (DF).
5. According to § 15.31(o), emission levels are not reported much lower than the limits by over 20 dB.
6. The maximized peak measured value complies with the average limit, to perform an average measurement is unnecessary.

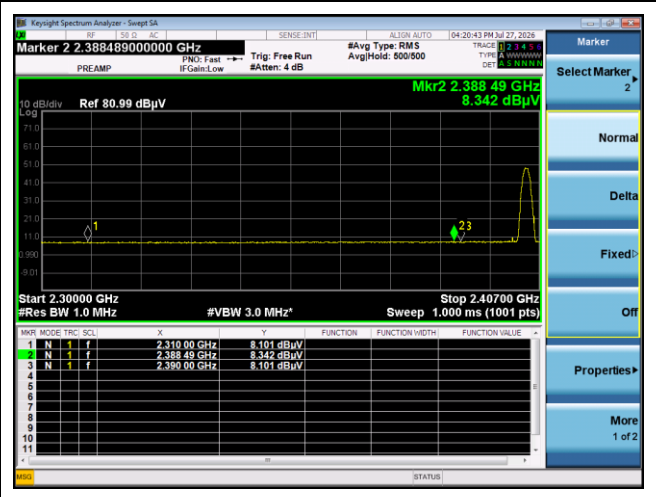
- Test plots

Mode: ASK

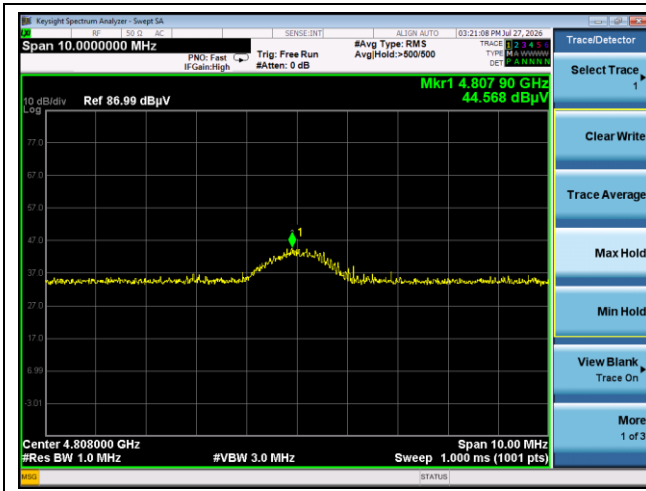
Low channel band edge (Peak)



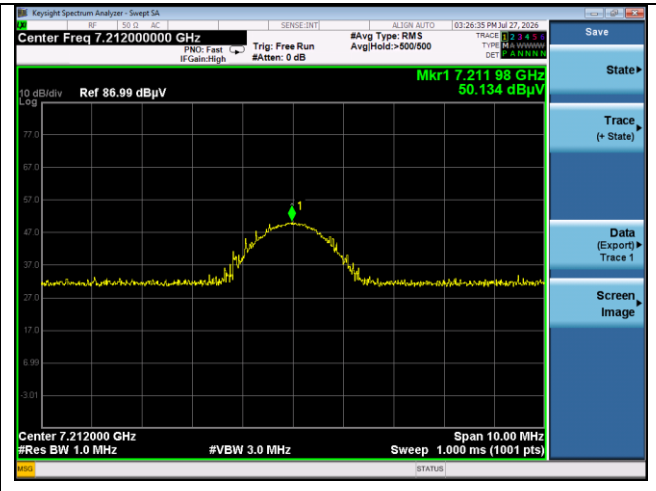
Low channel band edge (Average)



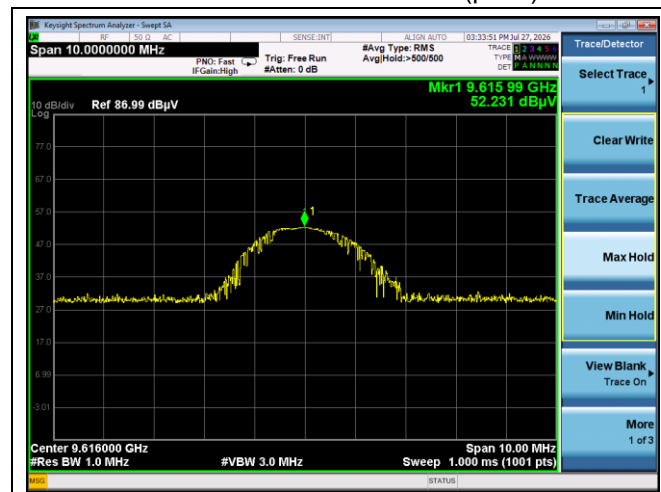
Low channel 2nd Harmonic (peak)



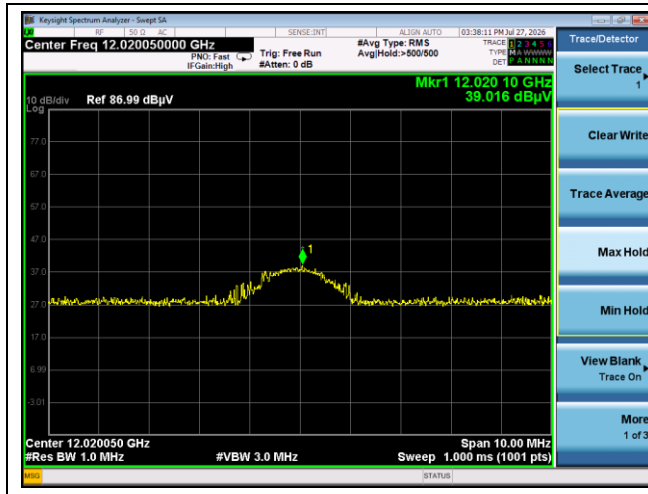
Low channel 3rd Harmonic (peak)



Low channel 4th Harmonic (peak)



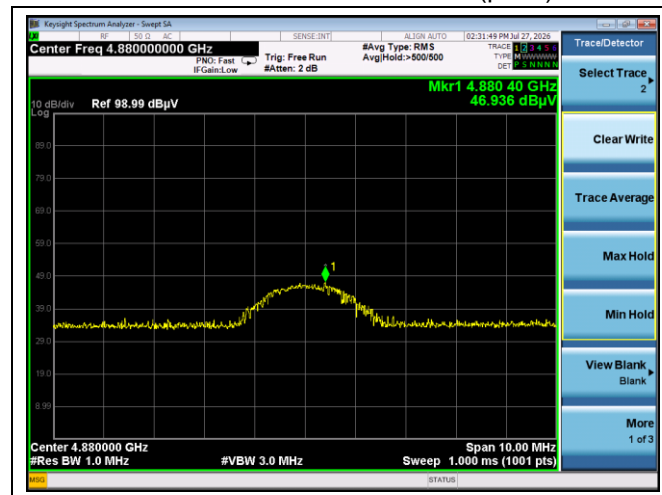
Low channel 5th Harmonic (peak)



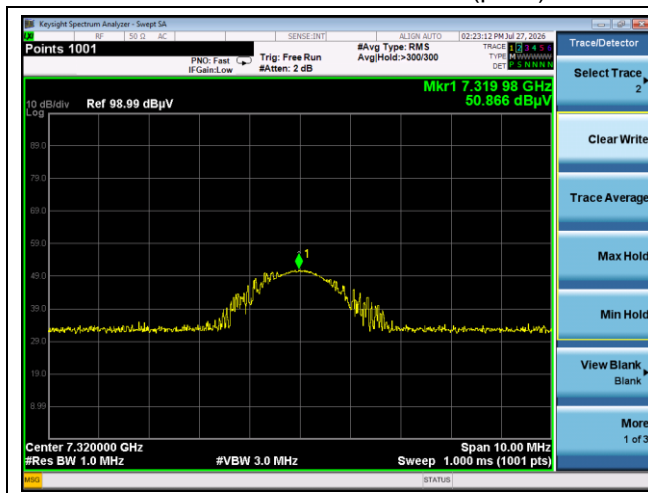
Low channel 5th Harmonic (Average)



Middle channel 2nd Harmonic (peak)



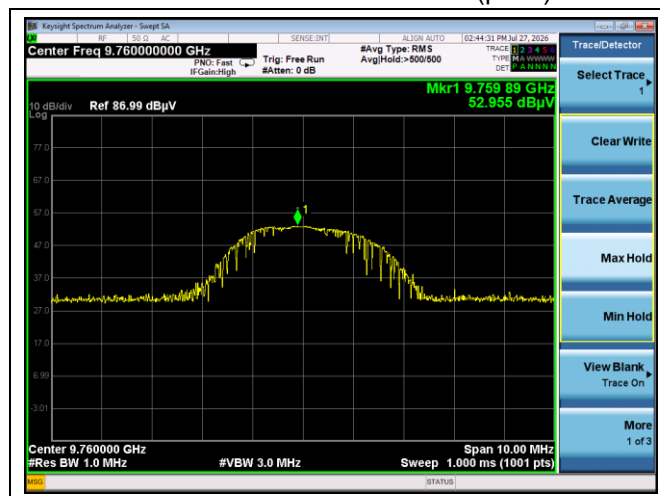
Middle channel 3rd Harmonic (peak)



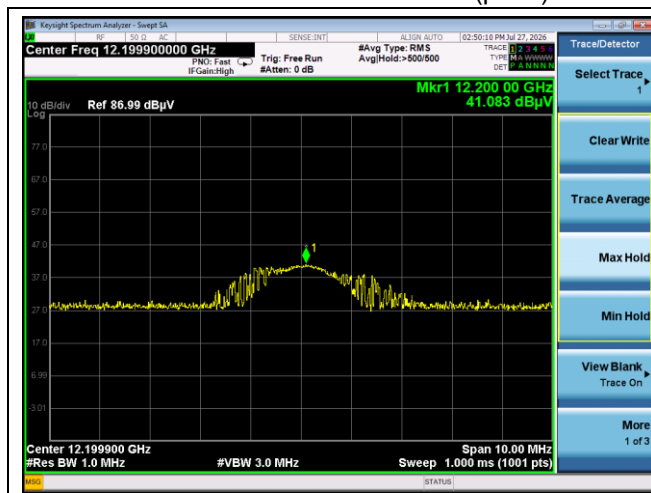
Middle channel 3rd Harmonic (Average)



Middle channel 4th Harmonic (peak)



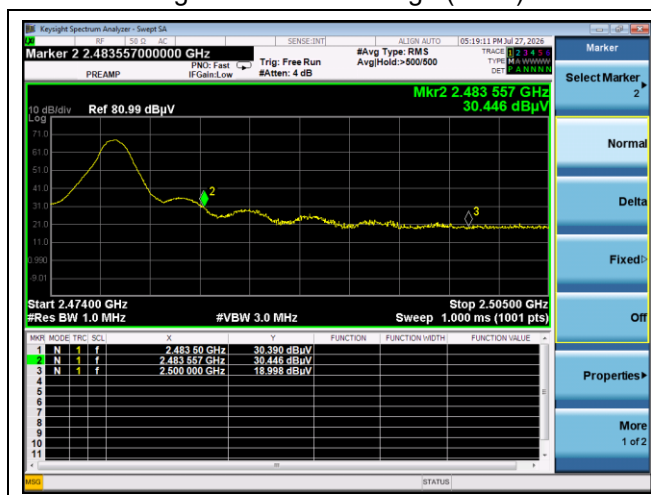
Middle channel 5th Harmonic (peak)



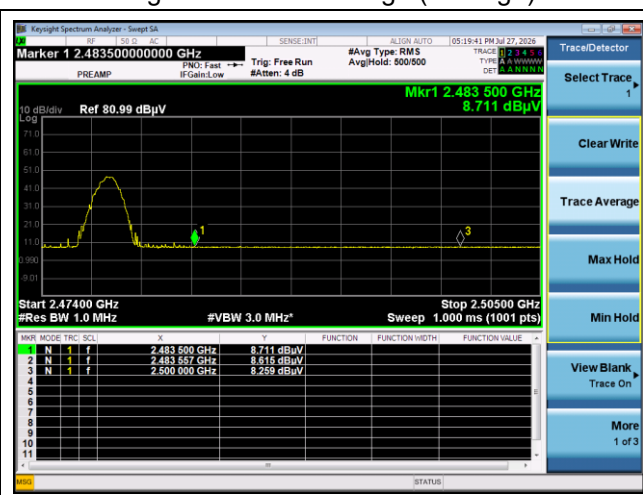
Middle channel 5th Harmonic (Average)



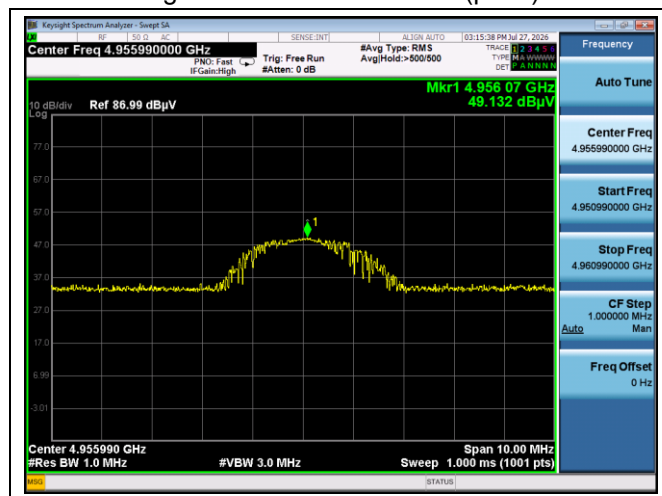
High channel band edge (Peak)



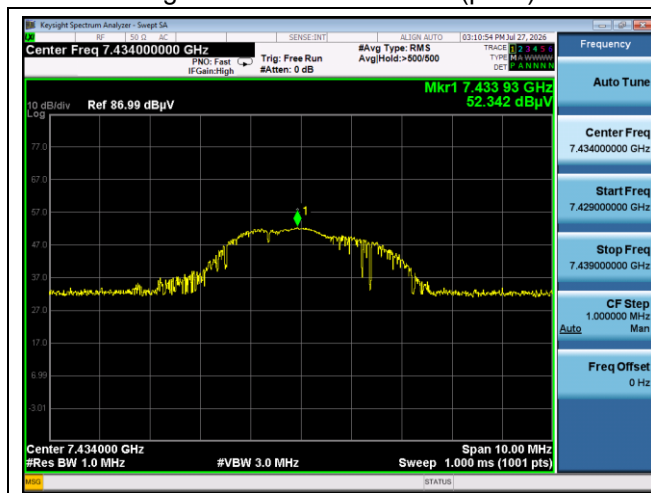
High channel band edge (Average)



High channel 2nd Harmonic (peak)



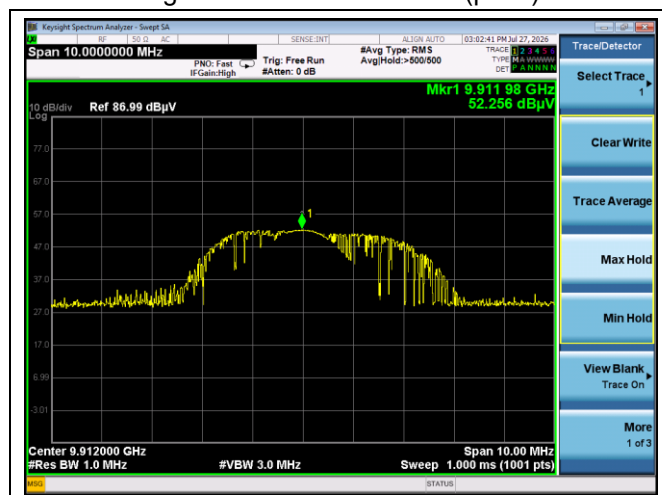
High channel 3rd Harmonic (peak)



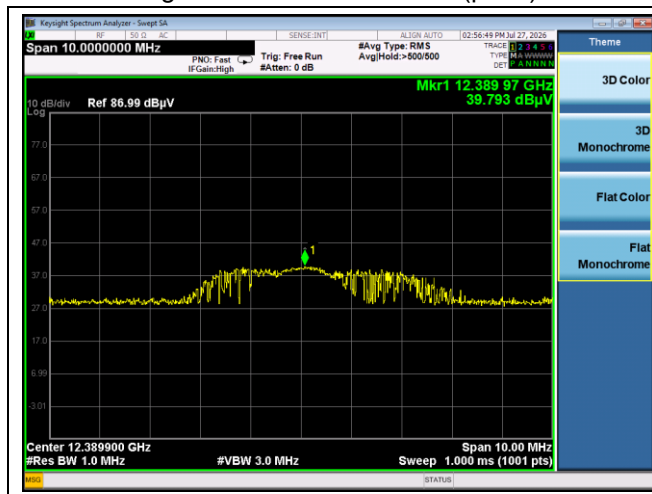
High channel 3rd Harmonic (Average)



High channel 4th Harmonic (peak)



High channel 5th Harmonic (peak)



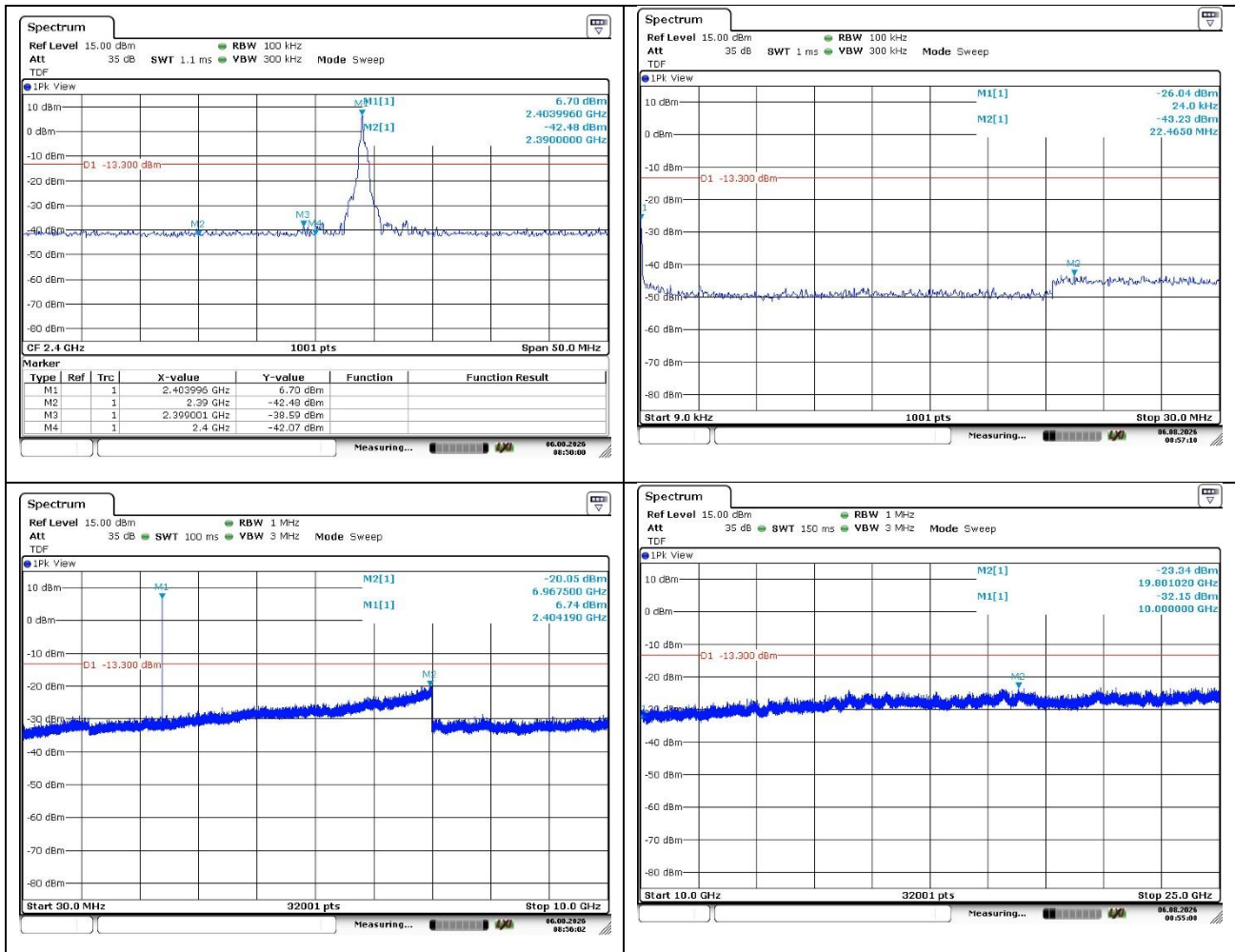
High channel 5th Harmonic (Average)



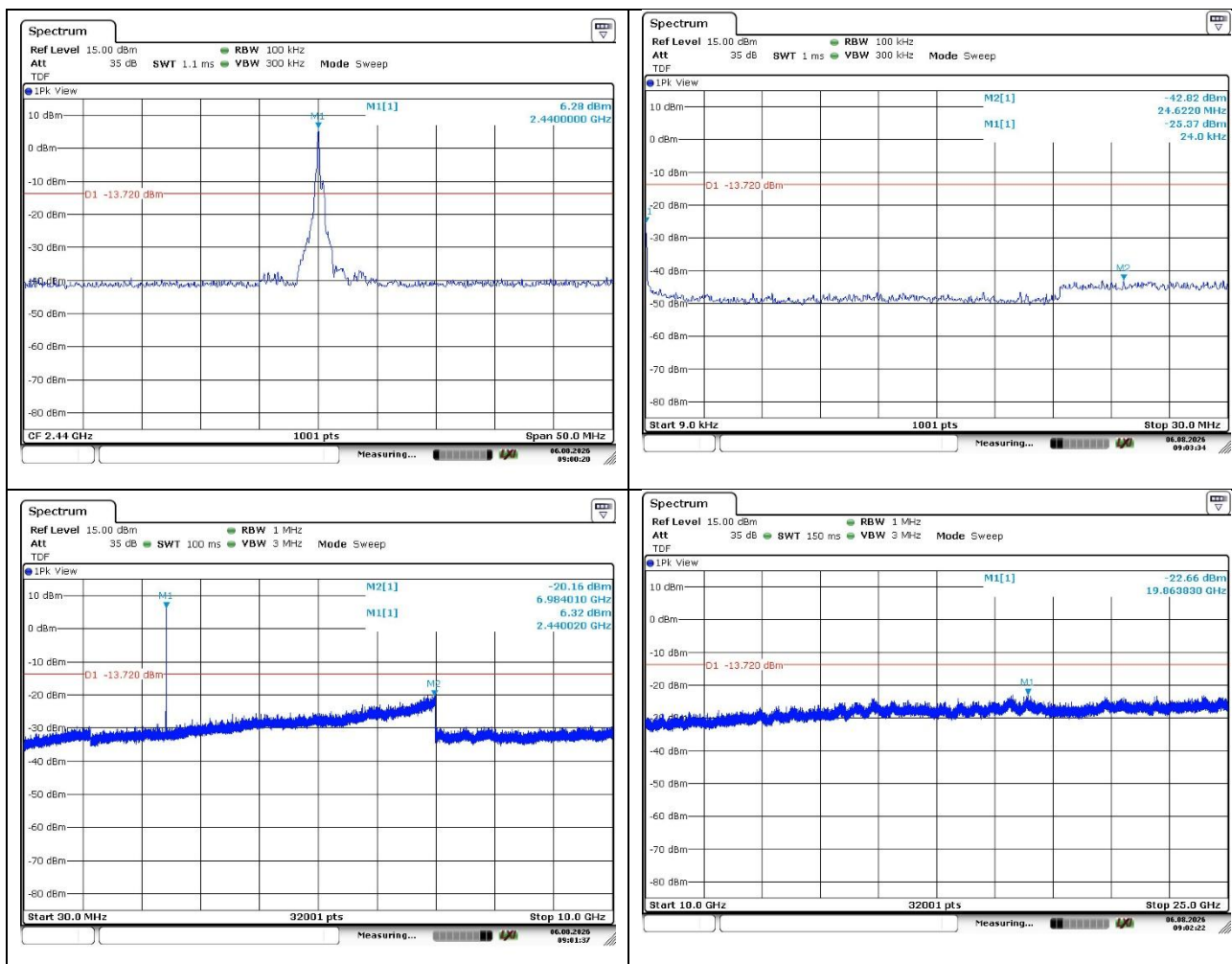
2.4.3. Plot of Conducted Spurious Emissions

Mode: ASK_hopping function turned off

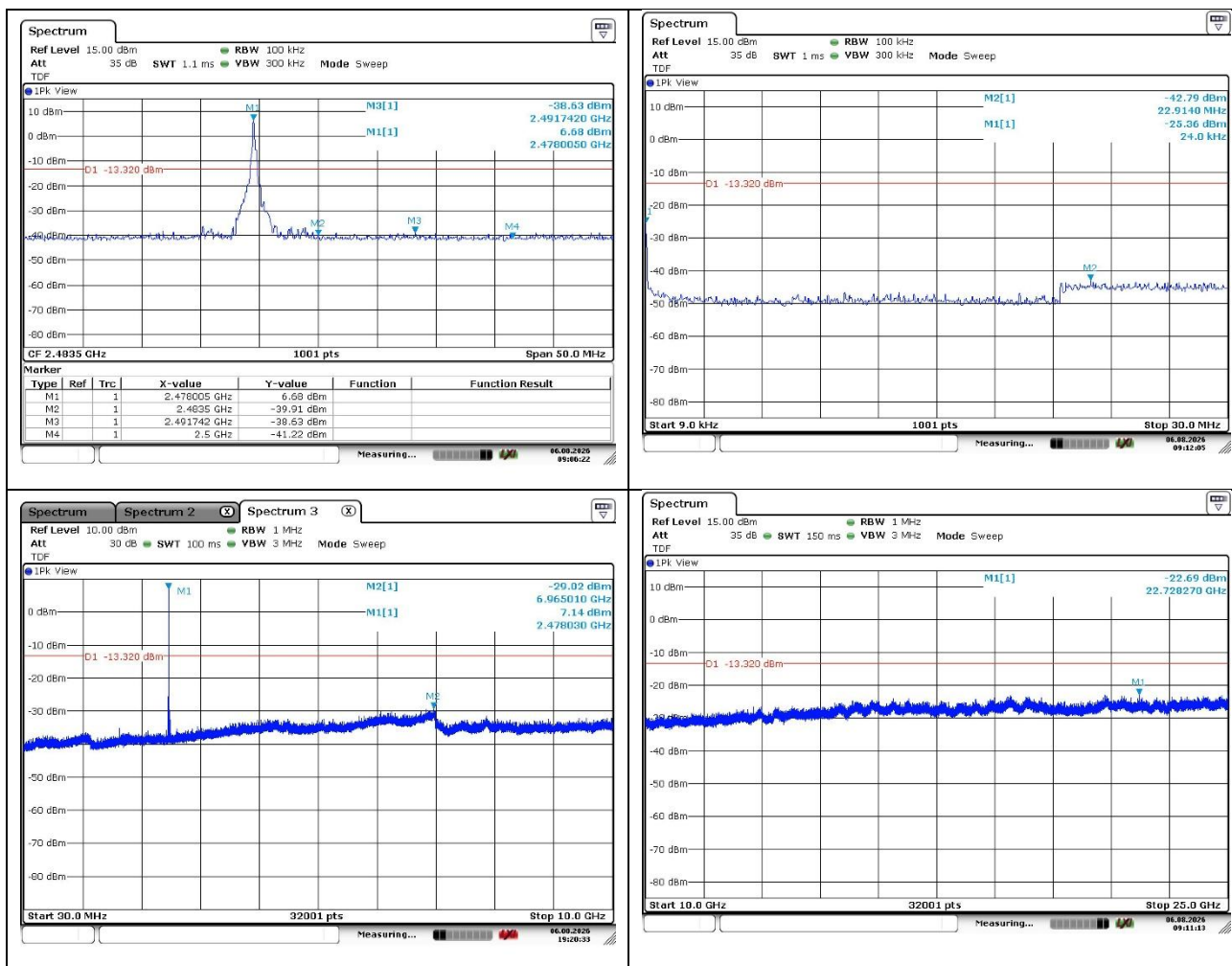
- Low Channel



- Middle Channel



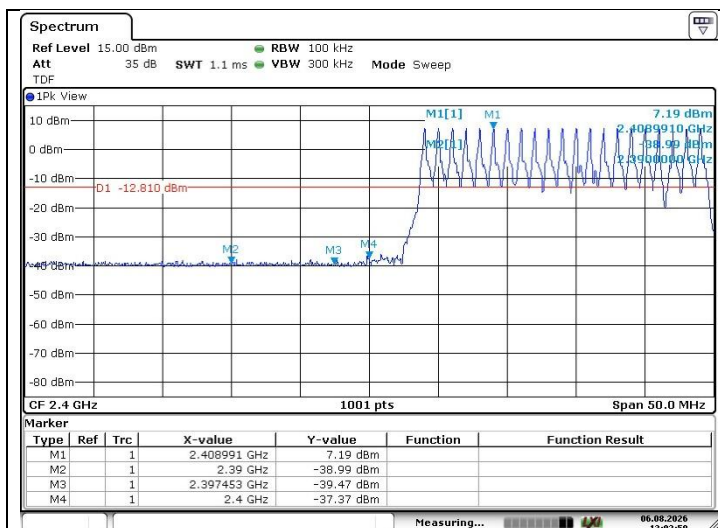
- High Channel



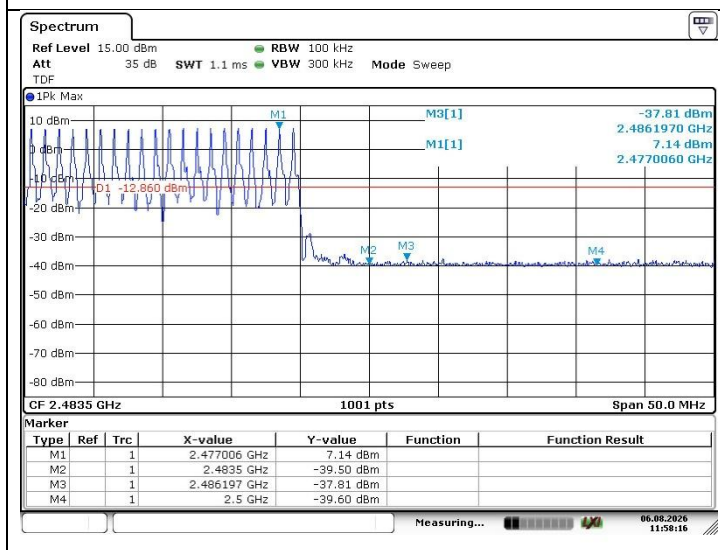
Mode: ASK_hopping function turned on

Band edge compliance

Low Channel

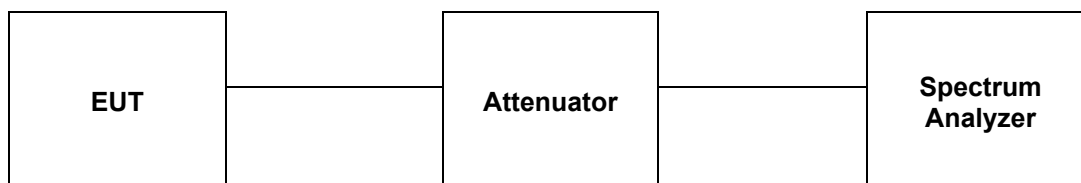


High Channel



3. 20 dB Bandwidth and 99 % Bandwidth

3.1. Test Setup



3.2. Limit

Limit: Not Applicable

3.3. Test Procedure

3.3.1. 20 dB Bandwidth

The test follows ANSI C63.10-2020 (for FCC) and ANSI C63.10-2020 + Cor.1-2023 + C63.10a-2024 + Errata to C63.10a-2024 (for ISSED).

The 20 dB bandwidth was measured with a spectrum analyzer connected to RF antenna connector (conducted measurement) while EUT was operating in transmit mode at the appropriate center frequency.

Use the following spectrum analyzer setting:

1. Span = approximately 2 to 5 times the 20 dB bandwidth.
2. RBW $\geq$ 1 % to 5 % of the 20 dB bandwidth.
3. VBW $\geq$ 3 x RBW
4. Sweep = auto
5. Detector = peak
6. Trace = max hold

The marker-to-peak function to set the mark to the peak of the emission. Use the marker-delta function to measure 20 dB down one side of the emission. Reset the function, and move the marker to the other side of the emission, until it is (as close as possible to) even with the reference marker level. The marker-delta reading at this point is 20 dB bandwidth of the emission.

3.3.2. 99 % Bandwidth

The test follows section 6.9.3 of ANSI C63.10-2020 (for FCC) and ANSI C63.10-2020 + Cor.1-2023 + C63.10a-2024 + Errata to C63.10a-2024 (for ISSED).

The occupied bandwidth is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers are each equal to 0.5% of the total mean power of the given emission. The following procedure shall be used for measuring 99% power bandwidth:

- a) The instrument center frequency is set to the nominal EUT channel center frequency. The frequency span for the spectrum analyzer shall be between 1.5 times and 5.0 times the OBW.
- b) The nominal IF filter bandwidth (3 dB RBW) shall be in the range of 1% to 5% of the OBW, and VBW shall be at least three times the RBW, unless otherwise specified by the applicable requirement.
 - 1) When measuring OBW for UWB, the VBW shall be set to three times the RBW or the maximum available VBW of the measuring instrument.
- c) Set the reference level of the instrument as required, keeping the signal from exceeding the maximum input mixer level for linear operation. In general, the peak of the spectral envelope shall be more than $10 \log (\text{OBW}/\text{RBW})$ below the reference level. Specific guidance is given in 4.1.6.2.
- d) Step a) through step c) might require iteration to adjust within the specified range.
- e) Video averaging is not permitted. Where practical, a sample detection and single sweep mode shall be used. Otherwise, peak detection and max-hold mode (until the trace stabilizes) shall be used.
- f) Use the 99% power bandwidth function of the instrument (if available) and report the measured bandwidth.
- g) If the instrument does not have a 99% power bandwidth function, then the trace data points are recovered and directly summed in linear power terms. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5% of the total is reached; that frequency is recorded as the lower frequency. The process is repeated until 99.5% of the total is reached; that frequency is recorded as the upper frequency. The 99% power bandwidth is the difference between these two frequencies.
- h) The occupied bandwidth shall be reported by providing spectral plot(s) of the measuring instrument display; the plot axes and the scale units per division shall be clearly labeled. Tabular data may be reported in addition to the plot(s).

3.4. Test Results

Ambient temperature : $(23 \pm 1) ^\circ\text{C}$
 Relative humidity : 47 %

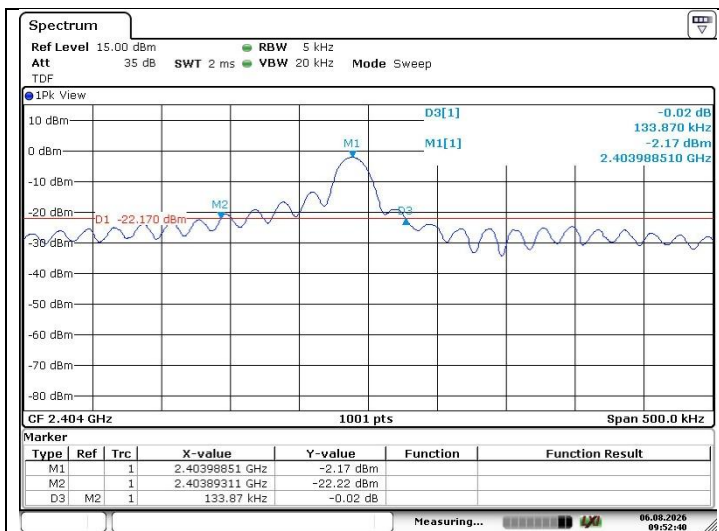
Mode	Channel	Frequency (MHz)	20 dB Bandwidth (kHz)	99 % Bandwidth (kHz)
ASK	Low	2 404	133.87	649.351
	Middle	2 440	108.89	523.477
	High	2 478	106.39	459.540

- Test plots

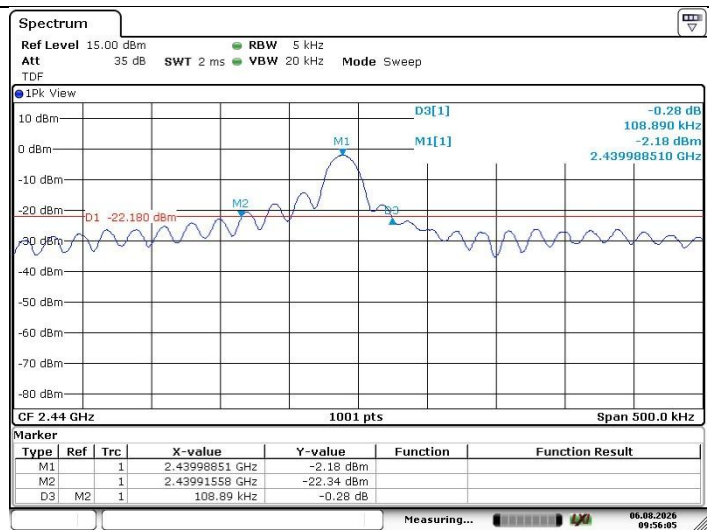
20 dB Bandwidth

Mode: ASK

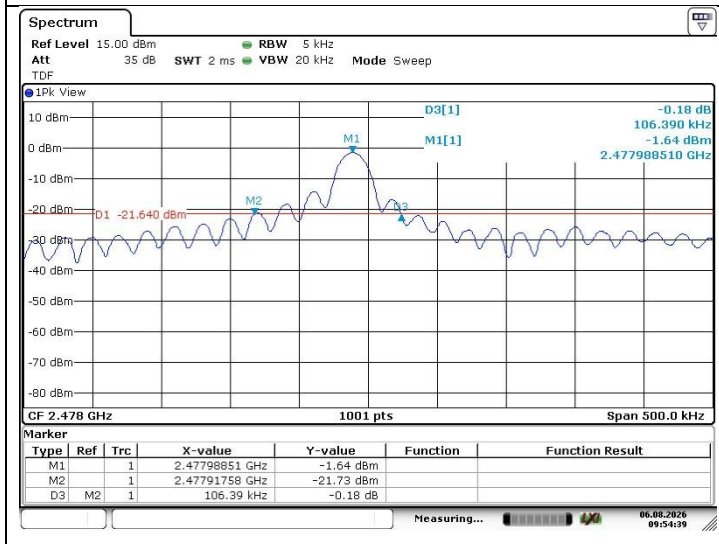
Low Channel



Middle Channel



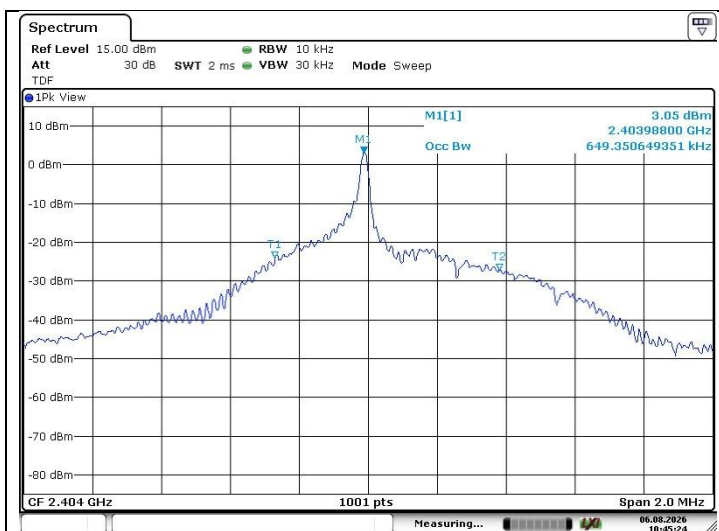
High Channel



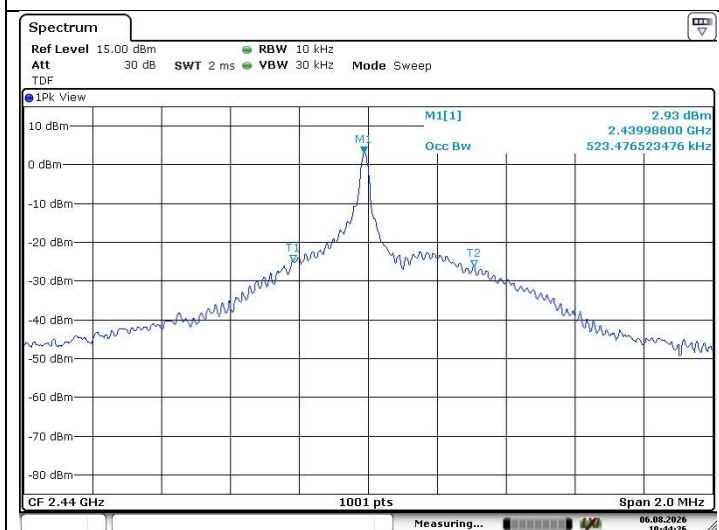
99 % Bandwidth

Mode: ASK

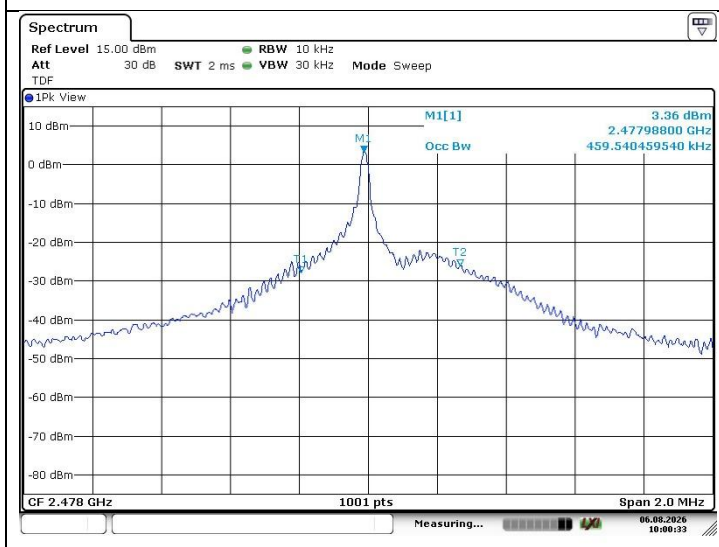
Low Channel



Middle Channel

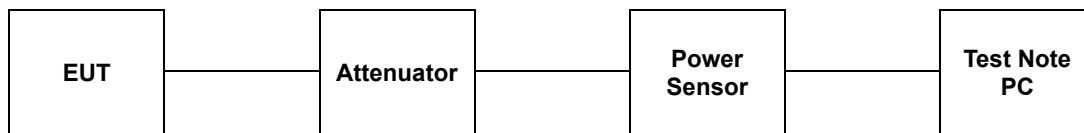


High Channel



4. Maximum Peak Conducted Output Power

4.1. Test Setup



4.2. Limit

4.2.1. FCC

1. §15.247(a)(1), Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2 400-2 483.5 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, provided the systems operate with an output power no greater than 125 mW.
2. §15.247(b)(1), For frequency hopping systems operating in the 2 400-2 483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5 725-5 850 MHz band: 1 watt. For all other frequency hopping systems in the 2 400-2 483.5 MHz band: 0.125 watts.

4.2.2. IC

1. According to RSS-247 Issue 4, 6.2.3.1(a), FHS operating in the band 2 400-2 483.5 MHz 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, provided that the systems operate with an output power no greater than 0.125 W.
2. According to RSS-247 Issue 4, 6.2.3.2, The following transmitter output power and e.i.r.p. requirements shall apply:
 - a) If the hopset uses 75 or more hopping channels, the maximum peak conducted output power shall not exceed 1.0 W.
 - b) If the hopset uses less than 75 hopping channels the maximum peak conducted output power shall not exceed 0.125 W.
 - c) The e.i.r.p. shall not exceed 4 W, except as provided in sections 6.5 a) and b).

4.3. Test Procedure

The test follows ANSI C63.10-2020 (for FCC) and ANSI C63.10-2020 + Cor.1-2023 + C63.10a-2024 + Errata to C63.10a-2024 (for ISSED). Using the power sensor instead of a spectrum analyzer.

1. Initially overall offset for directional coupler and cable loss is measured per frequencies.
2. Place the EUT on the table and set it in the transmitting mode.
3. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the Power sensor.
4. Test program: (S/W name: R&S Power Viewer, Version: 3.2.0)
5. Measure each channel.

4.4. Test Results

Ambient temperature : $(23 \pm 1) ^\circ\text{C}$
 Relative humidity : 47 %

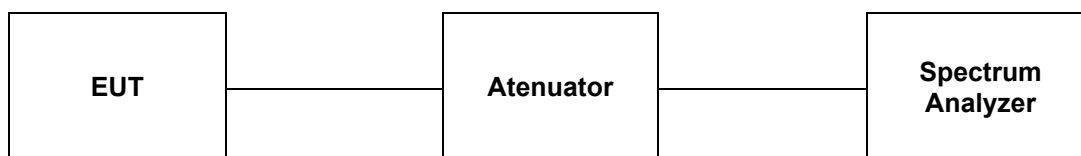
Mode	Channel	Frequency (MHz)	Average Power Result (dB m)	Peak Power Result (dB m)	Limit (dB m)
ASK	Low	2 404	6.78	6.86	20.97
	Middle	2 440	6.32	6.43	
	High	2 478	<u>6.79</u>	<u>6.90</u>	

Remark;

The limit for peak power is 0.125 W.

5. Carrier Frequency Separation

5.1. Test Setup



5.2. Limit

5.2.1. FCC

§15.247(a)(1), Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2 400-2 483.5 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, provided the systems operate with an output power no greater than 125 mW.

5.2.2. IC

According to RSS-247 Issue 4, 6.2.3.1(a), FHS operating in the band 2 400-2 483.5 MHz 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, provided that the systems operate with an output power no greater than 0.125 W.

5.3. Test Procedure

The test follows ANSI C63.10-2020 (for FCC) and ANSI C63.10-2020 + Cor.1-2023 + C63.10a-2024 + Errata to C63.10a-2024 (for ISSED).

The device is operating in hopping mode between 79 channels and also supporting Adaptive Frequency Hopping with hopping between 20 channels. As compared with each operating mode, 79 channels are chosen as a representative for test.

Use the following spectrum analyzer settings:

1. Span: Wide enough to capture the peaks of two adjacent channels
2. 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.
3. VBW $\geq 1/10^{\text{th}}$ the RBW.
4. Sweep: No faster than coupled (auto) time
5. Detector: Peak
6. Trace: Max hold
7. Allow the trace to stabilize.

Use the marker-delta function to determine the separation between the peaks of the adjacent channels. Compliance of an EUT with the appropriate regulatory limit shall be determined. A spectral plot of the data shall be included in the test report.

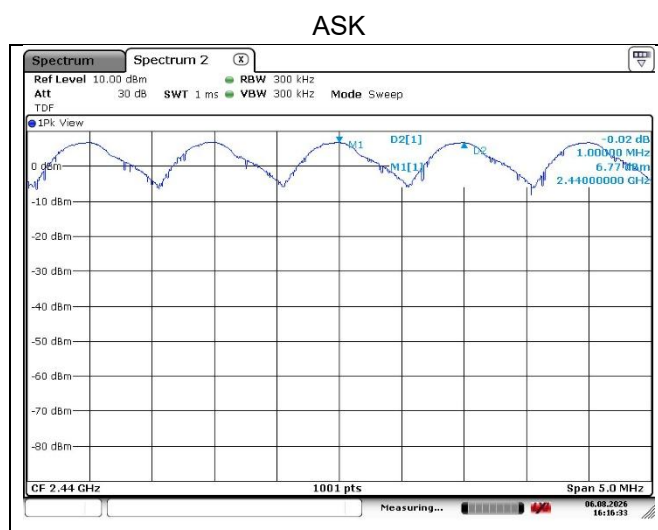
Where the device shares the same channel plan (carrier frequencies and number of channels) across multiple data rates or modulation schemes then the carrier separation need only be measured for one of those modulation schemes or data rates.

5.4. Test Results

Ambient temperature : $(23 \pm 1) ^\circ\text{C}$
 Relative humidity : 47 %

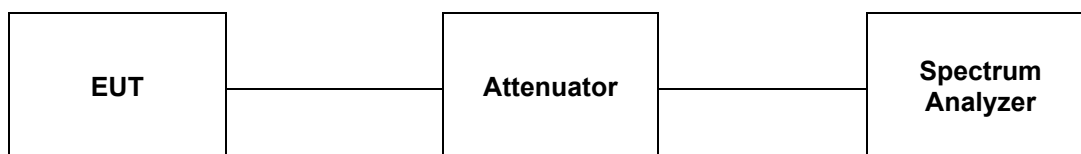
Mode	Frequency (MHz)	Adjacent Hopping Channel Separation (kHz)	20 dB Bandwidth (kHz)
ASK	2 441	1 000	108.89

- Test plot



6. Number of Hopping Frequencies

6.1. Test Setup



6.2. Limit

6.2.1. FCC

§15.247(a)(1)(iii), Frequency hopping systems in the 2 400-2 483.5 MHz band shall use at least 15 channels. 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. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

6.2.2. IC

According to RSS-247 Issue 4, 6.2.3.1(b), FHS operating in the band 2 400-2 483.5 MHz shall use at least 15 hopping channels. The average time of occupancy on any channel shall not be greater than greater than 0.4 s within a period of 0.4 s, multiplied by the number of hopping channels employed. Transmissions on particular hopping frequencies may be avoided or suppressed provided that at least 15 hopping channels are used.

6.3. Test Procedure

The test follows ANSI C63.10-2020 (for FCC) and ANSI C63.10-2020 + Cor.1-2023 + C63.10a-2024 + Errata to C63.10a-2024 (for ISSED).

The device supports Adaptive Frequency Hopping and will use a minimum of 20 channels of the 79 available channels.

The EUT shall have its hopping function enabled. Use the following spectrum analyzer settings:

1. Span: The frequency band of operation. Depending on the number of channels the device supports, it could be necessary to divide the frequency range of operation across multiple spans, to allow the individual channels to be clearly seen.
2. 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.
3. VBW $\geq 1/10^{\text{th}}$ the RBW.
4. Sweep: No faster than coupled (auto) time.
5. Detector function: Peak
6. Trace: Max hold
7. Allow the trace to stabilize.

It might prove necessary to break the span up into subranges to show clearly all of the hopping frequencies. Compliance of an EUT with the appropriate regulatory limit shall be determined for the number of hopping channels. A spectral plot of the data shall be included in the test report.

Where the device shares the same channel plan (carrier frequencies and number of channels) across multiple data rates or modulation schemes then the number of channels need only be measured for one of those modulation schemes or data rates.

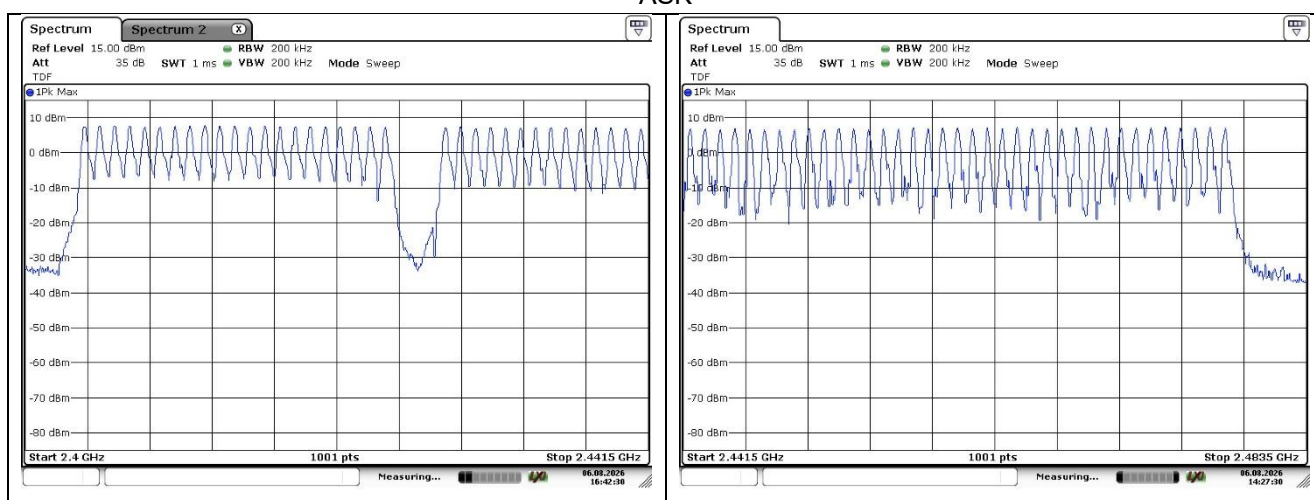
6.4. Test Results

Ambient temperature : (23 ± 1) °C
 Relative humidity : 47 %

Mode	Number of Hopping Frequency	Limit
ASK	72	≥ 15

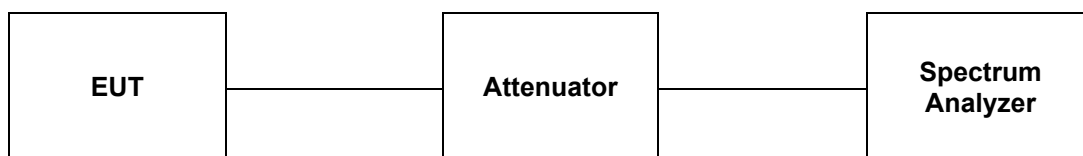
- Test plots

ASK



7. Time of Occupancy (Dwell Time)

7.1. Test Set up



7.2. Limit

7.2.1. FCC

§15.247(a)(1)(iii), Frequency hopping systems in the 2 400-2 483.5 MHz band, the average time of occupancy on any frequency shall not be greater than 0.4 second within a 31.6 second period.

7.2.2. IC

According to RSS-247 Issue 4, 6.2.3.1(b), FHS operating in the band 2 400-2 483.5 MHz shall use at least 15 hopping channels. The average time of occupancy on any channel shall not be greater than greater than 0.4 s within a period of 0.4 s, multiplied by the number of hopping channels employed. Transmissions on particular hopping frequencies may be avoided or suppressed provided that at least 15 hopping channels are used.

A period time = 0.4 (s) * 72 = 28.8 (s)

7.3. Test Procedure

The test follows ANSI C63.10-2020 (for FCC) and ANSI C63.10-2020 + Cor.1-2023 + C63.10a-2024 + Errata to C63.10a-2024 (for ISSED).

1. The dwell time per hop on a channel is the time from the start of the first transmission to the end of the last transmission for that hop. If the device has a single transmission per hop then the dwell time is the duration of that transmission. If the device has a multiple transmissions per hop then the dwell time is measured from the start of the first transmission to the end of the last transmission.

2. The time of occupancy is the total time that the device dwells on a channel over an observation period specified in the regulatory requirement. To determine the time of occupancy the spectrum analyzer will be configured to measure both the dwell time per hop and the number of times the device transmits on a specific channel in a given period.

3. The EUT shall have its hopping function enabled. Compliance with the requirements shall be made with the minimum and with the maximum number of channels enabled. If the dwell time per channel does not vary with the number of channels then compliance with the requirements may be based on the minimum number of channels. If the device supports different dwell times per channel (example Bluetooth devices can dwell on a channel for 1, 3 or 5 time slots) then measurements can be limited to the longest dwell time with the minimum number of channels.

The transmitter output is connected to a spectrum analyzer. The span is set to zero, centered on a single, selected hopping channel.

The number of pulses is calculated based on the customer's declared operational cycle, in which the device transmits a burst of 100 pulses (each 52 μ s ON time with a 238 μ s inter-pulse idle time, totaling 28.76 ms burst duration) followed by a 500 ms channel idle time on a single channel before hopping to the next channel.

The observation occupancy time is hopping channel $72 \times 400 \text{ ms} = 28.8 \text{ sec}$.

Within the 28.8 s observation period, a single channel is visited at most once, resulting in a total maximum occupancy time of 5.20 ms (nominal: 3.93 ms), which complies with the 400 ms limit.

7.4. Test Results

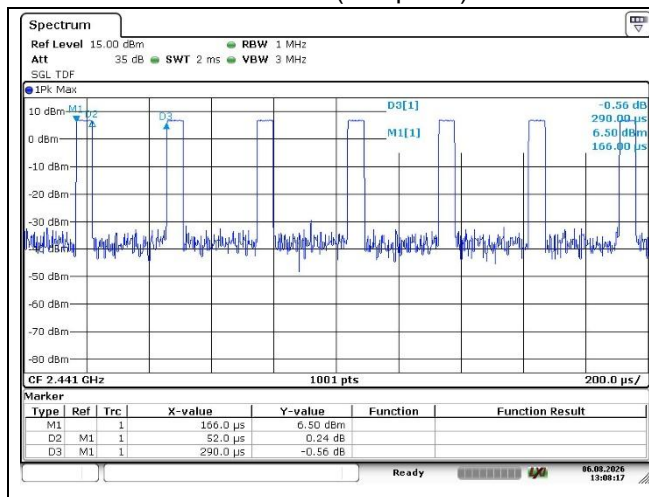
Ambient temperature : $(23 \pm 1) ^\circ\text{C}$
 Relative humidity : 47 %

Mode	Frequency (MHz)	Dwell Time (ms)		Time of occupancy on the Tx Channel in 28.8 sec (ms)	Limit for time of occupancy on the Tx Channel in 28.8 sec (ms)
		One pulse	One channel		
GFSK	2 441	0.05	28.76	5.20	400

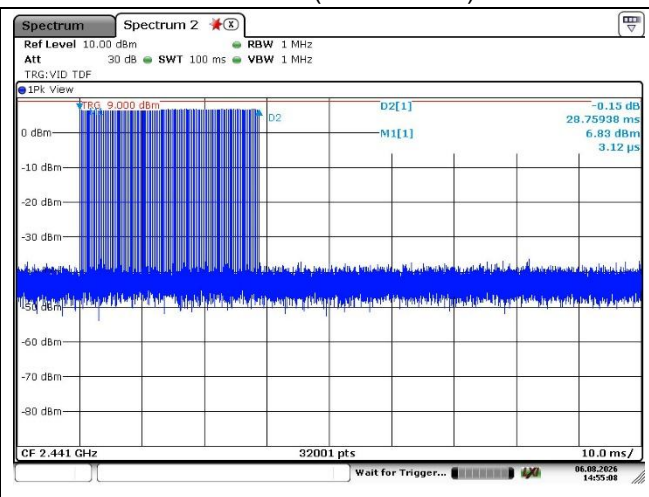
- Test plots

Operation Mode: ASK

Dwell time (one pluse)



Dwell time (one channel)



8. Antenna Requirement

8.1. Standard Applicable

For intentional device, according to FCC 47 CFR 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 provisions of this section. 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. And according to FCC 47 CFR Section §15.247(b) if transmitting antennas of directional gain greater than 6 dB i are used, the conducted output power shall be reduced appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dB i.

8.2. Antenna Connected Construction

Antenna used in this product is LDS antenna with gain of -1.19 dB i

- End of the Test Report -