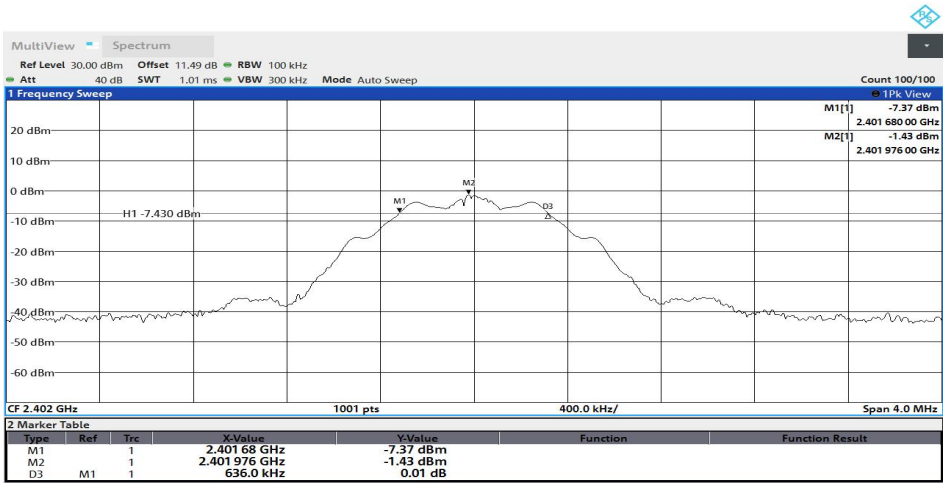
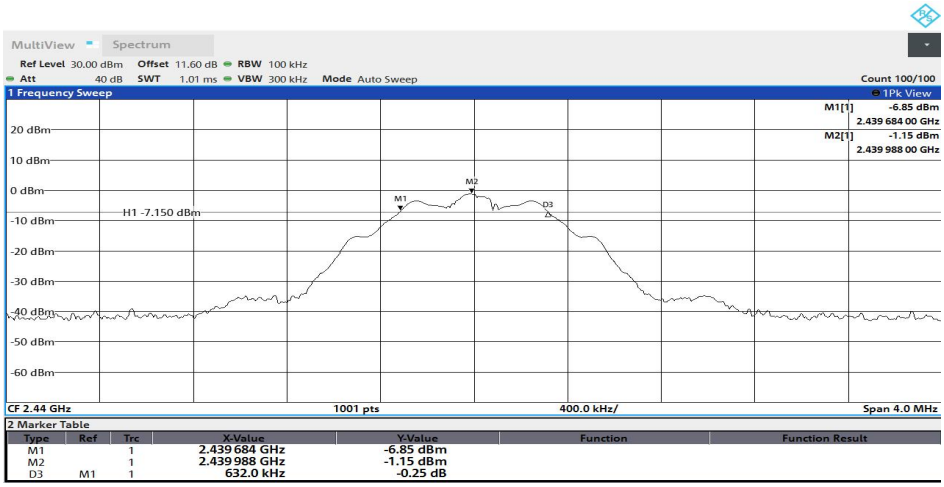
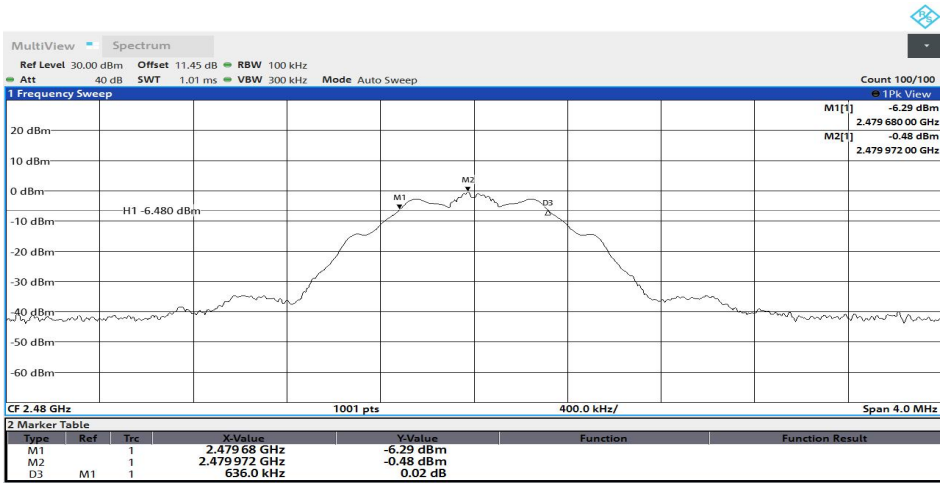


BLE_500K-Ant1-2440



BLE_500K-Ant1-2480



6.6. Frequency Band Edges-Conducted

Specifications:	FCC 47 Part 15.247(d)
DUT Serial Number:	S1
Test conditions:	Ambient Temperature:15℃-35℃ Relative Humidity:30%-60% Air pressure: 86-106kPa
Test Results:	Pass

Limit Level Construction:

Standard	Limit
FCC 47 Part 15.247(d)	>20

Measurement Uncertainty:

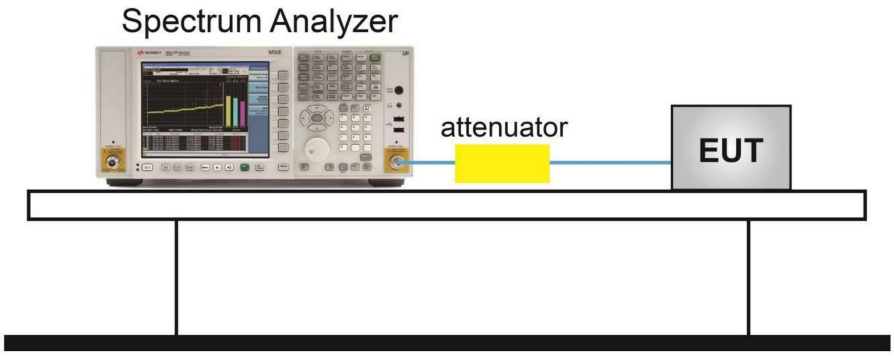
Measurement Uncertainty	±1.02dBm/KHz

Test procedures

The measurement is according to ANSI C63.10 clause 11.13.2

1. 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 that fall outside of the authorized band of operation.
2. Reference level: As required to keep the signal from exceeding the maximum instrument input mixer level for linear operation. In general, the peak of the spectral envelope shall be more than [10 log (OBW/RBW)] below the reference level. Specific guidance is given in 4.1.5.2.
3. Attenuation: Auto (at least 10 dB preferred).
4. Sweep time: Coupled.
5. Resolution bandwidth: 100 kHz.6) Video bandwidth: 300 kHz.7) Detector: Peak.8) Trace: Max hold.

Test Setup

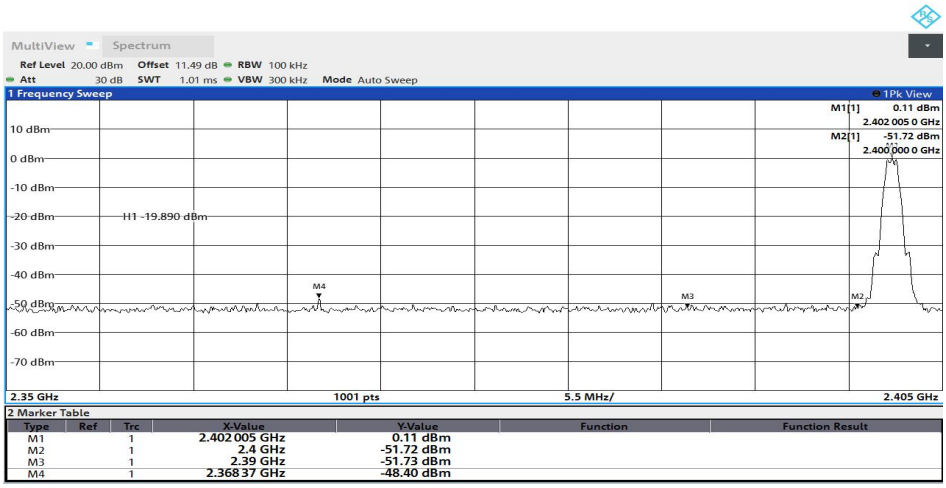

Spectrum Analyzer
attenuator
EUT

Measurement Result

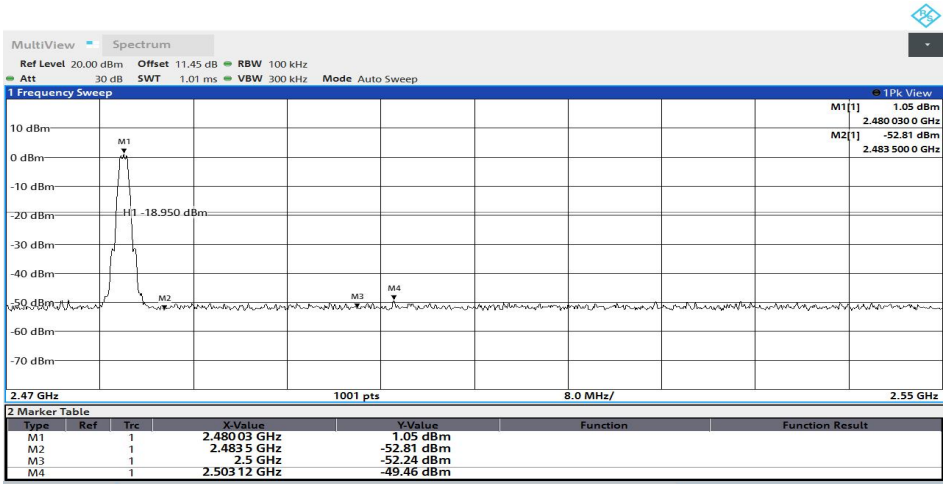
TestMode	Antenna	ChName	Frequency [MHz]	RefLevel[dBm]	Result[dBm]	Limit[dBm]	Verdict
BLE_1M	Ant1	Low	2402	0.11	-48.4	≤-19.89	PASS
BLE_1M	Ant1	High	2480	1.05	-49.46	≤-18.95	PASS
BLE_2M	Ant1	Low	2402	-0.24	-45.42	≤-20.24	PASS
BLE_2M	Ant1	High	2480	0.93	-49.28	≤-19.07	PASS
BLE_125K	Ant1	Low	2402	-0.19	-49.85	≤-20.19	PASS
BLE_125K	Ant1	High	2480	0.96	-49.77	≤-19.04	PASS
BLE_500K	Ant1	Low	2402	-1.31	-49.93	≤-21.31	PASS
BLE_500K	Ant1	High	2480	-1.15	-49.52	≤-21.15	PASS

Test graphs as below

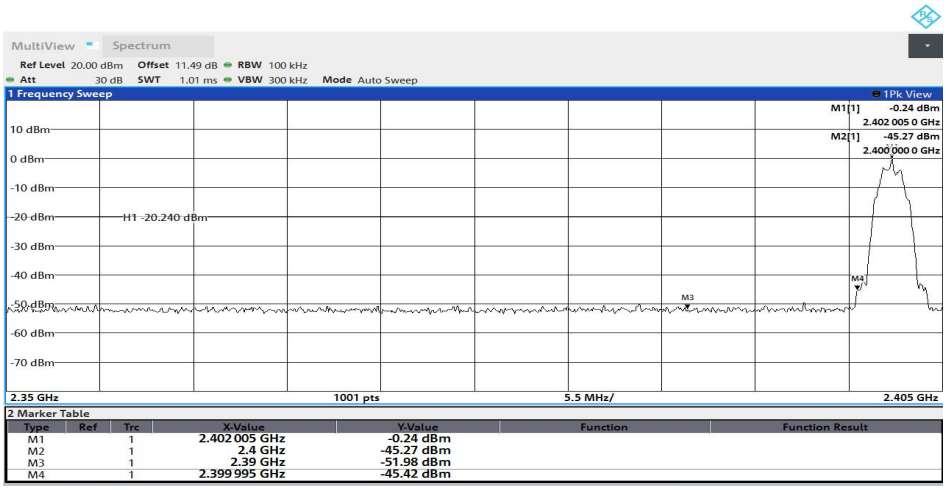
BLE_1M-Ant1-Low-2402-0.11



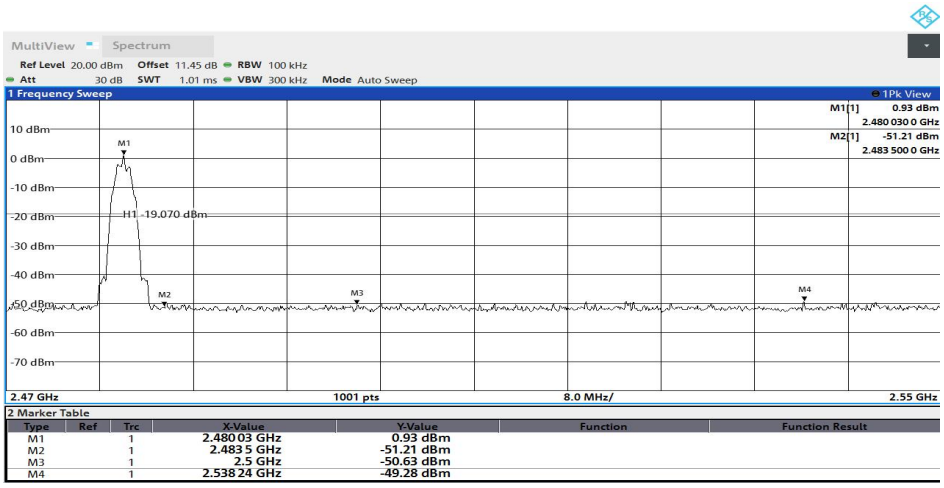
BLE_1M-Ant1-High-2480-1.05



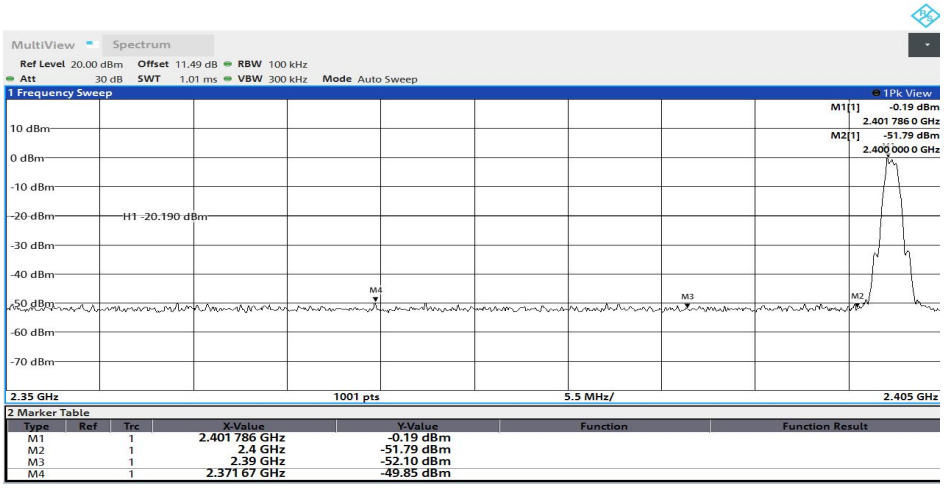
BLE_2M-Ant1-Low-2402--0.24



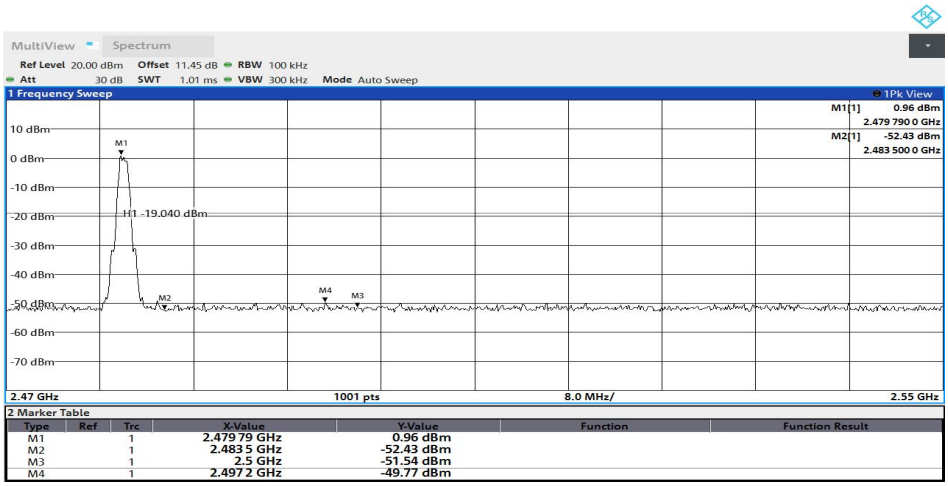
BLE_2M-Ant1-High-2480-0.93



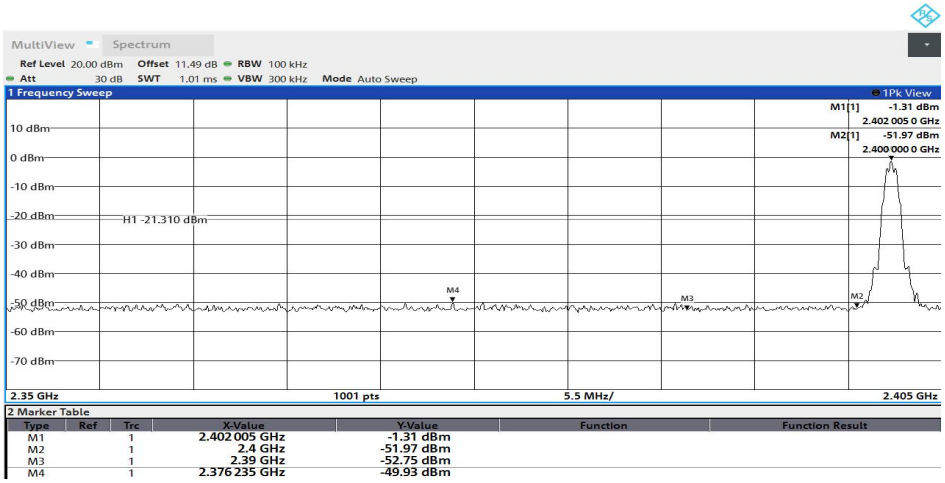
BLE_125K-Ant1-Low-2402--0.19



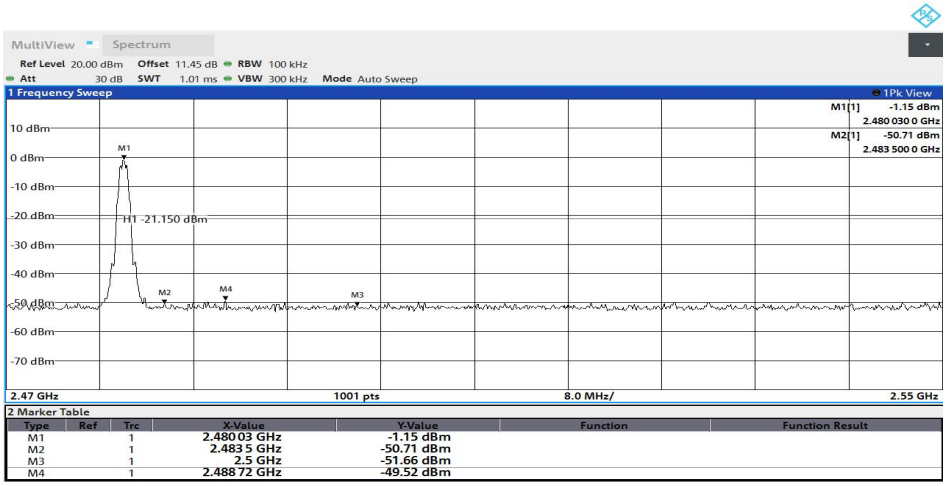
BLE_125K-Ant1-High-2480-0.96



BLE_500K-Ant1-Low-2402--1.31



BLE_500K-Ant1-High-2480--1.15



6.7. Conducted Emission

Specifications:	FCC 47 Part 15.247(d)
DUT Serial Number:	S1
Test conditions:	Ambient Temperature:15℃-35℃ Relative Humidity:30%-60% Air pressure: 86-106kPa
Test Results:	Pass

Limit Level Construction:

Standard	Limit
FCC 47 Part 15.247(d)	20dB below peak output power in 100KHz bandwidth

Measurement Uncertainty:

Measurement Uncertainty	±1.02dBm/100KHz

Test procedures

This measurement is according to ANSI C63.10 clause 11.11.

1. The output power of EUT was connected to the spectrum analyzer. The path loss was compensated to the results for each measurement.
2. Enable EUT transmitter maximum power continuously.

Reference level measurement

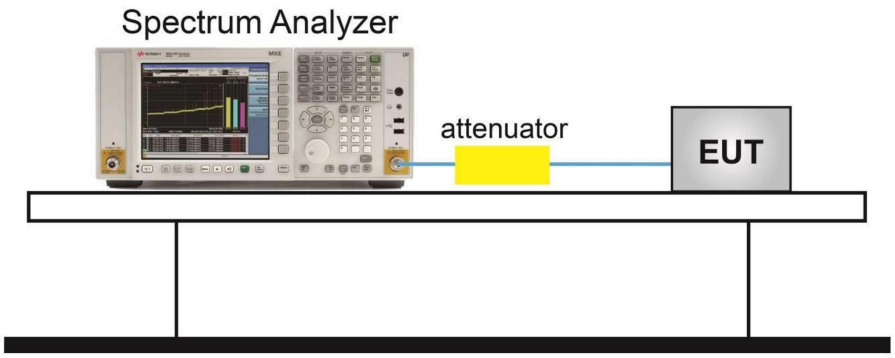
3. Set instrument center frequency to DTS channel center frequency.
4. Set the span to ≥ 1.5 times the DTS bandwidth.
5. Set the RBW = 100 kHz.
6. Set the VBW ≥ [3 × RBW].
7. Detector = peak.
8. Sweep time = auto couple.
9. Trace mode = max hold.
10. Allow trace to fully stabilize.
11. Use the peak marker function to determine the maximum PSD level.

Emission level measurement

1. Set the center frequency and span to encompass frequency range to be measured.
2. Set the RBW = 100 kHz.
3. Set the VBW ≥ [3 × RBW].
4. Detector = peak.
5. Sweep time = auto couple.

6. Trace mode = max hold.
7. Allow trace to fully stabilize.
8. Use the peak marker function to determine the maximum amplitude level.

Test Setup



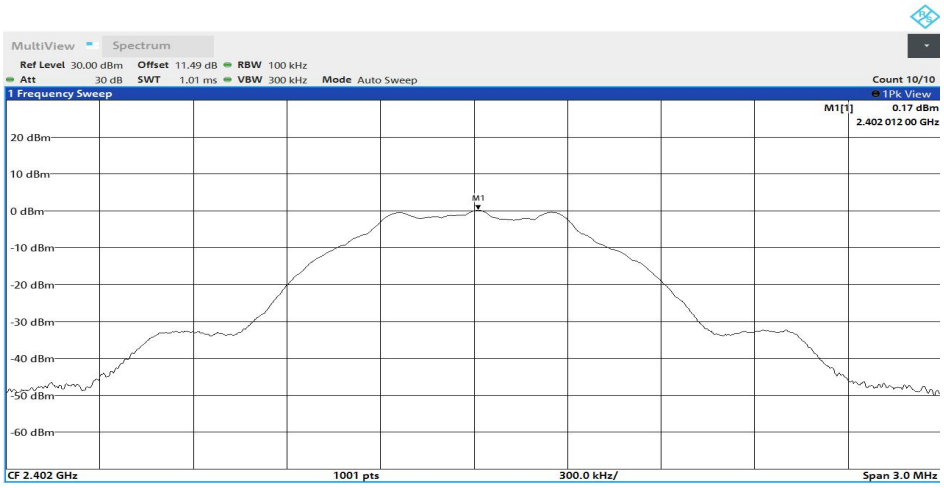
Measurement Result

TestMode	Antenna	Frequency [MHz]	FreqRange [MHz]	RefLevel [dBm]	Result[dBm]	Limit[dBm]	Verdict
BLE_1M	Ant1	2402	0~Reference	0.17	0.17	---	PASS
BLE_1M	Ant1	2402	30~1000	0.17	-58.31	≤-19.83	PASS
BLE_1M	Ant1	2402	1000~26500	0.17	-53.37	≤-19.83	PASS
BLE_1M	Ant1	2440	0~Reference	0.35	0.35	---	PASS
BLE_1M	Ant1	2440	30~1000	0.35	-58.62	≤-19.65	PASS
BLE_1M	Ant1	2440	1000~26500	0.35	-53.46	≤-19.65	PASS
BLE_1M	Ant1	2480	0~Reference	1.10	1.10	---	PASS
BLE_1M	Ant1	2480	30~1000	1.10	-59.11	≤-18.9	PASS
BLE_1M	Ant1	2480	1000~26500	1.10	-53.9	≤-18.9	PASS
BLE_2M	Ant1	2402	0~Reference	-0.18	-0.18	---	PASS
BLE_2M	Ant1	2402	30~1000	-0.18	-57.93	≤-20.18	PASS
BLE_2M	Ant1	2402	1000~26500	-0.18	-53.6	≤-20.18	PASS
BLE_2M	Ant1	2440	0~Reference	0.10	0.10	---	PASS
BLE_2M	Ant1	2440	30~1000	0.10	-58.22	≤-19.9	PASS
BLE_2M	Ant1	2440	1000~26500	0.10	-53.34	≤-19.9	PASS
BLE_2M	Ant1	2480	0~Reference	0.99	0.99	---	PASS
BLE_2M	Ant1	2480	30~1000	0.99	-58.92	≤-19.01	PASS
BLE_2M	Ant1	2480	1000~26500	0.99	-52.95	≤-19.01	PASS
BLE_125K	Ant1	2402	0~Reference	-0.11	-0.11	---	PASS
BLE_125K	Ant1	2402	30~1000	-0.11	-58.78	≤-20.11	PASS
BLE_125K	Ant1	2402	1000~26500	-0.11	-53.32	≤-20.11	PASS

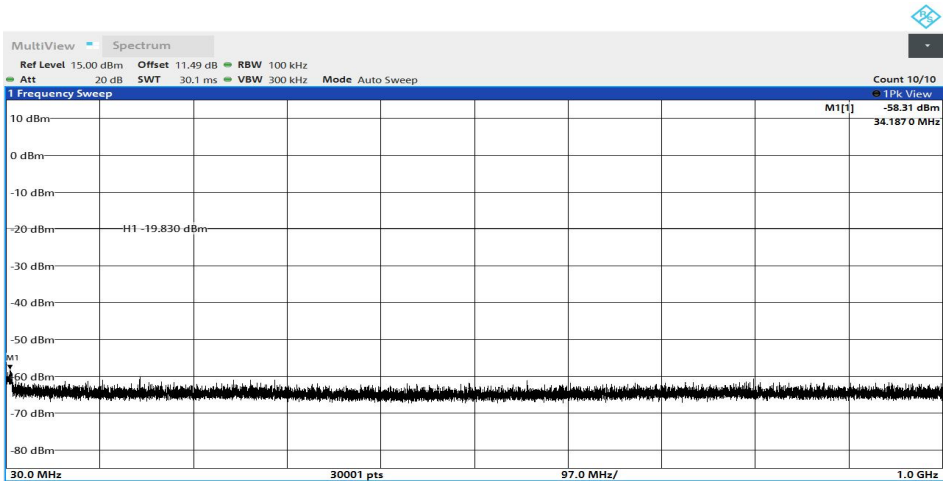
BLE_125K	Ant1	2440	0~Reference	0.20	0.20	---	PASS
BLE_125K	Ant1	2440	30~1000	0.20	-58.86	≤-19.8	PASS
BLE_125K	Ant1	2440	1000~26500	0.20	-52.79	≤-19.8	PASS
BLE_125K	Ant1	2480	0~Reference	1.01	1.01	---	PASS
BLE_125K	Ant1	2480	30~1000	1.01	-57.69	≤-18.99	PASS
BLE_125K	Ant1	2480	1000~26500	1.01	-53.6	≤-18.99	PASS
BLE_500K	Ant1	2402	0~Reference	-1.40	-1.40	---	PASS
BLE_500K	Ant1	2402	30~1000	-1.40	-58.83	≤-21.4	PASS
BLE_500K	Ant1	2402	1000~26500	-1.40	-53.45	≤-21.4	PASS
BLE_500K	Ant1	2440	0~Reference	-1.12	-1.12	---	PASS
BLE_500K	Ant1	2440	30~1000	-1.12	-58.02	≤-21.12	PASS
BLE_500K	Ant1	2440	1000~26500	-1.12	-53.35	≤-21.12	PASS
BLE_500K	Ant1	2480	0~Reference	-0.33	-0.33	---	PASS
BLE_500K	Ant1	2480	30~1000	-0.33	-57.44	≤-20.33	PASS
BLE_500K	Ant1	2480	1000~26500	-0.33	-53.73	≤-20.33	PASS

Test graphs as below

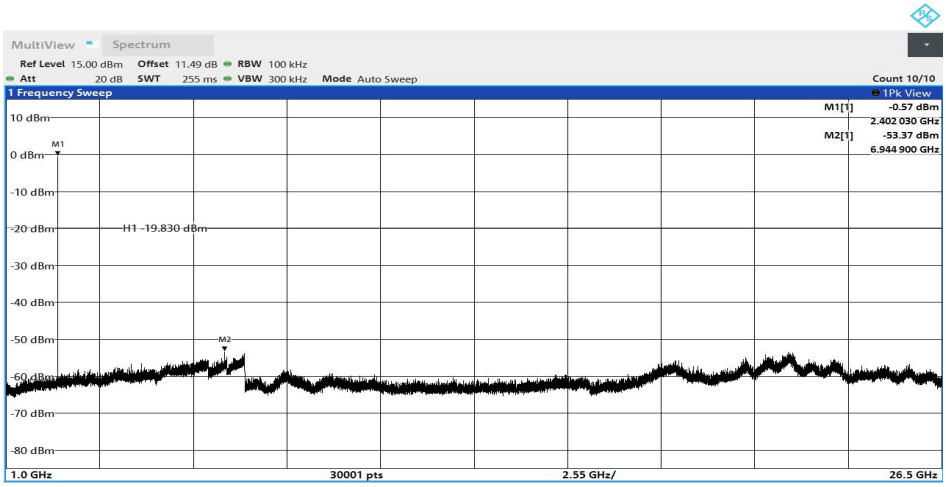
BLE_1M-Ant1-2402-0~Reference-0.17



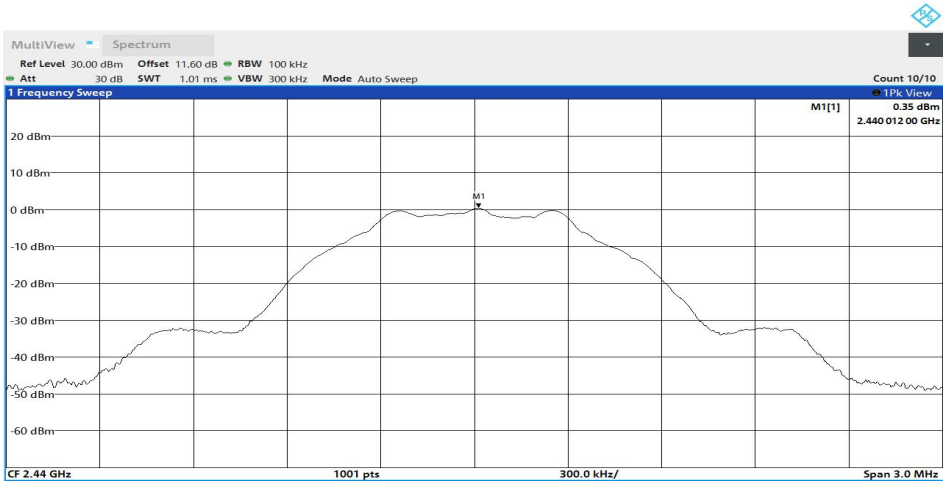
BLE_1M-Ant1-2402-30~1000-0.17



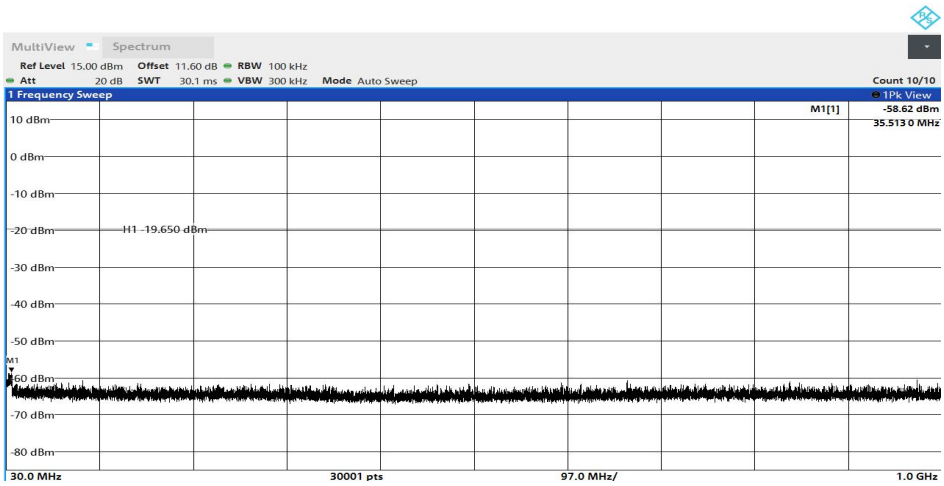
BLE_1M-Ant1-2402-1000~26500-0.17



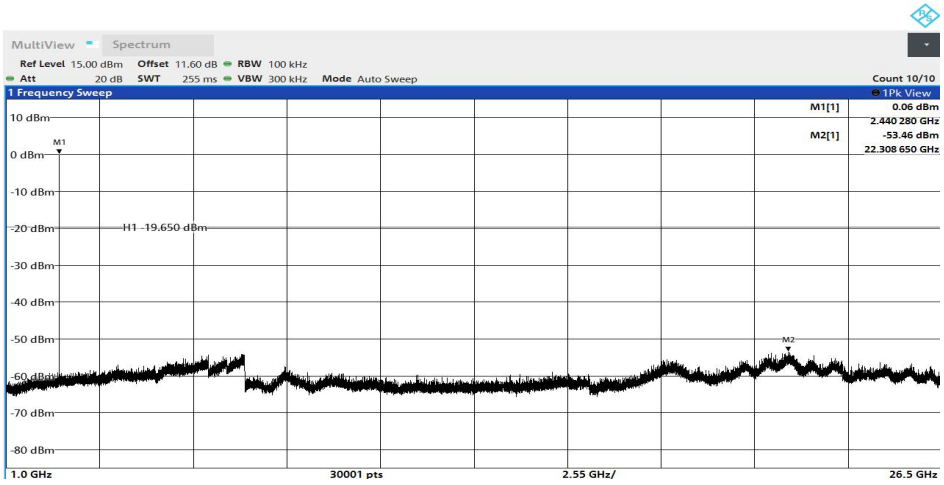
BLE_1M-Ant1-2440-0~Reference-0.35



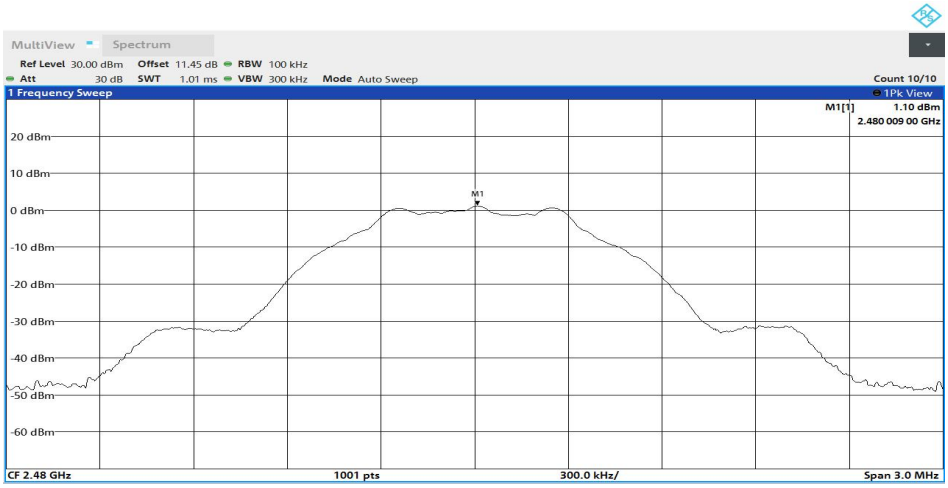
BLE_1M-Ant1-2440-30~1000-0.35



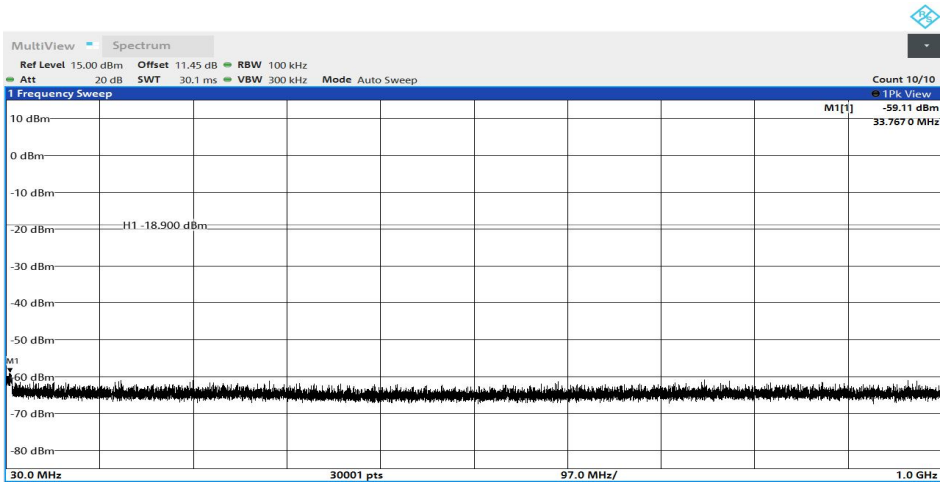
BLE_1M-Ant1-2440-1000~26500-0.35



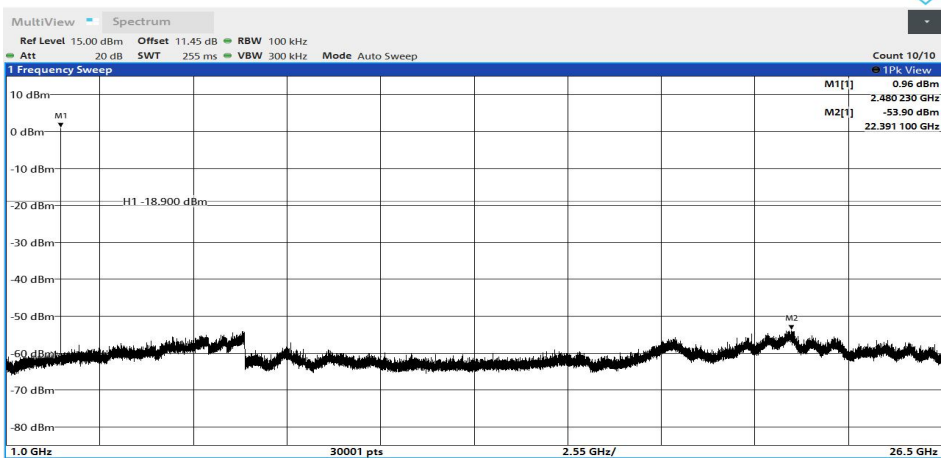
BLE_1M-Ant1-2480-0~Reference-1.10



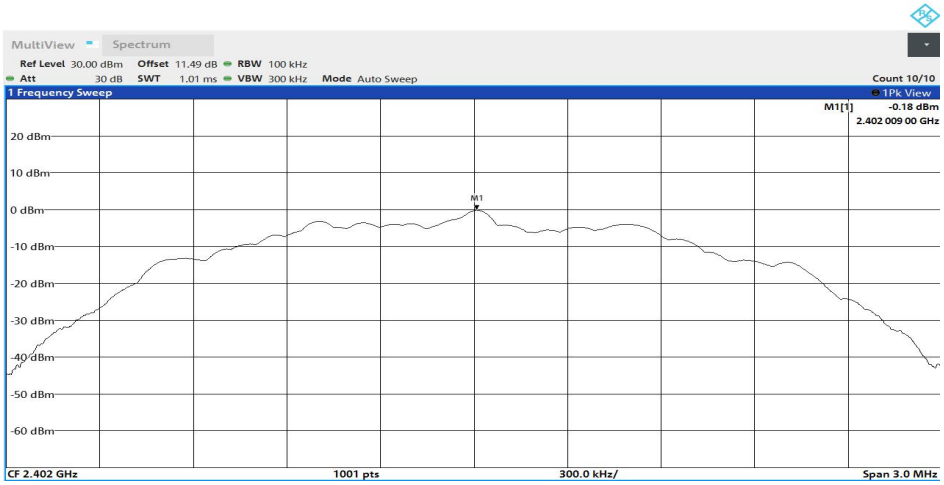
BLE_1M-Ant1-2480-30~1000-1.10



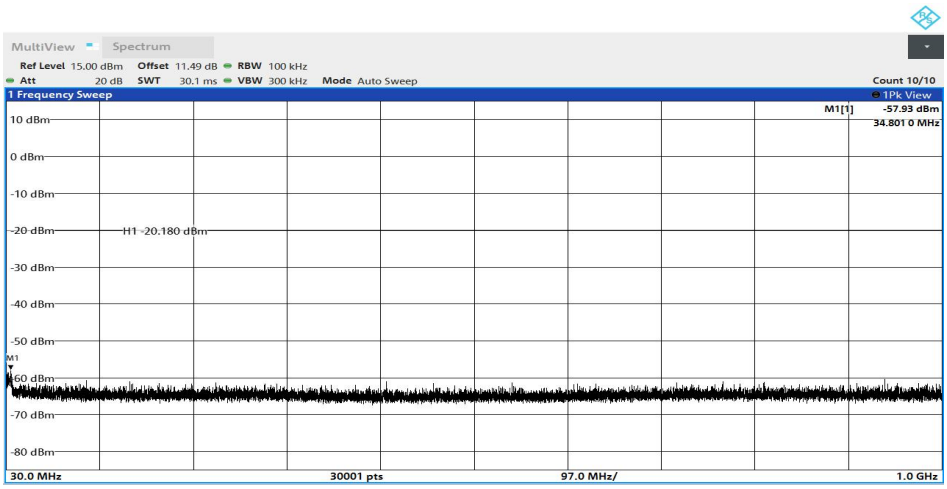
BLE_1M-Ant1-2480-1000~26500-1.10



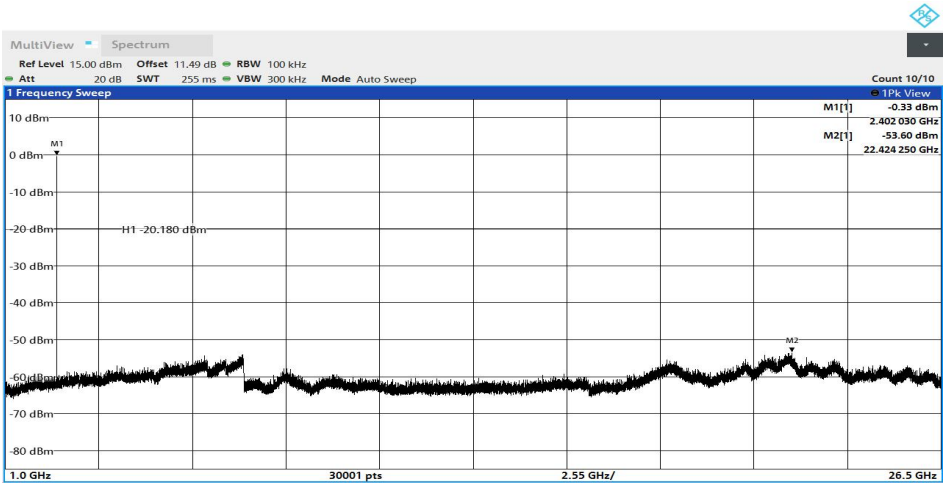
BLE_2M-Ant1-2402-0~Reference--0.18



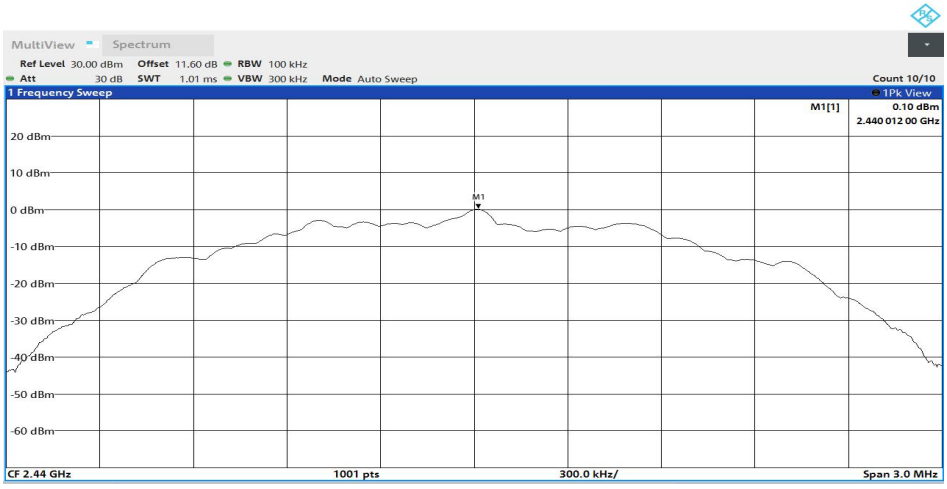
BLE_2M-Ant1-2402-30~1000--0.18



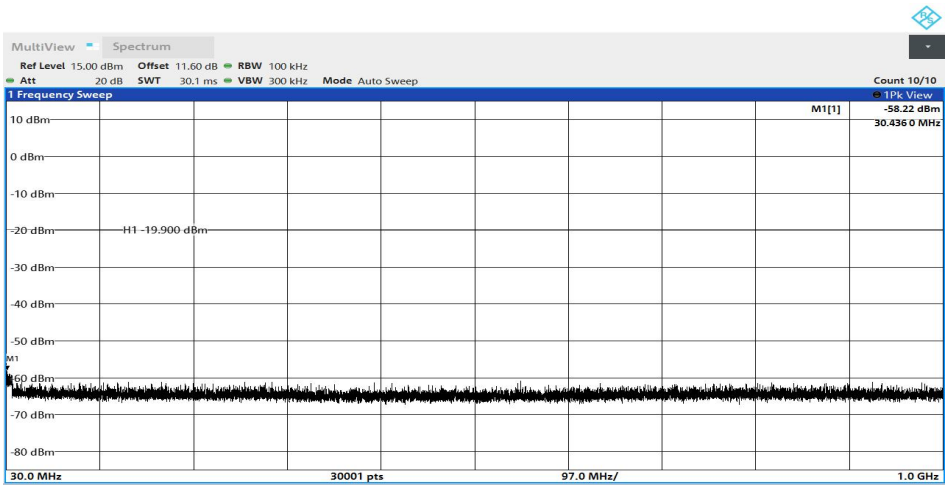
BLE_2M-Ant1-2402-1000~26500--0.18



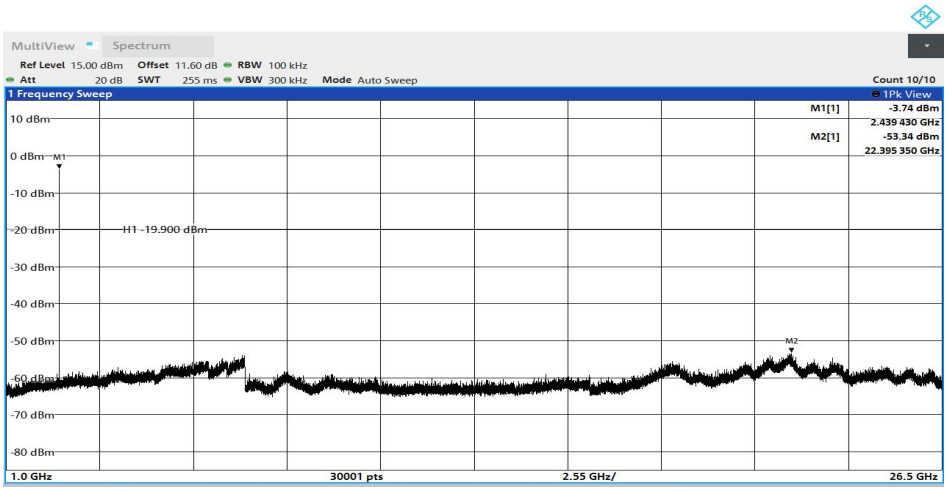
BLE_2M-Ant1-2440-0~Reference-0.10



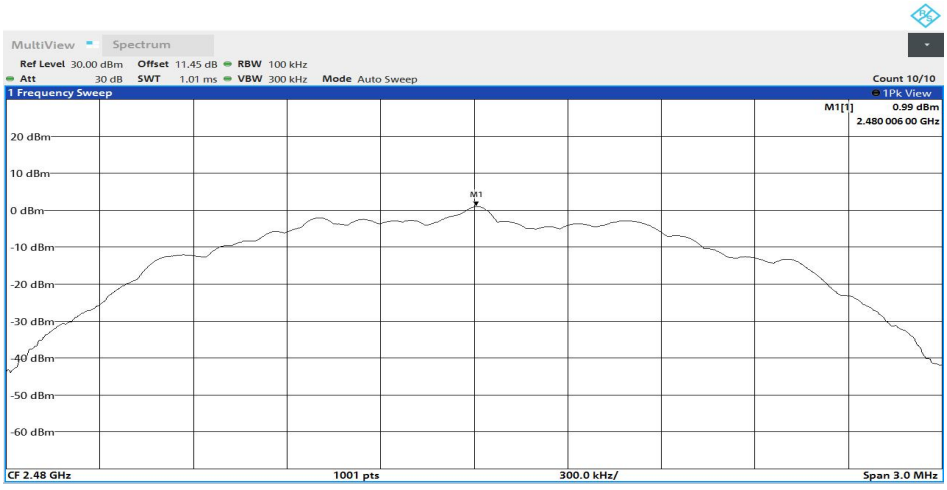
BLE_2M-Ant1-2440-30~1000-0.10



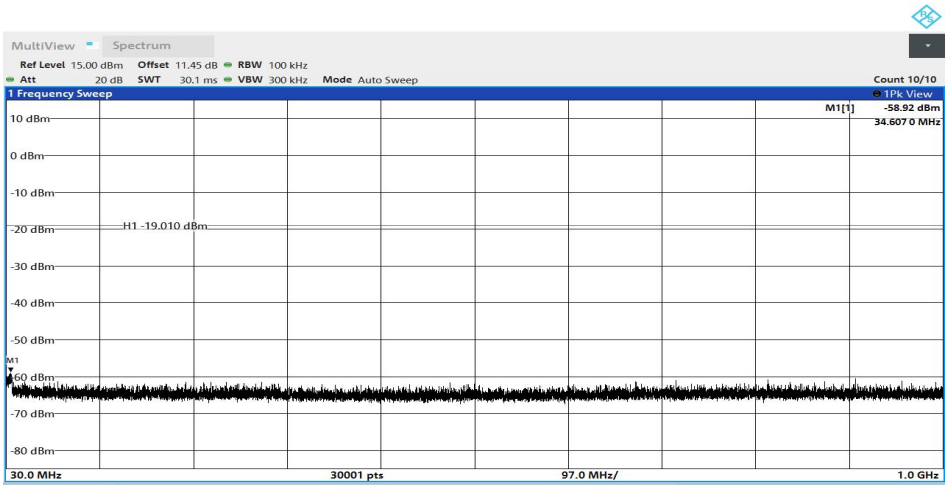
BLE_2M-Ant1-2440-1000~26500-0.10



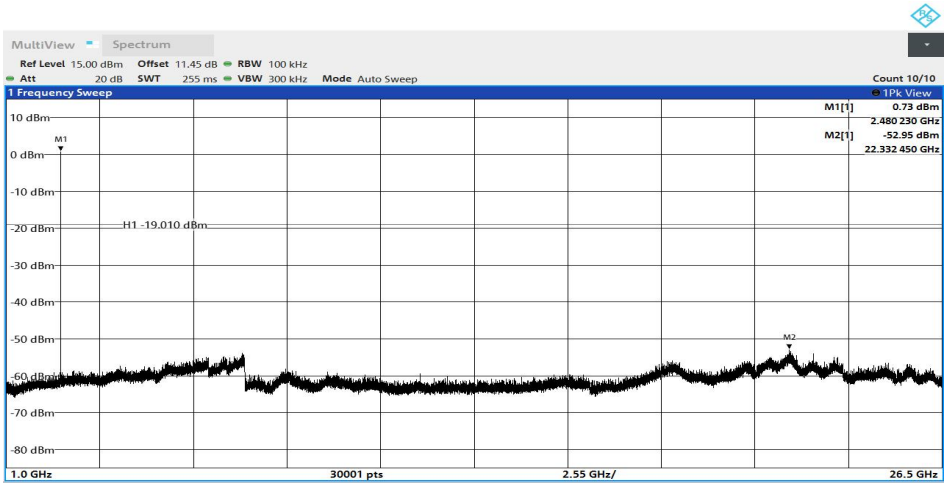
BLE_2M-Ant1-2480-0~Reference-0.99



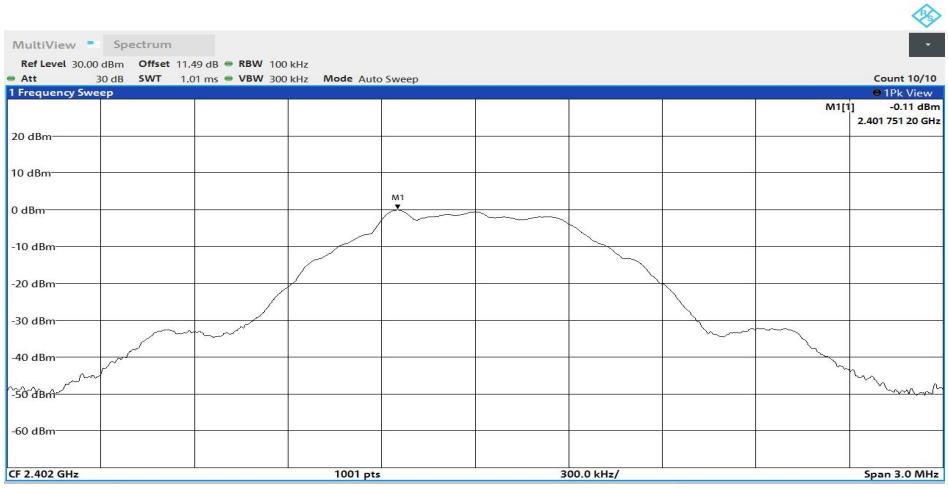
BLE_2M-Ant1-2480-30~1000-0.99



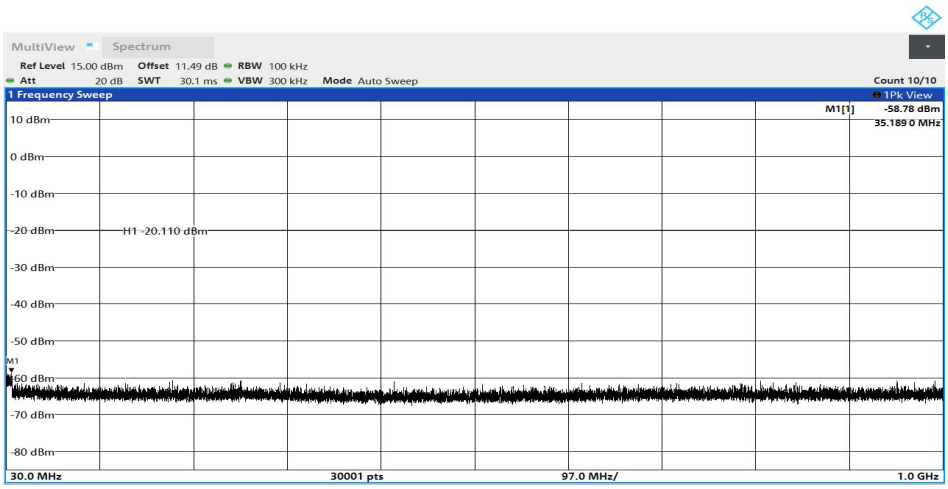
BLE_2M-Ant1-2480-1000~26500-0.99



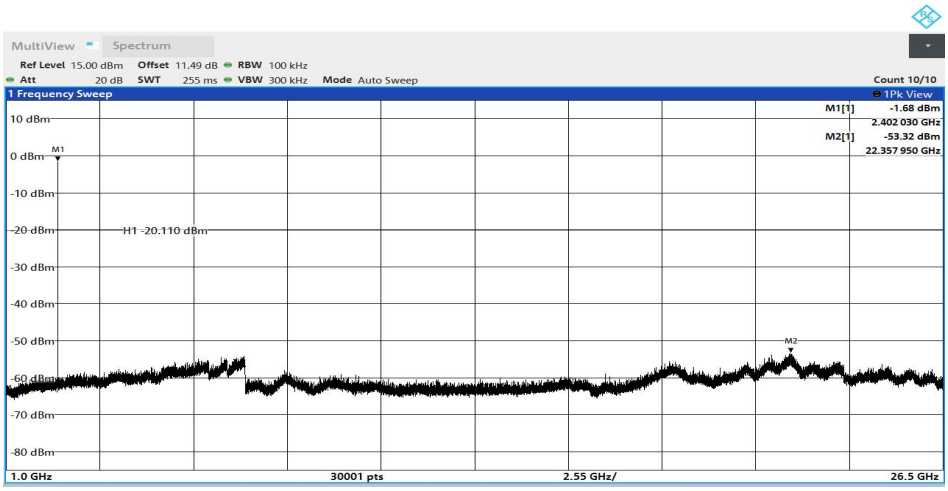
BLE_125K-Ant1-2402-0~Reference--0.11



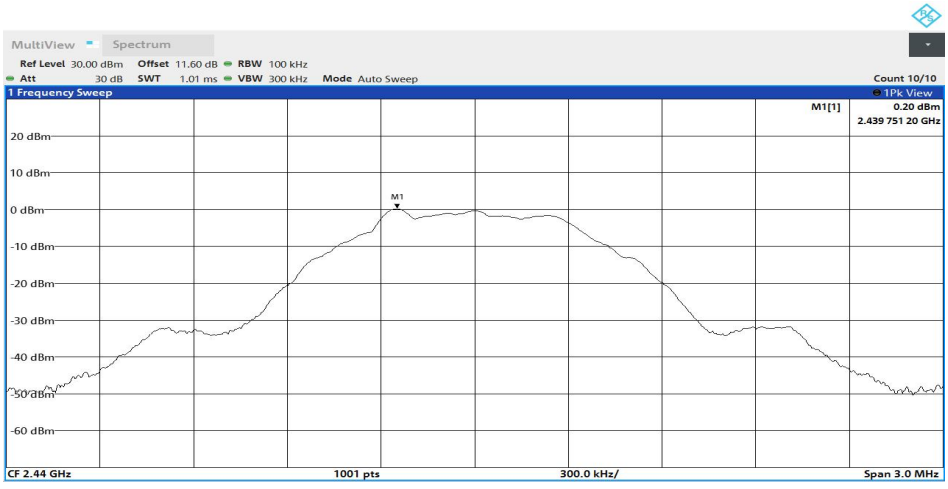
BLE_125K-Ant1-2402-30~1000--0.11



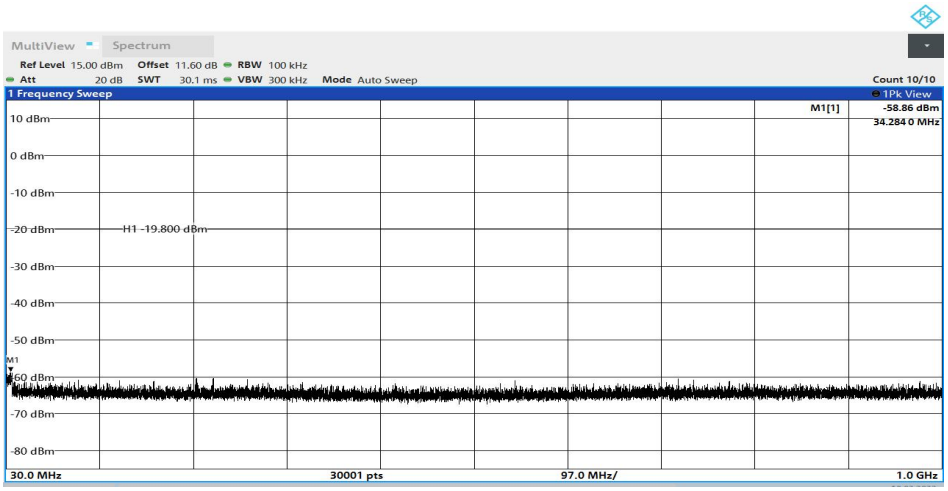
BLE_125K-Ant1-2402-1000~26500--0.11



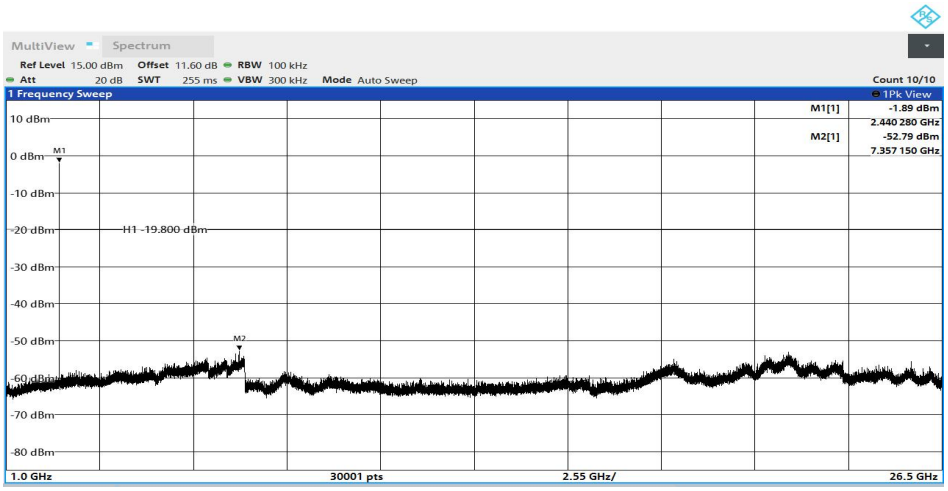
BLE_125K-Ant1-2440-0~Reference-0.20



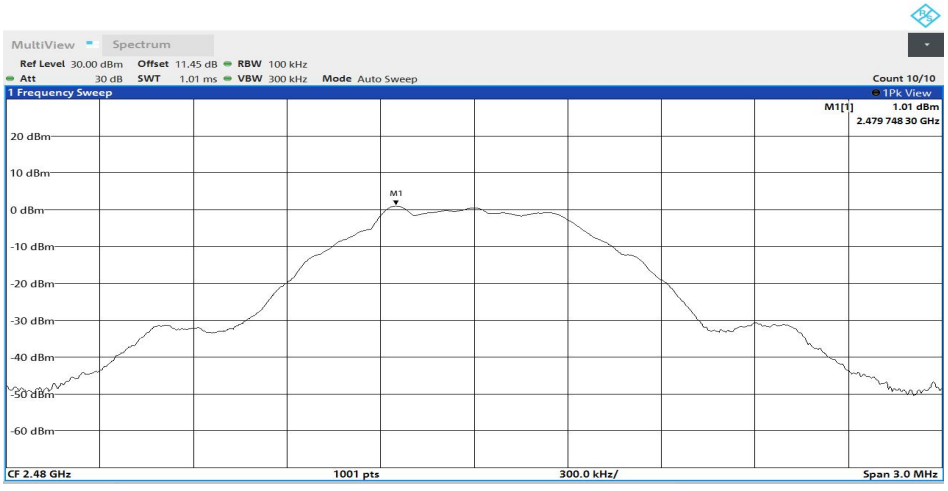
BLE_125K-Ant1-2440-30~1000-0.20



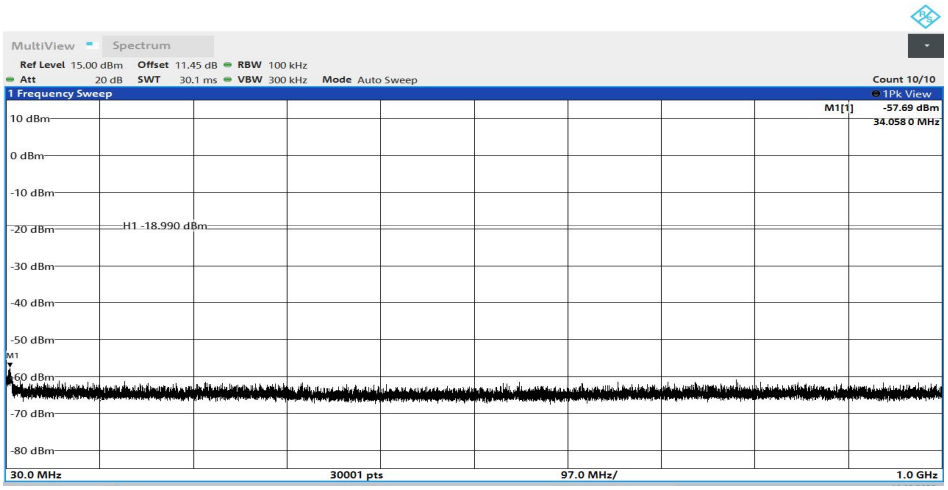
BLE_125K-Ant1-2440-1000~26500-0.20



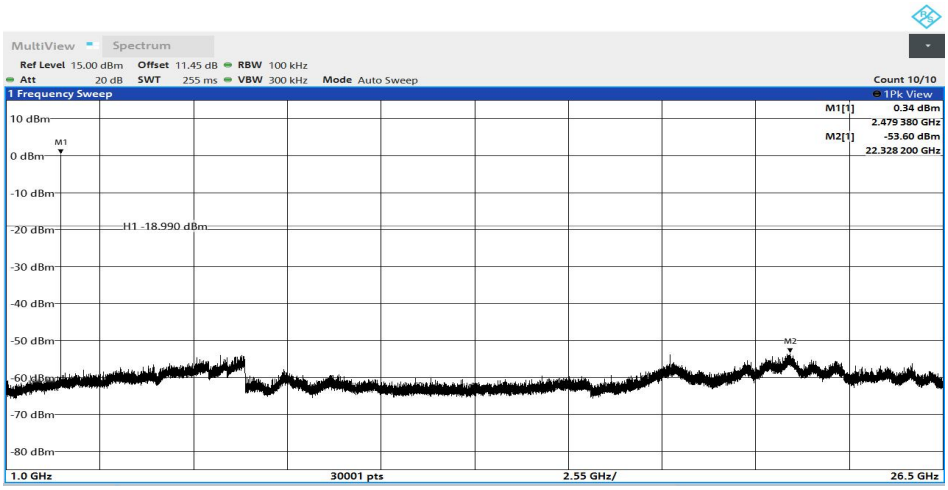
BLE_125K-Ant1-2480-0~Reference-1.01



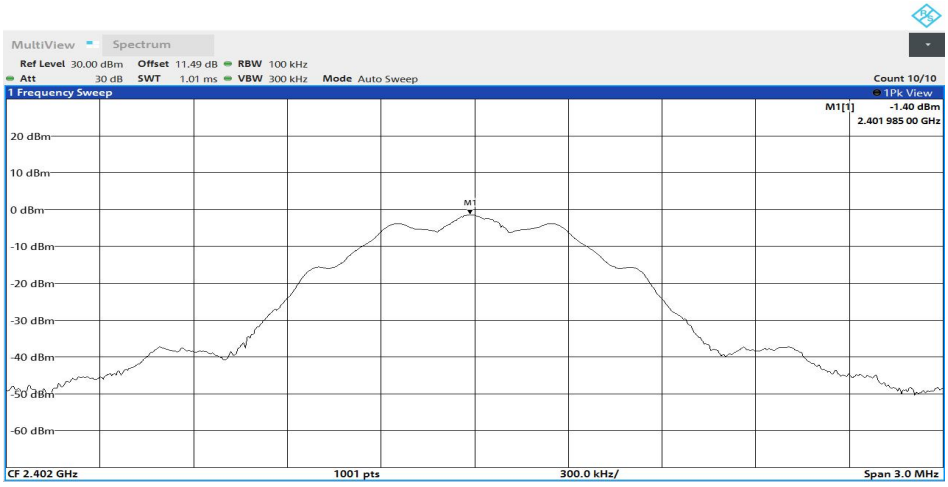
BLE_125K-Ant1-2480-30~1000-1.01



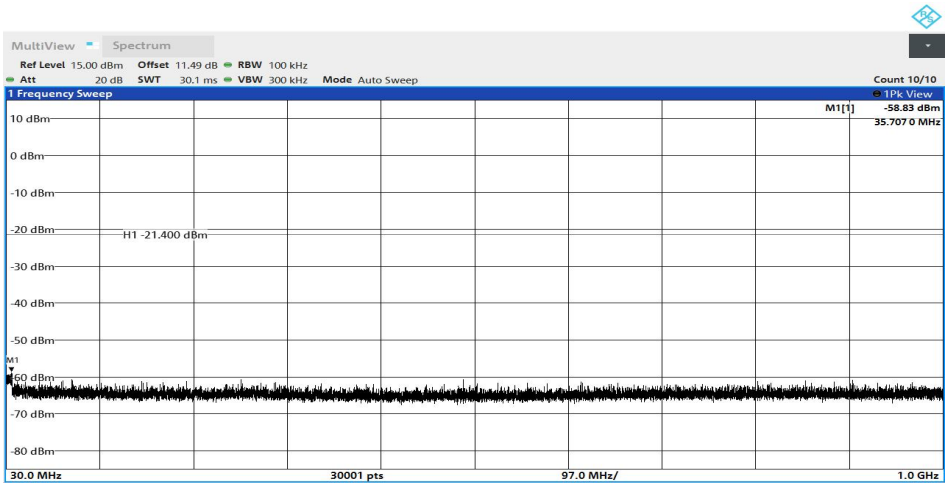
BLE_125K-Ant1-2480-1000~26500-1.01



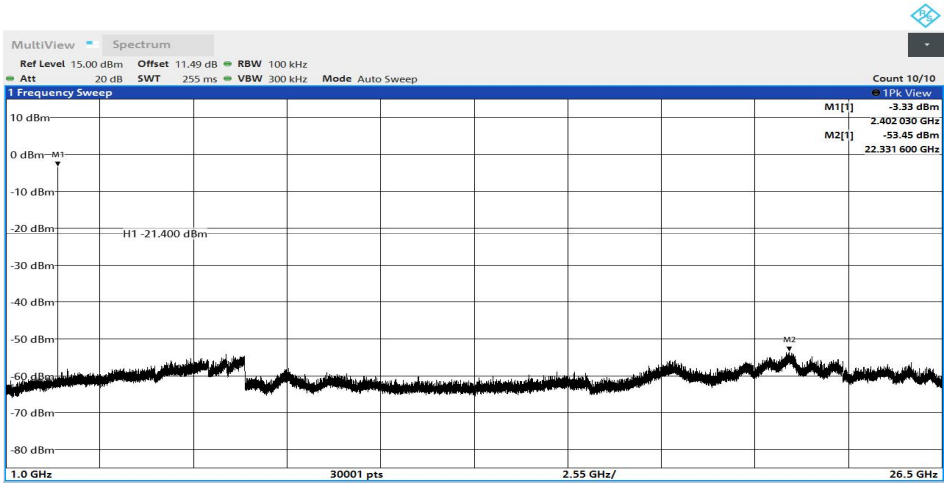
BLE_500K-Ant1-2402-0~Reference--1.40



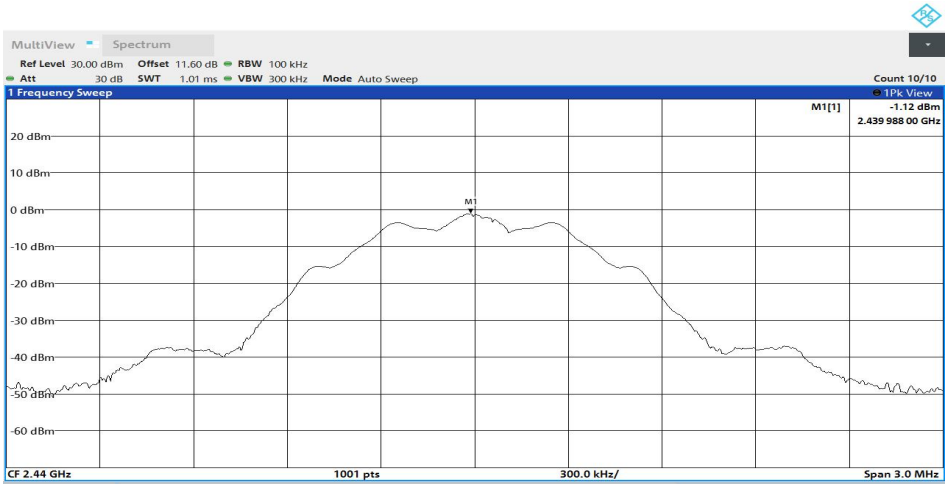
BLE_500K-Ant1-2402-30~1000--1.40



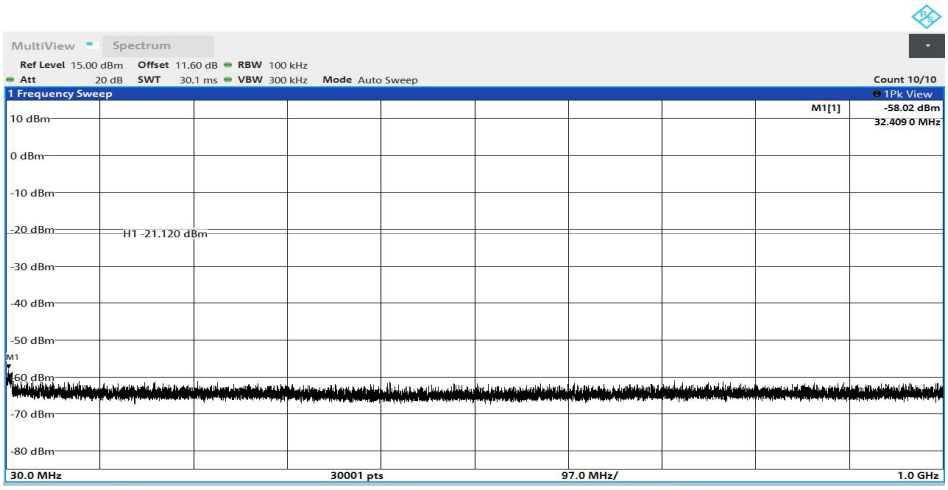
BLE_500K-Ant1-2402-1000~26500--1.40



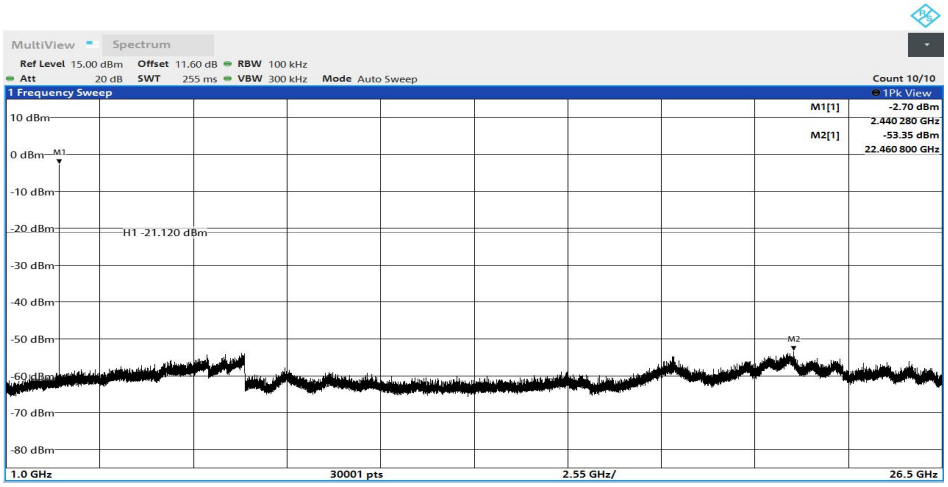
BLE_500K-Ant1-2440-0~Reference--1.12



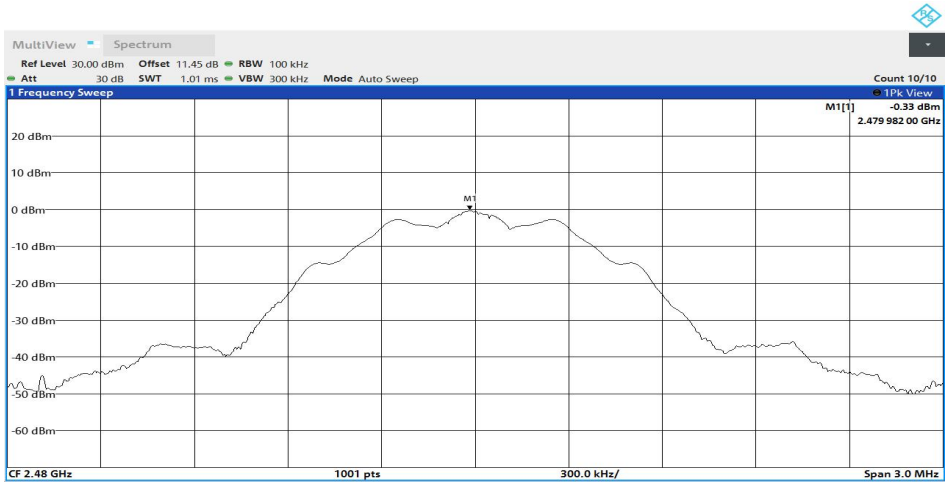
BLE_500K-Ant1-2440-30~1000--1.12



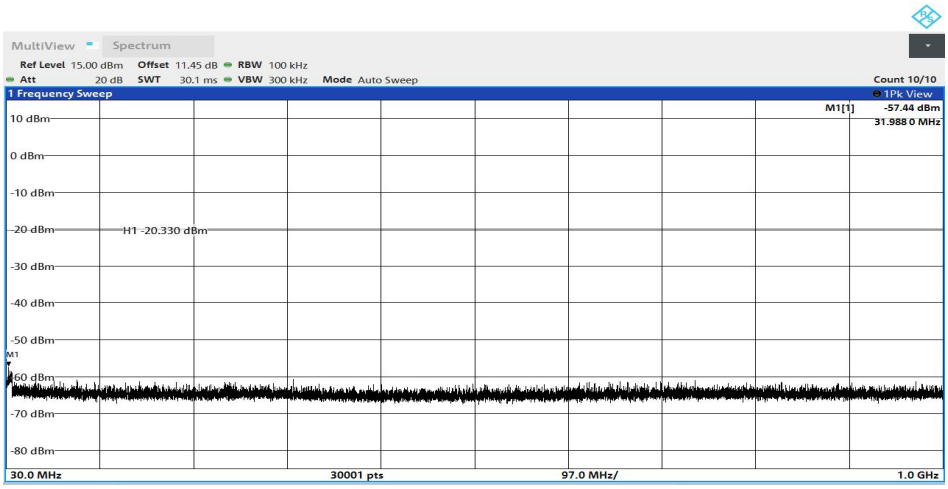
BLE_500K-Ant1-2440-1000~26500--1.12



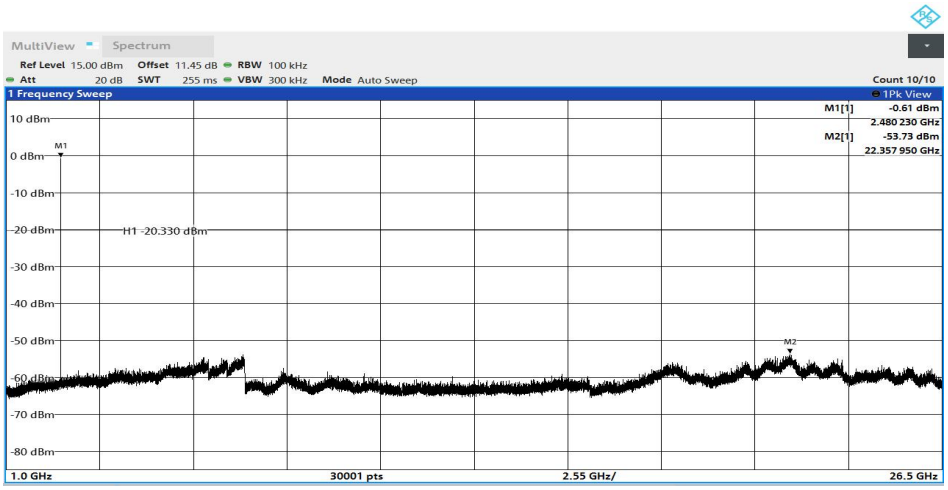
BLE_500K-Ant1-2480-0~Reference--0.33



BLE_500K-Ant1-2480-30~1000--0.33



BLE_500K-Ant1-2480-1000~26500--0.33



6.8. Radiated Emission

Specifications:	FCC 47 Part 15.247(d),15.205(a),15.209(a)
DUT Serial Number:	S2
Test conditions:	Ambient Temperature:15℃-35℃ Relative Humidity:30%-60% Air pressure: 86-106kPa
Test Results:	Pass

Limit Level Construction:

Standard	Limit
FCC 47 Part 15.247(d),15.205(a),15.209(a)15.247(d),15.205(a),15.209(a)	20dB below peak output power in 100KHz bandwidth

Measurement Uncertainty:

Measurement Uncertainty	30MHz-1000MHz: 4.09 dB(MAX) (k=2). 1000MHz-6000MHz : 4.84 dB (k=2). 6000MHz-18000MHz : 4.52 dB (k=2).

In addition, radiated emissions 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)).

Limit in restricted band

Frequency of emission (MHz)	Field strength (uV/m)	Field strength (dBuV/m)
0.009~0.49	2400/F (kHz)	129-94
0.49~1.705	24000/F (kHz)	74-63
1.705~30	30	70
30~88	100	40
88~216	150	43.5
216~960	200	46
Above 960	500	54

Test Method

Portable, small, lightweight, or modular devices that may be handheld, worn on the body, or placed on a table during operation shall be positioned on a non-conducting platform, the top of which is 80 cm above the reference ground plane. The preferred area occupied by the EUT arrangement is 1 m by 1.5 m, but it

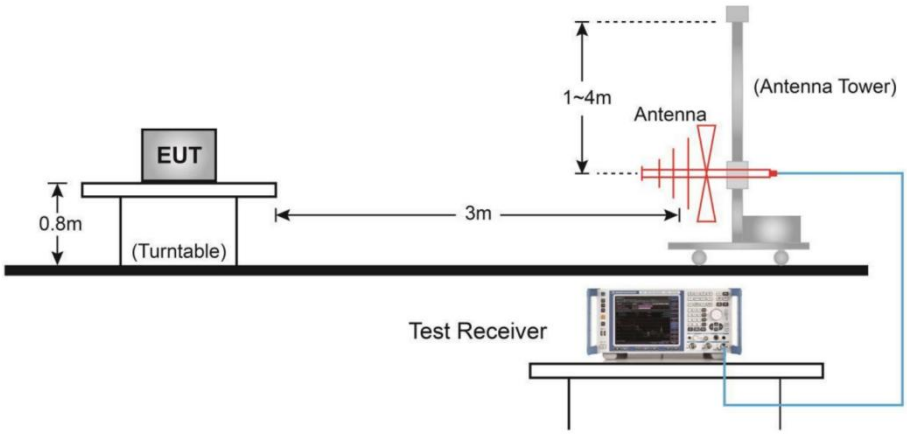
may be larger or smaller to accommodate various sized EUTs. For testing purposes, ceiling- and wall-mounted devices also shall be positioned on a tabletop (see also ANSI C63.10-2013 section 6.3.4 and 6.3.5). In making any tests involving handheld, body-worn, or ceiling-mounted equipment, it is essential to recognize that the measured levels may be dependent on the orientation (attitude) of the three orthogonal axes of the EUT. Thus, exploratory tests as specified in 8.3.1 shall be carried out for various axes orientations to determine the attitude having maximum or near-maximum emission level.

The EUT was placed on a non-conductive table. The measurement antenna was placed at a distance of 3 meters from the EUT. During the tests, the antenna height and the EUT azimuth were varied in order to identify the maximum level of emissions from the EUT. This maximization process was repeated with the EUT positioned in each of its three orthogonal orientations.

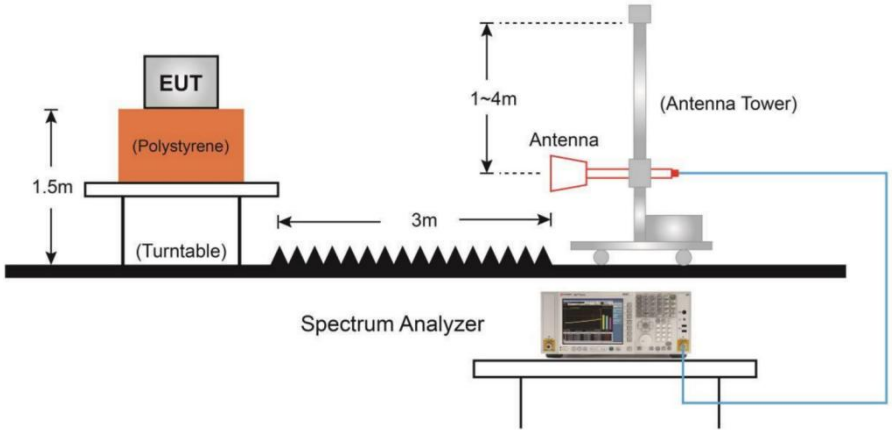
Frequency of emission (MHz)	RBW/VBW	Sweep Time (s)
0.009~30	9KHz/30KHz	Auto
30~1000	100KHz/300KHz	5
1000~4000	1MHz/3MHz	15
4000~18000	1MHz/3MHz	40
18000~26500	1MHz/3MHz	20

Test Setup

Below 1GHz Test Setup



Above 1GHz Test Setup


EUT
(Polystyrene)
1.5m
(Turntable)
3m
1~4m
Antenna
(Antenna Tower)
Spectrum Analyzer

Measurement Results:

A “reference path loss” is established and ARpi is the attenuation of “reference path loss”, and including the gain of receive antenna, the gain of the preamplifier, the cable loss.

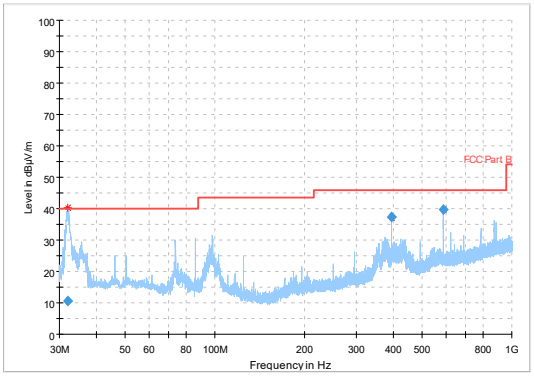
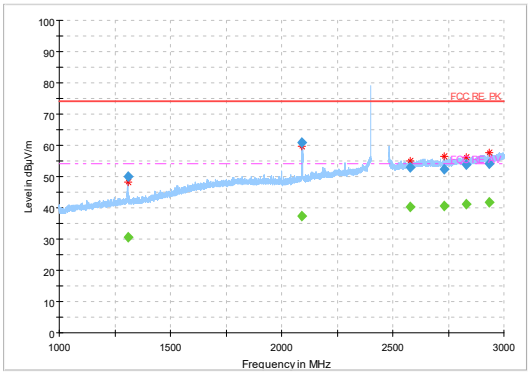
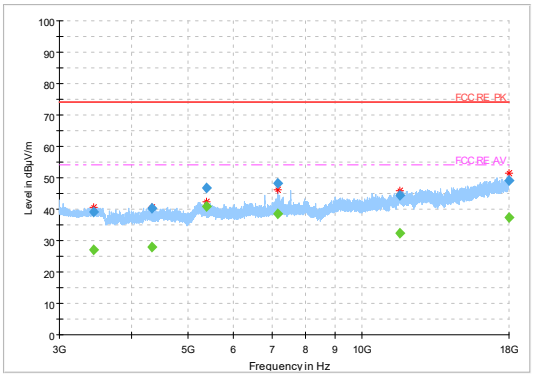
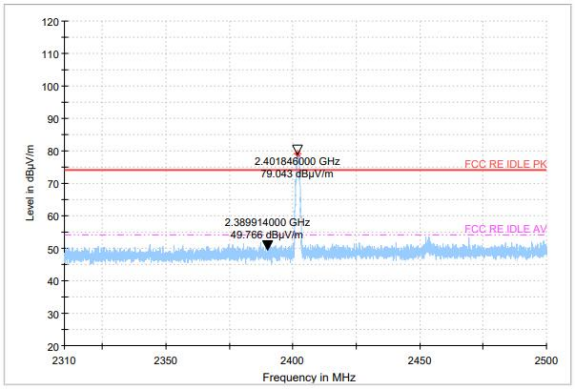
The measurement results are obtained as described below:

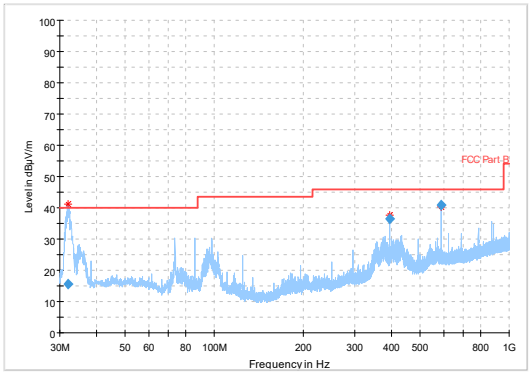
A_{Rpi} = Cable loss + Antenna Factor-Preamplifier gain

Result=P_{Mea} + A_{Rpi}

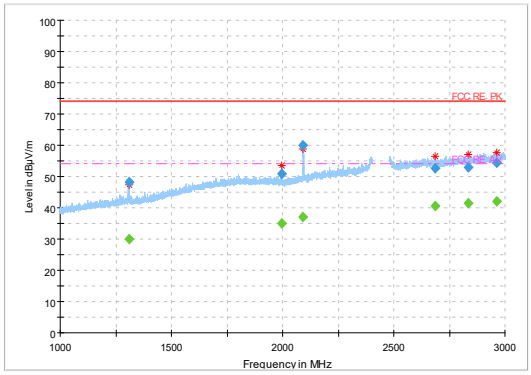
The test data below 30MHz is more than 20dB lower than the limit value, so it is not provided in the report.

Main Supply

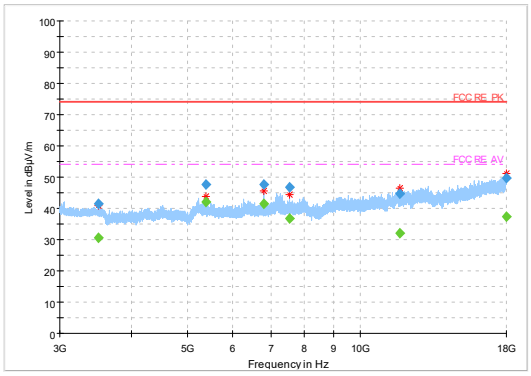
Radiated emission: Ch0, 30MHz~1GHz	Radiated emission: Ch0, 1GHz~3GHz
	
Radiated emission: Ch0, 3GHz~18GHz	Bandedge:Ch0
	
Radiated emission: Ch39, 30MHz~1GHz	Radiated emission: Ch39, 1GHz~3GHz

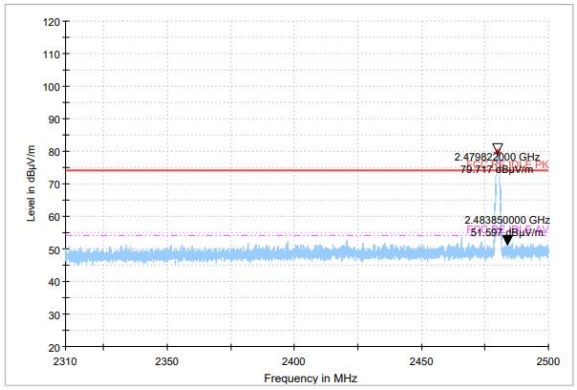


Radiated emission: Ch39, 3GHz~18GHz



Bandedge:Ch39





Note1: The out-of- limit signal in the picture is the main frequency signal.

Note2: Sweep the whole frequency band through the range from 30MHz to the 5th harmonic of the carrier, the Emissions in the frequency band 18GHz-40GHz is more than 20dB below the limit are not report.

GFSK Ch0 30MHz-1GHz

Frequency (MHz)	Result (dBµV/m)	ARpl (dB)	PMea (dBµV/m)	Polarity
32.0	10.58	-14.3	24.88	H
393.2	37.28	-8.2	45.48	V
589.8	39.8	-3.7	43.5	V

GFSK Ch0 1GHz-3GHz

Frequency (MHz)	Result (dBµV/m)	ARpl (dB)	PMea (dBµV/m)	Polarity
1308.1	49.89	4	45.89	V
2092.8	60.92	11.2	49.72	H

2578.7	53.04	15.6	37.44	H
2730.6	52.5	16.3	36.2	V
2832.1	53.69	17	36.69	H
2935.4	54.15	17.7	36.45	V

GFSK Ch0 1GHz-3GHz (Average)

Frequency (MHz)	Result (dBμV/m)	ARpl (dB)	PMea (dBμV/m)	Polarity
2092.8	37.42	11.2	26.22	H
2935.4	41.9	17.7	24.2	V

GFSK Ch0 3GHz-18GHz

Frequency (MHz)	Result (dBμV/m)	ARpl (dB)	PMea (dBμV/m)	Polarity
3442.8	39.15	-6.6	45.75	V
4339.3	40.27	-5.1	45.37	V
5400.0	46.85	-2.8	49.65	V
7152.0	48.19	-2.4	50.59	V
11635.4	44.51	2.6	41.91	H
17996.1	49.19	12.2	36.99	H

GFSK Ch39 30MHz-1GHz

Frequency (MHz)	Result (dBμV/m)	ARpl (dB)	PMea (dBμV/m)	Polarity
32.1	15.54	-14.3	29.84	H
393.2	36.47	-8.2	44.67	V
589.8	40.91	-3.7	44.61	V

GFSK Ch39 1GHz-3GHz

Frequency (MHz)	Result (dBμV/m)	ARpl (dB)	PMea (dBμV/m)	Polarity
1308.4	48.14	4	44.14	H
1997.2	50.87	10.1	40.77	H
2092.1	60.02	11.2	48.82	V
2684.7	52.53	16.1	36.43	V

2834.3	53.06	17	36.06	H
2962.7	54.53	18	36.53	V

GFSK Ch39 1GHz-3GHz (Average)

Frequency (MHz)	Result (dBμV/m)	ARpl (dB)	PMea (dBμV/m)	Polarity
2092.1	37.18	11.2	25.98	V
2962.7	42.16	18	24.16	V

GFSK Ch39 3GHz-18GHz

Frequency (MHz)	Result (dBμV/m)	ARpl (dB)	PMea (dBμV/m)	Polarity
3502.4	41.52	-6.8	48.32	V
5400.0	47.79	-2.8	50.59	V
6812.6	47.68	-2.8	50.48	V
7534.9	46.74	-1.9	48.64	V
11724.5	44.77	2.5	42.27	V
17969.5	49.67	11.7	37.97	V

6.9. AC Powerline Conducted Emission

In accordance with the requirements of standard FCC Part 15.207, conducted emission is not applicable.

Annex A EUT Photos

See the document"I23W00008-External Photos".
See the document" I23W00008-Internal Photos ".

ANNEX B Deviations from Prescribed Test Methods

No deviation from Prescribed Test Methods.

*****END OF REPORT*****