

CERTIFICATION TEST REPORT

Report Number. : 4790841159-E3V2

Applicant : SAMSUNG ELECTRONICS CO., LTD.
129 SAMSUNG-RO, YEONGTONG-GU, SUWON-SI,
GYEONGGI-DO, 16677, KOREA

Model : SM-X510

FCC ID : A3LSMX510

IC : 649E-SMX510

EUT Description : BT/BLE Tablet + DTS/UNII a/b/g/n/ac/ax and Digitizer

Test Standard(s) : FCC 47 CFR PART 15 SUBPART C
INDUSTRY CANADA RSS-247 Issue 2
INDUSTRY CANADA RSS-GEN Issue 5

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Revision History

<u>Rev.</u>	<u>Issue Date</u>	<u>Revisions</u>	<u>Revised By</u>
V1	2023-07-19	Initial issue	Dexter(Hyunsik) Yun
V2	2023-08-01	Updated to address TCB's question	Dexter(Hyunsik) Yun

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: SAMSUNG ELECTRONICS CO., LTD.

EUT DESCRIPTION: GSM/WCDMA/LTE 5G NR Tablet + BT/BLE, DTS/UNII a/b/g/n/ac/ax and Digitizer

MODEL: SM-X516B

SERIAL NUMBER: 2W500GF0B, 74134cec50397ece (CONDUCTED, Original);
74b2c4c8e3397ece, 74134cec51397ece (RADIATED, Original);
74ab471810397ece, 74aadb216a397ece, R32W600ADXF (RADIATED, Spot-check);

DATE TESTED: 2023-06-09 ~ 2023-07-14(Original);
2023-07-07 ~ 2023-07-19(Spot-check);

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
CFR 47 Part 15 Subpart C	Complies
INDUSTRY CANADA RSS-247 Issue 2	Complies
INDUSTRY CANADA RSS-GEN Issue 5	Complies

UL KOREA LTD. tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by UL KOREA LTD. based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL KOREA LTD. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL KOREA LTD. will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by IAS, any agency of the Federal Government, or any agency of any government.

Approved & Released For
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Tested By:



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1.1. INTRODUCTION OF TEST DATA REUSE

This report referenced from the FCC ID: A3LSMX516B DSS Bluetooth(FCC CFR 47 Part 15C). And the applicant takes full responsibility that the test data as referenced in this report represent compliance for this FCC ID.

1.2. DIFFERENCE

Except for removing WWAN RF components, The SM-X510(IC: 649E-SMX510) model shares the same enclosure and circuit board as SM-X516B.The Bluetooth antennas and surrounding circuitry and layout are identical between these two units.

After confirming through preliminary radiated emissions that the performance of the SM-X510 (IC: 649E-SMX510) remains representative of SM-X516B. The test data of SM-X516B being submitted for this application to cover Bluetooth features.

1.3. SPOT CHECK VERIFICATION DATA

(Worst case of the radiated band-edge and radiated spurious emissions)

Band	Test Item	Mode	Frequency	Test Limit	Original model	Spot check model	Deviation	Remark
					SM-X516B Results	SM-X510 Results		
					FCC ID : A3LSMX516B	FCC ID : A3LSMX510		
DSS BT (2.4GHz)	BANDEDGE	GFSK	2480 MHz	74 dBuV/m	63.28 dBuV/m	61.94 dBuV/m	-1.34 dB	
	RSE	GFSK	4804 MHz	54 dBuV/m	43.52 dBuV/m	41.99 dBuV/m	-1.53 dB	

Comparison of two models, upper deviation is within 3 dB range and all test results are under FCC Technical Limits.

1.4. REFERENCE DETAIL

Reference application that contains the reused reference data in the individual test reports:

Equipment Class	Reference FCC ID (Parent)	Application Type	Reference Test report number	Exhibit Type	Variant Test Report Number	Data Re-used
DTS	A3LSMX516B	Original Grant	4790841155-E5 (802.11b/g/n/ax)	Test Report	4790841159-E1 (802.11b/g/n/ax)	Partial Note1
DSS	A3LSMX516B	Original Grant	4790841155-E7 (Bluetooth)	Test Report	4790841159-E3 (Bluetooth)	All
NII	A3LSMX516B	Original Grant	4790841155-E8 (802.11a/n/ac/ax)	Test Report	4790841159-E4 (802.11a/n/ac/ax)	Partial Note2
DCD	A3LSMX516B	Original Grant	4790841155-E9 (Digitizer)	Test Report	4790841159-E5 (Digitizer)	All

Note1. 802.11b & 802.11n HT20 mode with changed target power was fully tested.

Note2. DFS was fully tested.

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with following methods.

1. FCC CFR 47 Part 2.
2. FCC CFR 47 Part 15.
3. KDB 558074 D01 15.247 Meas Guidance v05r02.
4. KDB 484596 D01 Referencing Test Data v01
5. IC RSS-GEN Issue 5.
6. IC RSS-247 Issue 2.
7. ANSI C63.10-2013.

3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea. Line conducted emissions are measured only at the 218 address. The following table identifies which facilities were utilized for radiated emission measurements documented in this report. Specific facilities are also identified in the test results sections.

218 Maeyeong-ro	
<input checked="" type="checkbox"/>	Chamber 1(3m semi-anechoic chamber)
<input checked="" type="checkbox"/>	Chamber 2(3m semi-anechoic chamber)
<input checked="" type="checkbox"/>	Chamber 3(3m semi-anechoic chamber)
<input type="checkbox"/>	Chamber 4(3m Full-anechoic chamber)
<input type="checkbox"/>	Chamber 5(3m Full-anechoic chamber)

Used ISED Test Site Reg.(company number): 2324L
CAB Identifier: KR0161

UL KOREA LTD. is accredited by IAS, Laboratory Code TL-637. The full scope of accreditation can be viewed at <https://www.iasonline.org/wp-content/uploads/2017/05/TL-637-cert-New.pdf>.

4. DECISION RULES AND MEASUREMENT UNCERTAINTY

4.1. METROLOGICAL TRACEABILITY

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

4.2. SAMPLE CALCULATION

Where relevant, the following sample calculation is provided:

$$\begin{aligned} \text{Field Strength (dBuV/m)} &= \text{Measured Voltage (dBuV)} + \text{Antenna Factor (dB/m)} + \\ &\text{Cable Loss (dB)} - \text{Preamp Gain (dB)} \\ 36.5 \text{ dBuV} + 18.7 \text{ dB/m} + 0.6 \text{ dB} - 26.9 \text{ dB} &= 28.9 \text{ dBuV/m} \end{aligned}$$

$$\begin{aligned} \text{AC Corrected Reading (dBuV)} &= \text{Measured Voltage (dBuV)} + \text{Extension Cord} \\ &\text{Loss (dB)} + \text{Cable Loss (dB)} \\ 44.72 \text{ dBuV} &= 34.72 \text{ dBuV} + 9.9 \text{ dB} + 0.1 \text{ dB} \end{aligned}$$

4.3. MEASUREMENT UNCERTAINTY

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

PARAMETER	UNCERTAINTY
RF Output Power	1.30 dB
Time	2.50 %
Occupied Bandwidth	0.20 %
Conducted Spurious Emissions	1.30 dB
Conducted Disturbance, 0.15 to 30 MHz	2.80 dB
Radiated Disturbance, 30 MHz to 1 GHz	3.92 dB
Radiated Disturbance, 1 GHz to 18 GHz	5.06 dB
Radiated Disturbance, 18 GHz to 40 GHz	6.02 dB

Uncertainty figures are valid to a confidence level of 95%.

4.4. DECISION RULES

Decision rule for statement(s) of conformity is based on Procedure 2, Clause 4.4.3 in IEC Guide 115:2021.

5. EQUIPMENT UNDER TEST

5.1. EUT DESCRIPTION

The EUT is a BT/BLE Tablet + DTS/UNII a/b/g/n/ac/ax and Digitizer.
This test report addresses the BT(DSS) operational mode.

5.2. MAXIMUM OUTPUT POWER

The transmitter has a maximum peak conducted output power as follows:

Frequency Range [MHz]	Mode	Power Mode	Output Power [dBm]	Output Power [mW]
2 402 ~ 2 480	Basic GFSK	Peak	14.090	25.645
		Average	13.817	24.082
	Enhanced Pi/4-DPSK	Peak	12.700	18.621
		Average	10.421	11.018
	Enhanced 8PSK	Peak	13.310	21.429
		Average	10.425	11.028

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

An intentional radiator antenna shall be designed to ensure that no antenna other than that furnished by the responsible party can 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 internal antenna was Permanently attached.
Therefore this E.U.T Complies with the requirement of §15.203.**

The radio utilizes an internal antennas with ANT1's maximum gain of -4.80 dBi.

5.4. WORST-CASE CONFIGURATION AND MODE

Radiated emission below 1GHz and power line conducted emission were performed with the EUT set to transmit at the channel with highest output power as worst-case scenario.

Radiated emission above 1GHz was performed with the EUT set to transmit low/mid/high channels.

Worst case of antenna axis: X

All radiated and power line conducted tests were performed attached with travel adapter for the worst-case condition mode.

GFSK, Pi/4-DQPSK, 8PSK average Power are all investigated, The GFSK & 8PSK Power are the worst case. Testing is based on this mode to showing compliance.

5.5. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	Manufacturer	Model	Serial Number	FCC ID
Charger	SAMSUNG	EP-TA800	R37M9KN2LV2DK3	N/A
Data Cable	SAMSUNG	EP-DN980	GH39-02115A	N/A

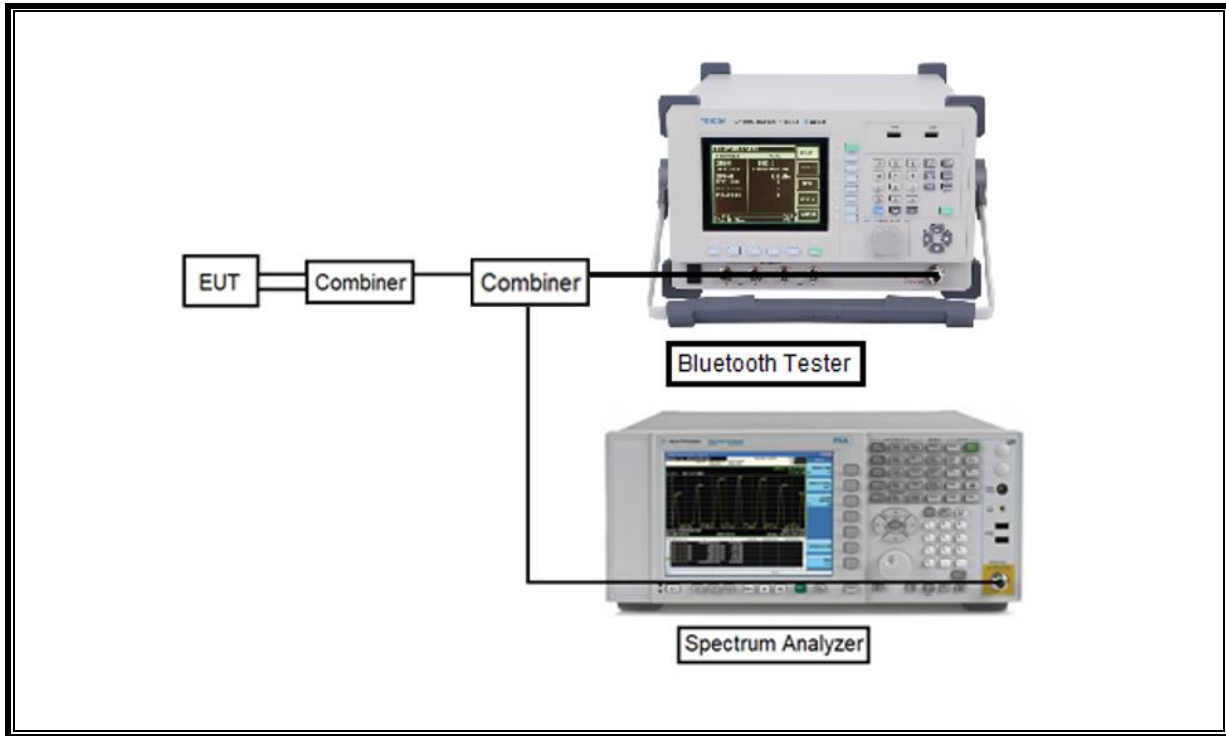
I/O CABLE

I/O Cable List						
Cable No.	Port	# of identical ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	DC Power	1	C Type	Shielded	1.0 m	N/A

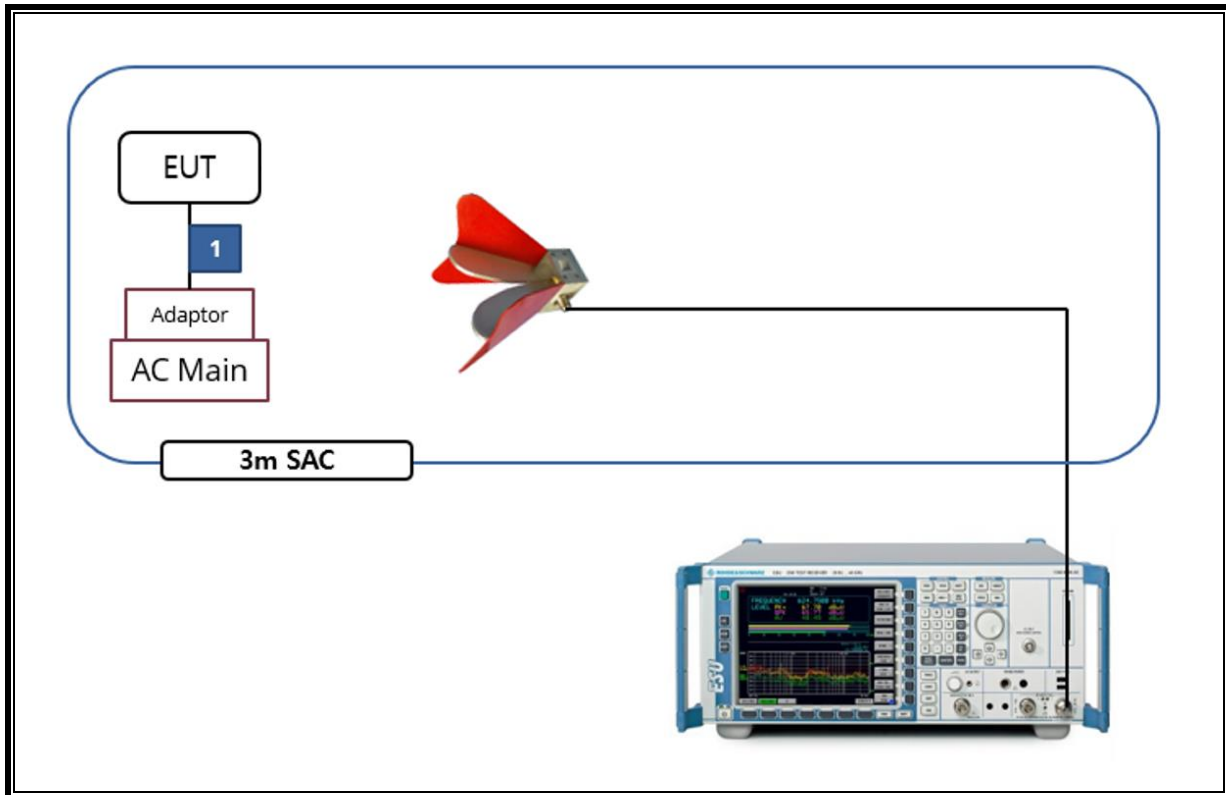
TEST SETUP

The EUT is continuously communicating to the Bluetooth tester during the tests. Test software enable BT communications.

SETUP DIAGRAM FOR TESTS (CONDUCTED TEST SETUP)



SETUP DIAGRAM FOR TESTS (RADIATED TEST SETUP)



6. TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment was utilized for the tests documented in this report:

Test Equipment List				
Description	Manufacturer	Model	S/N	Cal Due
Antenna, Bilog, 30MHz-1GHz	SCHWARZBECK	VULB9163	750	2024-08-15
Antenna, Bilog, 30MHz-1GHz	SCHWARZBECK	VULB9163	749	2024-08-15
Antenna, Bilog, 30MHz-1GHz	SCHWARZBECK	VULB9163	845	2024-08-15
Antenna, Loop, 9kHz-30MHz	R&S	HFH2-Z2	100418	2023-10-06
Antenna, Horn, 18 GHz	ETS	3115	00167211	2024-08-04
Antenna, Horn, 18 GHz	ETS	3115	00161451	2024-08-21
Antenna, Horn, 18 GHz	ETS	3117	00168724	2024-08-04
Antenna, Horn, 18 GHz	ETS	3117	00168717	2024-08-21
Antenna, Horn, 40 GHz	ETS	3116C	00166155	2024-08-02
Preamplifier	ETS	3115-PA	00167475	2023-08-04
Preamplifier	ETS	3116C-PA	00168841	2023-08-04
Directional Antenna	Cobham	FPA3-0.8-6.0R/1329	80108-0004	N/A
Directional Antenna	Cobham	FPA3-0.8-6.0R/1329	110367-0003	N/A
Preamplifier, 1000 MHz	Sonoma	310N	341282	2023-08-02
Preamplifier, 1000 MHz	Sonoma	310N	351741	2023-08-02
Preamplifier, 1000 MHz	Sonoma	310N	370599	2023-08-02
Preamplifier, 18 GHz	Miteq	AFS42-00101800-25-S-42	1896138	2023-08-01
Preamplifier, 18 GHz	Miteq	AFS42-00101800-25-S-42	2029169	2023-08-01
Spectrum Analyzer, 44 GHz	Agilent / HP	N9030A	MY54170614	2023-08-03
Spectrum Analyzer, 44 GHz	Agilent / HP	N9030A	MY54490312	2023-08-01
Spectrum Analyzer, 44 GHz	KEYSIGHT	N9030B	MY60070693	2024-01-09
Spectrum Analyzer, 44 GHz	KEYSIGHT	N9040B	MY60080268	2024-01-09
Average Power Sensor	Agilent / HP	U2000	MY54270007	2023-08-03
Average Power Sensor	Agilent / HP	U2000	MY54260010	2023-08-03
Bluetooth Tester	TESCOM	TC-3000C	3000C000546	2023-08-02
Power Splitter	MINI-CIRCUITS	WA1534	UL003	2024-01-09
Power Splitter	MINI-CIRCUITS	WA1534	UL004	2024-01-09
Attenuator	PASTERNAK	PE7087-10	A009	2023-08-03
Attenuator	PASTERNAK	PE7087-10	A001	2023-08-03
Attenuator	PASTERNAK	PE7087-10	A008	2023-08-03
Attenuator	PASTERNAK	PE7004-10	2	2023-08-01
EMI Test Receive, 40 GHz	R&S	ESU40	100439	2023-08-02
EMI Test Receive, 40 GHz	R&S	ESU40	100457	2023-07-29
Low Pass Filter 5GHz	Micro-Tronics	LPS17541	009	2023-08-02
Low Pass Filter 5GHz	Micro-Tronics	LPS17541	015	2023-08-01
Low Pass Filter 5GHz	Micro-Tronics	LPS17541	020	2023-08-01
High Pass Filter 3GHz	Micro-Tronics	HPM17543	010	2023-08-02
High Pass Filter 3GHz	Micro-Tronics	HPM17543	015	2023-08-01
High Pass Filter 3GHz	Micro-Tronics	HPM17543	020	2023-08-01
High Pass Filter 6GHz	Micro-Tronics	HPS17542	009	2023-08-02
High Pass Filter 6GHz	Micro-Tronics	HPS17542	016	2023-08-01
High Pass Filter 6GHz	Micro-Tronics	HPS17542	021	2023-08-01
LISN	R&S	ENV-216	101837	2023-08-04
Termination	WEINSCHEL	M1406A	T09	2023-08-03
UL Software				
Description	Manufacturer	Model	Version	
Radiated software	UL	UL EMC	Ver 9.5	
AC Line Conducted software	UL	UL EMC	Ver 9.5	

7. TEST RESULTS SUMMARY

FCC Part Section	IC Part Section	Test Description	Test Limit	Test Condition	Test Result
2.1051, 15.247(d)	RSS-247 5.5	Band Edge / Conducted Spurious Emission	-20 dBc	Conducted	Complies
15.247 (b)(1)	RSS-247 5.1(b)	TX conducted output power	< 21 dBm		Complies
15.247 (a)(1)	RSS-247 5.1(b)	Hopping frequency separation	> two-thirds of the 20 dB bandwidth		Complies
15.247 (a)(1)(iii)	RSS-247 5.1(d)	Number of Hopping channels	More than 15 non-overlapping channels		Complies
15.247 (a)(1)(iii)	RSS-247 5.1(d)	Avg Time of Occupancy	< 8 dBm		Complies
15.207(a)	RSS-GEN Clause 7.2 & 8.8	AC Power Line conducted emissions	Section 11	Power Line conducted	Complies
15.205, 15.209	RSS-GEN Clause 8.9 & 8.10	Radiated Spurious Emission	< 54dBuV/m(Av)	Radiated	Complies

8. MEASUREMENT METHODS

20dB BW : ANSI C63.10, Section 6.9.2

99% BW : ANSI C63.10, Section 6.9.3

HOPPING FREQUENCY SEPARATION : ANSI C63.10, Section 7.8.2

NUMBER OF HOPPING CHANNELS : ANSI C63.10, Section 7.8.3

AVERAGE TIME OF OCCUPANCY : ANSI C63.10, Section 7.8.4

OUTPUT POWER : ANSI C63.10, Section 7.8.5.

Out-of-band EMISSIONS (Conducted) : ANSI C63.10, Section 7.8.6, 7.8.8

Out-of-band EMISSIONS IN NON-RESTRICTED BANDS: ANSI C63.10, Section 6.

Out-of-band EMISSIONS IN RESTRICTED BANDS : ANSI C63.10, Section 6.

AC Power Line Conducted Emission : ANSI C63.10-2013, Section 6.2.

9. ANTENNA PORT TEST RESULTS

9.1. ON TIME AND DUTY CYCLE

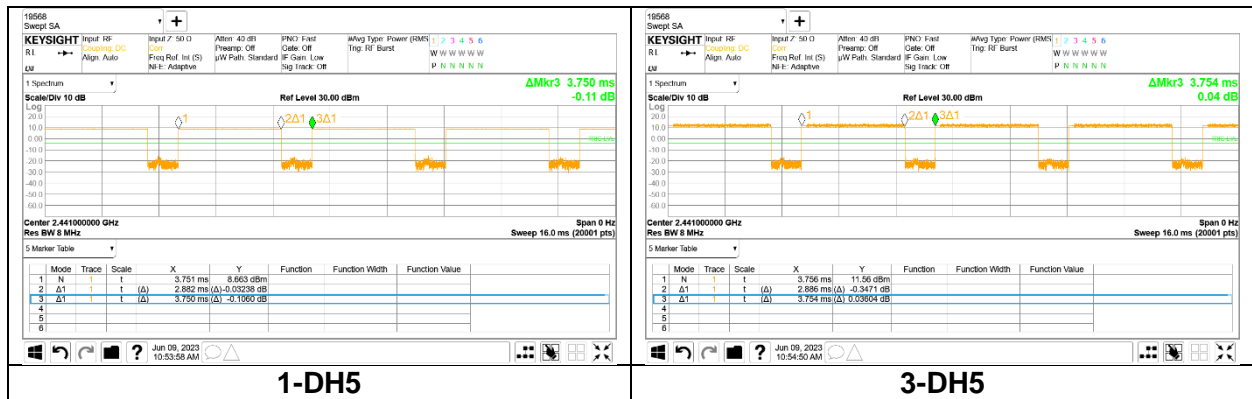
LIMITS

None; for reporting purposes only.

PROCEDURE

ANSI C63.10, Section 11.6 : Zero-Span Spectrum Analyzer Method.

ON TIME AND DUTY CYCLE RESULTS



Mode	On time [msec]	Period [msec]	Duty Cycle [%]	1/T Minimum VBW [kHz]
2 400 ~ 2 483.5 MHz Band				
BDR	2.882	3.750	76.85	0.35
EDR	2.886	3.754	76.88	0.35

9.2. 20 dB & 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The nominal IF filter bandwidth (3 dB RBW) shall be in the range of 1% to 5% of the OBW and video bandwidth (VBW) shall be approximately three times RBW, unless otherwise specified by the applicable requirement. The sweep time is coupled.

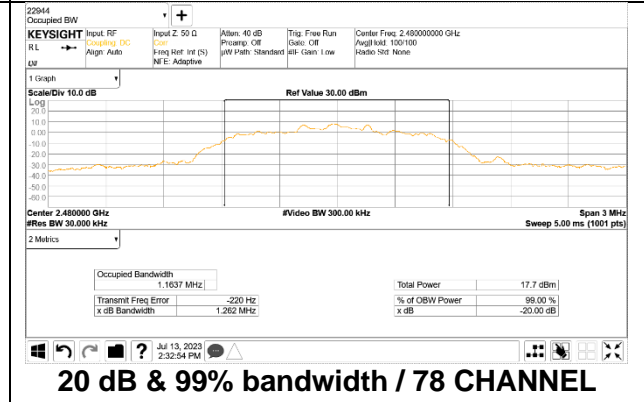
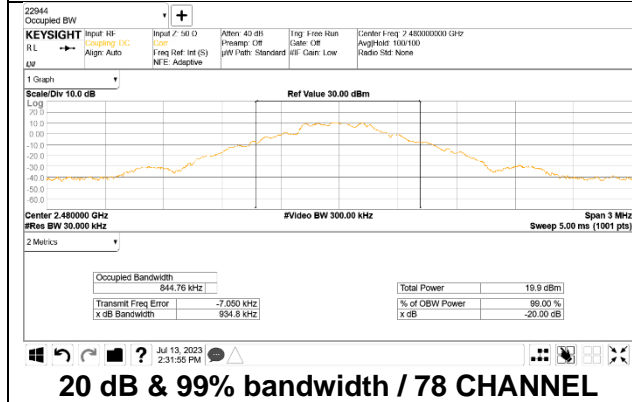
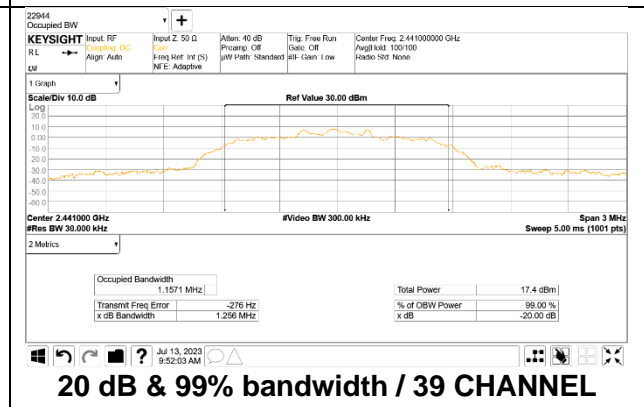
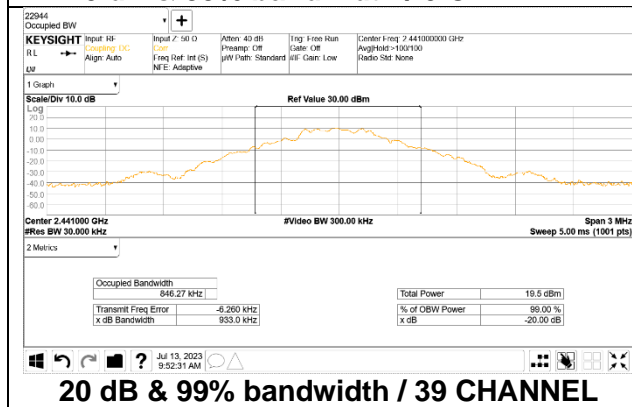
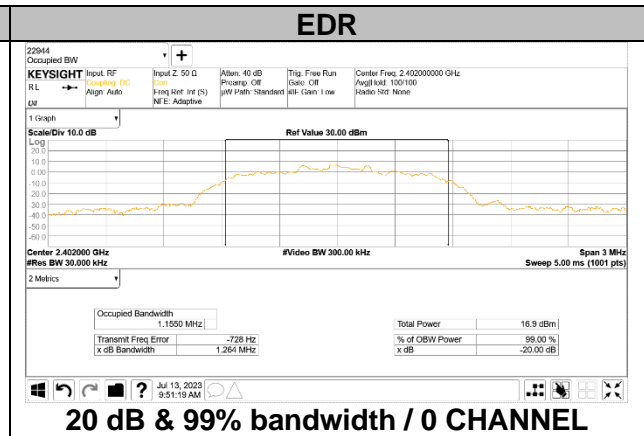
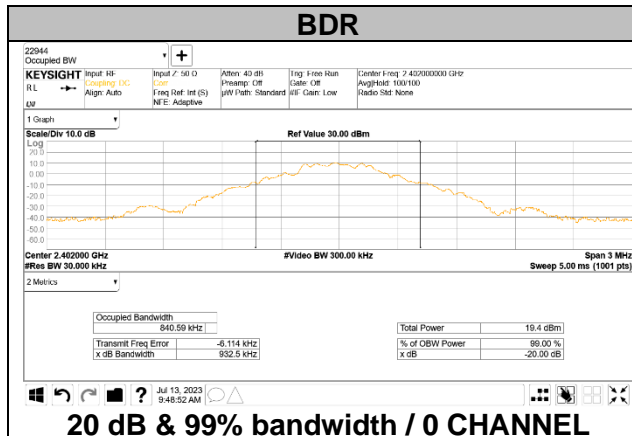
RESULTS

9.2.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION

Channel	Frequency [MHz]	20 dB Bandwidth [MHz]	99% Bandwidth [MHz]
0	2 402	0.933	0.841
39	2 441	0.933	0.846
78	2 480	0.935	0.845
Worst		0.935	

9.2.2. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION

Channel	Frequency [MHz]	20 dB Bandwidth [MHz]	99% Bandwidth [MHz]
0	2 402	1.264	1.155
39	2 441	1.256	1.157
78	2 480	1.262	1.164
Worst		1.264	



9.3. HOPPING FREQUENCY SEPARATION

LIMITS

RSS-247 (5.1) (b)
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.

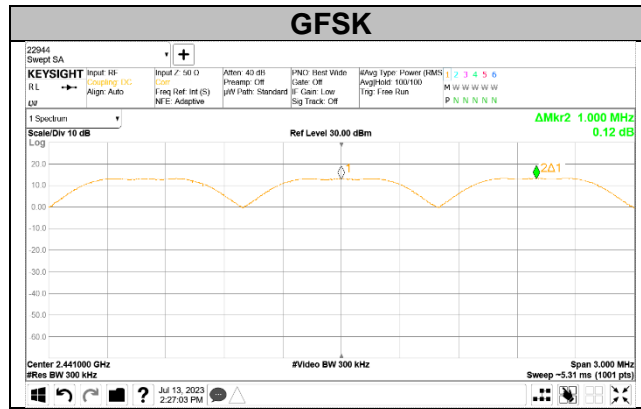
Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

TEST PROCEDURE

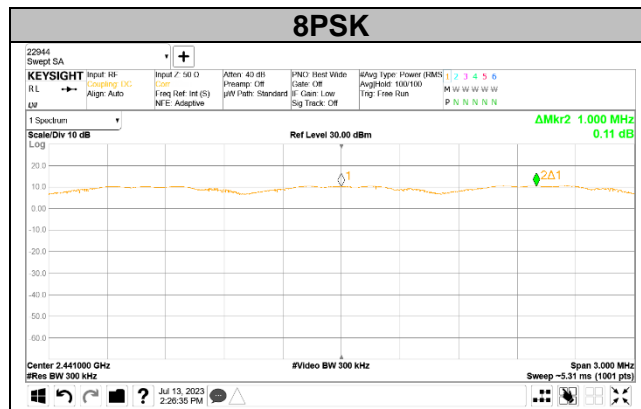
The transmitter output is connected to a spectrum analyzer. Start with the RBW set to approximately 30% of the channel spacing; adjust as necessary to best identify the center of each individual channel. The VBW is set to $VBW \geq RBW$. The sweep time is coupled.

RESULTS

9.3.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION



9.3.2. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION



9.4. NUMBER OF HOPPING CHANNELS

LIMITS

RSS-247 (5.1) (d)
FCC §15.247 (a) (1) (iii)

Frequency hopping systems in the 2400 – 2483.5 MHz band shall use at least 15 non-overlapping channels.

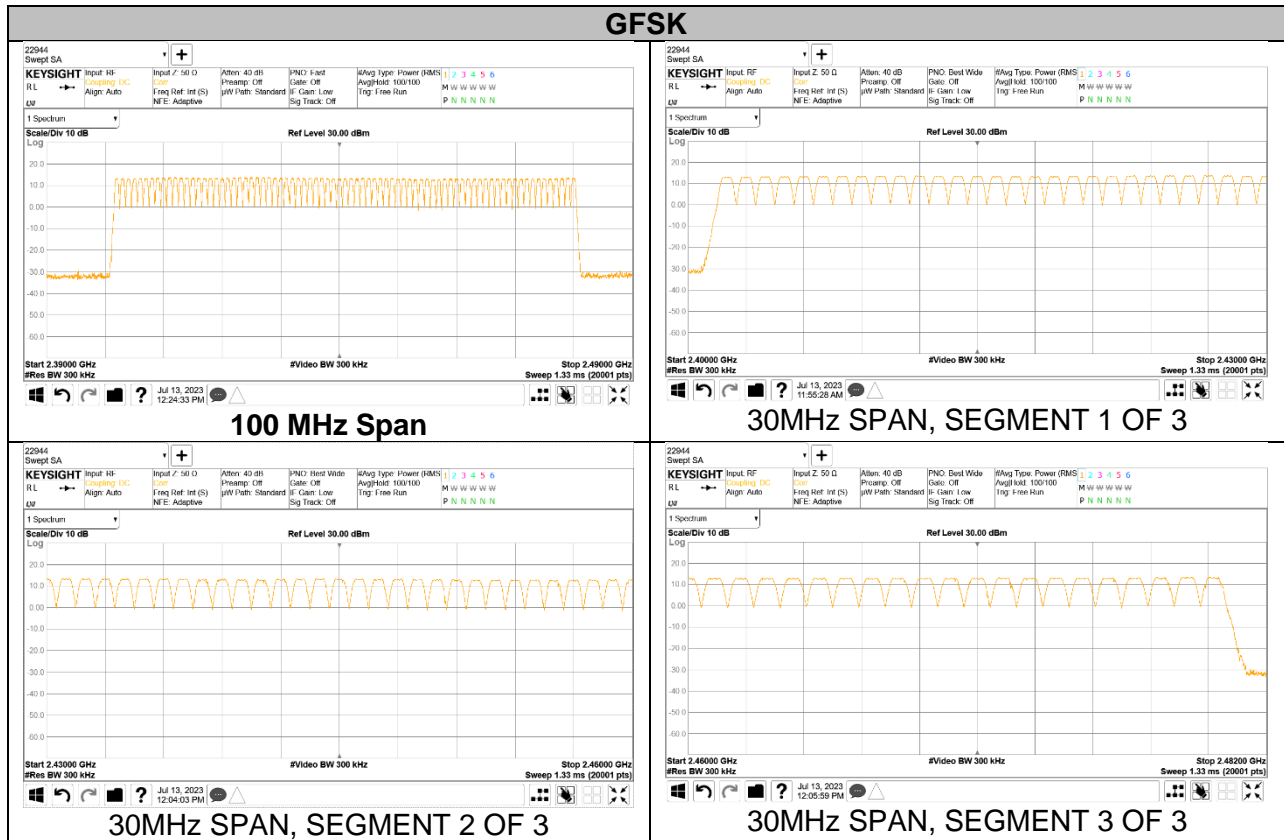
TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The span is set to cover the entire authorized band, in either a single sweep or in multiple contiguous sweeps. 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. The analyzer is set to Max Hold.

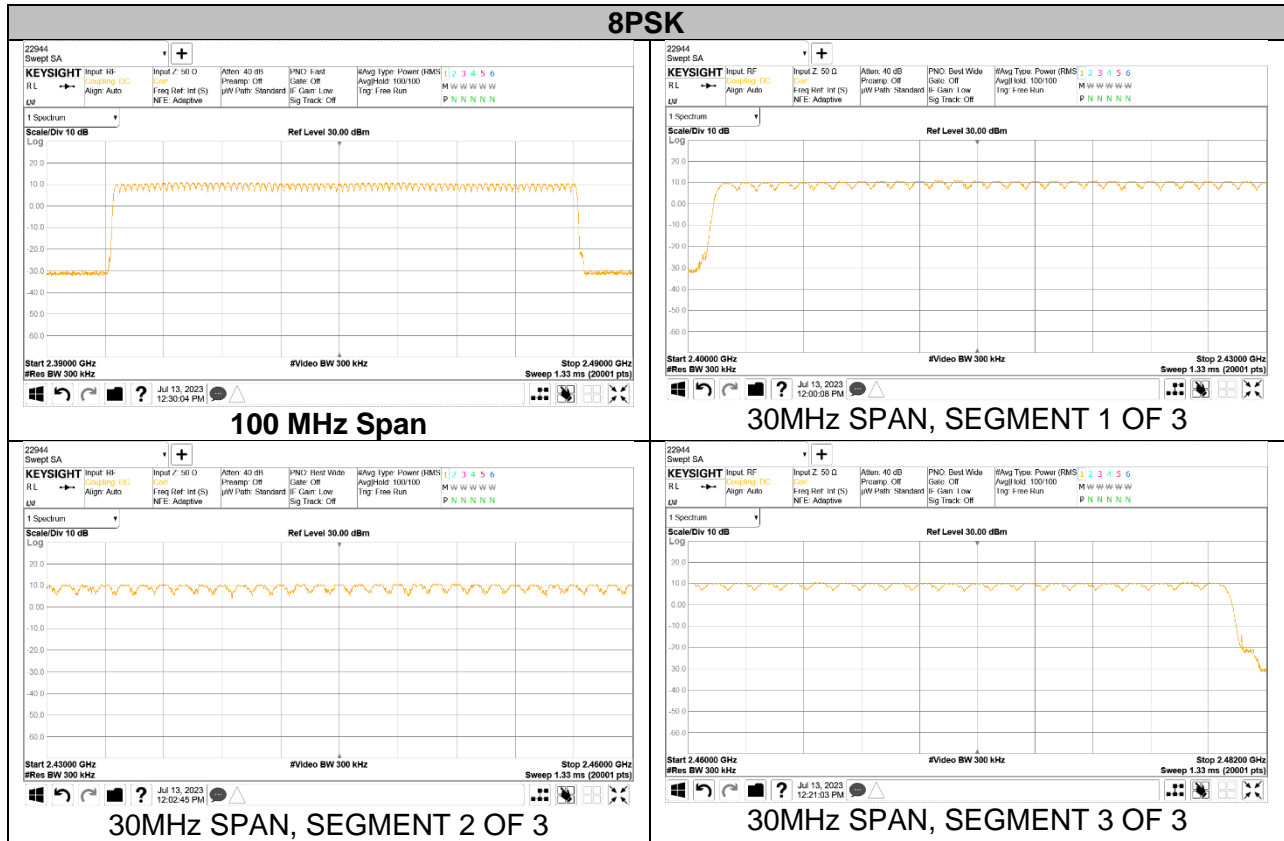
RESULTS

Normal Mode: All Channels Observed

9.4.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION



9.4.2. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION



9.5. AVERAGE TIME OF OCCUPANCY

LIMITS

RSS-247 (5.1) (d)
FCC §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.

TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The span is set to 0 Hz, centered on a single, selected hopping channel. The width of a single pulse is measured in a fast scan. The number of pulses is measured in a 3.16 second scan, to enable resolution of each occurrence.

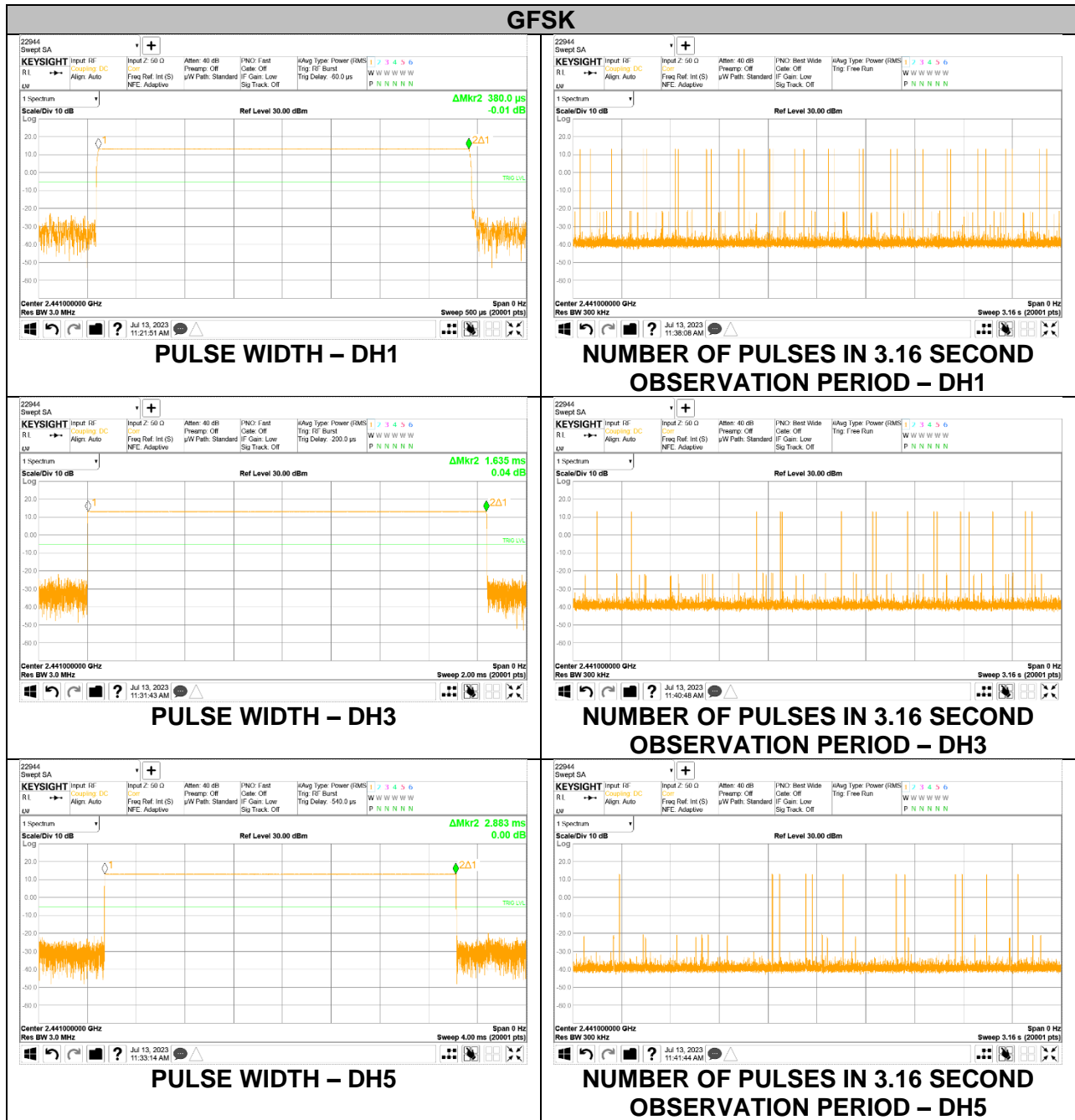
The average time of occupancy in the specified 3.16 second period (79 channels * 0.4 s) is equal to $10 * (\# \text{ of pulses in } 3.16 \text{ s}) * \text{ pulse width}$.

For AFH mode, the average time of occupancy in the specified 8 second period (20 channels * 0.4 seconds) is equal to $10 * (\# \text{ of pulses in } 0.8 \text{ s}) * \text{ pulse width}$.

RESULTS

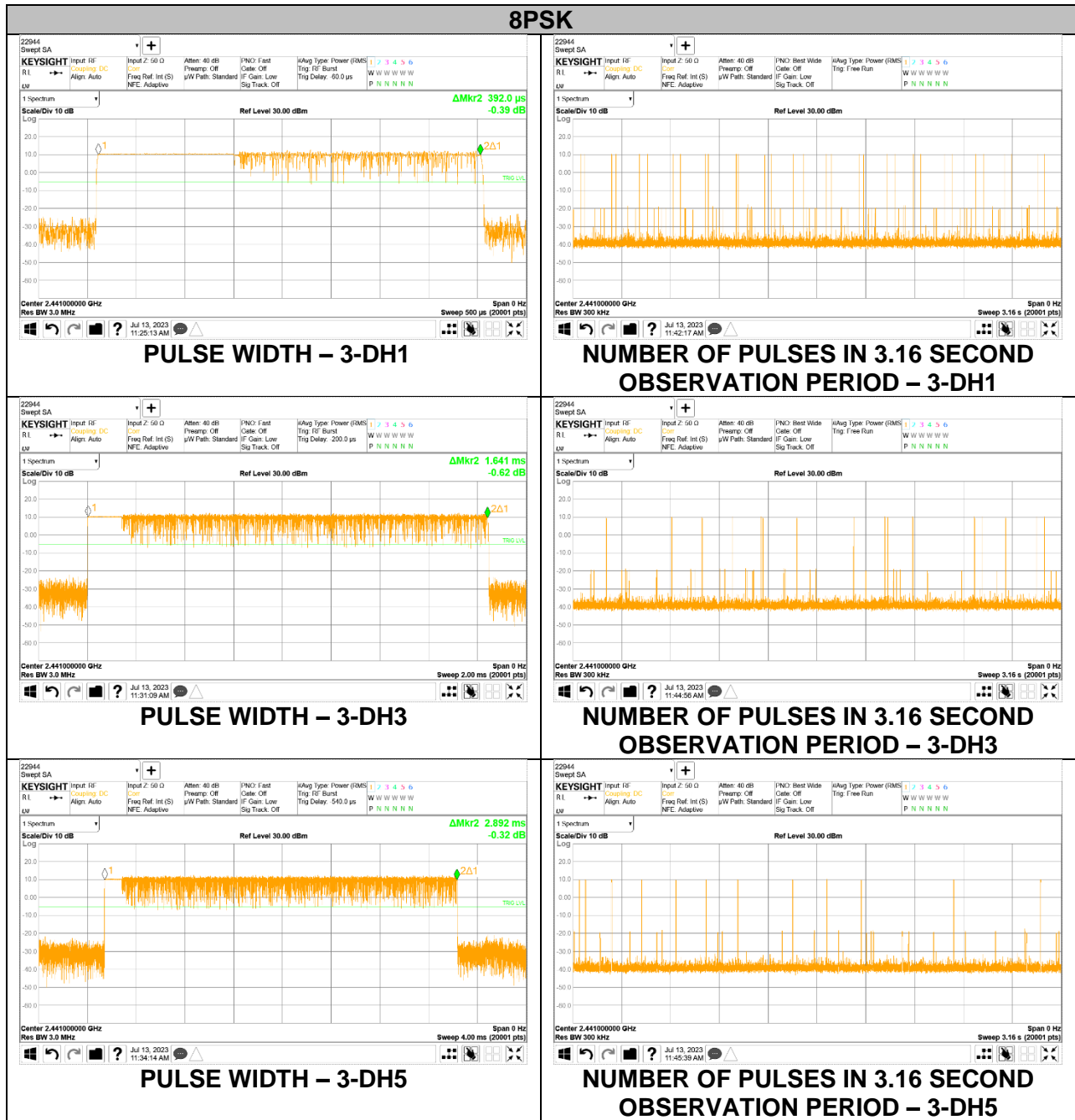
9.5.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION

DH Packet	Pulse Width [msec]	Number of Pulses in 3.16 seconds	Average Time of Occupancy [sec]	Limit [sec]	Margin [sec]
GFSK Normal					
DH1	0.380	32	0.122	0.4	-0.278
DH3	1.635	16	0.262	0.4	-0.138
DH5	2.883	12	0.346	0.4	-0.054
DH Packet	Pulse Width [msec]	Number of Pulses in 0.8 seconds	Average Time of Occupancy [sec]	Limit [sec]	Margin [sec]
GFSK AFH					
DH1	0.380	8	0.030	0.4	-0.370
DH3	1.635	4	0.065	0.4	-0.335
DH5	2.883	3	0.086	0.4	-0.314



9.5.2. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION

DH Packet	Pulse Width [msec]	Number of Pulses in 3.16 seconds	Average Time of Occupancy [sec]	Limit [sec]	Margin [sec]
8PSK Normal					
DH1	0.390	32	0.125	0.4	-0.275
DH3	1.641	16	0.263	0.4	-0.137
DH5	2.892	12	0.347	0.4	-0.053
DH Packet	Pulse Width [msec]	Number of Pulses in 0.8 seconds	Average Time of Occupancy [sec]	Limit [sec]	Margin [sec]
8PSK AFH					
DH1	0.390	8	0.031	0.4	-0.369
DH3	1.641	4	0.066	0.4	-0.334
DH5	2.892	3	0.087	0.4	-0.313



9.6. OUTPUT POWER

LIMITS

RSS-247 5.1(b)
 §15.247 (b) (1)

The maximum antenna gain is less than 6 dBi, therefore the limit is 21 dBm.

TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer the analyzer bandwidth is set to a value greater than the 20 dB bandwidth of the EUT.

RESULTS

9.6.1. BASIC DATA RATE GFSK MODULATION

Channel	Frequency [MHz]	Peak Output Power [dBm]	Limit [dBm]	Margin [dB]
0	2 402	13.600	21.00	-7.400
39	2 441	14.090		-6.910
78	2 480	13.880		-7.120
Worst		14.090		-6.910

9.6.2. ENHANCED DATA RATE Pi/4-DPSK MODULATION

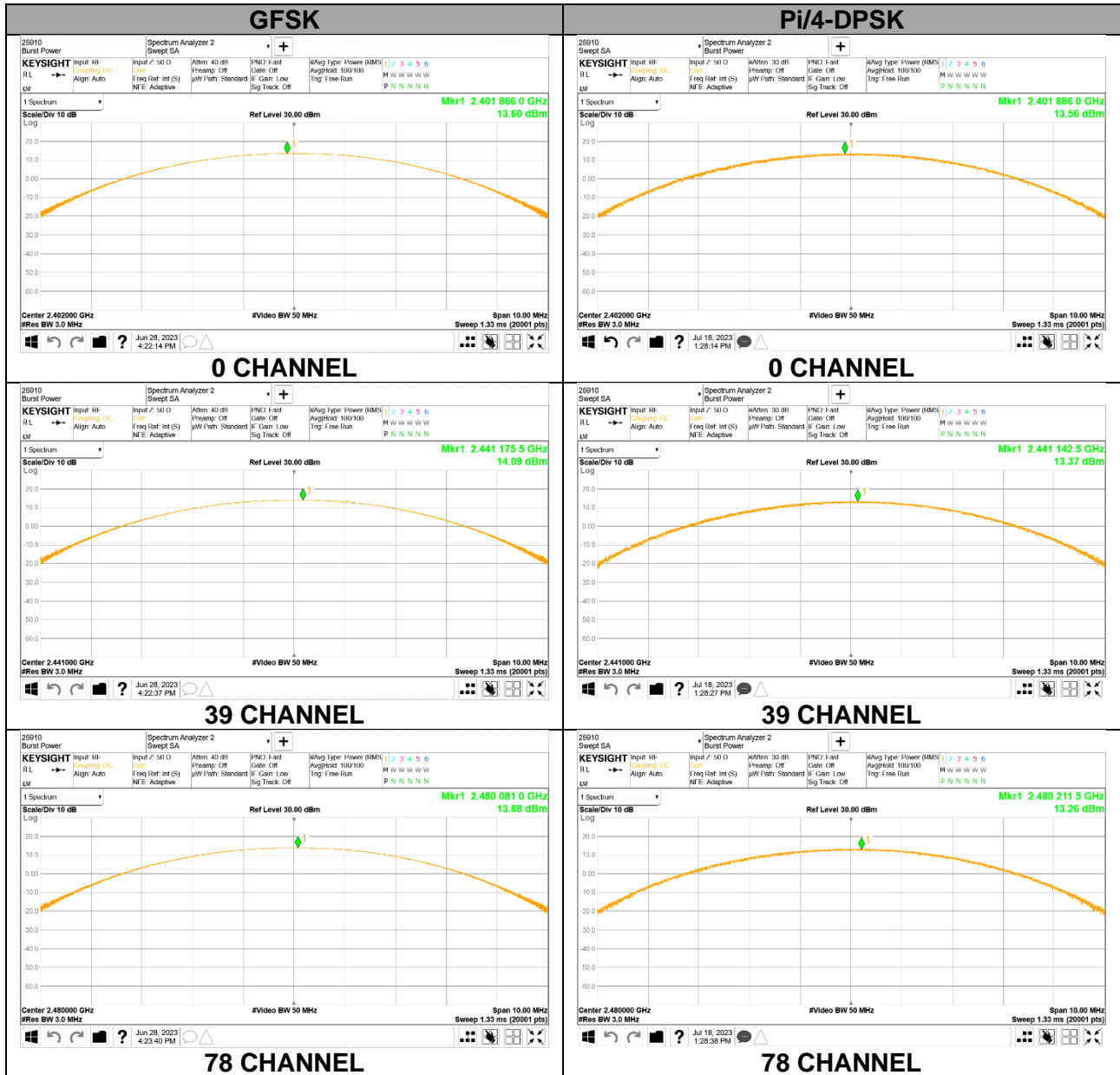
Channel	Frequency [MHz]	Peak Output Power [dBm]	Limit [dBm]	Margin [dB]
0	2 402	13.560	21.00	-7.440
39	2 441	13.370		-7.630
78	2 480	13.260		-7.740
Worst		12.700		-8.300

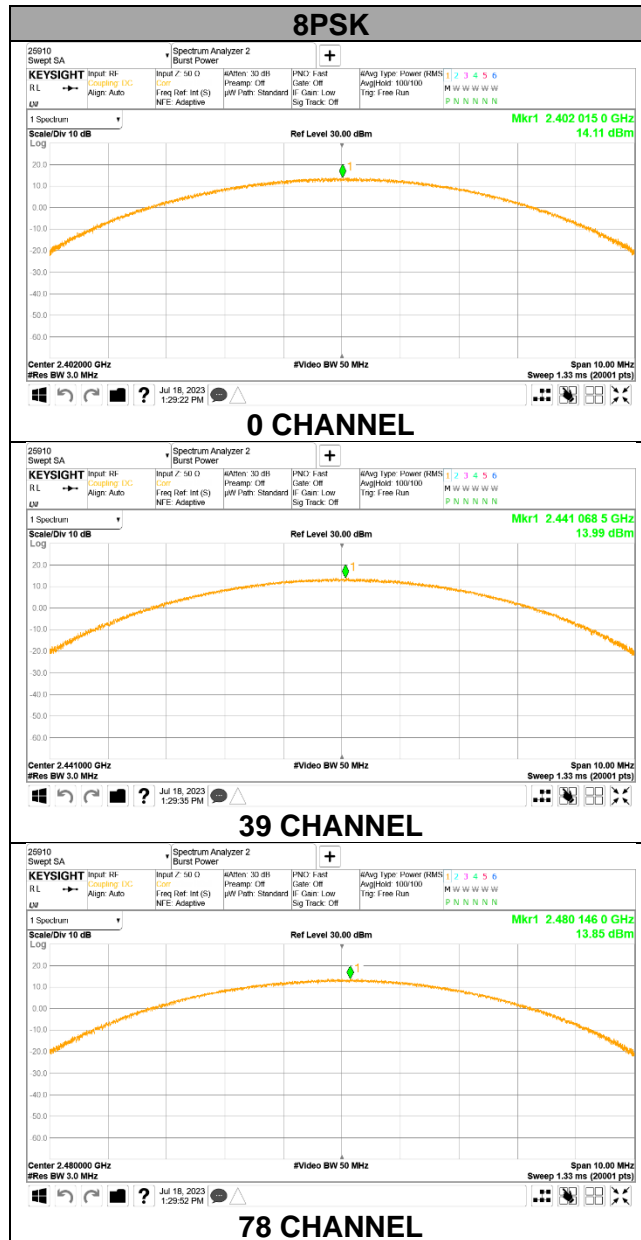
9.6.3. ENHANCED DATA RATE 8PSK MODULATION

Channel	Frequency [MHz]	Peak Output Power [dBm]	Limit [dBm]	Margin [dB]
0	2 402	14.110	21.00	-6.890
39	2 441	13.990		-7.010
78	2 480	13.850		-7.150
Worst		13.310		-7.690

9.6.4. OUTPUT POWER PLOTS

PEAK OUTPUT POWER





9.7. AVERAGE POWER

LIMITS

None; for reporting purposes only

TEST PROCEDURE

Measurements perform using a wideband gated RF power meter.
The cable assembly insertion loss was entered as an offset in the power meter to allow for direct reading of power.

RESULTS

9.7.1. BASIC DATA RATE GFSK MODULATION

Channel	Frequency [MHz]	Average Output Power [dBm]	Average Output Power [mW]
0	2 402	13.343	21.59
39	2 441	13.817	24.08
78	2 480	13.636	23.10

9.7.2. ENHANCED DATA RATE PI/4-DQPSK MODULATION

Channel	Frequency [MHz]	Average Output Power [dBm]	Average Output Power [mW]
0	2 402	11.385	13.76
39	2 441	11.293	13.47
78	2 480	11.165	13.08

9.7.3. ENHANCED DATA RATE 8PSK MODULATION

Channel	Frequency [MHz]	Average Output Power [dBm]	Average Output Power [mW]
0	2 402	11.390	13.77
39	2 441	11.297	13.48
78	2 480	11.172	13.10

9.8. CONDUCTED SPURIOUS EMISSIONS

LIMITS

RSS-247 5.5
FCC §15.247 (d)

Limit = -20 dBc

TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

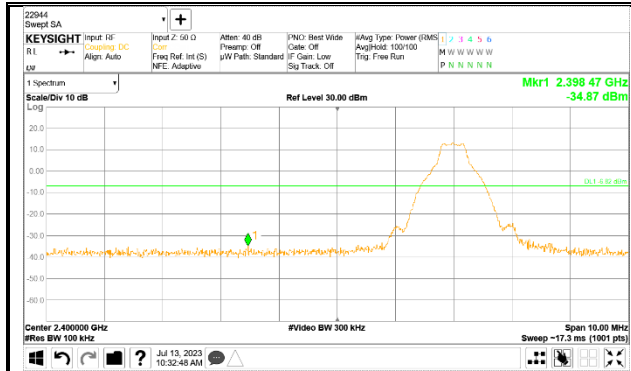
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

The band-edges at 2.4 and 2.4835 GHz are investigated with the transmitter set to the normal hopping mode.

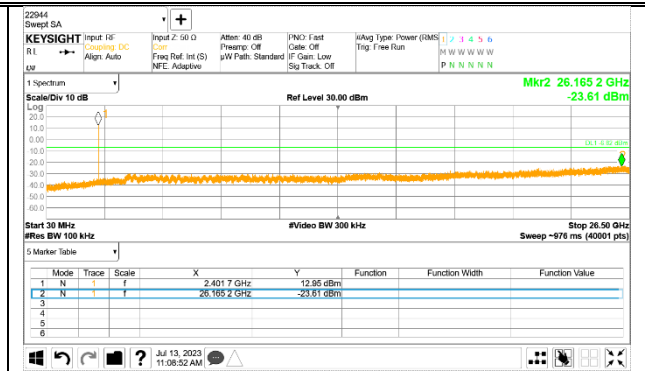
RESULTS

9.8.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION

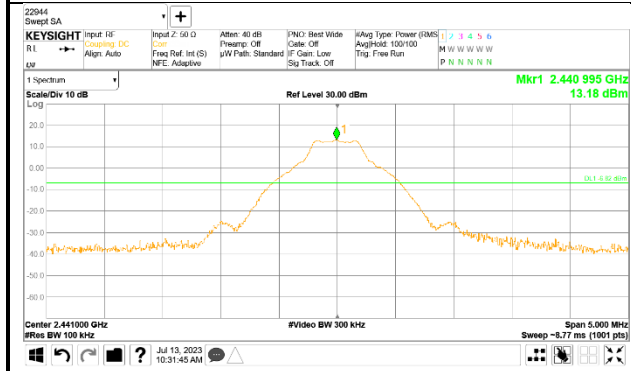
SPURIOUS EMISSIONS, NON-HOPPING



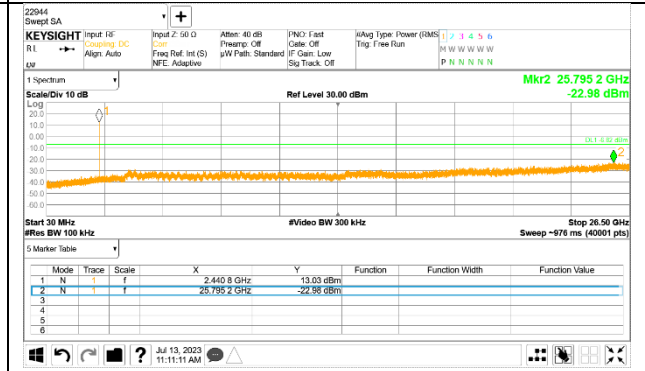
0 CHANNEL BANDEDGE



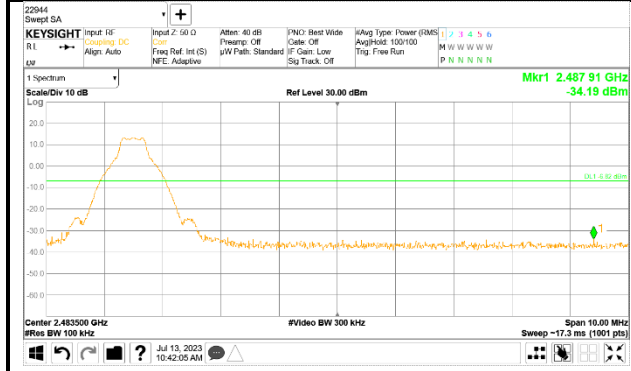
OUT-OF-BAND 0 CHANNEL



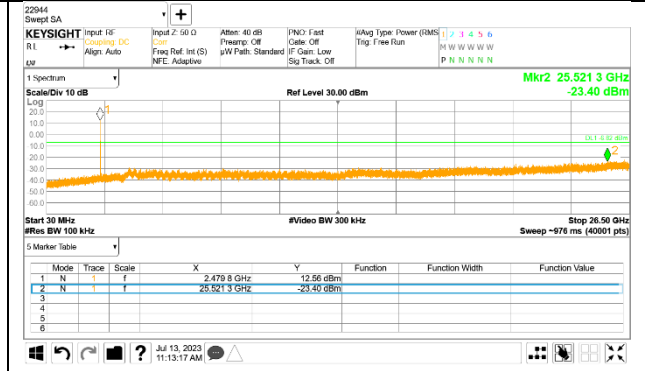
IN-BAND REFERENCE LEVEL



OUT-OF-BAND 39 CHANNEL

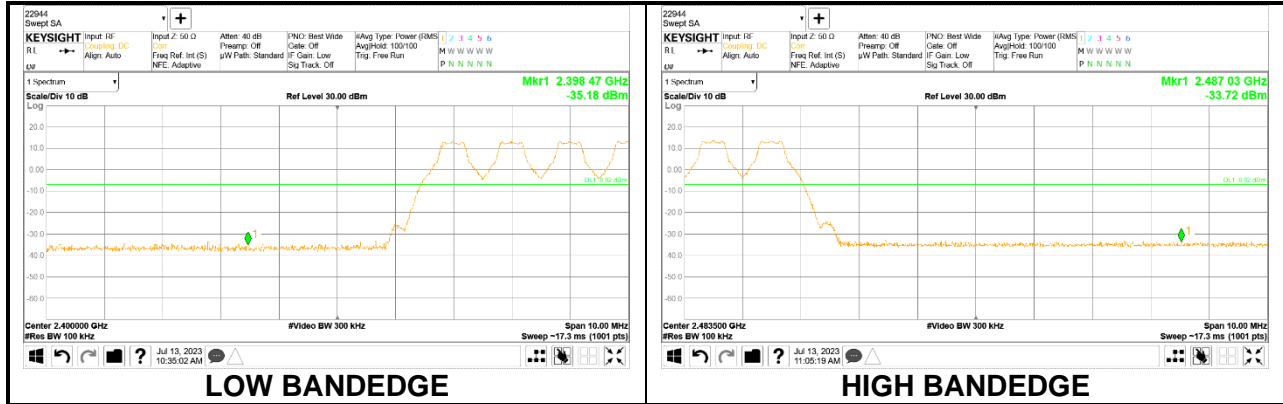


78 CHANNEL BANDEDGE



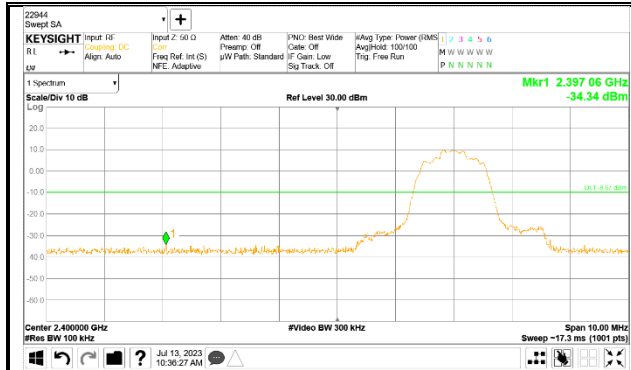
OUT-OF-BAND 78 CHANNEL

SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON

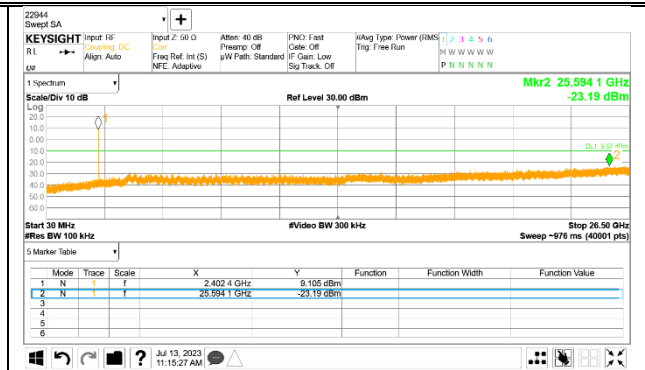


9.8.2. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION

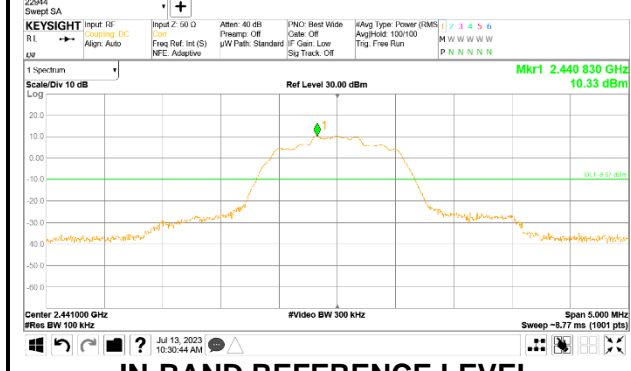
SPURIOUS EMISSIONS, NON-HOPPING



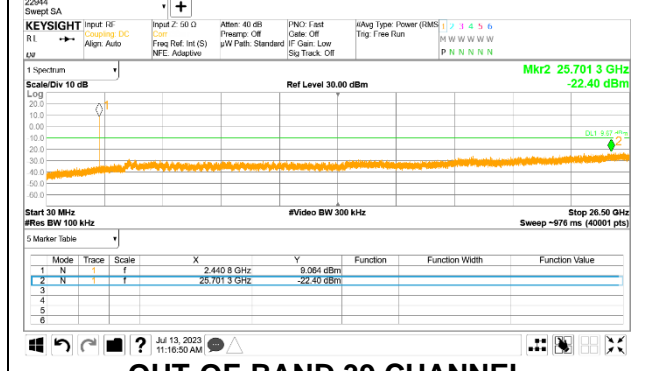
0 CHANNEL BANDEDGE



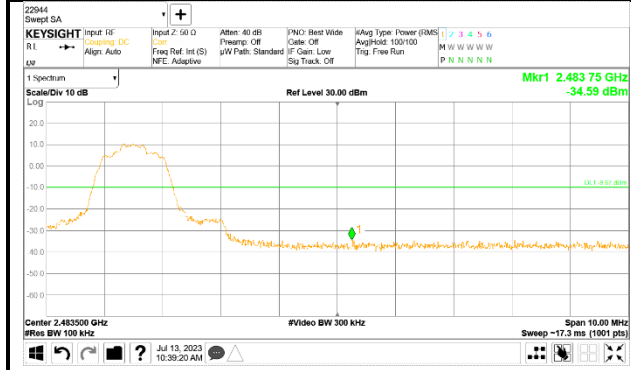
OUT-OF-BAND 0 CHANNEL



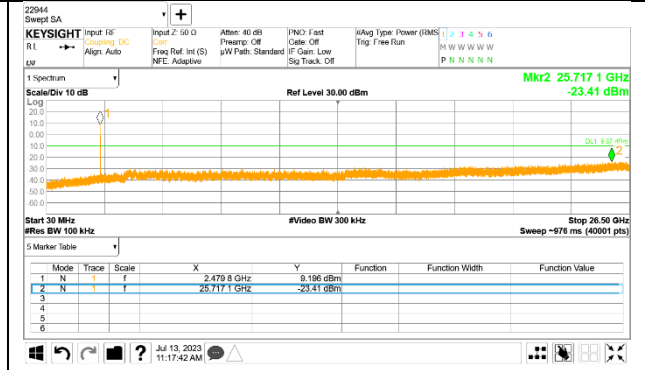
IN-BAND REFERENCE LEVEL



OUT-OF-BAND 39 CHANNEL

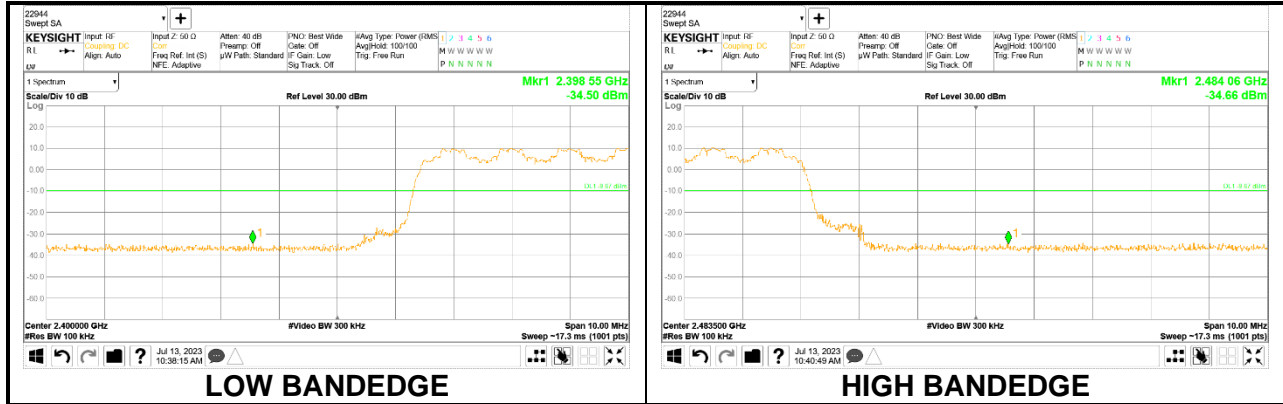


78 CHANNEL BANDEDGE



OUT-OF-BAND 78 CHANNEL

SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON



10. RADIATED TEST RESULTS

LIMITS

IC RSS-Gen (8.9) & (8.10) / FCC §15.205 and §15.209
 FCC §15.209 (a)

Frequency (MHz)	E-Field Strength (mV/meter)	Measurement Distance (m)
0.009–0.490	2400/F(kHz)	300
0.490–1.705	24000/F(kHz)	30
1.705–30.0	30	30
30–88	100	3
88 to 216	150	3
216 to 960	200	3
Above 960 MHz	500	3

Note: The lower limit shall apply at the transition frequency.

** 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.

IC RSS-GEN Sections 8.9 and 8.10.

Frequency (MHz)	H-Field Strength (mA/meter)	Measurement Distance (m)
0.009–0.490	6.37/F(kHz)	300
0.490–1.705	63.7/F(kHz)	30
1.705–30.0	0.08	30

Sample calculation (FCC Part 15.209 verse IC RSS-GEN 8.9)

FCC and IC limit are similar or have more margin, so FCC measurement data meets IC limit.

Standard \ Range	0.009 ~ 0.490	0.490 ~ 1.705	1.705 ~ 30.0
FCC(E-field)	48.52 ~ 13.80	33.80 ~ 22.97	29.54
IC(H-field)	-3.00 ~ -37.72	-17.72 ~ -28.55	-21.94
IC(H-field to E-field)Note1	48.50 ~ 13.78	33.78 ~ 22.95	29.56

Note1. $\text{dB}\mu\text{A/m} + 51.5 = \text{dB}\mu\text{V/m}$

FCC Part 15.205 (a) : Only spurious emissions are permitted in any of the frequency bands listed below :

MHz	MHz	MHz	MHz	GHz	GHz
0.009 ~ 0.110	8.41425 ~ 8.41475	108 ~ 121.94	1300 ~ 1427	4.5 ~ 5.15	14.47 ~ 14.5
0.495 ~ 0.505	12.29 ~ 12.293	123 ~ 138	1435 ~ 1626.5	5.35 ~ 5.46	15.35 ~ 16.2
2.1735 ~ 2.1905	12.51975 ~ 12.52025	149.9 ~ 150.05	1645.5 ~ 1646.5	7.25 ~ 7.75	17.7 ~ 21.4
4.125 ~ 4.128	12.57675 ~ 12.57725	156.52475 ~	1660 ~ 1710	8.025 ~ 8.5	22.01 ~ 23.12
4.17725 ~ 4.17775	13.36 ~ 13.41	156.52525	1718.8 ~ 1722.2	9.0 ~ 9.2	23.6 ~ 24.0
4.20725 ~ 4.20775	16.42 ~ 16.423	156.7 ~ 156.9	2200 ~ 2300	9.3 ~ 9.5	31.2 ~ 31.8
6.215 ~ 6.218	16.69475 ~ 16.69525	162.0125 ~	2310 ~ 2390	10.6 ~ 12.7	36.43 ~ 36.5
6.26775 ~ 6.26825	16.80425 ~ 16.80475	167.17	2483.5 ~ 2500	13.25 ~ 13.4	Above 38.6
6.31175 ~ 6.31225	25.5 ~ 25.67	167.72 ~ 173.2	2655 ~ 2900		
8.291 ~ 8.294	37.5 ~ 38.25	240 ~ 285	3260 ~ 3267		
8.362 ~ 8.366	73 ~ 74.6	322 ~ 335.4	3332 ~ 3339		
8.37625 ~ 8.38675	74.8 ~ 75.2	399.90 ~ 410	3345.8 ~ 3358		
		608 ~ 614	3600 ~ 4400		
		960 ~ 1240			

▪ FCC Part 15.205(b) : The field strength of emissions appearing within these frequency bands shall not exceed the limits shown in §15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in §15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in §15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in §15.35 apply to these measurements.

TEST PROCEDURE

The EUT is placed on a non-conducting table 80 cm above the ground plane for below 1GHz and 150 cm for above 1GHz. The EUT is configured in accordance with ANSI C63.10. The EUT is set to transmit in a continuous mode.

For measurements 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 measurements above 1 GHz the resolution bandwidth is set to 1 MHz; the video bandwidth is set to 3 MHz for peak measurements. (Pre-scans to detect harmonic and spurious emissions, the resolution bandwidth is set to 1 MHz; the video bandwidth is set to 30 kHz for peak measurements.)

For band edge measurements above 1 GHz the resolution bandwidth is set to 1 MHz, then the video bandwidth is set to 3 MHz for peak measurements and 1/T (on time) for average measurement.

$$\text{GFSK} = 1/T = 1 / 0.00288\text{s} = 345\text{Hz}.$$

The minimum VBW was 347Hz, but test receiver(ESU40) couldn't set value 347Hz. Due to this reason, testing VBW was set to 500Hz(Worst cases).

The spectrum from 1GHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in the 2.4 GHz band.
(From 30MHz to 1GHz, test was performed with the EUT set to transmit at the channel with highest output power)

The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized in both the vertical and the horizontal positions.

Note: Emission was pre-scanned from 9kHz to 30MHz; No emissions were detected which was at least 20dB below the specification limit (consider distance correction factor).
Per FCC part 15.31(o), test results were not reported.

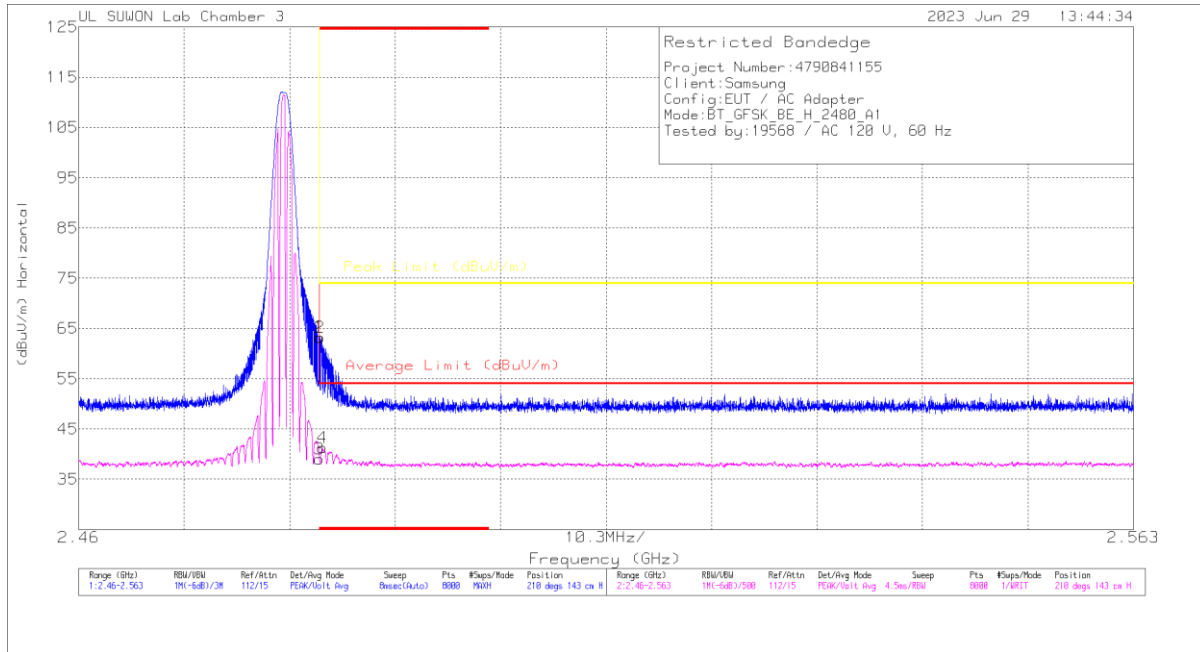
Although these tests were performed other than open field test site, adequate comparison measurements were confirmed against 30 m open are test site.
Therefore sufficient tests were made to demonstrate that the alternative site produces results that correlate with the one of tests made in an open field based on KDB 414788.

10.1. TRANSMITTER ABOVE 1 GHz

10.1.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION

BANDEDGE (WORST CASE: 78 CHANNEL)

HORIZONTAL RESULT



Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117_00218957	10dB_ATT(dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.4835	55.88	Pk	32.4	-25	63.28	-	-	74	-10.72	210	143	H
2	* 2.48356	55.77	PK	32.4	-25	63.17	-	-	74	-10.83	210	143	H
3	* 2.4835	31.62	VA1T	32.4	-25	39.02	54	-14.98	-	-	210	143	H
4	* 2.48381	33.91	VA1T	32.4	-25	41.31	54	-12.69	-	-	210	143	H

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
 Pk - Peak detector
 VA1T - FHSS: Linear Voltage Average VB=1/Ton where: Ton is transmit duration

BANDEGE TEST DATA

Freq. [MHz]	Antenna	Frequency [GHz]	Reading [dBuV]	Detector Mode	ANT Factor	Loss [dB]	DC Corr [dB]	Result [dBuV/m]	AV Limit [dBuV/m]	AV Margin [dB]	PK Limit [dBuV/m]	PK Margin [dB]	Azimuth [Degs]	Height [cm]	Polarity	
2402	ANT1	* 2.39	41.46	Pk	32.10	-25.10	0.00	48.46	-	-	74.00	-25.54	210	152	H	
		* 2.33615	44.56	Pk	31.90	-25.10	0.00	51.36	-	-	74.00	-22.64	210	152	H	
		* 2.39	29.51	VA1T	32.10	-25.10	0.00	36.51	54.00	-17.49	-	-	-	210	152	H
		* 2.37441	30.26	VA1T	32.00	-25.10	0.00	37.16	54.00	-16.84	-	-	-	210	152	H
		* 2.39	42.40	Pk	32.10	-25.10	0.00	49.40	-	-	74.00	-24.60	155	358	V	
		* 2.35953	45.06	Pk	32.00	-25.10	0.00	51.96	-	-	74.00	-22.04	155	358	V	
		* 2.39	29.74	VA1T	32.10	-25.10	0.00	36.74	54.00	-17.26	-	-	-	155	358	V
		* 2.37936	30.41	VA1T	32.10	-25.10	0.00	37.41	54.00	-16.59	-	-	-	155	358	V
		* 2.4835	55.88	Pk	32.40	-25.00	0.00	63.28	-	-	74.00	-10.72	210	143	H	
		* 2.48356	55.77	Pk	32.40	-25.00	0.00	63.17	-	-	74.00	-10.83	210	143	H	
2480	ANT1	* 2.4835	31.62	VA1T	32.40	-25.00	0.00	39.02	54.00	-14.98	-	-	210	143	H	
		* 2.48381	33.91	VA1T	32.40	-25.00	0.00	41.31	54.00	-12.69	-	-	210	143	H	
		* 2.4835	44.79	Pk	32.40	-25.00	0.00	52.19	-	-	74.00	-21.81	163	332	V	
		* 2.48353	54.03	Pk	32.40	-25.00	0.00	61.43	-	-	74.00	-12.57	163	332	V	
		* 2.4835	32.89	VA1T	32.40	-25.00	0.00	40.29	54.00	-13.71	-	-	-	163	332	V
		* 2.48362	33.19	VA1T	32.40	-25.00	0.00	40.59	54.00	-13.41	-	-	-	163	332	V

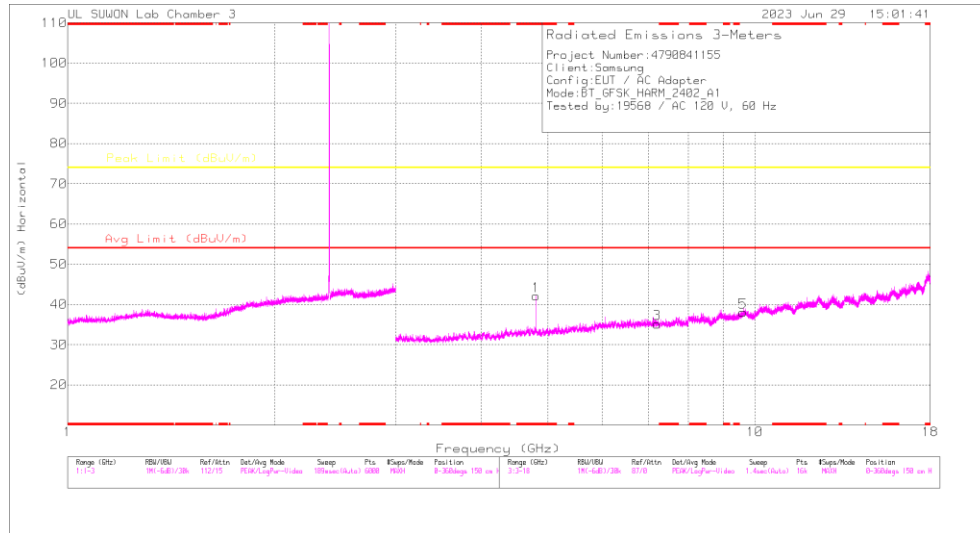
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Pk - Peak detector

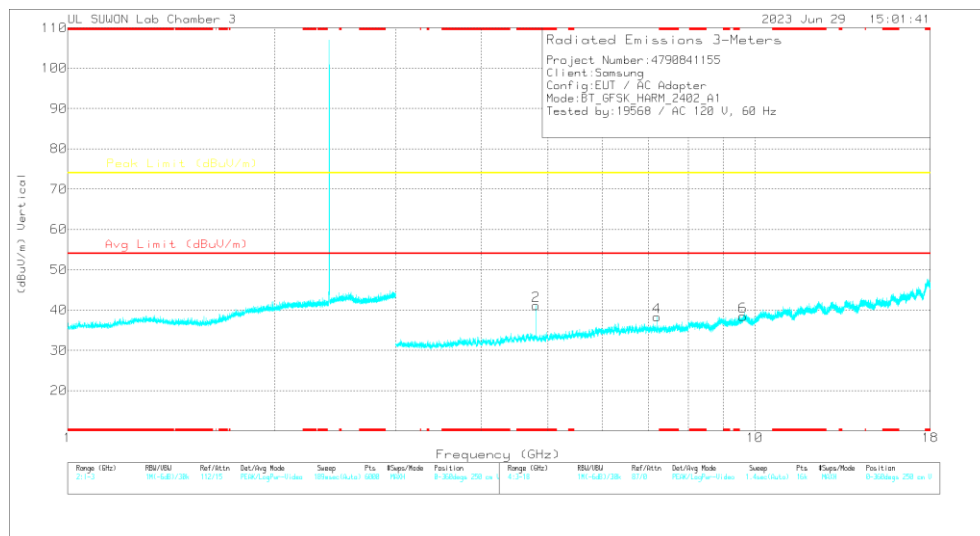
VA1T - FHSS: Linear Voltage Average $VB=1/Ton$ where: Ton is transmit duration

HARMONICS AND SPURIOUS EMISSIONS(WORST CASE: 0 CHANNEL)

0 CHANNEL RESULTS



HORIZONTAL



VERTICAL

Radiated Emissions

Frequency (GHz)	Meter Reading (dBuV)	Det	3117_0021895 7	3GHz_HP(dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 4.80378	44.06	PKFH	34.3	-30.1	48.26	-	-	74	-25.74	200	101	H
* 4.80406	39.32	VA1T	34.3	-30.1	43.52	54	-10.48	-	-	200	101	H
* 4.80374	41.52	PKFH	34.3	-30.1	45.72	-	-	74	-28.28	154	100	V
* 4.80395	33.61	VA1T	34.3	-30.1	37.81	54	-16.19	-	-	154	100	V
7.20631	34.41	PKFH	35.8	-25.7	44.51	-	-	74	-29.49	193	108	H
7.20547	36.13	PKFH	35.8	-25.7	46.23	-	-	74	-27.77	359	110	V
9.61109	31.86	PKFH	36.7	-21.6	46.96	-	-	74	-27.04	0	100	H
9.6078	30.57	PKFH	36.7	-21.7	45.57	-	-	74	-28.43	0	100	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
 PKFH FHSS/BT RB=100k for Frequencies<1GHz / RB=1MHz for Frequencies>1GHz, VB=3 x RB, Peak
 VA1T - FHSS: Linear Voltage Average VB=1/Ton where: Ton is transmit duration

HARMONICS AND SPURIOUS EMISSIONS TEST DATA

Freq. [MHz]	Antenna	Frequency [GHz]	Reading [dBuV]	Detector Mode	ANT Factor	Loss [dB]	DC Corr [dB]	Result [dBuV/m]	AV Limit [dBuV/m]	AV Margin [dB]	PK Limit [dBuV/m]	PK Margin [dB]	Azimuth [Degs]	Height [cm]	Polarity
2402	ANT1	* 4.80378	44.06	PKFH	34.30	-30.10	0.00	48.26	-	-	74.00	-25.74	200	101	H
		* 4.80406	39.32	VA1T	34.30	-30.10	0.00	43.52	54.00	-10.48	-	-	200	101	H
		* 4.80374	41.52	PKFH	34.30	-30.10	0.00	45.72	-	-	74.00	-28.28	154	100	V
		* 4.80395	33.61	VA1T	34.30	-30.10	0.00	37.81	54.00	-16.19	-	-	154	100	V
		7.206	34.41	PKFH	35.80	-25.70	0.00	44.51	-	-	74.00	-29.49	193	108	H
		7.205	36.13	PKFH	35.80	-25.70	0.00	46.23	-	-	74.00	-27.77	359	110	V
		9.611	31.86	PKFH	36.70	-21.60	0.00	46.96	-	-	74.00	-27.04	0	100	H
		9.608	30.57	PKFH	36.70	-21.70	0.00	45.57	-	-	74.00	-28.43	0	100	V
2441	ANT1	* 4.88168	42.32	PKFH	34.20	-30.90	0.00	45.62	-	-	74.00	-28.38	198	100	H
		* 4.88199	35.53	VA1T	34.20	-30.90	0.00	38.83	54.00	-15.17	-	-	198	100	H
		* 4.88205	39.87	PKFH	34.20	-30.90	0.00	43.17	-	-	74.00	-30.83	155	103	V
		* 4.88214	30.32	VA1T	34.20	-30.90	0.00	33.62	54.00	-20.38	-	-	155	103	V
		* 7.32089	33.46	PKFH	35.80	-25.30	0.00	43.96	-	-	74.00	-30.04	193	111	H
		* 7.32337	20.88	VA1T	35.80	-25.30	0.00	31.38	54.00	-22.62	-	-	193	111	H
		* 7.32432	33.38	PKFH	35.80	-25.30	0.00	43.88	-	-	74.00	-30.12	358	100	V
		* 7.32299	21.37	VA1T	35.80	-25.30	0.00	31.87	54.00	-22.13	-	-	358	100	V
		9.764	30.45	PKFH	36.90	-21.20	0.00	46.15	-	-	74.00	-27.85	0	100	H
		9.765	30.55	PKFH	36.90	-21.20	0.00	46.25	-	-	74.00	-27.75	0	100	V
2480	ANT1	* 4.95967	43.14	PKFH	34.30	-30.50	0.00	46.94	-	-	74.00	-27.06	196	108	H
		* 4.95984	37.16	VA1T	34.30	-30.50	0.00	40.96	54.00	-13.04	-	-	196	108	H
		* 4.95997	39.48	PKFH	34.30	-30.50	0.00	43.28	-	-	74.00	-30.72	154	100	V
		* 4.96001	31.94	VA1T	34.30	-30.50	0.00	35.74	54.00	-18.26	-	-	154	100	V
		* 7.44426	33.38	PKFH	35.70	-25.20	0.00	43.88	-	-	74.00	-30.12	192	104	H
		* 7.43974	21.15	VA1T	35.70	-25.10	0.00	31.75	54.00	-22.25	-	-	192	104	H
		* 7.44062	34.00	PKFH	35.70	-25.10	0.00	44.60	-	-	74.00	-29.40	357	114	V
		* 7.43971	22.13	VA1T	35.70	-25.10	0.00	32.73	54.00	-21.27	-	-	357	114	V
		9.922	29.34	PKFH	37.10	-21.30	0.00	45.14	-	-	74.00	-28.86	0	100	H
		9.920	28.95	PKFH	37.10	-21.40	0.00	44.65	-	-	74.00	-29.35	0	100	V

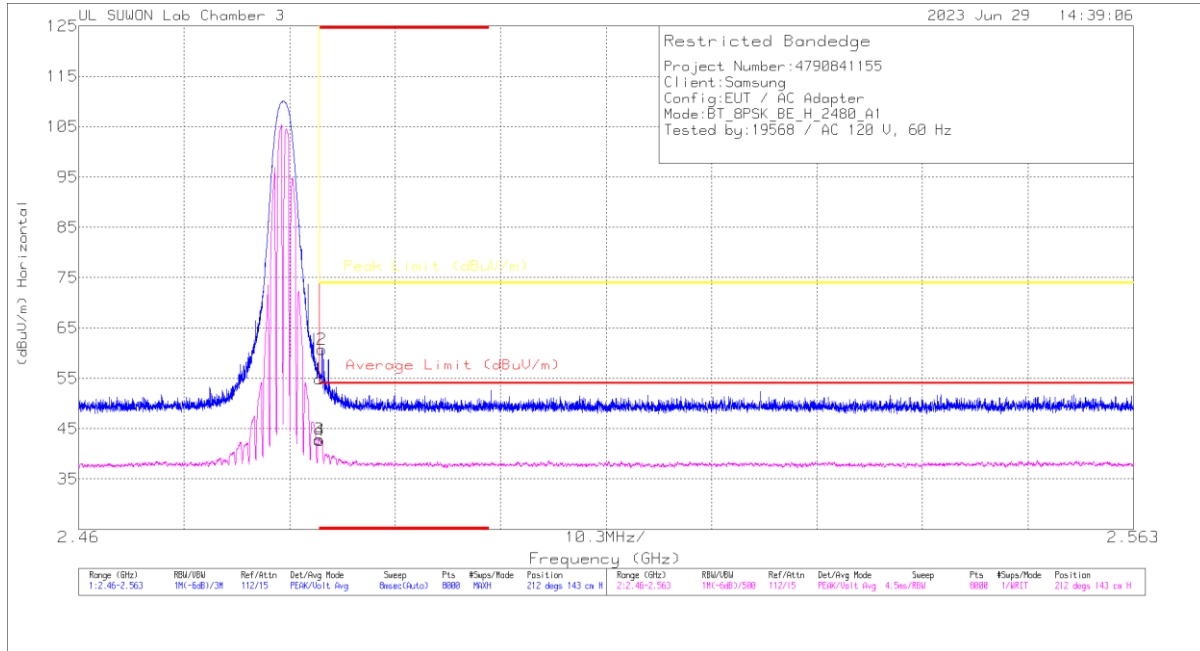
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

PKFH FHSS/BT RB=100k for Frequencies<1GHz / RB=1MHz for Frequencies>1GHz, VB=3 x RB, Peak VA1T - FHSS: Linear Voltage Average VB=1/Ton where: Ton is transmit duration

10.1.2. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION

BANDEDGE (WORST CASE: 78 CHANNEL)

HORIZONTAL RESULT



Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117_00218957	10dB_ATT(dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.4835	47.47	Pk	32.4	-25	54.87	-	-	74	-19.13	212	143	H
2	* 2.48376	53.38	Pk	32.4	-25	60.78	-	-	74	-13.22	212	143	H
3	* 2.4835	35.53	VA1T	32.4	-25	42.93	54	-11.07	-	-	212	143	H
4	* 2.48353	35.3	VA1T	32.4	-25	42.7	54	-11.3	-	-	212	143	H

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
 Pk - Peak detector
 VA1T - FHSS: Linear Voltage Average VB=1/Ton where: Ton is transmit duration

BANDEGE TEST DATA

Freq. [MHz]	Antenna	Frequency [GHz]	Reading [dBuV]	Detector Mode	ANT Factor	Loss [dB]	DC Corr [dB]	Result [dBuV/m]	AV Limit [dBuV/m]	AV Margin [dB]	PK Limit [dBuV/m]	PK Margin [dB]	Azimuth [Degs]	Height [cm]	Polarity	
2402	ANT1	* 2.39	42.08	Pk	32.10	-25.10	0.00	49.08	-	-	74.00	-24.92	210	152	H	
		* 2.36298	44.73	Pk	32.00	-25.20	0.00	51.53	-	-	74.00	-22.47	210	152	H	
		* 2.39	29.61	VA1T	32.10	-25.10	0.00	36.61	54.00	-17.39	-	-	-	210	152	H
		* 2.34447	30.41	VA1T	32.00	-25.10	0.00	37.31	54.00	-16.69	-	-	-	210	152	H
		* 2.39	42.21	Pk	32.10	-25.10	0.00	49.21	-	-	74.00	-24.79	-	157	359	V
		* 2.32571	44.85	Pk	31.90	-25.10	0.00	51.65	-	-	74.00	-22.35	-	157	359	V
		* 2.39	29.96	VA1T	32.10	-25.10	0.00	36.96	54.00	-17.04	-	-	-	157	359	V
		* 2.37623	30.27	VA1T	32.10	-25.10	0.00	37.27	54.00	-16.73	-	-	-	157	359	V
		* 2.4835	47.47	Pk	32.40	-25.00	0.00	54.87	-	-	74.00	-19.13	-	212	143	H
		* 2.48376	53.38	Pk	32.40	-25.00	0.00	60.78	-	-	74.00	-13.22	-	212	143	H
2480	ANT1	* 2.4835	35.53	VA1T	32.40	-25.00	0.00	42.93	54.00	-11.07	-	-	212	143	H	
		* 2.48353	35.30	VA1T	32.40	-25.00	0.00	42.70	54.00	-11.30	-	-	212	143	H	
		* 2.4835	46.45	Pk	32.40	-25.00	0.00	53.85	-	-	74.00	-20.15	-	165	335	V
		* 2.48407	50.69	Pk	32.40	-25.00	0.00	58.09	-	-	74.00	-15.91	-	165	335	V
		* 2.4835	32.85	VA1T	32.40	-25.00	0.00	40.25	54.00	-13.75	-	-	-	165	335	V
		* 2.48351	33.00	VA1T	32.40	-25.00	0.00	40.40	54.00	-13.60	-	-	-	165	335	V

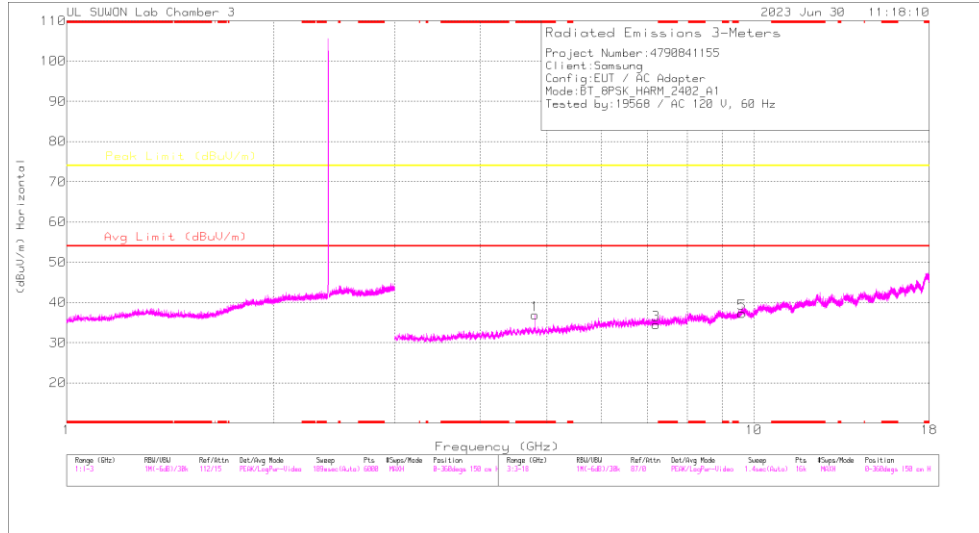
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Pk - Peak detector

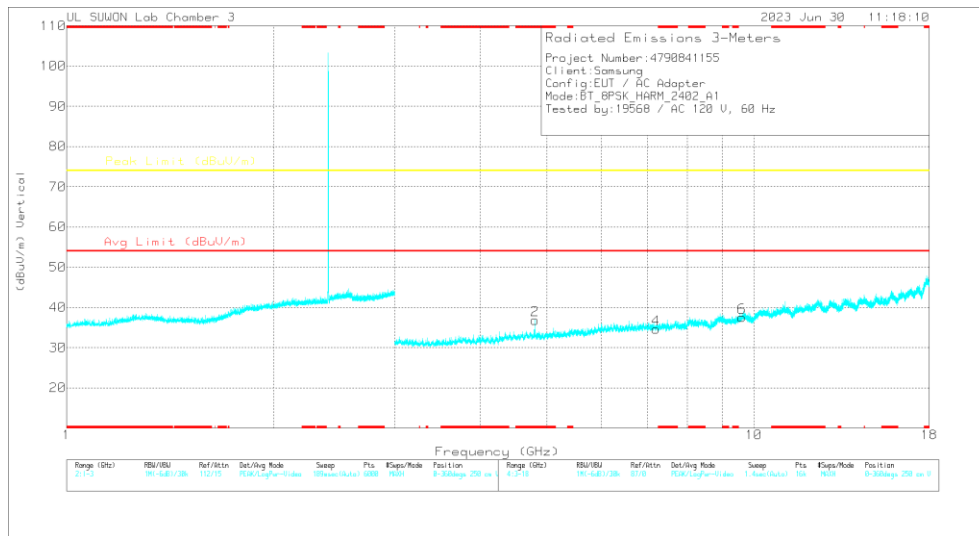
VA1T - FHSS: Linear Voltage Average $VB=1/Ton$ where: Ton is transmit duration

HARMONICS AND SPURIOUS EMISSIONS(WORST CASE: 0 CHANNEL)

0 CHANNEL RESULTS



HORIZONTAL



VERTICAL

Radiated Emissions

Frequency (GHz)	Meter Reading (dBuV)	Det	3117_0021895 7	3GHz_HP(dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 4.80388	41.53	PKFH	34.3	-30.1	45.73	-	-	74	-28.27	198	117	H
* 4.80411	31.88	VA1T	34.3	-30.1	36.08	54	-17.92	-	-	198	117	H
* 4.80442	40.09	PKFH	34.3	-30.1	44.29	-	-	74	-29.71	166	260	V
* 4.80411	30.02	VA1T	34.3	-30.1	34.22	54	-19.78	-	-	166	260	V
7.20777	32.72	PKFH	35.8	-25.8	42.72	-	-	74	-31.28	0	100	H
7.2079	33.7	PKFH	35.8	-25.9	43.6	-	-	74	-30.4	0	100	V
9.6058	30.46	PKFH	36.7	-21.6	45.56	-	-	74	-28.44	0	100	H
9.60652	30.38	PKFH	36.7	-21.6	45.48	-	-	74	-28.52	0	100	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

PKFH FHSS/BT RB=100k for Frequencies<1GHz / RB=1MHz for Frequencies>1GHz, VB=3 x RB, Peak

VA1T - FHSS: Linear Voltage Average VB=1/Ton where: Ton is transmit duration

HARMONICS AND SPURIOUS EMISSIONS TEST DATA

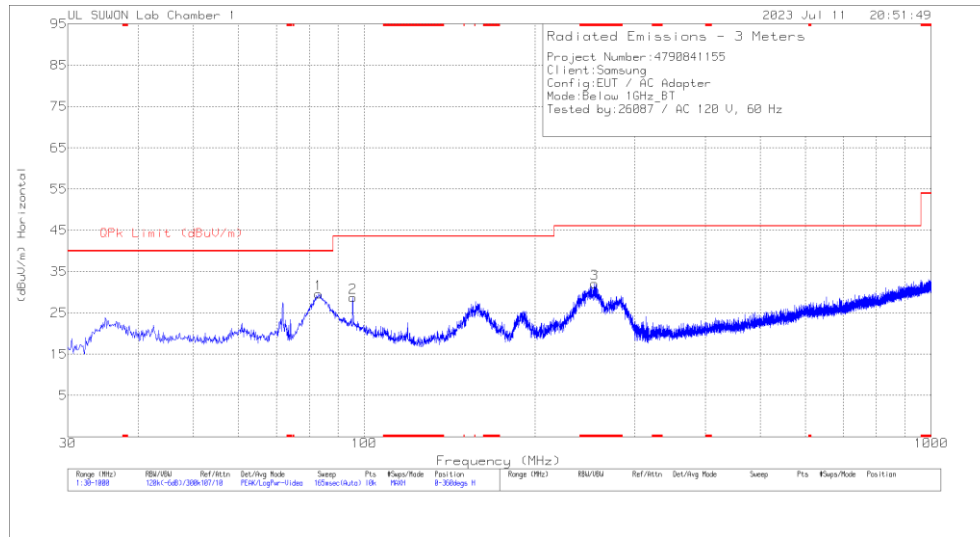
Freq. [MHz]	Antenna	Frequency [GHz]	Reading [dBuV]	Detector Mode	ANT Factor	Loss [dB]	DC Corr [dB]	Result [dBuV/m]	AV Limit [dBuV/m]	AV Margin [dB]	PK Limit [dBuV/m]	PK Margin [dB]	Azimuth [Degs]	Height [cm]	Polarity	
2402	ANT1	* 4.80388	41.53	PKFH	34.30	-30.10	0.00	45.73	-	-	74.00	-28.27	198	117	H	
		* 4.80411	31.88	VA1T	34.30	-30.10	0.00	36.08	54.00	-17.92	-	-	198	117	H	
		* 4.80442	40.09	PKFH	34.30	-30.10	0.00	44.29	-	-	74.00	-29.71	166	260	V	
		* 4.80411	30.02	VA1T	34.30	-30.10	0.00	34.22	54.00	-19.78	-	-	166	260	V	
		7.208	32.72	PKFH	35.80	-25.80	0.00	42.72	-	-	-	74.00	-31.28	0	100	H
		7.208	33.70	PKFH	35.80	-25.90	0.00	43.60	-	-	-	74.00	-30.40	0	100	V
		9.606	30.46	PKFH	36.70	-21.60	0.00	45.56	-	-	-	74.00	-28.44	0	100	H
		9.607	30.38	PKFH	36.70	-21.60	0.00	45.48	-	-	-	74.00	-28.52	0	100	V
2441	ANT1	* 4.88227	39.66	PKFH	34.20	-30.90	0.00	42.96	-	-	74.00	-31.04	198	115	H	
		* 4.88213	29.06	VA1T	34.20	-30.90	0.00	32.36	54.00	-21.64	-	-	198	115	H	
		* 4.88182	37.48	PKFH	34.20	-30.90	0.00	40.78	-	-	74.00	-33.22	151	100	V	
		* 4.8822	26.12	VA1T	34.20	-30.90	0.00	29.42	54.00	-24.58	-	-	151	100	V	
		* 7.3244	32.34	PKFH	35.80	-25.30	0.00	42.84	-	-	-	74.00	-31.16	0	100	H
		* 7.32216	32.89	PKFH	35.80	-25.40	0.00	43.29	-	-	-	74.00	-30.71	0	100	V
		9.759	30.40	PKFH	36.90	-21.20	0.00	46.10	-	-	-	74.00	-27.90	0	100	H
		9.761	29.84	PKFH	36.90	-21.20	0.00	45.54	-	-	-	74.00	-28.46	0	100	V
2480	ANT1	* 4.95918	41.31	PKFH	34.30	-30.50	0.00	45.11	-	-	74.00	-28.89	196	108	H	
		* 4.96004	31.44	VA1T	34.30	-30.50	0.00	35.24	54.00	-18.76	-	-	196	108	H	
		* 4.96063	38.42	PKFH	34.30	-30.50	0.00	42.22	-	-	74.00	-31.78	153	100	V	
		* 4.96004	26.95	VA1T	34.30	-30.50	0.00	30.75	54.00	-23.25	-	-	153	100	V	
		* 7.43598	32.71	PKFH	35.70	-25.10	0.00	43.31	-	-	-	74.00	-30.69	0	100	H
		* 7.44388	32.75	PKFH	35.70	-25.20	0.00	43.25	-	-	-	74.00	-30.75	0	100	V
		9.919	29.47	PKFH	37.10	-21.30	0.00	45.27	-	-	-	74.00	-28.73	0	100	H
		9.917	29.06	PKFH	37.10	-21.30	0.00	44.86	-	-	-	74.00	-29.14	0	100	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

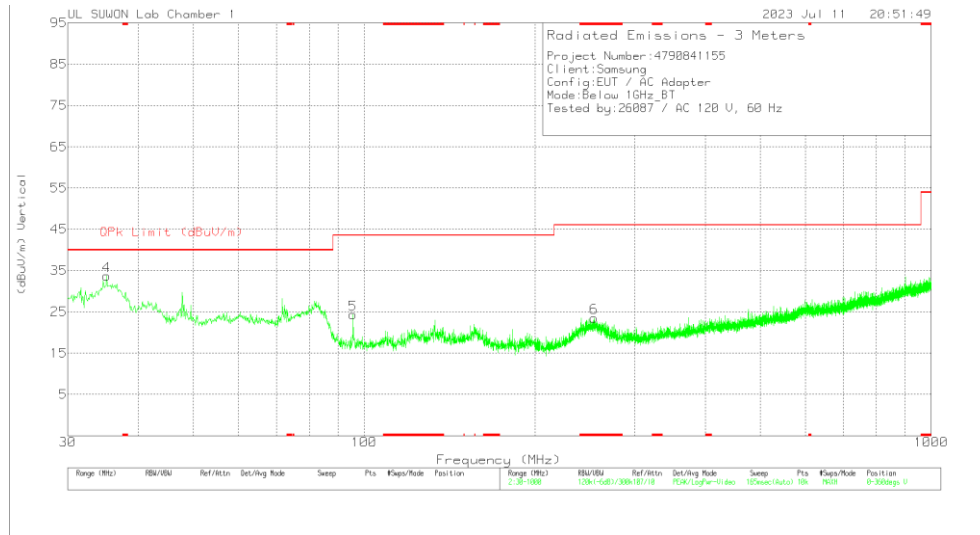
PKFH FHSS/BT RB=100k for Frequencies<1GHz / RB=1MHz for Frequencies>1GHz, VB=3 x RB, Peak

VA1T - FHSS: Linear Voltage Average VB=1/Ton where: Ton is transmit duration

10.2. WORST CASE BELOW 1 GHz SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION)



HORIZONTAL



VERTICAL

Trace Markers

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	VULB9163_750	Below_1G[dB]	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	83.156	46.55	Pk	13.5	-30.4	29.65	40	-10.35	0-360	100	H
2	95.475	42.38	Pk	16.7	-30.3	28.78	43.52	-14.74	0-360	200	H
3	* 254.652	42.9	Pk	18.1	-28.9	32.1	46.02	-13.92	0-360	100	H
4	35.141	48.38	Pk	16.6	-31.3	33.68	40	-6.32	0-360	200	V
5	95.572	37.93	Pk	16.8	-30.4	24.33	43.52	-19.19	0-360	200	V
6	* 254.458	34.26	Pk	18.1	-28.8	23.56	46.02	-22.46	0-360	200	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
 Pk - Peak detector

Radiated Emissions

Frequency (MHz)	Meter Reading (dBuV)	Det	VULB9163_750	Below_1G[dB]	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
35.141	43.52	Qp	16.6	-31.3	28.82	40	-11.18	209	100	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
 Qp - Quasi-Peak detector

11. AC POWER LINE CONDUCTED EMISSIONS

LIMITS

FCC §15.207 (a)

Frequency of Emission (MHz)	Conducted Limit (dBuV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

*Decreases with the logarithm of the frequency.

TEST PROCEDURE

The EUT is placed on a non-conducting table 40 cm from the vertical ground plane and 80 cm above the horizontal ground plane. The EUT is configured in accordance with ANSI C63.10:2013.

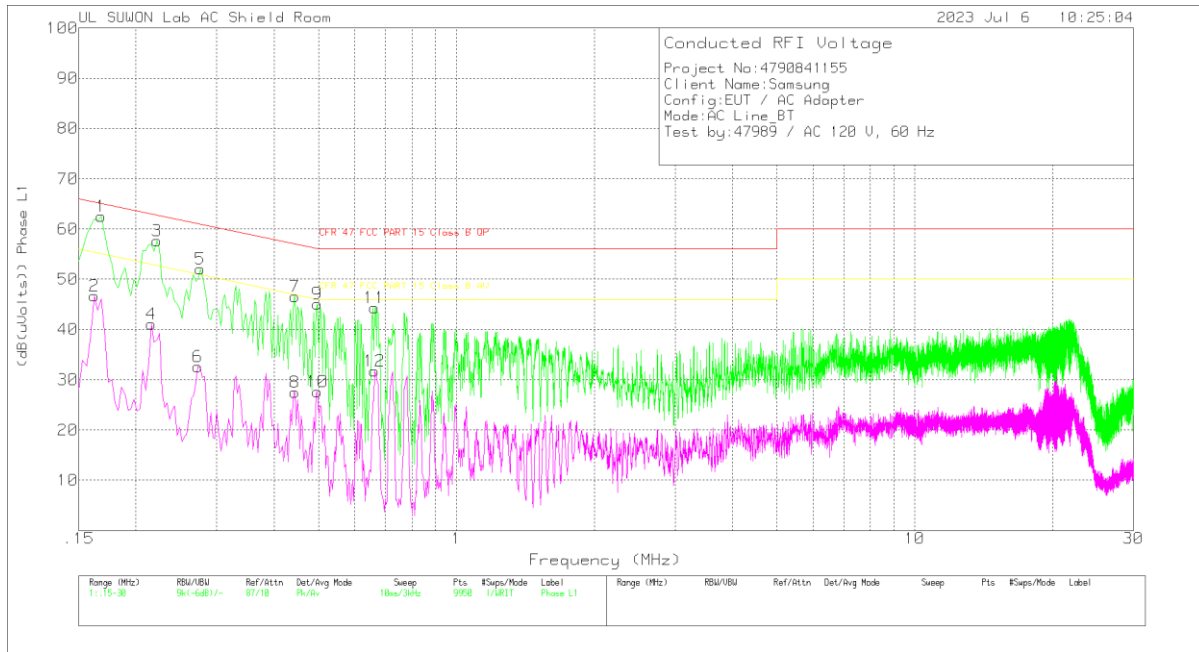
The receiver is set to a resolution bandwidth of 9 kHz. Peak detection is used unless otherwise noted as quasi-peak or average.

Line conducted data is recorded for both NEUTRAL and HOT lines.

RESULTS

11.1. AC Power Line

LINE 1 RESULTS



Trace Markers

Range 1: Phase L1 .15 - 30MHz

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	101836_AU TO_With EX_L1[dB]	CABLELOS S[dB]	Corrected Reading (dB(uVolts))	CFR 47 FCC PART 15 Class B QP	Margin (dB)	CFR 47 FCC PART 15 Class B AV	Margin (dB)
1	.168	52.89	Pk	9.5	.1	62.49	65.06	-2.57	-	-
2	.162	37.04	Av	9.5	.1	46.64	-	-	55.36	-8.72
3	.222	47.97	Pk	9.5	.2	57.67	62.74	-5.07	-	-
4	.216	31.39	Av	9.5	.2	41.09	-	-	52.97	-11.88
5	.276	42.34	Pk	9.5	.2	52.04	60.94	-8.9	-	-
6	.273	22.89	Av	9.5	.2	32.59	-	-	51.03	-18.44
7	.444	36.88	Pk	9.5	.2	46.58	56.99	-10.41	-	-
8	.444	17.81	Av	9.5	.2	27.51	-	-	46.99	-19.48
9	.498	35.43	Pk	9.5	.2	45.13	56.03	-10.9	-	-
10	.498	17.91	Av	9.5	.2	27.61	-	-	46.03	-18.42
11	.663	34.57	Pk	9.6	.2	44.37	56	-11.63	-	-
12	.663	21.97	Av	9.6	.2	31.77	-	-	46	-14.23

Pk - Peak detector

Av - Average detection

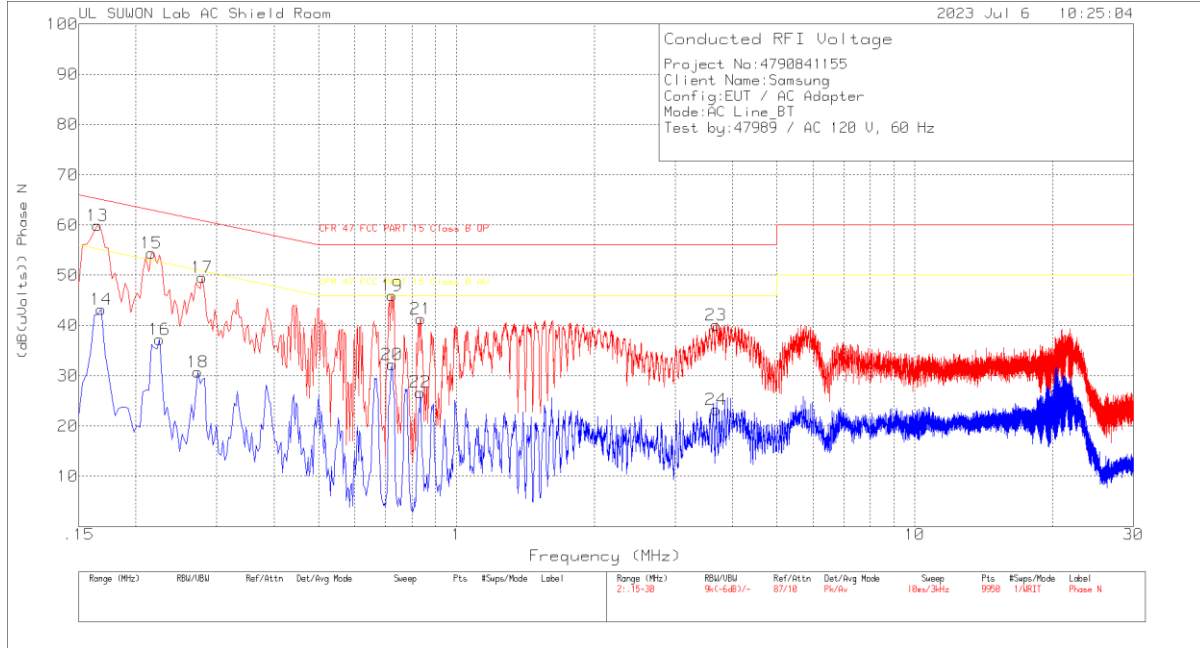
Quasi-Peak Emissions

Range 1: Phase L1 .15 - 30MHz

Frequency (MHz)	Meter Reading (dBuV)	Det	101836_AU TO_With EX_L1[dB]	CABLELOS S[dB]	Corrected Reading (dB(uVolts))	CFR 47 FCC PART 15 Class B QP	Margin (dB)	CFR 47 FCC PART 15 Class B AV	Margin (dB)
.16725	43.67	Qp	9.5	.1	53.27	65.1	-11.83	-	-
.22275	47.03	Qp	9.5	.2	56.73	62.72	-5.99	-	-

Qp - Quasi-Peak detector

LINE 2 RESULTS



Trace Markers

Range 2: Phase N .15 - 30MHz

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	101836_AU TO_With EX_N[dB]	CABLELOS S[dB]	Corrected Reading (dB(uVolts))	CFR 47 FCC PART 15 Class B QP	Margin (dB)	CFR 47 FCC PART 15 Class B AV	Margin (dB)
13	.165	50.26	Pk	9.5	.1	59.86	65.21	-5.35	-	-
14	.168	33.55	Av	9.5	.1	43.15	-	-	55.06	-11.91
15	.216	44.72	Pk	9.5	.2	54.42	62.97	-8.55	-	-
16	.225	27.56	Av	9.5	.2	37.26	-	-	52.63	-15.37
17	.279	39.87	Pk	9.5	.2	49.57	60.85	-11.28	-	-
18	.273	21.09	Av	9.5	.2	30.79	-	-	51.03	-20.24
19	.723	36.14	Pk	9.6	.2	45.94	56	-10.06	-	-
20	.723	22.4	Av	9.6	.2	32.2	-	-	46	-13.8
21	.837	31.45	Pk	9.6	.3	41.35	56	-14.65	-	-
22	.834	16.79	Av	9.6	.3	26.69	-	-	46	-19.31
23	3.687	30.17	Pk	9.6	.3	40.07	56	-15.93	-	-
24	3.687	13.37	Av	9.6	.3	23.27	-	-	46	-22.73

Pk - Peak detector

Av - Average detection

Quasi-Peak Emissions

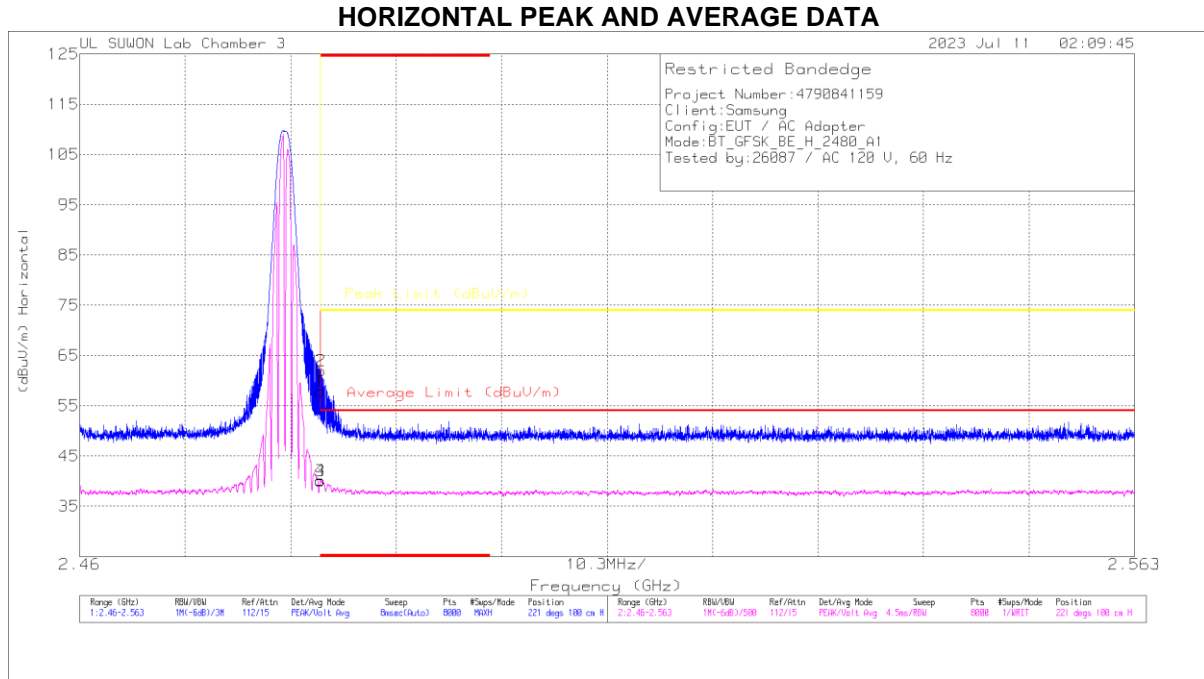
Range 2: Phase N .15 - 30MHz

Frequency (MHz)	Meter Reading (dBuV)	Det	101836_AU TO_With EX_N[dB]	CABLELOS S[dB]	Corrected Reading (dB(uVolts))	CFR 47 FCC PART 15 Class B QP	Margin (dB)	CFR 47 FCC PART 15 Class B AV	Margin (dB)
.16425	43.46	Qp	9.5	.1	53.06	65.25	-12.19	-	-
.21675	38.72	Qp	9.5	.2	48.42	62.94	-14.52	-	-

Qp - Quasi-Peak detector

12. SPOT-CHECK TEST RESULT

BANDEDGE (WORST CASE: GFSK / 2480 MHz)

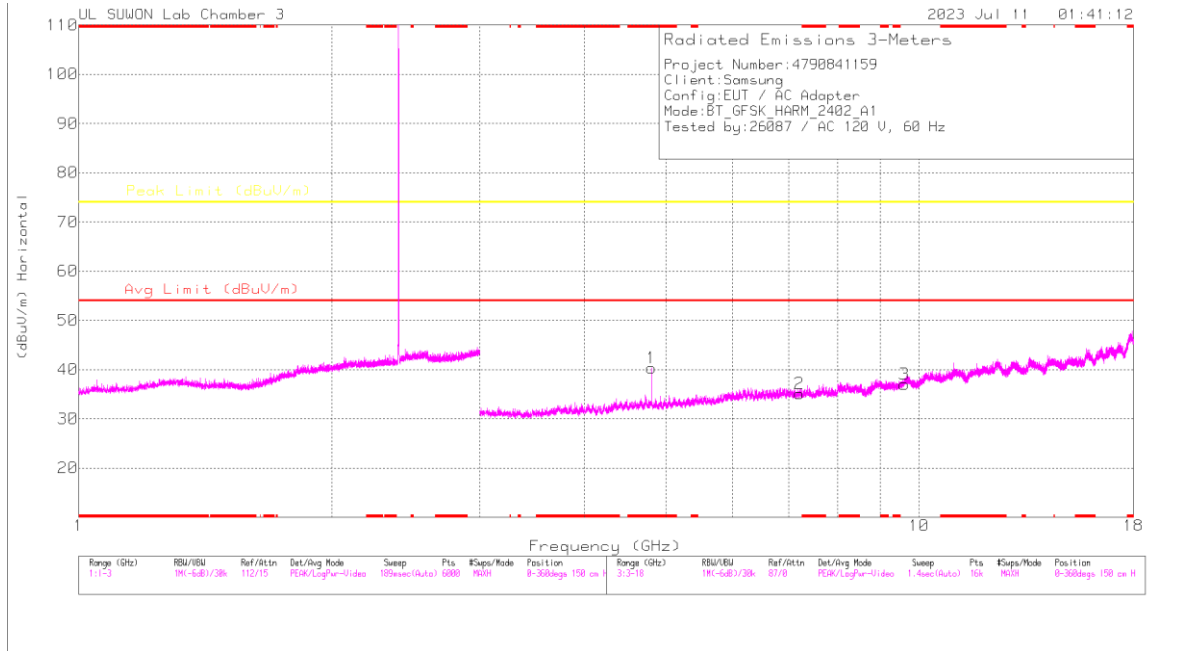


Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117_00218957	10dB_ATT(dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.4835	50.46	Pk	32.4	-25	57.86	-	-	74	-16.14	221	100	H
2	* 2.48358	54.54	Pk	32.4	-25	61.94	-	-	74	-12.06	221	100	H
3	* 2.4835	32.63	VA1T	32.4	-25	40.03	54	-13.97	-	-	221	100	H
4	* 2.48351	32.72	VA1T	32.4	-25	40.12	54	-13.88	-	-	221	100	H

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
 Pk - Peak detector
 VA1T - FHSS: Linear Voltage Average VB=1/Ton where: Ton is transmit duration

HARMONICS AND SPURIOUS EMISSIONS(WORST CASE: GFSK / 2402 MHz)
2402 MHz HORIZONTAL



Note: Emission was scanned up to 40GHz; No emissions were detected above the noise floor which was at least 20dB below the specification limit.

Radiated Emissions

Frequency (GHz)	Meter Reading (dBuV)	Det	3117_0021895 7	3GHz_HP(dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 4.80369	43.58	PKFH	34.3	-30.1	47.78	-	-	74	-26.22	202	121	H
* 4.804	37.79	VA1T	34.3	-30.1	41.99	54	-12.01	-	-	202	121	H

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
 PKFH FHSS/BT RB=100k for Frequencies<1GHz / RB=1MHz for Frequencies>1GHz, VB=3 x RB, Peak
 VA1T - FHSS: Linear Voltage Average VB=1/Ton where: Ton is transmit duration

END OF TEST REPORT