TEST REPORT

Report Number. : 14586572-E2V3

Applicant	:	SAMSUNG ELECTRONICS CO., LTD. 129, SAMSUNG-RO, YEONGTONG-GU, SUWON-SI, GYEONGGI-DO, 16677, KOREA
Model	:	SM-A145M/DS, SM-A145M, SM-A145MB/DS and SM-A145MB
FCC ID	:	A3LSMA145M
EUT Description	:	GSM/WCDMA/LTE Phone with BT/BLE, DTS/UNII a/b/g/n/ac
Test Standard(s)	:	FCC 47 CFR PART 15 SUBPART C

Date Of Issue:
2023-01-31

Prepared by:
UL VERIFICATION SERVICES
47173 Benicia Street
Fremont, CA 94538 U.S.A.
TEL: (510) 319-4000
FAX: (510) 661-0888

ACCREDITED
CERT #0751.05

REPORT REVISION HISTORY

Rev.	Issue Date	Revisions	Revised By
V1	2023-01-18	Initial Issue	
V2	2023-01-26	Updated Section 9.6 and 10.2	Kiya Kedida
V3	2023-01-31	Updated Section 7	Kiya Kedida

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME:	SAMSUNG ELECTRONICS CO., LTD. 129, SAMSUNG-RO, YEONGTONG-GU, SUWON-SI, GYEONGGI-DO, 16677, KOREA
EUT DESCRIPTION:	GSM/WCDMA/LTE Phone with BT/BLE, DTS/UNII a/b/g/n/ac
MODEL:	SM-A145M/DS, SM-A145M, SM-A145MB/DS and SM-A145MB
SERIAL NUMBER:	Conducted:R93TA00067A Radiated: R93TA0007MT
DATE TESTED:	2022-12-05 to 2023-01-12

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
CFR 47 Part 15 Subpart C	Complies

UL Verification Services Inc. tested the above equipment in accordance with the requirements set forth in the above standards. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical components. All samples tested were in good operating condition throughout the entire test program. Measurement Uncertainties are published for informational purposes only and were not taken into account unless noted otherwise.

This document may not be altered or revised in any way unless done so by UL Verification Services Inc. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL Verification Services Inc. will constitute fraud and shall nullify the document.

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Approved & Released For
UL Verification Services Inc. By:

Dan Coronia
Operations Leader
Consumer Technology Division
UL Verification Services Inc.

Prepared By:

Gerardo Abrego
Test Engineer
Consumer Technology Division
UL Verification Services Inc.

1st Reviewed By:

Vien Tran
Senior Laboratory Engineer
Consumer Technology Division
UL Verification Services Inc.

2nd Reviewed By:

Kiya Kedida
Senior Project Engineer
Consumer Technology Division
UL Verification Services Inc.

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2. TEST RESULTS SUMMARY

This report contains data provided by the customer which can impact the validity of results. UL Verification Services Inc. is only responsible for the validity of results after the integration of the data provided by the customer.

FCC Clause	Requirement	Result	Comment
See Comment	Duty Cycle	Reporting purposes only	Per ANSI C63.10, Section 11.6.
See Comment	20dB BW/99% OBW	Reporting purposes only	ANSI C63.10 Sections 6.9.2 and 6.9.3
15.247 (a)(1)	Hopping Frequency Separation		None.
15.247 (a)(1)(iii)	Number of Hopping Channels		None.
15.247 (a)(1)(iii)	Average Time of Occupancy		None.
15.247 (b)(1)	Output Power		None.
See Comment	Average Power	Reporting purposes only	Per ANSI C63.10, Section 11.9.2.3.2.
15.247 (d)	Conducted Spurious Emissions		None.
15.209, 15.205	Radiated Emissions		None.
15.207	AC Mains Conducted Emissions		None.

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3. TEST METHODOLOGY

The tests documented in this report were performed in accordance with FCC CFR 47 Part 2, FCC CFR 47 Part 15, ANSI C63.10-2013, KDB 558074 D01 15.247 Meas Guidance v05r02 and KDB 414788 D01 Radiated Test Site v01r01.

4. FACILITIES AND ACCREDITATION

UL Verification Services Inc. is accredited by A2LA, Certificate Number 0751.05, for all testing performed within the scope of this report. Testing was performed at the locations noted below.

	Address	ISED CABID	FCC Registration
☐	Building 1: 47173 Benicia Street Fremont, CA 94538, U.S.A	US0104	550739
☐	Building 2: 47266 Benicia Street Fremont, CA 94538, U.S.A	US0104	550739
☒	Building 4: 47658 Kato Rd Fremont, CA 94538, U.S.A	US0104	550739

5. DECISION RULES AND MEASUREMENT UNCERTAINTY

5.1. METROLOGICAL TRACEABILITY

All test and measuring equipment utilized to perform the tests documented in this report are calibrated on a regular basis, with a maximum time between calibrations of one year or the manufacturers' recommendation, whichever is less, and where applicable is traceable to recognized national standards.

5.2. DECISION RULES

The Decision Rule is based on Simple Acceptance in accordance with ISO Guide 98-4:2012 Clause 8.2. (Measurement uncertainty is not taken into account when stating conformity with a specified requirement.)

5.3. MEASUREMENT UNCERTAINTY

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

PARAMETER	U_{Lab}
Radio Frequency (Spectrum Analyzer)	141.16 Hz
Occupied Bandwidth	1.22%
Power Spectral Density	2.47 dB
RF Power Measurement Direct Method Using Power Meter	1.3 dB (PK) / 0.45 dB (AV)
Unwanted Emissions, Conducted	1.94 dB
Worst Case Conducted Disturbance, 9KHz to 0.15 MHz	3.78 dB
Worst Case Conducted Disturbance, 0.15 to 30 MHz	3.40 dB
Worst Case Radiated Disturbance, 9KHz to 30 MHz	2.87 dB
Worst Case Radiated Disturbance, 30 to 1000 MHz	6.01 dB
Worst Case Radiated Disturbance, 1000 to 18000 MHz	4.73 dB
Worst Case Radiated Disturbance, 18000 to 26000 MHz	4.51 dB
Worst Case Radiated Disturbance, 26000 to 40000 MHz	5.29 dB
Time Domain Measurements	3.39%
Temperature	0.57˚C
Humidity	3.39%
DC Supply Voltages	0.57%

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

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5.4. SAMPLE CALCULATION

RADIATED EMISSIONS

Where relevant, the following sample calculation is provided:
Field Strength (dBuV/m) = Measured Voltage (dBuV) + Antenna Factor (dB/m) + Cable Loss (dB) – Preamp Gain (dB)
36.5 dBuV + 18.7 dB/m + 0.6 dB – 26.9 dB = 28.9 dBuV/m

MAINS CONDUCTED EMISSIONS

Where relevant, the following sample calculation is provided:
Final Voltage (dBuV) = Measured Voltage (dBuV) + Cable Loss (dB) + Limiter Factor (dB) + LISN Insertion Loss.
36.5 dBuV + 0 dB +10.1 dB+ 0 dB = 46.6 dBuV

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6. EQUIPMENT UNDER TEST

6.1. EUT DESCRIPTION

The EUT is a GSM/WCDMA/LTE Phone with BT/BLE, DTS/UNII a/b/g/n/ac.
The model SM-A145M/DS was used for final testing and is representative of the test results in this report.

The models are electronically equivalent the only differences is as follows:

1) SM-A145M/DS : Dual SIM

2) SM-A145M : Single SIM

3) SM-A145MB/DS : Dual SIM with KNOX Security Platform

4) SM-A145MB : Single SIM with KNOX Security Platform

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6.2. MAXIMUM OUTPUT POWER

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

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
2402 - 2480	Basic GFSK	9.90	9.77
2402 - 2480	Enhanced DQPSK	10.27	10.64
2402 - 2480	Enhanced 8PSK	11.02	12.65

Note: GFSK, DQPSK, 8PSK average Power are all investigated, The GFSK & 8PSK Power are the worst case. Testing is based on these modes to showing compliance. For average power data please refer to section 4.7.

6.3. DESCRIPTION OF AVAILABLE ANTENNAS

The antenna(s) gain and type, as provided by the manufacturer' are as follows:

The radio utilizes an LDS antenna, with a maximum gain of -4.51 dBi.

6.4. SOFTWARE AND FIRMWARE

The test utility software used during testing was A145M.001.

6.5. WORST-CASE CONFIGURATION AND MODE

Radiated emissions below 1GHz, above 18GHz, and power line conducted emission were performed with the EUT set to transmit at the channel with highest output power as worst-case scenario.

Band edge and radiated emissions between 1GHz and 18GHz were performed with the EUT set to transmit at the highest power on low, middle, and high channels.

The fundamental of the EUT was investigated in three orthogonal orientations X,Y,Z, it was determined that Z orientation was worst-case orientation; therefore, all final radiated testing was performed with the EUT in Z orientation.

Worst-case data rates as provided by the client were:

GFSK mode: DH5
8PSK mode: 3-DH5

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6.6. DESCRIPTION OF TEST SETUP

Support Equipment List				
Description	**Manufacturer**	**Model**	**Serial Number**	**FCC ID**
AC Adapter	Samsung	EP-TA800	R37MAMT21J2SE3	N/A
Earphone	Samsung	N/A	N/A	N/A

I/O CABLES CONDUCTED

I/O Cable List						
Cable No	**Port**	**# of identical ports**	**Connector Type**	**Cable Type**	**Cable Length (m)**	**Remarks**
1	Antenna	1	RF	Shielded	0.2	To spectrum Analyzer
2	USB	1	USB	Un-shielded	1	EUT to AC Mains

I/O CABLES (RADIATED AND CONDUCTED EMISSIONS)

I/O Cable List						
Cable No	**Port**	**# of identical ports**	**Connector Type**	**Cable Type**	**Cable Length (m)**	**Remarks**
1	USB	1	USB	Shielded	1	N/A
2	Earphone	1	3.5mm	Un-shielded	1	N/A

TEST SETUP

The EUT is a stand-alone unit. Test software exercised the radio card.

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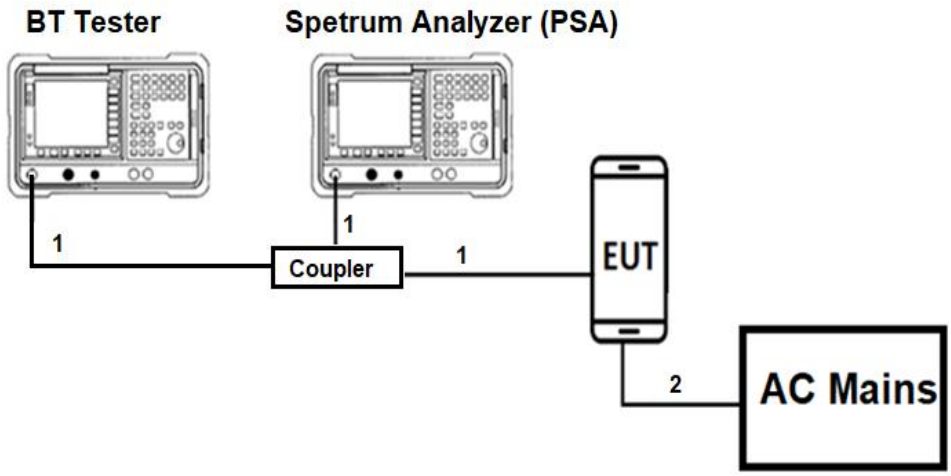
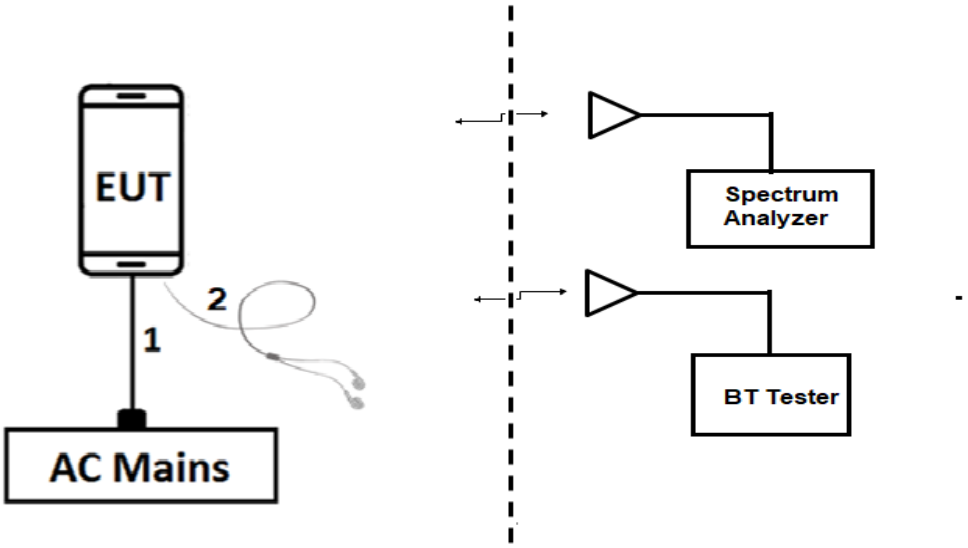
SETUP DIAGRAMS

Conducted Configuration



Radiated Configuration



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7. 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**	**ID Num**	**Cal Due**	**Last Cal**
Antenna, Broadband Hybrid, 30MHz to 3GHz	Sunol Sciences Corp.	JB3	80706	2023-07-28	2022-07-28
Amplifier, 10KHz to 1GHz, 32dB	SONOMA INSTRUMENT	310	175953	2023-02-03	2022-02-08
Amplifier, 10KHz to 1GHz, 32dB	SONOMA INSTRUMENT	310N	29654	2023-04-24	2022-04-24
Antenna, Horn 1-18GHz	ETS-Lindgren (Cedar Park, Texas)	3117	223083	2023-07-05	2022-07-05
RF Filter Box, 1-18GHz	UL-FR1	N/A	171875	2023-08-12	2022-08-12
EMI TEST RECEIVER	Rohde & Schwarz	ESW44	169937	2023-02-20	2022-02-20
EMI TEST RECEIVER	Rohde & Schwarz	ESW44	169927	2023-02-13	2022-02-13
Bluetooth Tester	Rohde & Schwarz	CBT	81045	2023-03-03	2022-03-03
Antenna, Horn 18 to 26.5GHz	ARA	MWH-1826/B	172364	2023-03-08	2023-03-08
Amplifier 18-26.5GHz, +5Vdc, 60dB min	AMPLICAL	AMP18G26.5-60	215705	2023-02-26	2022-02-26
Antenna, Passive Loop 30Hz – 1MHz	ELECTRO METRICS	EM-6871	219909	2023-05-10	2022-05-10
Antenna, Passive Loop 100KHz – 30MHz	ELECTRO METRICS	EM-6872	219911	2023-05-10	2022-05-10
Spectrum Analyzer, PSA, 3Hz to 44GHz	Agilent Technologies	N4440A	80386	2023-03-02	2022-03-02
Directional Coupler	Krytar	152610	PRE0211471	2023-09-19	2022-09-19
Power Meter, P-series single channel	Keysight Technologies Inc	N1911A	T1268	2023-02-03	2022-02-03
Power Sensor, P - series, 50MHz to 18GHz, Wideband	Keysight Technologies Inc	N1921A	90419	2023-03-02	2022-03-02
10dB Fixed Attenuator	Pasternack Enterprises	PE7087-10	N/A	Verified	Verified
AC Line Conducted					
LISN	Fischer Custom Communications, Inc	FCC-LISN-50/250-25-2-01-480V	175765	2023-01-25	2022-01-25
EMI TEST RECEIVER	Rohde & Schwarz	ESR	93091	2023-02-21	2022-02-21
Transient Limiter	Com-Power	LIT-930	127455	2023-02-02	2022-02-02
UL TEST SOFTWARE LIST					
Radiated Software	UL	UL EMC	Ver 2022-10-25, 2022-05-18, 2020-06-04, 2020-06-05, 2020-06-14, 2014-07-15,		
Antenna Port Software	UL	UL RF	Ver 2022-08-16		
AC Line Software	UL	UL EMC	Ver. 2022-02-17		

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8. MEASUREMENT METHODS

On Time and Duty Cycle: ANSI C63.10-2013 Section 11.6

Occupied BW (20dB): ANSI C63.10-2013 Section 6.9.2

Occupied BW (99%): ANSI C63.10-2013 Section 6.9.3

Carrier Frequency Separation: ANSI C63.10-2013 Section 7.8.2

Number of Hopping Frequencies: ANSI C63.10-2013 Section 7.8.3

Time of Occupancy (Dwell Time): ANSI C63.10-2013 Section 7.8.4

Peak Output Power: ANSI C63.10-2013 Section 7.8.5

Conducted Spurious Emissions: ANSI C63.10-2013 Section 7.8.8

Conducted Band-Edge: ANSI C63.10-2013 Section 6.10.4

Radiated Spurious Emissions Below 30MHz: ANSI C63.10-2013 Section 6.4

Radiated Spurious Emissions 30-1000MHz: ANSI C63.10-2013 Section 6.3 and 6.5

Radiated Spurious Emissions above 1GHz: ANSI C63.10-2013 Section 6.3 and 6.6

Radiated Band-edge: ANSI C63.10-2013 Section 6.10.5

AC Power-line conducted emissions: ANSI C63.10-2013, Section 6.2.

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9. ANTENNA PORT TEST RESULTS

9.1. ON TIME AND DUTY CYCLE

LIMITS

None; for reporting purposes only.

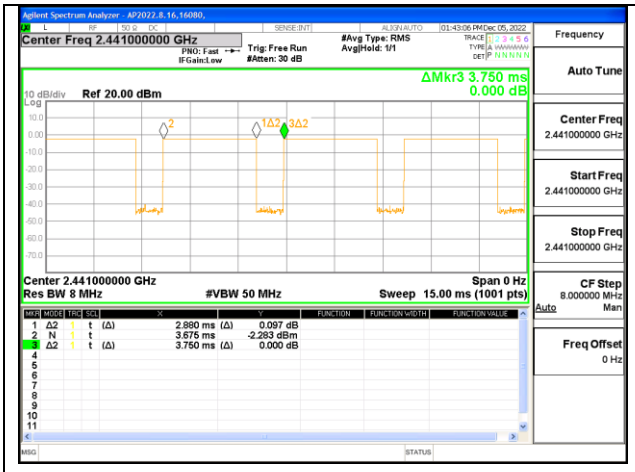
PROCEDURE

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

ON TIME AND DUTY CYCLE RESULTS

Mode	ON Time B (msec)	Period (msec)	Duty Cycle x (linear)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)	1/T Minimum VBW (kHz)
BLUETOOTH GFSK	2.88	3.75	0.768	76.80	1.15	0.347
BLUETOOTH 8PSK	2.88	3.75	0.768	76.80	1.15	0.347

DUTY CYCLE PLOTS



BLUETOOTH GFSK

BLUETOOTH 8PSK

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9.2. 20 dB AND 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The RBW is set to ≥ 1% of the 20 dB bandwidth. The VBW is set to ≥ RBW. The sweep time is coupled.

RESULTS

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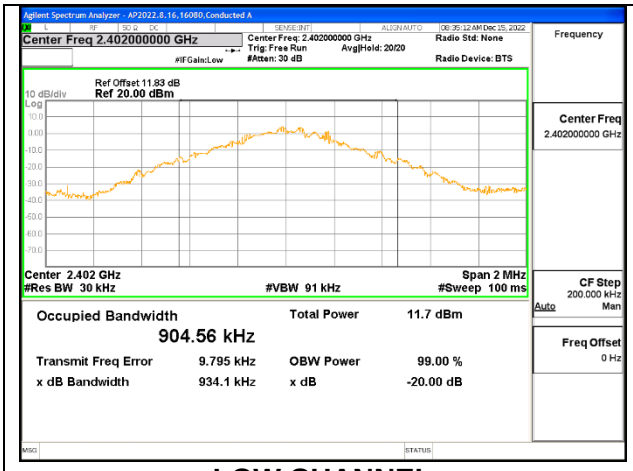
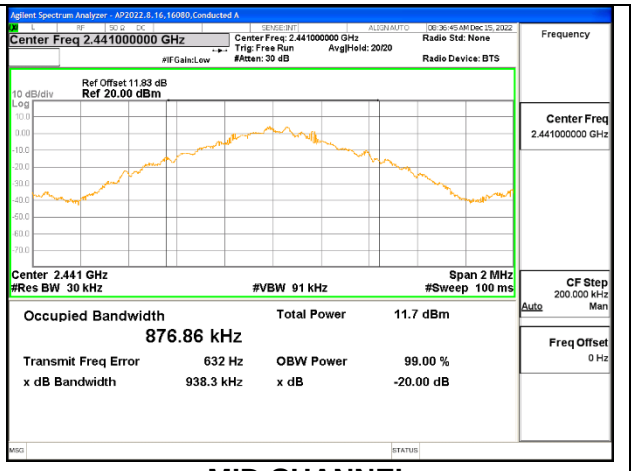
9.2.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION

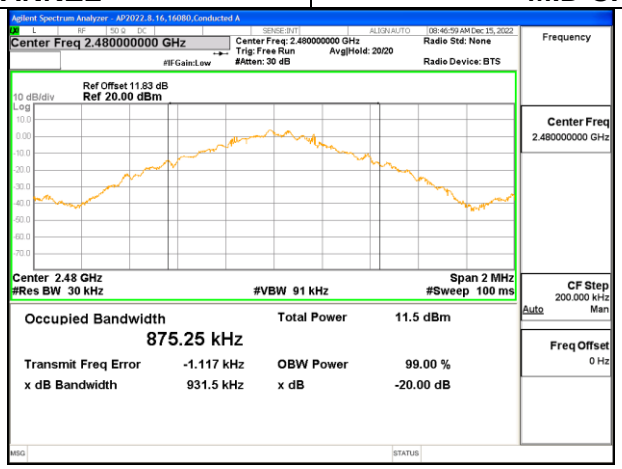
Channel	Frequency (MHz)	20dB Bandwidth (KHz)	99% Bandwidth (KHz)
Low	2402	934.1	904.56
Mid	2441	938.3	876.86
High	2480	931.5	875.25



LOW CHANNEL



MID CHANNEL



HIGH CHANNEL

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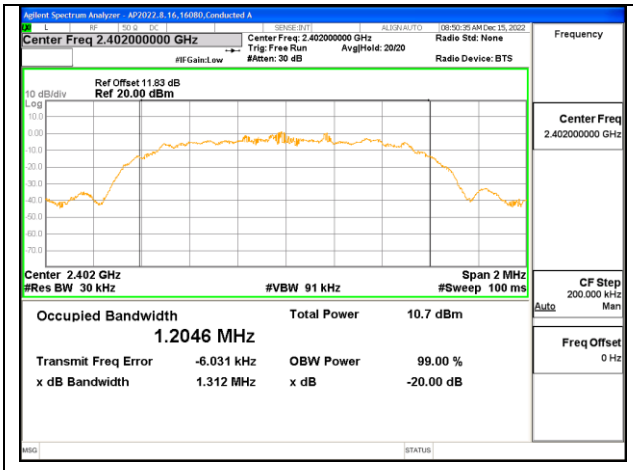
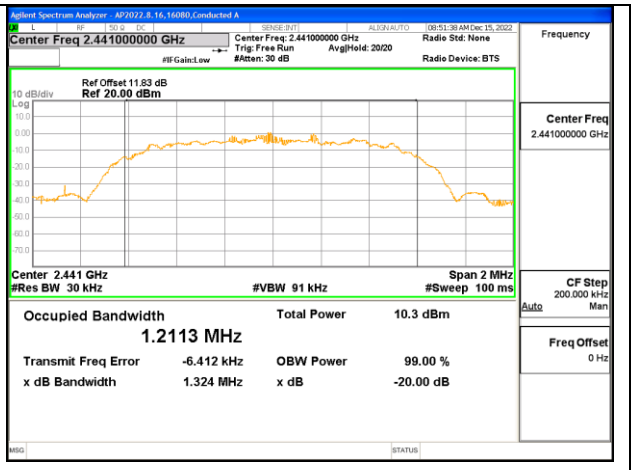
9.2.2. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION

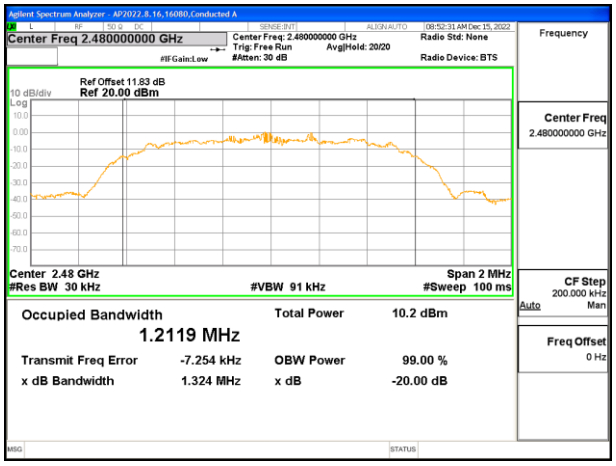
Channel	Frequency (MHz)	20dB Bandwidth (MHz)	99% Bandwidth (MHz)
Low	2402	1.312	1.2046
Mid	2441	1.324	1.2113
High	2480	1.324	1.2119



LOW CHANNEL



MID CHANNEL



HIGH CHANNEL

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9.3. HOPPING FREQUENCY SEPARATION

LIMITS

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 hoping 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. The RBW is set to 300 kHz and the VBW is set to VBW >= RBW. The sweep time is coupled.

RESULTS

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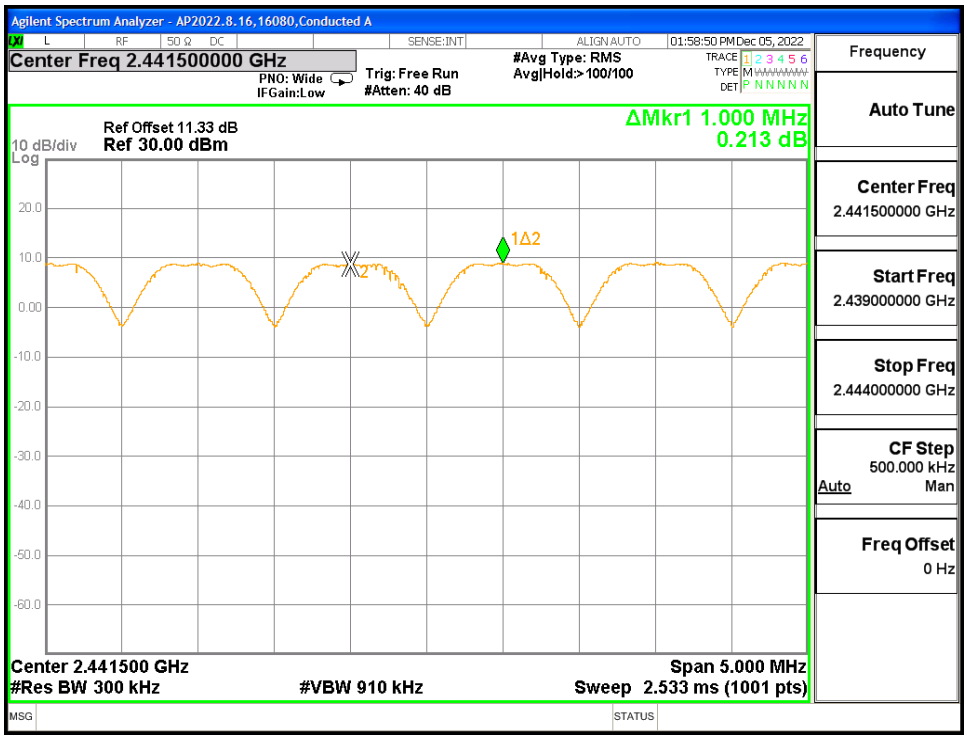
9.3.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION



HOPPING FREQUENCY SEPARATION PLOT

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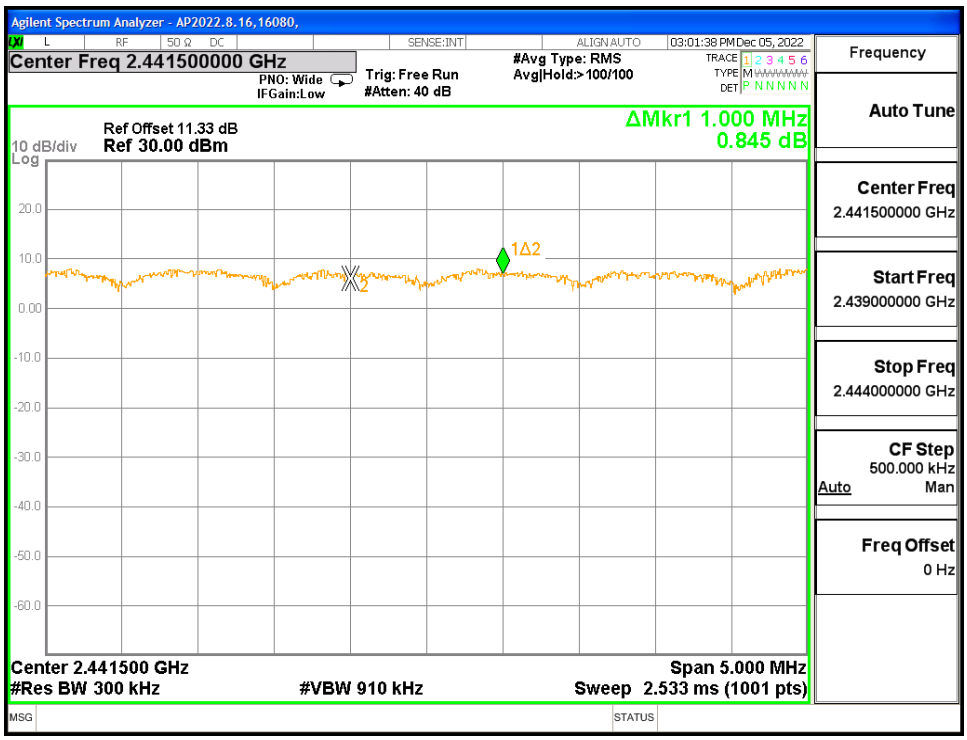
9.3.2. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION



HOPPING FREQUENCY SEPARATION PLOT

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9.4. NUMBER OF HOPPING CHANNELS

LIMITS

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. The RBW is set to a maximum of 1 % of the span. The analyzer is set to Max Hold.

RESULTS

Normal Mode: 79 Channels Observed

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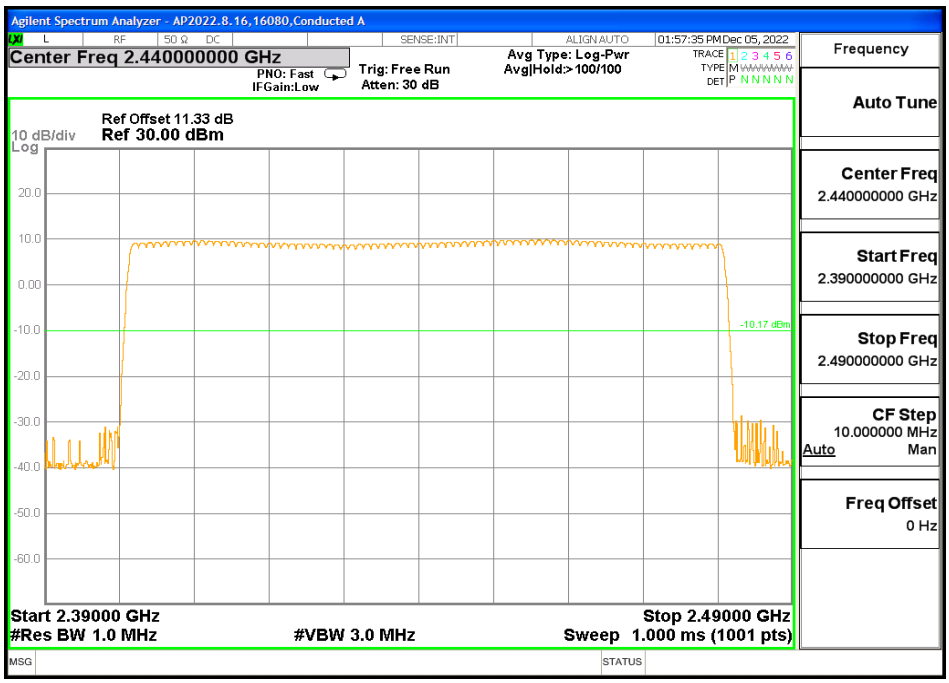
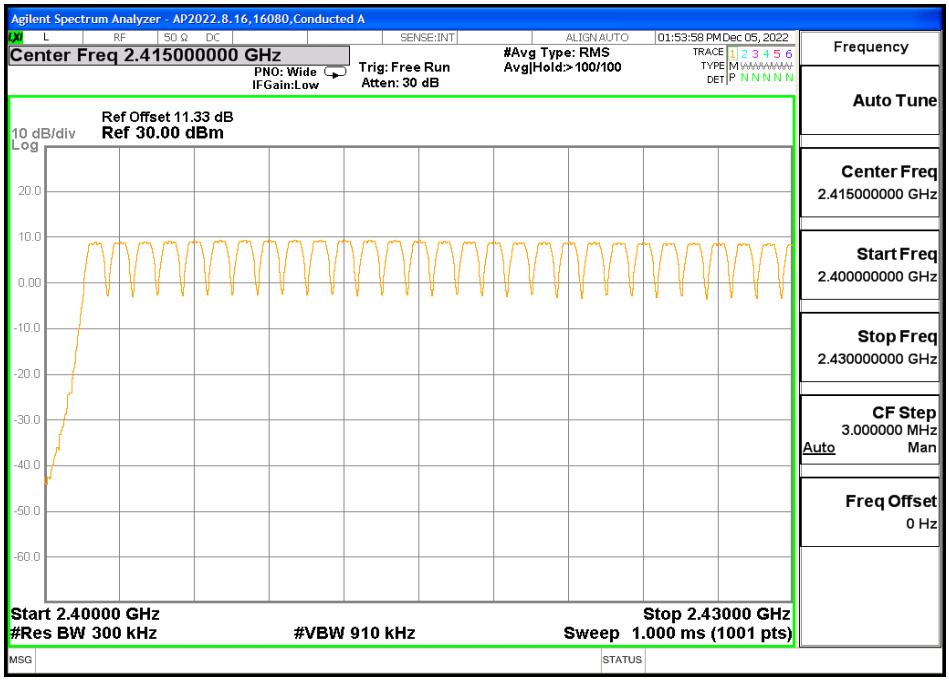
9.4.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION



100MHz SPAN



30MHz SPAN, SEGMENT 1 OF 3

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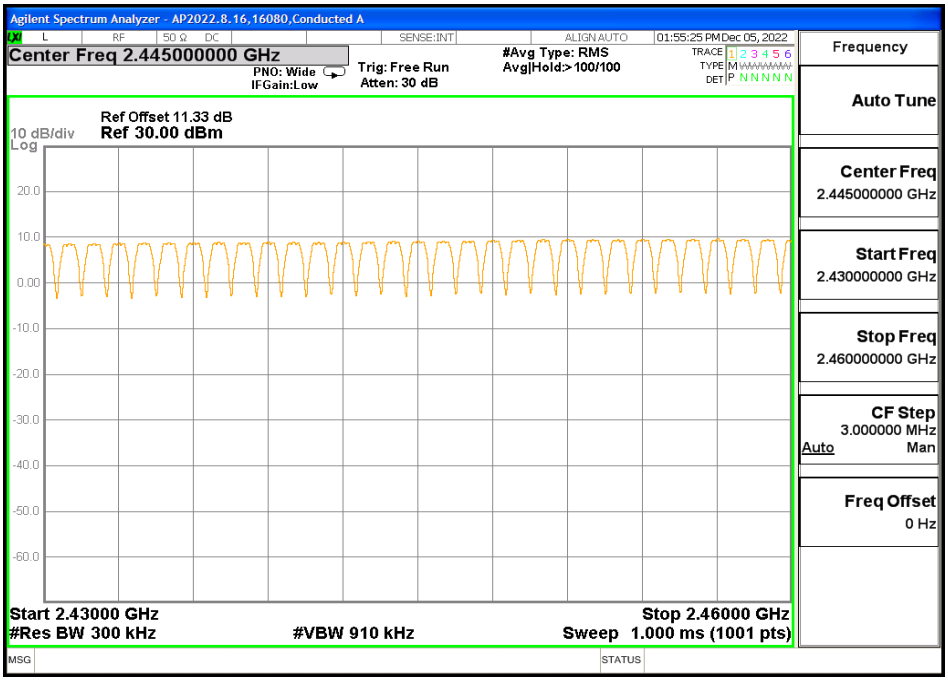
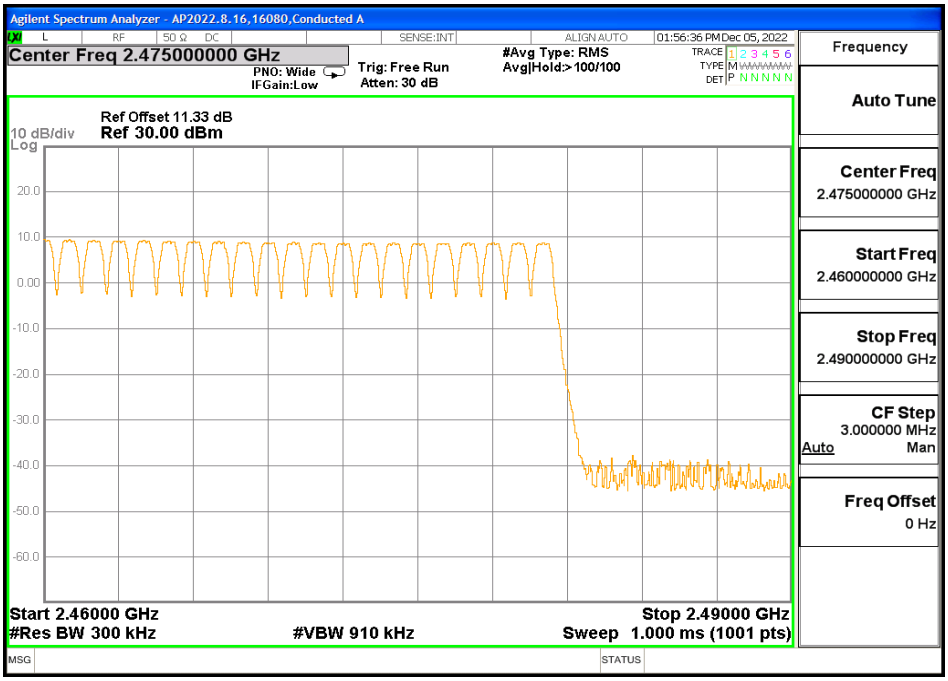


30MHz SPAN, SEGMENT 2 OF 3



30MHz SPAN, SEGMENT 3 OF 3

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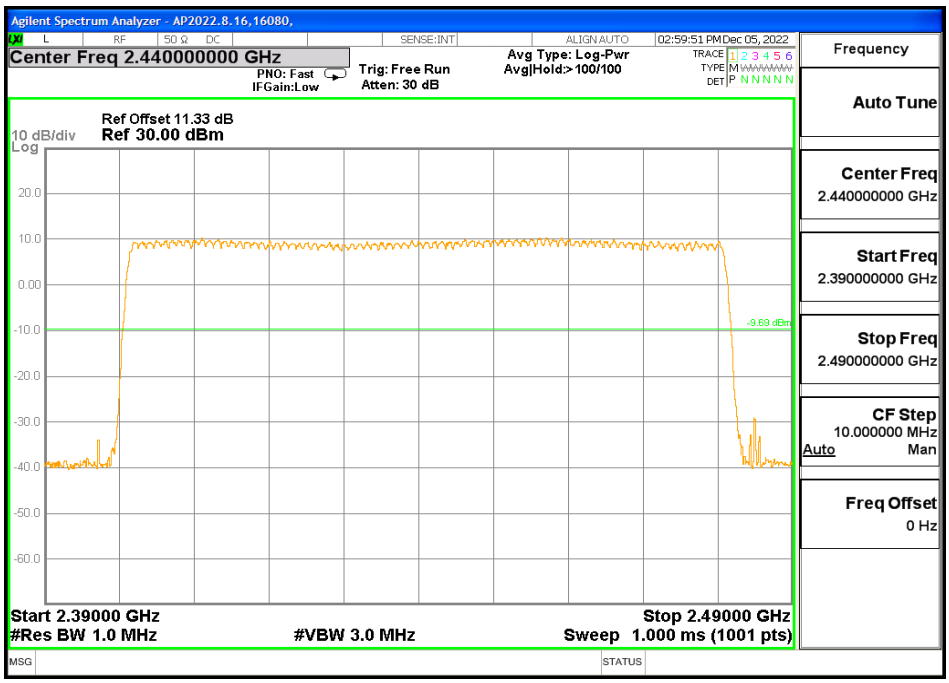
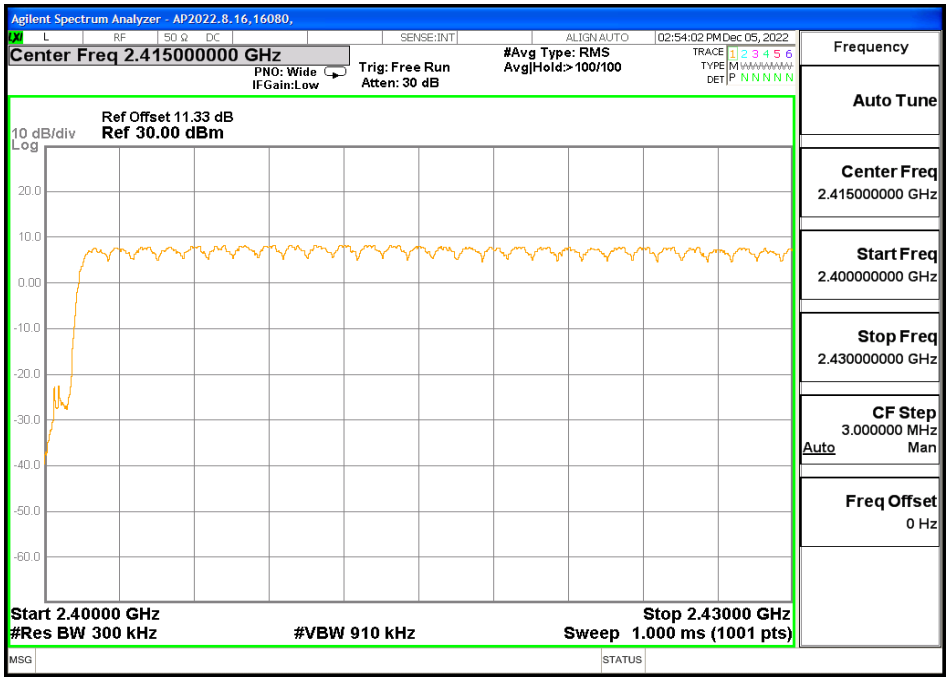
9.4.2. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION



100MHz SPAN



30MHz SPAN, SEGMENT 1 OF 3

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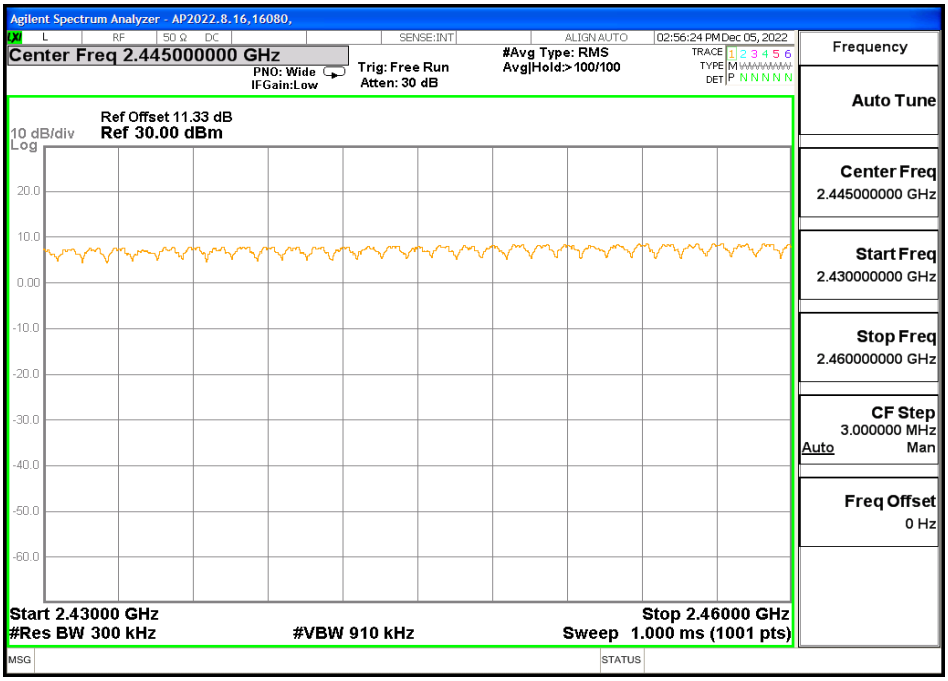
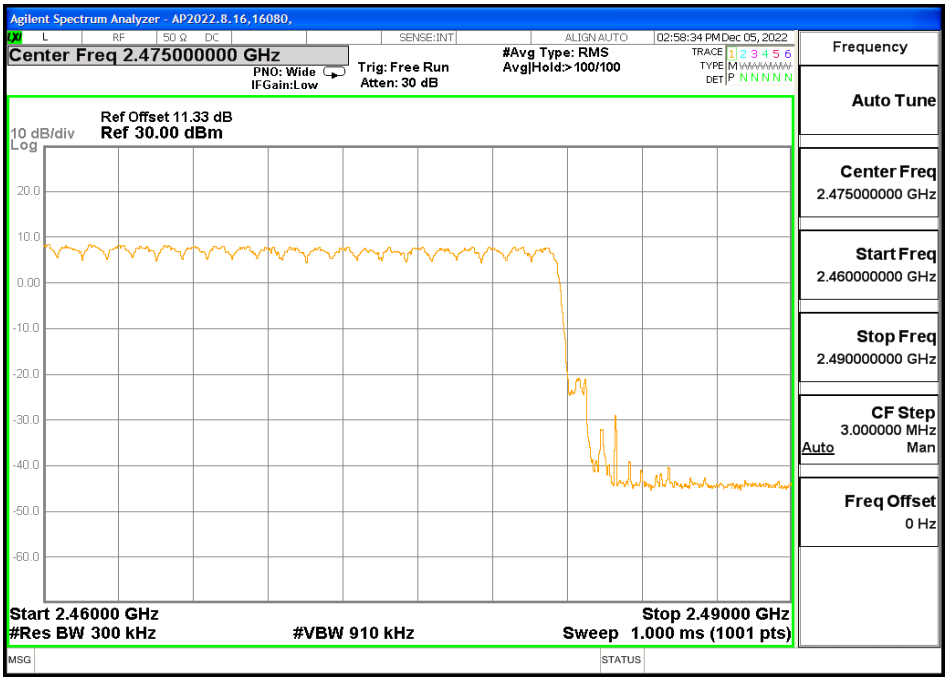


30MHz SPAN, SEGMENT 2 OF 3



30MHz SPAN, SEGMENT 3 OF 3

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9.5. AVERAGE TIME OF OCCUPANCY

LIMITS

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 * (# of pulses in 3.16 s) * 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 * (# of pulses in 0.8 s) * pulse width.

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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 Mode					
DH1	0.372	34	0.1265	0.4	-0.2735
DH3	1.626	18	0.2927	0.4	-0.1073
DH5	2.868	13	0.3728	0.4	-0.0272
DH Packet	Pulse Width (sec)	Number of Pulses in 0.8 seconds	Average Time of Occupancy (sec)	Limit (sec)	Margin (sec)
GFSK AFH Mode					
DH1	0.372	8.5	0.03162	0.4	-0.3684
DH3	1.626	4.5	0.07317	0.4	-0.3268
DH5	2.868	3.25	0.09321	0.4	-0.3068

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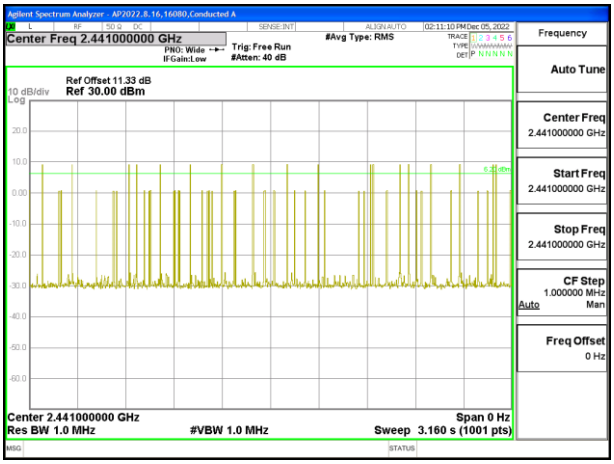
PULSE WIDTH – DH1

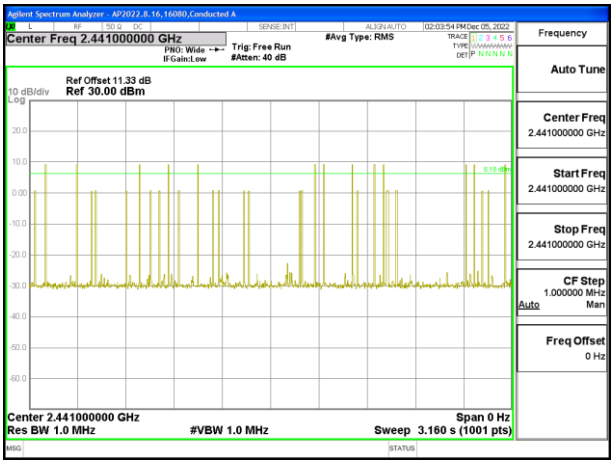
PULSE WIDTH – DH3

PULSE WIDTH – DH5

NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH1



NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH3



NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH5

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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 Mode					
3DH1	0.384	31	0.11904	0.4	-0.28096
3DH3	1.63	15	0.2445	0.4	-0.1555
3DH5	2.876	8	0.23008	0.4	-0.16992

Note: for AFH(8PSK) mode, please refer to the results of AFH(GFSK) mode; the channel selection and hopping rate are the same for both EDR and Basic Rate operation, data for Basic Rate demonstrates compliance with channel occupancy when AFH is employed.

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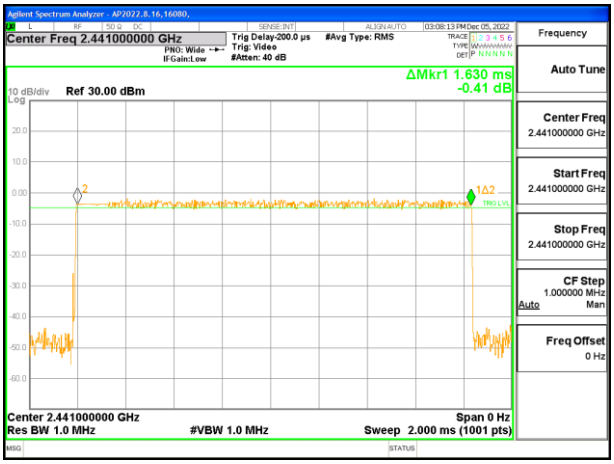
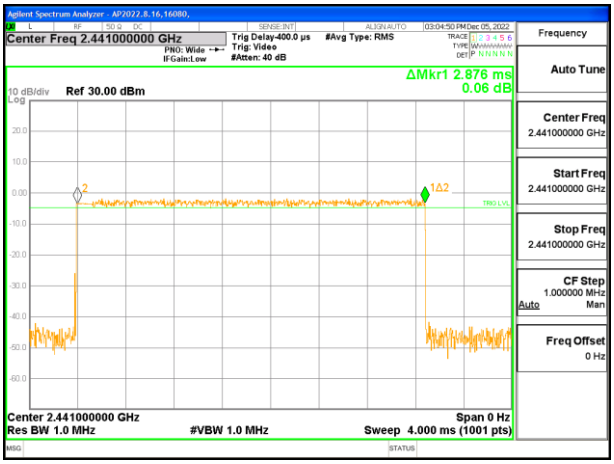
PULSE WIDTH – 3DH1



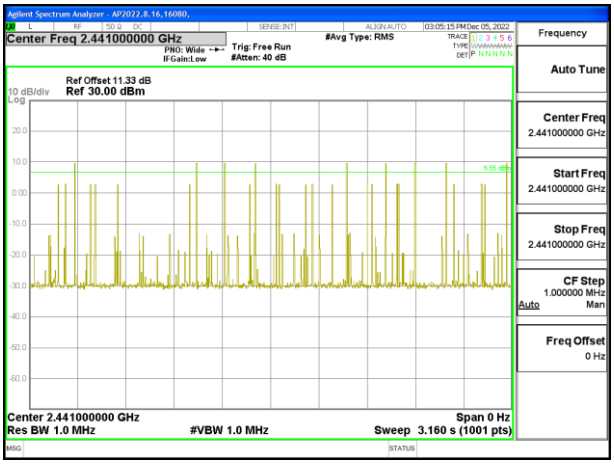
PULSE WIDTH – 3DH3



PULSE WIDTH – 3DH5

NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – 3DH1

NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – 3DH3



NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – 3DH5

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9.6. OUTPUT POWER

LIMITS

§15.247 (b) (1)

The maximum antenna gain is less than 6 dBi, therefore the limit is 30 dBm. 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.

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

TEST PROCEDURE

The transmitter output is connected to a power meter.

The power output was measured on the EUT antenna port using SMA cable with 10dB attenuator connected to a power meter via wideband power sensor. Peak output power was read directly from power meter.

RESULTS

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9.6.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION

Tested By:	ZS 16080
Date:	2022-12-06

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	9.9	21	-11.1
Middle	2441	9.82	21	-11.18
High	2480	9.753	21	-11.247

9.6.2. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION

Tested By:	ZS 16080
Date:	2022-12-06

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	11.02	21	-9.98
Middle	2441	10.82	21	-10.18
High	2480	10.68	21	-10.32

9.6.3. BLUETOOTH ENHANCED DATA RATE DQPSK MODULATION

Tested By:	ZS 16080
Date:	2022-12-06

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	10.27	21	-10.73
Middle	2441	10.19	21	-10.81
High	2480	10.07	21	-10.93

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9.7. AVERAGE POWER

LIMITS

None; for reporting purposes only

TEST PROCEDURE

The transmitter output is connected to a power meter.

The power output was measured on the EUT antenna port using SMA cable with 10dB attenuator connected to a power meter via wideband power sensor. Gated average output power was read directly from power meter.

RESULTS

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9.7.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION

Tested By:	ZS 16080
Date	2022-12-06

Channel	Frequency (MHz)	Average Power (dBm)
Low	2402	9.27
Middle	2441	9.26
High	2480	9.17

9.7.2. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION

Tested By:	ZS 16080
Date	2022-12-06

Channel	Frequency (MHz)	Average Power (dBm)
Low	2402	7.66
Middle	2441	7.75
High	2480	7.68

9.7.3. BLUETOOTH ENHANCED DATA RATE DQPSK MODULATION

Tested By:	ZS 16080
Date	2022-12-06

Channel	Frequency (MHz)	Average Power (dBm)
Low	2402	7.74
Middle	2441	7.85
High	2480	7.73

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9.8. CONDUCTED SPURIOUS EMISSIONS

LIMITS

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 bandedges at 2.4 and 2.4835 GHz are investigated with the transmitter set to the normal hopping mode.

RESULTS

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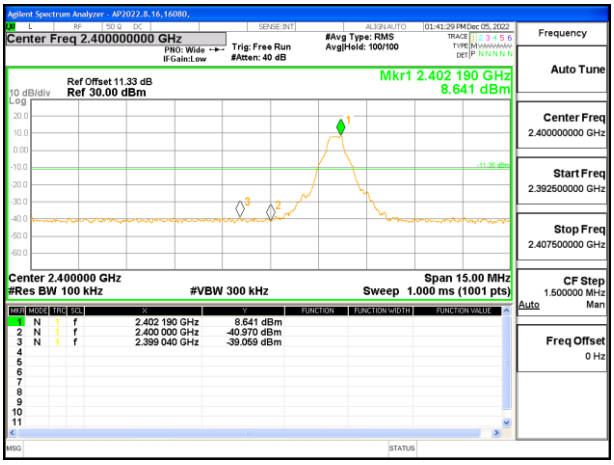
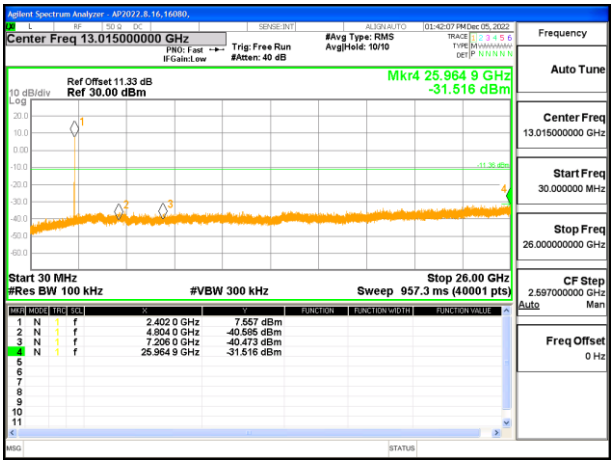
9.8.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION

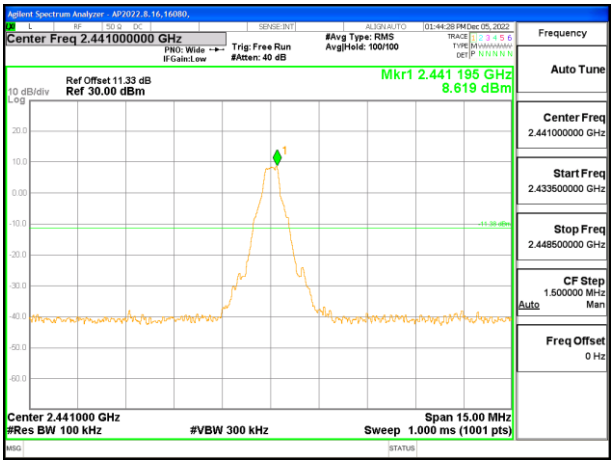
SPURIOUS EMISSIONS, NON-HOPPING



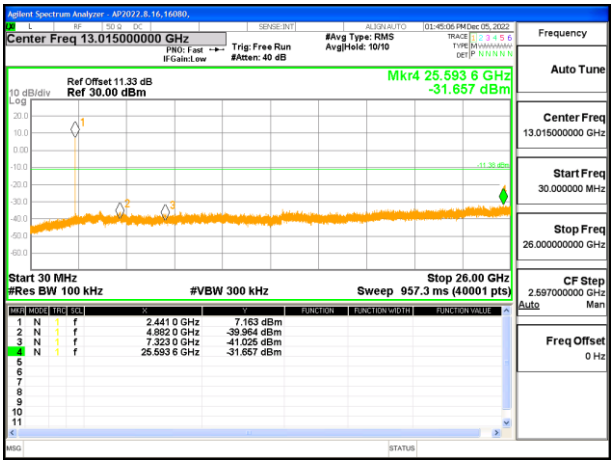
LOW CHANNEL BANDEDGE



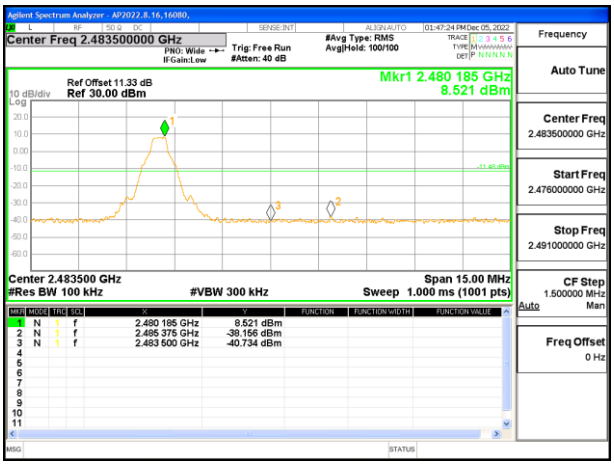
OUT-OF-BAND LOW CHANNEL



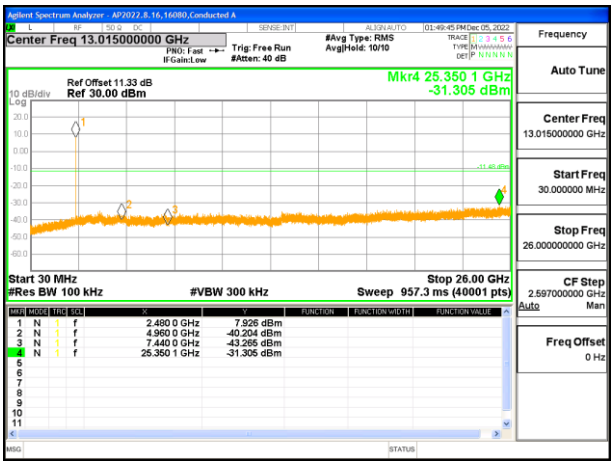
IN-BAND REFERENCE LEVEL



OUT-OF-BAND MID CHANNEL



HIGH CHANNEL BANDEDGE



OUT-OF-BAND HIGH CHANNEL

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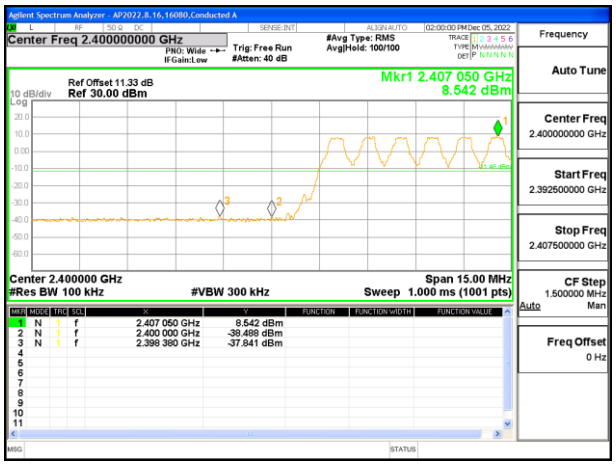
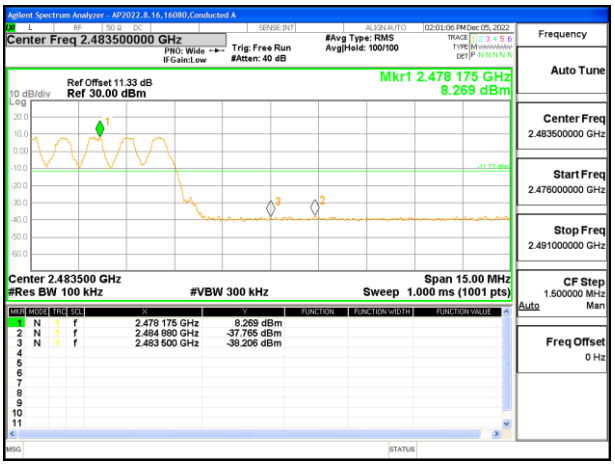
SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON



LOW BANDEDGE



HIGH BANDEDGE

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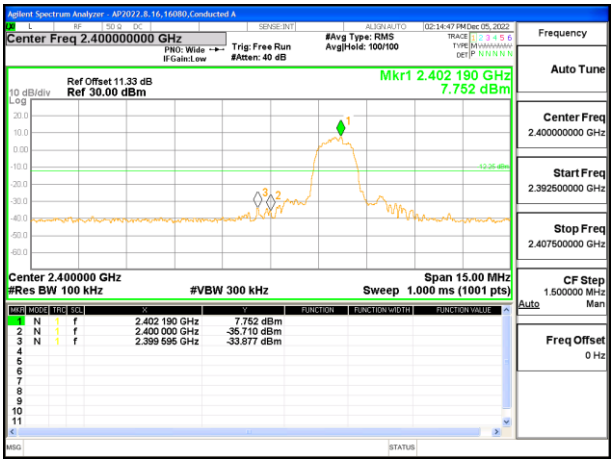
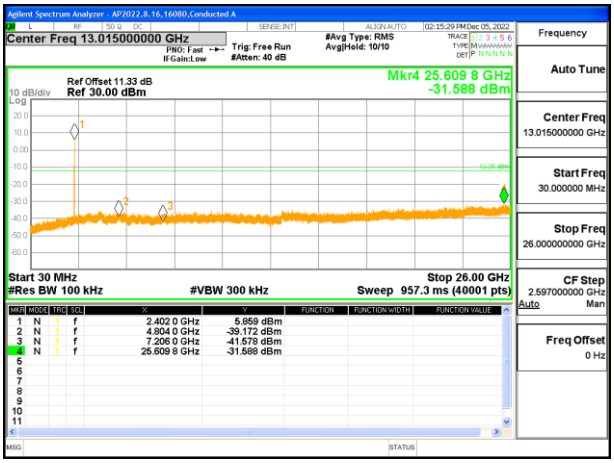
9.8.2. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION

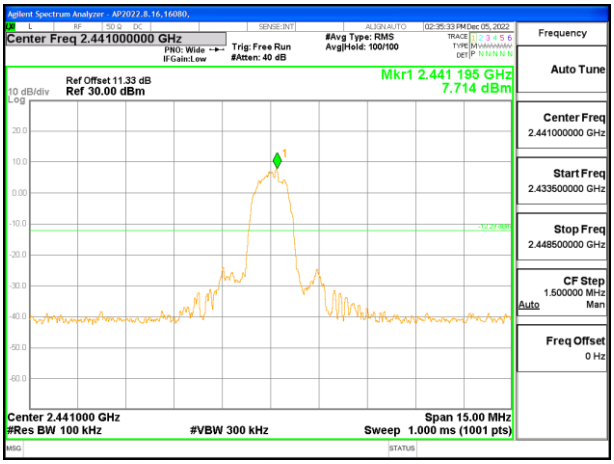
SPURIOUS EMISSIONS, NON-HOPPING



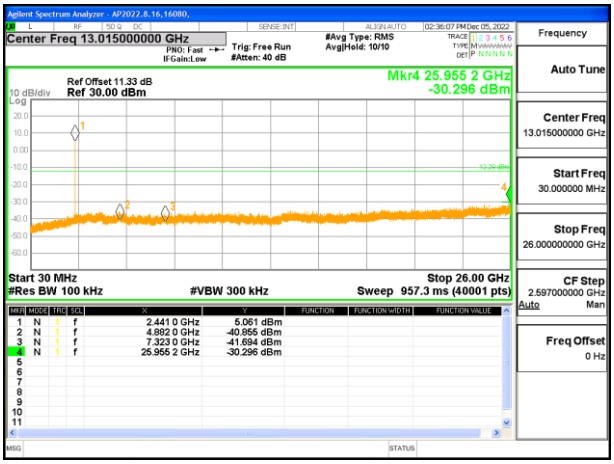
LOW CHANNEL BANDEDGE



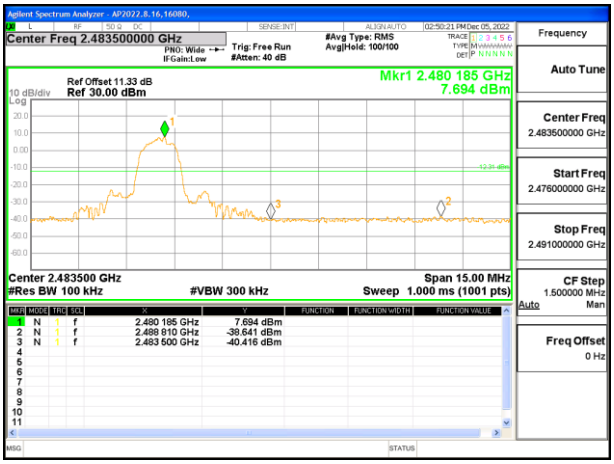
OUT-OF-BAND LOW CHANNEL



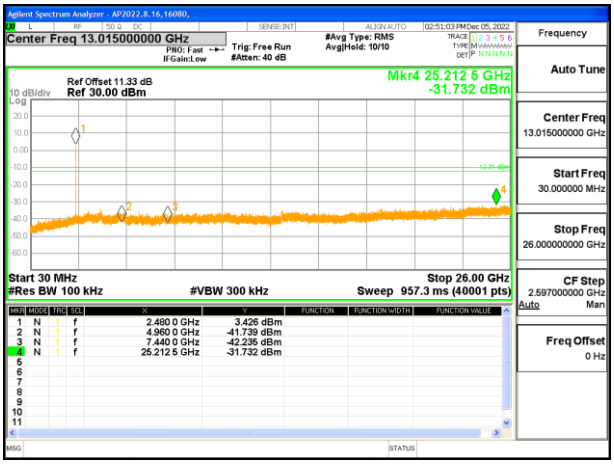
IN-BAND REFERENCE LEVEL



OUT-OF-BAND MID CHANNEL



HIGH CHANNEL BANDEDGE



OUT-OF-BAND HIGH CHANNEL

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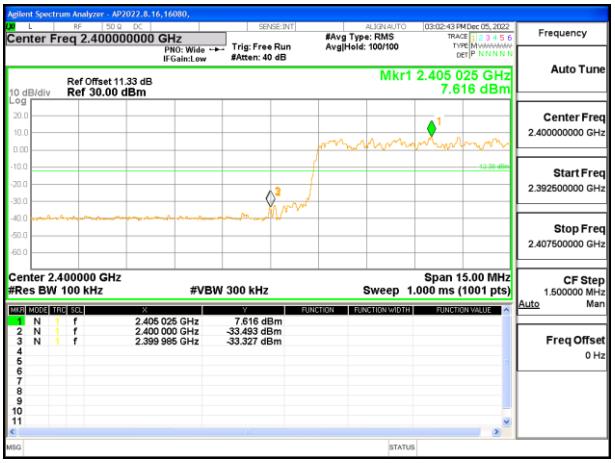
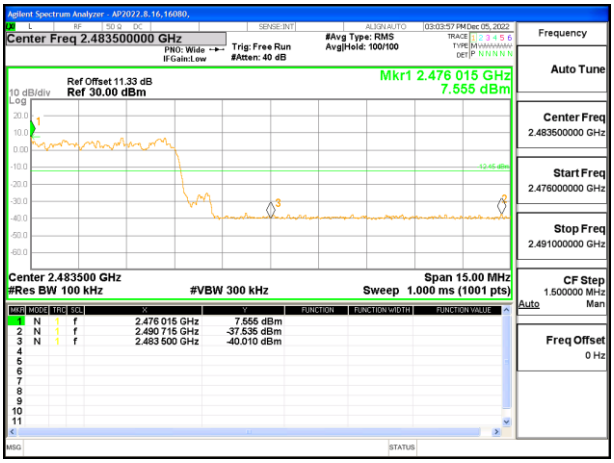
SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON



LOW BANDEDGE



HIGH BANDEDGE

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10. RADIATED TEST RESULTS

LIMITS

FCC §15.205 and §15.209

Frequency Range (MHz)	Field Strength Limit (uV/m) at 3 m	Field Strength Limit (dBuV/m) at 3 m
0.009-0.490	2400/F(kHz) @ 300 m	-
0.490-1.705	24000/F(kHz) @ 30 m	-
1.705 - 30	30 @ 30m	-
30 - 88	100	40
88 - 216	150	43.5
216 - 960	200	46
Above 960	500	54

TEST PROCEDURE

The EUT is placed on a non-conducting table 80 cm above the ground plane for measurement below 1GHz; 1.5 m above the ground plane for measurement above 1GHz. The antenna to EUT distance is 3 meters. 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 in the 30-1000MHz range, 9kHz for peak and/or quasi-peak detection measurements in the 0.15-30MHz range and 200Hz for peak and/or quasi-peak detection measurements in the 9 to 150kHz range. Peak detection is used unless otherwise noted as quasi-peak or average (9-90kHz and 110-490kHz).

For pre-scans above 1 GHz the resolution bandwidth is set to 1 MHz; the video bandwidth is set to 30 KHz for peak measurements.

For final measurements above 1 GHz the resolution bandwidth is set to 1 MHz; the video bandwidth is set to 3 MHz for peak measurements and 1 MHz resolution bandwidth with 1/T (10 Hz) video bandwidth with peak detector for average measurements.

The spectrum from 1 GHz to 18 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in each applicable band. Below 1GHz and above 18GHz emissions, the channel with the highest output power was tested.

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.

2D antenna use - For below 30MHz testing, investigation was done on three antenna orientations (parallel, perpendicular, and ground-parallel), parallel and perpendicular are the worst orientations, therefore testing was performed on these two orientations only.

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Base on FCC 15.31 (f) (2): measurements may be performed at a distance closer than that specified in the regulations; however, an attempt should be made to avoid making measurements in the near field.

KDB 414788 Open Field Site(OFS) and Chamber Correlation Justification

OFS and chamber correlation testing had been performed and chamber measured test result is the worst case test result.

KDB 558074 D01 15.247 Meas Guidance v05r02

Use of a duty cycle correction factor (DCCF) is permitted for calculating average radiated field strength emission levels for an FHSS device in 15.247. This DCCF can be applied when the field strength limit (e.g., within a Government Restricted band) and the conditions specified in Section 15.35(c) can be satisfied. The average radiated field strength is calculated by subtracting the DCCF from the maximum radiated field strength level as determined through measurement. The maximum radiated field strength level represents the worst-case (maximum amplitude) RMS measurement of the emission(s) during continuous transmission (i.e., not including any time intervals during which the transmitter is off or is transmitting at a reduced power level). It is also acceptable to apply the DCCF to a measurement performed with a peak detector instead of the specified RMS power averaging detector. Note that Section 15.35(c) specifies that the DCCF shall represent the worst-case (greatest duty cycle) over any 100 msec transmission period.

Note: The limits in CFR 47, Part 15, Subpart C, paragraph 15.209(a), are identical to those in RSS-Gen section 8.9, Table 6, since the measurements are performed in terms of magnetic field strength and converted to electric field strength levels (as reported in the table), using the free space impedance of 377 Ohms. For example, the measurement at frequency X kHz resulted in a level of Y dBuV/m, which is equivalent to Y – 51.5 = Z dBuA/m, which has the same margin, W dB, to the corresponding RSS-Gen Table 6 limit as it has to 15.209(a) limit.

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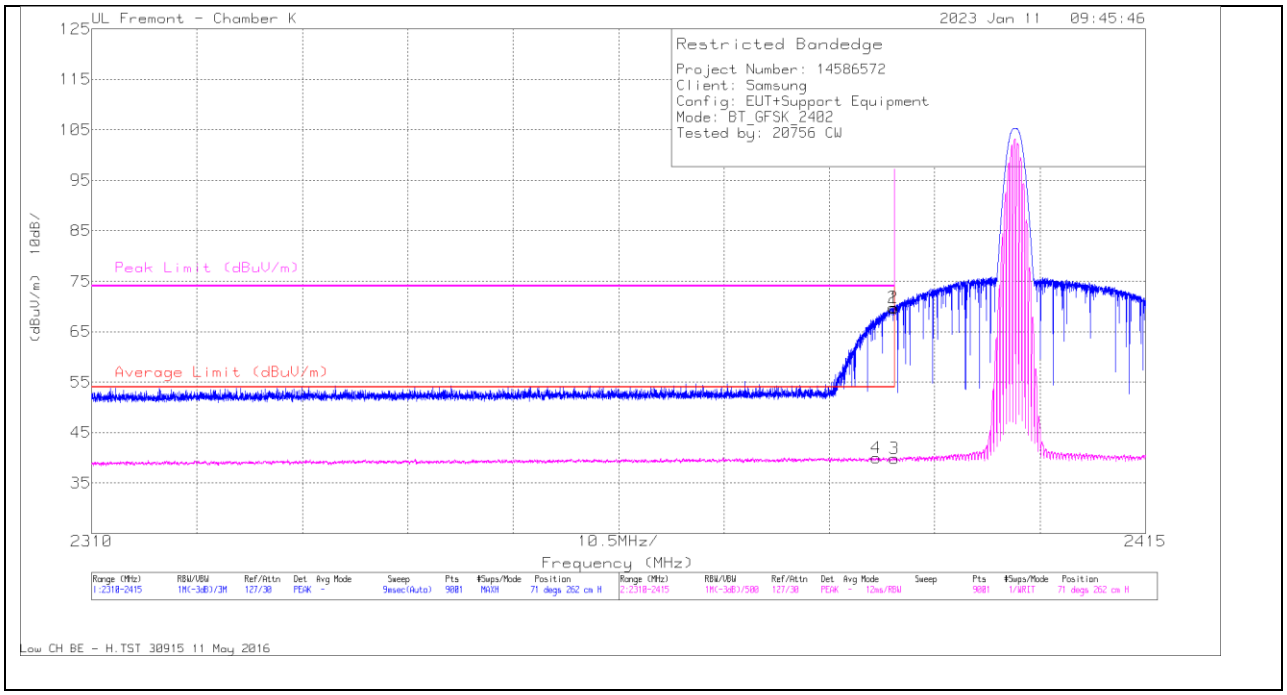
10.1. TRANSMITTER ABOVE 1 GHz

10.1.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION

BANDEDGE (LOW CHANNEL)

HORIZONTAL RESULT



Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	223083 ACF (dB) 3mH	Amp/Cbl/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	2390	72.72	Pk	31.8	-34.9	69.62	-	-	74	-4.38	71	262	H
2	2389.872	72.88	Pk	31.8	-34.9	69.78	-	-	74	-4.22	71	262	H
3	2390	43.01	VA1T	31.8	-34.9	39.91	54	-14.09	-	-	71	262	H
4	2388.169	43.02	VA1T	31.8	-34.8	40.02	54	-13.98	-	-	71	262	H

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

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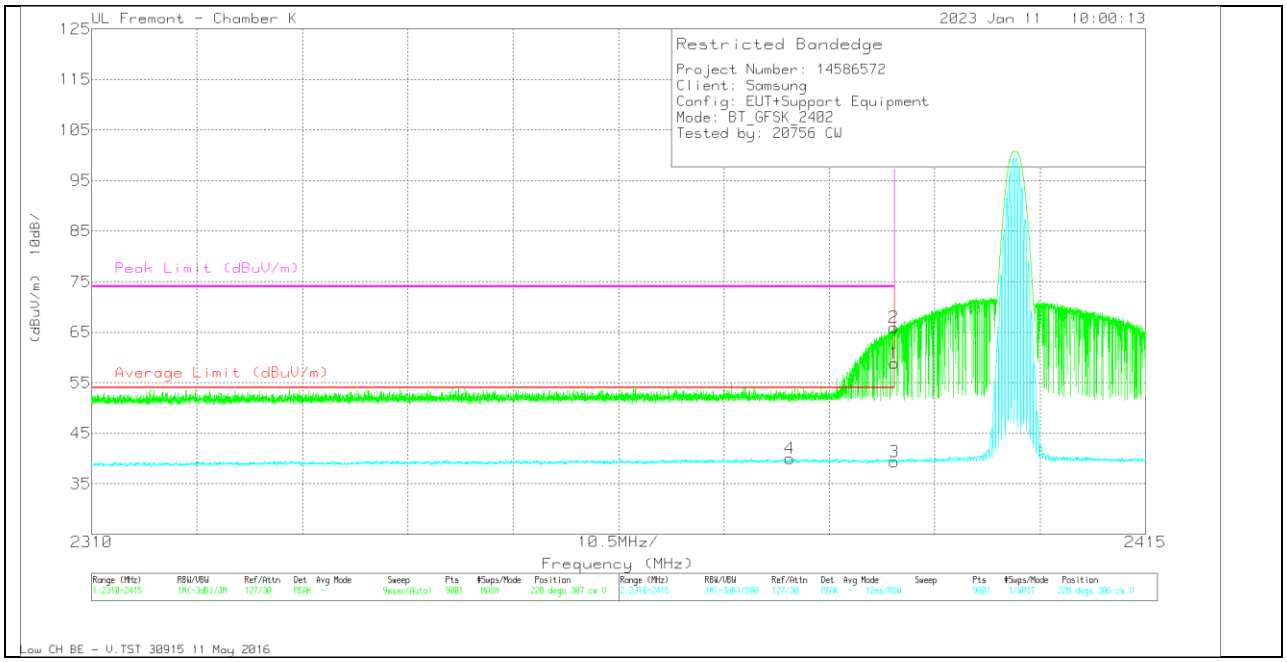
VERTICAL RESULT



Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	223083 ACF (dB) 3mH	Amp/Cbl/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	2390	61.9	Pk	31.8	-34.9	58.8	-	-	74	-15.2	228	307	V
2	2389.896	69	Pk	31.8	-34.9	65.9	-	-	74	-8.1	228	307	V
3	2390	42.45	VA1T	31.8	-34.9	39.35	54	-14.65	-	-	228	306	V
4	2379.57	43.1	VA1T	31.8	-34.9	40	54	-14	-	-	228	306	V

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

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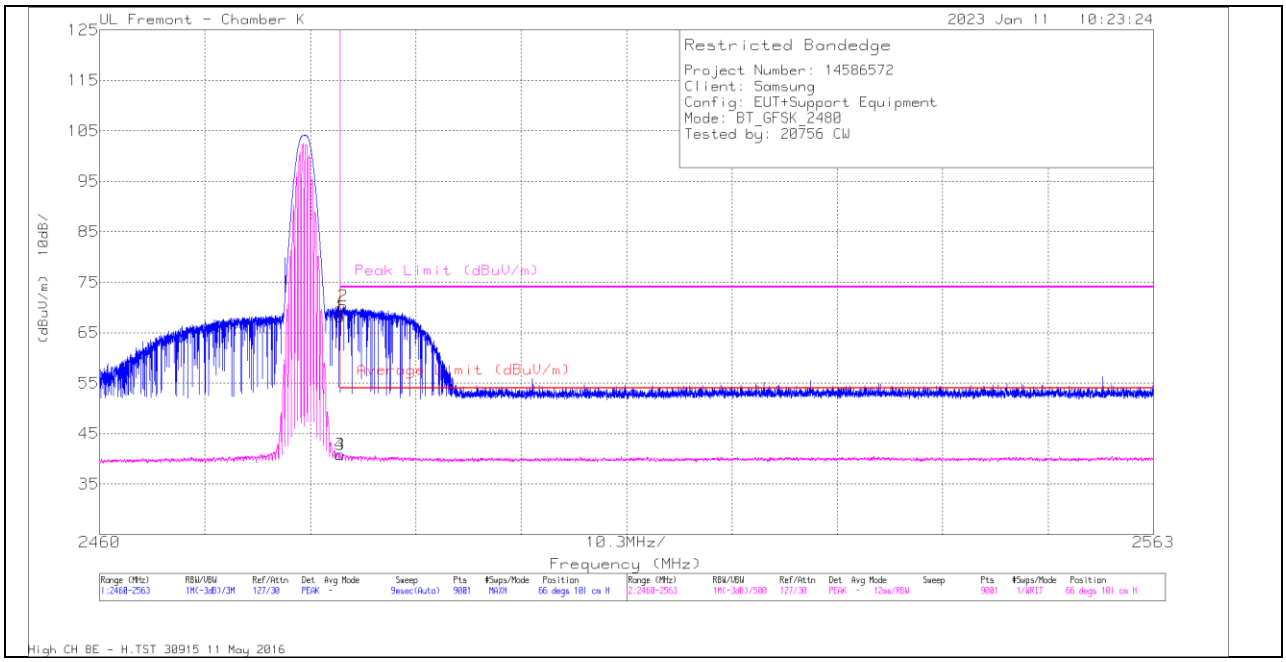
BANDEDGE (HIGH CHANNEL)

HORIZONTAL RESULT



Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	223083 ACF (dB) 3mH	Amp/Cbl/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	2483.5	70.48	Pk	32.2	-34.5	68.18	-	-	74	-5.82	66	101	H
2	2483.815	72.62	Pk	32.2	-34.5	70.32	-	-	74	-3.68	66	101	H
3	2483.5	43.12	VA1T	32.2	-34.5	40.82	54	-13.18	-	-	66	101	H
4	2483.506	43.14	VA1T	32.2	-34.5	40.84	54	-13.16	-	-	66	101	H

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

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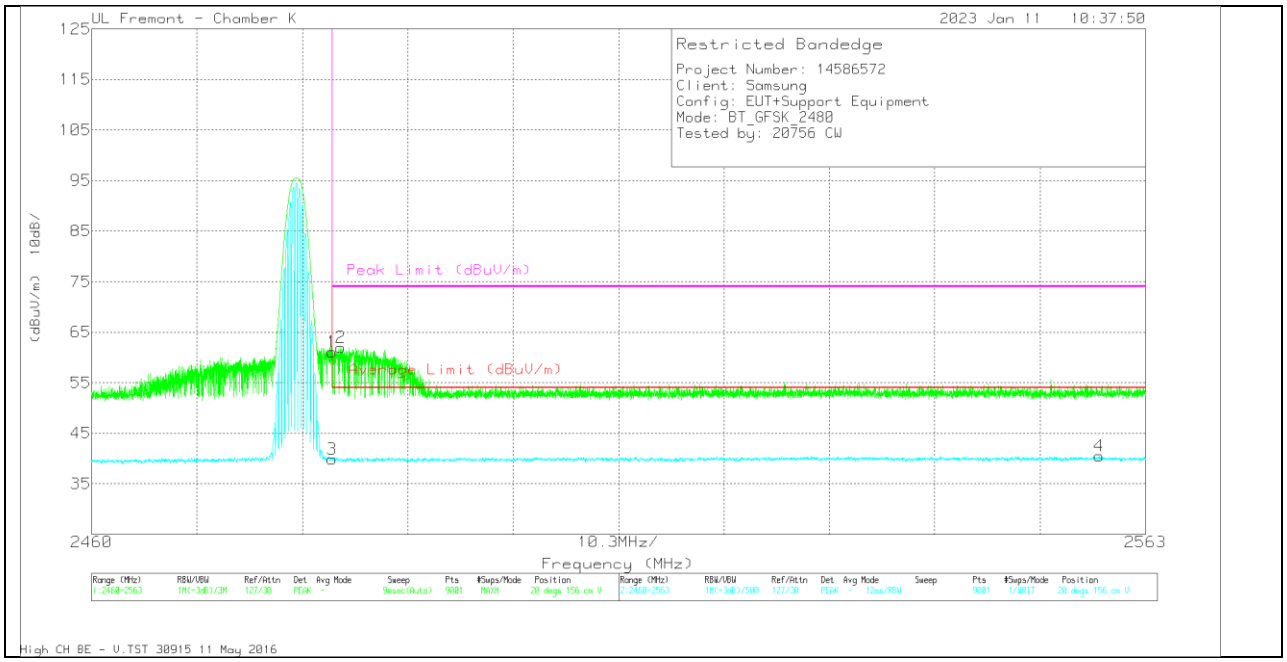
VERTICAL RESULT



Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	223083 ACF (dB) 3mH	Amp/Cbl/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	2483.5	63.4	Pk	32.2	-34.5	61.1	-	-	74	-12.9	20	156	V
2	2484.364	64.22	Pk	32.2	-34.5	61.92	-	-	74	-12.08	20	156	V
3	2483.5	42.17	VA1T	32.2	-34.5	39.87	54	-14.13	-	-	20	156	V
4	2558.453	42.45	VA1T	32.2	-34.2	40.45	54	-13.55	-	-	20	156	V

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

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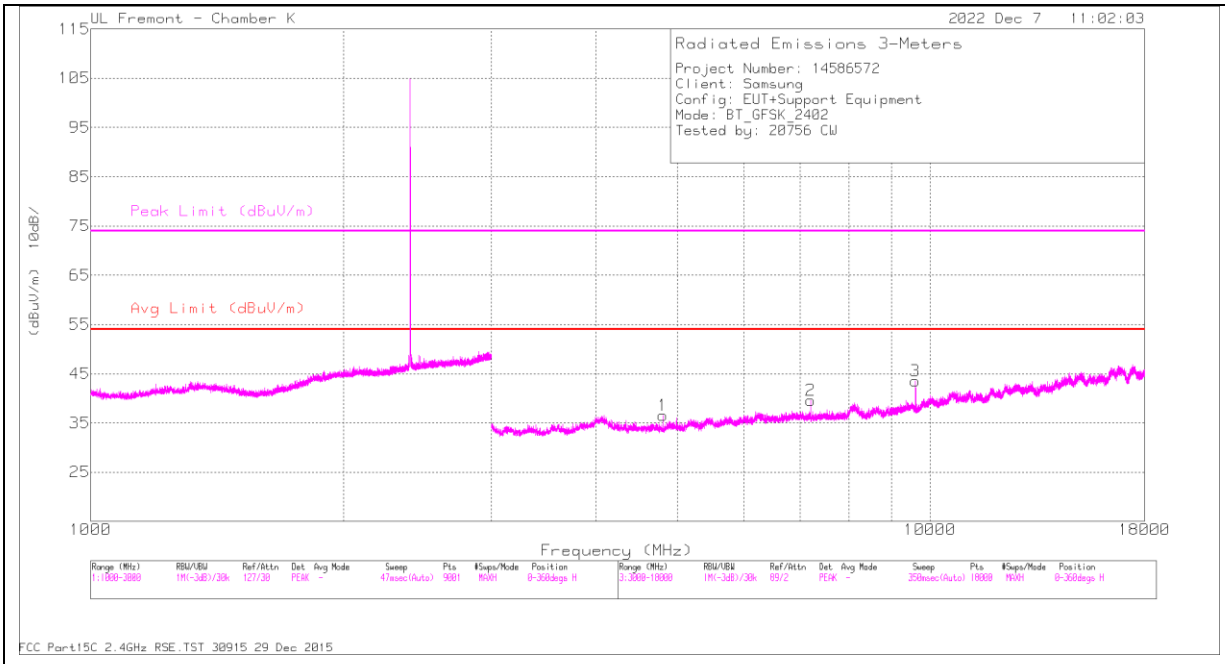
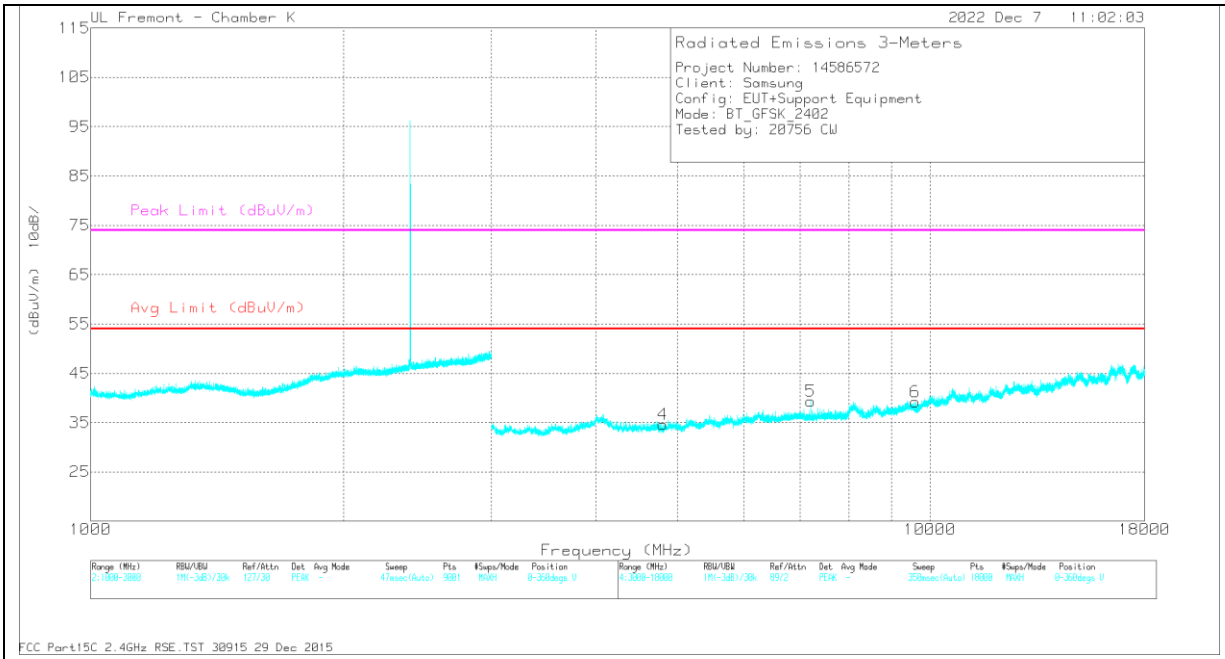
HARMONICS AND SPURIOUS EMISSIONS

LOW CHANNEL RESULTS



HORIZONTAL



VERTICAL

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RADIATED EMISSIONS

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	223083 ACF (dB) 3mH	Amp/Cbl/Fltr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 4804.407	49.36	PKFH	33.7	-40.6	42.46	-	-	74	-31.54	194	151	H
	* 4804.171	36.72	VA1T	33.7	-40.6	29.82	54	-24.18	-	-	194	151	H
2	7205.43	48.28	PKFH	35.7	-38.3	45.68	-	-	-	-	316	115	H
	7205.852	35.75	VA1T	35.7	-38.3	33.15	-	-	-	-	316	115	H
3	9608.218	46.94	PKFH	36.7	-36.2	47.44	-	-	-	-	66	167	H
	9608.024	35.61	VA1T	36.7	-36.2	36.11	-	-	-	-	66	167	H
4	* 4805.38	48.76	PKFH	33.7	-40.5	41.96	-	-	74	-32.04	106	163	V
	* 4807.129	36.09	VA1T	33.7	-40.4	29.39	54	-24.61	-	-	106	163	V
5	7206.308	47.05	PKFH	35.7	-38.3	44.45	-	-	-	-	125	143	V
	7205.933	34.71	VA1T	35.7	-38.3	32.11	-	-	-	-	125	143	V
6	9608.001	46.29	PKFH	36.7	-36.2	46.79	-	-	-	-	60	342	V
	9608.877	33.91	VA1T	36.7	-36.2	34.41	-	-	-	-	60	342	V

* - indicates frequency in CFR47 Pt 15
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

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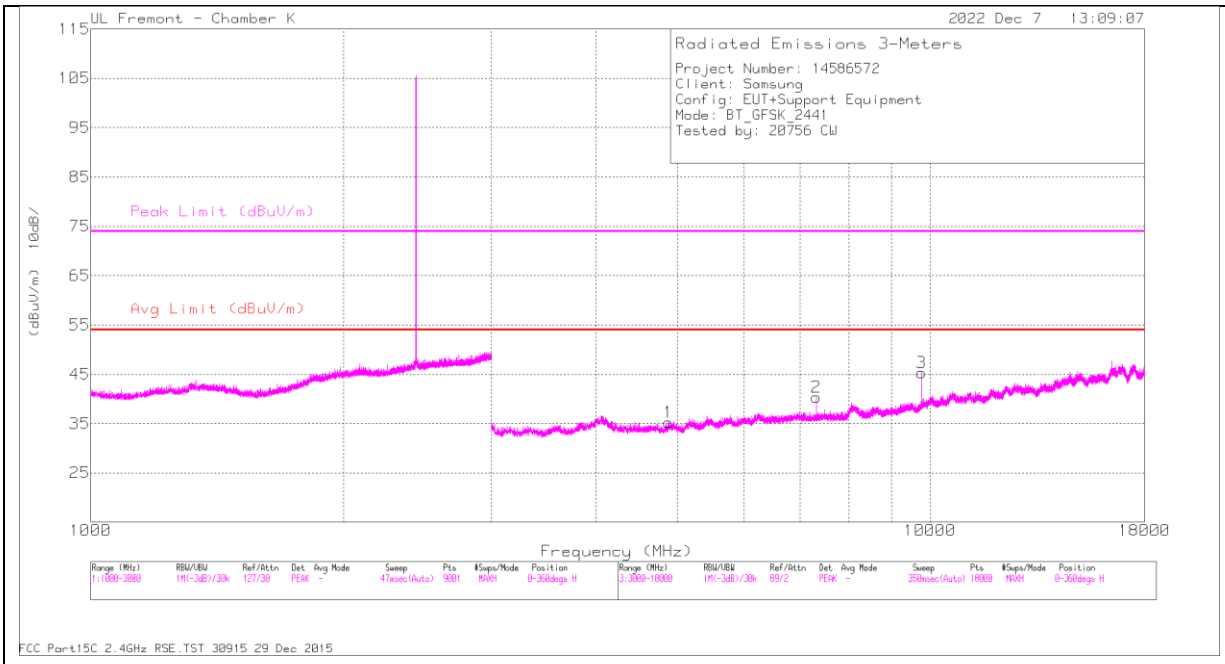
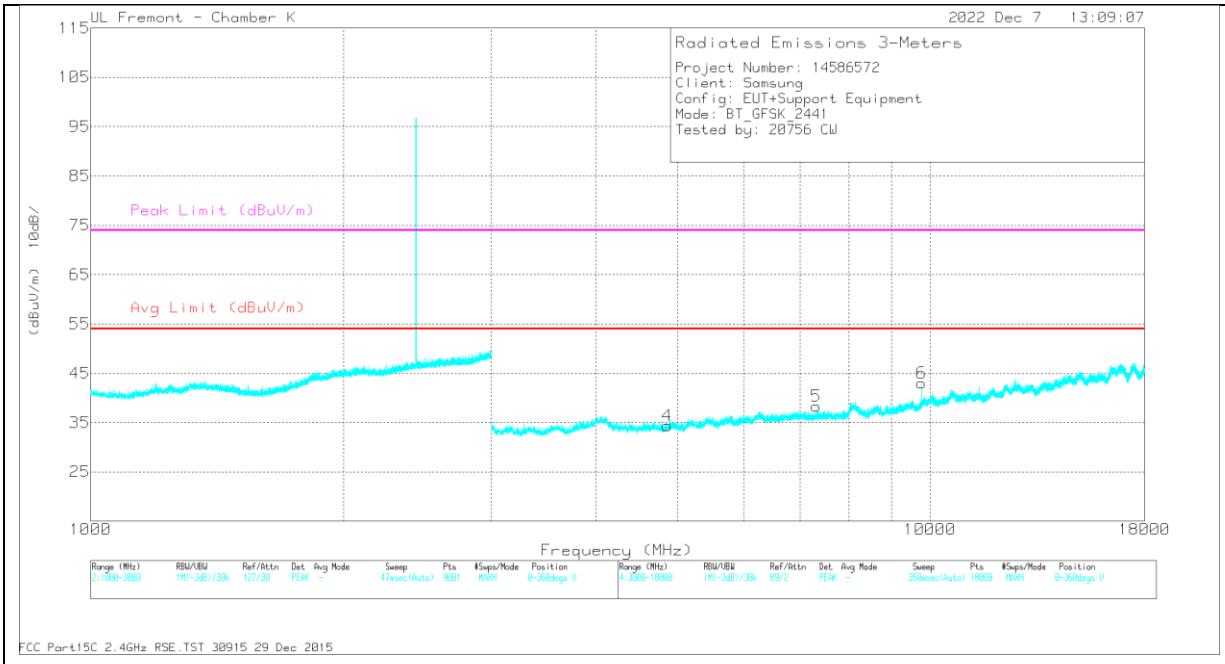
MID CHANNEL RESULTS



HORIZONTAL



VERTICAL

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RADIATED EMISSIONS

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	223083 ACF (dB) 3mH	Amp/Cbl/Fltr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 4882.399	50.51	PKFH	33.7	-40.3	43.91	-	-	74	-30.09	281	374	H
	* 4881.889	37.14	VA1T	33.7	-40.3	30.54	54	-23.46	-	-	281	374	H
2	* 7321.78	46.44	PKFH	35.7	-38	44.14	-	-	74	-29.86	37	164	H
	* 7322.008	34.16	VA1T	35.7	-38	31.86	54	-22.14	-	-	37	164	H
3	9763.67	49.58	PKFH	37	-36.4	50.18	-	-	-	-	175	124	H
	9763.975	38.57	VA1T	37	-36.4	39.17	-	-	-	-	175	124	H
4	* 4865.111	49.47	PKFH	33.7	-40.3	42.87	-	-	74	-31.13	235	369	V
	* 4863.856	36.46	VA1T	33.7	-40.4	29.76	54	-24.24	-	-	235	369	V
5	* 7322.728	48.74	PKFH	35.7	-37.9	46.54	-	-	74	-27.46	63	126	V
	* 7322.855	38.23	VA1T	35.7	-37.9	36.03	54	-17.97	-	-	63	126	V
6	9764.43	48.84	PKFH	37	-36.4	49.44	-	-	-	-	291	118	V
	9764.429	37.97	VA1T	37	-36.4	38.57	-	-	-	-	291	118	V

* - indicates frequency in CFR47 Pt 15
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

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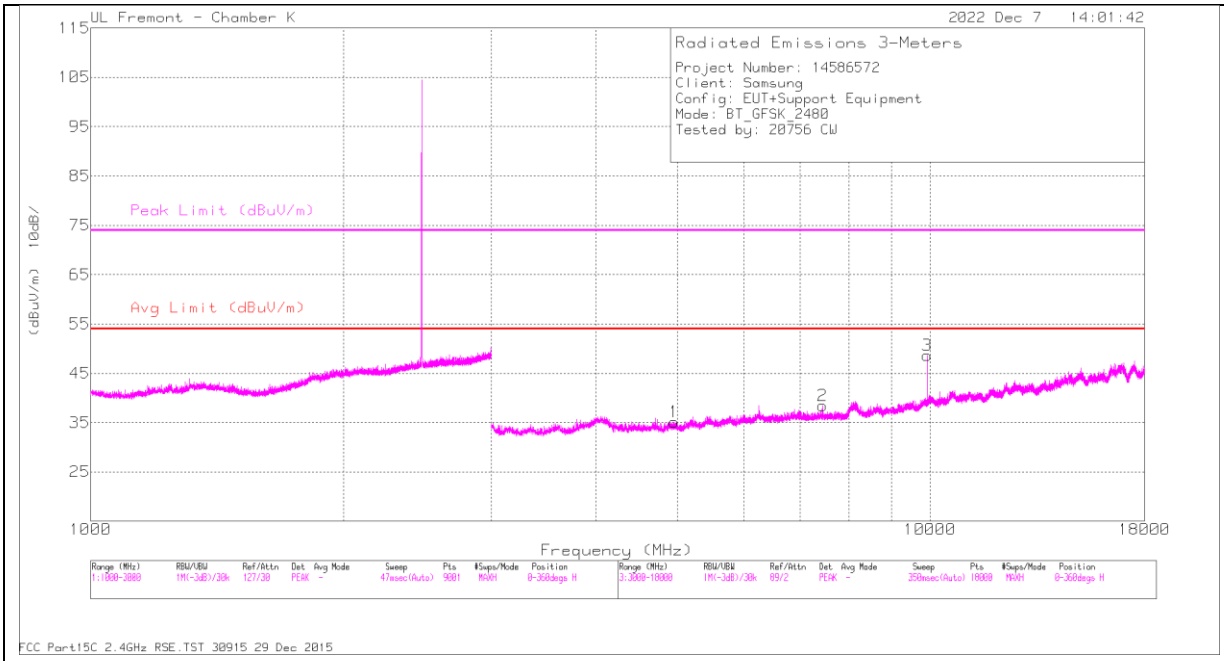
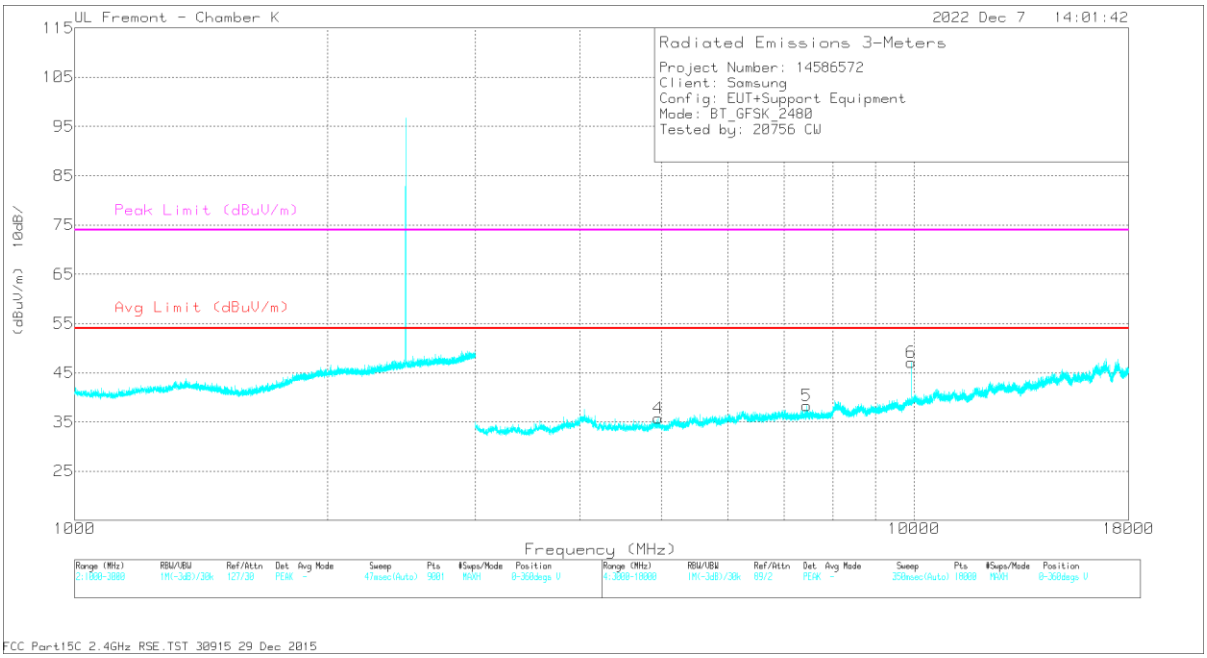
HIGH CHANNEL RESULTS



HORIZONTAL



VERTICAL

UL VERIFICATION SERVICES
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RADIATED EMISSIONS

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	223083 ACF (dB) 3mH	Amp/Cbl/Fltr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 4959.915	50.4	PKFH	33.7	-40.4	43.7	-	-	74	-30.3	96	161	H
	* 4959.931	38.49	VA1T	33.7	-40.4	31.79	54	-22.21	-	-	96	161	H
2	* 7439.49	47.53	PKFH	35.7	-37.7	45.53	-	-	74	-28.47	133	336	H
	* 7439.549	36.04	VA1T	35.7	-37.8	33.94	54	-20.06	-	-	133	336	H
3	9919.745	52.15	PKFH	37.1	-36.1	53.15	-	-	-	-	106	126	H
	9919.747	42.01	VA1T	37.1	-36.1	43.01	-	-	-	-	106	126	H
4	* 4957.421	50.09	PKFH	33.7	-40.3	43.49	-	-	74	-30.51	274	283	V
	* 4957.306	36.89	VA1T	33.7	-40.3	30.29	54	-23.71	-	-	274	283	V
5	* 7441.75	47.02	PKFH	35.7	-37.7	45.02	-	-	74	-28.98	16	285	V
	* 7439.937	34.38	VA1T	35.7	-37.8	32.28	54	-21.72	-	-	16	285	V
6	9919.608	50.16	PKFH	37.1	-36.1	51.16	-	-	-	-	209	206	V
	9919.727	40.09	VA1T	37.1	-36.1	41.09	-	-	-	-	209	206	V

* - indicates frequency in CFR47 Pt 15
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

UL VERIFICATION SERVICES
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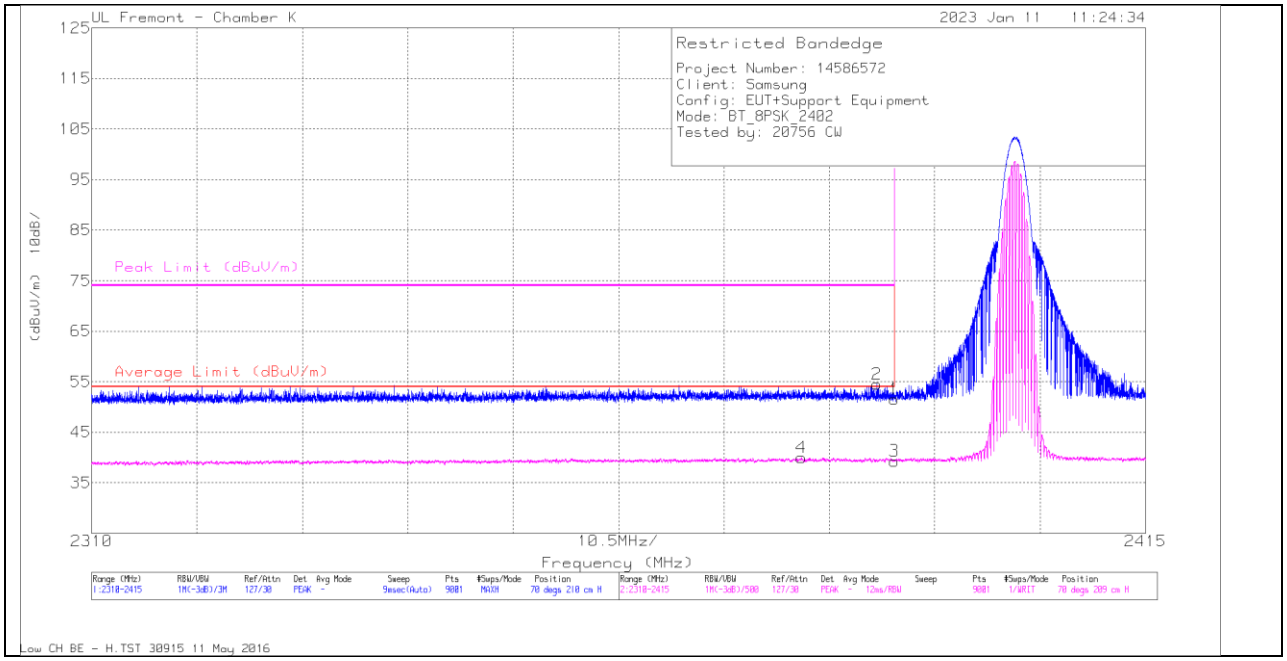
10.1.2. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION

BANDEDGE (LOW CHANNEL)

HORIZONTAL RESULT



Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	223083 ACF (dB) 3mH	Amp/Cbl/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	2390	54.69	Pk	31.8	-34.9	51.59	-	-	74	-22.41	70	210	H
2	2388.204	57.47	Pk	31.8	-34.8	54.47	-	-	74	-19.53	70	210	H
3	2390	42.4	VA1T	31.8	-34.9	39.3	54	-14.7	-	-	70	209	H
4	2380.714	43.04	VA1T	31.8	-34.9	39.94	54	-14.06	-	-	70	209	H

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

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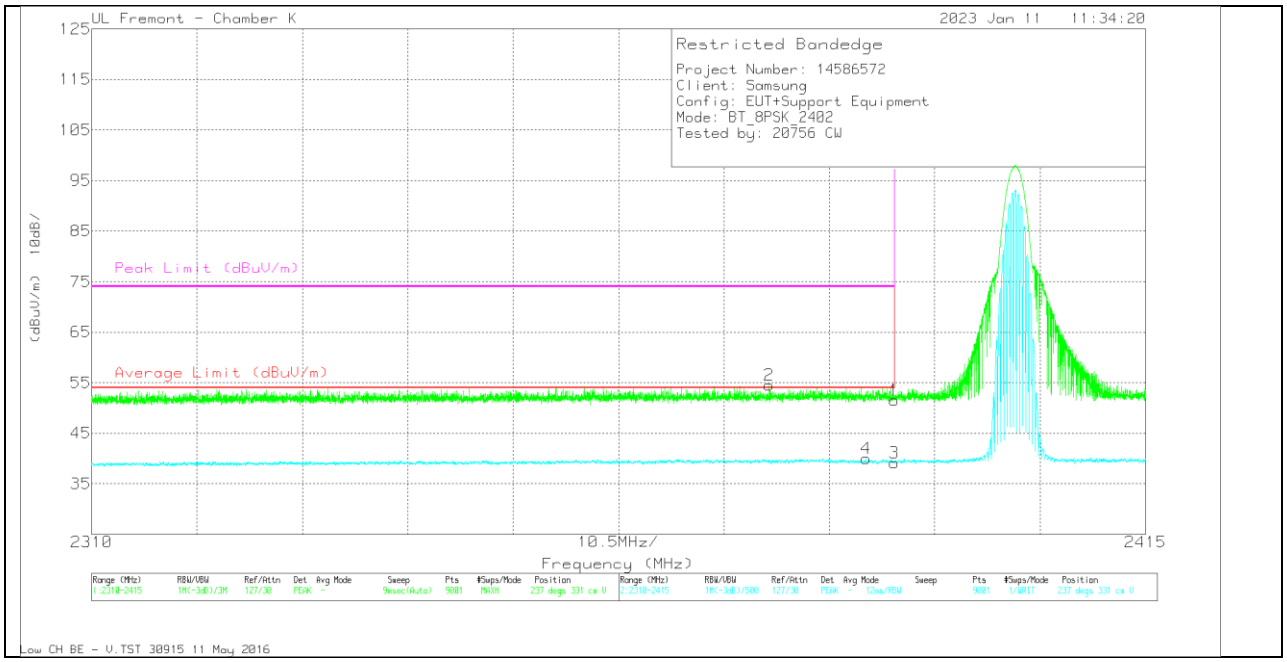
VERTICAL RESULT



Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	223083 ACF (dB) 3mH	Amp/Cbl/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	2390	54.66	Pk	31.8	-34.9	51.56	-	-	74	-22.44	237	331	V
2	2377.505	57.67	Pk	31.7	-34.9	54.47	-	-	74	-19.53	237	331	V
3	2390	42.24	VA1T	31.8	-34.9	39.14	54	-14.86	-	-	237	331	V
4	2387.166	43.03	VA1T	31.8	-34.9	39.93	54	-14.07	-	-	237	331	V

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

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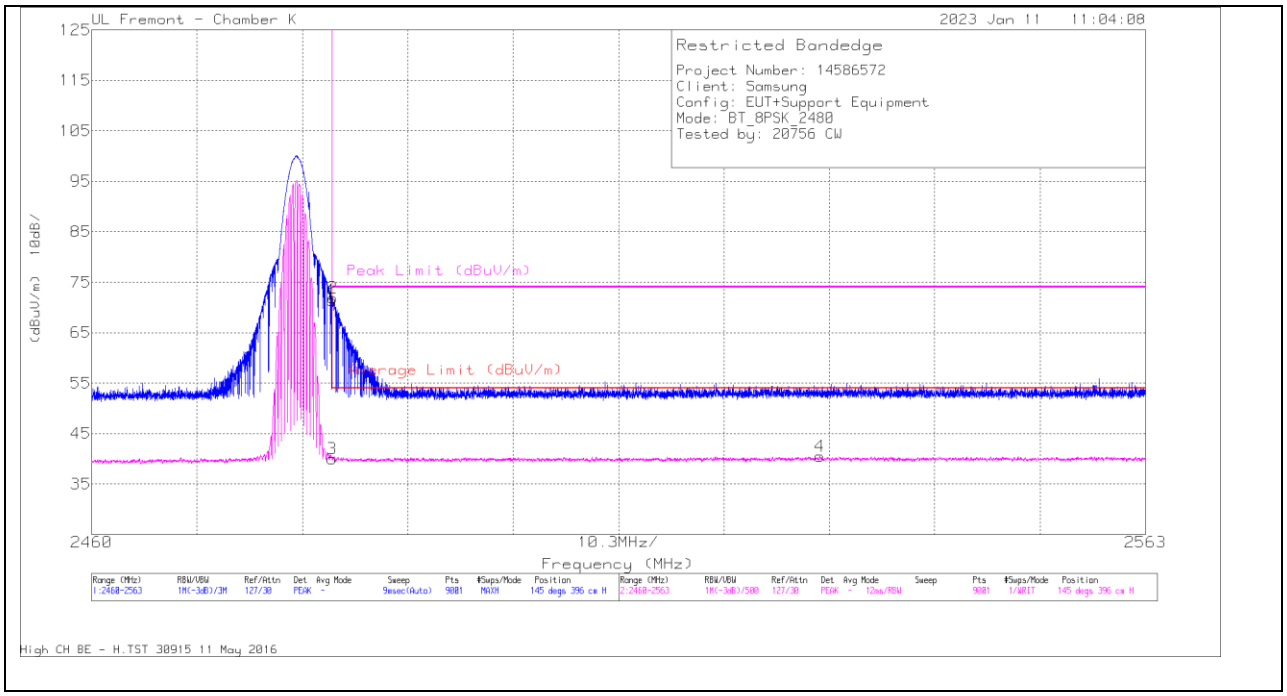
BANDEDGE (HIGH CHANNEL)

HORIZONTAL RESULT



Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	223083 ACF (dB) 3mH	Amp/Cbl/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	2483.5	73.71	Pk	32.2	-34.5	71.41	-	-	74	-2.59	145	396	H
2	2483.54	74.19	Pk	32.2	-34.5	71.89	-	-	74	-2.11	145	396	H
3	2483.5	42.23	VA1T	32.2	-34.5	39.93	54	-14.07	-	-	145	396	H
4	2531.159	42.53	VA1T	32.2	-34.3	40.43	54	-13.57	-	-	145	396	H

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

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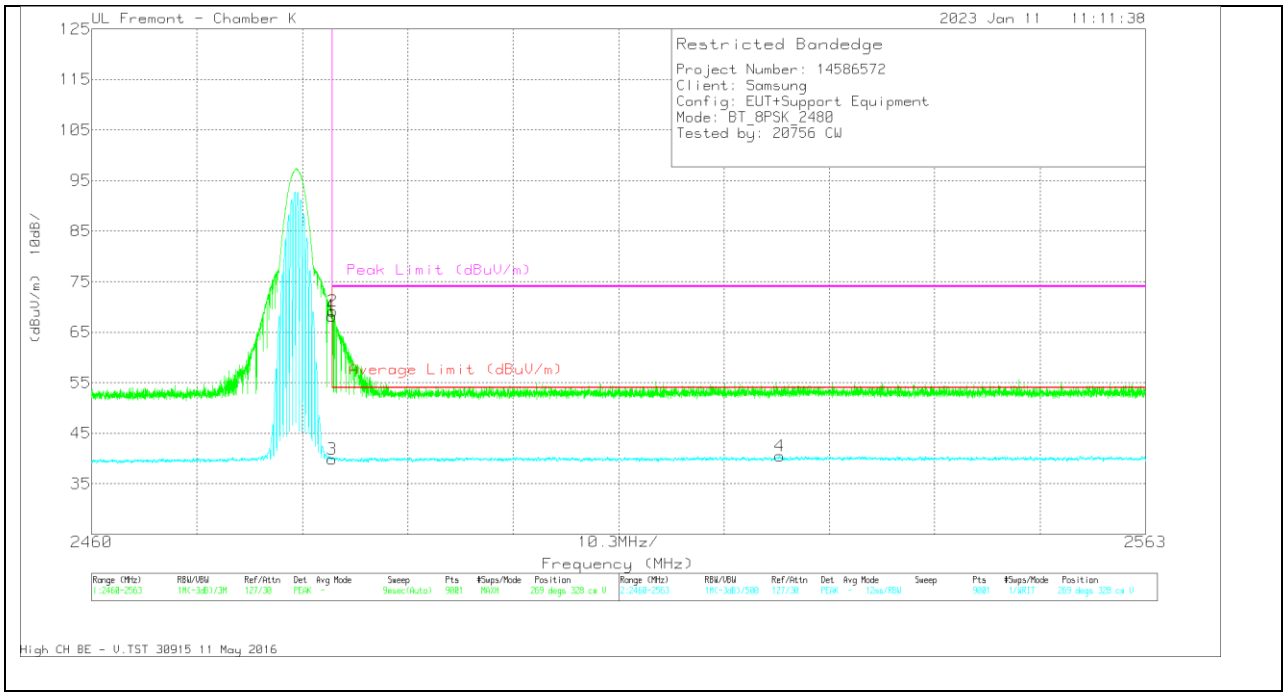
VERTICAL RESULT



Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	223083 ACF (dB) 3mH	Amp/Cbl/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	2483.5	70.53	Pk	32.2	-34.5	68.23	-	-	74	-5.77	269	328	V
2	2483.54	71.45	Pk	32.2	-34.5	69.15	-	-	74	-4.85	269	328	V
3	2483.5	42.21	VA1T	32.2	-34.5	39.91	54	-14.09	-	-	269	328	V
4	2527.268	42.62	VA1T	32.2	-34.3	40.52	54	-13.48	-	-	269	328	V

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

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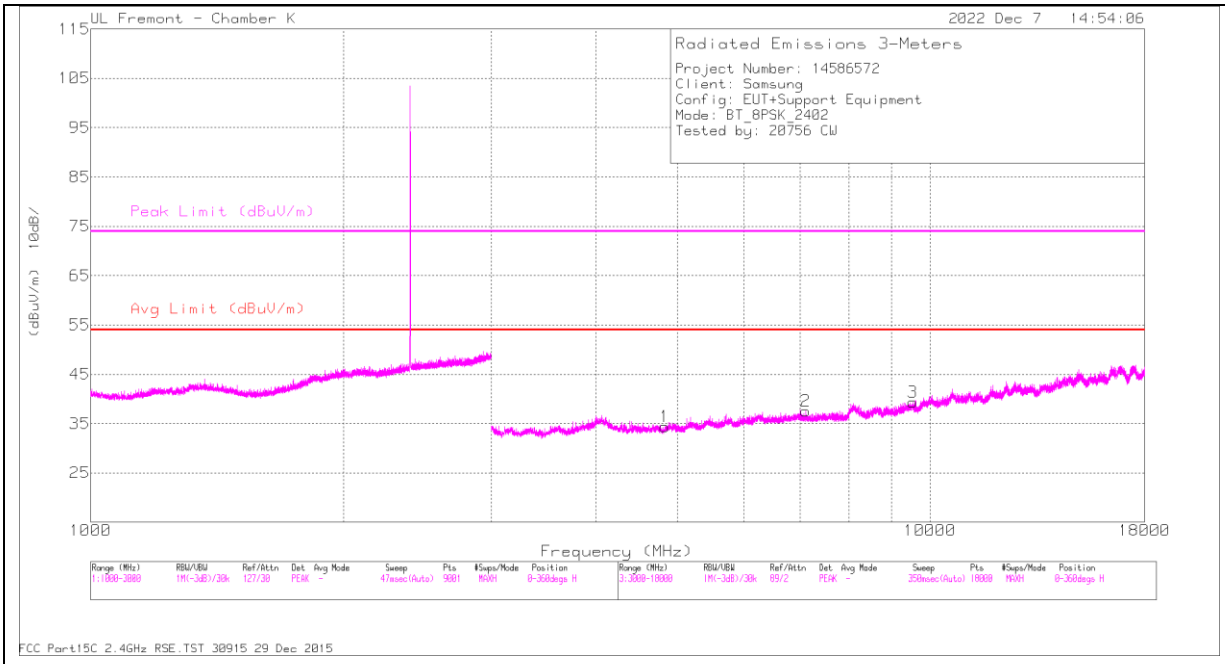
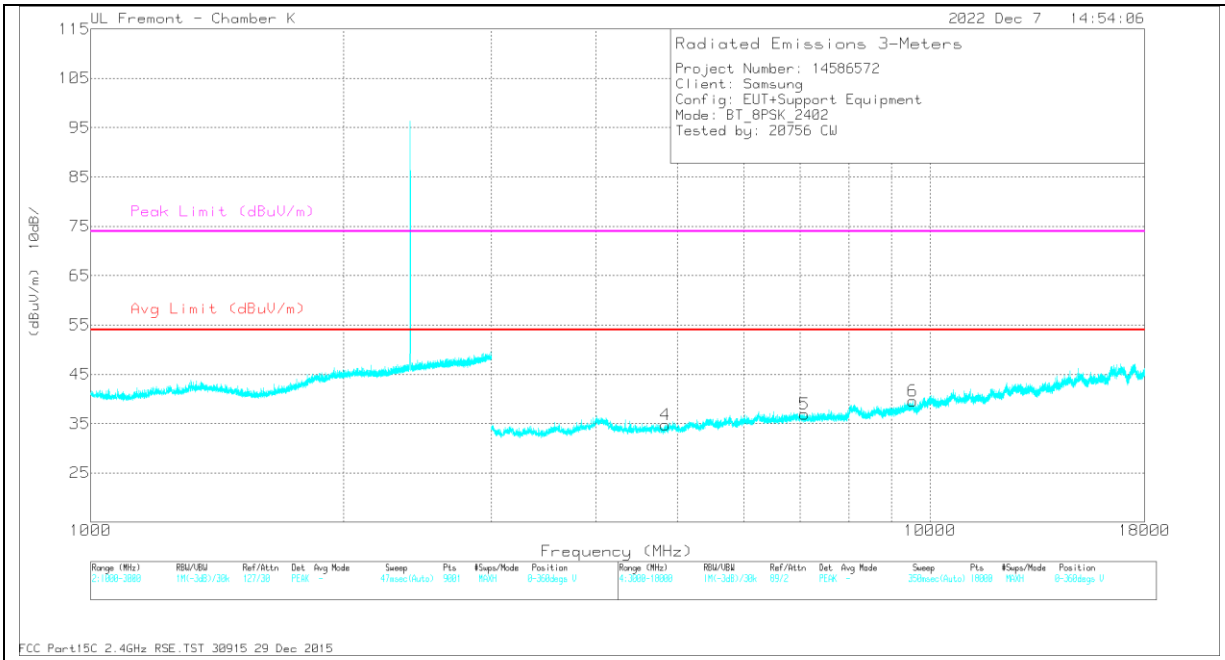
HARMONICS AND SPURIOUS EMISSIONS

LOW CHANNEL RESULTS



HORIZONTAL



VERTICAL

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RADIATED EMISSIONS

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	223083 ACF (dB) 3mH	Amp/Cbl/Fltr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 4826.702	49.23	PKFH	33.7	-40.5	42.43	-	-	74	-31.57	128	288	H
	* 4829.381	36.32	VA1T	33.7	-40.4	29.62	54	-24.38	-	-	128	288	H
2	7107.762	47.02	PKFH	35.7	-38.3	44.42	-	-	-	-	242	363	H
	7107.901	34.37	VA1T	35.7	-38.3	31.77	-	-	-	-	242	363	H
3	9534.67	46.6	PKFH	36.6	-36.3	46.9	-	-	-	-	307	203	H
	9534.413	33.85	VA1T	36.6	-36.3	34.15	-	-	-	-	307	203	H
4	* 4836.358	49.73	PKFH	33.7	-40.3	43.13	-	-	74	-30.87	293	334	V
	* 4834.966	36.42	VA1T	33.7	-40.4	29.72	54	-24.28	-	-	293	334	V
5	7084.409	46.7	PKFH	35.8	-38.3	44.2	-	-	-	-	15	307	V
	7084.306	34.3	VA1T	35.8	-38.3	31.8	-	-	-	-	15	307	V
6	9529.437	46.95	PKFH	36.6	-36.4	47.15	-	-	-	-	342	369	V
	9529.683	33.97	VA1T	36.6	-36.3	34.27	-	-	-	-	342	369	V

* - indicates frequency in CFR47 Pt 15
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

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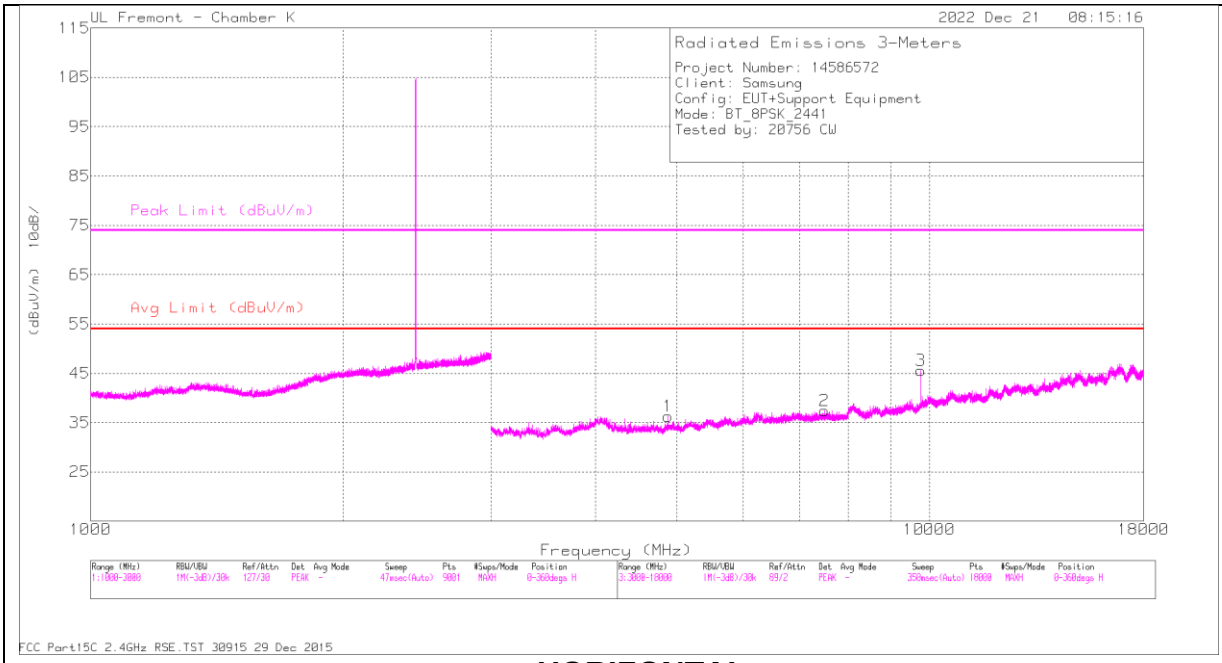
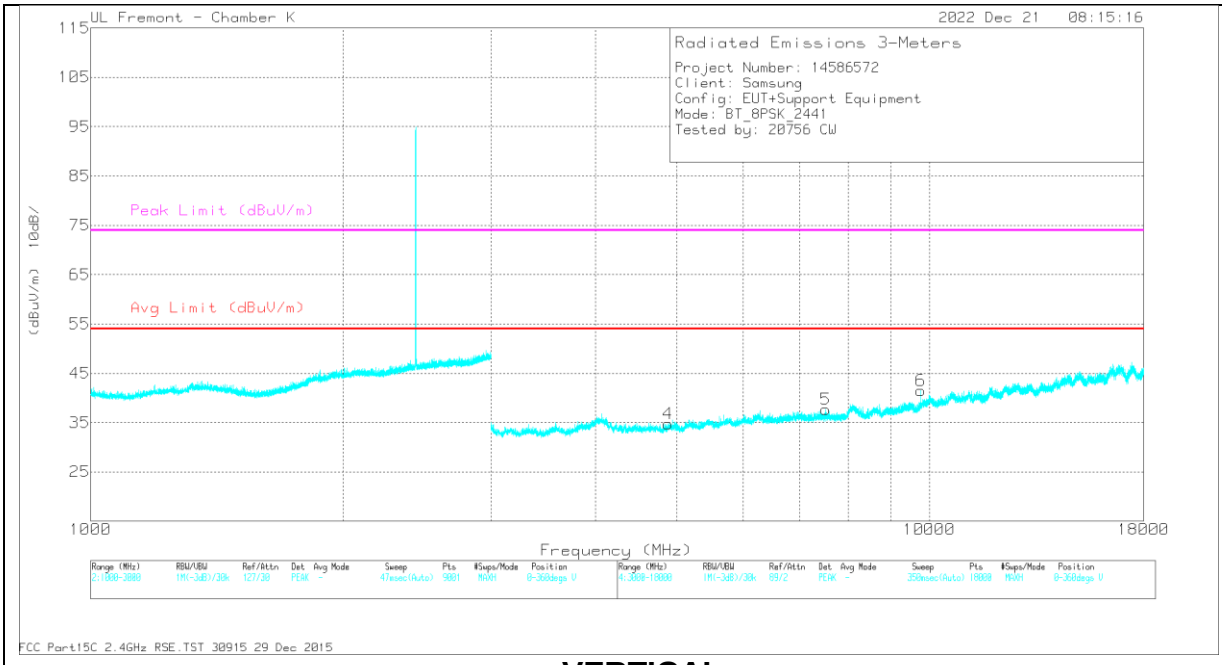
MID CHANNEL RESULTS



HORIZONTAL



VERTICAL

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RADIATED EMISSIONS

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	223083 ACF (dB) 3mH	Amp/Cbl/Fltr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 4882.43	49.76	PKFH	33.7	-40.3	43.16	-	-	74	-30.84	62	145	H
	* 4883.406	36.5	VA1T	33.7	-40.4	29.8	54	-24.2	-	-	62	145	H
2	* 7493.529	45.52	PKFH	35.7	-37.8	43.42	-	-	74	-30.58	156	114	H
	* 7493.764	33.86	VA1T	35.7	-37.8	31.76	54	-22.24	-	-	156	114	H
3	9763.891	52.83	PKFH	37	-36.4	53.43	-	-	-	-	114	119	H
	9764.007	41.87	VA1T	37	-36.4	42.47	-	-	-	-	114	119	H
4	* 4880.414	50.03	PKFH	33.7	-40.4	43.33	-	-	74	-30.67	243	395	V
	* 4881.684	36.42	VA1T	33.7	-40.3	29.82	54	-24.18	-	-	243	395	V
5	* 7519.373	45.79	PKFH	35.7	-37.8	43.69	-	-	74	-30.31	139	320	V
	* 7519.462	34.27	VA1T	35.7	-37.8	32.17	54	-21.83	-	-	139	320	V
6	9763.71	49.35	PKFH	37	-36.4	49.95	-	-	-	-	197	193	V
	9763.854	36.51	VA1T	37	-36.4	37.11	-	-	-	-	197	193	V

* - indicates frequency in CFR47 Pt 15
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

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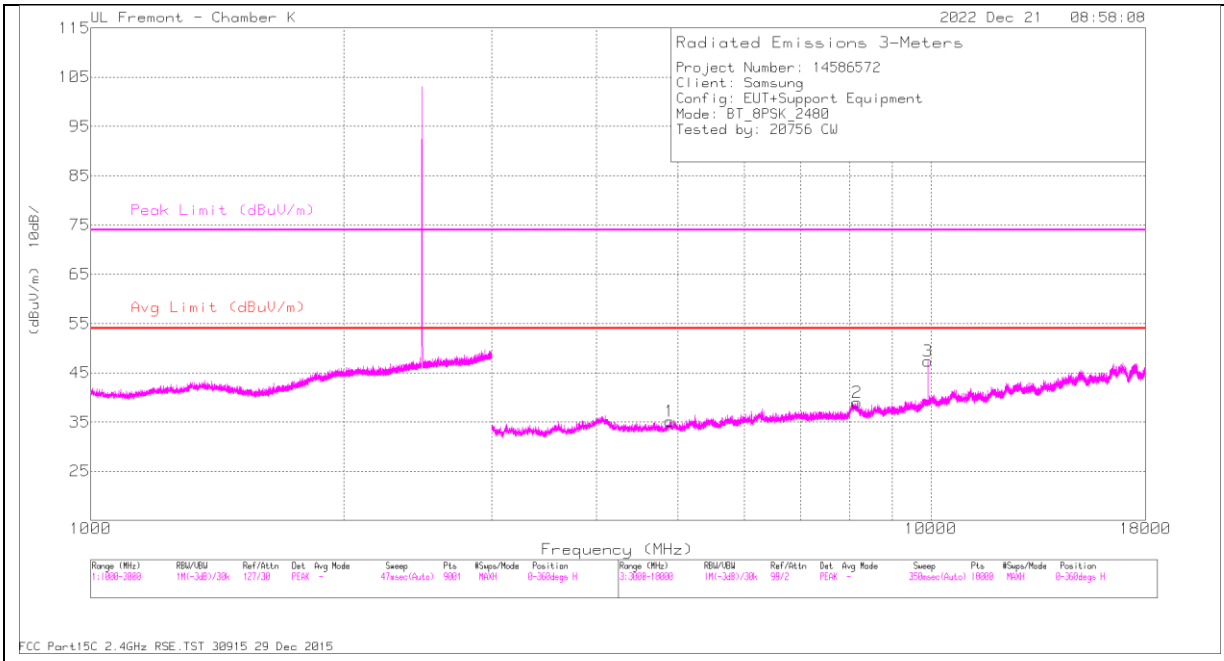
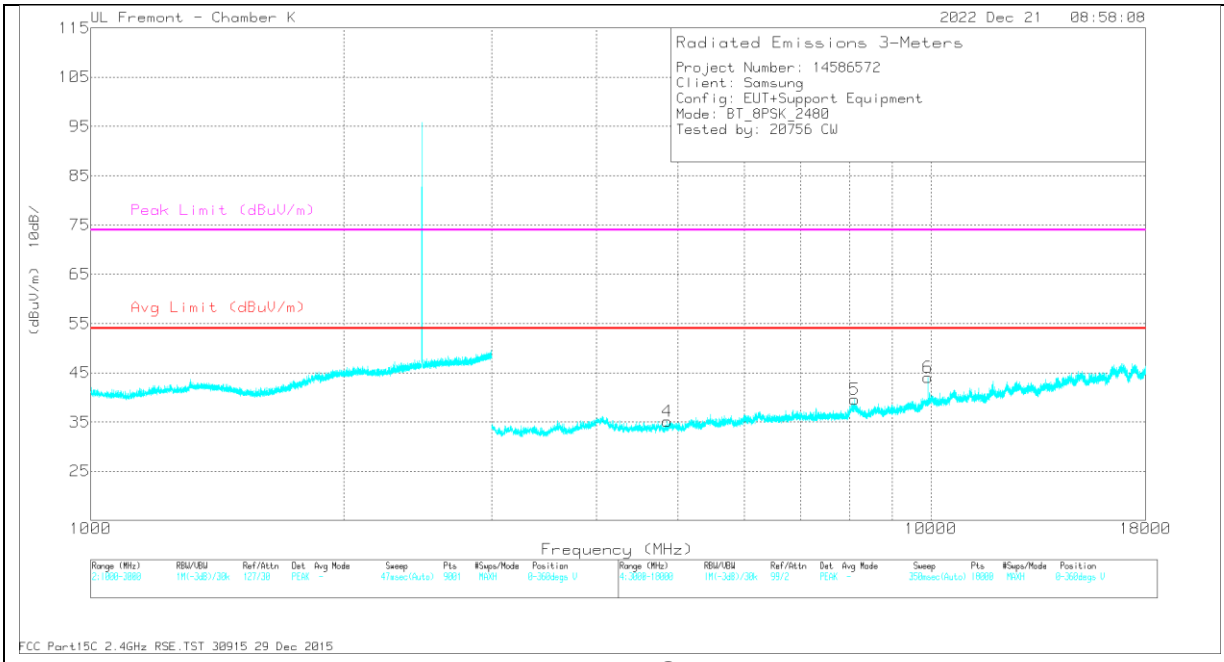
HIGH CHANNEL RESULTS



HORIZONTAL



VERTICAL

UL VERIFICATION SERVICES
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RADIATED EMISSIONS

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	223083 ACF (dB) 3mH	Amp/Cbl/Fltr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 4888.748	49.9	PKFH	33.7	-40.4	43.2	-	-	74	-30.8	273	242	H
	* 4887.825	36.74	VA1T	33.7	-40.4	30.04	54	-23.96	-	-	273	242	H
2	* 8167.727	47.59	PKFH	35.9	-37.6	45.89	-	-	74	-28.11	177	293	H
	* 8167.739	35.11	VA1T	35.9	-37.6	33.41	54	-20.59	-	-	177	293	H
3	9920.351	51.48	PKFH	37.1	-36.1	52.48	-	-	-	-	122	102	H
	9920.197	41.87	VA1T	37.1	-36.1	42.87	-	-	-	-	122	102	H
4	* 4856.909	49.98	PKFH	33.7	-40.4	43.28	-	-	74	-30.72	203	262	V
	* 4854.745	36.26	VA1T	33.7	-40.5	29.46	54	-24.54	-	-	203	262	V
5	* 8118.468	47.04	PKFH	35.9	-37.2	45.74	-	-	74	-28.26	243	253	V
	* 8118.804	35.14	VA1T	35.9	-37.2	33.84	54	-20.16	-	-	243	253	V
6	9919.62	51.11	PKFH	37.1	-36.1	52.11	-	-	-	-	191	134	V
	9919.754	41.18	VA1T	37.1	-36.1	42.18	-	-	-	-	191	134	V

* - indicates frequency in CFR47 Pt 15
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

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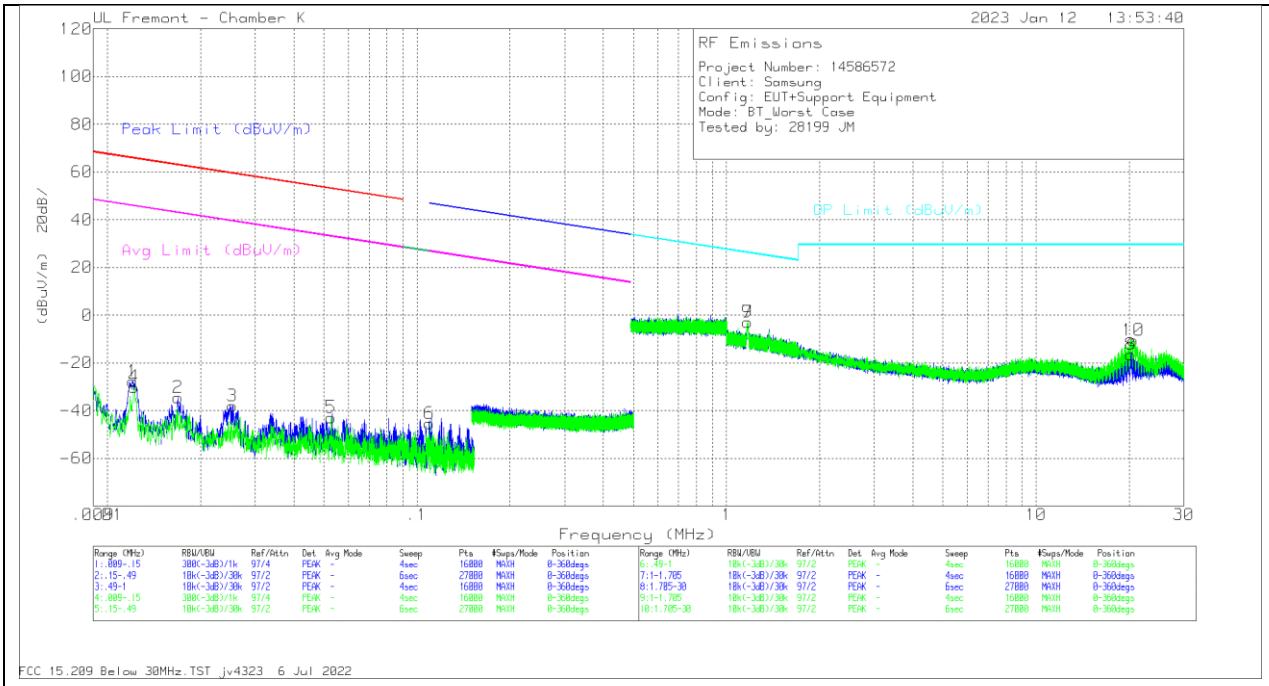
10.2. WORST CASE BELOW 30MHZ

SPURIOUS EMISSIONS BELOW 30 MHz (WORST-CASE CONFIGURATION)



ANTENNA- TWO ORIENTATIONS FACE ON/FACE OFF

Below 30MHz Data

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Loop Antenna (ACF)	Amp/Cbl (dB)	Dist Corr 300m	Corrected Reading (dBuV/m)	Peak Limit (dBuV/m)	Margin (dB)	Avg Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Polarity
1	.0121	23.42	Pk	60	-31	-80	-27.58	65.93	-93.51	45.93	-73.51	0-360	Face-On
2	.0169	17.55	Pk	59.4	-31.5	-80	-34.55	63.03	-97.58	43.03	-77.58	0-360	Face-On
3	.0254	15.66	Pk	58.4	-32	-80	-37.94	59.49	-97.43	39.49	-77.43	0-360	Face-On
4	.0122	20.98	Pk	60	-31	-80	-30.02	65.86	-95.88	45.86	-75.88	0-360	Face-Off
5	.0529	12.59	Pk	56.8	-32.2	-80	-42.81	53.12	-95.93	33.12	-75.93	0-360	Face-Off
6	.1096	11.08	Pk	55.7	-32.2	-80	-45.42	-	-	-	-	0-360	Face-Off

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Loop Antenna (ACF)	Amp/Cbl (dB)	Dist Corr 30m (dB) 40Log	Corrected Reading (dBuV/m)	QP Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Polarity
7	1.1687	23.14	Pk	46	-32.1	-40	-2.96	26.27	-29.23	0-360	Face-On
8	20.1812	20.94	Pk	34.2	-31.6	-40	-16.46	29.5	-45.96	0-360	Face-On
9	1.1705	23.24	Pk	46	-32.1	-40	-2.86	26.26	-29.12	0-360	Face-Off
10	20.5837	26.93	Pk	34.1	-31.6	-40	-10.57	29.5	-40.07	0-360	Face-Off

Pk - Peak detector

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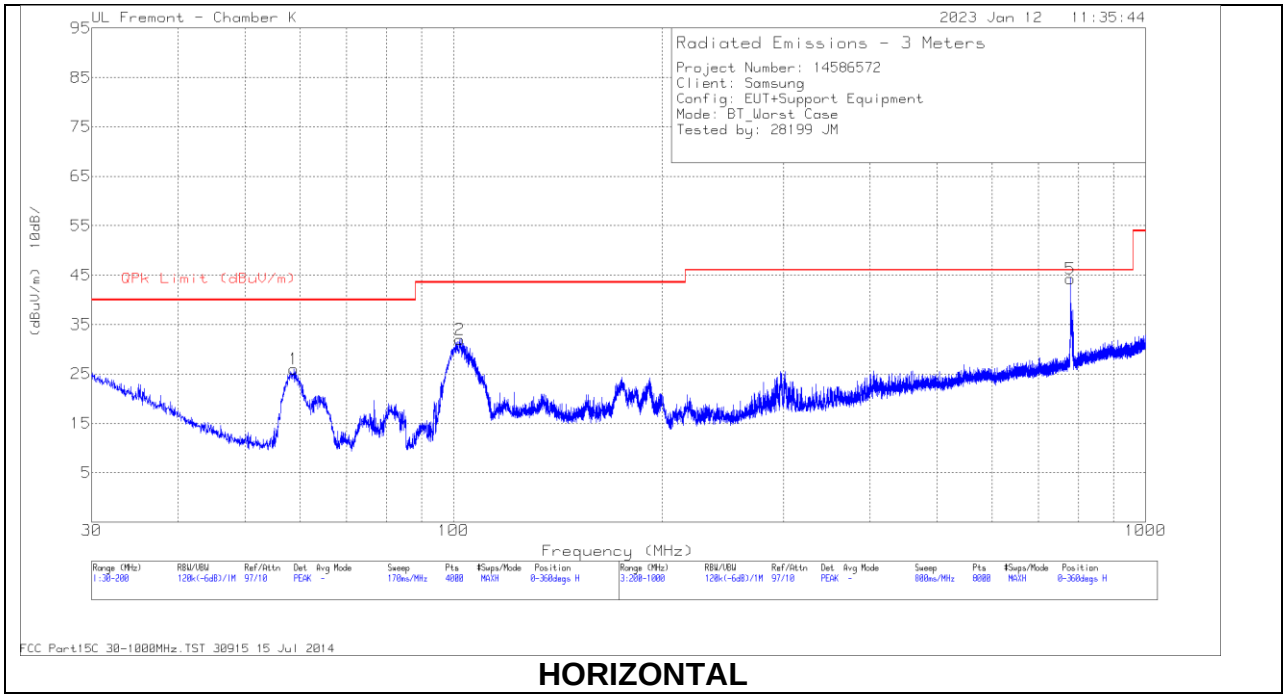
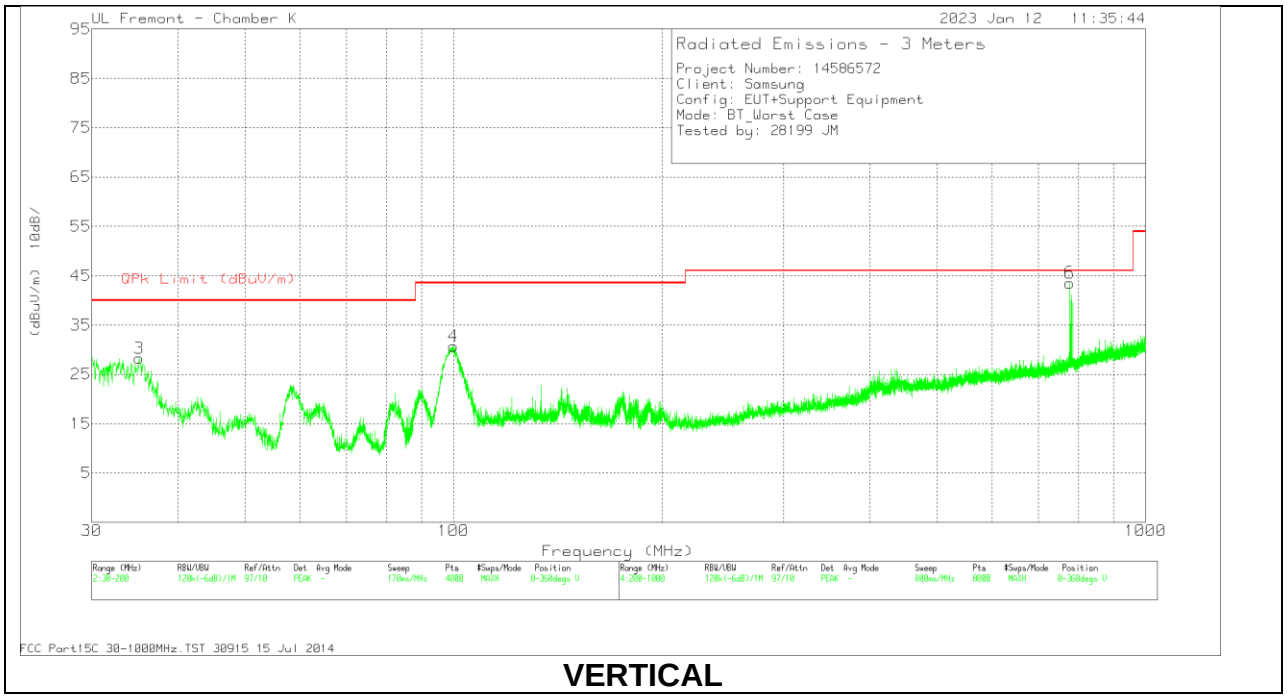
10.3. WORST CASE BELOW 1 GHZ

SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION)



HORIZONTAL



VERTICAL

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Below 1GHz Data

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Hybrid Antenna ACF(dB)	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	58.78	43.58	Pk	13.6	-31.2	25.98	40	-14.02	0-360	299	H
2	102.099	45.85	Pk	17	-30.9	31.95	43.52	-11.57	0-360	299	H
3	35.1438	35.51	Pk	24.2	-31.5	28.21	40	-11.79	0-360	101	V
4	99.9306	45.3	Pk	16.3	-30.9	30.7	43.52	-12.82	0-360	101	V
5	778.342	28.69	Pk	27.8	-27.7	28.79	46.02	-17.23	2	355	H
	778.362	19.88	Qp	27.8	-27.7	19.98	46.02	-26.04	2	355	H
6	776.808	28.48	Pk	27.7	-27.7	28.48	46.02	-17.54	246	342	V
	777.323	19.84	Qp	27.8	-27.7	19.94	46.02	-26.08	246	342	V

Pk - Peak detector

Radiated Emissions

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Hybrid Antenna ACF(dB)	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
5	778.342	28.69	Pk	27.8	-27.7	28.79	46.02	-17.23	2	355	H
	778.362	19.88	Qp	27.8	-27.7	19.98	46.02	-26.04	2	355	H
6	776.808	28.48	Pk	27.7	-27.7	28.48	46.02	-17.54	246	342	V
	777.323	19.84	Qp	27.8	-27.7	19.94	46.02	-26.08	246	342	V

Pk - Peak detector
Qp - Quasi-Peak detector

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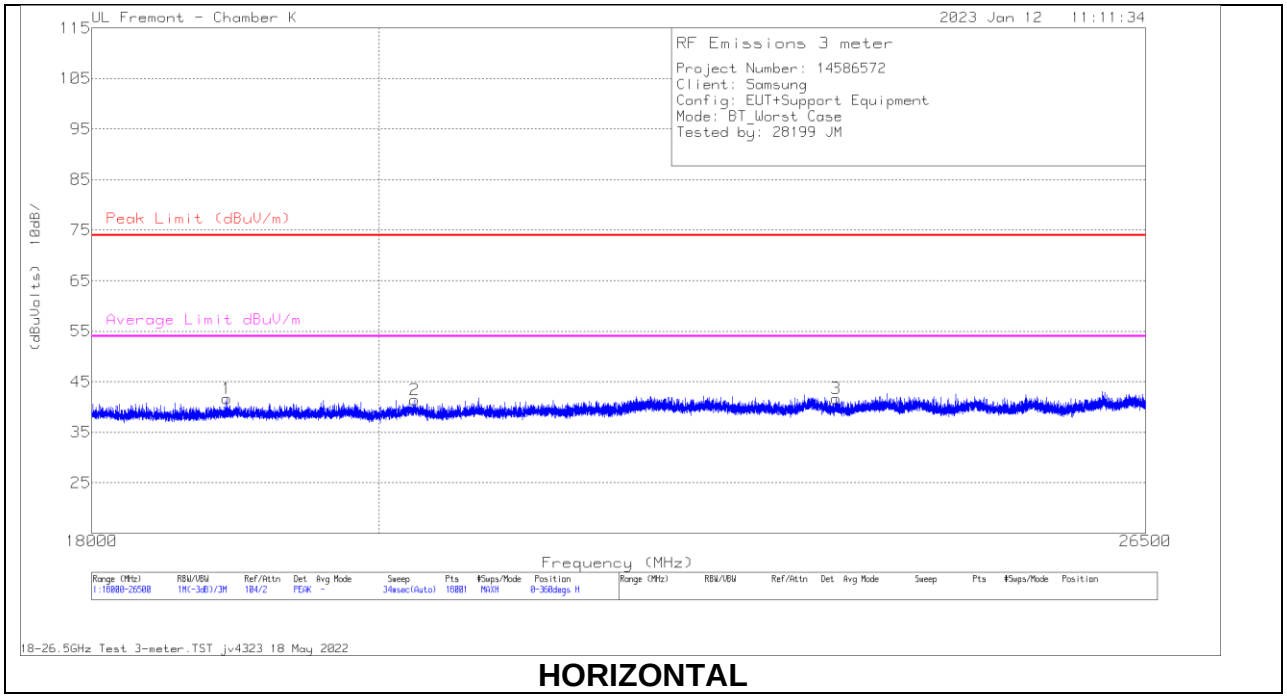
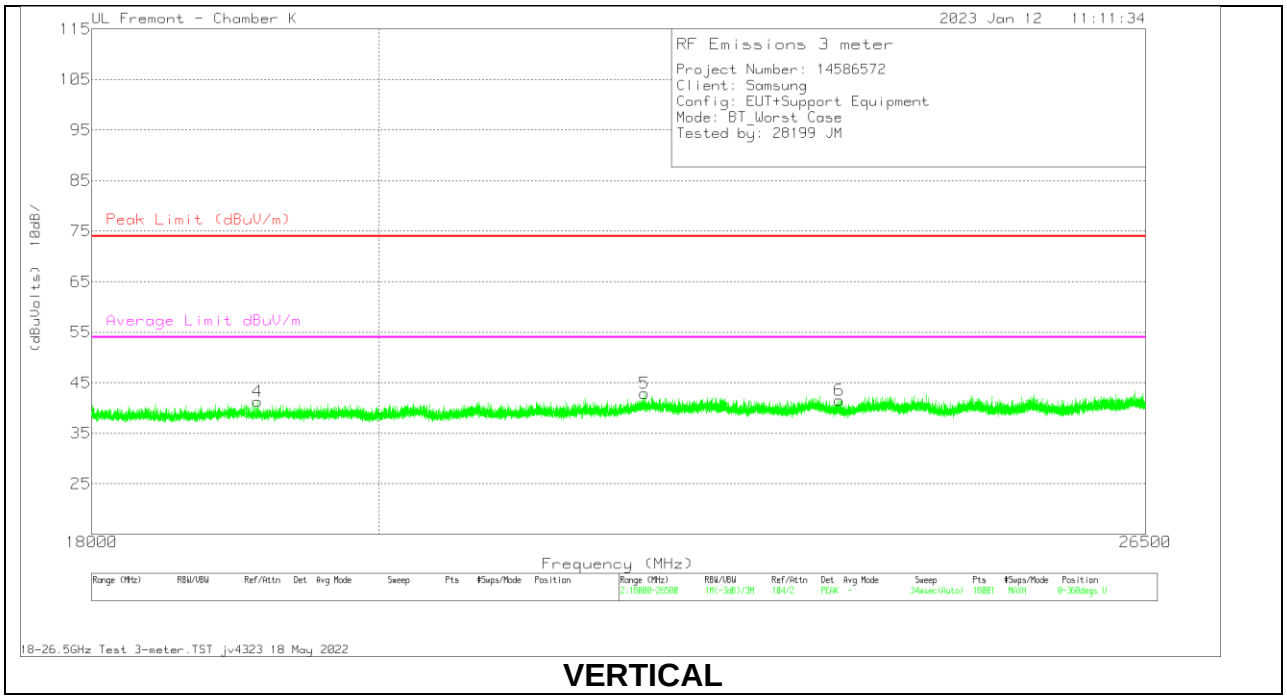
10.4. WORST CASE 18-26 GHZ

SPURIOUS EMISSIONS 18-26 GHz (WORST-CASE CONFIGURATION)



HORIZONTAL



VERTICAL

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18 – 26GHz Data

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	172364 AF (dB)	215705 amp/cbl (dB)	Cables (dB)	Corrected Reading (dBuVolts)	Peak Limit (dBuV/m)	PK Margin (dB)	Average Limit dBuV/m	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 18915.166	51.6	Pk	32.7	-60.6	18	41.7	74	-32.3	54	-12.3	0-360	101	H
2	* 20264.777	49.8	Pk	33	-60	18.6	41.4	74	-32.6	54	-12.6	0-360	199	H
3	* 23656.275	48.88	Pk	33.9	-61.2	20.1	41.68	74	-32.32	54	-12.32	0-360	199	H
4	* 19130.499	51.23	Pk	32.7	-60.8	18.1	41.23	74	-32.77	54	-12.77	0-360	101	V
5	* 22049.27	50.89	PK2	33.5	-60.8	19.3	42.89	74	-31.11	54	-11.11	340	122	V
	* 22045.581	39.24	MAv1	33.5	-60.8	19.3	31.24	-	-	54	-22.76	340	122	V
6	* 23680.831	48.62	Pk	34	-61.2	20.1	41.52	74	-32.48	54	-12.48	0-360	200	V

* - indicates frequency in CFR47 Pt 15
PK2 - KDB558074 Method: Maximum Peak
MAv1 - KDB558074 Option 1 Maximum RMS Average

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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 C63.4.

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

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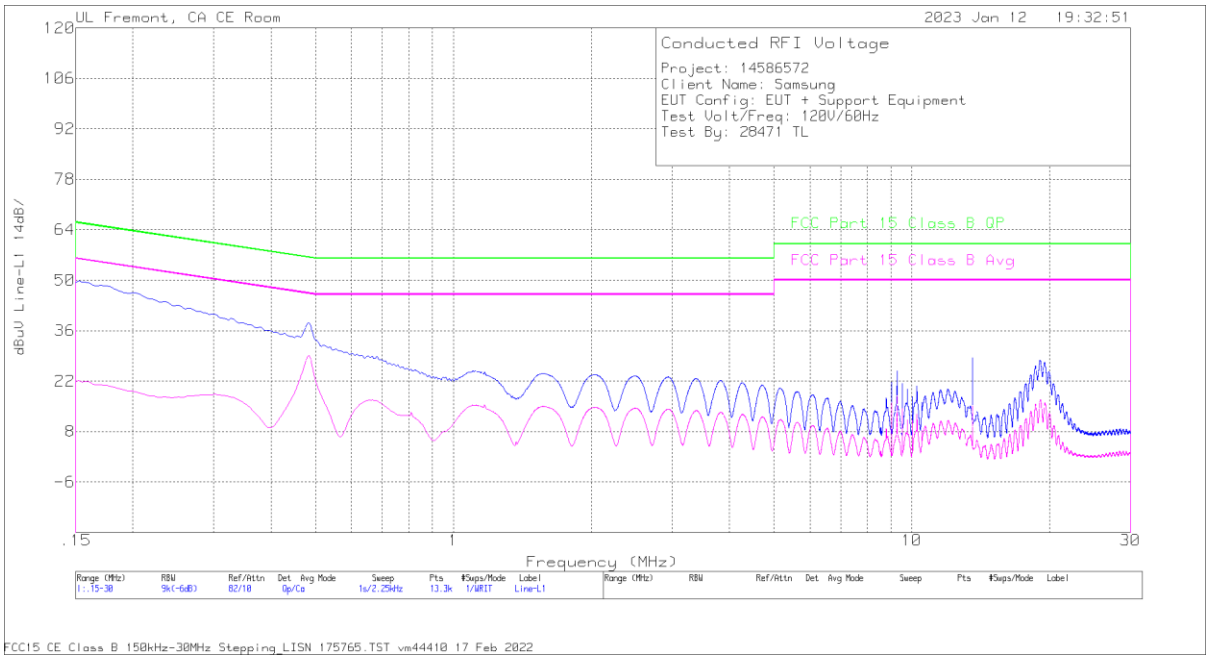
11.1.1. AC Power Line Norm

LINE 1 RESULTS



Trace Markers

Range 1: Line-L1 .15 - 30MHz											
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	175765 LISN L1	C1&C3 cable path loss	207996 Limiter with short cabl	Corrected Reading dBuV	FCC Part 15 Class B QP	QP Margin (dB)	FCC Part 15 Class B Avg	Av(CISPR)M argin (dB)
2	.483	19.79	Ca	0	.1	9.3	29.19	-	-	46.29	-17.1
4	1.1693	5.99	Ca	0	.1	9.3	15.39	-	-	46	-30.61
6	3.8333	3.95	Ca	0	.1	9.3	13.35	-	-	46	-32.65
8	9.3705	-3.67	Ca	.1	.2	9.3	5.93	-	-	50	-44.07
10	13.5893	-6.18	Ca	.1	.2	9.3	3.42	-	-	50	-46.58
12	19.1603	6.03	Ca	.1	.3	9.3	15.73	-	-	50	-34.27
1	.483	28.75	Qp	0	.1	9.3	38.15	56.29	-18.14	-	-
3	1.1423	15.11	Qp	0	.1	9.3	24.51	56	-31.49	-	-
5	3.8288	12.8	Qp	0	.1	9.3	22.2	56	-33.8	-	-
7	9.3671	3.79	Qp	.1	.2	9.3	13.39	60	-46.61	-	-
9	13.6343	1.09	Qp	.1	.2	9.3	10.69	60	-49.31	-	-
11	19.1603	16.27	Qp	.1	.3	9.3	25.97	60	-34.03	-	-

Qp - Quasi-Peak detector
Ca - CISPR average detection

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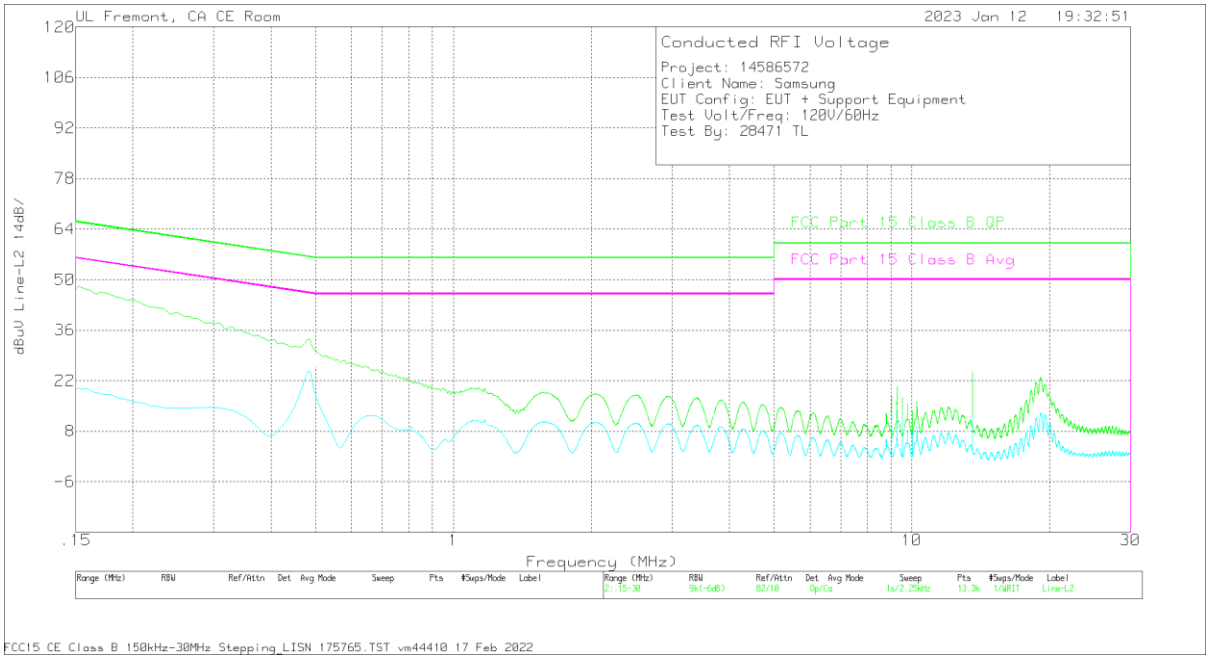
LINE 2 RESULTS



Trace Markers

Range 2: Line-L2 .15 - 30MHz											
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	175765 LISN L2	C2&C3 cable path loss	207996 Limiter with short cabl	Corrected Reading dBuV	FCC Part 15 Class B QP	QP Margin (dB)	FCC Part 15 Class B Avg	Av(CISPR)Margin (dB)
14	.483	15.3	Ca	0	.1	9.3	24.7	-	-	46.29	-21.59
16	1.1693	1.82	Ca	0	.1	9.3	11.22	-	-	46	-34.78
18	3.8299	-.18	Ca	0	.1	9.3	9.22	-	-	46	-36.78
20	9.2625	-5.07	Ca	0	.2	9.3	4.43	-	-	50	-45.57
22	13.5881	-7.48	Ca	.1	.2	9.3	2.12	-	-	50	-47.88
24	19.122	3.45	Ca	.1	.3	9.3	13.15	-	-	50	-36.85
13	.483	24.15	Qp	0	.1	9.3	33.55	56.29	-22.74	-	-
15	1.1333	10.58	Qp	0	.1	9.3	19.98	56	-36.02	-	-
17	3.8198	7.29	Qp	0	.1	9.3	16.69	56	-39.31	-	-
19	9.2603	1.47	Qp	0	.2	9.3	10.97	60	-49.03	-	-
21	13.5893	-1.19	Qp	.1	.2	9.3	8.41	60	-51.59	-	-
23	19.1018	13.18	Qp	.1	.3	9.3	22.88	60	-37.12	-	-

Qp - Quasi-Peak detector
Ca - CISPR average detection

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