Microtest
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Test Report

Report No.: MTi230418006-02E3

Date of issue: 2023-09-06

Applicant: Shenzhen Binary Technology Co., Ltd.

Product: Car Multimedia Player

Model(s): 12-22ES,13-21IS/RC, 15-21NX

FCC ID: 2BCC5-22ES

Shenzhen Microtest Co., Ltd.

http://www.mtitest.com

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Test Result Certification	
Applicant:	Shenzhen Binary Technology Co., Ltd.
Address:	Room 1203-1205, No.5, Xiangzhao Building Longping Community, Dalang subdistrict, Longhua District, Shenzhen City
Manufacturer:	Longhua Branch of Shenzhen Binary Technology Co., Ltd.
Address:	Room 401, Floor 4, No.1 building, Guanghui Technology Park, Minqing Road, Fukang Community, Longhua Distrist, Shenzhen City
Product description	
Product name:	Car Multimedia Player
Trademark:	BINARYTEK
Model name:	12-22ES
Series Model:	13-21IS/RC, 15-21NX
Standards:	47 CFR Part 15.247
Test method:	ANSI C63.10-2013 KDB 558074 D01 15.247 Meas Guidance v05r02
Date of Test	
Date of test:	2023-07-10 to 2023-09-05
Test result:	Pass

Test Engineer	:	David. Lee
		(David Lee)
Reviewed By	:	Leon chen
		(Leon Chen)
Approved By	:	Tom Xue
		(Tom Xue)

1 General Description

1.1 Description of the EUT

Product name:	Car Multimedia Player
Model name:	12-22ES
Series Model:	13-21IS/RC, 15-21NX
Model difference:	All the models are electrical identical including the same software parameter and hardware design (i.e., circuit design, PCB Layout, RF module/circuit, antenna type(s) , components on PCB, etc.,), the differences are the appearance, internal mechanical structure and design (such as antenna locaiton) and fixture.
Electrical rating:	Input:DC 12V
Accessories:	N/A
Hardware version:	V1
Software version:	V1
Test sample(s) number:	MTi230418006-02S1001(12-22ES) MTi230418006-02S1002(13-21IS/RC) MTi230418006-02S1003(15-21NX)
RF specification	
Operating frequency range:	802.11b/g/n20:2412~2462 MHz 802.11n40:2422~2452 MHz
Channel number:	11
Modulation type:	IEEE 802.11b : DSSS (DBPSK, DQPSK, CCK) IEEE 802.11g/n (HT20/HT40) : OFDM (64QAM, 16QAM, QPSK, BPSK)
Antenna(s) type:	FPC
Antenna(s) gain:	3.15dBi

1.2 Description of test modes

No.	Emission test modes
Mode1	TX-802.11B(CH1, CH6, CH11)
Mode2	TX-802.11G(CH1, CH6, CH11)
Mode3	TX-802.11N40(CH3, CH6, CH9)
Mode4	TX-802.11N20(CH1, CH6, CH11)

1.2.1 Operation channel list

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	2412	5	2432	9	2452
2	2417	6	2437	10	2457
3	2422	7	2442	11	2462
4	2427	8	2447	/	/

Note: The test software provided by manufacturer is used to control EUT for working in engineering mode, that enables selectable channel, and capable of continuous transmitting mode.

Test Software:

Test software:	**QRCT3**		
802.11b		**802.11g**	
Channel	Power setting	Channel	Power setting
1	13	1	10
6	13	6	10
11	13	11	10
802.11n(HT20)		**802.11n(HT40)**	
Channel	Power setting	Channel	Power setting
1	10	3	10
6	10	6	10
11	10	9	10

1.3 Environmental Conditions

During the measurement the environmental conditions were within the listed ranges:

Temperature:	15°C ~ 35°C
Humidity:	20% RH ~ 75% RH
Atmospheric pressure:	98 kPa ~ 101 kPa

1.4 Description of support units

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

Support equipment list			
Description	Model	Serial No.	Manufacturer
Accumulator	6-QW-45(370)-L	/	Camel Group Co., Ltd.

1.5 Measurement uncertainty

Measurement	Uncertainty
Conducted emissions (AMN 150kHz~30MHz)	3.1dB
Occupied channel bandwidth	±3 %
RF output power, conducted	±1 dB
Power Spectral Density, conducted	±1 dB
Unwanted Emissions, conducted	±1 dB
Radiated spurious emissions (1GHz~40GHz)	5.3dB
Radiated spurious emissions (9kHz~30MHz)	4.3dB
Radiated spurious emissions (30MHz~1GHz)	4.7dB
Temperature	±1 °C
Humidity	± 5 %

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

2 Summary of Test Result

No.	Item	Standard	Requirement	Result
1	Antenna requirement	47 CFR Part 15.247	47 CFR 15.203	Pass
2	Conducted Emission at AC power line	47 CFR Part 15.247	47 CFR 15.207(a)	N/A
3	Occupied Bandwidth	47 CFR Part 15.247	47 CFR 15.247(a)(2)	Pass
4	Maximum Conducted Output Power	47 CFR Part 15.247	47 CFR 15.247(b)(3)	Pass
5	Power Spectral Density	47 CFR Part 15.247	47 CFR 15.247(e)	Pass
6	Unwanted emission	47 CFR Part 15.247	47 CFR 15.247(d)	Pass
7	Band edge emissions (Radiated)	47 CFR Part 15.247	47 CFR 15.247(d)	Pass
8	Radiated spurious emissions (below 1GHz)	47 CFR Part 15.247	47 CFR 15.247(d)	Pass
9	Radiated spurious emissions (above 1GHz)	47 CFR Part 15.247	47 CFR 15.247(d)	Pass

Notes:

N/A means not applicable.
Since the EUT is power by DC power source, therefore AC power line conducted emissions test is not required.

3 Test Facilities and accreditations

3.1 Test laboratory

Test laboratory:	Shenzhen Microtest Co., Ltd.
Test site location:	101, No.7, Zone 2, Xinxing Industrial Park, Fuhai Avenue, Xinhe Community, Fuhai Street, Bao'an District, Shenzhen, Guangdong, China
Telephone:	(86-755)88850135
Fax:	(86-755)88850136
CNAS Registration No.:	CNAS L5868
FCC Registration No.:	448573

4 List of test equipment

No.	Equipment	Manufacturer	Model	Serial No.	Cal. date	Cal. Due
Conducted Emission at AC power line						
1	EMI Test Receiver	Rohde&schwarz	ESCI3	101368	2023-04-26	2024-04-25
2	Artificial mains network	Schwarzbeck	NSLK 8127	183	2023-05-05	2024-05-04
3	Artificial Mains Network	Schwarzbeck	NSLK 8127	1001	2023-05-06	2024-05-05
Occupied Bandwidth						
1	Wideband Radio Communication Tester	Rohde&schwarz	CMW500	149155	2023-04-26	2024-04-25
2	ESG Series Analog Ssignal Generator	Agilent	E4421B	GB40051240	2023-04-25	2024-04-24
3	PXA Signal Analyzer	Agilent	N9030A	MY51350296	2023-04-25	2024-04-24
4	Synthesized Sweeper	Agilent	83752A	3610A01957	2023-04-25	2024-04-24
5	MXA Signal Analyzer	Agilent	N9020A	MY50143483	2023-04-26	2024-04-25
6	RF Control Unit	Tonscend	JS0806-1	19D8060152	2023-04-26	2024-04-25
7	Band Reject Filter Group	Tonscend	JS0806-F	19D8060160	2023-05-05	2024-05-04
8	ESG Vector Signal Generator	Agilent	N5182A	MY50143762	2023-04-25	2024-04-24
9	DC Power Supply	Agilent	E3632A	MY40027695	2023-05-05	2024-05-04
Maximum Conducted Output Power						
1	Wideband Radio Communication Tester	Rohde&schwarz	CMW500	149155	2023-04-26	2024-04-25
2	ESG Series Analog Ssignal Generator	Agilent	E4421B	GB40051240	2023-04-25	2024-04-24
3	PXA Signal Analyzer	Agilent	N9030A	MY51350296	2023-04-25	2024-04-24
4	Synthesized Sweeper	Agilent	83752A	3610A01957	2023-04-25	2024-04-24
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7	Band Reject Filter Group	Tonscend	JS0806-F	19D8060160	2023-05-05	2024-05-04
8	ESG Vector Signal Generator	Agilent	N5182A	MY50143762	2023-04-25	2024-04-24
9	DC Power Supply	Agilent	E3632A	MY40027695	2023-05-05	2024-05-04
Power Spectral Density						
1	Wideband Radio Communication Tester	Rohde&schwarz	CMW500	149155	2023-04-26	2024-04-25
2	ESG Series Analog Ssignal Generator	Agilent	E4421B	GB40051240	2023-04-25	2024-04-24
3	PXA Signal Analyzer	Agilent	N9030A	MY51350296	2023-04-25	2024-04-24
4	Synthesized Sweeper	Agilent	83752A	3610A01957	2023-04-25	2024-04-24

No.	Equipment	Manufacturer	Model	Serial No.	Cal. date	Cal. Due
5	MXA Signal Analyzer	Agilent	N9020A	MY50143483	2023-04-26	2024-04-25
6	RF Control Unit	Tonscend	JS0806-1	19D8060152	2023-04-26	2024-04-25
7	Band Reject Filter Group	Tonscend	JS0806-F	19D8060160	2023-05-05	2024-05-04
8	ESG Vector Signal Generator	Agilent	N5182A	MY50143762	2023-04-25	2024-04-24
9	DC Power Supply	Agilent	E3632A	MY40027695	2023-05-05	2024-05-04
Unwanted emission						
1	Wideband Radio Communication Tester	Rohde&schwarz	CMW500	149155	2023-04-26	2024-04-25
2	ESG Series Analog Ssignal Generator	Agilent	E4421B	GB40051240	2023-04-25	2024-04-24
3	PXA Signal Analyzer	Agilent	N9030A	MY51350296	2023-04-25	2024-04-24
4	Synthesized Sweeper	Agilent	83752A	3610A01957	2023-04-25	2024-04-24
5	MXA Signal Analyzer	Agilent	N9020A	MY50143483	2023-04-26	2024-04-25
6	RF Control Unit	Tonscend	JS0806-1	19D8060152	2023-04-26	2024-04-25
7	Band Reject Filter Group	Tonscend	JS0806-F	19D8060160	2023-05-05	2024-05-04
8	ESG Vector Signal Generator	Agilent	N5182A	MY50143762	2023-04-25	2024-04-24
9	DC Power Supply	Agilent	E3632A	MY40027695	2023-05-05	2024-05-04
Band edge emissions (Radiated)						
1	EMI Test Receiver	Rohde&schwarz	ESCI7	101166	2023-04-26	2024-04-25
2	Double Ridged Broadband Horn Antenna	schwarabeck	BBHA 9120 D	2278	2023-05-26	2024-05-25
3	Amplifier	Agilent	8449B	3008A01120	2023-05-26	2024-05-25
4	Multi-device Controller	TuoPu	TPMDC	/	2023-05-04	2024-05-03
5	MXA signal analyzer	Agilent	N9020A	MY54440859	2023-05-05	2024-05-04
Radiated spurious emissions (below 1GHz)						
1	EMI Test Receiver	Rohde&schwarz	ESCI7	101166	2023-04-26	2024-04-25
2	TRILOG Broadband Antenna	schwarabeck	VULB 9163	9163-1338	2023-06-11	2025-06-10
3	Amplifier	Hewlett-Packard	8447F	3113A06184	2023-04-26	2024-04-25
4	Multi-device Controller	TuoPu	TPMDC	/	2023-05-04	2024-05-03
5	Active Loop Antenna	Schwarzbeck	FMZB 1519 B	00066	2023-06-11	2025-06-10
Radiated spurious emissions (above 1GHz)						
1	EMI Test Receiver	Rohde&schwarz	ESCI7	101166	2023-04-26	2024-04-25
2	Double Ridged Broadband Horn Antenna	schwarabeck	BBHA 9120 D	2278	2023-05-26	2024-05-25

No.	Equipment	Manufacturer	Model	Serial No.	Cal. date	Cal. Due
3	Amplifier	Agilent	8449B	3008A01120	2023-05-26	2024-05-25
4	Multi-device Controller	TuoPu	TPMDC	/	2023-05-04	2024-05-03
5	MXA signal analyzer	Agilent	N9020A	MY54440859	2023-05-05	2024-05-04

5 Evaluation Results (Evaluation)

5.1 Antenna requirement

Test Requirement:	An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section.
Description of the antenna of EUT:	The antenna of the EUT is permanently attached.
Conclusion:	The EUT complies with the requirement of FCC PART 15.203.

6 Radio Spectrum Matter Test Results (RF)

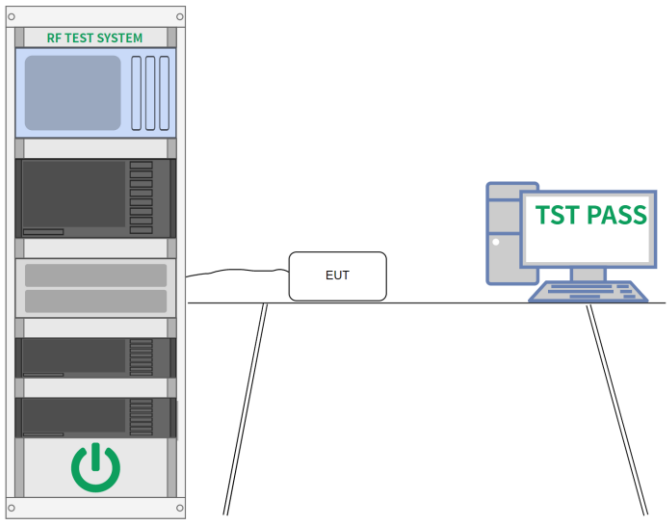
6.1 Occupied Bandwidth

Test Requirement:	47 CFR 15.247(a)(2)
Test Limit:	Refer to 47 CFR 15.247(a)(2), Systems using digital modulation techniques may operate in the 902-928 MHz, and 2400-2483.5 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.
Test Method:	ANSI C63.10-2013, section 11.8 KDB 558074 D01 15.247 Meas Guidance v05r02
Procedure:	a) Set RBW = 100 kHz. b) Set the VBW >= [3 × RBW]. c) Detector = peak. d) Trace mode = max hold. e) Sweep = auto couple. f) Allow the trace to stabilize. g) Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission. 11.8.1 Option 1 The steps for the first option are as follows: a) Set RBW = shall be in the range of 1% to 5% of the OBW but not less than 100 kHz. b) Set the VBW ≥ [3 × RBW]. c) Detector = peak. d) Trace mode = max-hold. e) Sweep = No faster than coupled (auto) time. f) Allow the trace to stabilize. g) Measure the maximum width of the emission by placing two markers, one at the lowest frequency and the other at the highest frequency of the envelope of the spectral display, such that each marker is at or slightly below the “−6 dB down amplitude”. If a marker is below this “−6 dB down amplitude” value, then it shall be as close as possible to this value. 11.8.2 Option 2 The automatic bandwidth measurement capability of an instrument may be employed using the X dB bandwidth mode with X set to 6 dB, if the functionality described in 11.8.1 (i.e., RBW = 100 kHz, VBW ≥ 3 × RBW, and peak detector with maximum hold) is implemented by the instrumentation function. When using this capability, care shall be taken so that the bandwidth measurement is not influenced by any intermediate power nulls in the fundamental emission that might be ≥ 6 dB.

6.1.1 E.U.T. Operation:

Operating Environment:					
Temperature:	19.7 °C	Humidity:	56.6 %	Atmospheric Pressure:	98 kPa
Pre test mode:	Mode1, Mode2, Mode3, Mode4				
Final test mode:	Mode1, Mode2, Mode3, Mode4				

6.1.2 Test Setup Diagram:



6.1.3 Test Data:

Please Refer to Appendix for Details.

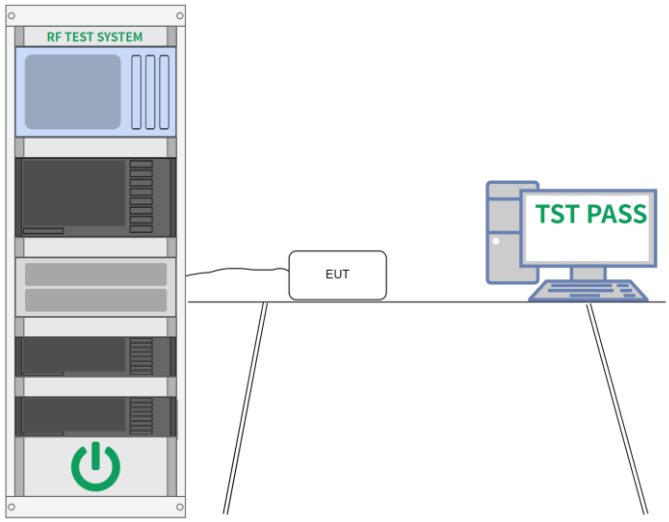
6.2 Maximum Conducted Output Power

Test Requirement:	47 CFR 15.247(b)(3)
Test Limit:	Refer to 47 CFR 15.247(b)(3), For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.
Test Method:	ANSI C63.10-2013, section 11.9.1 KDB 558074 D01 15.247 Meas Guidance v05r02
Procedure:	ANSI C63.10-2013, section 11.9.1 Maximum peak conducted output power

6.2.1 E.U.T. Operation:

Operating Environment:					
Temperature:	19.7 °C	Humidity:	56.6 %	Atmospheric Pressure:	98 kPa
Pre test mode:	Mode1, Mode2, Mode3, Mode4				
Final test mode:	Mode1, Mode2, Mode3, Mode4				

6.2.2 Test Setup Diagram:



6.2.3 Test Data:

Please Refer to Appendix for Details.

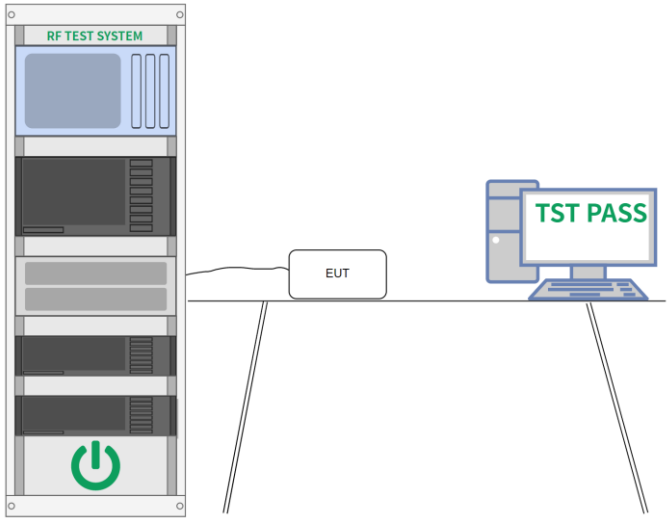
6.3 Power Spectral Density

Test Requirement:	47 CFR 15.247(e)
Test Limit:	Refer to 47 CFR 15.247(e), For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.
Test Method:	ANSI C63.10-2013, section 11.10 KDB 558074 D01 15.247 Meas Guidance v05r02
Procedure:	ANSI C63.10-2013, section 11.10, Maximum power spectral density level in the fundamental emission

6.3.1 E.U.T. Operation:

Operating Environment:					
Temperature:	19.7 °C	Humidity:	56.6 %	Atmospheric Pressure:	98 kPa
Pre test mode:	Mode1, Mode2, Mode3, Mode4				
Final test mode:	Mode1, Mode2, Mode3, Mode4				

6.3.2 Test Setup Diagram:



6.3.3 Test Data:

Please Refer to Appendix for Details.

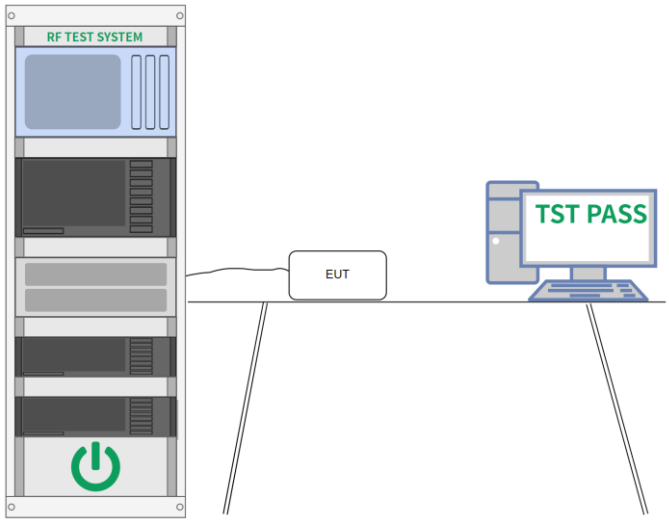
6.4 Unwanted emission

Test Requirement:	47 CFR 15.247(d)
Test Limit:	Refer to 47 CFR 15.247(d), In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in § 15.209(a) is not required.
Test Method:	ANSI C63.10-2013 section 11.11 KDB 558074 D01 15.247 Meas Guidance v05r02
Procedure:	ANSI C63.10-2013 Section 11.11.1, Section 11.11.2, Section 11.11.3

6.4.1 E.U.T. Operation:

Operating Environment:					
Temperature:	19.7 °C	Humidity:	56.6 %	Atmospheric Pressure:	98 kPa
Pre test mode:	Mode1, Mode2, Mode3, Mode4				
Final test mode:	Mode1, Mode2, Mode3, Mode4				

6.4.2 Test Setup Diagram:



6.4.3 Test Data:

Please Refer to Appendix for Details.

6.5 Band edge emissions (Radiated)

Test Requirement:	Refer to 47 CFR 15.247(d), In addition, radiated emissions which fall in the restricted bands, as defined in § 15.205(a), must also comply with the radiated emission limits specified in § 15.209(a)(see § 15.205(c)).`
Test Limit:	

Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)
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
88-216	150 **	3
216-960	200 **	3
Above 960	500	3

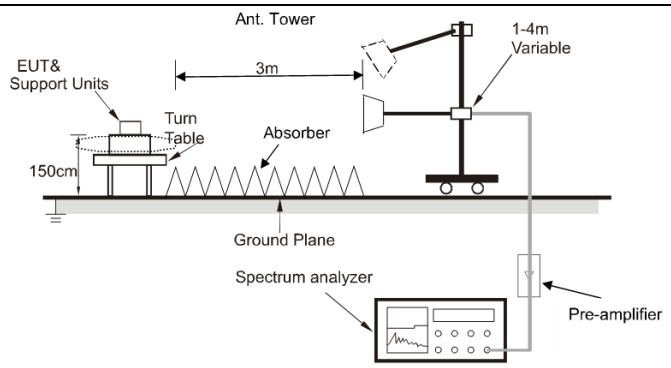
** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this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

Test Method:	ANSI C63.10-2013 section 6.10 KDB 558074 D01 15.247 Meas Guidance v05r02
Procedure:	ANSI C63.10-2013 section 6.10.5.2

6.5.1 E.U.T. Operation:

Operating Environment:					
Temperature:	25 °C	Humidity:	57 %	Atmospheric Pressure:	100 kPa
Pre test mode:	Mode1, Mode2, Mode3, Mode4				
Final test mode:	Mode1, Mode2, Mode3, Mode4				
Note: All other emissions are attenuated 20dB below the limit, so does not recorded					

6.5.2 Test Setup Diagram:



6.5.3 Test Data:

Mode1 / Polarization: Horizontal / Band: 2.4G / BW: 20 / CH: 1

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector
1		2310.000	42.46	-8.08	34.38	74.00	-39.62	peak
2		2310.000	33.74	-8.08	25.66	54.00	-28.34	AVG
3		2390.000	45.64	-7.71	37.93	74.00	-36.07	peak
4	*	2390.000	34.53	-7.71	26.82	54.00	-27.18	AVG

Mode1 / Polarization: Vertical / Band: 2.4G / BW: 20 / CH: 1

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector
1		2310.000	43.94	-8.08	35.86	74.00	-38.14	peak
2		2310.000	35.09	-8.08	27.01	54.00	-26.99	AVG
3		2390.000	48.96	-7.71	41.25	74.00	-32.75	peak
4	*	2390.000	35.17	-7.71	27.46	54.00	-26.54	AVG

Mode1 / Polarization: Horizontal / Band: 2.4G / BW: 20 / CH: 11

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector
1		2483.500	47.06	-7.24	39.82	74.00	-34.18	peak
2		2483.500	37.59	-7.24	30.35	54.00	-23.65	AVG
3		2500.000	46.99	-7.17	39.82	74.00	-34.18	peak
4	*	2500.000	37.89	-7.17	30.72	54.00	-23.28	AVG

Mode1 / Polarization: Vertical / Band: 2.4G / BW: 20 / CH: 11

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector
1		2483.500	47.48	-7.24	40.24	74.00	-33.76	peak
2		2483.500	37.87	-7.24	30.63	54.00	-23.37	AVG
3		2500.000	47.18	-7.17	40.01	74.00	-33.99	peak
4	*	2500.000	38.02	-7.17	30.85	54.00	-23.15	AVG

Mode2 / Polarization: Horizontal / Band: 2.4G / BW: 20 / CH: 1

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector
1		2310.000	42.23	-8.08	34.15	74.00	-39.85	peak
2		2310.000	32.33	-8.08	24.25	54.00	-29.75	AVG
3		2390.000	45.14	-7.71	37.43	74.00	-36.57	peak
4	*	2390.000	35.54	-7.71	27.83	54.00	-26.17	AVG

Mode2 / Polarization: Vertical / Band: 2.4G / BW: 20 / CH: 1

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector
1		2310.000	43.61	-8.08	35.53	74.00	-38.47	peak
2		2310.000	32.24	-8.08	24.16	54.00	-29.84	AVG
3		2390.000	47.21	-7.71	39.50	74.00	-34.50	peak
4	*	2390.000	35.77	-7.71	28.06	54.00	-25.94	AVG

Mode2 / Polarization: Horizontal / Band: 2.4G / BW: 20 / CH: 11

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector
1		2483.500	48.24	-7.24	41.00	74.00	-33.00	peak
2		2483.500	37.75	-7.24	30.51	54.00	-23.49	AVG
3		2500.000	47.97	-7.17	40.80	74.00	-33.20	peak
4	*	2500.000	37.85	-7.17	30.68	54.00	-23.32	AVG

Mode2 / Polarization: Vertical / Band: 2.4G / BW: 20 / CH: 11

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector
1		2483.500	47.60	-7.24	40.36	74.00	-33.64	peak
2		2483.500	37.83	-7.24	30.59	54.00	-23.41	AVG
3		2500.000	47.75	-7.17	40.58	74.00	-33.42	peak
4	*	2500.000	37.91	-7.17	30.74	54.00	-23.26	AVG

Mode3 / Polarization: Horizontal / Band: 2.4G / BW: 40 / CH: 3

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector
1		2310.000	43.09	-8.08	35.01	74.00	-38.99	peak
2		2310.000	33.24	-8.08	25.16	54.00	-28.84	AVG
3		2390.000	50.75	-7.71	43.04	74.00	-30.96	peak
4	*	2390.000	39.53	-7.71	31.82	54.00	-22.18	AVG

Mode3 / Polarization: Vertical / Band: 2.4G / BW: 40 / CH: 3

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector
1		2310.000	43.06	-8.08	34.98	74.00	-39.02	peak
2		2310.000	34.44	-8.08	26.36	54.00	-27.64	AVG
3		2390.000	49.89	-7.71	42.18	74.00	-31.82	peak
4	*	2390.000	39.83	-7.71	32.12	54.00	-21.88	AVG

Mode3 / Polarization: Horizontal / Band: 2.4G / BW: 40 / CH: 9

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector
1		2483.500	47.92	-7.24	40.68	74.00	-33.32	peak
2	*	2483.500	37.87	-7.24	30.63	54.00	-23.37	AVG
3		2500.000	46.86	-7.17	39.69	74.00	-34.31	peak
4		2500.000	37.79	-7.17	30.62	54.00	-23.38	AVG

Mode3 / Polarization: Vertical / Band: 2.4G / BW: 40 / CH: 9

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector
1		2483.500	48.06	-7.24	40.82	74.00	-33.18	peak
2	*	2483.500	38.18	-7.24	30.94	54.00	-23.06	AVG
3		2500.000	48.41	-7.17	41.24	74.00	-32.76	peak
4		2500.000	37.72	-7.17	30.55	54.00	-23.45	AVG

Mode4 / Polarization: Horizontal / Band: 2.4G / BW: 20 / CH: 1

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector
1		2310.000	41.43	-8.08	33.35	74.00	-40.65	peak
2		2310.000	32.32	-8.08	24.24	54.00	-29.76	AVG
3		2390.000	45.86	-7.71	38.15	74.00	-35.85	peak
4	*	2390.000	35.63	-7.71	27.92	54.00	-26.08	AVG

Mode4 / Polarization: Vertical / Band: 2.4G / BW: 20 / CH: 1

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector
1		2310.000	42.35	-8.08	34.27	74.00	-39.73	peak
2		2310.000	32.44	-8.08	24.36	54.00	-29.64	AVG
3		2390.000	46.47	-7.71	38.76	74.00	-35.24	peak
4	*	2390.000	36.45	-7.71	28.74	54.00	-25.26	AVG

Mode4 / Polarization: Horizontal / Band: 2.4G / BW: 20 / CH: 11

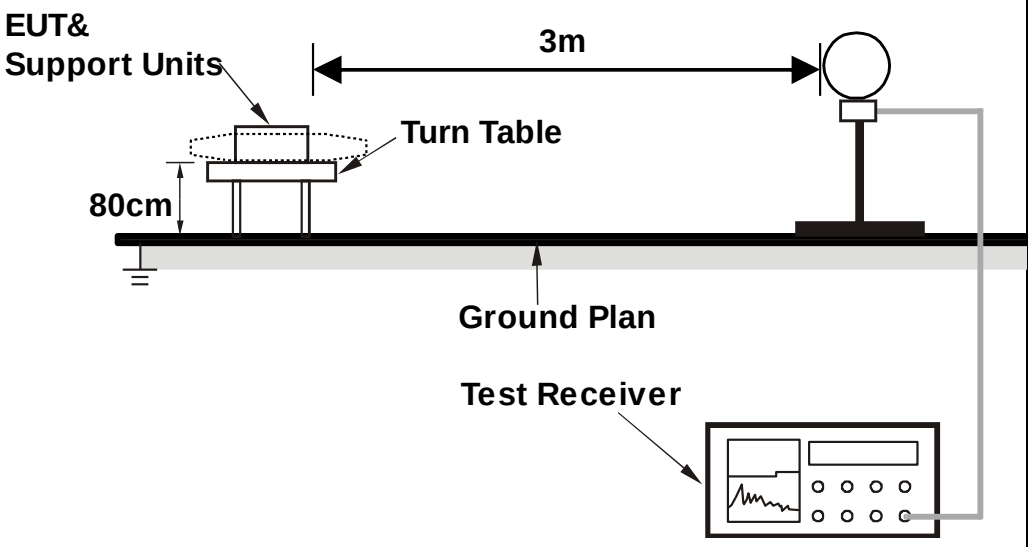
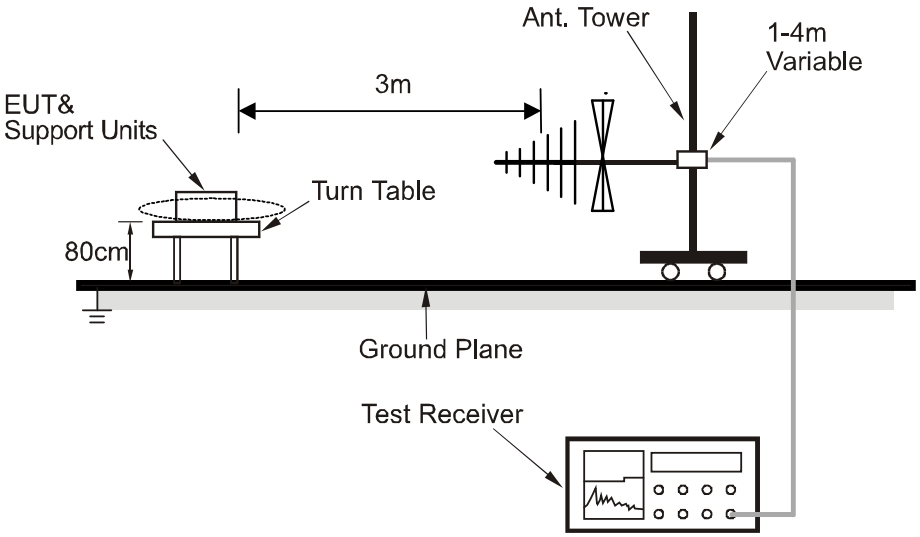
No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector
1		2483.500	47.91	-7.24	40.67	74.00	-33.33	peak
2		2483.500	37.83	-7.24	30.59	54.00	-23.41	AVG
3		2500.000	48.07	-7.17	40.90	74.00	-33.10	peak
4	*	2500.000	37.99	-7.17	30.82	54.00	-23.18	AVG

Mode4 / Polarization: Vertical / Band: 2.4G / BW: 20 / CH: 11

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector
1		2483.500	47.19	-7.24	39.95	74.00	-34.05	peak
2		2483.500	37.79	-7.24	30.55	54.00	-23.45	AVG
3		2500.000	47.27	-7.17	40.10	74.00	-33.90	peak
4	*	2500.000	37.81	-7.17	30.64	54.00	-23.36	AVG

6.6 Radiated spurious emissions (below 1GHz)

<table>
<tr><td>Test Requirement:</td><td>Refer to 47 CFR 15.247(d), In addition, radiated emissions which fall in the restricted bands, as defined in § 15.205(a), must also comply with the radiated emission limits specified in § 15.209(a)(see § 15.205(c)).`</td></tr>
<tr><td>Test Limit:</td><td>
<table>
<tr><td>Frequency (MHz)</td><td>Field strength (microvolts/meter)</td><td>Measurement distance (meters)</td></tr>
<tr><td>0.009-0.490</td><td>2400/F(kHz)</td><td>300</td></tr>
<tr><td>0.490-1.705</td><td>24000/F(kHz)</td><td>30</td></tr>
<tr><td>1.705-30.0</td><td>30</td><td>30</td></tr>
<tr><td>30-88</td><td>100 **</td><td>3</td></tr>
<tr><td>88-216</td><td>150 **</td><td>3</td></tr>
<tr><td>216-960</td><td>200 **</td><td>3</td></tr>
<tr><td>Above 960</td><td>500</td><td>3</td></tr>
</table>
** 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.
</td></tr>
<tr><td>Test Method:</td><td>ANSI C63.10-2013 section 6.6.4
KDB 558074 D01 15.247 Meas Guidance v05r02</td></tr>
<tr><td>Procedure:</td><td>ANSI C63.10-2013 section 6.6.4</td></tr>
</table>

Test setup:	Below 30MHz  30MHz~1GHz  For the actual test configuration, please refer to the related item – Photographs of the test setup.

6.6.1 E.U.T. Operation:

Operating Environment:					
Temperature:	25 °C	Humidity:	56 %	Atmospheric Pressure:	100 kPa
Pre test mode:	Mode1, Mode2, Mode3, Mode4				
Final test mode:	Mode1				

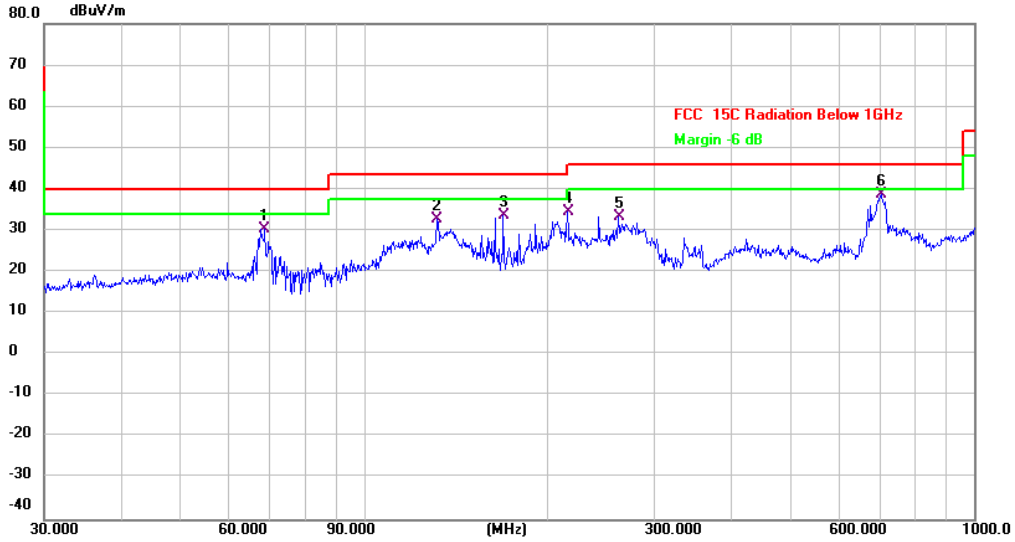
Note:

The amplitude of spurious emissions which are attenuated more than 20 dB below the limits are not reported.

All modes of operation of the EUT were investigated, and only the worst-case results are reported. There were no emissions found below 30MHz within 20dB of the limit.

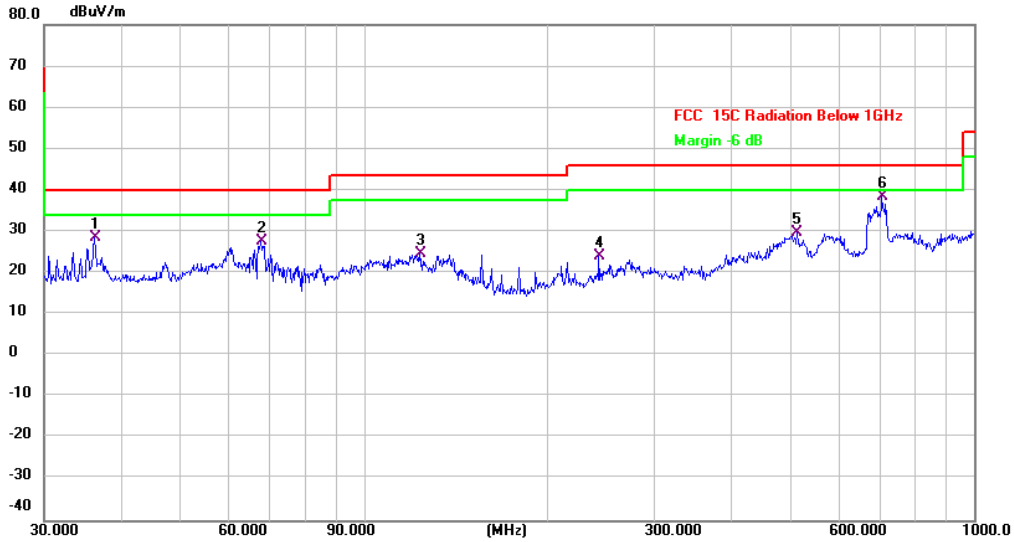
6.6.2 Test Data:

Mode1 / Polarization: Horizontal / Band: 2.4G / BW: 20 / CH: 1



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		68.8721	39.81	-9.37	30.44	40.00	-9.56	QP	
2		131.7577	45.30	-12.48	32.82	43.50	-10.68	QP	
3		169.0054	45.58	-11.80	33.78	43.50	-9.72	QP	
4		216.0240	41.24	-6.62	34.62	46.00	-11.38	QP	
5		261.9753	41.05	-7.80	33.25	46.00	-12.75	QP	
6	*	704.2261	38.33	0.45	38.78	46.00	-7.22	QP	

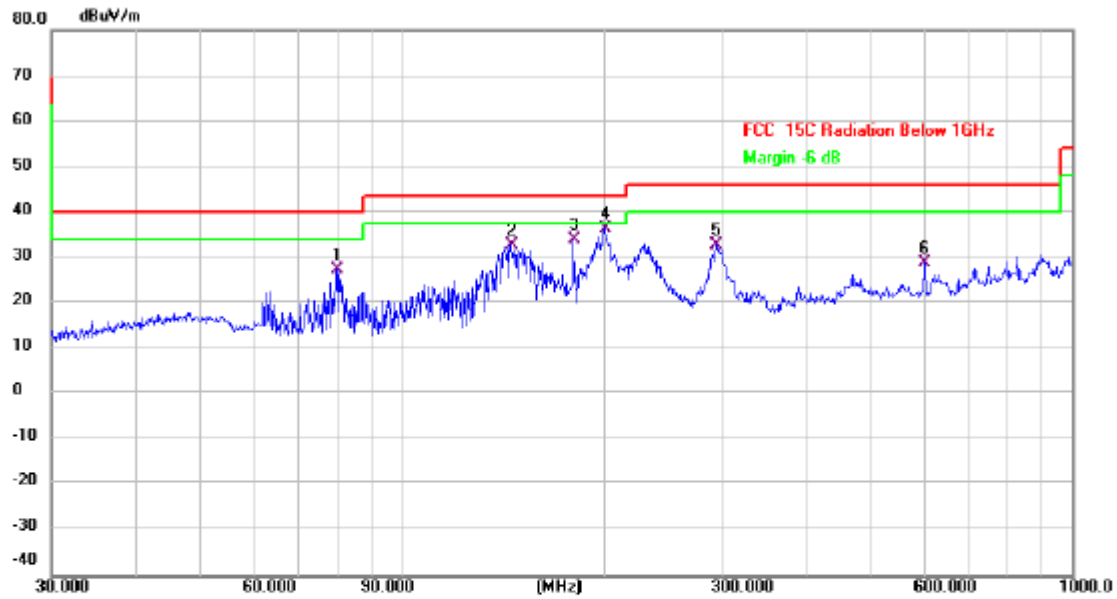
Mode1 / Polarization: Vertical / Band: 2.4G / BW: 20 / CH: 1



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		36.2541	36.05	-7.61	28.44	40.00	-11.56	QP	
2		67.9129	36.75	-9.09	27.66	40.00	-12.34	QP	
3		123.2655	35.85	-11.07	24.78	43.50	-18.72	QP	
4		243.3772	30.98	-6.91	24.07	46.00	-21.93	QP	
5		513.6331	34.63	-4.89	29.74	46.00	-16.26	QP	
6	*	706.6999	37.93	0.46	38.39	46.00	-7.61	QP	

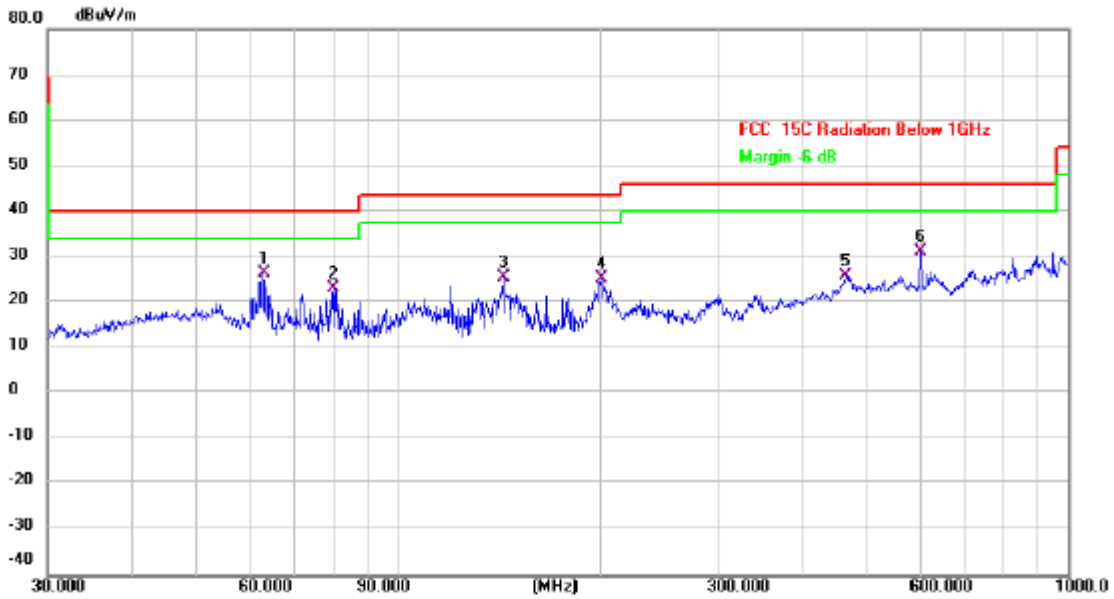
13-21IS/RC

Mode1 / Polarization: Horizontal / Band: 2.4G / BW: 20 / CH: 1



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		80.0806	40.30	-13.00	27.30	40.00	-12.70	QP	
2		145.3506	43.95	-11.33	32.62	43.50	-10.88	QP	
3		180.0165	43.84	-9.96	33.88	43.50	-9.62	QP	
4	*	200.6881	42.82	-6.32	36.50	43.50	-7.00	QP	
5		294.1137	37.70	-5.02	32.68	46.00	-13.32	QP	
6		601.4265	31.94	-2.99	28.95	46.00	-17.05	QP	

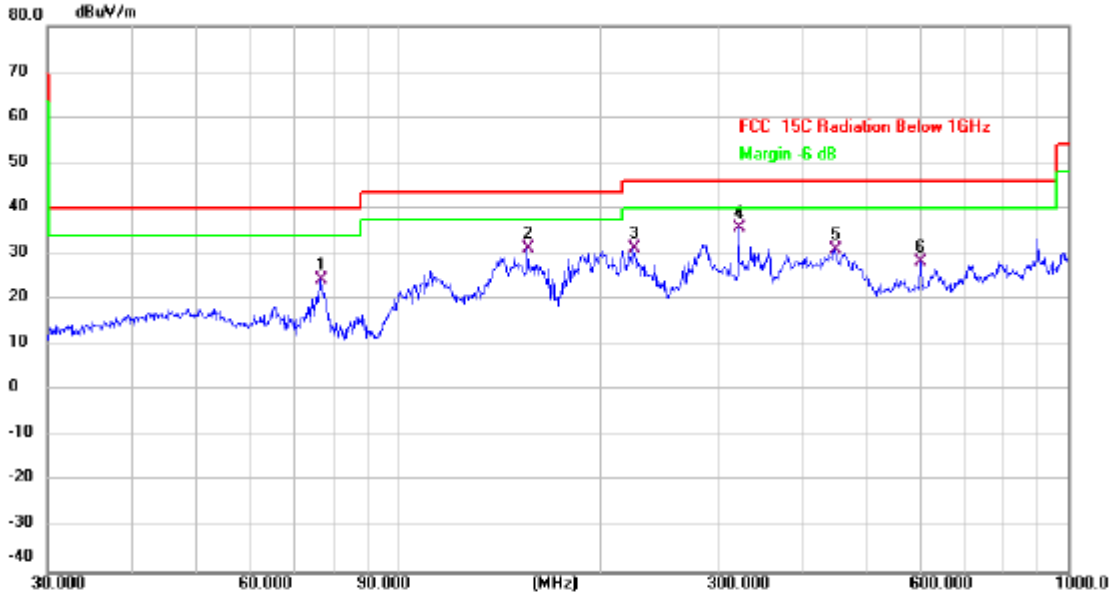
Mode1 / Polarization: Vertical / Band: 2.4G / BW: 20 / CH: 1



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1	*	62.8708	36.12	-9.76	26.36	40.00	-13.64	QP	
2		80.0806	36.26	-13.00	23.26	40.00	-16.74	QP	
3		143.8295	36.02	-10.56	25.46	43.50	-18.04	QP	
4		201.3930	31.84	-6.57	25.27	43.50	-18.23	QP	
5		465.5994	29.86	-4.03	25.83	46.00	-20.17	QP	
6		601.4265	34.23	-2.99	31.24	46.00	-14.76	QP	

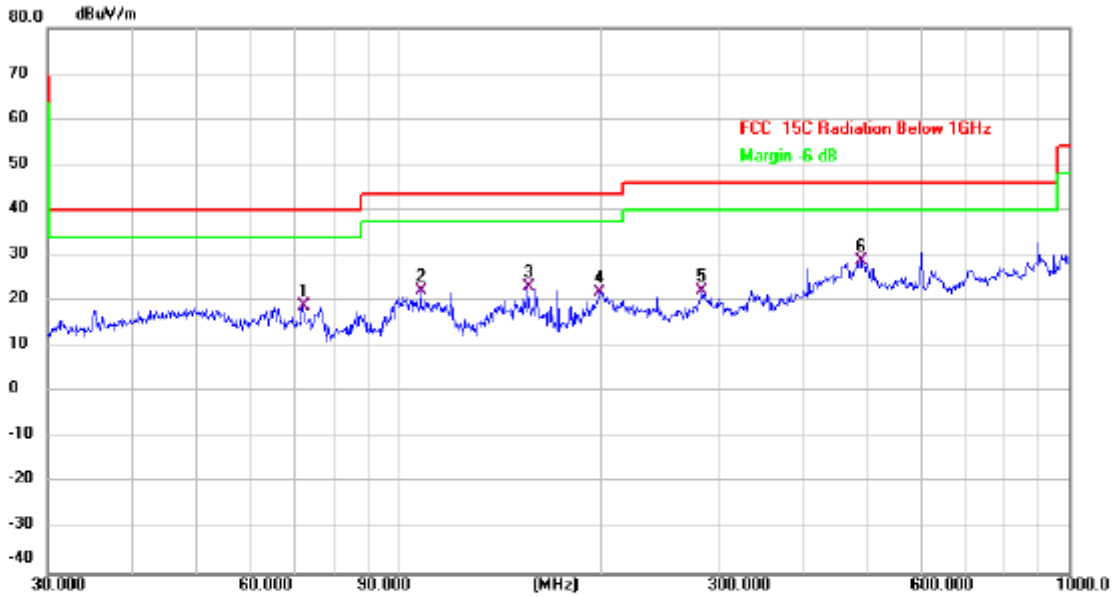
15-21NX

Mode1 / Polarization: Horizontal / Band: 2.4G / BW: 20 / CH: 1



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		76.5121	37.01	-12.78	24.23	40.00	-15.77	QP	
2		155.9101	41.57	-10.28	31.29	43.50	-12.21	QP	
3		224.5193	39.60	-8.46	31.14	46.00	-14.86	QP	
4	*	322.1886	42.12	-6.28	35.84	46.00	-10.16	QP	
5		447.9822	35.14	-4.19	30.95	46.00	-15.05	QP	
6		601.4265	31.34	-2.99	28.35	46.00	-17.65	QP	

Mode1 / Polarization: Vertical / Band: 2.4G / BW: 20 / CH: 1



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		72.0843	30.08	-11.27	18.81	40.00	-21.19	QP	
2		107.8877	29.66	-7.26	22.40	43.50	-21.10	QP	
3		155.9101	33.57	-10.28	23.29	43.50	-20.21	QP	
4		199.2855	29.20	-7.14	22.06	43.50	-21.44	QP	
5		283.9791	28.50	-6.34	22.16	46.00	-23.84	QP	
6	*	489.0269	32.51	-3.67	28.84	46.00	-17.16	QP	

6.7 Radiated spurious emissions (above 1GHz)

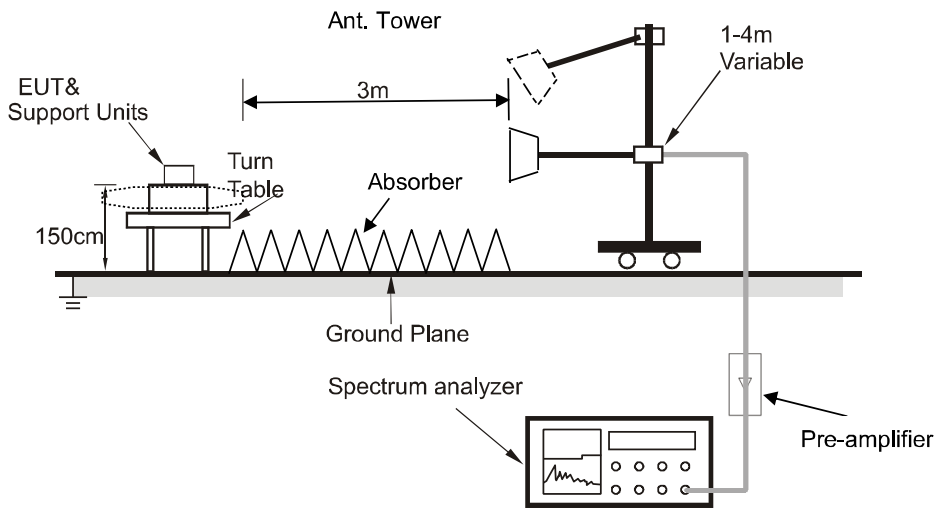
Test Requirement:	In addition, radiated emissions which fall in the restricted bands, as defined in § 15.205(a), must also comply with the radiated emission limits specified in § 15.209(a)(see § 15.205(c)).`
Test Limit:	

Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)
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
88-216	150 **	3
216-960	200 **	3
Above 960	500	3

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

§§ 15.231 and 15.241.

Test Method:	ANSI C63.10-2013 section 6.6.4 KDB 558074 D01 15.247 Meas Guidance v05r02
Procedure:	ANSI C63.10-2013 section 6.6.4
Test setup:	Above 1GHz



For the actual test configuration, please refer to the related item – Photographs of the test setup.

6.7.1 E.U.T. Operation:

Operating Environment:					
Temperature:	25 °C	Humidity:	59 %	Atmospheric Pressure:	100 kPa
Pre test mode:	Mode1, Mode2, Mode3, Mode4				
Final test mode:	Mode1				

Note: Test frequency are from 1GHz to 25GHz, the amplitude of spurious emissions which are attenuated more than 20 dB below the limits are not reported.
All modes of operation of the EUT were investigated, and only the worst-case results are reported.

6.7.2 Test Data:

Mode1 / Polarization: Horizontal / Band: 2.4G / BW: 20 / CH: 1

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector
1		4824.000	40.56	0.82	41.38	74.00	-32.62	peak
2		4824.000	34.32	0.82	35.14	54.00	-18.86	AVG
3		7236.000	40.49	6.00	46.49	74.00	-27.51	peak
4		7236.000	34.22	6.00	40.22	54.00	-13.78	AVG
5		9648.000	41.17	6.17	47.34	74.00	-26.66	peak
6	*	9648.000	35.09	6.17	41.26	54.00	-12.74	AVG

Mode1 / Polarization: Vertical / Band: 2.4G / BW: 20 / CH: 1

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector
1		4824.000	40.00	0.82	40.82	74.00	-33.18	peak
2		4824.000	33.54	0.82	34.36	54.00	-19.64	AVG
3		7236.000	39.74	6.00	45.74	74.00	-28.26	peak
4		7236.000	33.48	6.00	39.48	54.00	-14.52	AVG
5		9648.000	41.19	6.17	47.36	74.00	-26.64	peak
6	*	9648.000	35.05	6.17	41.22	54.00	-12.78	AVG

Mode1 / Polarization: Horizontal / Band: 2.4G / BW: 20 / CH: 6

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector
1		4874.000	40.22	1.01	41.23	74.00	-32.77	peak
2		4874.000	34.10	1.01	35.11	54.00	-18.89	AVG
3		7311.000	40.30	5.94	46.24	74.00	-27.76	peak
4		7311.000	34.28	5.94	40.22	54.00	-13.78	AVG
5		9748.000	41.36	6.54	47.90	74.00	-26.10	peak
6	*	9748.000	34.85	6.54	41.39	54.00	-12.61	AVG

Mode1 / Polarization: Vertical / Band: 2.4G / BW: 20 / CH: 6

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector
1		4874.000	40.09	1.01	41.10	74.00	-32.90	peak
2		4874.000	34.05	1.01	35.06	54.00	-18.94	AVG
3		7311.000	40.40	5.94	46.34	74.00	-27.66	peak
4		7311.000	34.28	5.94	40.22	54.00	-13.78	AVG
5		9748.000	41.09	6.54	47.63	74.00	-26.37	peak
6	*	9748.000	34.79	6.54	41.33	54.00	-12.67	AVG

Mode1 / Polarization: Horizontal / Band: 2.4G / BW: 20 / CH: 11

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector
1		4924.000	40.99	1.27	42.26	74.00	-31.74	peak
2		4924.000	34.84	1.27	36.11	54.00	-17.89	AVG
3		7386.000	39.92	5.86	45.78	74.00	-28.22	peak
4		7386.000	33.46	5.86	39.32	54.00	-14.68	AVG
5		9848.000	41.00	6.31	47.31	74.00	-26.69	peak
6	*	9848.000	34.91	6.31	41.22	54.00	-12.78	AVG

Mode1 / Polarization: Vertical / Band: 2.4G / BW: 20 / CH: 11

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector
1		4924.000	40.30	1.27	41.57	74.00	-32.43	peak
2		4924.000	33.95	1.27	35.22	54.00	-18.78	AVG
3		7386.000	41.21	5.86	47.07	74.00	-26.93	peak
4		7386.000	34.62	5.86	40.48	54.00	-13.52	AVG
5		9848.000	41.57	6.31	47.88	74.00	-26.12	peak
6	*	9848.000	35.07	6.31	41.38	54.00	-12.62	AVG

Note: Spurious radiations (above 1GHz) for 12-22ES,13-21IS/RC, 15-21NX have been tested. The report only shows the worst product(12-22ES).

Photographs of the test setup

Refer to Appendix - Test Setup Photos.

Photographs of the EUT

Refer to Appendix - EUT Photos

Appendix

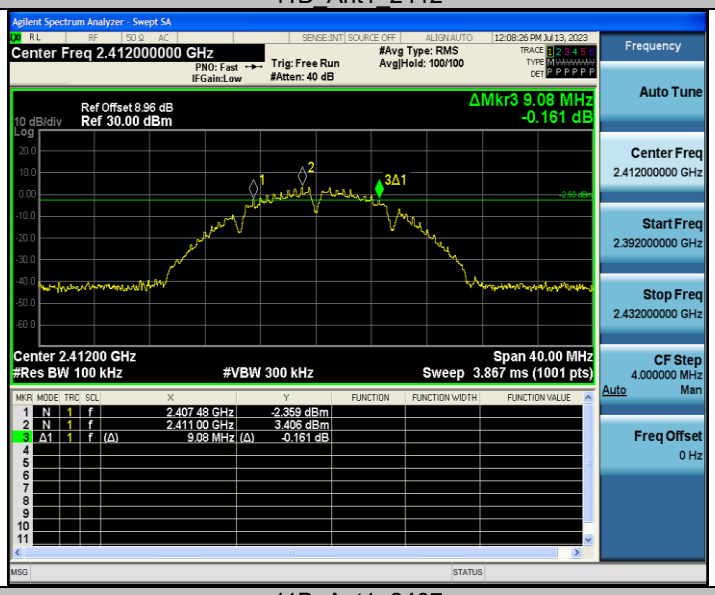
Appendix A: DTS Bandwidth

Test Result

Test Mode	Antenna	Frequency [MHz]	DTS BW [MHz]	Limit [MHz]	Verdict
11B	Ant1	2412	9.080	0.5	PASS
		2437	8.600	0.5	PASS
		2462	8.560	0.5	PASS
11G	Ant1	2412	16.280	0.5	PASS
		2437	15.400	0.5	PASS
		2462	15.720	0.5	PASS
11N20SISO	Ant1	2412	16.560	0.5	PASS
		2437	16.640	0.5	PASS
		2462	16.840	0.5	PASS
11N40SISO	Ant1	2422	35.440	0.5	PASS
		2437	35.520	0.5	PASS
		2452	35.040	0.5	PASS

Test Graphs

11B_Ant1_2412



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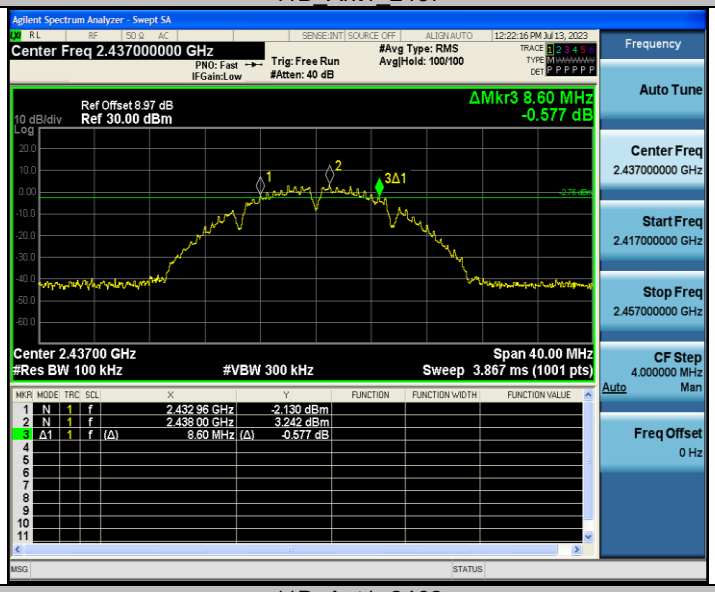

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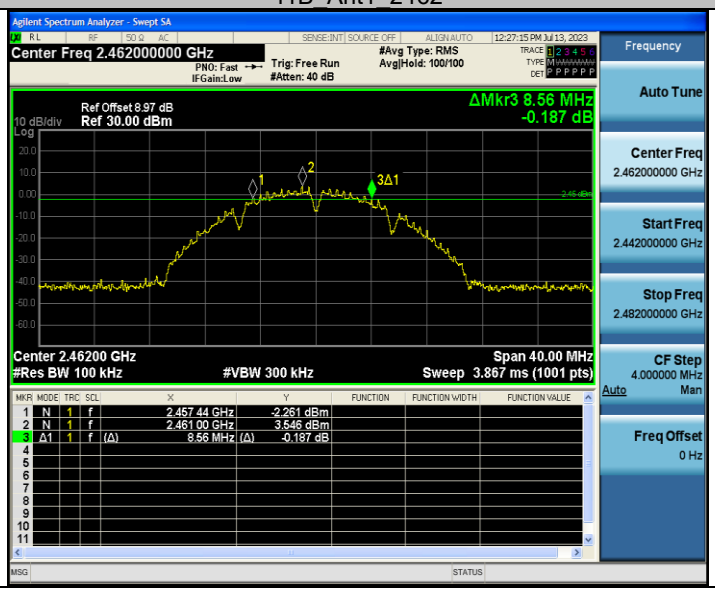

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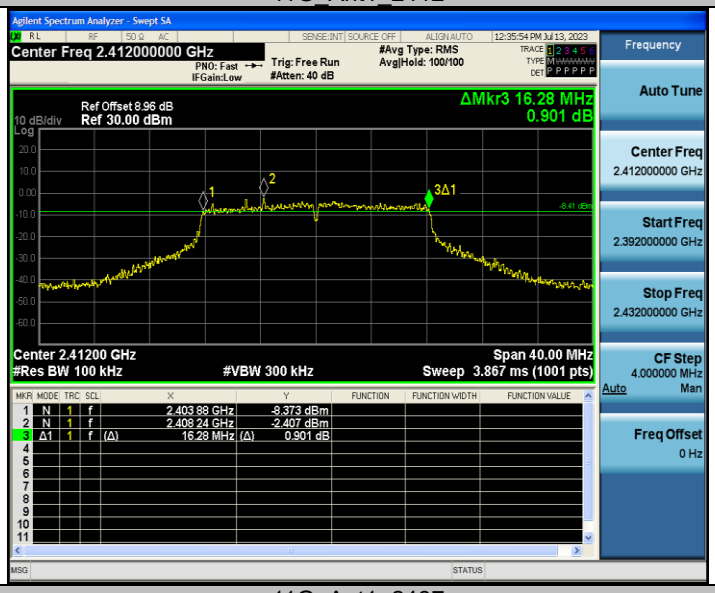
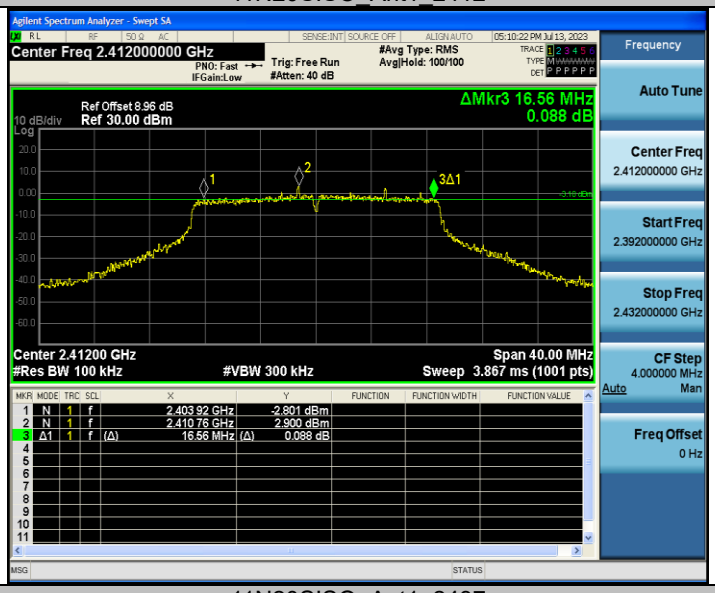


11G_Ant1_2437

11G_Ant1_2462

11N20SISO_Ant1_2412



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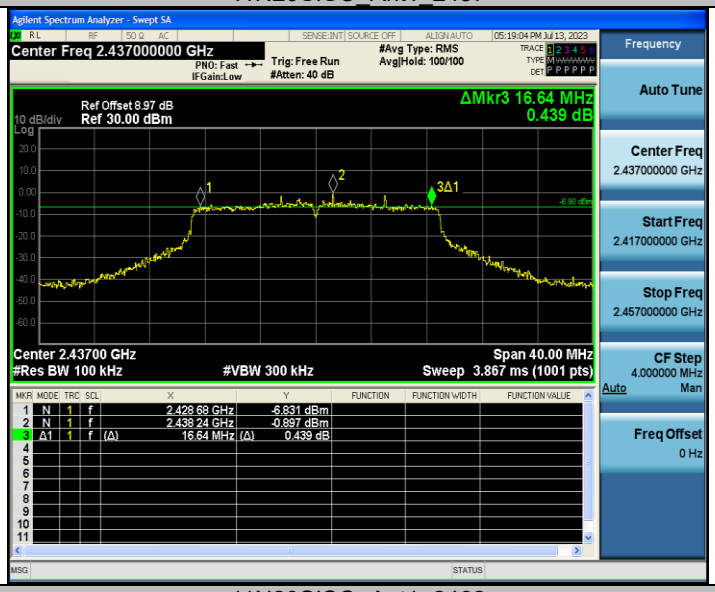

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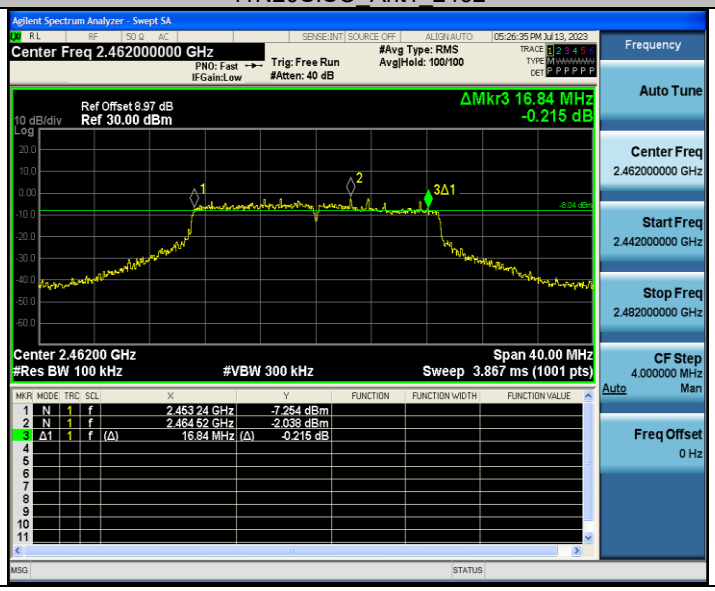
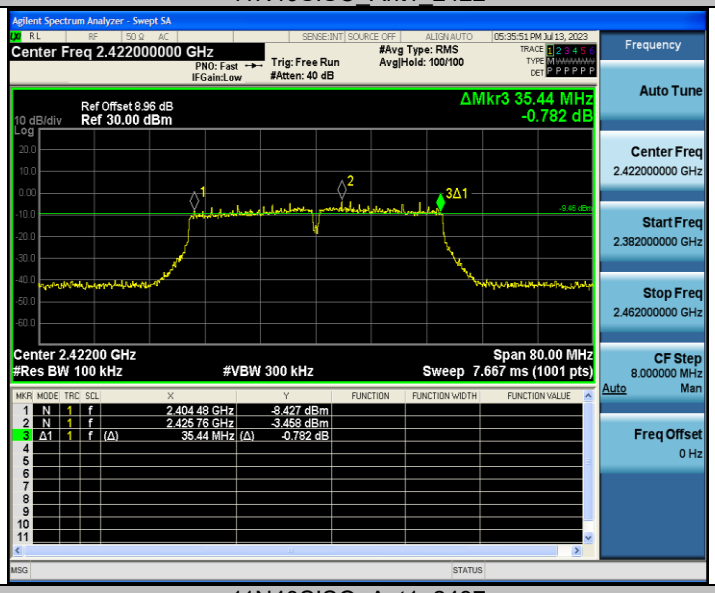


11N40SISO_Ant1_2422



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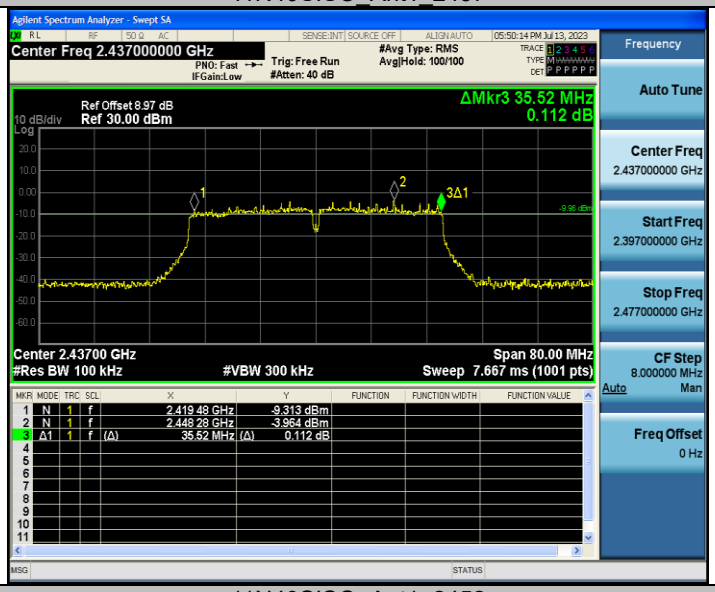
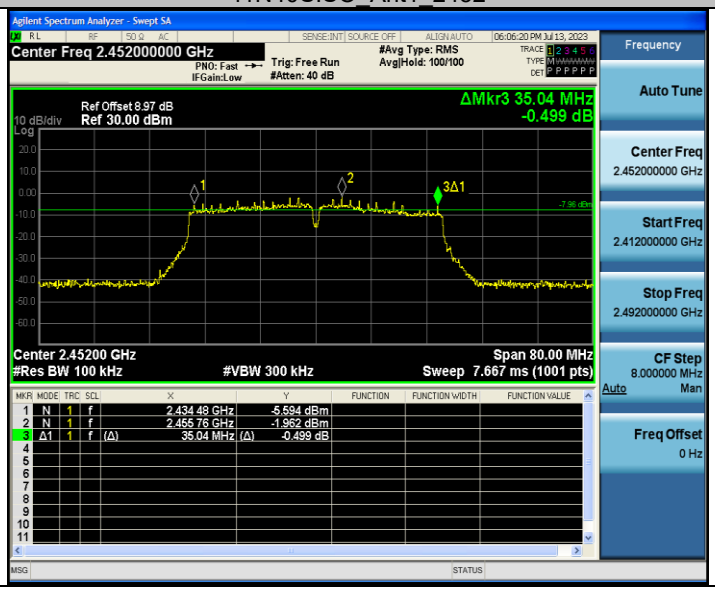


11N40SISO_Ant1_2452



Appendix B: Maximum conducted output power

Test Result Peak

Test Mode	Antenna	Frequency [MHz]	Peak Power [dBm]	Conducted Limit [dBm]	Verdict
11B	Ant1	2412	14.72	≤30.00	PASS
		2437	14.81	≤30.00	PASS
		2462	14.68	≤30.00	PASS
11G	Ant1	2412	16.14	≤30.00	PASS
		2437	16.15	≤30.00	PASS
		2462	15.99	≤30.00	PASS
11N20SISO	Ant1	2412	15.98	≤30.00	PASS
		2437	16.12	≤30.00	PASS
		2462	16.01	≤30.00	PASS
11N40SISO	Ant1	2422	16.93	≤30.00	PASS
		2437	17.12	≤30.00	PASS
		2452	17.26	≤30.00	PASS

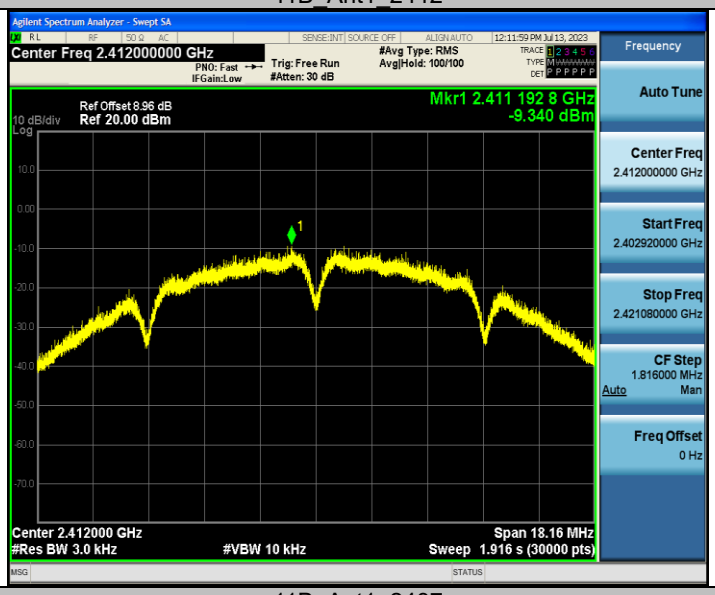
Appendix C: Maximum power spectral density

Test Result

Test Mode	Antenna	Frequency [MHz]	Result [dBm/3-100kHz]	Limit [dBm/3kHz]	Verdict
11B	Ant1	2412	-9.34	≤8.00	PASS
		2437	-9.28	≤8.00	PASS
		2462	-9.47	≤8.00	PASS
11G	Ant1	2412	-14.03	≤8.00	PASS
		2437	-13.82	≤8.00	PASS
		2462	-14.51	≤8.00	PASS
11N20SISO	Ant1	2412	-15.06	≤8.00	PASS
		2437	-14.84	≤8.00	PASS
		2462	-16.16	≤8.00	PASS
11N40SISO	Ant1	2422	-16.95	≤8.00	PASS
		2437	-17.24	≤8.00	PASS
		2452	-16.64	≤8.00	PASS

Test Graphs

11B_Ant1_2412



11B_Ant1_2437

11B_Ant1_2462