

TEST REPORT

FCC BT LE Test for SL600

APPLICANT
PASSTECH CO., LTD

REPORT NO.
HCT-RF-2108-FC040

DATE OF ISSUE
August 25, 2021

Tested by
Jin Gwan Lee



Technical Manager
Jong Seok Lee



HCT CO., LTD.
BongJai Huh
BongJai Huh / CEO



HCT Co., Ltd.

74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, 17383 KOREA
Tel. +82 31 634 6300 Fax. +82 31 645 6401

TEST REPORT

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SL600

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Additional Model

SL600E, SL600TWR, SL600ERW

Applicant

PASSTECH CO., LTD

B-402. 215 Galmachi-ro, Jungwon-gu, Seongnam-si, Gyeonggi-do, Rep. of Korea (Zip 13217)

**Eut Type
Model Name**

SLIM LOCK
SL600

FCC ID

W6YSL600

Max. RF Output Power

-6.312 dBm (0.234 mW)

Modulation type

GFSK

FCC Classification

Digital Transmission System(DTS)

FCC Rule Part(s)

Part 15.247

The result shown in this test report refer only to the sample(s) tested unless otherwise stated.

This test results were applied only to the test methods required by the standard.

REVISION HISTORY

The revision history for this test report is shown in table.

Revision No.	Date of Issue	Description
0	August 25, 2021	Initial Release

Engineering Statement:

The measurements shown in this report were made in accordance with the procedures indicated, and the emissions from this equipment were found to be within the limits applicable. I assume full responsibility for the accuracy and completeness of these measurements, and for the qualifications of all persons taking them. It is further stated that upon the basis of the measurements made, the equipment tested is capable of operation in accordance with the requirements of the FCC Rules under normal use and maintenance.

If this report is required to confirmation of authenticity, please contact to www.hct.co.kr

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1. EUT DESCRIPTION

Model	SL600	
Additional Model	SL600E, SL600TWR, SL600ERW	
EUT Type	SLIM LOCK	
Power Supply	6 V	
Frequency Range	2402 MHz - 2480 MHz	
Max. RF Output Power	Peak	1 MBit/s - 37 byte: -6.312 dBm (0.234 mW) 2 MBit/s - 37 byte: -6.556 dBm (0.221 mW) 125 kBit/s - 37 byte : -6.652 dBm (0.216 mW) 500 kBit/s - 37 byte: -6.474 dBm (0.225 mW)
	Average	1 MBit/s - 37 byte: -6.77 dBm (0.210 mW) 2 MBit/s - 37 byte: -6.81 dBm (0.209 mW) 125 kBit/s - 37 byte : -6.72 dBm (0.213 mW) 500 kBit/s - 37 byte: -6.73 dBm (0.212 mW)
Modulation Type	GFSK	
Bluetooth Version	5.0	
Number of Channels	40 Channels	
Antenna Specification	Antenna type: Multilayer Chip Antenna Peak Gain : 3.5 dBi	
Date(s) of Tests	August 10, 2021~ August 24, 2021	

2. TEST METHODOLOGY

FCC KDB 558074 D01 15.247 Meas Guidance v05r02 dated April 02, 2019 entitled “guidance for compliance measurements on digital transmission system, frequency hopping spread spectrum system, and hybrid system devices and the measurement procedure described in ANSI C63.10 (Version : 2013) ‘the American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices’.

EUT CONFIGURATION

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner that intends to maximize its emission characteristics in a continuous normal application.

EUT EXERCISE

The EUT was operated in the engineering mode to fix the Tx frequency that was for the purpose of the measurements. According to its specifications, the EUT must comply with the requirements of the Section 15.207, 15.209 and 15.247 under the FCC Rules Part 15 Subpart C.

GENERAL TEST PROCEDURES

Conducted Emissions

The EUT is placed on the turntable, which is 0.8 m above ground plane. According to the requirements in Section 6.2 of ANSI C63.10. (Version :2013) Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30 MHz using CISPR Quasi-peak and average detector modes.

Radiated Emissions

The EUT is placed on a turn table, which is 0.8 m above ground plane below 1 GHz. Above 1 GHz with 1.5 m using absorbers between the EUT and receive antenna. The turntable shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3 m away from the receiving antenna, which varied from 1 m to 4 m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the max. emission, the relative positions of this hand-held transmitter (EUT) was rotated through three orthogonal axes according to the requirements in Section 6.6.5 of ANSI C63.10. (Version: 2013)

DESCRIPTION OF TEST MODES

The EUT has been tested under operating condition. Test program used to control the EUT for staying in continuous transmitting and receiving mode is programmed.

3. INSTRUMENT CALIBRATION

The measuring equipment, which was utilized in performing the tests documented herein, has been calibrated in accordance with the manufacturer's recommendations for utilizing calibration equipment's, which is traceable to recognized national standards.

Especially, all antenna for measurement is calibrated in accordance with the requirements of C63.5 (Version : 2017).

4. FACILITIES AND ACCREDITATIONS

FACILITIES

The SAC(Semi-Anechoic Chamber) and conducted measurement facility used to collect the radiated data are located at the 74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, 17383, Rep. of KOREA.

The site is constructed in conformance with the requirements of ANSI C63.4. (Version :2014) and CISPR Publication 22.

Detailed description of test facility was submitted to the Commission and accepted dated April 02, 2018 (Registration Number: KR0032).

EQUIPMENT

Radiated emissions are measured with one or more of the following types of Linearly polarized antennas: tuned dipole, bi-conical, log periodic, bi-log, and/or ridged waveguide, horn. Spectrum analyzers with pre-selectors and quasi-peak detectors are used to perform radiated measurements. Conducted emissions are measured with Line Impedance Stabilization Networks and EMI Test Receivers. Calibrated wideband preamplifiers, coaxial cables, and coaxial attenuators are also used for making measurements.

All receiving equipment conforms to CISPR Publication 16-1, "Radio Interference Measuring Apparatus and Measurement Methods."

5. ANTENNA REQUIREMENTS

According to FCC 47 CFR § 15.203

“An intentional radiator antenna shall be designed to ensure that no antenna other than that furnished by the responsible party can be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section.”

- (1) The antennas of this E.U.T are permanently attached.
- (2) The E.U.T Complies with the requirement of § 15.203

6. MEASUREMENT UNCERTAINTY

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI C63.10-2013.

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

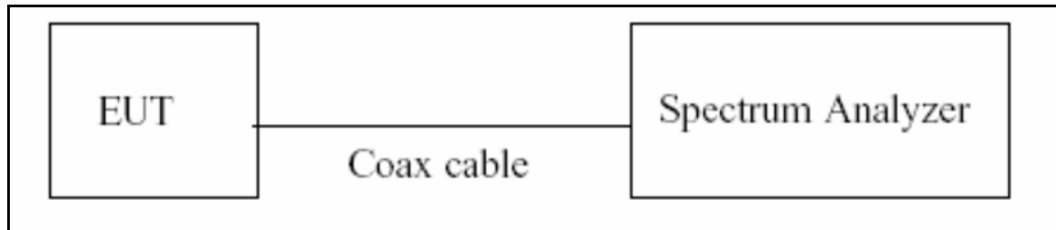
The measurement data shown herein meets or exceeds the U_{CISPR} measurement uncertainty values specified in CISPR 16-4-2 and, thus, can be compared directly to specified limits to determine compliance.

Parameter	Expanded Uncertainty (dB)
Conducted Disturbance (150 kHz ~ 30 MHz)	1.82 (Confidence level about 95 %, $k=2$)
Radiated Disturbance (9 kHz ~ 30 MHz)	3.40 (Confidence level about 95 %, $k=2$)
Radiated Disturbance (30 MHz ~ 1 GHz)	4.80 (Confidence level about 95 %, $k=2$)
Radiated Disturbance (1 GHz ~ 18 GHz)	5.70 (Confidence level about 95 %, $k=2$)
Radiated Disturbance (18 GHz ~ 40 GHz)	5.05 (Confidence level about 95 %, $k=2$)

7. DESCRIPTION OF TESTS

7.1. Duty Cycle

Test Configuration



Test Procedure

The transmitter output is connected to the Spectrum Analyzer.

We tested according to the zero-span measurement method, 6.0)b) in KDB 558074 v05r02.

The largest available value of RBW is 8 MHz and VBW is 50 MHz.

The zero-span method of measuring duty cycle shall not be used if $T \leq 6.25$ microseconds. $(50/6.25 = 8)$

The zero-span method was used because all measured T data are > 6.25 microseconds and both RBW and VBW are $> 50/T$.

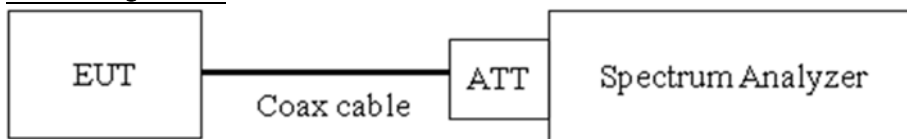
1. RBW = 8 MHz (the largest available value)
2. VBW = 8 MHz ($\geq$ RBW)
3. SPAN = 0 Hz
4. Detector = Peak
5. Number of points in sweep > 100
6. Trace mode = Clear write
7. Measure T_{total} and T_{on}
8. Calculate Duty Cycle = T_{on}/T_{total} and Duty Cycle Factor = $10\log(1/\text{Duty Cycle})$

7.2. 6 dB Bandwidth

Limit

The minimum permissible 6 dB bandwidth is 500 kHz.

Test Configuration



Test Procedure

The transmitter output is connected to the Spectrum Analyzer.

The Spectrum Analyzer is set to (Procedure 8.2 in KDB 558074 v05r02, Procedure 11.8.1 in ANSI 63.10-2013)

- 1) RBW = 100 kHz
- 2) VBW $\geq 3 \times$ RBW
- 3) Detector = Peak
- 4) Trace mode = max hold
- 5) Sweep = auto couple
- 6) Allow the trace to stabilize
- 7) We tested 6 dB bandwidth using the automatic bandwidth measurement capability of a spectrum analyzer. X dB is set 6 dB.

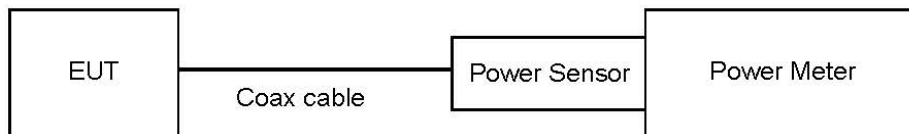
Note : We tested OBW using the automatic bandwidth measurement capability of a spectrum analyzer.

7.3. Output Power

Limit

The maximum permissible conducted output power is 1 Watt.

Test Configuration



Test Procedure

The transmitter output is connected to the Power Meter.

- Peak Power (Procedure 11.9.1.3 in ANSI 63.10-2013)
: Measure the peak power of the transmitter.

- Average Power (Procedure 8.3.2.3 in KDB 558074 v05r02, Procedure 11.9.2.3 in ANSI 63.10-2013)
 - 1) Measure the duty cycle.
 - 2) Measure the average power of the transmitter. This measurement is an average over both the on and off periods of the transmitter.
 - 3) Add $10 \log(1/x)$, where x is the duty cycle, to the measured power in order to compute the average power during the actual transmission times.

Sample Calculation

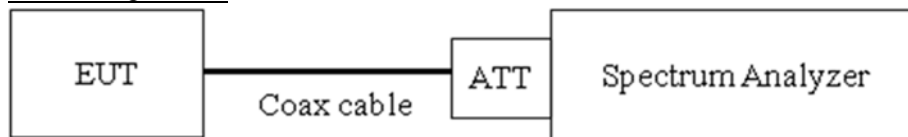
- Conducted Output Power(Peak) = Reading Value + ATT loss + Cable loss
- Conducted Output Power(Average) = Reading Value + ATT loss + Cable loss + Duty Cycle Factor

7.4. Power Spectral Density

Limit

The transmitter power density average over 1-second interval shall not be greater than 8dBm in any 3 kHz BW.

Test Configuration



Test Procedure

The transmitter output is connected to the Spectrum Analyzer.

We tested according to Procedure 8.4 in KDB 558074 v05r02, Procedure 11.10 in ANSI 63.10-2013.

The spectrum analyzer is set to :

- 1) Set analyzer center frequency to DTS channel center frequency.
- 2) Set span to at least 1.5 times the OBW.
- 3) $RBW = 3 \text{ kHz} \leq RBW \leq 100 \text{ kHz}$.
- 4) $VBW \geq 3 \times RBW$.
- 5) Sweep = auto couple
- 6) Detector = Peak
- 7) Trace mode = max hold
- 8) Allow trace to fully stabilize.
- 9) Use the peak marker function to determine the maximum amplitude level.
- 10) Use the peak marker function to determine the maximum amplitude level within the RBW.

If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

Sample Calculation

- Power Spectral Density = Reading Value + ATT loss + Cable loss

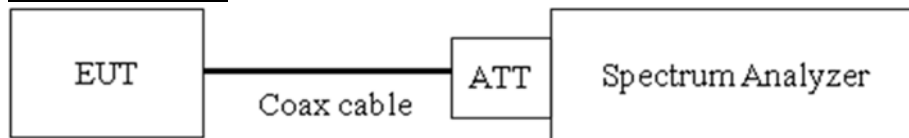
7.5. Conducted Band Edge(Out of Band Emissions) & Conducted Spurious Emissions

Limit

The maximum conducted (peak) output power was used to demonstrate compliance, then the peak power in any 100 kHz bandwidth outside of the authorized frequency band shall be attenuated by at least 20dBc relative to the maximum in-band peak PSD level in 100 kHz.

[Conducted > 20dBc]

Test Configuration



Test Procedure

The transmitter output is connected to the spectrum analyzer.

(Procedure 8.5 in KDB 558074 v05r02, Procedure 11.11 in ANSI 63.10-2013)

- 1) RBW = 100 kHz
- 2) VBW $\geq 3 \times$ RBW
- 3) Set span to encompass the spectrum to be examined
- 4) Detector = Peak
- 5) Trace Mode = max hold
- 6) Sweep time = auto couple
- 7) Ensure that the number of measurement points $\geq 2 \times$ Span/VBW
- 8) Allow trace to fully stabilize.
- 9) Use peak marker function to determine the maximum amplitude level.

Measurements are made over the 30 MHz to 25 GHz range with the transmitter set to the lowest, middle, and highest channels.

Factors for frequency

Freq(MHz)	Factor(dB)
30	11.05
100	11.10
200	11.14
300	11.19
400	11.25
500	11.25
600	11.26
700	11.27
800	11.28
900	11.30
1 000	11.35
2 000	11.50
2 400	11.53
2 412	11.55
2 437	11.55
2 462	11.55
2 500	11.54
3 000	11.64
4 000	11.72
5 000	11.79
5 700	11.80
5 800	11.87
6 000	11.88
7 000	12.01
8 000	12.01
9 000	12.09
10 000	12.19
11 000	12.28
12 000	12.37
13 000	12.38
14 000	12.41
15 000	12.51
16 000	12.59
17 000	12.80
18 000	12.93
19 000	12.85
20 000	12.52
21 000	12.65
22 000	12.64
23 000	12.65
24 000	12.66
25 000	12.76

Note : 1. 2 400 ~ 2 500 MHz is fundamental frequency range.

2. Factor = Attenuator loss(10 dB) + Cable loss + EUT Cable loss

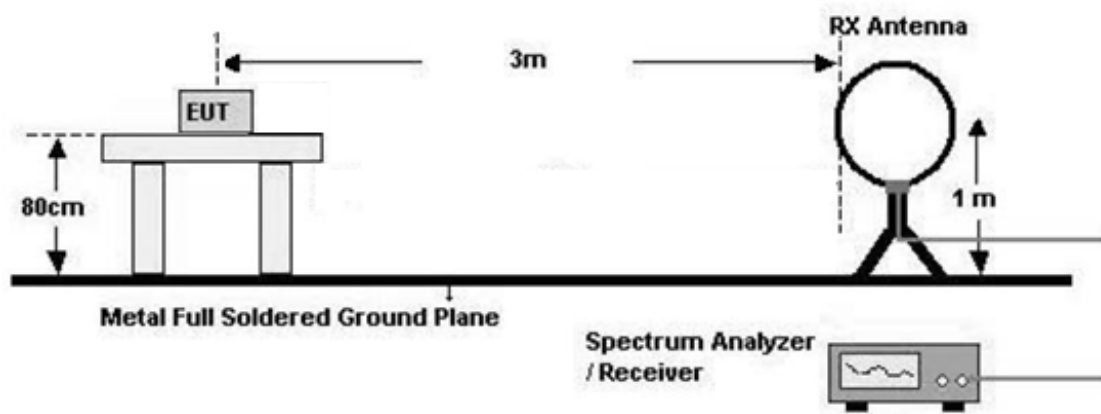
7.6. Radiated Test

Limit

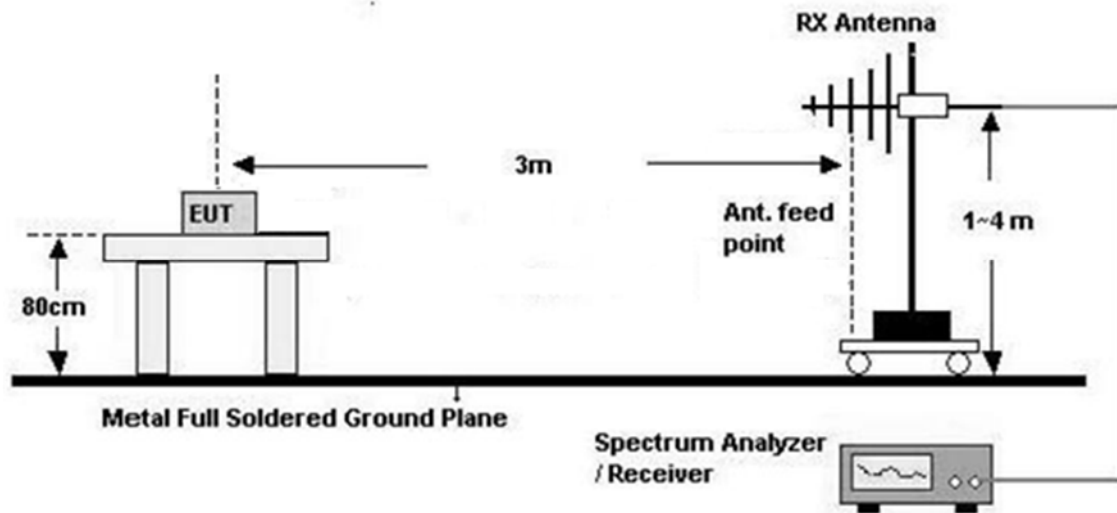
Frequency (MHz)	Field Strength ($\mu\text{V/m}$)	Measurement Distance (m)
0.009 – 0.490	$2400/F(\text{kHz})$	300
0.490 – 1.705	$24000/F(\text{kHz})$	30
1.705 – 30	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

Test Configuration

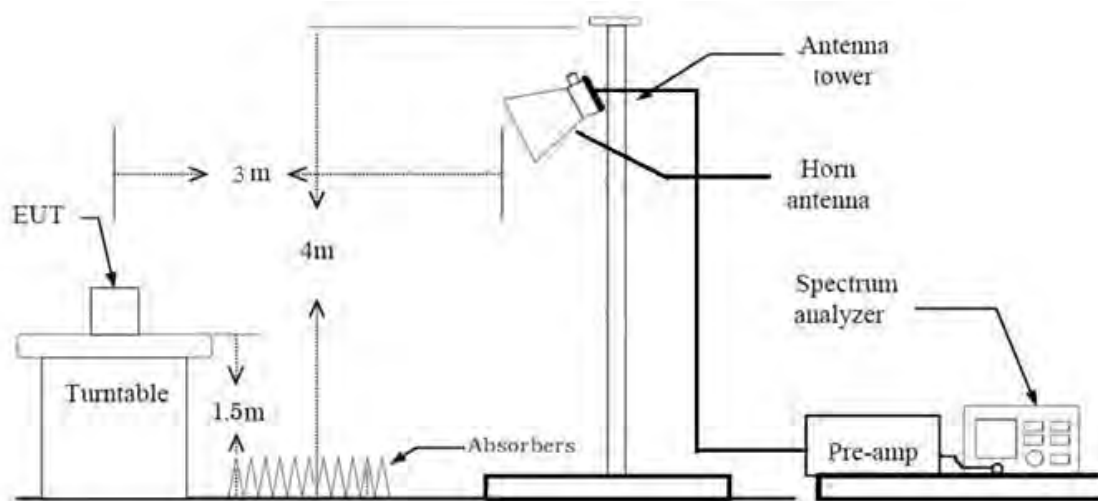
Below 30 MHz



30 MHz - 1 GHz



Above 1 GHz



Test Procedure of Radiated spurious emissions(Below 30 MHz)

1. The EUT was placed on a non-conductive table located on semi-anechoic chamber.
2. The loop antenna was placed at a location 3 m from the EUT
3. The EUT is placed on a turntable, which is 0.8 m above ground plane.
4. We have done x, y, z planes in EUT and horizontal and vertical polarization and Parallel to the ground plane in detecting antenna.
5. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
6. Distance Correction Factor(0.009 MHz – 0.490 MHz) = $40\log(3\text{ m}/300\text{ m}) = -80\text{ dB}$
Measurement Distance : 3 m
7. Distance Correction Factor(0.490 MHz – 30 MHz) = $40\log(3\text{ m}/30\text{ m}) = -40\text{ dB}$
Measurement Distance : 3 m
8. Spectrum Setting
 - Frequency Range = 9 kHz ~ 30 MHz
 - Detector = Peak
 - Trace = Maxhold
 - RBW = 9 kHz
 - VBW $\geq 3 \times$ RBW
9. Total = Reading Value + Antenna Factor(A.F) + Cable Loss(C.L) + Distance Factor(D.F)
10. Measurement value only up to 6 maximum emissions noted, or would be lesser if no specific emissions from the EUT are recorded (ie: margin > 20 dB from the applicable limit) and considered that's already beyond the background noise floor.

KDB 414788 OFS and Chamber Correlation Justification

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.

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

Test Procedure of Radiated spurious emissions (Above 1 GHz)

1. The EUT is placed on a turntable, which is 1.5 m above ground plane.
2. We have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna.
3. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
4. EUT is set 3 m away from the receiving antenna, which is varied from 1 m to 4 m to find out the highest emissions.
5. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
6. Each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
7. The unit was tested with its standard battery.
8. Spectrum Setting (Method 8.6 in KDB 558074 v05r02, Procedure 11.12 in ANSI 63.10-2013)
 - (1) Measurement Type(Peak):
 - Measured Frequency Range : 1 GHz – 25 GHz
 - Detector = Peak
 - Trace = Max hold
 - RBW = 1 MHz
 - VBW $\geq 3 \times$ RBW
 - (2) Measurement Type(Average):
 - Duty cycle < 98 %, duty cycle variations are less than ± 2 %
 - Measured Frequency Range : 1 GHz – 25 GHz
 - Detector = RMS
 - Averaging type = power (*i.e.*, RMS)
 - RBW = 1 MHz
 - VBW $\geq 3 \times$ RBW
 - Sweep time = auto.
 - Trace mode = average (at least 100 traces).
 - Correction factor shall be added to the measurement results prior to comparing to the emission limit in order to compute the emission level that would have been measured had the test been performed at 100 percent duty cycle.
- Duty Cycle Factor (dB) : Please refer to the please refer to section 9.1
9. Measurement value only up to 6 maximum emissions noted, or would be lesser if no specific emissions from the EUT are recorded (ie: margin > 20 dB from the applicable limit) and considered that's already beyond the background noise floor.
10. Distance extrapolation factor = $20 \log (\text{test distance} / \text{specific distance})$ (dB)

11. Total (Measurement Type : Peak)

= Peak Reading Value + Antenna Factor(A.F) + Cable Loss(C.L) - Amp Gain(G) + Distance

Factor(D.F)

Total (Measurement Type : Average)

= Average Reading Value + Antenna Factor(A.F) + Cable Loss(C.L) - Amp Gain(G)

+ Distance Factor(D.F) + Duty Cycle Factor

Test Procedure of Radiated Restricted Band Edge

1. The EUT is placed on a turntable, which is 1.5 m above ground plane.
2. We have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna.
3. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
4. EUT is set 3 m away from the receiving antenna, which is varied from 1 m to 4 m to find out the highest emissions.
5. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
6. Each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
7. The unit was tested with its standard battery.
8. Spectrum Setting

(1) Measurement Type(Peak):

- Measured Frequency Range : 2310 MHz ~ 2390 MHz/ 2483.5 MHz ~ 2500 MHz
- Detector = Peak
- Trace = Max hold
- RBW = 1 MHz
- VBW $\geq 3 \times$ RBW

(2) Measurement Type(Average):

- Duty cycle < 98 %, duty cycle variations are less than ± 2 %
- Measured Frequency Range : 2310 MHz ~ 2390 MHz/ 2483.5 MHz ~ 2500 MHz
- Detector = RMS
- Averaging type = power (*i.e.*, RMS)
- RBW = 1 MHz
- VBW $\geq 3 \times$ RBW
- Sweep time = auto.
- Trace mode = average (at least 100 traces).
- Correction factor shall be added to the measurement results prior to comparing to the

emission limit in order to compute the emission level that would have been measured had the test been performed at 100 percent duty cycle.

- Duty Cycle Factor (dB) : Please refer to the please refer to section 9.1.

9. Measurement value only up to 6 maximum emissions noted, or would be lesser if no specific emissions from the EUT are recorded (ie: margin > 20 dB from the applicable limit) and considered that's already beyond the background noise floor.

10. Distance extrapolation factor = $20\log(\text{test distance} / \text{specific distance})$ (dB)

11. Total(Measurement Type : Peak

= Peak Reading Value + Antenna Factor(A.F) + Cable Loss(C.L) + Distance Factor(D.F)

Total(Measurement Type : Average)

= Average Reading Value + Antenna Factor(A.F) + Cable Loss(C.L) + Distance Factor(D.F)

+ Duty Cycle Factor

7.7. Worst case configuration and mode

Radiated Test

1. All modes of operation were investigated and the worst case configuration results are reported.

- Mode : Stand alone
- Worstcase : Stand alone

2. EUT Axis:

- Radiated Spurious Emissions : X
- Radiated Restricted Band Edge : X

3. All packet length of operation were investigated and the test results are worst case in lowest packet length.

- Worst case : 1 MBit/s 37Bytes (LE Data Packet Length Extension : Not Supported)

4. All position of loop antenna were investigated and the test result is a no critical peak found at all positions.

- Position : Horizontal, Vertical, Parallel to the ground plane

5. SL600, SL600E were tested and the worst case results are reported.

- Worst case : SL600

AC Power line Conducted Emissions

1. We don't perform powerline conducted emission test. Because this EUT is used DC.

Conducted test

1. The EUT was configured with packet length of highest power.

- EUT supported All mode was tested.
- B.E (Worst case : 1M Bit & 2M 37Bytes)
- C.S.E (Worst case : 1M Bit 37Bytes)

2. SL600, SL600E were tested and the worst case results are reported.

- Worst case : SL600

8. SUMMARY TEST OF RESULTS

FCC Part

Test Description	FCC Part Section(s)	Test Limit	Test Condition	Test Result
6 dB Bandwidth	§ 15.247(a)(2)	> 500 kHz	Conducted	PASS
Conducted Maximum Output Power	§ 15.247(b)(3)	< 1 Watt		PASS
Power Spectral Density	§ 15.247(e)	< 8 dBm / 3 kHz Band		PASS
Band Edge (Out of Band Emissions)	§ 15.247(d)	Conducted > 20 dBc		PASS
AC Power line Conducted Emissions	§ 15.207	cf. Section 7.7		N/A(#Note1)
Radiated Spurious Emissions	§ 15.247(d), 15.205, 15.209	cf. Section 7.6	Radiated	PASS
Radiated Restricted Band Edge	§ 15.247(d), 15.205, 15.209	cf. Section 7.6		PASS

#Note1 : Not Tested

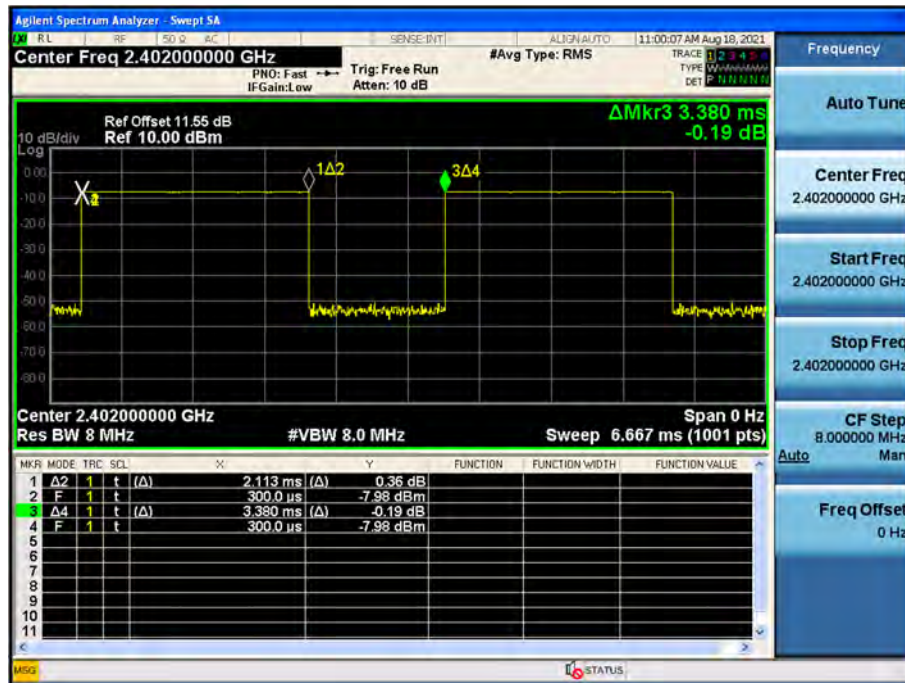
9. TEST RESULT

9.1 DUTY CYCLE

Data rate (Bit/s)	Packet length (Byte)	T _{on} (ms)	T _{total} (ms)	Duty Cycle	Duty Cycle Factor (dB)
1M	37	2.113	3.380	0.6252	2.04
2M	37	1.067	3.273	0.3259	4.87
125k	37	8.790	10.200	0.8618	0.65
500k	37	2.500	3.760	0.6649	1.77

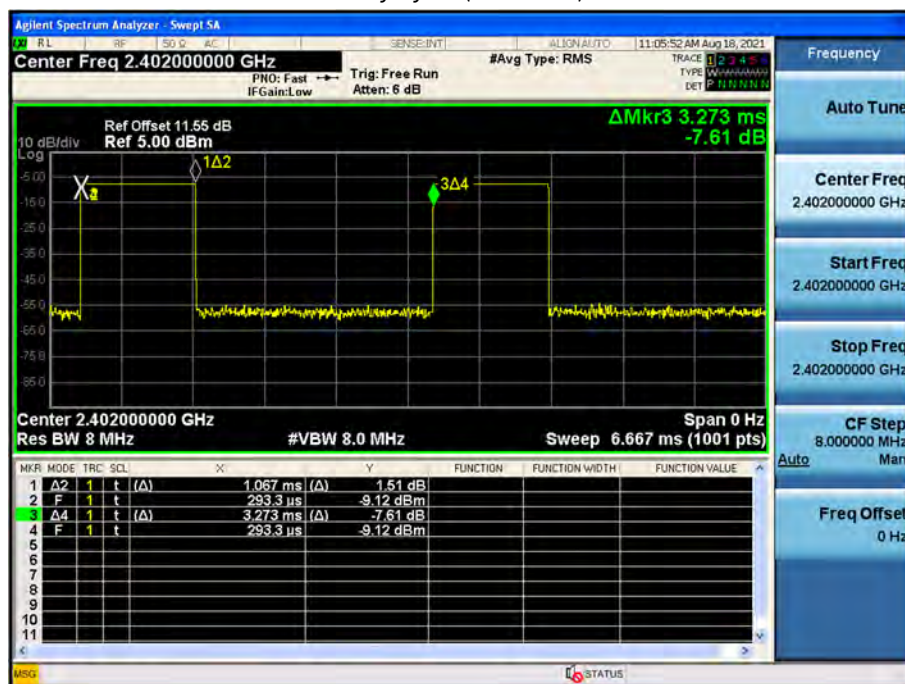
1 MBit/s(37 Byte) Test Plots

Duty Cycle (Low-CH 0)



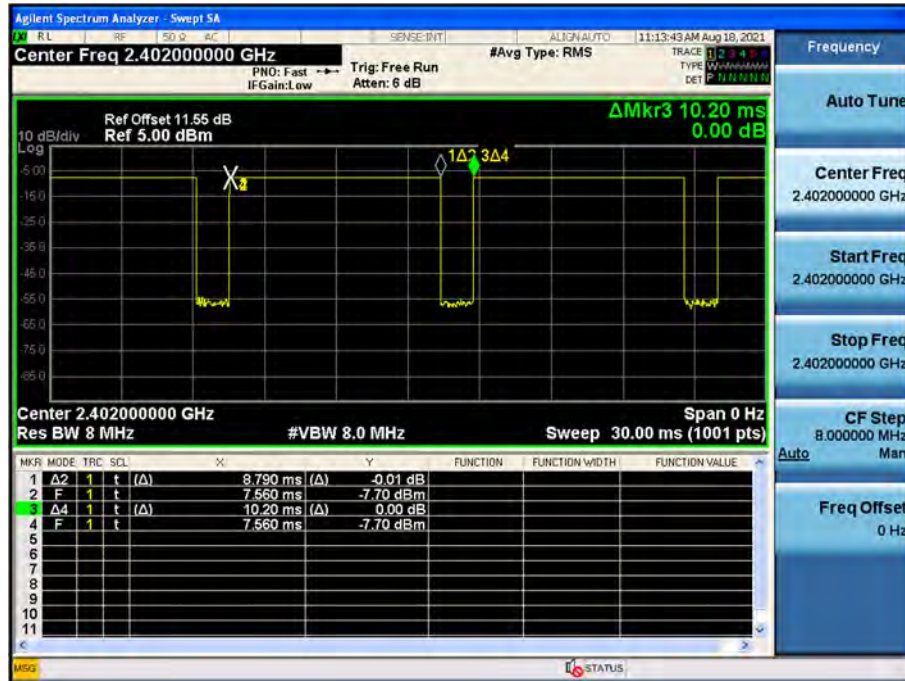
2 MBit/s(37 Byte) Test Plots

Duty Cycle (Low-CH 0)



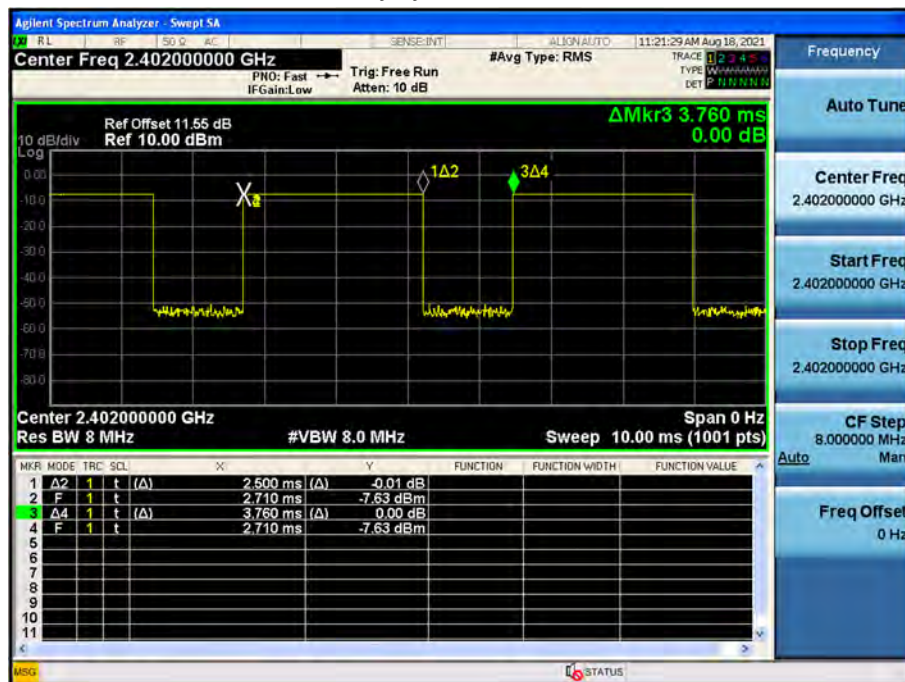
125 kBit/s(37 Byte) Test Plots

Duty Cycle (Low-CH 0)



500 kBit/s(37 Byte) Test Plots

Duty Cycle (Low-CH 0)



9.2 6 dB BANDWIDTH

Mode (Bit/s)	Channel	6 dB Bandwidth (kHz)	Limit (kHz)
1M 37 Byte	0	706.6	> 500
	19	704.1	
	39	712.9	
2M 37 Byte	0	1120.8	> 500
	19	1190.3	
	39	1176.3	
125k 37 Byte	0	619.9	> 500
	19	631.3	
	39	620.5	
500k 37 Byte	0	686.6	> 500
	19	716.0	
	39	698.9	

1 MBit/s(37 Byte) Test Plots

6 dB Bandwidth plot (Low-CH 0)



6 dB Bandwidth plot (Mid-CH 19)



6 dB Bandwidth plot (High-CH 39)



2 MBit/s(37 Byte) Test Plots

6 dB Bandwidth plot (Low-CH 0)



6 dB Bandwidth plot (Mid-CH 19)



6 dB Bandwidth plot (High-CH 39)



125 kBit/s(37 Byte) Test Plots

6 dB Bandwidth plot (Low-CH 0)



6 dB Bandwidth plot (Mid-CH 19)



6 dB Bandwidth plot (High-CH 39)



500 kBit/s(37 Byte) Test Plots

6 dB Bandwidth plot (Low-CH 0)



6 dB Bandwidth plot (Mid-CH 19)



6 dB Bandwidth plot (High-CH 39)



9.3 OUTPUT POWER

Peak Power

- SL600

Data rate (Bit/s)	Packet length (Byte)	LE Mode		Measured Power(dBm)	Limit (dBm)	PLS
		Frequency [MHz]	Channel			
1M	37	2402	0	-7.663	30	-4
		2440	19	-6.312		
		2480	39	-6.859		
2M	37	2402	0	-7.644		
		2440	19	-6.556		
		2480	39	-6.810		
125k	37	2402	0	-7.743		
		2440	19	-6.652		
		2480	39	-7.161		
500k	37	2402	0	-7.617		
		2440	19	-6.474		
		2480	39	-7.061		

- SL600E

Data rate (Bit/s)	Packet length (Byte)	LE Mode		Measured Power(dBm)	Limit (dBm)	PLS
		Frequency [MHz]	Channel			
1M	37	2402	0	-8.732	30	-8
		2440	19	-8.647		
		2480	39	-8.359		
2M	37	2402	0	-8.700		
		2440	19	-8.642		
		2480	39	-8.339		
125k	37	2402	0	-8.718		
		2440	19	-8.625		
		2480	39	-8.366		
500k	37	2402	0	-8.584		
		2440	19	-8.549		
		2480	39	-8.449		

Average Power

- SL600

Data rate	Packet length	LE Mode		Measure d Power (dBm)	Duty Cycle Facto r	Result	Limit (dBm)	PL S
(Bit/s)	(Byte)	Frequenc y [MHz]	Channe l		(dB)	(dBm)		
1M	37	2402	0	-9.85	2.04	-7.81	30	-4
		2440	19	-8.81	2.04	-6.77		
		2480	39	-9.14	2.04	-7.10		
2M	37	2402	0	-12.62	4.87	-7.75		
		2440	19	-11.68	4.87	-6.81		
		2480	39	-11.85	4.87	-6.98		
125k	37	2402	0	-8.40	0.65	-7.75		
		2440	19	-7.37	0.65	-6.72		
		2480	39	-7.82	0.65	-7.17		
500k	37	2402	0	-9.52	1.77	-7.75		
		2440	19	-8.50	1.77	-6.73		
		2480	39	-9.09	1.77	-7.32		

- SL600E

Data rate	Packet length	LE Mode		Measure d Power (dBm)	Duty Cycle Factor	Result	Limit (dBm)	PL S
(Bit/s)	(Byte)	Frequenc y [MHz]	Channe l		(dB)	(dBm)		
1M	37	2402	0	-11.07	2.04	-9.03	30	-8
		2440	19	-10.87	2.04	-8.83		
		2480	39	-10.57	2.04	-8.53		
2M	37	2402	0	-13.77	4.87	-8.90		
		2440	19	-13.59	4.87	-8.72		
		2480	39	-13.52	4.87	-8.65		
125k	37	2402	0	-9.43	0.65	-8.78		
		2440	19	-9.34	0.65	-8.69		
		2480	39	-9.18	0.65	-8.53		
500k	37	2402	0	-10.49	1.77	-8.72		
		2440	19	-10.45	1.77	-8.68		
		2480	39	-10.38	1.77	-8.61		

Note :

1. Power meter offset = Attenuator loss + Cable loss + EUT Cable Loss
2. We apply to the offset in the 2.4 GHz range that was rounded off to the closest tenth dB.
So, 11.55 dB is offset for 2.4 GHz Band.

9.4 POWER SPECTRAL DENSITY

Frequency (MHz)	Channel No.	Mode (Bit/s)	Test Result	
			Measured Power(dBm)	Limit (dBm)
2402	0	1M 37 Byte	-20.807	8
2440	19		-20.213	
2480	39		-18.162	
2402	0	2M 37 Byte	-22.282	
2440	19		-22.778	
2480	39		-23.082	
2402	0	125k 37 Byte	-13.794	
2440	19		-12.684	
2480	39		-13.161	
2402	0	500k 37 Byte	-13.758	
2440	19		-12.686	
2480	39		-13.149	

Note :

1. Spectrum reading values are not plot data.

The PSD results in plot is already including the actual values of loss for the attenuator and cable combination.

2. Spectrum offset = Attenuator loss + Cable loss + EUT Cable loss

3. We apply to the offset in the 2.4 GHz range that was rounded off to the closest tenth dB.

So, 11.55 dB is offset for 2.4 GHz Band.

1 MBit/s (37 Byte) Test Plots

Power Spectral Density (Low-CH 0)



Power Spectral Density (Mid-CH 19)



Power Spectral Density (High-CH 39)



2 MBit/s (37 Byte) Test Plots

Power Spectral Density (Low-CH 0)



Power Spectral Density (Mid-CH 19)



Power Spectral Density (High-CH 39)



125 kBit/s (37 Byte) Test Plots

Power Spectral Density (Low-CH 0)



Power Spectral Density (Mid-CH 19)



Power Spectral Density (High-CH 39)



500 kBit/s (37 Byte) Test Plots

Power Spectral Density (Low-CH 0)



Power Spectral Density (Mid-CH 19)



Power Spectral Density (High-CH 39)



9.5 BAND EDGE/ CONDUCTED SPURIOUS EMISSIONS

Test Result : please refer to the plot below.

In order to simplify the report, attached plots were only the worst case channel and data rate.

2 MBit/s (37 Byte) Test Plots -BandEdge

Low-CH 0



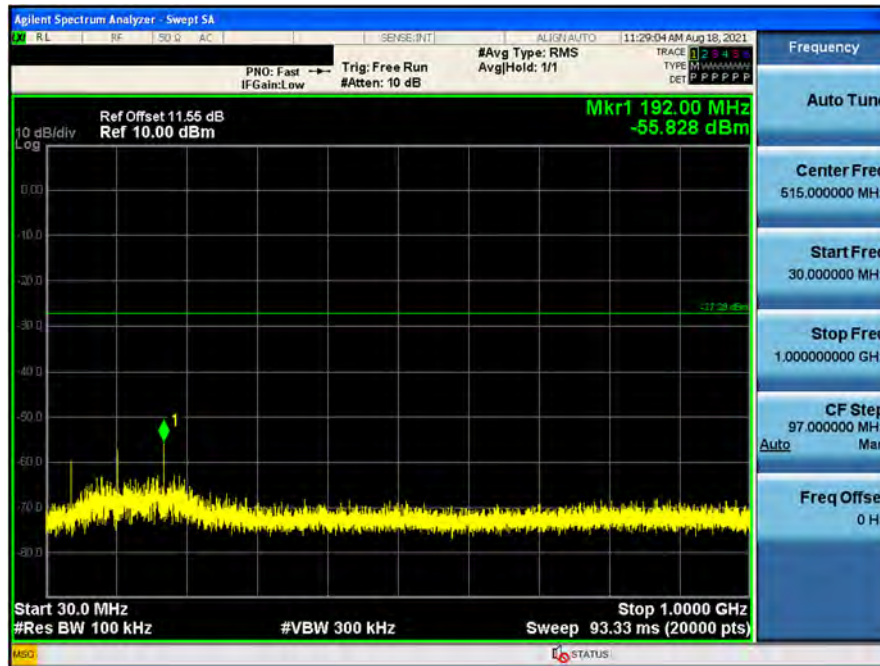
High-CH 39



1 MBit/s (37 Byte) Test Plots -Conducted Spurious Emission

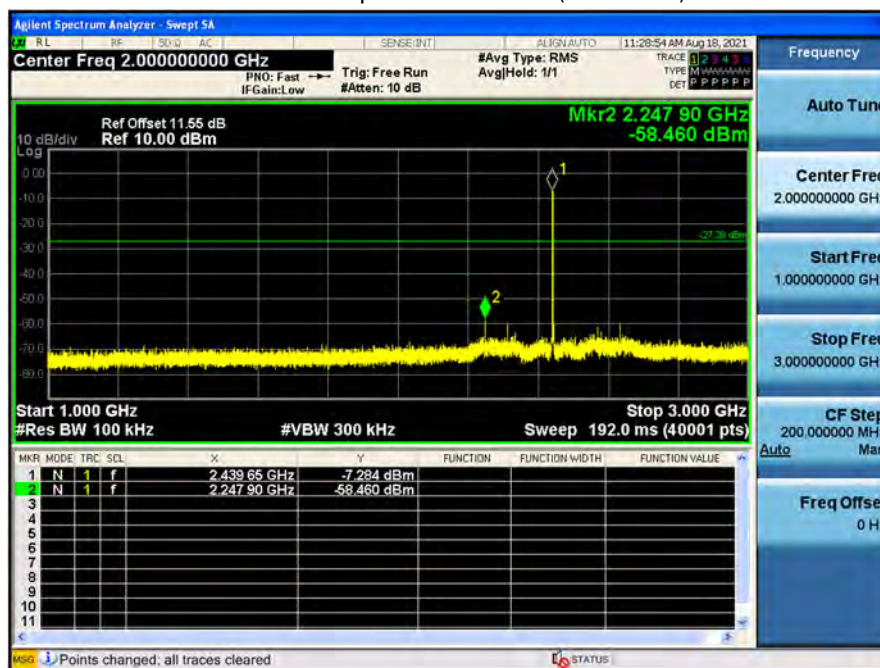
30 MHz ~ 1 GHz

Conducted Spurious Emission (Mid-CH 19)



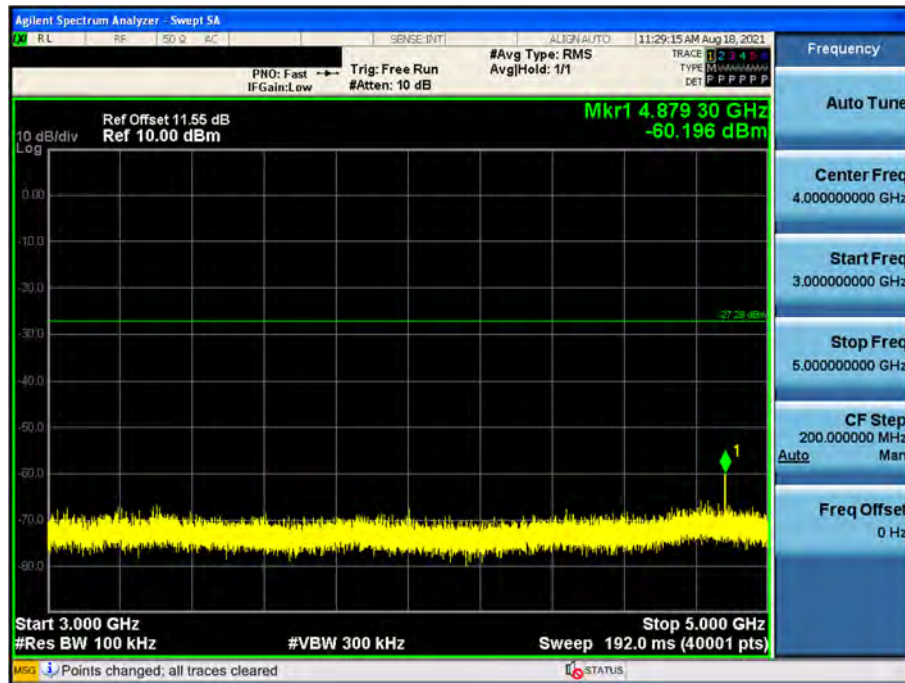
1 GHz ~ 3 GHz

Conducted Spurious Emission (Mid-CH 19)



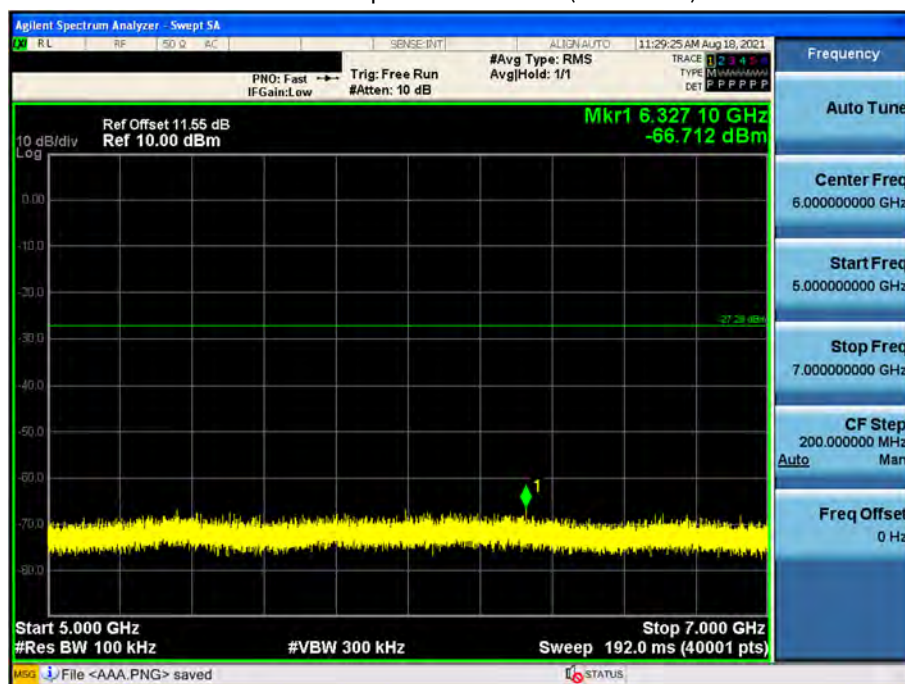
3 GHz ~ 5 GHz

Conducted Spurious Emission (Mid-CH 19)



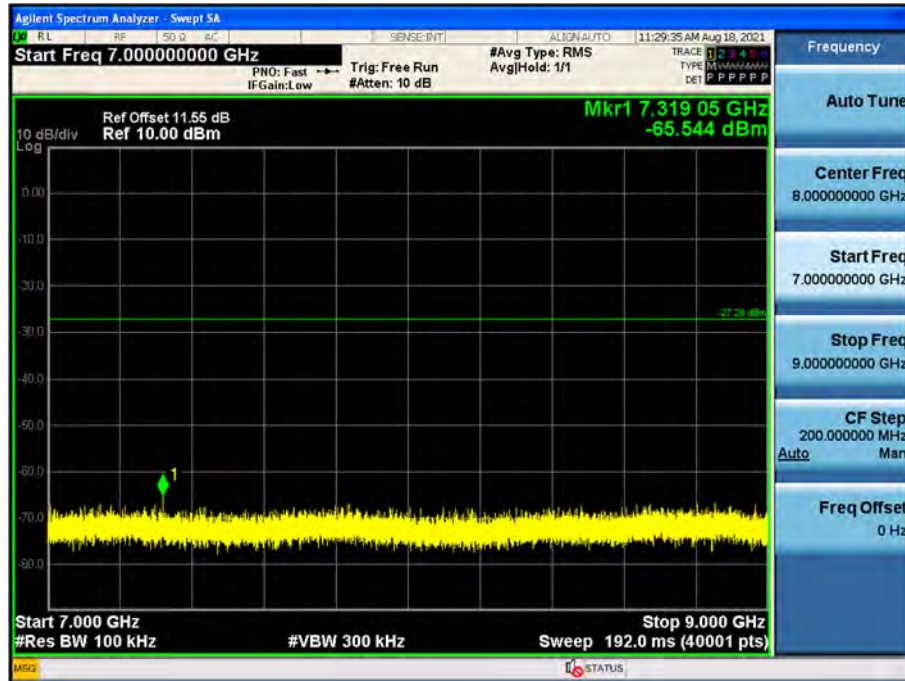
5 GHz ~ 7 GHz

Conducted Spurious Emission (Mid-CH 19)



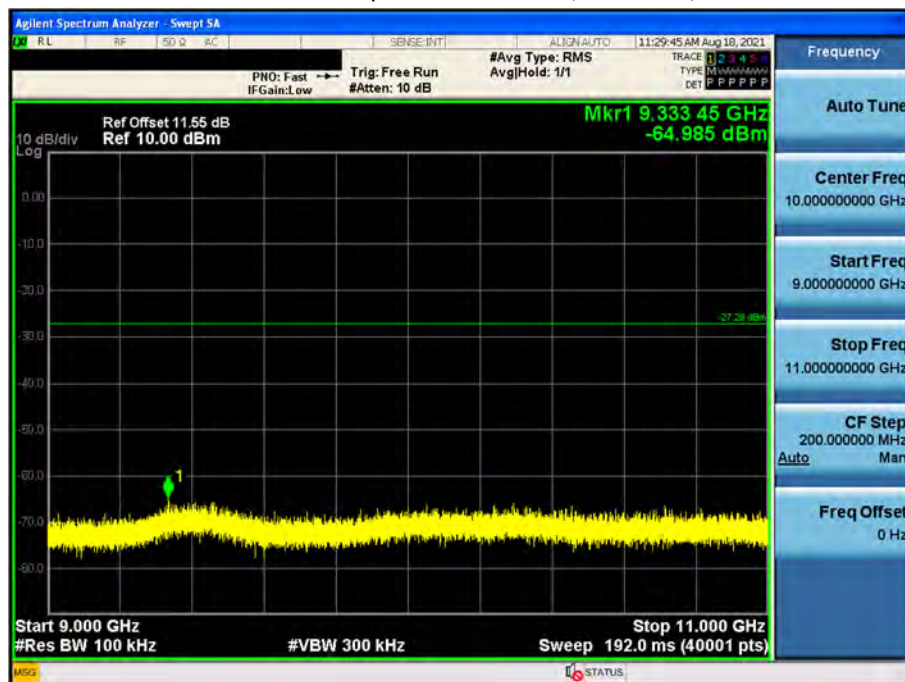
7 GHz ~ 9 GHz

Conducted Spurious Emission (Mid-CH 19)



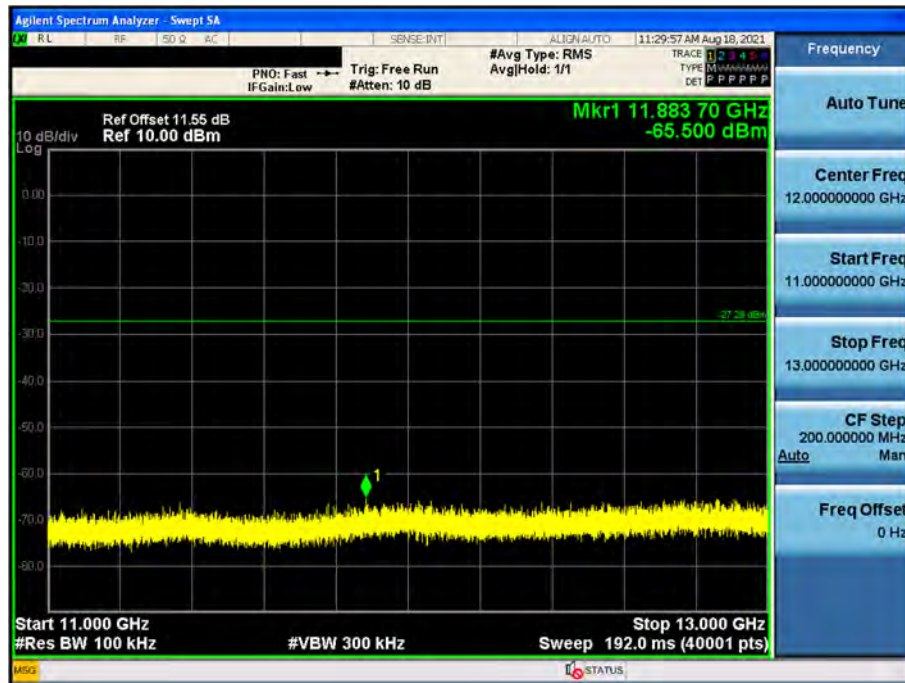
9 GHz ~ 11 GHz

Conducted Spurious Emission (Mid-CH 19)



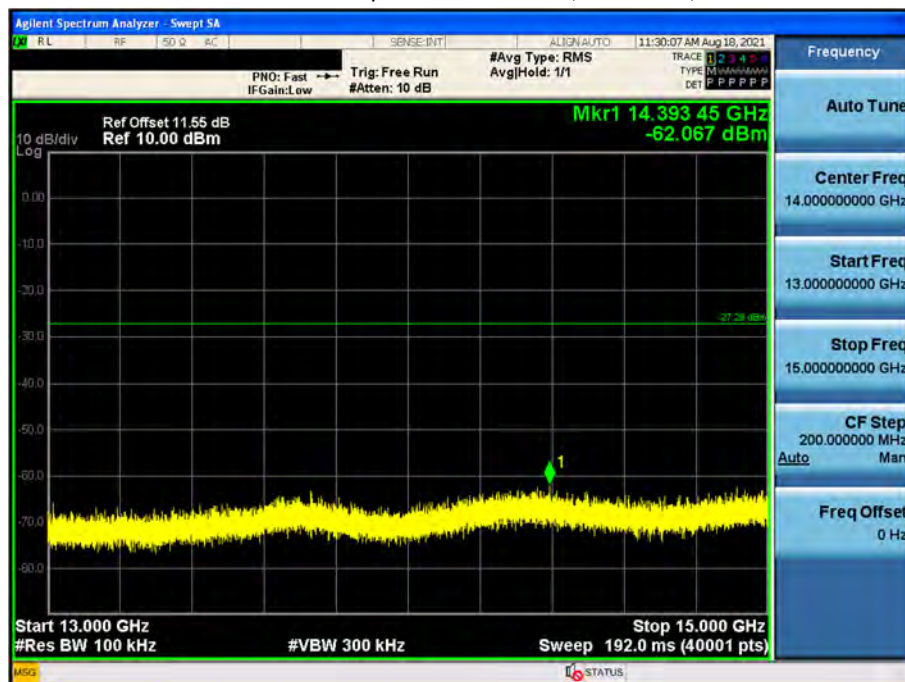
11 GHz ~ 13 GHz

Conducted Spurious Emission (Mid-CH 19)



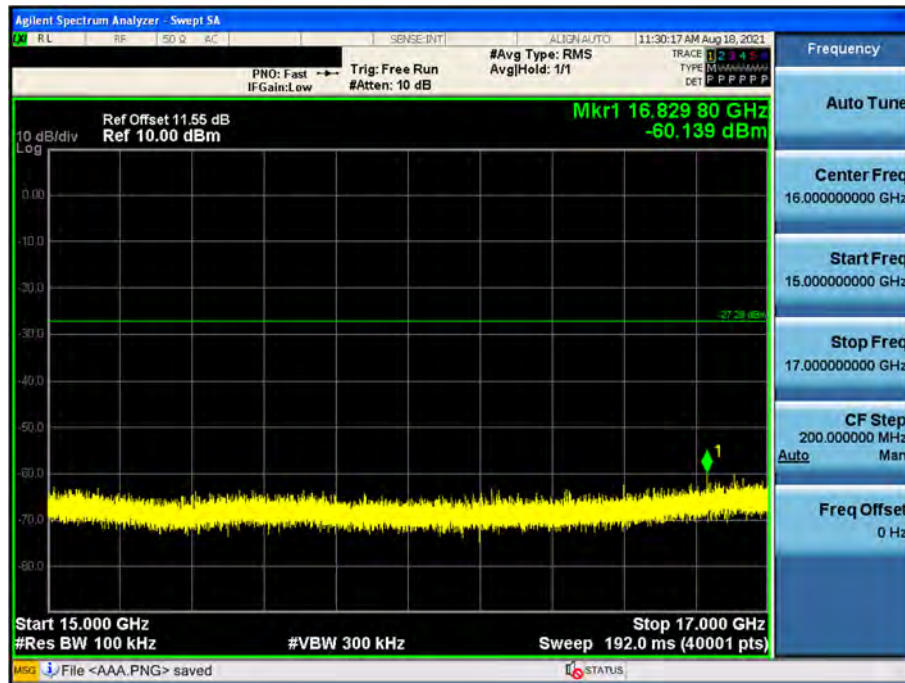
13 GHz ~ 15 GHz

Conducted Spurious Emission (Mid-CH 19)



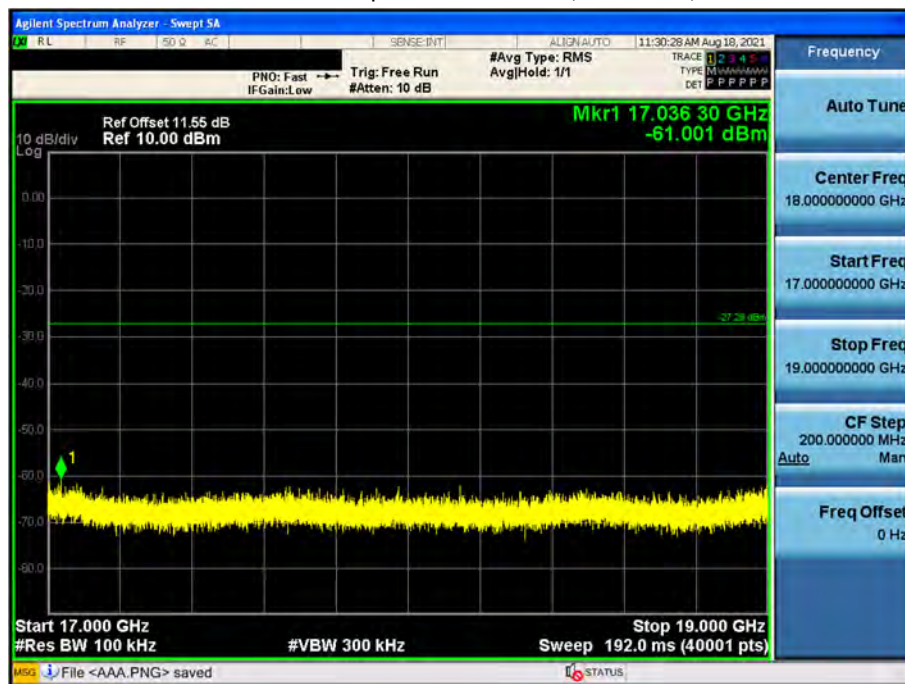
15 GHz ~ 17 GHz

Conducted Spurious Emission (Mid-CH 19)



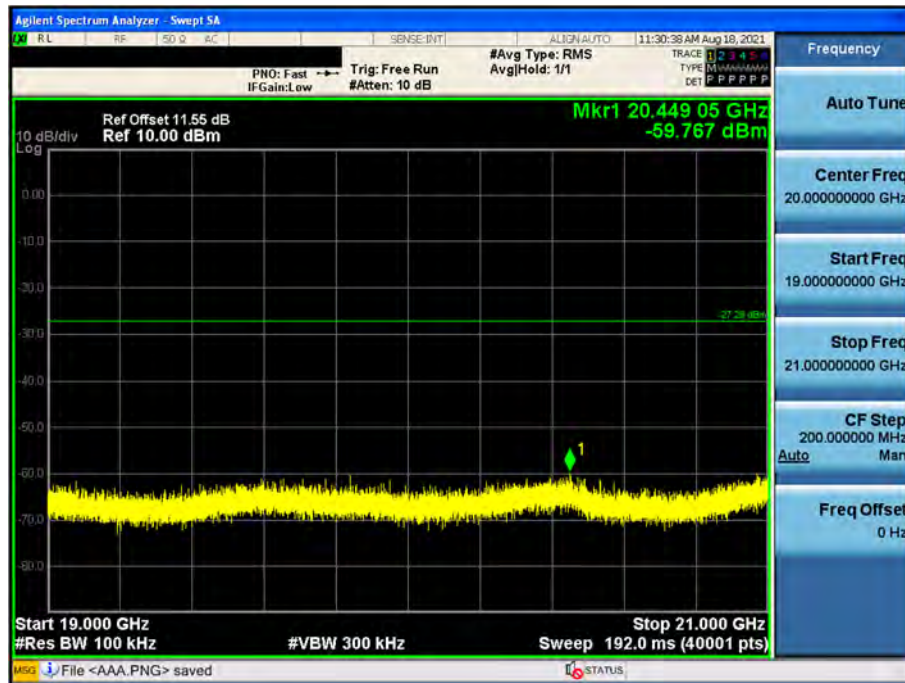
17 GHz ~ 19 GHz

Conducted Spurious Emission (Mid-CH 19)



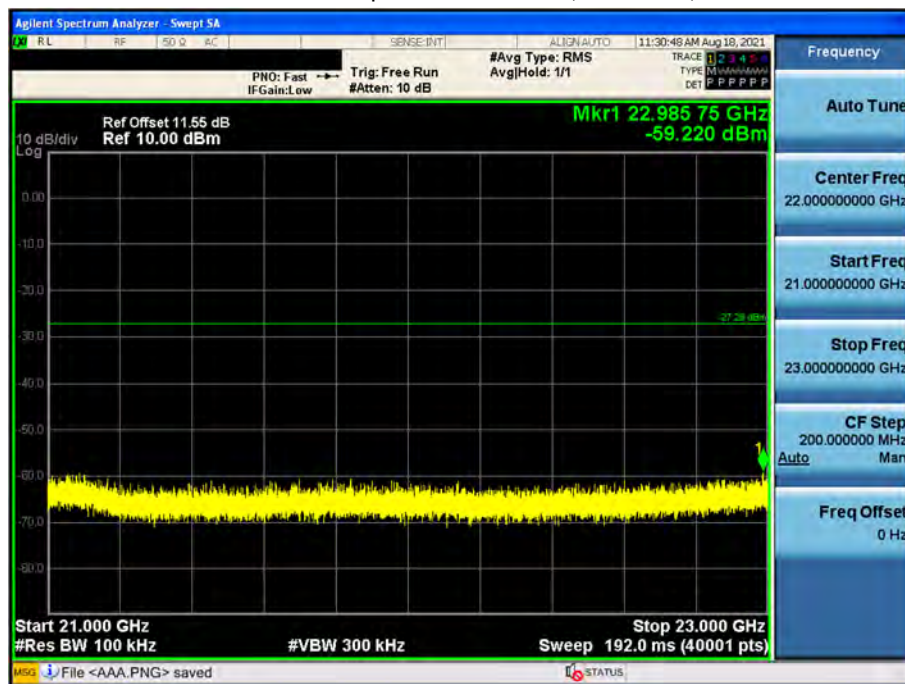
19 GHz ~ 21 GHz

Conducted Spurious Emission (Mid-CH 19)



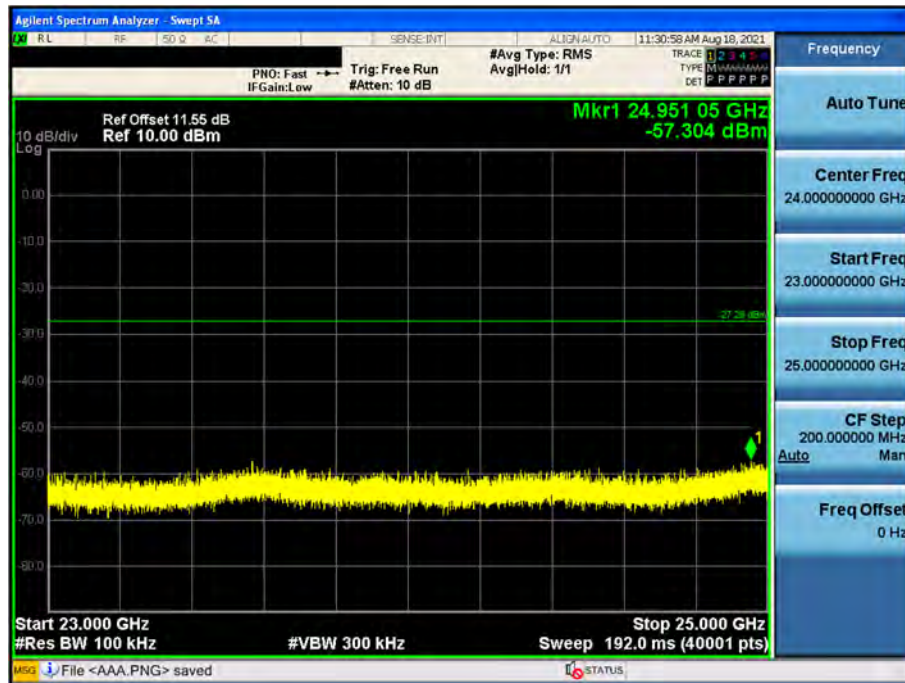
21 GHz ~ 23 GHz

Conducted Spurious Emission (Mid-CH 19)



23 GHz ~ 25 GHz

Conducted Spurious Emission (Mid-CH 19)



Limit : -27.28 dBm

9.6 RADIATED SPURIOUS EMISSIONS

Frequency Range : 9 kHz – 30 MHz

Frequency	Reading	Ant. factor	Cable loss	Ant. POL	Total	Limit	Margin
MHz	dBμV/m	dBm/m	dBm	(H/V)	dBμV/m	dBμV/m	dB

No Critical peaks found

Note:

1. The reading of emissions are attenuated more than 20 dB below the permissible limits or the field strength is too small to be measured.
2. Distance extrapolation factor = $40\log(\text{specific distance} / \text{test distance})$ (dB)
3. Limit line = specific Limits (dBμV/m) + Distance extrapolation factor
4. Radiated test is performed with hopping off.

Frequency Range : Below 1 GHz

Frequency	Reading	Ant. factor	Cable loss	Ant. POL	Total	Limit	Margin
MHz	dBμV/m	dBm/m	dBm	(H/V)	dBμV/m	dBμV/m	dB

No Critical peaks found

Note:

1. Radiated emissions measured in frequency range from 30 MHz to 1000 MHz were made with an instrument using Quasi peak detector mode.

Frequency Range : Above 1 GHz

- SL600

Mode : 1 MBit/s (37 Byte)

Operation Mode: CH Low

Frequency	Reading	Duty cycle Factor	A.F+C.L- A.G+D.F	ANT. POL	Total	Limit	Margin	Measurement Type
[MHz]	[dBμV]	[dB]	[dB]	[H/V]	[dBμV/m]	[dBμV/m]	[dB]	
4804	45.50	0.00	2.76	V	48.26	73.98	25.72	PK
4804	33.75	2.04	2.76	V	38.54	53.98	15.44	AV
7206	46.62	0.00	8.96	V	55.58	73.98	18.40	PK
7206	37.15	2.04	8.96	V	48.15	53.98	5.83	AV
4804	44.79	0.00	2.76	H	47.55	73.98	26.43	PK
4804	33.73	2.04	2.76	H	38.52	53.98	15.46	AV
7206	45.68	0.00	8.96	H	54.64	73.98	19.34	PK
7206	35.70	2.04	8.96	H	46.70	53.98	7.28	AV

Operation Mode: CH Mid

Frequency	Reading	Duty cycle Factor	A.F+C.L- A.G+D.F	ANT. POL	Total	Limit	Margin	Measurement Type
[MHz]	[dBμV]	[dB]	[dB]	[H/V]	[dBμV/m]	[dBμV/m]	[dB]	
4880	44.03	0.00	3.15	V	47.18	73.98	26.80	PK
4880	32.39	2.04	3.15	V	37.58	53.98	16.40	AV
7320	46.34	0.00	9.45	V	55.79	73.98	18.19	PK
7320	36.66	2.04	9.45	V	48.15	53.98	5.83	AV
4880	42.08	0.00	3.15	H	45.23	73.98	28.75	PK
4880	30.15	2.04	3.15	H	35.34	53.98	18.64	AV
7320	45.80	0.00	9.45	H	55.25	73.98	18.73	PK
7320	35.36	2.04	9.45	H	46.85	53.98	7.13	AV

Operation Mode: CH High

Frequency	Reading	Duty cycle Factor	A.F+C.L- A.G+D.F	ANT. POL	Total	Limit	Margi n	Measurement Type
[MHz]	[dBμV]	[dB]	[dB]	[H/V]	[dBμV/m]	[dBμV/m]	[dB]	
4960	44.26	0.00	2.23	V	46.49	73.98	27.49	PK
4960	32.89	2.04	2.23	V	37.16	53.98	16.82	AV
7440	44.89	0.00	10.35	V	55.24	73.98	18.74	PK
7440	34.81	2.04	10.35	V	47.20	53.98	6.78	AV
4960	43.71	0.00	2.23	H	45.94	73.98	28.04	PK
4960	32.42	2.04	2.23	H	36.69	53.98	17.29	AV
7440	45.38	0.00	10.35	H	55.73	73.98	18.25	PK
7440	34.93	2.04	10.35	H	47.32	53.98	6.66	AV

Mode : 2 MBit/s (37 Byte)

Operation Mode: CH Low

Frequency	Reading	Duty cycle Factor	A.F+C.L- A.G+D.F	ANT. POL	Total	Limit	Margi n	Measurement Type
[MHz]	[dBμV]	[dB]	[dB]	[H/V]	[dBμV/m]	[dBμV/m]	[dB]	
4804	45.39	0.00	2.76	V	48.15	73.98	25.83	PK
4804	33.20	4.87	2.76	V	40.82	53.98	13.16	AV
7206	46.26	0.00	8.96	V	55.22	73.98	18.76	PK
7206	33.48	4.87	8.96	V	47.31	53.98	6.67	AV
4804	45.18	0.00	2.76	H	47.94	73.98	26.04	PK
4804	32.99	4.87	2.76	H	40.61	53.98	13.37	AV
7206	45.17	0.00	8.96	H	54.13	73.98	19.85	PK
7206	33.28	4.87	8.96	H	47.11	53.98	6.87	AV

Operation Mode: CH Mid

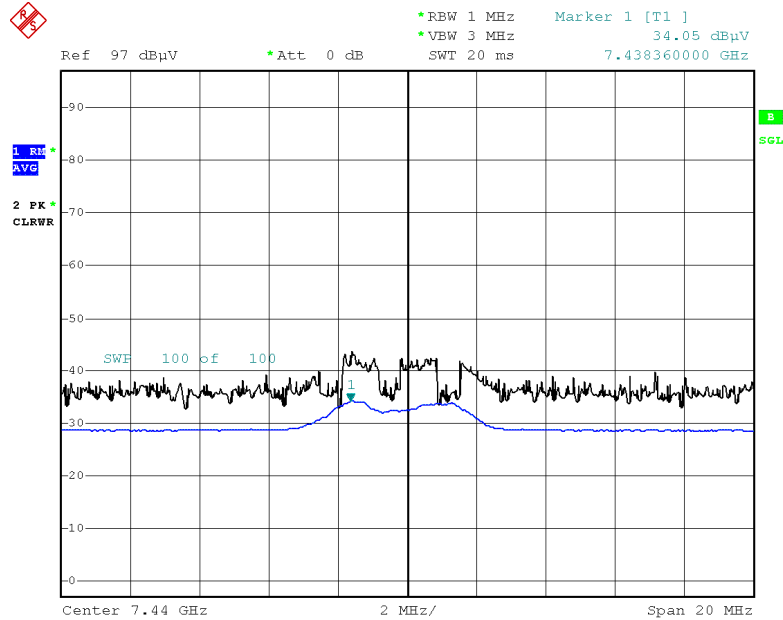
Frequency	Reading	Duty cycle Factor	A.F+C.L- A.G+D.F	ANT. POL	Total	Limit	Margi n	Measurement Type
[MHz]	[dBμV]	[dB]	[dB]	[H/V]	[dBμV/m]	[dBμV/m]	[dB]	
4880	44.09	0.00	3.15	V	47.24	73.98	26.74	PK
4880	31.90	4.87	3.15	V	39.92	53.98	14.06	AV
7320	46.40	0.00	9.45	V	55.85	73.98	18.13	PK
7320	33.28	4.87	9.45	V	47.60	53.98	6.38	AV
4880	42.41	0.00	3.15	H	45.56	73.98	28.42	PK
4880	30.55	4.87	3.15	H	38.57	53.98	15.41	AV
7320	44.08	0.00	9.45	H	53.53	73.98	20.45	PK
7320	31.25	4.87	9.45	H	45.57	53.98	8.41	AV

Operation Mode: CH High

Frequency	Reading	Duty cycle Factor	A.F+C.L- A.G+D.F	ANT. POL	Total	Limit	Margi n	Measurement Type
[MHz]	[dBμV]	[dB]	[dB]	[H/V]	[dBμV/m]	[dBμV/m]	[dB]	
4960	44.20	0.00	2.23	V	46.43	73.98	27.55	PK
4960	32.30	4.87	2.23	V	39.40	53.98	14.58	AV
7440	44.87	0.00	10.35	V	55.22	73.98	18.76	PK
7440	34.05	4.87	10.35	V	49.27	53.98	4.71	AV
4960	41.98	0.00	2.23	H	44.21	73.98	29.77	PK
4960	30.58	4.87	2.23	H	37.68	53.98	16.30	AV
7440	42.67	0.00	10.35	H	53.02	73.98	20.96	PK
7440	32.09	4.87	10.35	H	47.31	53.98	6.67	AV

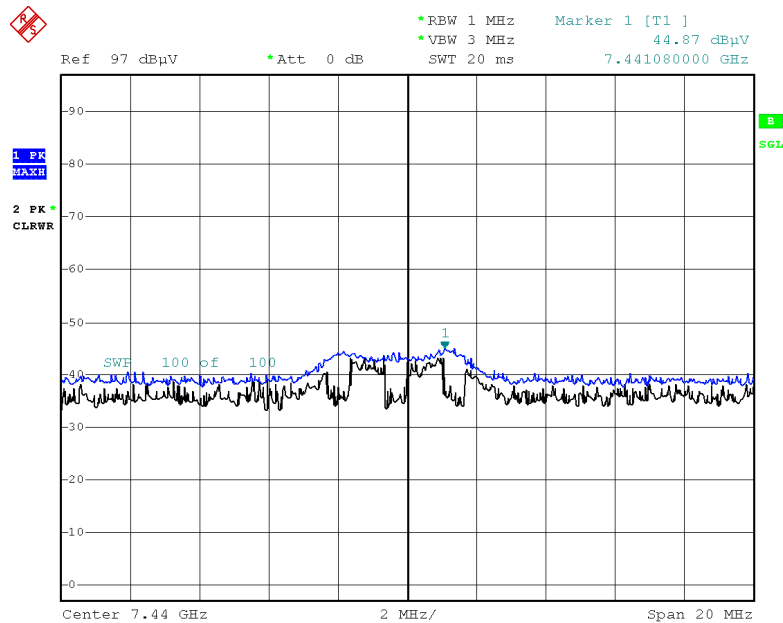
Mode : 2 MBit/s (37 Byte) Test Plots (Worst case : V)

Radiated Spurious Emissions plot – Average Reading (Ch.39 3rd Harmonic)



Date: 12.AUG.2021 14:30:57

Radiated Spurious Emissions plot – Peak Reading (Ch.39 3rd Harmonic)



Date: 12.AUG.2021 14:31:04

Note:

Plot of worst case are only reported.

- SL600E

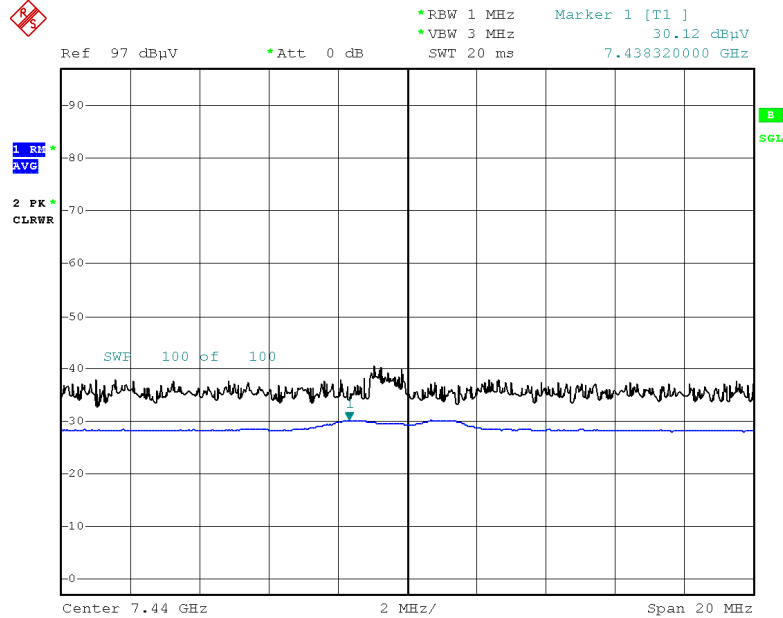
Mode : 2 MBit/s (37 Byte)

Operation Mode: CH High

Frequency	Reading	Duty cycle	AN.+CL-AMP G	ANT. POL	Total	Limit	Margin	
[MHz]	[dBμV]	Factor	[dB]	[H/V]	[dBμV/m]	[dBμV/m]	[dB]	Detect
7440	42.81	0.00	10.35	V	53.16	73.98	20.82	PK
7440	30.12	4.87	10.35	V	45.34	53.98	8.64	AV

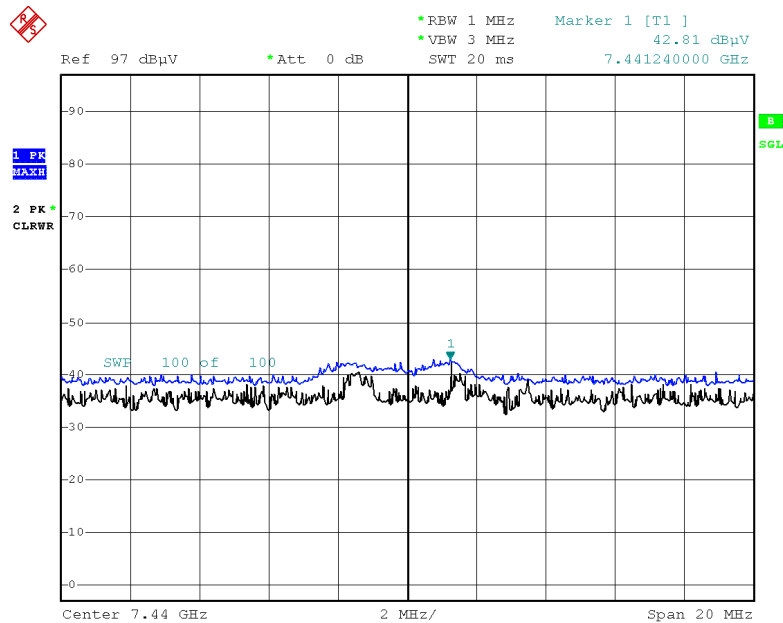
Mode : 2 MBit/s (37 Byte) Test Plots (Worst case : V)

Radiated Spurious Emissions plot – Average Reading (Ch.39 3rd Harmonic)



Date: 18.AUG.2021 12:35:49

Radiated Spurious Emissions plot – Peak Reading (Ch.39 3rd Harmonic)



Date: 18.AUG.2021 12:36:02

Note:

Plot of worst case are only reported.

9.7 RADIATED RESTRICTED BAND EDGES

- SL600

Mode : Mode : 1 MBit/s (37 Byte)

Operating Frequency 2402 MHz & 2480 MHz

Channel No. 0 & 39

Frequency	Reading	AN.+CL-AMP G	Duty Cycle Factor	Ant. Pol.	Total	Limit	Margin	Measurement Type
[MHz]	[dBμV/m]	[dB]	[dB]	[H/V]	[dBμV/m]	[dBμV/m]	[dB]	
2390.0	48.86	0.75	0.00	H	49.61	73.98	24.37	PK
2390.0	37.28	0.75	2.04	H	40.07	53.98	13.91	AV
2390.0	48.80	0.75	0.00	V	49.55	73.98	24.43	PK
2390.0	37.21	0.75	2.04	V	40.00	53.98	13.98	AV
2483.5	48.20	1.34	0.00	H	49.54	73.98	24.44	PK
2483.5	37.45	1.34	2.04	H	40.83	53.98	13.15	AV
2483.5	48.72	1.34	0.00	V	50.06	73.98	23.92	PK
2483.5	37.37	1.34	2.04	V	40.75	53.98	13.23	AV

Mode : Mode : 2 MBit/s (37 Byte)

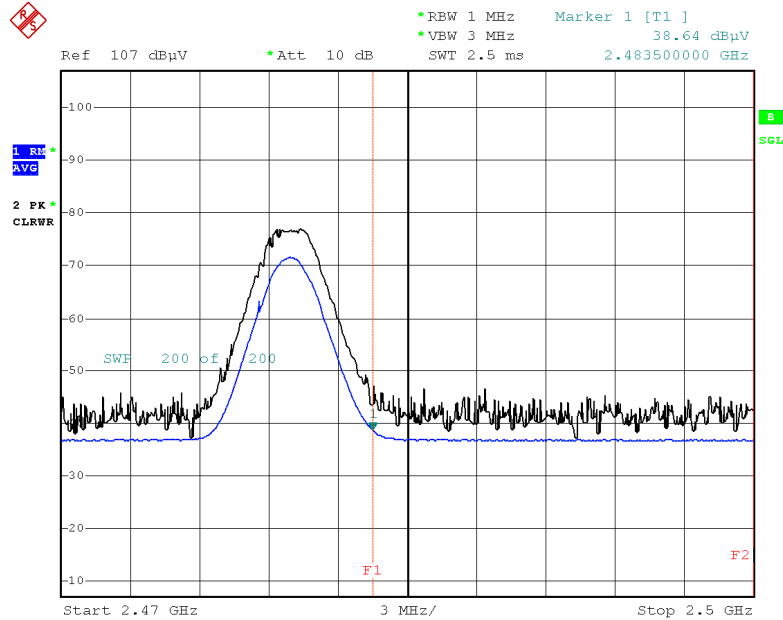
Operating Frequency 2402 MHz & 2480 MHz

Channel No. 0 & 39

Frequency	Reading	AN.+CL-AMP G	Duty Cycle Factor	Ant. Pol.	Total	Limit	Margin	Measurement Type
[MHz]	[dBμV/m]	[dB]	[dB]	[H/V]	[dBμV/m]	[dBμV/m]	[dB]	
2390.0	48.83	0.75	0.00	H	49.58	73.98	24.40	PK
2390.0	37.31	0.75	4.87	H	42.93	53.98	11.05	AV
2390.0	49.30	0.75	0.00	V	50.05	73.98	23.93	PK
2390.0	37.36	0.75	4.87	V	42.98	53.98	11.00	AV
2483.5	48.62	1.34	0.00	H	49.96	73.98	24.02	PK
2483.5	38.64	1.34	4.87	H	44.85	53.98	9.13	AV
2483.5	49.19	1.34	0.00	V	50.53	73.98	23.45	PK
2483.5	38.15	1.34	4.87	V	44.36	53.98	9.62	AV

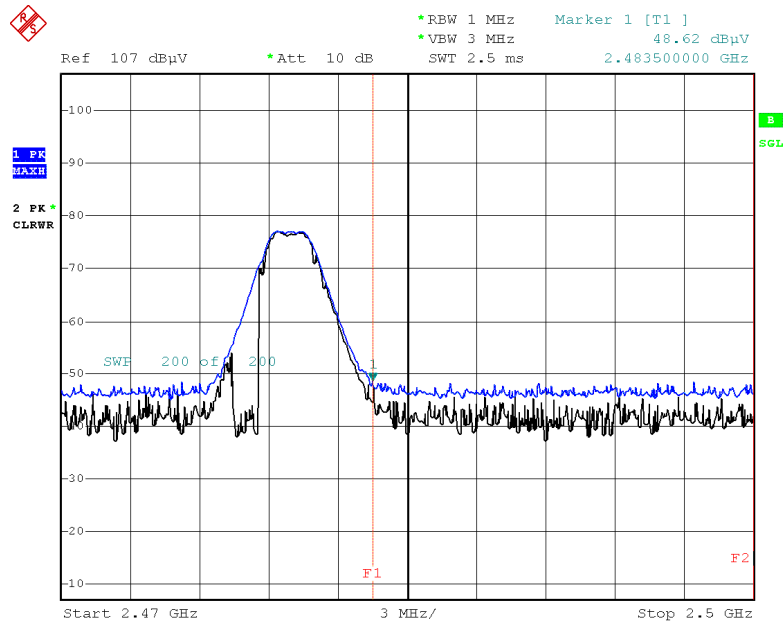
Mode : 2 MBit/s (37 Byte) Test Plots

Radiated Restricted Band Edges plot – Average Reading (Ch.39, H)



Date: 12.AUG.2021 14:17:23

Radiated Restricted Band Edges plot – Peak Reading (Ch.39, H)



Date: 12.AUG.2021 14:17:32

Note:

Plot of worst case are only reported.

- SL600E

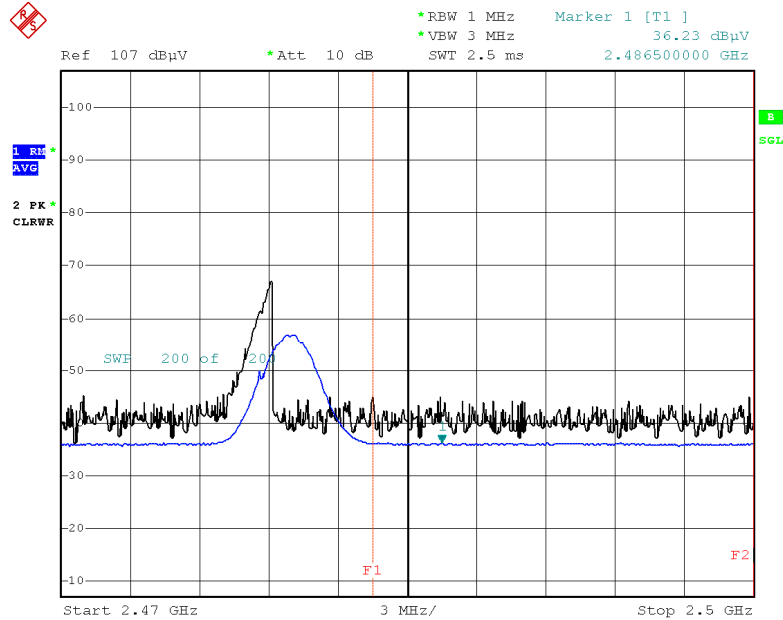
Mode : 2 MBit/s (37 Byte)

Operating Frequency	2402 MHz & 2480 MHz
Channel No.	0 & 39

Frequency	Reading	AN.+CL-AMP G	Duty Cycle Factor	Ant. Pol.	Total	Limit	Margin	Measurement Type
[MHz]	[dBμV/m]	[dB]	[dB]	[H/V]	[dBμV/m]	[dBμV/m]	[dB]	
2483.5	48.02	1.34	0.00	H	49.36	73.98	24.62	PK
2483.5	36.23	1.34	4.87	H	42.44	53.98	11.54	AV

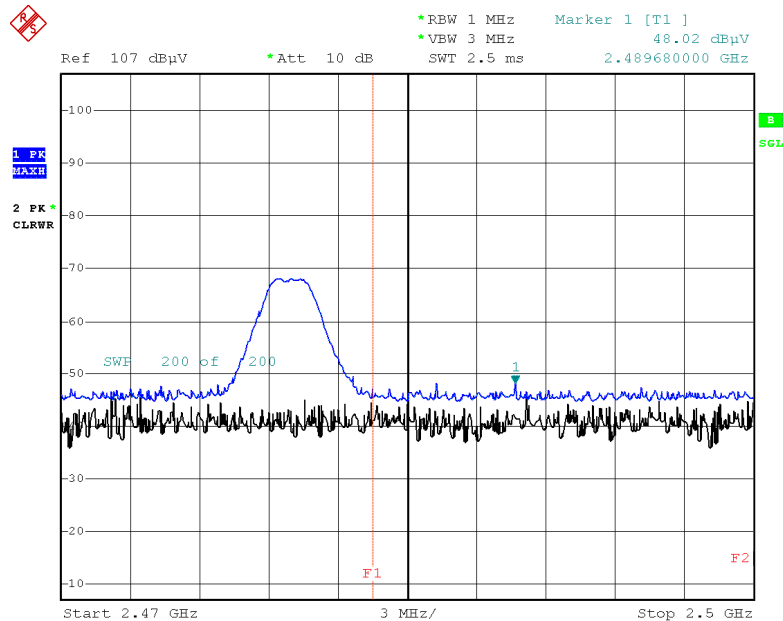
Mode : 2 MBit/s (37 Byte) Test Plots

Radiated Restricted Band Edges plot – Average Reading (Ch.39, H)



Date: 18.AUG.2021 12:47:53

Radiated Restricted Band Edges plot – Peak Reading (Ch.39, H)



Date: 18.AUG.2021 12:48:05

Note:

Plot of worst case are only reported.

10. LIST OF TEST EQUIPMENT

Conducted Test

Equipment	Model	Manufacturer	Serial No.	Due to Calibration	Calibration Interval
LISN	ENV216	Rohde & Schwarz	102245	09/04/2021	Annual
Test Receiver	ESCI	Rohde & Schwarz	100033	06/15/2022	Annual
Temperature Chamber	SU-642	ESPAC	0093008124	03/15/2022	Annual
Signal Analyzer	N9020A	Agilent	MY47380318	01/28/2022	Annual
Signal Analyzer	N9030A	Agilent	MY49431210	01/11/2022	Annual
Power Meter	N1911A	Agilent	MY45100523	04/08/2022	Annual
Power Sensor	N1921A	Agilent	MY57820067	04/08/2022	Annual
Directional Coupler	87300B	Agilent	3116A03621	11/10/2021	Annual
Power Splitter	11667B	Hewlett Packard	05001	05/20/2022	Annual
DC Power Supply	E3632A	Hewlett Packard	KR75303960	06/10/2022	Annual
Attenuator (10 dB)	5910-N-50-010	H+S	00801	10/28/2021	Annual
Software	EMC32	Rohde & Schwarz	N/A	N/A	N/A
FCC WLAN&BT&BLE Conducted Test Software v3.0	FCC WLAN&BT&BLE Conducted Test Software v3.0	HCT CO., LTD.	N/A	N/A	N/A
Bluetooth Tester	CBT	Rohde & Schwarz	100422	05/04/2022	Annual

Note:

- Equipment listed above that calibrated during the testing period was set for test after the calibration.
- Equipment listed above that has a calibration due date during the testing period, the testing is completed before equipment expiration date.

Radiated Test

Equipment	Model	Manufacturer	Serial No.	Due to Calibration	Calibration Interval
Controller (Antenna mast)	CO3000	Innco system	CO3000-4p	N/A	N/A
Antenna Position Tower	MA4640/800-XP-EP	Innco system	N/A	N/A	N/A
Controller	2090	Emco	060520	N/A	N/A
Turn Table	Turn Table	Ets	N/A	N/A	N/A
Loop Antenna	Loop Antenna	Rohde & Schwarz	1513-333	03/19/2022	Biennial
Hybrid Antenna	VULB 9168	Schwarzbeck	9168-0895	09/04/2022	Biennial
Horn Antenna	BBHA 9120D	Schwarzbeck	9120D-1191	11/18/2021	Biennial
Horn Antenna (15 GHz ~ 40 GHz)	BBHA9170	Schwarzbeck	BBHA9170541	11/29/2021	Biennial
Spectrum Analyzer	FSP (9 kHz ~ 30 GHz)	Rohde & Schwarz	836650/016	09/14/2021	Annual
Spectrum Analyzer	FSV40-N	Rohde & Schwarz	101068-SZ	09/22/2021	Annual
Band Reject Filter	WRCJV2400/2483.5-2370/2520-60/12SS	Wainwright Instruments	2	01/06/2022	Annual
Band Reject Filter	WRCJV5100/5850-40/50-8EEK	Wainwright Instruments	1	02/08/2022	Annual
Attenuator (10 dB)	CBLU1183540B-01	CERNEX	N/A	12/23/2021	Annual
56-10	56-10	WEINSCHTEL			
Broadband Low Noise Amplifier	CBL06185030	CERNEX	N/A	12/23/2021	Annual
Attenuator (3 dB)	18B-03	Api tech.			
High Pass Filter	WHKX10-2700-3000-18000-40SS	Wainwright Instruments	N/A	12/23/2021	Annual
High Pass Filter	WHKX8-6090-7000-18000-40SS	Wainwright Instruments	N/A	12/23/2021	Annual
Thru	COAXIAL ATTENUATOR	T&M SYSTEM	N/A	12/23/2021	Annual
Power Amplifier	CBL18265035	CERNEX	22966	12/04/2021	Annual
Power Amplifier	CBL26405040	CERNEX	25956	03/23/2022	Annual
Bluetooth Tester	TC-3000C	TESCOM	3000C000276	03/09/2022	Annual

Note:

1. Equipment listed above that calibrated during the testing period was set for test after the calibration.
2. Equipment listed above that has a calibration due date during the testing period, the testing is completed before equipment expiration date.
3. Especially, all antenna for measurement is calibrated in accordance with the requirements of C63.5(Version : 2017).

11. ANNEX A_ TEST SETUP PHOTO

Please refer to test setup photo file no. as follows;

No.	Description
1	HCT-RF-2108-FC040-P