

TEST REPORT

FCC/ISED UWB Test for TMCDD15G
Certification

APPLICANT

LG Electronics Inc.

REPORT NO.

HCT-RF-2608-FI001-R3

DATE OF ISSUE

September 15, 2026

Tested by

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TEST REPORT

REPORT NO.

HCT-RF-2608-FI001-R3

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Additional Model

TMCD15S

**Applicant
(FCC)**

LG Electronics Inc.
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**Applicant
(ISED)**

LG Electronics Inc.
170, Seongsanpaechong-ro, Seongsan-gu, Changwon-si, Gyeongsangnam-do
51533 Korea (Republic Of)

**Product Name
Model Name**

LG Smart Deadbolt Lock
TMCD15G

FCC ID

2B03L-TMCD15

IC

2703N-TMCD15

Date of Test

Initial Test : August 03, 2026 ~ August 07, 2026
Simultaneous transmission Test : September 08, 2026 ~ September 15, 2026

Test Results

PASS

FCC Classification

Ultra Wideband (UWB)

Test Standard Used

FCC Part 15 Subpart F (15.519, 15.521)
ISED Rule Part(s):
RSS-220 Issue 1_Amendment 1
RSS-Gen Issue 5_Amendment 2

Location of Test

■ Permanent Testing Lab □ On Site Testing Lab
(Address: 74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, Republic of Korea)

Brand

LG

REVISION HISTORY

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

Revision No.	Date of Issue	Description
0	August 07, 2026	Initial Release
1	August 10, 2026	Deleted the HW Version.
2	September 09, 2026	Added the HVIN. Page 8, Deleted Conducted Disturbance Page 7, 14, 22, Revised Facilities and Description Page 28, 29, Deleted Note Page 30, Added Radiated emissions Data Page 34, Revised Plot Added the Simultaneous transmission Scenario Data. Section 9.7 was revised. Corrected standard version display (RSS-Gen Issue 5).
3	September 15, 2026	Revised the Simultaneous transmission Scenario Data. (Page 24, 41 - 45)

Notice

Content
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. The results shown in this test report only apply to the sample(s), as received, provided by the applicant, unless otherwise stated. The test results have only been applied with the test methods required by the standard(s). The laboratory is not accredited for the test results marked *. Information provided by the applicant is marked **. Test results provided by external providers are marked ***. When confirmation of authenticity of this test report is required, please contact www.hct.co.kr The test results in this test report are not associated with the ((KS Q) ISO/IEC 17025) accreditation by KOLAS (Korea Laboratory Accreditation Scheme) / A2LA (American Association for Laboratory Accreditation) that are under the ILAC (International Laboratory Accreditation Cooperation) Mutual Recognition Agreement (MRA).

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1. GENERAL INFORMATION

EUT DESCRIPTION

Model	TMCDD15G	
Additional Model	TMCDD15S Note: The variant model has identical hardware and RF circuitry to the basic model, differing only in the exterior color (Basic: Graphite, Variant: Silver)	
EUT Type	LG Smart Deadbolt Lock	
Power Supply	DC 6V(DC 1.5V AA battery 4EA)	
Frequency Range	7 987.2 MHz	
Max. RF Output Power (EIRP)	Peak (dBm/50 MHz)	-3.04
	Average (dBm/MHz)	-43.98
Channel	9ch	
Packet Configuration	SP0, SP1, SP3	
PRF Mode	62.4 MHz BPRF Only	
PSDU DATA RATE	6.81Mbps	
BPRF PHR DATA RATE	850Kbps	
STS LENGTH	64symbols	
PAYLOAD LENGTH	20byte	
UWB Classification	Hand-held Communication Device	
Modulation type	BPSK pulsed modulation signal	
Serial number	Initial Test : 607HTXP00186 Simultaneous transmission Test : 607HTDD00010	
PMN (Product Marketing Name)	LG Smart Deadbolt Lock	
HVIN (Hardware Version Identification Number)	TMCDD15G, TMCDD15S	
FVIN (Firmware Version Identification Number)	1.1.00	
Factory	HYUNDAI HT GLOBAL COMPANY LIMITED Lot M, Binh Xuyen Industrial Zone, Binh Nguyen Commune, Phu Tho Province, Vietnam	
Manufacturer	LG Electronics Inc. 170, Seongsanpaechong-ro, Seongsan-gu, Changwon-si, Gyeongsangnam-do 51533 Korea (Republic Of)	

This device supports simultaneous transmission operation, which allows for two channels to operate independent of one another in the Bands simultaneously on each antenna.

Simultaneous transmission Scenario	Thread (Rear)	BT (Rear)	UWB	BT (Front)	NFC	Test Case
(Rear) BT + (Front) UWB + BT + NFC	-	on	on	on	on	Scenario1
(Rear) Thread + (Front) UWB + BT + NFC	on	-	on	on	on	Scenario2

2. TEST METHODOLOGY

Unlicensed wireless device were tested using the following measurement procedure.

FCC

[1] FCC KDB 393764 D01 UWB FAQ

[2] ANSI C63.10-2020 + Cor. 1-2023

Note : Here in after, ANSI C63.10-2020 + Cor. 1-2023 will be referred to as ANSI C63.10-2020

ISED

[1] RSS-220 Issue 1_Amendment 1

[2] ANSI C63.10-2020 + Cor. 1-2023+C63.10a-2024 + Errata to C63.10a-2024

Note : Hereinafter, ANSI C63.10-2020 + Cor. 1-2023+C63.10a-2024 + Errata to C63.10a-2024 will be referred to as ANSI C63.10-2020

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 15.519, 15.521 under the FCC Rules Part 15 Subpart F.

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 RSS-Gen issue 5, RSS-220 Issue 1_Amendment 1.

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 C63.10-2020. 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

According to the requirements in Section 6.3 ~ Section 6.6 of ANSI C63.10-2020

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.

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 – 2017.

4. FACILITIES AND ACCREDITATIONS**FACILITIES****FCC**

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, Republic of Korea. This test facility has completed the evaluation in compliance with the standards and evaluation period required for chamber validity verification. ANSI C63.4-2014 + C63.4a-2017 and ANSI C63.25.1-2018.

Detailed description of test facility was submitted to the Commission and accepted dated February 26, 2026 (Registration Number: KR0032).

ISED

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, Republic of Korea. The site is constructed in conformance with the requirements of ANSI C63.4-2014 + C63.4a-2017 and ANSI C63.25.1-2018.

Detailed description of test facility was submitted to the Commission and accepted dated March 11, 2026 (CAB identifier: 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 ANSI/USEMCSC C63.2-2023, "American National Standard for Specifications of Electromagnetic Interference and Field Strength Measuring Instrumentation in the Frequency Range 9 kHz to 40 GHz".

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."

According to RSS-GEN(Issue 5) Section 6.8:

The applicant for equipment certification shall provide a list of all antenna types that may be used with the transmitter, where applicable (i.e. for transmitters with detachable antenna), indicating the maximum permissible antenna gain (in dBi) and the required impedance for each antenna. The test report shall demonstrate the compliance of the transmitter with the limit for maximum equivalent isotropically radiated power (e.i.r.p.) specified in the applicable RSS, when the transmitter is equipped with any antenna type, selected from this list.

For expediting the testing, measurements may be performed using only the antenna with highest gain of each combination of transmitter and antenna type, with the transmitter output power set at the maximum level. However, the transmitter shall comply with the applicable requirements under all operational conditions and when in combination with any type of antenna from the list provided in the test report (and in the notice to be included in the user manual, provided below).

When measurements at the antenna port are used to determine the RF output power, the effective gain of the device's antenna shall be stated, based on a measurement or on data from the antenna's manufacturer.

The test report shall state the RF power, output power setting and spurious emission measurements with each antenna type that is used with the transmitter being tested.

According to RSS-220 Issue 1_Amendment 1:

The following general provisions apply to both indoor and hand-held communication devices.

- The antenna of the UWB device shall be factory-installed and shall not be made modifiable by users.

6. MEASUREMENT UNCERTAINTY

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI C63.10-2020.

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 ($\pm$ kHz)
Emission Bandwidth	95 (Confidence level about 95 %, $k=2$)

Parameter	Expanded Uncertainty ($\pm$ dB)
Radiated Disturbance (9 kHz ~ 30 MHz)	4.54 (Confidence level about 95 %, $k = 2$)
Radiated Disturbance (30 MHz ~ 1 GHz)	5.74 (Confidence level about 95 %, $k = 2$)
Radiated Disturbance (1 GHz ~ 18 GHz)	5.80 (Confidence level about 95 %, $k = 2$)
Radiated Disturbance (18 GHz ~ 40 GHz)	5.86 (Confidence level about 95 %, $k = 2$)
Radiated Disturbance (Above 40 GHz)	5.44 (Confidence level about 95 %, $k=2$)

7. DESCRIPTION OF TESTS

FCC

Test Item	Test Procedure
10 dB Bandwidth	- ANSI C63.10-2020 – Section 10.1
Cessation Time	- KDB 393764 – Q4
Maximum Peak Power	- ANSI C63.10-2020 – Section 10.3.5
Maximum Average Emission	- ANSI C63.10-2020 – Section 10.3.7
Radiated Emissions Above 960MHz	- ANSI C63.10-2020 – Section 10.3 (Above 960 MHz)
Radiated Emissions Below 960MHz	- ANSI C63.10-2020 – Section 6.4 (Below 30 MHz) - ANSI C63.10-2020 – Section 6.5 (30 MHz to 960 MHz) - ANSI C63.10-2020 – Section 10.2(Below 960MHz)
Radiated Emissions in the 1 164 – 1 240MHz and 1 559 – 1 610MHz GPS Bands	- ANSI C63.10-2020– Section 10.3.10
AC Conducted Emissions 150kHz – 30MHz	- ANSI C63.10-2020– Section 6.2

ISED

Test Item	Test Procedure
10 dB Bandwidth	- ANSI C63.10-2020 – Section 10.1
Cessation Time	- KDB 393764 D01 UWB v03 - Section 3.6 (c), (d)
Maximum Peak Power	- ANSI C63.10-2020 – Section 10.3.5
Maximum Average Power	- ANSI C63.10-2020 – Section 10.3.7
Radiated Emissions Above 960MHz	- ANSI C63.10-2020 – Section 10.3 (Above 960 MHz)
Radiate Emissions Below 960MHz	- ANSI C63.10-2020 – Section 6.4 (Below 30 MHz) - ANSI C63.10-2020 – Section 10.2 (Below 960 MHz)
Radiated Emissions in the 1 164 – 1 240MHz and 1 559 – 1 610MHz GPS Bands	- ANSI C63.10-2020– Section 10.3.10
AC Conducted Emissions 150kHz – 30MHz	- ANSI C63.10-2020– Section 6.2

7.1. Radiated Emissions

FCC 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

ISED Limit

Frequency (MHz)	Field Strength ($\mu\text{V/m}$)	Measurement Distance (m)	E.i.r.p (dBmW)
0.009 – 0.490	$2400/F(\text{kHz})$	300	$10\log(17.28/F^2)$ (F in kHz)
0.490 – 1.705	$24000/F(\text{kHz})$	30	$10\log(17.28/F^2)$ (F in kHz)
1.705 – 30	30	30	-45.7
30-88	100	3	-55.2
88-216	150	3	-51.7
216-960	200	3	-49.2

The radiated emissions above 960 MHz from a device operating under the provisions of this section shall not exceed the following average limits when measured using a resolution bandwidth of 1 MHz

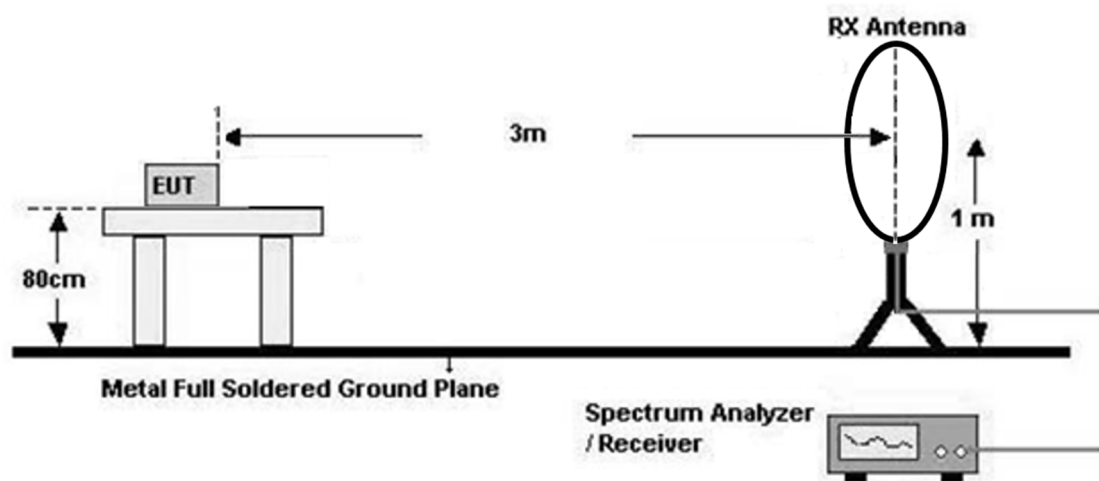
Frequency (MHz)	EIRP in dBm
960 – 1610	-75.3
** 1164 – 1240	-85.3
** 1559 – 1610	-85.3
1610 – 1990	-63.3
1990 – 3100	-61.3
3100 – 10600	-41.3
Above 10600	-61.3

** GPS Bands shall not exceed the following average limits when measured using a resolution bandwidth of less than 1 kHz.

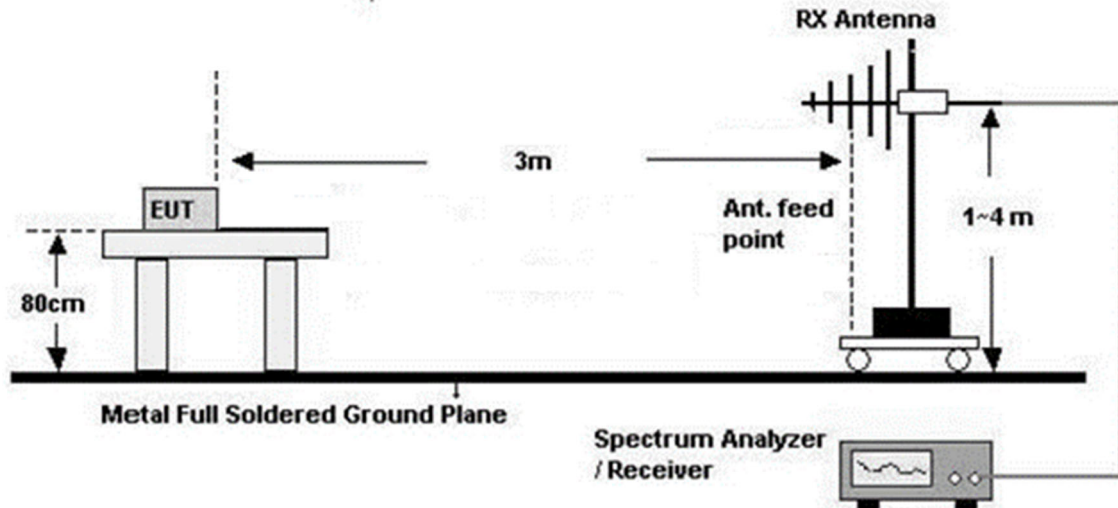
There is a limit on the peak level of the emissions contained within a 50 MHz bandwidth centered on the frequency at which the highest radiated emission occurs, f_m . That limit is 0 dBm EIRP.

Test Configuration

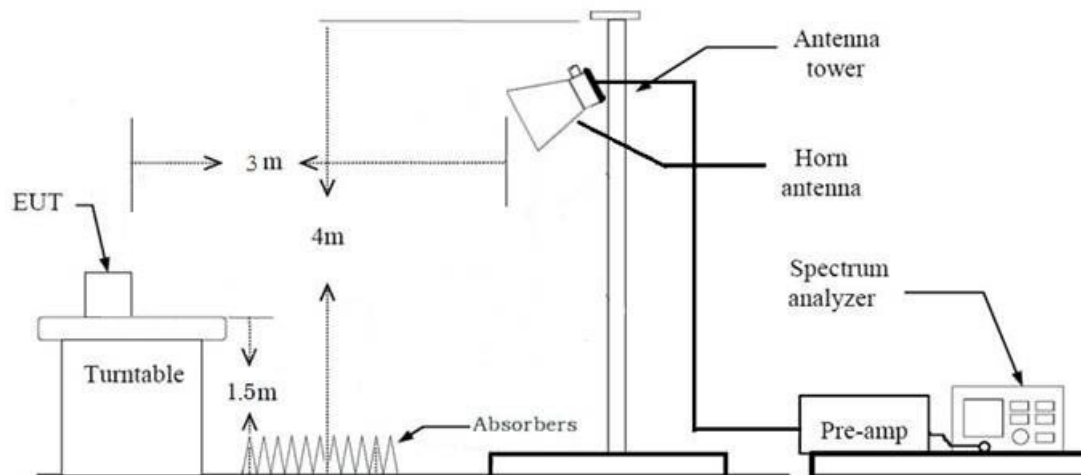
Below 30 MHz



30 MHz - 960 MHz



Above 960 MHz



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 3m from the EUT
3. The EUT is placed on a turntable, which is 0.8m 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 = Max hold
 - RBW = 9 kHz
 - VBW $\geq 3 \times$ RBW
9. Total = Measured 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.

Test Procedure of Radiated spurious emissions(Below 960 MHz)

1. The EUT was placed on a non-conductive table located on semi-anechoic chamber.
2. The EUT is placed on a turntable, which is 0.8m above ground plane.
3. The Hybrid antenna was placed at a location 3m from the EUT, which is varied from 1m to 4m to find out the highest emissions.
4. We have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna.
5. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
6. Spectrum Setting
 - (1) Measurement Type(Peak):
 - Measured Frequency Range: 30 MHz – 1 GHz
 - Detector = Peak
 - Trace = Max hold
 - RBW = 100 kHz
 - VBW $\geq 3 \times$ RBW
 - (2) Measurement Type(Quasi-peak):
 - Measured Frequency Range: 30 MHz – 1 GHz
 - Detector = Quasi-Peak
 - RBW = 120 kHz

※In general, (1) is used mainly
7. Total = Measured Value + Antenna Factor(A.F.) + Cable Loss(C.L.)
8. 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.

Test Procedure of Maximum Average emissions(Above 960 MHz)

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 1m to 4m 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. Spectrum Setting
 - RBW = 1 MHz (1 kHz for emissions in the GPS bands)
 - VBW = 3 MHz (3 kHz for emissions in the GPS bands)
 - Detector = Average(RMS)
 - Trace = Max hold
 - Set the span to examine the spectrum across a convenient frequency segment
 - Trace was allowed to stabilize
 - Sweep time = No more than 1 ms integration period over measurement bin
8. 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.
9. Pre-scan measurements for the GPS bands and frequencies from 960 MHz to 1 610 MHz and frequencies above 10 600 MHz were performed at the following measurement distances: 0.5 m
The pre-scan plots are provided for spurious emission identification purposes only. If no spurious emissions are observed during the pre-scan, no further final measurement is required for those frequency ranges.
10. Below 10 600 MHz
 - E (dB μ V/m) = Measured Value(dB μ V)
 - We apply to the offset in all range
 - The offset = Antenna Factor(A.F.) + Cable Loss(C.L.) – Amp Gain(A.G.)+ Distance Factor(D.F)
 - EIRP (dBm) = E (dB μ V /m) – 95.23 dB
11. GPS bands & Above 10 600 MHz
 - E (dB μ V/m) = Measured Value(dB μ V)
 - We apply to the offset in all range

- The offset = Antenna Factor(A.F.) + Cable Loss(C.L.) – Amp Gain(A.G)+ Distance Factor(D.F)
 $EIRP\ (dBm) = E\ (dB\mu V/m) - Distance\ Factor(D.F) - 95.23\ dB$

Test Procedure of Maximum Peak Power

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 1m to 4m to find out the highest emissions.
5. Each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
6. Spectrum Setting
 - RBW = 50 MHz
 - VBW = 80 MHz
 - Detector = Peak
 - Trace = Maxhold
 - Trace was allowed to stabilize
 - Sweep time = auto coupled
7. $E\ (dB\mu V/m) = Measured\ Value(dB\mu V)$
 - We apply to the offset in all range
 - The offset = Antenna Factor(A.F.) + Cable Loss(C.L.) – Amp Gain(A.G) + Distance Factor(D.F) $EIRP\ (dBm) = E\ (dB\mu V/m) - 95.23\ dB$

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.

7.2. 10 dB Bandwidth

Limit

Fractional bandwidth is equal to or greater than 0.20, or UWB bandwidth is equal to or greater than 500 MHz.

The UWB bandwidth of hand held UWB system must be contained between 3 100 MHz and 10 600 MHz.

Test Procedure

The Analyzer is set to

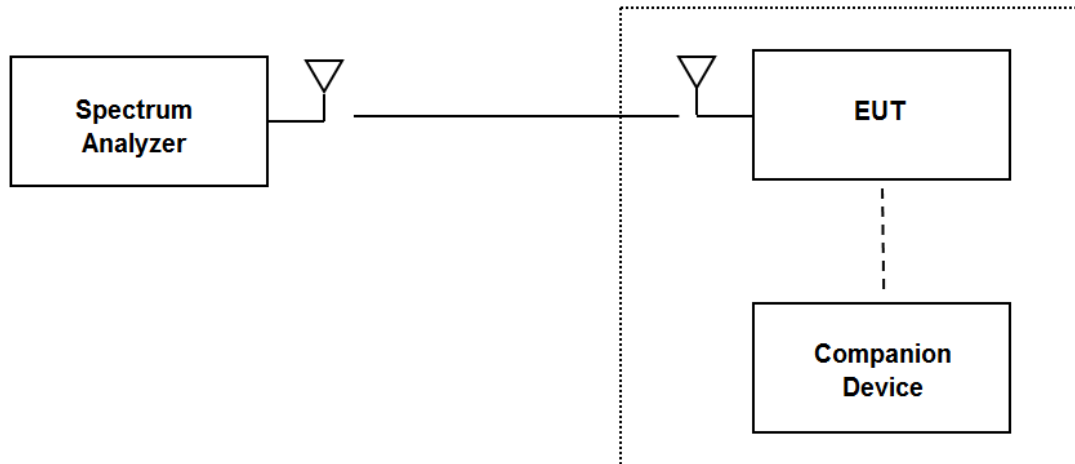
1. Set the analyzer's center frequency to a supported channel.
2. Trace = Max hold
3. Detector = Peak
4. RBW = 1 MHz
5. VBW = 3 MHz
6. Sweep time = 2s
7. Allow the trace to stabilize
8. The frequency of maximum power level is designated f_M . The upper and lower frequency boundaries, f_H and f_L , are defined as the outermost 1 MHz segments where the peak power drops 10 dB below the level measured at f_M .
9. 10 dB bandwidth is defined as $(f_H - f_L)$.
The center frequency (f_c) is calculated from $(f_H + f_L) / 2$.
The fractional bandwidth is defined as $2(f_H - f_L) / (f_H + f_L)$.

7.3. Cessation Time

Limit

A UWB device operating under the provisions of this section shall transmit only when it is sending information to an associated receiver. The UWB intentional radiator shall cease transmission within 10 seconds unless it receives an acknowledgement from the associated receiver that its transmission is being received. An acknowledgment of reception must continue to be received by the UWB intentional radiator at least every 10 seconds or the UWB device must cease transmitting

Test Configuration



Test Procedure

The Analyzer is set to

1. SPAN = Zero Span(0 Hz)
2. RBW = 1 MHz
3. VBW = 3 MHz
4. Sweep time shall be sufficient to demonstrate EUTs compliance with the rule part.
5. Sets the marker to the points where 10 seconds after the EUT recognizes the interruption of reception.

7.4. AC Power line Conducted Emissions

Limit

For an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 μ H/50 ohms line impedance stabilization network (LISN).

Frequency Range (MHz)	Limits (dB μ V)	
	Quasi-peak	Average
0.15 to 0.50	66 to 56 ^(a)	56 to 46 ^(a)
0.50 to 5	56	46
5 to 30	60	50

^(a)Decreases with the logarithm of the frequency.

Compliance with this provision shall be based on the measurement of the radio frequency voltage between each power line (LINE and NEUTRAL) and ground at the power terminals.

Test Configuration

See test photographs attached in Annex A for the actual connections between EUT and support equipment.

Test Procedure

1. The EUT is placed on a wooden table 80 cm above the reference ground plane.
2. The EUT is connected via LISN to a test power supply.
3. The measurement results are obtained as described below:
4. Detectors : Quasi Peak and Average Detector.

Sample Calculation

Quasi-peak(Final Result) = Measured Value + Correction Factor

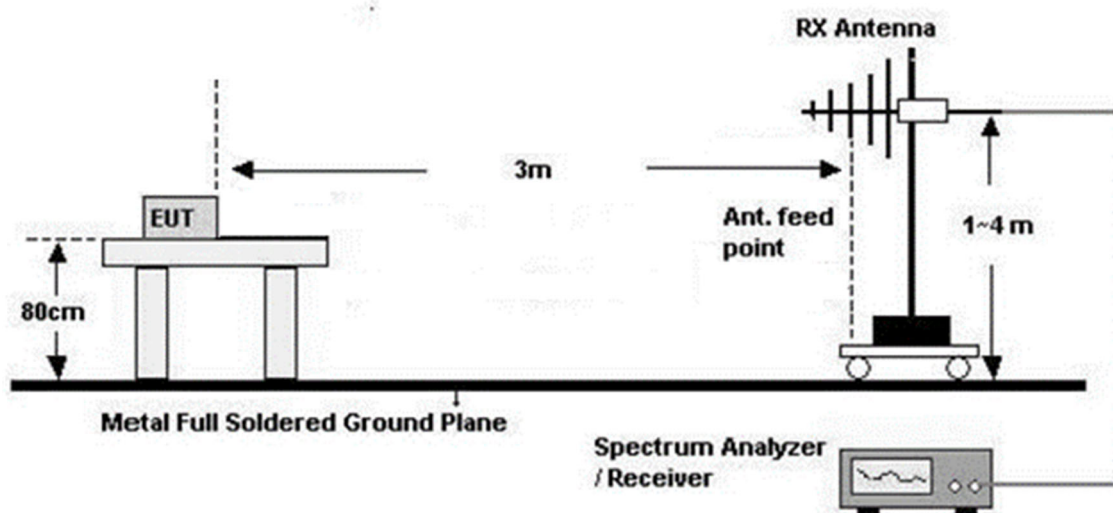
7.5 Receiver Spurious Emissions Limit

Frequency (MHz)	Field Strength ($\mu\text{V/m}$)	Measurement Distance (m)
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

Note:
Measurements for compliance with the limits in table may be performed at distances other than 3 meters.

Test Configuration

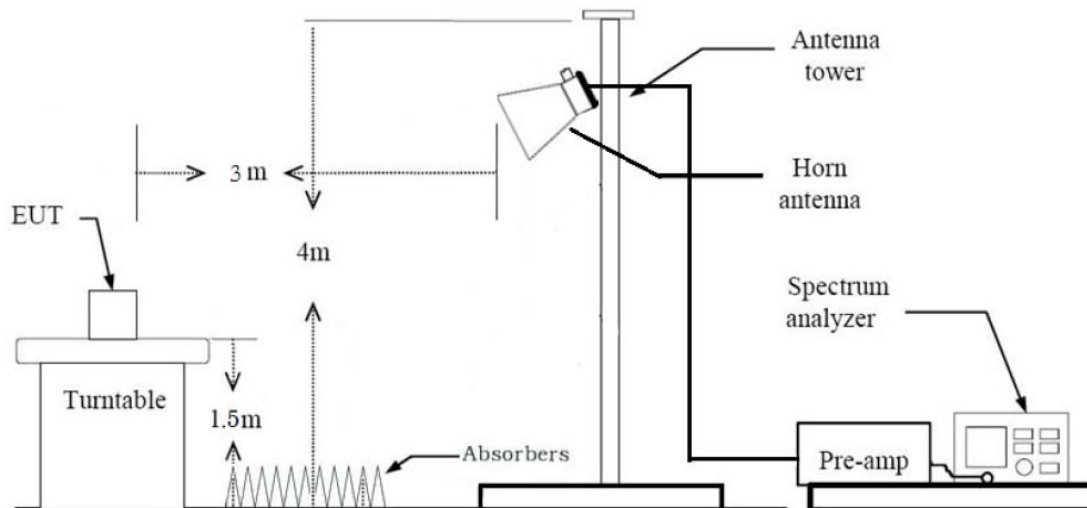
30 MHz - 1 GHz



Test Procedure of Receiver Spurious Emissions (Below 1GHz)

1. The EUT was placed on a non-conductive table located on semi-anechoic chamber.
2. The EUT is placed on a turntable, which is 0.8m above ground plane.
3. The Hybrid antenna was placed at a location 3m from the EUT, which is varied from 1m to 4m to find out the highest emissions.
4. We have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna.
5. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
6. Spectrum Setting
 - (1) Measurement Type(Peak):
 - Measured Frequency Range : 30 MHz – 1 GHz
 - Detector = Peak
 - Trace = Maxhold
 - RBW = 100 kHz
 - VBW $\geq 3 \times$ RBW
 - (2) Measurement Type(Quasi-peak):
 - Measured Frequency Range : 30 MHz – 1 GHz
 - Detector = Quasi-Peak
 - RBW = 120 kHz
7. Total = Measured Value + Antenna Factor(A.F) + Cable Loss(C.L) – Amp Gain(A.G)

Above 1 GHz



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 1m to 4m 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. Spectrum Setting
 - (1) Measurement Type(Average):
 - RBW = 1 MHz
 - VBW = 3 MHz
 - Detector = Average(RMS)
 - Trace = Average
 - Trace was allowed to stabilize
8. 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.
9. Total = Measured Value + Antenna Factor(A.F) + Cable Loss(C.L) - Amp Gain(A.G) + Distance Factor(D.F)

7.6. Worst case configuration and mode

7.6.1. 10 dB Bandwidth, Peak Power, Average Emission

1. All modes of operation were investigated and the worst case configuration results are reported.
 - Mode : Stand alone
2. The radiated emission testing in three orthogonal positions (X, Y, and Z axes) was not performed based on the following:
 - Installation Type: Fixed wall-mounted installation with a single intended operating orientation
 - Test Configuration: The EUT was evaluated in its normal intended operating orientation. Testing in three orthogonal positions was not applicable because the EUT is not intended to be operated in handheld, portable, or multiple-orientation conditions during normal use.
3. All Preamble IDs of operation were investigated and the worst case results are reported.
 - Only Preamble IDs : BPRF(9)
4. All Payload types were investigated and the worst case results are reported.
 - Only 20 bytes

7.6.2. Radiated Emission

1. All modes of operation were investigated and the worst case configuration results are reported.
 - Mode : Stand alone
2. The radiated emission testing in three orthogonal positions (X, Y, and Z axes) was not performed based on the following:
 - Installation Type: Fixed wall-mounted installation with a single intended operating orientation
 - Test Configuration: The EUT was evaluated in its normal intended operating orientation. Testing in three orthogonal positions was not applicable because the EUT is not intended to be operated in handheld, portable, or multiple-orientation conditions during normal use.
3. All Preamble IDs of operation were investigated and the worst case results are reported.
 - Only Preamble IDs : BPRF(9)
4. All Packet types were investigated and the worst case results are reported.
 - Packet : SP0, SP1, SP3
 - Worst case : SP0
5. All Payload types were investigated and the worst case results are reported.
 - Only 20 bytes
6. 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
7. Radiated spurious emissions were investigated up to 40 GHz. The pre-scan confirmed that the 2nd harmonic emission represented the worst-case condition among the investigated emissions. Other emissions above the 2nd harmonic were not higher than the reported worst-case level; therefore, only the 2nd harmonic final measurement result is reported.
8. TMCDD15G, TMCDD15S were tested and the worst case results are reported.
(Worst case: TMCDD15G)

7.6.3. AC Power line Conducted Emissions

1. This test is not applicable (N/A) because the EUT is a battery-operated device with no direct connection to the AC mains during the evaluated stand-alone operating mode.
 - Mode: Battery-powered operation (Stand-alone)

Radiated test(Simultaneous transmission Scenario)

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
3. All of Simultaneous transmission Scenario were investigated and the worst case configuration results are reported.

Simultaneous transmission Scenario	Thread (Rear)	BT (Rear)	UWB	BT (Front)	NFC	Test Case
(Rear) BT + (Front) UWB + BT + NFC	-	on	on	on	on	Scenario1
(Rear) Thread + (Front) UWB + BT + NFC	on	-	on	on	on	Scenario2

4. The Simultaneous transmission Scenario mode test investigated both intermodulation and radiated spurious emissions.

- Worst result: Radiated spurious emissions
- Intermodulation: No signals are generated.
- Radiated spurious emissions: cf. Section 9.9

5. The following tables show the worst cases configurations determined during testing.

(Worst case: The lowest margin condition the channels and modes were selected for test.)

Scenario 1	Description	BT (Rear)	UWB	BT (Front)	NFC
(Rear) BT + (Front) UWB + BT + NFC	Antenna	ANT 1	ANT 1	ANT 1	ANT 1
	Channel	19	9	39	Single Channel
	Data Rate	1 Mbps	BPRF	1 Mbps	106 kbps
	Mode	1M 255 Bytes	SP3	1M 255 Bytes	ASK

Scenario 2	Description	Thread (Rear)	UWB	BT (Front)	NFC
(Rear) Thread + (Front) UWB + BT + NFC	Antenna	ANT 1	ANT 1	ANT 1	ANT 1
	Channel	26	9	19	Single Channel
	Data Rate	250 kbps	BPRF	1 Mbps	106 kbps
	Mode	O-QPSK	SP3	1M 255 Bytes	ASK

6. TMCDD15G, TMCDD15S were tested and the worst case results are reported.

(Worst case: TMCDD15G)

8. SUMMARY TEST OF RESULTS

8.1 UWB

FCC Part Section(s)	Test Description	Test Limit	Test Result
§15.503, §15.519 (b)	10 dB Bandwidth	10 dB BW $\geq$ 500 MHz or Fractional BW $\geq$ 0.2	PASS
§15.519(a)(1)	Cessation Time	Transmission shall cease in less than 10s	PASS
§15.519(e)	Maximum Peak Power	< 0 dBm/50MHz EIRP	PASS
§15.519(c)	Maximum Average Emission	< -41.3 dBm/MHz EIRP	PASS
§15.519(c)	Radiated Emissions Above 960MHz	cf. Section 7.1	PASS
§15.519(c)	Radiated Emissions Below 960MHz	cf. Section 7.1	PASS
§15.519(d)	Radiated Emissions in the 1 164 – 1 240Mhz and 1 559 – 1 610MHz GPS Bands	< -85.3 dBm EIRP	PASS
§15.207	AC Conducted Emissions 150kHz – 30MHz	cf. Section 7.4	N/A

Note:

1. All tests except for AC conducted emissions were performed under radiated conditions.
2. The decision rule applies 'simple acceptance'
3. The AC Conducted Emissions test was not applicable because the EUT is powered solely by a battery and has no connection to the AC mains during the evaluated operating mode.

ISED Part Section(s)	Test Description	Test Limit	Test Result
RSS-220, 2	10 dB Bandwidth	10 dB BW $\geq$ 500 MHz or Fractional BW $\geq$ 0.2	PASS
RSS-220, 5.3.1(b)	Cessation Time	Transmission shall cease in less than 10s	PASS
RSS-220, Annex 4(c)	Maximum Peak Power	< 0 dBm/50MHz EIRP	PASS
RSS-220, 5.3.1(d),(f)	Maximum Average Power	< -41.3 dBm/MHz EIRP	PASS
RSS-220, 5.3.1(d),(f) RSS-220, Annex 4(h)	Radiated Emissions Above 960MHz	cf. Section 7.1	PASS
RSS-220, 3.4	Radiate Emissions Below 960MHz	cf. Section 7.1	PASS
RSS-220, 5.3.1(e),(f)	Radiated Emissions in the 1 164 – 1 240Mhz and 1 559 – 1 610MHz GPS Bands	< -85.3 dBm EIRP	PASS
RSS-GEN, 8.8	AC Conducted Emissions 150kHz – 30MHz	cf. Section 7.4	N/A
RSS-220, Annex 4(n) RSS-GEN, 5 RSS-GEN, 7.3	Receiver Spurious Emissions	RSS-GEN section 7.3 table 3	PASS

Note:

1. All tests except the AC conducted emissions were performed radiated condition.
2. The decision rule applies 'simple acceptance'
3. The AC Conducted Emissions test was not applicable because the EUT is powered solely by a battery and has no connection to the AC mains during the evaluated operating mode.

8.2 BT

Test Item	FCC Part Section(s)	Test Limit	Test Condition	Test Result
Radiated Spurious Emissions	§15.247(d), 15.205, 15.209	cf. Section 8.5	Radiated	PASS

Test Description	ISED Part Section(s)	Test Limit	Test Condition	Test Result
Radiated Spurious Emissions	RSS-GEN, 8.9	cf. Section 8.5	Radiated	PASS
Receiver Spurious Emissions	RSS-GEN, 5 RSS-GEN, 7.3	cf. Section 7.5		PASS

Note:

1. The decision rule applies 'simple acceptance'

8.3 NFC

Regulation	Requirement	Result
Part 15.209	Radiated Electric Field Emissions (9 kHz to 30 MHz)	Pass
Part 15.209	Radiated Electric Field Emissions (30 MHz to 1 GHz)	Pass

Test Item	ISED Part Section(s)	Test Result
Radiated Electric Field Emissions (9kHz to 30MHz)	RSS-GEN, 8.9	Pass
Radiated Electric Field Emissions (30MHz to 1GHz)	RSS-GEN, 8.9	Pass
Receiver Spurious Emissions	RSS-GEN, 7	Pass

Note. The decision rule applies 'simple acceptance'

8.4 Thread

Test Item	FCC Part Section(s)	Test Limit	Test Condition	Test Result
Radiated Spurious Emissions	§15.247(d), 15.205, 15.209	cf. Section 7.6	Radiated	PASS

Test Item	ISED Part Section(s)	Test Limit	Test Condition	Test Result
Radiated Spurious Emissions	RSS-GEN, 8.9	cf. Section 8.5	Radiated	PASS
Receiver Spurious Emissions	RSS-GEN, 5 RSS-GEN, 7.3	cf. Section 8.5		PASS

Note: The decision rule applies 'simple acceptance'

8.5 BT, Thread Test Limit

1. FCC Test Limit

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

2. ISED Test Limit

Frequency (MHz)	Field Strength ($\mu\text{A}/\text{m}$)	Measurement Distance (m)
0.009 – 0.490	$6.37/F$ (F in kHz)	300
0.490 – 1.705	$63.7/F$ (F in kHz)	30
1.705 – 30	0.08	30

Frequency (MHz)	Field Strength ($\mu\text{V}/\text{m}$)	Measurement Distance (m)
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

9. TEST RESULT

9.1 10 dB Bandwidth

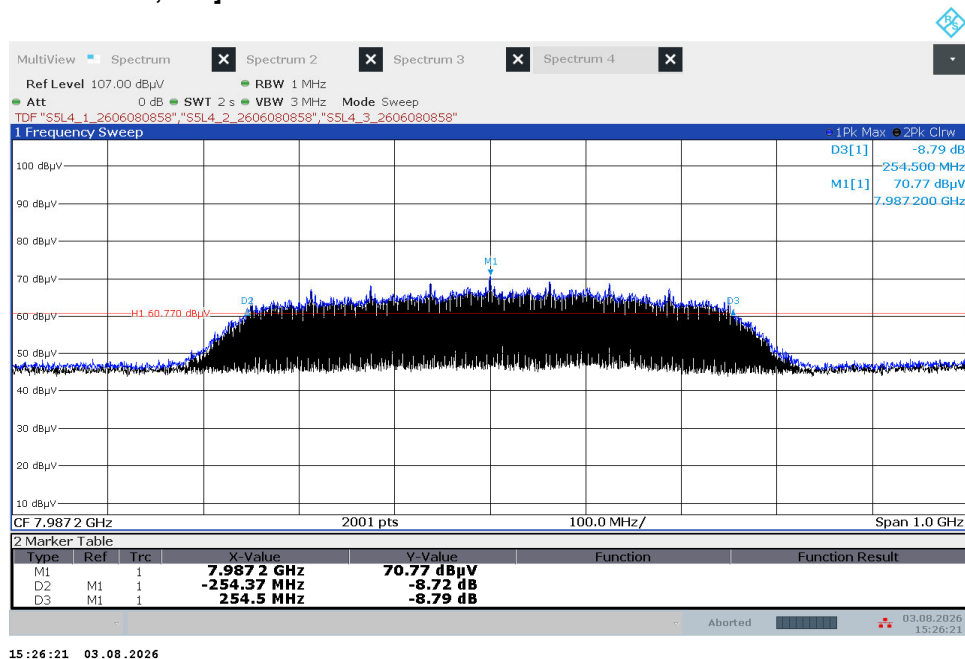
Channel	Preamble ID	Config.	Payload	f _M (MHz)	f _L (MHz)	f _H (MHz)	f _C (MHz)	-10 dB BW (MHz)	Limit (MHz)
9	9	SP0	20	7987.20	7729.83	8249.07	7989.45	519.24	>500
		SP1	20	7987.20	7728.33	8250.69	7989.51	522.36	
		SP3	N/A	7987.20	7732.83	8241.70	7987.27	508.87	

Note:

1. f_M : The frequency at which the maximum power level is measured with the peak detector.
2. f_L : For the lowest frequency bound
3. f_H : For the highest frequency bound
4. $f_C: (f_H + f_L) / 2$
5. -10 dB BW: $f_H - f_L$

Test Plots

Note : To simplify the report, the attached plots represent the worst case 10 dB BW.
[Ch 9, Preamble ID 9, SP3]



9.2 MAXIMUM PEAK POWER

(Ch. 9)

Preamble ID	Config.	Payload	Meas. Value	Pol	E	EIRP	Limit	Margin
			(dBμV/m)		(dBμV/m)	(dBm/50MHz)	(dBm/50MHz)	(dB)
9	SP0	20	92.19	H	92.19	-3.04	0	3.04
	SP1	20	90.81	H	90.81	-4.42	0	4.42
	SP3	N/A	82.68	H	82.68	-12.55	0	12.55

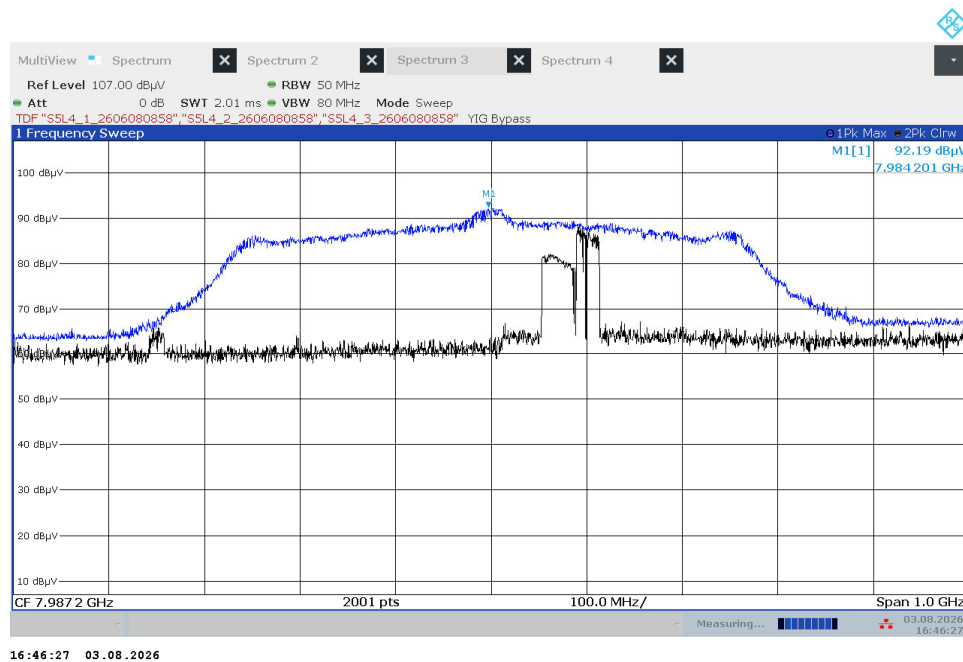
Note:

1. $E \text{ (dBμV/m)} = \text{Measured Value (dBμV)}$
 $EIRP \text{ (dBm/50MHz)} = E \text{ (dBμV/m)} - 95.23$

Test Plots

Note:

To simplify the report, the attached plots represent the worst-case EIRP.
[Ch 9, Preamble ID 9, SP0]



9.3 MAXIMUM AVERAGE POWER

(Ch. 9)

Preamble ID	Config.	Payload	Meas. Value	Pol	E	EIRP	Limit	Margin
			(dBμV/m)		(dBμV/m)	(dBm/MHz)	(dBm/MHz)	(dB)
9	SP0	20	50.25	H	50.25	-44.98	-41.3	3.68
	SP1	20	51.02	H	51.02	-44.21	-41.3	2.91
	SP3	N/A	51.25	H	51.25	-43.98	-41.3	2.68

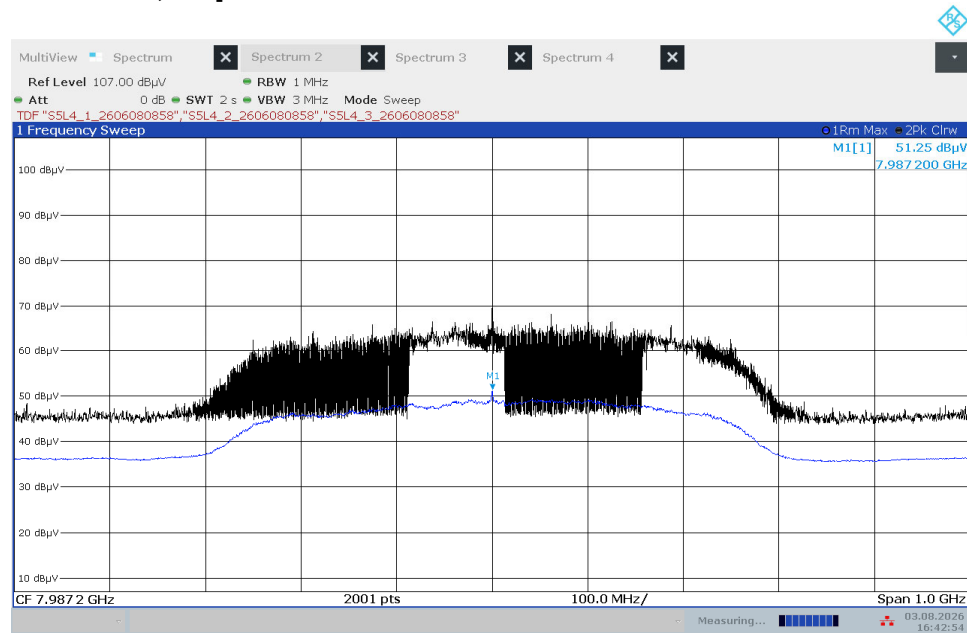
Note:

1. $E \text{ (dBμV/m)} = \text{Measured Value (dBμV)}$
 $EIRP \text{ (dBm)} = E \text{ (dBμV/m)} - 95.23$

Test Plots

Note :

To simplify the report, the attached plots represent the worst-case EIRP.
[Ch 9, Preamble ID 9, SP3]



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9.4 RADIATED EMISSIONS BELOW 960 MHz

Frequency Range : 9 kHz – 30MHz

Frequency	Measured Value	A.F+C.L+D.F	POL	Total	Limit	Margin
[MHz]	[dBμV]	[dB/m]	[H/V]	[dBμV/m]	[dBμV/m]	[dB]
No Critical peaks found						

Note:

1. The Measured 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) + Distance extrapolation factor

Channel :	9
Operation Freq. :	7987.2 MHz
Operation Mode :	BPRF
Preamble ID :	9
Configuration. :	SP0
Payload :	20

Meas. Freq	Meas. Value	Pol.	Total	Limit	Margin
(MHz)	(dBμV/m)		(dBμV/m)	(dBμV/m)	(dB)
689.51	41.899	H	41.90	46.02	4.12

Channel :	9
Operation Freq. :	7987.2 MHz
Operation Mode :	BPRF
Preamble ID :	9
Configuration. :	SP1
Payload :	20

Meas. Freq	Meas. Value	Pol.	E	Limit	Margin
(MHz)	(dBμV/m)		(dBμV/m)	(dBμV/m)	(dB)
696.78	42.053	H	42.05	46.02	3.97

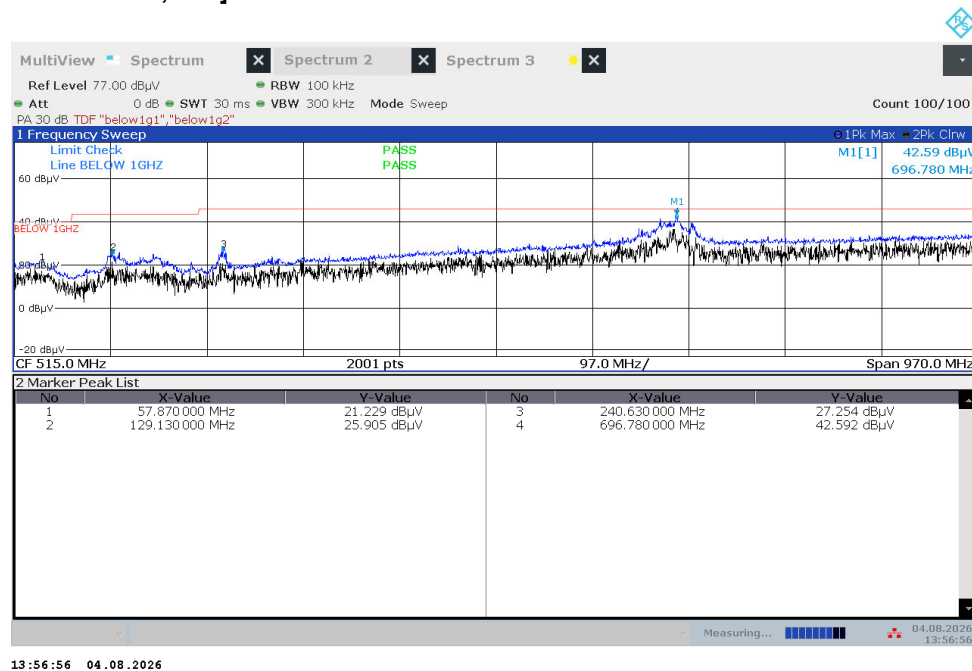
Channel :	9
Operation Freq. :	7987.2 MHz
Operation Mode :	BPRF
Preamble ID :	9
Configuration. :	SP3
Payload :	N/A

Meas. Freq	Meas. Value	Pol.	E	Limit	Margin
(MHz)	(dBμV/m)		(dBμV/m)	(dBμV/m)	(dB)
696.78	42.592	H	42.59	46.02	3.43

Test Plots

Note :

To simplify the report, the attached plots represent the worst-case mode.
[Ch 9, Preamble ID 9, SP3]



9.5 RADIATED EMISSIONS ABOVE 960 MHz

Channel :	9
Operation Freq. :	7987.2 MHz
Operation Mode :	BPRF
Preamble ID :	9
Configuration. :	SP3
Payload :	N/A

Meas. Freq (MHz)	Meas. Value (dBμV/m)	Pol.	E (dBμV/m)	EIRP (dBm)	Limit (dBm)	Margin (dB)
1317.48	28.18	H	28.18	-82.61	-75.30	7.31
1941.66	27.48	H	27.48	-67.75	-63.30	4.45
3064.27	29.28	H	29.28	-65.95	-61.30	4.65
10540.9	41.35	H	41.35	-53.88	-41.30	12.58

Channel :	9
Operation Freq. :	7987.2 MHz
Operation Mode :	BPRF
Preamble ID :	9
Configuration. :	SP0
Payload :	20

Meas. Freq (MHz)	Meas. Value (dBμV/m)	Pol.	E (dBμV/m)	EIRP (dBm)	Limit (dBm)	Margin (dB)
15974.2	41.51	H	41.51	-66.67	-61.30	5.37

Channel :	9
Operation Freq. :	7987.2 MHz
Operation Mode :	BPRF
Preamble ID :	9
Configuration. :	SP1
Payload :	20

Meas. Freq (MHz)	Meas. Value (dBμV/m)	Pol.	E (dBμV/m)	EIRP (dBm)	Limit (dBm)	Margin (dB)
15974.2	42.59	H	42.59	-65.59	-61.30	4.29

Channel :	9
Operation Freq. :	7987.2 MHz
Operation Mode :	BPRF
Preamble ID :	9
Configuration. :	SP3
Payload :	N/A

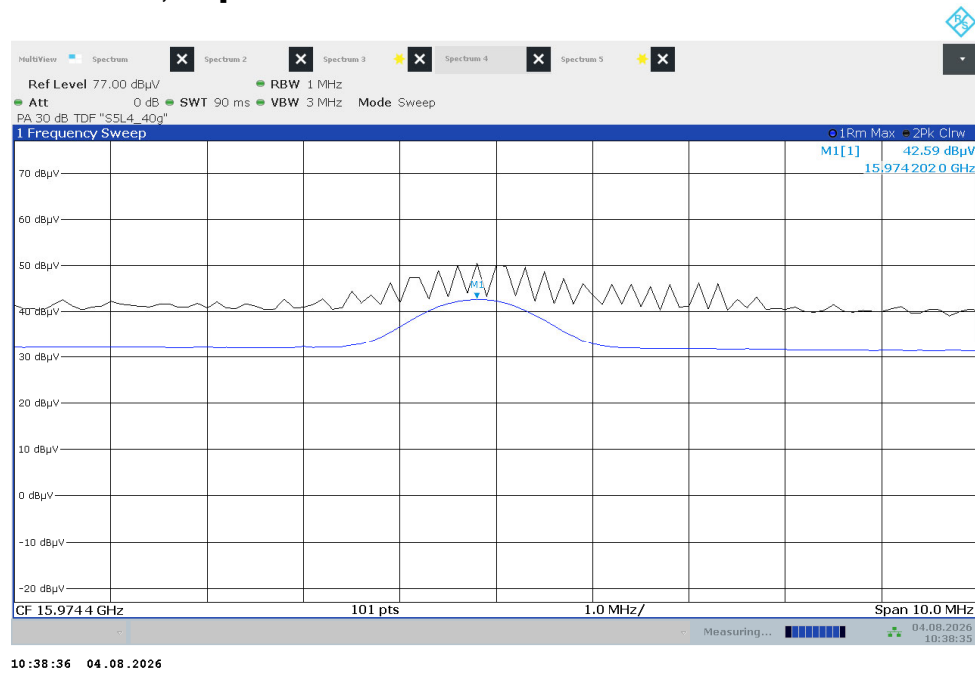
Meas. Freq (MHz)	Meas. Value (dBμV/m)	Pol.	E (dBμV/m)	EIRP (dBm)	Limit (dBm)	Margin (dB)
15974.2	41.89	H	41.89	-66.29	-61.30	4.99

Test Plots

Note :

To simplify the report, the attached plots represent the worst-case mode.

[Ch 9, Preamble ID 9, SP1]



9.6 RADIATED EMISSIONS IN THE 1164 MHz - 1240 MHz AND 1559 MHz - 1610 MHz GPS BANDS

Channel : 9

Operation Freq. : 7987.2 MHz

Operation Mode : BPRF

Preamble ID : 9

Configuration. : SP0

Payload : 20

Meas. Freq (MHz)	Meas. Value (dBμV/m)	Pol.	E (dBμV/m)	EIRP (dBm)	Limit (dBm)	Margin (dB)
1165.30	14.16	V	14.16	-90.61	-85.30	5.31
1594.63	7.36	V	7.36	-97.41	-85.30	12.11

Channel : 9

Operation Freq. : 7987.2 MHz

Operation Mode : BPRF

Preamble ID : 9

Configuration. : SP1

Payload : 20

Meas. Freq (MHz)	Meas. Value (dBμV/m)	Pol.	E (dBμV/m)	EIRP (dBm)	Limit (dBm)	Margin (dB)
1166.81	14.38	V	14.38	-90.39	-85.30	5.09
1592.66	7.82	V	7.82	-96.95	-85.30	11.65

Channel :	9
Operation Freq. :	7987.2 MHz
Operation Mode :	BPRF
Preamble ID :	9
Configuration. :	SP3
Payload :	N/A

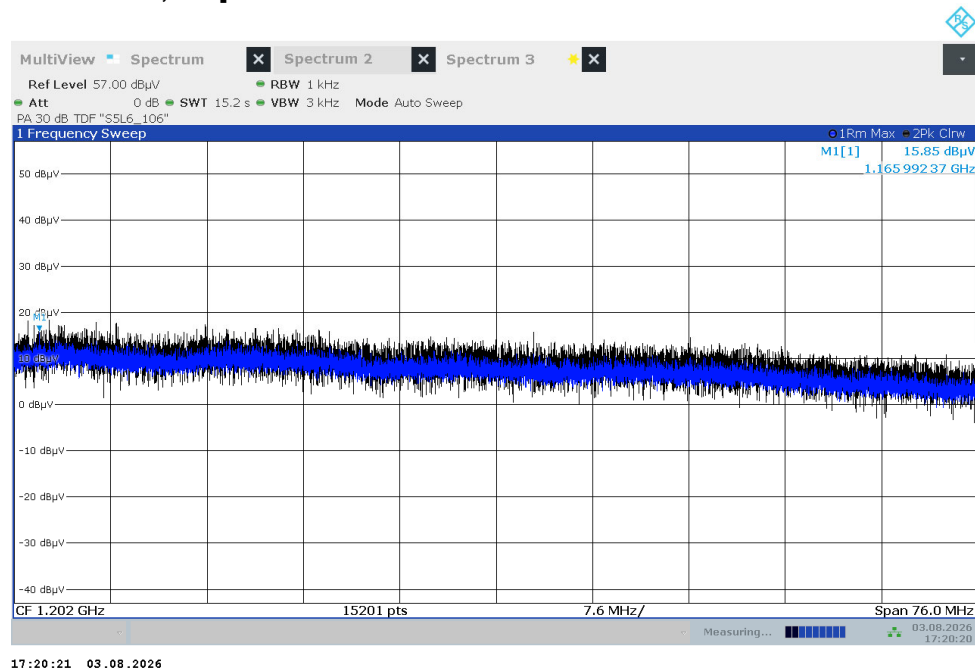
Meas. Freq (MHz)	Meas. Value (dBμV/m)	Pol.	E (dBμV/m)	EIRP (dBm)	Limit (dBm)	Margin (dB)
1165.99	15.85	V	15.85	-88.92	-85.30	3.62
1566.56	10.24	V	10.24	-94.53	-85.30	9.23

Test Plots

Note :

To simplify the report, the attached plots represent the worst-case mode.

[Ch 9, Preamble ID 9, SP3]



9.7 CEASE TRANSMISSION TIME



Note:

1. Result: 0.002101 s
2. Limit: 10.00 s
3. X2 represents the EUT for UWB stop receiving, and 1 Δ 2 shows the EUT for UWB cease transmitting.
4. The smart phone ends the UWB link
 - The smart phone Information
 - FCC ID : BCG-E3539A
 - S/N : F4GJ31BV0GPX

9.8 RECEIVER SPURIOUS EMISSIONS

Frequency Range : Below 1 GHz

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

Frequency	Reading	Ant. factor	Cable loss	Ant. POL	Total	Limit	Margin
MHz	dBuV/m	dBm/m	dBm	(H/V)	dBuV/m	dBuV/m	dB
No Critical peaks found							

9.9 Simultaneous transmission Scenario

Scenario 1 (Rear) BT + (Front) UWB + BT + NFC

CH 19		2440 MHz		Mode : Rear BLE				
Frequency [MHz]	Measured Value [dBμV]	A.F+C.L-A.G+D.F [dB/m]	D.C.F [dB]	ANT. POL [H/V]	Total [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Measurement Type
4880	55.81	-10.35	0.00	V	45.46	73.98	28.52	PK
4880	46.84	-10.35	0.69	V	37.18	53.98	16.80	AV
7320	57.74	-3.70	0.00	V	54.04	73.98	19.94	PK
7320	48.48	-3.70	0.69	V	45.48	53.98	8.50	AV
4880	57.98	-10.35	0.00	H	47.63	73.98	26.35	PK
4880	49.08	-10.35	0.69	H	39.42	53.98	14.56	AV
7320	54.69	-3.70	0.00	H	50.99	73.98	22.99	PK
7320	46.73	-3.70	0.69	H	43.73	53.98	10.25	AV

CH 39		2480 MHz		Mode : Front BLE				
Frequency [MHz]	Measured Value [dBμV]	A.F+C.L-A.G+D.F [dB/m]	D.C.F [dB]	ANT. POL [H/V]	Total [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Measurement Type
4960	62.31	-10.14	0.00	V	52.17	73.98	21.81	PK
4960	56.18	-10.14	2.06	V	48.09	53.98	5.89	AV
7440	56.42	-3.55	0.00	V	52.87	73.98	21.11	PK
7440	48.29	-3.55	2.06	V	46.80	53.98	7.18	AV
4960	65.67	-10.14	0.00	H	55.53	73.98	18.45	PK
4960	59.80	-10.14	2.06	H	51.71	53.98	2.27	AV
7440	56.71	-3.55	0.00	H	53.16	73.98	20.82	PK
7440	48.48	-3.55	2.06	H	46.99	53.98	6.99	AV

Antenna : 2
 Channel : 9
 Operation Freq. : 7987.2
 Operation Mode : BPRF
 Preamble ID : 9
 Config. : SP3
 Payload : N/A

Meas. Freq (MHz)	Meas. Value (dBμV/m)	Pol.	E (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector
704.2652	37.26	H	37.26	46.02	8.76	PK

Scenario 2 (Rear) Thread + (Front) UWB + BT + NFC

CH 26		2480 MHz		Mode : Rear_Thread				
Frequency [MHz]	Measured Value [dBμV]	A.F+C.L-A.G+D.F [dB/m]	D.C.C.F [dB]	ANT. POL [H/V]	Total [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Measurement Type
4960	55.91	-10.14	0.00	V	45.77	73.98	28.21	PK
4960	55.91	-10.14	-39.43	V	6.34	53.98	47.64	AV
7440	65.70	-3.55	0.00	V	62.15	73.98	11.83	PK
7440	65.70	-3.55	-39.43	V	22.72	53.98	31.26	AV
4960	58.48	-10.14	0.00	H	48.34	73.98	25.64	PK
4960	58.48	-10.14	-39.43	H	8.91	53.98	45.07	AV
7440	65.42	-3.55	0.00	H	61.87	73.98	12.11	PK
7440	65.42	-3.55	-39.43	H	22.44	53.98	31.54	AV

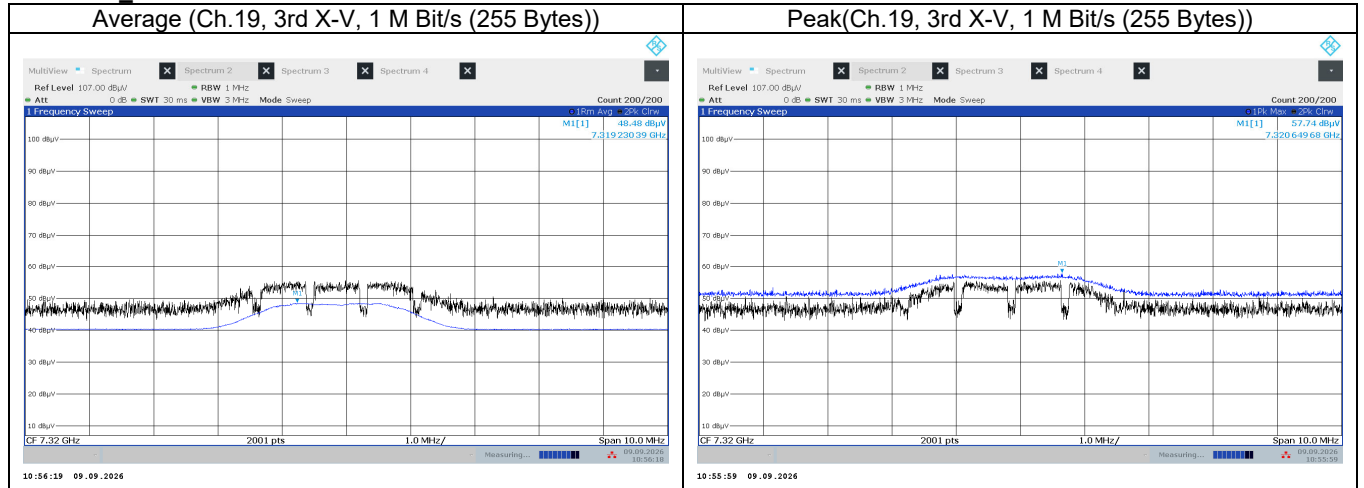
CH 19		2440 MHz		Mode : Front_BLE				
Frequency [MHz]	Measured Value [dBμV]	A.F+C.L-A.G+D.F [dB/m]	D.C.F [dB]	ANT. POL [H/V]	Total [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Measurement Type
4880	61.73	-10.35	0.00	V	51.38	73.98	22.60	PK
4880	55.68	-10.35	2.06	V	47.38	53.98	6.60	AV
7320	0.00	-3.70	0.00	V	-3.70	73.98	77.68	PK
7320	0.00	-3.70	2.06	V	-1.64	53.98	55.62	AV
4880	64.21	-10.35	0.00	H	53.86	73.98	20.12	PK
4880	58.54	-10.35	2.06	H	50.24	53.98	3.74	AV
7320	59.79	-3.70	0.00	H	56.09	73.98	17.89	PK
7320	52.97	-3.70	2.06	H	51.33	53.98	2.65	AV

Antenna : 2
 Channel : 9
 Operation Freq. : 7987.2
 Operation Mode : BPRF
 Preamble ID : 9
 Config. : SP3
 Payload : N/A

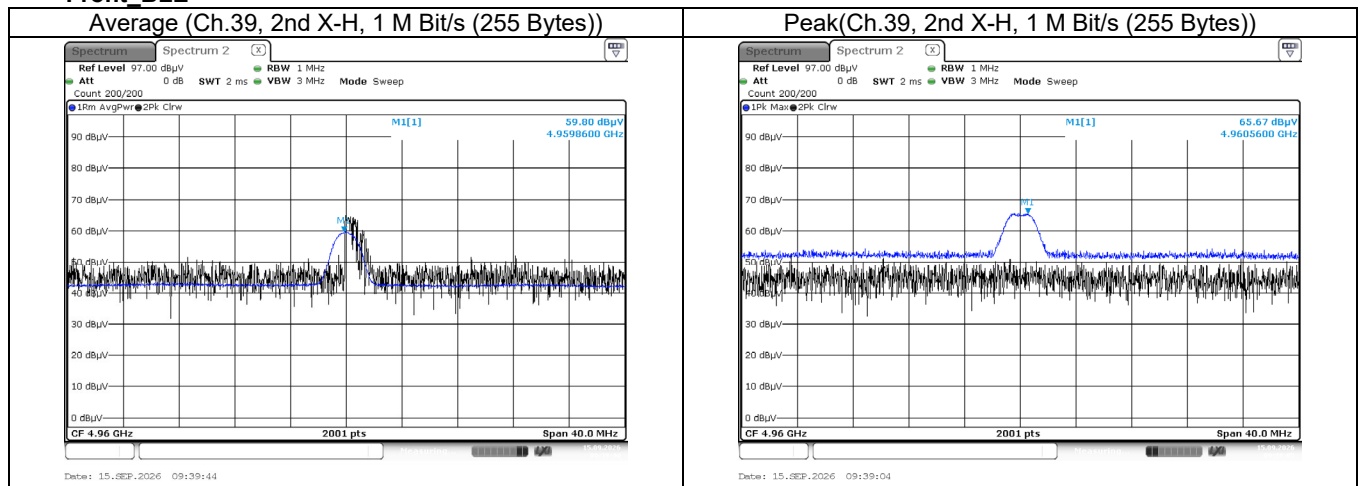
Meas. Freq (MHz)	Meas. Value (dBμV/m)	Pol.	E (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector
704.2652	38.64	H	38.64	46.02	7.38	PK

Test Plots

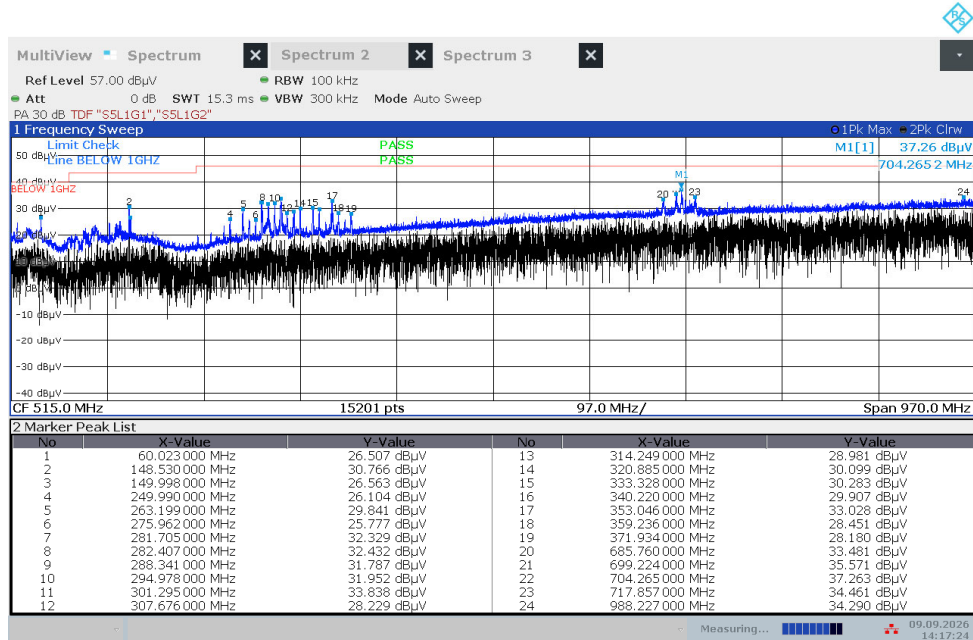
Scenario 1 (Rear) BT + (Front) UWB + BT + NFC Rear BLE



Front BLE



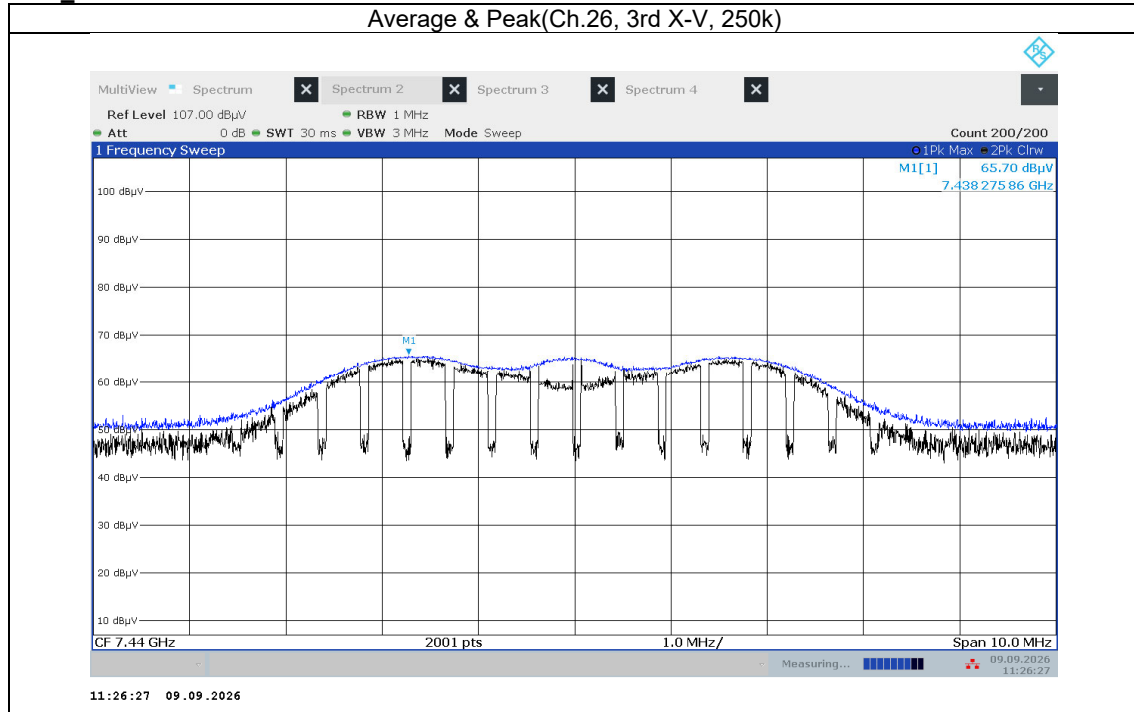
UWB & NFC_Below 1G [Ch 9, Preamble ID 9, SP3]



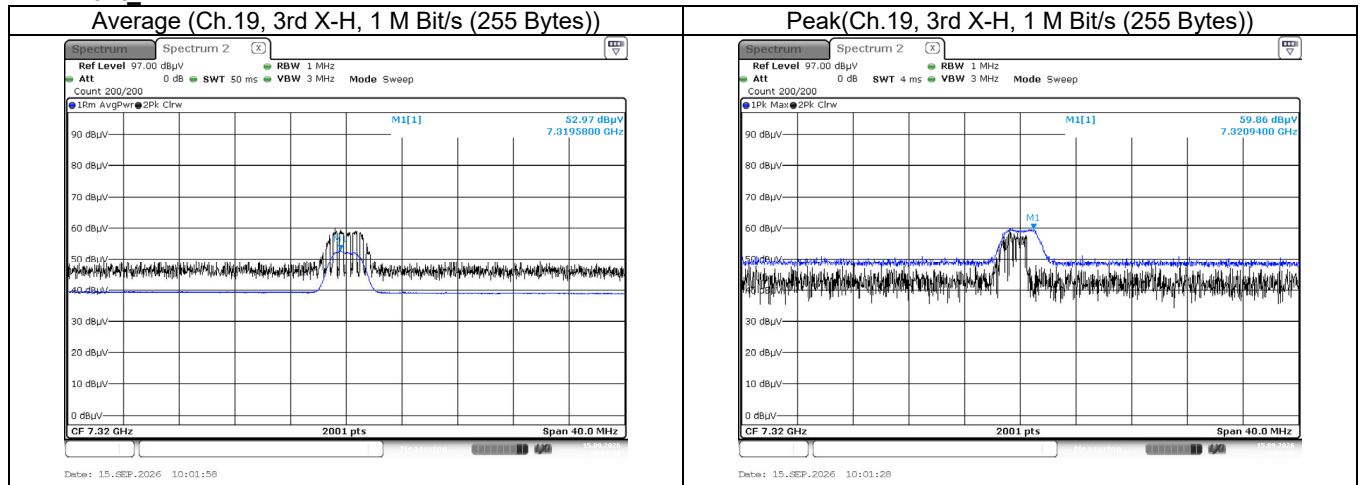
14:17:24 09.09.2026

Scenario 2 (Rear) Thread + (Front) UWB + BT + NFC

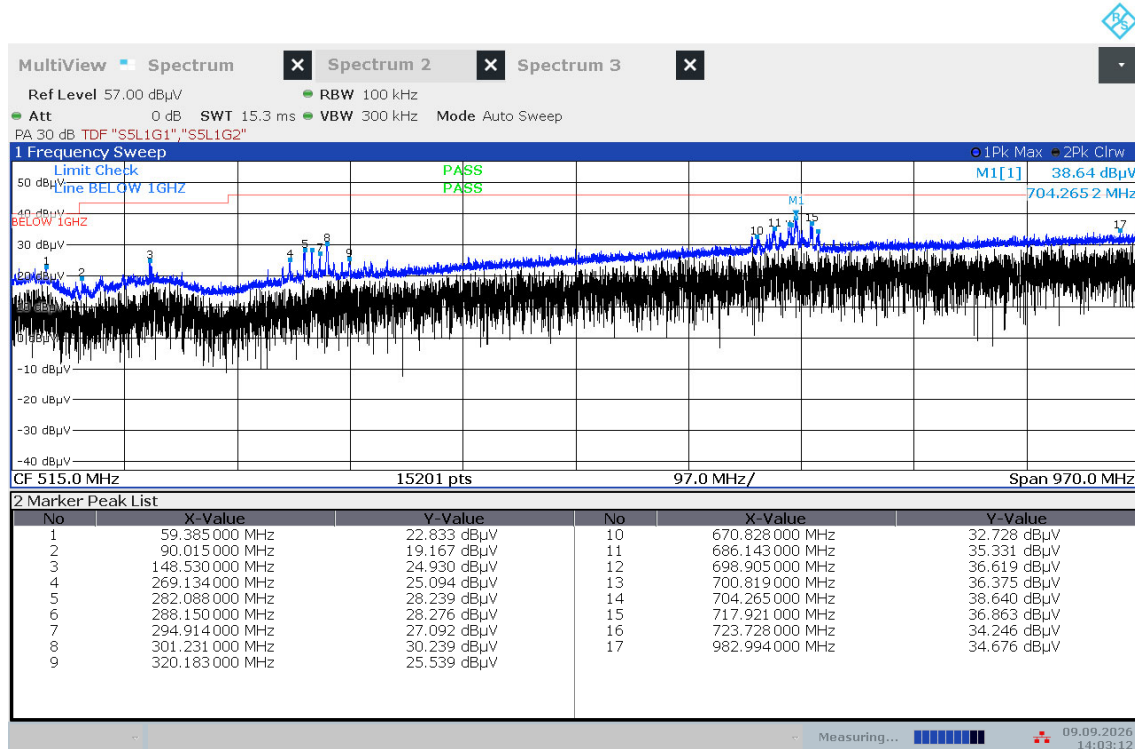
Rear_Thread



Front_BLE

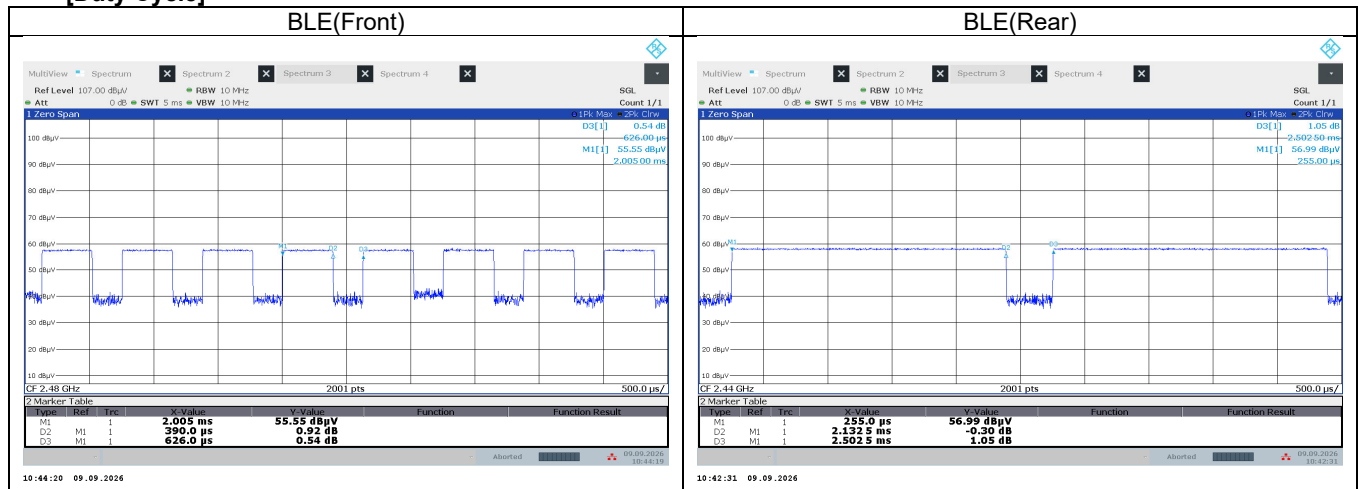


UWB & NFC_Below 1G [Ch 9, Preamble ID 9, SP3]



14:03:12 09.09.2026

[Duty Cycle]



Note : Duty Cycle Factor(D.C.F)

Duty Cycle = T_{on} / T_{Total}

Duty Cycle Factor = $10\log(1/\text{Duty Cycle})$

1. BLE(Front)

- Duty Cycle : $0.36/0.626 = 0.62$

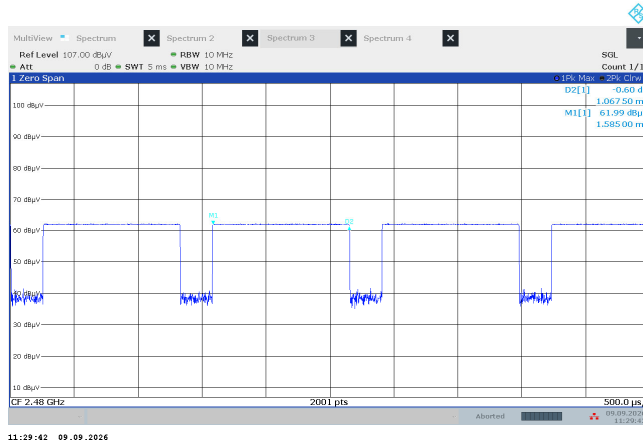
- Duty Cycle Factor : $10\log(1/0.62) = 2.06 \text{ dB}$

2. BLE(Rear) :

- Duty Cycle : $2.133/2.503 = 0.85$

- Duty Cycle Factor : $10\log(1/0.85) = 0.69 \text{ dB}$

Thread On Time



Note : Duty Cycle Correction Factor(D.C.C.F)

Duty Cycle Correction Factor(D.C.C.F) = $20\log(Ton \times \text{Number of hits in } 100 \text{ ms} / 100)$

1. Thread(Rear)

- Ton : 1.068 ms

- Number of hits in 100 ms : 1

- D.C.C.F = $20\log(1.068 \times 1 / 100) = -39.43 \text{ dB}$

10. List of Test Equipment

Radiated Test

Equipment	Model	Manufacturer	Serial No.	Due to Calibration	Calibration Interval
Antenna Mast Controller	CO3000	Innco systems GmbH	CO3000/15421/57580623/G	N/A	N/A
Antenna Mast	MA4640-XP-ET	Innco systems GmbH	9320422	03/24/2027	Annual
Turn Table	DT2000-2t	Innco systems GmbH	5930623	N/A	N/A
Horn Antenna	BBHA 9120 D	Schwarzbeck Mess-Elektronik OHG	9120D-1151	07/11/2027	Biennial
Horn Antenna	BBHA 9170	Schwarzbeck Mess-Elektronik OHG	BBHA9170342	09/20/2026	Biennial
Loop Antenna	FMZB 1513	Schwarzbeck Mess-Elektronik OHG	1513-175	01/06/2027	Biennial
Trilog Broadband Antenna	VULB 9168	Schwarzbeck Mess-Elektronik OHG	01135	08/12/2028	Biennial
Power Amplifier	310N	SONOMA INSTRUMENT	186169	01/23/2027	Annual
RF Switching System	FBSR-04C (HPF(3~18GHz) + LNA1(1~18GHz))	T&M system	S5L1	02/12/2027	Annual
RF Switching System	FBSR-04C (ATT(10dB) + LNA1(1~18GHz))	T&M system	S5L2	02/12/2027	Annual
RF Switching System	FBSR-04C (ATT(3dB) + LNA1(1~18GHz))	T&M system	S5L3	02/12/2027	Annual
RF Switching System	FBSR-04C (LNA1(1~18GHz))	T&M system	S5L4	02/12/2027	Annual
RF Switching System	FBSR-04C (HPF(7~18GHz) + LNA2(6~18GHz))	T&M system	S5L5	02/12/2027	Annual
RF Switching System	FBSR-04C (Thru(30MHz ~ 18GHz))	T&M system	S5L6	02/12/2027	Annual
Broadband LNA	CBL18265035	CERNEX	22966	10/21/2026	Annual
Broadband LNA	CBL26405040	CERNEX	25956	02/09/2027	Annual
LOW NOISE AMPLIFIER	TK-PA1840H	TESTEK	170011-L	09/29/2026	Annual
Signal Analyzer	FSV40	Rohde & Schwarz	101510	09/01/2027	Annual
Signal Analyzer	FSW67	Rohde & Schwarz	101736	05/29/2027	Annual
High Pass Filter	WHKX10-7150-8000-18000-50SS	Wainwright Instruments GmbH	1	02/09/2027	Annual

Note:

- Equipment whose calibration due date was updated during the test period was not used between the previous due date and the update.
All reported measurements were performed using equipment within valid calibration.
- Especially, all antenna for measurement is calibrated in accordance with the requirements of ANSI C63.5-2017.

11. ANNEX A_TEST SETUP PHOTO

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

No.	Description
1	HCT-RF-2608-FI001-P