

FCC Part 15C Compliance Test Report

Test Report no.:	FCC15CBT_RM-1154_05.docx	Date of Report:	11-Dec-2015
Number of pages:	53	Customer's Contact person:	Juha Paukku
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FCC listing no.:	94436		
IC recognition no.:	661AK-1		
Tested devices/ accessories:	Phone RM-1154 / Charger AC-18E / Battery BV-T3G (LG) / Headset WH-108 / Dummy battery SD-134		
FCC ID:	PYARM-1154	IC:	661X-RM1154
Supplement reports:	-		
Testing has been carried out in accordance with:	47 CFR 15C, ANSI C63.10 (2013), RSS-247 (Issue 1) and RSS-Gen (Issue 4). Deviations, modifications or clarifications (if any) to above mentioned documents are written in each section under "Test method and limit".		
Documentation:	The test report must always be reproduced in full; reproduction of an excerpt only is subject to written approval of the testing laboratory. The documentation of the testing performed on the tested devices is archived for 15 years at TCC Microsoft.		
Test Results:	The EUT complies with the requirements in respect of all parameters subject to the test. The test results relate only to devices specified in this document		
Date and signature for the contents:			

Hannu Soderholm, Engineer, EMC

1. Summary for FCC Part 15C Compliance Test Report

Date of receipt	21-Oct-2015
Testing completed	07-Dec-2014
The customer's contact person	Juha Paukku
Test Plan referred to	T:\Projects\RM-1152\TestPlan\Test_plan EMC FCC_RM-1152.xlsx
Notes	-
Document name	T:\Projects\RM-1154\EMC\Copy Reports\FCC15CBT_RM-1154_05.docx

1.1. EUT and Accessory Information

Product	Type	SN	HW	MV	SW	DUT
Phone	RM-1152	004402742963899	1540	-	01078.10006.15421.42000	400052
Charger	AC-18E	4090493521750501701;0675695	-	-	-	400050
Battery	BV-T3G (LG)	4955405343010304094;0670783	1.0	-	-	400051
Headset	WH-108	-	4.0	4.0	-	42927
Dummy battery	SD-134	2301637	v.1	-	-	400053

EUT antenna gain

Gain [dBi]	2400-2483.5 MHz
Antenna 1	0
Antenna 2	-

1.2. Summary of Test Results

Bluetooth:

Section in CFR 47	Section in RSS-GEN or RSS-247	Name of the test	Result
15.247(b)(1)	5.4 (2)	Conducted peak output power	PASSED
15.247(d), 15.205(b)	5.5	Band edge compliance of RF emissions	PASSED
15.247(d)	5.5	Spurious RF conducted emissions	PASSED
15.247(d), 15.209	5.5	Spurious radiated emissions	PASSED
15.207	8.8	AC powerline conducted emissions	PASSED
15.247(a)(1)	5.1 (1)	20 dB bandwidth	PASSED
15.247(a)(1)	5.1 (2)	Carrier frequency separation	PASSED
15.247(a)(1)(iii)	5.1 (4)	Number of hopping frequencies	PASSED
15.247(a)(1)(iii)	5.1 (4)	Time of occupancy	PASSED

The test results of RM-1152 are re-used for certification of the RM-1154. The table above indicates the results, which will be re-used.

PASSED
FAILED
NP

The EUT complies with the essential requirements in the standard.
The EUT does not comply with the essential requirements in the standard.
The test was not performed by the TCC Microsoft Laboratory.

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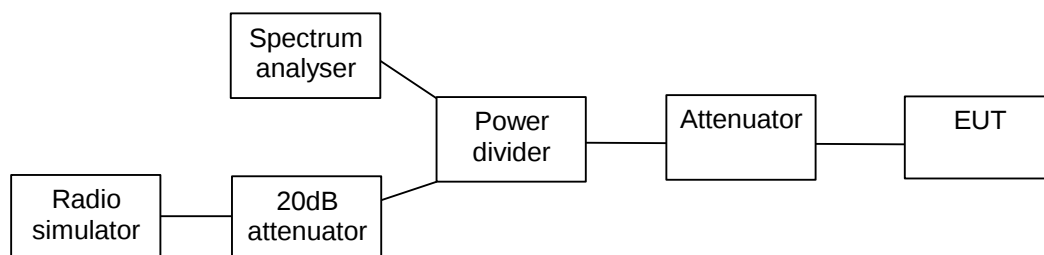
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2. Conducted peak output power

EUT with DUT number	RM-1152, DUT 400052
Accessories with DUT numbers	SD-134, DUT 400053
Operation Voltage [V] / [Hz]	Nominal
Results	PASSED
Remarks	RF Cond 2
Temp [°C] / Humidity [%RH] / Air Pressure [kPa]	21 / 47 / 101.4
Date of measurements	24-Oct-2015
Measured by	Hannu Soderholm

2.1. Test Setup



2.2. Test method and limit

The measurement is made according to ANSI C63.10 and RSS-247.

Limits for conducted peak output power measurements

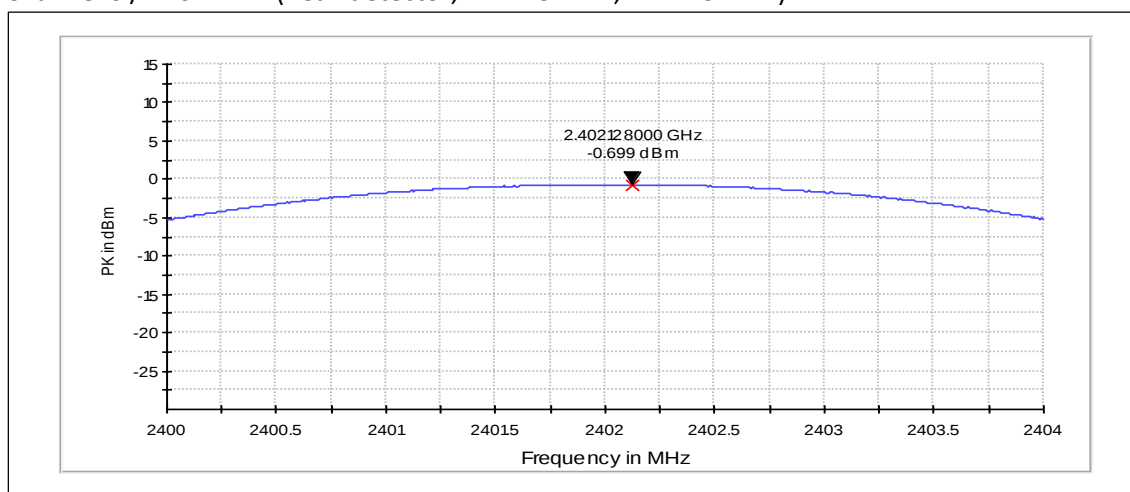
Frequency range [MHz]	Limit [W]	Limit [dBm]	IC only Limit [dBm eirp]
2400 – 2483.5	≤ 1	≤ 30	36

2.3. Bluetooth Test results

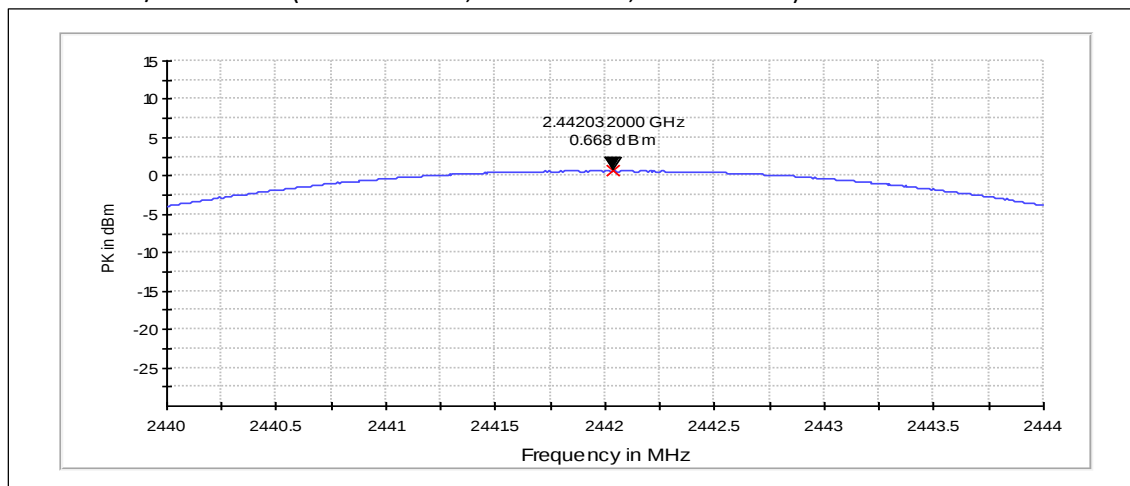
2.3.1 GFSK modulation, PRBS packet type

Channel / f_c [MHz]	P [dBm]	P [mW]	Result
0 / 2402	-0.7	0.851	PASSED
40 / 2442	0.67	1.167	PASSED
78 / 2480	-1.54	0.701	PASSED

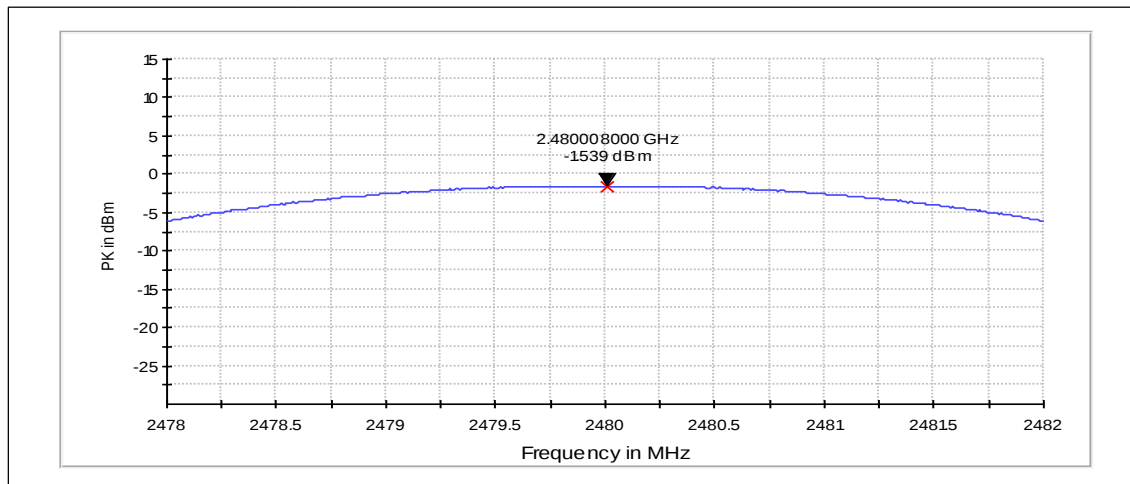
Channel 0 / 2402 MHz (Peak detector, RBW: 3 MHz, VBW: 3 MHz)



Channel 40 / 2442 MHz (Peak detector, RBW: 3 MHz, VBW: 3 MHz)



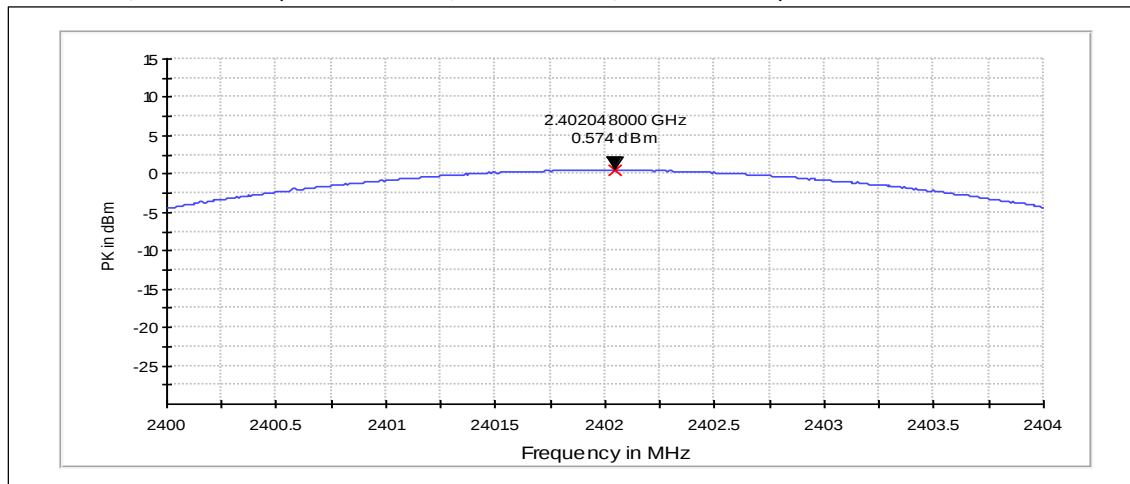
Channel 78 / 2480 MHz (Peak detector, RBW: 3 MHz, VBW: 3 MHz)



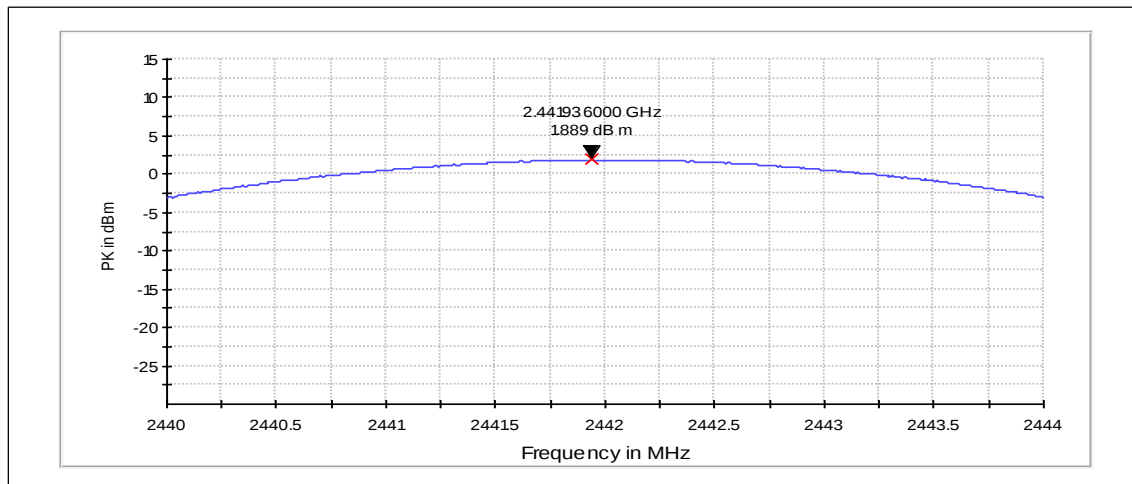
2.3.2 8DPSK modulation, PRBS packet type

Channel / f _c [MHz]	P [dBm]	P [mW]	Result
0 / 2402	0.57	1.14	PASSED
40 / 2442	1.89	1.545	PASSED
78 / 2480	-0.2	0.955	PASSED

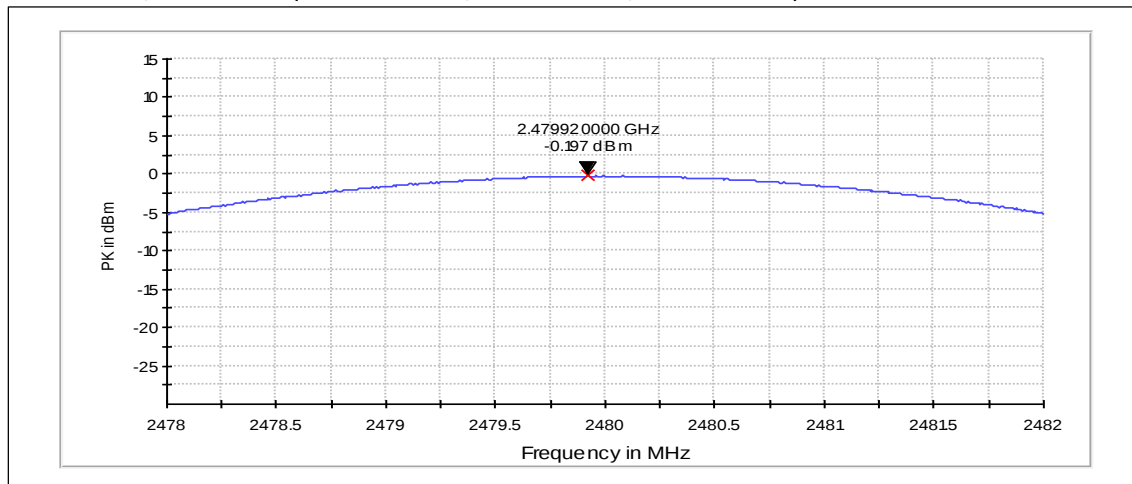
Channel 0 / 2402 MHz (Peak detector, RBW: 3 MHz, VBW: 3 MHz)



Channel 40 / 2442 MHz (Peak detector, RBW: 3 MHz, VBW: 3 MHz)



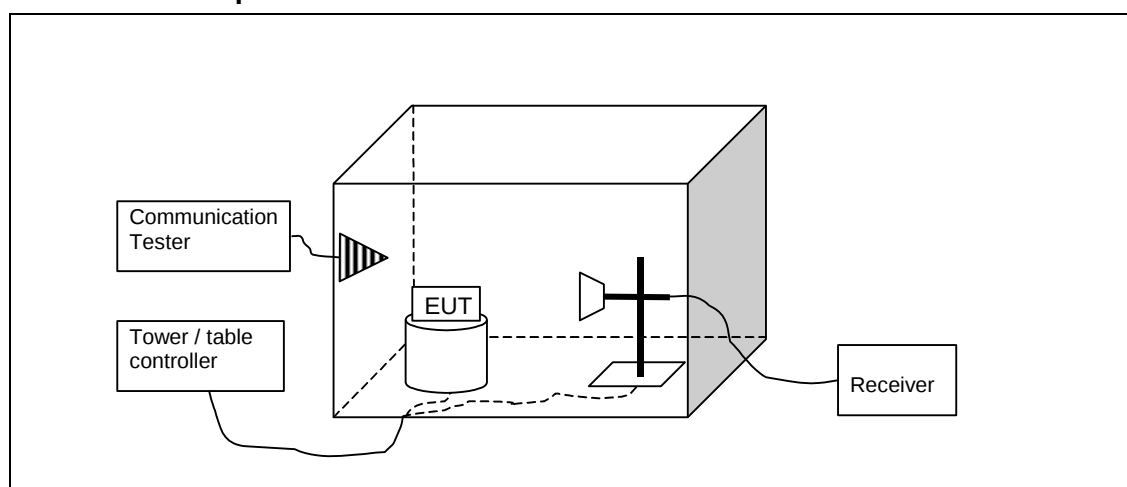
Channel 78 / 2480 MHz (Peak detector, RBW: 3 MHz, VBW: 3 MHz)



3. Band edge compliance of RF emissions

EUT with DUT number	RM-1152, DUT 400049
Accessories with DUT numbers	BV-T3G (LG), DUT 400051 ; AC-18E, DUT 400050 ; WH-108, DUT 42927
Operation Voltage [V] / [Hz]	115 / 60
Results	PASSED
Remarks	-
Temp [°C] / Humidity [%RH] / Air Pressure [kPa]	21 / 40 / 100.4
Date of measurements	09-Nov-2015
Measured by	Hannu Söderholm

3.1.1 Test setup



3.2. Test method and limit

The measurement is made according to ANSI C63.10 and RSS-247 as follows:

The measurement is made with absorbers on the floor, measuring antenna at fixed height in horizontal and vertical polarizations, EUT set in three orthogonal positions on the turn table and turn table rotated 0...360 degrees.

The measurement results are obtained as described below:

$$E [dB\mu V/m] = U_{RX} + A_{TOT}$$

Where U_{RX} is receiver reading and A_{TOT} is total correction factor including cable loss, antenna factor and preamplifier gain ($A_{TOT} = L_{CABLES} + A_F - G_{PREAMP}$).

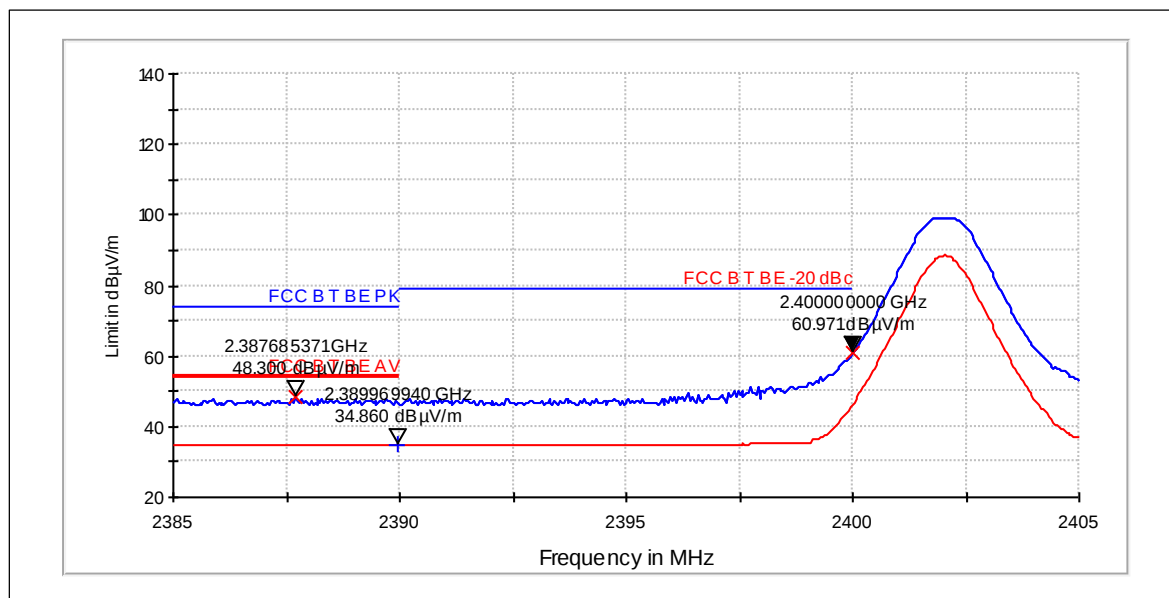
Limits for band edge compliance of RF emissions measurements (3 m measurement distance)

Frequency range [MHz]	Limit
Below 2390 and above 2483.5	54 dBuV/m (avg) and 74 dBuV/m (pk)
2390 - 2400	-20 dBc (pk)

3.3. Bluetooth test results, Orthogonal position 1 and 2

3.3.1 GFSK modulation, PRBS packet type

Channel 0 / 2402 MHz



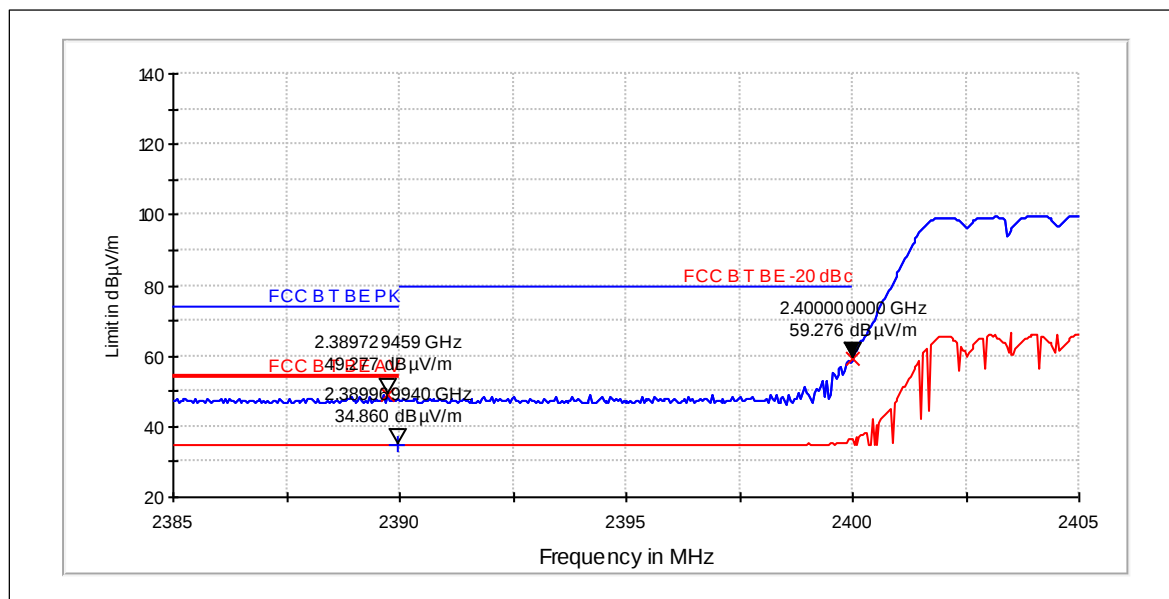
Peak (RBW: 1 MHz, VBW: 1 MHz)

Frequency [MHz]	E [dBμV/m]	E [μV/m]	U _{RX} [dBμV]	A _{TOT} [dB]	Results
2388	48.3	260.016	58.01	-9.71	PASSED
2400	60.97	1118.279	0	60.97	PASSED

Average (RBW: 1 MHz, VBW: 1 MHz)

Frequency [MHz]	E [dBμV/m]	E [μV/m]	U _{RX} [dBμV]	A _{TOT} [dB]	Results
2390	34.86	55.335	44.57	-9.71	PASSED

Hopping on. Low end.



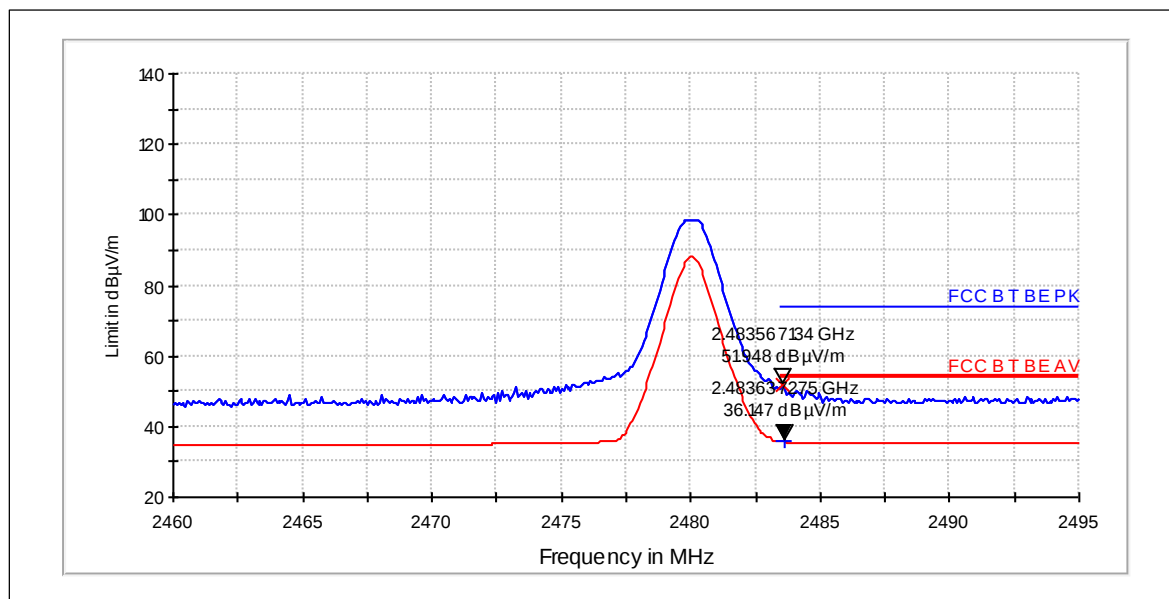
Peak (RBW: 1 MHz, VBW: 1 MHz)

Frequency [MHz]	E [dBμV/m]	E [μV/m]	U _{RX} [dBμV]	A _{TOT} [dB]	Results
2390	49.28	290.971	58.99	-9.71	PASSED
2400	59.28	920.026	0	59.28	PASSED

Average (RBW: 1 MHz, VBW: 1 MHz)

Frequency [MHz]	E [dBμV/m]	E [μV/m]	U _{RX} [dBμV]	A _{TOT} [dB]	Results
2390	34.86	55.335	44.57	-9.71	PASSED

Channel 78 / 2480 MHz



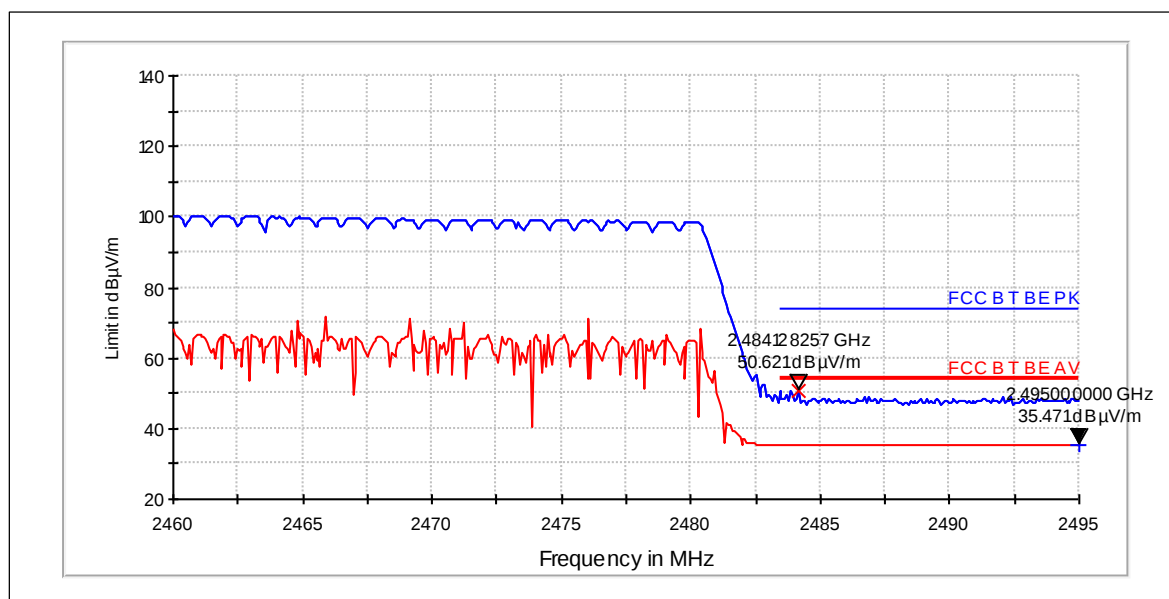
Peak (RBW: 1 MHz, VBW: 1 MHz)

Frequency [MHz]	E [dBμV/m]	E [μV/m]	U _{RX} [dBμV]	A _{TOT} [dB]	Results
2484	51.95	395.731	61.18	-9.23	PASSED

Average (RBW: 1 MHz, VBW: 1 MHz)

Frequency [MHz]	E [dBμV/m]	E [μV/m]	U _{RX} [dBμV]	A _{TOT} [dB]	Results
2484	36.15	64.173	45.38	-9.23	PASSED

Hopping on. High end.



Peak (RBW: 1 MHz, VBW: 1 MHz)

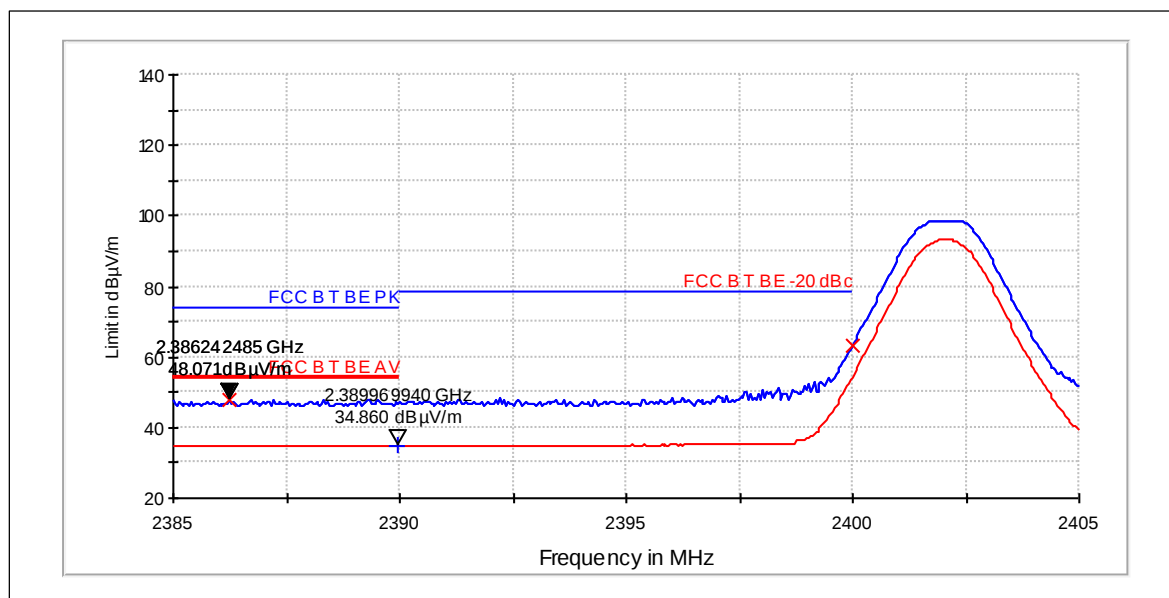
Frequency [MHz]	E [dBμV/m]	E [μV/m]	U _{RX} [dBμV]	A _{TOT} [dB]	Results
2484	50.62	339.664	59.85	-9.23	PASSED

Average (RBW: 1 MHz, VBW: 1 MHz)

Frequency [MHz]	E [dBμV/m]	E [μV/m]	U _{RX} [dBμV]	A _{TOT} [dB]	Results
2495	35.47	59.368	44.7	-9.23	PASSED

3.3.2 8DPSK modulation, PRBS packet type

Channel 0 / 2402 MHz



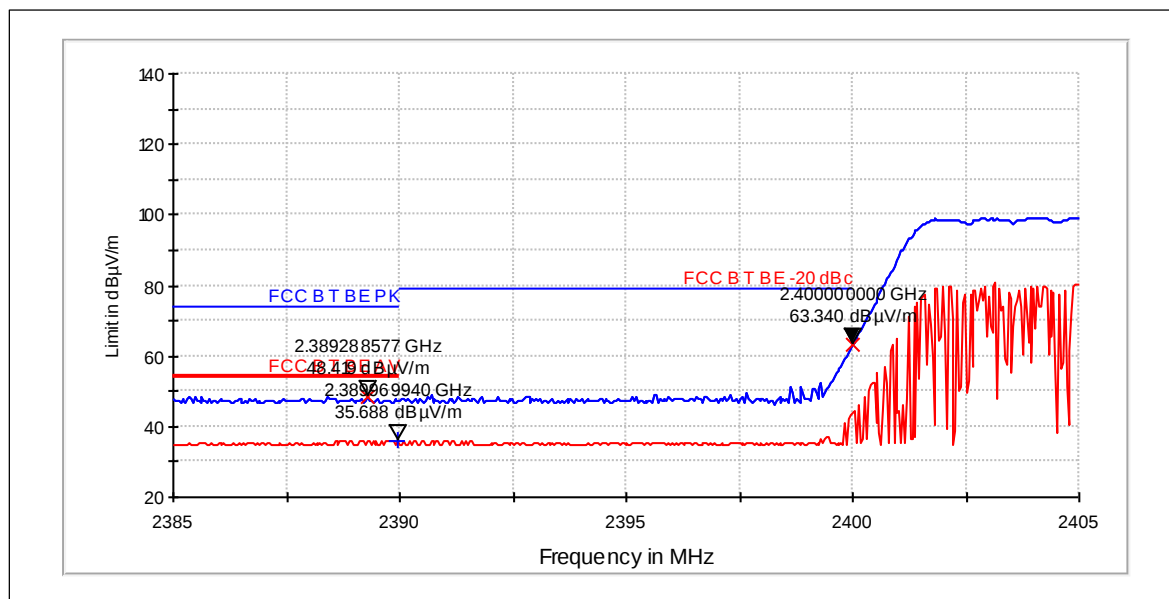
Peak (RBW: 1 MHz, VBW: 1 MHz)

Frequency [MHz]	E [dBμV/m]	E [μV/m]	U _{RX} [dBμV]	A _{TOT} [dB]	Results
2386	48.07	253.25	57.78	-9.71	PASSED
2400	63.42	1482.689	0	63.42	PASSED

Average (RBW: 1 MHz, VBW: 1 MHz)

Frequency [MHz]	E [dBμV/m]	E [μV/m]	U _{RX} [dBμV]	A _{TOT} [dB]	Results
2390	34.86	55.335	44.57	-9.71	PASSED

Hopping on. Low end.



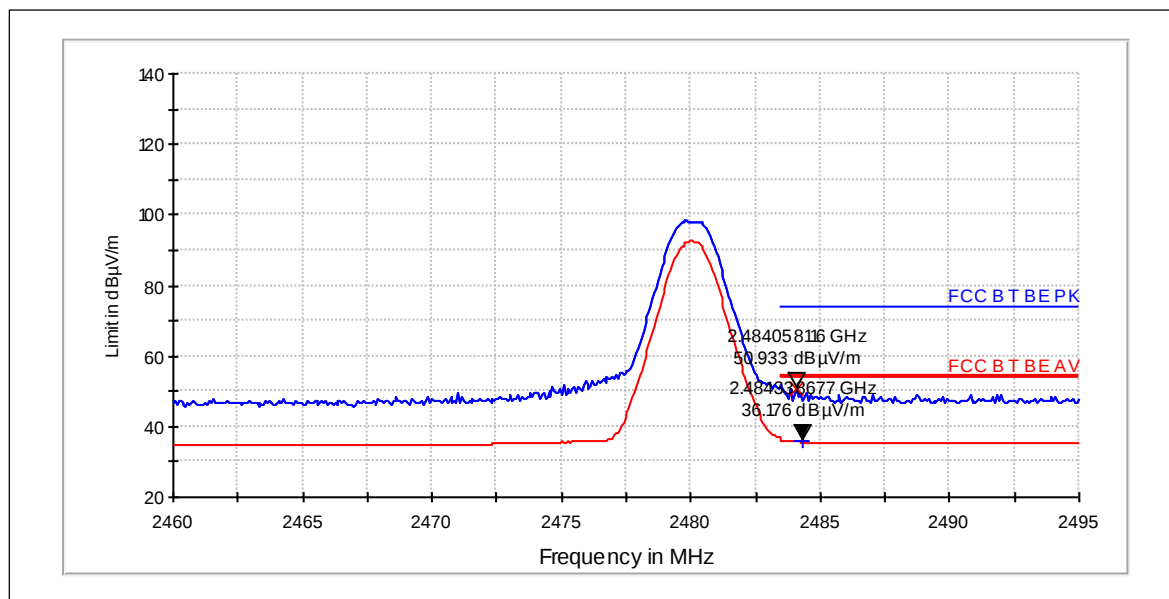
Peak (RBW: 1 MHz, VBW: 1 MHz)

Frequency [MHz]	E [dBμV/m]	E [μV/m]	U _{RX} [dBμV]	A _{TOT} [dB]	Results
2389	48.42	263.603	58.13	-9.71	PASSED
2400	63.34	1468.926	73.05	-9.71	PASSED

Average (RBW: 1 MHz, VBW: 1 MHz)

Frequency [MHz]	E [dBμV/m]	E [μV/m]	U _{RX} [dBμV]	A _{TOT} [dB]	Results
2390	35.69	60.87	45.4	-9.71	PASSED

Channel 78 / 2480 MHz



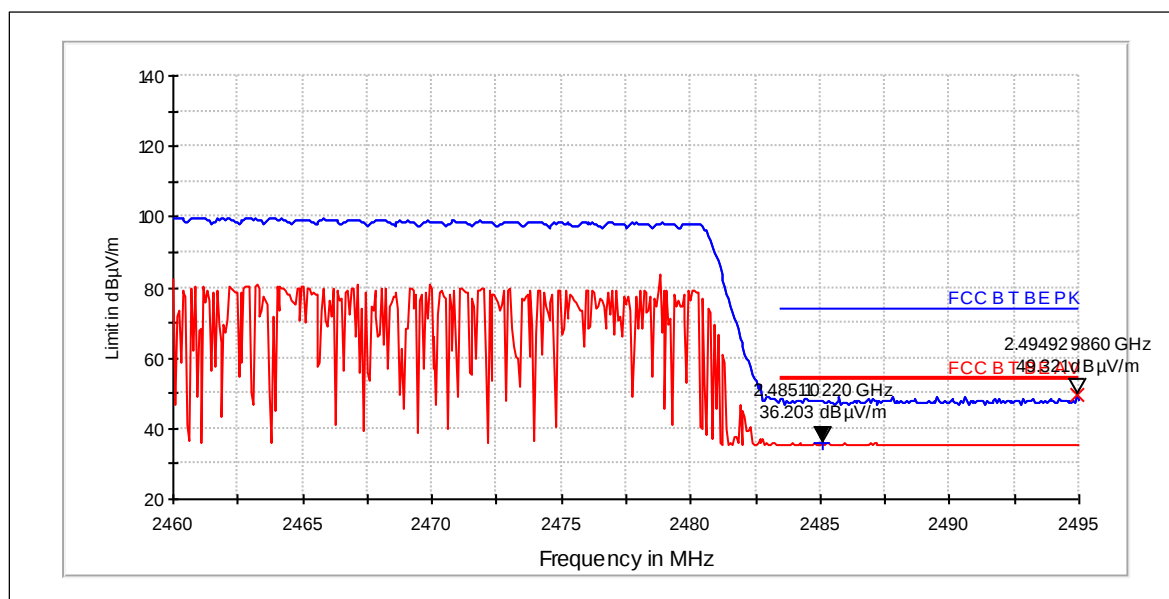
Peak (RBW: 1 MHz, VBW: 1 MHz)

Frequency [MHz]	E [dBμV/m]	E [μV/m]	U _{RX} [dBμV]	A _{TOT} [dB]	Results
2484	50.93	352.087	60.16	-9.23	PASSED

Average (RBW: 1 MHz, VBW: 1 MHz)

Frequency [MHz]	E [dBμV/m]	E [μV/m]	U _{RX} [dBμV]	A _{TOT} [dB]	Results
2484	36.18	64.387	45.41	-9.23	PASSED

Hopping on. High end.



Peak (RBW: 1 MHz, VBW: 1 MHz)

Frequency [MHz]	E [dBμV/m]	E [μV/m]	U _{RX} [dBμV]	A _{TOT} [dB]	Results
2495	49.32	292.449	58.55	-9.23	PASSED

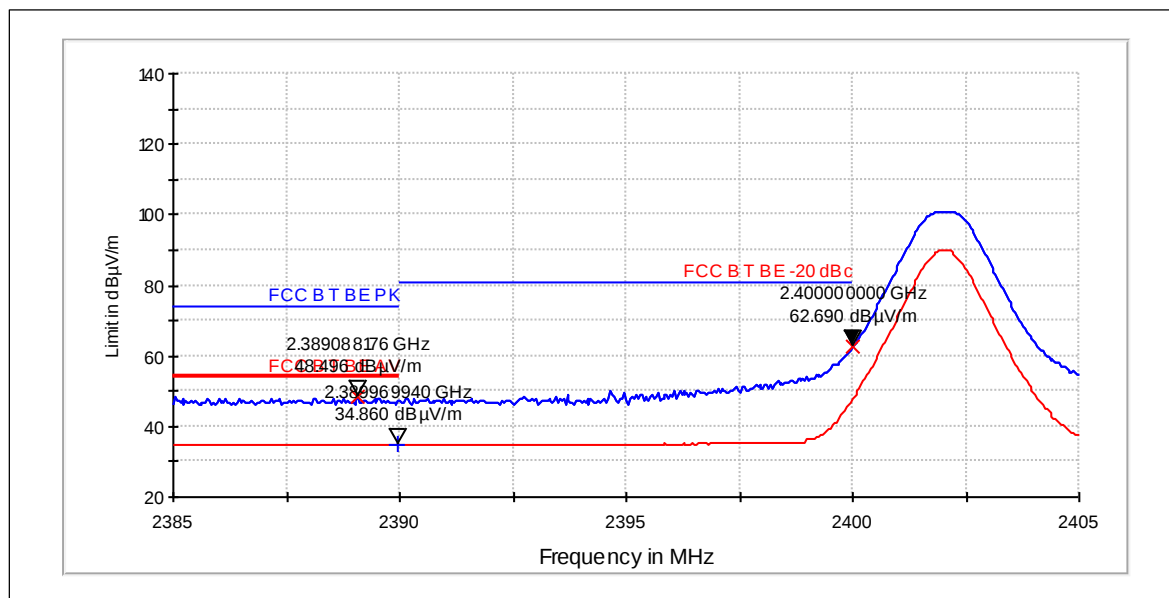
Average (RBW: 1 MHz, VBW: 1 MHz)

Frequency [MHz]	E [dBμV/m]	E [μV/m]	U _{RX} [dBμV]	A _{TOT} [dB]	Results
2485	36.2	64.588	45.43	-9.23	PASSED

3.4. Bluetooth test results, Orthogonal position 3

3.4.1 GFSK modulation, PRBS packet type

Channel 0 / 2402 MHz



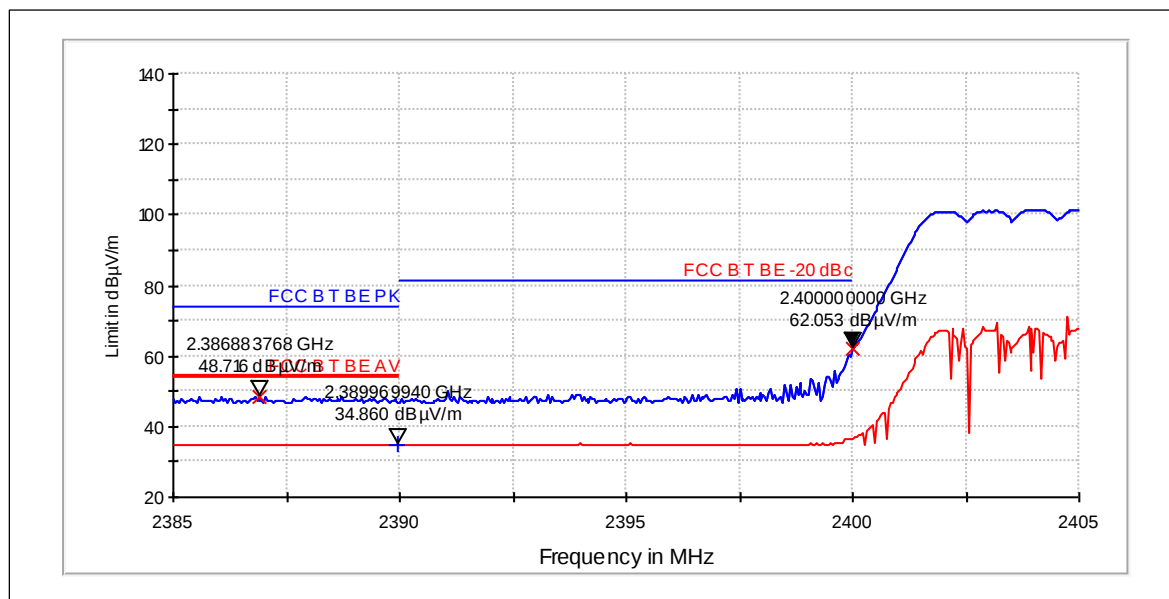
Peak (RBW: 1 MHz, VBW: 1 MHz)

Frequency [MHz]	E [dBμV/m]	E [μV/m]	U _{RX} [dBμV]	A _{TOT} [dB]	Results
2389	48.5	265.95	58.21	-9.71	PASSED
2400	62.69	1363.013	0	62.69	PASSED

Average (RBW: 1 MHz, VBW: 1 MHz)

Frequency [MHz]	E [dBμV/m]	E [μV/m]	U _{RX} [dBμV]	A _{TOT} [dB]	Results
2390	34.86	55.335	44.57	-9.71	PASSED

Hopping on. Low end.



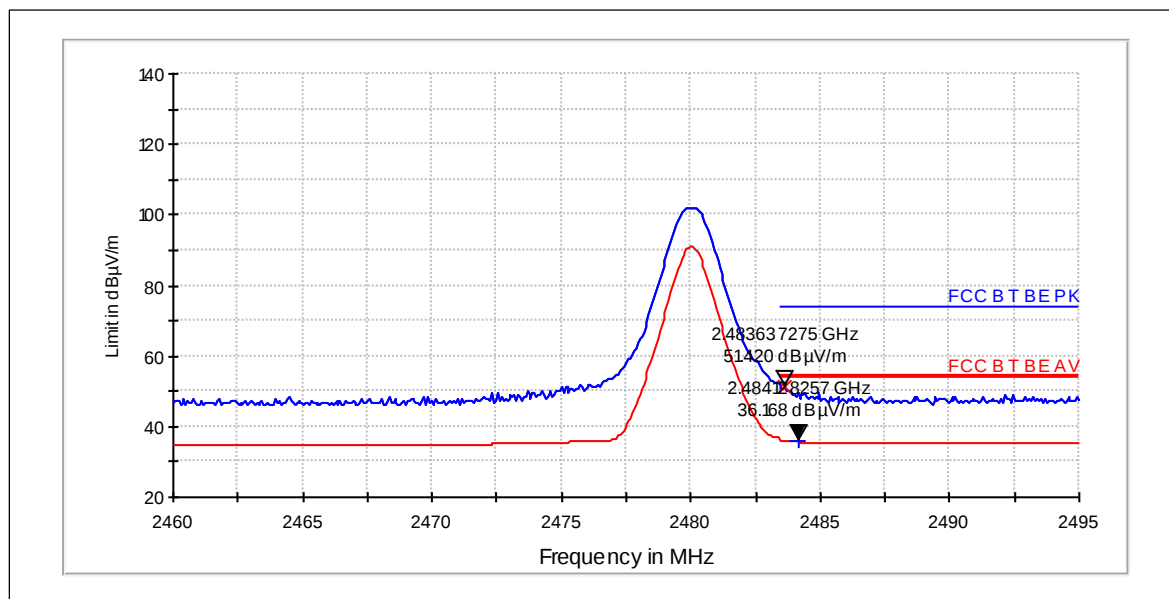
Peak (RBW: 1 MHz, VBW: 1 MHz)

Frequency [MHz]	E [dBμV/m]	E [μV/m]	U _{RX} [dBμV]	A _{TOT} [dB]	Results
2387	48.72	272.772	58.43	-9.71	PASSED
2400	62.05	1266.631	0	62.05	PASSED

Average (RBW: 1 MHz, VBW: 1 MHz)

Frequency [MHz]	E [dBμV/m]	E [μV/m]	U _{RX} [dBμV]	A _{TOT} [dB]	Results
2390	34.86	55.335	44.57	-9.71	PASSED

Channel 78 / 2480 MHz



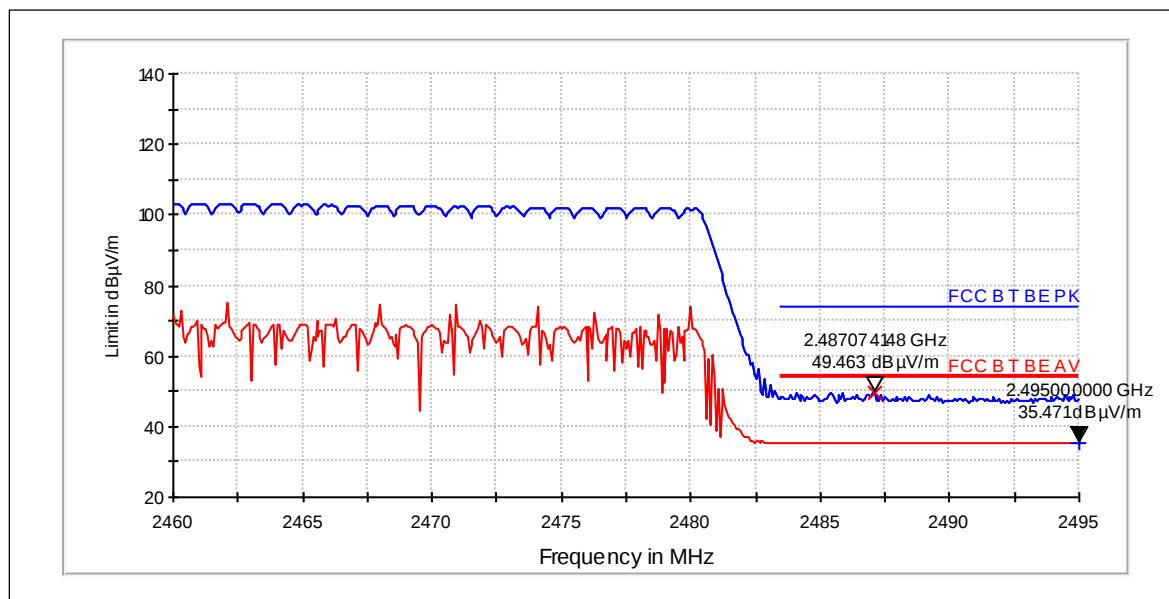
Peak (RBW: 1 MHz, VBW: 1 MHz)

Frequency [MHz]	E [dBμV/m]	E [μV/m]	U _{RX} [dBμV]	A _{TOT} [dB]	Results
2484	51.42	372.392	60.65	-9.23	PASSED

Average (RBW: 1 MHz, VBW: 1 MHz)

Frequency [MHz]	E [dBμV/m]	E [μV/m]	U _{RX} [dBμV]	A _{TOT} [dB]	Results
2484	36.17	64.328	45.4	-9.23	PASSED

Hopping on. High end.



Peak (RBW: 1 MHz, VBW: 1 MHz)

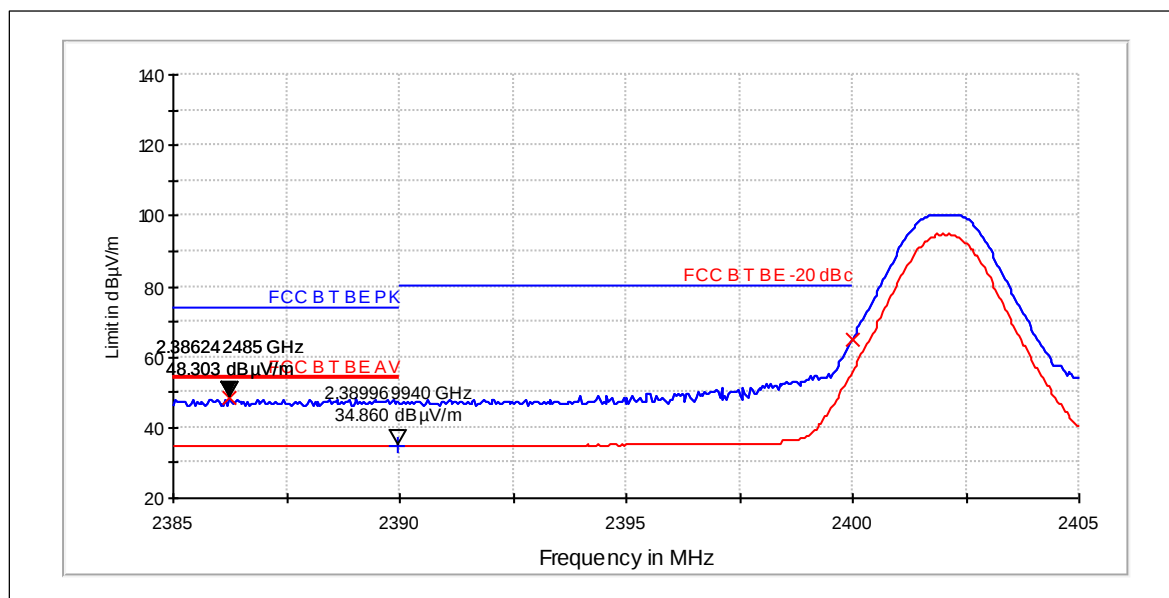
Frequency [MHz]	E [dBμV/m]	E [μV/m]	U _{RX} [dBμV]	A _{TOT} [dB]	Results
2487	49.46	297.269	58.69	-9.23	PASSED

Average (RBW: 1 MHz, VBW: 1 MHz)

Frequency [MHz]	E [dBμV/m]	E [μV/m]	U _{RX} [dBμV]	A _{TOT} [dB]	Results
2495	35.47	59.368	44.7	-9.23	PASSED

3.4.2 8DPSK modulation, PRBS packet type

Channel 0 / 2402 MHz



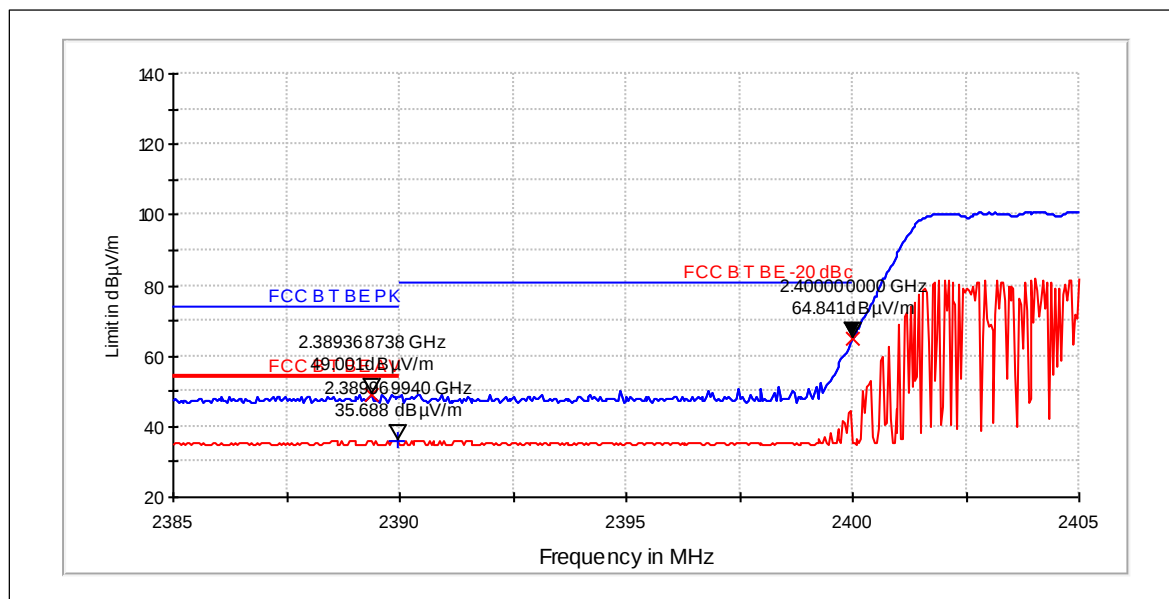
Peak (RBW: 1 MHz, VBW: 1 MHz)

Frequency [MHz]	E [dBμV/m]	E [μV/m]	U _{RX} [dBμV]	A _{TOT} [dB]	Results
2386	48.3	260.106	58.01	-9.71	PASSED
2400	65.01	1781.148	0	65.01	PASSED

Average (RBW: 1 MHz, VBW: 1 MHz)

Frequency [MHz]	E [dBμV/m]	E [μV/m]	U _{RX} [dBμV]	A _{TOT} [dB]	Results
2390	34.86	55.335	44.57	-9.71	PASSED

Hopping on. Low end.



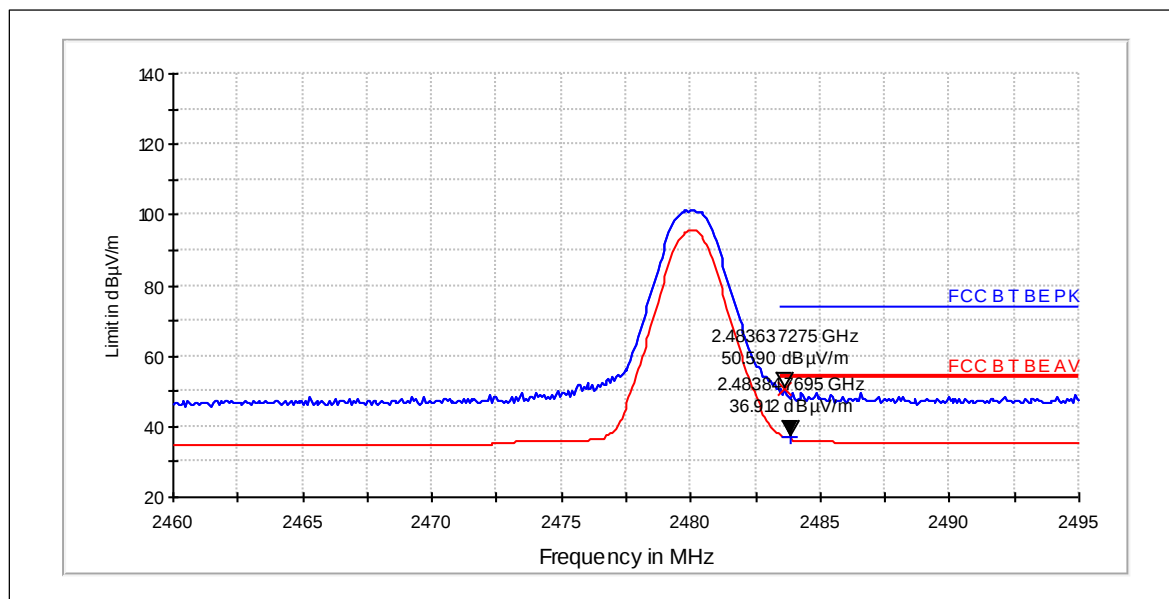
Peak (RBW: 1 MHz, VBW: 1 MHz)

Frequency [MHz]	E [dBμV/m]	E [μV/m]	U _{RX} [dBμV]	A _{TOT} [dB]	Results
2389	49	281.871	58.71	-9.71	PASSED
2400	64.84	1746.023	74.55	-9.71	PASSED

Average (RBW: 1 MHz, VBW: 1 MHz)

Frequency [MHz]	E [dBμV/m]	E [μV/m]	U _{RX} [dBμV]	A _{TOT} [dB]	Results
2390	35.69	60.87	45.4	-9.71	PASSED

Channel 78 / 2480 MHz



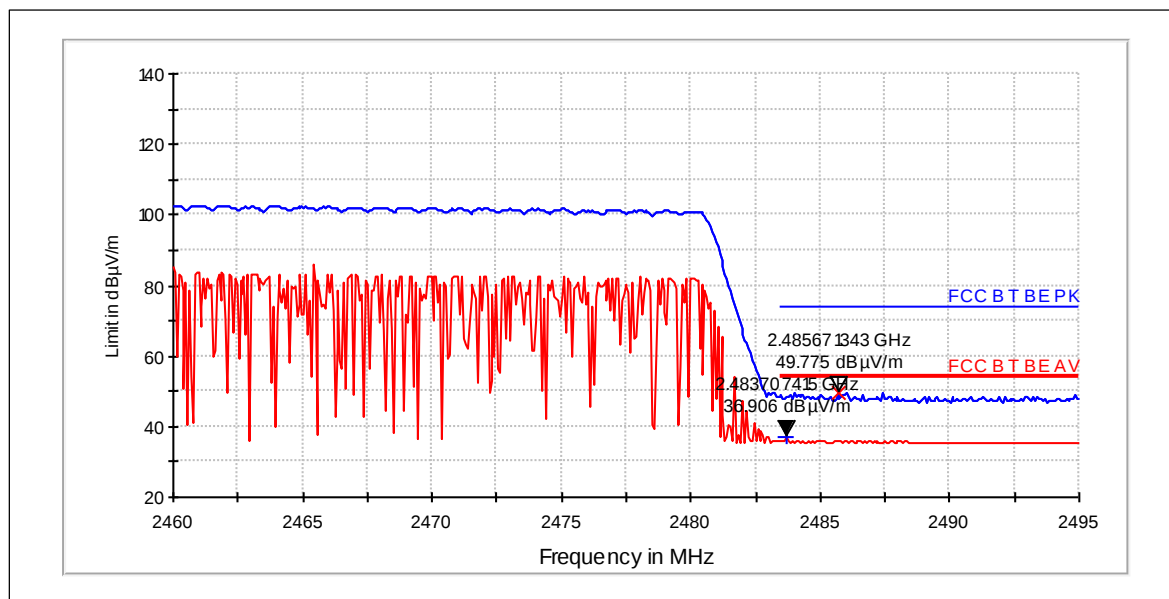
Peak (RBW: 1 MHz, VBW: 1 MHz)

Frequency [MHz]	E [dBμV/m]	E [μV/m]	U _{RX} [dBμV]	A _{TOT} [dB]	Results
2484	50.59	338.454	59.82	-9.23	PASSED

Average (RBW: 1 MHz, VBW: 1 MHz)

Frequency [MHz]	E [dBμV/m]	E [μV/m]	U _{RX} [dBμV]	A _{TOT} [dB]	Results
2484	36.91	70.081	46.14	-9.23	PASSED

Hopping on. High end.



Peak (RBW: 1 MHz, VBW: 1 MHz)

Frequency [MHz]	E [dB μ V/m]	E [μ V/m]	U _{RX} [dB μ V]	A _{TOT} [dB]	Results
2486	49.78	308.141	59.01	-9.23	PASSED

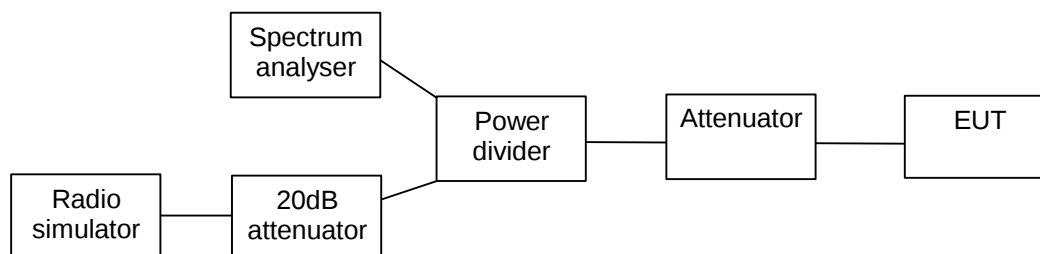
Average (RBW: 1 MHz, VBW: 1 MHz)

Frequency [MHz]	E [dB μ V/m]	E [μ V/m]	U _{RX} [dB μ V]	A _{TOT} [dB]	Results
2484	36.91	70.033	46.14	-9.23	PASSED

4. Spurious RF conducted emissions

EUT with DUT number	RM-1152, DUT 400052
Accessories with DUT numbers	SD-134, DUT 400053
Operation Voltage [V] / [Hz]	Nominal
Results	PASSED
Remarks	RF Cond 2
Temp [°C] / Humidity [%RH] / Air Pressure [kPa]	21 / 47 / 101.4
Date of measurements	24-Oct-2015
Measured by	Hannu Soderholm

4.1. Test Setup



4.2. Test method and limit

The measurement is made according to ANSI C63.10 and RSS-247.

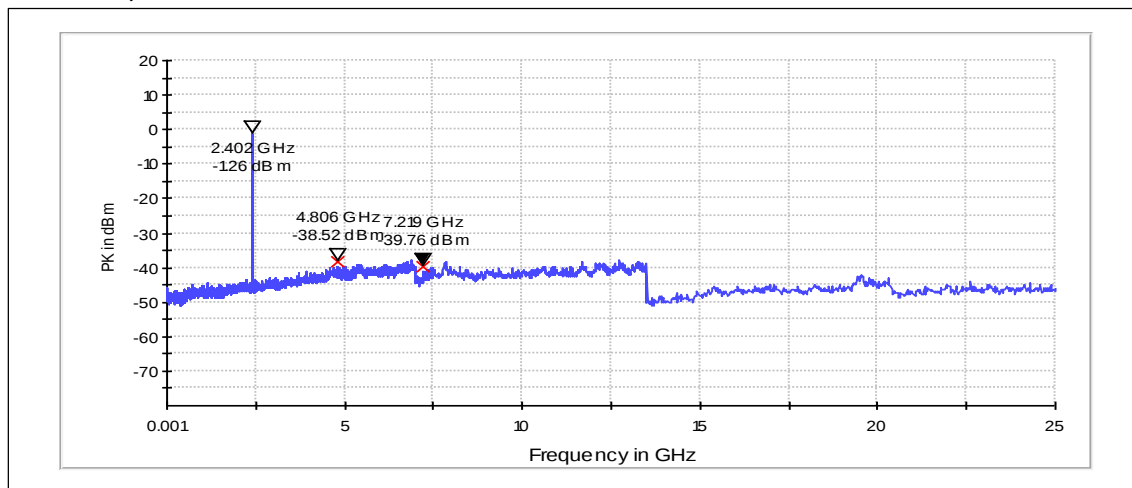
Limits for spurious RF conducted emissions measurements

Frequency range [MHz]	Limit [dBc]
1 – 25000	≤ -20

4.3. Bluetooth Test results

4.3.1 GFSK modulation, PRBS packet type

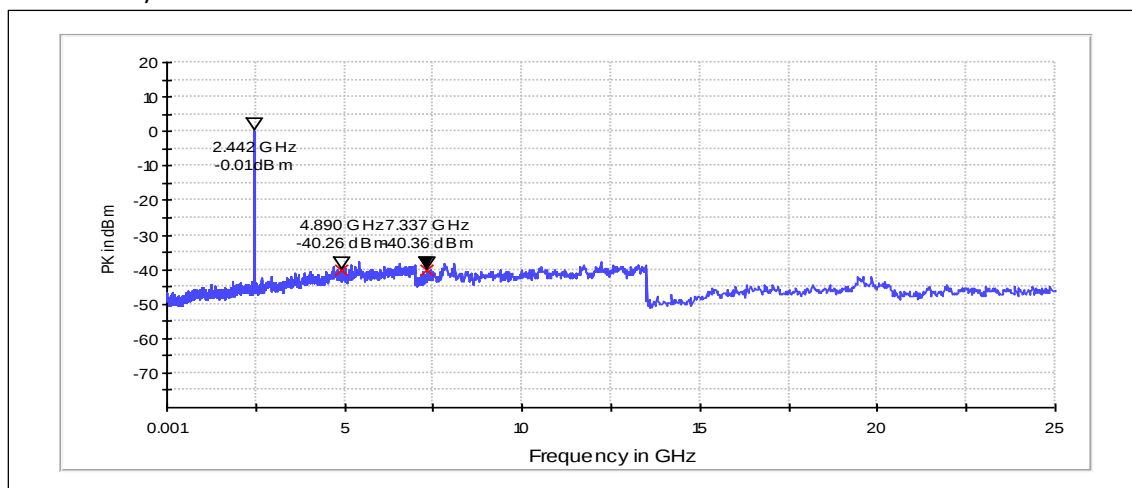
Channel 0 / 2402 MHz



Peak (RBW: 100 kHz, VBW: 100 kHz)

Frequency [MHz]	P [dBc]	Result
4806.400	-38.52	PASSED
7218.600	-39.76	PASSED

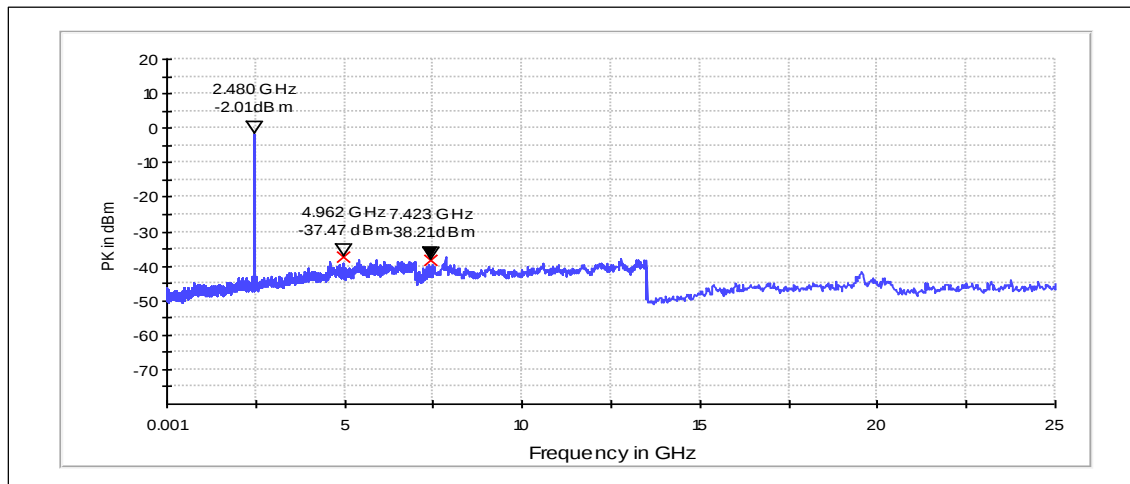
Channel 40 / 2442 MHz



Peak (RBW: 100 kHz, VBW: 100 kHz)

Frequency [MHz]	P [dBc]	Result
4889.600	-40.26	PASSED
7337.400	-40.36	PASSED

Channel 78 / 2480 MHz

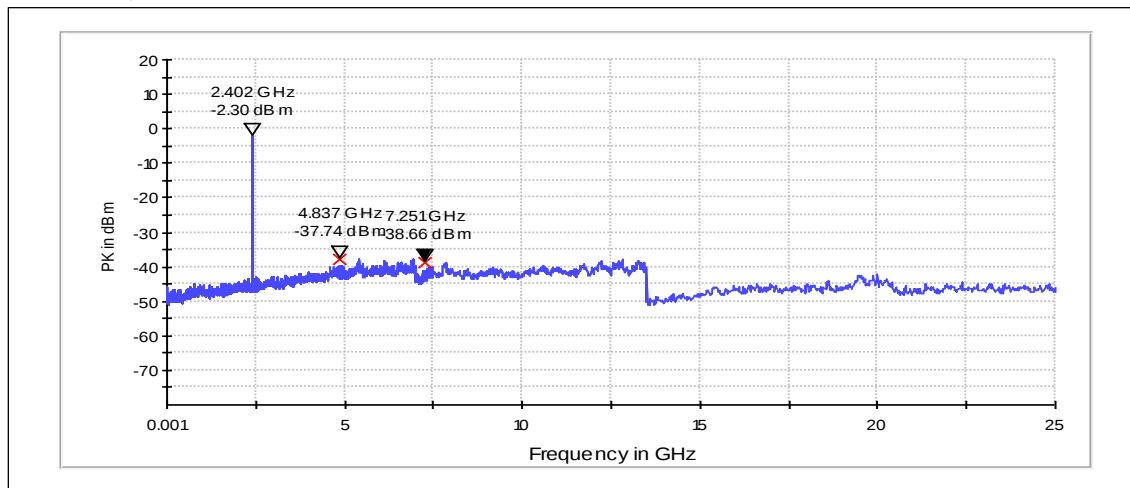


Peak (RBW: 100 kHz, VBW: 100 kHz)

Frequency [MHz]	P [dBc]	Result
4962.400	-37.47	PASSED
7423.200	-38.21	PASSED

4.3.2 8DPSK modulation, PRBS packet type

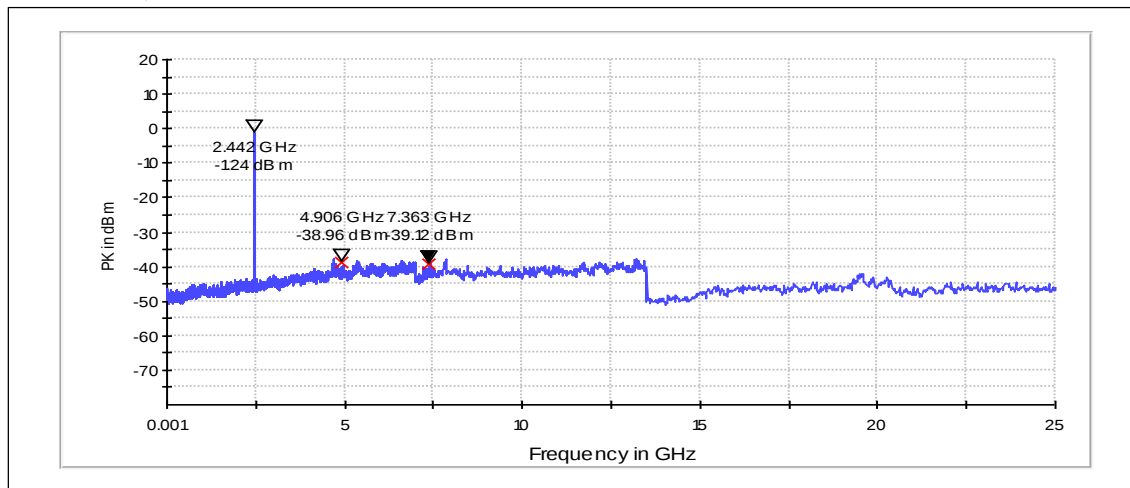
Channel 0 / 2402 MHz



Peak (RBW: 100 kHz, VBW: 100 kHz)

Frequency [MHz]	P [dBc]	Result
4836.800	-37.74	PASSED
7251.000	-38.66	PASSED

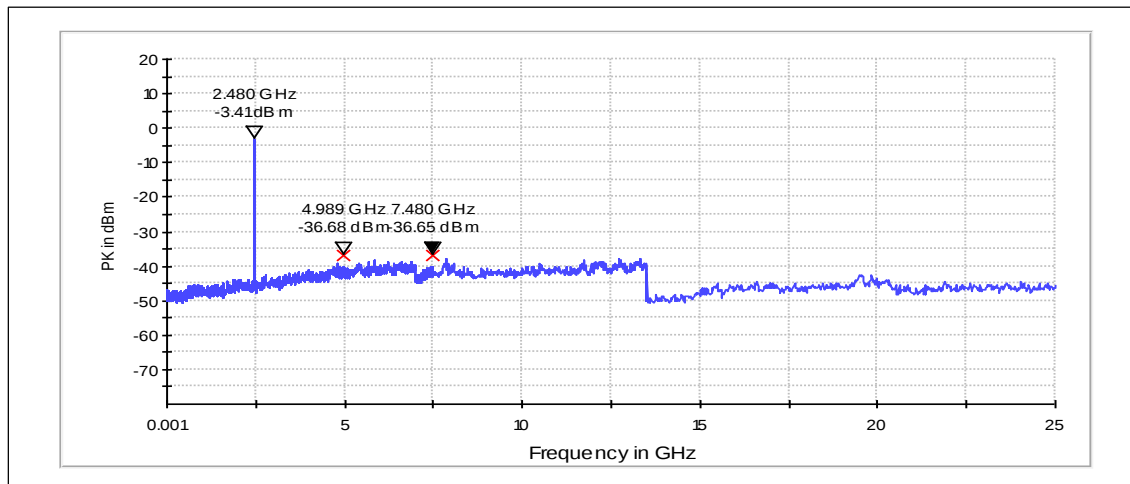
Channel 40 / 2442 MHz



Peak (RBW: 100 kHz, VBW: 100 kHz)

Frequency [MHz]	P [dBc]	Result
4906.000	-38.96	PASSED
7362.600	-39.12	PASSED

Channel 78 / 2480 MHz



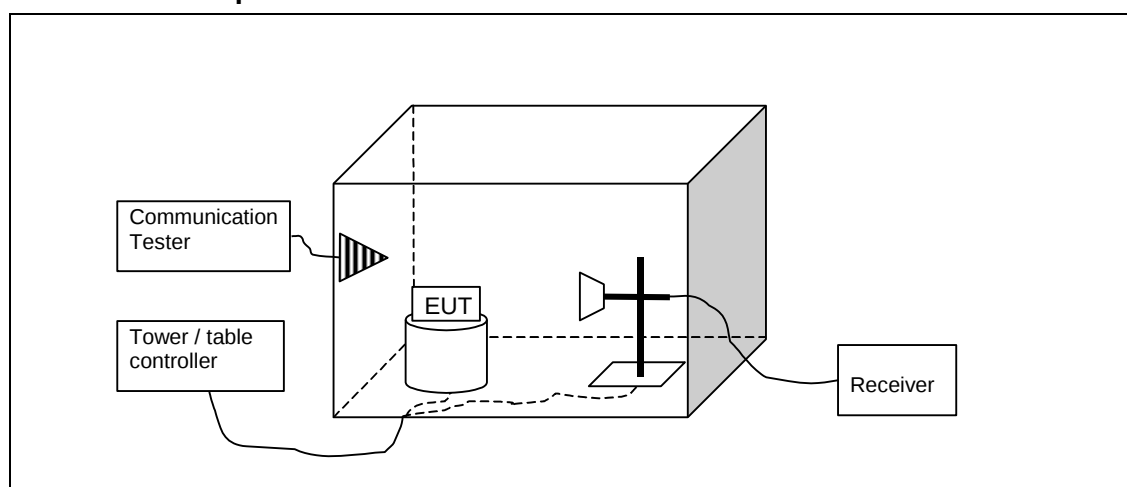
Peak (RBW: 100 kHz, VBW: 100 kHz)

Frequency [MHz]	P [dBc]	Result
4989.200	-36.68	PASSED
7480.200	-36.65	PASSED

5. Spurious radiated emissions

EUT with DUT number	RM-1152, DUT 400049
Accessories with DUT numbers	BV-T3G (LG), DUT 400051 ; AC-18E, DUT 400050 ; WH-108, DUT 42927
Operation Voltage [V] / [Hz]	115 / 60
Results	PASSED
Remarks	-
Temp [°C] / Humidity [%RH] / Air Pressure [kPa]	21 / 40 / 100.4
Date of measurements	09-Nov-2015
Measured by	Hannu Söderholm

5.1.1 Test setup



5.2. Test method and limit

The measurement is made according to ANSI C63.10 and RSS-247 as follows:

The measurement is divided into the Preliminary Measurement and the Final Measurement.

The suspected frequencies are searched for in Preliminary Measurement with absorbers on the floor, measuring antenna at fixed height and EUT set in three orthogonal positions on the turn table.

The Final Measurement is performed in the Semi-Anechoic Chamber with conducting metal floor, if the Preliminary Measurement results are closer than 20 dB to the permissible value.

For each suspected frequency, the turntable is rotated 360 degrees and antenna is scanned from 1 to 4 m. This is repeated for both horizontal and vertical receive antenna polarizations.

The emissions less than 20 dB below the permissible value are reported.

The measurement is made up to 10th harmonic of the EUT highest TX channel.

The measurement results are obtained as described below:

$$E [dB\mu V/m] = U_{RX} + A_{TOT}$$

Where U_{RX} is receiver reading and A_{TOT} is total correction factor including cable loss, antenna factor and preamplifier gain ($A_{TOT} = L_{CABLES} + A_F - G_{PREAMP}$).

Limits for spurious radiated emissions measurements (3 m measurement distance)

Frequency range [MHz]	Limit [$\mu V/m$]	Limit [$dB\mu V/m$]	Detector
30 - 88	100	40	Quasi peak
88 – 216	150	43.5	Quasi peak
216 – 960	200	46	Quasi peak
960 – 1000	500	54	Quasi peak
Above 1000	500	54	Average
Above 1000	5000	74	Peak

5.3. Bluetooth test results, Orthogonal position 1 and 2

5.3.1 GFSK modulation, PRBS packet type

Channel 0 / 2402 MHz

Peak (RBW: 1 MHz, VBW: 1 MHz)

Frequency [MHz]	E [dBμV/m]	E [μV/m]	U _{RX} [dBμV]	A _{TOT} [dB]	Limit [dBμV/m]	Margin	Results
4804.3	53.4	467.735	57.5	-4.1	74	20.58	PASSED
7205.8	45.27	183.443	43.77	1.5	95	49.96	PASSED

Average (RBW: 1 MHz, VBW: 1 MHz)

Frequency [MHz]	E [dBμV/m]	E [μV/m]	U _{RX} [dBμV]	A _{TOT} [dB]	Limit [dBμV/m]	Margin	Results
4804.3	39.78	97.499	43.88	-4.1	54	14.2	PASSED
7205.8	32.49	42.121	30.99	1.5	---	---	PASSED

Channel 40 / 2442 MHz

Quasi peak (RBW: 100 kHz, VBW: 100 kHz)

Frequency [MHz]	E [dBμV/m]	E [μV/m]	U _{RX} [dBμV]	A _{TOT} [dB]	Limit [dBμV/m]	Margin	Results
30.12	17.44	7.447	37.84	-20.4	40	22.56	PASSED
30.39	26.22	20.464	46.82	-20.6	40	13.78	PASSED
34.618	20.94	11.143	43.34	-22.4	40	19.06	PASSED
35.776	16.59	6.753	39.39	-22.8	40	23.41	PASSED
36.142	17.02	7.096	40.02	-23	40	22.98	PASSED
54.297	22.8	13.804	54.7	-31.9	40	17.2	PASSED
911.815	22.52	13.366	37.72	-15.2	46	23.5	PASSED
945.995	31.64	38.194	46.64	-15	46	14.38	PASSED
956.074	32.13	40.411	47.23	-15.1	46	13.89	PASSED

Peak (RBW: 1 MHz, VBW: 1 MHz)

Frequency [MHz]	E [dBμV/m]	E [μV/m]	U _{RX} [dBμV]	A _{TOT} [dB]	Limit [dBμV/m]	Margin	Results
4878.8	40.82	109.901	44.82	-4	74	33.16	PASSED
7321	46.61	214.042	44.61	2	74	27.37	PASSED

Average (RBW: 1 MHz, VBW: 1 MHz)

Frequency [MHz]	E [dBμV/m]	E [μV/m]	U _{RX} [dBμV]	A _{TOT} [dB]	Limit [dBμV/m]	Margin	Results
4878.8	27.85	24.689	31.85	-4	54	26.13	PASSED
7321	33.05	44.926	31.05	2	54	20.93	PASSED

Channel 78 / 2480 MHz

Peak (RBW: 1 MHz, VBW: 1 MHz)

Frequency [MHz]	E [dBμV/m]	E [μV/m]	U _{RX} [dBμV]	A _{TOT} [dB]	Limit [dBμV/m]	Margin	Results
4960	49.74	306.902	53.64	-3.9	74	24.24	PASSED
7438.8	47.38	233.884	44.68	2.7	74	26.6	PASSED

Average (RBW: 1 MHz, VBW: 1 MHz)

Frequency [MHz]	E [dBμV/m]	E [μV/m]	U _{RX} [dBμV]	A _{TOT} [dB]	Limit [dBμV/m]	Margin	Results
4960	37.58	75.683	41.48	-3.9	54	16.4	PASSED
7438.8	32.76	43.451	30.06	2.7	54	21.22	PASSED

5.3.2 8DPSK modulation, PRBS packet type

Channel 0 / 2402 MHz

Peak (RBW: 1 MHz, VBW: 1 MHz)

Frequency [MHz]	E [dBμV/m]	E [μV/m]	U _{RX} [dBμV]	A _{TOT} [dB]	Limit [dBμV/m]	Margin	Results
4804.1	50.59	338.454	54.69	-4.1	74	23.39	PASSED
7207.6	45.68	192.309	44.18	1.5	95	49.55	PASSED

Average (RBW: 1 MHz, VBW: 1 MHz)

Frequency [MHz]	E [dBμV/m]	E [μV/m]	U _{RX} [dBμV]	A _{TOT} [dB]	Limit [dBμV/m]	Margin	Results
4804.1	36.72	68.549	40.82	-4.1	54	17.26	PASSED
7207.6	32.51	42.218	31.01	1.5	---	---	PASSED

Channel 40 / 2442 MHz

Quasi peak (RBW: 100 kHz, VBW: 100 kHz)

Frequency [MHz]	E [dBμV/m]	E [μV/m]	U _{RX} [dBμV]	A _{TOT} [dB]	Limit [dBμV/m]	Margin	Results
30.75	22.03	12.633	42.73	-20.7	40	17.97	PASSED
33.33	18.9	8.81	40.7	-21.8	40	21.1	PASSED
33.418	15.46	5.929	37.26	-21.8	40	24.54	PASSED
35.782	17.13	7.186	39.93	-22.8	40	22.87	PASSED
35.836	17.38	7.396	40.18	-22.8	40	22.62	PASSED
38.379	14.42	5.26	38.22	-23.8	40	25.58	PASSED
53.907	22.1	12.735	53.8	-31.7	40	17.9	PASSED
945.935	32.64	42.855	47.64	-15	46	13.38	PASSED
956.074	36.01	63.168	51.11	-15.1	46	10.01	PASSED

Peak (RBW: 1 MHz, VBW: 1 MHz)

Frequency [MHz]	E [dBμV/m]	E [μV/m]	U _{RX} [dBμV]	A _{TOT} [dB]	Limit [dBμV/m]	Margin	Results
4881.6	41.32	116.413	45.32	-4	74	32.66	PASSED
7320.1	46.99	223.615	44.99	2	74	26.99	PASSED

Average (RBW: 1 MHz, VBW: 1 MHz)

Frequency [MHz]	E [dBμV/m]	E [μV/m]	U _{RX} [dBμV]	A _{TOT} [dB]	Limit [dBμV/m]	Margin	Results
4881.6	27.87	24.746	31.87	-4	54	26.11	PASSED
7320.1	33.02	44.771	31.02	2	54	20.96	PASSED

Channel 78 / 2480 MHz

Peak (RBW: 1 MHz, VBW: 1 MHz)

Frequency [MHz]	E [dBμV/m]	E [μV/m]	U _{RX} [dBμV]	A _{TOT} [dB]	Limit [dBμV/m]	Margin	Results
4960.3	47.8	245.471	51.7	-3.9	74	26.18	PASSED
7439.4	46.01	199.756	43.31	2.7	74	27.97	PASSED

Average (RBW: 1 MHz, VBW: 1 MHz)

Frequency [MHz]	E [dBμV/m]	E [μV/m]	U _{RX} [dBμV]	A _{TOT} [dB]	Limit [dBμV/m]	Margin	Results
4960.3	32.97	44.514	36.87	-3.9	54	21.01	PASSED
7439.4	33.04	44.875	30.34	2.7	54	20.94	PASSED

5.4. Bluetooth test results, Orthogonal position 3

5.4.1 8DPSK modulation, PRBS packet type

Channel 0 / 2402 MHz

Peak (RBW: 1 MHz, VBW: 1 MHz)

Frequency [MHz]	E [dBμV/m]	E [μV/m]	U _{RX} [dBμV]	A _{TOT} [dB]	Limit [dBμV/m]	Margin	Results
4804.1	48.63	270.085	52.73	-4.1	74	25.35	PASSED
7204.5	45.83	195.659	44.33	1.5	95	49.4	PASSED

Average (RBW: 1 MHz, VBW: 1 MHz)

Frequency [MHz]	E [dBμV/m]	E [μV/m]	U _{RX} [dBμV]	A _{TOT} [dB]	Limit [dBμV/m]	Margin	Results
4804.1	34.77	54.765	38.87	-4.1	54	19.21	PASSED
7204.5	32.47	42.024	30.97	1.5	---	---	PASSED

Channel 40 / 2442 MHz

Quasi peak (RBW: 100 kHz, VBW: 100 kHz)

Frequency [MHz]	E [dBμV/m]	E [μV/m]	U _{RX} [dBμV]	A _{TOT} [dB]	Limit [dBμV/m]	Margin	Results
30.09	26.56	21.281	46.96	-20.4	40	13.44	PASSED
30.63	26.24	20.512	46.94	-20.7	40	13.76	PASSED
35.848	25.46	18.75	48.26	-22.8	40	14.54	PASSED
35.962	25.2	18.197	48.1	-22.9	40	14.8	PASSED
36.226	25.47	18.772	48.47	-23	40	14.53	PASSED
38.949	23.76	15.417	47.86	-24.1	40	16.24	PASSED
54.477	22.42	13.213	54.42	-32	40	17.58	PASSED
54.741	22.4	13.183	54.5	-32.1	40	17.6	PASSED
945.935	33.37	46.612	48.37	-15	46	12.65	PASSED
956.044	30.96	35.318	46.06	-15.1	46	15.06	PASSED

Peak (RBW: 1 MHz, VBW: 1 MHz)

Frequency [MHz]	E [dBμV/m]	E [μV/m]	U _{RX} [dBμV]	A _{TOT} [dB]	Limit [dBμV/m]	Margin	Results
4879.6	41.95	125.17	45.95	-4	74	32.03	PASSED
7318.1	46	199.526	44	2	74	27.98	PASSED

Average (RBW: 1 MHz, VBW: 1 MHz)

Frequency [MHz]	E [dBμV/m]	E [μV/m]	U _{RX} [dBμV]	A _{TOT} [dB]	Limit [dBμV/m]	Margin	Results
4879.6	27.81	24.575	31.81	-4	54	26.17	PASSED
7318.1	32.88	44.055	30.88	2	54	21.1	PASSED

Channel 78 / 2480 MHz

Peak (RBW: 1 MHz, VBW: 1 MHz)

Frequency [MHz]	E [dBμV/m]	E [μV/m]	U _{RX} [dBμV]	A _{TOT} [dB]	Limit [dBμV/m]	Margin	Results
4960.3	46.17	203.47	50.07	-3.9	74	27.81	PASSED
7439.7	45.85	196.11	43.15	2.7	74	28.13	PASSED

Average (RBW: 1 MHz, VBW: 1 MHz)

Frequency [MHz]	E [dBμV/m]	E [μV/m]	U _{RX} [dBμV]	A _{TOT} [dB]	Limit [dBμV/m]	Margin	Results
4960.3	31.58	37.931	35.48	-3.9	54	22.4	PASSED
7439.7	32.75	43.401	30.05	2.7	54	21.23	PASSED

5.4.2 GFSK modulation, PRBS packet type

Channel 0 / 2402 MHz

Peak (RBW: 1 MHz, VBW: 1 MHz)

Frequency [MHz]	E [dBμV/m]	E [μV/m]	U _{RX} [dBμV]	A _{TOT} [dB]	Limit [dBμV/m]	Margin	Results
4804.3	49.16	287.078	53.26	-4.1	74	24.82	PASSED
7204.9	46.1	201.837	44.6	1.5	95	49.13	PASSED

Average (RBW: 1 MHz, VBW: 1 MHz)

Frequency [MHz]	E [dBμV/m]	E [μV/m]	U _{RX} [dBμV]	A _{TOT} [dB]	Limit [dBμV/m]	Margin	Results
4804.3	35.47	59.361	39.57	-4.1	54	18.51	PASSED
7204.9	32.47	42.024	30.97	1.5	---	---	PASSED

Channel 40 / 2442 MHz

Quasi peak (RBW: 100 kHz, VBW: 100 kHz)

Frequency [MHz]	E [dBμV/m]	E [μV/m]	U _{RX} [dBμV]	A _{TOT} [dB]	Limit [dBμV/m]	Margin	Results
30.45	17.66	7.638	38.26	-20.6	40	22.34	PASSED
35.758	16.27	6.509	39.07	-22.8	40	23.73	PASSED
35.866	25.18	18.155	48.08	-22.9	40	14.82	PASSED
35.932	27.3	23.174	50.2	-22.9	40	12.7	PASSED
54.777	21.55	11.954	53.65	-32.1	40	18.45	PASSED
55.581	18.04	7.98	50.44	-32.4	40	21.96	PASSED
97.302	15.47	5.936	45.27	-29.8	44	28.05	PASSED
98.946	16.46	6.653	46.06	-29.6	44	27.06	PASSED
945.935	32.72	43.251	47.72	-15	46	13.3	PASSED
956.074	31.37	37.025	46.47	-15.1	46	14.65	PASSED

Peak (RBW: 1 MHz, VBW: 1 MHz)

Frequency [MHz]	E [dBμV/m]	E [μV/m]	U _{RX} [dBμV]	A _{TOT} [dB]	Limit [dBμV/m]	Margin	Results
4881.3	41.19	114.683	45.19	-4	74	32.79	PASSED
7321.6	45.64	191.426	43.64	2	74	28.34	PASSED

Average (RBW: 1 MHz, VBW: 1 MHz)

Frequency [MHz]	E [dBμV/m]	E [μV/m]	U _{RX} [dBμV]	A _{TOT} [dB]	Limit [dBμV/m]	Margin	Results
4881.3	27.82	24.604	31.82	-4	54	26.16	PASSED
7321.6	33	44.668	31	2	54	20.98	PASSED

Channel 78 / 2480 MHz

Peak (RBW: 1 MHz, VBW: 1 MHz)

Frequency [MHz]	E [dBμV/m]	E [μV/m]	U _{RX} [dBμV]	A _{TOT} [dB]	Limit [dBμV/m]	Margin	Results
4960.3	47.8	245.471	51.7	-3.9	74	26.18	PASSED
7439.5	45.85	196.11	43.15	2.7	74	28.13	PASSED

Average (RBW: 1 MHz, VBW: 1 MHz)

Frequency [MHz]	E [dBμV/m]	E [μV/m]	U _{RX} [dBμV]	A _{TOT} [dB]	Limit [dBμV/m]	Margin	Results
4960.3	33.8	48.978	37.7	-3.9	54	20.18	PASSED
7439.5	32.85	43.904	30.15	2.7	54	21.13	PASSED

6. AC powerline conducted emissions

EUT with DUT number	RM-1152, DUT 400049
Accessories with DUT numbers	AC-18E, DUT 400050 ; BV-T3G (LG), DUT 400051 ; WH-108, DUT 42927
Operation Voltage [V] / [Hz]	115 / 60
Results	PASSED
Remarks	-
Temp [°C] / Humidity [%RH] / Air Pressure [kPa]	20 / 41 / 101.5
Date of measurements	03-Nov-2015
Measured by	Hannu Söderholm

6.1. Test Setup



6.2. Test method and limit

The measurement is made according to ANSI C63.10 and RSS-GEN as follows:

The EUT is placed on a wooden table 80 cm above the reference groundplane.

The EUT is connected via LISN to a test power supply.

The measurement results are obtained as described below:

$$U [dB\mu V] = U_{RX} + A_{TOT}$$

Where U_{RX} is receiver reading and A_{TOT} is total correction factor including cable and pulse limiter attenuations.

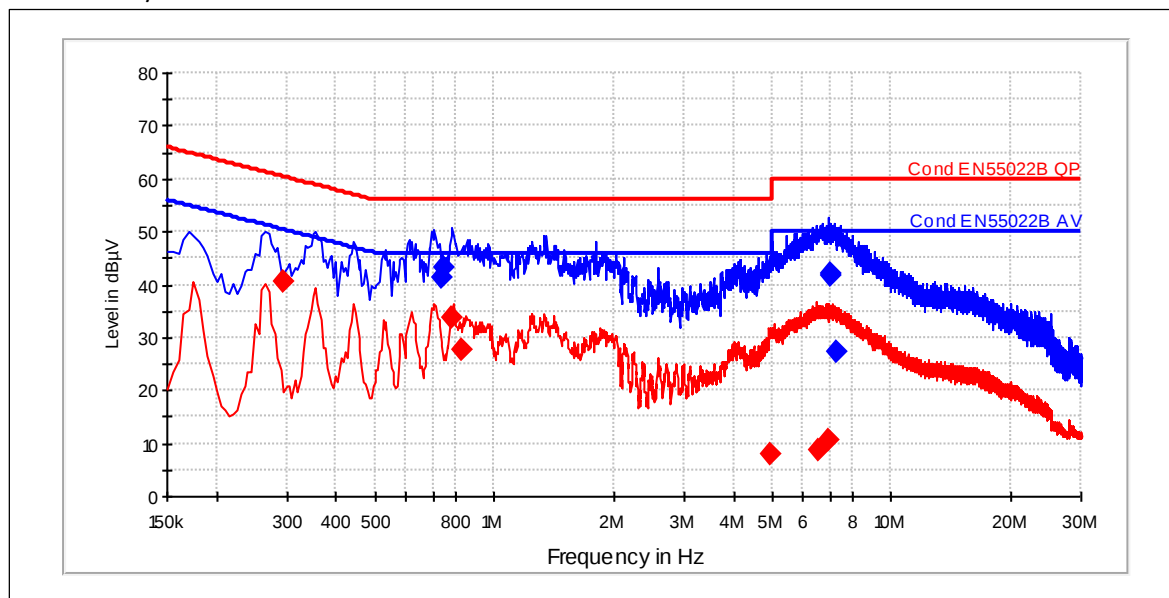
CISPR 22 Class B limits

Frequency range [MHz]	Quasi peak limit [dBμV]	Average limit [dBμV]
0.15 - 0.5	66 - 56	56 - 46
0.5 - 5	56	46
5 - 30	60	50

6.3. Bluetooth Test results

6.3.1 GFSK modulation, PRBS packet type

Channel 40 / 2442 MHz



QuasiPeak

Frequency [MHz]	QuasiPeak [dBμV]	Limit [dBμV]	Margin [dB]	Line	Results
0.735	41.43	56	14.57	L1	PASSED
0.745	43.26	56	12.74	L1	PASSED
7.02	41.9	60	18.1	L1	PASSED
7.03	41.6	60	18.4	L1	PASSED
7.23	27.35	60	32.65	L1	PASSED

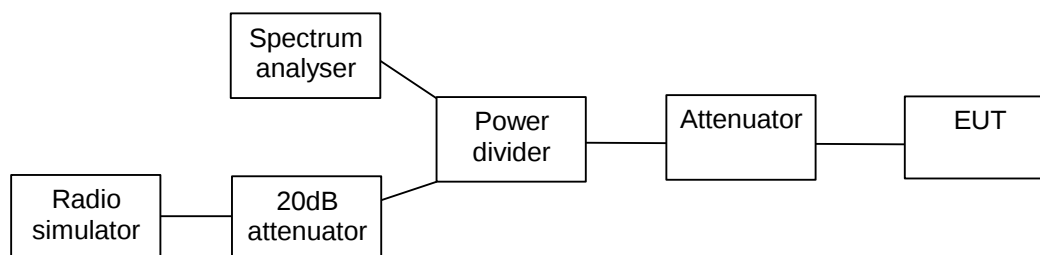
Average

Frequency [MHz]	Average [dBμV]	Limit [dBμV]	Margin [dB]	Line	Results
0.295	40.38	50.38	10	L1	PASSED
0.78	33.82	46	12.18	L1	PASSED
0.83	27.61	46	18.39	L1	PASSED
4.94	8.08	46	37.92	L1	PASSED
6.555	8.84	50	41.16	L1	PASSED
6.915	10.46	50	39.54	L1	PASSED

7. 20 dB bandwidth

EUT with DUT number	RM-1152, DUT 400052
Accessories with DUT numbers	SD-134, DUT 400053
Operation Voltage [V] / [Hz]	Nominal
Results	PASSED
Remarks	RF Cond 2
Temp [°C] / Humidity [%RH] / Air Pressure [kPa]	21 / 47 / 101.4
Date of measurements	24-Oct-2015
Measured by	Hannu Soderholm

7.1. Test Setup



7.2. Test method and limit

The measurement is made according to ANSI C63.10 and RSS-247.

Limits for 20 dB bandwidth measurements

Limit [MHz]
N/A

7.3. Bluetooth Test results

7.3.1 GFSK modulation, PRBS packet type

Channel / f _c [MHz]	20 dB bandwidth [kHz]
0 / 2402	714.6
40 / 2442	714.6
78 / 2480	722.6

0 / 2402



40 / 2442



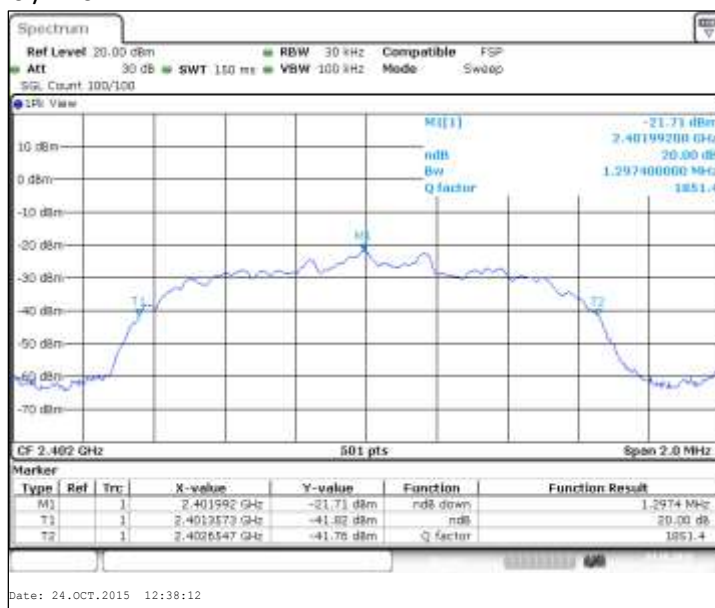
78 / 2480



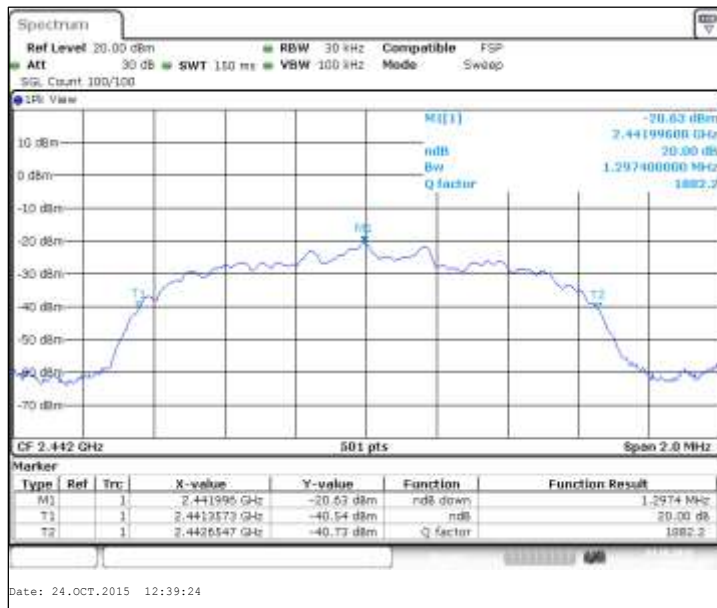
7.3.2 8DPSK modulation, PRBS packet type

Channel / f _c [MHz]	20 dB bandwidth [kHz]
0 / 2402	1297.4
40 / 2442	1297.4
78 / 2480	1297.4

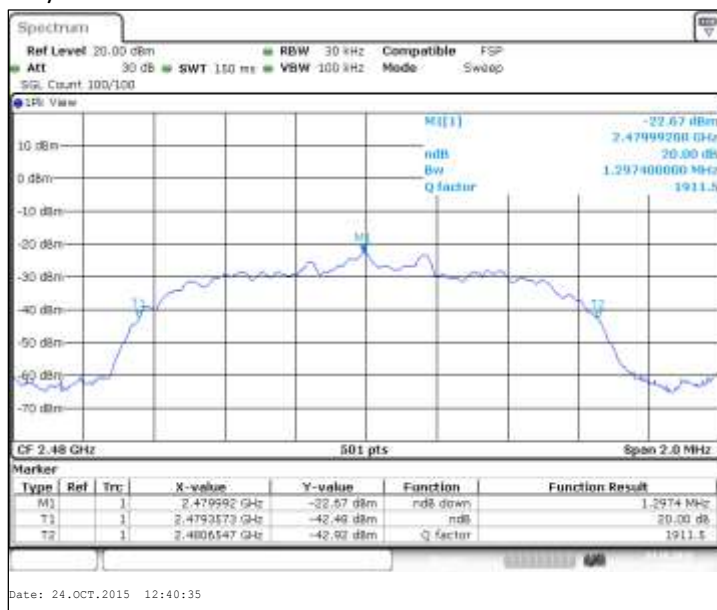
0 / 2402



40 / 2442



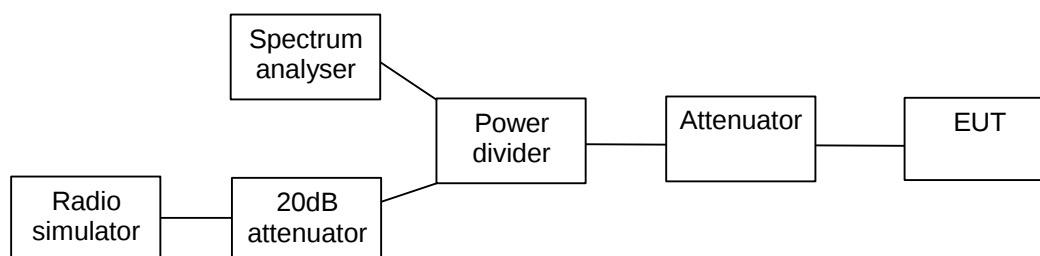
78 / 2480



1. Carrier frequency separation

EUT with DUT number	RM-1152, DUT 400052
Accessories with DUT numbers	SD-134, DUT 400053
Operation Voltage [V] / [Hz]	Nominal
Results	PASSED
Remarks	RF Cond 2
Temp [°C] / Humidity [%RH] / Air Pressure [kPa]	21 / 44 / 99.0
Date of measurements	07-Dec-2015
Measured by	Hannu Soderholm

1.1. Test Setup



1.2. Test method and limit

The measurement is made according ANSI C63.10 and RSS-247.

Limits for carrier frequency separation measurements

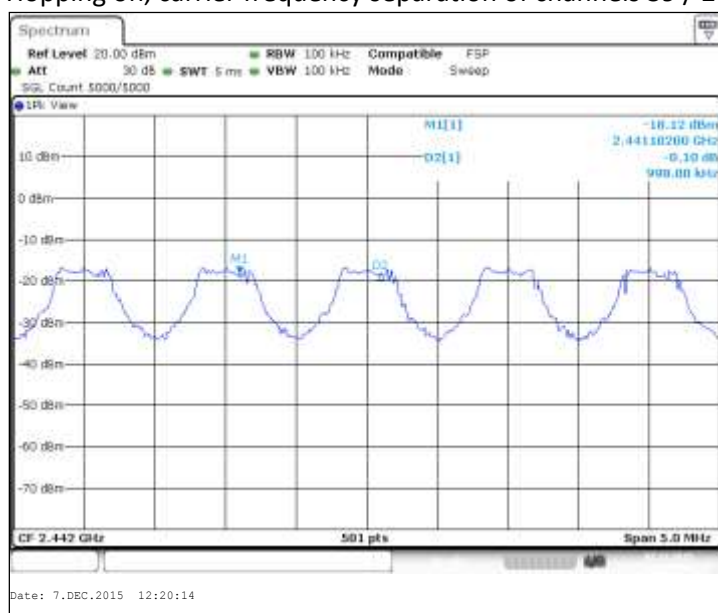
Limit [MHz]
≥ 0.025 or $2/3$ of the 20 dB bandwidth

1.3. Bluetooth Test results

1.3.1 GFSK modulation, PRBS packet type

Carrier frequency separation [kHz]	Result
998	PASSED

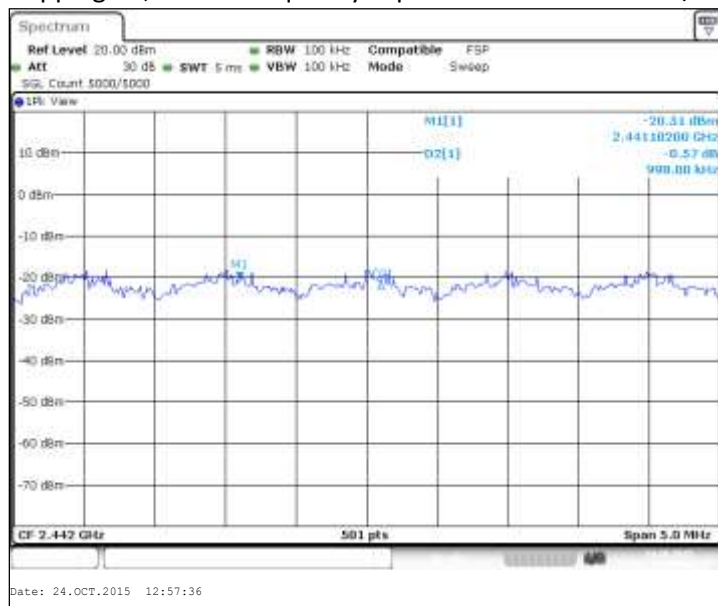
Hopping on, carrier frequency separation of channels 39 / 2441 MHz and 40 / 2442 MHz



1.3.2 8DPSK modulation, PRBS packet type

Carrier frequency separation [kHz]	Result
998	PASSED

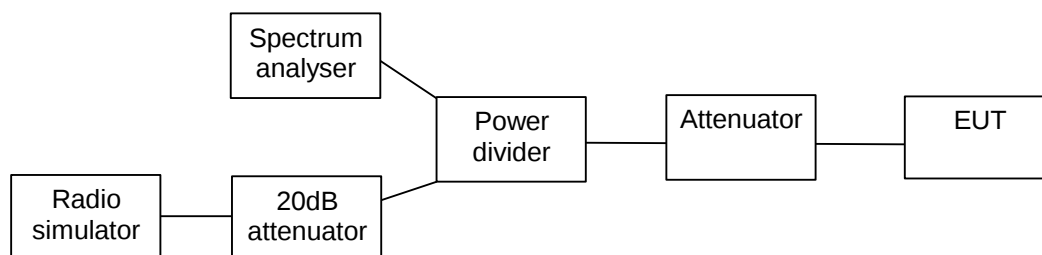
Hopping on, carrier frequency separation of channels 39 / 2441 MHz and 40 / 2442 MHz



2. Number of hopping frequencies

EUT with DUT number	RM-1152, DUT 400052
Accessories with DUT numbers	SD-134, DUT 400053
Operation Voltage [V] / [Hz]	Nominal
Results	PASSED
Remarks	RF Cond 2
Temp [°C] / Humidity [%RH] / Air Pressure [kPa]	21 / 47 / 101.4
Date of measurements	24-Oct-2015
Measured by	Hannu Soderholm

2.1. Test Setup



2.2. Test method and limit

The measurement is made according to ANSI C63.10 and RSS-247.

Limits for number of hopping frequencies measurements

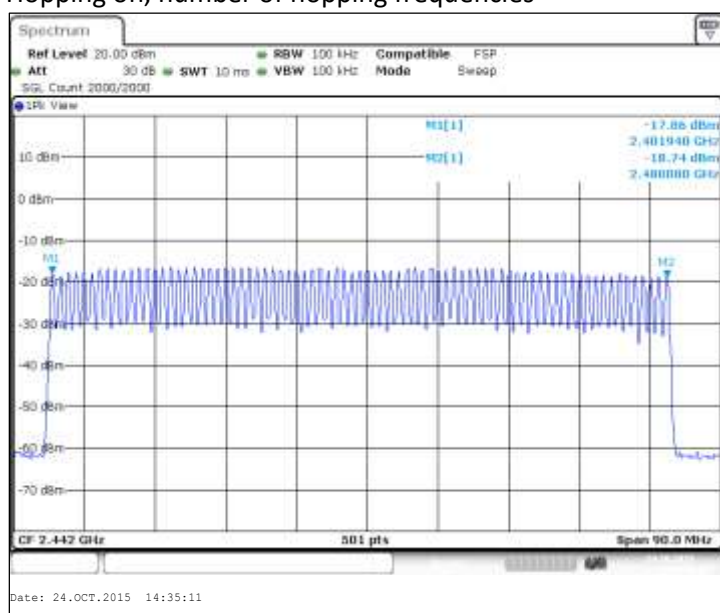
Limit [number]
≥ 15

2.3. Bluetooth Test results

2.3.1 GFSK modulation, PRBS packet type

Measured number of hopping frequencies	Result
78	PASSED

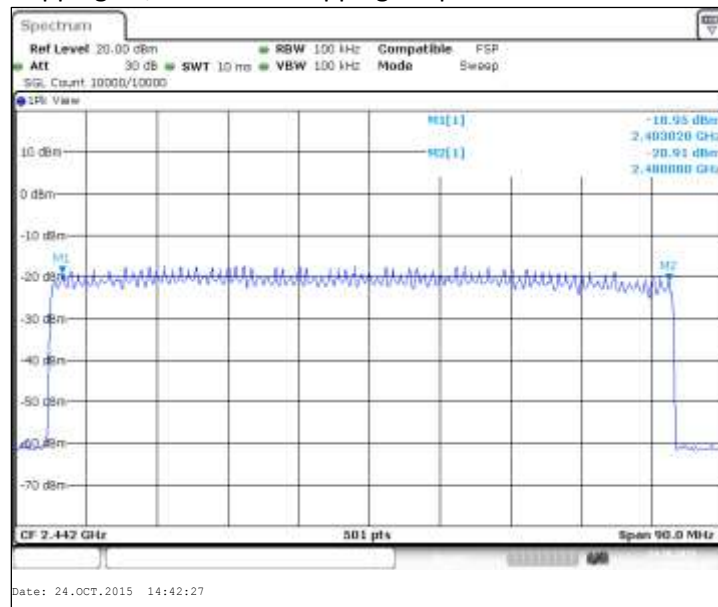
Hopping on, number of hopping frequencies



2.3.2 8DPSK modulation, PRBS packet type

Measured number of hopping frequencies	Result
78	PASSED

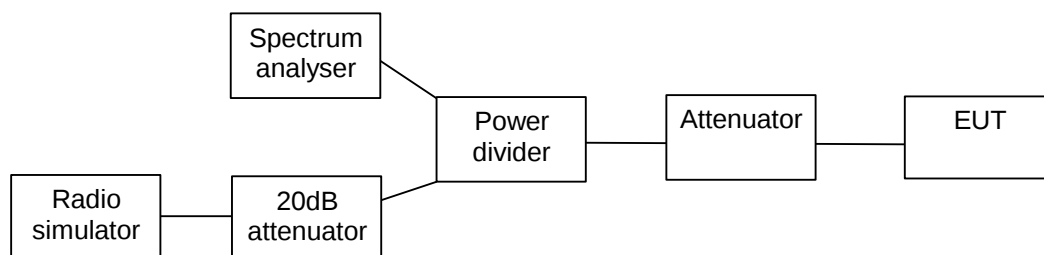
Hopping on, number of hopping frequencies



3. Time of occupancy

EUT with DUT number	RM-1152, DUT 400052
Accessories with DUT numbers	SD-134, DUT 400053
Operation Voltage [V] / [Hz]	Nominal
Results	PASSED
Remarks	RF Cond 2
Temp [°C] / Humidity [%RH] / Air Pressure [kPa]	21 / 47 / 101.4
Date of measurements	24-Oct-2015
Measured by	Hannu Soderholm

3.1. Test Setup



3.2. Test method and limit

The measurement is made according to ANSI C63.10 and RSS-247.

The total time of occupancy is obtained by multiplying the measured number of transmissions occurred during 31.6 second period with the duration of one transmission.

Limits for time of occupancy measurements

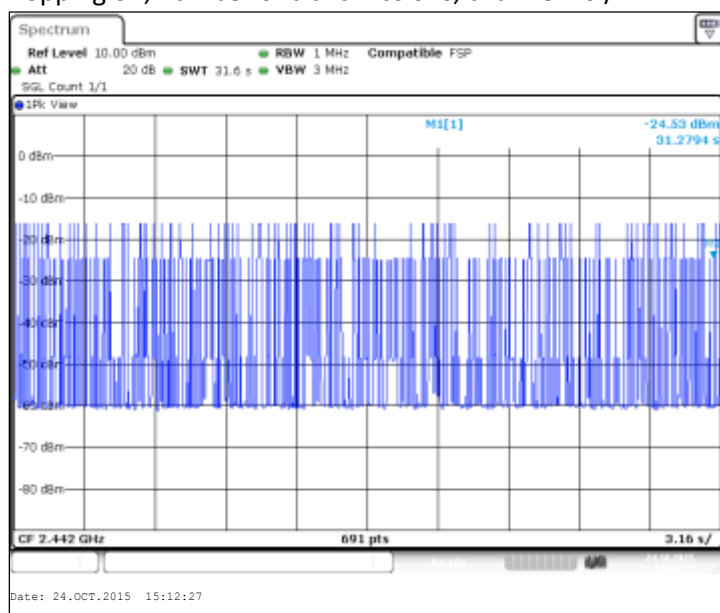
Limit [s]
≤ 0.4

3.3. Bluetooth Test results

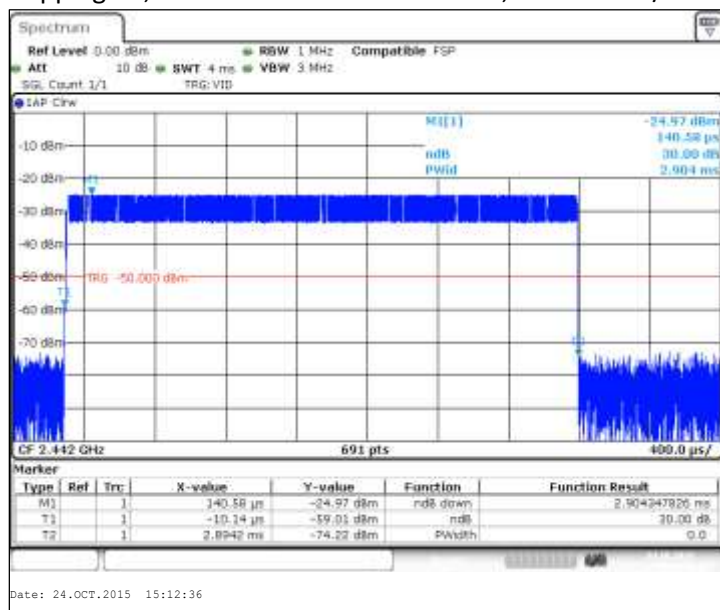
3.3.1 GFSK modulation, PRBS packet type

Measured number of transmissions	Duration of one transmission [ms]	Time of occupancy [s]	Result
80	2.904	0.232	PASSED

Hopping on, number of transmissions, channel 40 / 2442 MHz



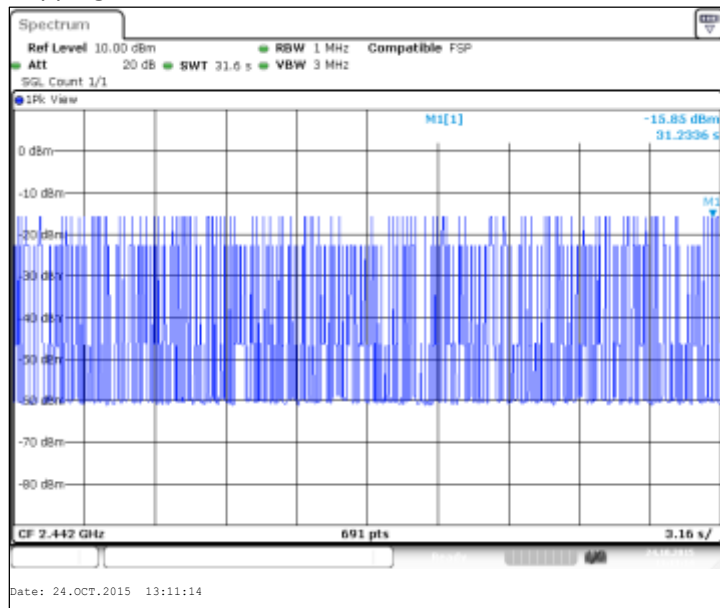
Hopping on, duration of one transmission, channel 40 / 2442 MHz



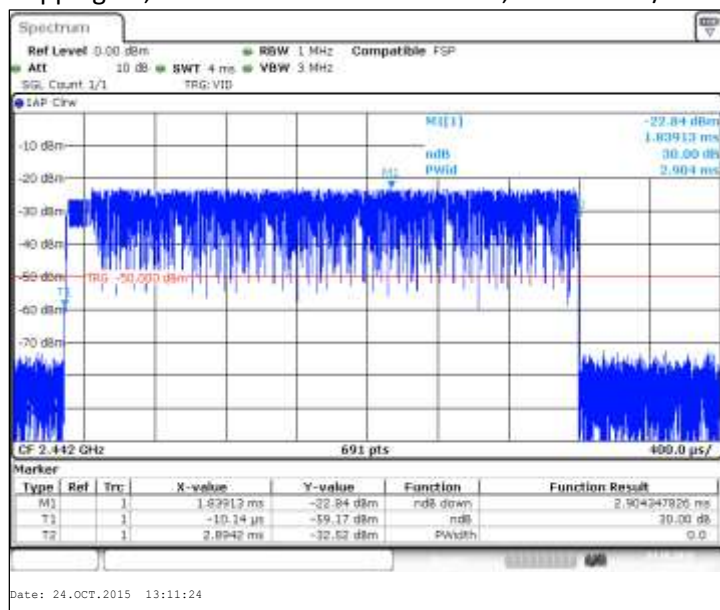
3.3.2 8DPSK modulation, PRBS packet type

Measured number of transmissions	Duration of one transmission [ms]	Time of occupancy [s]	Result
92	2.904	0.267	PASSED

Hopping on, number of transmissions, channel 40 / 2442 MHz



Hopping on, duration of one transmission, channel 40 / 2442 MHz



4. Test Equipment

The calibration dates for all test equipment are maintained in the equipment register. The register alerts the test lab about expired calibrations. Therefore, tests are always done with calibrated equipment. The dates are provided by request.

4.1. Conducted measurements

Eq. No	Equipment	Type	Manufacturer	Used in
TM350089	Power supply	6632A	Agilent	22/24/27, 15C, 15E
TM350090	Power supply	6632A	Agilent	22/24/27, 15C, 15E
TM30600	Impulse limiter	ESH3-Z2	R&S	15C, 15B
TM490017	LISN 50 µH	ESH3-Z5	R&S	15C, 15B
TM490018	LISN 50 µH	ESH3-Z5	R&S	15C, 15B
TM150128	Spectrum Analyzer	FSU26	R&S	22/24/27, 15C, 15E
TM23007	Oscilloscope	TDS684B	Tektronix	15E
TM22806	Battery	BAT 20/E	Fiskars	15C, 15B
TM22805	UPS	PS 20/1.2	Fiskars	15C, 15B
-	Temperature and humidity logger	175-H2	Testo	15C, 15B
-	Temperature and humidity logger	175-H2	Testo	22/24/27, 15C
-	Air pressure and temperature logger	635-2	Testo	22/24/27, 15C, 15B
-	Air pressure sensor	0638-1835	Testo	22/24/27, 15C, 15B
-	Temperature test chamber	VT 4002	Vötsch	22/24/27
2001	Bluetooth tester	CBT	R&S	15C, 15B
2009	LISN 50 µH	ENV216	R&S	15C, 15B
2010	LISN 50 µH	ENV216	R&S	15C, 15B
2012	Power splitter	11667B	Agilent	22/24/27, 15C
2013	Attenuator	8493C	Agilent	22/24/27, 15C
2014	Attenuator	8493C	Agilent	22/24/27, 15C
2019	Power splitter	ZN2PD-9G-S+	Mini-Circuits	15E
2020	Power splitter	ZN2PD-9G-S+	Mini-Circuits	15E
TM210166	Communication Tester	CMW500	R&S	22/24/27
TM210205	Communication Tester	CMU200	R&S	22/24/27
2023	Spectrum Analyzer	ESMI-RF	R&S	15B/15C
2024	Analyzer display unit	ESAI-D	R&S	15B/15C
TM110070	Signal Generator	SMF 100A	R&S	22/24/27, 15C, 15E, 15B
TM220065	Bluetooth tester	CBT	R&S	15C, 15B
TM210330	Communication Tester	CMU200	R&S	22/24/27, 15B
TM150131	Spectrum Analyzer	FSP30	R&S	22/24/27, 15C, 15E
TM210049	Communication Tester	CMU200	R&S	22/24/27

4.2. Radiated measurements

Eq. No	Equipment	Type	Manufacturer	Used in
-	Antenna	BBHA 9120 D	Schwarzbeck	22/24/27, 15C
TM38845	Receiver	ESIB 26	R&S	22/24/27, 15C, 15E, 15B
-	Antenna	HL562	R&S	22/24/27, 15C, 15E, 15B
-	Turntable	2188	EMCO	22/24/27, 15C, 15E, 15B
-	Turntable controller	2090	EMCO	22/24/27, 15C, 15E, 15B
-	RF system panel	OSP130	R&S	22/24/27, 15C, 15E, 15B
-	Mini mast	2075-2	ETS Lindgren	22/24/27, 15C, 15B
TM38843	Mini mast	2075	Emco	22/24/27, 15C, 15B
TM38842	Antenna mast controller	2090	Emco	22/24/27, 15C, 15B
TM30643	LISN 50 µH	LISN-5-20-2	FCC	22/24/27, 15C, 15B
TM30644	LISN 50 µH	LISN-5-20-2	FCC	22/24/27, 15C, 15B
-	Temperature and humidity logger	175-H2	Testo	22/24/27, 15C, 15B
-	Air pressure and temperature logger	635-2	Testo	22/24/27, 15C, 15B
-	Air pressure sensor	0638-1835	Testo	22/24/27, 15C, 15B
TM37523	Preamplifier	AMF-4D-10M-3G-25-20P	Miteq	22/24/27, 15C, 15B
TM37498	Preamplifier	AMF-5D-020180-26-10P	Miteq	22/24/27, 15C, 15B
TM30599	Semi anechoic chamber	UNKNOWN	TDK	22/24/27, 15C, 15B
TM22638	Power supply	OL63743-901	-	22/24/27, 15C, 15E, 15B
TM38066	High pass filter	WHKX3.0/18G-12SS	Wainwright	22/24/27, 15C, 15E, 15B
2028	High pass filter	WHKX 1.0/15G-12SS	Wainwright	22/24/27, 15C, 15E, 15B
TM37545	Tunable notch filter	800.0/960.0-0.2/40-8SSK	Wainwright	22
TM26512	Tunable notch filter	WRCD1850/1910-0.2/40-10SSK	Wainwright	24
-	Band reject filter	WRCG1877/1883-1870/1890-40/6EE	Wainwright	24
-	Band reject filter	WRCG1729.4/1735.4-1722.4/1742.4-40/6SS	Wainwright	27
TM23892	Controller	G-1000SDX	Yaesu	22/24/27, 15C, 15E
2001	Bluetooth tester	CBT	R&S	15C, 15B
TM210203	Communication Tester	CMU200	R&S	22/24/27, 15B
6023	Antenna	VUBA 9117	Schwarzbeck	22/24/27
TM210166	Communication Tester	CMW500	R&S	22/24/27
2025	Antenna	HFH2-Z2	R&S	15C
TM110070	Signal Generator	SMF 100A	R&S	22/24/27, 15C, 15E, 15B
2052	Antenna	BBHA 9120 D	Schwarzbeck	22/24/27, 15C, 15B, 15E
-	Antenna	QSH18S20	Q-Par	22/24/27, 15C, 15B, 15E
-	Antenna	QSH20S20	Q-Par	22/24/27, 15C, 15B, 15E
-	Antenna	QSH20S20	Q-Par	22/24/27, 15C, 15B, 15E
TM220065	Bluetooth tester	CBT	R&S	15C, 15B

END OF REPORT