

## 10. Measurement of radiated disturbance

Above 30 MHz Electric Field strength was measured in accordance with FCC PART 15.205, 15.209. The test setup was made according to ANSI C 63.10 (2013) Semi-anechoic chamber, which allows a 3 m distance measurement. The EUT was placed in the center of styrofoam turntable. The height of this table was 0.8 m. The measurement was conducted with both horizontal and vertical antenna polarization. The turntable has fully rotated. For further description of the configuration refer to the picture of the test setup.

### 10.1 Measurement equipments

Equipment Name	Type	Manufacturer	Serial No.	Next Calibration date
TEST Receiver	ESCI7	ROHDE & SCHWARZ	100916	19-Jul-22
Logbicon Antenna	VULB 9168	SCHWARZBECK	193	9-Dec-23
Turn Table	DT3000-2t	Innco System GmbH	N/A	-
Antenna Mast	MA4000-EP	Innco System GmbH	N/A	-
PREAMPLIFIER	8449B	HP	3008A00581	20-Jul-22
Horn Antenna	BBHA9120D	SCHWARZBECK	469	3-Dec-22
TEST Receiver	ESU	ROHDE & SCHWARZ	100529	19-Jul-22
Turn Table	DT1500-S	Innco System GmbH	N/A	-
Antenna Mast	MA4000-EP	Innco System GmbH	N/A	-
Horn Antenna	BBHA 9170	SCHWARZBECK	752	22-Jul-22
Antenna Master & Turn table controller	CO2000-P	Innco System GmbH	CO2000/642 /28051111/L	-

### 10.2 Environmental Condition

**Below 1 GHz –Test Place : 10 m Semi-anechoic chamber**

#### BT Basic Rate Mode

Temperature (°C) : 23.6 °C  
Humidity (% R.H.) : 44.5 % R.H.

#### BT EDR Mode

Temperature (°C) : 23.4 °C  
Humidity (% R.H.) : 43.0 % R.H.

**Above 1 GHz–Test Place : 3 m Semi-anechoic chamber**

#### BT Basic Rate Mode

Temperature (°C) : 23.1 °C  
Humidity (% R.H.) : 46.0 % R.H.

#### BT EDR Mode

Temperature (°C) : 23.4 °C  
Humidity (% R.H.) : 47.5 % R.H.

### 10.3 Test Data for Bluetooth (Basic Rate)

Left\_BDR

Measurement Distance : 3 m

Frequency (MHz)	Reading (dB $\mu$ W)	Position (V/H)	Height (m)	Correction Factor		Result Value		
				Ant Factor (dB)	Cable (dB)	Limit (dB $\mu$ W/m)	Result (dB $\mu$ W/m)	Margin (dB)
30.90	5.92	V	1.4	12.01	0.76	40.00	18.70	21.30
73.60	6.78	V	1.8	11.75	1.16	40.00	19.69	20.31
133.70	6.42	V	1.6	11.56	1.59	43.50	19.57	23.93
248.00	10.64	H	1.6	11.77	2.27	46.00	24.67	21.33
441.80	2.88	V	1.4	17.02	2.97	46.00	22.88	23.12
901.90	4.69	H	1.6	23.56	4.62	46.00	32.86	13.14
Remark	<p>H : Horizontal, V : Vertical Bluetooth (Basic Rate , 38 CH , 2 440 MHz)</p> <p>*CL = Cable Loss (In case of below 1 000 MHz)</p> <p>*The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Quasi-peak detection at frequency below 1 GHz.</p> <p>*Result Value = Reading + Ant Factor + Cable loss</p> <p>*Margin = Limit - Result</p>							



Test Data for Bluetooth (EDR)

Left\_EDR

Measurement Distance : 3 m

Frequency (MHz)	Reading (dB $\mu$ W)	Position (V/H)	Height (m)	Correction Factor		Result Value		
				Ant Factor (dB)	Cable (dB)	Limit (dB $\mu$ W/m)	Result (dB $\mu$ W/m)	Margin (dB)
31.30	8.46	V	1.0	12.02	0.81	40.00	21.29	18.71
39.00	3.64	H	1.0	12.35	0.90	40.00	16.89	23.11
103.30	8.04	H	1.3	8.77	1.54	43.50	18.35	25.15
114.10	13.43	V	1.4	9.98	1.62	43.50	25.03	18.47
224.00	11.34	V	1.6	10.20	2.35	46.00	23.89	22.11
627.30	4.74	H	1.8	20.33	4.05	46.00	29.12	16.88
Remark	<p>H : Horizontal, V : Vertical Bluetooth (EDR , 38 CH , 2 440 MHz)</p> <p>*CL = Cable Loss(In case of below 1 000 MHz)</p> <p>*The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Quasi-peak detection at frequency below 1 GHz.</p> <p>*Result Value = Reading + Ant Factor + Cable loss</p> <p>*Margin = Limit - Result</p>							



Test Data for Bluetooth (Basic Rate)

Right\_BDR

Measurement Distance : 3 m

Frequency (MHz)	Reading (dB $\mu$ W)	Position (V/H)	Height (m)	Correction Factor		Result Value		
				Ant Factor (dB)	Cable (dB)	Limit (dB $\mu$ W/m)	Result (dB $\mu$ W/m)	Margin (dB)
30.80	7.82	V	1.4	12.01	0.76	40.00	20.59	19.41
74.30	6.17	V	1.8	11.76	1.16	40.00	19.09	20.91
113.30	14.10	V	1.6	9.96	1.47	43.50	25.53	17.97
255.30	6.20	H	1.6	11.82	2.30	46.00	20.32	25.68
349.40	3.52	H	1.4	14.49	2.63	46.00	20.64	25.36
645.00	4.47	H	1.6	20.55	3.82	46.00	28.84	17.16
Remark	<p>H : Horizontal, V : Vertical Bluetooth (Basic Rate , 38 CH , 2 440 MHz)</p> <p>*CL = Cable Loss (In case of below 1 000 MHz)</p> <p>*The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Quasi-peak detection at frequency below 1 GHz.</p> <p>*Result Value = Reading + Ant Factor + Cable loss</p> <p>*Margin = Limit - Result</p>							



### Test Data for Bluetooth (EDR)

Right\_EDR

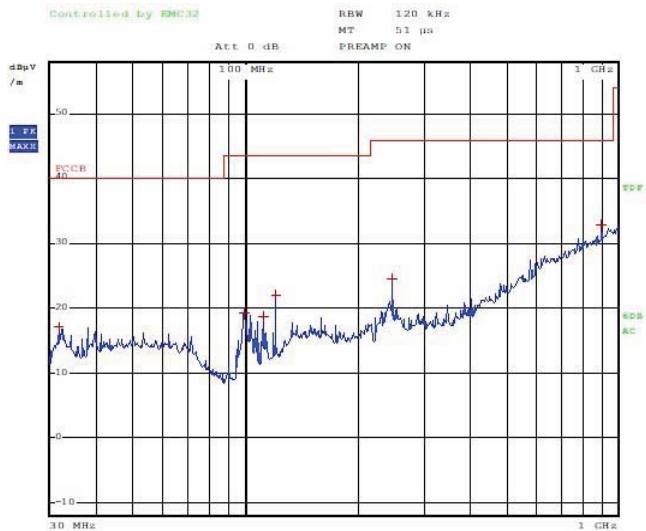
Measurement Distance : 3 m

Frequency (MHz)	Reading (dB $\mu$ W)	Position (V/H)	Height (m)	Correction Factor		Result Value		
				Ant Factor (dB)	Cable (dB)	Limit (dB $\mu$ W/m)	Result (dB $\mu$ W/m)	Margin (dB)
30.20	7.73	V	1.0	12.00	0.76	40.00	20.49	19.51
46.70	1.96	H	1.0	13.42	0.94	40.00	16.32	23.68
72.80	6.74	V	1.3	11.74	1.15	40.00	19.63	20.37
100.10	16.61	V	1.4	8.70	1.39	43.50	26.70	16.80
651.50	3.91	H	1.6	20.60	3.85	46.00	28.36	17.64
846.50	5.79	H	1.8	22.97	4.45	46.00	33.20	12.80
Remark	<p>H : Horizontal, V : Vertical Bluetooth (EDR , 38 CH , 2 440 MHz)</p> <p>*CL = Cable Loss(In case of below 1 000 MHz)</p> <p>*The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Quasi-peak detection at frequency below 1 GHz.</p> <p>*Result Value = Reading + Ant Factor + Cable loss</p> <p>*Margin = Limit - Result</p>							

## Restricted Band Edges for BT(Basic Rate)

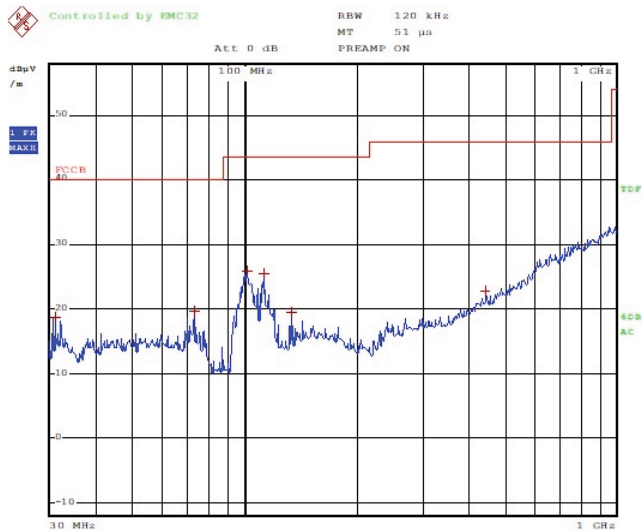
Band Edges(CH Middle) Left\_BDR

Polarity:Horizontal



ESTR-22-00164

Polarity:Vertical

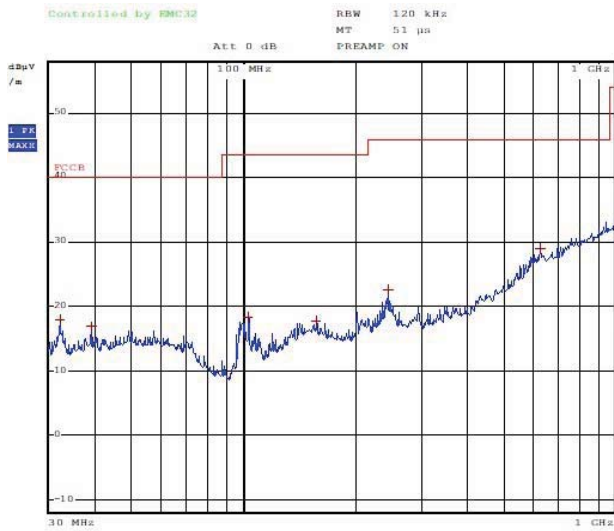


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## Restricted Band Edges for BT(EDR)

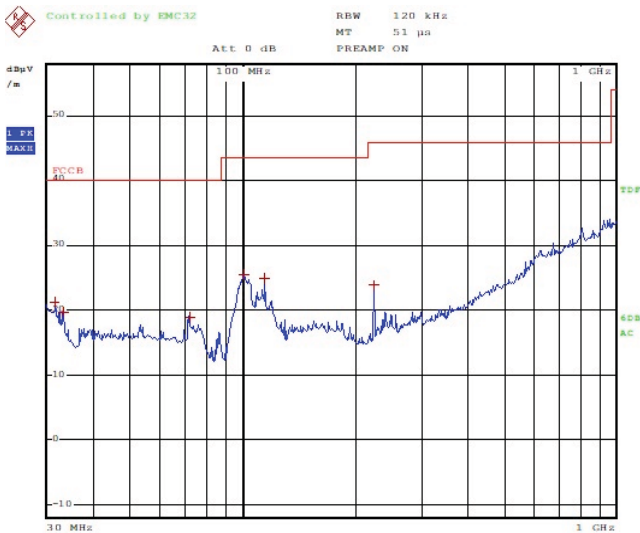
Band Edges(CH Middle) Left\_EDR

Polarity:Horizontal



ESTR-22-00164

Polarity:Vertical

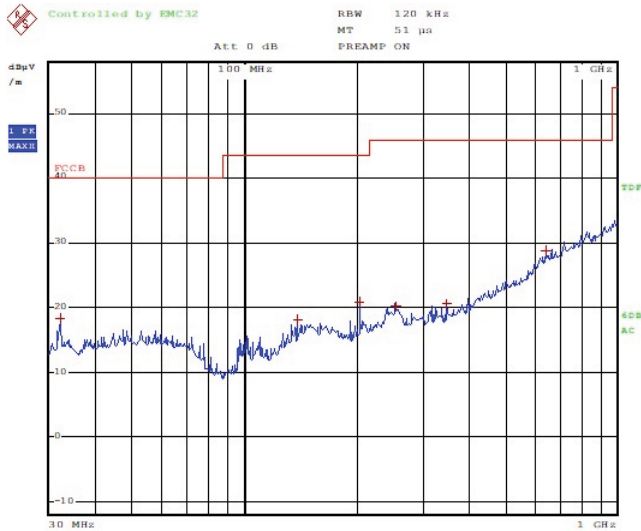


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## Restricted Band Edges for BT(Basic Rate)

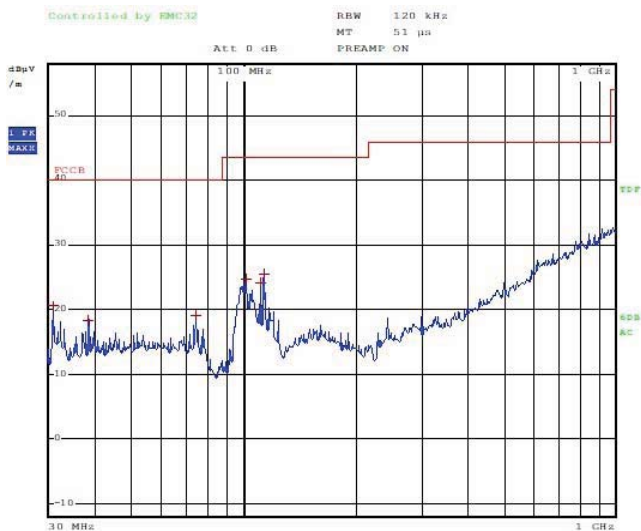
Band Edges(CH Middle) Right\_BDR

Polarity:Horizontal



ESTR-22-00164

Polarity:Vertical



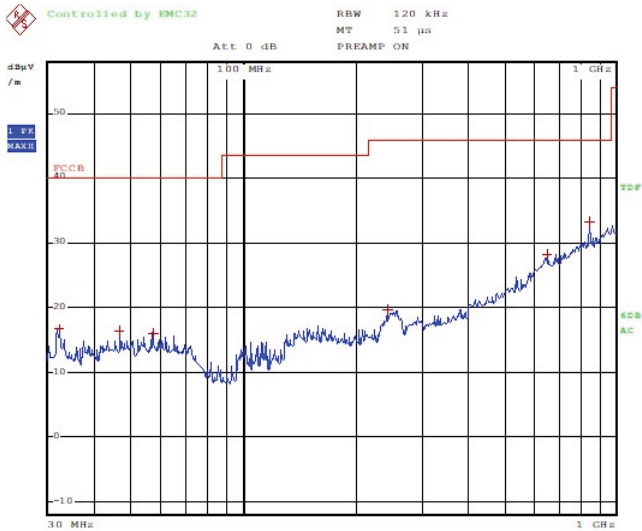
ESTR-22-00164



## Restricted Band Edges for BT(EDR)

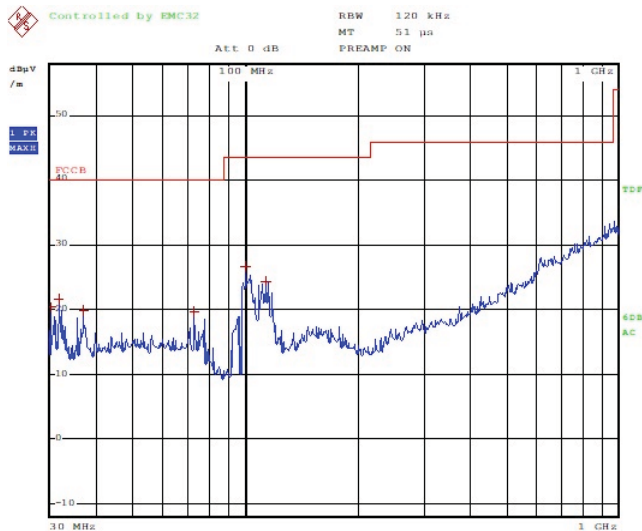
Band Edges(CH Middle) Right\_EDR

Polarity:Horizontal



ESTR-22-00164

Polarity:Vertical



ESTR-22-00164



### 10.4 Test Data for Bluetooth(Basic Rate)

Left\_BDR

Measurement Distance : 3 m

Frequency (MHz)	Reading (dBμV)	Position (V/H)	Height (m)	Correction Factor		Duty Cycle Correction (dB)	Result Value		
				Ant Factor (dB)	Cable (dB)		Limit (dBμV/m)	Result (dBμV/m)	Margin (dB)
<b>PEAK(RBW:1 MHz VBW:3 MHz)</b>									
2390.00	48.52	H	1.5	27.54	-28.39	/	74.00	47.67	26.33
2390.00	52.75	V	1.5	27.54	-28.39	/	74.00	51.90	22.10
4804.00	32.48	H	1.5	31.30	-25.75	/	74.00	38.03	35.97
4804.00	34.24	V	1.5	31.30	-25.75	/	74.00	39.79	34.21
<b>Average (RBW:1 MHz VBW:3 MHz)</b>									
2390.00	35.46	H	1.5	27.54	-28.39	1.04	54.00	35.65	18.35
2390.00	35.33	V	1.5	27.54	-28.39	1.04	54.00	35.52	18.48
4804.00	24.58	H	1.5	31.30	-25.75	1.04	54.00	31.17	22.83
4804.00	24.42	V	1.5	31.30	-25.75	1.04	54.00	31.01	22.99
Remark	<p>H : Horizontal, V : Vertical TEST MODE : Bluetooth Basic Rate-CH0 (2 402 MHz)            *This test was radiated up to 26.5 GHz but no noise was measured.            *The TX signal wasn't detected from 3th harmonics.            *Result Value = Reading + Ant Factor + Cable loss - Amplifier Gain + Duty Cycle Correction Factor            *Margin = Limit - Result            *The resolution bandwidth and video bandwidth of spectrum analyzer is 1 MHz and 1 kHz for average detection at frequency above 1 GHz.            FYI : Duty Cycle Correction Factor (79 channel hopping)            a. Time to cycle through all channels= <math>\Delta t = \tau</math> [ms] x 79 channels = 295.934 ms, where <math>\tau</math> = pulse width            b. <math>100 \text{ ms} / \Delta t</math> [ms] = H → Round up to next highest integer, H' =1            c. Worst Case Dwell Time = <math>\tau</math> [ms] x H' = 3.746 ms            d. Duty Cycle Correction = <math>20 \log (\text{Worst Case Dwell Time} / 100\text{ms}) \text{ dB} = -28.528 \text{ dB}</math></p>								



Test Data for Bluetooth(Basic Rate)

Left\_BDR

Measurement Distance : 3 m

Frequency (MHz)	Reading (dBμV)	Position (V/H)	Height (m)	Correction Factor		Duty Cycle Correction (dB)	Result Value		
				Ant Factor (dB)	Cable (dB)		Limit (dBμV/m)	Result (dBμV/m)	Margin (dB)
<b>PEAK(RBW:1 MHz VBW:3 MHz)</b>									
4880.00	35.12	H	1.5	31.30	-25.67	/	74.00	40.75	33.25
4880.00	35.34	V	1.5	31.30	-25.67		74.00	40.97	33.03
<b>Average (RBW:1 MHz VBW:3 MHz)</b>									
4880.00	27.05	H	1.5	31.30	-25.67	1.04	54.00	33.72	20.28
4880.00	26.99	V	1.5	31.30	-25.67	1.04	54.00	33.66	20.34
Remark	<p>H : Horizontal, V : Vertical TEST MODE : Bluetooth Basic Rate-CH38 (2 440 MHz)</p> <p>*This test was radiated up to 26.5 GHz but no noise was measured.</p> <p>*The TX signal wasn't detected from 3th harmonics.</p> <p>*Result Value = Reading + Ant Factor + Cable loss - Amplifier Gain + Duty Cycle Correction Factor</p> <p>*Margin = Limit - Result</p> <p>*The resolution bandwidth and video bandwidth of spectrum analyzer is 1 MHz and 1 kHz for average detection at frequency above 1 GHz.</p> <p>FYI : Duty Cycle Correction Factor (79 channel hopping)</p> <p>a. Time to cycle through all channels= <math>\Delta t = \tau</math> [ms] x 79 channels = 295.934 ms, where <math>\tau</math> = pulse width</p> <p>b. <math>100 \text{ ms} / \Delta t</math> [ms] = H → Round up to next highest integer, H' =1</p> <p>c. Worst Case Dwell Time = <math>\tau</math> [ms] x H' = 3.746 ms</p> <p>d. Duty Cycle Correction = <math>20 \log (\text{Worst Case Dwell Time} / 100\text{ms}) \text{ dB} = -28.528 \text{ dB}</math></p>								



### Test Data for Bluetooth(Basic Rate)

Left\_BDR

Measurement Distance : 3 m

Frequency (MHz)	Reading (dBμV)	Position (V/H)	Height (m)	Correction Factor		Duty Cycle Correction (dB)	Result Value		
				Ant Factor (dB)	Cable (dB)		Limit (dBμV/m)	Result (dBμV/m)	Margin (dB)
<b>PEAK(RBW:1 MHz VBW:3 MHz)</b>									
2483.50	63.22	H	1.5	27.42	-28.28	/	74.00	62.36	11.64
2483.50	57.80	V	1.7	27.42	-28.28	/	74.00	56.94	17.06
4960.00	46.38	H	1.5	31.48	-25.59	/	74.00	52.27	21.73
4960.00	44.71	V	1.7	31.48	-25.59	/	74.00	50.60	23.40
<b>Average (RBW:1 MHz VBW:3 MHz)</b>									
2483.50	52.90	H	1.5	27.42	-28.28	1.04	54.00	53.08	0.92
2483.50	36.84	V	1.7	27.42	-28.28	1.04	54.00	37.02	16.98
4960.00	37.58	H	1.5	31.48	-25.59	1.04	54.00	44.51	9.49
4960.00	27.81	V	1.7	31.48	-25.59	1.04	54.00	34.74	19.26
Remark	<p>H : Horizontal, V : Vertical TEST MODE : Bluetooth Basic Rate-CH78 (2 480 MHz)</p> <p>*This test was radiated up to 26.5 GHz but no noise was measured.</p> <p>*The TX signal wasn't detected from 3th harmonics.</p> <p>*Result Value = Reading + Ant Factor + Cable loss - Amplifier Gain + Duty Cycle Correction Factor</p> <p>*Margin = Limit - Result</p> <p>*The resolution bandwidth and video bandwidth of spectrum analyzer is 1 MHz and 1 kHz for average detection at frequency above 1 GHz.</p> <p>FYI : Duty Cycle Correction Factor (79 channel hopping)</p> <p>a. Time to cycle through all channels= <math>\Delta t = \tau</math> [ms] x 79 channels = 295.934 ms, where <math>\tau</math> = pulse width</p> <p>b. <math>100 \text{ ms} / \Delta t</math> [ms] = H → Round up to next highest integer, H' =1</p> <p>c. Worst Case Dwell Time = <math>\tau</math> [ms] x H' = 3.746 ms</p> <p>d. Duty Cycle Correction = <math>20 \log (\text{Worst Case Dwell Time} / 100\text{ms}) \text{ dB} = -28.528 \text{ dB}</math></p>								



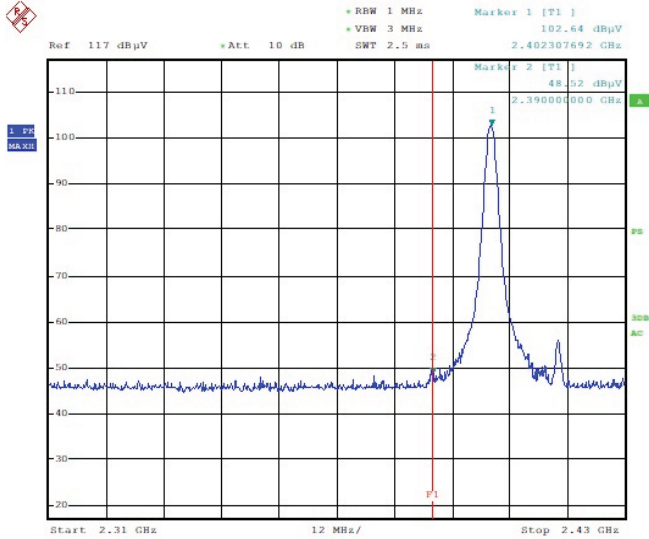
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## Restricted Band Edges for BT(Basic Rate)

Band Edges(CH Low)

Detector mode:Peak

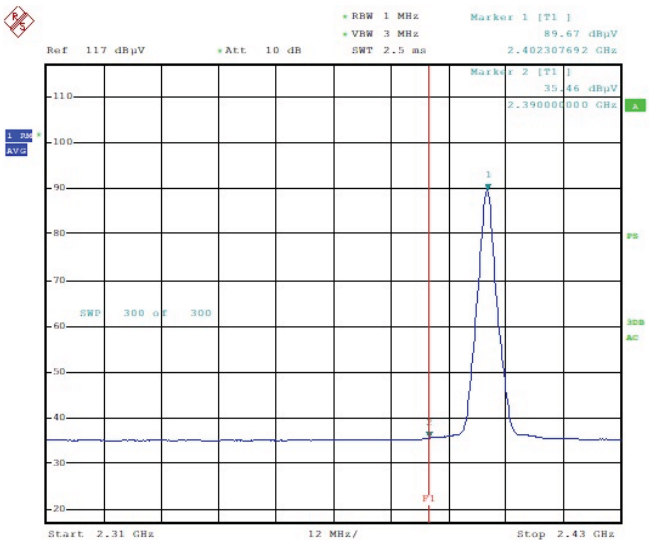
Polarity:Horizontal



ESTR-22-00164

Detector mode:Average

Polarity:Horizontal



ESTR-22-00164

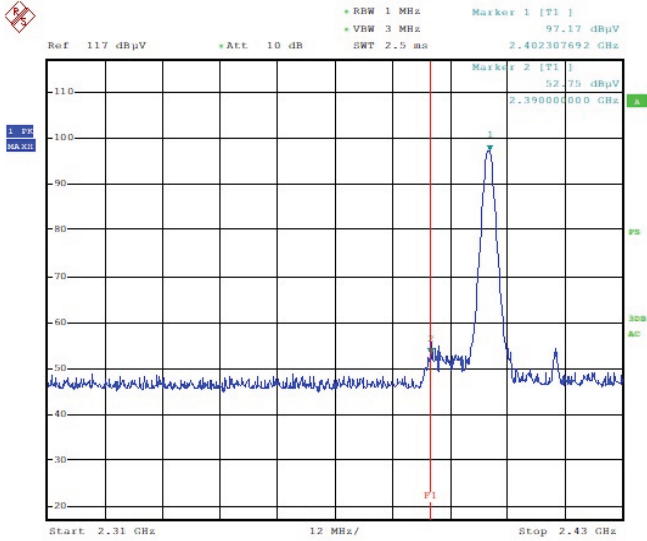


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Band Edges(CH Low)

Detector mode:Peak

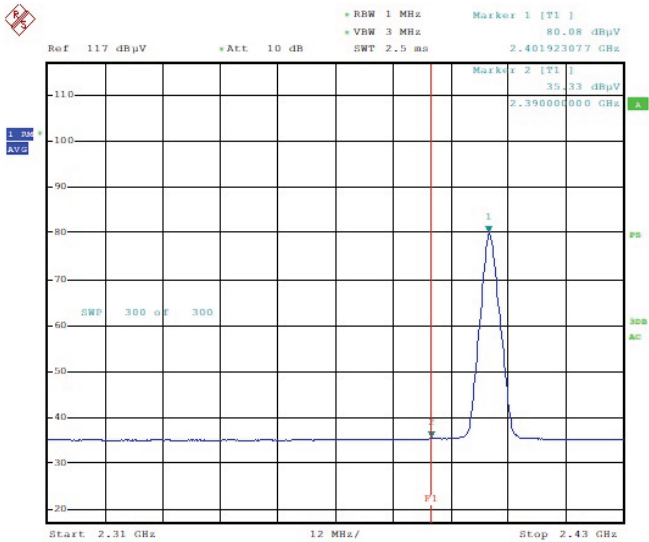
Polarity:Vertical



ESTR-22-00164

Detector mode:Average

Polarity:Vertical



ESTR-22-00164

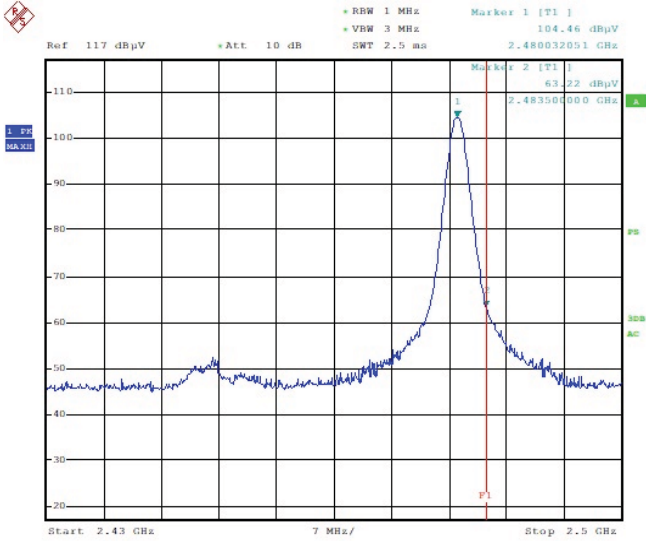


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Band Edges(CH High)

Detector mode:Peak

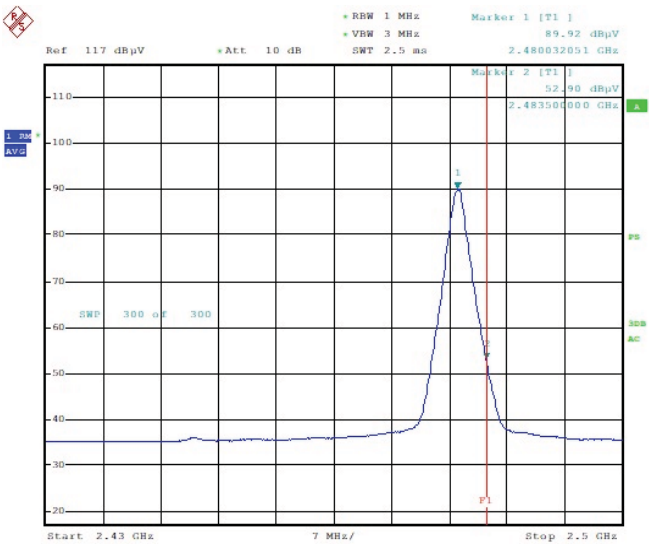
Polarity:Horizontal



ESTR-22-001e4

Detector mode:Average

Polarity:Horizontal



ESTR-22-001e4

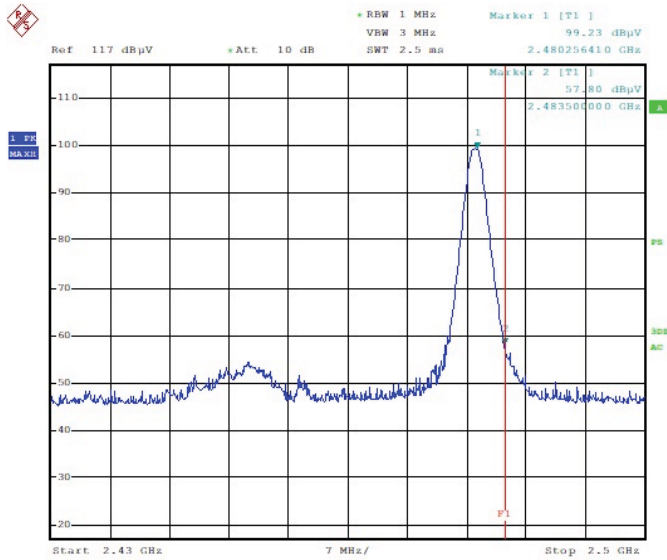


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Band Edges(CH High)

Detector mode:Peak

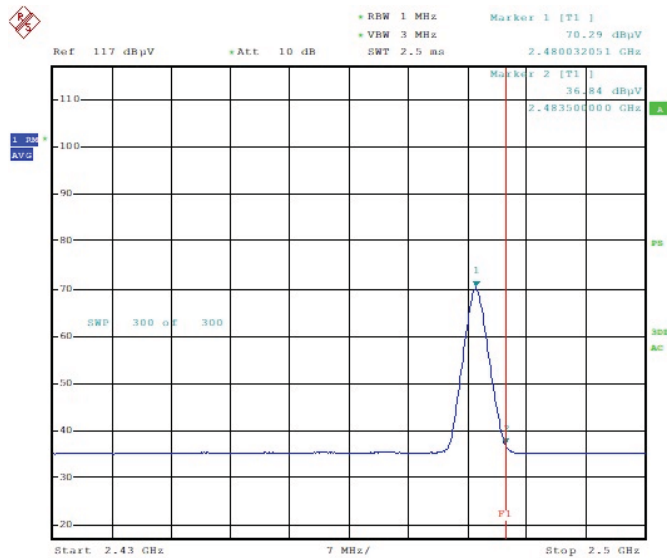
Polarity:Vertical



ESTR-22-00164

Detector mode:Average

Polarity:Vertical



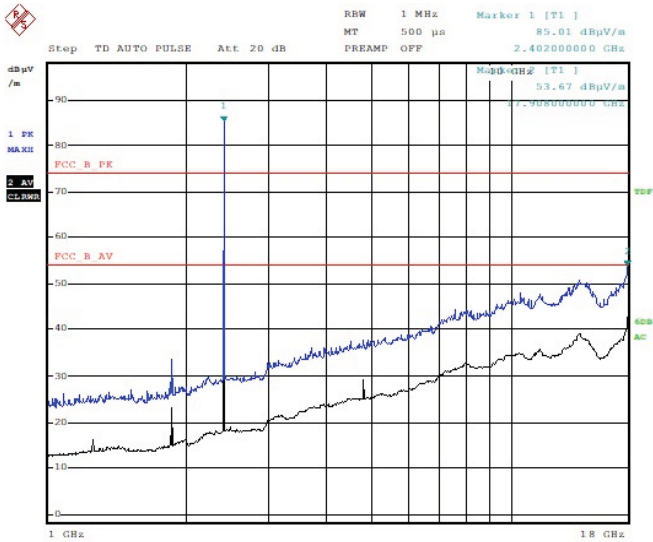
ESTR-22-00164



## Restricted Band Edges for BT(Basic Rate)

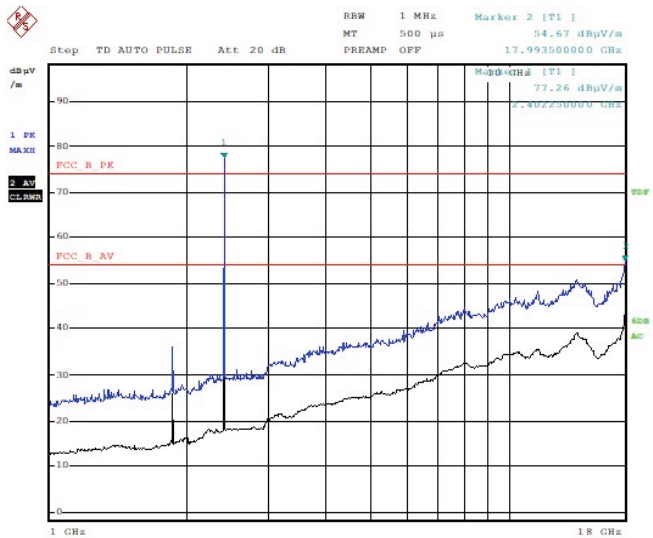
Band Edges(CH Low)

Polarity:Horizontal



ESTR-22-00164

Polarity:Vertical



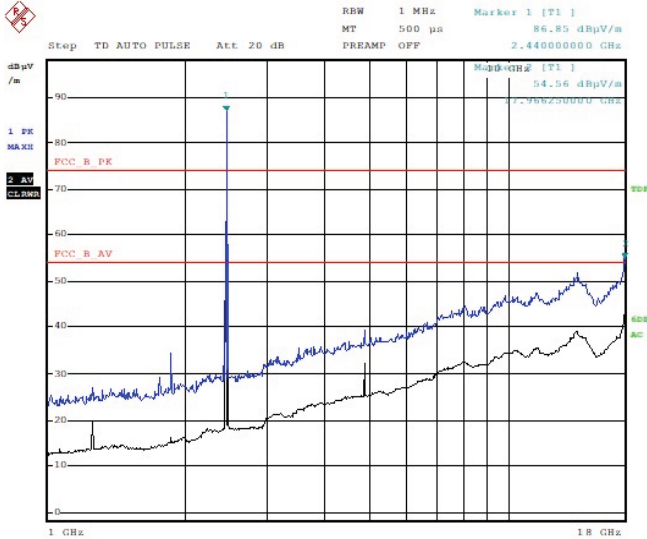
ESTR-22-00164



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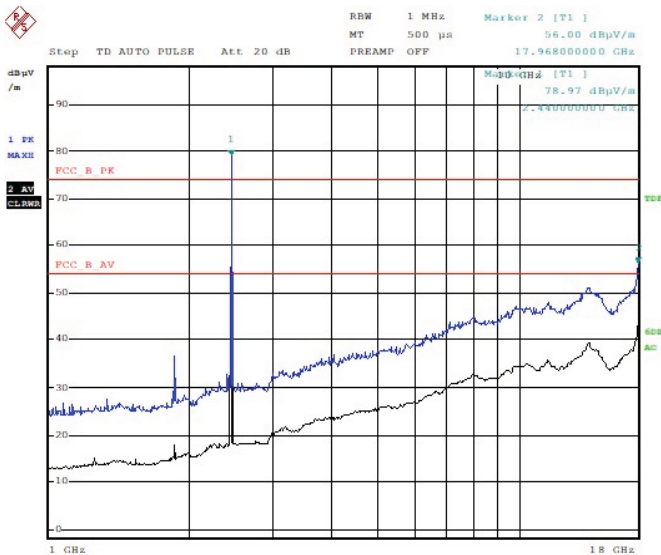
Band Edges(CH Middle)

Polarity:Horizontal



ESTR-22-00164

Polarity:Vertical



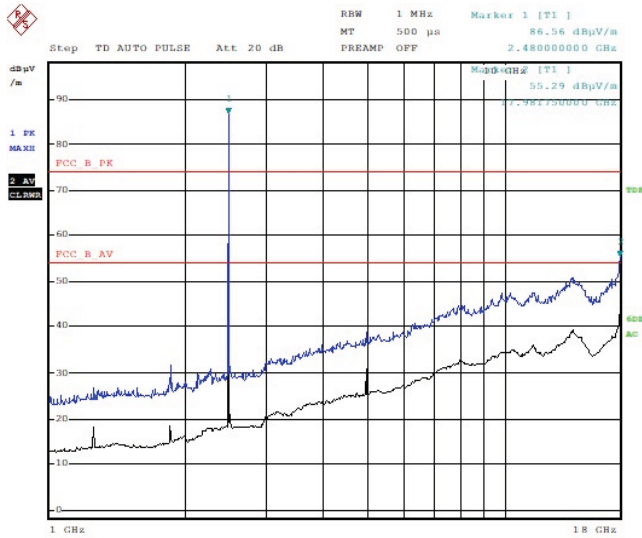
ESTR-22-00164



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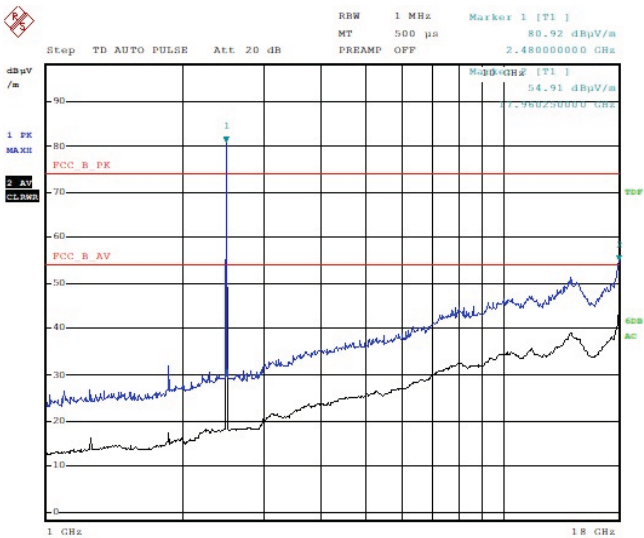
Band Edges(CH High)

Polarity:Horizontal



ESTR-22-00164

Polarity:Vertical



ESTR-22-00164



### Test Data for Bluetooth(EDR)

Left\_EDR

Measurement Distance : 3 m

Frequency (MHz)	Reading (dB $\mu$ V)	Position (V/H)	Height (m)	Correction Factor		Duty Cycle Correction (dB)	Result Value		
				Ant Factor (dB)	Cable (dB)		Limit (dB $\mu$ V/m)	Result (dB $\mu$ V/m)	Margin (dB)
<b>PEAK(RBW:1 MHz VBW:3 MHz)</b>									
2390.00	47.06	H	1.6	27.54	-28.39	/	74.00	46.21	27.79
2390.00	47.60	V	1.5	27.54	-28.39	/	74.00	46.75	27.25
4804.00	33.61	H	1.6	31.30	-25.75	/	74.00	39.16	34.84
4804.00	33.68	V	1.5	31.30	-25.75	/	74.00	39.23	34.77
<b>Average (RBW:1 MHz VBW:3 MHz)</b>									
2390.00	35.40	H	1.6	27.54	-28.39	1.06	54.00	35.61	18.39
2390.00	35.32	V	1.5	27.54	-28.39	1.06	54.00	35.53	18.47
4804.00	26.91	H	1.6	31.30	-25.75	1.06	54.00	33.52	20.48
4804.00	26.84	V	1.5	31.30	-25.75	1.06	54.00	33.45	20.55
Remark	<p>H : Horizontal, V : Vertical TEST MODE : Bluetooth EDR-CH0 (2 402 MHz)</p> <p>*This test was radiated up to 26.5 GHz but no noise was measured.</p> <p>*The TX signal wasn't detected from 3th harmonics.</p> <p>*Result Value = Reading + Ant Factor + Cable loss - Amplifier Gain + Duty Cycle Correction Factor</p> <p>*Margin = Limit - Result</p> <p>*The resolution bandwidth and video bandwidth of spectrum analyzer is 1 MHz and 1 kHz for average detection at frequency above 1 GHz.</p> <p>FYI : Duty Cycle Correction Factor (79 channel hopping)</p> <p>a. Time to cycle through all channels= <math>\Delta t = \tau</math> [ms] x 79 channels = 296.25 ms, where <math>\tau</math> = pulse width</p> <p>b. <math>100 \text{ ms} / \Delta t</math> [ms] = H <math>\rightarrow</math> Round up to next highest integer, H' =1</p> <p>c. Worst Case Dwell Time = <math>\tau</math> [ms] x H' = 3.79ms</p> <p>d. Duty Cycle Correction = <math>20 \log (\text{Worst Case Dwell Time} / 100\text{ms}) \text{ dB} = - 28.427 \text{ dB}</math></p>								



Test Data for Bluetooth(EDR)

Left\_EDR

Measurement Distance : 3 m

Frequency (MHz)	Reading (dBμV)	Position (V/H)	Height (m)	Correction Factor		Duty Cycle Correction (dB)	Result Value		
				Ant Factor (dB)	Cable (dB)		Limit (dBμV/m)	Result (dBμV/m)	Margin (dB)
<b>PEAK(RBW:1 MHz VBW:3 MHz)</b>									
4880.00	32.65	H	1.5	31.30	-25.67	/	74.00	38.28	35.72
4880.00	32.69	V	1.7	31.30	-25.67		74.00	38.32	35.68
<b>Average (RBW:1 MHz VBW:3 MHz)</b>									
4880.00	26.97	H	1.5	31.30	-25.67	1.06	54.00	33.66	20.34
4880.00	26.88	V	1.7	31.30	-25.67	1.06	54.00	33.57	20.43
Remark	<p>H : Horizontal, V : Vertical TEST MODE : Bluetooth EDR-CH38 (2 440 MHz)</p> <p>*This test was radiated up to 26.5 GHz but no noise was measured.</p> <p>*The TX signal wasn't detected from 3th harmonics.</p> <p>*Result Value = Reading + Ant Factor + Cable loss - Amplifier Gain + Duty Cycle Correction Factor</p> <p>*Margin = Limit - Result</p> <p>*The resolution bandwidth and video bandwidth of spectrum analyzer is 1 MHz and 1 kHz for average detection at frequency above 1 GHz.</p> <p>FYI : Duty Cycle Correction Factor (79 channel hopping)</p> <p>a. Time to cycle through all channels= <math>\Delta t = \tau</math> [ms] x 79 channels = 296.25 ms, where <math>\tau</math> = pulse width</p> <p>b. <math>100 \text{ ms} / \Delta t</math> [ms] = H → Round up to next highest integer, H' =1</p> <p>c. Worst Case Dwell Time = <math>\tau</math> [ms] x H' = 3.79ms</p> <p>d. Duty Cycle Correction = <math>20\log(\text{Worst Case Dwell Time} / 100\text{ms}) \text{ dB} = -28.427 \text{ dB}</math></p>								



### Test Data for Bluetooth(EDR)

Left\_EDR

Measurement Distance : 3 m

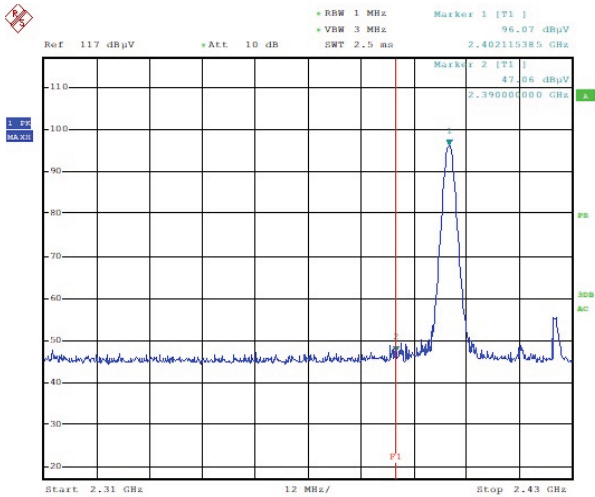
Frequency (MHz)	Reading (dB $\mu$ V)	Position (V/H)	Height (m)	Correction Factor		Duty Cycle Correction (dB)	Result Value		
				Ant Factor (dB)	Cable (dB)		Limit (dB $\mu$ V/m)	Result (dB $\mu$ V/m)	Margin (dB)
<b>PEAK(RBW:1 MHz VBW:3 MHz)</b>									
2483.50	61.17	H	1.5	27.42	-28.28	/	74.00	60.31	13.69
2483.50	57.23	V	1.7	27.42	-28.28	/	74.00	56.37	17.63
4960.00	48.69	H	1.5	31.48	-25.59	/	74.00	54.58	19.42
4960.00	47.32	V	1.7	31.48	-25.59	/	74.00	53.21	20.79
<b>Average (RBW:1 MHz VBW:3 MHz)</b>									
2483.50	40.11	H	1.5	27.42	-28.28	1.06	54.00	40.31	13.69
2483.50	44.04	V	1.7	27.42	-28.28	1.06	54.00	44.24	9.76
4960.00	32.34	H	1.5	31.48	-25.59	1.06	54.00	39.29	14.71
4960.00	33.61	V	1.7	31.48	-25.59	1.06	54.00	40.56	13.44
Remark	<p>H : Horizontal, V : Vertical TEST MODE : Bluetooth EDR-CH78 (2 480 MHz)            *This test was radiated up to 26.5 GHz but no noise was measured.            *The TX signal wasn't detected from 3th harmonics.            *Result Value = Reading + Ant Factor + Cable loss - Amplifier Gain + Duty Cycle Correction Factor            *Margin = Limit - Result            *The resolution bandwidth and video bandwidth of spectrum analyzer is 1 MHz and 1 kHz for average detection at frequency above 1 GHz.</p> <p>FYI : Duty Cycle Correction Factor (79 channel hopping)            a. Time to cycle through all channels= <math>\Delta t = \tau</math> [ms] x 79 channels = 296.25 ms, where <math>\tau</math> = pulse width            b. <math>100 \text{ ms} / \Delta t</math> [ms] = H <math>\rightarrow</math> Round up to next highest integer, H' =1            c. Worst Case Dwell Time = <math>\tau</math> [ms] x H' = 3.79ms            d. Duty Cycle Correction = <math>20 \log (\text{Worst Case Dwell Time} / 100\text{ms}) \text{ dB} = - 28.427 \text{ dB}</math></p>								

## Restricted Band Edges for BT(EDR)

Band Edges(CH Low)

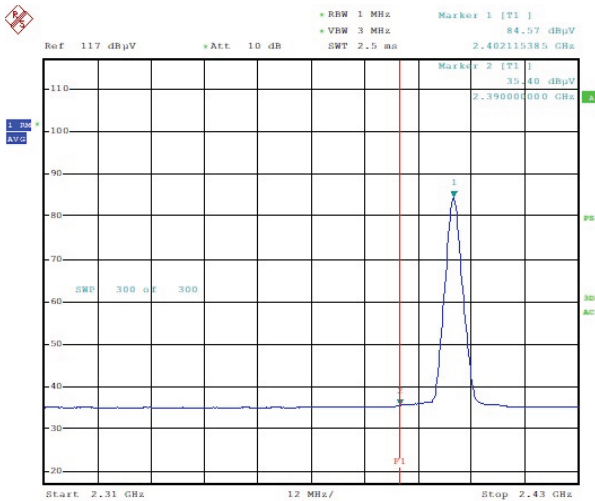
Detector mode:Peak

Polarity:Horizontal



Detector mode:Average

Polarity:Horizontal



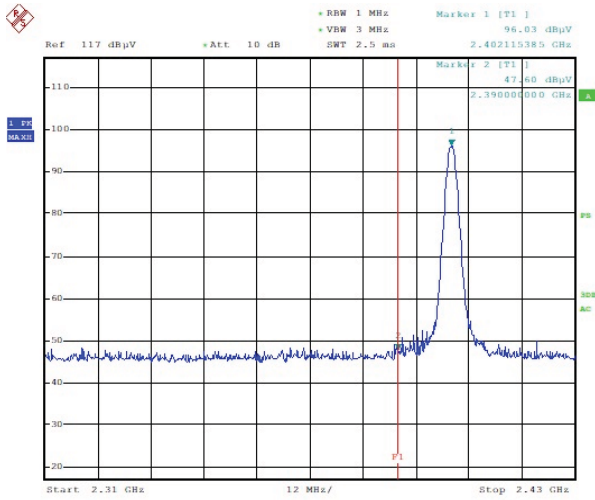


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Band Edges(CH Low)

Detector mode:Peak

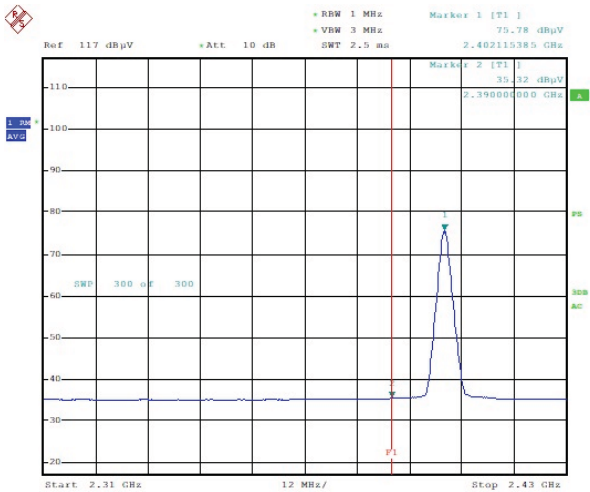
Polarity:Vertical



ESTR-22-00164

Detector mode:Average

Polarity:Vertical



ESTR-22-00164



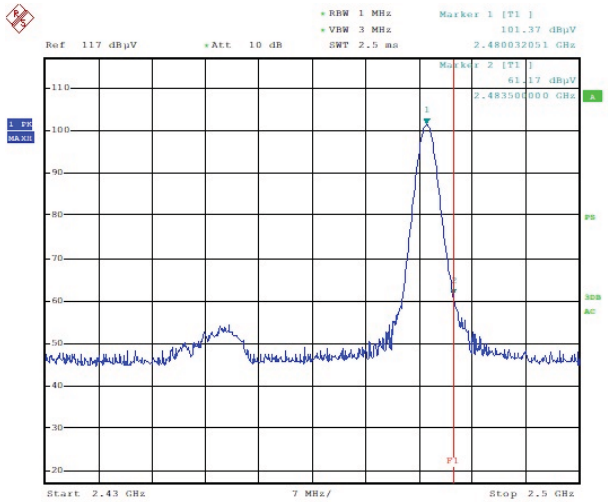


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Band Edges(CH High)

Detector mode:Peak

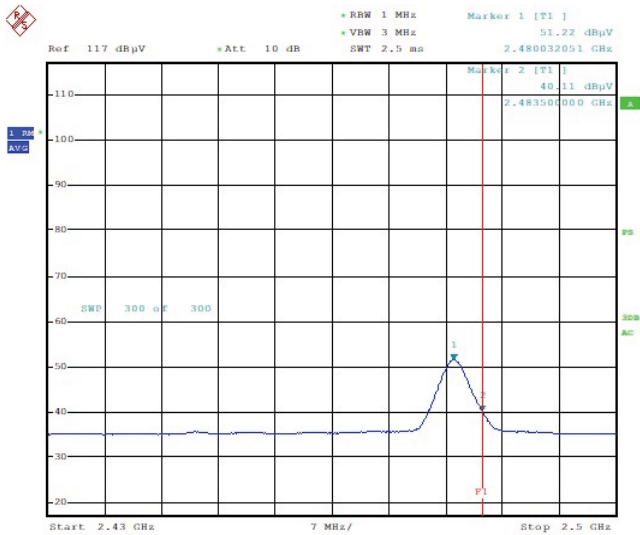
Polarity:Horizontal



ESTR-22-00164

Detector mode:Average

Polarity:Horizontal



ESTR-22-00164

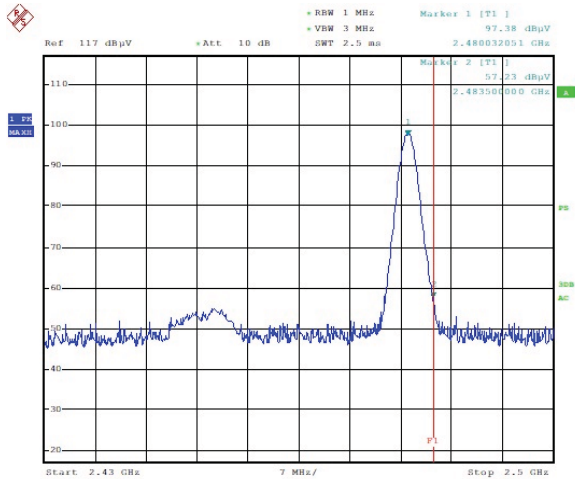


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Band Edges(CH High)

Detector mode:Peak

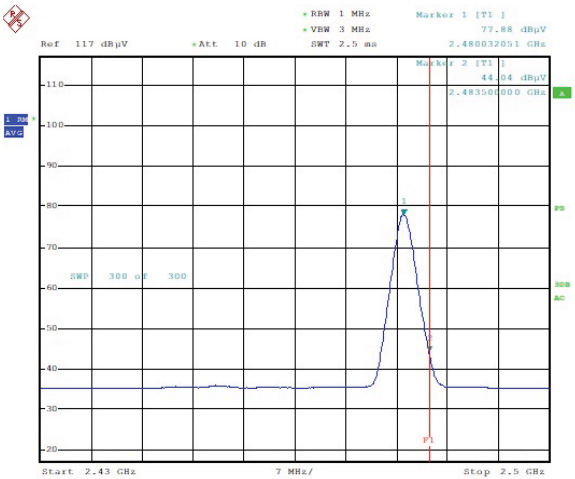
Polarity:Vertical



ESTR-22-00164

Detector mode:Average

Polarity:Vertical

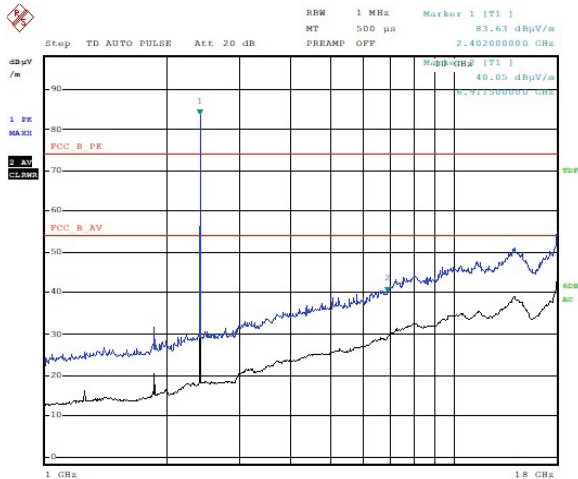


ESTR-22-00164

## Restricted Band Edges for BT(EDR)

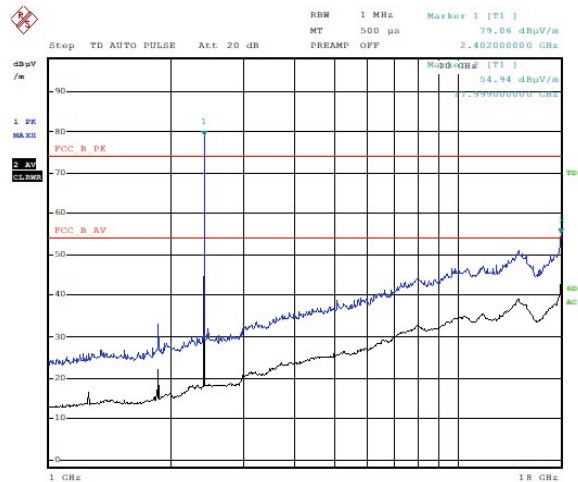
Band Edges(CH Low)

Polarity:Horizontal



ESTR-22-00164

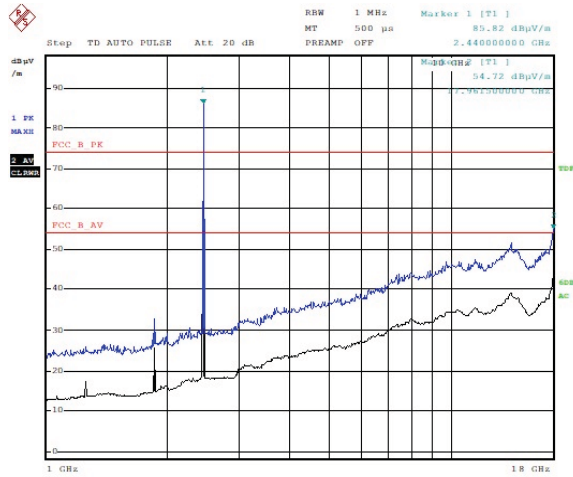
Polarity:Vertical



ESTR-22-00164

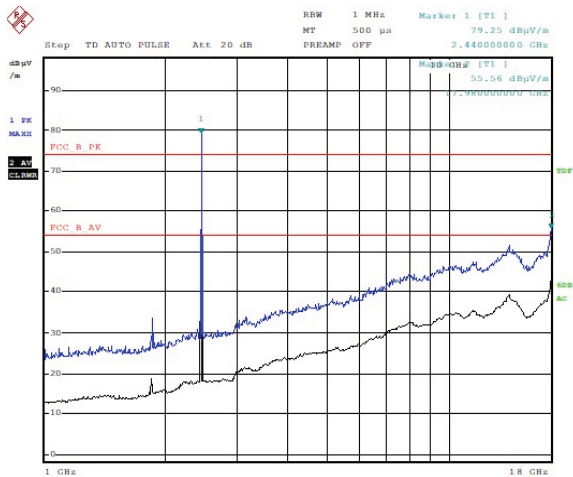
Band Edges(CH Middle)

Polarity:Horizontal



ESTR-22-00164

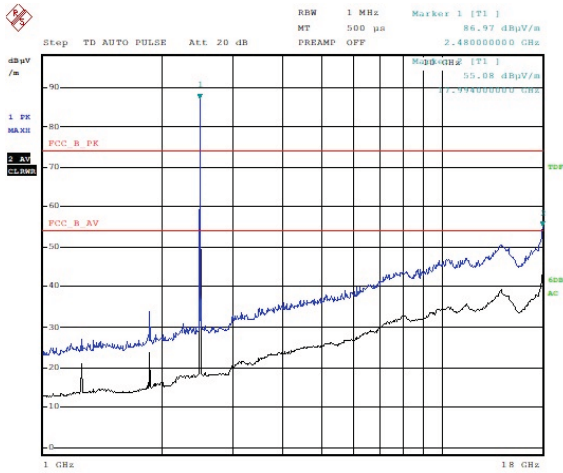
Polarity:Vertical



ESTR-22-00164

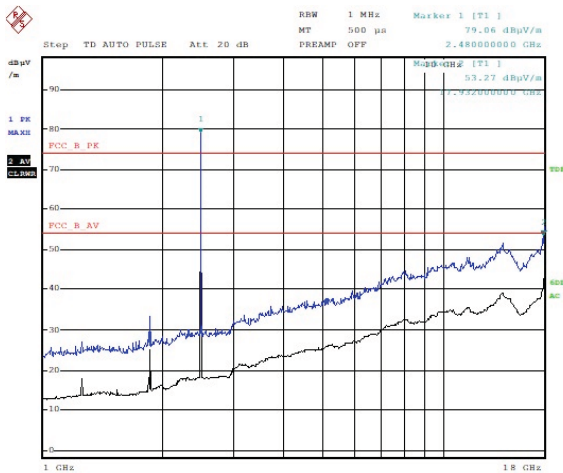
Band Edges(CH High)

Polarity:Horizontal



ESTR-22-00164

Polarity:Vertical



ESTR-22-00164



### Test Data for Bluetooth(Basic Rate)

Right\_BDR

Measurement Distance : 3 m

Frequency (MHz)	Reading (dBμV)	Position (V/H)	Height (m)	Correction Factor		Duty Cycle Correction (dB)	Result Value		
				Ant Factor (dB)	Cable (dB)		Limit (dBμV/m)	Result (dBμV/m)	Margin (dB)
<b>PEAK(RBW:1 MHz VBW:3 MHz)</b>									
2390.00	52.41	H	1.5	27.89	-29.82	/	74.00	50.48	23.52
2390.00	46.81	V	1.5	27.89	-29.82	/	74.00	44.88	29.12
4804.00	38.52	H	1.5	31.30	-25.75	/	74.00	44.07	29.93
4804.00	34.12	V	1.5	31.30	-25.75	/	74.00	39.67	34.33
<b>Average (RBW:1 MHz VBW:3 MHz)</b>									
2390.00	35.85	H	1.5	27.89	-29.82	1.04	54.00	34.96	19.04
2390.00	35.53	V	1.5	27.89	-29.82	1.04	54.00	34.64	19.36
4804.00	26.21	H	1.5	31.30	-25.75	1.04	54.00	32.80	21.20
4804.00	26.15	V	1.5	31.30	-25.75	1.04	54.00	32.74	21.26
Remark	<p>H : Horizontal, V : Vertical TEST MODE : Bluetooth Basic Rate-CH0 (2 402 MHz)            *This test was radiated up to 26.5 GHz but no noise was measured.            *The TX signal wasn't detected from 3th harmonics.            *Result Value = Reading + Ant Factor + Cable loss - Amplifier Gain + Duty Cycle Correction Factor            *Margin = Limit - Result            *The resolution bandwidth and video bandwidth of spectrum analyzer is 1 MHz and 1 kHz for average detection at frequency above 1 GHz.            FYI : Duty Cycle Correction Factor (79 channel hopping)            a. Time to cycle through all channels= <math>\Delta t = \tau</math> [ms] x 79 channels = 295.934 ms, where <math>\tau</math> = pulse width            b. <math>100 \text{ ms} / \Delta t</math> [ms] = H → Round up to next highest integer, H' =1            c. Worst Case Dwell Time = <math>\tau</math> [ms] x H' = 3.746 ms            d. Duty Cycle Correction = <math>20 \log (\text{Worst Case Dwell Time} / 100\text{ms}) \text{ dB} = -28.528 \text{ dB}</math></p>								



Test Data for Bluetooth(Basic Rate)

Right\_BDR

Measurement Distance : 3 m

Frequency (MHz)	Reading (dBμV)	Position (V/H)	Height (m)	Correction Factor		Duty Cycle Correction (dB)	Result Value		
				Ant Factor (dB)	Cable (dB)		Limit (dBμV/m)	Result (dBμV/m)	Margin (dB)
<b>PEAK(RBW:1 MHz VBW:3 MHz)</b>									
4880.00	35.12	H	1.5	31.30	-25.67	/	74.00	40.75	33.25
4880.00	35.34	V	1.5	31.30	-25.67		74.00	40.97	33.03
<b>Average (RBW:1 MHz VBW:3 MHz)</b>									
4880.00	27.05	H	1.5	31.30	-25.67	1.04	54.00	33.72	20.28
4880.00	26.99	V	1.5	31.30	-25.67	1.04	54.00	33.66	20.34
Remark	<p>H : Horizontal, V : Vertical TEST MODE : Bluetooth Basic Rate-CH38 (2 440 MHz)</p> <p>*This test was radiated up to 26.5 GHz but no noise was measured.</p> <p>*The TX signal wasn't detected from 3th harmonics.</p> <p>*Result Value = Reading + Ant Factor + Cable loss - Amplifier Gain + Duty Cycle Correction Factor</p> <p>*Margin = Limit - Result</p> <p>*The resolution bandwidth and video bandwidth of spectrum analyzer is 1 MHz and 1 kHz for average detection at frequency above 1 GHz.</p> <p>FYI : Duty Cycle Correction Factor (79 channel hopping)</p> <p>a. Time to cycle through all channels= <math>\Delta t = \tau</math> [ms] x 79 channels = 295.934 ms, where <math>\tau</math> = pulse width</p> <p>b. <math>100 \text{ ms} / \Delta t</math> [ms] = H → Round up to next highest integer, H' =1</p> <p>c. Worst Case Dwell Time = <math>\tau</math> [ms] x H' = 3.746 ms</p> <p>d. Duty Cycle Correction = <math>20 \log (\text{Worst Case Dwell Time} / 100\text{ms}) \text{ dB} = -28.528 \text{ dB}</math></p>								



Test Data for Bluetooth(Basic Rate)

Right\_BDR

Measurement Distance : 3 m

Frequency (MHz)	Reading (dBμV)	Position (V/H)	Height (m)	Correction Factor		Duty Cycle Correction (dB)	Result Value		
				Ant Factor (dB)	Cable (dB)		Limit (dBμV/m)	Result (dBμV/m)	Margin (dB)
<b>PEAK(RBW:1 MHz VBW:3 MHz)</b>									
2483.50	64.58	H	1.5	27.48	-29.75	/	74.00	62.31	11.69
2483.50	62.98	V	1.7	27.48	-29.75	/	74.00	60.71	13.29
4960.00	49.12	H	1.5	31.48	-25.59	/	74.00	55.01	18.99
4960.00	48.12	V	1.7	31.48	-25.59	/	74.00	54.01	19.99
<b>Average (RBW:1 MHz VBW:3 MHz)</b>									
2483.50	43.93	H	1.5	27.48	-29.75	1.04	54.00	42.70	11.30
2483.50	50.60	V	1.7	27.48	-29.75	1.04	54.00	49.37	4.63
4960.00	37.23	H	1.5	31.48	-25.59	1.04	54.00	44.16	9.84
4960.00	41.47	V	1.7	31.48	-25.59	1.04	54.00	48.40	5.60
Remark	<p>H : Horizontal, V : Vertical TEST MODE : Bluetooth Basic Rate-CH78 (2 480 MHz)</p> <p>*This test was radiated up to 26.5 GHz but no noise was measured.</p> <p>*The TX signal wasn't detected from 3th harmonics.</p> <p>*Result Value = Reading + Ant Factor + Cable loss - Amplifier Gain + Duty Cycle Correction Factor</p> <p>*Margin = Limit - Result</p> <p>*The resolution bandwidth and video bandwidth of spectrum analyzer is 1 MHz and 1 kHz for average detection at frequency above 1 GHz.</p> <p>FYI : Duty Cycle Correction Factor (79 channel hopping)</p> <p>a. Time to cycle through all channels= <math>\Delta t = \tau</math> [ms] x 79 channels = 295.934 ms, where <math>\tau</math> = pulse width</p> <p>b. <math>100 \text{ ms} / \Delta t</math> [ms] = H → Round up to next highest integer, H' =1</p> <p>c. Worst Case Dwell Time = <math>\tau</math> [ms] x H' = 3.746 ms</p> <p>d. Duty Cycle Correction = <math>20 \log (\text{Worst Case Dwell Time} / 100\text{ms}) \text{ dB} = -28.528 \text{ dB}</math></p>								





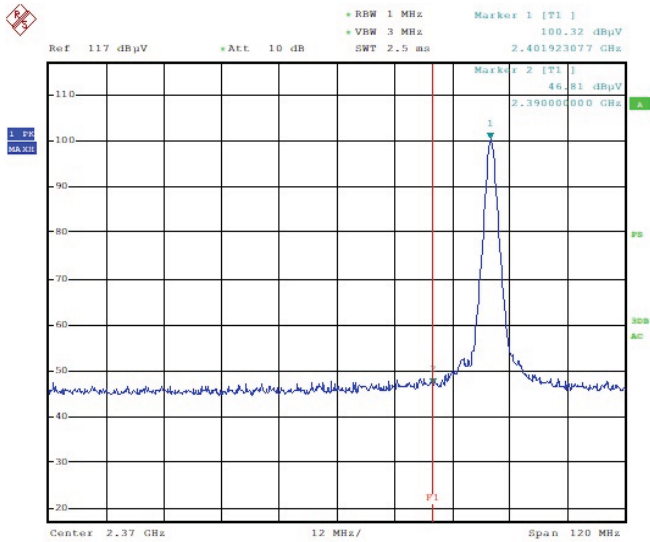
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## Restricted Band Edges for BT(Basic Rate)

Band Edges(CH Low)

Detector mode:Peak

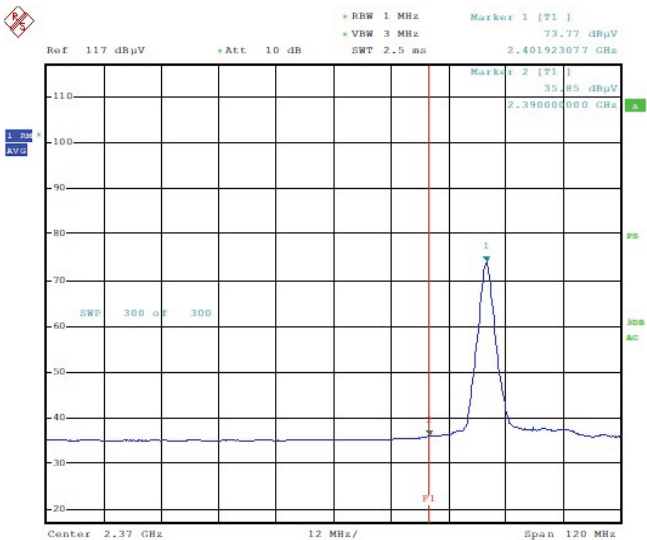
Polarity:Horizontal



ESTR-22-00164

Detector mode:Average

Polarity:Horizontal



ESTR-22-00164

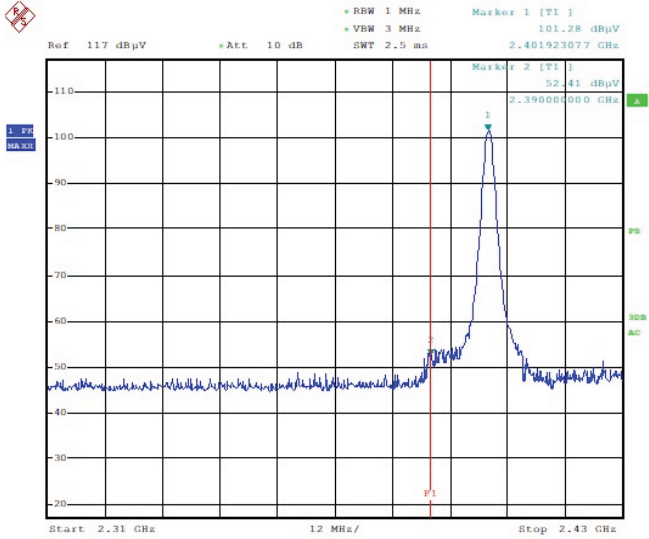


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Band Edges(CH Low)

Detector mode:Peak

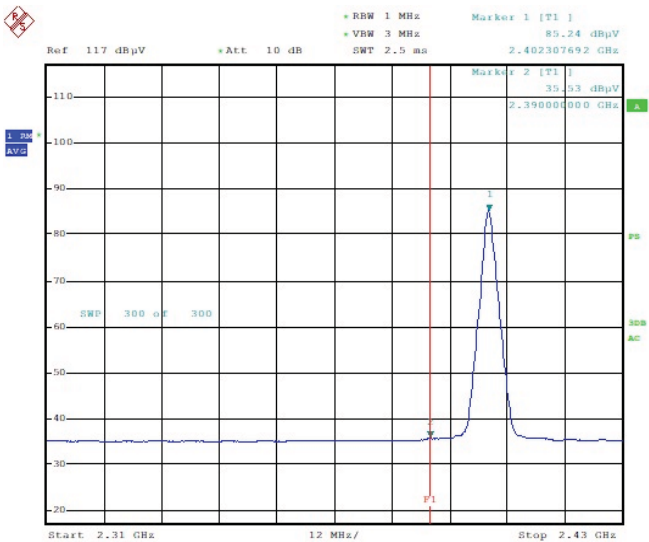
Polarity:Vertical



ESTR-22-00164

Detector mode:Average

Polarity:Vertical



ESTR-22-00164

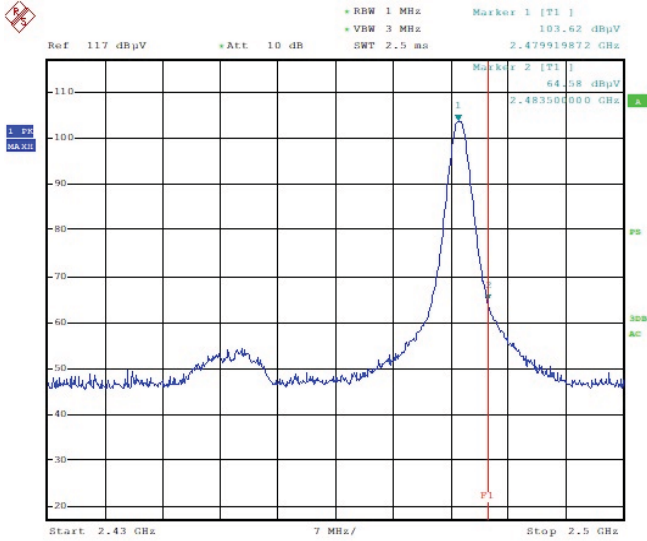


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Band Edges(CH High)

Detector mode:Peak

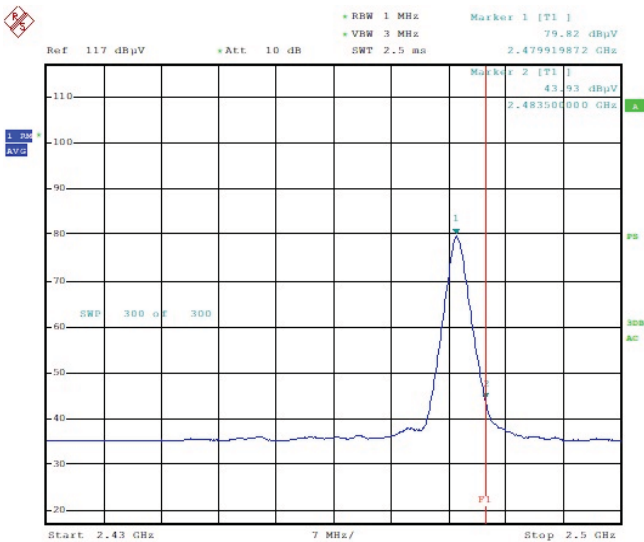
Polarity:Horizontal



ESTR-22-00164

Detector mode:Average

Polarity:Horizontal



ESTR-22-00164

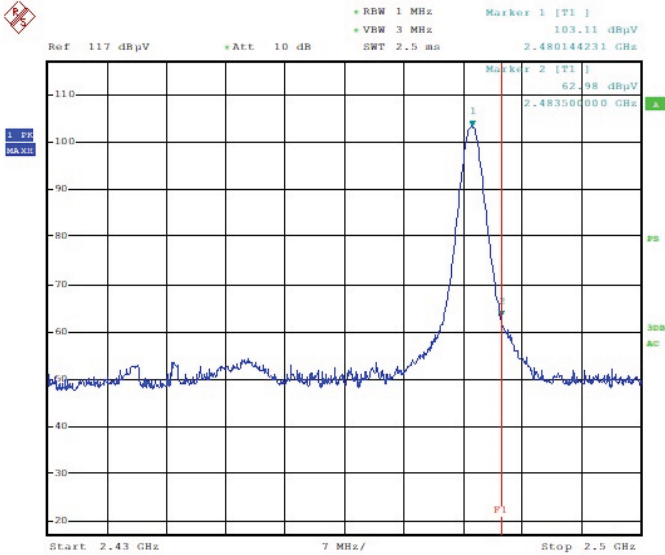


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Band Edges(CH High)

Detector mode:Peak

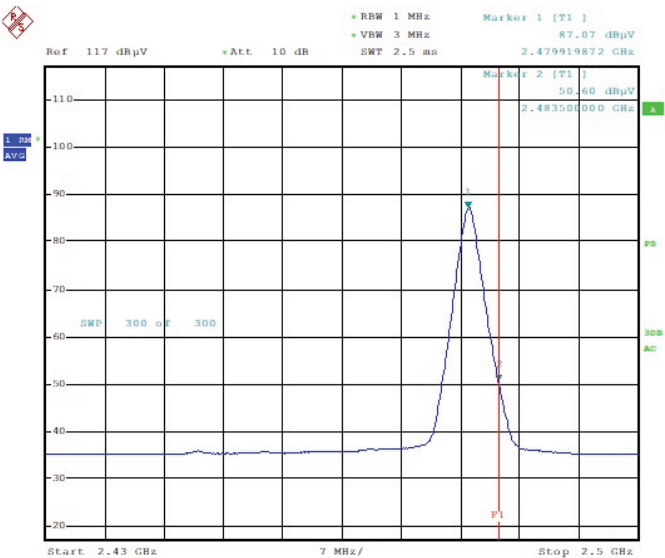
Polarity:Vertical



ESTR-22-00164

Detector mode:Average

Polarity:Vertical



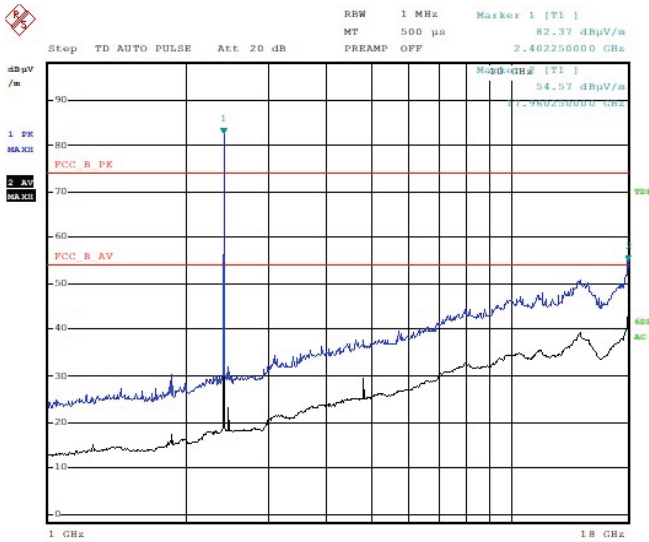
ESTR-22-00164



## Restricted Band Edges for BT(Basic Rate)

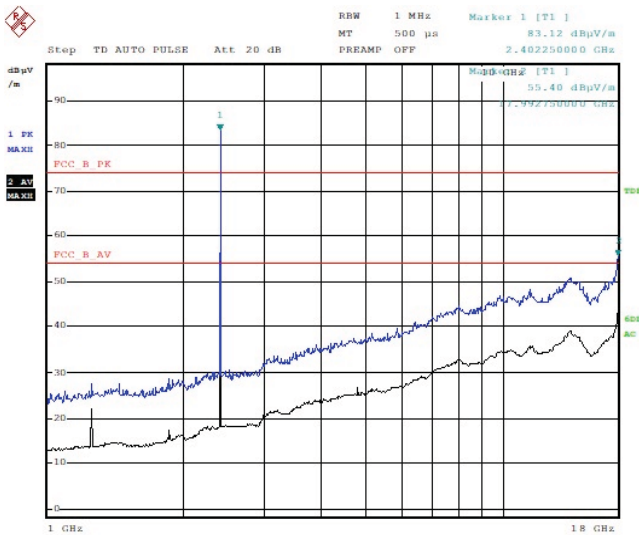
Band Edges(CH Low)

Polarity:Horizontal



ESTR-22-00164

Polarity:Vertical



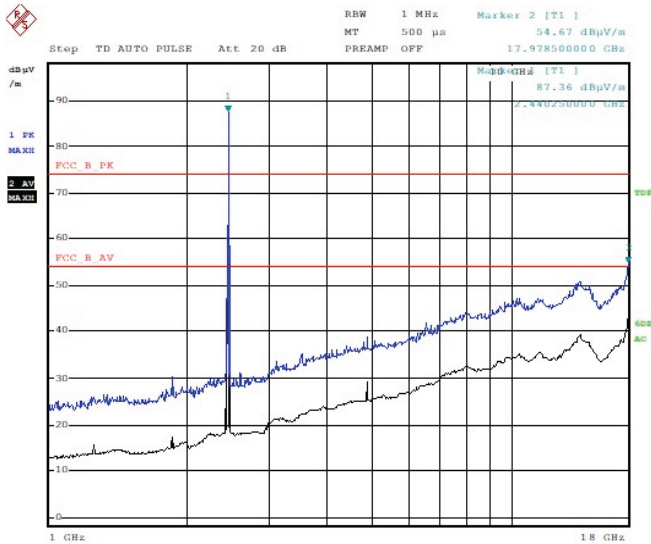
ESTR-22-00164



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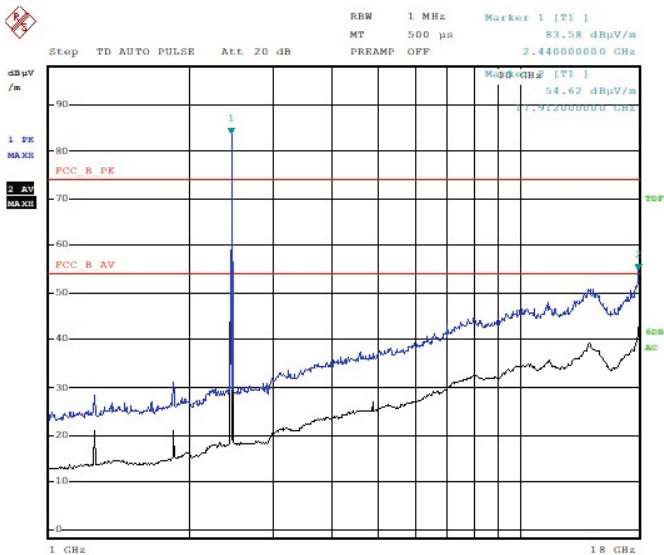
Band Edges(CH Middle)

Polarity:Horizontal



ESTR-22-00164

Polarity:Vertical



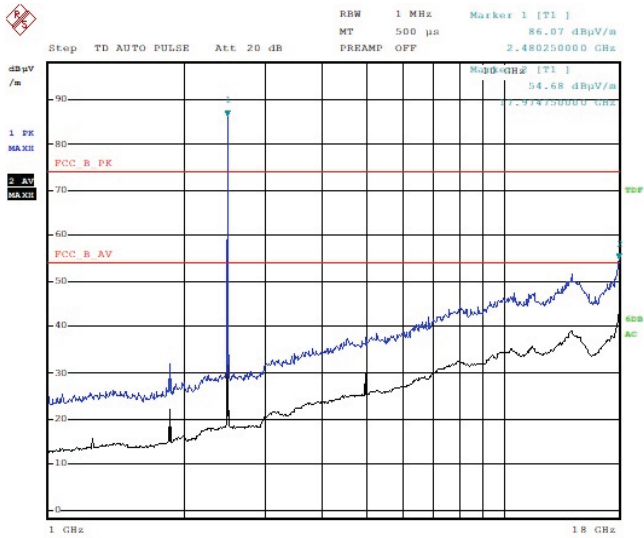
ESTR-22-00164



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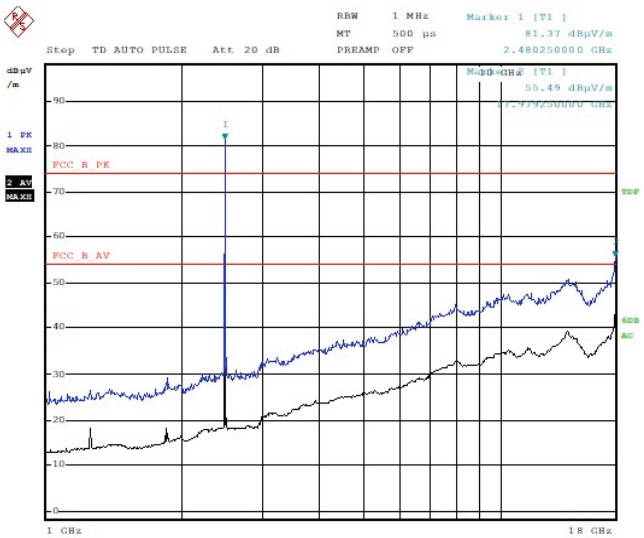
Band Edges(CH High)

Polarity:Horizontal



ESTR-22-00164

Polarity:Vertical



ESTR-22-00164



Test Data for Bluetooth(EDR)

Right\_EDR

Measurement Distance : 3 m

Frequency (MHz)	Reading (dBμV)	Position (V/H)	Height (m)	Correction Factor		Duty Cycle Correction (dB)	Result Value		
				Ant Factor (dB)	Cable (dB)		Limit (dBμV/m)	Result (dBμV/m)	Margin (dB)
<b>PEAK(RBW:1 MHz VBW:3 MHz)</b>									
2390.00	47.49	H	1.6	27.54	-28.39	/	74.00	46.64	27.36
2390.00	55.81	V	1.5	27.54	-28.39	/	74.00	54.96	19.04
4804.00	37.25	H	1.6	31.30	-25.75	/	74.00	42.80	31.20
4804.00	42.36	V	1.5	31.30	-25.75	/	74.00	47.91	26.09
<b>Average (RBW:1 MHz VBW:3 MHz)</b>									
2390.00	35.91	H	1.6	27.54	-28.39	1.06	54.00	36.12	17.88
2390.00	35.59	V	1.5	27.54	-28.39	1.06	54.00	35.80	18.20
4804.00	27.12	H	1.6	31.30	-25.75	1.06	54.00	33.73	20.27
4804.00	26.66	V	1.5	31.30	-25.75	1.06	54.00	33.27	20.73
Remark	<p>H : Horizontal, V : Vertical TEST MODE : Bluetooth EDR-CH0 (2 402 MHz)</p> <p>*This test was radiated up to 26.5 GHz but no noise was measured.</p> <p>*The TX signal wasn't detected from 3th harmonics.</p> <p>*Result Value = Reading + Ant Factor + Cable loss - Amplifier Gain + Duty Cycle Correction Factor</p> <p>*Margin = Limit - Result</p> <p>*The resolution bandwidth and video bandwidth of spectrum analyzer is 1 MHz and 1 kHz for average detection at frequency above 1 GHz.</p> <p>FYI : Duty Cycle Correction Factor (79 channel hopping)</p> <p>a. Time to cycle through all channels= <math>\Delta t = \tau</math> [ms] x 79 channels = 296.25 ms, where <math>\tau</math> = pulse width</p> <p>b. <math>100 \text{ ms} / \Delta t</math> [ms] = H → Round up to next highest integer, H' =1</p> <p>c. Worst Case Dwell Time = <math>\tau</math> [ms] x H' = 3.79ms</p> <p>d. Duty Cycle Correction = <math>20 \log (\text{Worst Case Dwell Time} / 100\text{ms}) \text{ dB} = - 28.427 \text{ dB}</math></p>								





Test Data for Bluetooth(EDR)

Right\_EDR

Measurement Distance : 3 m

Frequency (MHz)	Reading (dBμV)	Position (V/H)	Height (m)	Correction Factor		Duty Cycle Correction (dB)	Result Value		
				Ant Factor (dB)	Cable (dB)		Limit (dBμV/m)	Result (dBμV/m)	Margin (dB)
<b>PEAK(RBW:1 MHz VBW:3 MHz)</b>									
4880.00	37.10	H	1.5	31.30	-25.67	/	74.00	42.73	31.27
4880.00	36.99	V	1.7	31.30	-25.67		74.00	42.62	31.38
<b>Average (RBW:1 MHz VBW:3 MHz)</b>									
4880.00	27.63	H	1.5	31.30	-25.67	1.06	54.00	34.32	19.68
4880.00	27.29	V	1.7	31.30	-25.67	1.06	54.00	33.98	20.02
Remark	<p>H : Horizontal, V : Vertical TEST MODE : Bluetooth EDR-CH38 (2 440 MHz)</p> <p>*This test was radiated up to 26.5 GHz but no noise was measured.</p> <p>*The TX signal wasn't detected from 3th harmonics.</p> <p>*Result Value = Reading + Ant Factor + Cable loss - Amplifier Gain + Duty Cycle Correction Factor</p> <p>*Margin = Limit - Result</p> <p>*The resolution bandwidth and video bandwidth of spectrum analyzer is 1 MHz and 1 kHz for average detection at frequency above 1 GHz.</p> <p>FYI : Duty Cycle Correction Factor (79 channel hopping)</p> <p>a. Time to cycle through all channels= <math>\Delta t = \tau</math> [ms] x 79 channels = 296.25 ms, where <math>\tau</math> = pulse width</p> <p>b. <math>100 \text{ ms} / \Delta t</math> [ms] = H → Round up to next highest integer, H' =1</p> <p>c. Worst Case Dwell Time = <math>\tau</math> [ms] x H' = 3.79ms</p> <p>d. Duty Cycle Correction = <math>20\log(\text{Worst Case Dwell Time} / 100\text{ms}) \text{ dB} = -28.427 \text{ dB}</math></p>								



Test Data for Bluetooth(EDR)

Right\_EDR

Measurement Distance : 3 m

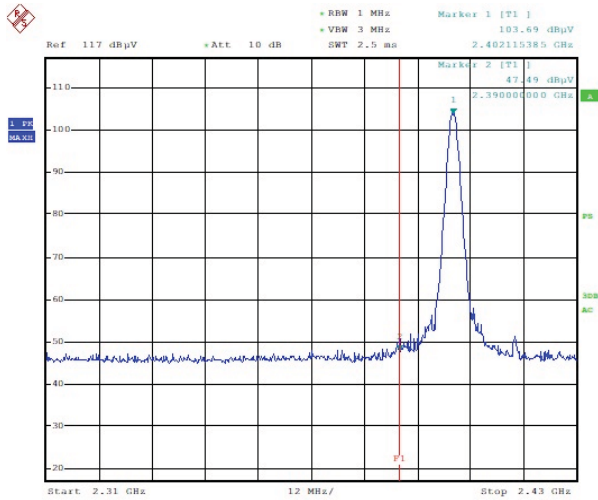
Frequency (MHz)	Reading (dB $\mu$ V)	Position (V/H)	Height (m)	Correction Factor		Duty Cycle Correction (dB)	Result Value		
				Ant Factor (dB)	Cable (dB)		Limit (dB $\mu$ V/m)	Result (dB $\mu$ V/m)	Margin (dB)
<b>PEAK(RBW:1 MHz VBW:3 MHz)</b>									
2483.50	63.86	H	1.5	27.42	-28.28	/	74.00	63.00	11.00
2483.50	60.44	V	1.7	27.42	-28.28	/	74.00	59.58	14.42
4960.00	48.63	H	1.5	31.48	-25.59	/	74.00	54.52	19.48
4960.00	46.19	V	1.7	31.48	-25.59	/	74.00	52.08	21.92
<b>Average (RBW:1 MHz VBW:3 MHz)</b>									
2483.50	52.64	H	1.5	27.42	-28.28	1.06	54.00	52.84	1.16
2483.50	50.37	V	1.7	27.42	-28.28	1.06	54.00	50.57	3.43
4960.00	39.93	H	1.5	31.48	-25.59	1.06	54.00	46.88	7.12
4960.00	37.18	V	1.7	31.48	-25.59	1.06	54.00	44.13	9.87
Remark	<p>H : Horizontal, V : Vertical TEST MODE : Bluetooth EDR-CH78 (2 480 MHz)            *This test was radiated up to 26.5 GHz but no noise was measured.            *The TX signal wasn't detected from 3th harmonics.            *Result Value = Reading + Ant Factor + Cable loss - Amplifier Gain + Duty Cycle Correction Factor            *Margin = Limit - Result            *The resolution bandwidth and video bandwidth of spectrum analyzer is 1 MHz and 1 kHz for average detection at frequency above 1 GHz.</p> <p>FYI : Duty Cycle Correction Factor (79 channel hopping)            a. Time to cycle through all channels= <math>\Delta t = \tau</math> [ms] x 79 channels = 296.25 ms, where <math>\tau</math> = pulse width            b. <math>100 \text{ ms} / \Delta t</math> [ms] = H <math>\rightarrow</math> Round up to next highest integer, H' =1            c. Worst Case Dwell Time = <math>\tau</math> [ms] x H' = 3.79ms            d. Duty Cycle Correction = <math>20 \log (\text{Worst Case Dwell Time} / 100\text{ms}) \text{ dB} = - 28.427 \text{ dB}</math></p>								

## Restricted Band Edges for BT(EDR)

Band Edges(CH Low)

Detector mode:Peak

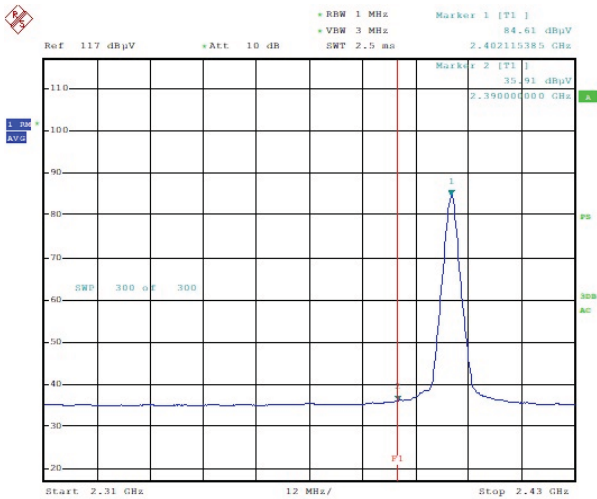
Polarity:Horizontal



ESTR-22-00164

Detector mode:Average

Polarity:Horizontal



ESTR-22-00164

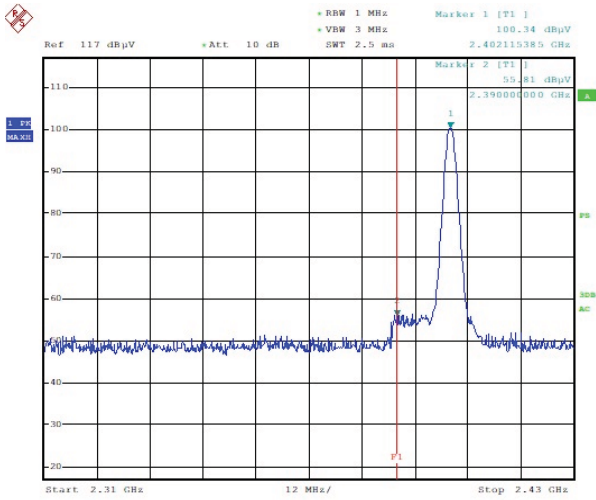


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Band Edges(CH Low)

Detector mode:Peak

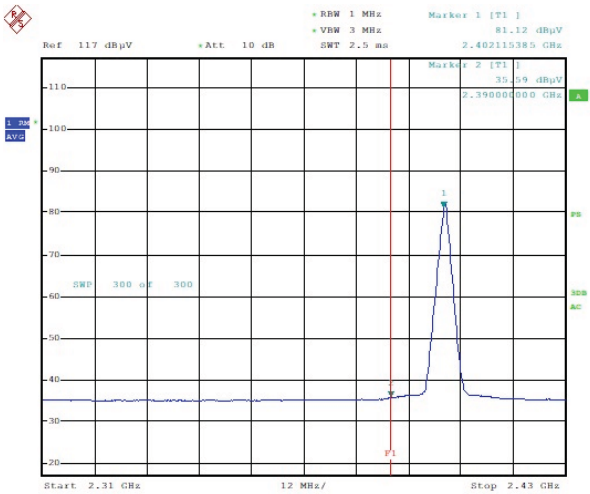
Polarity:Vertical



ESTR-22-00164

Detector mode:Average

Polarity:Vertical



ESTR-22-00164

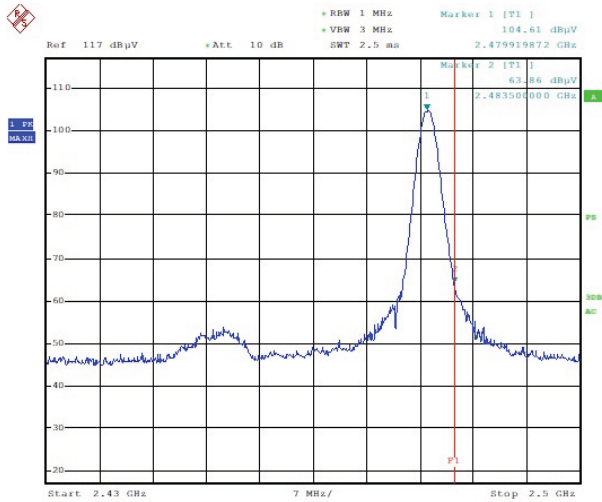


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Band Edges(CH High)

Detector mode:Peak

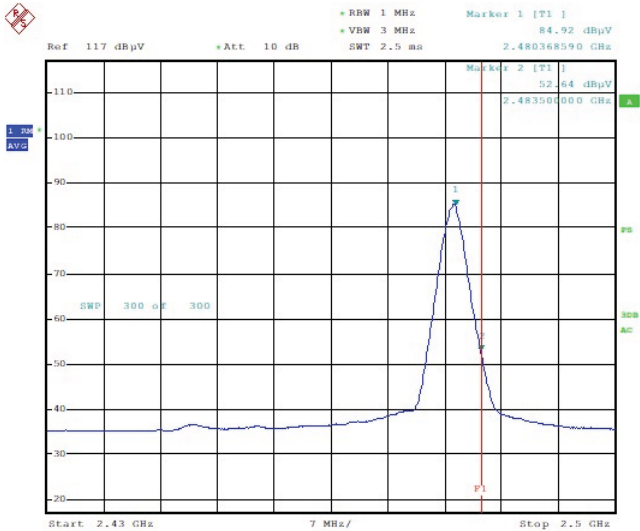
Polarity:Horizontal



ESTR-22-00164

Detector mode:Average

Polarity:Horizontal



ESTR-22-00164

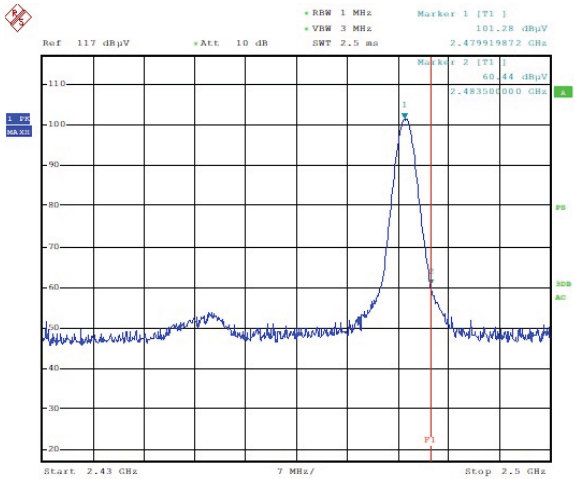


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Band Edges(CH High)

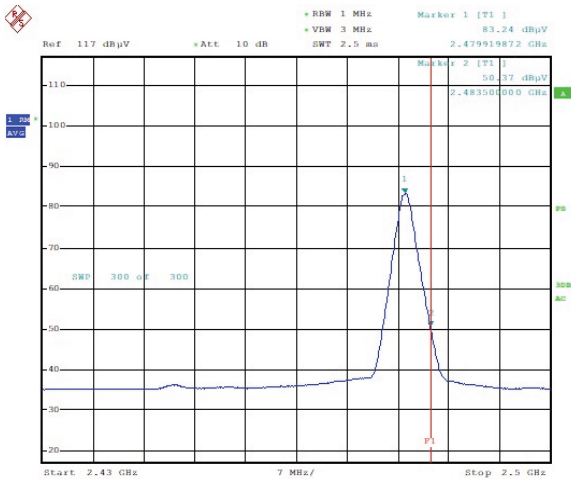
Detector mode:Peak

Polarity:Vertical



Detector mode:Average

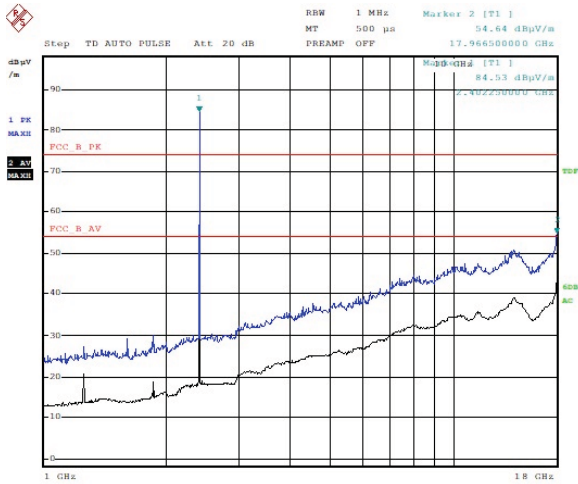
Polarity:Vertical



## Restricted Band Edges for BT(EDR Rate)

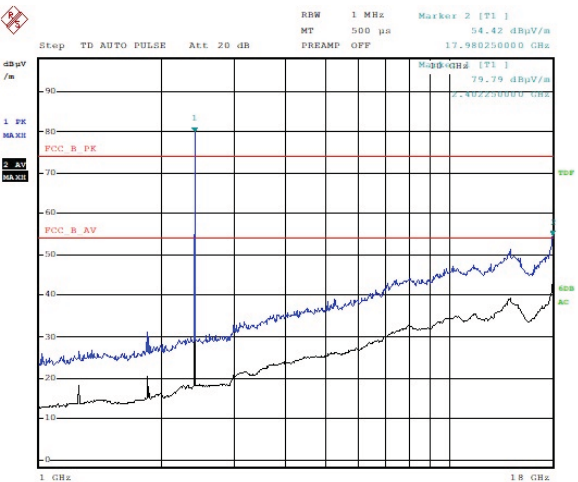
Band Edges(CH Low)

Polarity:Horizontal



ESTR-22-00164

Polarity:Vertical



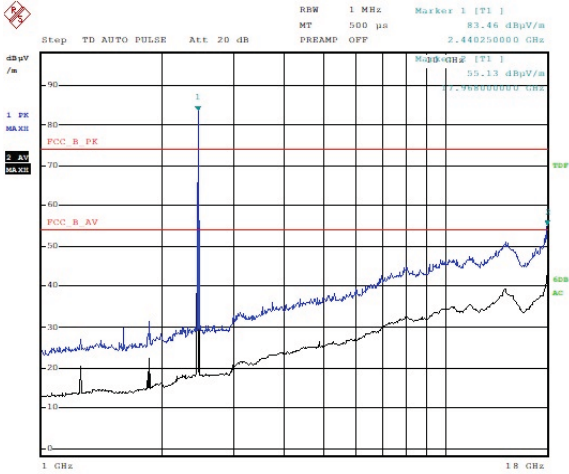
ESTR-22-00164



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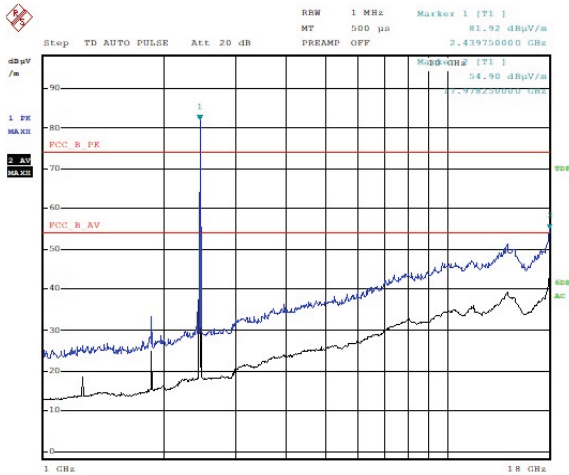
Band Edges(CH Middle)

Polarity:Horizontal



ESTR-22-00164

Polarity:Vertical



ESTR-22-00164

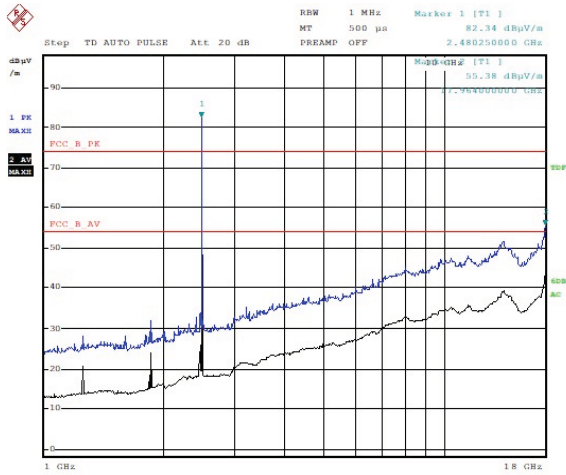




**Estech**  
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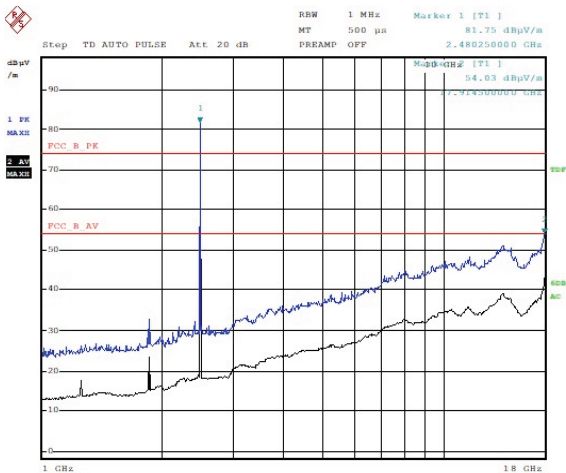
Band Edges(CH High)

Polarity:Horizontal



ESTR-22-00164

Polarity:Vertical



ESTR-22-00164

## 11. Measurement of conducted disturbance

The continuous disturbance voltage of AC Mains in the frequency from 0.15 MHz to 30 MHz was measured in accordance to FCC PART 15.207. The test setup was made according to ANSI C 63.4 (2009) in a shielded room. The EUT was placed on a non-conductive table at least 0.8 m above the ground plan. A grounded vertical reference plane was positioned in a distance of 0.4 m from the EUT. The distance from the EUT to other metal surfaces was at least 0.8 m. The EUT was only earthen by its power cord through the line impedance stabilizing network. The power cord has been bundled to a length of 1.0 m. The test receiver with Quasi Peak detector complies with CISPR 16.

### 11.1 Measurement equipments

Equipment Name	Type	Manufacturer	Serial No.	Next Calibration date
TEST RECEIVER	ESPI	Rohde & Schwarz	100005	19-Jul-22
LISN	ESH3-Z5	Rohde & Schwarz	836679/025	19-Jul-22
Pulse Limiter	ESH3Z2	Rohde & Schwarz	NONE	19-Jul-22

### 11.2 Environmental Condition

Test Place : Shielded Room

#### BT Basic Mode

Temperature (°C) : 21.5 °C

Humidity (% R.H.) : 46.5 % R.H.

#### BT EDR Mode

Temperature (°C) : 21.5 °C

Humidity (% R.H.) : 46.5 % R.H.



### 11.3 Test Data for Bluetooth (Basic Rate)

Frequency (MHz)	Correction Factor		Line (H/N)	Quasi-peak Value			Average Value		
	Lisn (dB)	Cable (dB)		Limit (dB $\mu$ V)	Reading (dB $\mu$ V)	Result (dB $\mu$ V)	Limit (dB $\mu$ V)	Reading (dB $\mu$ V)	Result (dB)
<h1>N/A</h1>									
Remark	H : Hot Line, N : Neutral Line TEST MODE : *Correction Factor = Lisn + Cable *Result = Correction Factor + Reading								



11.3-1 Test Data for Bluetooth (EDR)

Frequency (MHz)	Correction Factor		Line (H/N)	Quasi-peak Value			Average Value		
	Lisn (dB)	Cable (dB)		Limit (dB $\mu$ V)	Reading (dB $\mu$ V)	Result (dB $\mu$ V)	Limit (dB $\mu$ V)	Reading (dB $\mu$ V)	Result (dB)
<h1>N/A</h1>									
Remark	H : Hot Line, N : Neutral Line TEST MODE : *Correction Factor = Lisn + Cable *Result = Correction Factor + Reading								