TEST REPORT

relevant to Bluetooth transmitter

Secondo i seguenti Standard / *According to following Standards*

Test Methods	ANSI C63.4: 2014 -06 ANSI C63.10: 2013-06
Test specification	FCC Rules: Code of Federal Regulations (CFR) no. 47 Part 15 Subpart C Section 15.247, 15.205, 15.203, 15.207, 15.209 Test plan: Test_Plan_RADIO_for_TRIUMPH_5INCH&7INCH_rev_9: 24/02/2021, Issue date: 21/08/2020

Maximum Peak Output Power, FCC Section 15.247 (b) (1)	**Conforme / *Compliant***
20dB Bandwidth & 99%, FCC Section 15.247 (a) (1)	**Conforme / *Compliant***
Band-edge, FCC Section 15.247(d)	**Conforme / *Compliant***
Number of Hopping Frequency and Dwell Time, FCC Section 15.247 (a)(1)(iii)	**Conforme / *Compliant***
Frequency Separation, FCC Section 15.247 (a)(1)	**Conforme / *Compliant***
Conducted Spurious Emissions, Section 15.247(d)	**Conforme / *Compliant***
Radiated Spurious Emissions, FCC Section 15.205 (a), 15.209, 15.247(d)	**Conforme / *Compliant***
Restricted Bands of Operation, Section 15.205	**Conforme / *Compliant***
Antenna Requirement/ Transmit Antenna, FCC Section 15.203	**Conforme / *Compliant***
AC Power Line Conducted Emissions, Section 15.207	**Non Applicabile / Not Applicable** (vedi par. 10.0 / see par. 10.0)

Richiedente/ *Applicant's name*.....:	MTA S.p.A.
Indirizzo / *Address* .....:	Viale dell'Industria, 12 - 26845 Codogno (LO) - Italy
Produttore / *Manufacturer*.....:	MTA S.p.A.
Indirizzo / *Address* .....:	Viale dell'Industria, 12 - 26845 Codogno (LO) - Italy
Dispositivo sottoposto ai test / *Device Under Test*.....:	Instrument panel TRIUMPH 7INCH
Data di emission / *Date of issue*	11th March 2021
Validità/ *Validity*	Vedi sezione 1.2 / *See section 1.2*
Test report redatto da / *Author of Test report*	Loris Fruch
Tecnico/i di prova *Engineer/s*	Loris Fruch, Rudy Valent
Approvato da (+ firma) *Approved by (+ signature)*.....	Silvano Chialina
	Responsabile del laboratorio/ .....
	Head of the Laboratory
Laboratorio / *Testing Laboratory* .....:	Emilab Srl a Socio Unico
Indirizzo / *Address* .....:	Via F.lli Solari 5/A – 33020 Amaro (UD) - Italy

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1.0 Informazioni Generali / *General Information*

1.1 Laboratorio / *Testing Laboratory*

Luogo di Prova e partecipanti / *Testing location and participants:*	
Testing Laboratory:	
Testing location/ address ..... :	Emilab Srl a Socio Unico Via F.lli Solari 5/A – 33020 Amaro (UD) – Italy Tel +39 0433 468625 Fax +39 0433 494739 Email: info.emilab@applus.com
Partecipanti / *Participants*:	/

1.2 Campionamento e Documentazione / *Sampling and Documentation*

I campioni, eventuali specifici simulatori ed accessori hardware e software, di seguito chiamati *apparati ausiliari* e le informazioni specifiche su essi (campioni ed apparati ausiliari), sono stati consegnati dal Cliente sotto la propria responsabilità. I risultati dei test contenuti in questo documento si riferiscono esclusivamente al modello e numero di serie provato in combinazione con gli eventuali *apparati ausiliari*. E' responsabilità del costruttore assicurare che la produzione dei modelli in serie rispetti i requisiti del presente documento. Il laboratorio declina ogni responsabilità relativamente agli *apparati ausiliari* e alle informazioni forniti dal cliente. Questo documento non può essere riprodotto in parte senza il consenso scritto del responsabile del laboratorio EMILAB.

EMILAB non si assume nessuna responsabilità per danni derivanti da interpretazioni che esulano dal contesto e dall'applicazione del presente documento.

The samples and any specific hardware and software simulators and accessories, hereinafter called auxiliary apparatus and the related information (samples and auxiliary apparatus) was delivered by customer under his own responsibility. The results contained in this report reflect the results for this particular model and serial number tested in combination with the auxiliary apparatuses. It is the responsibility of the manufacturer to ensure that all production models meet the intent of the requirements detailed within this report. The laboratory takes no responsibility for the auxiliary equipment and for the information provided by the customer. This report shall not be reproduced, except in full, without the written approval of the Issuing testing Emilab laboratory.

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1.3 Specifiche del test / *Test specifications*

Test performed according to:	
Test plan	Test_Plan_RADIO_for_TRIUMPH_5INCH&7INCH_rev_9 Number: TP153-17 Issue Date: 21/08/2020 Revision date: 24/02/2021 Author: R. Nunnari – MTA S.p.A.
Test specification	All compliance measurements have been carried out using the procedures described in the standard ANSI C63.4-2014, ANSI C63.10-2013, Section 15.31 of CFR47 Part 15 – Subpart A (General) FCC Rules: Code of Federal Regulations (CFR) no. 47 Part 15 Subpart C Section 15.247, 15.205, 15.207, 15.209
Test Method/Basic Standard	ANSI C63.4: 2014-06 Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9KHz to 40GHz. ANSI C63.10: 2013-06 American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices

1.4 Svolgimento dei test e condizioni generali / *Test scheduling and general condition*

Svolgimento dei test/ *Scheduling* ..... :	
Data ricezione EUT	
Date of receipt of EUT ..... :	23/12/2020
Data esecuzione test	
Date (s) of performance of tests ..... :	20/01/2021 - 17/02/2021
Numero EUT / *EUT Number* .....:	20LA00545/01 (EUT with external RF antenna connectors), 20LA00545/02 (normal product)
Condizioni ambientali	Se non diversamente specificato / *If not otherwise specified:*
/ Environment Conditions	Temperature: 18-28°C
	Humidity: 20-90%
	Pressure: 87-108.56 kPa
Intervallo delle tarature/	Minimum 1 year
Calibration Interval	

1.5 Espressione dei risultati finali / *Test case of final verdicts*

I risultati considerano l'incertezza di misura, ove applicabile, mediante lo schema seguente	
/ *The results consider the measurement uncertainty, where applicable, using the following scheme*	
- test case does not apply to the test object.. :	N/A (Not Applicable)
- test object does meet the requirement ..... :	Compliant or PASS
- test object does not meet the requirement . :	Not Compliant or FAIL

1.6 Incertezza / *Uncertainty*

L'incertezza estesa riportata è espressa come l'incertezza tipo moltiplicata per il fattore di copertura k = 2, che per una distribuzione normale corrisponde ad una probabilità di copertura di circa il 95 %.

The reported expanded uncertainty of measurements is stated as the standard uncertainty of measurement, multiplied by the coverage factor k=2, which for a normal distribution corresponding to a coverage probability of approximately 95%.

1.7 Termini, Definizioni e Acronimi / *Terms, definitions and abbreviations*

AC	Alternating Current
ACK	Acknowledgement
AFH	Adaptive Frequency Hopping
AM	amplitude modulation
AVE det	Average Detector
BIT	Burst Interval Time
CAC	Channel Availability Check
BW	BandWidth
CCA	Clear Channel Assessment
CW	Continuous Wave
DAA	Detect And Avoid
DC	Duty Cycle DFS
DFS	Dynamic Frequency Selection
DSSS	Direct Sequence Spread Spectrum
DUT	Device Under Test
e.i.r.p.	equivalent isotropically radiated power
e.r.p.	effective radiated power
EMC	ElectroMagnetic Compatibility
EUT	Equipment Under test
FAR	Fully Anechoic Room
FHSS	Frequency Hopping Spread Spectrum
HT20 High	Throughput in a 20 MHz channel
HT40 High	Throughput in a 40 MHz channel
ISM	Industrial, Scientific and Medical
LBT	Listen Before Talk
LPDA	Logarithmic Periodic Dipole Antenna
MCS	Modulation Coding Scheme
MIMO	Multiple Input, Multiple Output
MU	Medium Utilization
MS/s	Mega-Samples per second
NACK	Not Acknowledged
OATS	Open Air Test Site
OFDM	Orthogonal Frequency Division Multiplexing
OM	Operating Modes
OOB	Out Of Band
PK det	Peak Detector
PM	Pulse Modulation
Ppm	parts per million
PPS	Pulses Per Second
PRF	Pulse Repetition Frequency
RBW	Resolution BandWidth
RE	Radiated Emission
RLAN	Radio Local Area Network
RMS	Root Mean Square
R&TTE	Radio and Telecommunications Terminal Equipment
RF	Radio Frequency
Rx	Receiver
SAC	Semi Anechoic Chamber
TEM	Transverse Electromagnetic
TL	Threshold Level
TPC	Transmit Power Control
Tx	Transmitter
VBW	Video BandWidth
VSWR	Voltage Standing Wave Ratio
WLAN	Wireless Local Area Network
BT	Bluetooth
BLE	Bluetooth Low Energy

2.0 Apparecchiatura sottoposta a test / *Device Under Test*

2.1 Descrizione del dispositivo e informazioni sul setup / *Device description and setup information*

Queste informazioni sono fornite dal cliente sotto la propria responsabilità / *These information are provided by the customer under his own responsibility*

Descrizione / ***Description*** **.....:**	Instrument panel TRIUMPH
Marchio commercial / *Trade Mark* .....:	
Produttore / *Manufacturer*.....:	MTA S.p.A.
Modello / *Model/Type reference* .....:	Version 7INCH
Voltage/Current.....:	14V DC (nominal voltage)
Current.....:	1A
Frequency.....:	/
Power.....:	/
Serial Number.....:	S/N: 00121, batch: 450 (20LA00545/01) S/N: 00045, batch: 450 (20LA00545/02)
Numero di campioni testati / *Number of samples tested*.....:	1+1
Numero EUT del produttore / Internal customer EUT Number	**MTA P/N:** 6100354/11 **TRIUMPH P/N:** 2506607
Hardware stage/level.....:	04.04.00.00
Software stage/level .....:	01.07.05.00.00.00.10
Modification stage.....:	/
Operating Mode .....:	**Mode 1 (radiated measures):** during the tests the EUT was powered at 14V DC and was connected to the EMC RF structure which in turn was connected to the Box Sim Opto Tx by an optical fiber. The EMC RF structure was also connected by CAN and LIN bus to the PC using optical converters. For radiated tests the Box Sim Opto Tx and the PC were placed outside the anechoic chamber. The EUT is programmed with customer application software which periodically tests the whole functionality of the instrument panel (CFG diagnostic test, analog inputs, digital inputs, LOAD, Bus LIN, memory EEPROM, RF radio module BT&BLE, etc.). The EUT radio modules are set to perform the radio tests on BT&BLE with different modulations (hopping or fixed channel). **Mode 2 (conducted measures):** during the tests the EUT was powered at 14V DC and was connected to the EMC RF structure which in turn was connected to the Box Sim Opto

	Tx by an optical fiber. The EMC RF structure was also connected by CAN and LIN bus to the PC. Bluetooth antenna output (50ohm, SMA) was connected to the Spectrum Analyser. The EUT is programmed with customer application software which periodically tests the whole functionality of the instrument panel (CFG diagnostic test) and the EUT radio modules are set to perform the radio tests on different channels/modulations of BT&BLE. During all tests, the EUT BT transmitter was set at its maximum Tx-power, as per control software setting.
Wiring harness ..... :	Harness type 1 (1.7m -0.0/+0.3m)
Monitoring ..... :	/
Info ..... :	Auxiliary equipment provided by the applicant:

Equipment	***Model***	***Serial Number***	***Manufacturer***
Personal Computer	Latitude 3570	885	DELL
USB/CAN converter	CAN Case XL	007129052509	Vector
EMC RF structure	-	-	MTA
Tester RF Triumph	-	-	MTA
Box Sim Opto Tx	-	-	MTA

2.2 Scostamento dalle condizioni specificate / *Deviation from the specified conditions*

Scostamenti dalle condizioni specificate / *Deviation from the specified conditions*: N/A

2.3 Lista dei Canali / *Channel List*

Bluetooth

Frequency band [MHz]: 2400 – 2483.5							
Channel	**Frequency [MHz]**	**Channel**	**Frequency [MHz]**	**Channel**	**Frequency [MHz]**	**Channel**	**Frequency [MHz]**
0	2402	20	2422	40	2442	60	2462
1	2403	21	2423	41	2443	61	2463
2	2404	22	2424	42	2444	62	2464
3	2405	23	2425	43	2445	63	2465
4	2406	24	2426	44	2446	64	2466
5	2407	25	2427	45	2447	65	2467
6	2408	26	2428	46	2448	66	2468
7	2409	27	2429	47	2449	67	2469
8	2410	28	2430	48	2450	68	2470
9	2411	29	2431	49	2451	69	2471
10	2412	30	2432	50	2452	70	2472
11	2413	31	2433	51	2453	71	2473
12	2414	32	2434	52	2454	72	2474
13	2415	33	2435	53	2455	73	2475
14	2416	34	2436	54	2456	74	2476
15	2417	35	2437	55	2457	75	2477
16	2418	36	2438	56	2458	76	2478
17	2419	37	2439	57	2459	77	2479
18	2420	38	2440	58	2460	78	2480
19	2421	39	2441	59	2461	-	-

2.4 Modalità di Test e Dettagli dei Canali / *Test Modes and Channel Details*

Bluetooth

Test Description	Channel Frequency	Modulation	Data Rate
Maximum Peak Output Power, FCC Section 15.247 (b) (1)	2402 / 2441 / 2480	GFSK π/4 DQPSK 8DPSK	1Mbps (BR) 2Mbps (EDR) 3Mbps (EDR)
Band-edge, FCC Section 15.247(d)	2402 / 2480 and Hopping	GFSK π/4 DQPSK 8DPSK	1Mbps (BR) 2Mbps (EDR) 3Mbps (EDR)
20dB Bandwidth & 99%, FCC Section 15.247 (a) (1)	2402 / 2441 / 2480	GFSK π/4 DQPSK 8DPSK	1Mbps (BR) 2Mbps (EDR) 3Mbps (EDR)
Number of Hopping Frequency and Dwell Time, FCC Section 15.247 (a)(1)(iii)	Hopping	GFSK π/4 DQPSK 8DPSK	1Mbps (BR) 2Mbps (EDR) 3Mbps (EDR)
Frequency Separation, FCC Section 15.247 (a)(1)	Hopping	GFSK π/4 DQPSK 8DPSK	1Mbps (BR) 2Mbps (EDR) 3Mbps (EDR)
Conducted Spurious Emissions, FCC Section 15.247(d)	2402 / 2441 / 2480	GFSK π/4 DQPSK 8DPSK	1Mbps (BR) 2Mbps (EDR) 3Mbps (EDR)
Radiated Spurious Emissions, FCC Section 15.205 (a), 15.209, 15.247(d)	Worst case detected during Max Peak Output Power test	-	-
Restricted Bands of Operation, Section 15.205	Worst case detected during Max Peak Output Power test	-	-
Antenna Requirement/ Transmit Antenna, FCC Section 15.203	-	-	-

3.0 Maximum Conducted Output Power – Condizioni di prova / *Test Conditions*

Technician / Tecnico: Loris Fruch			
Table No.	TEST: Maximum Peak Output Power, FCC Section 15.247 (b) (1)		\
Method	ANSI C63.10: 2013-06, par. 7.8.5		\
Parameters required prior to the test		Laboratory Ambient Temperature	18 to 28 °C
		Relative Humidity	20 to 90%
Parameters recorded during the test		Laboratory Ambient Temperature	21 °C
		Relative Humidity	21 %

Supplementary information:

- Test performed on EUT 20LA00545/01;
- Conducted Test, executed at Bluetooth antenna output (50ohm, SMA) connected to the Spectrum Analyser through an attenuator (30 dB);
- EUT powered at 14Vdc;
- EUT Operating Mode: Mode 2 (see par. 2.1);
- Spectrum analyser settings setup:
  - Detector: Peak
  - RBW: 3MHz and VBW=3MHz
  - Trace mode: Max Hold
- Test executed first on BT CHIP 1 (Phones) and then on BT CHIP 2 (Headsets) with the following settings:
  - BR mode with modulation GFSK on channel 0, 39 and 78 with data rate at 1Mbps
  - EDR mode with modulation π/4 DQPSKon channel 0, 39 and 78 with data rate at 2Mbps
  - EDR mode with modulation 8DPSK on channel 0, 39 and 78with data rate at 3Mbps

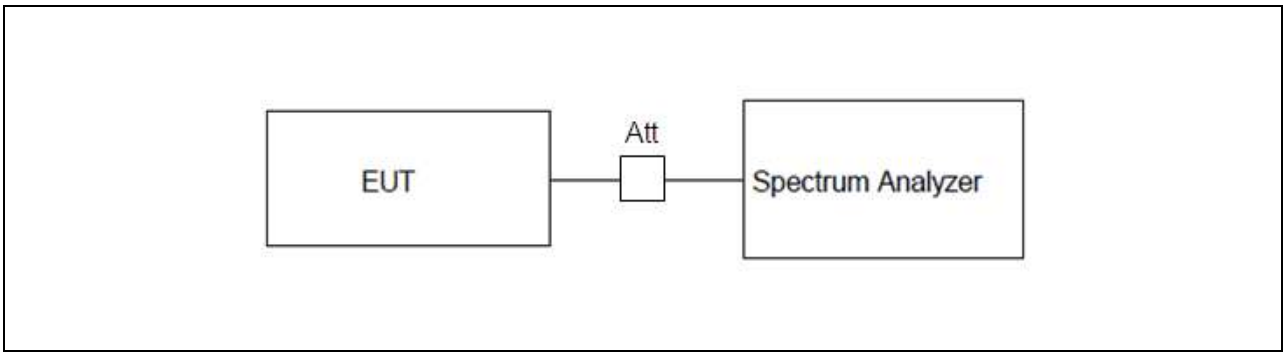
3.1 Apparecchiature utilizzate / *Test Equipment Used* – Maximum Conducted Output Power

Apparecchiature usate/Equipment Used	***Modello/Model***	***Costruttore/ Manufacturer***	***Numero di serie/ Serial Number***	**Data calibrazione / *Calibration date***	**Intervallo / *Interval***
EMI Receiver MXE	N9038A	Agilent Technologies	MY51210230	07/2020	1 year
30dB Attenuator	PE7087-30	Pasternack	1349	02/2020	1 year
RF Cable	SKBL-2M-LOW	Mini-Circuits	1101189	09/2020	1 year
DataLogger T/UR	HL-1D	Rotronic	A18012240	07/2020	1 year
Dual DC Power Supply	CPX400D	TTi	482828	10/2020	1 year

3.1.1 Apparecchiature ausiliarie / *Auxiliary Equipment* – Maximum Conducted Output Power

Apparecchiature /Equipment	***Modello/Model***	***Costruttore/ Manufacturer***	***Numero di serie/ Serial Number***	**Data calibrazione / *Calibration date***	**Intervallo / *Interval***
Signal Generator	8648D	HP	3642U01713	02/2020	1 year

3.2 Fotografie del setup / *Photo of the test setup* – Maximum Conducted Output Power



3.3 Requisiti / *Requirements* – Maximum Conducted Output Power

FCC Section 15.247

(b) The maximum peak conducted output power of the intentional radiator shall not exceed the following:

(1) For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt (30dBm). For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts (21dBm).

3.4 Risultati / *Results* – Maximum Conducted Output Power

The result of the test is: **PASS**.
See the details in the charts/tables of the following paragraphs (see the worst case in bold text).

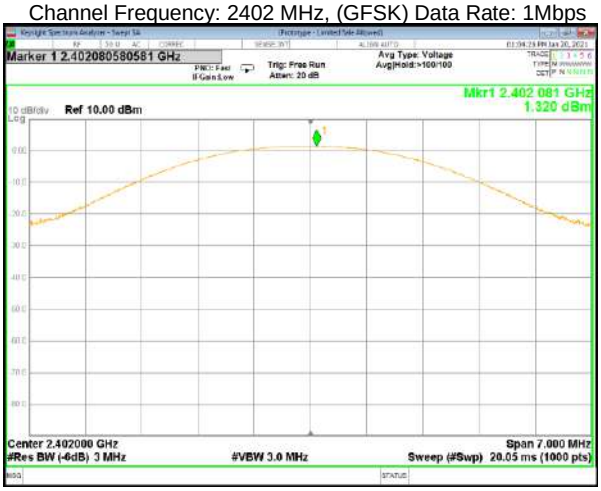
3.4.1 Tabelle e grafici dei risultati / *Tables and graphical representation of data* – Maximum Conducted Output Power

Note: all the traces reported in this section have been obtained with Peak detector, Max Hold.

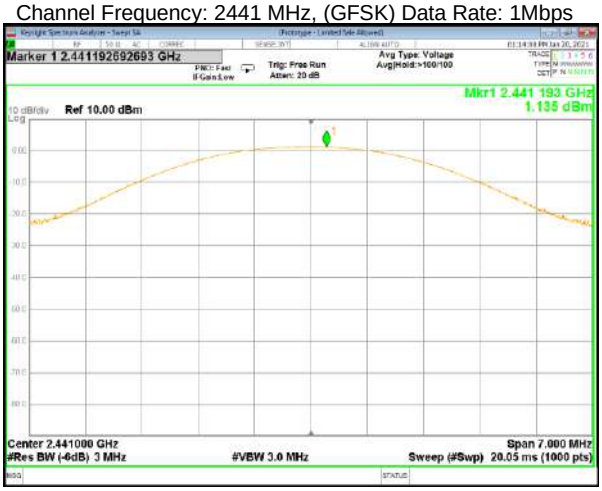
Measures executed on BT (DSS) active on CHIP 1 (Phones)

Modulation mode	Data Rate (Mbps)	Channel Frequency (MHz)	Peak Output Power (dBm)	Limit (dBm)	Margin (dB)
GFSK	1	2402,0	1,3	30,0	28,7
		2441,0	1,4	30,0	28,7
		2480,0	-0,5	30,0	30,5
π/4 DQPSK	2	2402,0	1,8	30,0	28,3
		2441,0	1,9	30,0	28,1
		2480,0	0,3	30,0	29,7
8DPSK	3	2402,0	2,2	30,0	27,8
		2441,0	**2,4**	30,0	27,6
		2480,0	0,8	30,0	29,2

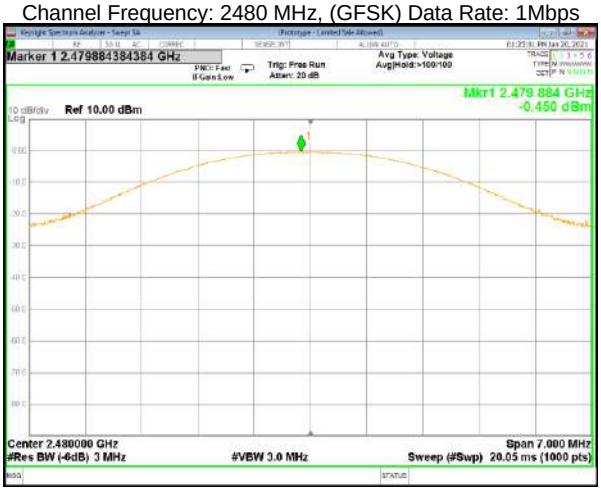
Channel Frequency: 2402 MHz, (GFSK) Data Rate: 1Mbps



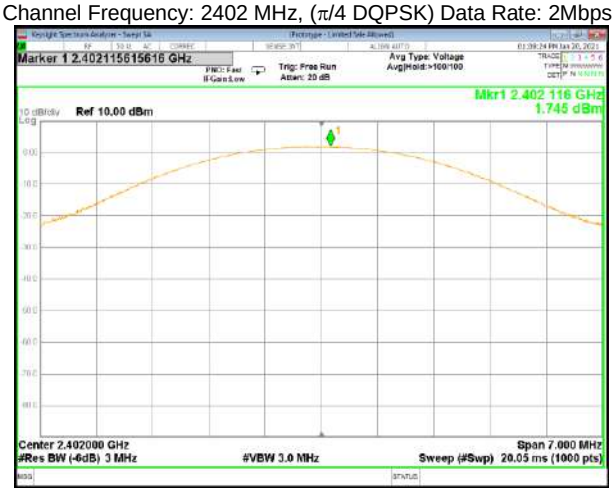
Channel Frequency: 2441 MHz, (GFSK) Data Rate: 1Mbps



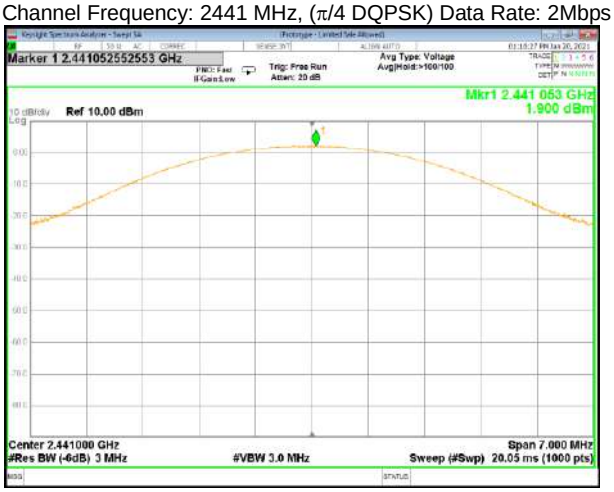
Channel Frequency: 2480 MHz, (GFSK) Data Rate: 1Mbps



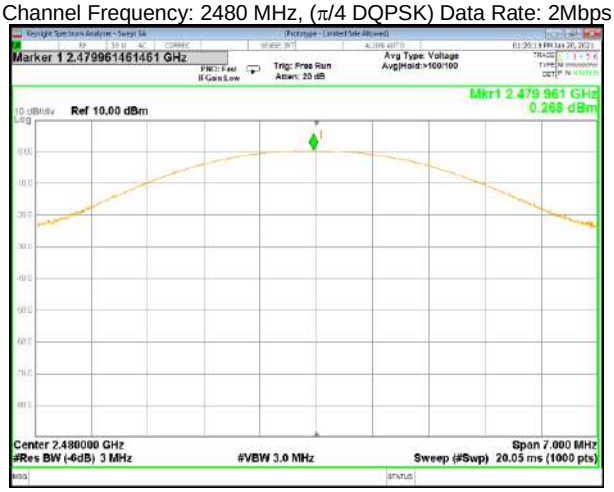
Channel Frequency: 2402 MHz, (π/4 DQPSK) Data Rate: 2Mbps



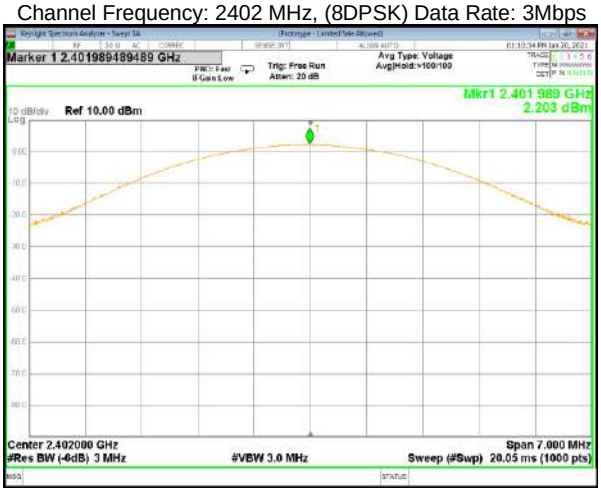
Channel Frequency: 2441 MHz, (π/4 DQPSK) Data Rate: 2Mbps



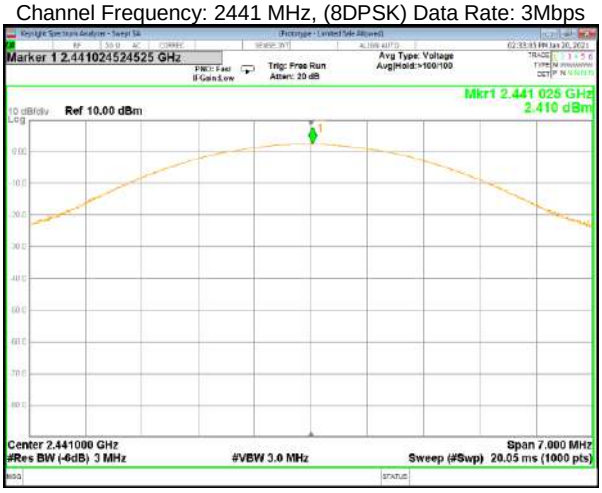
Channel Frequency: 2480 MHz, (π/4 DQPSK) Data Rate: 2Mbps



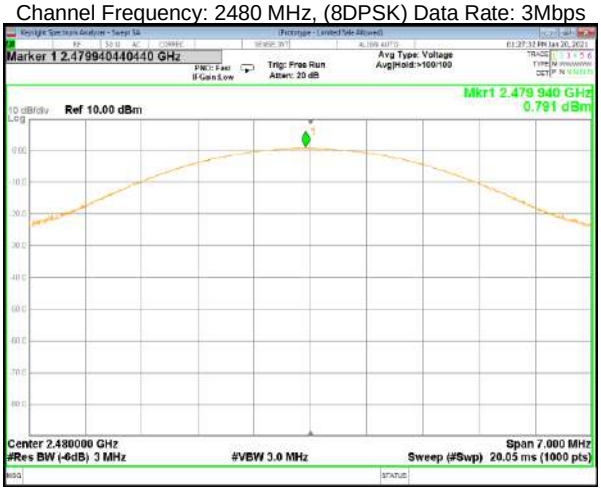
Channel Frequency: 2402 MHz, (8DPSK) Data Rate: 3Mbps



Channel Frequency: 2441 MHz, (8DPSK) Data Rate: 3Mbps



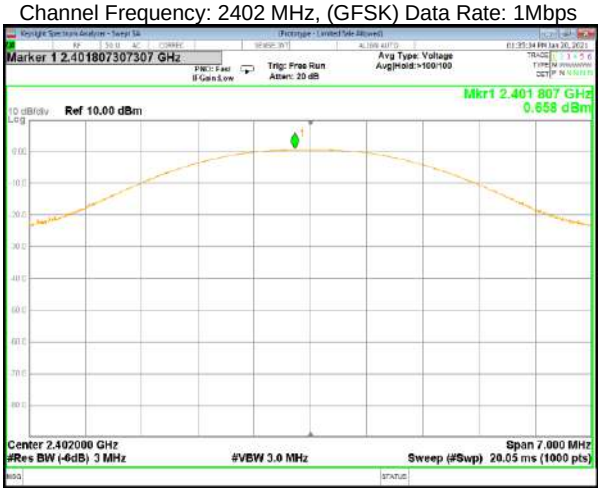
Channel Frequency: 2480 MHz, (8DPSK) Data Rate: 3Mbps



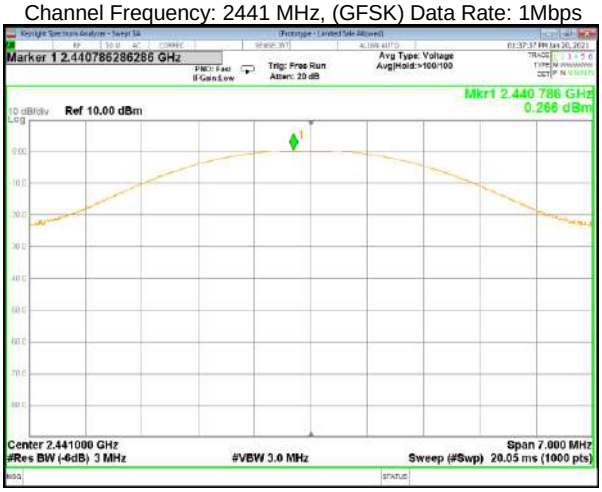
Measures executed on BT (DSS) active on CHIP 2 (Headsets)

Modulation mode	Data Rate (Mbps)	Channel Frequency (MHz)	Peak Output Power (dBm)	Limit (dBm)	Margin (dB)
GFSK	1	2402,0	0,7	30,0	29,3
		2441,0	0,3	30,0	29,7
		2480,0	-0,8	30,0	30,8
π/4 DQPSK	2	2402,0	1,0	30,0	29,0
		2441,0	1,3	30,0	28,7
		2480,0	1,2	30,0	28,8
8DPSK	3	2402,0	1,6	30,0	28,4
		2441,0	1,7	30,0	28,3
		2480,0	0,4	30,0	29,6

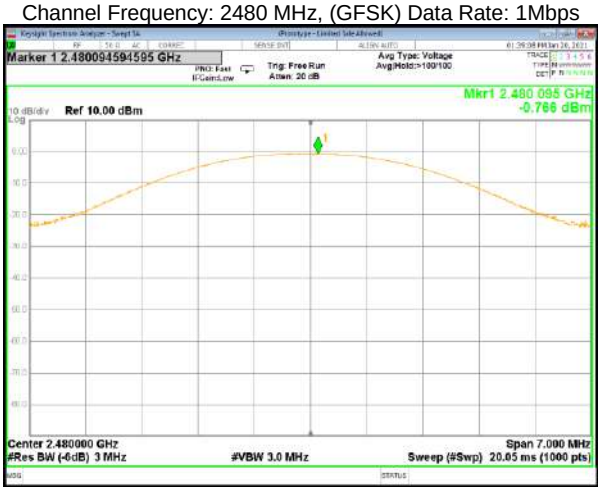
Channel Frequency: 2402 MHz, (GFSK) Data Rate: 1Mbps



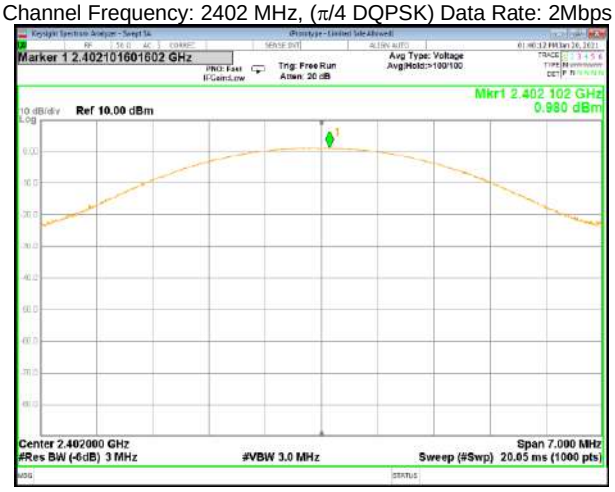
Channel Frequency: 2441 MHz, (GFSK) Data Rate: 1Mbps



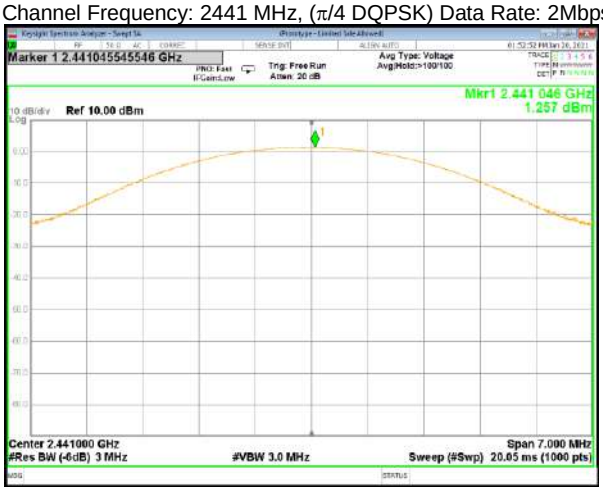
Channel Frequency: 2480 MHz, (GFSK) Data Rate: 1Mbps



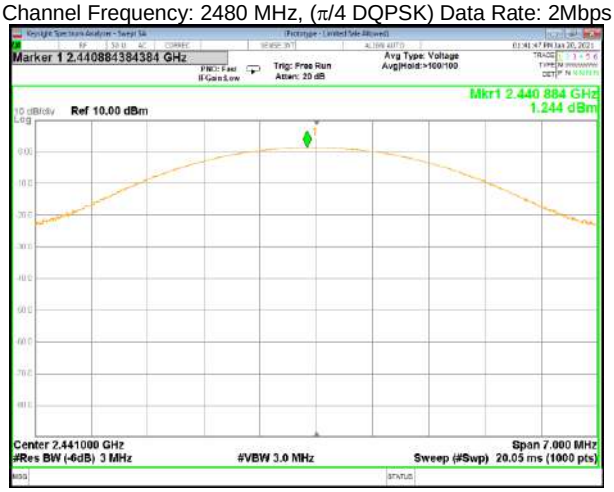
Channel Frequency: 2402 MHz, (π/4 DQPSK) Data Rate: 2Mbps



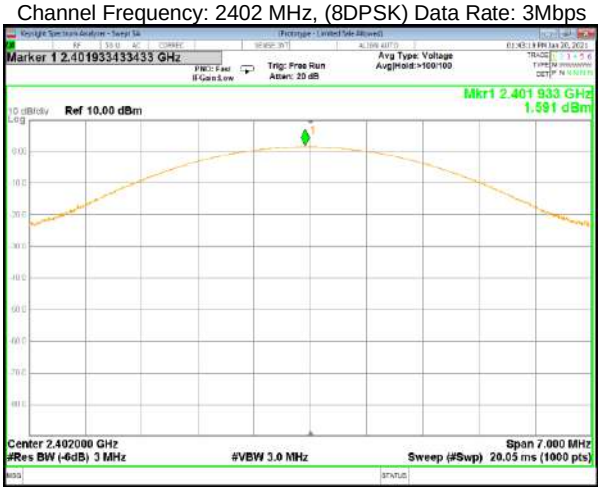
Channel Frequency: 2441 MHz, (π/4 DQPSK) Data Rate: 2Mbps



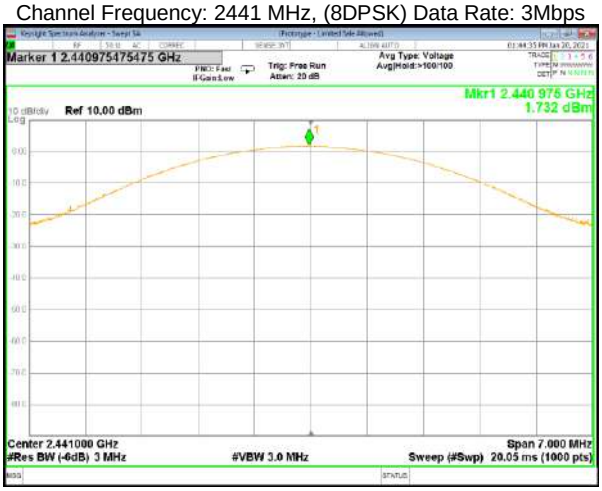
Channel Frequency: 2480 MHz, (π/4 DQPSK) Data Rate: 2Mbps



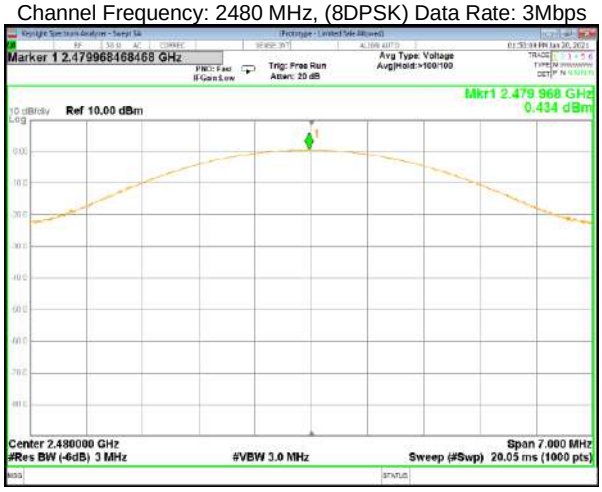
Channel Frequency: 2402 MHz, (8DPSK) Data Rate: 3Mbps



Channel Frequency: 2441 MHz, (8DPSK) Data Rate: 3Mbps



Channel Frequency: 2480 MHz, (8DPSK) Data Rate: 3Mbps



4.0 Bandwidth – Condizioni di prova / *Test Conditions*

Technician / Tecnico: Loris Fruch		
Table No.	TEST: 20dB Bandwidth & 99%, FCC Section 15.247 (a) (1)	\
Method	ANSI C63.10: 2013-06, par. 6.9	\

Parameters required prior to the test	Laboratory Ambient Temperature	18 to 28 °C
	Relative Humidity	20 to 90 %
Parameters recorded during the test	Laboratory Ambient Temperature	22 °C
	Relative Humidity	24 %

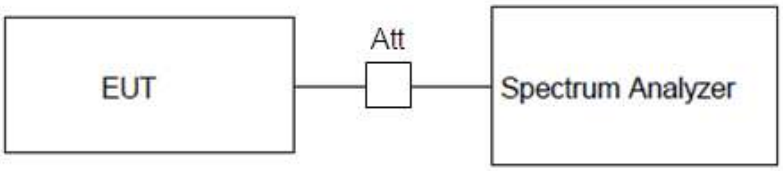
Supplementary information:

- Test performed on EUT 20LA00545/01;
- Conducted Test, executed at Bluetooth antenna output (50ohm, SMA) connected to the Spectrum Analyser through an attenuator (30 dB);
- EUT powered at 14Vdc;
- EUT Operating Mode: Mode 2 (see par. 2.1);
- Spectrum analyser settings setup:
  - Automatic bandwidth measurement
  - Detector: Peak
  - Trace mode: max hold (over last 10 sweeps)
  - RBW: 30 kHz and VBW=3xRBW
- Test executed first on BT CHIP 1 (Phones) and then on BT CHIP 2 (Headsets) with the following settings:
  - BR mode with modulation GFSK on channel 0, 39 and 78 with data rate at 1Mbps
  - EDR mode with modulation π/4 DQPSKon channel 0, 39 and 78 with data rate at 2Mbps
  - EDR mode with modulation 8DPSK on channel 0, 39 and 78 with data rate at 3Mbps

4.1 Apparecchiature utilizzate / *Test Equipment Used* – Bandwidth

Apparecchiature usate/Equipment Used	***Modello/Model***	***Costruttore/ Manufacturer***	***Numero di serie/ Serial Number***	**Data calibrazione / *Calibration date***	**Intervallo / *Interval***
EMI Receiver MXE	N9038A	Agilent Technologies	MY51210230	07/2020	1 year
30dB Attenuator	PE7087-30	Pasternack	1349	02/2020	1 year
RF Cable	SKBL-2M-LOW	Mini-Circuits	1101189	09/2020	1 year
DataLogger T/UR	HL-1D	Rotronic	A18012240	07/2020	1 year
Dual DC Power Supply	CPX400D	TTi	482828	10/2020	1 year

4.2 Fotografie del setup / *Photo of the test setup* – Bandwidth



4.3 Requisiti / *Requirements* – Bandwidth

FCC Section 15.247

(a) Operation under the provisions of this Section is limited to frequency hopping and digitally modulated intentional radiators that comply with the following provisions:

(1) Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

4.4 Risultati / *Results* – Bandwidth

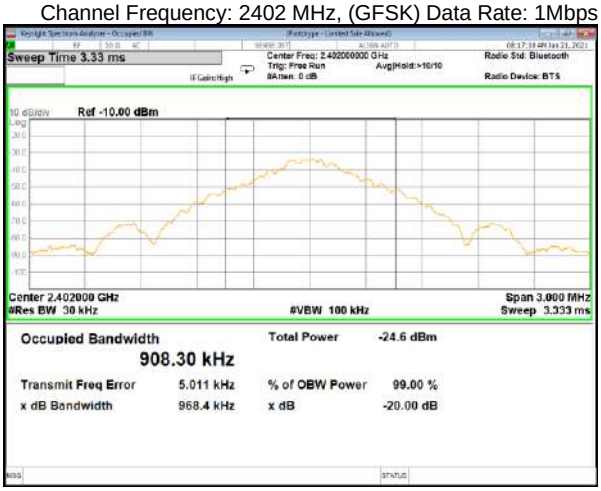
The 20dB bandwidth is used to verify conformity to the channel separation requirement (see par. 6.4.1.2). See the details in the charts/tables of the following paragraphs.

4.4.1 Tabelle e grafici dei risultati / *Tables and graphical representation of data* – Bandwidth

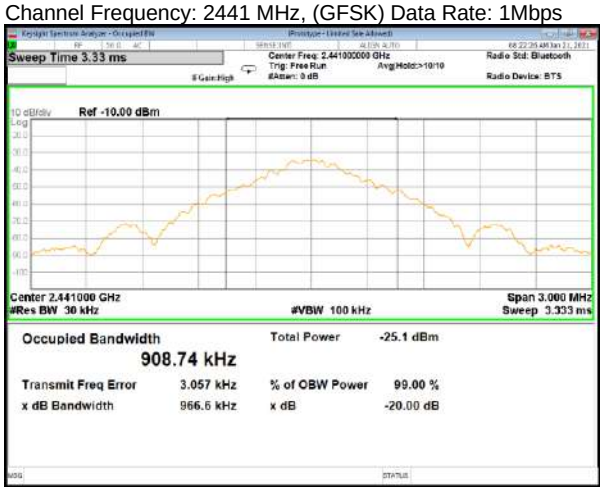
Measures executed on BT (DSS) active on CHIP 1 (Phones)

Modulation mode	Data Rate (Mbps)	Channel Frequency (MHz)	20dB Bandwidth (MHz)	99% Bandwidth (MHz)
GFSK	1	2402,0	0,968	0,908
		2441,0	0,967	0,909
		2480,0	0,972	0,911
π/4 DQPSK	2	2402,0	1,393	1,234
		2441,0	1,392	1,235
		2480,0	1,395	1,236
8DPSK	3	2402,0	1,378	1,235
		2441,0	1,386	1,235
		2480,0	1,379	1,235

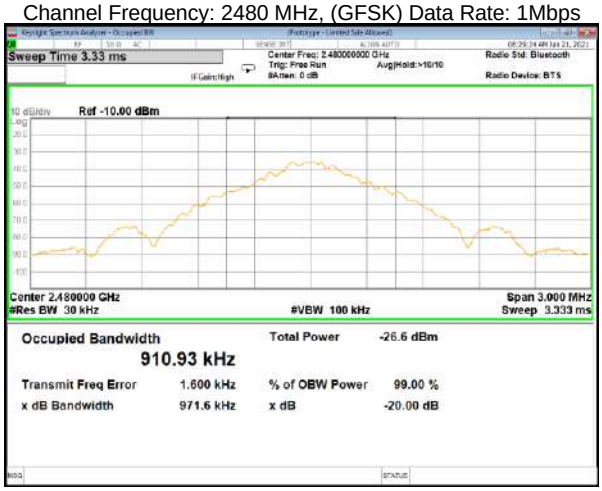
Channel Frequency: 2402 MHz, (GFSK) Data Rate: 1Mbps



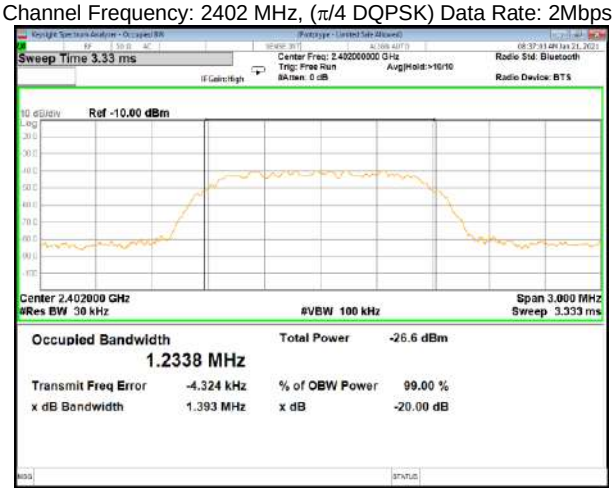
Channel Frequency: 2441 MHz, (GFSK) Data Rate: 1Mbps



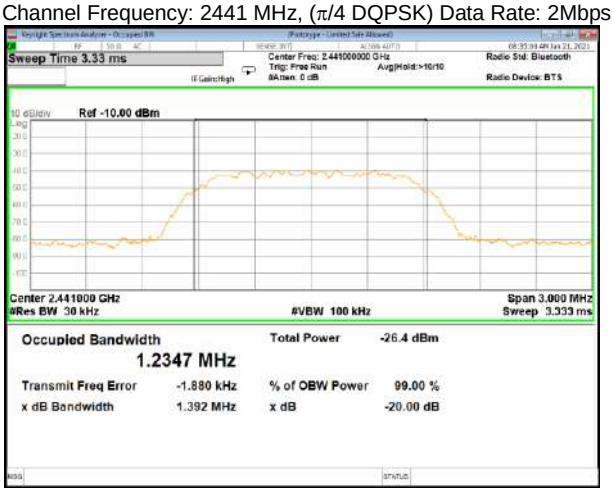
Channel Frequency: 2480 MHz, (GFSK) Data Rate: 1Mbps



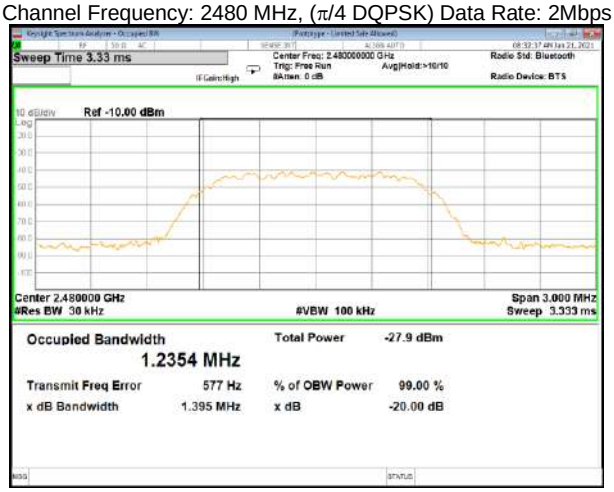
Channel Frequency: 2402 MHz, (π/4 DQPSK) Data Rate: 2Mbps



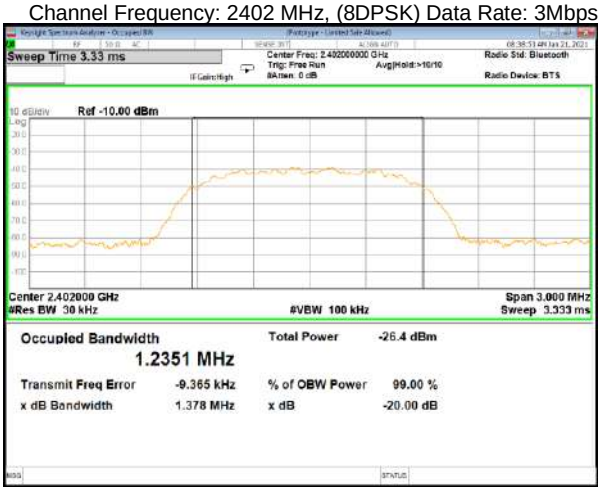
Channel Frequency: 2441 MHz, (π/4 DQPSK) Data Rate: 2Mbps



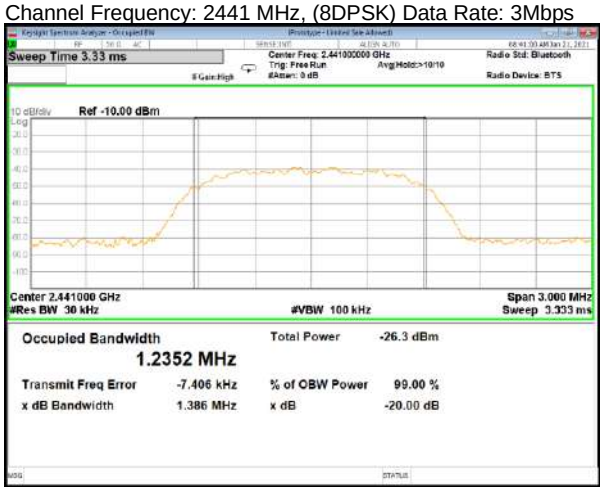
Channel Frequency: 2480 MHz, (π/4 DQPSK) Data Rate: 2Mbps



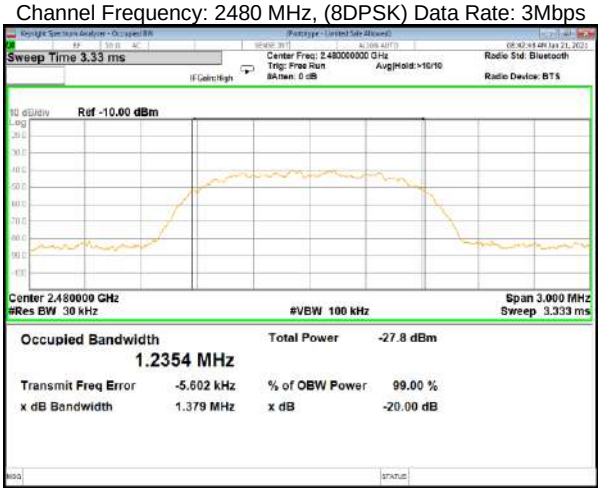
Channel Frequency: 2402 MHz, (8DPSK) Data Rate: 3Mbps



Channel Frequency: 2441 MHz, (8DPSK) Data Rate: 3Mbps



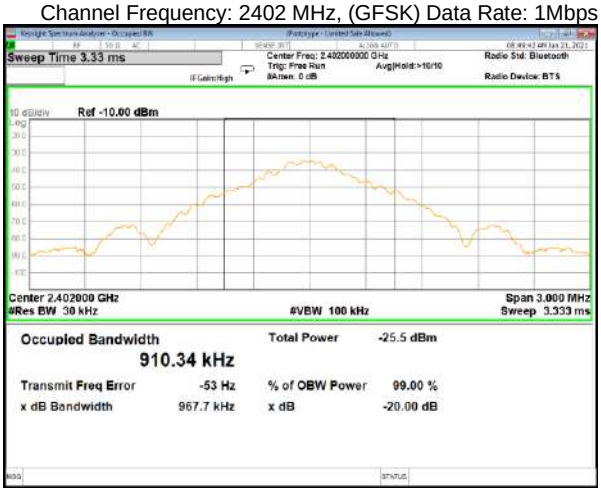
Channel Frequency: 2480 MHz, (8DPSK) Data Rate: 3Mbps



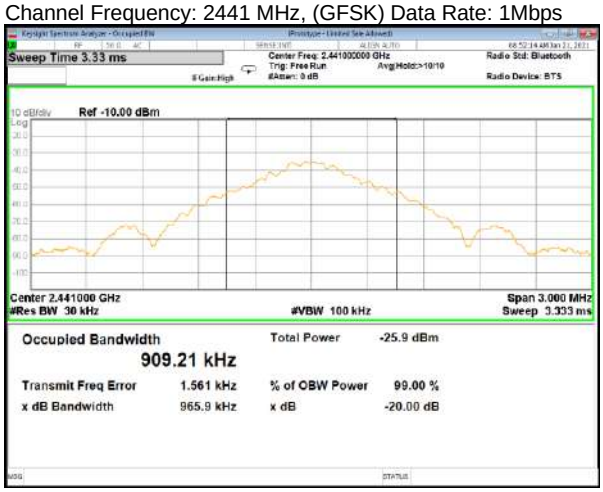
Measures executed on BT (DSS) active on CHIP 2 (Headsets)

Modulation mode	Data Rate (Mbps)	Channel Frequency (MHz)	20dB Bandwidth (MHz)	99% Bandwidth (MHz)
GFSK	1	2402,0	0,968	0,910
		2441,0	0,966	0,909
		2480,0	1,023	0,910
π/4 DQPSK	2	2402,0	1,391	1,233
		2441,0	1,391	1,232
		2480,0	1,391	1,234
8DPSK	3	2402,0	1,376	1,235
		2441,0	1,376	1,234
		2480,0	1,376	1,235

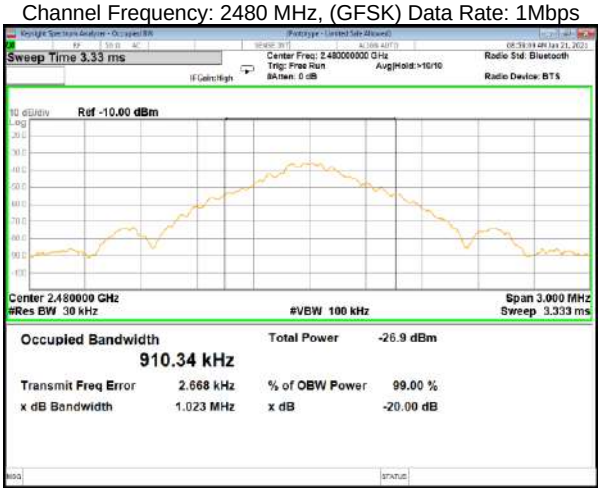
Channel Frequency: 2402 MHz, (GFSK) Data Rate: 1Mbps



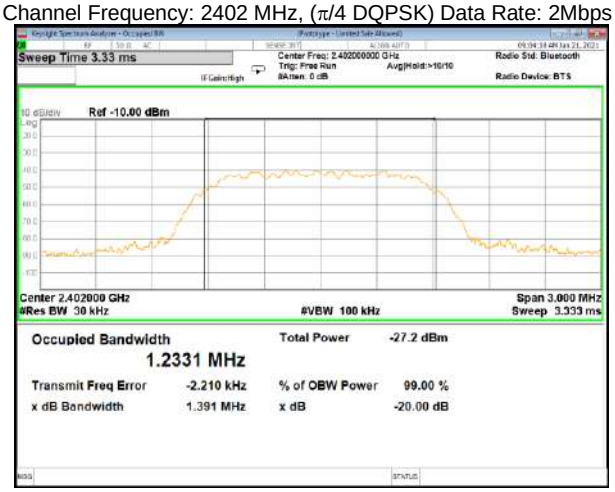
Channel Frequency: 2441 MHz, (GFSK) Data Rate: 1Mbps



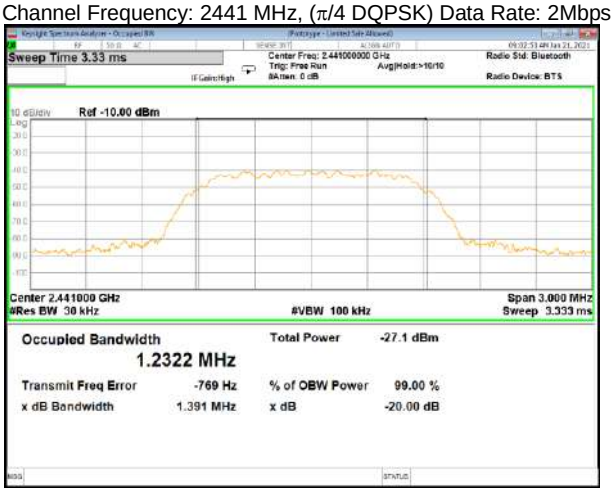
Channel Frequency: 2480 MHz, (GFSK) Data Rate: 1Mbps



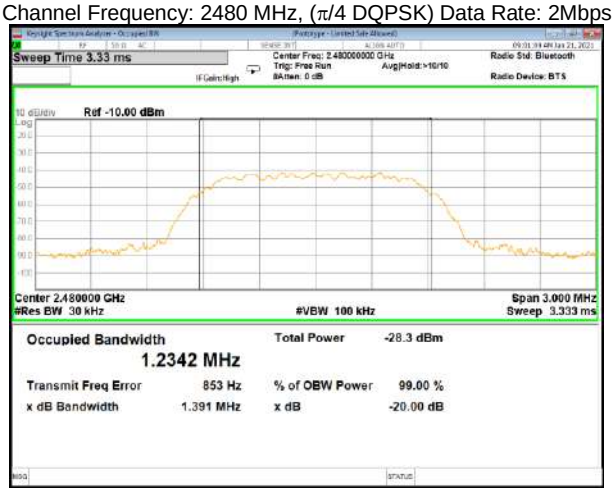
Channel Frequency: 2402 MHz, (π/4 DQPSK) Data Rate: 2Mbps



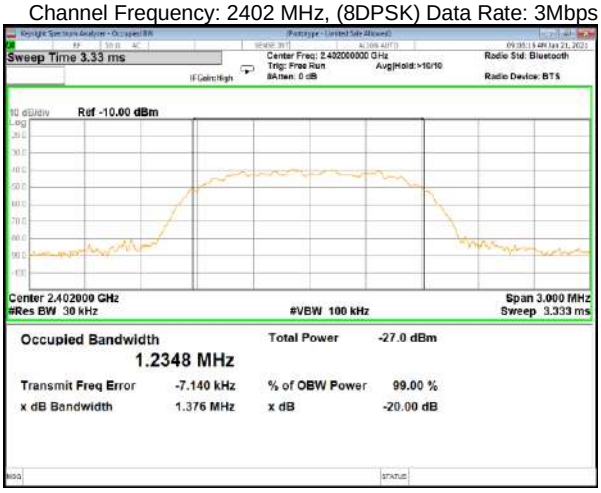
Channel Frequency: 2441 MHz, (π/4 DQPSK) Data Rate: 2Mbps



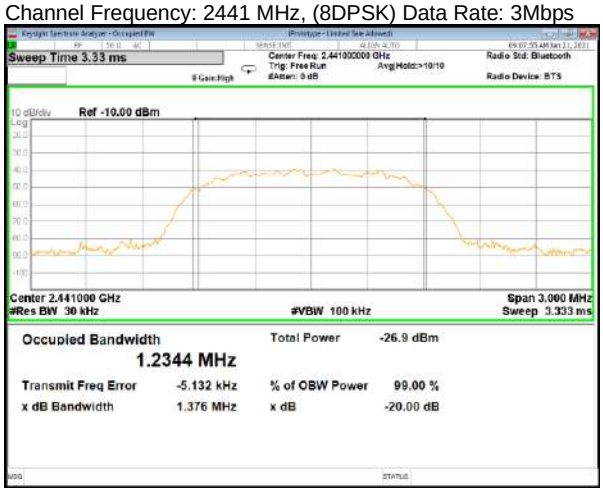
Channel Frequency: 2480 MHz, (π/4 DQPSK) Data Rate: 2Mbps



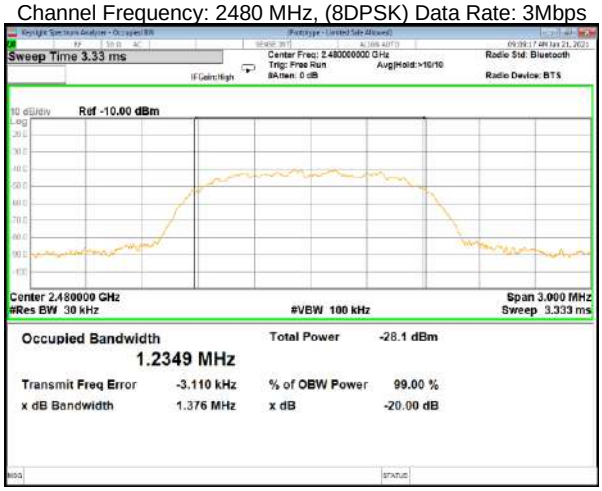
Channel Frequency: 2402 MHz, (8DPSK) Data Rate: 3Mbps



Channel Frequency: 2441 MHz, (8DPSK) Data Rate: 3Mbps



Channel Frequency: 2480 MHz, (8DPSK) Data Rate: 3Mbps



5.0 Band-edge Compliance – Condizioni di prova / *Test Conditions*

Technician / Tecnico: Loris Fruch		
Table No.	TEST: Band-edge, FCC Section 15.247(d)	\
Method	ANSI C63.10: 2013-06, par. 6.10.4	\
Parameters required prior to the test	Laboratory Ambient Temperature	18 to 28 °C
	Relative Humidity	20 to 90 %
Parameters recorded during the test	Laboratory Ambient Temperature	22 °C
	Relative Humidity	26 %

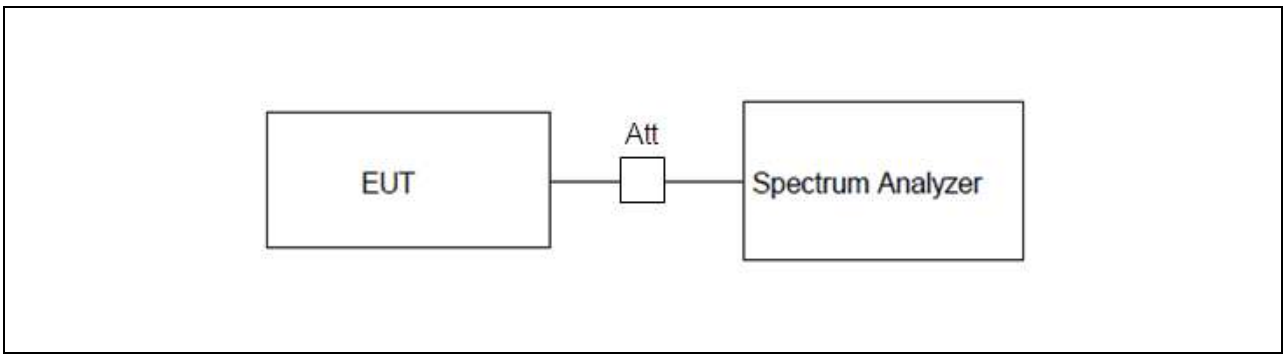
Supplementary information:

- Test performed on EUT 20LA00545/01;
- Conducted Test, executed at Bluetooth antenna output (50ohm, SMA) connected to the Spectrum Analyser through an attenuator (30 dB);
- EUT powered at 14Vdc;
- EUT Operating Mode: Mode 2 (see par. 2.1);
- Spectrum analyser settings setup:
  - Detector: Peak,
  - Trace max hold (over last 100 sweeps),
  - RBW: 100 kHz and VBW=300 kHz;
- Applicable limit: 20dBc (output power conformity assessed using peak detector);
- Test executed first on BT CHIP 1 (Phones) and then on BT CHIP 2 (Headsets) with the following settings:
  - BR mode with modulation GFSK on channel 0 and 78 with data rate at 1Mbps
  - EDR mode with modulation π/4 DQPSKon channel 0 and 78 with data rate at 2Mbps
  - EDR mode with modulation 8DPSK on channel 0 and 78 with data rate at 3Mbps
  - BR mode with modulation GFSK in Hopping mode with data rate at 1Mbps
  - EDR mode with modulation π/4 DQPSK in Hopping mode with data rate at 2Mbps
  - EDR mode with modulation 8DPSK in Hopping mode with data rate at 3Mbps

5.1 Apparecchiature utilizzate / *Test Equipment Used* – Band-edge Compliance

Apparecchiature usate/Equipment Used	***Modello/Model***	***Costruttore/ Manufacturer***	***Numero di serie/ Serial Number***	**Data calibrazione / *Calibration date***	**Intervallo / *Interval***
EMI Receiver MXE	N9038A	Agilent Technologies	MY51210230	07/2020	1 year
30dB Attenuator	PE7087-30	Pasternack	1349	02/2020	1 year
RF Cable	SKBL-2M-LOW	Mini-Circuits	1101189	09/2020	1 year
DataLogger T/UR	HL-1D	Rotronic	A18012240	07/2020	1 year
Dual DC Power Supply	CPX400D	TTi	482828	10/2020	1 year

5.2 Fotografie del setup / *Photo of the test setup* – Band-edge Compliance



5.3 Requisiti / *Requirements* – Band-edge Compliance

FCC Section 15.247

(d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

5.4 Risultati / *Results* – Band-edge Compliance

The result of the test is: **PASS**.
See the details in the charts/tables of the following paragraphs (see the worst case in bold text).

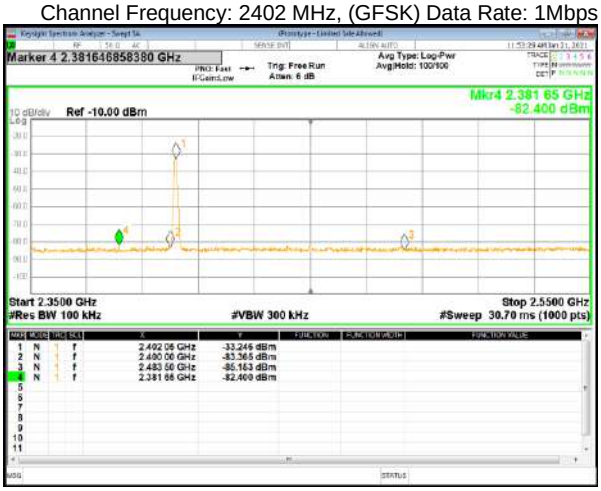
5.4.1 Tabelle e grafici dei risultati / *Tables and graphical representation data* – Band-edge Compliance

Measures executed on BT (DSS) active on CHIP 1 (Phones)

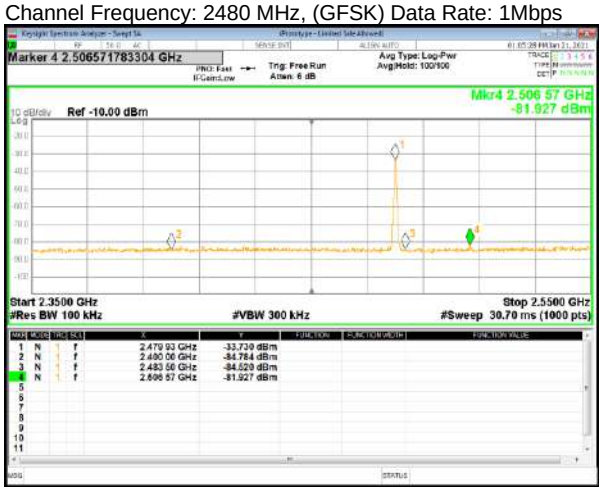
Hopping OFF

Modulation mode	Data Rate (Mbps)	Max Signal Frequency (MHz)	Max Signal (dBm)	Frequency of Max OOB signal (MHz)	Max OOB Signal (dBm)	Value (dBc)	Limit (dBc)
GFSK	1	2402,1	-33,2	2381,7	-82,40	49,2	20,0
		2479,9	-33,7	2506,6	-81,93	48,2	20,0
□/4 DQPSK	2	2402,1	-34,8	2361,4	-82,08	47,2	20,0
		2480,1	-36,7	2513,0	-82,65	45,9	20,0
8DPSK	3	2401,9	-35,1	2363,0	-83,33	48,2	20,0
		2479,9	-36,0	2520,6	-81,29	**45,2**	20,0

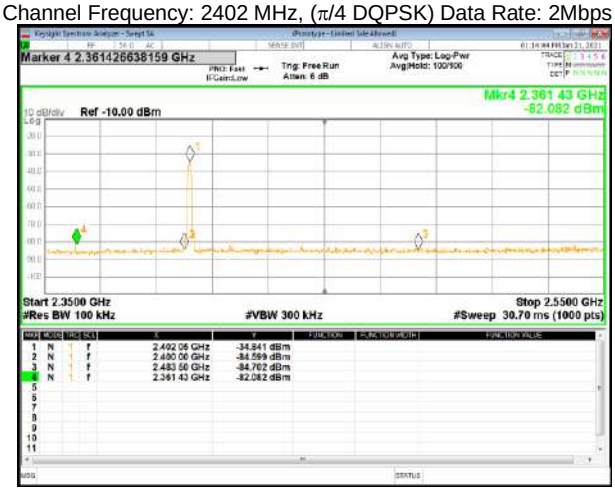
Channel Frequency: 2402 MHz, (GFSK) Data Rate: 1Mbps



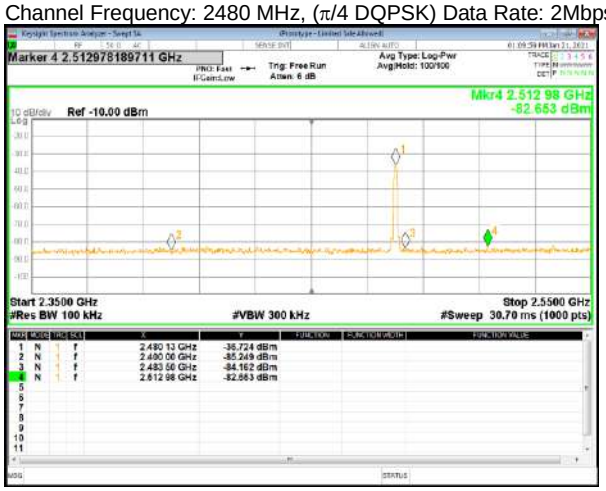
Channel Frequency: 2480 MHz, (GFSK) Data Rate: 1Mbps



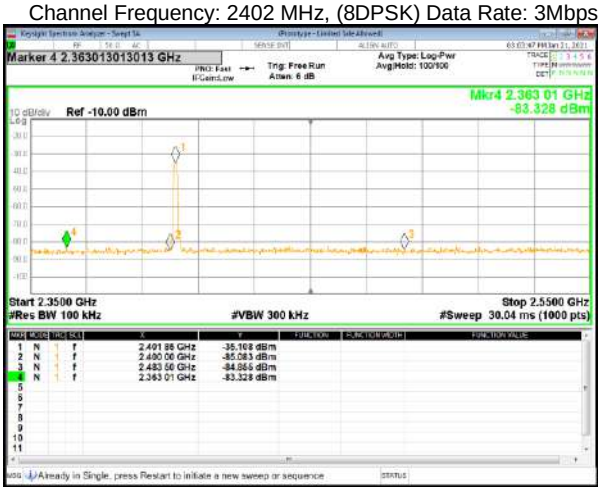
Channel Frequency: 2402 MHz, (π/4 DQPSK) Data Rate: 2Mbps



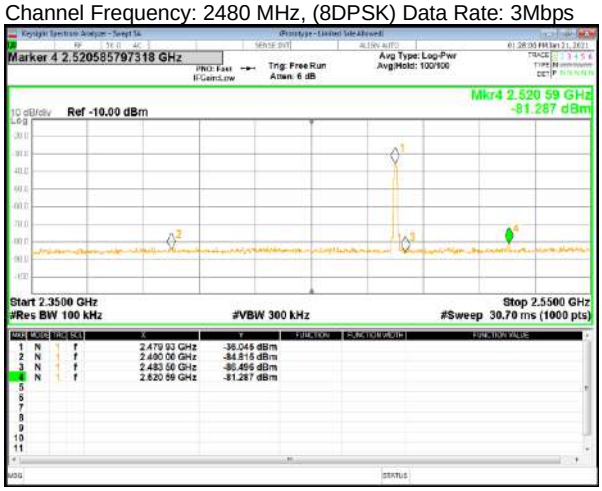
Channel Frequency: 2480 MHz, (π/4 DQPSK) Data Rate: 2Mbps



Channel Frequency: 2402 MHz, (8DPSK) Data Rate: 3Mbps



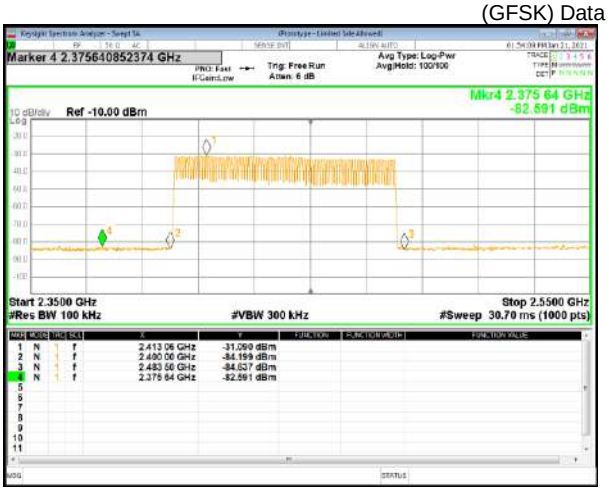
Channel Frequency: 2480 MHz, (8DPSK) Data Rate: 3Mbps



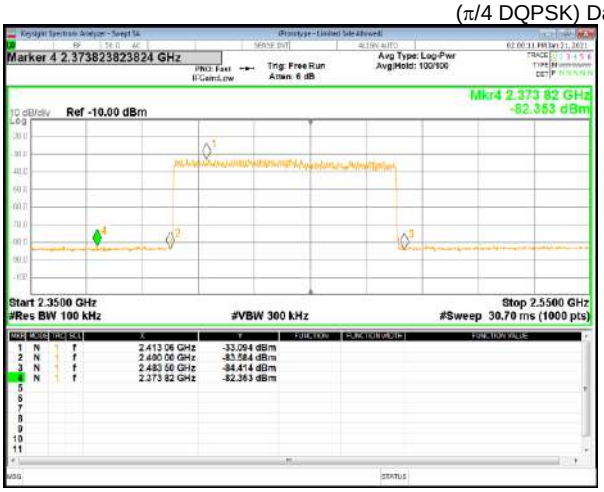
Hopping ON

Modulation mode	Data Rate (Mbps)	Max Signal Frequency (MHz)	Max Signal (dBm)	Frequency of Max OOB signal (MHz)	Max OOB Signal (dBm)	Value (dBc)	Limit (dBc)
GFSK	1	2413,6	-31,1	2375,6	-82,59	51,5	20,0
				2508,6	-81,68	50,6	20,0
□/4 DQPSK	2	2413,1	-33,1	2373,8	-82,35	49,3	20,0
				2515,6	-81,97	**48,9**	20,0
8DPSK	3	2421,1	-33,0	2397,9	-82,00	49,0	20,0
				2515,4	-82,57	49,5	20,0

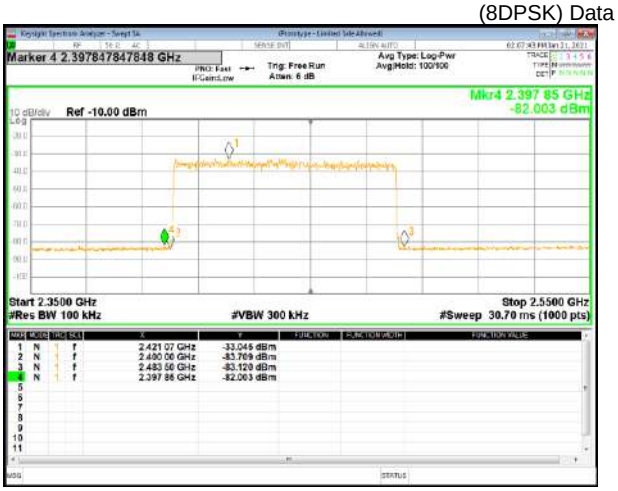
(GFSK) Data Rate: 1Mbps



(π/4 DQPSK) Data Rate: 2Mbps



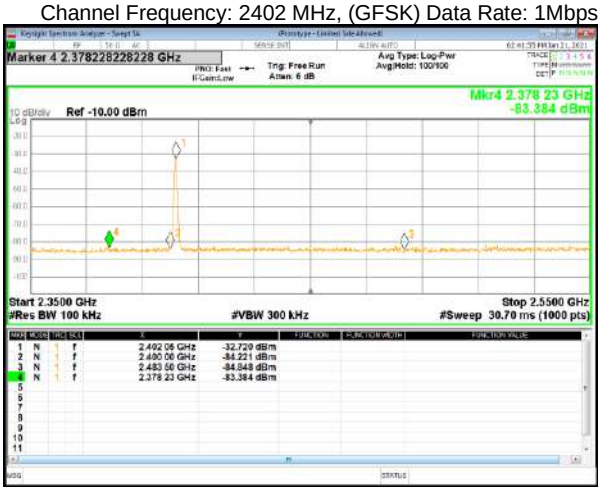
(8DPSK) Data Rate: 3Mbps



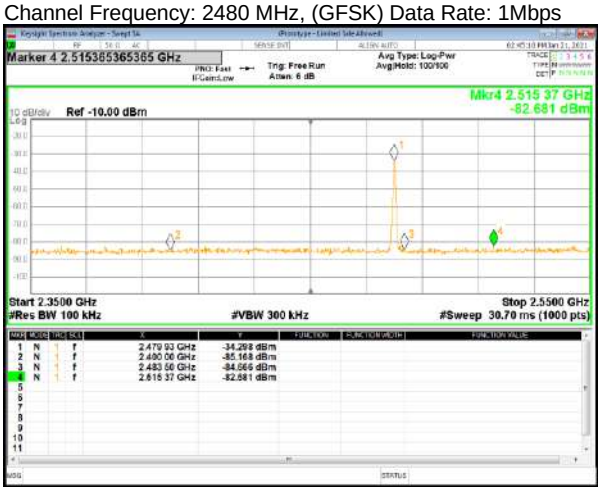
Measures executed on BT (DSS) active on CHIP 2 (Headsets)

Modulation mode	Data Rate (Mbps)	Max Signal Frequency (MHz)	Max Signal (dBm)	Frequency of Max OOB signal (MHz)	Max OOB Signal (dBm)	Value (dBc)	Limit (dBc)
GFSK	1	2402,1	-32,7	2378,2	-83,38	50,7	20,0
		2479,9	-34,3	2515,4	-82,68	48,4	20,0
□/4 DQPSK	2	2402,5	-35,6	2378,6	-82,34	46,7	20,0
		2480,1	-37,1	2529,6	-82,37	**45,3**	20,0
8DPSK	3	2402,1	-35,7	2388,4	-83,27	47,5	20,0
		2479,9	-36,8	2513,4	-82,85	46,0	20,0

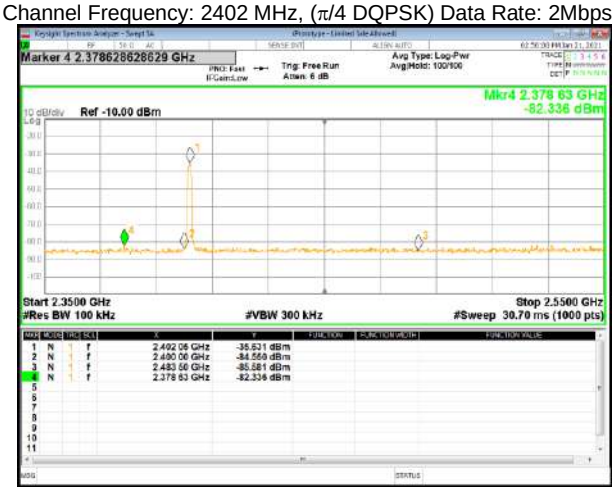
Channel Frequency: 2402 MHz, (GFSK) Data Rate: 1Mbps



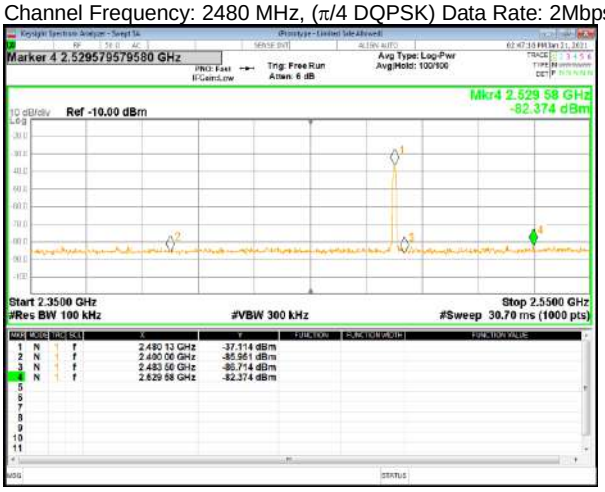
Channel Frequency: 2480 MHz, (GFSK) Data Rate: 1Mbps



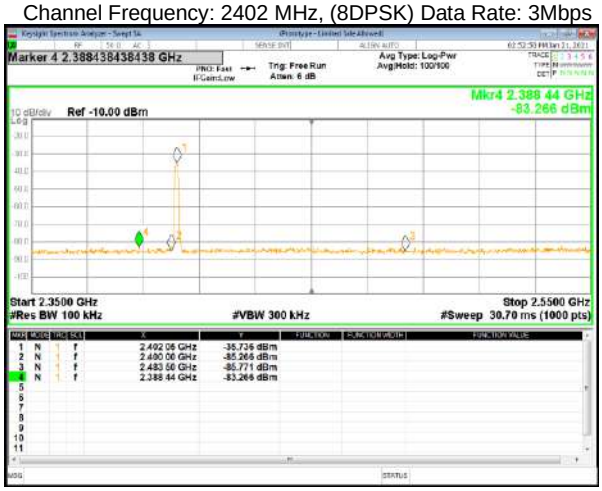
Channel Frequency: 2402 MHz, (π/4 DQPSK) Data Rate: 2Mbps



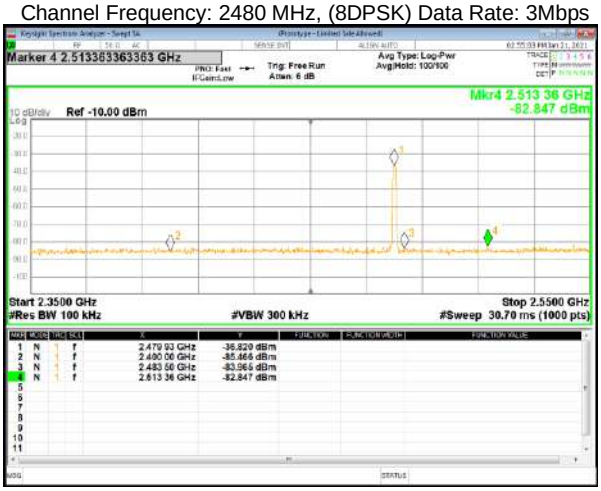
Channel Frequency: 2480 MHz, (π/4 DQPSK) Data Rate: 2Mbps



Channel Frequency: 2402 MHz, (8DPSK) Data Rate: 3Mbps



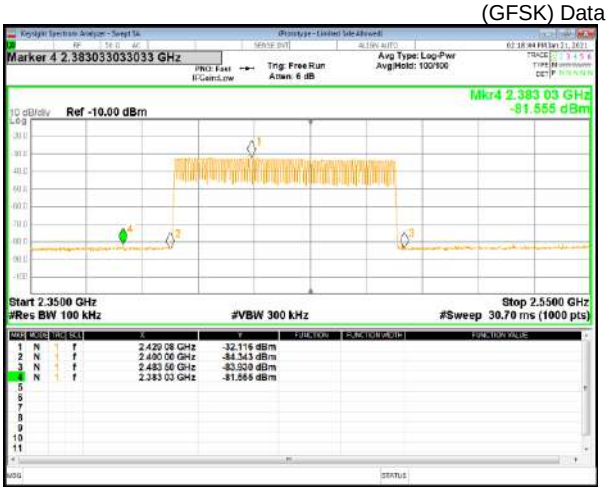
Channel Frequency: 2480 MHz, (8DPSK) Data Rate: 3Mbps



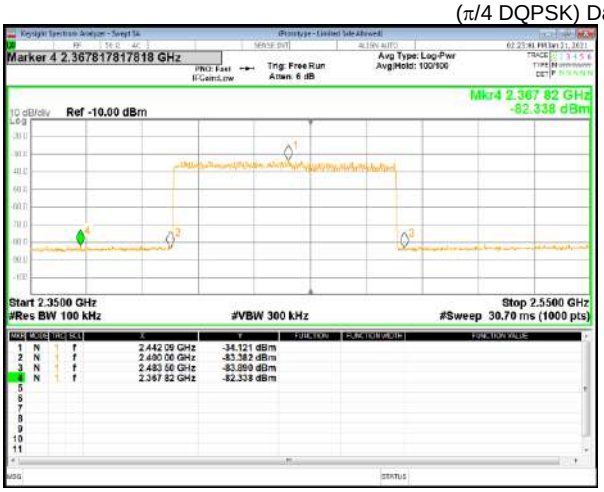
Hopping ON

Modulation mode	Data Rate (Mbps)	Max Signal Frequency (MHz)	Max Signal (dBm)	Frequency of Max OOB signal (MHz)	Max OOB Signal (dBm)	Value (dBc)	Limit (dBc)
GFSK	1	2429,1	-32,1	2383,0	-81,56	49,4	20,0
				2540,4	-81,51	49,4	20,0
□/4 DQPSK	2	2442,1	-34,1	2367,8	-82,34	48,2	20,0
				2532,2	-81,75	**47,6**	20,0
8DPSK	3	2444,1	-33,8	2375,2	-82,68	48,9	20,0
				2542,0	-81,43	47,7	20,0

(GFSK) Data Rate: 1Mbps



(π/4 DQPSK) Data Rate: 2Mbps



(8DPSK) Data Rate: 3Mbps

6.0 Hopping Verifications – Condizioni di prova / *Test Conditions*

Technician / Tecnico: Loris Fruch		
Table No.	TEST: Number of Hopping Frequency and Dwell Time, FCC Section 15.247 (a)(1)(iii) Frequency Separation, FCC Section 15.247 (a)(1)	\
Method	ANSI C63.10: 2013-06 par. 7.8.2, 7.8.3 and 7.8.4	\

Parameters required prior to the test	Laboratory Ambient Temperature	18 to 28 °C
	Relative Humidity	20 to 90 %
Parameters recorded during the test	Laboratory Ambient Temperature	22 °C
	Relative Humidity	30 %

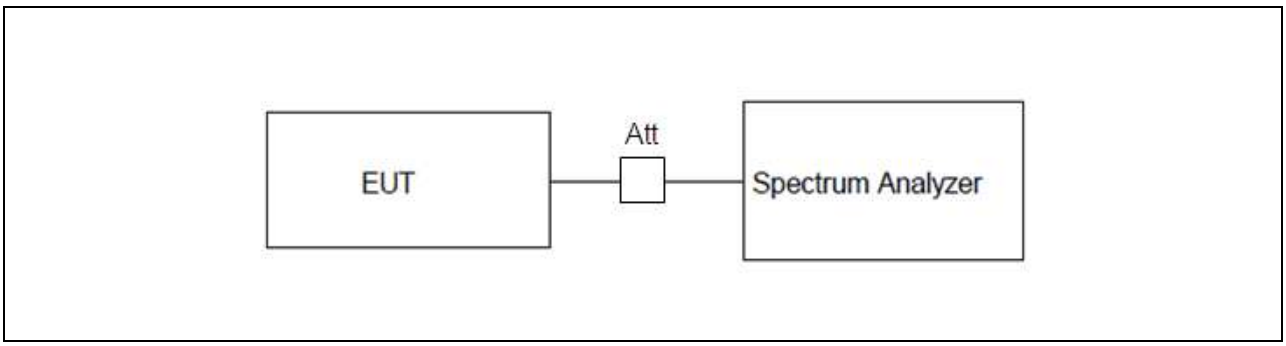
Supplementary information:

- Test performed on EUT 20LA00545/01;
- Conducted Test, executed at Bluetooth antenna output (50ohm, SMA) connected to the Spectrum Analyser through an attenuator (30 dB);
- EUT powered at 14Vdc;
- EUT Operating Mode: Mode 2 (see par. 2.1);
- Spectrum analyser settings setup:
  - Detector: Peak,
  - Trace: max hold (over last 100 sweeps)
  - RBW: 100 kHz and VBW=300 kHz
- Test executed first on BT CHIP 1 (Phones) and then on BT CHIP 2 (Headsets) with the following settings:
  - BR mode with modulation GFSK (1Mbps), Hopping with DH1, DH3 and DH5 packet types;
  - EDR mode with modulation $\pi/4$ DQPSK (2Mbps) in Hopping with DH1, DH3 and DH5 packet types;
  - EDR mode with modulation 8DPSK (3Mbps), Hopping with DH1, DH3 and DH5 packet types;

6.1 Apparecchiature utilizzate / *Test Equipment Used* – Hopping Verifications

Apparecchiature usate/Equipment Used	***Modello/Model***	***Costruttore/ Manufacturer***	***Numero di serie/ Serial Number***	**Data calibrazione / *Calibration date***	**Intervallo / *Interval***
EMI Receiver MXE	N9038A	Agilent Technologies	MY51210230	07/2020	1 year
30dB Attenuator	PE7087-30	Pasternack	1349	02/2020	1 year
RF Cable	SKBL-2M-LOW	Mini-Circuits	1101189	09/2020	1 year
DataLogger T/UR	HL-1D	Rotronic	A18012240	07/2020	1 year
Dual DC Power Supply	CPX400D	TTi	482828	10/2020	1 year

6.2 Fotografie del setup / *Photo of the test setup* – Hopping Verifications



6.3 Requisiti / *Requirements* – Hopping Verifications

FCC Section 15.247

(a) Operation under the provisions of this Section is limited to frequency hopping and digitally modulated intentional radiators that comply with the following provisions:

(1) Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

(iii) Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

6.4 Risultati / *Results* – Hopping Verifications

The result of the test is: **PASS**.
See the details in the charts/tables of the following paragraphs.

6.4.1 Tabelle e grafici dei risultati / *Tables and graphical representation of data* – Hopping Verifications

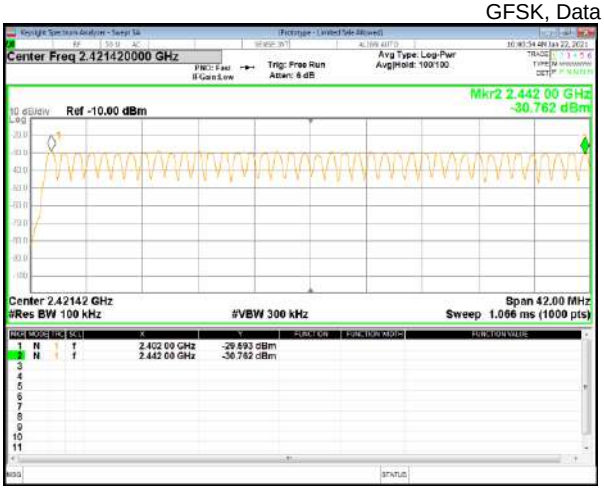
6.4.1.1 Number of Hopping Channels – Hopping Verifications

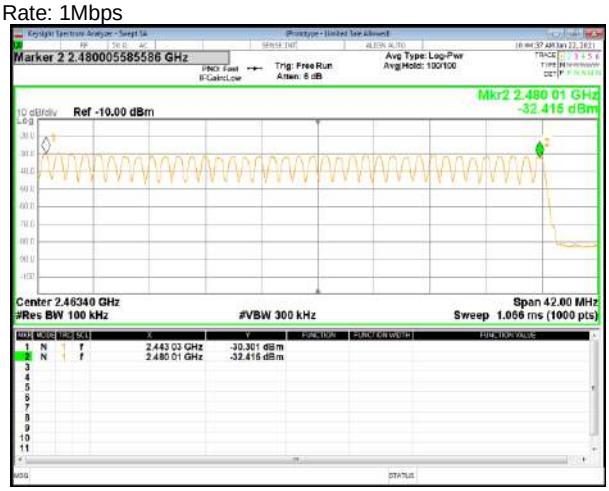
Section 15.247 (a)(1)(iii) Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels.

Measures executed on BT active on CHIP 1 (Phones)

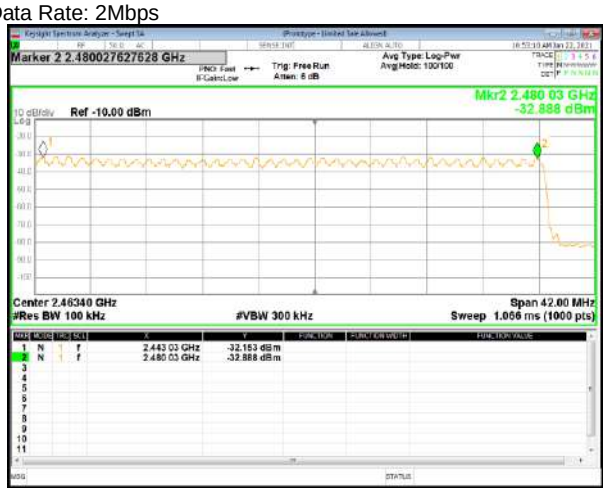
Modulation Mode	Number do hopping channel	Limit	Conclusion
GFSK / 1Mbps	79	>15	PASS
π/4 DQPSK / 2Mbps	79	>15	PASS
8DPSK / 3Mbps	79	>15	PASS

GFSK, Data Rate: 1Mbps

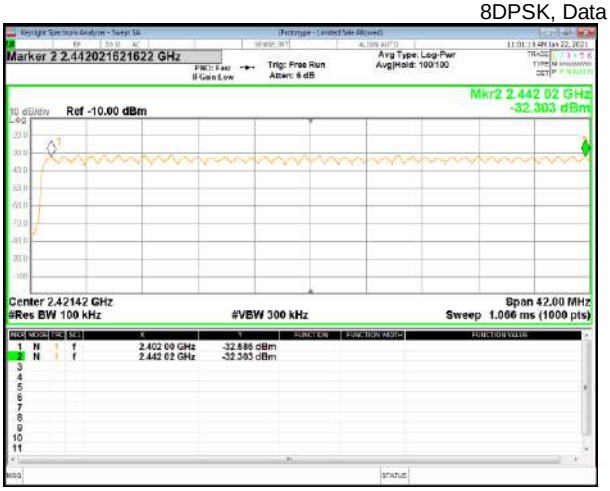


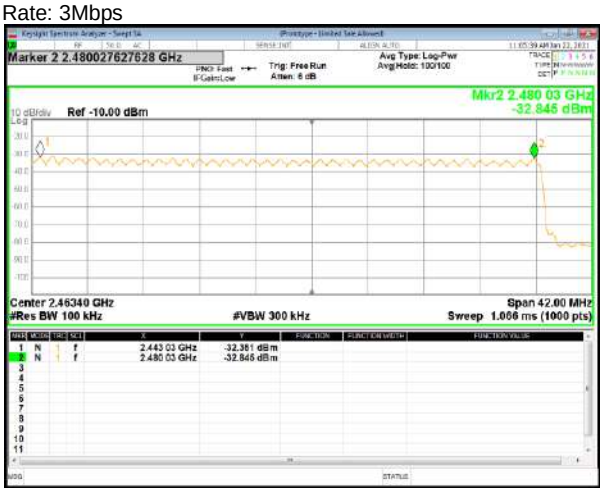


π/4 DQPSK, Data Rate: 2Mbps



8DPSK, Data Rate: 3Mbps

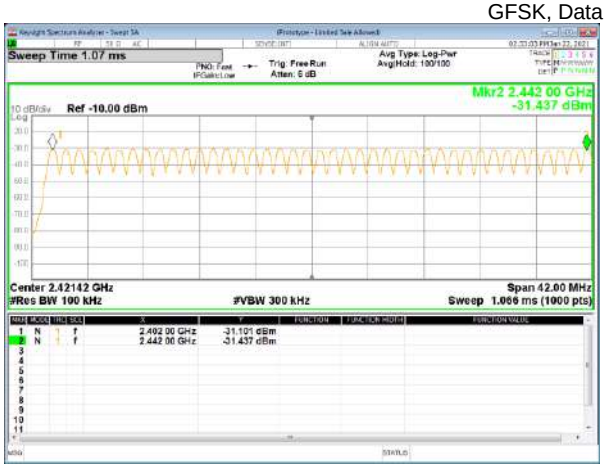


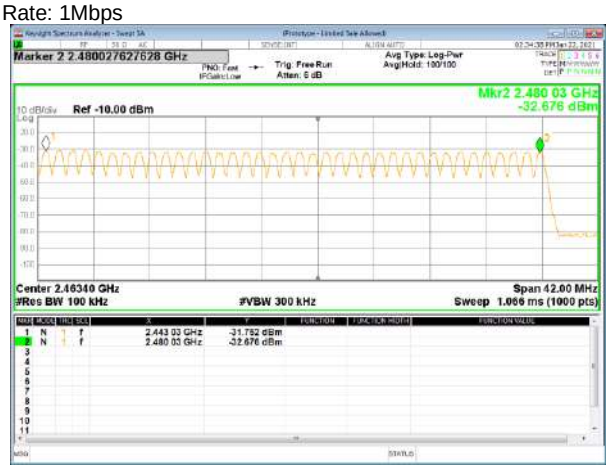


Measures executed on BT active on CHIP 2 (Headsets)

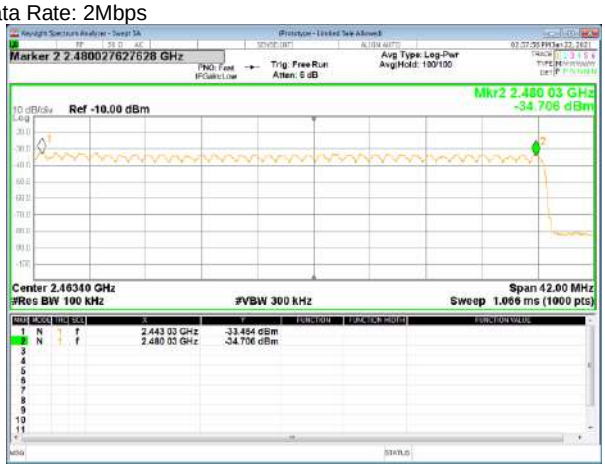
Modulation Mode	Number do hopping channel	Limit	Conclusion
GFSK / 1Mbps	79	>15	PASS
π/4 DQPSK / 2Mbps	79	>15	PASS
8DPSK / 3Mbps	79	>15	PASS

GFSK, Data Rate: 1Mbps

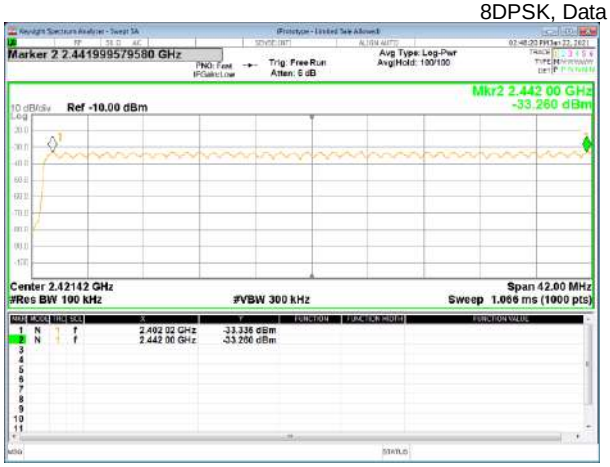


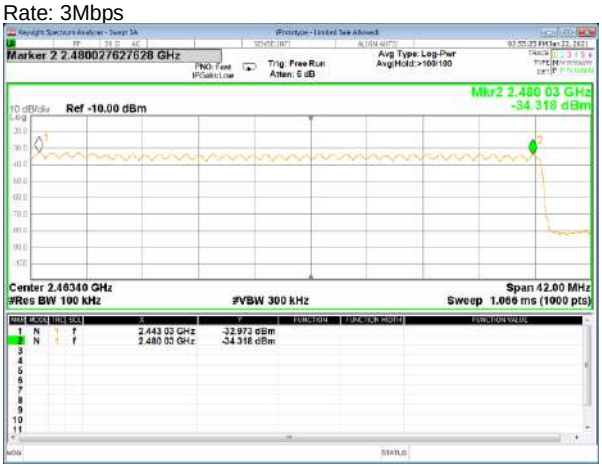


π/4 DQPSK, Data Rate: 2Mbps



8DPSK, Data Rate: 3Mbps





6.4.1.2 Channel Separation – Hopping Verification

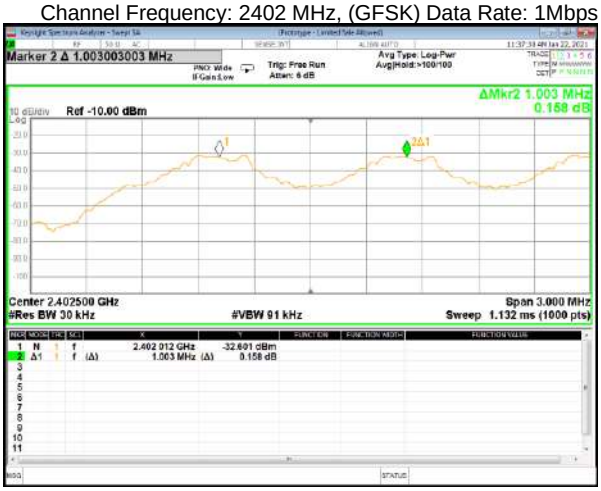
Section 15.247 (a) (1) Frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

Measures executed on BT active on CHIP 1 (Phones)

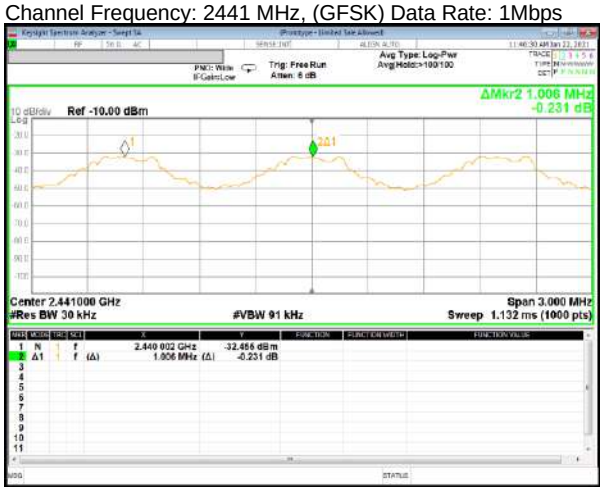
Modulation Mode	Frequency (MHz)	Measured Channel Separation (MHz)	Measured 20dB Bandwidth (*) (MHz)	Applicable Minimum Limit (MHz)	Result
GFSK	2402	1,003	0,968	0,646	Pass
	2441	1,006	0,967	0,644	Pass
	2480	1,000	0,972	0,648	Pass
π/4 DQPSK	2402	1,000	1,393	0,929	Pass
	2441	1,006	1,392	0,928	Pass
	2480	1,006	1,395	0,930	Pass
8DPSK	2402	1,000	1,378	0,919	Pass
	2441	1,000	1,386	0,924	Pass
	2480	1,006	1,379	0,919	Pass

(*) Measures were collected at paragraph 4.4.1

Channel Frequency: 2402 MHz, (GFSK) Data Rate: 1Mbps



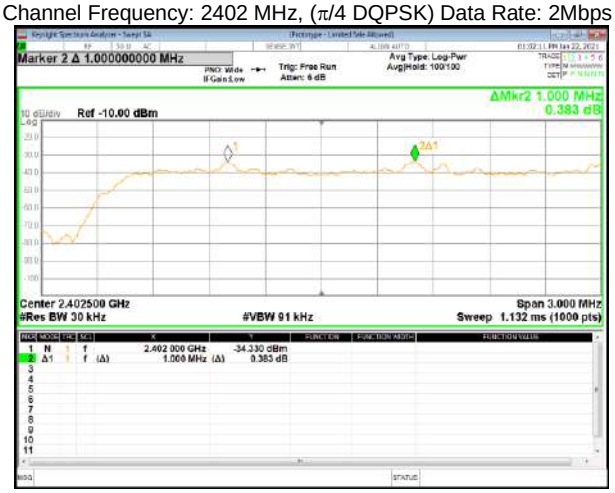
Channel Frequency: 2441 MHz, (GFSK) Data Rate: 1Mbps



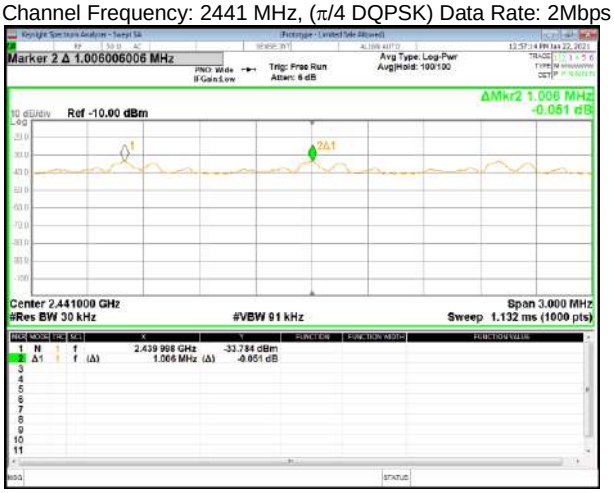
Channel Frequency: 2480 MHz, (GFSK) Data Rate: 1Mbps


Marker 2 Δ 1.000000000 MHz
Trig: Free Run
Atten: 6 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
ΔMkr2 1.000 MHz
0.452 dB
Ref -10.00 dBm
Center 2.480000 GHz
#Res BW 30 kHz
#VBW 91 kHz
Span 3.000 MHz
Sweep 1.132 ms (1000 pts)
1 N 1 f 2.479 002 GHz -34.402 dBm
2 Δ1 1 f (Δ) 1.000 MHz (Δ) 0.452 dB

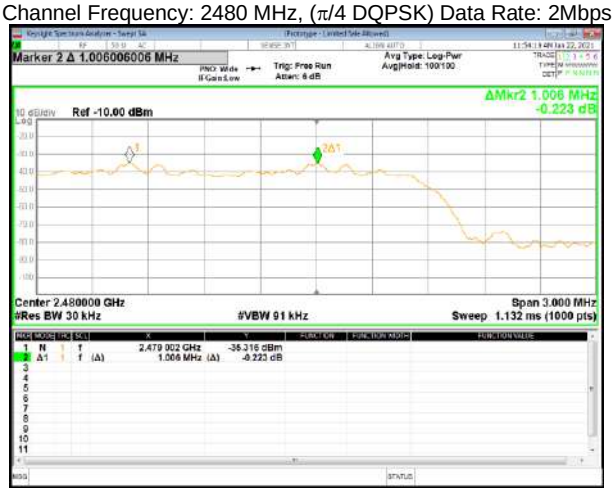
Channel Frequency: 2402 MHz, (π/4 DQPSK) Data Rate: 2Mbps



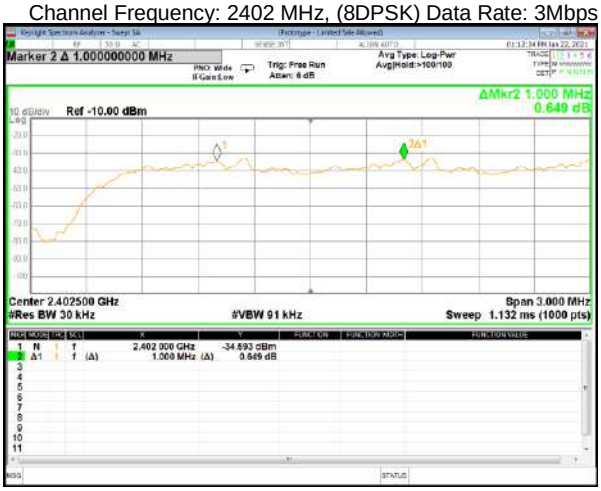
Channel Frequency: 2441 MHz, (π/4 DQPSK) Data Rate: 2Mbps



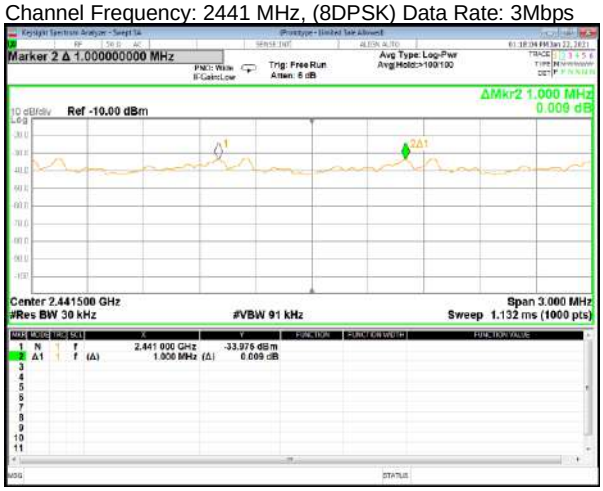
Channel Frequency: 2480 MHz, (π/4 DQPSK) Data Rate: 2Mbps



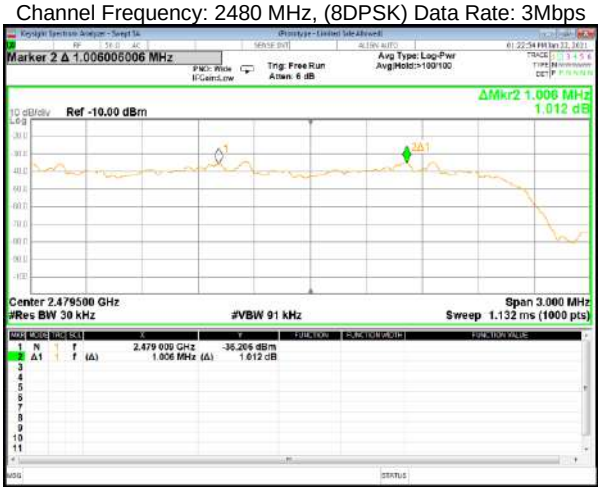
Channel Frequency: 2402 MHz, (8DPSK) Data Rate: 3Mbps



Channel Frequency: 2441 MHz, (8DPSK) Data Rate: 3Mbps



Channel Frequency: 2480 MHz, (8DPSK) Data Rate: 3Mbps

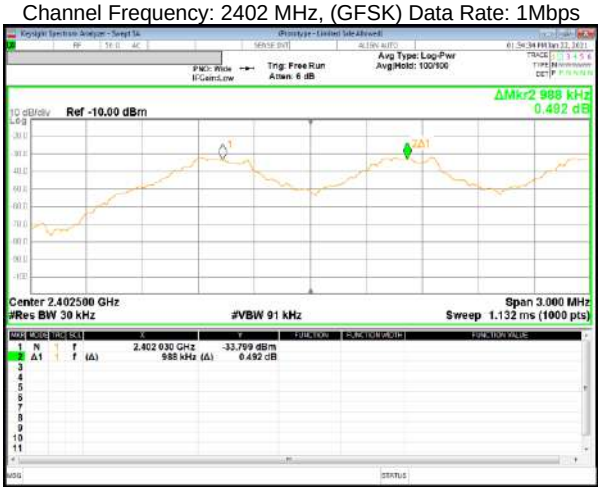


Measures executed on BT active on CHIP 2 (Headsets)

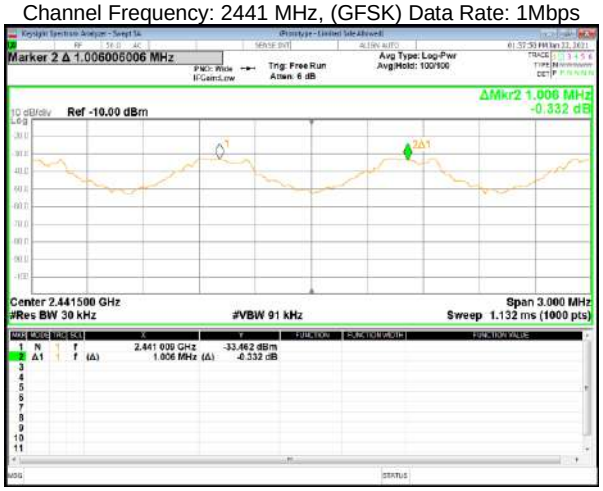
Modulation Mode	Frequency (MHz)	Measured Channel Separation (MHz)	Measured 20dB Bandwidth (*) (MHz)	Applicable Minimum Limit (MHz)	Result
GFSK	2402	0,988	0,968	0,645	Pass
	2441	1,006	0,966	0,644	Pass
	2480	0,982	1,023	0,682	Pass
π/4 DQPSK	2402	1,003	1,391	0,927	Pass
	2441	0,985	1,391	0,927	Pass
	2480	1,005	1,391	0,927	Pass
8DPSK	2402	1,000	1,376	0,917	Pass
	2441	0,997	1,376	0,917	Pass
	2480	1,006	1,376	0,917	Pass

(*) Measures were collected at paragraph 4.4.1

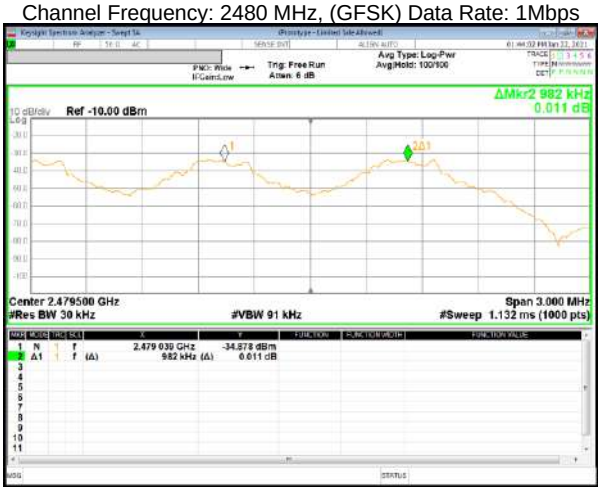
Channel Frequency: 2402 MHz, (GFSK) Data Rate: 1Mbps



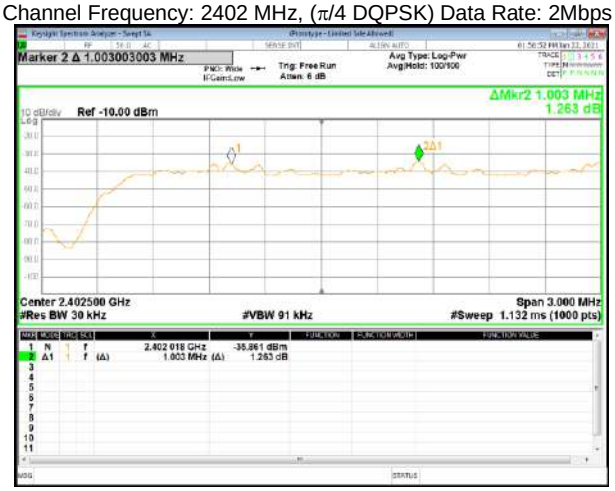
Channel Frequency: 2441 MHz, (GFSK) Data Rate: 1Mbps



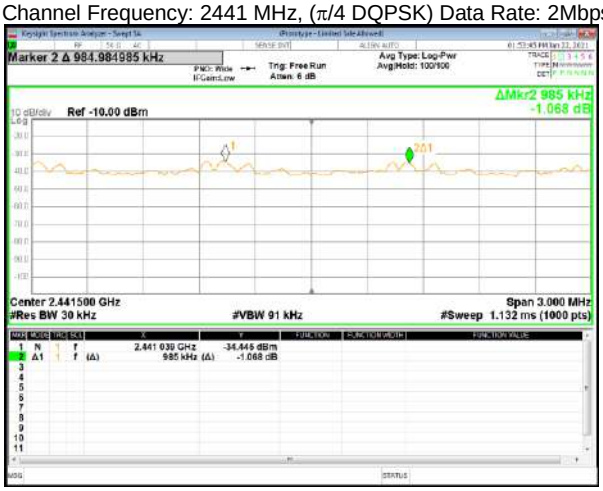
Channel Frequency: 2480 MHz, (GFSK) Data Rate: 1Mbps



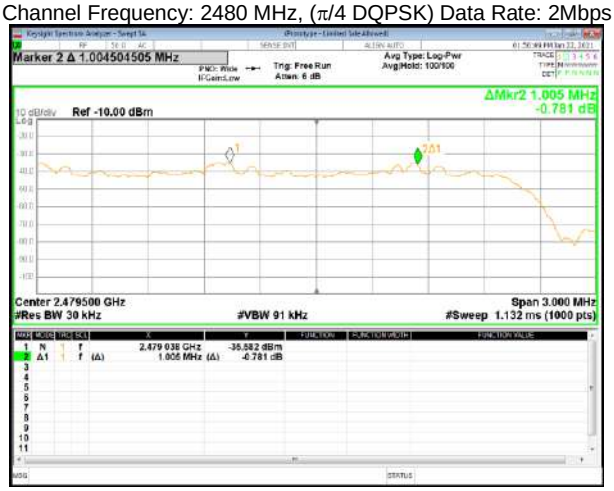
Channel Frequency: 2402 MHz, (π/4 DQPSK) Data Rate: 2Mbps



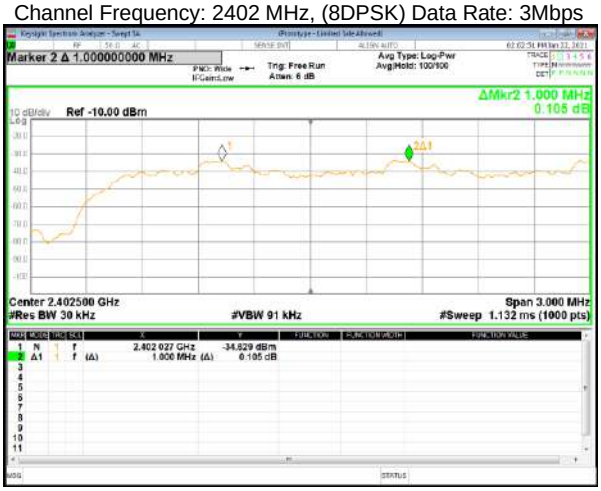
Channel Frequency: 2441 MHz, (π/4 DQPSK) Data Rate: 2Mbps



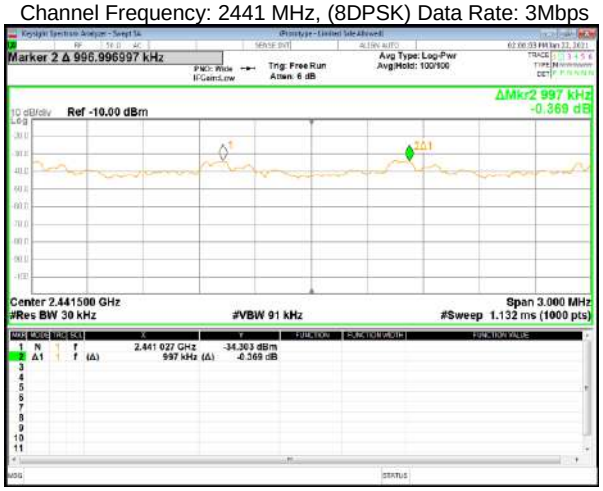
Channel Frequency: 2480 MHz, (π/4 DQPSK) Data Rate: 2Mbps



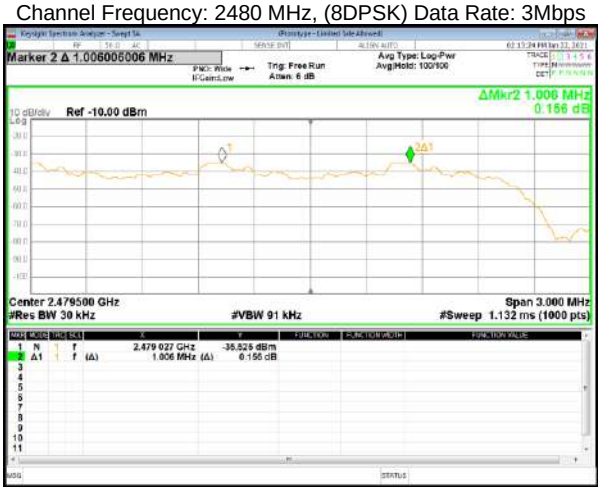
Channel Frequency: 2402 MHz, (8DPSK) Data Rate: 3Mbps



Channel Frequency: 2441 MHz, (8DPSK) Data Rate: 3Mbps



Channel Frequency: 2480 MHz, (8DPSK) Data Rate: 3Mbps



6.4.1.3 Dwell Time – Hopping Verification

Section 15.247 (a)(1)(iii) Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

Measures executed on BT active on CHIP 1 (Phones)

Modulation Mode	Frequency (MHz)	[LTT] Lenght of Transmission Time (ms)	[N] Number of Transmissions in a 31.6s interval (*) (79Hopp Ch*0.4)	[LTT x N] Occupancy Time (ms)	Occupancy Time Limit (ms)	Result
GFSK-DH1	2402	0,409	320	0,131	0,4	Pass
GFSK-DH3	2402	1,675	160	0,268	0,4	Pass
GFSK-DH5	2402	2,934	106,6	0,313	0,4	Pass
π/4 DQPSK-2DH1	2402	0,415	320	0,133	0,4	Pass
π/4 DQPSK-2DH3	2402	1,677	160	0,268	0,4	Pass
π/4 DQPSK-2DH5	2402	2,923	106,6	0,312	0,4	Pass
8DPSK-3DH1	2402	0,414	320	0,133	0,4	Pass
8DPSK-3DH3	2402	1,679	160	0,269	0,4	Pass
8DPSK-3DH5	2402	2,934	106,6	0,313	0,4	Pass

(*) The DH1 packet can cover a single time slot. A maximum length packet has duration of 1 time slot.
The hopping rate is 1600 hops/second so the maximum dwell time is 1/1600 seconds, or 0.625ms.
DH1 Packet permit maximum 1600/79/2=10.12 hops per second in each channel (1 time slot Tx, 1 time slot Rx).
So, the dwell time is the time duration of the pulse time 10.12x31.6=320 within 31.6 seconds.

The DH3 packet can cover up to 3 time slots. A maximum length packet has duration of 3 time slot.
The hopping rate is 1600 hops/second so the maximum dwell time is 3/1600 seconds, or 1.875ms.
DH3 Packet permit maximum 1600/79/4=5.06 hops per second in each channel (3 time slot Tx, 1 time slot Rx).
So, the dwell time is the time duration of the pulse time 5.06x31.6=160 within 31.6 seconds.

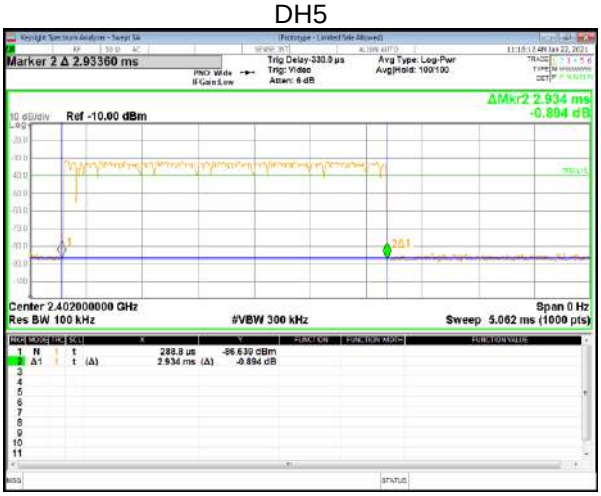
The DH5 packet can cover up to 5 time slots. Operate DH5 at maximum dwell time and maximum duty cycle. A maximum length packet has duration of 5 time slot. The hopping rate is 1600 hops/second so the maximum dwell time is 5/1600 seconds, or 3.125ms.
DH5 Packet permit maximum 1600/79/6=3.37 hops per second in each channel (5 time slot Tx, 1 time slot Rx).
So, the dwell time is the time duration of the pulse time 3.37x31.6=106.6 within 31.6 seconds.

GFSK

DH1

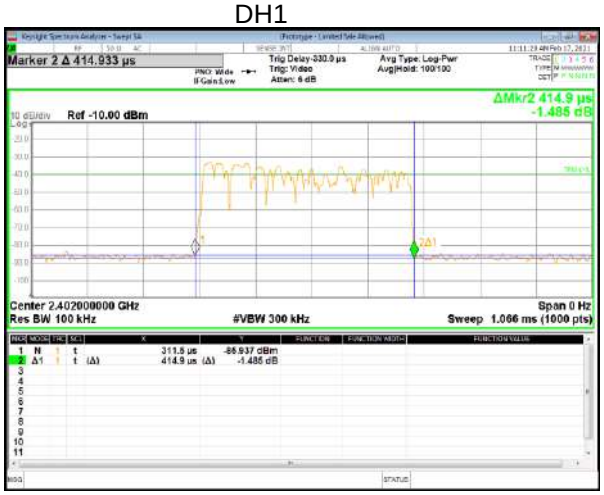
DH3

DH5

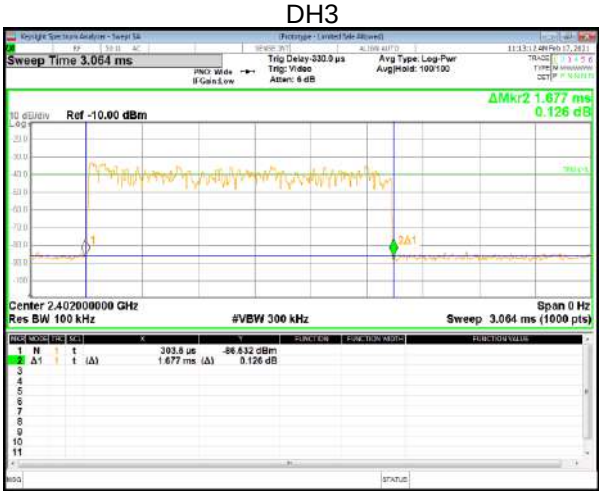


π/4 DQPSK

DH1



DH3

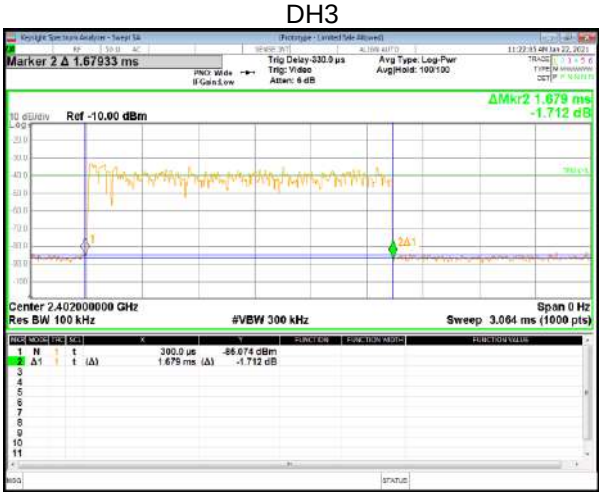


DH5

8DPSK

DH1

DH3



DH5


Marker 2 Δ 2.93360 ms
Trig Delay-330.0 µs
Trig: Video
Atten: 6 dB
Avg Type: Log-Pwr
Avg|Hold: 100/100
ΔMkr2 2.934 ms
-1.412 dB
Ref -10.00 dBm
Center 2.402000000 GHz
Res BW 100 kHz
#VBW 300 kHz
Span 0 Hz
Sweep 5.062 ms (1000 pts)
1 N 1 t 293.9 µs -85.680 dBm
2 Δ1 1 t (Δ) 2.934 ms (Δ) -1.412 dB

Measures executed on BT active on CHIP 2 (Headsets)

Modulation Mode	Frequency (MHz)	[LTT] Lenght of Transmission Time (ms)	[N] Number of Transmissions in a 31.6s interval (*) (79Hopp Ch*0.4)	[LTT x N] Occupancy Time (ms)	Occupancy Time Limit (ms)	Result
GFSK-DH1	2402	0,411	320	0,131	0,4	Pass
GFSK-DH3	2402	1,671	160	0,267	0,4	Pass
GFSK-DH5	2402	2,934	106,6	0,313	0,4	Pass
π/4 DQPSK-2DH1	2402	0,417	320	0,133	0,4	Pass
π/4 DQPSK-2DH3	2402	1,671	160	0,267	0,4	Pass
π/4 DQPSK-2DH5	2402	2,929	106,6	0,312	0,4	Pass
8DPSK-3DH1	2402	0,415	320	0,133	0,4	Pass
8DPSK-3DH3	2402	1,677	160	0,268	0,4	Pass
8DPSK-3DH5	2402	2,929	106,6	0,312	0,4	Pass

(*) The DH1 packet can cover a single time slot. A maximum length packet has duration of 1 time slot.
The hopping rate is 1600 hops/second so the maximum dwell time is 1/1600 seconds, or 0.625ms.
DH1 Packet permit maximum 1600/79/2=10.12 hops per second in each channel (1 time slot Tx, 1 time slot Rx).
So, the dwell time is the time duration of the pulse time 10.12x31.6=320 within 31.6 seconds.

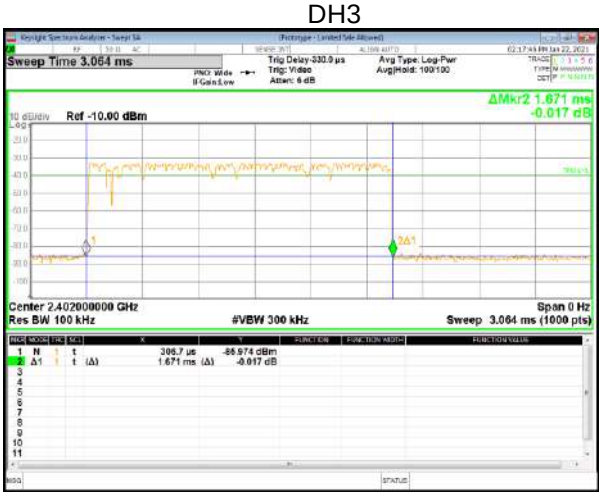
The DH3 packet can cover up to 3 time slots. A maximum length packet has duration of 3 time slot.
The hopping rate is 1600 hops/second so the maximum dwell time is 3/1600 seconds, or 1.875ms.
DH3 Packet permit maximum 1600/79/4=5.06 hops per second in each channel (3 time slot Tx, 1 time slot Rx).
So, the dwell time is the time duration of the pulse time 5.06x31.6=160 within 31.6 seconds.

The DH5 packet can cover up to 5 time slots. Operate DH5 at maximum dwell time and maximum duty cycle. A maximum length packet has duration of 5 time slot. The hopping rate is 1600 hops/second so the maximum dwell time is 5/1600 seconds, or 3.125ms.
DH5 Packet permit maximum 1600/79/6=3.37 hops per second in each channel (5 time slot Tx, 1 time slot Rx).
So, the dwell time is the time duration of the pulse time 3.37x31.6=106.6 within 31.6 seconds.

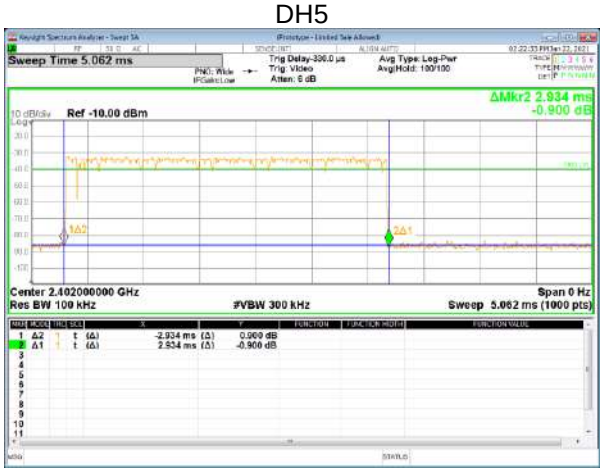
GFSK

DH1

DH3



DH5

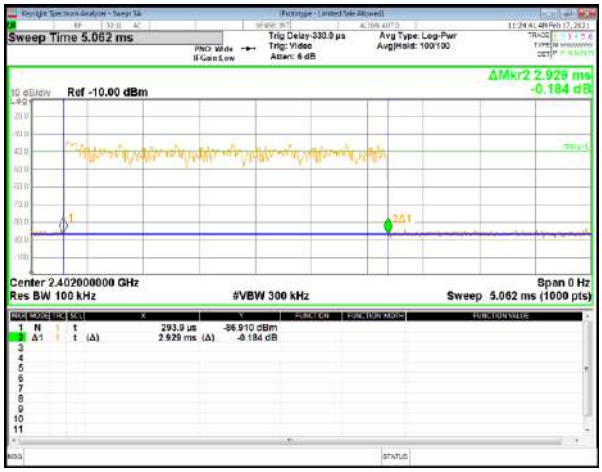


π/4 DQPSK

DH1

DH3

DH5

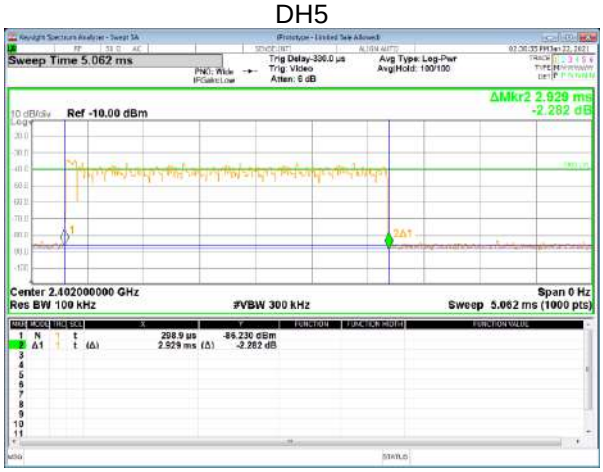


8DPSK

DH1

DH3

DH5



7.0 Conducted Spurious Emissions – Condizioni di prova / *Test Conditions*

Technician / Tecnico: Loris Fruch		
Table No.	TEST: Conducted Spurious Emissions, Section 15.247 (d)	\
Method	ANSI C63.10: 2013-06, par. 7.8.8	\

Parameters required prior to the test	Laboratory Ambient Temperature	18 to 28 °C
	Relative Humidity	20 to 90 %
Parameters recorded during the test	Laboratory Ambient Temperature	22 °C
	Relative Humidity	28 %

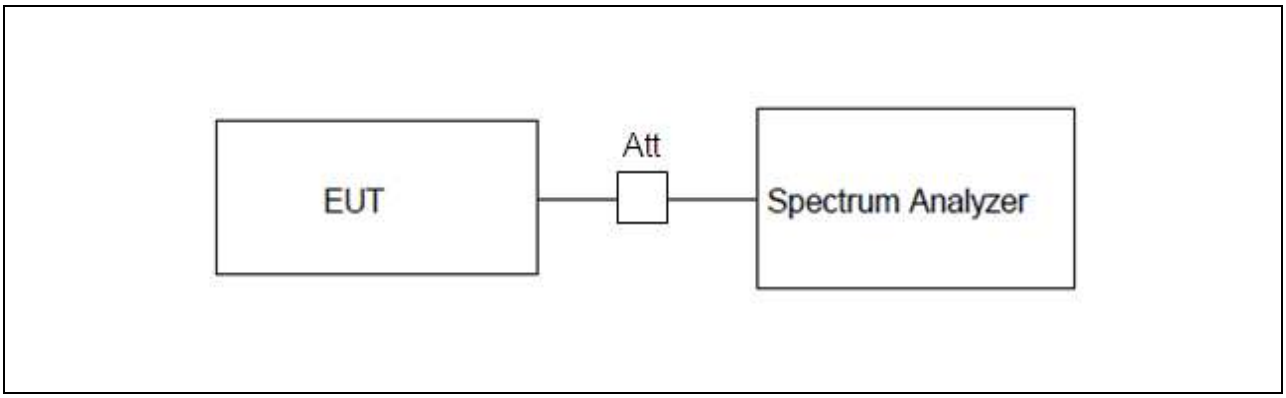
Supplementary information:

- Test performed on EUT 20LA000545/01;
- Conducted Test, executed at Bluetooth antenna output (50ohm, SMA) connected to the Spectrum Analyser through an attenuator (30 dB);
- Frequency range of the measurements: up to 26GHz.
- EUT powered at 14Vdc;
- EUT Operating Mode: Mode 2 (see par. 2.1);
- Spectrum analyser setting:
  - Detector= Peak,
  - Trace= max hold (over last 20 sweeps),
  - RBW= 100 kHz and VBW=300 kHz,
- Test aim is to verify that in any 100 kHz bandwidth outside the frequency band in which the digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator is at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power.
- Test executed first on BT CHIP 1 (Phones) and then on BT CHIP 2 (Headsets) with the following settings:
  - BR mode with modulation GFSK on channel 0, 39 and 78 with data rate at 1Mbps
  - EDR mode with modulation $\pi/4$ DQPSKon channel 0, 39 and 78 with data rate at 2Mbps
  - EDR mode with modulation 8DPSK on channel 0, 39 and 78 with data rate at 3Mbps

7.1 Apparecchiature utilizzate / *Test Equipment Used* – Maximum Peak Conducted Output Power

Apparecchiature usate/Equipment Used	***Modello/Model***	***Costruttore/ Manufacturer***	***Numero di serie/ Serial Number***	**Data calibrazione / *Calibration date***	**Intervallo / *Interval***
EMI Receiver MXE	N9038A	Agilent Technologies	MY51210230	07/2020	1 year
30dB Attenuator	PE7087-30	Pasternack	1349	02/2020	1 year
RF Cable	SKBL-2M-LOW	Mini-Circuits	1101189	09/2020	1 year
DataLogger T/UR	HL-1D	Rotronic	A18012240	07/2020	1 year
Dual DC Power Supply	CPX400D	TTi	482828	10/2020	1 year

7.2 Fotografie del setup / *Photo of the test setup* – Conducted Spurious Emissions



7.3 Requisiti / *Requirements* – Conducted Spurious Emissions

FCC Section 15.247

(d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

7.4 Risultati / *Results* – Conducted Spurious Emissions

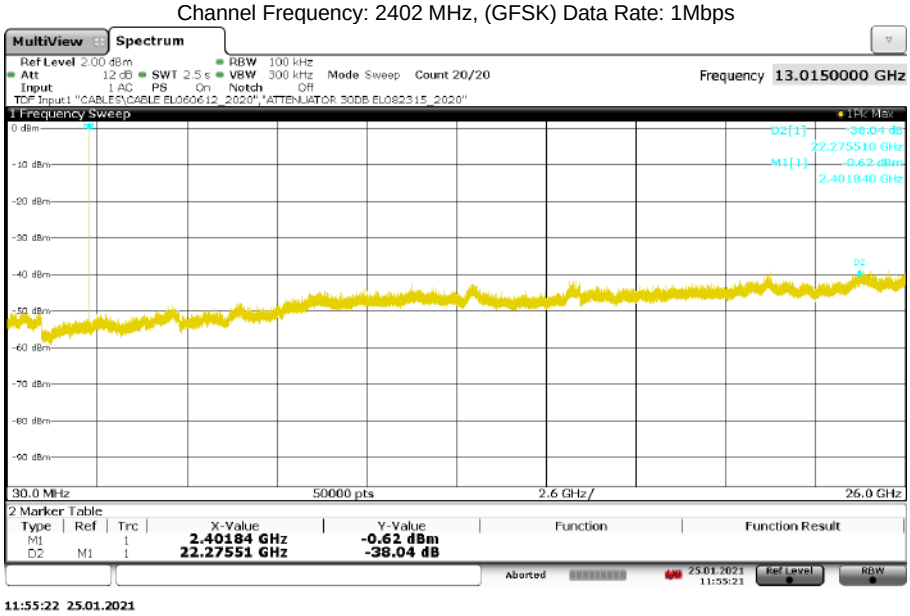
The amplitude of spurious emissions is lower than 20 dBc, thus the result of the test is: **PASS**. See the details in the charts of the following paragraphs.

7.4.1 Grafici dei risultati / *Graphical representation data* – Conducted Spurious Emissions

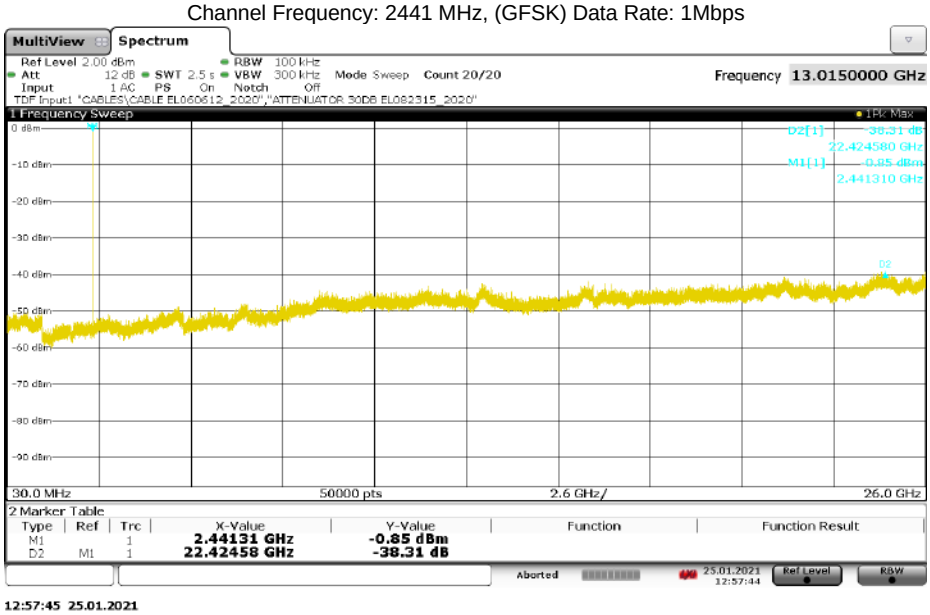
Note: all the traces reported in this section have been obtained with detector Peak, max hold (over last 20 sweeps); RBW: 100kHz, VBW: 300kHz

Measures executed on BT (DSS) active on CHIP 1 (Phones)

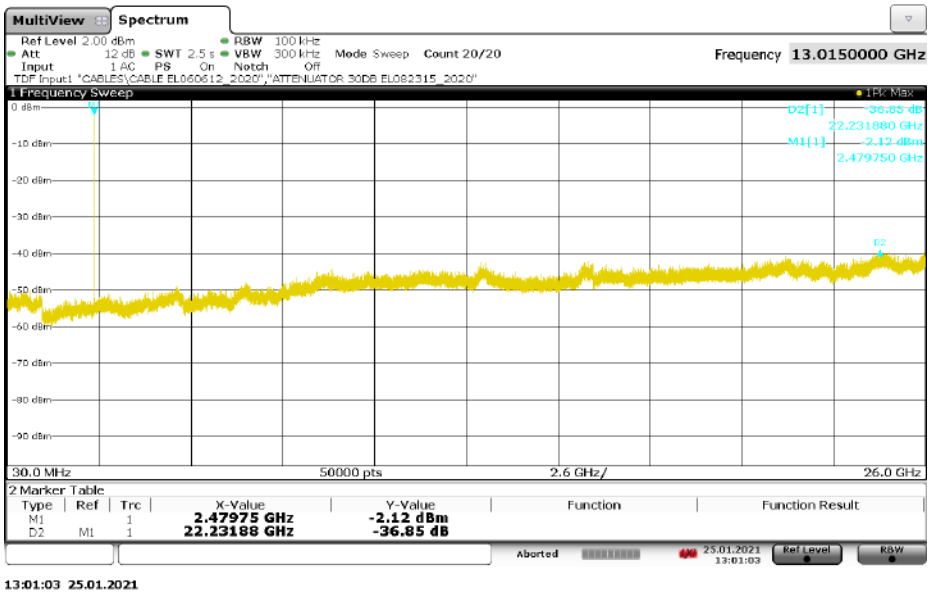
Channel Frequency: 2402 MHz, (GFSK) Data Rate: 1Mbps



Channel Frequency: 2441 MHz, (GFSK) Data Rate: 1Mbps

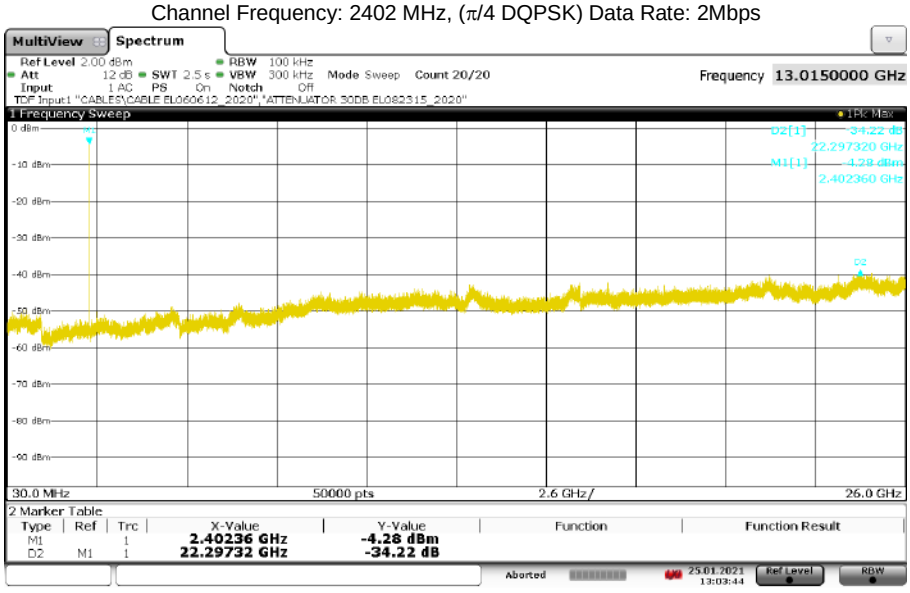


Channel Frequency: 2480 MHz, (GFSK) Data Rate: 1Mbps



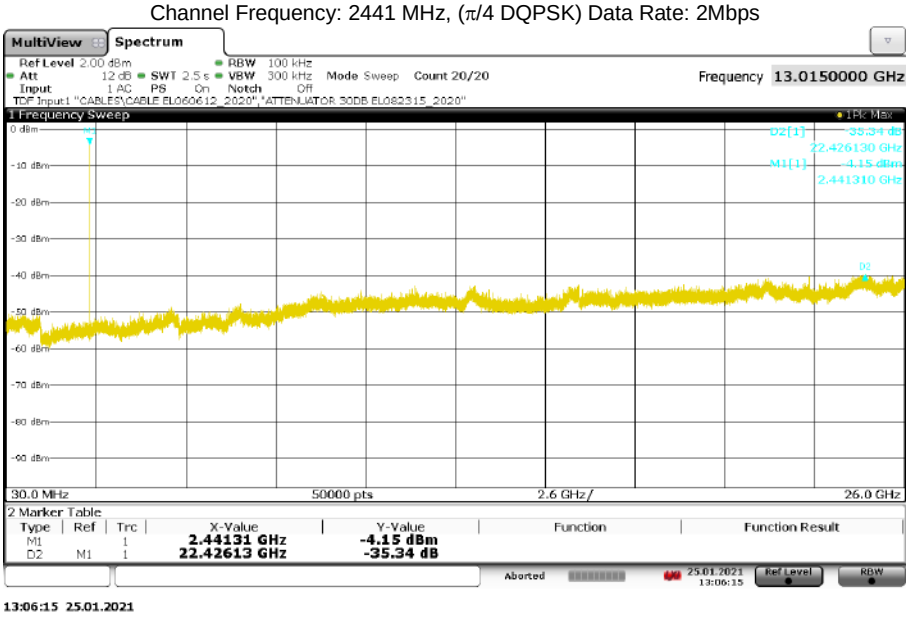
13:01:03 25.01.2021

Channel Frequency: 2402 MHz, (π/4 DQPSK) Data Rate: 2Mbps



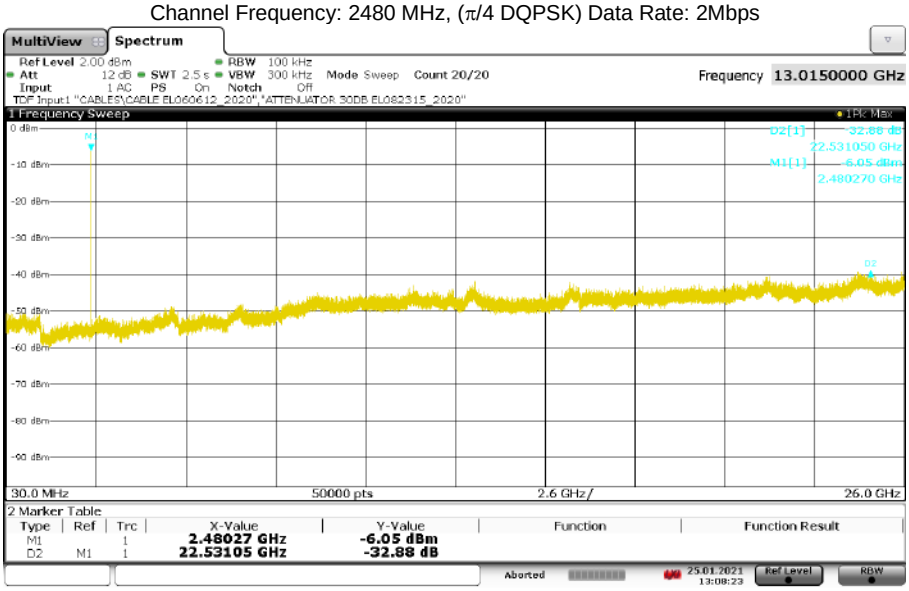
13:03:44 25.01.2021

Channel Frequency: 2441 MHz, (π/4 DQPSK) Data Rate: 2Mbps



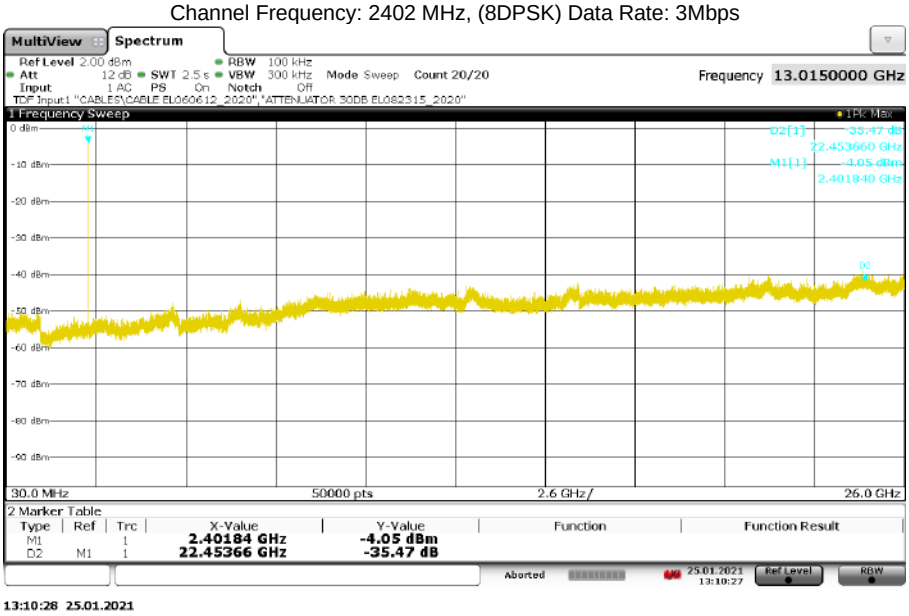
13:06:15 25.01.2021

Channel Frequency: 2480 MHz, (π/4 DQPSK) Data Rate: 2Mbps



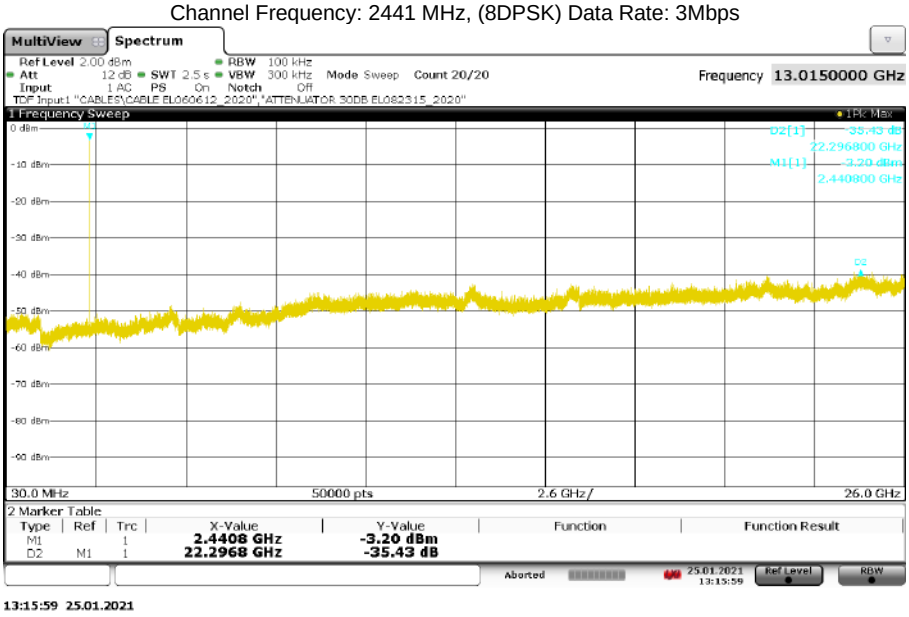
13:08:23 25.01.2021

Channel Frequency: 2402 MHz, (8DPSK) Data Rate: 3Mbps



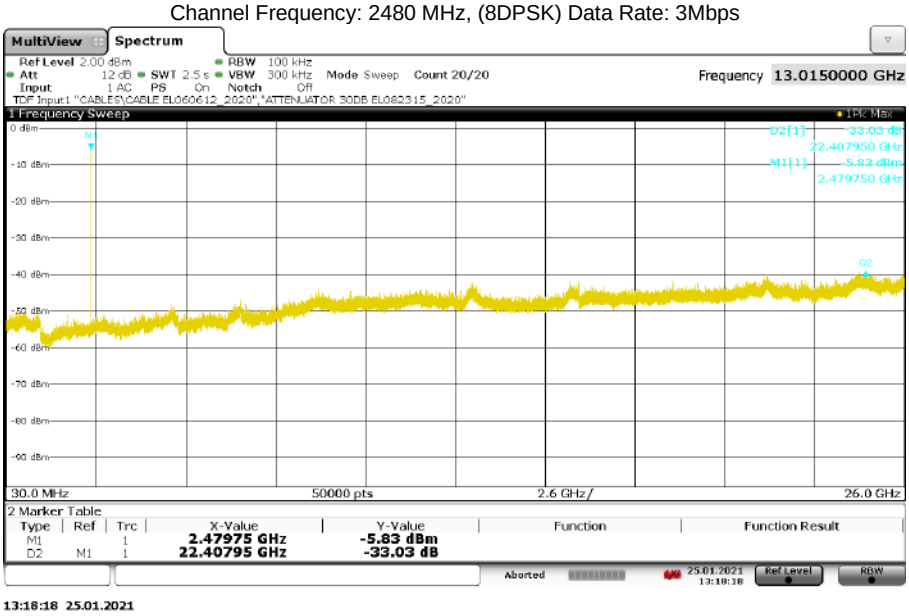
13:10:28 25.01.2021

Channel Frequency: 2441 MHz, (8DPSK) Data Rate: 3Mbps



13:15:59 25.01.2021

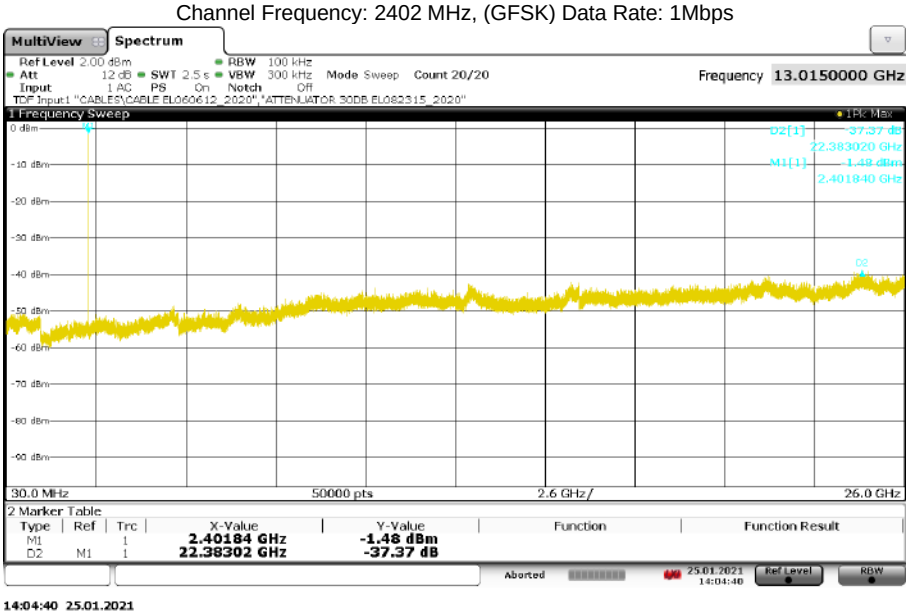
Channel Frequency: 2480 MHz, (8DPSK) Data Rate: 3Mbps



13:18:18 25.01.2021

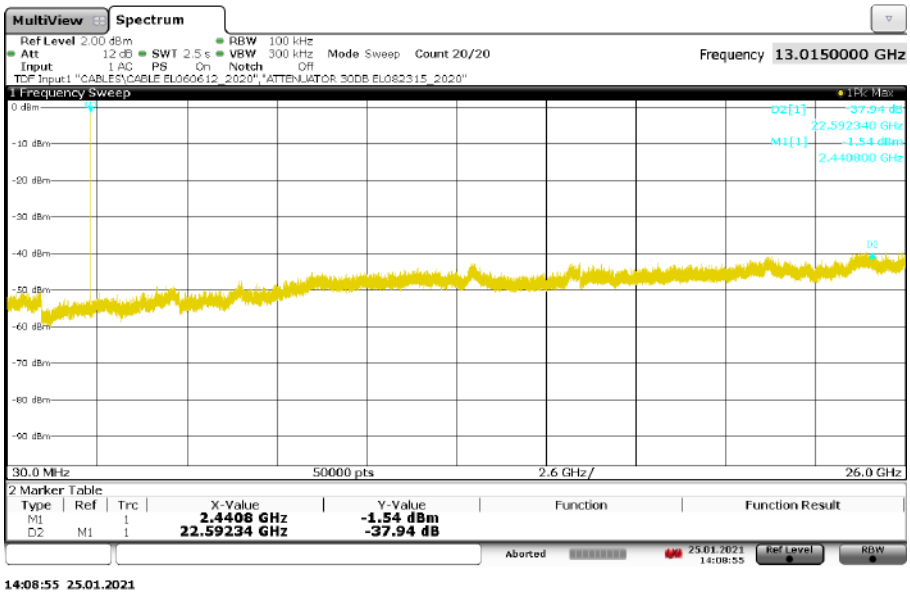
Measures executed on BT (DSS) active on CHIP 2 (Headsets)

Channel Frequency: 2402 MHz, (GFSK) Data Rate: 1Mbps

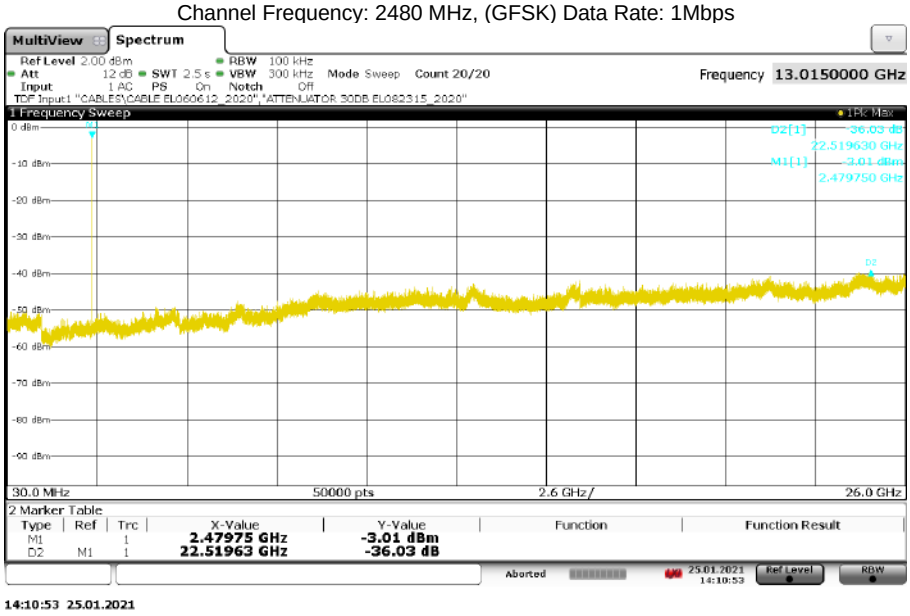


14:04:40 25.01.2021

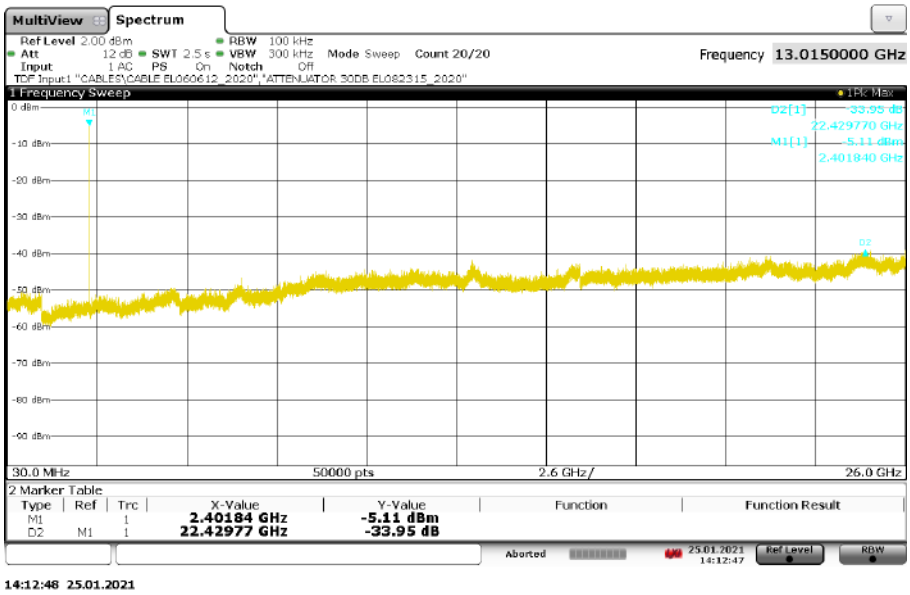
Channel Frequency: 2441 MHz, (GFSK) Data Rate: 1Mbps



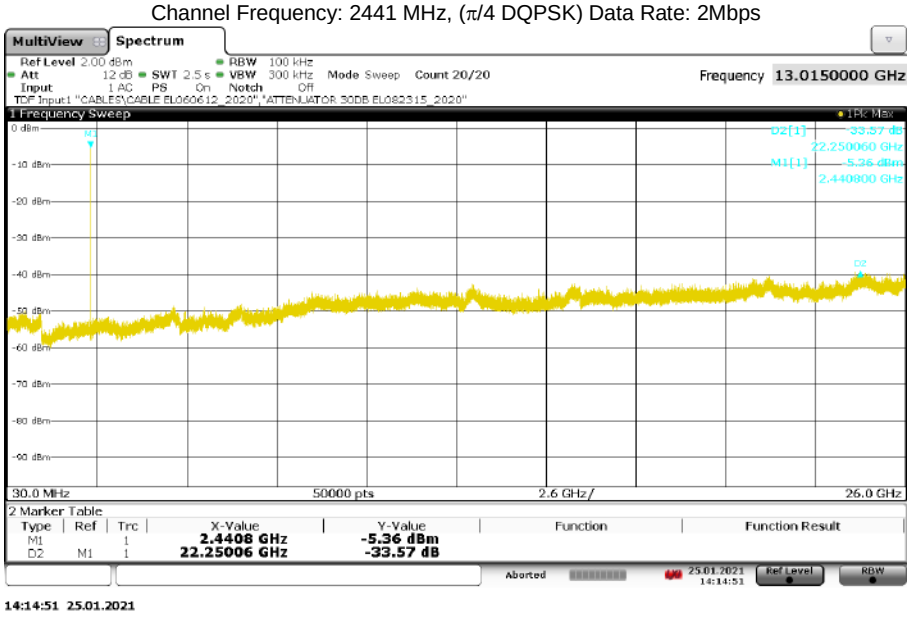
Channel Frequency: 2480 MHz, (GFSK) Data Rate: 1Mbps



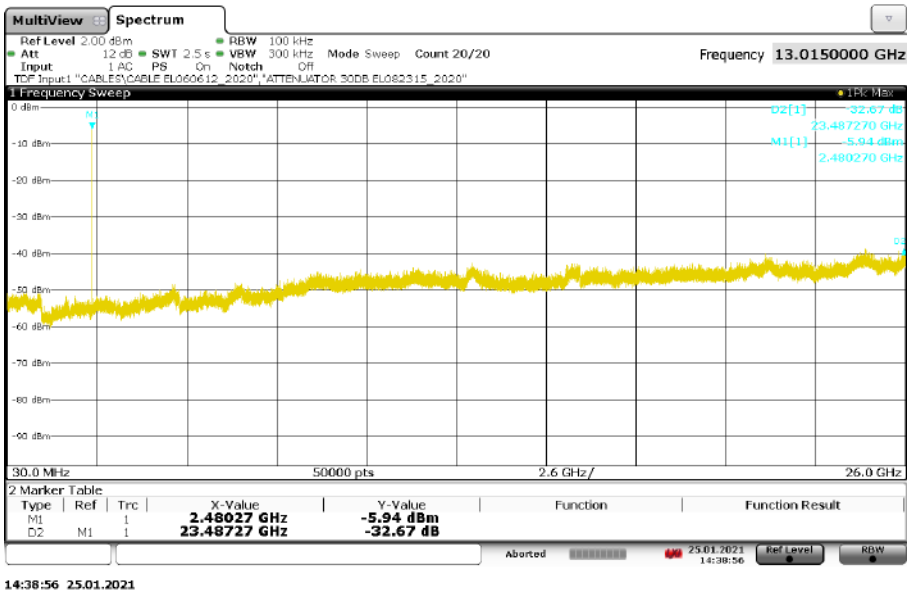
Channel Frequency: 2402 MHz, (π/4 DQPSK) Data Rate: 2Mbps



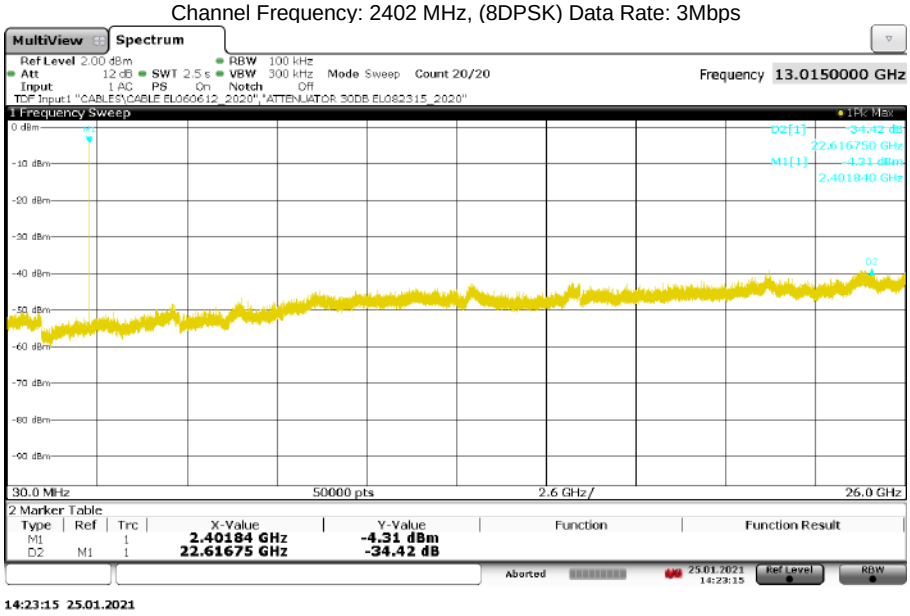
Channel Frequency: 2441 MHz, (π/4 DQPSK) Data Rate: 2Mbps



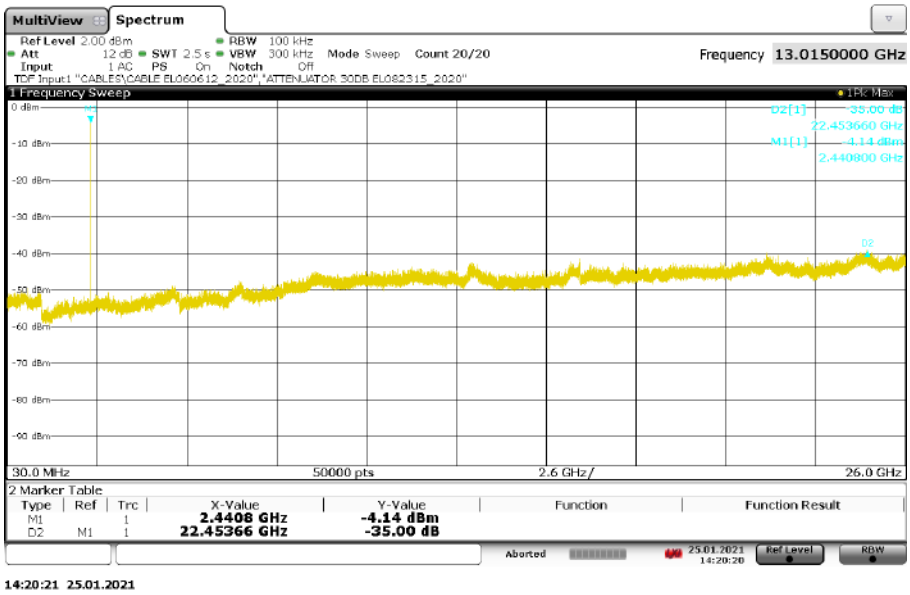
Channel Frequency: 2480 MHz, (π/4 DQPSK) Data Rate: 2Mbps



Channel Frequency: 2402 MHz, (8DPSK) Data Rate: 3Mbps

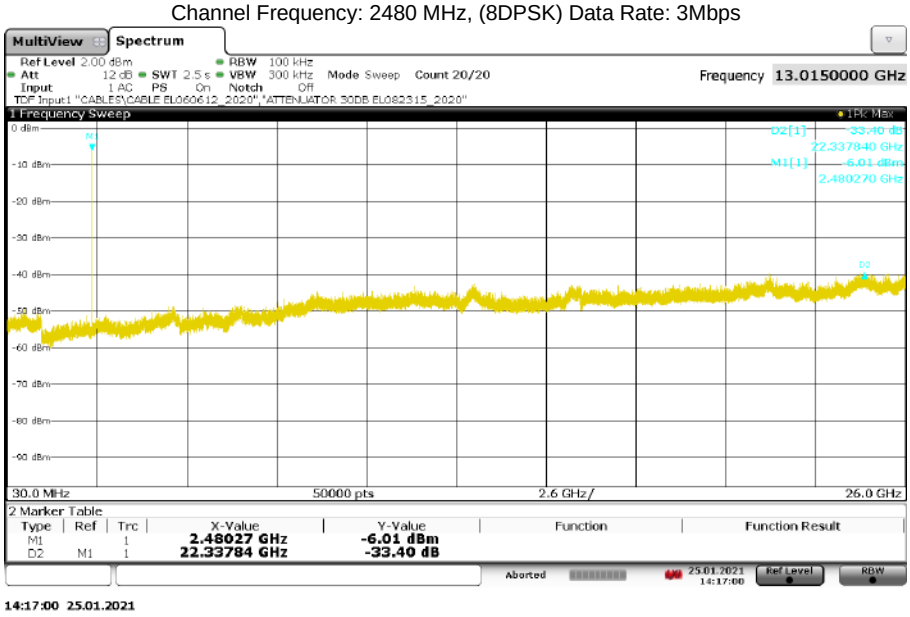


Channel Frequency: 2441 MHz, (8DPSK) Data Rate: 3Mbps



14:20:21 25.01.2021

Channel Frequency: 2480 MHz, (8DPSK) Data Rate: 3Mbps



14:17:00 25.01.2021

8.0 Spurious Radiated Emissions and Restricted Bands of Operation – Condizioni di prova / *Test Conditions*

Technician / Tecnico: Loris Fruch, Rudy Valent		
Table No.	TEST: Spurious Radiated Emissions and Restricted Bands of Operation, Section 15.205 (a), 15.209, 15.247(d)	\
Method	ANSI C63.10: 2013-06, Par. 6.3	\

Parameters required prior to the test	Laboratory Ambient Temperature	18 to 28 °C
	Relative Humidity	20 to 90 %
Parameters recorded during the test	Laboratory Ambient Temperature	21 - 23 °C
	Relative Humidity	30 - 40 %

Supplementary information:

- Test performed on EUT 20LA00545/01 in operating mode 1 (see section 2.1) powered at 14Vdc.
- Frequency range: 9kHz to 25GHz (tenth harmonic of the highest frequency used in the EUT), see FCC section 15.33 (a) (1);
- Test site: Semi-anechoic chamber for measures from 9kHz to 1GHz and Full-anechoic chamber for measures from 1GHz to 25GHz;
- The EUT was placed on turn-platform on a support at 0.8m above the ground plane for measures from 9kHz to 1GHz and on a support at 1.5m above the ground plane for measures from 1GHz to 25GHz;
- The EUT was placed at 3m apart from the receiving antenna;
- The turn-platform is rotated from 0° to 360° degrees to determine the position of maximum emission level, the antenna height is changed from 1m to 4m to find the highest emission;
- The receiving antenna was positioned in vertical and horizontal polarization and from 1GHz to 25GHz aim the EUT (source of emission) by the use of the Accessory for azimuth antenna control, as required at section 8.3.2.2 of ANSI C63.4: 2014;
- The preliminary measurements were made with the detector set to Peak within an IF bandwidth of 200Hz from 9kHz to 150kHz, of 9kHz from 150kHz to 30MHz, of 120kHz from 30MHz to 1GHz and with the detector set to Average within an IF bandwidth of 1000KHz from 1GHz to 25GHz;
- Antennas used during measurements:
  - Loop antenna from 9kHz to 30MHz
  - Bilog antenna from 30MHz to 1GHz
  - Horn antenna ETS 3117 from 1GHz to 18GHz;
  - Horn antenna AMTP-42-20-C-SF from 18GHz to 25GHz;
- The final measurements of the peaks were made with the RBW and detector set to:
  - 200Hz/Quasi-Peak from 90kHz to 150kHz (CISPR-Average from 9kHz to 90kHz);
  - 9kHz/Quasi-Peak from 150kHz to 30MHz (CISPR-Average from 110kHz to 490kHz);
  - 120kHz/Quasi-Peak from 30MHz to 1GHz;
  - 1MHz /CISPR-Average from 1GHz to 25GHz;
- The measurements with Quasi-Peak and CISPR-Average detector were performed only for the six highest EUT emissions, excluding peaks lower than 20 dB from the limit;
- FCC Limits: Sections 15.209 (a) of 47 CFR Part 15

  Remark: In accordance with part 15.31 (f) (2) of FCC, when performing measurements at a closer distance than specified, the results shall be extrapolated to the specified distance by either making measurements at a minimum of two distances on at least one radial to determine the proper extrapolation factor or by using the square of an inverse linear distance extrapolation factor (40 dB/decade).
  The applied formula for limits at 3 meter is:
  Extrapolation (dB) = 40log (300meter / 3meter) = +80dB
  Extrapolation (dB) = 40log (30meter / 3meter) = +40dB
- Test executed setting the BT respect to the worst case detected during Max Peak Output Power Test:
  - BT with 8DPSK modulation active at 2441MHz on CHIP1 (Phones) and at 2402MHz on CHIP2 (Headsets)
  - For Restricted Band of Operation test BT active with 8DPSK at 2402MHz and 2480MHz on CHIP1 (Phones) and then with 8DPSK at 2402MHz and with π/4 DQPSK at 2480MHz on CHIP2 (Headsets)

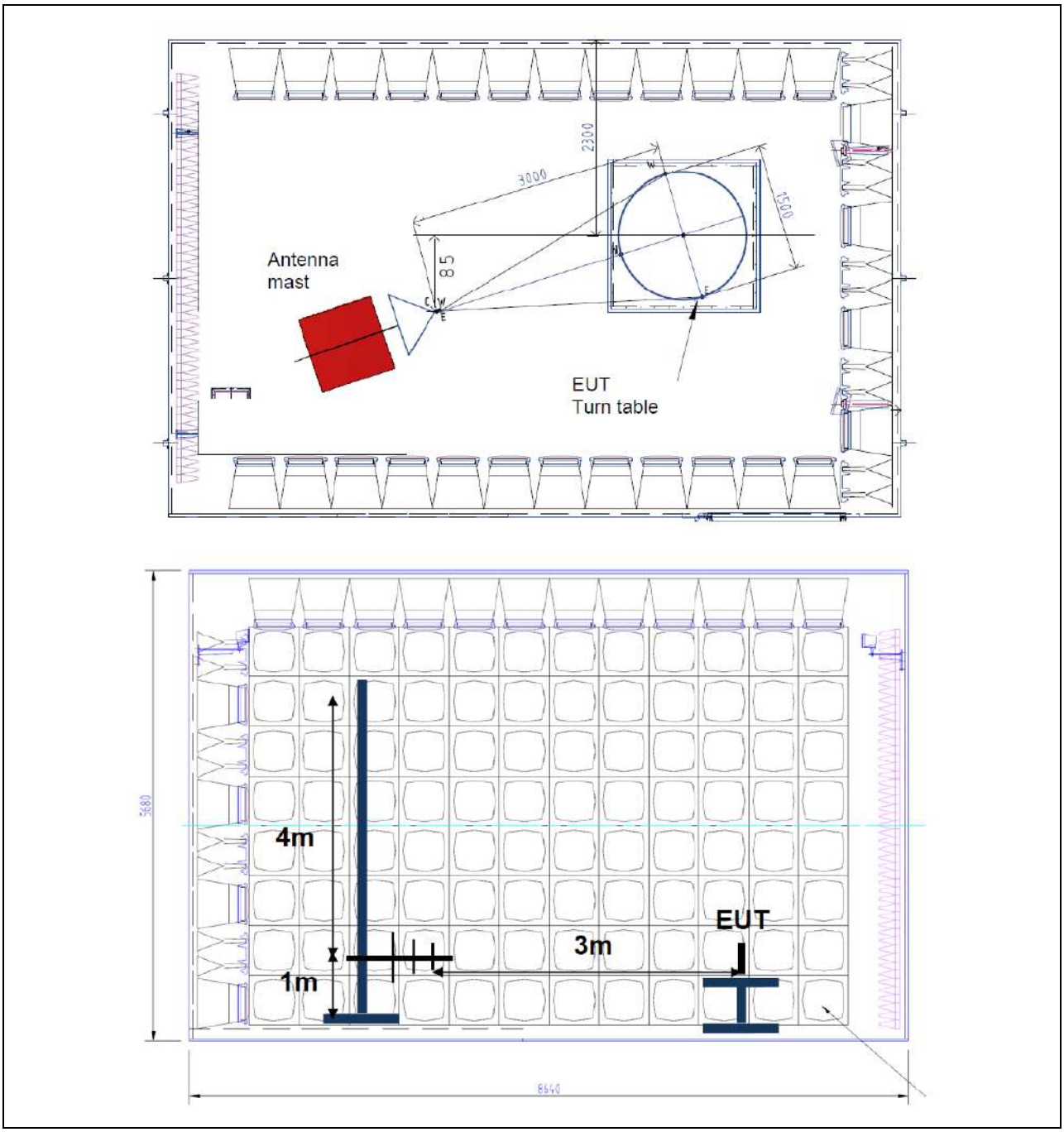
8.1 Apparecchiature utilizzate / *Test Equipment Used* – Spurious Radiated Emissions and Restricted Bands of Operation

Apparecchiature usate/Equipment Used	*Modello/Model*	*Costruttore/ Manufacturer*	*Numero di serie/ Serial Number*	Data calibrazione/ *Calibration date*	Intervallo / *Interval*
EMI Receiver	ESW44	Rohde&Schwarz	101546	12/2020	1 year
Loop Antenna	6502	ETS-Lindgren	00164807	07/2020	1 year
Bilog Antenna	CBL6111C	Chase	2415	10/2018 10/2020	3 years 1 year
Horn Antenna Double-Ridged Waveguides	3117	ETS-Lindgren	00201258	08/2018 01/2021 (verification)	3 years 1 year
Standard Gain Horn Antenna	AMTP-62-20_C-SF	SPIN Electronics	01-165-12	09/2019	3 years
High Pass Filter	VHF-7150+	Mini-Circuits	31510	11/2020	1 year
Pre-Amplifier	JS32-00104000-58-5P-R	Narda-Miteq	2008138	09/2020	1 year
RF Cable	SLULL18-NMNM	TimesMicrowave	10022-001-001	11/2020	1 year
RF Cable	SLULL18-NMNM-9.00M	Timesmicrowave	13305-001-001	06/2020	1 year
RF Cable	SFT-205-PUR	Timesmicrowave	TP105790008	09/2020	1 year
RF Cable	SFT-205-PUR	Timesmicrowave	473079-0001	09/2020	1 year
Dual DC Power Supply	CPX400DP	TTi	376596	05/2020	1 year
Dual DC Power Supply	CPX400D	TTi	482828	10/2020	1 year
DataLogger T/UR	HL-1D	Rotronic	A18012240	07/2020	1 year
LIN Optical Converter	090	EMC TOOLS	080276	-	-
LIN Optical Converter	090	EMC TOOLS	080277	-	-
HS-CAN Optical Converter	050	EMC TOOLS	040395	-	-
HS-CAN Optical Converter	050	EMC TOOLS	040383	-	-
Multi-Device Controller	2090	ETS-Lindgren	81311	-	-
Antenna Mast	2175	ETS-Lindgren	136028	-	-
Accessory for azimut antenna control	EL088916	Emilab	-	-	-
SAC3 – DC Filter	N6006	ETS-Lindgren	202031	-	-
Semi-Anechoic Chamber	-	ETS-Lindgren	5207	06/2020 04/2020 (verification)	3 years 1 year

8.1.1 Apparecchiature ausiliarie / *Auxiliary Equipment* – Spurious Radiated Emissions and Restricted Bands of Operation

Apparecchiature /Equipment	*Modello/Model*	*Costruttore/ Manufacturer*	*Numero di serie/ Serial Number*	Data calibrazione/ *Calibration date*	Intervallo / *Interval*
Comb Generator	CG-515	COM-POWER	19104	-	-
Loop Antenna	ALR25M	Electro-Metrics	813	-	-
Signal Generator	MG3693A	Anritsu	040614	10/2020	1 year
RF Cable	SKBL-2M-LOW	Mini-Circuits	1101189	09/2020	1 year
Broadband Horn Antenna	JXTXLB-20245	A-INFOMW	J2031090818001	01/2021	1 year

8.2 Fotografie del setup / *Photo of the test setup* – Spurious Radiated Emissions and Restricted Bands of Operation



8.3 Requisiti / *Requirements* – Radiated Emissions

FCC Section 15.205

(a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

Frequency (MHz)
…
2310 - 2390
2483.5 - 2500
…

FCC Section 5.209

(a) Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	30
30-88	100**	3
88-216	150**	3
216-960	200**	3
Above 960	500	3

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

(b) In the emission table above, the tighter limit applies at the band edges.
(c) The level of any unwanted emissions from an intentional radiator operating under these general provisions shall not exceed the level of the fundamental emission. For intentional radiators which operate under the provisions of other sections within this part and which are required to reduce their unwanted emissions to the limits specified in this table, the limits in this table are based on the frequency of the unwanted emission and not the fundamental frequency. However, the level of any unwanted emissions shall not exceed the level of the fundamental frequency.
(d) The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.

FCC Section 5.247

(d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

8.4 Risultati / *Results* – Spurious Radiated Emissions and Restricted Bands of Operation

The result of the test is: **PASS**.
See the details in the charts/tables of the following paragraphs.

Level of maximum spurious detected:

Frequency (MHz)	Instrument Reading QP (dBµV)	Cables Correction Factors (dB)	Attenuator Correction Factor (dB)	Antenna Correction Factor (dBµV/m)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Azimuth (deg)	Result
337.980000	13.0	2.6	5.9	14.0	35.5	46.0	-10.5	100.0	69.0	Pass

Frequency (MHz)	Instrument Reading CAv (dBµV)	Cables Correction Factors (dB)	Antenna Correction Factor (dBµV/m)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Azimuth (deg)	Result
1650.000000	**7.3**	3.9	**29.0**	**40.2**	**54.0**	**-13.8**	**343.0**	**173.0**	**Pass**

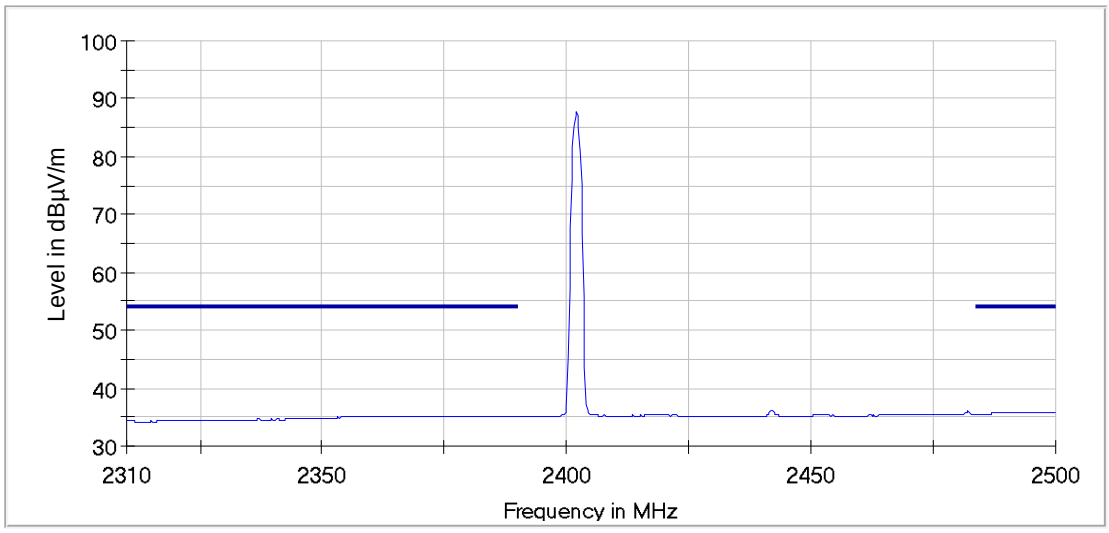
8.4.1 Tabelle e grafici dei risultati / *Tables and graphical representation data* – Spurious Radiated Emissions and Restricted Bands of Operation

8.4.1.1 Restricted Bands of Operation – Spurious Radiated Emissions and Restricted Bands of Operation

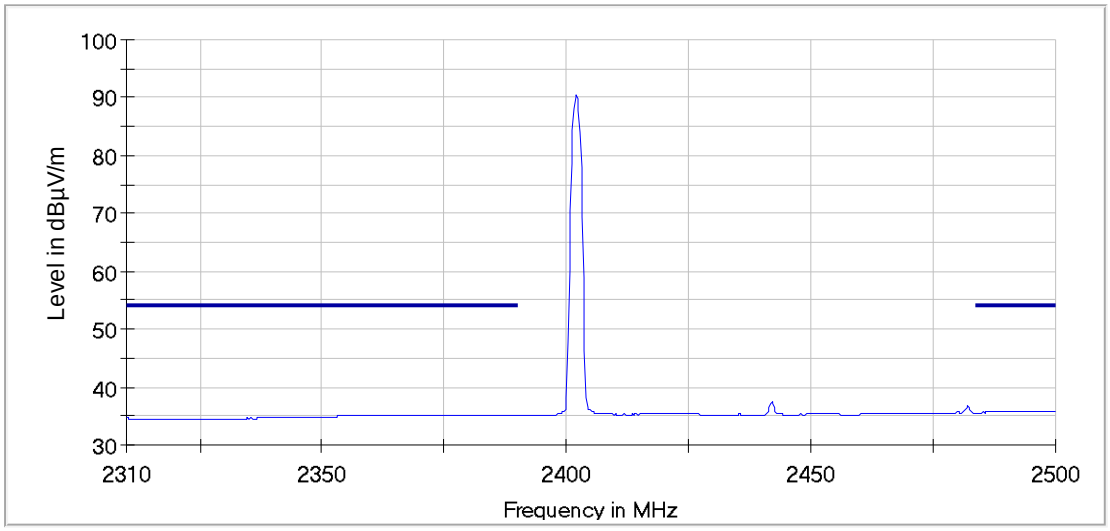
Measures executed on BT (DSS) active on CHIP 1 (Phones)

Channel Frequency: 2402 MHz, (8DPSK) Data Rate: 3Mbps

Radiated emissions measured from 2.31GHz to 2.5GHz. Average detector with IF=1MHz.
FCC section 15.209 Average Limit. Vertical polarization.

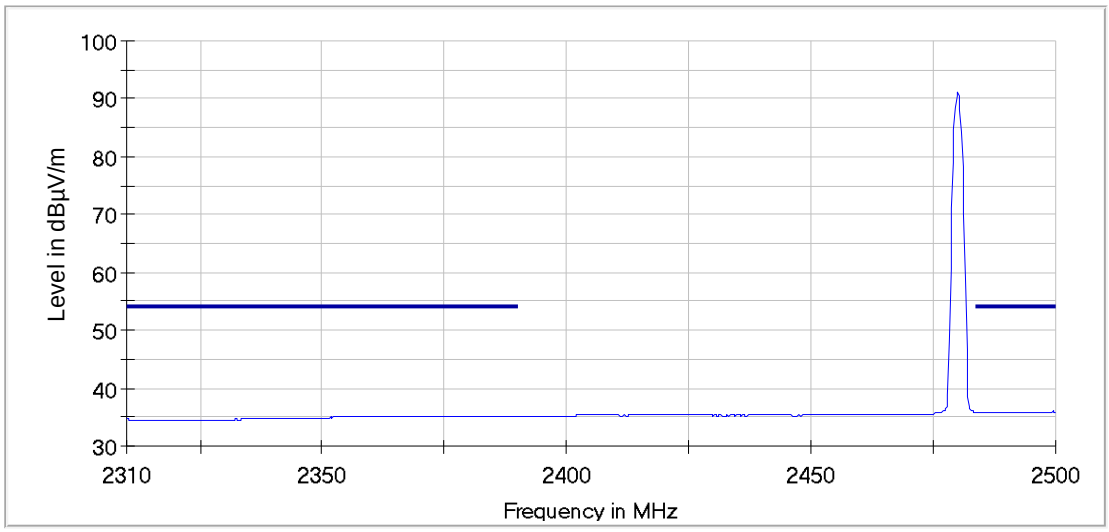


Radiated emissions measured from 2.31GHz to 2.5GHz. Average detector with IF=1MHz.
FCC section 15.209 Average Limit. Horizontal polarization.

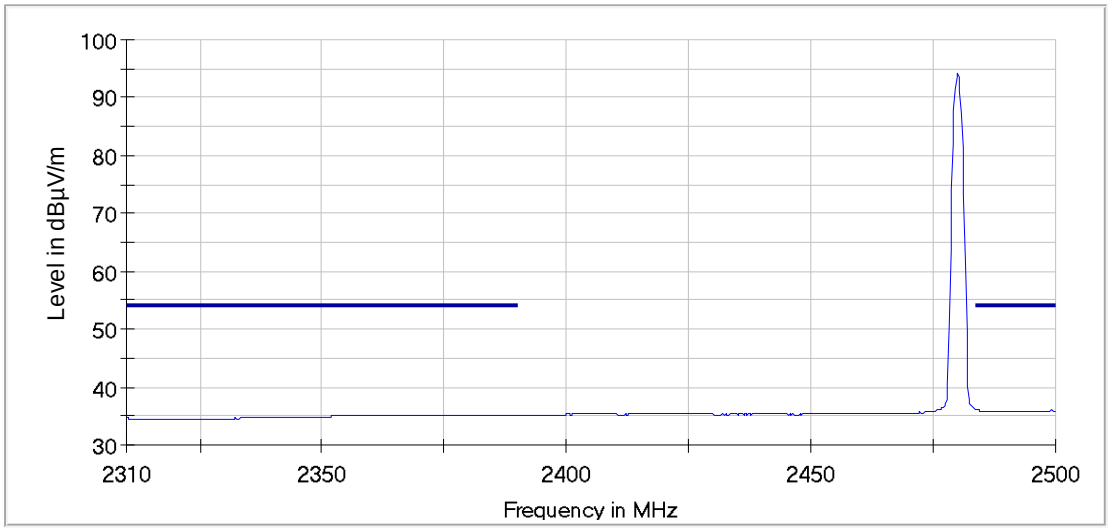


Channel Frequency: 2480 MHz, (8DPSK) Data Rate: 3Mbps

Radiated emissions measured from 2.31GHz to 2.5GHz. Average detector with IF=1MHz.
FCC section 15.209 Average Limit. Vertical polarization.



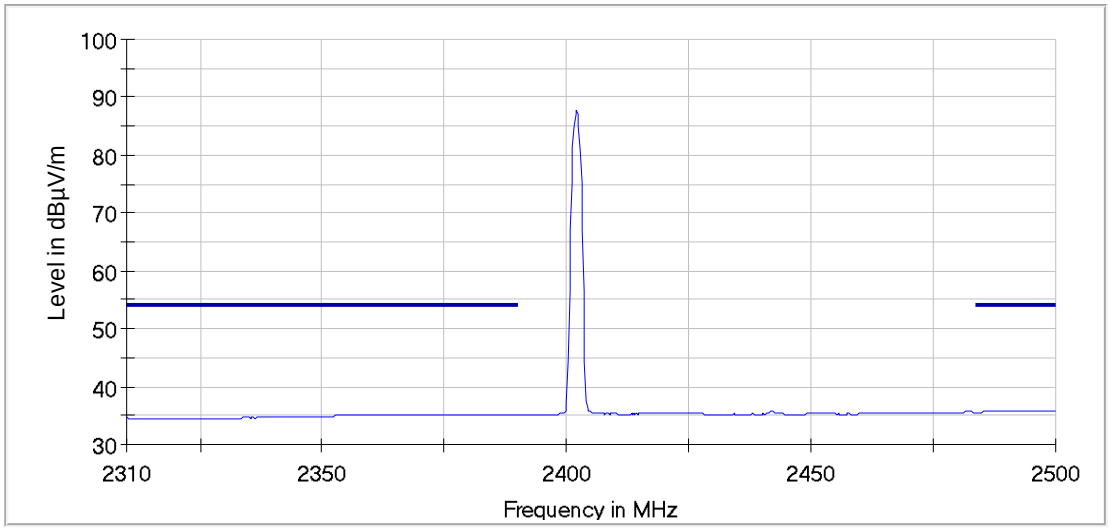
Radiated emissions measured from 2.31GHz to 2.5GHz. Average detector with IF=1MHz.
FCC section 15.209 Average Limit. Horizontal polarization.



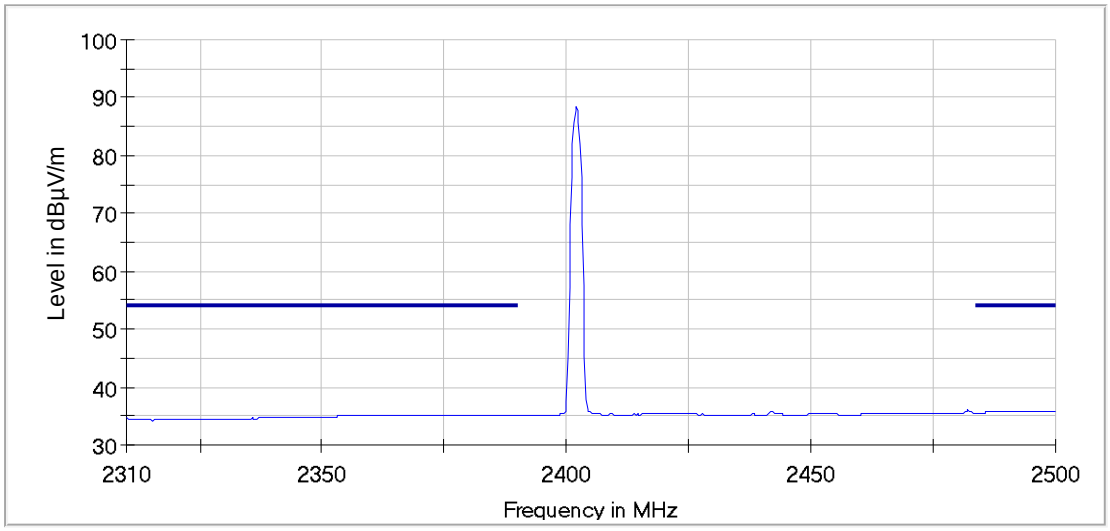
Measures executed on BT (DSS) active on CHIP 2 (Headsets)

Channel Frequency: 2402 MHz, (8DPSK) Data Rate: 3Mbps

Radiated emissions measured from 2.31GHz to 2.5GHz. Average detector with IF=1MHz.
FCC section 15.209 Average Limit. Vertical polarization.

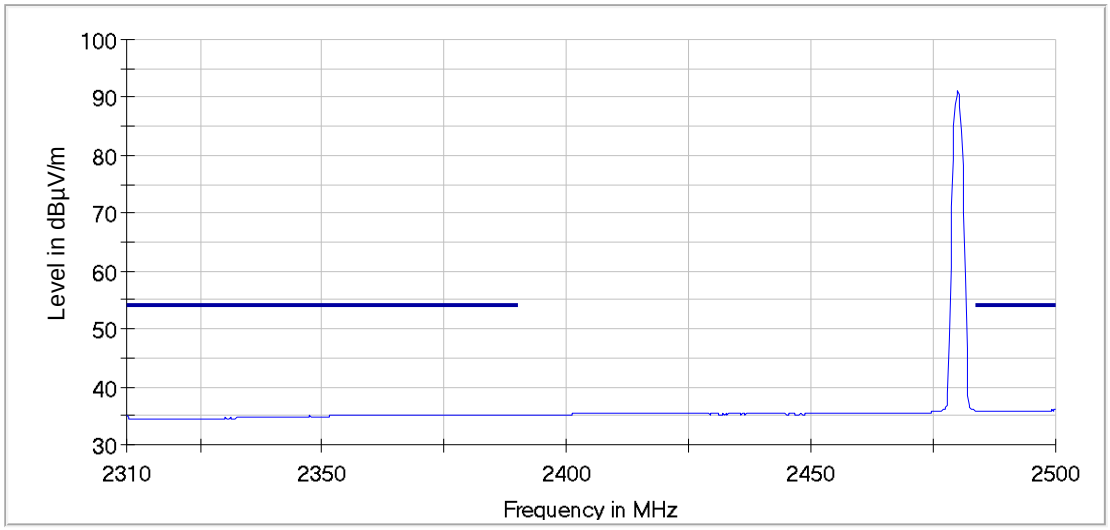


Radiated emissions measured from 2.31GHz to 2.5GHz. Average detector with IF=1MHz.
FCC section 15.209 Average Limit. Horizontal polarization.

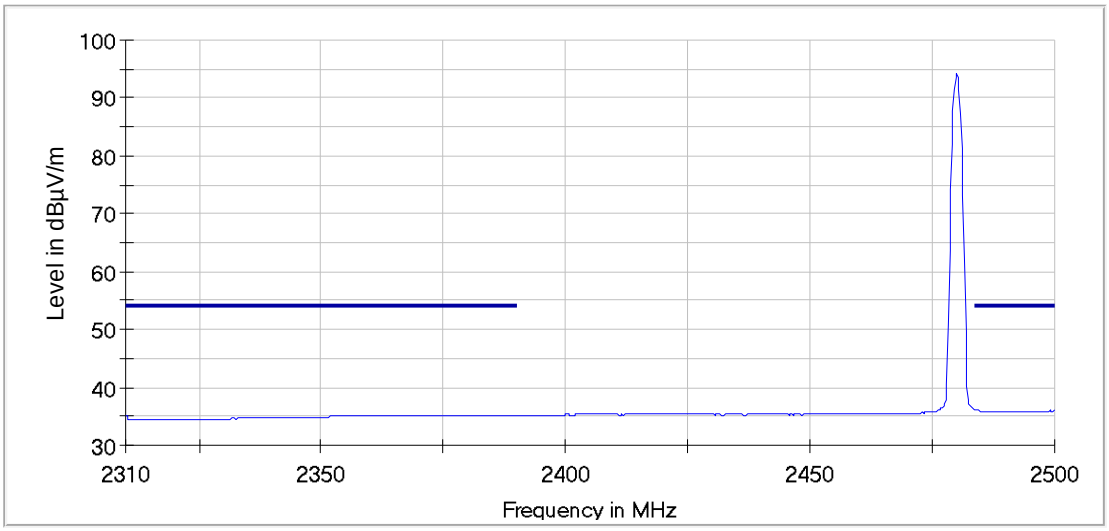


Channel Frequency: 2480 MHz, (π/4 DQPSK) Data Rate: 2Mbps

Radiated emissions measured from 2.31GHz to 2.5GHz. Average detector with IF=1MHz.
FCC section 15.209 Average Limit. Vertical polarization.



Radiated emissions measured from 2.31GHz to 2.5GHz. Average detector with IF=1MHz.
FCC section 15.209 Average Limit. Horizontal polarization.



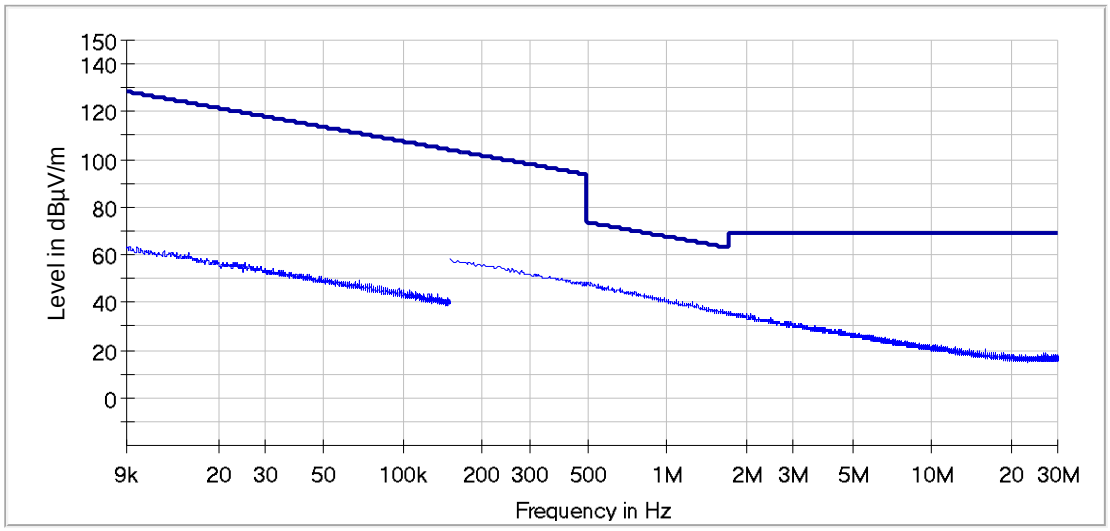
8.4.1.2 Spurious Radiated Emissions – Spurious Radiated Emissions and Restricted Bands of Operation

Measures from 9kHz to 30MHz

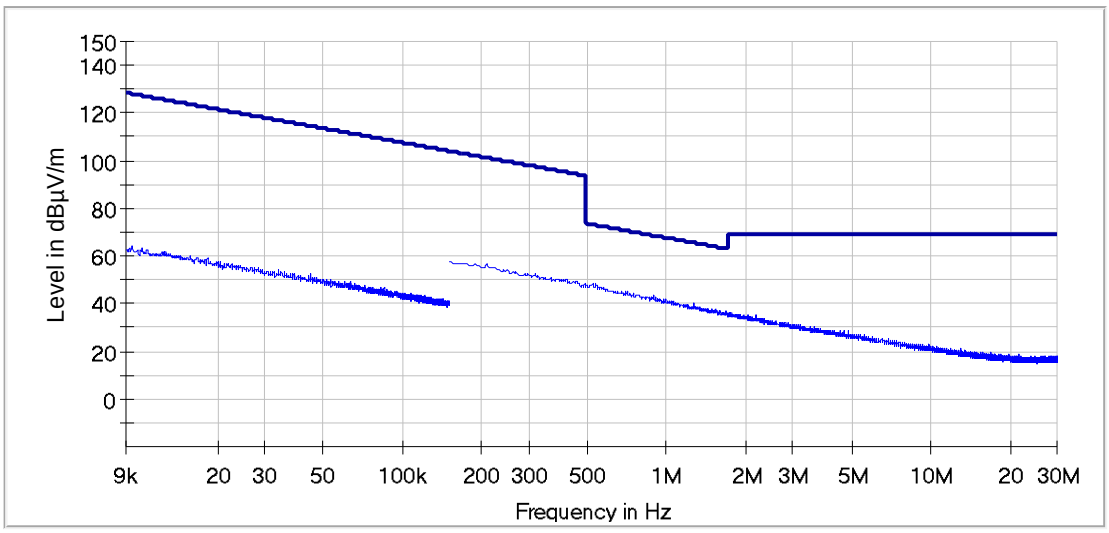
Noise Floor Measurements

Note: EUT switched OFF and auxiliary equipment (load box and optical converters) switched ON

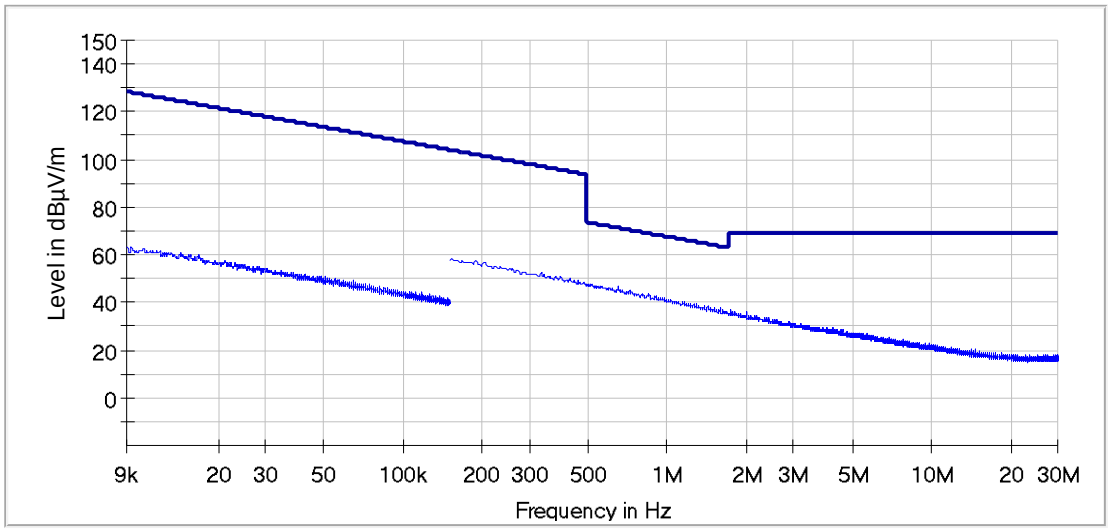
Noise floor measured from 9kHz to 30MHz. Peak detector with IF=200Hz from 9kHz to 150kHz and IF=9kHz from 150kHz to 30MHz. Q-Peak/Average limit. Measuring antenna on X axis.



Noise floor measured from 9kHz to 30MHz. Peak detector with IF=200Hz from 9kHz to 150kHz and IF=9kHz from 150kHz to 30MHz. Q-Peak/Average limit. Measuring antenna on Y axis.



Noise floor measured from 9kHz to 30MHz. Peak detector with IF=200Hz from 9kHz to 150kHz and IF=9kHz from 150kHz to 30MHz. Q-Peak/Average limit. Measuring antenna on Z axis.



EUT Emissions Measurements

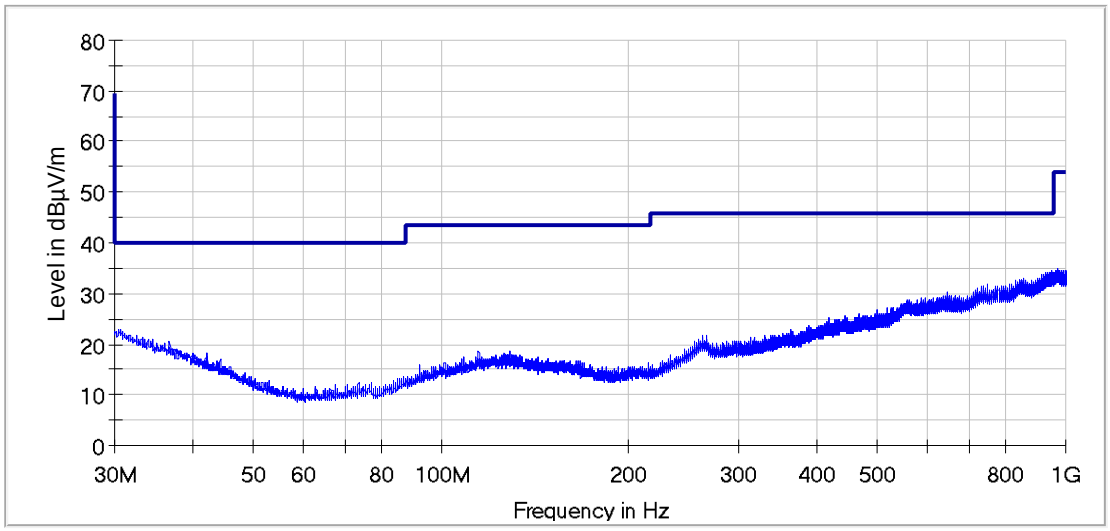
No emissions detected above noise level.

Measures from 1GHz to 10GHz

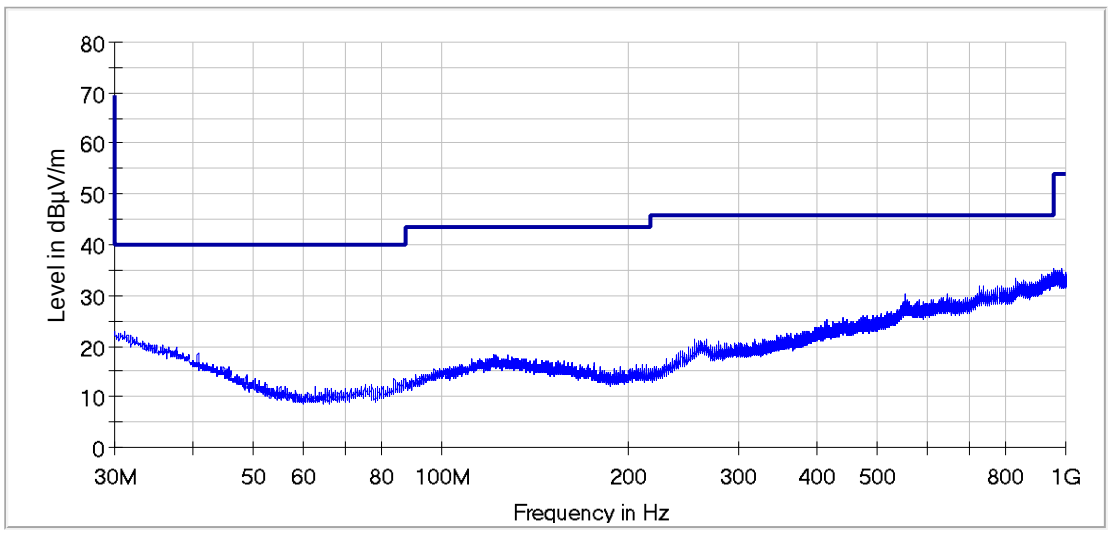
Noise Floor Measurements

Note: EUT switched OFF and auxiliary equipment (load box and optical converters) switched ON

Noise floor measured from 30MHz to 1GHz: Peak detector with IF 120kHz.
FCC section 15.209 Quasi-Peak Limit. Vertical polarization.

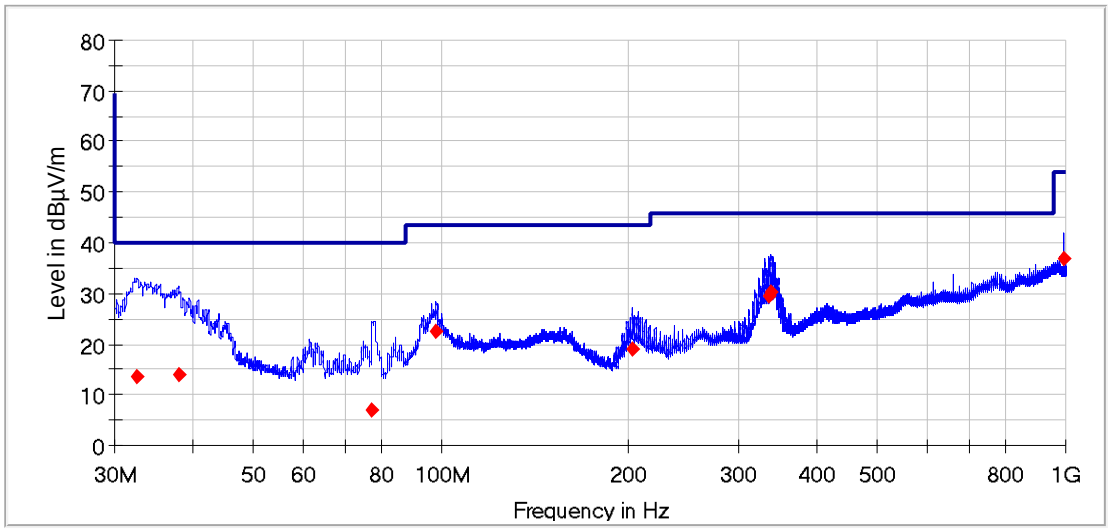


Noise floor measured from 30MHz to 1GHz: Peak detector with IF 120kHz.
FCC section 15.209 Quasi-Peak Limit. Horizontal polarization.



EUT Emissions Measurements

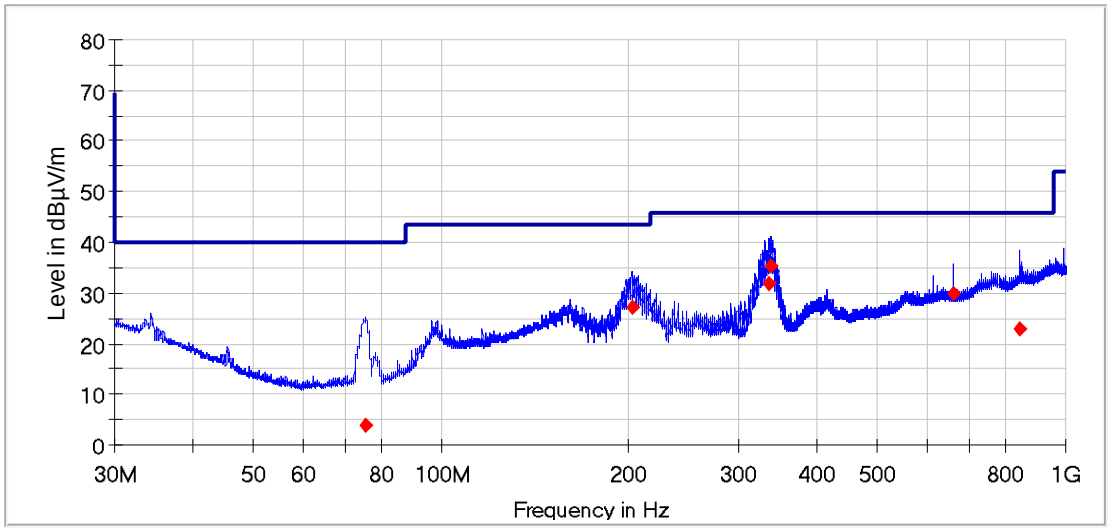
Radiated emissions measured from 30MHz to 1GHz: Peak detector with IF 120kHz.
FCC section 15.209 Quasi-Peak Limit. Vertical polarization.



Higher signals, maximized and re-measured with quasi-peak detector

Frequency (MHz)	Instrument Reading QP (dBµV)	Cables Correction Factors (dB)	Attenuator Correction Factor (dB)	Antenna Correction Factor (dBµV/m)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Azimuth (deg)	Result
32.610000	-10.6	0.4	5.9	18.0	13.7	40.0	-26.3	210.0	178.0	Pass
37.950000	-7.4	0.5	5.9	15.0	14.0	40.0	-26.0	120.0	161.0	Pass
77.520000	-6.9	1.1	5.9	7.0	7.1	40.0	-32.9	119.0	251.0	Pass
98.250000	5.1	1.3	5.9	10.0	22.3	43.5	-21.2	117.0	77.0	Pass
202.500000	2.1	2.0	5.9	9.0	19.0	43.5	-24.5	251.0	110.0	Pass
334.320000	7.3	2.4	5.9	14.0	29.6	46.0	-16.4	140.0	74.0	Pass
338.220000	7.9	2.6	5.9	14.0	30.4	46.0	-15.6	153.0	87.0	Pass
989.970000	2.1	3.9	5.9	25.0	36.9	54.0	-17.1	198.0	160.0	Pass

Radiated emissions measured from 30MHz to 1GHz: Peak detector with IF 120kHz.
FCC section 15.209 Quasi-Peak Limit. Horizontal polarization.



Higher signals, maximized and re-measured with quasi-peak detector

Frequency (MHz)	Instrument Reading QP (dBµV)	Cables Correction Factors (dB)	Attenuator Correction Factor (dB)	Antenna Correction Factor (dBµV/m)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Azimuth (deg)	Result
75.600000	-9.7	0.8	5.9	7.0	4.00	40.0	-36.0	169.0	76.0	Pass
202.410000	10.4	2.0	5.9	9.0	27.3	43.5	-16.2	197.0	46.0	Pass
334.020000	9.4	2.4	5.9	14.0	31.7	46.0	-14.3	100.0	77.0	Pass
337.980000	13.0	2.6	5.9	14.0	35.5	46.0	-10.5	100.0	69.0	Pass
660.000000	0.0	4.0	5.9	20.0	29.9	46.0	-16.1	241.0	210.0	Pass
842.760000	-10.2	4.4	5.9	23.0	23.1	46.0	-22.9	394.0	254.0	Pass

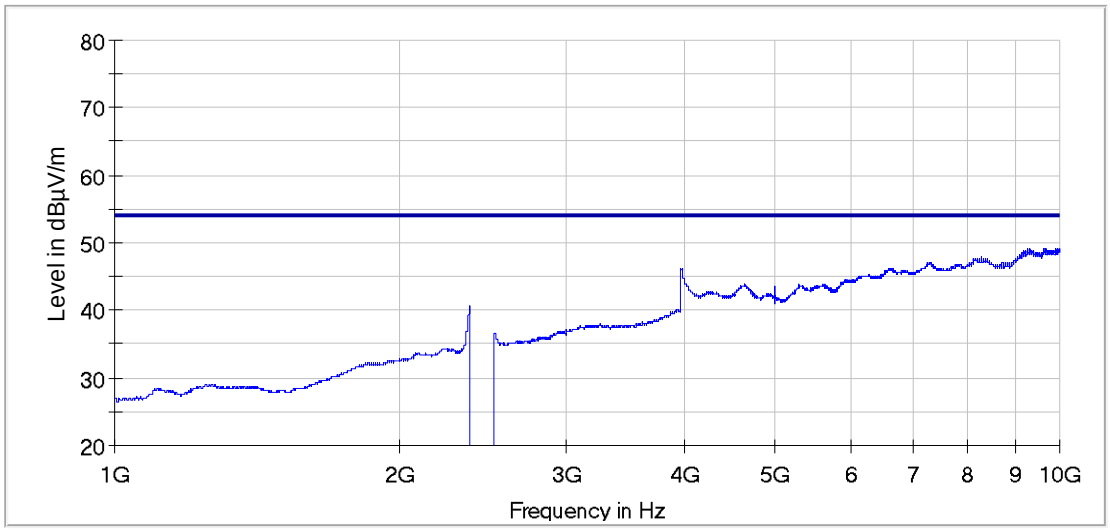
Measures from 1GHz to 10GHz

Noise Floor Measurements

Note: EUT switched OFF and auxiliary equipment (load box and optical converters) switched ON

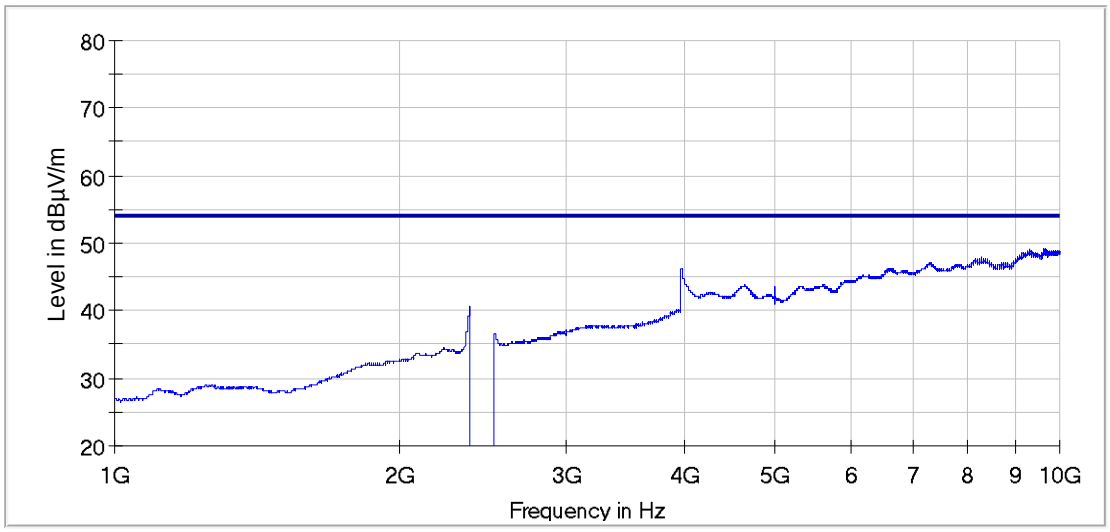
Noise floor measured from 1GHz to 10GHz: Average detector with IF 1MHz.
FCC section 15.209 Average Limit. Vertical polarization.

Note: EMI receiver internal notch filter from 2400MHz to 2483.5MHz.



Noise floor measured from 1GHz to 10GHz: Average detector with IF 1MHz.
FCC section 15.209 Average Limit. Horizontal polarization.

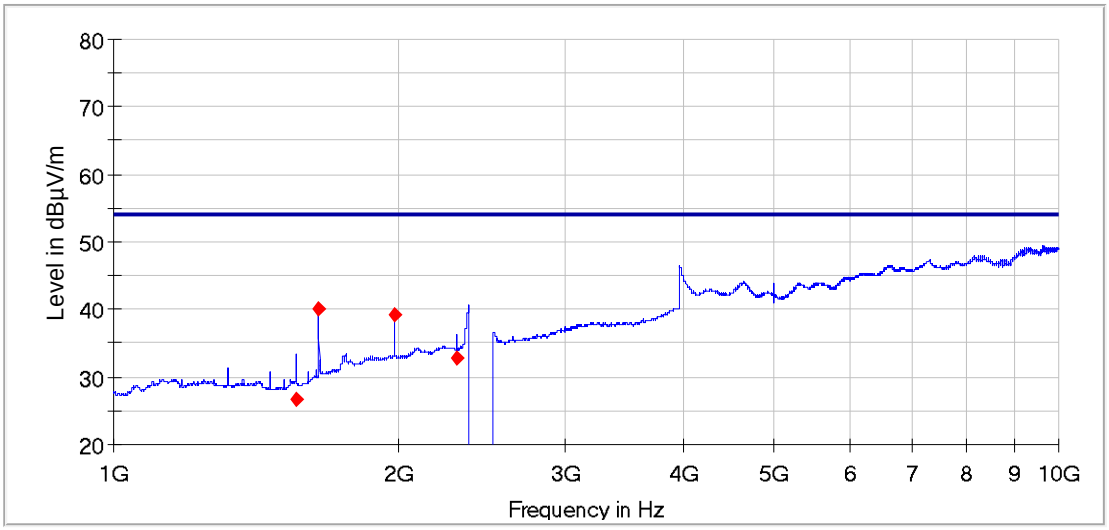
Note: EMI receiver internal notch filter from 2400MHz to 2483.5MHz.



EUT Emissions Measurements

Radiated emissions measured from 1GHz to 10GHz: Average detector with IF 1MHz.
FCC section 15.209 Average Limit. Vertical polarization.

Note: EMI receiver internal notch filter from 2400MHz to 2483.5MHz.

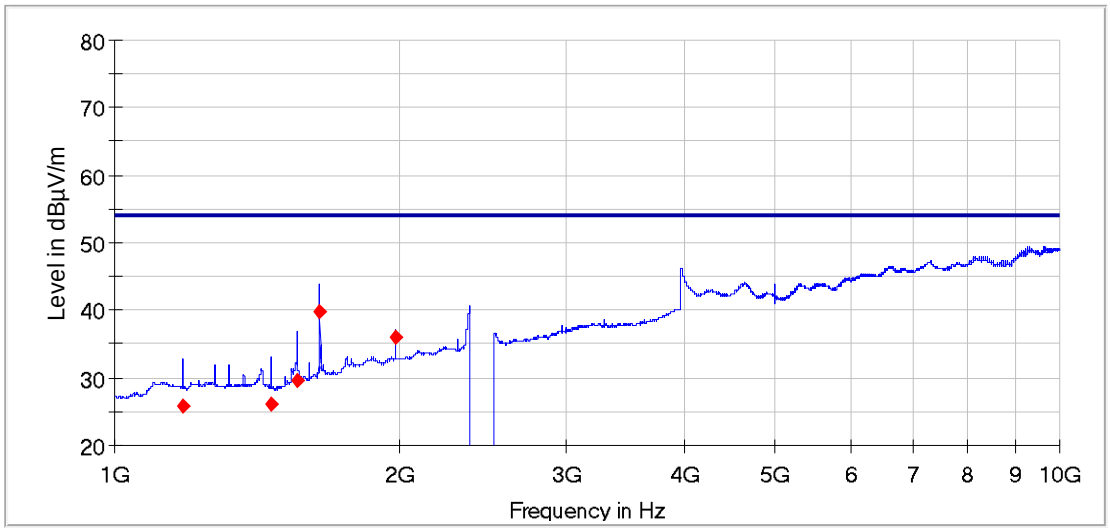


Higher signals, maximized and re-measured with CISPR-Average detector

Frequency (MHz)	Instrument Reading CAv (dBµV)	Cables Correction Factors (dB)	Antenna Correction Factor (dBµV/m)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Azimuth (deg)	Result
1559.500000	**-5.2**	4.0	**28.0**	**26.8**	**54.0**	**-27.2**	**390.0**	**204.0**	**Pass**
1650.000000	**7.3**	3.9	**29.0**	**40.2**	**54.0**	**-13.8**	**343.0**	**173.0**	**Pass**
1980.000000	**3.2**	4.9	**31.0**	**39.1**	**54.0**	**-14.9**	**197.0**	**170.0**	**Pass**
2310.000000	**-4.1**	4.8	**32.0**	**32.7**	**54.0**	**-21.3**	**230.0**	**201.0**	**Pass**

Radiated emissions measured from 1GHz to 10GHz: Average detector with IF 1MHz.
FCC section 15.209 Average Limit. Horizontal polarization.

Note: EMI receiver internal notch filter from 2400MHz to 2483.5MHz.



Higher signals, maximized and re-measured with CISPR-Average detector

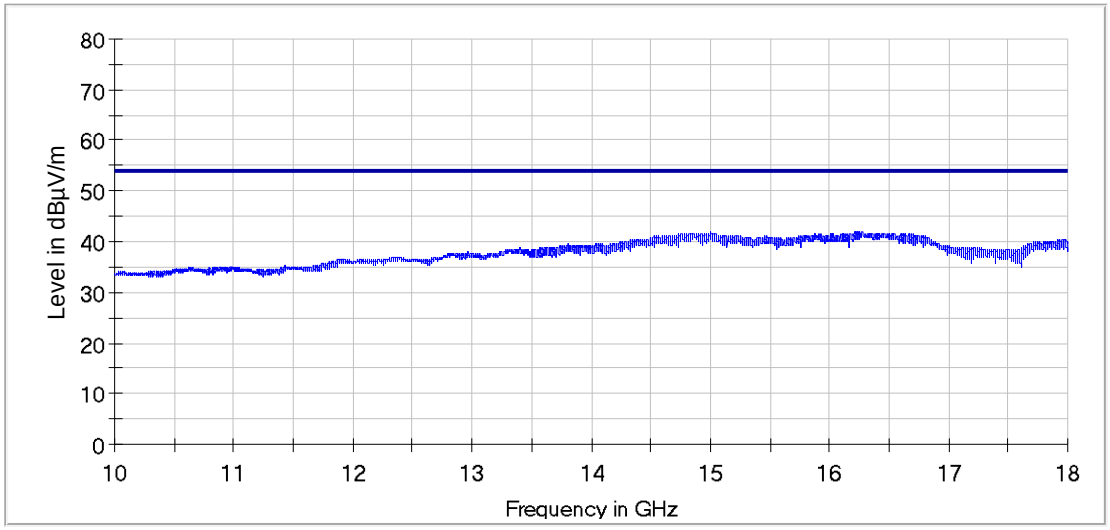
Frequency (MHz)	Instrument Reading CAv (dBµV)	Cables Correction Factors (dB)	Antenna Correction Factor (dBµV/m)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Azimuth (deg)	Result
1181.500000	-5.9	3.6	28.0	25.7	54.0	-28.3	268.0	194.0	Pass
1465.000000	-5.4	3.6	28.0	26.2	54.0	-27.8	340.0	163.0	Pass
1559.750000	-2.4	4.0	28.0	29.6	54.0	-24.4	209.0	169.0	Pass
1650.000000	7.0	3.9	29.0	39.9	54.0	-14.1	226.0	208.0	Pass
1980.000000	0.3	4.9	31.0	36.2	54.0	-17.8	184.0	199.0	Pass

Measures from 10GHz to 18GHz

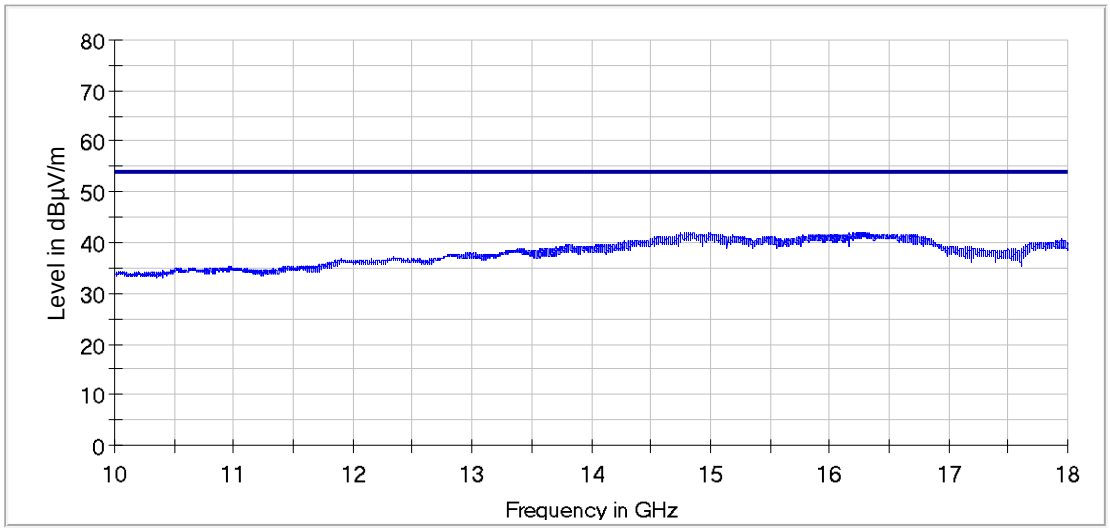
EUT Emissions Measurements

Note: EUT switched OFF and auxiliary equipment (load box and optical converters) switched ON

Noise floor measured from 10GHz to 18GHz: Average detector with IF 1MHz.
FCC section 15.209 Average Limit. Vertical polarization.

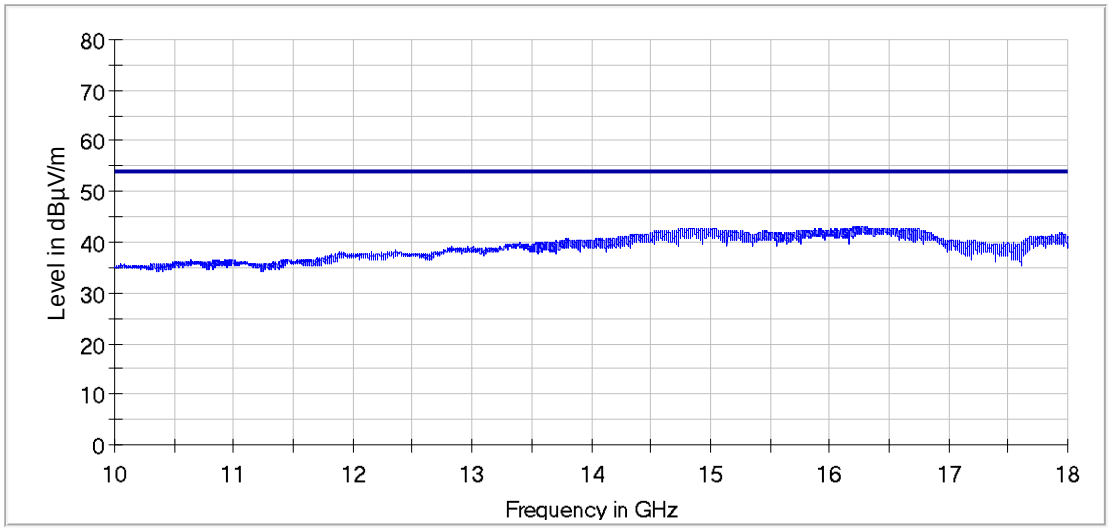


Noise floor measured from 10GHz to 18GHz: Average detector with IF 1MHz.
FCC section 15.209 Average Limit. Horizontal polarization.

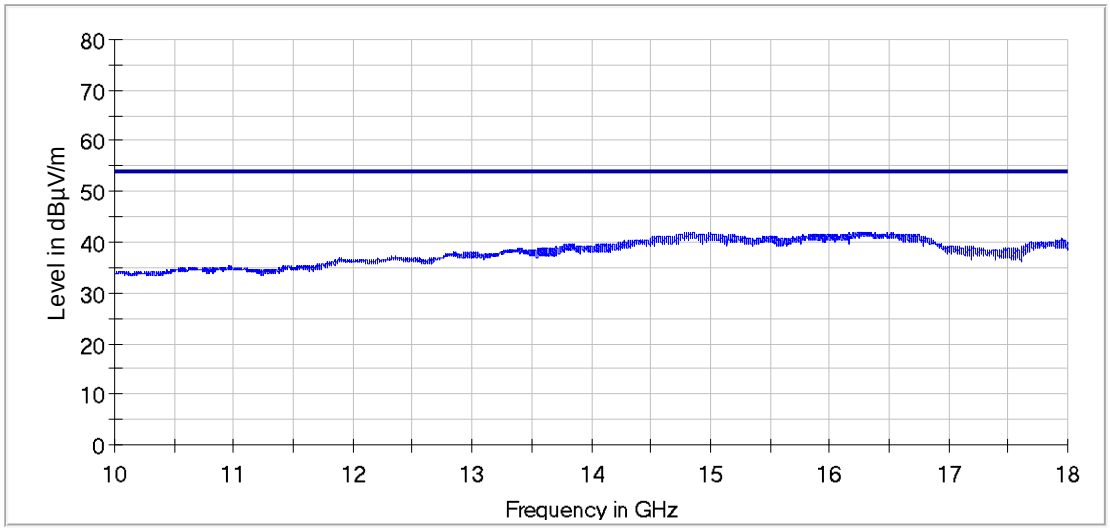


EUT Emissions Measurements

Radiated emissions measured from 10GHz to 18GHz: Average detector with IF 1MHz.
FCC section 15.209 Average Limit. Vertical polarization.



Radiated emissions measured from 10GHz to 18GHz: Average detector with IF 1MHz.
FCC section 15.209 Average Limit. Horizontal polarization.

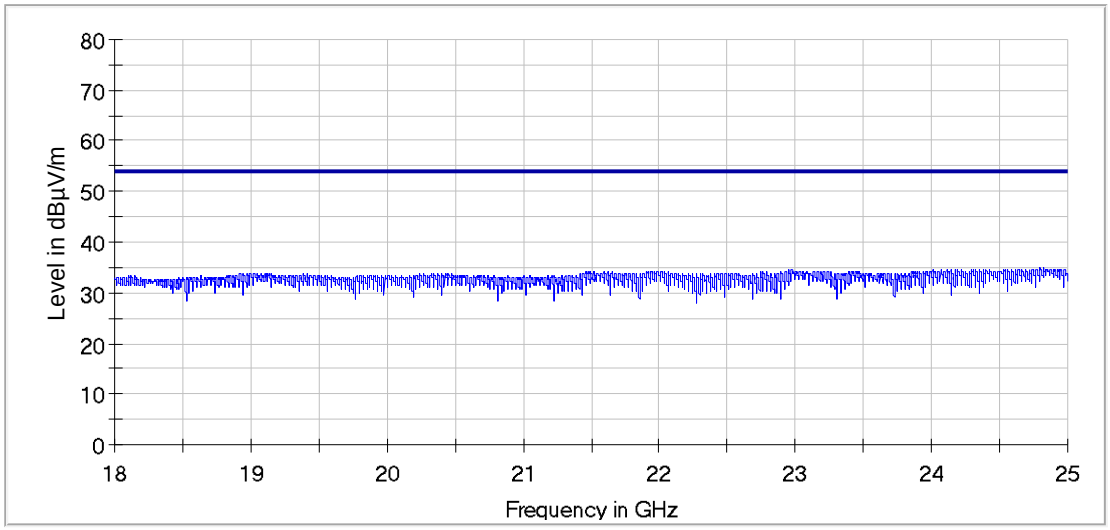


Measures from 18GHz to 25GHz

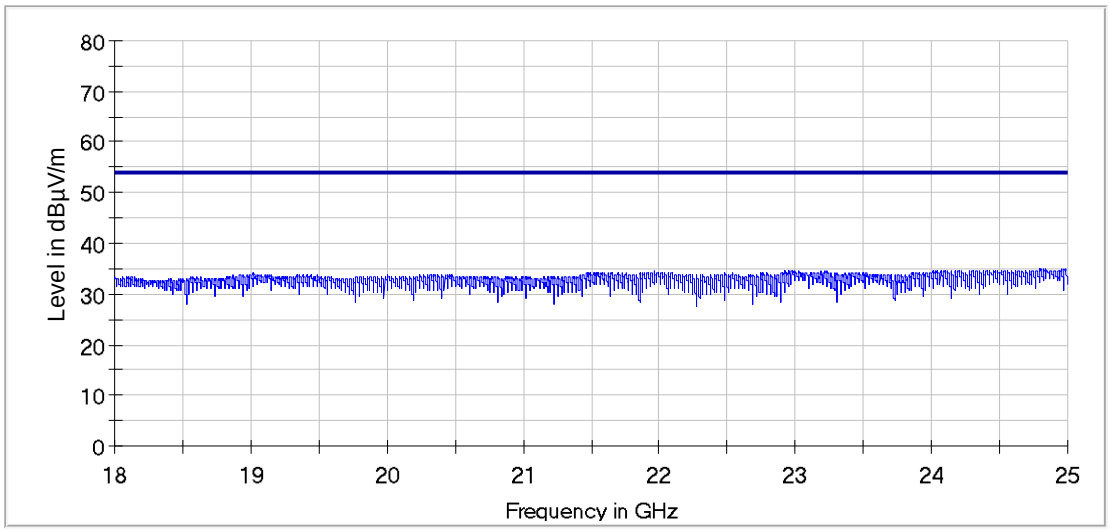
EUT Emissions Measurements

Note: EUT switched OFF and auxiliary equipment (load box and optical converters) switched ON

Noise floor measured from 18GHz to 25GHz: Average detector with IF 1MHz.
FCC section 15.209 Average Limit. Vertical polarization.

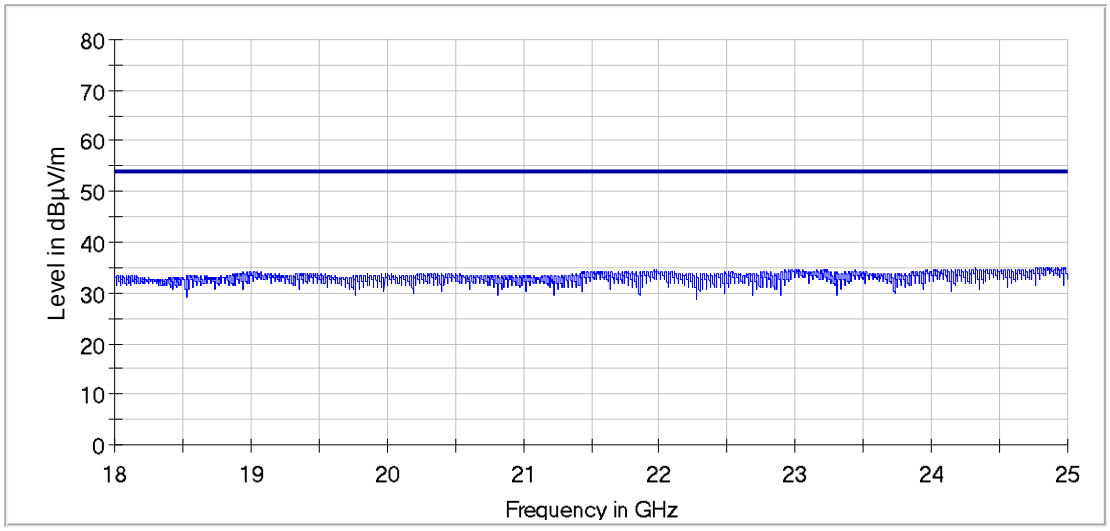


Noise floor measured from 18GHz to 25GHz: Average detector with IF 1MHz.
FCC section 15.209 Average Limit. Horizontal polarization.

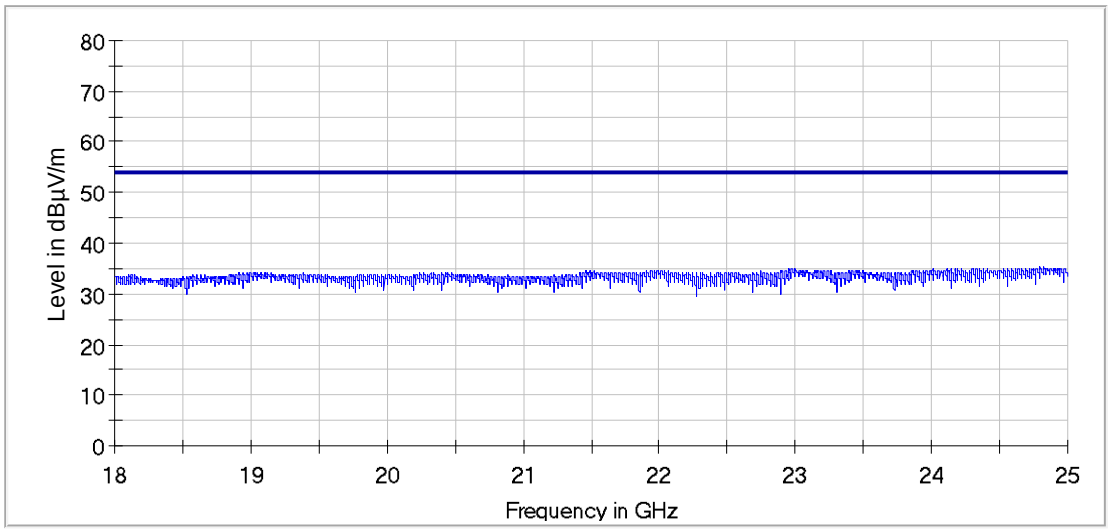


EUT Emissions Measurements

Radiated emissions measured from 18GHz to 25GHz: Average detector with IF 1MHz.
FCC section 15.209 Average Limit. Vertical polarization.



Radiated emissions measured from 18GHz to 25GHz: Average detector with IF 1MHz.
FCC section 15.209 Average Limit. Horizontal polarization.



9.0 Antenna requirement – Condizioni di prova / *Test Conditions*

Technician / Tecnico: Loris Fruch			
Table No.	TEST: Antenna Requirement, Section 15.203		\
Method	/		\
Parameters required prior to the test		Laboratory Ambient Temperature	18 to 28 °C
		Relative Humidity	20 to 90 %
Parameters recorded during the test		Laboratory Ambient Temperature	/
		Relative Humidity	/
Supplementary information: since this product has permanent integrated antennas (see par. 1.11.5 of the applicable cited Test Plan), then it fulfills the requirement of this section.			

10.0 Conducted emission – Condizioni di prova / *Test Conditions*

Technician / Tecnico: /			
Table No.	TEST: AC Power Line Conducted Emissions, Section 15.207		\
Method	/		\
Parameters required prior to the test		Laboratory Ambient Temperature	18 to 28 °C
		Relative Humidity	20 to 90 %
Parameters recorded during the test		Laboratory Ambient Temperature	/
		Relative Humidity	/
Fully configured sample scanned over the following frequency range		150kHz to 30MHz	
Supplementary information: this test is not applicable since the EUT is battery powered.			

Allegato 1 / Annex 1: Incertezza / *Uncertainty*

A.1.1 Measurement of Environmental parameters

Temperature: ±1°C
RH: ±4%

A.1.2 Radio test

Conducted output power: **±2.1 dB**

Conducted adjacent channel power: **± 1.6 dB**

Conducted Bandwidth: **± 2.1 kHz (Span=3MHz, RBW=30kHz, 10000pti)**

Conducted spurious emission: **± 3.7 dB**

A.1.3 Radiated Spurious Emissions: FCC

From 9kHz to 30MHz using Loop antenna
Field intensity: **+/- 4.2 dB**

From 30MHz to 200MHz using Bilog antenna
Field intensity: **+/- 5.5 dB**

From 200MHz to 1000MHz using Bilog antenna
Field intensity: **+/- 4.4 dB**

From 1GHz to 12GHz using Horn antenna[1]
Field intensity: **+/- 5.8 dB**

From 12GHz to 18GHz using Horn antenna
Field intensity: **+/- 5.95 dB**

From 18GHz to 26GHz using Horn antenna (ANSI C63.4, ANSI C63.10)
Field intensity: **+/- 6.2 dB**

[1]