Datasheet

for

SBM.0106

2.4GHz communication module

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Contents

Figures

Tables

1 Document info

1.1 Document scope

This document provides the technical description of the SBM.0106 communication module from RTX A/S . It is intended as the technical documentation that accompanies the delivery of the SBM.0106 modules. The module operates in the 2.4GHz frequency band and are delivered with a standard RTX production test software. Customized firmware for specific applications must be specified separately. The target readers of this document are customer system engineers, system architects, and component selection decision makers.

1.2 References

Readers of this document may find additional information and supportive specifications in the following documents.

Reference	Name
1	DA14195 datasheet from Dialog Semiconductor (NDA may apply)
2	nRF52810 datasheet from Nordic Semiconductor (NDA may apply)
3	PSU guideline – RTX1290 2.4GHz communication module

1.3 Terms and abbreviations

Abbreviation	Description
ADC	Analog to Digital Converter
ARM	Advanced RISC Machine
BOM	Bill of Material
BPF	Band Pass Filter
CELT	Constrained Energy Lapped Transform
DC	Direct Current
DMA	Direct Memory Access
DNC	Do not connect
DSP	Digital Signal Processor
EIRP	Effective Isotropic Radiated Power
EMC	Electromagnetic Compatibility
ETSI	European Telecommunications Standards Institute
GND	Ground
GPIO	General Purpose Input/Output
I/O	Input/Output
LED	Light Emitting Diode
LGA	Land Grid Array
MAC	Media Access Control
NC	Not connected
NDA	Non-Disclosure Agreement
nRF	Nordic radio chip
PAEC	Perceptual Acoustic Echo Cancellation
PA VCC	Power Amplifier Voltage Common Collector
PCB	Printed Circuit Board without Components
PCM	Pulse Code Modulation
PDM	Pulse Density Modulation
PHY	Physical Layer
PON	Power on
PSRR	Power Supply Rejection Ratio
PSU	Power Supply
REACH	Registration, Evaluation, Authorization and Restriction of Chemical substances
RF	Radio Frequency
RISC	Reduced Instruction Set Computer

Abbreviation	Description
RoHS	Restriction of Hazardous Substances
RTX1090	Product name of the RTX 1.9GHz DECT module
RTX1290	Product name of the RTX 2.4GHz module
RX	Receive or receiver
SPI	Serial Peripheral Interface
TCE	Exponential temperature coefficient
TX	Transmit or transmitter
UART	Universal Asynchronous Receive and Transmit
USB	Universal Serial Bus
USBN	Negative USB Data Pin
USBP	Positive USB Data Pin
VBAT	Input for fixed and battery supplies
VBUS	Input for USB supplies
VDC	Voltage, direct current
VDD	Voltage Drain with reference to GND
VSUPPLY	Internal linear regulator generating 3.45V, sourcing from VBAT or VBUS

1.4 Document history

Revision	Author	Issue date	Comments
1.0	RAF	30-Oct-2019	First published version
1.1	STL	26-Nov-2019	Added note regarding VDDIO_2 and P2_11 Corrected some formatting of text and heading Added term to table 2 Updated pin types for some pins
1.2	STL	05-Dec-2019	Added charge current to table 5
1.3	LKN	17-Dec-2019	Corrected E1/G1 pin description
1.4	BKI	24-Mar-2020	New template
1.5	STL	23-Apr-2020	Corrected some typos regarding mechanical and electrical specification, and PSU guideline – RTX1290 2.4GHz communication module has been added as a ref. doc.
1.6	LKN	14-Aug-2020	Added comments regarding 3V3 output voltage
1.7	PBB / BKI	18-Jun-2021	Added reset state for each pin
1.8	TBJ / BKI	08-Oct-2021	Added figure showing module feed direction from reel
1.9	TBJ / BKI	13-Jan-2022	Updated figure 8

2 Concept

The S BM.0106 enables product vendors to develop high-performance, digital, end-to-end wireless solutions without having an extensive knowledge of 2.4 GHz radio frequency technology. The SBM.0106 has been created with the objective of supporting use cases for portable professional and semi-professional audio devices - primarily within the product domains of wireless microphones, instruments, and DJ accessories.

The SBM.0106 not only supports excellent digital audio handling, but also provides the foundation for an extremely robust radio. Thus, the SBM.0106 supports antenna diversity and typical RTX firmware solutions for the above - mentioned use cases, it also supports channel diversity and retransmission schemes. The RF output power is adjustable to accommodate sub 10dBm EIRP certification requirement on the final product. The ordering part number for SBM.0106 is 95104600.

2.1 SBM.0106 module family

The SBM.0106 2.4GHz radio module is member of the RTX communication module portfolio and is designed to allow easy migration to and from the SBM.0106 1.9GHz DECT module. The easy migration path allows designing products for DECT and 2.4GHz domains with relatively low development efforts.

2.2 Module description

The SBM.0106 is a 2.4GHz module based on a Dialog Semiconductor DA14195 audio processor and a Nordic nRF52 radio chip. The module offers full DA14195 feature set and requires only a motherboard with antenna(s) and power supply in its basic form. Please note that the SBM.0106 module only provides digital audio interfaces, and hence, if an analog audio interface is required, a hardware codec and analog circuits need to be added to the motherboard as well.

Most of the DA14195 functional pins are connected to a module board contact point. The contact points are placed at the bottom of the module, using LGA technology. The module is delivered with the necessary parameters tested and calibrated.

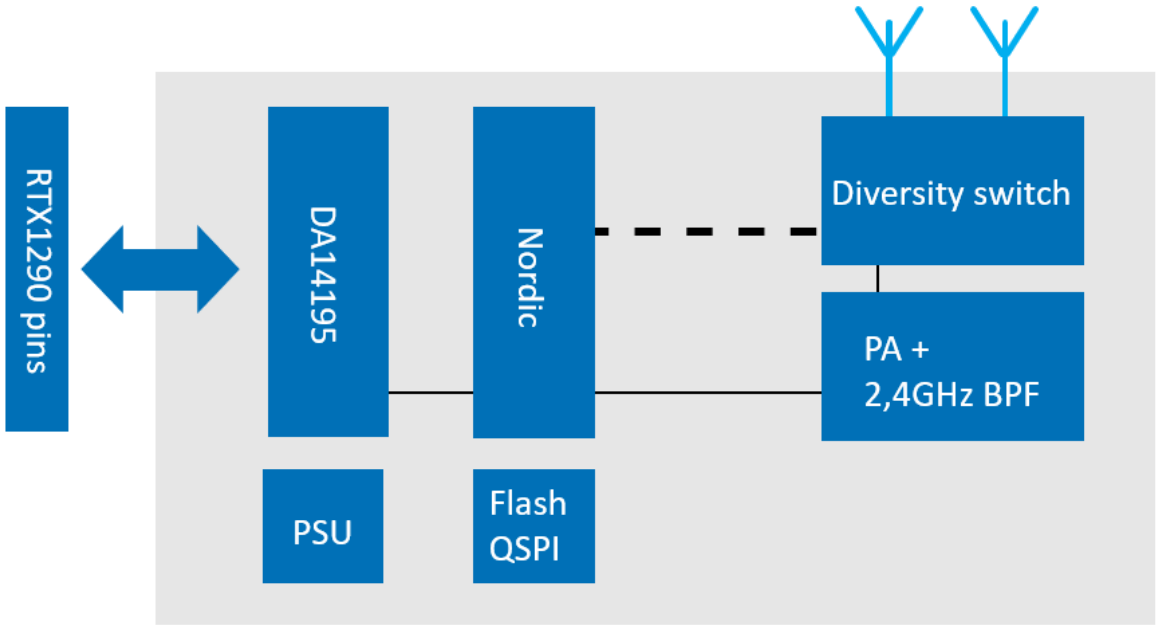


Figure 1: RTX1290 module block diagram

This document describes module pin out, pin description, electrical specifications, mechanical specifications, labeling, and packaging.

3 Module features

The SBM.0106 module features a small footprint with fully integrated radio transceiver with RF power amplifier, antenna diversity, baseband processor, and DSP for 2.4GHz based audio applications. The RTX1290 module is based on the Dialog Semiconductor DA14195 CMOS IC, the Nordic nRF52 radio chip, and an RF Power Amplifier. The HW related key figures are listed below.

Feature list

- Complies with sub 10 dBm EIRP 2.4GHz worldwide standards
- Supported audio codec and audio features: G.726, G.722, CELT 4.0, PAEC 6.0, Sheersound™ along with other options via software customization
- Operating range:
    - Power supply
        - VBAT: 2.0 – 5.0VDC (typical battery supply)
        - VBUS: 4.2 – 5.75VDC (typical USB)
    - Ambient temperature: -20 – 60°C
- USB charge control for rechargeable battery (e.g., lithium-ion)

Analog interfaces

- 2 input 10-bit ADC, single ended/differential

Digital interfaces

- USB 2.0 HS[1]/FS device MAC/PHY with DMA
- 28 I/O pads with state retention and slope control
- Dual UART full duplex 9.6kBd to 812.5kBd with FIFO and DMA support
- Dual SPI interface 20.736 MHz (master/slave)
- I2C interface 100 kHz, 400 kHz, 1.152 MHz (master/slave)
- Dual PCM interface, M/S, 2 x 32 bits, 196 kHz, I2S
- Three stereo PDM I/O for digital microphones

Radio transceiver

- 2.4 GHz transceiver

Radio transmitter and protocol features

- Interference avoidance algorithms for avoiding interference from Wi-Fi and other 2.4GHz standards
- Antenna diversity
- Optional interference avoidance algorithms utilizing:
    - Dual slot diversity
    - Seamless bearer selection and handover
    - Retransmission of real-time data
- HW provides adjustable saturation power from +4.5dBm to 9.5dBm conducted power

Available program memory

- 32 Mbit flash

[1] USB 2.0 HS (High Speed) requires reservation of two GPIOs for USB impedance control.

4 Mechanical specification

The module is a rectangular PCB which is to be soldered onto a motherboard, using contact points at the bottom of the module PCB (i.e., the module employs LGA technology for the contact points). The component side of the module is covered by a shield, which is convenient for vacuum pick and place manufacturing equipment.

The module measures 15.4 x 21.6mm, and the module height is 2.60mm nom. (min: 2.20mm, max:2.84mm)[2]. The module has 88 contact points[3], each of which is made as a single solder point. The module does not have any buttons, LED, connectors, or a display.

The dimensions of the module are outlined in millimeters in the figure below. Please notice the three (3) guidance markings (two at the top of the module, and one at the bottom). Please refer to the footprint overview on the next page for dimensions and location of the soldering points.

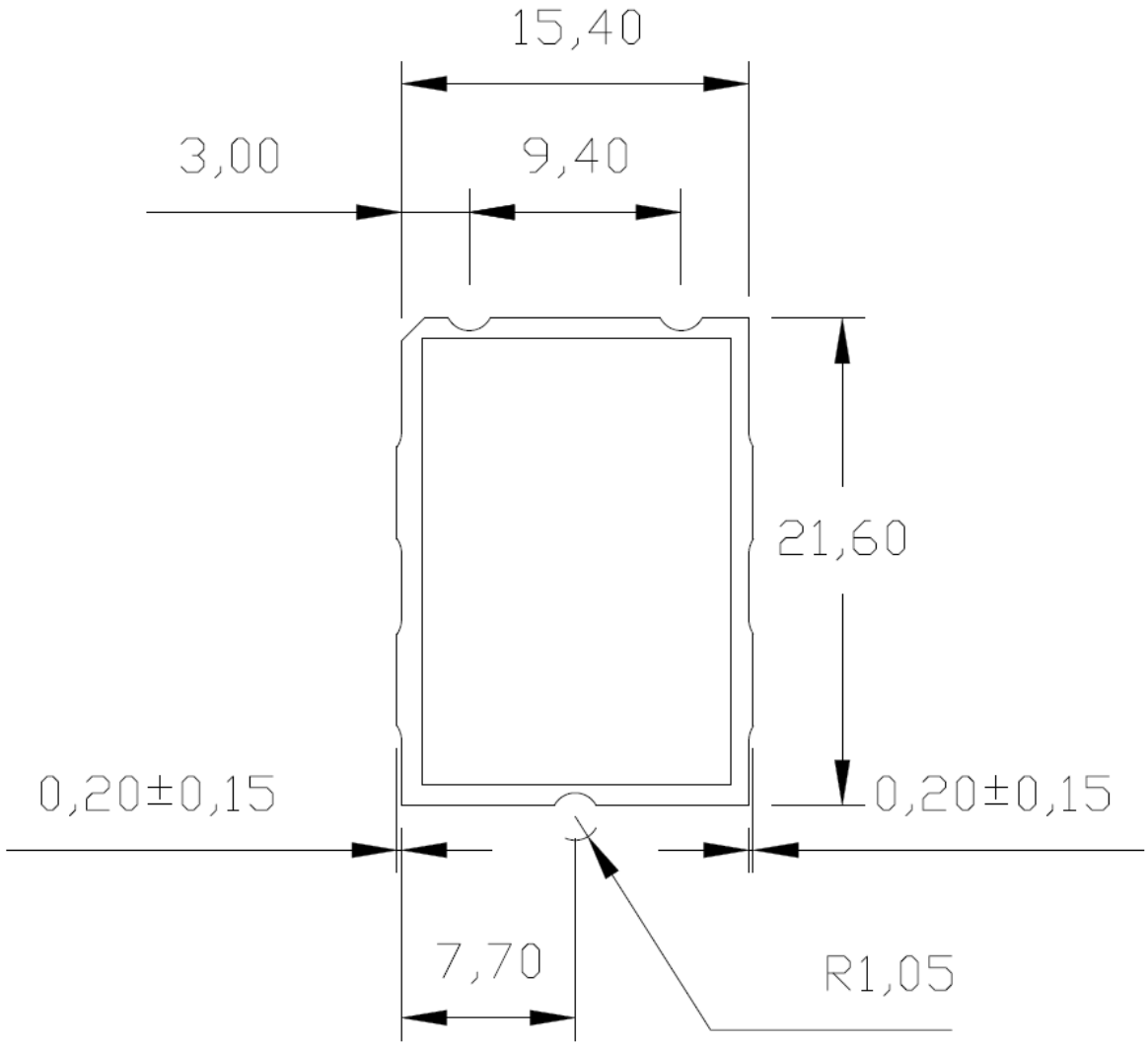


Figure 2: Module dimensions

[2] When the module is mounted on a carrier board, lift from the solder will elevate the module with typical 0.04mm. The elevation caused by soldering is included.
[3] The contact points are arranged in an 8x11 matrix structure as outlined in the module solder footprint, and the diameter of the pads is 0.8mm.

The module solder footprint (top view) including outlining of pin-numbering. The solder pad is 0.8mm in diameter:

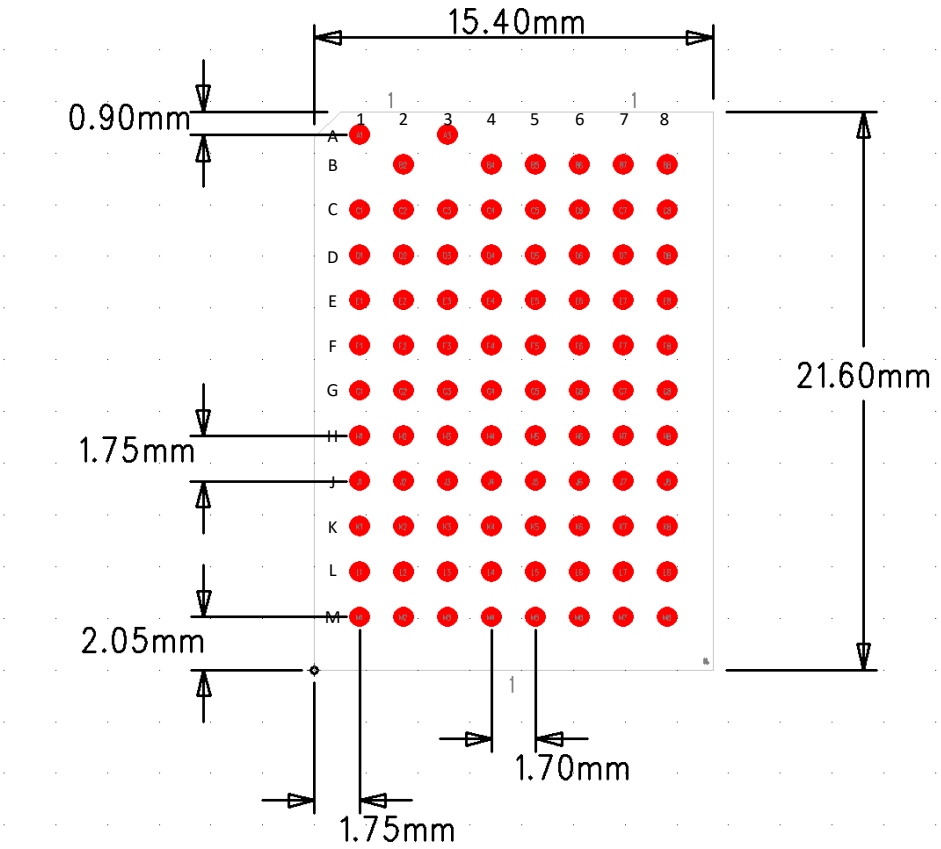


Figure 3: Module solder footprint

5 Hardware specification

The design is based on the following main components.

Description	Module
Baseband	DA14195 (Dialog Semiconductor)
Radio	nRF52 (Nordic Semiconductor)
Flash	32Mbit Quad Flash

Table 1: Main components

The Quad SPI Flash memory is used to store the firmware and a non-volatile storage area for storage of tuning and other parameters on the module.

5.1 Electrical specification

5.1.1 Current consumption

The SBM.0106 current consumption and power supply requirements depend on the software application (processing load, etc.). Request SW specific consumption characteristics for the dimensioning of the power supply.

5.1.2 Recommended operating conditions

Parameter	Description	Min.	Typ.	Max.	Unit
V_{BAT}	Supply voltage on pin VBAT	2		5	V
V_{BUS}	Supply voltage on pin VBUS_CHARGE	4.2		5.75	V
V_{DDIO0}	Supply voltage for I/O bank	1.6		3.45	V
V_{DDIO1}	Supply voltage for I/O bank	1.6		3.45	V
V_{DDIO2}	Supply voltage for I/O bank and radio **Must never be supplied before module is running**[4]	1.7		3.45	V
V_{CC_PA}	Supply for RF power amplifier		1.8		V
V_{PON}	Voltage on P0_15/PON			5	V
V_{PIN_NEG}	Negative voltage on a pin	GND-0.3			V
V_{PIN_POS}	Positive voltage on a pin			VDDIO_x+0.2	V
T_A	Ambient temperature operating range	-20		60	°C
Humidity	Non-condensing	30		95	%

Table 2: Recommended operating conditions

5.1.3 DC characteristics

Parameter	Description	Min.	Typ.	Max.	Unit
$Vout_{VDD1V8}$	Output voltage for VDD_1V8	1.71	1.8	1.89	V
$Imax_{VDD1V8}$	Maximum output current for VDD_1V8[5]	100			mA
$Vout_{VDD3V3}$	Output voltage for VDD_3V3[6]	3.13	3.3	3.46	V
$Imax_{VDD3V3}$	Maximum output current for VDD_3V3[7]	100			mA
$Vout_{VSUPPLY}$	Output voltage for VSUPPLY[6]	3.28	3.45	3.62	V
$Imax_{VSUPPLY}$	Maximum output current for VSUPPLY	300			mA
I_{charge}	Maximum current draw on VBUS for charging on VBAT[8]	360	400	440	mA

Table 3: DC characteristics

[4] More information available in the PSU guidelines application note.
[5] Without subtracting current consumption from internal module usage (e.g., VCC_PA).
[6] This assumes an input voltage on VBAT/VBUS above the specified regulated voltage output (i.e., 3.3V for VDD_3V3 and 3.45V for VSUPPLY). Otherwise, the LDO internally in the module for the output will enter 'pass through' mode, and the output of the LDO will follow the supply voltage, hence losing any features inherited to regulation (i.e., PSRR). For more details see ref. 1.
[7] Without subtracting current consumption from internal module usage (e.g., VDDIO).
[8] Charge current can be adjusted in 14 intervals ranging from 5 to 400mA.

5.1.4 Common electrical specifications – GPIO pads

Parameter	Description	Conditions	Min.	Typ.	Max.	Unit
V_{IH}	High level input voltage	VDDIO_x = 1.6 – 3.45V	0.7*VDDIO_x			V
V_{IL}	Low level input voltage	VDDIO_x = 1.6 – 3.45V			0.3*VDDIO_x	V
V_{IH_reset}	High level for RESET inactive		0.80			V
V_{IL_reset}	Low level for RESET active				0.16	V
V_{IH_pon}	High input level for PON		0.75			V
$V_{IL\ pon}$	Low input level for PON				0.35	V

Table 4: Electrical specifications – recommended operation conditions

5.1.5 Electrical specifications – DC characteristics

Parameter	Description	Min.	Typ.	Max.	Unit
V_{OH}	High level output voltage	0.8*VDDIO_x			V
V_{OL}	Low level output voltage			0.2*VDDIO_x	V
Total sink current of IOs	Drive strength of GPIO, dependent of VDDIO supply	3		8	mA
I_{LED}	Drive strength of LED pins with back drive protection to VSUPPLY			16	mA

Table 5: Electrical specifications - DC characteristics

5.1.6 Radio performance

The radio uses a 2.4GHz proprietary protocol designed by RTX. The characteristics are verified as conducted measurements on the TX and RX ports (pin A1 and A3) of the module (VCC_PA = 1.8VDC). For condition, please see comments.

RTX1290 RF parameter	Specification	Comment
Operating frequency range	2402-2480MHz	
Channel step size	3MHz	Valid for 1Mbit GFSK, depends on SW
Receiver sensitivity	Typ: -90dBm	Room temp. Dual bearer FER = 3%
Transmit power range[9]	Typ: +4.5 - 9.5dBm	Room temp. PA VCC Res = 82 to 0ohm
Power variation over temp.	Typ: 1.3dB Typ: 0.5dB	-20°C to +60°C 0°C to +40°C
Ripple over band	Typ: 0.6dB	-20°C to +60°C
Part to part variation	Typ: 0.8dB	Room temp.
TX harmonics	Max: -30dBm	-20°C to +60°C Conducted

Table 6: RTX1290 key RF parameters

[9] RF output power can be adjusted by the PA VCC resistor at pin B6 (VCC_PA). Further details in section 6.

5.2 Module pin specification

The pin-out specification is listed in the following table.

Pin	Port name	Function	Type	Reset state[10]
A1	A1	RF TX/RX Port 1 (50Ω)	Input/output	
A3	A2	RF TX/RX Port 2 (50Ω)	Input/output	
B2	GND	GND		
B4	GND	GND		
B5	GND	GND		
B6	VCC_PA	RF PA supply	Input	
B7	RF_SPIEN	Internal use	DNC	
B8	GND	GND		
C1	GND	GND		
C2	GND	GND		
C3	GND	GND		
C4	P2_2	GPIO	Input/output	I-PD
C5	RF_COM2	Internal use	DNC	
C6	GND	GND		
C7	GND	GND		
C8	RF_SPIMISO	Internal use	DNC	
D1	\RF_RESET	Internal use	DNC	
D2	RF_SPICLK	Internal use	DNC	
D3	P2_0	GPIO	Input/output	I-PD
D4	P2_1	GPIO	Input/output	I-PD
D5	RF_SWDCLK	RF debug	DNC	
D6	RF_SWDIO[11]	RF debug	DNC	
D7	P1_5	P1_5	Input/output	I-PD
D8	GND	GND		
E1	R_BIAS1	Connect to R_BIAS2 with short trace		
E2	P0_15	P0_15/ PON	Input	I-PD
E3	P0_14	P0_14/ ADC0/ NTC	Input/output Analog input	I-PD
E4	RF_SPIINT/SYNC	Internal use	Input/output	SPI Interrupt
E5	GND	GND		
E6	P1_6/LED0	GPIO LED0	Input/output	I-PU
E7	P1_4	P1_4	Input/output	I-PD
E8	RF_SPIMOSI	Internal use	DNC	
F1	$\overline{\text{RESET}}$	Reset	Input	I-PU: 25kΩ to 1V2
F2	P0_13	P0_13/ ADC1/ COMP	Input Analog input	I-PD
F3	GND	GND		
F4	RF_P0_12	nRF GPIO	Input/output	I-F
F5	P1_8/LED2	GPIO LED2	Input/output	I-PU
F6	P1_7/LED1	GPIO LED1	Input/output	I-PU
F7	P1_3	P1_3	Input/output	I-PD

[10] Whenever reset is active this is the pin state. I: Input. PU: Pull-Up. PD: Pull-Down. F: Floating.
[11] Must not be pulled high during power up of module. If used for JTAG interface, module handles pull-up after power up.

Pin	Port name	Function	Type	Reset state[10]
F8	VDDIO_2	Supply for GPIO bank 2	Input	
G1	R_BIAS2	Connect to R_BIAS1 with short trace		
G2	P0_12	P0_12/ SPDIF_IN	Input Analog input	I-PD
G3	P0_5	GPIO	Input/output	I-PD
G4	P0_10	GPIO	Input/output	I-PD
G5	GND	GND		
G6	GND	GND		
G7	P1_2	P1_2	Input/output	I-PD
G8	GND	GND		
H1	P0_11	P0_11/ BXTAL	Input/output	I-PD
H2	P0_3	GPIO	Input/output	I-PD
H3	P0_2	GPIO. If high during reset: wait loop mode for HW debug.	Input/output	I-PD
H4	GND	GND		
H5	RF_UTX	Debug	DNC	
H6	RF_P0_14	nRF GPIO	Input/output	I-F
H7	P1_1	P1_1	Input/output	I-PD
H8	VDDIO_1	Supply for GPIO bank 1	Input	
J1	GND	GND		
J2	P0_1	GPIO URX	Input/output	I-PD
J3	P0_0	GPIO - UTX. If low during reset: UART Boot mode	Input/output	I-PU
J4	P0_9	GPIO	Input/output	I-PD
J5	RF_URX	Internal use	NC	
J6	GND	GND		
J7	P1_0	P1_0	Input/output	I-PD
J8	VDDIO_0	Supply for GPIO bank 0	Input	
K1	VDD_1V8	1V8 supply	Output	1.8V output
K2	GND	GND		
K3	P0_4	GPIO	Input/output	I-PD
K4	P0_8	GPIO	Input/output	I-PD
K5	GND	GND		
K6	SWDIO	ARM debug (For debug purposes only)	Input/output	I-PU
K7	SWCLK	ARM debug (For debug purposes only)	Input	I-PD
K8	GND	GND		
L1	VDD_3V3	3V3 digital supply	Output	3.3V output
L2	SOCN	Battery fuel gage	Input	I-F
L3	SOCP	Battery fuel gage	Input	I-F
L4	GND	GND		
L5	P0_6	GPIO/32k_xtal1	Input/output 32kHz crystal in	I-PD
L6	GND	GND		
L7	P0_7	GPIO/32k_xtal2	Input/output 32kHz crystal in	I-PU
L8	VDD_USB	Supply to USB_LDO Supply for NTC Pullup	Output	3.3V output
M1	VSUPPLY	LED supply	Output	3.45V output

Pin	Port name	Function	Type	Reset state[10]
M2	GND	GND		
M3	VBAT	Main supply	Input	
M4	VBUS_CHARGE	VBUS/VCHARGE	Input	
M5	GND	GND		
M6	USB_DM	USBN	Input/output	I-F
M7	USB_DP	USBP	Input/output	I-F
M8	GND	GND		

Table 7: RTX1290 pin description

Please note that several of the SBM.0106 pins have multiple functions. Usage will depend on the software variant. Also, please note that some of the pins are only for internal communication between DA14195 and nRF52. Please leave these NC.

6 Design guidelines

The following section contains guidelines and practical advice for system designers to obtain best performance, when using the SBM.0106 module.

6.1 Antennas

- Well separated from other electronics and each other
- Placed in non-shielded environment
- Impedance matched in representative environment

6.2 RF output power tuning

The RF output power can be tuned to meet the ETSI 300 328 compliance of max +10dBm EIRP by adapting the value of the PA VCC resistor. The PA VCC resistor is connected to pin B6 (VCC_PA).

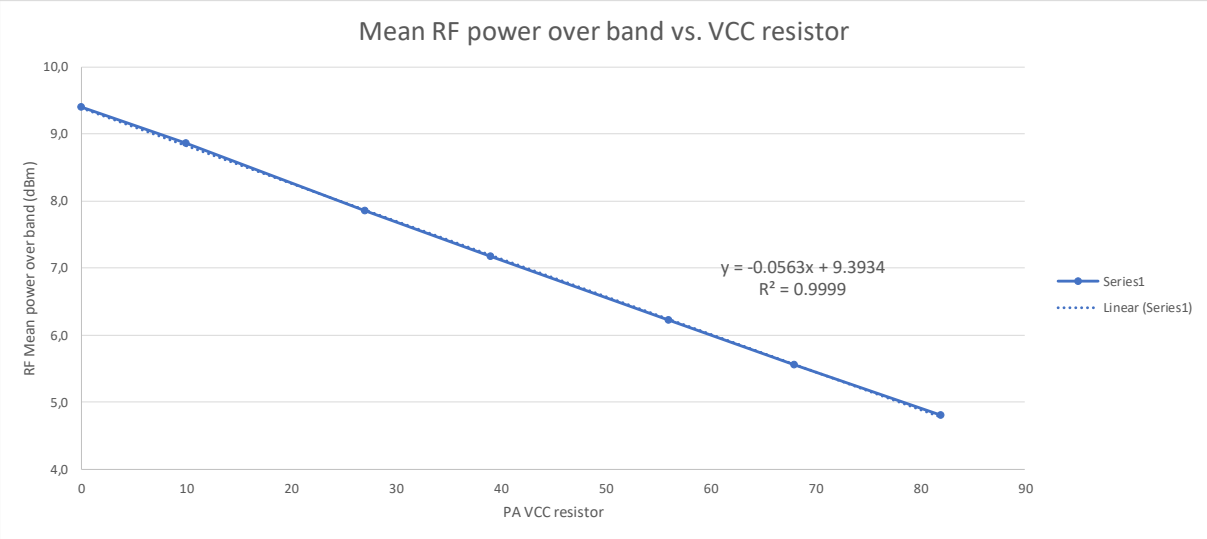


Figure 4: Typical RF power (mean over band) vs. PA VCC resistor

6.3 Module placement on carrier board

Although the module is small, it would be beneficial to consider mechanical forces close to the module, e.g., placing a push button close to the module, could cause the module soldering to break due to repeated use of the button (i.e., the mechanical force on the carrier board could cause the carrier board to bend slightly).

6.4 Test interface

For firmware download and debug purposes, UART and ARM debug interface must be made accessible, when the module is mounted in the host system. It is recommended to reserve the associated pins for development and production test purposes.

The UART connection must be accessible by production test equipment for firmware download and optionally also for development purposes. It is recommended to expose the ARM debug interface for development purposes.

The following connections should be reserved and exposed.

Function	Pin name
Ground	GND
UART RX	J2
UART TX	J3
ARM Debug interface	K6, K7

Table 8: Test and debugging interface

7 Soldering profile

As stated below, the SBM.0106 should be soldered using a standard reflow soldering profile and standard solder paste (Sn96.5 / Ag3 / Cu0.5 alloy). Solder paste supplier is Indium Corporation. Adjustments to the profile may be necessary, depending on the process requirements. Consequently, the following information represents a typical starting point for the optimization process in relation to the specific solder profile for use in the specific product.

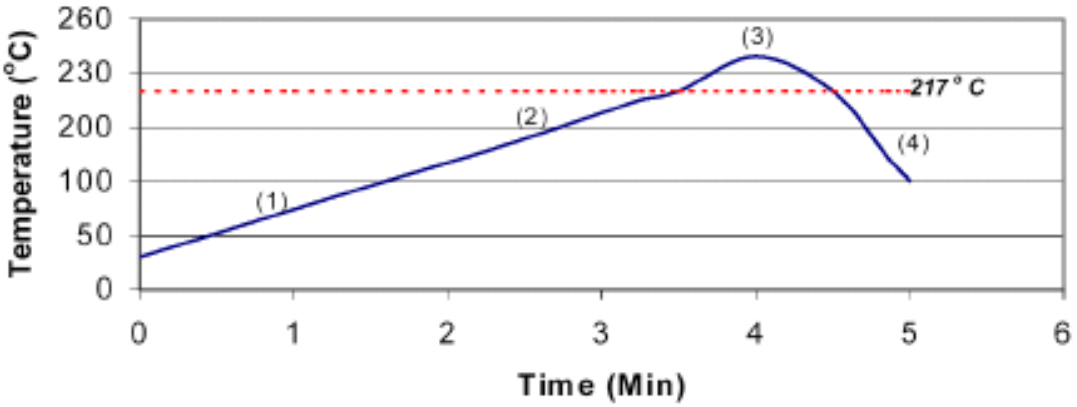


Figure 5: Solder paste composition

7.1 Preheat

The temperature rise from room temperature to 150 degrees shall be made for 30 seconds or longer - typically 90 – 120 seconds. A linear ramp rate of 0.5 – 2.0 degrees/second allows gradual evaporation of volatiles.

7.2 Soak or dry-out

When 150 degrees is reached, the temperature rises to 190 degrees with a continued linear ramp of 0.5 – 2.0 degrees/second - typically 90 – 120 seconds. This stage serves to activate the flux and stabilize the temperature across the board. The uniform heating allows a more linear ramp rate right up to liquid temperature.

7.3 Reflow

The linear ramp rate of 0.5 – 2.0 degrees/second is continued up to the point of liquidus. When liquidus is reached, the temperature should rise with about 1 - 2 degrees/second to a spike 15 - 43 degree above liquidus to form a quality solder joint. Time above liquidus should be 30-90 seconds to reduce excessive inter-metallic compound. Thermal damage and charring of the post-reflow residue can also result from excessive time above liquidus and/or too high a peak temperature.

7.4 Cooling

A rapid cooldown of < 4 degrees/second is desired to form a fine grain structure. Slow cooling will form a large grain structure which typically exhibits poor fatigue resistance. If excessive cooling > 4 degrees/second is used, both the component and the solder joint can be stressed due to a high TCE mismatch. Stencil thickness of 0.150mm is recommended.

8 Packaging of module

The SBM.0106 module is delivered in a tape and reel solution (see chapter 11 for details).

Module software
The module is shipped with a production specific software and must be updated when deployed in the actual product. Refer to section 6.4 for design recommendations for the software update interfacing.

Packaging material and quantity
The SBM.0106 module is delivered as a tape and reel cassette with 1000 pcs. per cassette. The cassettes are sealed in an anti-static bag with an anti-moisture pad and a humidity indicator.

9 Standards and approvals

The SBM.0106 is designed to meet the standards listed below when integrated in target applications. Conformance with the standards is dependent on the software application, the product type, and its application context. Therefore, please be aware that this section cannot be used as a confirmed list across all possible product use cases.

Please consult your RTX contact and align on the requirements for your specific firmware configuration.

9.1 Radio, EMC, and safety

EU type approvals	EU standard
Radio	EN 300 328 V2
EMC	EN 55022:2010 Class A for emissions: EMC (CISPR) EN 61000-4-X for immunity EUROPE – EN 55024: EMC (immunity) EN 301 489-17, EN 301 489-1)
Environmental	Comply with European RoHS & REACH requirements

Table 9: EU type approvals

US type approvals	US standard
Radio and EMC	FCC part 15.247

Table 10: US type approvals

9.2 Environmental (operating)

Parameter	Requirement
Temperature	-20°C to 60°C
Humidity	30 - 95%, non-condensing

Table 11: Environmental (ideal operation)

10 Product labeling

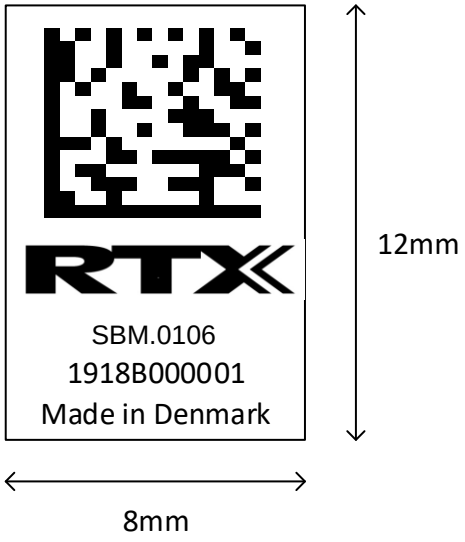


Figure 6: Product labeling

10.1 Serial number definition

The serial number uses the syntax ”YYWWAXXXXXX” based on the following information:

- Digit 1-4: YY = production year, WW = production week
- Digit 5: B = B (unique RTX1290 identifier)
- Digit 6-11: XXXXXX = serial number incrementing by one for each unit

Hence, from the label example above, the following information can be extracted:

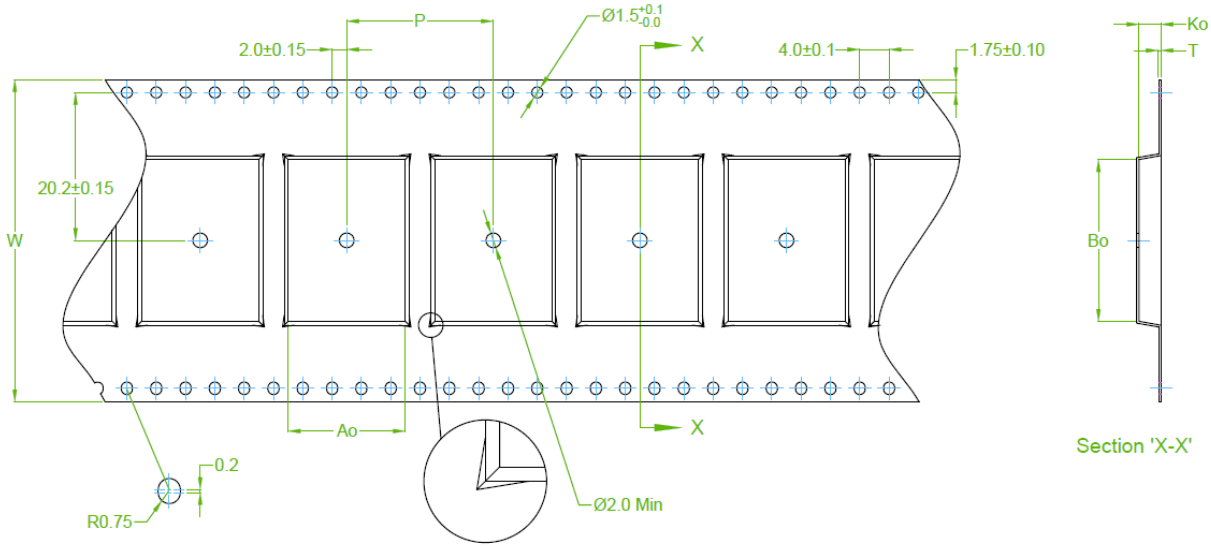
- Production year = 2019
- Production week = 18
- Serial number = 000001

10.2 Barcode

ECC200 data matrix: product serial number

11 Tape and reel specification

Measurements of the tape and reel solution is provided in figure 7 below. The module is placed in the chambers with the shield, and the label is visible through the clear protective membrane.



DIMENSIONS	
Ao	16.00 ±0.10
Bo	22.10 ±0.10
Ko	3.00 ±0.10
P	20.00 ±0.10
T	0.30 ±0.05
W	44.00 ±0.30

NOTES:

ALL DIMENSIONS IN MILLIMETRES
10 SPROCKET HOLE PITCH CUMULATIVE TOLERANCE ± 0.20
MATERIAL: CONDUCTIVE POLYSTYRENE
CAMBER NOT TO EXCEED 1.0mm IN 250mm

Figure 7: Tape and reel specifications

The module is placed in the chambers as outlined in figure 8 below i.e., with the cut corner placed in the lower left corner according to the feeding direction.

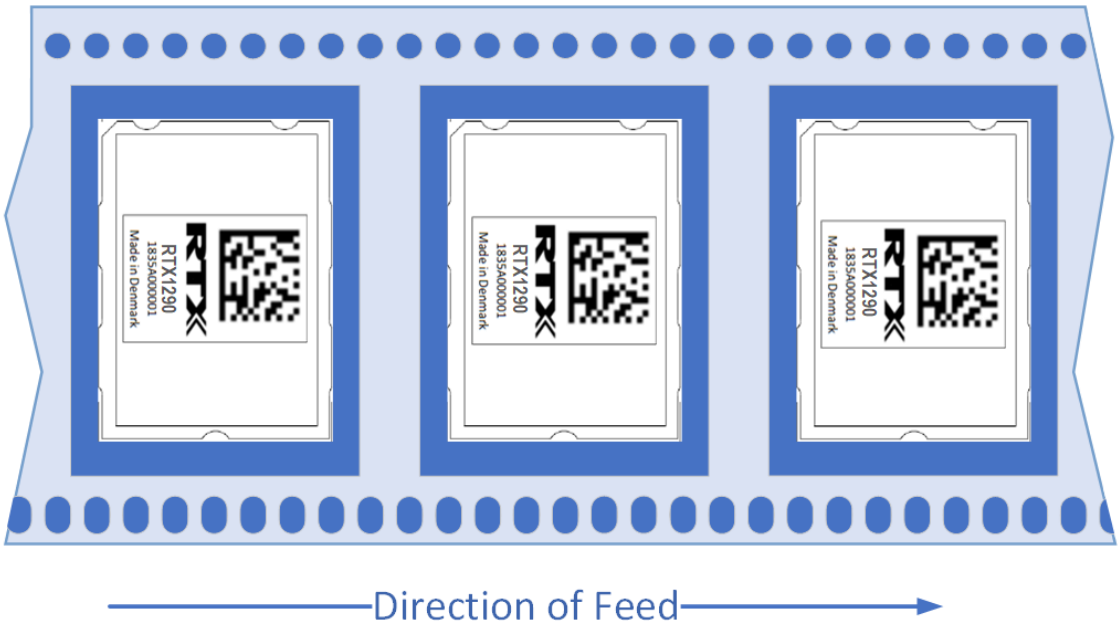


Figure 8: Module feed direction from reel

12 Environmental declaration

BOM check https://www.bomcheck.net/ is used for declaration of ROHS/REACH. Please request the latest declaration from your RTX contact.

13 Life cycle notifications

Any life cycle notifications related to the module will be available at ww.rtx.dk. Customers having ordered the module for production purpose within the last 12 months will be notified.

In the case of an End-of-life (EOL) notification, the period, from the EOL notification to Last Time Buy, will be a minimum of six months.

IC Warning This device complies with Industry Canada licence-exempt RSS standard(s). Operation is subject to the following two conditions:
(1) This device may not cause interference, and
(2) This device must accept any interference, including interference that may cause undesired operation of the device.
The modular can be installed or integrated in mobile or fix devices only. This modular cannot be installed in any portable device.

For a host manufacture's using a certified modular, if (1) the module's IC number is not visible when installed in the host, or (2) if the host is marketed so that end users do not have straightforward commonly used methods for access to remove the module so that the IC number of the module is visible; then an additional permanent label referring to the enclosed module: "Contains Transmitter Module IC: 32740-RTX1290 " or "Contains IC: 32740-RTX1290" must be used.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes: (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement Le modular peut être installé ou intégré dans un mobile ou réparer une seule chose Installation dans n’importe quell appareil portable.

Pour un hôte, on utilise un modular, si (1) le numéro de module est non visible Quand on est installé dans le serveur, or (2) si le propriétaire est commercialisé Straightforward commonly used for the access to remove travail so that the number IC en vue Le module est visible;Ensuite, le label permanent a été attribué au module: "Contient le Module IC: 32740-RTX1290 " " ou "contenu IC:32740-RTX1290 " doit be used.

Radiation Exposure Statement
This modular complies with RF radiation exposure limits set forth for an uncontrolled environment. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter except in accordance with multi-transmitter product procedures. This modular must be installed and operated with a minimum distance of 20 cm between the radiator and user body.

Déclaration d'exposition aux rayonnements
Ce module est conforme aux limites d'exposition aux rayonnements RF définies pour un environnement non contrôlé. Cet émetteur ne doit pas être co-localisé ou fonctionner en conjonction avec une autre antenne ou émetteur, sauf conformément aux procédures du produit multi-émetteur. Ce modulaire doit être installé et exploité avec une distance minimale de 20 cm entre le radiateur et le corps de l'utilisateur.

FCC Statement

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:

(1) This device may not cause harmful interference, and

(2) this device must accept any interference received, including interference that may cause undesired operation.

Any Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

If the FCC identification number is not visible when the module is installed inside another device, then the outside of the device into which the module is installed must also display a label referring to the enclosed module. This exterior label can use wording such as the following: “Contains Transmitter Module FCC ID: 2BHC6RTX1290” Or “Contains FCC ID: 2BHC6RTX1290 ”

When the module is installed inside another device, the user manual of the host must contain below warning statements;

1. This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

(1) This device may not cause harmful interference.

(2) This device must accept any interference received, including interference that may cause undesired operation.

2. Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

The devices must be installed and used in strict accordance with the manufacturer's instructions as described in the user documentation that comes with the product.

Any company of the host device which install this modular with Limited Single modular approval should perform the test of radiated emission and spurious emission according to FCC part 15C : 15.247 and 15.209 requirement, Only if the test result comply with FCC part 15C : 15.247 and 15.209 requirement，then the host can be sold legally.

Requirement per KDB996369 D03

2.2 List of applicable FCC rules

List the FCC rules that are applicable to the modular transmitter. These are the rules that specifically establish the bands of operation, the power, spurious emissions, and operating fundamental frequencies. DO NOT list compliance to unintentional-radiator rules (Part 15 Subpart B) since that is not a condition of a module grant that is extended to a host manufacturer. See also Section 2.10 below concerning the need to notify host manufacturers that further testing is required.3

Explanation: This module meets the requirements of FCC part 15.247.

2.3 Summarize the specific operational use conditions

Describe use conditions that are applicable to the modular transmitter, including for example any limits on antennas, etc. For example, if point-to-point antennas are used that require reduction in power or compensation for cable loss, then this information must be in the instructions. If the use condition limitations extend to professional users,

then instructions must state that this information also extends to the host manufacturer's instruction manual. In addition, certain information may also be needed, such as peak gain per frequency band and minimum gain, specifically for master devices in 5 GHz DFS bands.

Explanation: The EUT has a FPC Antenna, and the antenna use a permanently attached antenna which is not replaceable.

2.4 Limited module procedures

If a modular transmitter is approved as a "limited module," then the module manufacturer is responsible for approving the host environment that the limited module is used with. The manufacturer of a limited module must describe, both in the filing and in the installation instructions, the alternative means that the limited module manufacturer uses to verify that the host meets the necessary requirements to satisfy the module limiting conditions.

A limited module manufacturer has the flexibility to define its alternative method to address the conditions that limit the initial approval, such as: shielding, minimum signaling amplitude, buffered modulation/data inputs, or power supply regulation. The alternative method could include that the limited module manufacturer reviews detailed test data or host designs prior to giving the host manufacturer approval.

This limited module procedure is also applicable for RF exposure evaluation when it is necessary to demonstrate compliance in a specific host. The module manufacturer must state how control of the product into which the modular transmitter will be installed will be maintained such that full compliance of the product is always ensured. For additional hosts other than the specific host originally granted with a limited module, a Class II permissive change is required on the module grant to register the additional host as a specific host also approved with the module.

Explanation: The module is a single module.

2.5 Trace antenna designs

For a modular transmitter with trace antenna designs, see the guidance in Question 11 of KDB Publication 996369 D02 FAQ – Modules for Micro-Strip Antennas and traces. The integration information shall include for the TCB review the integration instructions for the following aspects: layout of trace design, parts list (BOM), antenna, connectors, and isolation requirements.

a) Information that includes permitted variances (e.g., trace boundary limits, thickness,
length, width, shape(s), dielectric constant, and impedance as applicable for each type of antenna);

b) Each design shall be considered a different type (e.g., antenna length in multiple(s) of frequency, the wavelength, and antenna shape (traces in phase) can affect antenna gain and must be considered);

c) The parameters shall be provided in a manner permitting host manufacturers to design the printed circuit (PC) board layout;

d) Appropriate parts by manufacturer and specifications;

e) Test procedures for design verification; and

f) Production test procedures for ensuring compliance.

The module grantee shall provide a notice that any deviation(s) from the defined parameters of the antenna trace, as described by the instructions, require that the host product manufacturer must notify the module grantee that they wish to change the antenna trace design. In this case, a Class II permissive change application is required to be filed by the grantee, or the host manufacturer can take responsibility through the change in FCC ID (new application) procedure followed by a Class II permissive change application.

Explanation: Yes, The module with trace antenna designs, and This manual has been shown the layout of trace design, antenna, connectors, and isolation requirements.

2.6 RF exposure considerations

It is essential for module grantees to clearly and explicitly state the RF exposure conditions that permit a host product manufacturer to use the module. Two types of instructions are required for RF exposure information: (1) to the host product manufacturer, to define the application conditions (mobile, portable – xx cm from a person’s body); and (2) additional text needed for the host product manufacturer to provide to end users in their end-product manuals. If RF exposure statements and use conditions are not provided, then the host product manufacturer is required to take responsibility of the module through a change in FCC ID (new application).

Explanation: This module complies with FCC RF radiation exposure limits set forth for an uncontrolled environment, This equipment should be installed and operated with a minimum distance of 20 centimeters between the radiator and your body." This module is designed to comply with the FCC statement, FCC ID is: 2BHC6RTX1290 .

2.7 Antennas

A list of antennas included in the application for certification must be provided in the instructions. For modular transmitters approved as limited modules, all applicable professional installer instructions must be included as part of the information to the host product manufacturer. The antenna list shall also identify the antenna types (monopole, PIFA, dipole, etc. (note that for example an “omni-directional antenna” is not considered to be a specific “antenna type”)).

For situations where the host product manufacturer is responsible for an external connector, for example with an RF pin and antenna trace design, the integration instructions shall inform the installer that unique antenna connector must be used on the Part 15 authorized transmitters used in the host product. The module manufacturers shall provide a list of acceptable unique connectors.

Explanation: The EUT has a FPC Antenna, and the antenna use a permanently attached antenna which is unique.

2.8 Label and compliance information

Grantees are responsible for the continued compliance of their modules to the FCC rules. This includes advising host product manufacturers that they need to provide a physical or e-label stating “Contains FCC ID” with their finished product. See Guidelines for Labeling and User Information for RF Devices – KDB Publication 784748.

Explanation: The host system using this module, should have label in a visible area indicated the following texts: “Contains FCC ID: 2BHC6RTX1290 , Contains IC: 32740-RTX1290”

2.9 Information on test modes and additional testing requirements5

Additional guidance for testing host products is given in KDB Publication 996369 D04 Module Integration Guide. Test modes should take into consideration different operational conditions for a stand-alone modular transmitter in a host, as well as for multiple simultaneously transmitting modules or other transmitters in a host product. The grantee should provide information on how to configure test modes for host product evaluation for different operational conditions for a stand-alone modular transmitter in a host, versus with multiple, simultaneously transmitting modules or other transmitters in a host.

Grantees can increase the utility of their modular transmitters by providing special means, modes, or instructions that simulates or characterizes a connection by enabling a transmitter. This can greatly simplify a host manufacturer’s determination that a module as installed in a host complies with FCC requirements.

Explanation: Top band can increase the utility of our modular transmitters by providing instructions that simulates or characterizes a connection by enabling a transmitter.

2.10 Additional testing, Part 15 Subpart B disclaimer

The grantee should include a statement that the modular transmitter is only FCC authorized for the specific rule parts (i.e., FCC transmitter rules) listed on the grant, and that the host product manufacturer is responsible for compliance to any other FCC rules that apply to the host not covered by the modular transmitter grant of certification. If the grantee markets their product as being Part 15 Subpart B compliant (when it also contains unintentional-radiator digital circuity), then the grantee shall provide a notice stating that the final host product still requires Part 15 Subpart B compliance testing with the modular transmitter installed.

Explanation: The module without unintentional-radiator digital circuity, so the module does not require an evaluation by FCC Part 15 Subpart B. The host shoule be evaluated by the FCC Subpart B.